NISSAN TRUCK/ PATHFINDER

MODEL D21 SERIES

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FOREWORD

This manual contains maintenance and repair procedures for the 1990 Nissan TRUCK and PATHFINDER.

In order to assure your safety and the efficient functioning of the vehicle, this manual should be read thoroughly. It is especially important that the PRECAUTIONS in the GI section be completely understood before starting any repair task.

All information in this manual is based on the latest product information at the time of publication. The right is reserved to make changes in specifications and methods at any time without notice.

IMPORTANT SAFETY NOTICE

The proper performance of service is essential for both the safety of the technician and the efficient functioning of the vehicle.
The service methods in this Service Manual are described in such a manner that the service may be performed safely and accurately.
Service varies with the procedures used, the skills of the technician and the tools and parts available. Accordingly, anyone using service procedures, tools or parts which are not specifically recommended by NISSAN must first completely satisfy himself that neither his safety nor the vehicle's safety will be jeopardized by the service method selected.

NISSAN MOTOR CO., LTD.
Overseas Service Department
Tokyo, Japan

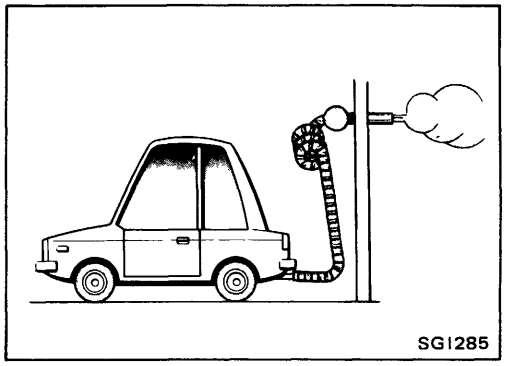
GENERAL INFORMATION

SECTION GI

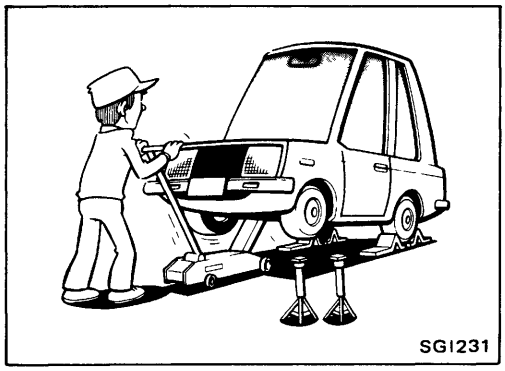
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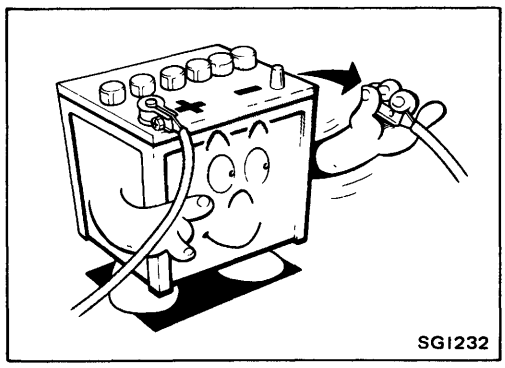
The following precautions should be observed to ensure safe and proper service operations. These precautions are not described in each individual section.

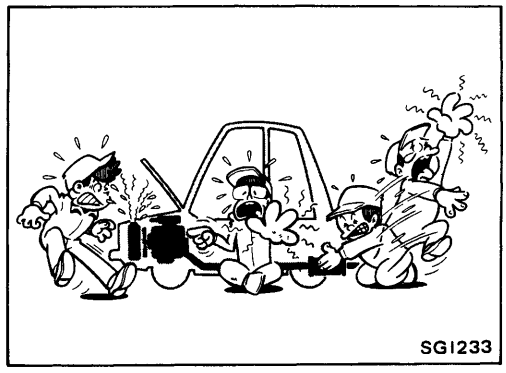

SGI285

1. Do not operate the engine for an extended period of time without proper exhaust ventilation.
   Keep the work area well ventilated and free of any inflammable materials. Special care should be taken when handling any inflammable or poisonous materials, such as gasoline, refrigerant gas, etc. When working in a pit or other enclosed area, be sure to properly ventilate the area before working with hazardous materials.
   Do not smoke while working on the vehicle.

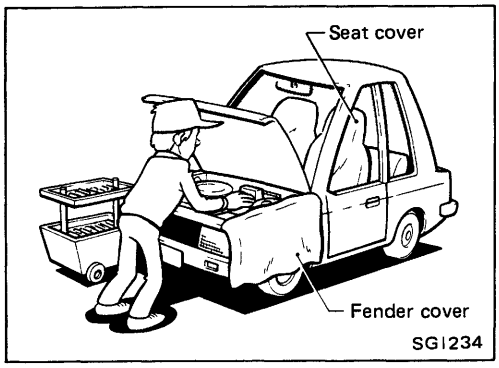

SGI231

2. Before jacking up the vehicle, apply wheel chocks or other tire blocks to the wheels to prevent the vehicle from moving. After jacking up the vehicle, support the vehicle weight with safety stands at the points designated for proper lifting and towing before working on the vehicle.
   These operations should be done on a level surface.
3. When removing a heavy component such as the engine or transaxle/transmission, take care not to lose your balance and drop it. Also, do not allow it to hit against adjacent parts, especially brake tube and brake master cylinder.
4. Before starting repairs which do not require battery power, always turn off the ignition switch, then disconnect the ground cable from the battery to prevent accidental short circuit.

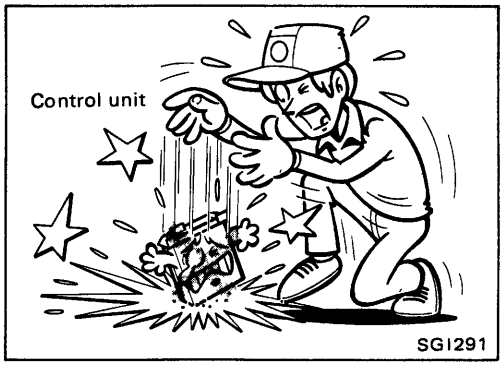

SGI232

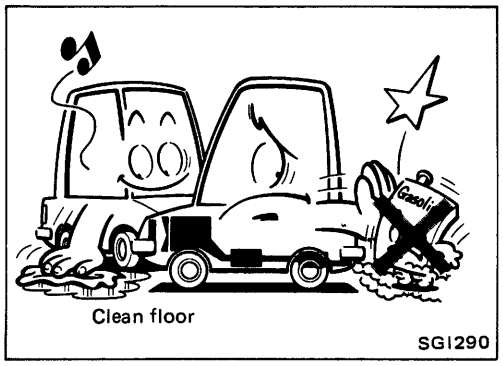

SGI233

5. To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe and muffler.
   Do not remove the radiator cap when the engine is hot.



6. To prevent scratches and soiling, protect fenders, upholstery and carpeting with appropriate covers before starting servicing.
   Take caution that keys, buckles or buttons on your person do not scratch the paint.
7. Clean all disassembled parts in the designated liquid or solvent prior to inspection or assembly.
8. Replace oil seals, gaskets, packings, O-rings, locking washers, cotter pins, self-locking nuts, etc. as instructed and discard used ones.
9. Tapered roller bearings and needle bearings should be replaced as a set of inner and outer races.
10. Arrange the disassembled parts in accordance with their assembled locations and sequence.
11. Do not touch the terminals of electrical components which utilize microcomputers such as electronic control units. Static electrical charges stored in your body may damage internal electronic components.
12. After disconnecting vacuum hose or air hose, attach tag which indicates the proper connection to prevent incorrect connection.
13. Use only the lubricants specified in the applicable section or those indicated under "Recommended Fuel and Lubricants".
14. Use approved bonding agent, sealants or their equivalents when required.
15. The use of the proper tools and recommended essential tools should be used where specified for proper, safe and efficient service repairs.
16. When effecting repairs on the fuel, oil, water, vacuum or exhaust systems, make certain to check all affected lines for leaks.
17. Dispose of drained oil or the solvent used for cleaning parts in an appropriate manner.





Precautions for E.F.I. or E.C.C.S. Engine

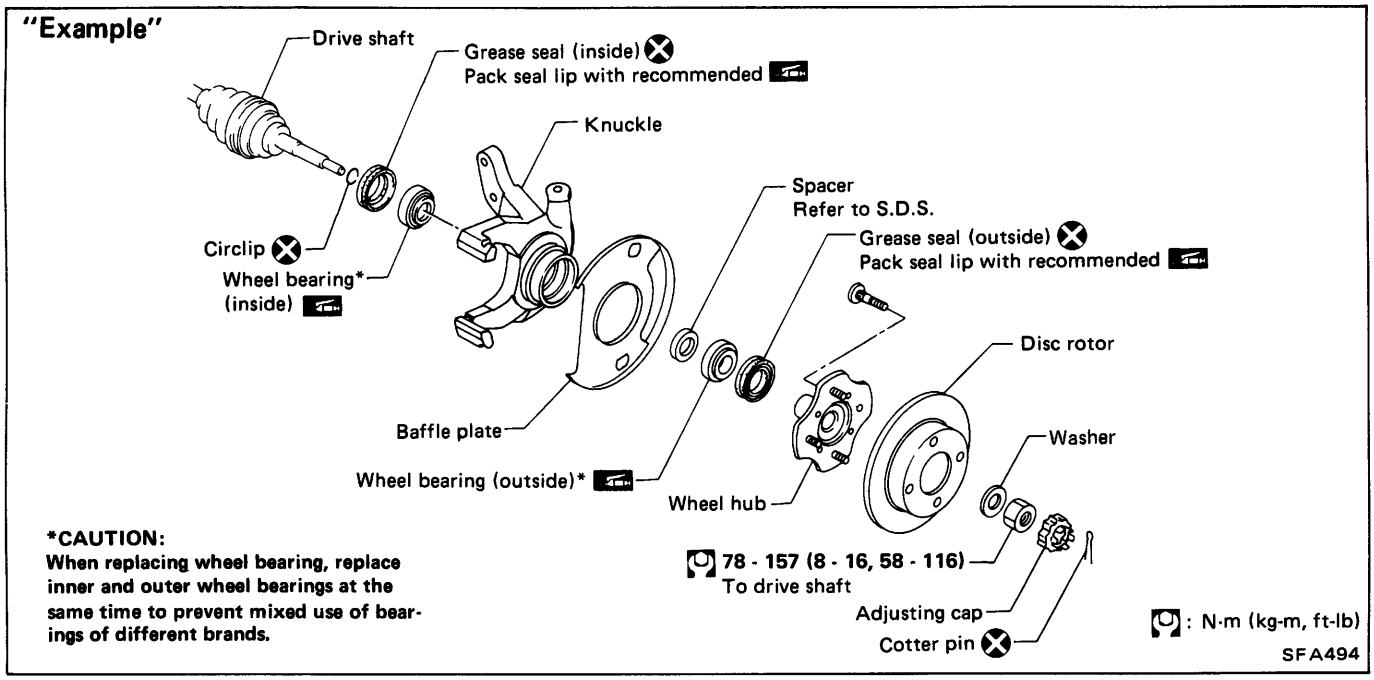
1. Before connecting or disconnecting E.F.I. or E.C.C.S. harness connector to or from any E.F.I. or E.C.C.S. control unit, be sure to turn the ignition switch to the "OFF" position and disconnect the negative battery terminal.
   Otherwise, there may be damage to control unit.
2. Before disconnecting pressurized fuel line from fuel pump to injectors, be sure to release fuel pressure to eliminate danger.
3. Be careful not to jar components such as control unit and air flow meter.

Precautions for a Catalyst

If a large amount of unburned fuel flows into the converter, the converter temperature will be excessively high. To prevent this, follow the procedure below.

1. Use unleaded gasoline only. Leaded gasoline will seriously damage the catalytic converter.
2. When checking for ignition spark or measuring engine compression, make tests quickly and only when necessary.
3. Do not run engine when the fuel tank level is low, otherwise the engine may misfire causing damage to the converter.
4. Do not place the vehicle on inflammable material. Keep inflammable material off the exhaust pipe.

1. **A QUICK REFERENCE INDEX**, a black tab (e.g. FA) is provided on the first page. You can quickly find the first page of each section by mating it to the section's black tab.
2. **THE CONTENTS** are listed on the first page of each section.
3. **THE TITLE** is indicated on the upper portion of each page and shows the part or system.
4. **THE PAGE NUMBER** of each section consists of two letters, which designate the particular section, and a number (e.g. "FA-5").
5. **THE LARGE ILLUSTRATION** is an exploded view (See below) and contains tightening torques, lubrication points and other information necessary to perform repairs.
   The illustration should be used in reference to the service matters only. When ordering parts, refer to the appropriate **PARTS CATALOG**.



6. **THE SMALL ILLUSTRATION** shows the important steps such as inspection, use of special tools, knacks of work and hidden or tricky steps which are not shown in the previous large illustration.
   Assembly, inspection and adjustment procedures for the complicated units such as the automatic transaxle or transmission, etc. are presented in a step-by-step format where necessary.
7. The following **SYMBOLS AND ABBREVIATIONS** are used:

: Tightening Torque

: Should be lubricated with grease. Unless otherwise indicated, use recommended multi-purpose grease.

: Should be lubricated with oil.

: Sealing point

: Checking point

: Always replace when disassembled.

S.D.S.: Service Data and Specifications
L.H., R.H.: Left-Hand, Right-Hand
M/T: Manual Transaxle/Transmission
A/T: Automatic Transaxle/Transmission
Tool: Special Service Tools

8. The **UNITS** given in this manual are primarily expressed with the SI UNIT (International System of Unit), and alternately expressed in the metric system and in the yard/pound system.

   "Example"

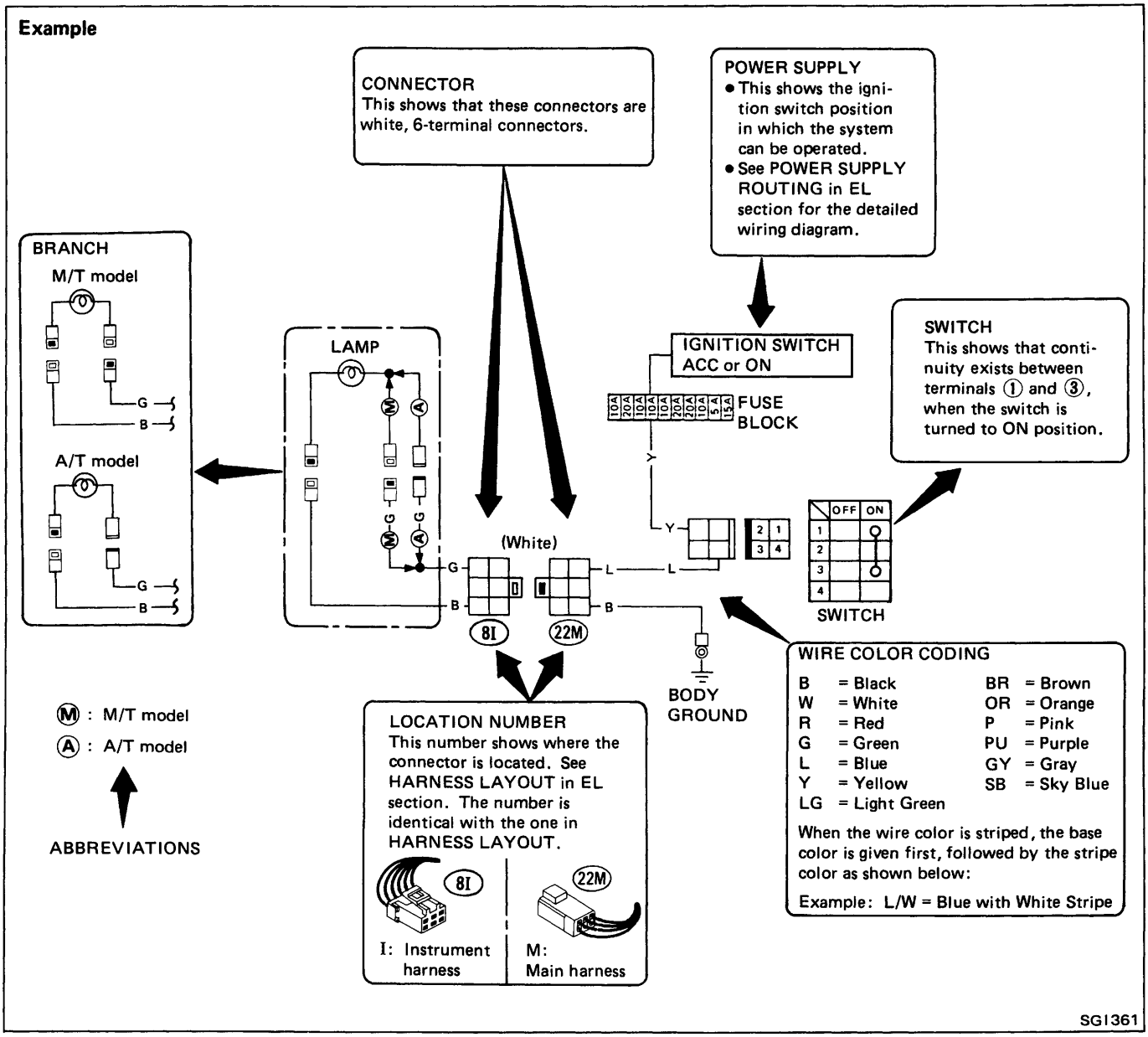
   Tightening torque

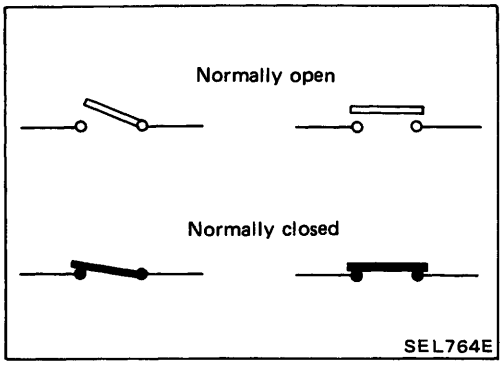
   59 - 78 N·m (6.0 - 8.0 kg-m, 43 - 58 ft-lb)

9. **TROUBLE DIAGNOSES AND CORRECTIONS** are included in sections dealing with complicated components.
10. **SERVICE DATA AND SPECIFICATIONS** is contained at the end of each section for quick reference of data.
11. The captions **WARNING** and **CAUTION** warn you of steps that must be followed to prevent personal injury and/or damage to some part of the vehicle.

WIRING DIAGRAM

Symbols used in WIRING DIAGRAM are shown below.

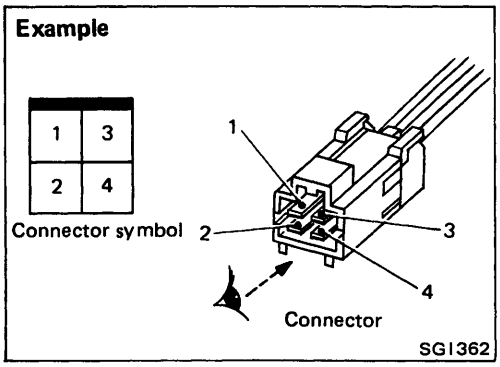




SWITCH POSITIONS

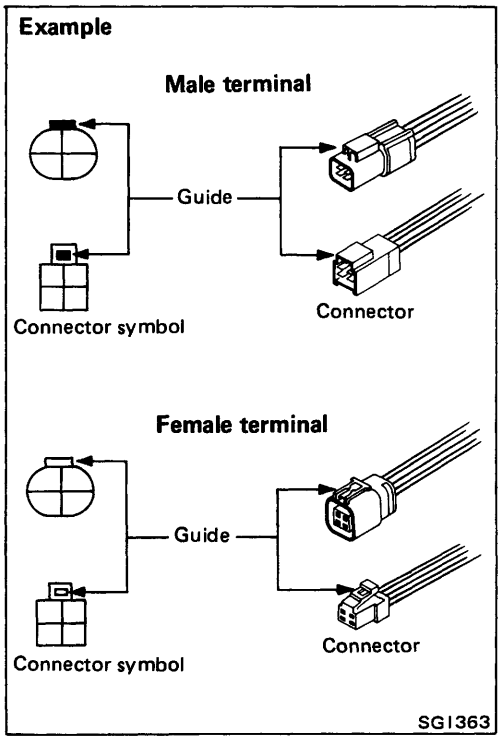
Wiring diagram switches are shown with the vehicle in the following condition:

- Ignition switch "OFF".
- Doors, hood and trunk lid/back door closed.
- Pedals are not depressed and parking brake is released.

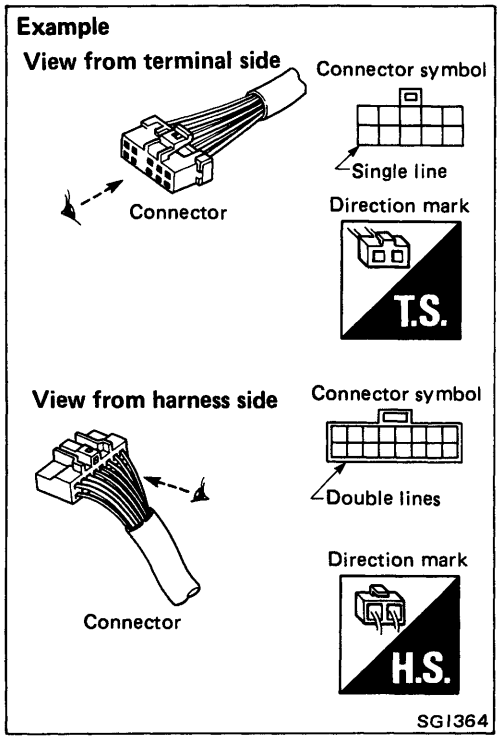


CONNECTOR SYMBOLS

- All connector symbols in wiring diagrams are shown from the terminal side.



- Male and female terminals
  Connector guides for male terminals are shown in black and female terminals in white in wiring diagrams.



DIRECTION MARK

A direction mark is shown to clarify the side of connector (terminal side or harness side).

Direction marks are mainly used in the illustrations indicating terminal inspection.

T.S. : **View from terminal side . . . T.S.**

- **All connector symbols shown from the terminal side are enclosed by a single line.**

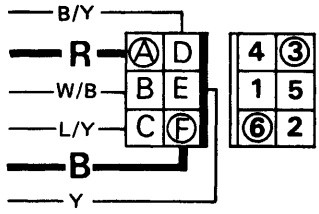
H.S. : **View from harness side . . . H.S.**

- **All connector symbols shown from the harness side are enclosed by double lines.**

MULTIPLE SWITCH

The continuity of the multiple switch is identified in the switch chart in wiring diagrams.

Example



WIPER SWITCH

	OFF	INT	LO	HI	WASH
1					○
2				○	
3	○	○	●		
4	○	○			
5		○			
6		○	●	○	○

Continuity circuit of wiper switch

SWITCH POSITION	CONTINUITY CIRCUIT
OFF	3 - 4
INT	3 - 4, 5 - 6
LO	3 - 6
HI	2 - 6
WASH	1 - 6

Example: Wiper switch in LO position

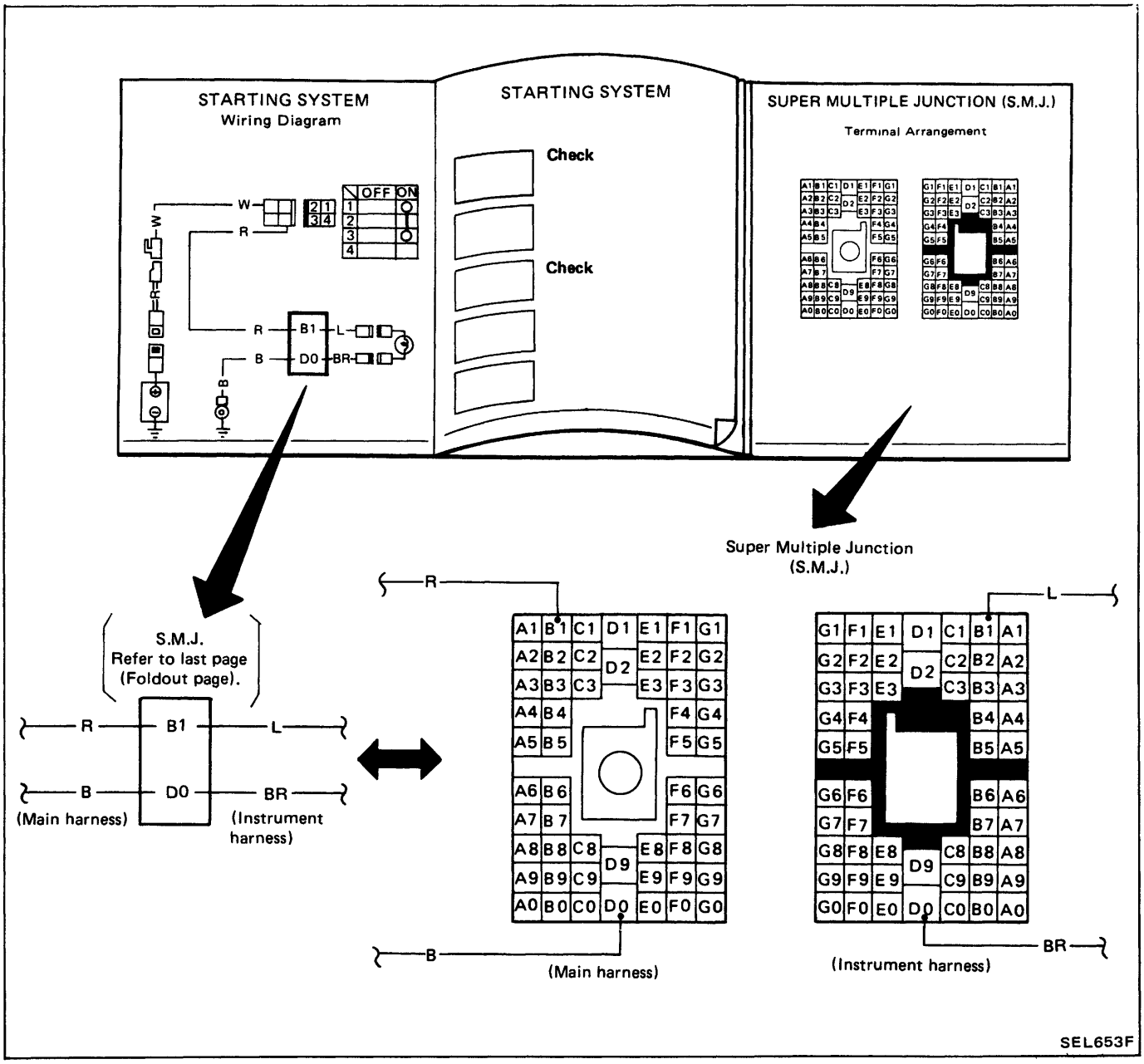
Continuity circuit: Red wire – Ⓐ terminal – ③ terminal – Wiper switch (● – ●: LO) – ⑥ terminal – Ⓕ terminal – Black wire

SGI365

SUPER MULTIPLE JUNCTION (S.M.J.)

- The "S.M.J." indicated in wiring diagrams is shown in a simplified form. The terminal arrangement should therefore be referred to in the foldout at the end of the Service Manual.
- The foldout should be spread to read the entire wiring diagram.

"Example"



Model Variation

2-WHEEL DRIVE TRUCK

Destination	Body		Engine	KA24E			VG30E	
			Transmission	FS5W71C	RL4R01A (Floor shift)	RL4R01A (Column shift)	FS5R30A	RE4R01A (Floor shift)
			Differential carrier	H190A	H190A	H190A	H233B	H233B
Non-California, U.S.A.	Regular Cab	E	Standard wheelbase	SLD21FBU	–	SLD21YBU	–	–
	King Cab	E	Long wheelbase	KSLGD21FBU	KSLGD21KBU	–	–	–
		SE		–	–	–	KHLGD21PFBU	KHLGD21PKBU
	Heavy duty	E		–	–	–	EHLGD21FBU	EHLGD21KBU
California, U.S.A.	Regular Cab	E	Standard wheelbase	SLD21FBV	–	SLD21YBV	–	–
	King Cab	E	Long wheelbase	KSLGD21FBV	KSLGD21KBV	–	–	–
		SE		–	–	–	KHLGD21PFBV	KHLGD21PKBV
	Heavy duty	E		–	–	–	EHLGD21FBV	EHLGD21KBV
Canada	Regular Cab	E	Standard wheelbase	SLD21FBN	–	SLD21YBN	–	–
			Long wheelbase	SLGD21FBN	–	SLGD21YBN	–	–
	King Cab	E	Long wheelbase	KSLGD21FBN	KSLGD21KBN	–	–	–
		SE		–	–	–	KHLGD21PFBN	KHLGD21PKBN
	Heavy duty	E		–	–	–	EHLGD21FBN	EHLGD21KBN

4-WHEEL DRIVE TRUCK

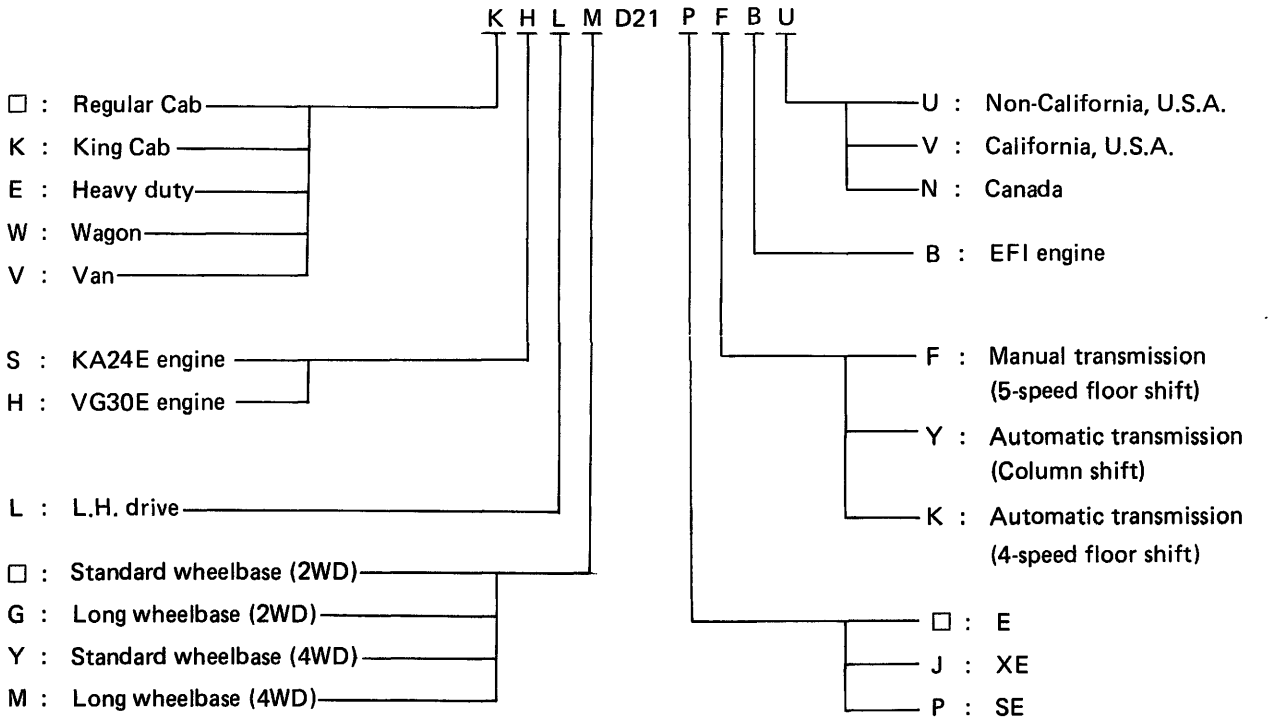
Destination	Body		Engine	KA24E		VG30E			
			Transmission	FS5W71C		FS5R30A		RE4R01A	
			Transfer	TX10		TX10		TX10	
			Differential carrier	Front R180A	Rear C200	Front R200A	Rear H233B	Front R200A	Rear H233B
Non-California, U.S.A.	Regular Cab	E	Standard wheelbase	SLYD21FBU		HLYD21FBU		HLYD21KBU	
	King Cab	E	Long wheelbase	KSLMD21FBU		–		–	
		SE		–		KHLMD21PFBU		KHLMD21PKBU	
California, U.S.A.	Regular Cab	E	Standard wheelbase	SLYD21FBV		HLYD21FBV		HLYD21KBV	
	King Cab	E	Long wheelbase	KSLMD21FBV		–		–	
		SE		–		KHLMD21PFBV		KHLMD21PKBV	
Canada	Regular Cab	E	Standard wheelbase	SLYD21FBN		HLYD21FBN		HLYD21KBN	
	King Cab	XE	Long wheelbase	KSLMD21JFBN		–		–	
		SE		–		KHLMD21PFBN		KHLMD21PKBN	

Model Variation (Cont'd)

4-WHEEL DRIVE PATHFINDER

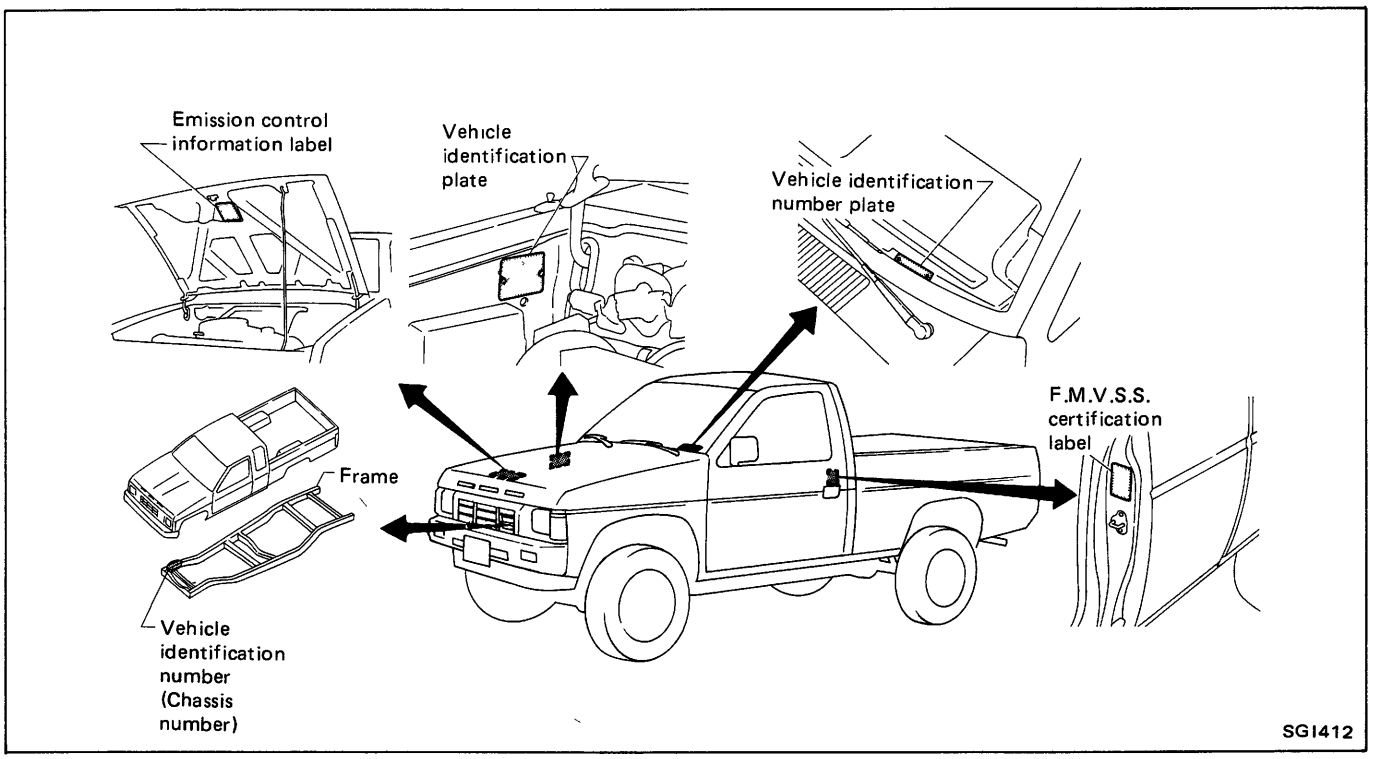
Destination	Body	Engine	VG30E			
		Transmission	FS5R30A		RE4R01A	
		Transfer	TX10		TX10	
		Differential carrier	Front R200A	Rear H233B	Front R200A	Rear H233B
Non-California, U.S.A.	Wagon	XE	WHLYD21JFBU		WHLYD21JKBU	
		SE	WHLYD21PFBU		WHLYD21PKBU	
California, U.S.A.	Wagon	XE	WHLYD21JFBV		WHLYD21JKBV	
		SE	WHLYD21PFBV		WHLYD21PKBV	
Canada	Van	XE	VHLYD21JFBN		VHLYD21JKBN	
		SE	VHLYD21PFBN		VHLYD21PKBN	

Prefix and suffix designations:



Note: □ means no indication.

Identification Number



VEHICLE IDENTIFICATION NUMBER ARRANGEMENT

JN6 H D 1 1 S * L W 000001

Manufacturer
- JN6: Truck
- 1N6: U.S.A. produced truck
- JN8: Multi purpose passenger vehicle

Engine type
- H : VG30E
- S : KA24E

Vehicle line
- D : Nissan Truck, Nissan Pathfinder

Model change (0 to 9)

Body type
- 1 : Standard wheelbase
- 2 : Long wheelbase
- 4 : Van
- 6 : King Cab, Wagon

Other information
- S : Standard
- Y : 4-wheel drive
- H : Heavy duty

Check digit (0 to 9 or X)
The code for the check digit is determined by mathematical computation.

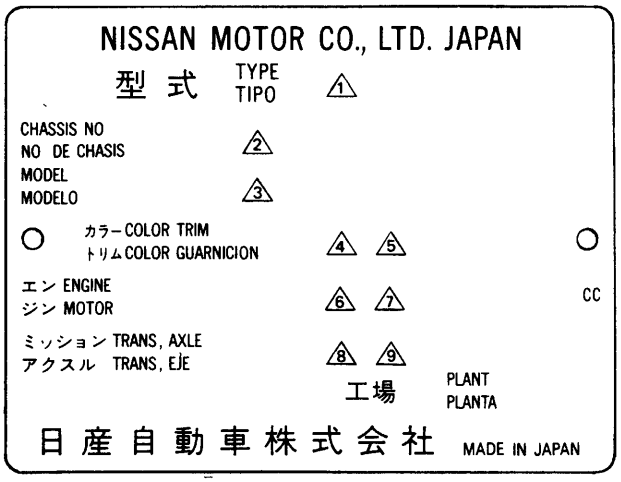
Model year
- L : 1990 year model

Manufacturing plant
- W : Kyushu
- C : Smyrna, Tennessee

Vehicle serial number

Identification Number (Cont'd)

IDENTIFICATION PLATE

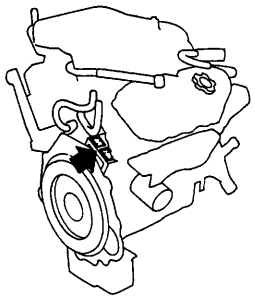


1 Type
2 Vehicle identification number (Chassis number)
3 Model
4 Body color code
5 Trim color code
6 Engine model
7 Engine displacement
8 Transmission model
9 Axle model

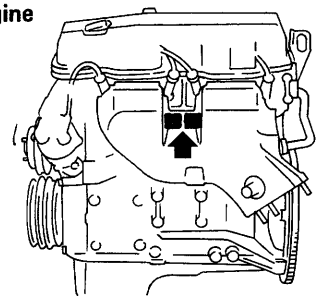
SGI315

ENGINE SERIAL NUMBER

VG30E engine

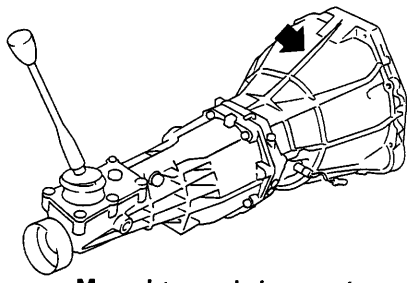


KA24E engine



SGI629

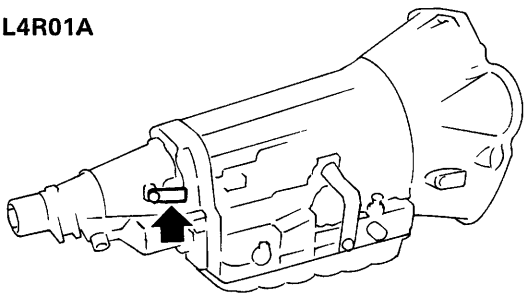
TRANSMISSION SERIAL NUMBER



Manual transmission number

SGI418

RL4R01A

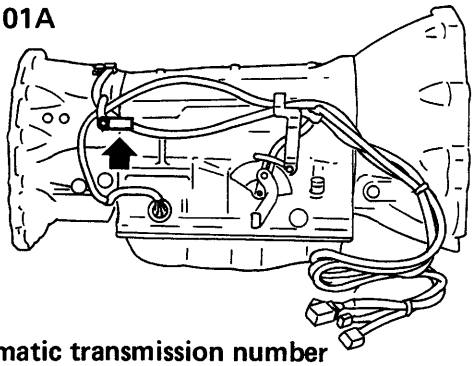


Automatic transmission number

SGI601

TRANSMISSION SERIAL NUMBER

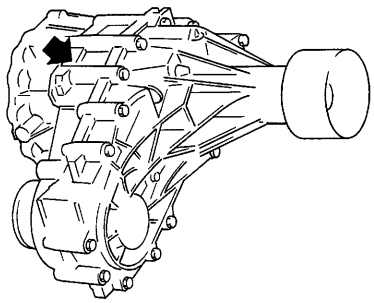
RE4R01A



Automatic transmission number

SGI509

TRANSFER SERIAL NUMBER



SGI419

Dimensions

Truck

Unit: mm (in)

		2-wheel drive				4-wheel drive	
		Regular Cab		King Cab	Heavy duty	Regular Cab	King Cab
		Standard wheelbase	Long wheelbase			Standard wheelbase	Long wheelbase
Overall length*		4,435 (174.6)	4,825 (190.0)	4,825 (190.0)	4,825 (190.0)	4,435 (174.6)	4,825 (190.0)
Overall width		1,650 (65.0)	1,650 (65.0)	1,650 (65.0)	1,650 (65.0)	1,690 (66.5)	1,690 (66.5)
Overall height (KA24E engine models)		1,575 (62.0)	1,575 (62.0)	1,575 (62.0)	–	1,695 (66.7)	1,695 (66.7)
Overall height (VG30E engine models)		–	–	1,575 (62.0)	1,575 (62.0)	1,695 (66.7)	1,705 (67.1)
Front tread (KA24E engine models)		1,395 (54.9)	1,395 (54.9)	1,395 (54.9)	–	1,425 (56.1)	1,425 (56.1)
Front tread (VG30E engine models)		–	–	1,415 (55.7)	1,395 (54.9)	1,425 (56.1)	1,445 (56.9)
Rear tread (KA24E engine models)		1,385 (54.5)	1,385 (54.5)	1,385 (54.5)	–	1,385 (54.5)	1,385 (54.5)
Rear tread (VG30E engine models)		–	–	1,430 (56.3)	1,410 (55.5)	1,410 (55.5)	1,430 (56.3)
Wheelbase		2,650 (104.3)	2,950 (116.1)	2,950 (116.1)	2,950 (116.1)	2,650 (104.3)	2,950 (116.1)
Cargo space	Length	1,875 (73.8)	2,265 (89.2)	1,895 (74.6)	2,265 (89.2)	1,875 (73.8)	1,895 (74.6)
	Width	1,520 (59.8)	1,520 (59.8)	1,520 (59.8)	1,520 (59.8)	1,520 (59.8)	1,520 (59.8)
	Height	435 (17.1)	435 (17.1)	435 (17.1)	435 (17.1)	435 (17.1)	435 (17.1)

*: On step bumper equipped models, the bumper adds 140 mm (5.5 in) to the overall length.

Pathfinder

Unit: mm (in)

	Wagon & Van
	VG30E
Overall length *1	4,365 (171.9)
Overall width	1,690 (66.5)
Overall height	1,670 (65.7)/1,680 (66.1)*2
Front tread	1,425 (56.1)/1,445 (56.9)*2
Rear tread	1,410 (55.5)/1,430 (56.3)*2
Wheelbase	2,650 (104.3)

*1: On models with a spare tire carrier, the overall length is increased by the following lengths depending on the spare tire.
230 mm (9.1 in) for P215/75R tires, 260 mm (10.2 in) for P235/75R tires, 275 mm (10.8 in) for 10.5R tires.

*2: SE model

Wheels & Tires

	Body	Grade	Road wheel/offset mm (in)	Tire
4x2	Regular and King Cab	E	5-Jx14/40 (1.57) 6-JJx14/30 (1.18)*	P195/75R14
		SE	6-JJx14/30 (1.18) 6-JJx14 Aluminum/30 (1.18)*	P215/75R14
	Heavy duty	E	5-Jx14/40 (1.57)	LT195/75R14
4x4	Regular, King Cab and Pathfinder	E	5-1/2-Kx15/40 (1.57) 6-JJx15/30 (1.18)*	P215/75R15
		XE	5-1/2-Kx15/40 (1.57)	P215/75R15 P235/75R15*
		SE	6-JJx15/30 (1.18) 7-JJx15 Aluminum/25 (0.98)*	P235/75R15 31x10.5R15*

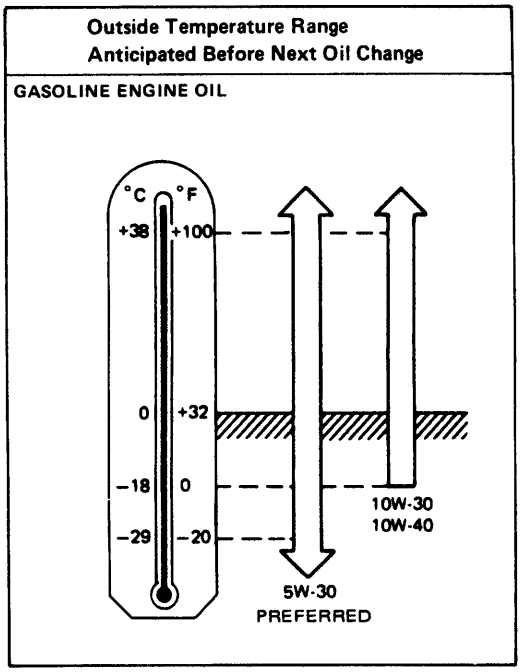
*: Option

Fuel and Lubricants

			Capacity (Approximate) US measure	Capacity (Approximate) Imp measure	Capacity (Approximate) Liter	Recommended Fuel/Lubricants
Fuel			15-7/8 gal 21-1/8 gal*1	13-1/4 gal 17-5/8 gal*1	60 80*1	Unleaded gasoline with an octane rating of at least 87 AKI (RON 91)
Engine oil (Refill)						
VG30E	2WD	With oil filter	4-1/4 qt	3-1/2 qt	4.0	Energy Conserving Oils*3 of API SG
		Without oil filter	3-7/8 qt	3-1/8 qt	3.6	
VG30E	4WD	With oil filter	3-5/8 qt	3 qt	3.4	
		Without oil filter	3-1/8 qt	2-5/8 qt	3.0	
KA24E	2WD	With oil filter	4-1/8 qt	3-3/8 qt	3.9	
		Without oil filter	3-3/4 qt	3-1/8 qt	3.5	
KA24E	4WD	With oil filter	3-1/2 qt	2-7/8 qt	3.3	
		Without oil filter	3-1/8 qt	2-1/2 qt	2.9	
Cooling system (With heater)						
	VG30E	2WD	11-3/8 qt	9-3/8 qt	10.7	Anti-freeze coolant (Ethylene glycol base)
		4WD	12-3/8 qt	10-1/4 qt	11.7	
	KA24E	2WD	8-5/8 qt	7-1/8 qt	8.1	
		4WD	9-1/2 qt	7-7/8 qt	9.0	
Manual transmission gear oil	FS5W71C	2WD	4-1/4 pt	3-1/2 pt	2.0	API GL-4*2
		4WD	8-1/2 pt	7 pt	4.0	
	FS5R30A	2WD	5-1/8 pt	4-1/4 pt	2.4	
		4WD	7-5/8 pt	6-3/8 pt	3.6	
Transfer gear oil			2-3/8 qt	2 qt	2.2	Type DEXRON™
Manual steering gear oil			3/4 pt	5/8 pt	0.33	API GL-4*2
Differential carrier gear oil						
Rear:	H190A		3-1/8 pt	2-5/8 pt	1.5	Standard differential gear: API GL-5*2 Limited-slip differential (L.S.D.) gear: Use only LSD gear oil API GL-5 and SAE 80W-90*5 approved for Nissan LSD*6.
	C200		2-3/4 pt	2-1/4 pt	1.3	
	H233B		5-7/8 pt	4-7/8 pt	2.8	
Front (4WD):	R180A		2-3/4 pt	2-1/4 pt	1.3	
	R200A		3-1/8 pt	2-5/8 pt	1.5	
Automatic transmission fluid	2WD		8-3/8 qt	7 qt	7.9	Genuine Nissan ATF*4 or equivalent Type DEXRON™
	4WD		9 qt	7-1/2 qt	8.5	
Power steering fluid			2-1/8 pt	1-3/4 pt	1.0	Type DEXRON™
Brake and clutch fluid			–	–	–	Genuine Nissan Brake Fluid*4 or equivalent DOT 3 (US FMVSS No. 116)
Multi-purpose grease			–	–	–	NLGI No. 2 (Lithium soap base)
Free-running hub grease (Auto-lock)			–	–	–	Genuine Nissan grease or equivalent

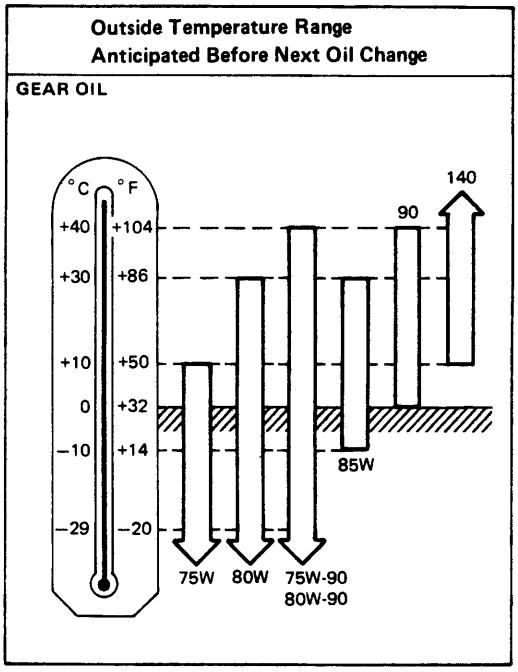
*1: VG30E engine models except 2WD Truck SE models.
*2: For further details, see the recommended SAE viscosity number chart.
*3: These oils can be identified by such labels as EC-I, EC-II, energy conserving, energy saving, improved fuel economy, etc.
*4: Available in mainland U.S.A. through your Nissan dealer.
*5: SAE 90 is acceptable in ambient temperatures above −18°C (0°F).
*6: Contact a Nissan dealer for a list of approved oils.

SAE Viscosity Number



TI0008

5W-30 is preferable for all ambient temperatures. 20W-40 and 20W-50 are usable if the ambient temperature is above 10°C (50°F) for all seasons.



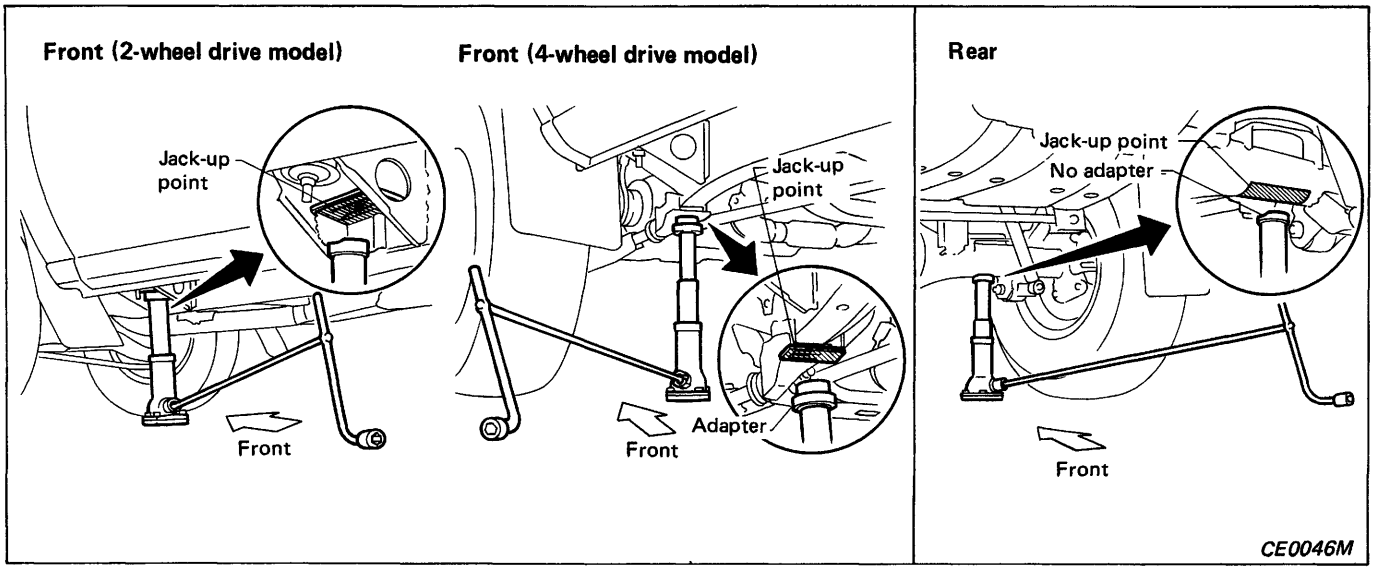
TI0003

75W-90 for transmission, and 80W-90 for differential are preferable if the ambient temperature is below 40°C (104°F).

WARNING:

a. Never get under the vehicle while it is supported only by the jack. Always use safety stands to support the frame when you have to get under the vehicle.
b. Place wheel chocks at both front and back of the wheel which is diagonally opposite the jack position.
Example: If the jack is positioned at the L.H. front wheel, place wheel chocks at R.H. rear wheel.

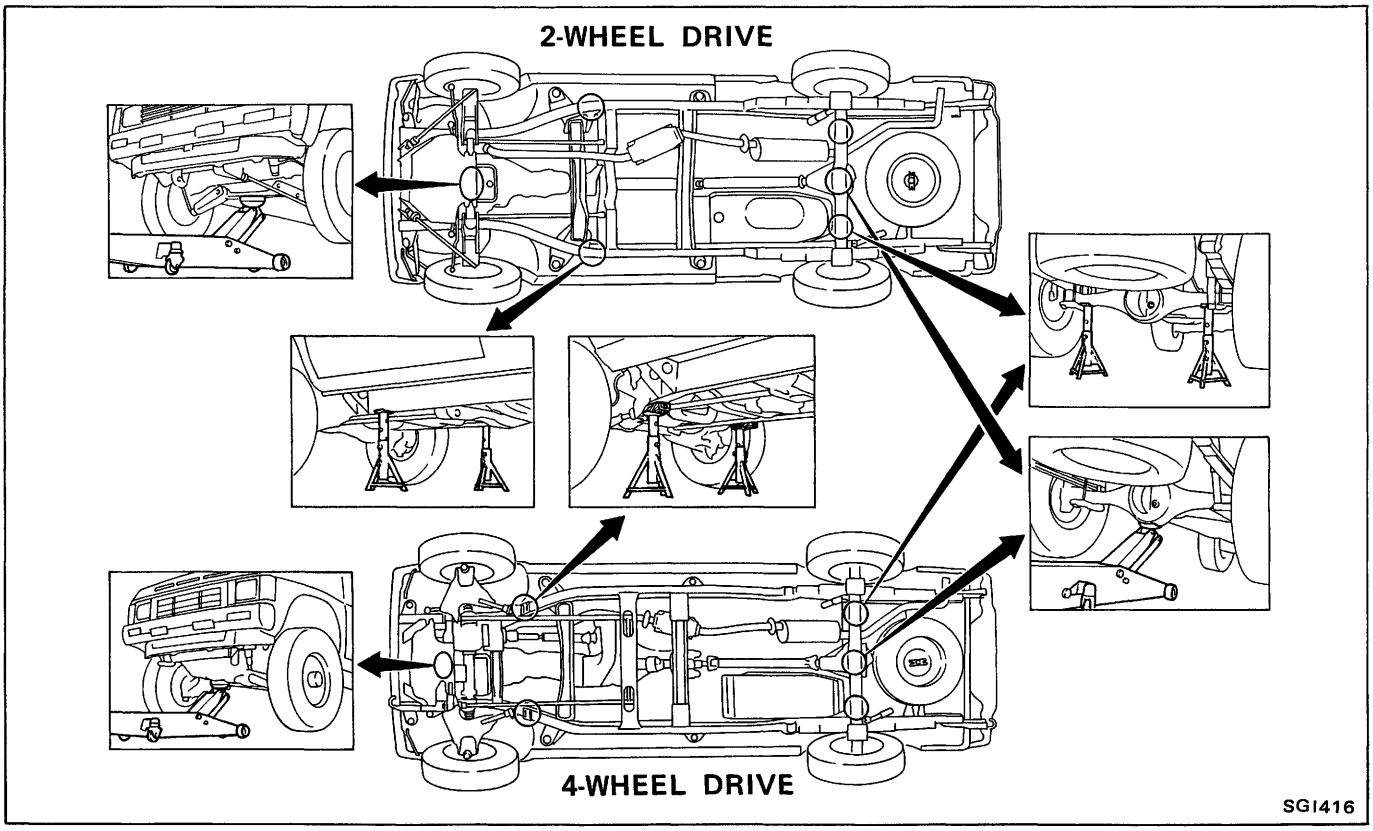
Screw Jack



Garage Jack and Safety Stand

CAUTION:

- Place a wooden or rubber block between safety stand and vehicle body when the supporting body is flat.

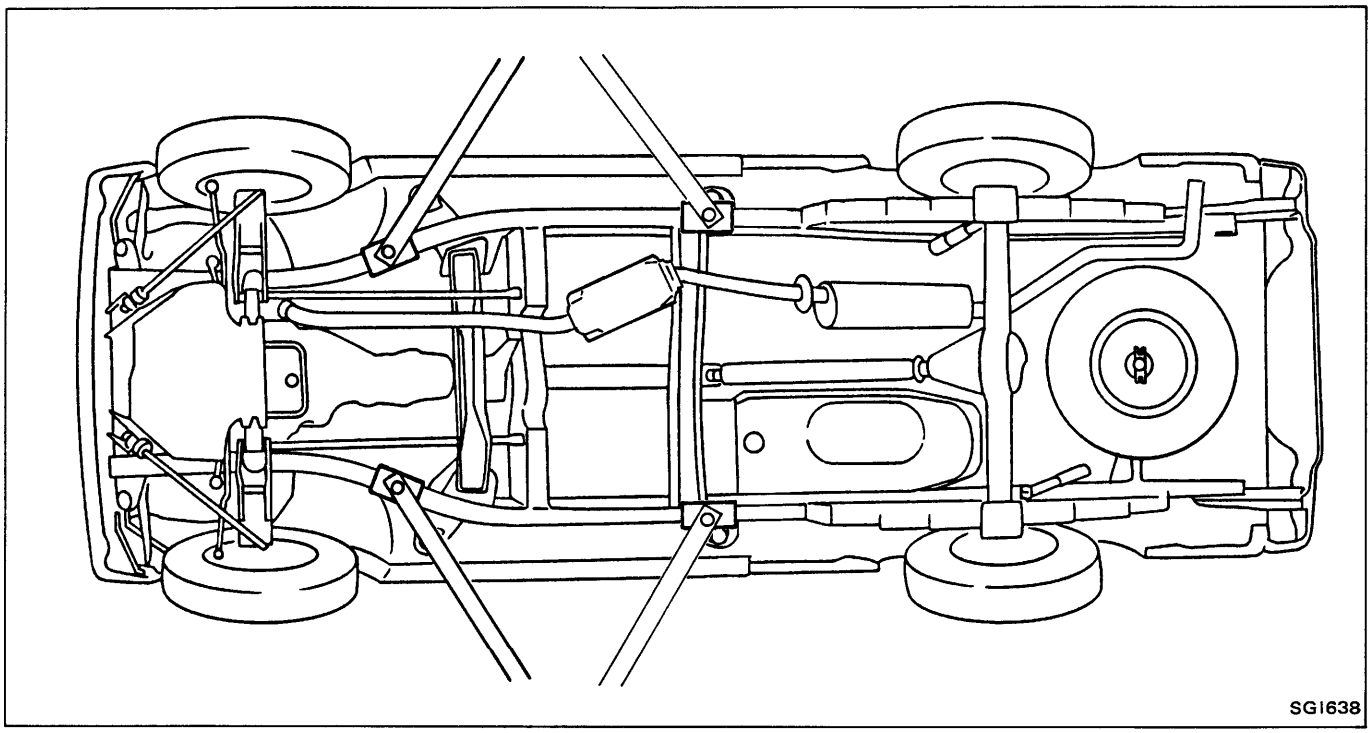


2-pole Lift

WARNING:

When lifting the vehicle, open the lift arms as wide as possible and ensure that the front and rear of the vehicle are well balanced.

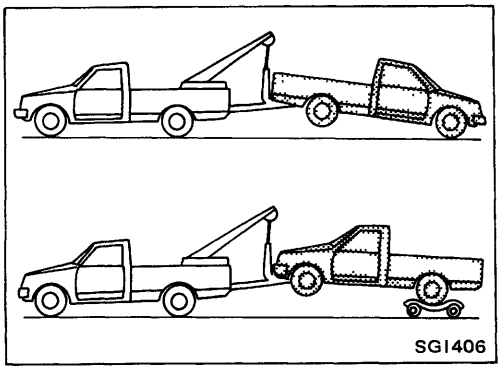
When setting the lift arm, do not allow the arm to contact the brake tubes and fuel lines.



Tow Truck Towing

CAUTION:

- All applicable state or Provincial (in Canada) laws and local laws regarding the towing operation must be obeyed.
- It is necessary to use proper towing equipment to avoid possible damage to the vehicle during towing operation. Towing is in accordance with Towing Procedure Manual at dealer.
- Attach safety chains for all towing.
- When towing, make sure that the transmission, steering system and power train are in good order. If any unit is damaged, a dolly must be used.
- When towing with the front wheels on the ground: Turn the ignition key to the "OFF" position and secure the steering wheel in a straightahead position with a rope or similar device. Never place the ignition key in the "LOCK" position. This will result in damage to the steering lock mechanism.
- When towing with the rear wheels on the ground, release the parking brake and move the gearshift lever to neutral ("N" position).
- Never tow vehicle from the rear (i.e., backward) with four wheels on the ground as this may cause serious and expensive damage to the transmission.
- For 4-wheel drive model: Set the free-running hubs to the free position and move both the gearshift and transfer levers to neutral ("N" position).


SGI406

2-WHEEL DRIVE MODELS

NISSAN recommends that vehicle be towed with the driving (rear) wheels off the ground as illustrated.

Towing with four wheels on ground or towing with front wheels raised (With rear wheels on ground)

Observe the following restricted towing speeds and distances.

Automatic transmission model:

Speed

Below 50 km/h (30 MPH)

Distance

Less than 65 km (40 miles)

Tow Truck Towing (Cont'd)

Manual transmission model with KA24E engine:

Speed

Below 95 km/h (60 MPH)

Distance

Less than 800 km (500 miles)

Manual transmission model with VG30E engine:

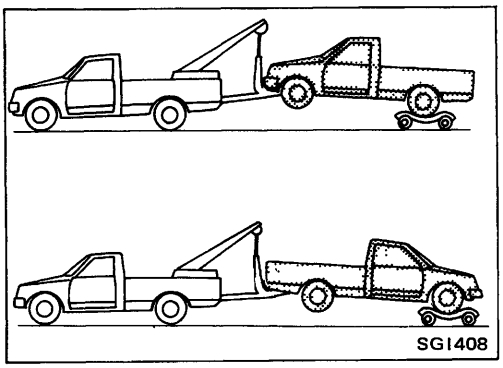
Speed

Below 95 km/h (60 MPH)

Distance

Less than 320 km (200 miles)

If the speed or distance must necessarily be greater, remove the propeller shaft beforehand to prevent damage to the transmission.



4-WHEEL DRIVE MODELS

NISSAN recommends that a dolly be used as illustrated when towing 4-wheel drive models.

Towing with four wheels on ground or towing with front or rear wheels raised

Observe the following restricted towing speeds and distances.

Automatic transmission model:

Speed

Below 50 km/h (30 MPH)

Distance

Less than 65 km (40 miles)

Manual transmission model:

Speed

Below 95 km/h (60 MPH)

Distance

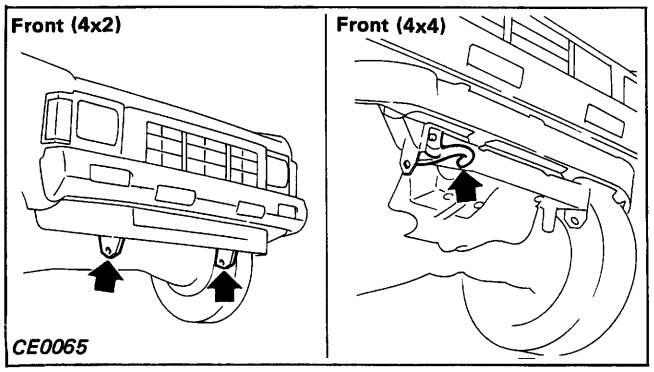
Less than 800 km (500 miles)

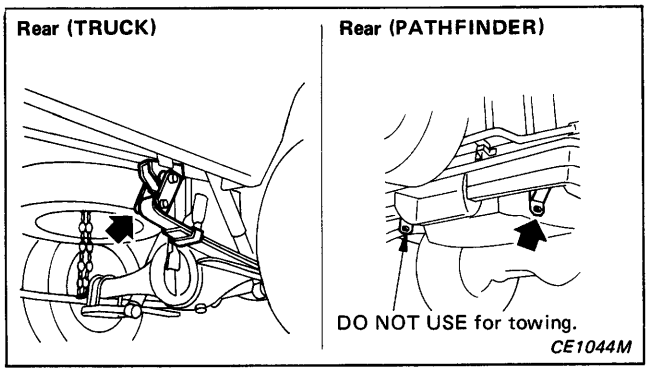
If the speed or distance must necessarily be greater, remove the front and rear propeller shafts beforehand to prevent damage to the transmission.

Tow Truck Towing (Cont'd)

TOWING POINT

- Never tow the vehicle using only the towing hooks. Use proper towing equipment when towing. Otherwise, the vehicle body will be damaged.
- Always pull the cable straight out from the vehicle. Never pull on the hook at a sideways angle.





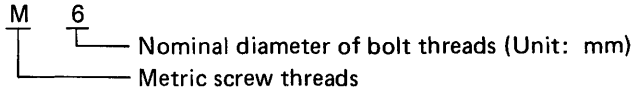
TIGHTENING TORQUE OF STANDARD BOLTS

Grade	Bolt size	Bolt diameter* mm	Pitch mm	Tightening torque (Without lubricant)					
				Hexagon head bolt			Hexagon flange bolt		
				N·m	kg-m	ft-lb	N·m	kg-m	ft-lb
4T	M6	6.0	1.0	5.1	0.52	3.8	6.1	0.62	4.5
	M8	8.0	1.25	13	1.3	9	15	1.5	11
			1.0	13	1.3	9	16	1.6	12
	M10	10.0	1.5	25	2.5	18	29	3.0	22
			1.25	25	2.6	19	30	3.1	22
	M12	12.0	1.75	42	4.3	31	51	5.2	38
			1.25	46	4.7	34	56	5.7	41
	M14	14.0	1.5	74	7.5	54	88	9.0	65
7T	M6	6.0	1.0	8.4	0.86	6.2	10	1.0	7
	M8	8.0	1.25	21	2.1	15	25	2.5	18
			1.0	22	2.2	16	26	2.7	20
	M10	10.0	1.5	41	4.2	30	48	4.9	35
			1.25	43	4.4	32	51	5.2	38
	M12	12.0	1.75	71	7.2	52	84	8.6	62
			1.25	77	7.9	57	92	9.4	68
	M14	14.0	1.5	127	13.0	94	147	15.0	108
9T	M6	6.0	1.0	12	1.2	9	15	1.5	11
	M8	8.0	1.25	29	3.0	22	35	3.6	26
			1.0	31	3.2	23	37	3.8	27
	M10	10.0	1.5	59	6.0	43	70	7.1	51
			1.25	62	6.3	46	74	7.5	54
	M12	12.0	1.75	98	10.0	72	118	12.0	87
			1.25	108	11.0	80	137	14.0	101
	M14	14.0	1.5	177	18.0	130	206	21.0	152

1. **Special parts are excluded.**
2. **This standard is applicable to bolts having the following marks embossed on the bolt head.**

Grade	Mark
4T	4
7T	7
9T	9

*: Nominal diameter



MAINTENANCE

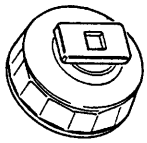
SECTION MA

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PERIODIC MAINTENANCE ..... MA- 3
GENERAL MAINTENANCE ..... MA- 6
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CHASSIS AND BODY MAINTENANCE MA-21
SERVICE DATA AND SPECIFICATIONS (S.D.S.) MA-48

SPECIAL SERVICE TOOL

For engine maintenance

Tool number (Kent-Moore No.) Tool name	Description	Engine Application	
		VG30E	KA24E
KV10105900 (J34274) Oil filter cap wrench	 Removing oil filter	X	–

Two different maintenance schedules are provided, and should be used, depending upon the conditions in which the vehicle is mainly operated. **After 60,000 miles (96,000 km) or 48 months, continue the periodic maintenance at the same mileage/time intervals.**

SCHEDULE 1

Follow Periodic Maintenance Schedule 1 if your driving habits frequently includes one or more of the following driving conditions:

- Repeated short trips of less than 5 miles (8 km).
- Repeated short trips of less than 10 miles (16 km) with outside temperatures remaining below freezing.
- Operating in hot weather in stop-and-go "rush hour" traffic.
- Extensive idling and/or low speed driving for long distances, such as police, taxi or door-to-door delivery use.
- Driving in dusty conditions.
- Driving on rough, muddy, or salt spread roads.
- Towing a trailer, using a camper or a car-top carrier.

SCHEDULE 2

Follow Periodic Maintenance Schedule 2 if none of the driving conditions shown in Schedule 1 apply to your driving habits.

Maintenance for off-road driving (4x4 only)

Whenever you drive off-road through sand, mud or water, more frequent maintenance may be required of the following items:

- ▲ Brake pads and discs
- ▲ Brake lining and drums
- ▲ Brake lines and hoses
- ▲ Wheel bearing grease and free-running hub grease
- ▲ Differential, transaxle and transfer oil
- ▲ Steering linkage
- ▲ Propeller shaft and drive shafts
- ▲ Air cleaner filter
- ▲ Clutch housing (Check water entry. Refer to MA-22.)

Abbreviations: R = Replace I = Inspect. Correct or replace if necessary. [ ]: At the mileage intervals only

MAINTENANCE OPERATION		MAINTENANCE INTERVAL																Reference page	
Perform at number of miles, kilometers or months, whichever comes first.	Miles x 1,000	3.75	7.5	11.25	15	18.75	22.5	26.25	30	33.75	37.5	41.25	45	48.75	52.5	56.25	60		
	(km x 1,000)	(6)	(12)	(18)	(24)	(30)	(36)	(42)	(48)	(54)	(60)	(66)	(72)	(78)	(84)	(90)	(96)		
	Months	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48		
Emission control system maintenance																		KA24E	VG30E
Drive belts									I*								I*	MA-15	MA-8
Air cleaner filter	See NOTE (1)								[R]								[R]	MA-17	MA-11
Positive crankcase ventilation (P.C.V.) filter (KA24E engine only)	See NOTE (3)								[R]								[R]	MA-20	–
Air induction valve filter (KA24E engine only)	See NOTE (2)																	MA-20	–
Vapor lines									I*								I*	MA-19	MA-14
Fuel lines									I*								I*	MA-16	MA-10
Fuel filter	See NOTE (3)*																	MA-17	MA-11
Engine coolant									R*								R*	MA-15	MA-9
Engine oil		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MA-18	MA-11
Engine oil filter (Use Nissan PREMIUM type or equivalent.)		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	MA-18	MA-12
Spark plugs									[R]								[R]	MA-19	MA-13
Timing belt (VG30E engine only)																	[R]	–	EM-13
Chassis and body maintenance																			
Brake lines & cables					I				I				I				I	MA-37	
Brake pads, discs, drums & linings			I		I		I		I		I		I		I		I	MA-37, 38	
Manual and automatic transmission, transfer & differential gear oil (exc. L.S.D.)	See NOTE (4)				I				I				I				I	MA-22, 24, 25	
Limited-slip differential (L.S.D.) gear oil	See NOTE (4)				I				R				I				R	MA-25	
Steering gear (box) & linkage, (steering damper 4x4), axle & suspension parts			I		I		I		I		I		I		I		I	MA-26, 36, 45	
Drive shaft boots & propeller shaft (4x4)			I		I		I		I		I		I		I		I	MA-25, 36	
Steering linkage ball joints & front suspension ball joints			I		I		I		I		I		I		I		I	MA-27, 45	
Front wheel bearing grease (4x2)									I								I	MA-27	
Front wheel bearing grease & free-running hub grease (4x4)	See NOTE (5)				I				R				I				R	MA-27, 35	
Exhaust system			I		I		I		I		I		I		I		I	MA-21	

NOTE: **(1) If operating mainly in dusty conditions, more frequent maintenance may be required.**

(2) If operating mainly in dusty conditions, replace every 30,000 miles (48,000 km).

(3) If vehicle is operated under extremely adverse weather conditions or in areas where ambient temperatures are either extremely low or extremely high, the filters might become clogged. In such an event, replace them immediately.

(4) If towing a trailer, using a camper or a car-top carrier, or driving on rough or muddy roads, change (not just inspect) oil at every 30,000 miles (48,000 km) or 24 months except for L.S.D. Change L.S.D. gear oil every 15,000 miles (24,000 km) or 12 months.

(5) If operating frequently in water, replace grease every 3,750 miles (6,000 km) or 3 months.

(6) Maintenance items and intervals with "*" are recommended by NISSAN for reliable vehicle operation. The owner need not perform such maintenance in order to maintain the emission warranty or manufacturer recall liability. Other maintenance items and intervals are required.

Abbreviations: R = Replace I = Inspect. Correct or replace if necessary. [ ]: At the mileage intervals only

MAINTENANCE OPERATION Perform at number of miles, kilometers or months, whichever comes first.		MAINTENANCE INTERVAL								Reference page	
	Miles x 1,000	7.5	15	22.5	30	37.5	45	52.5	60		
	(km x 1,000)	(12)	(24)	(36)	(48)	(60)	(72)	(84)	(96)		
	Months	6	12	18	24	30	36	42	48		
Emission control system maintenance										KA24E	VG30E
Drive belts					I*				I*	MA-15	MA-8
Air cleaner filter					[R]				[R]	MA-17	MA-11
Positive crankcase ventilation (P.C.V.) filter (KA24E engine only)	See NOTE (1)				[R]				[R]	MA-20	–
Vapor lines					I*				I*	MA-19	MA-14
Fuel lines					I*				I*	MA-16	MA-10
Fuel filter	See NOTE (1)*									MA-17	MA-11
Engine coolant					R*				R*	MA-15	MA-9
Engine oil		R	R	R	R	R	R	R	R	MA-18	MA-11
Engine oil filter (Use Nissan PREMIUM type or equivalent.)		R		R		R		R		MA-18	MA-12
Spark plugs					[R]				[R]	MA-19	MA-13
Timing belt (VG30E engine only)									[R]	–	EM-13
Chassis and body maintenance											
Brake lines & cables			I		I		I		I	MA-37	
Brake pads, discs, drums & linings			I		I		I		I	MA-37, 38	
Manual and automatic transmission, transfer & differential gear oil (exc. L.S.D.)			I		I		I		I	MA-22, 24, 25	
Limited-slip differential (L.S.D.) gear oil			I		R		I		R	MA-25	
Steering gear (box) & linkage, (steering damper 4X4), axle & suspension parts					I				I	MA-26, 36, 45	
Drive shaft boots (4X4)			I		I		I		I	MA-36	
Steering linkage ball joints & ftont suspension ball joints									I	MA-27, 45	
Front wheel bearing grease (4x2)					I				I	MA-27	
Front wheel bearing grease & free-running hub grease (4X4)			I		R		I		R	MA-27	
Exhaust system			I		I		I		I	MA-21	

NOTE: (1) If vehicle is operated under extremely adverse weather conditions or in areas where ambient temperatures are either extremely low or extremely high, the filters might become clogged. In such an event, replace them immediately.

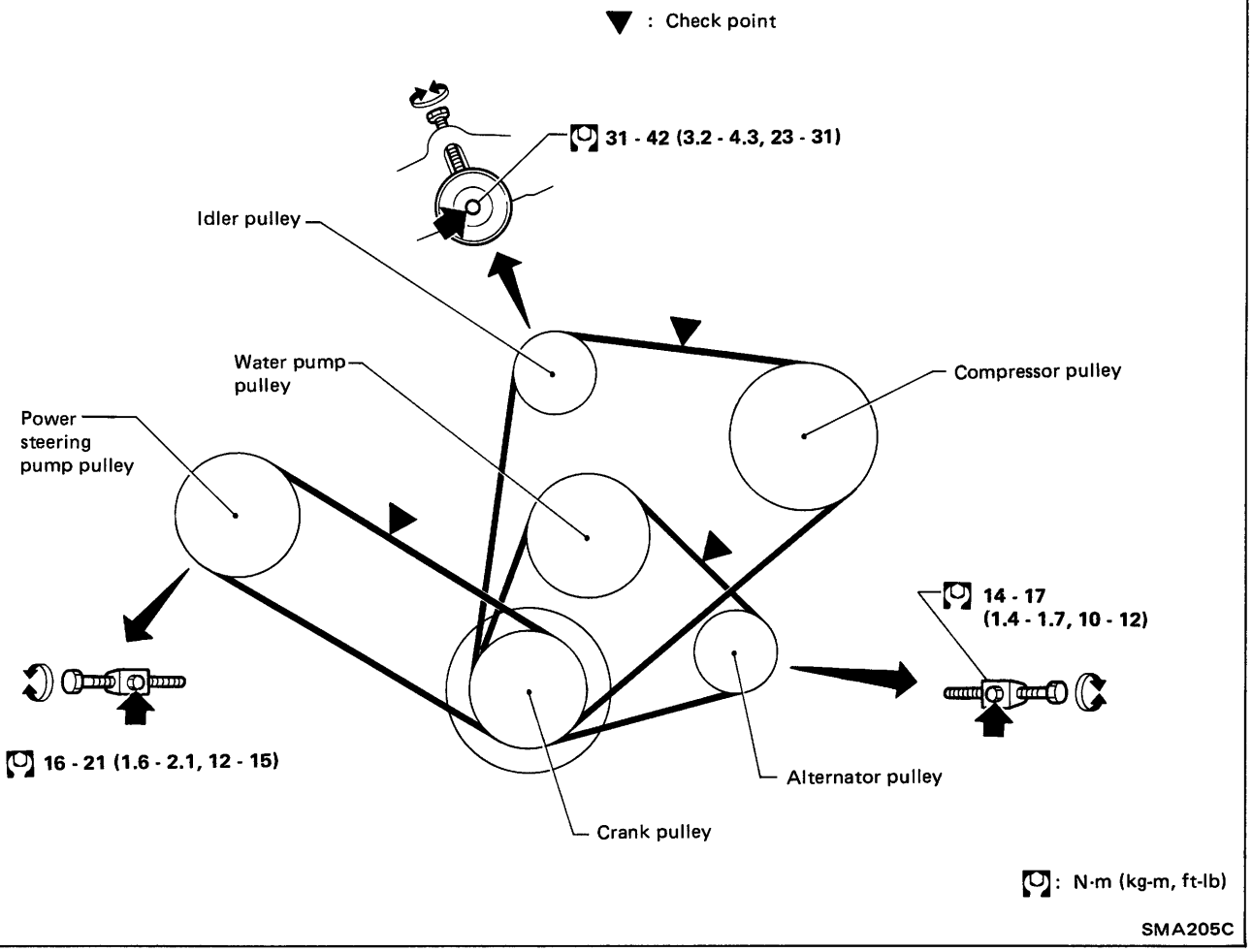
(2) Maintenance items and intervals with "*" are recommended by NISSAN for reliable vehicle operation. The owner need not perform such maintenance in order to maintain the emission warranty or manufacturer recall liability. Other maintenance items and intervals are required.

General maintenance includes those items which should be checked during the normal day-to-day operation of the vehicle. They are essential if the vehicle is to continue operating properly. The owners can perform the checks and inspections themselves or they can have their NISSAN dealers do them for a nominal charge.

Item	Reference page
OUTSIDE THE VEHICLE The maintenance items listed here should be performed from time to time, unless otherwise specified.	
Tires Check the pressure with a gauge periodically when at a service station, including the spare, and adjust to the specified pressure if necessary. Check carefully for damage, cuts or excessive wear.	–
Wheel nuts When checking the tires, make sure no nuts are missing, and check for any loose nuts. Tighten if necessary.	–
Tire rotation Tires should be rotated every 12,000 km (7,500 miles.)	MA-43
Wheel alignment and balance If the vehicle should pull to either side while driving on a straight and level road, or if you detect uneven or abnormal tire wear, there may be a need for wheel alignment. If the steering wheel or seat vibrates at normal highway speeds, wheel balancing may be needed.	MA-30
Windshield wiper blades Check for cracks or wear if they do not wipe properly.	–
Doors and engine hood Check that all doors and the engine hood operate smoothly as well as the trunk lid and back hatch. Also ensure, that all latches lock securely. Lubicate hinges, latches, rollers and links if necessary. Make sure that the secondary latch keeps the hood from opening when the primary latch is released. When driving in areas using road salt or other corrosive materials, check lubrication frequently.	MA-46
INSIDE THE VEHICLE The maintenance items listed here should be checked on a regular basis, such as when performing periodic maintenance, cleaning the vehicle, etc.	
Lights Make sure that the headlights, stop lights, tail lights, turn signal lights, and other lights are all operating properly and installed securely. Also check headlight aim.	–
Warning lights and buzzers/chimes Make sure that all warning lights and buzzers/chimes are operating properly.	–
Windshield wiper and washer Check that the wipers and washer operate properly and that the wipers do not streak.	–
Windshield defroster Check that the air comes out of the defroster outlets properly and in sufficient quantity when operating the heater or air conditioner.	–
Steering wheel Check that it has the specified free play. Be sure to check for changes in the steering condition, such as excessive free play, hard steering or strange noises. **Free play: Less than 35 mm (1.38 in)**	–
Seats Check seat position controls such as seat adjusters, seatback recliner, etc. to ensure they operate smoothly and that all latches lock securely in every position. Check that the head restraints move up and down smoothly and that the locks (if so equipped) hold securely in all latched positions. Check that the latches lock securely for folding-down rear seatbacks.	–
Seat belts Check that all parts of the seat belt system (e.g. buckles, anchors, adjusters and retractors) operate properly and smoothly, and are installed securely. Check the belt webbing for cuts, fraying, wear or damage.	MA-47

Item	Reference page
Clutch pedal Make sure the pedal operates smoothly and check that it has the proper free travel.	MA-21
Brakes Check that the brake does not pull the vehicle to one side when applied.	–
Brake pedal Check the pedal for smooth operation and make sure it has the proper distance under it when depressed fully. Check the brake booster function.	MA-39
Parking brake Check that the lever has the proper travel and confirm that your vehicle is held securely on a fairly steep hill with only the parking brake applied.	MA-39
Automatic transmission "Park" mechanism Check that the lock release button on the selector lever operates properly and smoothly. On a fairly steep hill check that your vehicle is held securely with the selector lever in the "P" position without applying any brakes.	–
UNDER THE HOOD AND VEHICLE The maintenance items listed here should be checked periodically (e.g. each time you check the engine oil or refuel).	
Windshield washer fluid Check that there is adequate fluid in the tank.	–
Engine coolant level Check the coolant level when the engine is cold.	MA-10, 16
Radiator and hoses Check the front of the radiator and clean off any dirt, insects, leaves, etc., that may have accumulated. Make sure the hoses have no cracks, deformation, rot or loose connections.	–
Brake and clutch fluid levels Make sure that the brake and clutch fluid levels are between the "MAX" and "MIN" lines on the reservoir.	MA-36
Battery Check the fluid level in each cell. It should be between the "MAX" and "MIN" lines.	–
Engine drive belts Make sure that no belt is frayed, worn, cracked or oily.	MA-8, 15
Engine oil level Check the level on the dipstick after parking the vehicle on a level spot and turning off the engine.	MA-12, 18
Power steering fluid level and lines Check the level when the fluid is cold and the engine is turned off. Check the lines for proper attachment, leaks, cracks, etc.	MA-45
Automatic transmission fluid level Check the level on the dipstick after putting the selector lever in "P" with the engine idling.	MA-22
Exhaust system Make sure there are no loose supports, cracks or holes. If the sound of the exhaust seems unusual or there is a smell of exhaust fumes, immediately locate the trouble and correct it.	MA-21
Underbody The underbody is frequently exposed to corrosive substances such as those used on icy roads or to control dust. It is very important to remove these substances, otherwise rust will form on the floor pan, frame, fuel lines and around the exhaust system. At the end of winter, the underbody should be thoroughly flushed with plain water, being careful to clean those areas where mud and dirt can easily accumulate.	–
Fluid leaks Check under the vehicle for fuel, oil, water or other fluid leaks after the vehicle has been parked for a while. Water dripping from the air conditioner after use is normal. If you should notice any leaks or gasoline fumes are evident, check for the cause and correct it immediately.	–

Checking Drive Belts



1. Inspect for cracks, fraying, wear or oil adhesion. If necessary, replace with a new one.
2. Inspect drive belt deflection by pushing on the belt midway between pulleys.

Adjust if belt deflection exceed the limit.

Belt deflection:

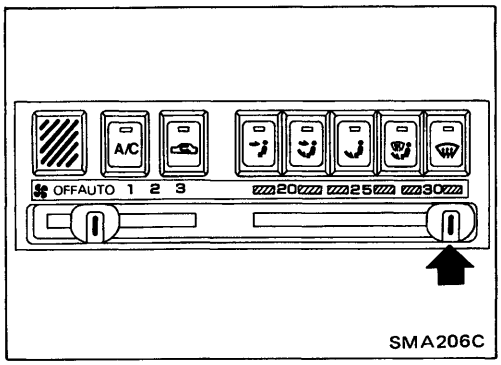
Unit: mm (in)

	Used belt deflection		Deflection of new belt
	Limit	Deflection after adjustment	
Alternator	12 (0.47)	6 - 8 (0.24 - 0.31)	5 - 7 (0.20 - 0.28)
Air conditioner compressor	16 (0.63)	9 - 11 (0.35 - 0.43)	7 - 9 (0.28 - 0.35)
Power steering oil pump	17 (0.67)	11 - 13 (0.43 - 0.51)	9 - 11 (0.35 - 0.43)
Applied pushing force	98 N (10 kg, 22 lb)		

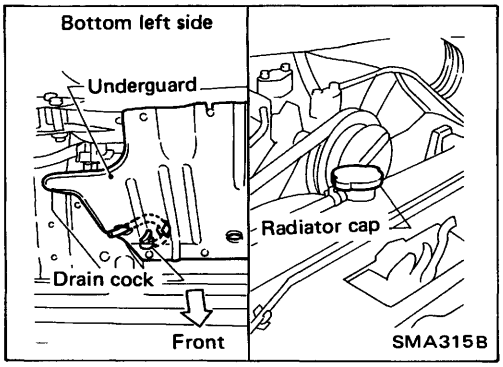
Inspect drive belt deflection when engine is cold.

Changing Engine Coolant

WARNING:
To avoid being scalded, never change the coolant when the engine is hot.

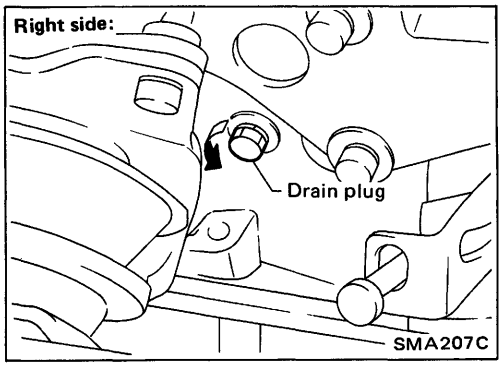


1. Move heater "TEMP" control lever all the way to "HOT" position.



2. Open drain cock at the bottom of radiator, and remove radiator cap.

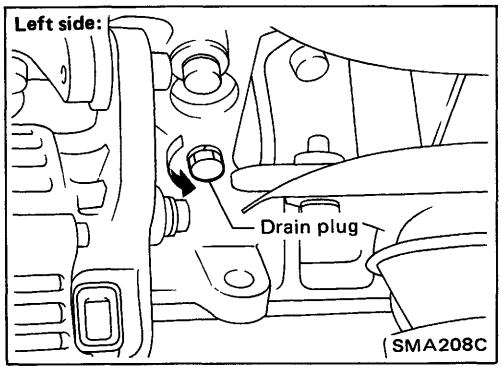
Be careful not to allow coolant to contact drive belts.



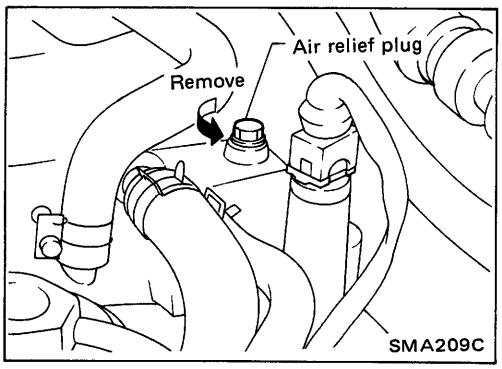
3. Remove drain plugs on both sides of cylinder block.
4. Close drain cock and tighten drain plugs securely.

: 34 - 44 N•m
(3.5 - 4.5 kg-m, 25 - 33 ft-lb)

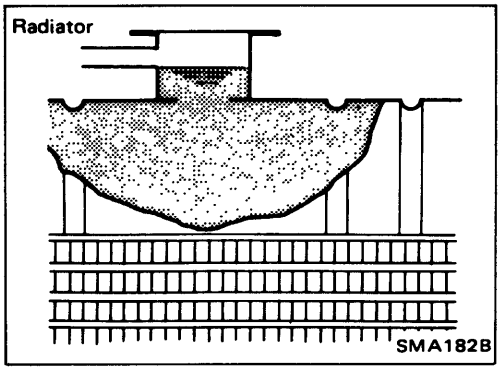
Apply sealant to the drain plug thread.



Changing Engine Coolant (Cont'd)



5. Open air relief plug.
6. Fill radiator with water and close air relief plug.
7. Start engine and warm it up sufficiently.
8. Stop engine and wait until it cools down.
9. Repeat step 3 through step 8 until clear water begins to drain from radiator.
10. Drain water.

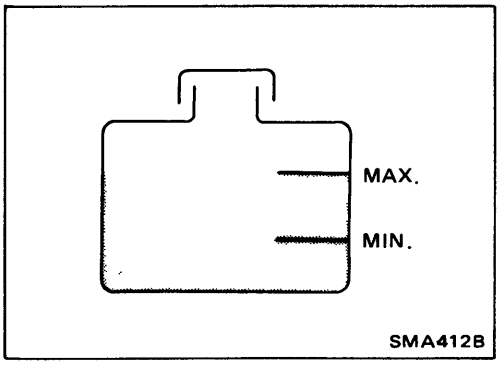


11. Open air relief plug again.
12. Fill radiator with coolant up to specified level.
    Follow instructions attached to anti-freeze container for mixing ratio of anti-freeze to water.

Unit: ℓ (US qt, Imp qt)

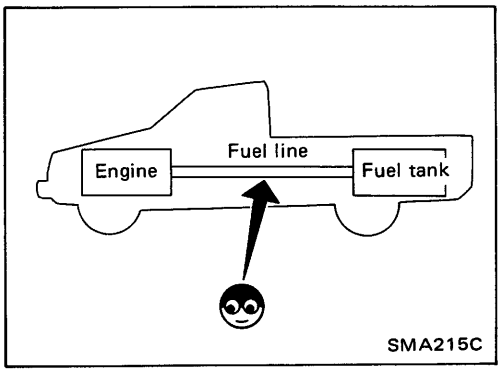
	Coolant capacity	
	2WD	4WD
Without reservoir tank	9.9 (10-1/2, 8-3/4)	10.9 (11-1/2, 9-5/8)
Reservoir tank	0.8 (7/8, 3/4)	

Pour coolant through coolant filler neck slowly to allow air in system to escape.

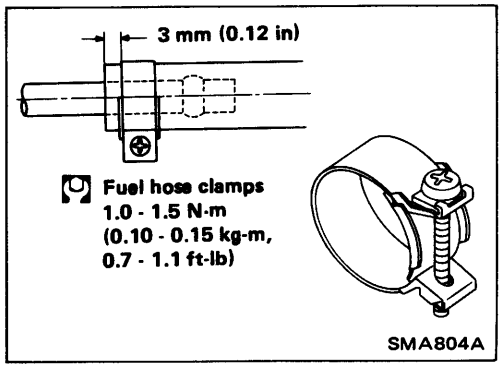


13. Remove reservoir tank, drain coolant, then clean reservoir tank.
14. Fill reservoir tank with coolant up to "MAX" level.
15. Close air relief plug again.
16. Run engine and warm it up.
17. Stop engine and cool it down, then add coolant as necessary.

Checking Fuel Lines



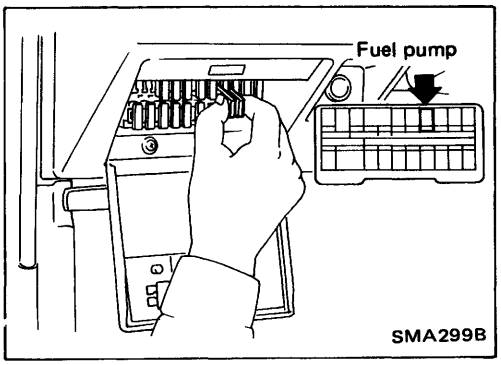
Inspect fuel lines and tank for improper attachment and for leaks, cracks, damage, loose connections, chafing and deterioration.
If necessary, repair or replace malfunctioning parts.



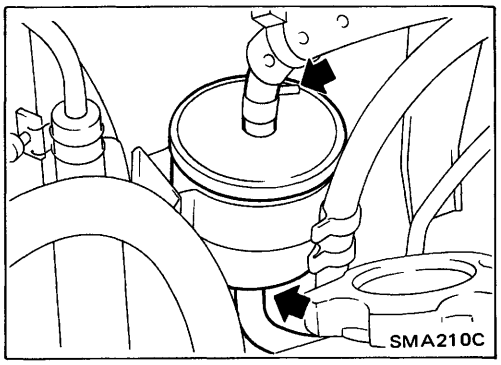
CAUTION:
Tighten high-pressure rubber hose clamp so that clamp end is 3 mm (0.12 in) from hose end.
Tightening torque specifications are the same for all rubber hose clamps.
Ensure that screw does not contact adjacent parts.

Changing Fuel Filter

WARNING:
Before removing fuel filter, release fuel pressure from fuel line to eliminate danger.



1. Remove fuse for fuel pump.
2. Start engine.
3. After engine stalls, crank engine two or three times to make sure that fuel pressure is released.
4. Turn ignition switch off and install fuse for fuel pump.

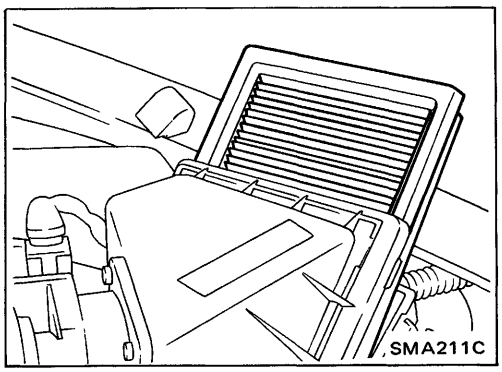


5. Loosen fuel hose clamps.
6. Replace fuel filter.

- **Be careful not to spill fuel over engine compartment. Place a shop towel to absorb fuel.**
- **Use a high-pressure type fuel filter. Do not use a synthetic resinous fuel filter.**
- **When tightening fuel hose clamps, refer to "Checking Fuel Lines".**

Changing Air Cleaner Filter

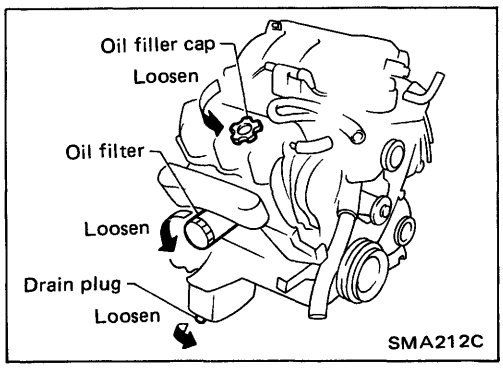
The viscous paper type filter does not need cleaning between renewals.



Changing Engine Oil

WARNING:
Be careful not to burn yourself, as the engine oil is hot.

1. Warm up engine, and check for oil leakage from engine components.
2. Remove drain plug and oil filler cap.



Changing Engine Oil (Cont'd)

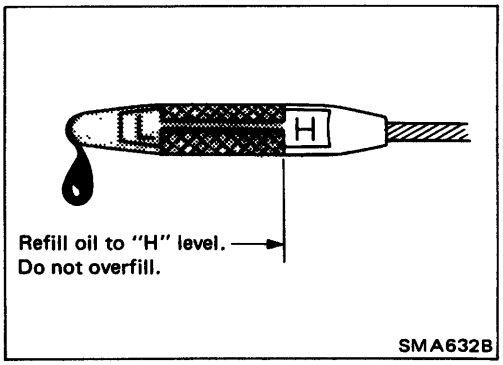
3. Drain oil and refill with new engine oil.

Oil capacity (Refill): Unit: ℓ (US qt, Imp qt)

	2WD	4WD
With oil filter change	4.0 (4-1/4, 3-1/2)	3.4 (3-5/8, 3)
Without oil filter change	3.6 (3-7/8, 3-1/8)	3.0 (3-1/8, 2-5/8)

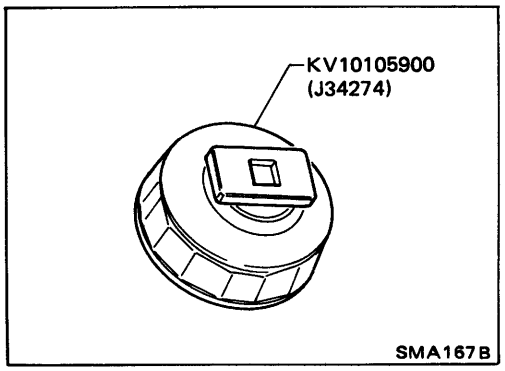
CAUTION:

- **Be sure to clean drain plug and install with new washer.**
  Oil pan drain plug:
  : 29 - 39 N·m
  (3.0 - 4.0 kg-m, 22 - 29 ft-lb)
- **Use recommended engine oil.**
- **The refill capacity changes depending on the oil temperature and drain time, use these values as a reference and be certain to check with the dipstick when changing the oil.**



4. Check oil level.
5. Start engine and check area around drain plug and oil filter for oil leakage.
6. Run engine for a few minutes, then turn it off. After several minutes, check oil level.

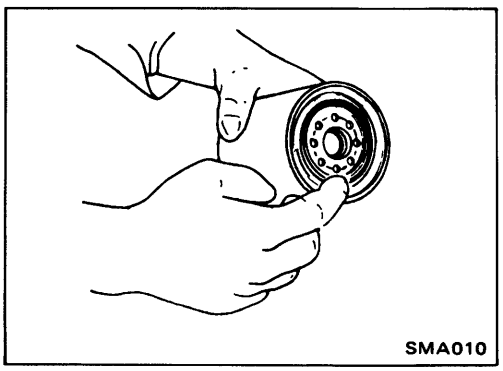
Changing Oil Filter



1. Remove oil filter with Tool.

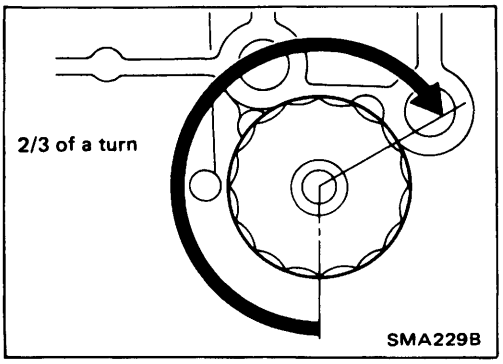
WARNING:

Be careful not to burn yourself, as the engine and engine oil are hot.



2. Before installing a new oil filter, clean the oil filter mounting surface on cylinder block, and coat the oil filter rubber seal with a little engine oil.

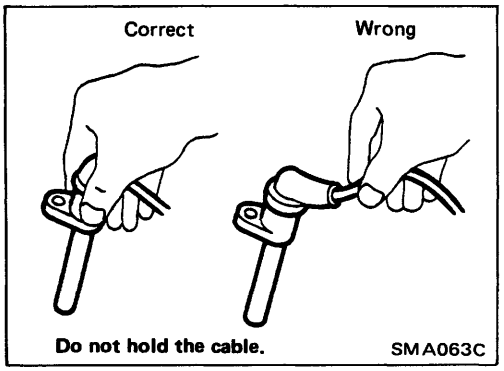
Changing Oil Filter (Cont'd)



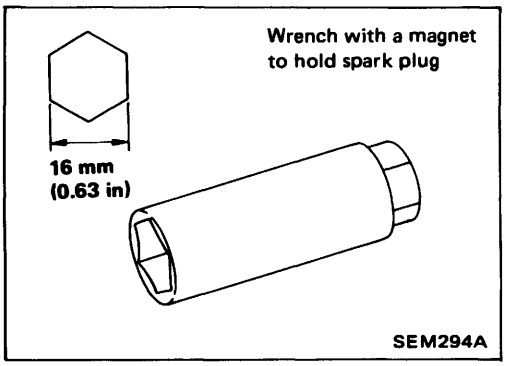
3. Screw in the oil filter until a slight resistance is felt, then tighten additionally more than 2/3 turn.
4. Add engine oil.

Refer to Changing Engine Oil.

Changing Spark Plugs



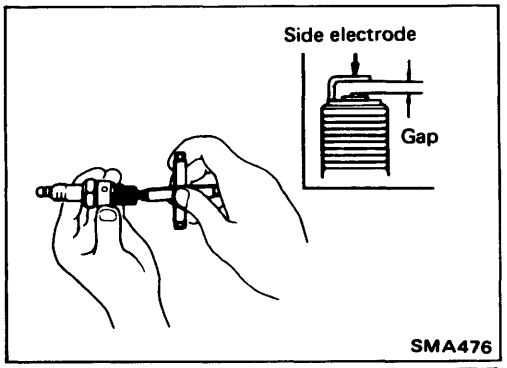
1. Disconnect ignition wires from spark plugs at boot. Do not pull on the wire.



2. Remove spark plugs with spark plug wrench.

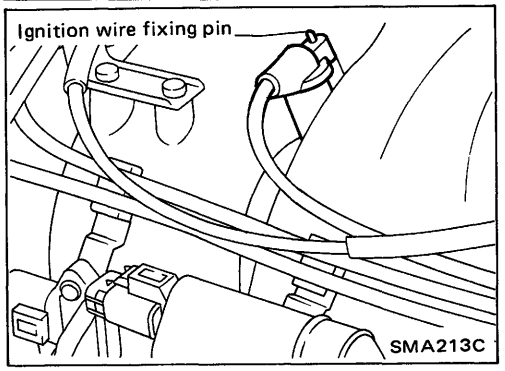
Spark plug:

Standard type	BKR6EY
Hot type	BKR5EY
Cold type	BKR7EY



3. Check spark plug gap of each new spark plug.

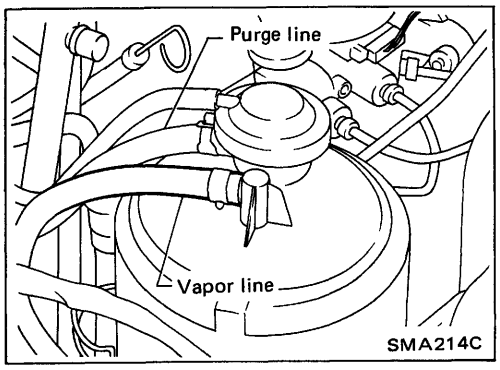
Gap:
0.8 - 0.9 mm (0.031 - 0.035 in)



4. Install spark plugs. Reconnect ignition wires according to Nos. indicated on them.

When installing spark plugs to No. 2 and 4 cylinders, securely fit each ignition wire mounting hole onto the ignition wire fixing pin.

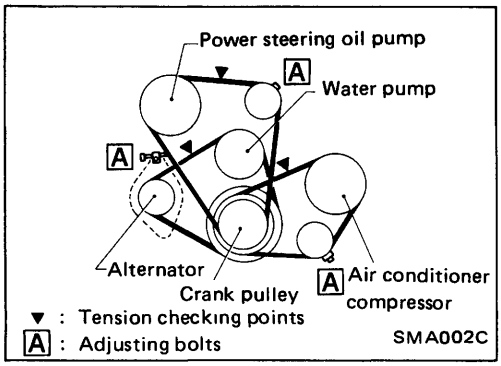
Spark plug:
[O]: 20 - 29 N·m
(2.0 - 3.0 kg-m, 14 - 22 ft-lb)



Checking Vapor Lines

1. Visually inspect vapor lines for improper attachment and for cracks, damage, loose connections, chafing and deterioration.
2. Inspect vacuum relief valve of fuel tank filler cap for clogging, sticking, etc.

Refer to "EVAPORATIVE EMISSION CONTROL SYSTEM" in EF & EC section.



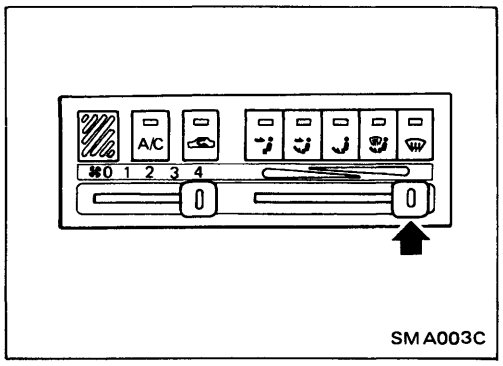
Checking Drive Belts

1. Inspect for cracks, fraying, wear or oil adhesion. If necessary, replace with a new one.
2. Inspect drive belt deflections by pushing on the belt midway between pulleys.

Adjust if belt deflections exceed the limit.
Belt deflection:
Inspect drive belt deflections when engine is cold.

Unit: mm (in)

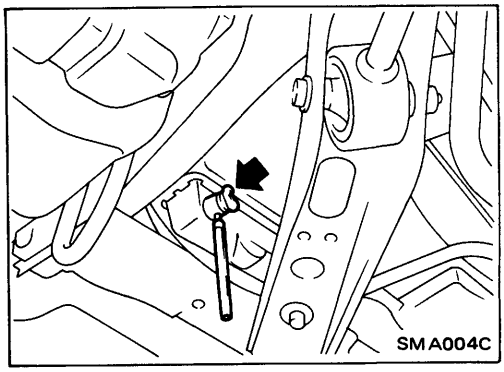
	Used belt deflection		Deflection of new belt
	Limit	Deflection after adjustment	
Alternator	17 (0.67)	10 - 12 (0.39 - 0.47)	8 - 10 (0.31 - 0.39)
Air conditioner compressor	16 (0.63)	10 - 12 (0.39 - 0.47)	8 - 10 (0.31 - 0.39)
Power steering oil pump	15 (0.59)	9 - 11 (0.35 - 0.43)	7 - 9 (0.28 - 0.35)
Applied pushing force	98 N (10 kg, 22 lb)		



Changing Engine Coolant

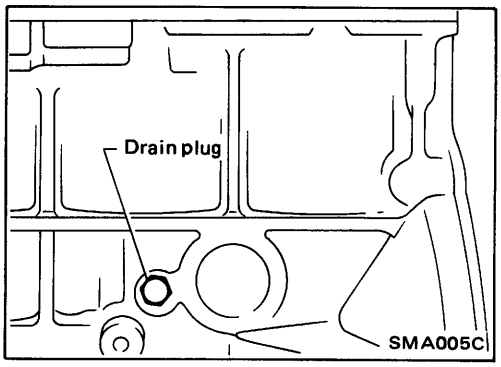
WARNING:
To avoid being scalded, never change the coolant when the engine is hot.

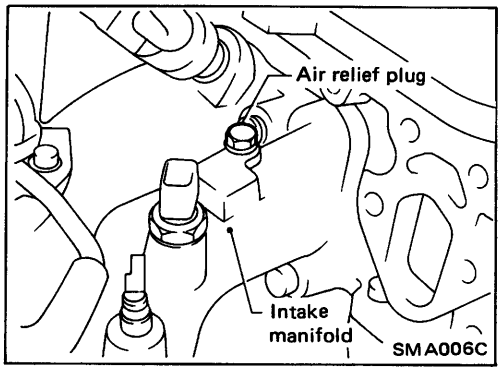
1. Move heater "TEMP" control lever all the way to "HOT" position.



2. Open drain cock at the bottom of radiator, and remove radiator cap.

Changing Engine Coolant (Cont'd)

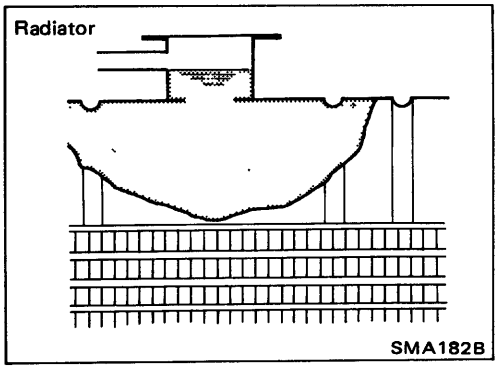




3. Remove cylinder block drain plug.
4. Close drain cock and tighten drain plug securely.
- **Apply sealant to the thread of drain plug.**

   : 34 - 44 N·m

   (3.5 - 4.5 kg-m, 25 - 33 ft-lb)
5. Open air relief plug.
6. Fill radiator with water and close air relief plug and radiator cap.
7. Run engine and warm it up sufficiently.
8. Race engine 2 or 3 times under no-load.
9. Stop engine and wait until it cools down.
10. Repeat step 2 through step 9 until clear water begins to drain from radiator.
11. Drain water.

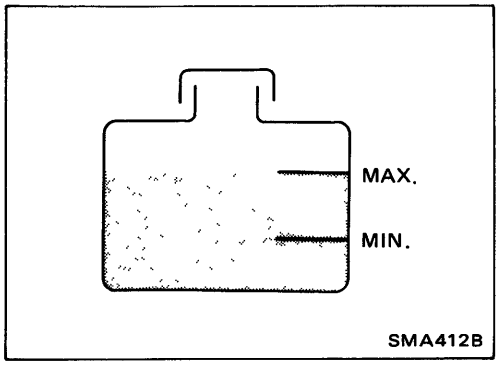


12. Open radiator cap and air relief plug.
13. Fill rafdiator with coolant up to specified level.
    Follow instructions attached to anti-freeze container for mixing ratio of anti-freeze to water.

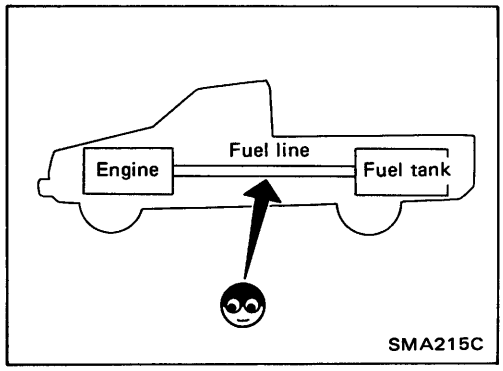
Unit: ℓ (US qt, Imp qt)

	Coolant capacity	
	2WD	4WD
Without reservoir tank	7.3 (7-3/4, 6-3/8)	8.2 (8-5/8, 7-1/4)
Reservoir tank	0.8 (7/8, 3/4)	

Pour coolant through coolant filler neck slowly to allow air in system to escape.



14. Close air relief plug.
15. Remove reservoir tank, drain coolant, then clean reservoir tank.
16. Install reservoir tank and fill it with coolant up to "MAX" level and then install radiator cap.
17. Run engine and warm it up sufficiently.
18. Race engine 2 or 3 times under no-load.
19. Stop engine and cool it down, then add coolant as necesary.

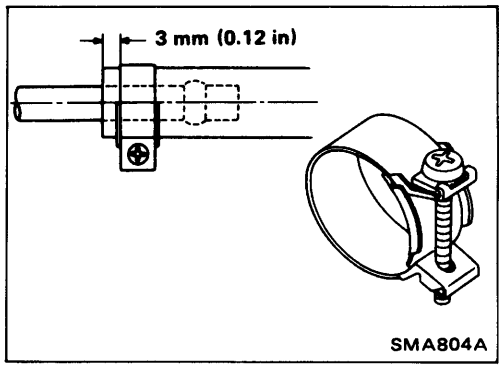


Checking Fuel Lines

Inspect fuel lines and tank for improper attachment and for leaks, cracks, damage, loose connections, chafing and deterioration.

If necessary, repair or replace faulty parts.

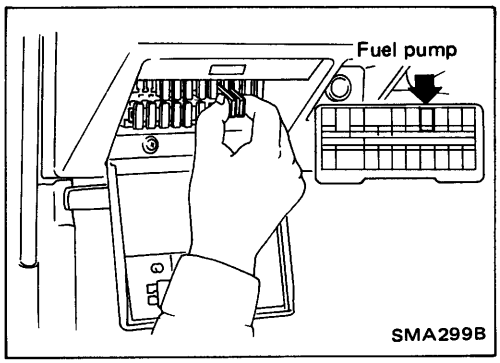
Checking Fuel Lines (Cont'd)



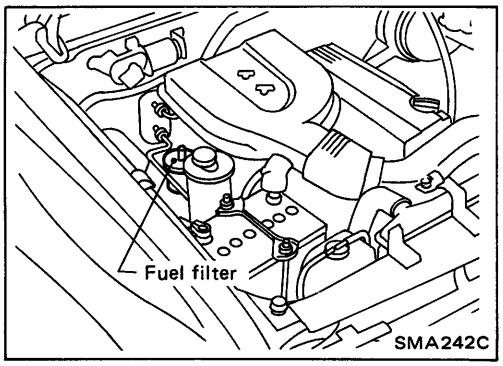
CAUTION:
Tighten high-pressure rubber hose clamp so that clamp end is 3 mm (0.12 in) from hose end.
Ensure that screw does not contact adjacent parts.

Changing Fuel Filter

WARNING:
Before removing fuel filter, release fuel pressure from fuel line.



1. Remove fuse for fuel pump.
2. Start engine.
3. After engine stalls, crank engine two or three times to make sure that fuel pressure is released.
4. Turn ignition switch off and install fuse for fuel pump.

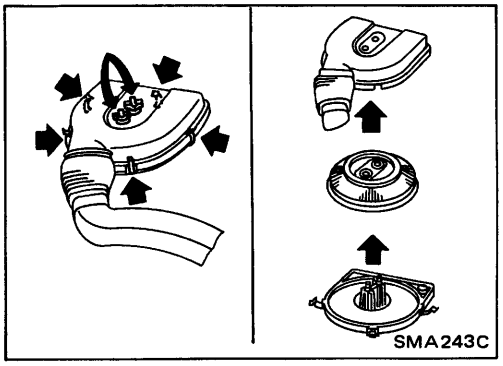


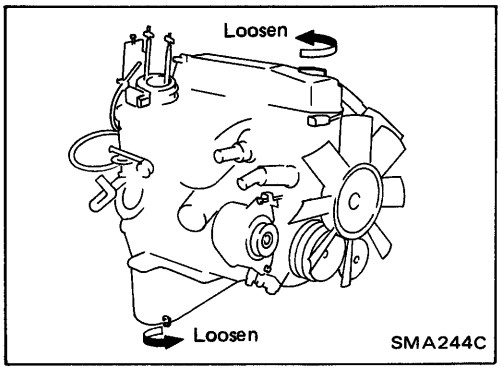
5. Loosen fuel hose clamps.
6. Replace fuel filter.

- **Be careful not to spill fuel over engine compartment. Place a shop towel to absorb fuel.**
- **Use a high-pressure type fuel filter. Do not use a synthetic resinous fuel filter.**
- **When tightening fuel hose clamps, refer to "Checking Fuel Lines".**

Changing Air Cleaner Filter

The viscous paper type filter does not need cleaning between renewals.





Changing Engine Oil

WARNING:
Be careful not to burn yourself, as the engine oil is hot.

1. Warm up engine, and check for oil leakage from engine components.
2. Remove drain plug and oil filler cap.
3. Drain oil and refill with new engine oil.

Refill oil capacity (Approximate):

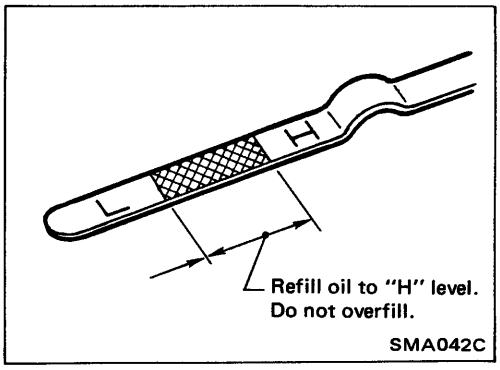
Unit: ℓ (US qt, Imp qt)

	2WD	4WD
With oil filter change	3.9 (4-1/8, 3-3/8)	3.3 (3-1/2, 2-7/8)
Without oil filter change	3.5 (3-3/4, 3-1/8)	2.9 (3-1/8, 2-1/2)

CAUTION:

- **Be sure to clean drain plug and install with new washer.**
  Drain plug:
  : 29 - 39 N·m
  (3.0 - 4.0 kg-m, 22 - 29 ft-lb)
- **Use recommended engine oil.**
- **The refill capacity changes depending on the oil temperature and drain time, use these values as a reference and be certain to check with the dipstick when changing the oil.**

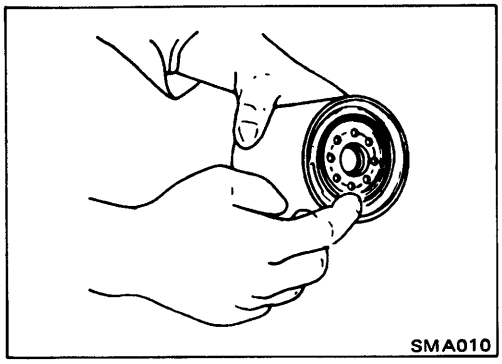
4. Check oil level.
5. Start engine and check area around drain plug and oil filter for oil leakage.
6. Run engine for a few minutes, then turn it off. After several minutes, check oil level.



Changing Oil Filter

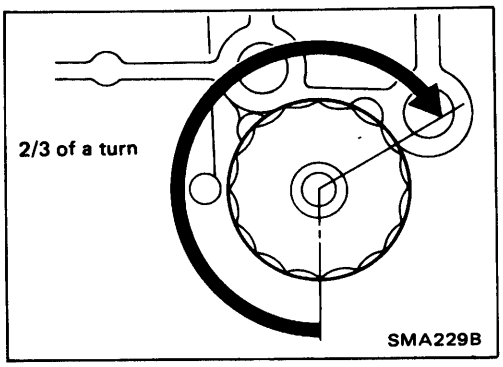
1. Remove oil filter with a suitable tool.

WARNING:
Be careful not to burn yourself, as the engine and the engine oil are hot.



2. Before installing new oil filter, clean the oil filter mounting surface on cylinder block, and coat the rubber seal of oil filter with a little engine oil.

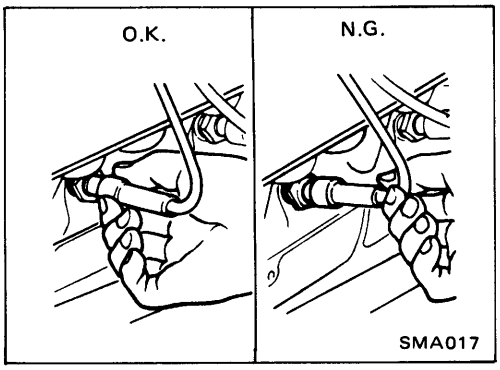
Changing Oil Filter (Cont'd)



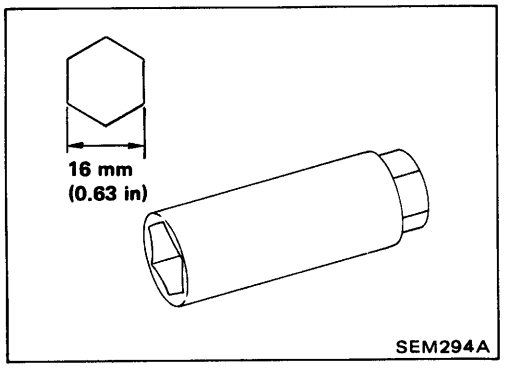
3. Screw in the oil filter until a slight resistance is felt, then tighten additionally more than 2/3 turn.
4. Add engine oil.

Refer to Changing Engine Oil.

Changing Spark Plugs

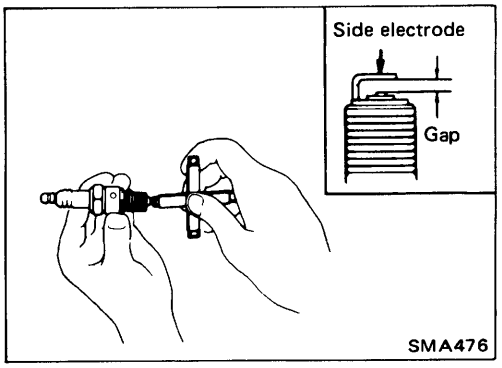


1. Disconnect ignition wires from spark plugs at boot. Do not pull on the wire.



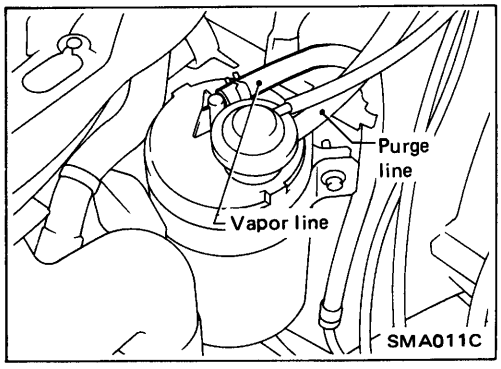
2. Remove spark plugs with spark plug wrench.

Spark plug:
Standard type
ZFR5E-11
Hot type
ZFR4E-11
Cold type
ZFR6E-11



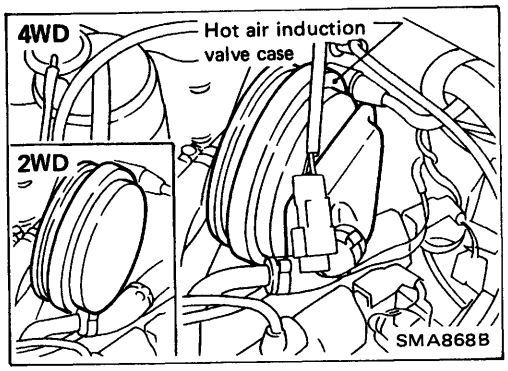
3. Check plug gap of each new spark plug.
   Gap: 1.0 - 1.1 mm (0.039 - 0.043 in)
4. Install spark plugs. Reconnect ignition wires according to Nos. indicated on them.
   Spark plug:
   : 20 - 29 N•m
   (2.0 - 3.0 kg-m, 14 - 22 ft-lb)

Checking Vapor Lines



1. Visually inspect vapor lines for improper attachment and for cracks, damage, loose connections, chafing and deterioration.
2. Inspect vacuum relief valve of fuel tank filler cap for clogging, sticking, etc.

Refer to EVAPORATIVE EMISSION CONTROL SYSTEM INSPECTION in EF & EC section.

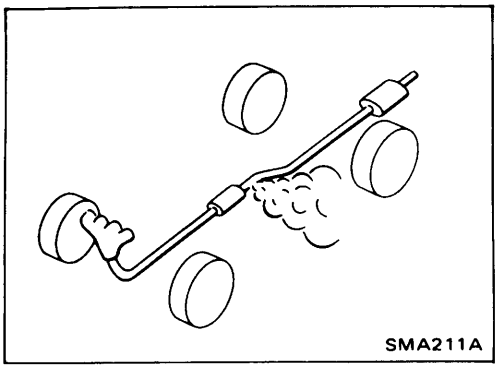


Changing Air Induction Valve (A.I.V.) Filter

Remove air induction valve case and take out air induction valve filter. Then install new air induction valve filter.

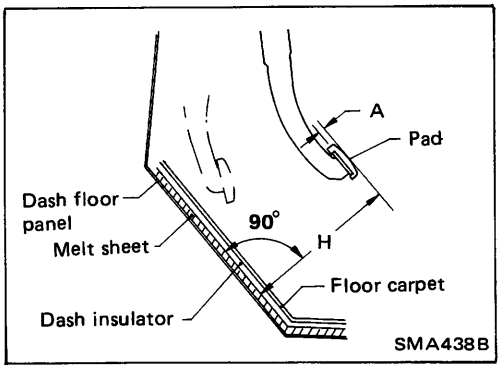
Changing Positive Crankcase Ventilation (P.C.V.) Filter

Remove air cleaner cover and take out P.C.V. filter located inside air cleaner cover. Then install new P.C.V. filter.


SMA211A

Checking Exhaust System

Check exhaust pipes, muffler and mounting for improper attachment and for leaks, cracks, damage, loose connections, chafing and deterioration.



SMA438B

Checking Clutch Pedal Operation

Check clutch pedal height, free play and smooth operation.

Pedal height "H":

KA24E engine

236 - 246 mm (9.29 - 9.69 in)

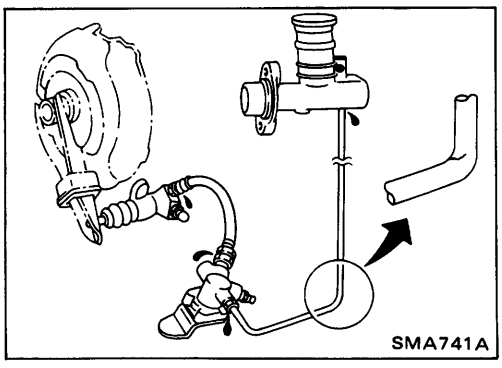
VG30E engine

227 - 237 mm (8.94 - 9.33 in)

Pedal free play "A":

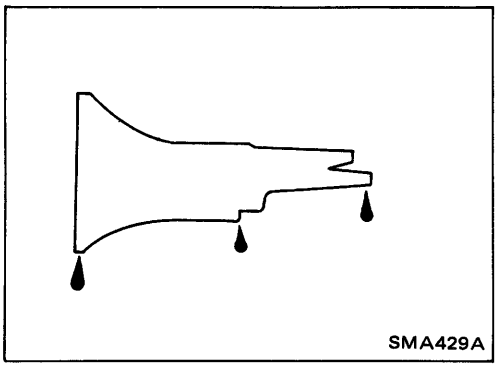
1.0 - 3.0 mm (0.039 - 0.118 in)

If necessary, adjust clutch pedal height and pedal free play. Refer to Section CL.


SMA741A

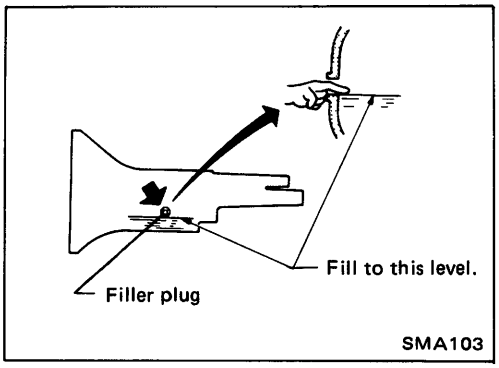
Checking Clutch System

If fluid level is extremely low, check clutch system for leaks.


SMA429A

Checking M/T Oil

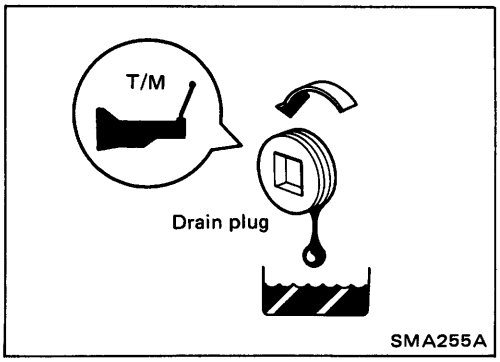
1. Check manual transmission for oil leakage.



SMA103

2. If leakage is found, check oil level.
   ⟨⟩ : **Filler plug**
   25 - 34 N·m
   (2.5 - 3.5 kg-m, 18 - 25 ft-lb)

CAUTION:
Never start engine while checking oil level.

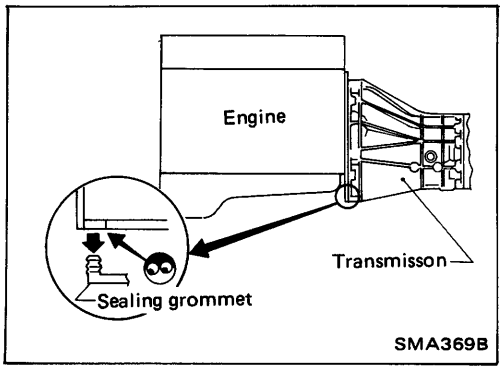


SMA255A

Changing M/T Oil

Oil capacity:
- **FS5W71C**
  - **2WD** 2.0 liters (4-1/4 US pt, 3-1/2 Imp pt)
  - **4WD** 4.0 liters (8-1/2 US pt, 7 Imp pt)
- **FS5R30A**
  - **2WD** 2.4 liters (5-1/8 US pt, 4-1/4 Imp pt)
  - **4WD** 3.6 liters (7-5/8 US pt, 6-3/8 Imp pt)

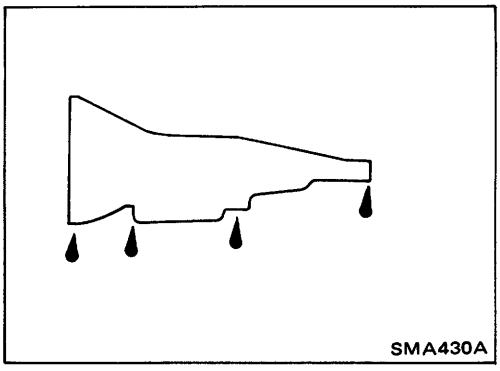
Drain plug:
⟨⟩ : 25 - 34 N·m (2.5 - 3.5 kg-m, 18 - 25 ft-lb)



SMA369B

Checking Water Entry — For 4WD model

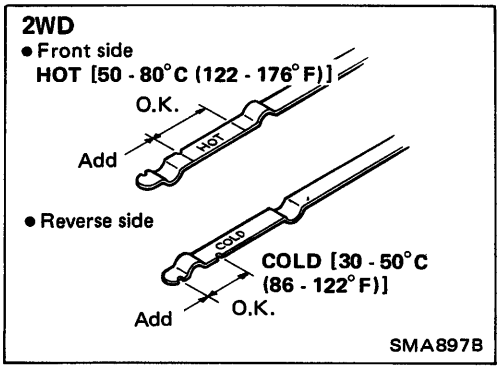
Check water entry in the clutch housing by removing the sealing grommet, whenever driving in deep water or mud.

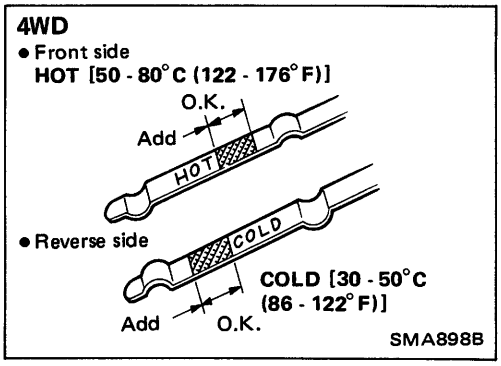

SMA430A

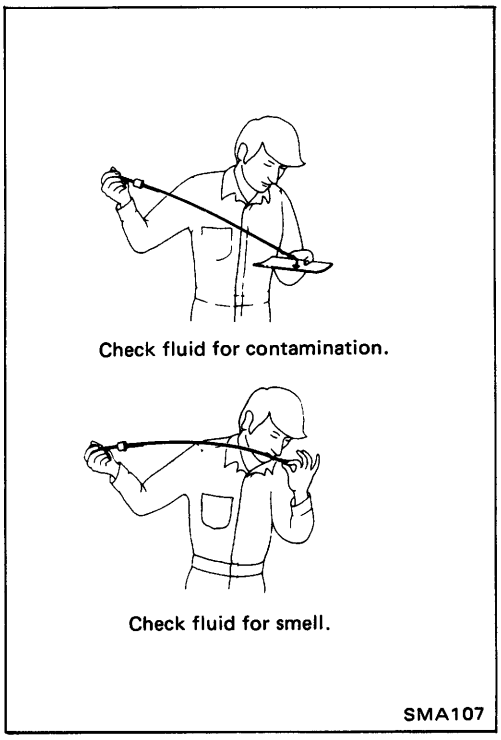
Checking A/T Fluid

1. Check automatic transmission for fluid leakage.

Checking A/T Fluid (Cont'd)







2. If leakage is found, check fluid level.
   Fluid level should be checked using "HOT" range on dipstick at fluid temperatures of 50 to 80°C (122 to 176°F) after vehicle has been driven approximately 5 minutes in urban areas after engine is warmed up. But it can be checked at fluid temperatures of 30 to 50°C (86 to 122°F) using "COLD" range on dipstick for reference after engine is warmed up and before driving. However, fluid level must be rechecked using "HOT" range.
   (1) Park vehicle on level surface and set parking brake.
   (2) Start engine and then move selector lever through each gear range, ending in "P".
   (3) Check fluid level with engine idling.
   (4) Remove dipstick and wipe it clean with lint-free paper.
   (5) Reinsert dipstick into charging pipe as far as it will go.
   (6) Remove dipstick and note reading. If level is at low side of either range, add fluid to the charging pipe.

Do not overfill.

3. Check automatic fluid condition.
   Check fluid for contamination. If fluid is very dark or smells burned, or contains the frictional material (clutches, band, etc.), check operation of A/T.
   Refer to section AT for checking operation of A/T.

Changing A/T Fluid

1. Drain fluid by removing oil pan.
2. Replace gasket with new one.
3. Refill with fluid and then check fluid level.

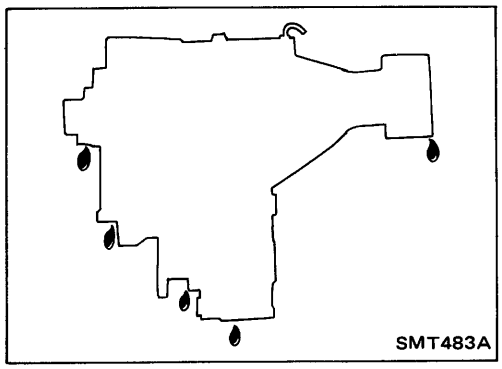
Oil capacity (With torque converter):

2WD

7.9 liters (8-3/8 US qt, 7 Imp qt)

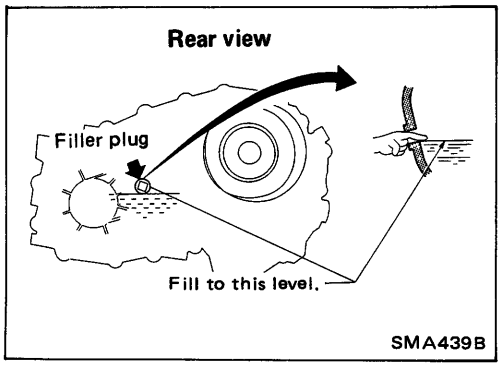
4WD

8.5 liters (9 US qt, 7-1/2 Imp qt)



Checking Transfer Oil

1. Check transfer for oil leakage.



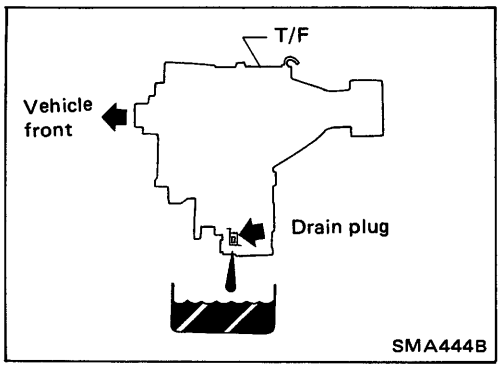
2. If leakage is found, check oil level.

"DEXRON™ " type Automatic Transmission Fluid is used for the transfer in the factory. Never add gear oil (75W-90) to Automatic Transmission Fluid.

Never start engine while checking oil level.

Filler plug:

: 25 - 34 N·m (2.5 - 3.5 kg-m, 18 - 25 ft-lb)



Changing Transfer Oil

When changing transfer oil completely, either "DEXRON™ " type Automatic Transmission Fluid or gear oil (75W-90) may be used.

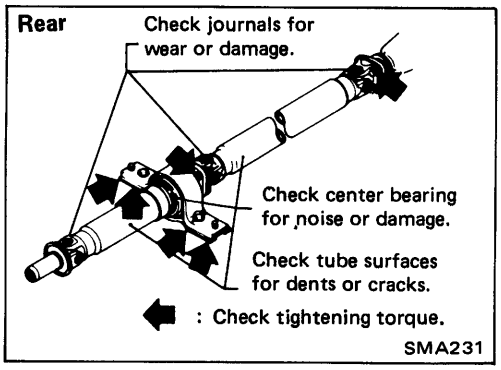
Do not mix Automatic Transmission Fluid and gear oil.

Oil capacity:

2.2 liters (2-3/8 US qt, 2 Imp qt)

Drain plug:

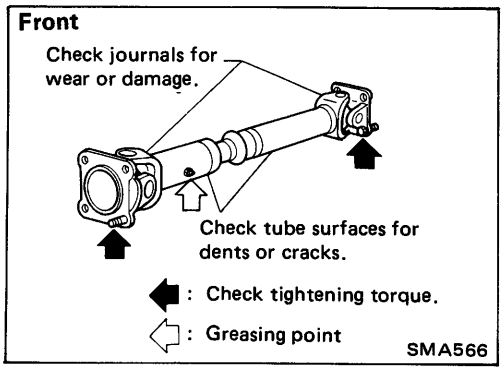
: 25 - 34 N·m (2.5 - 3.5 kg-m, 18 - 25 ft-lb)

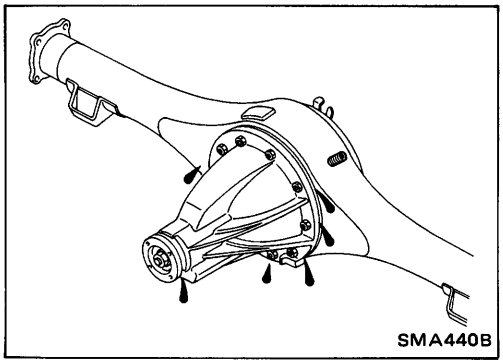


Checking Propeller Shaft

Check propeller shaft for damage, looseness or grease leakage.

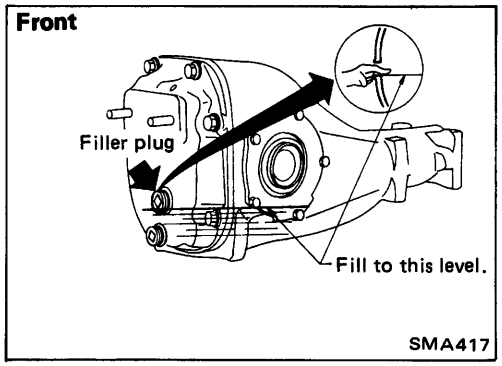
Tightening torque: Refer to section PD.





Checking Differential Gear Oil

1. Check differential carrier for oil leakage.



2. If leakage is found, check oil level.

Filler plug:

Front

: 39 - 59 N·m (4 - 6 kg-m, 29 - 43 ft-lb)

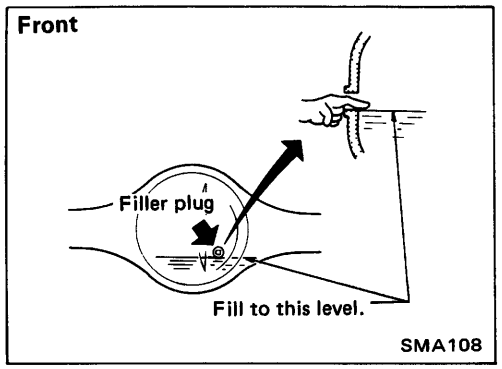
Rear

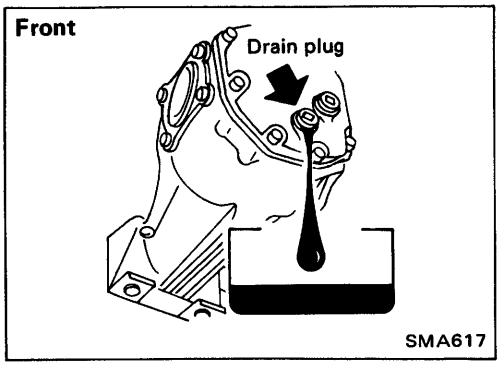
H190A, H233B

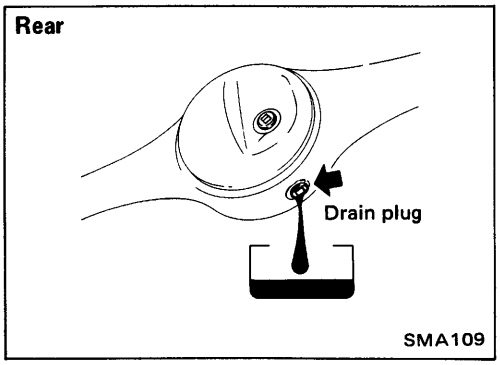
: 59 - 98 N·m (6 - 10 kg-m, 43 - 72 ft-lb)

C200

: 39 - 59 N·m (4 - 6 kg-m, 29 - 43 ft-lb)







Changing Differential Gear Oil

Oil capacity:

Front

R180A

1.3 liters (2-3/4 US pt, 2-1/4 Imp pt)

R200A

1.5 liters (3-1/8 US pt, 2-5/8 Imp pt)

Drain plug:

: 39 - 59 N·m (4 - 6 kg-m, 29 - 43 ft-lb)

Oil capacity:

Rear

H190A

1.5 liters (3-1/8 US pt, 2-5/8 Imp pt)

C200

1.3 liters (2-3/4 US pt, 2-1/4 Imp pt)

H233B

2.8 liters (5-7/8 US pt, 4-7/8 Imp pt)

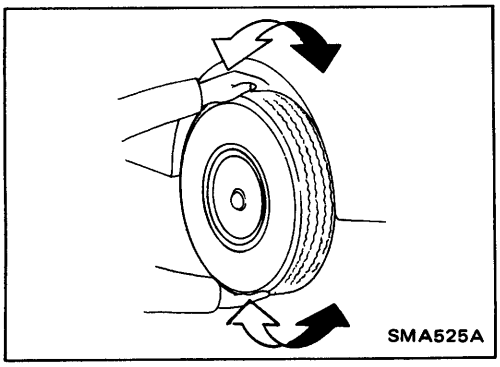
Drain plug:

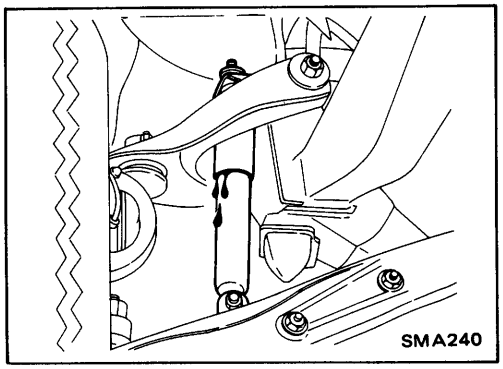
: 59 - 98 N·m (6 - 10 kg-m, 43 - 72 ft-lb)

Limited-slip differential gear

- Use only approved limited-slip differential gear oil.
- Limited-slip differential identification.

(1) Lift both rear wheels off the ground.
(2) Turn one rear wheel by hand.
(3) If both rear wheels turn in the same direction simultaneously, vehicle is equipped with limited-slip differential.





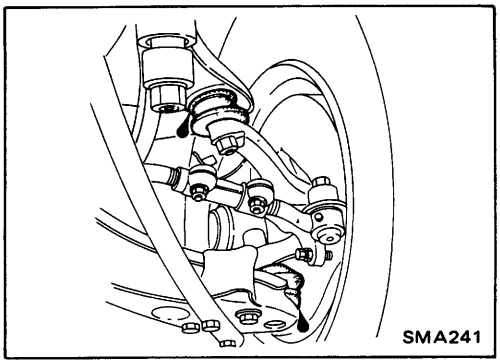
Checking Front Axle and Front Suspension Parts

- Check front axle and front suspension parts for looseness, cracks, wear or other damage.

(1) Shake each front wheel to check for excessive play.
(2) Make sure that cotter pin is inserted.
(3) Retighten all nuts and bolts to the specified torque.
Tightening torque: Refer to section FA.
(4) Check front axle and front suspension parts for wear, cracks or other damage.

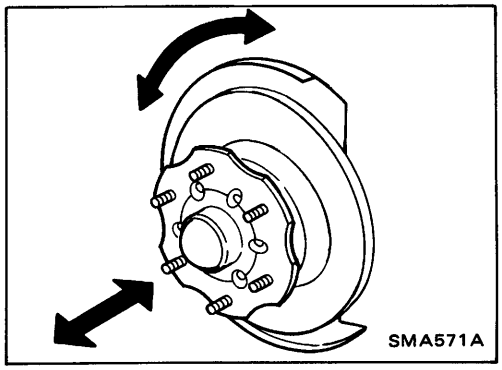
- Check shock absorber for oil leakage or other damage.

Checking Front Axle and Front Suspension Parts (Cont'd)


SMA241

- Check suspension ball joint for grease leakage and ball joint dust cover for cracks or other damage.

Checking (Replacing) Front Wheel Bearing Grease

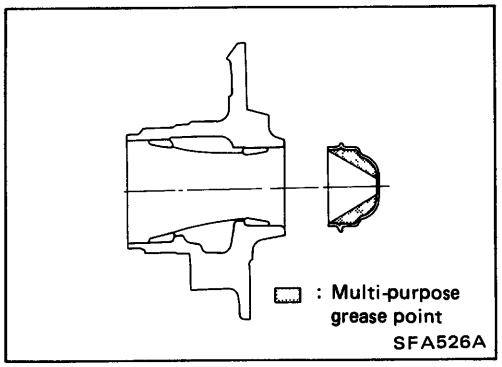

SMA571A

- Check that wheel bearings operate smoothly.
- Check front wheel bearings for grease leakage and water or dust entry.
- Replace front wheel bearings or front wheel bearing grease if wheel bearings do not turn smoothly.
- Adjust wheel bearing preload after installing wheel bearings or replacing wheel bearing grease.

PRELOAD ADJUSTMENT (2WD Trucks)

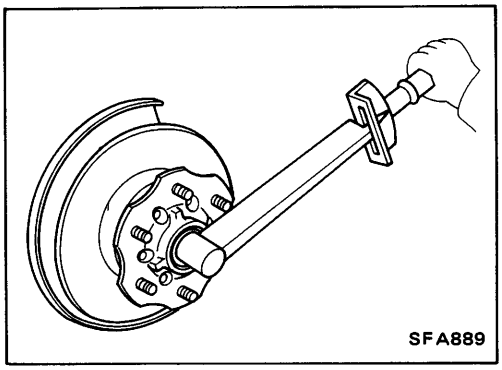
Adjust wheel bearing preload as follows:

1. Before adjustment, thoroughly clean all parts and check them for wear, cracks or other damage.



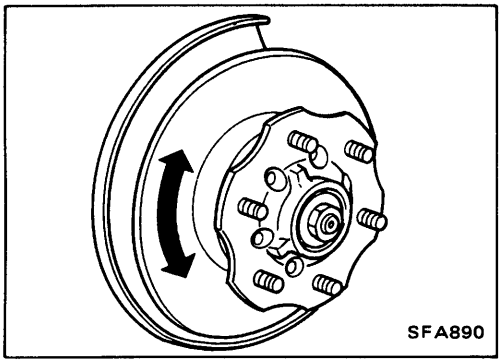
SFA526A

2. Apply multi-purpose grease sparingly to the following parts:
   - Rubbing surface of spindle
   - Contact surface between lock washer and outer wheel bearing
   - Hub cap (as shown at the left)
   - Grease seal lip


SFA889

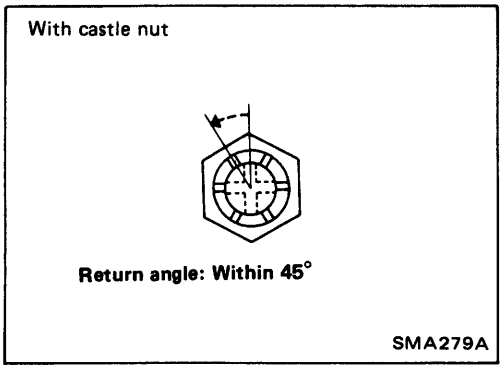
3. Tighten wheel bearing lock nut to the specified torque.
   : 34 - 39 N·m (3.5 - 4.0 kg-m, 25 - 29 ft-lb)

Checking (Replacing) Front Wheel Bearing Grease (Cont'd)


SFA890

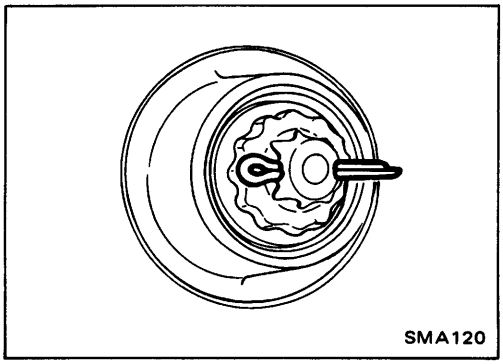
4. Turn wheel hub several times in both directions to seat wheel bearing correctly.
5. Again tighten wheel bearing lock nut to the specified torque.

   : **34 - 39 N·m (3.5 - 4.0 kg-m, 25 - 29 ft-lb)**

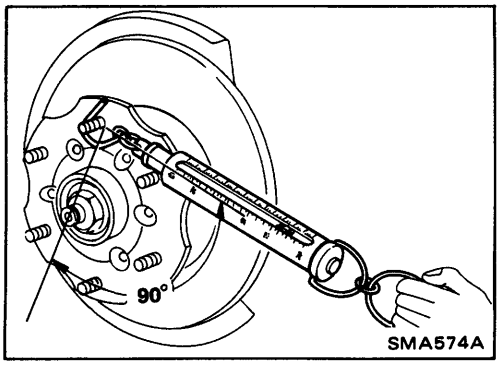


SMA279A

6. Turn back wheel bearing lock nut 45 degrees.


SMA120

7. Fit adjusting cap and new cotter pin. Align cotter pin slot by loosening nut 15 degrees or less.



SMA574A

8. Measure wheel bearing preload and axial end play.

   Axial end play: 0 mm (0 in)

   Wheel bearing preload

   (As measured at wheel hub bolt):

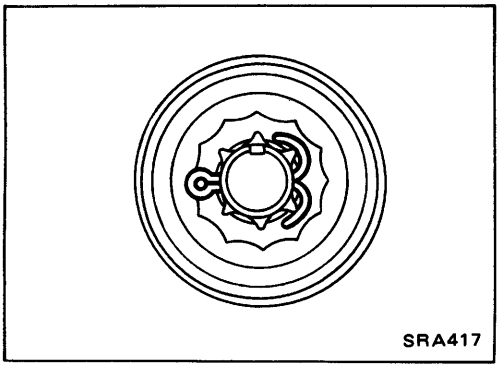
   [New grease seal]

   9.8 - 28.4 N (1.0 - 2.9 kg, 2.2 - 6.4 lb)

   [Used grease seal]

   9.8 - 23.5 N (1.0 - 2.4 kg, 2.2 - 5.3 lb)

   Repeat above procedures until correct bearing preload is obtained.
9. Spread cotter pin.
10. Install hub cap.

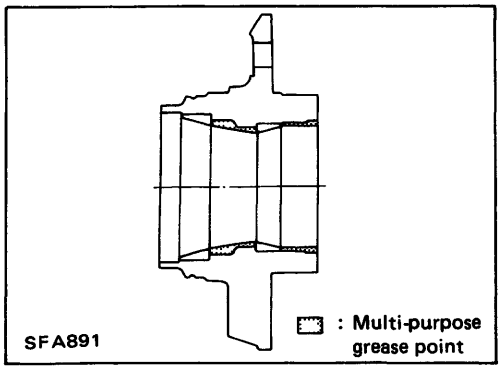

SRA417

Checking (Replacing) Front Wheel Bearing Grease (Cont'd)

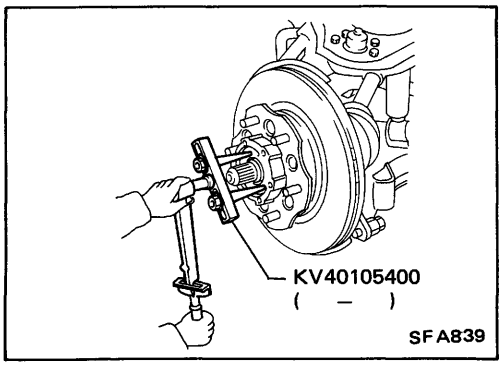
PRELOAD ADJUSTMENT (Except 2WD Trucks)

Adjust wheel bearing preload as follows:

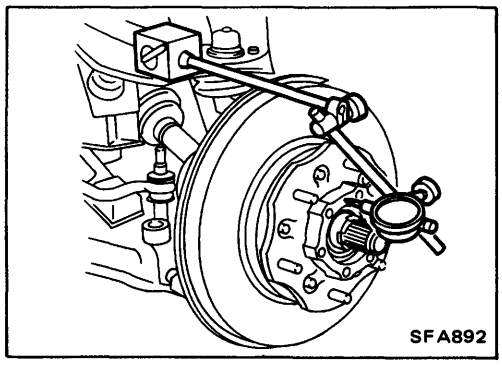
1. Before adjustment, thoroughly clean all parts and check them for wear, cracks or other damage.



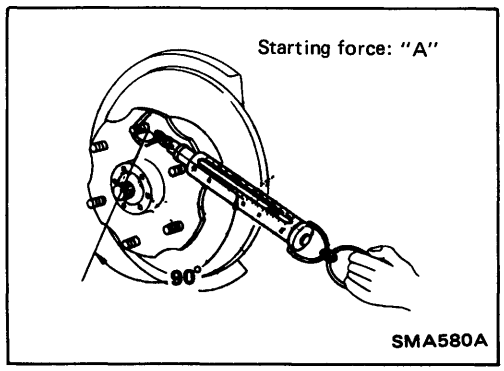
2. Apply multi-purpose grease sparingly to the following parts:
   - Threaded portion of spindle
   - Contact surface between wheel bearing washer and outer wheel bearing
   - Grease seal lip
   - Wheel hub (as shown at the left)



3. Tighten wheel bearing lock nut with Tool.
   : 78 - 98 N·m (8 - 10 kg-m, 58 - 72 ft-lb)
4. Turn wheel hub several times in both directions.
5. Loosen wheel bearing lock nut so that torque becomes 0 N·m (0 kg-m, 0 ft-lb).
6. Retighten wheel bearing lock nut with Tool.
   : 0.5 - 1.5 N·m (0.05 - 0.15 kg-m, 0.4 - 1.1 ft-lb)

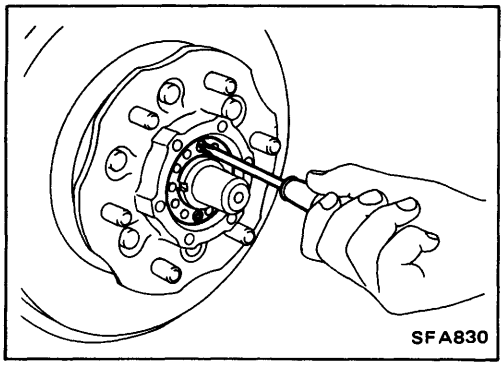


7. Turn wheel hub several times in both directions.
8. Retighten wheel bearing lock nut with Tool.
   : 0.5 - 1.5 N·m (0.05 - 0.15 kg-m, 0.4 - 1.1 ft-lb)
9. Measure wheel bearing axial end play.
   Axial end play: 0 mm (0 in)



10. Measure starting force "A" at wheel hub bolt.

Checking (Replacing) Front Wheel Bearing Grease (Cont'd)



11. Install lock washer by tightening the lock nut within 15 to 30 degrees.
12. Turn wheel hub several times in both directions to seat wheel bearing correctly.
13. Measure starting force "B" at wheel hub bolt. Refer to procedure 10.
14. Wheel bearing preload "C" can be calculated as shown below:

$$C = B - A$$

Wheel bearing preload "C":
7.06 - 20.99 N
(0.72 - 2.14 kg, 1.59 - 4.72 lb)

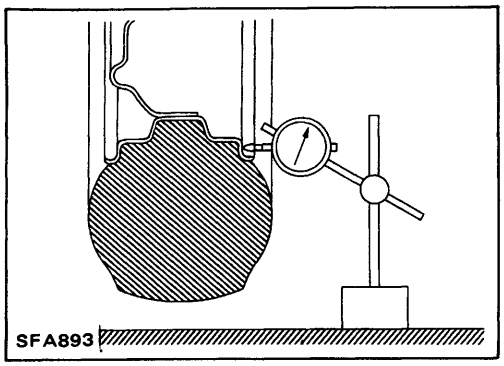
15. Repeat above procedures until correct axial end play and wheel bearing preload are obtained.
16. Install free-running hub and brake pads.

Checking Front Wheel Alignment

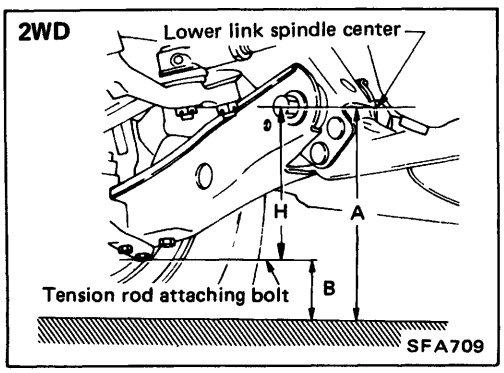
Before checking front wheel alignment, be sure to make a preliminary inspection.

PRELIMINARY INSPECTION

1. Check tires for wear and proper inflation.

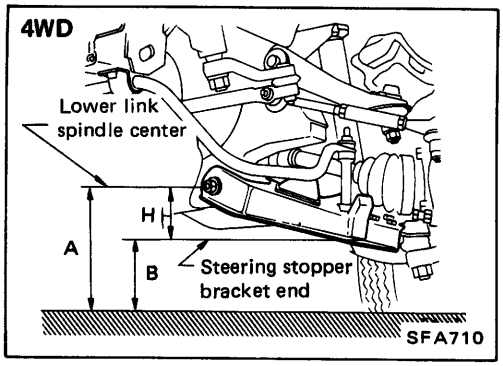


2. Check wheel runout.
   Lateral runout:
   Refer to Wheel Inspection in section MA.
3. Check front wheel bearings for looseness.
4. Check front suspension for looseness.
5. Check steering linkage for looseness.
6. Check that front shock absorbers work properly by using the standard bounce test.

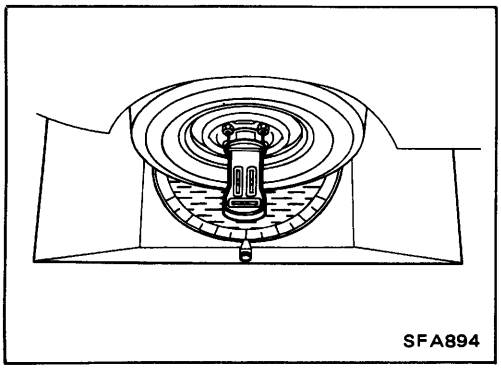


7. Measure vehicle height (Unladen): H = A – B mm (in)
   Vehicle height:
   Refer to S.D.S.
   1) Exercise the front suspension by bouncing the front of the vehicle 4 or 5 times to ensure that the vehicle is in a neutral height attitude.
   2) Measure wheel alignment.
      (Refer to ALLOWABLE LIMIT on S.D.S.)
   3) If wheel alignment is not as specified, adjust vehicle posture.
      (Refer to ADJUSTING RANGE on S.D.S.)

Checking Front Wheel Alignment (Cont'd)



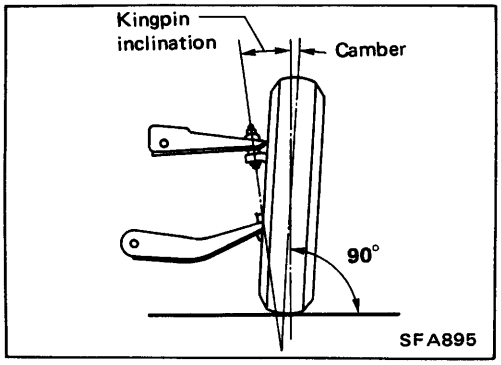
4) Adjust wheel alignment.
(Refer to ADJUSTING RANGE on S.D.S.)



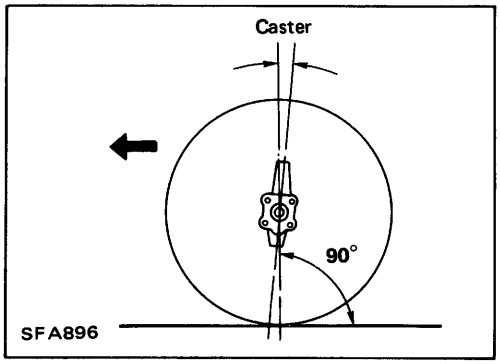
CAMBER, CASTER AND KINGPIN INCLINATION

Before checking camber, caster or kingpin inclination, move vehicle up and down on turning radius gauge to minimize friction.

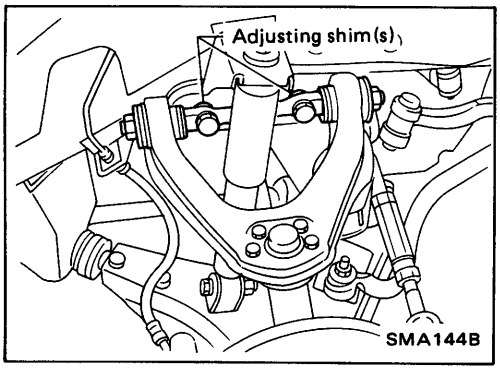
- **Measure camber, caster and kingpin inclination of both right and left wheels with a suitable alignment gauge and adjust in accordance with the following procedures.**



Camber (Unladen):
Refer to S.D.S.
Kingpin inclination (Unladen):
Refer to S.D.S.



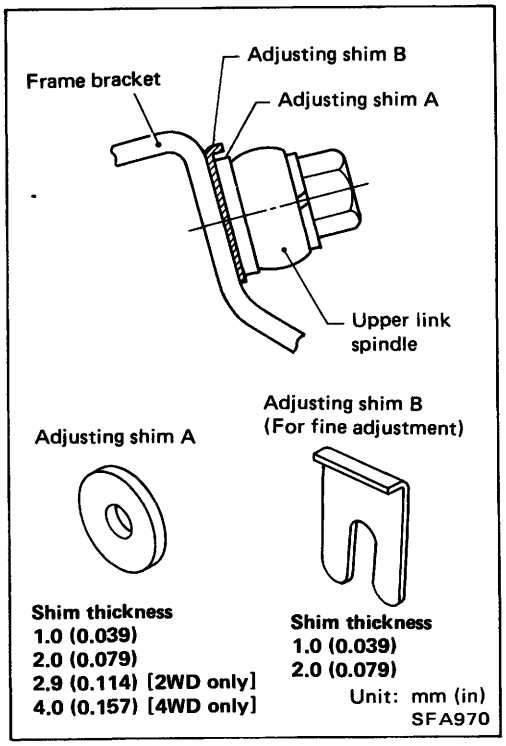
Caster (Unladen):
Refer to S.D.S.



ADJUSTMENT

Both camber and caster angles are adjusted by increasing or decreasing the number of adjusting shims inserted between upper link spindle and frame.

Checking Front Wheel Alignment (Cont'd)



Before removing or installing adjusting shim(s), be sure to place a jack under lower link.

Adjusting shim standard thickness:

2WD Trucks

2.9 mm (0.114 in)

Except 2WD Trucks

4.0 mm (0.157 in)

- **Do not use three or more shims at one place.**
- **When installing shim B, always face the pawl towards spindle and insert them from bracket side. Use only one shim in a place.**
- **Total thickness of shims must be within 8.0 mm (0.315 in).**
- **Difference of total thickness of the front and rear must be within 2.0 mm (0.079 in).**
- **Determine thickness and number of shims necessary for adjusting camber and caster, in acoordance with the following graph.**

[Example]

(1) When service data value minus measured value is equal to:

Caster angle: –30'

Camber angle: +30'

(2) Obtain the intersecting point of lines in accordance with the graph.

(3) Choose shims which are nearest to the intersecting point.

(4) For the above example:

2WD Trucks:

Add 2.0 mm (0.079 in) shim on front side.

Add 3.0 mm (0.118 in) shim on rear side.

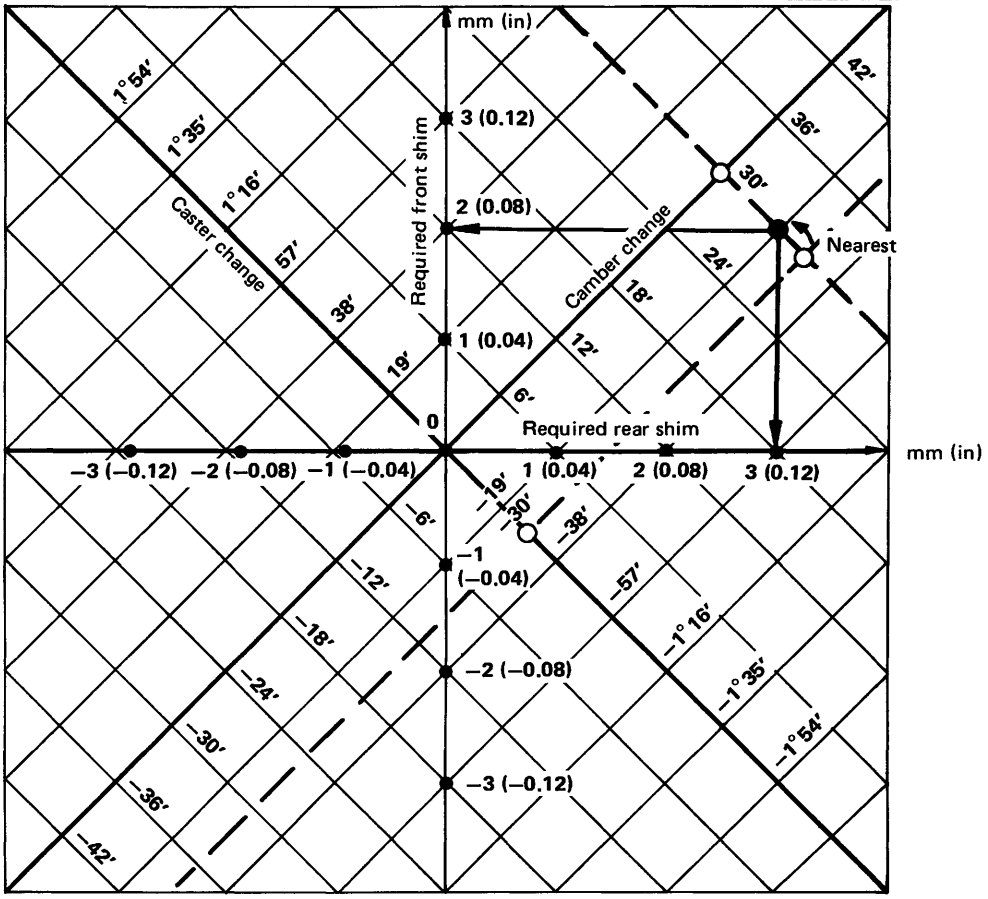
Except 2WD Trucks:

Add 1.0 mm (0.039 in) shim on front side.

Add 3.0 mm (0.118 in) shim on rear side.

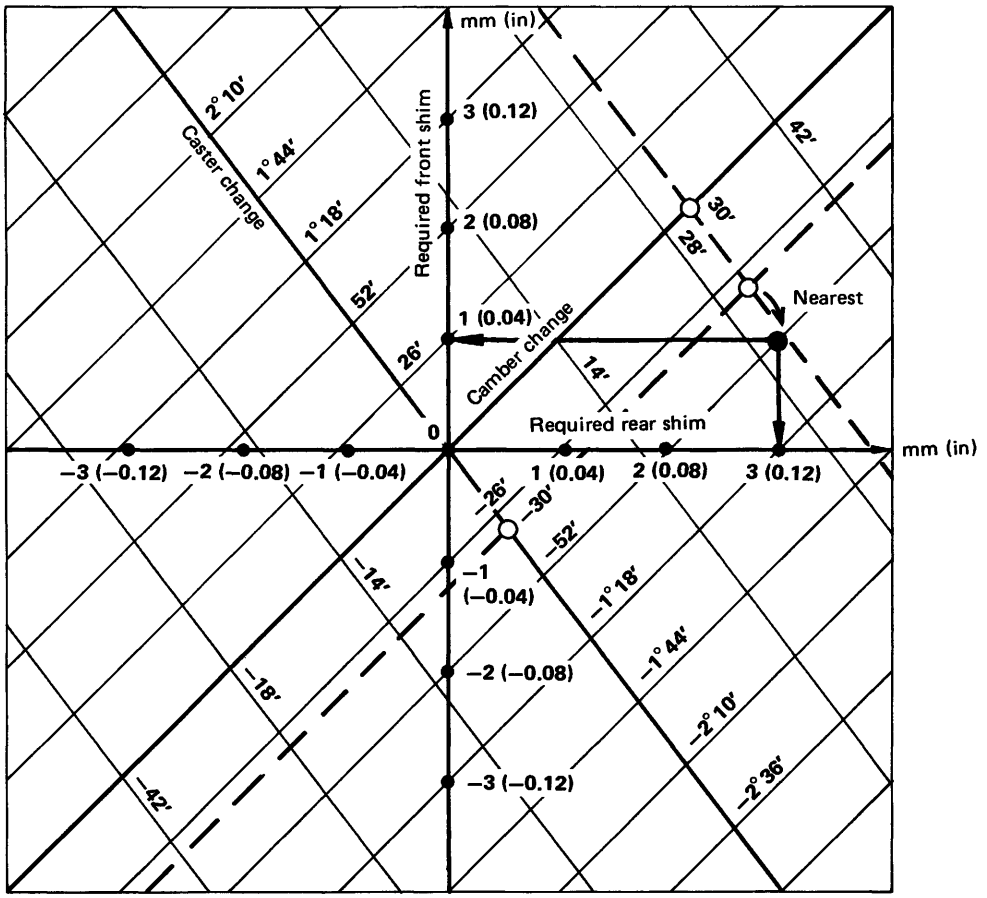
Checking Front Wheel Alignment (Cont'd)

2WD Trucks



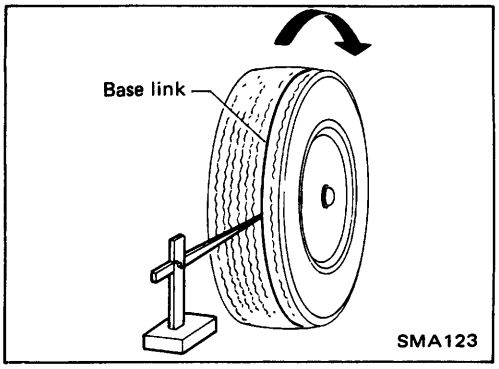
SFA878A

Except 2WD Trucks



SFA879A

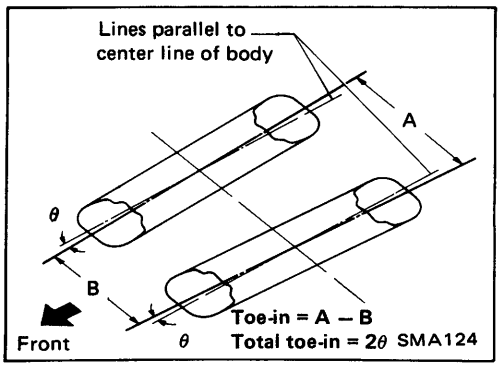
Checking Front Wheel Alignment (Cont'd)



TOE-IN

1. Mark a base line across the tread.

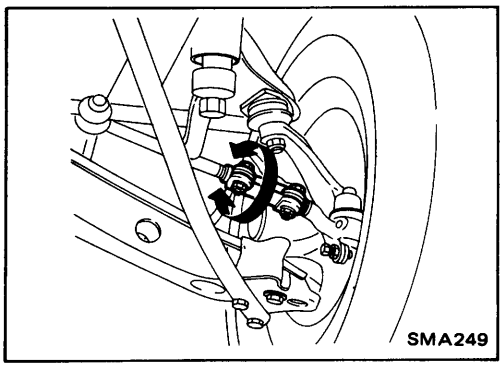
After lowering front of vehicle, move it up and down to eliminate friction, and set steering wheel in straight ahead position.



2. Measure toe-in.

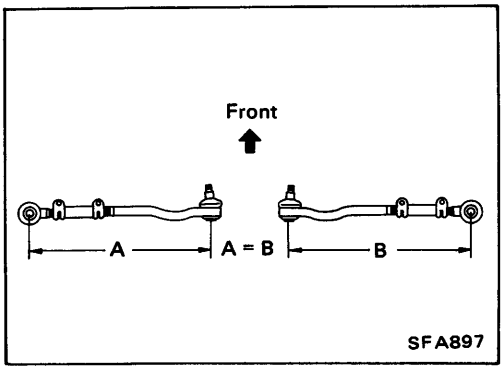
Measure distance "A" and "B" at the same height as hub center.

Toe-in (Unladen): Refer to S.D.S.



3. Adjust toe-in by varying the length of steering tie-rods.
(1) Loosen clamp bolts or lock nuts.
(2) Adjust toe-in by turning the left and right tie-rod tubes an equal amount.

Make sure that the tie-rod bars are screwed into the tie-rod tube more than 35 mm (1.38 in).



Make sure that the tie-rods are the same length.

Standard length A = B

2WD Trucks:

344 mm (13.54 in)

Except 2WD Trucks:

281 mm (11.06 in)

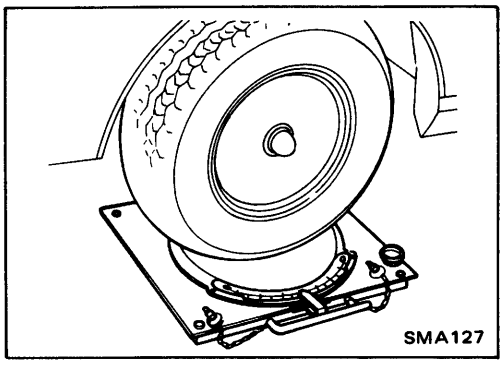
(3) Tighten clamp bolts or lock nuts.

Clamp bolts (2WD Trucks)

: 14 - 20 N·m (1.4 - 2.0 kg-m, 10 - 14 ft-lb)

Lock nuts (Except 2WD Trucks)

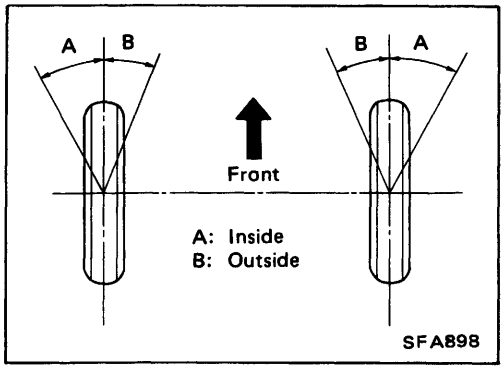
: 78 - 98 N·m (8.0 - 10.0 kg-m, 58 - 72 ft-lb)



WHEEL TURNING ANGLE

1. Set wheels in straight ahead position and then move vehicle forward until front wheels rest on turning radius gauge properly.

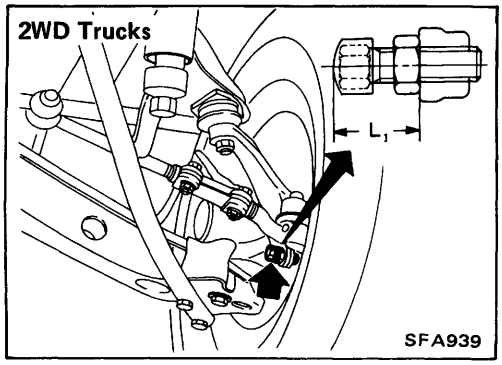
Checking Front Wheel Alignment (Cont'd)



2. Rotate steering wheel all the way right and left; measure turning angle.

Wheel turning angle		2WD Trucks	Except 2WD Trucks	31x10.5R15*
Full turns	Inside wheel	36° - 38°	33° - 35°	27° - 29°
	Outside wheel	33° - 35°	31° - 33°	25° - 27°

*: Tire size

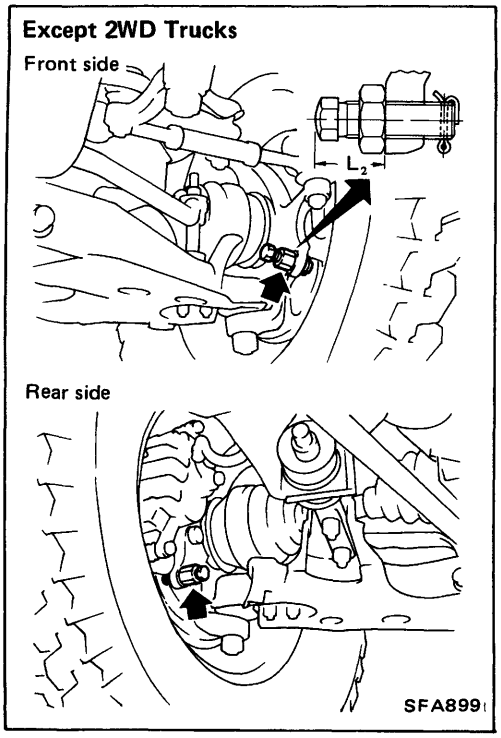


3. Adjust by stopper bolt if necessary.

[2WD Trucks]

Standard length "L_1":

20 mm (0.79 in)



[Except 2WD Trucks]

Standard length "L_2":

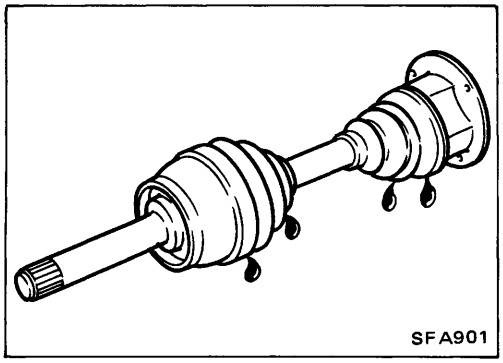
26.5 mm (1.043 in) [Except tire size 31x10.5R15]

37.5 mm (1.476 in) [Tire size 31X10.5R15]

Checking Free-running Hub Grease

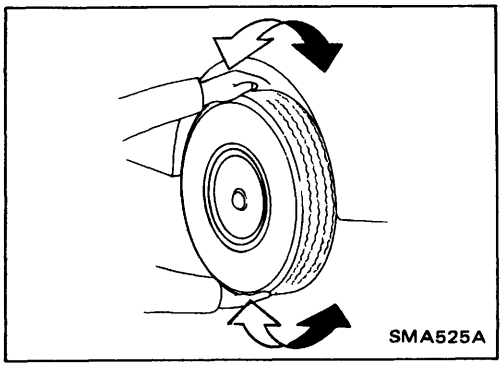
- **Check free-running hub for grease leakage and water or dust entry.**
- **When installing free-running hub, use multi-purpose grease for manual-lock free-running hub and NISSAN GENUINE GREASE (KRC19-00025) or equivalent grease for auto-lock free-running hub.**

Refer to Section FA.



Checking Drive Shaft

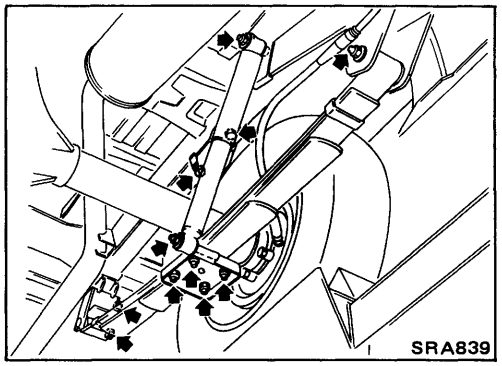
Check boot and drive shaft for cracks, wear, damage or grease leakage.



Checking Rear Axle and Rear Suspension Parts

- Check axle and suspension parts for looseness, wear or damage.

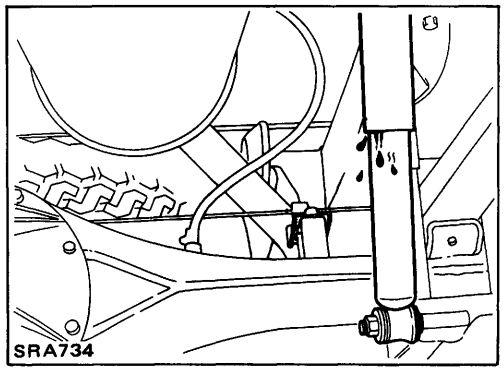
(1) Shake each rear wheel to check for excessive play.



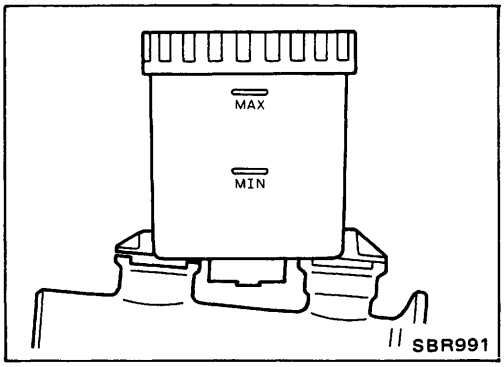
(2) Retighten all nuts and bolts to the specified torque.

Tightening torque: Refer to section RA.

(3) Check axle and suspension parts for wear, cracks or other damage.

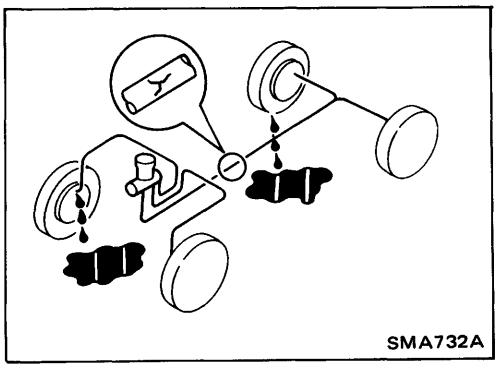


- Check shock absorber for oil leakage or damage.



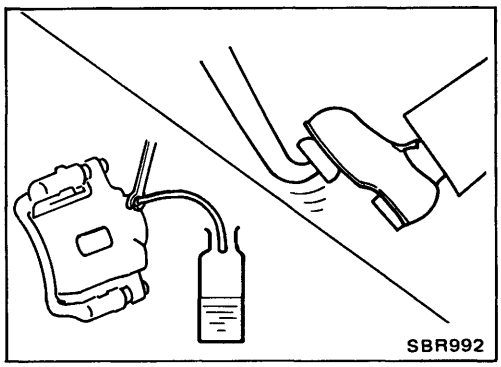
Checking Brake Fluid Level and Leaks

If fluid level is extremely low, check brake system for leaks.


SMA732A

Checking Brake System

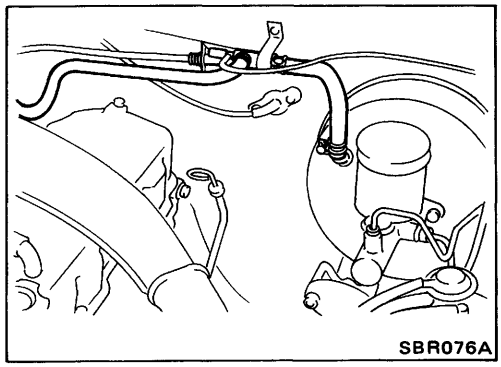
Check brake fluid lines and parking brake cables for proper attachment, leaks, chafing, abrasion, deterioration, etc.


SBR992

Changing Brake Fluid

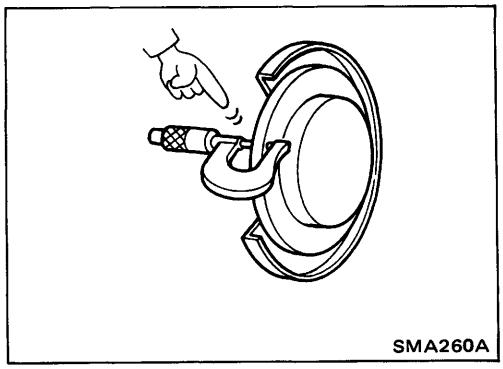
1. Drain brake fluid from each air bleeder valve.
2. Refill until new brake fluid comes out from each air bleeder valve.
   Use same procedure as in bleeding hydraulic system to refill brake fluid.
   Refer to section BR.

- **Refill with recommended brake fluid "DOT 3".**
- **Do not reuse drained brake fluid.**
- **Be careful not to splash brake fluid on painted areas.**


SBR076A

Checking Vacuum Hoses

Check vacuum lines, connections and check valve for proper attachment, air tightness, chafing and deterioration.


SMA260A

Checking Disc Brake

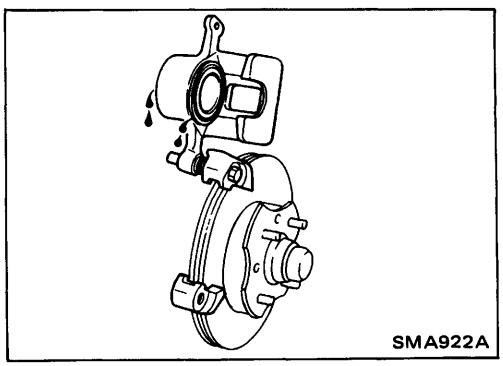
Check condition of disc brake components.

ROTOR

Check condition and thickness.

Minimum thickness:

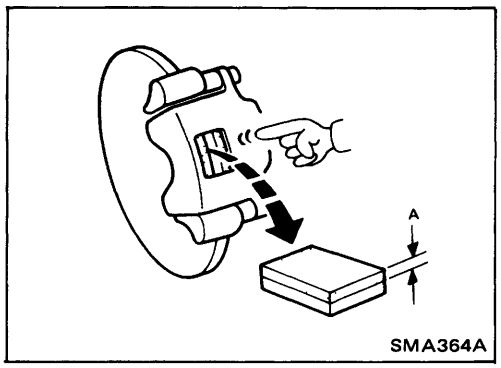
CL28VA	**20 mm (0.79 in)**
CL28VD	**24 mm (0.94 in)**
AD14VB	**16 mm (0.63 in)**


SMA922A

CALIPER

Check operation and leakage.

Checking Disc Brake (Cont'd)



PAD

Check wear or damage.

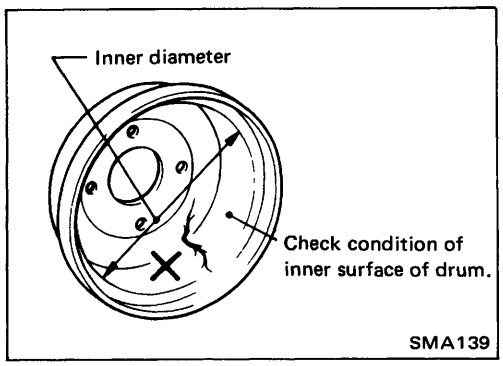
Minimum thickness: 2 mm (0.08 in)

Checking Drum Brake

Check condition of drum brake components.

WHEEL CYLINDER

Check operation and leakage.

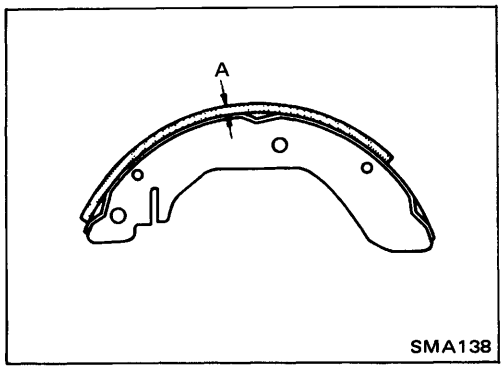


DRUM

Check condition and inner surface.

Drum repair limit (Inner diameter):

LT26B	**261.5 mm (10.30 in)**
LT30A	**296.5 mm (11.67 in)**
DS17H	**191.0 mm (7.52 in)**



LINING

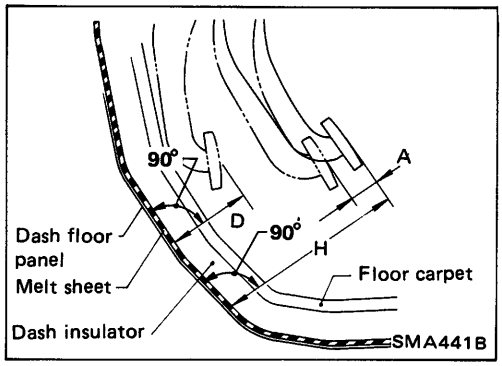
Check wear or damage.

Lining wear limit (Minimum thickness):
1.5 mm (0.059 in)

PARKING DRUM BRAKE

Adjust lining and drum as follows:

(1) Set the transfer lever in the "2H" position. Using either low or 2nd transmission speed, drive the unloaded vehicle at approximately 30 km/h (19 MPH) on a safe, level and dry road.
(2) Depress the release button of the parking brake lever and pull the lever back with a force of 98 N (10 kg, 22 lb).
(3) While holding the lever back, continue to drive the vehicle 100 m (328 ft).
(4) Repeat steps 1 through 3 two or three times.



Checking Foot Brake Pedal Operation

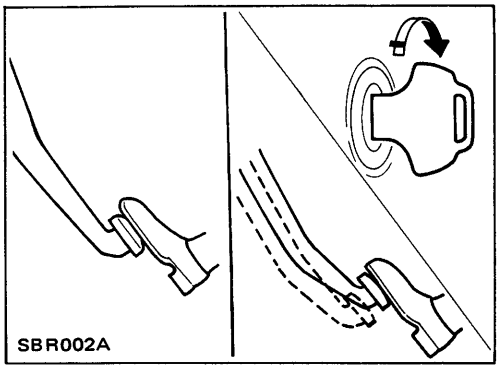
Check brake pedal free height, depressed height and for smooth operation.

H: Free height
A/T 212 - 222 mm (8.35 - 8.74 in)
M/T 209 - 219 mm (8.23 - 8.62 in)

D: Depressed height
Under force of 490 N (50 kg, 110 lb) with engine running
115 mm (4.53 in) or more (2WD VG30E)
120 mm (4.72 in) or more (Except 2WD VG30E)

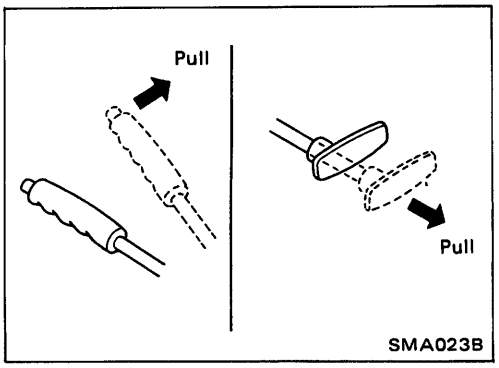
A: Pedal free play
1.0 - 3.0 mm (0.039 - 0.118 in)

If necessary, adjust brake pedal free height and depressed height. Refer to section BR.



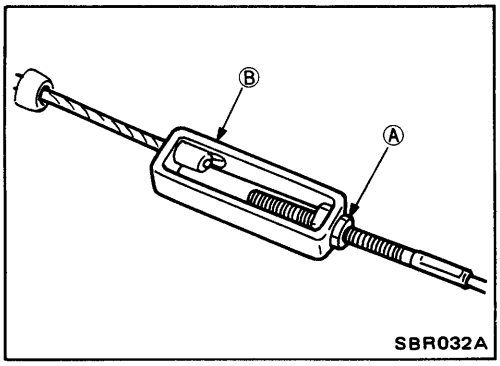
Checking Brake Booster Function

- Depress brake pedal several times with engine off, then check that there is no change in pedal stroke.
- Depress brake pedal, then start engine. If pedal goes down slightly, operation is normal.

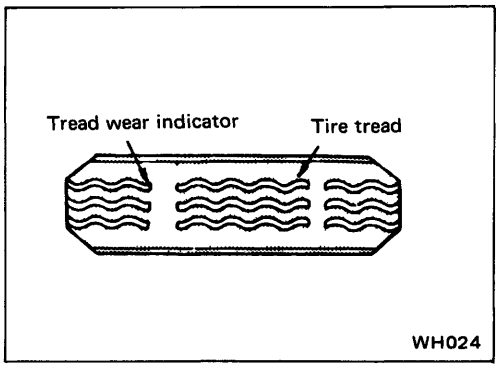


Checking Parking Brake

1. Pull lever with specified amount of force.
   Check lever stroke and for smooth operation.
   Number of notches
   [At pulling force of 196 N (20 kg, 44 lb)] :
   Refer to S.D.S.



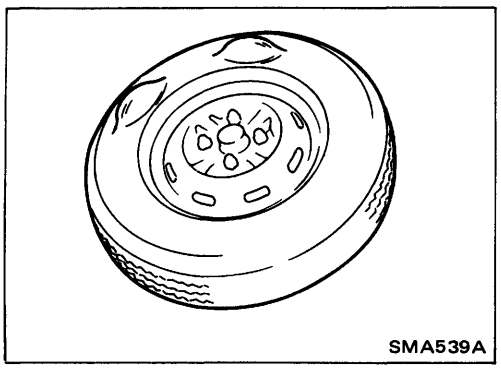
2. Use adjuster to adjust lever stroke.
(1) Loosen lock nut Ⓐ , rotate adjuster Ⓑ .
(2) Tighten lock nut Ⓐ .



Checking Tire Condition

TIRE CONDITION

- When tread wear indicators appear, replace tire with new one.



- Check tread and side walls for cracks, holes, separation or damage.
- Check tire valves for air leakage.

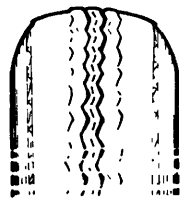
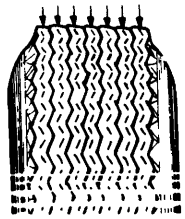
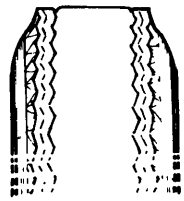
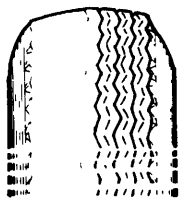
TIRE INFLATION

Tire pressure should be measured when tire is cold.

Tire pressure should be set to the specifications on the tire placard located into the glove box.

ABNORMAL TIRE WEAR

Correct abnormal tire wear according to the chart shown below:

Condition	Probable cause	Corrective action	Condition	Probable cause	Corrective action
 Shoulder wear	• Underinflation (both sides wear) • Incorrect wheel camber (one side wear) • Hard cornering • Lack of rotation	• Measure and adjust pressure. • Repair, or replace axle and suspension parts. • Reduce speed. • Rotate tires.	Feathered edge  Toe-in or toe-out wear	• Incorrect toe	• Adjust toe-in.
 Center wear SMA197B	• Overinflation • Lack of rotation	• Measure and adjust pressure. • Rotate tires.	 Uneven wear	• Incorrect camber or caster • Malfunctioning suspension • Unbalanced wheel • Out-of-round brake drum • Other mechanical conditions • Lack of rotation	• Repair, or replace axle and suspension parts. • Repair, replace or, if necessary, reinstall. • Balance or replace. • Correct or replace. • Correct or replace. • Rotate tires.

Tire Replacement

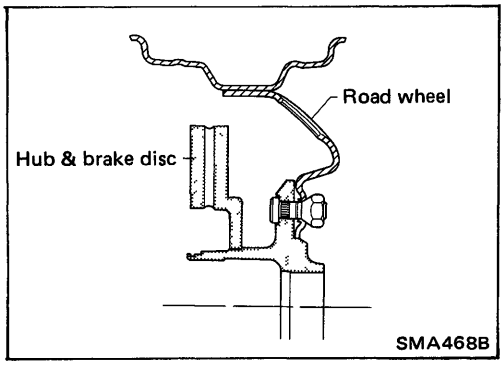
CAUTION:

- Do not mix different types of tires, such as bias, bias belted and radial tires under any circumstances.
- When replacing a tire, use a tire of the same size and type (Bias, Belted or Radial).
- Use recommended tires and wheels.
- Do not mix tires of different brands, tread patterns or type.
- When replacing standard tires with those tires of an optional recommended size and of different diameter, the speedometer requires to be recalibrated.
- Install road wheel using the wheel hub boss.

Wheel Nut

CAUTION:

- Be careful not to smear threaded portion of bolt and nut as well as seat of nut with oil or grease.



- Tighten wheel nuts in crisscross fashion.

Be sure to check wheel nuts for tightness, after aluminum wheel has been run for the first 1,000 km (600 miles) (also in case of repairing flat tires, tire rotation, etc.).
Retighten if necessary.

Tire Repair

CAUTION:

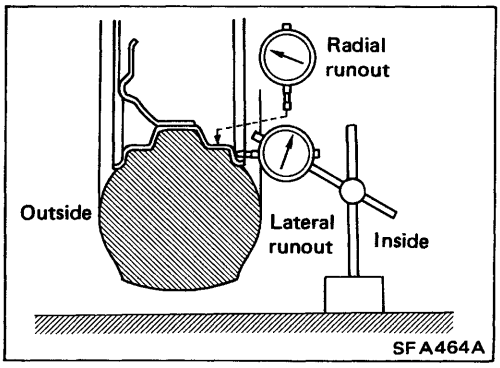
When replacing tire, take extra care not to damage tire bead, rim-flange and bead seat.

When installing tire, note the following items:

a. **Install valve core and inflate to proper pressure. Check the locating rings of the tire to be sure they show around the rim flanges on both sides.**
b. **Check valves for leakage after inflating tires.**
c. **Be sure to tighten valve caps firmly by hand.**

WARNING:

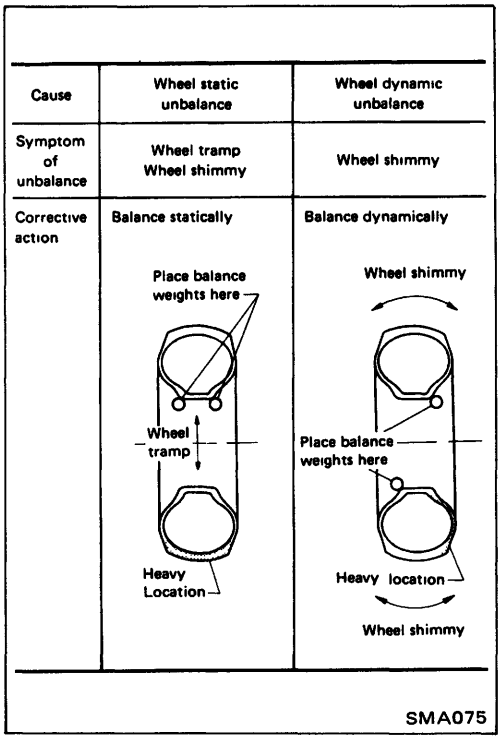
To avoid serious personal injury, never stand over tire when inflating it. Never inflate to a pressure greater than 40 psi (275 kPa). If beads fail to seat at that pressure, deflate the tire, lubricate it again, and then reinflate it. If the tire is overinflated, the bead might break, possibly resulting in serious personal injury.



Wheel Inspection

- Check wheel rim (especially rim flange and bead seat) for rust, distortion, cracks or other damage.
- Examine wheel rim for lateral and radial runout with dial gauge.

  Refer to S.D.S.
- Replace wheel when any of the following conditions occur.
  a. Bent, dented or heavily rusted
  b. Elongated bolt holes
  c. Excessive lateral or radial runout
  d. Air leaks through welds
  e. Wheel nuts will not stay tight



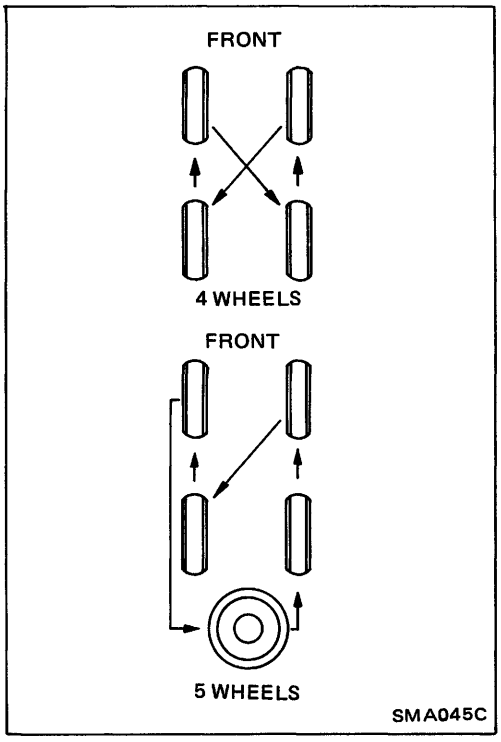
Balancing Wheels

- Adjust wheel balance using the road wheel center.

Wheel balance (Maximum allowable unbalance at rim flange):

Refer to S.D.S.

Tire balancing weight: Refer to S.D.S.



Tire Rotation

Spare Tire

T-TYPE SPARE TIRE AND SMALL SIZE SPARE TIRE

The T-type/Small size spare tire is designed for emergency use only.

The spare tire can be used repeatedly for emergency situations.

Precautions when using T-type/Small size spare tire

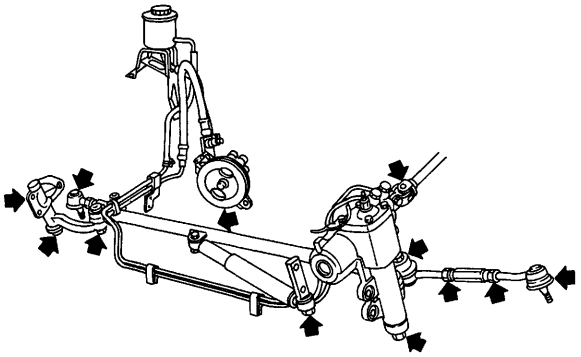
- **Periodically check tire inflation pressure, and always keep it at 60 psi (415 kPa) [T-type spare tire].**
- **Periodically check tire inflation pressure, and always keep it at 26 psi (180 kPa) [Small size spare tire].**
- **Do not drive vehicle at speed faster than 80 km/h (50 MPH).**
- **The T-type/Small size spare tire is designed only for temporary use as a spare. Dismount it and keep it as a spare as soon as the standard tire repair has been completed.**
- **Do not attach a tire chain.**
- **Do not use the T-type/Small size spare tire on other cars.**
- **Do not make a sharp turn, or apply the brake suddenly while driving.**
- **As soon as the tread wear indicator becomes visible, replace the tire with a new one.**
- **Mounting and dismounting to and from the road wheel can be carried out in the same manner as any ordinary tire.**
- **Use of wheel balance is unnecessary.**

CAUTION:

If the vehicle is equipped with aluminum wheels, be sure to use the wheel nuts for steel wheel on the T-type/Small size spare tire wheel. Never use the wheel nuts for aluminum wheel on the spare tire wheel.

The spare tire wheel may come off the axle and cause personal injury if the wheel nuts for aluminum wheels are used.

Checking Steering Gear and Linkage



SMA442B

- Steering gear:

(1) Check gear housing for looseness, damage or grease leakage.

(2) Check connection with steering column for looseness.

- Steering linkage:

(1) Check ball joint, dust cover and other component parts for looseness, wear, damage or grease leakage.

(2) Check for missing parts (cotter pins, washer, etc.).

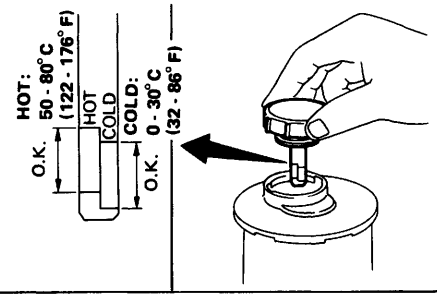
SMA232B

Checking Power Steering System Fluid and Lines

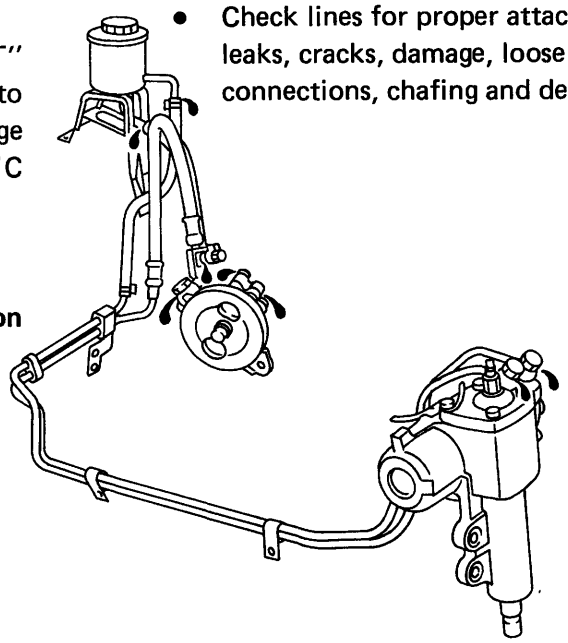
- Check fluid level.
  Fluid level should be checked using "HOT" range on dipstick at fluid temperatures of 50 to 80°C (122 to 176°F) or using "COLD" range on dipstick at fluid temperatures of 0 to 30°C (32 to 86°F).

CAUTION:

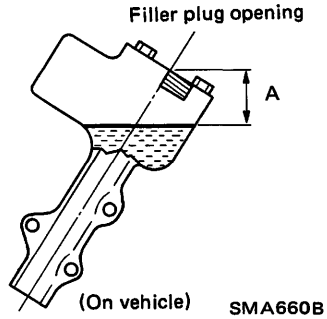
- **Do not overfill.**
- **Recommended fluid is Automatic Transmission Fluid "DEXRON™ " type.**



- Check lines for proper attachment, leaks, cracks, damage, loose connections, chafing and deterioration.



SMA238C



SMA660B

Checking Steering Gear

- Check steering gear for oil level and leakage.
- Check oil level.

Oil level:

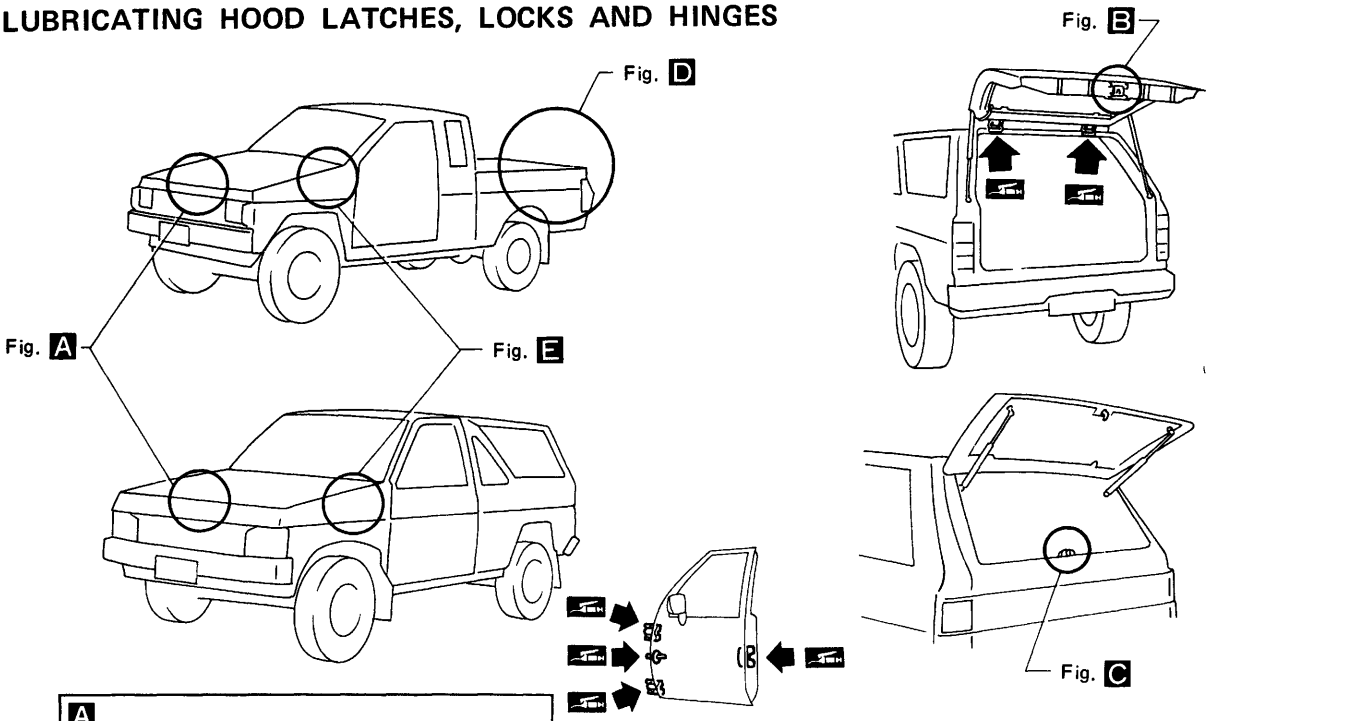
Distance "A"

43 mm (1.69 in) or less

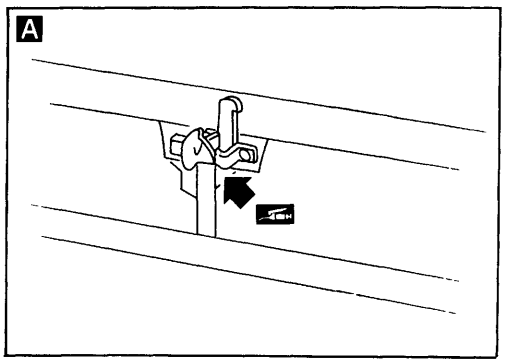
Be careful not to overflow gear oil when filling up.

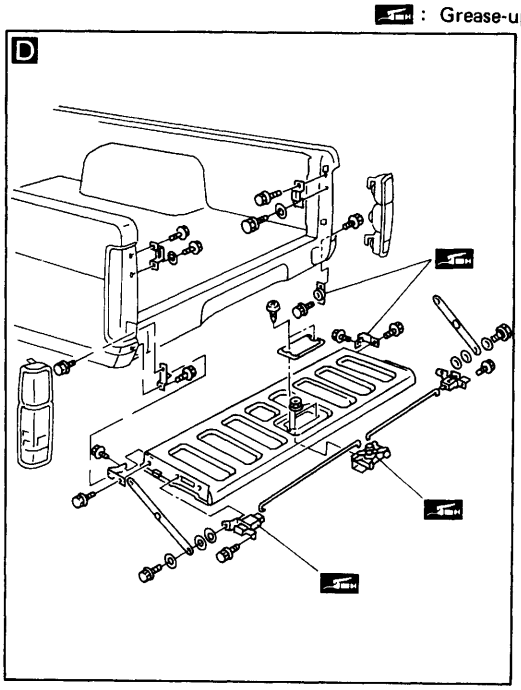
Body

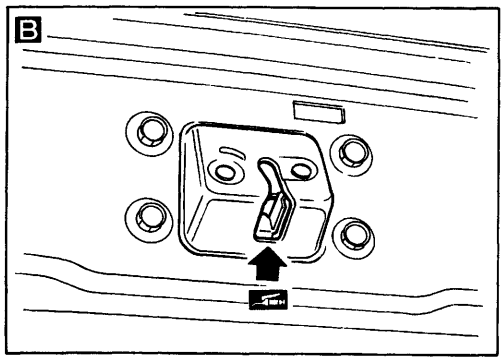
LUBRICATING HOOD LATCHES, LOCKS AND HINGES

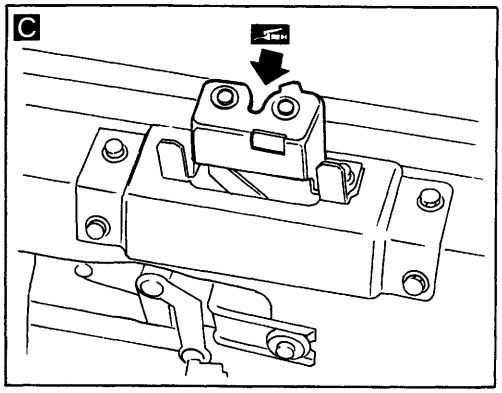


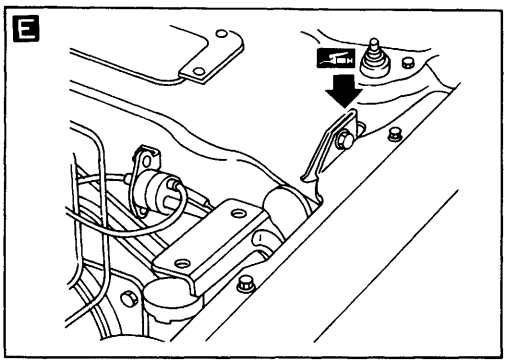
: Grease-up points







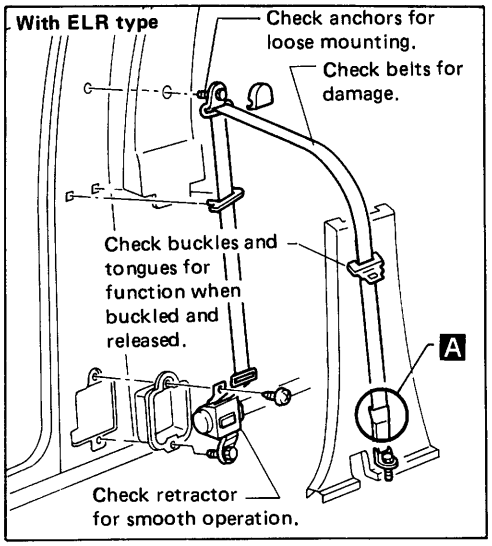


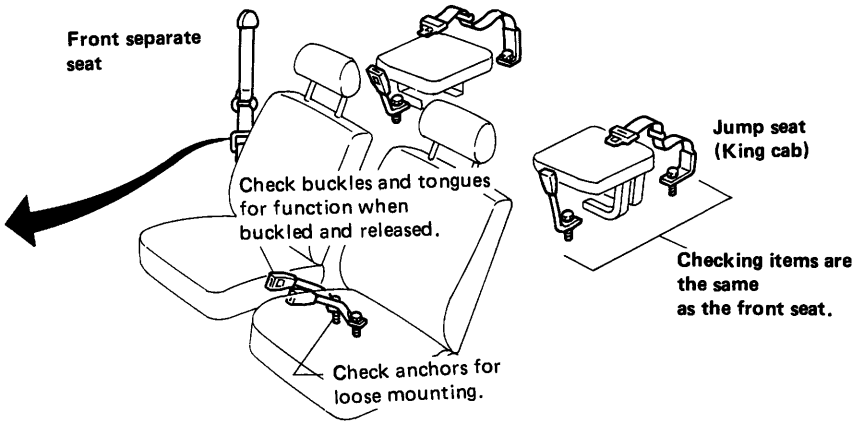


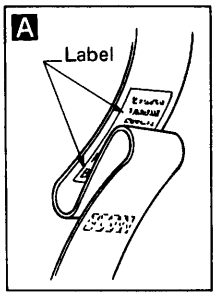
SMA652B

Body (Cont'd)

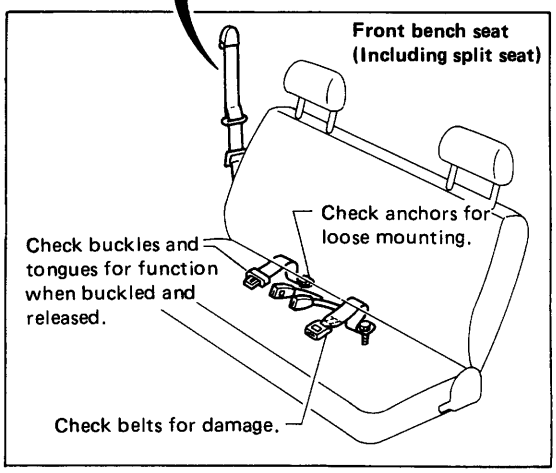
CHECKING SEAT BELTS, BUCKLES, RETRACTORS, ANCHORS AND ADJUSTERS

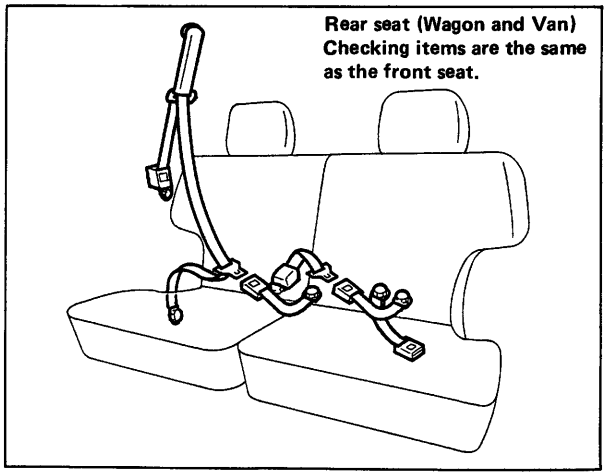






For front seat belt, shock absorber type belt has been used.
Replace the belt when loop has been pulled out and "REPLACE BELT" is visible because this seat belt has a loop of webbing under the sleeve.





CAUTION:

1. **If the vehicle is collided or overturned, replace the entire belt assembly, regardless of nature of accident.**
2. **If the condition of any component of a seat belt is questionable, do not repair seat belt, but replace it as a belt assembly.**
3. **If webbing is cut, frayed, or damaged, replace belt assembly.**
4. **Do not spill drinks, oil, etc. on inner lap belt buckle. Never oil tongue and buckle.**
5. **Use a NISSAN genuine seat belt assembly.**

Anchor bolt:

: 35.8 - 45.6 N·m (3.65 - 4.65 kg-m, 26.4 - 33.6 ft-lb)

SMA256C

Engine Maintenance

INSPECTION AND ADJUSTMENT

Drive belt deflection

Unit: mm (in)

	Used belt deflection		Deflection of new belt
	Limit	Deflection after adjustment	
Alternator	12 (0.47)	6 - 8 (0.24 - 0.31)	5 - 7 (0.20 - 0.28)
Air conditioner compressor	16 (0.63)	9 - 11 (0.35 - 0.43)	7 - 9 (0.28 - 0.35)
Power steering oil pump	17 (0.67)	11 - 13 (0.43 - 0.51)	9 - 11 (0.35 - 0.43)
Applied pushing force	98 N (10 kg, 22 lb)		

Oil capacity (Refill)

Unit: ℓ (US qt, Imp qt)

	2WD	4WD
With oil filter change	4.0 (4-1/4, 3-1/2)	3.4 (3-5/8, 3)
Without oil filter change	3.6 (3-7/8, 3-1/8)	3.0 (3-1/8, 2-5/8)

Coolant capacity

Unit: ℓ (US qt, Imp qt)

	2WD	4WD
Without reservoir tank	9.9 (10-1/2, 8-3/4)	10.9 (11-1/2, 9-5/8)
Reservoir tank	0.8 (7/8, 3/4)	

Spark plug

Standard type		BKR6EY
Hot type		BKR5EY
Cold type		BKR7EY
Plug gap	mm (in)	0.8 - 0.9 (0.031 - 0.035)

Engine Maintenance (Cont'd)

INSPECTION AND ADJUSTMENT

Drive belt deflection

Unit: mm (in)

	Used belt deflection		Set deflection of new belt
	Limit	Adjusted deflection	
Alternator	17 (0.67)	10 - 12 (0.39 - 0.47)	8 - 10 (0.31 - 0.39)
Air conditioner compressor	16 (0.63)	10 - 12 (0.39 - 0.47)	8 - 10 (0.31 - 0.39)
Power steering oil pump	15 (0.59)	9 - 11 (0.35 - 0.43)	7 - 9 (0.28 - 0.35)
Applied pushing force	98 N (10 kg, 22 lb)		

Oil capacity (Refill)

Unit: ℓ (US qt, Imp qt)

	2WD	4WD
With oil filter	3.9 (4-1/8, 3-3/8)	3.3 (3-1/2, 2-7/8)
Without oil filter	3.5 (3-3/4, 3-1/8)	2.9 (3-1/8, 2-1/2)

Coolant capacity

Unit: ℓ (US qt, Imp qt)

	2WD	4WD
Without reservoir tank	7.3 (7-3/4, 6-3/8)	8.2 (8-5/8, 7-1/4)
Reservoir tank	0.8 (7/8, 3/4)	

Spark plug

Standard type	ZFR5E-11
Hot type	ZFR4E-11
Cold type	ZFR6E-11
Plug gap	1.0 - 1.1 mm (0.039 - 0.043 in)

Chassis and Body Maintenance

INSPECTION AND ADJUSTMENT

Clutch

Unit: mm (in)

Item \ Engine	KA24E	VG30E
Pedal height "H"	236 - 246 (9.29 - 9.69)	227 - 237 (8.94 - 9.33)
Pedal free play "A"	1.0 - 3.0 (0.039 - 0.118)	

Front axle and front suspension

Wheel bearing preload (2WD Trucks)

Wheel bearing axial play mm (in)	0 (0)
Wheel bearing nut Tightening torque N·m (kg-m, ft-lb)	34 - 39 (3.5 - 4.0, 25 - 29)
Return angle degree	45°
Wheel bearing starting torque At wheel hub bolt With new grease seal N (kg, lb)	9.8 - 28.4 (1.0 - 2.9, 2.2 - 6.4)
With used grease seal N (kg, lb)	9.8 - 23.5 (1.0 - 2.4, 2.2 - 5.3)

Wheel bearing preload (Except 2WD Trucks)

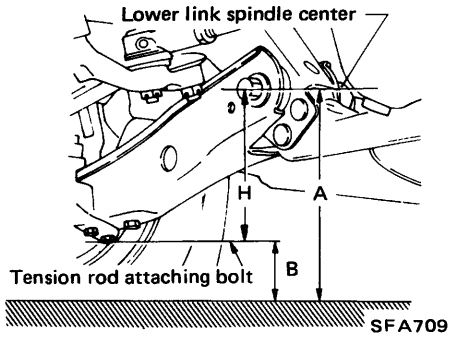
Wheel bearing lock nut Tightening torque N·m (kg-m, ft-lb)	78 - 98 (8 - 10, 58 - 72)
Retightening torque after loosening wheel bearing lock nut N·m (kg-m, ft-lb)	0.5 - 1.5 (0.05 - 0.15, 0.4 - 1.1)
Axial end play mm (in)	0 (0)
Starting force at wheel hub bolt N (kg, lb)	A
Turning angle degree	15° - 30°
Starting force at wheel hub bolt N (kg, lb)	B
Wheel bearing preload at wheel hub bolt N (kg, lb) B-A	7.06 - 20.99 (0.72 - 2.14, 1.59 - 4.72)

Chassis and Body Maintenance (Cont'd)

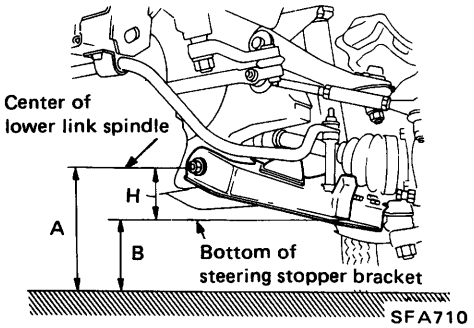
WHEEL ALIGNMENT (Unladen*1)

Applied model		ALLOWABLE LIMIT		ADJUSTING RANGE	
		2WD Truck	Except 2WD Truck	2WD Truck	Except 2WD Truck
Camber	degree	–0°20′ to 1°10′	–0°05′ to 1°25′	–0°5′ to 0°55′	0°10′ - 1°10′
Caster	degree	–0°23′ to 1°07′	33′ - 2°03′	–0°8′ to 0°52′	0°48′ - 1°48′
Kingpin inclination	degree	8°20′ - 9°50′	7°21′ - 8°51′	8°35′ - 9°35′	7°36′ - 8°36′
Camber, caster, and kingpin inclination difference between both sides	degree	45′		30′	
Total toe-in					
Bias tire	mm (in)	3 - 7 (0.12 - 0.28)	3 - 7 (0.12 - 0.28)	4 - 6 (0.16 - 0.24)	4 - 6 (0.16 - 0.24)
	degree	15′ - 35′	15′ - 35′	20′ - 30′	20′ - 30′
Radial tire	mm (in)	1 - 5 (0.04 - 0.20)	2 - 6 (0.08 - 0.24)	2 - 4 (0.08 - 0.16)	3 - 5 (0.12 - 0.20)
	degree	7′ - 27′	12′ - 32′	12′ - 22′	17′ - 27′
Front wheel turning angle					
Full turn*2	degree				
Except 31 x 10.5R15 tire					
Inside		34° - 38°	31° - 35°	36° - 38°	33° - 35°
Outside		31° - 35°	29° - 33°	33° - 35°	31° - 33°
31 x 10.5R15 tire					
Inside		–	25° - 29°	–	27° - 29°
Outside		–	23° - 27°	–	25° - 29°
Vehicle posture					
Lower arm pivot height (H)	mm (in)	108 - 118 (4.25 - 4.65)	41 - 51 (1.61 - 2.01)	111 - 115 (4.37 - 4.53)	44 - 48 (1.73 - 1.89)

2WD Trucks



Except 2WD Trucks



*1: Fuel, radiator coolant and engine oil full. Spare tire, jack, hand tools and mats in designated positions.
*2: On power steering models, wheel turning force (at circumference of steering wheel) of 98 to 147 N (10 to 15 kg, 22 to 33 lb) with engine idle.

Brake

Unit: mm (in)

Disc brake Pad repair limit			2.0 (0.079)
Rotor thickness repair limit CL28VA CL28VD AD14VB			20 (0.79) 24 (0.94) 16 (0.63)
Drum brake Drum inner dia. repair limit LT26B LT30A DS17H			261.5 (10.30) 296.5 (11.67) 191.0 (7.52)
Lining wear limit			1.5 (0.059)
Pedal free height	A/T		212 - 222 (8.35 - 8.74)
	M/T		209 - 219 (8.23 - 8.62)
Pedal depressed height	2WD VG30E		115 (4.53) or more
	Except 2WD VG30E		120 (4.72) or more
Pedal free play			4 - 12 (0.16 - 0.47)
Parking brake Number of notches	Center lever type	Truck	10 - 12
		Van & Wagon	7 - 9
	Stick lever type	2WD	10 - 12
		4WD	9 - 11

Wheel and tire

Tire inflation

Proper tire pressures are shown on the tire placard affixed into the glove box of vehicle.

Tire pressure should be checked when tires are COLD.

WHEEL RUNOUT

Wheel type	Aluminum	Steel		
		15 inches	14 inches	
			Painted	Plated
Radial runout limit mm (in)	0.3 (0.012)	0.8 (0.031)	0.5 (0.020)	1.2 (0.047)
Lateral runout limit mm (in)	0.3 (0.012)	0.8 (0.031)	0.8 (0.031)	1.2 (0.047)

BALANCING WHEELS

Wheel blanace (Maximum allowable unbalance at rim flange)	g (oz)	10 (0.35)
Tire balancing weight	g (oz)	5 - 60 (0.18 - 2.12) Spacing 5 (0.18)

TIGHTENING TORQUE

Unit	N·m	kg-m	ft-lb
Manual transmission Drain and filler plugs	25 - 34	2.5 - 3.5	18 - 25
Transfer Drain and filler plugs	25 - 34	2.5 - 3.5	18 - 25
Differential carrier Drain and filler plugs (Except C200 type) Front Rear	 39 - 59 59 - 98	 4 - 6 6 - 10	 29 - 43 43 - 72
Drain plug*2	59 - 98	6 - 10	43 - 72
Filler plug*2	39 - 59	4 - 6	29 - 43
Front axle and front suspension Tie-rod lock nut (4WD)	78 - 98	8.0 - 10.0	58 - 72
Tie-rod clamp bolt (2WD)	14 - 20	1.4 - 2.0	10 - 14
Wheel nut Single tire	118 - 147	12 - 15	87 - 108
Aluminum wheel	118 - 147	12 - 15	87 - 108

*2: Model equipped with C200

ENGINE MECHANICAL

SECTION EM

EM

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PREPARATION ..... EM- 3

VG30E

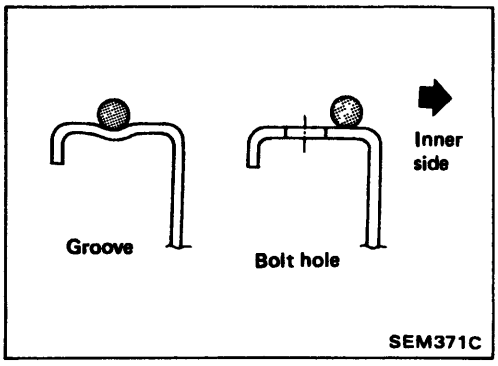
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KA24E

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Parts Requiring Angular Tightening

- Some important engine parts are tightened using an angular-tightening method rather than a torque setting method.
- If these parts are tightened using a torque setting method, dispersal of the tightening force (axial bolt force) will be two or three times that of the dispersal produced by using the correct angular-tightening method.
- Although the torque setting values (described in this manual) are equivalent to those used when bolts and nuts are tightened with an angular-tightening method, they should be used for reference only.
- To assure the satisfactory maintenance of the engine, bolts and nuts must be tightened using an angular-tightening method.
- Before tightening the bolts and nuts, ensure that the thread and seating surfaces are clean and then coated with engine oil.
- The bolts and nuts which require the angular-tightening method are as follows:
  (1) Cylinder head bolts
  (2) Connecting rod cap nuts



Liquid Gasket Application Procedure

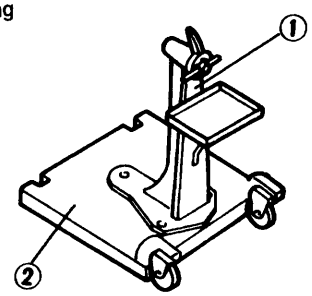
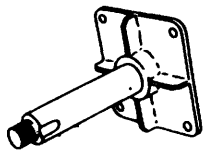
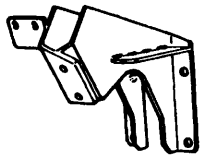
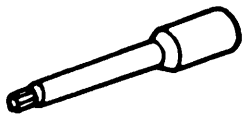
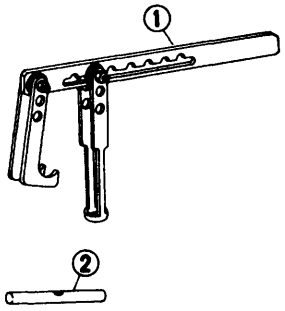
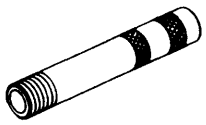
a. Before applying liquid gasket, use a scraper to remove all traces of old liquid gasket from mating surface.

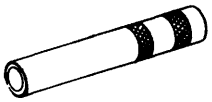
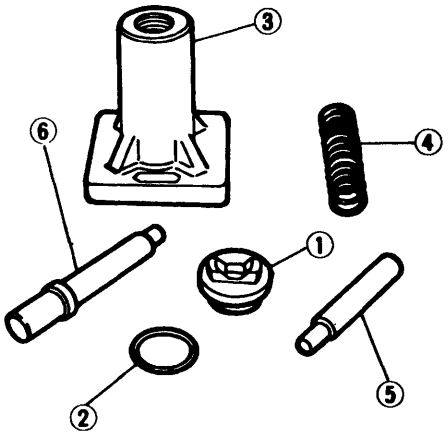
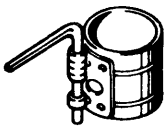
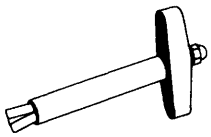
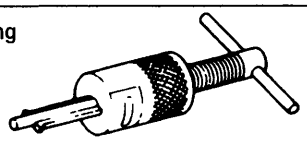
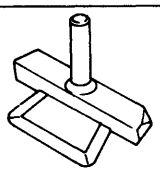
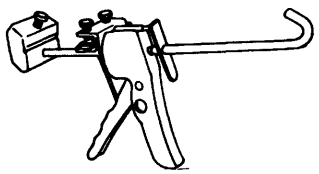
b. Apply a continuous bead of liquid gasket to mating surfaces. (Use Genuine Liquid Gasket or equivalent.)
- **Be sure liquid gasket is 3.5 to 4.5 mm (0.138 to 0.177 in) wide (for oil pan).**
- **Be sure liquid gasket is 2.0 to 3.0 mm (0.079 to 0.118 in) wide (in areas except oil pan).**

c. Apply liquid gasket to inner surface around hole perimeter area.
(Assembly should be done within 5 minutes after coating.)

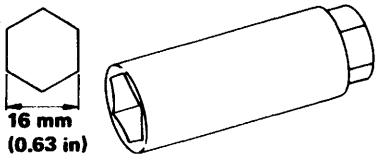
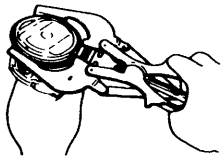
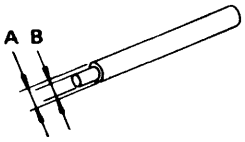
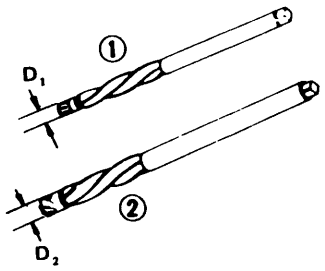
d. Wait at least 30 minutes before refilling engine oil and engine coolant.

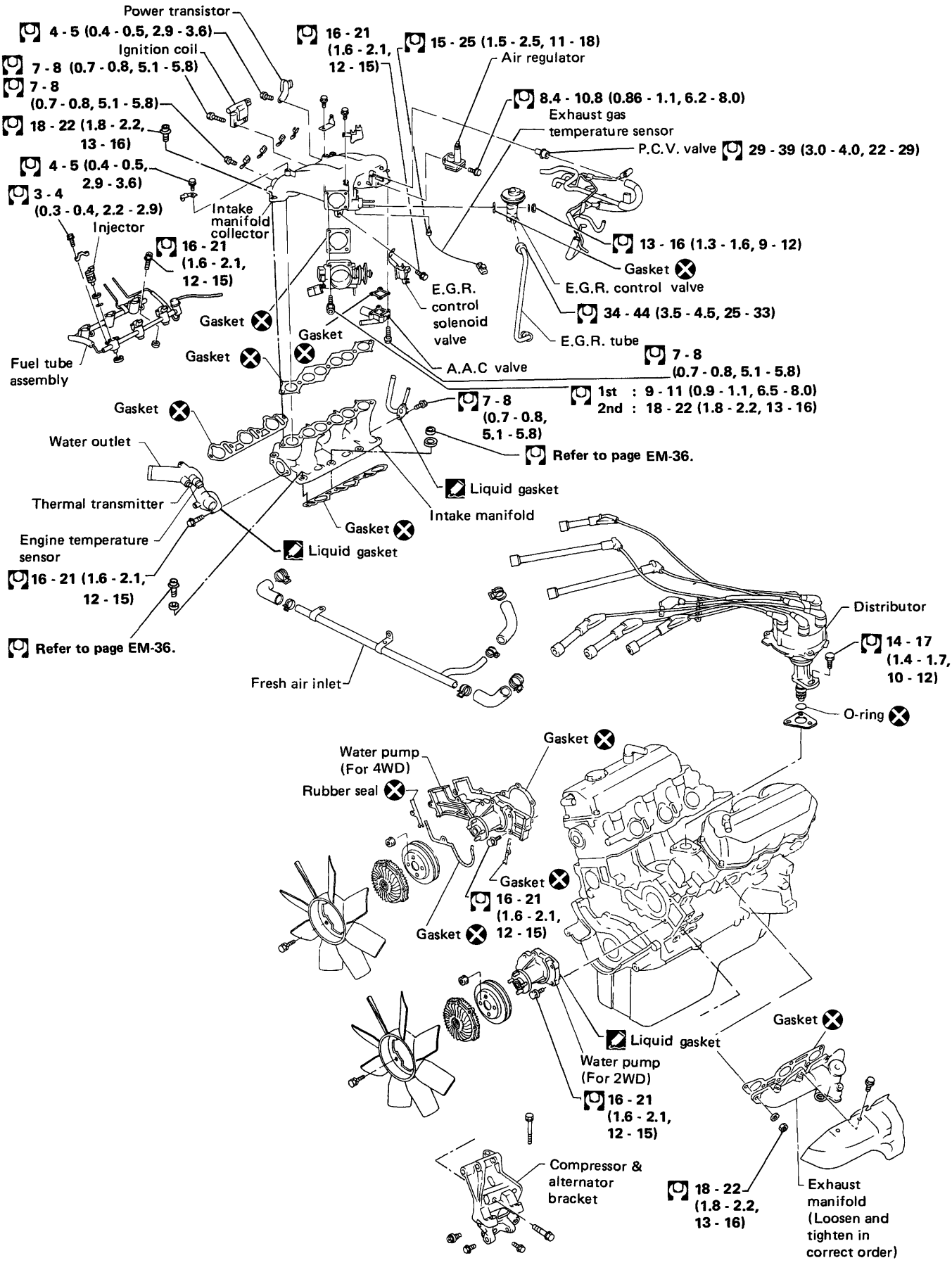
SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.) Tool name	Description	Engine application	
		VG30E	KA24E
ST0501S000 (–) Engine stand assembly ① ST05011000 (–) Engine stand ② ST05012000 (–) Base	Disassembling and assembling 	X	X
KV10106500 (–) Engine stand shaft		X	–
KV10105001 (–) Engine attachment		–	X
KV10110001 (–) Engine sub-attachment		X	–
ST10120000 (J24239-01) Cylinder head bolt wrench	Loosening and tightening cylinder head bolt 	X	–
KV10110600 (J33986) Valve spring compressor	Disassembling and assembling valve components 	X	–
KV101092S0 (–) Valve spring compressor ① KV10109210 (–) Compressor ② KV10109220 (–) Adapter	Disassembling and assembling valve components 	–	X
KV10107501 (–) Valve oil seal drift	Installing valve oil seal 	X	–

Tool number (Kent-Moore No.) Tool name	Description	Engine application	
		VG30E	KA24E
KV109B0010 (–) Valve oil seal drift	Installing valve oil seal. 	–	X
KV10110300 (–) Piston pin press stand assembly ① KV10110310 (–) Cap ② KV10110330 (–) Spacer ③ ST13030020 (–) Press stand ④ ST13030030 (–) Spring ⑤ KV10110340 (–) Drift ⑥ KV10110320 (–) Center shaft	Disassembling and assembling piston with connecting rod 	X	X
EM03470000 (J8037) Piston ring compressor	Installing piston assembly into cylinder bore 	X	X
(J36467) Valve oil seal remover	Displacement valve oil seal 	–	X
ST16610001 (J23907) Pilot bushing puller	Removing crankshaft pilot bushing 	X	X
KV10111100 (–) Seal cutter	Removing oil pan 	X	X
WS39930000 (–) Tube presser	Pressing the tube of liquid gasket 	X	X

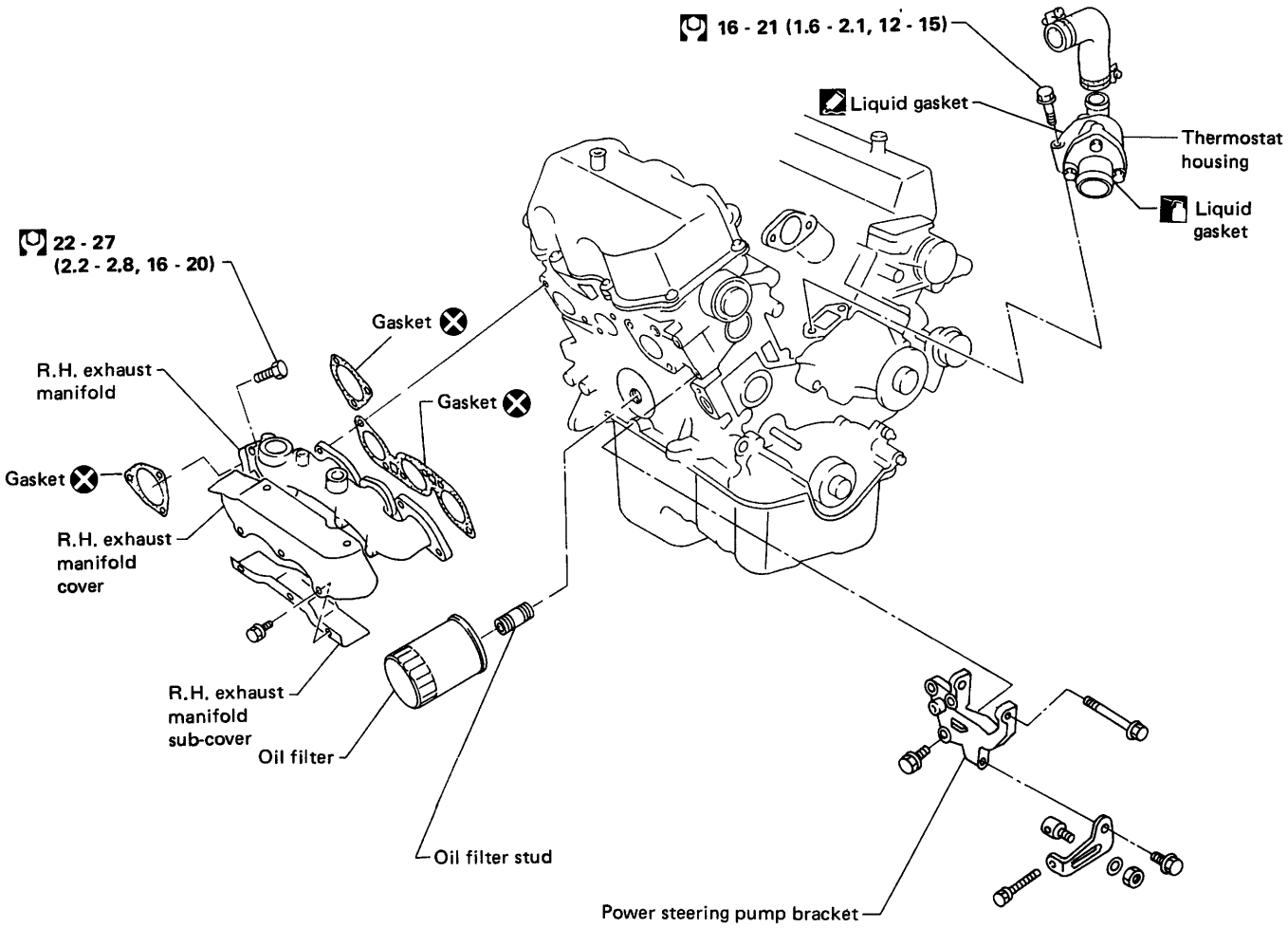
COMMERCIAL SERVICE TOOLS

Tool name	Description	Engine application	
		VG30E	KA24E
Spark plug wrench	Removing and installing spark plug 	X	X
Pulley holder	Holding camshaft pulley while tightening or loosening camshaft bolt 	X	X
Valve seat cutter set	Finishing valve seat dimensions 	X	X
Piston ring expander	Removing and installing piston ring 	X	X
Valve guide drift	Removing and installing valve guide Diameter: mm (in) Intake: 10.5 (0.413) — Exhaust: 10.5 (0.413) VG30E B: 6.6 (0.260) — Exhaust: 6.6 (0.260) KA24E A: 10.5 (0.413) — Exhaust: 11.5 (0.453) KA24E B: 6.6 (0.260) — Exhaust: 7.6 (0.299) 	X	X
Valve guide reamer	Reaming valve guide ① or hole for oversize valve guide ② **Intake:** **D_1 = 7.0 mm (0.276 in) dia.** **D_2 = 11.2 mm (0.441 in) dia.** **Exhaust:** **D_1 = 8.0 mm (0.315 in) dia.** **D_2 = 12.2 mm (0.480 in) dia.** 	X	X



: N·m (kg-m, ft-lb)

SEM812C

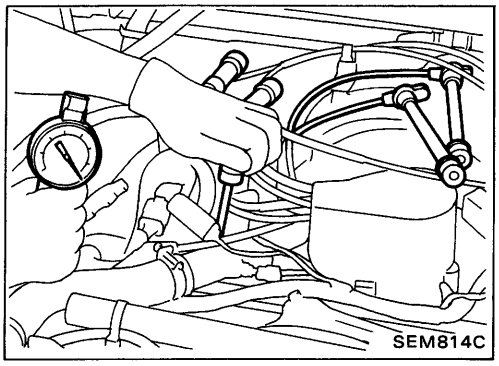


: N·m (kg-m, ft-lb)

SEM813C

Measurement of Compression Pressure

1. Warm up engine.
2. Turn ignition switch off.
3. Release fuel pressure.
   Refer to "Releasing Fuel Pressure" in section EF & EC.
4. Remove all spark plugs.
5. Disconnect distributor center cable.


SEM814C

6. Attach a compression tester to No. 1 cylinder.
7. Depress accelerator pedal fully to keep throttle valve wide open.
8. Crank engine and record highest gauge indication.
9. Repeat the measurement on each cylinder as shown above.

- **Always use a fully-charged battery to obtain specified engine revolution.**

Compression pressure: kPa (kg/cm², psi)/300 rpm

Standard
1,196 (12.2, 173)
Minimum
883 (9.0, 128)
Difference limit between cylinders
98 (1.0, 14)

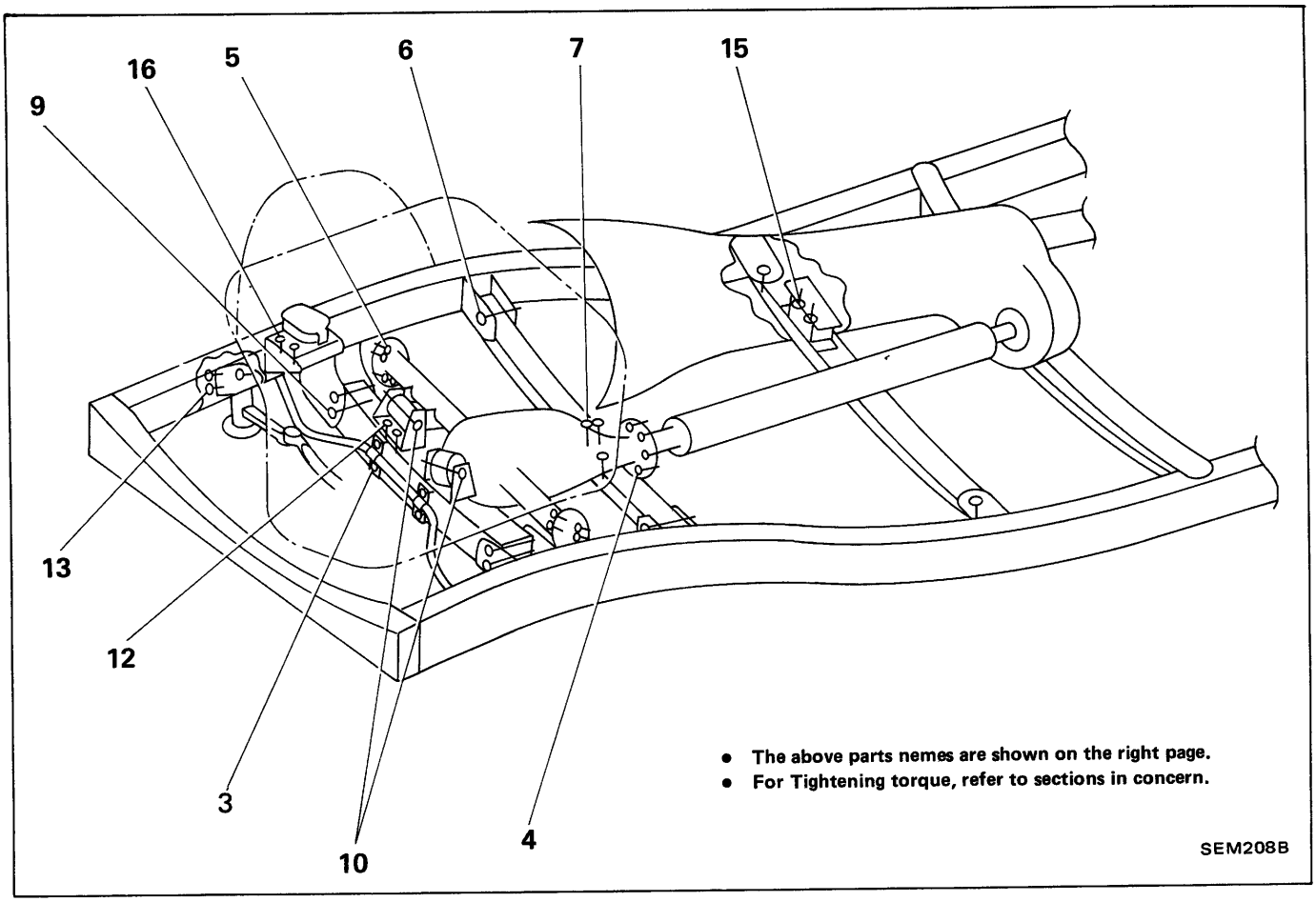
10. If cylinder compression in one or more cylinders is low, pour a small amount of engine oil into cylinders through spark plug holes and retest compression.

- **If adding oil helps compression, piston rings may be worn or damaged. If so, replace piston rings after checking piston.**
- **If pressure stays low, a valve may be sticking or seating improperly. Inspect and repair valve and valve seat. (Refer to S.D.S.) If valve or valve seat is damaged excessively, replace them.**
- **If compression in any two adjacent cylinders is low and if adding oil does not help compression, there is leakage past the gasket surface. If so, replace cylinder head gasket.**


20 mm (0.79 in) dia.

Use compressor tester whose end (rubber portion) is less than 20 mm (0.79 in) dia. Otherwise, it may be caught by cylinder head during removal.
SEM387C

Removal



WARNING:

a. Place vehicle on a flat and solid surface.
b. Place chocks at front and rear of rear wheels.
c. You should not remove oil pan until exhaust system and cooling system have completely cooled off.
   Otherwise, you may burn yourself and/or fire may break out in the fuel line.
d. When remove front and/or rear engine mounting bolts or nuts, lift up slightly engine for safety work.

CAUTION:

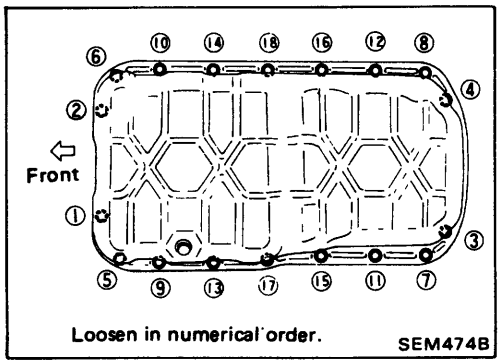
a. In lifting engine, be careful not to hit against adjacent parts, especially against accelerator wire casing end, brake tube and brake master cylinder.
b. For tightening torque, refer to sections AT, MT and PD.

Removal (Cont'd)

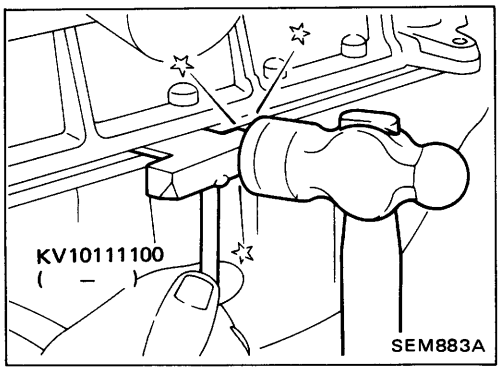
Removal order and points	VG30E	
	2WD model	4WD model
1 Remove undercover.	O	O
2 Drain engine oil.	O	O
3 Remove stabilizer bracket bolts (R.H. & L.H.).	O	–
4 Remove front propeller shaft from front differential carrier.	–	O
5 Remove front drive shaft fixing bolts (R.H. & L.H.).	–	O
6 Remove front differential carrier member bolt (R.H. & L.H.).	–	O
7 Remove front differential carrier fixing bolts and support it.	–	O
8 Remove front differential carrier bleeder hose.	–	O
9 Remove front suspension cross-member.	O	–
10 Remove differential front mounting bolts (R.H. & L.H.).	–	O
11 Remove front differential carrier.	–	O
12 Remove front differential carrier mounting bracket.	–	O
13 Remove idler arm.	O	O
14 Remove starter motor.	O	O
15 Remove transmission to rear engine mounting bracket nuts (R.H. & L.H.).	–	O
16 Remove engine mounting bolts or nuts (R.H. & L.H.).	–	O
17 Remove engine gussets.	O	O
18 Lift up engine. If necessary, disconnect exhaust tube.	–	O
19 Remove oil pan.	*	*

* Refer to next page.

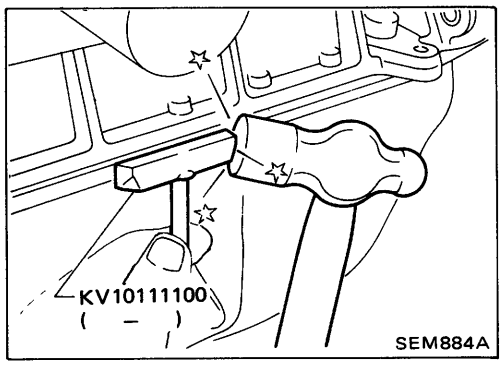
Removal (Cont'd)



1. Remove oil pan bolts.

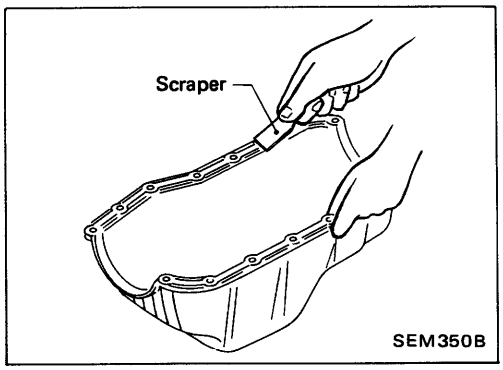


2. Remove oil pan.
(1) Insert Tool between cylinder block and oil pan.
- **Do not drive seal cutter into oil pump or rear oil seal retainer portion, or aluminum mating face will be damaged.**
- **Do not insert screwdriver, or oil pan flange will be deformed.**

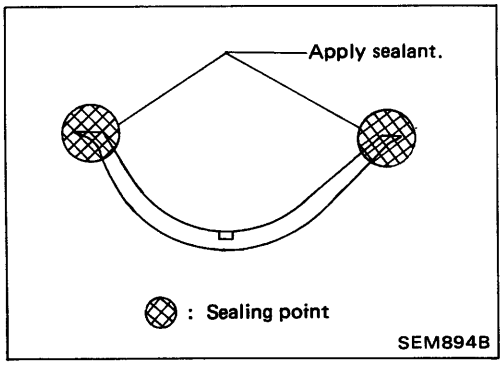


(2) Slide Tool by tapping its side with a hammer, and remove oil pan.

Installation

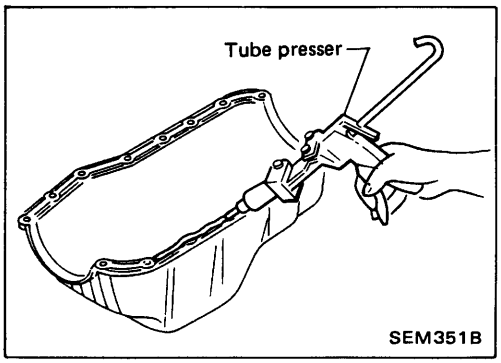


1. Before installing oil pan, remove all traces of liquid gasket from mating surface using a scraper.
- Also remove traces of liquid gasket from mating surface of cylinder block.

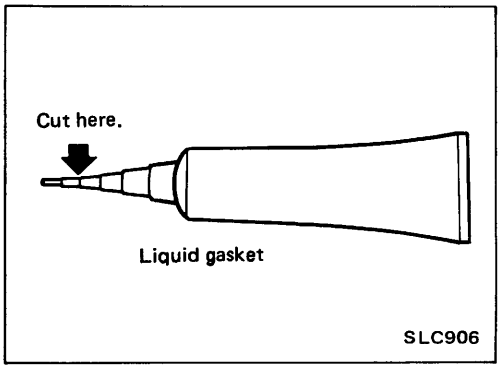


2. Apply sealant to oil pump gasket and rear oil seal retainer gasket.

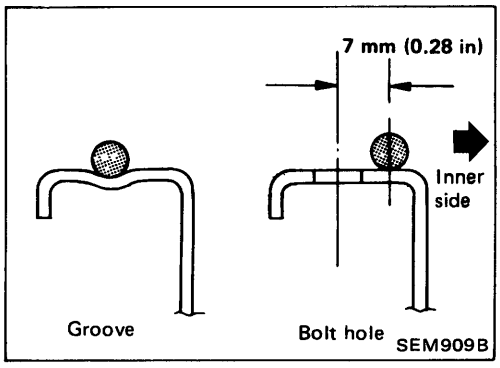
Installation (Cont'd)



3. Apply a continuous bead of liquid gasket to mating surface of oil pan.
- **Use Genuine Liquid Gasket or equivalent.**



- Be sure liquid gasket is 3.5 to 4.5 mm (0.138 to 0.177 in) wide.

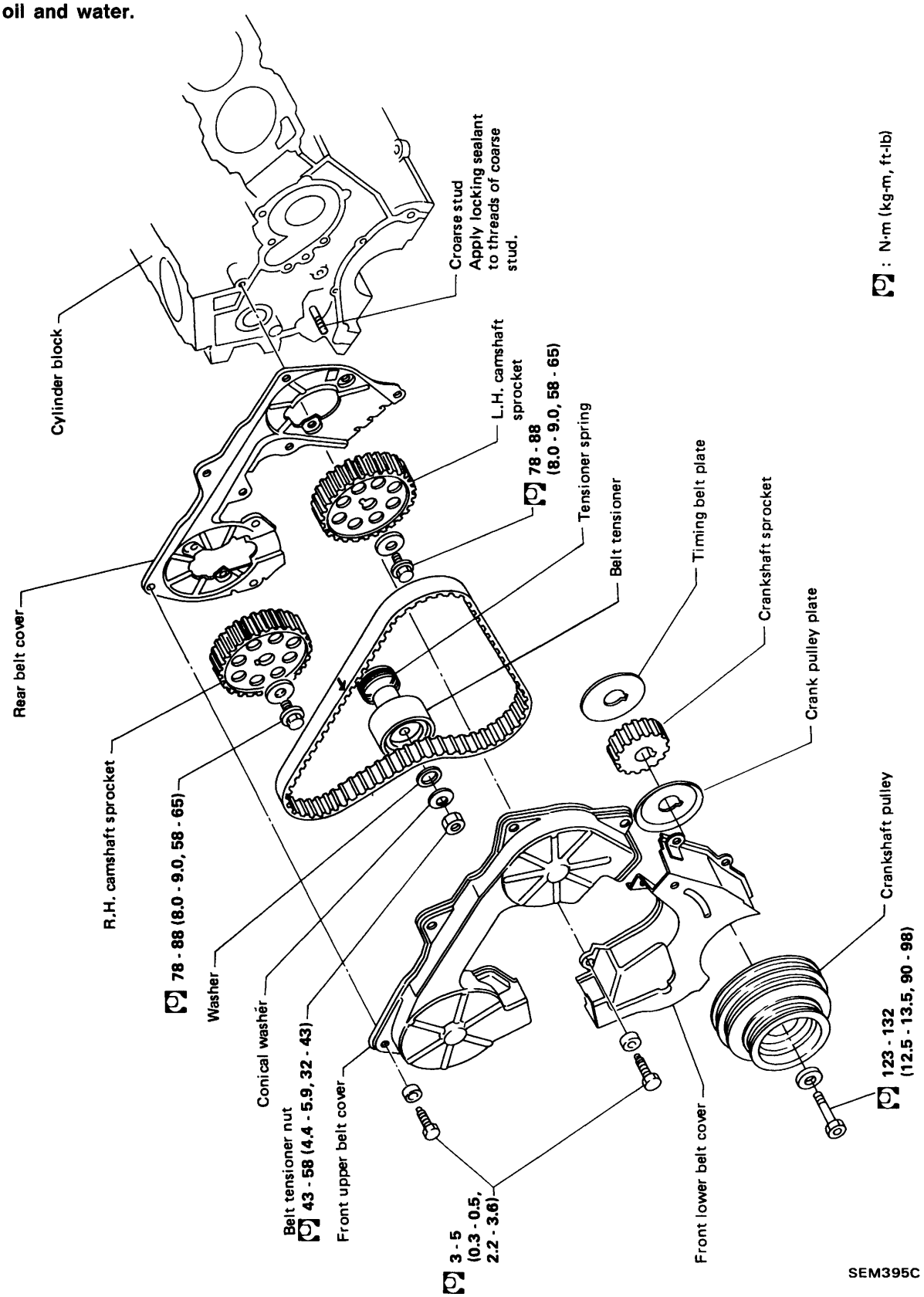


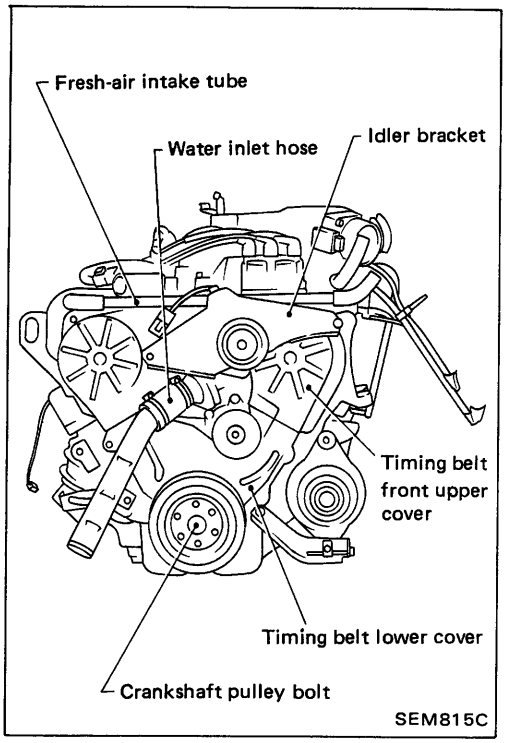
4. Apply liquid gasket to inner sealing surface as shown in figure.
- Attaching should be done within 5 minutes after coating.

5. Install oil pan.
- **Install bolts/nuts in their reverse order of removal.**
- **Wait at least 30 minutes before refilling engine oil.**

CAUTION:

a. **Do not bend or twist timing belt.**
b. **After removing timing belt, do not turn crankshaft and camshaft separately because valves will strike piston heads.**
c. **Make sure that timing belt, camshaft sprocket, crankshaft sprocket and belt tensioner are clean and free from oil and water.**



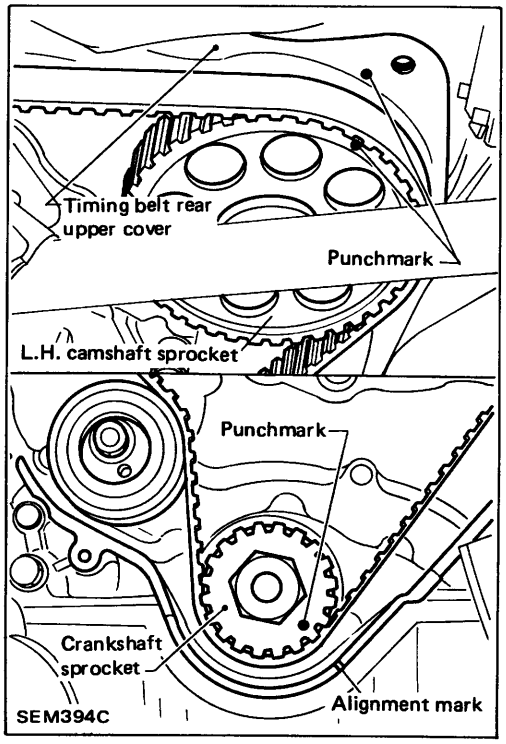


Removal

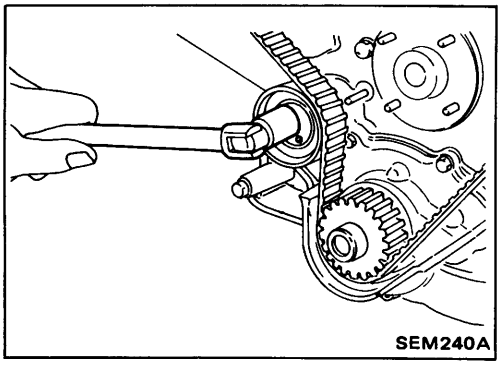
1. Remove engine under cover.
2. Drain engine coolant from radiator.

Be careful not to spill coolant on drive belts.

3. Remove radiator. (Refer to LC section.)
4. Remove engine cooling fan and water pump pulley.
5. Remove the following belts.
   - Power steering pump drive belt
   - Compressor drive belt
   - Alternator drive belt
6. Remove all spark plugs.
7. Remove distributor protector.
8. Remove compressor drive belt idler bracket.
9. Remove fresh-air intake tube for rocker cover.
10. Remove water hose for thermostat housing.
11. Remove crankshaft pulley bolt.
12. Remove crankshaft pulley with a suitable puller.
13. Remove front upper and lower belt covers.



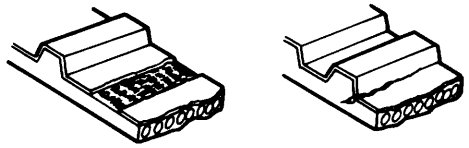
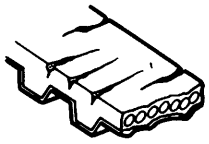
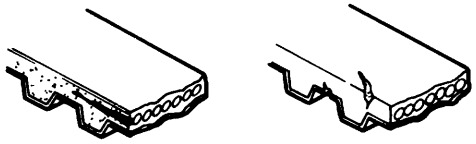
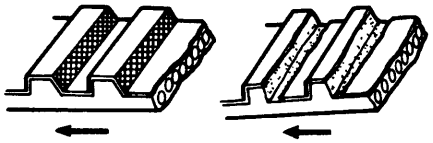
14. Set No. 1 piston at T.D.C. on its compression stroke by rotating crankshaft.
    - **Align punchmark on L.H. camshaft sprocket with punchmark on timing belt upper rear cover.**
    - **Align punchmark on crankshaft sprocket with notch on oil pump housing.**
    - **Temporarily install crank pulley bolt on crankshaft so that crankshaft can be rotated.**



15. Loosen timing belt tensioner nut, turn tensioner, then remove timing belt.

Inspection

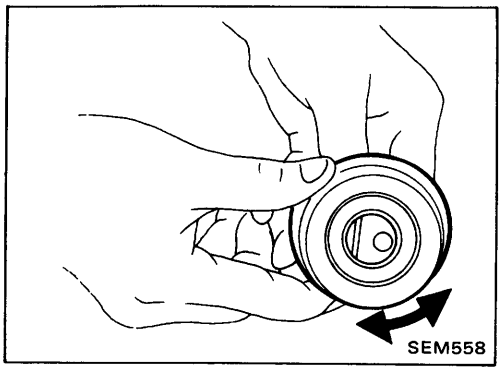
Visually check the condition of timing belt.
Replace if any abnormality is found.

Item to check	Problem	Cause
Tooth is broken/ tooth root is cracked.	 SEM394A	• Camshaft jamming • Distributor jamming • Damaged camshaft/crankshaft oil seal
Back surface is cracked/worn.	 SEM395A	• Tensioner jamming • Overheated engine • Interference with belt cover
Side surface is worn.	 • Belt corners are worn and round. • Wicks are frayed and coming out. SEM396A	• Improper installation of belt • Malfunctioning crankshaft pulley plate/ timing belt plate
Teeth are worn.	 Rotating direction • Canvas on tooth face is worn down. • Canvas on tooth is fluffy, rubber layer is worn down and faded white, or weft is worn down and invisible. SEM397A	• Poor belt cover sealing • Coolant leakage at water pump • Camshaft not functioning properly • Distributor not functioning properly • Excessive belt tension
Oil/Coolant or water is stuck to belt.		• Poor oil sealing of each oil seal • Coolant leakage at water pump • Poor belt cover sealing

Inspection (Cont'd)

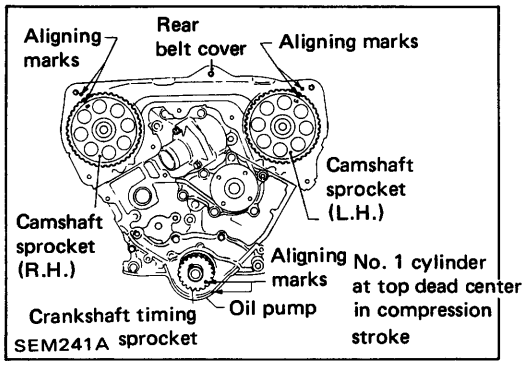
BELT TENSIONER AND TENSIONER SPRING

1. Check belt tensioner for smooth turning.
2. Check condition of tensioner spring.


SEM558

Installation

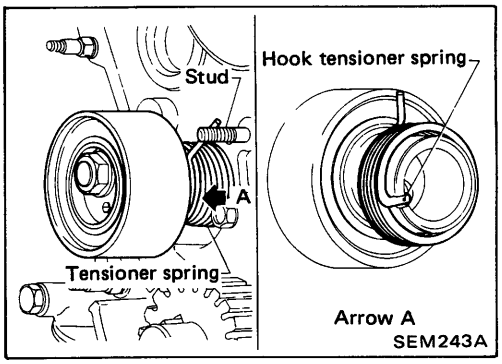
1. Confirm that No. 1 piston is set at T.D.C. on its compression stroke.



SEM241A

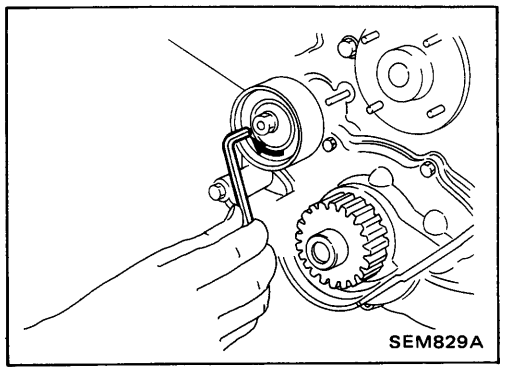
2. Install tensioner and tensioner spring.

If stud is once removed, apply locking sealant to threads of stud before installing.



SEM243A

3. Turn tensioner fully clockwise with hexagon wrench, and temporarily tighten lock nut.

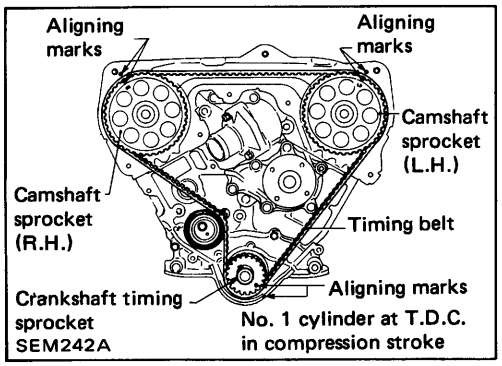

SEM829A

4. Set timing belt.

(1) Align white lines on timing belt with punchmarks on camshaft sprockets and crankshaft sprocket.

(2) Point arrow on timing belt toward front belt cover.

Number of teeth (reference):

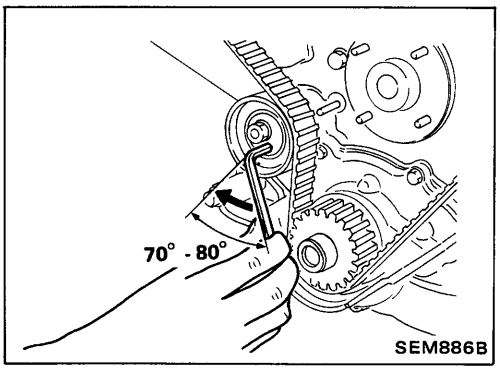


SEM242A

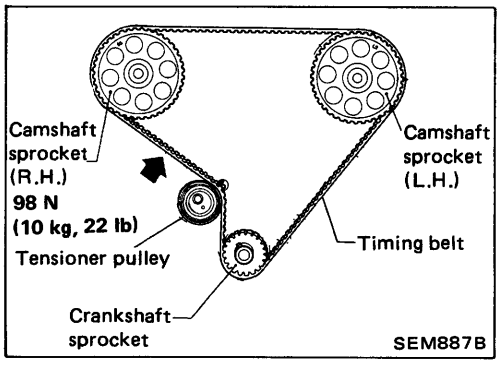
Number of timing belt teeth		133
Number of teeth between timing marks	Between L.H. and R.H. camshaft sprockets	40
	Between L.H. camshaft sprocket and crankshaft timing sprocket	43

Installation (Cont'd)

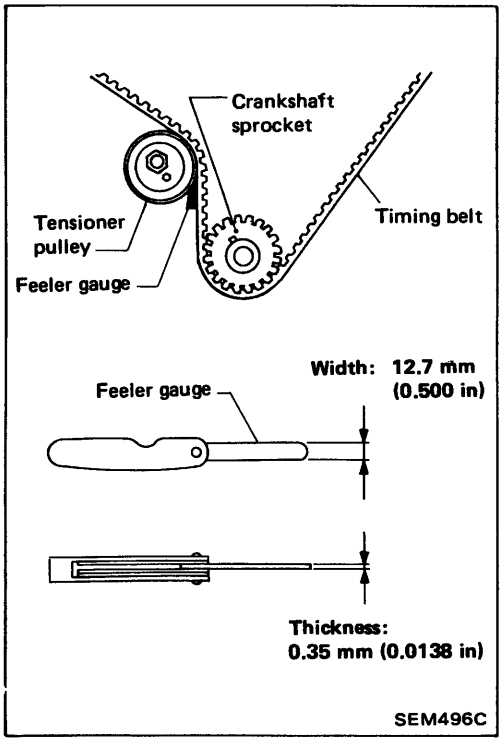
5. Loosen tensioner lock nut, keeping tensioner steady with hexagon wrench.



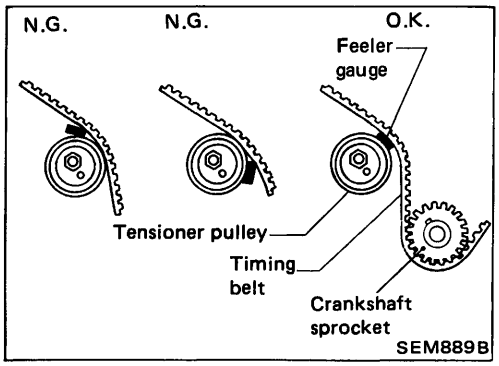
6. Turn tensioner 70 to 80 degrees clockwise with hexagon wrench, and temporarily tighten lock nut.
7. Turn crankshaft clockwise at least 2 times, then slowly set No. 1 piston at T.D.C. on its compression stroke.



8. Push middle of timing belt between R.H. camshaft sprocket and tensioner pulley with force of 98 N (10 kg, 22 lb).
9. Loosen tensioner lock nut, keeping tensioner steady with hexagon wrench.



10. Set feeler gauge as shown in figure which is 0.35 mm (0.0138 in) thick and 12.7 mm (0.500 in) wide.

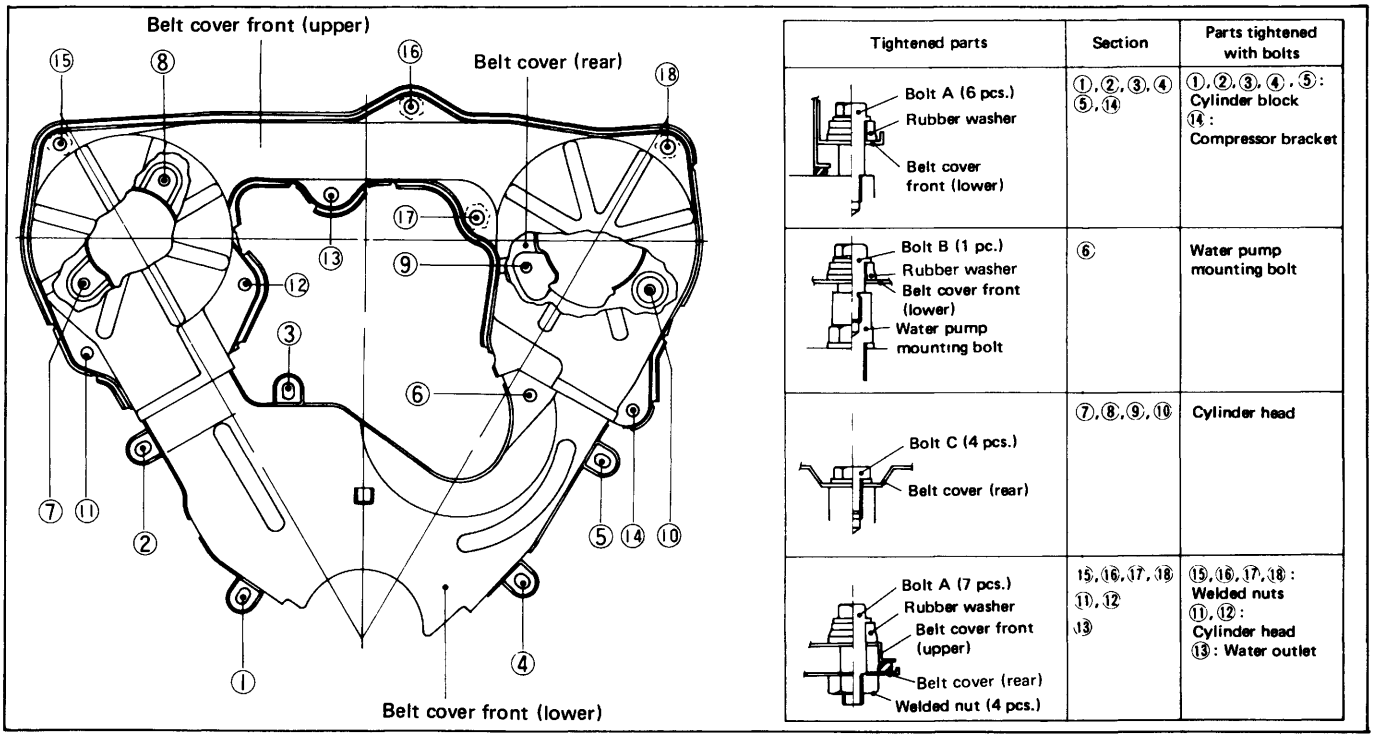


Installation (Cont'd)

11. Turn crankshaft clockwise, and set feeler gauge as shown in figure.
- Timing belt will move about 2.5 teeth.

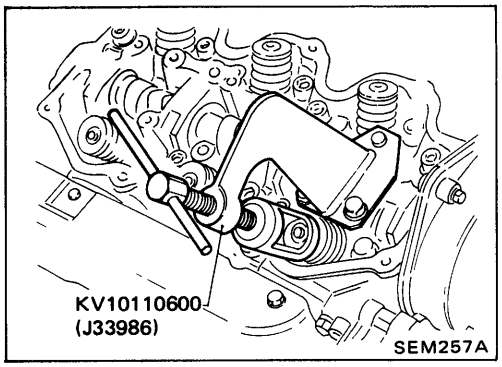
12. Tighten tensioner lock nut, keeping tensioner steady with hexagon wrench.

13. Turn crankshaft clockwise or counterclockwise, and remove feeler gauge.
14. Turn crankshaft clockwise at least 2 times, then slowly set No. 1 piston at T.D.C. on its compression stroke.
15. Install lower and upper belt covers.



Tightened parts	Section	Parts tightened with bolts
Bolt A (6 pcs.), Rubber washer, Belt cover front (lower)	①, ②, ③, ④, ⑤, ⑭	①, ②, ③, ④, ⑤: Cylinder block ⑭: Compressor bracket
Bolt B (1 pc.), Rubber washer, Belt cover front (lower), Water pump mounting bolt	⑥	Water pump mounting bolt
Bolt C (4 pcs.), Belt cover (rear)	⑦, ⑧, ⑨, ⑩	Cylinder head
Bolt A (7 pcs.), Rubber washer, Belt cover front (upper), Belt cover (rear), Welded nut (4 pcs.)	⑮, ⑯, ⑰, ⑱, ⑪, ⑫, ⑬	⑮, ⑯, ⑰, ⑱: Welded nuts ⑪, ⑫: Cylinder head ⑬: Water outlet

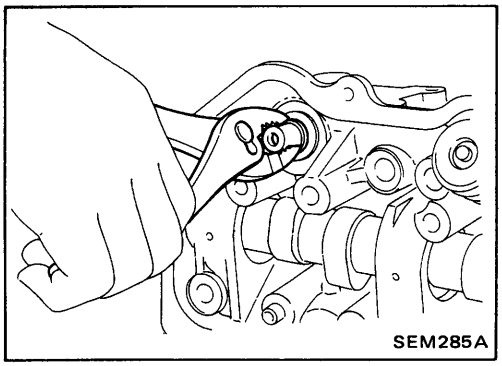
SEM248A



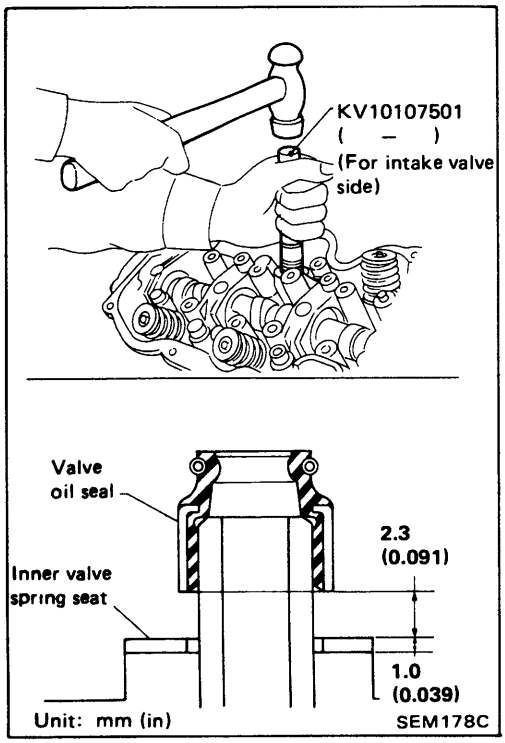
VALVE OIL SEAL

1. Remove rocker cover.
2. Remove rocker shaft assembly and valve lifters with valve lifter guide.
3. Remove valve springs and valve oil seal.

- Piston concerned should be set at T.D.C. to prevent valve from falling.
- When removing intake side valve oil seal, use Tool or suitable tool.

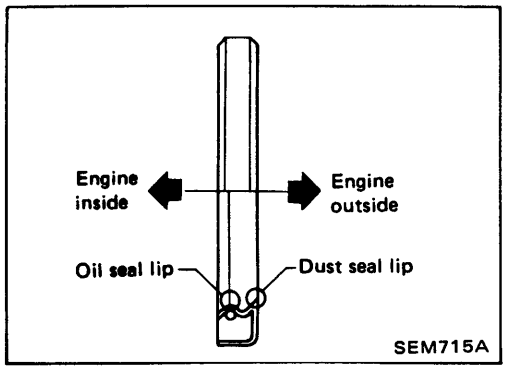


- When removing exhaust side valve oil seal, pull it out with suitable tool.

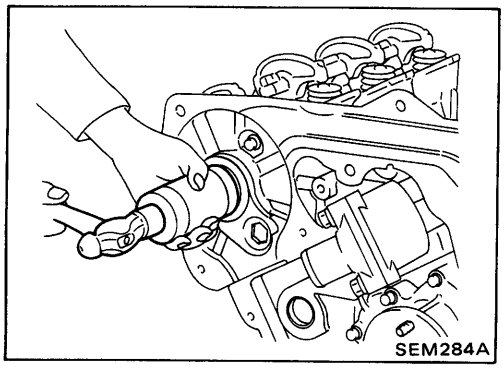


4. Apply engine oil to new valve oil seal and install it.

- Before installing valve oil seal, install inner valve spring seat.
- When installing intake side valve oil seal, use Tool.
- When installing exhaust side valve oil seal, set it by hand.



OIL SEAL INSTALLING DIRECTION

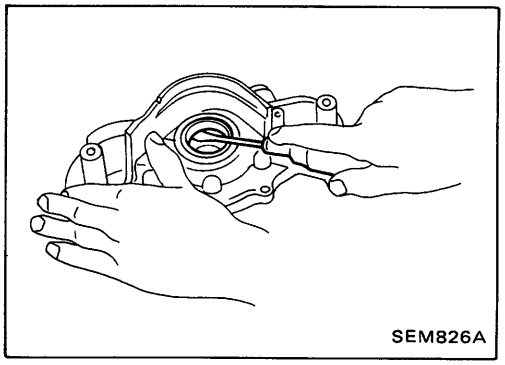

SEM284A

CAMSHAFT OIL SEAL

1. Remove timing belt.
2. Remove camshaft sprocket.
3. Remove camshaft.
4. Remove camshaft oil seal.

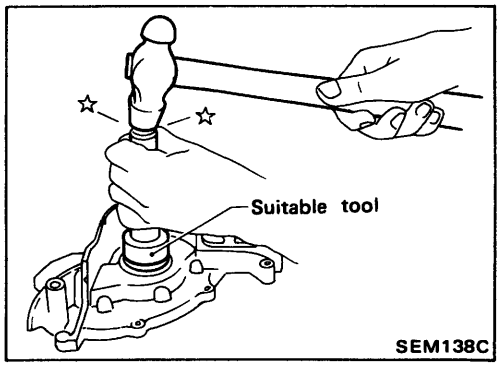
Be careful not to scratch camshaft.

5. Apply engine oil to new camshaft oil seal.


SEM826A

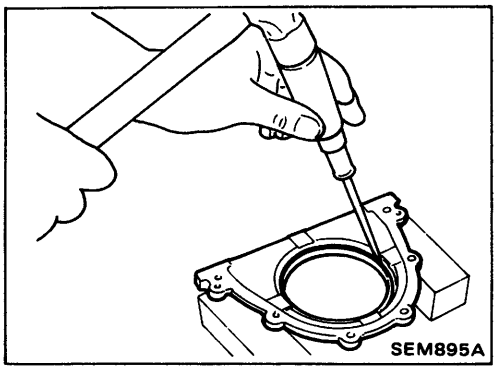
FRONT OIL SEAL

1. Remove timing belt and crankshaft sprocket.
2. Remove oil pump assembly.
3. Remove front oil seal from oil pump body.



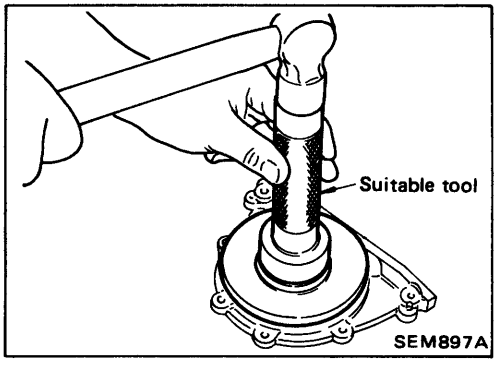
SEM138C

4. Apply engine oil to new oil seal and install it using suitable tool.


SEM895A

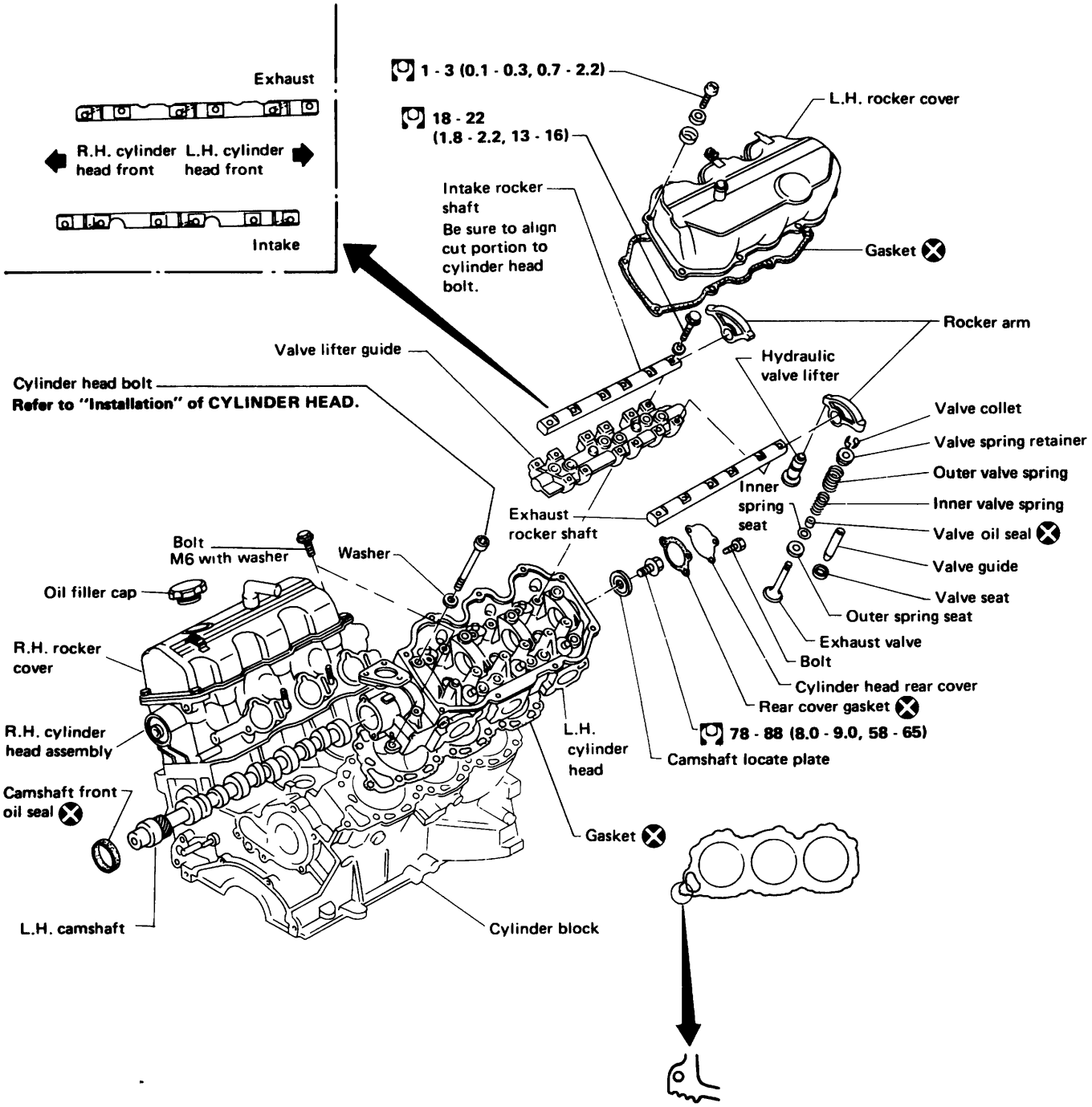
REAR OIL SEAL

1. Remove flywheel or drive plate.
2. Remove rear oil seal retainer.
3. Remove rear oil seal from retainer.



SEM897A

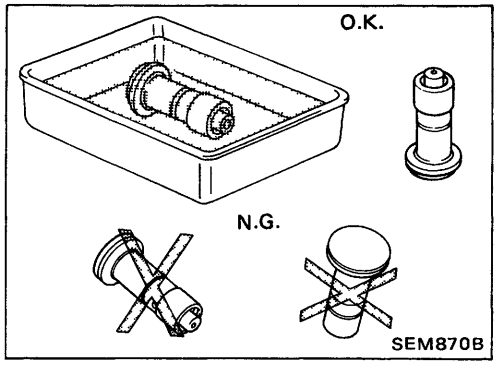
4. Apply engine oil to new oil seal and install it using suitable tool.
5. Install rear oil seal retainer with a new gasket to cylinder block.



: N·m (kg-m, ft-lb)

SEM912B

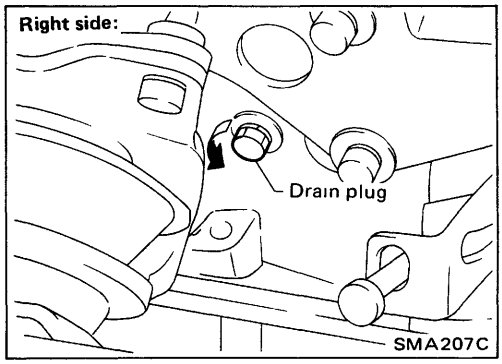
CAUTION:
- **When installing sliding parts such as rocker arms, camshaft and oil seal, be sure to apply new engine oil on their sliding surfaces.**
- **When tightening cylinder head bolts and rocker shaft bolts, apply new engine oil to thread portions and seat surfaces of bolts.**

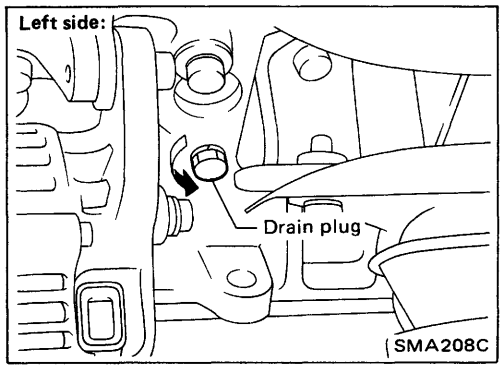


- **If hydraulic valve lifter is kept on its side, there is a risk of air entering it. After removal, always set hydraulic valve lifter straight up, or when laying it on its side, have it soak in new engine oil.**
- **Do not disassemble hydraulic valve lifter.**
- **Attach tags to valve lifters so as not to mix them up.**

Removal

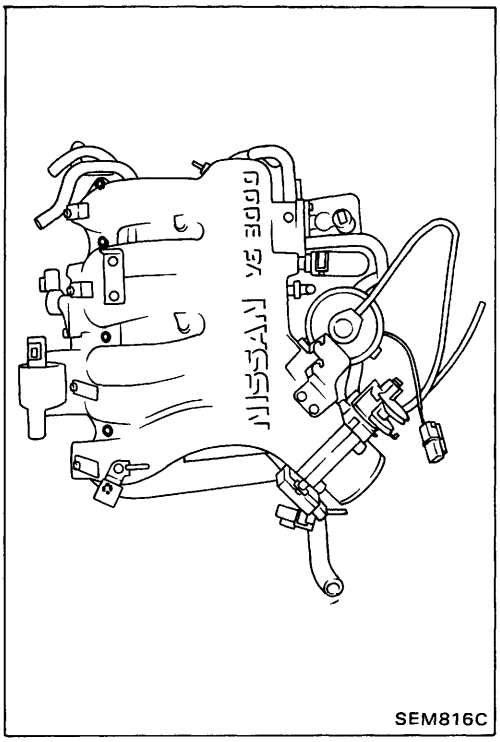
1. Release fuel pressure.
   Refer to "Releasing Fuel Pressure" in section EF & EC.
2. Remove timing belt.
   Refer to "TIMING BELT — Removal".





3. Drain coolant by removing drain plugs from both sides of cylinder block.

Removal (Cont'd)

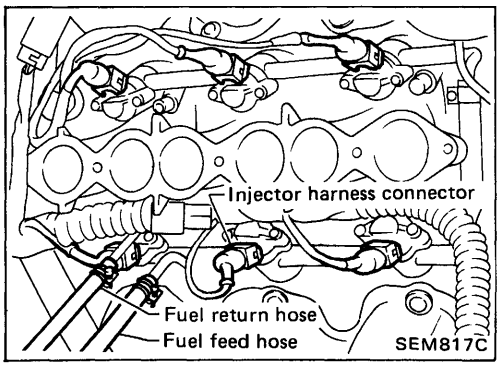


4. Separate A.S.C.D. and accelerator control wire from intake manifold collector.
5. Remove intake manifold collector from engine. The following parts should be disconnected to remove intake manifold collector.

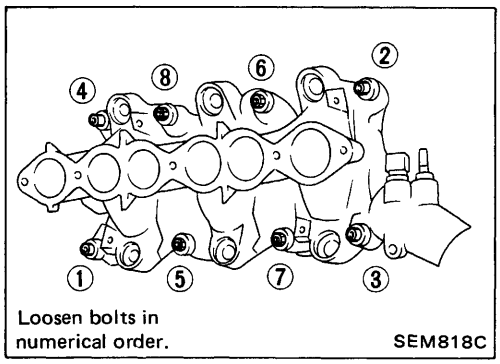
a. Harness connectors for
- A.A.C. valve
- Throttle sensor and throttle valve switch
- Ignition coil
- Power transistor
- E.G.R. control solenoid valve
- Air regulator
- Exhaust gas temperature sensor (California model only)

b. Water hoses from collector
c. Heater hoses
d. P.C.V. hose from R.H. rocker cover
e. Vacuum hoses for
- Canister
- Master brake cylinder
- Pressure regulator

f. Purge hose from canister
g. E.G.R. tube
h. Earth harnesses
i. Air duct hose



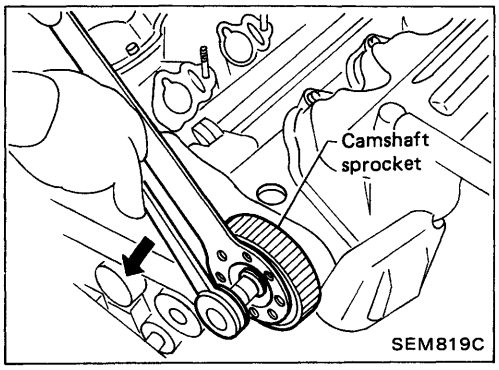
6. Remove fuel feed and fuel return hoses from injector fuel tube assembly.
7. Disconnect all injector harness connectors.
8. Remove injector fuel tube assembly.



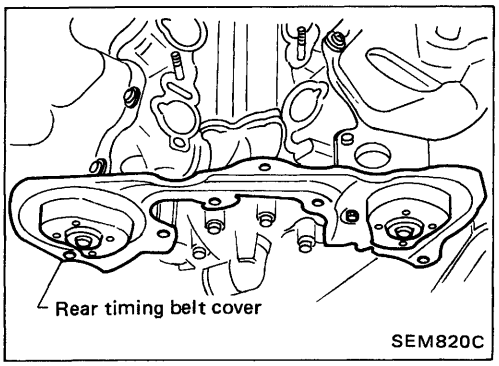
9. Remove intake manifold from engine.
The following parts should be disconnected to remove intake manifold.

a. Engine temperature switch harness connector
b. Thermal transmitter harness connector
c. Water hose from thermostat housing

Removal (Cont'd)



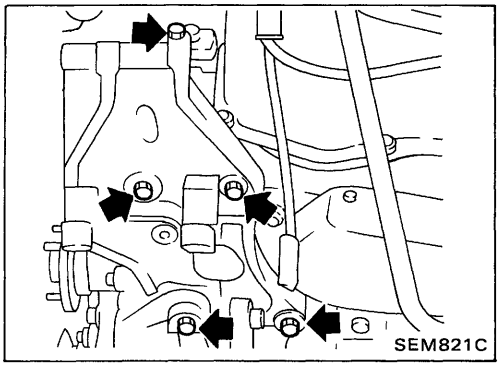
10. Remove both camshaft sprockets.



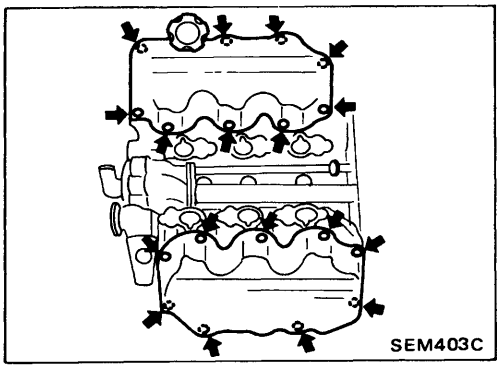
11. Remove rear timing belt cover.
12. Remove distributor and ignition wires.

After pulling out distributor from cylinder head, do not rotate distributor rotor.

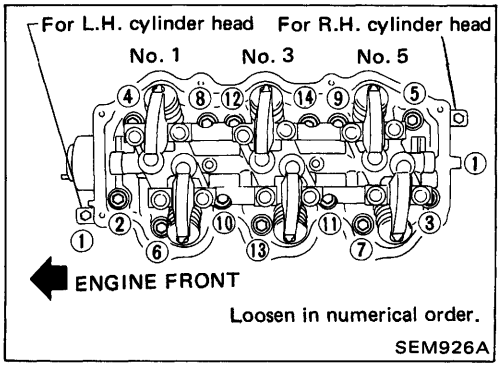
13. Remove harness clamp from R.H. rocker cover.
14. Remove front exhaust tube from exhaust manifold.



15. Remove compressor from its bracket.
16. Remove alternator from its bracket.
17. Remove compressor and alternator bracket.

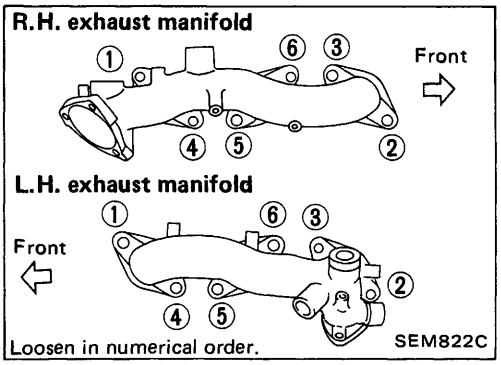


18. Remove both rocker covers.



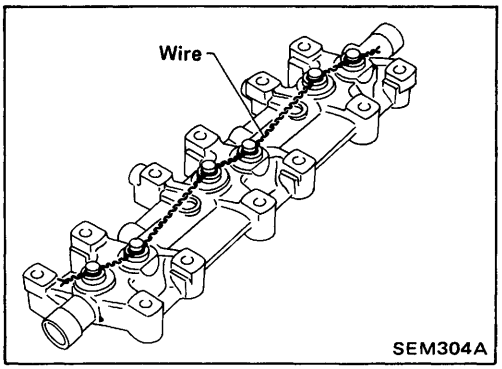
19. Remove cylinder head with exhaust manifold.

- **Head warpage or cracking could result from removing in incorrect order.**
- **Cylinder head bolts should be loosened in two or three steps.**



Disassembly

1. Remove exhaust manifolds from cylinder head.

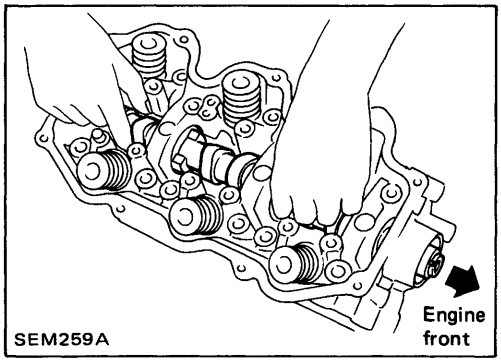


2. Remove rocker shafts with rocker arms.

Bolts should be loosened in two or three steps.

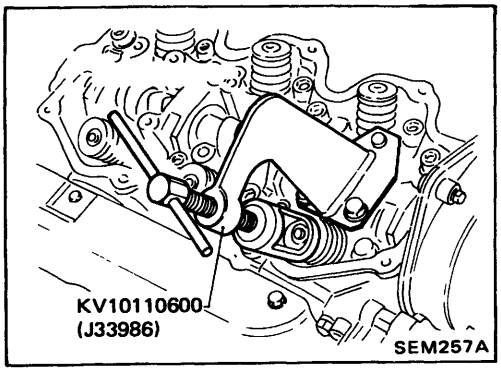
3. Remove hydraulic valve lifters and lifter guide.

- **Hold hydraulic valve lifters with wire so that they will not drop from lifter guide.**

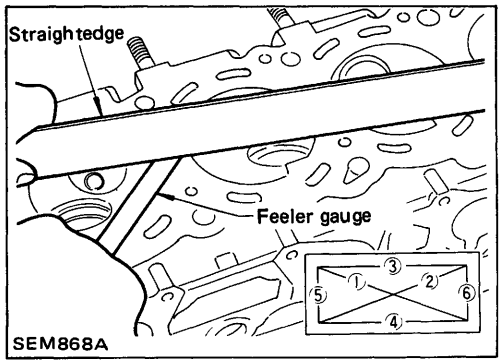


4. Remove oil seal and camshaft.

- **Before removing camshaft, measure camshaft end play.**



5. Remove valve components with Tool.
6. Remove valve oil seals with Tool or suitable tool.



Inspection

CYLINDER HEAD DISTORTION

Head surface flatness:

Less than 0.1 mm (0.004 in)

If beyond the specified limit, replace it or resurface it.

Resurfacing limit:

The resurfacing limit of cylinder head is determined by the cylinder block resurfacing in an engine.

Amount of cylinder head resurfacing is "A".

Amount of cylinder block resurfacing is "B".

Inspection (Cont'd)

The maximum limit is as follows:

A + B = 0.2 mm (0.008 in)

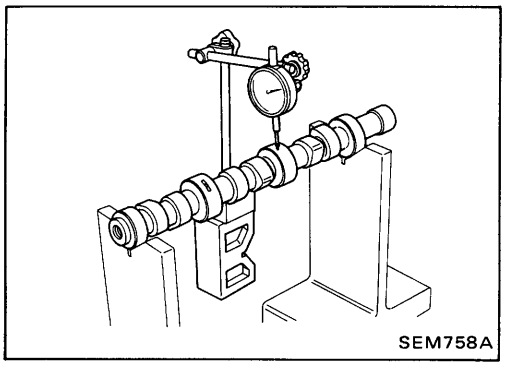
After resurfacing cylinder head, check that camshaft rotates freely by hand. If resistance is felt, cylinder head must be replaced.

Nominal cylinder head height:

106.8 - 107.2 mm (4.205 - 4.220 in)

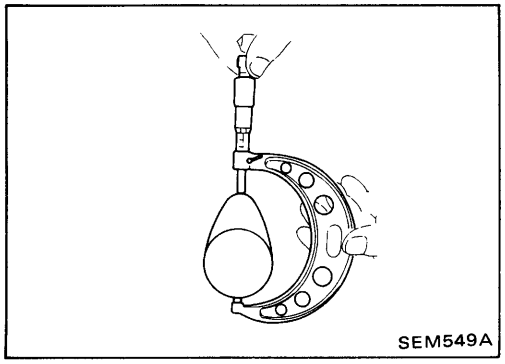
CAMSHAFT VISUAL CHECK

Check camshaft for scratches, seizure and wear.


SEM758A

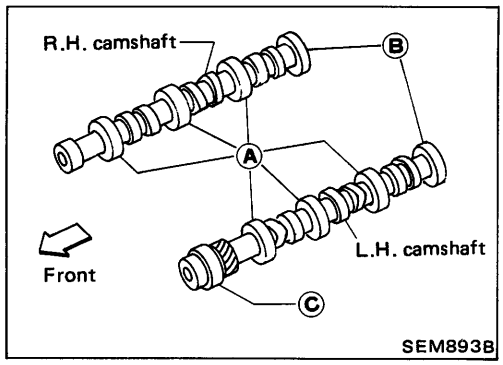
CAMSHAFT RUNOUT

1. Measure camshaft runout at the center journal.
   Runout (Total indicator reading):
   Limit 0.1 mm (0.004 in)
2. If it exceeds the limit, replace camshaft.


SEM549A

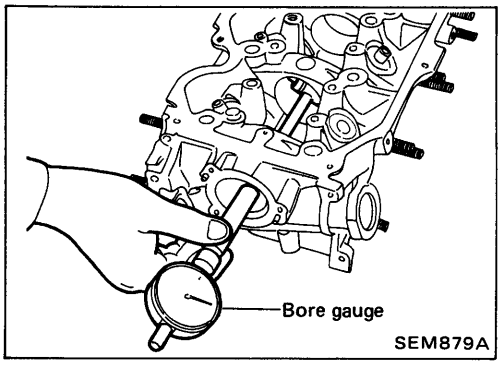
CAMSHAFT CAM HEIGHT

1. Measure camshaft cam height.
   Standard cam height:
   39.537 - 39.727 mm (1.5566 - 1.5641 in)
   Cam wear limit:
   0.15 mm (0.0059 in)
2. If wear is beyond the limit, replace camshaft.



SEM893B

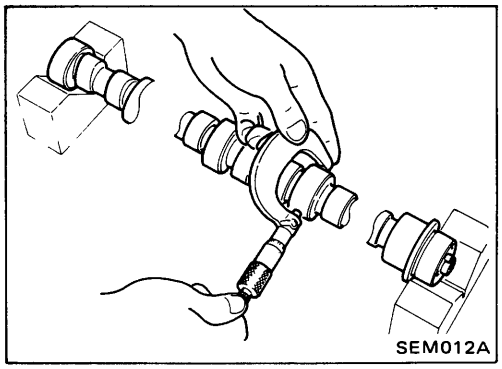
CAMSHAFT JOURNAL CLEARANCE



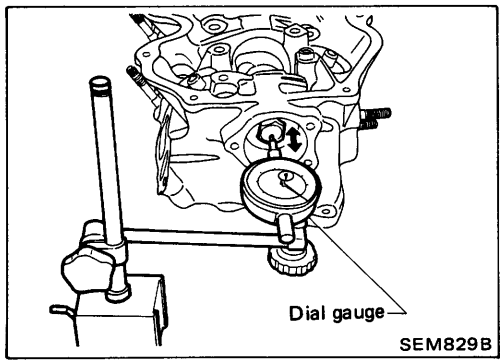
SEM879A

1. Measure inner diameter of camshaft bearing.
   Standard inner diameter:
   A 47.000 - 47.025 mm (1.8504 - 1.8514 in)
   B 42.500 - 42.525 mm (1.6732 - 1.6742 in)
   C 48.000 - 48.025 mm (1.8898 - 1.8907 in)

Inspection (Cont'd)


SEM012A

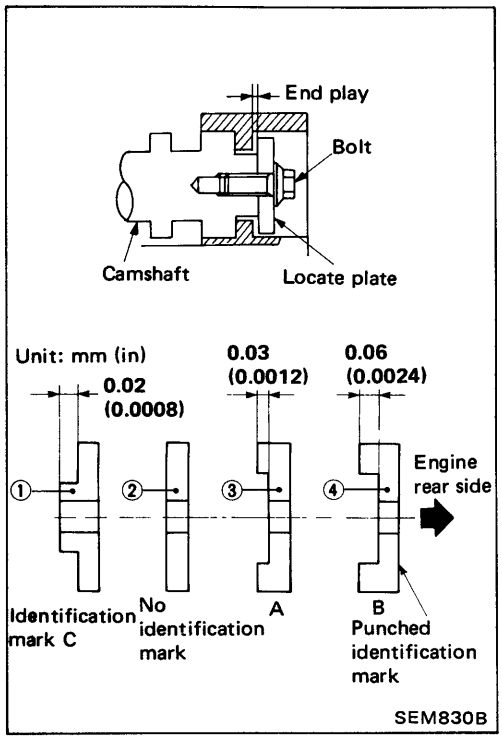
2. Measure outer diameter of camshaft journal.
   Standard outer diameter:
   A 46.920 - 46.940 mm (1.8472 - 1.8480 in)
   B 42.420 - 42.440 mm (1.6701 - 1.6709 in)
   C 47.920 - 47.940 mm (1.8866 - 1.8874 in)
3. If clearance exceeds the limit, replace camshaft and/or cylinder head.
   Camshaft journal clearance limit:
   0.15 mm (0.0059 in)



SEM829B

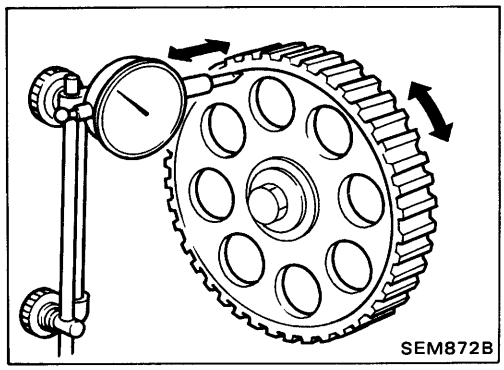
CAMSHAFT END PLAY

1. Install camshaft and locate plate in cylinder head.
2. Measure camshaft end play.
   Camshaft end play:
   Standard 0.03 - 0.06 mm (0.0012 - 0.0024 in)



SEM830B

3. If it is out of the specified range, select thickness of camshaft locate plate to obtain standard specified end play.
   Example:
   When camshaft end play is 0.08 mm (0.0031 in) with camshaft locate plate ②, replace camshaft locate plate ② with camshaft locate plate ③ to set the end play at 0.05 mm (0.0020 in).

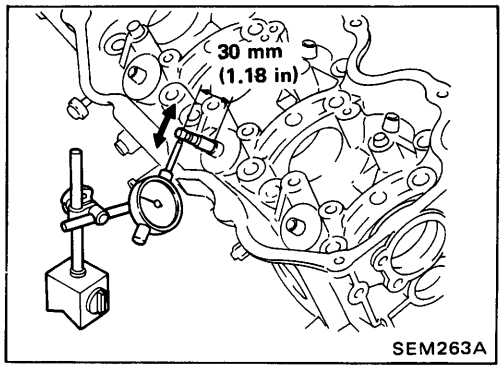

SEM872B

CAMSHAFT SPROCKET RUNOUT

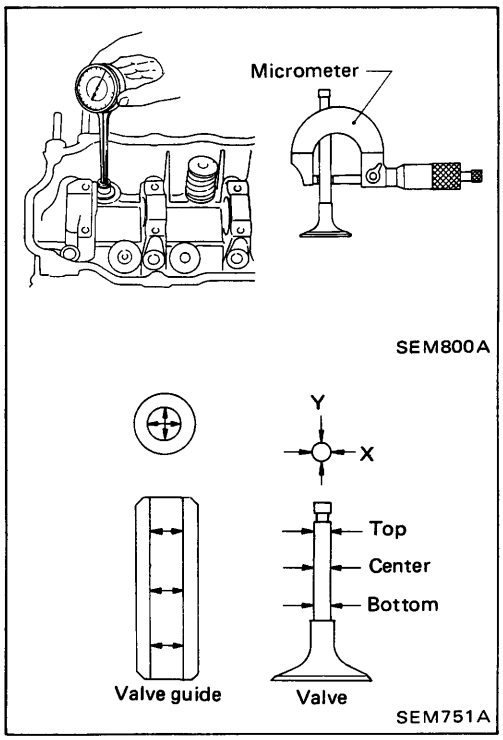
1. Install sprocket on camshaft.
2. Measure camshaft sprocket runout.
   Runout (Total indicator reading):
   Limit 0.1 mm (0.004 in)
3. If it exceeds the limit, replace camshaft sprocket.

Inspection (Cont'd)

VALVE GUIDE CLEARANCE

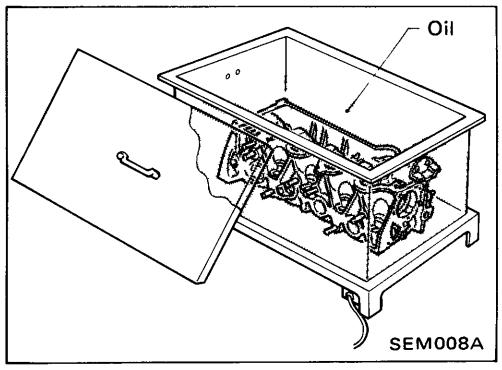


1. Measure valve deflection in a right-angled direction with camshaft. (Valve and valve guide mostly wear in this direction.)
   Valve deflection limit (Dial gauge reading):
   0.20 mm (0.0079 in)

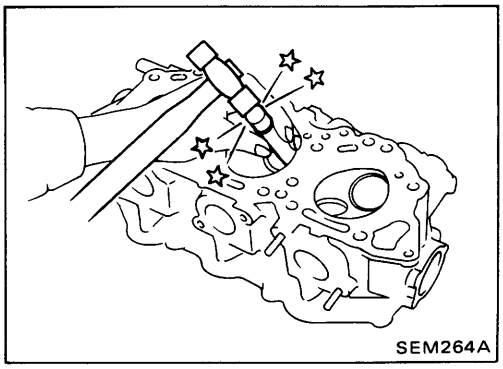


2. If it exceeds the limit, check valve to valve guide clearance.
a. Measure valve stem diameter and valve guide inner diameter.
b. Check that clearance is within specification.
   Valve to valve guide clearance:
   Intake
   0.020 - 0.053 mm (0.0008 - 0.0021 in)
   Exhaust
   0.030 - 0.053 mm (0.0012 - 0.0021 in)
   Limit
   0.10 mm (0.0039 in)
c. If it exceeds the limit, replace valve or valve guide.

VALVE GUIDE REPLACEMENT

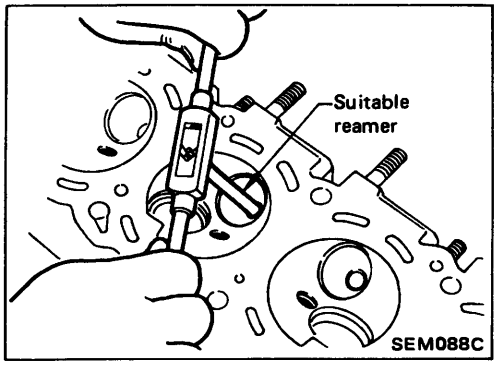


1. To remove valve guide, heat cylinder head to 150 to 160°C (302 to 320°F).

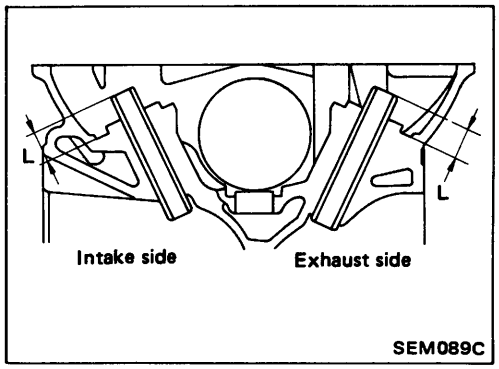


2. Drive out valve guide with a press [under a 20 kN (2 t, 2.2 US ton, 2.0 Imp ton) pressure] or hammer and suitable tool.

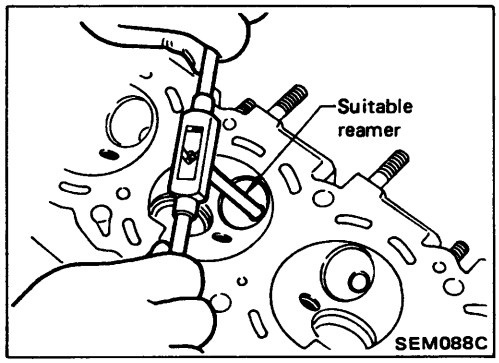
Inspection (Cont'd)



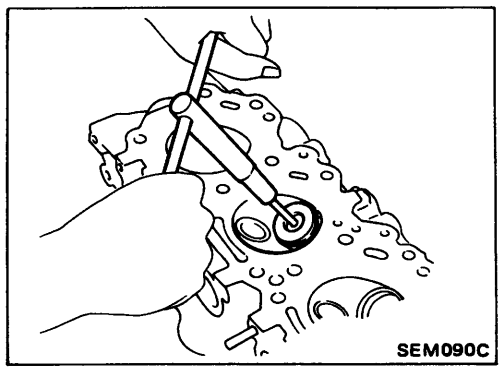
3. Ream cylinder head valve guide hole.
   Valve guide hole diameter
   (for service parts):
   Intake
   11.175 - 11.196 mm (0.4400 - 0.4408 in)
   Exhaust
   12.175 - 12.196 mm (0.4793 - 0.4802 in)



4. Heat cylinder head to 150 to 160°C (302 to 320°F) and press service valve guide onto cylinder head.
   Projection "L":
   13.2 - 13.4 mm (0.520 - 0.528 in)



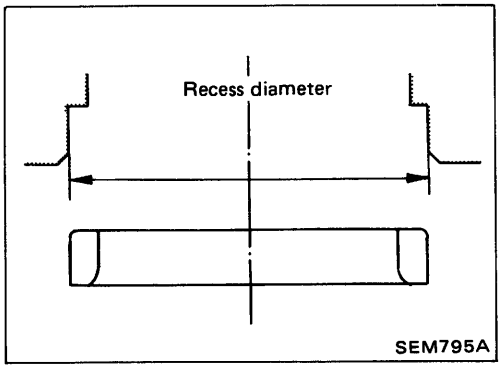
5. Ream valve guide.
   Finished size:
   Intake
   7.000 - 7.018 mm (0.2756 - 0.2763 in)
   Exhaust
   8.000 - 8.018 mm (0.3150 - 0.3157 in)



VALVE SEATS

Check valve seats for any evidence of pitting at valve contact surface, and reseat or replace if it has worn out excessively.

- **Before repairing valve seats, check valve and valve guide for wear. If they have worn, replace them. Then correct valve seat.**
- **Cut with both hands to maintain a uniform cutting surface.**

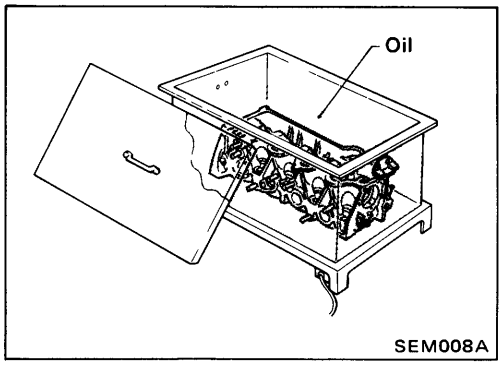


REPLACING VALVE SEAT FOR SERVICE PARTS

1. Bore out old seat until it collapses. The machine depth stop should be set so that boring cannot continue beyond the bottom face of the seat recess in cylinder head.
2. Ream cylinder head recess.
   Reaming bore for service valve seat
   Oversize [0.5 mm (0.020 in)]:
   Intake
   44.500 - 44.516 mm (1.7520 - 1.7526 in)
   Exhaust
   37.500 - 37.516 mm (1.4764 - 1.4770 in)

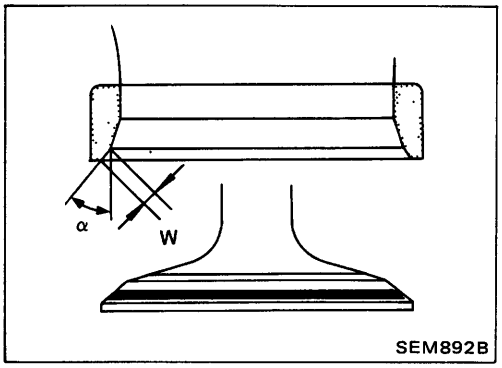
Inspection (Cont'd)

Reaming should be done in circles concentric to the valve guide center so that valve seat will have the correct fit.



SEM008A

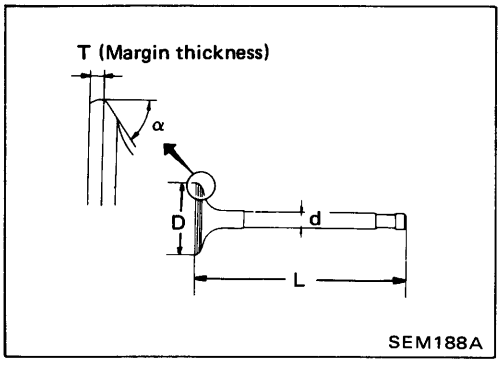
3. Heat cylinder head to 150 to 160°C (302 to 320°F).
4. Press fit valve seat until it seats on the bottom.



SEM892B

5. Cut or grind valve seat using suitable tool at the specified dimensions as shown in S.D.S.
6. After cutting, lap valve seat with abrasive compound.
7. Check valve seating condition.

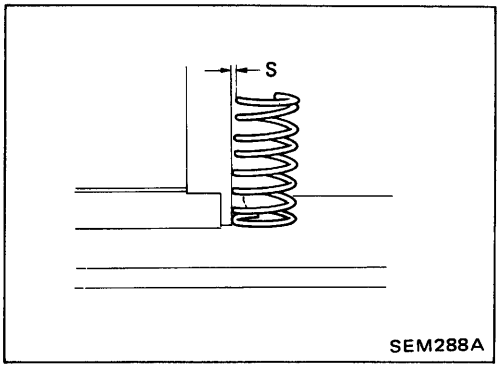
		Intake	Exhaust
Seat face angle "α"	degree	45	45
Contacting width "W"	mm (in)	1.75 (0.0689)	1.7 (0.067)



SEM188A

VALVE DIMENSIONS

Check dimensions in each valve. For dimensions, refer to S.D.S.
When valve head has been worn down to 0.5 mm (0.020 in) in margin thickness, replace valve.
Grinding allowance for valve stem tip is 0.2 mm (0.008 in) or less.



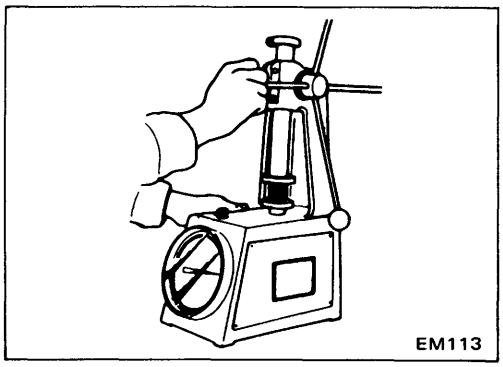
SEM288A

VALVE SPRING

Squareness

1. Measure "S" dimension.
   Out-of-square:
   Outer
   Less than 2.2 mm (0.087 in)
   Inner
   Less than 1.9 mm (0.075 in)
2. If it exceeds the limit, replace spring.

Inspection (Cont'd)

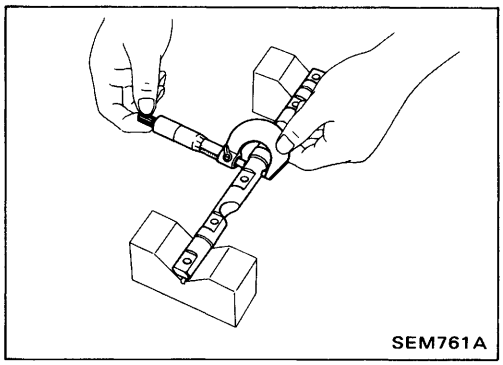

EM113

Pressure

Check valve spring pressure.

Pressure: N (kg, lb) at height mm (in)
- **Standard**
  - **Outer**
    - **250.1 (25.5, 56.2) at 40.0 (1.575)**
  - **Inner**
    - **255.0 (26.0, 57.3) at 25.0 (0.984)**
- **Limit**
  - **Outer**
    - **More than 228.5 (23.3, 51.4) at 25.0 (0.984)**
  - **Inner**
    - **More than 225.6 (23.0, 50.7) at 25.0 (0.984)**

If it exceeds the limit, replace spring.

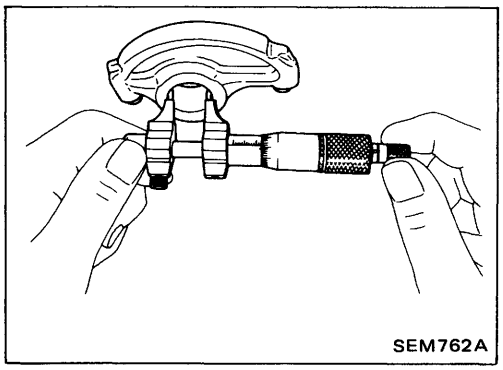

SEM761A

ROCKER SHAFT AND ROCKER ARM

1. Check rocker shafts for scratches, seizure and wear.
2. Check outer diameter of rocker shaft.

Diameter:

17.979 - 18.000 mm (0.7078 - 0.7087 in)


SEM762A

3. Check inner diameter of rocker arm.

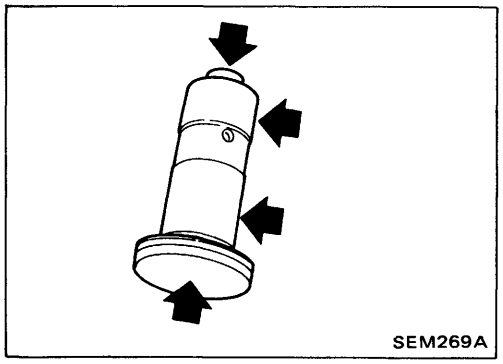
Diameter:

18.007 - 18.028 mm (0.7089 - 0.7098 in)

Rocker arm to shaft clearance:

0.007 - 0.049 mm (0.0003 - 0.0019 in)

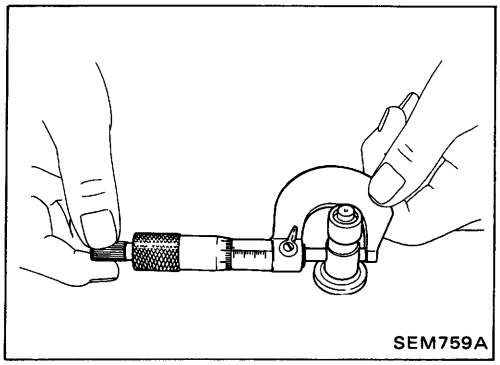
- **Keep rocker arm with hydraulic valve lifter standing to prevent air from entering hydraulic valve lifter when checking.**


SEM269A

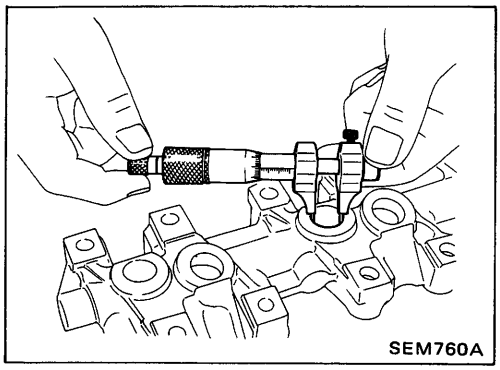
HYDRAULIC VALVE LIFTER

1. Check contact and sliding surfaces for wear or scratches.

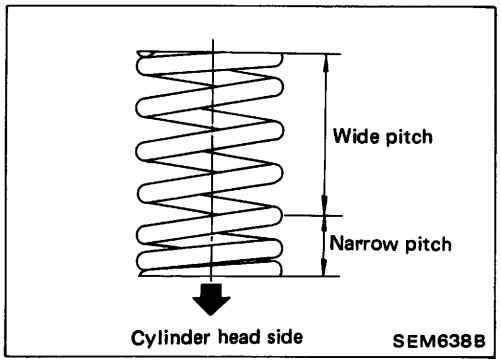
Inspection (Cont'd)


SEM759A

2. Check diameter of valve lifter.
   Outer diameter:
   15.947 - 15.957 mm (0.6278 - 0.6282 in)


SEM760A

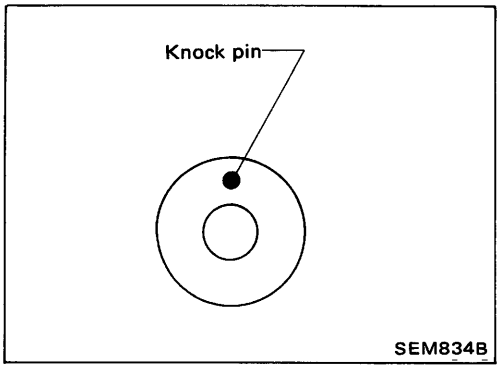
3. Check valve lifter guide inner diameter.
   Inner diameter:
   16.000 - 16.013 mm (0.6299 - 0.6304 in)
   Standard clearance between valve lifter and lifter guide:
   0.043 - 0.066 mm (0.0017 - 0.0026 in)



SEM638B

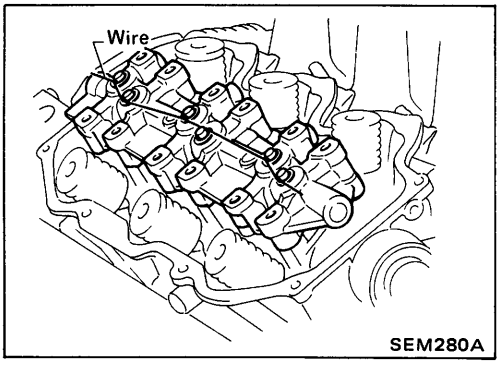
Assembly

1. Install valve component parts.
- **Always use new valve oil seal. Refer to OIL SEAL REPLACEMENT.**
- **Before installing valve oil seal, install inner valve spring seat.**
- **Install outer valve spring (uneven pitch type) with its narrow pitch side toward cylinder head side.**
- **After installing valve component parts, use plastic hammer to lightly tap valve stem tip to assure a proper fit.**



SEM834B

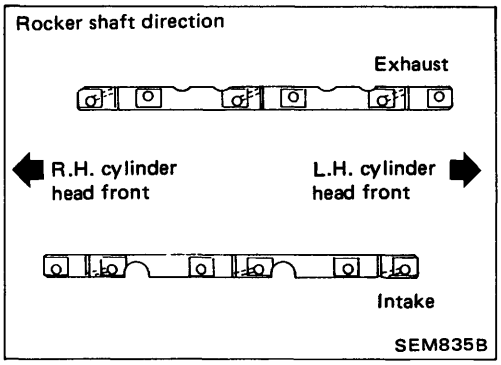
2. Install camshafts, locate plates and cylinder head rear covers.
- **Set knock pin of camshaft at the top.**



SEM280A

3. Install valve lifters into valve lifter guide.
- **Assemble valve lifters to their original position and hold all valve lifters with wire to prevent lifters from falling off.**
- **After installing them, remove the wire.**

Assembly (Cont'd)

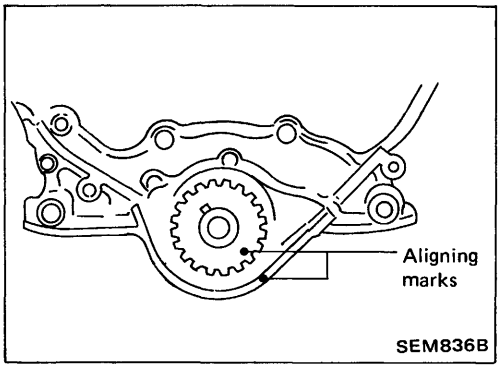


4. Install rocker shafts with rocker arms.
- **Tighten bolts gradually in two or three stages.**
- **Before tightening, be sure to set camshaft the lobe at the position where lobe is not lifted.**

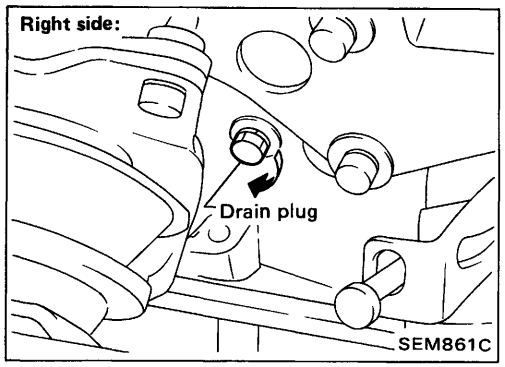
a. Set No. 1 piston at T.D.C. on its compression stroke and tighten rocker shaft bolts for No. 2, No. 4 and No. 6 cylinders.
b. Set No. 4 piston at T.D.C. on its compression stroke and tighten rocker shaft bolts for No. 1, No. 3 and No. 5 cylinders.

5. Install exhaust manifold to cylinder head in reverse order of removal.

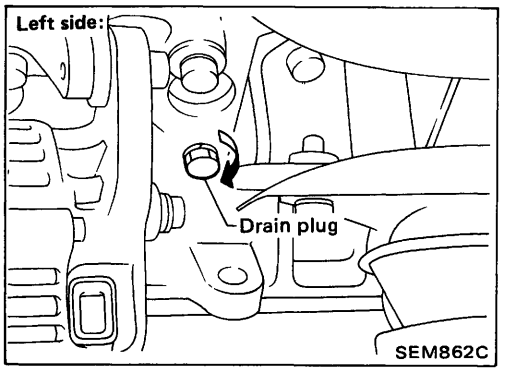
Installation

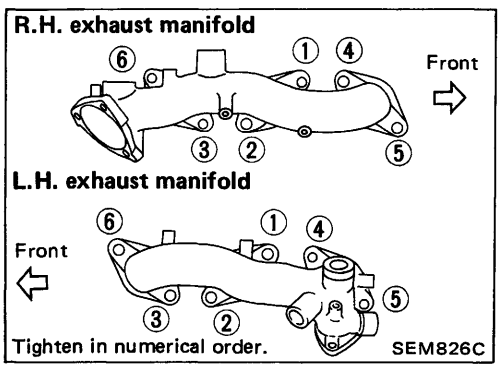


1. Set No. 1 piston at T.D.C. on its compression stroke as follows:
a. Align crankshaft sprocket aligning mark with mark on oil pump body.
b. Confirm that knock pin on camshaft is set at the top.



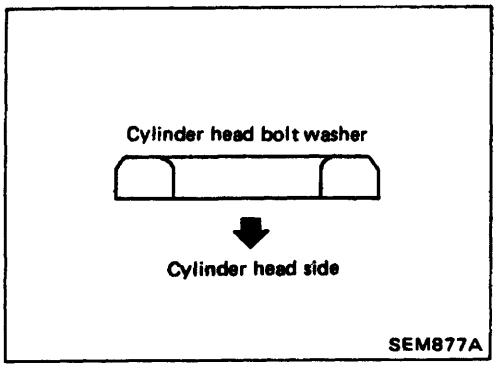
2. Install both drain plugs.
- Apply sealant to drain plug threads.



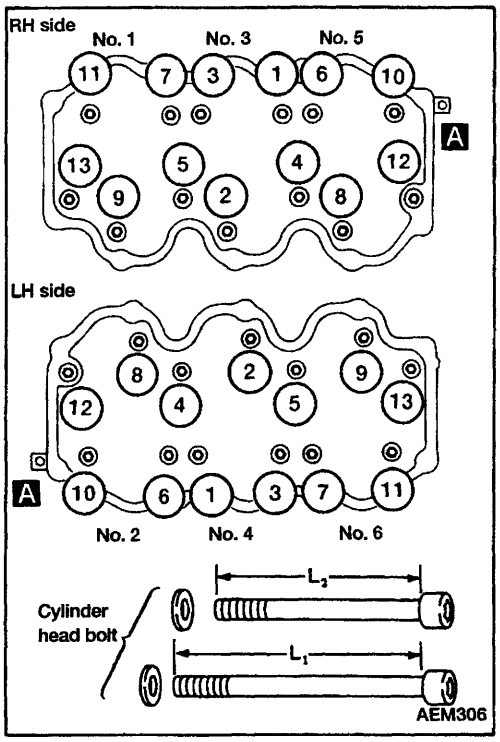


3. Install exhuast manifolds to cylinder head.

Installation (Cont'd)



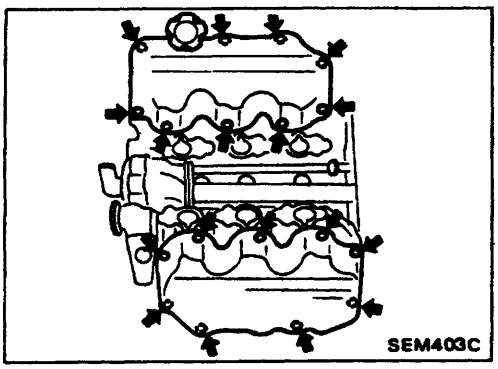
4. Install cylinder head with new gasket.
- **Be sure to install washers between bolts and cylinder head.**
- **Do not rotate crankshaft and camshaft separately, or valves will hit piston heads.**



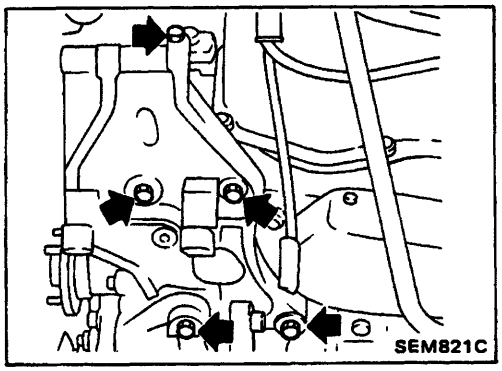
5. Tighten cylinder head bolts in numerical order using ST10120000 (J24239-01).
- **Tightening procedure:**

(1) Tighten all bolts to 29 N·m (3.0 kg-m, 22 ft-lb).
(2) Tighten all bolts to 59 N·m (6.0 kg-m, 43 ft-lb).
(3) Loosen all bolts completely.
(4) Tighten all bolts to 29 N·m (3.0 kg-m, 22 ft-lb).
(5) Turn all bolts 60 to 65 degrees clockwise.
If an angle wrench is not available, tighten all bolts to 54 to 64 N·m (5.5 to 6.5 kg-m, 40 to 47 ft-lb).

- **Bolts for ④, ⑤, ⑫ and ⑬ are longer than the others.**
  L_1: 127 mm (5.00 in) for ④, ⑤, ⑫ and ⑬
  L_2: 106 mm (4.17 in) for others



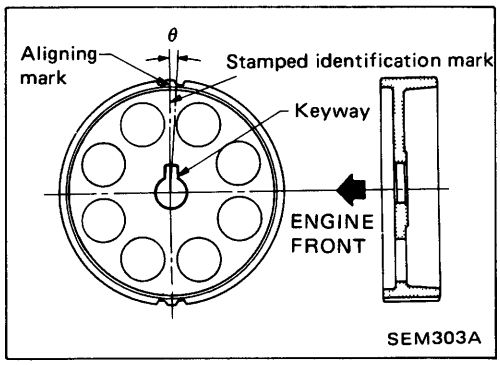
6. Install both rocker covers.



7. Install compressor and alternator bracket.
8. Install alternator.
9. Install compressor.

Installation (Cont'd)

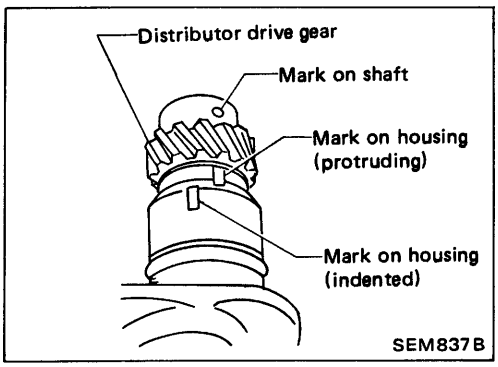
10. Install exhaust front tube to exhaust manifold.



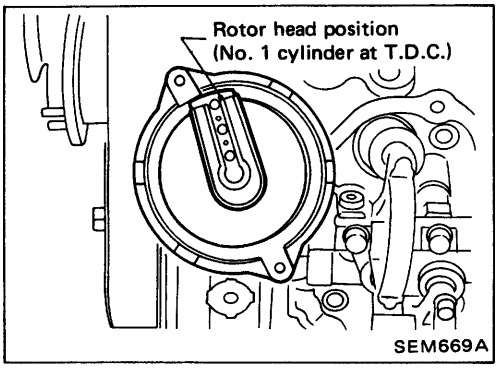
11. Install rear belt cover and camshaft sprocket.
- **R.H. camshaft sprocket and L.H. camshaft sprocket are different parts. Be sure to install them in the correct location.**

	Identification mark	θ
R.H. camshaft sprocket	R3	0°53′
L.H. camshaft sprocket	L3	−3°27′

12. Install timing belt and adjust belt tension.
Refer to "TIMING BELT — Installation".

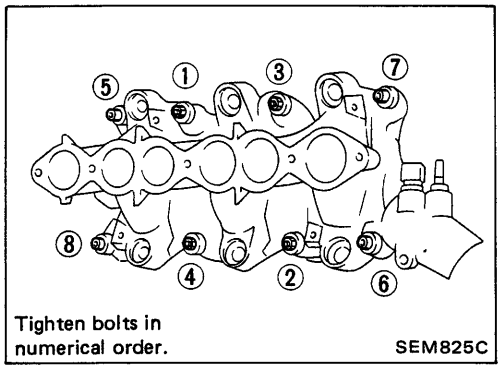


13. Install distributor.
(1) Align mark on shaft with protruding mark on housing.



(2) After installing, confirm that distributor rotor head is set as shown in figure.

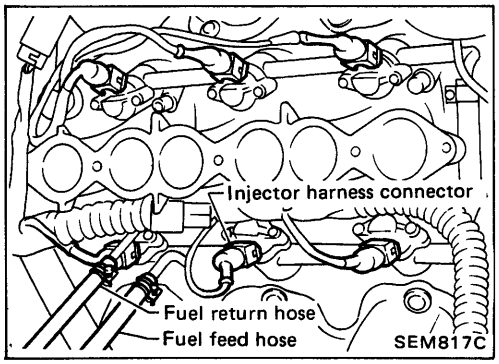
Installation (Cont'd)



Tighten bolts in numerical order. SEM825C

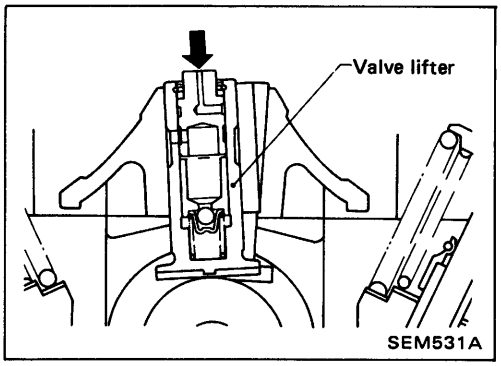
14. Install intake manifold.
    Install all parts which were removed in step 9 under "CYLINDER HEAD — Removal". (See page EM-23.)
- **Tightening procedure**

(1) Tighten all bolts to 3 to 5 N·m (0.3 to 0.5 kg-m, 2.2 to 3.6 ft-lb).
Tighten all nuts to 3 to 5 N·m (0.3 to 0.5 kg-m, 2.2 to 3.6 ft-lb).
(2) Tighten all bolts to 16 to 20 N·m (1.6 to 2.0 kg-m, 12 to 14 ft-lb).
Tighten all nuts to 24 to 27 N·m (2.4 to 2.8 kg-m, 17 to 20 ft-lb).
(3) Tighten all bolts to 16 to 20 N·m (1.6 to 2.0 kg-m, 12 to 14 ft-lb).
Tighten all nuts to 24 to 27 N·m (2.4 to 2.8 kg-m, 17 to 20 ft-lb).



SEM817C

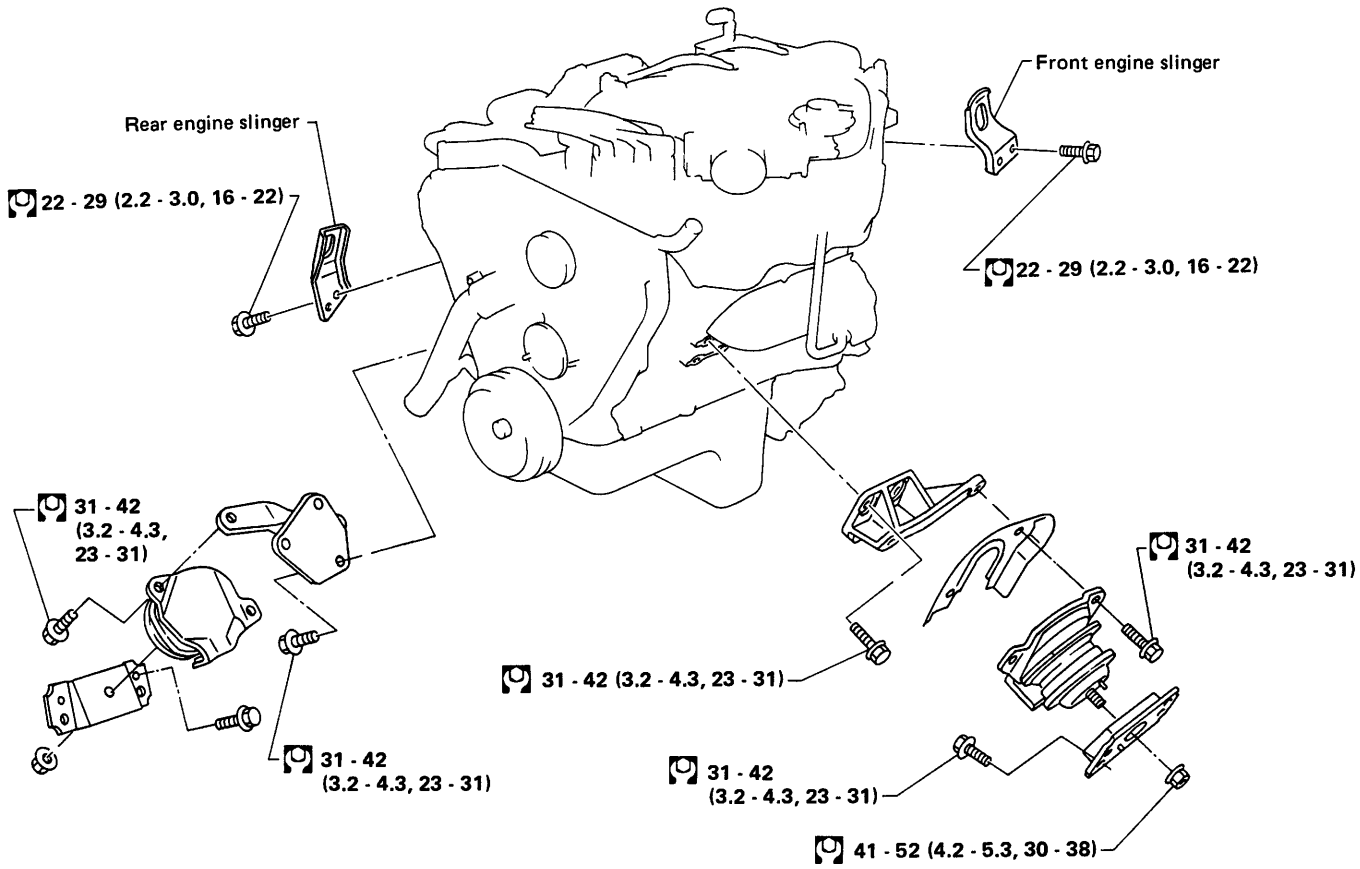
15. Install injector fuel tube assembly.
16. Connect all injector harness connectors.
17. Install fuel feed and fuel return hoses to injector fuel tube assembly.
18. Install intake manifold collector.
    Install all parts which were removed in step 5 under "CYLINDER HEAD — Removal". (See page EM-23.)
19. Install A.S.C.D. and accelerator control wire.

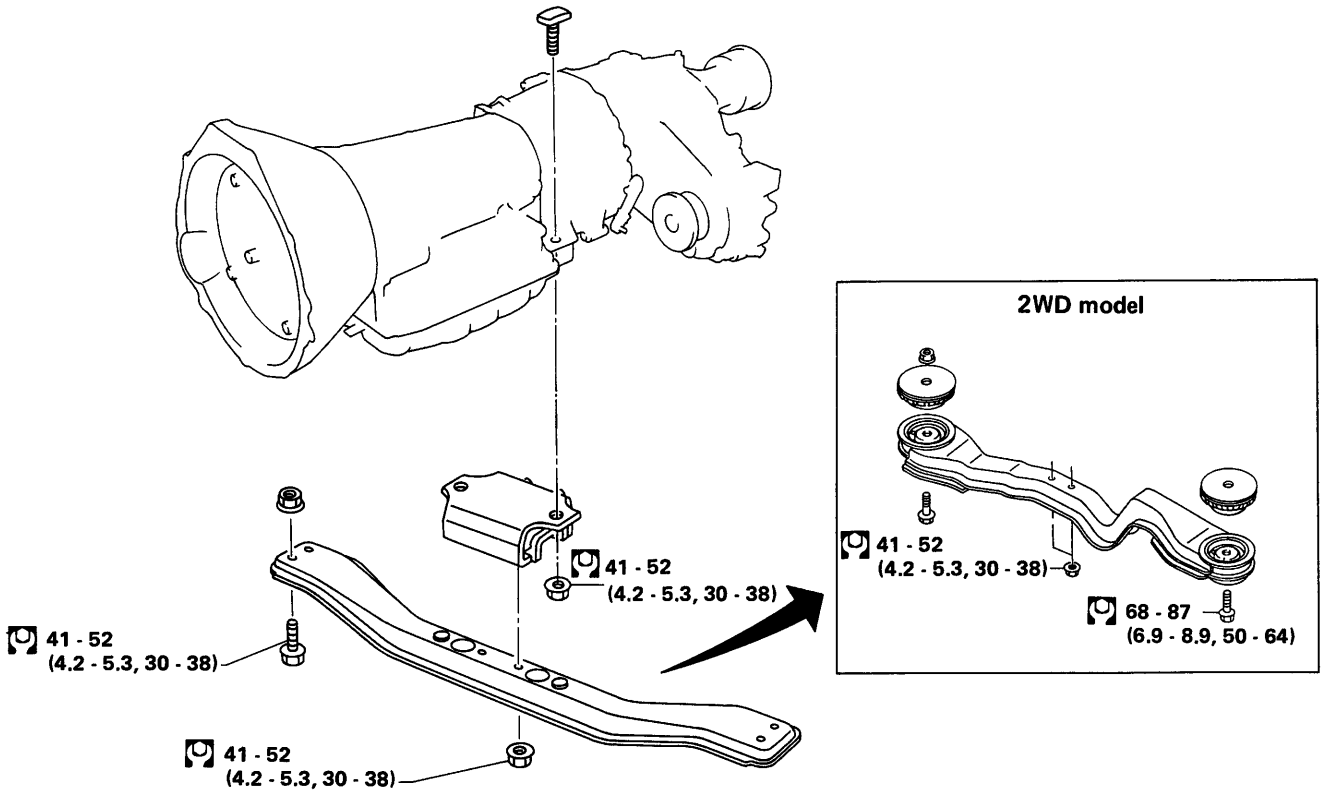


SEM531A

20. Check hydraulic valve lifter.
a. Push plunger forcefully with your finger.
- **Be sure to check it with rocker arm in its free position (not on the lobe).**

b. If valve lifter moves more than 1 mm (0.04 in), air may be inside it.
c. Bleed air off by running engine at 1,000 rpm under no load for about 10 minutes.
d. If hydraulic valve lifters are still noisy, replace them and bleed air off again in the same manner as in step 20 (c).





: N·m (kg-m, ft-lb)

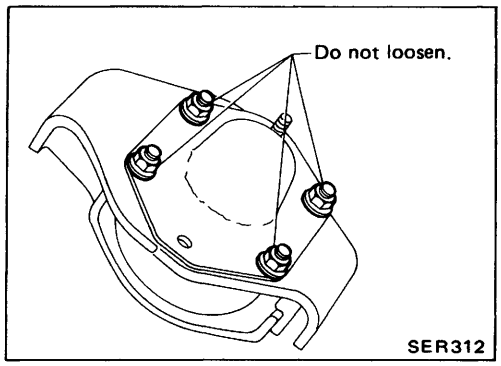
SEM827C

WARNING:

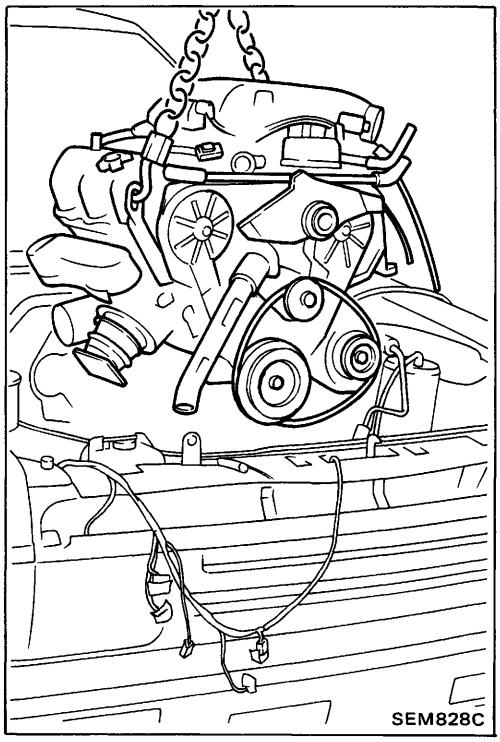
a. Situate vehicle on a flat and solid surface.
b. Place chocks at front and back of rear wheels.
c. Do not remove engine until exhaust system has completely cooled off. Otherwise, you may burn yourself and/or fire may break out in fuel line.
d. For safety during subsequent steps, the tension of wires should be slackened against the engine.
e. Before disconnecting fuel hose, release fuel pressure from fuel line.
   Refer to "Releasing Fuel Pressure" in section EF & EC.
f. Before removing front axle from transmission, place safety stands under designated front supporting points. Refer to GI section for lifting points and towing.
g. Be sure to hoist engine and transmission in a safe manner.
h. For engines not equipped with engine slingers, attach proper slingers and bolts described in PARTS CATALOG.

CAUTION:

- When lifting engine, be careful not to strike adjacent parts, especially accelerator wire casing, brake lines, and brake master cylinder.
- In hoisting the engine, always use engine slingers in a safe manner.



- Do not loosen front engine mounting insulator cover securing nuts.
  When cover is removed, damper oil flows out and mounting insulator will not function.
  For tightening torque, refer to sections AT, MT and PD.
  For 4WD model, sealant should be applied between engine and transmission.
  Refer to section MT.

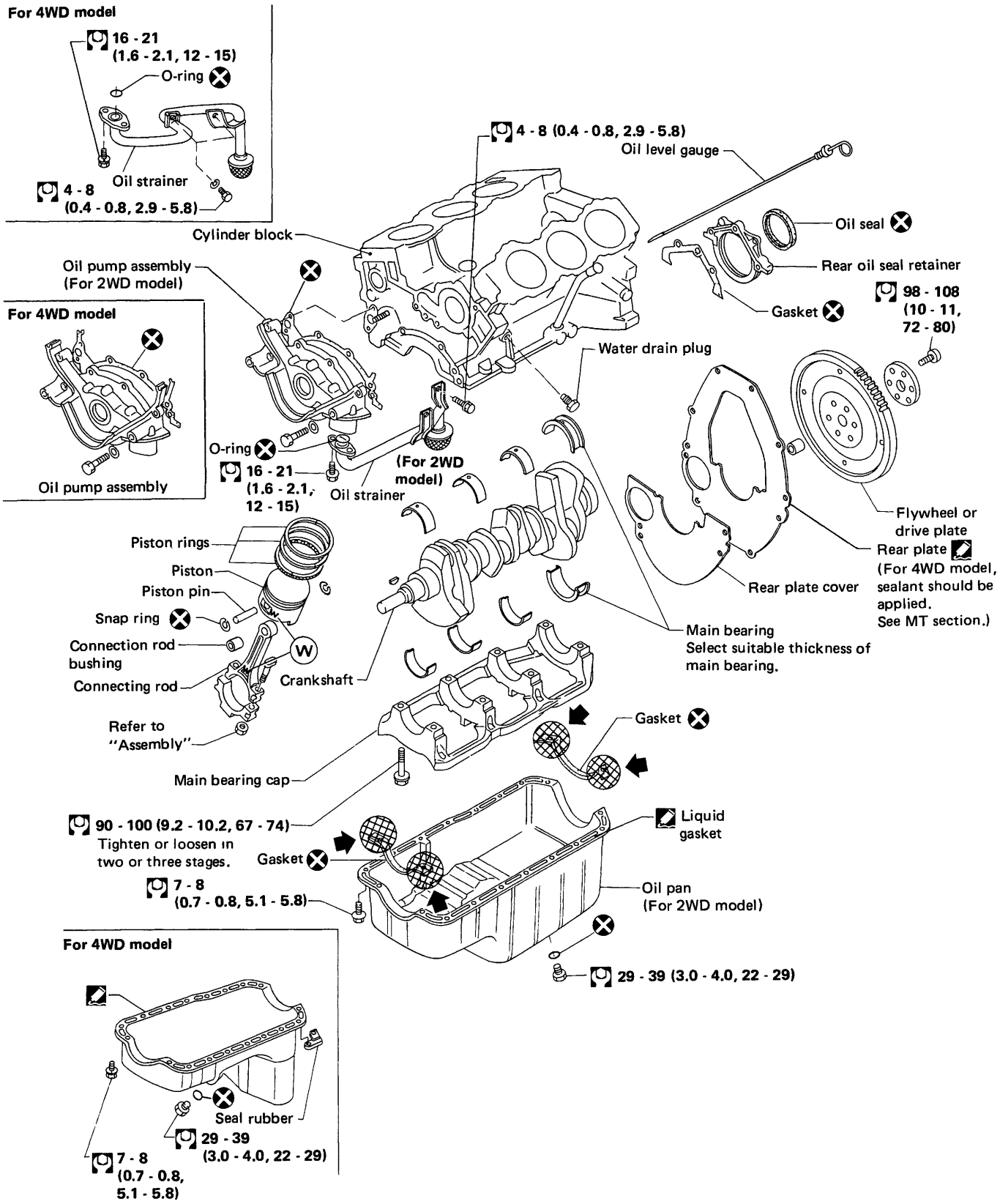


Removal

1. Remove engine undercover and hood.
2. Drain engine coolant.
3. Remove vacuum hoses, fuel tubes, wires, harnesses and connectors and so on.
4. Remove radiator with shroud and cooling fan.
5. Remove drive belts.
6. Remove power steering oil pump and air conditioner compressor.
7. Remove front exhaust tube.
8. Remove transmission from vehicle.

Refer to MT and AT sections.

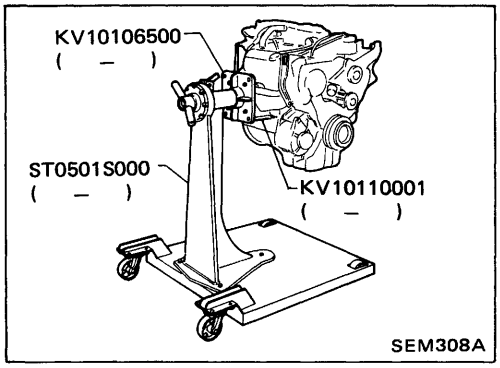
9. Install engine slingers.
10. Hoist engine with engine slingers and remove engine mounting bolts from both sides.
11. Remove engine from vehicle.



: Apply sealant.
: N·m (kg-m, ft-lb)

SEM903B

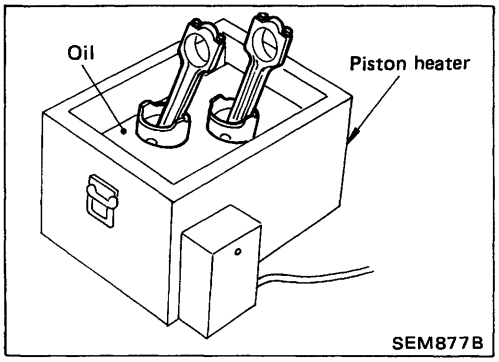
CAUTION:
- **When installing sliding parts such as bearings and pistons, be sure to apply engine oil on the sliding surfaces.**
- **Place removed parts such as bearings and bearing caps in their proper order and direction.**
- **When tightening connecting rod bolts and main bearing cap bolts, apply engine oil to thread portion of bolts and seating surface of nuts.**



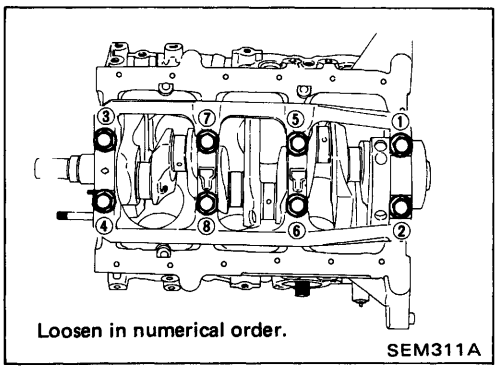
Disassembly

PISTON AND CRANKSHAFT

1. Place engine on a work stand.
2. Drain coolant and oil.
3. Remove oil pan and oil pump.
4. Remove timing belt.
5. Remove water pump.
6. Remove cylinder head.



7. Remove pistons with connecting rods.
- When disassembling piston and connecting rod, remove snap ring first, then heat piston to 60 to 70°C (140 to 158°F) or use piston pin press stand at room temperature.

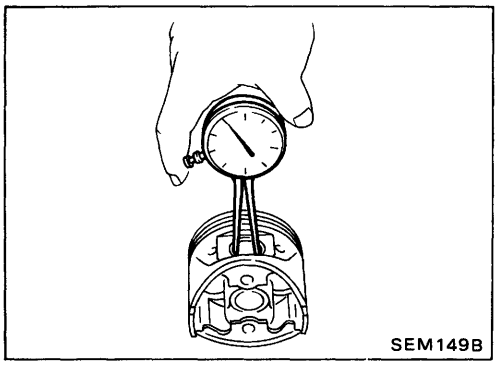


8. Remove bearing cap and crankshaft.
- **Before removing bearing cap, measure crankshaft end play.**
- **Bolts should be loosened in two or three steps.**

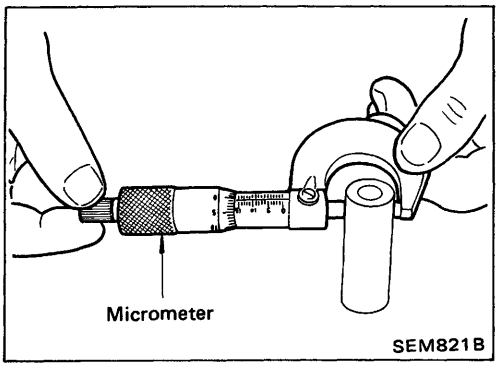
Inspection

PISTON AND PISTON PIN CLEARANCE

1. Measure inner diameter of piston pin hole "dp".
   Standard diameter "dp":
   20.969 - 20.981 mm (0.8255 - 0.8260 in)

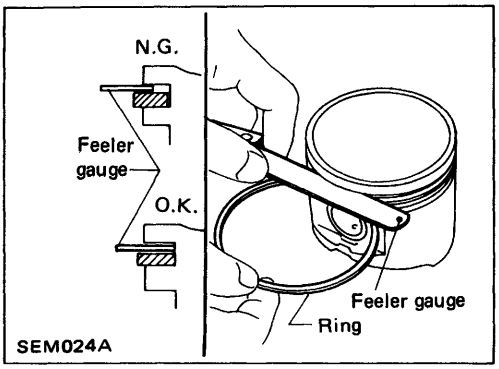


Inspection (Cont'd)



2. Measure outer diameter of piston pin "Dp".
   Standard diameter "Dp":
   20.971 - 20.983 mm (0.8256 - 0.8261 in)
3. Calculate piston pin clearance.
   dp – Dp = –0.008 to 0.004 mm (–0.0003 to 0.0002 in)

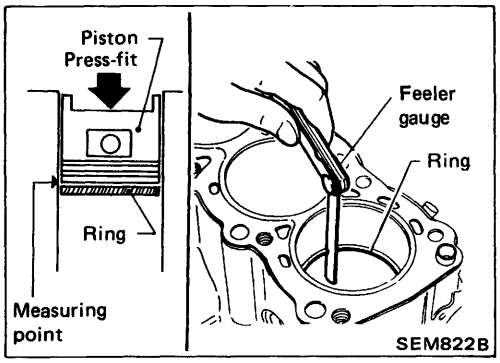
If it exceeds the above value, replace piston assembly with pin.



PISTON RING SIDE CLEARANCE

Side clearance:
Top ring
0.040 - 0.073 mm (0.0016 - 0.0029 in)
2nd ring
0.030 - 0.063 mm (0.0012 - 0.0025 in)
Max. limit of side clearance:
0.1 mm (0.004 in)

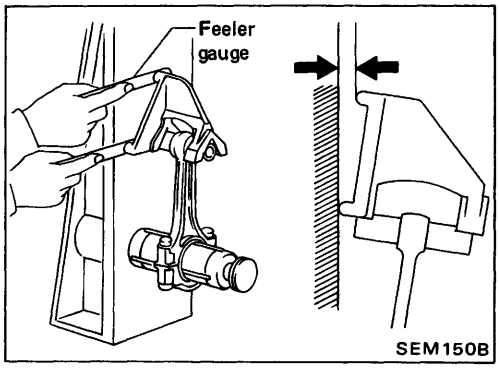
If out of specification, replace piston and/or piston ring assembly.



PISTON RING END GAP

End gap:
Top ring
0.21 - 0.44 mm (0.0083 - 0.0173 in)
2nd ring
0.18 - 0.44 mm (0.0071 - 0.0173 in)
Oil ring
0.20 - 0.76 mm (0.0079 - 0.0299 in)
Max. limit of ring gap:
1.0 mm (0.039 in)

If out of specification, replace piston ring. If gap still exceeds the limit even with a new ring, rebore cylinder and use oversized piston and piston rings.
Refer to S.D.S.

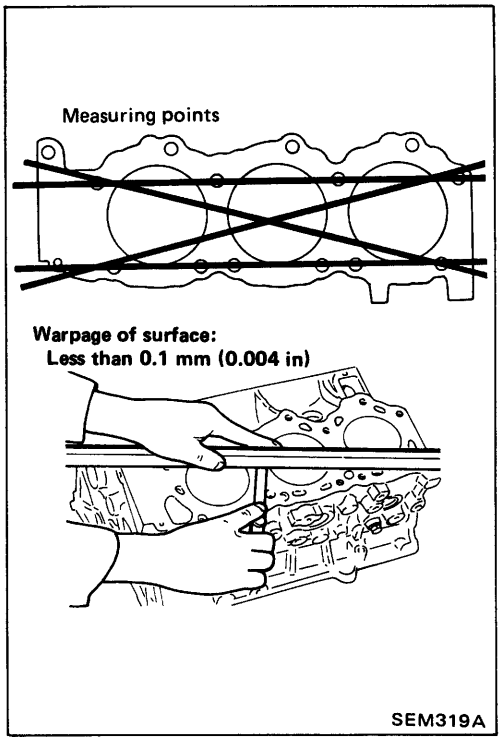


CONNECTING ROD BEND AND TORSION

Bend:
Limit 0.15 mm (0.0059 in)
per 100 mm (3.94 in) length
Torsion:
Limit 0.30 mm (0.0118 in)
per 100 mm (3.94 in) length

If it exceeds the limit, replace connecting rod assembly.

Inspection (Cont'd)

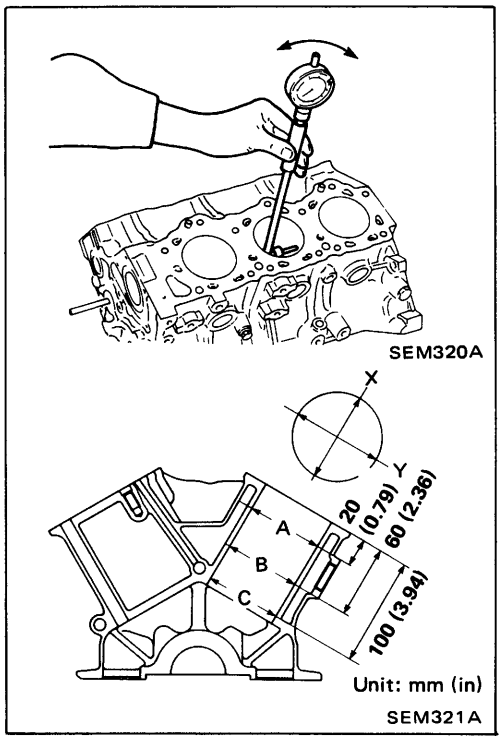


CYLINDER BLOCK DISTORTION AND WEAR

1. Clean upper face of cylinder block and measure the distortion.
   Limit:
   0.10 mm (0.0039 in)
2. If out of specification, resurface it.
   The resurfacing limit is determined by cylinder head resurfacing in engine.

Amount of cylinder head resurfacing is "A".
Amount of cylinder block resurfacing is "B".
The maximum limit is as follows:
A + B = 0.2 mm (0.008 in)
Nominal cylinder block height from crankshaft center:
227.60 - 227.70 mm (8.9606 - 8.9645 in)

3. If necessary, replace cylinder block.

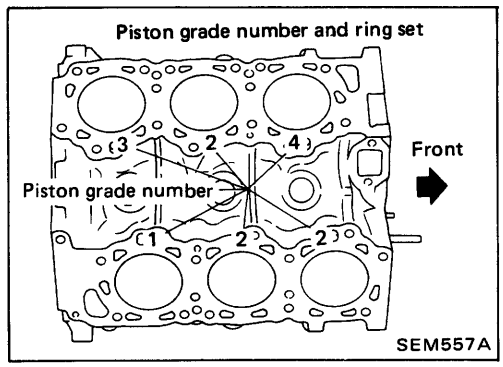


PISTON-TO-BORE CLEARANCE

1. Using a bore gauge, measure cylinder bore for wear, out-of-round and taper.
   Standard inner diameter:
   87.000 - 87.030 mm (3.4252 - 3.4264 in)
   Wear limit:
   0.20 mm (0.0079 in)
   Out-of-round (X – Y) limit:
   0.015 mm (0.0006 in)
   Taper (A – B) limit:
   0.015 mm (0.0006 in)

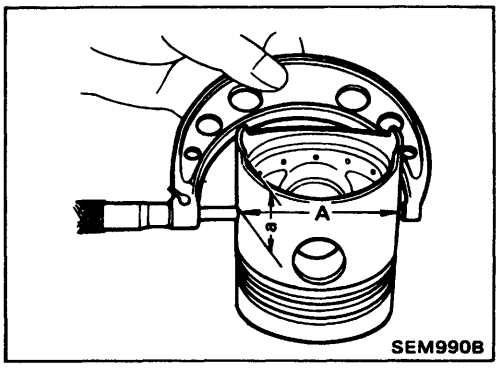
If it exceeds the limit, rebore all cylinders. Replace cylinder block if necessary.

2. Check for scratches and seizure. If seizure is found, hone it.



- **If both cylinder block and piston are replaced with new ones, select piston of the same grade number punched on cylinder block upper surface.**

Inspection (Cont'd)



3. Measure piston skirt diameter.
   Piston diameter "A":
   Refer to S.D.S.
   Measuring point "a" (Distance from the bottom):
   18 mm (0.71 in)
4. Check that piston-to-bore clearance is within specification.
   Piston-to-bore clearance "B":
   0.025 - 0.045 mm (0.0010 - 0.0018 in)
5. Determine piston oversize according to amount of cylinder wear.

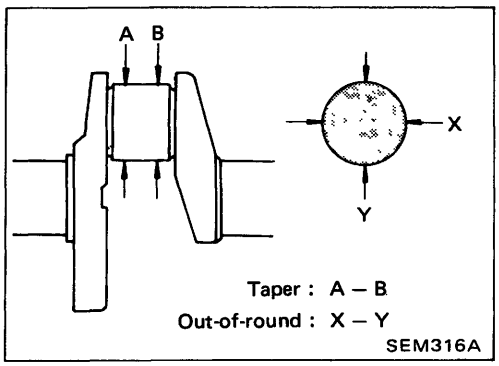
Oversize pistons are available for service. Refer to S.D.S.

6. Cylinder bore size is determined by adding piston-to-bore clearance to piston diameter "A".
   Rebored size calculation:
   D = A + B - C
   where,
   D: Bored diameter
   A: Piston diameter as measured
   B: Piston-to-bore clearance
   C: Honing allowance 0.02 mm (0.0008 in)
7. Install main bearing caps, and tighten to the specified torque to prevent distortion of cylinder bores in final assembly.
8. Cut cylinder bores.

- **When any cylinder needs boring, all other cylinders must also be bored.**
- **Do not cut too much out of cylinder bore at a time. Cut only 0.05 mm (0.0020 in) or so in diameter at a time.**

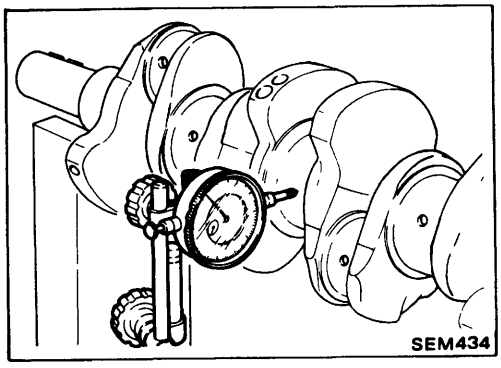
9. Hone cylinders to obtain specified piston-to-bore clearance.
10. Measure finished cylinder bore for out-of-round and taper.

- **Measurement should be done after cylinder bore cools down.**



CRANKSHAFT

1. Check crankshaft main and pin journals for score, wear or cracks.
2. With a micrometer, measure journals for taper and out-of-round.
   Out-of-round (X – Y):
   Less than 0.005 mm (0.0002 in)
   Taper (A – B):
   Less than 0.005 mm (0.0002 in)



3. Measure crankshaft runout.
   Runout (Total indicator reading):
   Less than 0.10 mm (0.0039 in)

Inspection (Cont'd)

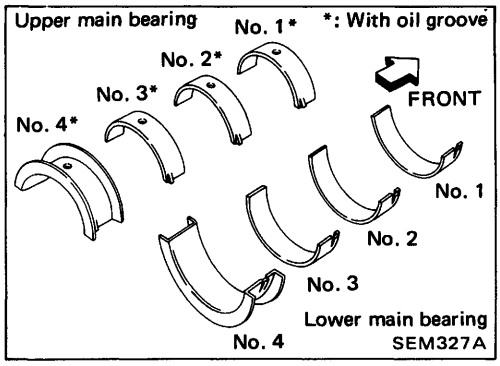
BEARING CLEARANCE

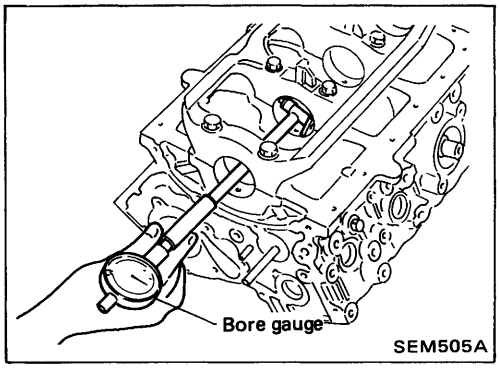
- Either of the following two methods may be used, however, method A gives more reliable results and is preferable.

Method A (Using bore gauge & micrometer)

Main bearing

1. Set main bearings in their proper positions on cylinder block and main bearing cap.

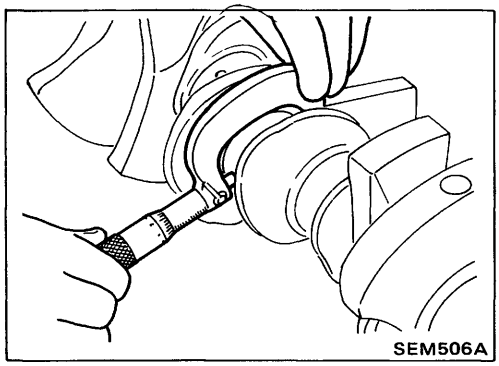




2. Install main bearing cap to cylinder block.

Tighten all bolts in correct order in two or three stages.

3. Measure inner diameter "A" of each main bearing.



4. Measure outer diameter "Dm" of each crankshaft main journal.
5. Calculate main bearing clearance.

   Main bearing clearance (A – Dm):

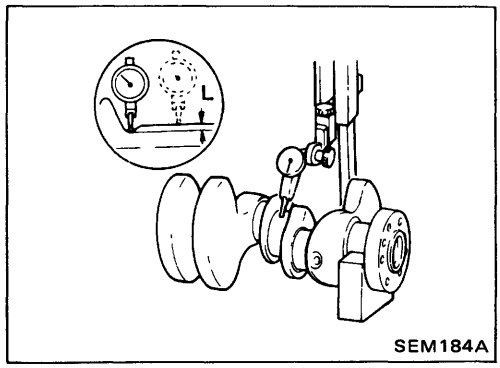
   Standard

   0.028 - 0.055 mm (0.0011 - 0.0022 in)

   Limit

   0.090 mm (0.0035 in)

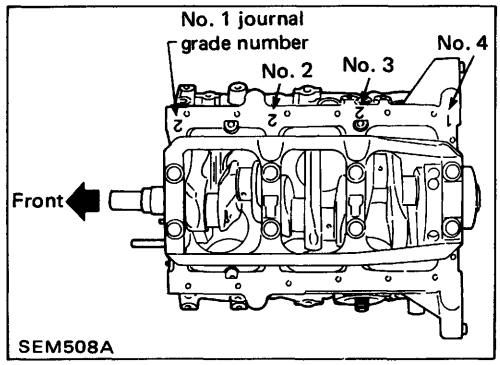
6. If it exceeds the limit, replace bearing.
7. If clearance cannot be adjusted within the standard of any bearing, grind crankshaft journal and use undersized bearing.



a. When grinding crankshaft journal, confirm that "L" dimension in fillet roll is more than the specified limit.

   "L": 0.1 mm (0.004 in)

b. Refer to S.D.S. for grinding crankshaft and available service parts.

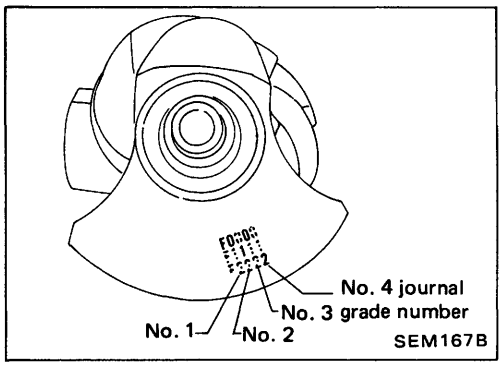


8. If crankshaft is reused, measure main bearing clearances and select thickness of main bearings.

   If crankshaft is replaced with a new one, it is necessary to select thickness of main bearings as follows:

a. Grade number of each cylinder block main journal is punched on the respective cylinder block.

Inspection (Cont'd)



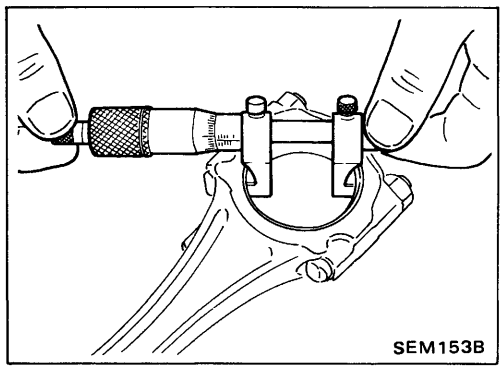
b. Grade number of each crankshaft main journal is punched on the respective crankshaft.

c. Select main bearing with suitable thickness according to the following table.

Main bearing grade number:

Crankshaft journal grade number \ Main journal grade number	0	1	2
0	0	1	2
1	1	2	3
2	2	3	4

For example:
Main journal grade number: 1
Crankshaft journal grade number: 2
Main bearing grade number = 1 + 2
= 3

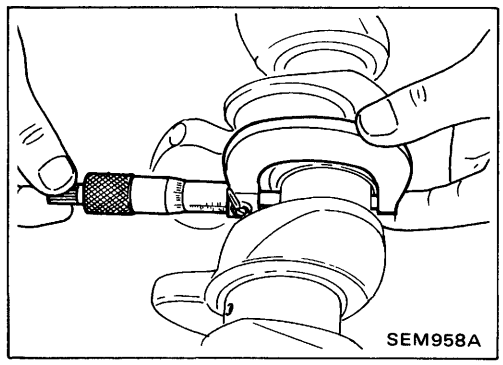


Connecting rod bearing (Big end)

1. Install connecting rod bearing to connecting rod and cap.
2. Install connecting rod cap to connecting rod.

Tighten bolts to the specified torque.

3. Measure inner diameter "C" of each bearing.

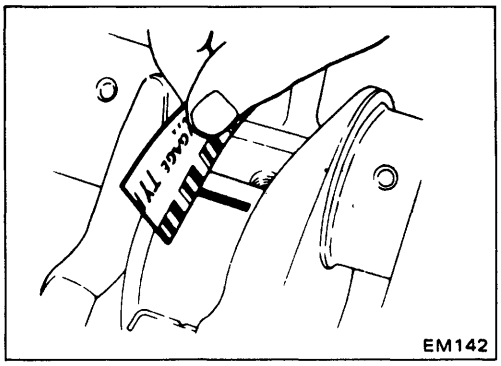


4. Measure outer diameter "Dp" of each crankshaft pin journal.
5. Calculate connecting rod bearing clearance.

Connecting rod bearing clearance (C – Dp):
Standard
0.014 - 0.054 mm (0.0006 - 0.0021 in)
Limit
0.090 mm (0.0035 in)

6. If it exceeds the limit, replace bearing.
7. If clearance cannot be adjusted within the standard of any bearing, grind crankshaft journal and use undersized bearing. Refer to step 7 of "BEARING CLEARANCE — Main bearing".

Inspection (Cont'd)

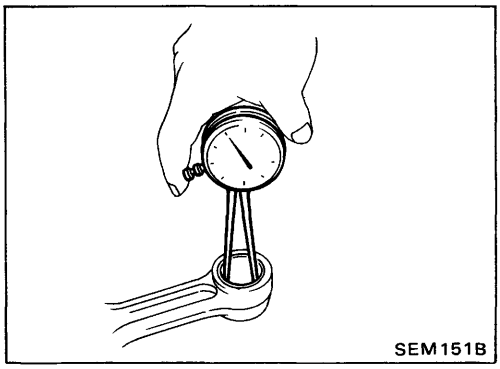

EM142

Method B (Using plastigauge)

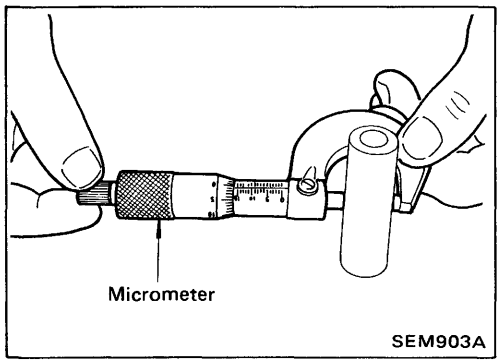
CAUTION:

- **Do not turn crankshaft or connecting rod while plastigage is being inserted.**
- **When bearing clearance exceeds the specified limit, ensure that the proper bearing has been installed. Then if excessive bearing clearance exists, use a thicker main bearing or undersized bearing so that the specified bearing clearance is obtained.**

CONNECTING ROD BUSHING CLEARANCE (Small end)


SEM151B

1. Measure inner diameter "C" of bushing.



SEM903A

2. Measure outer diameter "Dp" of piston pin.
3. Calculate connecting rod bushing clearance.

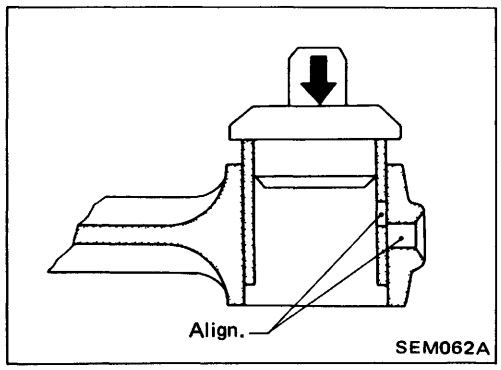
Connecting rod bushing clearance = C – Dp

Standard: 0.005 - 0.017 mm (0.0002 - 0.0007 in)

Limit: 0.023 mm (0.0009 in)

If it exceeds the limit, replace connecting rod assembly or connecting rod bushing and/or piston set with pin.

REPLACEMENT OF CONNECTING ROD BUSHING (Small end)



SEM062A

1. Drive in small end bushing until it is flush with end surface of rod.

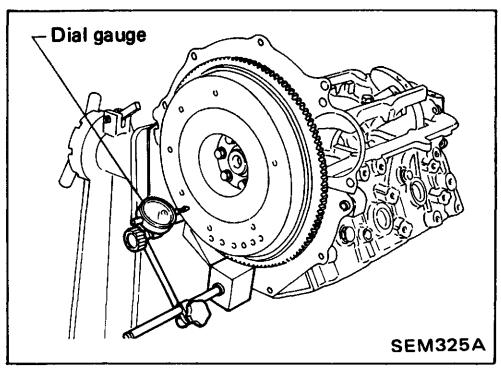
Be sure to align the oil holes.

2. After driving in small end bushing, ream the bushing so that clearance between connecting rod bushing and piston pin is the specified value.

Clearance between connecting rod bushing and piston pin:

0.005 - 0.017 mm (0.0002 - 0.0007 in)

FLYWHEEL/DRIVE PLATE RUNOUT



SEM325A

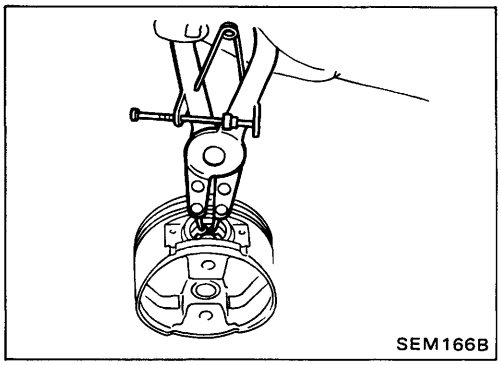
Runout (Total indicator reading):

Flywheel (M/T model)

Less than 0.15 mm (0.0059 in)

Drive plate (A/T model)

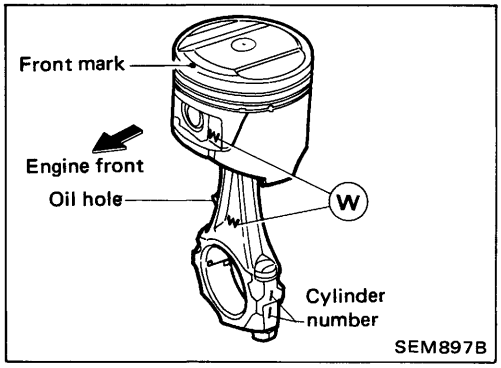
Less than 0.15 mm (0.0059 in)


SEM166B

Assembly

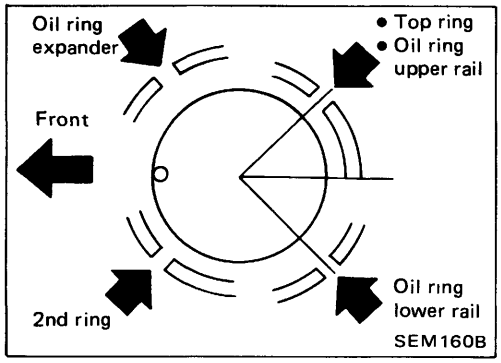
PISTON

1. Install new snap ring on one side of piston pin hole.



SEM897B

2. Heat piston to 60 to 70°C (140 to 158°F) and assemble piston, piston pin, connecting rod and new snap ring.
- **Align the direction of piston and connecting rod.**
- **Numbers stamped on connecting rod and cap correspond to each cylinder.**
- **After assembly, make sure connecting rod swings smoothly.**



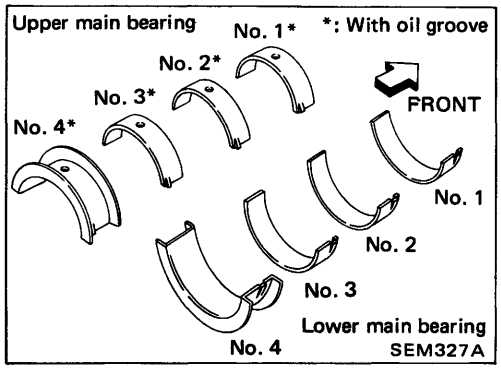
SEM160B

3. Set piston rings as shown.

CRANKSHAFT

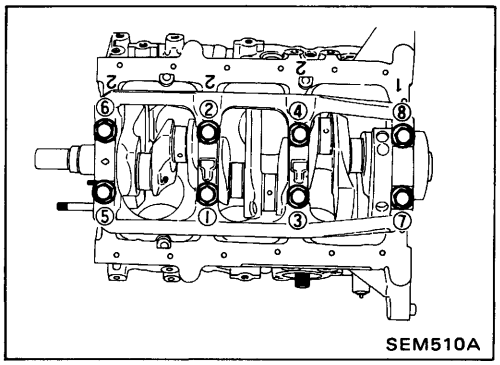
1. Set main bearings in their proper positions on cylinder block and main bearing cap.
- **Confirm that correct main bearings are used.**

Refer to "Inspection" in this section.

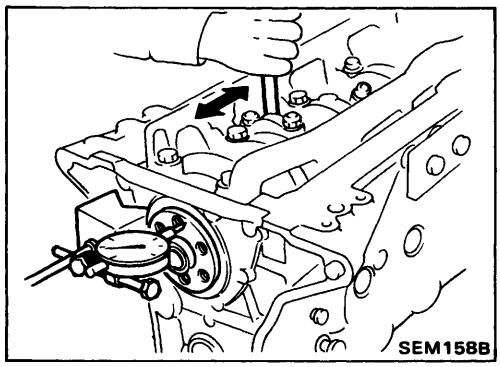


SEM327A

2. Install crankshaft and main bearing caps and tighten bolts to the specified torque.
- **Prior to tightening bearing cap bolts, place bearing cap in its proper position by shifting crankshaft in the axial direction.**
- **Tighten bearing cap bolts gradually in two or three stages. Start with center bearing and move outward sequentially.**
- **After securing bearing cap bolts, make sure crankshaft turns smoothly by hand.**


SEM510A

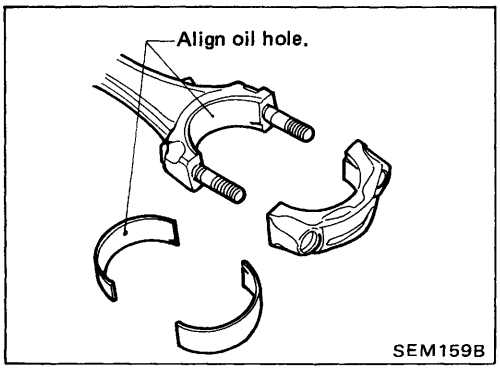
Assembly (Cont'd)



3. Measure crankshaft end play.

Crankshaft end play:
Standard
0.050 - 0.170 mm (0.0020 - 0.0067 in)
Limit
0.30 mm (0.0118 in)

If beyond the limit, replace bearing with a new one.

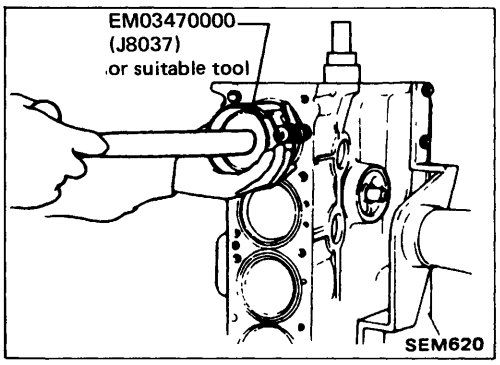


4. Install connecting rod bearings in connecting rods and connecting rod caps.

- **Confirm that correct bearings are used.**

Refer to "Inspection".

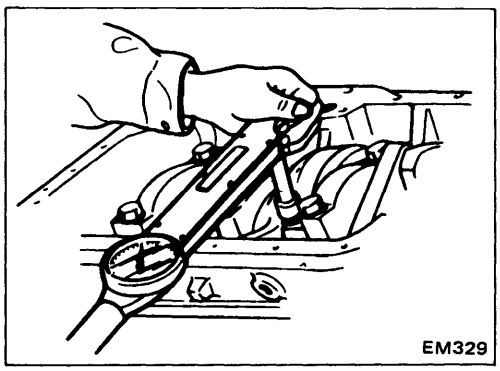
- Install bearings so that oil hole in connecting rod aligns with oil hole of bearing.



5. Install pistons with connecting rods.

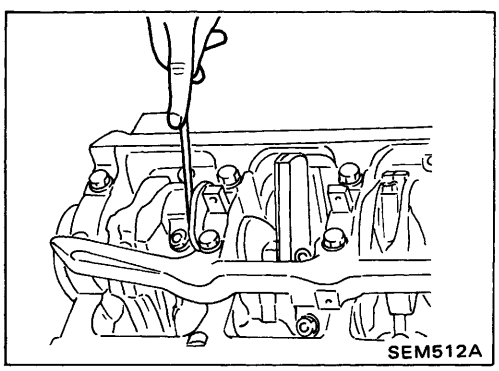
a. Install them into corresponding cylinders with Tool.

- **Be careful not to scratch cylinder wall by connecting rod.**
- **Arrange so that front mark on piston head faces toward front of engine.**



b. Install connecting rod bearing caps.
Tighten connecting rod bearing cap nuts to the specified torque.

: Connecting rod bearing nut
(1) Tighten to 14 to 16 N·m (1.4 to 1.6 kg-m, 10 to 12 ft-lb).
(2) Turn nuts 60 to 65 degrees clockwise. If an angle wrench is not available, tighten nuts to 38 to 44 N·m (3.9 to 4.5 kg-m, 28 to 33 ft-lb).

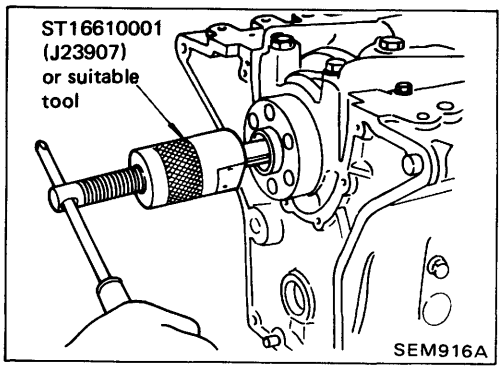


6. Measure connecting rod side clearance.

Connecting rod side clearance:
Standard
0.20 - 0.35 mm (0.0079 - 0.0138 in)
Limit
0.40 mm (0.0157 in)

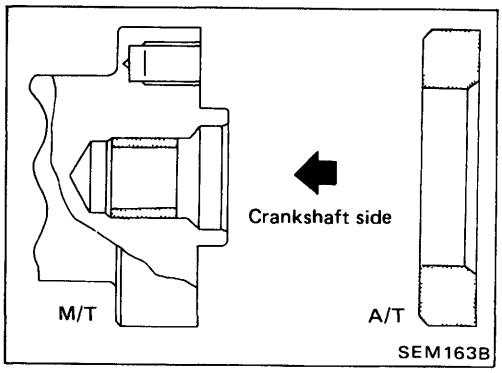
If beyond the limit, replace connecting rod and/or crankshaft.

Assembly (Cont'd)



REPLACING PILOT BUSHING

1. Remove pilot bushing (M/T) or pilot convertor (A/T).

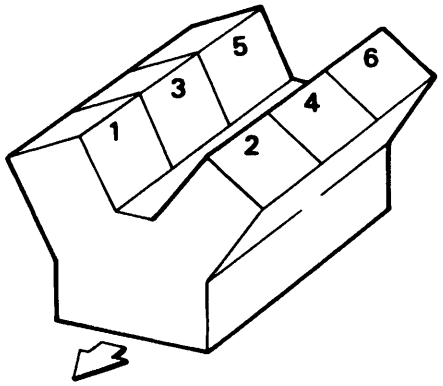


2. Install pilot bushing (M/T) or pilot convertor (A/T).

General Specifications

Cylinder arrangement		V-6
Displacement	cm^3 (cu in)	2,960 (180.62)
Bore and stroke	mm (in)	87 x 83 (3.43 x 3.27)
Valve arrangement		O.H.C.
Firing order		1-2-3-4-5-6
Number of piston rings		
Compression		2
Oil		1
Number of main bearings		4
Compression ratio		9.0

Cylinder number



SEM713A

COMPRESSION PRESSURE

Unit: kPa (kg/cm^2, psi)/300 rpm

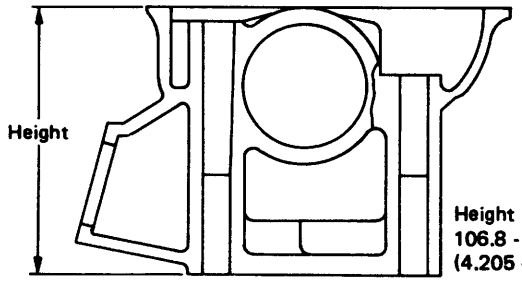
Compression pressure	
Standard	1,196 (12.2, 173)
Minimum	883 (9.0, 128)
Differential limit between cylinders	98 (1.0, 14)

Inspection and Adjustment

CYLINDER HEAD

Unit: mm (in)

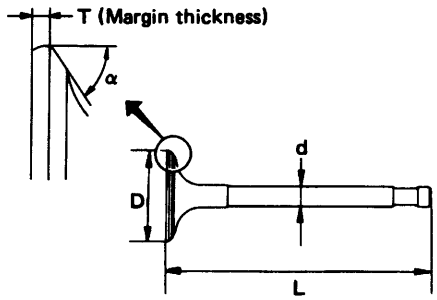
	Standard	Limit
Head surface distortion	Less than 0.03 (0.0012)	0.1 (0.004)



SEM082B

VALVE

Unit: mm (in)



SEM188

Valve head diameter "D"	
Intake	42.0 - 42.2 (1.654 - 1.661)
Exhaust	35.0 - 35.2 (1.378 - 1.386)
Valve length "L"	
Intake	125.3 - 125.9 (4.933 - 4.957)
Exhaust	124.2 - 124.8 (4.890 - 4.913)
Valve stem diameter "d"	
Intake	6.965 - 6.980 (0.2742 - 0.2748)
Exhaust	7.965 - 7.970 (0.3136 - 0.3138)
Valve seat angle "α"	
Intake	45°15' - 45°45'
Exhaust	
Valve margin "T"	
Intake	1.15 - 1.45 (0.0453 - 0.0571)
Exhaust	1.35 - 1.65 (0.0531 - 0.0650)
Valve margin "T" limit	More than 0.5 (0.020)
Valve stem end surface grinding limit	Less than 0.2 (0.008)
Valve clearance	
Intake	0 (0)
Exhaust	0 (0)

Valve spring

Free height	mm (in)	Outer	51.2 (2.016)
		Inner	44.1 (1.736)
Pressure N (kg, lb) at height mm (in)		Outer	523.7 (53.4, 117.7) at 30.0 (1.181)
		Inner	255.0 (26.0, 57.3) at 25.0 (0.984)
Out-of-square	mm (in)	Outer	2.2 (0.087)
		Inner	1.9 (0.075)

Hydraulic valve lifter

Unit: mm (in)

Lifter outside diameter	15.947 - 15.957 (0.6278 - 0.6282)
Lifter guide inside diameter	16.000 - 16.013 (0.6299 - 0.6304)
Clearance between lifter and lifter guide	0.043 - 0.066 (0.0017 - 0.0026)

Inspection and Adjustment (Cont'd)

Valve guide

Unit: mm (in)

		Standard	Service
Valve guide Outer diameter	Intake	11.023 - 11.034 (0.4340 - 0.4344)	11.223 - 11.234 (0.4418 - 0.4423)
	Exhaust	12.023 - 12.034 (0.4733 - 0.4738)	12.223 - 12.234 (0.4812 - 0.4817)
Valve guide Inner diameter (Finished size)	Intake	7.000 - 7.018 (0.2756 - 0.2763)	
	Exhaust	8.000 - 8.018 (0.3150 - 0.3157)	
Cylinder head valve guide hole diameter	Intake	10.975 - 10.996 (0.4321 - 0.4329)	11.175 - 11.196 (0.4400 - 0.4408)
	Exhaust	11.975 - 11.996 (0.4715 - 0.4723)	12.175 - 12.196 (0.4793 - 0.4802)
Interference fit of vlave guide	Intake / Exhaust	0.027 - 0.059 (0.0011 - 0.0023)	
		Standard	Max. tolerance
Stem to guide clearance	Intake	0.020 - 0.053 (0.0008 - 0.0021)	0.10 (0.0039)
	Exhaust	0.030 - 0.053 (0.0012 - 0.0021)	
Valve deflection limit		—	0.20 (0.0079)

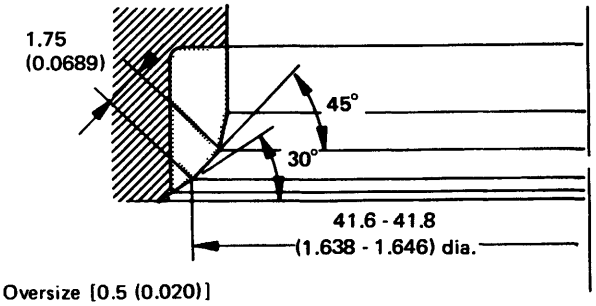
Rocker shaft and rocker arm

Unit: mm (in)

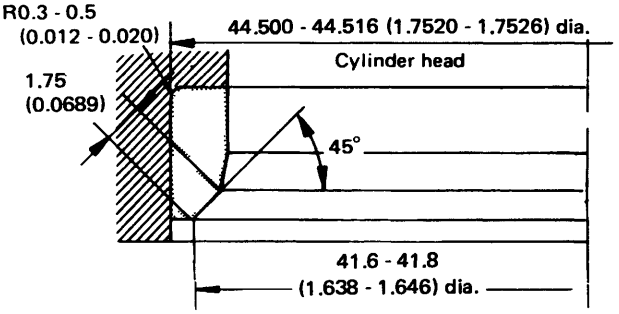
Rocker shaft Outer diameter	17.979 - 18.000 (0.7078 - 0.7087)
Rocker arm Inner diameter	18.007 - 18.028 (0.7089 - 0.7098)
Clearance between rocker arm and rocker shaft	0.007 - 0.049 (0.0003 - 0.0019)

Intake valve seat

Standard



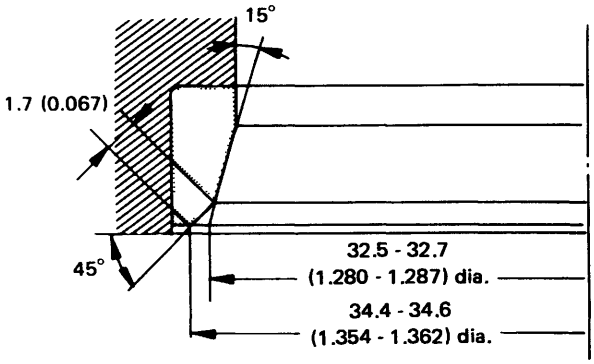
Oversize [0.5 (0.020)]



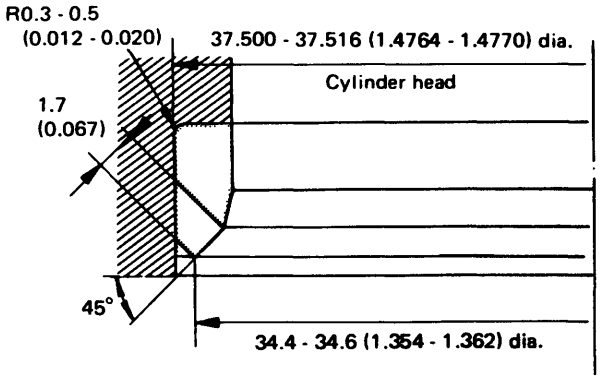
Unit: mm (in) SEM755A

Exhaust valve seat

Standard



Oversize [0.5 (0.020)]

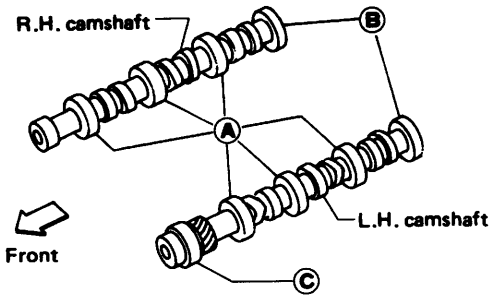


Unit: mm (in) SEM756A

Inspection and Adjustment (Cont'd)

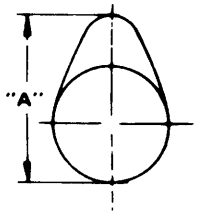
CAMSHAFT AND CAMSHAFT BEARING

Unit: mm (in)



SEM893B

		Standard	Max. tolerance
Camshaft journal to bearing clearance		0.060 - 0.105 (0.0024 - 0.0041)	–
Inner diameter of camshaft bearing	Ⓐ :	47.000 - 47.025 (1.8504 - 1.8514)	–
	Ⓑ :	42.500 - 42.525 (1.6732 - 1.6742)	–
	Ⓒ :	48.000 - 48.025 (1.8898 - 1.8907)	–
Outer diameter of camshaft journal	Ⓐ :	46.920 - 46.940 (1.8472 - 1.8480)	–
	Ⓑ :	42.420 - 42.440 (1.6701 - 1.6709)	–
	Ⓒ :	47.920 - 47.940 (1.8866 - 1.8874)	–
Camshaft runout [T.I.R.*]		Less than 0.04 (0.0016)	0.1 (0.004)
Camshaft end play		0.03 - 0.06 (0.0012 - 0.0024)	–

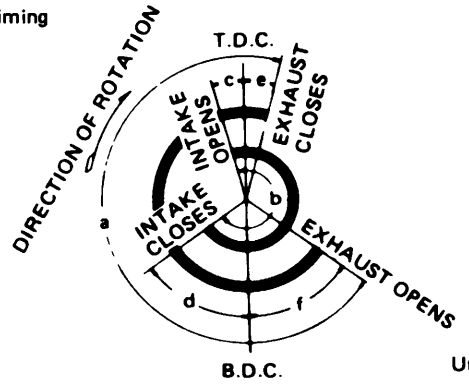


EM671

Cam height "A"	
Intake	39.537 - 39.727 (1.5566 - 1.5641)
Exhaust	
Wear limit of cam height	0.15 (0.0059)

*Total indicator reading

Valve timing



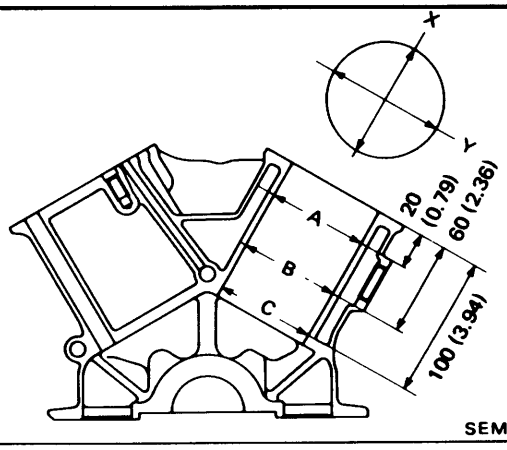
EM120

Unit: degree

a	b	c	d	e	f
248	248	10	58	10	58

CYLINDER BLOCK

Unit: mm (in)



SEM321A

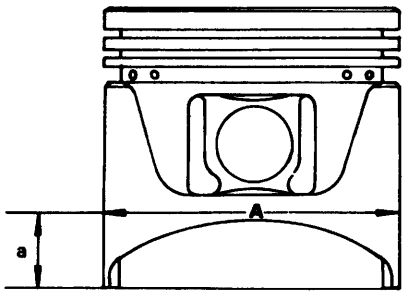
Surface flatness	
Standard	Less than 0.03 (0.0012)
Limit	0.10 (0.0039)
Cylinder bore	
Inner diameter	
Standard	
Grade No. 1	87.000 - 87.010 (3.4252 - 3.4256)
Grade No. 2	87.010 - 87.020 (3.4256 - 3.4260)
Grade No. 3	87.020 - 87.030 (3.4260 - 3.4264)
Wear limit	0.20 (0.0079)
Out-of-round (X – Y)	Less than 0.015 (0.0006)
Taper (A – B – C)	Less than 0.015 (0.0006)
Main journal inner diameter	
Grade No. 0	66.645 - 66.654 (2.6238 - 2.6242)
Grade No. 1	66.654 - 66.663 (2.6242 - 2.6245)
Grade No. 2	66.663 - 66.672 (2.6245 - 2.6249)
Difference in inner diameter between cylinders	
Standard	Less than 0.05 (0.0020)

Inspection and Adjustment (Cont'd)

PISTON, PISTON RING AND PISTON PIN

Available piston

Unit: mm (in)



SEM891B

Piston skirt diameter "A"	
Standard	
Grade No. 1	86.965 - 86.975 (3.4238 - 3.4242)
Grade No. 2	86.975 - 86.985 (3.4242 - 3.4246)
Grade No. 3	86.985 - 86.995 (3.4246 - 3.4250)
0.25 (0.0098) oversize (Service)	87.215 - 87.265 (3.4337 - 3.4356)
0.50 (0.0197) oversize (Service)	87.465 - 87.515 (3.4435 - 3.4455)
"a" dimension	18 (0.71)
Piston pin hole diameter	20.969 - 20.981 (0.8255 - 0.8260)
Piston clearance to cylinder block	0.025 - 0.045 (0.0010 - 0.0018)

Piston ring

Unit: mm (in)

	Standard	Limit
Side clearance		
Top	0.040 - 0.073 (0.0016 - 0.0029)	0.1 (0.004)
2nd	0.030 - 0.063 (0.0012 - 0.0025)	
Ring gap		
Top	0.21 - 0.44 (0.0083 - 0.0173)	1.0 (0.039)
2nd	0.18 - 0.44 (0.0071 - 0.0173)	
Oil (rail ring)	0.20 - 0.76 (0.0079 - 0.0299)	

Piston pin

Unit: mm (in)

Piston pin outer diameter	20.971 - 20.983 (0.8256 - 0.8261)
Interference fit of piston pin to piston	–0.008 to 0.004 (–0.0003 to 0.0002)
Piston pin to connecting rod bushing clearance	0.005 - 0.017 (0.0002 - 0.0007)

*Values measured at ambient temperature of 20°C (68°F)

CONNECTING ROD

Unit: mm (in)

Center distance	154.1 - 154.2 (6.067 - 6.071)
Bend, torsion [per 100 (3.94)] Limit	Bend: 0.15 (0.0059) Torsion: 0.30 (0.0118)
Piston pin bushing inner diameter*	20.982 - 20.994 (0.8261 - 0.8265)
Connecting rod big end inner diameter	53.000 - 53.013 (2.0866 - 2.0871)
Side clearance Standard Limit	0.20 - 0.35 (0.0079 - 0.0138) 0.40 (0.0157)

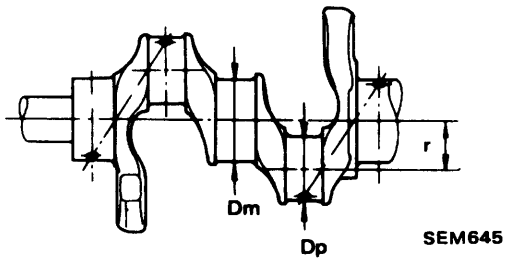
*After installing in connecting rod

Inspection and Adjustment (Cont'd)

CRANKSHAFT

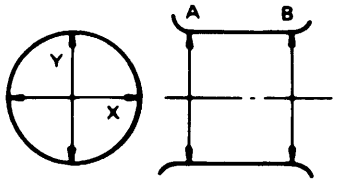
Unit: mm (in)

Main journal dia. "Dm"	
Grade No. 0	62.967 - 62.975 (2.4790 - 2.4793)
Grade No. 1	62.959 - 62.967 (2.4787 - 2.4790)
Grade No. 2	62.951 - 62.959 (2.4784 - 2.4787)
Pin journal dia. "Dp"	49.955 - 49.974 (1.9667 - 1.9675)
Center distance "r"	41.5 (1.634)
Out-of-round (X – Y)	
Standard	Less than 0.005 (0.0002)
Taper (A – B)	
Standard	Less than 0.005 (0.0002)
Runout [T.I.R.]	
Standard	Less than 0.10 (0.0039)
Free end play	
Standard	0.050 - 0.170 (0.0020 - 0.0067)
Limit	0.30 (0.0118)



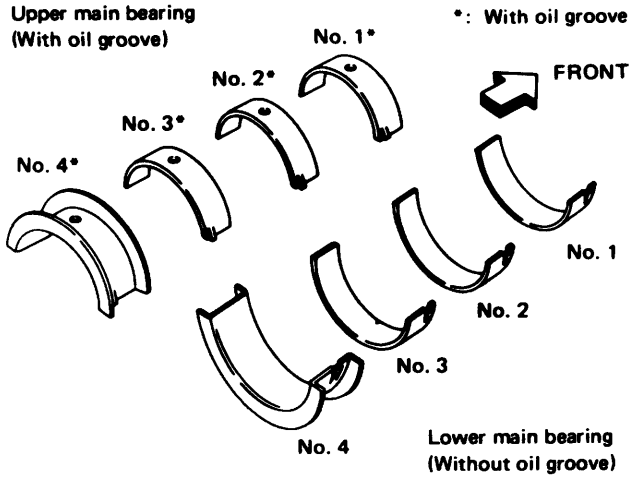
SEM645

Out-of-round X – Y
Taper A – B



EM715

AVAILABLE MAIN BEARING



SEM327A

No. 1 main bearing

Grade number	Thickness "T" mm (in)	Width "W" mm (in)	Identification color
0	1.817 - 1.821 (0.0715 - 0.0717)		Black
1	1.821 - 1.825 (0.0717 - 0.0719)		Brown
2	1.825 - 1.829 (0.0719 - 0.0720)	22.4 - 22.6 (0.882 - 0.890)	Green
3	1.829 - 1.833 (0.0720 - 0.0722)		Yellow
4	1.833 - 1.837 (0.0722 - 0.0723)		Blue

No. 2 and 3 main bearing

Grade number	Thickness "T" mm (in)	Width "W" mm (in)	Identification color
0	1.817 - 1.821 (0.0715 - 0.0717)		Black
1	1.821 - 1.825 (0.0717 - 0.0719)		Brown
2	1.825 - 1.829 (0.0719 - 0.0720)	18.9 - 19.1 (0.744 - 0.752)	Green
3	1.829 - 1.833 (0.0720 - 0.0722)		Yellow
4	1.833 - 1.837 (0.0722 - 0.0723)		Blue

Inspection and Adjustment (Cont'd)

No. 4 main bearing

Grade number	Thickness "T" mm (in)	Identification color
0	1.817 - 1.821 (0.0715 - 0.0717)	Black
1	1.821 - 1.825 (0.0717 - 0.0719)	Brown
2	1.825 - 1.829 (0.0719 - 0.0720)	Green
3	1.829 - 1.833 (0.0720 - 0.0722)	Yellow
4	1.833 - 1.837 (0.0722 - 0.0723)	Blue

Main bearing 0.25 mm (0.0098 in) undersize

Unit: mm (in)

Thickness "T"	1.948 - 1.956 (0.0767 - 0.0770)

AVAILABLE CONNECTING ROD BEARING

Connecting rod bearing undersize

Unit: mm (in)

	Thickness	Crank pin journal diameter "Dp"
Standard	1.502 - 1.506 (0.0591 - 0.0593)	49.955 - 49.974 (1.9667 - 1.9675)
Undersize 0.08 (0.0031) 0.12 (0.0047) 0.25 (0.0098)	 1.542 - 1.546 (0.0607 - 0.0609) 1.562 - 1.566 (0.0615 - 0.0617) 1.627 - 1.631 (0.0641 - 0.0642)	Grind so that bearing clearance is the specified value.

MISCELLANEOUS COMPONENTS

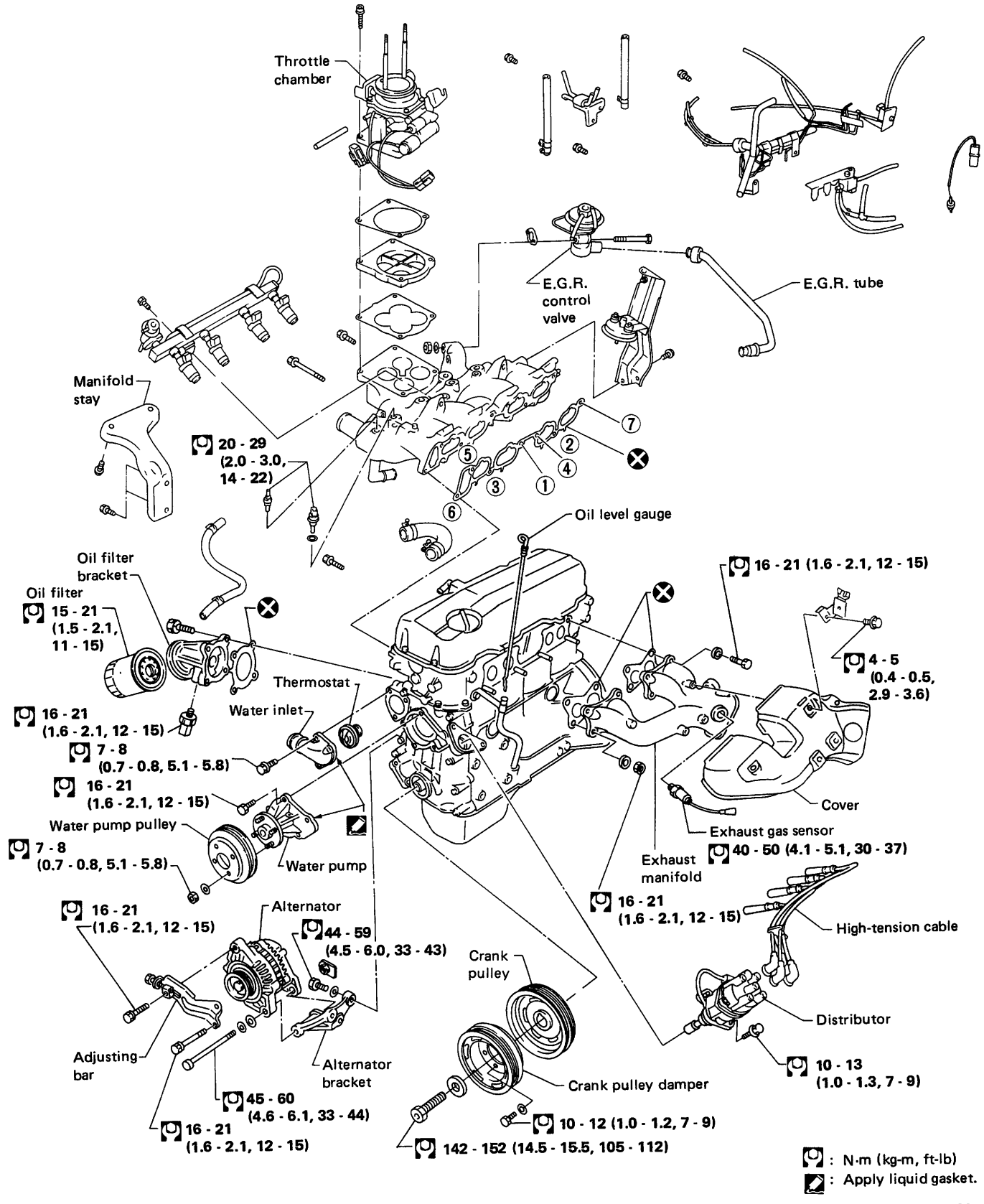
Unit: mm (in)

Flywheel Runout [T.I.R.]	 Less than 0.15 (0.0059)

Bearing clearance

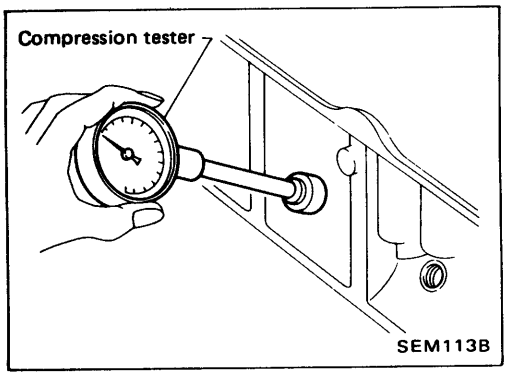
Unit: mm (in)

Main bearing clearance	
Standard	0.028 - 0.055 (0.0011 - 0.0022)
Limit	0.090 (0.0035)
Connecting rod bearing clearance	
Standard	0.014 - 0.054 (0.0006 - 0.0021)
Limit	0.090 (0.0035)


Throttle chamber
E.G.R. control valve
E.G.R. tube
Manifold stay
20 - 29 (2.0 - 3.0, 14 - 22)
Oil level gauge
Oil filter bracket
Oil filter
15 - 21 (1.5 - 2.1, 11 - 15)
16 - 21 (1.6 - 2.1, 12 - 15)
Thermostat
Water inlet
7 - 8 (0.7 - 0.8, 5.1 - 5.8)
16 - 21 (1.6 - 2.1, 12 - 15)
Water pump pulley
7 - 8 (0.7 - 0.8, 5.1 - 5.8)
Water pump
16 - 21 (1.6 - 2.1, 12 - 15)
Alternator
44 - 59 (4.5 - 6.0, 33 - 43)
Adjusting bar
Alternator bracket
45 - 60 (4.6 - 6.1, 33 - 44)
16 - 21 (1.6 - 2.1, 12 - 15)
Crank pulley
Crank pulley damper
10 - 12 (1.0 - 1.2, 7 - 9)
142 - 152 (14.5 - 15.5, 105 - 112)
16 - 21 (1.6 - 2.1, 12 - 15)
4 - 5 (0.4 - 0.5, 2.9 - 3.6)
Cover
Exhaust gas sensor
40 - 50 (4.1 - 5.1, 30 - 37)
Exhaust manifold
16 - 21 (1.6 - 2.1, 12 - 15)
High-tension cable
Distributor
10 - 13 (1.0 - 1.3, 7 - 9)
: N·m (kg-m, ft-lb)
: Apply liquid gasket.
SEM838C

Measurement of Compression Pressure

1. Warm up engine.
2. Turn ignition switch off.
3. Disconnect fusible link for injectors.
4. Remove all spark plugs.
5. Disconnect distributor center cable.



6. Attach a compression tester to No. 1 cylinder.
7. Depress accelerator pedal fully to keep throttle valve wide open.
8. Crank engine and record highest gauge indication.
9. Repeat the measurement on each cylinder as shown above.

- **Always use a fully-charged battery to obtain specified engine revolution.**

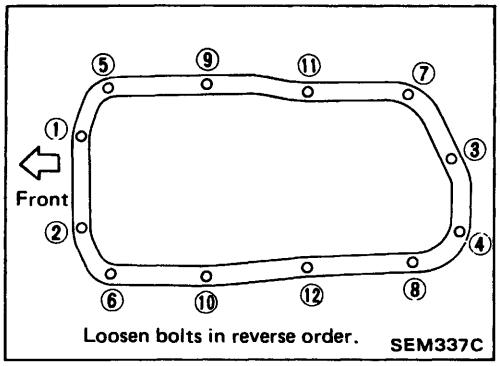
Compression pressure:
kPa (kg/cm^2, psi)/rpm
Standard
1,324 (13.5, 192)/300
Minimum
981 (10, 142)/300
Difference limit between cylinders
98 (1.0, 14)/300

10. If cylinder compression in one or more cylinders is low, pour a small amount of engine oil into cylinders through spark plug holes and retest compression.

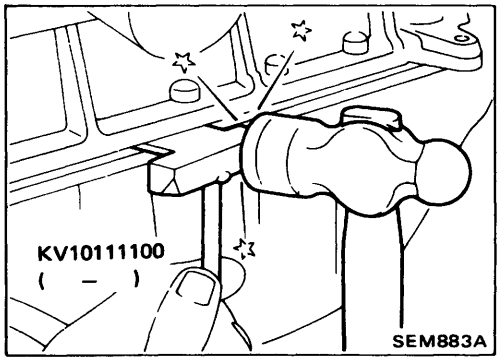
- **If adding oil helps compression, piston rings may be worn or damaged. If so, replace piston rings after checking piston.**
- **If pressure stays low, a valve may be sticking or seating improperly. Inspect and repair valve and valve seat. (Refer to S.D.S.) If valve or valve seat is damaged excessively, replace them.**
- **If compression in any two adjacent cylinders is low and if adding oil does not help compression, there is leakage past the gasket surface. If so, replace cylinder head gasket.**

Removal

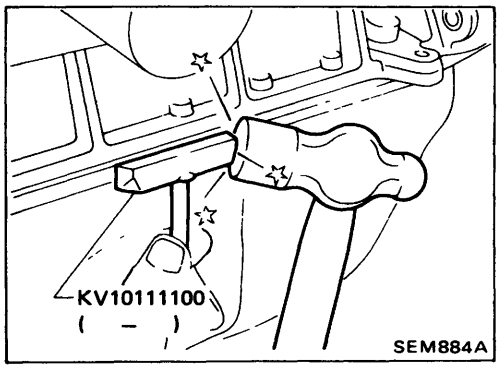
1. Raise vehicle and support it with safety stands.
2. Drain engine oil.
3. Remove front stabilizer bar securing bolts and nuts from side member.
4. Lift engine.



5. Remove oil pan bolts.

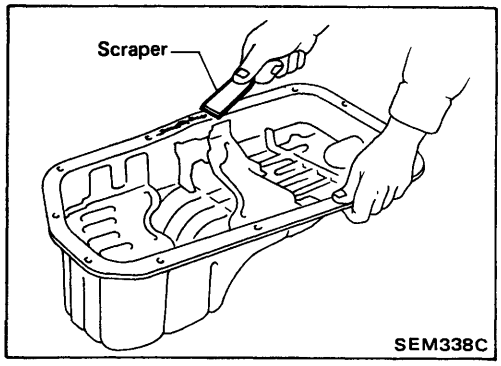


6. Remove oil pan.
(1) Insert Tool between cylinder block and oil pan.
- **Do not drive seal cutter into oil pump or rear oil seal retainer portion, or aluminum mating face will be damaged.**
- **Do not insert screwdriver, or oil pan flange will be deformed.**



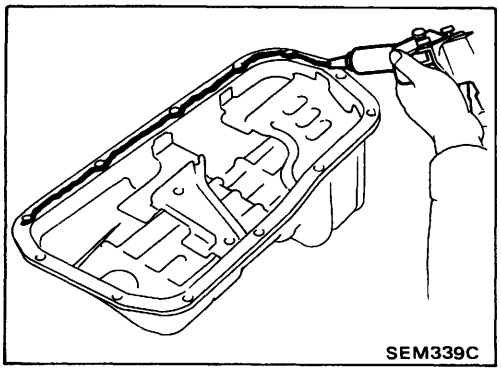
(2) Slide Tool by tapping its side with a hammer, and remove oil pan.

7. Pull out oil pan from front side.

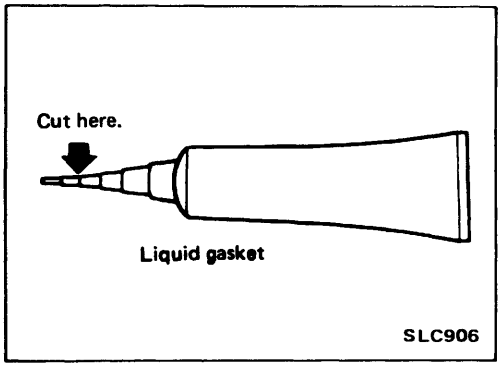


Installation

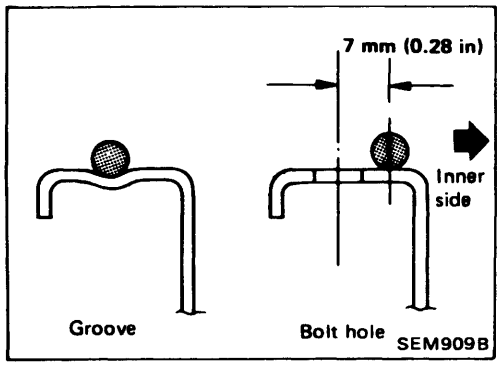
1. Before installing oil pan, remove all traces of liquid gasket from mating surface using a scraper.
- Also remove traces of liquid gasket from mating surface of cylinder block.



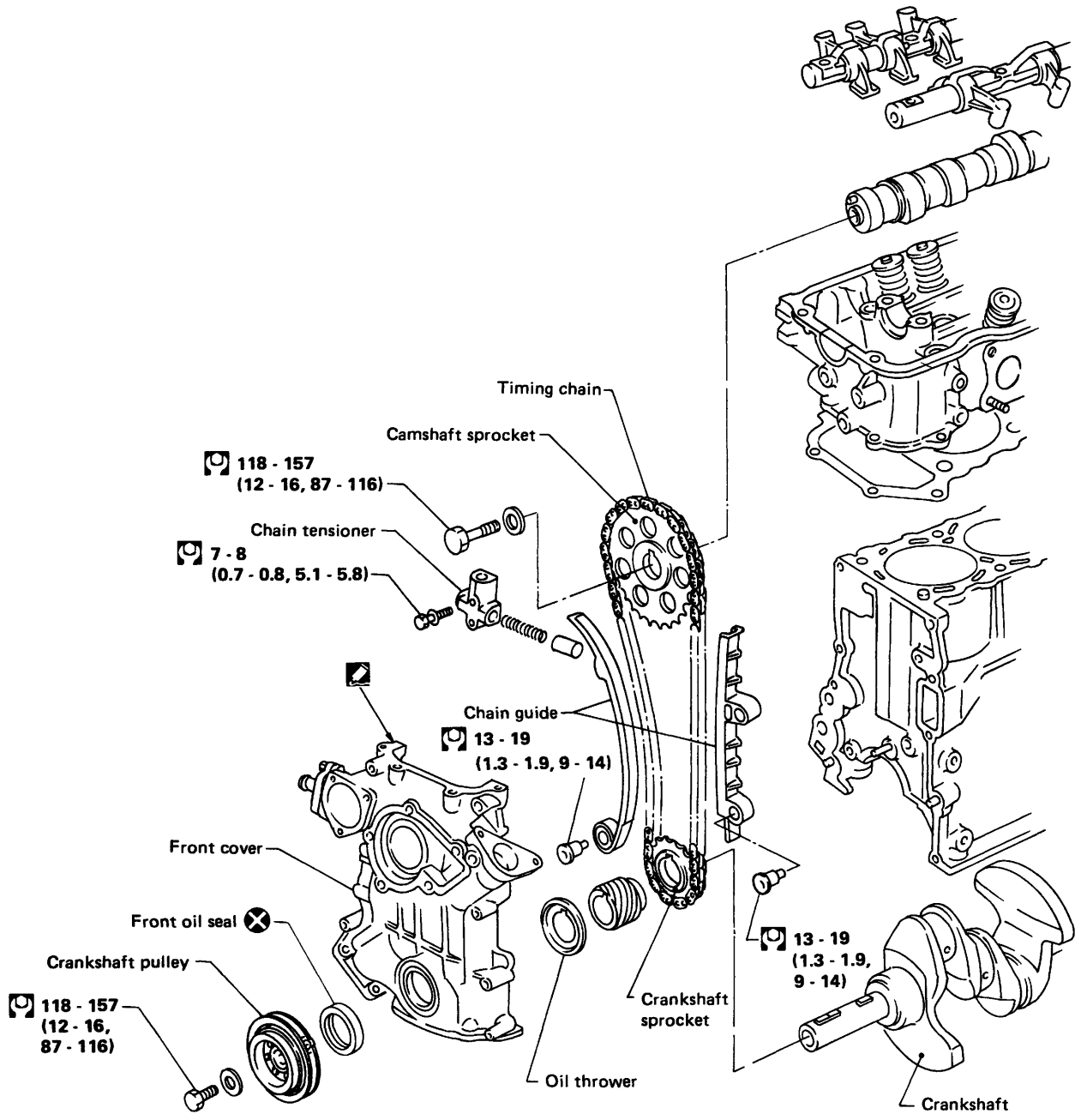
2. Apply a continuous bead of liquid gasket to mating surface of oil pan.
- **Use Genuine Liquid Gasket or equivalent.**



- Be sure liquid gasket is 3.5 to 4.5 mm (0.138 to 0.177 in) wide.



3. Apply liquid gasket to inner sealing surface as shown in figure.
- Attaching should be done within 5 minutes after coating.
4. Install oil pan.
- **Wait at least 30 minutes before refilling engine oil.**

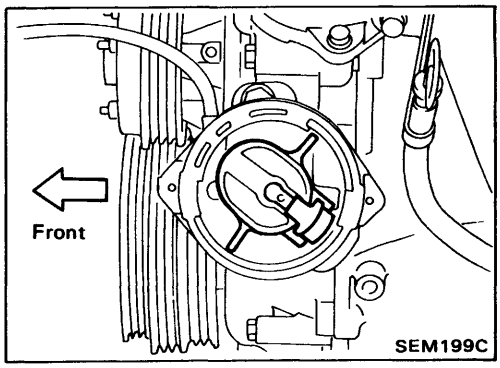


CAUTION:

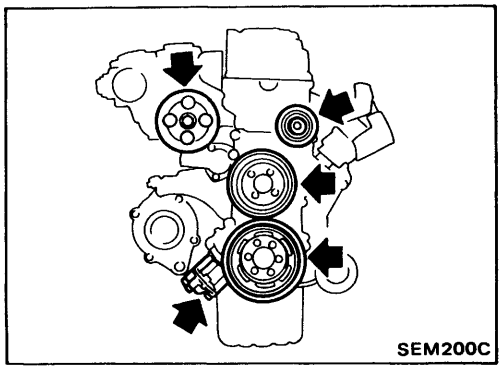
- **After removing timing chain, do not turn crankshaft and camshaft separately, or valves will strike piston heads.**

Removal

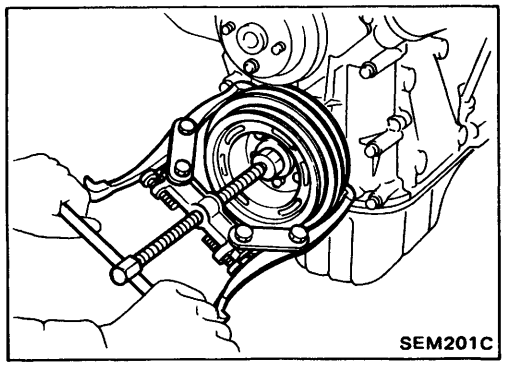
1. Disconnect battery terminal.
2. Drain coolant from radiator.
3. Remove radiator shroud and cooling fan.
4. Remove the following belts.
- Power steering drive belt
- Compressor drive belt
- Alternator drive belt

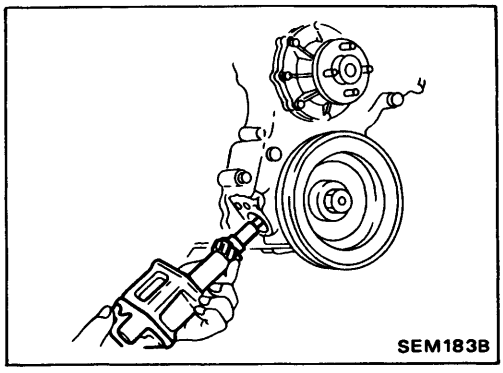


5. Remove all spark plugs.
6. Set No. 1 piston at T.D.C. on its compression stroke.

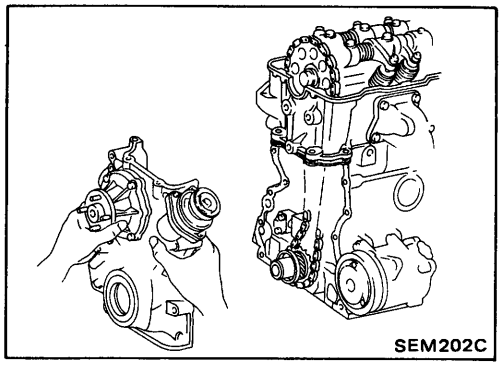


7. Remove the following parts.
- Power steering pump, idler pulley and power steering pump brackets
- Compressor idler pulley
- Crankshaft pulley
- Oil pump with pump drive spindle
- Rocker cover

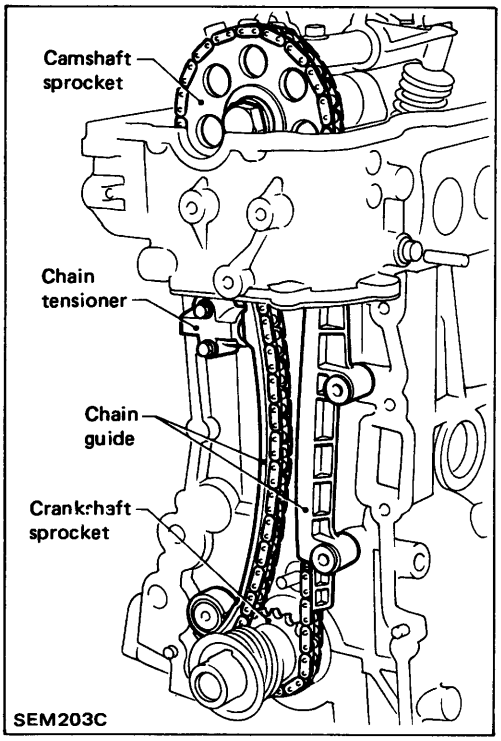




Removal (Cont'd)


SEM202C

8. Remove oil pan. (Refer to OIL PAN.)
9. Remove front cover.

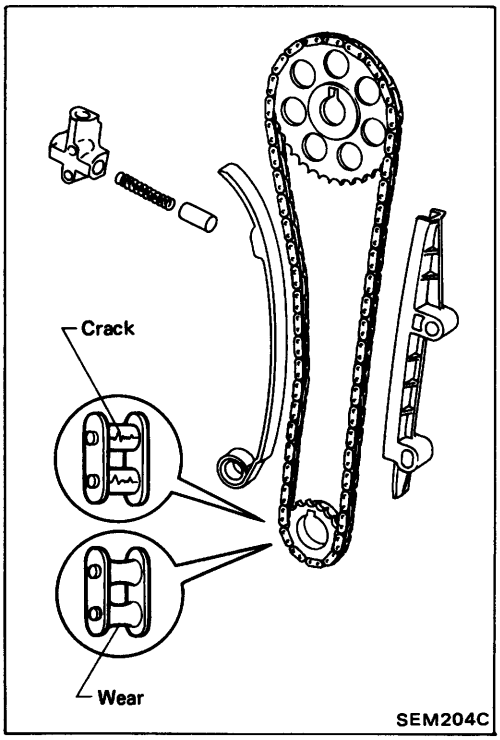


SEM203C

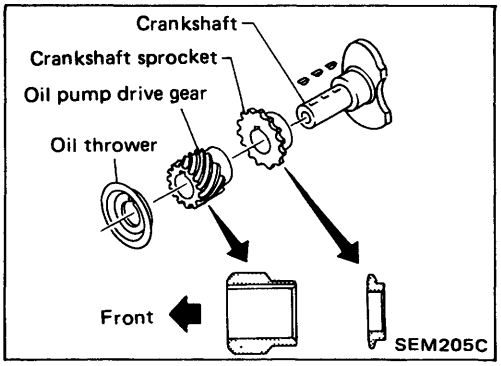
10. Remove the following parts.
- Chain tensioner
- Chain guides
- Timing chain and sprocket
- Oil thrower, oil pump drive gear and crankshaft sprocket

Inspection

Check for cracks and excessive wear at roller links. Replace if necessary.

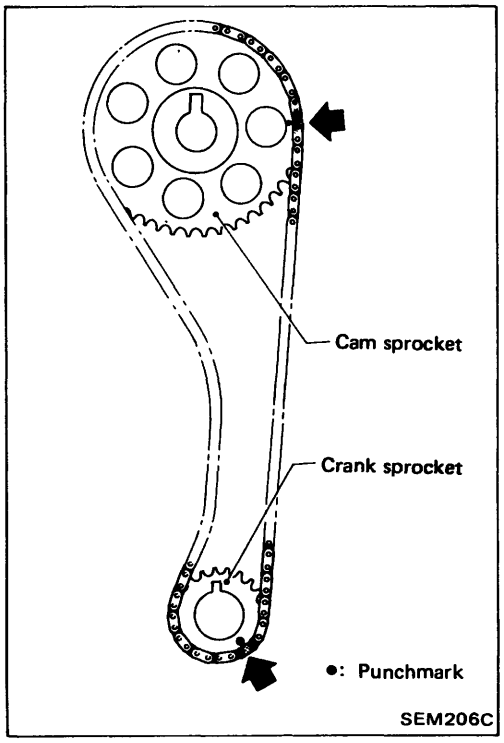


SEM204C

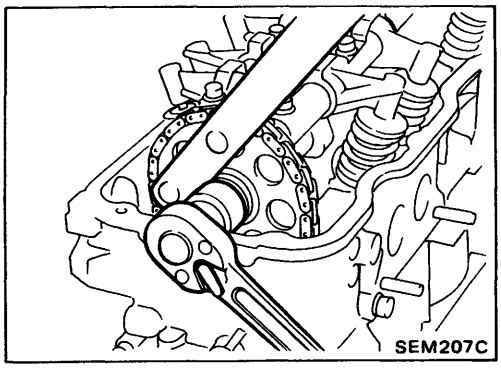


Installation

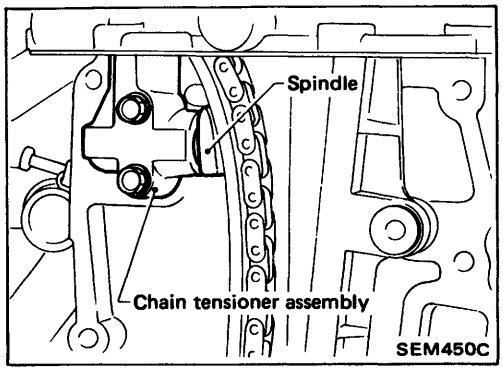
1. Install crankshaft sprocket, oil pump drive gear and oil thrower.
- **Make sure that mating marks of crankshaft sprocket face engine front.**



2. Install camshaft sprocket.
3. Confirm that No. 1 piston is set at T.D.C. on its compression stroke.
4. Install timing chain.
- **Set timing chain by aligning its mating marks with those of crankshaft sprocket and camshaft sprocket.**

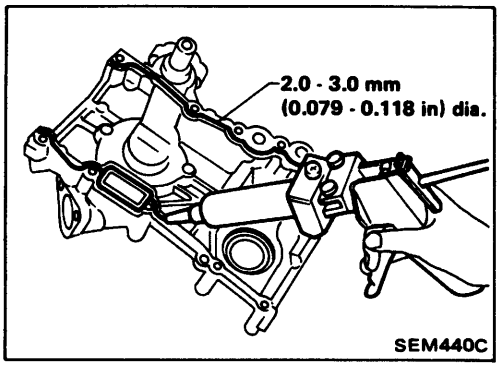


5. Tighten camshaft sprocket bolt.

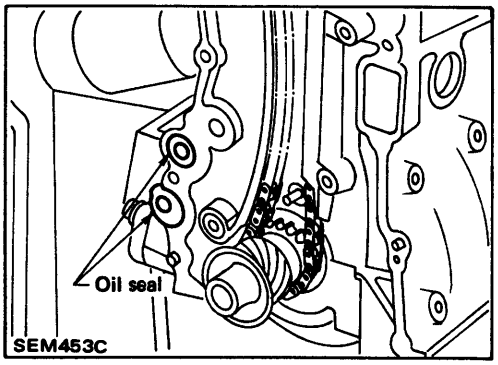


6. Install chain guide and chain tensioner.

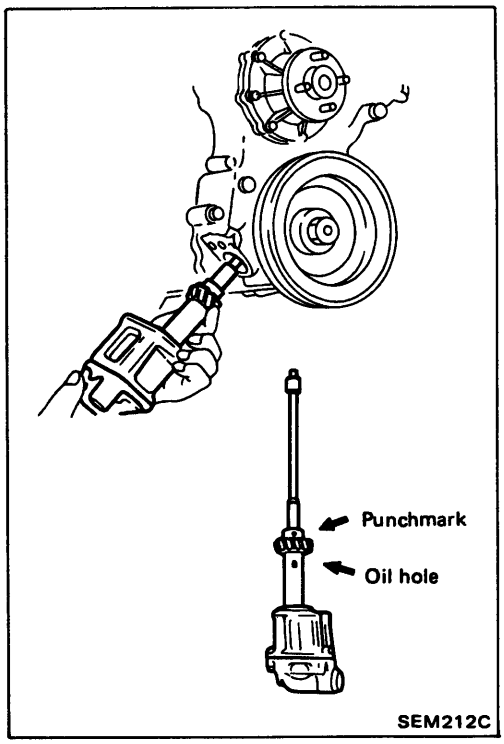
Installation (Cont'd)



7. Apply liquid gasket to front cover.
8. Apply lithium grease to sealing lip of crankshaft oil seal.

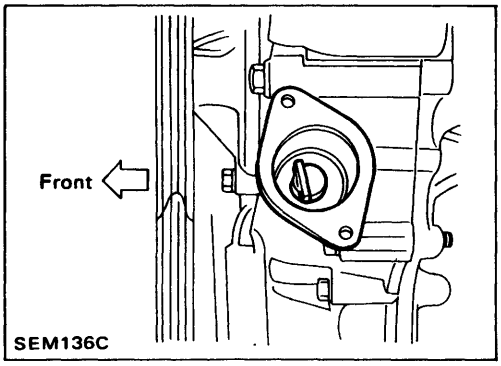


9. Install front cover.
   - **Be careful not to damage cylinder head gasket.**
   - **Do not forget oil seal.**
10. Install rubber plug. (Refer to "Installation" of CYLINDER HEAD.)
11. Install oil pan. (Refer to OIL PAN.)

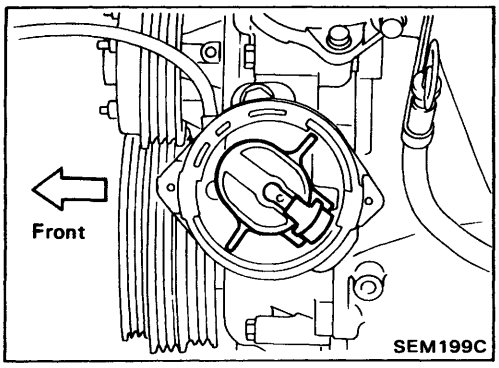


12. Install oil pump and distributor driving spindle with new gasket in front cover.
(1) Assemble oil pump and driving spindle, aligning punchmark on driving spindle with oil hole.

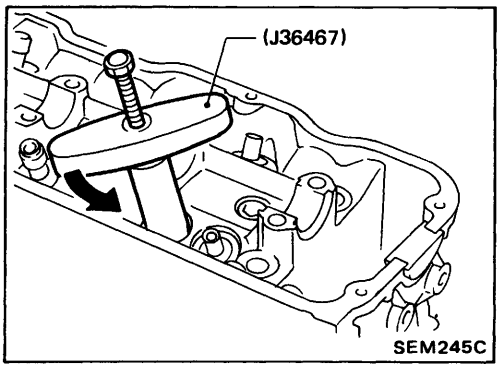
Installation (Cont'd)



(2) Make sure that driving spindle is set as shown in figure.



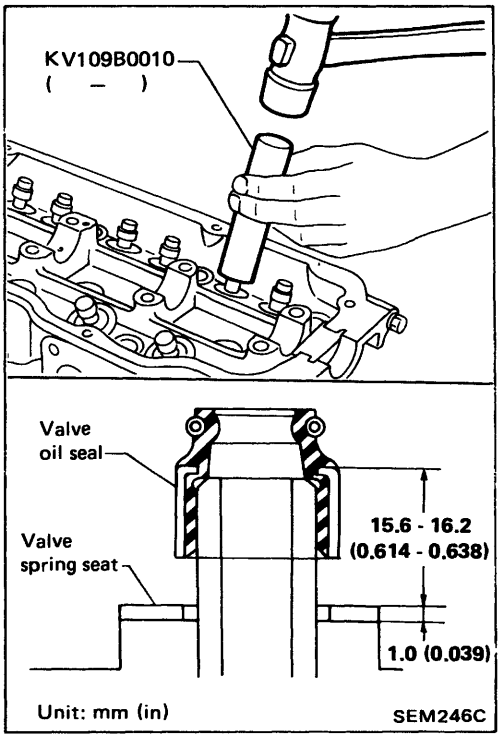
13. Install distributor.
14. Make sure that No. 1 piston is set at T.D.C. and that distributor rotor is set at No. 1 cylinder spark position.



VALVE OIL SEAL

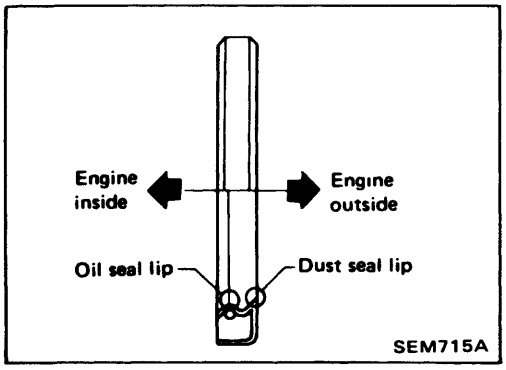
1. Remove rocker cover.
2. Remove rocker shaft assembly.
3. Remove valve spring and valve oil seal with Tool or suitable tool.

Piston concerned should be set at T.D.C. to prevent valve from falling.



4. Apply engine oil to new valve oil seal and install it with Tool.

Before installing valve oil seal, install valve spring seat.

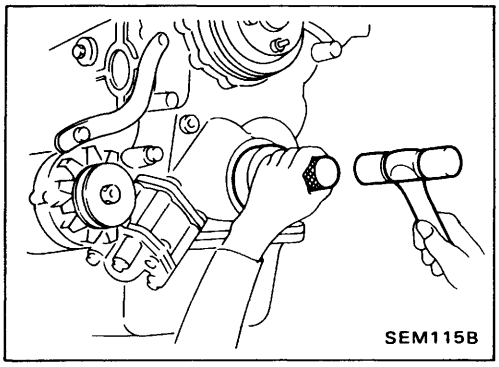


OIL SEAL INSTALLING DIRECTION

FRONT OIL SEAL

1. Remove radiator shroud and crankshaft pulley.
2. Remove front oil seal.

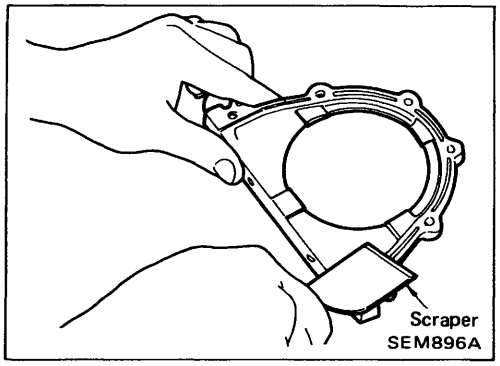
Be careful not to damage crankshaft.

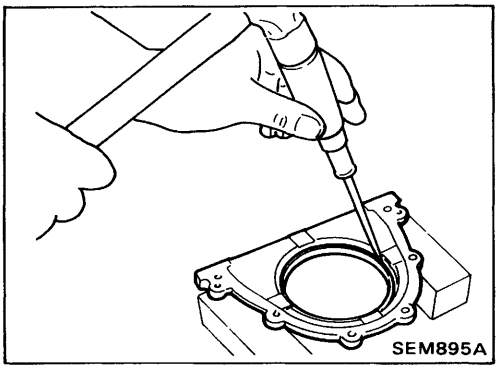


3. Apply engine oil to new oil seal and install it using suitable tool.

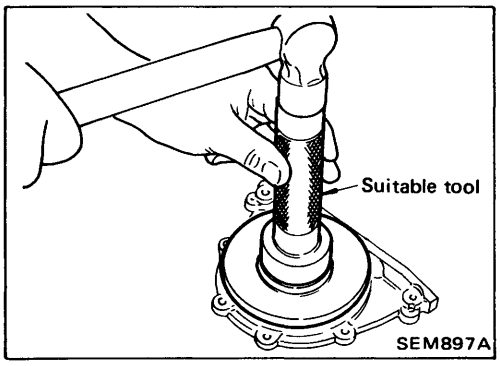
REAR OIL SEAL

1. Remove flywheel or drive plate.
2. Remove rear oil seal retainer.
3. Remove traces of liquid gasket using scraper.

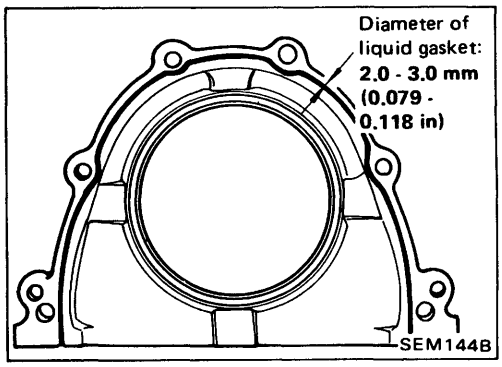




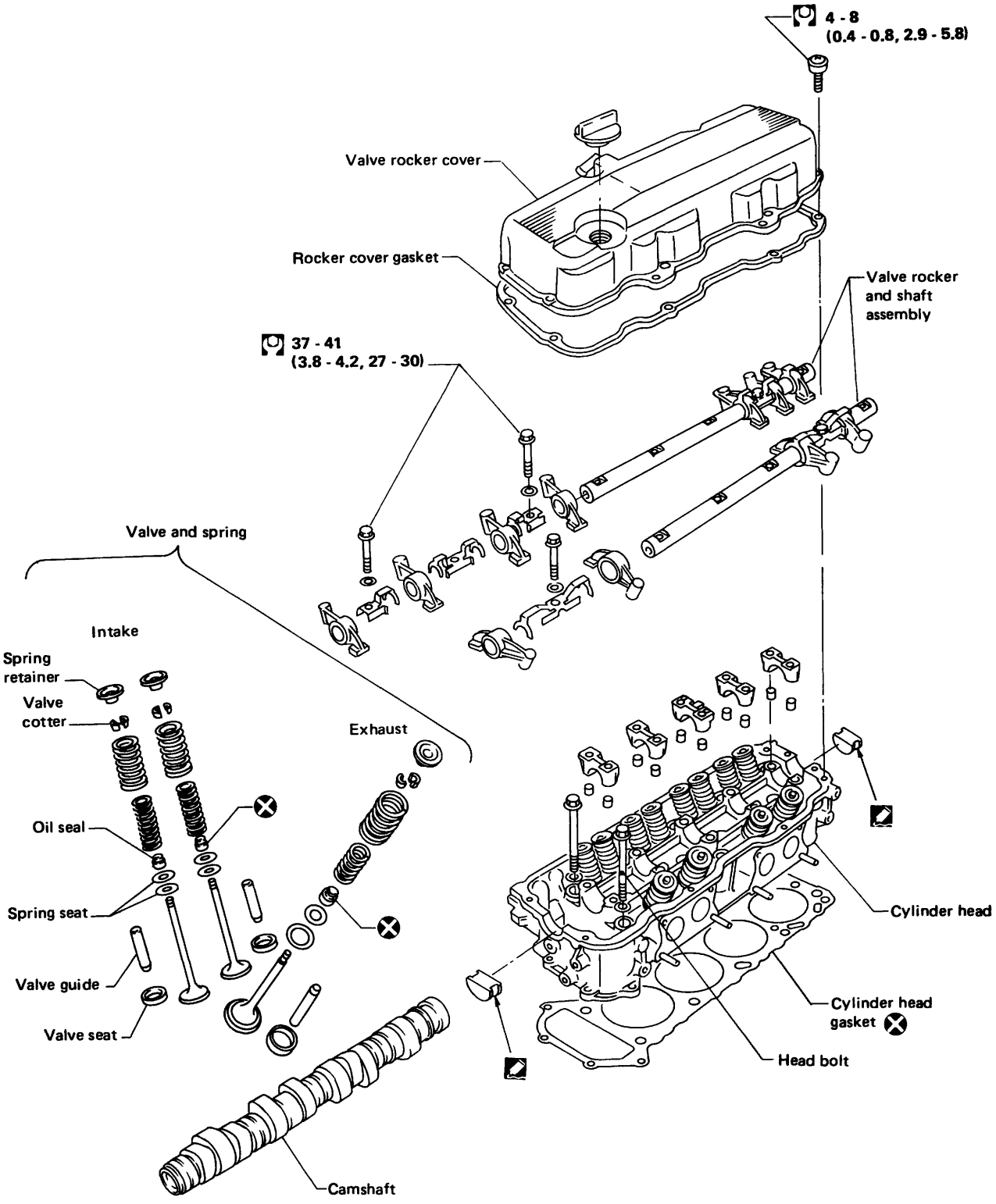
4. Remove rear oil seal from retainer.



5. Apply engine oil to new oil seal and install it using suitable tool.



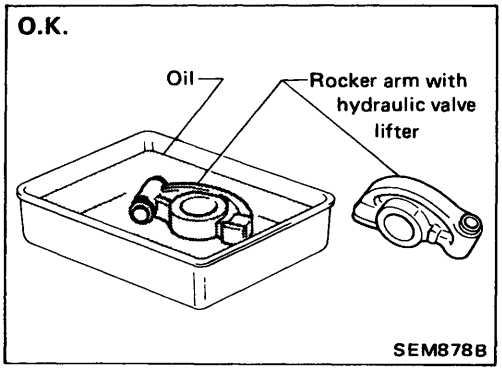
6. Apply liquid gasket to rear oil seal retainer.



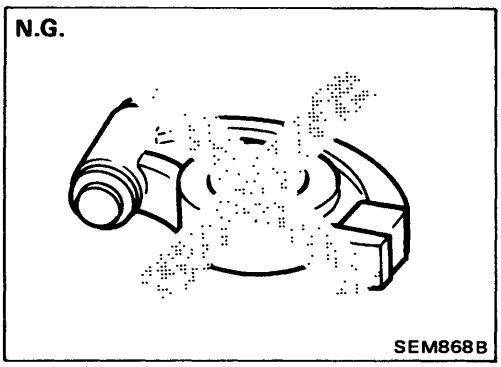
: N·m (kg-m, ft-lb)

SEM215C

CAUTION:
- **When installing sliding parts such as rocker arms, camshaft and oil seal, be sure to apply new engine oil on their sliding surfaces.**
- **When tightening cylinder head bolts and rocker shaft bolts, apply new engine oil to thread portions and seat surfaces of bolts.**



- **Hydraulic valve lifters are installed in each rocker arm. If hydraulic valve lifter is kept on its side, even when installed in rocker arm, there is a possibility of air entering it. After removal, always set rocker arm straight up, or when laying it on its side, have it soak in new engine oil.**



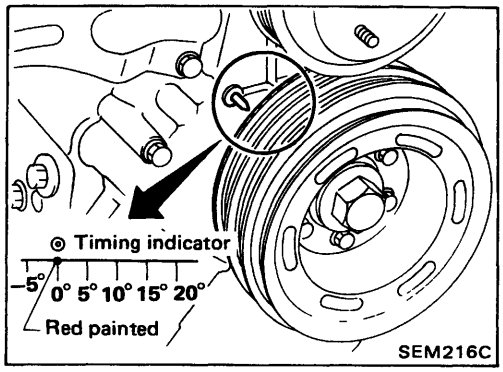
- **Do not disassemble hydraulic valve lifter.**
- **Attach tags to valve lifters so as not to mix them up.**

Removal

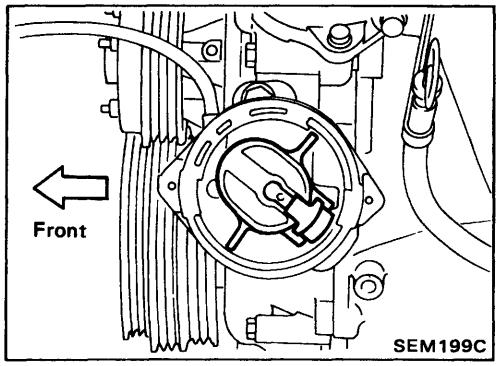
1. Drain coolant from radiator and drain plug of block.
2. Remove the following parts.
- Power steering drive belt
- Power steering pump, idler pulley and power steering brackets
- Vacuum hoses of S.C.V. and pressure control solenoid valve
- Accelerator wire bracket
3. Disconnect E.G.R. tube from exhaust manifold.
4. Remove bolts which hold intake manifold collector to intake manifold.
5. Remove bolts which hold intake manifold to cylinder head while raising collector upwards.
6. Remove rocker cover.

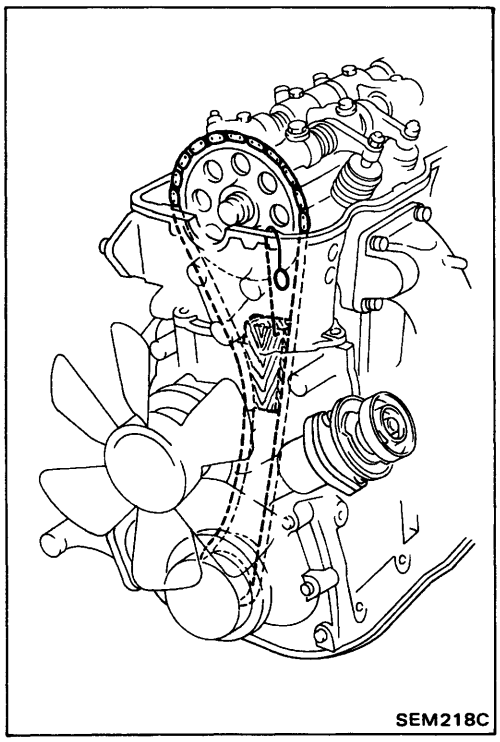
When removing rocker cover, do not hit rocker cover against rocker arm.

Removal (Cont'd)

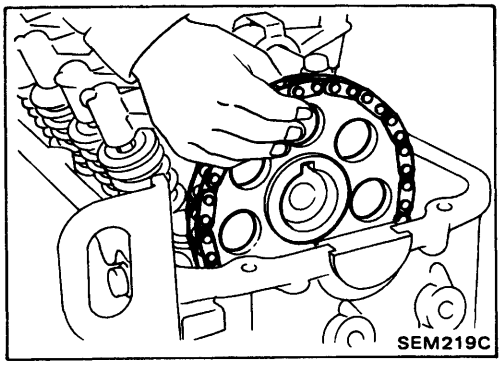


7. Set No. 1 piston at T.D.C. on its compression stroke.



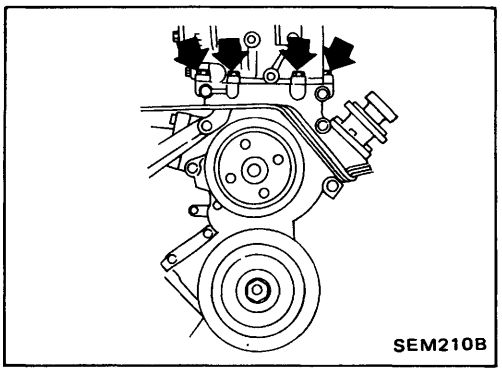


8. Loosen camshaft sprocket bolt.
- Support timing chain by using Tool as shown in figure.

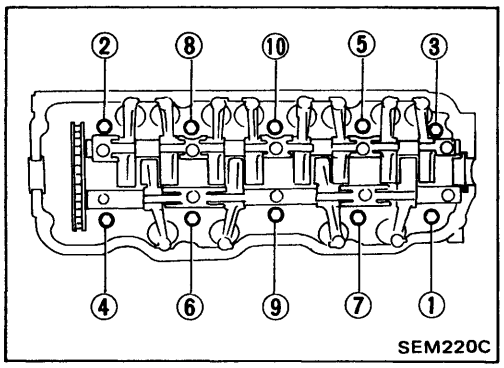


9. Remove camshaft sprocket.

Removal (Cont'd)


SEM210B

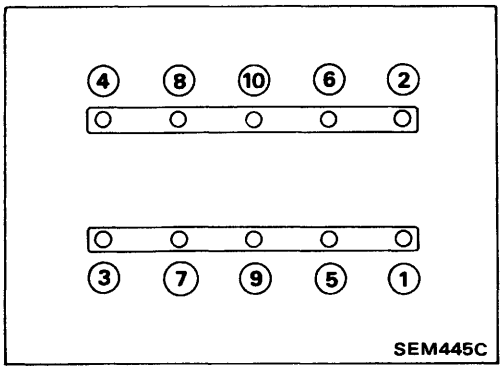
10. Remove front cover tightening bolts to cylinder head.



SEM220C

11. Remove cylinder head.
- **Head warpage or cracking could result from removing in incorrect order.**
- **Cylinder head bolts should be loosened in two or three steps.**

Disassembly



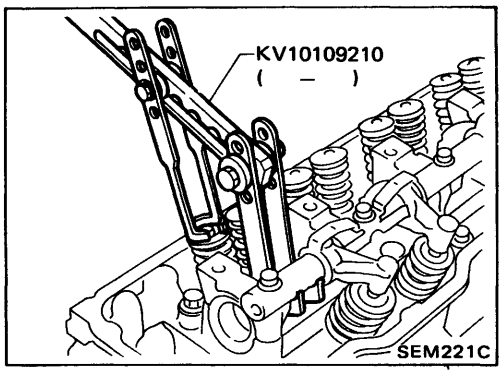
SEM445C

1. Remove rocker shaft assembly.

a. When loosening bolts, evenly loosen from outside in sequence.

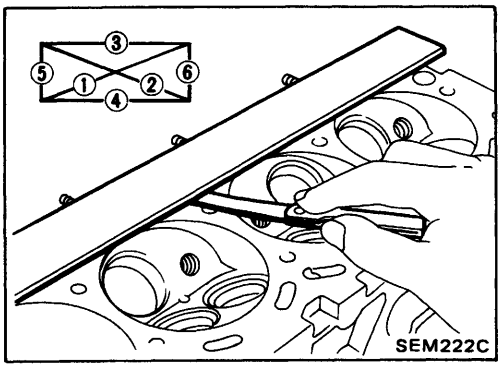
b. Bolts should be loosened in two or three steps.

2. Remove camshaft.
- **Before removing camshaft, measure camshaft end play. (Refer to "Inspection".)**



SEM221C

3. Remove valve components with Tool.
4. Remove valve oil seals. (Refer to OIL SEAL REPLACEMENT.)



Inspection

CYLINDER HEAD DISTORTION

Head surface flatness:

Less than 0.1 mm (0.004 in)

If beyond the specified limit, replace it or resurface it.

Resurfacing limit:

The resurfacing limit of cylinder head is determined by the cylinder block resurfacing in an engine.

Amount of cylinder head resurfacing is "A"

Amount of cylinder block resurfacing is "B"

The maximum limit is as follows:

A + B = 0.2 mm (0.008 in)

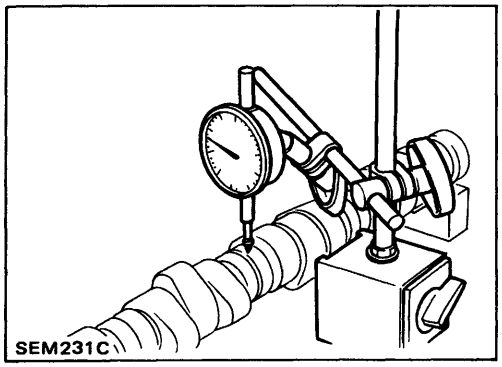
After resurfacing cylinder head, check that camshaft rotates freely by hand. If resistance is felt, cylinder head must be replaced.

Nominal cylinder head height:

98.8 - 99.0 mm (3.890 - 3.898 in)

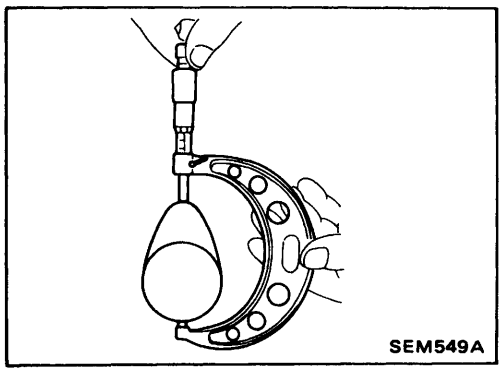
CAMSHAFT VISUAL CHECK

Check camshaft for scratches, seizure and wear.



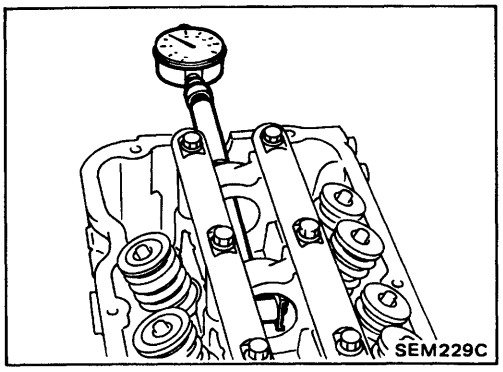
CAMSHAFT RUNOUT

1. Measure camshaft runout at the center journal.
   Runout (Total indicator reading):
   0 - 0.02 mm (0 - 0.0008 in)
2. If it exceeds the limit, replace camshaft.



CAMSHAFT CAM HEIGHT

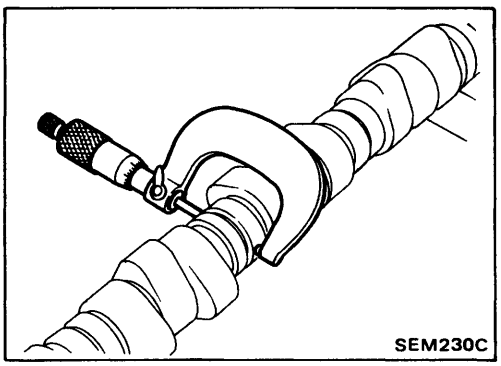
1. Measure camshaft cam height.
   Standard cam height:
   44.839 - 45.029 mm (1.7653 - 1.7728 in)
   Cam wear limit:
   0.2 mm (0.008 in)
2. If wear is beyond the limit, replace camshaft.



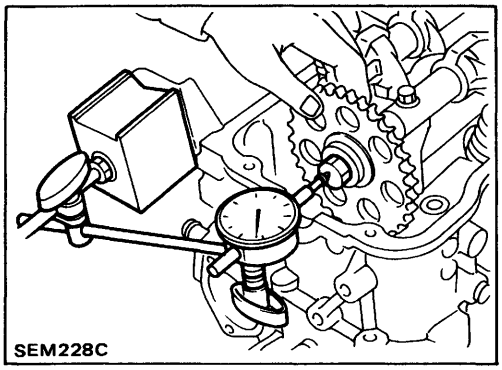
CAMSHAFT JOURNAL CLEARANCE

1. Install camshaft bracket and rocker shaft and tighten bolts to the specified torque.
2. Measure inner diameter of camshaft bearing.
   Standard inner diameter:
   33.000 - 33.025 mm (1.2992 - 1.3002 in)

Inspection (Cont'd)

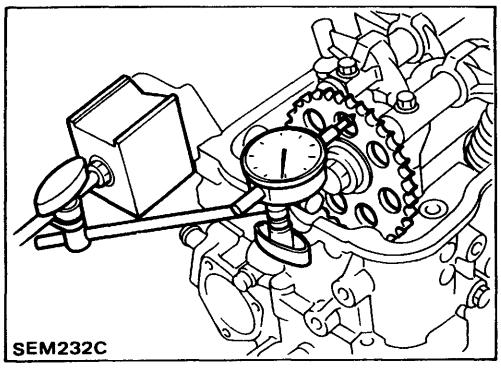

SEM230C

3. Measure outer diameter of camshaft journal.
   Standard outer diameter:
   32.935 - 32.955 mm (1.2967 - 1.2978 in)
4. If clearance exceeds the limit, replace camshaft and/or cylinder head.
   Camshaft journal clearance:
   Standard
   0.045 - 0.090 mm (0.0018 - 0.0035 in)
   Limit
   0.12 mm (0.0047 in)


SEM228C

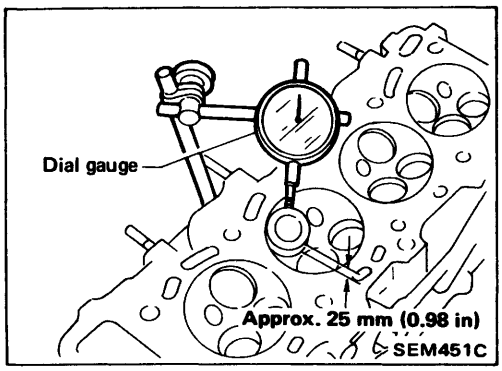
CAMSHAFT END PLAY

1. Install camshaft in cylinder head.
2. Measure camshaft end play.
   Camshaft end play:
   Standard
   0.07 - 0.15 mm (0.0028 - 0.0059 in)
   Limit
   0.2 mm (0.008 in)


SEM232C

CAMSHAFT SPROCKET RUNOUT

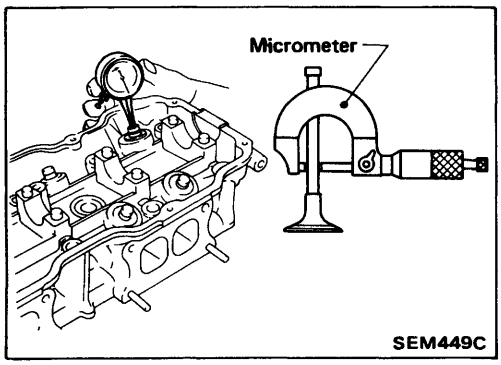
1. Install sprocket on camshaft.
2. Measure camshaft sprocket runout.
   Runout (Total indicator reading):
   Limit 0.12 mm (0.0047 in)
3. If it exceeds the limit, replace camshaft sprocket.



SEM451C

VALVE GUIDE CLEARANCE

1. Measure valve deflection in a right-angled direction with camshaft. (Valve and valve guide mostly wear in this direction.)
   Valve deflection limit (Dial gauge reading):
   0.15 mm (0.0059 in)



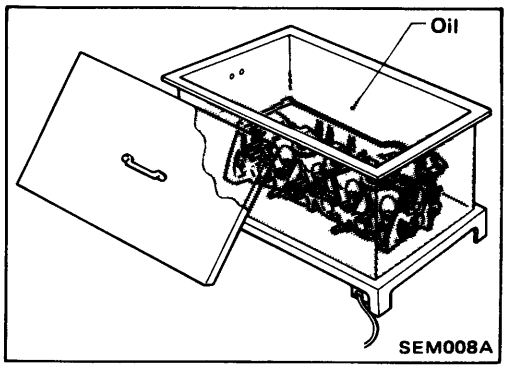
SEM449C

2. If it exceeds the limit, check valve to valve guide clearance.

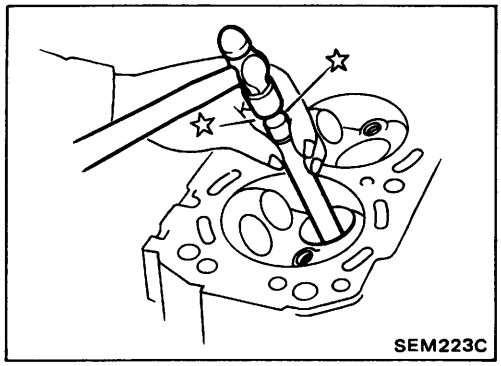
a. Measure valve stem diameter and valve guide inner diameter.
b. Check that clearance is within specification.
   Valve to valve guide clearance:
   Standard
   0.020 - 0.053 mm
   (0.0008 - 0.0021 in) (Intake)
   0.040 - 0.070 mm
   (0.0016 - 0.0028 in) (Exhaust)
   Limit
   0.1 mm (0.004 in)
c. If it exceeds the limit, replace valve or valve guide.

Inspection (Cont'd)

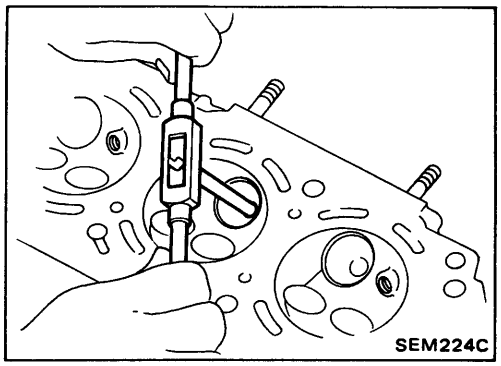
VALVE GUIDE REPLACEMENT



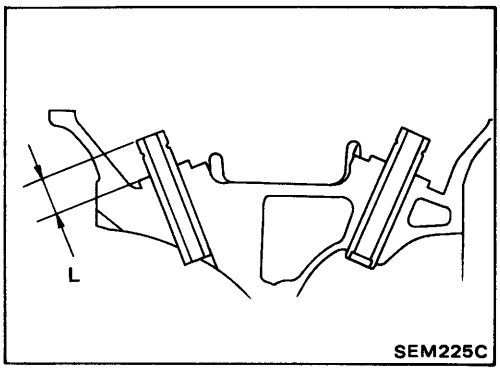
1. To remove valve guide, heat cylinder head to 150 to 160°C (302 to 320°F).



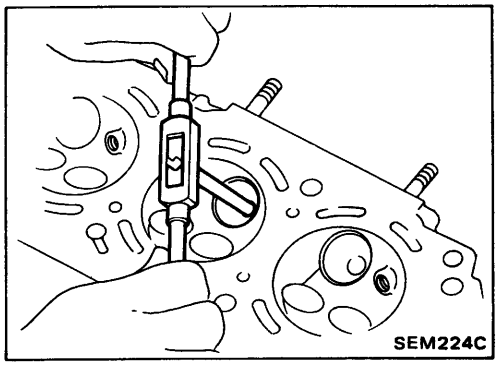
2. Drive out valve guide with a press [under a 20 kN (2 t, 2.2 US ton, 2.0 Imp ton) pressure] or hammer and suitable tool.



3. Ream cylinder head valve guide hole.
   Valve guide hole diameter (for service parts):
   Intake
   11.175 - 11.196 mm (0.4400 - 0.4408 in)
   Exhaust
   12.175 - 12.196 mm (0.4793 - 0.4802 in)

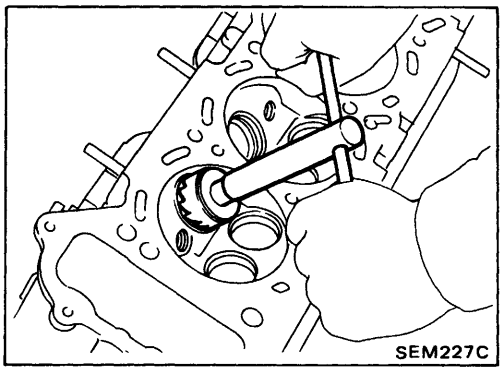


4. Heat cylinder head to 150 to 160°C (302 to 320°F) and press service valve guide onto cylinder head.
   Projection "L":
   14.9 - 15.1 mm (0.587 - 0.594 in)



5. Ream valve guide.
   Finished size:
   Intake
   7.000 - 7.018 mm (0.2756 - 0.2763 in)
   Exhaust
   8.000 - 8.018 mm (0.3150 - 0.3157 in)

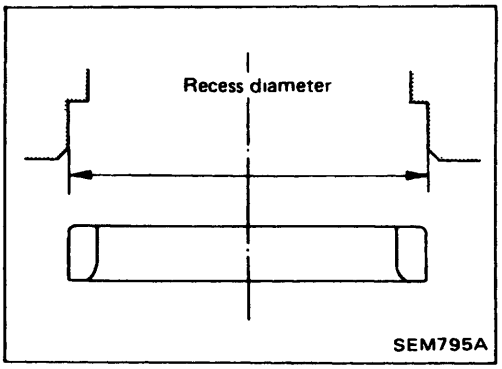
Inspection (Cont'd)


SEM227C

VALVE SEATS

Check valve seats for any evidence of pitting at valve contact surface, and reseat or replace if it has worn out excessively.

- **Before repairing valve seats, check valve and valve guide for wear. If they have worn, replace them. Then correct valve seat.**
- **Cut with both hands to uniform the cutting surface.**



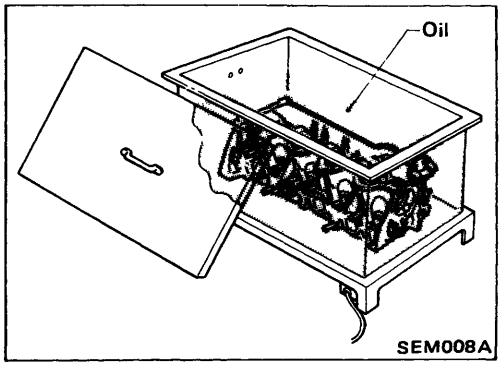
SEM795A

REPLACING VALVE SEAT FOR SERVICE PARTS

1. Bore out old seat until it collapses. The machine depth stop should be set so that boring cannot continue beyond the bottom face of the seat recess in cylinder head.
2. Ream cylinder head recess.

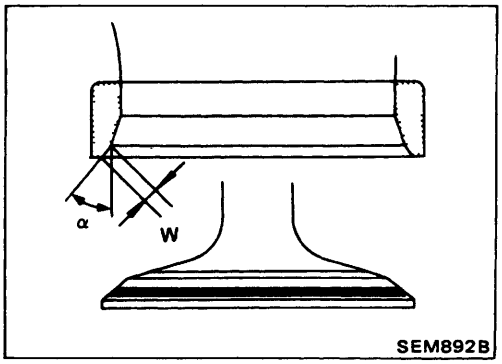
Reaming bore for service valve seat
Oversize [0.5 mm (0.020 in)]:
Intake
36.500 - 36.516 mm (1.4370 - 1.4376 in)
Exhaust
42.500 - 42.516 mm (1.6732 - 1.6739 in)

Reaming should be done to the concentric circles to valve guide center so that valve seat will have the correct fit.



SEM008A

3. Heat cylinder head to 150 to 160°C (302 to 320°F).

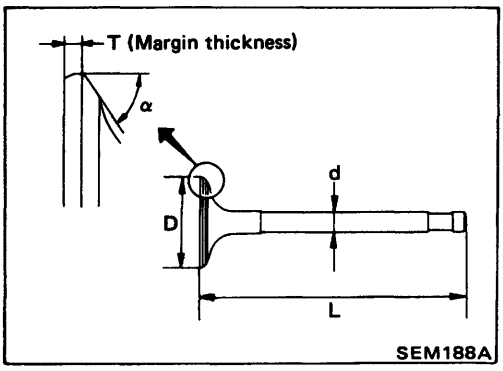


SEM892B

4. Cut or grind valve seat using suitable tool at the specified dimensions as shown in S.D.S.
5. After cutting, lap valve seat with abrasive compound.
6. Check valve seating condition.

Seat face angle "α":
45 deg.
Contacting width "W":
Intake
1.6 - 1.7 mm (0.063 - 0.067 in)
Exhaust
1.7 - 2.1 mm (0.067 - 0.083 in)

Inspection (Cont'd)

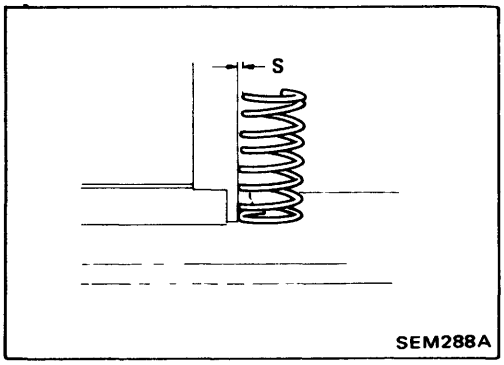


SEM188A

VALVE DIMENSIONS

Check dimensions in each valve. For dimensions, refer to S.D.S. When valve head has been worn down to 0.5 mm (0.020 in) in margin thickness, replace valve.

Grinding allowance for valve stem tip is 0.2 mm (0.008 in) or less.



SEM288A

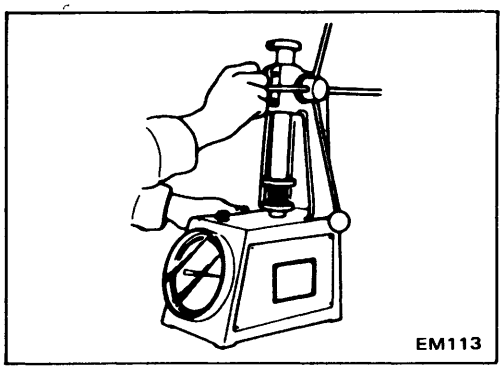
VALVE SPRING

Squareness

1. Measure "S" dimension.

Out-of-square:
- **Outer**
  - **Intake**
    - **Less than 2.5 mm (0.098 in)**
  - **Exhaust**
    - **Less than 2.3 mm (0.091 in)**
- **Inner**
  - **Intake**
    - **Less than 2.3 mm (0.091 in)**
  - **Exhaust**
    - **Less than 2.1 mm (0.083 in)**

2. If it exceeds the limit, replace spring.


EM113

Pressure

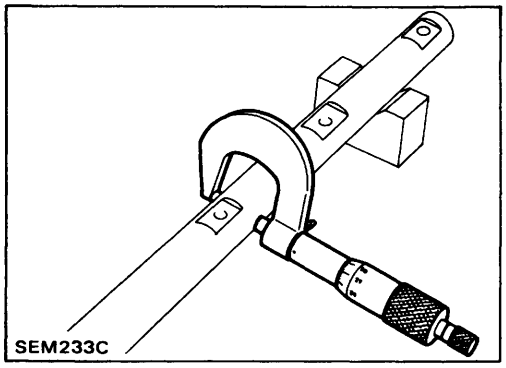
Check valve spring pressure.

Pressure: N (kg, lb) at height mm (in)
- **Standard**
  - **Outer**
    - **Intake**
      604.1 (61.6, 135.8) at 37.6 (1.480)
    - **Exhaust**
      640.4 (65.3, 144.0) at 34.1 (1.343)
  - **Inner**
    - **Intake**
      284.4 (29.0, 63.9) at 32.6 (1.283)
    - **Exhaust**
      328.5 (33.5, 73.9) at 29.1 (1.146)
- **Limit**
  - **Outer**
    - **Intake**
      567.8 (57.9, 127.7) at 37.6 (1.480)
    - **Exhaust**
      620.8 (63.3, 139.6) at 34.1 (1.343)
  - **Inner**
    - **Intake**
      266.8 (27.2, 60.0) at 32.6 (1.283)
    - **Exhaust**
      318.7 (32.5, 71.7) at 29.1 (1.146)

If it exceeds the limit, replace spring.

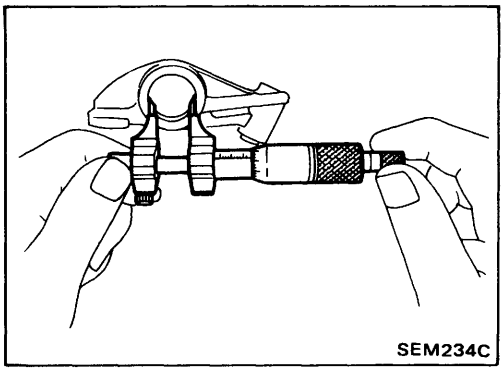
Inspection (Cont'd)

ROCKER SHAFT AND ROCKER ARM



1. Check rocker shafts for scratches, seizure and wear.
2. Check outer diameter of rocker shaft.

Diameter mm (in):
21.979 - 22.000 mm (0.8653 - 0.8661 in)

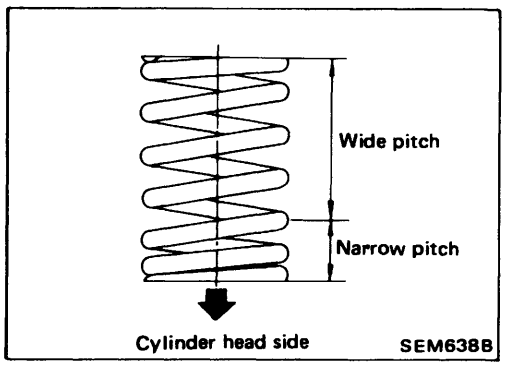


3. Check inner diameter of rocker arm.

Diameter mm (in):
22.012 - 22.029 mm (0.8666 - 0.8673 in)
Rocker arm to shaft clearance mm (in):
0.012 - 0.050 mm (0.0005 - 0.0020 in)

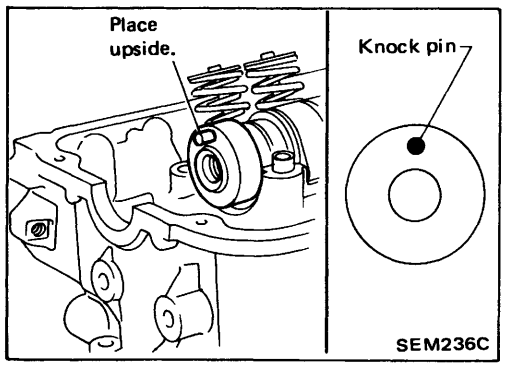
- **Keep rocker arm with hydraulic valve lifter standing to prevent air from entering hydraulic valve lifter when checking.**

Assembly



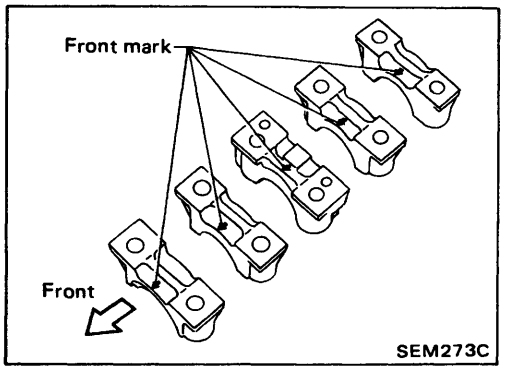
1. Install valve component parts.

- **Always use new valve oil seal. Refer to OIL SEAL REPLACEMENT.**
- **Before installing valve oil seal, install inner valve spring seat.**
- **Install outer valve spring (uneven pitch type) with its narrow pitch side toward cylinder head side.**
- **After installing valve component parts, use plastic hammer to lightly tap valve stem tip to assure a proper fit.**



2. Mount camshaft onto cylinder head, placing knock pin at front end to top position.

Apply engine oil to camshaft when mounting onto cylinder head.

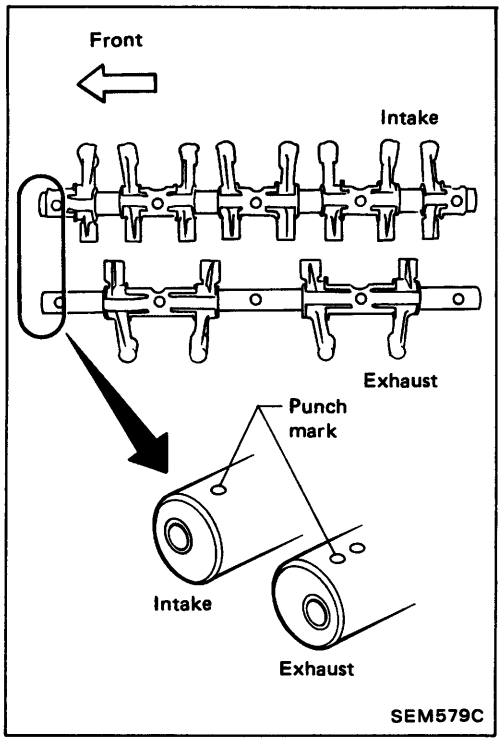


3. Install camshaft brackets.

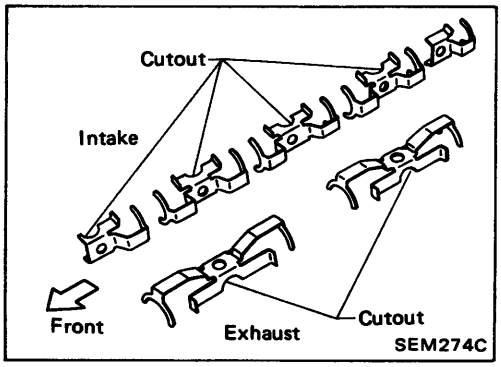
Front mark is punched on the camshaft bracket.

Assembly (Cont'd)

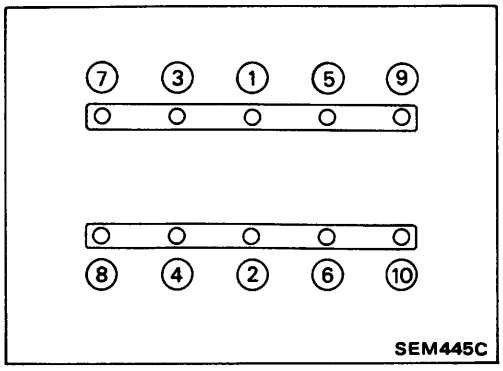
4. Install rocker shaft with rocker arms.

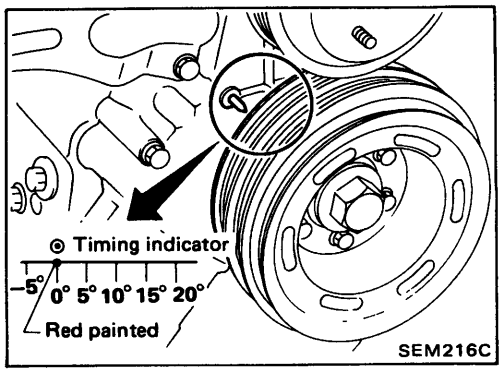


- Install retainer with cutout facing direction shown in figure at left.



5. Tighten bolts as shown in figure at left.

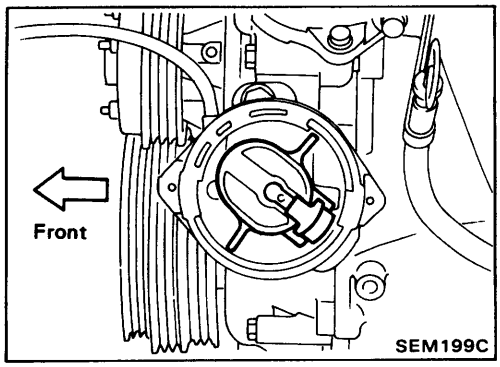


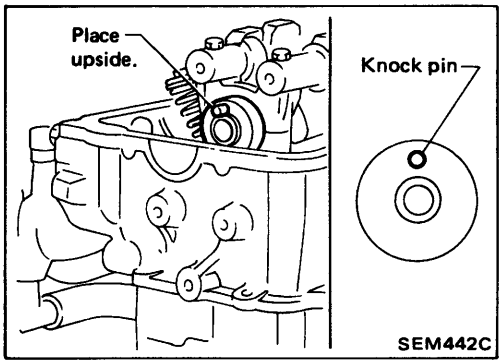


Installation

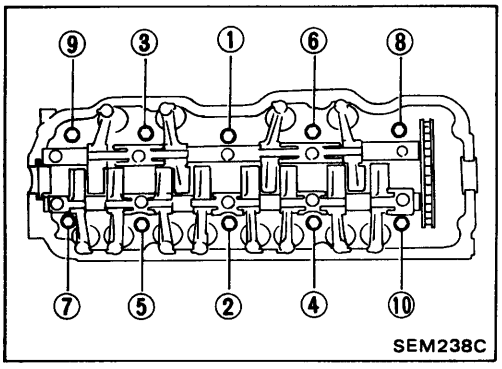
1. Set No. 1 piston at T.D.C. on its compression stroke as follows:

(1) Align mark on crankshaft pulley with "0°" position and confirm that distributor rotor head is set as shown in figure.





(2) Confirm that knock pin on camshaft is set at the top.

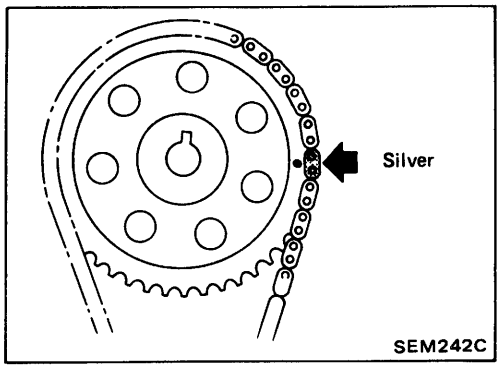


2. Install cylinder head with new gasket and tighten cylinder head bolts in numerical order.

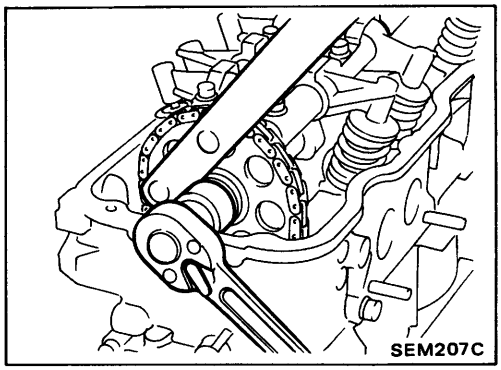
- **Do not rotate crankshaft and camshaft separately, or valves will hit piston heads.**
- **Tightening procedure**

(1) Tighten all bolts to 29 N·m (3.0 kg-m, 22 ft-lb).
(2) Tighten all bolts to 78 N·m (8.0 kg-m, 58 ft-lb).
(3) Loosen all bolts completely.
(4) Tighten all bolts to 29 N·m (3.0 kg-m, 22 ft-lb).
(5) Turn all bolts 80 to 85 degrees clockwise with an angle wrench, or if an angle wrench is not available, tighten all bolts to 74 to 83 N·m (7.5 to 8.5 kg-m, 54 to 61 ft-lb).

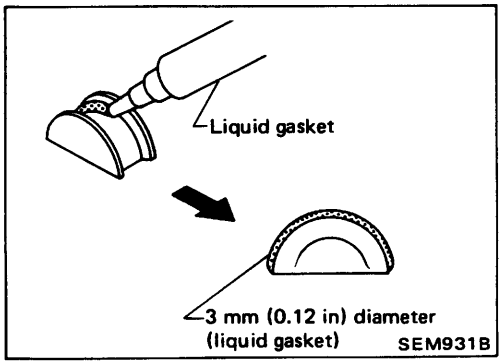
Installation (Cont'd)



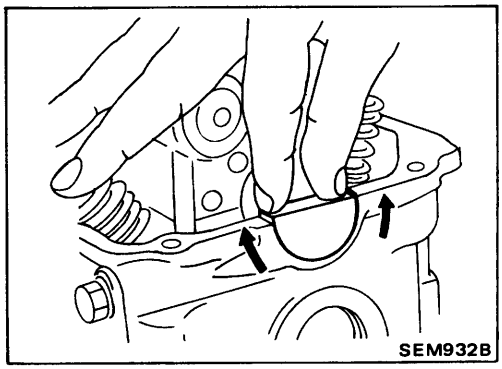
3. Set chain on camshaft sprocket by aligning each mating mark. Then install camshaft sprocket to camshaft.



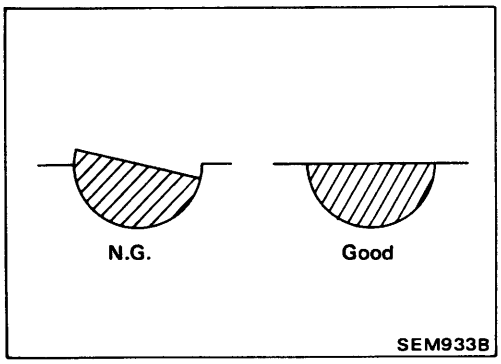
4. Tighten camshaft sprocket bolt.



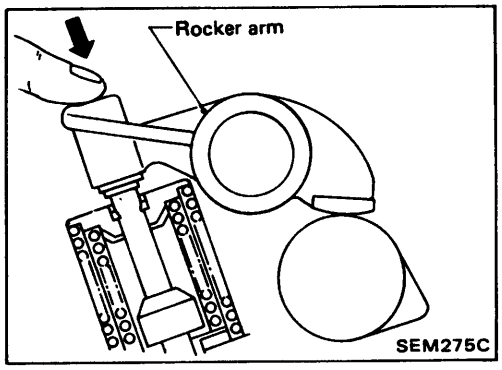
5. Install rubber plugs as follows:
(1) Apply liquid gasket to rubber plugs.
- **Rubber plugs should be replaced with new ones.**
- **Rubber plugs should be installed within 5 minutes of applying liquid gasket.**



(2) Install rubber plugs, then move them with your fingers to uniformly spread the gasket on cylinder head surface.
- **Rubber plugs should be installed flush with the surface.**
- **Do not start the engine for 30 minutes after installing rocker cover.**
- **Wipe clean excessive liquid gasket from cylinder head top surface.**



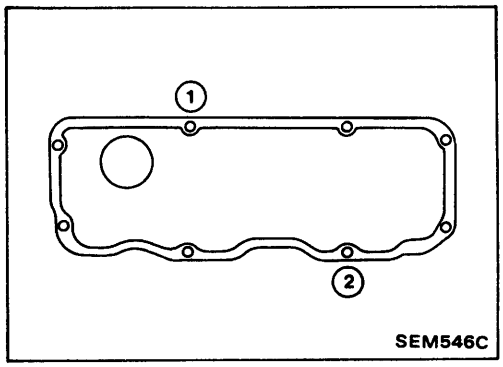
Installation (Cont'd)



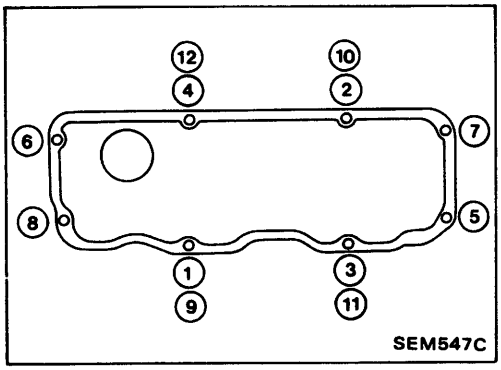
6. Check hydraulic valve lifter.
(1) Push hydraulic valve lifter forcefully with your finger.
- **Be sure to check it with rocker arm in its free position.**

(2) If valve lifter moves more than 1 mm (0.04 in), air may be inside of it.
(3) Bleed air off by running engine at 1,000 rpm under no-load for about 20 minutes.
(4) If hydraulic valve lifters are still noisy, replace them and bleed air off again in the same manner as in step (3).

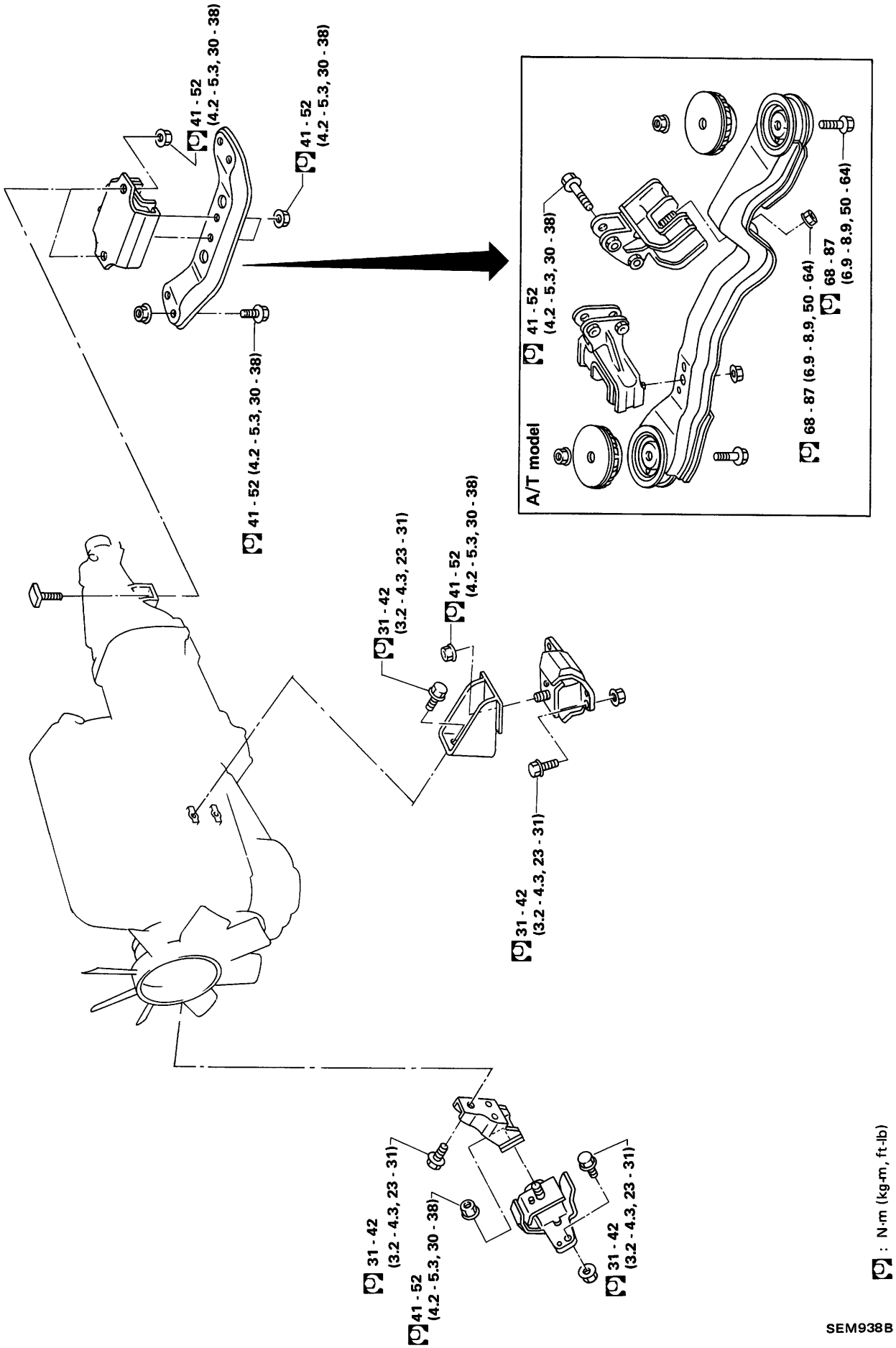
7. Install rocker cover.
- **Be sure to avoid interference between rocker cover and rocker arm.**



8. Tighten bolts as follows:
(1) Tighten 2 bolts to 3 N•m (0.3 kg-m, 2.2 ft-lb) temporarily in order shown in figure.



(2) Then tighten bolts to 7 to 10 N•m (0.7 to 1.0 kg-m, 5.1 to 7.2 ft-lb) in order shown in figure.
9. Install any parts removed.

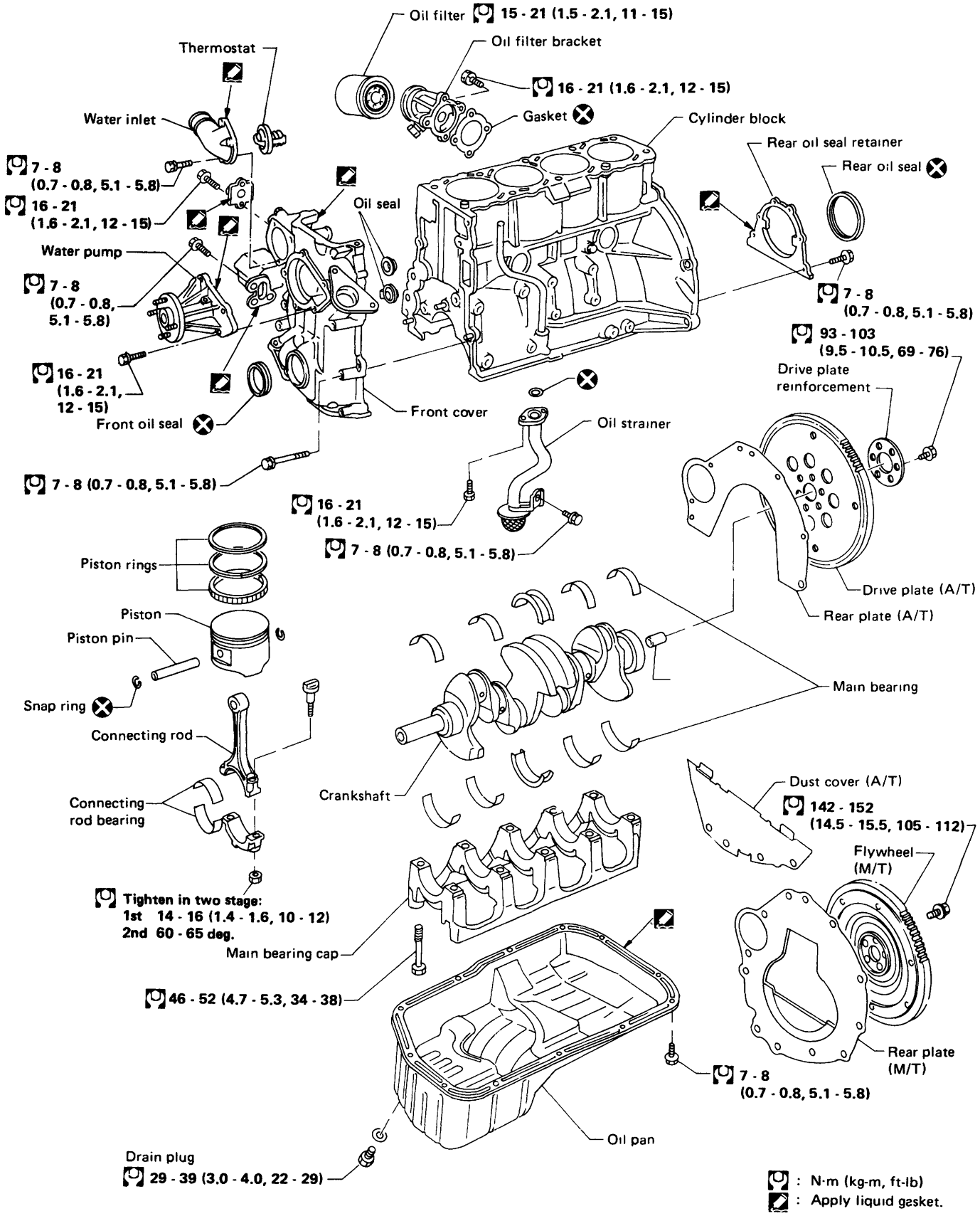

41 - 52 (4.2 - 5.3, 30 - 38)
41 - 52 (4.2 - 5.3, 30 - 38)
41 - 52 (4.2 - 5.3, 30 - 38)
41 - 52 (4.2 - 5.3, 30 - 38)
A/T model
41 - 52 (4.2 - 5.3, 30 - 38)
68 - 87 (6.9 - 8.9, 50 - 64)
68 - 87 (6.9 - 8.9, 50 - 64)
31 - 42 (3.2 - 4.3, 23 - 31)
41 - 52 (4.2 - 5.3, 30 - 38)
31 - 42 (3.2 - 4.3, 23 - 31)
31 - 42 (3.2 - 4.3, 23 - 31)
31 - 42 (3.2 - 4.3, 23 - 31)
41 - 52 (4.2 - 5.3, 30 - 38)
31 - 42 (3.2 - 4.3, 23 - 31)
: N·m (kg-m, ft-lb)
SEM938B

WARNING:

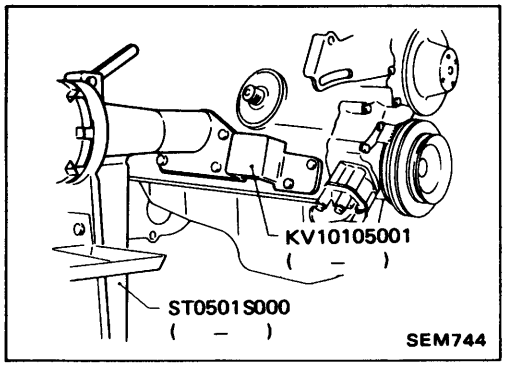
a. Situate vehicle on a flat and solid surface.
b. Place chocks at front and back of rear wheels.
c. Do not remove engine until exhaust system has completely cooled off.
   Otherwise, you may burn yourself and/or fire may break out in fuel line.
d. For safety during subsequent steps, the tension of wires should be slackened against the engine.
e. Before disconnecting fuel hose, release fuel pressure from fuel line.
   Refer to "Releasing Fuel Pressure" in section EF & EC.
f. Be sure to hoist engine and transmission in a safe manner.
g. For engines not equipped with engine slingers, attach proper slingers and bolts described in PARTS CATALOG.

CAUTION:

- When lifting engine, be careful not to strike adjacent parts, especially accelerator wire casing, brake lines, and brake master cylinder.
- In hoisting the engine, always use engine slingers in a safe manner.


Oil filter
15 - 21 (1.5 - 2.1, 11 - 15)
Oil filter bracket
16 - 21 (1.6 - 2.1, 12 - 15)
Gasket
Cylinder block
Thermostat
Water inlet
7 - 8 (0.7 - 0.8, 5.1 - 5.8)
16 - 21 (1.6 - 2.1, 12 - 15)
Oil seal
Rear oil seal retainer
Rear oil seal
Water pump
7 - 8 (0.7 - 0.8, 5.1 - 5.8)
7 - 8 (0.7 - 0.8, 5.1 - 5.8)
93 - 103 (9.5 - 10.5, 69 - 76)
Drive plate reinforcement
16 - 21 (1.6 - 2.1, 12 - 15)
Front oil seal
Front cover
Oil strainer
7 - 8 (0.7 - 0.8, 5.1 - 5.8)
16 - 21 (1.6 - 2.1, 12 - 15)
7 - 8 (0.7 - 0.8, 5.1 - 5.8)
Piston rings
Drive plate (A/T)
Piston
Piston pin
Rear plate (A/T)
Snap ring
Main bearing
Connecting rod
Crankshaft
Dust cover (A/T)
142 - 152 (14.5 - 15.5, 105 - 112)
Connecting rod bearing
Flywheel (M/T)
Tighten in two stage:
1st 14 - 16 (1.4 - 1.6, 10 - 12)
2nd 60 - 65 deg.
Main bearing cap
46 - 52 (4.7 - 5.3, 34 - 38)
Rear plate (M/T)
7 - 8 (0.7 - 0.8, 5.1 - 5.8)
Oil pan
Drain plug
29 - 39 (3.0 - 4.0, 22 - 29)
: N·m (kg-m, ft-lb)
: Apply liquid gasket.

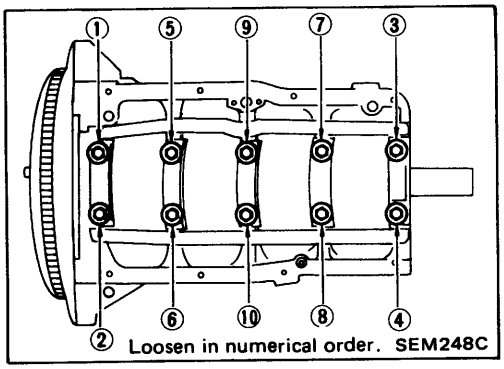
SEM247C



Disassembly

PISTON AND CRANKSHAFT

1. Place engine on a work stand.
2. Drain coolant and oil.
3. Remove oil pan.
4. Remove timing chain.
5. Remove water pump.
6. Remove cylinder head.
7. Remove pistons with connecting rod.



8. Remove bearing caps and crankshaft.

- **Before removing bearing caps, measure crankshaft end play.**
- **Bolts should be loosened in two or three steps.**

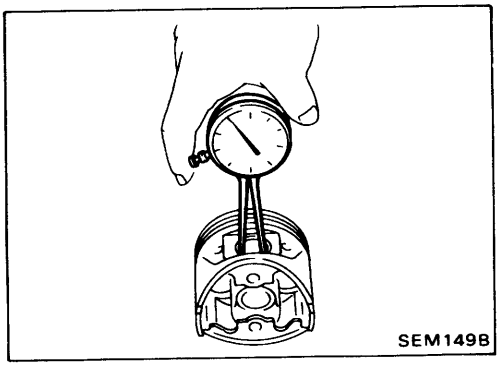
Inspection

PISTON AND PISTON PIN CLEARANCE

- Confirm the fitting of piston pin into piston pin hole to such an extent that it can be pressed smoothly by finger at room temperature.

1. Measure inner diameter of piston pin hole "dp".

Standard diameter "dp":
21.002 - 21.008 mm (0.8268 - 0.8271 in)



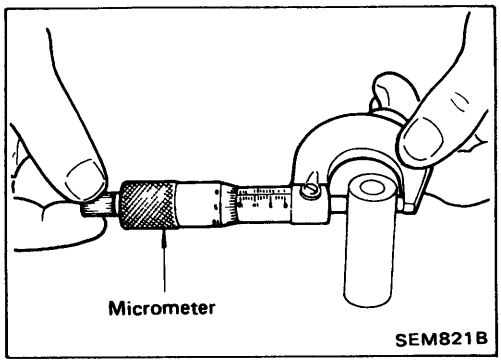
2. Measure outer diameter of piston pin "Dp".

Standard diameter "Dp":
20.994 - 20.996 mm (0.8265 - 0.8266 in)

3. Calculate interference fit of piston pin to piston.

dp – Dp = 0.008 - 0.012 mm (0.0003 - 0.0005 in)

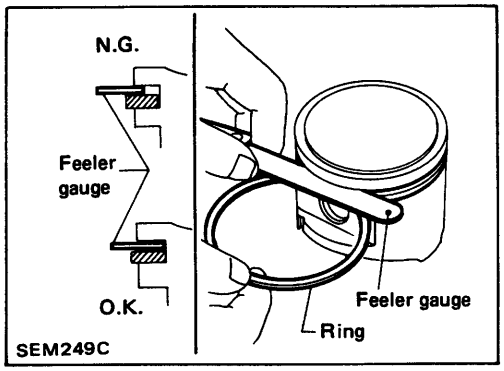
If it exceeds the above value, replace piston assembly with pin.



PISTON RING SIDE CLEARANCE

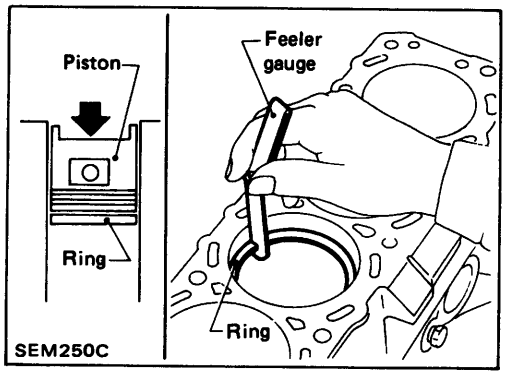
Side clearance:
Top ring
0.04 - 0.08 mm (0.0016 - 0.0031 in)
2nd ring
0.03 - 0.07 mm (0.0012 - 0.0028 in)
Oil ring
0.065 - 0.135 mm (0.0026 - 0.0053 in)
Max. limit of side clearance:
0.1 mm (0.004 in)

If out of specification, replace piston and/or piston ring assembly.



Inspection (Cont'd)

PISTON RING END GAP



End gap:

Top ring

0.28 - 0.52 mm (0.0110 - 0.0205 in)

2nd ring

0.45 - 0.69 mm (0.0177 - 0.0272 in)

(R or T is punched on the ring.)

0.55 - 0.70 mm (0.0217 - 0.0276 in)

(N is punched on the ring.)

Oil ring

0.20 - 0.69 mm (0.0079 - 0.0272 in)

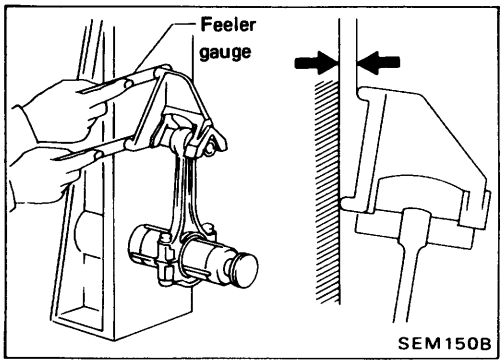
Max. limit of ring gap:

0.5 mm (0.020 in)

If out of specification, replace piston ring. If gap still exceeds the limit even with a new ring, rebore cylinder and use oversized piston and piston rings.

Refer to S.D.S.

CONNECTING ROD BEND AND TORSION



Bend:

Limit 0.15 mm (0.0059 in)

per 100 mm (3.94 in) length

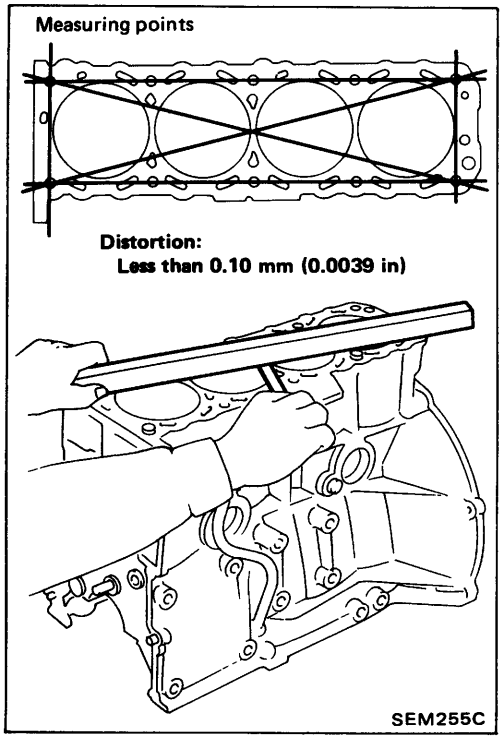
Torsion:

Limit 0.30 mm (0.0118 in)

per 100 mm (3.94 in) length

If it exceeds the limit, replace connecting rod assembly.

CYLINDER BLOCK DISTORTION AND WEAR



1. Clean upper face of cylinder block and measure the distortion.

   Limit:

   0.10 mm (0.0039 in)

2. If out of specification, resurface it.

   The resurfacing limit is determined by cylinder head resurfacing in engine.

Amount of cylinder head resurfacing is "A"

Amount of cylinder block resurfacing is "B"

The maximum limit is as follows:

A + B = 0.2 mm (0.008 in)

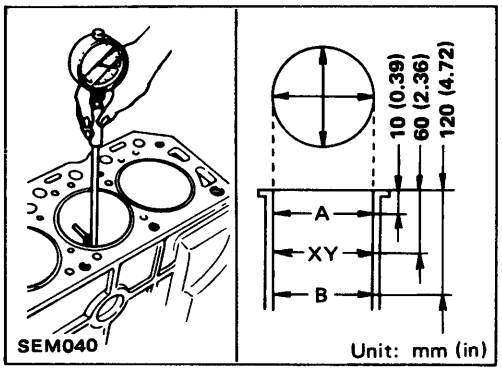
Nominal cylinder block height from crankshaft center:

246.95 - 247.05 mm (9.7224 - 9.7264 in)

3. If necessary, replace cylinder block.

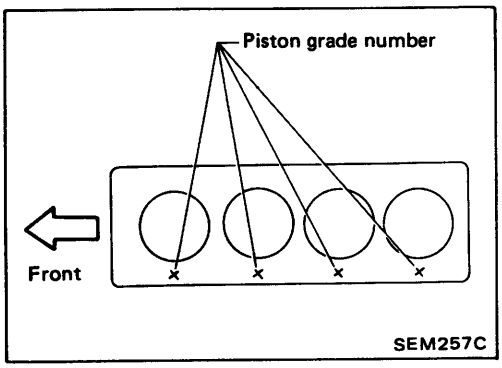
Inspection (Cont'd)

PISTON-TO-BORE CLEARANCE

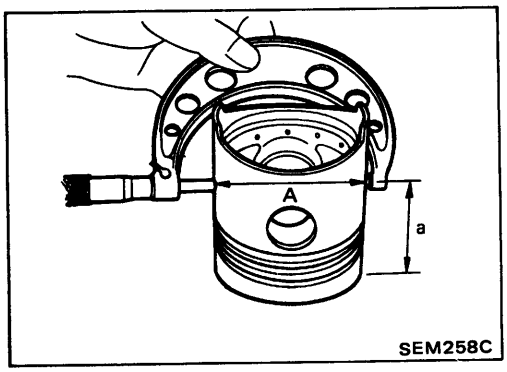


1. Using a bore gauge, measure cylinder bore for wear, out-of-round and taper.
   Standard inner diameter:
   89.000 - 89.030 mm (3.5039 - 3.5051 in)
   Wear limit:
   0.2 mm (0.008 in)
   Out-of-round (X–Y) limit:
   0.015 mm (0.0006 in)
   Taper (A–B) limit:
   0.015 mm (0.0006 in)

   If it exceeds the limit, rebore all cylinders. Replace cylinder block if necessary.
2. Check for scratches and seizure. If seizure is found, hone it.



- **If both cylinder block and piston are replaced with new ones, select piston of the same grade number punched on cylinder block upper surface.**



3. Measure piston skirt diameter.
   Piston diameter "A":
   Refer to S.D.S.
   Measuring point "a" (Distance from the top):
   52 mm (2.05 in)
4. Check that piston-to-bore clearance is within specification.
   Piston-to-bore clearance "B":
   0.020 - 0.040 mm (0.0008 - 0.0016 in)

Inspection (Cont'd)

5. Determine piston oversize according to amount of cylinder wear.

Oversize pistons are available for service. Refer to S.D.S.

6. Cylinder bore size is determined by adding piston-to-bore clearance to piston diameter "A".

Rebored size calculation:

D = A + B – C

where,

D: Bored diameter

A: Piston diameter as measured

B: Piston-to-bore clearance

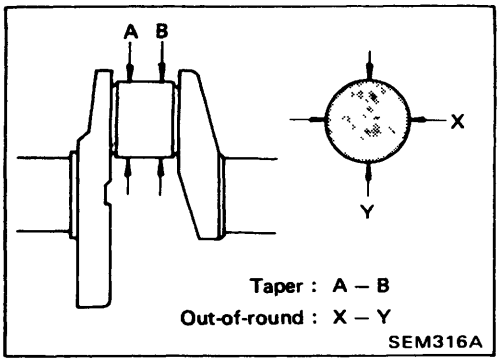
C: Honing allowance 0.02 mm (0.0008 in)

7. Install main bearing caps, and tighten to the specified torque to prevent distortion of cylinder bores in final assembly.
8. Cut cylinder bores.

- **When any cylinder needs boring, all other cylinders must also be bored.**
- **Do not cut too much out of cylinder bore at a time. Cut only 0.05 mm (0.0020 in) or so in diameter at a time.**

9. Hone cylinders to obtain specified piston-to-bore clearance.
10. Measure finished cylinder bore for out-of-round and taper.

- **Measurement should be done after cylinder bore cools down.**



CRANKSHAFT

1. Check crankshaft main and pin journals for score, wear or cracks.
2. With a micrometer, measure journals for taper and out-of-round.

Out-of-round (X–Y):

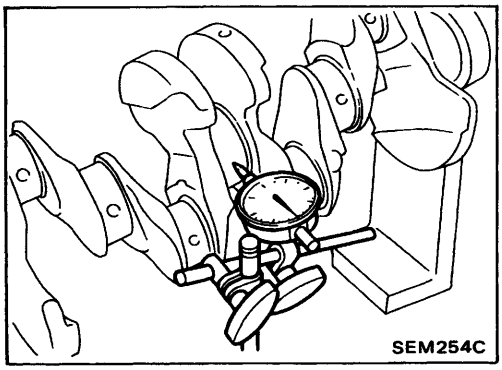
Main journal Less than 0.01 mm (0.0004 in)

Crank pin Less than 0.005 mm (0.0002 in)

Taper (A–B):

Main journal Less than 0.01 mm (0.0004 in)

Crank pin Less than 0.005 mm (0.0002 in)



3. Measure crankshaft runout.

Runout (Total indicator reading):

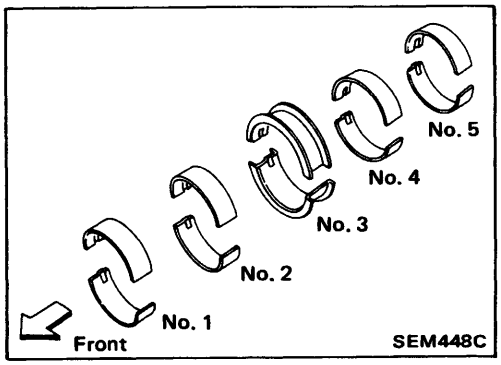
Less than 0.10 mm (0.0039 in)

BEARING CLEARANCE

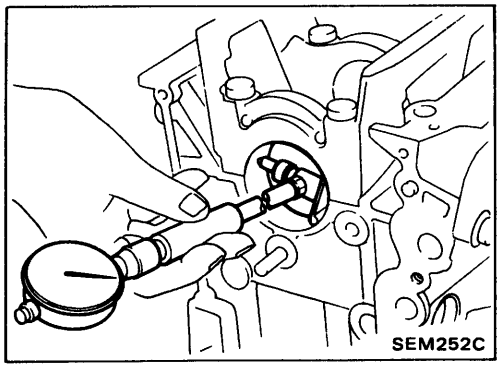
Method A (Using bore gauge and micrometer)

Main bearing

1. Set main bearings in their proper positions on cylinder block and main bearing cap.



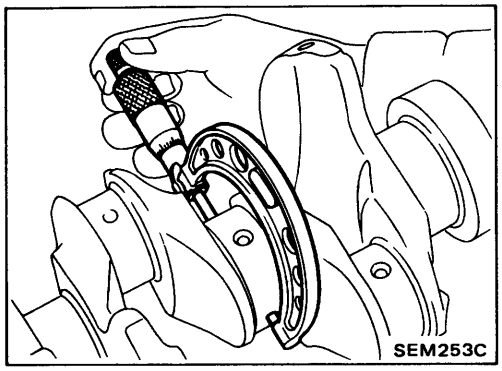
Inspection (Cont'd)



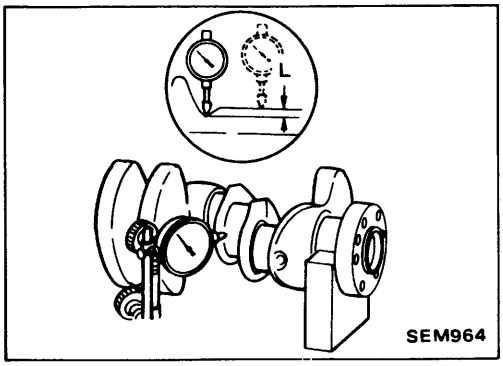
2. Install main bearing cap to cylinder block.

Tighten all bolts in correct order in two or three stages. Refer to "Assembly".

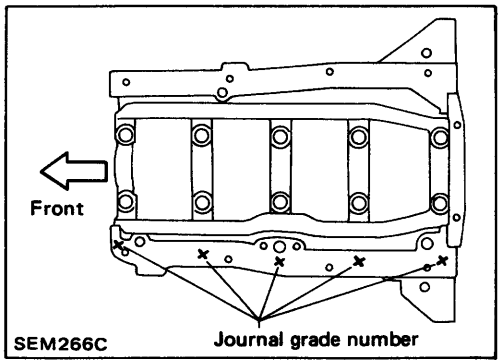
3. Measure inner diameter "A" of each main bearing.



4. Measure outer diameter "Dm" of each crankshaft main journal.
5. Calculate main bearing clearance.
   Main bearing clearance = A – Dm
   Standard:
   0.020 - 0.047 mm (0.0008 - 0.0019 in)
   Limit: 0.1 mm (0.004 in)
6. If it exceeds the limit, replace bearing.
7. If clearance cannot be adjusted within the standard of any bearing, grind crankshaft journal and use undersized bearing.

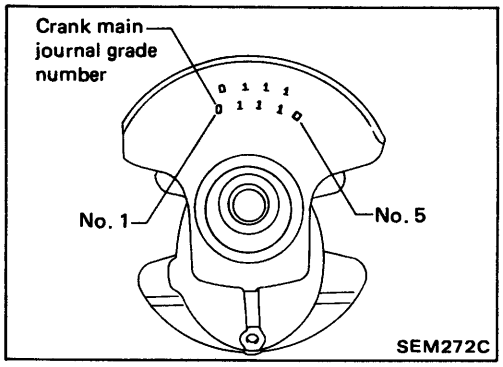


a. When grinding crankshaft journal, confirm that "L" dimension in fillet roll is more than the specified limit.
   "L": 0.1 mm (0.004 in)
b. Refer to S.D.S. for grinding crankshaft and available service parts.



8. If crankshaft is reused, measure main bearing clearance and select thickness of main bearing.
   If crankshaft is replaced with a new one, it is necessary to select thickness of main bearings as follows:

a. Grade number of each cylinder block main journal is punched on the respective cylinder block.



b. Grade number of each crankshaft main journal is punched on crankshaft.

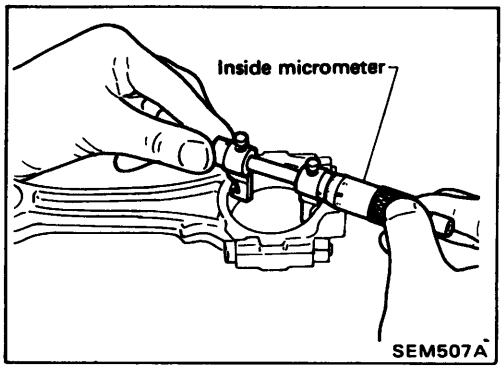
Inspection (Cont'd)

c. Select main bearing with suitable thickness according to the following table.

Main bearing grade number:

Crankshaft journal grade number \ Main journal grade number	0	1	2
0	0	1	2
1	1	2	3
2	2	3	4

For example:
Main journal grade number: 1
Crankshaft journal grade number: 2
Main bearing grade number = 1 + 2
= 3

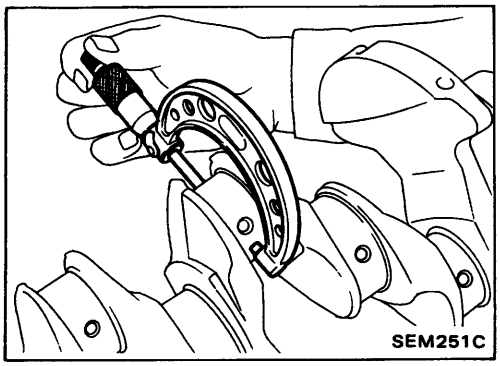


Connecting rod bearing (Big end)

1. Install connecting rod bearing to connecting rod and cap.
2. Install connecting rod cap to connecting rod.

Tighten bolts to the specified torque.

3. Measure inner diameter "C" of each bearing.



4. Measure outer diameter "Dp" of each crankshaft pin journal.
5. Calculate connecting rod bearing clearance.

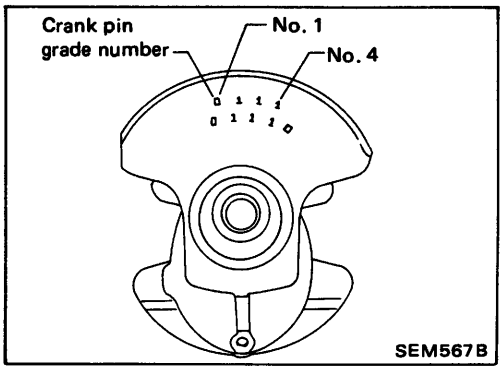
Connecting rod bearing clearance = C – Dp

Standard:

0.010 - 0.035 mm (0.0004 - 0.0014 in)

Limit: 0.09 mm (0.0035 in)

6. If it exceeds the limit, replace bearing.
7. If clearance cannot be adjusted within the standard of any bearing, grind crankshaft journal and use undersized bearing. Refer to step 7 of "BEARING CLEARANCE — Main bearing".

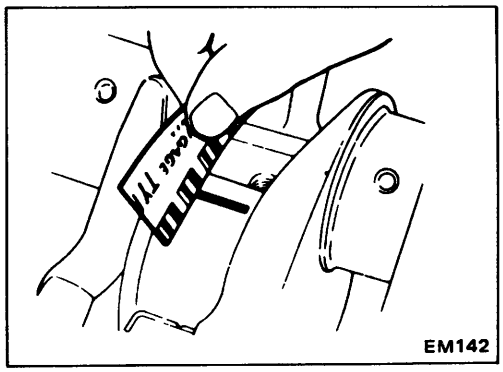


8. If crankshaft is replaced with a new one, select connecting rod bearing according to the following table.

Connecting rod bearing grade number:

Crank pin grade number	Connecting rod bearing grade number
0	0
1	1
2	2

Inspection (Cont'd)

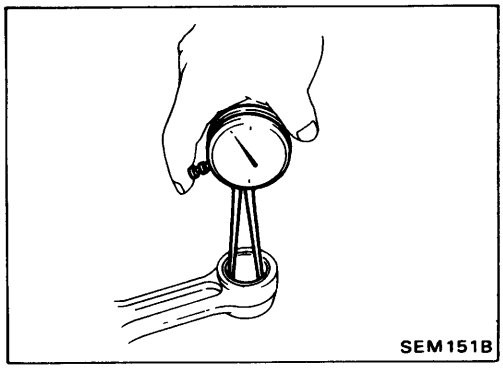

EM142

Method B (Using plastigauge)

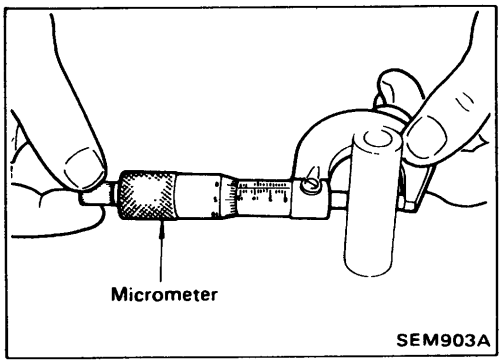
CAUTION:

- **Do not turn crankshaft or connecting rod while plastigage is being inserted.**
- **When bearing clearance exceeds the specified limit, ensure that the proper bearing has been installed. Then if excessive bearing clearance exists, use a thicker main bearing or undersized bearing so that the specified bearing clearance is obtained.**

CONNECTING ROD BUSHING CLEARANCE (Small end)


SEM151B

1. Measure inner diameter "C" of bushing.



SEM903A

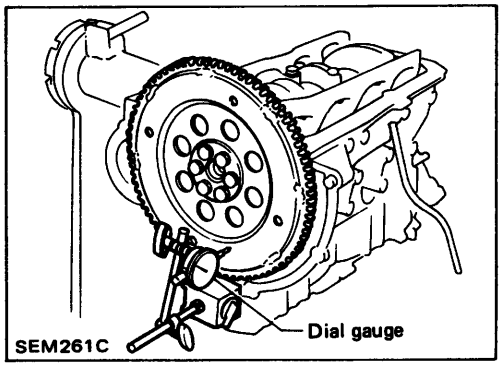
2. Measure outer diameter "Dp" of piston pin.
3. Calculate connecting rod bearing clearance.

   C – Dp =

   0.015 - 0.033 mm (0.0006 - 0.0013 in) (Standard)

   If it exceeds the limit, replace connecting rod assembly and/or piston set with pin.

FLYWHEEL/DRIVE PLATE RUNOUT



SEM261C

Runout (Total indicator reading):

Flywheel (M/T model)

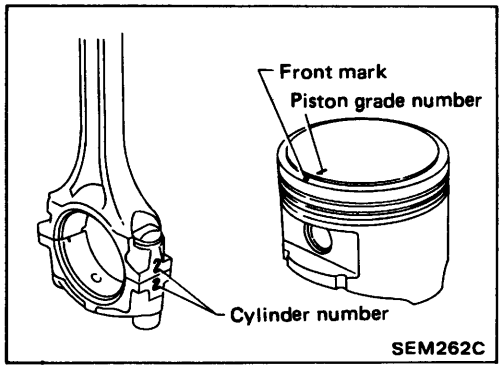
Less than 0.1 mm (0.004 in)

Drive plate (A/T model)

Less than 0.1 mm (0.004 in)

Assembly

PISTON

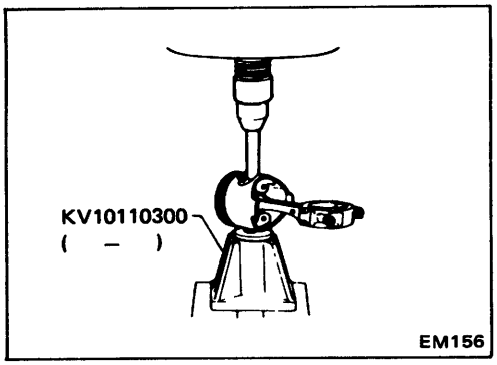


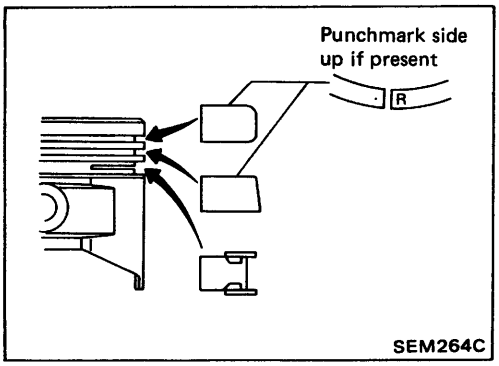
SEM262C

1. Heat piston to 60 to 70°C (140 to 158°F) and assemble piston, piston pin and connecting rod.

- **Align the direction of piston and connecting rod.**
- **Numbers stamped on connecting rod and cap correspond to each cylinder.**
- **After assembly, make sure connecting rod swings smoothly.**

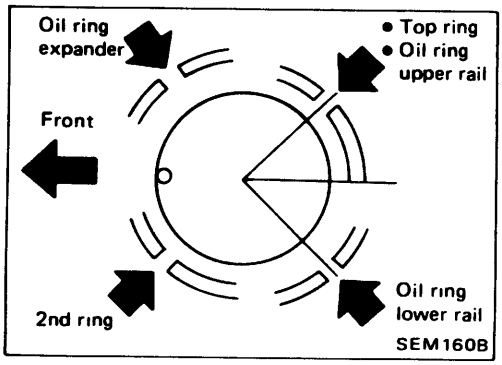
Assembly (Cont'd)





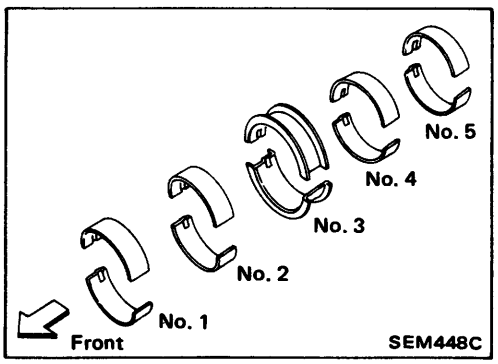
2. Set piston rings as shown.

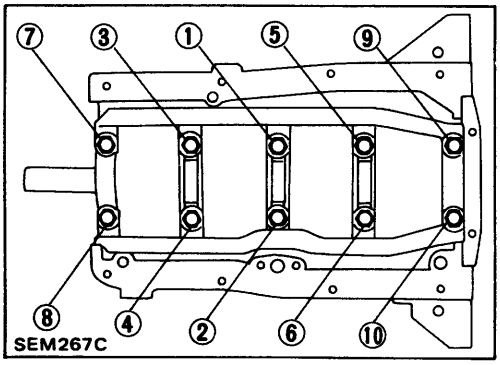
CAUTION:
- **When piston rings are not replaced, make sure that piston rings are mounted in their original positions.**
- **When piston rings are being replaced and no punchmark is present, piston rings can be mounted with either side up.**



CRANKSHAFT

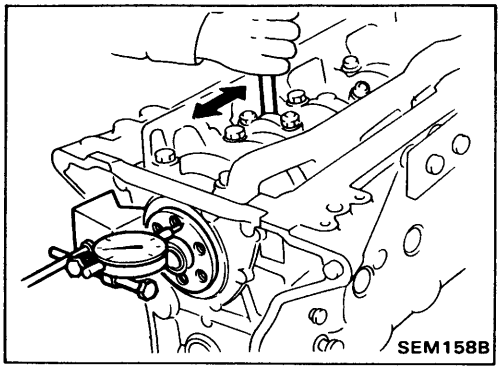
1. Set main bearings in their proper positions on cylinder block and main bearing beam.
- **Confirm that correct main bearings are used. Refer to "Inspection" of this section.**





2. Install crankshaft and main bearing beam and tighten bolts to the specified torque.
- **Prior to tightening bearing cap bolts, place bearing cap in its proper position by shifting crankshaft in the axial direction.**
- **Tighten bearing cap bolts gradually in two or three stages. Start with center bearing and move outward sequentially.**
- **After securing bearing cap bolts, make sure crankshaft turns smoothly by hand.**

Assembly (Cont'd)



3. Measure crankshaft end play.

Crankshaft end play:

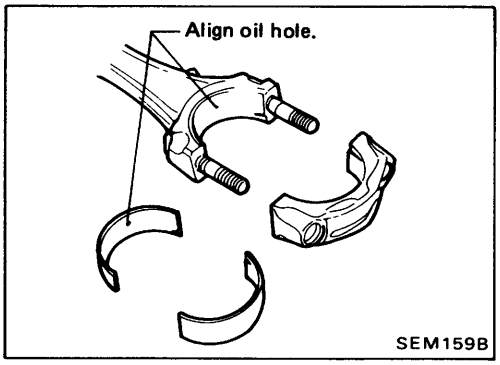
Standard

0.05 - 0.18 mm (0.0020 - 0.0071 in)

Limit

0.3 mm (0.012 in)

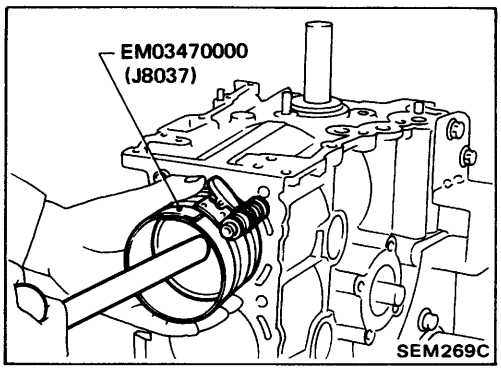
If beyond the limit, replace bearing with a new one.



4. Install connecting rod bearings in connecting rods and connecting rod caps.
- Confirm that correct bearings are used.

Refer to "Inspection".

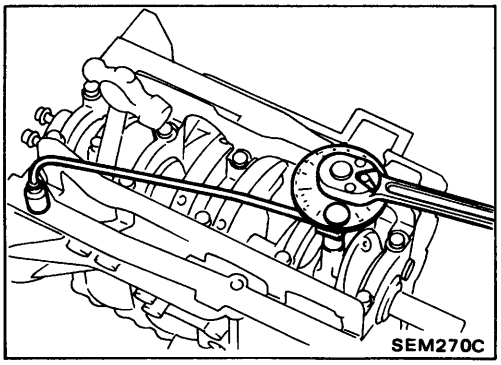
- Install bearings so that oil hole in connecting rod aligns with oil hole of bearing.



5. Install pistons with connecting rods.

a. Install them into corresponding cylinders with Tool.

- **Be careful not to scratch cylinder wall by connecting rod.**
- **Arrange so that front mark on piston head faces toward front of engine.**

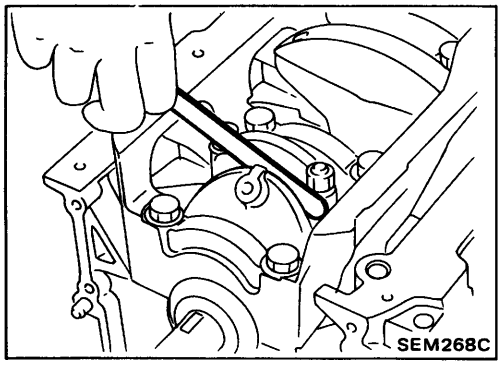


b. Install connecting rod bearing caps.
Tighten connecting rod bearing cap nuts to the specified torque.

Connecting rod bearing nut:

(1) Tighten to 14 to 16 N·m (1.4 to 1.6 kg-m, 10 to 12 ft-lb).

(2) Tighten bolts 60 to 65 degrees clockwise with an angle wrench, or if an angle wrench is not available, tighten them to 38 to 44 N·m (3.9 to 4.5 kg-m, 28 to 33 ft-lb).



6. Measure connecting rod side clearance.

Connecting rod side clearance:

Standard

0.2 - 0.4 mm (0.008 - 0.016 in)

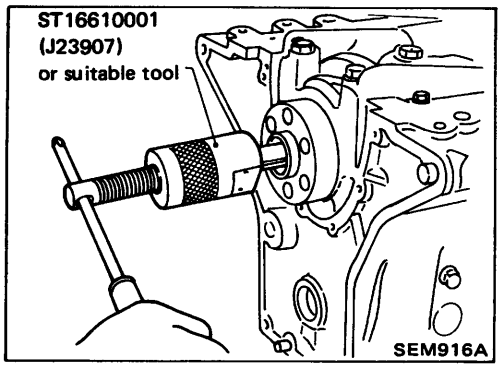
Limit

0.6 mm (0.024 in)

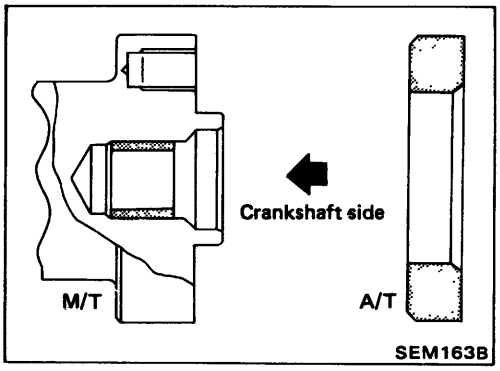
If beyond the limit, replace connecting rod and/or crankshaft.

Assembly (Cont'd)

REPLACING PILOT BUSHING



1. Remove pilot bushing (M/T) or pilot convertor (A/T).



2. Install pilot bushing (M/T) or pilot convertor (A/T).

General Specifications

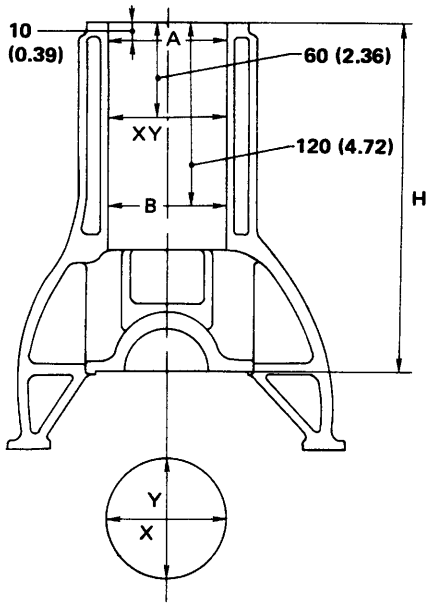
Engine model	KA24E
Cylinder arrangement	4, in-line
Displacement cm^3 (cu in)	2,389 (145.78)
Bore x stroke mm (in)	89 x 96 (3.50 x 3.78)
Valve arrangement	O.H.C.
Firing order	1-3-4-2
Number of piston rings	
Compression	2
Oil	1
Number of main bearings	5
Compression ratio	8.6

Unit: kPa (kg/cm^2, psi)/rpm

Compression pressure	
Standard	1,324 (13.5, 192)/300
Minimum	981 (10, 142)/300
Differential limit between cylinders	98 (1.0, 14)/300

Inspection and Adjustment

CYLINDER BLOCK



SEM447C

Unit: mm (in)

			Standard	Limit
Distortion			–	0.1 (0.004)
Cylinder bore	Inner diameter	Grade 1	89.000 - 89.010 (3.5039 - 3.5043)	0.2 (0.008)*
		Grade 2	89.010 - 89.020 (3.5043 - 3.5047)	
		Grade 3	89.020 - 89.030 (3.5047 - 3.5051)	
	Out-of-round (X-Y)		Less than 0.015 (0.0006)	–
	Taper (A-B)		Less than 0.010 (0.0004)	–
Difference in inner diameter between cylinders			Less than 0.05 (0.0020)	0.2 (0.008)
Piston-to-cylinder clearance			0.020 - 0.040 (0.0008 - 0.0016)	–
Cylinder block height (From crankshaft center)			246.95 - 247.05 (9.7224 - 9.7264)	0.2 (0.008)**

* Wear limit
** Total amount of cylinder head resurfacing and cylinder block resurfacing

CYLINDER HEAD

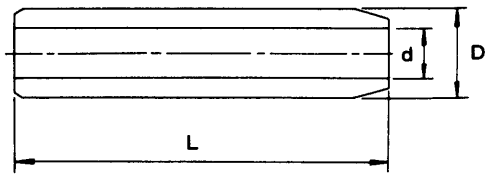
Unit: mm (in)

	Standard	Limit
Height (H)	98.8 - 99.0 (3.890 - 3.898)	0.2 (0.008)*
Surface distortion	0.03 (0.0012)	0.1 (0.004)

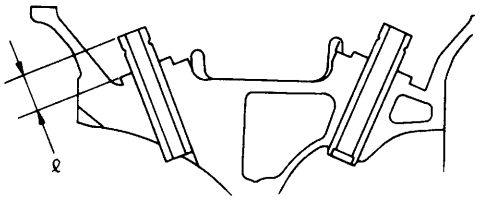
* Total amount of cylinder head resurfacing and cylinder block resurfacing

Inspection and Adjustment (Cont'd)

VALVE GUIDE



SEM571B



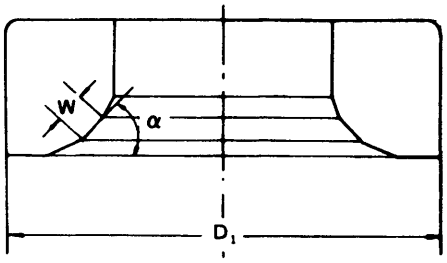
SEM225C

Unit: mm (in)

	Standard		Service		Limit
	Intake	Exhaust	Intake	Exhaust	–
Length (L)	52.6 (2.071)	56.0 (2.205)	52.6 (2.071)	56.0 (2.205)	–
Outer diameter (D)	11.023 - 11.034 (0.4340 - 0.4344)	12.023 - 12.034 (0.4733 - 0.4738)	11.223 - 11.234 (0.4418 - 0.4423)	12.223 - 12.234 (0.4812 - 0.4817)	–
Inner diameter (d) (Finished size)	7.000 - 7.018 (0.2756 - 0.2763)	8.000 - 8.018 (0.3150 - 0.3157)	7.000 - 7.018 (0.2756 - 0.2763)	8.000 - 8.018 (0.3150 - 0.3157)	–
Cylinder head hole diameter	10.975 - 10.996 (0.4321 - 0.4329)	11.975 - 11.996 (0.4715 - 0.4723)	11.175 - 11.196 (0.4400 - 0.4408)	12.175 - 12.196 (0.4793 - 0.4802)	–
Interference fit	0.027 - 0.059 (0.0011 - 0.0023)				–
Stem to guide clearance	0.020 - 0.053 (0.0008 - 0.0021)	0.040 - 0.070 (0.0016 - 0.0028)	0.020 - 0.053 (0.0008 - 0.0209)	0.040 - 0.070 (0.0016 - 0.0028)	0.1 (0.004)
Tapping length (ℓ)	14.9 - 15.1 (0.587 - 0.594)				–

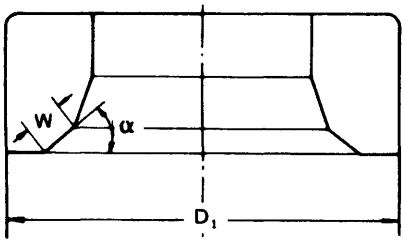
Inspection and Adjustment (Cont'd)

Standard



SEM177

Service



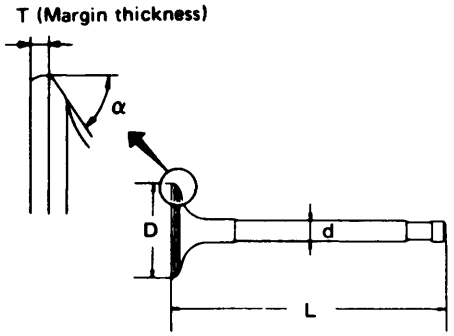
SEM178

Unit: mm (in)

	Standard		Service	
	Intake	Exhaust	Intake	Exhaust
Cylinder head seat recess diameter	36.000 - 36.016 (1.4173 - 1.4179)	42.000 - 42.016 (1.6535 - 1.6542)	36.500 - 36.516 (1.4370 - 1.4376)	42.500 - 42.516 (1.6732 - 1.6739)
Valve seat outer diameter (D_1)	36.080 - 36.096 (1.4205 - 1.4211)	42.080 - 42.096 (1.6567 - 1.6573)	36.580 - 36.596 (1.4402 - 1.4408)	42.580 - 42.596 (1.6764 - 1.6770)
Face angle (α)	45°	45°	45°	45°
Contacting width (W)	1.6 - 1.7 (0.063 - 0.067)	1.7 - 2.1 (0.067 - 0.083)	1.6 - 1.7 (0.063 - 0.067)	1.7 - 2.1 (0.067 - 0.083)

Inspection and Adjustment (Cont'd)

VALVE



SEM188A

Unit: mm (in)

		Standard	Limit
Valve head diameter (D)	In.	34.0 - 34.2 (1.339 - 1.346)	–
	Ex.	40.0 - 40.2 (1.575 - 1.583)	–
Valve length (L)	In.	119.9 - 120.2 (4.720 - 4.732)	–
	Ex.	120.67 - 120.97 (4.7508 - 4.7626)	–
Valve stem diameter (d)	In.	6.965 - 6.980 (0.2742 - 0.2748)	–
	Ex.	7.948 - 7.960 (0.3129 - 0.3134)	–
Valve face angle (α)	In.	45°30′	–
	Ex.	45°30′	–
Valve head margin (T)	In.	1.15 - 1.45 (0.0453 - 0.0571)	0.5 (0.020)
	Ex.	1.35 - 1.65 (0.0531 - 0.0650)	
Valve clearance		0 (0)	

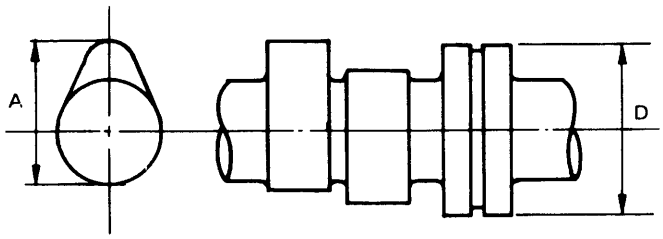
VALVE SPRING

Unit: mm (in)

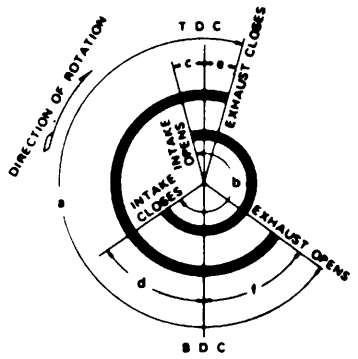
		Standard		Limit	
		Intake	Exhaust	Intake	Exhaust
Free height (H)	Outer	57.44 (2.2614)	53.21 (2.0949)	–	–
	Inner	53.34 (2.1000)	47.95 (1.8878)	–	–
Pressure N (kg, lb) at height	Outer	604.1 (61.6, 135.8) at 37.6 (1.480)	640.4 (65.3, 144.0) at 34.1 (1.343)	567.8 (57.9, 127.7) at 37.6 (1.480)	620.8 (63.3, 139.6) at 34.1 (1.343)
	Inner	284.4 (29.0, 63.9) at 32.6 (1.283)	328.5 (33.5, 73.9) at 29.1 (1.146)	266.8 (27.2, 60.0) at 32.6 (1.283)	318.7 (32.5, 71.7) at 29.1 (1.146)
Out-of-square	Outer	–	–	2.5 (0.098)	2.3 (0.091)
	Inner	–	–	2.3 (0.091)	2.1 (0.083)

Inspection and Adjustment (Cont'd)

CAMSHAFT AND CAMSHAFT BEARING



SEM568A



EM120

Unit: mm (in)

		Standard	Limit
Cam height (A)		44.839 - 45.029 (1.7653 - 1.7728)	–
Valve lift (h)		9.86 (0.3882)	–
Wear limit of cam height		–	0.2 (0.008)
Camshaft journal to bearing clearance		0.045 - 0.090 (0.0018 - 0.0035)	0.12 (0.0047)
Inner diameter of camshaft bearing		33.000 - 33.025 (1.2992 - 1.3002)	–
Outer diameter of camshaft journal (D)		32.935 - 32.955 (1.2967 - 1.2974)	–
Camshaft runout		0 - 0.02 (0 - 0.0008)	–
Camshaft end play		0.07 - 0.15 (0.0028 - 0.0059)	0.2 (0.008)
Valve timing (Degree on crankshaft)	a	248	–
	b	240	–
	c	3	–
	d	57	–
	e	12	–
	f	56	–

ROCKER ARM AND ROCKER SHAFT

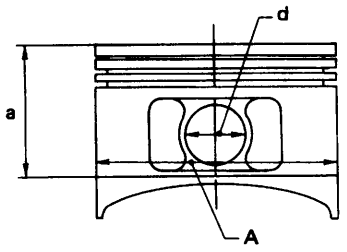
Unit: mm (in)

Rocker arm to shaft clearance	0.012 - 0.050 (0.0005 - 0.0020)
Rocker shaft diameter	21.979 - 22.000 (0.8653 - 0.8661)
Rocker arm rocker shaft hole diameter	22.012 - 22.029 (0.8666 - 0.8673)

Inspection and Adjustment (Cont'd)

PISTON, PISTON RING AND PISTON PIN

Piston



SEM444C

Unit: mm (in)

Piston skirt diameter (A)	Standard	Grade No. 1	88.970 - 88.980 (3.5027 - 3.5031)
		Grade No. 2	88.980 - 88.990 (3.5031 - 3.5035)
		Grade No. 3	88.990 - 89.000 (3.5035 - 3.5039)
	Service (Oversize)	0.5 (0.020)	89.470 - 89.500 (3.5224 - 3.5236)
		1.0 (0.039)	89.970 - 90.000 (3.5421 - 3.5433)
Dimension (a)		Approximately 52 (2.05)	
Piston pin hole diameter (d)		21.002 - 21.008 (0.8268 - 0.8271)	
Piston-to-cylinder bore clearance		0.020 - 0.040 (0.0008 - 0.0016)	

Piston pin

Unit: mm (in)

	Standard
Piston pin outer diameter	20.994 - 20.996 (0.28265 - 0.8266)
Pin to piston pin hole clearance	0.008 - 0.012 (0.0003 - 0.0005)
Piston pin to connecting rod clearance	−0.015 to −0.033 (−0.0006 to −0.0013)

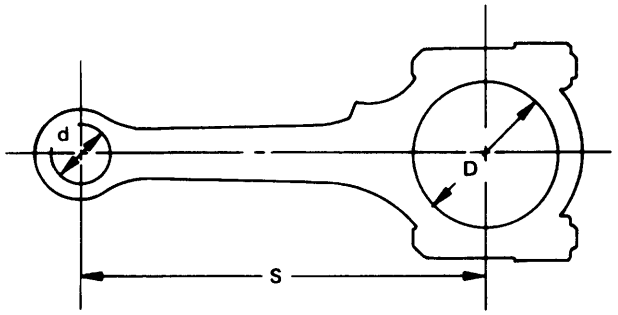
Piston ring

Unit: mm (in)

		Standard	Limit
Side clearance	Top	0.040 - 0.080 (0.0016 - 0.0031)	0.1 (0.004)
	2nd	0.030 - 0.070 (0.0012 - 0.0028)	0.1 (0.004)
	Oil	0.065 - 0.135 (0.0026 - 0.0053)*3	0.1 (0.004)
Ring gap	Top	0.28 - 0.52 (0.0118 - 0.0205)	0.5 (0.020)
	2nd	0.45 - 0.69 (0.0177 - 0.0272)	0.5 (0.020)
	Oil (rail ring)	0.20 - 0.69 (0.0079 - 0.0272)	0.5 (0.020)

*1: R or T is punched on the ring.
*2: N is punched on the ring.
*3: Riken-make

CONNECTING ROD



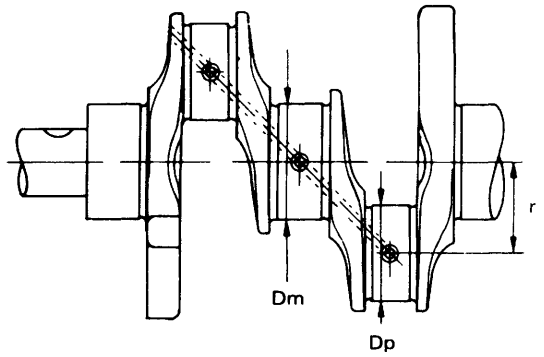
SEM570A

Unit: mm (in)

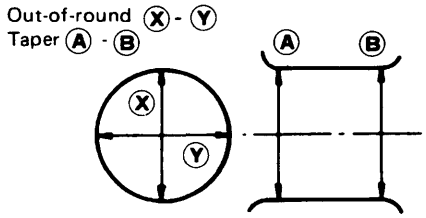
	Standard	Limit
Center distance (S)	164.95 - 165.05 (6.4941 - 6.4980)	–
Bend [per 100 mm (3.94 in)]	–	0.15 (0.0059)
Torsion [per 100 mm (3.94 in)]	–	0.3 (0.012)
Small end inner diameter (d)	20.948 - 20.978 (0.8247 - 0.8259)	–
Connecting rod big end inner diameter (D)	53.000 - 53.013 (2.0866 - 2.0871)	–
Side clearance	0.2 - 0.4 (0.008 - 0.016)	0.6 (0.024)

Inspection and Adjustment (Cont'd)

CRANKSHAFT



SEM394



EM715

Unit: mm (in)

Main journal diameter (Dm)	Grade	No. 0	63.645 - 63.652 (2.5057 - 2.5060)
		No. 1	63.652 - 63.663 (2.5060 - 2.5064)
		No. 2	63.663 - 63.672 (2.5064 - 2.5068)
Pin journal diameter (Dp)			59.951 - 59.975 (2.3603 - 2.3612)
Center distance (r)			47.97 - 48.03 (1.8886 - 1.8909)
			Standard / Limit
Taper of journal and pin [Ⓐ - Ⓑ]	Journal		– / 0.01 (0.0004)
	Pin		– / 0.005 (0.0002)
Out-of-round of journal and pin [Ⓧ - Ⓨ]	Journal		– / 0.01 (0.0004)
	Pin		– / 0.005 (0.0002)
Runout [T.I.R.] *			– / 0.10 (0.0039)
Free end play			0.05 - 0.18 (0.0020 - 0.0071) / 0.3 (0.012)
Fillet roil			More than 0.1 (0.004)

* Total indicator reading

BEARING CLEARANCE

Unit: mm (in)

	Standard	Limit
Main bearing clearance	0.020 - 0.047 (0.0008 - 0.0019)	0.1 (0.004)
Connecting rod bearing clearance	0.010 - 0.035 (0.0004 - 0.0014)	0.09 (0.0035)

Inspection and Adjustment (Cont'd)

AVAILABLE MAIN BEARING

Standard

Grade number	Thickness mm (in)	Identification color
0	1.821 - 1.825 (0.0717 - 0.0719)	Black
1	1.825 - 1.829 (0.0719 - 0.0720)	Brown
2	1.829 - 1.833 (0.0720 - 0.0722)	Green
3	1.833 - 1.837 (0.0722 - 0.0723)	Yellow
4	1.837 - 1.841 (0.0723 - 0.0725)	Blue

Undersize (service)

Unit: mm (in)

	Thickness	Main journal diameter "Dm"
0.25 (0.0098)	1.952 - 1.960 (0.0769 - 0.0772)	Grind so that bearing clearance is the specified value.

AVAILABLE CONNECTING ROD BEARING

Standard

Grade number	Thickness mm (in)	Identification color
0	1.505 - 1.508 (0.0593 - 0.0594)	–
1	1.508 - 1.511 (0.0594 - 0.0595)	Brown
2	1.511 - 1.514 (0.0595 - 0.0596)	Green

Undersize (service)

Unit: mm (in)

	Thickness	Crank pin journal diameter "Dp"
0.08 (0.0031)	1.540 - 1.548 (0.0606 - 0.0609)	Grind so that bearing clearance is the specified value.
0.12 (0.0047)	1.560 - 1.568 (0.0614 - 0.0617)	
0.25 (0.0098)	1.625 - 1.633 (0.0640 - 0.0643)	

MISCELLANEOUS COMPONENTS

Unit: mm (in)

Camshaft sprocket runout	[T.I.R.] *	Less than 0.12 (0.0047)
Flywheel runout	[T.I.R.] *	Less than 0.1 (0.004)
Drive plate runout	[T.I.R.] *	Less than 0.1 (0.004)

* Total indicator reading

ENGINE LUBRICATION & COOLING SYSTEMS

SECTION LC

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PREPARATION ..... LC- 2
PRECAUTION ..... LC- 3

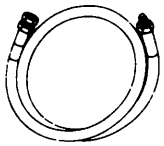
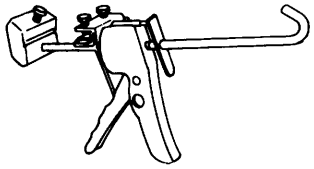
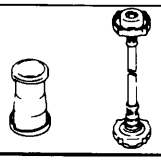
VG30E

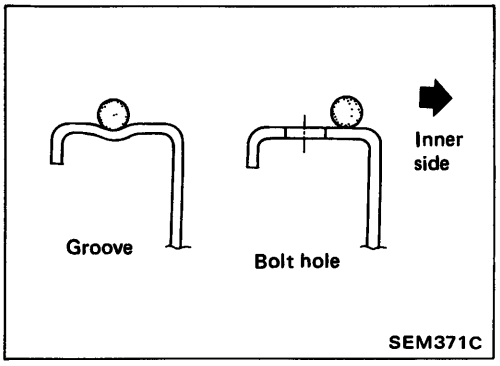
ENGINE LUBRICATION SYSTEM ..... LC- 4
ENGINE COOLING SYSTEM ..... LC- 8
SERVICE DATA AND SPECIFICATIONS (S.D.S.) LC-14

KA24E

ENGINE LUBRICATION SYSTEM LC-15
ENGINE COOLING SYSTEM LC-19
SERVICE DATA AND SPECIFICATIONS (S.D.S.) LC-24

SPECIAL SERVICE TOOLS

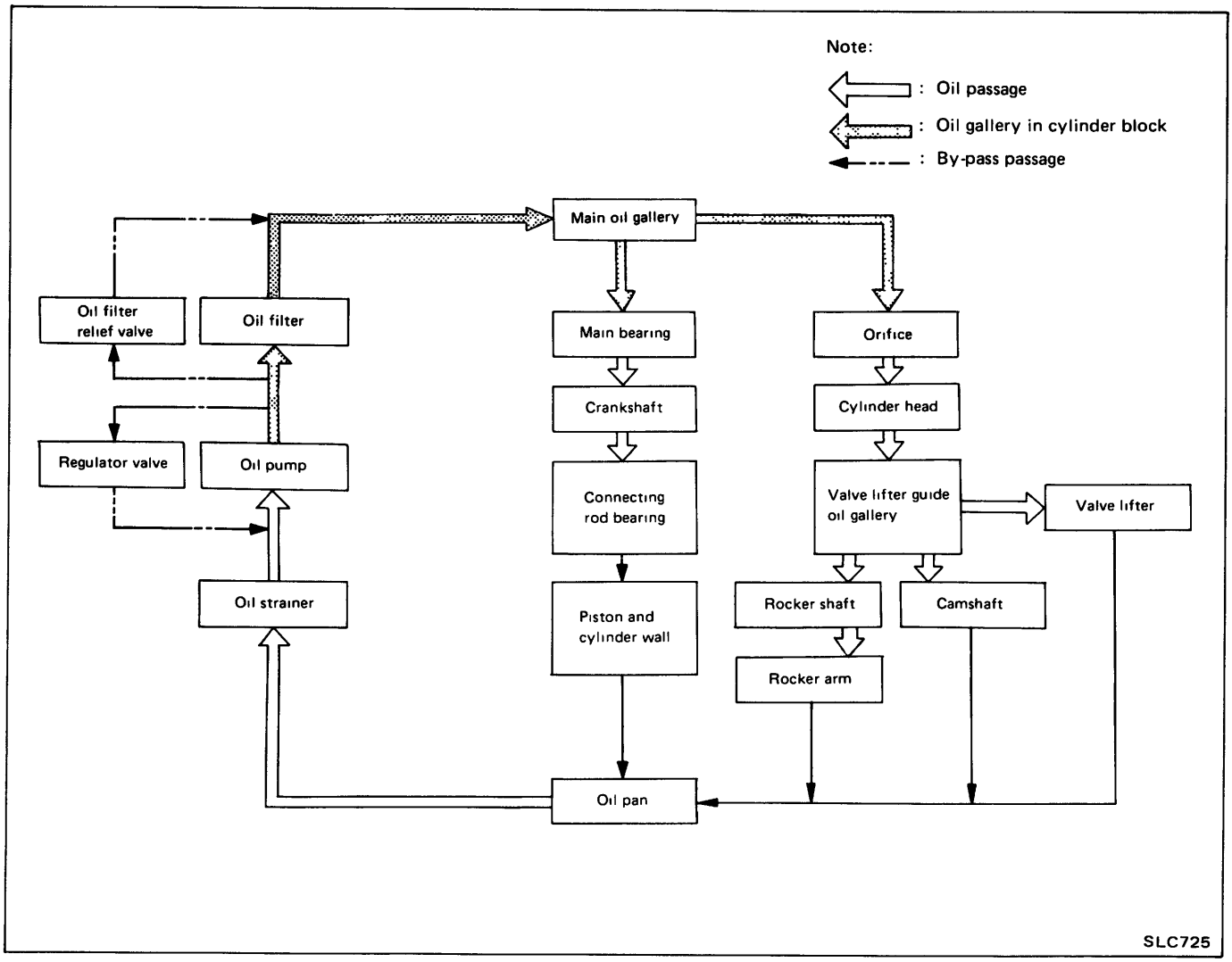
Tool number (Kent-Moore No.) Tool name	Description	Engine application	
		VG30E	KA24E
ST25051001 (J25695-1) Oil pressure gauge		X	X
ST25052000 (J25695-2) Hose	Adapting oil pressure gauge to cylinder block 	X	X
EG17650301 (—) Radiator cap tester adapter	Pressing the tube of liquid gasket 	X	X
WS39930000 (—) Tube presser	Adapting radiator cap tester to radiator filler neck 	X	X



LIQUID GASKET APPLICATION PROCEDURE

a. Before applying liquid gasket, use a scraper to remove all traces of old liquid gasket from mating surface.
b. Apply a continuous bead of liquid gasket to mating surfaces. (Use Genuine Liquid Gasket or equivalent.)
   - Be sure liquid gasket is 3.5 to 4.5 mm (0.138 to 0.177 in) wide (for oil pan).
   - Be sure liquid gasket is 2.0 to 3.0 mm (0.079 to 0.118 in) wide (in areas except oil pan).
c. Apply liquid gasket to inner sealing surface around hole perimeter area.
   (Assembly should be done within 5 minutes after coating.)
d. Wait at least 30 minutes before refilling engine oil and engine coolant.

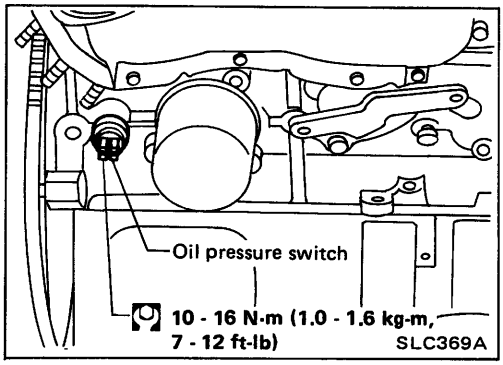
Lubrication Circuit



Oil Pressure Check

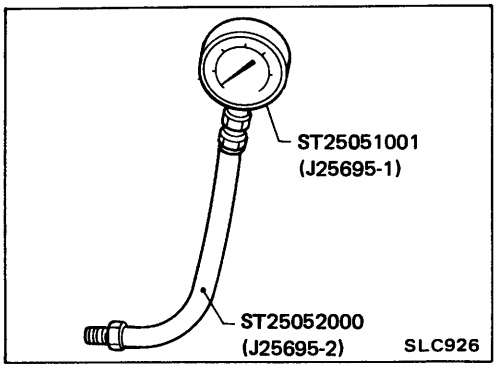
WARNING:

- **Be careful not to burn yourself, as the engine and oil may be hot.**
- **Oil pressure check should be done in "Neutral" gear position.**



1. Check oil level.
2. Remove oil pressure switch.

Oil Pressure Check (Cont'd)

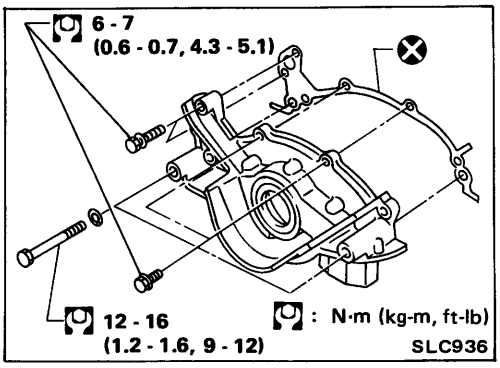


3. Install pressure gauge.
4. Start engine and warm it up to normal operating temperature.
5. Check oil pressure with engine running under no-load.

Engine rpm	Approximate discharge pressure kPa (kg/cm^2, psi)
Idle speed	More than 59 (0.6, 9)
3,200	363 - 451 (3.7 - 4.6, 53 - 65)

If difference is extreme, check oil passage and oil pump for oil leaks.

6. Install oil pressure switch with sealant.



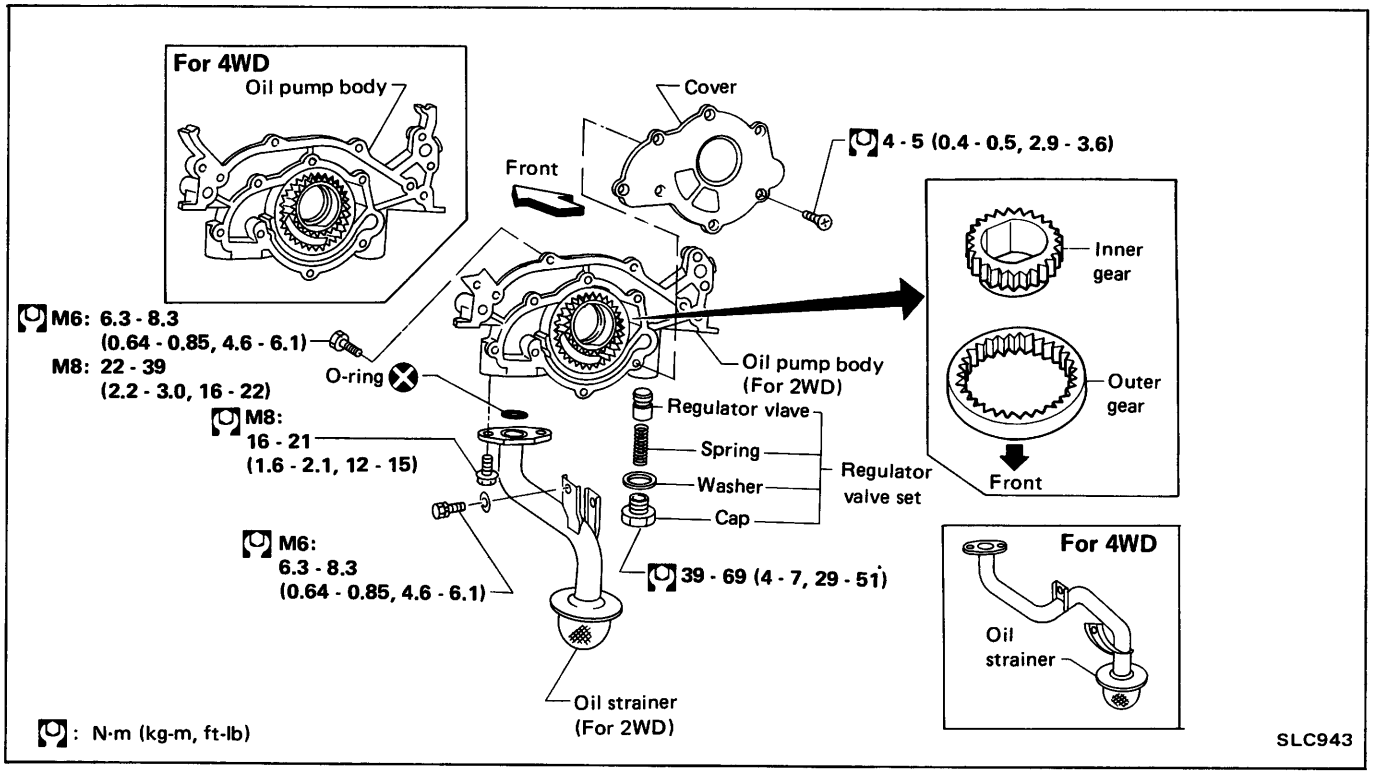
Oil Pump

REMOVAL

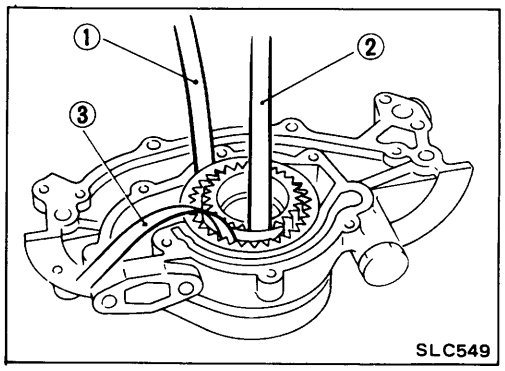
1. Drain oil.
2. Remove oil pan.
3. Remove oil pump assembly.

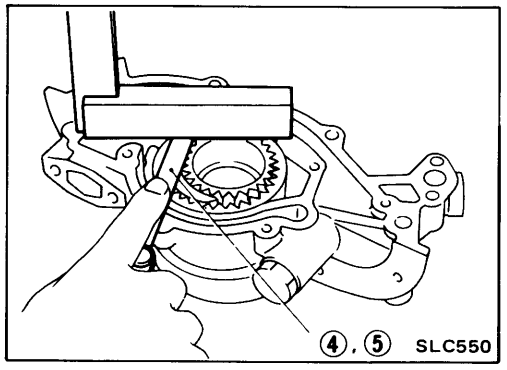
Oil Pump (Cont'd)

DISASSEMBLY AND ASSEMBLY



- **Always replace with new oil seal and gasket.**
- **When installing oil pump, apply engine oil to inner and outer gears.**
- **Be sure that O-ring is properly installed.**





INSPECTION

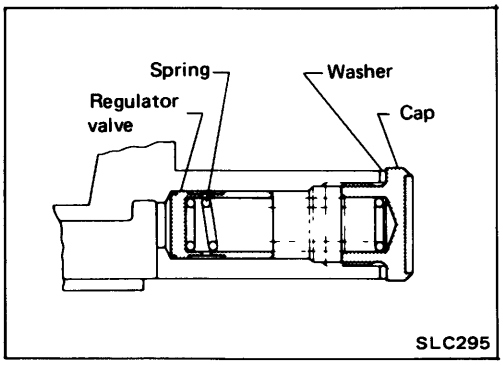
Using a feeler gauge, check the following clearances:

Standard clearance: Unit: mm (in)

Body to outer gear clearance ①	0.11 - 0.20 (0.0043 - 0.0079)
Inner gear to crescent clearance ②	0.12 - 0.23 (0.0047 - 0.0091)
Outer gear to crescent clearance ③	0.21 - 0.32 (0.0083 - 0.0126)
Housing to inner gear clearance ④	0.05 - 0.09 (0.0020 - 0.0035)
Housing to outer gear clearance ⑤	0.05 - 0.11 (0.0020 - 0.0043)

If any clearance exceeds the limit, replace gear set or entire oil pump assembly.

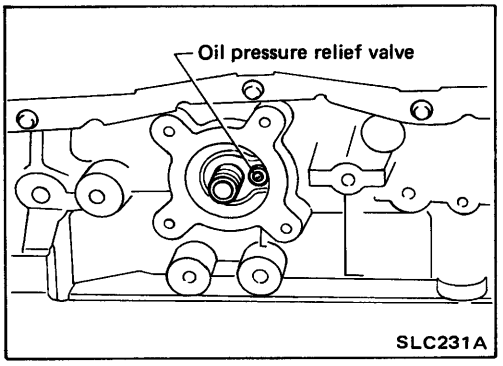
Oil Pump (Cont'd)



REGULATOR VALVE INSPECTION

1. Visually inspect components for wear and damage.
2. Check oil pressure regulator valve sliding surface and valve spring.
3. Coat regulator valve with engine oil and check to make sure that it falls smoothly into the valve hole by its own weight.

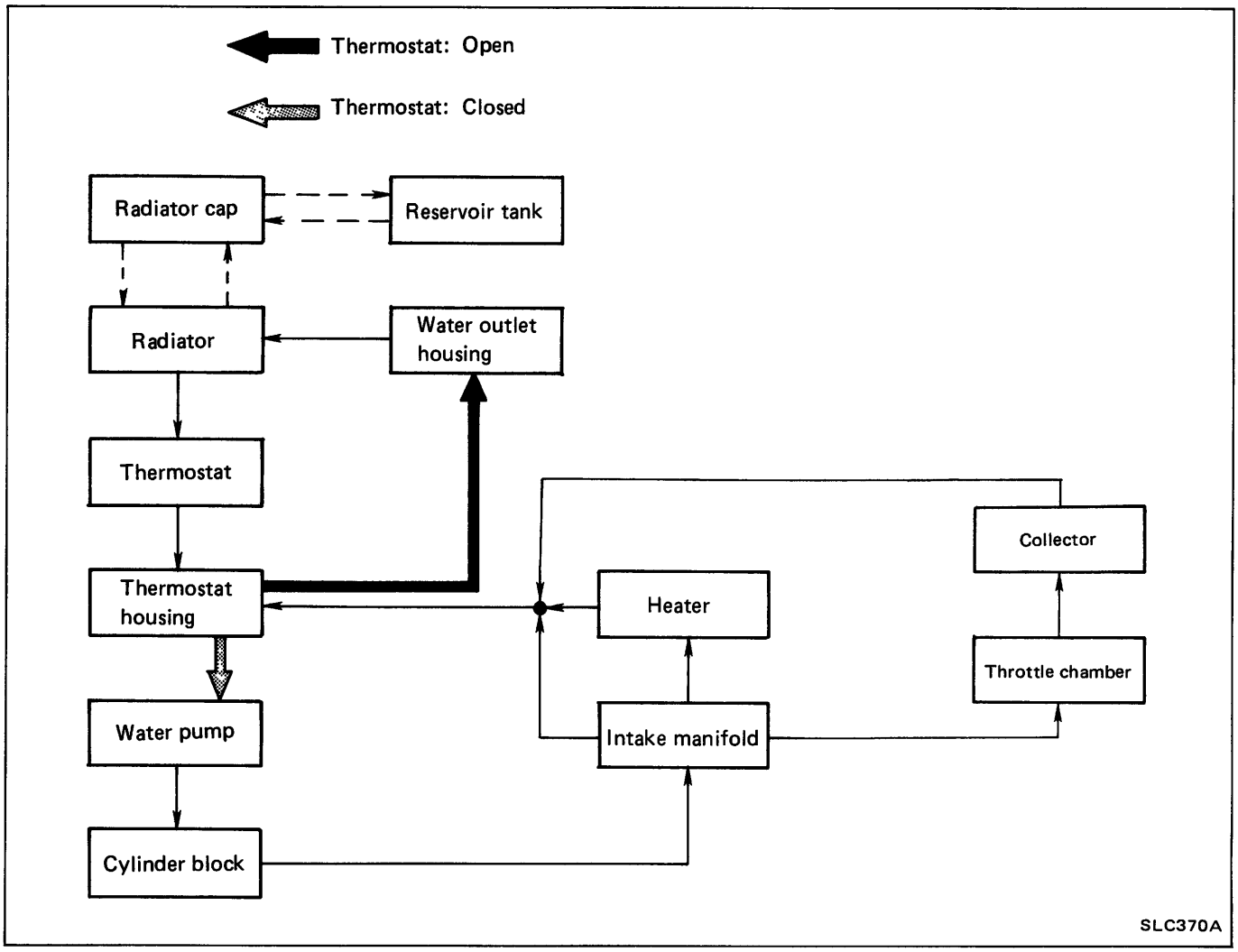
If damaged, replace regulator valve set or oil pump assembly.



OIL PRESSURE RELIEF VALVE INSPECTION

Inspect oil pressure relief valve for movement, cracks and breaks by pushing the ball. If replacement is necessary, remove valve by prying it out with a suitable tool.
Install a new valve by tapping it.

Cooling Circuit



System Check

WARNING:

Never remove the radiator cap when the engine is hot; serious burns could be caused by high pressure fluid escaping from the radiator.

Wrap a thick cloth around the cap and carefully remove the cap by turning it a quarter turn to allow built-up pressure to escape. Then continue turning the cap until it can be removed safety.

CHECKING COOLING SYSTEM HOSES

Check hoses for improper attachment, leaks, cracks, damage, loose connections, chafing and deterioration.

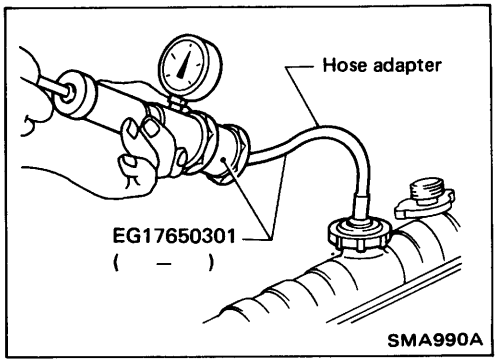
System Check (Cont'd)

CHECKING COOLING SYSTEM FOR LEAKS

To check for leakage, apply pressure to the cooling system with a tester.

Testing pressure:
98 kPa (1.0 kg/cm², 14 psi)

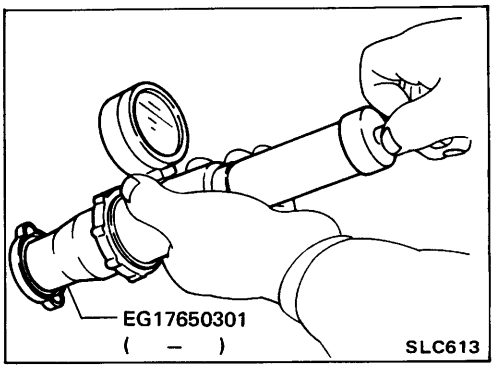
CAUTION:
Higher than the specified pressure may cause radiator damage.



CHECKING RADIATOR CAP

To check radiator cap, apply pressure to cap with a tester.

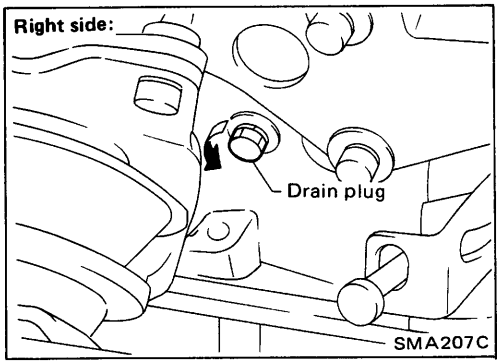
Radiator cap relief pressure:
78 - 98 kPa (0.8 - 1.0 kg/cm², 11 - 14 psi)

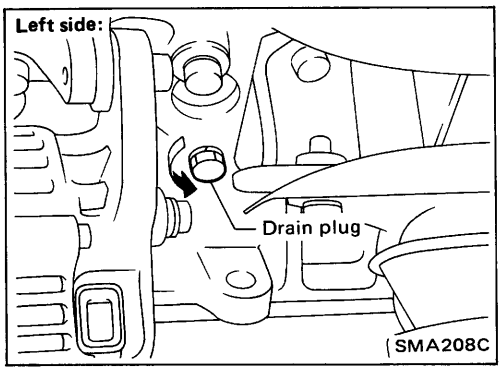


Water Pump

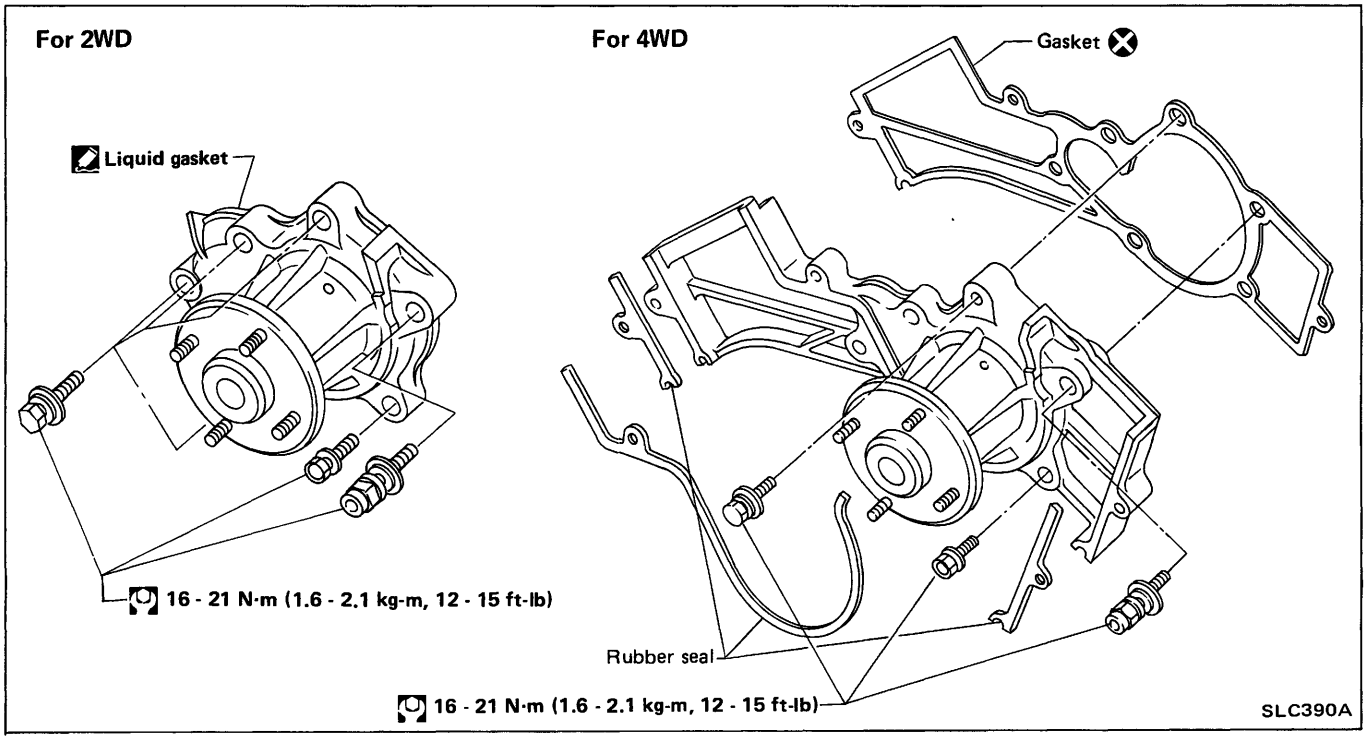
REMOVAL AND INSTALLATION

Drain coolant from drain cocks on both sides of cylinder block and radiator.



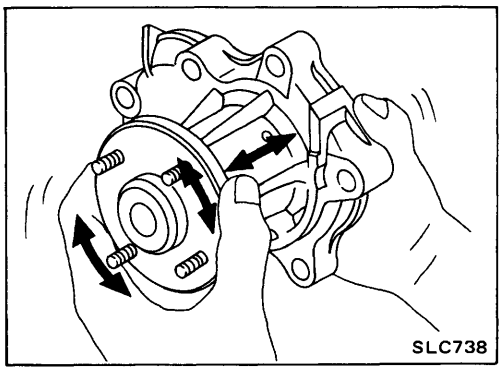


Water Pump (Cont'd)



CAUTION:

- **When removing water pump assembly, be careful not to get coolant on timing belt.**
- **Water pump cannot be disassembled and should be replaced as a unit.**
- **To avoid deforming timing cover, make sure there is adequate clearance between it and the hose clamp.**
- **After installing water pump, connect hose and clamp securely, then check for leaks using radiator cap tester.**



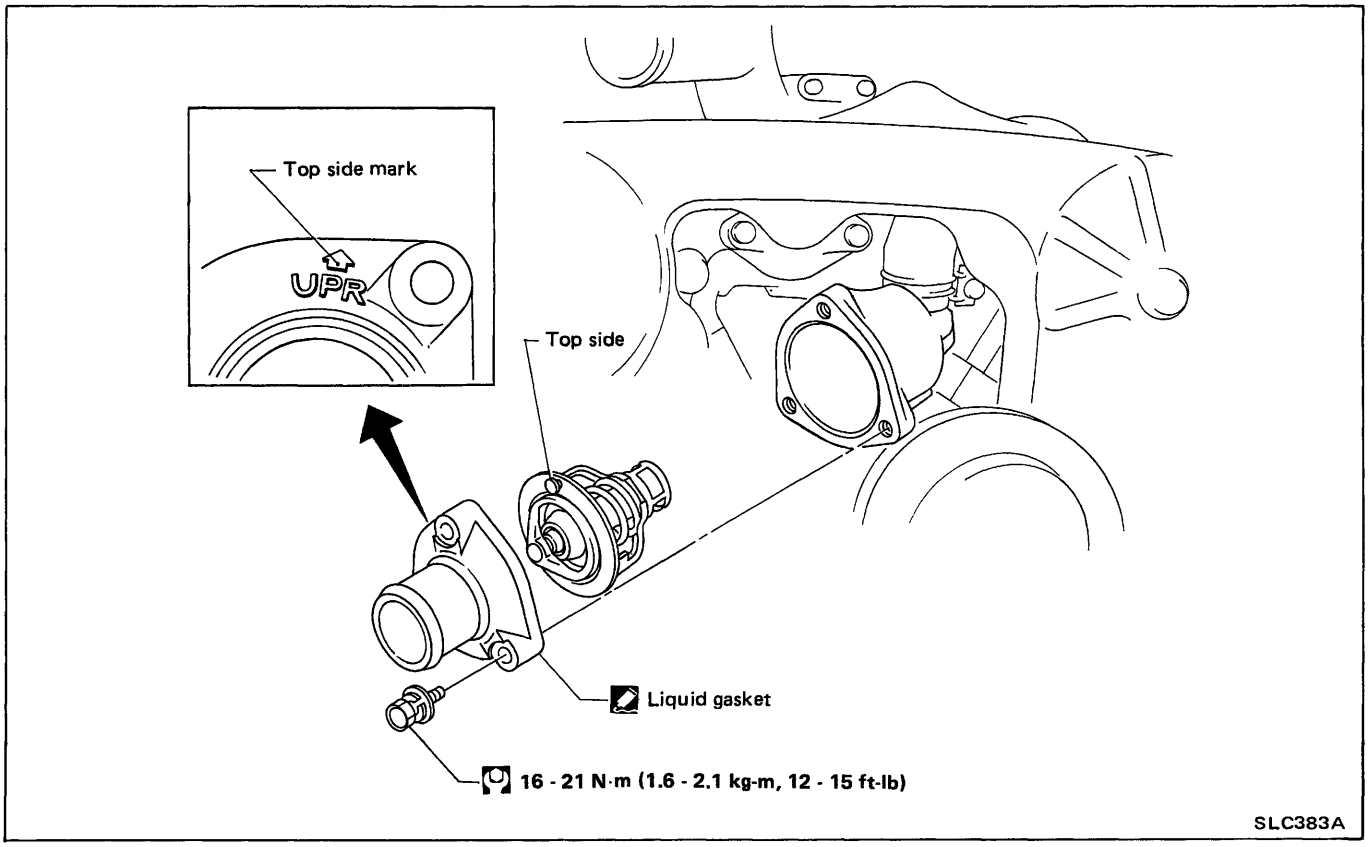
INSPECTION

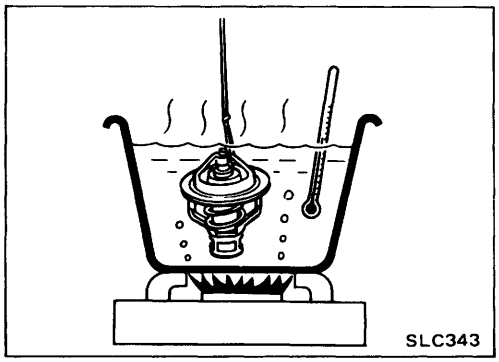
1. Check for badly rusted or corroded body assembly and vanes.
2. Check for rough operation due to excessive end play.

Thermostat

INSPECTION

1. Check valve seating condition at ordinary temperatures. It should seat tightly.





2. Check valve opening temperature and maximum valve lift.

		Standard
Valve opening temperature	°C (°F)	76.5 (170)
Maximum valve lift	mm/°C (in/°F)	10/90 (0.39/194)

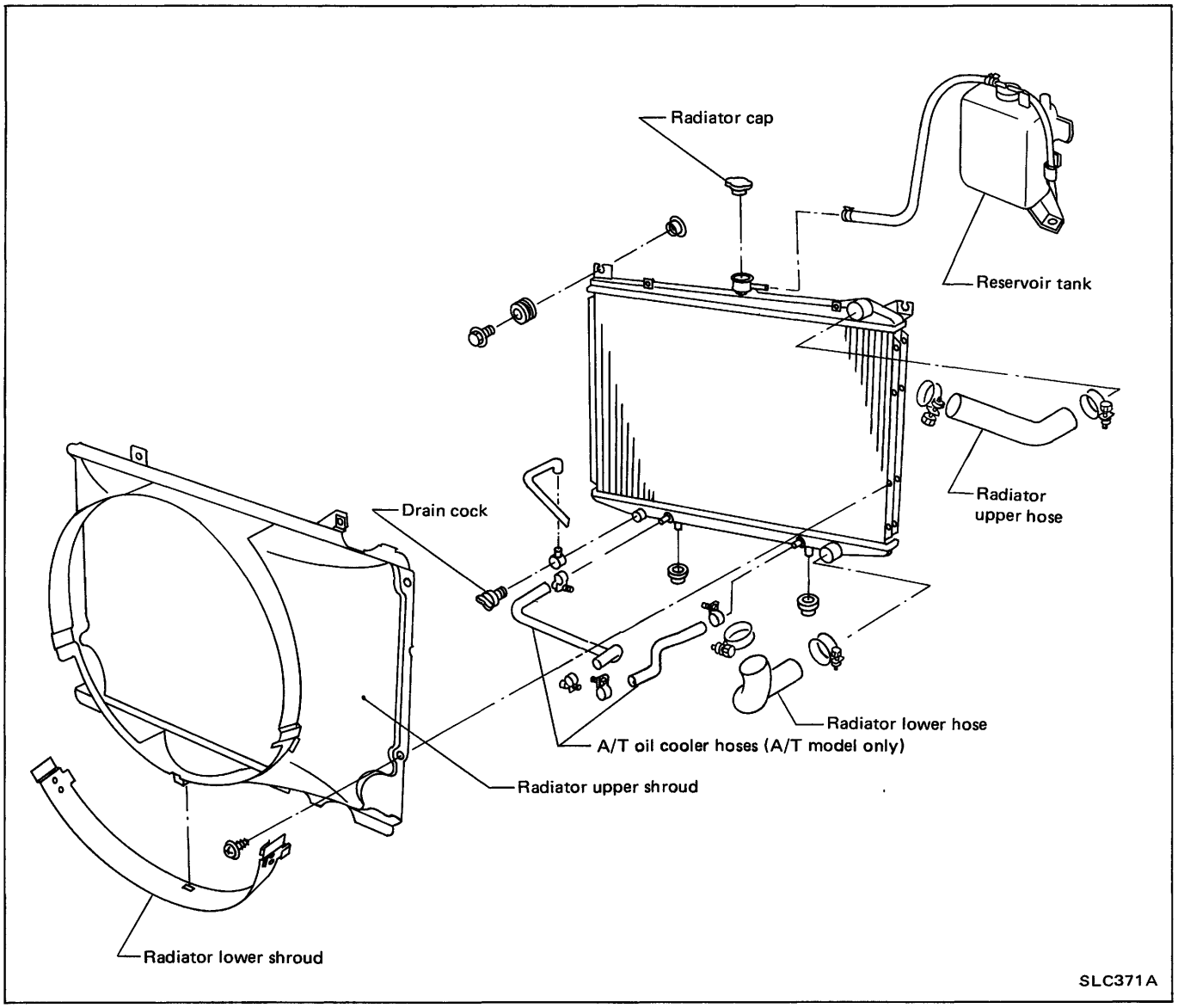
3. Then check if valve is closed at 5°C (9°F) below valve opening temperature.

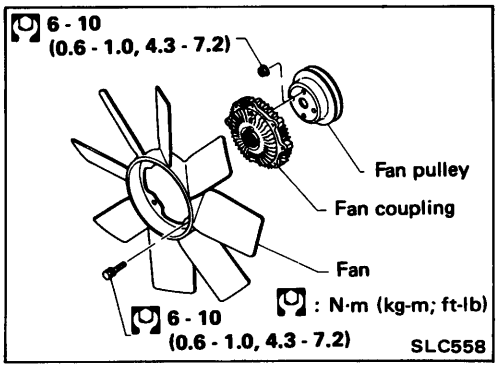
- **After installation, run engine for a few minutes, and check for leaks.**
- **Be careful not to spill coolant over engine compartment. Use a rag to absorb coolant.**

Radiator

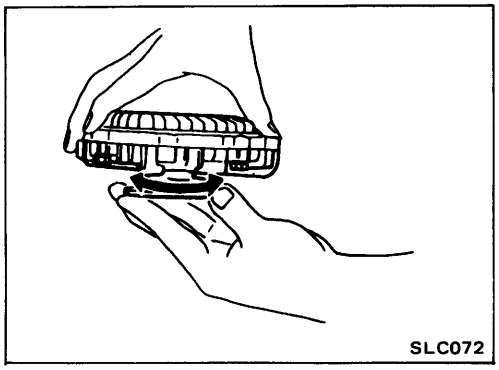
REMOVAL AND INSTALLATION

1. Remove under cover.
2. Drain coolant from radiator drain cock.
3. Disconnect radiator upper and lower hoses.
4. Remove A/T oil cooler hoses. (A/T model only)
5. Remove radiator lower shroud.
6. Disconnect reservoir tank hose.
7. Remove radiator.
8. After repairing or replacing radiator, install any part removed in reverse order of removal.





Cooling Fan



INSPECTION

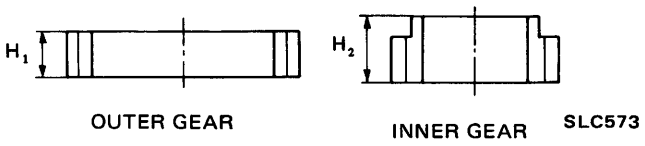
Check fan coupling for oil leakage or bent bimetal.

Engine Lubrication System

Oil pressure check

Engine rpm	Approximate discharge pressure kPa (kg/cm², psi)
Idle speed	More than 59 (0.6, 9)
3,200	363 - 451 (3.7 - 4.6, 53 - 65)

Oil pump



Unit: mm (in)

	H_1	H_2
Height	12.5 (0.492)	18.5 (0.728)

Unit: mm (in)

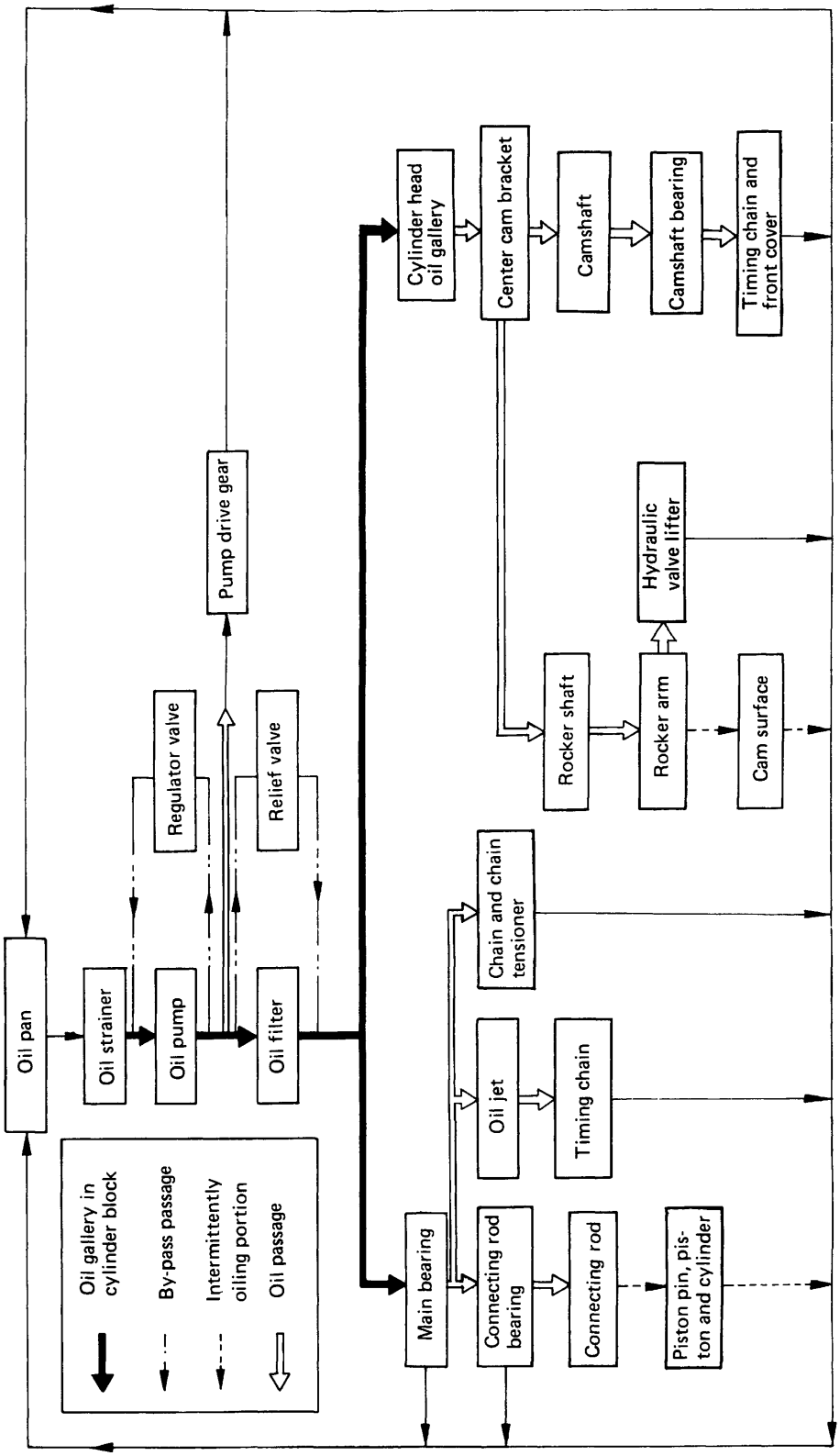
Body to outer gear clearance ①	0.11 - 0.20 (0.0043 - 0.0079)
Inner gear to crescent clearance ②	0.12 - 0.23 (0.0047 - 0.0091)
Outer gear to crescent clearance ③	0.21 - 0.32 (0.0083 - 0.0126)
Housing to inner gear side clearance ④	0.05 - 0.09 (0.0020 - 0.0035)
Housing to outer gear side clearance ⑤	0.05 - 0.11 (0.0020 - 0.0043)

Engine Cooling System

Thermostat

	Standard
Valve opening temperature °C (°F)	76.5 (170)
Maximum valve lift mm/°C (in/°F)	10/90 (0.39/194)

Lubrication Circuit

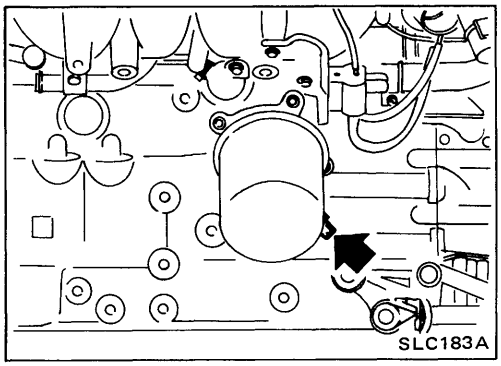


SLC182A

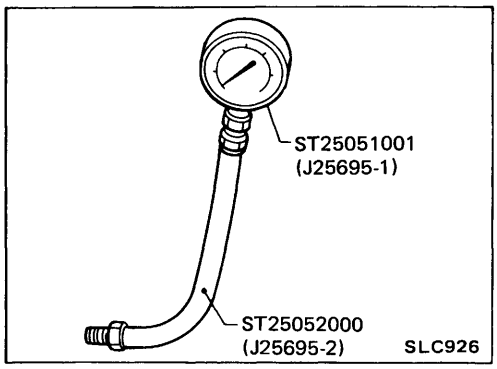
Oil Pressure Check

WARNING:

- **Be careful not to burn yourself, as the engine and oil may hot.**
- **Oil pressure check should be done in "Neutral" gear position.**



1. Check oil level.
2. Remove oil pressure switch.



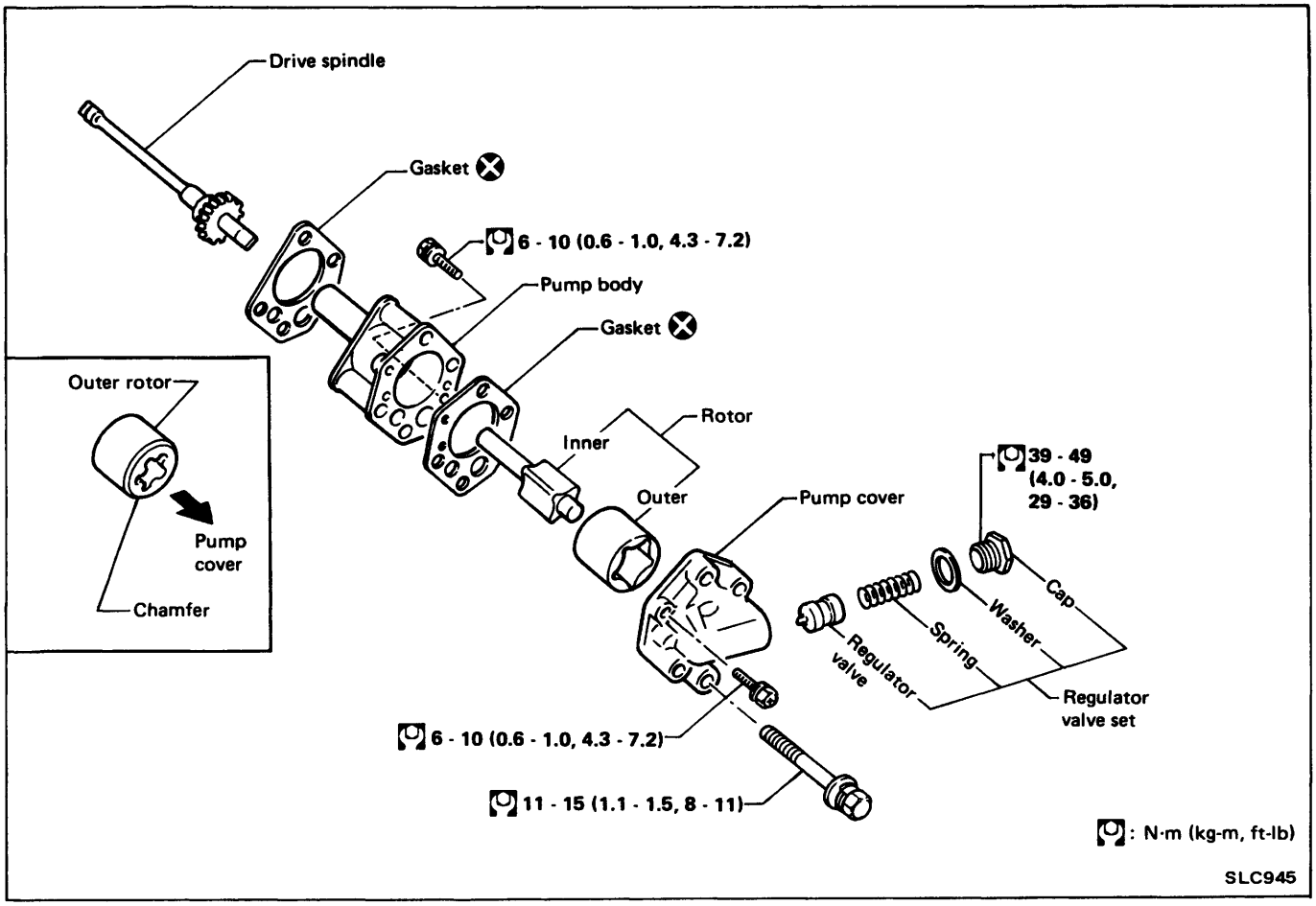
3. Install pressure gauge.
4. Start engine and warm it up to normal operating temperature.
5. Check oil pressure with engine running under no-load.

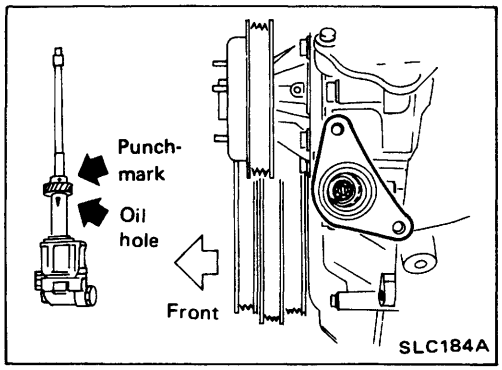
Engine rpm	Approximate discharge pressure kPa (kg/cm^2, psi)
Idle speed	More than 78 (0.8, 11)
3,000	412 - 481 (4.2 - 4.9, 60 - 70)

If difference is extreme, check oil passage and oil pump for oil leaks.

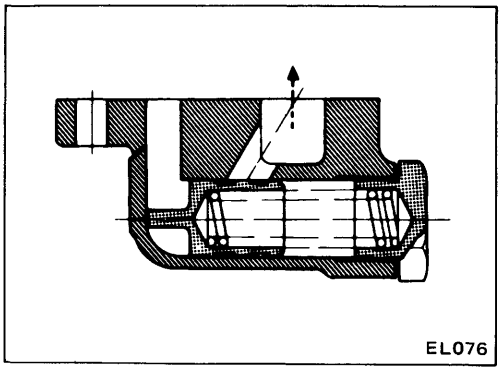
6. Install oil pressure switch with sealant.

Oil Pump





- **Always replace with new oil seal and gasket.**
- **When removing oil pump, turn crankshaft so that No. 1 piston is at T.D.C. on its compression stroke.**
- **When installing oil pump, align punchmark on drive spindle and oil hole on oil pump.**

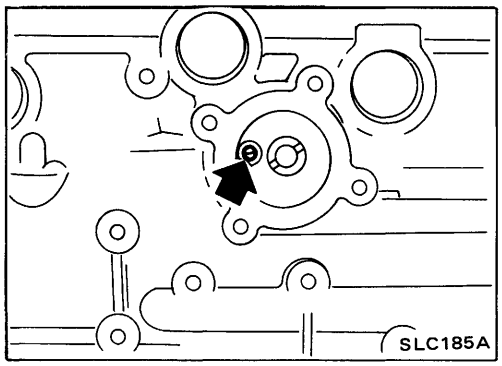


REGULATOR VALVE INSPECTION

1. Visually inspect components for wear and damage.
2. Check oil pressure regulator valve sliding surface and valve spring.
3. Coat regulator valve with engine oil and check that it falls smoothly into the valve hole by its own weight.

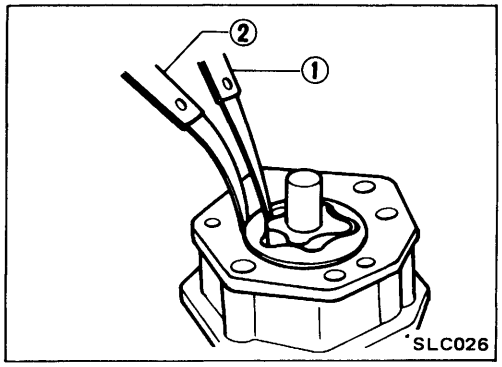
If damaged, replace regulator valve set or oil pump assembly.

Oil Pump (Cont'd)



OIL PRESSURE RELIEF VALVE INSPECTION

Inspect oil pressure relief valve for movement, cracks and breaks by pushing the ball. If replacement is necessary, remove valve by prying it out with suitable tool.
Install a new valve in place by tapping it.



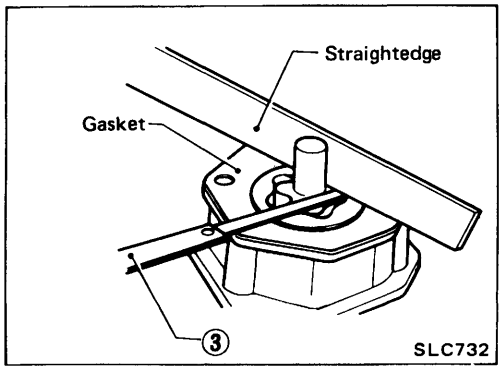
OIL PUMP INSPECTION

Using a feeler gauge, check the following clearance.

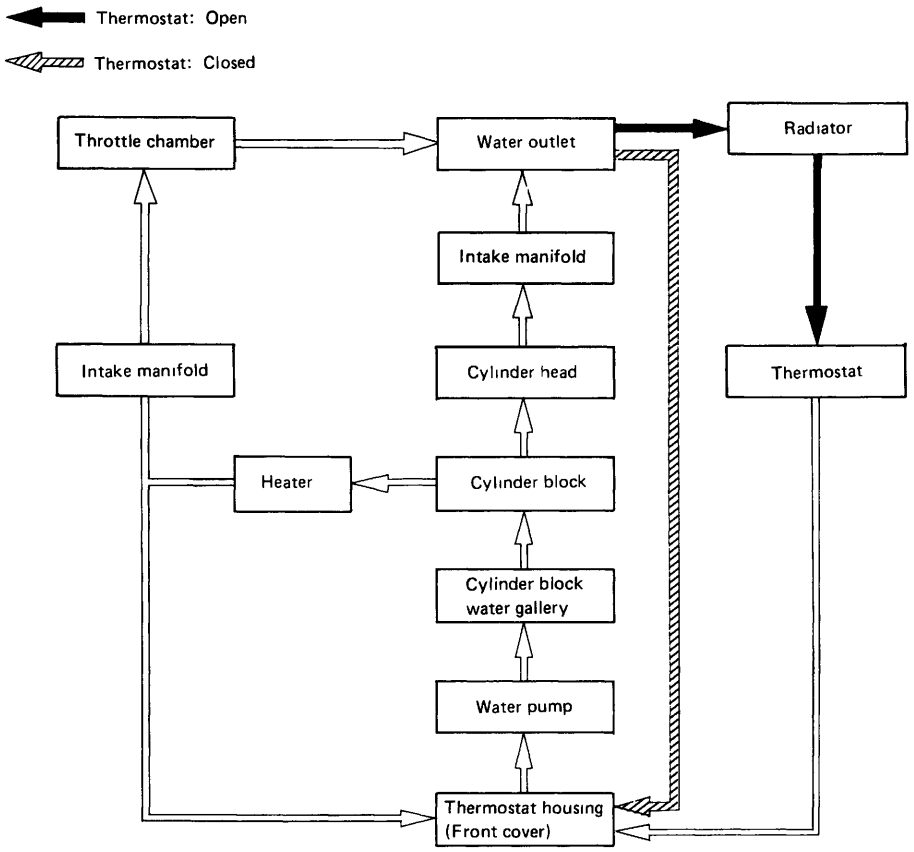
Unit: mm (in)

Rotor tip clearance ①	Less than 0.12 (0.0047)
Outer rotor to body clearance ②	0.15 - 0.21 (0.0059 - 0.0083)
Side clearance (with gasket) ③	0.04 - 0.08 (0.0016 - 0.0031)

If it exceeds the limit, replace gear set or entire oil pump assembly.



Cooling Circuit



SLC186A

System Check

WARNING:

Never remove the radiator cap when the engine is hot; serious burns could be caused by high pressure fluid escaping from the radiator.

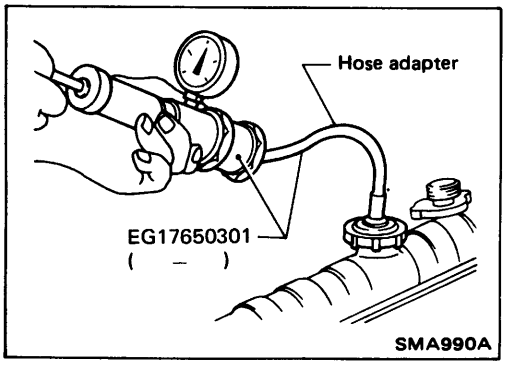
Wrap a thick cloth around cap and carefully remove the cap by turning it a quarter turn to allow built-up pressure to escape and then turn the cap all the way off.

CHECKING COOLING SYSTEM HOSES

Check hoses for improper attachment, leaks, cracks, damage, loose connections, chafing and deterioration.

System Check (Cont'd)

CHECKING COOLING SYSTEM FOR LEAKS

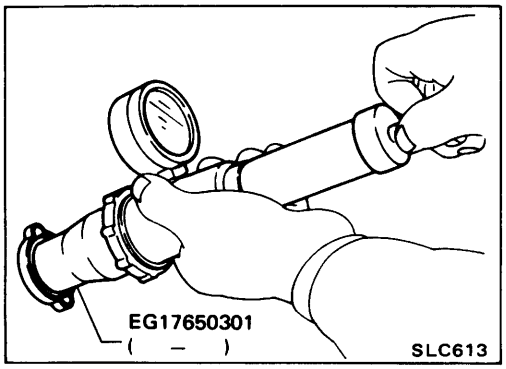


To check for leakage, apply pressure to the cooling system with a tester.

Testing pressure:
98 kPa (1.0 kg/cm², 14 psi)

CAUTION:
Higher than the specified pressure may cause radiator damage.

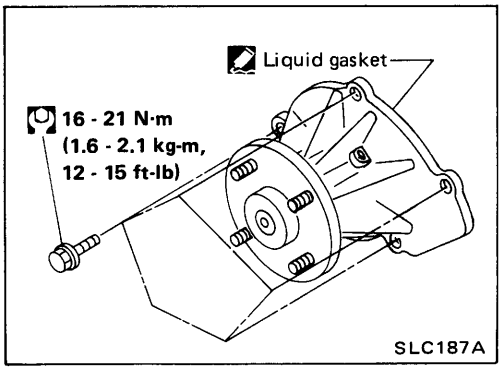
CHECKING RADIATOR CAP



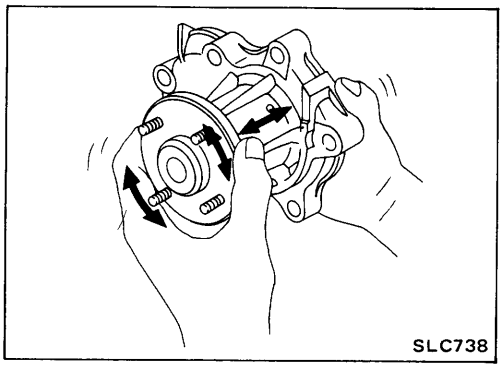
To check radiator cap, apply pressure to cap with a tester.

Radiator cap relief pressure:
78 - 98 kPa (0.8 - 1.0 kg/cm², 11 - 14 psi)

Water Pump

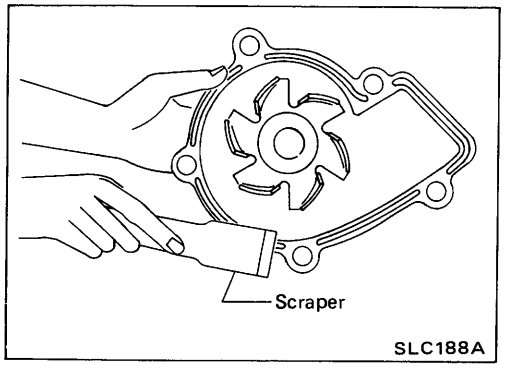


INSPECTION



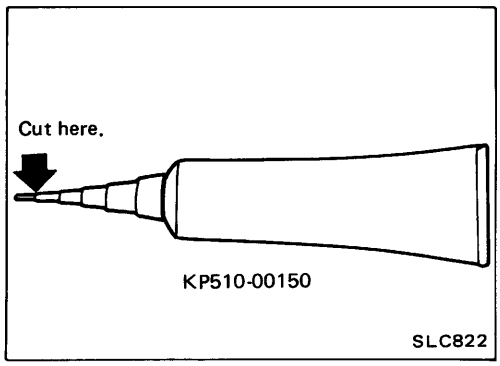
Check for excessive end play and rough operation.

INSTALLATION

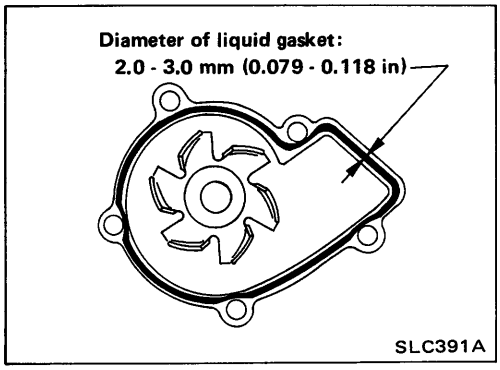


- Remove liquid gasket from mating surface of pump housing using a scraper.
  Be sure liquid gasket in grooves is also removed.
- Remove liquid gasket from mating surface of cylinder block.
- Clean all traces of liquid gasket using white gasoline.

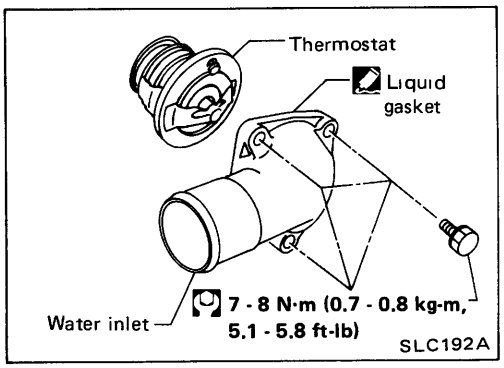
Water Pump (Cont'd)



- Cut off tip of nozzle of liquid gasket tube at point shown in figure.
- Use Genuine Liquid Gasket or equivalent.



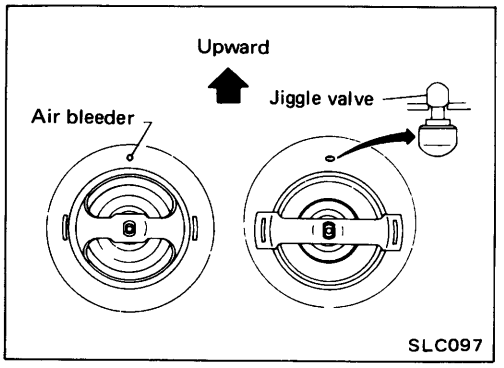
- Apply a continuous bead of liquid gasket to mating surface of pump housing as shown.



Thermostat

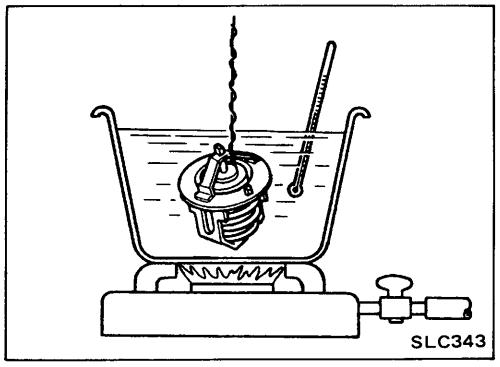
INSPECTION

1. Check for valve seating condition at ordinary temperatures. It should seat tightly.



2. Check valve opening temperature and maximum valve lift.

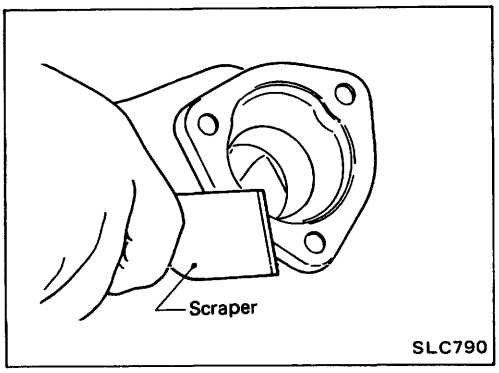
Valve opening temperature °C (°F)	76.5 (170)
Max. valve lift mm/°C (in/°F)	8/90 (0.31/194)



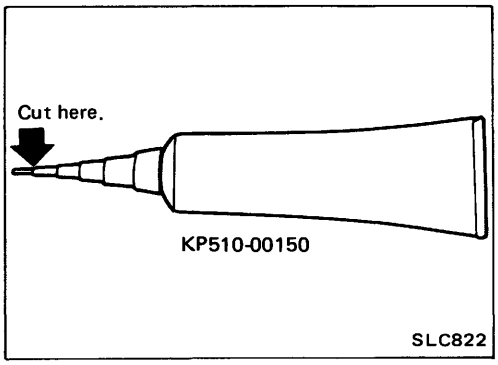
3. Then check if valve closes at 5°C (9°F) below valve opening temperature.
- **After installation, run engine for a few minutes, and check for leaks.**

Thermostat (Cont'd)

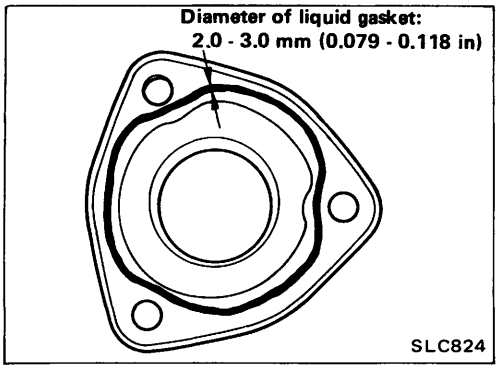
INSTALLATION



- Remove liquid gasket from mating surface of thermostat using a scraper.
- Similarly, remove liquid gasket from mating surface of cylinder block.
- Clean all traces of liquid gasket using white gasoline.

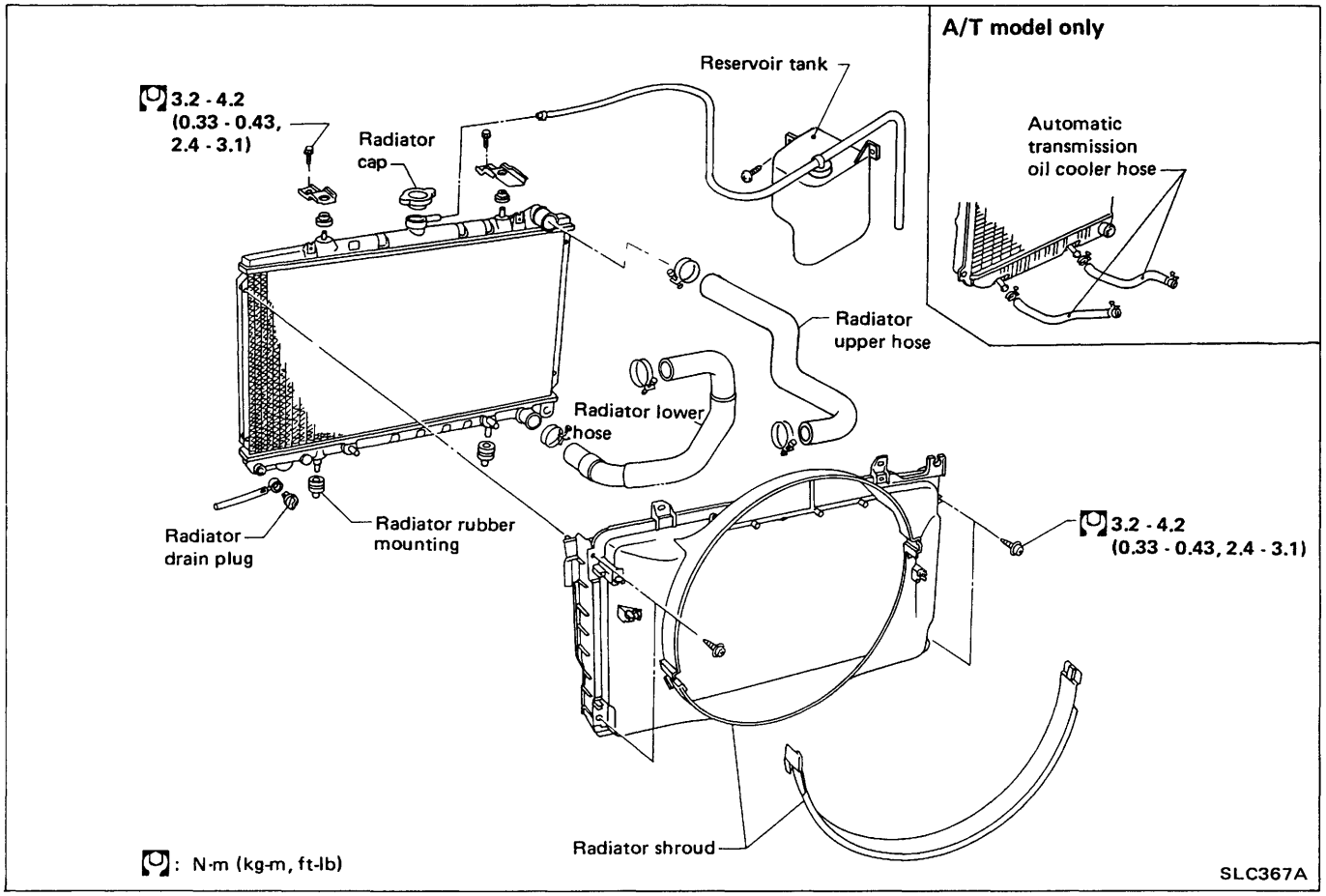


- Cut off tip of nozzle of liquid gasket tube at point shown in figure.
- Use Genuine Liquid Gasket or equivalent.

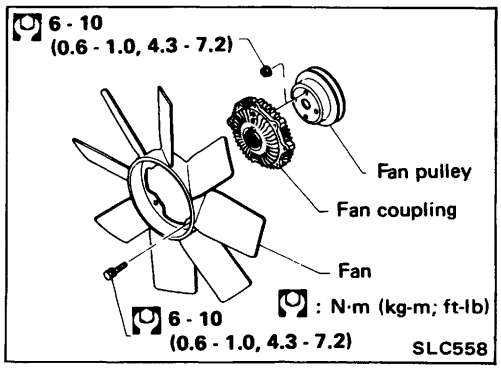


- Apply a continuous bead of liquid gasket to mating surface of water inlet.

Radiator

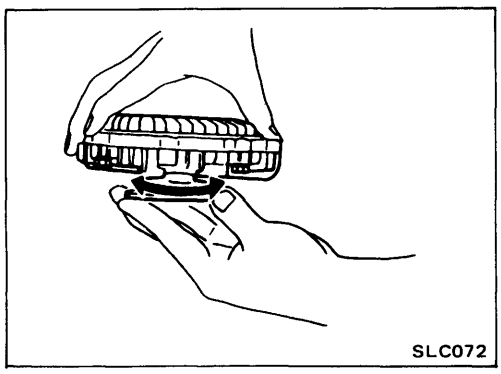


CAUTION:
When filling radiator with coolant, refer to MA section.



Cooling Fan

DISASSEMBLY AND ASSEMBLY



INSPECTION

Check fan coupling for rough operation, oil leakage or bent bimetal.

Engine Lubrication System

Oil pressure check

Engine rpm	Approximate discharge pressure kPa (kg/cm², psi)
Idle speed	More than 78 (0.8, 11)
3,000	412 - 481 (4.2 - 4.9, 60 - 70)

Oil pump

Unit: mm (in)

Rotor tip clearance	Less than 0.12 (0.0047)
Outer rotor to body clearance	0.15 - 0.21 (0.0059 - 0.0083)
Side clearance (with gasket)	0.04 - 0.08 (0.0016 - 0.0031)

Engine Cooling System

Thermostat

Valve opening temperature	°C (°F)	76.5 (170)
Max. valve lift	mm/°C (in/°F)	8/90 (0.31/194)

Radiator

Unit: kPa (kg/cm², psi)

Cap relief pressure	78 - 98 (0.8 - 1.0, 11 - 14)
Leakage test pressure	98 (1.0, 14)

ENGINE FUEL & EMISSION CONTROL SYSTEM

SECTION EF & EC

CONTENTS

PREPARATION ..... EF & EC- 2
PRECAUTIONS ..... EF & EC- 3

VG30E

ENGINE AND EMISSION CONTROL OVERALL SYSTEM ..... EF & EC- 4
ENGINE AND EMISSION CONTROL PARTS DESCRIPTION ..... EF & EC- 12
ENGINE AND EMISSION CONTROL SYSTEM DESCRIPTION ..... EF & EC- 18
IDLE SPEED/IGNITION TIMING/IDLE MIXTURE RATIO INSPECTION ..... EF & EC- 26
TROUBLE DIAGNOSES ..... EF & EC- 31
FUEL INJECTION CONTROL SYSTEM INSPECTION ..... EF & EC-158
EVAPORATIVE EMISSION CONTROL SYSTEM ..... EF & EC-161
CRANKCASE EMISSION CONTROL SYSTEM ..... EF & EC-163
SERVICE DATA AND SPECIFICATIONS (S.D.S.) ..... EF & EC-164

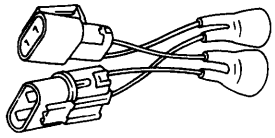
KA24E

ENGINE AND EMISSION CONTROL OVERALL SYSTEM ..... EF & EC-165
ENGINE AND EMISSION CONTROL PARTS DESCRIPTION ..... EF & EC-172
ENGINE AND EMISSION CONTROL SYSTEM DESCRIPTION ..... EF & EC-178
IDLE SPEED/IGNITION TIMING/IDLE MIXTURE RATIO INSPECTION ..... EF & EC-189
TROUBLE DIAGNOSES ..... EF & EC-194
FUEL INJECTION CONTROL SYSTEM INSPECTION ..... EF & EC-321
EVAPORATIVE EMISSION CONTROL SYSTEM ..... EF & EC-323
CRANKCASE EMISSION CONTROL SYSTEM ..... EF & EC-325
SERVICE DATA AND SPECIFICATIONS (S.D.S.) ..... EF & EC-326

When you read wiring diagrams:
- **Read GI section, "HOW TO READ WIRING DIAGRAMS".**
- **See EL section, "POWER SUPPLY ROUTING" for power distribution circuit.**

When you perform trouble diagnoses, read GI section, "HOW TO FOLLOW FLOW CHART IN TROUBLE DIAGNOSES".

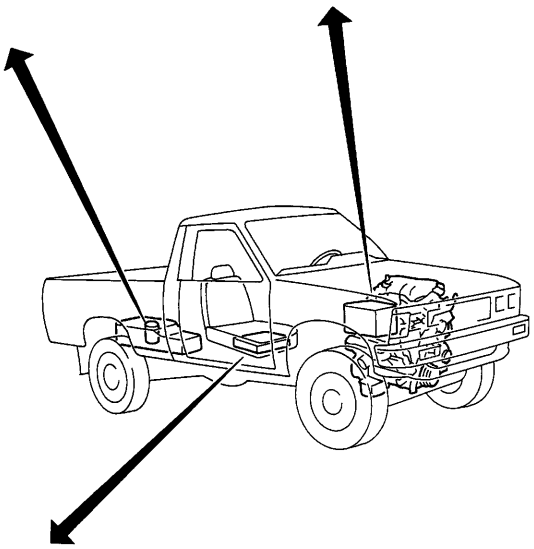
SPECIAL SERVICE TOOL

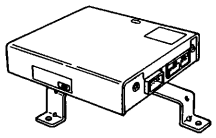
Tool number (Kent-Moore No.) Tool name	Description		Engine application	
			VG30E	KA24E
EG11160000 (–) Adapter harness		Measuring engine speed	X	X

FUEL PUMP
- Do not operate fuel pump when there is no fuel in lines.
- Tighten fuel hose clamps to the specified torque



BATTERY
- Always use a 12 volt battery as power source.
- Do not attempt to disconnect battery cables while engine is running.





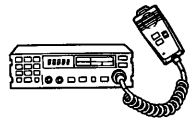
E.C.U.
- Do not disassemble E.C.C.S. control unit (E.C.U.).
- Do not turn diagnosis mode selector forcibly.
- If a battery terminal is disconnected, the memory will return to the ROM value. The E.C.C.S. will now start to self-control at its initial value. Engine operation can vary slightly when the terminal is disconnected. However, this is not an indication of a problem. Do not replace parts because of a slight variation.



WHEN STARTING
- Do not depress accelerator pedal when starting.
- Immediately after starting, do not rev up engine unnecessarily.
- Do not rev up engine just prior to shutdown.

WIRELESS EQUIPMENT
- When installing C.B. ham radio or a mobile phone, be sure to observe the following as it may adversely affect electronic control systems depending on its installation location.

1) Keep the antenna as far as possible away from the electronic control units.
2) Keep the antenna feeder line more than 20 cm (7.9 in) away from the harness of electronic controls. Do not let them run parallel for a long distance.
3) Adjust the antenna and feeder line so that the standing-wave ratio can be kept smaller.
4) Be sure to ground the radio to vehicle body.



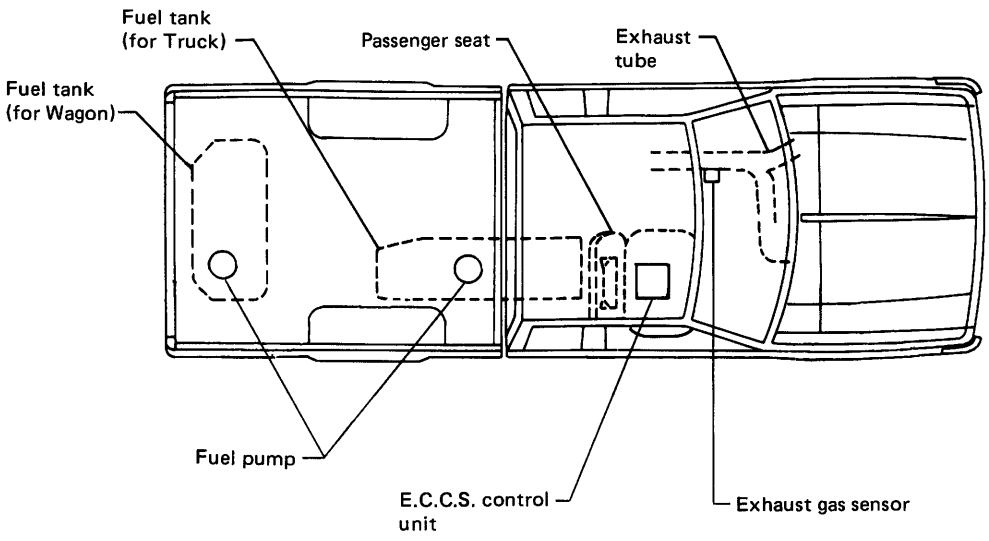
INJECTOR
- Do not disconnect injector harness connectors with engine running.
- Do not apply battery power directly to injectors.

E.C.C.S. PARTS HANDLING
- Handle air flow meter carefully to avoid damage.
- Do not disassemble air flow meter.
- Do not clean air flow meter with any type of detergent.
- Do not disassemble auxiliary air control valve.
- Even a slight leak in the air intake system can cause serious problems.
- Do not shock or jar the crank angle sensor.

E.C.C.S. HARNESS HANDLING
- Securely connect E.C.C.S. harness connectors. A poor connection can cause an extremely high (surge) voltage to develop in coil and condenser, thus resulting in damage to ICs.
- Keep E.C.C.S. harness at least 10 cm (3.9 in) away from adjacent harnesses, to prevent an E.C.C.S. system malfunction due to receiving external noise, degraded operation of ICs, etc.
- Keep E.C.C.S. parts and harnesses dry.
- Before removing parts, turn off ignition switch and then disconnect battery ground cable.

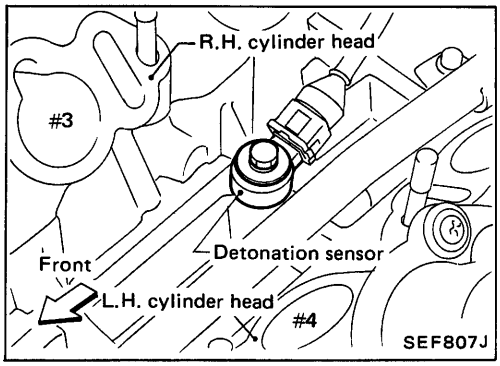
SEF805J

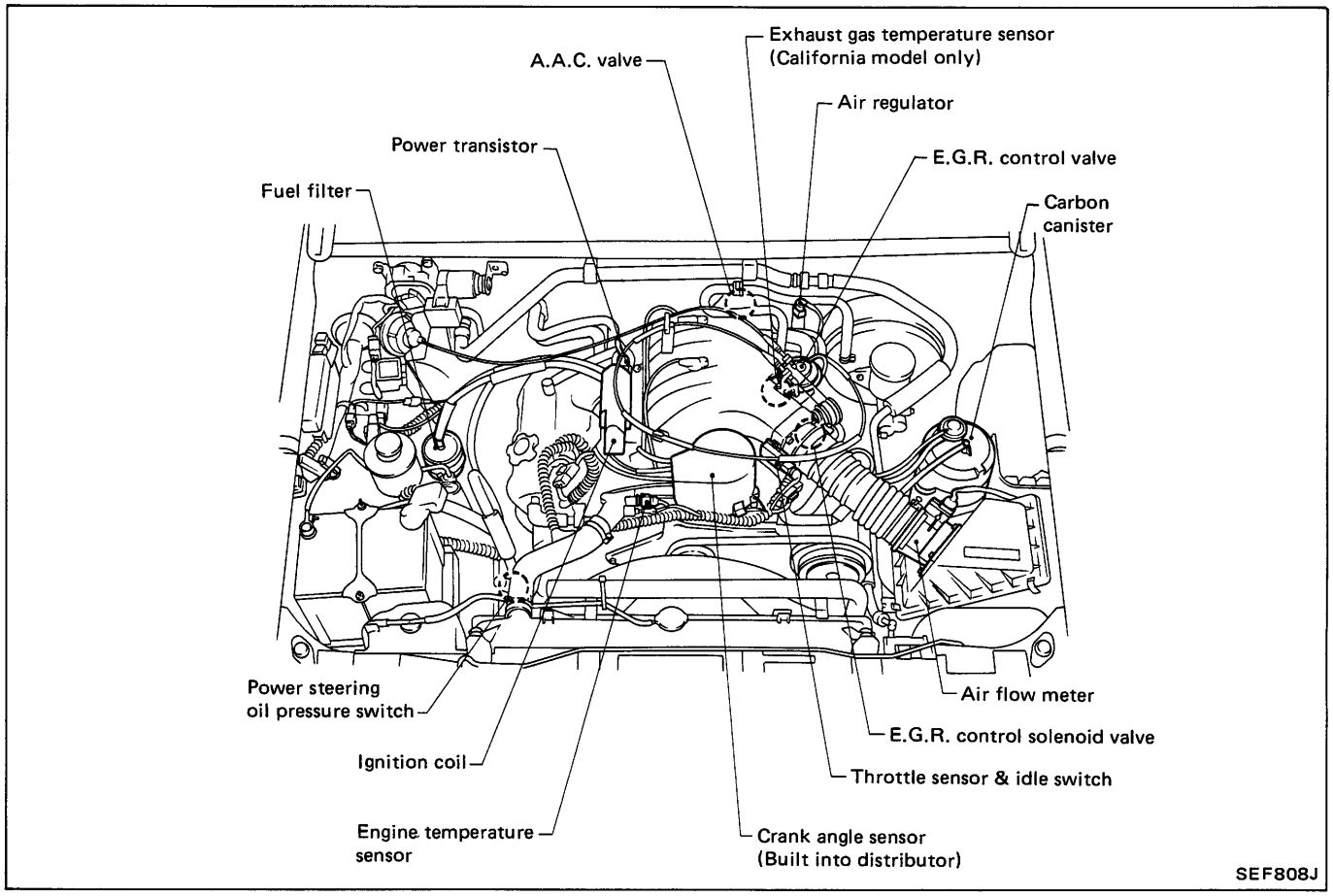
E.C.C.S. Component Parts Location

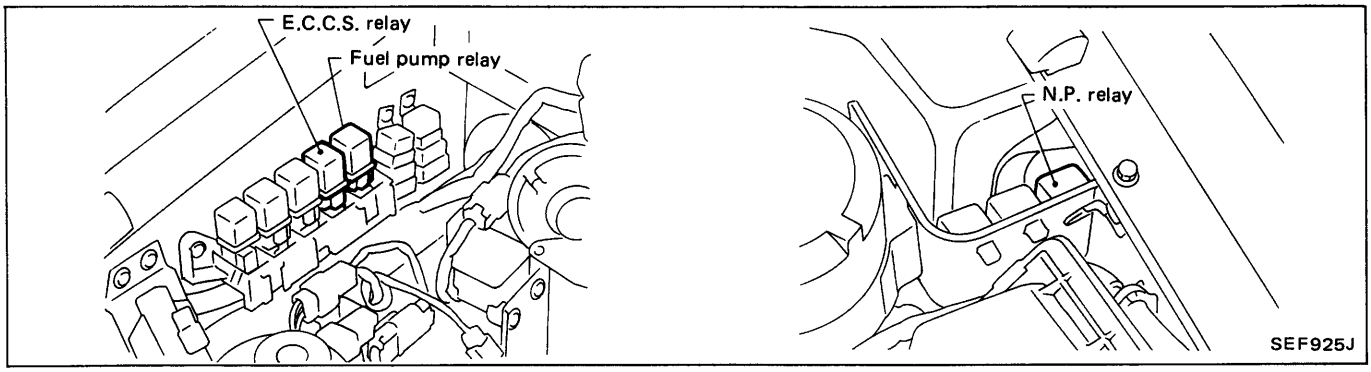


SEF806J

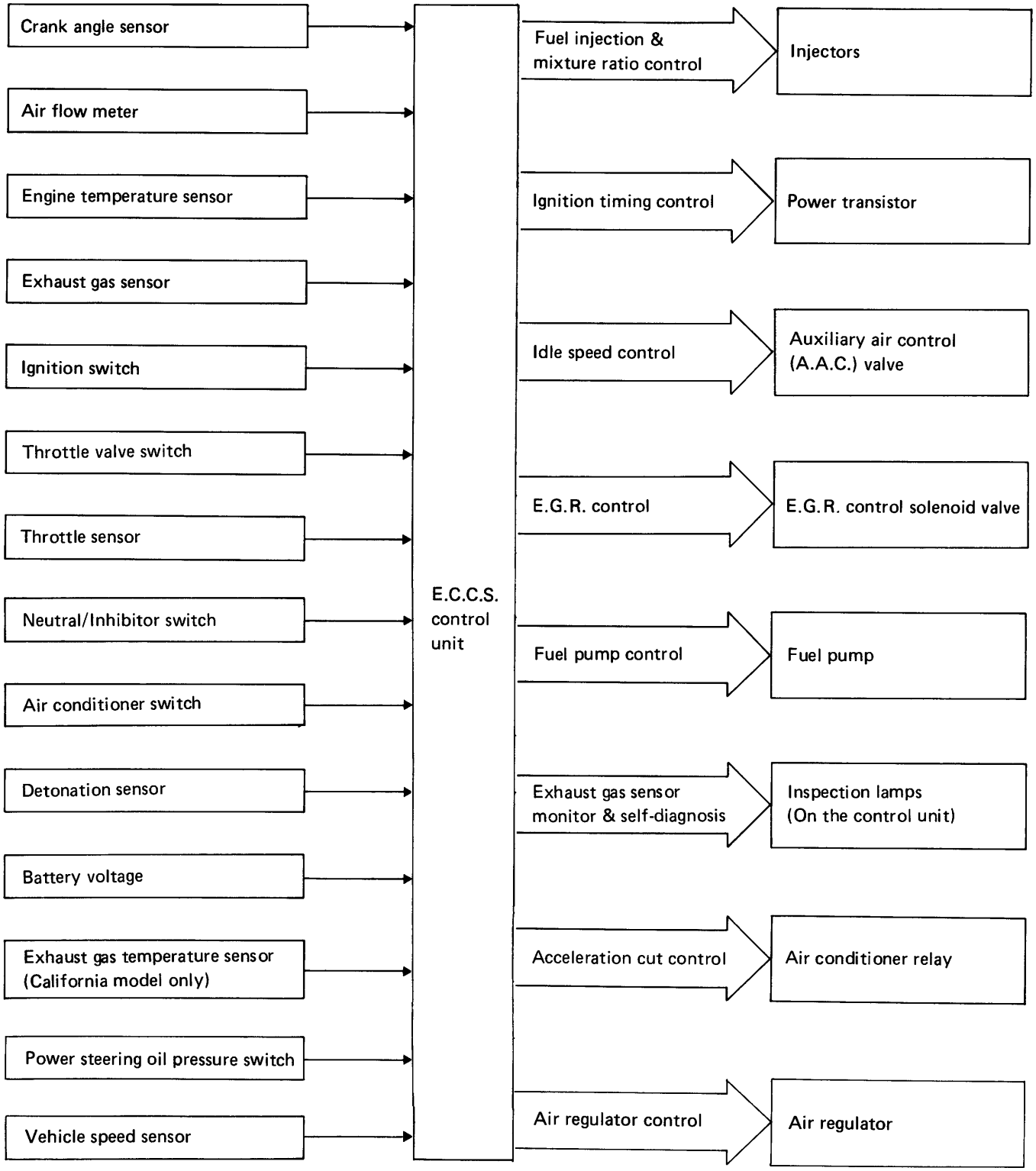
E.C.C.S. Component Parts Location (Cont'd)



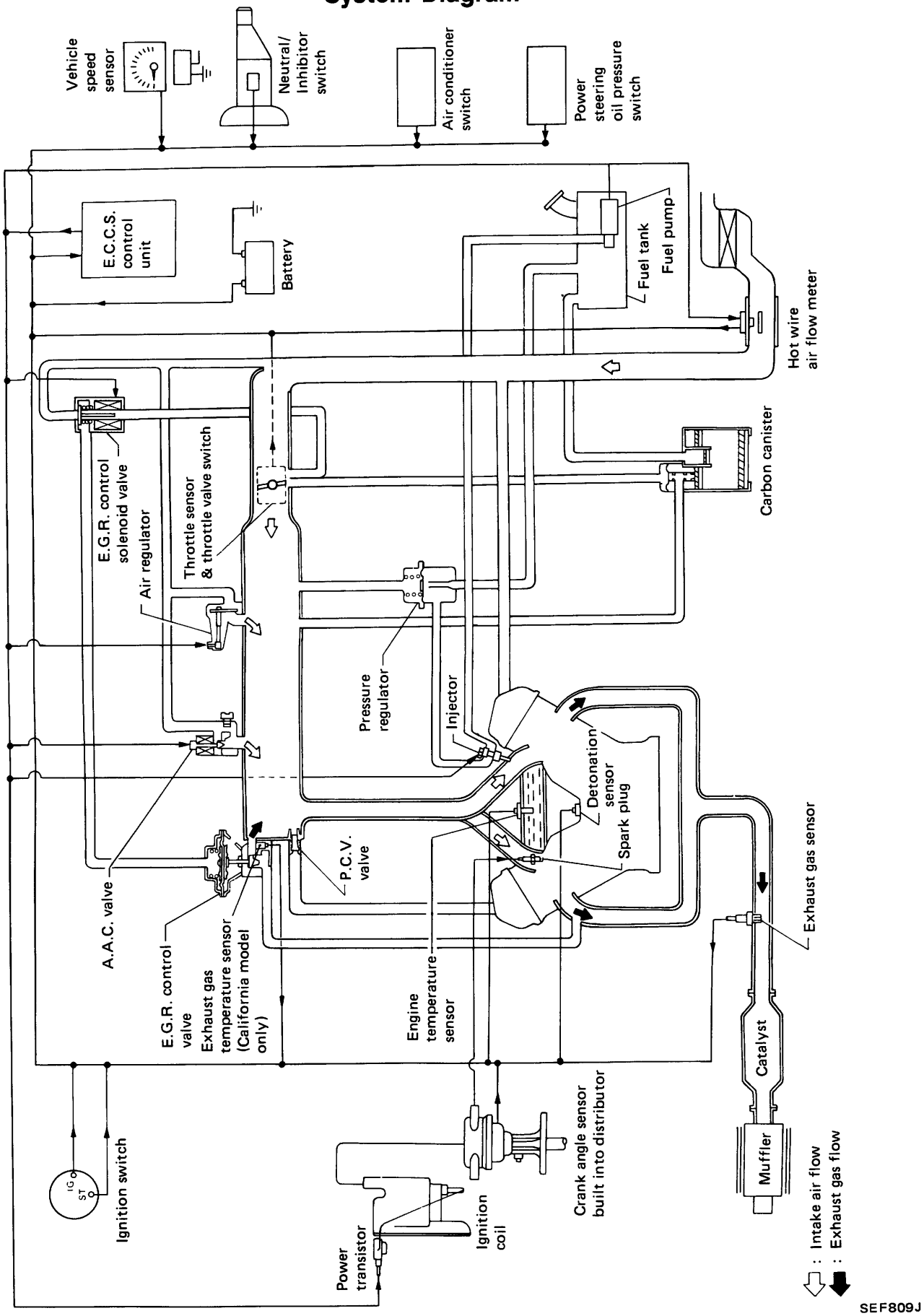




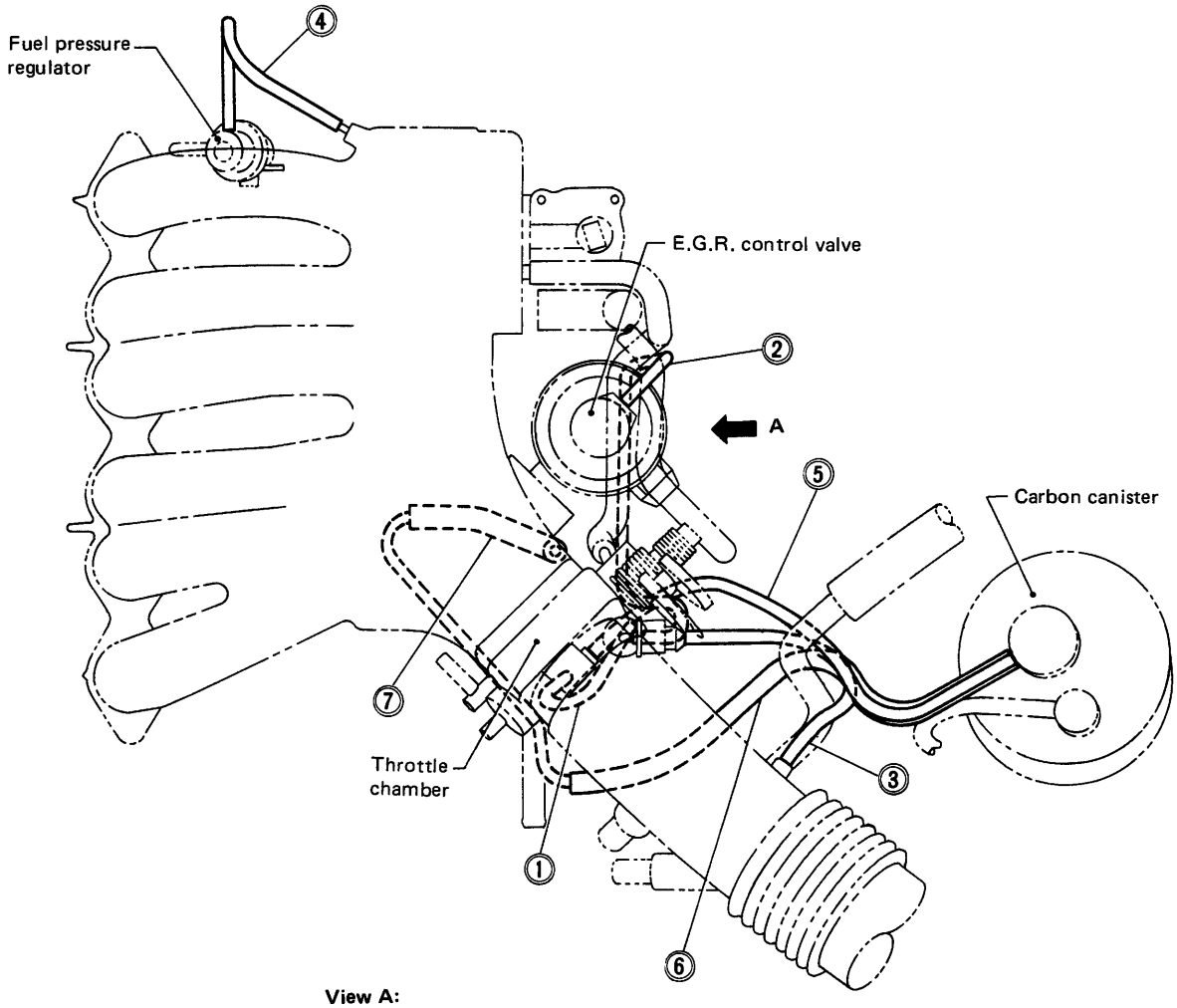
System Chart



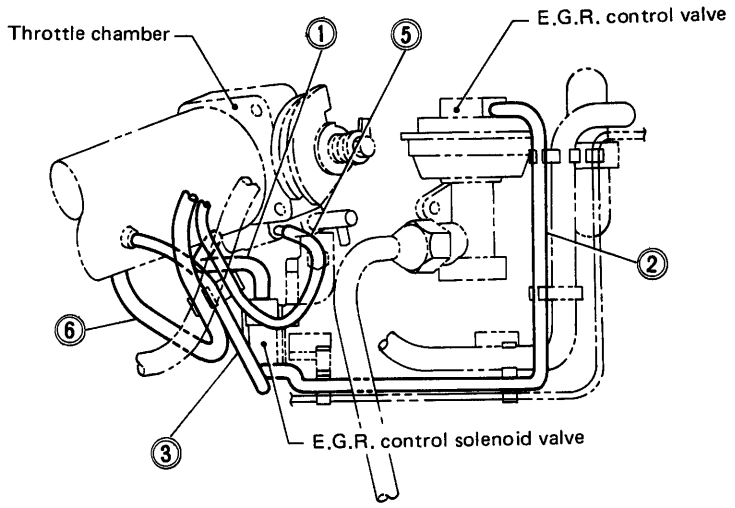
System Diagram



Vacuum Hose Drawing



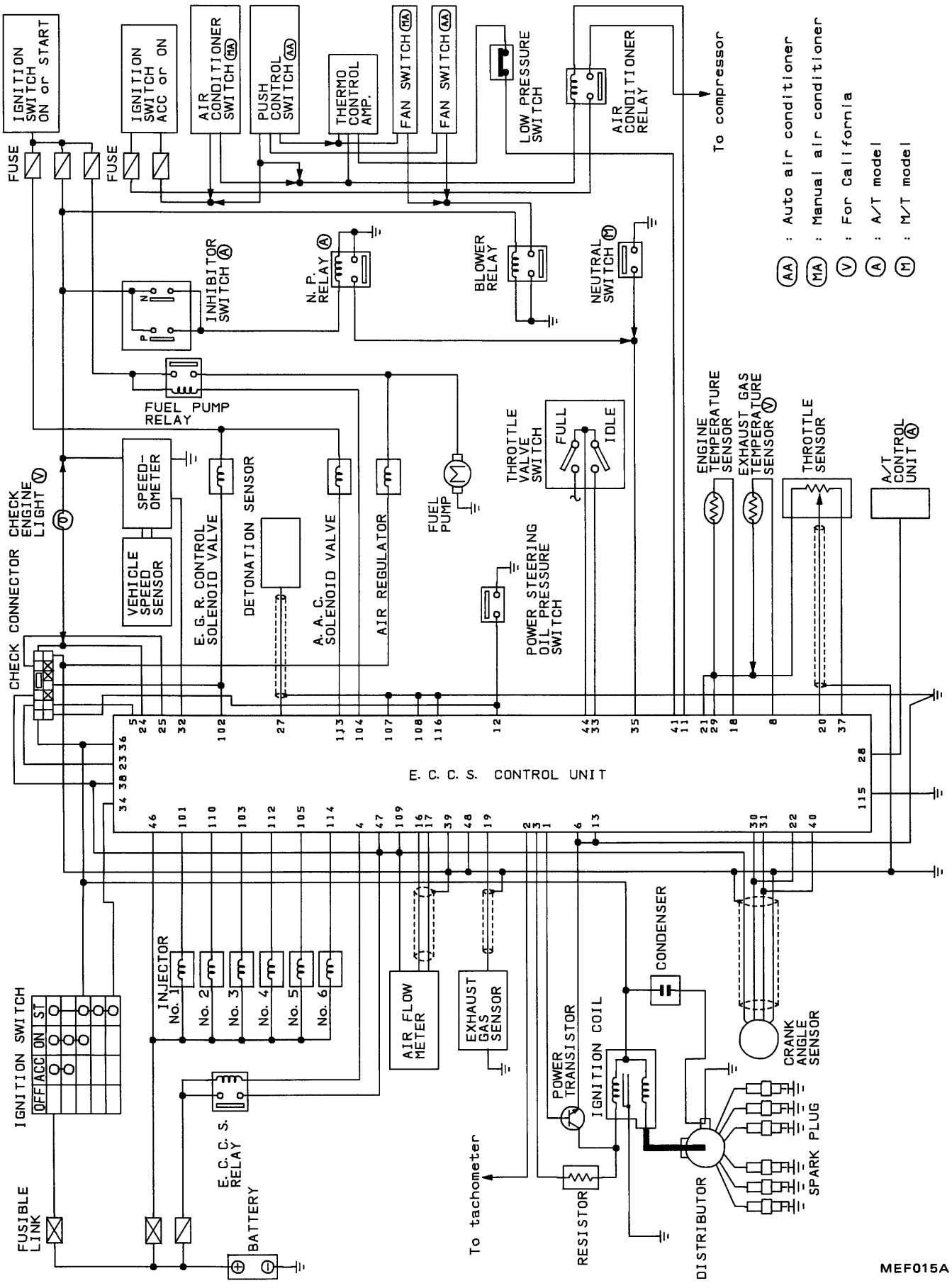
View A:



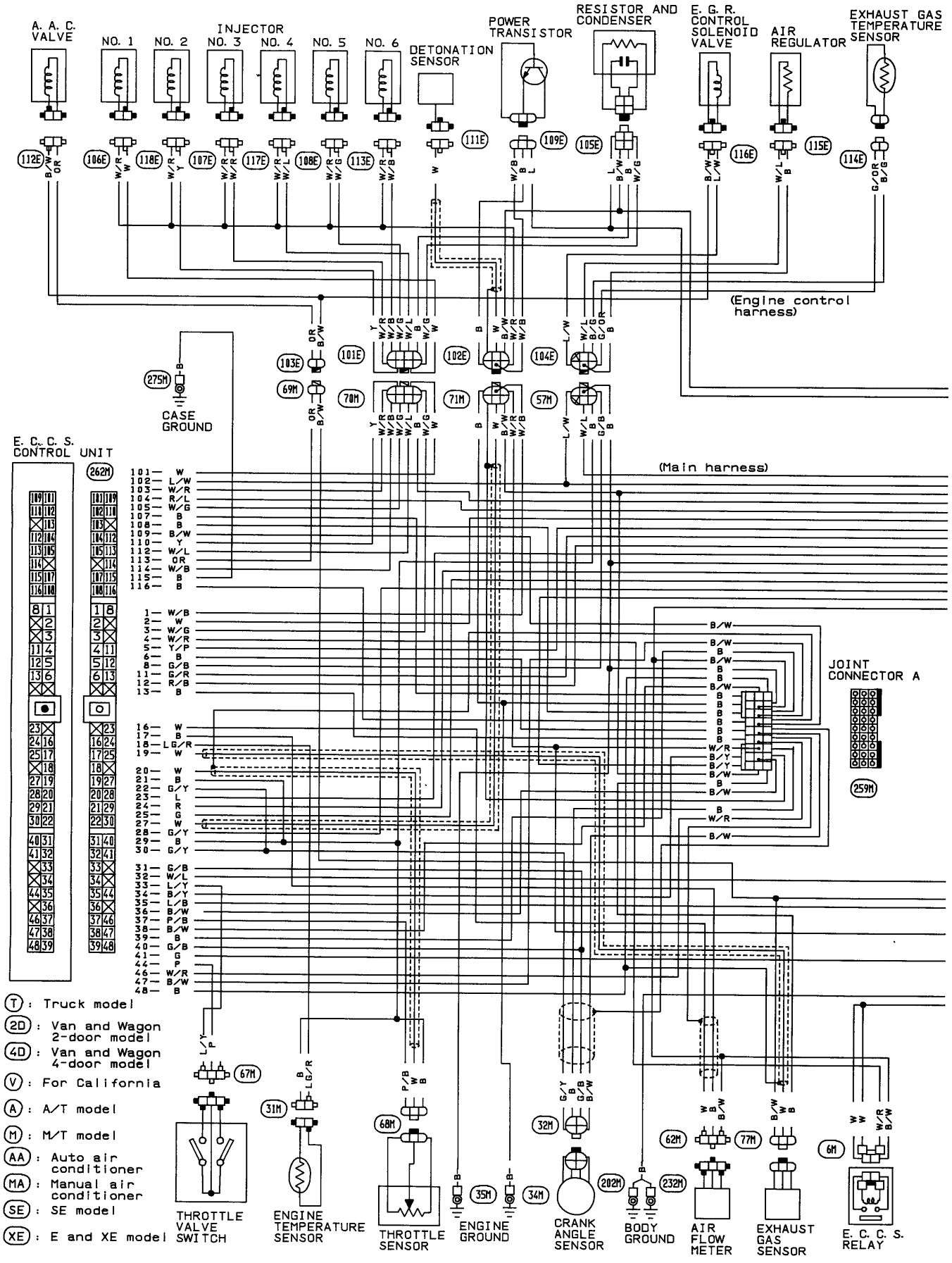
① E.G.R. control solenoid valve to Throttle chamber
② E.G.R. control solenoid valve to E.G.R. control valve
③ E.G.R. control solenoid valve to Air duct
④ Fuel pressure regulator to Intake manifold collector
⑤ Carbon canister vacuum port to Throttle chamber
⑥ Carbon canister purge port to Vapor purge tube
⑦ Vapor purge tube to Throttle chamber

SEF810J

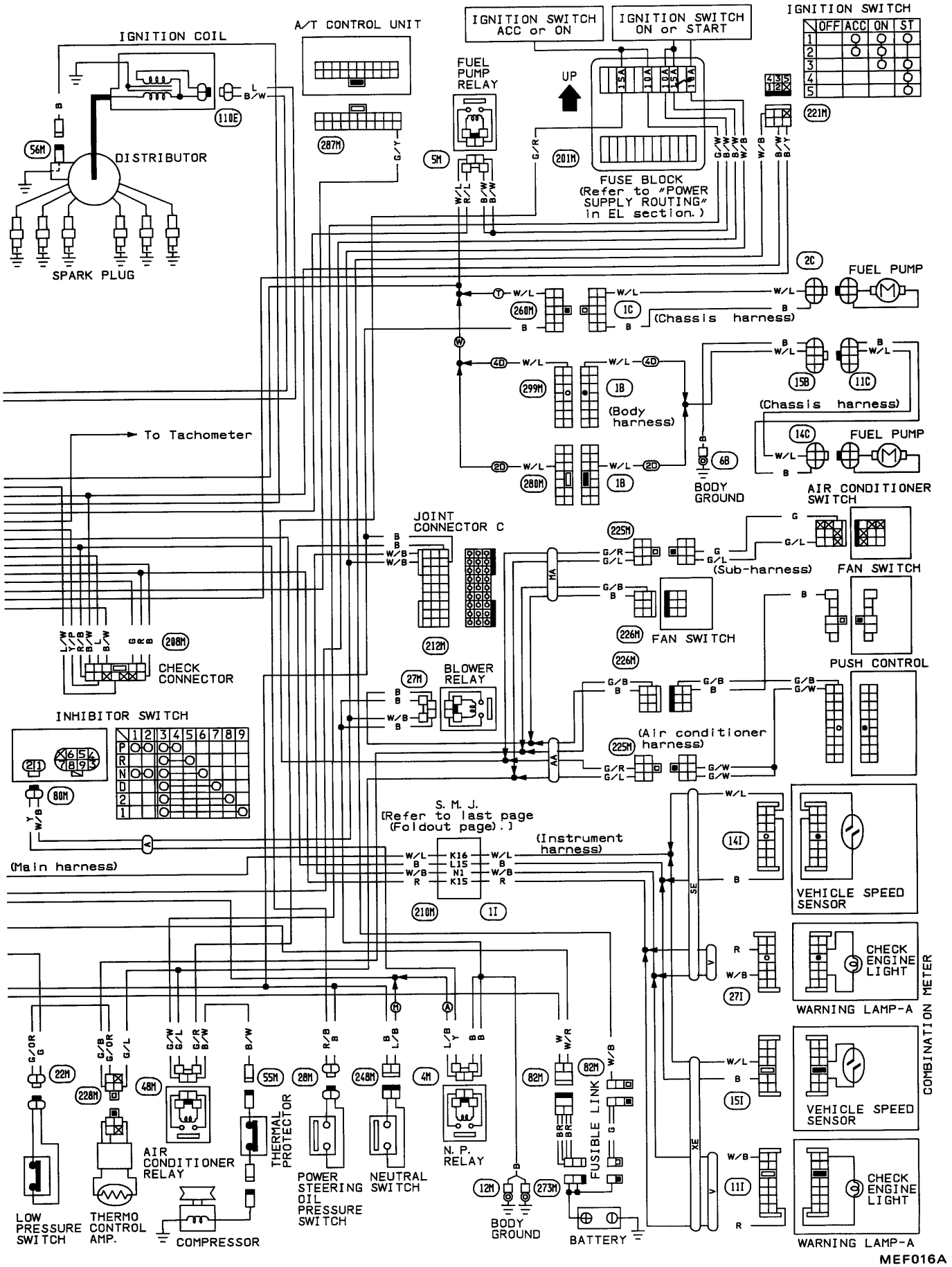
Circuit Diagram

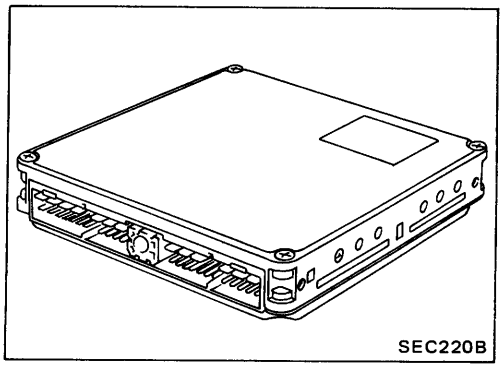


Wiring Diagram



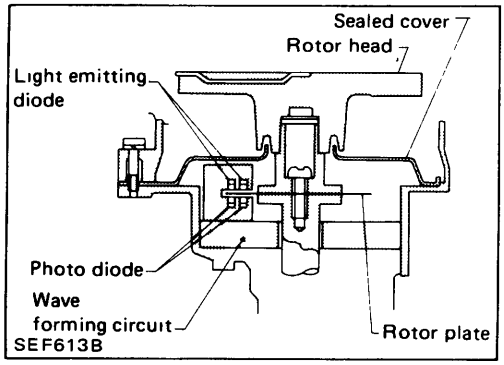
Wiring Diagram (Cont'd)




SEC220B

E.C.C.S. Control Unit (E.C.U.)

The E.C.U. consists of a microcomputer, inspection lamps, a diagnostic mode selector, and connectors for signal input and output and for power supply. The unit controls the engine.

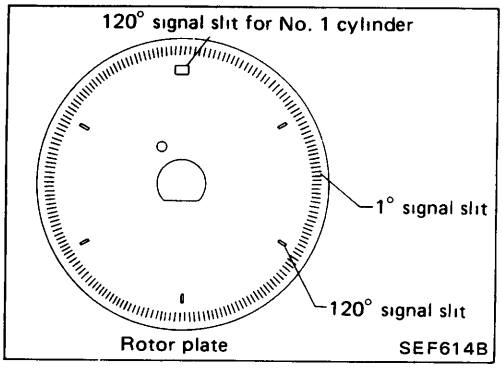


SEF613B

Crank Angle Sensor

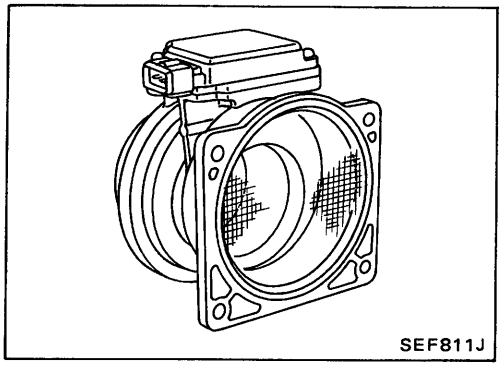
The crank angle sensor is a basic component of the entire E.C.C.S. It monitors engine speed and piston position, and sends signals to the E.C.U. to control fuel injection, ignition timing and other functions.

The crank angle sensor has a rotor plate and a wave-forming circuit. The rotor plate has 360 slits for 1° signal and 6 slits for 120° signal. Light Emitting Diodes (L.E.D.) and photo diodes are built in the wave-forming circuit.



SEF614B

When the rotor plate passes between the L.E.D. and the photo diode, the slits in the rotor plate continually cut the light being transmitted to the photo diode from the L.E.D. This generates rough-shaped pulses which are converted into on-off pulses by the wave-forming circuit, which are sent to the E.C.U.

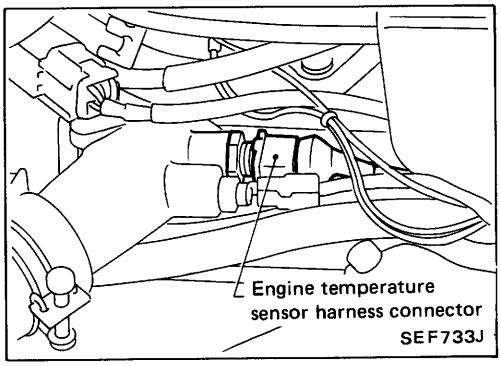

SEF811J

Air Flow Meter

The air flow meter measures the intake air flow rate by taking a part of the entire flow. Measurements are made in such a manner that the E.C.U. receives electrical output signals varied by the amount of heat emitting from the hot wire placed in the stream of the intake air.

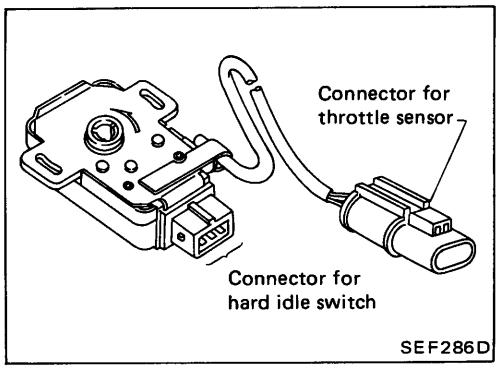
When intake air flows into the intake manifold through a route around the hot wire, the heat generated from the hot wire is taken away by the air. The amount of heat depends on the air flow. On the other hand, the temperature of the hot wire is automatically controlled to a certain number of degrees.

Therefore, it is necessary to supply the hot wire with more electric current in order to maintain the temperature of the hot wire. The E.C.U. knows the air flow by means of the electric change.



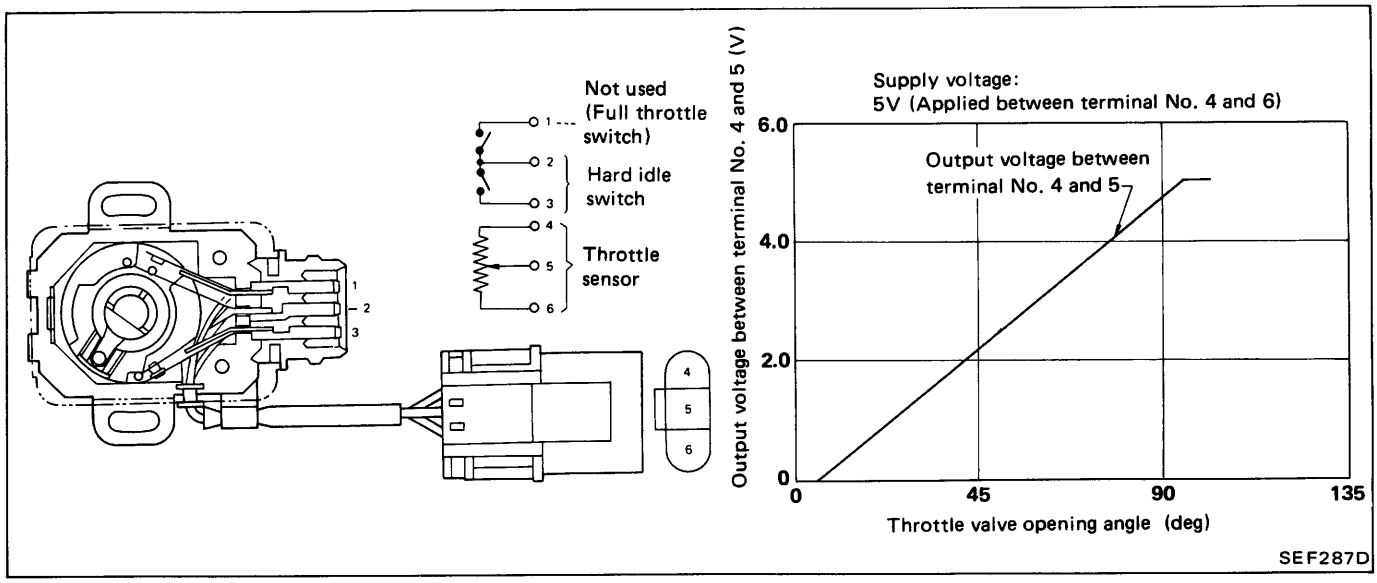
Engine Temperature Sensor

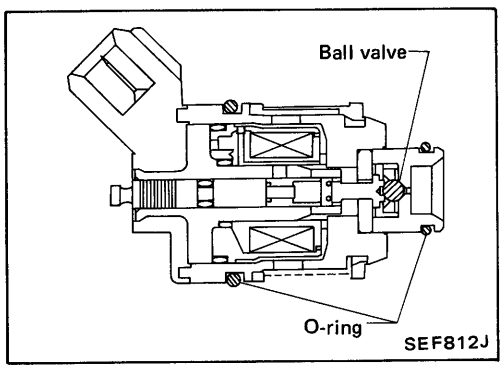
The engine temperature sensor, located on the water outlet housing, detects engine coolant temperature and transmits a signal to the E.C.U.
The temperature sensing unit employs a thermistor which is sensitive to the change in temperature. Electrical resistance of the thermistor decreases in response to the temperature rise.



Throttle Sensor & Soft/Hard Idle Switch

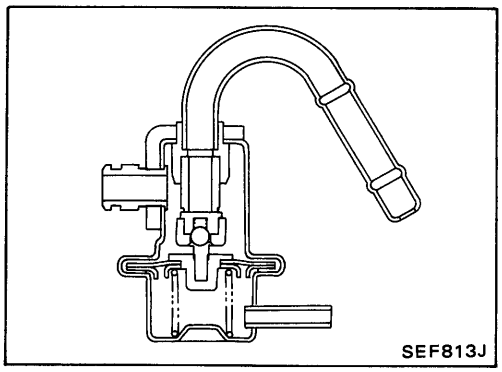
The throttle sensor responds to the accelerator pedal movement. This sensor is a kind of potentiometer which transforms the throttle valve position into output voltage, and emits the voltage signal to the E.C.U. In addition, the sensor detects the opening and closing speed of the throttle valve and feeds the voltage signal to the E.C.U.
Idle position of the throttle valve is determined by the E.C.U. receiving the signal from the throttle sensor. This system is called "soft idle switch". This one controls engine operation such as fuel cut. On the other hand, "hard idle switch", which is built in the throttle sensor unit, is used not for engine control but for self-diagnosis.





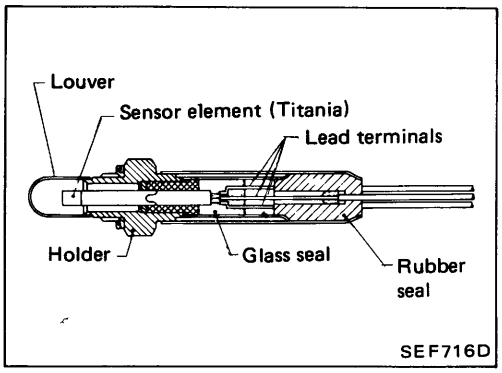
Fuel Injector

The fuel injector is a small, elaborate solenoid valve. As the E.C.U. sends injection signals to the injector, the coil in the injector pulls the ball valve back and fuel is released into the intake manifold through the nozzle. The injected fuel is controlled by the E.C.U. in terms of injection pulse duration.


SEF813J

Pressure Regulator

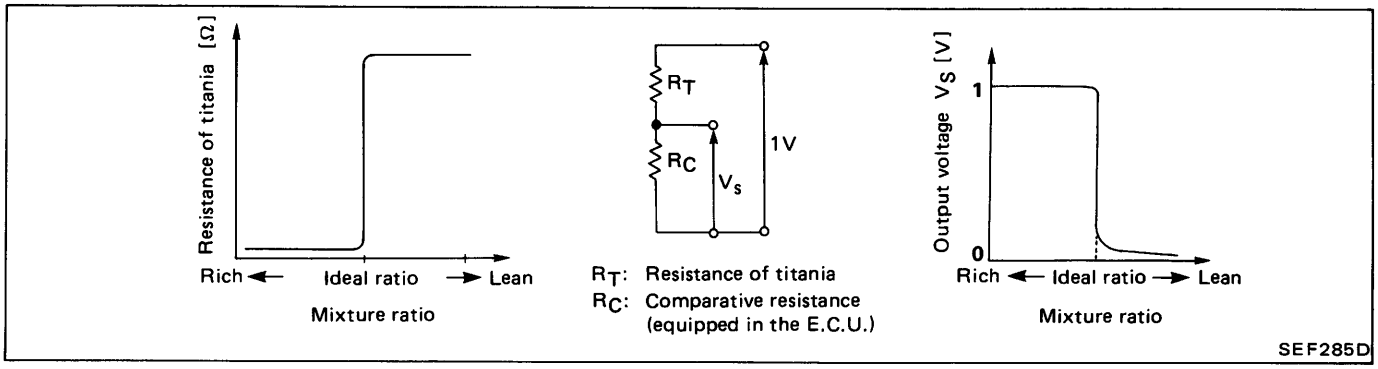
The pressure regulator maintains the fuel pressure at 299.1 kPa (3.05 kg/cm^2, 43.4 psi). Since the injected fuel amount depends on injection pulse duration, it is necessary to maintain the pressure at the above value.



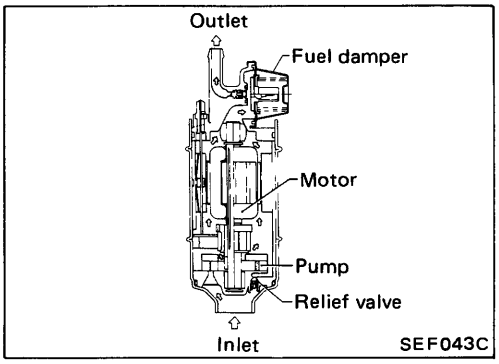
SEF716D

Exhaust Gas Sensor

The exhaust gas sensor, located in the exhaust tube, monitors the oxygen level in the exhaust gas.
This sensor is made of ceramic titania, the electric resistance of which drastically changes at the ideal air-fuel ratio.
The E.C.U. supplies the sensor with approximately 1V and then measures the output voltage depending on its resistance.
In order to activate the sensor element, it is equipped with a heater.



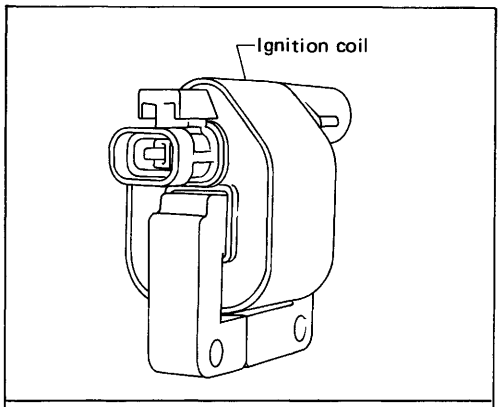
SEF285D



SEF043C

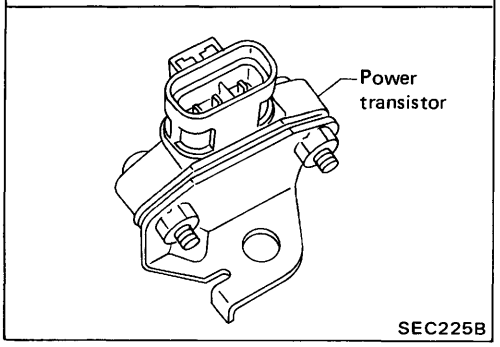
Fuel Pump

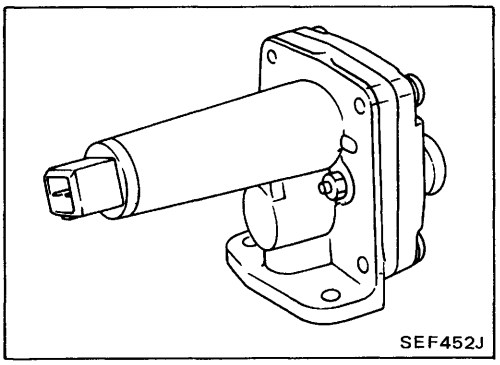
The fuel pump with a fuel damper is an in-tank type, that is the pump and damper are located in the fuel tank.
The vane rollers are directly coupled to a motor which is cooled by the fuel.



Power Transistor & Ignition Coil

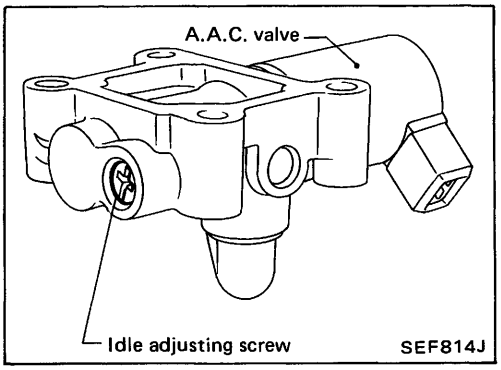
The ignition signal from the E.C.U. is amplified by the power transistor, which turns the ignition coil primary circuit on and off, inducing the proper high voltage in the secondary circuit. The ignition coil is a small, molded type.





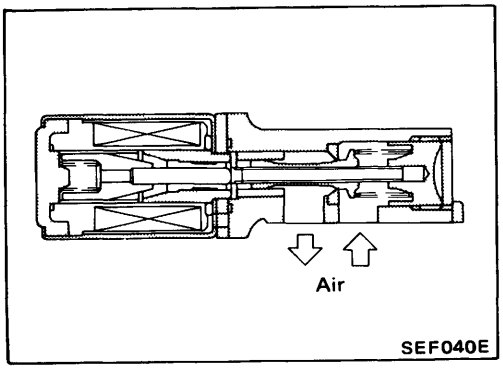
Air Regulator

The air regulator provides an air by-pass when the engine is cold for a fast idle during warm-up.
A bimetal, heater and rotary shutter are built into the air regulator. When the bimetal temperature is low, the air by-pass port opens. As the engine starts and electric current flows through a heater, the bimetal begins to turn the shutter to close the by-pass port. The air passage remains closed until the engine stops and the bimetal temperature drops.



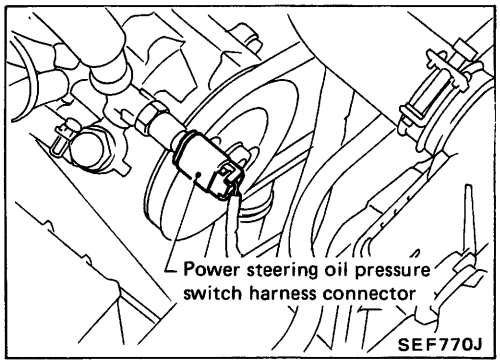
Idle Air Adjusting (I.A.A.) Unit

The I.A.A. unit is made up of the A.A.C. valve and idle adjusting screw. It receives the signal from the E.C.U. and controls the idle speed at the preset value.



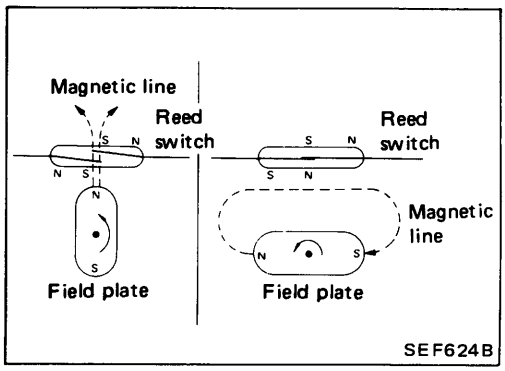
Auxiliary Air Control (A.A.C.) Valve

The E.C.U. actuates the A.A.C. valve by an ON/OFF pulse. The longer that ON duty is left on, the larger the amount of air that will flow through the A.A.C. valve.



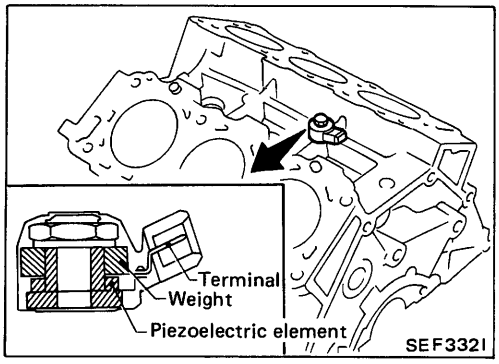
Power Steering Oil Pressure Switch

The power steering oil pressure switch is attached to the power steering high-pressure tube and detects the power steering load, sending the load signal to the E.C.U. The E.C.U. then sends the idle-up signal to the A.A.C valve.



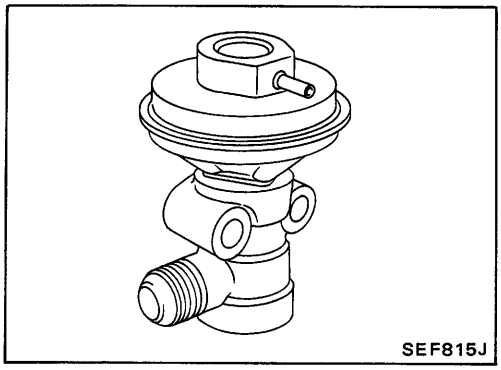
Vehicle Speed Sensor

The vehicle speed sensor provides a vehicle speed signal to the E.C.U.
The speed sensor consists of a reed switch, which is installed in the speedometer unit and transforms vehicle speed into a pulse signal.



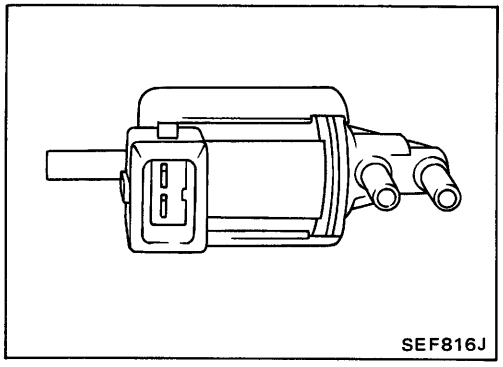
Detonation Sensor

The detonation sensor is attached to the cylinder block and senses engine knocking conditions.
A knocking vibration from the cylinder block is applied as pressure to the piezoelectric element. This vibrational pressure is then converted into a voltage signal which is sent to the E.C.U.



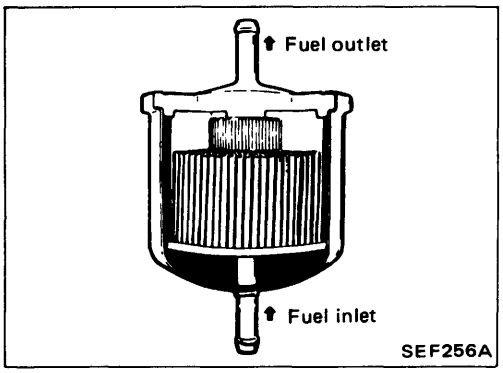
E.G.R. Control Valve

The E.G.R. control valve controls the quantity of exhaust gas to be led to the intake manifold through vertical movement of the taper valve connected to the diaphragm, to which vacuum is applied in response to the opening of the throttle valve.



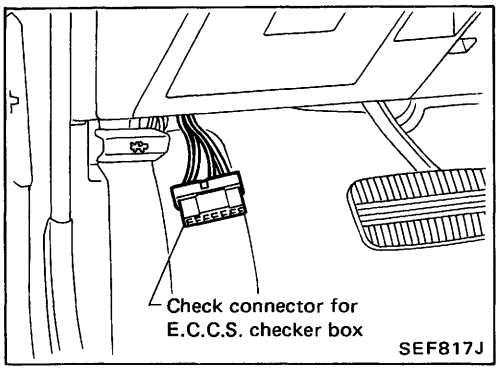
E.G.R. Control Solenoid Valve

The E.G.R. system is controlled only by the E.C.U. At both low- and high-speed revolutions of engine, the solenoid valve turns on and accordingly the E.G.R. valve cuts the exhaust gas leading to the intake manifold.



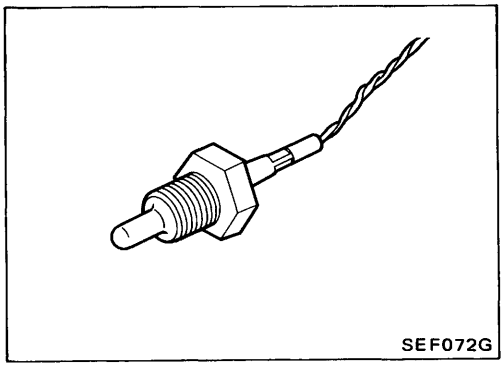
Fuel Filter

The specially designed fuel filter has a metal case in order to withstand high fuel pressure.



Check Connector for E.C.C.S. Checker Box

The check connector for E.C.C.S. checker box is located in the instrument panel to the rear of the hood opener.

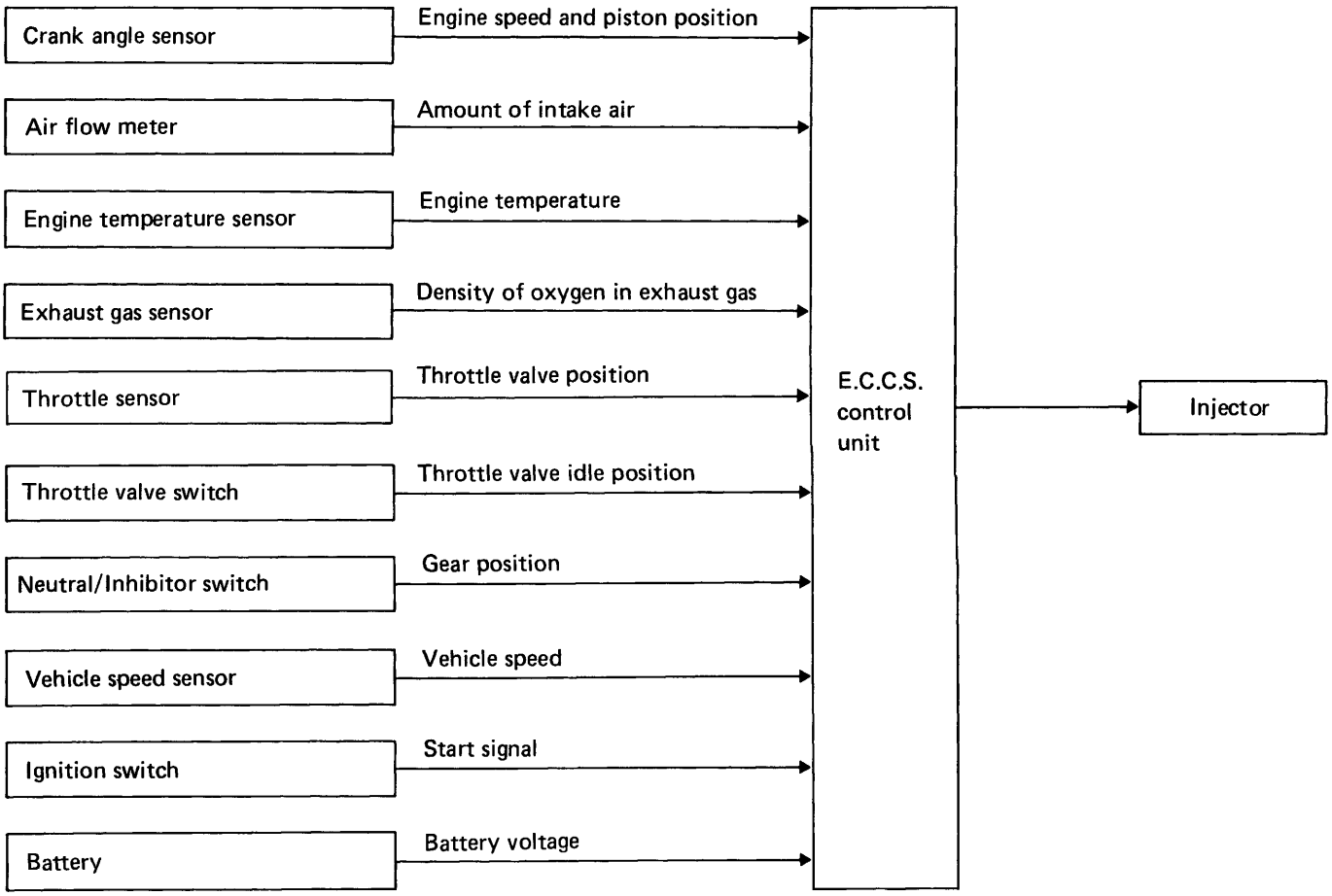


Exhaust Gas Temperature Sensor

The exhaust gas temperature sensor monitors in exhaust gas temperature and transmits a signal to the E.C.U. The temperature sensing unit employs a thermistor which is sensitive to the change in temperature. Electric resistance of the thermistor decreases in response to the temperature rise.

Fuel Injection Control

INPUT/OUTPUT SIGNAL LINE



BASIC FUEL INJECTION CONTROL

The amount of fuel injected from the fuel injector, or the length of time the valve remains open, is determined by the E.C.U. The basic amount of fuel injected is a program value mapped in the E.C.U. ROM memory. In other words, the program value is preset by engine operating conditions determined by input signals (for engine rpm and air intake) from both the crank angle sensor and the air flow meter.

VARIOUS FUEL INJECTION INCREASE/DECREASE COMPENSATION

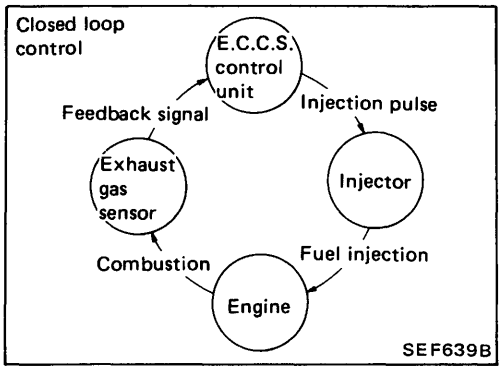
In addition, the amount of fuel injection is compensated for to improve engine performance under various operating conditions as listed below.

<Fuel increase>

1) During warm-up
2) When starting the engine
3) During acceleration
4) Hot-engine operation

<Fuel decrease>

1) During deceleration



Fuel Injection Control (Cont'd)

MIXTURE RATIO FEEDBACK CONTROL

Mixture ratio feedback system is designed to precisely control the mixture ratio to the stoichiometric point so that the three-way catalyst can reduce CO, HC and NOx emissions. This system uses an exhaust gas sensor in the exhaust manifold to check the air-fuel ratio. The control unit adjusts the injection pulse width according to the sensor voltage so the mixture ratio will be within the range of the stoichiometric air-fuel ratio.

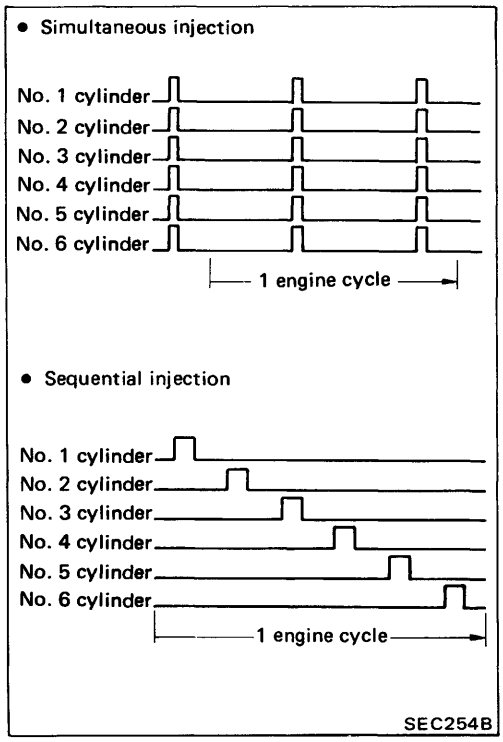
This stage refers to the closed-loop control condition. The open-loop control condition refers to that under which the E.C.U. detects any of the following conditions and feedback control stops in order to maintain stabilized fuel combustion.

1) Deceleration
2) High-load, high-speed operation
3) Engine idling
4) Malfunction of exhaust gas sensor or its circuit
5) Insufficient activation of exhaust gas sensor at low engine temperature
6) Engine starting

MIXTURE RATIO SELF-LEARNING CONTROL

The mixture ratio feedback control system monitors the mixture ratio signal transmitted from the exhaust gas sensor. This feedback signal is then sent to the E.C.U. to control the amount of fuel injection to provide a basic mixture ratio as close to the theoretical mixture ratio as possible. However, the basic mixture ratio is not necessarily controlled as originally designed. This is due to manufacturing errors (e.g., air flow meter hot wire) and changes during operation (injector clogging, etc.) of E.C.C.S. parts which directly affect the mixture ratio.

Accordingly, a difference between the basic and theoretical mixture ratios is quantitatively monitored in this system. It is then computed in terms of "fuel injection duration" to automatically compensate for the difference between the two ratios.



FUEL INJECTION TIMING

Two types of fuel injection systems are used — simultaneous injection and sequential injection. In the former, fuel is injected into all six cylinders simultaneously twice each engine cycle.

In other words, pulse signals of the same width are simultaneously transmitted from the E.C.U. to the six injectors two times for each engine cycle.

In the sequential injection system, fuel is injected into each cylinder during each engine cycle according to the firing order. When engine is starting, fuel is injected into all six cylinders simultaneously twice a cycle.

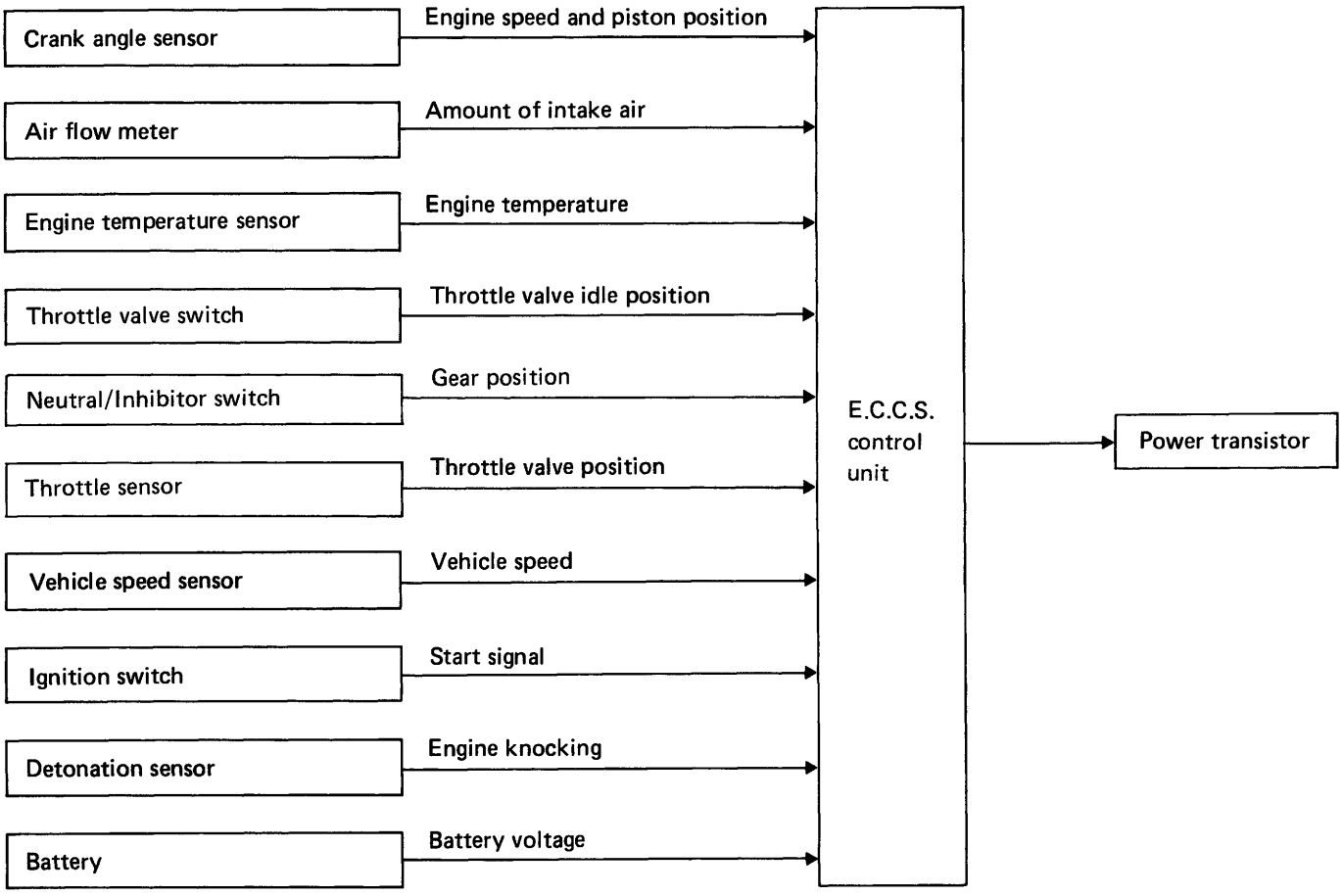
Fuel Injection Control (Cont'd)

FUEL SHUT-OFF

Fuel to each cylinder is cut off during deceleration or high-speed operation.

Ignition Timing Control

INPUT/OUTPUT SIGNAL LINE



Ignition Timing Control (Cont'd)

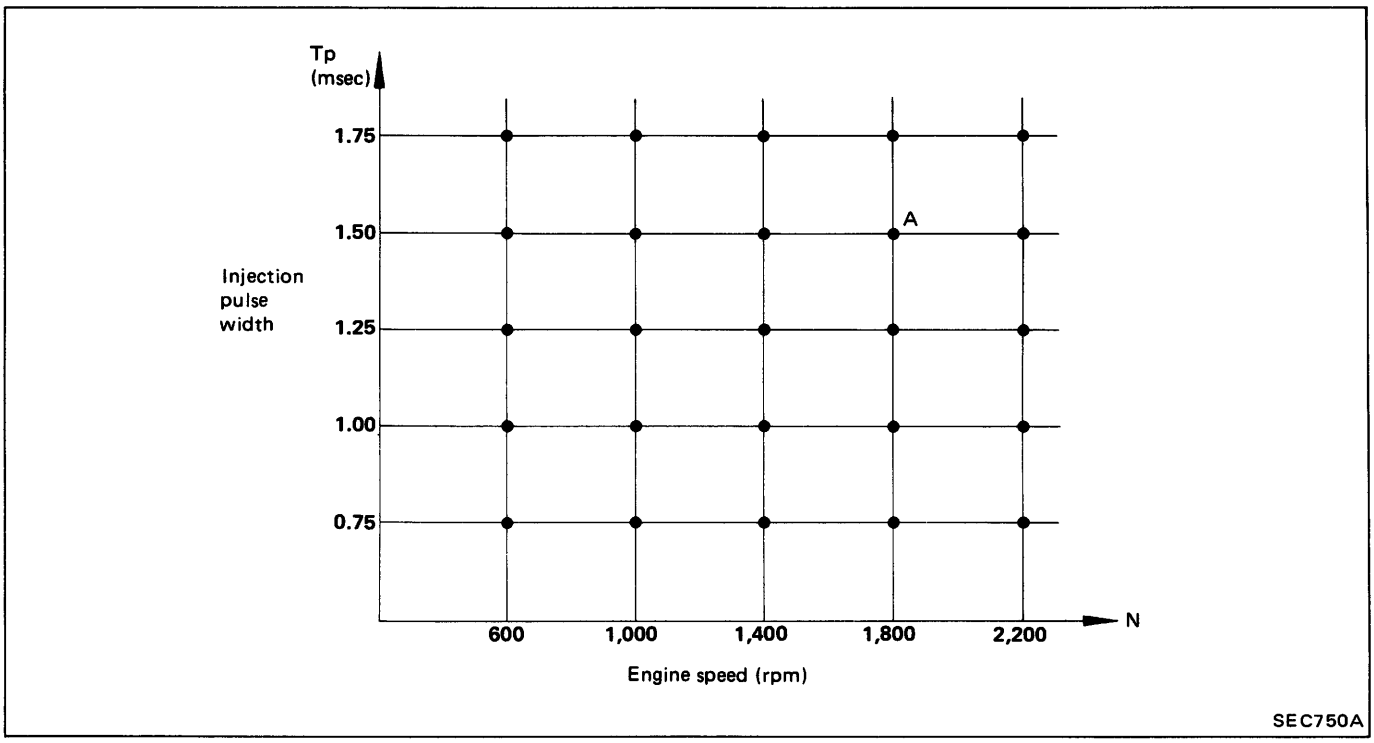
SYSTEM DESCRIPTION

The ignition timing is controlled by the E.C.U. in order to maintain the best air-fuel ratio in response to every running condition of the engine.
The ignition timing data is stored in the ROM located in the E.C.U., in the form of the map shown below.
The E.C.U. detects information such as the injection pulse width and crank angle sensor signal which varies every moment. Then responding to this information, ignition signals are transmitted to the power transistor.

e.g. N: 1,800 rpm, Tp: 1.50 msec
A °B.T.D.C.

In addition to this,
1) At starting
2) During warm-up
3) At idle
4) At low battery voltage

the ignition timing is revised by the E.C.U. according to the other data stored in the ROM.

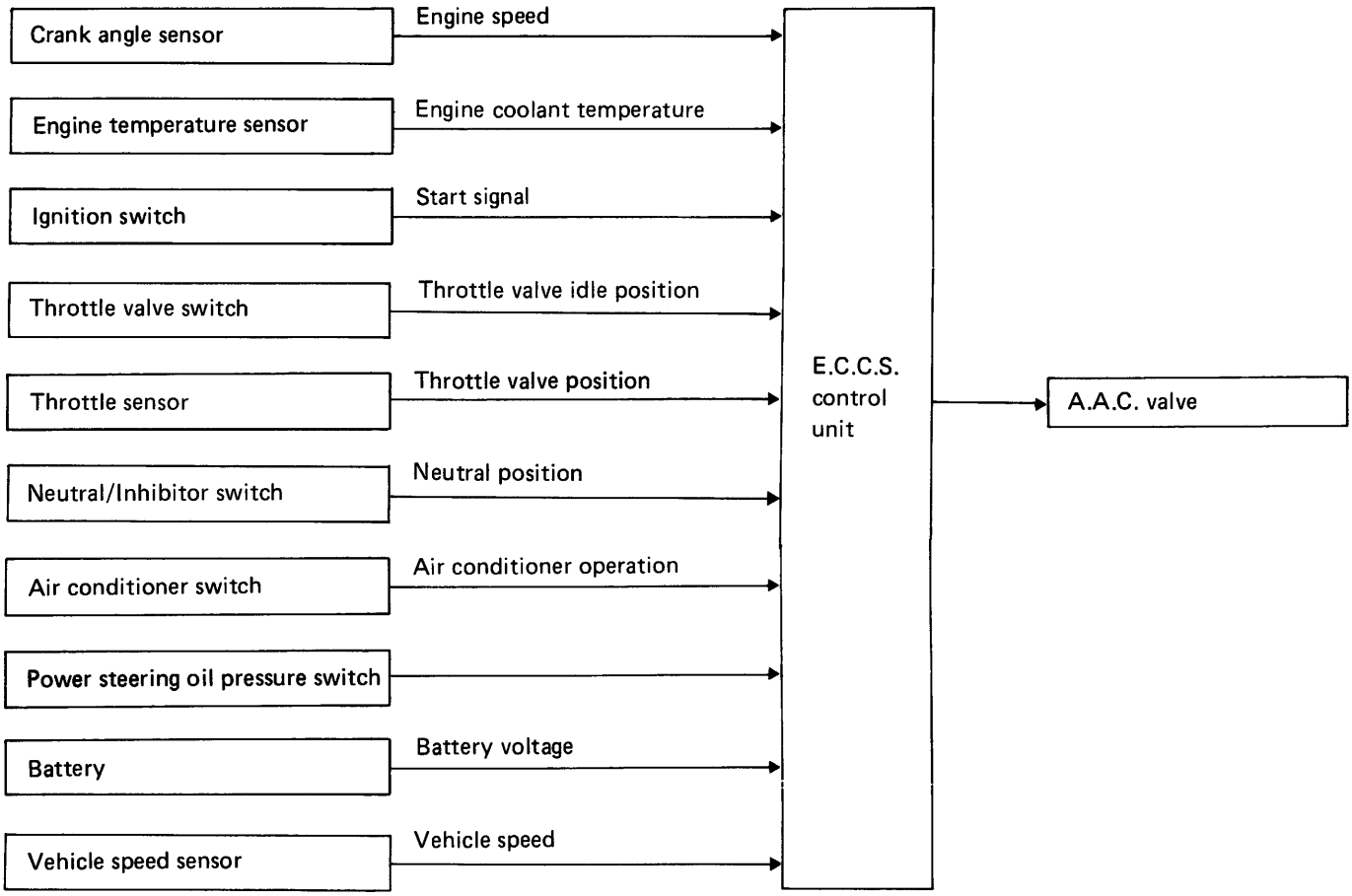


The retard system by detonation sensor is designed only for emergencies. The basic ignition timing is pre-programmed within the anti-knocking zone, even if recommended fuel is used under dry conditions. Consequently, the retard system does not operate under normal driving conditions.

However, if engine knocking occurs, the detonation sensor monitors the condition and the signal is transmitted to the E.C.C.S. control unit. After receiving it, the control unit retards the ignition timing to avoid the knocking condition.

Idle Speed Control

INPUT/OUTPUT SIGNAL LINE

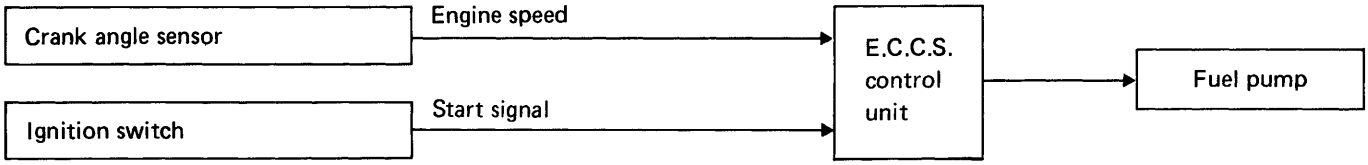


SYSTEM DESCRIPTION

This system automatically controls engine idle speed to a specified level. Idle speed is controlled through fine adjustment of the amount of air which by-passes the throttle valve via A.A.C. valve. The A.A.C. valve changes the opening of the air by-pass passage to control the amount of auxiliary air. The opening of the valve is varied to allow for optimum control of the engine idling speed. The crank angle sensor detects the actual engine speed and sends a signal to the E.C.U. The E.C.U. then controls the ON/OFF time of the A.A.C. valve so that engine speed coincides with the target value memorized in ROM. The target engine speed is the lowest speed at which the engine can operate steadily. The optimum value stored in the ROM is determined by taking into consideration various engine conditions, such as warming up and during deceleration, fuel consumption, and engine load (air conditioner, electrical load).

Fuel Pump Control

INPUT/OUTPUT SIGNAL LINE



SYSTEM DESCRIPTION

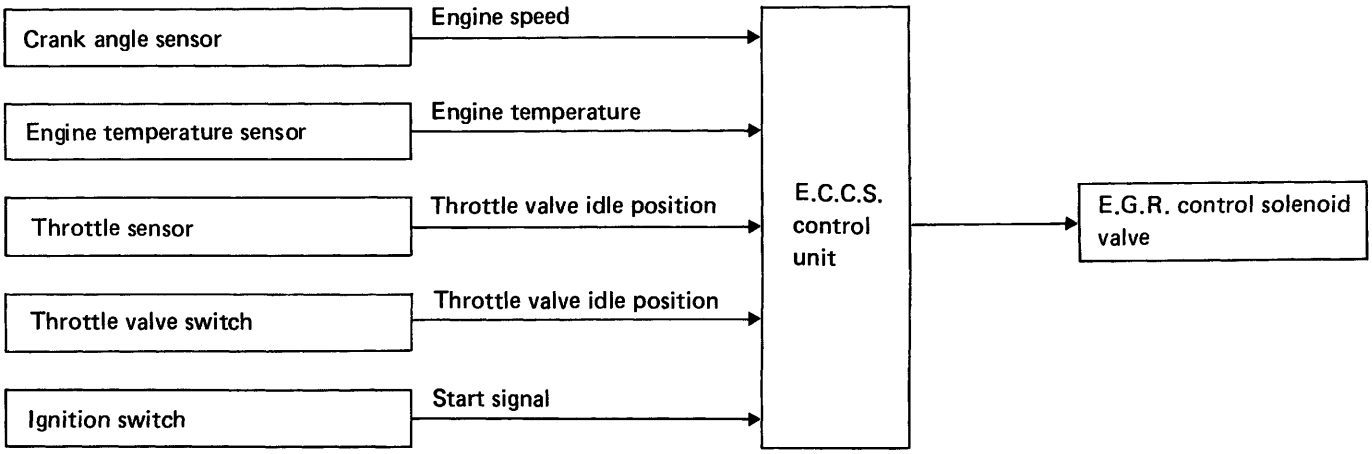
To reduce power consumption, fuel pump relay ON-OFF operation controls the fuel pump as follows:

Fuel pump ON-OFF control

Ignition switch position	Engine condition	Fuel pump relay	Fuel pump operation
ON	Stopped	ON → OFF	Operates for a few seconds after ignition switch turns to "ON"
	Starting	ON	Operates
	Running	ON	Operates

E.G.R. (Exhaust Gas Recirculation) Control

INPUT/OUTPUT SIGNAL LINE



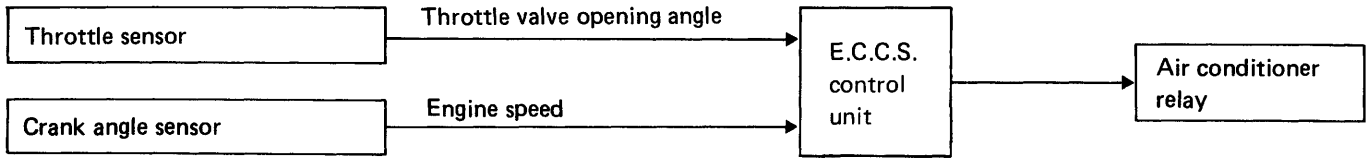
SYSTEM DESCRIPTION

In addition, a system is provided which precisely cuts and controls port vacuum applied to the E.G.R. valve to suit engine operating conditions. This cut-and-control operation is accomplished through the E.C.U. When the E.C.U. detects any of the following conditions, current flows through the solenoid valve in the E.G.R. control vacuum line. This causes the port vacuum to be discharged into the atmosphere so that the E.G.R. control valve remains closed.

1) Low engine temperature
2) Engine starting
3) High-speed engine operation
4) Engine idling
5) Excessively high engine temperature
6) C.P.U. malfunction of E.C.U. and crank angle sensor malfunction

Acceleration Cut Control

INPUT/OUTPUT SIGNAL LINE



SYSTEM DESCRIPTION

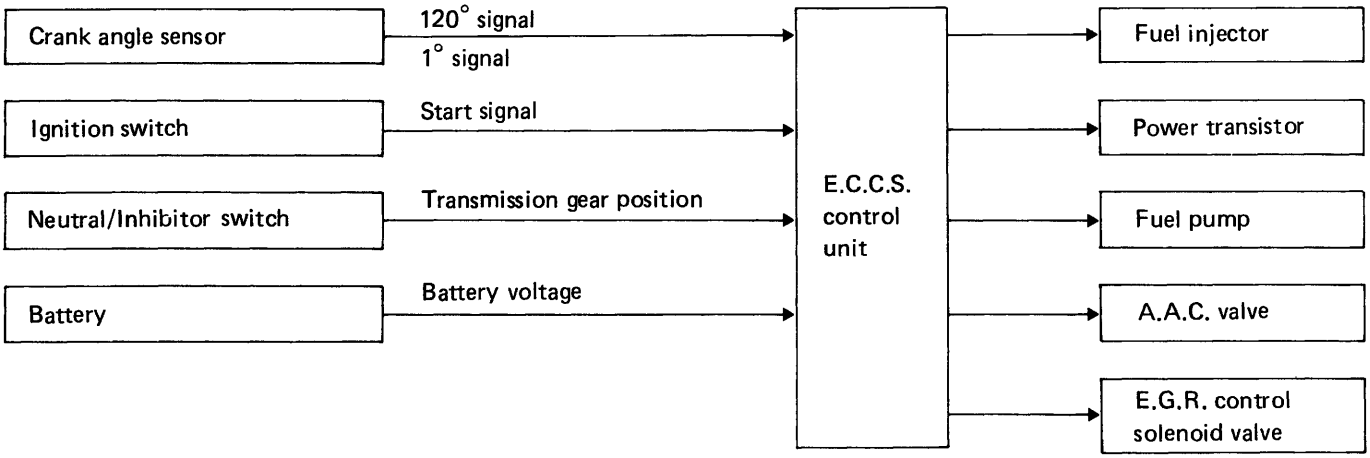
Air conditioner is turned off for a few seconds during accelerating condition.

This system improves acceleration when air conditioner is used.

Fail-safe System

C.P.U. MALFUNCTION OF E.C.U. AND CRANK ANGLE SENSOR MALFUNCTION

Input/output signal line



Outline

The fail-safe system makes engine starting possible if there is something malfunctioning in the E.C.U.'s C.P.U. circuit, or if there is a disconnection or short/open circuit in the crank angle sensor circuit. In former models, engine starting was difficult under the conditions mentioned above. But with the provisions provided in this fail-safe system, it is possible to start the engine.

Fail-safe system activating condition when crank angle sensor is malfunctioning

The fail-safe mode operation starts immediately after all of the following conditions have been satisfied for several seconds.

(1) No pulse of 120° signal (reference signal) detected for several seconds, or 1° signal (position signal) is equivalent to 0 rpm.
(2) Ignition switch in START
(3) Battery voltage is greater than 10 volts with ignition switch ON.
(4) The neutral switch is ON, or the inhibitor switch is in the "P" or "N" position.
(5) When ignition switch is in START, battery voltage is at least 1 volt lower than when ignition switch is ON.

Fail-safe system activating condition when E.C.U. is malfunctioning

The computing function of the E.C.U. was judged to be malfunctioning.

When the fail-safe system activates, i.e. if the E.C.U. detects a malfunction condition in the C.P.U. of E.C.U. or crank angle sensor circuit, the CHECK ENGINE LIGHT on the instrument panel lights to warn the driver.

Fail-safe System (Cont'd)

Engine control, with fail-safe system, operates when E.C.U. or crank angle sensor is malfunctioning

When the fail-safe system is operating, fuel injection, ignition timing, fuel pump operation, engine idle speed, and E.G.R. operation, are controlled under certain limitations.

Cancellation of fail-safe system when E.C.U. or crank angle sensor is malfunctioning

Activation of the fail-safe system is canceled each time the ignition switch is turned OFF. The system is reactivated if all of the above-mentioned activating conditions are satisfied after turning the ignition switch from OFF to ON.

AIR FLOW METER MALFUNCTION

If the air flow meter output voltage is above or below the specified value, the E.C.U. senses an air flow meter malfunction. In case of a malfunction, the throttle sensor substites for the air flow meter.

Though air flow meter is malfunctioning, it is possible to drive the vehicle and start the engine. But engine speed will not rise more than 3,000 rpm in order to inform the driver of fail-safe system operation while driving.

Operation

Engine condition	Starter switch	Fail-safe system	Fail-safe functioning
Stopped	ANY	Does not operate	–
Cranking	ON	Operates	Engine will be started by a pre-determined injection pulse on E.C.U.
Running	OFF		Engine speed will not rise above 3,000 rpm

ENGINE TEMPERATURE SENSOR MALFUNCTION

When engine temperature sensor output voltage is below or above the specified value, water temperature is fixed at the preset value as follows:

Operation

Condition	Engine temperature decided
Just as ignition switch is turned ON or Start	20°C (68°F)
More than 6 minutes after ignition ON or Start	80°C (176°F)
Except as shown above	20 - 80°C (68 - 176°F) (Depends on the time)

DETONATION SENSOR MALFUNCTION

When the output signal of the detonation sensor is abnormal, the E.C.U. judges it to be malfunctioning. When detonation sensor is malfunctioning, ignition timing will retard according to operating conditions.

THROTTLE SENSOR MALFUNCTION

When throttle sensor output voltage is below or above the specified value, throttle sensor output is fixed at the preset value.

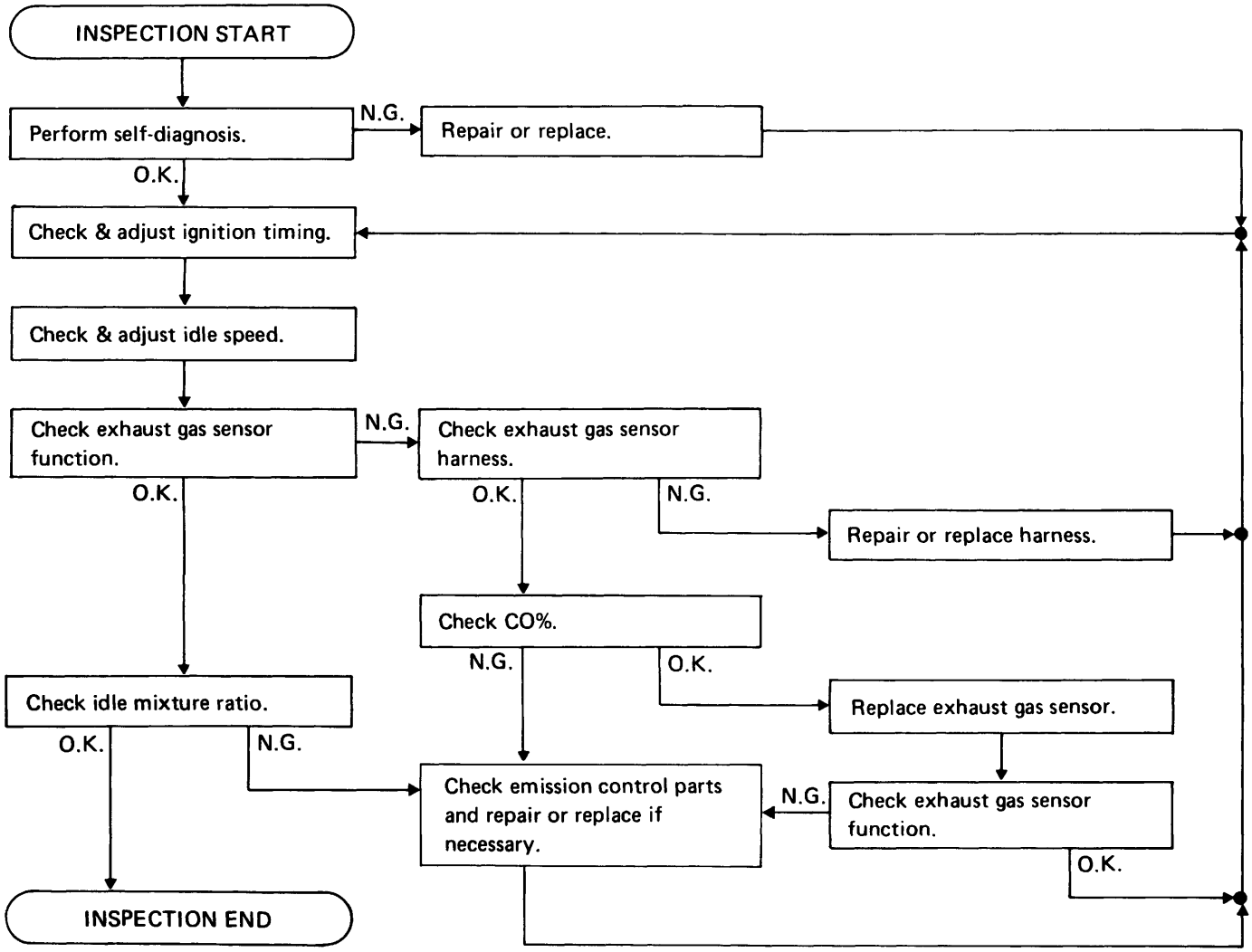
PREPARATION

1. Make sure that the following parts are in good order.
- Battery
- Ignition system
- Engine oil and coolant levels
- Fuses
- E.C.U. S.M.J. harness connector
- Vacuum hoses
- Air intake system
  (Oil filler cap, oil level gauge, etc.)
- Fuel pressure
- Engine compression
- E.G.R. control valve operation
- Throttle valve

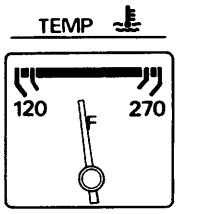
2. On air conditioner equipped models, checks should be carried out while the air conditioner is "OFF".
3. On automatic transmission equipped models, when checking idle rpm, ignition timing and mixture ratio, checks should be carried out while shift lever is in "N" position.
4. When measuring "CO" percentage, insert probe more than 40 cm (15.7 in) into tail pipe.
5. Turn off headlamps, heater blower, rear defogger.
6. Keep front wheels pointed straight ahead.
7. Make the check after the radiator fan has stopped.

WARNING:
Apply parking brake and block both front and rear wheels with chocks.

Overall inspection sequence



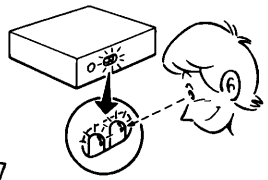
Idle check and set procedure

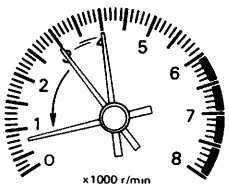


SEF246F



SEF247F


SEF292H



SEF248F

INSPECTION START

Visually check the following:
- Air cleaner clogging
- Hoses and ducts for leaks
- E.G.R. control valve operation
- Electrical connectors
- Gaskets
- Throttle valve switch operation

Start engine and warm it up until water temperature indicator points to the middle of gauge.

Open engine hood and run engine at about 2,000 rpm for about 2 minutes under no-load.

Perform E.C.C.S. self-diagnosis (Mode III, IV, V).

O.K. / N.G.

Repair or replace components as necessary.

Does engine run smoothly?

Yes / No

Clean injectors.

Race engine two or three times under no-load and run engine for about one minute at idle speed.

Check ignition timing.

A/T: 15°±2° B.T.D.C. (A/T: in "N" position)
M/T:

O.K. / N.G.

Adjust ignition timing by turning distributor after loosening bolt which secures distributor.

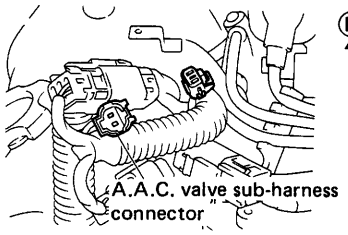
Ⓐ Ⓑ

Check idle speed (A/T: in "N" position).

A/T: M/T: 750±50 rpm

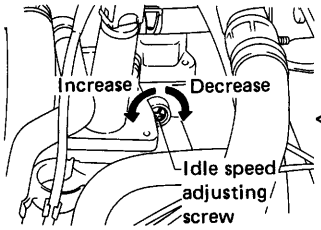
O.K.

N.G.



SEF825J

Disconnect A.A.C. valve sub-harness connector.



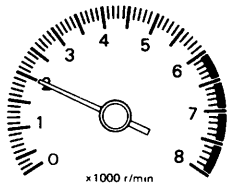
SEF826J

Adjust engine speed by turning idle speed adjusting screw (A/T: in "N" position).

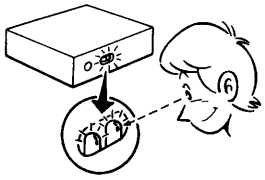
A/T: M/T: 700 rpm

Reconnect A.A.C. valve sub-harness connector.

Run engine at about 2,000 rpm for about 2 minutes under no-load.



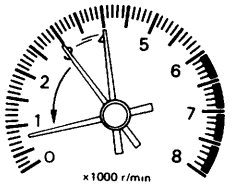
SEF247F


SEF292H

Keep engine speed at 2,000 rpm and make sure that green inspection lamp on E.C.U. goes ON and OFF more than 5 times during 10 seconds.

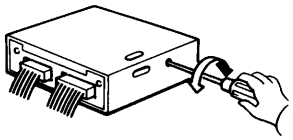
N.G.

O.K.



SEF248F

Race engine two or three times under no-load, then run engine at idle speed.


SEF957D

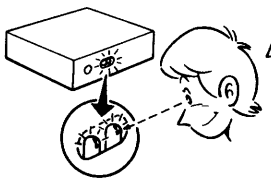
Set the diagnosis mode selector on E.C.U. to Mode II.

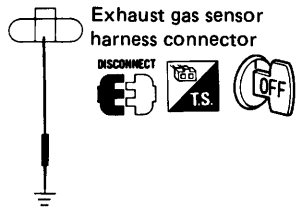
N.G.

Make sure that inspection lamps (red and green) go on and off more than 5 times simultaneously during 10 seconds at 2,000 rpm under no-load.

O.K.

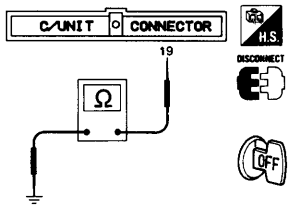
INSPECTION END


SEF292H



As for the location of exhaust gas sensor harness connector, refer to page EF & EC-110.

SEC240B



SEC241B

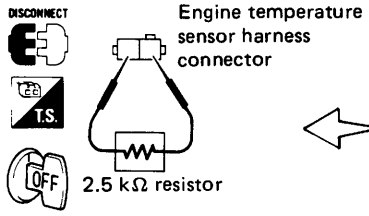
Check exhaust gas sensor harness:
1) Turn off engine and disconnect battery ground cable.
2) Disconnect E.C.U. S.M.J. harness connector from E.C.U.
3) Disconnect exhaust gas sensor harness connector and connect main harness side terminal for exhaust gas sensor to ground with a jumper wire.
4) Check for continuity between terminal No. 19 of E.C.U. S.M.J. harness connector and body ground.

Continuity exists . . . . . O.K.
Continuity does not exist . . . . . N.G.

O.K. | N.G.

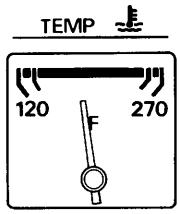
Repair or replace harness.

Connect S.M.J. harness connector to E.C.U.



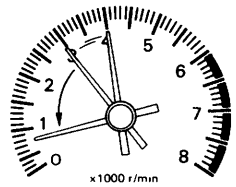
SEC242B

1) Disconnect engine temperature sensor harness connector.
2) Connect a resistor (2.5 kΩ) between terminals of engine temperature sensor harness connector.
3) Disconnect a jumper wire connected to exhaust gas sensor harness connector (main harness side).



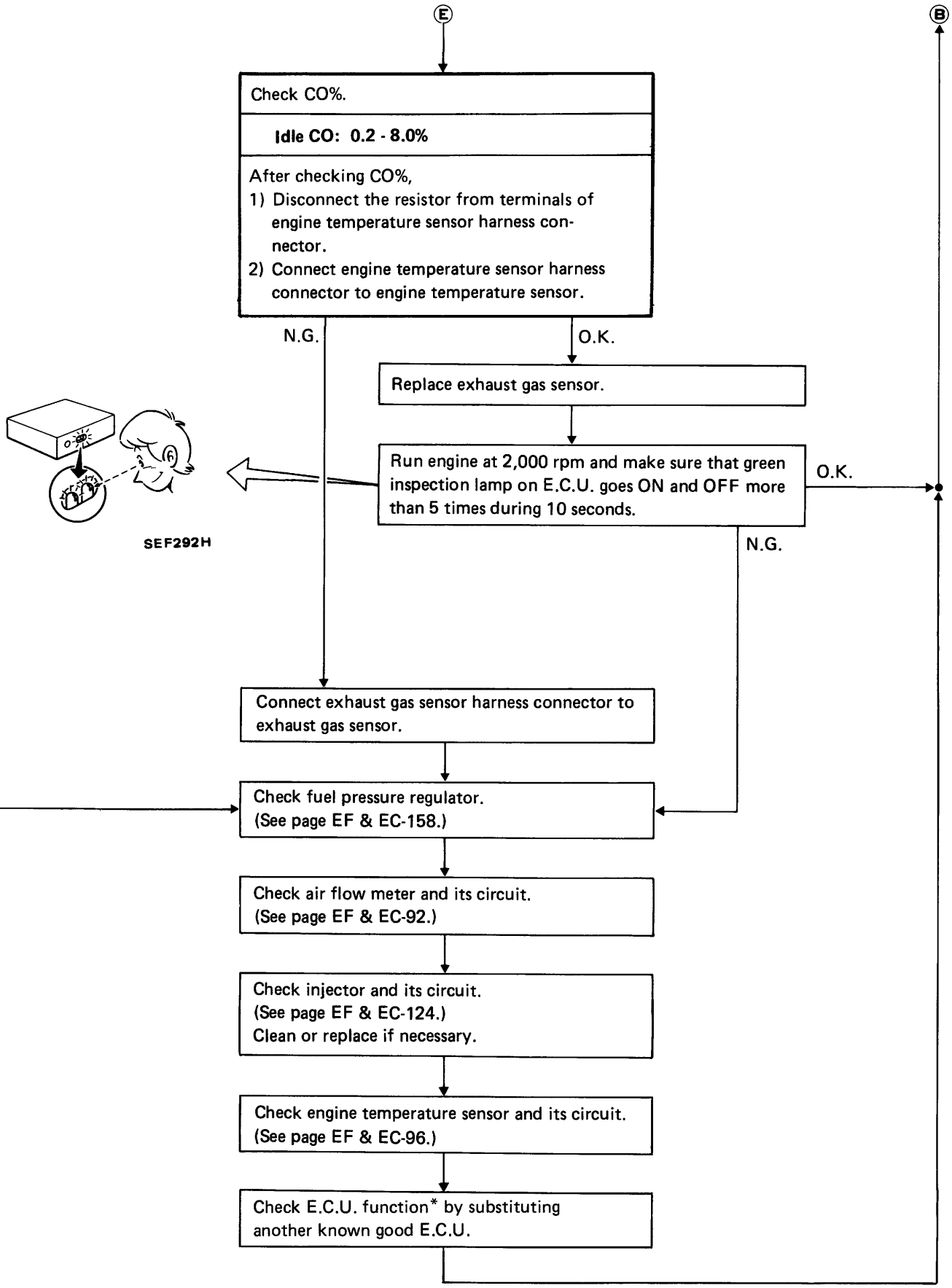
SEF246F

Connect battery ground cable, start engine and warm it up until water temperature indicator points to middle of gauge.



SEF248F

Race engine two or three times under no-load, then run engine at idle.



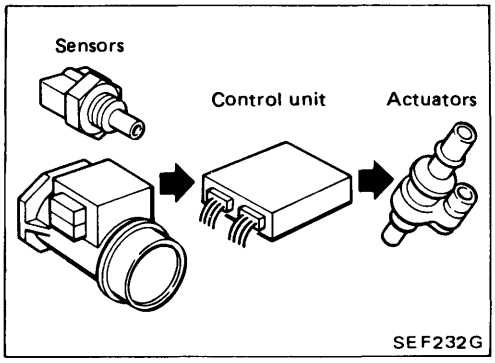
*: E.C.U. may be the cause of a problem, but this is rarely the case.

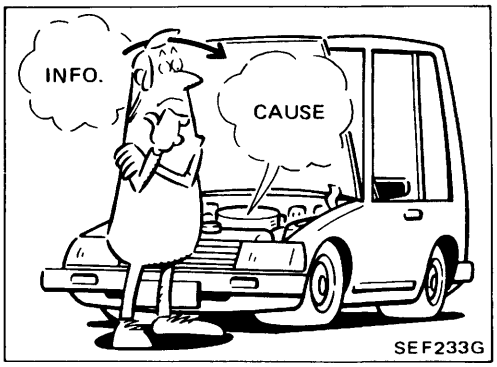
Contents

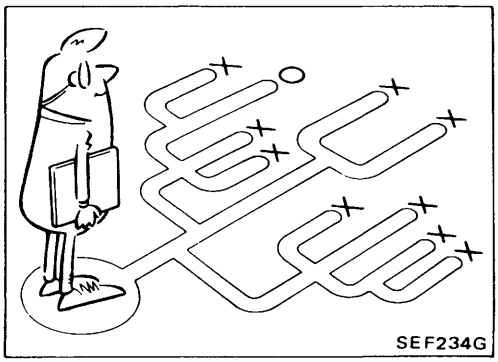
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How to Perform Trouble Diagnoses for Quick and Accurate Repair

INTRODUCTION

The engine has an electronic control unit to control major systems such as fuel control, ignition control, idle speed control, etc. The control unit accepts input signals from sensors and instantly drives actuators. It is essential that both kinds of signals are proper and stable. At the same time, it is important that there are no conventional problems such as vacuum leaks, fouled spark plugs, or other problems with the engine.

It is much more difficult to diagnose a problem that occurs intermittently rather than continuously. Most intermittent problems are caused by poor electric connections or improper wiring. In this case, careful checking of suspected circuits may help prevent the replacement of good parts.

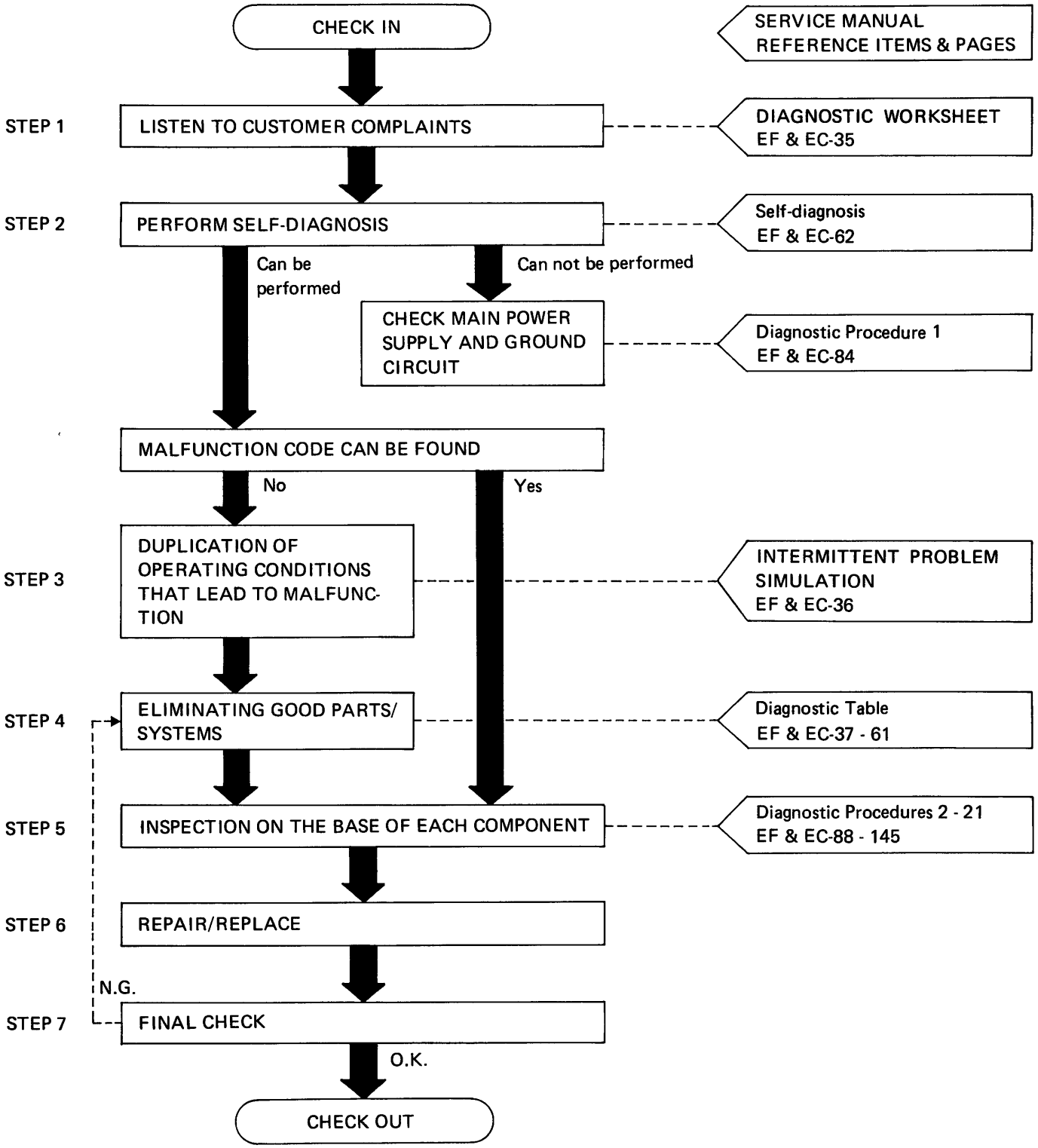
A visual check only may not find the cause of the problems, so a road test with a circuit tester connected to a suspected circuit should be performed.

Before undertaking actual checks, take just a few minutes to talk with a customer who approaches with a driveability complaint. The customer is a very good supplier of information on such problems, especially intermittent ones. Through interaction with the customer, find out what symptoms are present and under what conditions they occur.

Start your diagnosis by looking for "conventional" problems first. This is one of the best ways to troubleshoot driveability problems on an electronically controlled engine vehicle.

How to Perform Trouble Diagnoses for Quick and Accurate Repair (Cont'd)

WORK FLOW



KEY POINTS

WHAT ..... Vehicle & engine model
WHEN ..... Date, Frequencies
WHERE ..... Road conditions
HOW ..... Operating conditions, Weather conditions, Symptoms

How to Perform Truoble Diagnoses for Quick and Accurate Repair (Cont'd)

DIAGNOSTIC WORKSHEET

There are many kinds of operating conditions that lead to malfunctions on engine components.

A good grasp of such conditions can make trouble-shooting faster and more accurate.

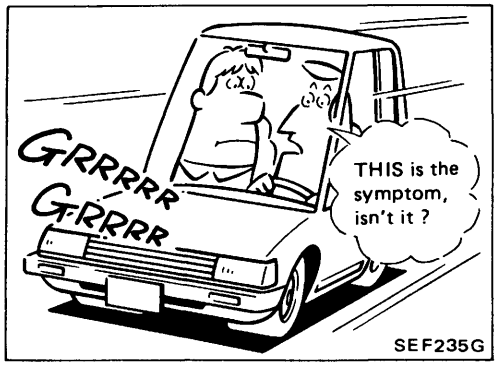
In general, feelings for a problem depend on each customer. It is important to fully understand the symptoms or under what conditions a customer complains.

Make good use of a diagnostic worksheet such as the one shown below in order to utilize all the complaints for trouble-shooting.

Worksheet sample

Customer name MR/MS	Model & Year	VIN
Engine #	Trans.	Mileage
Incident Date	Manuf. Date	In Service Date

Symptoms	☐ Startability	☐ Impossible to start ☐ No combustion ☐ Partial combustion ☐ Partial combustion affected by throttle position ☐ Partial combustion NOT affected by throttle position ☐ Possible but hard to start ☐ Others [ ]
	☐ Idling	☐ No fast idle ☐ Unstable ☐ High idle ☐ Low idle ☐ Others [ ]
	☐ Driveability	☐ Stumble ☐ Surge ☐ Detonation ☐ Lack of power ☐ Intake backfire ☐ Exhaust backfire ☐ Others [ ]
	☐ Engine stall	☐ At the time of start ☐ While idling ☐ While accelerating ☐ While decelerating ☐ Just after stopping ☐ While loading
Incident occurrence		☐ Just after delivery ☐ Recently ☐ In the morning ☐ At night ☐ In the daytime
Frequency		☐ All the time ☐ Under certain conditions ☐ Sometimes
Weather conditions		☐ Not affected
	Weather	☐ Fine ☐ Raining ☐ Snowing ☐ Others [ ]
	Temperature	☐ Hot ☐ Warm ☐ Cool ☐ Cold ☐ Humid °F
Engine conditions		☐ Cold ☐ During warm-up ☐ After warm-up Engine speed 0 2,000 4,000 6,000 8,000 rpm
Road conditions		☐ In town ☐ In suburbs ☐ Highway ☐ Off road (up/down)
Driving conditions		☐ Not affected ☐ At starting ☐ While idling ☐ At racing ☐ While accelerating ☐ While cruising ☐ While decelerating ☐ While turning (RH/LH) Vehicle speed 0 10 20 30 40 50 60 MPH
Check engine light		☐ Turned on ☐ Not turned on



How to Perform Trouble Diagnoses for Quick and Accurate Repair (Cont'd)

INTERMITTENT PROBLEM SIMULATION

In order to duplicate an intermittent problem, it is effective to create similar conditions for component parts, under which the problem might occur.
Perform the activity listed under Service procedure and note the result.

	Variable factor	Influential part	Target condition	Service procedure
1	Mixture ratio	Pressure regulator	Made lean	Remove vacuum hose and apply vacuum.
			Made rich	Remove vacuum hose and apply pressure.
2	Ignition timing	Crank angle sensor	Advanced	Rotate distributor counter clockwise.
			Retarded	Rotate distributor clockwise.
3	Mixture ratio feedback control	Exhaust gas sensor	Suspended	Disconnect exhaust gas sensor harness connector.
		Control unit	Operation check	Perform self-diagnosis (Mode I/II) at 2,000 rpm.
4	Idle speed	A.A.C. valve	Raised	Turn idle adjusting screw counterclockwise.
			Lowered	Turn idle adjusting screw clockwise.
5	Electrical connection (Electric continuity)	Harness connectors and wires	Poor electrical connection or improper wiring	Tap or wiggle.
				Race engine rapidly. See if the torque reaction of the engine unit causes electric breaks.
6	Temperature	Control unit	Cooled	Cool with an icing spray or similar device.
			Warmed	Heat with a hair drier. **[WARNING: Do not overheat the unit.]**
7	Moisture	Electric parts	Damp	Wet. **[WARNING: Do not directly pour water on components. Use a mist sprayer.]**
8	Electric loads	Load switches	Loaded	Turn on head lights, air conditioner, rear defogger, etc.
9	Idle switch condition	Control unit	ON-OFF switching	Rotate throttle sensor body.
10	Ignition spark	Timing light	Spark power check	Try to flash timing light for each cylinder using ignition coil adapter (S.S.T.).

Diagnostic Table

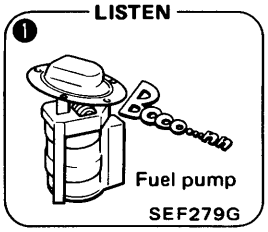
SYMPTOM & CONDITION 1 Impossible to start – no combustion

	POSSIBLE CAUSES	❶	❷	❸	❹	❺	❻	❼	❽
SPECIFICATIONS	Mixture ratio (too lean)	○	○						
	Ignition sparks (weak, missing)				○	○	○		
	Ignition timing							○	
FUEL SYSTEM	Fuel pump (no operation)	○							
	Fuel pump relay (open circuited)	○							
	Injectors (no operation, clogged)		○						
IGNITION SYSTEM	Ignition switch	○	○	○	○			○	
	Main relay	○	○	○	○			○	
	Power transistor			○	○			○	
	Ignition coil				○			○	
	Center cable (ignition leaks)				○			○	
	Ignition wires (ignition leaks)				○	○			
	Spark plugs						○		
CONTROL SYSTEM	Crank angle sensor	○	○		○			○	○

The numbers correspond to those in the chart below.
In the above chart, possible causes can be checked through the service procedure shown by the mark "○".

SERVICE PROCEDURE

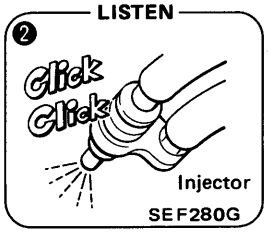
❶ LISTEN



Listen for fuel pump operating sound.

N.G. → Check fuel pump and/or related circuits. [See page EF & EC-134.]

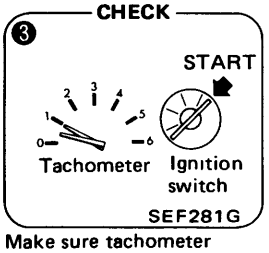
❷ LISTEN



Listen for injector operating sound.

N.G. → Check injector circuit. [See page EF & EC-124.]

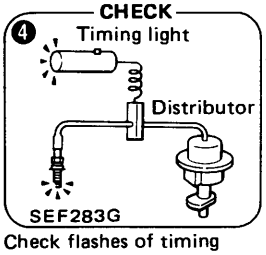
❸ CHECK



Make sure tachometer needle moves when cranking.

N.G. →

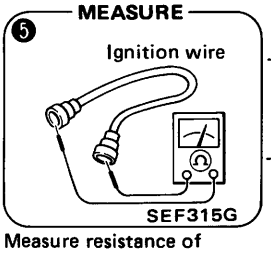
❹ CHECK



Check flashes of timing light for weakness.

N.G. →

❺ MEASURE

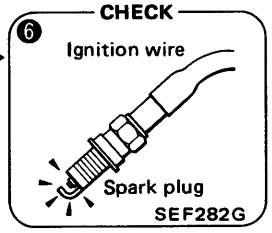


Measure resistance of suspect wires.

N.G. → Replace the wire.

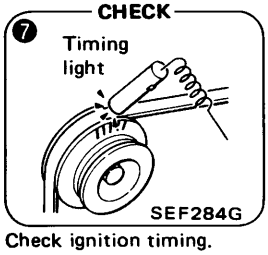
O.K. →

❻ CHECK



Remove spark plugs and check their ignition sparks.

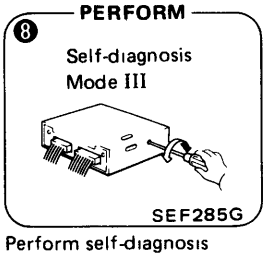
❼ CHECK



Check ignition timing.

N.G. → Adjust ignition timing. [See page EF & EC-26.]

❽ PERFORM



Perform self-diagnosis Mode III (for crank angle sensor).

N.G. → Check crank angle sensor and/or related circuits. [See page EF & EC-88.]

Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 2 **Impossible to start – partial combustion**

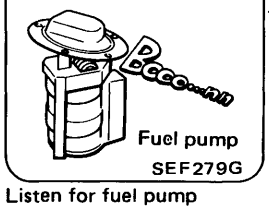
POSSIBLE CAUSES		❶	❷	❸	❹	❺
SPECIFICATIONS	Mixture ratio	○	○	○		
	Fuel pressure (too low)				○	
	Ignition timing					○
FUEL SYSTEM	Fuel pump	○				
	Fuel pump relay (open circuited)	○				
	Injectors (clogged)		○			

The numbers correspond to those in the chart below.

In the above chart, possible causes can be checked through the service procedure shown by the mark "○".

SERVICE PROCEDURE

❶ **LISTEN**

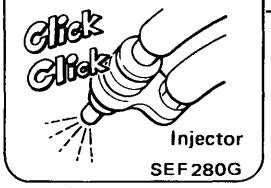


Listen for fuel pump operating sound.

N.G. → Check fuel pump and/or related circuits. [See page EF & EC-134.]

O.K. →

❷ **LISTEN**

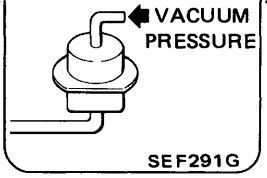


Listen for injector operating sound.

N.G. → Check injector circuit. [See page EF & EC-124.]

O.K. →

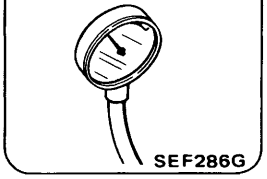
❸ **APPLY**



Remove vacuum hose from pressure regulator, and apply vacuum and/or pressure, and try to start.

Improved →

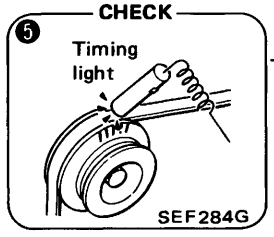
❹ **MEASURE** Fuel pressure gauge



Connect vacuum hose to pressure regulator and measure fuel pressure.

Check Mixture ratio feedback system. [See page EF & EC-26.]

❺ **CHECK**



Check ignition timing.

Adjust ignition timing. [See page EF & EC-26.]

Diagnostic Table (Cont'd)

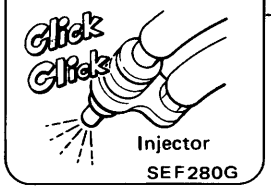
SYMPTOM & CONDITION 3 Impossible to start – partial combustion (not affected by throttle position)

	POSSIBLE CAUSES	❶	❷	❸	❹	❺	❻	❼	❽	❾	❿	⓫	⓬
SPECIFICATIONS	Mixture ratio	○		○	○								
	Fuel pressure (too low)			○	○	○							
	Ignition timing						○						
FUEL SYSTEM	Fuel filter (clogged)					○							
	Fuel line (clogged)					○							
	Injectors (clogged)	○											
	Pressure regulator				○								
	Pressure regulator vacuum hose (clogged)			○									
IGNITION SYSTEM	Ignition wires (ignition leaks)							○	○				
	Spark plugs (wet with fuel)									○			
	Ignition switch	○						○			○		
INTAKE SYSTEM	Throttle chamber (with ports clogged)		○										
	Throttle valve (clogged)		○										
CONTROL SYSTEM	Engine temperature sensor											○	○

The numbers correspond to those in the chart below.
In the above chart, possible causes can be checked through the service procedure shown by the mark "○".

SERVICE PROCEDURE

❶ LISTEN

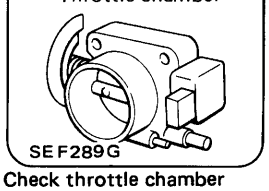


Listen for injector operating sound.

N.G. → Check injector circuit. [See page EF & EC-124.]

O.K. ↓

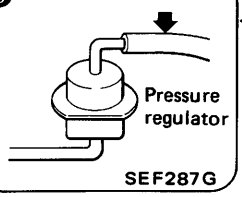
❷ CHECK — Throttle chamber



Check throttle chamber ports and valve for clogging.

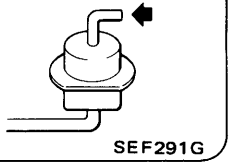
N.G. → Clean the ports and/or throttle valve.

❸ CHECK



Check vacuum hose of pressure regulator for clogging.

O.K. → ❹ REMOVE — Pressure regulator



Remove vacuum hose from pressure regulator, and try to start.

Improved → ❺ MEASURE — Fuel pressure

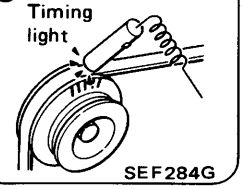
Connect vacuum hose to pressure regulator and measure fuel pressure.

→ Check Mixture ratio feedback system. [See page EF & EC-26.]

N.G. ↓

Repair or replace the hose.

❻ CHECK — Timing light

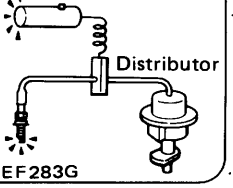


Check ignition timing.

N.G. ↓

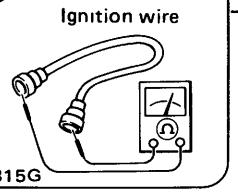
Adjust ignition timing. [See page EF & EC-30.]

❼ CHECK — Timing light



Check flashes of timing light for weakness.

N.G. → ❽ MEASURE — Ignition wire

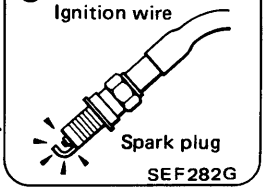


Measure resistance of suspect ignition wires.

N.G. ↓

Replace the wires.

O.K. → ❾ CHECK — Ignition wire



Remove spark plugs and check their ignition sparks by cranking.

❿ PERFORM — Self-diagnosis Mode IV

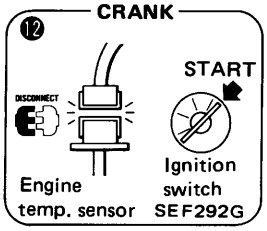
Perform self-diagnosis Mode IV (for start signal).

N.G. → Check starter circuit. [See page EF & EC-132.]

⓫ PERFORM — Self-diagnosis Mode III

Perform self-diagnosis Mode III (for engine temp. sensor).

N.G. → ⓬ CRANK



Start with engine temp. sensor connector disconnected.

N.G. ↓

Check the sensor circuits. [See page EF & EC-96.] (Engine temp. sensor).

Diagnostic Table (Cont'd)

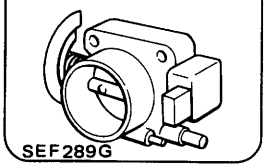
SYMPTOM & CONDITION **4** **Impossible to start – partial combustion (throttle position changes combustion quality)**

POSSIBLE CAUSES		❶	❷	❸
INTAKE SYSTEM	Throttle chamber (with ports clogged)	○		
	Throttle valve (clogged)		○	
	Air regulator (stuck closed)			○
CONTROL SYSTEM	Engine temperature sensor			○
	Throttle sensor			○
	Neutral switch			○

The numbers correspond to those in the chart below.
In the above chart, possible causes can be checked through the service procedure shown by the mark "○".

SERVICE PROCEDURE

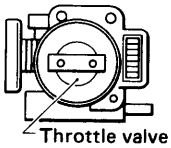
❶ CHECK
Throttle chamber



N.G. → Clean the ports.

Check throttle chamber ports for clogging.

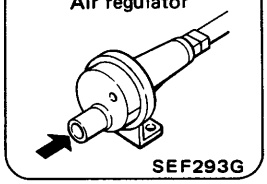
❷ CHECK
Throttle chamber



N.G. → Clean the valve.

Check throttle valve for clogging.

❸ CHECK
Air regulator



N.G. → Check air regulator and/or its circuit.
[See page EF & EC-136.]

Make sure air regulator stays open before warm-up

Diagnostic Table (Cont'd)

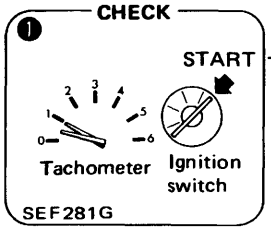
SYMPTOM & CONDITION 5 **Hard to start – before warm-up**

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻
SPECIFICATIONS	Mixture ratio			○			○
IGNITION SYSTEM	Ignition switch (no start signal)	○			○		
INTAKE SYSTEM	Air regulator			○			
CONTROL SYSTEM	Cylinder head temperature sensor					○	○
	Throttle sensor				○		
	Neutral switch	○					
OTHERS	Starter (operation too slow)	○					
	Battery (voltage too low)	○	○				

The numbers correspond to those in the chart below.
In the above chart, possible causes can be checked through the service procedure shown by the mark "○".

SERVICE PROCEDURE

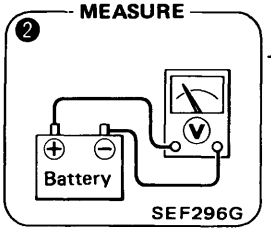
❶ CHECK



Make sure tachometer indicates about 300 rpm while cranking.

N.G. →

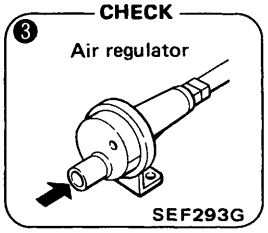
❷ MEASURE



Measure battery voltage.

N.G. (less than 12V) → Charge the battery.

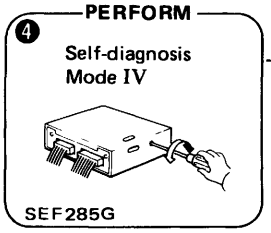
❸ CHECK



Make sure air regulator stays open before warm-up

N.G. → Check air regulator and/or its circuit. [See page EF & EC-136.]

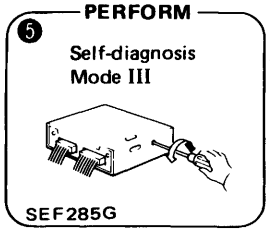
❹ PERFORM



Perform self-diagnosis Mode IV (for start signal and soft idle switch).

N.G. → Check the malfunctioning switches and/or circuits. [See page EF & EC-132 (start signal), page EF & EC-118 (throttle sensor).]

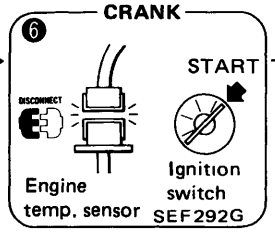
❺ PERFORM



Perform self-diagnosis Mode III (for engine temp. sensor).

N.G. →

❻ CRANK



Start with engine temp. sensor connector disconnected.

N.G. → Check sensor circuit. [See page EF & EC-96.]

Diagnostic Table (Cont'd)

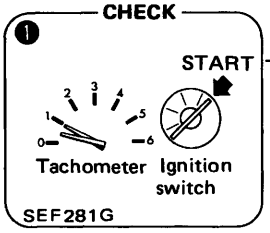
SYMPTOM & CONDITION 6 Hard to start – after warm-up

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻
SPECIFICATIONS	Mixture ratio			O			O
	Fuel pressure			O			O
FUEL SYSTEM	Fuel line (hot fuel)			O			
	Pressure regulator vacuum hose (clogged)						O
IGNITION SYSTEM	Ignition switch (no start signal)	O				O	
CONTROL SYSTEM	Engine temperature sensor				O		
	Air flow meter				O		
OTHERS	Starter (operation too slow)	O					
	Battery (voltage too low)	O	O				

The numbers correspond to those in the chart below.
In the above chart, possible causes can be checked through the service procedure shown by the mark "O".

SERVICE PROCEDURE

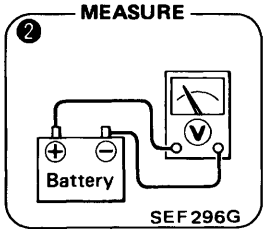
❶ CHECK



Make sure tachometer indicates about 300 rpm while cranking.

N.G. →

❷ MEASURE

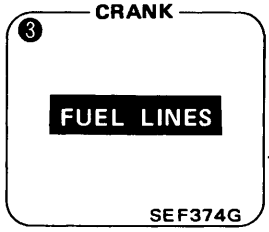


Measure battery voltage.

N.G. (less than 12V) ↓

Charge the battery.

❸ CRANK



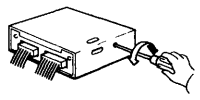
Cool fuel lines with wet rags, etc. and try to start.

No change → Proceed to other steps.

Improved → Proceed to other steps. If everything is O.K., check fuel vapor pressure.

❹ PERFORM

Self-diagnosis Mode III

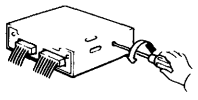


Perform self-diagnosis Mode III (for engine temp. sensor and air flow meter).

N.G. → Check sensor circuits. [See page EF & EC-96 (engine temp. sensor), page EF & EC-92 (air flow meter).]

❺ PERFORM

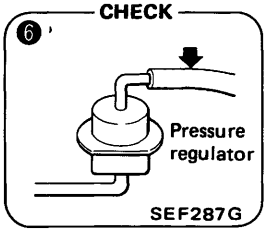
Self-diagnosis Mode IV



Perform self-diagnosis Mode IV (for start signal).

N.G. → Check starter circuit. [See page EF & EC-132.]

❻ CHECK



Check vacuum hose of pressure regulator for clogging.

N.G. ↓

Repair or replace the hose.

Diagnostic Table (Cont'd)

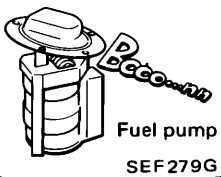
SYMPTOM & CONDITION 7 Hard to start – every time

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼	❽	❾	❿	⓫	⓬
SPECIFICATIONS	Mixture ratio	○				○	○						
	Fuel pressure						○	○					
	Ignition sparks (missing)								○	○		○	
	Ignition timing				○								
FUEL SYSTEM	Fuel pump (improper operation)	○											
	Fuel line (clogged)							○					
	Canister (air leaks)					○							
	Pressure regulator (low fuel pressure)						○						
IGNITION SYSTEM	Ignition wires (ignition leaks)								○	○			
	Spark plugs (improper gap)										○		
CONTROL SYSTEM	Engine temperature sensor												○
	Throttle sensor												○
	Neutral switch		○										
OTHERS	Starter (operation too slow)		○										
	Battery (voltage too low)		○	○									

The numbers correspond to those in the chart below.
In the above chart, possible causes can be checked through the service procedure shown by the mark "○".

SERVICE PROCEDURE

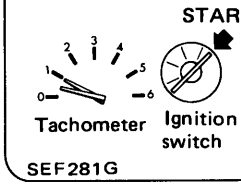
❶ **LISTEN**



N.G. → Check fuel pump and/or related circuits. [See page EF & EC-134.]

Listen for fuel pump operating sound.

❷ **CHECK**



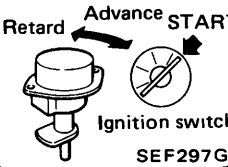
N.G. → ❸ **MEASURE** Battery

Measure battery voltage.

N.G. → Charge the battery.

Make sure tachometer indicates about 300 rpm while cranking.

❹ **CRANK**

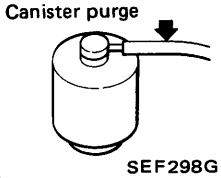


No change → [Proceed to other steps.]

Advance/retard ignition timing and try to start.

Improved → Check Mixture ratio feedback system. [See page EF & EC-26.]

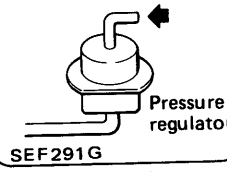
❺ **CHECK**



N.G. → Repair or replace the hose.

Check vacuum hose of canister for air leaks.

❻ **REMOVE**



Remove vacuum hose from pressure regulator, and try to start.

❼ **MEASURE** Fuel pressure

Connect vacuum hose to pressure regulator and measure fuel pressure.

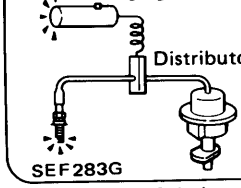
❿ **PERFORM** Self-diagnosis Mode III/IV

N.G. → Check the malfunctioning circuits. [See page EF & EC-96 (engine temp. sensor), page EF & EC-118 (throttle sensor).]

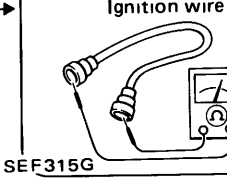
Perform self-diagnosis Mode III (for engine temp. sensor), Mode IV (for soft idle switch).

Replace the wires. ← N.G.

❽ **CHECK** Timing light



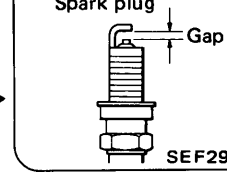
N.G. → ❾ **MEASURE** Ignition wire



Check flashes of timing light for weakness.

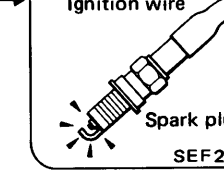
Measure resistance of suspect ignition wires.

O.K. → ❿ **MEASURE** Spark plug



Remove spark plugs and measure their gaps.

O.K. → ⓫ **CHECK** Ignition wire



Check ignition sparks.

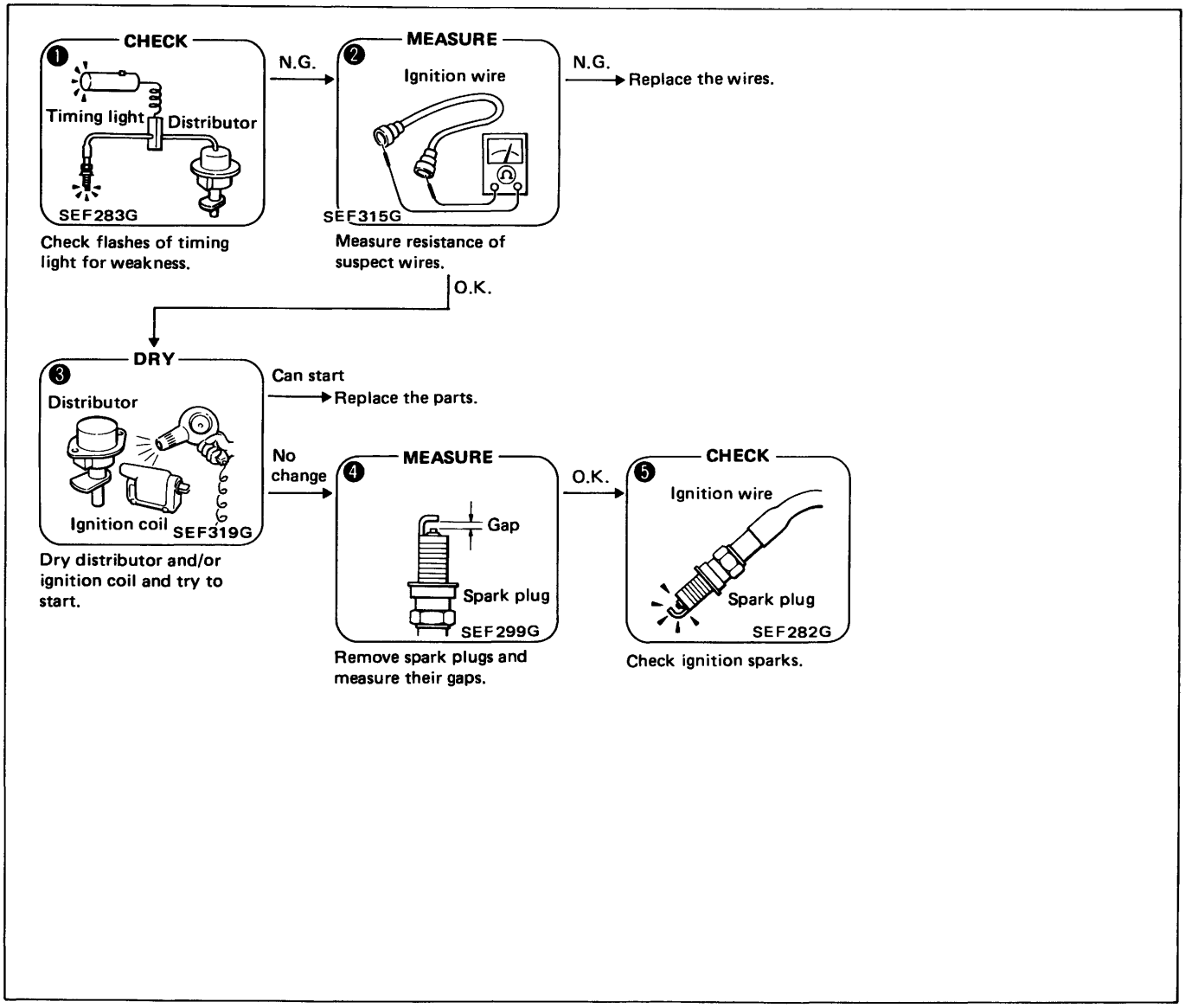
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 8 Hard to start – morning after a rainy day

POSSIBLE CAUSES		❶	❷	❸	❹	❺
SPECIFICATIONS	Ignition sparks (weak)	○	○			○
IGNITION SYSTEM	Power transistor	○				○
	Ignition coil	○		○		○
	Center cable (ignition leaks)	○				○
	Ignition wires (ignition leaks)	○	○			○
	Distributor cap (ignition leaks)	○		○		○
	Spark plugs (improper gap)				○	○

The numbers correspond to those in the chart below.
In the above chart, possible causes can be checked through the service procedure shown by the mark "○".

SERVICE PROCEDURE



Diagnostic Table (Cont'd)

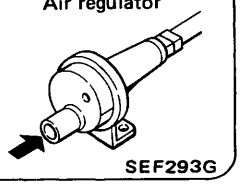
SYMPTOM & CONDITION 9 **Abnormal idling – no fast idle**

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻
SPECIFICATIONS	Mixture ratio	○	○		○		
	Ignition timing			○			
INTAKE SYSTEM	Blow-by hose (clogged)		○				
	Air regulator (stuck closed)	○					
CONTROL SYSTEM	Engine temperature sensor					○	○

The numbers correspond to those in the chart below.
In the above chart, possible causes can be checked through the service procedure shown by the mark "○".

SERVICE PROCEDURE

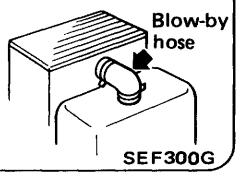
❶ CHECK
Air regulator



Make sure air regulator stays open before warm-up

N.G. → Check air regulator and/or its circuit. [See page EF & EC-136.]

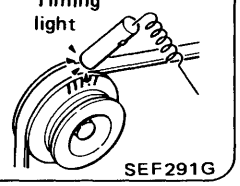
❷ CHECK



Check blow-by hose for clogging.

N.G. → Clean or replace the hose.

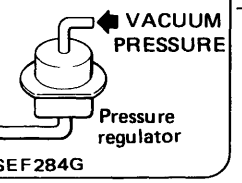
❸ APPLY
Timing light



Check ignition timing.

Improved → Adjust ignition timing. [See page EF & EC-26.]

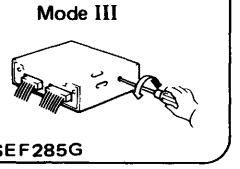
❹ CHECK



Apply vacuum/pressure to pressure regulator after disconnecting vacuum hose, and check idling.

N.G. → Check Mixture ratio feedback system. [See page EF & EC-26.]

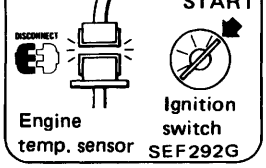
❺ PERFORM
Self-diagnosis Mode III



Perform self-diagnosis Mode III (for engine temp. sensor).

N.G. →

❻ CRANK



Start with engine temp. sensor connector disconnected.

N.G. → Check sensor circuit. [See page EF & EC-96.]

Diagnostic Table (Cont'd)

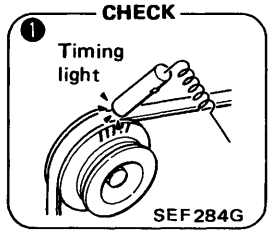
SYMPTOM & CONDITION 10 Abnormal idling – low idle (after warm-up)

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼
SPECIFICATIONS	Mixture ratio		○			○		
	Ignition timing (too retarded)	○						
INTAKE SYSTEM	Throttle chamber (with ports clogged)			○				
	Throttle valve (clogged)				○			
	Blow-by hose (clogged)		○					
CONTROL SYSTEM	Crank angle sensor						○	
	Air flow meter						○	
	Engine temperature sensor						○	○
	Load switches (remaining OFF)							

The numbers correspond to those in the chart below.
In the above chart, possible causes can be checked through the service procedure shown by the mark "○".

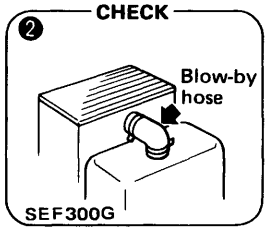
SERVICE PROCEDURE

❶ CHECK



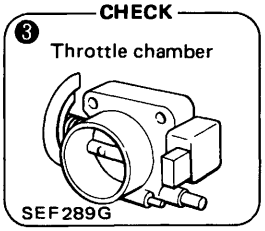
Check ignition timing.
N.G. ↓
Adjust ignition timing.
[See page EF & EC-26.]

❷ CHECK



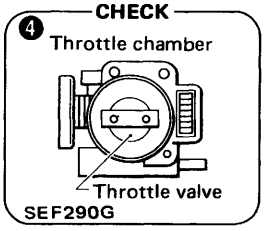
Check blow-by hose for clogging.
N.G. ↓
Clean or replace the hose.

❸ CHECK



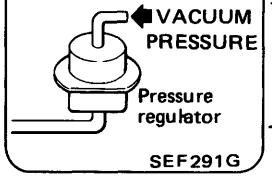
Check throttle chamber ports for clogging.
N.G. ↓
Clean the ports.

❹ CHECK



Check throttle valve for clogging.
N.G. ↓
Clean the valve.

❺ APPLY

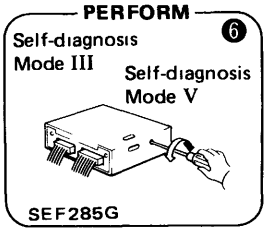


Apply vacuum/pressure to pressure regulator after disconnecting vacuum hose, and check idling.

Improved → Check Mixture ratio feedback system. [See page EF & EC-26.]

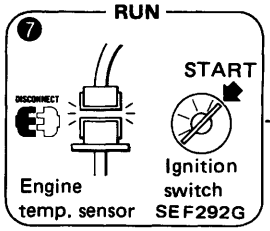
No change → Check load signal circuit. [See EL section.]

❻ PERFORM



Perform self-diagnosis Modes III and V (for air flow meter, and engine temp. sensor).
N.G. ↓
Check the malfunctioning parts and/or circuits.
[See pages EF & EC-79 and 92 (air flow meter), page EF & EC-96 (engine temp. sensor).]

❼ RUN



Start and run engine with engine temp. sensor connector disconnected.
N.G. →

Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 11 Abnormal idling – high idle (after warm-up)

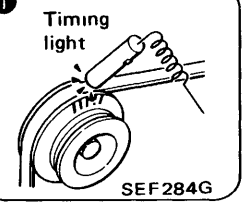
POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼	❽	❾	❿
SPECIFICATIONS	Mixuture ratio		○	○		○	○		○		
	Ignition timing (too advanced)	○									
INTAKE SYSTEM	Air duct (leaks)		○								
	Throttle chamber (air leaks)				○						
	Throttle valve (stuck control wire)				○						
	Intake manifold (gasket) (air leaks)		○								
	Air regulator (stuck open)			○							
	A.A.C. valve							○			
CONTROL SYSTEM	Crank angle sensor									○	
	Air flow meter									○	
	Engine temperature sensor									○	○
	Throttle sensor			○					○		
	Load switches (remaining ON)			○							
OTHERS	Battery (voltage too low)										

The numbers correspond to those in the chart below.

In the above chart, possible causes can be checked through the service procedure shown by the mark "○".

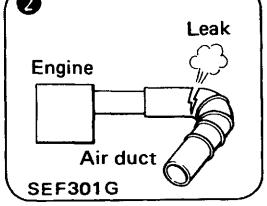
SERVICE PROCEDURE

❶ CHECK



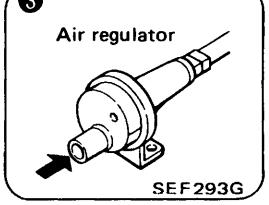
Check ignition timing.
↓ N.G.
Adjust ignition timing.
[See page EF & EC-26.]

❷ CHECK



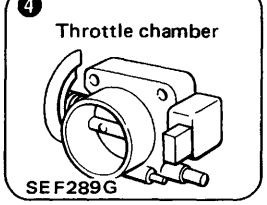
Check intake system for air leaks.
O.K. ↓
N.G. ↓
Check throttle wire for rough sliding.
Repair/replace the part.

❸ CHECK



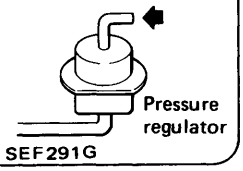
Make sure air regulator stays closed after warm-up.
↓ N.G.
Check air regulator and/or its circuit.
[See page EF & EC-136.]

❹ CHECK



Check throttle chamber ports and valve for clogging.
↓ N.G.
Clean the ports and/or throttle valve.

❺ REMOVE



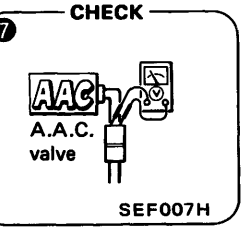
Remove vacuum hose from pressure regulator, and try to start.

Improved →

❻ MEASURE
Fuel pressure

Connect vacuum hose to pressure regulator and measure fuel pressure.
↓
Check Mixture ratio feedback system.
[See page EF & EC-26.]

❼ CHECK



Check terminal voltage of A.A.C. valve while idling.
↓ N.G.
Check the part and/or circuit.
[See page EF & EC-138.]

❽ PERFORM
Self-diagnosis Mode IV

Perform self-diagnosis Mode IV (for soft idle switch).
↓ N.G.
Check the throttle sensor circuit. [See page EF & EC-118.]

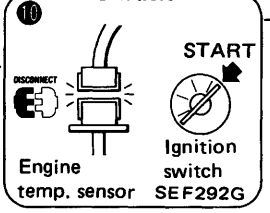
❾ PERFORM
Self-diagnosis Mode III

N.G. → Check sensor circuit.
[See page EF & EC-96 (engine temp. sensor), page EF & EC-88 (crank angle sensor), page EF & EC-92 (air flow meter).]

O.K. →

Perform self-diagnosis Mode III (for engine temp. sensor, crank angle sensor and air flow meter).

❿ CRANK



N.G.

Start with engine temp. sensor connector disconnected.

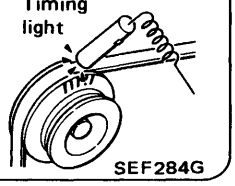
Diagnostic Table (Cont'd)

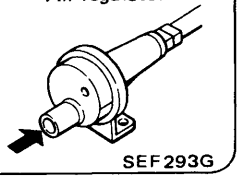
SYMPTOM & CONDITION 12 Unstable idling – before warm-up

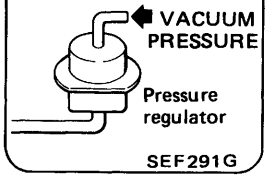
POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼	❽
SPECIFICATIONS	Mixuture ratio		○	○					
	Ignition timing	○							
INTAKE SYSTEM	Air regulator (not open enough)		○						
	A.A.C. valve				○				
CONTROL SYSTEM	Engine temperature sensor							○	○
E.G.R. SYSTEM	E.G.R. control valve (stuck open)					○			
	E.G.R. solenoid (remaining OFF)					○	○		

The numbers correspond to those in the chart below.
In the above chart, possible causes can be checked through the service procedure shown by the mark "○".

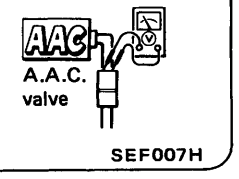
SERVICE PROCEDURE

❶ CHECK
Timing light

SEF284G
N.G. → Adjust ignition timing. [See page EF & EC-26.]
Check ignition timing.

❷ CHECK
Air regulator

SEF293G
N.G. → Check air regulator and/or its circuit. [See page EF & EC-136.]
Make sure air regulator stays open before warm-up.

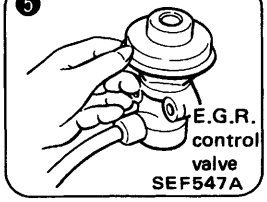
❸ APPLY


SEF291G
Improved → Check Mixture ratio feedback system. [See page EF & EC-26.]
Apply vacuum/pressure to pressure regulator after disconnecting vacuum hose, and check idling.

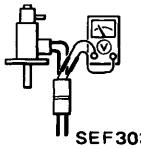
❹ CHECK


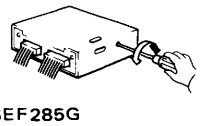
SEF007H
Does not turn ON → Check its circuit. [See page EF & EC-138.]
Check terminal voltage of A.A.C. valve while idling.

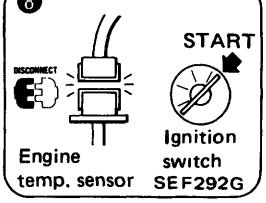
Check sensor circuit. [See page EF & EC-96.]

❺ CHECK


SEF547A
Stays lifted
Check E.G.R. control valve for operation.

❻ CHECK
E.G.R. solenoid

SEF303G
Check terminal voltage of E.G.R. solenoid while idling.
N.G. → Check the solenoid circuit. [See page EF & EC-104.]

❼ PERFORM
Self-diagnosis Mode III

SEF285G
N.G.
Perform self-diagnosis Mode III (for engine temp. sensor).

❽ RUN


SEF292G
N.G.
Start and run engine with engine temp. sensor connector disconnected.

Diagnostic Table (Cont'd)

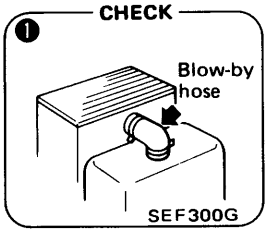
SYMPTOM & CONDITION 13 Unstable idling – after warm-up

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼	❽	❾	❿	⓫
SPECIFICATIONS	Mixture ratio	○	○	○								
	Ignition sparks				○	○	○					
	Ignition timing							○				
	Compression pressure								○			
FUEL SYSTEM	Fuel line (clogged)											
	Canister (air leaks)			○								
	Pressure regulator control solenoid											
IGNITION SYSTEM	Power transistor				○		○					
	Ignition coil				○		○					
	Ignition wires				○	○	○					
INTAKE SYSTEM	Blow-by hose (leaks)	○										
	Air duct (leaks)		○									
CONTROL SYSTEM	Throttle sensor											○
	Load switches											
E.G.R. SYSTEM	E.G.R. control valve									○		
	E.G.R. solenoid									○	○	

The numbers correspond to those in the chart below.
In the above chart, possible causes can be checked through the service procedure shown by the mark "○".

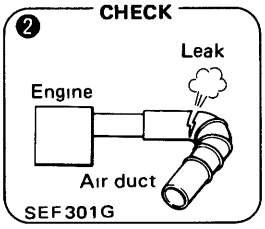
SERVICE PROCEDURE

❶ CHECK



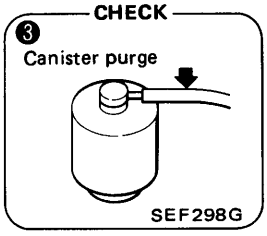
Check blow-by hose for leaks.
↓ N.G.
Repair/replace the hose.

❷ CHECK



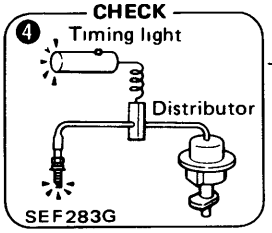
Check intake system for air leaks.
↓ N.G.
Repair/replace the part.

❸ CHECK



Check purge line for leaks.
↓ N.G.
Repair/replace the hose.

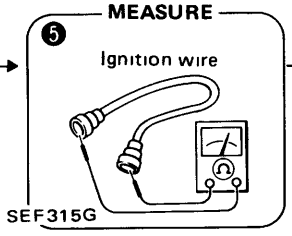
❹ CHECK



Check flashes of timing light for weakness.

N.G. →

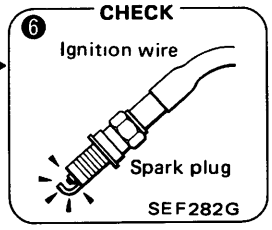
❺ MEASURE



Measure resistance of suspect wires.
↓ N.G.
Replace the wire.

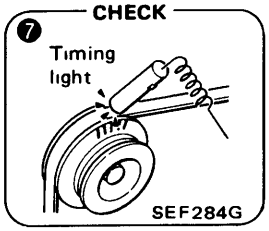
O.K. →

❻ CHECK



Remove spark plugs and check their ignition sparks.

❼ CHECK



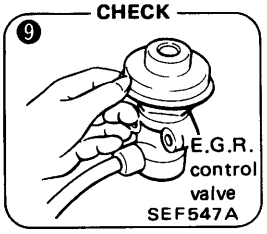
Check ignition timing.
↓ N.G.
Adjust ignition timing.
[See page EF & EC-26.]

❽ MEASURE



Measure compression pressure.
↓ N.G.
Check cylinder head and gasket.
[See EM section.]

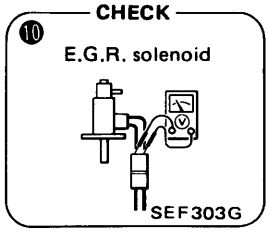
❾ CHECK



Check E.G.R. control valve for operation.

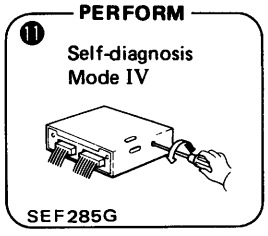
Stays lifted →

❿ CHECK



Check terminal voltage of E.G.R. solenoid while idling.
↓ N.G.
Check the solenoid circuit.
[See page EF & EC-104.]

⓫ PERFORM



Perform self-diagnosis Mode IV (for soft idle switch).
↓ N.G.
Check the throttle sensor circuit. [See page EF & EC-118.]

Diagnostic Table (Cont'd)

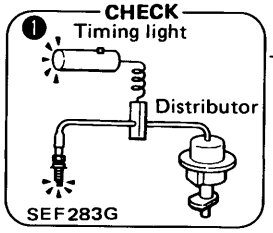
SYMPTOM & CONDITION 14 Poor driveability – stumble (while accelerating)

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼	❽	❾
SPECIFICATIONS	Mixture ratio				○		○	○		○
	Fuel pressure						○	○		
FUEL SYSTEM	Fuel filter (clogged)							○		
	Fuel line (clogged)							○		
	Injectors (clogged)							○		
IGNITION SYSTEM	Power transistor	○		○						
	Ignition coil	○		○						
	Ignition wires (ignition leaks)	○	○	○						
	Spark plugs (ignition leaks, improper gap)			○						
INTAKE SYSTEM	Air duct (leaks)				○					
CONTROL SYSTEM	Air flow meter								○	
	Engine temperature sensor								○	
	Exhaust gas sensor								○	○
	Throttle sensor					○				
OTHERS	Fuel (poor quality)									

The numbers correspond to those in the chart below.
In the above chart, possible causes can be checked through the service procedure shown by the mark "○".

SERVICE PROCEDURE

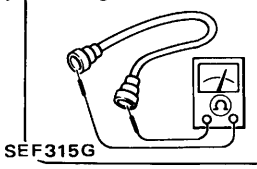
❶ **CHECK** Timing light



Check flashes of timing light for weakness.

N.G. →

❷ **MEASURE** Ignition wire

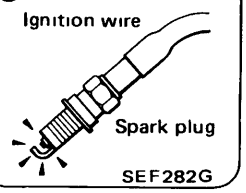


Measure resistance of suspect wires.

N.G. → Replace the wires.

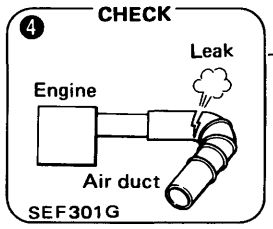
O.K. →

❸ **CHECK** Ignition wire



Remove spark plugs and check their ignition sparks.

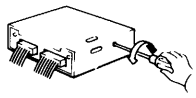
❹ **CHECK**



Check intake system for air leaks.

N.G. → Repair/replace the part.

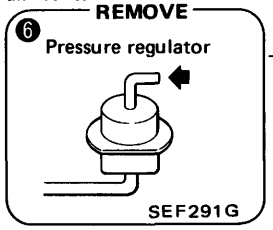
❺ **PERFORM** Self-diagnosis Mode IV



Perform self-diagnosis Mode IV (for soft idle switch).

N.G. → Check the throttle sensor circuit. [See page EF & EC-118.]

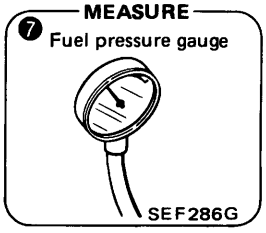
❻ **REMOVE** Pressure regulator



Remove vacuum hose from pressure regulator, and try to drive.

Improved →

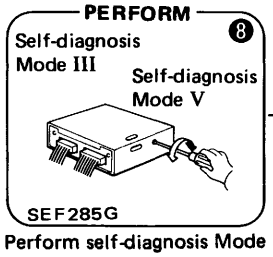
❼ **MEASURE** Fuel pressure gauge



Connect vacuum hose to pressure regulator and measure fuel pressure while driving.

→ Check Mixture ratio feedback system. [See page EF & EC-26.]

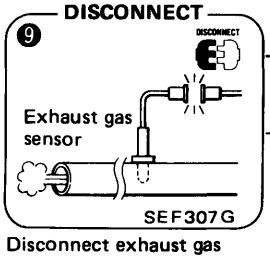
❽ **PERFORM** Self-diagnosis Mode III, Self-diagnosis Mode V



Perform self-diagnosis Mode III and V (for air flow meter and exhaust gas sensor).

N.G. → Check the malfunctioning parts and/or circuits. [See pages EF & EC-79 and 92 (air flow meter), page EF & EC-110 (exhaust gas sensor).]

❾ **DISCONNECT**



Disconnect exhaust gas sensor connector, and try to drive.

Improved → Replace the sensor.

No change → Check Mixture ratio feedback system. [See page EF & EC-26.]

Diagnostic Table (Cont'd)

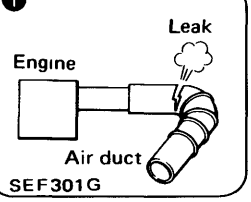
SYMPTOM & CONDITION 15 Poor driveability – surge (while cruising)

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼	❽	❾
SPECIFICATIONS	Mixture ratio (too lean)	○				○	○			○
	Fuel pressure (low)					○	○			
	Ignition timing		○							
IGNITION SYSTEM	(missing)								○	
INTAKE SYSTEM	Air duct (leaks)	○								
	Throttle chamber (air leaks)	○								
	Intake manifold (gasket) (air leaks)	○								
CONTROL SYSTEM	Crank angle sensor								○	
	Air flow meter								○	
	Exhaust gas sensor								○	○
	Throttle sensor							○		
E.G.R. SYSTEM	E.G.R. control valve (stuck open)			○						
	E.G.R. solenoid (remaining OFF)			○	○					
	E.G.R. vacuum hose (removed)			○						

The numbers correspond to those in the chart below.
In the above chart, possible causes can be checked through the service procedure shown by the mark "○".

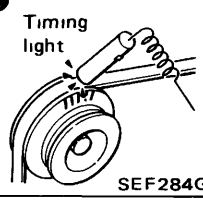
SERVICE PROCEDURE

❶ CHECK



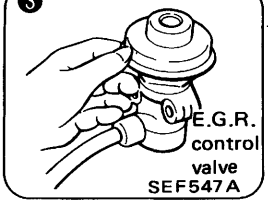
Check intake system for air leaks
↓ N.G.
Repair/replace the part.

❷ CHECK



Check ignition timing.
↓ N.G.
Adjust ignition timing.
[See page EF & EC-26.]

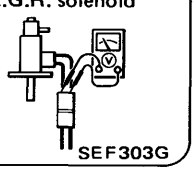
❸ CHECK



Check E.G.R. control valve for operation.

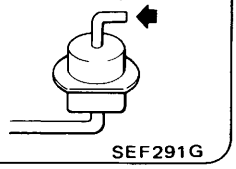
Stays lifted →

❹ CHECK



Check terminal voltage of E.G.R. solenoid.
↓ N.G.
Check the solenoid circuit.
[See page EF & EC-104.]

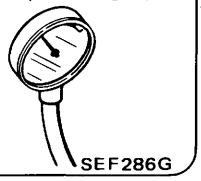
❺ REMOVE



Remove vacuum hose from pressure regulator, and try to drive.

Improved →

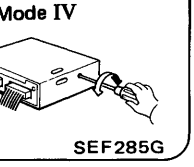
❻ MEASURE



Connect vacuum hose to pressure regulator and measure fuel pressure while driving.

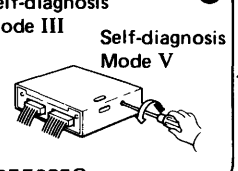
→ Check Mixture ratio feedback system.
[See page EF & EC-26.]

❼ PERFORM



Perform self-diagnosis Mode IV (for soft idle switch).
↓ N.G.
Check the throttle sensor circuit.
[See page EF & EC-118.]

❽ PERFORM

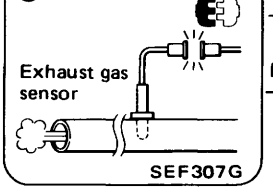


Perform self-diagnosis Mode III and V (for crank angle sensor, air flow meter, ignition signal and exhaust gas sensor).

N.G. →

Check the malfunctioning parts and/or circuits.
[See pages EF & EC-78 and 88 (crank angle sensor), pages EF & EC-79 and 92 (air flow meter), pages EF & EC-80 and 100 (ignition signal), page EF & EC-110 (exhaust gas sensor).]

❾ DISCONNECT



Disconnect exhaust gas sensor connector, and try to drive.

Improved → Replace the sensor.

No change → Check mixture ratio feedback system.
[See page EF & EC-26.]

Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 16 Poor driveability — lack of power

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼	❽	❾	❿	⓫
SPECIFICATIONS	Fuel pressure								○	○		
	Ignition timing		○									
	Compression pressure (too low)							○				
FUEL SYSTEM	Fuel pump (low fuel output)									○		
	Fuel filter (clogged)									○		
	Fuel line (clogged)									○		
	Injectors (clogged)									○		
IGNITION SYSTEM	Ignition wires (ignition leaks)				○	○	○					
	Spark plugs (improper gap)						○					
INTAKE SYSTEM	Air cleaner element (clogged)	○										
	Throttle chamber (clogged)			○								
	Throttle valve (not open enough)			○								
CONTROL SYSTEM	Air flow meter										○	
	Exhaust gas sensor											○

The numbers correspond to those in the chart below.
In the above chart, possible causes can be checked through the service procedure shown by the mark "○".

SERVICE PROCEDURE

❶ CHECK
AIR CLEANER ELEMENT
SEF320G
Check air cleaner element for clogging.
N.G.
Replace the part.

❷ CHECK
Timing light
SEF284G
Check ignition timing with a timing light.
N.G.
Adjust ignition timing.
[See page EF & EC-26.]

❸ CHECK
Throttle chamber
Throttle valve
SEF290G
Check throttle valve for rough movement.
N.G.
Repair/replace the part.

❹ CHECK
Timing light
Distributor
SEF283G
Check flashes of timing light for weakness.
N.G.

❺ MEASURE
Ignition wire
SEF315G
Measure resistance of suspect wires.
N.G.
Replace the wires.

O.K.

❻ CHECK
Ignition wire
Spark plug
SEF282G
Remove spark plugs and check their ignition sparks.

❼ MEASURE
COMPRESSION PRESSURE
SEF309G
Measure compression pressure.
→ Check cylinder head and gasket.
[See EM section.]

❽ REMOVE
Pressure regulator
SEF291G
Remove vacuum hose from pressure regulator, and try to drive.

Improved

❾ MEASURE
Fuel pressure gauge
SEF286G
Connect vacuum hose to pressure regulator and measure fuel pressure while driving.
Check Mixture ratio feedback system.
[See page EF & EC-26.]

❿ PERFORM
Self-diagnosis Mode III
Self-diagnosis Mode V
SEF285G
Perform self-diagnosis Mode III and V (for air flow meter).
N.G.
Check the malfunctioning parts and/or circuit.
[See pages EF & EC-79 and 92.]

⓫ DISCONNECT
Exhaust gas sensor
SEF307G
Disconnect exhaust gas sensor connector, and try to drive.
Improved
Replace the sensor.
No change
Check Mixture ratio feedback system.
[See page EF & EC-26.]

Diagnostic Table (Cont'd)

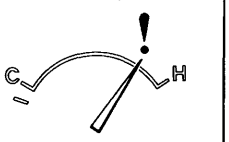
SYMPTOM & CONDITION 17 Poor driveability – detonation

POSSIBLE CAUSES		❶	❷	❸	❹	❺
SPECIFICATIONS	Mixture ratio (too lean)			○	○	
	Fuel pressure (low)			○		
	Ignition timing (too advanced)		○			
FUEL SYSTEM	Fuel filter (clogged)				○	
	Fuel line (clogged)				○	
	Injectors (clogged)				○	
CONTROL SYSTEM	Crank angle sensor (improper 1° signal)					○
	Air flow meter					○
OTHERS	Water temperature (too high)	○				
	Fuel (low octane rating, poor quality)					

The numbers correspond to those in the chart below.
In the above chart, possible causes can be checked through the service procedure shown by the mark "○".

SERVICE PROCEDURE

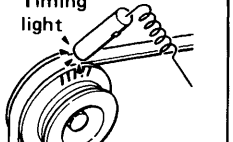
CHECK ❶ Water temperature



Too high → Check cooling system. [See LC section.]

Check water temperature.

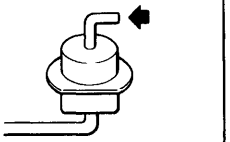
CHECK ❷ Timing light



N.G. → Adjust ignition timing. [See page EF & EC-26.]

Check ignition timing.

REMOVE ❸ Pressure regulator



Improved →

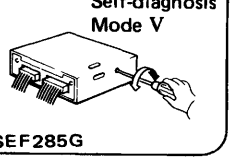
MEASURE ❹ Fuel pressure gauge



Remove vacuum hose from pressure regulator, and try to drive.

Connect vacuum hose to pressure regulator, and measure fuel pressure while driving.

PERFORM ❺ Self-diagnosis Mode III, Self-diagnosis Mode V



N.G. → Check the malfunctioning parts. [See pages EF & EC-78 and 88 (crank angle sensor), pages EF & EC-79 and 92 (air flow meter).]

Perform self-diagnosis Mode III and V (for crank angle sensor and air flow meter).

Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 18 Engine stall – during start-up

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼	❽	❾
SPECIFICATIONS	Mixture ratio (too rich/too lean)							○	○	○
	Ignition sparks (weak)			○	○					
	Ignition timing	○								
	Compression pressure (too low)						○			
FUEL SYSTEM	Canister (too much evaporation to intake)							○		
IGNITION SYSTEM	Ignition wires (ignition leaks)			○	○	○				
	Spark plugs (wet with fuel, improper gap)					○				
CONTROL SYSTEM	Exhaust gas sensor									○
INTAKE SYSTEM	Throttle valve (not open enough)		○							

The numbers correspond to those in the chart below.
In the above chart, possible causes can be checked through the service procedure shown by the mark "○".

SERVICE PROCEDURE

❶ CHECK — Timing light — SEF284G
Check ignition timing.
N.G. → Adjust ignition timing. [See page EF & EC-26.]

❷ CHECK — Throttle chamber — Throttle valve — SEF290G
Check throttle valve for rough movement.
N.G. → Repair/replace the part.

❸ CHECK — Timing light — Distributor — SEF283G
Check flashes of timing light for weakness.
N.G. →

❹ MEASURE — Ignition wire — SEF315G
Measure resistance of ignition wires.
N.G. → Replace the wires.
O.K. →

❺ CHECK — Ignition wire — Spark plug — SEF282G
Remove spark plugs and check their ignition sparks.

❻ MEASURE — COMPRESSION PRESSURE — SEF309G
Measure compression pressure.
Check cylinder head and gasket. [See EM section.]

❼ TRY — Canister purge — SEF314G
Shut evaporated fuel to intake valve and try to drive.
Improved → Replace the canister and/or the hoses.
No change →

❽ APPLY — VACUUM PRESSURE — Pressure regulator — SEF291G
Apply vacuum/pressure to pressure regulator after disconnecting vacuum hose, and try to drive.
Improved →

❾ DISCONNECT — Exhaust gas sensor — SEF307G
Disconnect exhaust gas sensor connector and try to drive.
No change → Check Mixture ratio feedback system. [See page EF & EC-26.]
Improved → Replace the sensor.

Diagnostic Table (Cont'd)

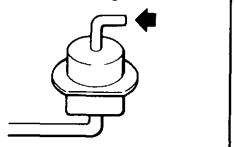
SYMPTOM & CONDITION 19 Engine stall – while idling

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼	❽
SPECIFICATIONS	Mixture ratio (too rich/too lean)	○	○						
	Fuel pressure (low)	○	○						
	Ignition sparks (weak, missing)				○				
	Idle speed (low)			○					
FUEL SYSTEM	Fuel line (clogged)		○						
IGNITION SYSTEM	Spark plugs (wet with fuel, improper gap)					○	○		
INTAKE SYSTEM	A.A.C. valve			○				○	
CONTROL SYSTEM	Throttle sensor								○
	Neutral switch (remaining OFF)			○					
	Load switches (remaining OFF)							○	

The numbers correspond to those in the chart below.
In the above chart, possible causes can be checked through the service procedure shown by the mark "○".

SERVICE PROCEDURE

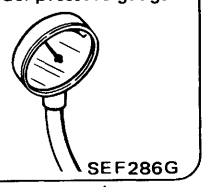
❶ REMOVE Pressure regulator



Remove vacuum hose from pressure regulator, and check idling.

Improved →

❷ MEASURE Fuel pressure gauge



Connect vacuum hose to pressure regulator and measure fuel pressure.

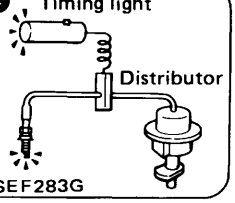
→ Check Mixture ratio feedback system. [See page EF & EC-26.]

❸ MEASURE Tachometer



Measure idle speed.
↓ N.G.
Adjust idle speed.
[See page EF & EC-26.]

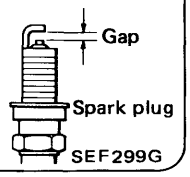
❹ CHECK Timing light



Check flashes of timing light for weakness.

N.G. →

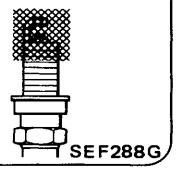
❺ CHECK



Remove spark plugs and check their gaps and tips.

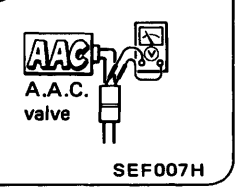
and/or

❻ CHECK Spark plug



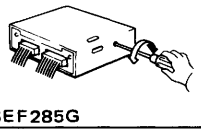
Check spark plugs for being foul or wet with fuel.

❼ CHECK



Check terminal voltages of A.A.C. valve.
↓ N.G.
Check the part and/or circuit.
[See page EF & EC-138.]

❽ PERFORM Self-diagnosis Mode IV



Perform self-diagnosis Mode IV (for soft idle switch).

N.G. → Check the throttle sensor circuit. [See page EF & EC-118.]

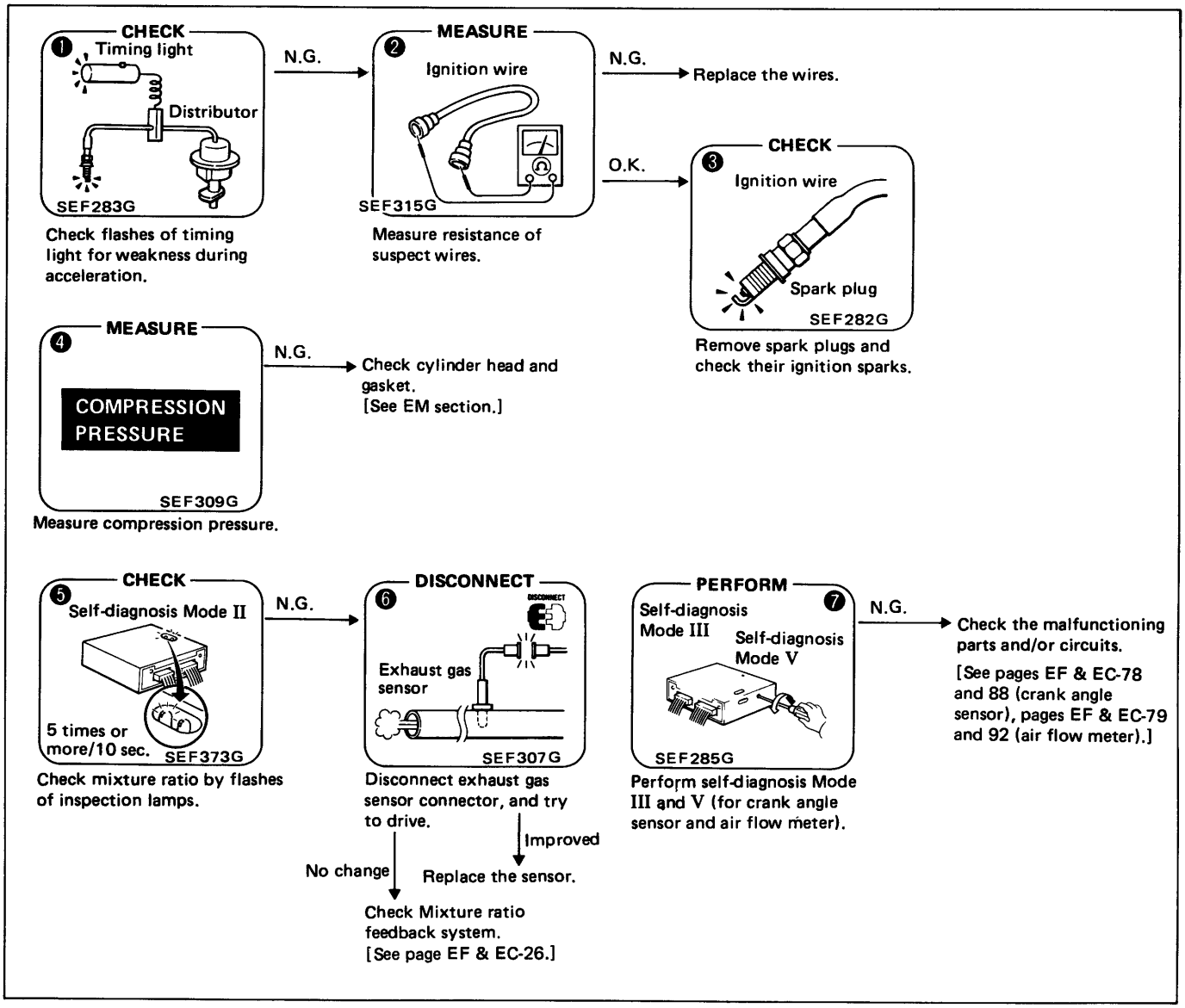
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 20 Engine stall – while accelerating

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼
SPECIFICATIONS	Mixture ratio					○	○	
	Ignition sparks (weak, missing)	○	○	○				
	Compression pressure (low)				○			
CONTROL SYSTEM	Crank angle sensor	○						○
	Air flow meter							○
	Exhaust gas sensor					○	○	

The numbers correspond to those in the chart below.
In the above chart, possible causes can be checked through the service procedure shown by the mark "○".

SERVICE PROCEDURE



Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 21 Engine stall – while cruising

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻
SPECIFICATIONS	Mixture ratio				○	○	
	Ignition sparks (weak, missing)	○	○	○			
CONTROL SYSTEM	Crank angle sensor						○
	Air flow meter						○
	Exhaust gas sensor				○	○	

The numbers correspond to those in the chart below.
In the above chart, possible causes can be checked through the service procedure shown by the mark "○".

SERVICE PROCEDURE

❶ CHECK — Timing light, Distributor — SEF283G
Check flashes of timing light for weakness at constant engine rev. (1,000 to 2,000 rpm).

N.G. → ❷ MEASURE — Ignition wire — SEF315G
Measure resistance of suspect wires.

N.G. → Replace the wires.

O.K. → ❸ CHECK — Ignition wire, Spark plug — SEF282G
Remove spark plugs and check their ignition sparks.

❹ CHECK — Self-diagnosis Mode II — 5 times or more/10 sec. — SEF373G
Check mixture ratio by flashes of inspection lamps.

N.G. → ❺ DISCONNECT — Exhaust gas sensor — SEF307G
Disconnect exhaust gas sensor connector, and try to drive.

Improved → Replace the sensor.

No change → Check Mixture ratio feedback system. [See page EF & EC-26.]

❻ PERFORM — Self-diagnosis Mode III, Self-diagnosis Move V — SEF285G
Perform self-diagnosis Mode III and V (for air flow meter and crank angle sensor).

N.G. → Check the circuits. [See pages EF & EC-78 and 88 (crank angle sensor), pages EF & EC-79 and 92 (air flow meter).]

Diagnostic Table (Cont'd)

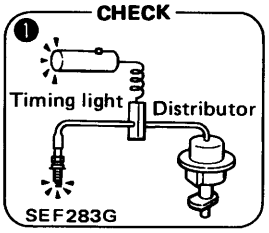
SYMPTOM & CONDITION 22 Engine stall – while decelerating/just after stopping

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻
SPECIFICATIONS	Mixture ratio					○	○
	Ignition sparks (missing)	○					
	Idle speed (too low)			○			
IGNITION SYSTEM	(missing)	○	○				
INTAKE SYSTEM	A.A.C. valve			○	○		
CONTROL SYSTEM	Exhaust gas sensor (malfunctioning feedback control)					○	○
	Crank angle sensor		○				
	Throttle sensor			○			
	Load switches (remaining OFF)			○	○		

The numbers correspond to those in the chart below.
In the above chart, possible causes can be checked through the service procedure shown by the mark "○".

SERVICE PROCEDURE

❶ CHECK

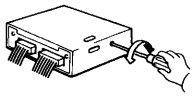


Check flashes of timing light while decreasing engine speed.

N.G. →

❷ PERFORM

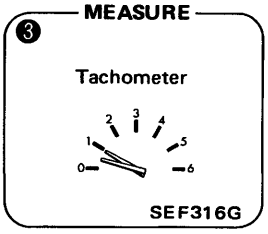
Self-diagnosis Mode V



Perform self-diagnosis Mode V (for ignition signal and crank angle sensor).

N.G. → Check the malfunctioning parts and/or circuits. [See page EF & EC-80 (ignition signal), page EF & EC-78 (crank angle sensor).]

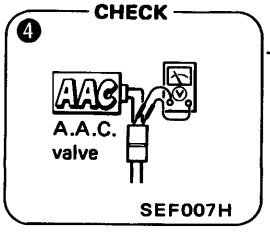
❸ MEASURE



Measure idle speed.

N.G. → Adjust idle speed. [See page EF & EC-26.]

❹ CHECK

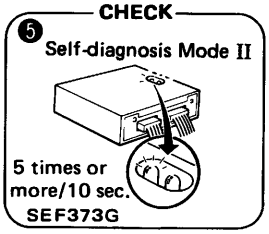


Check terminal voltage of A.A.C. valve.

N.G. → Check A.A.C. valve and/or its circuit. [See page EF & EC-138.]

❺ CHECK

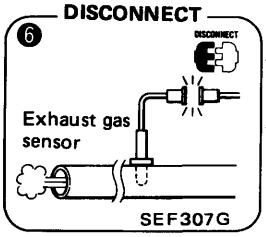
Self-diagnosis Mode II



Check mixture ratio by flashes of inspection lamps.

N.G. →

❻ DISCONNECT



Disconnect exhaust gas sensor connector, and try to drive.

Improved → Replace the sensor.

No change → Check Mixture ratio feedback system. [See page EF & EC-26.]

Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 23 Engine stall – while loading

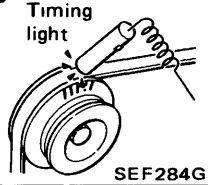
POSSIBLE CAUSES		❶	❷	❸	❹
SPECIFICATIONS	Ignition timing		○		
	Idle speed (too low)	○			
INTAKE SYSTEM	A.A.C. valve	○		○	
CONTROL SYSTEM	Throttle sensor	○			○
	Load switches (remaining OFF)	○		○	

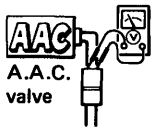
The numbers correspond to those in the chart below.
In the above chart, possible causes can be checked through the service procedure shown by the mark "○".

SERVICE PROCEDURE

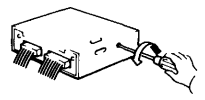
MEASURE ❶
Tachometer

SEF316G
N.G. → Adjust idle speed. [See page EF & EC-26.]
Measure idle speed.

CHECK ❷
Timing light

SEF284G
N.G. → Adjust ignition timing. [See page EF & EC-26.]
Check ignition timing.

CHECK ❸


SEF007H
N.G. → Check A.A.C. valve and/or its circuit. [See page EF & EC-138.]
Check terminal voltage of A.A.C. valve.

PERFORM ❹
Self-diagnosis Mode IV

SEF285G
N.G. → Check the throttle sensor circuit. [See page EF & EC-118.]
Perform self-diagnosis Mode IV (for soft idle switch).

Diagnostic Table (Cont'd)

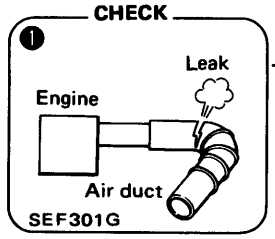
SYMPTOM & CONDITION 24 Backfire – through the intake

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼
SPECIFICATIONS	Mixture ratio (too lean)	○		○		○	○	
	Ignition timing (too retarded)		○					
FUEL SYSTEM	Injectors (clogged)				○			
INTAKE SYSTEM	Air duct (air leaks)	○						
	Intake manifold (gaskets) (air leaks)	○						
CONTROL SYSTEM	Air flow meter							○
	Exhaust gas sensor					○	○	

The numbers correspond to those in the chart below.
In the above chart, possible causes can be checked through the service procedure shown by the mark "○".

SERVICE PROCEDURE

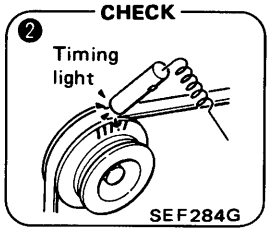
CHECK ❶



N.G. → Repair/replace the part.

Check intake system for air leaks.

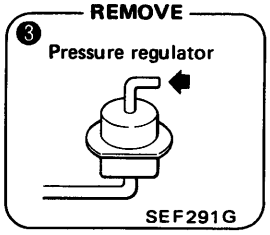
CHECK ❷



N.G. → Adjust ignition timing. [See page EF & EC-26.]

Check ignition timing.

REMOVE ❸



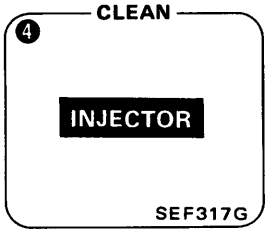
Improved → Check Mixture ratio feedback system. [See page EF & EC-26.]

Remove vacuum hose from pressure regulator, and try to drive.

No change ↓

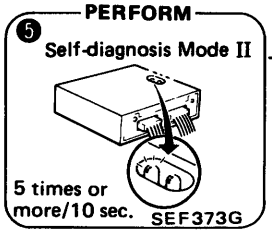
or

CLEAN ❹



Clean the injector.

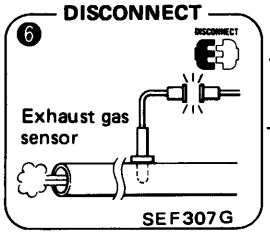
PERFORM ❺



N.G. →

Check mixture ratio by flashes of inspection lamps.

DISCONNECT ❻

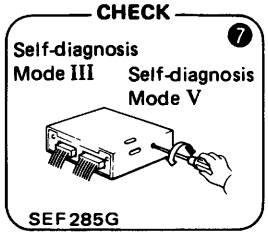


Disconnect exhaust gas sensor connector, and try to drive.

Improved → Replace the sensor.

No change → Check Mixture ratio feedback system. [See page EF & EC-26.]

CHECK ❼



Perform self-diagnosis Mode III and V (for air flow meter).

N.G. ↓

Check the circuits. [See pages EF & EC-79 and 92.] (air flow meter).]

Diagnostic Table (Cont'd)

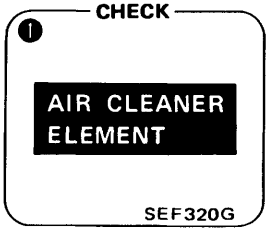
SYMPTOM & CONDITION 25 Backfire – through the exhaust

POSSIBLE CAUSES		❶	❷	❸	❹
SPECIFICATIONS	Mixture ratio (too rich)	○	○		
FUEL SYSTEM	Injectors (fuel leaks)		○		
IGNITION SYSTEM	(missing)				○
INTAKE SYSTEM	Air cleaner element (clogged)	○			
CONTROL SYSTEM	Throttle sensor			○	

The numbers correspond to those in the chart below.
In the above chart, possible causes can be checked through the service procedure shown by the mark "○".

SERVICE PROCEDURE

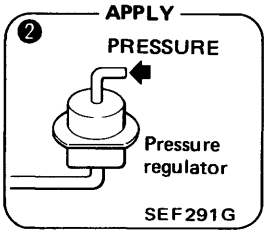
❶ CHECK



Check air cleaner element for clogging.

N.G. → Replace the element.

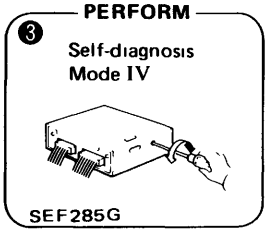
❷ APPLY PRESSURE



Apply pressure to pressure regulator after disconnecting vacuum hose, and try to drive.

Improved → Check Mixture ratio feedback system. [See page EF & EC-26.]

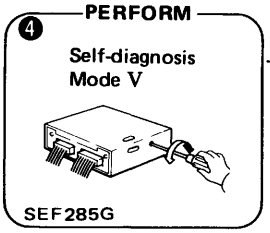
❸ PERFORM Self-diagnosis Mode IV



Perform self-diagnosis Mode IV (for soft idle switch).

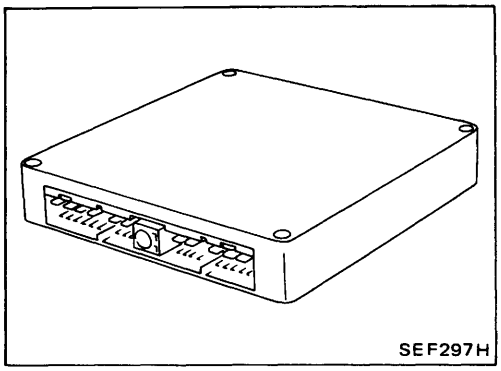
N.G. → Check throttle sensor and/or its circuit. [See page EF & EC-118.]

❹ PERFORM Self-diagnosis Mode V



Perform self-diagnosis Mode V (for ignition signal).

N.G. → Check the malfunctioning part and/or circuit. [See page EF & EC-80.] (ignition signal).]


SEF297H

Self-diagnosis — Description

The self-diagnosis is useful to diagnose malfunctions in major sensors and actuators of the E.C.C.S. There are 5 modes in the self-diagnosis system.

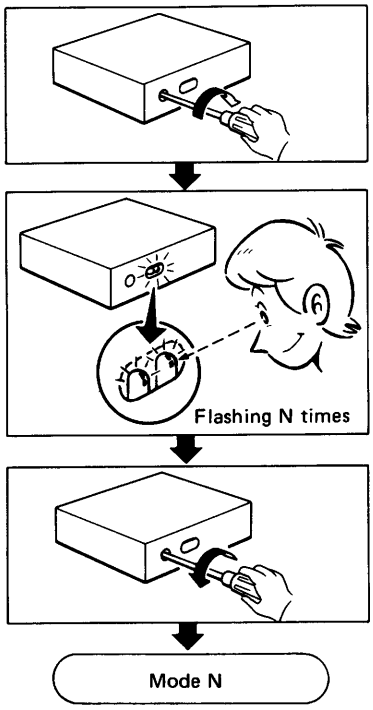
1. **Mode I (Exhaust gas sensor monitor)**
- During closed-loop operation:
  The green inspection lamp turns ON when a lean condition is detected and goes OFF under rich condition.
- During open-loop operation condition:
  The green inspection lamp remains OFF or ON.

2. **Mode II (Mixture ratio feedback control monitor)**
  The green inspection lamp function is the same as Mode I.
- During closed-loop operation:
  The red inspection lamp turns ON and OFF simultaneously with the green inspection lamp when the mixture ratio is controlled within the specified value.
- During open-loop operation:
  The red inspection lamp remains ON or OFF.

3. **Mode III (Self-diagnostic system)**
  In this mode the number of both green and red L.E.D.'s flashing indicates the group to which the malfunctioning part belongs.

4. **Mode IV (Switches ON/OFF diagnostic system)**
  During this mode, the inspection lamps monitor the switch ON-OFF condition.
- Soft idle switch
- Starter switch
- Vehicle speed sensor

5. **Mode V (Real-time diagnostic system)**
  The moment the malfunction is detected, the display will be presented immediately. That is, the condition at which the malfunction occurs can be found by observing the inspection lamps during driving test.

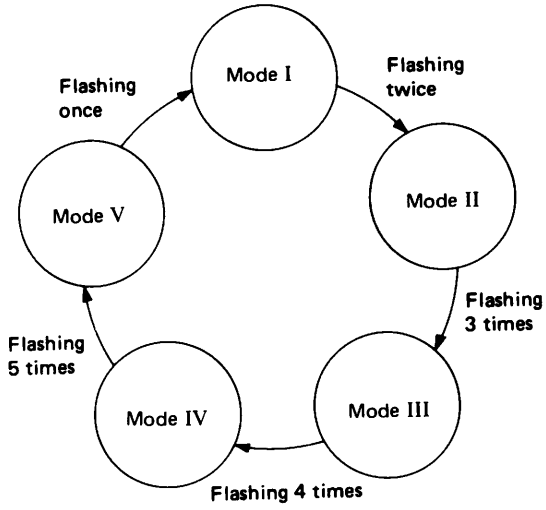


SEF288H

Self-diagnosis — Description (Cont'd)

HOW TO SWITCH THE DIAGNOSTIC MODES

1. Turn ignition switch "ON".
2. Turn diagnostic mode selector to E.C.U. (fully clockwise) and wait for inspection lamps to flash.
3. Count the number of flashes, and after the inspection lamps have flashed the number of the required mode, immediately turn diagnostic mode selector fully counterclockwise.

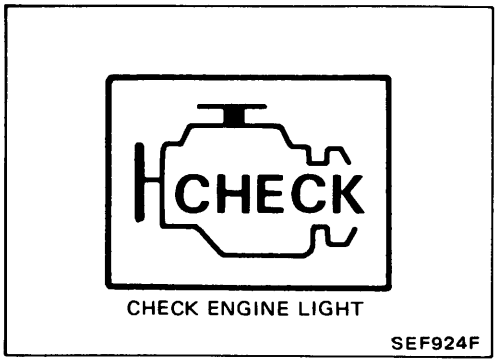


SEF989D

- **When the ignition switch is turned off during diagnosis in any mode and then turned on again (after power to the E.C.U. has dropped completely), the diagnosis will automatically return to Mode I.**
  The stored memory will be lost if:

1. Battery terminal is disconnected.
2. After selecting Mode III, Mode IV is selected.
   However, if the diagnostic mode selector is kept turned fully clockwise, it will continue to change in the order of Mode I → II → III → IV → V → I ... etc., and in this state the stored memory will not be erased.

This unit serves as an idle rpm feedback control. When the diagnostic mode selector is turned within the "diagnostic mode OFF" range, a target engine speed can be selected. Mark the original position of the selector before conducting self-diagnosis. Upon completion of self-diagnosis, return the selector to the previous position. Otherwise, engine speed may change before and after conducting self-diagnosis.



CHECK ENGINE LIGHT
SEF924F

Self-diagnosis — Description (Cont'd)

CHECK ENGINE LIGHT

This vehicle has a check engine light on the instrument panel. This light comes ON under the following conditions:

1) When ignition switch is turned "ON" (for bulb check).
2) When systems related to emission performance malfunction in Mode I (with engine running).

- **This check engine light always illuminates and is synchronous with red L.E.D.**
- **Malfunction systems related to emission performance can be detected by self-diagnosis, and they are clarified as self-diagnostic codes in Mode III.**

3) Check engine light will come "ON" only when malfunction is sensed.
The check engine light will turn off when normal operation is resumed. Mode III memory must be cleared as the contents remain stored.

Code No.	Malfunction
12	Air flow meter circuit
13	Engine temperature sensor circuit
14	Vehicle speed sensor circuit
31	E.C.U. (E.C.C.S. control unit)
32	E.G.R. function
33	Exhaust gas sensor circuit
35	Exhaust gas temperature sensor circuit
43	Throttle sensor circuit
45	Injector leak
51	Injector circuit

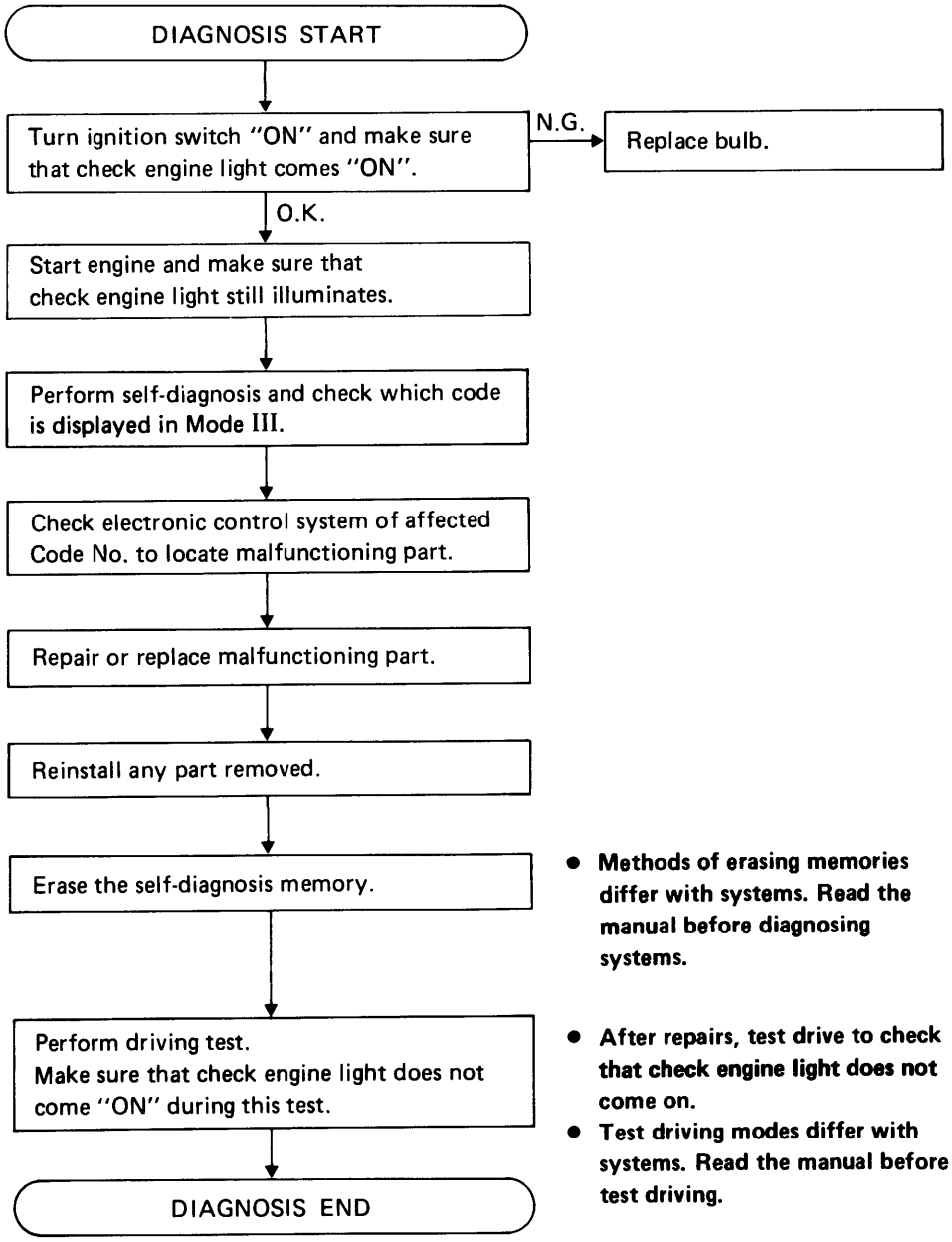
4) When crank angle sensor or C.P.U. of E.C.U. malfunctions and fail-safe system operates during engine rotation.

Conditions under which the check engine light illuminates differ between California and non-California models, as indicated in table below:

	California model	Non-California model
Condition	Light illuminates when any one of conditions 1), 2), 3) and 4) is satisfied.	Light illuminates when any one of conditions 1), 2) and 4) is satisfied.

Self-diagnosis — Description (Cont'd)

Use the following diagnostic flow chart to check and repair a malfunctioning system.



- **Methods of erasing memories differ with systems. Read the manual before diagnosing systems.**
- **After repairs, test drive to check that check engine light does not come on.**
- **Test driving modes differ with systems. Read the manual before test driving.**

Self-diagnosis — Mode I (Exhaust gas sensor monitor)

This mode checks the exhaust gas sensor for proper functioning. The operation of the E.C.U. L.E.D. in this mode differs with mixture ratio control conditions as follows:

Mode	L.E.D.	Engine stopped (Ignition switch "ON")	Engine running	
			Open loop condition	Closed loop condition
Mode I (Monitor A)	Green	ON	*Remains ON or OFF	Blinks
	Red	ON	• ON: a. when the CHECK ENGINE LIGHT ITEMS are stored in the E.C.U. (California model only) **b. when fail-safe system is operating • OFF: except for the above conditions	

*: Maintains conditions just before switching to open loop

**: When there is a malfunction in C.P.U. of E.C.U. or crank angle sensor circuit.

EXHAUST GAS SENSOR FUNCTION CHECK

If the number of L.E.D. blinks is less than that specified, replace the exhaust gas sensor.

If the L.E.D. does not blink, check exhaust gas sensor circuit.

EXHAUST GAS SENSOR CIRCUIT CHECK

See page EF & EC-110.

Self-diagnosis — Mode II (Mixture ratio feedback control monitor)

This mode checks, through the E.C.U. L.E.D., optimum control of the mixture ratio. The operation of the L.E.D., as shown below, differs with the control conditions of the mixture ratio (for example, richer or leaner mixture ratios, etc., which are controlled by the E.C.U.).

Mode	L.E.D.	Engine stopped (Ignition switch "ON")	Engine running			
			Open loop condition	Closed loop condition		
Mode II (Monitor B)	Green	ON	*Remains ON or OFF	Blinks		
	Red	OFF	*Remains ON or OFF	Compensating mixture ratio		
				More than 5% rich	Between 5% lean and 5% rich	More
				OFF	Synchronized with green L.E.D.	Remains ON

*: Maintains conditions just before switching to open loop

If the red L.E.D. remains ON or OFF during the closed-loop operation, the mixture ratio may not be controlled properly. Using the following procedures, check the related components or adjust the mixture ratio.

COMPONENT CHECK OR MIXTURE RATIO ADJUSTMENT

See page EF & EC-26.

Self-diagnosis — Mode III (Self-diagnostic system)

The E.C.U. constantly monitors the function of these sensors and actuators, regardless of ignition key position. If a malfunction occurs, the information is stored in the E.C.U. and can be retrieved from the memory by turning on the diagnostic mode selector, located on the side of the E.C.U. When activated, the malfunction is indicated by flashing a red and a green L.E.D. (Light Emitting Diode), also located on the E.C.U. Since all the self-diagnostic results are stored in the E.C.U.'s memory even intermittent malfunctions can be diagnosed.

A malfunction is indicated by the number of both red and green flashing L.E.D.s. First, the red L.E.D. flashes and the green flashes follow. The red L.E.D. corresponds to units of ten and the green L.E.D. corresponds to units of one. For example, when the red L.E.D. flashes once and the green L.E.D. flashes twice, this signifies the number "12", showing that the air flow meter signal is malfunctioning. All problems are classified by code numbers in this way.

- **When the engine fails to start, crank it two or more seconds before beginning self-diagnosis.**
- **Before starting self-diagnosis, do not erase the stored memory before beginning self-diagnosis. If it is erased, the self-diagnosis function for intermittent malfunctions will be lost.**

The stored memory would be lost if:

1. **Battery terminal is disconnected.**
2. **After selecting Mode III, Mode IV is selected.**

DISPLAY CODE TABLE

Code No.	Detected items	California	Non-California
11	Crank angle sensor ciruit	X	X
12	Air flow meter circuit	X	X
13	Engine temperature sensor circuit	X	X
14	Vehicle speed sensor circuit	X	X
21	Ignition signal missing in primary coil	X	X
31	E.C.U. (E.C.C.S. control unit)	X	X
32	E.G.R. function	X	–
33	Exhaust gas sensor circuit	X	X
34	Detonation sensor circuit	X	X
35	Exhaust gas temperature sensor circuit	X	–
43	Throttle sensor circuit	X	X
45	Injector leak	X	–
51	Injector circuit	X	–
55	No malfunction in the above circuit	X	X

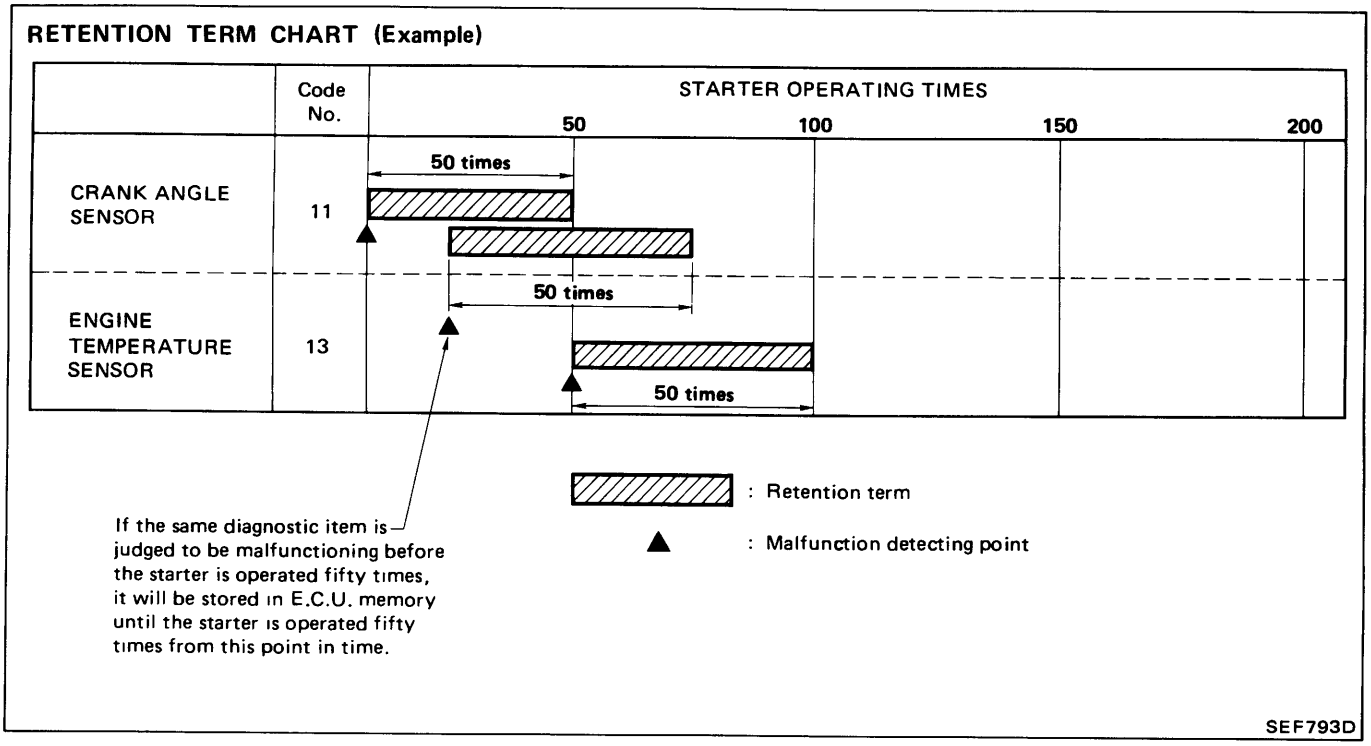
X: Available –: Not available

Self-diagnosis — Mode III (Self-diagnostic system) (Cont'd)

RETENTION OF DIAGNOSTIC RESULTS

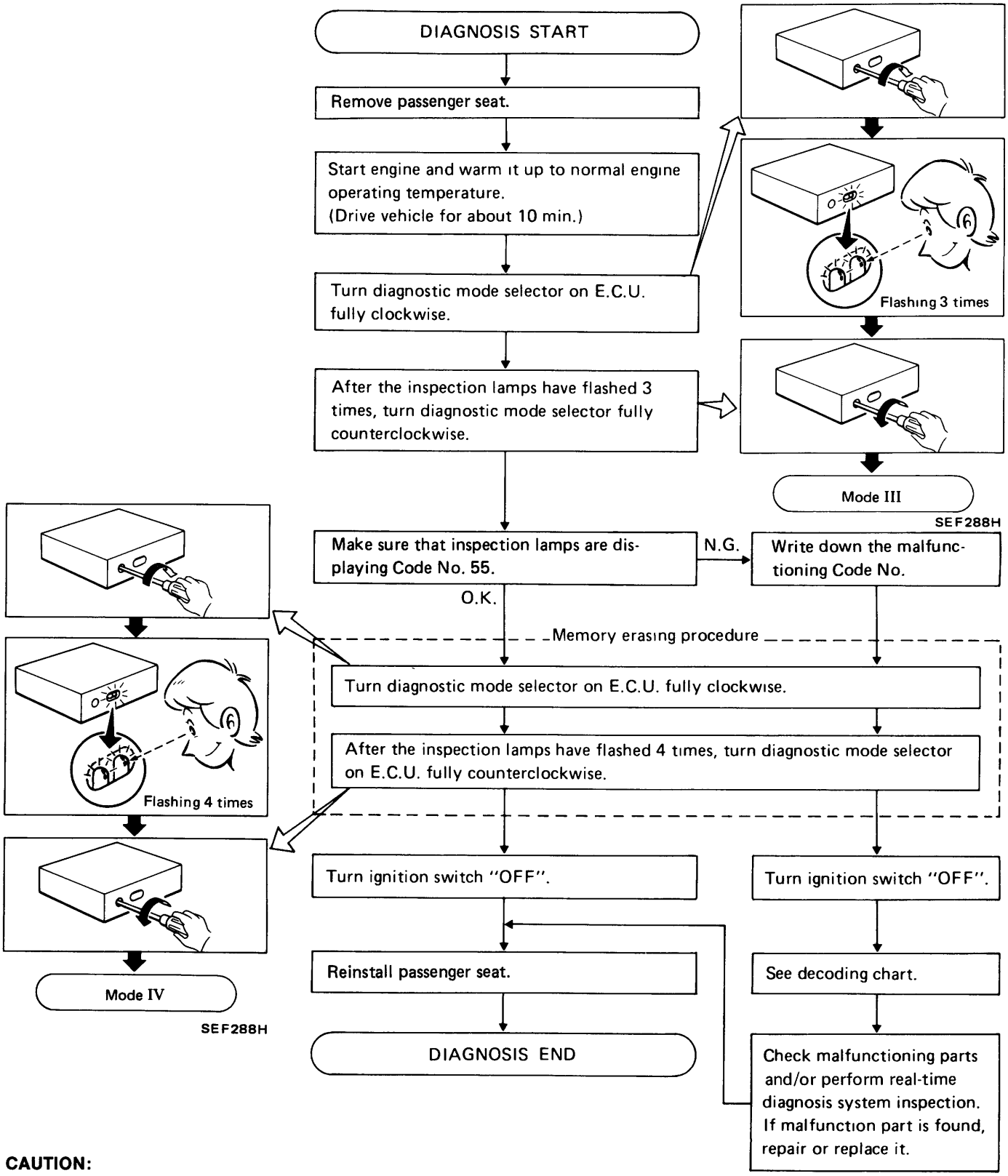
The diagnostic results will remain in E.C.U. memory until the starter is operated fifty times after a diagnostic item has been judged to be malfunctioning. The diagnostic result will then be cancelled automatically. If a diagnostic item which has been judged to be malfunctioning and stored in memory is again judged to be malfunctioning before the starter is operated fifty times, the second result will replace the previous one. It will be stored in E.C.U. memory until the starter is operated fifty times more.

RETENTION TERM CHART (Example)



Self-diagnosis — Mode III (Self-diagnostic system) (Cont'd)

SELF-DIAGNOSTIC PROCEDURE

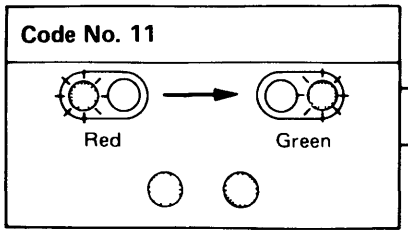
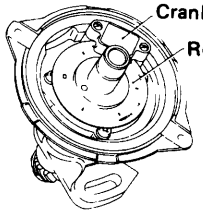
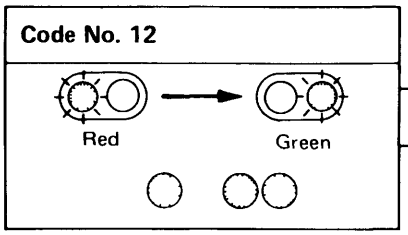
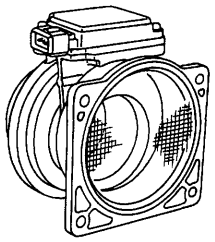
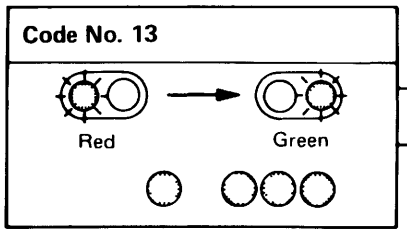
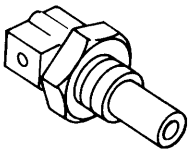
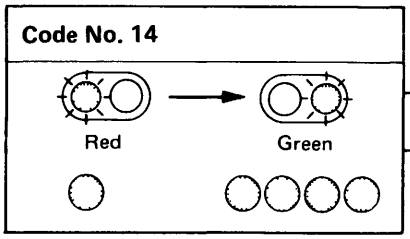
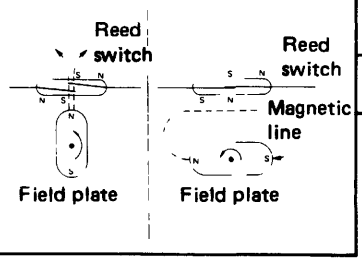


CAUTION:

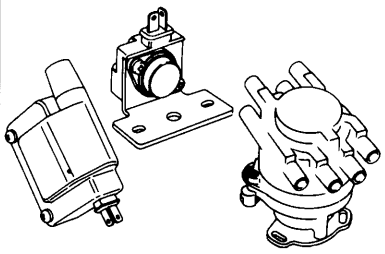
- **During display of a Code No. in self-diagnosis mode (Mode III), if another diagnostic mode is to be performed, be sure to note the malfunction Code No. before turning diagnostic mode selector on E.C.U. fully clockwise. When selecting an alternative, select the diagnosis mode after turning switch "OFF". Otherwise, self-diagnosis information in the E.C.U. memory will be lost.**
  Return the DIAGNOSTIC MODE selector to the previous position.

Self-diagnosis — Mode III (Self-diagnostic system) (Cont'd)

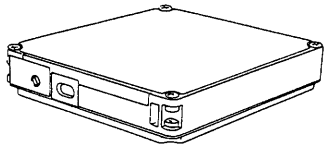
DECODING CHART

Display code	Malfunctioning circuit or parts	Control unit shows a malfunction signal when the following conditions are detected.
CRANK ANGLE SENSOR **Code No. 11** 	Crank angle sensor circuit is malfunctioning. 	• Either 1° or 120° signal is no entered for the first few seconds during engine cranking. • Either 1° or 120° signal is not input often enough while the engine speed is higher than the specified rpm. SYSTEM INSPECTION See page EF & EC-88.
SEF990D		
AIR FLOW METER CHECK **Code No. 12** 	Air flow meter circuit is malfunctioning. 	• The air flow meter circuit is open or shorted. (An abnormally high or low voltage is entered.) SYSTEM INSPECTION See page EF & EC-92.
SEF924J		
ENGINE TEMPERATURE SENSOR CHECK **Code No. 13** 	Engine temperature sensor circuit. 	• The engine temperature sensor circuit is open or shorted. (An abnormally high or low output voltage is entered.) SYSTEM INSPECTION See page EF & EC-96.
SEF833C		
VEHICLE SPEED SENSOR CHECK **Code No. 14** 	Vehicle speed sensor circuit Magnetic line 	• Signal circuit is open. SYSTEM INSPECTION See page EF & EC-98.
SEF928F		

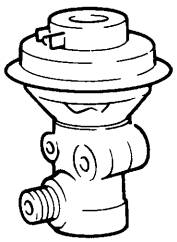
Self-diagnosis — Mode III (Self-diagnostic system) (Cont'd)

Display code	Malfunctioning circuit or parts	Control unit shows a malfunction signal when the following conditions are detected.
IGNITION SIGNAL Code No. 21 Red → Green	Ignition signal is malfunctioning. 	• The ignition signal in primary circuit is not entered during engine cranking or running. SYSTEM INSPECTION See page EF & EC-100.

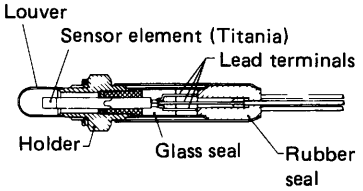
SEF993D

Display code	Malfunctioning circuit or parts	Control unit shows a malfunction signal when the following conditions are detected.
E.C.U. (E.C.C.S. CONTROL UNIT) CHECK Code No. 31 Red → Green	E.C.U. calculation function 	• Signal is beyond "normal" range. SYSTEM INSPECTION See page EF & EC-103.

SEC178B

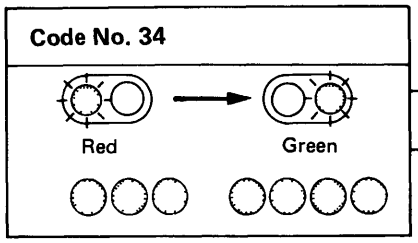
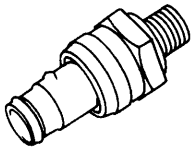
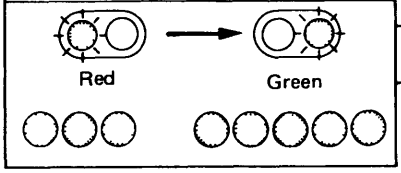
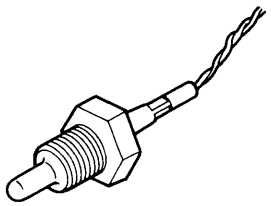
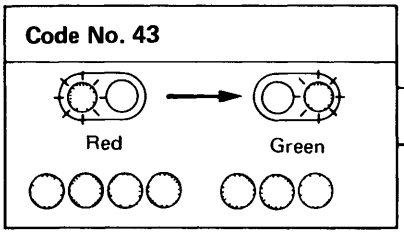
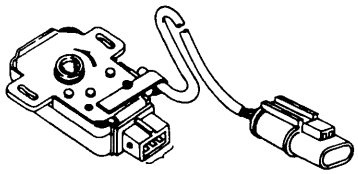
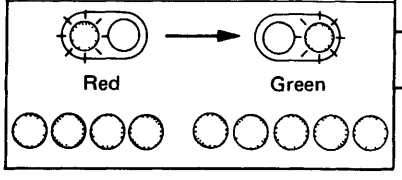
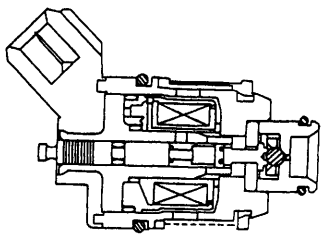
Display code	Malfunctioning circuit or parts	Control unit shows a malfunction signal when the following conditions are detected.
E.G.R. FUNCTION (California model only) CHECK Code No. 32 Red → Green	E.G.R. function 	• E.G.R. control valve does not operate. (E.G.R. control valve spring does not lift.) SYSTEM INSPECTION See page EF & EC-104.

SEF238G

Display code	Malfunctioning circuit or parts	Control unit shows a malfunction signal when the following conditions are detected.
EXHAUST GAS SENSOR CHECK Code No. 33 Red → Green	Exhaust gas sensor circuit  	• Signal circuit is open. DIAGNOSTIC PROCEDURE See page EF & EC-110.

SEC179B

Self-diagnosis — Mode III (Self-diagnostic system) (Cont'd)

Display code	Malfunctioning circuit or parts	Control unit shows a malfunction signal when the following conditions are detected.
DETONATION SENSOR Code No. 34 	Detonation sensor circuit is malfunctioning. 	• The detonation circuit is open or shorted. (An abnormally high or low voltage is entered.) SYSTEM INSPECTION See page EF & EC-114.
SEF191F		
EXHAUST GAS TEMPERATURE SENSOR CIRCUIT CHECK **(California model only)** Code No. 35 	Exhaust gas temperature sensor circuit 	• Signal circuit is open. SYSTEM INSPECTION See page EF & EC-116.
SEF239G		
THROTTLE SENSOR CHECK Code No. 43 	Throttle sensor circuit 	• Throttle sensor circuit is open or short. (Output voltage is too high or too low.) SYSTEM INSPECTION See page EF & EC-118.
SEF980F		
INJECTOR LEAK CHECK **(California model only)** Code No. 45 	Fuel leak 	Fuel leak from injector SYSTEM INSPECTION See page EF & EC-121.
SEF874J		

Self-diagnosis — Mode III (Self-diagnostic system) (Cont'd)

Display code	Malfunctioning circuit or parts	Control unit shows a malfunction signal when the following conditions are detected.
INJECTOR CIRCUIT CHECK **(California model only)** **Code No. 51** Red Green	Injector circuit	• Injector circuit is open. SYSTEM INSPECTION See page EF & EC-124.

SEF847J

Code No. 55 Red Green		E.C.C.S. normal operation.

SEF946F

Self-diagnosis — Mode Ⅳ (Switches ON/OFF diagnostic system)

In switches ON/OFF diagnostic system, ON/OFF operation of the following switches can be detected continuously.

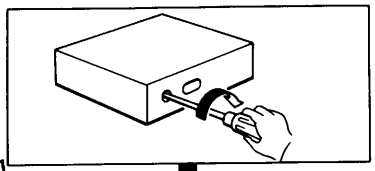
- Soft idle switch
- Starter switch
- Vehicle speed sensor

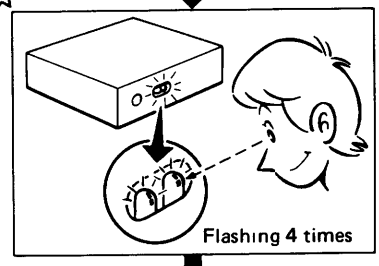
(1) Throttle valve switch & Starter switch
The switches ON/OFF status in Mode Ⅳ is stored in E.C.U. memory. When either switch is turned from "ON" to "OFF" or "OFF" to "ON", the red L.E.D. on E.C.U. alternately comes on and goes off each time switching is performed.

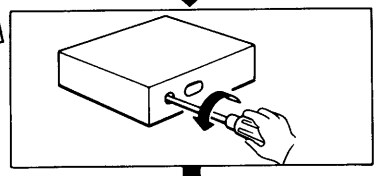
(2) Vehicle speed sensor
The switches ON/OFF status in Mode Ⅳ is selected is stored in E.C.U. memory. The green L.E.D. on E.C.U. remains off when vehicle speed is 20 km/h (12 MPH) or below, and comes ON at higher speeds.

Self-diagnosis — Mode IV (Switches ON/OFF diagnostic system) (Cont'd)

SELF-DIAGNOSTIC PROCEDURE







DIAGNOSIS START

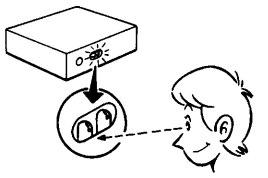
Remove passenger seat.

Turn ignition switch "ON".

Turn diagnostic mode selector on E.C.U. fully clockwise.

After the inspection lamps have flashed 4 times, turn diagnostic mode selector fully counterclockwise.

Make sure that a red inspection lamp goes "OFF".



SEF451H

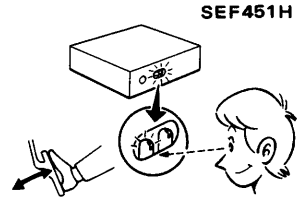
Mode IV

SEF288H

Make sure that a red inspection lamp goes "ON" when depressing accelerator pedal.

N.G. → Check throttle sensor circuit.

O.K.



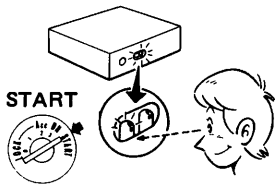
Accelerator pedal

SEF298H

Make sure that a red inspection lamp goes "ON" during turning ignition switch "START".

N.G. → Check starter signal circuit.

O.K.



SEF299H

Lift the rear of the vehicle.

Drive vehicle. Make sure that a green inspection lamp goes "ON" when vehicle speed is 20 km/h (12 MPH) or faster.

N.G. → Check vehicle speed sensor circuit.

O.K.

Turn ignition switch "OFF".

Reinstall passenger seat.

DIAGNOSIS END

CAUTION:

- **For safety, do not drive rear wheels at higher speed than required.**

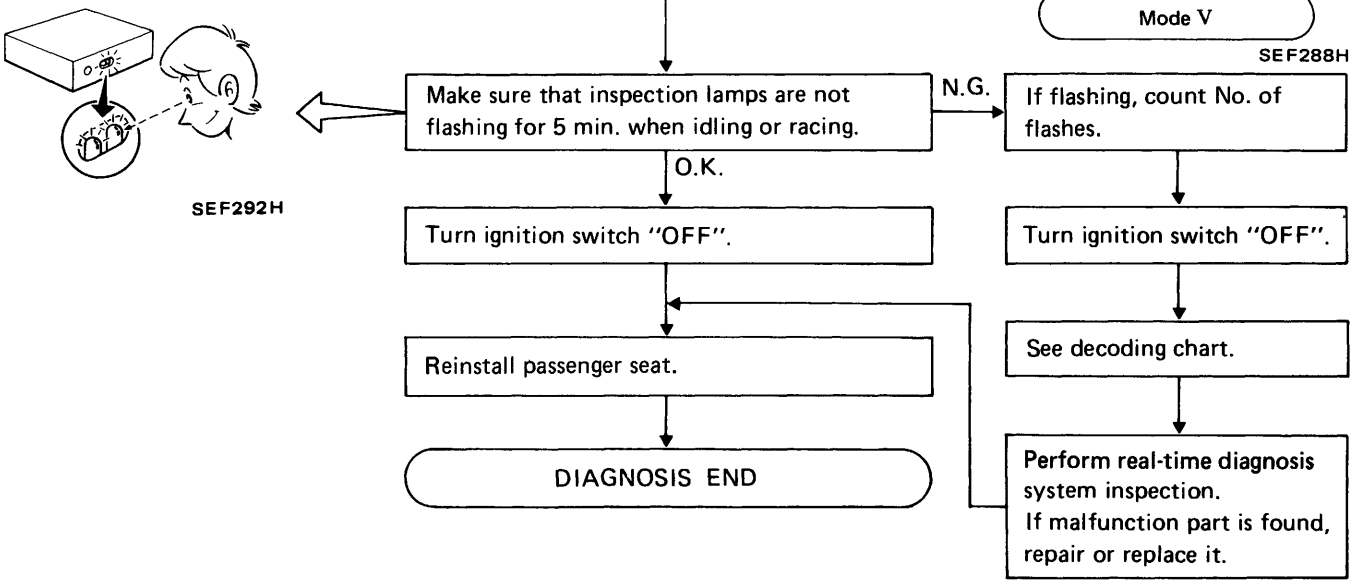
Self-diagnosis — Mode V (Real-time diagnostic system)

In real-time diagnosis, if the following items are judged to be working incorrectly, a malfunction will be indicated immediately.

- Crank angle sensor (120° signal & 1° signal) output signal
- Ignition signal
- Air flow meter output signal

Consequently, this diagnosis very effectively determines whether the above systems cause the malfunction, during driving test. Compared with self-diagnosis, real-time diagnosis is very sensitive and can detect malfunctions instantly. However, items regarded as malfunctions in this diagnosis are not stored in E.C.U. memory.

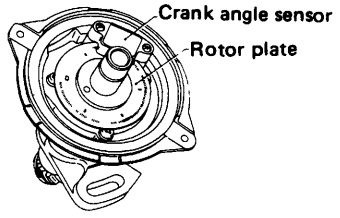
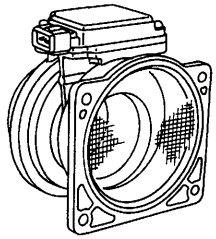
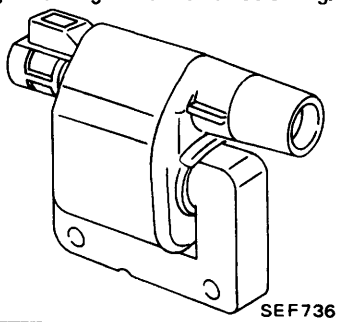
SELF-DIAGNOSTIC PROCEDURE



CAUTION:
In real-time diagnosis, pay attention to inspection lamp flashing. E.C.U. displays the malfunction code only once and does not memorize the inspection.

Self-diagnosis — Mode V (Real-time diagnostic system) (Cont'd)

DECODING CHART

Display presentation	Malfunction circuit or parts	Control unit shows a malfunction signal when the following conditions are detected. (Compare with Self-diagnosis — Mode III.)
CRANK ANGLE SENSOR RED L.E.D. ON OFF SEC730A	Crank angle sensor circuit is malfunctioning.  SEF612B	The 1° or 120° signal is momentarily missing, or, multiple, momentary noise signals enter. REAL TIME DIAGNOSTIC INSPECTION See page EF & EC-78.
AIR FLOW METER GREEN L.E.D. ON OFF SEC731A	Air flow meter circuit is malfunctioning.  SEF848J	Abnormal, momentary increase in air flow meter output signal. REAL TIME DIAGNOSTIC INSPECTION See page EF & EC-79.
IGNITION SIGNAL GREEN L.E.D. ON OFF SEC732A	Ignition signal is malfunctioning.  SEF736I	Signal from the primary ignition coil momentarily drops off. REAL TIME DIAGNOSTIC INSPECTION See page EF & EC-80.

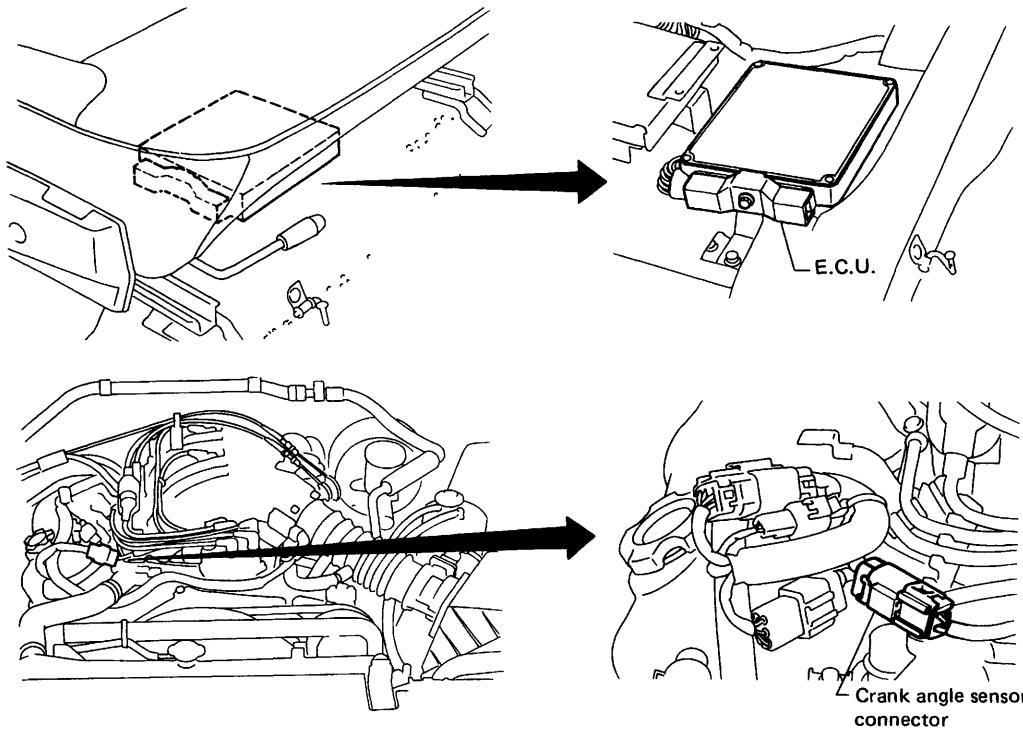
Self-diagnosis — Mode V (Real-time diagnostic system) (Cont'd)

REAL-TIME DIAGNOSTIC INSPECTION

Crank Angle Sensor

X: Available
—: Not available

Check sequence	Check items	Check conditions	Check parts			If malfunction, perform the following items.
			Crank angle sensor harness connector	Sensor & actuator	E.C.U. S.M.J. harness connector	
1	Tap and wiggle harness connector or component during real-time diagnosis.	During real-time diagnosis	X	X	X	Go to check item 2.
2	Check harness continuity at connector.	Engine stopped	X	—	—	Go to check item 3.
3	Disconnect harness connector, and then check dust adhesion to harness connector.	Engine stopped	X	—	X	Clean terminal surface.
4	Check pin terminal bend.	Engine stopped	—	—	X	Take out bend.
5	Reconnect harness connector and then recheck harness continuity at connector.	Engine stopped	X	—	—	Replace terminal.
6	Tap and wiggle harness connector or component during real-time diagnosis.	During real-time diagnosis	X	X	X	If malfunction codes are displayed during real-time diagnosis, replace terminal.



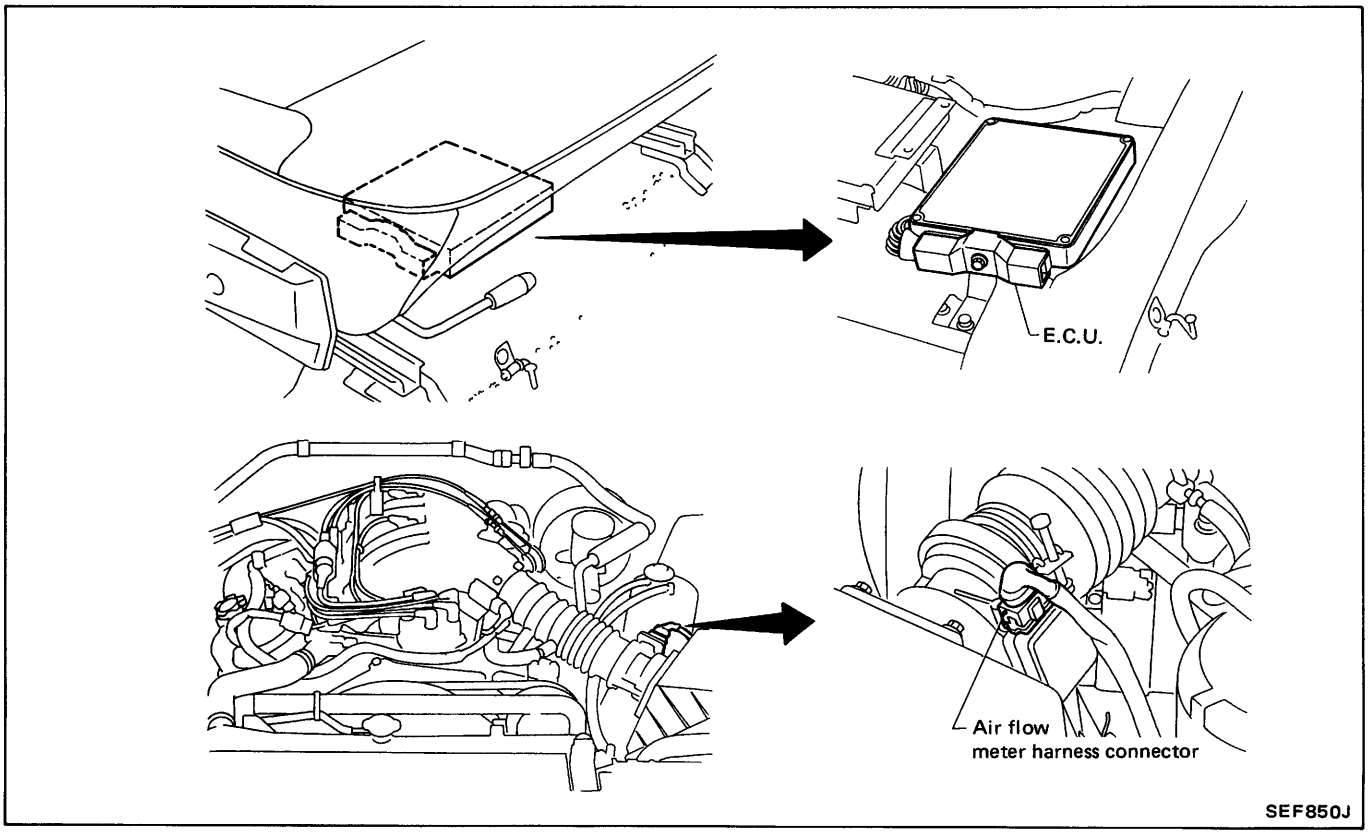
SEF849J

Self-diagnosis — Mode V (Real-time diagnostic system) (Cont'd)

Air Flow Meter

X: Available
—: Not available

Check sequence	Check items	Check conditions	Check parts			If malfunction, perform the following items.
			Air flow meter harness connector	Sensor & actuator	E.C.U. S.M.J. harness connector	
1	Tap and wiggle harness connector or component during real-time diagnosis.	During real-time diagnosis	X	X	X	Go to check item 2.
2	Check harness continuity at connector.	Engine stopped	X	—	—	Go to check item 3.
3	Disconnect harness connector, and then check dust adhesion to harness connector.	Engine stopped	X	—	X	Clean terminal surface.
4	Check pin terminal bend.	Engine stopped	—	—	X	Take out bend.
5	Reconnect harness connector and then recheck harness continuity at connector.	Engine stopped	X	—	—	Replace terminal.
6	Tap and wiggle harness connector or component during real-time diagnosis.	During real-time diagnosis	X	X	X	If malfunction codes are displayed during real-time diagnosis, replace terminal.

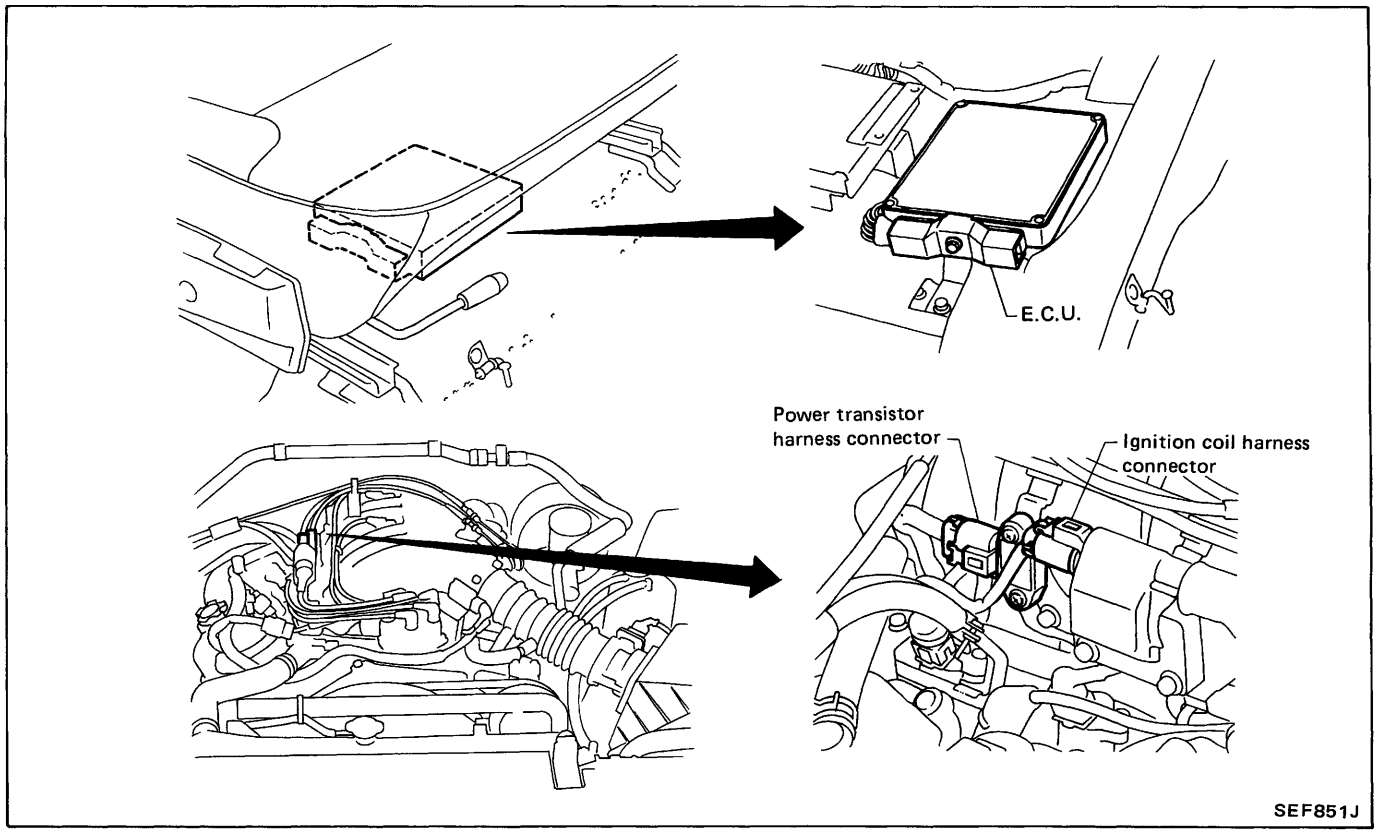


Self-diagnosis — Mode V (Real-time diagnostic system) (Cont'd)

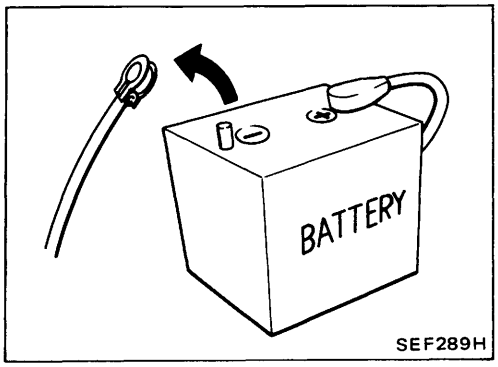
Ignition Signal

X: Available
—: Not available

Check sequence	Check items	Check conditions	Check parts			If malfunction, perform the following items.
			Ignition signal harness connector	Sensor & actuator	E.C.U. S.M.J. harness connector	
1	Tap and wiggle harness connector or component during real-time diagnosis.	During real-time diagnosis	X	X	X	Go to check item 2.
2	Check harness continuity at connector.	Engine stopped	X	—	—	Go to check item 3.
3	Disconnect harness connector, and then check dust adhesion to harness connector.	Engine stopped	X	—	X	Clean terminal surface.
4	Check pin terminal bend.	Engine stopped	—	—	X	Take out bend.
5	Reconnect harness connector and then recheck harness continuity at connector.	Engine stopped	X	—	—	Replace terminal.
6	Tap and wiggle harness connector or component during real-time diagnosis.	During real-time diagnosis	X	X	X	If malfunction codes are displayed during real-time diagnosis, replace terminal.



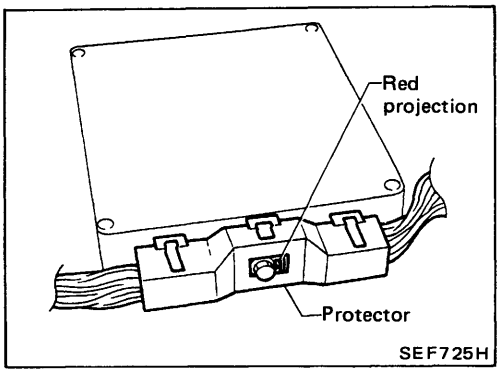
NOTE



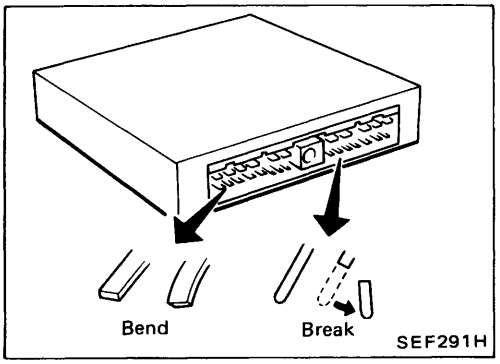
Diagnostic Procedure

CAUTION:

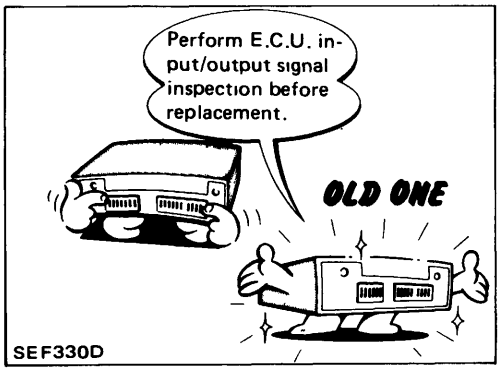
1. **Before connecting or disconnecting the E.C.U. harness connector to or from any E.C.U., be sure to turn the ignition switch to the "OFF" position and disconnect the negative battery terminal in order not to damage E.C.U. as battery voltage is applied to E.C.U. even if ignition switch is turned off. Failure to do so may damage the E.C.U.**



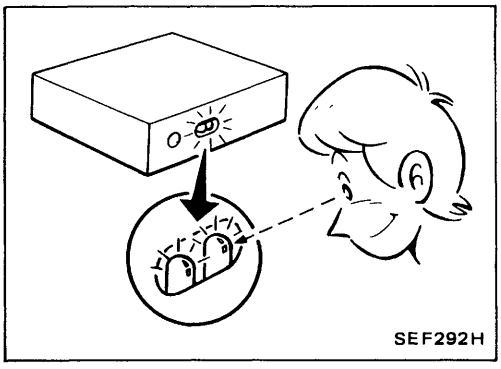
2. **When connecting E.C.U. harness connector, tighten securing bolt until red projection is in line with connector face.**



3. **When connecting or disconnecting pin connectors into or from E.C.U., take care not to damage pin terminals (bend or break).**
4. **Make sure that there are not any bends or breaks on E.C.U. pin terminal, when connecting pin connectors.**

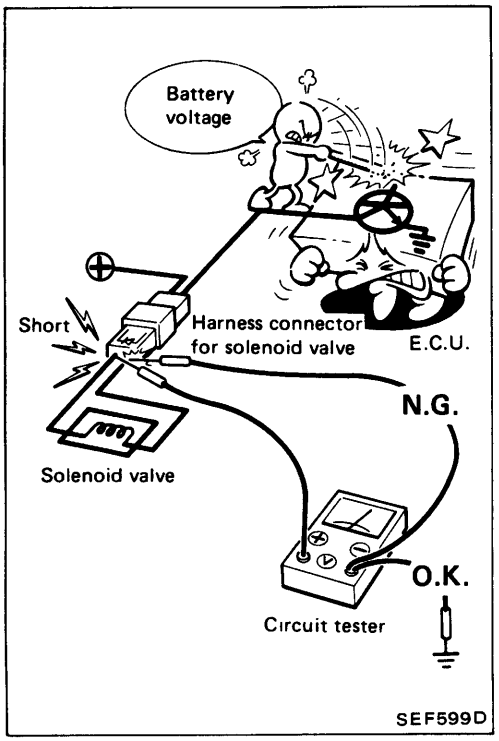


5. **Before replacing E.C.U., perform E.C.U. input/output signal inspection and make sure whether E.C.U. functions properly or not. (See page EF & EC-150.)**



6. **After performing this "Diagnostic Procedure", perform E.C.C.S. self-diagnosis and driving test.**

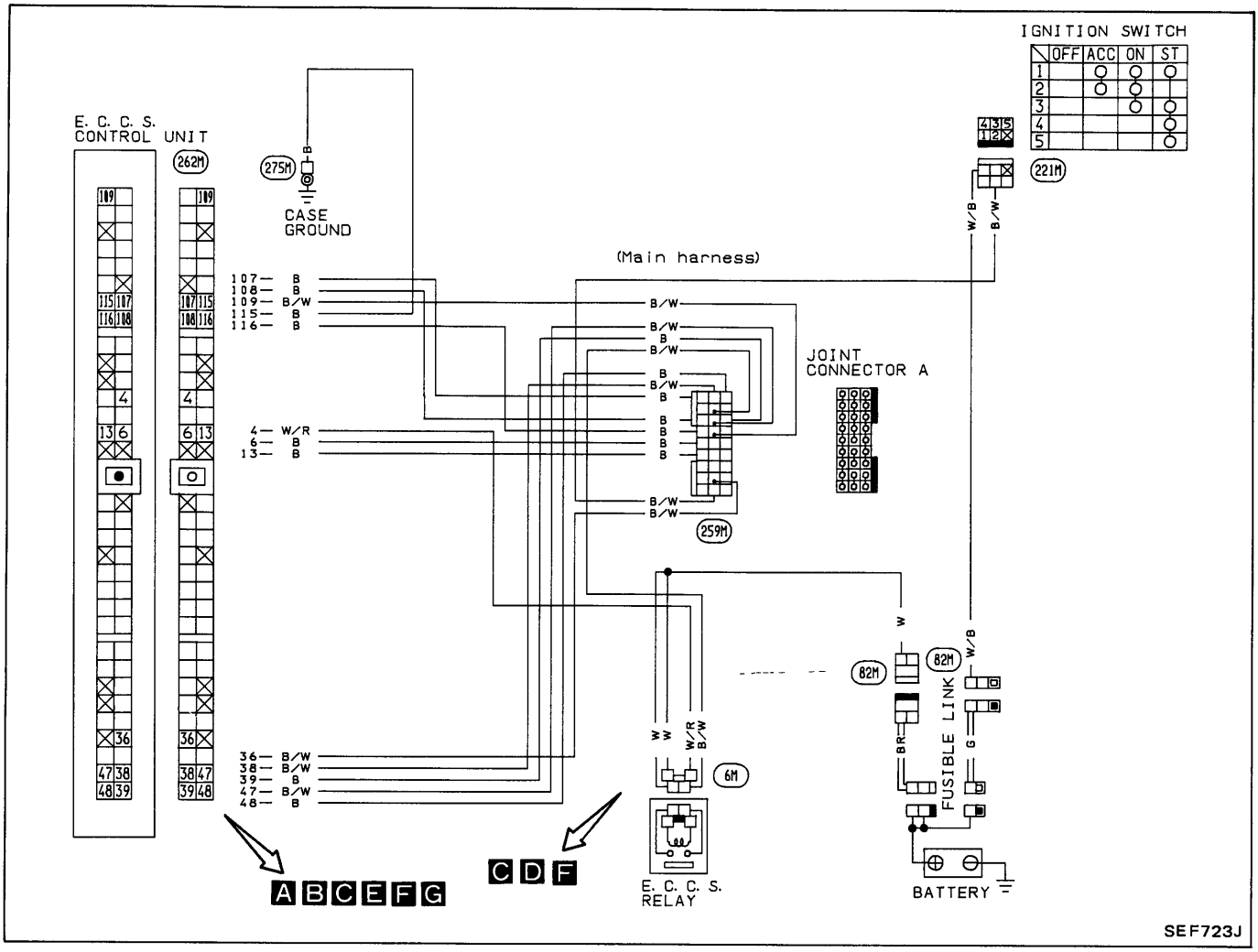
Diagnostic Procedure (Cont'd)



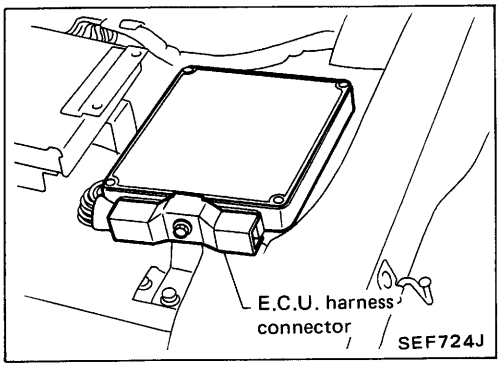
7. **When measuring E.C.U. controlled components supply voltage with a circuit tester, separate one tester probe from the other.**
   If the two tester probes accidentally make contact with each other during measurement, the circuit will be shorted, resulting in damage to the control unit power transistor.

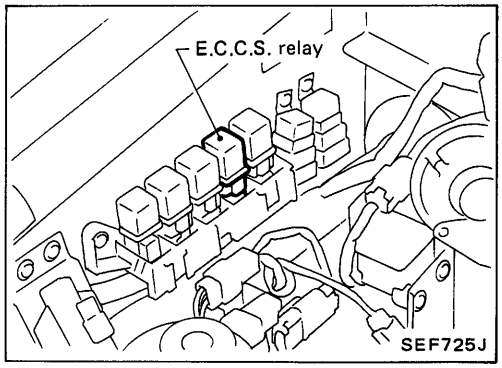
Diagnostic Procedure 1

MAIN POWER SUPPLY AND GROUND CIRCUIT (Not self-diagnostic item)

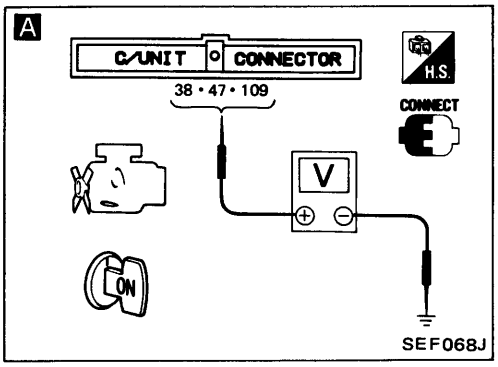


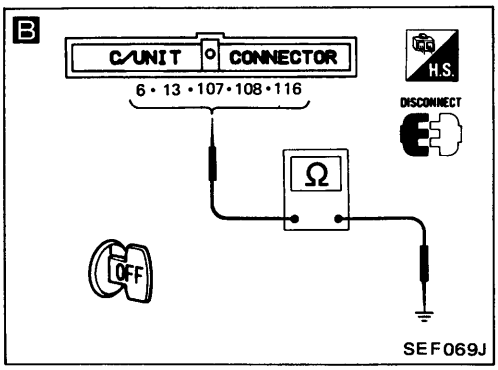
Harness layout

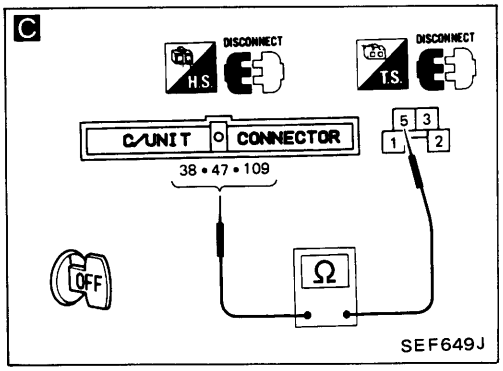


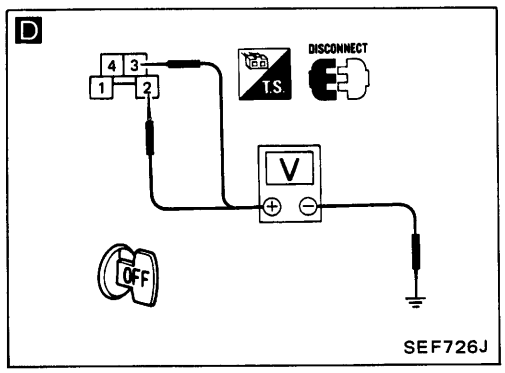


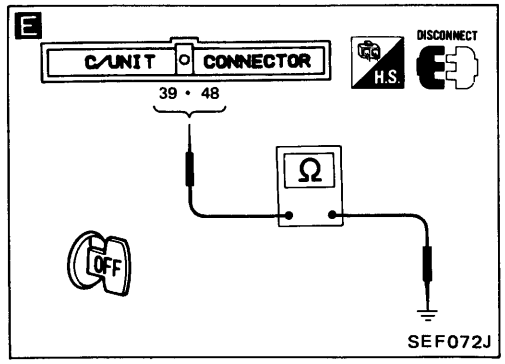
Diagnostic Procedure 1 (Cont'd)











INSPECTION START

A

CHECK POWER SUPPLY.
1) Turn ignition switch "ON".
2) Check voltage between E.C.U. terminals (38), (47), (109) and ground.
Voltage: Battery voltage

O.K. → **B**

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminals (6), (13), (107), (108), (116) and ground.
Continuity should exist.
If N.G., repair harness or connectors.

O.K.

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

N.G.

C

CHECK HARNESS CONTINUITY BETWEEN E.C.C.S. RELAY AND E.C.U.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Disconnect E.C.C.S. relay.
4) Check harness continuity between E.C.U. terminals (38), (47), (109) and terminal (5).
Continuity should exist.

N.G. →

Check the following.
- Joint connector-A (259M)
- Harness continuity between E.C.U. and E.C.C.S. relay

If N.G., repair harness or connectors.

O.K.

D

CHECK VOLTAGE BETWEEN E.C.C.S. RELAY AND GROUND.
1) Check voltage between terminals (2), (3) and ground.
Voltage: Battery voltage

N.G. →

Check the following.
- "BR" fusible link
- Harness continuity between E.C.C.S. relay and battery

If N.G., repair harness or connectors.

O.K.

E

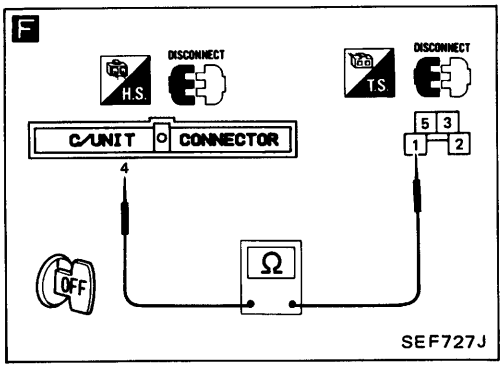
CHECK GROUND CIRCUIT.
1) Check harness continuity between E.C.U. terminals (39), (48) and engine ground.
Continuity should exist.

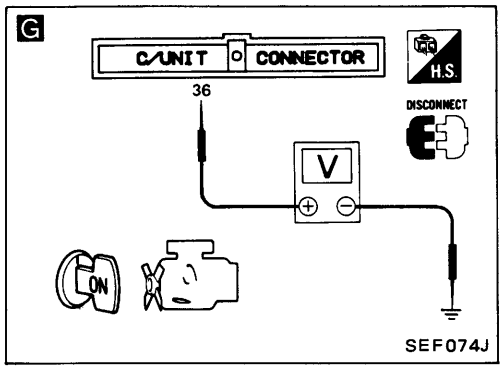
N.G. → Repair harness or connectors.

O.K.

(A)

Diagnostic Procedure 1 (Cont'd)





Ⓐ

F

CHECK OUTPUT SIGNAL CIRCUIT.
1) Check harness continuity between E.C.U. terminal ④ and terminal ①.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

G

CHECK INPUT SIGNAL CIRCUIT.
1) Turn ignition switch "ON".
2) Check voltage between E.C.U. terminal ㊱ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Joint connector-A (259M)
- Harness continuity between ignition switch and E.C.U.

If N.G., repair harness or connectors.

O.K. ↓

CHECK COMPONENT (E.C.C.S. relay).
Refer to "Electrical Components Inspection". (See page EF & EC-157.)

N.G. → Replace E.C.C.S. relay.

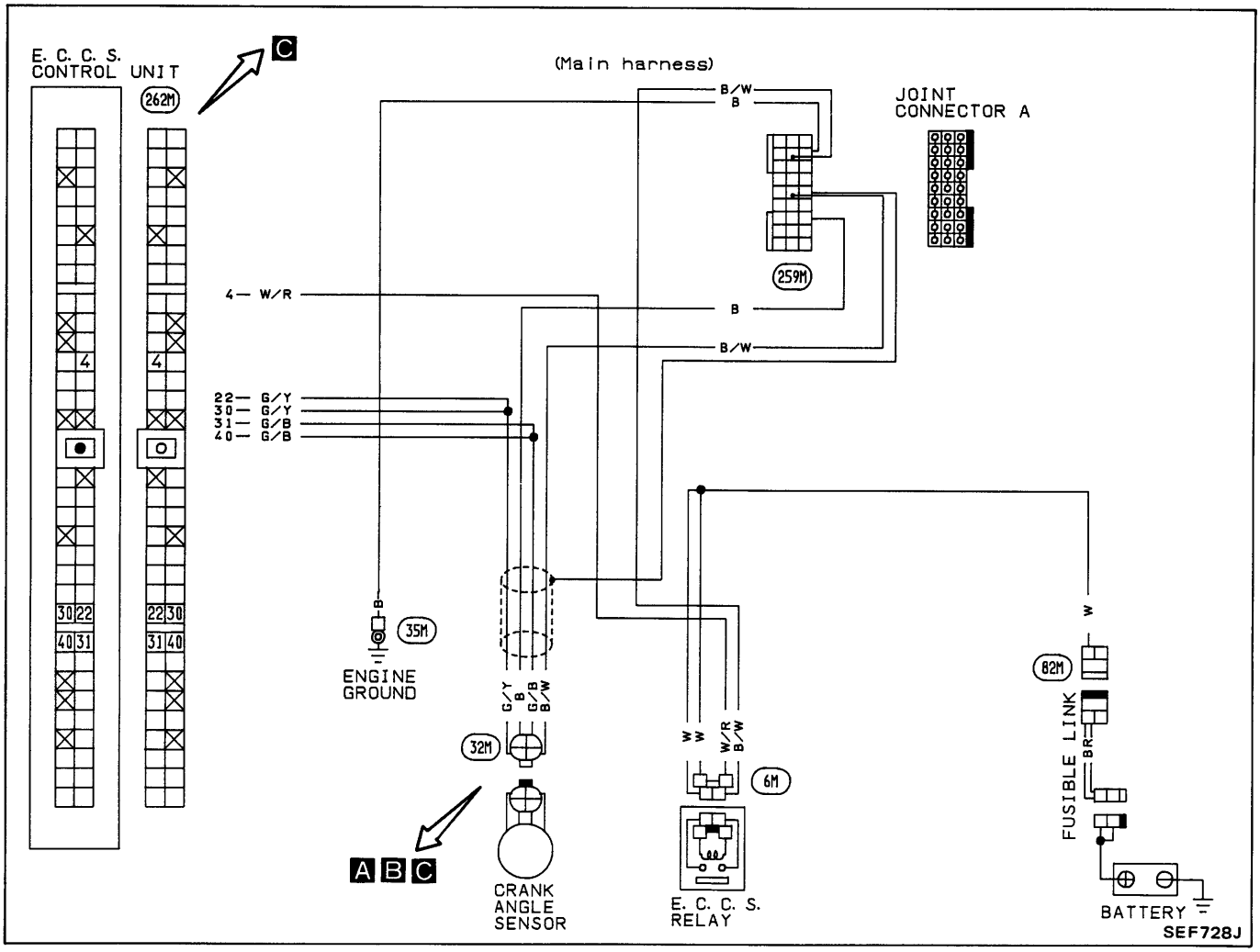
O.K. ↓

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

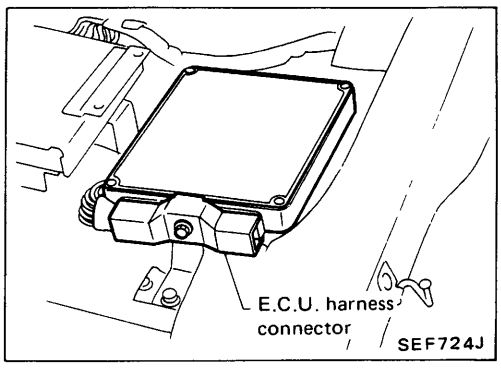
NOTE

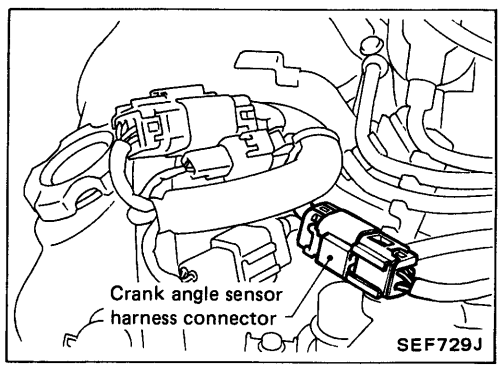
Diagnostic Procedure 2

CRANK ANGLE SENSOR (Code No. 11)

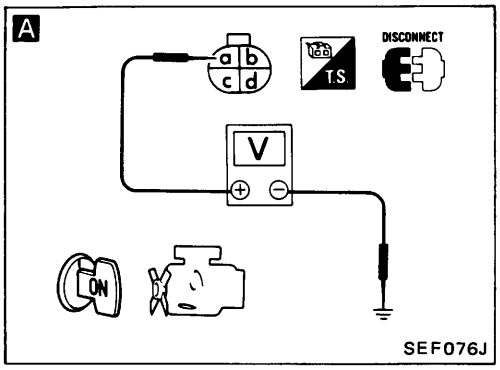


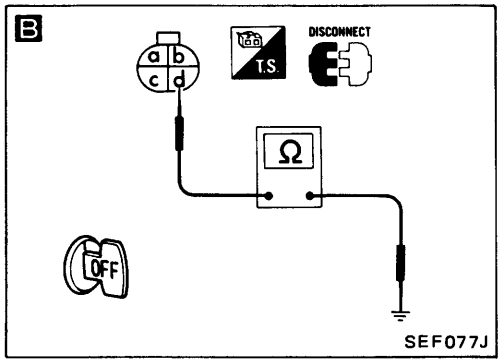
Harness layout

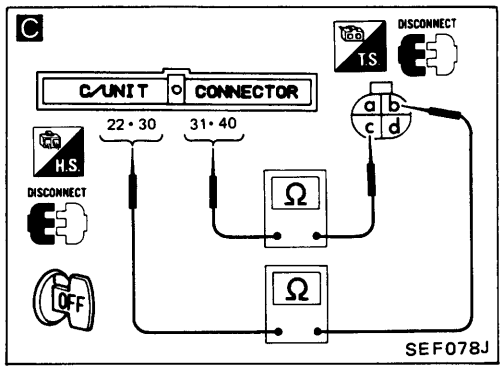




Diagnostic Procedure 2 (Cont'd)







INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect crank angle sensor harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓐ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Joint connector-A (259M)
- Harness continuity between crank angle sensor and E.C.C.S. relay

If N.G., repair harness or connectors.

O.K. ↓

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓓ and engine ground.
Continuity should exist.

N.G. → Check the following.
- Joint connector-A (259M)
- Harness continuity between crank angle sensor and ground

If N.G., repair harness or connectors.

O.K. ↓

C

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between terminal ⓒ and E.C.U. terminals (31), (40) (1° signal), terminal ⓑ and E.C.U. terminals (22), (30) (120° signal).
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

CHECK COMPONENT (Crank angle sensor).
Refer to "Electrical Components Inspection".
(See page EF & EC-151.)

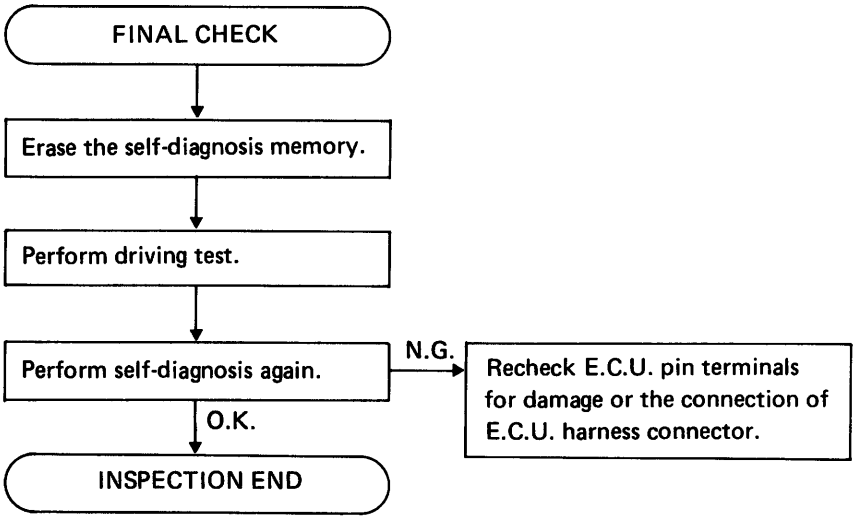
N.G. → Replace crank angle sensor.

O.K. ↓

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Diagnostic Procedure 2 (Cont'd)

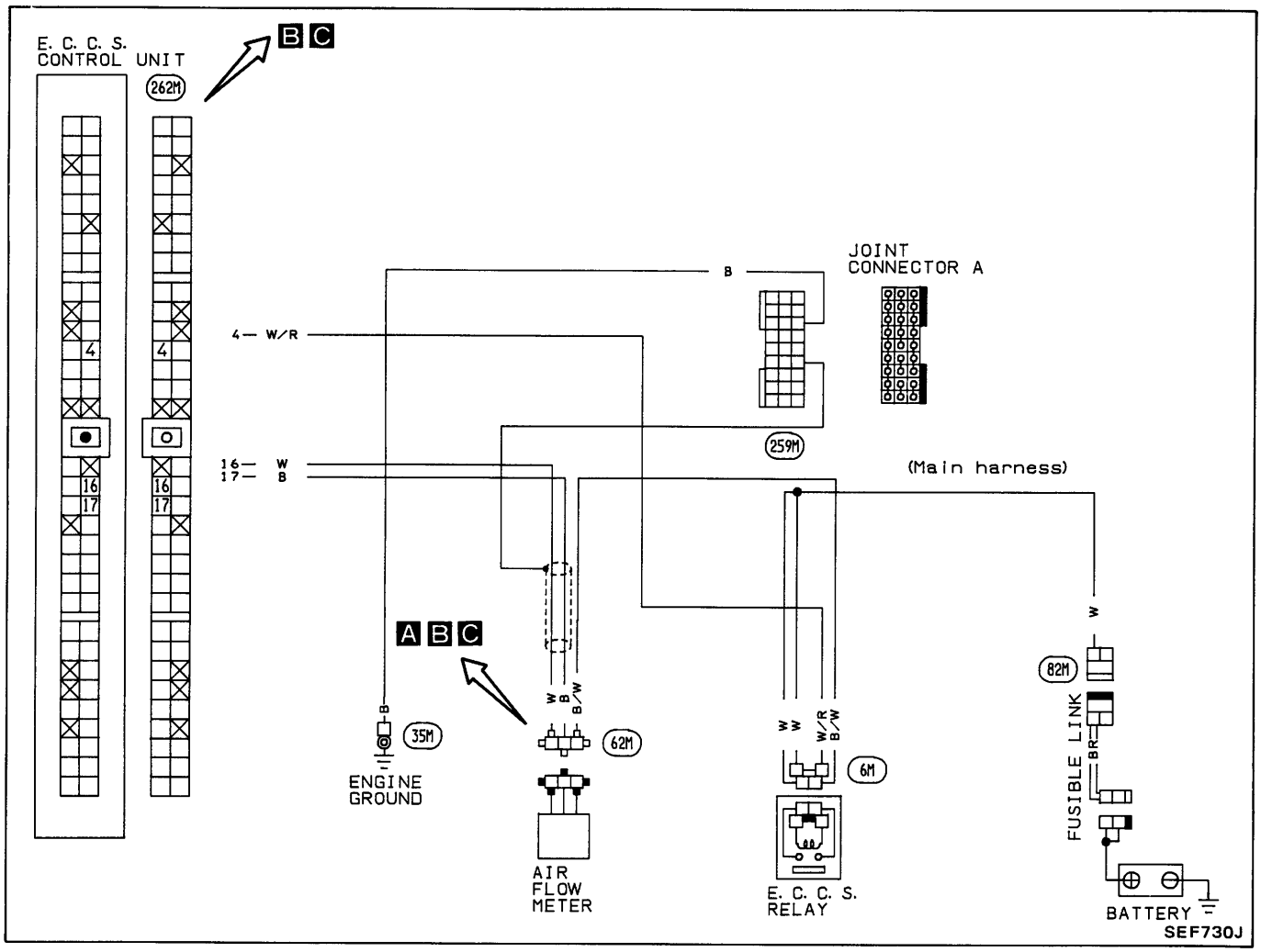
Perform FINAL CHECK by the following procedure after repair is completed.



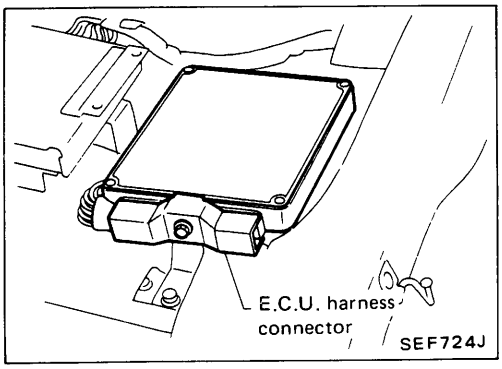
NOTE

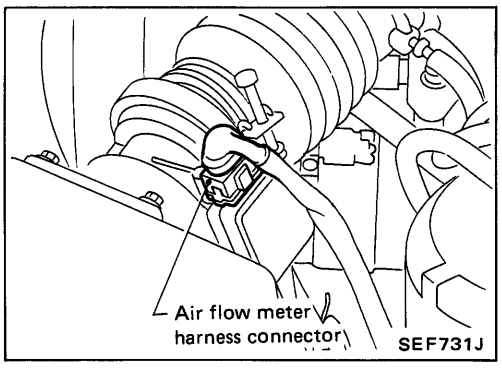
Diagnostic Procedure 3

AIR FLOW METER (Code No. 12) (CHECK ENGINE LIGHT ITEM)

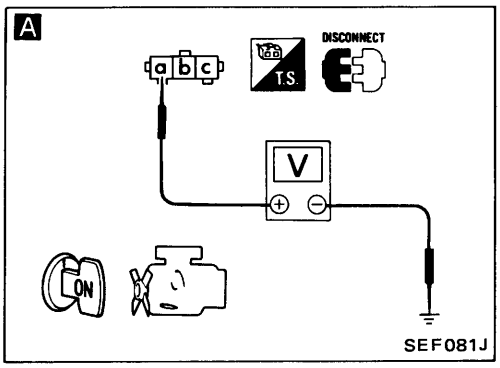


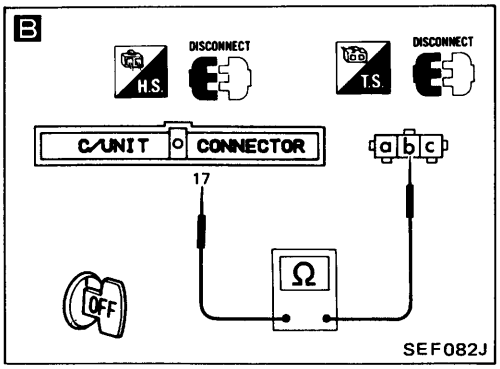
Harness layout

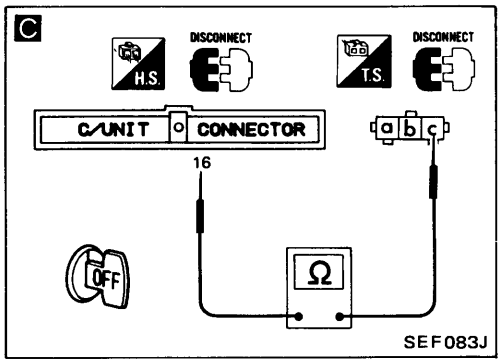




Diagnostic Procedure 3 (Cont'd)







INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect air flow meter harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓐ and ground.
Voltage: Battery voltage

N.G. → Repair harness or connectors.

O.K. ↓

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between terminal ⓑ and E.C.U. terminal ⑰.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

C

CHECK INPUT SIGNAL CIRCUIT.
1) Check harness continuity between terminal ⓒ and E.C.U. terminal ⑯.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

CHECK COMPONENT
(Air flow meter).
Refer to "Electrical Components Inspection".
(See page EF & EC-151.)

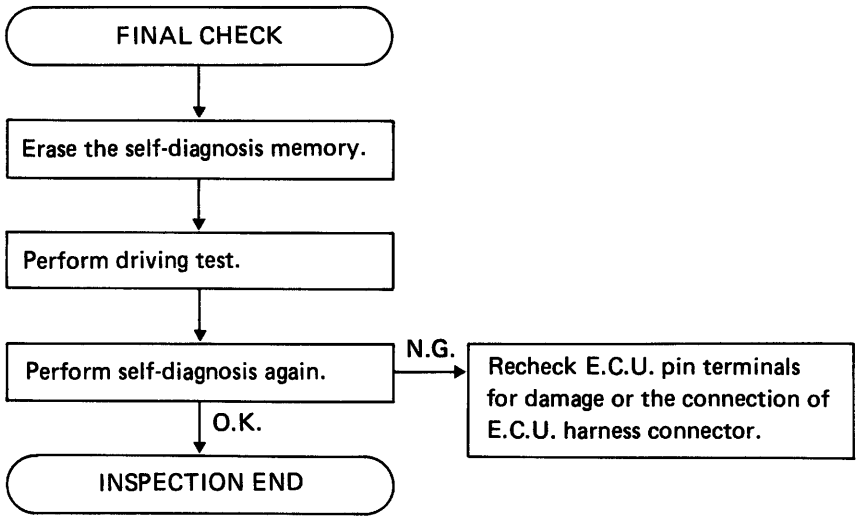
N.G. → Replace air flow meter.

O.K. ↓

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Diagnostic Procedure 3 (Cont'd)

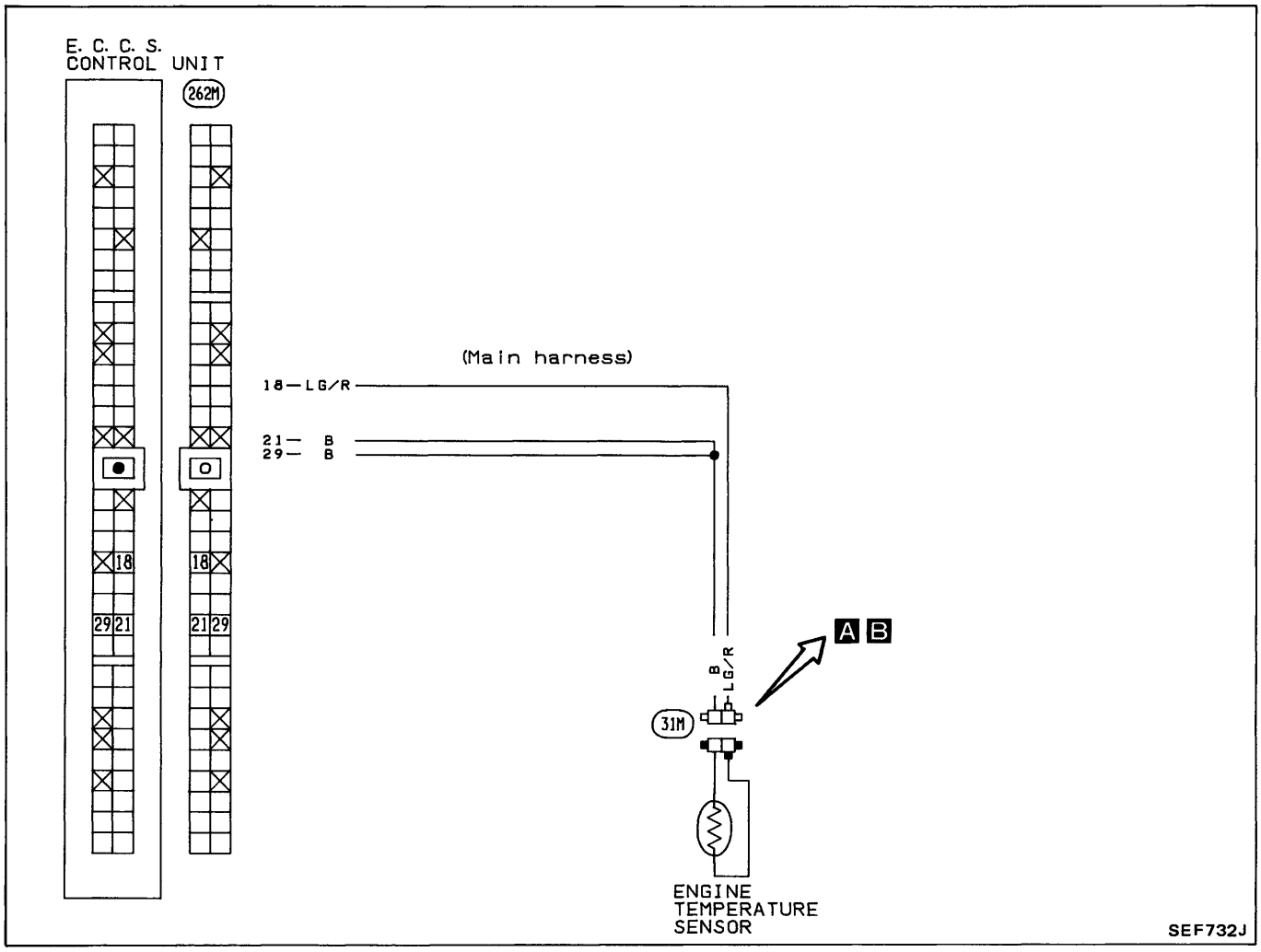
Perform FINAL CHECK by the following procedure after repair is completed.



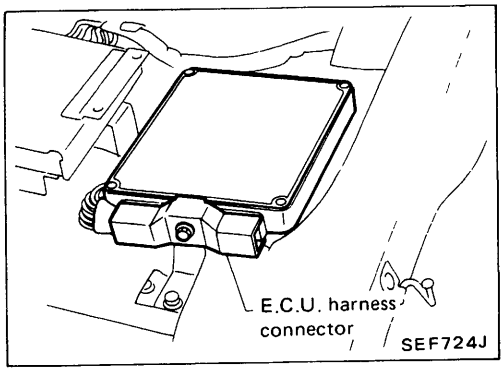
NOTE

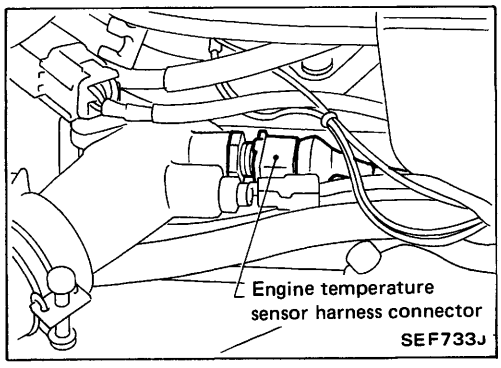
Diagnostic Procedure 4

ENGINE TEMPERATURE SENSOR (Code No. 13) (CHECK ENGINE LIGHT ITEM)

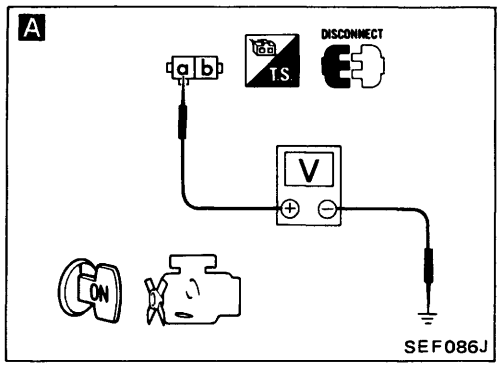


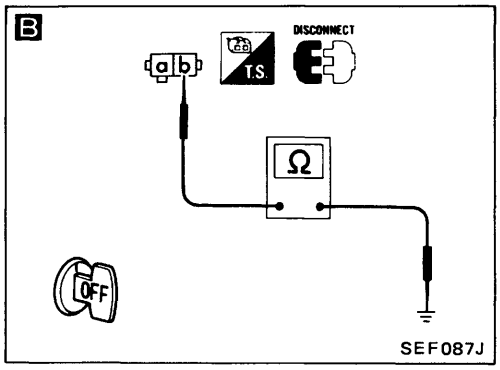
Harness layout





Diagnostic Procedure 4 (Cont'd)





INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect engine temperature sensor harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓐ and ground.
Voltage: Approximately 5V

N.G. → Repair harness or connectors.

O.K.

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓑ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

CHECK COMPONENT
(Engine temperature sensor).
Refer to "Electrical Components Inspection". (See page EF & EC-152.)

N.G. → Replace engine temperature sensor.

O.K.

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Perform FINAL CHECK by the following procedure after repair is completed.

FINAL CHECK

Erase the self-diagnosis memory.

Perform driving test.

Perform self-diagnosis again.

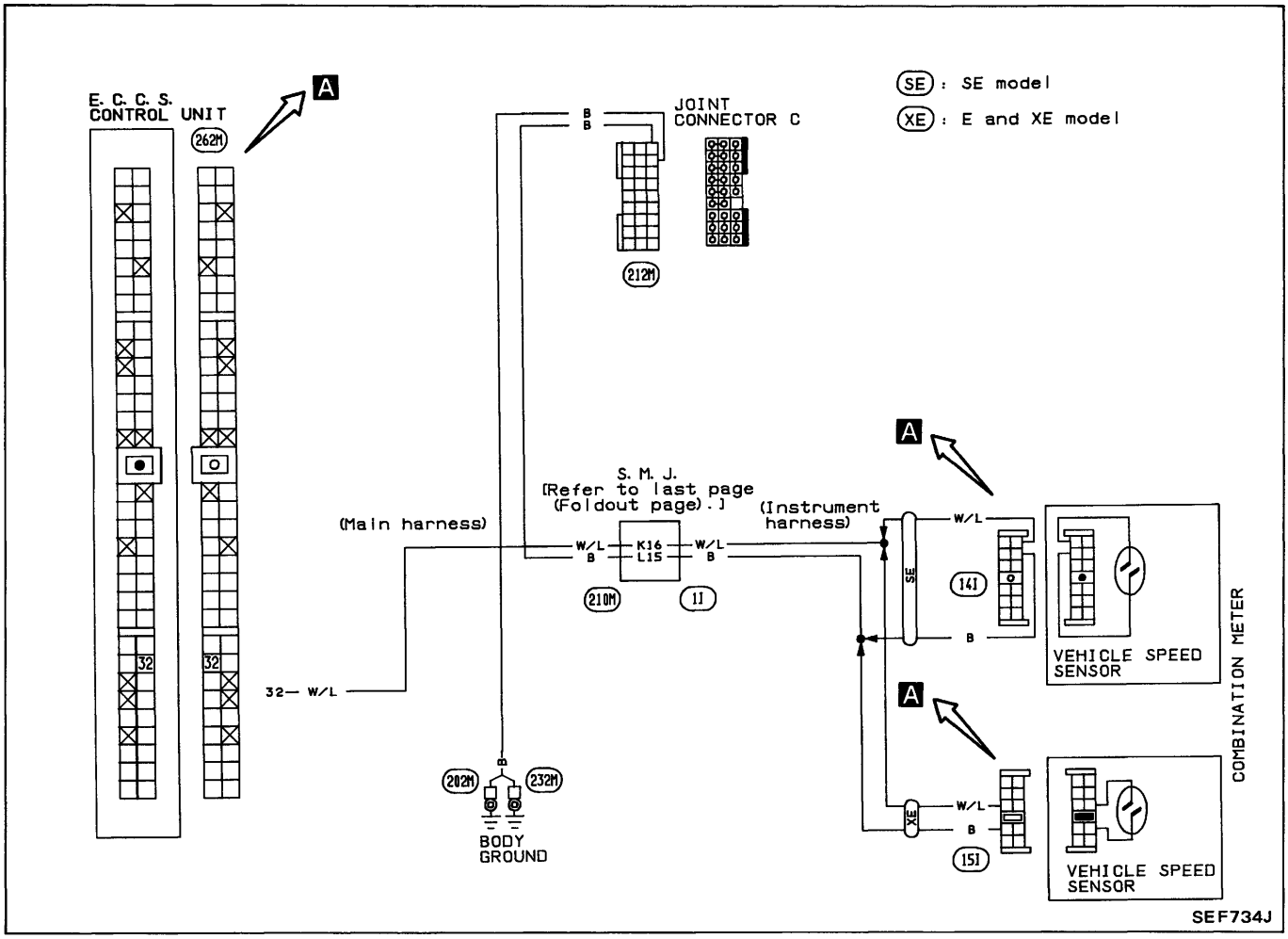
N.G. → Recheck E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K.

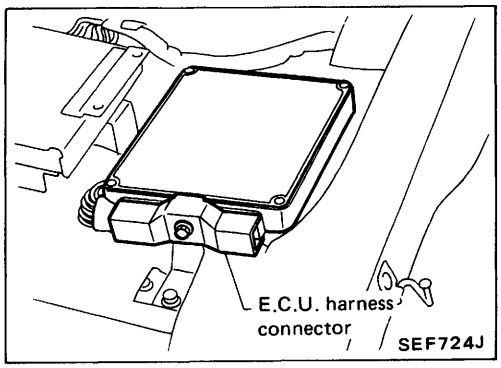
INSPECTION END

Diagnostic Procedure 5

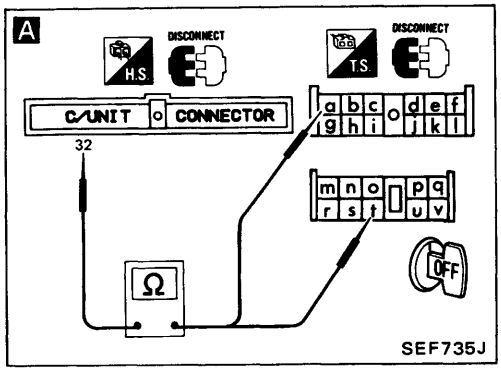
VEHICLE SPEED SENSOR (Code No. 14) (Switch ON/OFF diagnostic item) (CHECK ENGINE LIGHT ITEM)



Harness layout



Diagnostic Procedure 5 (Cont'd)



INSPECTION START

CHECK SPEEDOMETER FUNCTION.
Make sure that speedometer functions properly.

N.G. → Check vehicle speed sensor and its circuit. (Refer to EL section.)

O.K.

A

CHECK INPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Disconnect combination meter harness connector
   ⑭① (SE model),
   ⑮① (E and XE model).
4) Check harness continuity between E.C.U. terminal ㉜ and terminal ⓐ (SE model), ⓣ (E and XE model).

N.G. → Check the following.
- Harness connectors ㉑⓪Ⓜ, ⑪
- Harness continuity between E.C.U. and combination meter

If N.G., repair harness or connectors.

O.K.

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Perform FINAL CHECK by the following procedure after repair is completed.

FINAL CHECK

Start engine.

Perform switch ON/OFF diagnosis.

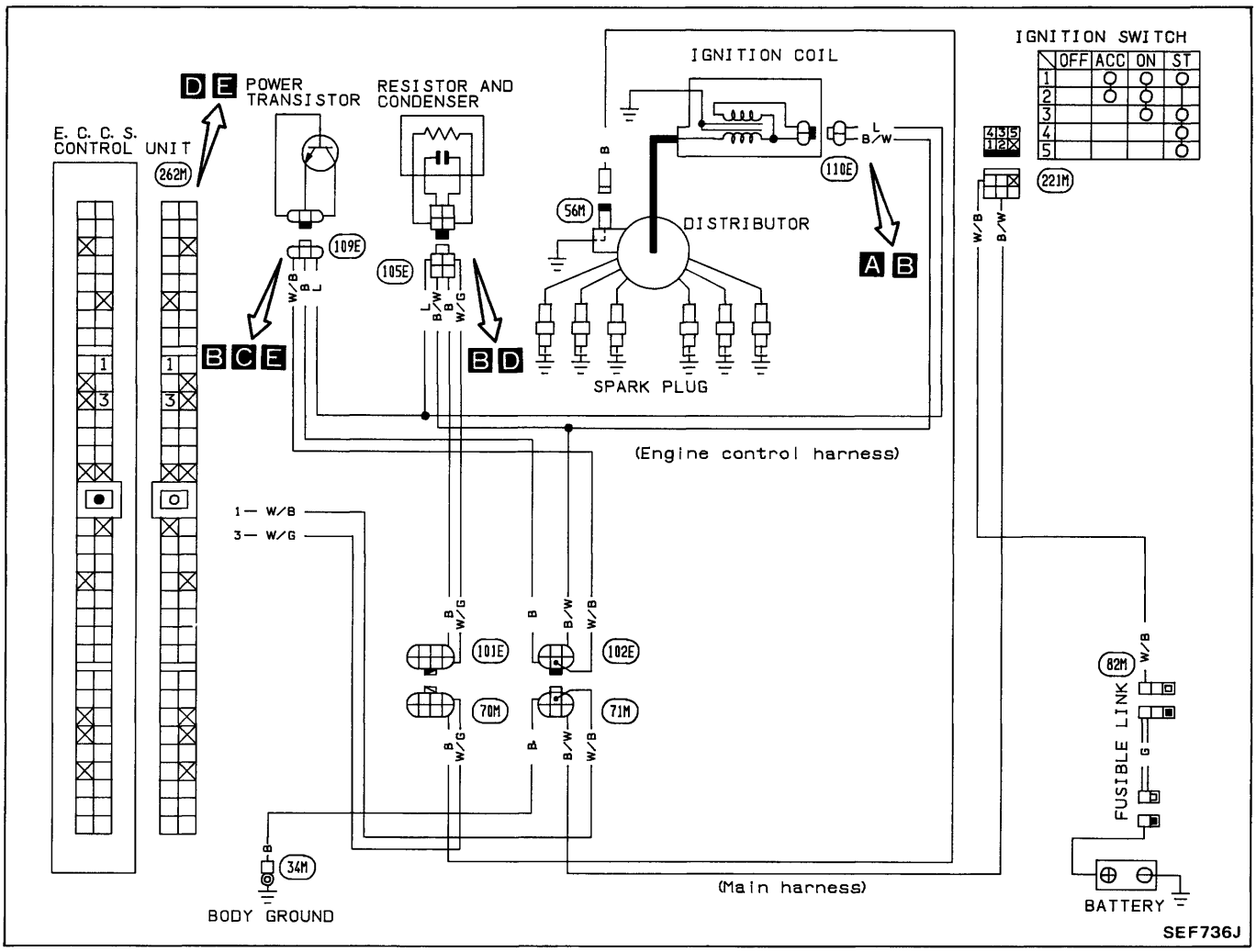
N.G. → Recheck E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K.

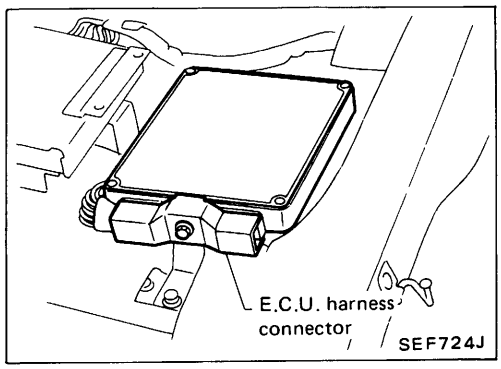
INSPECTION END

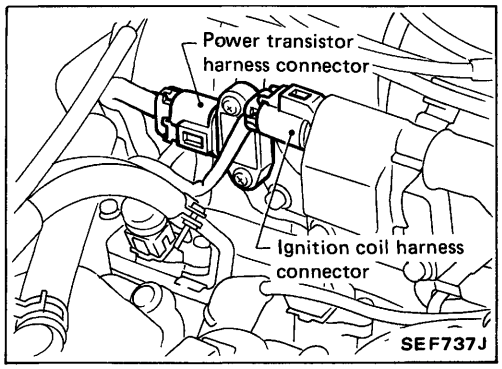
Diagnostic Procedure 6

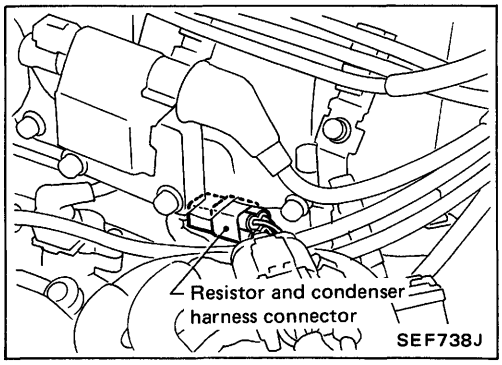
IGNITION SIGNAL (Code No. 21)



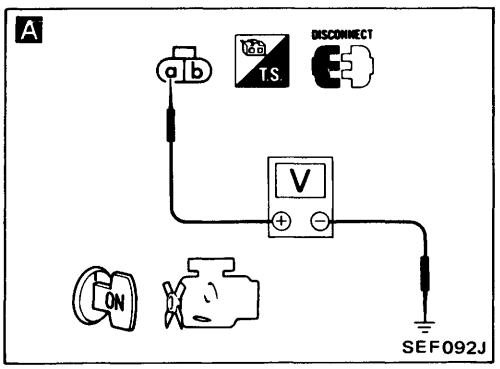
Harness layout

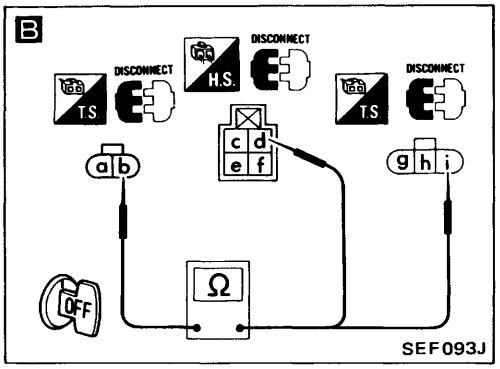


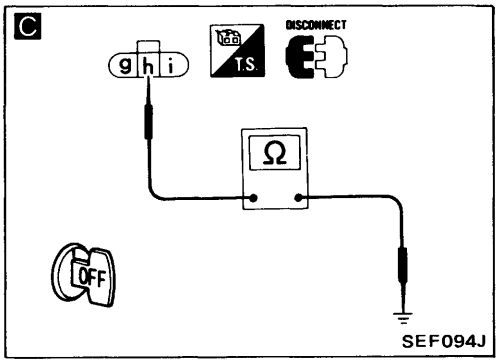


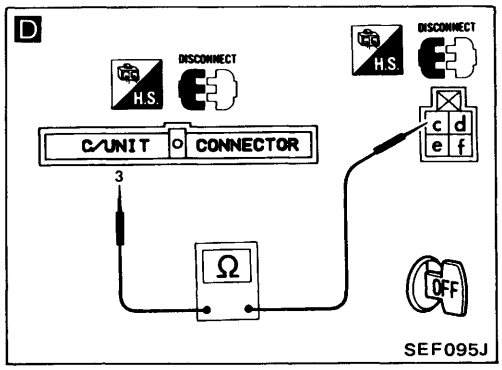


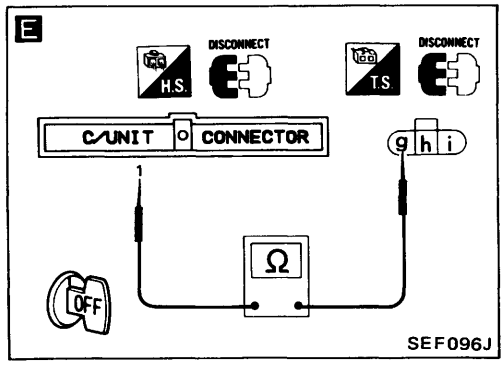
Diagnostic Procedure 6 (Cont'd)











INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect ignition coil harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓐ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (71M), (102E)
- Harness continuity between ignition coil and ignition switch

If N.G., repair harness or connectors.

O.K. ↓

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect resistor and condenser harness connector.
3) Disconnect power transistor harness connector.

B 4) Check harness continuity between terminals ⓑ and ⓓ, ⓘ.
Continuity should exist.

C 5) Check harness continuity between terminal ⓗ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

D

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between terminal ⓒ and E.C.U. terminal ③.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (101E), (70M)
- Harness continuity between resistor and E.C.U. harness connector

If N.G., repair harness or connectors.

O.K. ↓

E

CHECK OUTPUT SIGNAL CIRCUIT.
1) Check harness continuity between terminal ⓖ and E.C.U. terminal ①.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (102E), (71M)
- Harness continuity between resistor and E.C.U. harness connector

If N.G., repair harness or connectors.

O.K. ↓

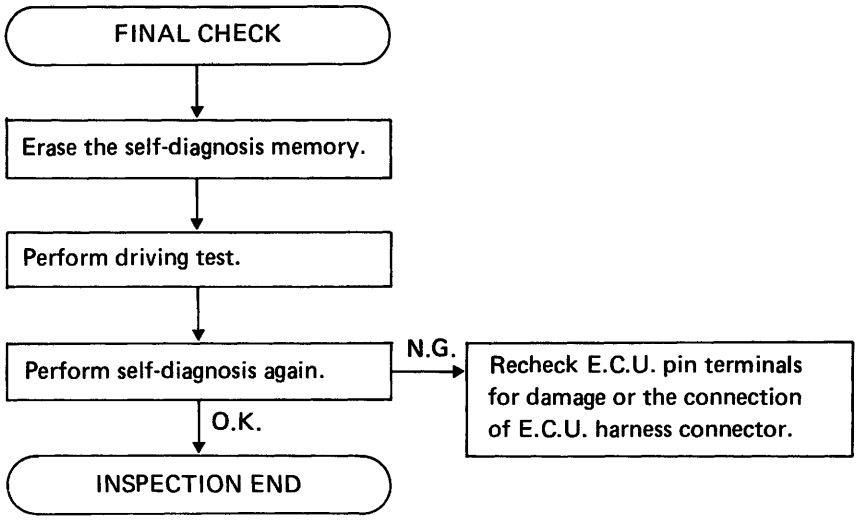
CHECK COMPONENTS
(Ignition coil, resistor and condenser, power transistor).
Refer to "Electrical Components Inspection".
(See page EF & EC-152.)

N.G. → Replace malfunctioning component(s).

O.K. → Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

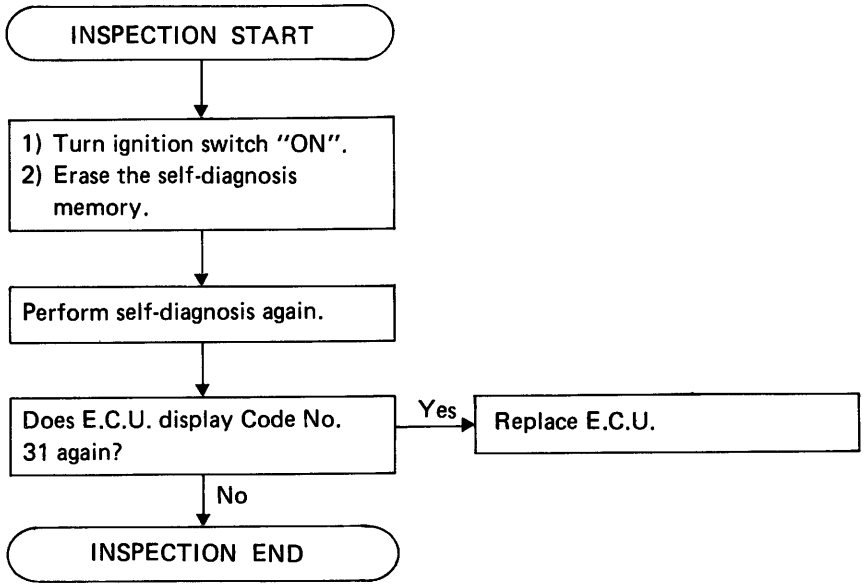
Diagnostic Procedure 6 (Cont'd)

Perform FINAL CHECK by the following procedure after repair is completed.



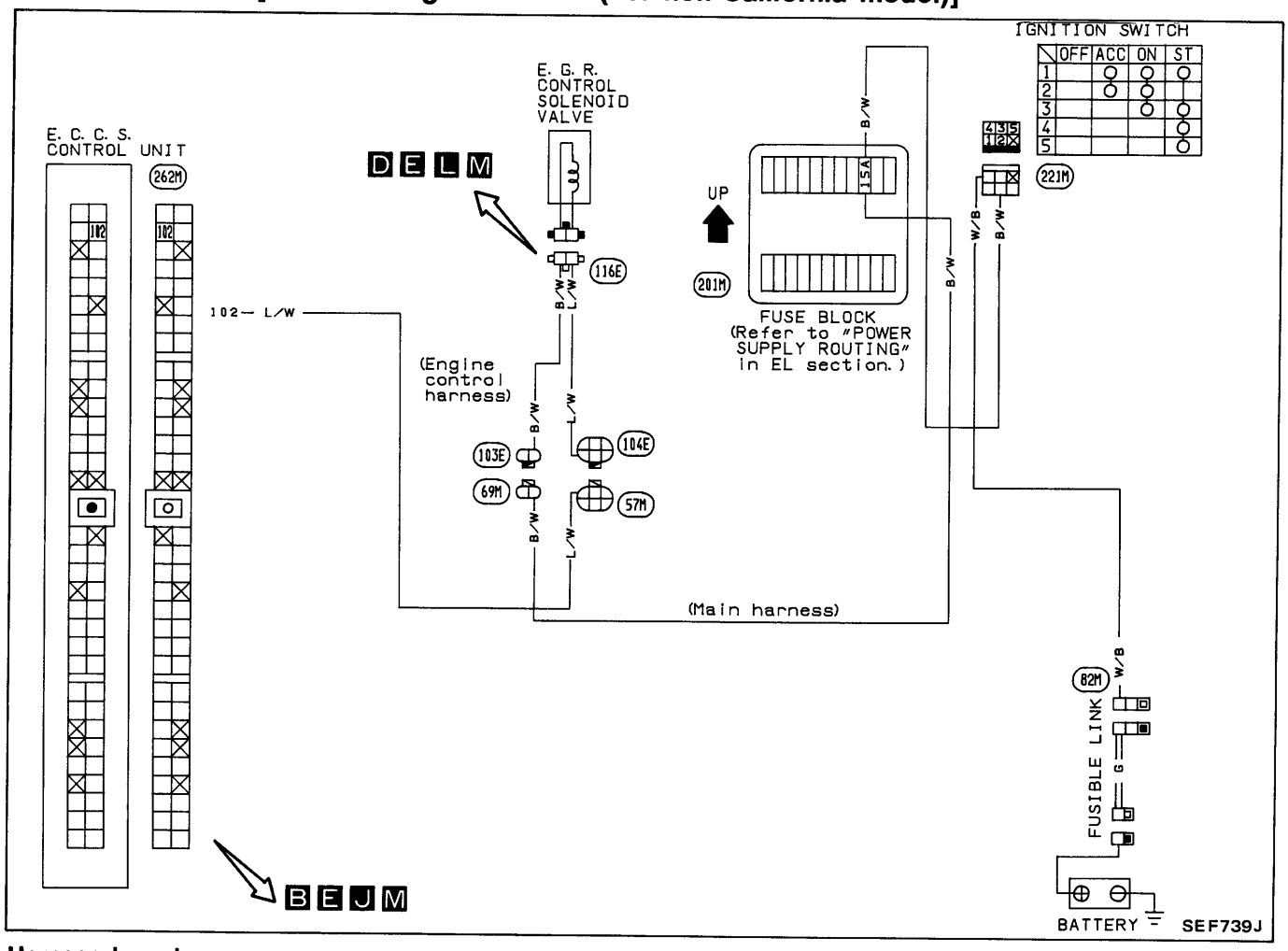
Diagnostic Procedure 7

E.C.C.S. CONTROL UNIT (Code No. 31) (CHECK ENGINE LIGHT ITEM)

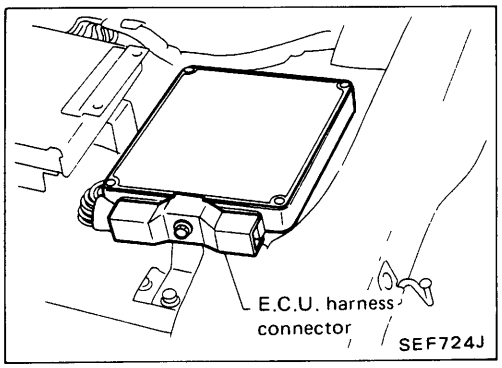


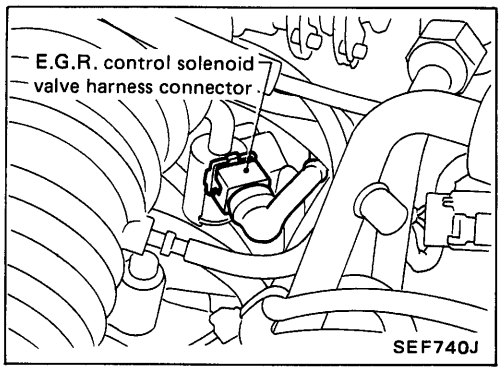
Diagnostic Procedure 8

E.G.R. FUNCTION (Code No. 32) [CHECK ENGINE LIGHT ITEM (For California model)]
E.G.R. CONTROL [Not self-diagnostic item (For non-California model)]

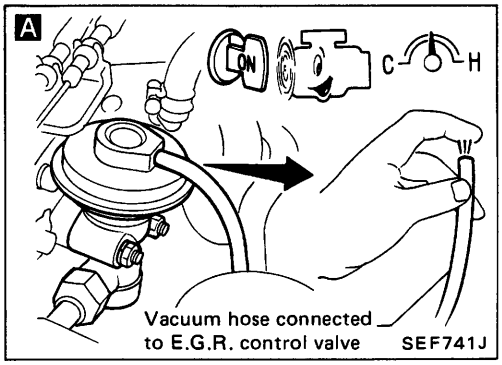


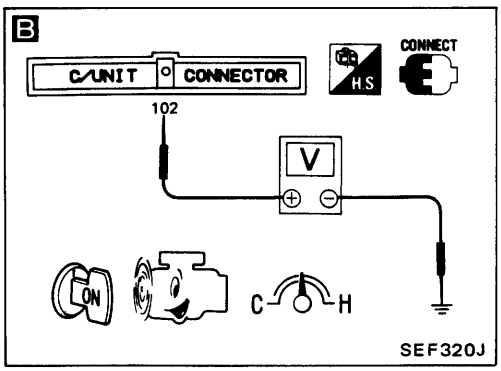
Harness layout

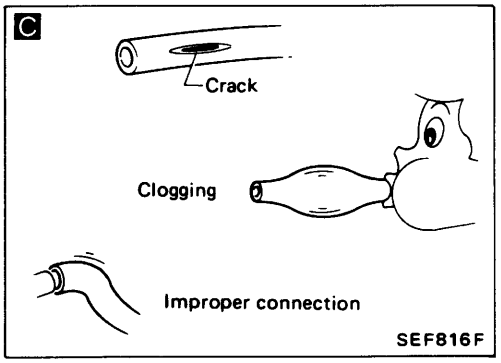


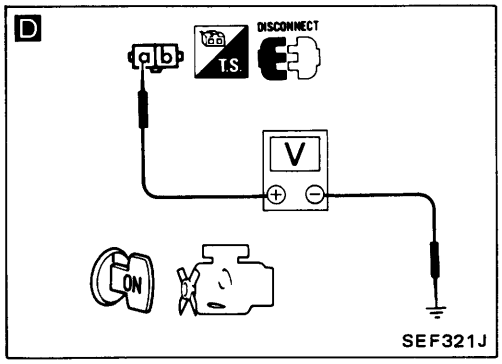


Diagnostic Procedure 8 (Cont'd)









California model

INSPECTION START

A

CHECK VACUUM SOURCE TO E.G.R. CONTROL VALVE.
1) Start engine and warm it up sufficiently.
2) Perform self-diagnosis.
Make sure that code No. 12 is not displayed.
Make sure that both crank angle sensor and E.C.U.'s C.P.U. are not in "fail-safe" state.
3) Keep engine speed at about 2,000 rpm.
4) Disconnect vacuum hose to E.G.R. control valve.
5) Make sure that vacuum exists.
Vacuum should exist.

O.K. → CHECK COMPONENTS (E.G.R. control valve and exhaust gas temperature sensor). Refer to "Electrical Components Inspection". (See page EF & EC-153.)

N.G. → Replace malfunctioning component(s).

N.G.

B

CHECK CONTROL FUNCTION.
1) Check voltage between E.C.U. terminal (102) and ground under the following conditions.
Voltage:
At idle
Approximately 0V
Engine speed is about 2,000 rpm
Battery voltage

O.K. → **C**

CHECK VACUUM HOSE.
1) Check vacuum hose for clogging, cracks and proper connection.

N.G.

D

CHECK POWER SUPPLY.
1) Stop engine.
2) Disconnect E.G.R. control solenoid valve harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓐ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (57M), (104E)
- "10A" fuse
- Harness continuity between E.G.R. control solenoid valve and ignition switch

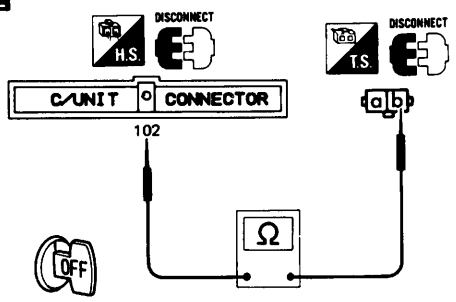
If N.G., repair harness or connectors.

O.K.

Ⓐ

Diagnostic Procedure 8 (Cont'd)

E



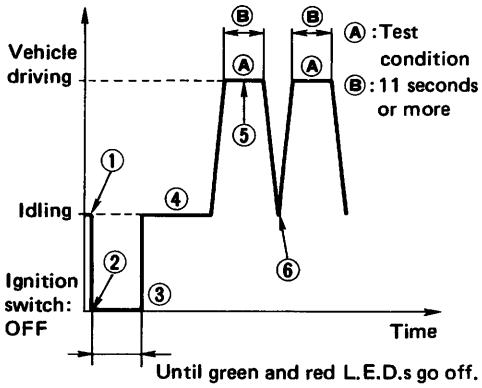
SEF322J

F ROAD TEST

Test condition

Drive vehicle under the following conditions with a suitable shift position.
(1) Engine speed:
2,100±300 rpm
(2) Intake manifold vacuum:
−36.0±6.7 kPa
(−270±50 mmHg, −10.63±1.97 inHg)

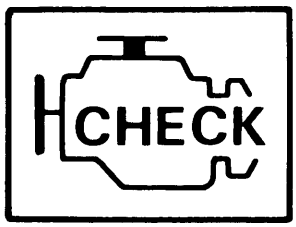
Driving mode



① Start engine and warm it up sufficiently.
② Turn off ignition switch and keep it off until green and red L.E.D.s go off.
③ Start engine and make sure that air conditioner switch and rear defogger are turned "OFF" during driving test.
④ Keep engine running for at least 3 minutes.
⑤ Shift to suitable gear position and drive in "Test condition" for at least 11 seconds.
⑥ Decrease engine revolution to less than 2,000 rpm.
⑦ Repeat steps ⑤ through ⑥ at least 1 time.

SEF302H

G



CHECK ENGINE LIGHT

SEF924F

Ⓐ

E

CHECK OUTPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal (102) and terminal ⓑ.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (57M), (104E)
- Harness continuity between E.G.R. control solenoid valve and E.C.U.

Resistance:
Approximately 0Ω
If N.G., repair harness or connectors.

O.K. ↓

CHECK COMPONENT (E.G.R. control solenoid valve). Refer to "Electrical Components Inspection". (See page EF & EC-153.)

N.G. → Replace E.G.R. control solenoid valve.

O.K. ↓

Check resistance of exhaust gas temperature sensor. (See page EF & EC-153.)

↓

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Perform FINAL CHECK by the following procedure after repair is completed.

FINAL CHECK

↓

Erase the self-diagnosis memory. Make sure code No. 55 is displayed in Mode III.

F

Perform driving test under the following conditions.
1) Warm up engine sufficiently.
2) Use test driving modes indicated in figure F.

G

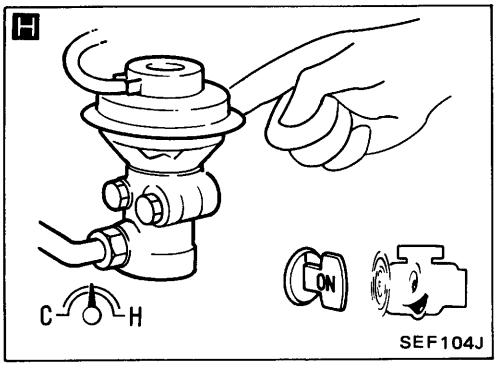
Make sure that check engine light does not come on during driving test.

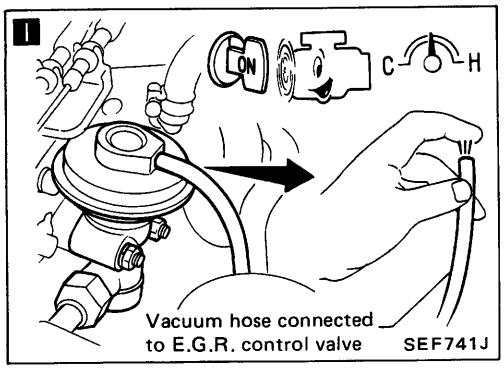
Comes on. → Recheck E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

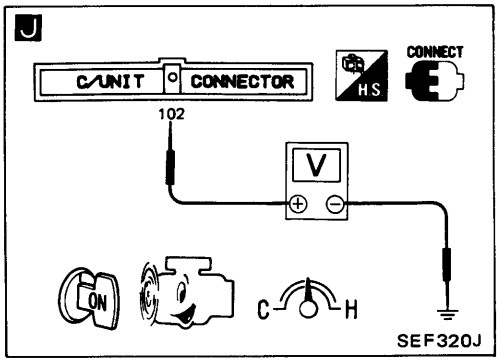
Does not come on. ↓

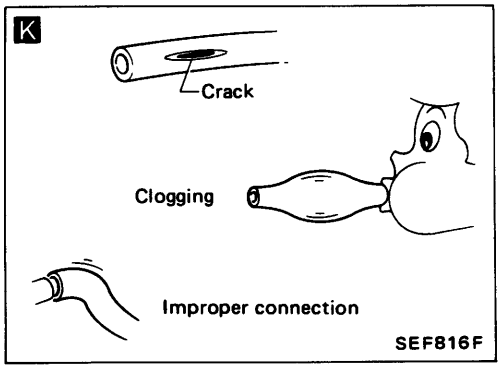
INSPECTION END

Diagnostic Procedure 8 (Cont'd)









Non-California model

INSPECTION START

Is lifted up and down.

H

CHECK OVERALL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Perform self-diagnosis. Make sure that code No. 12 is not displayed. Make sure that both crank angle sensor and E.C.U.'s C.P.U. are not in "fail-safe" state.
3) Make sure that E.G.R. control valve spring is lifted up and down when racing engine. (Use your finger.)

→ INSPECTION END

Is not lifted up and down.

I

CHECK VACUUM SOURCE TO E.G.R. CONTROL VALVE.
1) Disconnect vacuum hose to E.G.R. control valve.
2) Make sure that vacuum exists under the following conditions.

At idle:
Vacuum should not exist.
Engine speed is about 2,000 rpm:
Vacuum should exist.

O.K. →

CHECK COMPONENTS (E.G.R. control valve).
Refer to "Electrical Components Inspection".
(See page EF & EC-153.)

N.G. →

Replace malfunctioning component(s).

N.G.

J

CHECK CONTROL FUNCTION.
1) Check voltage between E.C.U. terminal (102) and ground under the following conditions.

Voltage:
At idle
Approximately 0V
Engine speed is about 2,000 rpm
Battery voltage

N.G. →

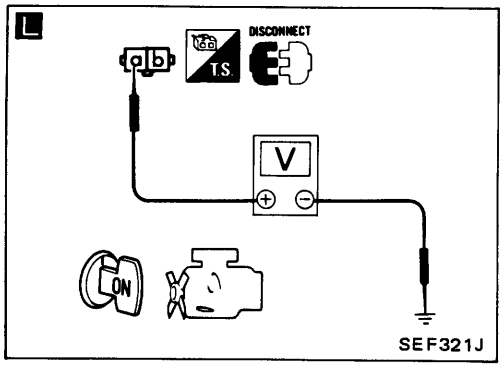
K

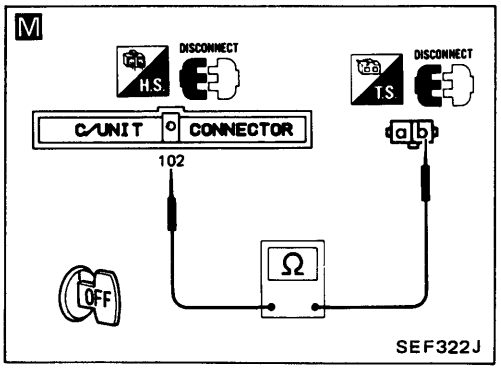
CHECK VACUUM HOSE.
1) Check vacuum hose for clogging, cracks and proper connection.

O.K.

Ⓐ

Diagnostic Procedure 8 (Cont'd)





Ⓐ

L

CHECK POWER SUPPLY.
1) Stop engine.
2) Disconnect E.G.R. control solenoid valve harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓐ and ground.
Voltage: Battery voltage

N.G. →
Check the following.
- Harness connectors (69M), (103E)
- "10A" fuse
- Harness continuity between E.G.R. control solenoid valve and ignition switch

If N.G., repair harness or connectors.

O.K. ↓

M

CHECK OUTPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal (102) and terminal ⓑ.
Continuity should exist.

N.G. →
Check the following.
- Harness connectors (57M), (104E)
- Harness continuity between E.G.R. control solenoid valve and E.C.U.
Resistance:
Approximately 0Ω

If N.G., repair harness or connectors.

O.K. ↓

CHECK COMPONENT (E.G.R. control solenoid valve).
Refer to "Electrical Components Inspection".
(See page EF & EC-153.)

N.G. → Replace E.G.R. control solenoid valve.

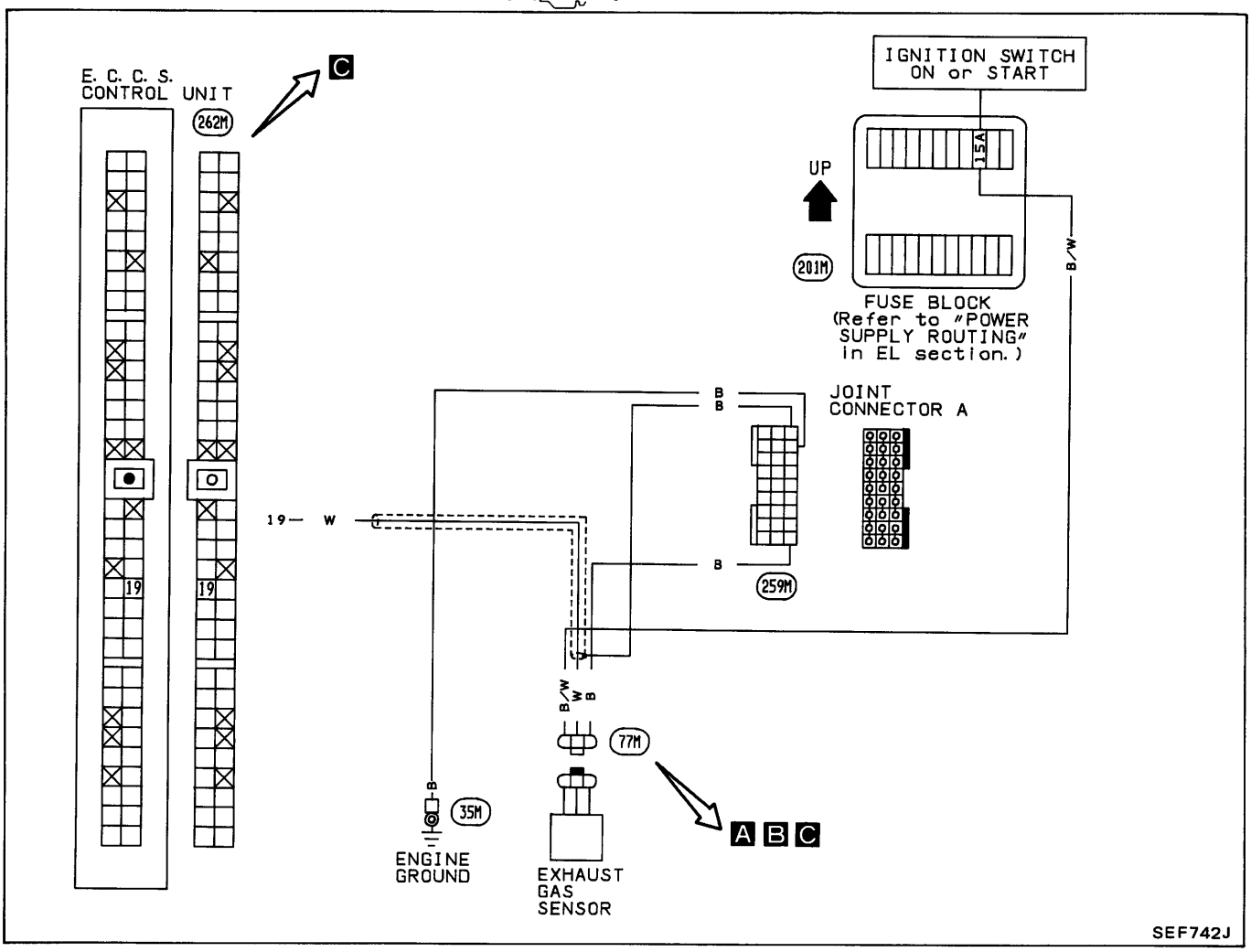
O.K. ↓

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

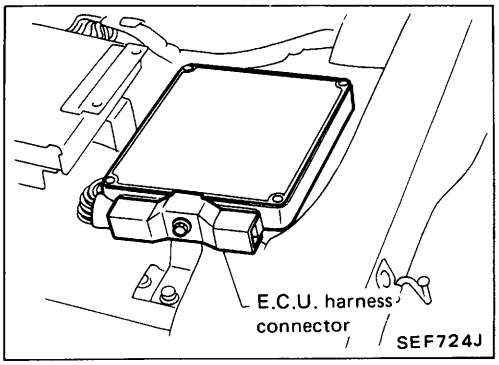
NOTE

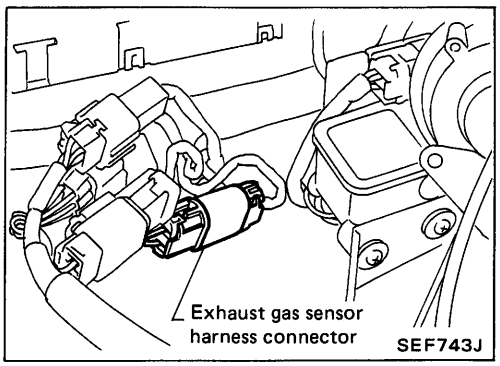
Diagnostic Procedure 9

EXHAUST GAS SENSOR (Code No. 33) (CHECK ENGINE LIGHT ITEM)

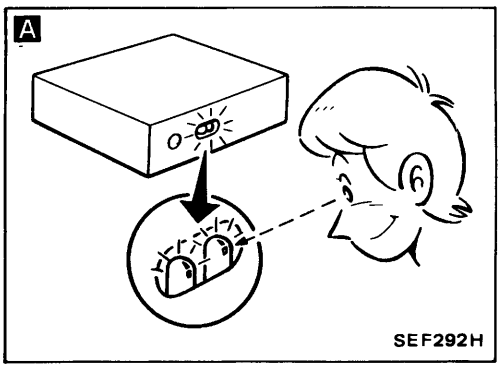


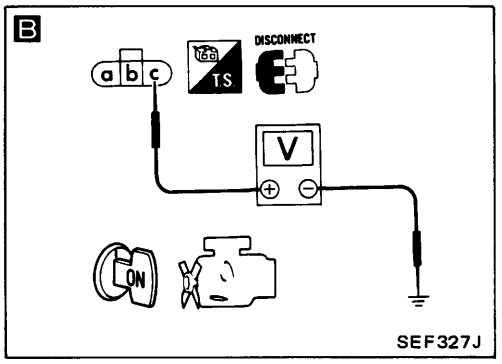
Harness layout

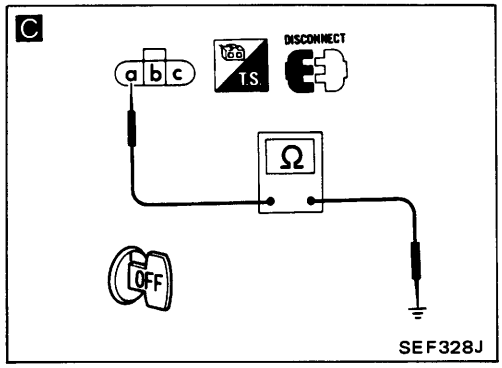


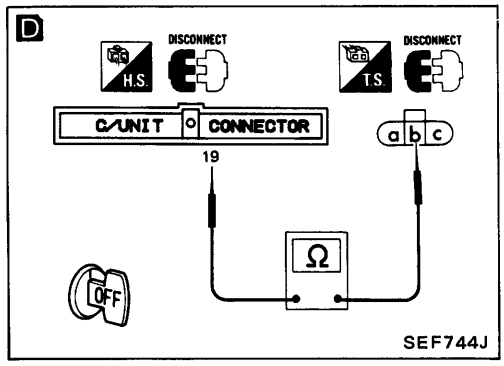


Diagnostic Procedure 9 (Cont'd)









INSPECTION START

A

CHECK EXHAUST GAS SENSOR CIRCUIT.
1) Start engine and warm it up sufficiently.
2) Run engine at about 2,000 rpm for about 2 minutes under no-load.
3) Keep engine speed at 2,000 rpm and make sure that green inspection lamp on E.C.U. goes ON and OFF.

O.K. → INSPECTION END

N.G. ↓

B

CHECK POWER SUPPLY.
1) Disconnect exhaust gas sensor harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓒ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- 10A fuse
- Harness continuity between exhaust gas sensor and ignition switch

If N.G., repair harness or connectors.

O.K. ↓

C

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓐ and engine ground.
Continuity should exist.

N.G. → Check the following.
- Joint connector-A (259M)
- Harness continuity between exhaust gas sensor and ground

If N.G., repair harness or connectors.

O.K. ↓

D

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal ⑲ and terminal ⓑ.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

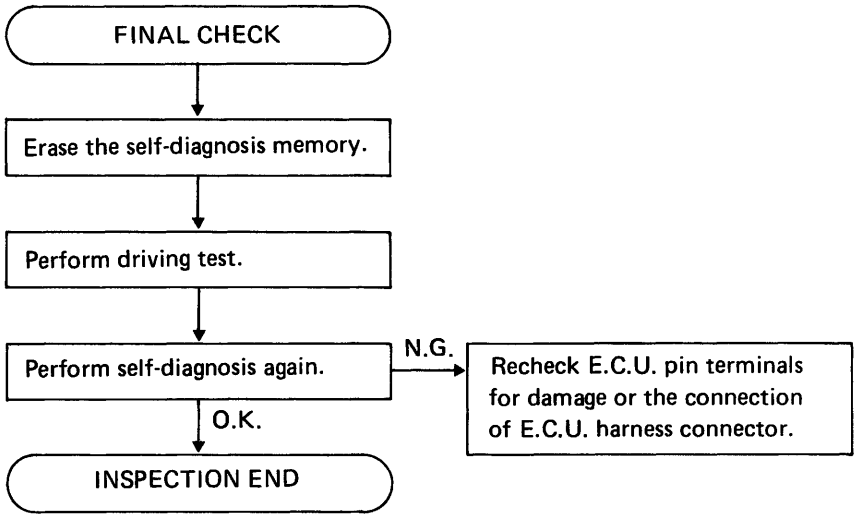
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K. ↓

Replace exhaust gas sensor.

Diagnostic Procedure 9 (Cont'd)

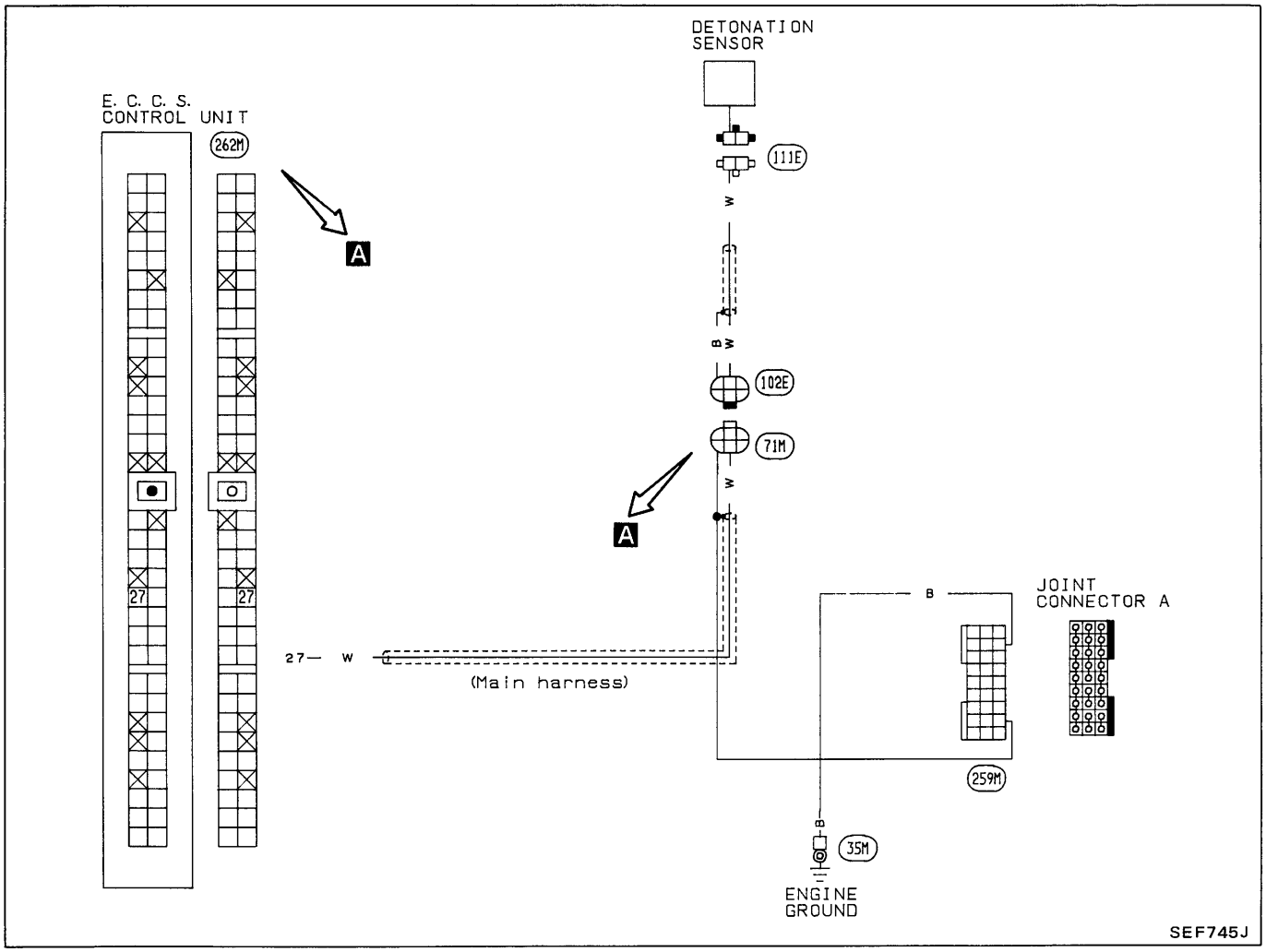
Perform FINAL CHECK by the following procedure after repair is completed.



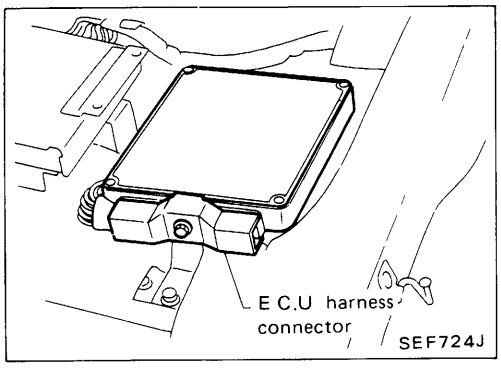
NOTE

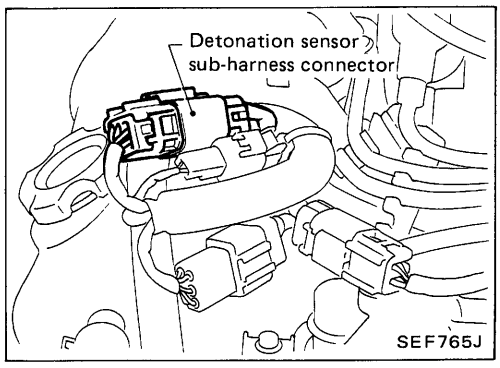
Diagnostic Procedure 10

DETONATION SENSOR (Code No. 34)

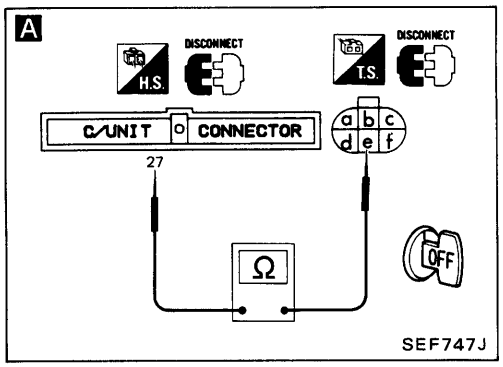


Harness layout





Diagnostic Procedure 10 (Cont'd)



INSPECTION START

A

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector and detonation sensor sub-harness connector.
2) Check harness continuity between terminal ⓔ and E.C.U. terminal ㉗.
Continuity should exist.

N.G. → If N.G., repair harness or connectors.

O.K. ↓

CHECK COMPONENT (Detonation sensor).
Refer to "Electrical Components Inspection".
(See page EF & EC-155.)

N.G. → Replace detonation sensor.

O.K. ↓

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Perform FINAL CHECK by the following procedure after repair is completed.

FINAL CHECK ↓

Erase the self-diagnosis memory. ↓

Perform driving test. ↓

Perform self-diagnosis again.

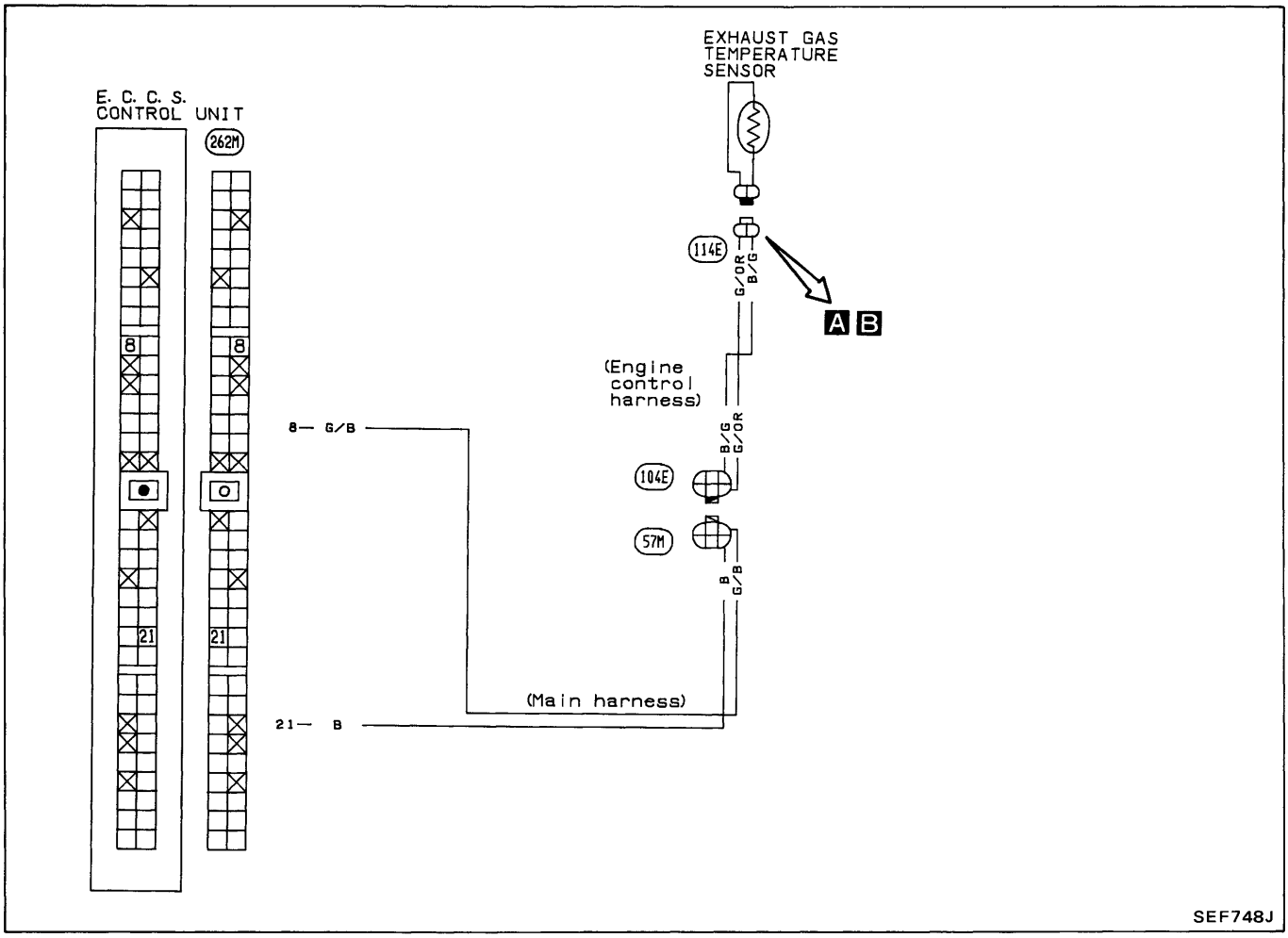
N.G. → Recheck E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K. ↓

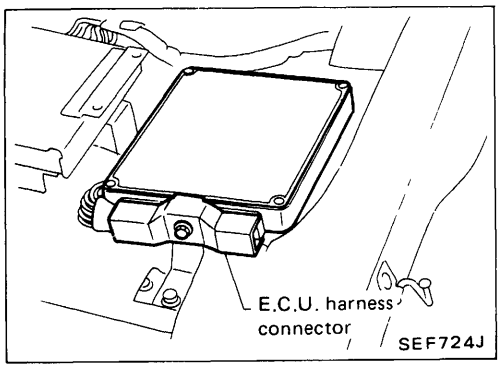
INSPECTION END

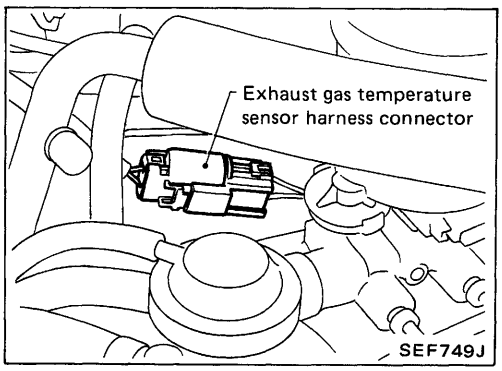
Diagnostic Procedure 11

EXHAUST GAS TEMPERATURE SENSOR (Code No. 35) CHECK (CHECK ENGINE LIGHT ITEM): CALIFORNIA MODEL ONLY

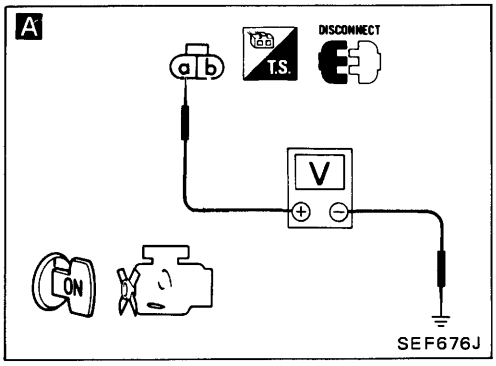


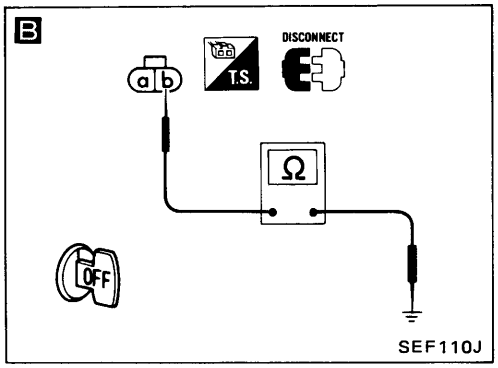
Harness layout





Diagnostic Procedure 11 (Cont'd)





INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect exhaust gas temperature sensor harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓐ and ground.
Voltage: Approximately 5V

N.G. → Check the following.
- Harness connectors (57M), (104E)
- Harness continuity between E.C.U. and exhaust gas temperature sensor

If N.G., repair harness or connectors.

O.K. ↓

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓑ and engine ground.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (57M), (104E)
- Harness continuity between E.C.U. and exhaust gas temperature sensor

If N.G., repair harness or connectors.

O.K. ↓

CHECK COMPONENT
(Exhaust gas temperature sensor).
Refer to "Electrical Components Inspection".
(See page EF & EC-153.)

N.G. → Replace exhaust gas temperature sensor.

O.K. ↓

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Perform FINAL CHECK by the following procedure after repair is completed.

FINAL CHECK

↓

Erase the self-diagnosis memory.

↓

Perform driving test.

↓

Perform self-diagnosis again.

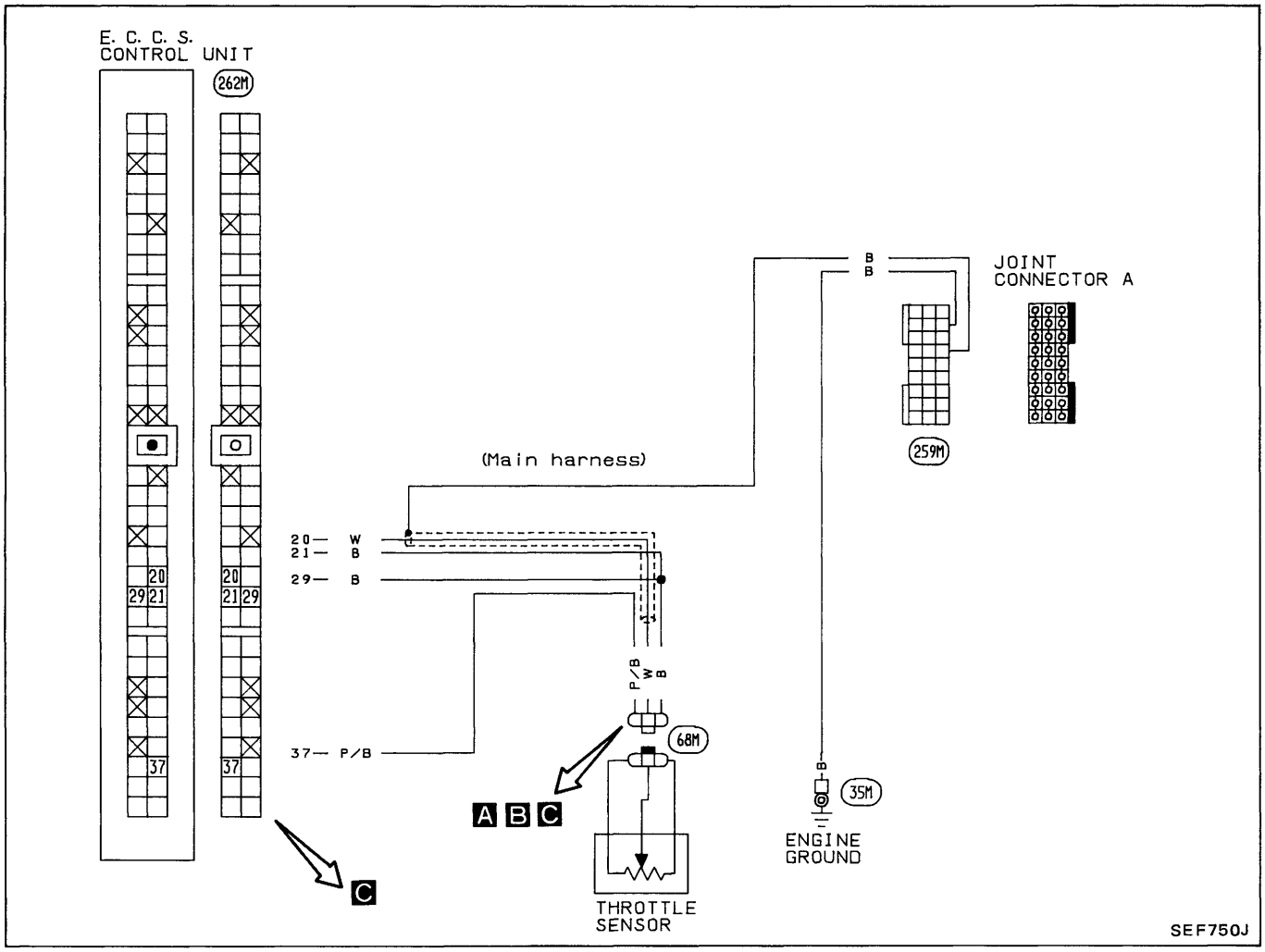
N.G. → Recheck E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K. ↓

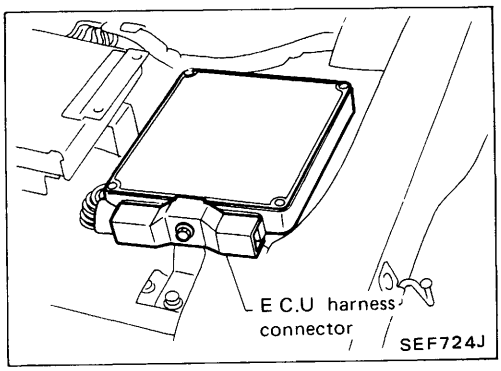
INSPECTION END

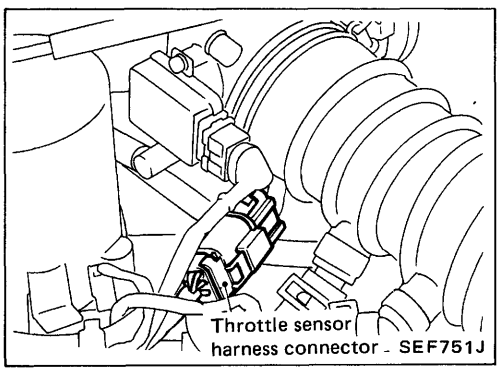
Diagnostic Procedure 12

THROTTLE SENSOR (Code No. 43) (CHECK ENGINE LIGHT ITEM)

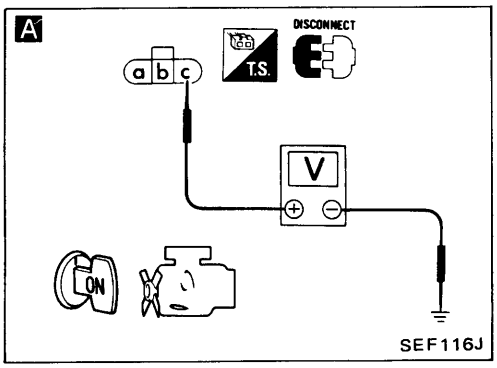


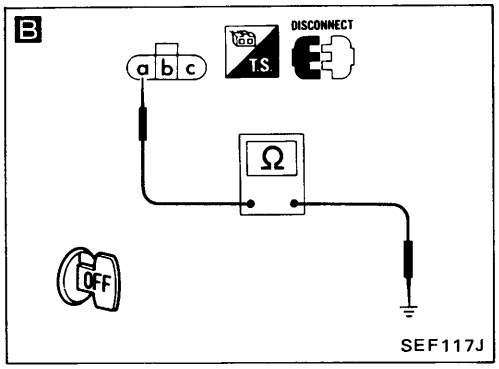
Harness layout

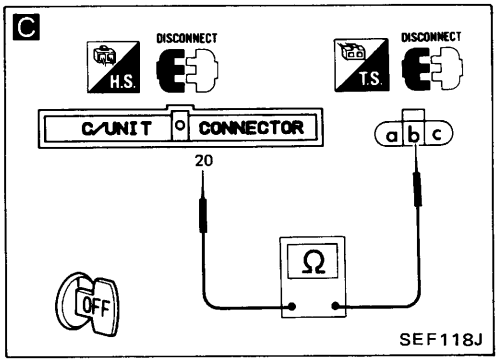




Diagnostic Procedure 12 (Cont'd)







INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect throttle sensor harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓒ and ground.
Voltage: Approximately 5V

N.G. → Repair harness or connectors.

O.K.

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓐ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

C

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal ⑳ and terminal ⓑ.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

CHECK COMPONENT (Throttle sensor).
Refer to "Electrical Components Inspection".
(See page EF & EC-154.)

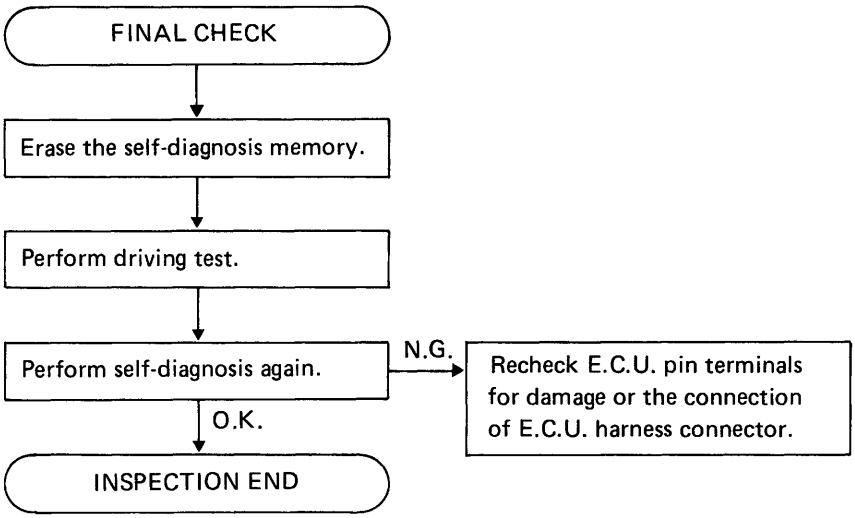
N.G. → Replace throttle sensor.

O.K.

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

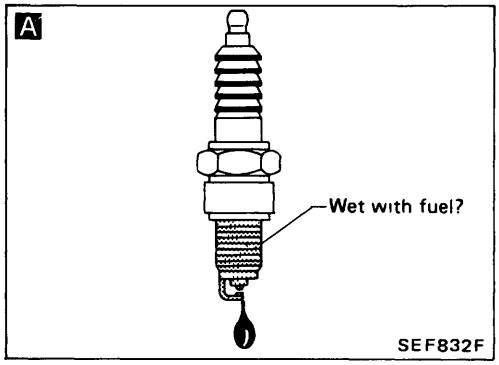
Diagnostic Procedure 12 (Cont'd)

Perform FINAL CHECK by the following procedure after repair is completed.



Diagnostic Procedure 13

INJECTOR LEAK (Code No. 45) HCHECK (CHECK ENGINE LIGHT ITEM): CALIFORNIA MODEL ONLY



B ROAD TEST

Test condition

Drive vehicle under the following conditions with a suitable shift position.

(1) Engine speed:

M/T: 2,600±600 rpm

A/T: 2,500±700 rpm

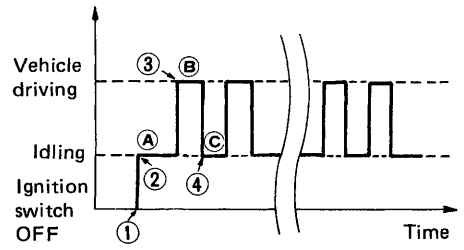
(2) Intake manifold vacuum:

−46.7±9.3 kPa

(−350±70 mmHg, −13.78±2.76 inHg)

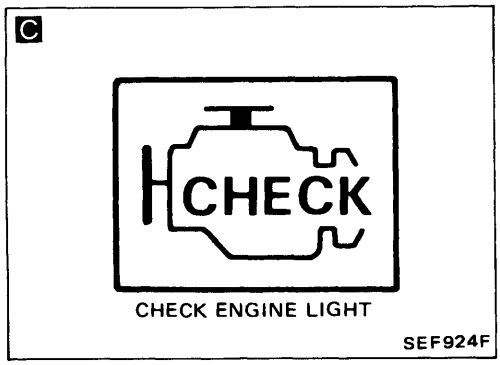
Driving mode

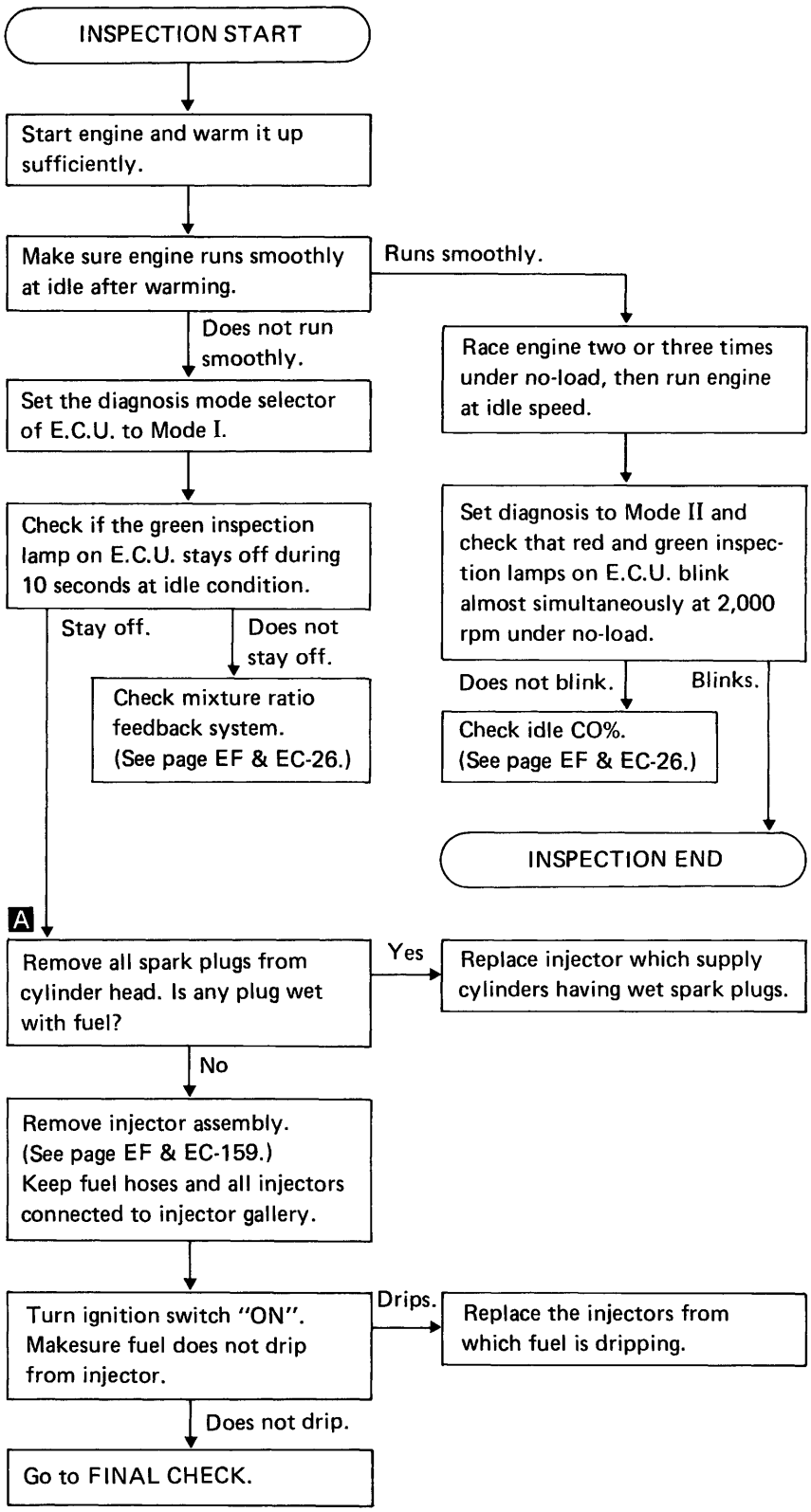
Ⓐ : 60 seconds or more
Ⓑ : 5 seconds or more
Ⓒ : 10 seconds or more



① Start engine and warm it up sufficiently.
② Keep engine at idle speed for at least 60 seconds.
③ Shift to a suitable gear position and drive in "Test condition" for at least 5 seconds.
④ Keep engine at idle speed for at least 10 seconds.
⑤ Repeat steps ② through ④ at least 10 times.

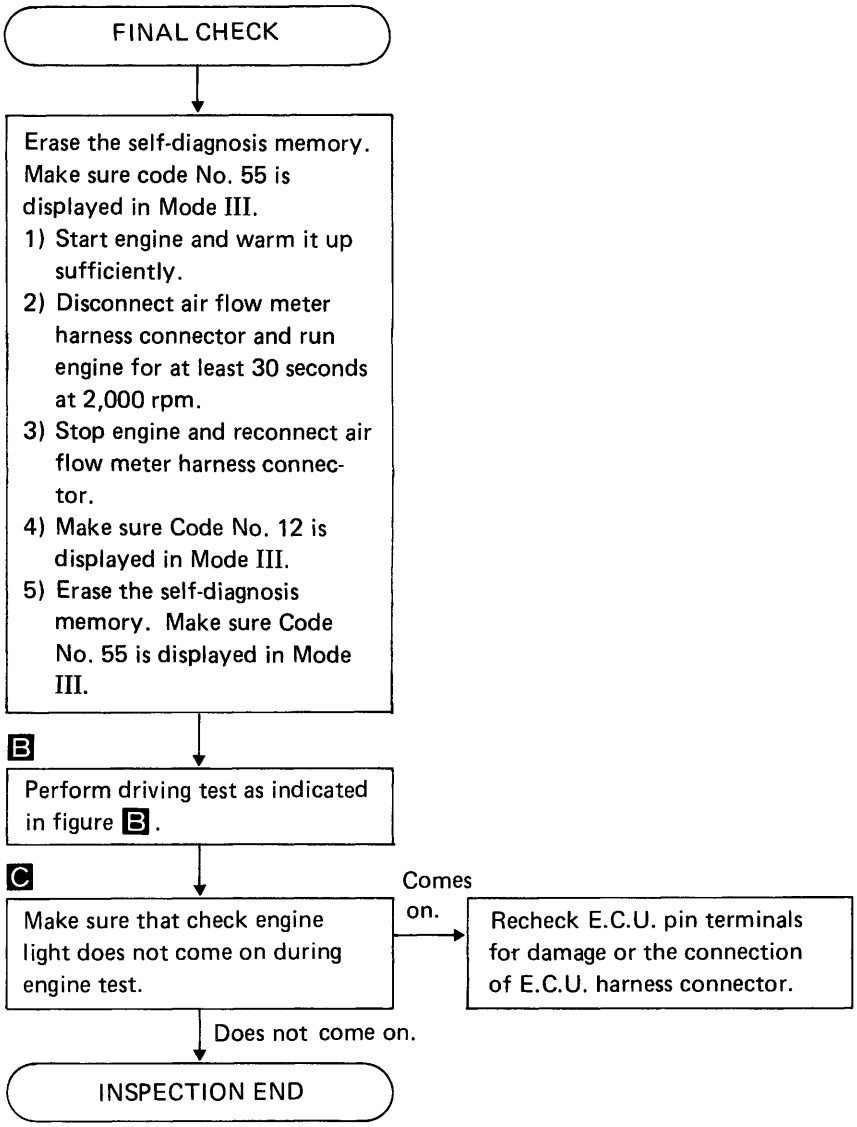
SEF889J





Diagnostic Procedure 13 (Cont'd)

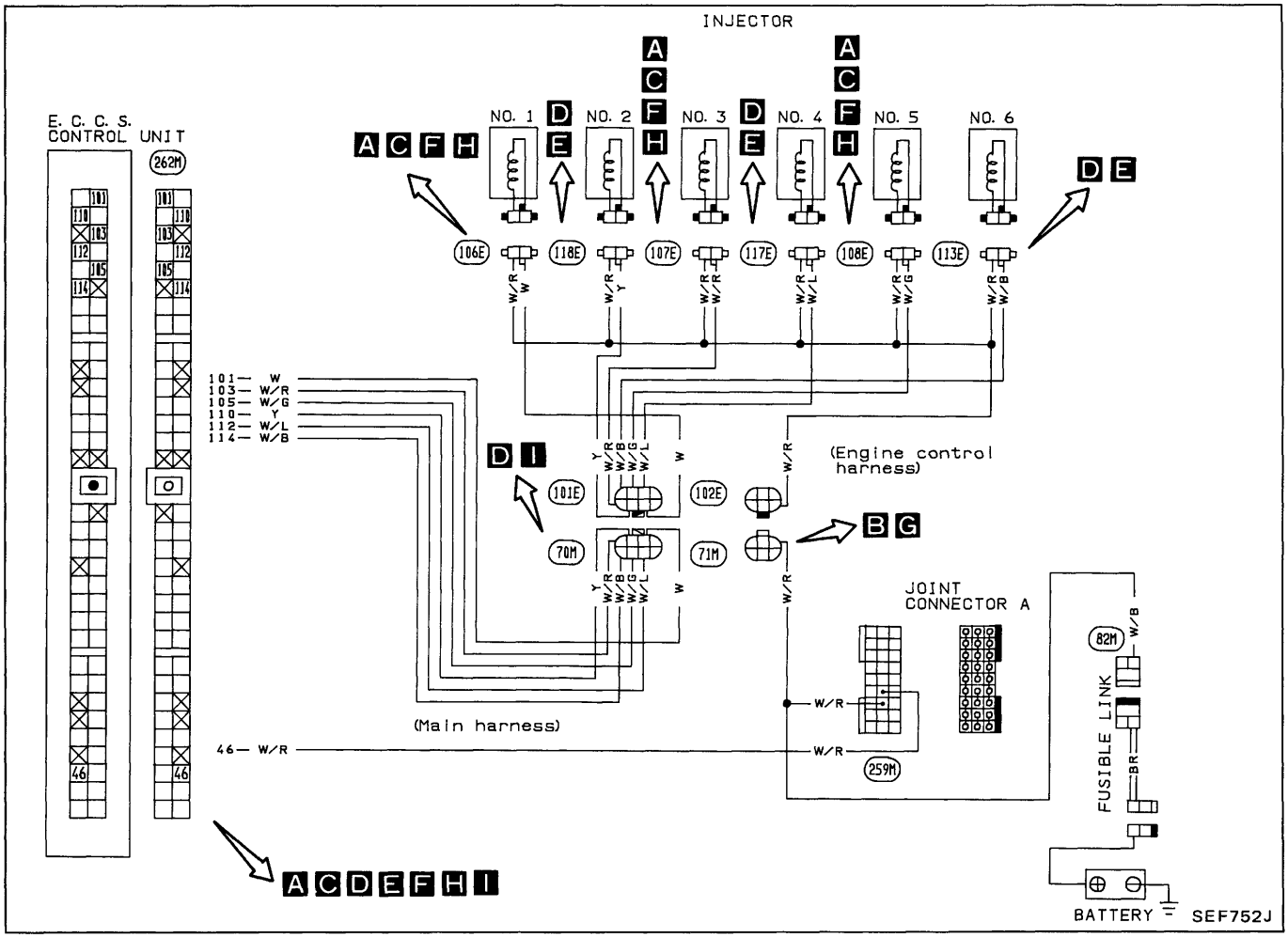
Perform FINAL CHECK by the following procedure after repair is completed.



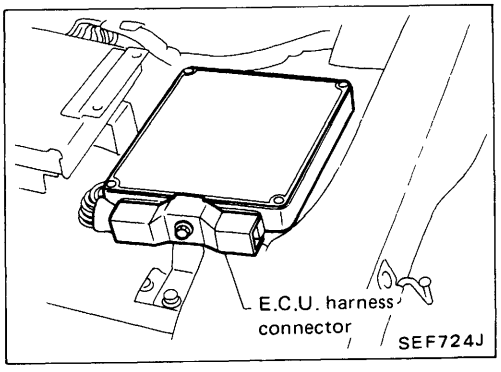
NOTE

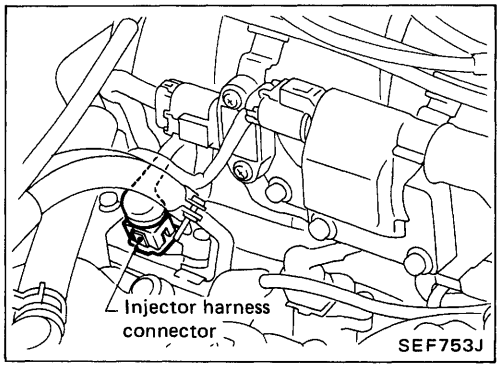
Diagnostic Procedure 14

INJECTOR CIRCUIT (Code No. 51) (CHECK ENGINE LIGHT ITEM): CALIFORNIA MODEL
INJECTOR (Not self-diagnostic item): NON-CALIFORNIA MODEL



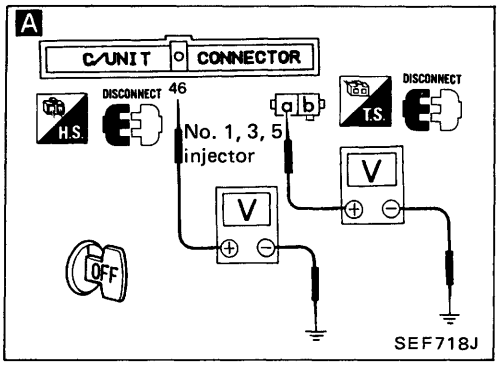
Harness layout



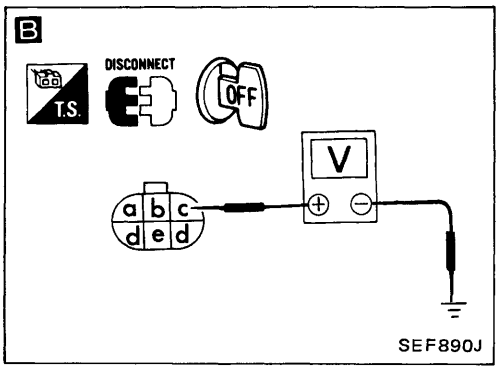


Diagnostic Procedure 14 (Cont'd)

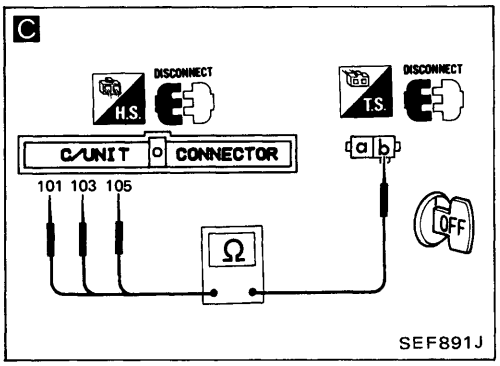
A



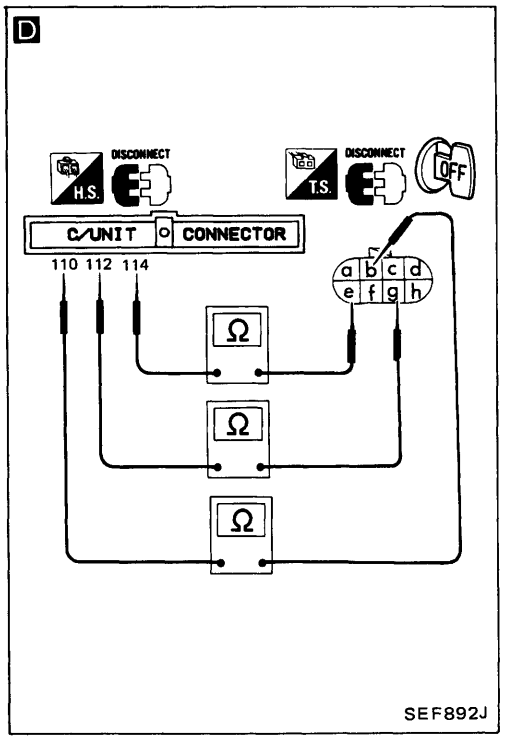
B



C



D



California model

INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect harness connectors for No. 1, No. 3 and No. 5 nectors ,
2) Disconnect E.C.U. S.M.J. harness connector.
A 3) Check voltage following figure A .
Voltage: Battery voltage
4) Disconnect sub-harness connector (71M) , (102E) for No. 2, No. 4 and No. 6 injectors.
B 5) Check voltage between terminal and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Joint connector-A (259M)
- Hrness connectors (71M) , (102E)
- "BR" fusible link
- Harness continuity between battery and injector
- Harness continuity between battery and E.C.U.

If N.G., repair harness or connectors.

O.K. ↓

CHECK OUTPUT SIGNAL CIRCUIT.
C 1) Check harness continuity following figure C for No. 1, No. 3 and No. 5 injectors.
Continuity should exist.
2) Disconnect sub-harness connectors (70M) , (101E) for No. 2, No. 4 and No. 6 injectors.
D 3) Check harness continuity following figure D .
Continuity should exist.

N.G. → Check the following.
- Harness connectors (70M) , (101E)
- Harness continuity between injector and E.C.U.

If N.G., repair harness or connectors.

O.K. ↓

CHECK COMPONENT (Injector).
Refer to "Electrical Components Inspection".
(See page EF & EC-155.)

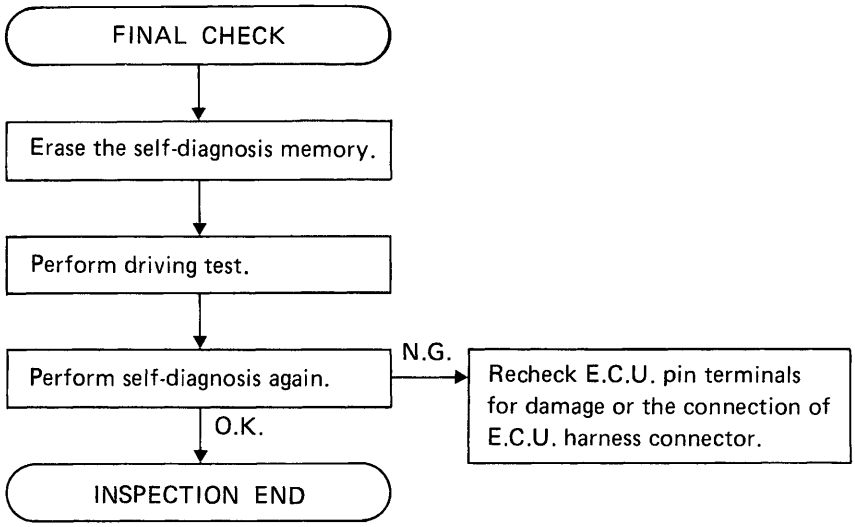
N.G. → Replace injector.

O.K. ↓

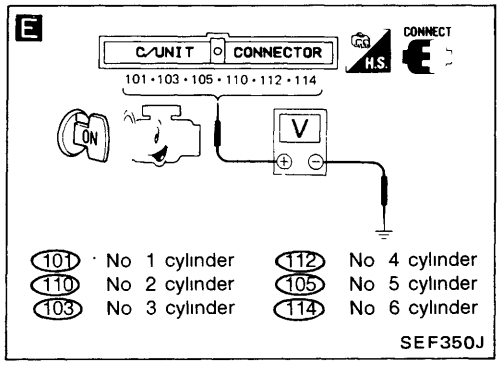
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

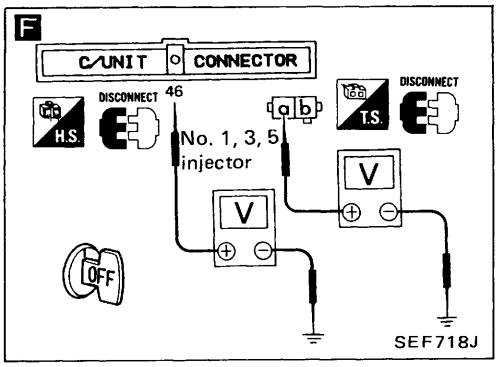
Diagnostic Procedure 14 (Cont'd)

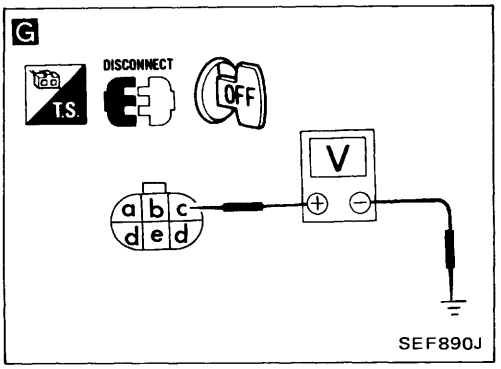
Perform FINAL CHECK by the following procedure after repair is completed.

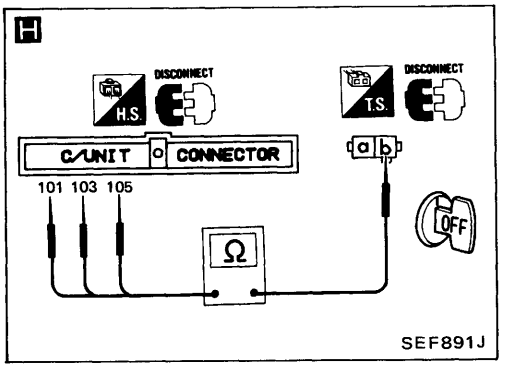


Diagnostic Procedure 14 (Cont'd)









Non-California model

INSPECTION START

E

CHECK CONTROL FUNCTION.
1) Start engine.
2) Check voltage between E.C.U. terminals (101), (103), (105), (110), (112), (114) and ground.
Voltage: Battery voltage

O.K. → INSPECTION END

N.G.

CHECK POWER SUPPLY.
1) Disconnect harness connectors for No. 1, No. 3 and No. 5 injectors.
2) Disconnect E.C.U. S.M.J. harness connector.
F 3) Check voltage following figure F.
Voltage: Battery voltage
4) Disconnect sub-harness connector (71M), (102E) for No. 2, No. 4 and No. 6 injectors.
G 5) Check voltage between terminal and ground.
Voltage: Battery voltage

N.G. →
Check the following.
- Joint connector-A (259M)
- Harness connectors (71M), (102E)
- "BR" fusible link
- Harness continuity between battery and injector
- Harness continuity between battery and E.C.U.

If N.G., repair harness or connectors.

O.K.

CHECK OUTPUT SIGNAL CIRCUIT.
H 1) Check harness continuity following figure H for No. 1, No. 3 and No. 5 injectors.
Continuity should exist.
2) Disconnect sub-harness connectors (70M), (101E) for No. 2, No. 4 and No. 6 injectors.
I 3) Check harness continuity following figure I.
Continuity should exist.

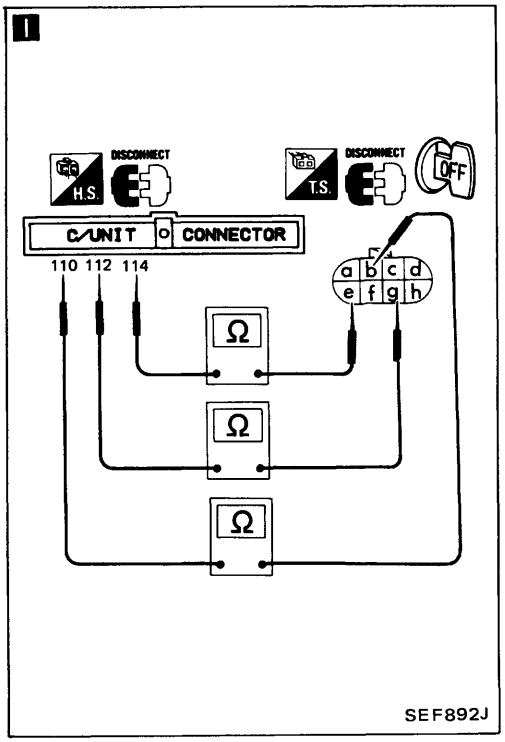
N.G. →
Check the following.
- Harnes connectors (70M), (101E)
- Harnes continuity between injector and E.C.U.

If N.G., repair harness or connectors.

O.K.

Ⓐ

Diagnostic Procedure 14 (Cont'd)



Ⓐ

CHECK COMPONENT
(Injector).
Refer to "Electrical Components Inspection".
(See page EF & EC-155.)

N.G. → Replace injector.

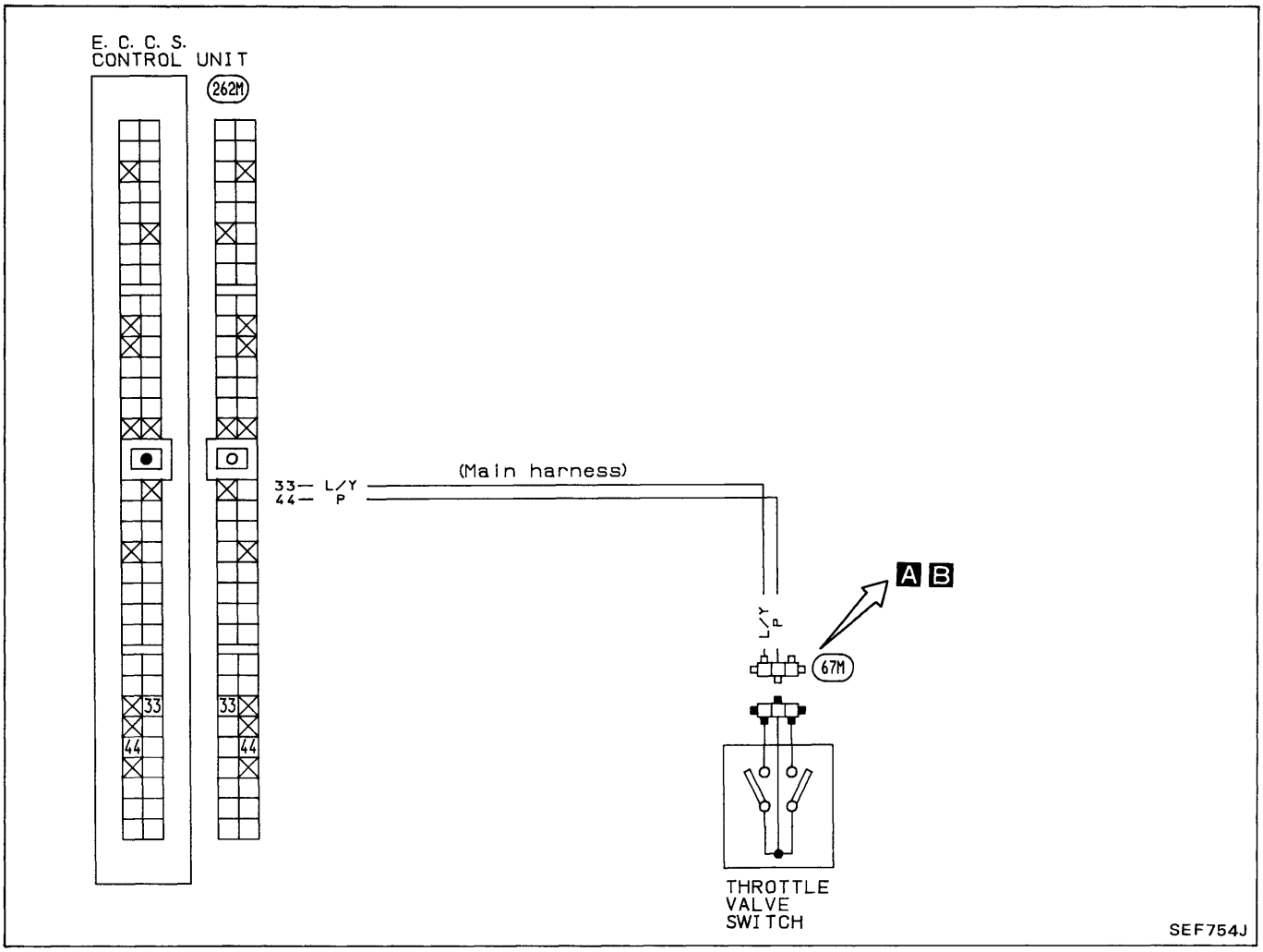
O.K. ↓

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

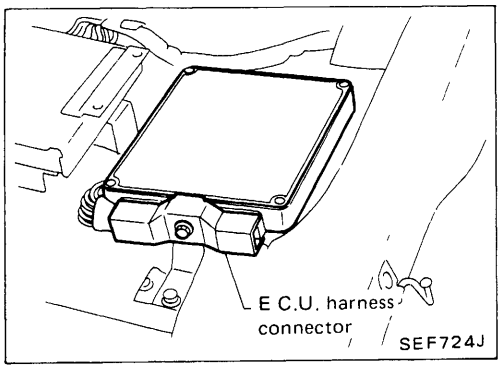
NOTE

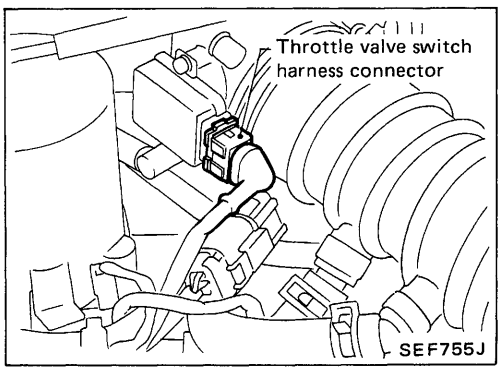
Diagnostic Procedure 15

THROTTLE VALVE SWITCH (Switch ON/OFF diagnostic item)

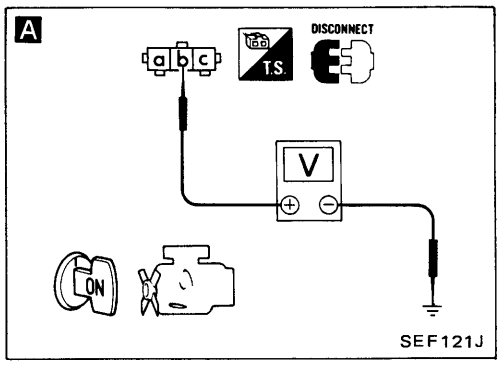


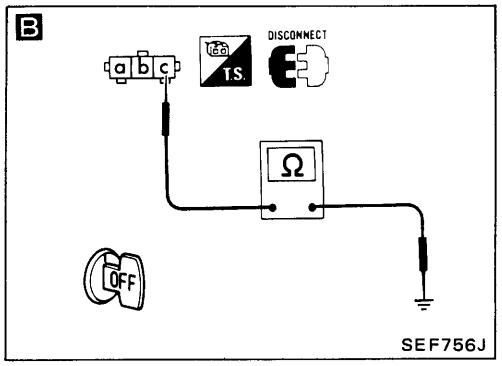
Harness layout





Diagnostic Procedure 15 (Cont'd)





INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect throttle valve switch harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓑ and ground.
Voltage:
Battery voltage

N.G. → Repair harness or connectors.

O.K.

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓒ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

CHECK COMPONENT
(Throttle valve switch).
Refer to "Electrical Components Inspection".
(See page EF & EC-156.)

N.G. → Replace throttle valve switch.

O.K.

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Perform FINAL CHECK by the following procedure after repair is completed.

FINAL CHECK

Start engine.

Perform switch ON/OFF diagnosis.

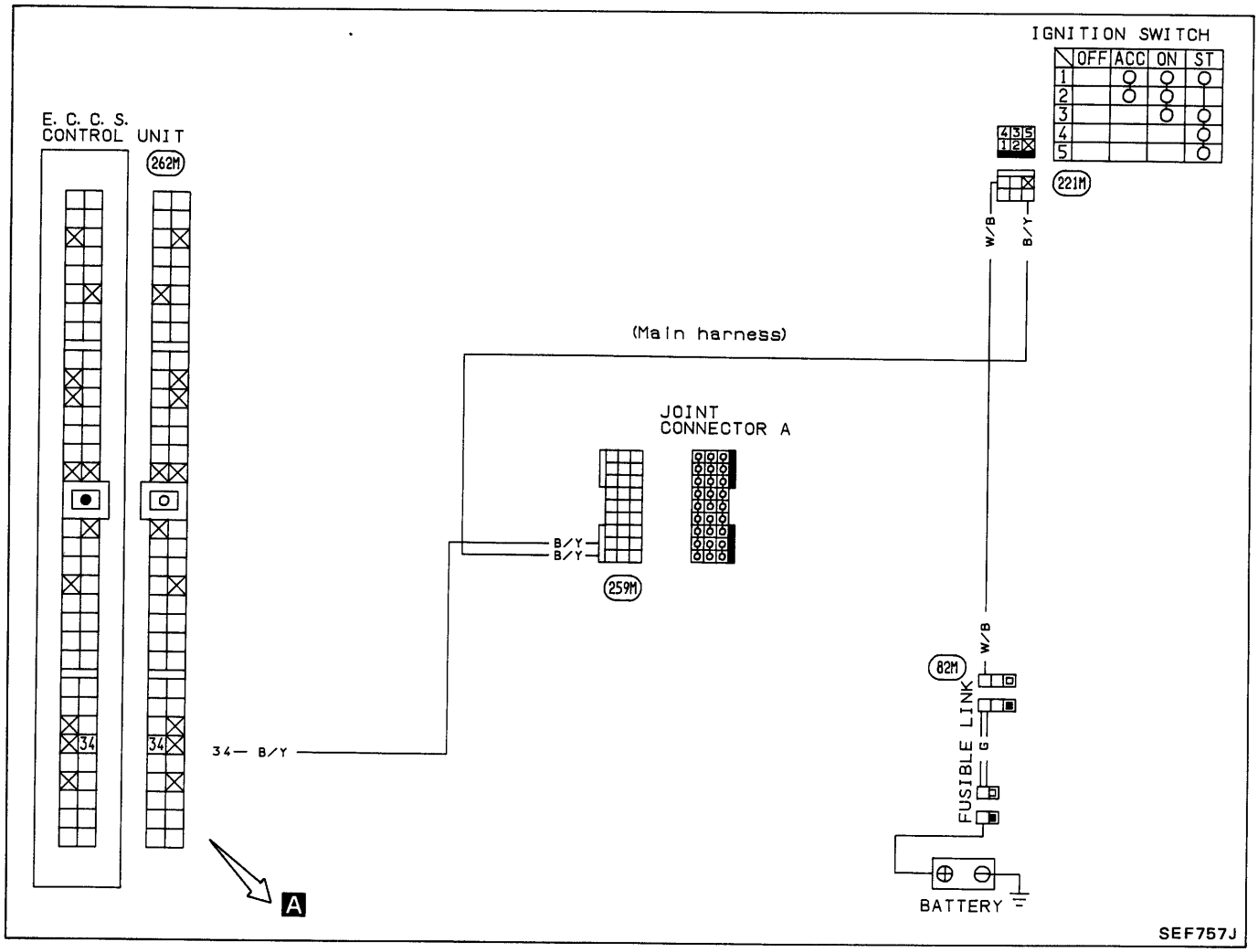
N.G. → Recheck E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K.

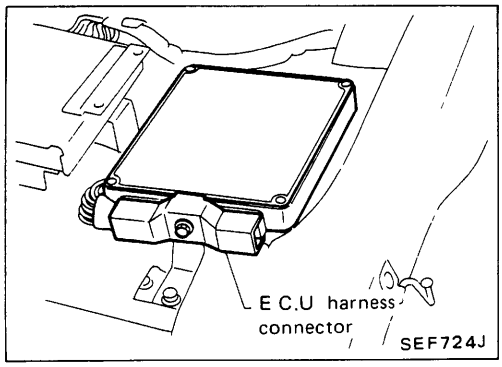
INSPECTION END

Diagnostic Procedure 16

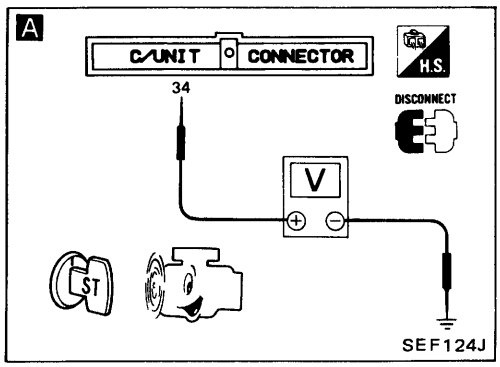
START SIGNAL (Switch ON/OFF diagnostic item)



Harness layout



Diagnostic Procedure 16 (Cont'd)



INSPECTION START

A

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Turn ignition switch to "ST".
3) Check voltage between E.C.U. terminal (34) and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Joint connector-A (259M)
- Harness continuity between E.C.U. and ignition switch

If N.G., repair harness or connectors.

O.K. ↓

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Perform FINAL CHECK by the following procedure after repair is completed.

FINAL CHECK

↓

Turn ignition switch "ON".

↓

Perform switch ON/OFF diagnosis.

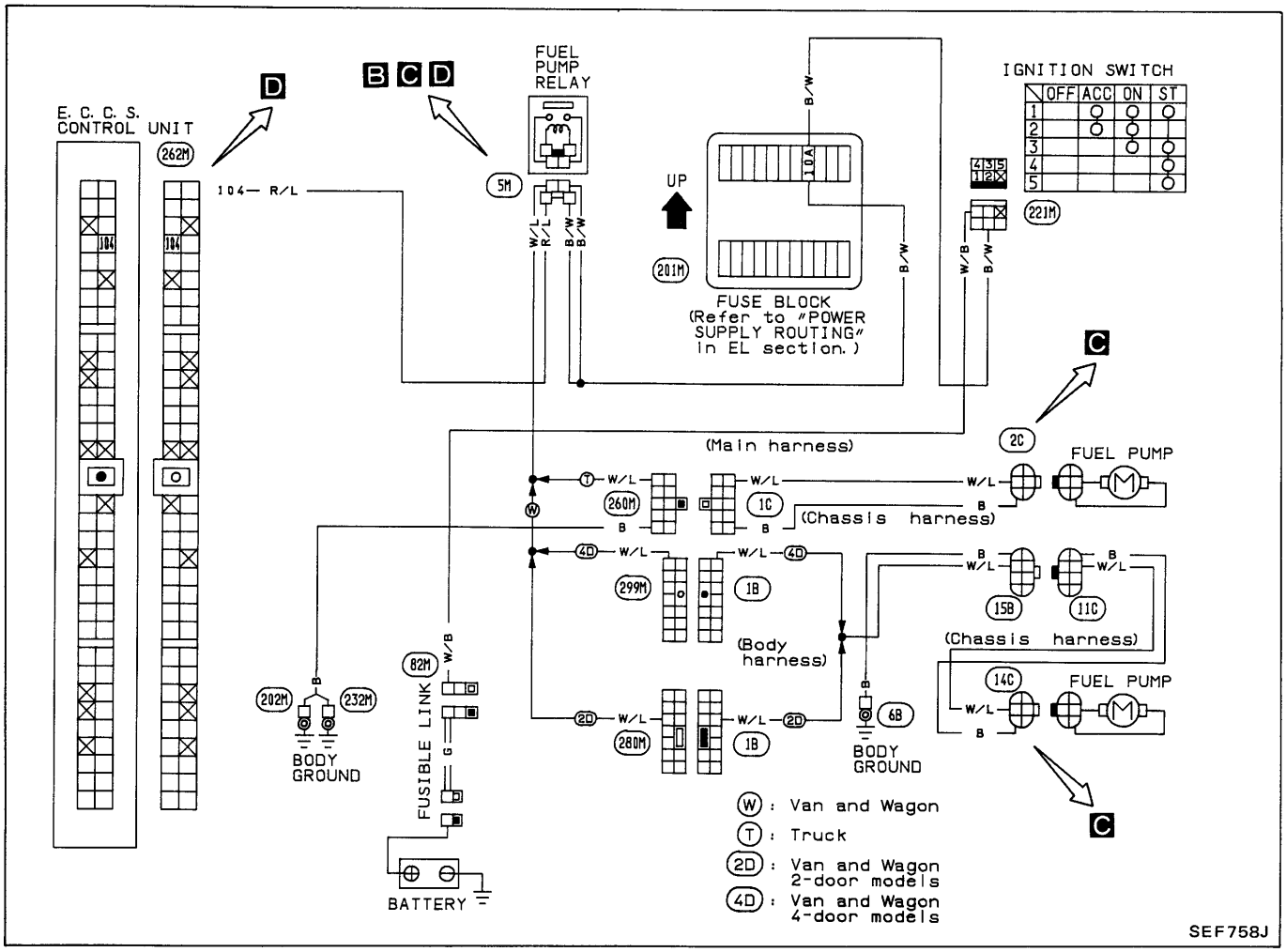
N.G. → Recheck E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K. ↓

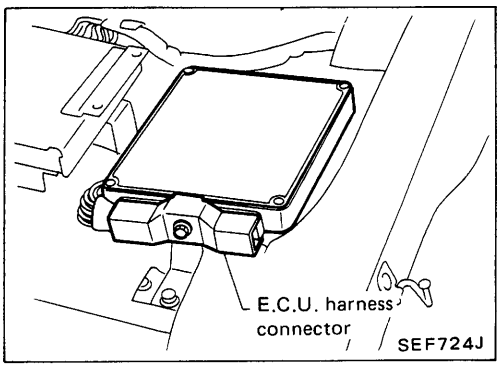
INSPECTION END

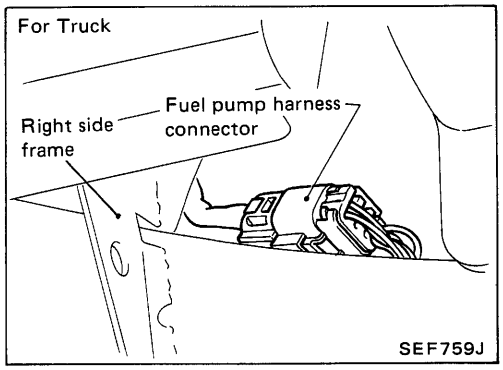
Diagnostic Procedure 17

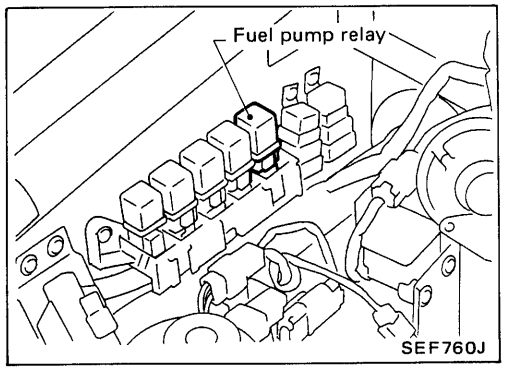
FUEL PUMP (Not self-diagnostic item)

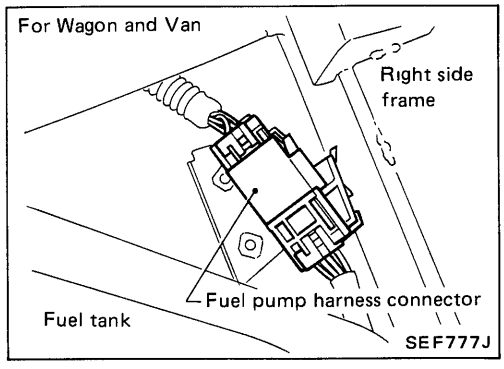


Harness layout

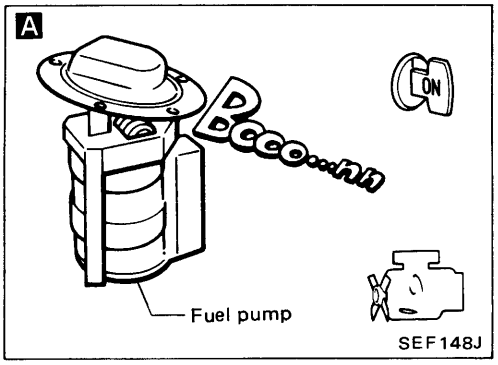


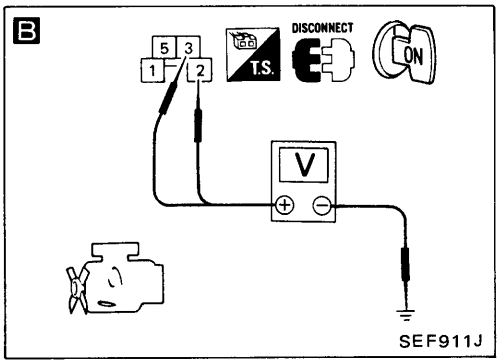


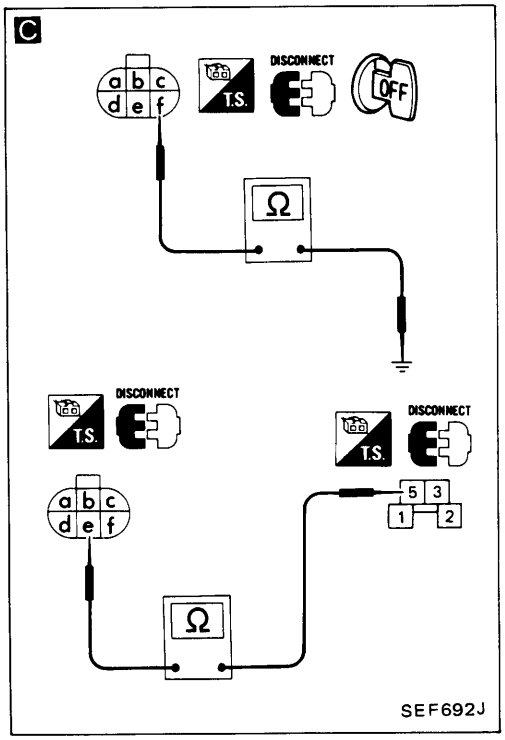


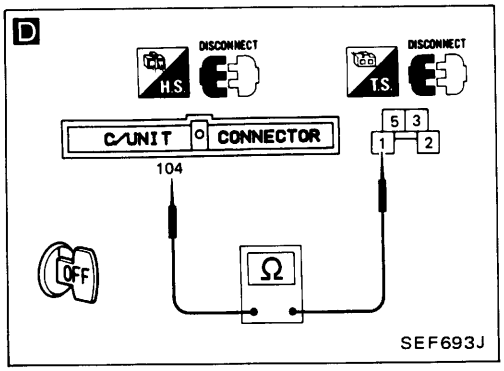


Diagnostic Procedure 17 (Cont'd)









INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Turn ignition switch "ON".
2) Listen to fuel pump operating sound.
Fuel pump should operate for 5 seconds after ignition switch is turned "ON".

O.K. → INSPECTION END

N.G. ↓

B

CHECK POWER SUPPLY.
1) Turn ignition switch "OFF".
2) Disconnect fuel pump relay.
3) Turn ignition switch "ON".
4) Check voltage between terminals ②, ③ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- 10A fuse
- Harness continuity between ignition switch and fuel pump relay

If N.G., repair harness or connectors.

O.K. ↓

C

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect fuel pump harness connector.
3) Check harness continuity between terminal ⓕ and body ground, terminal ⓔ and terminal ⑤.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (260M), (1C) (15B), (11C), (280M), (1B), (299M)
- Harness continuity between fuel pump and body ground
- Harness continuity between fuel pump and fuel pump relay

If N.G., repair harness or connectors.

O.K. ↓

D

CHECK OUTPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal (104) and terminal ①.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

CHECK COMPONENTS
(Fuel pump and fuel pump relay).
Refer to "Electrical Components Inspection".
(See page EF & EC-157.)

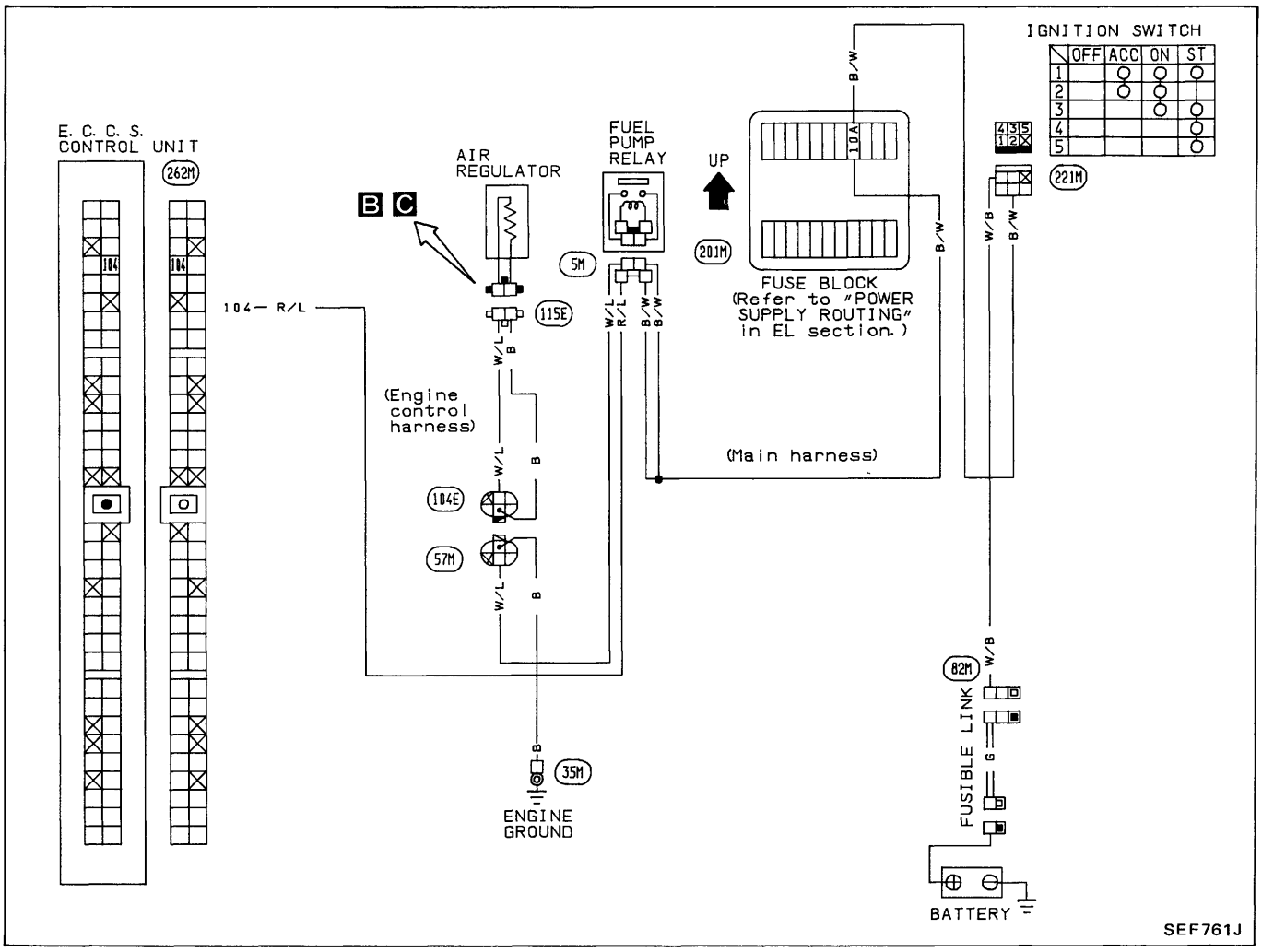
N.G. → Replace malfunctioning component(s).

O.K. ↓

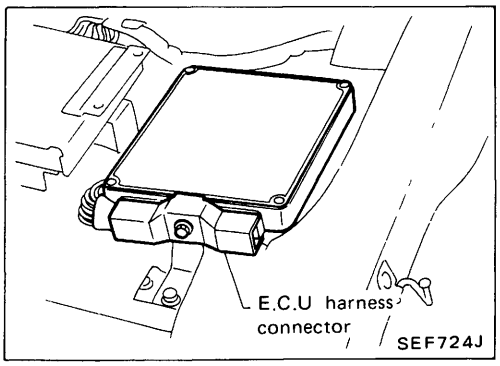
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

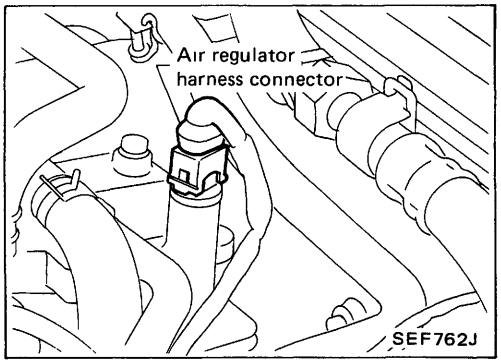
Diagnostic Procedure 18

AIR REGULATOR (Not self-diagnostic item)

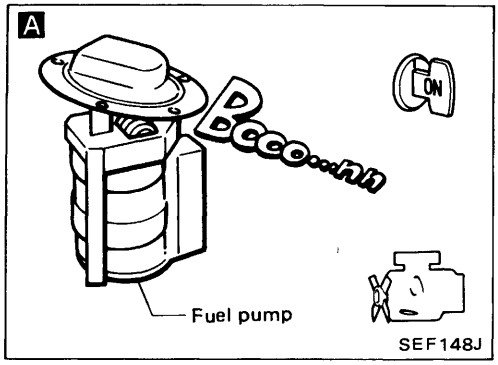


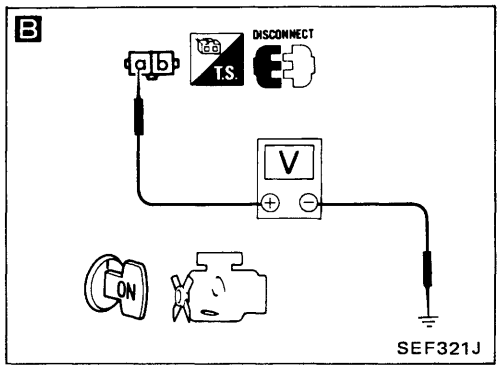
Harness layout

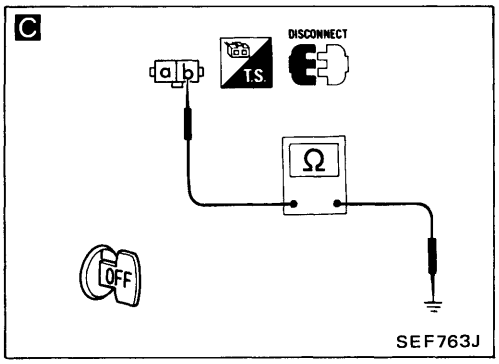




Diagnostic Procedure 18 (Cont'd)







INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Turn ignition switch "ON".
2) Listen to fuel pump operating sound.
Fuel pump should operate for 5 seconds after ignition switch is turned "ON".

N.G. → Check fuel pump control circuit. (See page EF & EC-134.)

O.K.

B

CHECK POWER SUPPLY.
1) Turn ignition switch "OFF".
2) Disconnect air regulator harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓐ and ground.
Battery voltage should exist for 5 seconds after ignition switch is turned "ON".

N.G. → Check the following.
- Harness connectors (57M), (104E)
- Harness continuity between air regulator and fuel pump relay

If N.G., repair harness or connectors.

O.K.

C

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓑ and engine ground.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (57M), (104E)
- Harness continuity between air regulator and engine ground

If N.G., repair harness or connectors.

O.K.

CHECK COMPONENT (Air regulator).
Refer to "Electrical Components Inspection".
(See page EF & EC-155.)

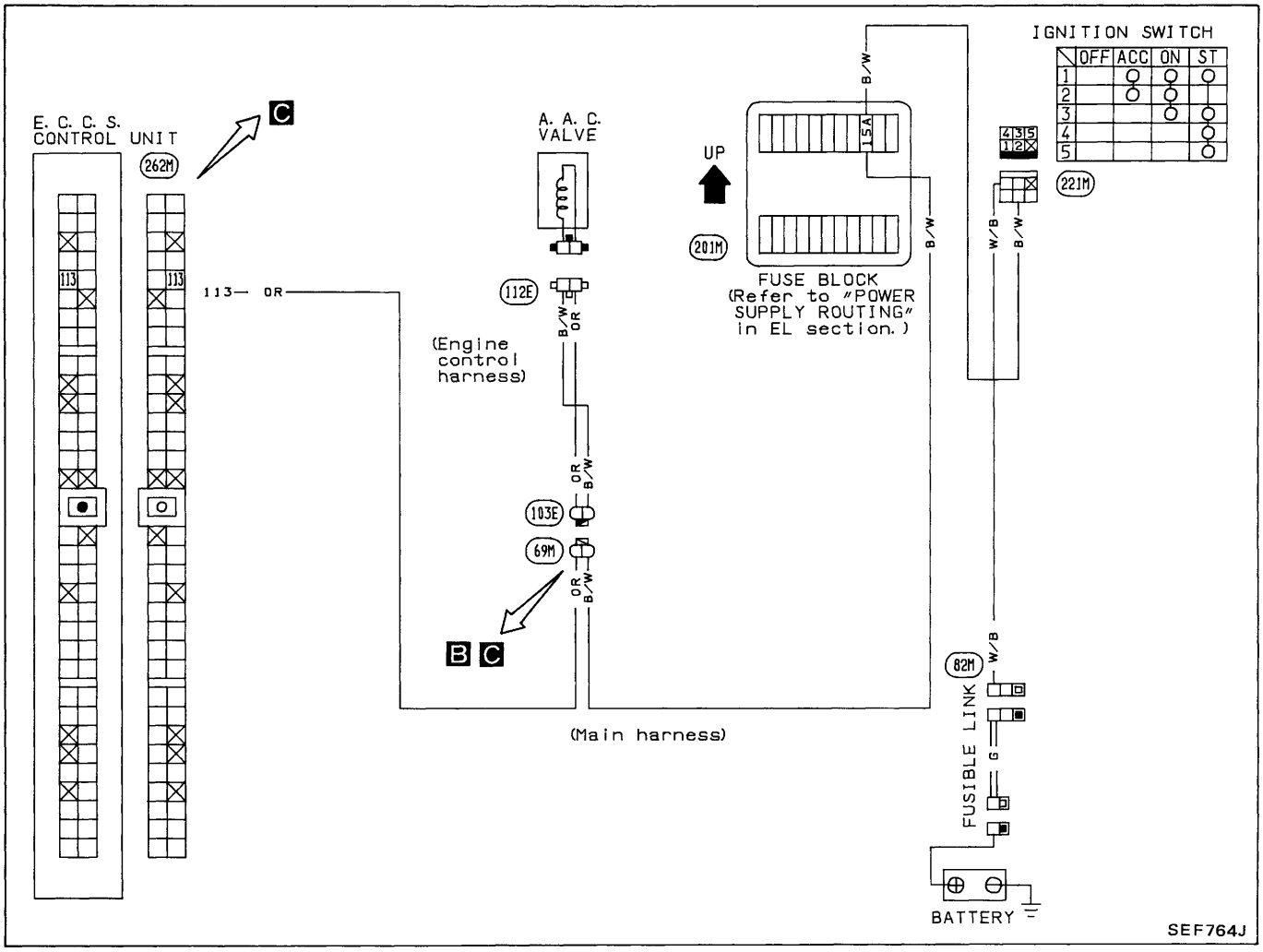
N.G. → Replace air regulator.

O.K.

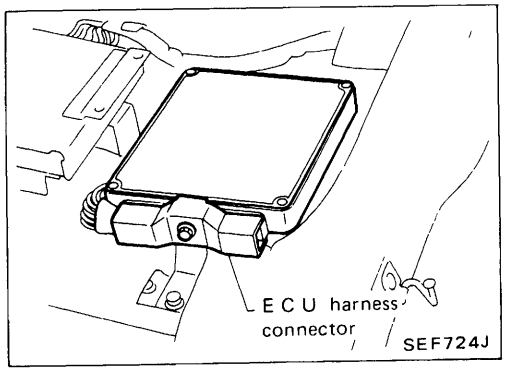
INSPECTION END

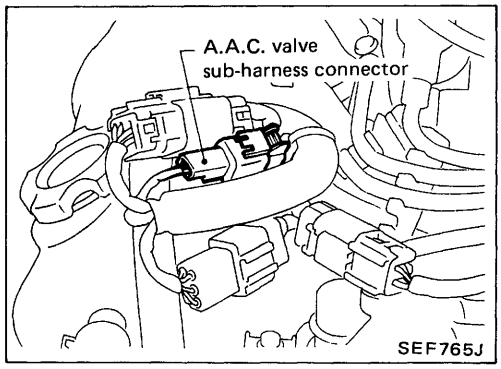
Diagnostic Procedure 19

A.A.C. VALVE (Not self-diagnostic item)

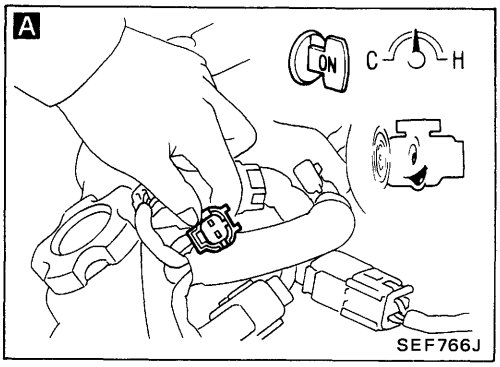


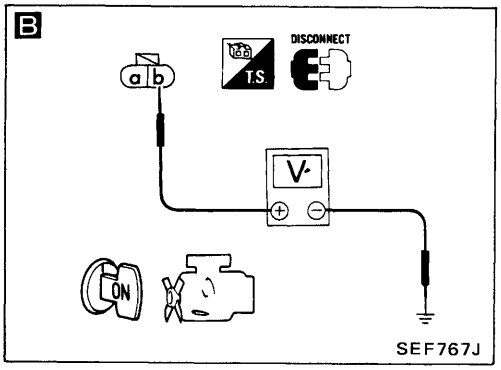
Harness layout

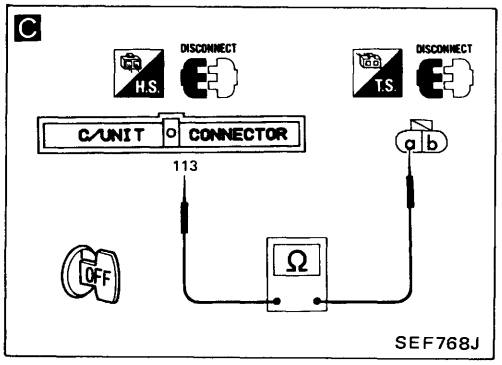




Diagnostic Procedure 19 (Cont'd)







INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Check idle speed.
750±50 rpm
(A/T in "N" position)
If N.G., adjust idle speed.
3) Disconnect A.A.C. valve sub-harness connector.
4) Make sure that idle speed drops.

Drops. → INSPECTION END

Does not drop.

B

CHECK POWER SUPPLY.
1) Stop engine.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓑ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- 15A fuse
- Harness continuity between A.A.C. valve sub-harness connector and ignition switch

If N.G., repair harness or connectors.

O.K.

C

CHECK OUTPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal (113) and terminal ⓐ.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

CHECK COMPONENT (A.A.C. valve).
Refer to "Electrical Components Inspection".
(See page EF & EC-155.)

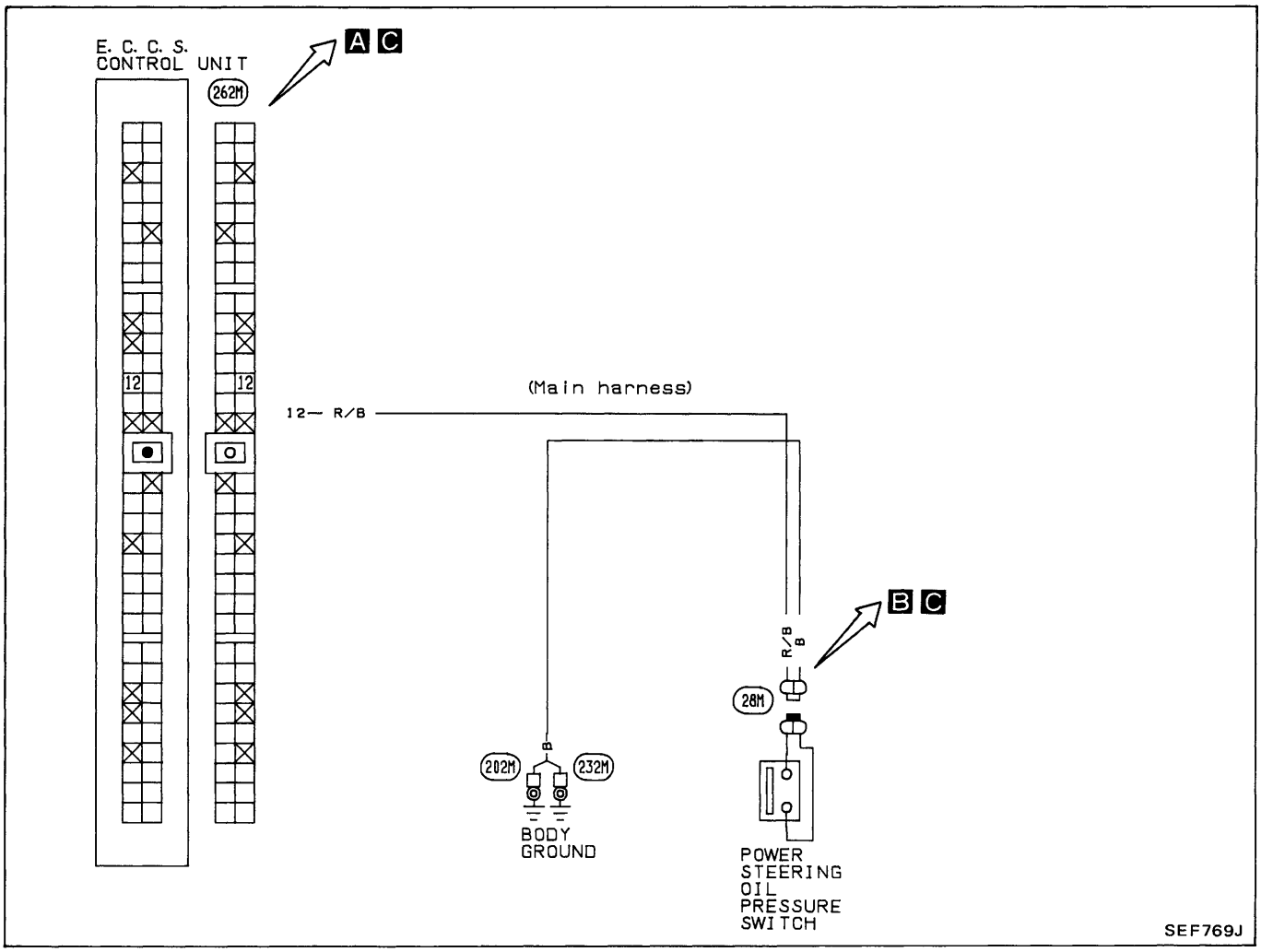
N.G. → Replace A.A.C. valve.

O.K.

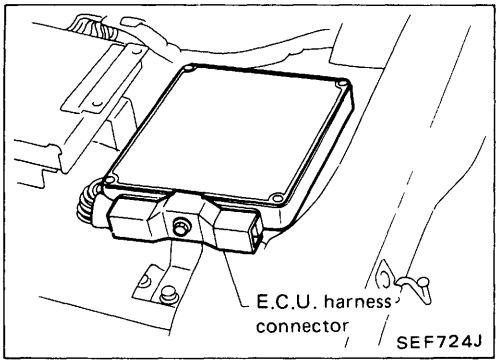
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

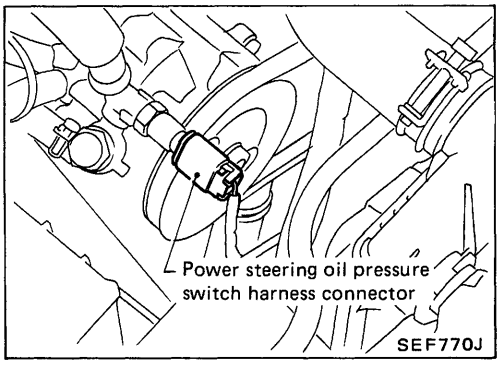
Diagnostic Procedure 20

POWER STEERING OIL PRESSURE SWITCH (Not self-diagnostic item)

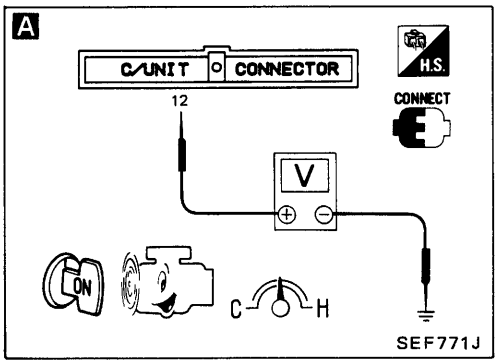


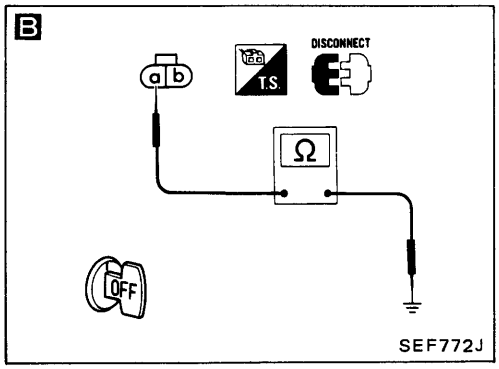
Harness layout

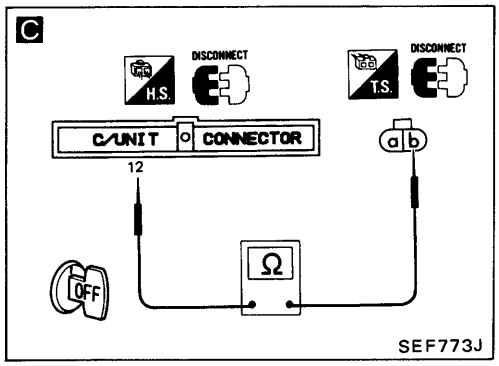




Diagnostic Procedure 20 (Cont'd)







INSPECTION START

A

CHECK CONTROL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Check voltage between E.C.U. terminal ⑫ and ground.
Voltage:
When steering wheel is turned quickly.
Approximately 0 - 2V
Except above
Approximately 4.8 - 4.9V

O.K. → INSPECTION END

N.G. ↓

B

CHECK GROUND CIRCUIT.
1) Stop engine.
2) Disconnect power steering oil pressure switch harness connector.
3) Check harness continuity between terminal ⓐ and body ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

C

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal ⑫ and terminal ⓑ.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

CHECK COMPONENT (Power steering oil pressure switch).
Refer to "Electrical Components Inspection".
(See page EF & EC-157.)

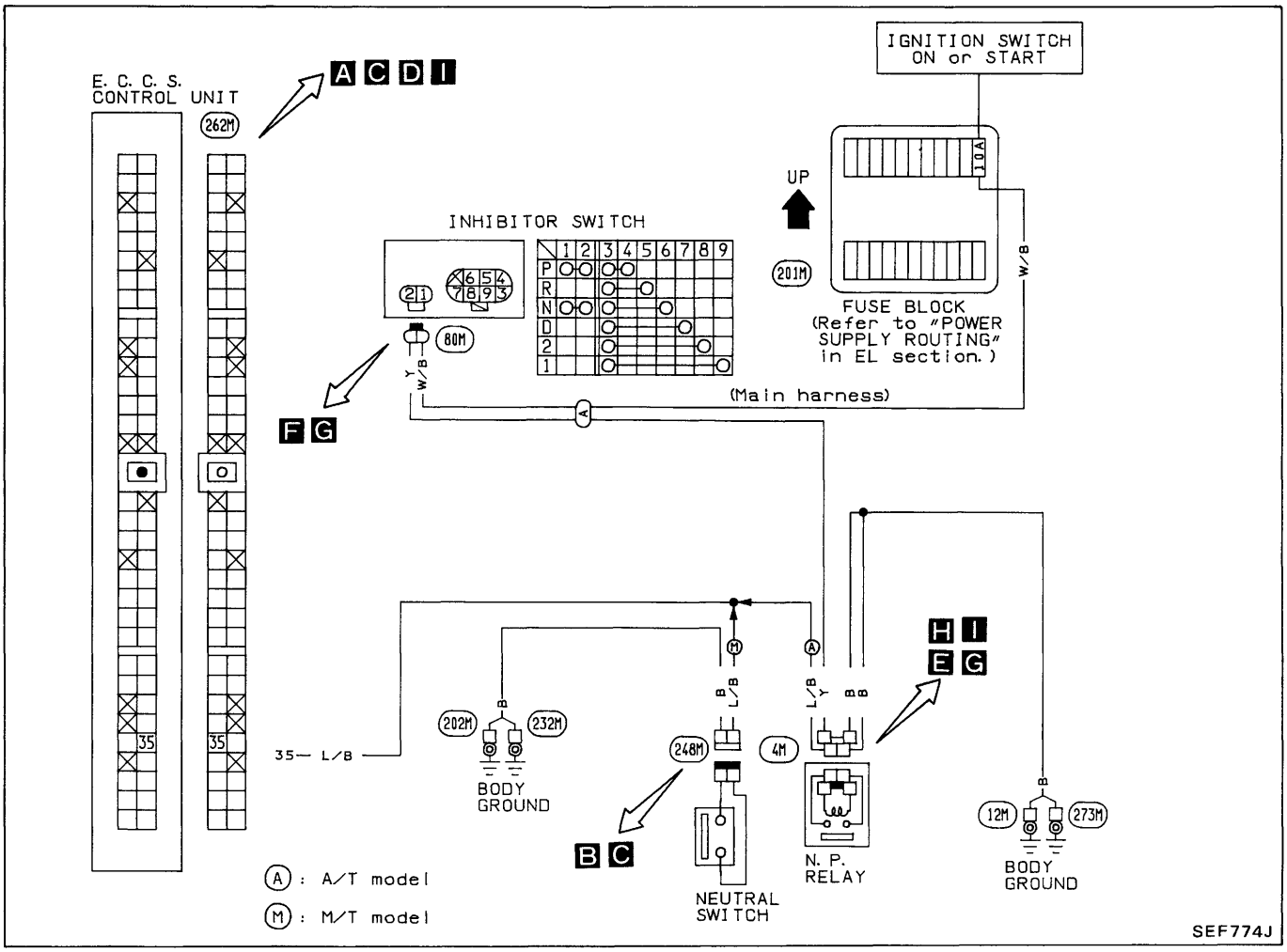
N.G. → Replace power steering oil pressure switch.

O.K. ↓

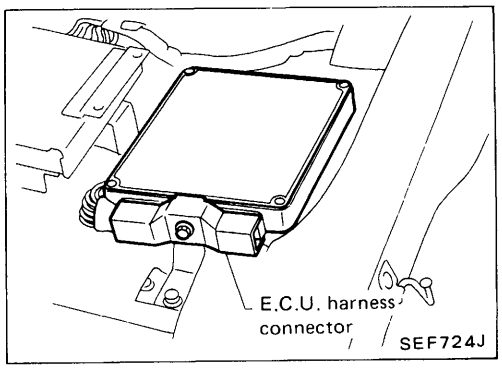
Check E.C.U. pin terminals for damage or the connection of the E.C.U. harness connector.

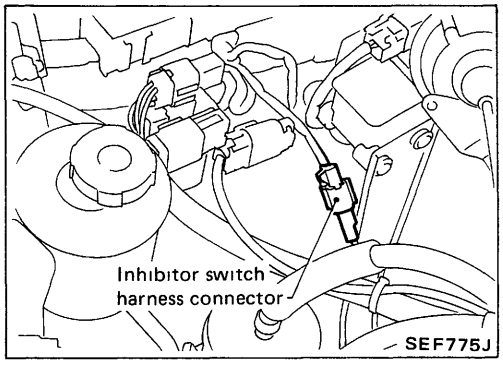
Diagnostic Procedure 21

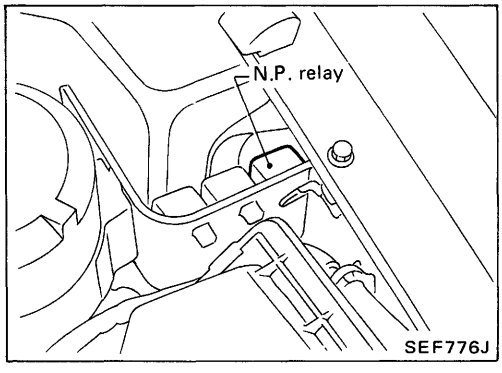
NEUTRAL/INHIBITOR SWITCH (Not self-diagnostic item)



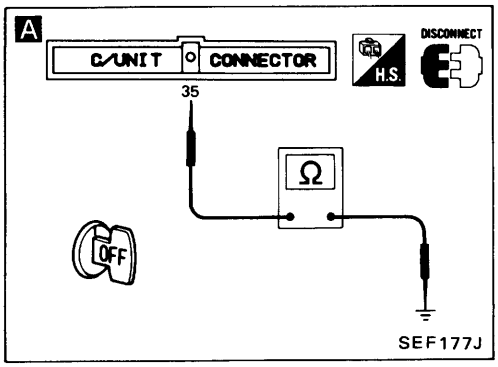
Harness layout

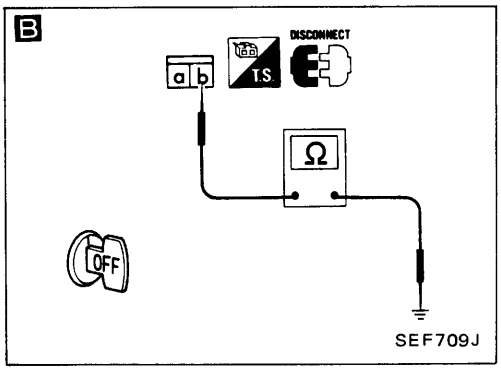


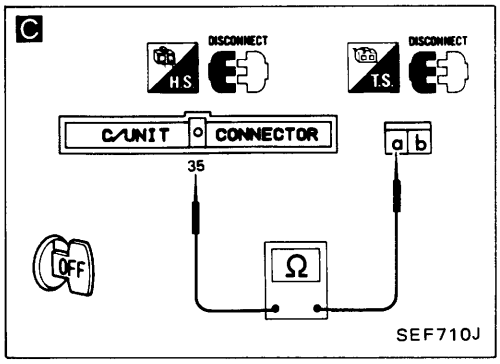




Diagnostic Procedure 21 (Cont'd)







Neutral switch

INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Set shift lever to the neutral position.
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal ㉟ and body ground.
Continuity should exist.

O.K. → INSPECTION END

N.G. ↓

B

CHECK GROUND CIRCUIT.
1) Disconnect neutral switch harness connector.
2) Check harness continuity between terminal ⓑ and body ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

C

CHECK INPUT SIGNAL CIRCUIT.
1) Check harness continuity between E.C.U. terminal ㉟ and terminal ⓐ.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

CHECK COMPONENT (Neutral switch).
Refer to "Electrical Components Inspection".
(See page EF & EC-156.)

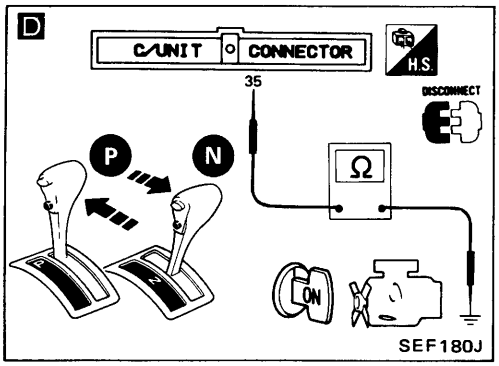
N.G. → Replace neutral switch.

O.K. ↓

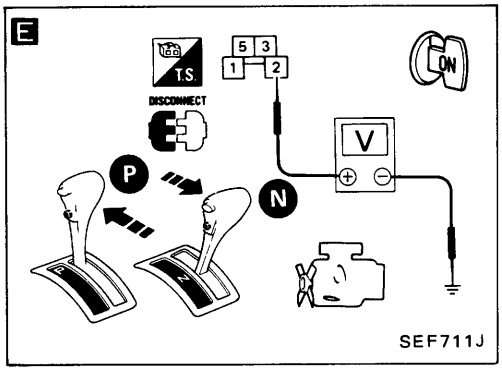
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Diagnostic Procedure 21 (Cont'd)

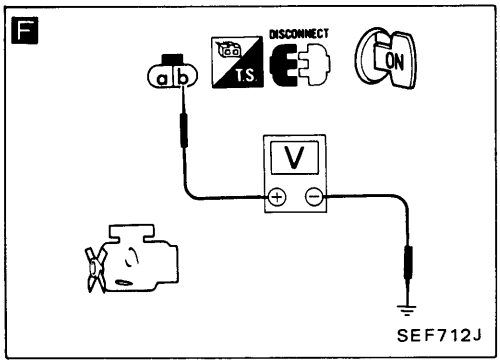
D



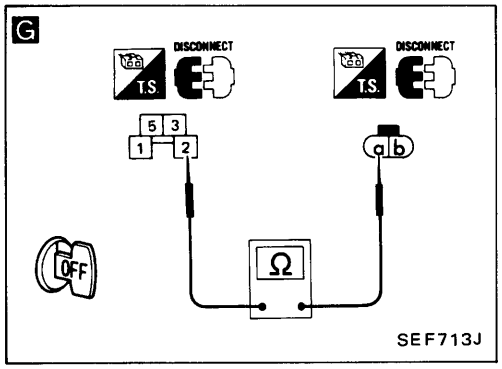
E



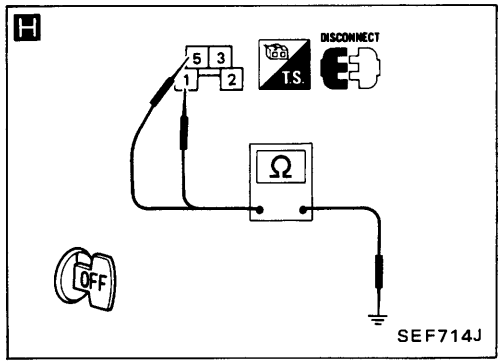
F



G



H



Inhibitor switch

INSPECTION START

D

CHECK OVERALL FUNCTION.
1) Shift selector lever to "P" range.
2) Disconnect E.C.U. harness connector.
3) Turn ignition switch "ON".
4) Check harness continuity between E.C.U. terminal ㉟ and body ground.
Continuity should exist.
5) Shift selector lever to "N" range.
6) Check harness continuity between E.C.U. terminal ㉟ and body ground.
Continuity should exist.

O.K. → INSPECTION END

N.G. ↓

E

CHECK POWER SUPPLY.
1) Turn ignition switch "OFF".
2) Disconnect N.P. relay.
3) Make sure that selector lever is in "N" range.
4) Turn ignition switch "ON".
5) Check voltage between terminal ② and ground.
Voltage: Battery voltage
6) Shift selector lever into "P" range.
7) Check voltage between terminal ② and ground.
Voltage: Battery voltage

N.G. →

Check the following.

F CHECK HARNESS CONTINUITY BETWEEN INHIBITOR SWITCH AND BATTERY.
1) Turn ignition switch "OFF".
2) Disconnect inhibitor switch harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓑ and ground.
Voltage: Battery voltage
If N.G., check the following.
- 10A fuse
- Harness continuity between fuse and inhibitor switch

If N.G., repair harness or connectors.

G CHECK HARNESS CONTINUITY BETWEEN INHIBITOR SWITCH AND N.P. RELAY.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓐ and terminal ②.
Continuity should exist.

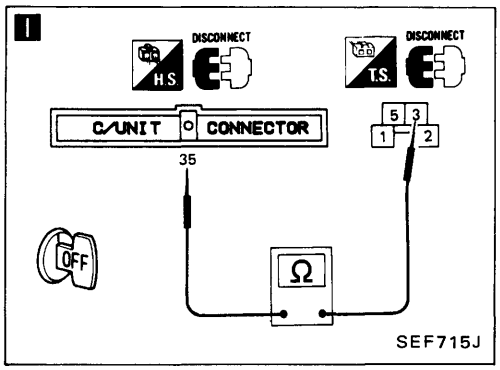
If N.G., repair harness or connectors.

CHECK COMPONENT (Inhibitor switch).
Refer to "Electrical Components Inspection".
(See page EF & EC-156.)

O.K. ↓

Ⓐ

Diagnostic Procedure 21 (Cont'd)



Ⓐ

H

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminals ①, ⑤ and body ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

I

CHECK INPUT SIGNAL CIRCUIT.
1) Check harness continuity between E.C.U. terminal ㉟ and terminal ③.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

CHECK COMPONENT (N.P. relay).
Refer to "Electrical Components Inspection".
(See page EF & EC-157.)

N.G. → Replace N.P. relay.

O.K. ↓

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Electrical Components Inspection

E.C.U. INPUT/OUTPUT SIGNAL INSPECTION

E.C.U. Inspection table

*Data are reference values.

TERMINAL NO.	ITEM	CONDITION	*DATA
1	Ignition signal	Engine is running. └ Idle speed	0.5 - 0.6V
		Engine is running. └ Engine speed is 2,000 rpm.	1.2 - 1.3V
2	Tachometer	Engine is running. └ Idle speed	Approximately 1.0V
		Engine is running. └ Engine speed is 2,000 rpm.	2.7 - 2.9V
3	Ignition check	Engine is running. └ Idle speed	9 - 12V
4	E.C.U. power source (Self-shutoff)	Engine is running. └ Idle speed	0 - 1V
		Engine is not running. └ For a few seconds after turning ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)
8	Exhaust gas temperature sensor (Only for California model)	Engine is running. └ Idle speed	1.0 - 2.0V
		Engine is running. (Racing) └ After warming up	0 - 1.0V
11	Air conditioner relay	Engine is ruuning. └ Both A/C switch and blower switch are "ON".	0 - 1.0V
		Engine is running. └ A/C switch is "OFF".	BATTERY VOLTAGE (11 - 14V)
12	Power steering oil pressure switch	Engine is running. └ Steering wheel is being turned.	0 - 2.0V
		Engine is running. └ Steering wheel is not being turned.	4.8 - 4.9V

E.C.U. INPUT/OUTPUT SIGNAL INSPECTION

E.C.U. Inspection table

*Data are reference values.

TERMINAL NO.	ITEM	CONDITION	*DATA
16	Air flow meter	Engine is running.	1.0 - 3.0V Output voltage varies with engine revolution.
18	Engine temperature sensor	Engine is running.	1.0 - 3.0V Output voltage varies with engine water temperature.
19	Exhaust gas sensor	Engine is running. └After warming up sufficiently.	0 - Approximately 1.0V
20	Throttle sensor	Ignition switch "ON"	0.4 - Approximately 4V Output voltage varies with the throttle valve opening angle.
22 30	Crank angle sensor (Reference signal)	Engine is running. **Do not run engine at high speed under no-load.**	0.2 - 0.5V
27	Detonation sensor	Engine is running. └Idle speed	Approximately 2.5V
28	Throttle opening signal	Ignition switch "ON"	0.3 - Approximately 3V
31 40	Crank angle sensor (Position signal)	Engine is running. **Do not run engine at high speed under no-load.**	2.0 - 3.0V
33	Throttle valve switch (⊖ side)	Ignition switch "ON" └Throttle valve: Idle position	Approximately 8 - 10V
		Ignition switch "ON" └Throttle valve: Any position except idle position	0V
34	Start signal	Cranking	8 - 12V
35	Neutral switch & Inhibitor switch	Ignition switch "ON" └Neutral/Parking	0V
		Ignition switch "ON" └Except the above gear position	6 - 7V

Electrical Components Inspection (Cont'd)

*Data are reference values.

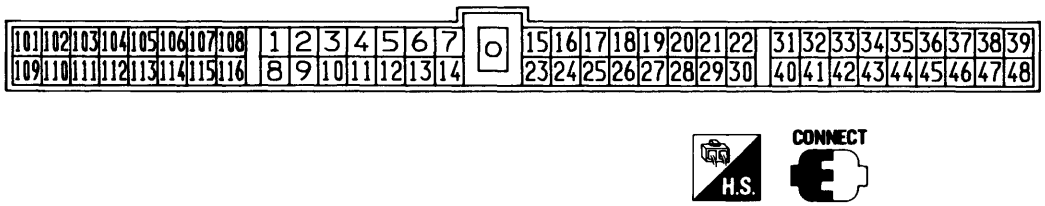
TERMINAL NO.	ITEM	CONDITION	*DATA
36	Ignition switch	Ignition switch "OFF"	0V
		Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
37	Throttle sensor power supply	Ignition switch "ON"	Approximately 5V
38 47	Power supply for E.C.U.	Ignition switch "ON"	BATTERY VOLTAGE
41	Air conditioner switch	Engine is running. └Both air conditioner switch and blower switch are "ON".	0V
		Engine is running. └Air conditioner switch is "OFF".	BATTERY VOLTAGE (11 - 14V)
44	Throttle valve switch (⊕ side)	Ignition switch "ON" └Throttle valve: Idle position	Approximately 9 - 10V
		Ignition switch "ON" └Throttle valve: Except idle position	BATTERY VOLTAGE (11 - 14V)
46	Power supply (Back-up)	Ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)
101	Injector No. 1	Engine is running.	BATTERY VOLTAGE (11 - 14V)
103	Injector No. 3		
105	Injector No. 5		
110	Injector No. 2		
112	Injector No. 4		
114	Injector No. 6		

Electrical Components Inspection (Cont'd)

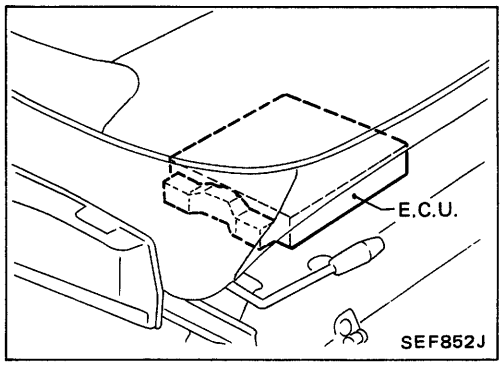
*Data are reference values.

TERMINAL NO.	ITEM	CONDITION	*DATA
102	E.G.R.control solenoid valve	Engine is running. (Warm-up condition) — Idle speed	0.7 - 0.9V
		Engine is running. (Warm-up condition) — Engine speed is 2,000 rpm.	BATTERY VOLTAGE (11 - 14V)
		Engine is running. (Warm-up condition) — Engine speed is above 3,100 rpm. (A/T model) — Engine speed is above 2,600 rpm. (M/T model)	0.8 - 0.9V
104	Fuel pump relay	Ignition switch "ON" — For 5 seconds after turning ignition switch "ON" Engine is running.	0.7 - 0.9V
		Ignition switch "ON" — Within 5 seconds after turning ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
113	A.A.C. valve	Engine is running. — Idle speed	7 - 10V
		Engine is running. — Steering wheel is being turned. — Air conditioner is operating. — Rear defogger is "ON". — Headlamps are in high position.	4 - 7V

E.C.U. HARNESS CONNECTOR TERMINAL LAYOUT



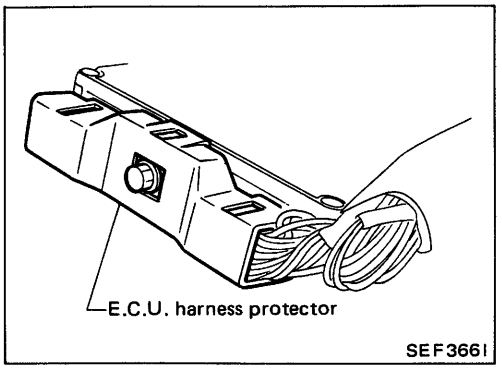
SEF419H



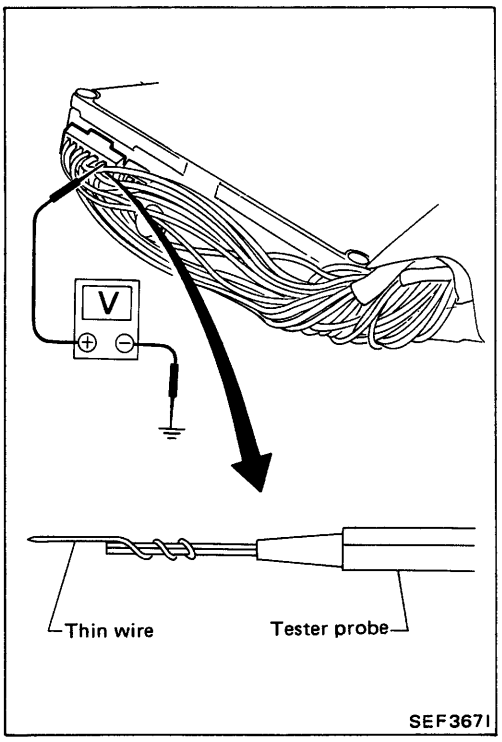
Electrical Components Inspection

E.C.U. INPUT/OUTPUT SIGNAL INSPECTION

1. E.C.U. is located under the passenger seat. For this inspection, remove passenger seat.

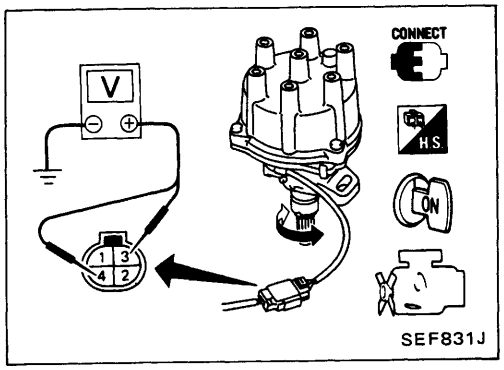


2. Remove E.C.U. harness protector.



3. Perform all voltage measurements with the connectors connected.
   Improve tester probe as shown to perform tests easily.

Electrical Components Inspection (Cont'd)

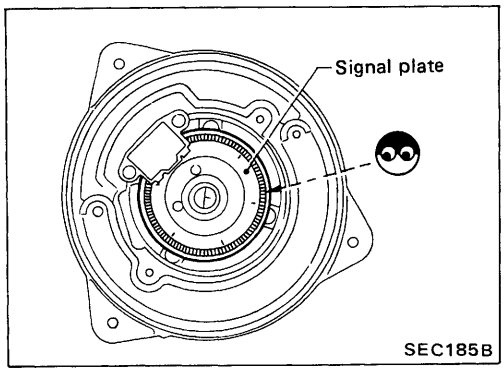


CRANK ANGLE SENSOR

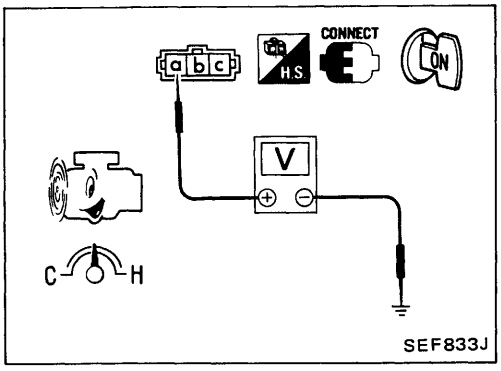
1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Turn ignition switch "ON".
3. Rotate distributor shaft slowly by hand and check voltage between terminals ③, ④ and ground.

Terminal	Voltage
③ (120° signal)	Tester's pointer fluctuates between 5V and 0V.
④ (1° signal)	

If N.G., replace distributor assembly with crank angle sensor.



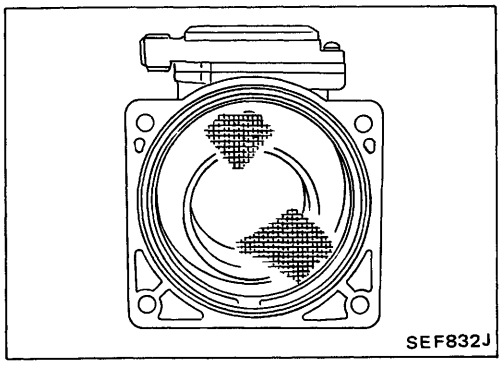
4. Visually check signal plate for damage or dust.



AIR FLOW METER

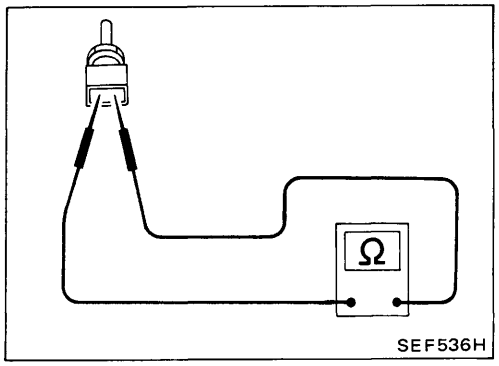
1. Peel air flow meter harness connector rubber as shown in the figure if the harness connector is connected.
2. Turn ignition switch "ON".
3. Start engine and warm it up sufficiently.
4. Check voltage between terminal ⓐ and ground.

Conditions	Voltage V
Ignition switch "ON" (Engine stopped.)	Less than 1.0
Idle (Engine is warm-up sufficiently.)	Approximately 1.5 - 2.0



5. If N.G., remove air flow meter from air duct. Check hot wire for damage or dust.

Electrical Components Inspection (Cont'd)

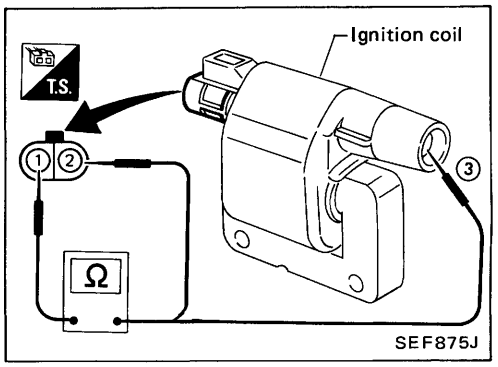


ENGINE TEMPERATURE SENSOR

1. Disconnect engine temperature sensor harness connector.
2. Check resistance as shown in the figure.

Temperature °C (°F)	Resistance kΩ
20 (68)	2.1 - 2.9
50 (122)	0.68 - 1.0
80 (176)	0.30 - 0.33

If N.G., replace engine temperature sensor.

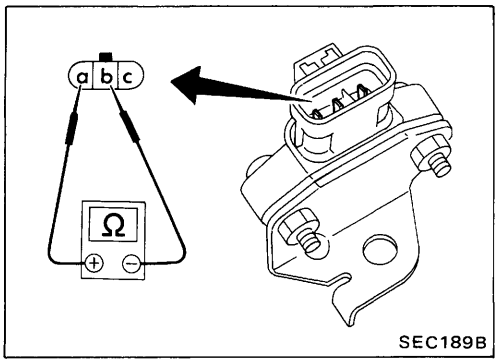


IGNITION COIL

1. Disconnect ignition coil harness connector.
2. Check resistance as shown in the figure.

Terminal	Resistance
① - ②	Approximately 1.0Ω
① - ③	Approximately 10 kΩ

If N.G., replace ignition coil.

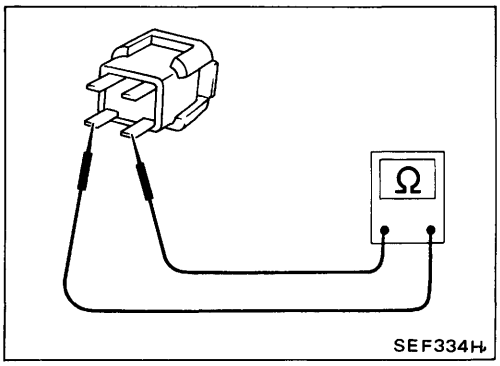


POWER TRANSISTOR

1. Disconnect power transistor harness connector.
2. Check power transistor continuity between terminals as shown in the figure.

Terminal No.	Tester polarity	Continuity
ⓐ	⊕	Yes
ⓑ	⊖	
ⓐ	⊖	No
ⓑ	⊕	
ⓐ	⊕	Yes
ⓒ	⊖	
ⓐ	⊖	No
ⓒ	⊕	

If N.G., replace power transistor.

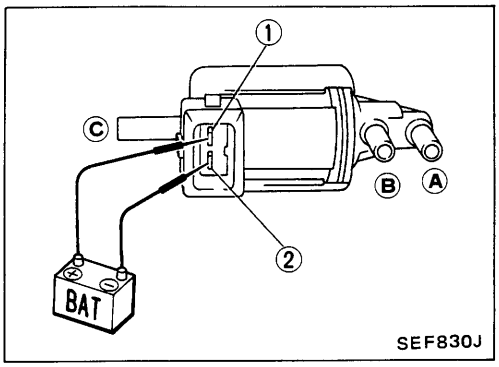


RESISTOR

1. Disconnect resistor harness connector.
2. Check resistance between terminal ⓐ and ⓑ.
   Resistance: Approximately 2.2Ω

If N.G., replace resistor.

Electrical Components Inspection (Cont'd)

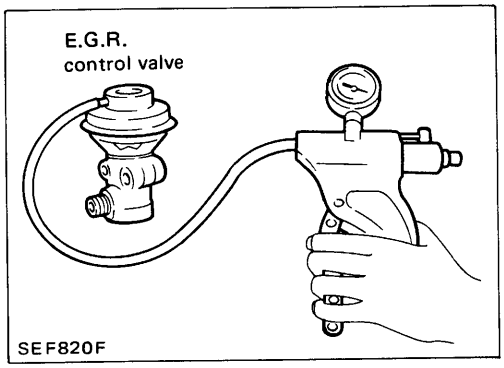


E.G.R. CONTROL SOLENOID VALVE

1. Disconnect E.G.R. control solenoid valve harness connector.
2. Check solenoid valve, following the table as shown below:

Conditions	Continuity between port Ⓐ and Ⓑ	Continuity between port Ⓑ and Ⓒ
Supply 12V direct current between terminals ① and ②	Yes	No
No current supply	No	Yes

If N.G., replace E.G.R. control solenoid valve.

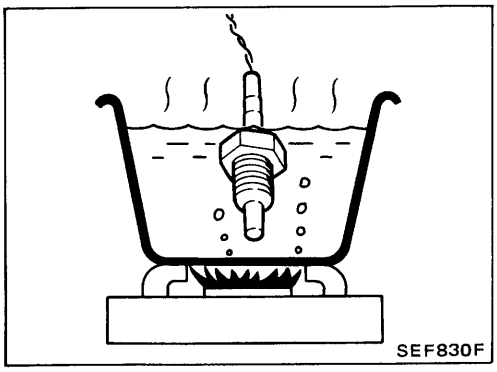


E.G.R. CONTROL VALVE

Apply vacuum to E.G.R. vacuum port with a hand vacuum pump.
E.G.R. control valve spring should lift.
If N.G., replace E.G.R. control valve.

EXHAUST GAS SENSOR

Refer to "Diagnostic Procedure 9".
(See page EF & EC-111.)



EXHAUST GAS TEMPERATURE SENSOR

Check resistance change and resistance value at 100°C (212°F).

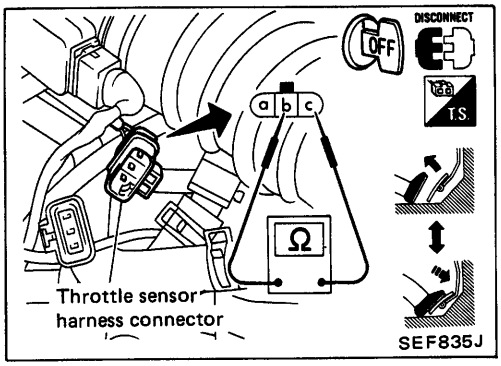
- **Resistance should decrease in response to temperature increase.**

  Resistance: 100°C (212°F)
  85.3 ± 8.53 kΩ

If N.G., replace exhaust gas temperature sensor.

Electrical Components Inspection (Cont'd)

THROTTLE SENSOR



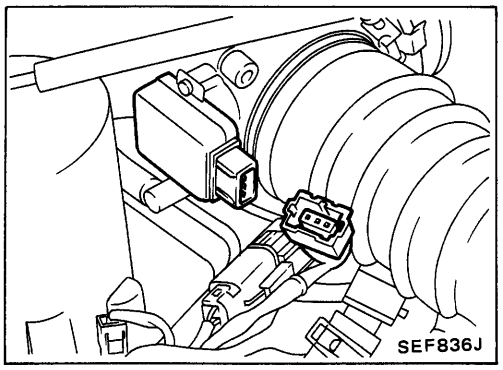
1. Disconnect throttle sensor harness connector.
2. Make sure that resistance between terminals ⓑ and ⓒ changes when opening throttle valve manually.

Accelerator pedal conditions	Resistance kΩ
Completely released	Approximately 1
Partially released	1 - 9
Completely depressed	Approximately 9

If N.G., replace throttle sensor.

Adjustment

If throttle sensor is replaced or removed, it is necessary to install in proper position, by following the procedure as shown below:



1. Install throttle sensor body in throttle chamber. Do not tighten bolts. Leave bolts loose.
2. Connect throttle sensor and throttle valve switch harness connector.
3. Start engine and warm it up sufficiently.
4. Disconnect A.A.C. valve sub-harness connector.
5. Disconnect throttle valve switch harness connector.
6. Check throttle valve switch OFF → ON speed with circuit tester, closing throttle valve manually.

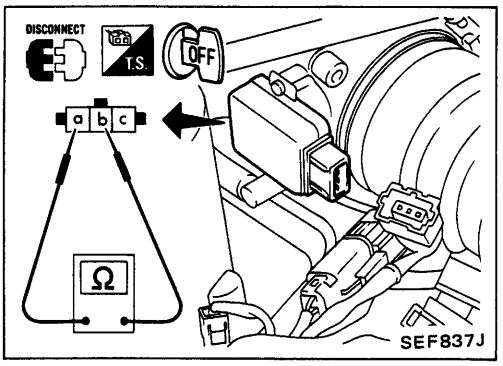
   Throttle valve switch OFF → ON speed:

   M/T

   Idle speed + 250 ± 150 rpm

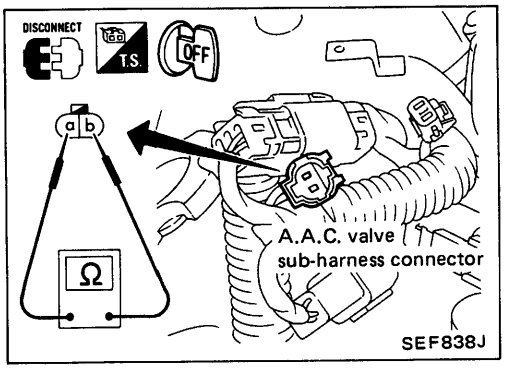
   A/T

   Engine speed (Idle speed in "N" position) + 250 ± 150 rpm



7. If N.G., set throttle valve switch OFF → ON speed to the specified value by turning throttle sensor body. Connect circuit tester with terminals ⓐ and ⓑ on throttle valve switch side and find out OFF → ON point.
8. Tighten throttle sensor installing bolts carefully after setting so that throttle sensor does not move.

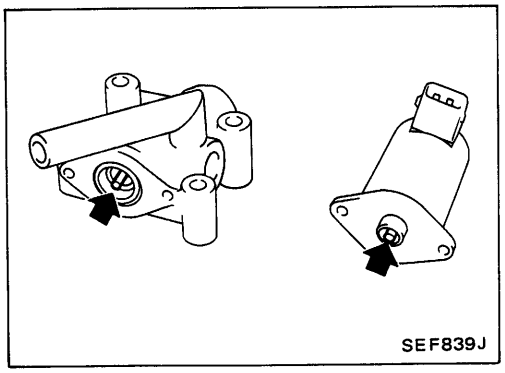
Electrical Components Inspection (Cont'd)



A.A.C. VALVE

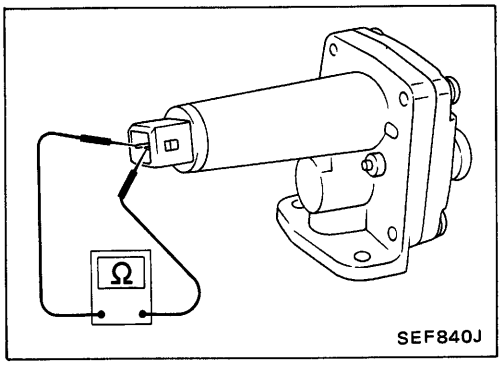
Resistance check

1. Disconnect A.A.C. valve sub-harness connector.
2. Check resistance between terminals, ⓐ and ⓑ :
   Resistance:
   Approximately 10Ω



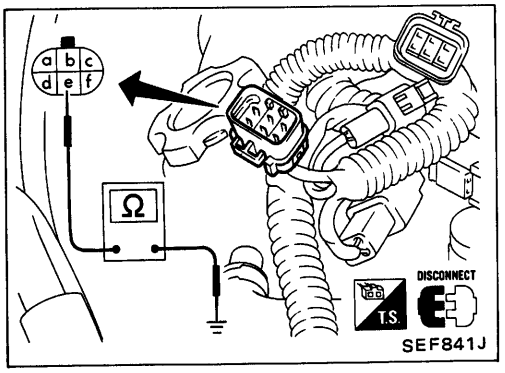
3. Check plunger for seizing or sticking.
4. Check for broken spring.

AIR REGULATOR



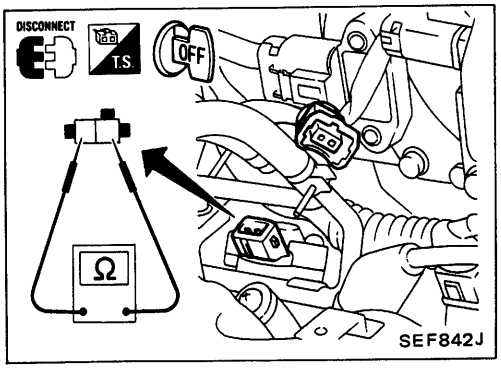
1. Disconnect air regulator harness connector.
2. Check resistance between terminals ⓐ and ⓑ.
   Resistance: Approximately 70 - 80Ω
3. Check air regulator for clogging.

DETONATION SENSOR



1. Disconnect detonation sensor sub-harness connector.
2. Check continuity between terminals ⓔ and ground.
   Continuity should exist.

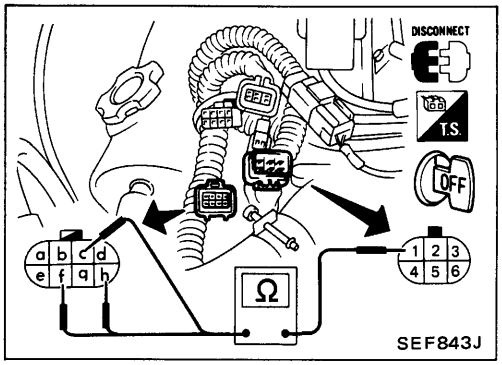
INJECTOR



No. 1, No. 3 and No. 5 cylinders

1. Disconnect injector harness connector.
2. Check resistance between terminals as shown in the figure.
   Resistance: 10 - 14Ω
   If N.G., replace injector.

Electrical Components Inspection (Cont'd)

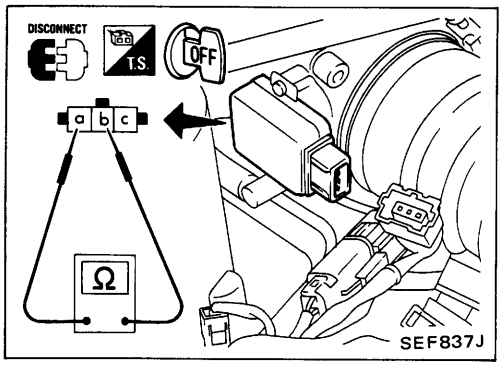


No. 2, No. 4 and No. 6 cylinders

1. Disconnect middle harness connectors for injectors.
2. Check resistance between terminals, following the table as shown below:

Cylinder	Terminal No.	Resistance
No. 2	① - ⓒ	10 - 14Ω
No. 4	① - ⓕ	
No. 6	① - ⓗ	

If N.G., replace injector.

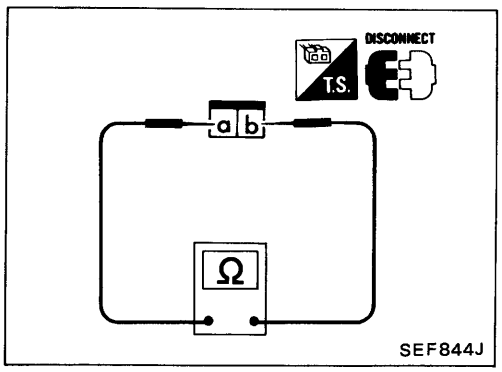


THROTTLE VALVE SWITCH

1. Disconnect throttle valve switch harness connector.
2. Check continuity between terminals ⓐ and ⓑ.

Accelerator pedal condition	Continuity
Released	Yes
Depressed	No

If N.G., replace idle switch.

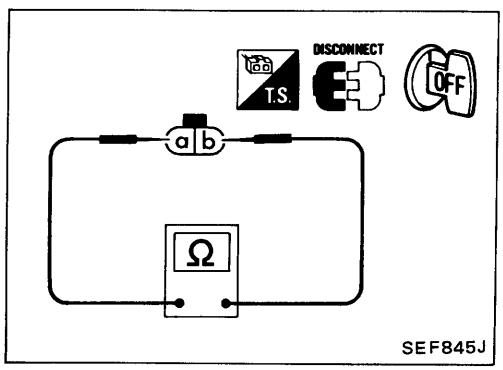


NEUTRAL SWITCH

Check continuity between terminals ⓐ and ⓑ.

Conditions	Continuity
Shift to Neutral	Yes
Shift to other position	No

If N.G., replace neutral switch.



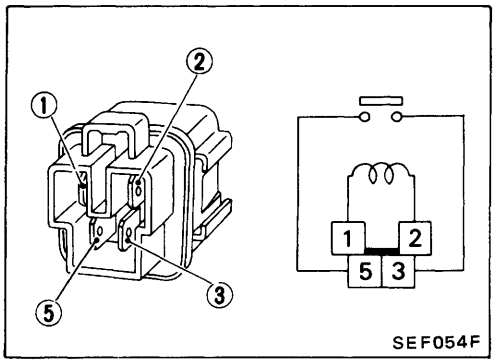
INHIBITOR SWITCH

Check continuity between terminals ⓐ and ⓑ.

Conditions	Continuity
Shift to "P" position	Yes
Shift to "N" position	Yes
Shift to positions other than "P" and "N"	No

If N.G., replace inhibitor switch.

Electrical Component Inspection (Cont'd)

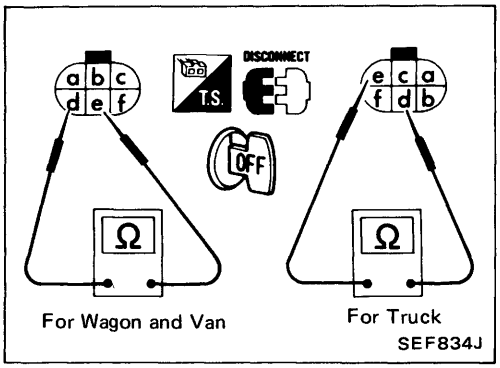


E.C.C.S. RELAY, FUEL PUMP RELAY, AIR CONDITIONER RELAY AND N.P. RELAY

Check continuity between terminals ③ and ⑤.

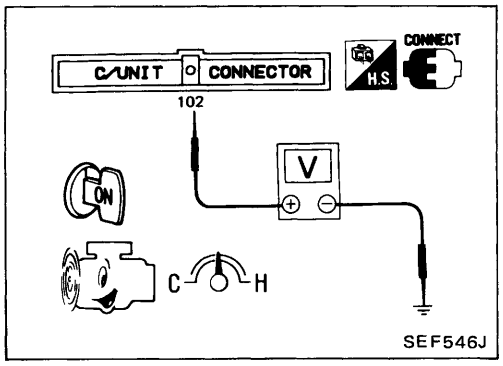
Conditions	Continuity
12V direct current supply between terminals ① and ②	Yes
No current supply	No

If N.G., replace relay.



FUEL PUMP

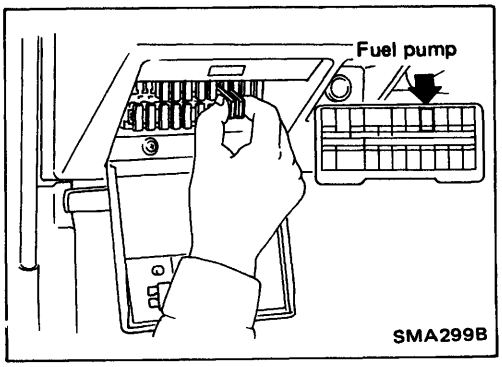
1. Disconnect fuel pump harness connector.
2. Check resistance between terminals ⓓ and ⓔ.
   Resistance: Approximately 1.5Ω
   If N.G., replace fuel pump.



POWER STEERING OIL PRESSURE SWITCH

1. Disconnect power steering oil pressure switch harness connector.
2. Start engine.
3. Check continuity between terminals ⓐ and ⓑ.

Condition	Continuity
Steering wheel is being turned	Yes
Steering wheel is not being turned	No



Releasing Fuel Pressure

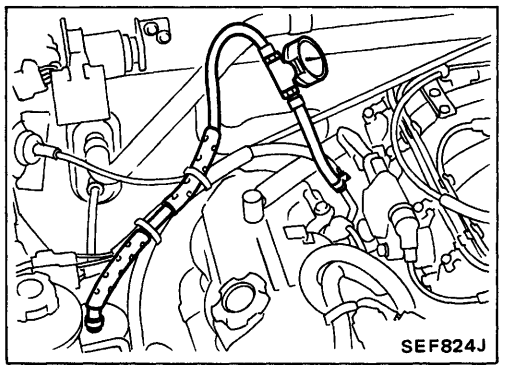
Before disconnecting fuel line, release fuel pressure from fuel line to eliminate danger.

1. Remove fuse for fuel pump.
2. Start engine.
3. After engine stalls, crank it two or three times to release all fuel pressure.
4. Turn ignition switch off and reconnect fuel pump fuse.

Fuel Pressure Check

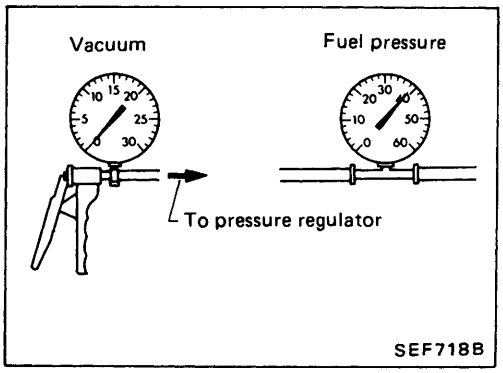
a. When reconnecting fuel line, always use new clamps.
b. Make sure that clamp screw does not contact adjacent parts.
c. Use a torque driver to tighten clamps.
d. Use Pressure Gauge to check fuel pressure.
e. Do not perform fuel pressure check while fuel pressure regulator control system is operating; otherwise, fuel pressure gauge might indicate incorrect readings.

1. Release fuel pressure to zero.
2. Disconnect fuel hose between fuel filter and fuel tube (engine side).
3. Install pressure gauge between fuel filter and fuel tube.
4. Start engine and check for fuel leakage.



5. Read the indication of fuel pressure gauge.
   At idling:
   When fuel pressure regulator valve vacuum hose is connected.
   Approximately 235 kPa (2.4 kg/cm², 34 psi)
   When fuel pressure regulator valve vacuum is disconnected.
   Approximately 294 kPa (3.0 kg/cm², 43 psi)
6. Stop engine and disconnect fuel pressure regulator vacuum hose from intake manifold.
7. Plug intake manifold with a rubber cap.
8. Connect variable vacuum source to fuel pressure regulator.

Fuel Pressure Check (Cont'd)

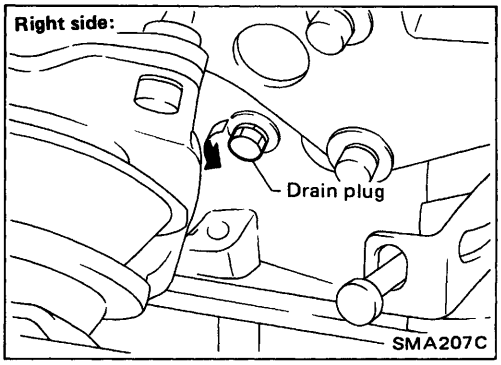


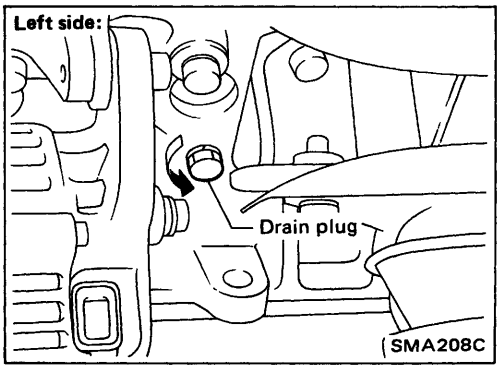
9. Start engine and read indication of fuel pressure gauge as vacuum is changed.

Fuel pressure should decrease as vacuum increases. If results are unsatisfactory, replace fuel pressure regulator.

Injector Removal

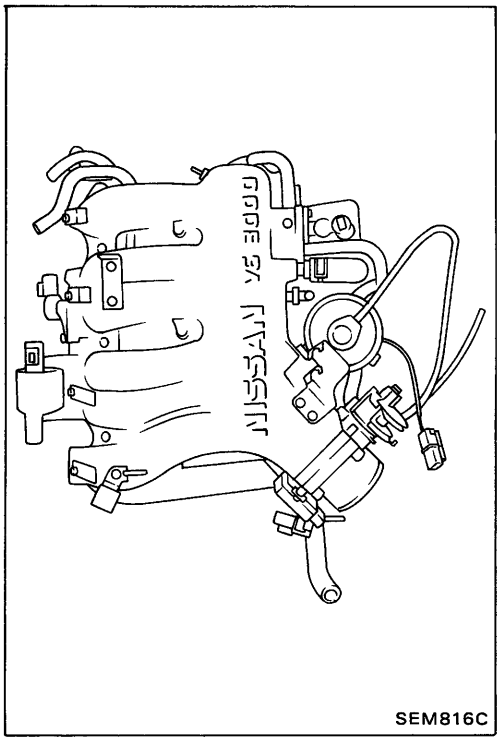
1. Release fuel pressure to zero.





2. Drain coolant by removing drain plugs from both sides of cylinder block.

Injector Removal (Cont'd)



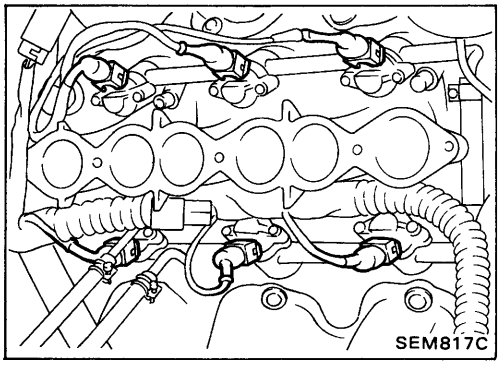
SEM816C

3. Separate A.S.C.D. and accelerator control wire from intake manifold collector.
4. Remove intake manifold collector from engine. The following parts should be disconnected to remove intake manifold collector.

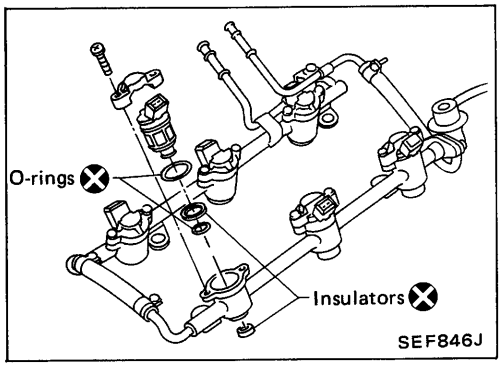
a. Harness connectors for
- A.A.C. valve
- Throttle sensor and throttle valve switch
- Ignition coil
- Power transistor
- E.G.R. control solenoid valve
- Air regulator
- Exhaust gas temperature sensor (California model only)

b. Water hoses from collector
c. Heater hoses
d. P.C.V. hose from R.H. rocker cover
e. Vacuum hoses for
- Canister
- Master brake cylinder
- Pressure regulator

f. Purge hose from canister
g. E.G.R. tube
h. Earth harnesses
i. Air duct hose


SEM817C

5. Remove fuel feed and return hose from injector fuel tube assembly.
6. Disconnect all injector harness connectors.
7. Remove injector fuel tube assembly.



SEF846J

8. Remove any malfunctioning injector from injector fuel tube.
9. Replace or clean injector as necessary.

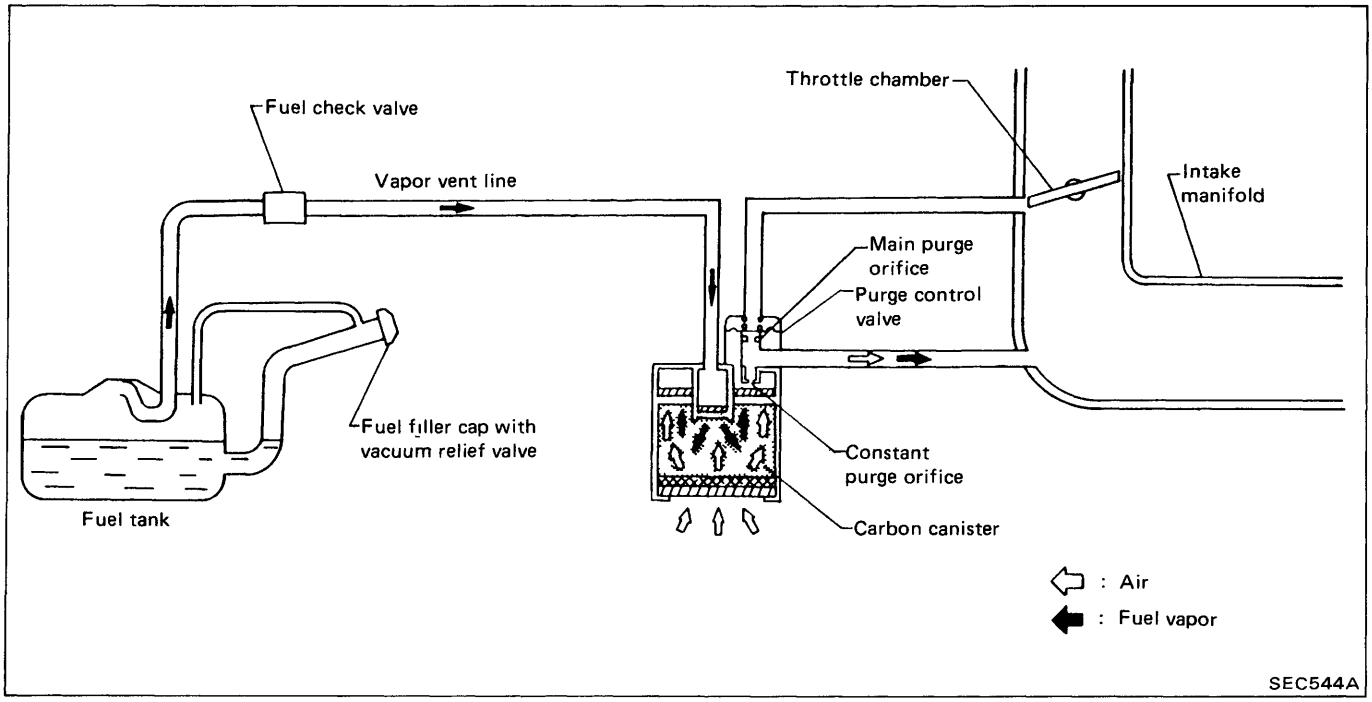
Always replace O-rings and insulators with new ones.

10. Connect injector to injector fuel tube.
11. Reinstall any part removed in reverse order of removal.

CAUTION:

After properly connecting fuel hose to injector and fuel tube, check connection for fuel leakage.

Description

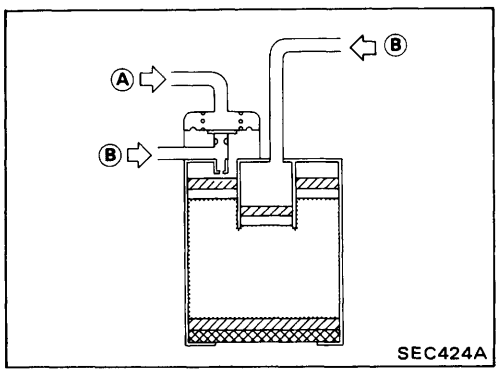


The evaporative emission control system is used to reduce hydrocarbons emitted to the atmosphere from the fuel system. This reduction of hydrocarbons is accomplished by activated charcoals in the carbon canister.

The fuel vapor from the sealed fuel tank is led into the canister which contains activated carbon and the vapor is stored there when the engine is not running.

The canister retains the fuel vapor until the canister is purged by the air drawn through the bottom of the canister to the intake manifold when the engine is running. When the engine runs at idle, the purge control valve is closed.

Only a small amount of stored vapor flows into the intake manifold through the constant purge orifice. As the engine speed increases, and the throttle vacuum rises higher, the purge control valve opens and the vapor is sucked into the intake manifold through both the main purge orifice and the constant purge orifice.



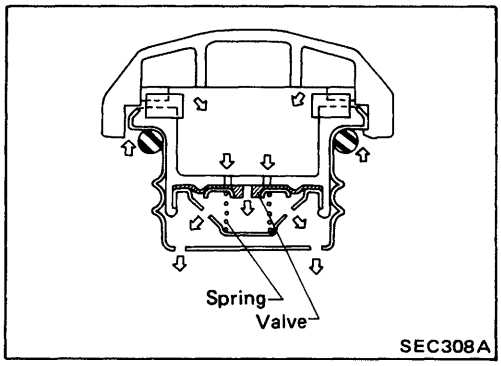
Inspection

CARBON CANISTER

Check carbon canister as follows:

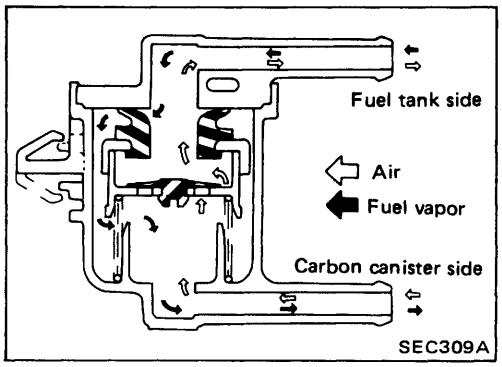
Ⓐ : Blow air and ensure that there is no leakage.
Ⓑ : Blow air and ensure that there is leakage.

Inspection (Cont'd)



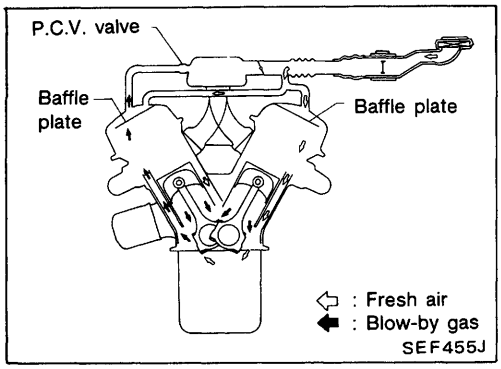
FUEL TANK VACUUM RELIEF VALVE

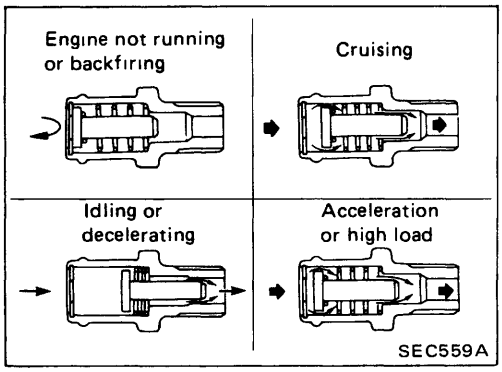
1. Wipe clean valve housing.
2. Inhale air through the cap. A slight resistance accompanied by valve clicks indicates that valve is in good mechanical condition. Note also that, by further inhaling air, the resistance should disappear with valve clicks.
3. If valve is clogged or if no resistance is felt, replace cap as an assembly.

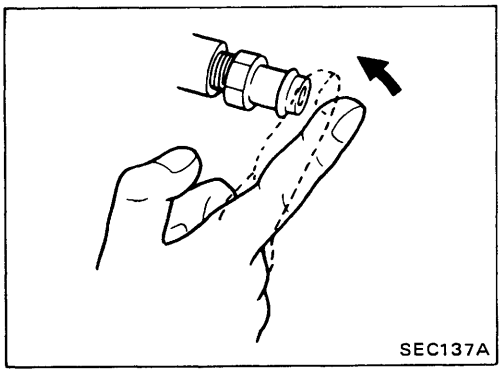


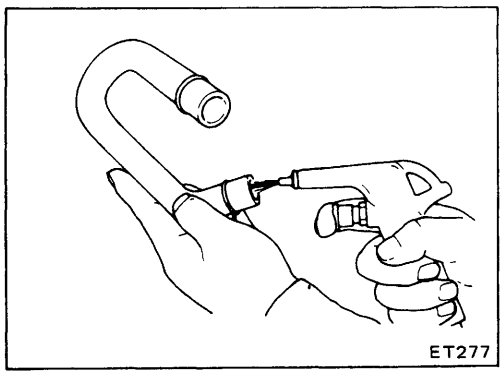
FUEL CHECK VALVE

1. Blow air through connector on fuel tank side.
   A considerable resistance should be felt and a portion of air flow should be directed toward the canister.
2. Blow air through connector on canister side.
   Air flow should be smoothly directed toward fuel tank.
3. If fuel check valve is suspected of not properly functioning in steps 1 and 2 above, replace it.









Description

This system returns blow-by gas to both the intake manifold and air cleaner.

The positive crankcase ventilation (P.C.V.) valve is provided to conduct crankcase blow-by gas to the intake manifold.

During partial throttle operation of the engine, the intake manifold sucks the blow-by gas through the P.C.V. valve.

Normally, the capacity of the valve is sufficient to handle any blow-by and a small amount of ventilating air.

The ventilating air is then drawn from the air cleaner, through the hose connecting air cleaner to rocker cover, into the crankcase.

Under full-throttle condition, the manifold vacuum is insufficient to draw the blow-by flow through the valve, and its flow goes through the hose connection in the reverse direction.

On vehicles with an excessively high blow-by some of the flow will go through the hose connection to the air cleaner under all conditions.

Inspection

P.C.V. (Positive Crankcase Ventilation)

With engine running at idle, remove ventilation hose from P.C.V. valve; if valve is working properly, a hissing noise will be heard as air passes through it and a strong vacuum should be felt immediately when a finger is placed over valve inlet.

VENTILATION HOSE

1. Check hoses and hose connections for leaks.
2. Disconnect all hoses and clean with compressed air. If any hose cannot be freed of obstructions, replace.

General Specifications

PRESSURE REGULATOR	
Regulated pressure kPa (kg/cm², psi)	299.1 (3.05, 43.4)

Inspection and Adjustment

Idle speed*1 rpm No-load*2 M/T A/T (in "N" position)	750±50 (700)*3
Air conditioner: ON M/T A/T (in "N" position)	800±50
Ignition timing degree	15° ±2° B.T.D.C.
Throttle valve switch touch speed rpm M/T A/T (in "N" position)	Idle speed + 250±150*3

*1: Feedback controlled and needs no adjustments
*2: Under the following conditions:
- Air conditioner switch: OFF
- Steering wheel: Kept straight
- Electric load: OFF (Lights, heater, fan & rear defogger)

*3: ( ): Disconnect A.A.C. valve sub-harness connector.

IGNITION COIL

Primary voltage	V	12
Primary resistance [at 20°C (68°F)]	Ω	Approximately 1.0
Secondary resistance [at 20°C (68°F)]	kΩ	Approximately 10

AIR FLOW METER

Supply voltage	V	Battery voltage (11 - 14)
Output voltage	V	Approximately 1.5 - 2.0*

*: Engine is warmed up sufficiently and idling under no-load.

ENGINE TEMPERATURE SENSOR

Temperature °C (°F)	Resistance kΩ
20 (68)	2.1 - 2.9
50 (122)	0.68 - 1.00
80 (176)	0.30 - 0.33

FUEL PUMP

Resistance	Ω	Approximately 1.5

EXHAUST GAS TEMPERATURE SENSOR

Resistance [at 100°C (212°F)]	kΩ	85.3±8.53

A.A.C. VALVE

Resistance	Ω	Approximately 10.0

INJECTOR

Resistance	Ω	10 - 14

RESISTOR

Resistance	kΩ	Approximately 2.2

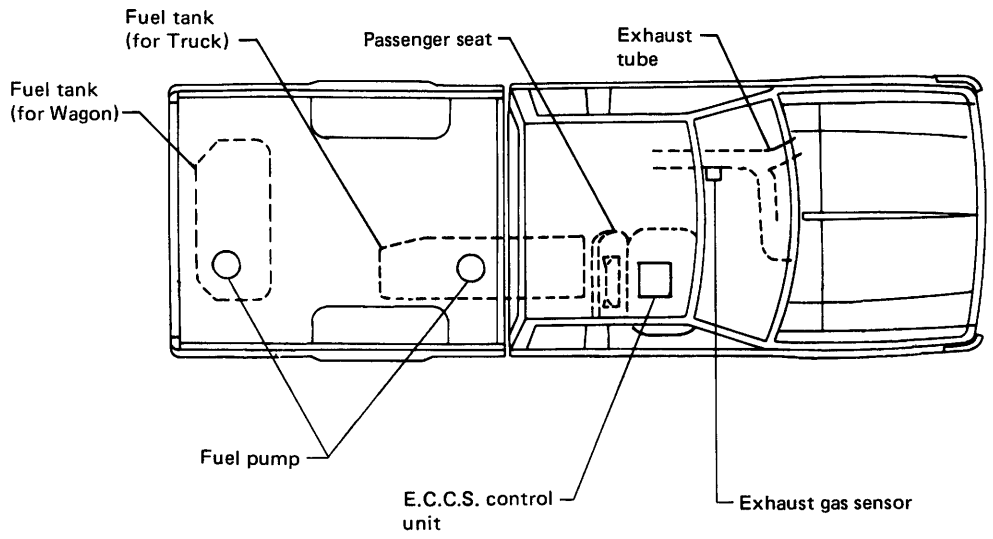
THROTTLE SENSOR

Accelerator pedal conditions	Resistance kΩ
Completely released	Approximately 1
Partially released	1 - 9
Completely depressed	Approximately 9

IGNITION WIRE

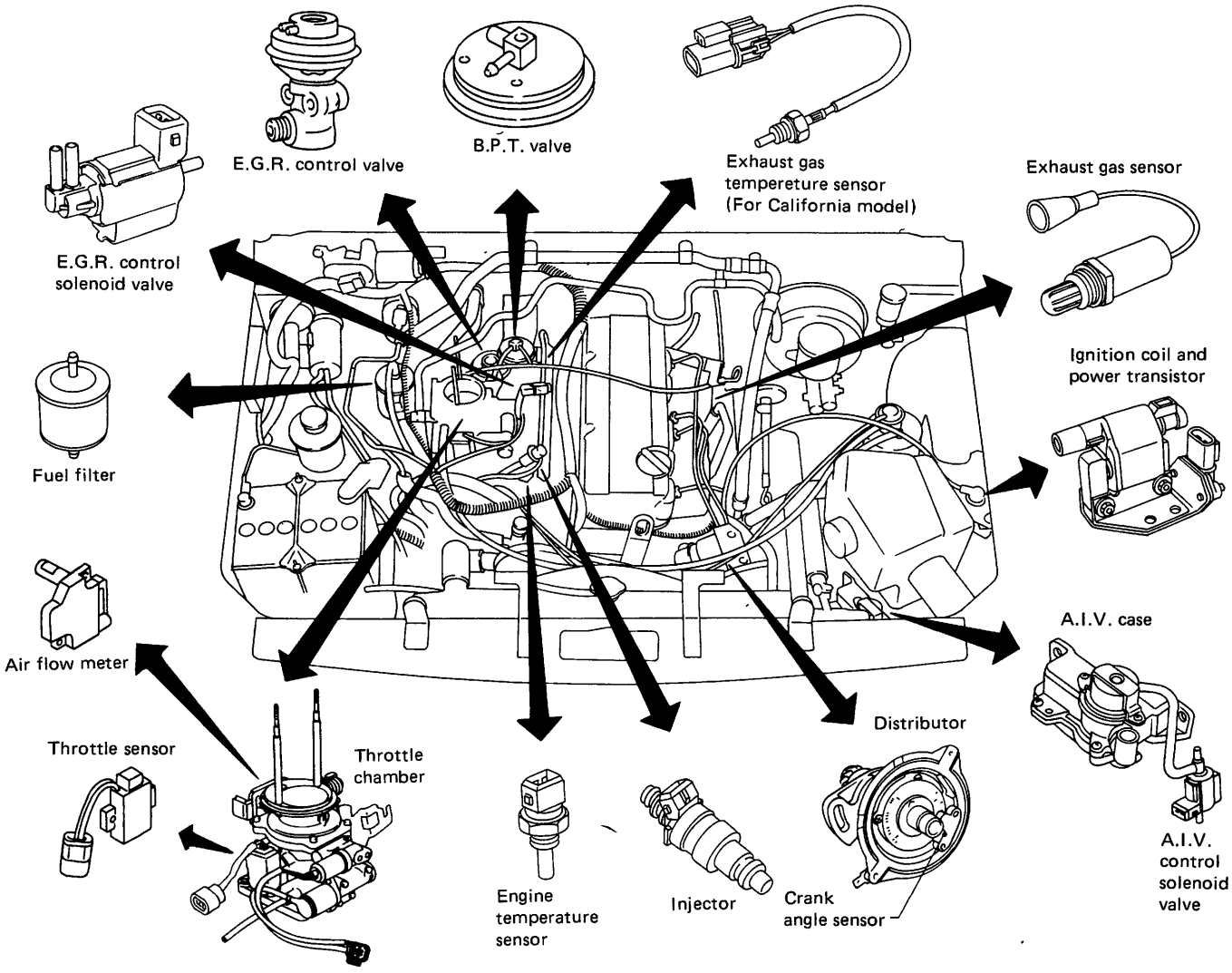
Resistance	kΩ/m (kΩ/ft)	Less than 30 (9.1)

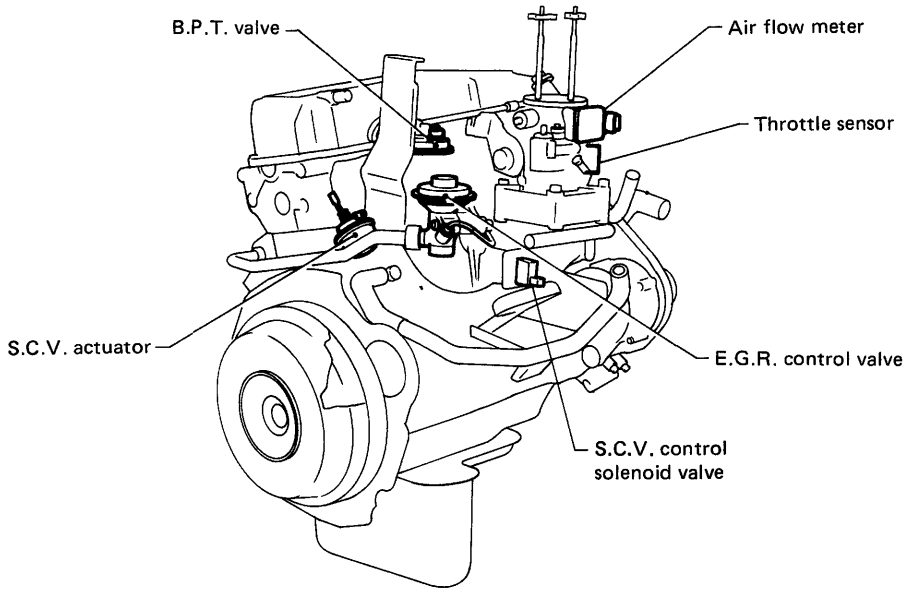
E.C.C.S. Component Parts Location



SEF806J

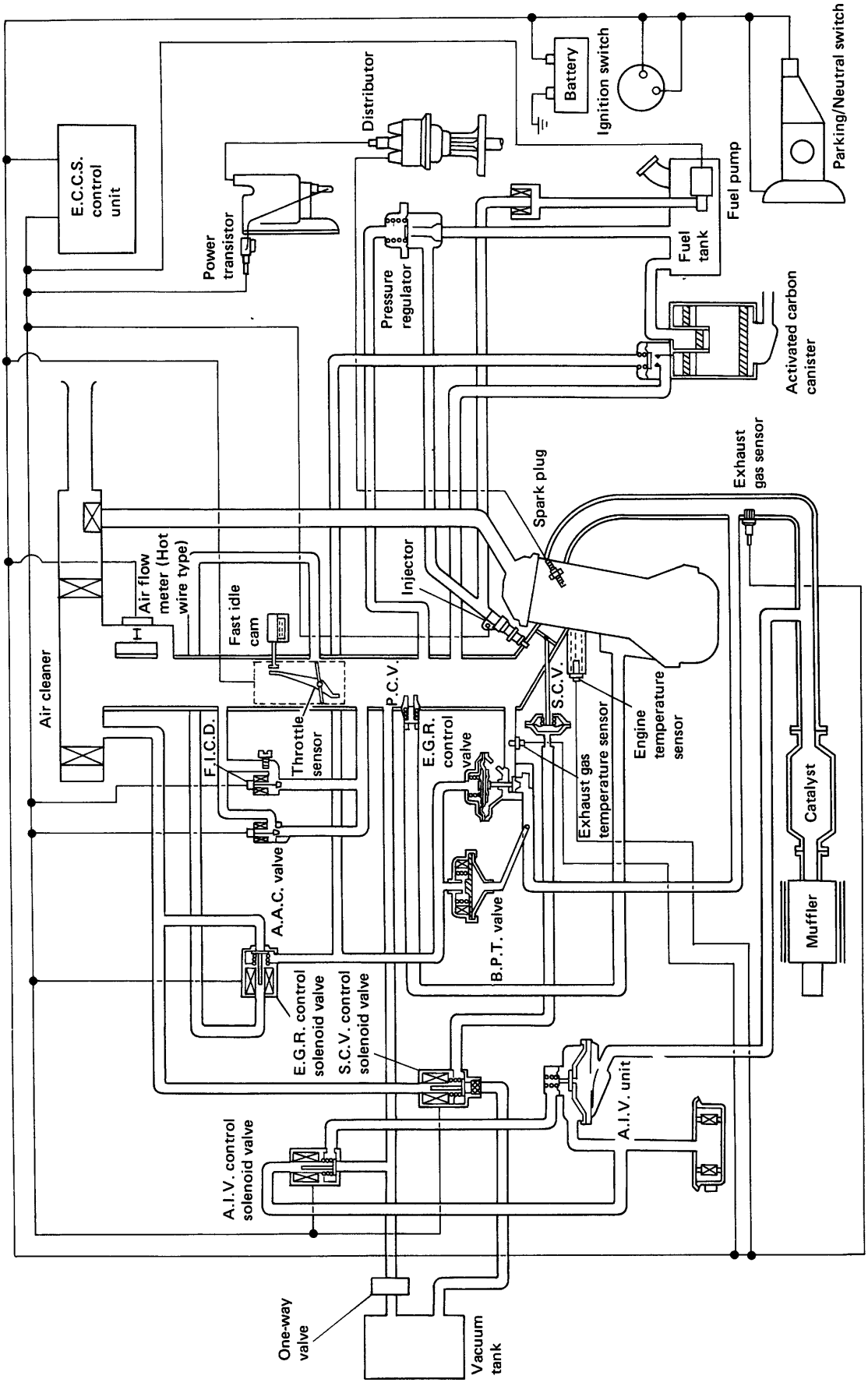
E.C.C.S. Component Parts Location (Cont'd)





SEF791J

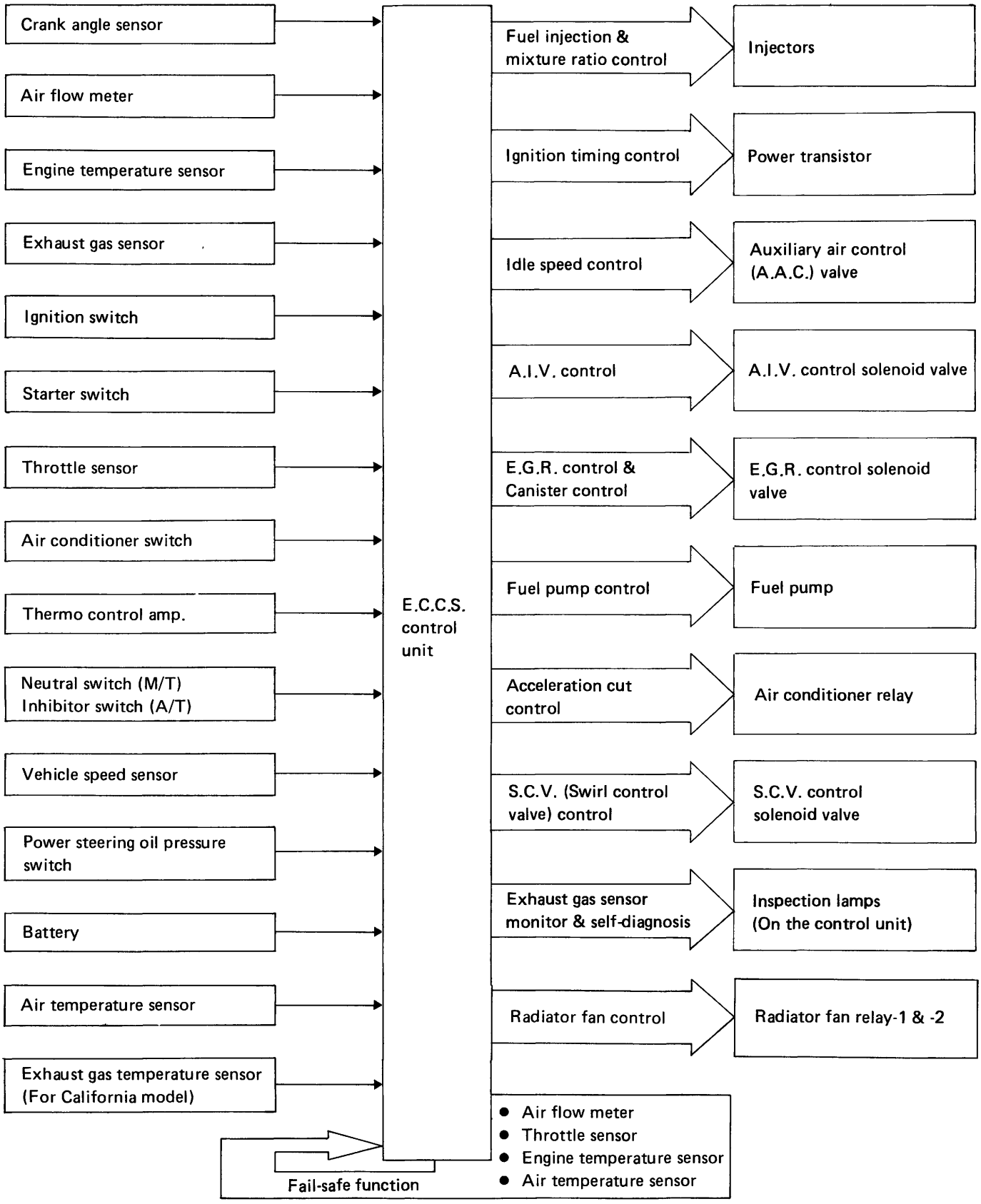
System Diagram



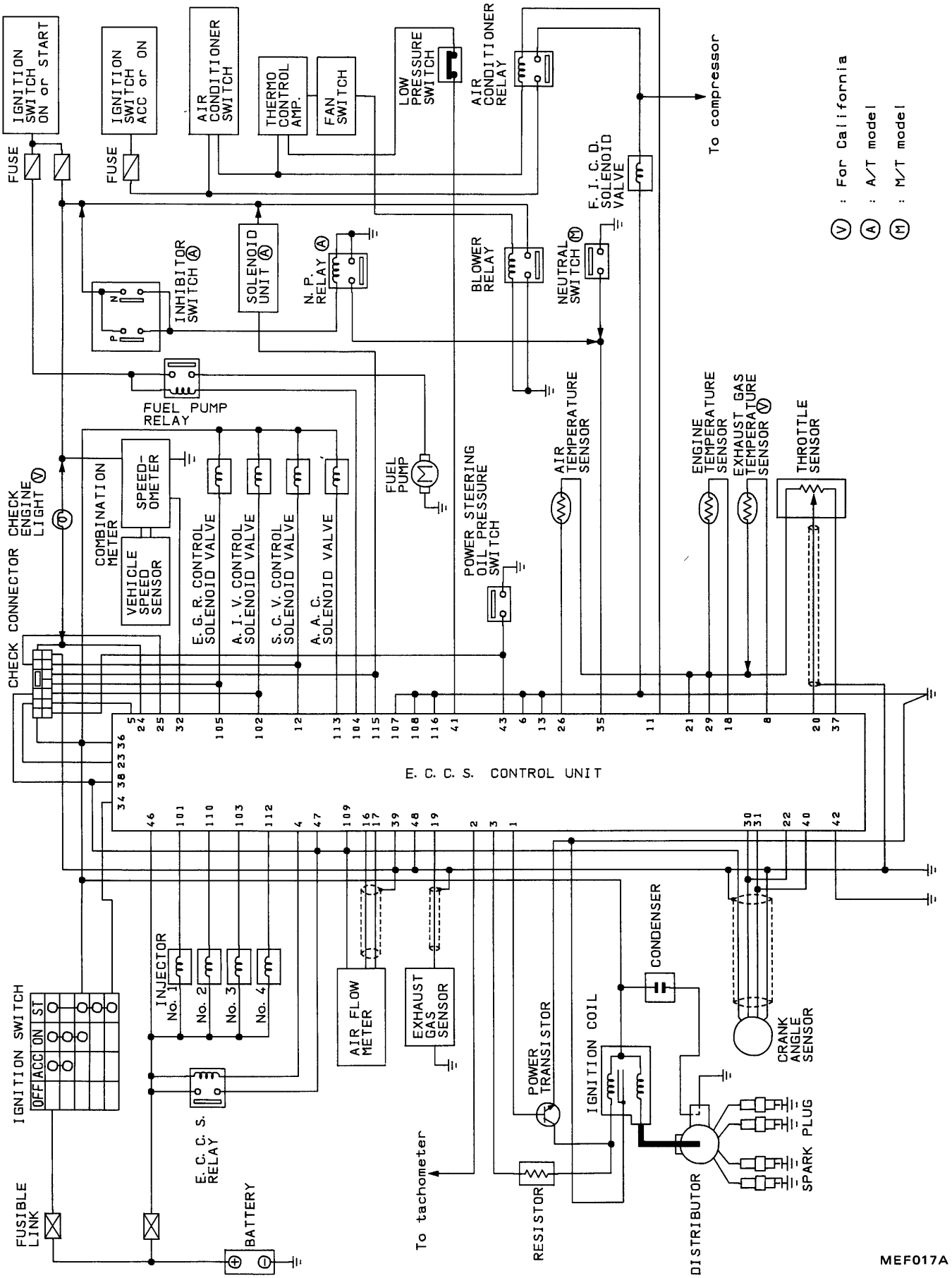
SEF792J

System Chart

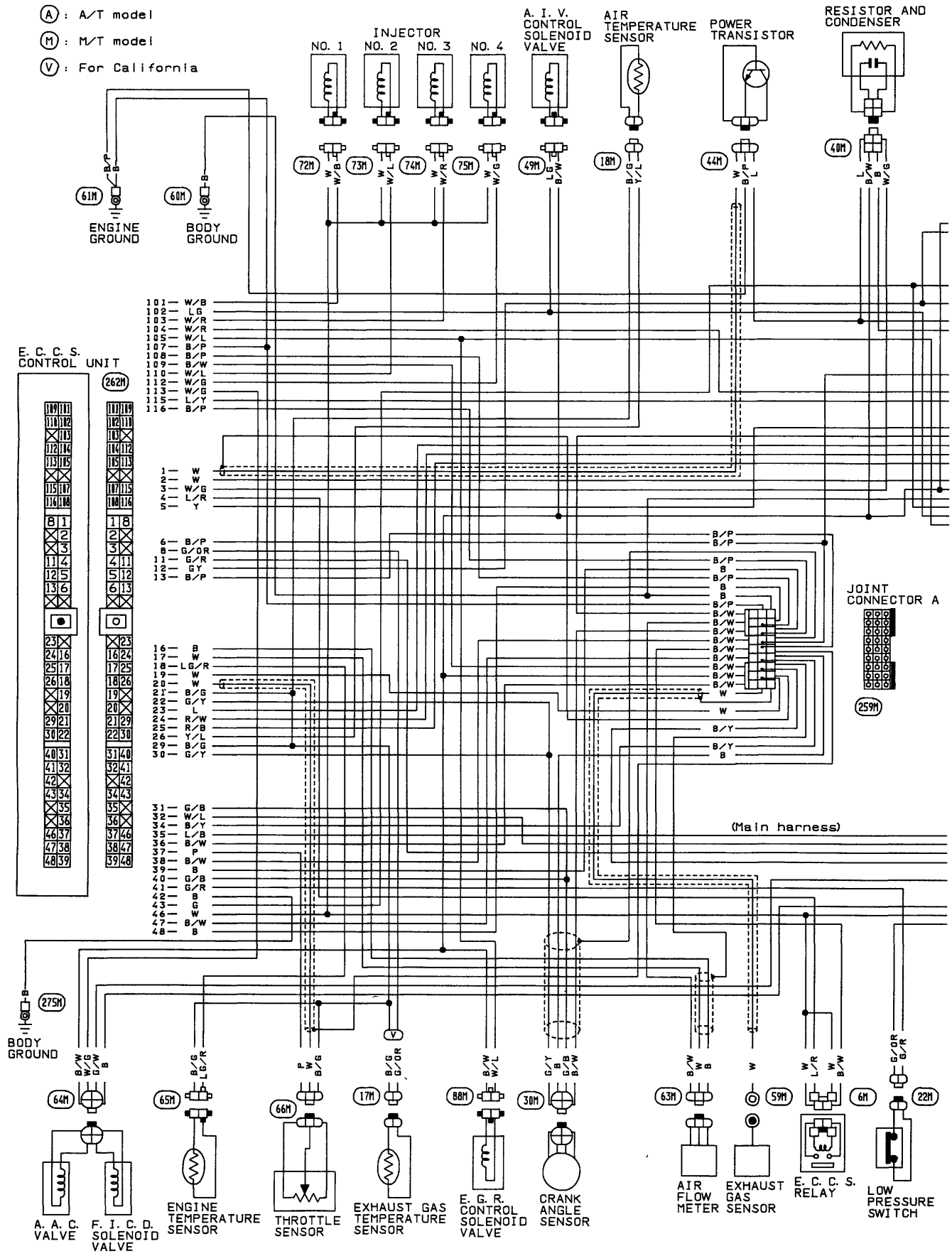
E.C.C.S. CONTROL SYSTEM



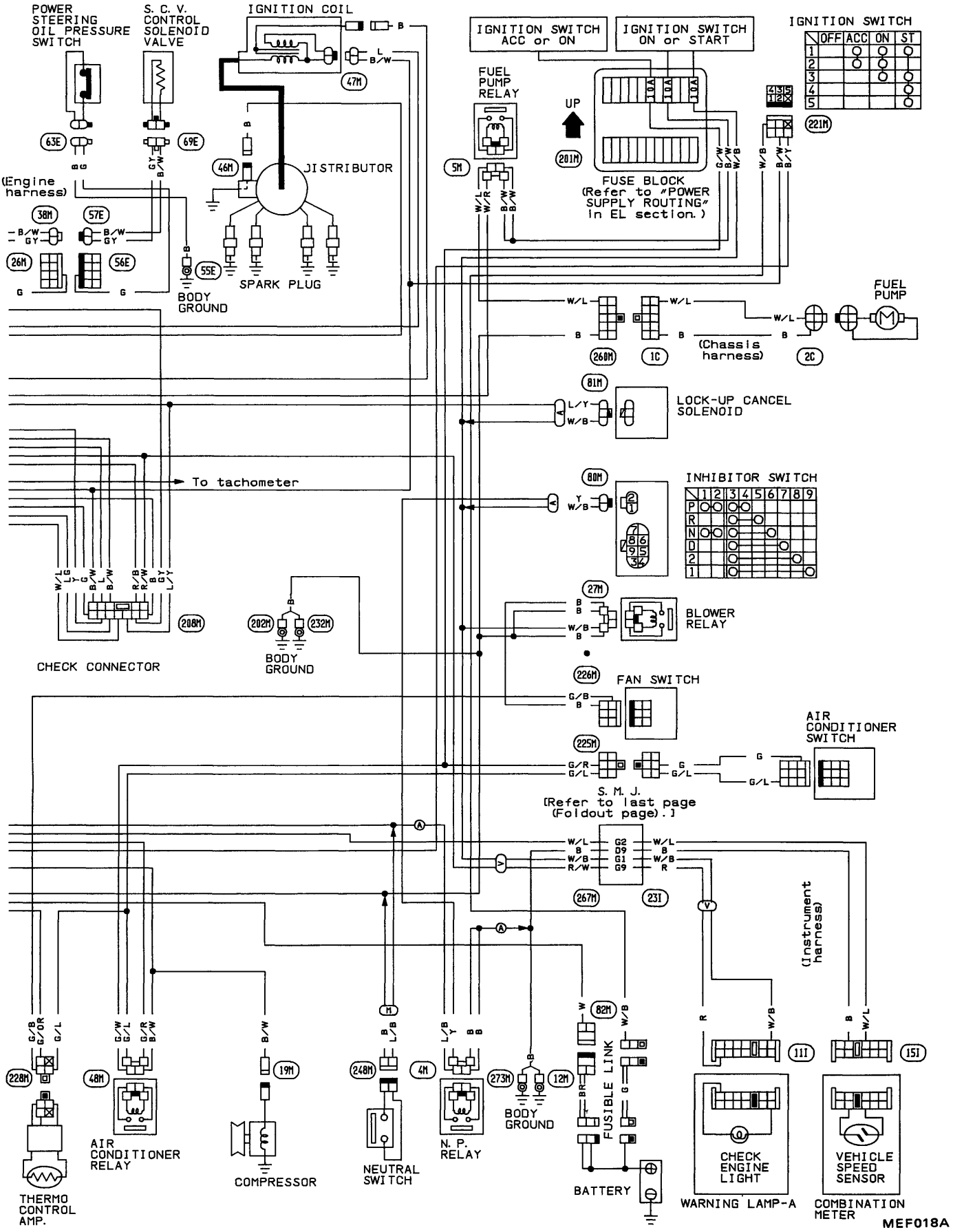
Circuit Diagram

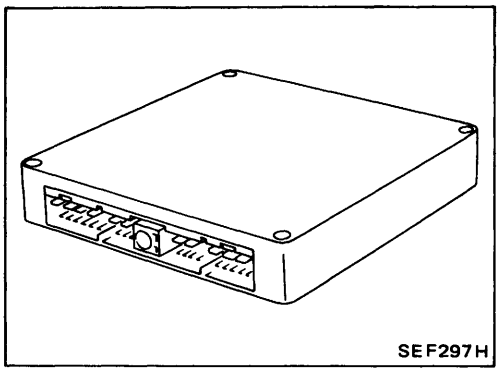


Wiring Diagram



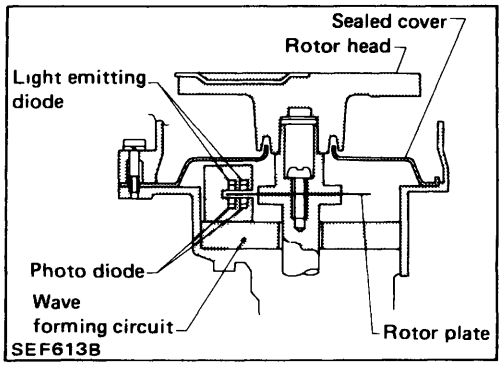
Wiring Diagram (Cont'd)




SEF297H

E.C.C.S. Control Unit (E.C.U.)

The E.C.U. consists of a microcomputer, inspection lamps, a diagnostic mode selector, and connectors for signal input and output and for power supply. The unit controls the engine.



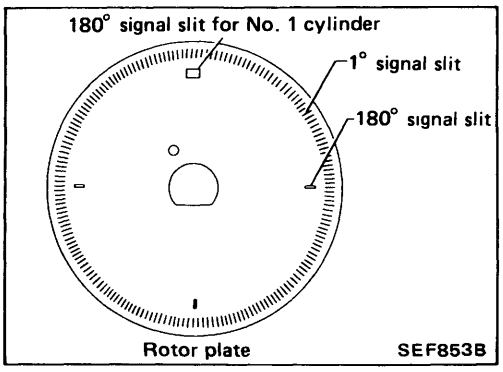
SEF613B

Crank Angle Sensor

The crank angle sensor is a basic component of the entire E.C.C.S. It monitors engine speed and piston position, and sends signals to the E.C.U. to control fuel injection, ignition timing and other functions.

The crank angle sensor has a rotor plate and a wave-forming circuit. The rotor plate has 360 slits for 1° signal and 4 slits for 180° signal. Light Emitting Diodes (L.E.D.) and photo diodes are built in the wave-forming circuit.

When the rotor plate passes between the L.E.D. and the photo diode, the slits in the rotor plate continually cut the light being transmitted to the photo diode from the L.E.D. This generates rough-shaped pulses which are converted into on-off signals by the wave-forming circuit, which are then sent to the E.C.U.

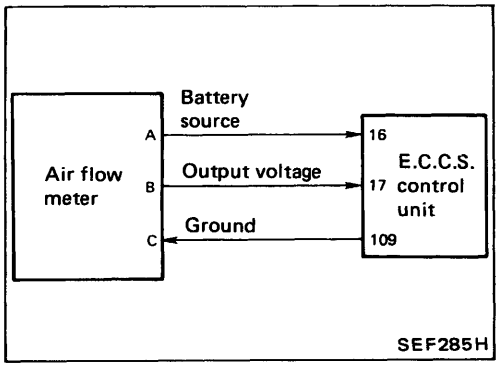


SEF853B

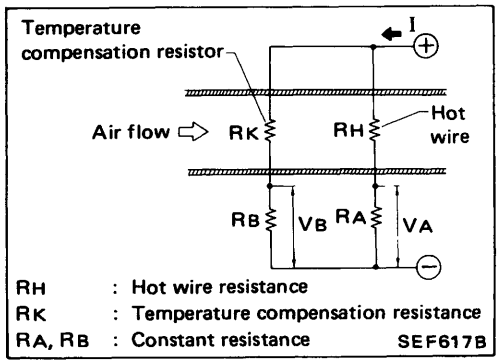
Air Flow Meter

The air flow meter measures the mass flow rate of intake air. Measurements are made so that the control circuit will emit an electrical output signal corresponding to the amount of heat dissipated from a hot wire placed in the stream of intake air.

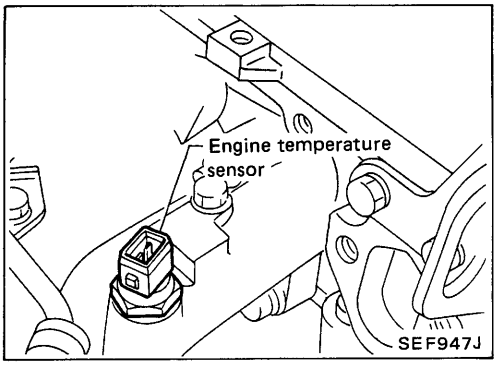
The airflow past the hot wire removes the heat from the hot wire. The temperature of the hot wire is very sensitive to the mass flow rate. The higher the temperature of the hot wire, the greater its resistance value. This temperature change (resistance) is determined by the mass air flow rate. The control circuit accurately regulates current (I) in relation to the varying resistance value (R_H) so that V_A always equals V_B. The air flow meter transmits a voltage value V_A to the control unit where the output is converted into an intake air signal.



SEF285H



SEF617B

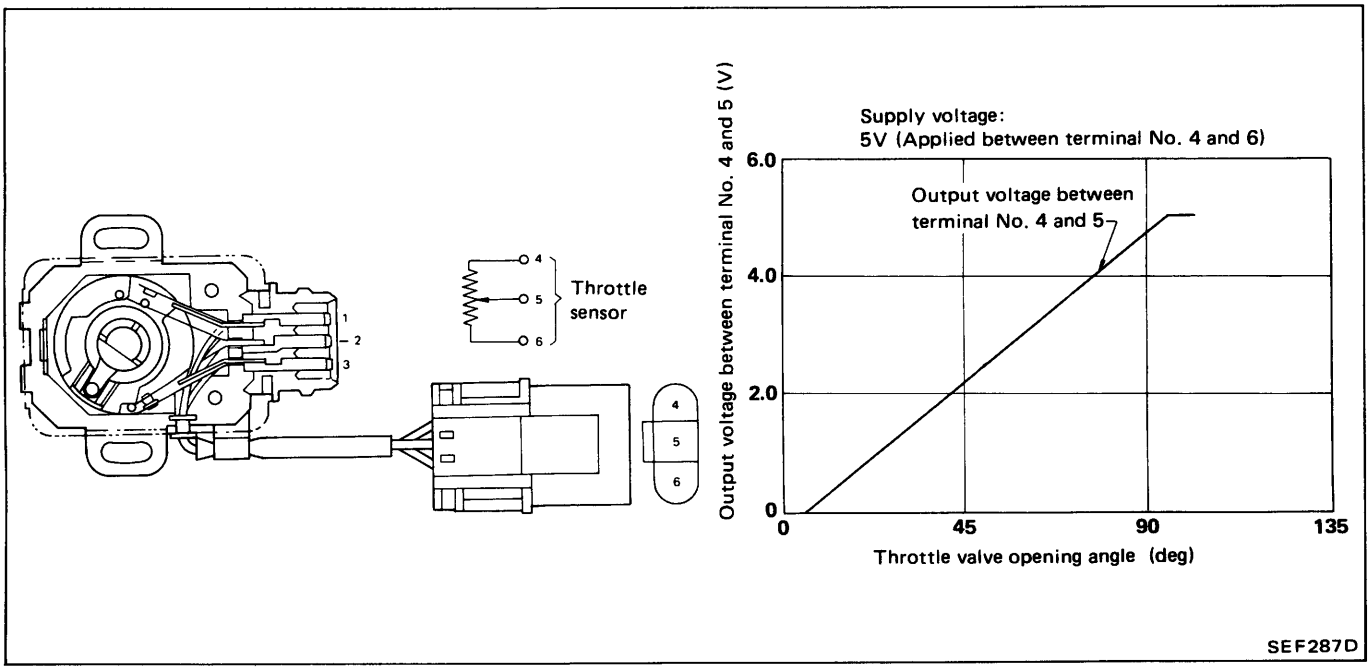


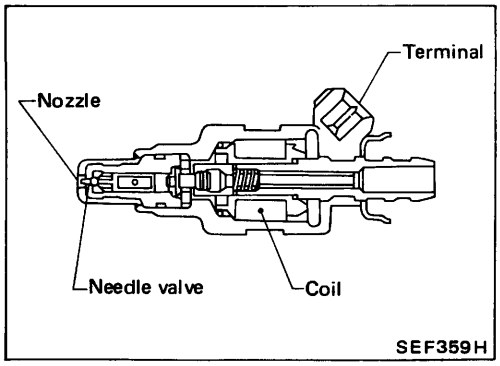
Engine Temperature Sensor

The engine temperature sensor detects the engine temperature, which is dependent on engine coolant temperature, and transmits a signal to the E.C.U.
The temperature sensing unit employs a thermistor which is sensitive to the change in temperature. Electrical resistance of the thermistor decreases in response to the temperature rise.

Throttle Sensor & Soft Idle Switch

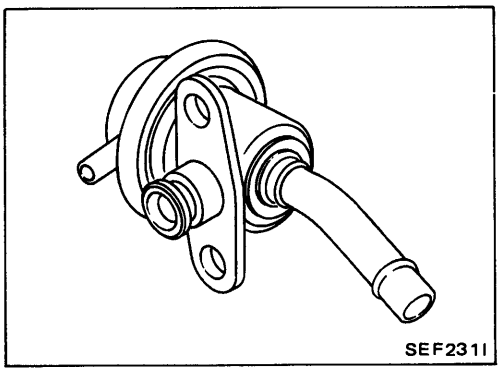
The throttle sensor responds to the throttle valve position which, in turn, is determined by accelerator pedal movement. This sensor is a kind of potentiometer which transforms the throttle valve position into an output voltage, and transmits it to the E.C.U. The sensor also detects the opening and closing speed of the throttle valve and feeds this information as a voltage signal to the E.C.U. too.
The throttle valve idle position is determined by the E.C.U. This positioning system is called the "soft idle switch" and controls engine operations such as fuel cut.





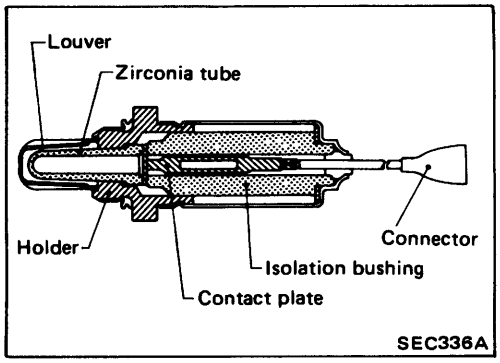
Fuel Injector

The fuel injector is a small, elaborate solenoid valve. As the E.C.U. sends injection signals to the injector, the coil in the injector pulls the needle valve back and fuel is released into the intake manifold through the nozzle. The injected fuel is controlled by the E.C.U. in terms of injection pulse duration.
Brass wire is used in the injector coil and thus the resistance is higher than a conventional injector.


SEF231I

Pressure Regulator

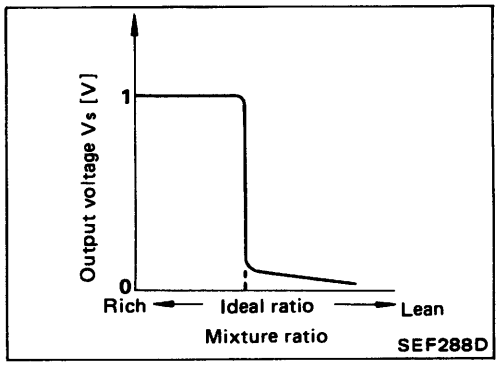
The pressure regulator maintains the fuel pressure at 299.1 kPa (3.05 kg/cm^2, 43.4 psi). Since the injected fuel amount depends on injection pulse duration, it is necessary to maintain the pressure at the above value.



SEC336A

Exhaust Gas Sensor

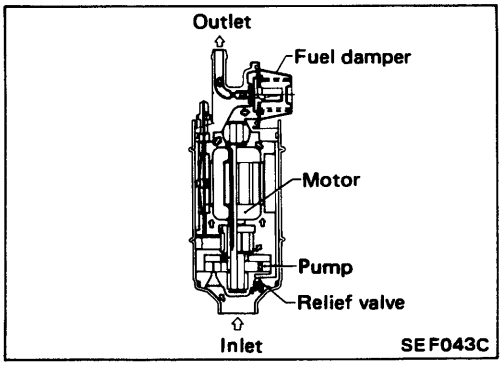
The exhaust gas sensor, which is placed into the exhaust manifold, monitors the amount of oxygen in the exhaust gas. The sensor has a closed-end tube made of ceramic zirconia. The outer surface of the tube is exposed to exhaust gas, and the inner surface to atmosphere. The zirconia of the tube compares the oxygen density of exhaust gas with that of atmosphere, and generates electricity. In order to improve the generating power of the zirconia, its tube is coated with platinum. The voltage is approximately 1V in a richer condition of the mixture ratio than the ideal air-fuel ratio, while approximately 0V in leaner conditions. The radical change from 1V to 0V occurs at around the ideal mixture ratio. In this way, the exhaust gas sensor detects the amount of oxygen in the exhaust gas and sends the signal of approximately 1V or 0V to the E.C.U.



SEF288D

Fuel Pump

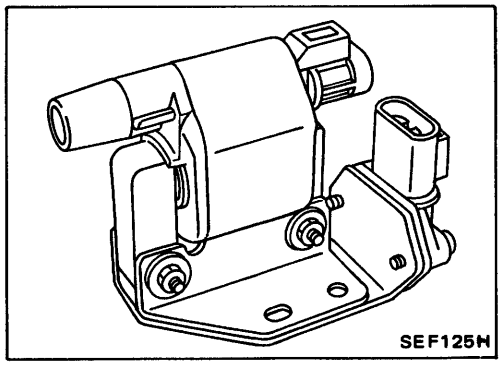
The fuel pump with a fuel damper is a submergible type, and are located in the fuel tank.

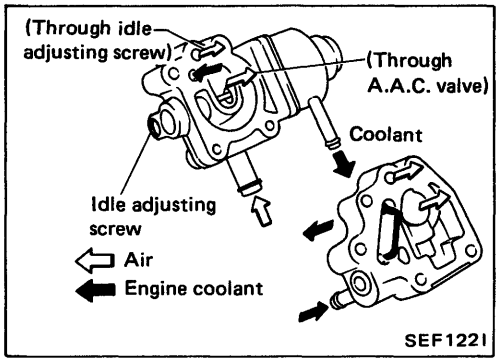


SEF043C

Power Transistor

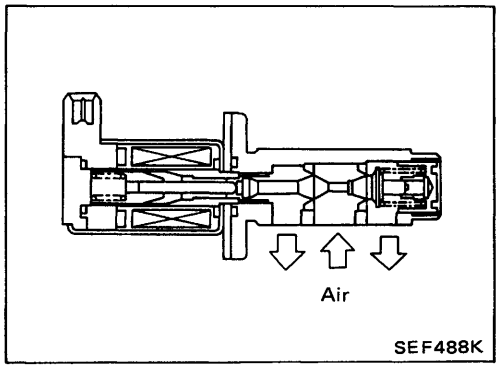
The ignition signal from the E.C.U. is amplified by the power transistor, which turns the ignition coil primary circuit on and off, inducing the proper high voltage in the secondary circuit. The ignition coil is a small, molded type.


SEF125H



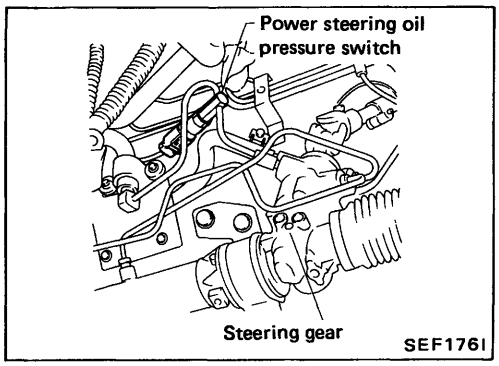
Idle Air Adjusting (I.A.A.) Unit

The I.A.A. unit is made up of the A.A.C. valve and air cut valve. It receives the signal from the E.C.U. and controls the idle speed at the preset value under various conditions.
The air cut valve prevents an abnormal rise of idle rpm when A.A.C. valve operates abnormally.



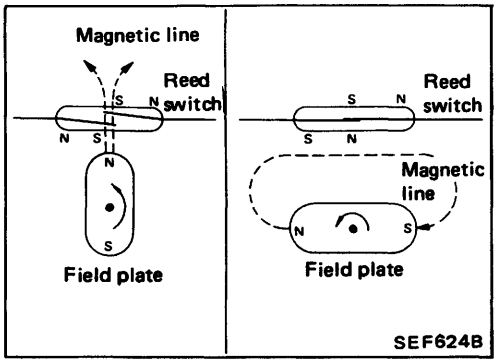
Auxiliary Air Control (A.A.C.) Valve

The A.A.C. valve is attached to the throttle chamber.
The E.C.U. actuates the A.A.C. valve by an ON/OFF pulse. The longer that ON pulse is received, the larger the amount of air that will flow through the A.A.C. valve.
The A.A.C. valve adjusts idle speed to the specified value.



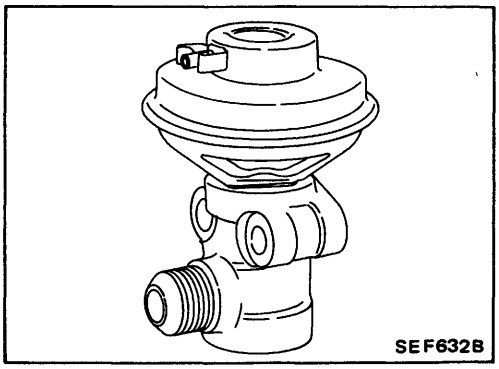
Power Steering Oil Pressure Switch

The power steering oil pressure switch is attached to the power steering high-pressure tube and detects the power steering load, sending the load signal to the E.C.U. The E.C.U. then sends the idle-up signal to the A.A.C. valve.



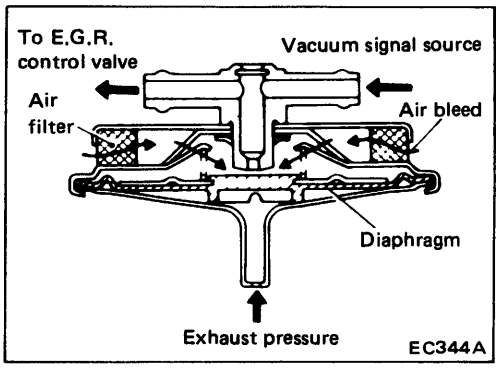
Vehicle Speed Sensor

The vehicle speed sensor provides a vehicle speed signal to the E.C.U.
The speed sensor consists of a reed switch, which is installed on the transmission unit and transforms vehicle speed into a pulse signal.



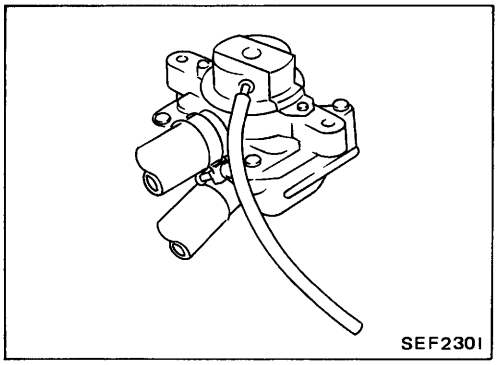
E.G.R. Control Valve

The E.G.R. control valve controls the quantity of exhaust gas to be led to the intake manifold through vertical movement of the taper valve connected to the diaphragm, to which vacuum is applied in response to the opening of the throttle valve.



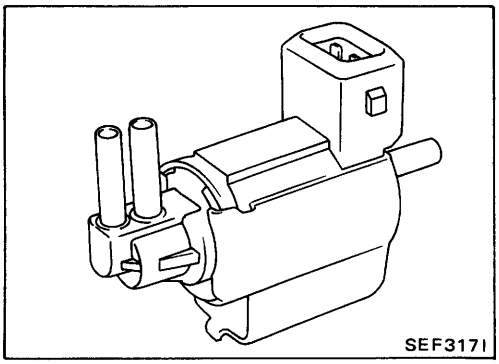
B.P.T. Valve

The B.P.T. valve monitors exhaust pressure to activate the diaphragm, controlling throttle chamber vacuum applied to the E.G.R. control valve. In other words, recirculated exhaust gas is controlled in response to positioning of the E.G.R. control valve or to engine operation.



Air Induction Valve (A.I.V.)

The air induction valve sends secondary air to the exhaust manifold, using a vacuum created by exhaust pulsation in the exhaust manifold. When the exhaust pressure is below atmospheric pressure (negative pressure), secondary air is sent to the exhaust manifold. When the exhaust pressure is above atmospheric pressure, the reed valves prevent secondary air from being sent back to the air cleaner.



A.I.V. Control Solenoid Valve

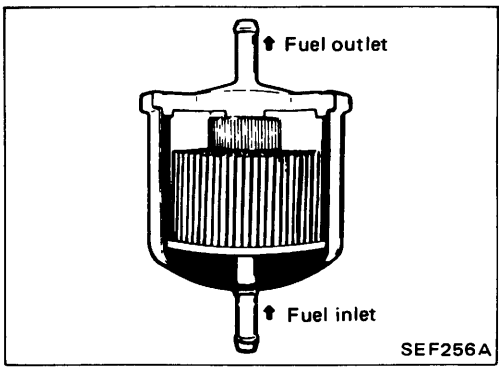
The A.I.V. control solenoid valve cuts the intake manifold vacuum signal for A.I.V. control. It responses to the ON/OFF signal from the E.C.U. When the solenoid is off, the vacuum signal from the intake manifold is cut. When the control unit sends an ON signal, the coil pulls the plunger downward and feeds the vacuum signal to the A.I.V. control valve.

E.G.R. Control Solenoid Valve

The E.G.R. system is controlled only by the E.C.U. At both low- and high-speed engine revolutions, the solenoid valve turns on and accordingly the E.G.R. valve cuts the exhaust gas leading to the intake manifold.

S.C.V. Control Solenoid Valve

The S.C.V. control solenoid valve cuts the intake manifold vacuum signal for swirl control valve. It responds to the ON/OFF signal from the E.C.U. When the solenoid is off, the vacuum signal from the intake manifold is cut. When the control unit sends an ON signal the coil pulls the plunger and feeds the vacuum signal to the swirl control valve actuator.

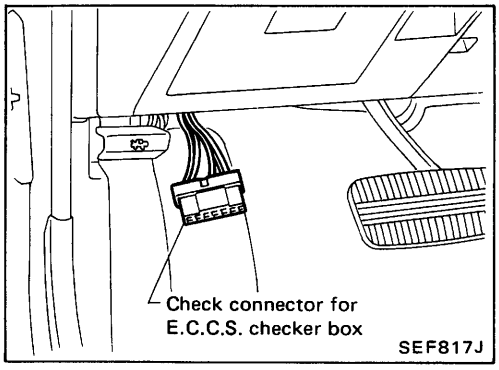


Fuel Filter

The specially designed fuel filter has a metal case in order to withstand high fuel pressure.

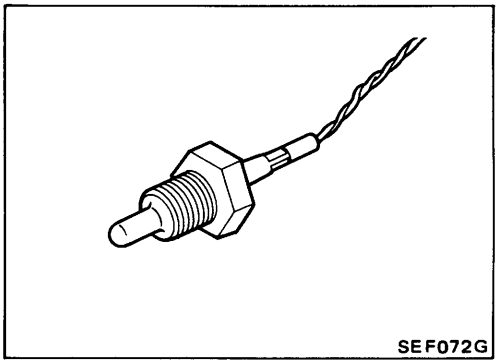
Carbon Canister

The carbon canister is filled with active charcoal to absorb evaporative gases produced in the fuel tank. These absorbed gases are then delivered to the intake manifold by manifold vacuum for combustion purposes.
The vacuum in the intake passage upstream of the throttle valve increases in response to the amount of the intake air.



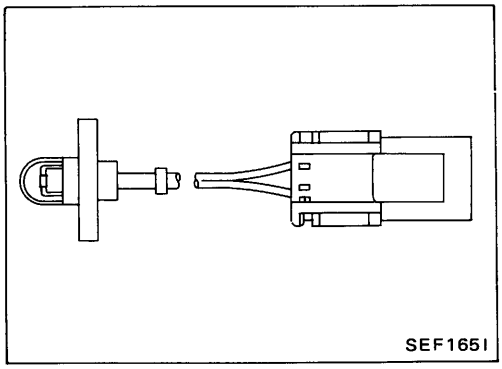
Check Connector for E.C.C.S. Checker Box

The check connector for E.C.C.S. checker box is beside the fuse box.



Exhaust Gas Temperature Sensor (For California model)

The exhaust gas temperature sensor monitors in exhaust gas temperature and transmits a signal to the E.C.U. The temperature sensing unit employs a thermistor which is sensitive to the change in temperature. Electric resistance of the thermistor decreases in response to the temperature rise.

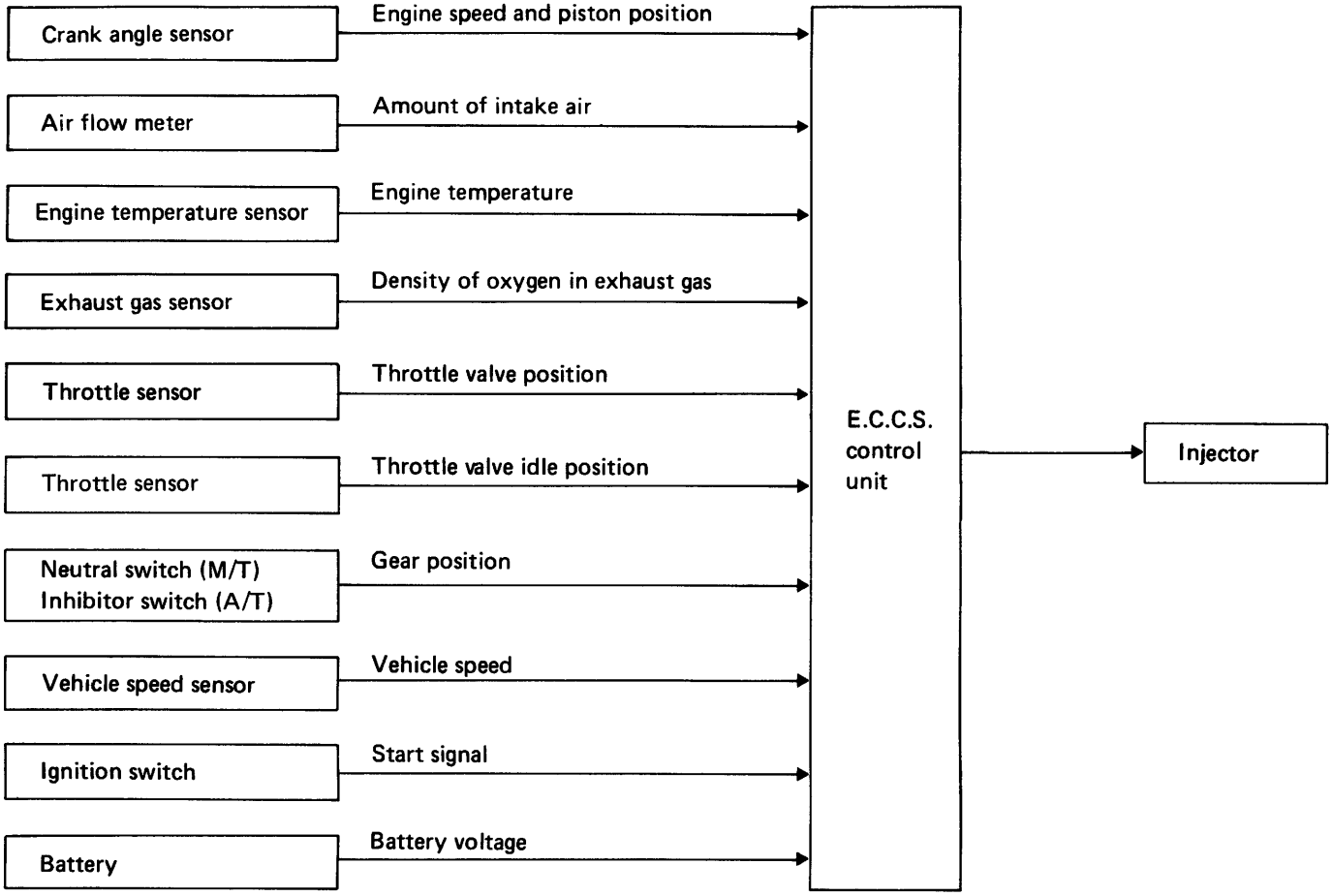


Air Temperature Sensor

The air temperature sensor controls ignition timing when the temperature of the intake air is extremely high, in order not to cause knocking.

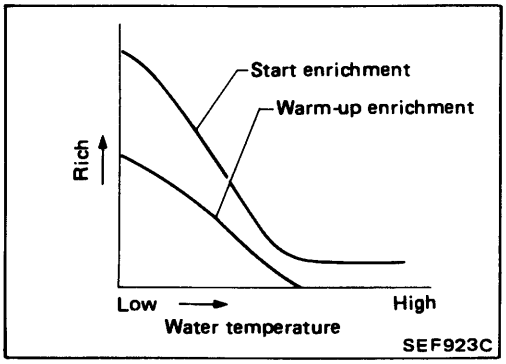
Fuel Injection Control

INPUT/OUTPUT SIGNAL LINE



BASIC FUEL INJECTION CONTROL

The amount of fuel injected from the fuel injector, or the length of time the valve remains open, is determined by the E.C.U. The basic amount of fuel injected is a programmable value mapped in the E.C.U. ROM memory. In other words, the programmable value is preset by engine operating conditions determined by input signals (for engine rpm and air intake) from both the crank angle sensor and the air flow meter.

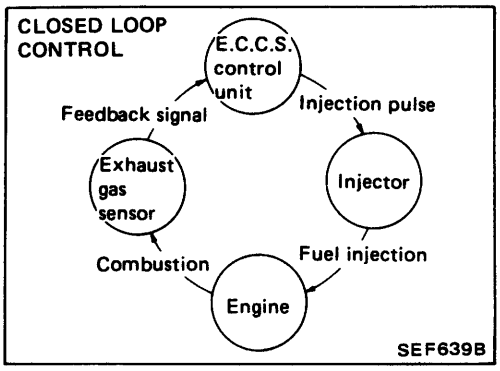


VARIOUS FUEL INJECTION INCREASE/DECREASE COMPENSATION

In addition, the amount of fuel injection is compensated for to improve engine performance under various operating conditions as listed below:

<Fuel increase>
1) During warm-up
2) When starting the engine
3) During acceleration
4) Hot-engine operation

<Fuel decrease>
1) During deceleration



Fuel Injection Control (Cont'd)

MIXTURE RATIO FEEDBACK CONTROL

Mixture ratio feedback system is designed to precisely control the mixture ratio to the stoichiometric point so that the three-way catalyst can reduce CO, HC and NOx emissions. This system uses an exhaust gas sensor in the exhaust manifold to check the air-fuel ratio. The control unit adjusts the injection pulse width according to the sensor voltage so the mixture ratio will be within the range of the stoichiometric air-fuel ratio.

This stage refers to the closed-loop control condition. The open-loop control condition refers to that under which the E.C.U. detects any of the following conditions and feedback control stops in order to maintain stabilized fuel combustion.

1) Deceleration
2) High-load, high-speed operation
3) Engine idling
4) Malfunctioning of exhaust gas sensor or its circuit
5) Insufficient activation of exhaust gas sensor at low engine temperature
6) Engine starting

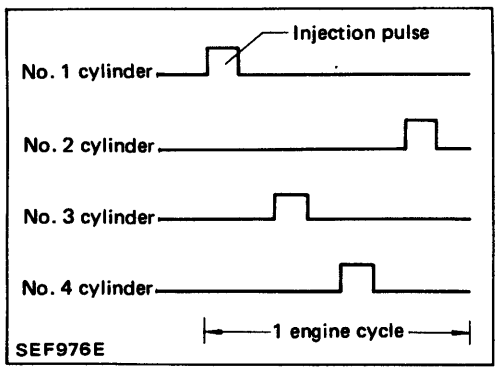
MIXTURE RATIO SELF-LEARNING CONTROL

The mixture ratio feedback control system monitors the mixture ratio signal transmitted from the exhaust gas sensor. This feedback signal is then sent to the E.C.U. to control the amount of fuel injection to provide a basic mixture ratio as close to the theoretical mixture ratio as possible. However, the basic mixture ratio is not necessarily controlled as originally designed. This is due to manufacturing errors (e.g., air flow meter hot wire) and changes during operation (injector clogging, etc.) of E.C.C.S. parts which directly affect the mixture ratio.

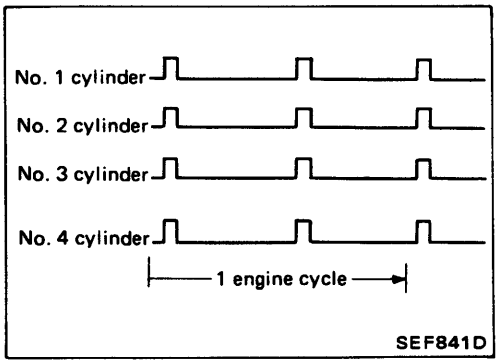
Accordingly, a difference between the basic and theoretical mixture ratios is quantitatively monitored in this system. It is then computed in terms of "fuel injection duration" to automatically compensate for the difference between the two ratios.

FUEL INJECTION TIMING

Fuel is injected once a cycle for each cylinder in the firing order.



When engine starts, fuel is injected into all four cylinders simultaneously twice a cycle.



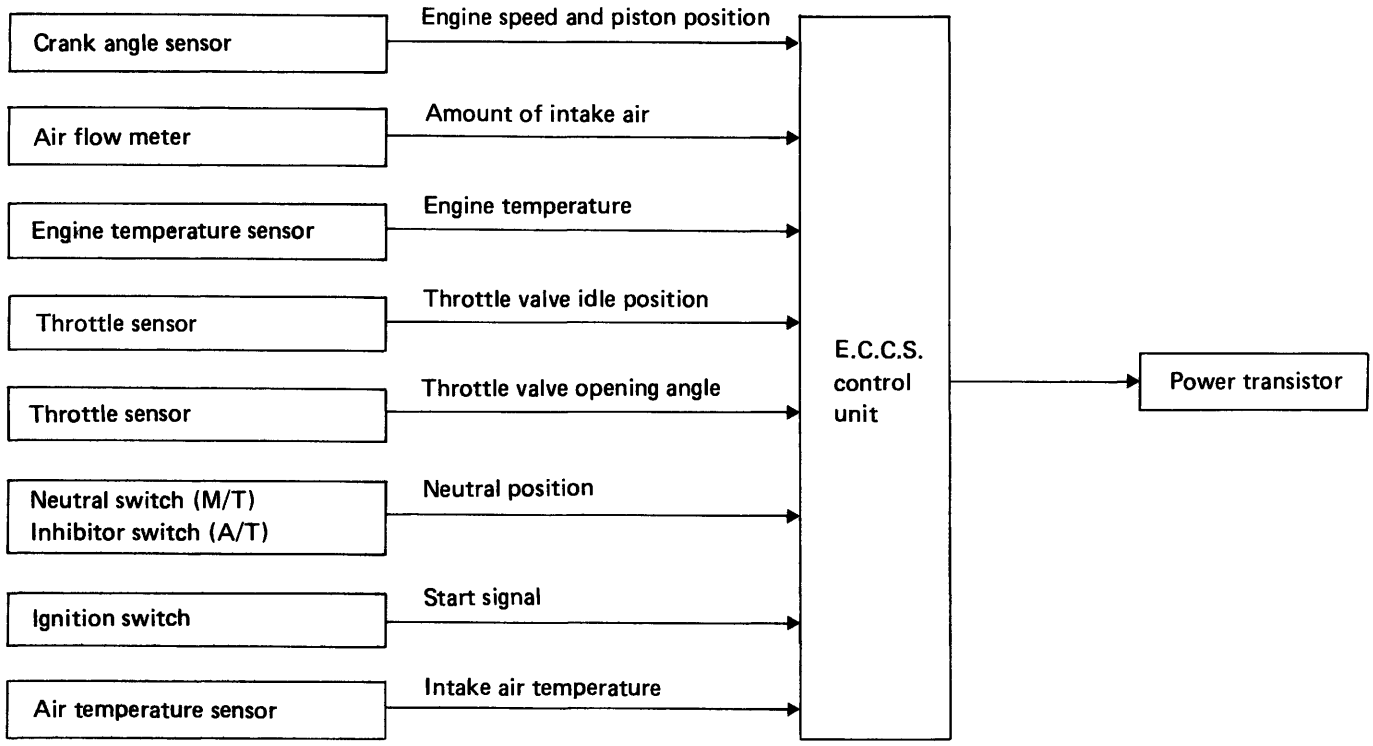
Fuel Injection Control (Cont'd)

FUEL SHUT-OFF

Fuel to all cylinders is cut off during deceleration or high-speed operation.

Ignition Timing Control

INPUT/OUTPUT SIGNAL LINE



Ignition Timing Control (Cont'd)

SYSTEM DESCRIPTION

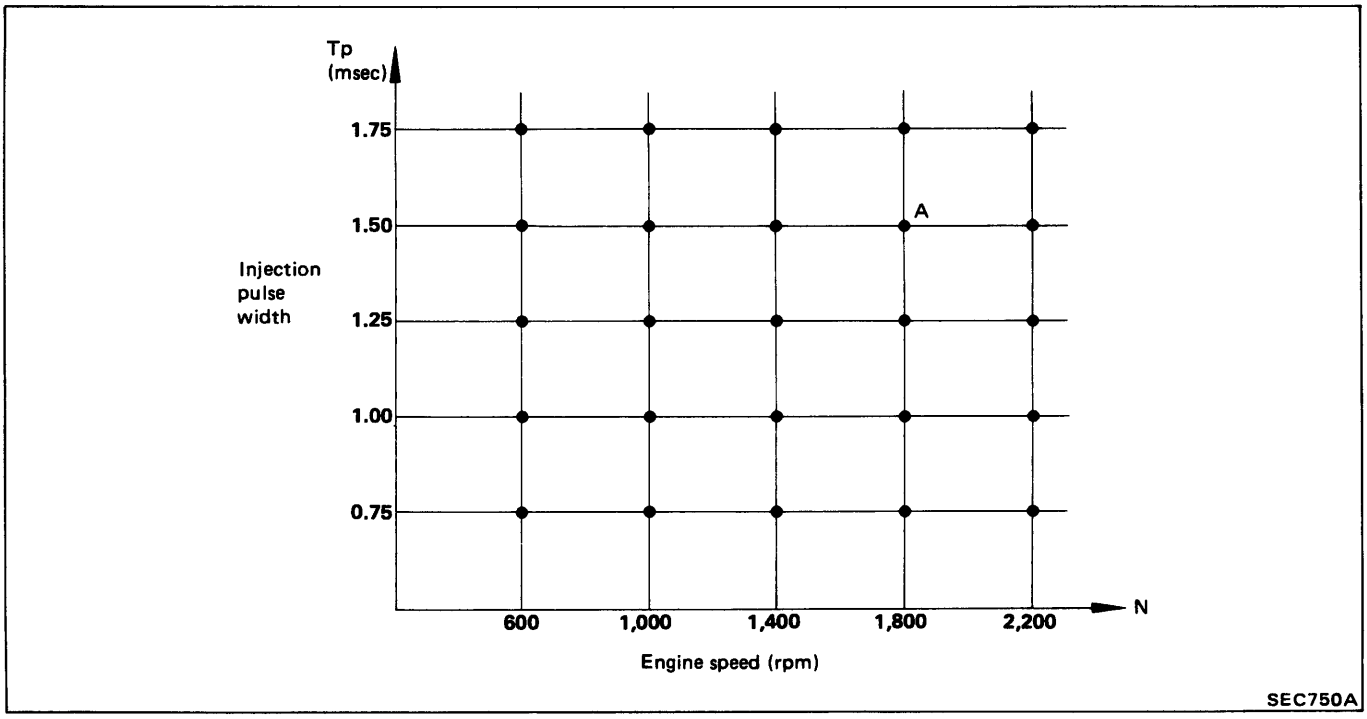
The ignition timing is controlled by the E.C.U. in order to maintain the best air-fuel ratio in response to every running condition of the engine.
The ignition timing data is stored in the ROM located in the E.C.U., in the form of the map shown below.
The E.C.U. detects information such as the injection pulse width and crank angle sensor signal which varies every moment. Then responding to this information, ignition signals are transmitted to the power transistor.

e.g. N: 1,800 rpm, Tp: 1.50 msec
A °B.T.D.C.

In addition to this,

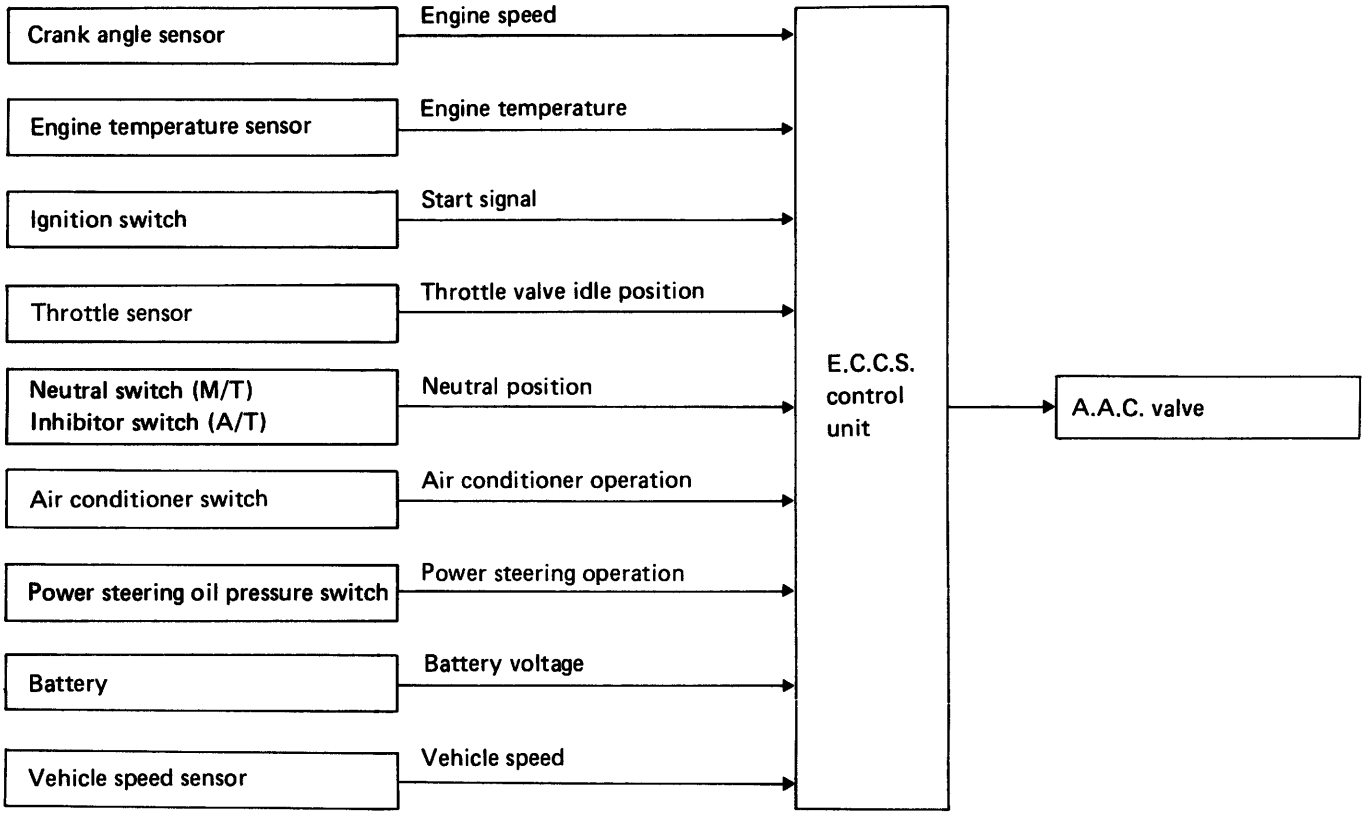
1 At starting
2 During warm-up
3 At idle
4 At low battery voltage
5 During swirl control valve operates
6 During hot engine operation
7 At acceleration
8 When intake air temperature is extremely high

the ignition timing is revised by the E.C.U. according to the other data stored in the ROM.



Idle Speed Control

INPUT/OUTPUT SIGNAL LINE

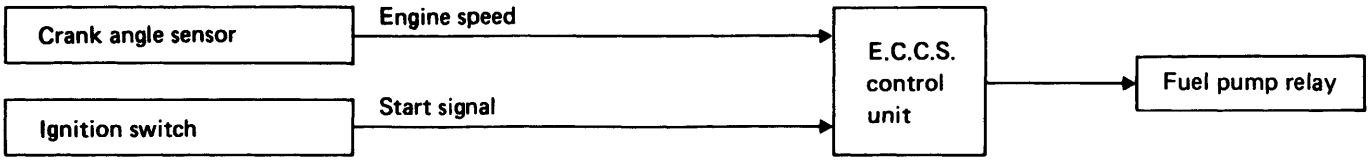


SYSTEM DESCRIPTION

This system automatically controls engine idle speed to a specified level. Idle speed is controlled through fine adjustment of the amount of air which by-passes the throttle valve via A.A.C. valve. The A.A.C. valve repeats ON/OFF operation according to the signal sent from the E.C.U. The crank angle sensor detects the actual engine speed and sends a signal to the E.C.U. The E.C.U. then controls the ON/OFF time of the A.A.C. valve so that engine speed coincides with the target value memorized in ROM. The target engine speed is the lowest speed at which the engine can operate steadily. The optimum value stored in the ROM is determined by taking into consideration various engine conditions, such as noise and vibration transmitted to the compartment, fuel consumption, and engine load.

Fuel Pump Control

INPUT/OUTPUT SIGNAL LINE



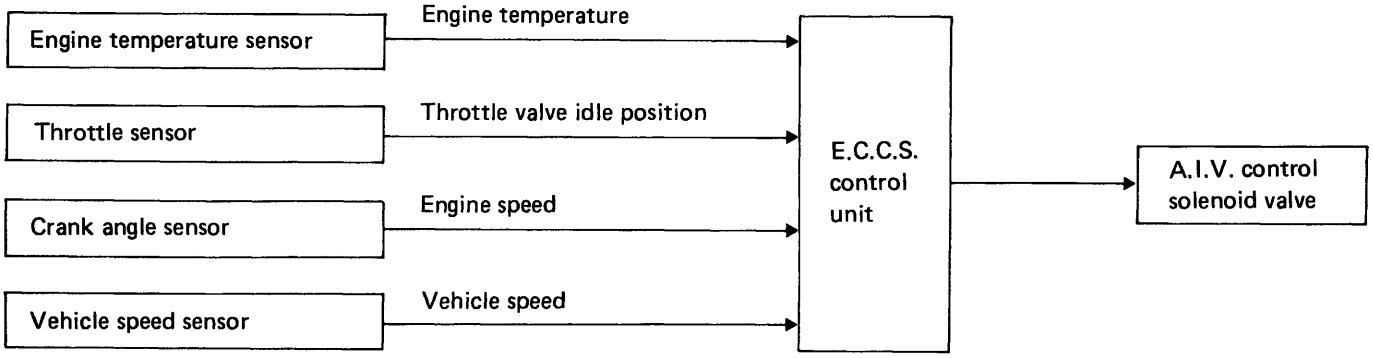
SYSTEM DESCRIPTION

The E.C.U. activates the fuel pump for several seconds after the ignition switch is turned on to improve engine startability. If the E.C.U. receives a 1° signal from the crank angle sensor, it knows that the engine is rotating, and causes the pump to perform. If the 1° signal is not received when the ignition switch is on, the engine stalls. The E.C.U. stops pump operation and prevents battery discharging, thereby improving safety. The E.C.U. does not directly drive the fuel pump. It controls the ON/OFF fuel pump relay, which in turn controls the fuel pump.

Condition	Fuel pump operation
Ignition switch is tunred to ON.	Operates for 5 seconds
Engine running and cranking	Operates
When engine is stopped	Stops in 1 second
Except as shown above	Stops

Air Induction Valve (A.I.V.) Control

INPUT/OUTPUT SIGNAL LINE



SYSTEM DESCRIPTION

The air induction system is designed to send secondary air to the exhaust manifold, utilizing the vacuum caused by exhaust pulsation in the exhaust manifold.

The exhaust pressure in the exhaust manifold usually pulsates in response to the opening and closing of the exhaust valve and decreases below atmospheric pressure periodically.

If a secondary air intake pipe is opened to the atmosphere under vacuum conditions, secondary air can be drawn into the exhaust manifold in proportion to the vacuum.

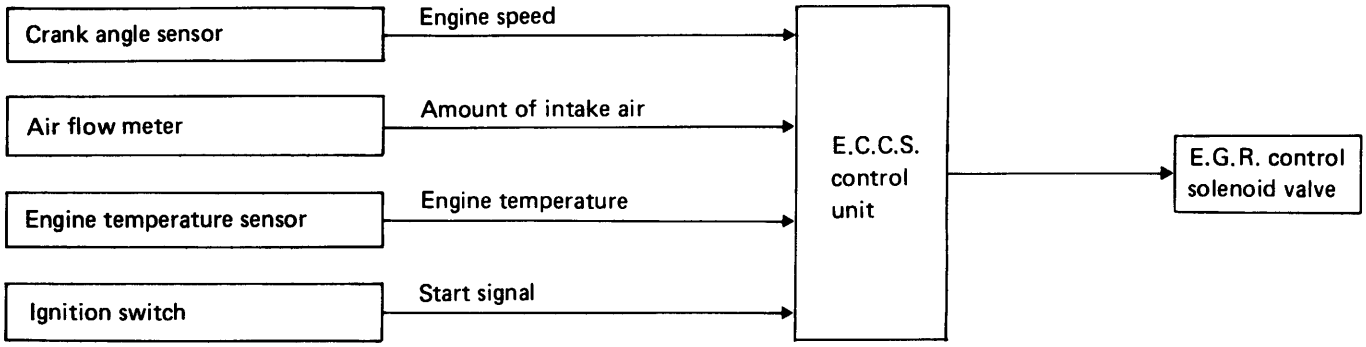
The air induction valve is controlled by the E.C.C.S. control unit, corresponding to the engine temperature. When the engine is cold, the A.I.V. control system operates to reduce HC and CO.

In extremely cold conditions, A.I.V. control system does not operate to reduce after-burning. This system also operates during deceleration for the purpose of blowing off water around the air induction valve.

Engine condition	Water temperature °C (°F)	A.I.V. control solenoid valve	A.I.V. control system
Idle or deceleration	Between 28 (82) and 115 (239)	ON	Operates

E.G.R. (Exhaust Gas Recirculation) Control

INPUT/OUTPUT SIGNAL LINE



SYSTEM DESCRIPTION

In addition, a system is provided which precisely cuts and controls port vacuum applied to the E.G.R. valve to suit engine operating conditions. This cut-and-control operation is accomplished through the E.C.U. When the E.C.U. detects any of the following conditions, current flows through the solenoid valve in the E.G.R. control vacuum line. This causes the port vacuum to be discharged into the atmosphere so that the E.G.R. control valve remains closed.

1) Low engine temperature
2) Engine starting
3) High-speed engine operation
4) Engine idling

E.G.R. control solenoid valve operation

Condition			E.G.R. control solenoid valve
When starting			ON
Water temperature	°C (°F)	Below 60 (140)	
		Above 115 (239)	
Idle & heavy load conditions			
Other conditions			OFF

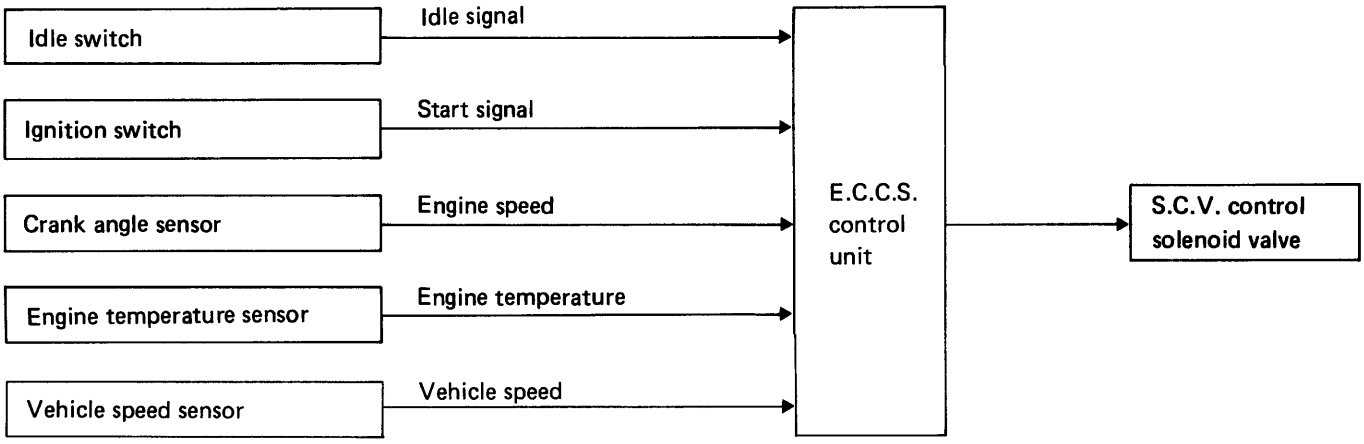
E.G.R. system operation

E.G.R. system operates under only the following conditions.

Water temperature °C (°F)	B.P.T. valve		Throttle position	E.G.R. control solenoid valve	E.G.R. system
	Exhaust gas pressure	Operation			
Between 60 (140) and 115 (239)	High	Closed	Partially open	OFF	Operates

Swirl Control Valve (S.C.V.) Control

INPUT/OUTPUT SIGNAL LINE



SYSTEM DESCRIPTION

This system has a swirl control valve (S.C.V.) in the intake passage of each cylinder.

While idling the S.C.V. closes. Thus the velocity of the air in the intake passage increases, promoting the vaporization of the fuel and producing a swirl in the combustion chamber.

Because of this operation, this system tends to increase the burning speed of the gas mixture, improve fuel consumption, and increase the stability in running conditions.

Also, except when idling, this system opens the S.C.V. In this condition, this system tends to increase power by improving intake efficiency via reduction of intake flow resistance, intake flow.

The solenoid valve controls S.C.V.'s shut/open condition. This solenoid valve is operated by the E.C.U.

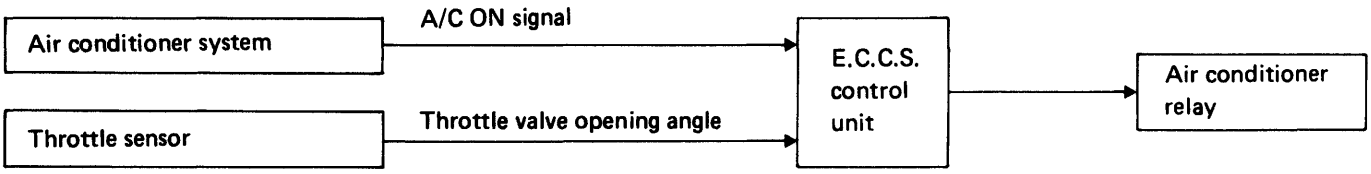
Water temperature is above 35°C (95°F) with vehicle stopped and engine running

Idle switch	Engine rpm	Solenoid valve	S.C.V.
ON	Below 1,800*1 Below 1,500*2	ON	Close
Except above		OFF	Open

*1: M/T *2: A/T

Acceleration Cut Control

INPUT/OUTPUT SIGNAL LINE



SYSTEM DESCRIPTION

When accelerator pedal is fully depressed, air conditioner is turned off for a few seconds.
This system improves acceleration when air conditioner is used.

Fail-safe System

AIR FLOW METER MALFUNCTION

If the air flow meter output voltage is above or below the specified value, the E.C.U. senses an air flow meter malfunction. In case of a malfunction, the throttle sensor substitutes for the air flow meter.

Though air flow meter is malfunctioning, it is possible to drive the vehicle and start the engine. But engine speed will not rise more than 2,400 rpm in order to inform the driver of fail-safe system operation while driving.

Operation

System	Fixed condition
E.G.R. control system	OFF
Idle speed control system	A duty ratio is fixed at the preprogrammed value.
Fuel injection control system	Fuel is shut off above 2,400 rpm. (Engine speed does not exceed 2,400 rpm.)

Fail-safe System (Cont'd)

ENGINE TEMPERATURE SENSOR MALFUNCTION

When engine temperature sensor output voltage is below or above the specified value, water temperature is fixed at the preset value as follows:

Operation

Condition	Engine temperature decided
Just as ignition switch is turned ON or Start	20°C (68°F)
More than 6 minutes after ignition ON or Start	80°C (176°F)
Except as shown above	20 - 80°C (68 - 176°F) (Depends on the time)

THROTTLE SENSOR MALFUNCTION

When throttle sensor output voltage is below or above the specified value, throttle sensor output is fixed at the preset value.

AIR TEMPERATURE SENSOR MALFUNCTION

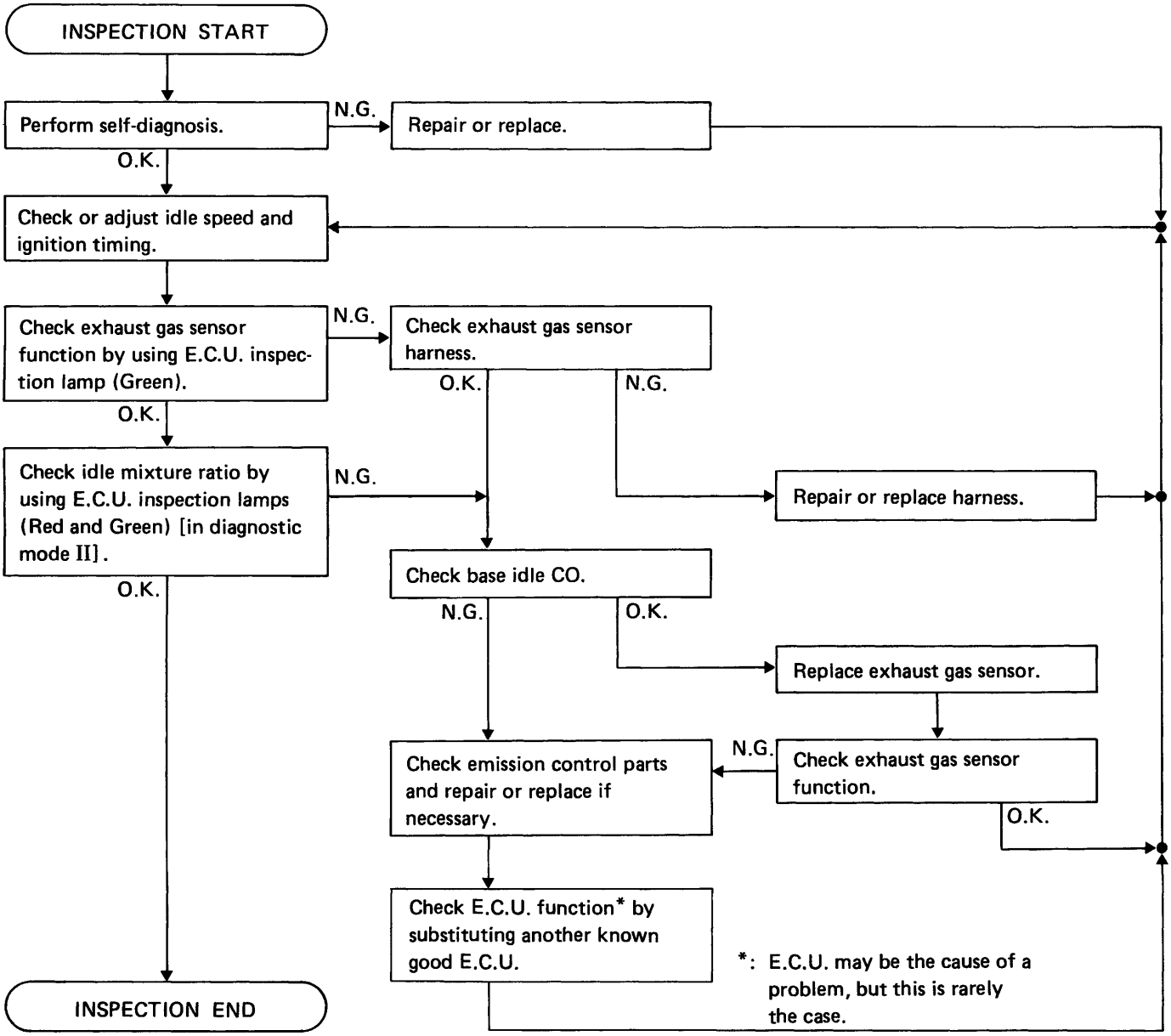
When air temperature sensor is below or above the specified value, air temperature value is fixed at the preset value [20°C (68°F)].

PREPARATION

1. Make sure that the following parts are in good order.
- Battery
- Ignition system
- Engine oil and coolant levels
- Fuses
- E.C.U. harness connector
- Vacuum hoses
- Air intake system (Oil filler cap, oil level gauge, etc.)
- Fuel pressure
- A.I.V. hose
- Engine compression
- E.G.R. control valve operation
- Throttle valve and idle switch

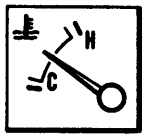
2. On air conditioner equipped models, checks should be carried out while the air conditioner is "OFF".
3. On automatic transaxle equipped models, when checking idle rpm, ignition timing and mixture ratio, checks should be carried out while shift lever is in "N" position.
4. When measuring "CO" percentage, insert probe more than 40 cm (15.7 in) into tail pipe.
5. Turn off headlamps, heater blower, rear defogger.
6. Keep front wheels pointed straight ahead.

Overall inspection sequence



INSPECTION START

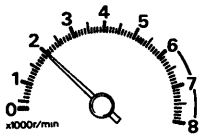
Visually check the following:
- Air cleaner clogging
- Hoses and ducts for leaks
- E.G.R. control valve operation
- Electrical connectors
- Gaskets
- Throttle valve and throttle sensor operation



SEF457C

Start engine and warm it up until water temperature indicator points to the middle of gauge.

Open engine hood and run engine at about 2,000 rpm for about 2 minutes under no-load.



SEF477B

Perform E.C.C.S. self-diagnosis (Mode III, IV, V).

O.K. / N.G.

Check, correct or replace malfunctioning parts.

Does engine run smoothly?

Yes / No

Check and clean injectors, and replace injectors if necessary.

Race engine two or three times under no-load, then run engine at idle speed.

Check idle speed.

M/T: 800±50 rpm
A/T: 800±50 rpm (in "N" position)

O.K. → Ⓐ

N.G. → Ⓑ

Ⓒ → Race engine two or three times under no-load, then run engine at idle speed.

Check ignition timing with a timing light.
10°±2° B.T.D.C.

O.K.

N.G.

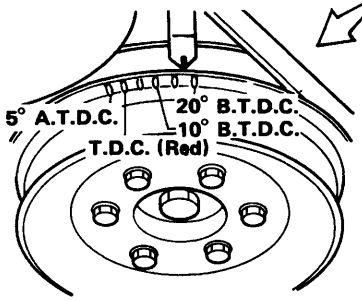
Disconnect throttle sensor harness connector.

Ensure that engine speed is below 850 rpm.

O.K.

N.G.

Adjust idle speed to less than 850 rpm by turning idle speed adjusting screw.



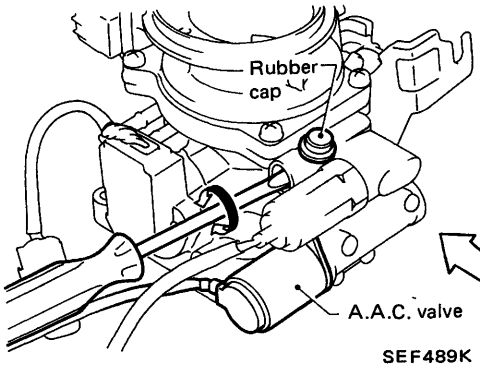
SMA189A

Check ignition timing with a timing light.
10°±2° B.T.D.C.

O.K.

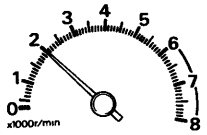
N.G.

Adjust ignition timing by turning distributor after loosening bolt which secures distributor.
15°±2° B.T.D.C.



SEF489K

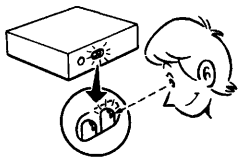
Remove rubber cap and adjust idle speed by turning idle speed adjusting screw.
M/T: 750±50 rpm
A/T: 750±50 rpm (in "N" position)



SEF477B

Connect throttle sensor harness connector.

Run engine at about 2,000 rpm for about 2 minutes under no-load.

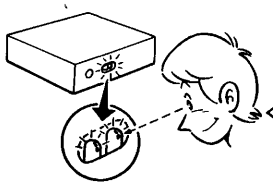


SEF450H

Make sure that inspection lamp (Green) on E.C.U. goes on and off periodically more than 5 times during 10 seconds at 2,000 rpm under no-load.

N.G.

O.K.



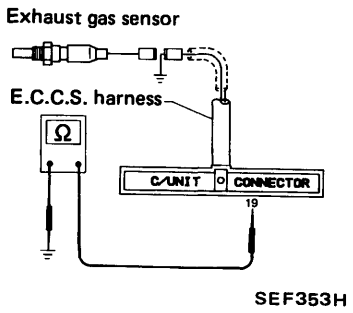
SEF292H

Set the diagnosis mode of E.C.U. to mode II.
Check inspection lamps (Red and Green) on E.C.U. blink at 2,000 rpm.
They should blink simultaneously.

No

Yes

INSPECTION END



SEF353H

Check exhaust gas sensor harness:
1) Turn off engine and disconnect battery ground cable.
2) Disconnect harness connector from E.C.U.
3) Disconnect exhaust gas sensor harness connector and connect terminal for exhaust gas sensor harness connector to ground with a jumping wire.
4) Check for continuity between terminal No. 19 of E.C.U. harness connector and ground metal on vehicle body.

Continuity exists. ..... O.K.
Continuity does not exist ..... N.G.

O.K.

N.G.

Repair or replace E.C.C.S. harness and connect battery ground cable.

Connect harness connector to E.C.U. and disconnect jumping wire from exhaust gas sensor.

- Disconnect engine temperature sensor harness connector.
- Connect a resistor (2.5 kΩ) between terminals of engine temperature sensor harness connector.
- Disconnect A.I.V. hose and install a suitable plug in A.I.V. pipe.
- Connect battery ground cable.

Start engine and warm it up until water temperature indicator points to the middle of gauge. (Wait more than 5 minutes after starting.)

Race engine two or three times under no-load then run engine at idle speed.

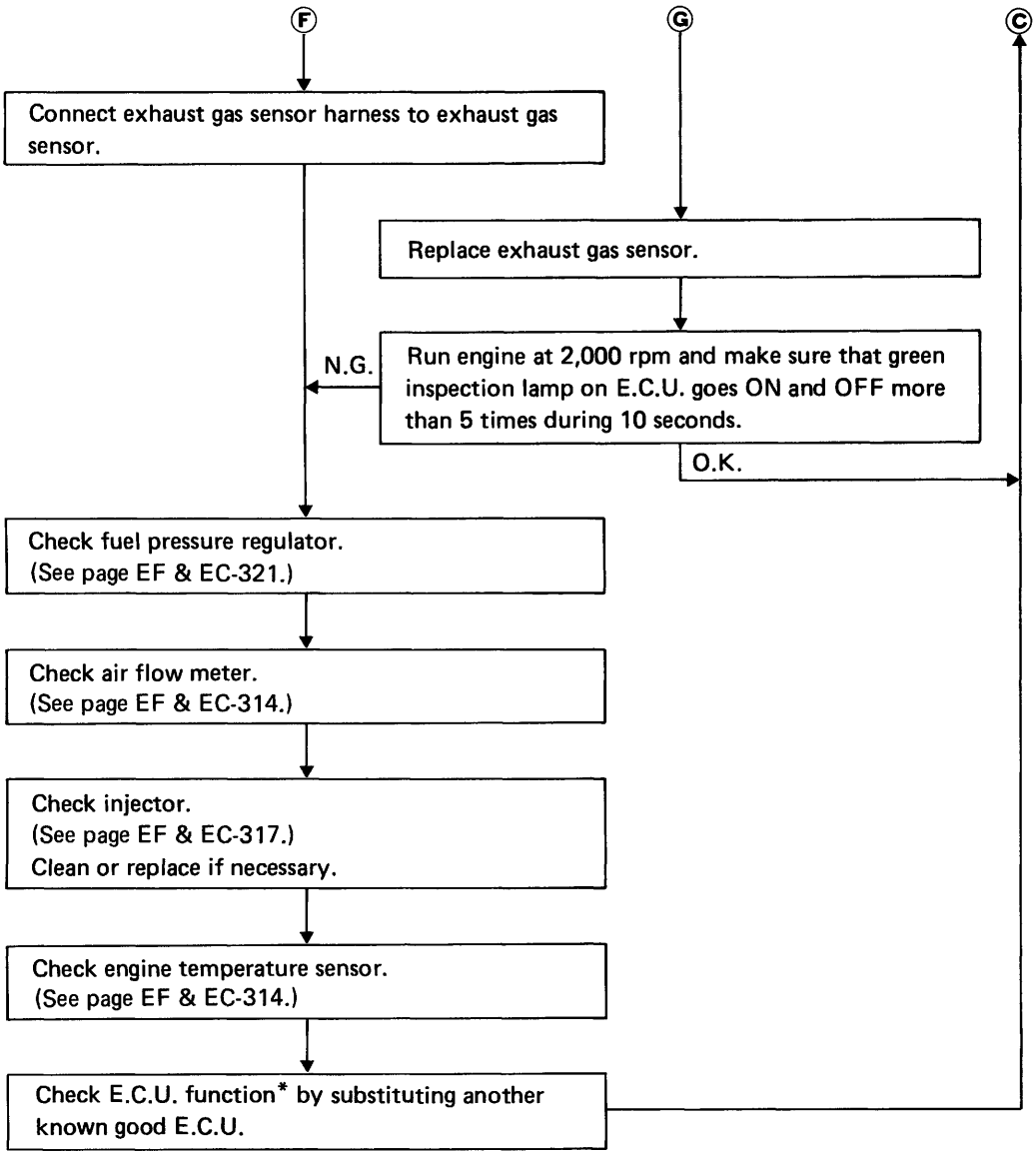
Check "CO"% and if engine runs smoothly.

Idle CO: Less than 5%

After checking CO%
1) Turn off engine.
2) Disconnect the resistor from terminals of engine temperature sensor harness connector.
3) Connect engine temperature sensor harness connector to engine temperature sensor.
4) Connect A.I.V. hose.

O.K.

N.G.



*: E.C.U. may be the cause of a problem, but this is rarely the case.

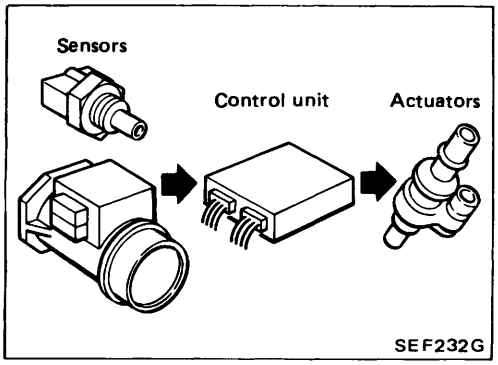
Contents

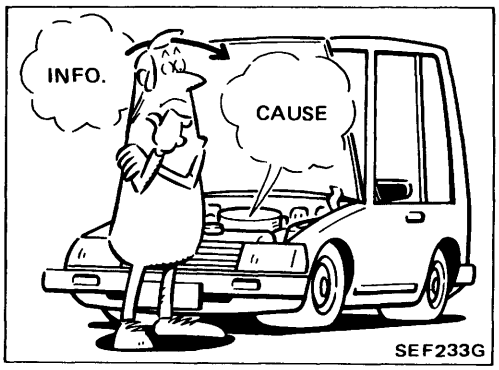
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2. Impossible to start — partial combustion ..... EF & EC-202
3. Impossible to start — partial combustion (not affected by throttle position) ..... EF & EC-203
4. Impossible to start — partial combustion (throttle position changes combustion quality) ..... EF & EC-204
5. Hard to start — before warm-up ..... EF & EC-205
6. Hard to start — after warm-up ..... EF & EC-206
7. Hard to start — every time ..... EF & EC-207
8. Hard to start — morning after a rainy day ..... EF & EC-208
9. Abnormal idling — no fast idle ..... EF & EC-209
10. Abnormal idling — low idle (after warm-up) ..... EF & EC-210
11. Abnormal idling — high idle (after warm-up) ..... EF & EC-211
12. Unstable idling — before warm-up ..... EF & EC-212
13. Unstable idling — after warm-up ..... EF & EC-213
14. Poor driveability — stumble (while accelerating) ..... EF & EC-214
15. Poor driveability — surge (while cruising) ..... EF & EC-215
16. Poor driveability — lack of power ..... EF & EC-216
17. Poor driveability — detonation ..... EF & EC-217
18. Engine stall — during start-up ..... EF & EC-218
19. Engine stall — while idling ..... EF & EC-219
20. Engine stall — while accelerating ..... EF & EC-220
21. Engine stall — while cruising ..... EF & EC-221
22. Engine stall — while decelerating/just after stopping ..... EF & EC-222
23. Engine stall — while loading (power steering, air conditioner, headlamps, etc.) ..... EF & EC-223
24. Backfire — through the intake ..... EF & EC-224
25. Backfire — through the exhaust ..... EF & EC-225

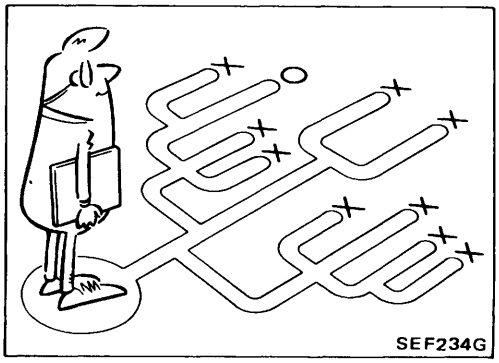
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Self-diagnosis — Mode II (Mixture ratio feedback control monitor) ..... EF & EC-230
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Self-diagnosis — Mode IV (Switches ON/OFF diagnostic system) ..... EF & EC-238
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CHECK ENGINE CONTROL UNIT ..... EF & EC-267
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CHECK E.G.R. FUNCTION ..... EF & EC-268
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CHECK EXHAUST GAS SENSOR ..... EF & EC-274

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Diagnostic Procedure 19
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How to Perform Trouble Diagnoses for Quick and Accurate Repair

INTRODUCTION

The engine has an electronic control unit to control major systems such as fuel control, ignition control, idle speed control, etc. The control unit accepts input signals from sensors and instantly drives actuators. It is essential that both kinds of signals are proper and stable. At the same time, it is important that there are no conventional problems such as vacuum leaks, fouled spark plugs, or other problems with the engine.

It is much more difficult to diagnose a problem that occurs intermittently rather than continuously. Most intermittent problems are caused by poor electric connections or faulty wiring. In this case, careful checking of suspicious circuits may help prevent the replacement of good parts.

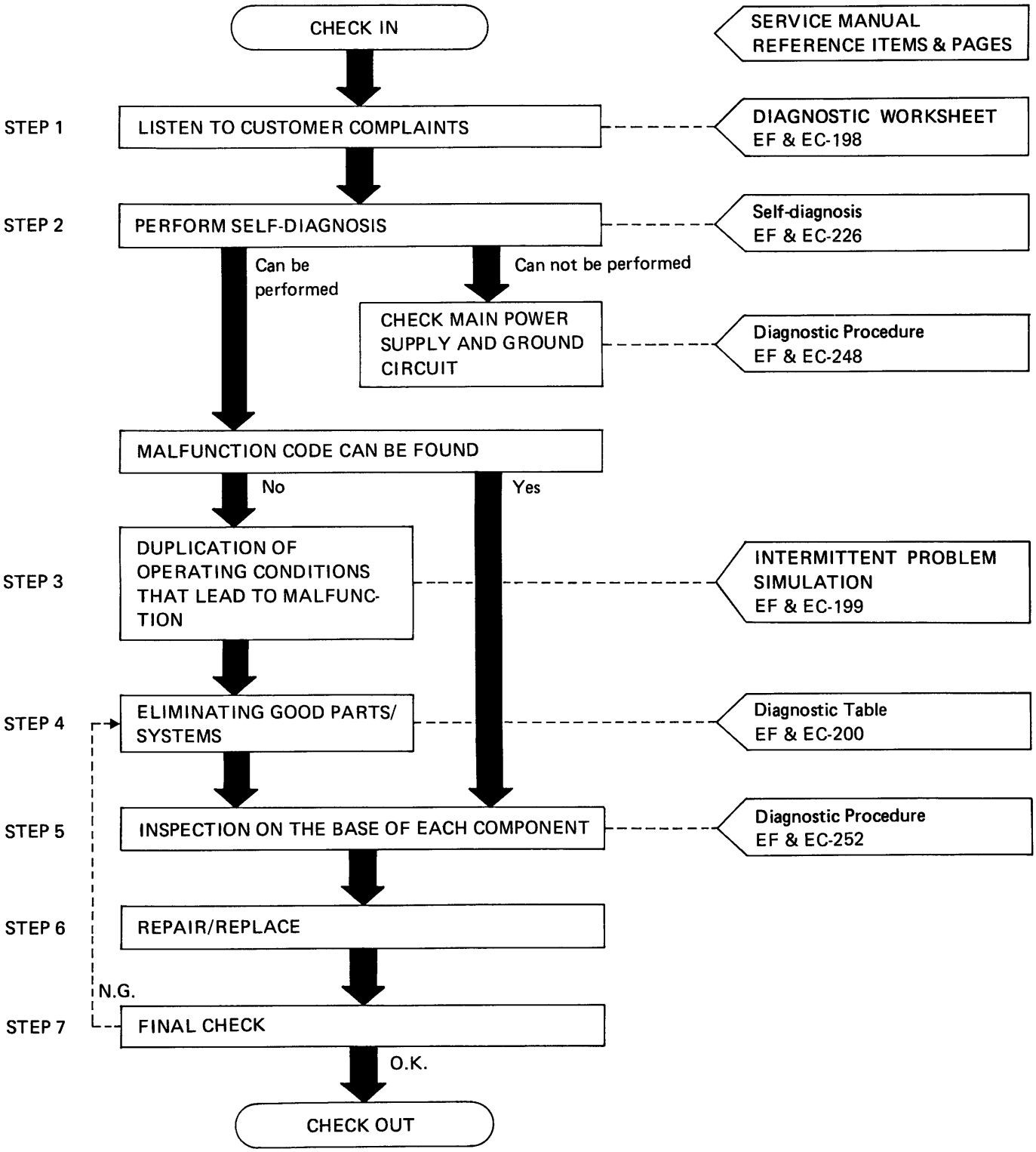
A visual check only may not find the cause of the problems. A road test with a circuit tester connected to a suspected circuit should be performed.

Before undertaking actual checks, take just a few minutes to talk with a customer who approaches with a driveability complaint. The customer is a very good supplier of information on such problems, especially intermittent ones. Through the talks with the customer, find out what symptoms are present and under what conditions they occur.

Start your diagnosis by looking for "conventional" problems first. This is one of the best ways to troubleshoot driveability problems on an electronically controlled engine vehicle.

How to Perform Trouble Diagnoses for Quick and Accurate Repair (Cont'd)

WORK FLOW



KEY POINTS

WHAT ..... Vehicle & engine model
WHEN ..... Date, Frequencies
WHERE ..... Road conditions
HOW ..... Operating conditions, Weather conditions, Symptoms

How to Perform Trouble Diagnoses for Quick and Accurate Repair (Cont'd)

DIAGNOSTIC WORKSHEET

There are many kinds of operating conditions that lead to malfunctions on engine components.

A good grasp of such conditions can make trouble-shooting faster and more accurate.

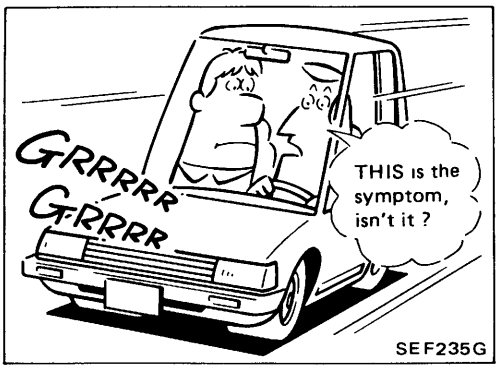
In general, feelings for a problem depend on each customer. It is important to fully understand the symptoms or under what conditions a customer complains..

Make good use of a diagnostic worksheet such as the one shown below in order to utilize all the complaints for trouble-shooting.

Worksheet sample

Customer name MR/MS	Model & Year	VIN
Engine #	Trans.	Mileage
Incident Date	Manuf. Date	In Service Date

Symptoms	☐ Startability	☐ Impossible to start ☐ No combustion ☐ Partial combustion ☐ Partial combustion affected by throttle position ☐ Partial combustion NOT affected by throttle position ☐ Possible but hard to start ☐ Others [ ]
	☐ Idling	☐ No fast idle ☐ Unstable ☐ High idle ☐ Low idle ☐ Others [ ]
	☐ Driveability	☐ Stumble ☐ Surge ☐ Detonation ☐ Lack of power ☐ Intake backfire ☐ Exhaust backfire ☐ Others [ ]
	☐ Engine stall	☐ At the time of start ☐ While idling ☐ While accelerating ☐ While decelerating ☐ Just after stopping ☐ While loading
Incident occurrence		☐ Just after delivery ☐ Recently ☐ In the morning ☐ At night ☐ In the daytime
Frequency		☐ All the time ☐ Under certain conditions ☐ Sometimes
Weather conditions		☐ Not effected
	Weather	☐ Fine ☐ Raining ☐ Snowing ☐ Others [ ]
	Temperature	☐ Hot ☐ Warm ☐ Cool ☐ Cold ☐ Humid °F
Engine conditions		☐ Cold ☐ During warm-up ☐ After warm-up Engine speed 0 2,000 4,000 6,000 8,000 rpm
Road conditions		☐ In town ☐ In suburbs ☐ Highway ☐ Off road (up/down)
Driving conditions		☐ Not affected ☐ At starting ☐ While idling ☐ At racing ☐ While accelerating ☐ While cruising ☐ While decelerating ☐ While turning (RH/LH) Vehicle speed 0 10 20 30 40 50 60 MPH
Check engine light		☐ Turned on ☐ Not turned on



How to Perform Trouble Diagnoses for Quick and Accurate Repair (Cont'd)

INTERMITTENT PROBLEM SIMULATION

In order to duplicate an intermittent problem, it is effective to create similar conditions for component parts, under which the problem might occur.

Perform the activity listed under Service procedure and note the result.

	Variable factor	Influential part	Target condition	Service procedure
1	Mixture ratio	Pressure regulator	Made lean	Remove vacuum hose and apply vacuum.
			Made rich	Remove vacuum hose and apply pressure.
2	Ignition timing	Distributor	Advanced	Rotate distributor clockwise.
			Retarded	Rotate distributor counterclockwise.
3	Mixture ratio feedback control	Exhaust gas sensor	Suspended	Disconnect exhaust gas sensor harness connector.
		Control unit	Operation check	Perform self-diagnosis (Mode I/II) at 2,000 rpm.
4	Idle speed	I.A.A. unit	Raised	Turn idle adjusting screw counterclockwise.
			Lowered	Turn idle adjusting screw clockwise.
5	Electric connection (Electric continuity)	Harness connectors and wires	Poor electric connection or faulty wiring	Tap or wiggle.
				Race engine rapidly. See if the torque reaction of the engine unit causes electric breaks.
6	Temperature	Control unit	Cooled	Cool with an icing spray or similar device.
			Warmed	Heat with a hair drier. **[WARNING: Do not overheat the unit.]**
7	Moisture	Electric parts	Damp	Wet. **[WARNING: Do not directly pour water on components. Use a mist sprayer.]**
8	Electric loads	Load switches	Loaded	Turn on head lights, air conditioner, rear defogger, etc.
9	Idle switch condition	Control unit	ON-OFF switching	Perform self-diagnosis (Mode IV).
10	Ignition spark	Timing light	Spark power check	Try to flash timing light for each cylinder.

Diagnostic Table

To assist with your trouble diagnoses, some typical diagnostic procedures for the following symptoms are described.

REMARKS

In the following pages, the numbers such as ❶, ❷ in the above chart correspond to those in the service procedure described below. Possible causes can be checked through the service procedure shown by the mark "○".

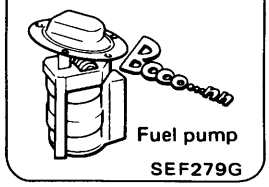
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 1 **Impossible to start – no combustion**

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼
SPECIFICATIONS	Mixture ratio (too lean)	○	○					
	Ignition sparks (weak, missing)				○	○	○	
	Ignition timing							○
FUEL SYSTEM	Fuel pump (no operation)	○						
	Fuel pump relay (open circuited)	○						
	Injectors (no operation, clogged)		○					
IGNITION SYSTEM	Ignition switch	○	○	○	○			○
	Main relay	○	○	○	○			○
	Power transistor			○	○			○
	Ignition coil				○			○
	Center cable (ignition leaks)				○			○
	Ignition wires (ignition leaks)				○	○		
	Spark plugs						○	
CONTROL SYSTEM	Crank angle sensor	○	○		○			○

SERVICE PROCEDURE

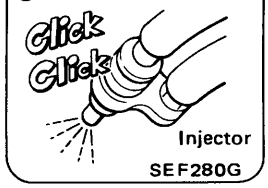
❶ LISTEN



Listen for fuel pump operating sound.

N.G. → Check fuel pump and/or related circuits. [See page EF & EC-294.]

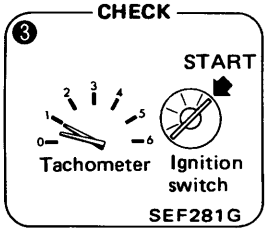
❷ LISTEN



Listen for injector operating sound.

N.G. → Check injector circuit. [See page EF & EC-292.]

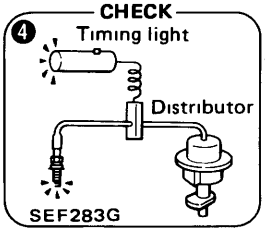
❸ CHECK



Make sure tachometer needle moves when cranking.

N.G. →

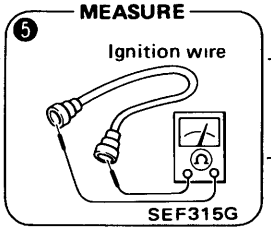
❹ CHECK



Check flashes of timing light for weakness.

N.G. →

❺ MEASURE

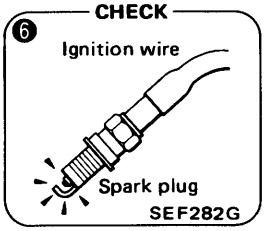


Measure resistance of suspect wires.

N.G. → Replace the wire.

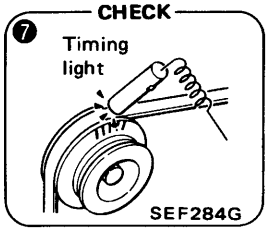
O.K. →

❻ CHECK



Remove spark plugs and check their ignition sparks.

❼ CHECK



Check ignition timing.

N.G. → Adjust ignition timing. [See page EF & EC-189.]

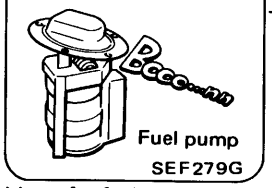
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 2 **Impossible to start – partial combustion**

POSSIBLE CAUSES		❶	❷	❸	❹	❺
SPECIFICATIONS	Mixture ratio	○	○	○		
	Fuel pressure (too low)				○	
	Ignition timing					○
FUEL SYSTEM	Fuel pump	○				
	Fuel pump relay (open circuited)	○				
	Injectors (clogged)		○			

SERVICE PROCEDURE

❶ LISTEN

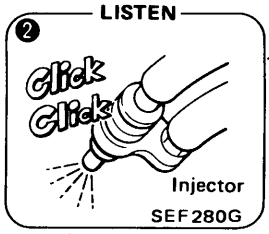


Listen for fuel pump operating sound.

N.G. → Check fuel pump and/or related circuits. [See page EF & EC-294.]

O.K.

❷ LISTEN

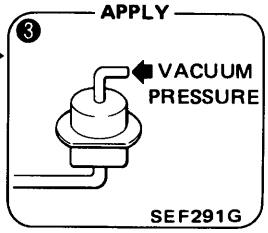


Listen for injector operating sound.

N.G. → Check injector circuit. [See page EF & EC-292.]

O.K.

❸ APPLY



Remove vacuum hose from pressure regulator, and apply vacuum and/or pressure, and try to start.

Improved →

❹ MEASURE

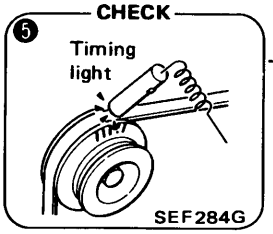
Fuel pressure gauge



Connect vacuum hose to pressure regulator and measure fuel pressure.

Check mixture ratio feedback system. [See page EF & EC-189.]

❺ CHECK



Check ignition timing.

Adjust ignition timing. [See page EF & EC-189.]

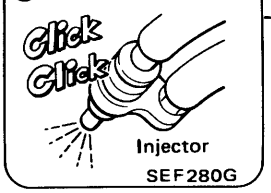
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 3 Impossible to start – partial combustion (not affected by throttle position)

	POSSIBLE CAUSES	❶	❷	❸	❹	❺	❻	❼	❽	❾	❿
SPECIFICATIONS	Mixture ratio	○		○	○						
	Fuel pressure (too low)			○	○	○					
	Ignition timing						○				
FUEL SYSTEM	Fuel filter (clogged)					○					
	Fuel line (clogged)					○					
	Injectors (clogged)	○									
	Pressure regulator				○						
	Pressure regulator vacuum hose (clogged)			○							
IGNITION SYSTEM	Ignition wires (ignition leaks)							○	○		
	Spark plugs (wet with fuel)									○	
	Ignition switch	○						○			○
INTAKE SYSTEM	Throttle chamber (with ports clogged)		○								
	Throttle valve (clogged)		○								
CONTROL SYSTEM	Engine temperature sensor										
	Crank angle sensor	○						○			

SERVICE PROCEDURE

❶ **LISTEN**

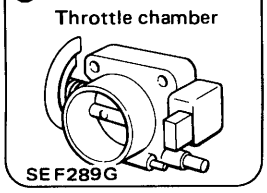


Listen for injector operating sound.

N.G. → Check injector circuit. [See page EF & EC-292.]

O.K. ↓

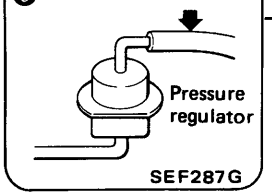
❷ **CHECK** Throttle chamber



Check throttle chamber ports and valve for clogging.

N.G. → Clean the ports and/or throttle valve.

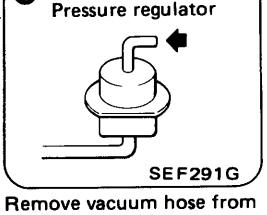
❸ **CHECK**



Check vacuum hose of pressure regulator for clogging.

O.K. →

❹ **REMOVE** Pressure regulator



Remove vacuum hose from pressure regulator, and try to start.

Improved →

❺ **MEASURE** Fuel pressure

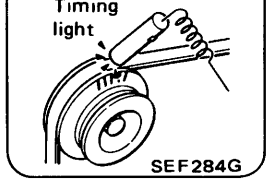
Connect vacuum hose to pressure regulator and measure fuel pressure.

→ Check mixture ratio feedback system. [See page EF & EC-189.]

N.G. ↓

Repair or replace the hose.

❻ **CHECK**

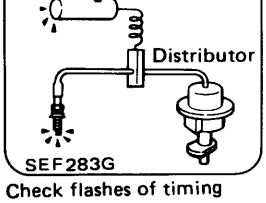


Check ignition timing.

N.G. ↓

Adjust ignition timing. [See page EF & EC-189.]

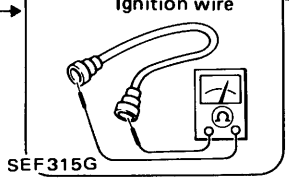
❼ **CHECK** Timing light



Check flashes of timing light for weakness.

N.G. →

❽ **MEASURE**



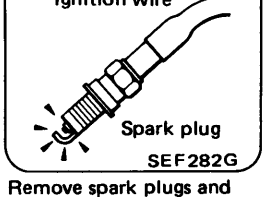
Measure resistance of suspect ignition wires.

N.G. ↓

Replace the wires.

O.K. →

❾ **CHECK**



Remove spark plugs and check their ignition sparks by cranking.

❿ **PERFORM** Self-diagnosis Mode IV

Perform self-diagnosis Mode IV (for start signal).

N.G. → Check starter circuit. [See page EF & EC-286.]

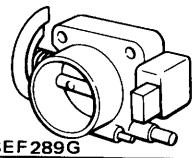
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION **4** **Impossible to start – partial combustion (throttle position changes combustion quality)**

POSSIBLE CAUSES		❶	❷	❸	❹
INTAKE SYSTEM	Throttle chamber (with ports clogged)	○			
	Throttle valve (clogged)		○		
	A.A.C. valve			○	
CONTROL SYSTEM	Engine temperature sensor				○
	Soft idle switch				○
	Neutral switch				○

SERVICE PROCEDURE

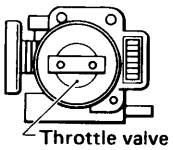
❶ CHECK — Throttle chamber



N.G. → Clean the ports.

Check throttle chamber ports for clogging.

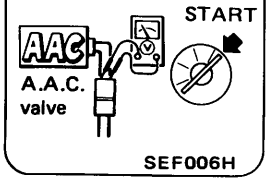
❷ CHECK — Throttle chamber



N.G. → Clean the valve.

Check throttle valve for clogging.

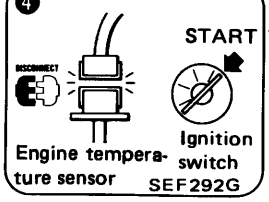
❸ CHECK



N.G. → Check idle speed control circuit. [See page EF & EC-300.]

Check terminal voltage of A.A.C. valve while cranking.

❹ CHECK



N.G. → Check sensor circuit. [See page EF & EC-260.]

Start with engine temperature sensor connector disconnected.

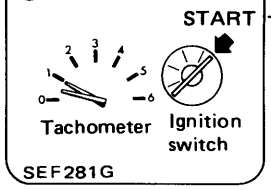
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 5 Hard to start – before warm-up

POSSIBLE CAUSES		❶	❷	❸	❹	❺
SPECIFICATIONS	Mixture ratio			○		○
IGNITION SYSTEM	Ignition switch (no start signal)	○			○	
INTAKE SYSTEM	A.A.C. valve			○		
CONTROL SYSTEM	Engine temperature sensor					○
	Soft idle switch				○	
	Neutral switch	○				
OTHERS	Starter (operation too slow)	○				
	Battery (voltage too low)	○	○			

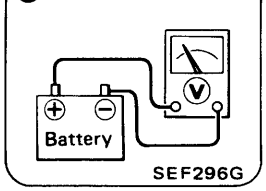
SERVICE PROCEDURE

❶ CHECK



Make sure tachometer indicates about 300 rpm while cranking.

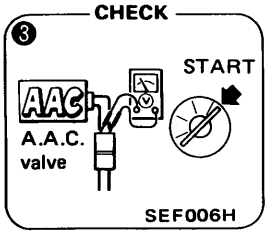
N.G. → ❷ MEASURE



Measure battery voltage.

N.G. (less than 12V) → Charge the battery.

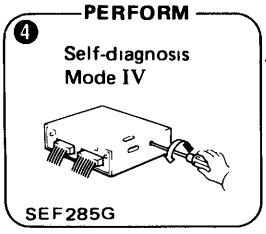
❸ CHECK



Check terminal voltage of A.A.C. valve while cranking.

N.G. → Check idle speed control circuit. [See page EF & EC-300.]

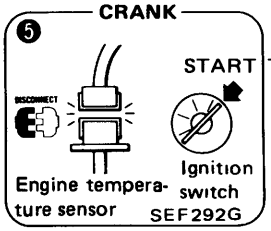
❹ PERFORM



Perform self-diagnosis Mode IV (for start signal and soft idle switch).

N.G. → Check the malfunctioning switches and/or circuits. [See page EF & EC-286 (start signal).]

❺ CRANK



Start with engine temperature sensor connector disconnected.

N.G. → Check sensor circuit. [See page EF & EC-260.]

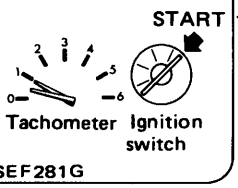
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 6 **Hard to start – after warm-up**

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼
SPECIFICATIONS	Mixture ratio			○		○		
	Fuel pressure			○		○	○	
FUEL SYSTEM	Fuel line (hot fuel)			○				
	Pressure regulator (low fuel pressure)					○		
	Pressure regulator vacuum hose (clogged)					○		
	Pressure regulator control solenoid						○	○
	Pressure regulator control solenoid vacuum hose					○		
	Fuel temperature sensor (open circuited)							
IGNITION SYSTEM	Ignition switch (no start signal)	○			○			
CONTROL SYSTEM	Engine temperature sensor							
	Air flow meter							
OTHERS	Starter (operation too slow)	○						
	Battery (voltage too low)	○	○					

SERVICE PROCEDURE

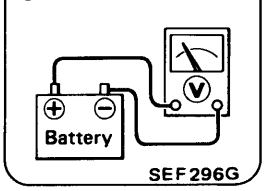
❶ CHECK



N.G. →

Make sure tachometer indicates about 250 rpm while cranking.

❷ MEASURE

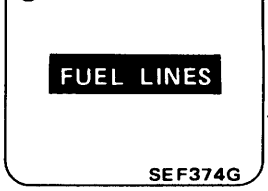


Measure battery voltage.

N.G. (less than 12V) ↓

Charge the battery.

❸ CRANK

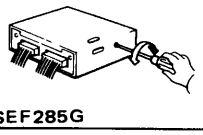


Cool fuel lines with wet rags, etc. and try to start.

No change → Proceed to other steps.

Improved → Proceed to other steps. If everything is O.K., check fuel vapor pressure.

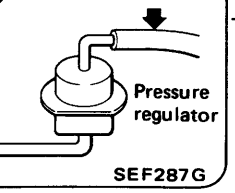
❹ PERFORM



N.G. → Check starter circuit. [See page EF & EC-286.]

Perform self-diagnosis Mode IV (for start signal).

❺ CHECK



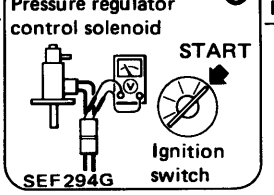
O.K. →

Check vacuum hose of pressure regulator for clogging.

N.G. ↓

Repair or replace the hose.

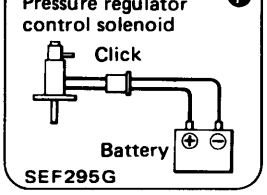
❻ CHECK



N.G. →

Check terminal voltage of pressure regulator control solenoid while cranking.

❼ LISTEN



Listen for clicking sound from pressure regulator control solenoid when applying battery voltage.

N.G. ↓ Replace the solenoid.

O.K. ↓ Check the solenoid circuit.

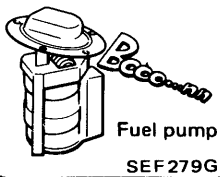
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 7 **Hard to start – every time**

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼	❽	❾	❿	⓫	⓬
SPECIFICATIONS	Mixture ratio	○				○	○						
	Fuel pressure						○	○					
	Ignition sparks (missing)								○	○		○	
	Ignition timing				○								
FUEL SYSTEM	Fuel pump (improper operation)	○											
	Fuel line (clogged)							○					
	Canister (air leaks)					○							
	Pressure regulator (low fuel pressure)						○						
IGNITION SYSTEM	Ignition wires (ignition leaks)								○	○			
	Spark plugs (improper gap)										○		
CONTROL SYSTEM	Crank angle sensor	○							○				
	Engine temperature sensor												
	Soft idle switch												○
	Neutral switch		○										
OTHERS	Starter (operation too slow)		○										
	Battery (voltage too low)		○	○									

SERVICE PROCEDURE

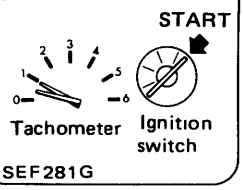
❶ **LISTEN**



Listen for fuel pump operating sound.

N.G. → Check fuel pump and/or related circuits. [See page EF & EC-294.]

❷ **CHECK**



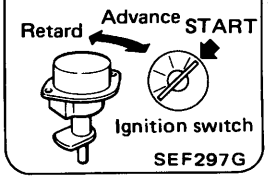
Make sure tachometer indicates about 300 rpm while cranking.

N.G. → ❸ **MEASURE** Battery

Measure battery voltage.

N.G. → Charge the battery.

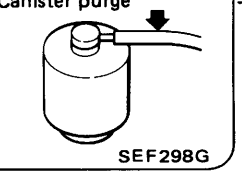
❹ **CRANK**



Advance/retard ignition timing and try to start.

No change → Proceed to other steps.

❺ **CHECK**

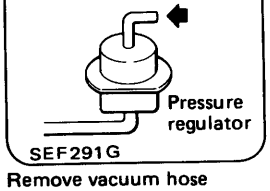


Check vacuum hose of canister for air leaks.

N.G. → Repair or replace the hose.

Improved → Check mixture ratio feedback system. [See page EF & EC-189.]

❻ **REMOVE**



Remove vacuum hose from pressure regulator, and try to start.

❼ **MEASURE** Fuel pressure

Connect vacuum hose to pressure regulator and measure fuel pressure.

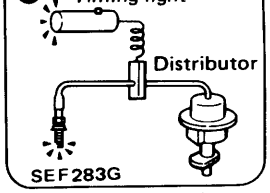
❿⓬ **PERFORM** Self-diagnosis Mode IV

N.G. → Check the malfunctioning circuits. [See page EF & EC-280 (throttle sensor).]

Perform self-diagnosis Mode IV (for soft idle switch).

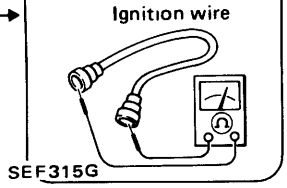
N.G. → Replace the wires.

❽ **CHECK** Timing light



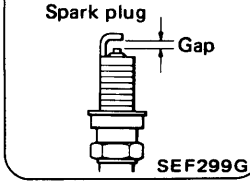
Check flashes of timing light for weakness.

N.G. → ❾ **MEASURE** Ignition wire



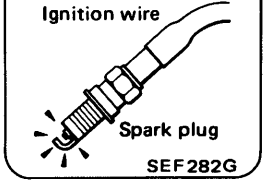
Measure resistance of suspect ignition wires.

O.K. → ❿ **MEASURE** Spark plug



Remove spark plugs and measure their gaps.

O.K. → ⓫ **CHECK** Ignition wire



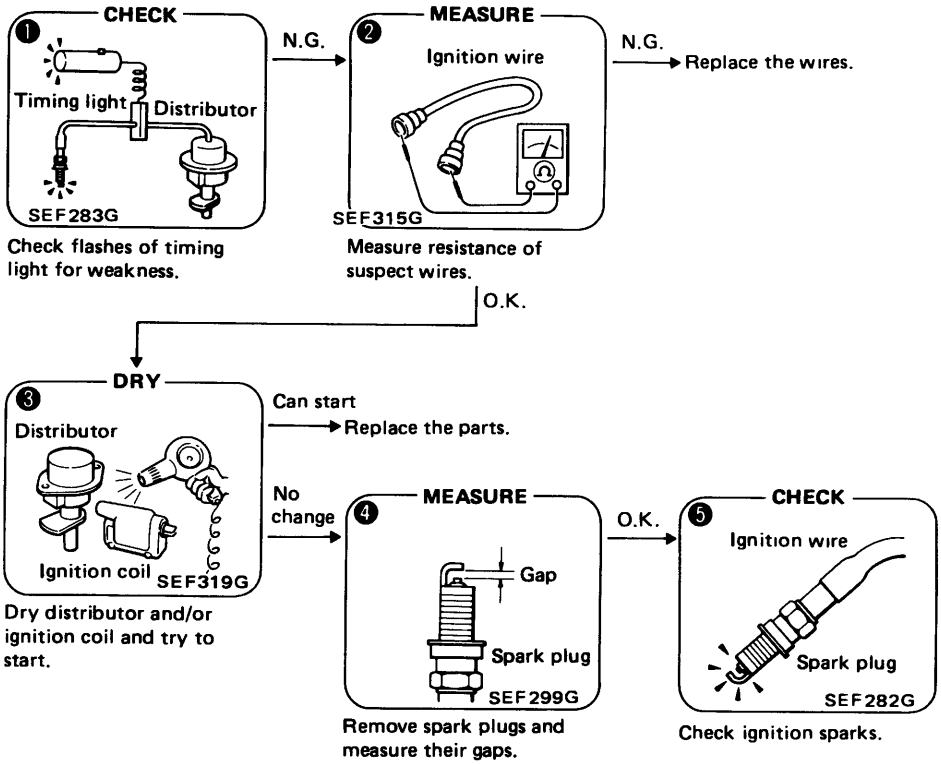
Check ignition sparks.

Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 8 **Hard to start – morning after a rainy day**

POSSIBLE CAUSES		❶	❷	❸	❹	❺
SPECIFICATIONS	Ignition sparks (weak)	○	○			○
IGNITION SYSTEM	Power transistor	○				○
	Ignition coil	○		○		○
	Center cable (ignition leaks)	○				○
	Ignition wires (ignition leaks)	○	○			○
	Distributor cap (ignition leaks)	○		○		○
	Spark plugs (improper gap)				○	○

SERVICE PROCEDURE



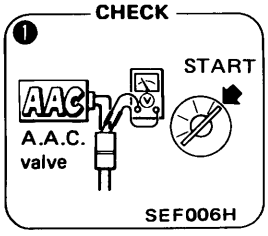
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 9 Abnormal idling – no fast idle

POSSIBLE CAUSES		❶	❷	❸	❹	❺
SPECIFICATIONS	Mixture ratio	○	○		○	
	Ignition timing			○		
INTAKE SYSTEM	Blow-by hose (clogged)		○			
	A.A.C. valve	○				
CONTROL SYSTEM	Engine temperature sensor					○

SERVICE PROCEDURE

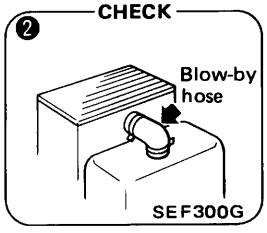
❶ CHECK



Check terminal voltage of A.A.C. valve while cranking.

N.G. → Check idle speed control circuit. [See page EF & EC-300.]

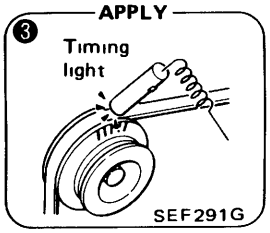
❷ CHECK



Check blow-by hose for clogging.

N.G. → Clean or replace the hose.

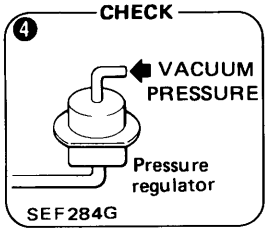
❸ APPLY



Check ignition timing.

Improved → Adjust ignition timing. [See page EF & EC-189.]

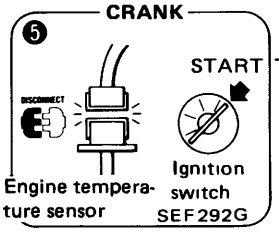
❹ CHECK



Apply vacuum pressure to pressure regulator after disconnecting vacuum hose, and check idling.

N.G. → Check mixture ratio feedback system. [See page EF & EC-189.]

❺ CRANK



Start with engine temperature sensor connector disconnected.

N.G. → Check sensor circuit. [See page EF & EC-260.]

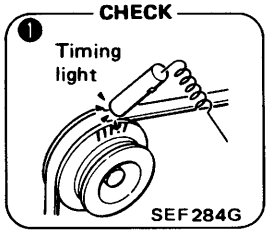
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 10 | **Abnormal idling – low idle (after warm-up)**

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼
SPECIFICATIONS	Mixture ratio		○			○		
	Ignition timing (too retarded)	○						
INTAKE SYSTEM	Throttle chamber (with ports clogged)			○				
	Throttle valve (clogged)				○			
CONTROL SYSTEM	Crank angle sensor						○	
	Air flow meter						○	
	Engine temperature sensor							○
	Load switches (remaining OFF)							

SERVICE PROCEDURE

❶ CHECK

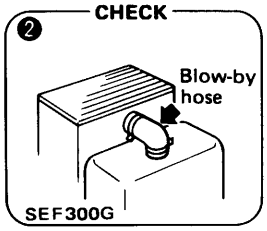


Check ignition timing.

N.G.

Adjust ignition timing.
[See page EF & EC-189.]

❷ CHECK

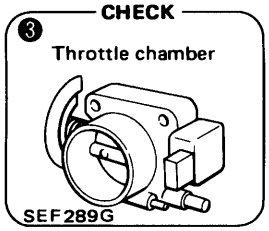


Check blow-by hose for clogging.

N.G.

Clean or replace the hose.

❸ CHECK

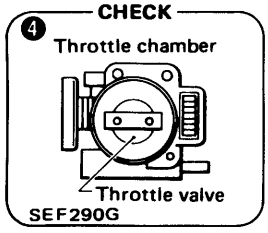


Check throttle chamber ports for clogging.

N.G.

Clean the ports.

❹ CHECK

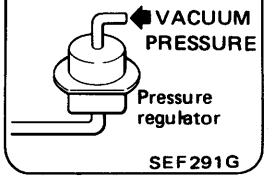


Check throttle valve for clogging.

N.G.

Clean the valve.

❺ APPLY

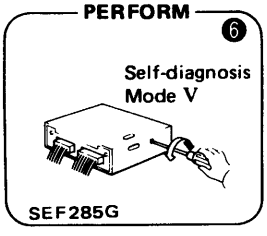


Apply vacuum pressure to pressure regulator after disconnecting vacuum hose, and check idling.

Improved → Check mixture ratio feedback system. [See page EF & EC-189.]

No change → Check load signal circuit. [See EL section.]

❻ PERFORM

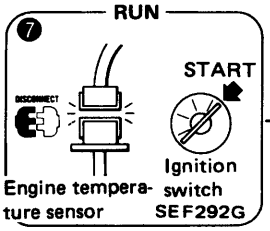


Perform self-diagnosis Mode V (for air flow meter).

N.G.

Check the malfunctioning parts and/or circuits.
[See page EF & EC-256 (air flow meter), page EF & EC-260 (engine temperature sensor).]

❼ RUN



Start and run engine with engine temperature sensor connector disconnected.

N.G.

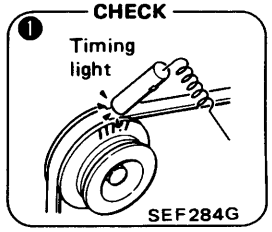
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 11 Abnormal idling – high idle (after warm-up)

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼	❽	❾
SPECIFICATIONS	Mixture ratio		○	○		○	○			
	Ignition timing (too advanced)	○								
INTAKE SYSTEM	Air duct (leaks)		○							
	Throttle chamber (air leaks)				○					
	Throttle valve (stuck control wire)				○					
	Intake manifold (gasket) (air leaks)		○							
	Idle speed control valve (remaining ON)			○						
CONTROL SYSTEM	Engine temperature sensor									○
	Soft idle switch							○		
	A/C switch circuit (remaining ON)							○	○	
	Load switches (remaining ON)							○	○	
OTHERS	Battery (voltage too low)									

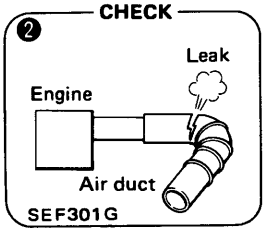
SERVICE PROCEDURE

❶ CHECK



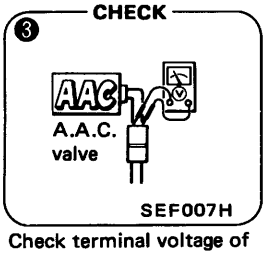
Check ignition timing.
N.G. ↓
Adjust ignition timing.
[See page EF & EC-189.]

❷ CHECK



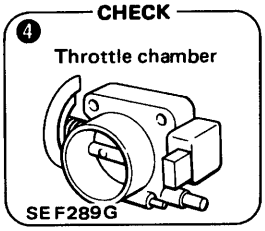
Check intake system for air leaks.
O.K. ↓
N.G. ↓
Check throttle wire for rough sliding.
Repair/replace the part.

❸ CHECK



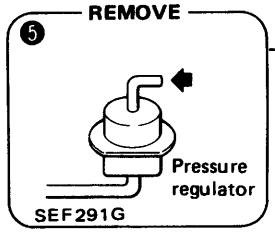
Check terminal voltage of A.A.C. valve while idling.
N.G. ↓
Check the part and/or circuit.
[See page EF & EC-300.]

❹ CHECK



Check throttle chamber ports and valve for clogging.
N.G. ↓
Clean the ports and/or throttle valve.

❺ REMOVE



Remove vacuum hose from pressure regulator, and try to start.

Improved →

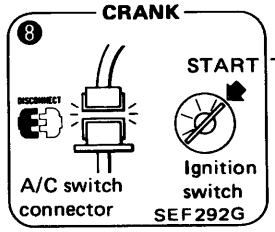
❻ MEASURE
Fuel pressure

Connect vacuum hose to pressure regulator and measure fuel pressure.
↓
Check mixture ratio feedback system.
[See page EF & EC-189.]

❼ PERFORM
Self-diagnosis Mode IV

Perform self-diagnosis Mode IV (for soft idle switch).
N.G. ↓
Check the throttle sensor circuit.
[See page EF & EC-280.]

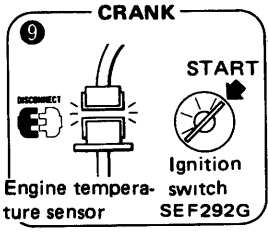
❽ CRANK



N.G. → Check A/C switch circuit.
[See HA section.]

Start with A/C switch connector disconnected.

❾ CRANK



N.G. → Check sensor circuit.
[See page EF & EC-260.]

Start with engine temperature sensor connector disconnected.

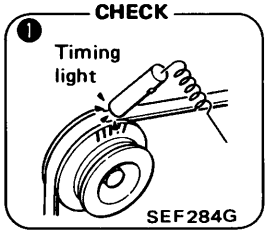
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 12 Unstable idling – before warm-up

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻
SPECIFICATIONS	Mixture ratio		○				
	Ignition timing	○					
INTAKE SYSTEM	Idle speed control valve (remaining OFF)			○			
CONTROL SYSTEM	Engine temperature sensor						○
E.G.R. SYSTEM	E.G.R. control valve (stuck open)				○		
	E.G.R. solenoid (remaining OFF)				○	○	

SERVICE PROCEDURE

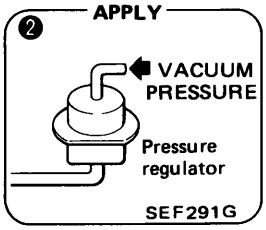
❶ CHECK



Check ignition timing.

N.G. → Adjust ignition timing. [See page EF & EC-189.]

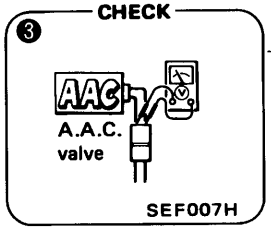
❷ APPLY



Apply vacuum pressure to pressure regulator after disconnecting vacuum hose, and check idling.

Improved → Check mixture ratio feedback system. [See page EF & EC-189.]

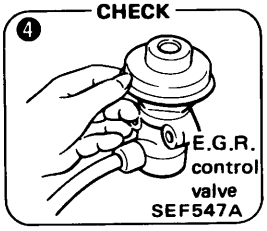
❸ CHECK



Check terminal voltage of A.A.C. valve while idling.

Does not turn ON → Check its circuit. [See page EF & EC-300.]

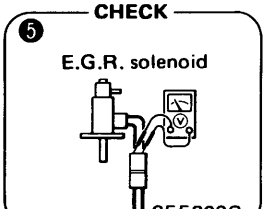
❹ CHECK



Check E.G.R. control valve for operation.

Stays lifted →

❺ CHECK

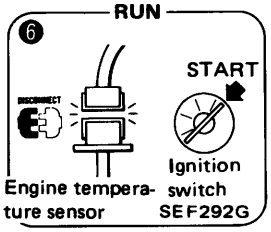


Check terminal voltage of E.G.R. solenoid while idling.

N.G. ↓

Check the solenoid circuit. [See page EF & EC-268.]

❻ RUN



Start and run engine with engine temperature sensor connector disconnected.

N.G. → Check sensor circuit. [See page EF & EC-260.]

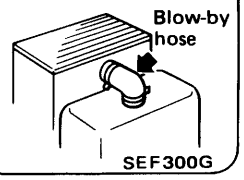
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 13 Unstable idling – after warm-up

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼	❽	❾	❿	⓫	⓬
SPECIFICATIONS	Mixture ratio	○	○	○	○								
	Ignition sparks					○	○	○					
	Ignition timing								○				
	Compression pressure									○			
FUEL SYSTEM	Fuel line (clogged)												
	Canister (air leaks)			○									
	Pressure regulator control solenoid				○								
IGNITION SYSTEM	Power transistor					○		○					
	Ignition coil					○		○					
	Ignition wires					○	○	○					
INTAKE SYSTEM	Blow-by hose (leaks)	○											
	Air duct (leaks)		○										
CONTROL SYSTEM	Soft idle switch												○
	Load switches												
E.G.R. SYSTEM	E.G.R. control valve										○		
	E.G.R. solenoid										○	○	

SERVICE PROCEDURE

❶ CHECK

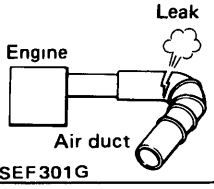


Check blow-by hose for leaks.

↓ N.G.

Repair/replace the hose.

❷ CHECK

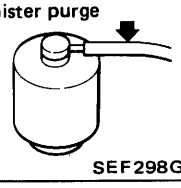


Check intake system for air leaks.

↓ N.G.

Repair/replace the part.

❸ CHECK

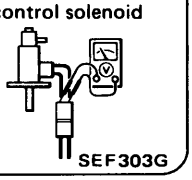


Check purge line for leaks.

↓ N.G.

Repair/replace the hose.

❹ CHECK

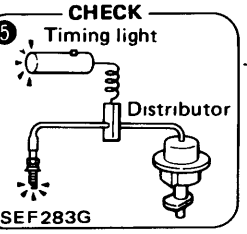


Check terminal voltage of the solenoid while idling.

↓ N.G.

Check the solenoid circuit.

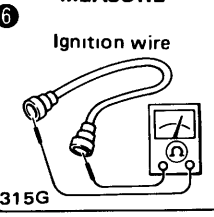
❺ CHECK



Check flashes of timing light for weakness.

N.G. →

❻ MEASURE



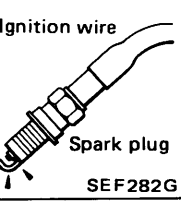
Measure resistance of suspect wires.

↓ N.G.

Replace the wire.

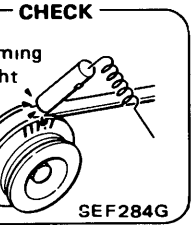
O.K. →

❼ CHECK



Remove spark plugs and check their ignition sparks.

❽ CHECK



Check ignition timing.

↓ N.G.

Adjust ignition timing.
[See page EF & EC-189.]

❾ MEASURE

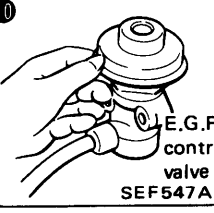


Measure compression pressure.

↓ N.G.

Check cylinder head and gasket.
[See EM section.]

❿ CHECK



Check E.G.R. control valve for operation.

Stays lifted →

⓫ CHECK

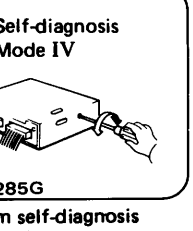


Check terminal voltage of E.G.R. solenoid while idling.

↓ N.G.

Check the solenoid circuit.
[See page EF & EC-268.]

⓬ PERFORM



Perform self-diagnosis Mode IV (for soft idle switch).

↓ N.G.

Check the throttle sensor circuit.
[See page EF & EC-280.]

Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 14 Poor driveability — stumble (while accelerating)

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼	❽	❾
SPECIFICATIONS	Mixture ratio				○		○	○		○
	Fuel pressure						○	○		
FUEL SYSTEM	Fuel filter (clogged)							○		
	Fuel line (clogged)							○		
	Injectors (clogged)							○		
IGNITION SYSTEM	Power transistor	○		○						
	Ignition coil	○		○						
	Ignition wires (ignition leaks)	○	○	○						
	Spark plugs (ignition leaks, improper gap)			○						
INTAKE SYSTEM	Air duct (leaks)				○					
CONTROL SYSTEM	Crank angle sensor	○							○	
	Air flow meter								○	
	Engine temperature sensor	○							○	
	Exhaust gas sensor									○
	Soft idle switch					○				
OTHERS	Fuel (poor quality)									

SERVICE PROCEDURE

❶ **CHECK** — Timing light, Distributor — SEF283G
Check flashes of timing light for weakness.

N.G. → ❷ **MEASURE** — Ignition wire — SEF315G
Measure resistance of suspect wires.

N.G. → Replace the wires.

O.K. → ❸ **CHECK** — Ignition wire, Spark plug — SEF282G
Remove spark plugs and check their ignition sparks.

❹ **CHECK** — Leak, Engine, Air duct — SEF301G
Check intake system for air leaks.

N.G. → Repair/replace the part.

❺ **PERFORM** — Self-diagnosis Mode IV — SEF285G
Perform self-diagnosis Mode IV (for soft idle switch).

N.G. → Check the throttle sensor circuit.
[See page EF & EC-280.]

❻ **REMOVE** — Pressure regulator — SEF291G
Remove vacuum hose from pressure regulator, and try to drive.

Improved → ❼ **MEASURE** — Fuel pressure gauge — SEF286G
Connect vacuum hose to pressure regulator and measure fuel pressure while driving.

→ Check mixture ratio feedback system.
[See page EF & EC-189.]

❽ **PERFORM** — Self-diagnosis Mode V — SEF285G
Perform self-diagnosis Mode V (for air flow meter).

N.G. → Check the malfunctioning parts and/or circuits.
[See page EF & EC-256 (air flow meter).]

❾ **DISCONNECT** — Exhaust gas sensor — SEF307G
Disconnect exhaust gas sensor connector, and try to drive.

Improved → Replace the sensor.

No change → Check mixture ratio feedback system.
[See page EF & EC-189.]

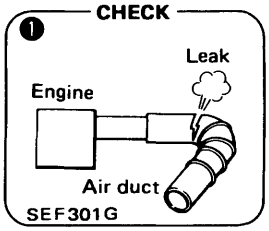
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 15 Poor driveability – surge (while cruising)

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼	❽	❾
SPECIFICATIONS	Mixture ratio (too lean)	○				○	○			○
	Fuel pressure (low)					○	○			
	Ignition timing		○							
IGNITION SYSTEM	(missing)								○	
INTAKE SYSTEM	Air duct (leaks)	○								
	Throttle chamber (air leaks)	○								
	Intake manifold (gasket) (air leaks)	○								
CONTROL SYSTEM	Crank angle sensor								○	
	Air flow meter								○	
	Exhaust gas sensor								○	
	Soft idle switch							○		
E.G.R. SYSTEM	E.G.R. control valve (stuck open)			○						
	E.G.R. solenoid (remaining OFF)			○	○					
	E.G.R. vacuum hose (removed)			○						

SERVICE PROCEDURE

❶ CHECK

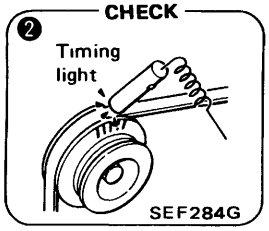


Check intake system for air leaks.

↓ N.G.

Repair/replace the part.

❷ CHECK

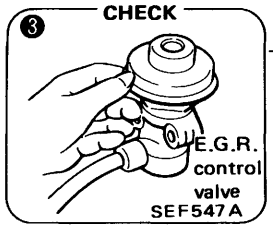


Check ignition timing.

↓ N.G.

Adjust ignition timing. [See page EF & EC-189.]

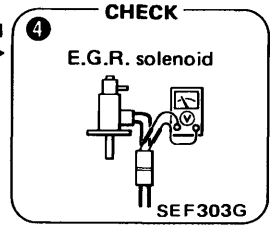
❸ CHECK



Stays lifted →

Check E.G.R. control valve for operation.

❹ CHECK

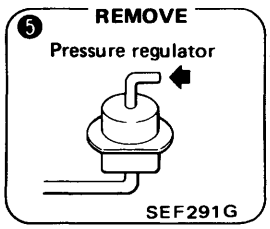


Check terminal voltage of E.G.R. solenoid.

↓ N.G.

Check the solenoid circuit. [See page EF & EC-268.]

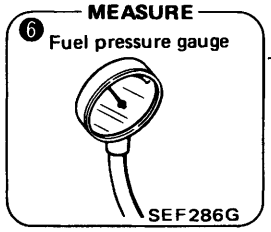
❺ REMOVE



Remove vacuum hose from pressure regulator, and try to drive.

Improved →

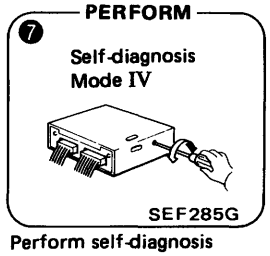
❻ MEASURE



Connect vacuum hose to pressure regulator and measure fuel pressure while driving.

→ Check mixture ratio feedback system. [See page EF & EC-189.]

❼ PERFORM

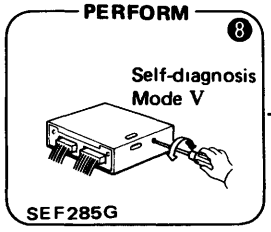


Perform self-diagnosis Mode IV (for soft idle switch).

↓ N.G.

Check the throttle sensor circuit. [See page EF & EC-280.]

❽ PERFORM

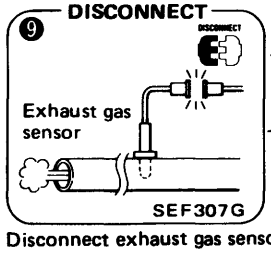


Perform self-diagnosis Mode V (for crank angle sensor, air flow meter, ignition signal.)

N.G. →

Check the malfunctioning parts and/or circuits. [See page EF & EC-252 (crank angle sensor), page EF & EC-256 (air flow meter), page EF & EC-264 (ignition signal).]

❾ DISCONNECT



Disconnect exhaust gas sensor connector, and try to drive.

Improved → Replace the sensor.

No change → Check mixture ratio feedback system. [See page EF & EC-189.]

Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 16 Poor driveability – lack of power

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼	❽	❾	❿	⓫
SPECIFICATIONS	Fuel pressure								○	○		
	Ignition timing		○									
	Compression pressure (too low)							○				
FUEL SYSTEM	Fuel pump (low fuel output)									○		
	Fuel filter (clogged)									○		
	Fuel line (clogged)									○		
	Injectors (clogged)									○		
IGNITION SYSTEM	Ignition wires (ignition leaks)				○	○	○					
	Spark plugs (improper gap)						○					
INTAKE SYSTEM	Air cleaner element (clogged)	○										
	Throttle chamber (clogged)			○								
	Throttle valve (not open enough)			○								
CONTROL SYSTEM	Air flow meter										○	
	Exhaust gas sensor											○

SERVICE PROCEDURE

❶ CHECK
AIR CLEANER ELEMENT
SEF320G
Check air cleaner element for clogging.
↓ N.G.
Replace the part.

❷ CHECK
Timing light
SEF284G
Check ignition timing with a timing light.
↓ N.G.
Adjust ignition timing.
[See page EF & EC-189.]

❸ CHECK
Throttle chamber
Throttle valve
SEF290G
Check throttle valve for rough movement.
↓ N.G.
Repair/replace the part.

❹ CHECK
Timing light
Distributor
SEF283G
Check flashes of timing light for weakness.
↓ N.G.

❺ MEASURE
Ignition wire
SEF315G
Measure resistance of suspect wires.
↓ N.G.
Replace the wires.

O.K. ←

❻ CHECK
Ignition wire
Spark plug
SEF282G
Remove spark plugs and check their ignition sparks.

❼ MEASURE
COMPRESSION PRESSURE
SEF309G
Measure compression pressure.
→ Check cylinder head and gasket.
[See EM section.]

❽ REMOVE
Pressure regulator
SEF291G
Remove vacuum hose from pressure regulator, and try to drive.

Improved →

❾ MEASURE
Fuel pressure gauge
SEF286G
Connect vacuum hose to pressure regulator and measure fuel pressure while driving.
↓
Check mixture ratio feedback system.
[See page EF & EC-189.]

❿ PERFORM
Self-diagnosis Mode V
SEF285G
Perform self-diagnosis Mode V (for air flow meter).
↓ N.G.
Check the malfunctioning parts and/or circuit.
[See page EF & EC-256.]

⓫ DISCONNECT
Exhaust gas sensor
SEF307G
Disconnect exhaust gas sensor connector, and try to drive.
No change ↓ / Improved ↓
Replace the sensor.
Check mixture ratio feedback system.
[See page EF & EC-189.]

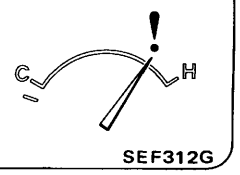
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 17 Poor driveability -- detonation

POSSIBLE CAUSES		❶	❷	❸	❹	❺
SPECIFICATIONS	Mixture ratio (too lean)			○	○	
	Fuel pressure (low)			○		
	Ignition timing (too advanced)		○			
FUEL SYSTEM	Fuel filter (clogged)				○	
	Fuel line (clogged)				○	
	Injectors (clogged)				○	
CONTROL SYSTEM	Crank angle sensor (improper 1°-signals)					○
	Air flow meter					○
	Engine temperature sensor					○
OTHERS	Water temperature (too high)	○				
	Fuel (low octane rating, poor quality)					

SERVICE PROCEDURE

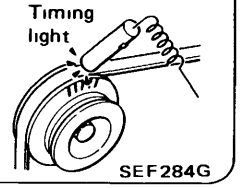
❶ CHECK
Water temperature



Too high → Check cooling system. [See LC section.]

Check water temperature.

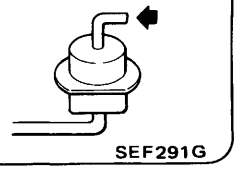
❷ CHECK
Timing light



N.G. → Adjust ignition timing. [See page EF & EC-189.]

Check ignition timing.

❸ REMOVE
Pressure regulator



Improved →

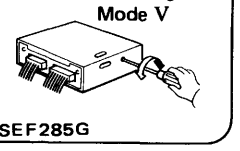
Remove vacuum hose from pressure regulator, and try to drive.

❹ MEASURE
Fuel pressure gauge



Connect vacuum hose to pressure regulator, and measure fuel pressure while driving.

❺ PERFORM
Self-diagnosis Mode V



N.G. → Check the malfunctioning parts.
[See page EF & EC-252 (crank angle sensor), page EF & EC-256 (air flow meter).]

Perform self-diagnosis Mode V (for crank angle sensor and air flow meter).

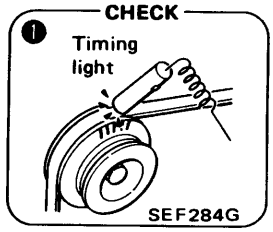
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 18 Engine stall – during start-up

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼	❽	❾
SPECIFICATIONS	Mixture ratio (too rich/too lean)							○	○	○
	Ignition sparks (weak)			○	○					
	Ignition timing	○								
	Compression pressure (too low)						○			
FUEL SYSTEM	Canister (too much evaporation to intake)							○		
IGNITION SYSTEM	Ignition wires (ignition leaks)			○	○	○				
	Spark plugs (wet with fuel, improper gap)					○				
INTAKE SYSTEM	Throttle valve (not open enough)		○							

SERVICE PROCEDURE

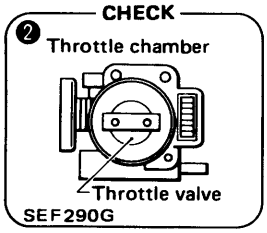
❶ CHECK — Timing light



Check ignition timing.

N.G. → Adjust ignition timing. [See page EF & EC-189.]

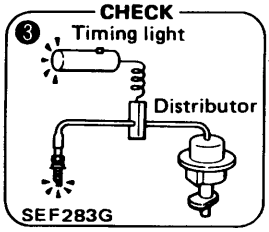
❷ CHECK — Throttle chamber



Check throttle valve for rough movement.

N.G. → Repair/replace the part.

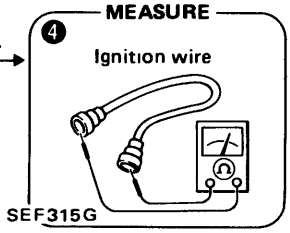
❸ CHECK — Timing light, Distributor



Check flashes of timing light for weakness.

N.G. →

❹ MEASURE — Ignition wire

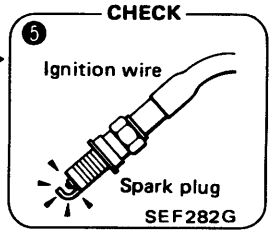


Measure resistance of ignition wires.

N.G. → Replace the wires.

O.K. →

❺ CHECK — Ignition wire, Spark plug



Remove spark plugs and check their ignition sparks.

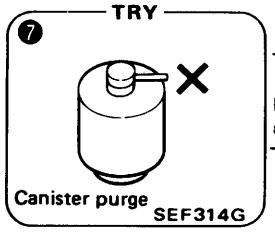
❻ MEASURE — COMPRESSION PRESSURE



Measure compression pressure.

Check cylinder head and gasket. [See EM section.]

❼ TRY — Canister purge

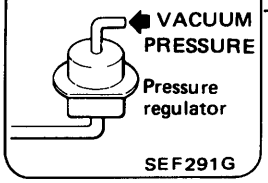


Shut evaporated fuel to intake valve and try to drive.

Improved → Replace the canister and/or the hoses.

No change

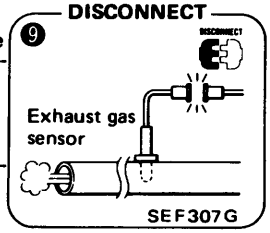
❽ APPLY — VACUUM PRESSURE, Pressure regulator



Apply vacuum pressure to pressure regulator after disconnecting vacuum hose, and try to drive.

Improved → Check mixture ratio feedback system. [See page EF & EC-189.]

❾ DISCONNECT — Exhaust gas sensor



Disconnect exhaust gas sensor connector and try to drive.

No change ← Check mixture ratio feedback system. [See page EF & EC-189.]

Improved → Replace the sensor.

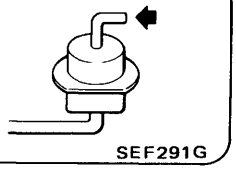
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 19 Engine stall – while idling

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼	❽	❾
SPECIFICATIONS	Mixture ratio (too rich/too lean)	○	○							
	Fuel pressure (low)	○	○							
	Ignition sparks (weak, missing)				○					
	Idle speed (low)			○						
FUEL SYSTEM	Fuel line (clogged)		○							
IGNITION SYSTEM	Spark plugs (wet with fuel, improper gap)					○	○			
INTAKE SYSTEM	Idle speed control valve (improper operation)			○				○		
CONTROL SYSTEM	Soft idle switch									○
	Neutral switch (remaining OFF)			○						
	A/C switch circuit (remaining OFF)							○	○	
	Load switches (remaining OFF)							○	○	

SERVICE PROCEDURE

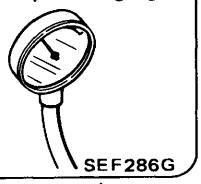
❶ REMOVE
Pressure regulator



Remove vacuum hose from pressure regulator, and check idling.

Improved →

❷ MEASURE
Fuel pressure gauge



Connect vacuum hose to pressure regulator and measure fuel pressure.

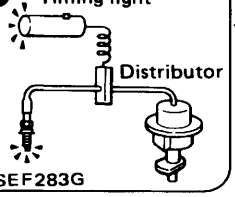
→ Check mixture ratio feedback system.
[See page EF & EC-189.]

❸ MEASURE
Tachometer



Measure idle speed.
↓ N.G.
Adjust idle speed.
[See page EF & EC-189.]

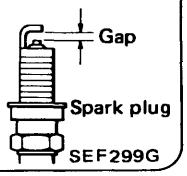
❹ CHECK
Timing light
Distributor



Check flashes of timing light for weakness.

N.G. →

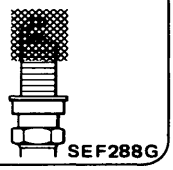
❺ CHECK
Gap
Spark plug



Remove spark plugs and check their gaps and tips.

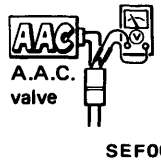
and/or

❻ CHECK
Spark plug



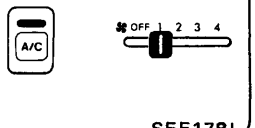
Check spark plugs for being foul or wet with fuel.

❼ CHECK
A.A.C. valve



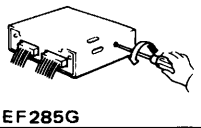
Check terminal voltages of A.A.C. valve.
↓ N.G.
Check the part and/or circuit.
[See page EF & EC-300.]

❽ CHECK



Check fast idle control
[See page EF & EC-318.]

❾ PERFORM
Self-diagnosis Mode IV



Perform self-diagnosis Mode IV (for soft idle switch).

N.G. → Check the throttle sensor circuit.
[See page EF & EC-280.]

Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 20 Engine stall – while accelerating

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼
SPECIFICATIONS	Mixture ratio					○	○	
	Ignition sparks (weak, missing)	○	○	○				
	Compression pressure (low)				○			
CONTROL SYSTEM	Crank angle sensor	○						○
	Air flow meter							○
	Exhaust gas sensor					○	○	

SERVICE PROCEDURE

❶ CHECK — Timing light, Distributor — SEF283G
Check flashes of timing light for weakness during acceleration.

N.G. → ❷ MEASURE — Ignition wire — SEF315G
Measure resistance of suspect wires.

N.G. → Replace the wires.

O.K. → ❸ CHECK — Ignition wire, Spark plug — SEF282G
Remove spark plugs and check their ignition sparks.

❹ MEASURE — COMPRESSION PRESSURE — SEF309G
Measure compression pressure.

N.G. → Check cylinder head and gasket. [See EM section.]

❺ CHECK — Self-diagnosis Mode II — 5 times or more/10 sec. — SEF373G
Check mixture ratio by flashes of inspection lamps.

N.G. → ❻ DISCONNECT — Exhaust gas sensor — SEF307G
Disconnect exhaust gas sensor connector, and try to drive.

Improved → Replace the sensor.

No change → Check mixture ratio feedback system. [See page EF & EC-189.]

❼ PERFORM — Self-diagnosis Mode V — SEF285G
Perform self-diagnosis Mode V (for crank angle sensor and air flow meter).

N.G. → Check the malfunctioning parts and/or circuits. [See page EF & EC-252 (crank angle sensor), page EF & EC-256 (air flow meter).]

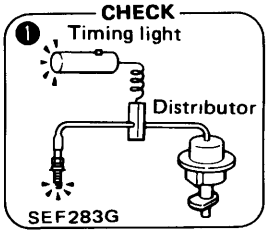
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 21 Engine stall — while cruising

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻
SPECIFICATIONS	Mixture ratio				○	○	
	Ignition sparks (weak, missing)	○	○	○			
CONTROL SYSTEM	Crank angle sensor						○
	Air flow meter						○

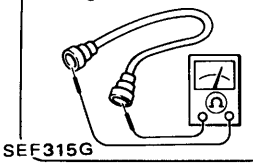
SERVICE PROCEDURE

❶ CHECK — Timing light



Check flashes of timing light for weakness at constant engine revolution. (1,000 - 2,000 rpm).

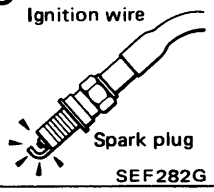
N.G. → ❷ MEASURE — Ignition wire



Measure resistance of suspect wires.

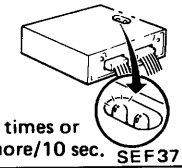
N.G. → Replace the wires.

O.K. → ❸ CHECK — Ignition wire



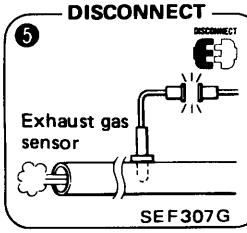
Remove spark plugs and check their ignition sparks.

❹ CHECK — Self-diagnosis Mode II



Check mixture ratio by flashes of inspection lamps.

N.G. → ❺ DISCONNECT

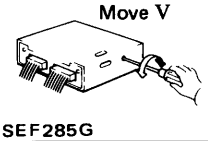


Disconnect exhaust gas sensor connector, and try to drive.

Improved → Replace the sensor.

No change → Check mixture ratio feedback system. [See page EF & EC-189.]

❻ PERFORM — Self-diagnosis Move V



Perform self-diagnosis Mode V (for air flow meter and crank angle sensor).

N.G. → Check the circuits. [See page EF & EC-252 (crank angle sensor), page EF & EC-256 (air flow meter).]

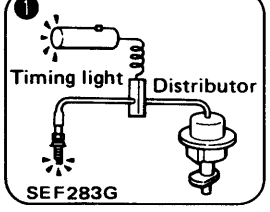
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 22 Engine stall – while decelerating/just after stopping

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻
SPECIFICATIONS	Mixture ratio					○	○
	Ignition sparks (missing)	○					
	Idle speed (too low)			○			
IGNITION SYSTEM	(missing)	○	○				
INTAKE SYSTEM	Idle speed control valve (remaining OFF)			○	○		
CONTROL SYSTEM	Exhaust gas sensor (malfunctioning feedback control)					○	○
	Crank angle sensor		○				
	Idle switch (remaining OFF)			○			
	Load switches (remaining OFF)			○	○		

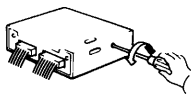
SERVICE PROCEDURE

❶ CHECK



Check flashes of timing light while decreasing engine speed.

N.G. → ❷ PERFORM



Perform self-diagnosis Mode V (for ignition signal and crank angle sensor).

N.G. → Check the malfunctioning parts and/or circuits. [See page EF & EC-264 (ignition signal), page EF & EC-252 (crank angle sensor).]

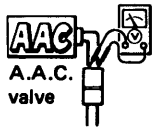
❸ MEASURE



Measure idle speed.

N.G. → Adjust idle speed. [See page EF & EC-189.]

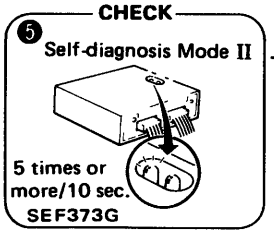
❹ CHECK



Check terminal voltage of A.A.C. valve.

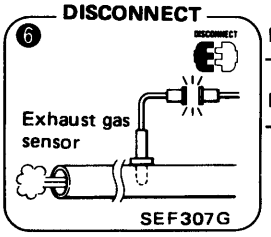
Left OFF → Check the circuit. [See page EF & EC-300.]

❺ CHECK



Check mixture ratio by flashes of inspection lamps.

N.G. → ❻ DISCONNECT



Disconnect exhaust gas sensor connector, and try to drive.

Improved → Replace the sensor.

No change → Check mixture ratio feedback system. [See page EF & EC-189.]

Diagnostic Table (Cont'd)

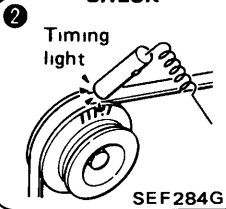
SYMPTOM & CONDITION 23 Engine stall – while loading

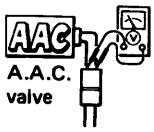
POSSIBLE CAUSES		❶	❷	❸	❹	❺
SPECIFICATIONS	Ignition timing		○			
	Idle speed (too low)	○				
INTAKE SYSTEM	Idle speed control valve (remaining OFF)	○		○		
CONTROL SYSTEM	Soft idle switch	○				○
	A/C switch circuit (remaining OFF)	○		○	○	
	Load switches (remaining OFF)	○		○	○	

SERVICE PROCEDURE

❶ MEASURE
Tachometer

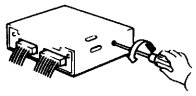
SEF316G
N.G. → Adjust idle speed. [See page EF & EC-189.]
Measure idle speed.

❷ CHECK
Timing light

SEF284G
N.G. → Adjust ignition timing. [See page EF & EC-189.]
Check ignition timing.

❸ CHECK

A.A.C. valve
SEF007H
N.G. → Check the part and/or circuit. [See page EF & EC-300.]
Check terminal voltage of A.A.C. valve.

❹ CHECK


SEF178I
Check fast idle control [See page EF & EC-318.]

❺ PERFORM
Self-diagnosis Mode IV

SEF285G
N.G. → Check the throttle sensor circuit. [See page EF & EC-280.]
Perform self-diagnosis Mode IV (for soft idle switch).

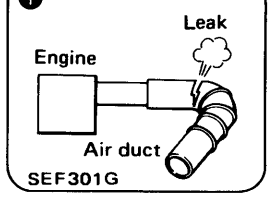
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 24 Backfire – through the intake

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼
SPECIFICATIONS	Mixture ratio (too lean)	○		○		○	○	
	Ignition timing (too retarded)		○					
FUEL SYSTEM	Injectors (clogged)				○			
INTAKE SYSTEM	Air duct (air leaks)	○						
	Intake manifold (gaskets) (air leaks)	○						
CONTROL SYSTEM	Air flow meter							○
	Exhaust gas sensor					○	○	

SERVICE PROCEDURE

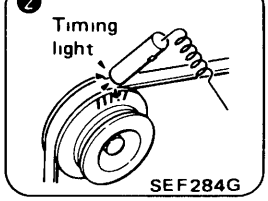
❶ CHECK



N.G. → Repair/replace the part.

Check intake system for air leaks.

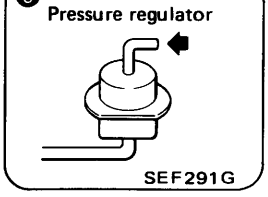
❷ CHECK



N.G. → Adjust ignition timing. [See page EF & EC-189.]

Check ignition timing.

❸ REMOVE



Improved → Check mixture ratio feedback system. [See page EF & EC-189.]

Remove vacuum hose from pressure regulator, and try to drive.

No change ↓

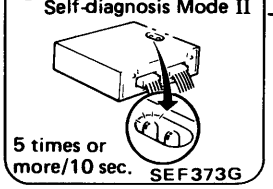
or

❹ CLEAN



Clean the injector.

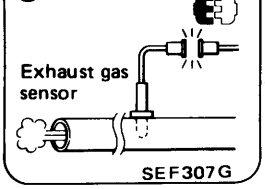
❺ PERFORM



N.G. →

Check mixture ratio by flashes of inspection lamps.

❻ DISCONNECT

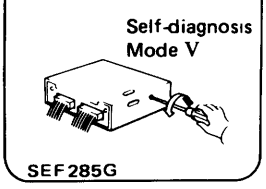


Disconnect exhaust gas sensor connector, and try to drive.

Improved → Replace the sensor.

No change → Check mixture ratio feedback system. [See page EF & EC-189.]

❼ CHECK



Perform self-diagnosis Mode V (for air flow meter).

N.G. ↓

Check the circuits. [See page EF & EC-256 (air flow meter).]

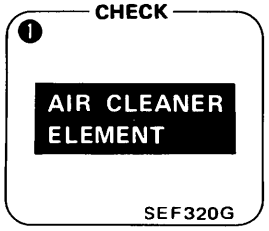
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 25 Backfire – through the exhaust

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻
SPECIFICATIONS	Mixture ratio (too rich)	○	○				
FUEL SYSTEM	Injectors (fuel leaks)		○				
IGNITION SYSTEM	(missing)				○		
INTAKE SYSTEM	Air cleaner element (clogged)	○					
	A.I.V. (always operating)					○	
	A.I.V. solenoid (remaining ON)					○	○
CONTROL SYSTEM	Soft idle switch			○			

SERVICE PROCEDURE

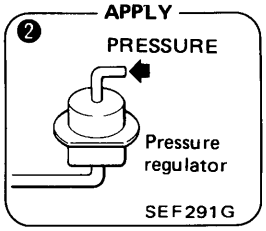
❶ CHECK



N.G. → Replace the element.

Check air cleaner element for clogging.

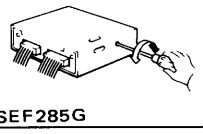
❷ APPLY PRESSURE



Improved → Check mixture ratio feedback system. [See page EF & EC-189.]

Apply pressure to pressure regulator after disconnecting vacuum hose, and try to drive.

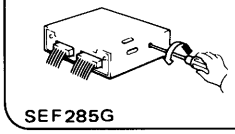
❸ PERFORM Self-diagnosis Mode IV



N.G. → Check throttle sensor and/or its circuit. [See page EF & EC-280.]

Perform self-diagnosis Mode IV (for soft idle switch).

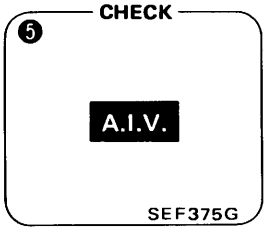
❹ PERFORM Self-diagnosis Mode V



N.G. → Check the malfunctioning part and/or circuit. [See page EF & EC-264 (ignition signal).]

Perform self-diagnosis Mode V (for ignition signal).

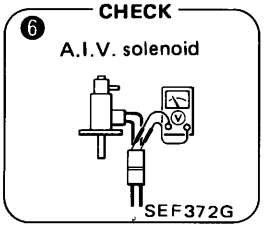
❺ CHECK



Keeps flowing →

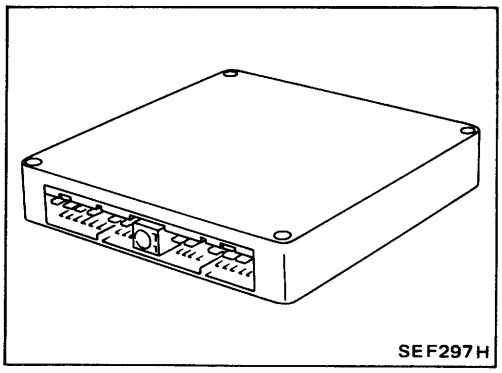
Check secondary air to exhaust system.

❻ CHECK A.I.V. solenoid



Left ON → Check the solenoid circuit. [See page EF & EC-268.]

Check terminal voltage of A.I.V. solenoid.


SEF297H

Self-diagnosis — Description

The self-diagnosis is useful to diagnose malfunctions in major sensors and actuators of the E.C.C.S. system. There are 5 modes in the self-diagnosis system.

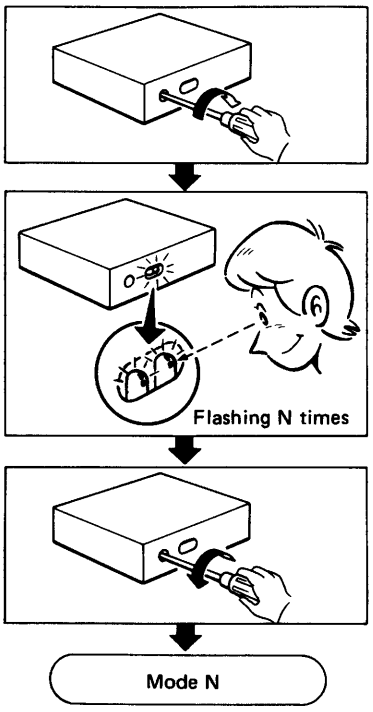
1. **Mode I (Exhaust gas sensor monitor)**
- During closed-loop operation:
  The green inspection lamp turns ON when a lean condition is detected and goes OFF under rich condition.
- During open-loop operation condition:
  The green inspection lamp remains OFF or ON.

2. **Mode II (Mixture ratio feedback control monitor)**
  The green inspection lamp function is the same as Mode I.
- During closed-loop operation:
  The red inspection lamp turns ON and OFF simultaneously with the green inspection lamp when the mixture ratio is controlled within the specified value.
- During open-loop operation:
  The red inspection lamp remains ON or OFF.

3. **Mode III (Self-diagnostic system)**
  In this mode the number of both green and red L.E.D.'s flashing indicates the group to which the malfunctioning part belongs.

4. **Mode IV (Switches ON/OFF diagnostic system)**
  During this mode, the inspection lamps monitor the switch ON-OFF condition.
- Soft idle switch
- Starter switch
- Vehicle speed sensor

5. **Mode V (Real-time diagnostic system)**
  The moment the malfunction is detected, the display will be presented immediately. That is, the condition at which the malfunction occurs can be found by observing the inspection lamps during driving test.

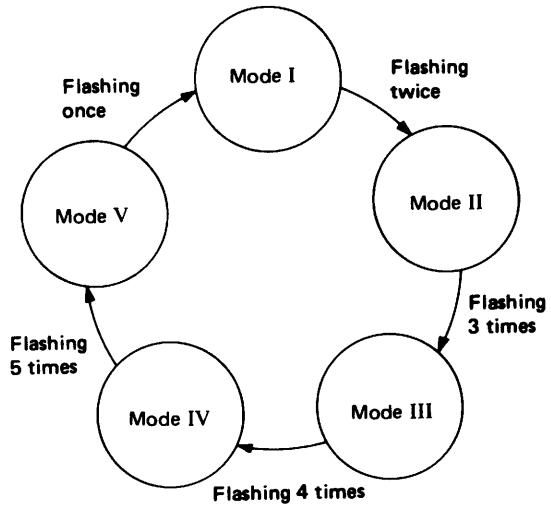


SEF288H

Self-diagnosis — Description (Cont'd)

HOW TO SWITCH THE DIAGNOSTIC MODES

1. Turn ignition switch "ON".
2. Turn diagnostic mode selector to E.C.U. (fully clockwise) and wait for inspection lamps to flash.
3. Count the number of flashes, and after the inspection lamps have flashed the number of the required mode, immediately turn diagnostic mode selector fully counterclockwise.



SEF989D

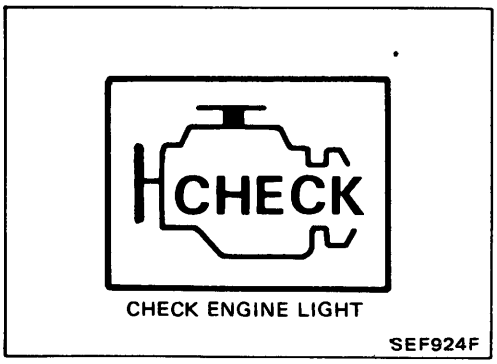
- **When the ignition switch is turned off during diagnosis in any mode and then turned on again (after power to the E.C.U. has dropped completely), the diagnosis will automatically return to Mode I.**

The stored memory will be lost if:

1. Battery terminal is disconnected.
2. After selecting Mode III, Mode IV is selected.
   However, if the diagnostic mode selector is kept turned fully clockwise, it will continue to change in the order of Mode I → II → III → IV → V → I ... etc., and in this state the stored memory will not be erased.

This unit serves as an idle rpm feedback control. When the diagnostic mode selector is turned within the "diagnostic mode OFF" range, a target engine speed can be selected. Mark the original position of the selector before conducting self-diagnosis. Upon completion of self-diagnosis, return the selector to the previous position. Otherwise, engine speed may change before and after conducting self-diagnosis.

Self-diagnosis — Description (Cont'd)



CHECK ENGINE LIGHT
SEF924F

CHECK ENGINE LIGHT (For California only)

This vehicle has a check engine light on the instrument panel. This light comes ON under the following conditions:

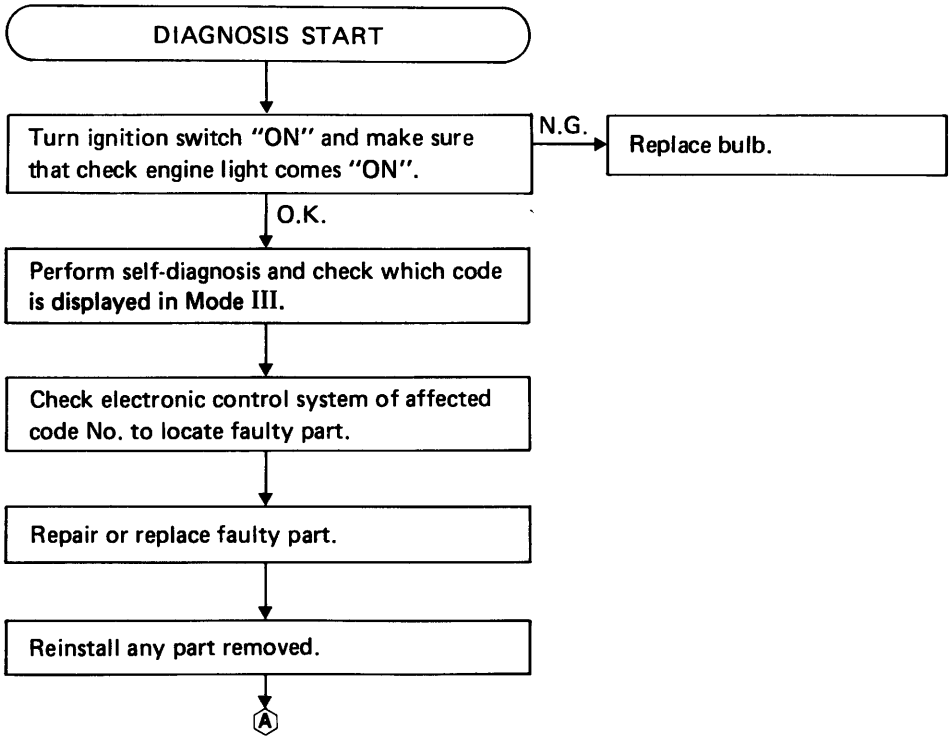
1) When ignition switch is turned "ON" (for bulb check).
2) When systems related to emission performance malfunction in Mode I (with engine running).

- **This check engine light always illuminates and is synchronous with red L.E.D.**
- **Malfunction systems related to emission performance can be detected by self-diagnosis, and they are clarified as self-diagnostic codes in Mode III.**

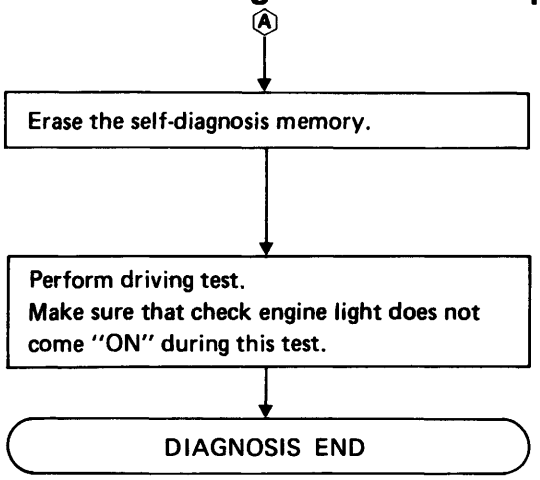
3) Check engine light will come "ON" only when malfunction is sensed.
   The check engine light will turn off when normal operation is resumed. Mode III memory must be cleared as the contents remain stored.

Code No.	Malfunction
12	Air flow meter circuit
13	Engine temperature sensor circuit
14	Vehicle speed sensor circuit
31	E.C.U. (E.C.C.S. control unit)
32	E.G.R. function
33	Exhaust gas sensor circuit
35	Exhaust gas temperature sensor circuit
43	Throttle sensor circuit
45	Injector leak

Use the following diagnostic flowchart to check and repair a malfunctioning system.



Self-diagnosis — Description (Cont'd)



- **Methods of erasing memories differ with systems. Read the manual before diagnosing systems.**
- **After repairs, test drive to check that check engine light does not come on.**
- **Test driving modes differ with systems. Read the manual before test driving.**

Self-diagnosis — Mode I (Exhaust gas sensor monitor)

This mode checks the exhaust gas sensor for proper functioning. The operation of the E.C.U. L.E.D. in this mode differs with mixture ratio control conditions as follows:

Mode	L.E.D.	Engine stopped (Ignition switch "ON")	Engine running	
			Open loop condition	Closed loop condition
Mode I (Monitor A)	Green	ON	*Remains ON or OFF	Blinks
	Red	ON	Except for California model • OFF	For California model • ON: when the CHECK ENGINE LIGHT ITEMS are stored in the E.C.U. • OFF: except for the above condition

*: Maintains conditions just before switching to open loop

EXHAUST GAS SENSOR FUNCTION CHECK

If the number of L.E.D. blinks is less than that specified, replace the exhaust gas sensor.
If the L.E.D. does not blink, check exhaust gas sensor circuit.

EXHAUST GAS SENSOR CIRCUIT CHECK

See page EF & EC-274.

Self-diagnosis — Mode II (Mixture ratio feedback control monitor)

This mode checks, through the E.C.U. L.E.D., optimum control of the mixture ratio. The operation of the L.E.D., as shown below, differs with the control conditions of the mixture ratio (for example, richer or leaner mixture ratios, etc., which are controlled by the E.C.U.).

Mode	L.E.D.	Engine stopped (Ignition switch "ON")	Engine running			
			Open loop condition	Closed loop condition		
Mode II (Monitor B)	Green	ON	*Remains ON or OFF	Blinks		
	Red	OFF	*Remains ON or OFF (synchronous with green L.E.D.)	Compensating mixture ratio		
				More than 5% rich	Between 5% lean and 5% rich	More than 5% lean
				OFF	Synchronized with green L.E.D.	Remains ON

*: Maintains conditions just before switching to open loop

If the red L.E.D. remains on or off during the closed-loop operation, the mixture ratio may not be controlled properly. Using the following procedures, check the related components or adjust the mixture ratio.

COMPONENT CHECK OR MIXTURE RATIO ADJUSTMENT

See page EF & EC-189.

Self-diagnosis — Mode III (Self-diagnostic system)

The E.C.U. constantly monitors the function of these sensors and actuators, regardless of ignition key position. If a malfunction occurs, the information is stored in the E.C.U. and can be retrieved from the memory by turning on the diagnostic mode selector, located on the side of the E.C.U. When activated, the malfunction is indicated by flashing a red and a green L.E.D. (Light Emitting Diode), also located on the E.C.U. Since all the self-diagnostic results are stored in the E.C.U.'s memory even intermittent malfunctions can be diagnosed.

A malfunction is indicated by the number of both red and green flashing L.E.D.s. First, the red L.E.D. flashes and the green flashes follow. The red L.E.D. corresponds to units of ten and the green L.E.D. corresponds to units of one. For example, when the red L.E.D. flashes once and the green L.E.D. flashes twice, this signifies the number "12", showing that the air flow meter signal is malfunctioning. All problems are classified by code numbers in this way.

- **When the engine fails to start, crank it two or more seconds before beginning self-diagnosis.**
- **Before starting self-diagnosis, do not erase the stored memory before beginning self-diagnosis. If it is erased, the self-diagnosis function for intermittent malfunctions will be lost.**

DISPLAY CODE TABLE

Code No.	Detected items	California	Non-California
11	Crank angle sensor circuit	X	X
12	Air flow meter circuit	X	X
13	Engine temperature sensor circuit	X	X
14	Vehicle speed sensor circuit	X	X
21	Ignition signal missing in primary coil	X	X
31	E.C.U. (E.C.C.S. control unit)	X	X
32	E.G.R. function	X	–
33	Exhaust gas sensor circuit	X	X
35	Exhaust gas temperature sensor circuit	X	–
41	Air temperature sensor circuit	X	X
43	Throttle sensor circuit	X	X
45	Injector leak	X	–
55	No malfunction in the above circuits	X	X

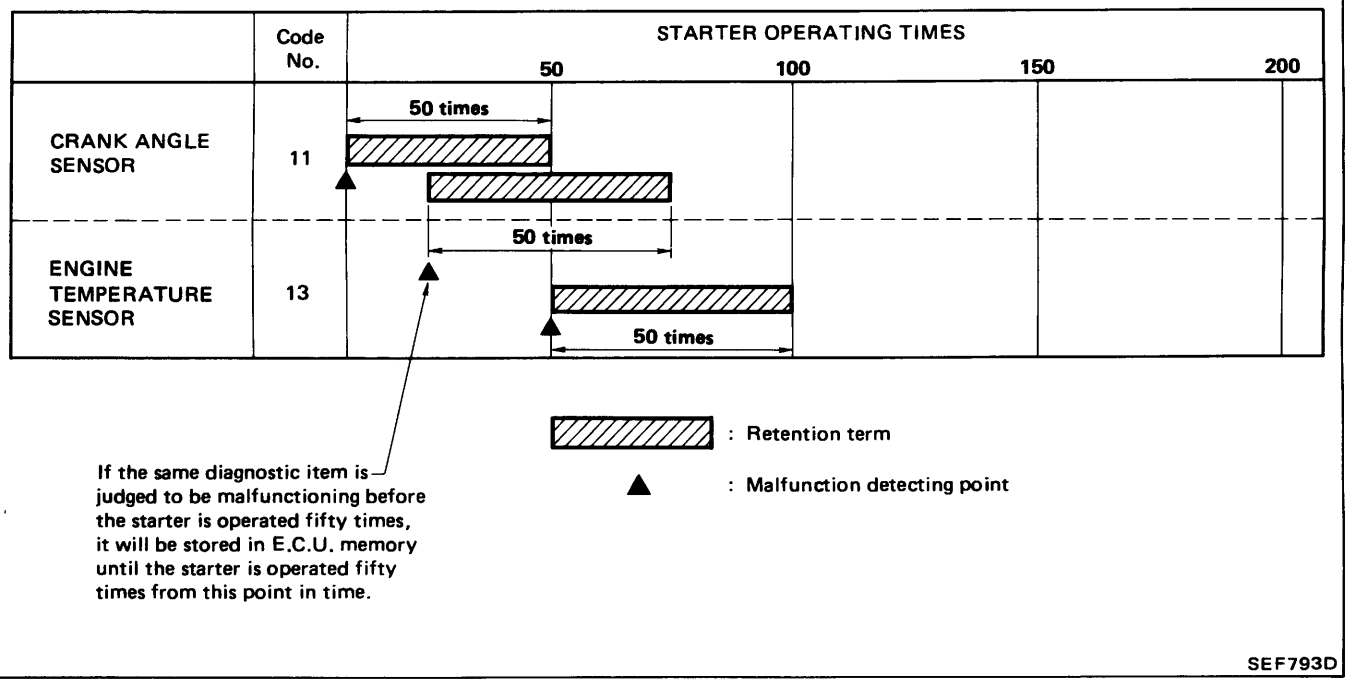
X: Available —: Not available

Self-diagnosis — Mode III (Self-diagnostic system) (Cont'd)

RETENTION OF DIAGNOSTIC RESULTS

The diagnostic results will remain in E.C.U. memory until the starter is operated fifty times after a diagnostic item has been judged to be malfunctioning. The diagnostic result will then be cancelled automatically. If a diagnostic item which has been judged to be malfunctioning and stored in memory is again judged to be malfunctioning before the starter is operated fifty times, the second result will replace the previous one. It will be stored in E.C.U. memory until the starter is operated fifty times more.

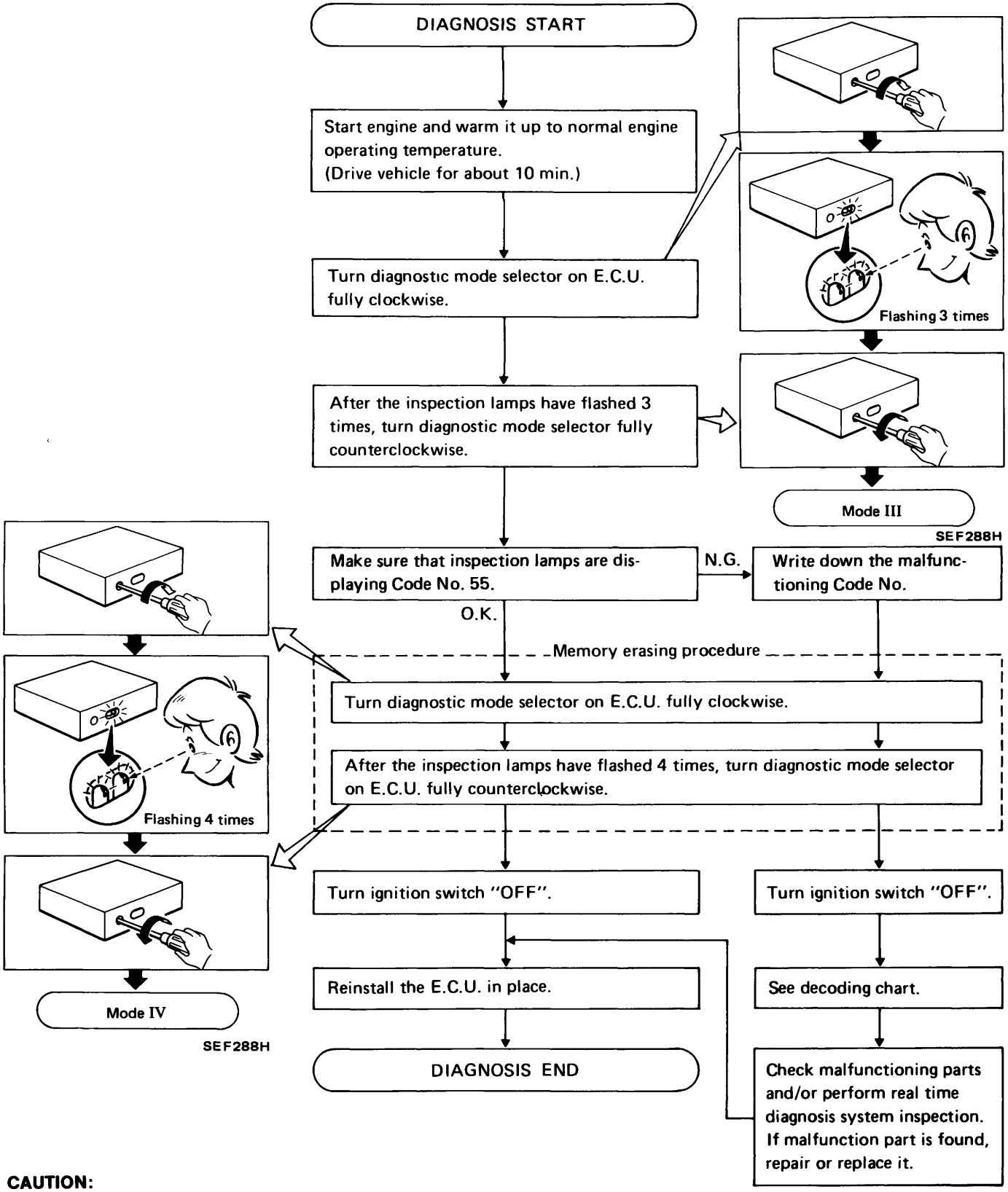
RETENTION TERM CHART (Example)



SEF793D

Self-diagnosis — Mode III (Self-diagnostic system) (Cont'd)

SELF-DIAGNOSTIC PROCEDURE

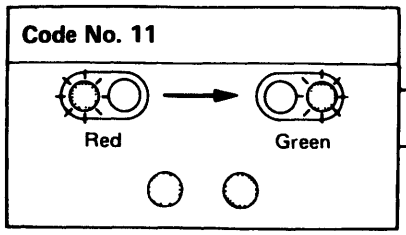
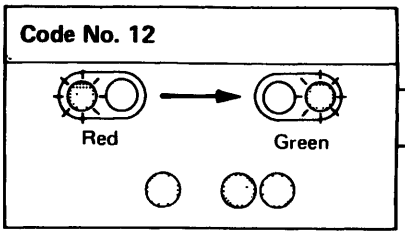
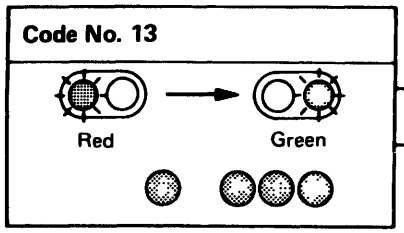
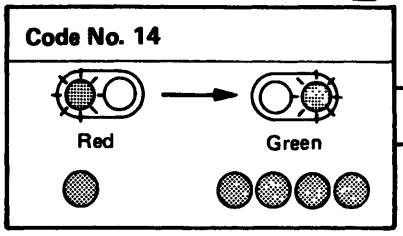


CAUTION:

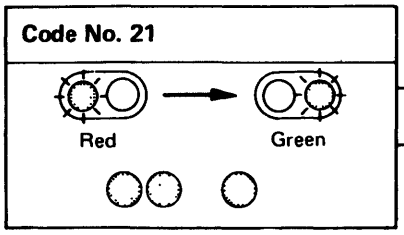
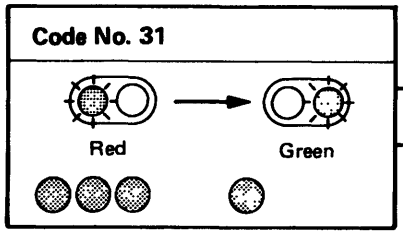
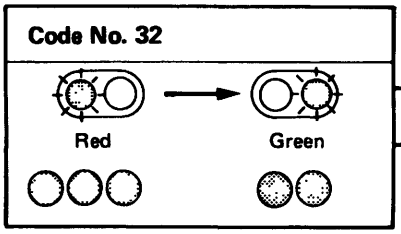
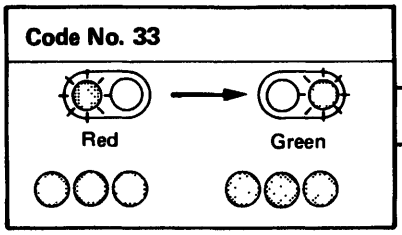
- **During display of a code number in self-diagnosis mode (Mode III), if another diagnostic mode is to be performed, be sure to note the malfunction code number before turning diagnostic mode selector on E.C.U. fully clockwise. When selecting an alternative, select the diagnosis mode after turning switch "OFF". Otherwise, self-diagnosis information in the E.C.U. memory will be lost.**
  Return the DIAGNOSTIC MODE selector to the previous position.

Self-diagnosis — Mode III (Self-diagnostic system) (Cont'd)

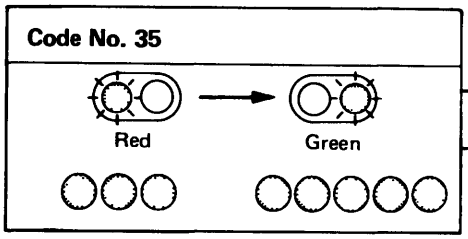
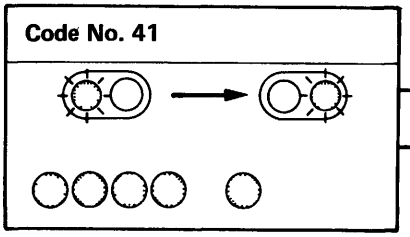
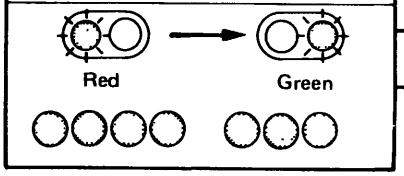
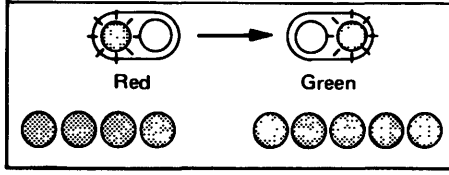
DECODING CHART

DISPLAY CODE	MALFUNCTIONING CIRCUIT OR PARTS	CONTROL UNIT SHOWS A MALFUNCTION SIGNAL WHEN THE FOLLOWING CONDITIONS ARE DETECTED.
CRANK ANGLE SENSOR **Code No. 11** 	Crank angle sensor circuit	• Either 1° or 180° signal is not entered for the first few seconds during engine cranking. • Either 1° or 180° signal is not input often enough while the engine speed is higher than the specified rpm. SYSTEM INSPECTION See page EF & EC-252.
SEF042F		
AIR FLOW METER (CHECK) **Code No. 12** 	Air flow meter circuit	• The air flow meter circuit is open or shorted. (An abnormally high or low voltage is entered.) SYSTEM INSPECTION See page EF & EC-256.
SEF043F		
ENGINE TEMPERATURE SENSOR (CHECK) **Code No. 13** 	Engine temperature sensor circuit	• The engine temperature sensor circuit is open or shorted. (An abnormally high or low output voltage is entered.) SYSTEM INSPECTION See page EF & EC-260.
SEF044F		
VEHICLE SPEED SENSOR (CHECK) **Code No. 14** 	Vehicle speed sensor circuit	• Signal circuit is open. SYSTEM INSPECTION See page EF & EC-262.
SEF074G		

Self-diagnosis — Mode III (Self-diagnostic system) (Cont'd)

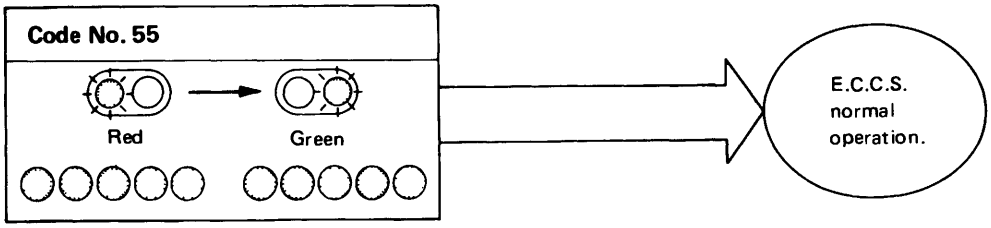
DISPLAY CODE	MALFUNCTIONING CIRCUIT OR PARTS	CONTROL UNIT SHOWS A MALFUNCTION SIGNAL WHEN THE FOLLOWING CONDITIONS ARE DETECTED.
IGNITION SIGNAL Code No. 21 	Ignition signal circuit	• The ignition signal in primary circuit does not enter to E.C.U. during engine cranking or running. SYSTEM INSPECTION See page EF & EC-264.
SEF045F		
E.C.U. (E.C.C.S. control unit) CHECK Code No. 31 	E.C.U. calculation function	• Signal is beyond "normal" range. SYSTEM INSPECTION See page EF & EC-267.
SEF076G		
E.G.R. function CHECK Code No. 32 	E.G.R. function	• E.G.R. valve does not operate. (E.G.R. valve spring does not lift.) SYSTEM INSPECTION See page EF & EC-268.
SEF077G		
EXHAUST GAS SENSOR CHECK Code No. 33 	Exhaust gas sensor circuit	• Signal circuit is open. SYSTEM INSPECTION See page EF & EC-274.
SEF078G		

Self-diagnosis — Mode III (Self-diagnostic system) (Cont'd)

DISPLAY CODE	MALFUNCTIONING CIRCUIT OR PARTS	CONTROL UNIT SHOWS A MALFUNCTION SIGNAL WHEN THE FOLLOWING CONDITIONS ARE DETECTED.
EXHAUST GAS TEMPERATURE SENSOR (CHECK)		
Code No. 35 	Exhaust gas temperature sensor circuit	• Signal circuit is open. SYSTEM INSPECTION See page EF & EC-276.
		SEF393G
AIR TEMPERATURE SENSOR		
Code No. 41 	Air temperature sensor circuit	• Signal circuit is open or shorted. (Output voltage is too high or too low.) SYSTEM INSPECTION See page EF & EC-278.
		SEF232I
THROTTLE SENSOR (CHECK)		
Code No. 43 	Throttle sensor circuit	• Throttle sensor circuit is open or short. (Output voltage is too high or too low.) SYSTEM INSPECTION See page EF & EC-280.
		SEF079G
INJECTOR LEAK (CHECK)		
Code No. 45 	Injector leak	• Fuel leak from injector. SYSTEM INSPECTION See page EF & EC-283.
		SEF080G

Self-diagnosis — Mode III (Self-diagnostic system) (Cont'd)

DISPLAY CODE	MALFUNCTIONING CIRCUIT OR PARTS	CONTROL UNIT SHOWS A MALFUNCTION SIGNAL WHEN THE FOLLOWING CONDITIONS ARE DETECTED.



SEF984F

Self-diagnosis — Mode IV (Switches ON/OFF diagnostic system)

In switches ON/OFF diagnosis system, ON/OFF operation of the following switches can be detected continuously.

- Soft idle switch
- Starter switch
- Vehicle speed sensor

(1) Soft idle switch & Starter switch

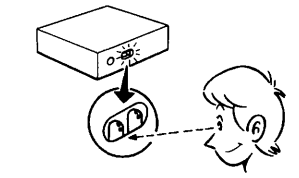
The switches ON/OFF status in mode Ⅳ is stored in E.C.U. memory. When either switch is turned from "ON" to "OFF" or "OFF" to "ON", the red L.E.D. on E.C.U. alternately comes on and goes off each time switching is performed.

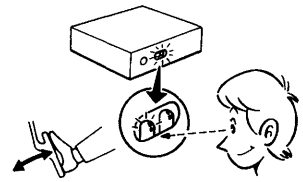
(2) Vehicle Speed Sensor

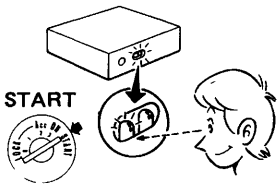
The switches ON/OFF status in mode IV is selected is stored in E.C.U. memory. The green L.E.D. on E.C.U. remains off when vehicle speed is 20 km/h (12 MPH) or below, and comes ON at higher speeds.

Self-diagnosis — Mode IV (Switches ON/OFF diagnostic system) (Cont'd)

SELF-DIAGNOSTIC PROCEDURE


SEF451H


Accelerator pedal
SEF298H


START
SEF299H

DIAGNOSIS START

Turn ignition switch "ON".

Turn diagnostic mode selector on E.C.U. fully clockwise.

After the inspection lamps have flashed 4 times, turn diagnostic mode selector fully counterclockwise.

Make sure that a red inspection lamp goes "OFF".

Make sure that a red inspection lamp goes "ON" when depressing accelerator pedal.
N.G. → Check throttle sensor circuit.
O.K.

Make sure that a red inspection lamp goes "ON" during turning ignition switch "START"*.
N.G. → Check starter signal circuit.
O.K.

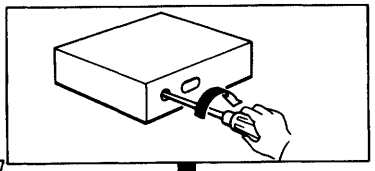
Lift the front of the vehicle.

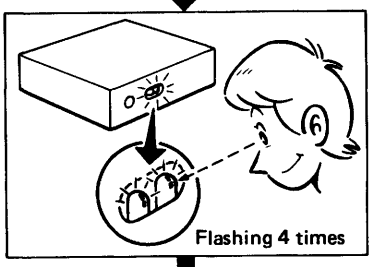
Drive vehicle. Make sure that a green inspection lamp goes "ON" when vehicle speed is 20 km/h (12 MPH) or faster.
N.G. → Check vehicle speed sensor circuit.
O.K.

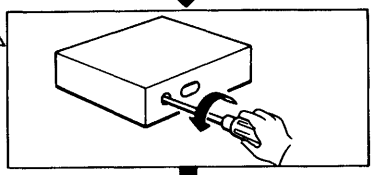
Turn ignition switch "OFF".

Reinstall the E.C.U. in place.

DIAGNOSIS END







Mode IV
SEF288H

CAUTION:

- **For safety, do not drive rear wheels at higher speed than required.**

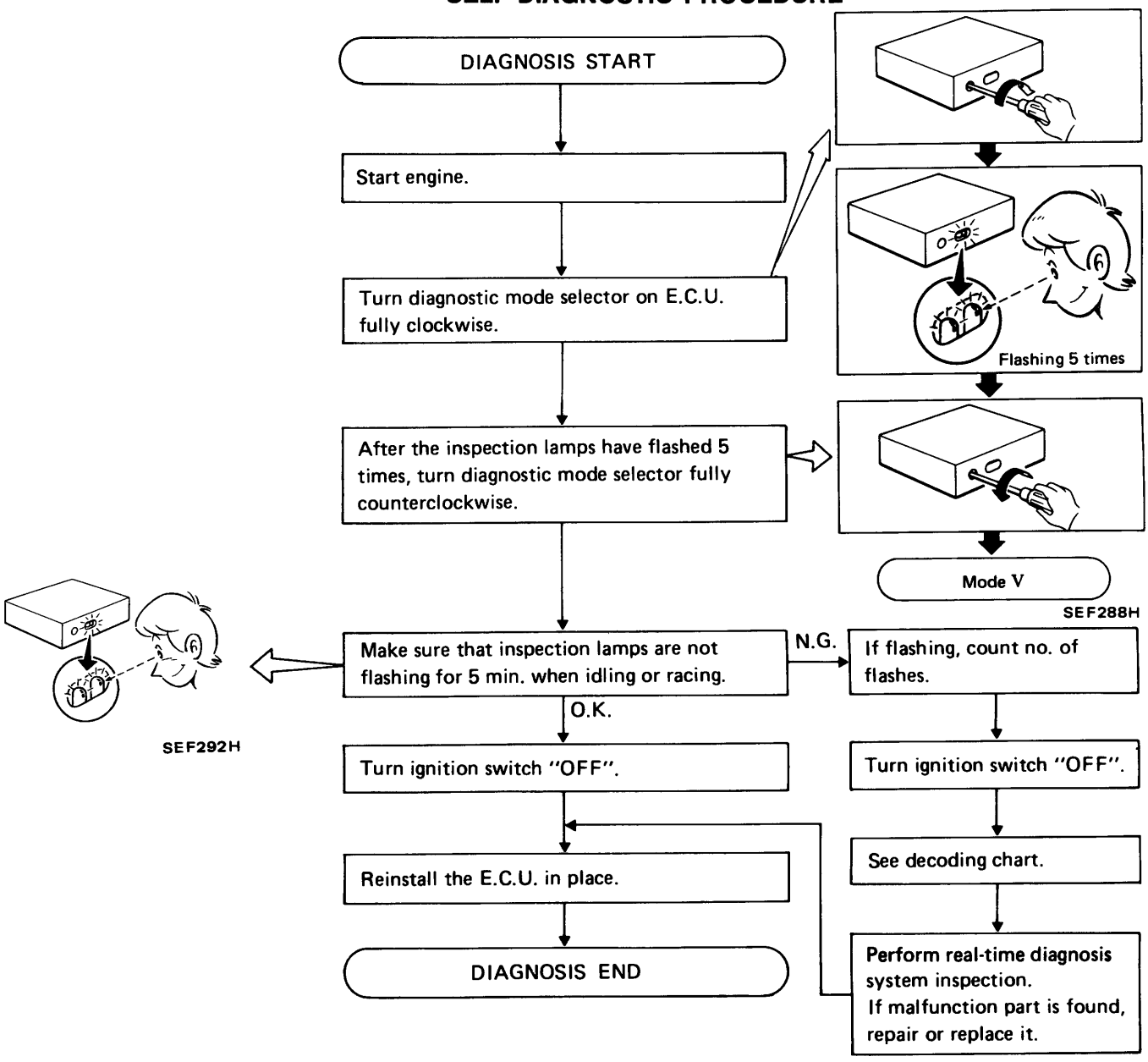
Self-diagnosis — Mode V (Real-time diagnostic system)

In real-time diagnosis, if the following items are judged to be working incorrectly, a malfunction will be indicated immediately.

- Crank angle sensor (180° signal & 1° signal) output signal
- Ignition signal
- Air flow meter output signal

Consequently, this diagnosis very effectively determines whether the above systems cause the malfunction, during driving test. Compared with self-diagnosis, real-time diagnosis is very sensitive and can detect malfunctions instantly. However, items regarded as malfunctions in this diagnosis are not stored in E.C.U. memory.

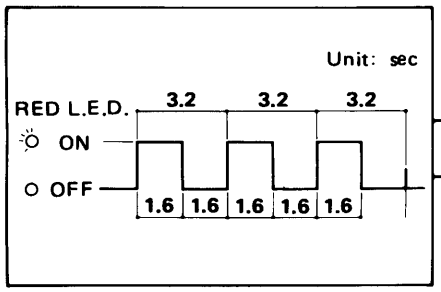
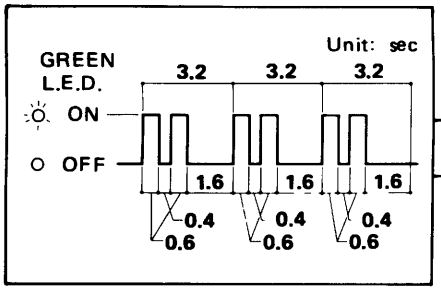
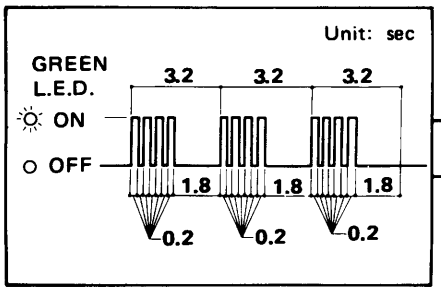
SELF-DIAGNOSTIC PROCEDURE



CAUTION:
In real-time diagnosis, pay attention to inspection lamp flashing. E.C.U. displays the malfunction code only once and does not memorize the inspection.

Self-diagnosis — Mode V (Real-time diagnostic system) (Cont'd)

DECODING CHART

DISPLAY CODE	MALFUNCTIONING CIRCUIT OR PARTS	CONTROL UNIT SHOWS A MALFUNCTION SIGNAL WHEN THE FOLLOWING CONDITIONS ARE DETECTED. (Compare with Self-diagnosis — Mode III.)
CRANK ANGLE SENSOR 	Malfunction of crank angle sensor circuit	• The 1° or 180° signal is momentarily missing, or, multiple, momentary noise signals enter. REAL-TIME DIAGNOSTIC INSPECTION See page EF & EC-252.
SEF047F		
AIR FLOW METER 	Malfunction of air flow meter circuit	• Abnormal, momentary increase in air flow meter output signal REAL-TIME DIAGNOSTIC INSPECTION See page EF & EC-256.
SEF048F		
IGNITION SIGNAL 	Malfunction of ignition signal	• Signal from the primary ignition coil momentarily drops off. REAL-TIME DIAGNOSTIC INSPECTION See page EF & EC-264.
SEF049F		

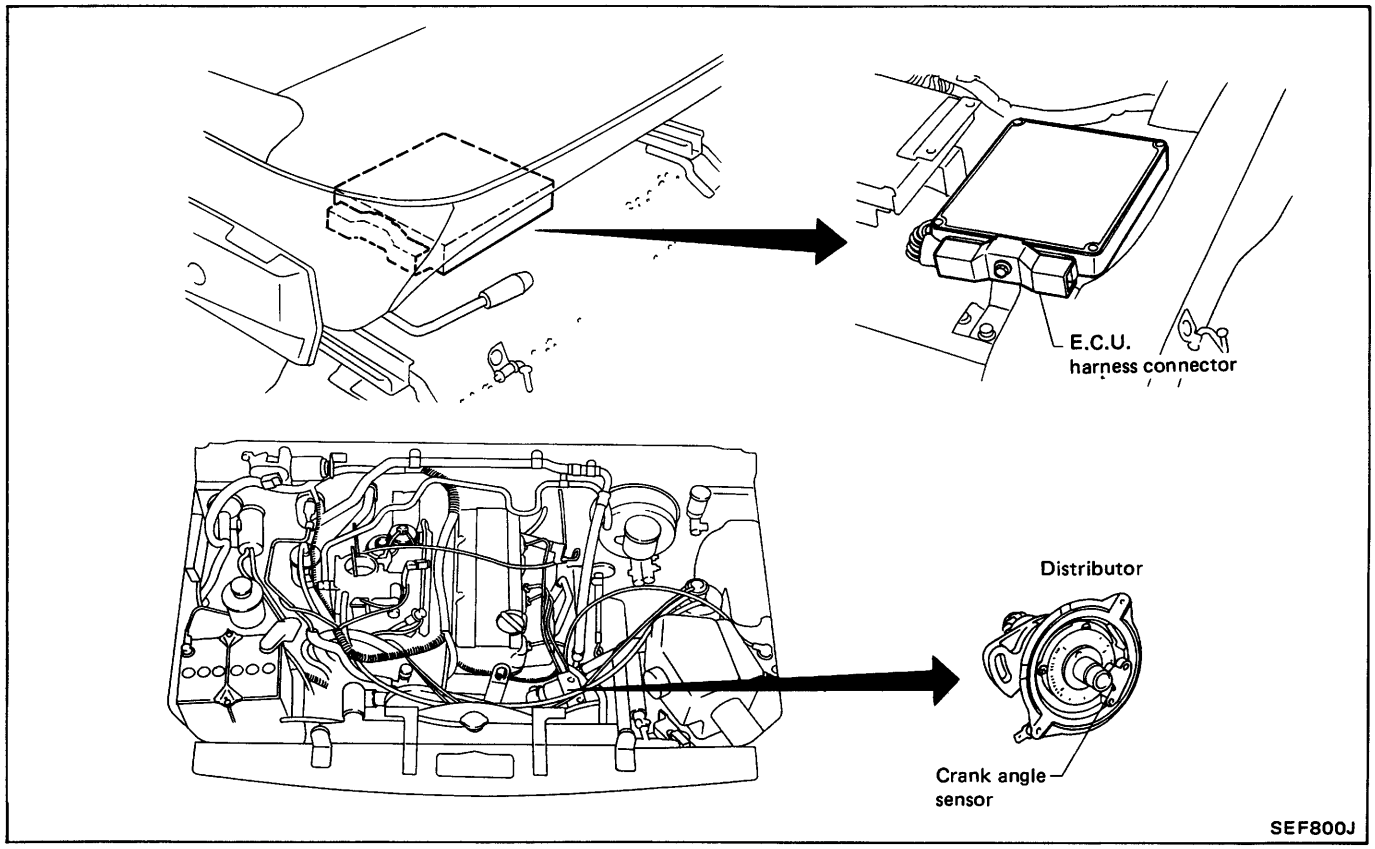
Self-diagnosis — Mode V (Real-time diagnostic system) (Cont'd)

Crank Angle Sensor

REAL-TIME DIAGNOSTIC INSPECTION

X: Available
—: Not available

Check sequence	Check items	Check conditions	Check parts			If malfunction, perform the following items.
			Middle connectors	Sensor & actuator	E.C.U. harness connector	
1	Tap harness connector or component during real-time diagnosis.	During real-time diagnosis	X	X	X	Go to check item 2.
2	Check harness continuity at connector.	Engine stopped	X	—	—	Go to check item 3.
3	Disconnect harness connector, and then check dust adhesion to harness connector.	Engine stopped	X	—	X	Clean terminal surface.
4	Check pin terminal bend.	Engine stopped	—	—	X	Take out bend.
5	Reconnect harness connector and then recheck harness continuity at connector.	Engine stopped	X	—	—	Replace terminal.
6	Tap harness connector or component during real-time diagnosis.	During real-time diagnosis	X	X	X	If malfunction codes are displayed during real-time diagnosis, replace terminal.

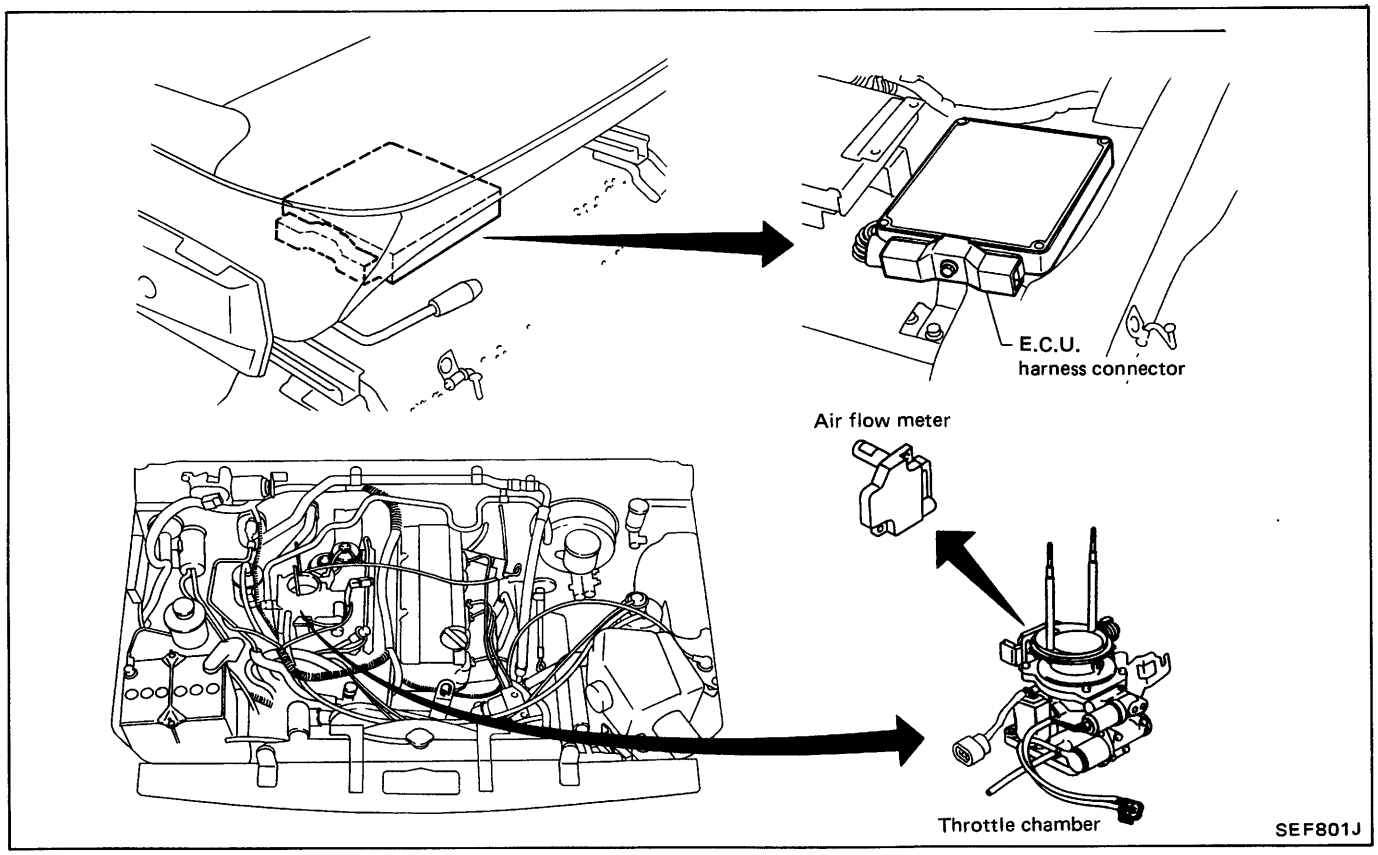


Self-diagnosis — Mode V (Real-time diagnostic system) (Cont'd)

Air Flow Meter

X: Available
—: Not available

Check sequence	Check items	Check conditions	Check parts			If malfunction, perform the following items.
			Middle connectors	Sensor & actuator	E.C.U. harness connector	
1	Tap harness connector or component during real-time diagnosis.	During real-time diagnosis	X	X	X	Go to check item 2.
2	Check harness continuity at connector.	Engine stopped	X	—	—	Go to check item 3.
3	Disconnect harness connector, and then check dust adhesion to harness connector.	Engine stopped	X	—	X	Clean terminal surface.
4	Check pin terminal bend.	Engine stopped	—	—	X	Take out bend.
5	Reconnect harness connector and then recheck harness continuity at connector.	Engine stopped	X	—	—	Replace terminal.
6	Tap harness connector or component during real-time diagnosis.	During real-time diagnosis	X	X	X	If malfunction codes are displayed during real-time diagnosis, replace terminal.

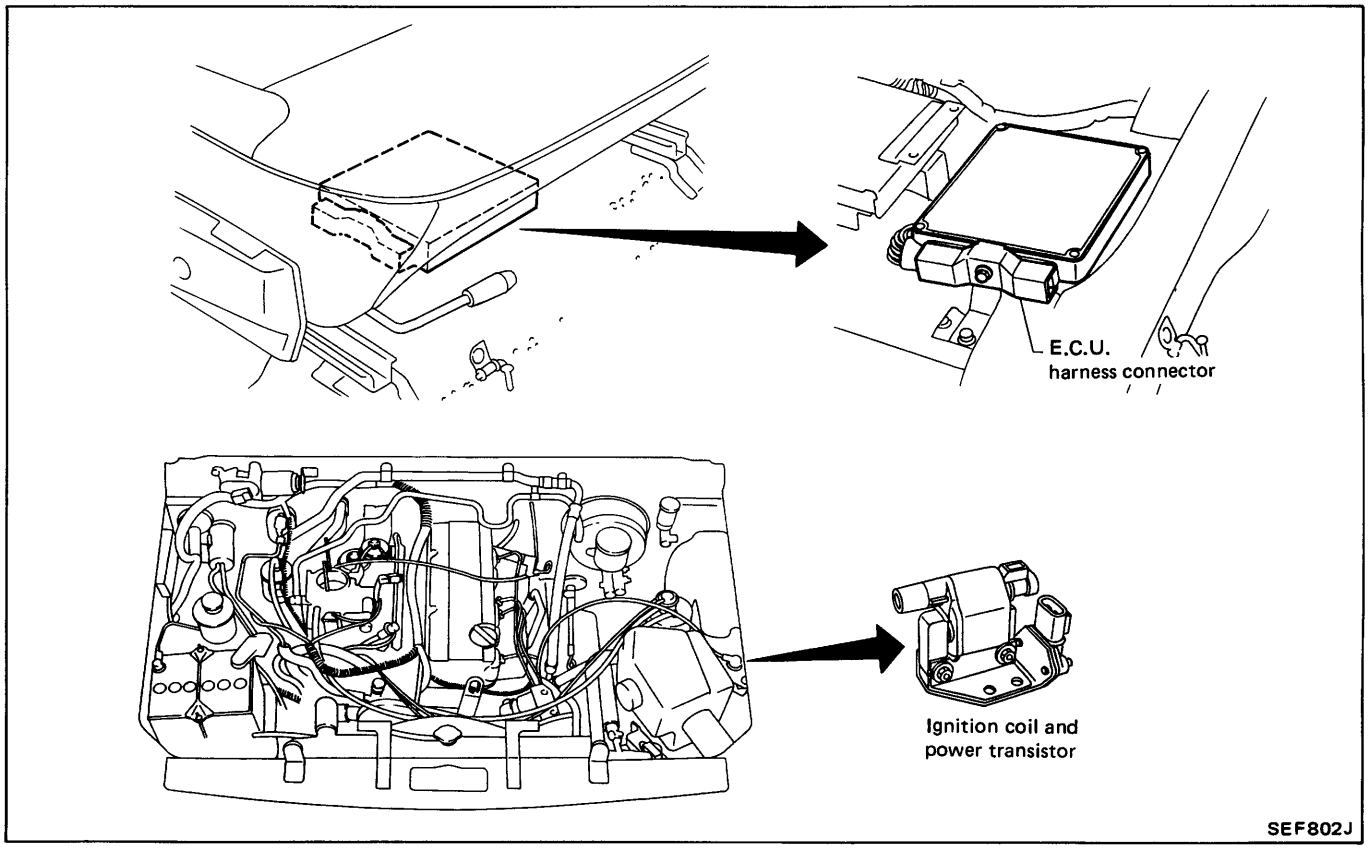


Self-diagnosis — Mode V (Real-time diagnostic system) (Cont'd)

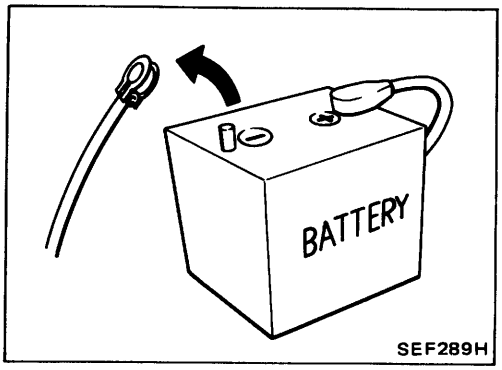
Ignition Signal

X: Available
—: Not available

Check sequence	Check items	Check conditions	Check parts			If malfunction, perform the following items.
			Middle connectors	Sensor & actuator	E.C.U. harness connector	
1	Tap harness connector or component during real-time diagnosis.	During real-time diagnosis	X	X	X	Go to check item 2.
2	Check harness continuity at connector.	Engine stopped	X	—	—	Go to check item 3.
3	Disconnect harness connector, and then check dust adhesion to harness connector.	Engine stopped	X	—	X	Clean terminal surface.
4	Check pin terminal bend.	Engine stopped	—	—	X	Take out bend.
5	Reconnect harness connector and then recheck harness continuity at connector.	Engine stopped	X	—	—	Replace terminal.
6	Tap harness connector or component during real-time diagnosis.	During real-time diagnosis	X	X	X	If malfunction codes are displayed during real-time diagnosis, replace terminal.



NOTE

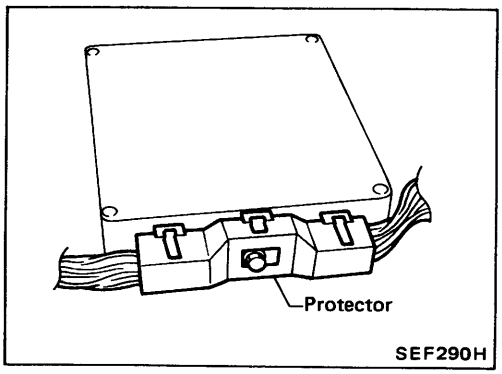


SEF289H

Diagnostic Procedure

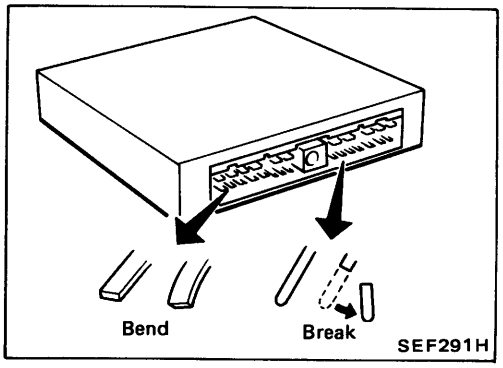
CAUTION:

1. **Before connecting or disconnecting the E.C.U. harness connector to or from any E.C.U., be sure to turn the ignition switch to the "OFF" position and disconnect the negative battery terminal in order not to damage E.C.U. as battery voltage is applied to E.C.U. even if ignition switch is turned off. Failure to do so may damage the E.C.U.**



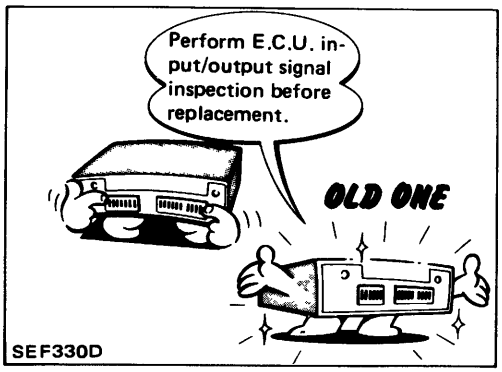
SEF290H

2. **When performing E.C.U. input/output signal inspection, remove connector protector to insert tester probe into connector.**



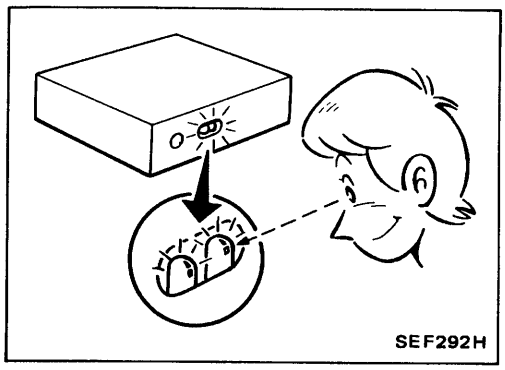
SEF291H

3. **When connecting or disconnecting pin connectors into or from E.C.U., take care not to damage pin terminals.**
4. **Make sure that there are not any bends or breaks on E.C.U. pin terminal, when connecting pin connectors.**



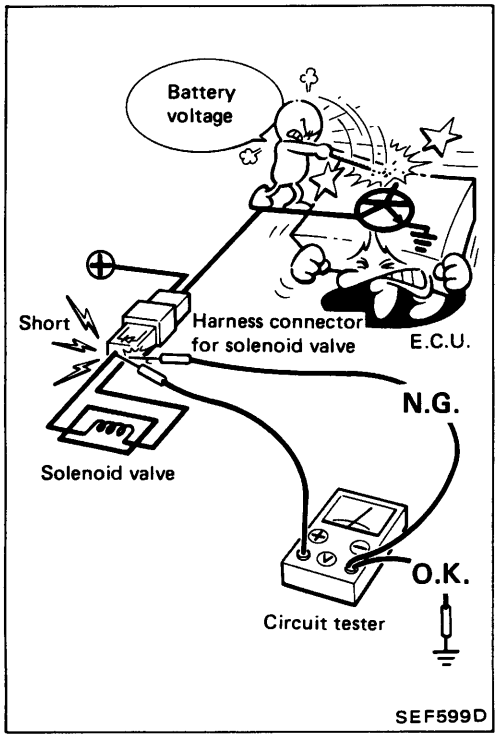
SEF330D

5. **Before replacing E.C.U., perform E.C.U. input/output signal inspection and make sure whether the E.C.U. unit functions properly or not. (See page EF & EC-310.)**


SEF292H

6. **After performing this "Diagnostic Procedure", perform E.C.C.S. self-diagnosis and driving test.**

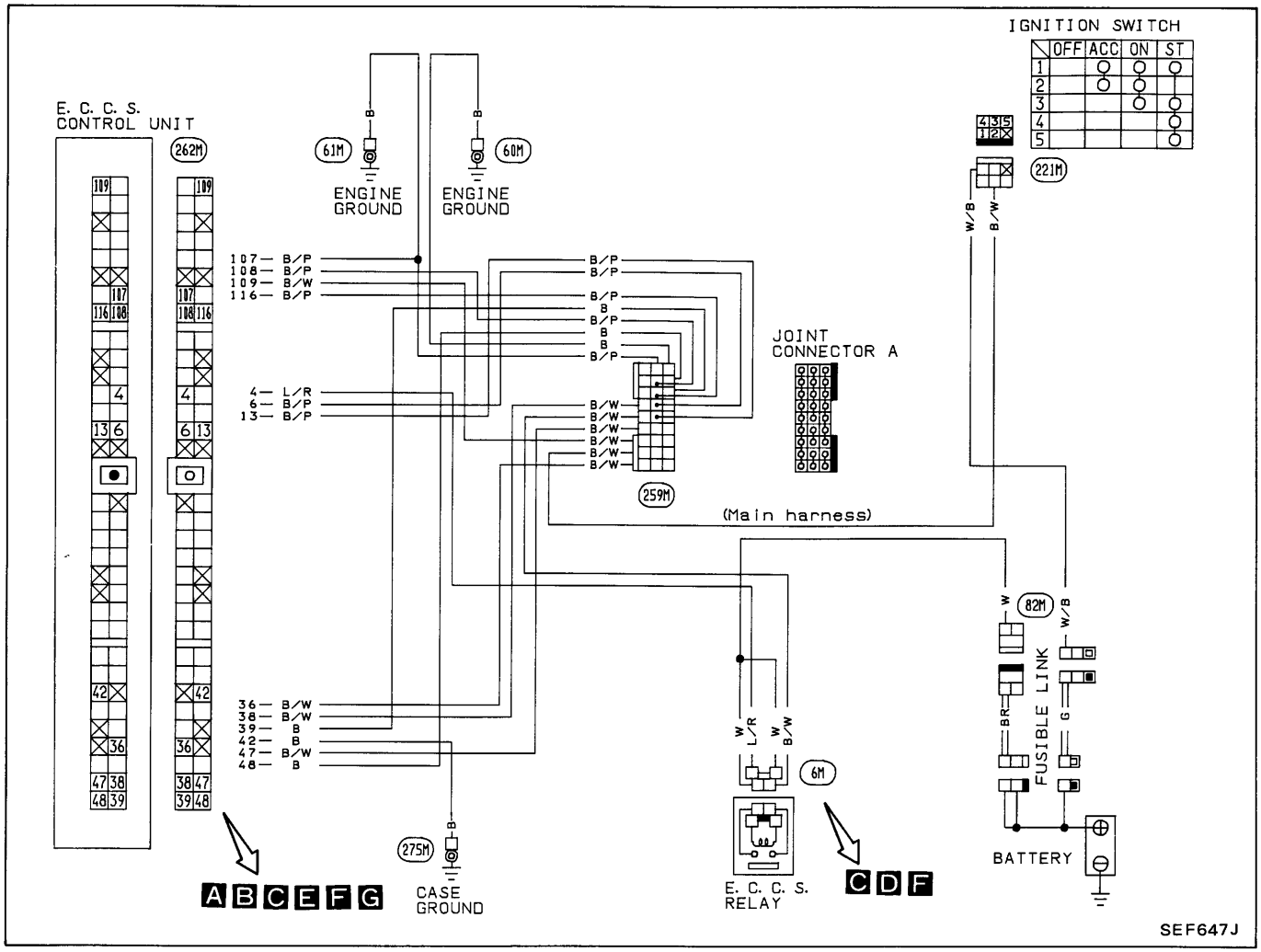
Diagnostic Procedure (Cont'd)



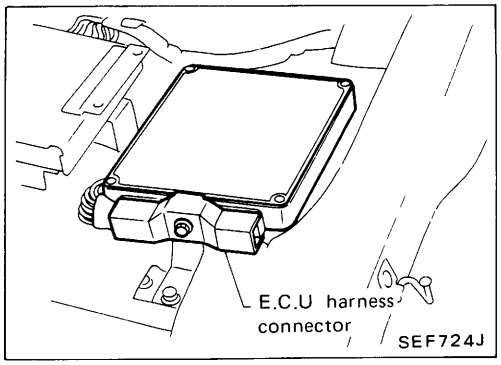
7. **When measuring E.C.U. controlled components supply voltage with a circuit tester, separate one tester probe from the other.**
   If the two tester probes accidentally make contact with each other during measurement, the circuit will be shorted, resulting in damage to the control unit power transistor.

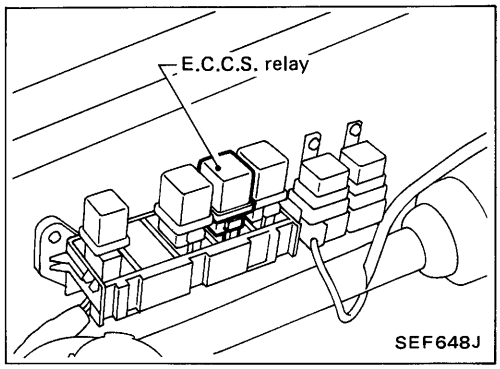
Diagnostic Procedure 1

MAIN POWER SUPPLY AND GROUND CIRCUIT (Not self-diagnostic item)

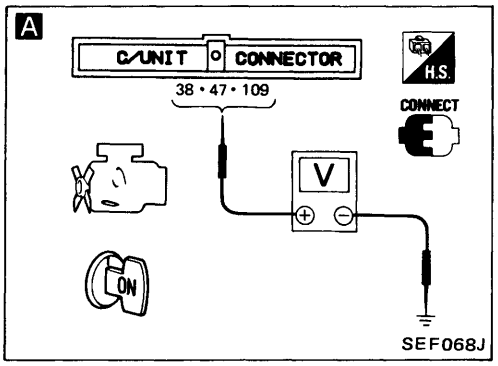


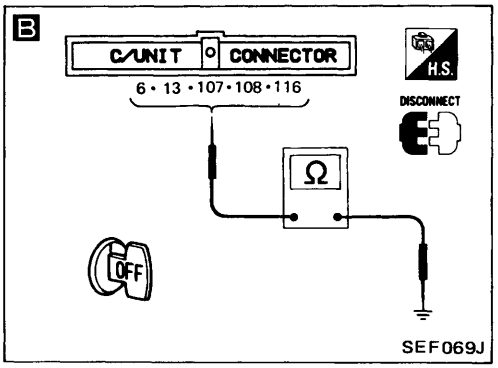
Harness layout

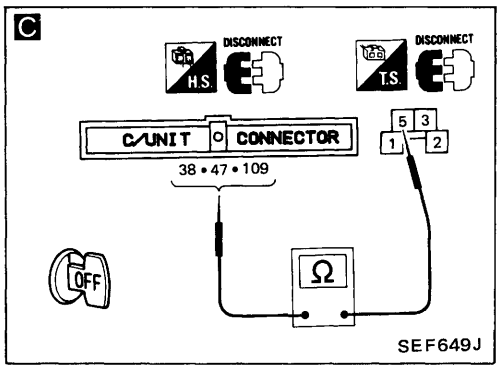


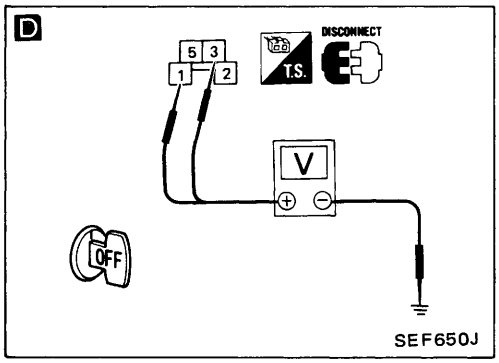


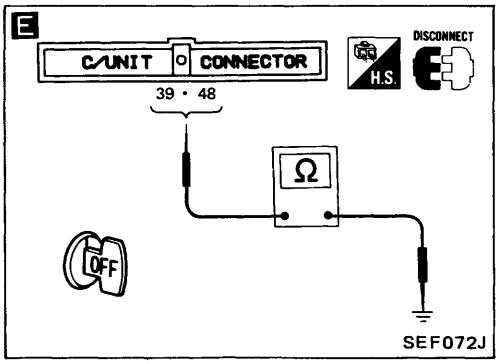
Diagnostic Procedure 1 (Cont'd)











INSPECTION START

A

CHECK POWER SUPPLY.
1) Turn ignition switch "ON".
2) Check voltage between E.C.U. terminals (38), (47), (109) and ground.
Voltage: Battery voltage

O.K. → **B**

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminals (6), (13), (107), (108), (116) and ground.
Continuity should exist.
If N.G., repair harness or connectors.

O.K. ↓

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

N.G. ↓

C

CHECK HARNESS CONTINUITY BETWEEN E.C.C.S. RELAY AND E.C.U.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Disconnect E.C.C.S. relay.
4) Check harness continuity between E.C.U. terminals (38), (47), (109) and terminal (5).
Continuity should exist.

N.G. → Check the following.
- Joint connector-A (259M)
- Harness continuity between E.C.U. and E.C.C.S. relay

If N.G., repair harness or connectors.

O.K. ↓

D

CHECK VOLTAGE BETWEEN E.C.C.S. RELAY AND GROUND.
1) Check voltage between terminals (1), (3) and ground.
Voltage: Battery voltage

N.G. → Check the following.
- "BR" fusible link
- Harness continuity between E.C.C.S. relay and battery

If N.G., repair harness or connectors.

O.K. ↓

E

CHECK GROUND CIRCUIT.
1) Check harness continuity between E.C.U. terminals (39), (48) and engine ground.
Continuity should exist.

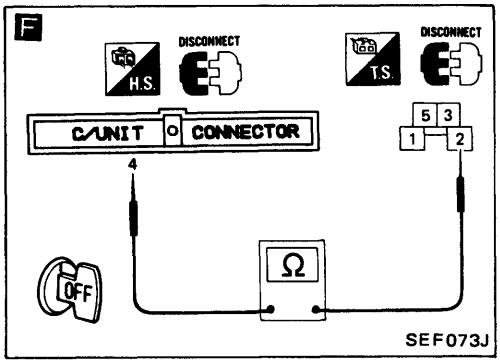
N.G. → Check the following.
- Joint connector-A (259M)
- Harness continuity between E.C.U. and engine ground

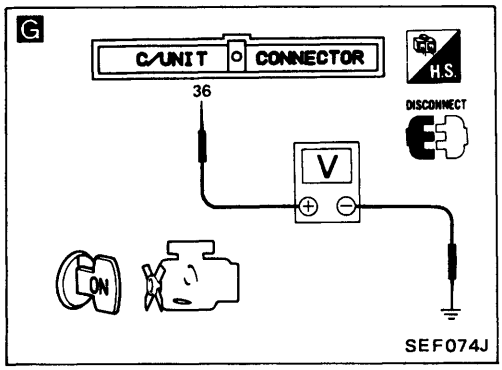
If N.G., repair harness or connectors.

O.K. ↓

(A)

Diagnostic Procedure 1 (Cont'd)





Ⓐ

F

CHECK OUTPUT SIGNAL CIRCUIT.
1) Check harness continuity between E.C.U. terminal ④ and terminal ②.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

G

CHECK INPUT SIGNAL CIRCUIT.
1) Turn ignition switch "ON".
2) Check voltage between E.C.U. terminal ㊱ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Joint connector-A (259M)
- Harness continuity between ignition switch and E.C.U.

If N.G., repair harness or connectors.

O.K. ↓

CHECK COMPONENT (E.C.C.S. relay).
Refer to "Electrical Components Inspection". (See page EF & EC-314.)

N.G. → Replace E.C.C.S. relay.

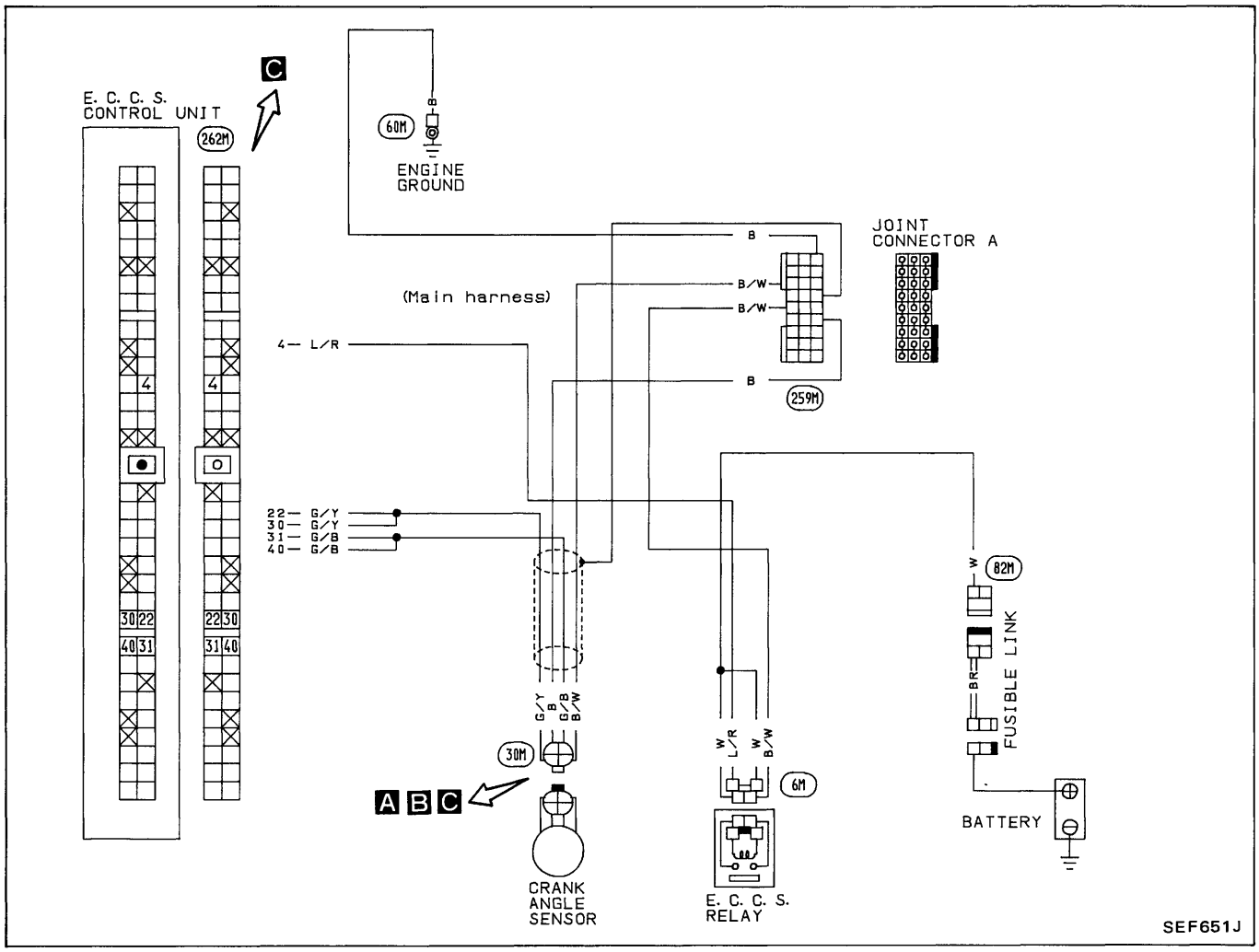
O.K. ↓

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

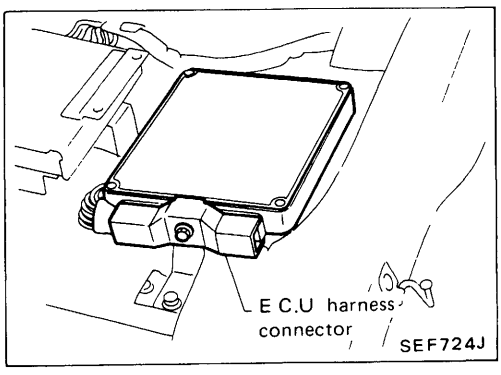
NOTE

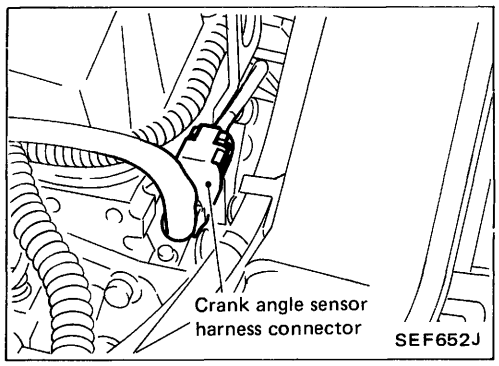
Diagnostic Procedure 2

CRANK ANGLE SENSOR (Code No. 11)

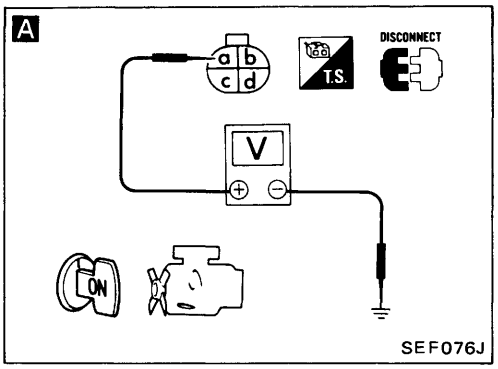


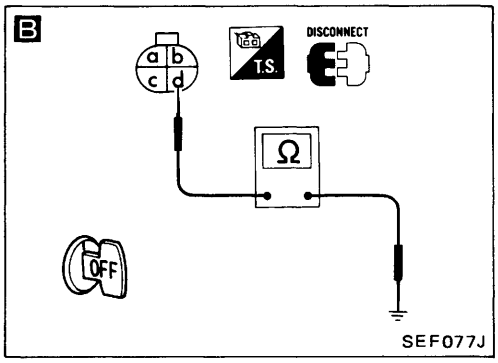
Harness layout

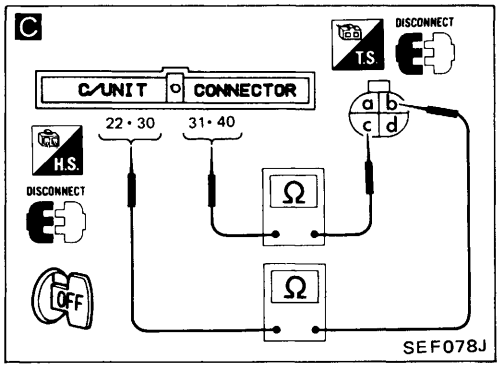




Diagnostic Procedure 2 (Cont'd)







INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect crank angle sensor harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓐ and ground.
Voltage: Battery voltage

N.G. →
Check the following.
- Joint connector-A (259M)
- Harness continuity between crank angle sensor and E.C.C.S. relay

If N.G., repair harness or connectors.

O.K. ↓

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓓ and engine ground.
Continuity should exist.

N.G. →
Check the following.
- Joint connector-A (259M)
- Harness continuity between crank angle sensor and ground

If N.G., repair harness or connector.

O.K. ↓

C

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between terminal ⓒ and E.C.U. terminals ㉛, ㊵ (1° signal), terminal ⓑ and E.C.U. terminals ㉒, ㉚ (180° signal).
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

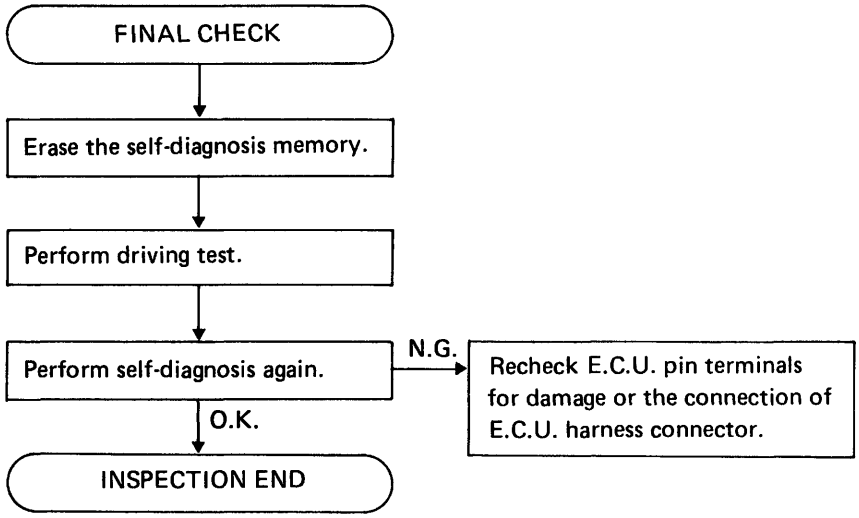
CHECK COMPONENT
(Crank angle sensor).
Refer to "Electrical Components Inspection".
(See page EF & EC-314.)

N.G. → Replace crank angle sensor.

O.K. ↓

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

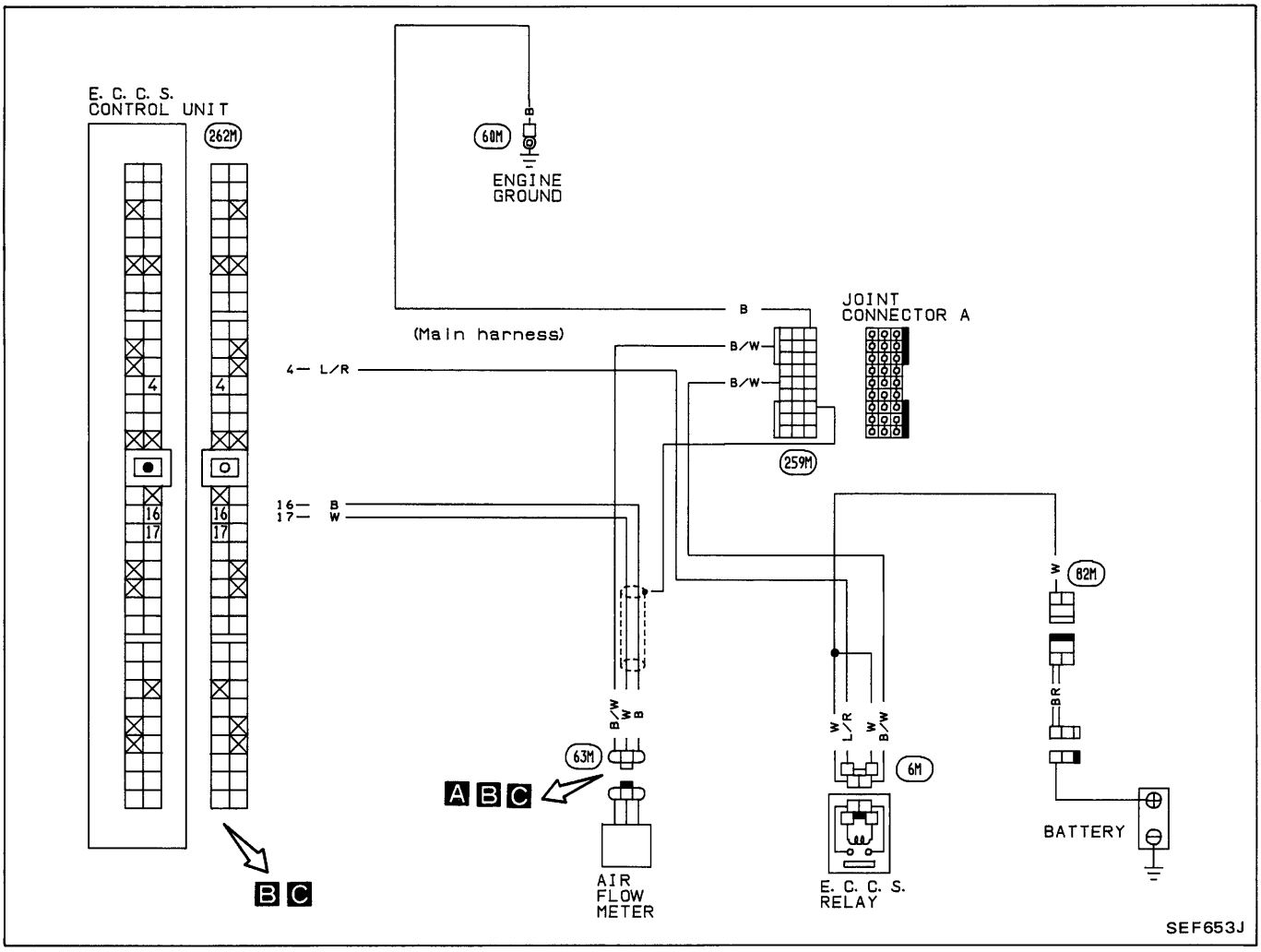
Perform FINAL CHECK by the following procedure after repair is completed.



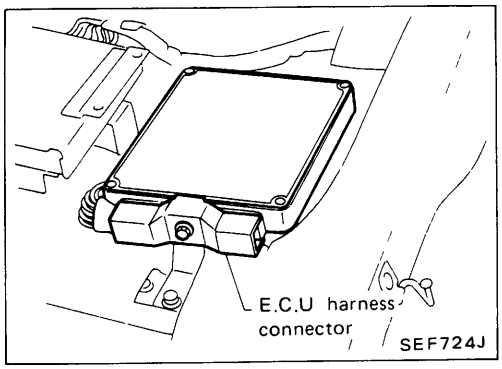
NOTE

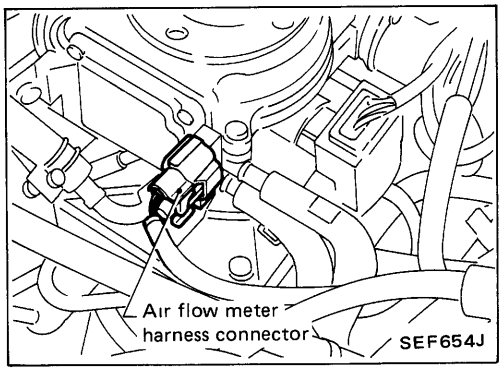
Diagnostic Procedure 3

AIR FLOW METER (Code No. 12) CHECK (CHECK ENGINE LIGHT ITEM)

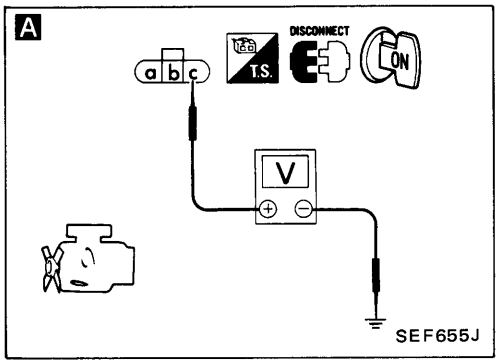


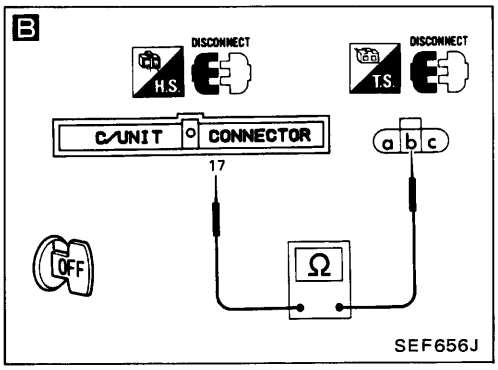
Harness layout

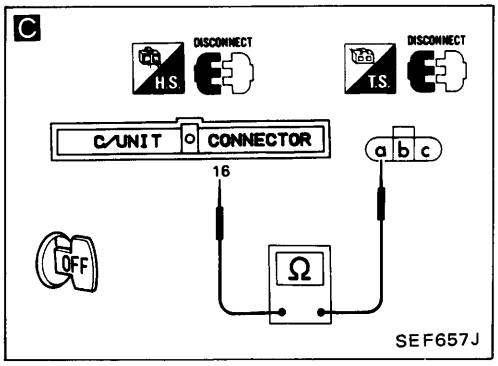




Diagnostic Procedure 3 (Cont'd)







INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect air flow meter harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓒ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Joint connector-A (259M)
- Harness continuity between air flow meter and E.C.C.S. relay

If N.G., repair harness or connectors.

O.K. ↓

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between terminal ⓑ and E.C.U. terminal ⑰.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

C

CHECK INPUT SIGNAL CIRCUIT.
1) Check harness continuity between terminal ⓐ and E.C.U. terminal ⑯.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

CHECK COMPONENT
(Air flow meter).
Refer to "Electrical Components Inspection".
(See page EF & EC-314.)

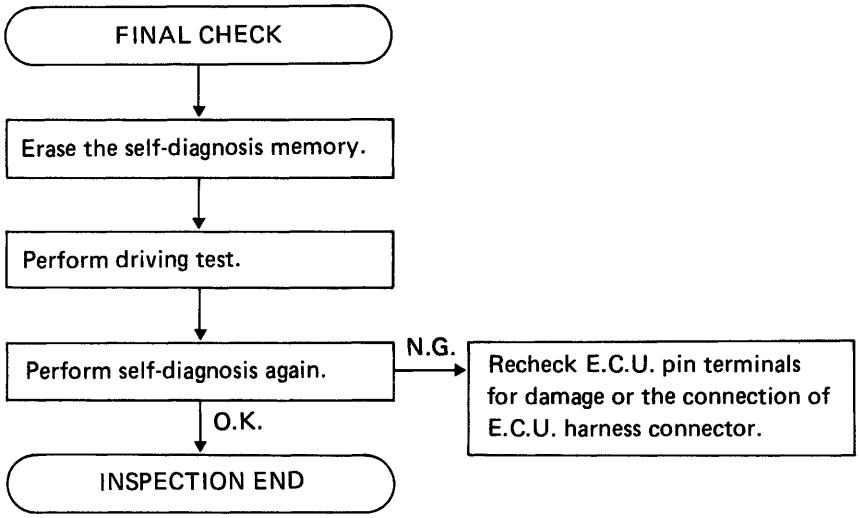
N.G. → Replace air flow meter.

O.K. ↓

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Diagnostic Procedure 3 (Cont'd)

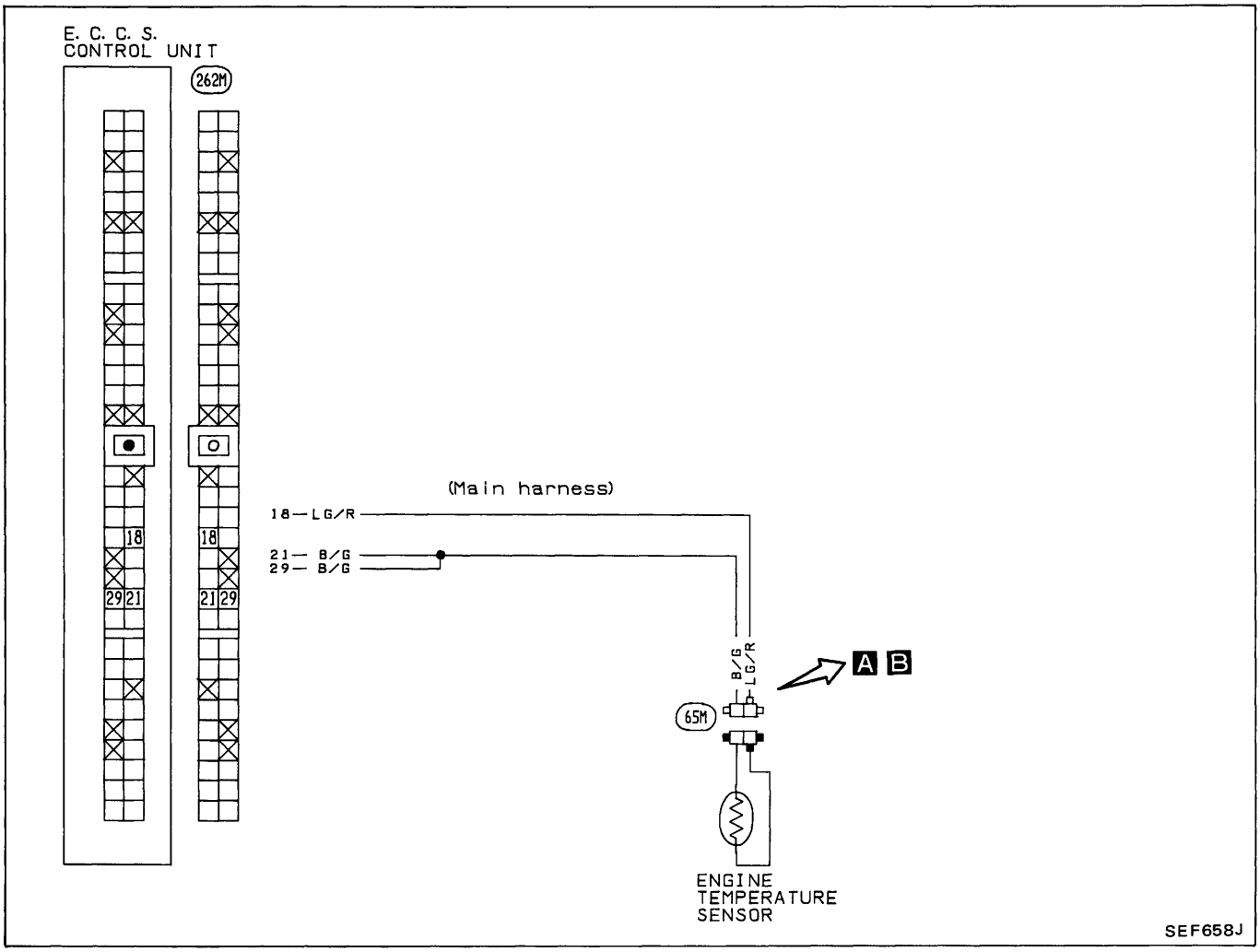
Perform FINAL CHECK by the following procedure after repair is completed.



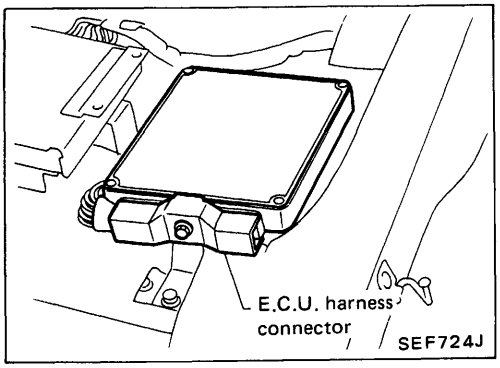
NOTE

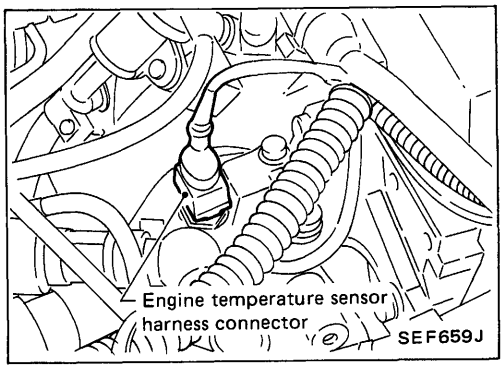
Diagnostic Procedure 4

ENGINE TEMPERATURE SENSOR (Code No. 13) (CHECK ENGINE LIGHT ITEM)

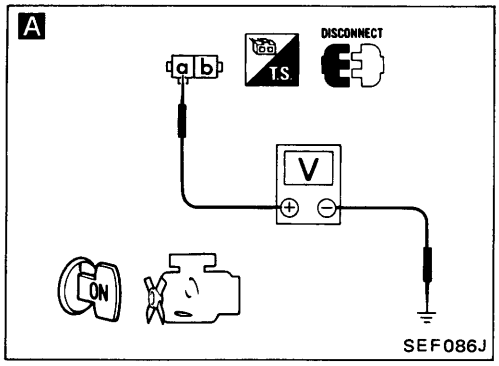


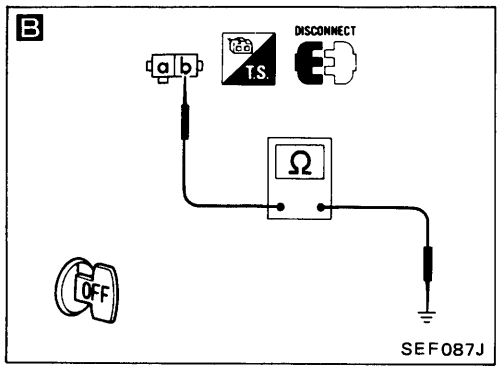
Harness layout





Diagnostic Procedure 4 (Cont'd)





INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect engine temperature sensor harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓐ and ground.
Voltage: Approximately 5V

N.G. → Repair harness or connectors.

O.K.

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓑ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

CHECK COMPONENT
(Engine temperature sensor).
Refer to "Electrical Components Inspection". (See page EF & EC-314.)

N.G. → Replace engine temperature sensor.

O.K.

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Perform FINAL CHECK by the following procedure after repair is completed.

FINAL CHECK

Erase the self-diagnosis memory.

Perform driving test.

Perform self-diagnosis again.

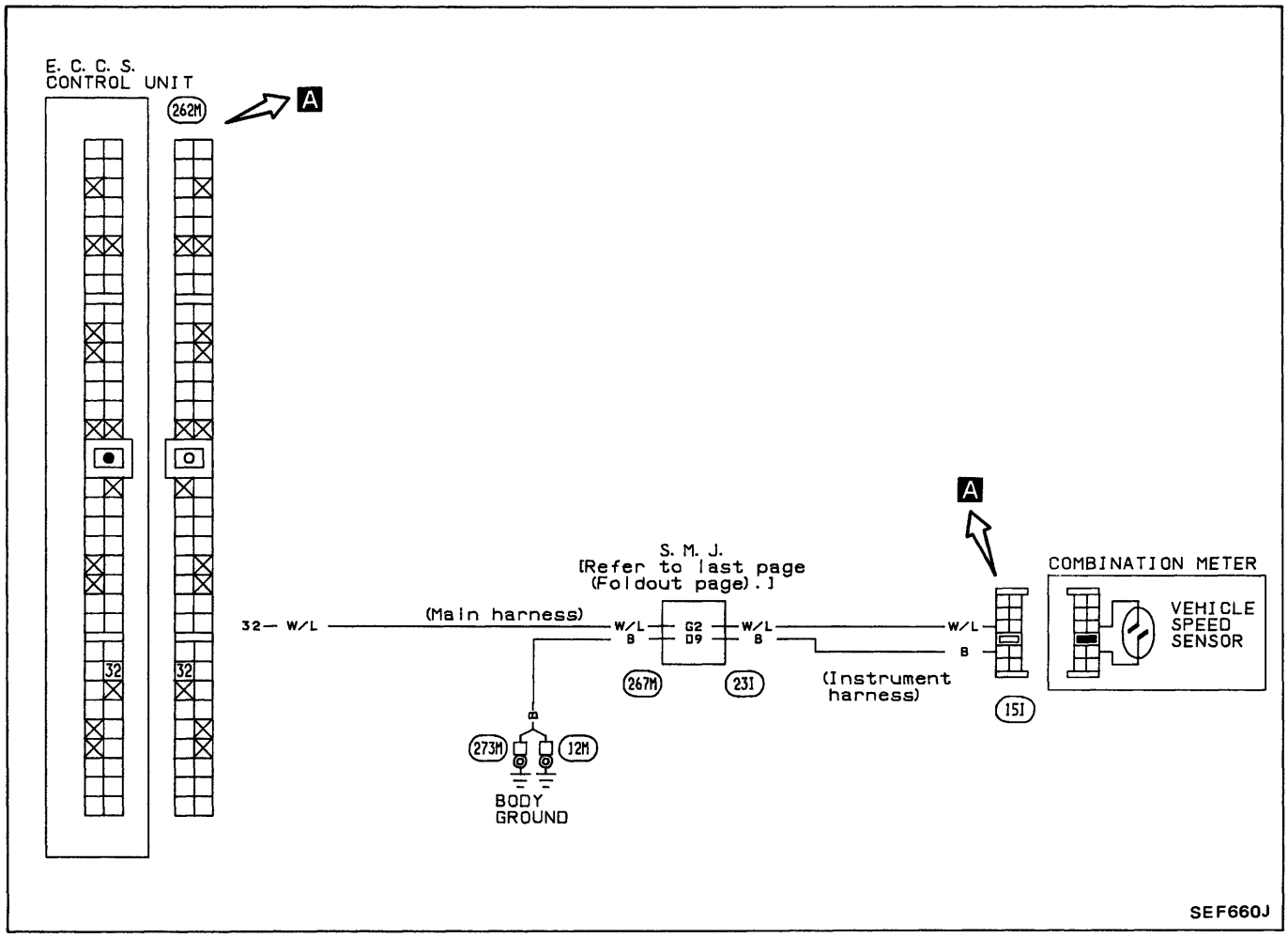
N.G. → Recheck E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K.

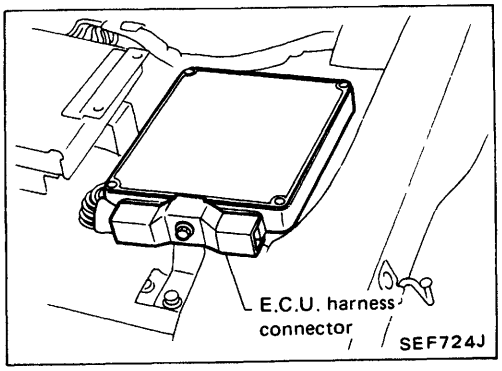
INSPECTION END

Diagnostic Procedure 5

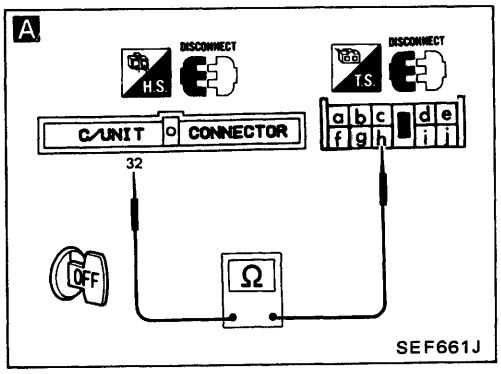
VEHICLE SPEED SENSOR (Code No. 14) (Switch ON/OFF diagnostic item) CHECK (CHECK ENGINE LIGHT ITEM)



Harness layout



Diagnostic Procedure 5 (Cont'd)



INSPECTION START

CHECK SPEEDOMETER FUNCTION.
Make sure that speedometer functions properly.

N.G. → Check vehicle speed sensor and its circuit. (Refer to EL section.)

O.K.

A

CHECK INPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Disconnect combination meter harness connector (151)
4) Check harness continuity between E.C.U. terminal (32) and terminal (h).

N.G. → Check the following.
- Harness connectors (267M), (231)
- Harness continuity between E.C.U. and combination meter

If N.G., repair harness or connectors.

O.K.

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Perform FINAL CHECK by the following procedure after repair is completed.

FINAL CHECK

Start engine.

Perform switch ON/OFF diagnosis.

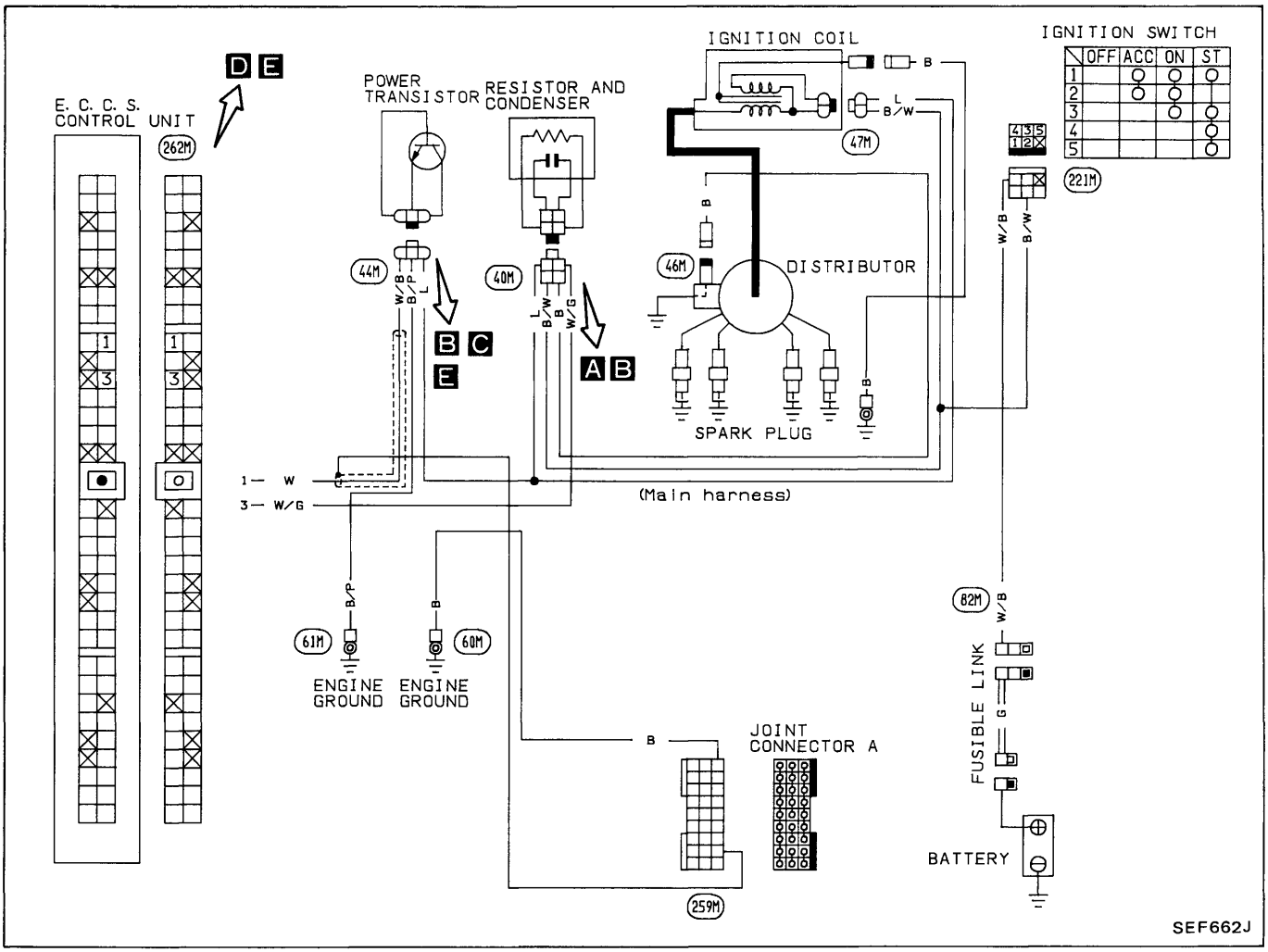
N.G. → Recheck E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K.

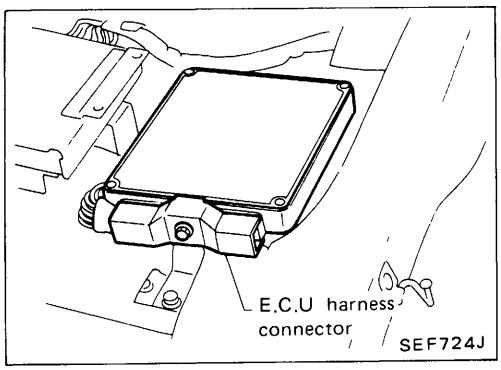
INSPECTION END

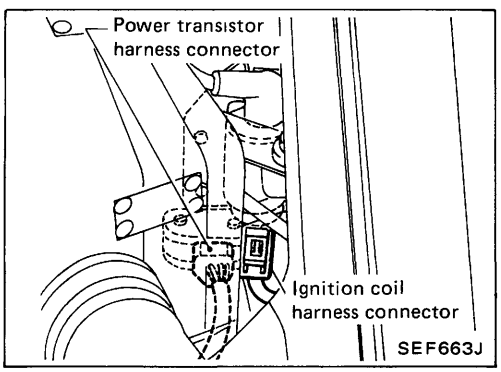
Diagnostic Procedure·6

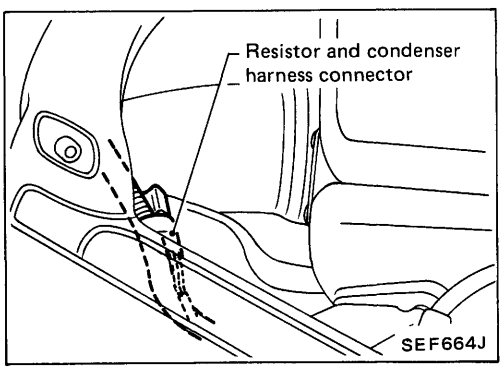
IGNITION SIGNAL (Code No. 21)



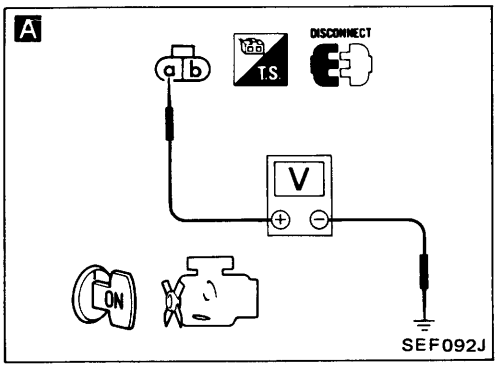
Harness layout

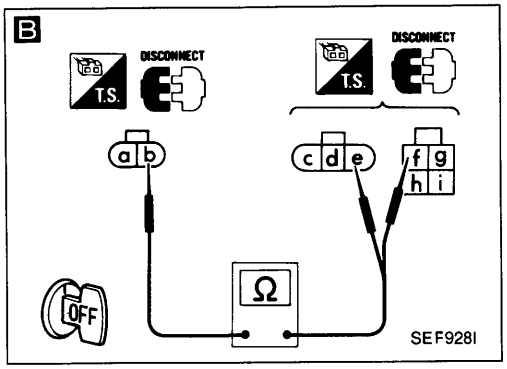


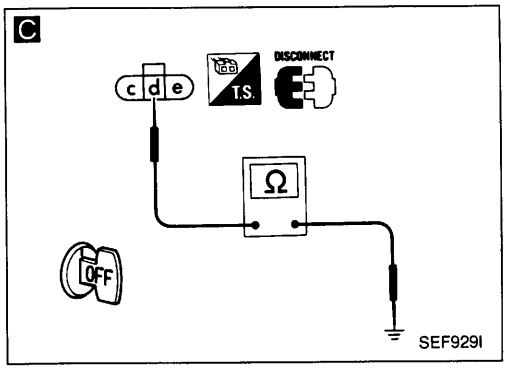


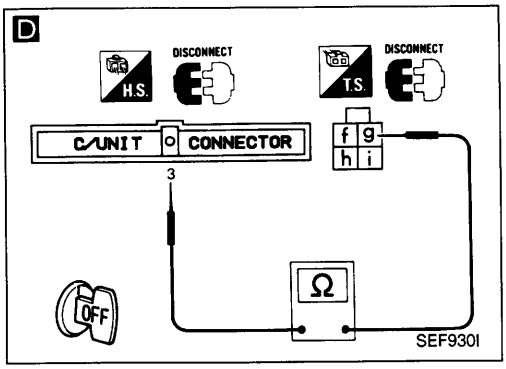


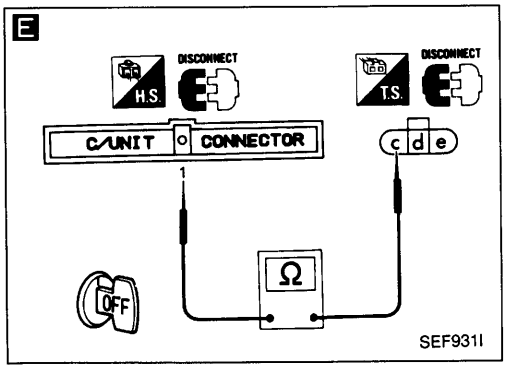
Diagnostic Procedure 6 (Cont'd)











INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect ignition coil harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓐ and ground.
Voltage: Battery voltage

N.G. → Repair harness or connectors.

O.K.

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect resistor and condenser harness connector.
3) Disconnect power transistor harness connector.
B 4) Check harness continuity between terminal ⓑ and ⓔ, ⓕ.
Continuity should exist.
C 5) Check harness continuity between terminal ⓓ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

D

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between terminal ⓖ and E.C.U. terminal ③.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

E

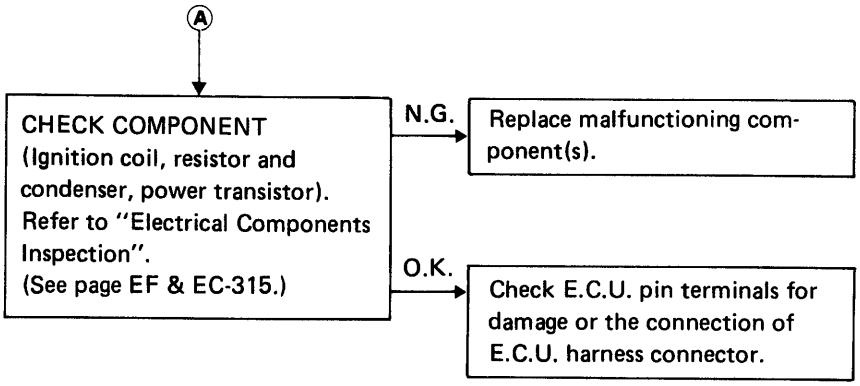
CHECK OUTPUT SIGNAL CIRCUIT.
1) Check harness continuity between terminal ⓒ and E.C.U. terminal ①.
Continuity should exist.

N.G. → Repair harness or connectors.

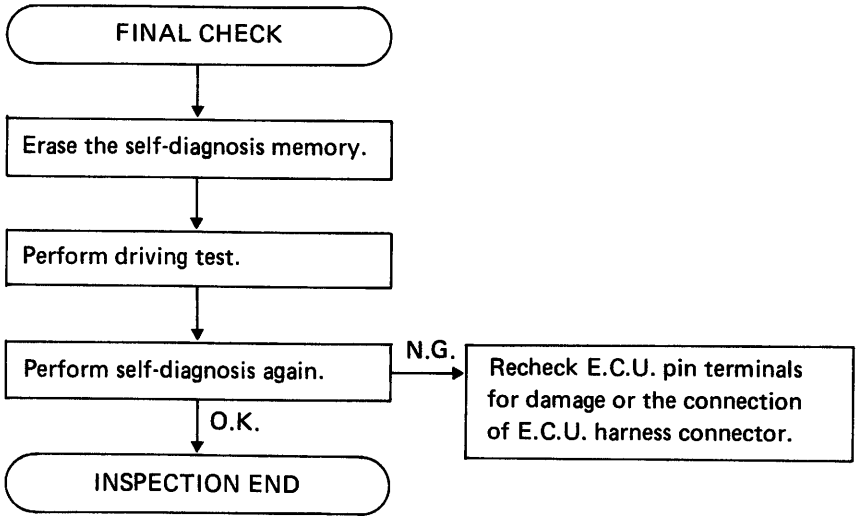
O.K.

Ⓐ

Diagnostic Procedure 6 (Cont'd)

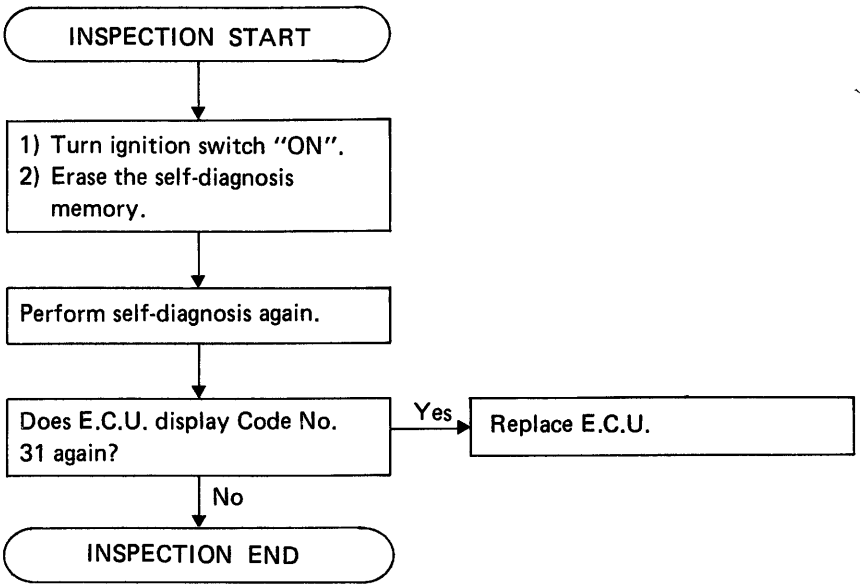


Perform FINAL CHECK by the following procedure after repair is completed.



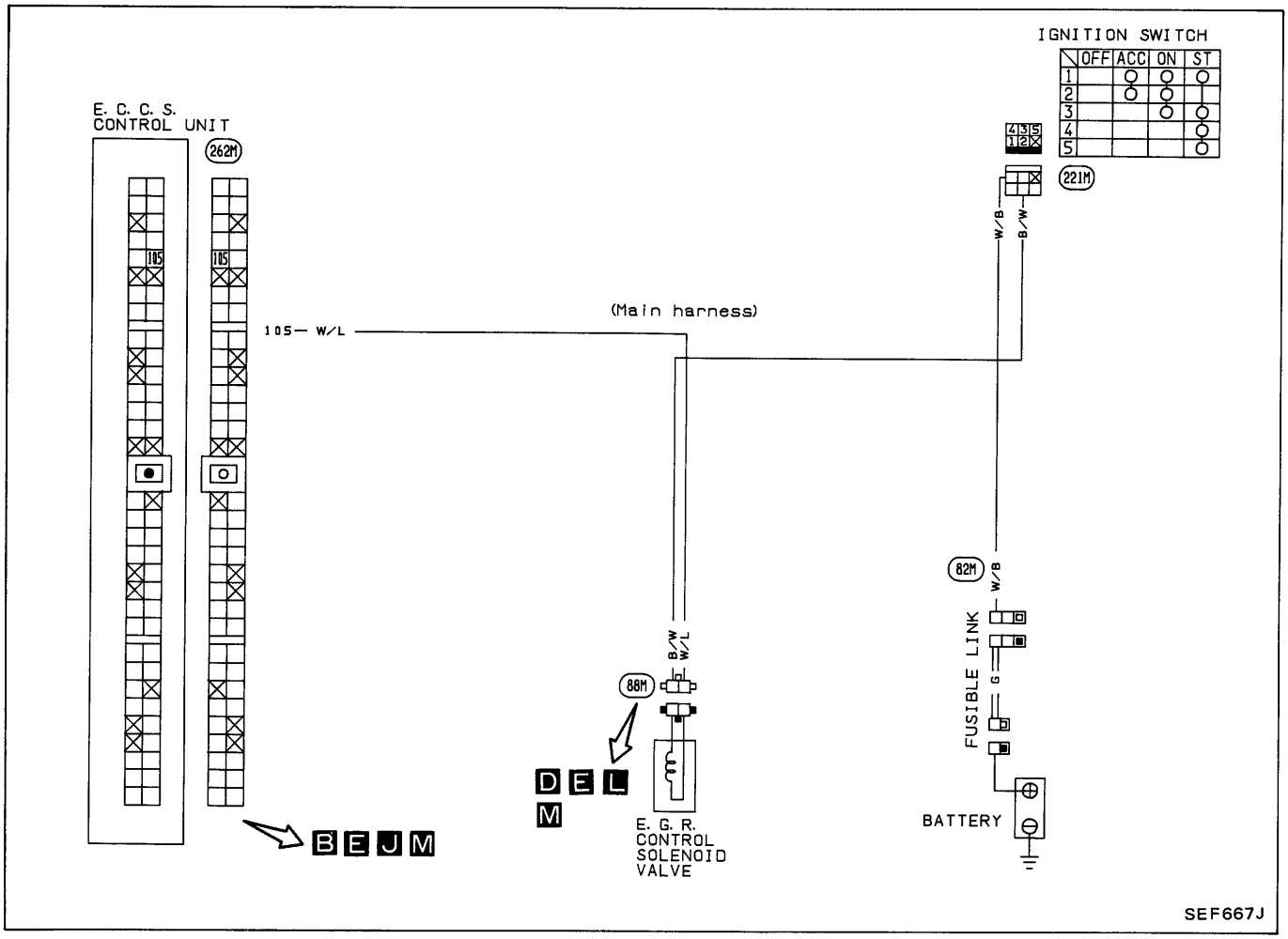
Diagnostic Procedure 7

E.C.C.S. CONTROL UNIT (Code No. 31) CHECK (CHECK ENGINE LIGHT ITEM)

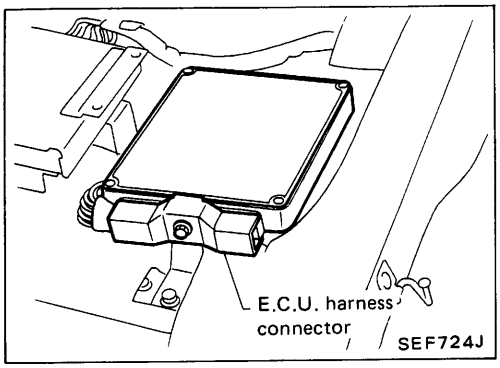


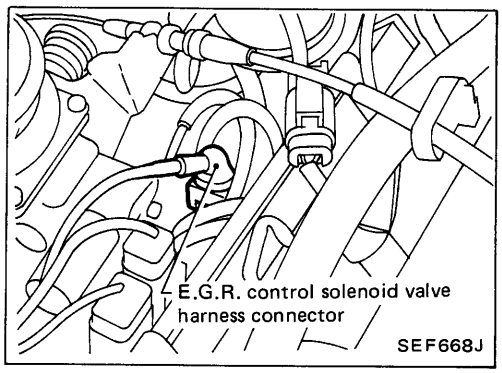
Diagnostic Procedure 8

E.G.R. FUNCTION (Code No. 32) CHECK **[CHECK ENGINE LIGHT ITEM (For California model)]**
E.G.R. CONTROL [Not self-diagnostic item (For non-California model)]

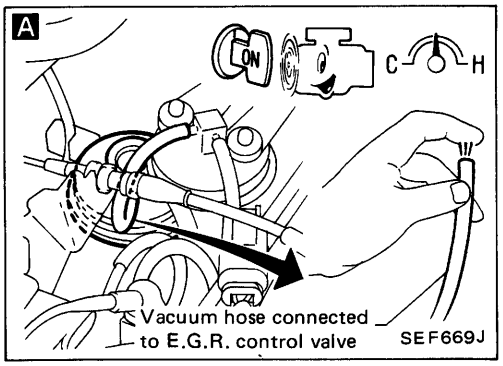


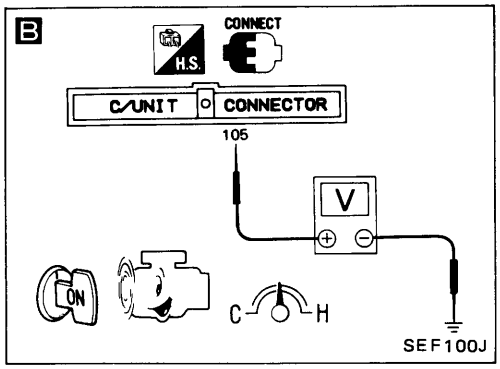
Harness layout

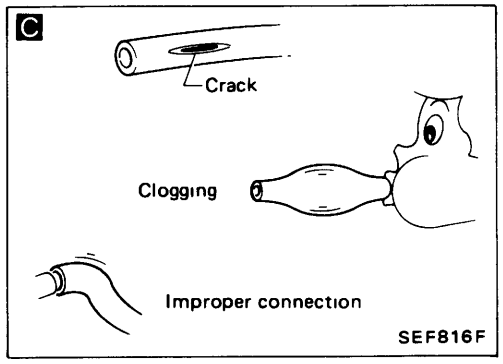


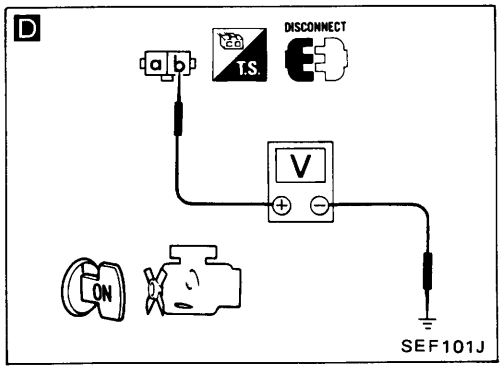


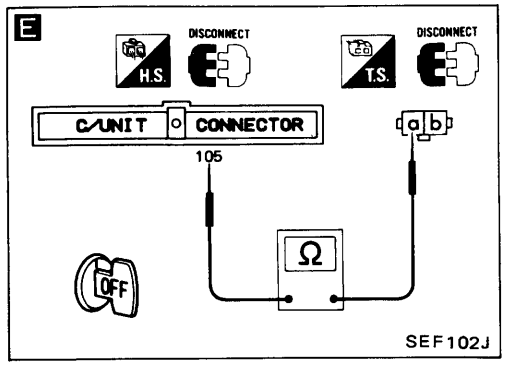
Diagnostic Procedure 8 (Cont'd)











California model

INSPECTION START

A

CHECK VACUUM SOURCE TO E.G.R. CONTROL VALVE.
1) Start engine and warm it up sufficiently.
2) Perform self-diagnosis. Make sure that code No. 12 does not displayed.
3) Keep engine speed at about 2,000 rpm.
4) Disconnect vacuum hose to E.G.R. control valve.
5) Make sure that vacuum exists. **Vacuum should exist.**

O.K. → CHECK COMPONENTS (E.G.R. control valve and exhaust gas temperature sensor). Refer to "Electrical Components Inspection". (See pages EF & EC-315/316.)

N.G. → Replace malfunctioning component(s).

N.G.

B

CHECK CONTROL FUNCTION.
1) Check voltage between E.C.U. terminal (105) and ground under the following conditions.
Voltage:
At idle
Approximately 0V
Engine speed is about 2,000 rpm
Battery voltage

O.K. → **C** CHECK VACUUM HOSE.
1) Check vacuum hose for clogging, cracks and proper connection.

N.G.

D

CHECK POWER SUPPLY.
1) Stop engine.
2) Disconnect E.G.R. control solenoid valve harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓑ and ground.
Voltage: Battery voltage

N.G. → Repair harness or connectors.

O.K.

E

CHECK OUTPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal (105) and terminal ⓐ.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

Ⓐ

Diagnostic Procedure 8 (Cont'd)

F ROAD TEST

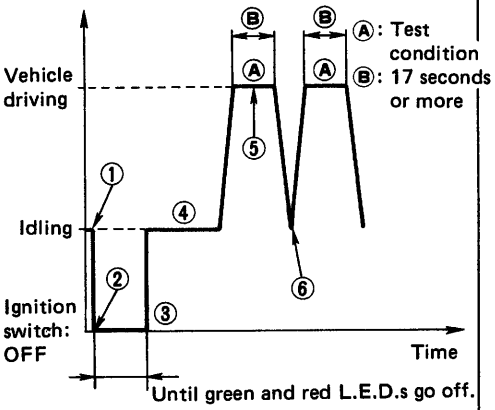
Test condition

Drive vehicle under the following conditions with a suitable shift position.

(1) Engine speed:
M/T: 2,500±500 rpm
A/T: 2,300±500 rpm

(2) Intake manifold vacuum:
M/T: −53.3±6.7 kPa (−400±50 mmHg, −15.75±1.97 inHg)
A/T: −49.3±5.3 kPa (−370±40 mmHg, −14.57±1.57 inHg)

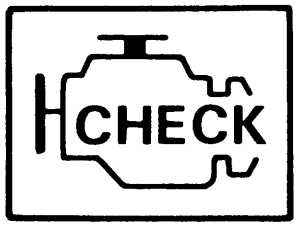
Driving mode



① Start engine and warm it up sufficiently.
② Turn off ignition switch and keep it off until green and red L.E.D.s go off.
③ Start engine and make sure that air conditioner switch and rear defogger are turned "OFF" during driving test.
④ Keep engine running for at least 20 seconds.
⑤ Shift to suitable gear position and drive in "Test condition" for at least 17 seconds.
⑥ Decrease engine revolution to less than 2,000 rpm
⑦ Repeat steps ⑤ through ⑥ at least 1 time.

SEF670J

G



CHECK ENGINE LIGHT

SEF924F

Ⓐ

CHECK COMPONENT (E.G.R. control solenoid valve). Refer to "Electrical Components Inspection". (See page EF & EC-316.)

N.G. → Replace E.G.R. control solenoid valve.

O.K.

Check resistance of exhaust gas temperature sensor. (See page EF & EC-316.)

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Perform FINAL CHECK by the following procedure after repair is completed.

FINAL CHECK

Erase the self-diagnosis memory.

F

Perform driving test under the following conditions.
1) Warm up engine sufficiently.
2) Use test driving modes indicated in figure **F**.

G

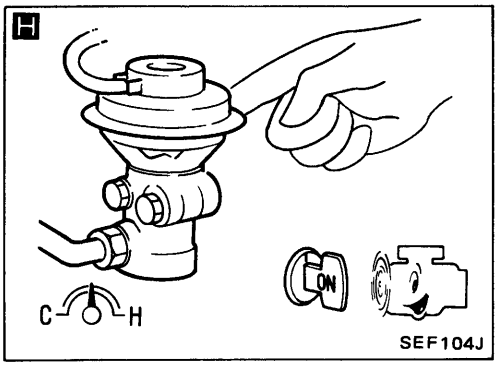
Make sure that check engine light does not come on during driving test.

Comes on. → Recheck E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

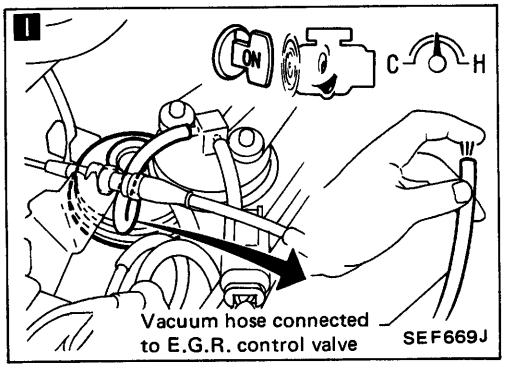
Does not come on.

INSPECTION END

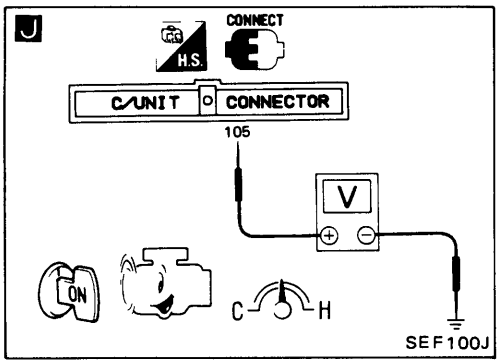
Diagnostic Procedure 8 (Cont'd)



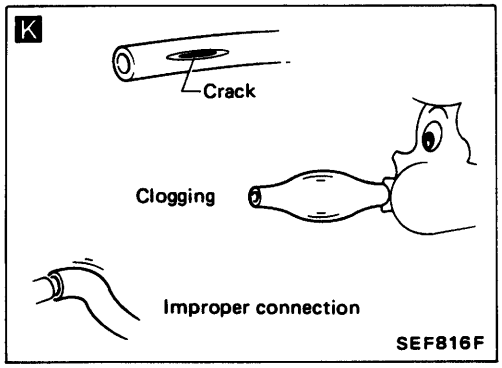
SEF104J



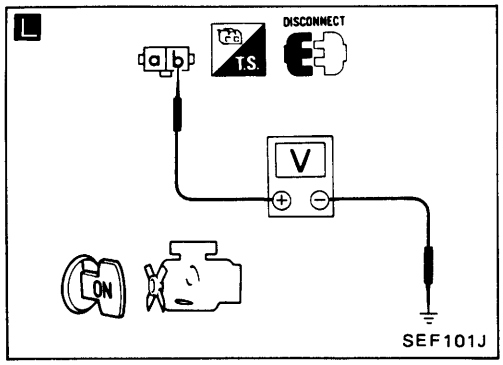
SEF669J



SEF100J



SEF816F



SEF101J

Non-California model

INSPECTION START

Is lifted up and down.

H CHECK OVERALL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Perform self-diagnosis. Make sure that code No. 12 is not displayed.
3) Make sure that E.G.R. control valve spring is lifted up and down when racing engine. (Use your finger.)

→ INSPECTION END

Is not lifted up and down.

I CHECK VACUUM SOURCE TO E.G.R. CONTROL VALVE.
1) Disconnect vacuum hose to E.G.R. control valve.
2) Make sure that vacuum exists under the following conditions.
At idle:
Vacuum should not exist.
Engine speed is about 2,000 rpm:
Vacuum should exist.

O.K. → CHECK COMPONENTS (E.G.R. control valve and B.P.T. valve).
Refer to "Electrical Components Inspection".
(See page EF & EC-315.)

N.G. → Replace malfunctioning component(s).

N.G.

J CHECK CONTROL FUNCTION.
1) Check voltage between E.C.U. terminal (105) and ground under the following conditions.
Voltage:
At idle
Approximately 0V
Engine speed is about 2,000 rpm
Battery voltage

N.G. → K CHECK VACUUM HOSE.
1) Check vacuum hose for clogging, cracks and proper connection.

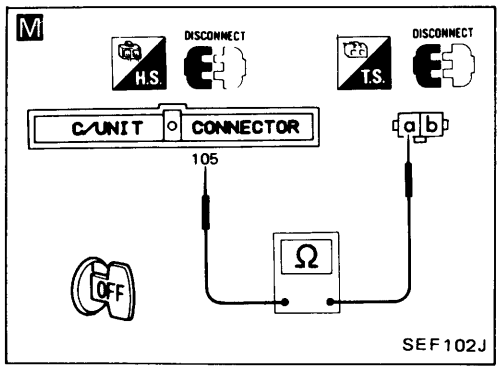
O.K.

L CHECK POWER SUPPLY.
1) Stop engine.
2) Disconnect E.G.R. control solenoid valve harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal (b) and ground.
Voltage: Battery voltage

N.G. → Repair harness or connectors.

O.K. → (A)

Diagnostic Procedure 8 (Cont'd)



Ⓐ

M

CHECK OUTPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal (105) and terminal ⓐ.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

CHECK COMPONENT
(E.G.R. control solenoid valve).
Refer to "Electrical Components Inspection".
(See page EF & EC-316.)

N.G. → Replace E.G.R. control solenoid valve.

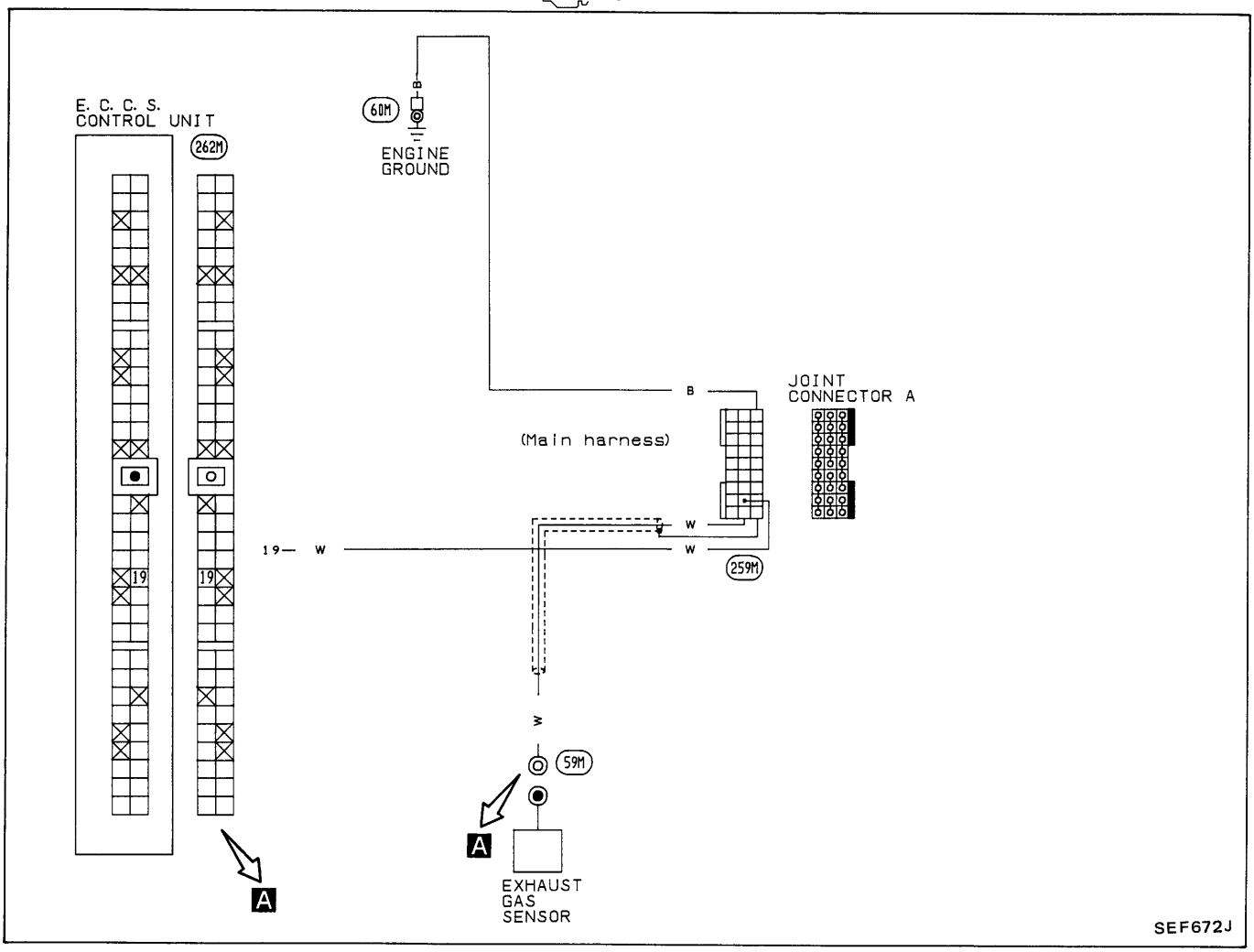
O.K. ↓

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

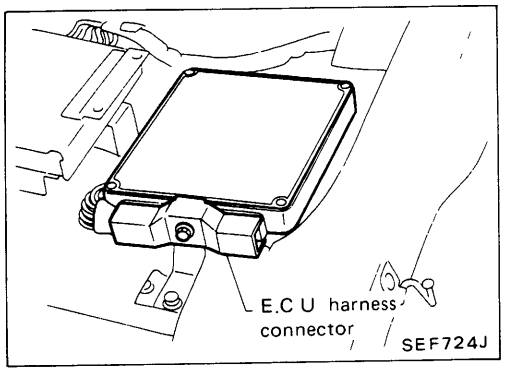
NOTE

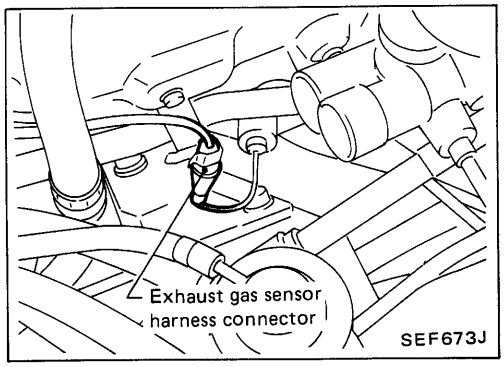
Diagnostic Procedure 9

EXHAUST GAS SENSOR (Code No. 33) (CHECK ENGINE LIGHT ITEM)

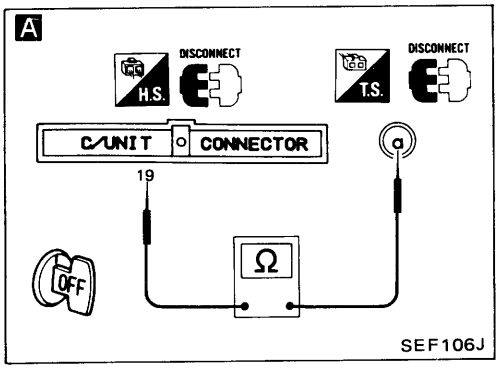


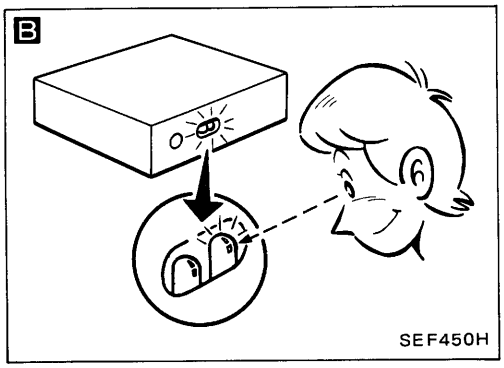
Harness layout





Diagnostic Procedure 9 (Cont'd)





INSPECTION START

A

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector and exhaust gas sensor harness connector.
2) Check harness continuity between terminal ⓐ and E.C.U. terminal ⑲.
Continuity should exist.

N.G. → Check the following.
- Joint connector-A (259M)
- Harness continuity between E.C.U. and exhaust gas sensor

If N.G., repair harness or connectors.

O.K. ↓

B

CHECK COMPONENT (Exhaust gas sensor).
Make sure that inspection lamp (Green) on E.C.U. goes on and off periodically more than 5 times during 10 seconds at 2,000 rpm under no-load.

N.G. → Replace exhaust gas sensor.

O.K. ↓

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Perform FINAL CHECK by the following procedure after repair is completed.

FINAL CHECK

↓

Erase the self-diagnosis memory.

↓

Perform driving test.

↓

Perform self-diagnosis again.

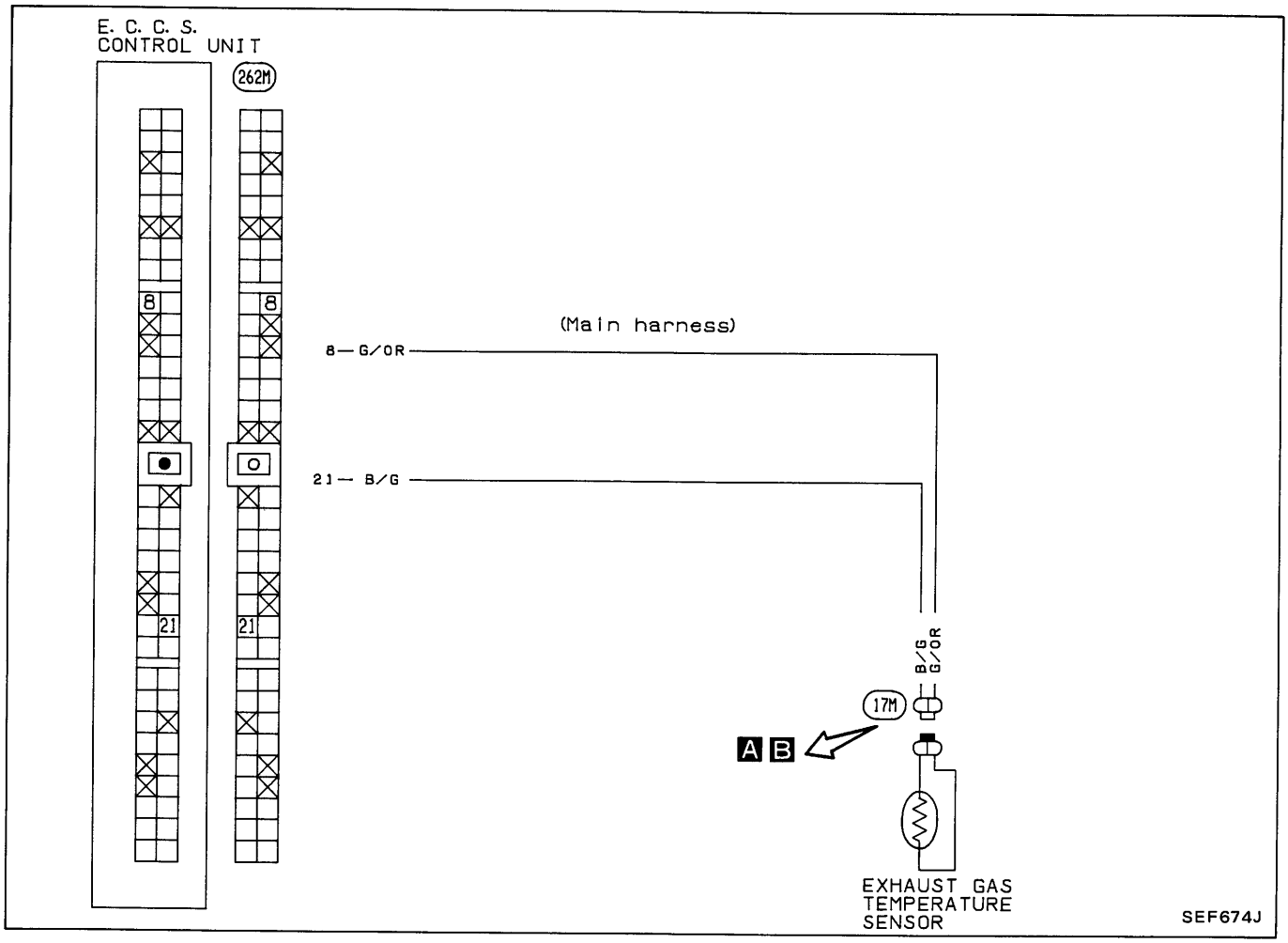
N.G. → Recheck E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K. ↓

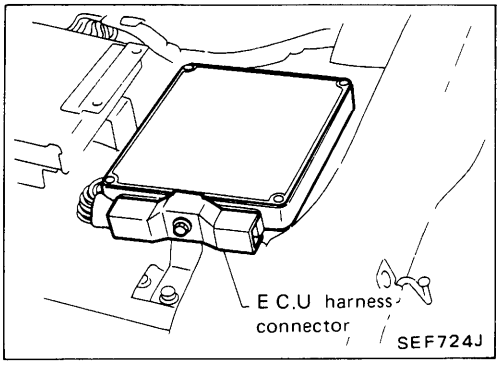
INSPECTION END

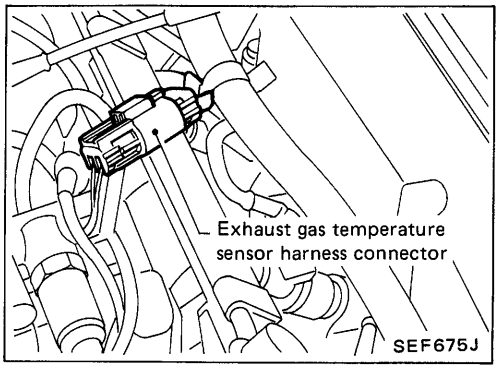
Diagnostic Procedure 10

EXHAUST GAS TEMPERATURE SENSOR (Code No. 35) (CHECK ENGINE LIGHT ITEM): CALIFORNIA MODEL ONLY

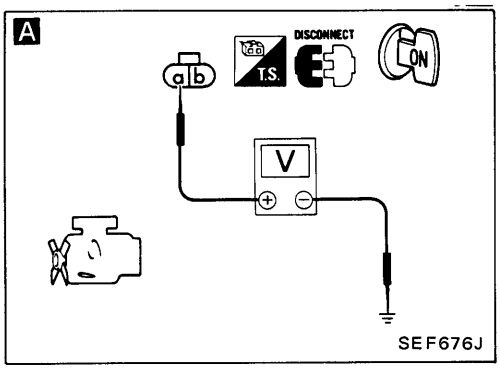


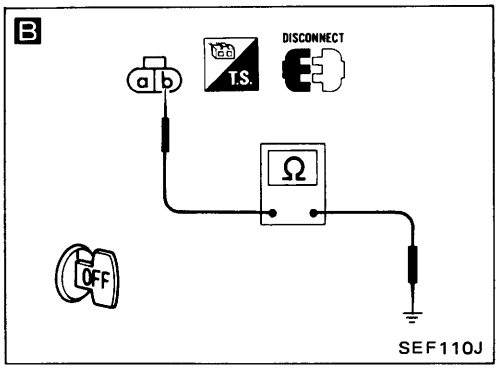
Harness layout





Diagnostic Procedure 10 (Cont'd)





INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect exhaust gas temperature sensor harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓐ and ground.
Voltage: Approximately 5V

N.G. → Repair harness or connectors.

O.K.

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓑ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

CHECK COMPONENT
(Exhaust gas temperature sensor).
Refer to "Electrical Components Inspection".
(See page EF & EC-316.)

N.G. → Replace exhaust gas temperature sensor.

O.K.

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Perform FINAL CHECK by the following procedure after repair is completed.

FINAL CHECK

Erase the self-diagnosis memory.

Perform driving test.

Perform self-diagnosis again.

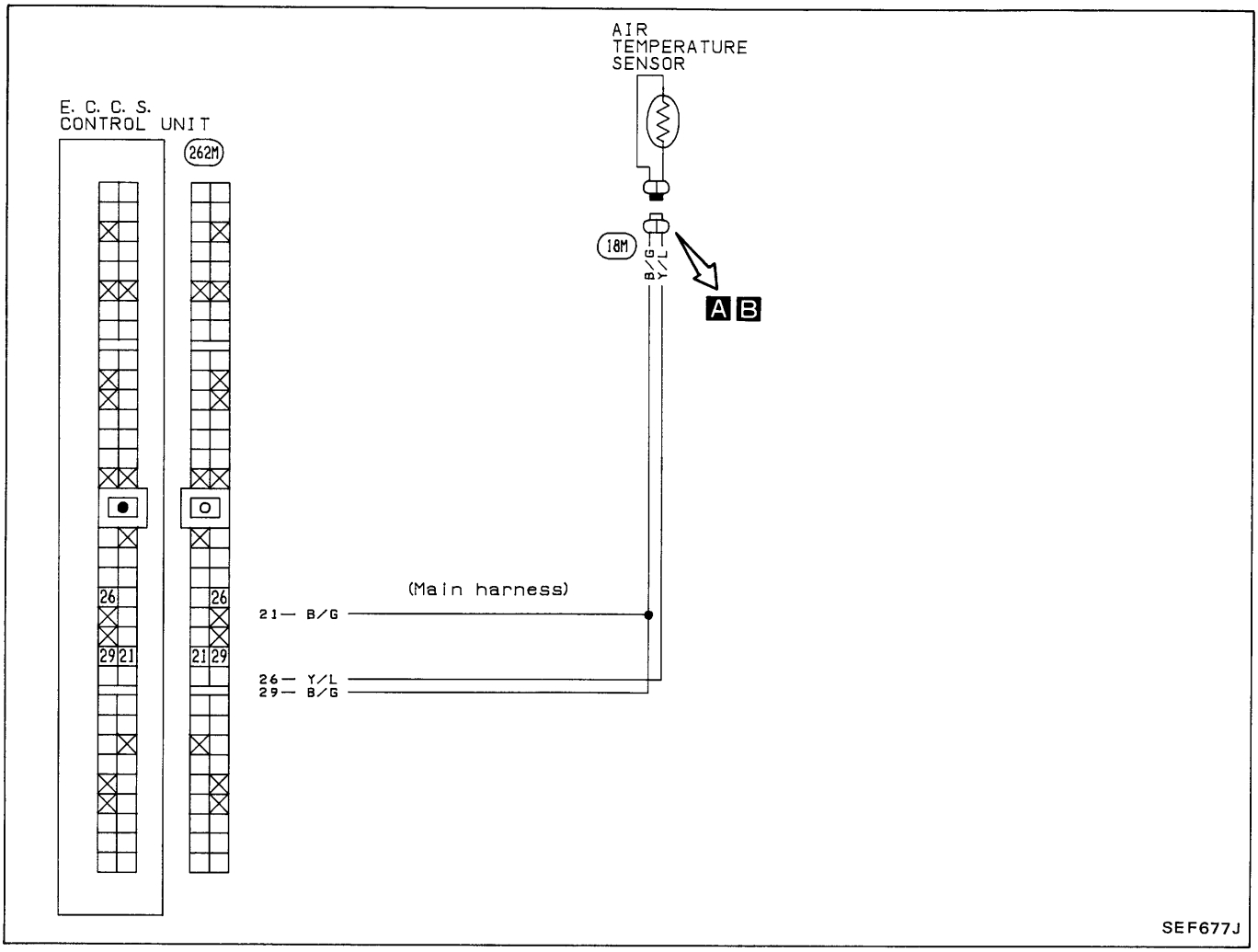
N.G. → Recheck E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K.

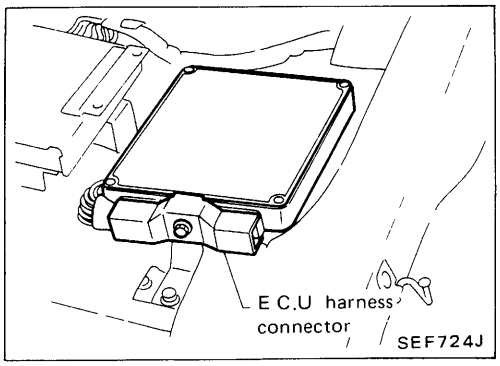
INSPECTION END

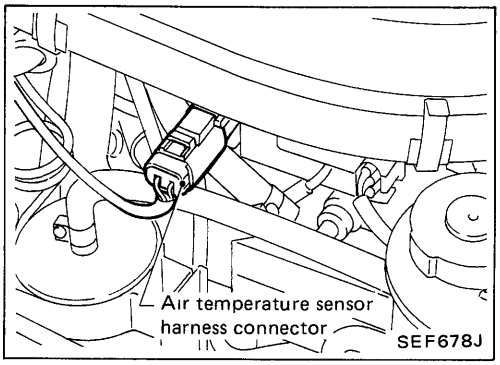
Diagnostic Procedure 11

AIR TEMPERATURE SENSOR (Code No. 41)

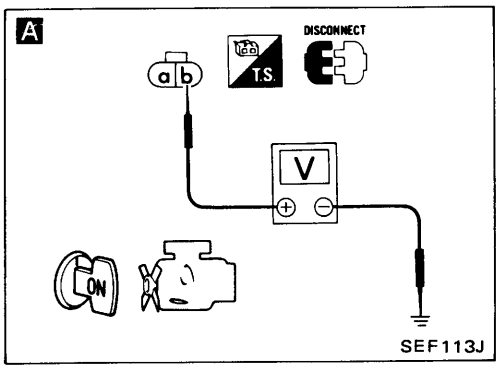


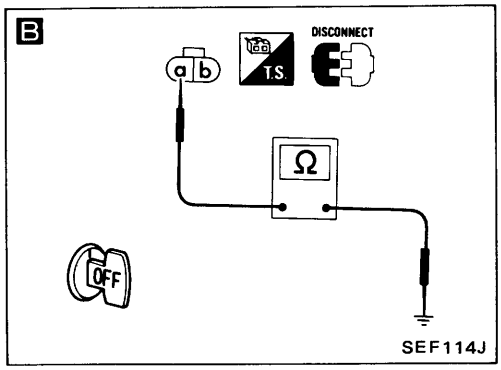
Harness layout





Diagnostic Procedure 11 (Cont'd)





INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect air temperature sensor harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓑ and ground.
Voltage: Approximately 5V

N.G. → Repair harness or connectors.

O.K.

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓐ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

CHECK COMPONENT
(Air temperature sensor).
Refer to "Electrical Components Inspection".
(See page EF & EC-320.)

N.G. → Replace air temperature sensor.

O.K.

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Perform FINAL CHECK by the following procedure after repair is completed.

FINAL CHECK

Erase the self-diagnosis memory.

Perform driving test.

Perform self-diagnosis again.

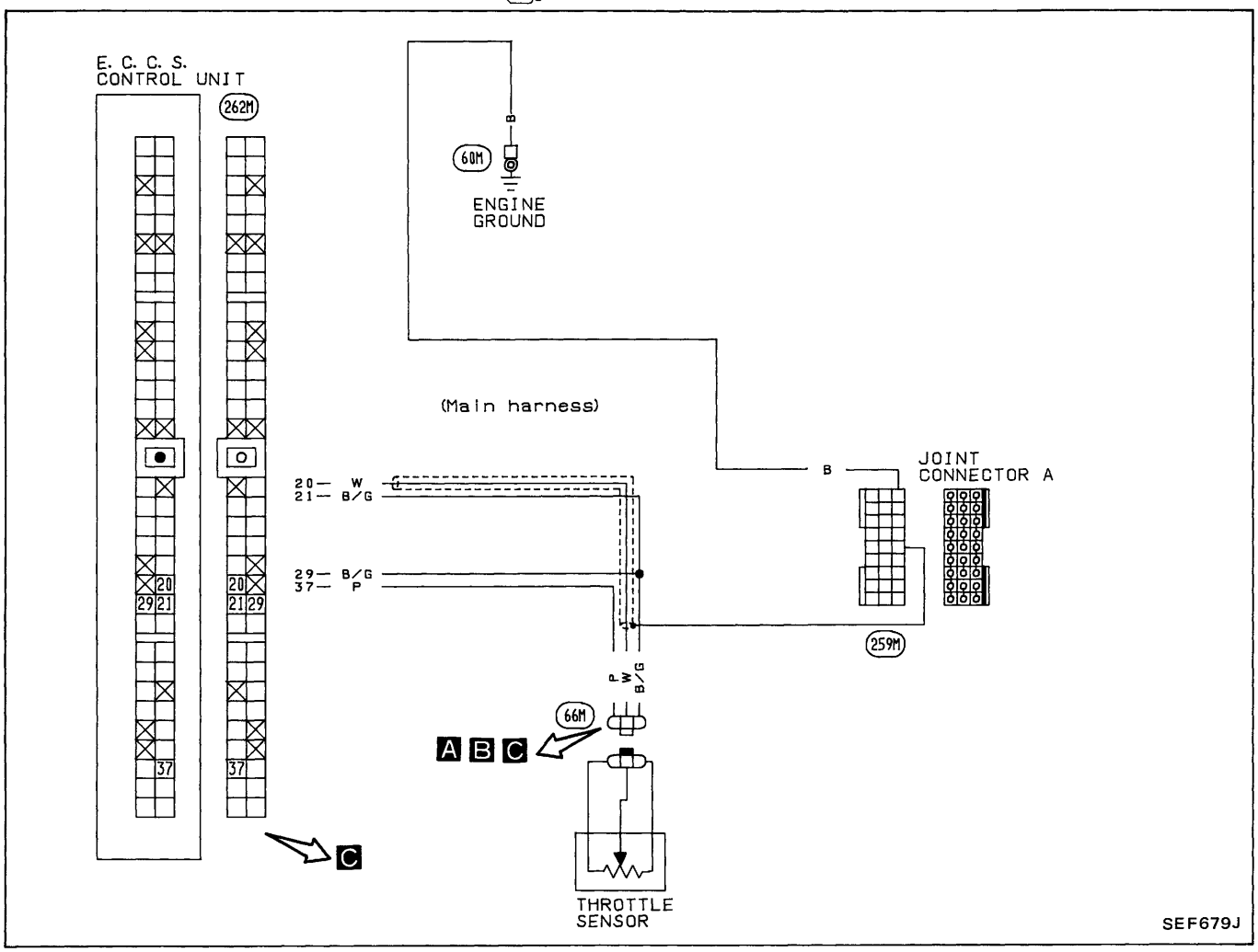
N.G. → Recheck E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K.

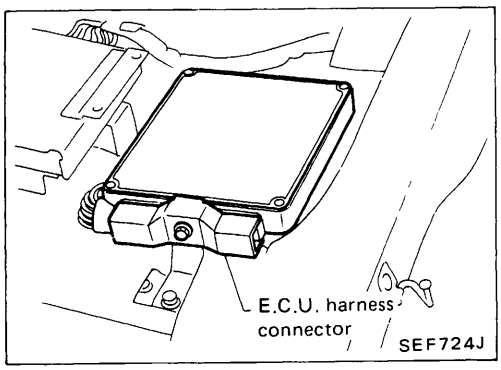
INSPECTION END

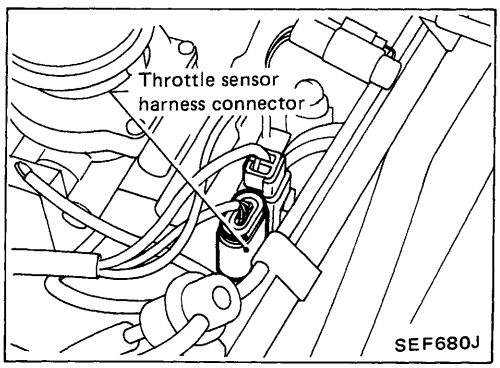
Diagnostic Procedure 12

THROTTLE SENSOR (Code No. 43) (CHECK ENGINE LIGHT ITEM)

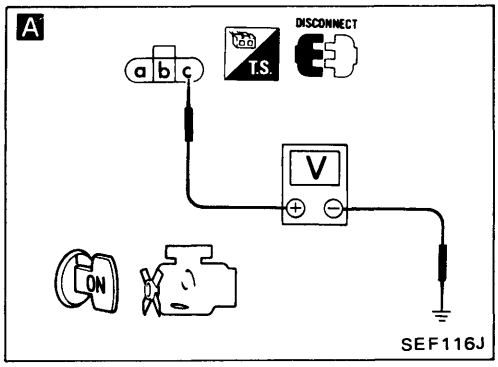


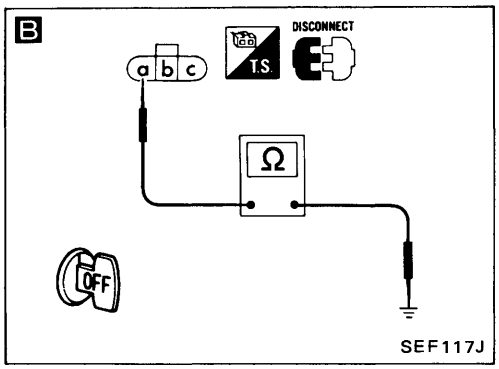
Harness layout

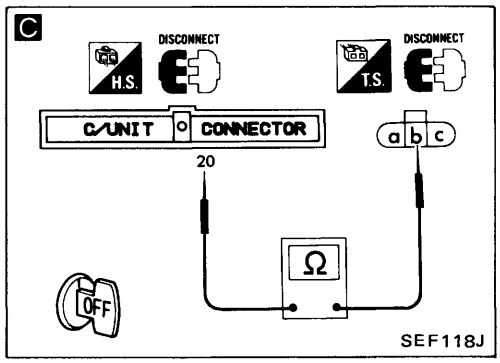




Diagnostic Procedure 12 (Cont'd)







INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect throttle sensor harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓒ and ground.
Voltage: Approximately 5V

N.G. → Repair harness or connectors.

O.K. ↓

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓐ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

C

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal ⑳ and terminal ⓑ.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

CHECK COMPONENT (Throttle sensor).
Refer to "Electrical Components Inspection".
(See page EF & EC-316.)

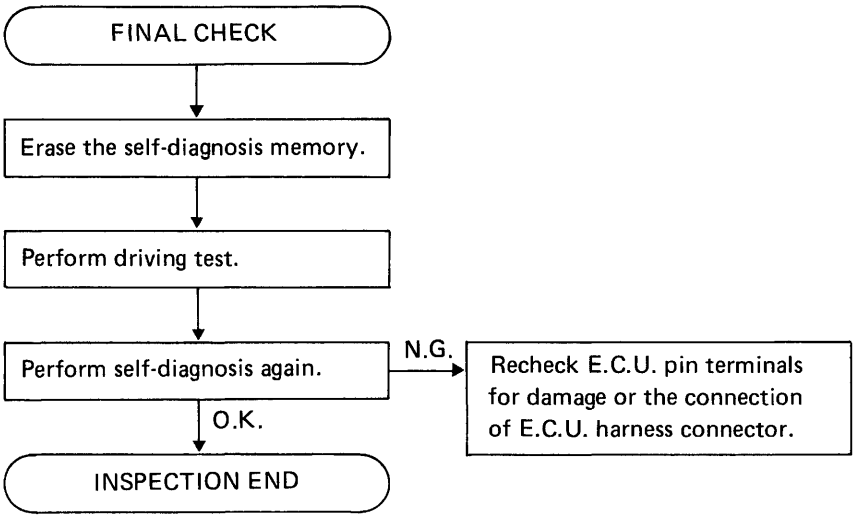
N.G. → Replace throttle sensor.

O.K. ↓

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Diagnostic Procedure 12 (Cont'd)

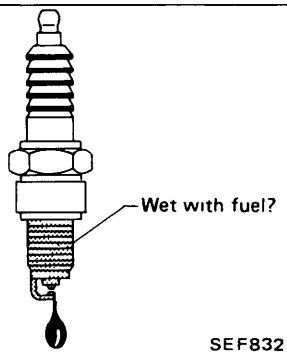
Perform FINAL CHECK by the following procedure after repair is completed.



Diagnostic Procedure 13

INJECTOR LEAK (Code No. 45) CHECK (CHECK ENGINE LIGHT ITEM): CALIFORNIA MODEL ONLY

A

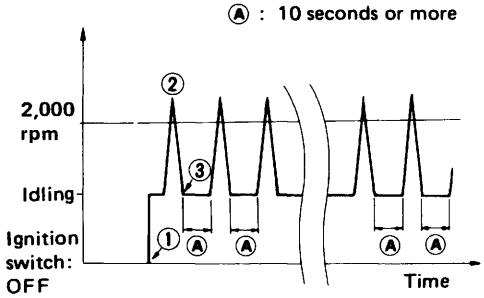


SEF832F

B

Engine racing mode

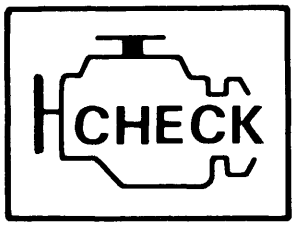
Ⓐ : 10 seconds or more



① Start engine and warm it up sufficiently.
② Race engine revolution higher than 2,000 rpm under no-load.
③ Keep engine at idle speed for at least 10 seconds.
④ Repeat steps ② through ③ at least 10 times.

SEF392G

C



CHECK ENGINE LIGHT

SEF924F

INSPECTION START

Start engine and warm it up sufficiently.

Make sure engine runs smoothly at idle after warming.

Runs smoothly.

Does not run smoothly.

Set the diagnosis mode selector of E.C.U. to Mode I.

Check if the green inspection lamp on E.C.U. stays off during 10 seconds at idle condition.

Stay off.

Does not stay off.

Check mixture ratio feedback system. (See page EF & EC-189.)

Race engine two or three times under no-load, then run engine at idle speed.

Set diagnosis to Mode II and check that red and green inspection lamps on E.C.U. blink almost simultaneously at 2,000 rpm under no-load.

Does not blink.

Blinks.

Check idle CO%. (See page EF & EC-189.)

INSPECTION END

A

Remove all spark plugs from cylinder head. Is any plug wet with fuel?

Yes

Replace injector which supply cylinders having wet spark plugs.

No

Remove injector assembly. (See page EF & EC-322.) Keep fuel hoses and all injectors connected to injector gallery.

Turn ignition switch "ON". Makesure fuel does not drip from injector.

Drips.

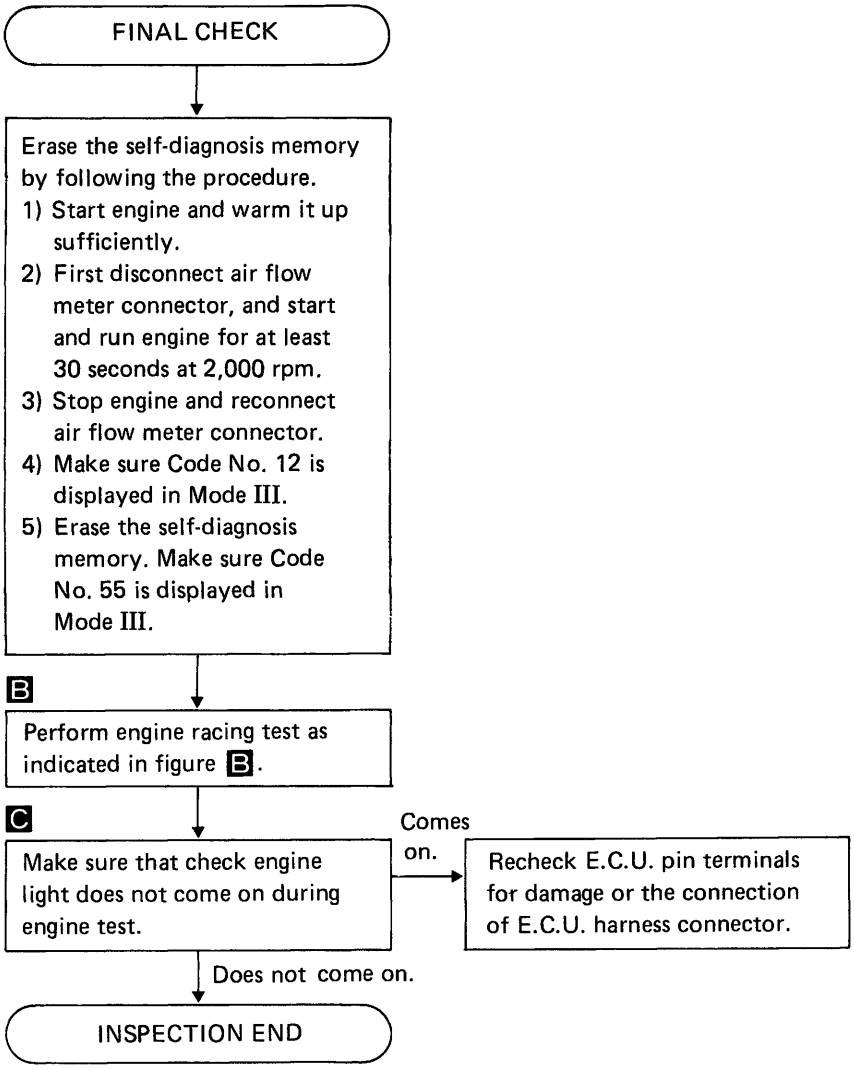
Replace the injectors from which fuel is dripping.

Does not drip.

Go to FINAL CHECK.

Diagnostic Procedure 13 (Cont'd)

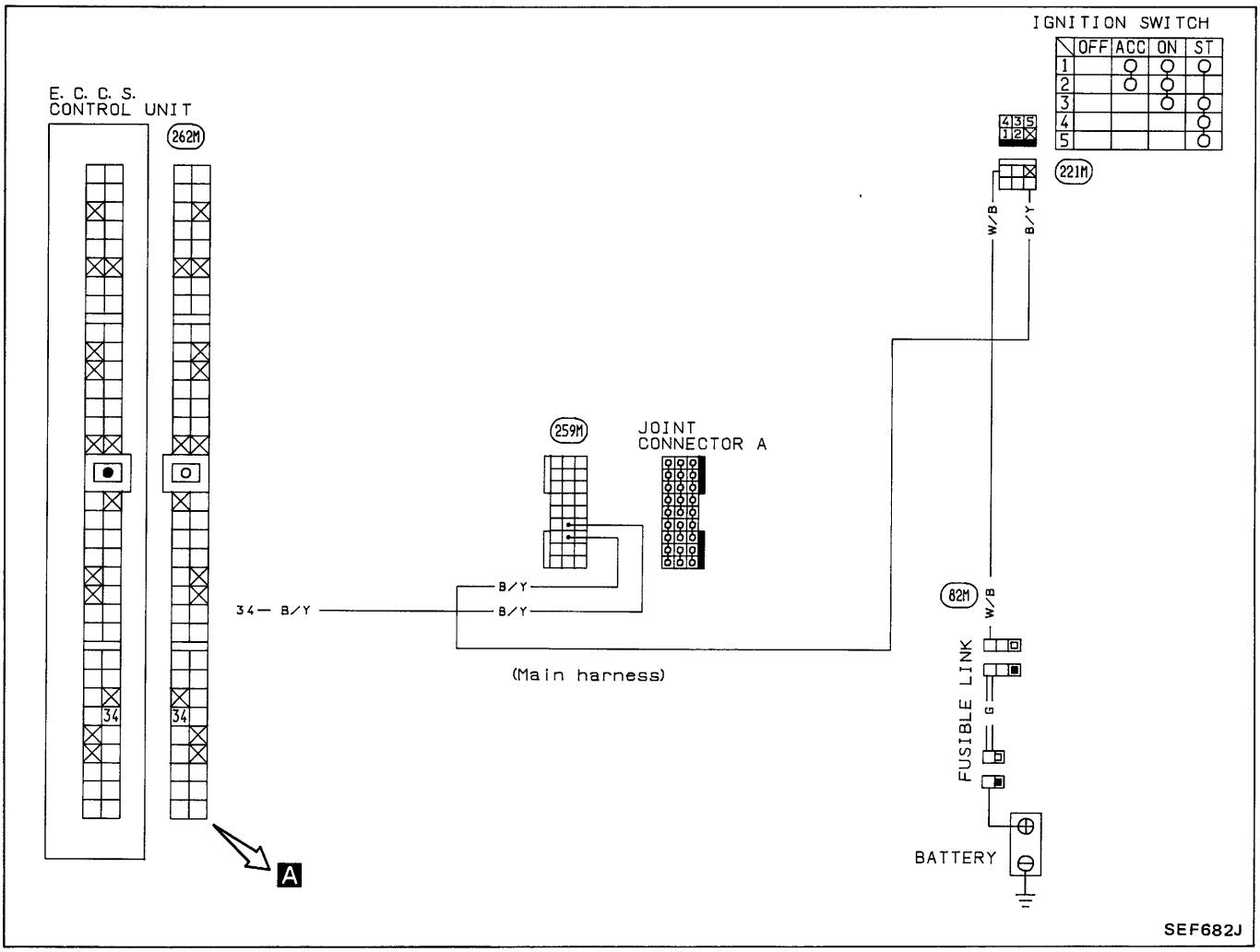
Perform FINAL CHECK by the following procedure after repair is completed.



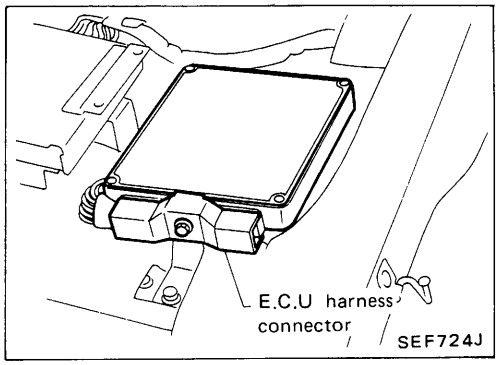
NOTE

Diagnostic Procedure 14

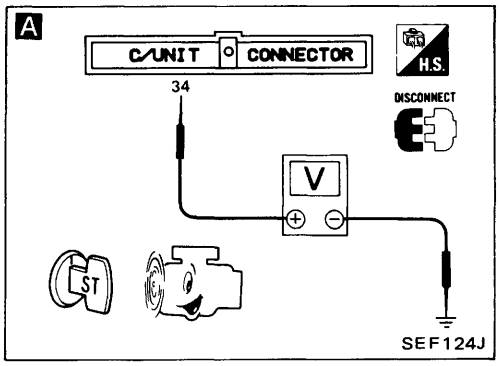
START SIGNAL (Switch ON/OFF diagnostic item)



Harness layout



Diagnostic Procedure 14 (Cont'd)



INSPECTION START

A

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Turn ignition switch to "ST".
3) Check voltage between E.C.U. terminal (34) and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Joint connector-A (259M)
- Harness continuity between E.C.U. and ignition switch

If N.G., repair harness or connectors.

O.K. ↓

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Perform FINAL CHECK by the following procedure after repair is completed.

FINAL CHECK

↓

Turn ignition switch "ON".

↓

Perform switch ON/OFF diagnosis.

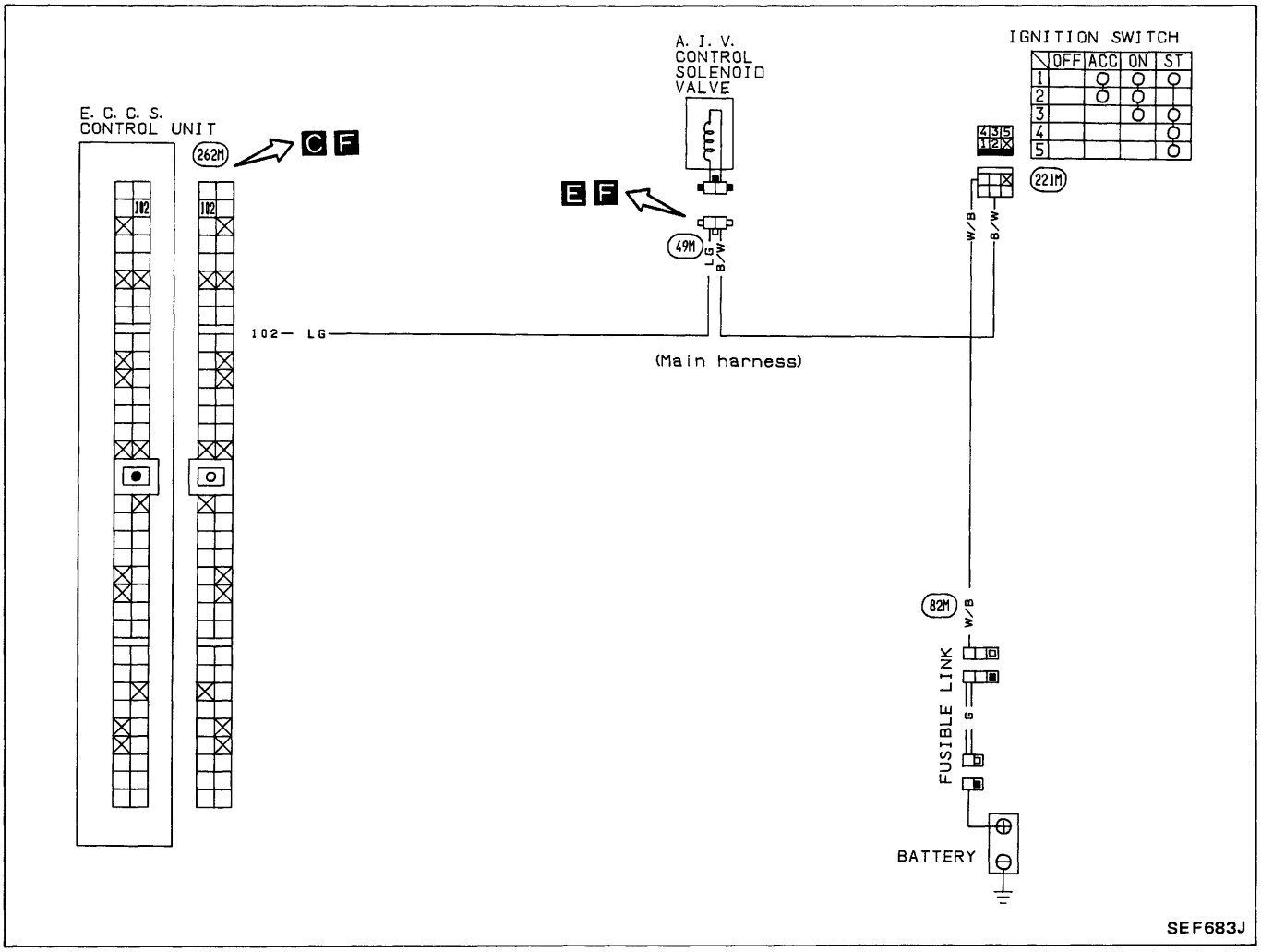
N.G. → Recheck E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K. ↓

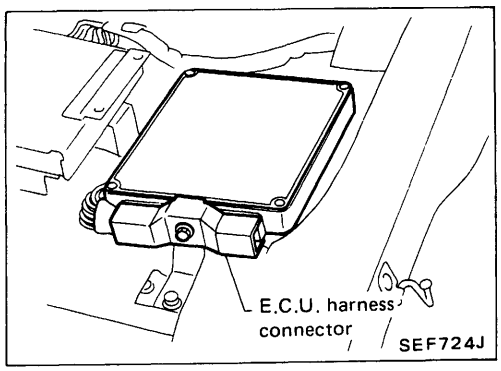
INSPECTION END

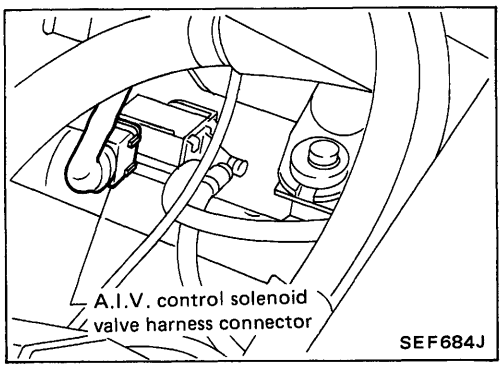
Diagnostic Procedure 15

A.I.V. CONTROL (Not self-diagnostic item)



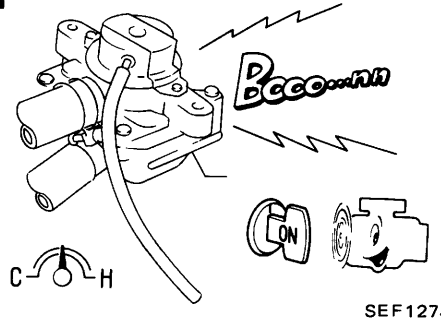
Harness layout





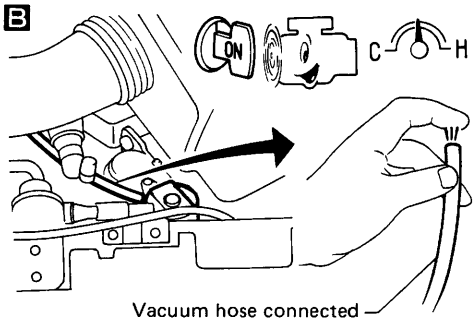
Diagnostic Procedure 15 (Cont'd)

A



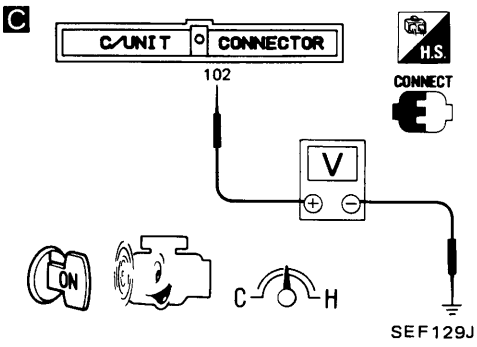
SEF127J

B



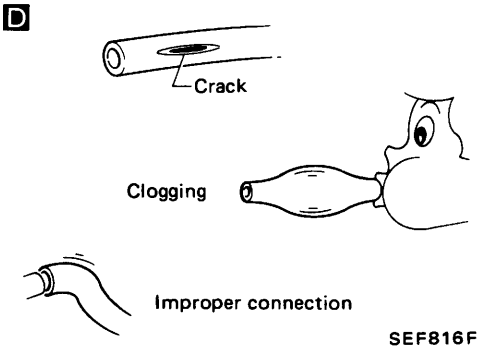
SEF685J

C



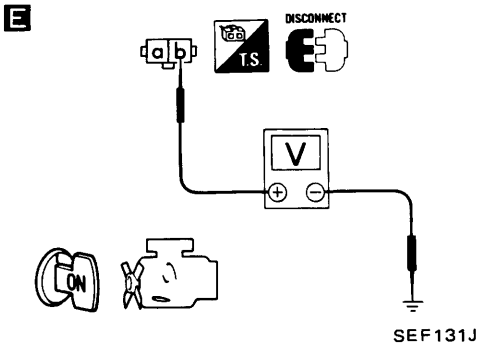
SEF129J

D



SEF816F

E



SEF131J

INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Run engine at about 2,000 rpm for about 2 minutes under no-load.
3) Make sure that inspection lamp (Green) on E.C.U. goes on and off periodically more than 5 times during 10 seconds at 2,000 rpm under no-load.
4) Release accelerator pedal fully, and run engine at idle.
5) Listen to A.I.V. operating sound.

At idle:
A.I.V. should operate.
Except at idle:
A.I.V. should not operate.

O.K. → INSPECTION END

N.G.

B

CHECK VACUUM SOURCE TO A.I.V.
1) Disconnect vacuum hose to A.I.V.
2) Make sure that vacuum exists under the following conditions.

At idle:
Vacuum should exist.
Except at idle:
Vacuum should not exist.

O.K. → CHECK COMPONENT (A.I.V.).
Refer to "Electrical Components Inspection".
(See page EF & EC-319.)

N.G.

C

CHECK CONTROL FUNCTION.
1) Check voltage between E.C.U. terminal (102) and ground.

Voltage:
At idle
Approximately 0V
Except at idle
Battery voltage

O.K. → D

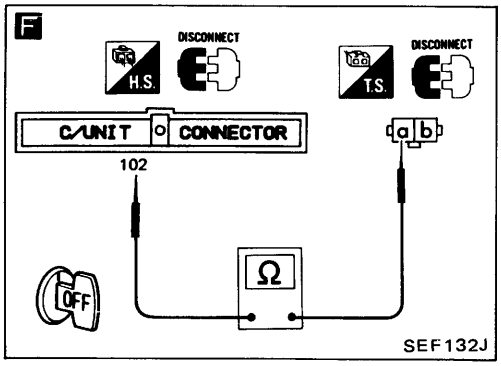
D

CHECK VACUUM HOSE.
Check vacuum hose for clogging, cracks and proper connections.

N.G.

Ⓐ

Diagnostic Procedure 15 (Cont'd)



Ⓐ

E

CHECK POWER SUPPLY.
1) Stop engine.
2) Disconnect A.I.V. control solenoid valve harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓑ and ground.
Voltage: Battery voltage

N.G. → Repair harness or connectors.

O.K. ↓

F

CHECK OUTPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal (102) and terminal ⓐ.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

CHECK COMPONENT
(A.I.V. control solenoid valve).
Refer to "Electrical Components Inspection".
(See page EF & EC-316.)

N.G. → Replace A.I.V. control solenoid valve.

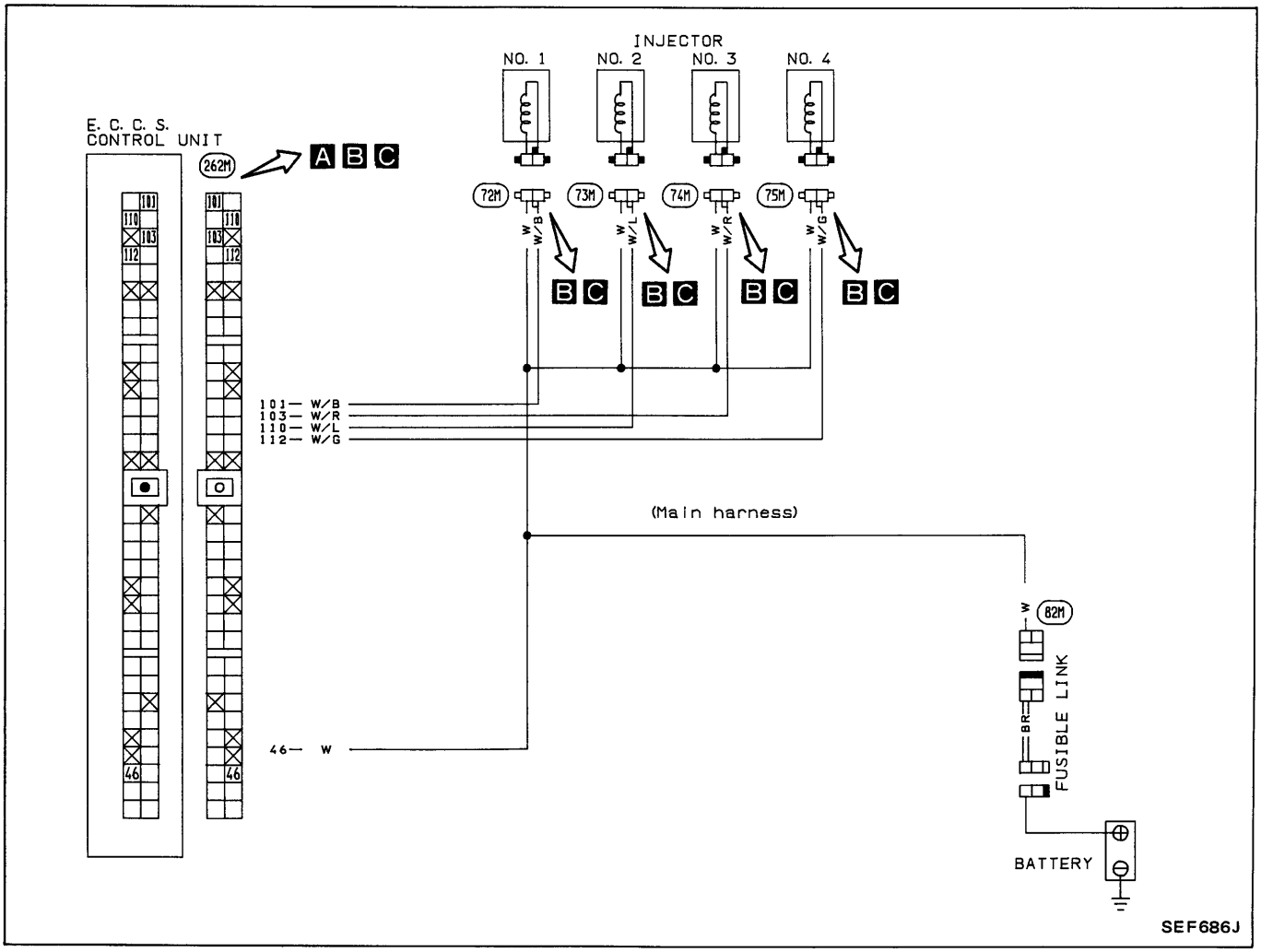
O.K. ↓

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

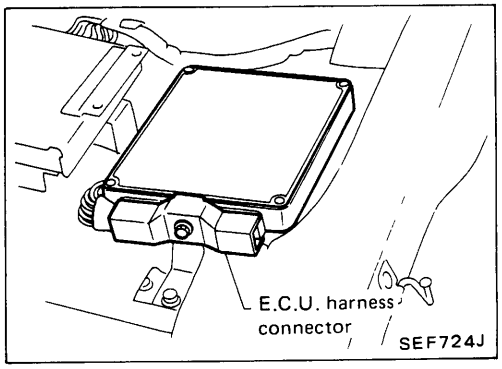
NOTE

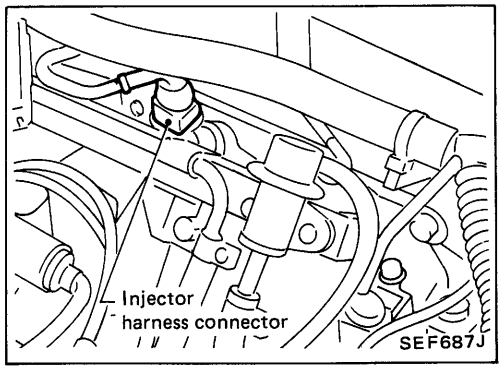
Diagnostic Procedure 16

INJECTOR (Not self-diagnostic item)

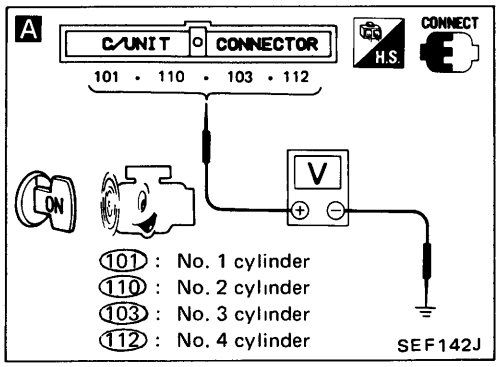


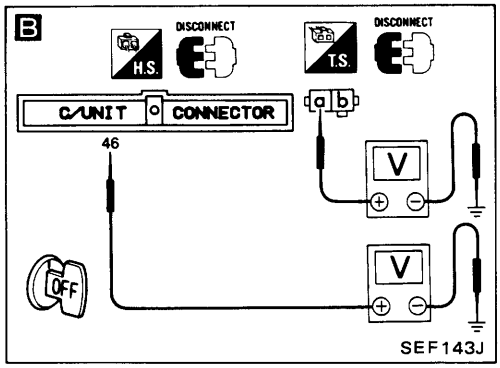
Harness layout

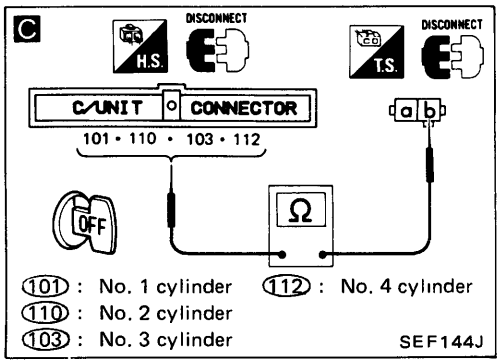




Diagnostic Procedure 16 (Cont'd)







INSPECTION START

A

CHECK CONTROL FUNCTION.
1) Start engine.
2) Check voltage between E.C.U. terminals (101), (110), (103), (112) and ground.
Voltage: Battery voltage

O.K. → INSPECTION END

N.G.

B

CHECK POWER SUPPLY.
1) Stop engine.
2) Disconnect injector harness connector and E.C.U. harness connector.
3) Check voltage between terminal ⓐ and ground, E.C.U. terminal (46) and ground.
Voltage: Battery voltage

N.G. → Repair harness or connectors.

O.K.

C

CHECK OUTPUT SIGNAL CIRCUIT.
1) Check harness continuity between terminal ⓑ and E.C.U. terminals (101) (No. 1 cylinder), (110) (No. 2 cylinder), (103) (No. 3 cylinder), (112) (No. 4 cylinder).
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

CHECK COMPONENT (Injector).
Refer to "Electrical Components Inspection".
(See page EF & EC-317.)

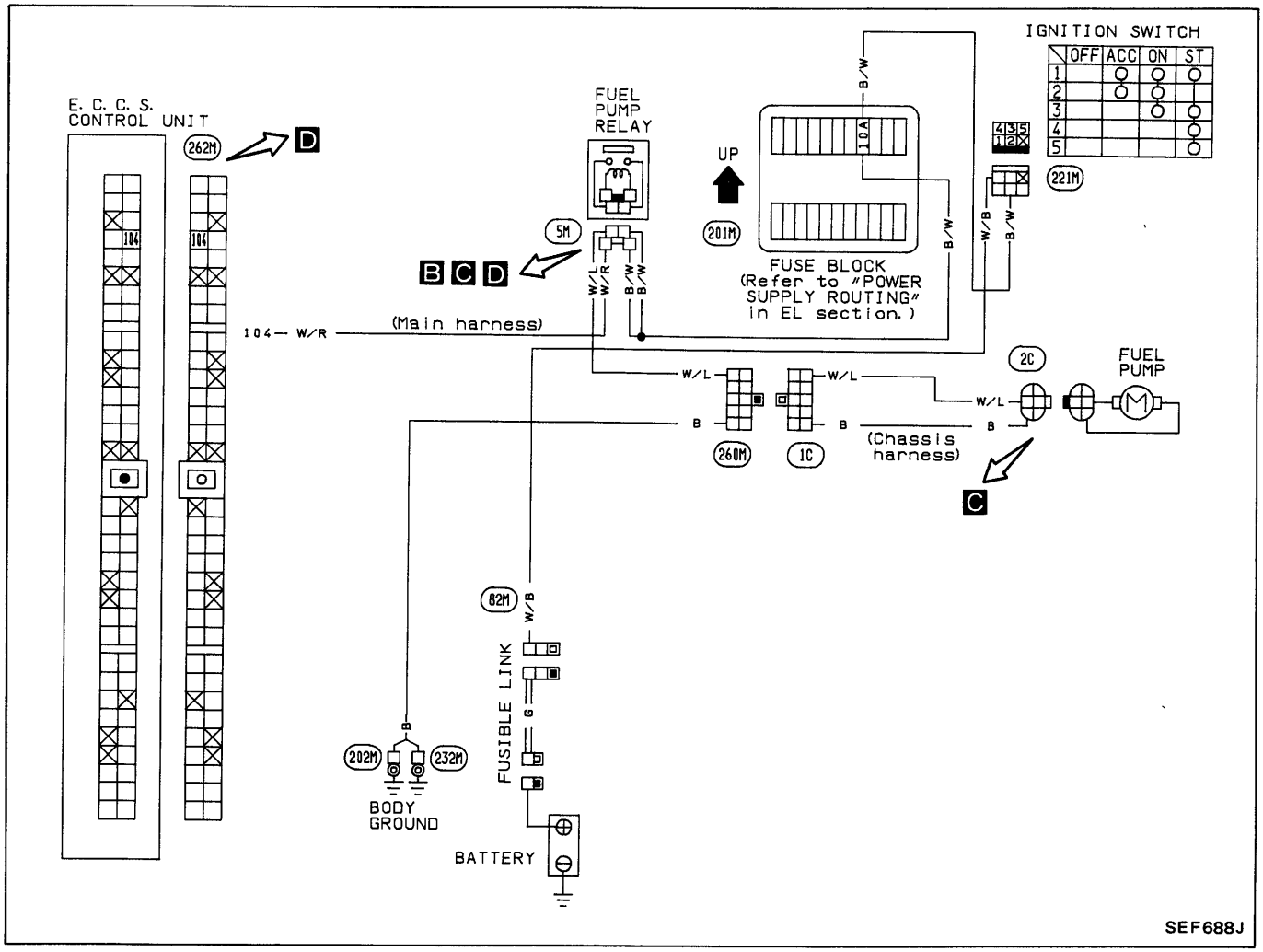
N.G. → Replace injector.

O.K.

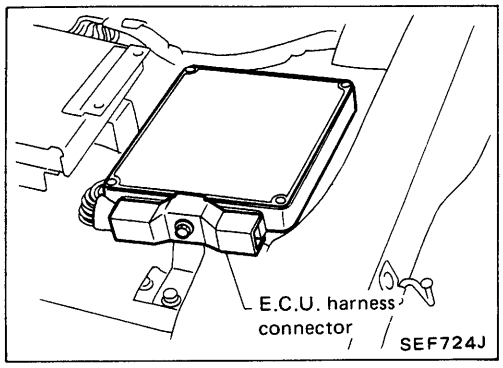
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

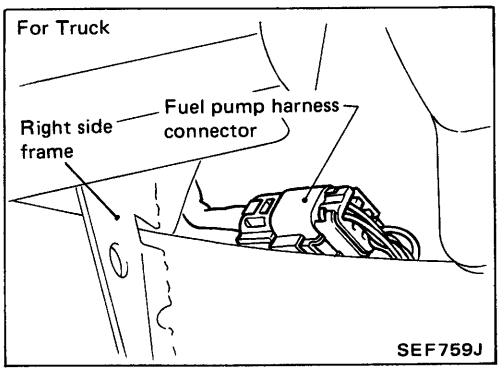
Diagnostic Procedure 17

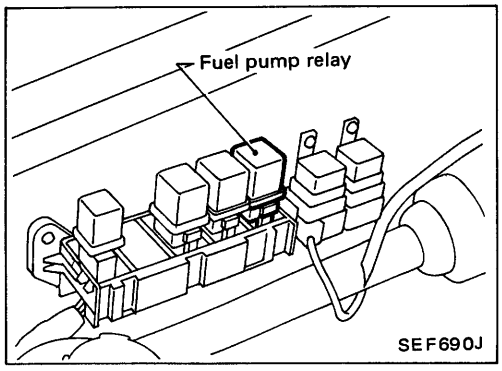
FUEL PUMP (Not self-diagnostic item)



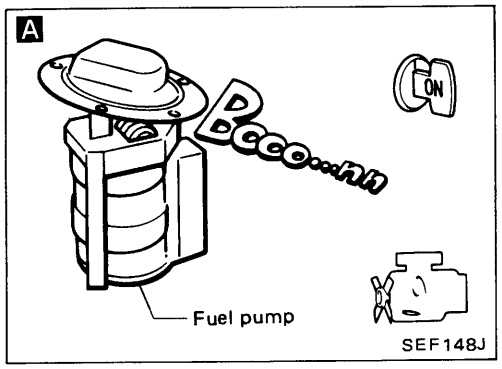
Harness layout

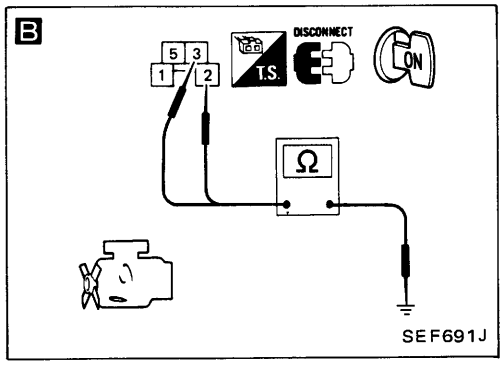


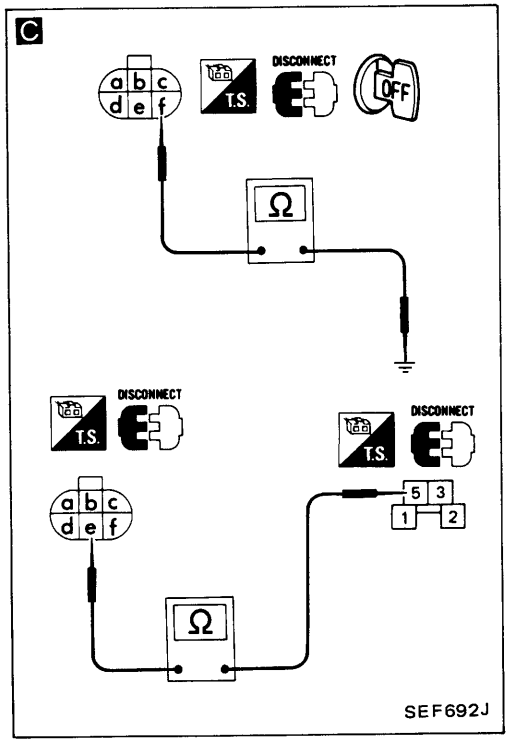


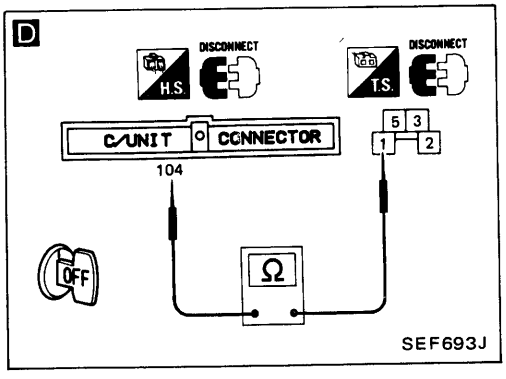


Diagnostic Procedure 17 (Cont'd)









INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Turn ignition switch "ON".
2) Listen to fuel pump operating sound.
Fuel pump should operate for 5 seconds after ignition switch is turned "ON".

O.K. → INSPECTION END

N.G. ↓

B

CHECK POWER SUPPLY.
1) Turn ignition switch "OFF".
2) Disconnect fuel pump relay.
3) Turn ignition switch "ON".
4) Check voltage between terminals ②, ③ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- 10A fuse
- Harness continuity between ignition switch and fuel pump relay

If N.G., repair harness or connectors.

O.K. ↓

C

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect fuel pump harness connector.
3) Check harness continuity between terminal ⓕ and body ground, terminal ⓔ and terminal ⑤.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (260M), (1C)
- Harness continuity between fuel pump and body ground
- Harness continuity between fuel pump and fuel pump relay

If N.G., repair harness or connectors.

O.K. ↓

D

CHECK OUTPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal (104) and terminal ①.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

CHECK COMPONENT
(Fuel pump and fuel pump relay).
Refer to "Electrical Components Inspection".
(See page EF & EC-317.)

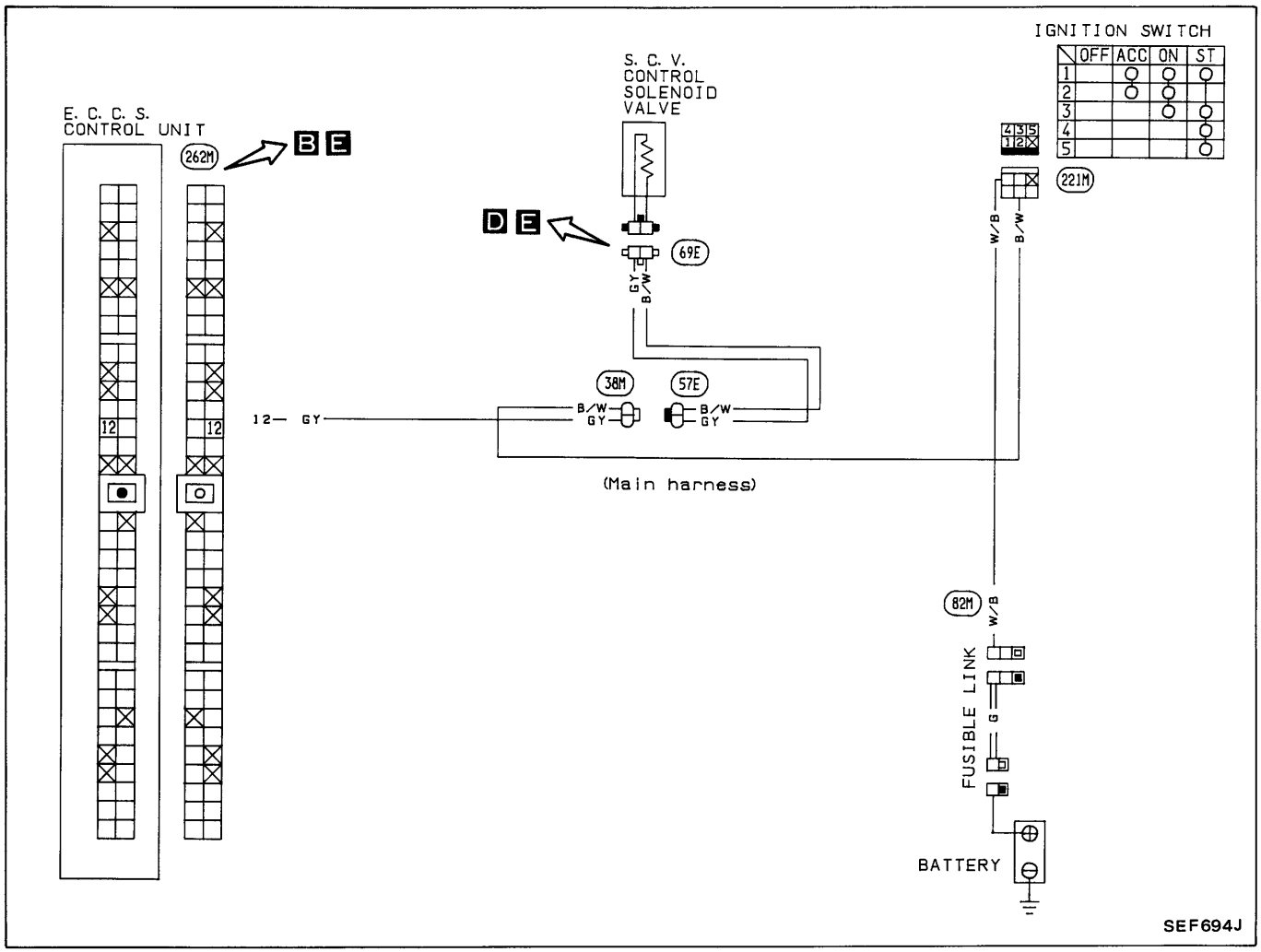
N.G. → Replace malfunctioning component(s).

O.K. ↓

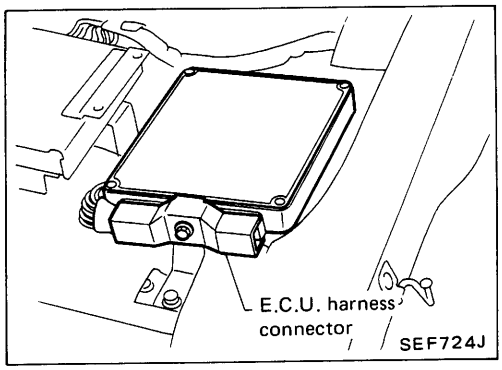
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

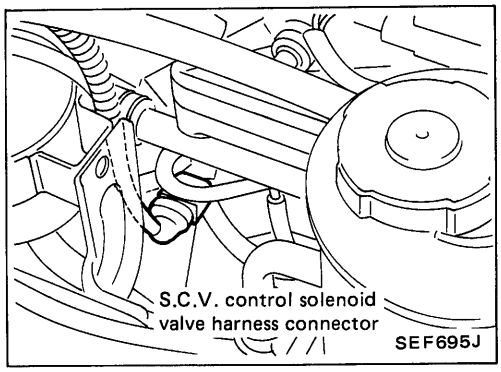
Diagnostic Procedure 18

S.C.V. CONTROL (Not self-diagnostic item)

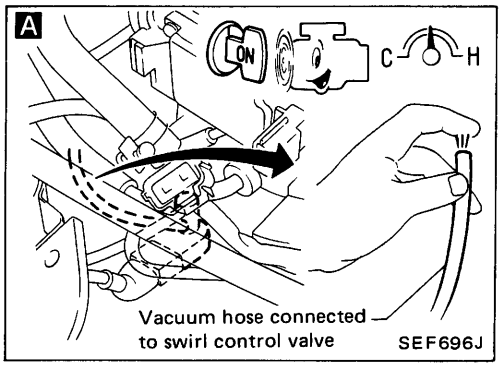


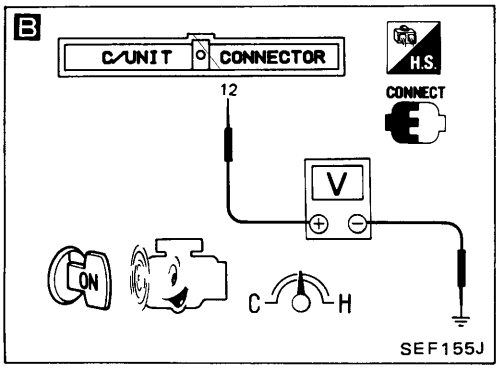
Harness layout

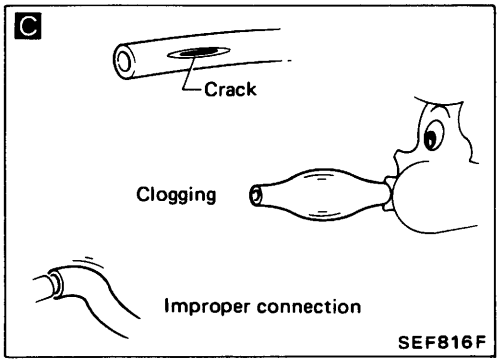


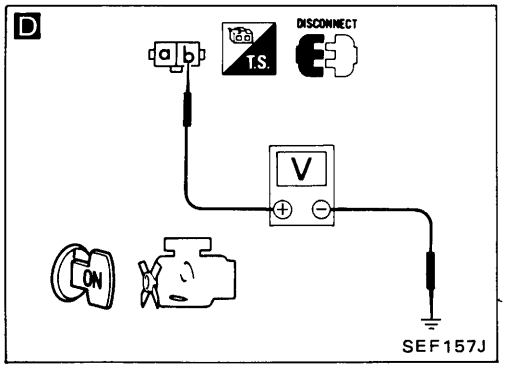


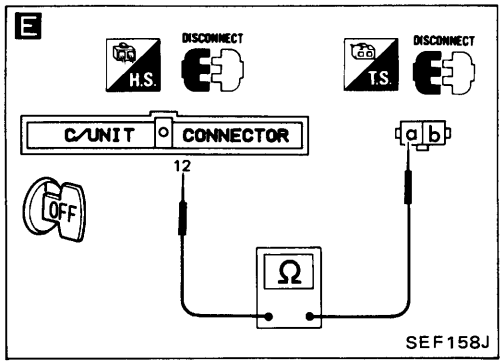
Diagnostic Procedure 18 (Cont'd)











INSPECTION START

A

CHECK VACUUM SOURCE TO SWIRL CONTROL VALVE.
1) Start engine and warm it up sufficiently.
2) Stop engine.
3) After a few seconds, disconnect vacuum hose to swirl control valve and restart engine.
4) Make sure that vacuum exists under the following conditions.
Engine speed is less than 3,600 rpm:
Vacuum should exist.
Engine speed is more than 3,600 rpm:
Vacuum should not exist.

O.K. → INSPECTION END

N.G. ↓

B

CHECK CONTROL FUNCTION.
1) Check voltage between E.C.U. terminal ⑫ and ground.
Voltage:
Engine speed is less than 3,600 rpm
Approximately 0V
Engine speed is more than 3,600 rpm
Battery voltage

N.G. → **C**

CHECK VACUUM HOSE AND SWIRL CONTROL VALVE.
1) Check vacuum hose and swirl control valve for clogging, cracks and proper connection.

N.G. ↓

D

CHECK POWER SUPPLY.
1) Stop engine.
2) Disconnect S.C.V. control solenoid valve harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓑ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (38M), (57E)
- Harness continuity between S.C.V. control solenoid valve and ignition switch

If N.G., repair harness or connectors.

O.K. ↓

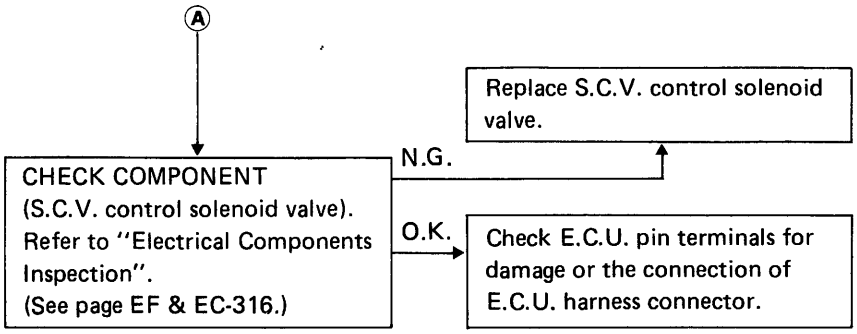
E

CHECK OUTPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal ⑫ and terminal ⓐ.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. → Ⓐ

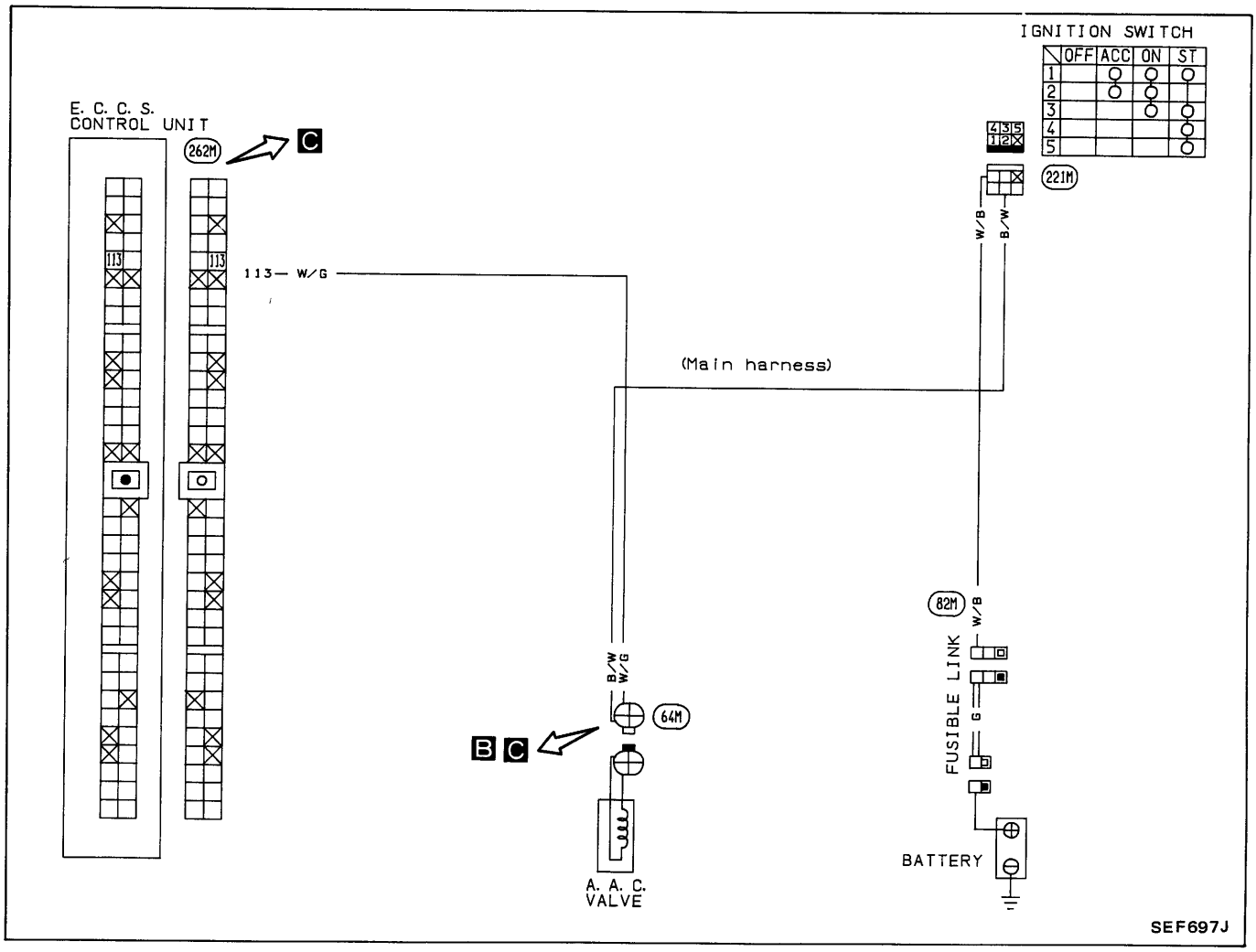
Diagnostic Procedure 18 (Cont'd)



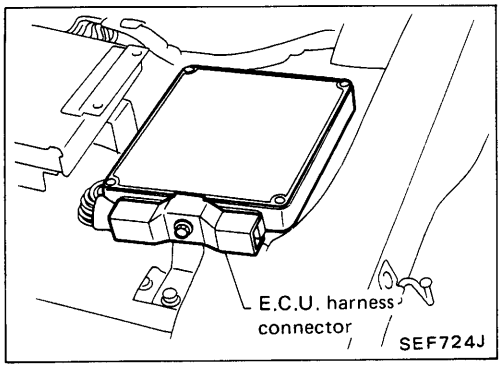
NOTE

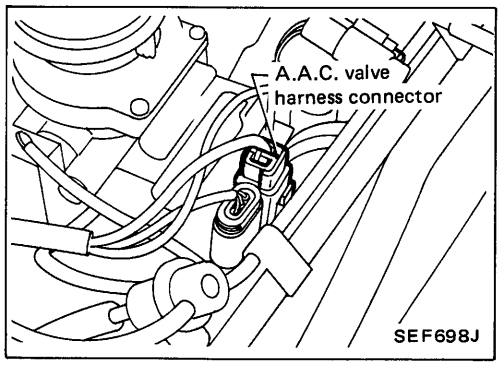
Diagnostic Procedure 19

A.A.C. VALVE (Not self-diagnostic item)

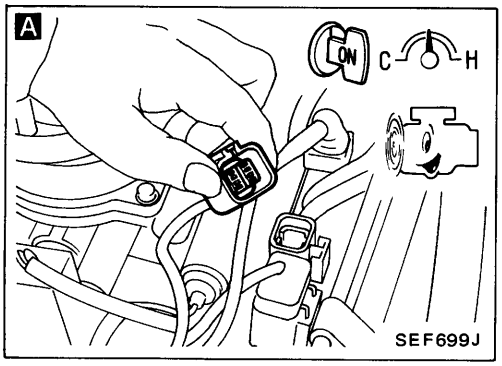


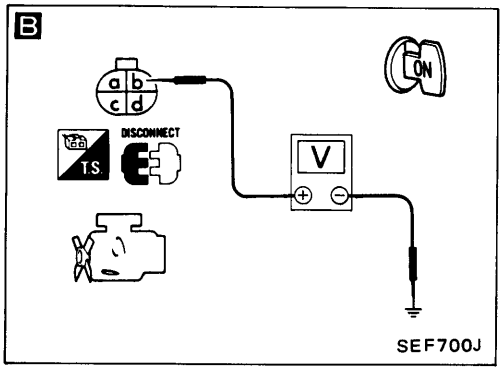
Harness layout

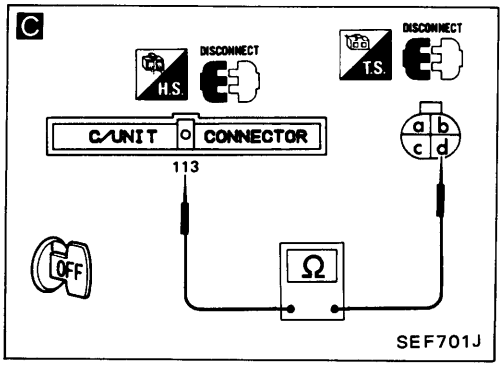




Diagnostic Procedure 19 (Cont'd)







INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Check idle speed.
M/T: 750±50 rpm
A/T: 750±50 rpm (in "N" position)
If N.G., adjust idle speed.
3) Disconnect A.A.C. valve harness connector.
4) Make sure that idle speed drops.

Drops. → INSPECTION END

Does not drop.

B

CHECK POWER SUPPLY.
1) Stop engine.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓑ and ground.
Voltage: Battery voltage

N.G. → Repair harness or connectors.

O.K.

C

CHECK OUTPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal (113) and terminal ⓓ.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

CHECK COMPONENT (A.A.C. valve).
Refer to "Electrical Components Inspection".
(See page EF & EC-318.)

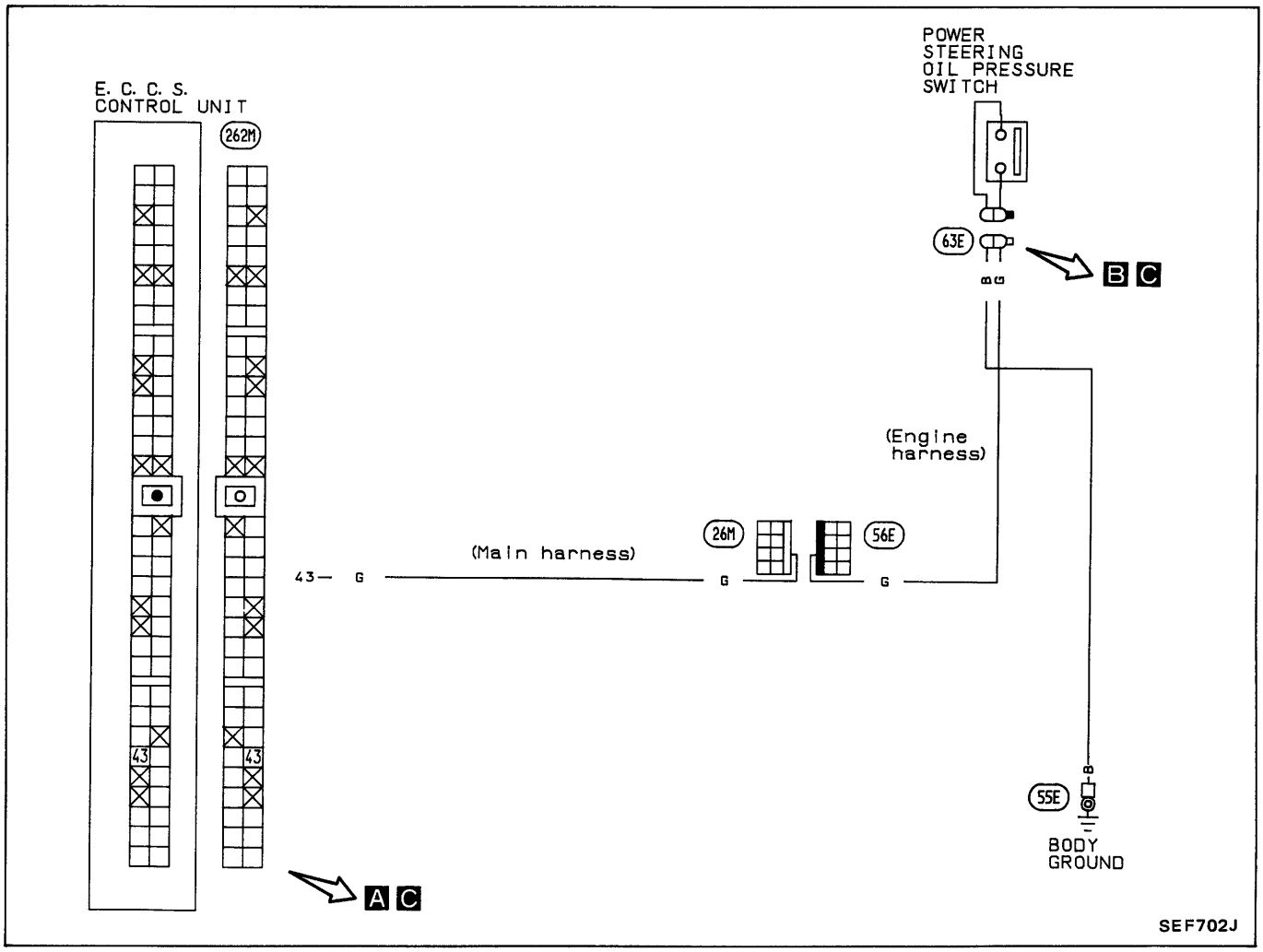
N.G. → Replace A.A.C. valve.

O.K.

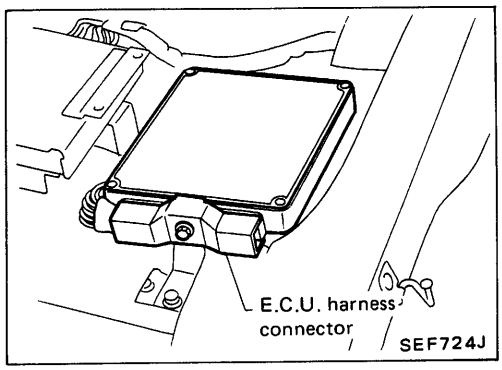
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

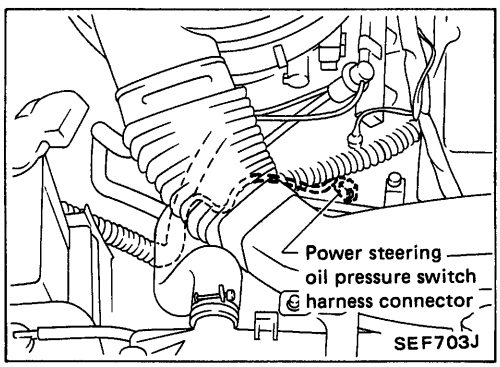
Diagnostic Procedure 20

POWER STEERING OIL PRESSURE SWITCH (Not self-diagnostic item)

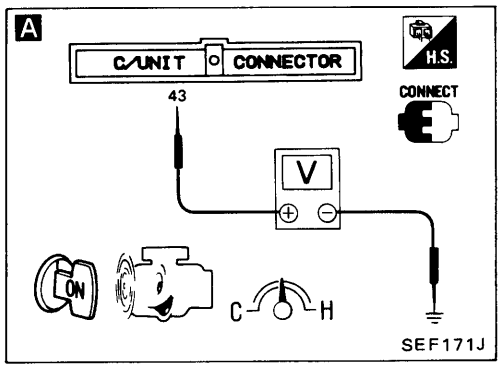


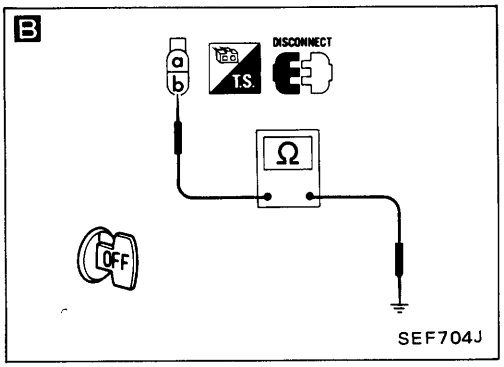
Harness layout

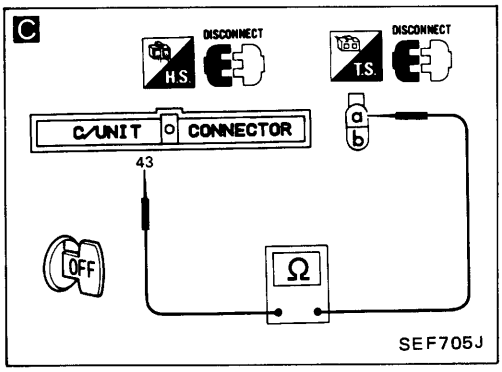




Diagnostic Procedure 20 (Cont'd)







INSPECTION START

A

CHECK CONTROL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Check voltage between E.C.U. terminal ㊸ and ground.
Voltage:
When steering wheel is turned quickly.
Approximately 0V
Except above
Approximately 8 - 9V

O.K. → INSPECTION END

N.G. ↓

B

CHECK GROUND CIRCUIT.
1) Stop engine.
2) Disconnect power steering oil pressure switch harness connector.
3) Check harness continuity between terminal ⓑ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

C

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal ㊸ and terminal ⓐ.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (26M) , (56E)
- Harness continuity between E.C.U. and power steering oil pressure switch

If N.G., repair harness or connectors.

O.K. ↓

CHECK COMPONENT (Power steering oil pressure switch).
Refer to "Electrical Components Inspection".
(See page EF & EC-320.)

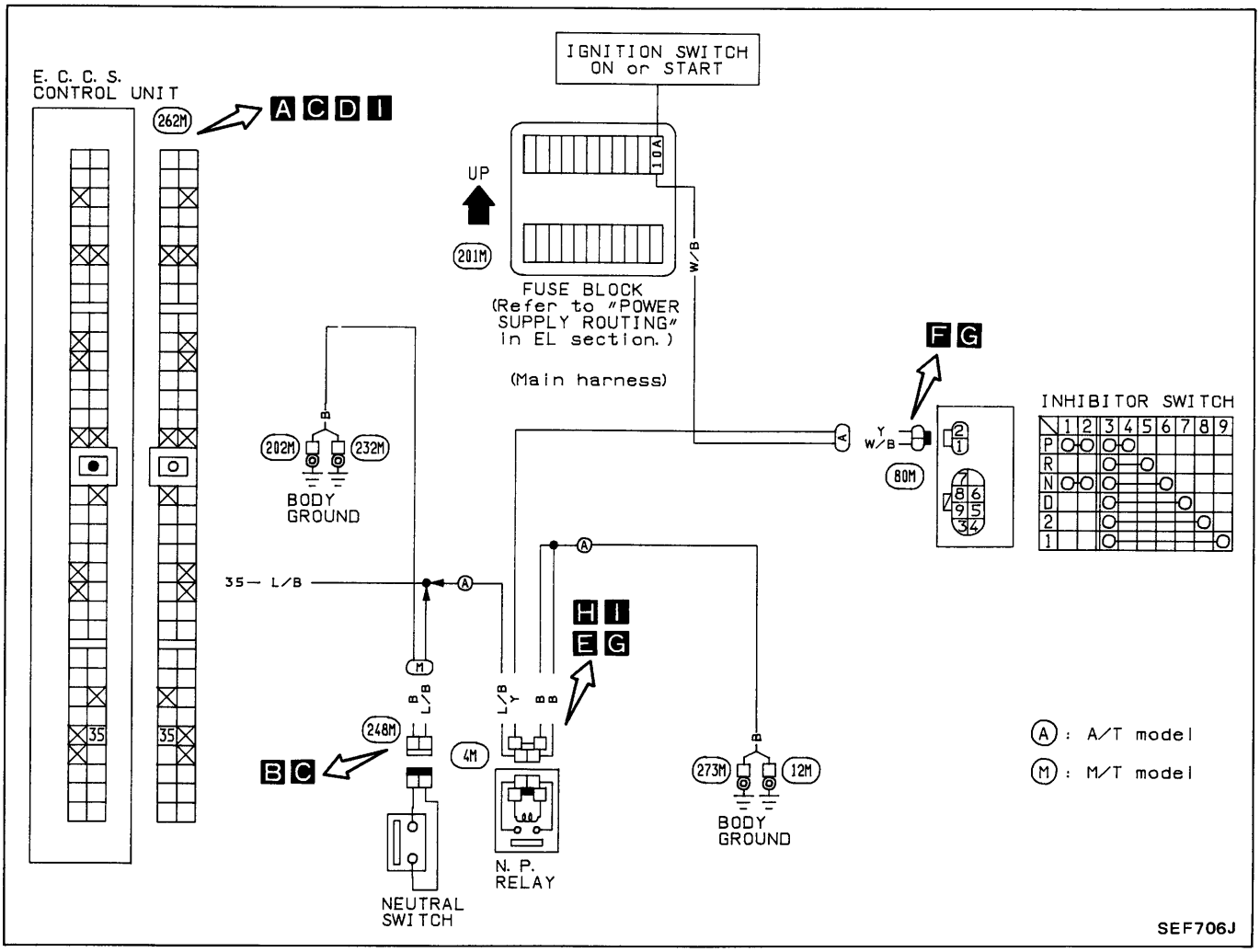
N.G. → Replace power steering oil pressure switch.

O.K. ↓

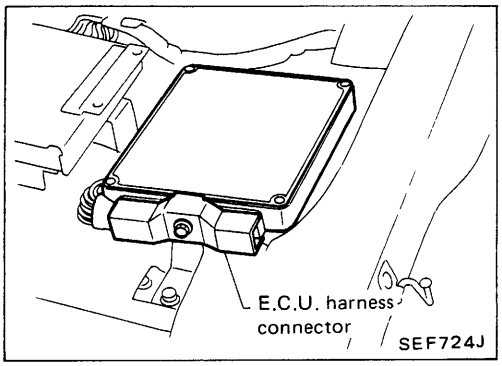
Check E.C.U. pin terminals for damage or the connection of the E.C.U. harness connector.

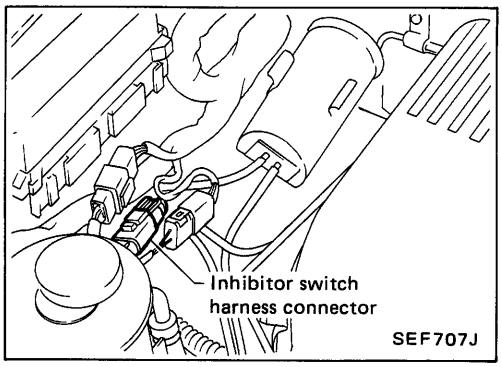
Diagnostic Procedure 21

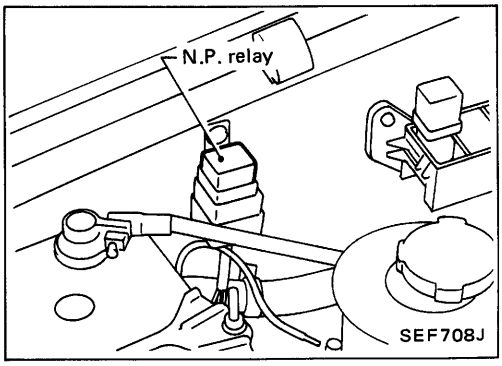
NEUTRAL/INHIBITOR SWITCH (Not self-diagnostic item)



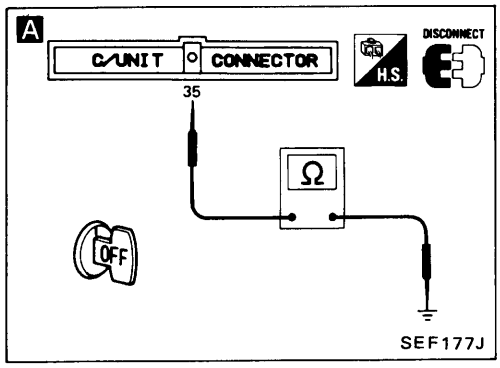
Harness layout

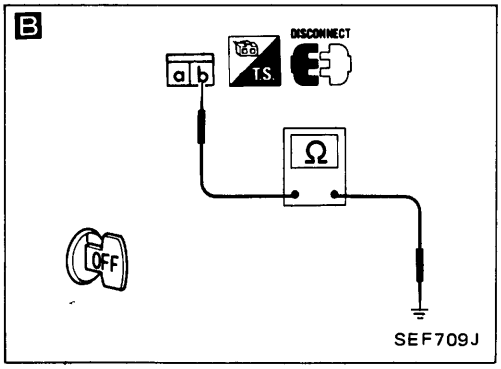


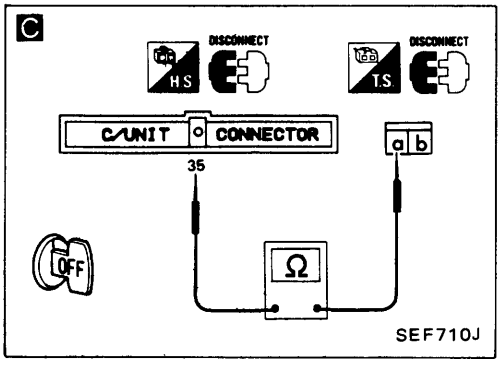




Diagnostic Procedure 21 (Cont'd)







Neutral switch

INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Set shift lever to the neutral position.
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal ㉟ and body ground.
Continuity should exist.

O.K. → INSPECTION END

N.G.

B

CHECK GROUND CIRCUIT.
1) Disconnect neutral switch harness connector.
2) Check harness continuity between terminal ⓑ and body ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

C

CHECK INPUT SIGNAL CIRCUIT.
1) Check harness continuity between E.C.U. terminal ㉟ and terminal ⓐ.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

CHECK COMPONENT
(Neutral switch).
Refer to "Electrical Components Inspection".
(See page EF & EC-319.)

N.G. → Replace neutral switch.

O.K.

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Diagnostic Procedure 21 (Cont'd)

Inhibitor switch

INSPECTION START

D

CHECK OVERALL FUNCTION.
1) Shift selector lever to "P" range.
2) Disconnect E.C.U. harness connector.
3) Turn ignition switch "ON".
4) Check harness continuity between E.C.U. terminal ㉟ and body ground.
Continuity should exist.
5) Shift selector lever to "N" range.
6) Check harness continuity between E.C.U. terminal ㉟ and body ground.
Continuity should exist.

O.K. → INSPECTION END

N.G. ↓

E

CHECK POWER SUPPLY.
1) Turn ignition switch "OFF".
2) Disconnect N.P. relay.
3) Make sure that selector lever is in "N" range.
4) Turn ignition switch "ON".
5) Check voltage between terminal ② and ground.
Voltage: Battery voltage
6) Shift selector lever into "P" range.
7) Check voltage between terminal ② and ground.
Voltage: Battery voltage

N.G. →

O.K. ↓

Ⓐ

Check the following.

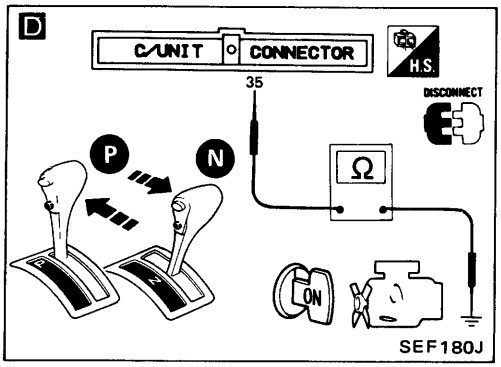
F CHECK HARNESS CONTINUITY BETWEEN INHIBITOR SWITCH AND BATTERY.
1) Turn ignition switch "OFF".
2) Disconnect inhibitor switch harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓑ and ground.
Voltage: Battery voltage
If N.G., check the following.
- 10A fuse
- Harness continuity between fuse and inhibitor switch

If N.G., repair harness or connectors.

G CHECK HARNESS CONTINUITY BETWEEN INHIBITOR SWITCH AND N.P. RELAY.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓐ and terminal ②.
3) Shift selector lever into "P" and "N" range.
Continuity should exist.
If N.G., repair harness or connectors.

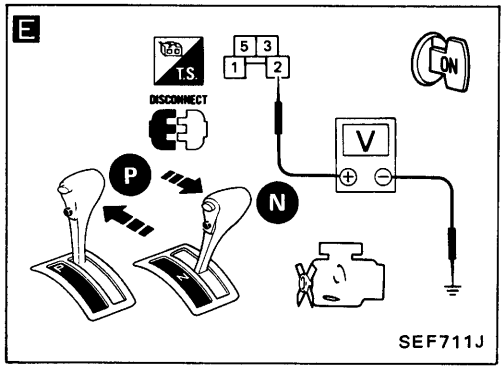
CHECK COMPONENT (Inhibitor switch).
Refer to "Electrical Components Inspection".
(See page EF & EC-319.)

D



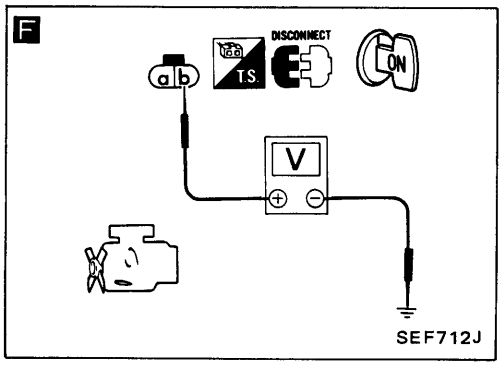
SEF180J

E



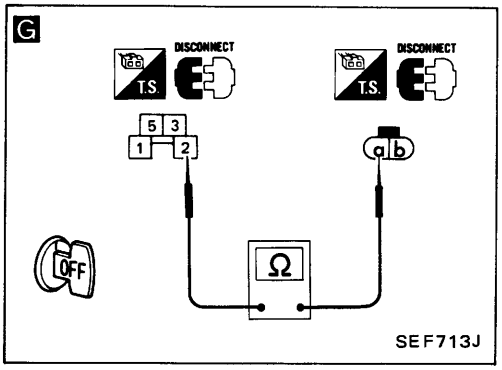
SEF711J

F



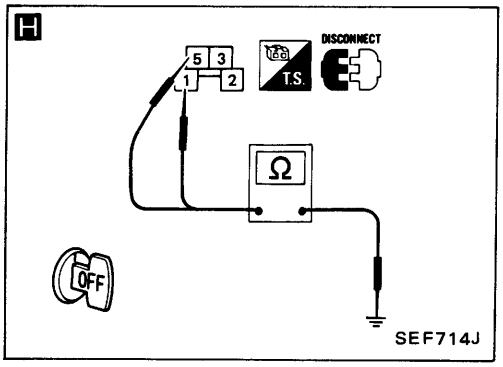
SEF712J

G



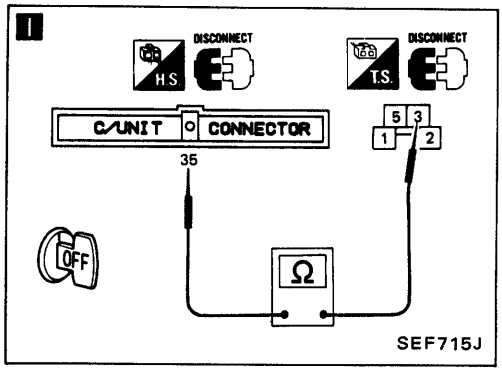
SEF713J

H



SEF714J

Diagnostic Procedure 21 (Cont'd)



Ⓐ

H

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminals ①, ⑤ and body ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

I

CHECK INPUT SIGNAL CIRCUIT.
1) Check harness continuity between E.C.U. terminal ㉟ and terminal ③.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

CHECK COMPONENT (N.P. relay).
Refer to "Electrical Components Inspection".
(See page EF & EC-320.)

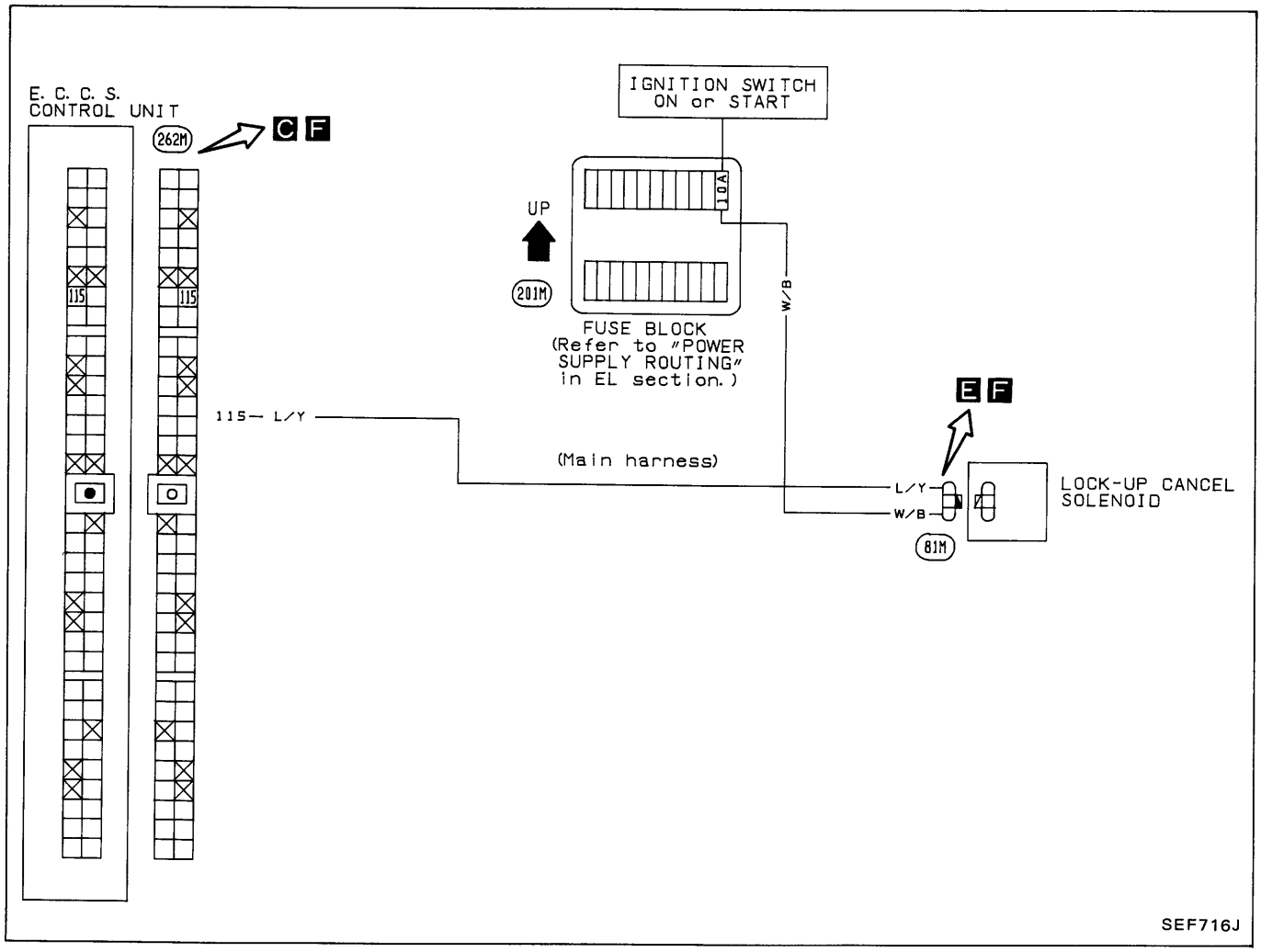
N.G. → Replace N.P. relay.

O.K.

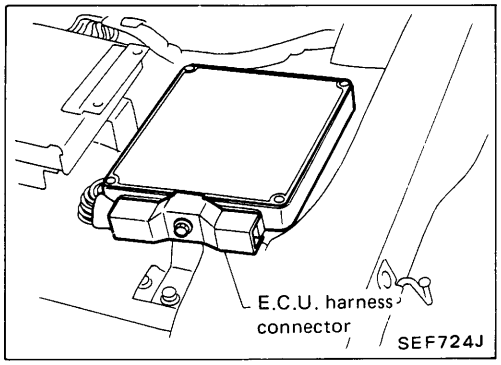
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

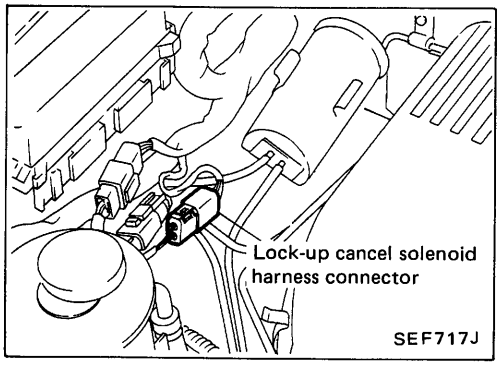
Diagnostic Procedure 22

LOCK-UP CANCEL (Not self-diagnostic item)

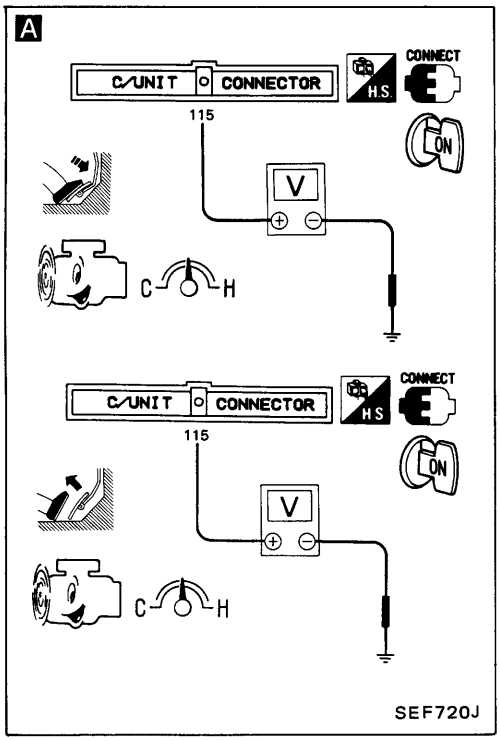


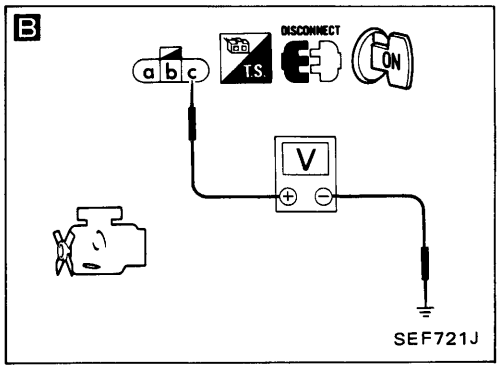
Harness layout

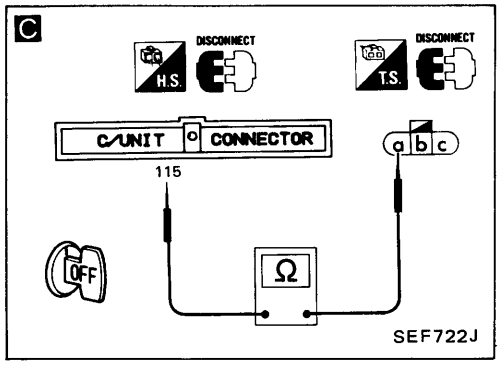




Diagnostic Procedure 22 (Cont'd)







INSPECTION START

A

CHECK CONTROL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Perform self-diagnosis. Make sure that code No. 43 is not displayed.
3) Check voltage between E.C.U. terminal (115) and ground.
Voltage:
Accelerator pedal is depressed
Battery voltage
Accelerator pedal is fully released
Approximately 0V

O.K. → CHECK COMPONENT (Lock-up cancel solenoid). Refer to "Electrical Components Inspection". (See page AT-107.)

B

CHECK POWER SUPPLY.
1) Stop engine.
2) Disconnect lock-up cancel solenoid harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal Ⓒ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- 10A fuse
- Harness continuity between lock-up cancel solenoid and ignition switch

If N.G., repair harness or connectors.

O.K.

C

CHECK OUTPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal (115) and terminal Ⓐ.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

CHECK COMPONENT (Lock-up cancel solenoid). Refer to "Electrical Components Inspection". (See page AT-107.)

N.G. → Replace lock-up cancel solenoid.

O.K.

Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Electrical Components Inspection

E.C.U. INPUT/OUTPUT SIGNAL INSPECTION

E.C.U. inspection table

*Data are reference values.

TERMINAL NO.	ITEM	CONDITION	*DATA
1	Ignition signal	Engine is running. └Idle speed	0.3 - 0.6V
		Engine is running. └Engine speed is 2,000 rpm.	1.2 - 1.5V
2	Tachometer	Engine is running. └Idle speed	Approximately 1.0V
		Engine is running. └Engine speed is 2,000 rpm.	Approximately 2.7V
3	Ignition check	Engine is running. └Idle speed	9 - 12V
4	E.C.C.S. relay (Main relay)	Engine is running. ▼ Ignition switch "OFF" └Within approximately 1 second after turning ignition switch "OFF"	0 - 1 V
		Ignition switch "OFF" └For approximately 1 second after turning ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)
8	Exhaust gas temperature sensor (Only for California model)	Engine is running. └Idle speed	3.0 - 4.0V
		Engine is running. (Racing) └After warming up	0 - 3.0V
11	Air conditioner relay	Engine is running. └Both A/C switch and blower switch are "ON".	0 - 1.0V
		Engine is running. └A/C switch is "OFF".	BATTERY VOLTAGE (11 - 14V)

Electrical Components Inspection (Cont'd)

*Data are reference values.

TERMINAL NO.	ITEM	CONDITION	*DATA
12	S.C.V. control solenoid valve	Engine is running. └Idle speed	0 - 1.0V
		Engine is running. └Engine speed is 2,000 rpm.	BATTERY VOLTAGE (11 - 14V)
16	Air flow meter	Engine is running.	1.0 - 3.0V Output voltage varies with engine revolution.
18	Engine temperature sensor	Engine is running.	1.0 - 3.0V Output voltage varies with engine water temperature.
19	Exhaust gas sensor	Engine is running. └After warming up sufficiently.	0 - Approximately 1.0V
20	Throttle sensor	Ignition switch "ON" └After warming up sufficiently.	0.5 - Approximately 4V Output voltage varies with the throttle valve opening angle.
22 30	Crank angle sensor (Reference signal)	Engine is running. **Do not run engine at high speed under no-load.**	0.3 - 0.4V
26	Air temperature sensor	Ignition switch "ON" └Air temperature is 20°C (68°F).	Approximately 2.4V
		Ignition switch "ON" └Air temperature is 80°C (176°F).	Approximately 0.3V.
28	Throttle opening signal	Ignition switch "ON"	0.5 - Approximately 4V
31 40	Crank angle sensor (Position signal)	Engine is running. **Do not run engine at high speed under no-load.**	2.0 - 3.0V
34	Start signal	Cranking	8 - 12V
35	Neutral switch & Inhibitor switch	Ignition switch "ON" └Neutral/Parking	0V
		Ignition switch "ON" └Except the above gear position	6 - 7V

Electrical Components Inspection (Cont'd)

*Data are reference values.

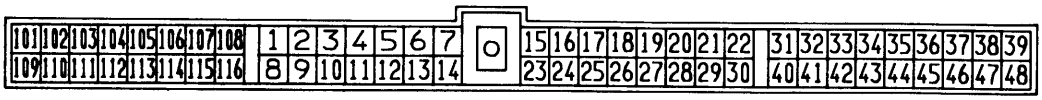
TERMINAL NO.	ITEM	CONDITION	*DATA
36	Ignition switch	Ignition switch "OFF"	0V
		Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
37	Throttle sensor power supply	Ignition switch "ON"	Approximately 5V
38 47	Power supply for E.C.U.	Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
41	Air conditioner switch	Engine is running. └Both air conditioner switch and blower switch are "ON".	0V
		Engine is running. └Air conditioner switch is "OFF".	BATTERY VOLTAGE (11 - 14V)
43	Power steering oil pressure switch	Engine is running. └Steering wheel is being turned.	0.1 - 0.3V
		Engine is running. └Steering wheel is not being turned.	Approximately 5V
46	Power supply (Back-up)	Ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)
101	Injector No. 1	Engine is running.	BATTERY VOLTAGE (11 - 14V)
103	Injector No. 3		
110	Injector No. 2		
112	Injector No. 4		
102	E.G.R. control solenoid valve	Engine is running. └Engine is cold. [Water temperature is below 60°C (140°F).	0.7 - 0.9V
		Engine is running. (Racing) └After warming up [Water temperature is between 60°C (140°F) and 105°C (221°F).	BATTERY VOLTAGE (11 - 14V)

Electrical Components Inspection (Cont'd)

*Data are reference values.

TERMINAL NO.	ITEM	CONDITION	*DATA
104	Fuel pump relay	Ignition switch "ON" —For 5 seconds after turning ignition switch "ON" Engine is running.	0.7 - 0.9V
		Ignition switch "ON" —Within 5 seconds after turning ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
113	A.A.C. valve	Engine is running. —Idle speed	7 - 10V
		Engine is running. —Steering wheel is being turned. —Air conditioner is operating. —Rear defogger is "ON". —Headlamps are in high position.	4 - 7V
115	Lock-up cancel solenoid	Engine is running —Idle speed [Water temperature is below 40°C (104°F).]	Approximately 0V
		Engine is running —After warming up [Water temperature is above 40°C (104°F).] —Engine speed is 2,000 rpm	BATTERY VOLTAGE (11 - 14V)

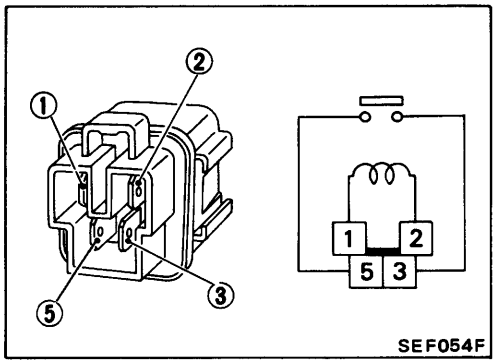
E.C.U. HARNESS CONNECTOR TERMINAL LAYOUT





SEF419H

Electrical Components Inspection (Cont'd)

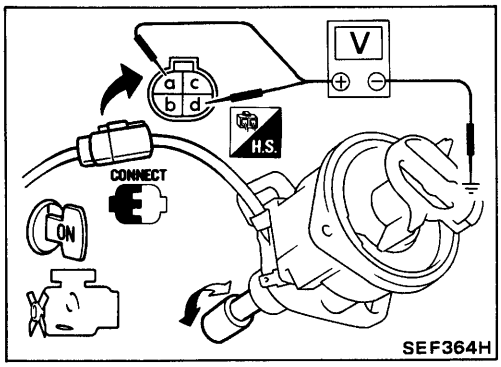


SEF054F

E.C.C.S. RELAY

Check continuity between terminals ③ and ⑤.

Condition	Continuity
12V direct current supply between terminals ① and ②	Yes
No supply	No

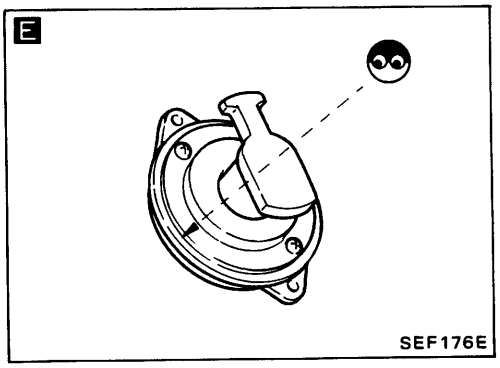


SEF364H

CRANK ANGLE SENSOR

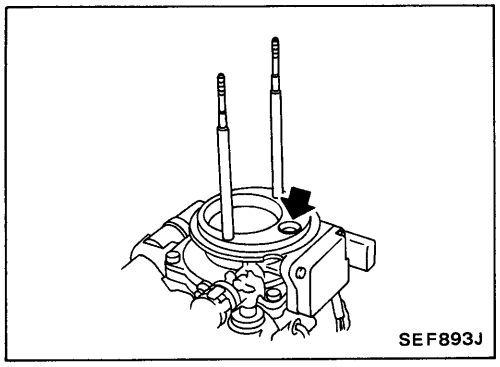
1. Remove distributor from engine. (crank angle sensor harness connector is connected.)
2. Turn ignition switch "ON".
3. Rotate crank angle sensor shaft slowly and check voltage between terminals ⓐ, ⓓ and ground.

Voltage fluctuates between 5V and 0V.



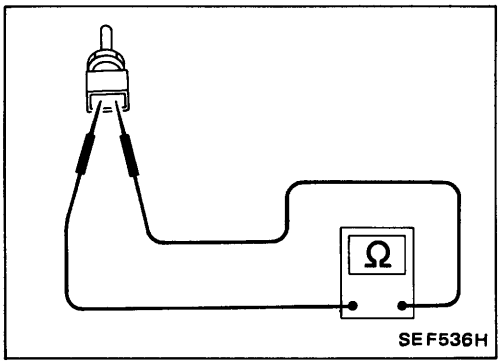
SEF176E

4. Visually check rotor plate for damage or dust.


SEF893J

AIR FLOW METER

- Visually check hot wire air passage for dust.



SEF536H

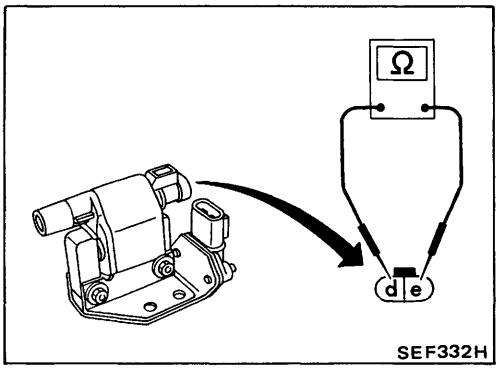
ENGINE TEMPERATURE SENSOR

Check engine temperature sensor resistance.

Temperature °C (°F)	Resistance kΩ
20 (68)	2.1 - 2.9
80 (176)	0.30 - 0.33

Electrical Components Inspection (Cont'd)

IGNITION COIL

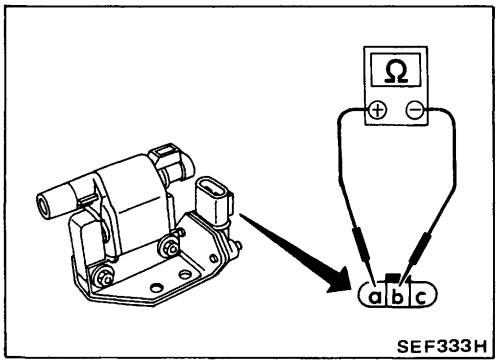


SEF332H

Check ignition coil resistance.

Terminal	Resistance
ⓓ - ⓔ	Approximately 0.7Ω

POWER TRANSISTOR

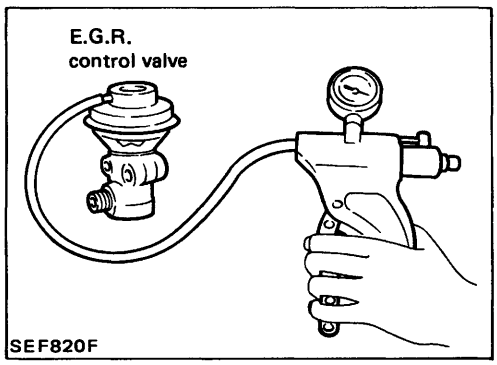


SEF333H

Check continuity between power transistor terminals.

Terminal No.	Tester polarity	Continuity
ⓐ	⊕	No
ⓑ	⊖	
ⓐ	⊖	Yes
ⓑ	⊕	
ⓐ	⊕	No
ⓒ	⊖	
ⓐ	⊖	Yes
ⓒ	⊕	

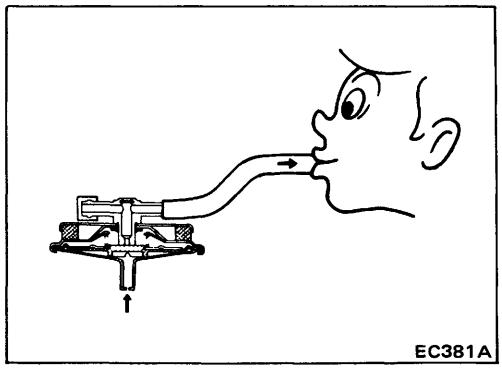
E.G.R. CONTROL VALVE



SEF820F

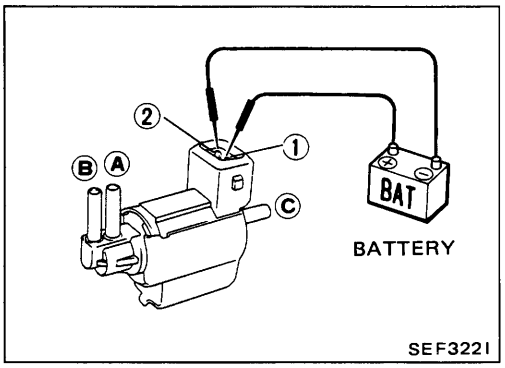
Apply vacuum to E.G.R. vacuum port with a hand vacuum pump.
E.G.R. control valve spring should lift.

B.P.T. VALVE


EC381A

Plug one of two ports of B.P.T. valve.
Apply a pressure above 0.490 kPa (50 mmH_2O, 1.97 inH_2O) to check for leakage. If a leak is noted, replace valve.

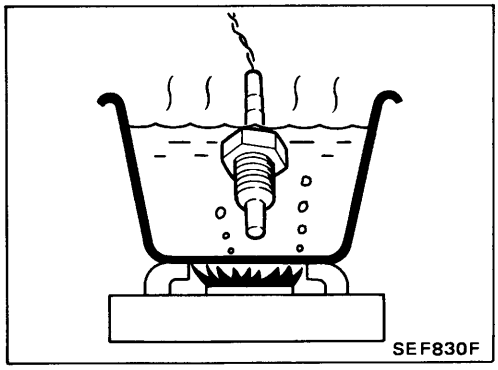
Electrical Components Inspection (Cont'd)



E.G.R. CONTROL SOLENOID VALVE, A.I.V. CONTROL SOLENOID VALVE AND S.C.V. CONTROL SOLENOID VALVE

Check air passages continuity.

Condition	Air passage continuity between Ⓐ and Ⓑ	Air passage continuity between Ⓐ and Ⓒ
12V direct current supply between terminals ① and ②	Yes	No
No supply	No	Yes



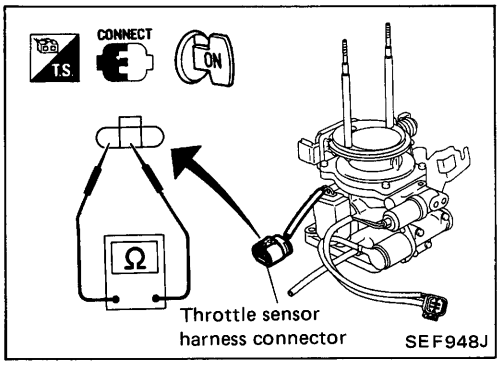
EXHAUST GAS TEMPERATURE SENSOR

Check resistance change and resistance value at 100°C (212°F).

- **Resistance should decrease in response to temperature increase.**

  Resistance: 100°C (212°F)

  85.3 ± 8.53 kΩ



THROTTLE SENSOR

Make sure that resistance between terminals ⓔ and ⓕ changes when opening throttle valve manually.

Resistance should change.

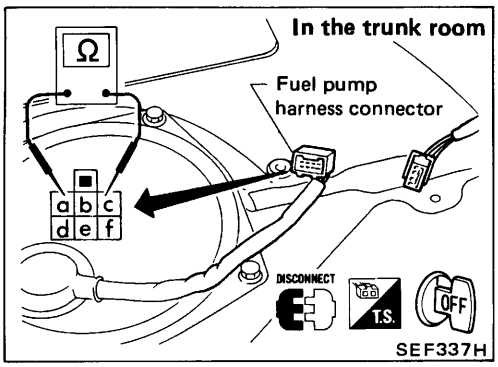
If N.G., replace throttle sensor.

Adjustment

If throttle sensor is replaced or removed, it is necessary to install it in the proper position, by following the procedure as shown below:

1. Install throttle sensor body in throttle chamber. Do not tighten bolts.
2. Connect throttle sensor harness connector.
3. Start engine and warm it up sufficiently.
4. Measure output voltage of throttle sensor using voltmeter.
5. Adjust by rotating throttle sensor body so that output voltage is 0.4 to 0.6V.
6. Tighten mounting bolts.
7. Disconnect throttle sensor harness connector for a few seconds and then reconnect it.

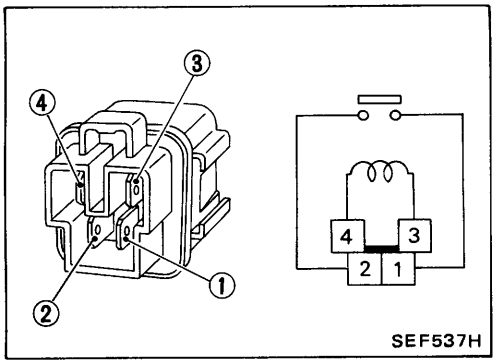
Electrical Components Inspection (Cont'd)



FUEL PUMP

Check continuity between terminals ⓐ and ⓒ.

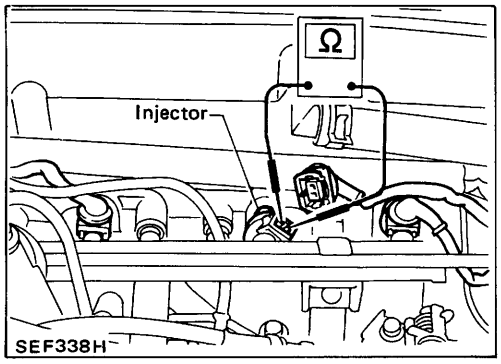
Continuity should exist.



FUEL PUMP RELAY

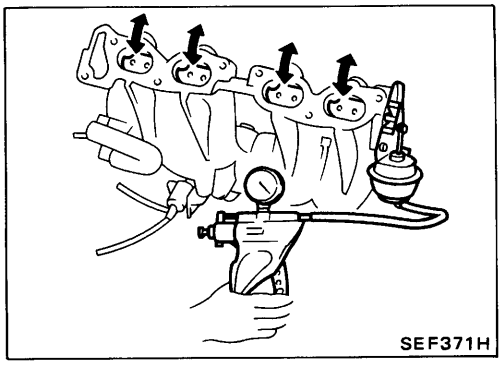
Check continuity between terminals ① and ②.

Condition	Continuity
12V direct current supply between terminals ③ and ④	Yes
No supply	No



INJECTORS

- Check injector resistance.
  Resistance:
  Approximately 10 - 15Ω
- Remove injector and check nozzle for clogging.



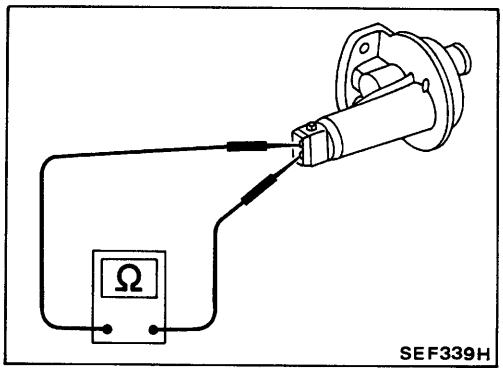
SWIRL CONTROL VALVE

Supply vacuum to actuator and check swirl control valve operation.

Condition	Swirl control valve
Supply vacuum to actuator	Close
No supply	Open

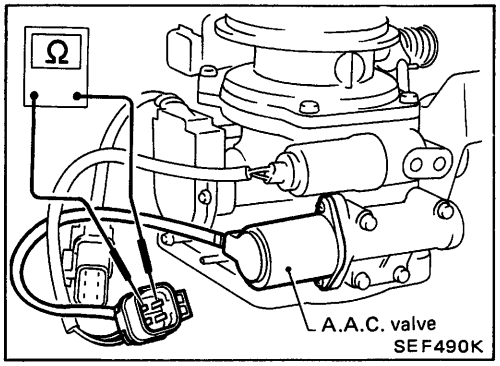
Electrical Components Inspection (Cont'd)

AIR REGULATOR

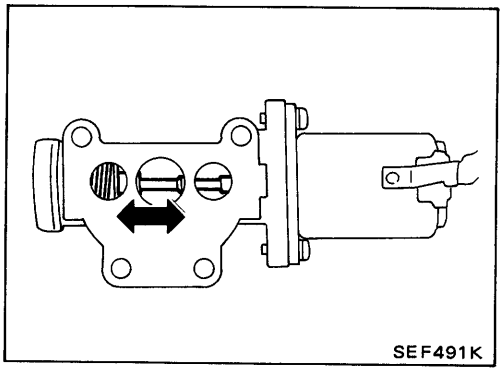


- Check air regulator resistance.
  Resistance:
  Approximately 75Ω
- Check air regulator for clogging.

A.A.C. VALVE

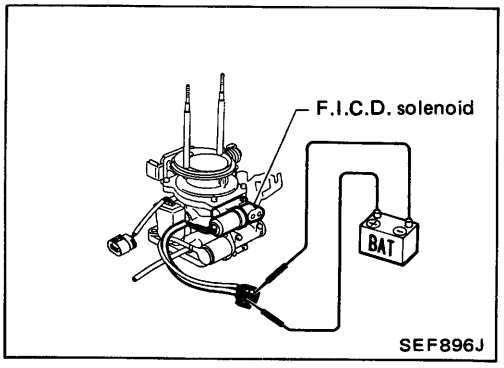


- Check A.A.C. valve resistance.
  Resistance:
  Approximately 10Ω

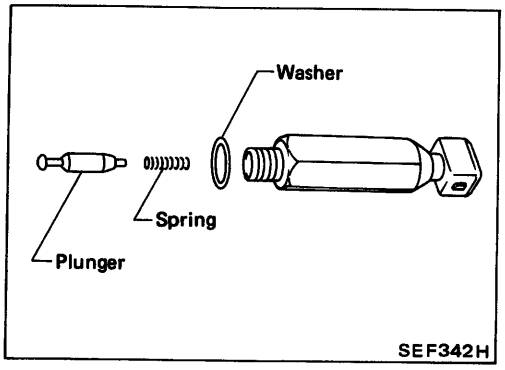


- Check plunger for seizure or sticking.
- Check spring for broken.

F.I.C.D. SOLENOID VALVE



- Check that clicking sound is heard when applying 12V dirct current to terminals.

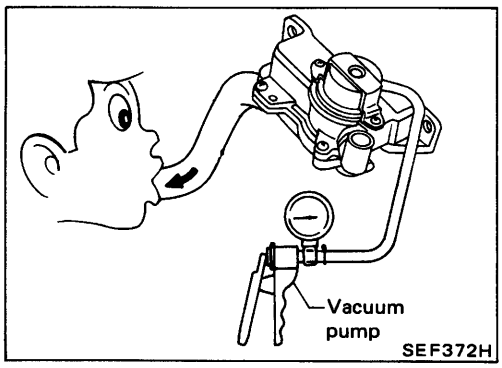


- Check plunger for seizure or sticking.
- Check for broken spring.

Electrical Components Inspection (Cont'd)

AIR INDUCTION VALVE

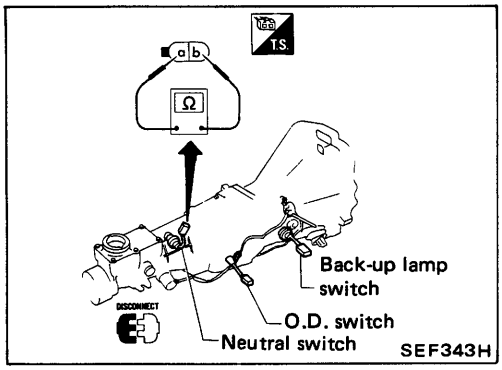
Apply vacuum to vacuum motor, suck or blow hose to make sure that air flows only towards the air induction side.



NEUTRAL SWITCH

- Check continuity between terminals ⓐ and ⓑ.

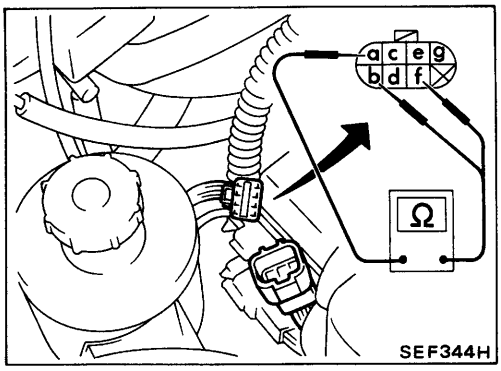
Conditions	Continuity
Shift to Neutral	Yes
Shift to other position	No



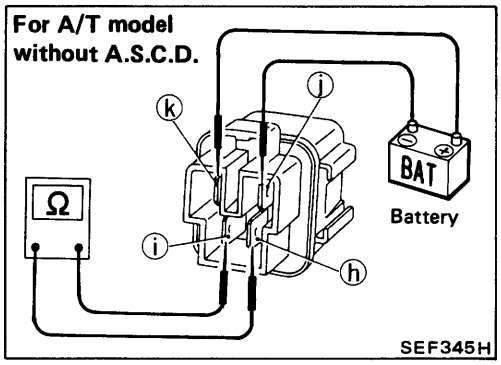
INHIBITOR SWITCH

Check continuity between terminals ⓐ and ⓑ, ⓕ.

Conditions	Continuity between terminals ⓐ and ⓑ	Continuity between terminals ⓐ and ⓕ
Shift to "P" position	Yes	No
Shift to "N" position	No	Yes
Shift to positions other than "P" and "N"	No	No



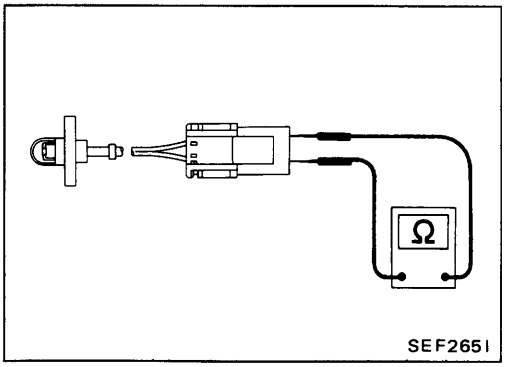
Electrical Components Inspection (Cont'd)



N.P. RELAY

- Check continuity between terminals ⓗ and ⓘ.

Condition	Continuity between terminals ⓗ and ⓘ
12V direct current supply between terminals ⓙ and ⓚ	Yes
No supply	No



AIR TEMPERATURE SENSOR

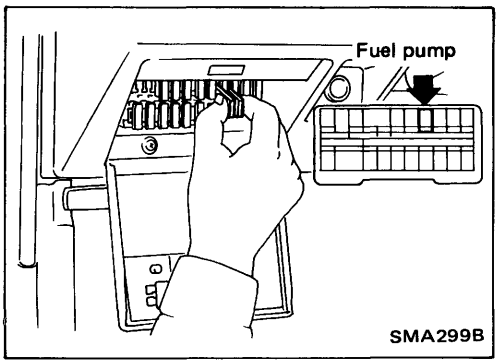
Check air temperature sensor resistance.

Temperature °C (°F)	Resistance kΩ
20 (68)	2.1 - 2.9
80 (176)	0.27 - 0.38

POWER STEERING OIL PRESSURE SWITCH

1. Disconnect power steering oil pressure switch harness connector.
2. Check continuity between terminals.

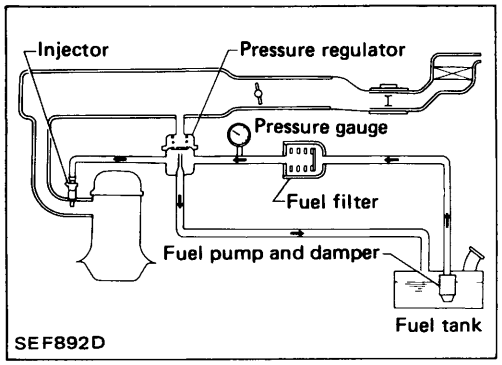
Conditions	Continuity
Steering wheel is being turned.	Yes
Steering wheel is not being turned.	No



Releasing Fuel Pressure

Before disconnecting fuel line, release fuel pressure from fuel line to eliminate danger.

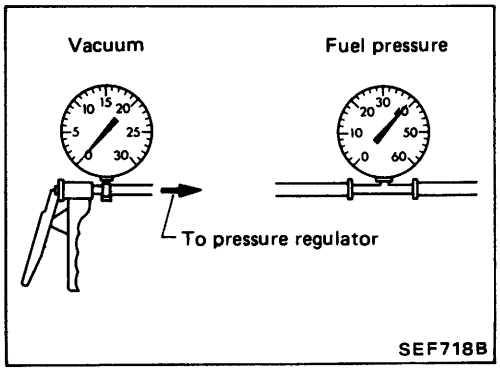
1. Remove fuel pump fuse.
2. Start engine.
3. After engine stalls, crank it two or three times to release all fuel pressure.
4. Turn ignition switch off and reconnect fuel pump fuse.



Fuel Pressure Check

a. When reconnecting fuel line, always use new clamps.
b. Make sure that clamp screw does not contact adjacent parts.
c. Use a torque driver to tighten clamps.
d. Use Pressure Gauge to check fuel pressure.
e. Do not perform fuel pressure check while fuel pressure regulator control system is operating; otherwise, fuel pressure gauge might indicate incorrect readings.

1. Release fuel pressure to zero.
2. Disconnect fuel hose between fuel filter and fuel tube (engine side).
3. Install pressure gauge between fuel filter and fuel tube.
4. Start engine and check for fuel leakage.
5. Read the fuel pressure gauge indication.
   At idling:
   When fuel pressure regulator valve vacuum hose is connected.
   More than 226 kPa (2.3 kg/cm^2, 33 psi)
   When fuel pressure regulator valve vacuum is disconnected.
   Approximately 294 kPa (3.0 kg/cm^2, 43 psi)
6. Stop engine and disconnect fuel pressure regulator vacuum hose from intake manifold.
7. Plug intake manifold with a rubber cap.
8. Connect variable vacuum source to fuel pressure regulator.



Fuel Pressure Check (Cont'd)

9. Start engine and read fuel pressure gauge indication as vacuum changes.

Fuel pressure should decrease as vacuum increases. If results are unsatisfactory, replace fuel pressure regulator.

Injector Removal and Installation

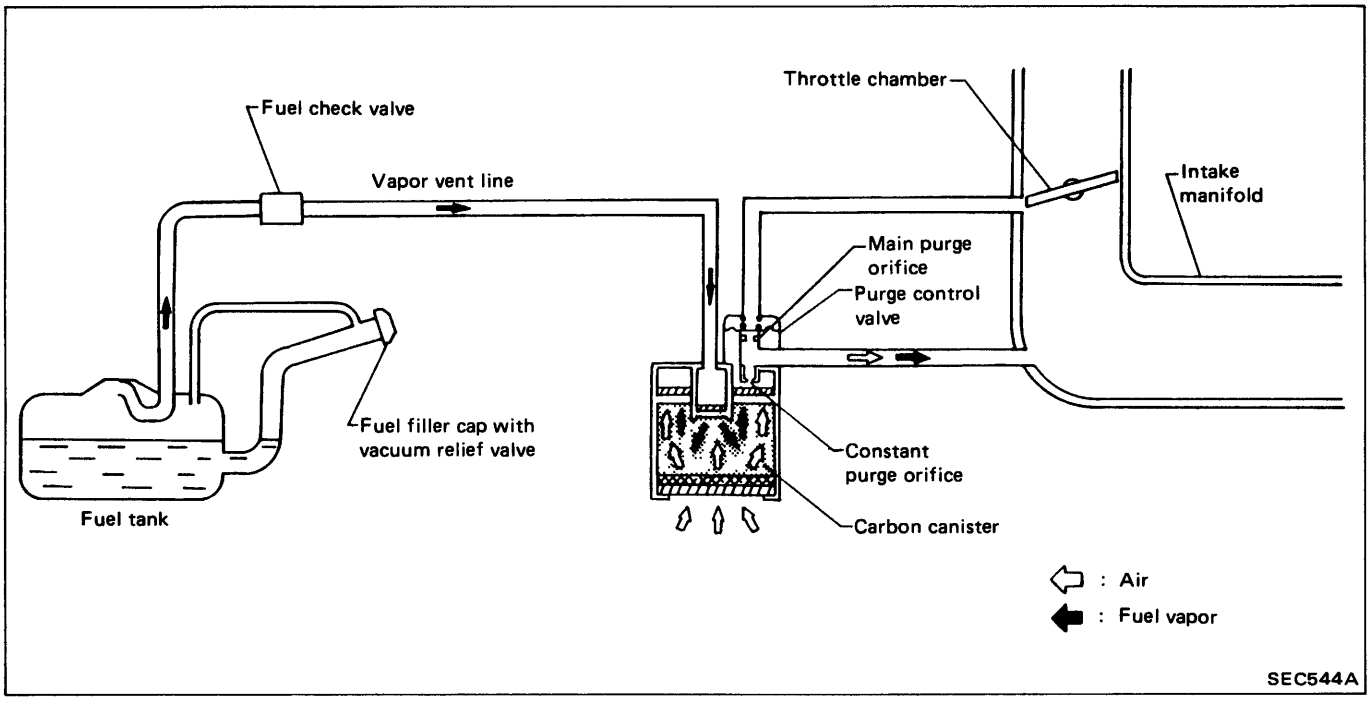
1. Release fuel pressure to zero.
2. Remove or disconnect the following:
- B.P.T. valve
- Fuel tube securing bolts
3. Remove injectors with fuel tube assembly.
4. Remove injector from fuel tube.
5. Install injector as follows:
1) Clean exterior of injector tail piece.
2) Use new O-rings.

CAUTION:

After properly connecting injectors to fuel tube, check connection for fuel leakage.

6. Assemble injectors with fuel pipe to intake manifold.

Description

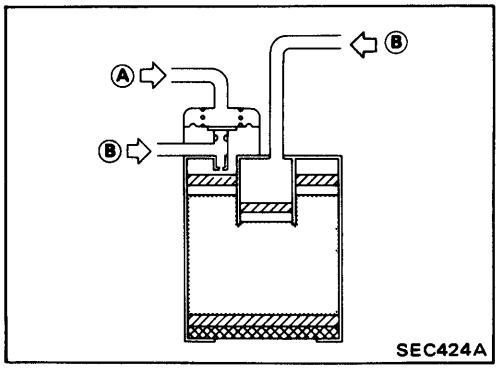


The evaporative emission control system is used to reduce hydrocarbons emitted to the atmosphere from the fuel system. This reduction of hydrocarbons is accomplished by activated charcoals in the carbon canister.

The fuel vapor from the sealed fuel tank is led into the canister which contains activated carbon and the vapor is stored there when the engine is not running.

The canister retains the fuel vapor until the canister is purged by the air drawn through the bottom of the canister to the intake manifold when the engine is running. When the engine runs at idle, the purge control valve is closed.

Only a small amount of stored vapor flows into the intake manifold through the constant purge orifice. As the engine speed increases, and the throttle vacuum increases, the purge control valve opens and the vapor is sucked into the intake manifold through both the main purge orifice and the constant purge orifice.



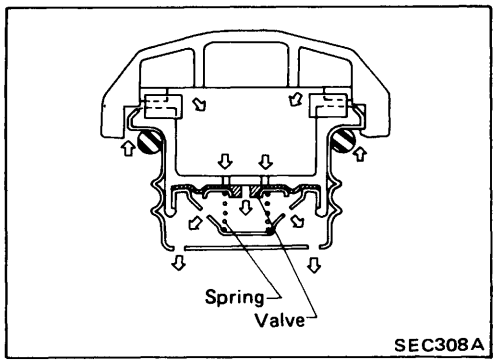
Inspection

CARBON CANISTER

Check carbon canister as follows:

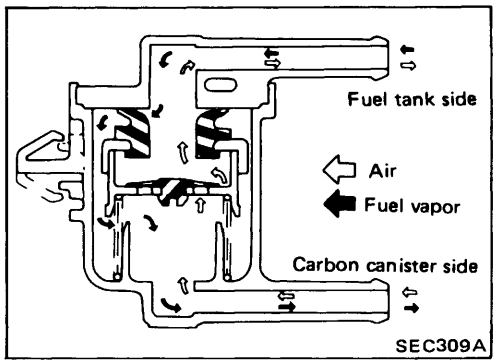
Ⓐ : Blow air and ensure that there is no leakage.
Ⓑ : Blow air and ensure that there is leakage.

Inspection (Cont'd)



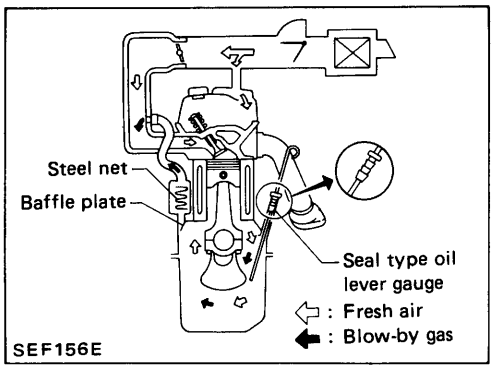
FUEL TANK VACUUM RELIEF VALVE

1. Wipe valve housing clean.
2. Inhale air through the cap. A slight resistance accompanied by valve clicks indicates that valve is in good mechanical condition. Note also that, by further inhaling air, the resistance should disappear with valve clicks.
3. If valve is clogged or if no resistance is felt, replace cap as an assembly.



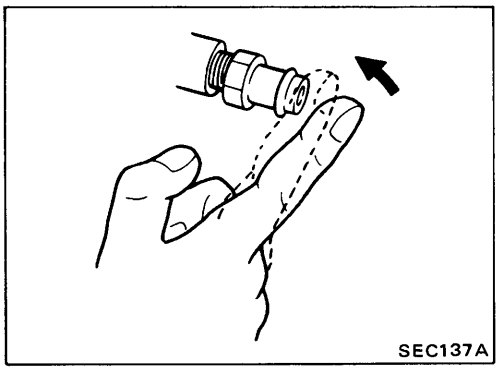
FUEL CHECK VALVE

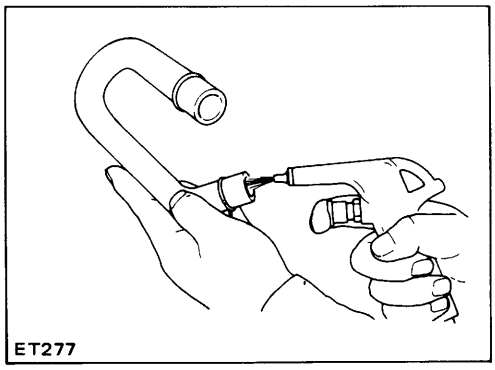
1. Blow air through connector on fuel tank side.
   A considerable resistance should be felt and a portion of air flow should be directed toward the canister.
2. Blow air through connector on canister side.
   Air flow should be smoothly directed toward fuel tank.
3. If fuel check valve is suspected of not properly functioning in steps 1 and 2 above, replace it.



Description

This system returns blow-by gas to both the intake manifold and air cleaner.
The positive crankcase ventilation (P.C.V.) valve is provided to conduct crankcase blow-by gas to the intake manifold.
During partial throttle operation of the engine, the intake manifold sucks the blow-by gas through the P.C.V. valve.
Normally, the capacity of the valve is sufficient to handle any blow-by and a small amount of ventilating air.
The ventilating air is then drawn from the air cleaner, through the hose connecting the air cleaner to rocker cover, into the crankcase.
Under full-throttle condition, the manifold vacuum is insufficient to draw the blow-by flow through the valve, and its flow goes through the hose connection in the reverse direction.
On vehicles with an excessively high blow-by some of the flow will go through the hose connection to the air cleaner under all conditions.





Inspection

P.C.V. (Positive Crankcase Ventilation)

With engine running at idle, remove ventilation hose from P.C.V. valve; if valve is working properly, a hissing noise will be heard as air passes through it and a strong vacuum should be felt immediately when a finger is placed over valve inlet.

VENTILATION HOSE

1. Check hoses and hose connections for leaks.
2. Disconnect all hoses and clean with compressed air. If any hose cannot be freed of obstructions, replace.

General Specifications

IGNITION TIMING	B.T.D.C.	15°±2°
IDLE SPEED	rpm	M/T 800±50 A/T 800±50 (in "N" position)

Inspection and Adjustment

ENGINE TEMPERATURE SENSOR	20°C (68°F)	80°C (176°F)
Thermistor resistance kΩ	2.1 - 2.9	0.30 - 0.33
FUEL PRESSURE at idling (Measuring point: between fuel filter and fuel pipe)		
Vacuum hose is connected kPa (kg/cm², psi)	Approximately 226 (2.3, 33)	
Vacuum hose is disconnected kPa (kg/cm², psi)	Approximately 294 (3.0, 43)	
FUEL INJECTOR		
Coil resistance Ω	Approximately 10 - 15	
AIR REGULATOR		
Resistance Ω	Approximately 75	
EXHAUST GAS TEMPERATURE SENSOR		
	100°C (212°F)	
Thermistor resistance kΩ	85.3±8.53	

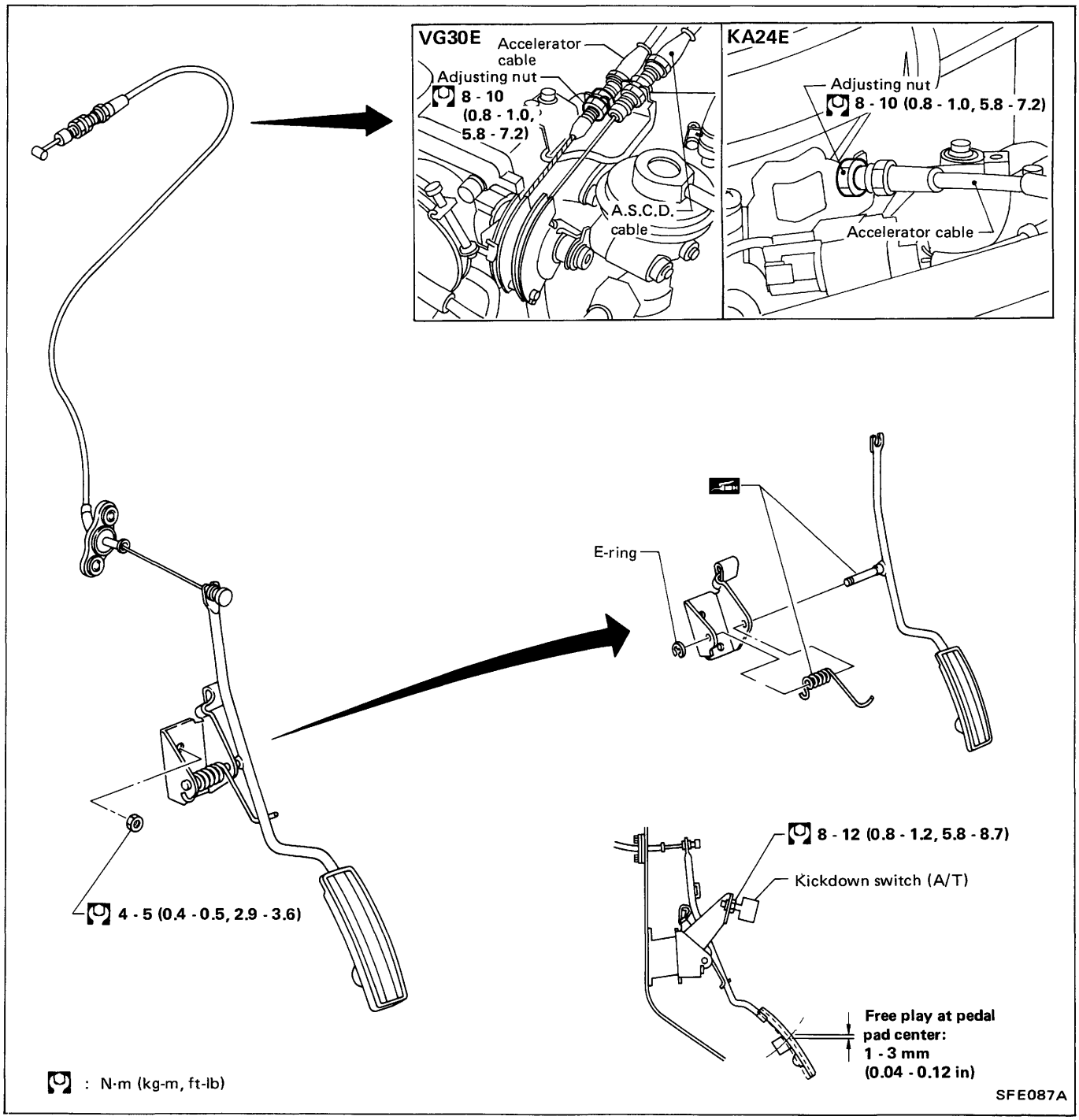
ENGINE CONTROL, FUEL & EXHAUST SYSTEMS

SECTION FE

CONTENTS

ENGINE CONTROL SYSTEM FE-2
FUEL SYSTEM FE-3
EXHAUST SYSTEM FE-5

a. Check to see if throttle valve fully opens when accelerator pedal is fully depressed and returns to idle when released.
b. Adjust accelerator pedal free play by turning adjusting nut.
c. On automatic transmission models, make sure kickdown switch rod is fully pushed in when accelerator pedal is depressed completely.
d. ON A.S.C.D. equipped models, first adjust accelerator cable and then A.S.C.D. cable. For details, refer to "Automatic Speed Control Device" in EL section.
e. Check accelerator control parts for improper contact with any adjacent parts.
f. When connecting accelerator cable, be careful not to twist or scratch its inner wire.
g. Apply a light coat of recommended multi-purpose grease to all sliding or friction surfaces. Do not apply grease to wire.



WARNING:

When replacing fuel line parts, be sure to observe the following:

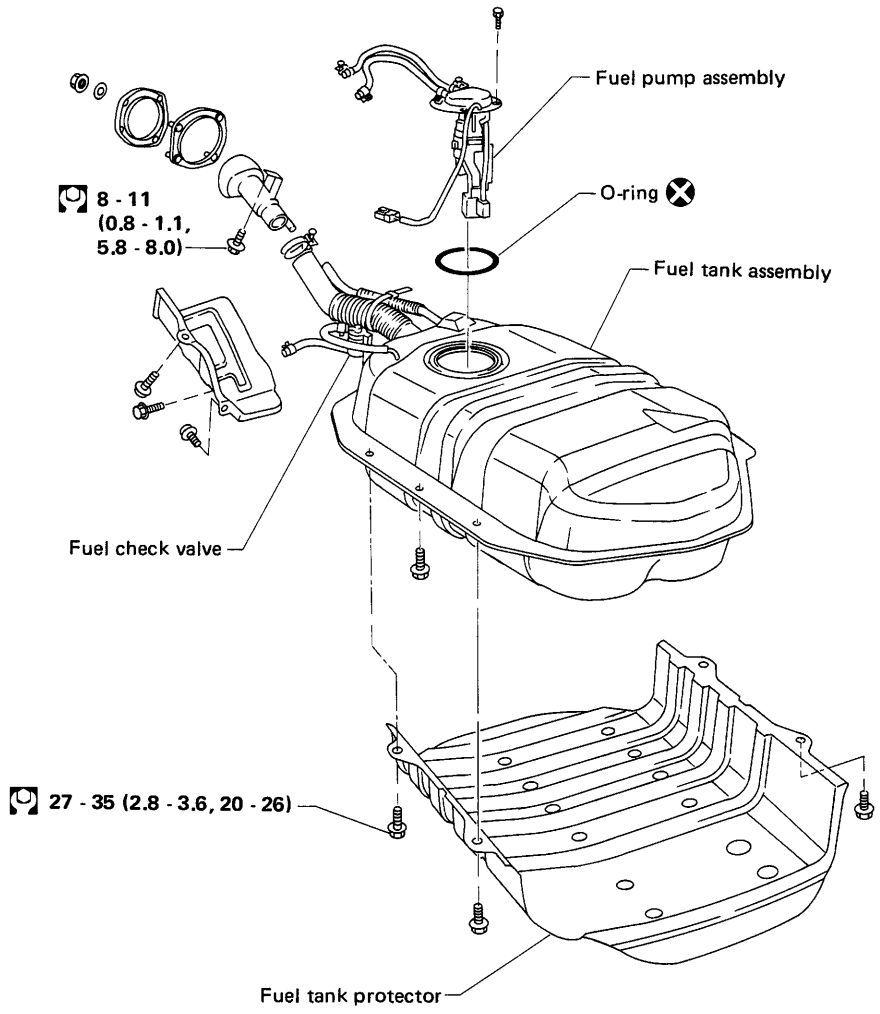
a. Put a "CAUTION: INFLAMMABLE" sign in workshop.
b. Be sure to furnish the workshop with a CO_2 fire extinguisher.
c. Be sure to disconnect battery ground cable before conducting operations.
d. Put drained fuel in an explosion-proof container and attach lid securely.

CAUTION:

Before disconnecting fuel hose on gasoline engine model, release fuel pressure from fuel line. Refer to the "Releasing Fuel Pressure" in EF & EC section.

a. Do not disconnect any fuel line unless absolutely necessary.
b. Plug hose and pipe openings to prevent entry of dust or dirt.
c. Always replace O-ring with new ones.
d. Do not kink or twist hose and tube when they are installed.
e. Do not tighten hose clamps excessively to avoid damaging hoses.
f. When installing fuel check valve, be careful of its designated direction (Refer to section EF & EC).
g. Run the engine and check for fuel leaks at connections.

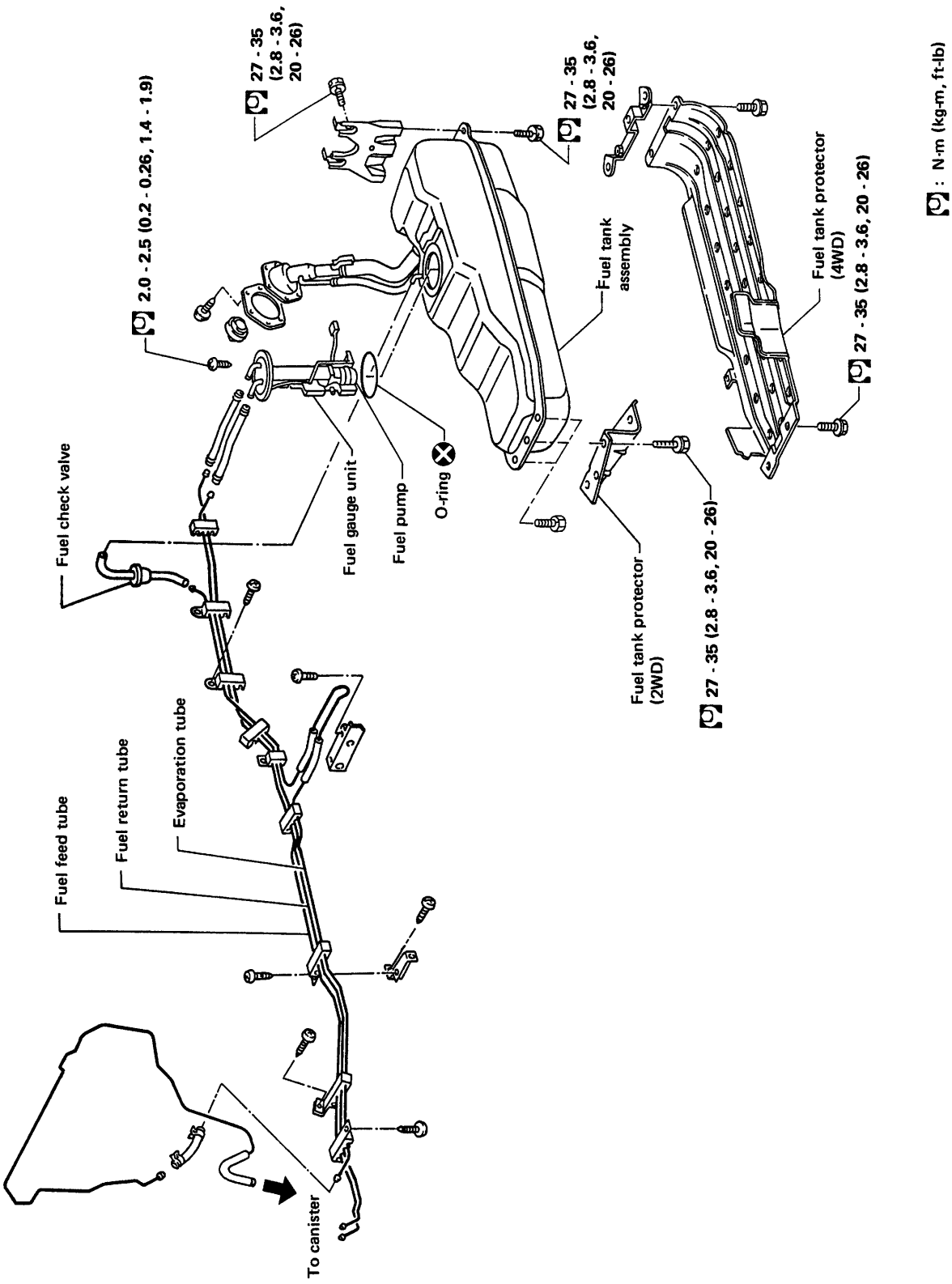
Van and Wagon



: N·m (kg-m, ft-lb)

SFE003A

Truck



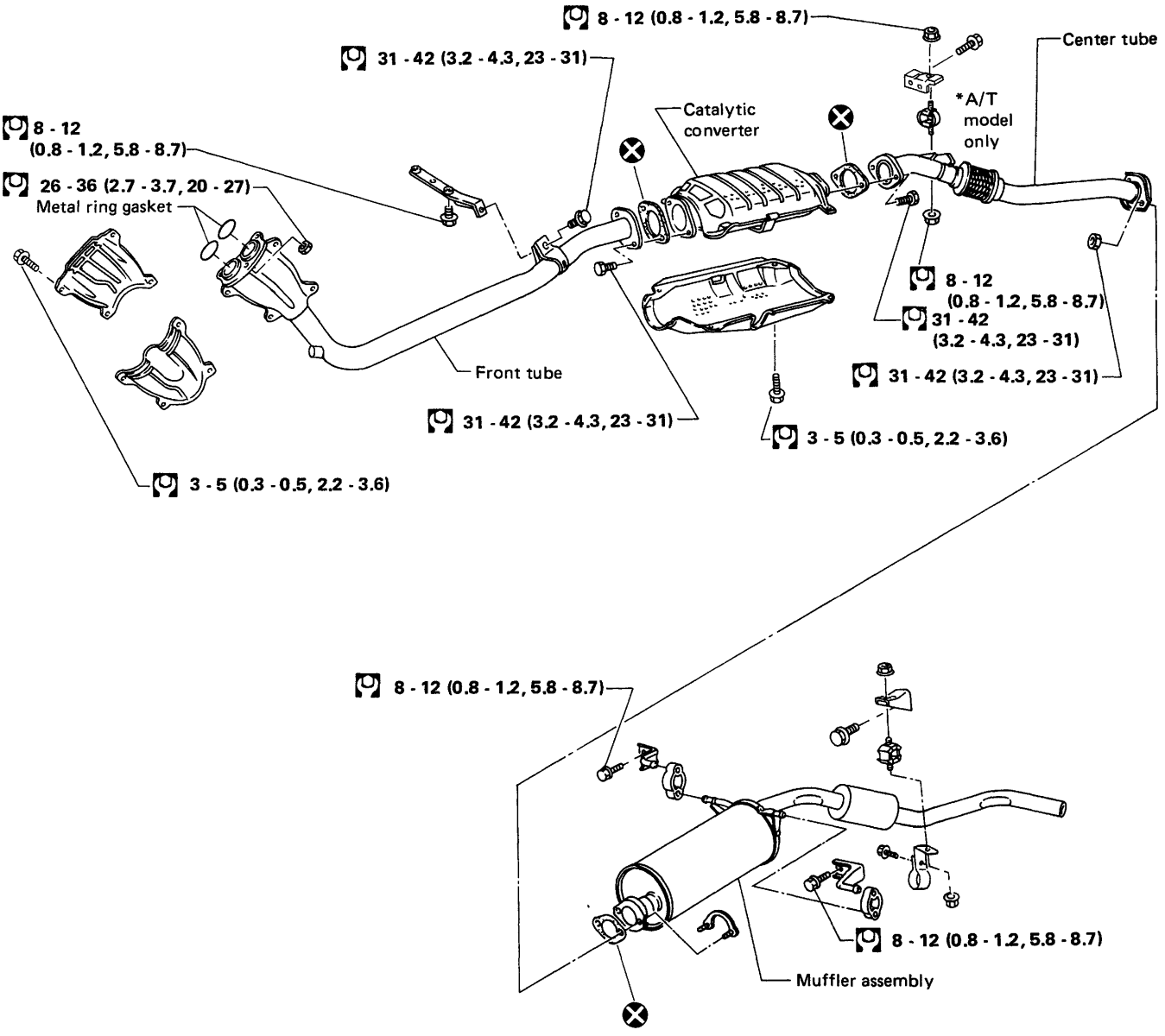
SFE002A

CAUTION:

a. **Be careful not to drop or damage catalytic converter.**
b. **Never wet catalytic converter with water, oil, etc.**

- After installation, make sure that mounting brackets and mounting insulators are free from undue stress. If any of above parts is not installed properly, excessive noises or vibrations may be transmitted to vehicle body.
- With engine running, check all tube connections for exhaust gas leaks, and entire system for unusual noises.

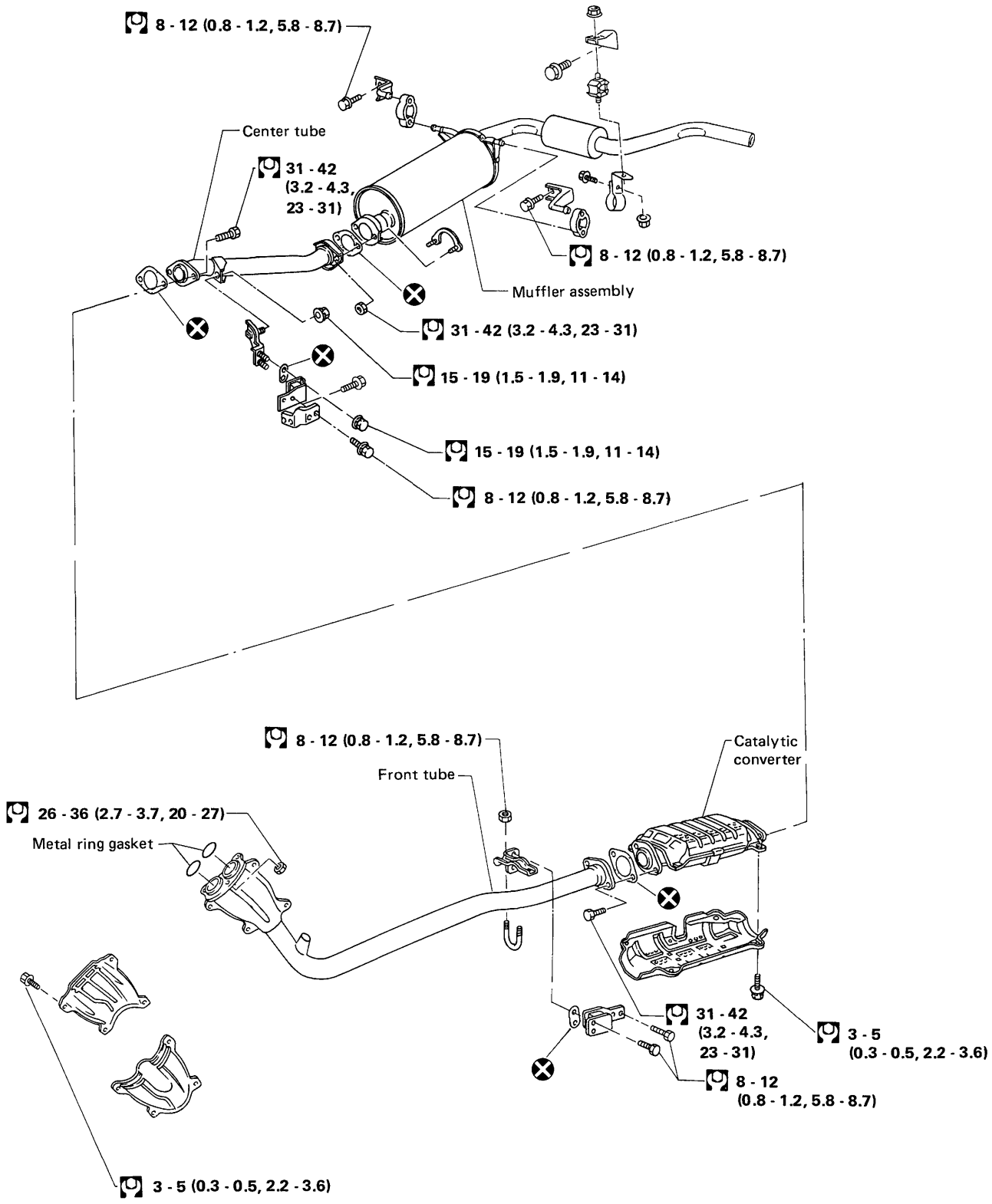
KA24E model (2WD) for Truck



: N·m (kg-m, ft-lb)

SFE088A

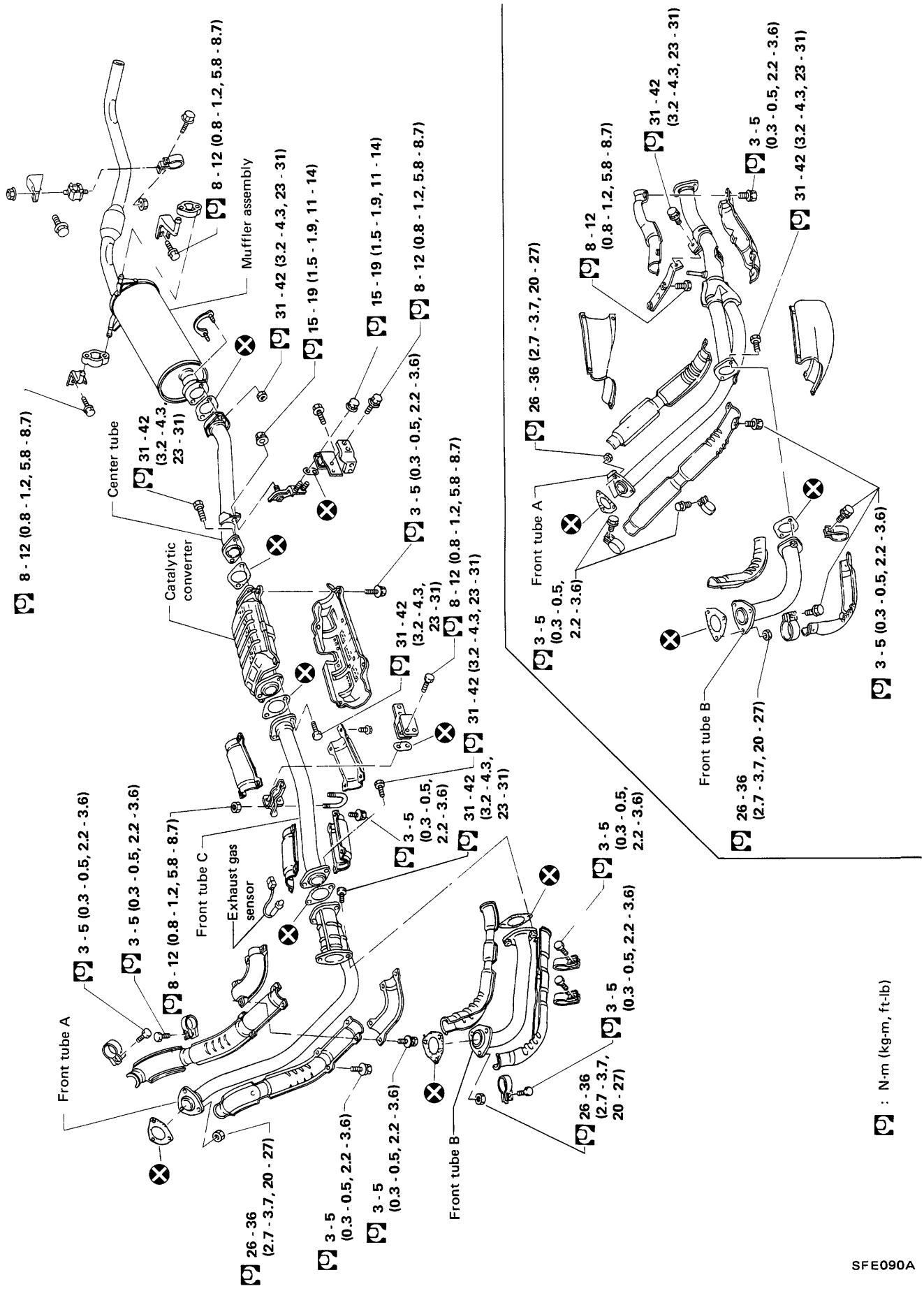
KA24E model (4WD) for Truck



: N·m (kg-m, ft-lb)

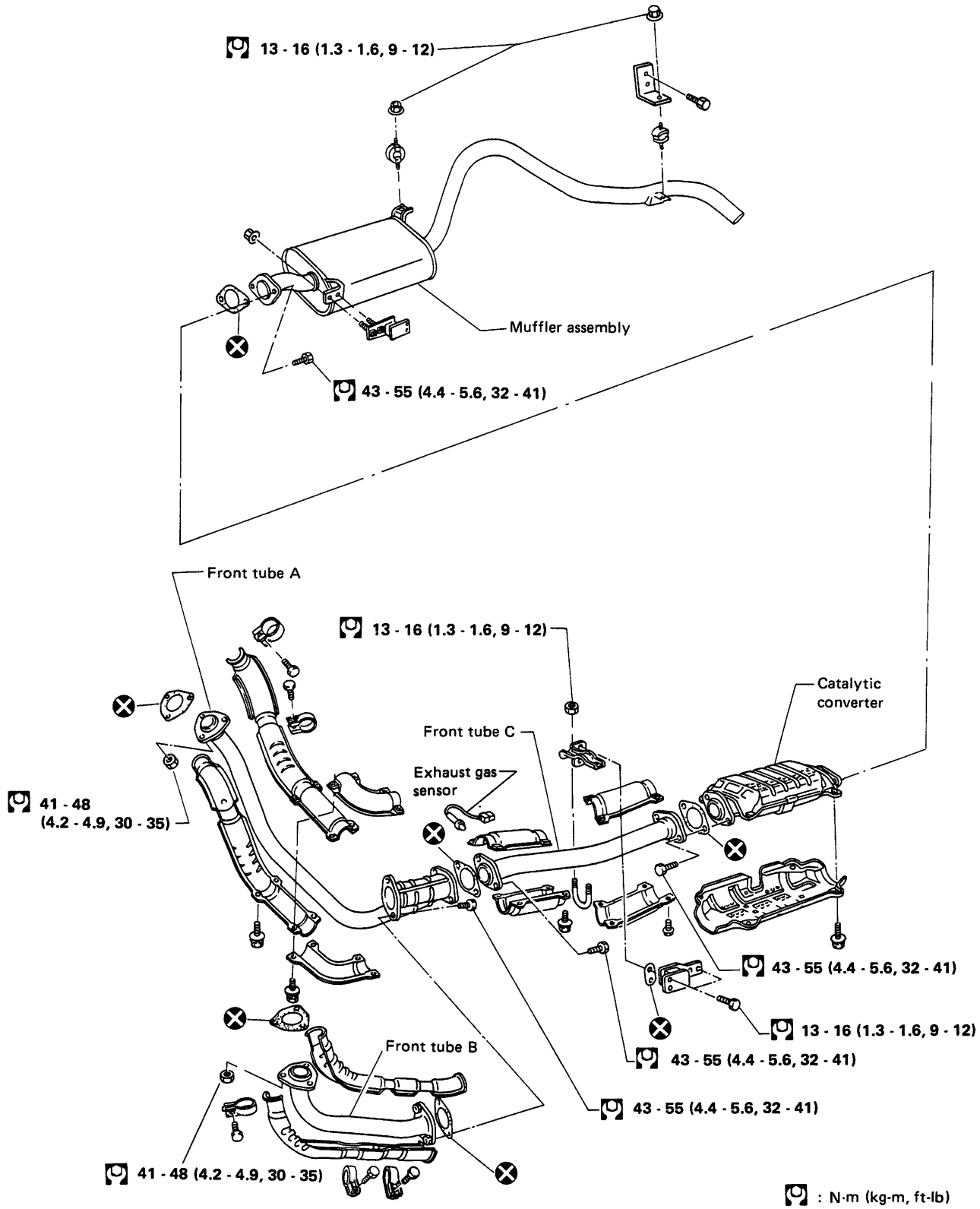
SFE089A

VG30E model for Truck



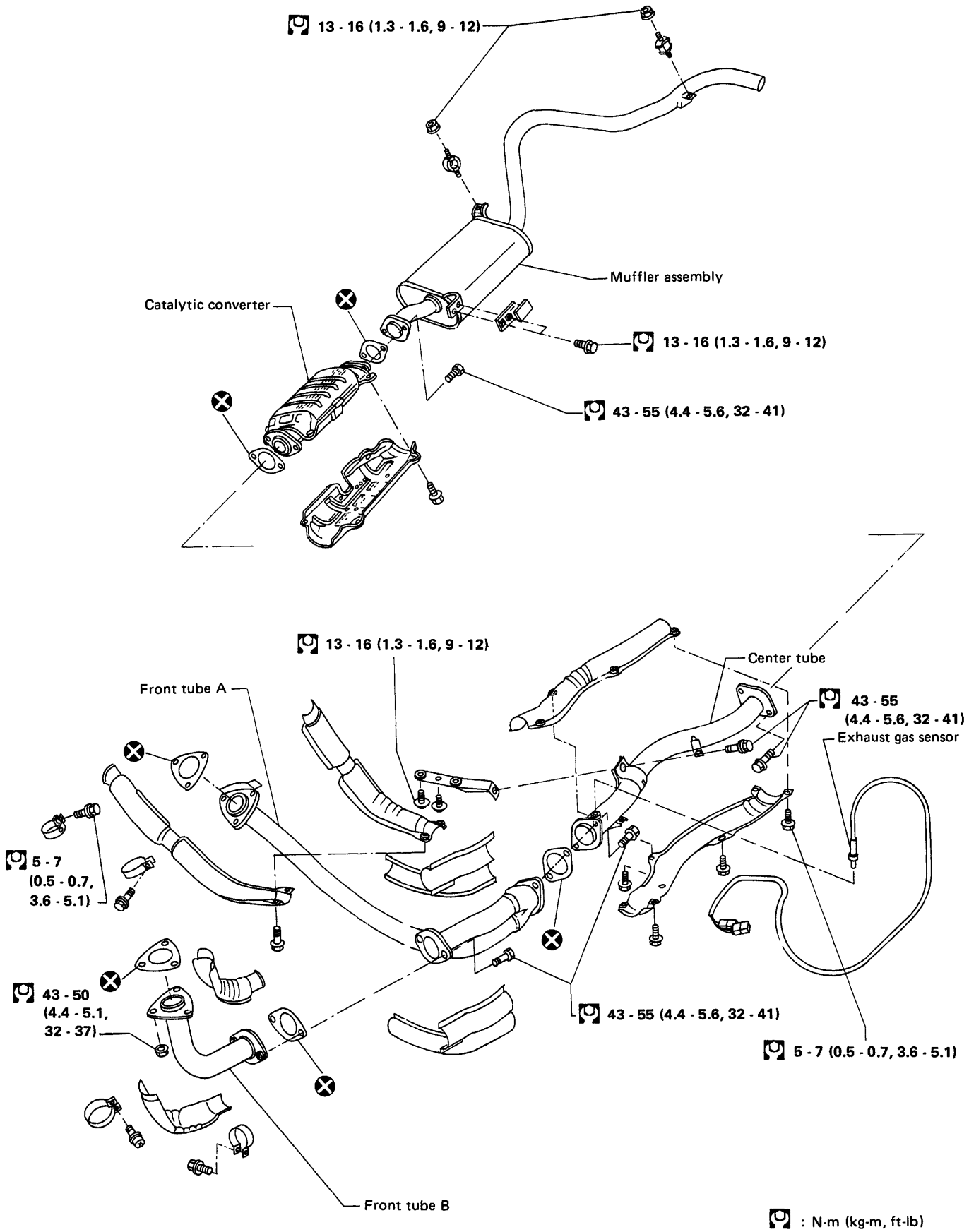
SFE090A

VG30E model (4WD) for Van and Wagon



SFE091A

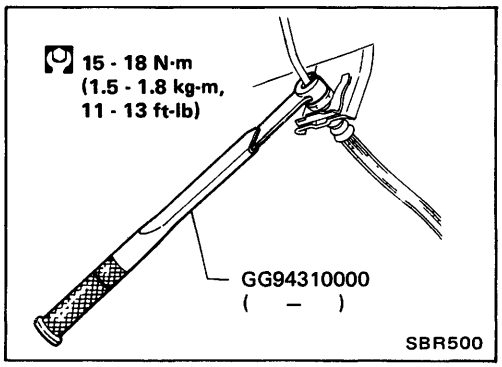
VG30E model (2WD) for Van and Wagon



SECTION CL

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PRECAUTIONS ..... CL- 2
PREPARATION ..... CL- 3
CLUTCH SYSTEM ..... CL- 4
INSPECTION AND ADJUSTMENT ..... CL- 6
HYDRAULIC CLUTCH CONTROL ..... CL- 8
CLUTCH RELEASE MECHANISM CL-11
CLUTCH DISC AND CLUTCH COVER CL-13
SERVICE DATA AND SPECIFICATIONS (S.D.S.) CL-15

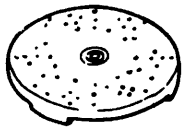
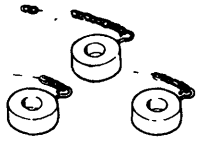
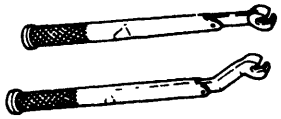
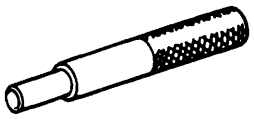


- Recommended fluid is brake fluid "DOT 3".
- Never reuse drained brake fluid.
- Be careful not to splash brake fluid on painted areas.
- When removing and installing clutch piping, use Tool.
- To clean or wash all parts of master cylinder, operating cylinder and clutch damper, use clean brake fluid.
- Never use mineral oils such as gasoline or kerosene.
  They will ruin the rubber parts of the hydraulic system.

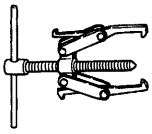
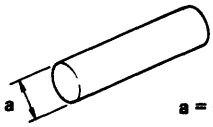
WARNING:

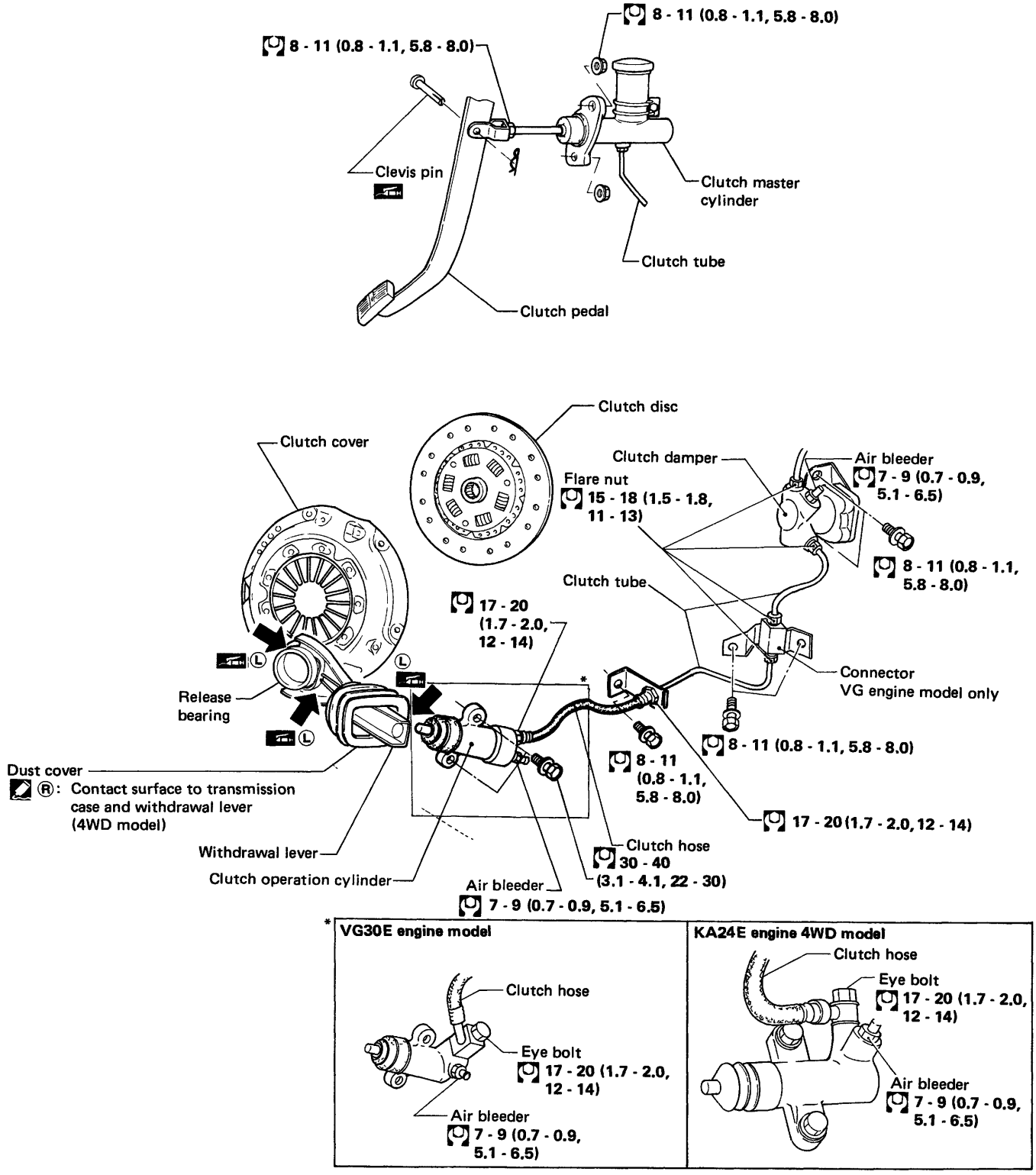
Remove all dust from clutch disc with a dust collector after cleaning with waste cloth.

SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.) Tool name	Description	
ST20050010 (—) Base plate		Inspecting diaphragm spring of clutch cover
ST20050100 (—) Distance piece		
GG94310000 (—) Flare nut torque wrench		Removing and installing each clutch piping
ST20600000 (J26366) Clutch aligning bar		Installing clutch cover and clutch disc
ST20050240 (—) Diaphragm spring adjusting wrench		Adjusting unevenness of diaphragm spring of clutch cover

COMMERCIAL SERVICE TOOLS

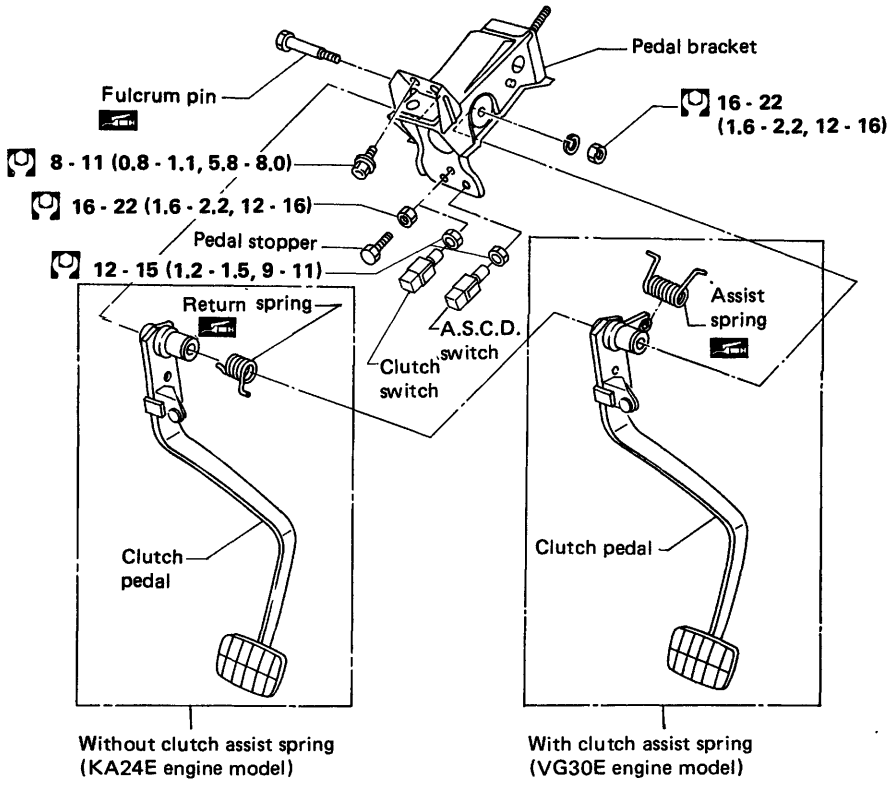
Tool name	Description	
Bearing puller		Removing release bearing
Bearing drift	 a = 50 mm (1.97 in) dia.	Installing release bearing



Ⓡ: Apply recommended sealant (Nissan genuine part: KP115-00100) or equivalent.
Ⓛ: Apply lithium-based grease including molybdenum disulphide.
: N·m (kg-m, ft-lb)

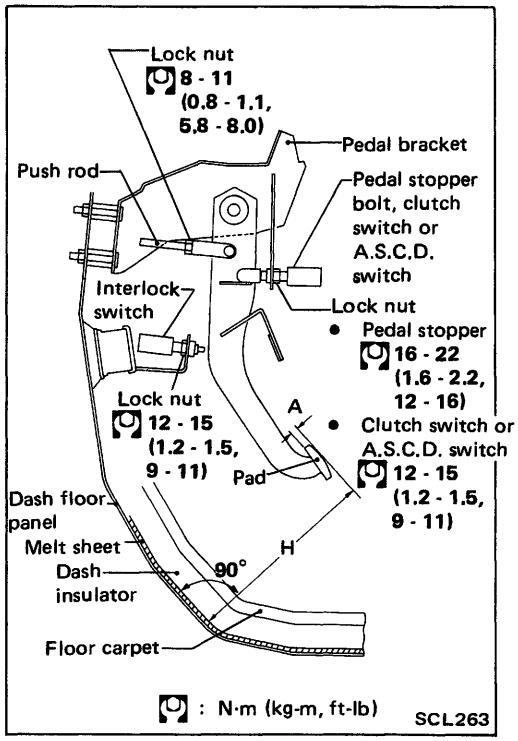
SCL396

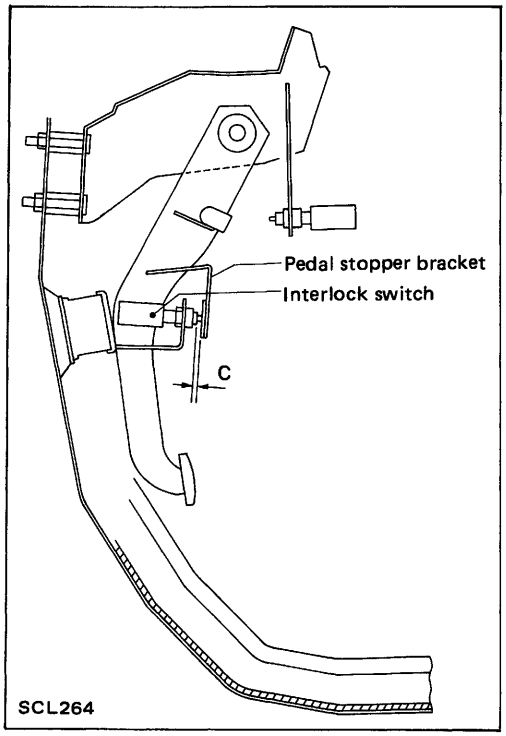
Clutch Pedal



: N·m (kg-m, ft-lb)

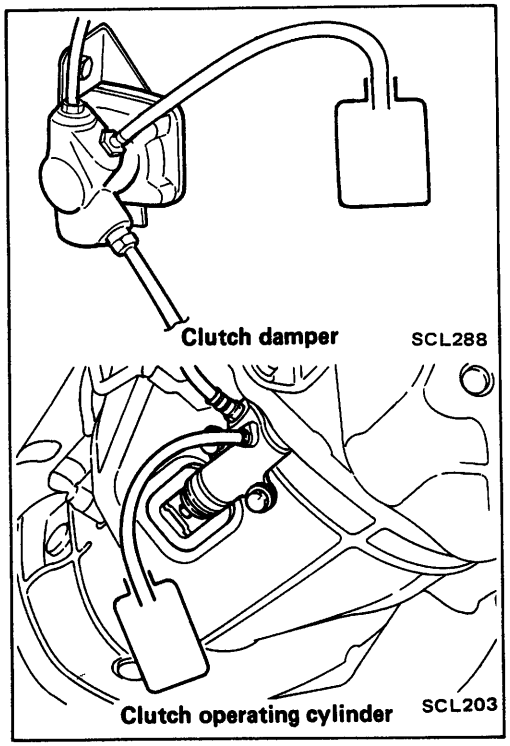
SCL282





Adjusting Clutch Pedal

1. Adjust pedal height with pedal stopper or clutch switch.
   Pedal height "H":
   KA24E engine 236 - 246 mm (9.29 - 9.69 in)
   VG30E engine 227 - 237 mm (8.94 - 9.33 in)
2. Adjust pedal free play with master cylinder push rod. Then tighten lock nut.
   Pedal free play "A":
   1.0 - 3.0 mm (0.039 - 0.118 in)
3. Adjust clearance "C" between pedal stopper bracket and threaded end of clutch interlock switch while depressing clutch pedal fully.
   Clearance "C":
   0.3 - 1.0 mm (0.012 - 0.039 in)



Bleeding Procedure

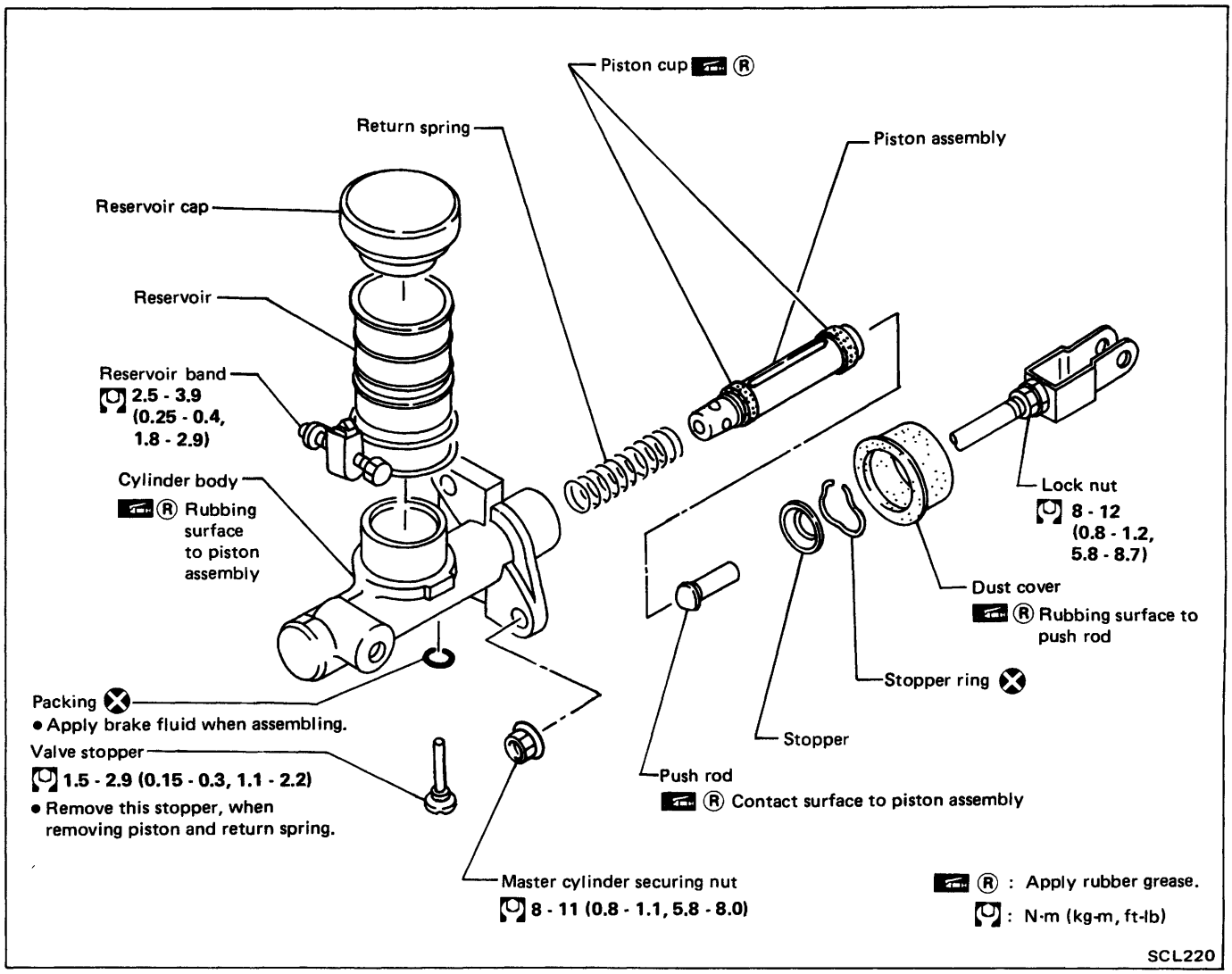
Bleed air according to the following procedure.

Clutch operating cylinder → Clutch damper

- **Carefully monitor fluid level at master cylinder during bleeding operation.**

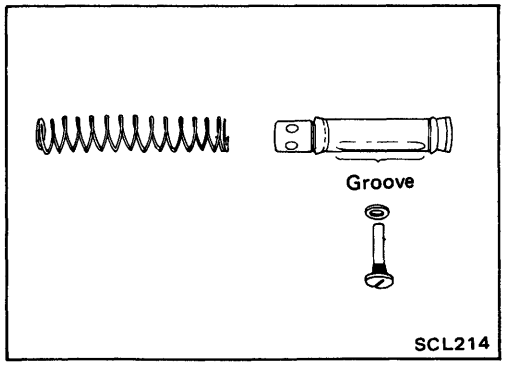
1. Top up reservoir with recommended brake fluid.
2. Connect a transparent vinyl tube to air bleeder valve.
3. Fully depress clutch pedal several times.
4. With clutch pedal depressed, open bleeder valve to release air.
5. Close bleeder valve.
6. Repeat steps 3 through 5 above until brake fluid comes out of air bleeder valve without air bubbles.

Clutch Master Cylinder



DISASSEMBLY AND ASSEMBLY

- Push piston in cylinder body with screwdriver when removing and installing valve stopper.



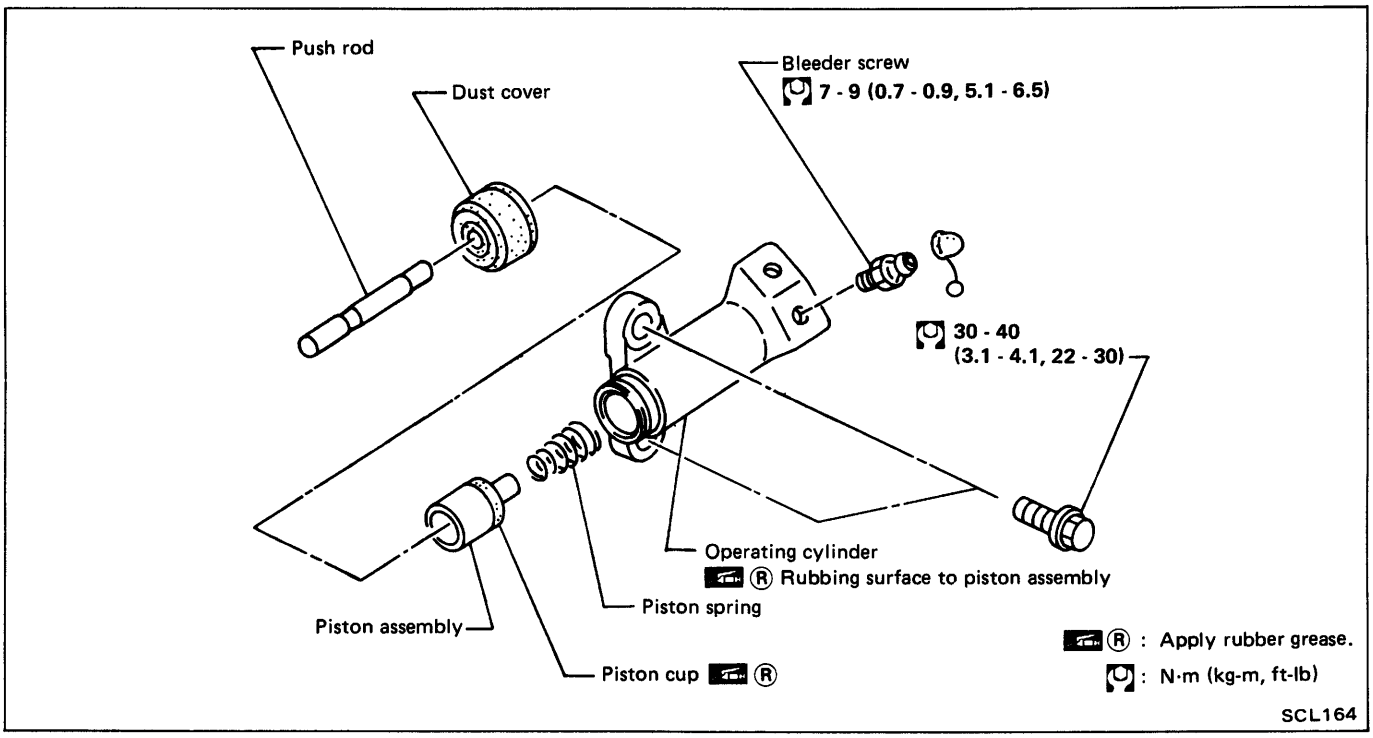
- Align groove of piston assembly and valve stopper portion when installing valve stopper.
- Check direction of piston caps.

Clutch Master Cylinder (Cont'd)

INSPECTION

- Check cylinder and piston rubbing surface for uneven wear, rust or damage. Replace if necessary.
- Check piston with piston cup for wear or damage. Replace if necessary.
- Check return spring for wear or damage. Replace if necessary.
- Check reservoir for deformation or damage. Replace if necessary.
- Check dust cover for cracks, deformation or damage. Replace if necessary.

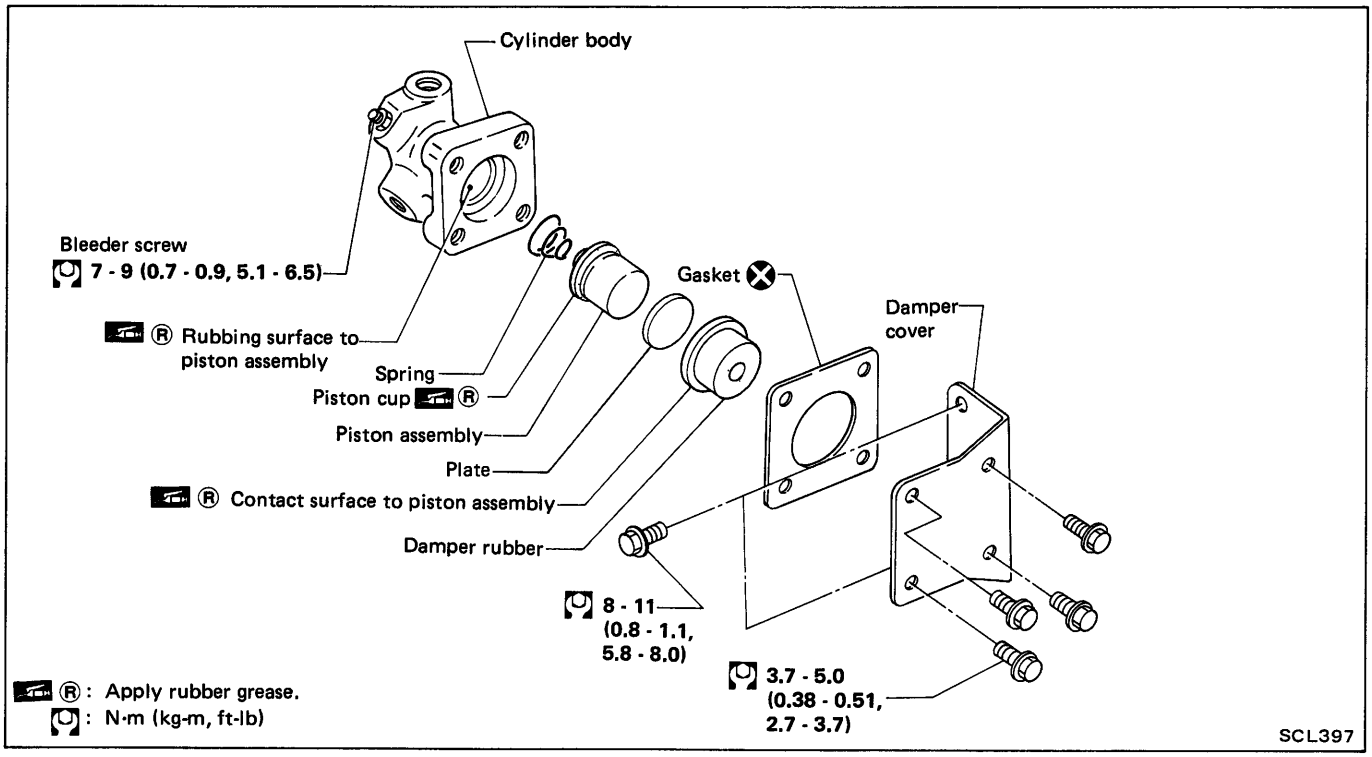
Operating Cylinder



INSPECTION

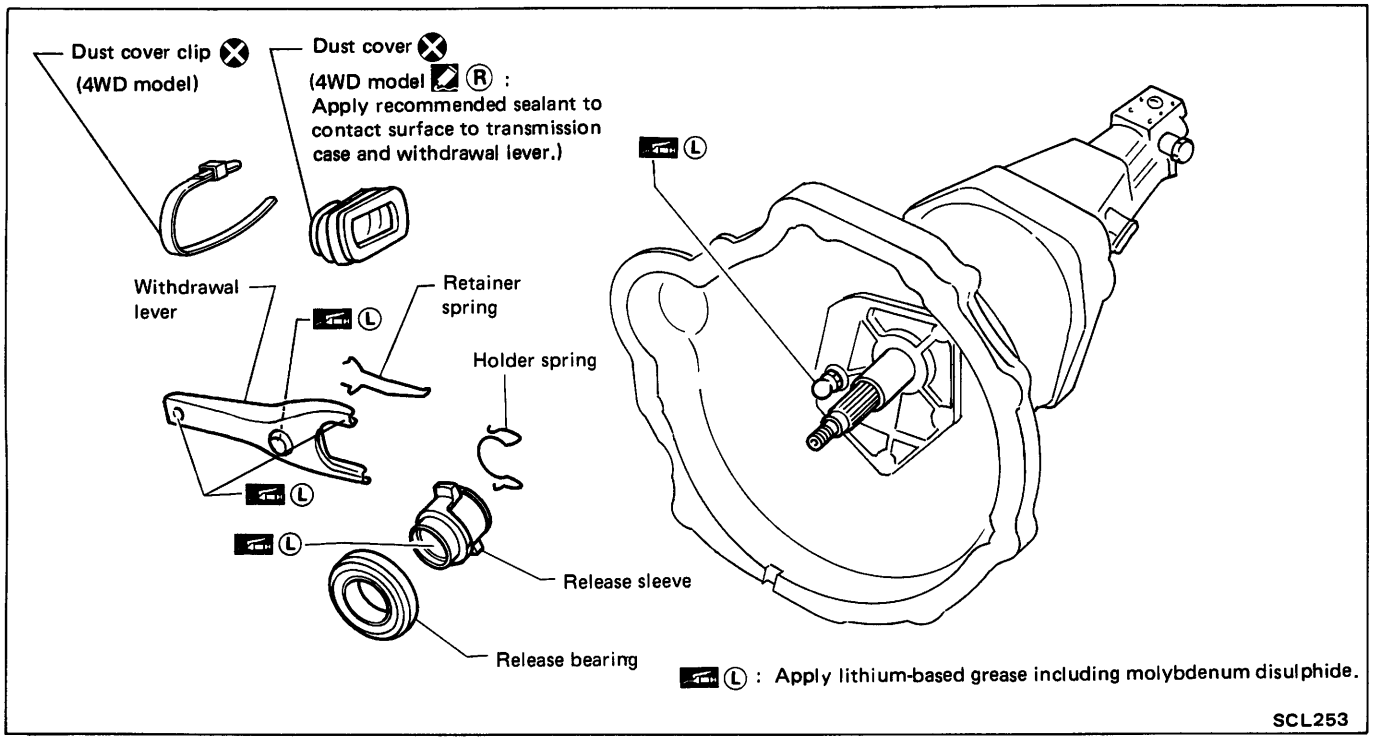
- Check rubbing surface of cylinder for wear, rust or damage. Replace if necessary.
- Check piston with piston cup for wear or damage. Replace if necessary.
- Check piston spring for wear or damage. Replace if necessary.
- Check dust cover for cracks, deformation or damage. Replace if necessary.

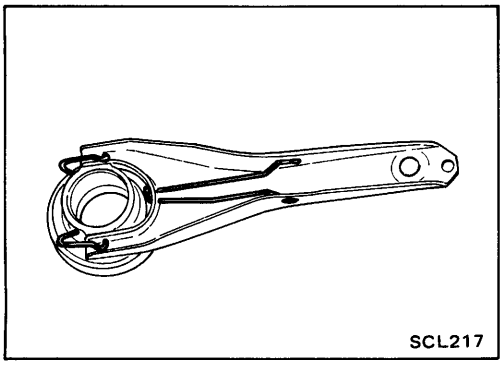
Clutch Damper



INSPECTION

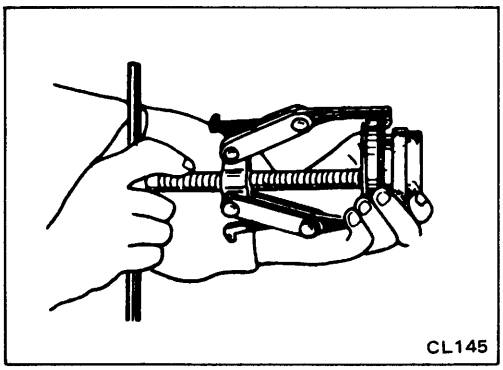
- Check cylinder and piston rubbing surface for uneven wear, rust or damage. Replace if necessary.
- Check damper rubber and piston cup for cracks, deformation or damage. Replace if necessary.



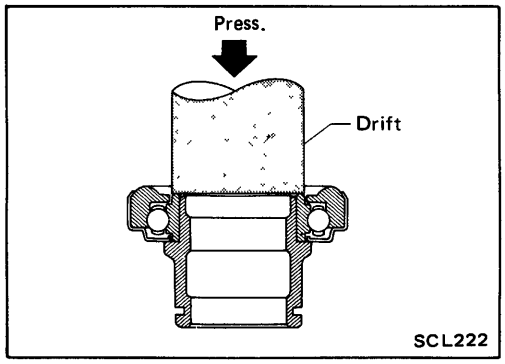


REMOVAL AND INSTALLATION

- Install retainer spring and holder spring.



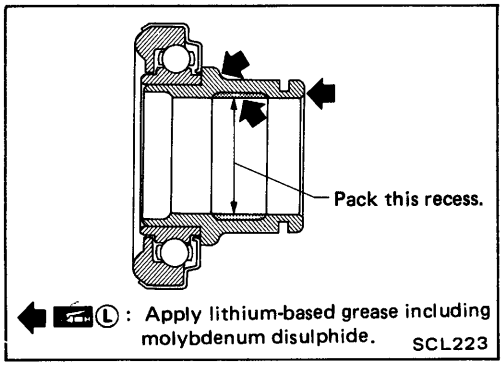
- Remove release bearing.



- Install release bearing with suitable drift.

INSPECTION

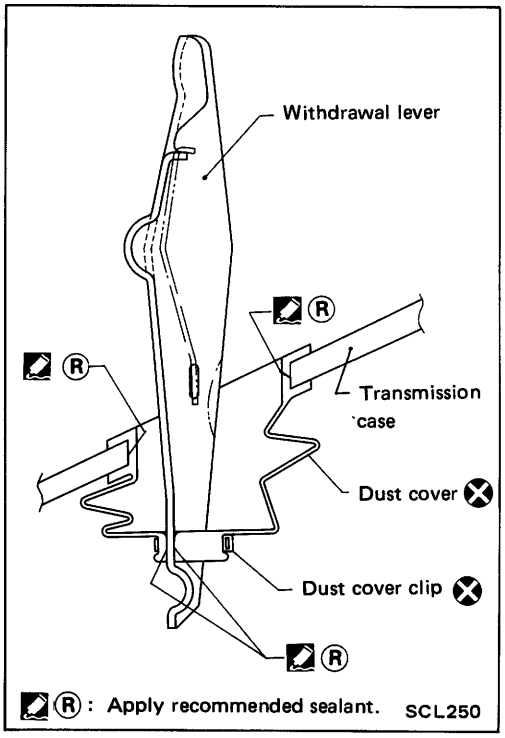
- Check release bearing to see that it rolls freely and is free from noise, crack, pitting or wear. Replace if necessary.
- Check release sleeve and withdrawal lever rubbing surface for wear, rust or damage. Replace if necessary.



LUBRICATION

- Apply recommended grease to contact surface and rubbing surface.

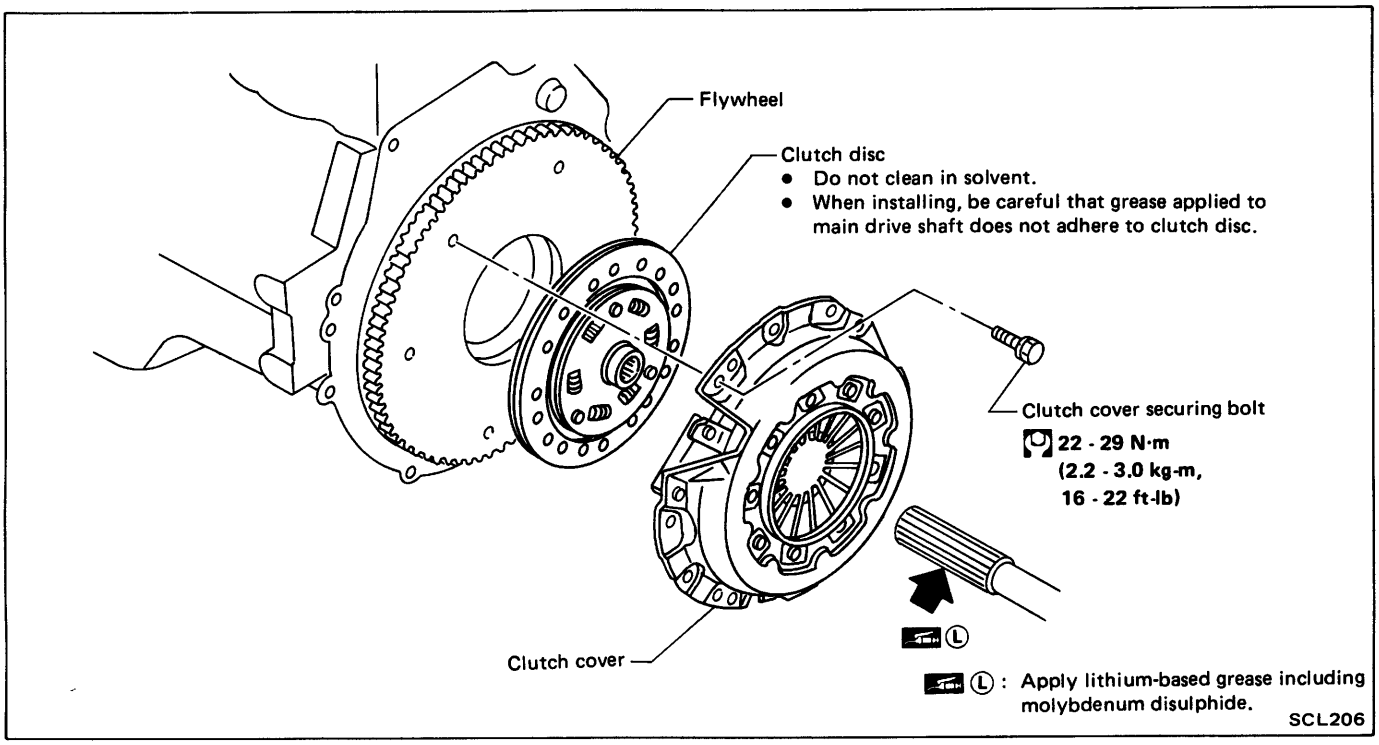
Too much lubricant might cause clutch disc facing damage.

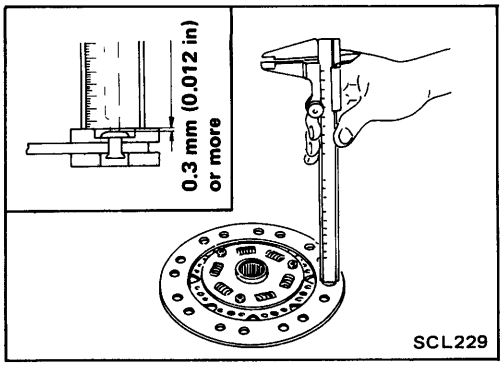


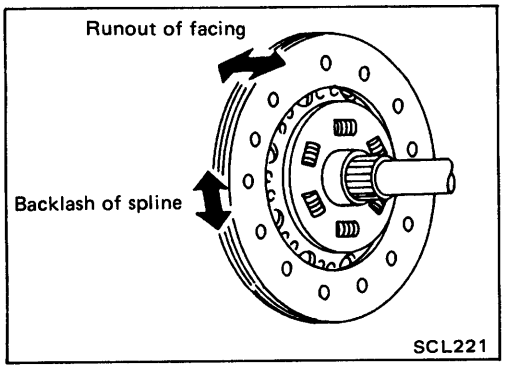
WATERPROOF — for 4WD model

- Apply recommended sealant to contact surface of dust cover to transmission case and withdrawal lever and then install dust cover clip.

Recommended sealant: Nissan genuine part (KP115-00100) or equivalent.







Clutch Disc

INSPECTION

Check clutch disc for wear of facing.

Wear limit of facing surface to rivet head:
0.3 mm (0.012 in)

- Check clutch disc for backlash of spline and runout of facing.

Maximum backlash of spline (at outer edge of disc):

240TBL	1.0 mm (0.039 in)
250TBL	1.0 mm (0.039 in)

Runout limit:
1.0 mm (0.039 in)
Distance of runout check point (from hub center)

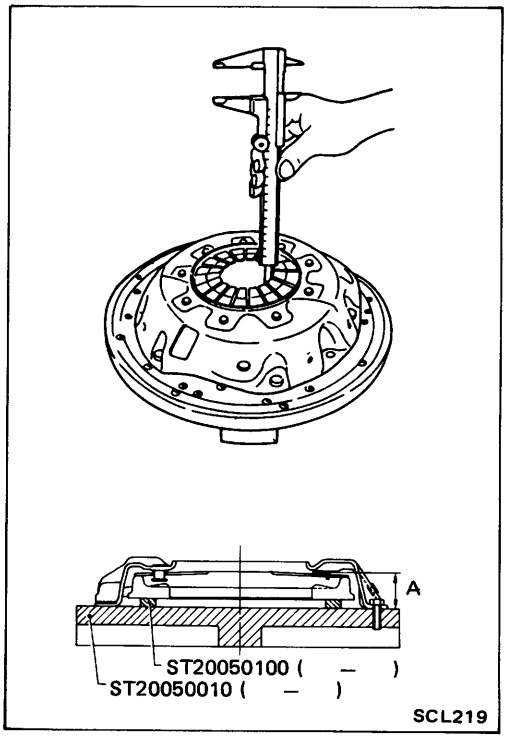
240TBL	115 mm (4.53 in)
250TBL	115 mm (4.53 in)

- Check clutch disc for burns, discoloration or oil or grease leakage. Replace if necessary.

INSTALLATION

- Apply recommended grease to contact surface of spline portion.

Too much lubricant might cause clutch disc facing damage.



Clutch Cover and Flywheel

INSPECTION AND ADJUSTMENT

- Set Tool and check height and unevenness of diaphragm spring.

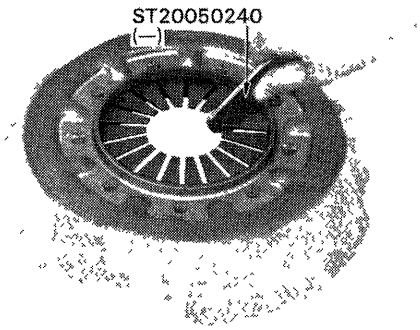
Set 0.2 mm (0.008 in) feeler gauges on distance pieces (ST20050100) when checking C240S or C250S.

Diaphragm spring height "A":

C240S 37.5 - 39.5 mm (1.476 - 1.555 in)

C250S 36.5 - 38.5 mm (1.437 - 1.516 in)

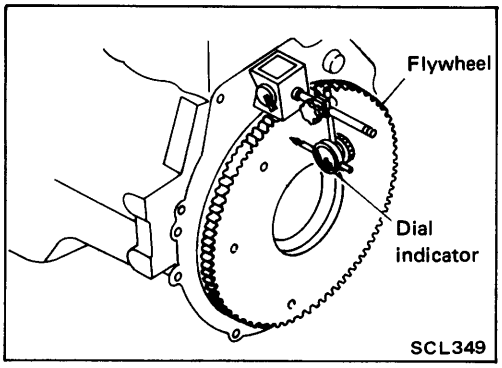
- Check thrust rings for wear or damage by shaking cover assembly and listening for a chattering noise, or by lightly hammering on rivets and listening for a cracking noise. Replace clutch cover assembly if necessary.
- Check pressure plate and clutch disc contact surface for slight burns or discoloration. Repair pressure plate with emery paper.
- Check pressure plate and clutch disc contact surface for deformation or damage. Replace if necessary.



- Adjust unevenness of diaphragm spring height with Tool.

Uneven limit:

0.5 mm (0.020 in)

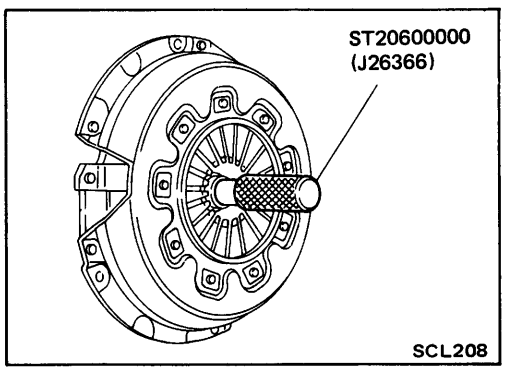


FLYWHEEL INSPECTION

- Check contact surface of flywheel for slight burns or discoloration. Repair flywheel with emery paper.
- Check flywheel runout.

Runout (Total indicator reading):

Less than 0.15 mm (0.0059 in)



INSTALLATION

- Insert Tool into clutch disc hub when installing clutch cover and disc.

General Specifications

CLUTCH MASTER CYLINDER

Inner diameter	mm (in)	15.87 (5/8)

CLUTCH OPERATING CYLINDER

Inner diameter	mm (in)	17.46 (11/16)

CLUTCH DAMPER

Inner diameter	mm (in)	19.05 (3/4)

CLUTCH DISC

Model	240TBL	250TBL
Engine	KA24E	VG30E
Facing size mm (in) (Outer dia. x inner dia. x thickness)	240 x 150 x 3.5 (9.45 x 5.91 x 0.138)	250 x 160 x 3.5 (9.84 x 6.30 x 0.138)
Thickness of disc assembly With load mm (in)	7.8 - 8.2 (0.307 - 0.323) with 4,904 N (500 kg, 1,103 lb)	7.9 - 8.3 (0.311 - 0.327) with 5,884 N (600 kg, 1,323 lb)

CLUTCH COVER

Model	C240S	C250S
Engine	KA24E	VG30E
Full load N (kg, lb)	4,413 (450, 992)	4,904 (500, 1,103)

Inspection and Adjustment

CLUTCH PEDAL

Unit: mm (in)

Pedal height* KA24E engine model	236 - 246 (9.29 - 9.69)
VG30E engine model	227 - 237 (8.94 - 9.33)
Pedal free play	1.0 - 3.0 (0.039 - 0.118)
Clearance between pedal stopper bracket and threaded end of clutch interlock switch (when depressing clutch pedal fully.)	0.3 - 1.0 (0.012 - 0.039)

*: Measured from surface of melt sheet to pedal pad

CLUTCH DISC

Unit: mm (in)

Model	240TBL	250TBL
Wear limit of facing surface to rivet head	0.3 (0.012)	
Runout limit of facing	1.0 (0.039)	
Distance of runout check point (from the hub center)	115 (4.53)	
Maximum backlash of spline (at outer edge of disc)	1.0 (0.039)	

CLUTCH COVER

Unit: mm (in)

Model	C240S	C250S
Diaphragm spring height	37.5 - 39.5 (1.476 - 1.555)	36.5 - 38.5 (1.437 - 1.516)
Uneven limit of diaphragm spring toe height	0.5 (0.020)	

MANUAL TRANSMISSION

SECTION MT

CONTENTS

Models FS5W71C & FS5R30A

PREPARATION ..... MT- 2
ON-VEHICLE SERVICE ..... MT- 6
REMOVAL AND INSTALLATION ..... MT- 7

Model FS5W71C

MAJOR OVERHAUL MT-10
DISASSEMBLY MT-14
INSPECTION MT-19
ASSEMBLY MT-21

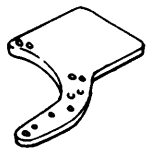
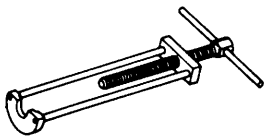
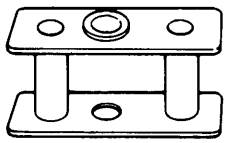
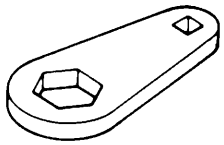
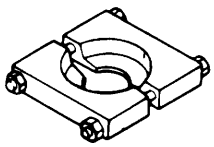
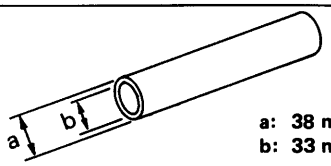
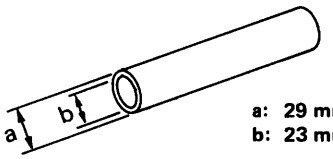
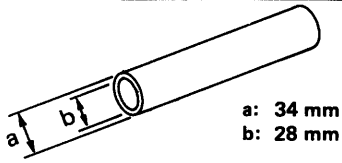
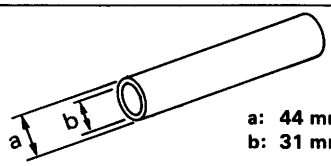
Model FS5R30A

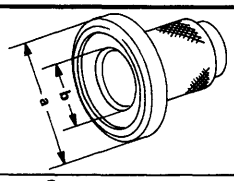
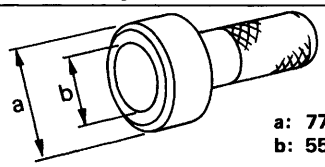
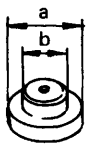
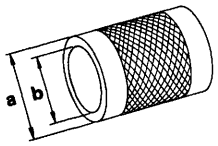
MAJOR OVERHAUL MT-31
DISASSEMBLY MT-35
INSPECTION MT-42
ASSEMBLY MT-44

Models FS5W71C & FS5R30A

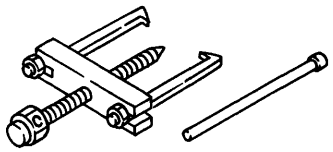
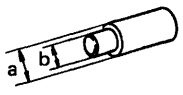
SERVICE DATA AND SPECIFICATIONS (S.D.S.) MT-56

SPECIAL SERVICE TOOLS

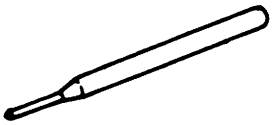
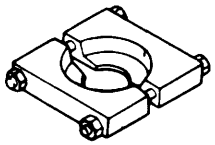
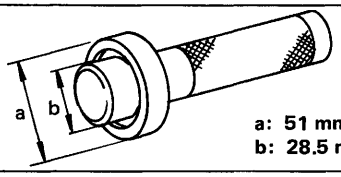
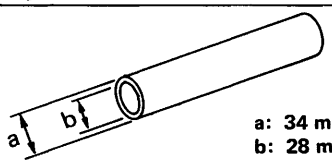
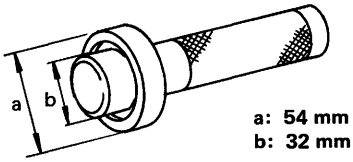
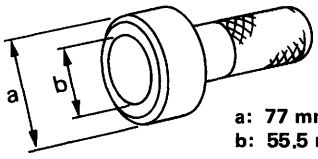
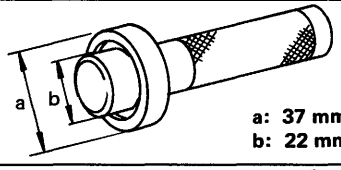
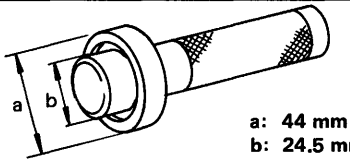
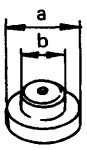
Tool number (Kent-Moore No.) Tool name	Description	
ST23810001 (–) Adapter setting plate		Fixing adapter plate with gear assembly
KV32101330 (See J26349-A) Puller		Removing overdrive mainshaft bearing
KV31100401 (–) Transmission press stand		Pressing counter gear and mainshaft
ST22520000 (J26348) Wrench		Tightening mainshaft lock nut
ST23540000 (J25689-A) Pin punch		Removing and installing fork rod retaining pin
ST30031000 (J22912-01) Puller		Removing and installing 1st gear bushing Removing main drive gear bearing
ST23860000 (–) Drift	 **a: 38 mm (1.50 in) dia.** **b: 33 mm (1.30 in) dia.**	Installing counter drive gear
ST22360002 (J25679-01) Drift	 **a: 29 mm (1.14 in) dia.** **b: 23 mm (0.91 in) dia.**	Installing counter gear front and rear end bearings
ST22350000 (J25678-01) Drift	 **a: 34 mm (1.34 in) dia.** **b: 28 mm (1.10 in) dia.**	Installing O.D. gear bushing
ST23800000 (J25691-01) Drift	 **a: 44 mm (1.73 in) dia.** **b: 31 mm (1.22 in) dia.**	Installing front cover oil seal

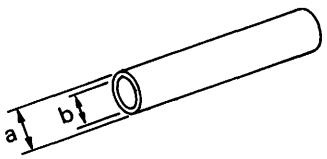
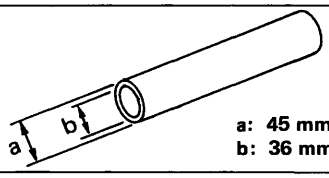
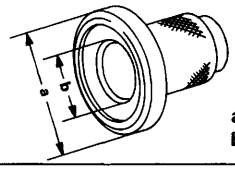
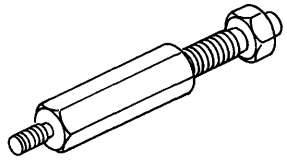
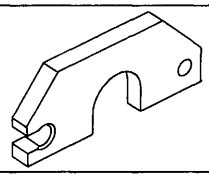
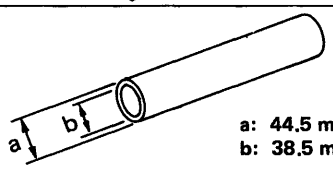
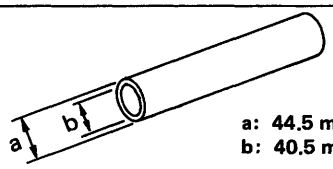
Tool number (Kent-Moore No.) Tool name	Description	
ST33400001 (J26082) Drift	 a: 60 mm (2.36 in) dia. b: 47 mm (1.85 in) dia.	Installing rear oil seal
ST33290001 (J25810-A) Puller		Removing rear oil seal
ST30720000 (—) Drift	 a: 77 mm (3.03 in) dia. b: 55.5 mm (2.185 in) dia.	Installing mainshaft ball bearing
ST30613000 (J25742-3) Drift	 a: 71.5 mm (2.815 in) dia. b: 47.5 mm (1.870 in) dia.	Installing main drive gear bearing
ST33200000 (J26082) Drift	 a: 60 mm (2.36 in) dia. b: 44.5 mm (1.752 in) dia.	Installing counter rear bearing

COMMERCIAL SERVICE TOOLS

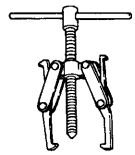
Tool name	Description	
Puller		Removing counter bearings, counter drive and O.D. gears
Drift	 a: 40 mm (1.57 in) dia. b: 30 mm (1.18 in) dia.	Installing countershaft rear end bearing (FS5W71C-4WD model)

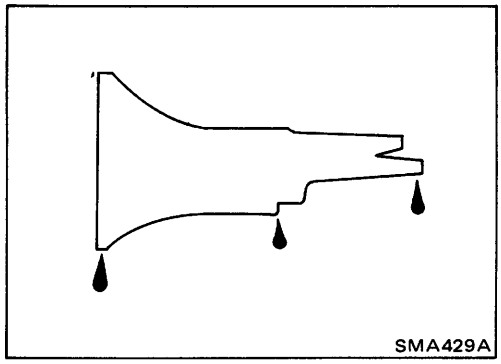
SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.) Tool name	Description	
ST23540000 (J25689-A) Pin punch		Removing and installing retaining pin
ST30031000 (J22912-01) Puller		Removing 1st & 2nd synchronizer assembly Removing counter gear rear thrust bearing Removing main drive bearing
ST33290001 (J25810-A) Puller		Removing rear oil seal
ST33230000 (—) Drift	 **a: 51 mm (2.01 in) dia.** **b: 28.5 mm (1.122 in) dia.**	Removing mainshaft and counter gear
ST22350000 (J25678-01) Drift	 **a: 34 mm (1.34 in) dia.** **b: 28 mm (1.10 in) dia.**	Removing counter gear front bearing (Use with KV38100300)
KV38100300 (J25523) Drift	 **a: 54 mm (2.13 in) dia.** **b: 32 mm (1.26 in) dia.**	Removing counter gear front bearing (Use with ST22350000) Installing counter gear rear bearing
ST30720000 ① (J34286) ② (J34331) Drift	 **a: 77 mm (3.03 in) dia.** **b: 55.5 mm (2.185 in) dia.**	① Removing mainshaft front bearing ② Installing mainshaft front bearing
ST33220000 (J25804-01) Drift	 **a: 37 mm (1.46 in) dia.** **b: 22 mm (0.87 in) dia.**	Removing and installing counter gear rear end bearing (4WD model)
ST33210000 ① (J25523) ② (J25803-01) Drift	 **a: 44 mm (1.73 in) dia.** **b: 24.5 mm (0.965 in) dia.**	① Installing counter gear front bearing ② Installing front cover oil seal
ST30613000 (J25742-3) Drift	 **a: 72 mm (2.83 in) dia.** **b: 48 mm (1.89 in) dia.**	Installing main drive gear bearing

Tool number (Kent-Moore No.) Tool name	Description	
ST37750000 ① (J34286) ② (J34332) ③ (J34334) ④ (J25679-01) Drift	 **a: 40 mm (1.57 in) dia.** **b: 31 mm (1.22 in) dia.**	① Removing counter gear rear bearing ② Installing O.D. gear bushing ② Installing reverse cone ③ Installing reverse counter gear ④ Installing counter gear rear end bearing
ST22452000 (J34337) Drift	 **a: 45 mm (1.77 in) dia.** **b: 36 mm (1.42 in) dia.**	Installing reverse hub Installing mainshaft rear bearing (2WD model)
ST33400001 (J26082) Drift	 **a: 60 mm (2.36 in) dia.** **b: 47 mm (1.85 in) dia.**	Installing rear oil seal
(J26349-3) Puller leg		Installing mainshaft and counter gear (Use with J34328)
(J34328) Puller		Installing mainshaft and counter gear (Use with J26349-3)
(J26092) Drift	 **a: 44.5 mm (1.752 in) dia.** **b: 38.5 mm (1.516 in) dia.**	Installing sub-gear snap ring
(J34342) Drift	 **a: 44.5 mm (1.752 in) dia.** **b: 40.5 mm (1.594 in) dia.**	Installing O.D. main gear Installing reverse gear bushing

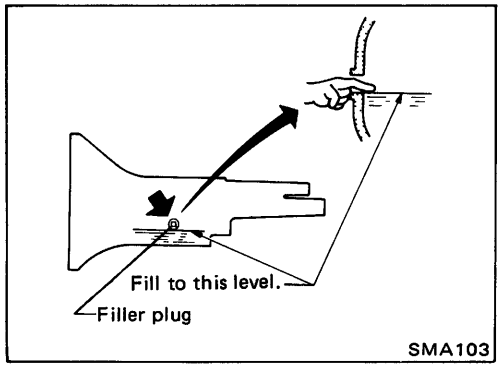
COMMERCIAL SERVICE TOOL

Tool name	Description	
Puller		Removing counter gear rear end bearing Removing mainshaft rear bearing (2WD model) Removing reverse synchronizer hub Removing reverse counter gear


SMA429A

Checking M/T Oil

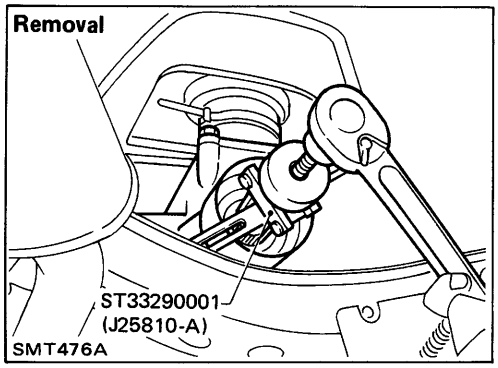
- Check manual transmission for oil leakage.



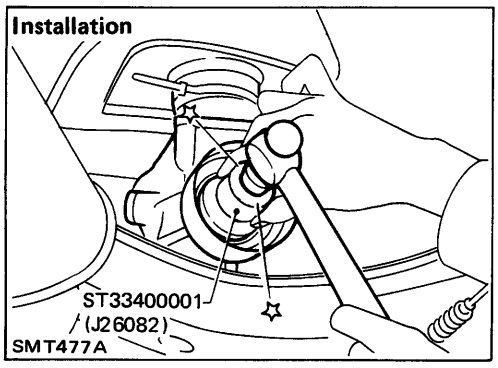
SMA103

- Check oil level.

Replacing Rear Oil Seal — 2WD Model



SMT476A



SMT477A

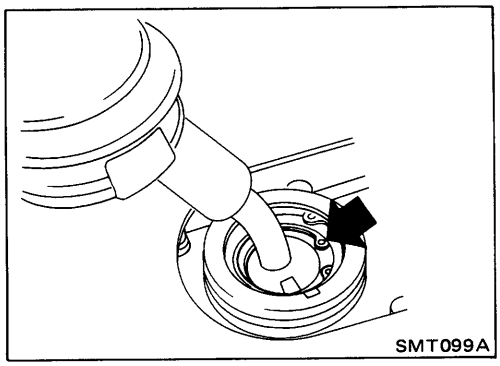
Removal — 2WD Model

- Remove propeller shaft. — Refer to section PD.
- **Insert plug into rear oil seal after removing propeller shaft.**

CAUTION:

Be careful not to damage spline, sleeve yoke and rear oil seal, when removing propeller shaft.

- Remove exhaust front tube A. (VG30E engine model) — Refer to section FE.


SMT099A

- Remove shift lever.
- Support engine by placing a jack under oil pan.

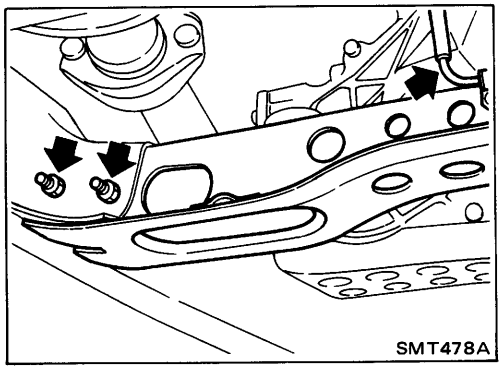
CAUTION:

Do not place jack under the oil pan drain plug.

- Remove transmission from engine.

WARNING:

Support Manual Transmission, while removing it.


SMT478A

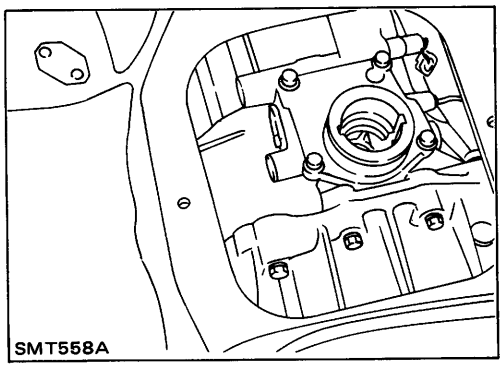
Removal — 4WD Model

- Remove front and rear propeller shafts. — Refer to section PD.
- **Insert plug into rear oil seal of transfer after removing propeller shaft.**

CAUTION:

Be careful not to damage spline, sleeve yoke and rear oil seal of transfer, when removing propeller shaft.

- Remove exhaust front tube A. (VG30E engine model) — Refer to section FE.
- Remove torsion bar springs. — Refer to REMOVAL of Torsion Bar Spring in section FA. Then remove second crossmember.


SMT558A

- Remove shift lever of transmission and transfer.
- Support engine by placing a jack under oil pan.

CAUTION:

Do not place jack under the oil pan drain plug.

- Remove transmission with transfer from engine.

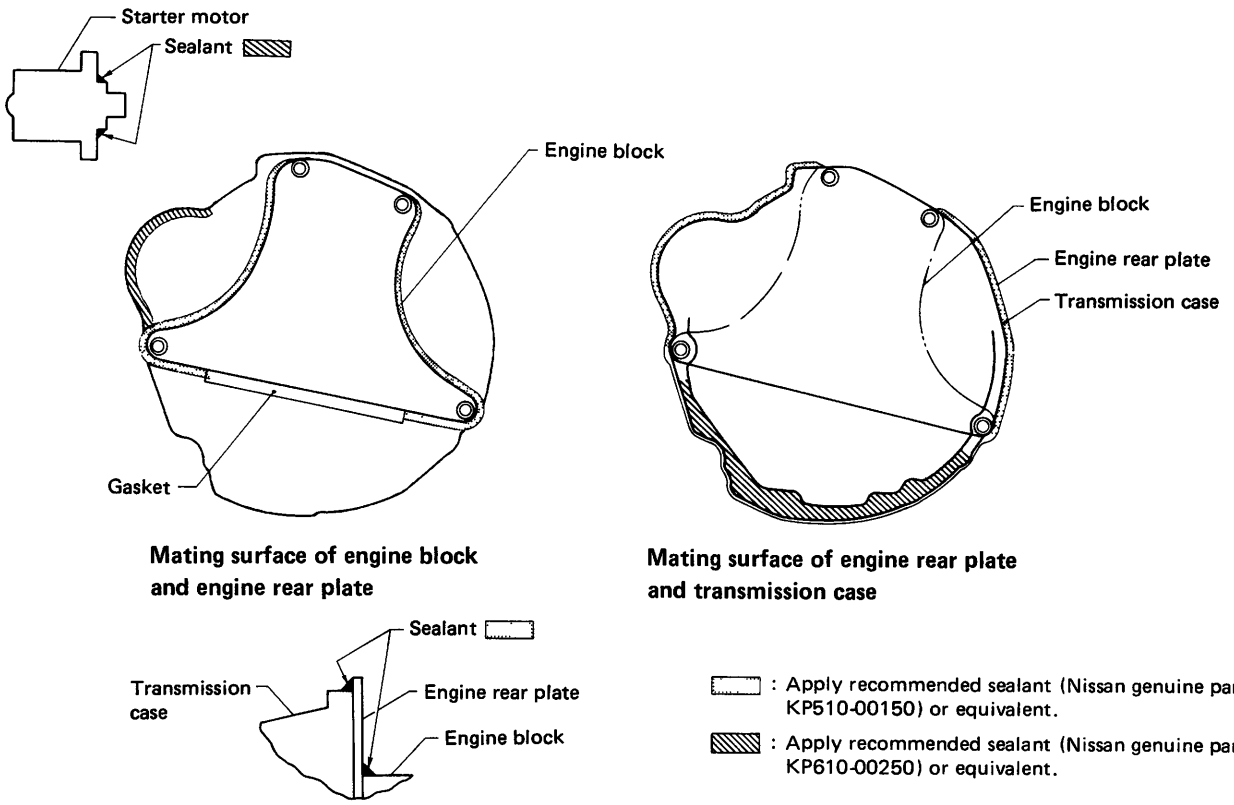
WARNING:

Support Manual Transmission with transfer, while removing it.

Installation

- Apply sealant as below: – **4WD model**

KA24E engine model



Mating surface of engine block and engine rear plate

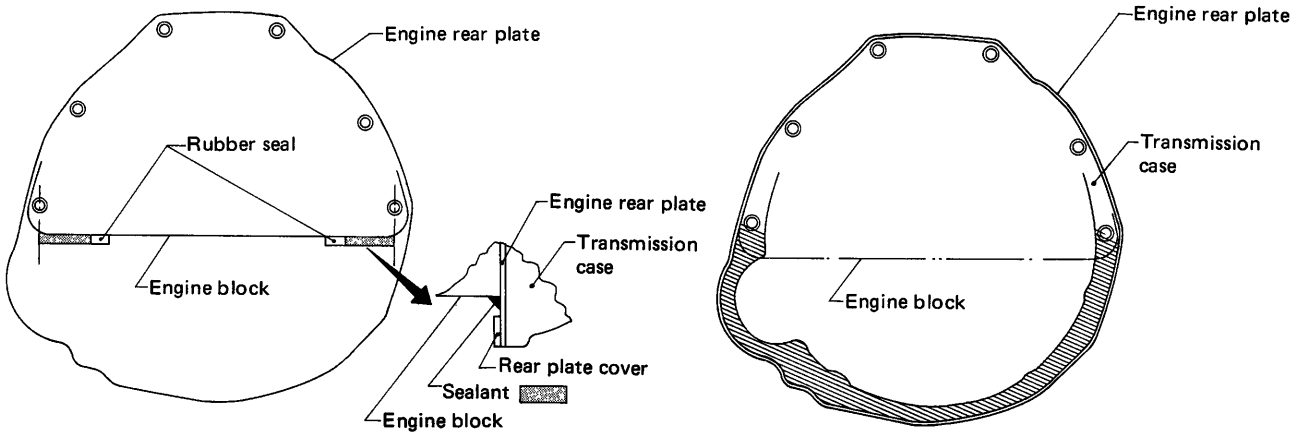
Mating surface of engine rear plate and transmission case

: Apply recommended sealant (Nissan genuine part: KP510-00150) or equivalent.

: Apply recommended sealant (Nissan genuine part: KP610-00250) or equivalent.

SMT481A

VG30E engine model



Mating surface of engine block and engine rear plate

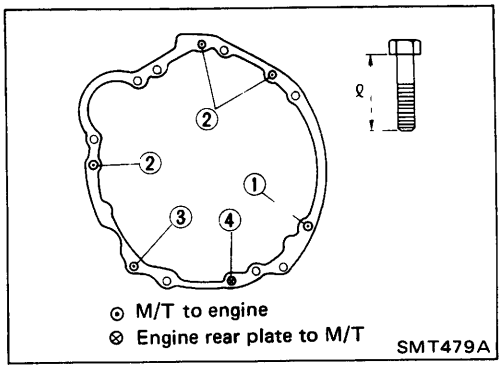
Mating surface of engine rear plate and transmission case

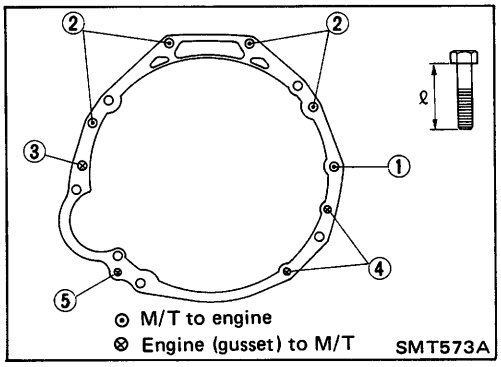
: Apply recommended sealant (Nissan genuine part: KP510-00150) or equivalent.

: Apply recommended sealant (Nissan genuine part: KP610-00250) or equivalent.

SMT572A

Installation (Cont'd)





- Tighten bolt securing transmission.
- **KA24E engine model**

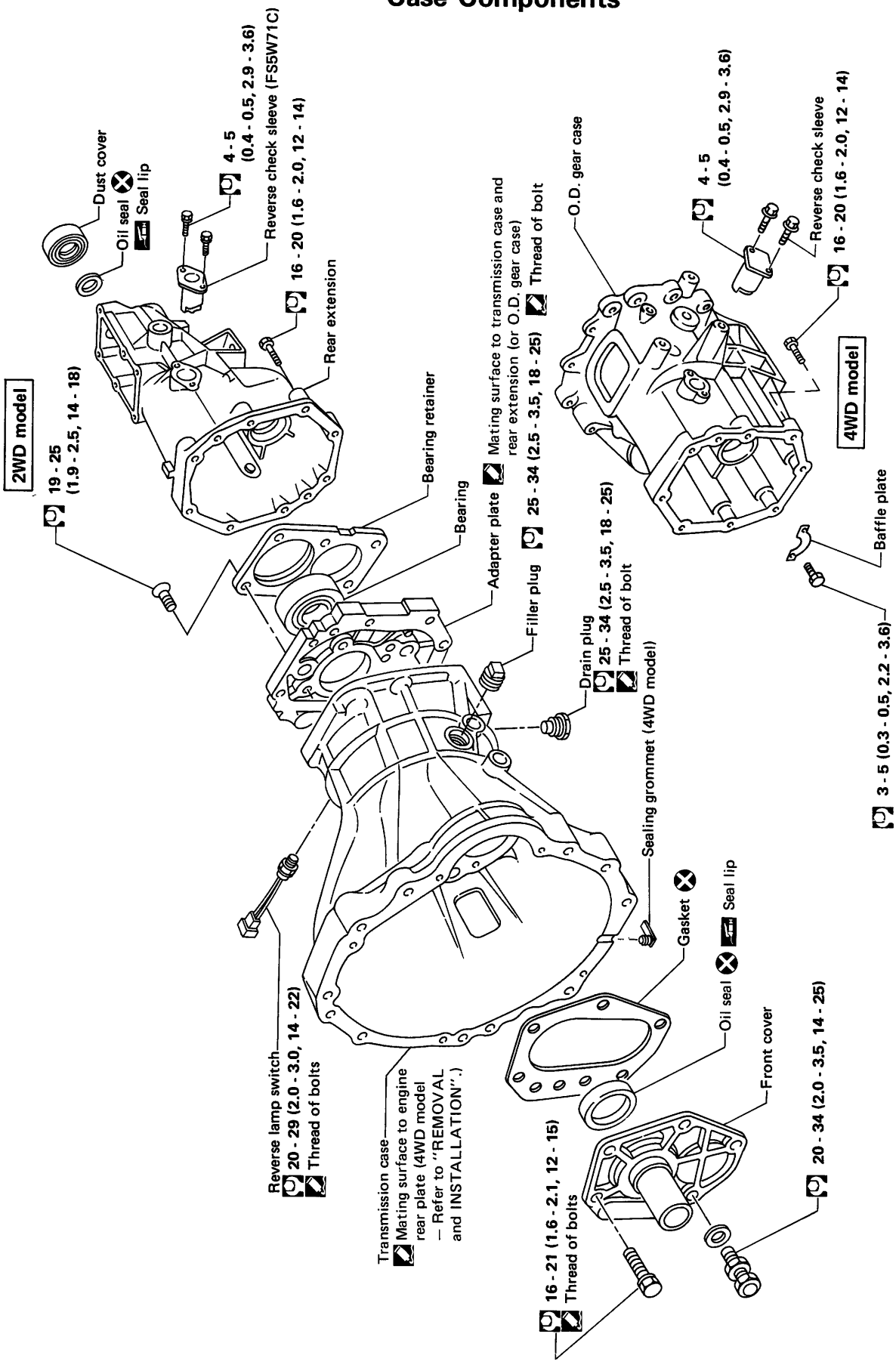
Bolt No.	Tightening torque N·m (kg-m, ft-lb)	ℓ mm (in)
1	39 - 49 (4.0 - 5.0, 29 - 36)	65 (2.56)
2	39 - 49 (4.0 - 5.0, 29 - 36)	60 (2.36)
3*	19 - 25 (1.9 - 2.5, 14 - 18)	25 (0.98)
4	19 - 25 (1.9 - 2.5, 14 - 18)	16 (0.63)

*: With nut

- **VG30E engine model**

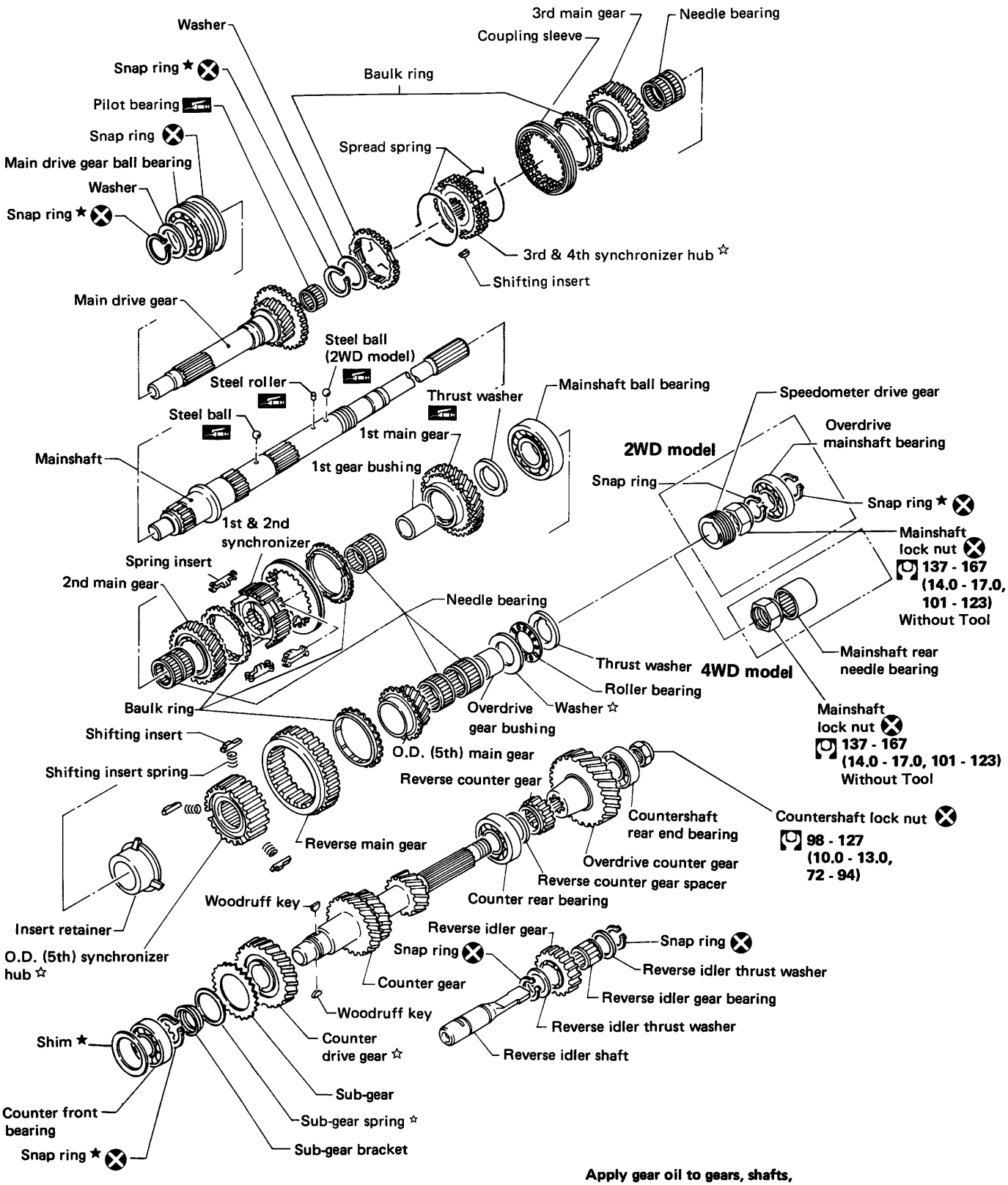
Bolt No.	Tightening torque N·m (kg-m, ft-lb)	ℓ mm (in)
1	39 - 49 (4.0 - 5.0, 29 - 36)	65 (2.56)
2	39 - 49 (4.0 - 5.0, 29 - 36)	60 (2.36)
3	29 - 39 (3.0 - 4.0, 22 - 29)	55 (2.17)
4	29 - 39 (3.0 - 4.0, 22 - 29)	30 (1.18)
5	29 - 39 (3.0 - 4.0, 22 - 29)	25 (0.98)

Case Components



SMT574A

Gear Components

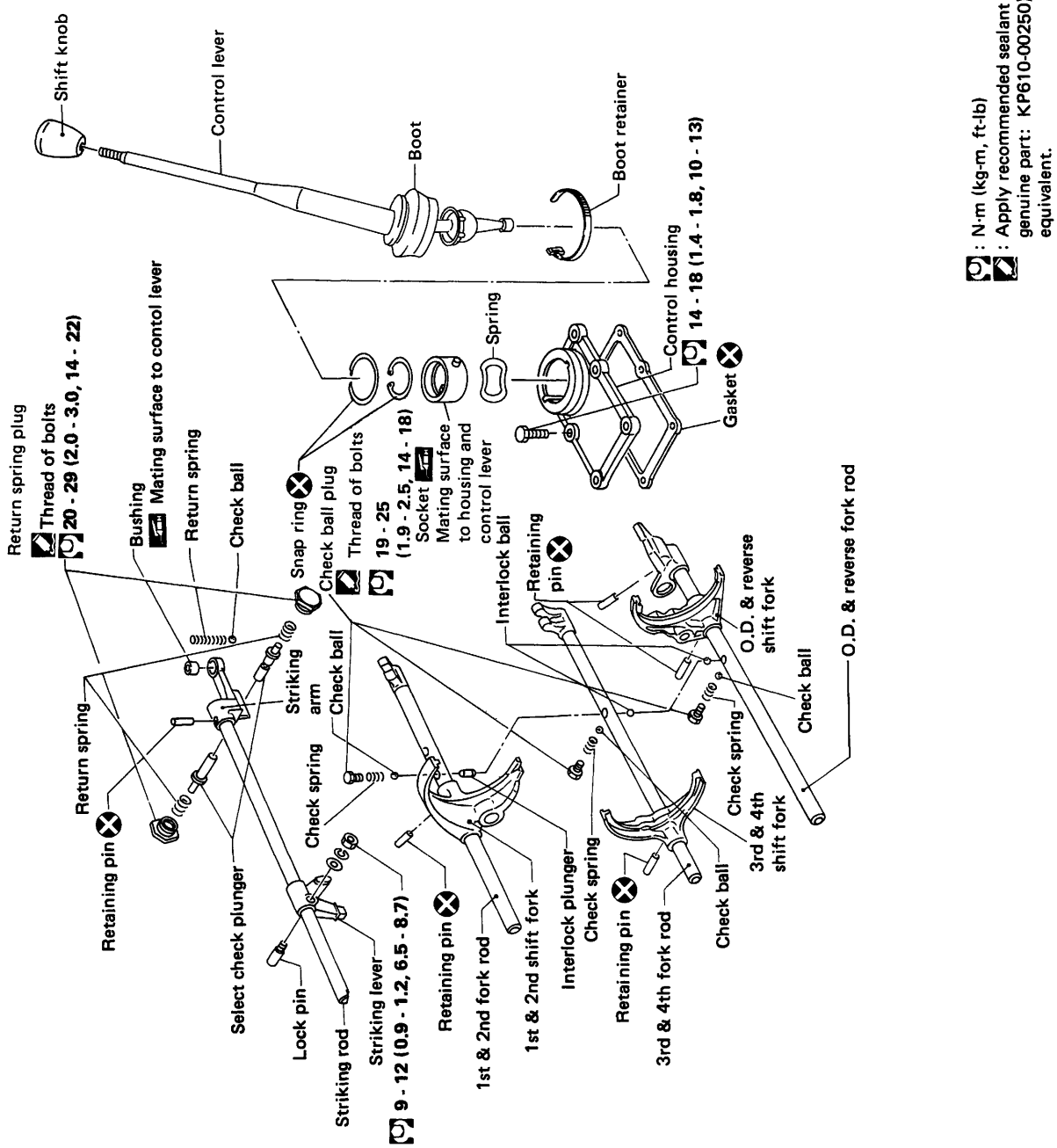


Apply gear oil to gears, shafts, synchronizers, and bearings when assembling.

★ Select with proper thickness.
☆ Pay attention to its direction.
: N·m (kg-m, ft-lb)

SMT648B

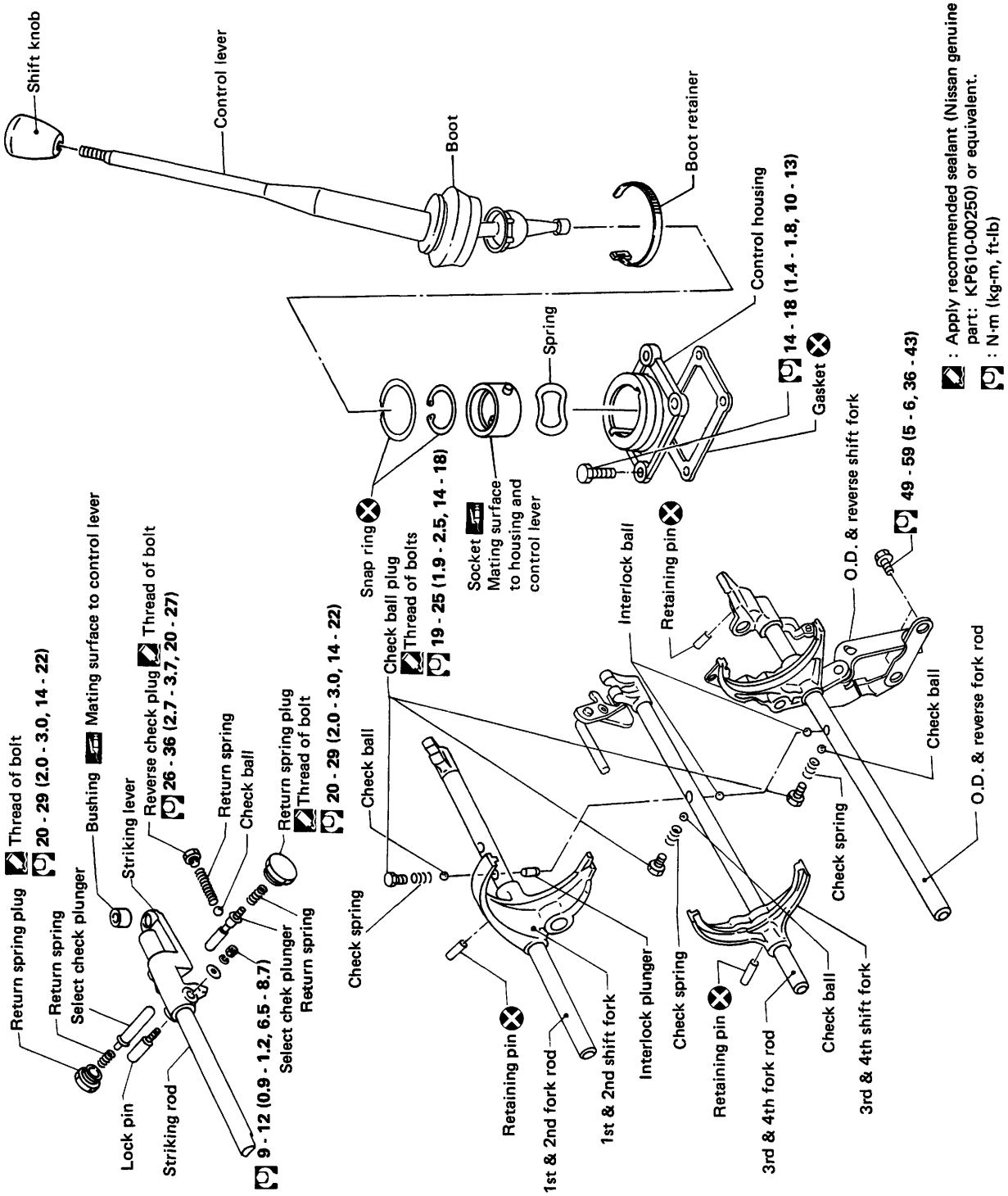
Shift Control Components — 2WD model



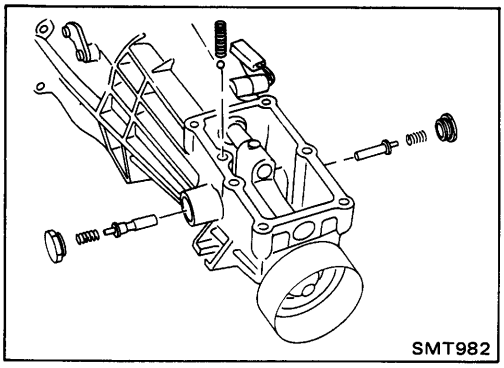
: N·m (kg-m, ft-lb)
: Apply recommended sealant (Nissan genuine part: KP610-00250) or equivalent.

SMT645B

Shift Control Components — 4WD model



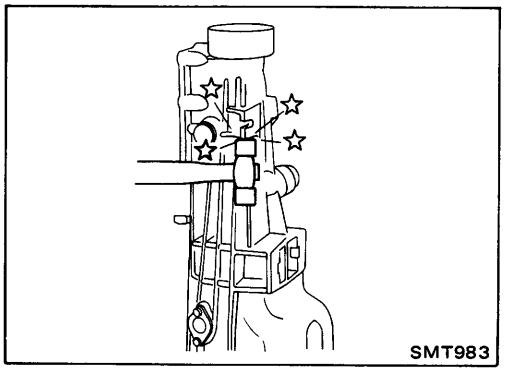
SMT646B


SMT982

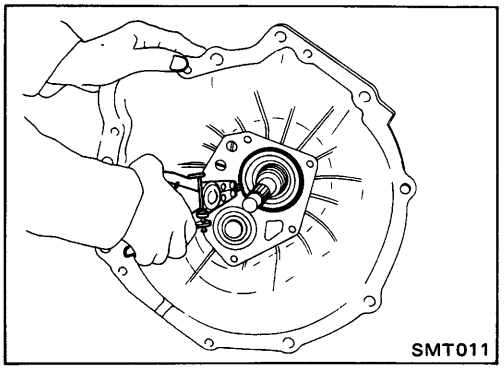
Case Components

1. Remove rear extension.

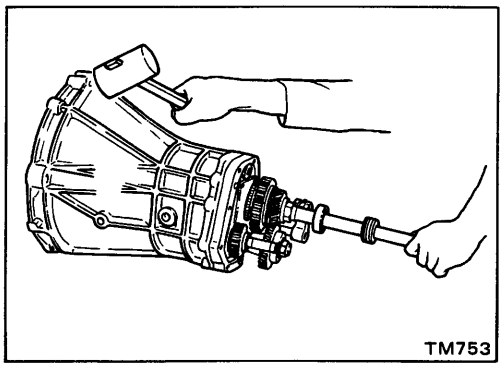
a. Remove control housing, check ball, return spring plug, select check plunger and return springs.


SMT983

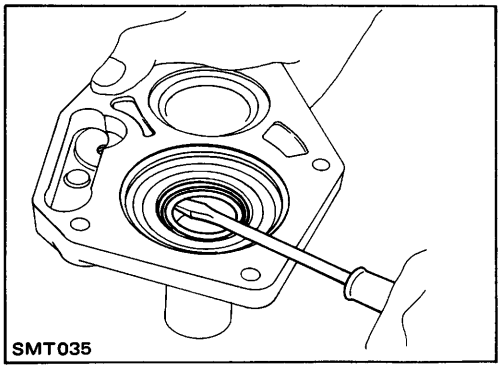
b. Remove rear extension by lightly tapping it.


SMT011

2. Remove front cover, gasket, shim of countershaft front bearing, and snap ring of main drive gear ball bearing.

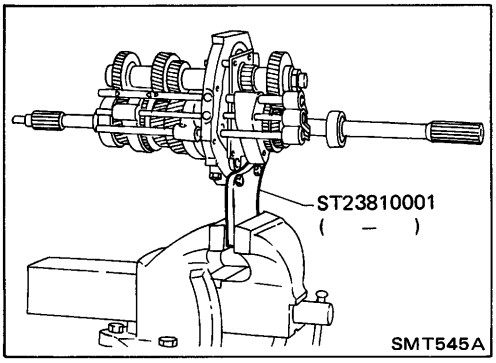

TM753

3. Separate transmission case from adapter plate.


SMT035

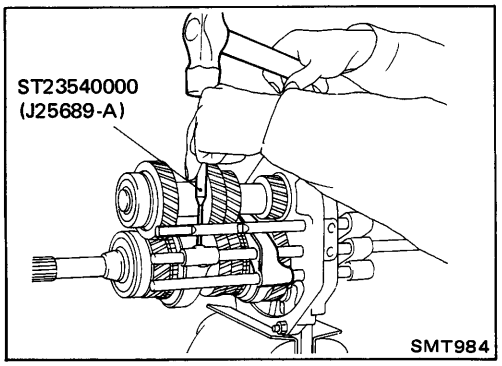
4. Remove oil seal of front cover.

Be careful not to damage mating surface of front cover.

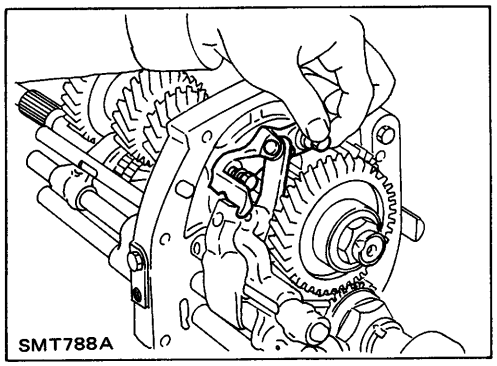


Shift Control Components

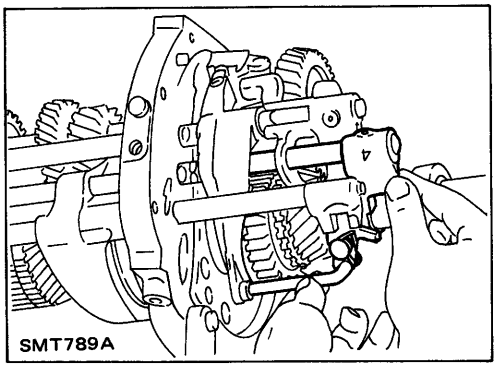
1. Set up Tool on adapter plate.
2. Remove check ball plugs, check springs, and check balls.



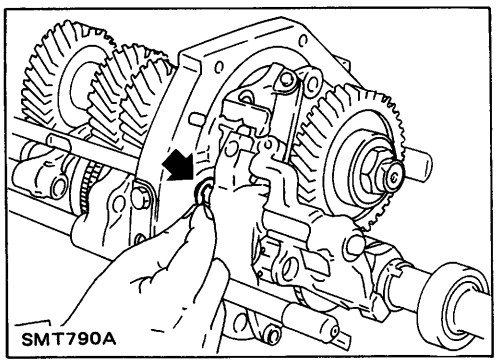
3. Drive out retaining pins. Then drive out fork rods and remove interlock balls.



4. Remove lever bracket securing bolt (4WD model with main-shaft braking mechanism only).

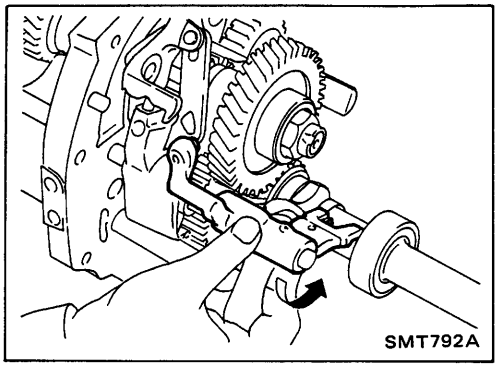


5. Draw out 3rd-4th fork rod (4WD model only).



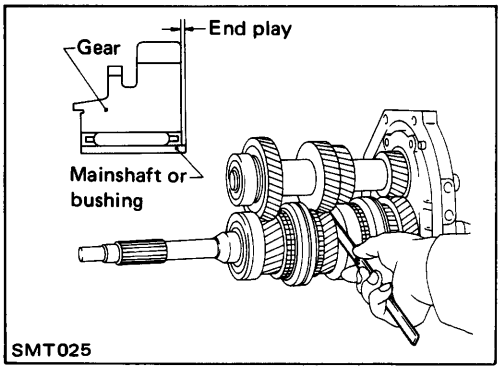
6. Remove E-ring from O.D.-rev. fork rod (4WD model only).

Shift Control Components (Cont'd)



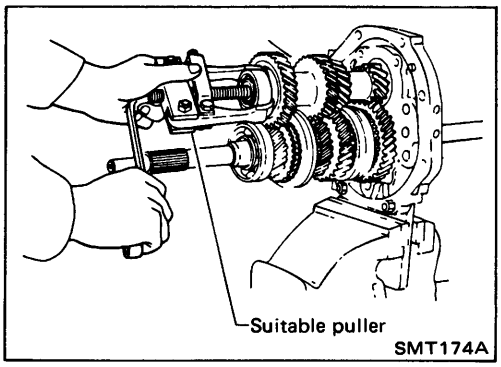
7. Draw out O.D.-rev. fork shaft by rotating O.D.-rev. bracket counterclockwise (4WD model only).

Gear Components

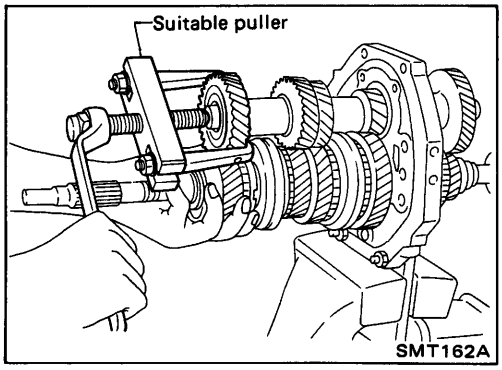


1. Before disassembly, measure each gear end play.
- If end play is not within the specified limit, disassemble and check the parts.
- Replace any part which is worn or damaged.

Gear	End play mm (in)
1st	0.31 - 0.41 (0.0122 - 0.0161)
2nd	0.11 - 0.21 (0.0043 - 0.0083)
3rd	0.11 - 0.21 (0.0043 - 0.0083)
O.D.	0.24 - 0.41 (0.0094 - 0.0161)

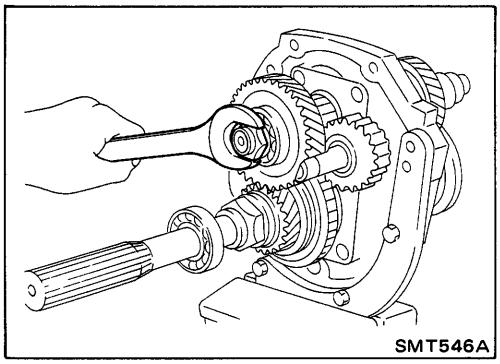


2. Mesh 2nd and reverse gear, then draw out counter front bearing with suitable puller.
3. Remove snap ring and then remove sub-gear bracket, sub-gear spring and sub-gear.

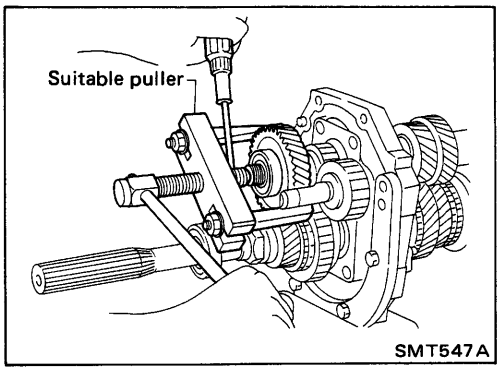


4. Draw out counter drive gear with main drive gear assembly with suitable puller.
- **When drawing out main drive gear assembly, be careful not to drop pilot bearing and baulk ring.**
5. Remove snap ring and draw out 3rd & 4th synchronizer and 3rd gear.

Gear Components (Cont'd)

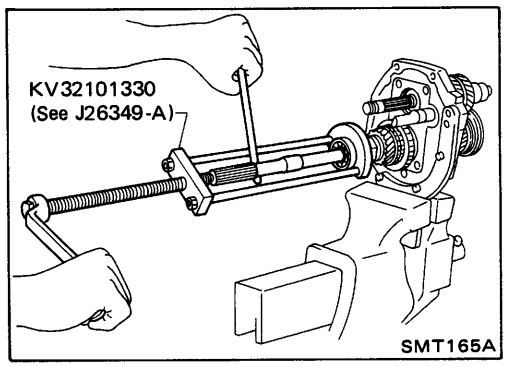

SMT546A

6. Disassemble parts at rear of adapter plate as follows:
a. Release staking on countershaft nut and mainshaft nut and loosen these nuts.
Mainshaft nut: Left-hand thread



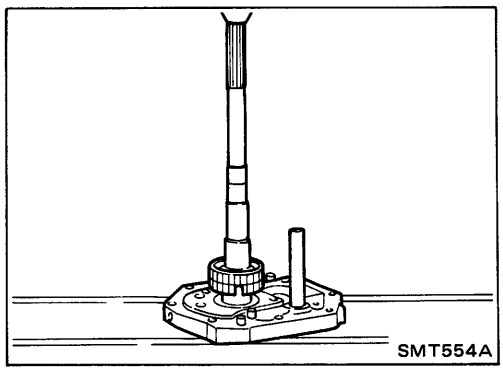
SMT547A

b. Pull out O.D. counter gear with bearing with suitable puller.
c. Draw out reverse counter gear and spacer.
d. Remove snap rings from reverse idler shaft, and draw out reverse idler gear, thrust washers and reverse idler gear bearing.



SMT165A

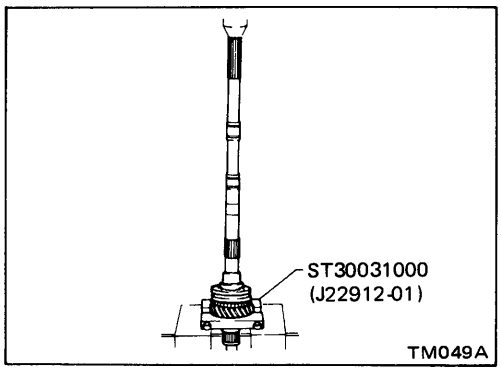
e. Remove snap ring and pull out overdrive mainshaft bearing, then remove snap ring. (2WD model)
f. Remove mainshaft nut.
g. Remove speedometer drive gear and steel ball. (2WD model)
h. Remove thrust washer, steel roller, roller bearing and washer.
i. Remove O.D. main gear, needle bearing and baulk ring (O.D.).
j. Remove O.D. coupling sleeve, shifting inserts and shifting insert springs.
k. Remove counter gear by tapping rear end of counter gear.
l. Press out O.D. gear bushing, insert retainer and O.D. synchronizer hub.


SMT554A

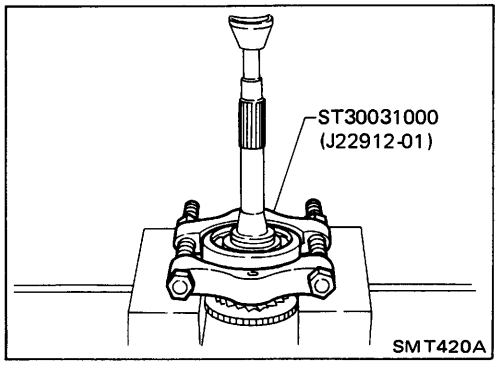
7. Remove thrust washer, steel ball, 1st main gear and needle bearing.

Be careful not to lose steel ball.

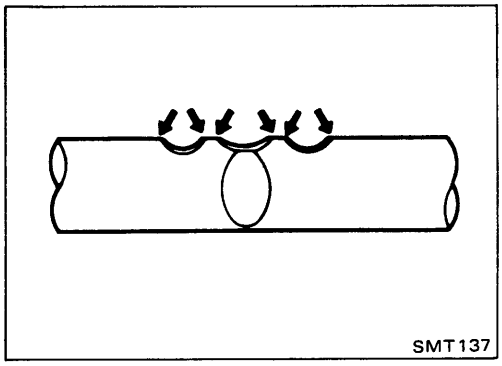
Gear Components (Cont'd)



8. Press out 1st gear mainshaft bushing together with 2nd main gear with Tool.
   Then remove 2nd gear needle bearing.

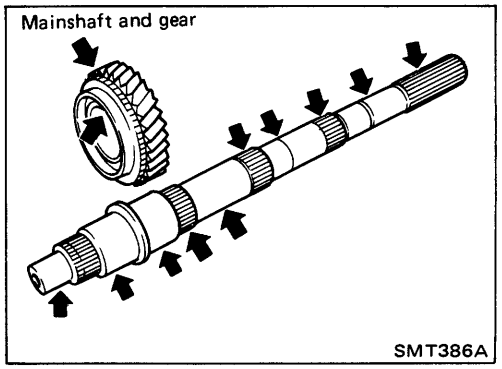


9. Remove main drive gear bearing.
a. Remove snap ring and washer.
b. Remove main drive gear bearing.


SMT137

Shift Control Components

- Check contact surface and sliding surface of fork rods for wear, scratches, projections or other damage.

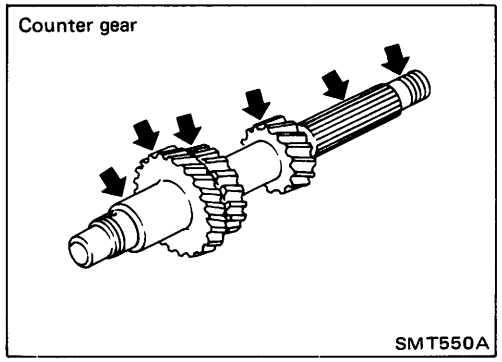


SMT386A

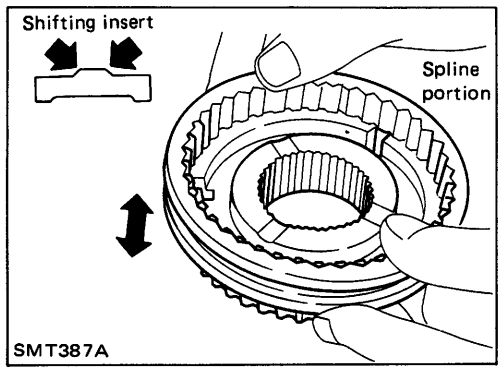
Gear Components

GEARS AND SHAFTS

- Check shafts for cracks, wear or bending.
- Check gears for excessive wear, chips or cracks.



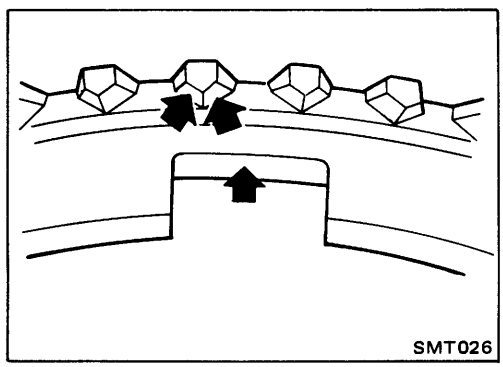
SMT550A

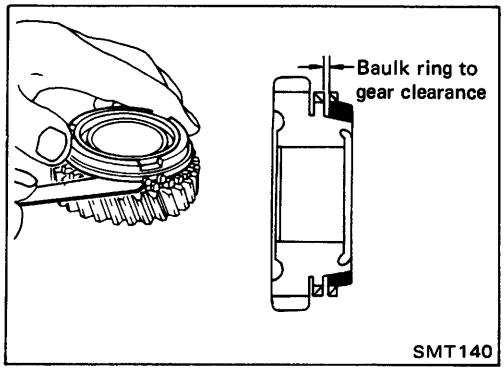


SMT387A

SYNCHRONIZERS

- Check spline portion of coupling sleeves, hubs and gears for wear or cracks.
- Check baulk rings for cracks or deformation.
- Check shifting inserts for wear or deformation.
- Check insert springs for deformation.


SMT026



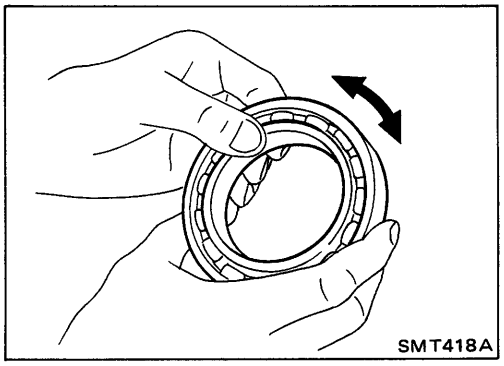
Gear Components (Cont'd)

- Measure clearance between baulk ring and gear.

Clearance between baulk ring and gear

Unit: mm (in)

	Standard	Wear limit
1st & 2nd	1.20 - 1.60 (0.0472 - 0.0630)	0.80 (0.0315)
3rd & main drive	1.20 - 1.60 (0.0472 - 0.0630)	0.80 (0.0315)
O.D.	1.20 - 1.60 (0.0472 - 0.0630)	0.80 (0.0315)



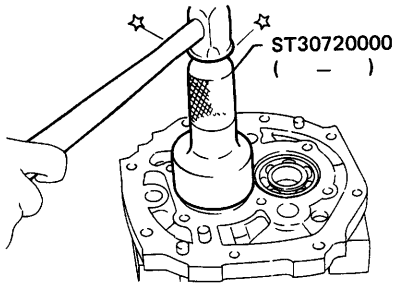
BEARINGS

- Make sure bearings roll freely and are free from noise, crack, pitting or wear.

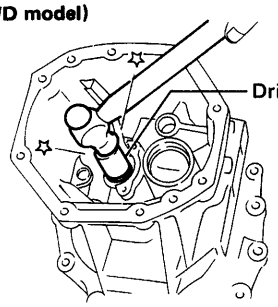
Gear Components

1. Install bearings into case components.

Mainshaft ball bearing in adapter plate

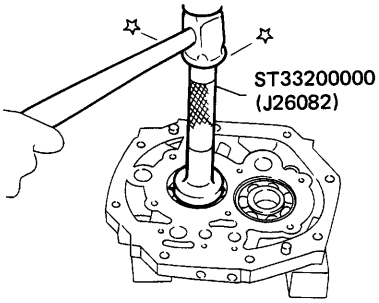


Countershaft rear end bearing in O.D. gear case (4WD model)

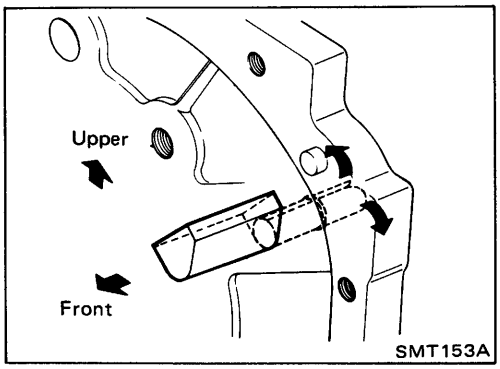


Be flush with front surface of O.D. gear case

Counter rear bearing in adapter plate

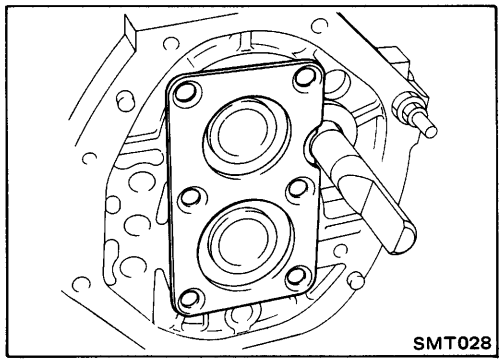


SMT638B



SMT153A

2. Assemble adapter plate parts.
- Install oil gutter on adapter plate and expand on rear side.

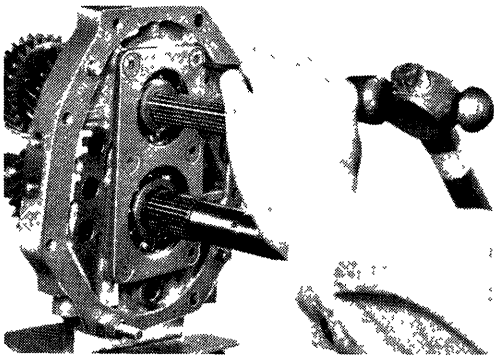


SMT028

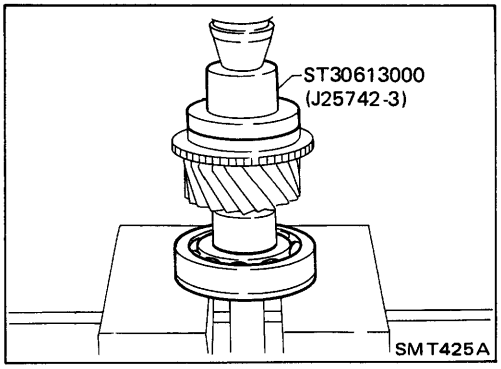
- Install bearing retainer.

a. Insert reverse shaft, then install bearing retainer.

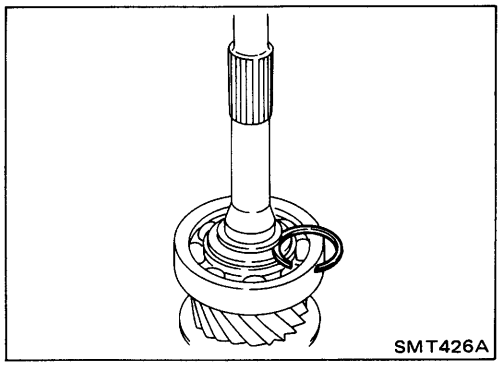
Gear Components (Cont'd)



b. Tighten each screw, then stake it at two points.



3. Install main drive gear bearing.
a. Press in main drive gear bearing.
b. Install main drive gear spacer.



c. Select proper main drive gear snap ring to minimize clearance of groove.

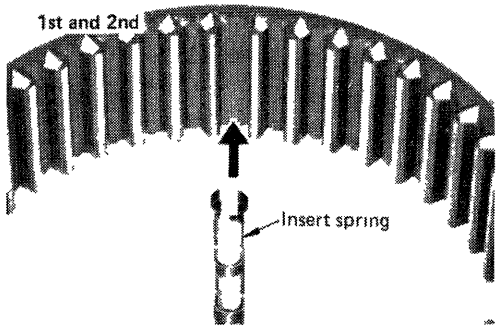
Allowable clearance of groove:
0 - 0.13 mm (0 - 0.0051 in)

Main drive gear snap ring

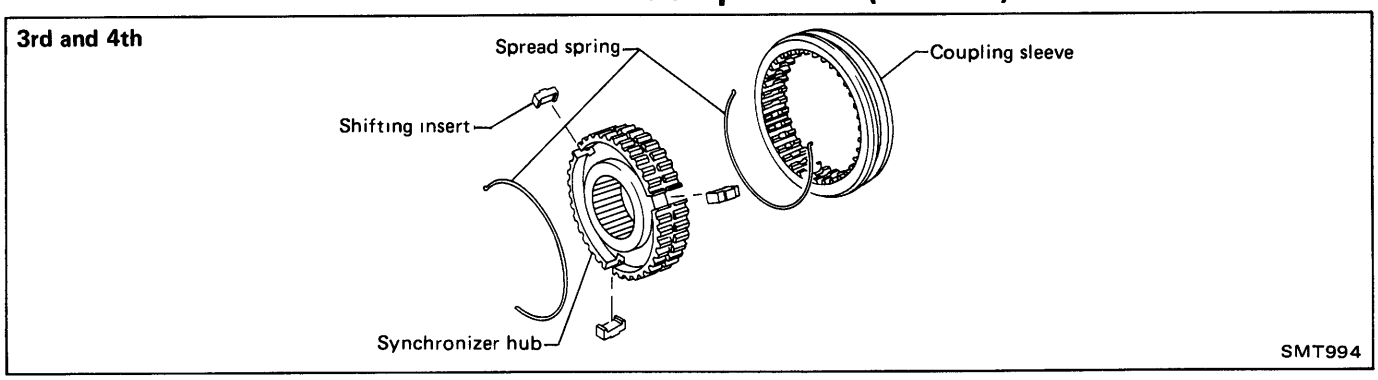
Thickness mm (in)	Part number
1.73 (0.0681)	32204-78005
1.80 (0.0709)	32204-78000
1.87 (0.0736)	32204-78001
1.94 (0.0764)	32204-78002
2.01 (0.0791)	32204-78003
2.08 (0.0819)	32204-78004

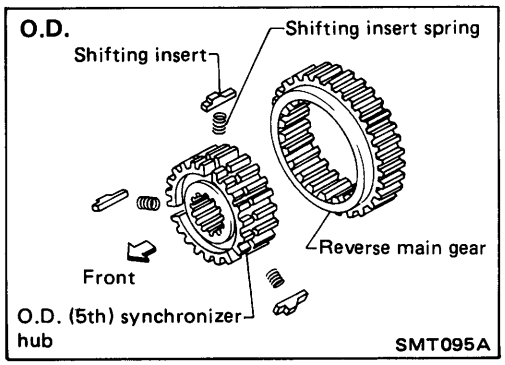
d. Install selected snap ring on main drive gear.

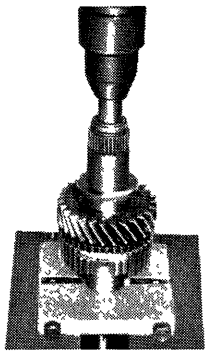
4. Assemble synchronizers.



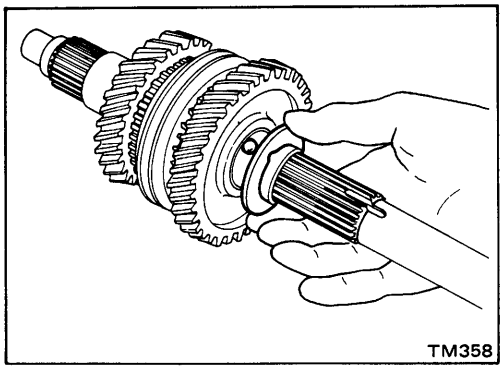
Gear Components (Cont'd)







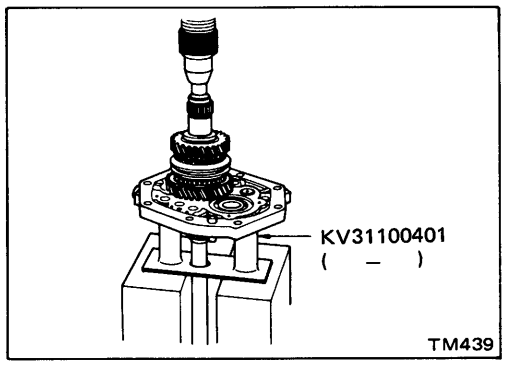
5. Assemble 2nd main gear, needle bearing and 1st & 2nd synchronizer assembly, then press 1st gear bushing on mainshaft.



6. Assemble 1st main gear, steel ball, and thrust washer on mainshaft.

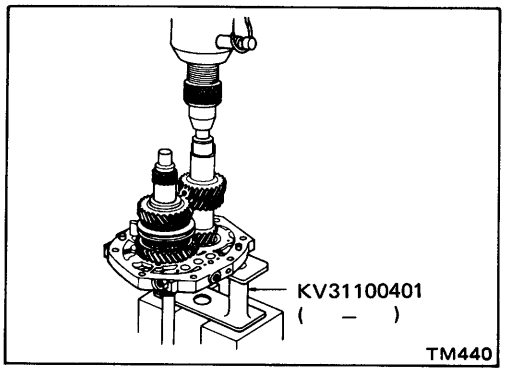
Before installing steel ball and thrust washer, apply grease to them.

7. Install counter rear bearing to adapter plate.

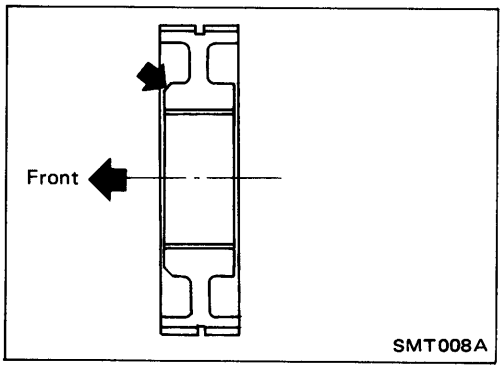


8. Press mainshaft assembly to adapter plate with Tool.

Gear Components (Cont'd)

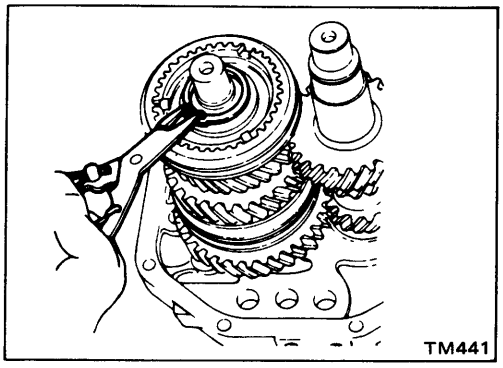


9. Press counter gear into adapter plate with Tool.



10. Install 3rd main gear and 3rd & 4th synchronizer assembly.

Pay attention to direction of synchronizer.



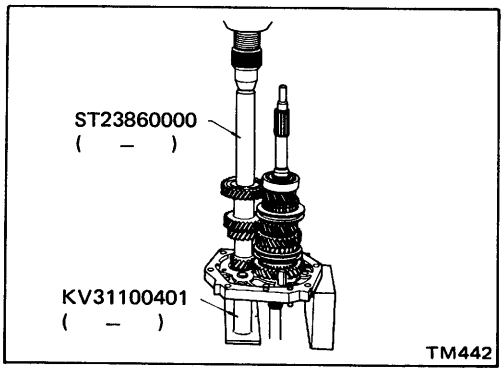
11. Install thrust washer on mainshaft and secure it with mainshaft front snap ring.

Select proper snap ring that will minimize clearance of groove in mainshaft.

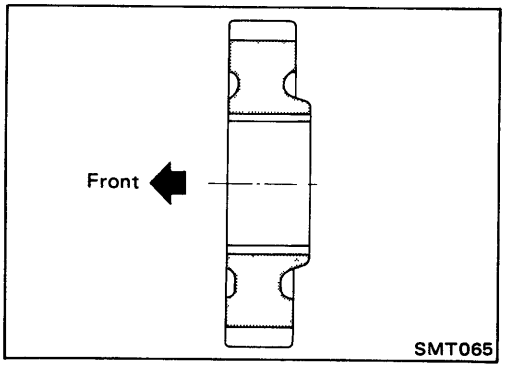
Mainshaft front snap ring:

Refer to S.D.S.

12. Apply gear oil to mainshaft pilot bearing and install it on mainshaft.



13. Press counter drive gear with main drive gear with Tool.



Pay attention to direction of counter drive gear.

Gear Components (Cont'd)

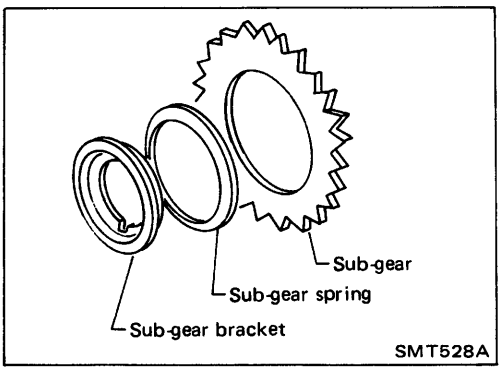
14. Install sub-gear components.

a. Install sub-gear and sub-gear bracket on counter drive gear and then select proper snap ring that will minimize clearance of groove in counter gear.

Allowable clearance of groove:
0 - 0.18 mm (0 - 0.0071 in)

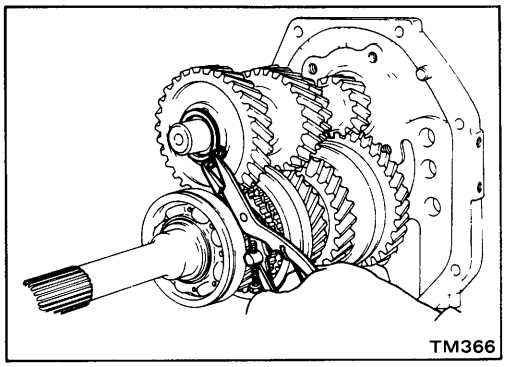
Counter drive gear snap ring:

Parts number	Thickness mm (in)
32215-E9000	1.4 (0.055)
32215-E9001	1.5 (0.059)
32215-E9002	1.6 (0.063)

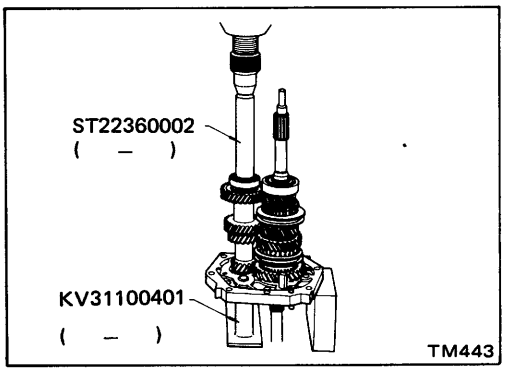


b. Remove snap ring, sub-gear bracket and sub-gear from counter gear.

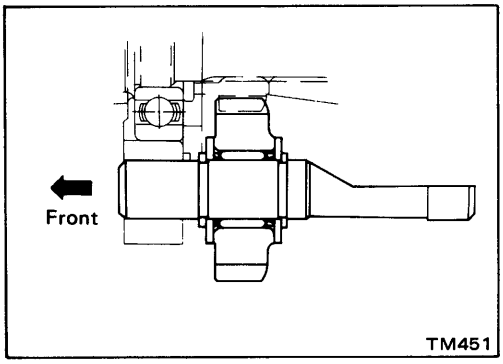
c. Reinstall sub-gear and sub-gear bracket with sub-gear spring between them.



15. Install selected counter drive gear snap ring.



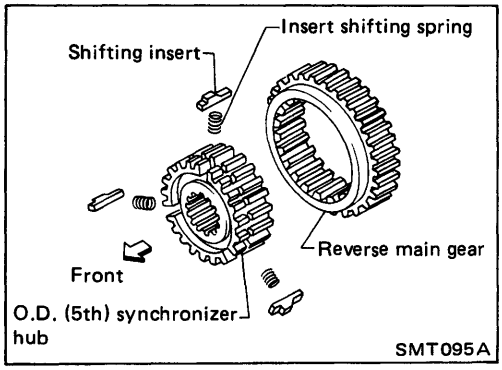
16. Press counter gear front bearing onto counter gear.



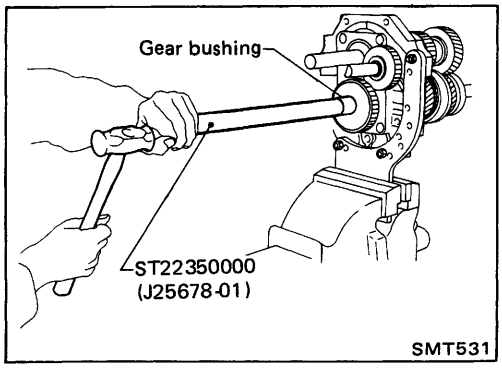
17. Assemble parts at rear of adapter plate as follows:

a. Install reverse idler gear to reverse idler shaft with spacers, snap rings and needle bearing.

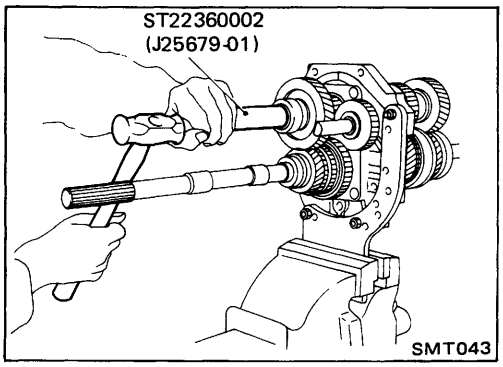
Gear Components (Cont'd)



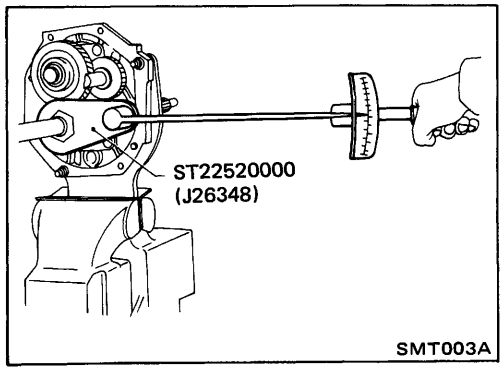
b. Install insert retainer and O.D. synchronizer to mainshaft.
Pay attention to direction of hub.



c. Install O.D. gear bushing with Tool.
d. Install O.D. main gear and needle bearing.
e. Install spacer, reverse counter gear and O.D. counter gear.
O.D. main gear and O.D. counter gear should be handled as a matched set.
f. Install washer, roller bearing, steel roller, thrust washer, steel ball and speedometer drive gear.
g. Tighten mainshaft rock nut temporarily.
Always use new lock nut.



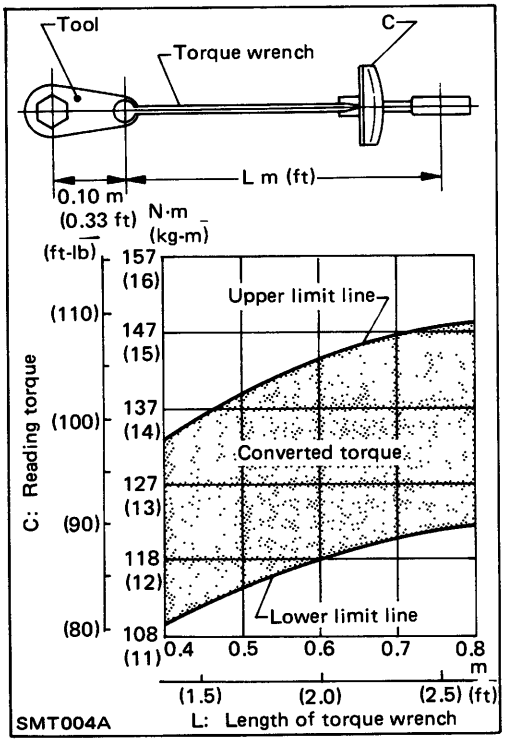
h. Install countershaft rear end bearing with Tool.



18. Mesh 2nd and reverse gears and tighten mainshaft lock nut with Tool.

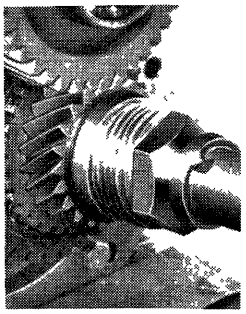
Gear Components (Cont'd)

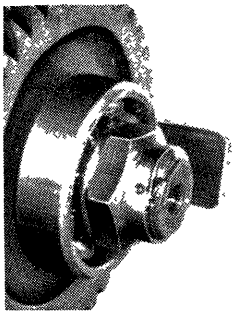
Use the left chart when deciding the reading torque
(Length of torque wrench vs. setting or reading torque)



19. Tighten countershaft lock nut.
Always use new lock nut.
20. Stake mainshaft lock nut and countershaft lock nut with a punch.
21. Measure gear end play. For the description, refer to "DISASSEMBLY".

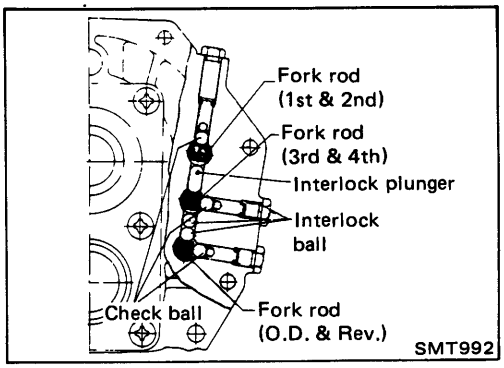
Mainshaft **Countershaft**

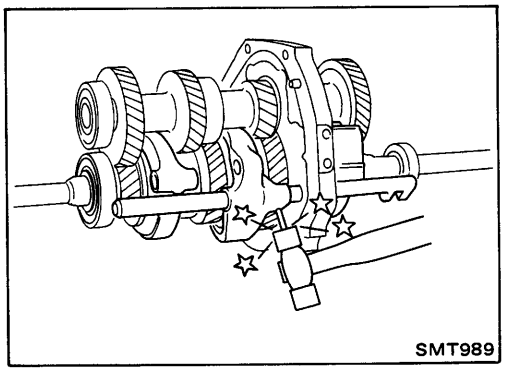




Shift Control Components

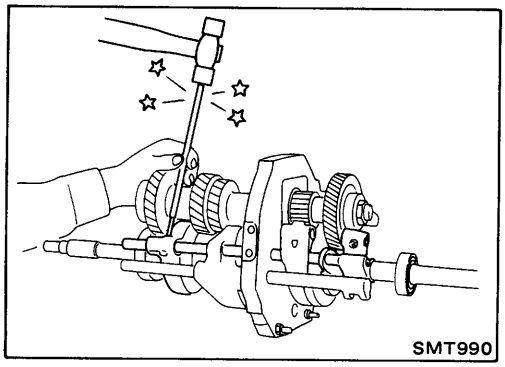
1. Install shift rods, interlock planger, interlock balls and check balls.



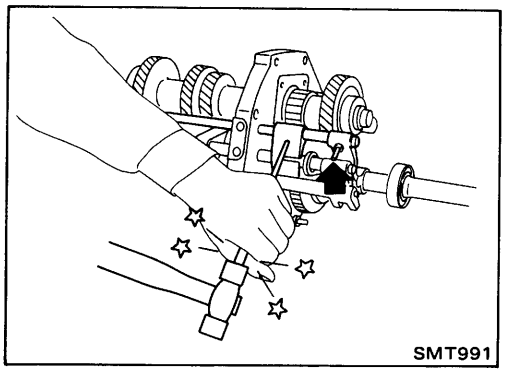


a. 1st-2nd shift fork

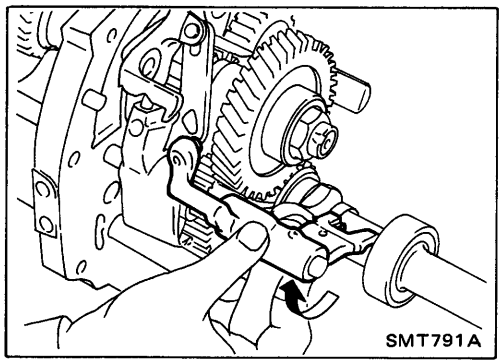
Shift Control Components (Cont'd)



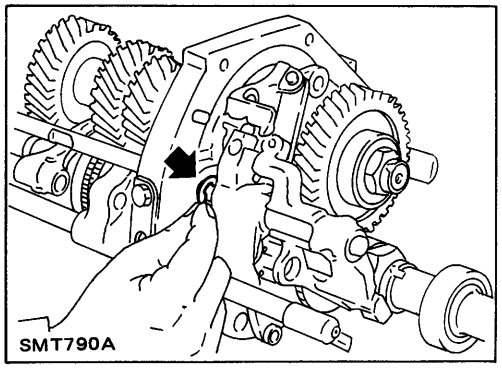
b. 3rd-4th shift fork



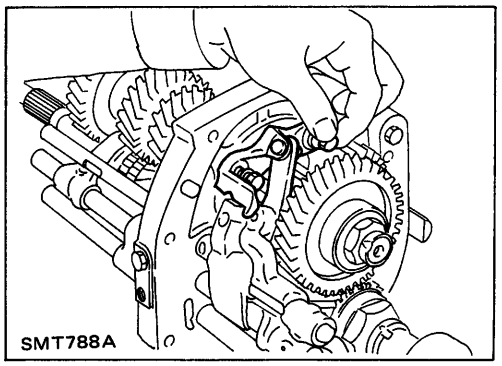
c. O.D.-reverse shift fork or reverse shift fork



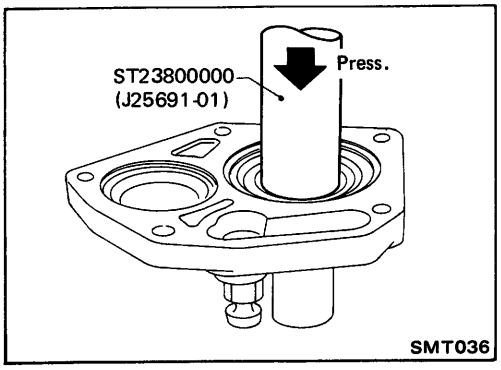
2. Install O.D.-rev. fork shaft by rotating O.D.-rev. bracket clockwise (4WD model with mainshaft braking mechanism only).



3. Install E-ring on O.D.-rev. fork rod (4WD model only).



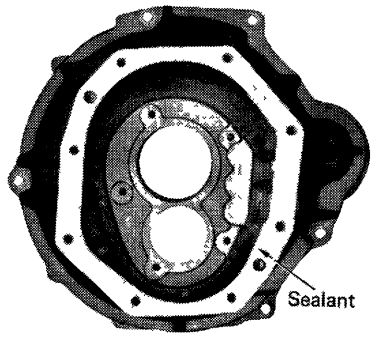
4. Install lever bracket securing bolt (4WD model only).



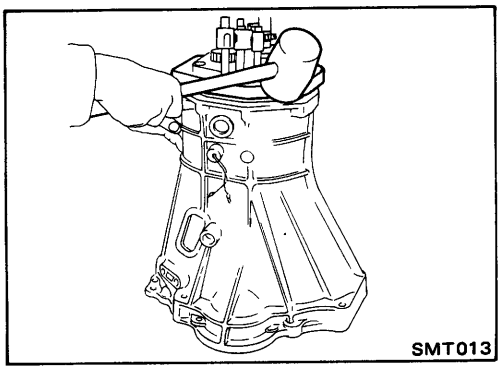
Case Components

1. Install front cover oil seal.

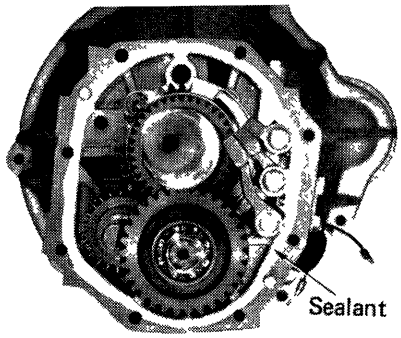
Apply multi-purpose grease to seal lip.



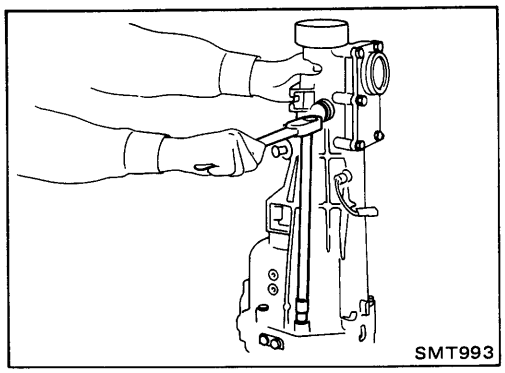
2. Apply sealant to mating surface of transmission case.



3. Slide gear assembly onto adapter plate by lightly tapping with a soft hammer.

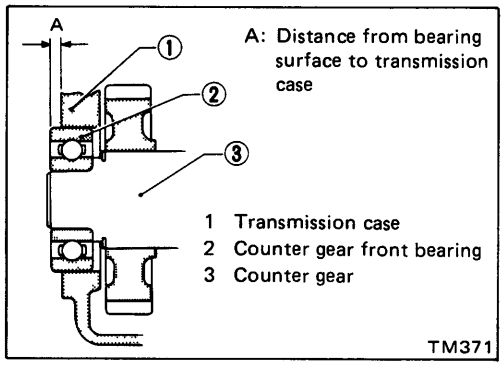


4. Apply sealant to mating surface of adapter plate.



5. Install rear extension.
6. Fit main drive bearing snap ring.

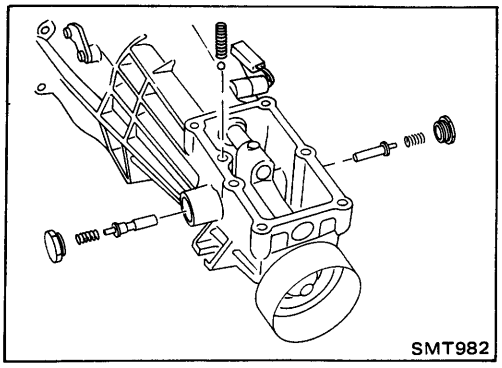
Case Components (Cont'd)



7. Select counter front bearing shim.

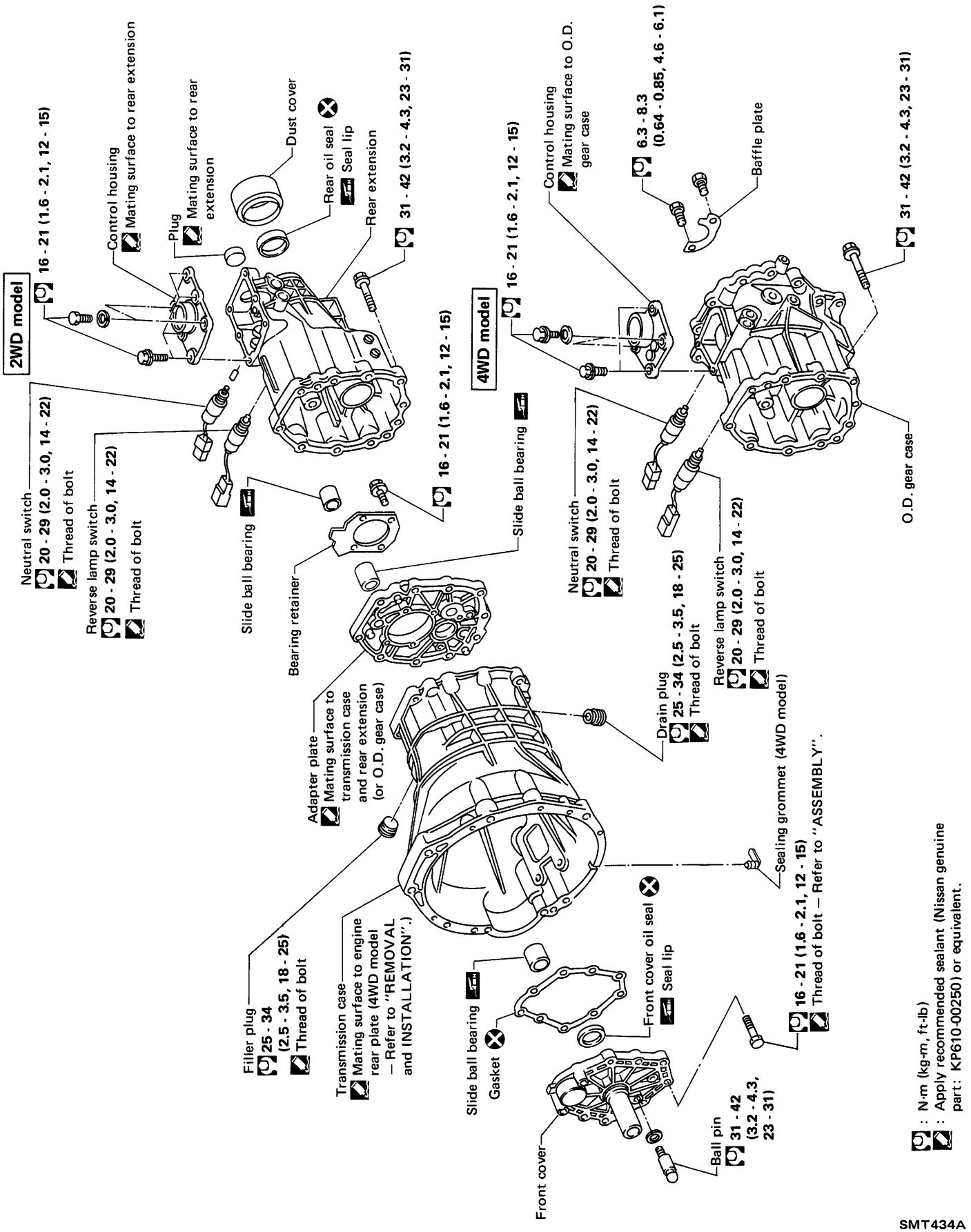
Unit: mm (in)

"A"	Thickness of shim	Part number
4.52 - 4.71 (0.1780 - 0.1854)	Not necessary	
4.42 - 4.51 (0.1740 - 0.1776)	0.1 (0.004)	32218-V5000
4.32 - 4.41 (0.1701 - 0.1736)	0.2 (0.008)	32218-V5001
4.22 - 4.31 (0.1661 - 0.1697)	0.3 (0.012)	32218-V5002
4.12 - 4.21 (0.1622 - 0.1657)	0.4 (0.016)	32218-V5003
4.02 - 4.11 (0.1583 - 0.1618)	0.5 (0.020)	32218-V5004
3.92 - 4.01 (0.1543 - 0.1579)	0.6 (0.024)	32218-V5005



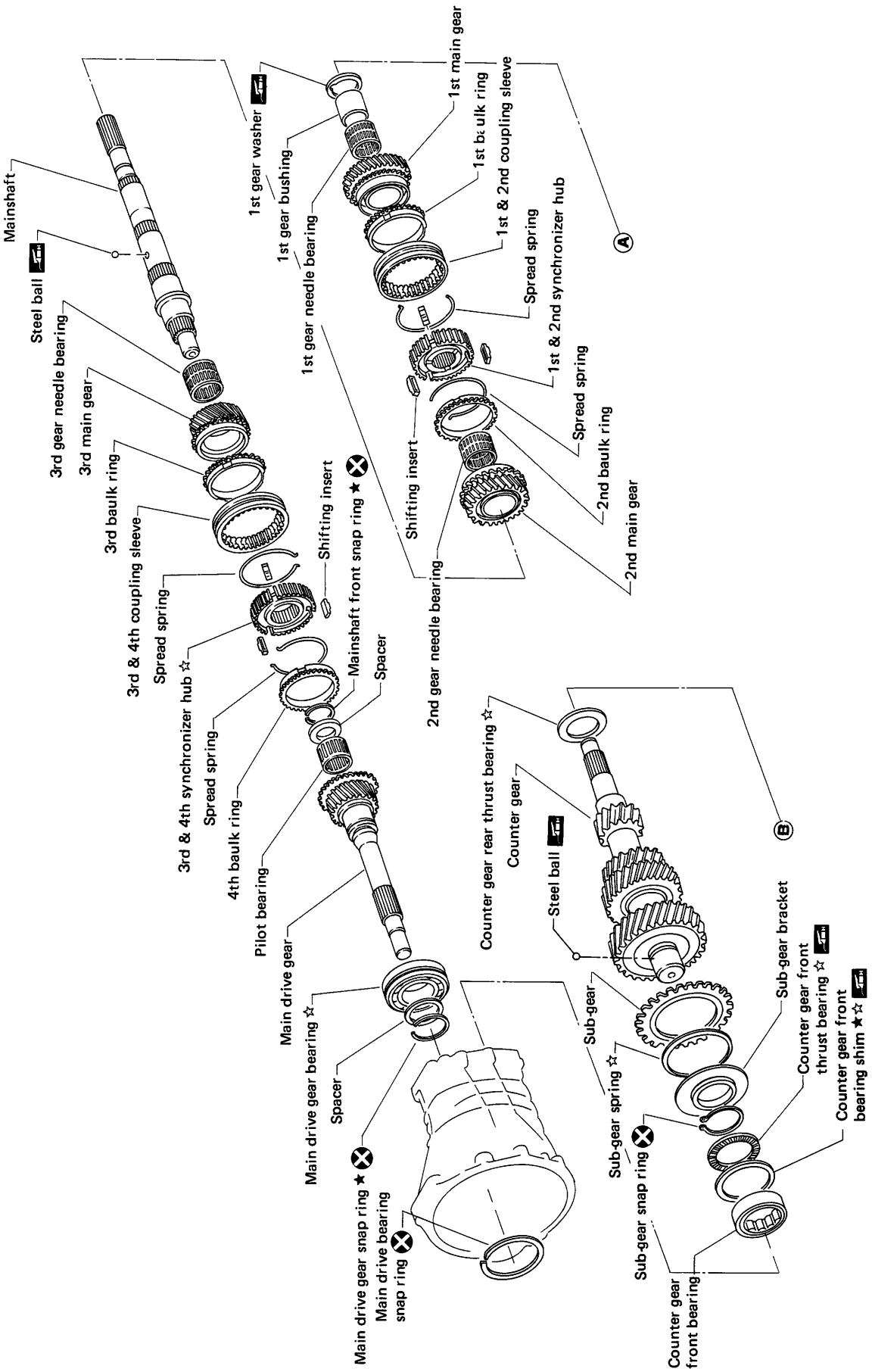
8. Install gasket and front cover.
9. Install return spring plugs, check ball, return springs and select check plunger.
10. Install control housing and gasket.

Case Components

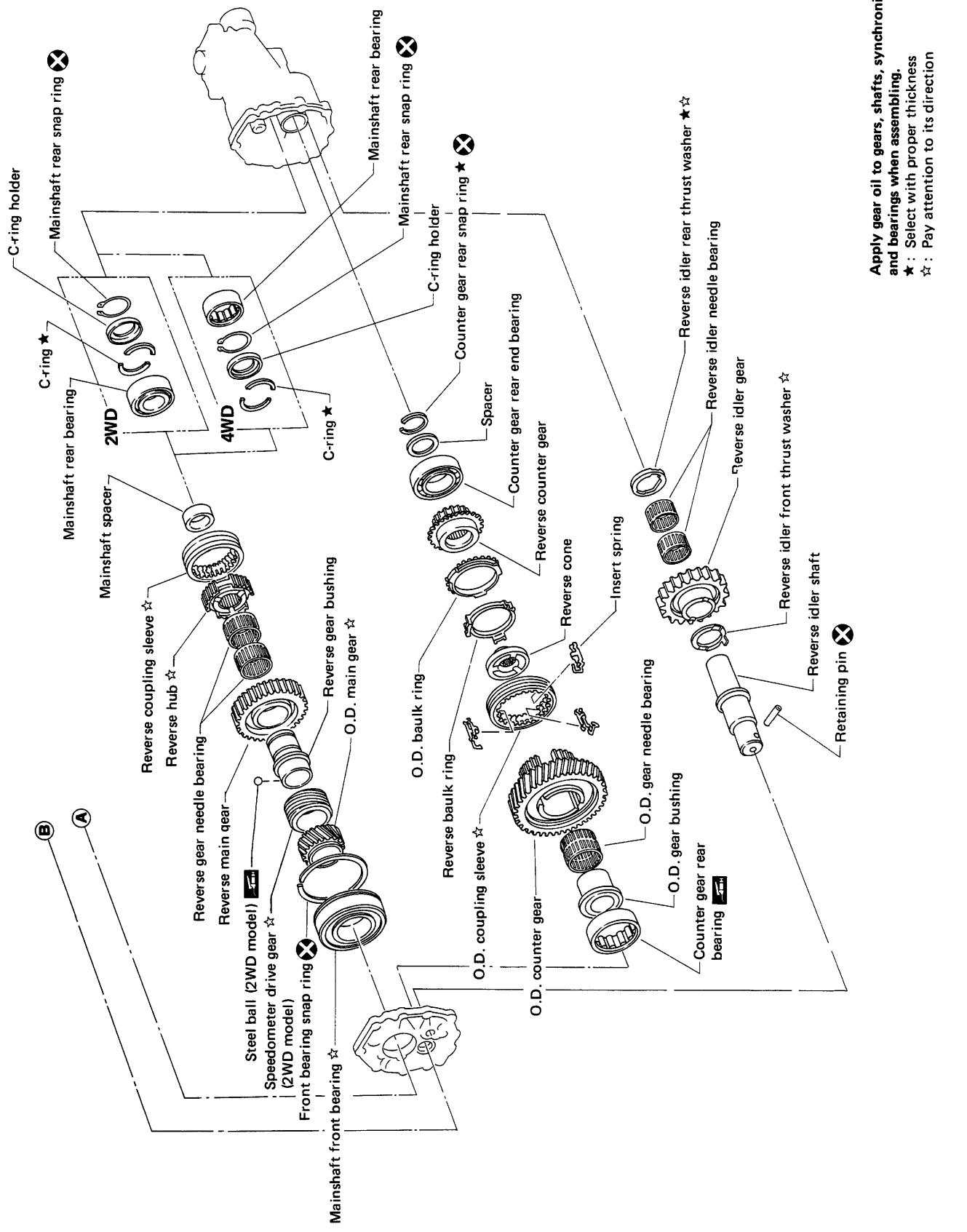


SMT434A

Gear Components

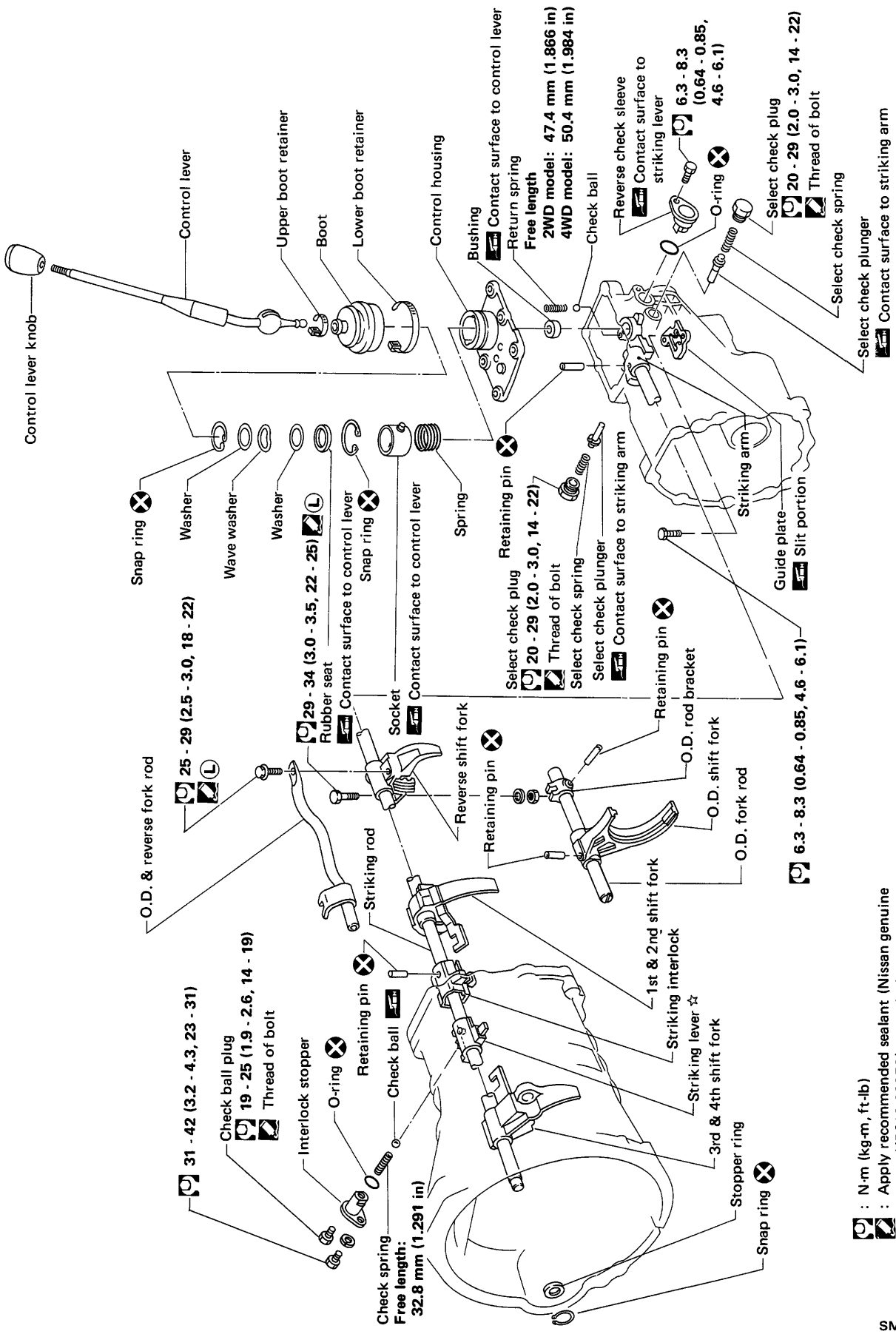


Gear Components (Cont'd)



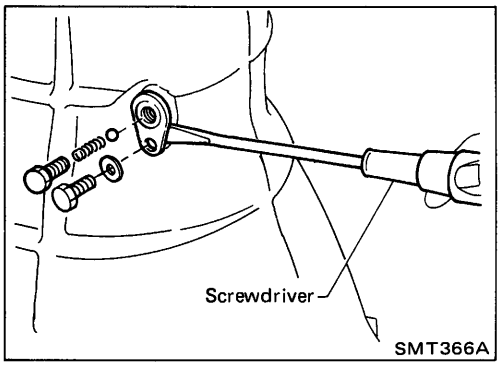
SMT435A

Shift Control Components



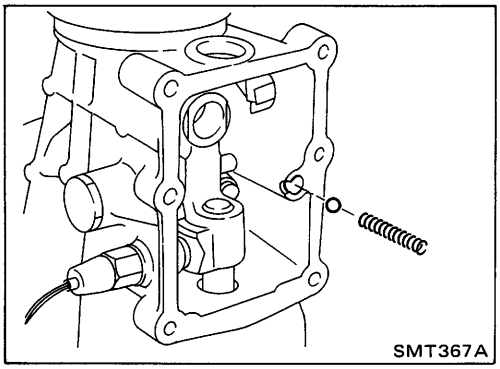
: N·m (kg-m, ft-lb)
: Apply recommended sealant (Nissan genuine part: KP610-00250) or equivalent.
Ⓛ: Apply locking sealant.
☆ : Pay attention to its direction.

SMT436A

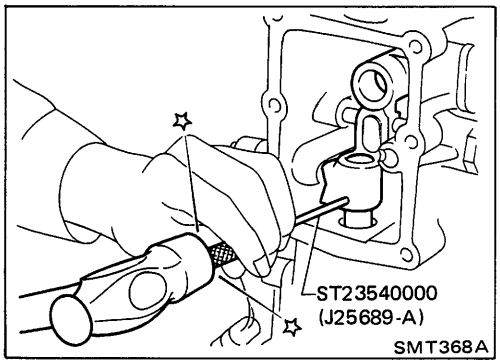


Case Components

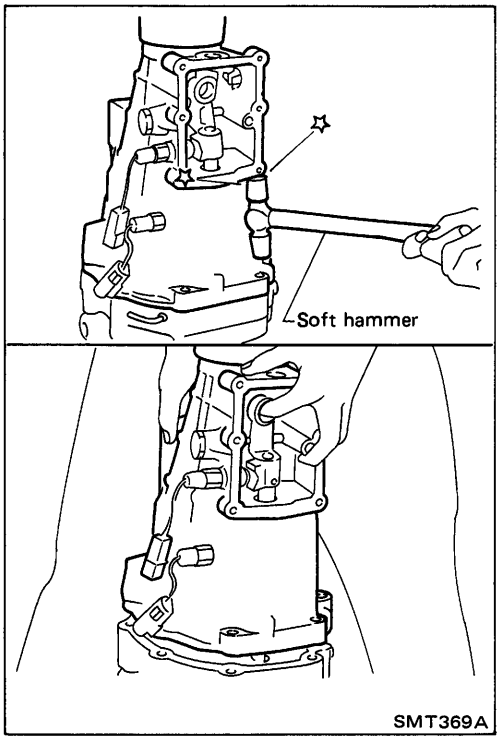
1. Remove check ball plug, check spring and check ball. Then remove interlock stopper.
   If interlock assembly is removed as a unit, the check ball can fall into transmission case.



2. Remove control housing, return spring and check ball.

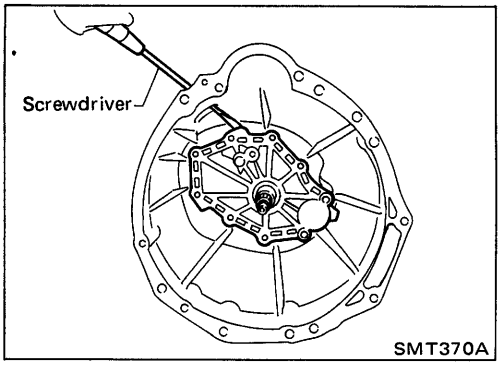


3. Drive out retaining pin from striking arm.

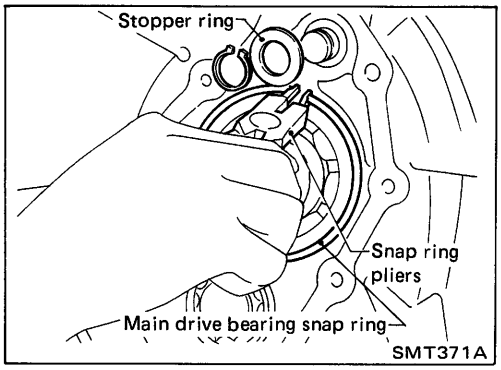


4. Remove rear extension (or O.D. gear case) together with striking arm by tapping lightly.

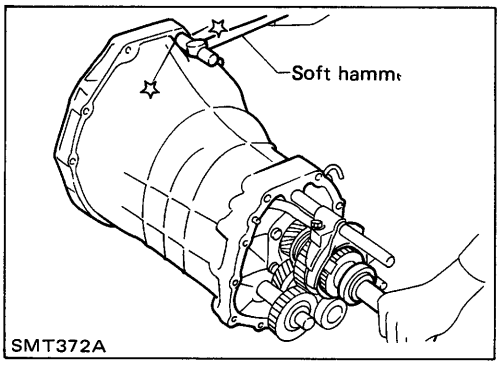
Case Components (Cont'd)



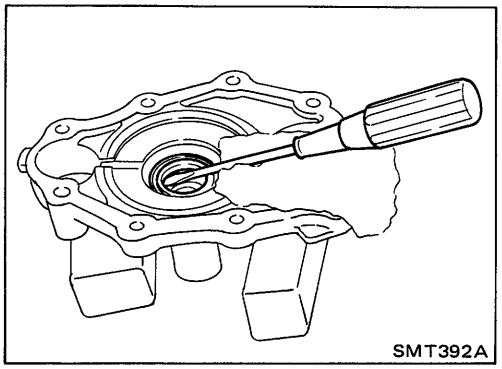
5. Remove front cover and gasket.



6. Remove stopper ring and main drive bearing snap ring.

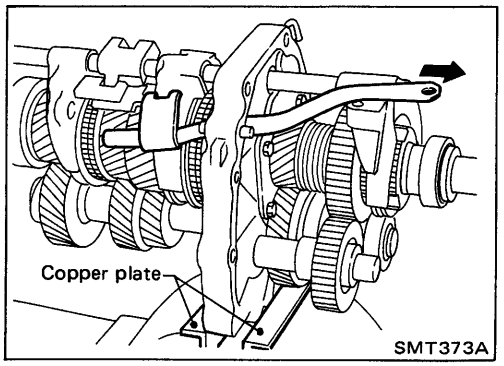


7. Remove transmission case by tapping lightly.



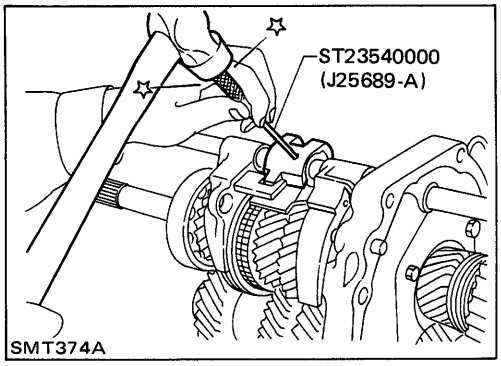
8. Remove front cover oil seal.

Shift Control Components

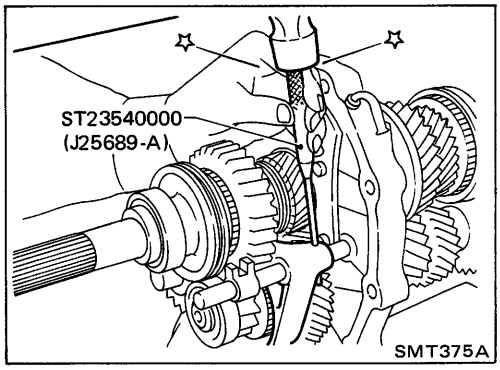


1. Mount adapter plate on vise.
2. Remove O.D. & reverse fork rod.

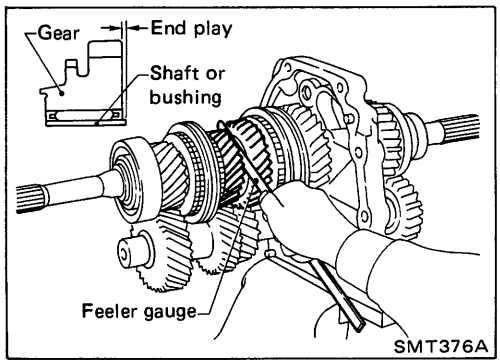
Shift Control Components (Cont'd)



3. Drive out retaining pin from striking lever.
4. While pulling out striking rod, remove striking lever and striking interlock. Then remove 1st & 2nd, 3rd & 4th and reverse shift fork.



5. Drive out retaining pin from O.D. shift fork.
6. Pull out O.D. fork rod and then remove O.D. shift fork.

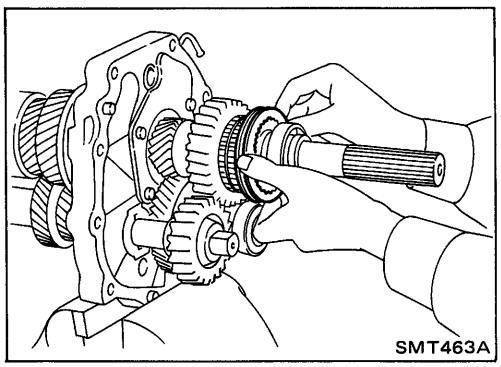


Gear Components

1. Before removing gears and shafts, measure each gear end play.

Gear	End play mm (in)
1st main gear	0.23 - 0.33 (0.0091 - 0.0130)
2nd main gear	0.23 - 0.33 (0.0091 - 0.0130)
3rd main gear	0.23 - 0.33 (0.0091 - 0.0130)
O.D. counter gear	0.23 - 0.33 (0.0091 - 0.0130)
Reverse main gear	0.33 - 0.43 (0.0130 - 0.0169)

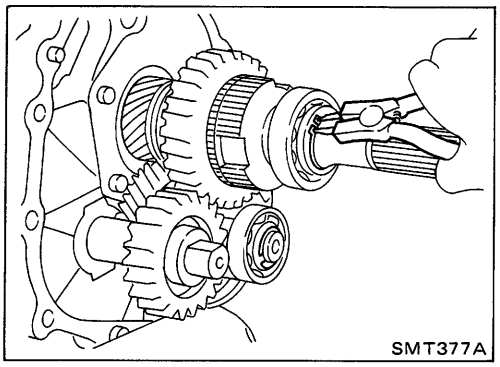
- If not within specification, disassemble and check contact surface of gear to hub, washer, bushing, needle bearing and shaft.



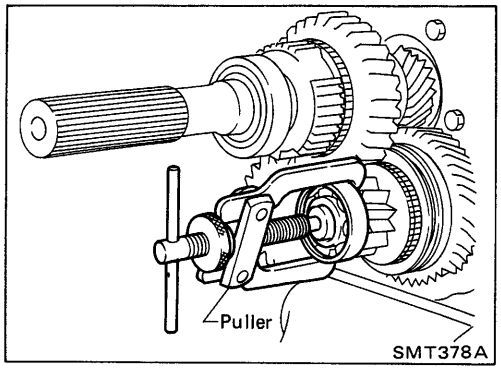
2. Remove rear side components on mainshaft and counter gear.

a. Remove reverse coupling sleeve.

Gear Components (Cont'd)

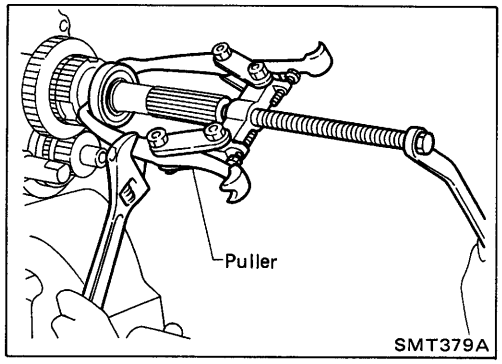

SMT377A

b. Remove mainshaft rear snap ring and counter gear rear snap ring.
c. Remove C-ring holder and mainshaft C-rings from mainshaft. Use punch and hammer to remove C-rings.



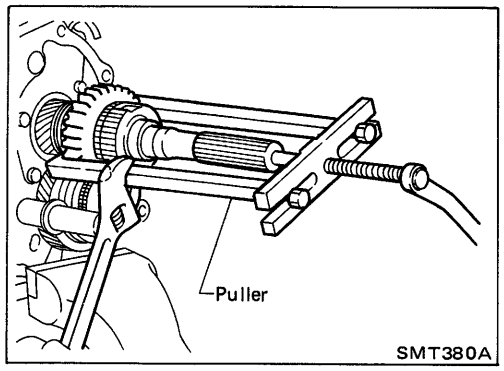
SMT378A

d. Pull out counter gear rear end bearing.
e. Remove reverse idler gear and reverse idler thrust washers.



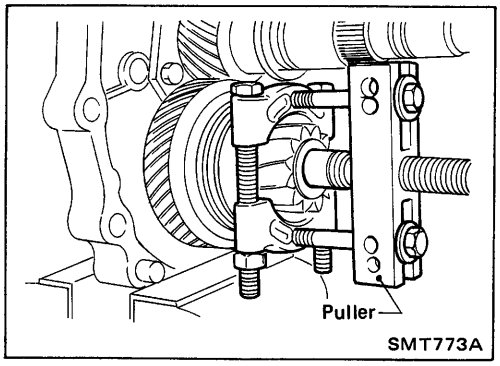
SMT379A

f. Pull out mainshaft rear bearing (2WD model).



SMT380A

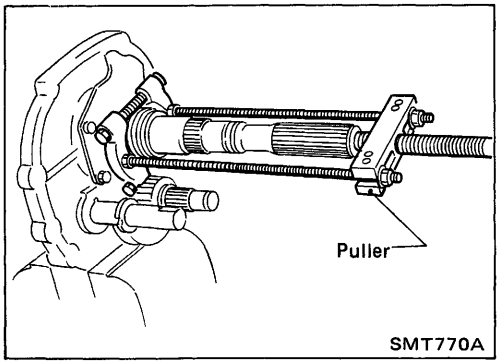
g. Pull out reverse main gear together with mainshaft spacer and reverse synchronizer hub. Then remove reverse gear needle bearings.



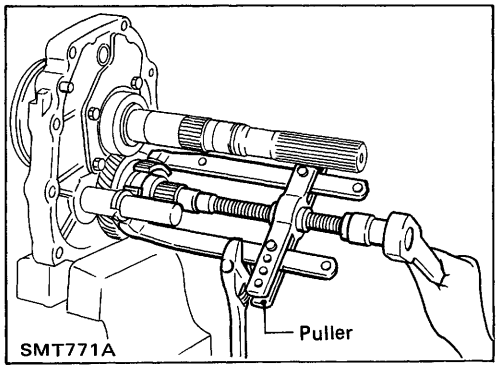
SMT773A

h. Pull out reverse counter gear.
i. Remove O.D. coupling sleeve together with O.D. baulk ring, reverse baulk ring and spring inserts.

Gear Components (Cont'd)

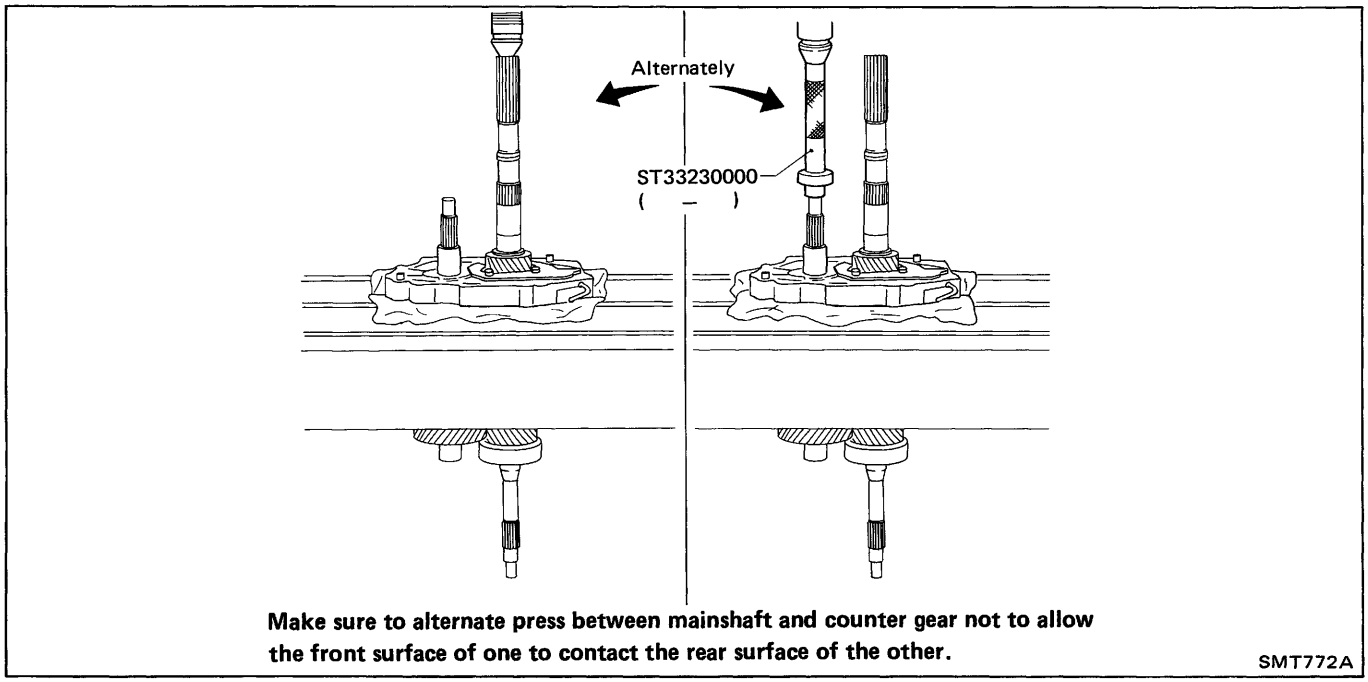


j. Pull out reverse gear bushing.

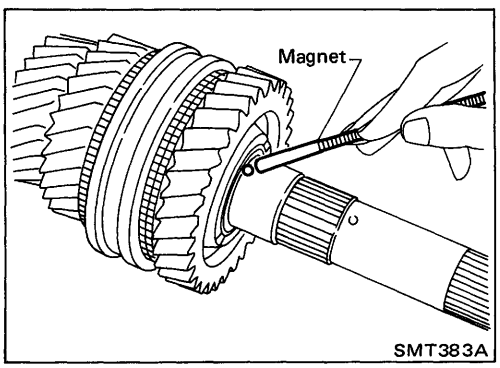


k. Pull out O.D. counter gear together with reverse cone.

3. Press out mainshaft and counter gear alternately.

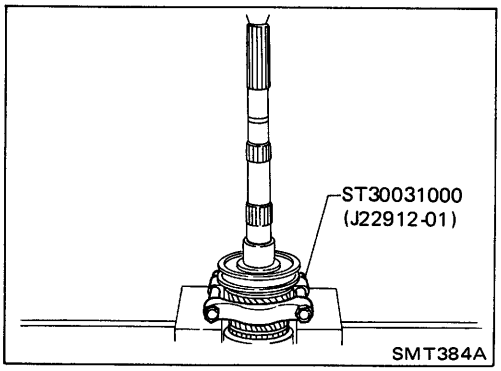


Make sure to alternate press between mainshaft and counter gear not to allow the front surface of one to contact the rear surface of the other.

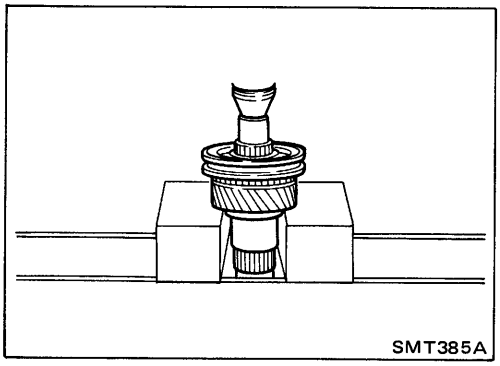


4. Remove front side components on mainshaft.
a. Remove 1st gear washer and steel ball.
b. Remove 1st main gear and 1st gear needle bearing.

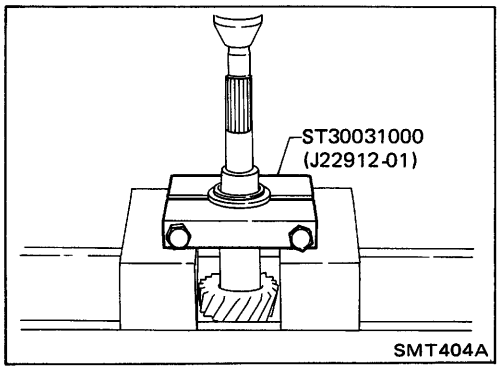
Gear Components (Cont'd)



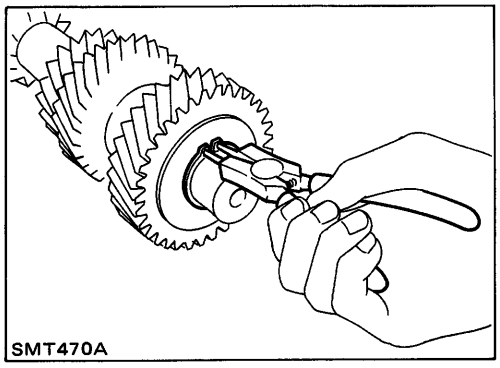
c. Press out 2nd main gear together with 1st gear bushing and 1st & 2nd synchronizer assembly.
d. Remove mainshaft front snap ring.



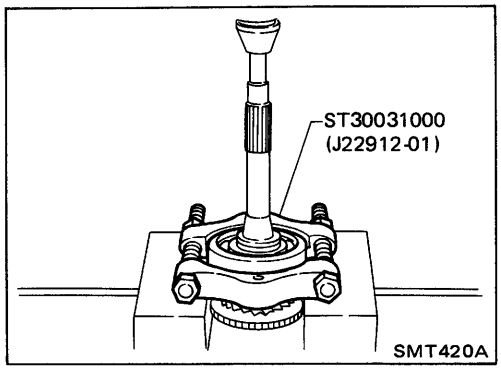
e. Press out 3rd main gear together with 3rd & 4th synchronizer assembly and 3rd gear needle bearing.



5. Remove front side components on counter gear.
a. Remove counter gear rear thrust bearing.



b. Remove sub gear components.

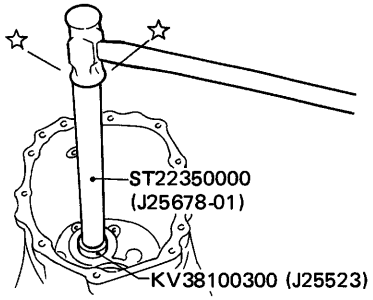


6. Remove main drive gear bearing.
a. Remove main drive gear snap ring and spacer.
b. Press out main drive gear bearing.

Gear Components (Cont'd)

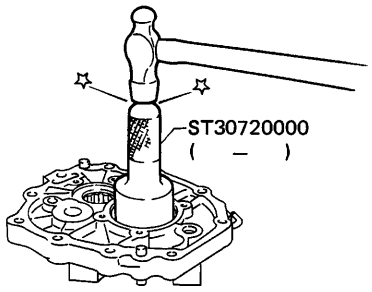
7. Remove bearings from case components.

Counter gear front bearing in transmission case



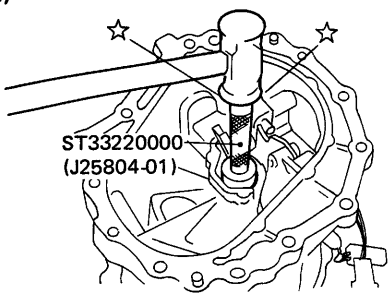
SMT388A

Mainshaft front bearing in adapter plate



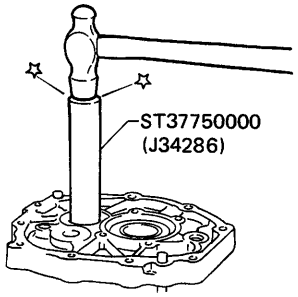
SMT396A

Counter gear rear end bearing in O.D. gear case (4WD model)

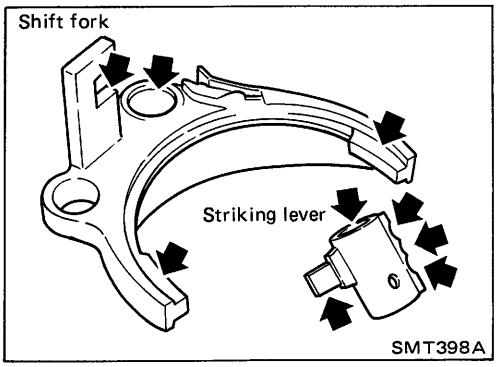


SMT390A

Counter gear rear bearing in adapter plate

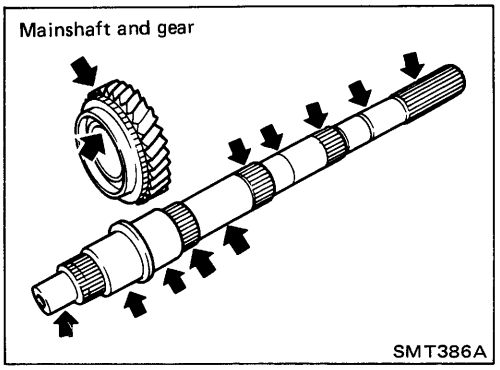


SMT394A



Shift Control Components

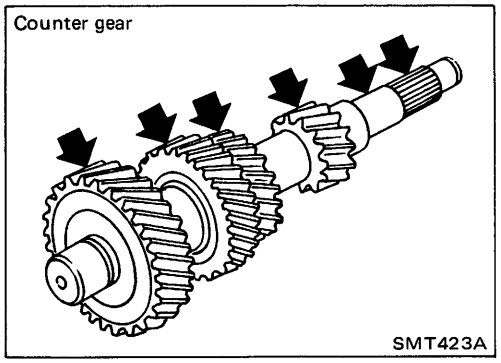
- Check contact surface and sliding surface for wear, scratches, projections or other damage.

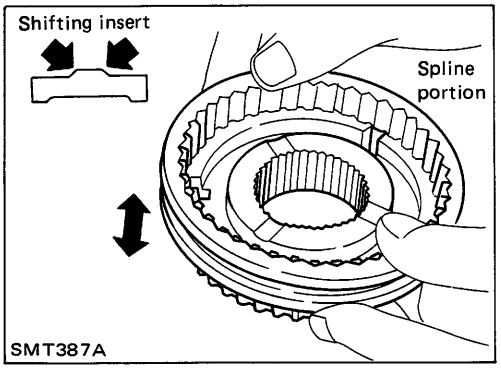


Gear Components

GEARS AND SHAFTS

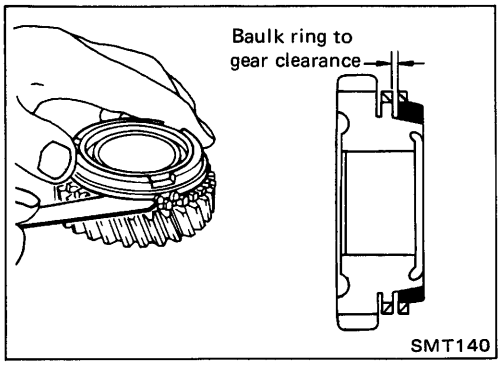
- Check shafts for cracks, wear or bending.
- Check gears for excessive wear, chips or cracks.





SYNCHRONIZERS

- Check spline portion of coupling sleeves, hubs, and gears for wear or cracks.
- Check baulk rings for cracks or deformation.
- Check shifting inserts for wear or deformation.
- Check insert springs for deformation.



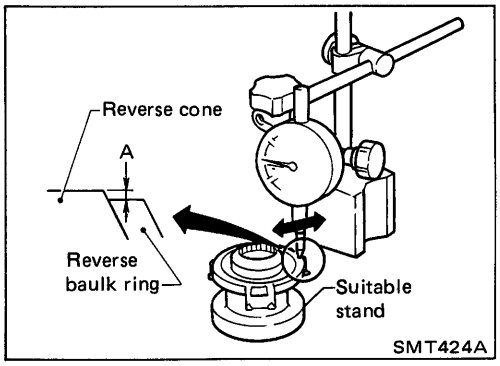
Clearance between baulk ring and gear

Unit: mm (in)

	Standard	Wear limit
1st & 2nd	1.05 - 1.3 (0.0413 - 0.0512)	0.7 (0.028)
3rd & main drive	1.05 - 1.3 (0.0413 - 0.0512)	0.7 (0.028)
O.D.	1.05 - 1.3 (0.0413 - 0.0512)	0.7 (0.028)

If the clearance is smaller than the wear limit, replace baulk ring.

Gear Components (Cont'd)



- Measure wear of reverse baulk ring.

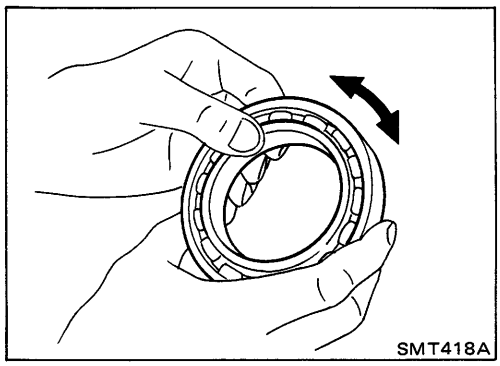
a. Place baulk ring in position on reverse cone.

b. While holding baulk ring against reverse cone as far as it will go, measure dimension "A" with dial indicator.

Unit: mm (in)

	Standard	Wear limit
Dimension "A"	−0.1 to 0.35 (−0.0039 to 0.0138)	0.7 (0.028)

c. If dimension "A" is larger than the wear limit, replace baulk ring.



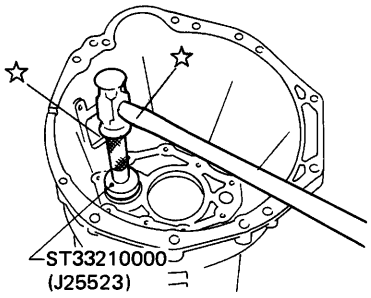
BEARINGS

- Make sure bearings roll freely and are free from noise, crack, pitting or wear.

Gear Components

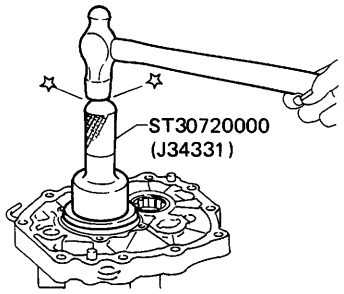
1. Install bearings into case components.

Counter gear front bearing in transmission case



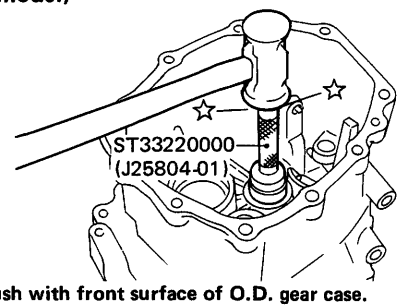
SMT389A

Mainshaft front bearing in adapter plate



SMT397A

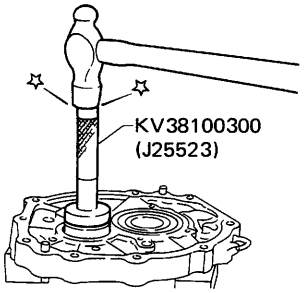
Counter gear rear end bearing in O.D. gear case (4WD model)



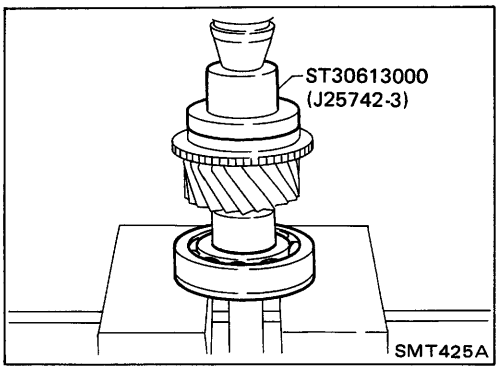
Be flush with front surface of O.D. gear case.

SMT391A

Counter gear rear bearing in adapter plate

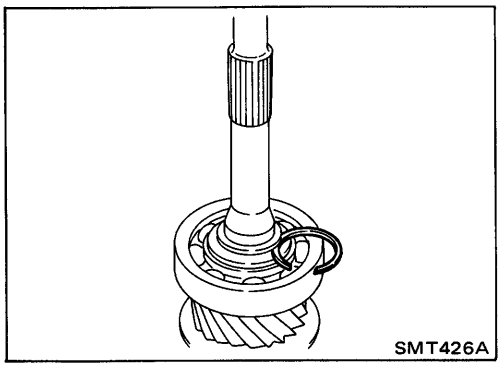


SMT395A



SMT425A

2. Install main drive gear bearing.
a. Press main drive gear bearing.
b. Install main drive gear spacer.



SMT426A

c. Select proper main drive gear snap ring to minimize clearance of groove.

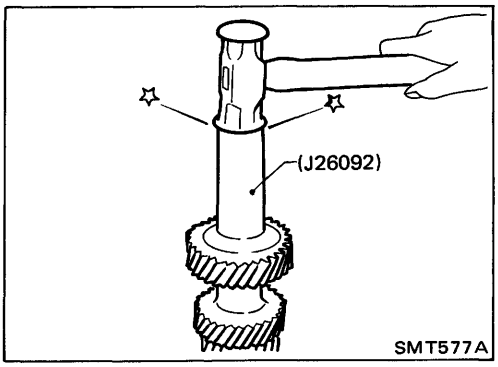
Allowable clearance of groove:
0 - 0.1 mm (0 - 0.004 in)

Main drive gear snap ring

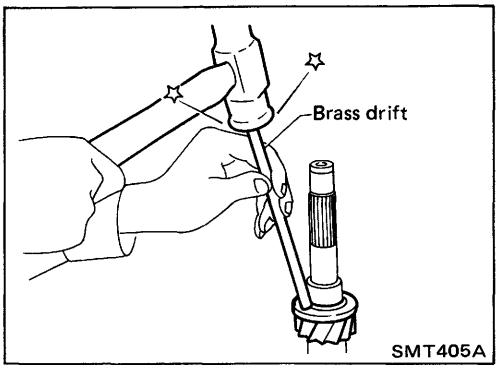
Thickness mm (in)	Part number
1.89 (0.0744)	32204-01G00
1.98 (0.0780)	32204-01G01
2.05 (0.0807)	32204-01G02
2.12 (0.0835)	32204-01G03
2.19 (0.0862)	32204-01G04

d. Install selected snap ring on main drive gear.

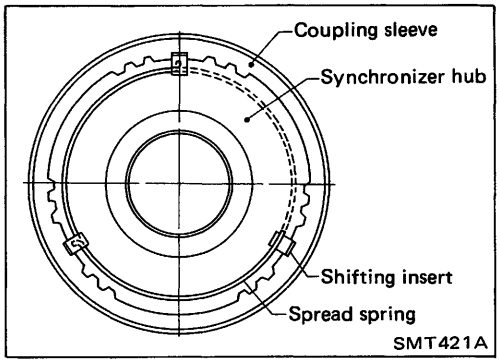
Gear Components (Cont'd)



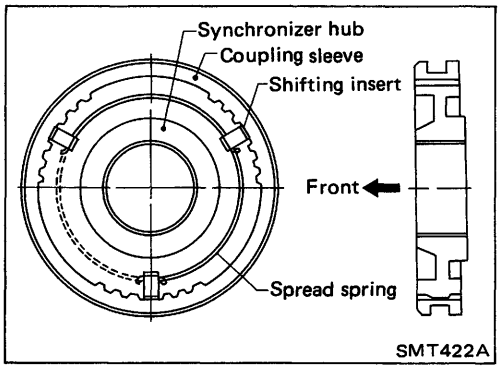
3. Install components on counter gear.
a. Install sub-gear components.
When installing sub-gear snap ring, tap sub-gear snap ring into position on counter gear.



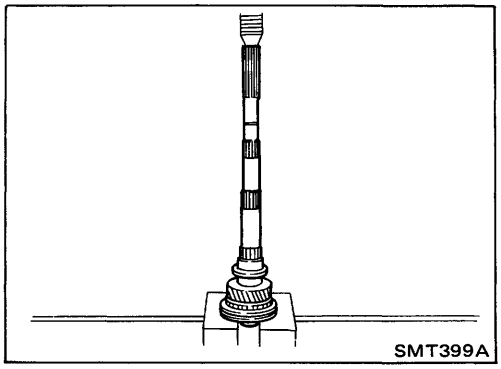
b. Install counter gear rear thrust bearing.



4. Install front side components on mainshaft.
a. Assemble 1st & 2nd synchronizer.

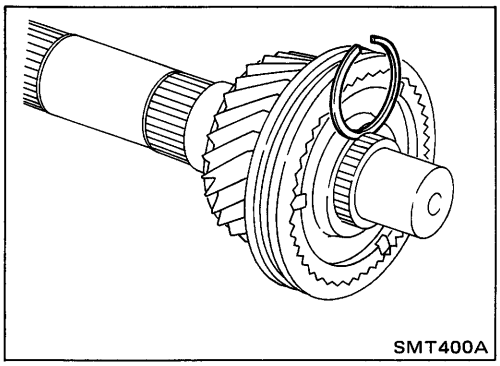


b. Assemble 3rd & 4th synchronizer.



c. Press on 3rd & 4th synchronizer assembly together with 3rd main gear and 3rd gear needle bearing.
Pay attention to direction of synchronizer assembly.

Gear Components (Cont'd)



d. Select proper snap ring to minimize clearance of groove.

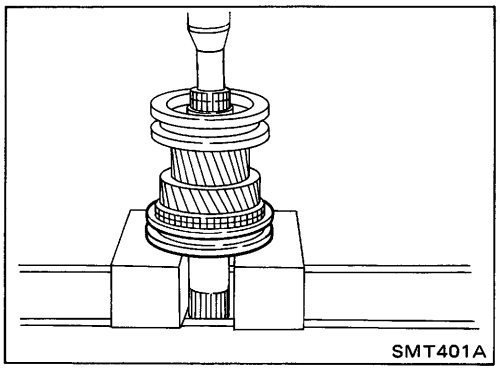
Allowable clearance of groove:

0 - 0.1 mm (0 - 0.004 in)

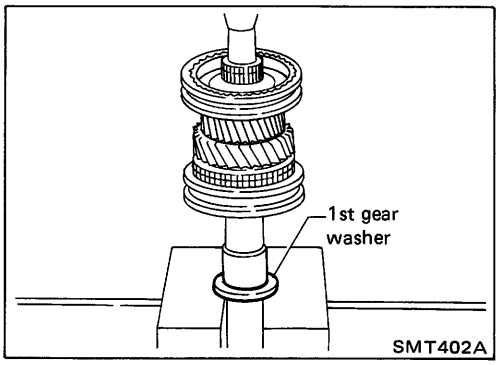
Mainshaft front snap ring

Thickness mm (in)	Part number
1.89 (0.0744)	32204-01G00
1.98 (0.0780)	32204-01G01
2.05 (0.0807)	32204-01G02
2.12 (0.0835)	32204-01G03
2.19 (0.0862)	32204-01G04

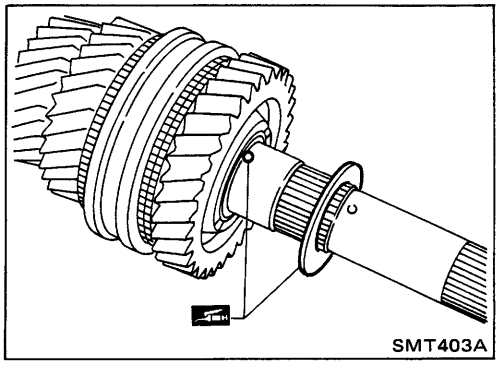
e. Install selected snap ring on mainshaft.



f. Press on 1st & 2nd synchronizer assembly together with 2nd main gear and 2nd gear needle bearing.

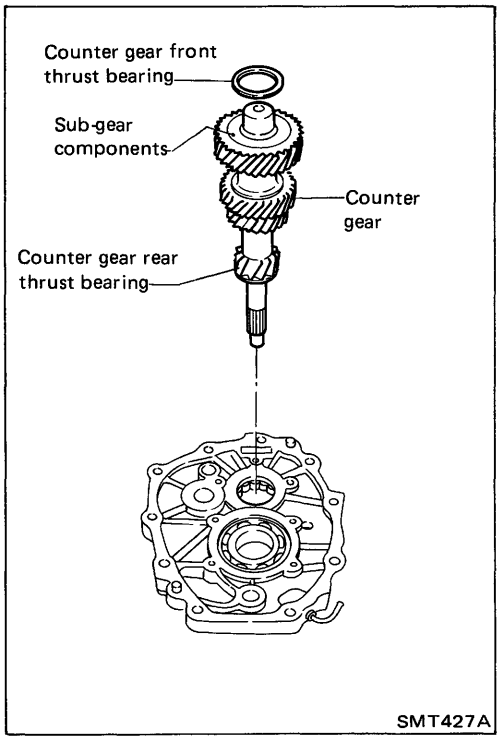


g. Press on 1st gear bushing using 1st gear washer.
h. Install 1st main gear and needle bearing.



i. Install steel ball and 1st gear washer.
Apply multi-purpose grease to steel ball and 1st gear washer before installing.

Gear Components (Cont'd)

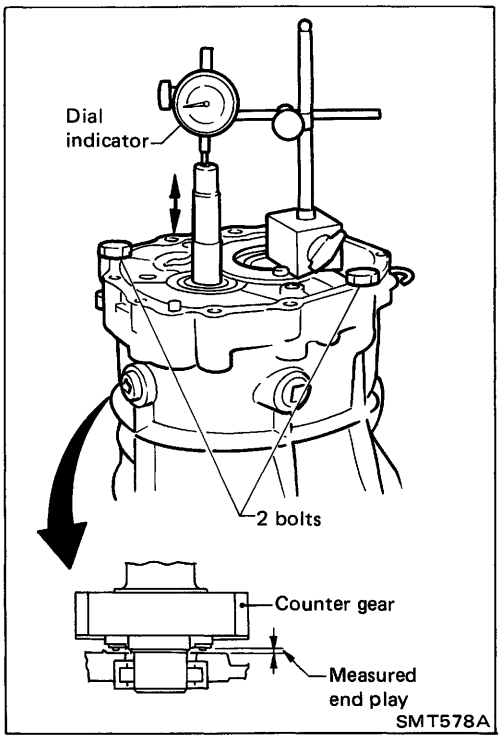


5. Select proper counter gear front bearing shim when replacing transmission case, counter gear, counter gear thrust bearing or sub-gear components.

a. Install counter gear with sub-gear components, counter gear front and rear thrust bearing on adapter plate.

b. Remove counter gear front bearing shim from transmission case.

c. Place adapter plate and counter gear assembly in transmission case (case inverted).



d. Tighten adapter plate to transmission case using 2 bolts.

e. Place dial indicator on rear end of counter gear.

f. Move counter gear up and down and measure dial indicator deflection.

g. Select proper shim using table below as a guide.

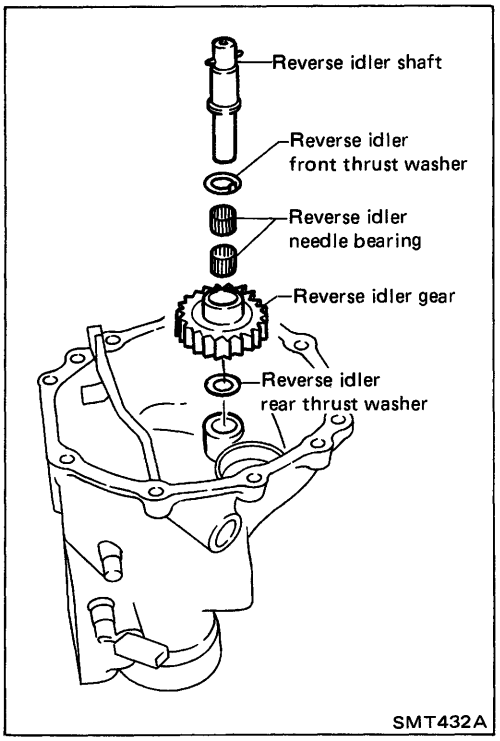
Counter gear end play:

0.10 - 0.25 mm (0.0039 - 0.0098 in)

Table for selecting proper counter gear front bearing shim

Dial indicator deflection mm (in)	Thickness of proper washer mm (in)	Part number
0.93 - 1.02 (0.0366 - 0.0402)	0.88 (0.0346)	32218-01G11
1.03 - 1.12 (0.0406 - 0.0441)	0.96 (0.0378)	32218-01G12
1.13 - 1.22 (0.0445 - 0.0480)	1.04 (0.0409)	32218-01G13
1.23 - 1.32 (0.0484 - 0.0520)	1.12 (0.0441)	32218-01G14
1.33 - 1.42 (0.0524 - 0.0559)	1.28 (0.0504)	32218-01G15
1.43 - 1.52 (0.0563 - 0.0598)	1.36 (0.0535)	32218-01G16
1.53 - 1.62 (0.0602 - 0.0638)	1.44 (0.0567)	32218-01G17

Gear Components (Cont'd)



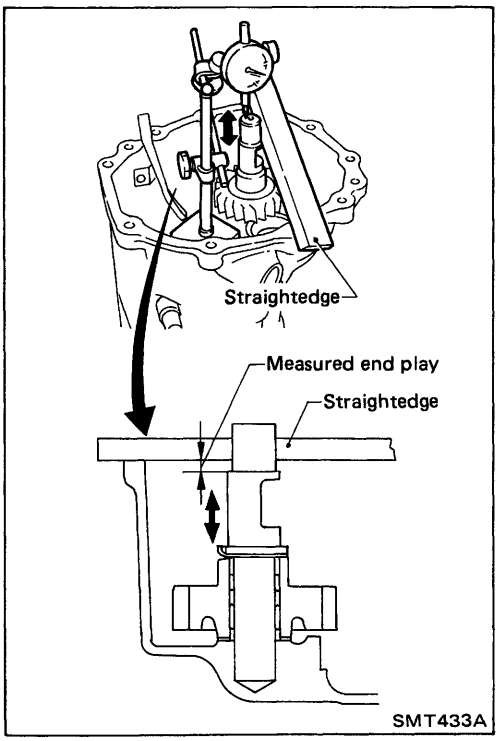
6. Select proper reverse idler rear thrust washer when replacing rear extension (or O.D. gear case), reverse idler gear, reverse idler shaft or reverse idler thrust washer.

a. Install reverse idler gear, reverse idler needle bearings, reverse idler thrust washers and reverse idler shaft into rear extension (or O.D. gear case).

When replacing reverse idler rear washer, install either A or B.

Reverse idler rear thrust washer

	Thickness mm (in)	Part number
A	1.97 (0.0776)	32284-01G10
B	2.07 (0.0815)	32284-01G11



b. Place dial indicator on front end of reverse idler shaft.

c. Put straightedge on front surface of rear extension (or O.D. gear case) as a stopper of reverse idler shaft.

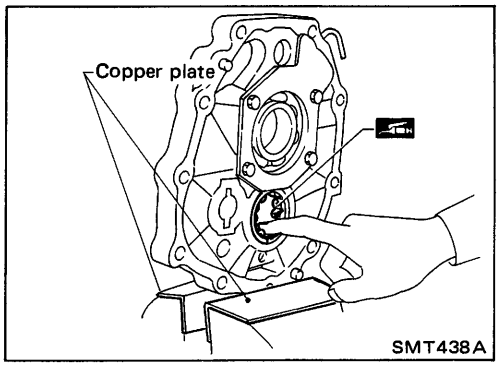
d. Move reverse idler shaft up and down and measure reverse idler gear end play.

Reverse idler gear end play:

0.30 - 0.53 mm (0.0118 - 0.0209 in)

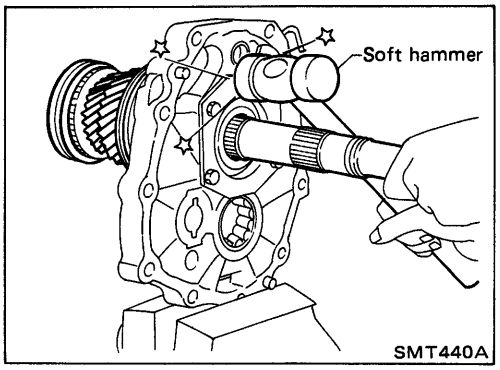
e. If not within specification, replace reverse idler rear thrust washer with the other (A or B) and check again.

Gear Components (Cont'd)

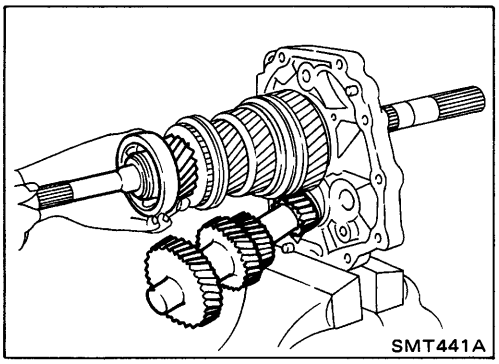


7. Install mainshaft and counter gear on adapter plate and main drive gear on mainshaft.

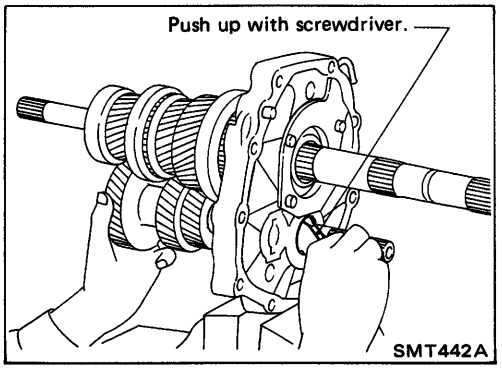
a. Mount adapter plate on vise and apply multi-purpose grease to counter gear rear bearing.



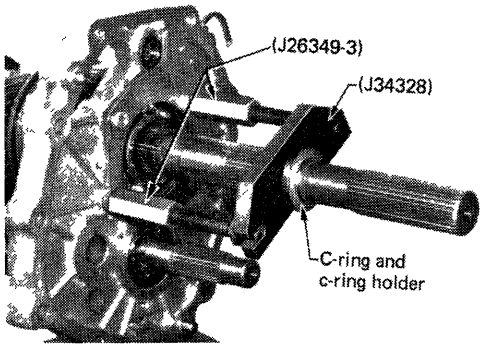
b. Install mainshaft a little on mainshaft front bearing.
To allow for installation of counter gear, do not install mainshaft completely.



c. Install counter gear on counter gear rear bearing and install main drive gear, pilot bearing and spacer on mainshaft.



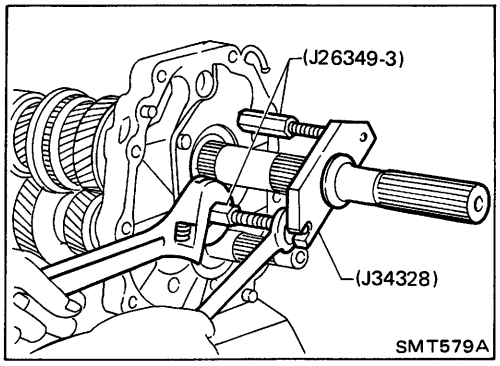
When installing counter gear into counter gear rear bearing, push up on upper roller of counter gear rear bearing with screwdriver.



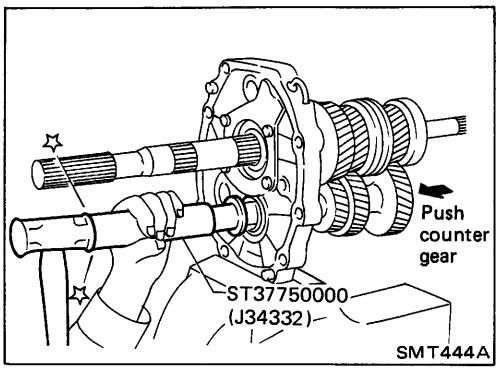
d. Install Tools (J26349-3) onto adapter plate and C-ring and C-ring holder on mainshaft.

e. Install Tool (J34328) on mainshaft.

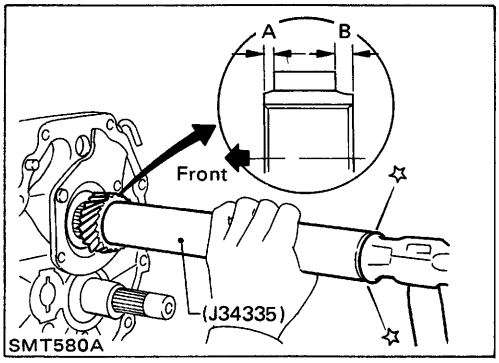
Gear Components (Cont'd)



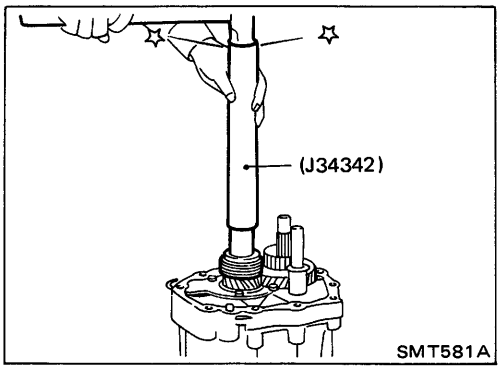
f. Install mainshaft and counter gear completely by extending length of J26349-3.



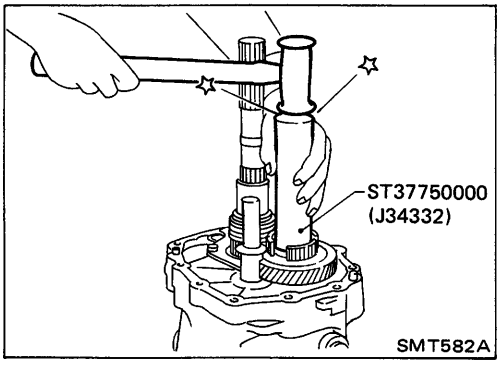
8. Install rear side components on mainshaft and counter gear.
a. Install O.D. gear bushing while pushing on the front of counter gear.



b. Install O.D. main gear.
Pay attention to direction of O.D. main gear. (B is wider than A as shown at left.)
c. Install adapter plate with gear assembly onto transmission case.
d. Install O.D. gear needle bearing and then install O.D. counter gear and reverse idler shaft.

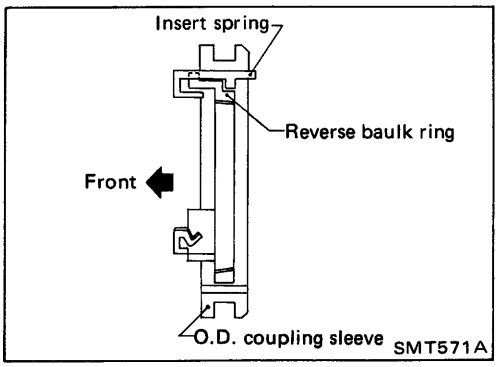


e. Install reverse gear bushing with speedometer drive gear (2WD model).

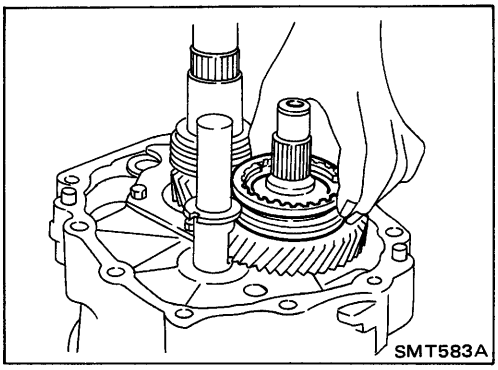


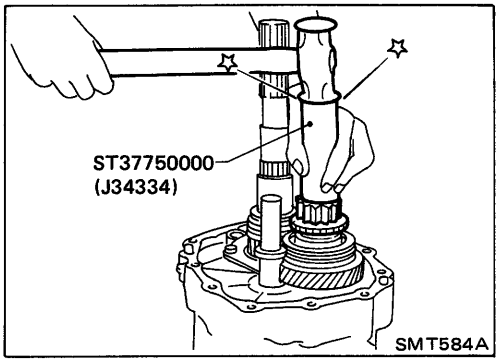
f. Install reverse cone.

Gear Components (Cont'd)

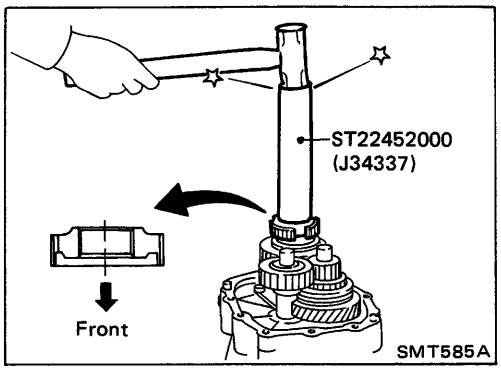


g. Install insert springs and reverse baulk ring on O.D. coupling sleeve. Then install them and O.D. baulk ring on O.D. counter gear.
Pay attention to direction of O.D. coupling sleeve.

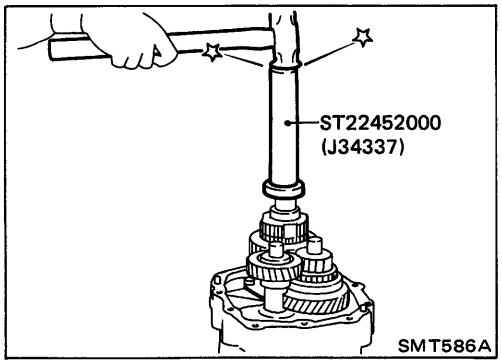




h. Install reverse counter gear.
i. Install reverse gear needle bearing and then install reverse main gear, reverse idler gear and reverse idler thrust washers.

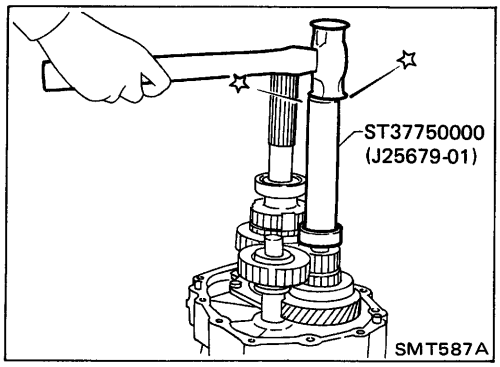


j. Install reverse hub.
Pay attention to its direction.



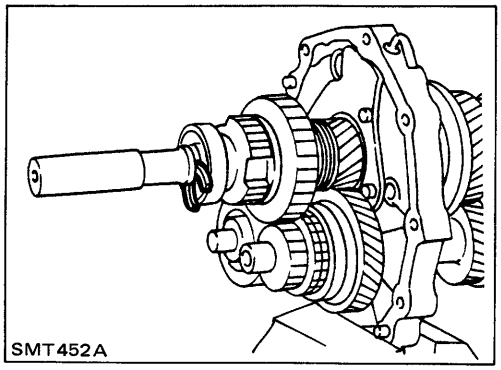
k. Install mainshaft spacer and mainshaft rear bearing (2WD model).

Gear Components (Cont'd)



l. Install counter gear rear end bearing.

m. Separate adapter plate from transmission case and Mount adapter plate on vice again.

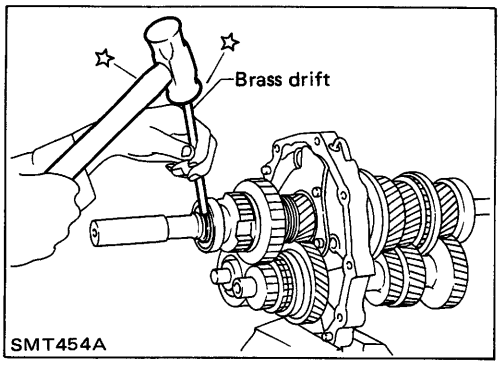


n. Select proper mainshaft C-ring to minimize clearance of groove.

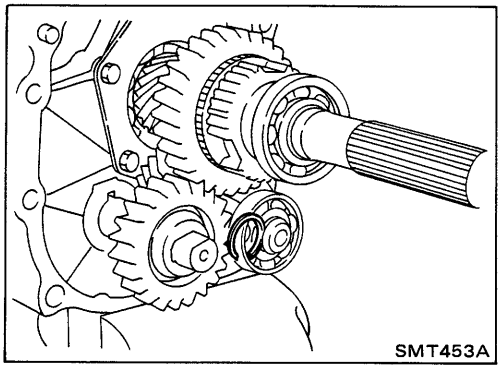
Allowable clearance of groove:
0 - 0.1 mm (0 - 0.004 in)

Mainshaft C-ring

Thickness mm (in)	Part number	Thickness mm (in)	Part number
2.63 (0.1035)	32348-01G15	3.19 (0.1256)	32348-01G07
2.70 (0.1063)	32348-01G00	3.26 (0.1283)	32348-01G08
2.77 (0.1091)	32348-01G01	3.33 (0.1311)	32348-01G09
2.84 (0.1118)	32348-01G02	3.40 (0.1339)	32348-01G10
2.91 (0.1146)	32348-01G03	3.47 (0.1366)	32348-01G11
2.98 (0.1173)	32348-01G04	3.54 (0.1394)	32348-01G12
3.05 (0.1201)	32348-01G05	3.61 (0.1421)	32348-01G13
3.12 (0.1228)	32348-01G06	3.68 (0.1449)	32348-01G14



o. Install selected C-ring, C-ring holder and mainshaft rear snap ring.

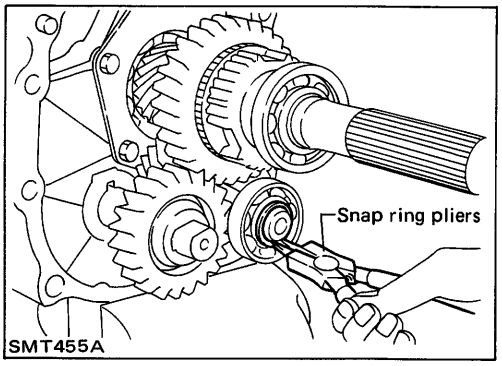


p. Install spacer and then select proper counter gear rear snap ring to minimize clearance of groove.

Allowable clearance of groove:
0 - 0.1 mm (0 - 0.004 in)

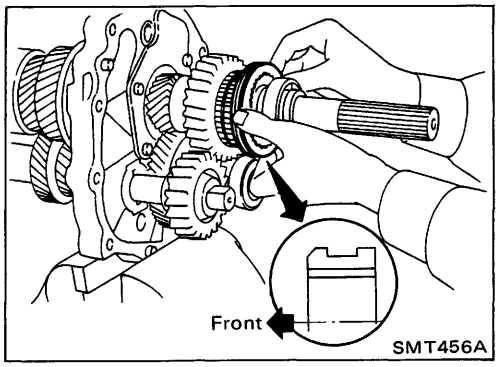
Counter gear rear snap ring

Thickness mm (in)	Part number
1.26 (0.0496)	32236-01G08
1.32 (0.0520)	32236-01G00
1.38 (0.0543)	32236-01G01
1.44 (0.0567)	32236-01G02
1.50 (0.0591)	32236-01G03
1.56 (0.0614)	32236-01G04
1.62 (0.0638)	32236-01G05
1.68 (0.0661)	32236-01G06
1.74 (0.0685)	32236-01G07



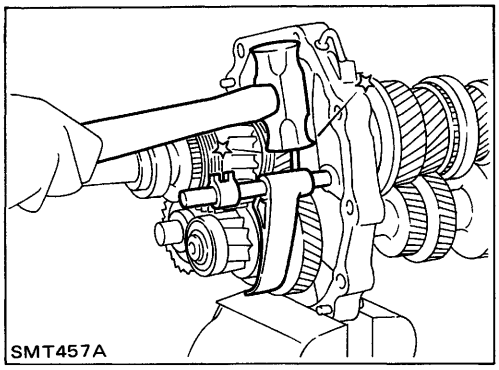
q. Install selected counter gear rear snap ring.

Gear Components (Cont'd)

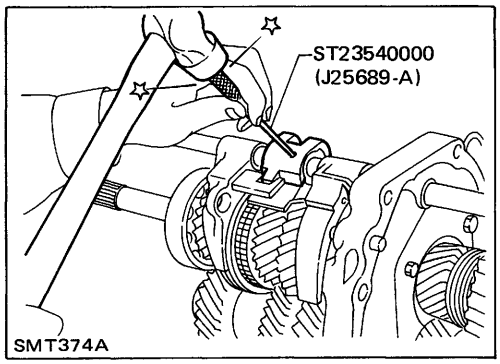


r. Install reverse coupling sleeve.
Pay attention to its direction.
s. Measure each gear end play as a final check — Refer to "DISASSEMBLY".

Shift Control Components

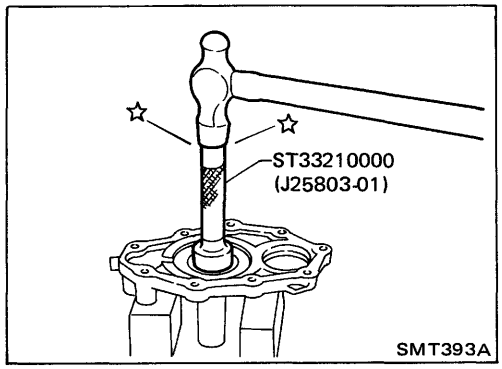


1. Install O.D. fork rod and O.D. shift fork. Then install retaining pin into O.D. shift fork.
2. Install 1st & 2nd, 3rd & 4th and reverse shift fork onto coupling sleeve.

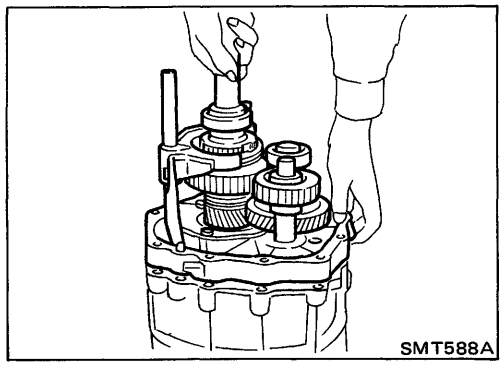


3. Install striking rod into hole of shift forks, striking lever and interlock and then install retaining pin into striking lever.
Make sure that striking rod moves smoothly.

Case Components

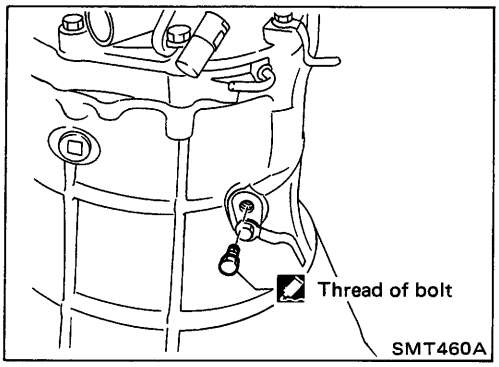


1. Install front cover oil seal.
Apply multi-purpose grease to seal lip.
2. Install selected counter gear front bearing shim onto transmission case.
Apply multi-purpose grease.
3. Apply sealant to mating surface of transmission case.

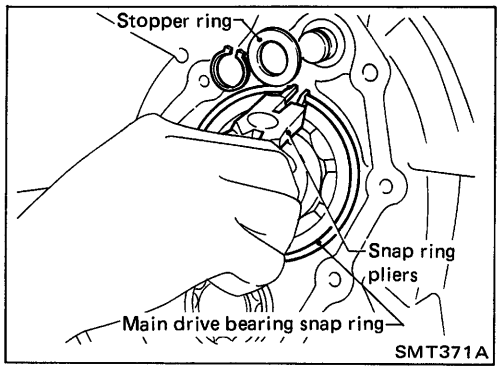


4. Install gear assembly onto transmission case.
5. Install check spring and check ball into interlock stopper.
Apply multi-purpose grease to check ball.

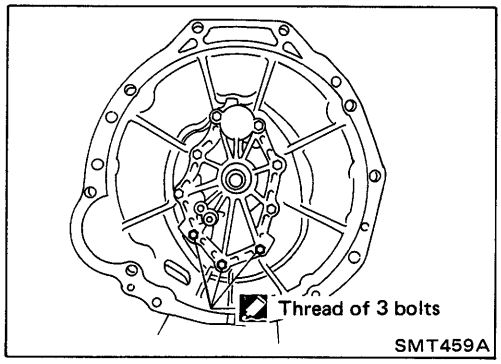
Case Components (Cont'd)



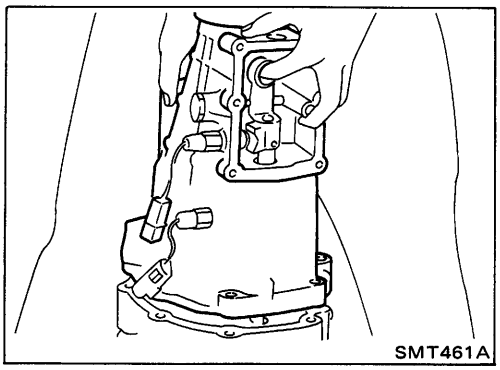
6. Install interlock stopper assembly and then tighten check ball plug.
   Apply sealant to thread of check ball plug.



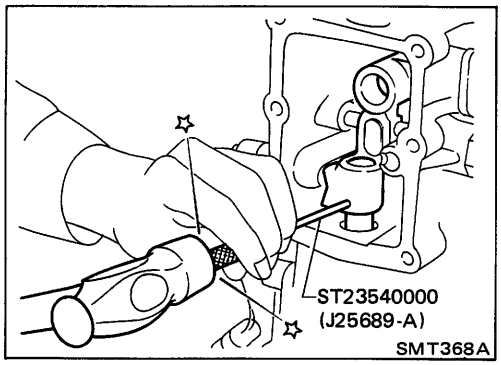
7. Install stopper ring and main drive bearing snap ring.



8. Install front cover and gasket.
   Apply sealant to thread of 3 bolts shown left.
9. Apply sealant to mating surface of adapter plate.

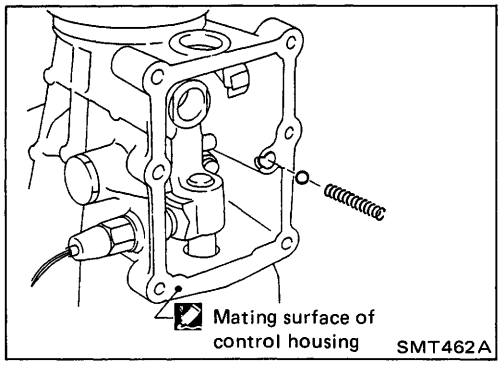


10. Install rear extension (or O.D. gear case) together with striking arm.



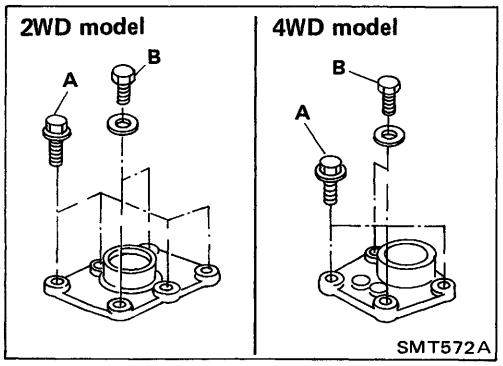
11. Install retaining pin into striking arm.

Case Components (Cont'd)



12. Install return spring and check ball and then install control housing.

    Apply sealant to mating surface of rear extension (or O.D. gear case).



13. Tighten control housing bolts.

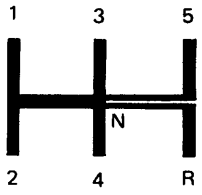
    Bolt head size:

    A bolts 12 mm

    B bolts 13 mm

FS5W71C & FS5R30A

General Specifications

Applied model	KA24E		VG30E		
	2WD	4WD	2WD		4WD
			Truck	Van & Wagon	
Transmission	FS5W71C		FS5R30A		
Number of speed	5				
Shift pattern					
Synchromesh type	Warner				
Gear ratio					
1st	3.321	3.985	3.580	4.061	
2nd	1.902	2.246	2.077	2.357	
3rd	1.308	1.415	1.360	1.490	
4th	1.000	1.000	1.000	1.000	
O.D.	0.838	0.821	0.811	0.862	
Reverse	3.382	3.657	3.636	4.125	
Number of teeth					
Mainshaft					
Drive	22	21	22	20	
1st	33	34	32	32	
2nd	27	28	30	30	
3rd	26	26	29	28	
O.D.	22	21	24	23	
Reverse	36	36	30	30	
Countershaft					
Drive	31	32	32	33	
1st	14	13	13	13	
2nd	20	19	21	21	
3rd	28	28	31	31	
O.D.	37	39	43	44	
Reverse	15	15	12	12	
Reverse idler gear	21	21	22	22	
Oil capacity ℓ (US pt, Imp pt)	2.0 (4-1/4, 3-1/2)	4.0 (8-1/2, 7)	2.4 (5-1/8, 4-1/4)		3.6 (7-5/8, 6-3/8)

Inspection and Adjustment

GEAR END PLAY

Unit: mm (in)

1st gear	0.31 - 0.41 (0.0122 - 0.0161)
2nd gear	0.11 - 0.21 (0.0043 - 0.0083)
3rd gear	0.11 - 0.21 (0.0043 - 0.0083)
O.D. gear	0.24 - 0.41 (0.0094 - 0.0161)

CLEARANCE BETWEEN BAULK RING AND GEAR

Unit: mm (in)

Standard	
1st & 2nd	1.20 - 1.60 (0.0472 - 0.0630)
3rd & main drive	1.20 - 1.60 (0.0472 - 0.0630)
O.D.	1.20 - 1.60 (0.0472 - 0.0630)
Wear limit	
1st & 2nd	0.80 (0.0315)
3rd & main drive	0.80 (0.0315)
O.D.	0.80 (0.0315)

AVAILABLE SNAP RINGS

Main drive gear bearing

Allowable clearance	0 - 0.13 mm (0 - 0.0051 in)
Thickness mm (in)	Part number
1.73 (0.0681)	32204-78005
1.80 (0.0709)	32204-78000
1.87 (0.0736)	32204-78001
1.94 (0.0764)	32204-78002
2.01 (0.0791)	32204-78003
2.08 (0.0819)	32204-78004

Mainshaft front

Allowable clearance	0 - 0.18 mm (0 - 0.0071 in)
Thickness mm (in)	Part number
2.4 (0.094)	32263-V5200
2.5 (0.098)	32263-V5201
2.6 (0.102)	32263-V5202

Mainshaft rear end bearing (2WD model)

Allowable clearance	0 - 0.14 mm (0 - 0.0055 in)
Thickness mm (in)	Part number
1.1 (0.043)	32228-20100
1.2 (0.047)	32228-20101
1.3 (0.051)	32228-20102
1.4 (0.055)	32228-20103

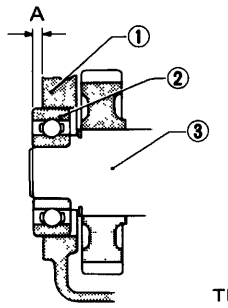
Counter drive gear

Allowable clearance	0 - 0.18 mm (0 - 0.0071 in)
Thickness mm (in)	Part number
1.4 (0.055)	32215-E9000
1.5 (0.059)	32215-E9001
1.6 (0.063)	32215-E9002

AVAILABLE SHIMS

Counter front bearing

Unit: mm (in)



TM371

A: Distance from bearing surface to transmission case

1 Transmission case
2 Counter gear front bearing
3 Counter gear

"A"	Thickness of shim	Part number
4.52 - 4.71 (0.1780 - 0.1854)	Not necessary	
4.42 - 4.51 (0.1740 - 0.1776)	0.1 (0.004)	32218-V5000
4.32 - 4.41 (0.1701 - 0.1736)	0.2 (0.008)	32218-V5001
4.22 - 4.31 (0.1661 - 0.1697)	0.3 (0.012)	32218-V5002
4.12 - 4.21 (0.1622 - 0.1657)	0.4 (0.016)	32218-V5003
4.02 - 4.11 (0.1583 - 0.1618)	0.5 (0.020)	32218-V5004
3.92 - 4.01 (0.1543 - 0.1579)	0.6 (0.024)	32218-V5005

Inspection and Adjustment

GEAR END PLAY

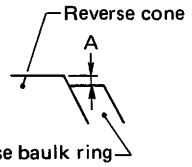
Gear	End play mm (in)
1st main gear	0.23 - 0.33 (0.0091 - 0.0130)
2nd main gear	0.23 - 0.33 (0.0091 - 0.0130)
3rd main gear	0.23 - 0.33 (0.0091 - 0.0130)
O.D. counter gear	0.23 - 0.33 (0.0091 - 0.0130)
Reverse main gear	0.33 - 0.43 (0.0130 - 0.0169)
Counter gear	0.10 - 0.25 (0.0039 - 0.0098)
Reverse idler gear	0.30 - 0.53 (0.0118 - 0.0209)

CLEARANCE BETWEEN BAULK RING AND GEAR

Unit: mm (in)

	Standard	Wear limit
1st & 2nd	1.05 - 1.3 (0.0413 - 0.0512)	0.7 (0.028)
3rd & main drive	1.05 - 1.3 (0.0413 - 0.0512)	0.7 (0.028)
O.D.	1.05 - 1.3 (0.0413 - 0.0512)	0.7 (0.028)

DISTANCE BETWEEN REAR SURFACE OF REVERSE CONE AND REVERSE BAULK RING



Unit: mm (in)

	Standard	Wear limit
Dimension "A"	–0.1 to 0.35 (–0.0039 to 0.0138)	0.7 (0.028)

AVAILABLE SNAP RING

Main drive gear snap ring

Allowable clearance	0 - 0.1 mm (0 - 0.004 in)
Thickness mm (in)	Part number
1.89 (0.0744)	32204-01G00
1.98 (0.0780)	32204-01G01
2.05 (0.0807)	32204-01G02
2.12 (0.0835)	32204-01G03
2.19 (0.0862)	32204-01G04

Mainshaft front snap ring

Allowable clearance	0 - 0.1 mm (0 - 0.004 in)
Thickness mm (in)	Part number
1.89 (0.0744)	32204-01G00
1.98 (0.0780)	32204-01G01
2.05 (0.0807)	32204-01G02
2.12 (0.0835)	32204-01G03
2.19 (0.0862)	32204-01G04

Counter gear rear snap ring

Allowable clearance	0 - 0.1 mm (0 - 0.004 in)
Thickness mm (in)	Part number
1.26 (0.0496)	32236-01G08
1.32 (0.0520)	32236-01G00
1.38 (0.0543)	32236-01G01
1.44 (0.0567)	32236-01G02
1.50 (0.0591)	32236-01G03
1.56 (0.0614)	32236-01G04
1.62 (0.0638)	32236-01G05
1.68 (0.0661)	32236-01G06
1.74 (0.0685)	32236-01G07

AVAILABLE C-RING

Mainshaft C-ring

Allowable clearance		0 - 0.1 mm (0 - 0.004 in)	
Thickness mm (in)	Part number	Thickness mm (in)	Part number
2.63 (0.1035)	32348-01G15	3.19 (0.1256)	32348-01G07
2.70 (0.1063)	32348-01G00	3.26 (0.1283)	32348-01G08
2.77 (0.1091)	32348-01G01	3.33 (0.1311)	32348-01G09
2.84 (0.1118)	32348-01G02	3.40 (0.1339)	32348-01G10
2.91 (0.1146)	32348-01G03	3.47 (0.1366)	32348-01G11
2.98 (0.1173)	32348-01G04	3.54 (0.1394)	32348-01G12
3.05 (0.1201)	32348-01G05	3.61 (0.1421)	32348-01G13
3.12 (0.1228)	32348-01G06	3.68 (0.1449)	32348-01G14

Inspection and Adjustment (Cont'd)

AVAILABLE SHIM AND WASHER

Table for selecting proper counter gear front bearing thrust washer

Dial indicator deflection mm (in)	Thickness of proper washer mm (in)	Part number
0.93 - 1.02 (0.0366 - 0.0402)	0.88 (0.0346)	32218-01G11
1.03 - 1.12 (0.0406 - 0.0441)	0.96 (0.0378)	32218-01G12
1.13 - 1.22 (0.0445 - 0.0480)	1.04 (0.0409)	32218-01G13
1.23 - 1.32 (0.0484 - 0.0520)	1.12 (0.0441)	32218-01G14
1.33 - 1.42 (0.0524 - 0.0559)	1.28 (0.0504)	32218-01G15
1.43 - 1.52 (0.0563 - 0.0598)	1.36 (0.0535)	32218-01G16
1.53 - 1.62 (0.0602 - 0.0638)	1.44 (0.0567)	32218-01G17

Reverse idler rear thrust washer

Thickness mm (in)	Part number
1.97 (0.0776)	32284-01G10
2.07 (0.0815)	32284-01G11

AUTOMATIC TRANSMISSION

SECTION AT

CONTENTS

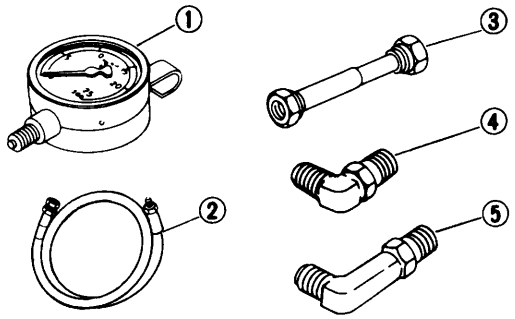
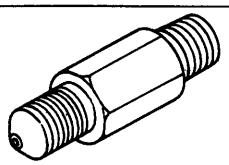
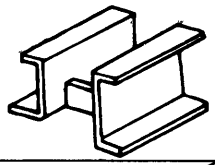
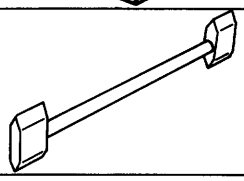
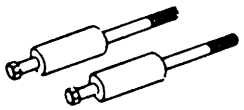
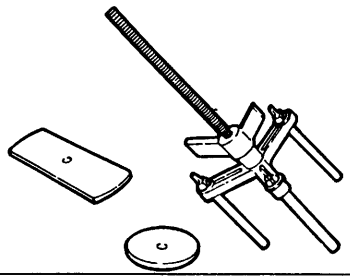
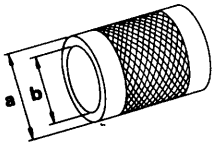
PREPARATION ..... AT- 2
PRECAUTIONS ..... AT- 4
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TROUBLE DIAGNOSES ..... AT- 19
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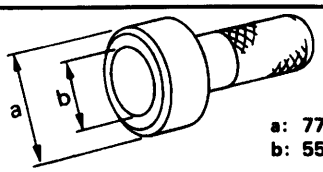
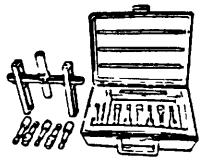
When you read wiring diagrams:

- **Read GI section, "HOW TO READ WIRING DIAGRAMS".**
- **See EL section, "POWER SUPPLY ROUTING" for power distribution circuit.**

When you perform trouble diagnoses, read GI section, "HOW TO FOLLOW FLOW CHART IN TROUBLE DIAGNOSES".

SPECIAL SERVICE TOOLS

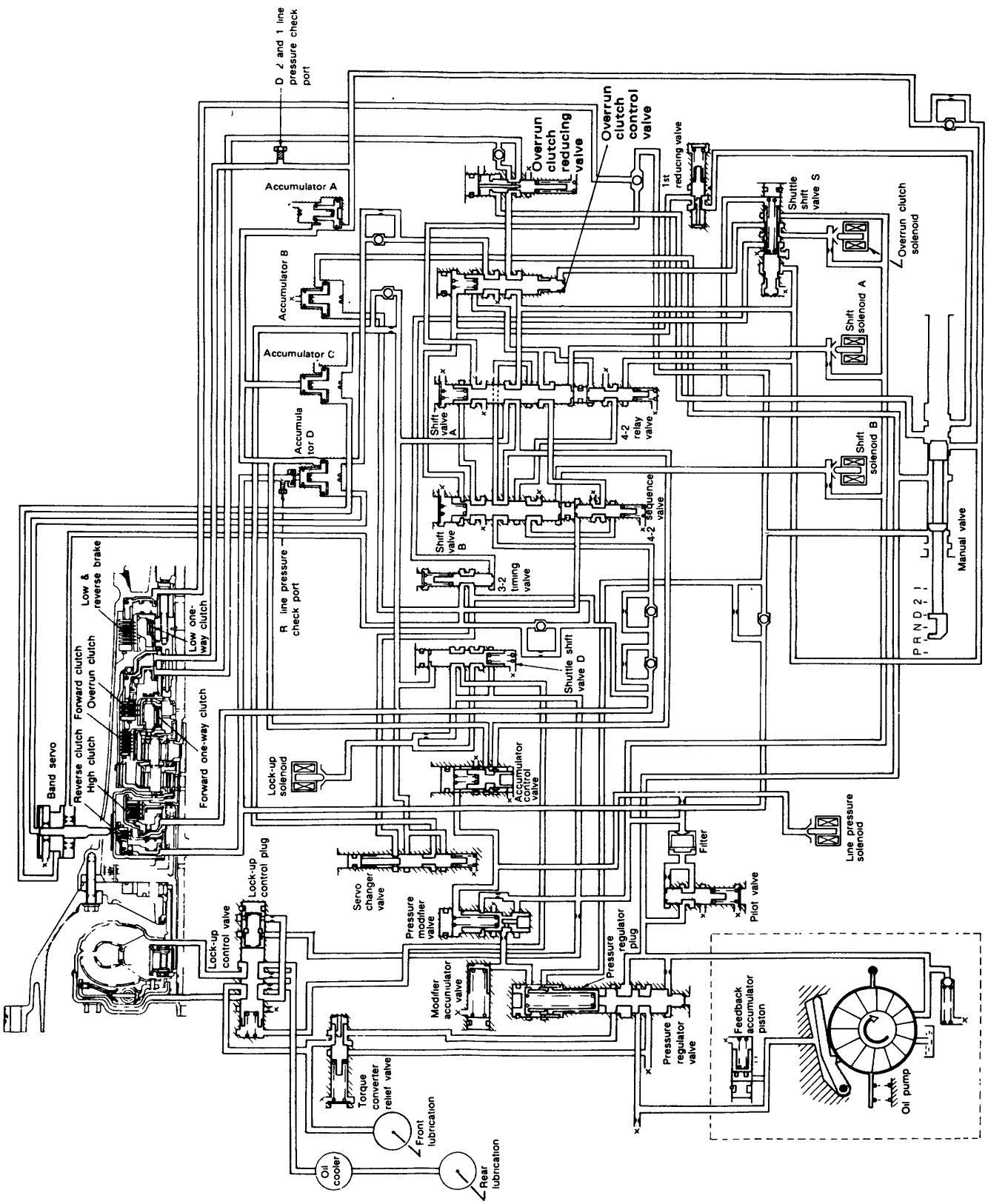
Tool number (Kent-Moore No.) Tool name	Description	
ST2505S001 (J25695-A) Oil pressure gauge set ① ST25051001 (–) Oil pressure gauge ② ST25052000 (–) Hose ③ ST25053000 (–) Joint pipe ④ ST25054000 (–) Adapter ⑤ ST25055000 (–) Adapter		Measuring line pressure
KV31101201 (–) Oil pressure gauge adapter		Measuring line pressure
ST07870000 (J37068) Transmission case stand		Disassembling and assembling A/T
KV31102100 (J37065) Torque converter one-way clutch check tool		Checking one-way clutch in torque converter
ST25850000 (J25721-A) Sliding hammer		Removing oil pump assembly
KV31102400 (J34285 and J34285-87) Clutch spring compressor		Removing and installing clutch return springs
ST33200000 (J37067) Drift	 a: 60 mm (2.36 in) dia. b: 44.5 mm (1.752 in) dia.	Installing oil pump housing oil seal Installing rear oil seal

Tool number (Kent-Moore No.) Tool name	Description	
ST30720000 (J34331) Drift	 **a: 77 mm (3.03 in) dia.** **b: 55.5 mm (2.185 in) dia.**	Installing rear oil seal
(J34291) Shim setting gauge set		Selecting oil pump cover bearing race and oil pump thrust washer

Service Notice

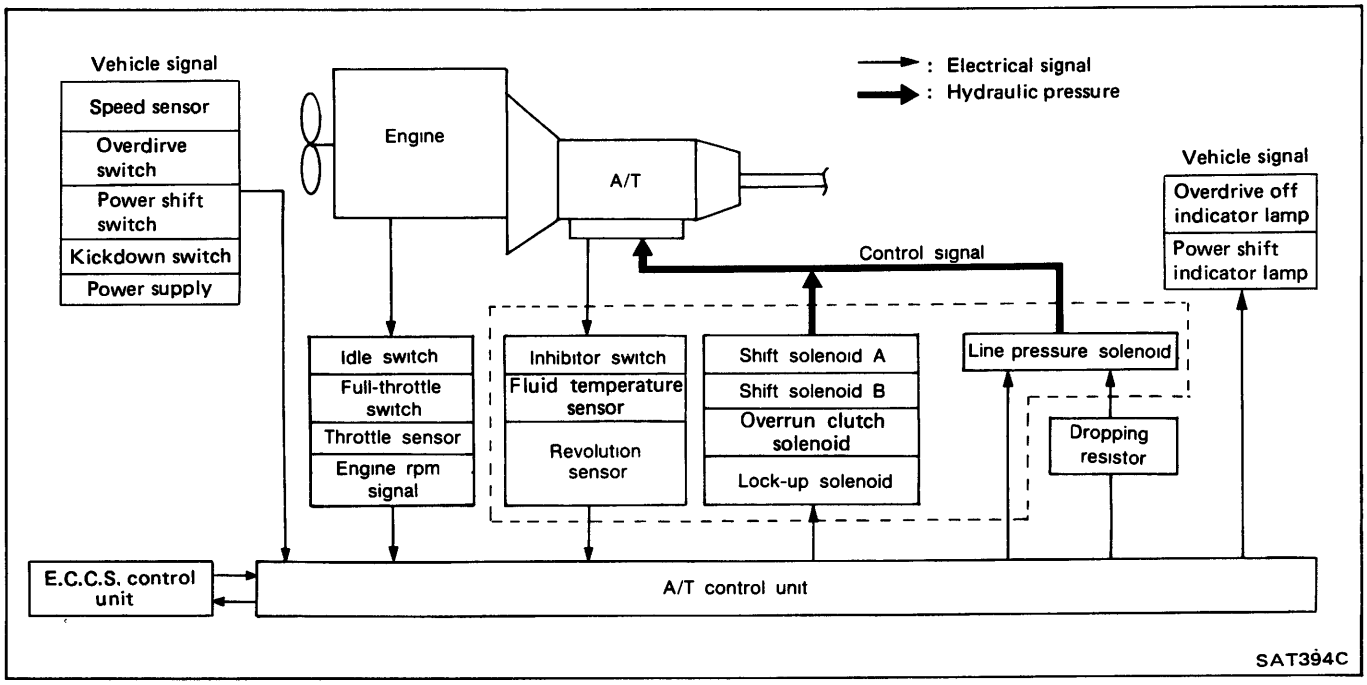
- Before proceeding with disassembly, thoroughly clean the outside of the transmission. It is important to prevent the internal parts from becoming contaminated by dirt or other foreign matter.
- Disassembly should be done in a clean work area.
- Use lint-free cloth or towels for wiping parts clean. Common shop rags can leave fibers that could interfere with the operation of the transmission.
- When disassembling parts, place them in order in a parts rack so that they can be put back into the unit in their proper positions.
- All parts should be carefully cleaned with a general purpose, non-flammable solvent before inspection or reassembly.
- Gaskets, seals and O-rings should be replaced any time the transmission is disassembled.
- It is very important to perform functional tests whenever they are indicated.
- The valve body contains precision parts and requires extreme care when parts are removed and serviced. Place removed parts in order on a parts rack so they can be put back in the valve body in the same positions and sequences. Care will also prevent springs and small parts from becoming scattered or lost.
- Properly installed valves, sleeves, plugs, etc. will slide along their bores in the valve body under their own weight.
- Before assembly, apply a coat of recommended A.T.F. to all parts. Petroleum jelly may be applied to O-rings and seals and used to hold small bearings and washers in place during reassembly. Do not use grease.
- Extreme care should be taken to avoid damage to O-rings, seals and gaskets when assembling.
- After overhaul, refill the transmission with new A.T.F.

Hydraulic Control Circuits — RE4R01A



SAT123B

Electrical Control Chart — RE4R01A

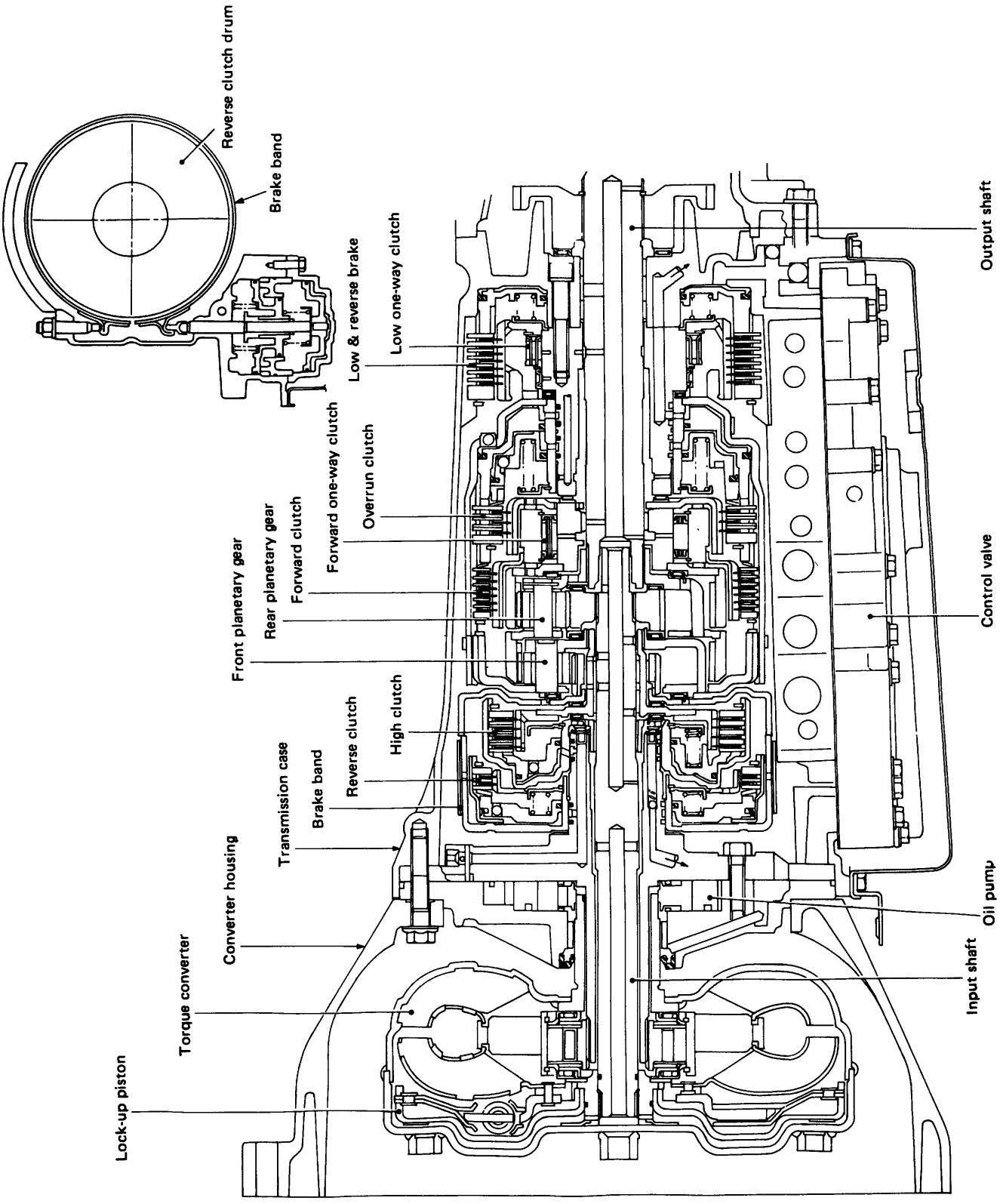


Mechanical Operation — RE4R01A

Shift position		Reverse clutch	High clutch	Forward clutch	Overrun clutch	Band servo 2nd apply	Band servo 3rd release	Band servo 4th apply	Forward one-way clutch	Low one-way clutch	Low & reverse brake	Lock-up	Remarks
P													PARK
R		○									○		REVERSE
N													NEUTRAL
D *4	1st			○	⊗				●	●			Automatic shift 1 ↔ 2 ↔ 3 ↔ 4
	2nd			○	*1 O	○			●				
	3rd		○	○	O	*2⊗	⊗		●				
	4th		○	⊗		*3⊗	⊗	○				○	
2	1st			○	⊗				●	●			Automatic shift 1 ↔ 2
	2nd			○	O	○			●				
1	1st			○	○				●		○		Locks (held stationary) in 1st speed 1 ← 2
	2nd			○	○	○			●				

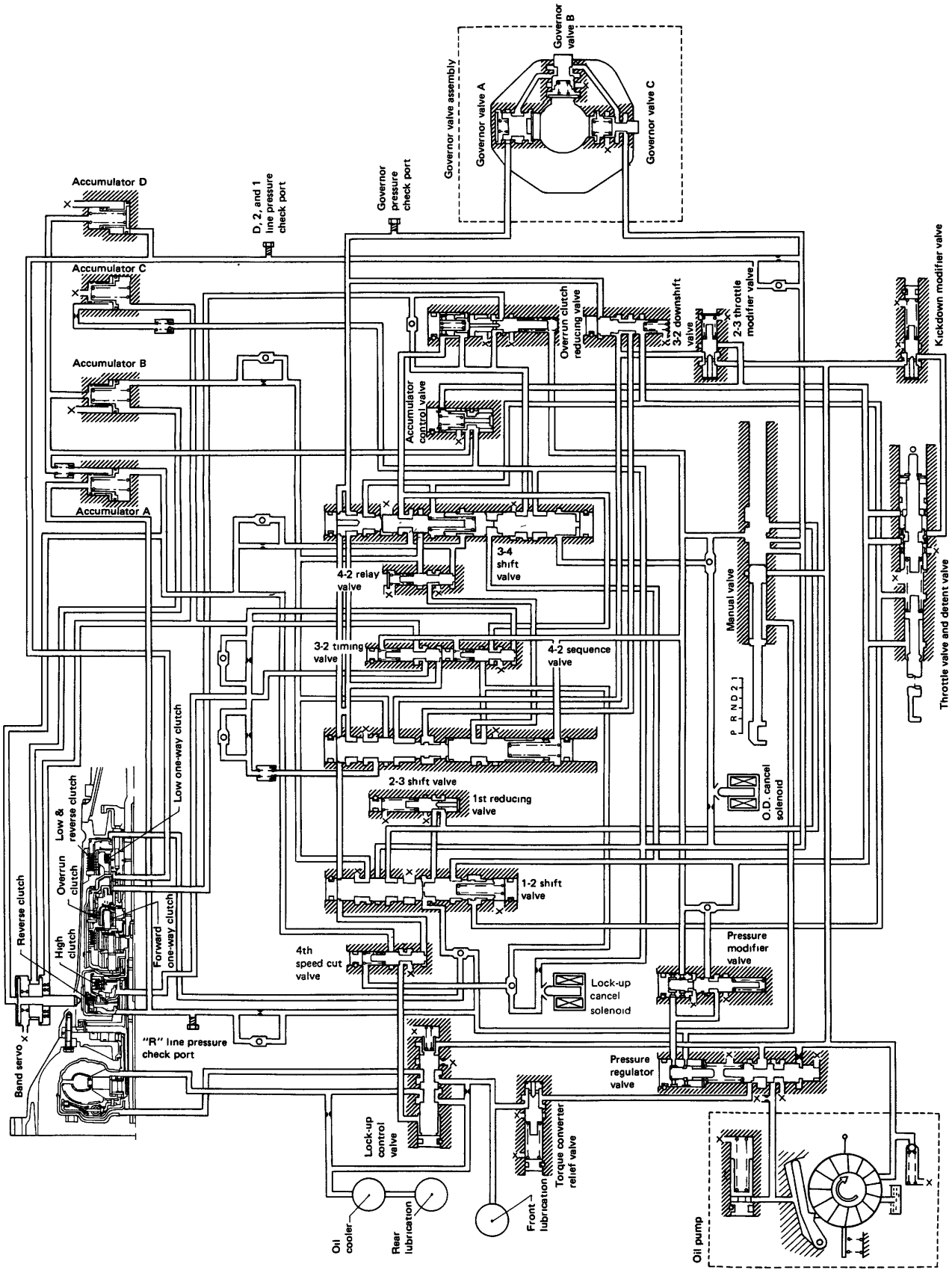
*1. Operates when overdrive switch is set to "OFF".
*2. Oil pressure is applied to both 2nd "apply" side and 3rd "release" side of band servo piston. However, because oil pressure area on the "release" side is greater than that on the "apply" side, brake band does not contract.
*3. Oil pressure is applied to 4th "apply" side in condition *2 above, and brake band contracts.
*4. A/T will not shift to 4th when overdrive switch is set to "OFF" position.
○ : Operates.
O : Operates when throttle opening is less than 1/16. Engine brake activates.
● : Operates during "progressive" acceleration.
⊗ : Operates but does not affect power transmission.
⊗ : Operates when throttle opening is less than 1/16 but does not affect engine brake.

Cross-Sectional View — RE4R01A



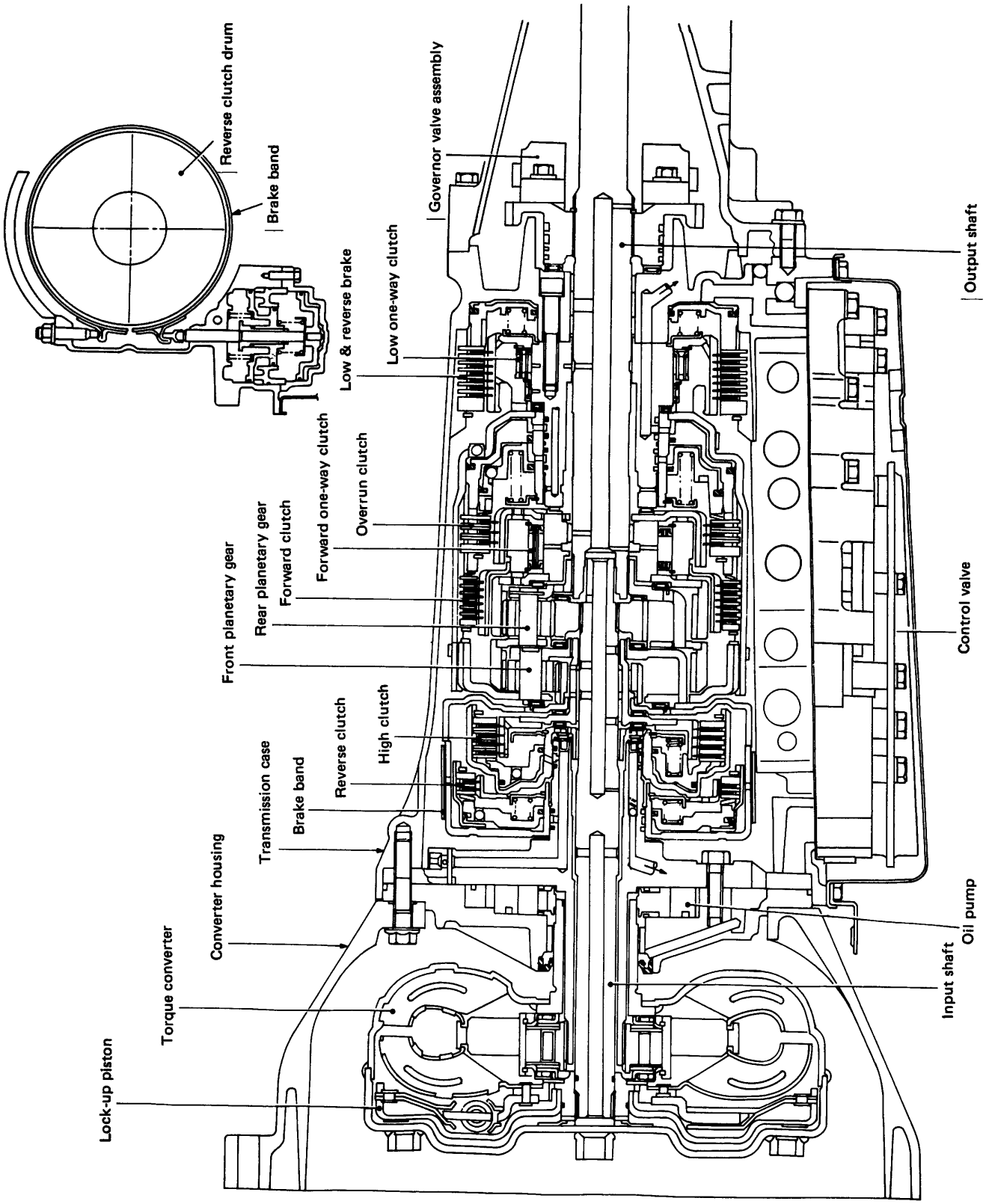
SAT125B

Hydraulic Control Circuits — RL4R01A



SAT092C

Cross-Sectional View — RL4R01A

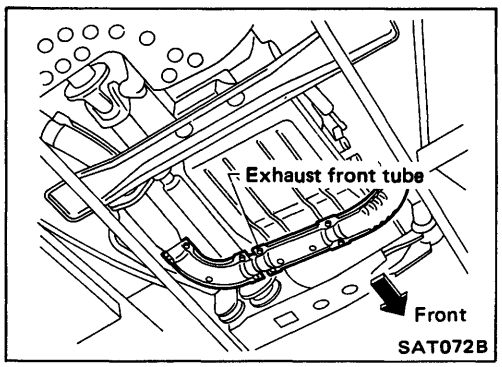


SAT117C

Mechanical Operation — RL4R01A

Shift position		Reverse clutch	High clutch	Forward clutch	Overrun clutch	Band servo			Forward one-way clutch	Low one-way clutch	Low & reverse brake	Lock-up	Remarks
						2nd apply	3rd release	4th apply					
P													PARK
R		○									○		REVERSE
N													NEUTRAL
D *4	1st			○	⊗				●	●			Automatic shift 1 ↔ 2 ↔ 3 ↔ 4
	2nd			○	*1 O	○			●				
	3rd		○	○	O	*2⊗	⊗		●				
	4th		○	⊗		*3⊗	⊗	○				○	
2	1st			○	⊗				●	●			Automatic shift 1 ↔ 2
	2nd			○	O	○			●				
1	1st			○	○				●		○		Locks (held stationary) in 1st speed 1 ← 2
	2nd			○	○	○			●				

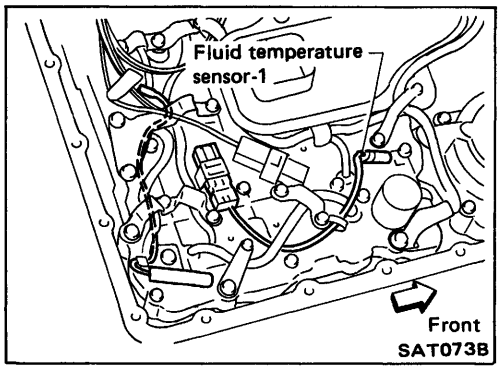
*1. Operates when overdrive switch is set to "OFF".
*2. Oil pressure is applied to both 2nd "apply" side and 3rd "release" side of band servo piston. However, because oil pressure area on the "release" side is greater than that on the "apply" side, brake band does not contract.
*3. Oil pressure is applied to 4th "apply" side in condition *2 above, and brake band contracts.
*4. A/T will not shift to 4th when overdrive switch is set to "OFF" position.
○ : Operates.
O : Operates when throttle opening is less than 1/16. Engine brake activates.
● : Operates during "progressive" acceleration.
⊗ : Operates but does not affect power transmission.
⊗ : Operates when throttle opening is less than 1/16 but does not affect engine brake.



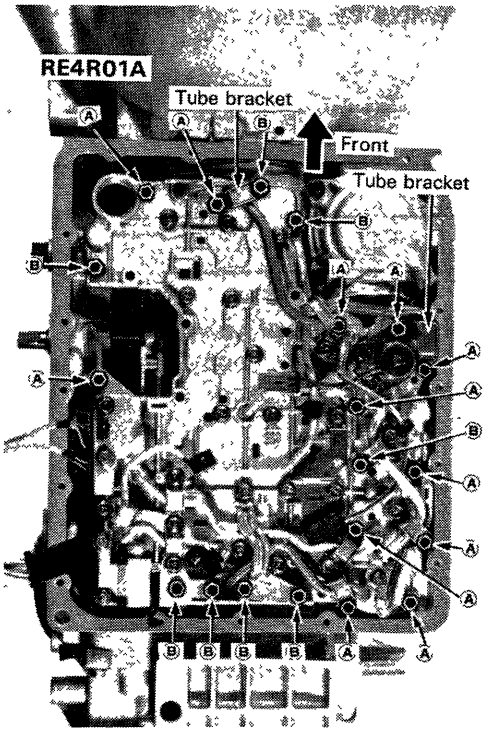
Control Valve Assembly and Accumulators Inspection

– RE4R01A –

1. Remove exhaust front tube.
2. Remove oil pan and gasket and drain A.T.F.



3. Remove fluid temperature sensor-1 if necessary.
4. Remove oil strainer.

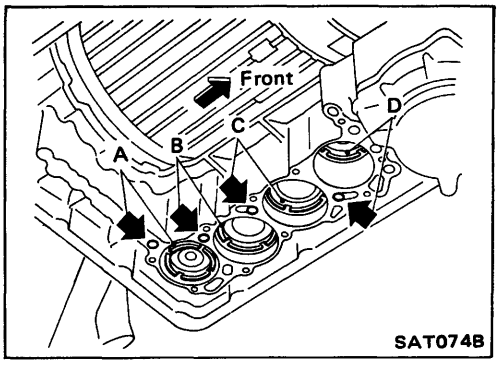


5. Remove control valve assembly by removing fixing bolts and disconnecting harness connector.

Bolt length and location

Bolt symbol	ℓ mm (in)
Ⓐ	33 (1.30)
Ⓑ	45 (1.77)

6. Remove solenoids and valves from valve body if necessary.
7. Remove terminal cord assembly if necessary.

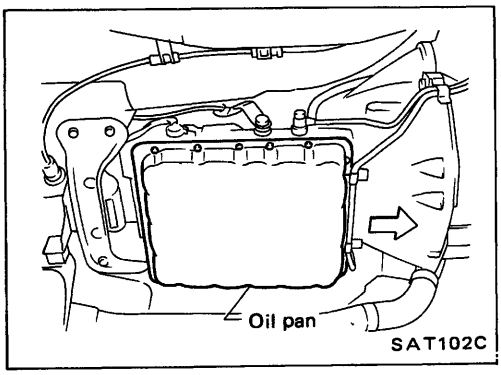


8. Remove accumulator A, B, C and D by applying compressed air if necessary.
- **Hold each piston with rag.**
9. Reinstall any part removed.
- **Always use new sealing parts.**

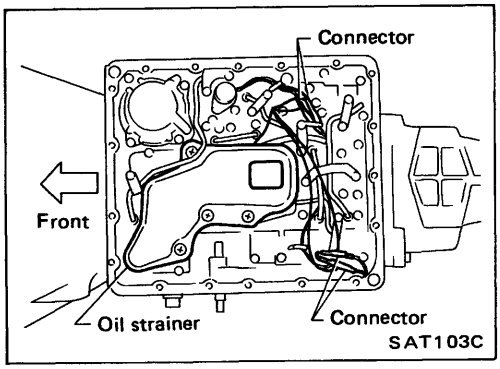
Control Valve Assembly and Accumulators Inspection (Cont'd)

– RL4R01A –

1. Remove oil pan and gasket and drain A.T.F.



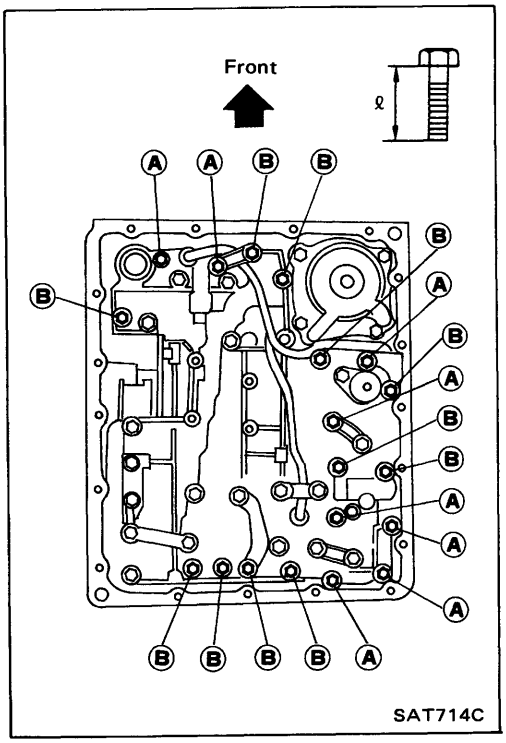
2. Remove oil strainer.
3. Disconnect harness connector



4. Remove control valve assembly by removing fixing bolts.

Bolt length and location

Bolt sysmbol	ℓ mm (in)
Ⓐ	33 (1.30)
Ⓑ	45 (1.77)



Be careful not to drop manual valve out of valve body.

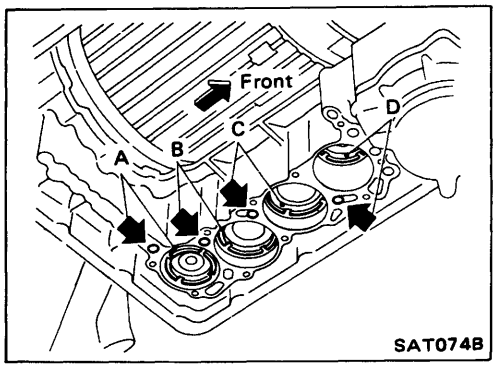
5. Remove solenoids and valves from valve body if necessary.
6. Remove terminal cord assembly if necessary.

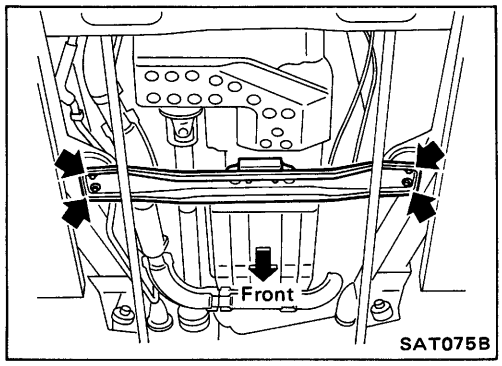
7. Remove accumulator A, B, C and D by applying compressed air if necessary.

Hold each piston with rag.

8. Reinstall any part removed.

Always use new sealing parts.



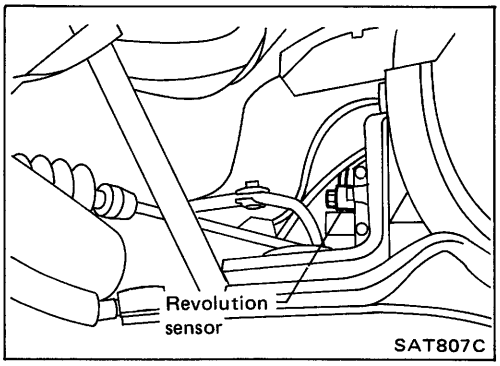


Revolution Sensor Replacement — RE4R01A

– 4WD model –

1. Remove rear engine mounting member from side member while supporting A/T with transfer case with jack.
2. Lower A/T with transfer case as much as possible.
3. Remove revolution sensor from A/T.
4. Reinstall any part removed.

- **Always use new sealing parts.**



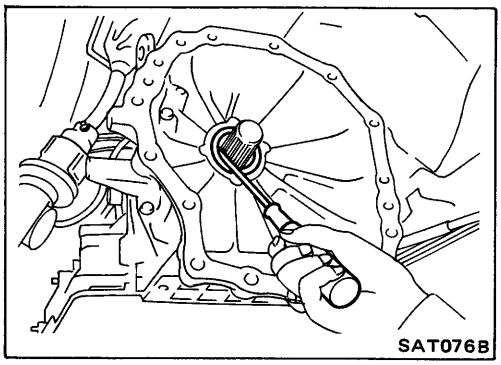
– 2WD model –

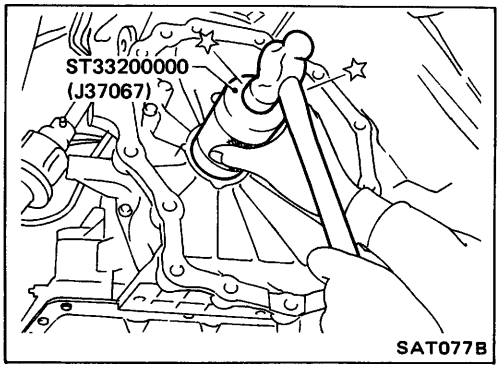
- Remove revolution sensor from A/T.
- **Always use new sealing parts.**

Rear Oil Seal Replacement

– 4WD model –

1. Remove transfer case from vehicle. – Refer to section TF.
2. Remove rear oil seal.



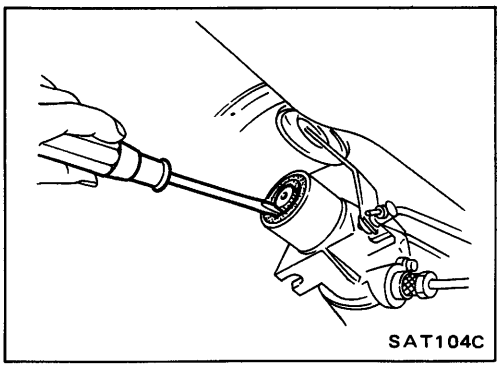


3. Install rear oil seal.

- **Apply A.T.F. before installing.**

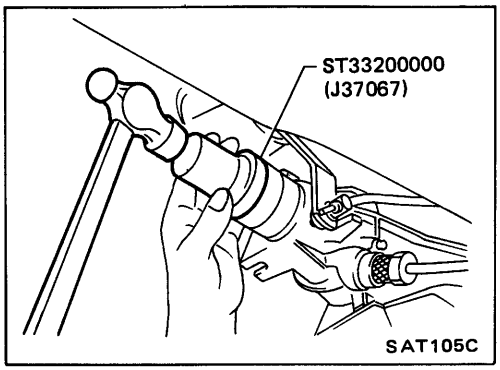
4. Reinstall any part removed.

Rear Oil Seal Replacement (Cont'd)



– 2WD model –

1. Remove propeller shaft from vehicle. – Refer to section PD.
2. Remove rear oil seal.

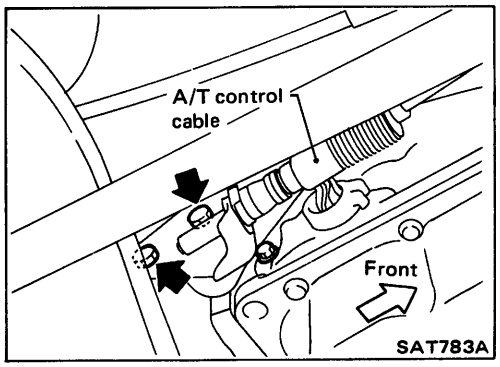


3. Install rear oil seal.

Apply A.T.F. before installing.

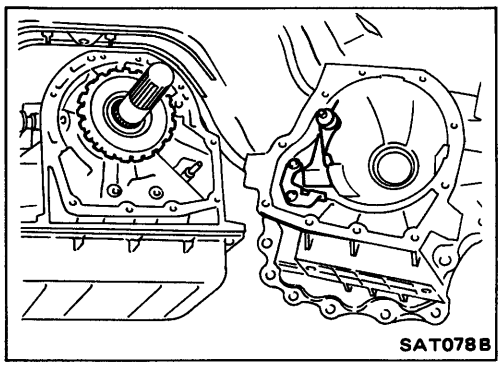
4. Reinstall any part removed.

Parking Components Inspection



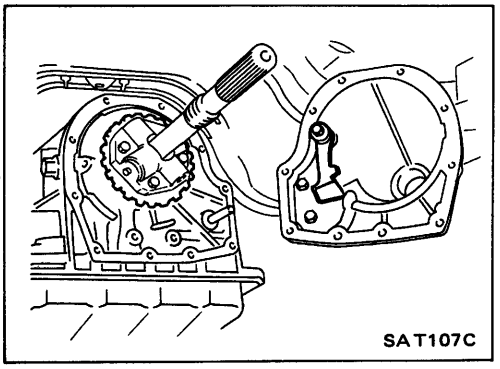
– 4WD model –

1. Remove propeller shaft. – Refer to section PD.
2. Remove transfer case from vehicle. – Refer to section TF.
3. Remove manual control linkage bracket from adapter case.



4. Support A/T assembly with a jack.
5. Remove adapter case from transmission case.
6. Replace parking components if necessary.
7. Reinstall any part removed.

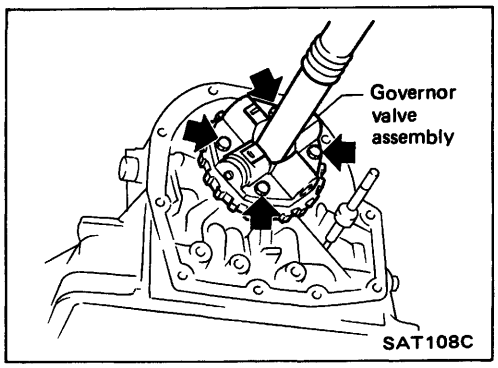
- **Always use new sealing parts.**



– 2WD model –

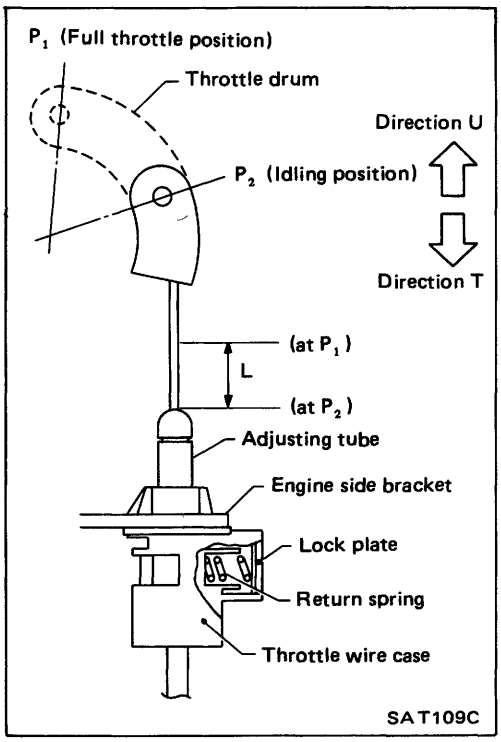
1. Remove propeller shaft from vehicle. – Refer to section PD.
2. Support A/T assembly with a jack.
3. Remove rear engine mounting member.
4. Remove rear extension from transmission case.
5. Replace parking components if necessary.
6. Reinstall any part removed.

- **Always use new sealing parts.**



Governor Valve — RL4R01A

1. Remove propeller shaft from vehicle. — Refer to section PD.
2. Support A/T assembly with a jack.
3. Remove rear engine mounting member from A/T assembly.
4. Remove rear extension from transmission case.
5. Remove governor valve assembly.
6. Inspect and repair governor valve assembly. Refer to "REPAIR FOR COMPONENT PARTS".



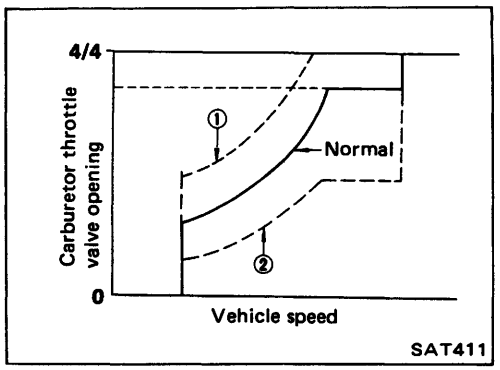
Throttle Wire Adjustment — RL4R01A

1. While pressing lock plate, move adjusting tube in direction "T".
2. Return lock plate.
3. Move throttle drum from "P_2" to "P_1" quickly.
4. Ensure that throttle wire stroke "L" is within specified range between full throttle and idle.

   Throttle wire stroke "L":

   38 - 42 mm (1.50 - 1.65 in)

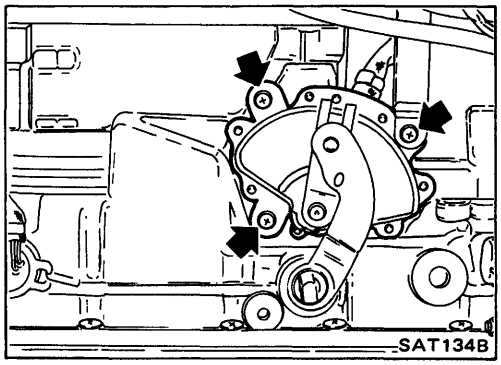
- **Adjust throttle wire stroke when throttle wire/accelerator wire is installed or after carburetor has been adjusted.**
- **Put marks on throttle wire to facilitate measuring wire stroke.**



If throttle wire stroke is improperly adjusted, the following problems may arise.

- When full-open position "P_1" of throttle drum is closer to direction "T", shift schedule will be as shown by ② in figure at left, and kickdown range will greatly increase.
- When full-open position "P_1" of throttle drum is closer to direction "U", shift schedule will be as shown by ① in figure at left, and kickdown range will not occur.

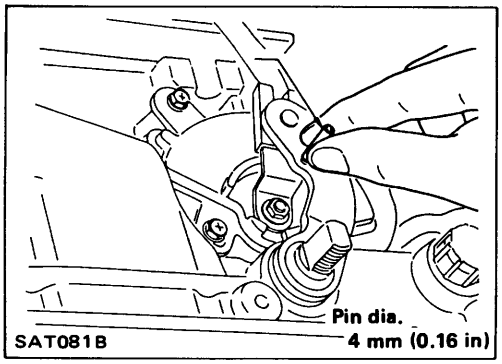
5. After properly adjusting throttle wire, ensure the parting line is as straight as possible.



Inhibitor Switch Adjustment

1. Remove manual control linkage from manual shaft of A/T assembly.
2. Set manual shaft of A/T assembly in "N" position.
3. Loosen inhibitor switch fixing bolts.

Inhibitor Switch Adjustment (Cont'd)



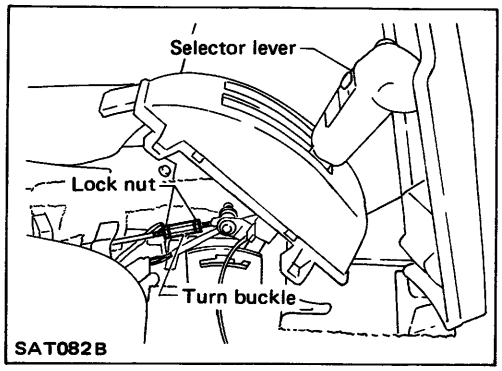
4. Insert pin into adjustment holes in both inhibitor switch and manual shaft of A/T assembly as near vertical as possible.
5. Reinstall any part removed.
6. Check continuity of inhibitor switch. — Refer to "Electrical System".

Manual Control Linkage Adjustment

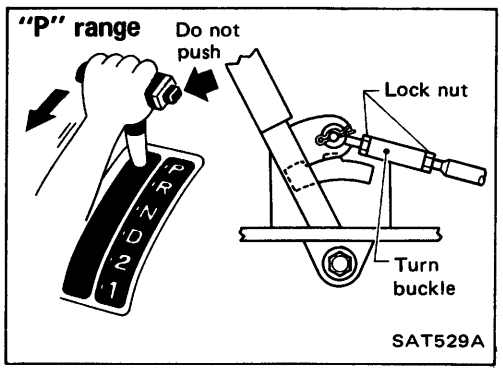
FLOOR SHIFT MODEL — 4WD

Move selector lever from "P" range to "1" range. You should be able to feel the detents in each range.

If the detents cannot be felt or the pointer indicating the range is improperly aligned, the linkage needs adjustment.



1. Place selector lever in "P" range.
2. Loosen lock nuts.



3. Tighten turn buckle until aligns with inner cable, pulling selector lever toward "R" range side without pushing button.
4. Back off turn buckle 1 turn and tighten lock nuts to the specified torque.

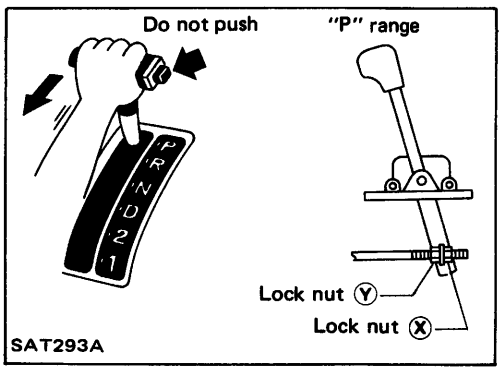
   ⓞ : **Lock nut**
   4.4 - 5.9 N·m
   (0.45 - 0.60 kg-m, 3.3 - 4.3 ft-lb)
5. Move selector lever from "P" range to "1" range. Make sure that selector lever can move smoothly.

FLOOR SHIFT MODEL — 2WD

Move the selector lever from the "P" range to "1" range. You should be able to feel the detents in each range.

If the detents cannot be felt or the pointer indicating the range is improperly aligned, the linkage needs adjustment.

1. Place selector lever in "P" range.
2. Loosen lock nuts.



3. Tighten lock nut Ⓧ until it touches trunnion, pulling selector lever toward "R" range side without pushing button.
4. Back off lock nut Ⓧ 1 turn and tighten lock nut Ⓨ to the specified torque.

   ⓞ : **Lock nut**
   11 - 15 N·m (1.1 - 1.5 kg-m, 8 - 11 ft-lb)
5. Move selector lever from "P" range to "1" range. Make sure that selector lever can move smoothly.

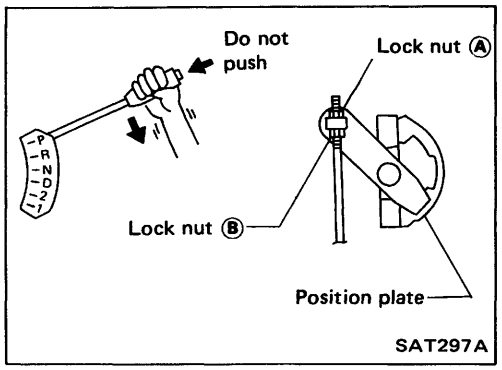
Manual Control Linkage Adjustment (Cont'd)

COLUMN SHIFT MODEL

Move the selector lever from the "P" range to "1" range. You should be able to feel the detents in each range.

If the detents cannot be felt or the pointer indicating the range is improperly aligned, the linkage needs adjustment.

1. Place selector lever in "P" range.
2. Loosen lock nuts.



3. Tighten lock nut Ⓐ until it touches trunnion, pulling selector lever toward "R" range side without pushing button.
4. Back off lock nut Ⓐ two turns and tighten lock nut Ⓑ to the specified torque.

   : Lock nut

   11 - 15 N·m

   (1.1 - 1.5 kg-m, 8 - 11 ft-lb)

5. Move selector lever from "P" range to "1" range. Make sure that selector lever can move smoothly.

NOTE

Contents

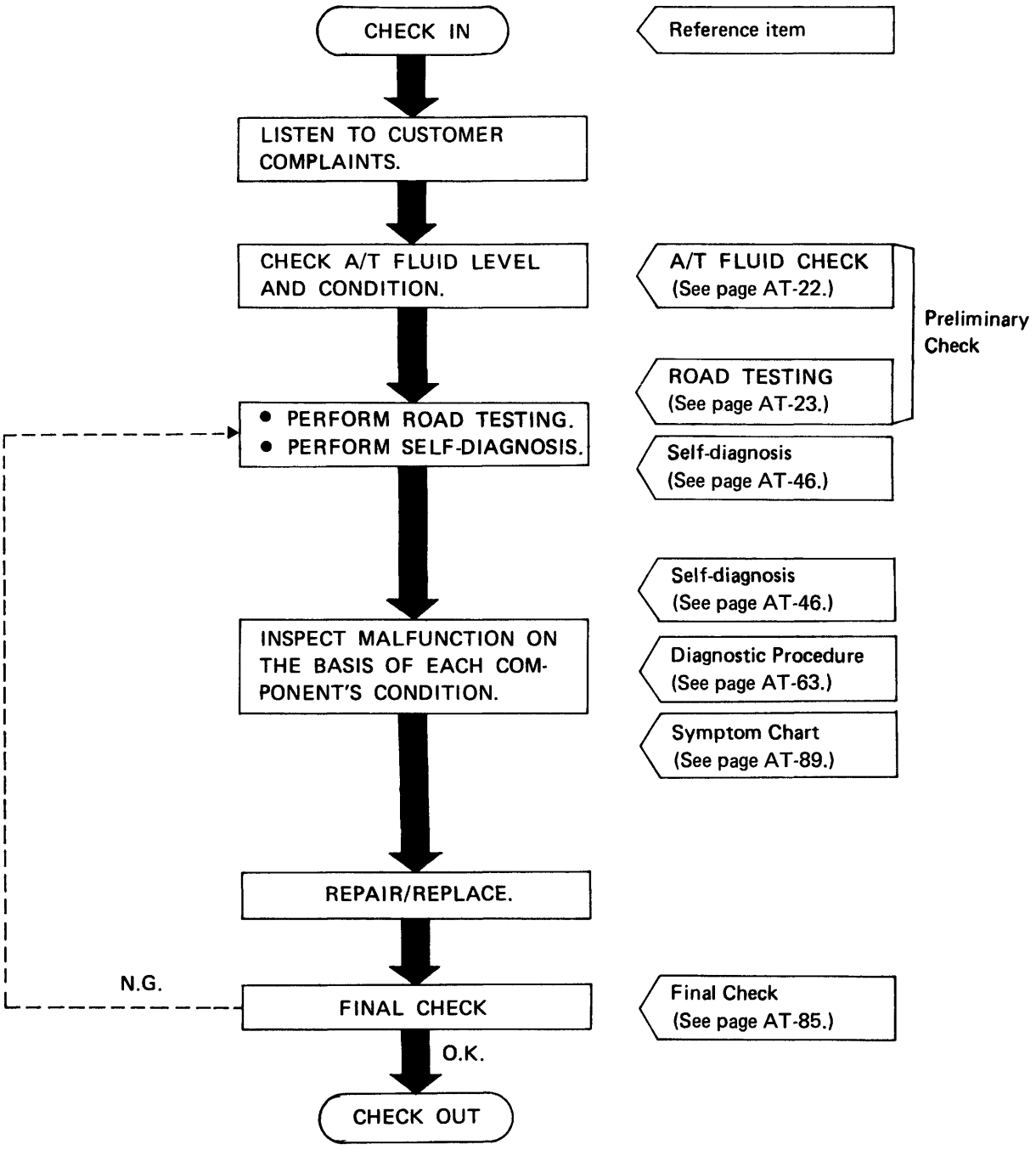
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(SYMPTOM: Engine cannot be started with selector lever in "P" or "N" range or engine can be started with selector lever in "D", "2", "1" or "R" range.) ..... AT- 64
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Diagnostic Procedure 5
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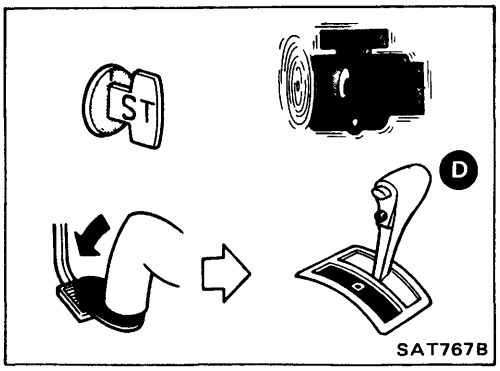
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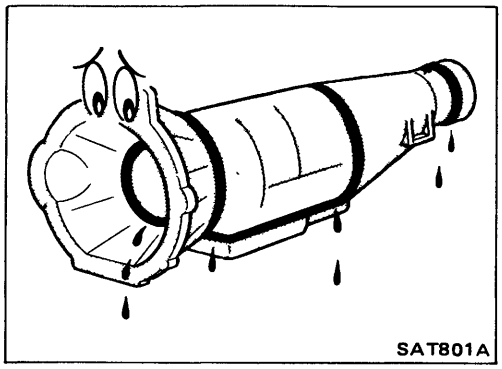
How to Perform Trouble Diagnoses for Quick and Accurate Repair

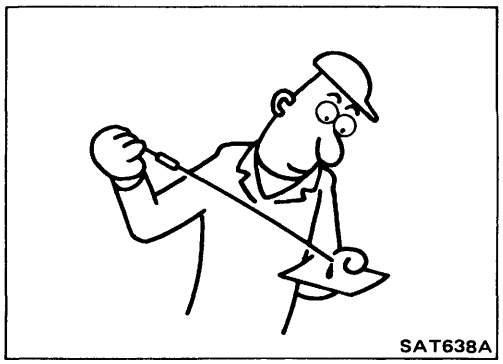
WORK FLOW





SAT767B


SAT801A


SAT638A

Preliminary Check

A/T FLUID CHECK

Fluid leakage check

1. Clean area suspected of leaking, — for example, mating surface of converter housing and transmission case.
2. Start engine, apply foot brake, place selector lever in "D" range and wait a few minutes.
3. Stop engine.
4. Check for fresh leakage.

Fluid condition check

Fluid color	Suspected problem
Dark or black with burned odor	Wear of frictional material
Milky pink	Water contamination – Road water entering through filler tube or breather
Varnished fluid, light to dark brown and tacky	Oxidation – Over or under filling – Overheating

Fluid level check

Refer to section MA.

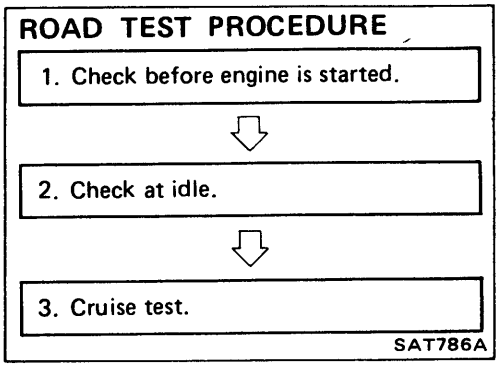
Preliminary Check (Cont'd)

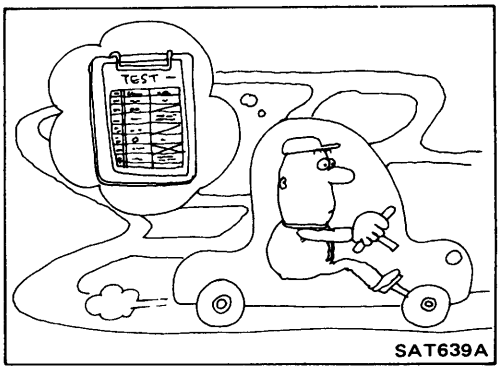
ROAD TESTING

Description

- The purpose of this road test is to determine overall performance of automatic transmission and analyze causes of problems.
- The road test consists of the following three parts:

1. Check before engine is started
2. Check at idle
3. Cruise test

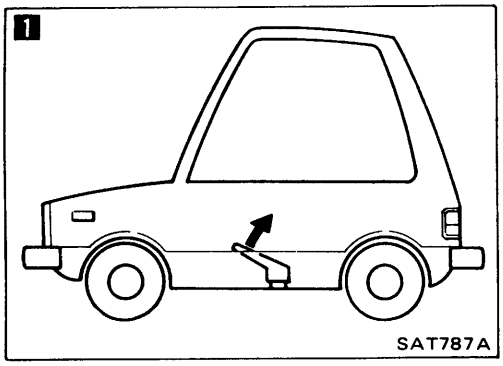


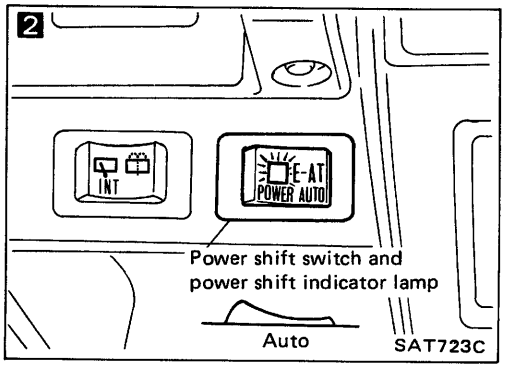


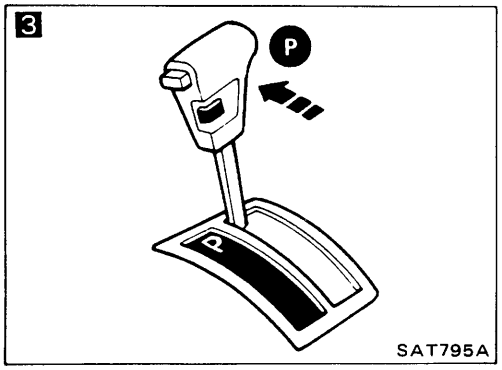
- Before road test, familiarize yourself with all test procedures and items to check.
- Conduct tests on all items. Troubleshoot items which check out No Good after road test. Refer to "Self-diagnosis" and "Diagnostic Procedure".

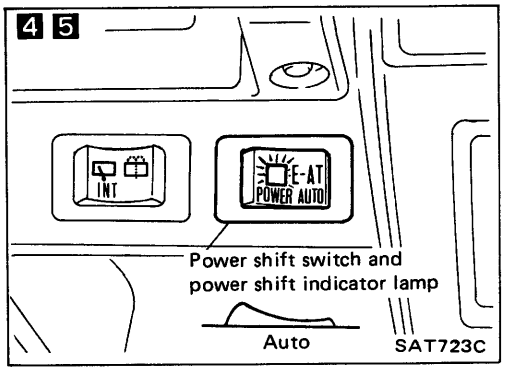
Preliminary Check (Cont'd)

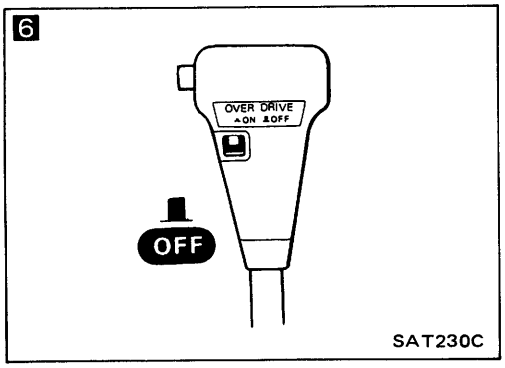
1. Check before engine is started



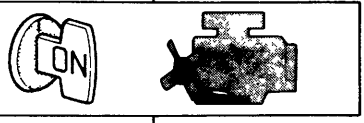








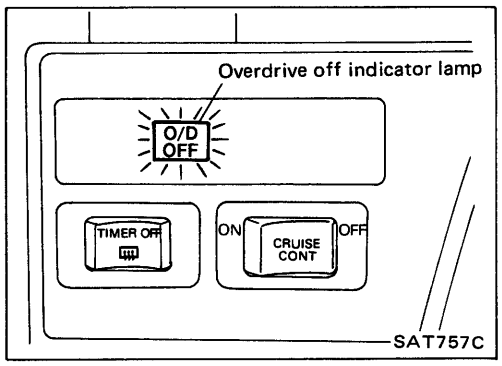
1. Park vehicle on flat surface.
2. Set power shift switch to "AUTO" position.
3. Move selector lever to "P" range.

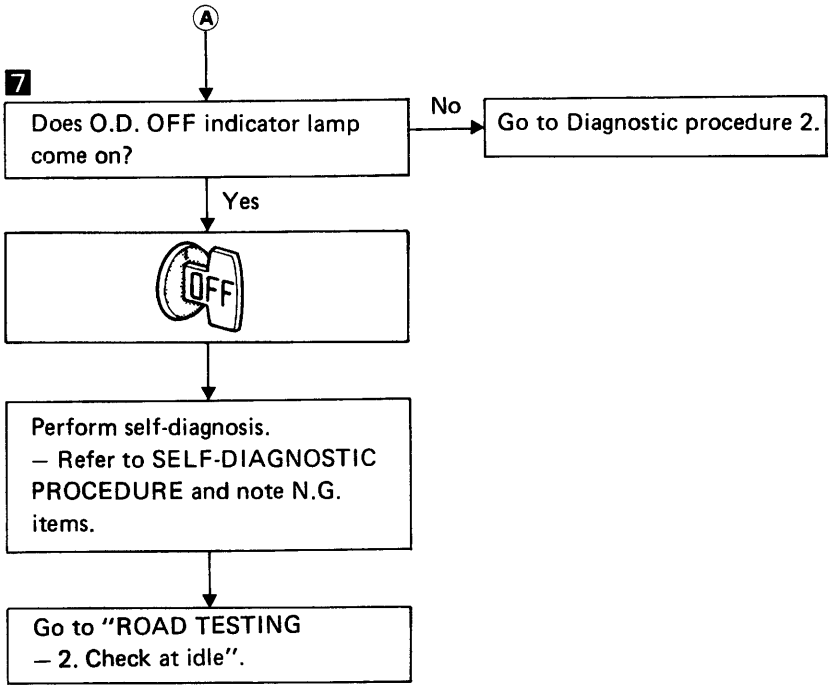


4. Does power shift indicator lamp come on for about 2 seconds?
   - No → Go to Diagnostic Procedure 1.
   - Yes ↓
5. Does power shift indicator lamp flicker for about 8 seconds?
   - Yes → Perform self-diagnosis. – Refer to SELF-DIAGNOSTIC PROCEDURE.
   - No ↓
6. Set overdrive switch to "OFF" position.

Ⓐ

Preliminary Check (Cont'd)

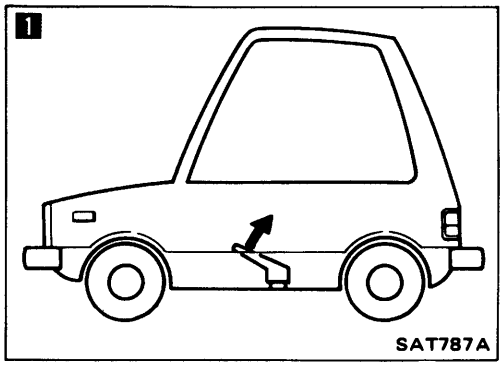




Preliminary Check (Cont'd)

2. Check at idle

1

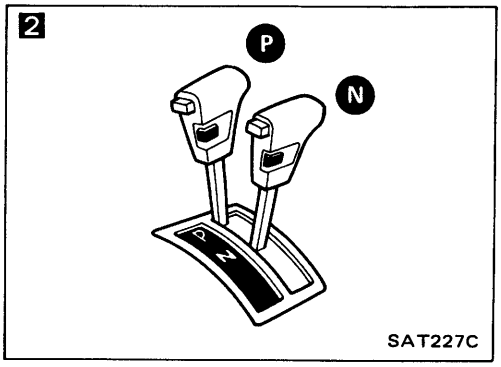

SAT787A

Park vehicle on flat surface.



2

Move selector lever to "P" or "N" range.


SAT227C



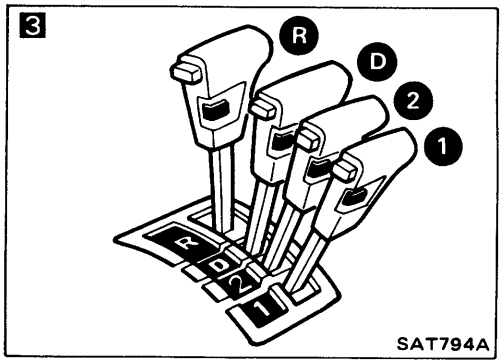
Is engine started? — No → Go to Diagnostic Procedure 3.

Yes



3

Move selector lever to "D", "1", "2" or "R" range.


SAT794A



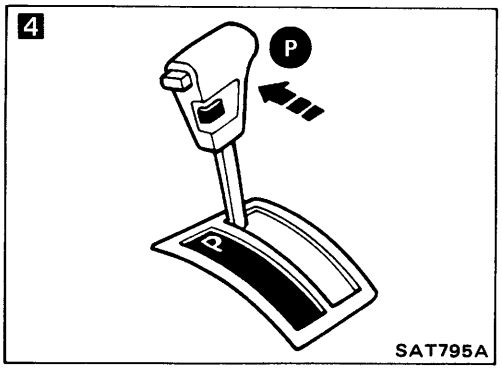
Is engine started? — Yes → Go to Diagnostic Procedure 3.

No



4

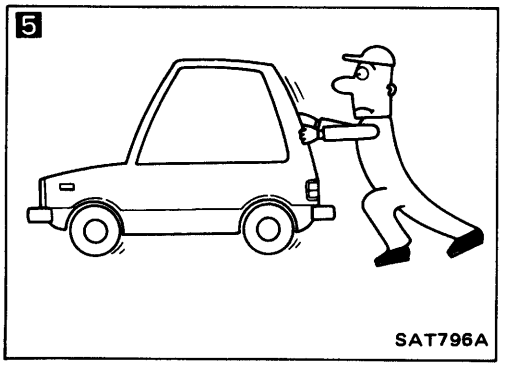
Move selector lever to "P" range.


SAT795A



5

Push vehicle forward or backward.


SAT796A

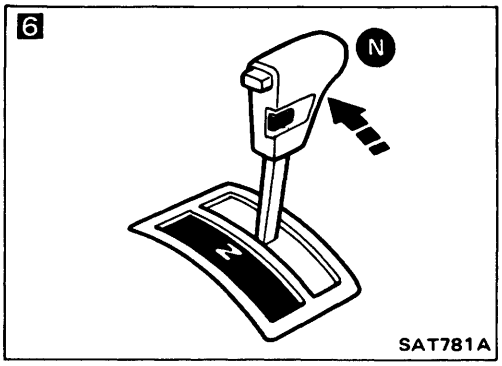
Does vehicle move when it is pushed forward or backward? — Yes → Go to Diagnostic Procedure 4.

No

Ⓐ

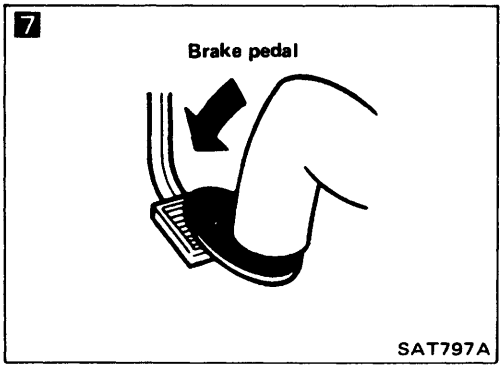
Preliminary Check (Cont'd)

6



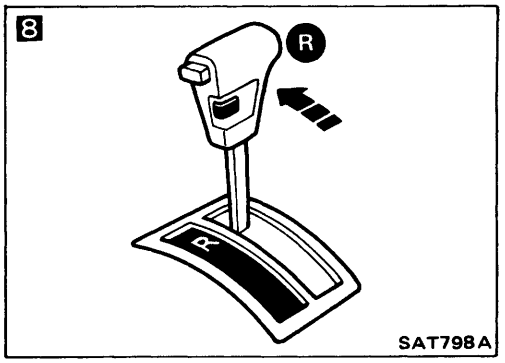
SAT781A

7



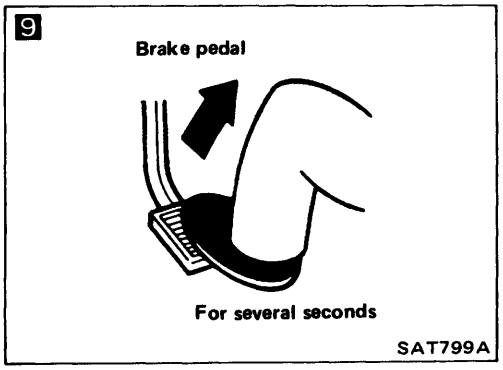
SAT797A

8



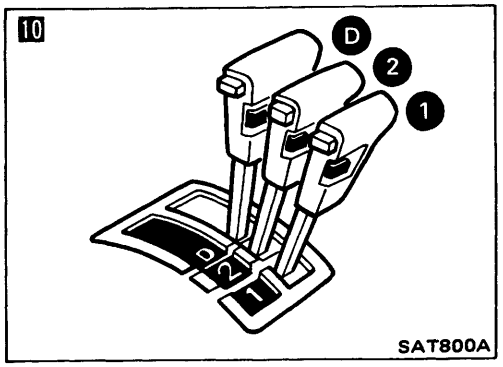
SAT798A

9

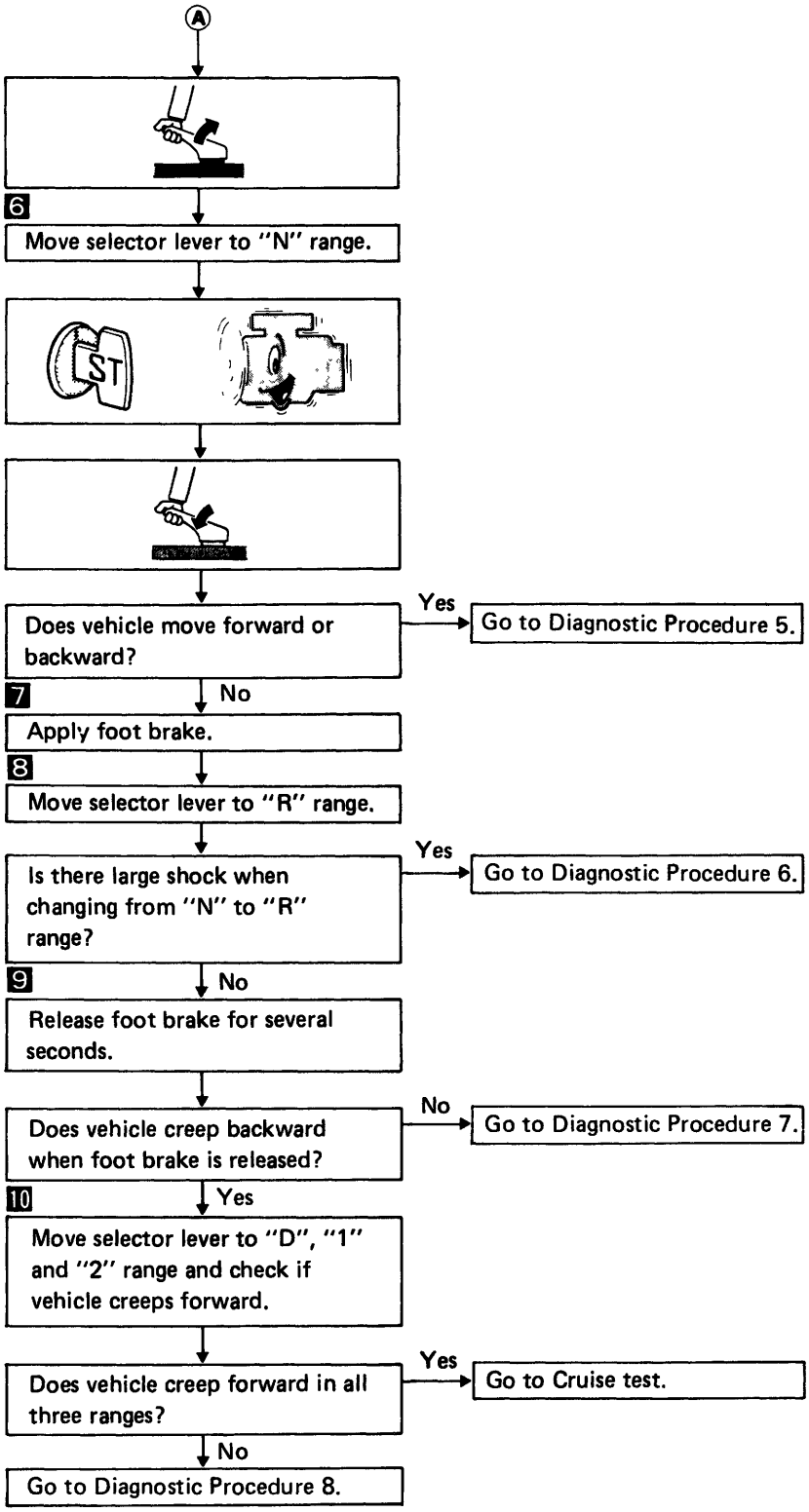


SAT799A

10



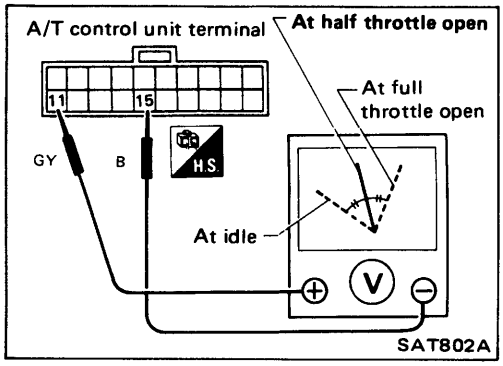
SAT800A



Preliminary Check (Cont'd)

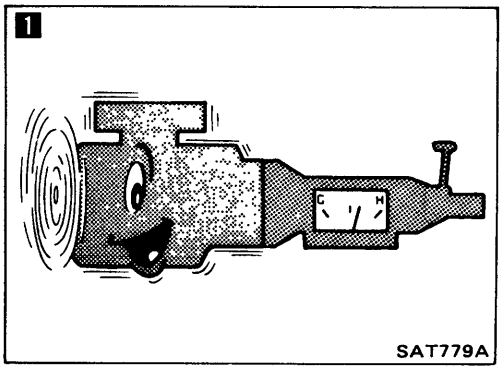
3. Cruise test

- Check all items listed in Parts 1 through 3.
- Throttle position can be controlled by voltage across terminals ⑪ and ⑮ of A/T control unit.



Cruise test — Part 1

1

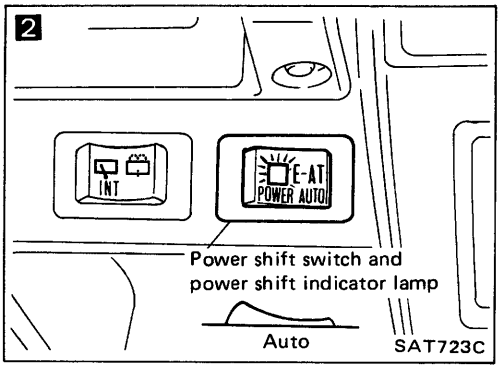


Warm up engine until engine oil and A.T.F. reach operating temperature after vehicle has been driven approx. 10 minutes.

A.T.F. operating temperature: 50 - 80°C (122 - 176°F)

Park vehicle on flat surface.

2

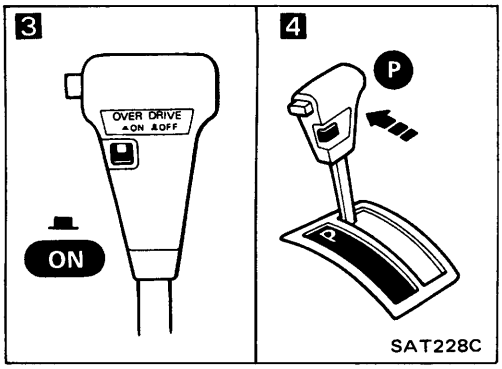


Set power shift switch to "AUTO" position.

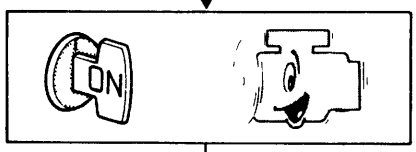
3

Set overdrive switch to "ON" position.

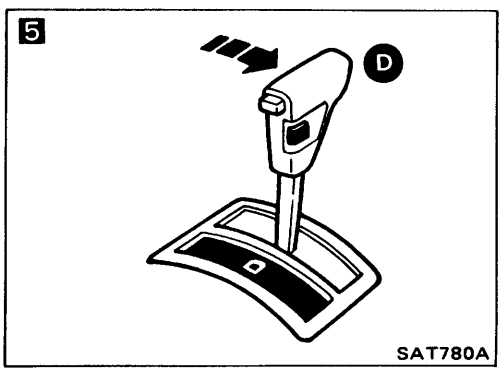
4



Move selector lever to "P" range.



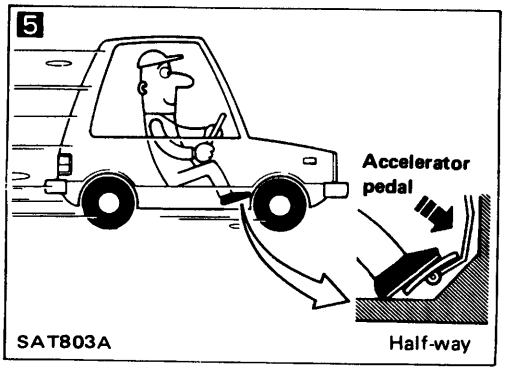
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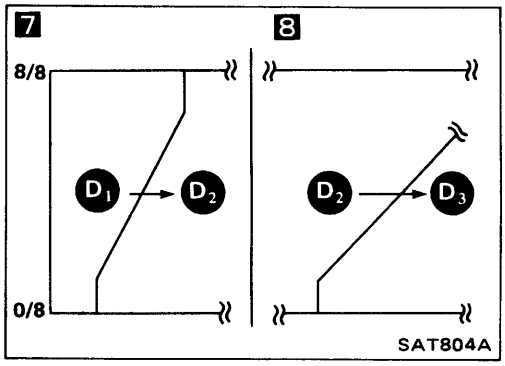


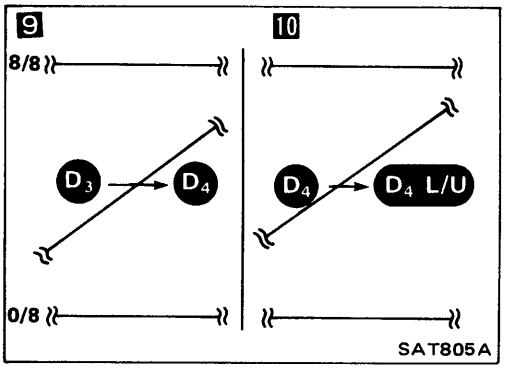
Move selector lever to "D" range.

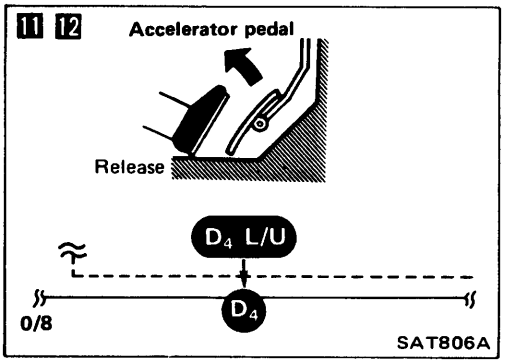
Ⓐ

Preliminary Check (Cont'd)









Ⓐ

6 Accelerate vehicle by constantly depressing accelerator pedal half-way.

Does vehicle start from D_1? — No → Go to Diagnostic Procedure 9.

Yes

7 Does A/T shift from D_1 to D_2 at the specified speed?
Specified speed when shifting from D_1 to D_2:
Refer to Shift schedule. — No → Go to Diagnostic Procedure 10.

Yes

8 Does A/T shift from D_2 to D_3 at the specified speed?
Specified speed when shifting from D_2 to D_3:
Refer to Shift schedule. — No → Go to Diagnostic Procedure 11.

Yes

9 Does A/T shift from D_3 to D_4 at the specified speed?
Specified speed when shifting from D_3 to D_4:
Refer to Shift schedule. — No → Go to Diagnostic Procedure 12.

Yes

10 Does A/T perform lock-up at the specified speed?
Specified speed when lock-up occurs:
Refer to Shift schedule. — No → Go to Diagnostic Procedure 13.

Yes

Does A/T hold lock-up condition for more than 30 seconds? — No → Go to Diagnostic Procedure 14.

Yes

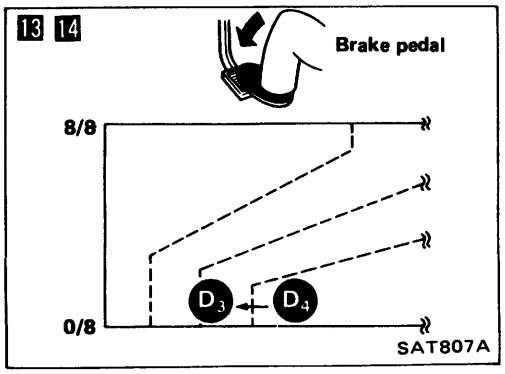
11 Release accelerator pedal.

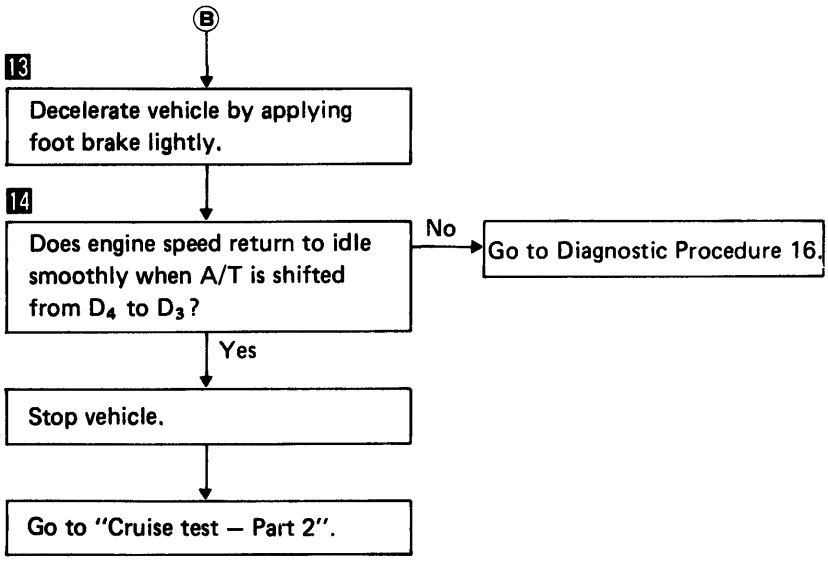
12 Is lock-up released when accelerator pedal is released? — No → Go to Diagnostic Procedure 15.

Yes

Ⓑ

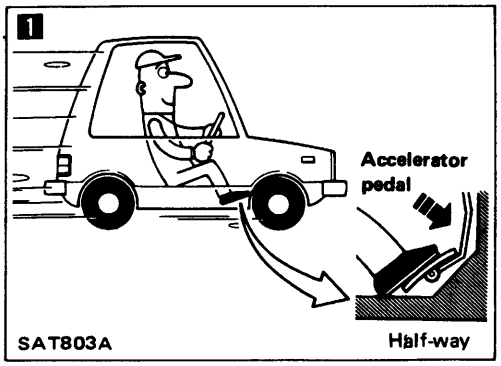
Preliminary Check (Cont'd)

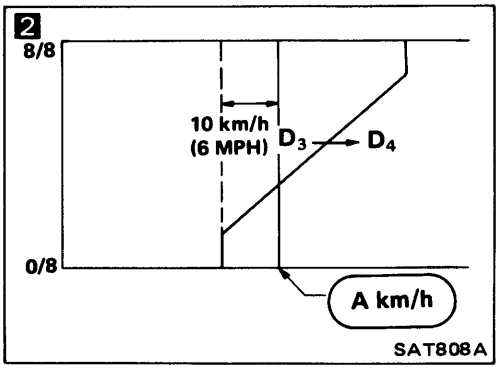


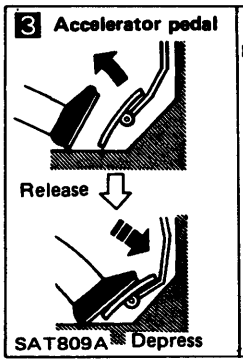


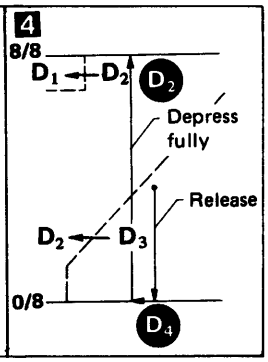
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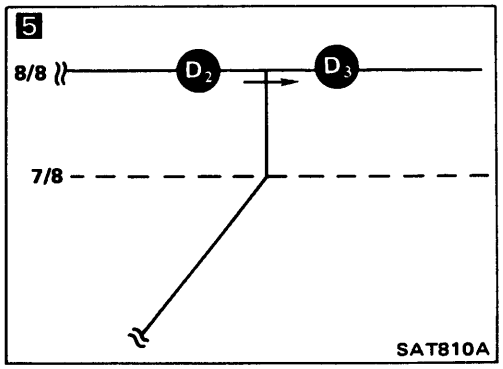
Cruise test – Part 2

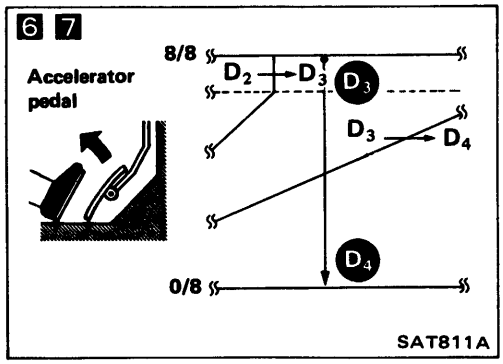












Confirm power shift switch is in "AUTO" position and overdrive switch is in "ON" position.

↓

Confirm selector lever is in "D" range.

↓

1 Accelerate vehicle by half throttle again.

↓

Does vehicle start from D_1? — No → Go to Diagnostic Procedure 17.

↓ Yes

2 Accelerate vehicle to A km/h as shown in illustration.

↓

3 Release accelerator pedal and then quickly depress it fully.

↓

4 Does A/T shift from D_4 to D_2 as soon as accelerator pedal is depressed fully? — No → Go to Diagnostic Procedure 10.

↓ Yes

5 Does A/T shift from D_2 to D_3 at the specified speed?
Specified speed when shifting from D_2 to D_3: Refer to Shift schedule. — No → Go to Diagnostic Procedure 11.

↓ Yes

6 Release accelerator pedal after shifting from D_2 to D_3.

↓

7 Does A/T shift from D_3 to D_4 and does vehicle decelerate by engine brake? — No → Go to Diagnostic Procedure 12.

↓ Yes

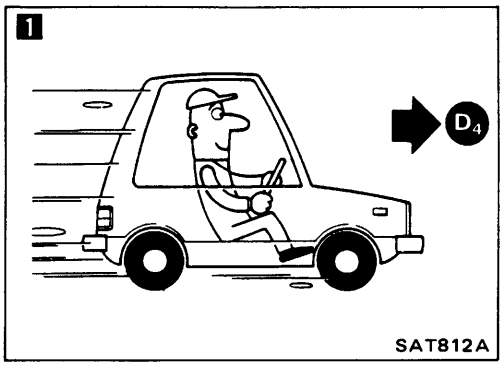
Stop vehicle.

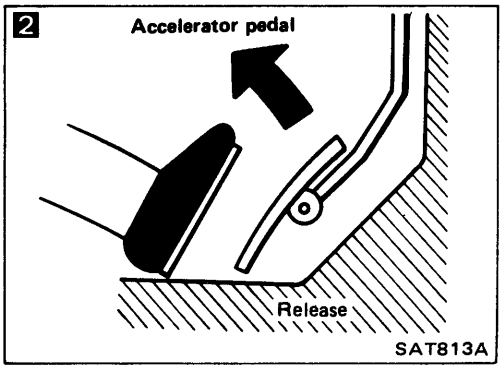
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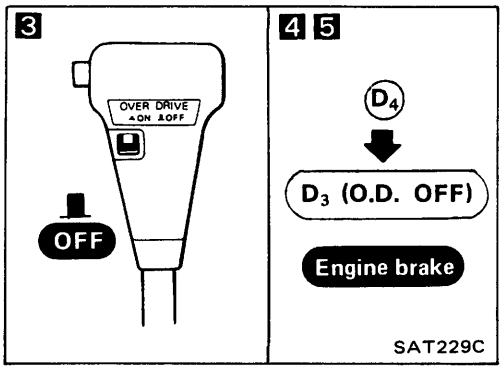
Go to "Cruise test – Part 3".

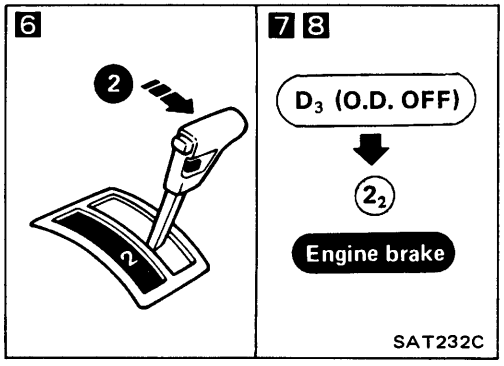
Preliminary Check (Cont'd)

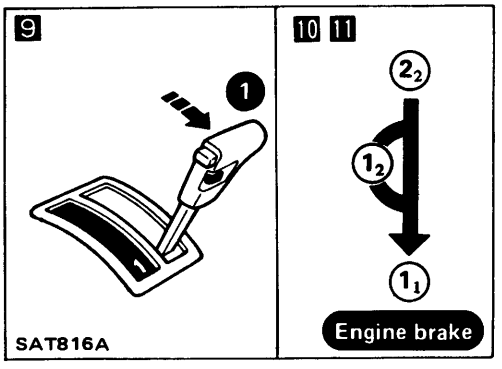
Cruise test – Part 3











Confirm power shift switch is in "AUTO" position and overdrive switch is in "ON" position.

↓

Confirm selector lever is in "D" range.

↓

1 Accelerate vehicle using half-throttle to D_4.

↓

2 Release accelerator pedal.

↓

3 Set overdrive switch to "OFF" position while driving in D_4 range.

↓

4 Does A/T shift from D_4 to D_3? — No → Go to Diagnostic Procedure 18.

↓ Yes

5 Does vehicle decelerate by engine brake? — No → Go to Diagnostic Procedure 16.

↓ Yes

6 Move selector lever from "D" to "2" range while driving in D_3.

↓ Yes

7 Does A/T shift from D_3 to 2_2? — No → Go to Diagnostic Procedure 19.

↓ Yes

8 Does vehicle decelerate by engine brake? — No → Go to Diagnostic Procedure 16.

↓ Yes

9 Move selector lever from "2" to "1" range while driving in 2_2.

↓

10 Does A/T shift from 2_2 to 1_1 range? — No → Go to Diagnostic Procedure 20.

↓ Yes

11 Does vehicle decelerate by engine brake? — No → Go to Diagnostic Procedure 21.

↓ Yes

Stop vehicle.

↓

Perform self-diagnosis. – Refer to SELF-DIAGNOSTIC PROCEDURE.

Preliminary Check (Cont'd)

Vehicle speed when shifting gears

VG30E engine 4WD (Final gear ratio: 4.375)

Throttle position	Vehicle speed km/h (MPH)						
	$D_1 \rightarrow D_2$	$D_2 \rightarrow D_3$	$D_3 \rightarrow D_4$	$D_4 \rightarrow D_3$	$D_3 \rightarrow D_2$	$D_2 \rightarrow D_1$	$1_2 \rightarrow 1_1$
Full throttle	53 - 57 (33 - 35)	99 - 107 (62 - 66)	162 - 172 (101 - 107)	157 - 167 (98 - 104)	92 - 100 (57 - 62)	38 - 42 (24 - 26)	38 - 42 (24 - 26)
Half throttle	32 - 36 (20 - 22)	63 - 71 (39 - 44)	100 - 108 (62 - 67)	63 - 71 (39 - 44)	28 - 36 (17 - 22)	10 - 14 (6 - 9)	38 - 42 (24 - 26)

VG30E engine 4WD (Final gear ratio: 4.625)

Throttle position	Vehicle speed km/h (MPH)						
	$D_1 \rightarrow D_2$	$D_2 \rightarrow D_3$	$D_3 \rightarrow D_4$	$D_4 \rightarrow D_3$	$D_3 \rightarrow D_2$	$D_2 \rightarrow D_1$	$1_2 \rightarrow 1_1$
Full throttle	50 - 54 (31 - 34)	93 - 101 (58 - 63)	150 - 160 (93 - 99)	145 - 155 (90 - 96)	86 - 94 (53 - 58)	38 - 42 (24 - 26)	38 - 42 (24 - 26)
Half throttle	30 - 34 (19 - 21)	59 - 67 (37 - 42)	97 - 107 (60 - 66)	59 - 69 (37 - 43)	32 - 40 (20 - 25)	10 - 14 (6 - 9)	38 - 42 (24 - 26)

VG30E engine 2WD

Throttle position	Vehicle speed km/h (MPH)						
	$D_1 \rightarrow D_2$	$D_2 \rightarrow D_3$	$D_3 \rightarrow D_4$	$D_4 \rightarrow D_3$	$D_3 \rightarrow D_2$	$D_2 \rightarrow D_1$	$1_2 \rightarrow 1_1$
Full throttle	48 - 52 (30 - 32)	104 - 112 (65 - 70)	159 - 169 (99 - 105)	154 - 164 (96 - 102)	91 - 99 (57 - 62)	44 - 48 (27 - 30)	38 - 42 (24 - 26)
Half throttle	33 - 37 (21 - 23)	66 - 74 (41 - 46)	104 - 114 (65 - 71)	62 - 72 (39 - 45)	28 - 36 (17 - 22)	10 - 14 (6 - 9)	38 - 42 (24 - 26)

Preliminary Check (Cont'd)

Vehicle speed when performing and releasing lock-up

VG30E engine 4WD (Final gear ratio: 4.375)

Throttle position	O.D. switch [Shift range]	Vehicle speed km/h (MPH)	
		Lock-up "ON"	Lock-up "OFF"
Full throttle	ON [D_4]	162 - 172 (101 - 107)	157 - 167 (98 - 104)
	OFF [D_3]	99 - 107 (62 - 66)	92 - 100 (57 - 62)
Half throttle	ON [D_4]	100 - 108 (62 - 67)	83 - 91 (52 - 57)
	OFF [D_3]	76 - 84 (47 - 52)	71 - 79 (44 - 49)

VG30E engine 4WD (Final gear ratio: 4.625)

Throttle position	O.D. switch [Shift range]	Vehicle speed km/h (MPH)	
		Lock-up "ON"	Lock-up "OFF"
Full throttle	ON [D_4]	150 - 160 (93 - 99)	145 - 155 (90 - 96)
	OFF [D_3]	93 - 101 (58 - 63)	86 - 94 (53 - 58)
Half throttle	ON [D_4]	97 - 107 (60 - 66)	83 - 91 (52 - 57)
	OFF [D_3]	76 - 84 (47 - 52)	71 - 79 (44 - 49)

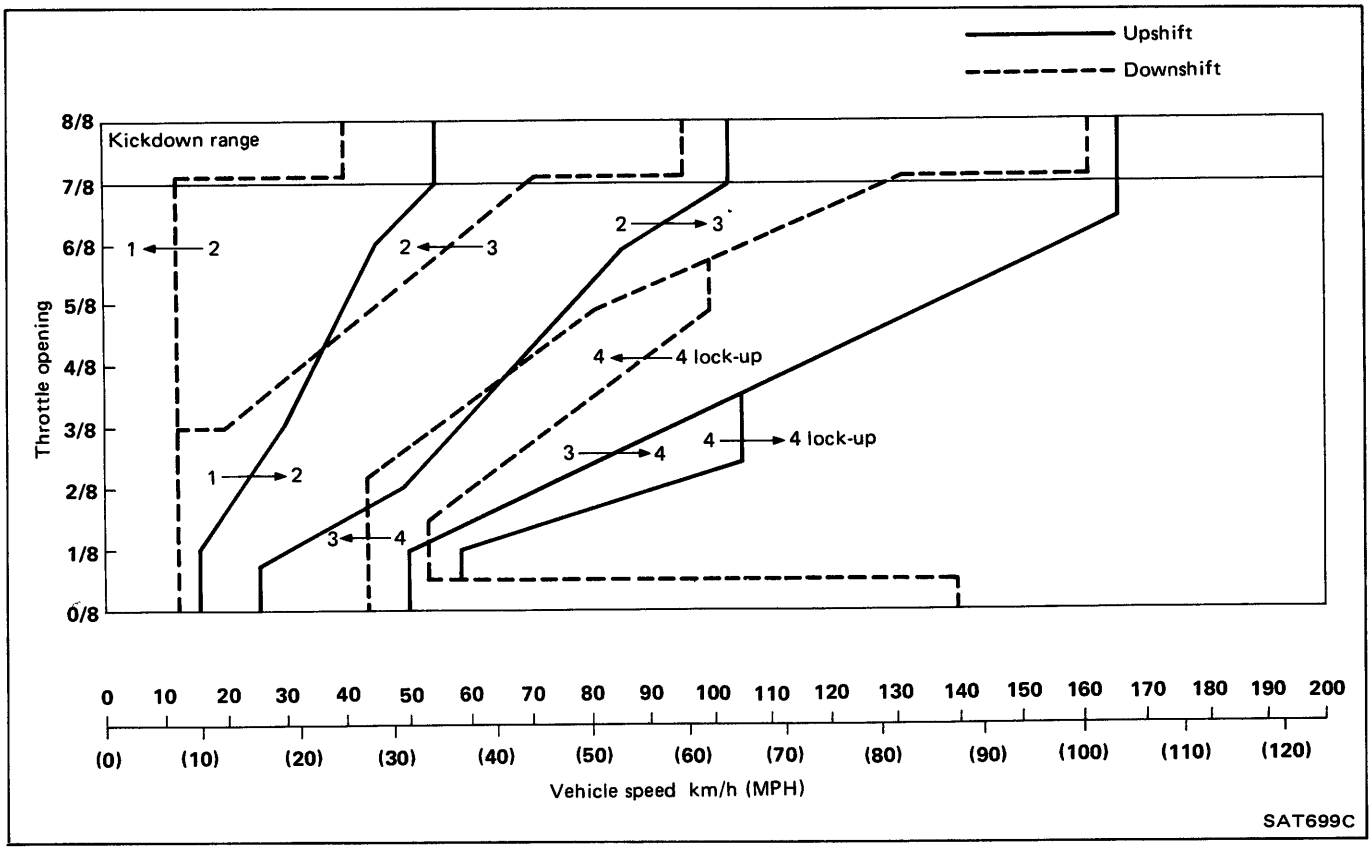
VG30E engine 2WD

Throttle position	O.D. switch [Shift range]	Vehicle speed km/h (MPH)	
		Lock-up "ON"	Lock-up "OFF"
Full throttle	ON [D_4]	159 - 169 (99 - 105)	154 - 164 (96 - 102)
	OFF [D_3]	104 - 112 (65 - 70)	91 - 99 (57 - 62)
Half throttle	ON [D_4]	104 - 112 (65 - 70)	82 - 90 (51 - 56)
	OFF [D_3]	76 - 84 (47 - 52)	71 - 79 (44 - 49)

Preliminary Check (Cont'd)

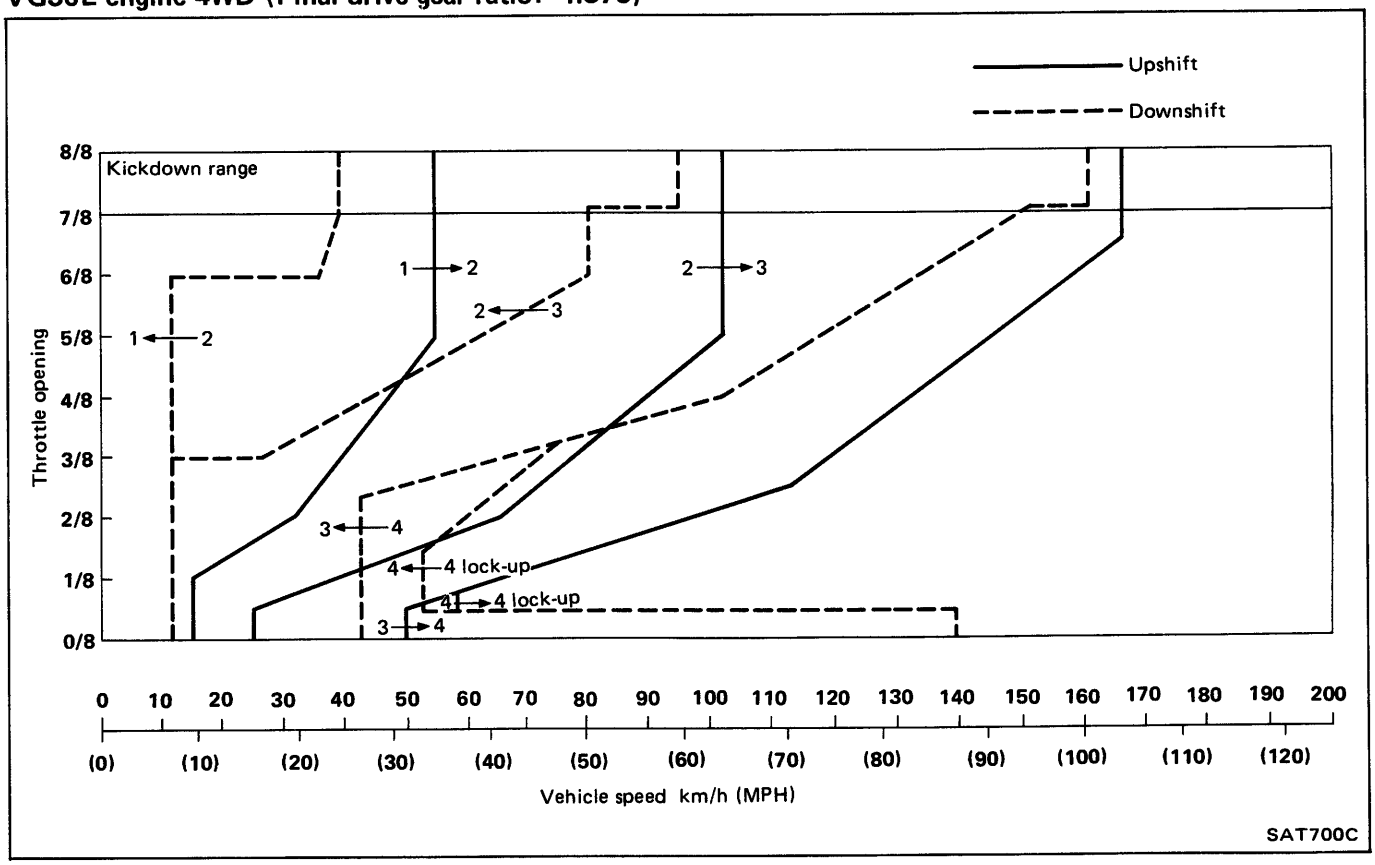
Shift schedule (Standard pattern: O.D. ON)

VG30E engine 4WD (Final drive gear ratio: 4.375)



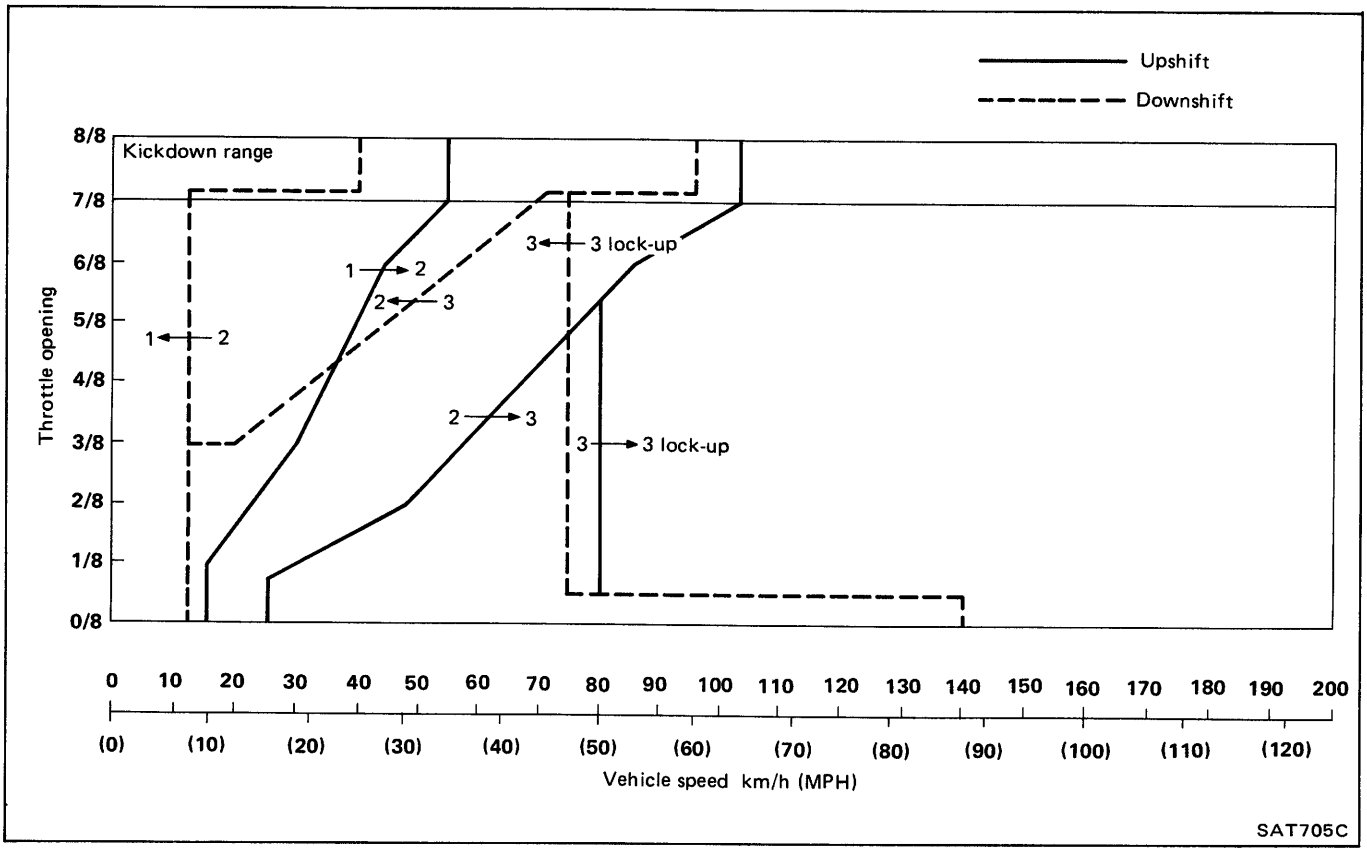
Shift schedule (Power pattern: O.D. ON)

VG30E engine 4WD (Final drive gear ratio: 4.375)

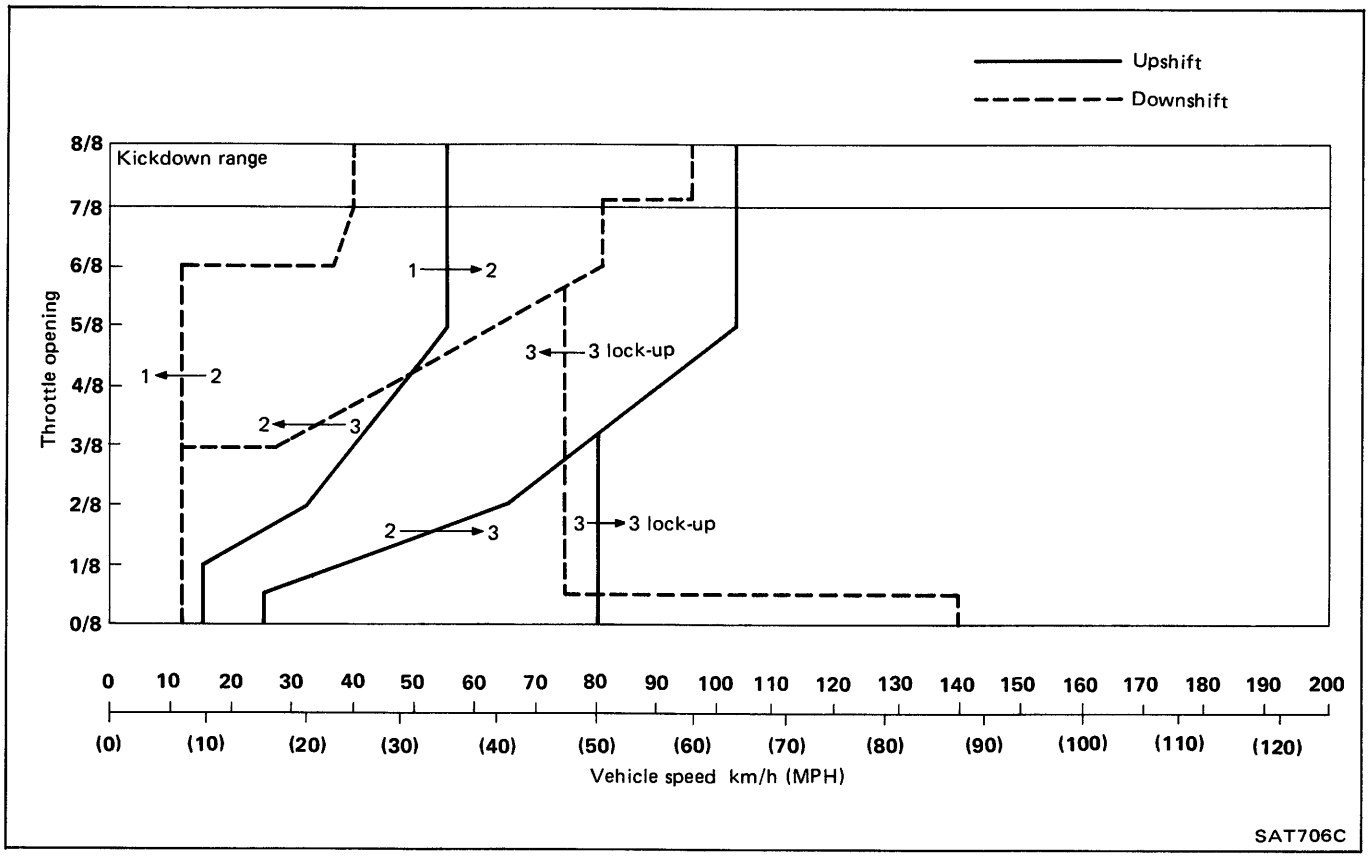


Preliminary Check (Cont'd)

Shift schedule (Standard pattern: O.D. OFF)
VG30E engine 4WD (Final drive gear ratio: 4.375)

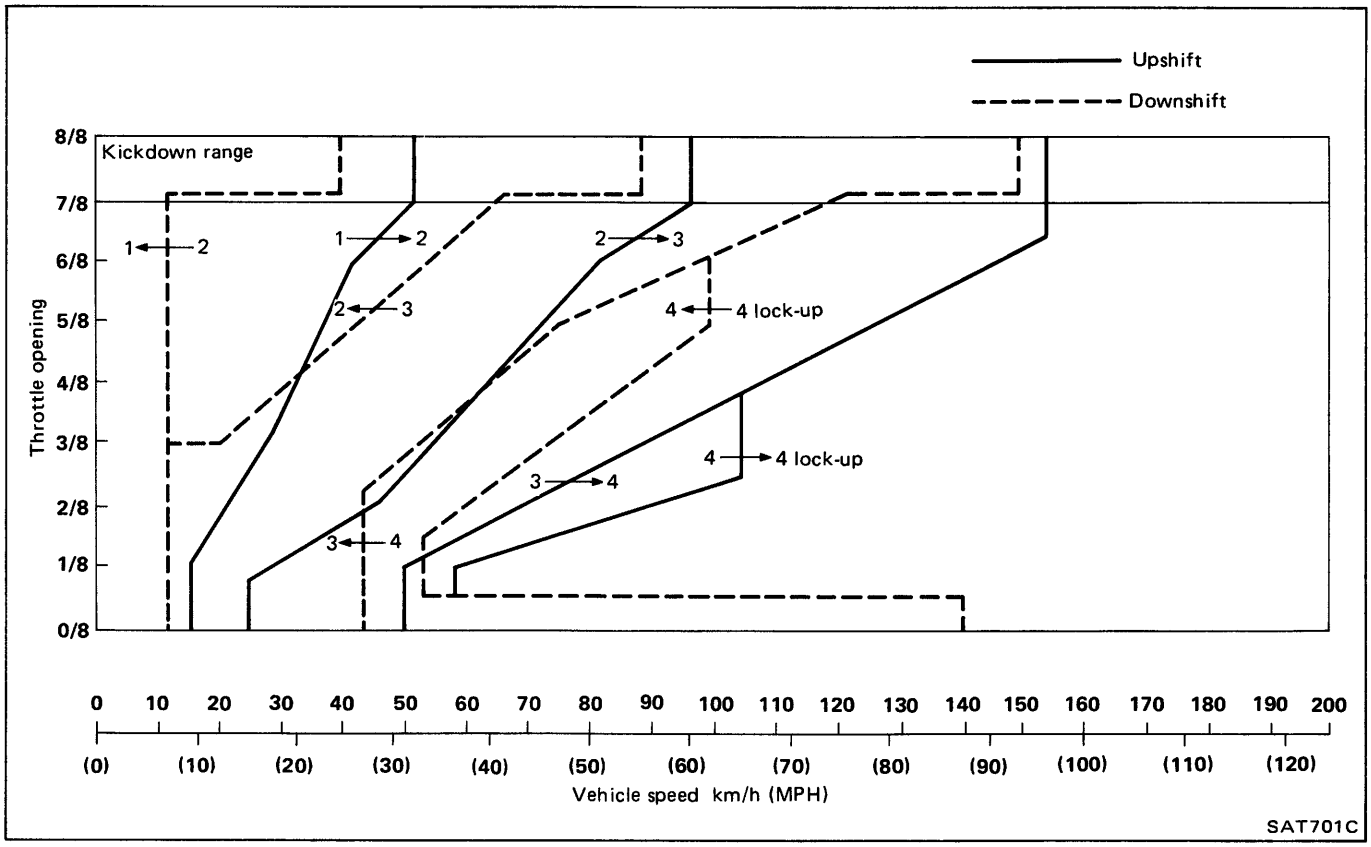


Shift schedule (Power pattern: O.D. OFF)
VG30E engine 4WD (Final drive gear ratio: 4.375)

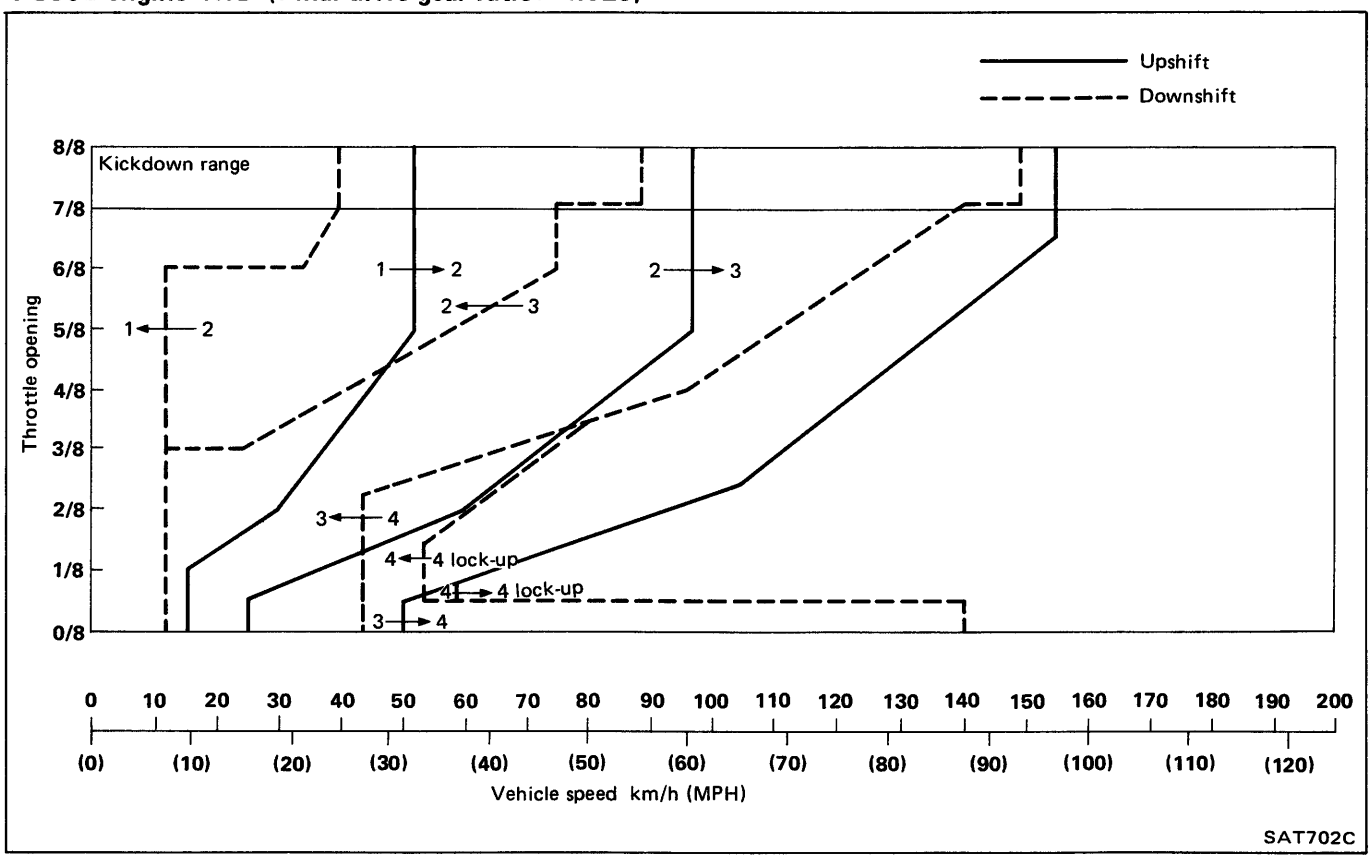


Preliminary Check (Cont'd)

Shift schedule (Standard pattern: O.D. ON)
VG30E engine 4WD (Final drive gear ratio: 4.625)



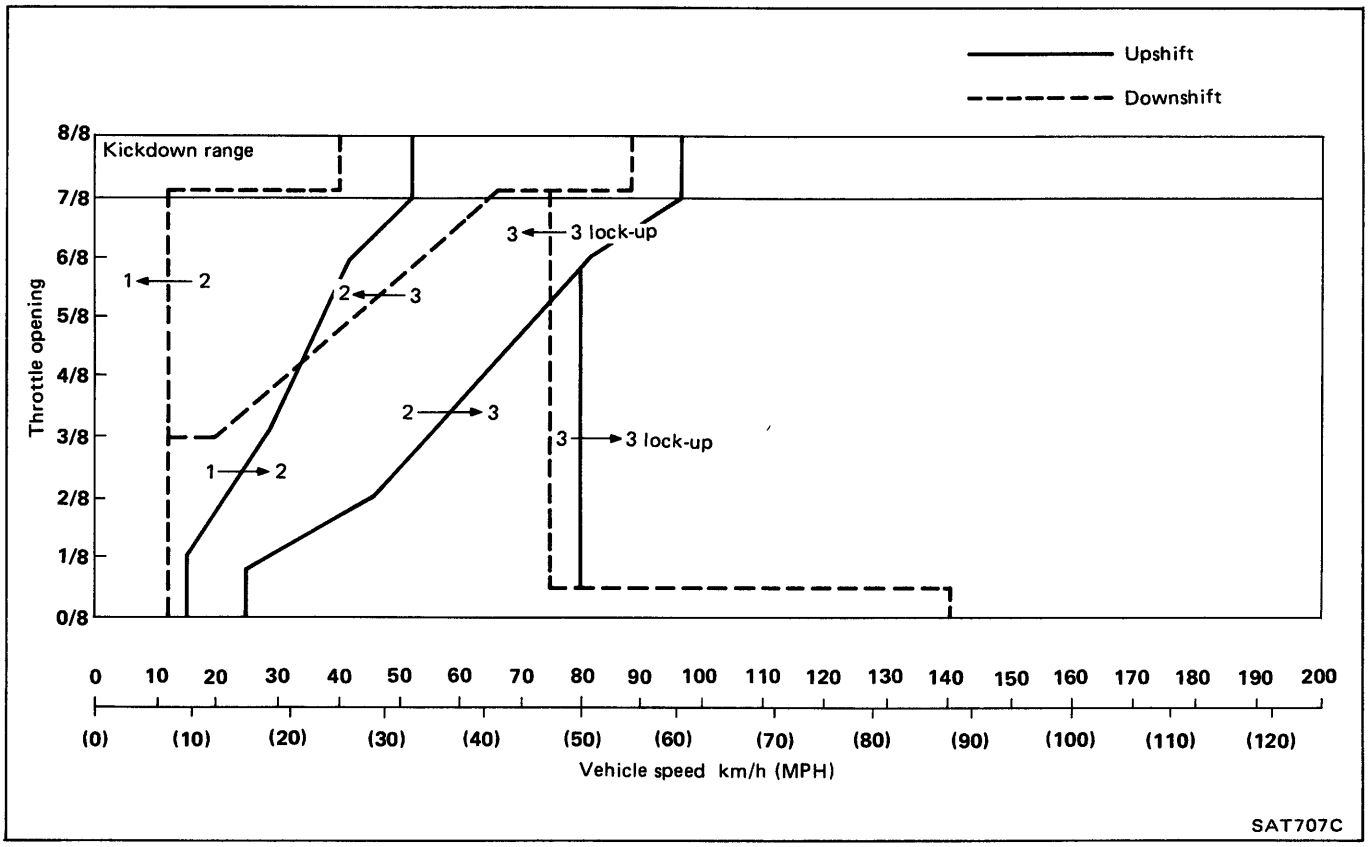
Shift schedule (Power pattern: O.D. ON)
VG30E engine 4WD (Final drive gear ratio: 4.625)



Preliminary Check (Cont'd)

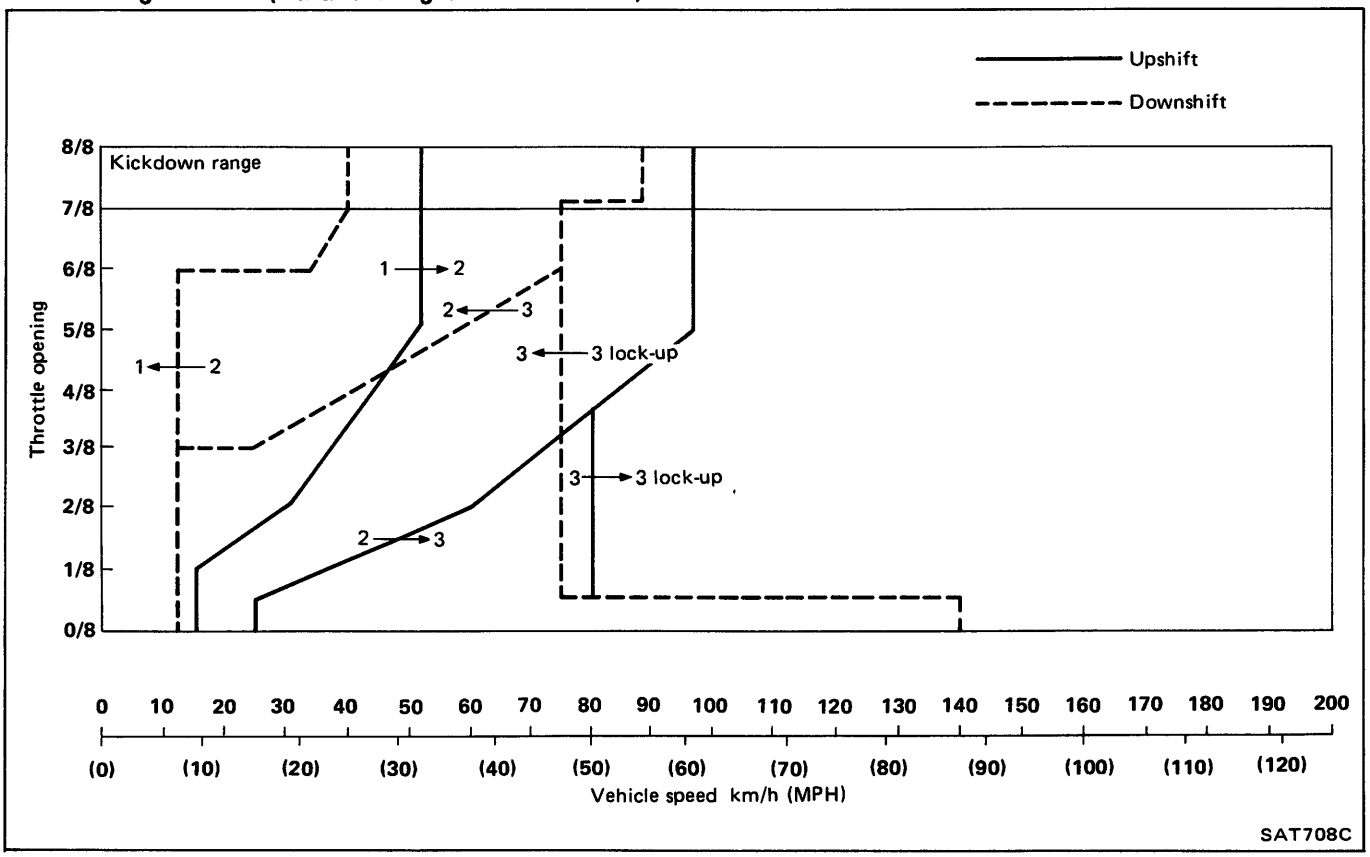
Shift schedule (Standard pattern: O.D. OFF)

VG30E engine 4WD (Final drive gear ratio: 4.625)



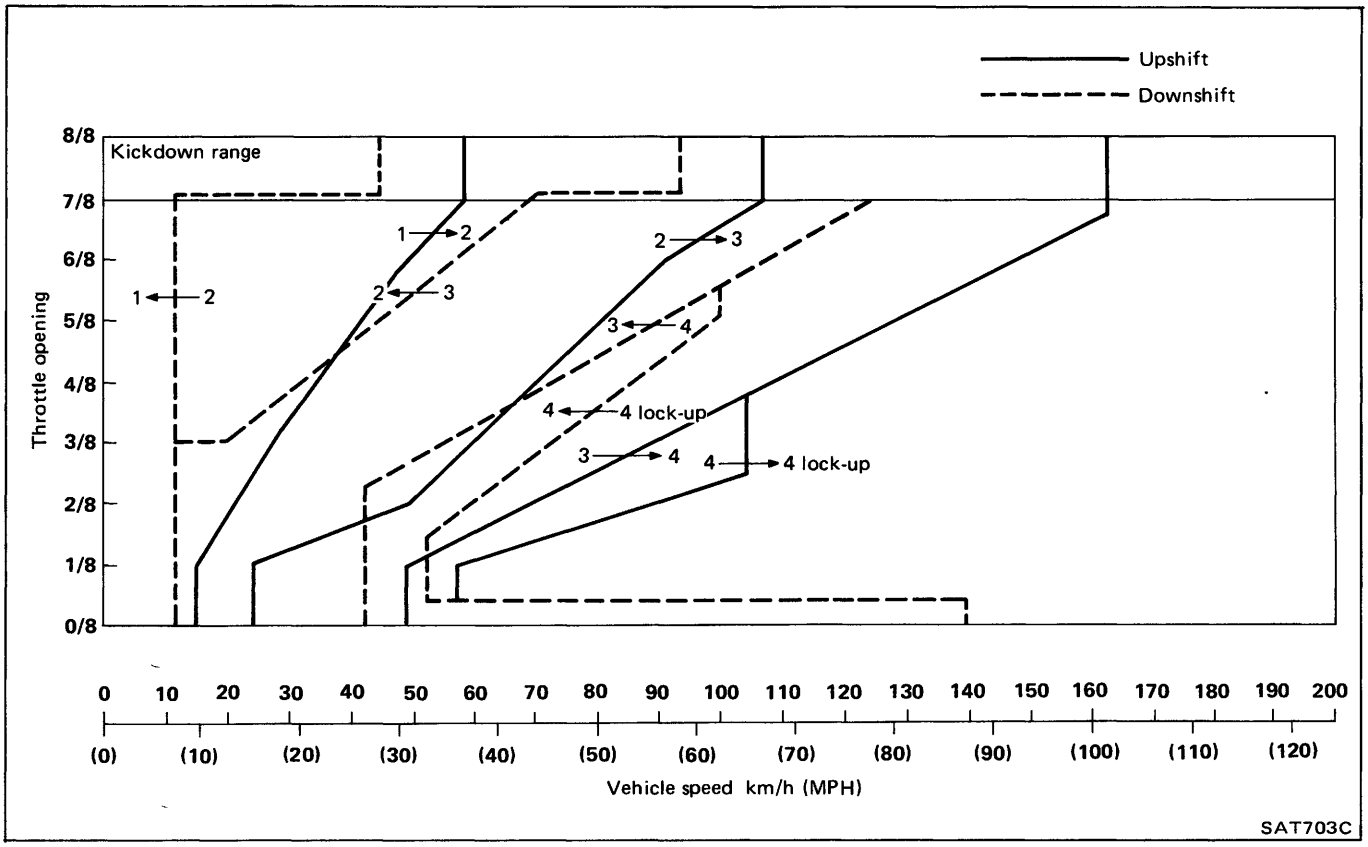
Shift schedule (Power pattern: O.D. OFF)

VG30E engine 4WD (Final drive gear ratio: 4.625)

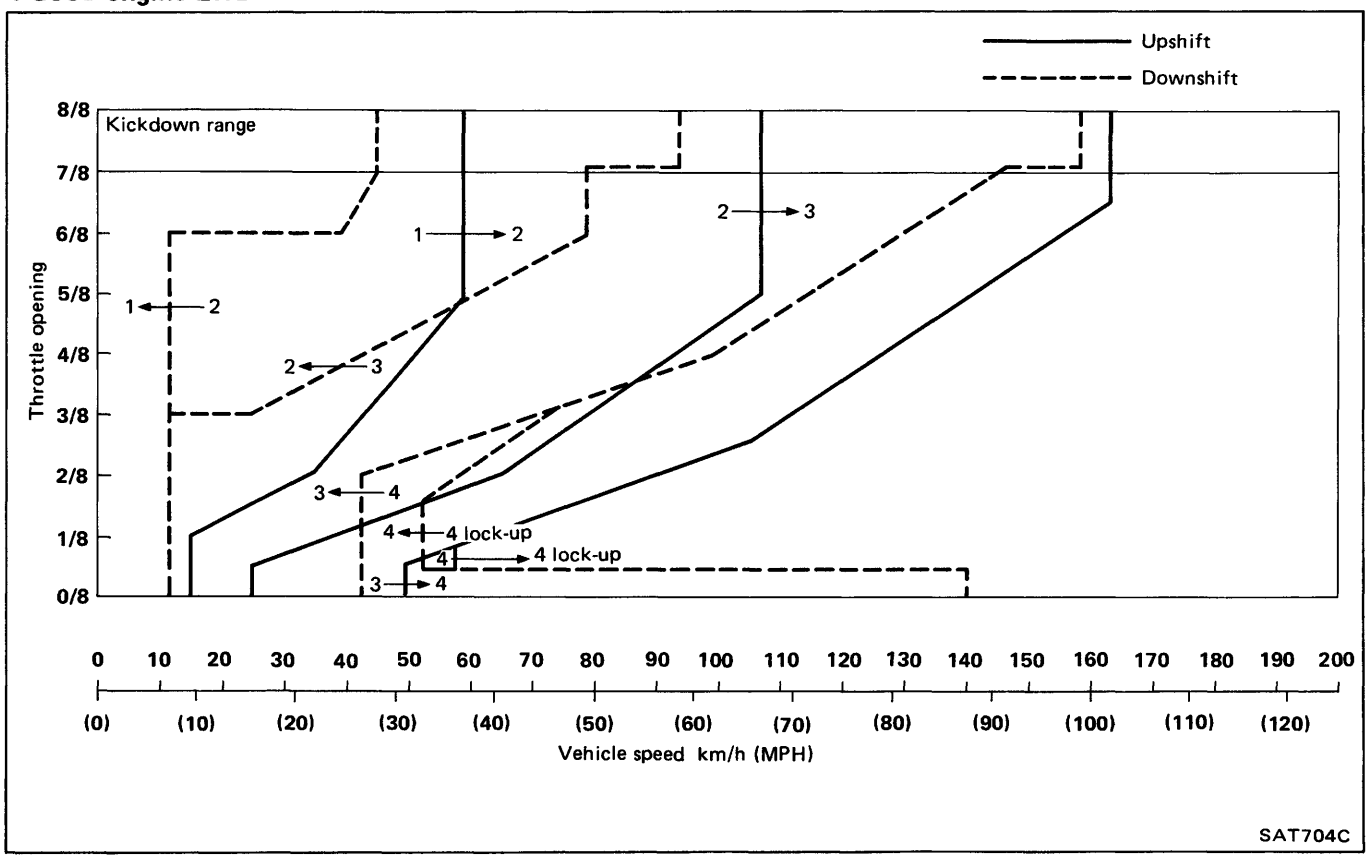


Preliminary Check (Cont'd)

Shift schedule (Standard pattern: O.D. ON)
VG30E engine 2WD

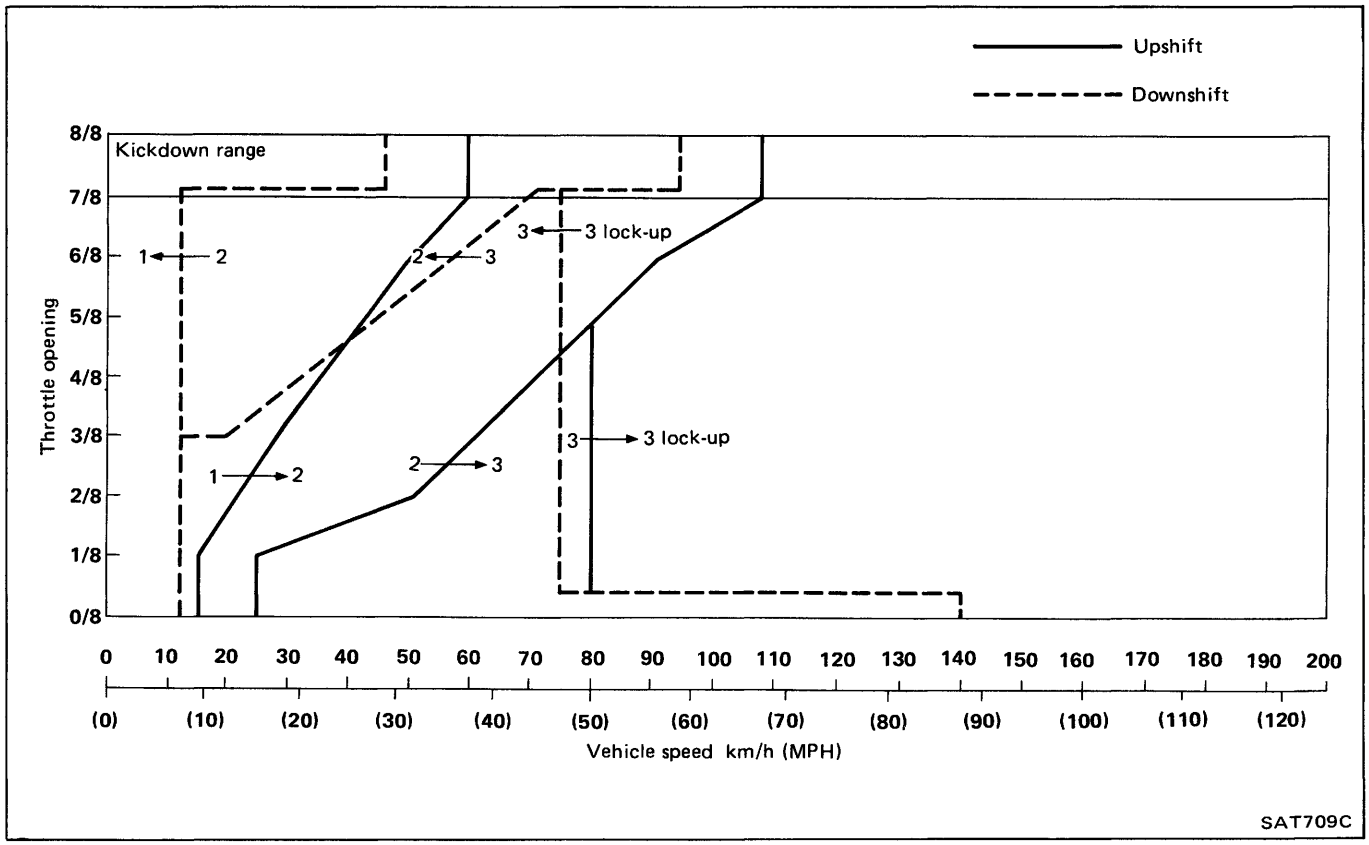


Shift schedule (Power pattern: O.D. ON)
VG30E engine 2WD

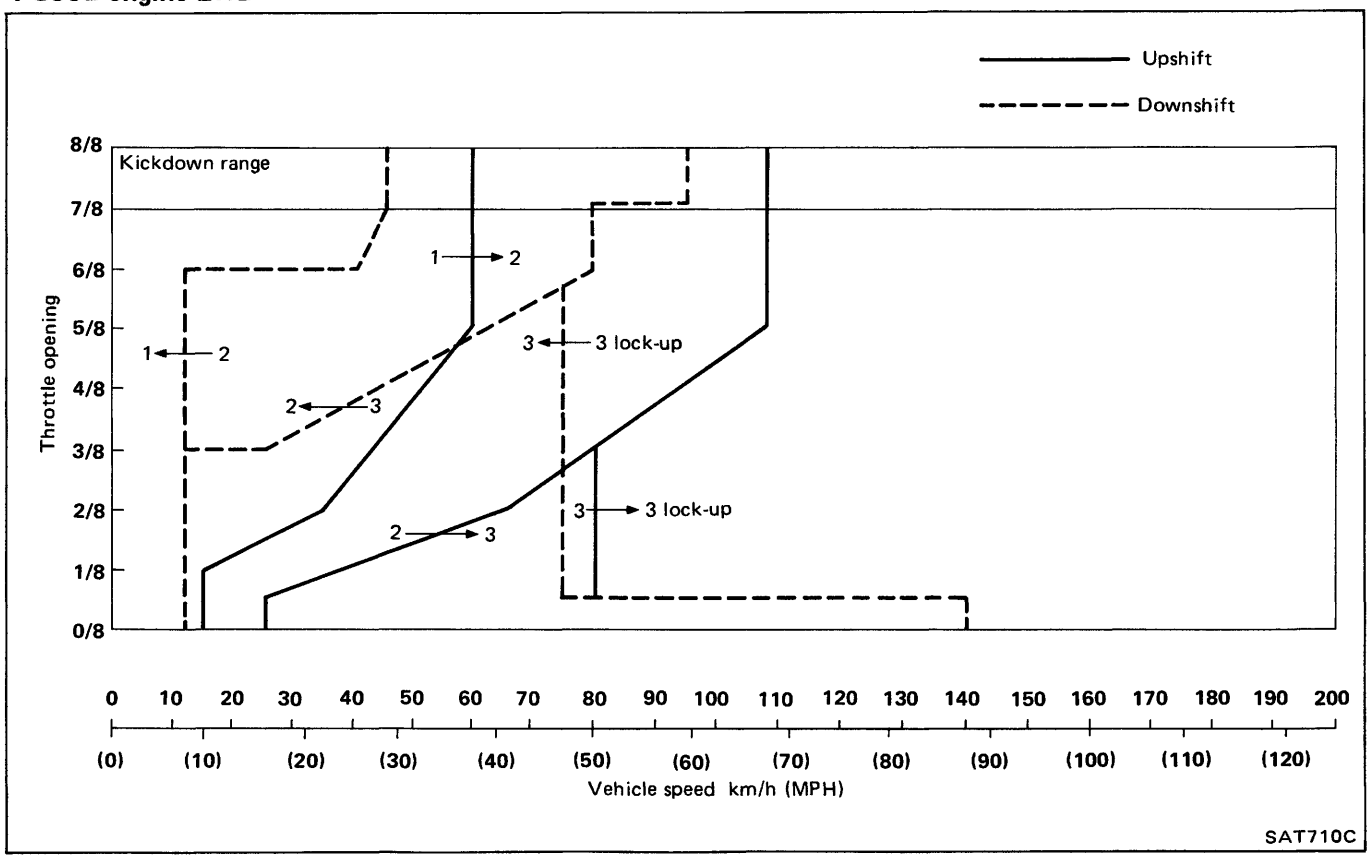


Preliminary Check (Cont'd)

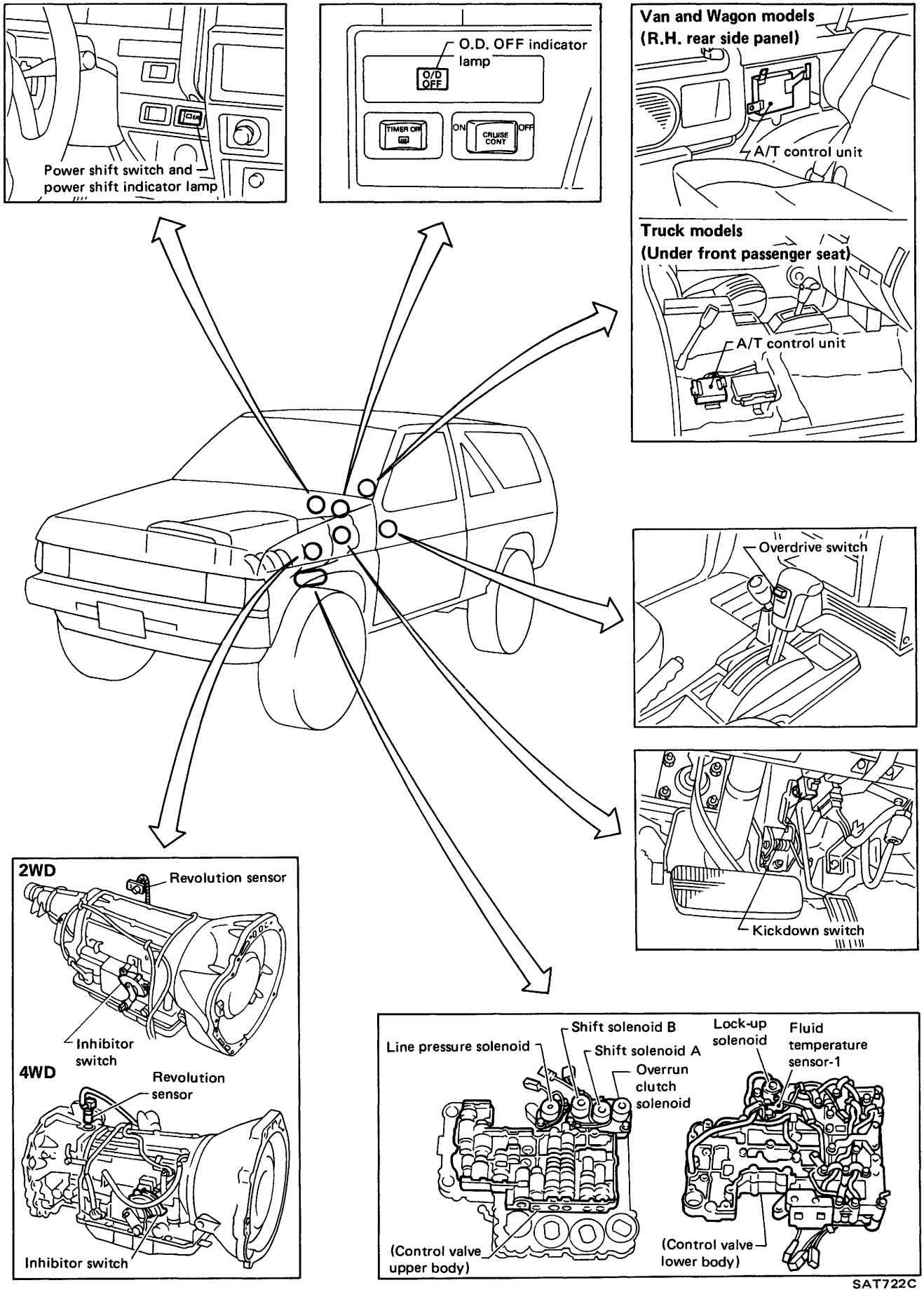
Shift schedule (Standard pattern: O.D. OFF)
VG30E engine 2WD



Shift schedule (Power pattern: O.D. OFF)
VG30E engine 2WD

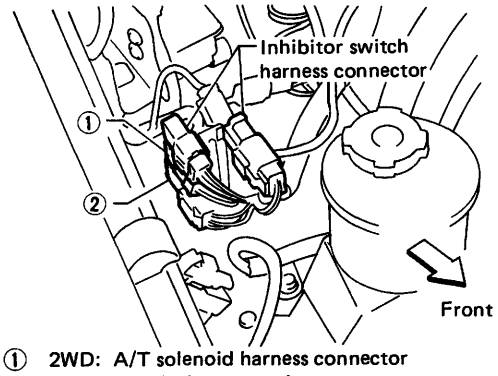


A/T Electrical Parts Location

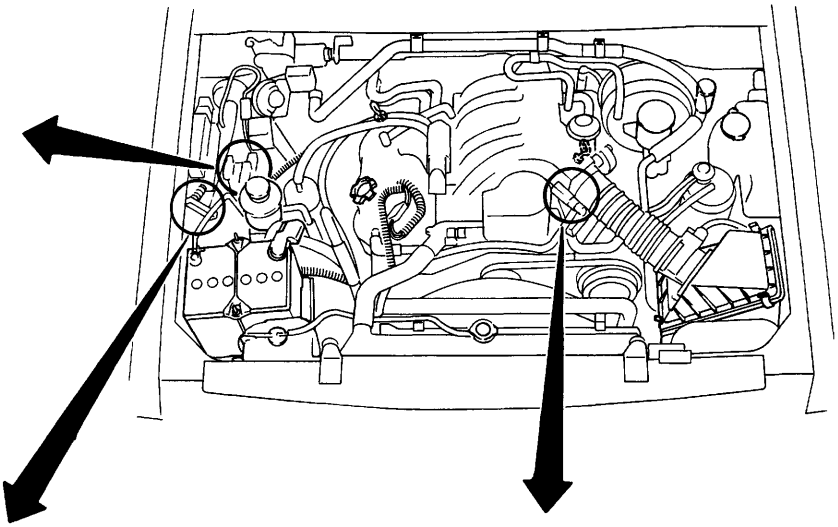


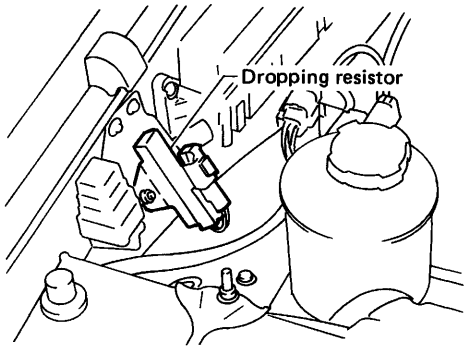
SAT722C

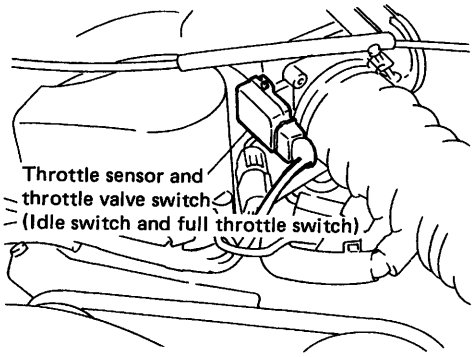
A/T Electrical Parts Location (Cont'd)



① 2WD: A/T solenoid harness connector
4WD: Revolution sensor harness connector
② 2WD: Revolution sensor harness connector
4WD: A/T solenoid harness connector

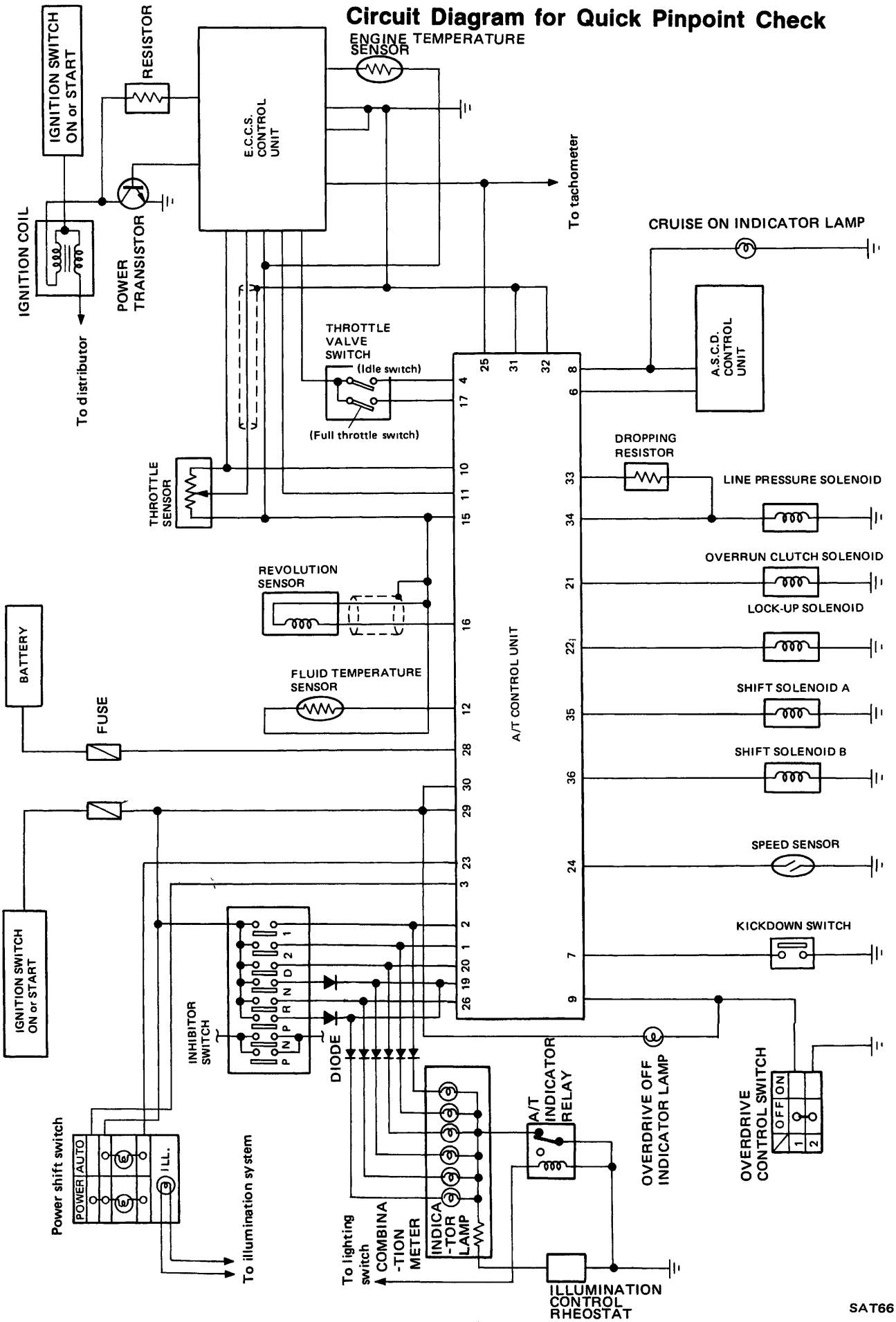






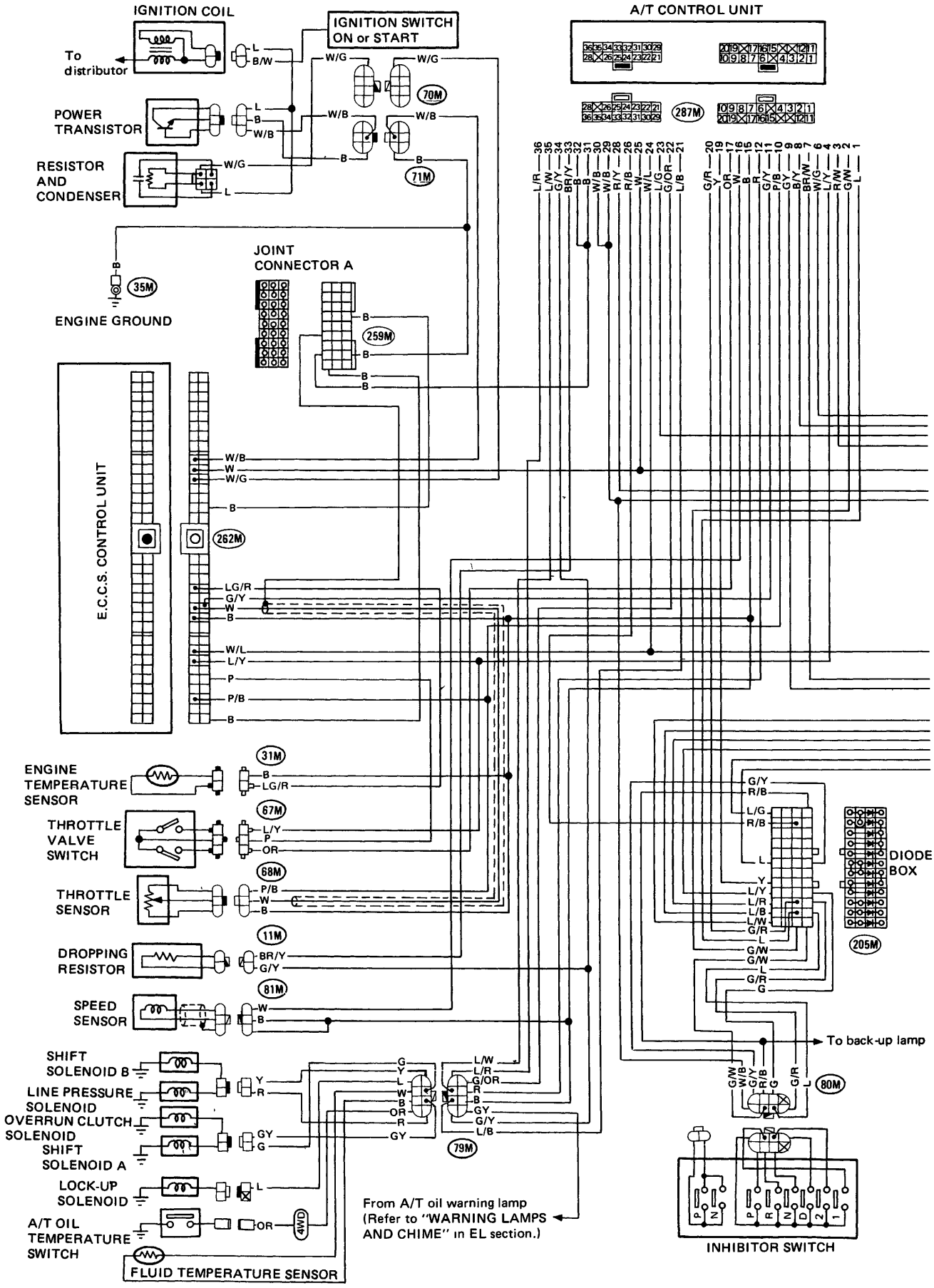
SAT721C

Circuit Diagram for Quick Pinpoint Check

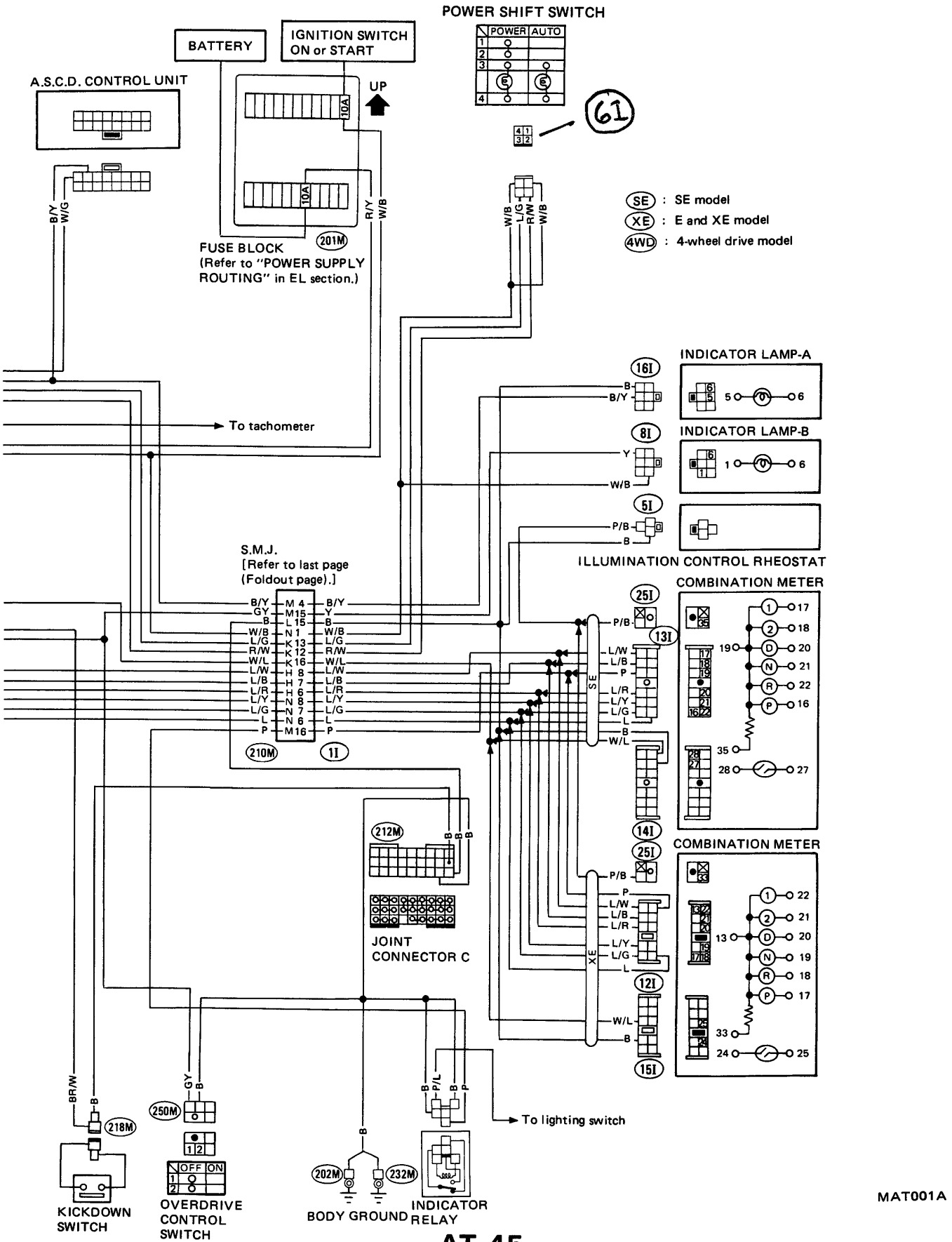


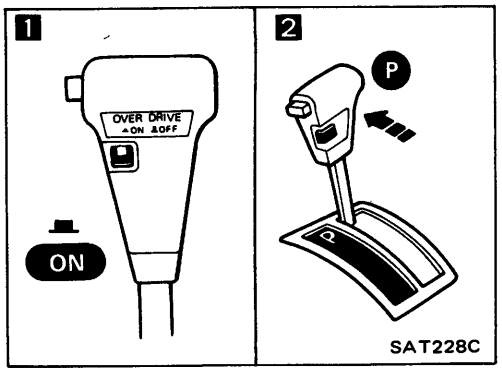
SAT661C

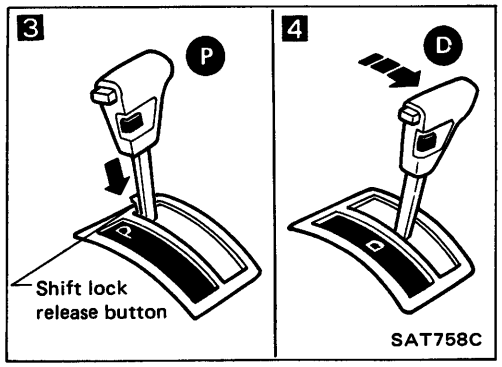
Wiring Diagram

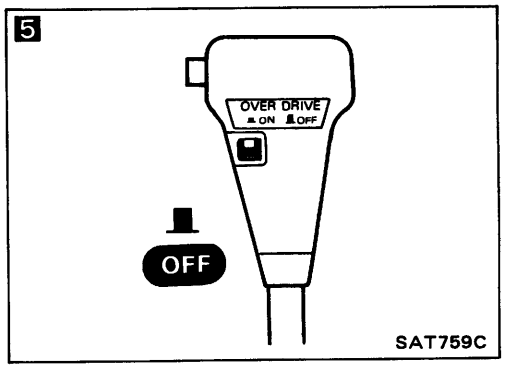


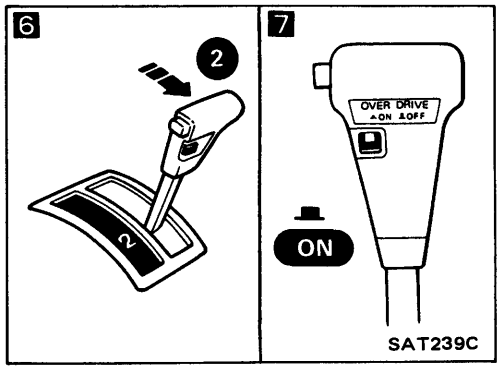
Wiring Diagram (Cont'd)

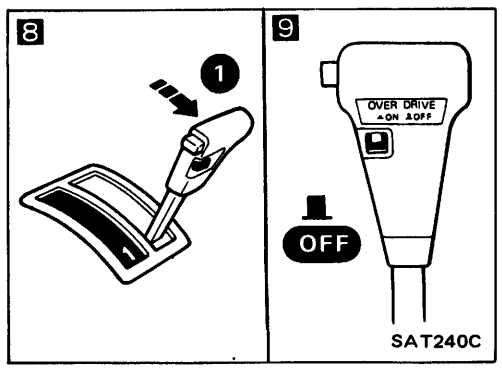












Self-diagnosis

SELF-DIAGNOSTIC PROCEDURE

DIAGNOSIS START

Start engine and warm it up to normal engine operating temperature.



Set power shift switch to "AUTO" position.

1 Set overdrive switch to "ON" position.

2 Move selector lever to "P" range.



Does power shift indicator lamp come on for about 2 seconds?

Yes

No → Go to Diagnostic Procedure 1.



3 Push shift lock release button.

4 Move selector lever to "D" range.

5 Set overdirve switch to "OFF" position.



Wait for more than 2 seconds after ignition switch "ON".

6 Move selector lever to "2" range.

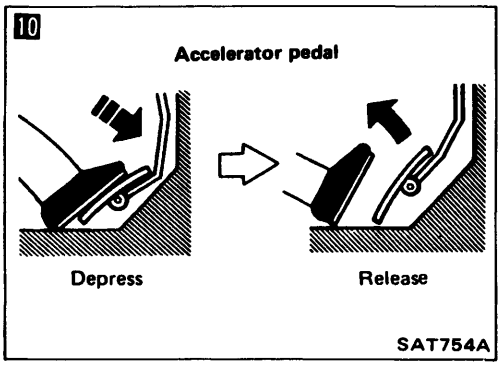
7 Set overdrive switch to "ON" position.

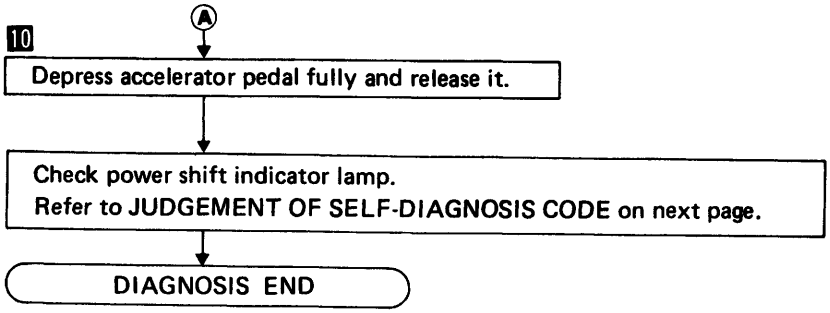
8 Move selector lever to "1" range.

9 Set overdrive switch to "OFF" position.

Ⓐ

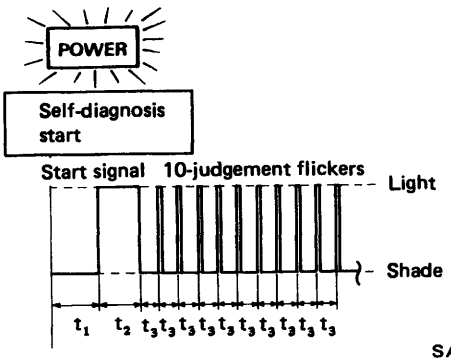
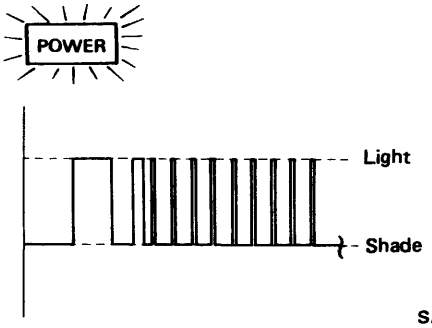
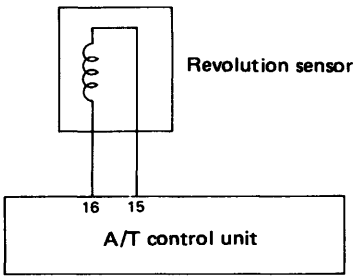
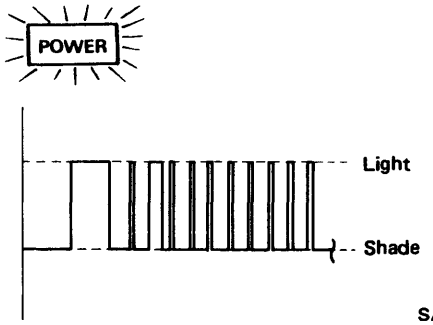
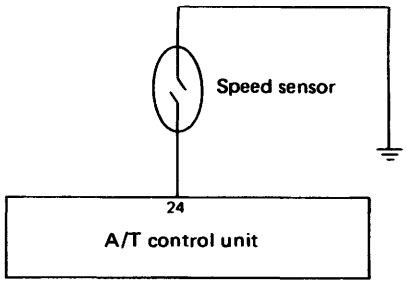
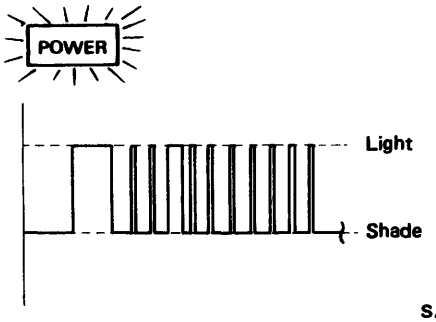
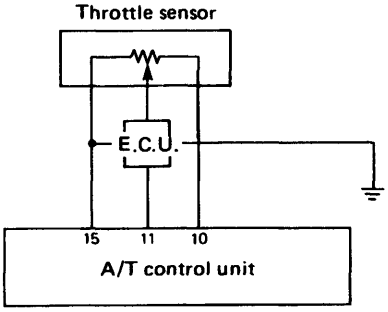
Self-diagnosis (Cont'd)





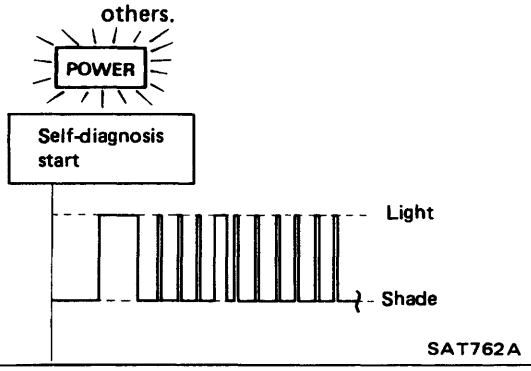
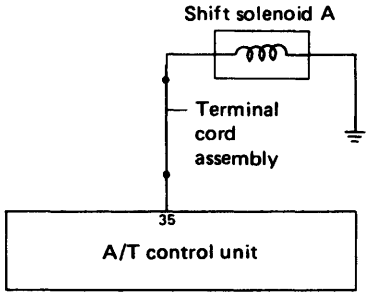
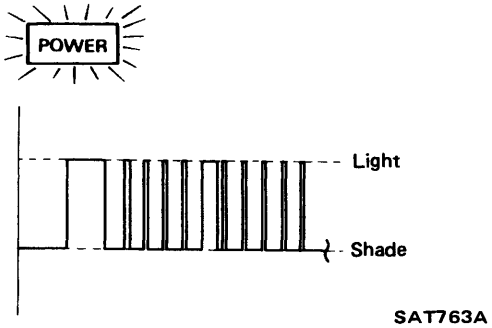
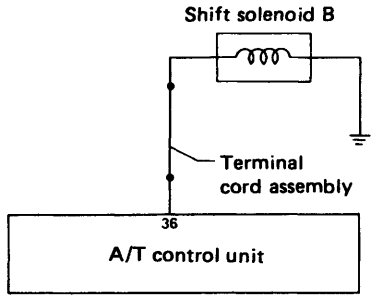
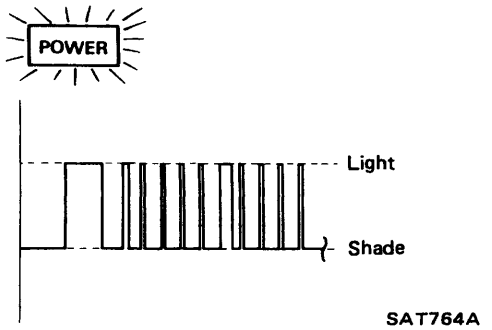
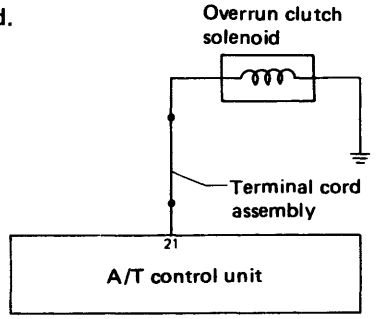
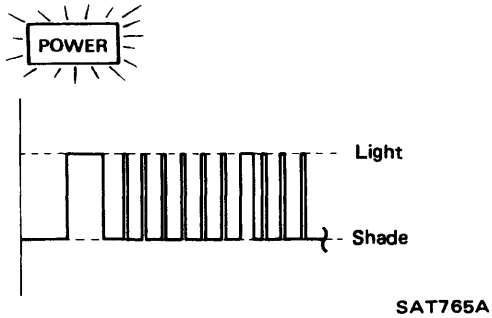
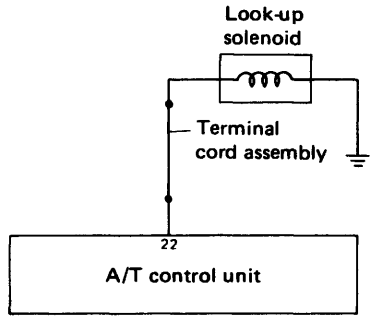
Self-diagnosis (Cont'd)

JUDGEMENT OF SELF-DIAGNOSIS CODE

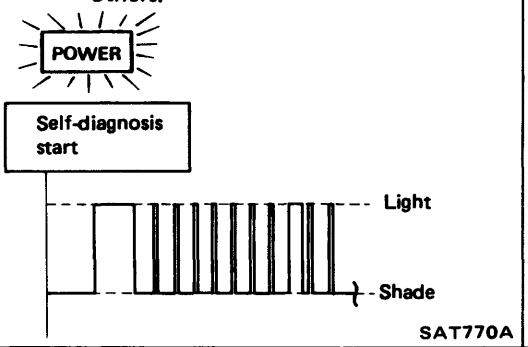
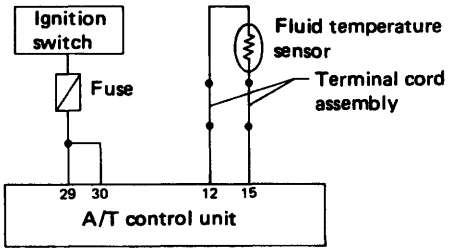
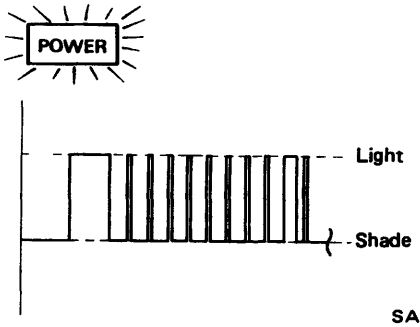
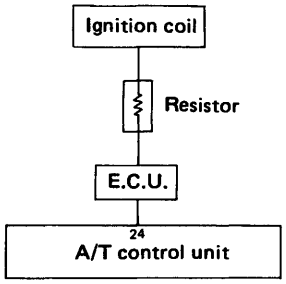
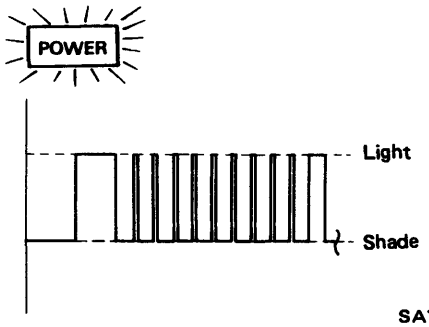
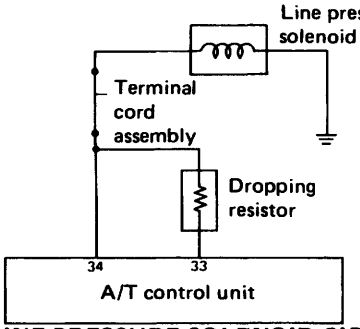
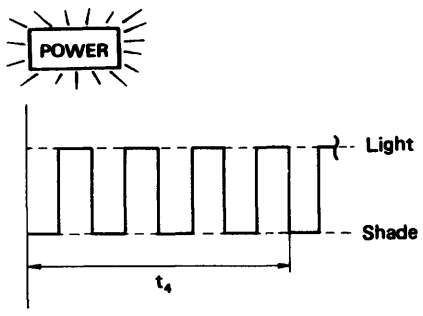
Power shift indicator lamp:	Damaged circuit
All judgement flickers are same.  SAT755A	All circuits that can be confirmed by self-diagnosis are O.K.
1st judgement flicker is longer than others.  SAT756A	Revolution sensor circuit is short-circuited or disconnected.  ➡ **Go to REVOLUTION SENSOR CIRCUIT CHECK.** SAT140B
2nd judgement flicker is longer than others.  SAT757A	Speed sensor circuit is short-circuited or disconnected.  ➡ **Go to SPEED SENSOR CIRCUIT CHECK.** SAT760A
3rd judgement flicker is longer than others.  SAT758A	Throttle sensor circuit is short-circuited or disconnected.  ➡ **Go to THROTTLE SENSOR CIRCUIT CHECK** SAT243C

t_1 = 2.5 seconds t_2 = 2.0 seconds t_3 = 1.0 second

Self-diagnosis (Cont'd)

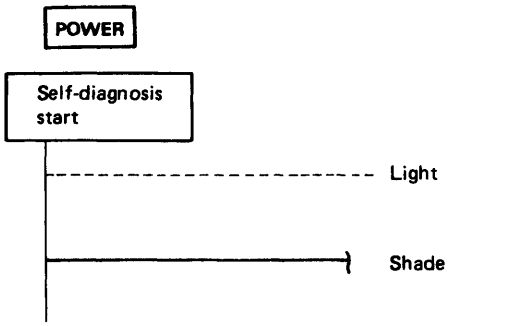
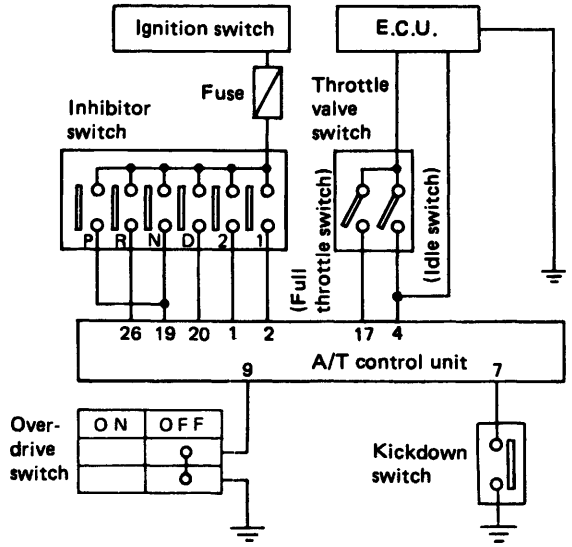
Power shift indicator lamp:	Damaged circuit
4th judgement flicker is longer than others. 	Shift solenoid A circuit is short-circuited or disconnected.  ➡ Go to SHIFT SOLENOID A CIRCUIT CHECK. SAT766A
5th judgement flicker is longer than others. 	Shift solenoid B circuit is short-circuited or disconnected.  ➡ Go to SHIFT SOLENOID B CIRCUIT CHECK. SAT767A
6th judgement flicker is longer than others. 	Overrun clutch solenoid circuit is short-circuited or disconnected.  ➡ Go to OVERRUN CLUTCH SOLENOID CIRCUIT CHECK. SAT768A
7th judgement flicker is longer than others. 	Lock-up solenoid circuit is short-circuited or disconnected.  ➡ Go to LOCK-UP SOLENOID CIRCUIT CHECK. SAT769A

Self-diagnosis (Cont'd)

Power shift indicator lamp:	Damaged circuit
8th judgement flicker is longer than others. 	Fluid temperature sensor is disconnected or A/T control unit power source circuit is damaged.  ➡ **Go to FLUID TEMPERATURE SENSOR CIRCUIT AND A/T CONTROL UNIT POWER SOURCE CIRCUIT CHECK.** SAT143B
9th judgement flicker is longer than others. 	Engine revolution signal circuit is short-circuited or disconnected.  ➡ **Go to ENGINE REVOLUTION SIGNAL CIRCUIT CHECK.** SAT413C
10th judgement flicker is longer than others. 	Line pressure solenoid circuit is short-circuited or disconnected.  ➡ **Go to LINE PRESSURE SOLENOID CIRCUIT CHECK.** SAT776A
Flickers as shown below. 	Battery power is low. Battery has been disconnected for a long time. Battery is connected conversely. (When reconnecting A/T control unit connectors. – This is not a problem.)

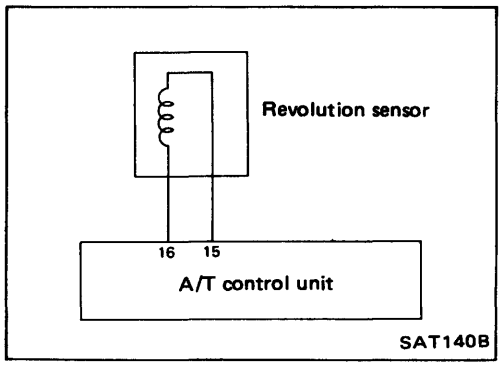
t_4 = 1.0 second

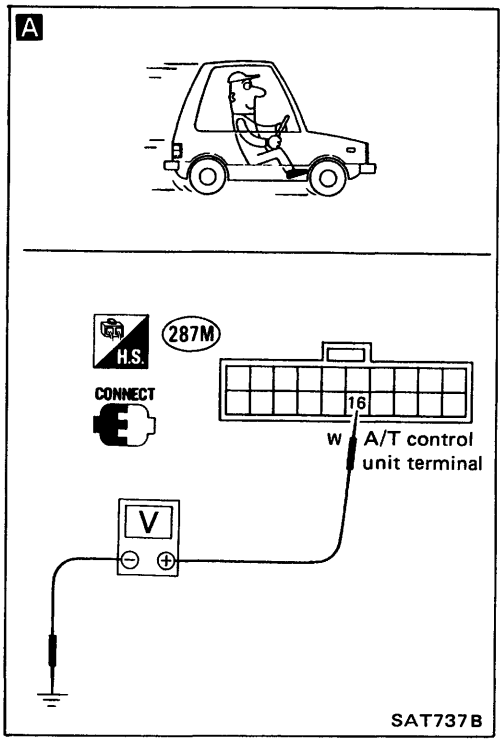
Self-diagnosis (Cont'd)

Power shift indicator lamp:	Damaged circuit
Comes on continuously.  SAT242C	Inhibitor switch, overdrive switch, kickdown switch or idle switch circuit is disconnected or A/T control unit is damaged.  ➡ **Go to INHIBITOR, OVERDRIVE, KICKDOWN AND IDLE SWITCH CIRCUIT CHECKS.** SAT244C

Self-diagnosis (Cont'd)

REVOLUTION SENSOR CIRCUIT CHECK



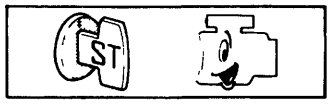


CHECK REVOLUTION SENSOR. – Refer to "Electrical Components Inspection". — N.G. → Repair or replace revolution sensor.

↓ O.K.

A

CHECK INPUT SIGNAL. — N.G. → Check the following items.
- Harness continuity between A/T control unit and revolution sensor (Main harness)
- Harness continuity between revolution sensor and E.C.U. (Main harness)
- Ground circuit for E.C.U. – Refer to section EF & EC.

1. 

2. Check voltage between A/T control unit terminal ⑯ and ground while driving. (Measure with A.C. range.)
   Voltage:
   At 0 km/h (0 MPH): 0V
   At 30 km/h (19 MPH): 1V or more
   (Voltage rises gradually in response to vehicle speed)

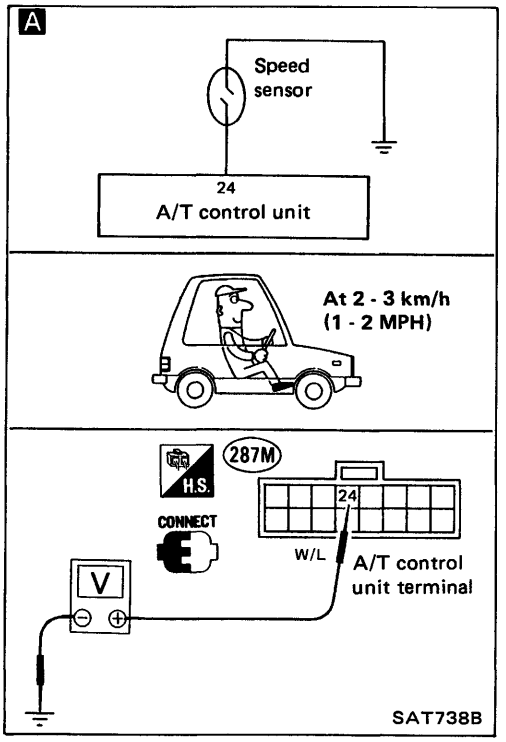
↓ O.K.

Perform self-diagnosis again after driving for a while. — N.G. → 1. Perform A/T control unit input/output signal inspection. 2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

↓ O.K.

INSPECTION END

SPEED SENSOR CIRCUIT CHECK



A

CHECK INPUT SIGNAL. — N.G. → Check the following items.
- Speed sensor and ground circuit for speed sensor – Refer to section EL.
- Harness continuity between A/T control unit and speed sensor (Main harness)

1. 

2. Check voltage between A/T control unit terminal ㉔ and ground while driving at 2 to 3 km/h (1 to 2 MPH) for 1 m (3 ft) or more.
   Voltage: Varies from 0V to 5V

↓ O.K.

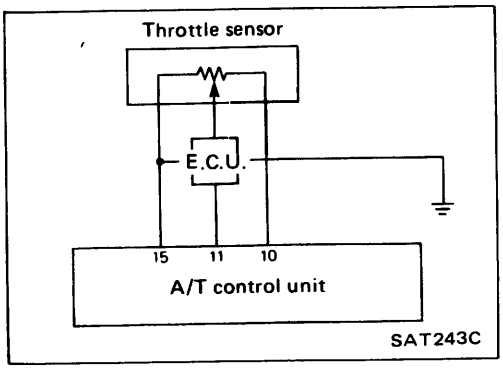
Perform self-diagnosis again after driving for a while. — N.G. → 1. Perform A/T control unit input/output signal inspection. 2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

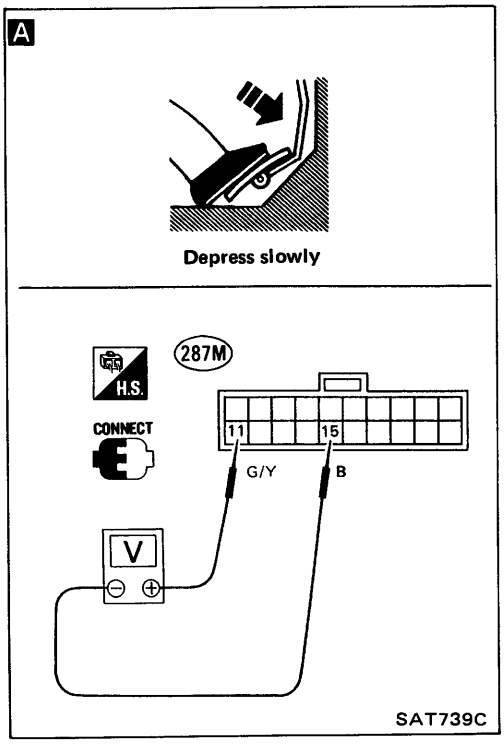
↓ O.K.

INSPECTION END

Self-diagnosis (Cont'd)

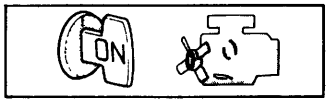
THROTTLE SENSOR CIRCUIT CHECK





A

CHECK INPUT SIGNAL.

1. 

2. Check voltage between A/T control unit terminals ⑪ and ⑮ while accelerator pedal is depressed slowly.

Voltage:

Fully-closed throttle:
0.2 - 0.6V
Fully-open throttle:
2.9 - 3.9V
(Voltage rises gradually in response to throttle valve opening.)

N.G. → Check harness continuity between E.C.U. and A/T control unit regarding throttle sensor circuit. (Main harness)

O.K. ↓

Perform self-diagnosis again after driving for a while.

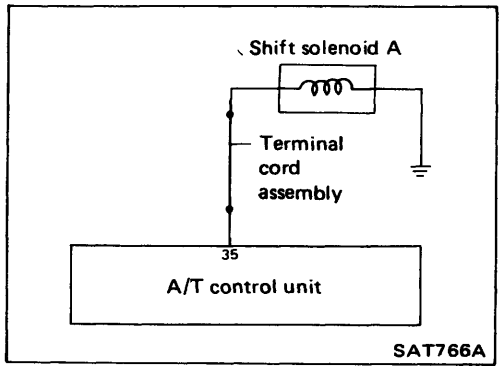
N.G. → 1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

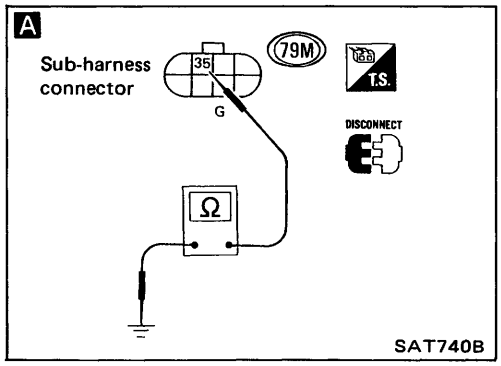
O.K. ↓

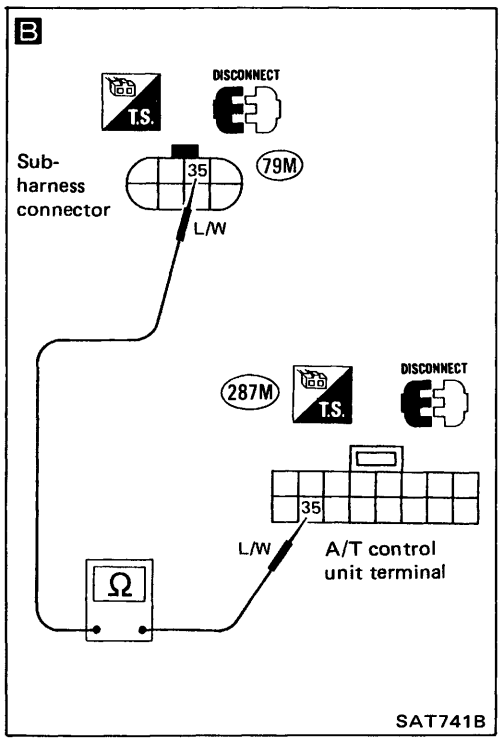
INSPECTION END

Self-diagnosis (Cont'd)

SHIFT SOLENOID A CIRCUIT CHECK

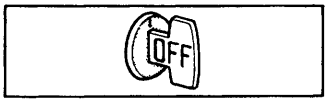






A

CHECK GROUND CIRCUIT.

1. 

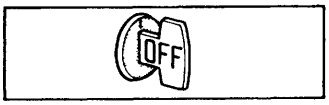
2. Disconnect terminal cord assembly connector in engine compartment.
3. Check resistance between terminal (35) and ground.
   Resistance: 20 - 30Ω

N.G. →
1. Remove control valve assembly. – Refer to "ON-VEHICLE SERVICE".
2. Check the following items.
- Shift solenoid A – Refer to "Electrical Components Inspection".
- Harness continuity of terminal cord assembly

O.K. ↓

B

CHECK POWER SOURCE CIRCUIT.

1. 

2. Disconnect A/T control unit 16-pin connector.
3. Check resistance between terminal (35) and A/T control unit terminal (35).
   Resistance:
   Approximately 0Ω
4. Reinstall any part removed.

N.G. → Repair or replace harness between A/T control unit and terminal cord assembly. (Main harness)

O.K. ↓

Perform self-diagnosis after driving for a while.

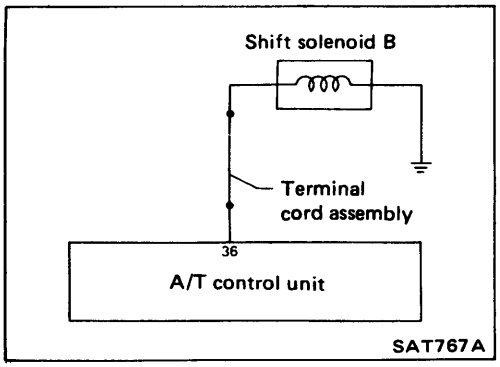
N.G. →
1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

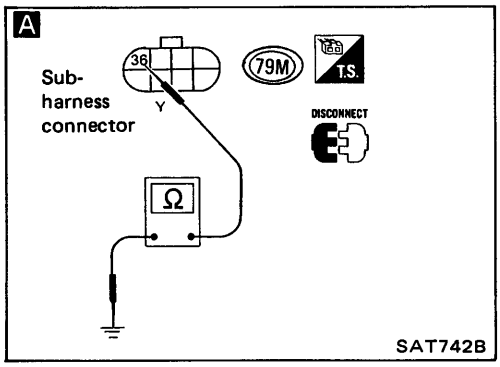
O.K. ↓

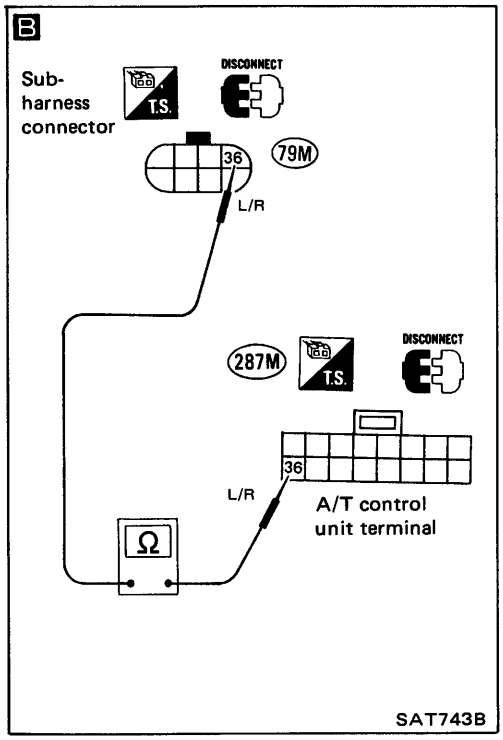
INSPECTION END

Self-diagnosis (Cont'd)

SHIFT SOLENOID B CIRCUIT CHECK

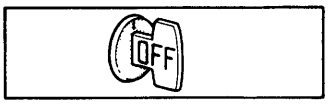






A

CHECK GROUND CIRCUIT.

1. 

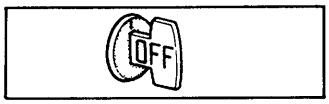
2. Disconnect terminal cord assembly connector in engine compartment.
3. Check resistance between terminal (36) and ground.
   Resistance: 20 - 30Ω

N.G. →
1. Remove control valve assembly. – Refer to "ON-VEHICLE SERVICE".
2. Check the following items.
- Shift solenoid B – Refer to "Electrical Components Inspection".
- Harness continuity of terminal cord assembly

O.K. ↓

B

CHECK POWER SOURCE CIRCUIT.

1. 

2. Disconnect A/T control unit 16-pin connector.
3. Check resistance between terminal (36) and A/T control unit terminal (36).
   Resistance:
   Approximately 0Ω
4. Reinstall any part removed.

N.G. → Repair or replace harness between A/T control unit and terminal cord assembly. (Main harness)

O.K. ↓

Perform self-diagnosis after driving for a while.

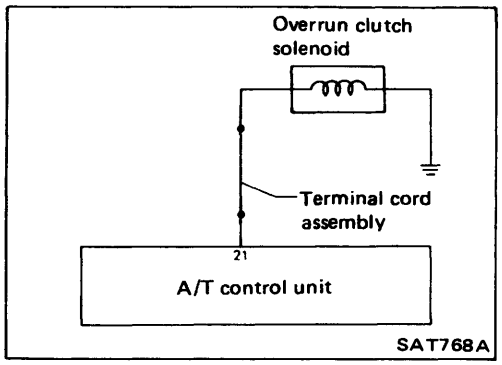
N.G. →
1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

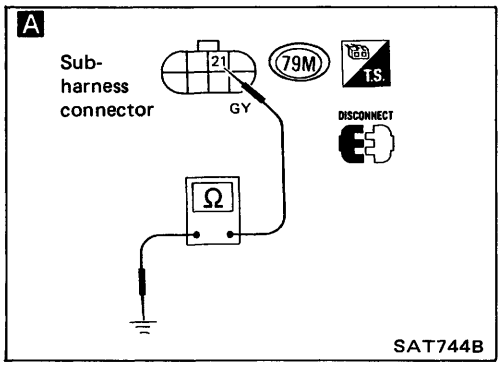
O.K. ↓

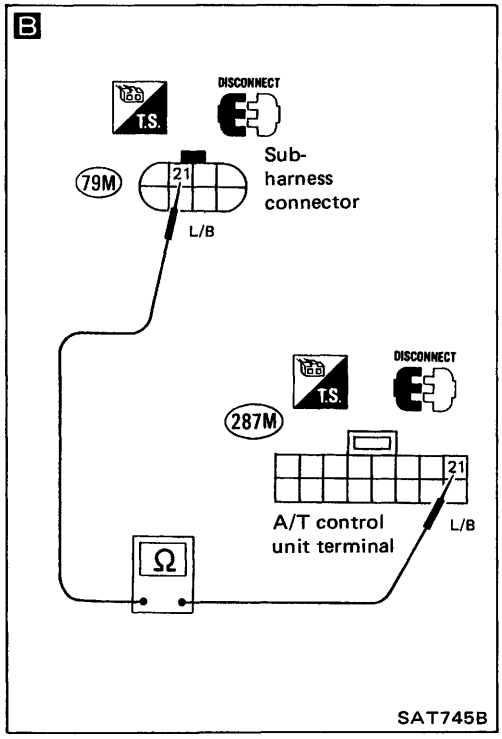
INSPECTION END

Self-diagnosis (Cont'd)

OVERRUN CLUTCH SOLENOID CIRCUIT CHECK

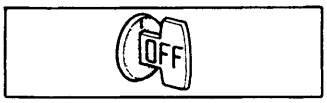






A

CHECK GROUND CIRCUIT.

1. 

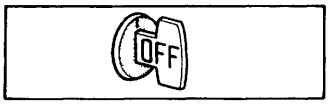
2. Disconnect terminal cord assembly connector in engine compartment.
3. Check resistance between terminal ㉑ and ground.
   Resistance: 20 - 30Ω

N.G. →
1. Remove control valve assembly. – Refer to "ON-VEHICLE SERVICE".
2. Check the following items.
- Overrun clutch solenoid. – Refer to "Electrical Components Inspection".
- Harness continuity of terminal cord assembly

O.K. ↓

B

CHECK POWER SOURCE CIRCUIT.

1. 

2. Disconnect A/T control unit 16-pin connector.
3. Check resistance between terminal ㉑ and A/T control unit terminal ㉑.
   Resistance:
   Approximately 0Ω
4. Reinstall any part removed.

N.G. → Repair or replace harness between A/T control unit and terminal cord assembly. (Main harness)

O.K. ↓

Perform self-diagnosis after driving for a while.

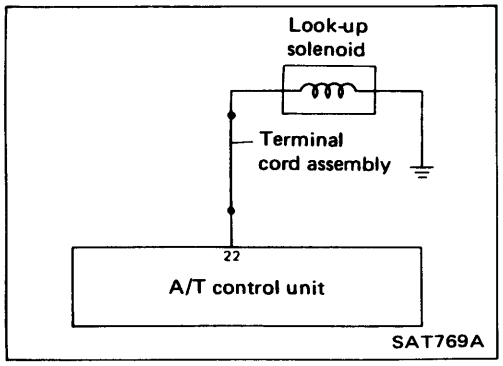
N.G. →
1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

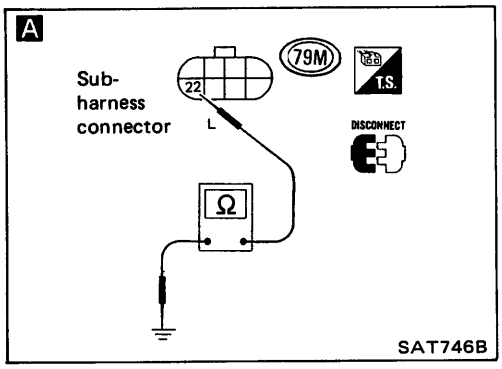
O.K. ↓

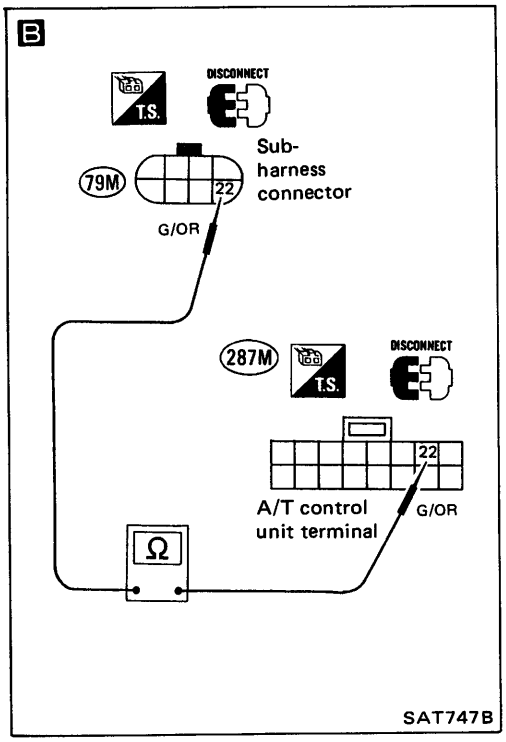
INSPECTION END

Self-diagnosis (Cont'd)

LOCK-UP SOLENOID CIRCUIT CHECK

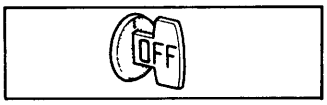






A

CHECK GROUND CIRCUIT.

1. 

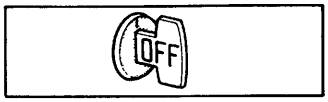
2. Disconnect terminal cord assembly connector in engine compartment.
3. Check resistance between terminal (22) and ground.
   Resistance: 2.5 - 5Ω

N.G. →
1. Remove oil pan. – Refer to "ON-VEHICLE SERVICE".
2. Check the following items.
- Lock-up solenoid – Refer to "Electrical Components Inspection".
- Harness continuity of terminal cord assembly

O.K. ↓

B

CHECK POWER SOURCE CIRCUIT.

1. 

2. Disconnect A/T control unit 16-pin connector.
3. Check resistance between terminal (22) and A/T control unit terminal (22).
   Resistance:
   Approximately 0Ω
4. Reinstall any part removed.

N.G. → Repair or replace harness between A/T control unit and terminal cord assembly. (Main harness)

O.K. ↓

Perform self-diagnosis after driving for a while.

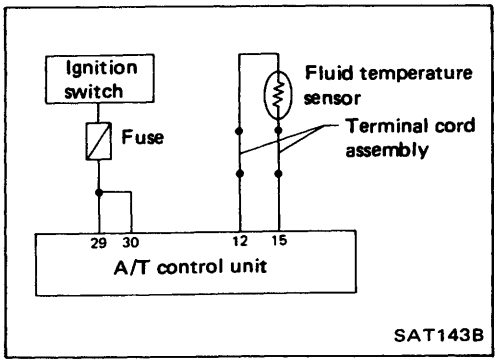
N.G. →
1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

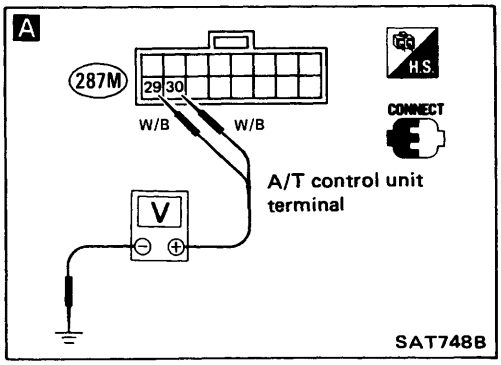
O.K. ↓

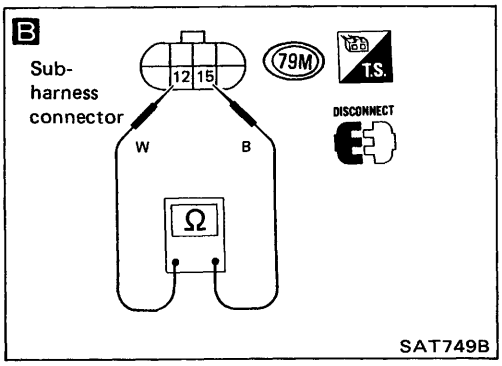
INSPECTION END

Self-diagnosis (Cont'd)

FLUID TEMPERATURE SENSOR CIRCUIT AND A/T CONTROL UNIT POWER SOURCE CIRCUIT CHECKS

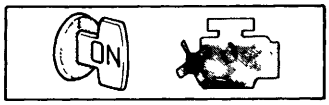






A

CHECK A/T CONTROL UNIT POWER SOURCE.

1. 

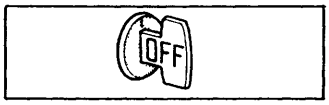
2. Check voltage between A/T control unit terminals (29), (30) and ground.
   Battery voltage should exist.

N.G. →
Check the following items.
- Harness continuity between ignition switch and A/T control unit (Main harness)
- Ignition switch and fuse
  – Refer to section EL.

O.K. ↓

B

CHECK FLUID TEMPERATURE SENSOR WITH TERMINAL CORD ASSEMBLY

1. 

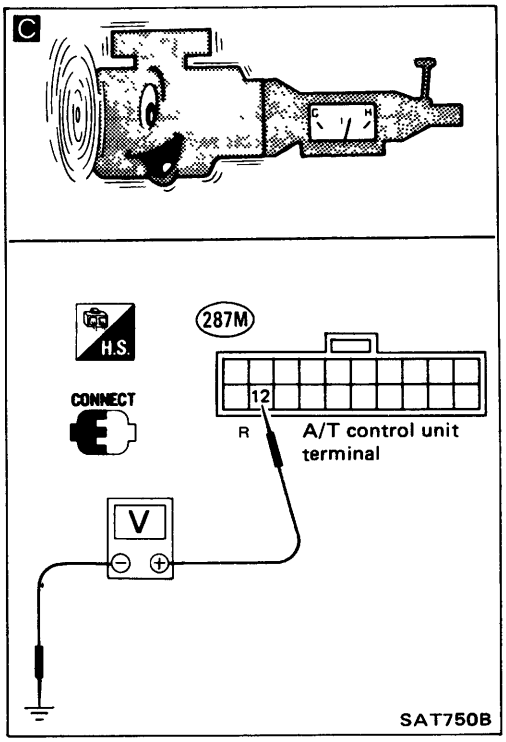
2. Disconnect terminal cord assembly connector in engine compartment.
3. Check resistance between terminals (12) and (15) when A/T is cold.
   Resistance:
   Cold [20°C (68°F)]
   Approximately 2.5 kΩ
4. Reinstall any part removed.

N.G. →
1. Remove oil pan.
2. Check the following items.
- Fluid temperature sensor
  – Refer to "Electrical Components Inspection".
- Harness continuity of terminal cord assembly

O.K. ↓

Ⓐ

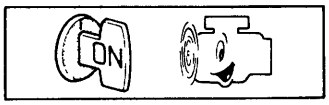
Self-diagnosis (Cont'd)



Ⓐ

C

CHECK INPUT SIGNAL OF FLUID TEMPERATURE SENSOR.

1. 

2. Check voltage between A/T control unit terminal ⑫ and ground while warming up A/T.
   Voltage:
   Cold [20°C (68°F)] → Hot [80°C (176°F)]:
   1.56V → 0.45V

N.G. → Check the following items.
- Harness continuity between A/T control unit and terminal cord assembly (Main harness)

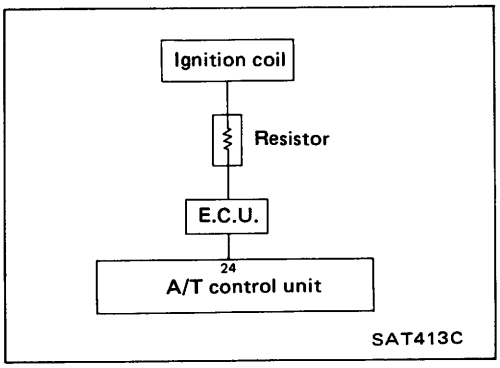
O.K. ↓

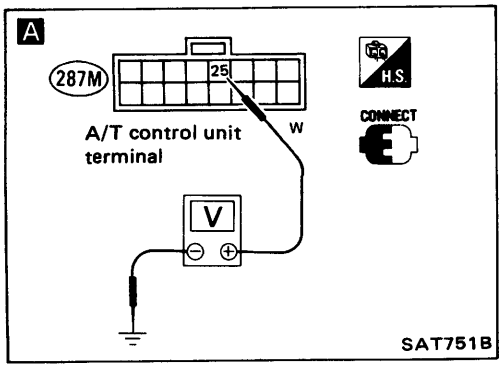
Perform self-diagnosis after driving for a while.

N.G. → 1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

O.K. ↓

INSPECTION END





ENGINE REVOLUTION SIGNAL CIRCUIT CHECK

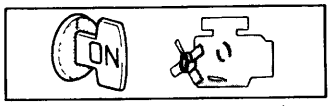
Perform self-diagnosis for engine control. Check ignition signal circuit condition.

N.G. → Check ignition signal circuit for engine control. — Refer to section EF & EC.

O.K. ↓

A

CHECK INPUT SIGNAL.

1. 

2. Check voltage between A/T control unit terminal ㉕ and ground.
   Voltage: 9.5 - 12V

N.G. → Check the following items.
- Harness continuity between A/T control unit and ignition coil.
- Resistor
- Ignition coil — Refer to section EF & EC.

O.K. ↓

Perform self-diagnosis again after driving for a while.

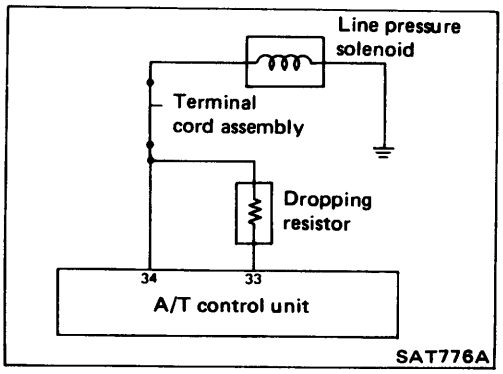
N.G. → 1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

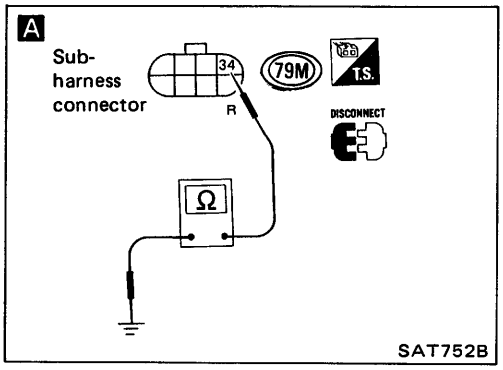
O.K. ↓

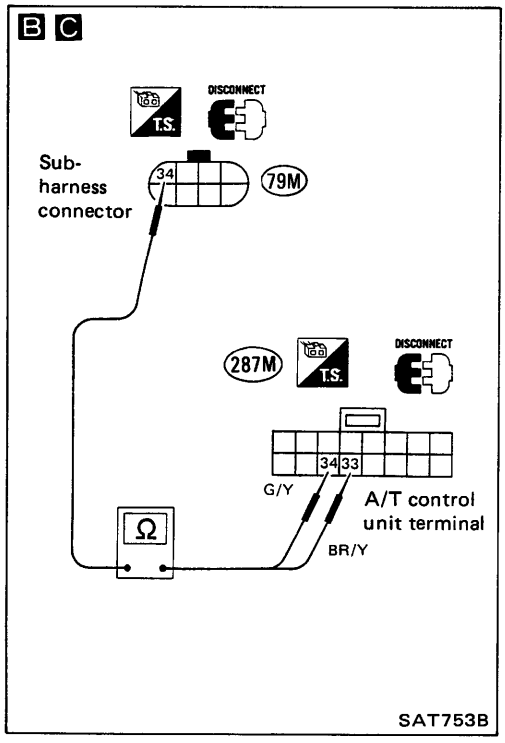
INSPECTION END

Self-diagnosis (Cont'd)

LINE PRESSURE SOLENOID CIRCUIT CHECK

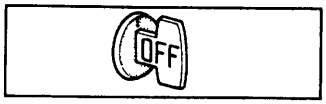






A

CHECK GROUND CIRCUIT.

1. 

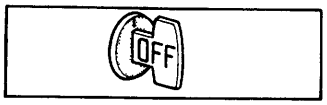
2. Disconnect terminal cord assembly connector in engine compartment.
3. Check resistance between terminal (34) and ground.
   Resistance: 2.5 - 5Ω

N.G. →
1. Remove control valve assembly. – Refer to "ON-VEHICLE SERVICE".
2. Check the following items.
- Line pressure solenoid – Refer to "Electrical Components Inspection".
- Harness continuity of terminal cord assembly

O.K. ↓

B

CHECK POWER SOURCE CIRCUIT.

1. 

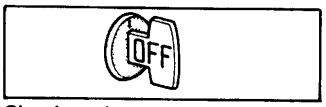
2. Disconnect A/T control unit 16-pin connector.
3. Check resistance between terminal (34) and A/T control unit terminal (33).
   Resistance: 11.2 - 12.8Ω

N.G. →
Check the following items.
- Dropping resistor – Refer to "Electrical Components Inspection".
- Harness continuity between A/T control unit (33) and terminal cord assembly (Main harness)

O.K. ↓

C

CHECK POWER SOURCE CIRCUIT

1. 

2. Check resistance between terminal (34) and A/T control unit terminal (34).
   Resistance:
   Approximately 0Ω
3. Reinstall any part removed.

N.G. →
Repair or replace harness between A/T control unit (34) and terminal cord assembly.

O.K. ↓

Perform self-diagnosis after driving for a while.

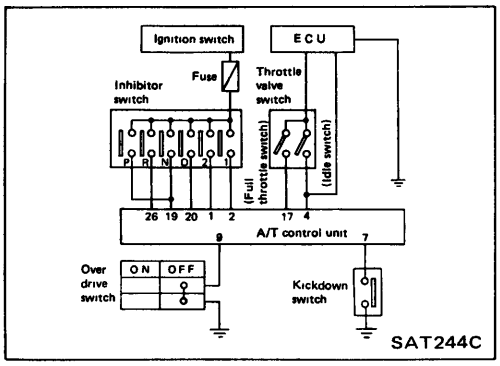
N.G. →
1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

O.K. ↓

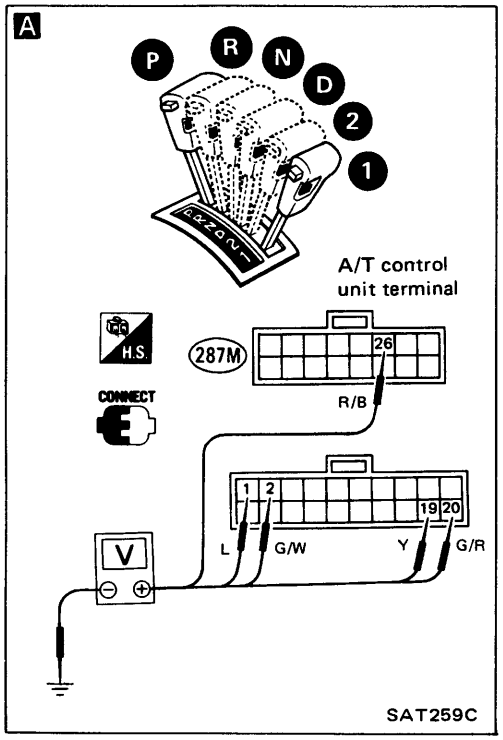
INSPECTION END

Self-diagnosis (Cont'd)

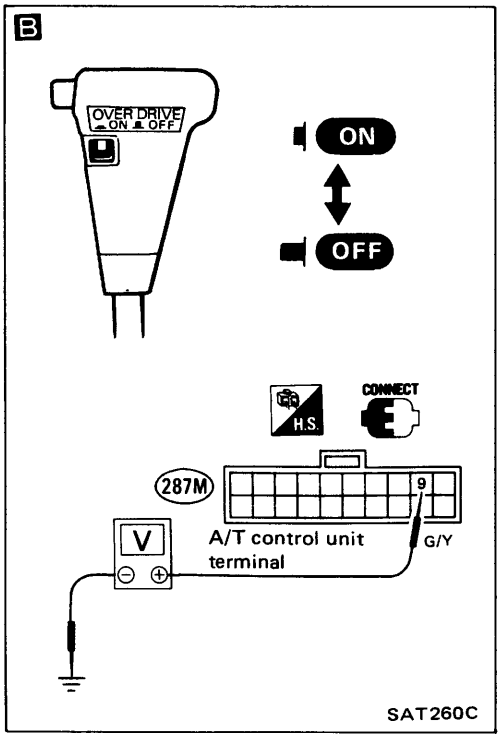
INHIBITOR, OVERDRIVE, KICKDOWN AND IDLE SWITCH CIRCUIT CHECKS



SAT244C



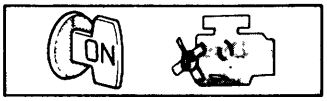
SAT259C



SAT260C

A

CHECK INHIBITOR SWITCH CIRCUIT.

1. 

2. Check voltage between A/T control unit terminals ①, ②, ⑲, ⑳, ㉖ and ground while moving selector lever through each range.

Voltage:

B: Battery voltage

0: 0V

Lever position \ Terminal No.	⑲	㉖	⑳	①	②
P, N	B	0	0	0	0
R	0	B	0	0	0
D	0	0	B	0	0
2	0	0	0	B	0
1	0	0	0	0	B

N.G. →

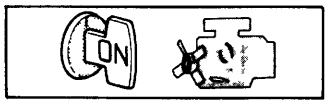
Check the following items.

- Inhibitor switch – Refer to "Electrical Components Inspection".
- Harness continuity between ignition switch and inhibitor switch (Main harness)
- Harness continuity between inhibitor switch and A/T control unit (Main harness)

O.K. ↓

B

CHECK OVERDRIVE SWITCH CIRCUIT.

1. 

2. Check voltage between A/T control unit terminal ⑨ and ground when overdrive switch is in "ON" position and in "OFF" position.

Switch position	Voltage
ON	Battery voltage
OFF	1V or less

N.G. →

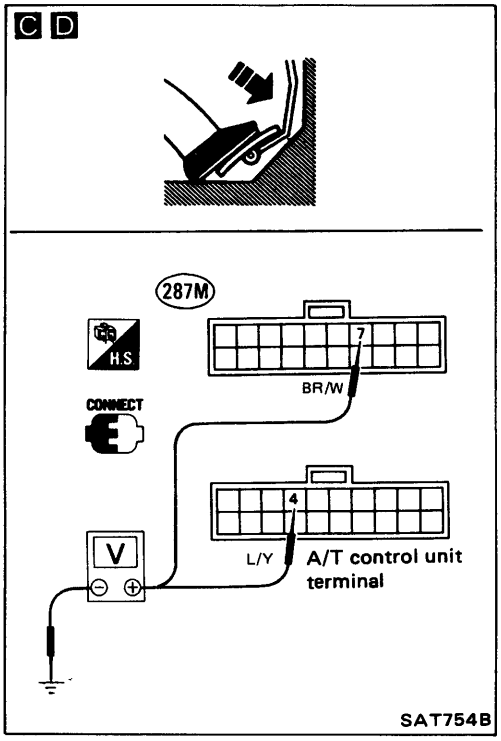
Check the following items.

- Overdrive switch – Refer to "Electrical Components Inspection".
- Harness continuity between A/T control unit and overdrive switch (Main harness)
- Harness continuity of ground circuit for overdrive switch (Main harness)

O.K. ↓

Ⓐ

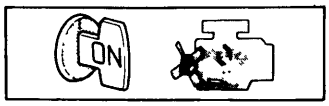
Self-diagnosis (Cont'd)



Ⓐ

C

CHECK KICKDOWN SWITCH CIRCUIT.

1. 

2. Check voltage between A/T control unit terminal ⑦ and ground while depressing accelerator pedal slowly. (after warming up engine)
   Voltage:
   When releasing accelerator pedal: 3 - 8V
   When depressing accelerator pedal fully: 1V or less

N.G. → Check the following items.
- Kickdown switch
- Harness continuity between A/T control unit and kick-down switch (Main harness)
- Harness continuity of ground circuit for kickdown switch

O.K. ↓

D

CHECK IDLE SWITCH CIRCUIT.

- Check voltage between A/T control unit terminal ④ and ground in the same way as kickdown switch circuit.
  Voltage:
  When releasing accelerator pedal: 8 - 15V
  When depressing accelerator pedal fully: 1V or less

N.G. → Perform self-diagnosis for engine control. Check idle switch circuit.
- O.K. → Check harness continuity between A/T control unit and idle switch. (Main harness)
- N.G. → Check idle switch circuit for engine control. — Refer to section EF & EC.

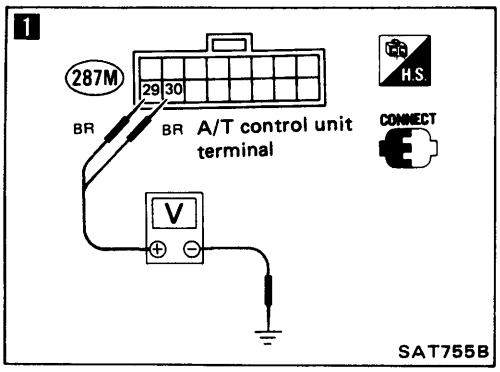
O.K. ↓

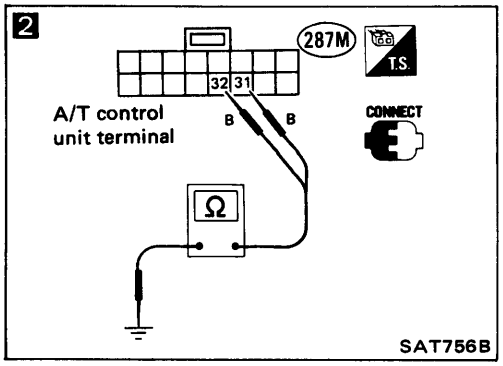
Perform self-diagnosis again after driving for a while.

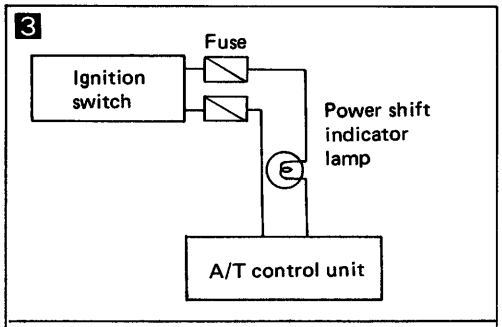
N.G. → 1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

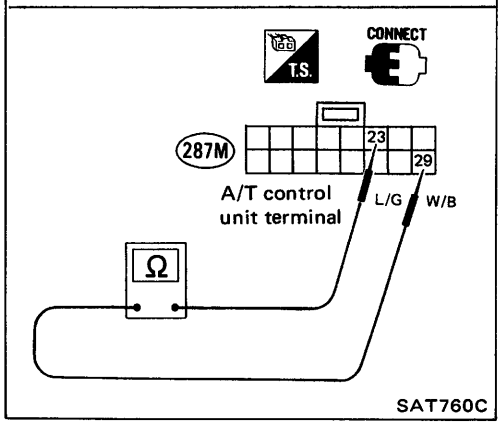
O.K. ↓

INSPECTION END







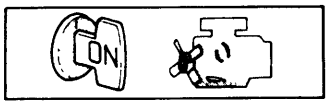


Diagnostic Procedure 1

SYMPTOM: Power shift indicator lamp does not come on for about 2 seconds when turning ignition switch to "ON".

1

CHECK A/T CONTROL UNIT POWER SOURCE.

1. 

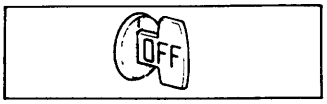
2. Check voltage between A/T control unit terminals (29), (30) and ground.
   Battery voltage should exist.

N.G. → Check the following items.
- Harness continuity between ignition switch and A/T control unit (Main harness)
- Ignition switch and fuse
  – Refer to section EL.

O.K. ↓

2

CHECK A/T CONTROL UNIT GROUND CIRCUIT.

1. 

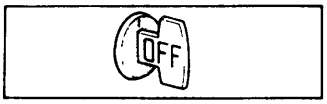
2. Disconnect A/T control unit 16-pin connector.
3. Check resistance between A/T control unit terminals (31), (32) and ground.
   Resistance:
   Approximately 0Ω

N.G. → Check harness continuity between A/T control unit and ground.

O.K. ↓

3

CHECK LAMP CIRCUIT.

1. 

2. Disconnect A/T control unit 16-pin connector.
3. Check resistance between A/T control unit terminals (23) and (29).
   Resistance: 50 - 100Ω
4. Reinstall any part removed.

N.G. → Check the following items.
- Power shift indicator lamp
  – Refer to section EL.
- Harness continuity between ignition switch and power shift indicator lamp (Main harness)
- Harness continuity between power shift indicator lamp and A/T control unit

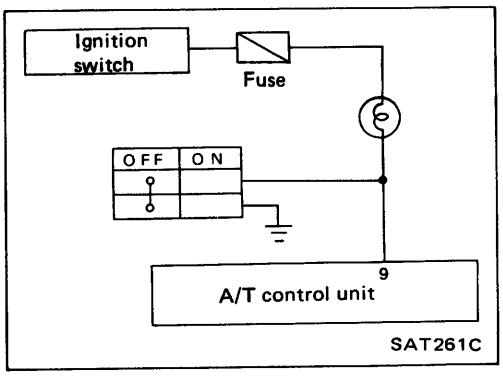
O.K. ↓

Check again.

N.G. → 1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

O.K. ↓

INSPECTION END

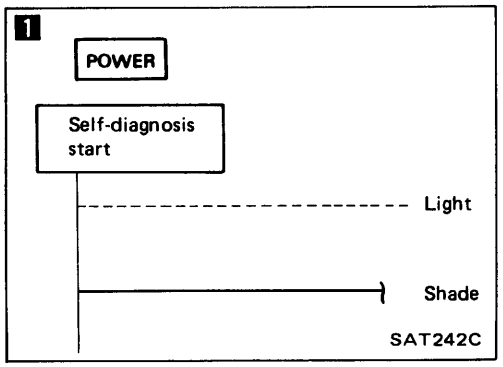


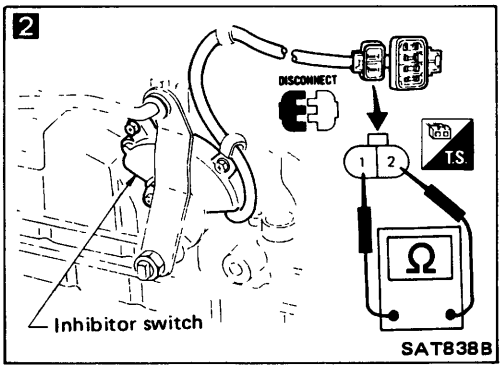
Diagnostic Procedure 2

SYMPTOM: O.D. OFF indicator lamp does not come on when setting overdrive switch to "OFF" position.

Check the following items.
- Overdrive switch
- O.D. OFF indicator lamp
- Harness continuity between ignition switch and O.D. OFF indicator lamp

N.G. → Repair or replace damaged parts.





Diagnostic Procedure 3

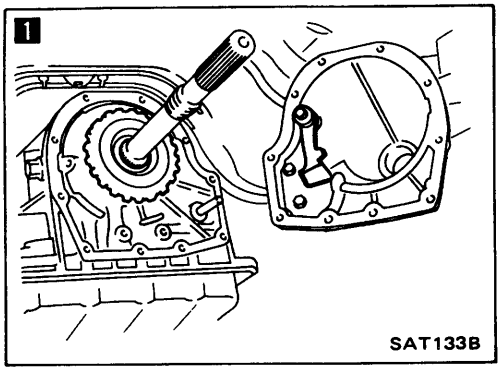
SYMPTOM: Engine cannot be started with selector lever in "P" or "N" range or engine can be started with selector lever in "D", "2", "1" or "R" range.

1 Does self-diagnosis show damage to inhibitor switch circuit?
- Yes → Check inhibitor switch circuit. — Refer to "Self-diagnosis".
- No ↓

2 Check continuity of inhibitor switch 2-pin connector. — Refer to "Electrical Components Inspection".
- N.G. → Repair or replace inhibitor switch.
- O.K. ↓

Check starting system. — Refer to section EL.
- N.G. → Repair or replace damaged parts.
- O.K. ↓

INSPECTION END



Diagnostic Procedure 4

SYMPTOM: Vehicle moves when it is pushed forward or backward with selector lever in "P" range.

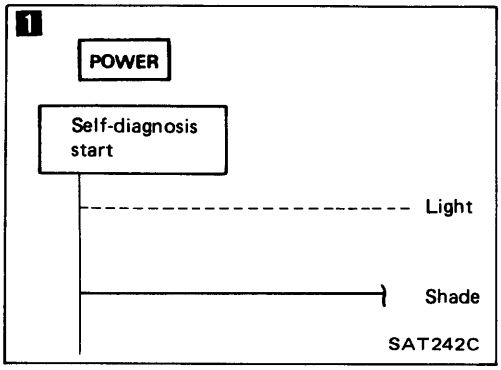
1

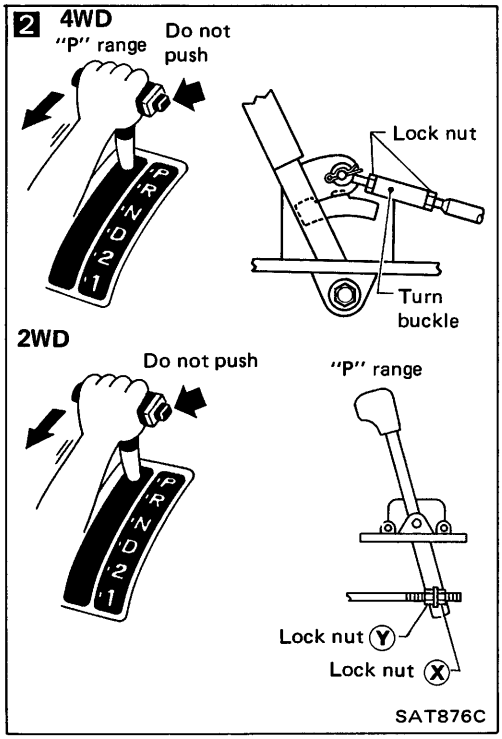
Check parking components. – Refer to "ON-VEHICLE SERVICE".

N.G. → Repair or replace damaged parts.

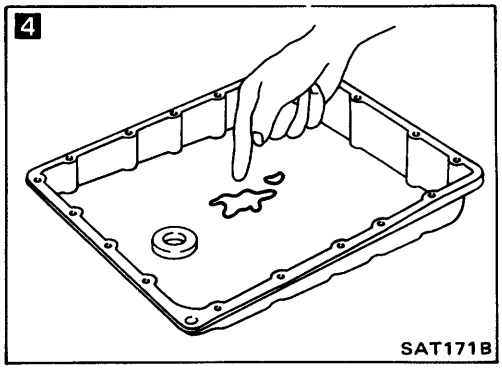
O.K. ↓

INSPECTION END









Diagnostic Procedure 5

SYMPTOM: Vehicle moves forward or backward when selecting "N" range.

1 Does self-diagnosis show damage to inhibitor switch after cruise test?
- Yes → Check inhibitor switch circuit. – Refer to "Self-diagnosis".
- No ↓

2 Check manual control cable. – Refer to "ON-VEHICLE SERVICE".
- N.G. → Adjust manual control cable. – Refer to "ON-VEHICLE SERVICE".
- O.K. ↓

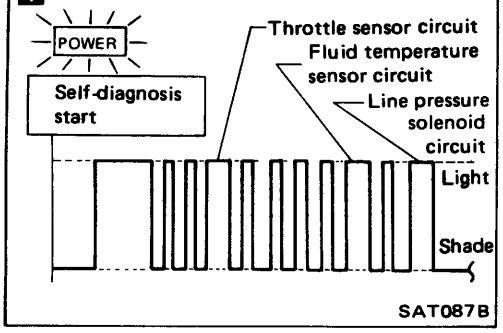
3 Check A/T fluid level again.
- N.G. → Refill A.T.F.
- O.K. ↓

4 1. Remove oil pan. 2. Check A/T fluid condition.
- N.G. → 1. Disassemble A/T. 2. Check the following items.
  - Forward clutch assembly
  - Overrun clutch assembly
  - Reverse clutch assembly
  - Accumulator piston D
- O.K. ↓

Check again.
- N.G. → 1. Perform A/T control unit input/output signal inspection. 2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.
- O.K. ↓

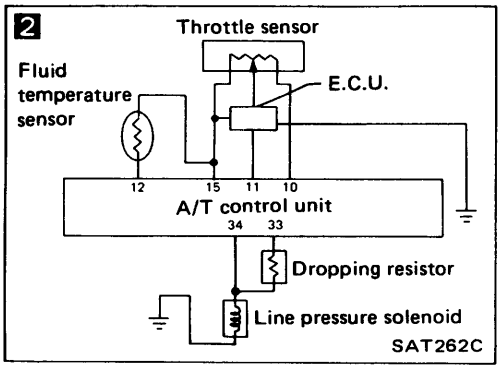
INSPECTION END

1



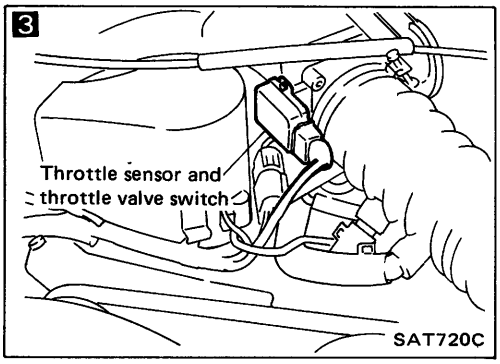
SAT087B

2



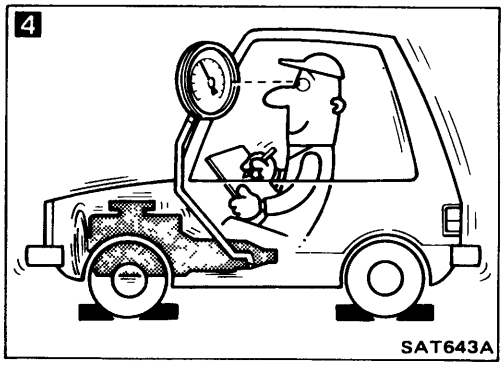
SAT262C

3



SAT720C

4



SAT643A

Diagnostic Procedure 6

SYMPTOM: There is large shock when changing from "N" to "R" range.

1 Does self-diagnosis show damage to throttle sensor, line pressure solenoid or fluid temperature sensor circuit?

Yes → **2** Check damaged circuit. – Refer to "Self-diagnosis".

No ↓

3 Check throttle sensor. – Refer to section EF & EC.

N.G. → Repair or replace throttle sensor.

O.K. ↓

4 Check line pressure at idle with selector lever in "D" range. – Refer to "PRESSURE TESTING".

N.G. →
1. Remove control valve assembly. – Refer to "ON-VEHICLE SERVICE".
2. Check the following items.
- Valves to control line pressure (Pressure regulator valve, modifier valve, pilot valve and pilot filter)
- Line pressure solenoid

O.K. ↓

Check again.

N.G. →
1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

O.K. ↓

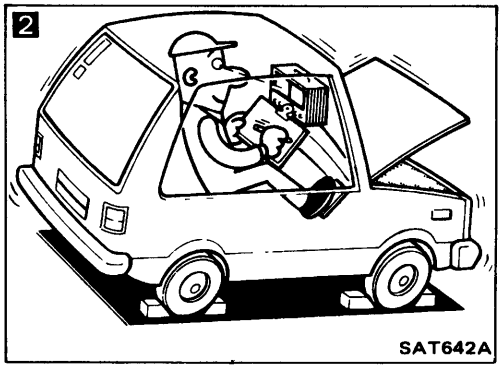
INSPECTION END

1



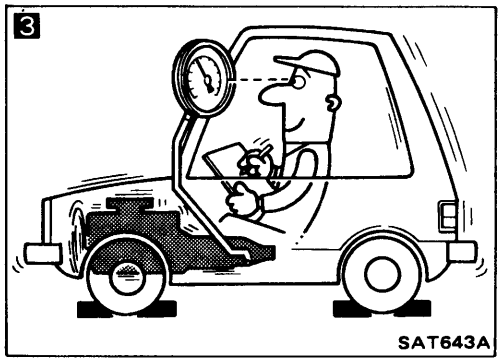
SAT638A

2



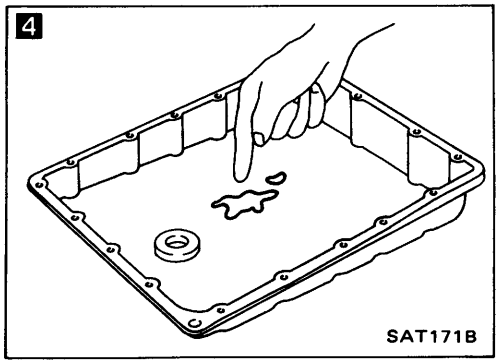
SAT642A

3



SAT643A

4



SAT171B

Diagnostic Procedure 7

SYMPTOM: Vehicle does not creep backward when selecting "R" range.

1

Check A/T fluid level again.

N.G. → Refill A.T.F.

O.K.

2

Check stall revolution with selector lever in "1" and "R" range.

N.G. in both "1" and "R" range

O.K. in "1" range
N.G. in "R" range.

O.K.

3

Check line pressure at idle with selector lever in "R" range.
– Refer to "PRESSURE TESTING".

N.G. →

1. Remove control valve assembly. – Refer to "ON-VEHICLE SERVICE".
2. Check the following items.
   - Valves to control line pressure (Pressure regulator valve, pilot valve and pilot filter)
   - Line pressure solenoid
3. Disassemble A/T.
4. Check the following items.
   - Oil pump assembly
   - Torque converter
   - Reverse clutch assembly
   - High clutch assembly
   - Low & reverse brake assembly
   - Low one-way clutch

O.K.

4

1. Remove oil pan.
2. Check fluid condition.

N.G. →

O.K.

Check again.

N.G. →

1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

O.K.

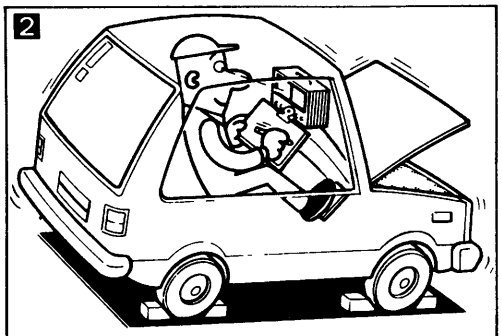
INSPECTION END

1



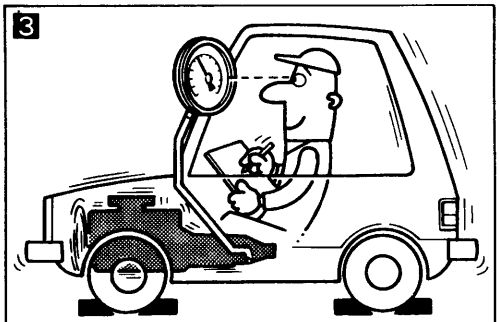
SAT638A

2



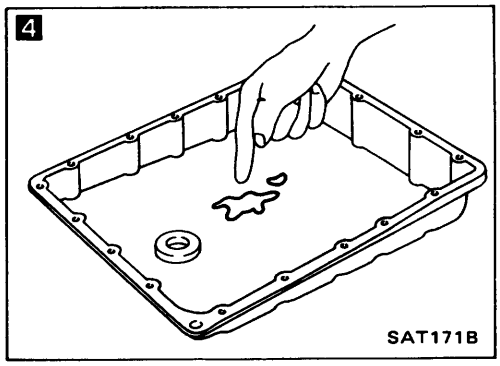
SAT642A

3



SAT643A

4



SAT171B

Diagnostic Procedure 8

SYMPTOM: Vehicle does not creep forward when selecting "D", "2" and "1" range.

1

Check A/T fluid level again.

N.G. → Refill A.T.F.

O.K.

2

Check stall revolution with selector lever in "D" range.
– Refer to "STALL TESTING".

N.G. →

1. Remove control valve assembly. – Refer to "ON-VEHICLE SERVICE".
2. Check the following items.
- Valves to control line pressure (Pressure regulator valve, modifier valve, pilot valve and pilot filter)
- Line pressure solenoid
3. Disassemble A/T
4. Check the following items.
- Oil pump assembly
- Forward clutch assembly
- Forward one-way clutch
- Low one-way clutch
- Torque converter

O.K.

3

Check line pressure at idle with selector lever in "D" range.
– Refer to "PRESSURE TESTING".

N.G. →

1. Remove control valve assembly. – Refer to "ON-VEHICLE SERVICE".
2. Check the following items.
- Valves to control line pressure (Pressure regulator valve, modifier valve, pilot valve and pilot filter)
- Line pressure solenoid
3. Disassemble A/T
4. Check the following items.
- Oil pump assembly
- Forward clutch assembly
- Forward one-way clutch
- Low one-way clutch
- Torque converter

O.K.

4

1. Remove oil pan.
2. Check A/T fluid condition.

N.G. →

1. Remove control valve assembly. – Refer to "ON-VEHICLE SERVICE".
2. Check the following items.
- Valves to control line pressure (Pressure regulator valve, modifier valve, pilot valve and pilot filter)
- Line pressure solenoid
3. Disassemble A/T
4. Check the following items.
- Oil pump assembly
- Forward clutch assembly
- Forward one-way clutch
- Low one-way clutch
- Torque converter

O.K.

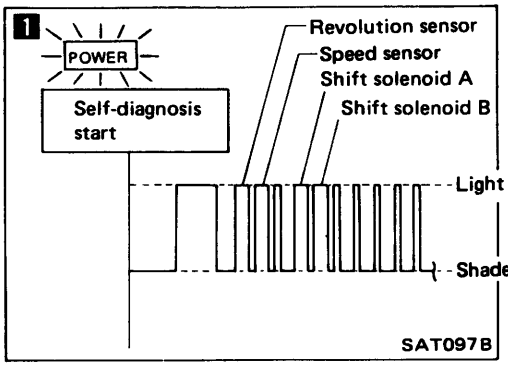
Check again.

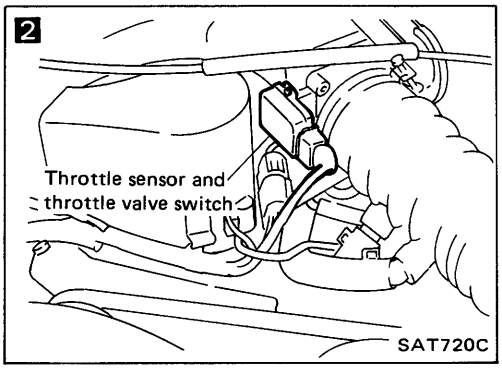
N.G. →

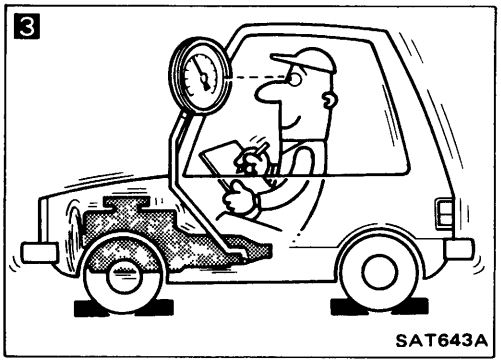
1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

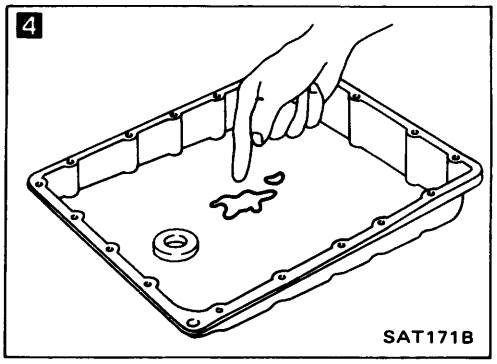
O.K.

INSPECTION END









Diagnostic Procedure 9

SYMPTOM: Vehicle cannot be started from D_1 on Cruise test — Part 1.

Is Diagnostic Procedure 8 O.K.? — No → Go to Diagnostic Procedure 8.

Yes ↓

1 Does self-diagnosis show damage to revolution sensor, speed sensor, shift solenoid A or B after cruise test? — Yes → Check damaged circuit. — Refer to "Self-diagnosis".

No ↓

2 Check throttle sensor. — Refer to section EF & EC. — N.G. → Repair or replace throttle sensor.

O.K. ↓

3 Check line pressure at stall point with selector lever in "D" range. — Refer to "PRESSURE TESTING". — N.G. →

1. Remove control valve assembly. — Refer to "ON-VEHICLE SERVICE".
2. Check the following items.
   - Shift valve A
   - Shift valve B
   - Shift solenoid A
   - Shift solenoid B
   - Pilot valve
   - Pilot filter

O.K. ↓

4 1. Remove oil pan. 2. Check A/T fluid condition. — O.K. → (to control valve assembly)

N.G. →

3. Disassemble A/T.
4. Check the following items.
   - Forward clutch assembly
   - Forward one-way clutch
   - Low one-way clutch
   - High clutch assembly
   - Torque converter
   - Oil pump assembly

O.K. ↓

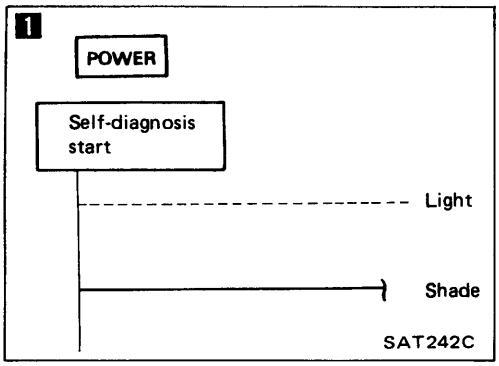
Check again. — N.G. →

1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

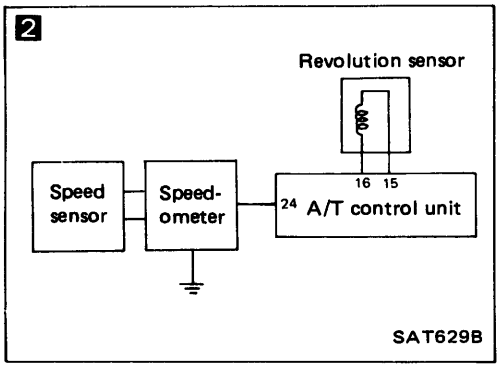
O.K. ↓

INSPECTION END

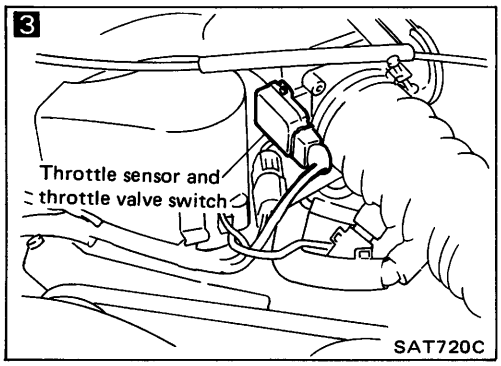
1



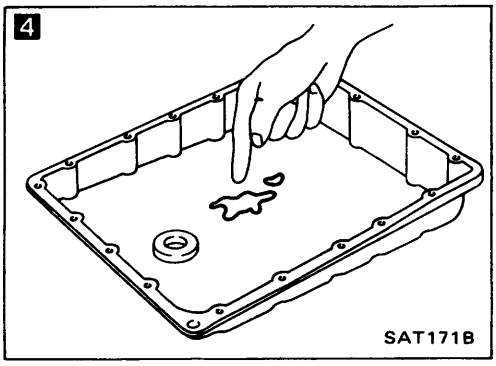
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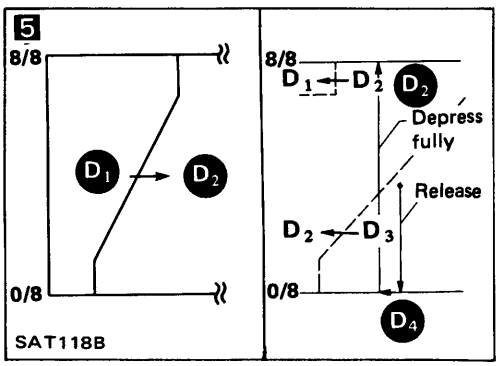
3



4



5



Diagnostic Procedure 10

SYMPTOM: A/T does not shift from D_1 to D_2 at the specified speed.
A/T does not shift from D_4 to D_2 when depressing accelerator pedal fully at the specified speed.

Are Diagnostic Procedures 8 and 9 O.K.?
- No → Go to Diagnostic Procedure 8 or 9.
- Yes ↓

1 Does self-diagnosis show damage to inhibitor switch after cruise test?
- Yes → Check inhibitor switch circuit. – Refer to "Self-diagnosis".
- No ↓

2 Check revolution sensor and speed sensor circuit. – Refer to "Self-diagnosis".
- N.G. → Repair or replace revolution sensor and speed sensor circuits.
- O.K. ↓

3 Check throttle sensor. – Refer to section EF & EC.
- N.G. → Repair or replace throttle sensor.
- O.K. ↓

4 1. Remove oil pan.
2. Check A/T fluid condition.
- N.G. → 1. Remove control valve. – Refer to "ON-VEHICLE SERVICE".
2. Check the following items.
- Shift valve A
- Shift solenoid A
- Pilot valve
- Pilot filter

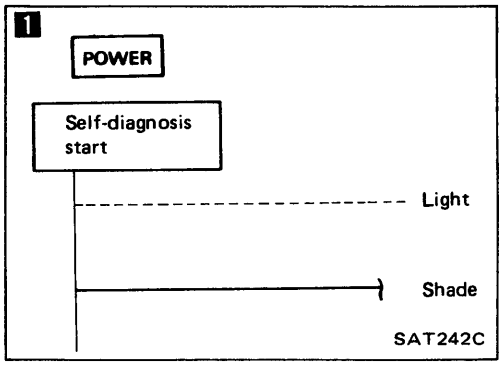
O.K. (from 4) → 3. Disassemble A/T.
4. Check the following items.
- Servo piston assembly
- Brake band
- Oil pump assembly

O.K. (from 4) ↓

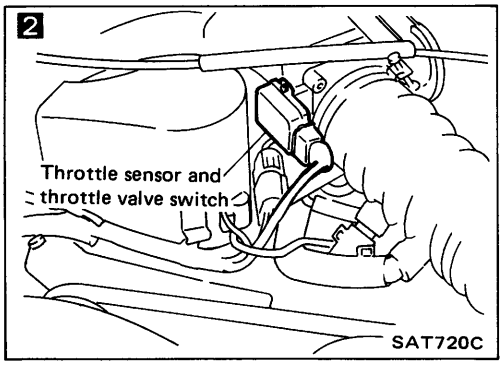
5 Check again.
- N.G. → 1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.
- O.K. ↓

INSPECTION END

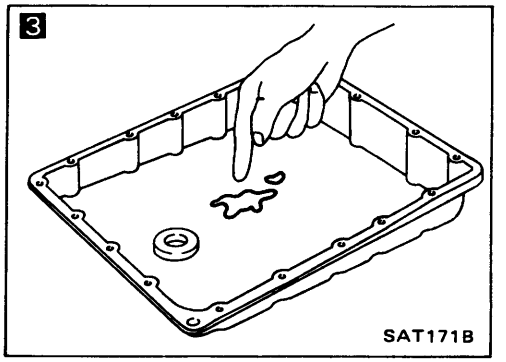
1



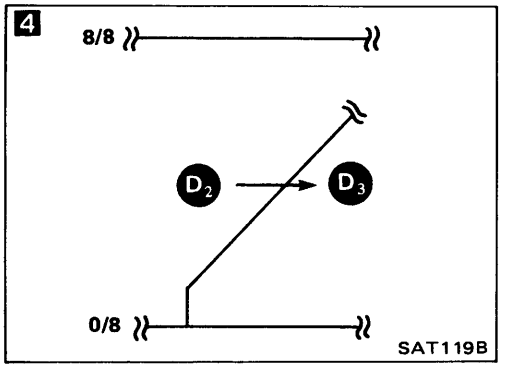
2



3



4



Diagnostic Procedure 11

SYMPTOM: A/T does not shift from D_2 to D_3 at the specified speed.

Are Diagnostic Procedures 8 and 9 O.K.? — No → Go to Diagnostic Procedure 8 or 9.

Yes ↓

1

Does self-diagnosis show damage to inhibitor switch after cruise test? — Yes → Check inhibitor switch circuit. – Refer to "Self-diagnosis".

No ↓

2

Check throttle sensor. – Refer to section EF & EC. — N.G. → Repair or replace throttle sensor.

O.K. ↓

3

1. Remove oil pan.
2. Check A/T fluid condition.

N.G. →
1. Remove control valve assembly. – Refer to "ON-VEHICLE SERVICE".
2. Check the following items.
   - Shift valve B
   - Shift solenoid B
   - Pilot valve
   - Pilot filter

   O.K. ↑
3. Disassemble A/T.
4. Check the following items.
   - Servo piston assembly
   - High clutch assembly
   - Oil pump assembly

   O.K. ↑

O.K. ↓

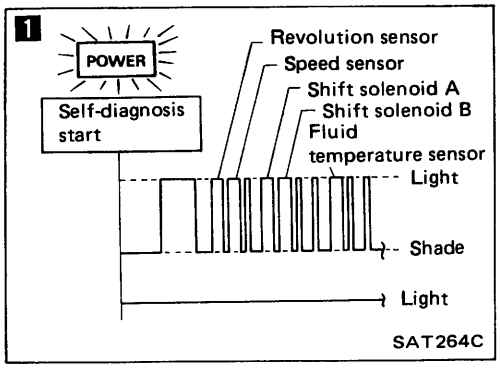
4

Check again. — N.G. → 1. Perform A/T control unit input/output signal inspection. 2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

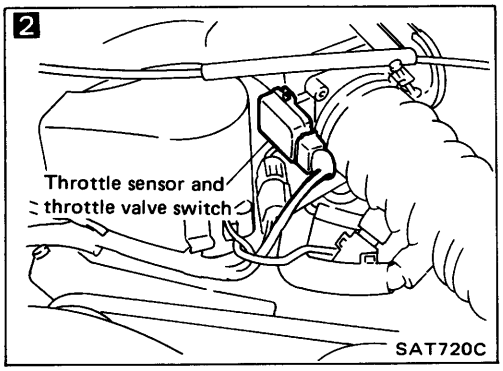
O.K. ↓

INSPECTION END

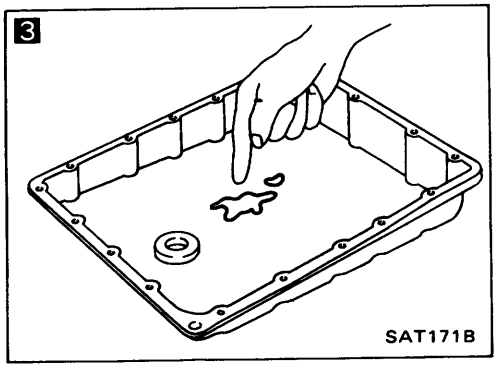
1



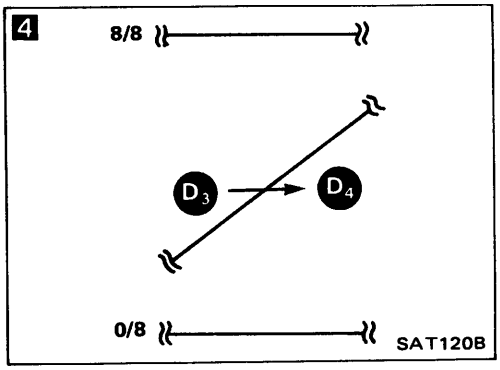
2



3



4



Diagnostic Procedure 12

SYMPTOM: A/T does not shift from D_3 to D_4 at the specified speed.

Are Diagnostic Procedures 8 and 9 O.K.? — No → Go to Diagnostic Procedure 8 or 9.

Yes ↓

1 Does self-diagnosis show damage to inhibitor switch, overdrive switch, shift solenoid A, B, revolution sensor, speed sensor or fluid temperature sensor circuit after cruise test? — Yes → Check damaged circuit. – Refer to "Self-diagnosis".

No ↓

2 Check throttle sensor. – Refer to section EF & EC. — N.G. → Repair or replace throttle sensor.

O.K. ↓

3 1. Remove oil pan.
2. Check A/T fluid condition. — N.G. →
1. Remove control valve assembly. – Refer to "ON-VEHICLE SERVICE".
2. Check the following items.
- Shift valve B
- Overrun clutch control valve
- Shift solenoid B
- Pilot valve
- Pilot filter

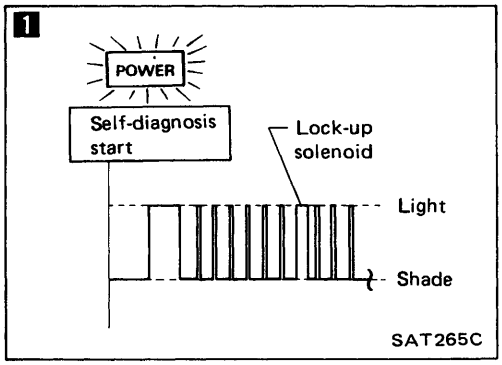
O.K. ↓ (O.K. ← from the above)

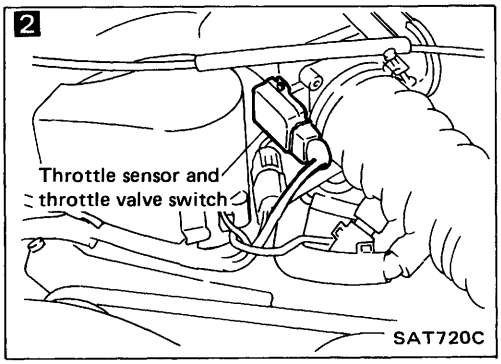
3. Disassemble A/T.
4. Check the following items.
- Servo piston assembly
- Brake band
- Torque converter
- Oil pump assembly

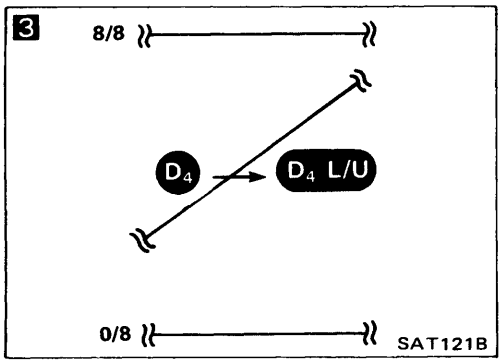
4 Check again. — N.G. →
1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

O.K. ↓

INSPECTION END







Diagnostic Procedure 13

SYMPTOM: A/T does not perform lock-up at the specified speed.

1 Does self-diagnosis show damage to lock-up solenoid circuit after cruise test?

- Yes → Check lock-up solenoid circuit. – Refer to "Self-diagnosis".
- No ↓

2 Check throttle sensor. – Refer to section EF & EC.

- N.G. → Repair or replace throttle sensor.
- O.K. ↓

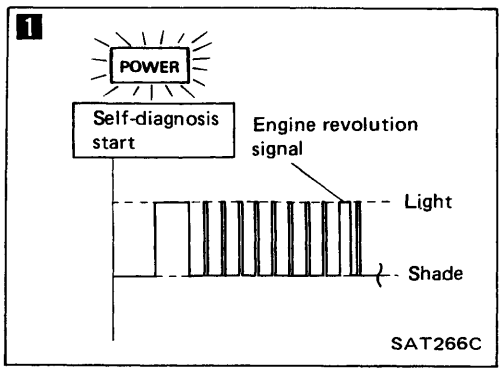
1. Remove control valve. – Refer to "ON-VEHICLE SERVICE".
2. Check following items.
   - Lock-up control valve
   - Shuttle shift valve D
   - Torque converter relief valve
   - Lock-up solenoid
   - Pilot valve
   - Pilot filter

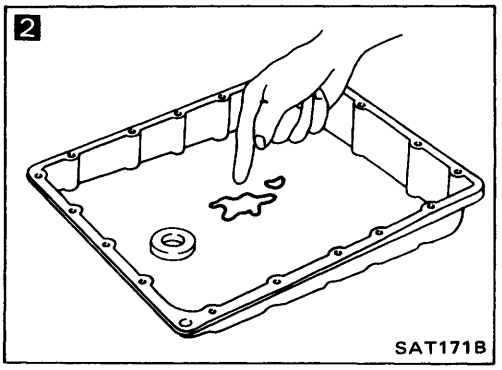
- N.G. → Repair or replace damaged parts.
- O.K. ↓

3 Check again.

- N.G. → 1. Perform A/T control unit input/output signal inspection. 2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.
- O.K. ↓

INSPECTION END





Diagnostic Procedure 14

SYMPTOM: A/T does not hold lock-up condition for more than 30 seconds.

1

Does self-diagnosis show damage to engine revolution signal circuit after cruise test?

Yes → Check engine revolution signal circuit – Refer to "Self-diagnosis".

No

2

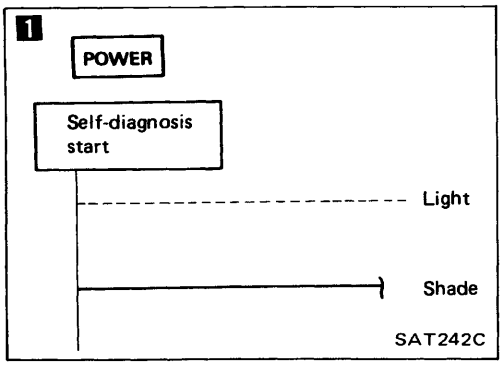
1. Remove oil pan.
2. Check A/T fluid condition.

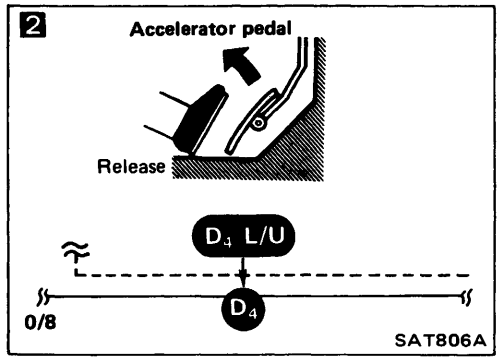
N.G. →
1. Remove control valve assembly. – Refer to "ON-VEHICLE SERVICE".
2. Check the following items.
- Lock-up control valve
- Pilot valve
- Pilot filter
3. Disassemble A/T.
4. Check torque converter and oil pump assembly.

O.K. → Check again.

O.K. → INSPECTION END

N.G. →
1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.





Diagnostic Procedure 15

SYMPTOM: Lock-up is not released when accelerator pedal is released.

1

Does self-diagnosis show damage to idle switch circuit after cruise test?

Yes → Check idle switch circuit. – Refer to "Self-diagnosis".

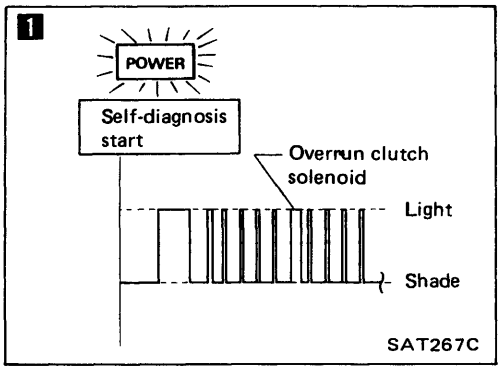
No

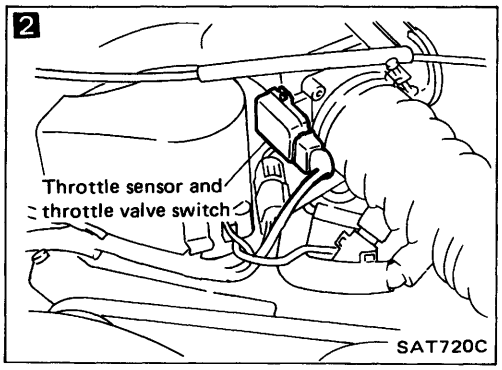
2

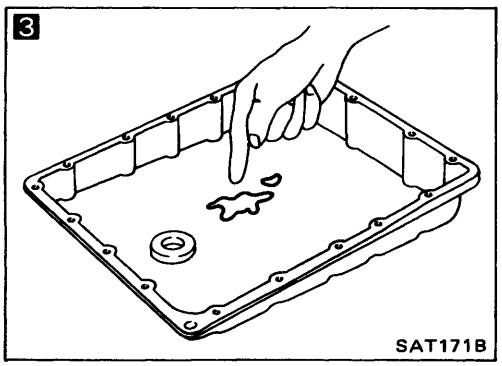
Check again.

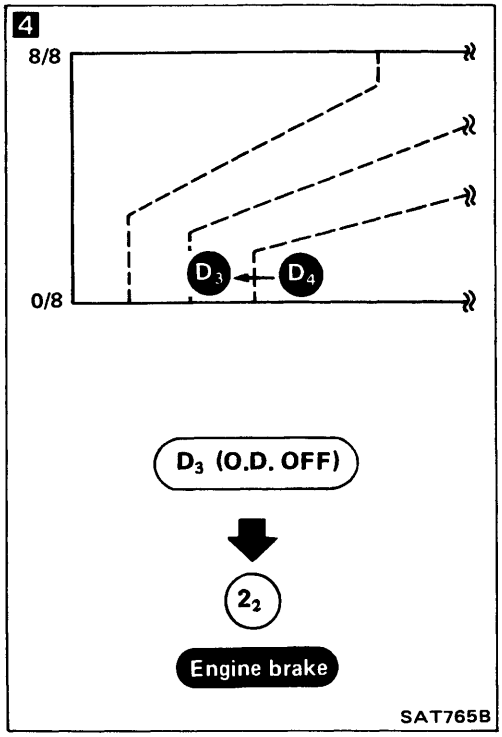
N.G. →
1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

O.K. → INSPECTION END









Diagnostic Procedure 16

SYMPTOM: Engine speed does not return to idle smoothly when A/T is shifted from D_4 to D_3 with accelerator pedal released.
Vehicle does not decelerate by engine brake when changing overdrive switch to "OFF" position with accelerator pedal released.
Vehicle does not decelerate by engine brake when changing selector lever from "D" to "2" range with accelerator pedal released.

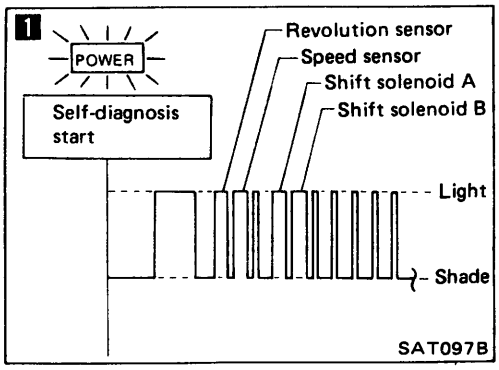
1 Does self-diagnosis show damage to overrun clutch solenoid circuit after cruise test?
- Yes → Check overrun clutch solenoid circuit. — Refer to "Self-diagnosis".
- No ↓

2 Check throttle sensor. — Refer to section EF & EC.
- N.G. → Repair or replace throttle sensor.
- O.K. ↓

3
1. Remove oil pan.
2. Check A/T fluid condition.
- N.G. →
  1. Remove control valve assembly. — Refer to "ON-VEHICLE SERVICE".
  2. Check the following items.
  - Overrun clutch control valve
  - Overrun clutch reducing valve
  - Overrun clutch solenoid
  - O.K. ↓
  3. Disassemble A/T.
  4. Check the following items.
  - Overrun clutch assembly
  - Oil pump assembly
- O.K. ↓

4 Check again.
- N.G. → 1. Perform A/T control unit input/output signal inspection. 2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.
- O.K. ↓

INSPECTION END



Diagnostic Procedure 17

SYMPTOM: Vehicle does not start from D_1 on Cruise test — Part 2.

1

Does self-diagnosis show damage to revolution sensor, speed sensor, shift solenoid A or B after cruise test?

Yes → Check damaged circuit. — Refer to "Self-diagnosis".

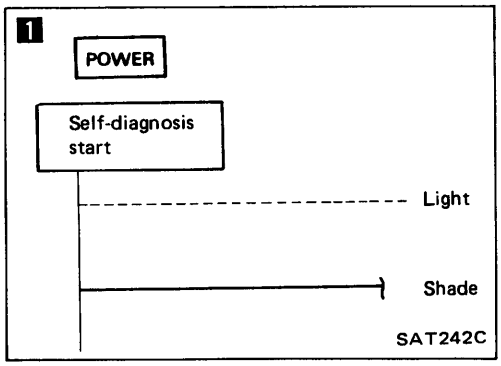
No ↓

Check again.

N.G. → 1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

O.K. ↓

Go to Diagnostic Procedure 9.



Diagnostic Procedure 18

SYMPTOM: A/T does not shift from D_4 to D_3 when changing overdrive switch to "OFF" position.

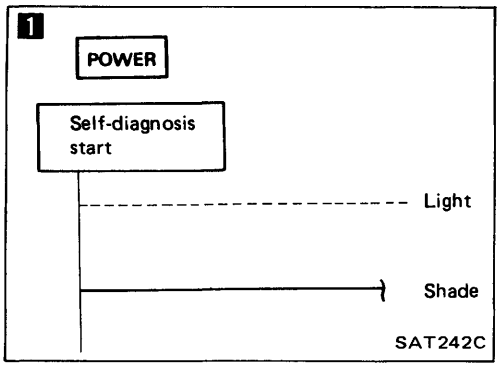
1

Does self-diagnosis show damage to overdrive switch circuit after cruise test?

Yes → Check overdrive switch circuit. — Refer to "Self-diagnosis".

No ↓

Go to Diagnostic Procedure 11.



Diagnostic Procedure 19

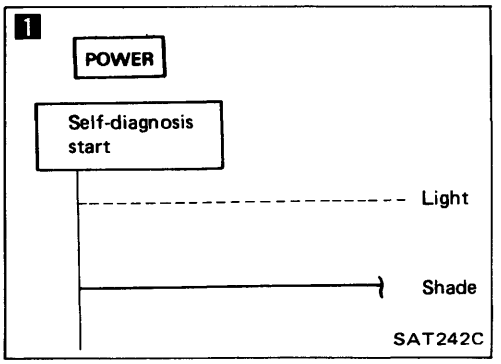
SYMPTOM: A/T does not shift from D_3 to 2_2 when changing selector lever from "D" to "2" range.

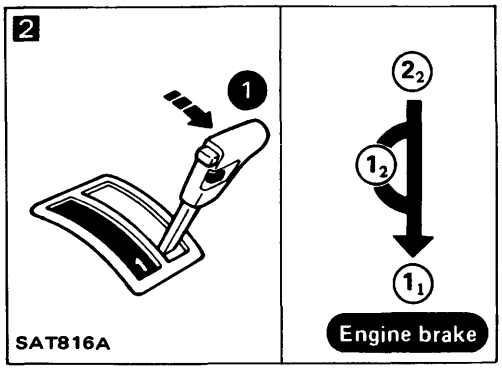
1

Does self-diagnosis show damage to inhibitor switch circuit after cruise test? — Yes → Check inhibitor switch circuit. – Refer to "Self-diagnosis".

No ↓

Go to Diagnostic Procedure 10.





Diagnostic Procedure 20

SYMPTOM: A/T does not shift from 2_2 to 1_1 when changing selector lever from "2" to "1" range.

1

Does self-diagnosis show damage to inhibitor switch after cruise test? — Yes → Check inhibitor switch circuit. – Refer to "Self-diagnosis".

No ↓

2

Check again. — N.G. → 1. Perform A/T control unit input/output signal inspection. 2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

O.K. ↓

INSPECTION END

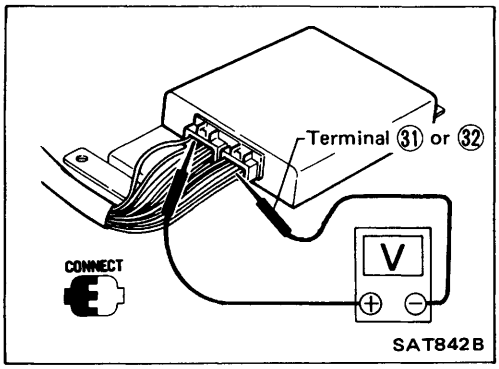
Diagnostic Procedure 21

SYMPTOM: Vehicle does not decelerate by engine brake when shifting from 2_2 (1_2) to 1_1.

Is diagnostic procedure 7 O.K.? — No → Go to Diagnostic Procedure 7.

Yes ↓

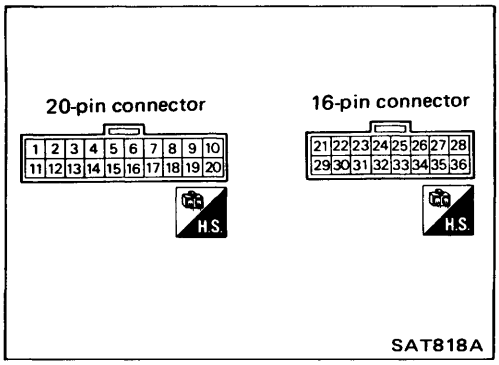
Go to Diagnostic Procedure 16.



Electrical Components Inspection

INSPECTION OF A/T CONTROL UNIT

- Measure voltage between each terminal and terminal ㉛ or ㉜ by following "A/T CONTROL UNIT INSPECTION TABLE".



- Pin connector terminal layout.

A/T CONTROL UNIT INSPECTION TABLE

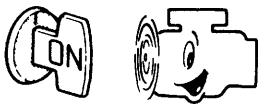
(Data are reference values.)

Terminal No.	Item	Condition		Judgement standard
1	Inhibitor "2" range switch		When selector lever is set to "2" range.	Battery voltage
			When selector lever is set to other ranges.	1V or less
2	Inhibitor "1" range switch		When selector lever is set to "1" range.	Battery voltage
			When selector lever is set to other ranges.	1V or less
3	Power shift switch		When power shift switch is set to "POWER" position.	Battery voltage
			When power shift switch is set to "AUTO" position.	1V or less
4	Idle switch (in throttle valve switch)		When accelerator pedal is released after warming up engine.	8 - 15V
			When accelerator pedal is depressed after warming up engine.	1V or less
5	–		–	–
6	A.S.C.D. O.D. cut signal		When "ACCEL" set switch is released on A.S.C.D. cruise.	5 - 8V
			When "ACCEL" set switch is applied on A.S.C.D. cruise.	1V or less

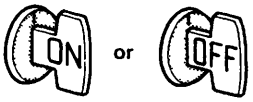
Electrical Components Inspection (Cont'd)

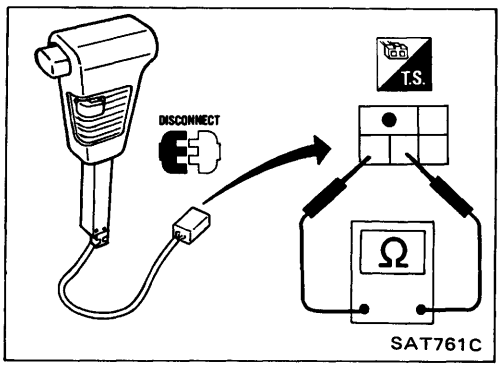
Terminal No.	Item	Condition		Judgement standard
7	Kickdown switch		When accelerator pedal is released after warming up engine.	3 - 8V
			When accelerator pedal is depressed fully after warming up engine.	1V or less
8	A.S.C.D. cruise signal		When A.S.C.D. cruise is being performed. ("CRUISE" light comes on.)	Battery voltage
			When A.S.C.D. cruise is not being performed. ("CRUISE" light does not come on.)	1V or less
9	Overdrive switch		When overdrive switch is set to "ON" position.	Battery voltage
			When overdrive switch is set to "OFF" position.	1V or less
10	Throttle sensor (Power source)		–	4.5 - 5.5V
11	Throttle sensor		When accelerator pedal is depressed slowly after warming up engine. Voltage rises gradually in response to throttle opening angle.	Fully-closed throttle: 0.2 - 0.6V Fully-open throttle: 2.9 - 3.9V
12	Fluid temperature sensor		When A.T.F. temperature is 20°C (68°F).	1.56V
			When A.T.F. temperature is 80°C (176°F).	0.45V
13	–		–	–
14	–		–	–
15	Throttle sensor (Ground)		–	–
16	Revolution sensor (Measure in AC range)		When vehicle is cruising at 30 km/h (19 MPH).	1V or more Voltage rises gradually in response to vehicle speed.
			When vehicle is parked.	0V

Electrical Components Inspection (Cont'd)

Terminal No.	Item	Condition		Judgement standard
17	Full throttle switch		When accelerator pedal is depressed more than half-way after warming up engine.	8 - 15V
			When accelerator pedal is released after warming up engine.	1V or less
18	–		–	–
19	Inhibitor "N" and "P" range switch		When selector lever is set to "N" or "P" range.	Battery voltage
			When selector lever is set to other ranges.	1V or less
20	Inhibitor "D" range switch		When selector lever is set to "D" range.	Battery voltage
			When selector lever is set to other ranges.	1V or less
21	Overrun clutch solenoid		When overrun clutch solenoid is operating.	Battery voltage
			When overrun clutch solenoid is not operating.	1V or less
22	Lock-up solenoid		When A/T is performing lock-up.	8 - 15V
			When A/T is not performing lock-up.	1V or less
23	Power shift indicator lamp		When power shift switch is set to "POWER" position.	Battery voltage
			When power shift switch is set to "AUTO" position.	1V or less
24	Speed sensor		When vehicle is moving at 2 to 3 km/h (1 to 2 MPH) for 1 m (3 ft) or more.	Vary from 0 to 5V
25	Engine revolution signal		When engine is running at idle speed.	9.5 - 12V
			When engine is running at 2,500 rpm.	Approximately 10V
26	Inhibitor "R" range switch		When selector lever is set to "R" range.	Battery voltage
			When selector lever is set to other ranges.	1V or less
27	–		–	–

Electrical Components Inspection (Cont'd)

Terminal No.	Item	Condition		Judgement standard
28	Power source (Back-up)		When ignition switch is turned to "OFF".	Battery voltage
			When ignition switch is turned to "ON".	Battery voltage
29 30	Power source		When ignition switch is turned to "ON".	Battery voltage
			When ignition switch is turned to "OFF".	1V or less
31 32	Ground		–	–
33	Line pressure solenoid (with dropping resistor)		When accelerator pedal is released after warming up engine.	5 - 14V
			When accelerator pedal is depressed fully after warming up engine.	0.5V or less
34	Line pressure solenoid		When accelerator pedal is released after warming up engine.	1.5 - 2.5V
			When accelerator pedal is depressed fully after warming up engine.	0.5V or less
35	Shift solenoid A		When shift solenoid A is operating. (When driving in "D_1" or "D_4".)	Battery voltage
			When shift solenoid A is not operating. (When driving in "D_2" or "D_3".)	1V or less
36	Shift solenoid B		When shift solenoid B is operating. (When driving in "D_1" or "D_2".)	Battery voltage
			When shift solenoid B is not operating. (When driving in "D_3" or "D_4".)	1V or less



OVERDRIVE SWITCH

- Check continuity between two terminals.

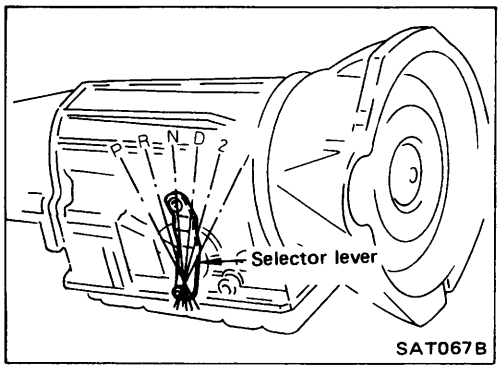
O.D. switch position	Continuity
ON	No
OFF	Yes

Electrical Components Inspection (Cont'd)

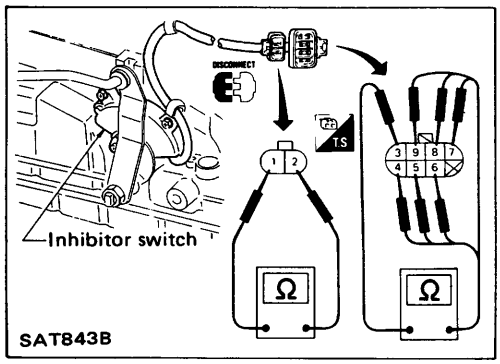
INHIBITOR SWITCH

1. Check continuity between terminals ① and ② and between terminals ③ and ④, ⑤, ⑥, ⑦, ⑧, ⑨ while moving selector lever through each range.

Lever position \ Terminal No.	①	②	③	④	⑤	⑥	⑦	⑧	⑨
P	○	○	○	○					
R			○		○				
N	○	○	○			○			
D			○				○		
2			○					○	
1			○						○

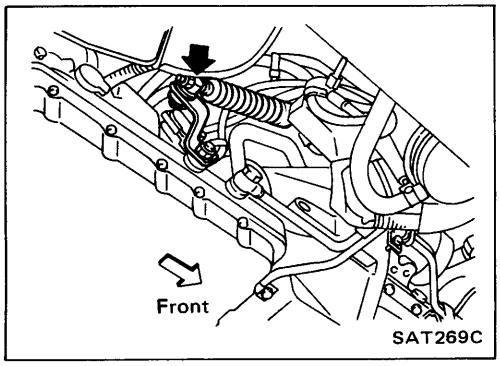


SAT067B

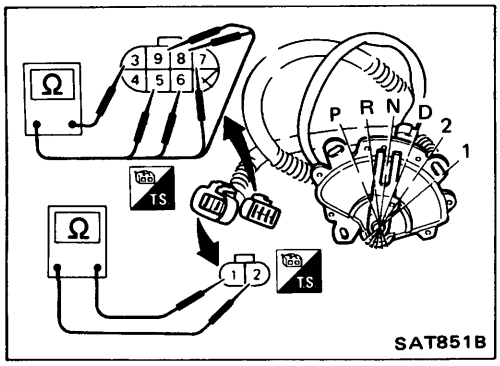


SAT843B

2. If N.G., check again with manual control cable disconnected from manual shaft of A/T assembly. — Refer to step 1.
3. If O.K. on step 2, adjust manual control cable — Refer to "ON-VEHICLE SERVICE".



SAT269C



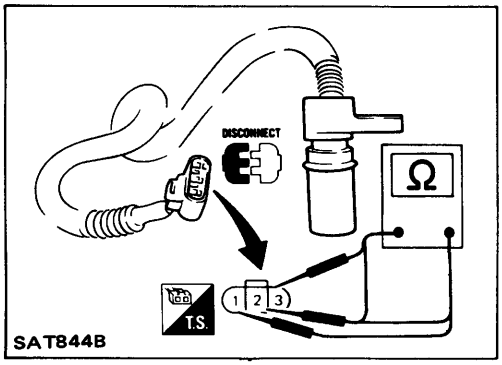
SAT851B

4. If N.G. on step 2, remove inhibitor switch from A/T and check continuity of inhibitor switch terminal. — Refer to step 1.
5. If O.K. on step 4, adjust inhibitor switch. — Refer to "ON-VEHICLE SERVICE".
6. If N.G. on step 4, replace inhibitor switch.

REVOLUTION SENSOR

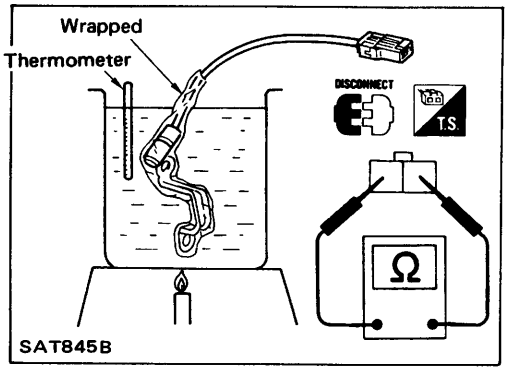
- For removal and installation, refer to "ON-VEHICLE SERVICE".
- Check resistance between terminals ①, ② and ③.

Terminal No.		Resistance
①	②	500 - 650Ω
②	③	No continuity
①	③	No continuity



SAT844B

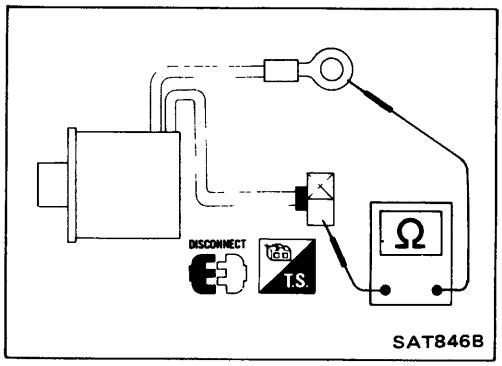
Electrical Components Inspection (Cont'd)



FLUID TEMPERATURE SENSOR

- For removal and installation, refer to "ON-VEHICLE SERVICE".
- Check resistance between two terminals while changing temperature as shown at left.

Temperature °C (°F)	Resistance
20 (68)	Approximately 2.5 kΩ
80 (176)	Approximately 0.3 kΩ



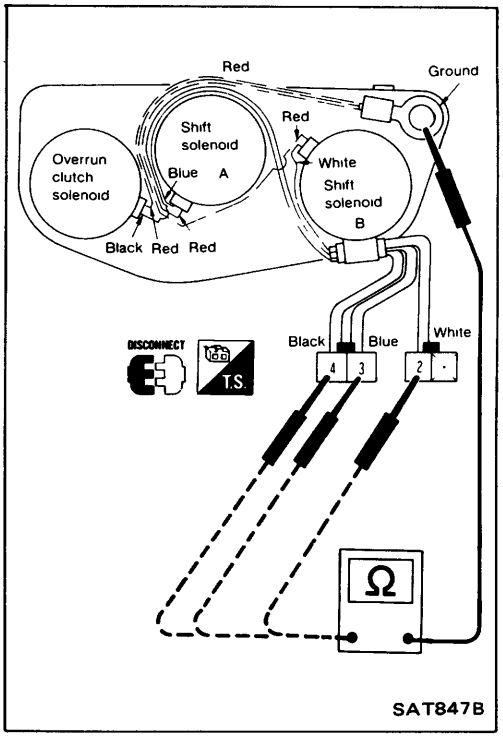
LOCK-UP SOLENOID AND LINE PRESSURE SOLENOID

- For removal and installation, refer to "ON-VEHICLE SERVICE".
- Check resistance between two terminals.

Resistance:

Lock-up solenoid 10 - 16Ω

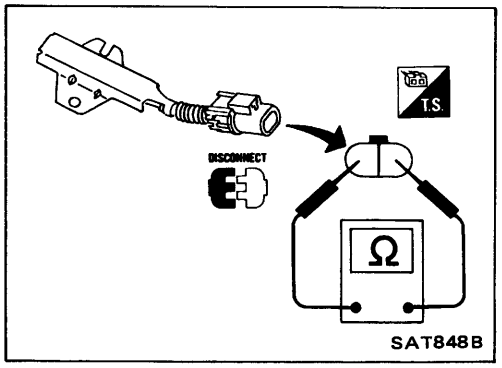
Line pressure solenoid 2.5 - 5Ω



3-UNIT SOLENOID ASSEMBLY
(Shift solenoid A, B and overrun clutch solenoid)

- For removal and installation, refer to "ON-VEHICLE SERVICE".
- Check resistance between terminals of each solenoid.

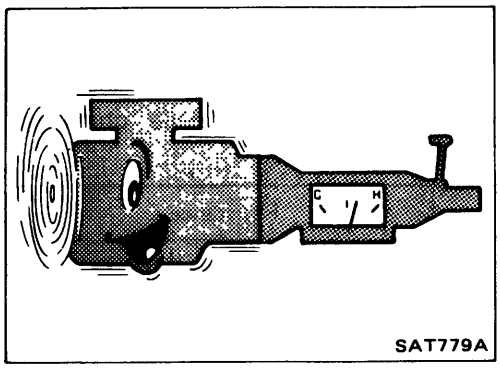
Solenoid	Terminal No.		Resistance
Shift solenoid A	③	Ground terminal	20 - 30Ω
Shift solenoid B	②		
Overrun clutch solenoid	④		



DROPPING RESISTOR

- Check resistance between two terminals.

Resistance: 11.2 - 12.8Ω


SAT779A

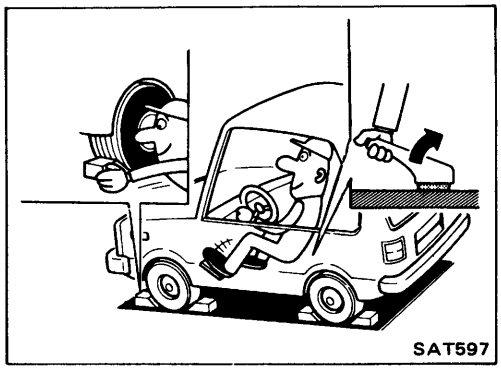
Final Check

STALL TESTING

Stall test procedure

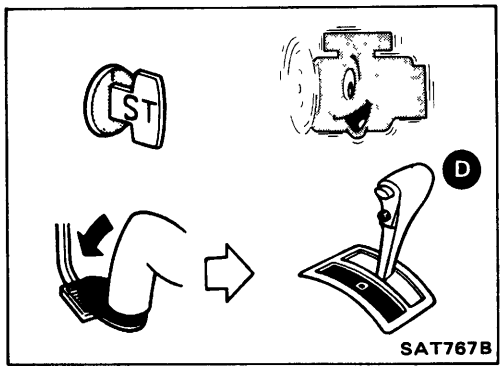
1. Check A/T and engine fluid levels. If necessary, add.
2. Warm up engine until engine oil and A.T.F. reach operating temperature after vehicle has been driven approx. 10 minutes.

   A.T.F. operating temperature:
   50 - 80°C (122 - 176°F)


SAT597

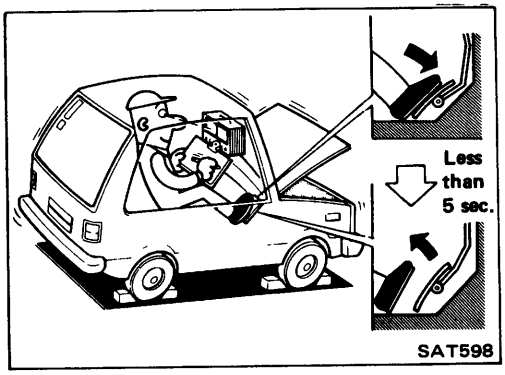
3. Set parking brake and block wheels.
4. Install a tachometer where it can be seen by driver during test.

- **It is good practice to put a mark on point of specified engine rpm on indicator.**



SAT767B

5. Start engine, apply foot brake, and place selector lever in "D" range.

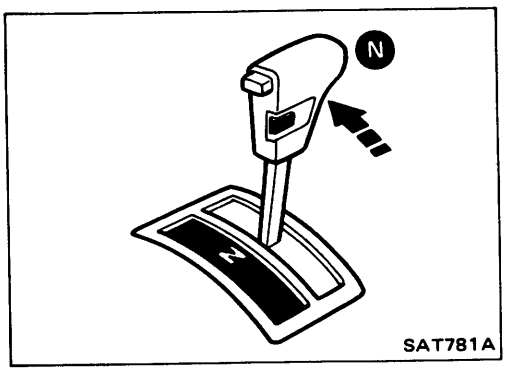


SAT598

6. Accelerate to wide-open throttle gradually while applying foot brake.
7. Quickly note the engine stall revolution and immediately release throttle.

- **During test, never hold throttle wide-open for more than 5 seconds.**

  Stall revolution:
  2,260 - 2,510 rpm



SAT781A

8. Shift selector lever to "N".
9. Cool off A.T.F.

- **Run engine at idle for at least one minute.**

10. Perform stall tests in the same manner as in steps 5 through 9 with selector lever in "2", "1" and "R", respectively.

Final Check (Cont'd)

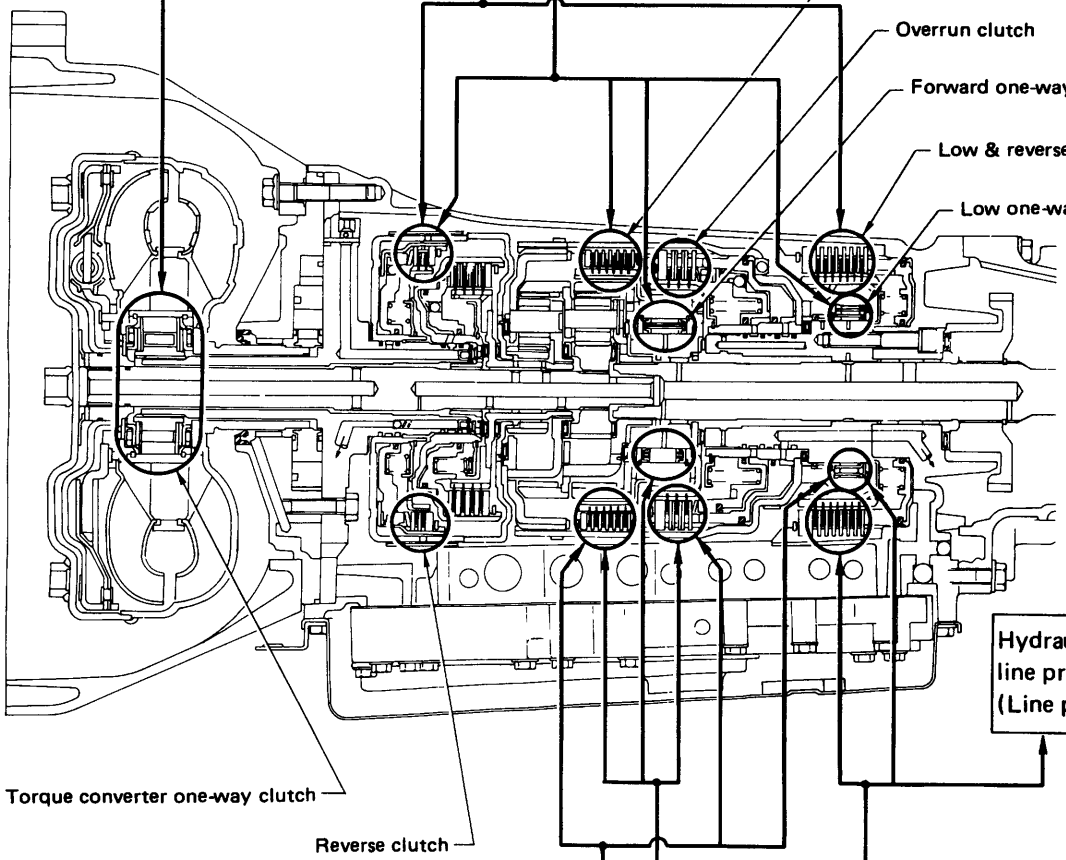
Judgement of stall test

Selector lever position	Judgement		
D	L	O	H
2	L	O	H
1	L	O	O
R	L	H	H

O : Stall revolution is normal.
H : Stall revolution is higher than specified.
L : Stall revolution is lower than specified.

Damaged components

Engine



Hydraulic circuit for line pressure control (Line pressure is low.)

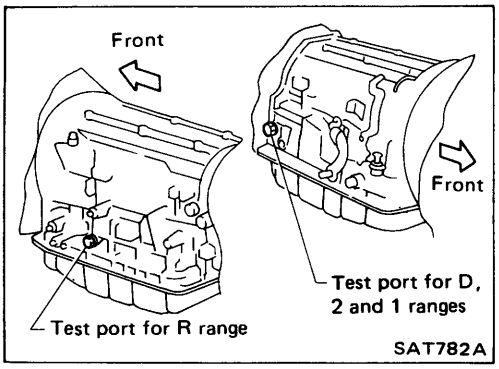
Clutches and brakes except high clutch and brake band are O.K. (Condition of high clutch and brake band cannot be confirmed by stall test.)

Selector lever position	Judgement			
D	H	H	H	O
2	H	H	H	O
1	O	H	H	O
R	O	O	H	O

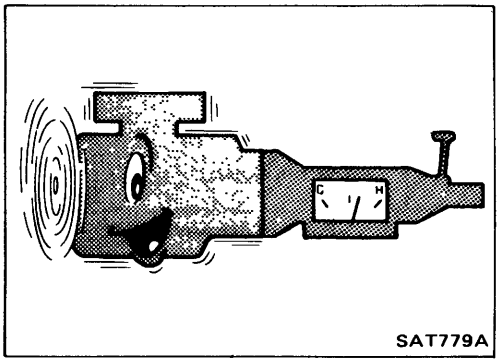
SAT107B

Final Check (Cont'd)

PRESSURE TESTING



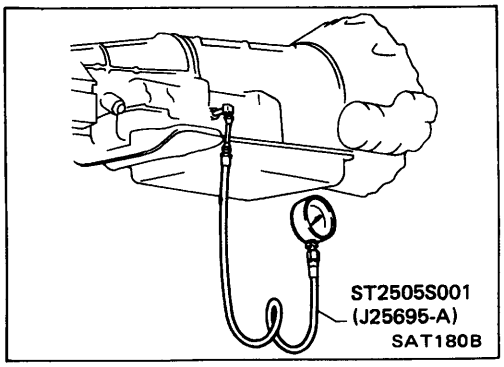
- Location of line pressure test port
- **Line pressure plugs are hexagon headed bolts.**
- **Always replace line pressure plugs as they are self-sealing bolts.**



Line pressure test procedure

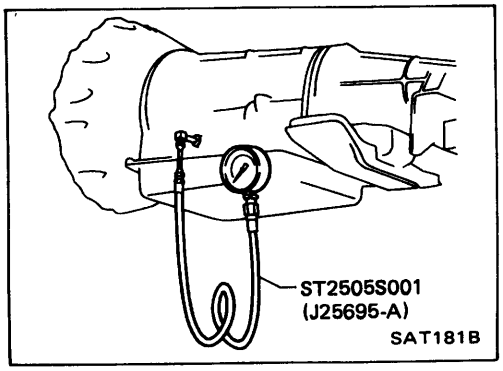
1. Check A/T and engine fluid levels. If necessary, add.
2. Warm up engine until engine oil and A.T.F. reach operating temperature after vehicle has been driven approx. 10 minutes.

   A.T.F. operating temperature:
   50 - 80°C (122 - 176°F)

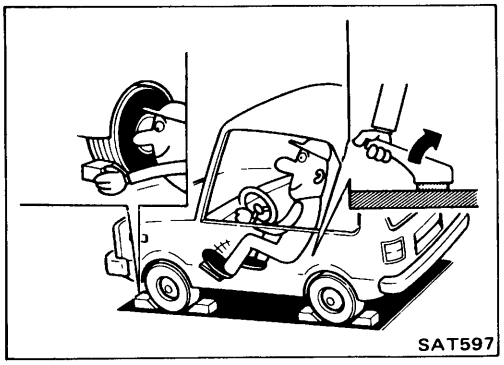


3. Install pressure gauge to line pressure port.

— **D, 2 and 1 ranges** —

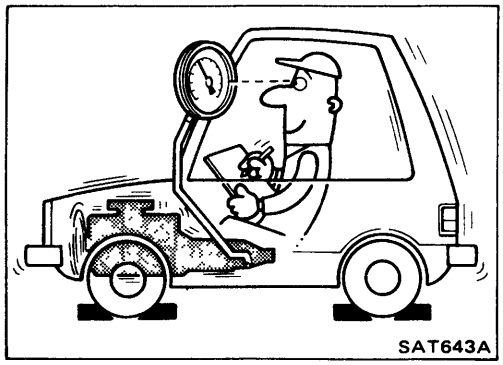


— **R range** —



4. Set parking brake and block wheels.
- **Continue to depress brake pedal fully while line pressure test at stall speed is performed.**

Final Check (Cont'd)


SAT643A

5. Start engine and measure line pressure at idle and stall speed.

- **When measuring line pressure at stall speed, follow the stall test procedure.**

Line pressure:

Engine speed rpm	Line pressure kPa (kg/cm^2, psi)	
	D, 2 and 1 ranges	R range
Idle	432 - 471 (4.4 - 4.8, 63 - 68)	667 - 706 (6.8 - 7.2, 97 - 102)
Stall	883 - 961 (9.0 - 9.8, 128 - 139)	1,393 - 1,471 (14.2 - 15.0, 202 - 213)

JUDGEMENT OF LINE PRESSURE TEST

	Judgement	Suspected parts
At idle	Line pressure is low in all ranges.	• Oil pump wear • Control piston damage • Pressure regulator valve or plug sticking • Spring for pressure regulator valve damaged • Fluid pressure leakage between oil strainer and pressure regulator valve
	Line pressure is low in particular range.	• Fluid pressure leakage between manual valve and particular clutch. • For example; If line pressure is low in "R" and "1" ranges but is normal in "D" and "2" range, fluid leakage exists at or around low & reverse brake circuit.
	Line pressure is high.	• Mal-adjustment of throttle sensor • Fluid temperature sensor damaged • Line pressure solenoid sticking • Short circuit of line pressure solenoid circuit • Pressure modifier valve sticking • Pressure regulator valve or plug sticking
At stall speed	Line pressure is low.	• Mal-adjustment of throttle sensor • Control piston damaged • Line pressure solenoid sticking • Short circuit of line pressure solenoid circuit • Pressure regulator valve or plug sticking • Pressure modifier valve sticking • Pilot valve sticking

Symptom Chart

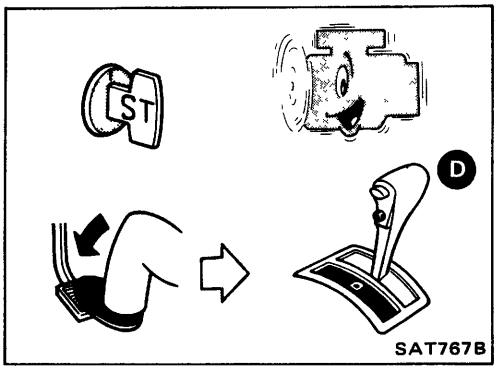
Reference page (AT-)	Numbers are arranged in order of probability. Perform inspections starting with number one and working up. Circled numbers indicate that the transmission must be removed from the vehicle.	ON vehicle										OFF vehicle					
	Reference page (AT-)	16, 22	83	83	87	84, 154	84	84	11, 84	11	11	135, 149	183, 187	189, 200	189, 197	193	207
		Fluid level Control cable	Inhibitor switch Throttle sensor (Adjustment)	Revolution sensor and speed sensor Engine revolution signal	Engine idling rpm Line pressure	Control valve assembly Shift solenoid A	Shift solenoid B Line pressure solenoid	Lock-up solenoid Overrun clutch solenoid	Fluid temperature sensor Accumulator N-D	Accumulator 1-2 Accumulator 2-3	Accumulator 3-4 (N-R) Ignition switch and starter	Torque converter Oil pump	Reverse clutch High clutch	Forward clutch Forward one-way clutch	Overrun clutch Low one-way clutch	Low & reverse brake Brake band	Parking components
64	Engine does not start in "N", "P" ranges.	2	3								1						
64	Engine starts in range other than "N" and "P".	1	2														
–	Transmission noise in "P" and "N" ranges.	1	3	4 5	2							⑦⑥					
65	Vehicle moves when changing into "P" range or parking gear does not disengage when shifted out of "P" range.	1															②
66	Vehicle runs in "N" range.	1									4		③	②	⑤		
68	Vehicle will not run in "R" range (but runs in "D", "2" and "1" ranges). Clutch slips. Very poor acceleration.	1			2	4	3						⑤⑥	⑦	⑧	⑨	
–	Vehicle braked when shifting into "R" range.	1 2			3	5	4						⑥	⑧	⑨	⑦	
–	Sharp shock in shifting from "N" to "D" range.		2	5	1 3	7	6		4 8					⑨			
–	Vehicle will not run in "D" and "2" ranges (but runs in "1" and "R" range).	1													②		
69	Vehicle will not run in "D", "1", "2" ranges (but runs in "R" range). Clutch slips. Very poor acceleration.	1			2	4	3		5				⑥ ⑦	⑧ ⑨	⑩		
–	Clutches or brakes slip somewhat in starting.	1 2	3		4	6	5		7		8	⑬ ⑫	⑩	⑨		⑪	
–	Excessive creep.				1												
68, 69	No creep at all.	1			2	3						⑥⑤		④			
–	Failure to change gear from "D_1" to "D_2".	2	1	5		4 3										⑥	
–	Failure to change gear from "D_2" to "D_3".	2	1	5		4	3						⑥			⑦	
–	Failure to change gear from "D_3" to "D_4".	2	1	4		3			5							⑥	
71, 72, 73	Too high a gear change point from "D_1" to "D_2", from "D_2" to "D_3", from "D_3" to "D_4".		1	2		3	4										
–	Gear change directly from "D_1" to "D_3" occurs.	1								2						③	
–	Engine stops when shifting lever into "R", "D", "2" and "1".				1	3		2				④					
–	Too sharp a shock in change from "D_1" to "D_2".		1		2	4			5	3						⑥	
–	Too sharp a shock in change from "D_2" to "D_3".		1		2	4				3			⑤			⑥	

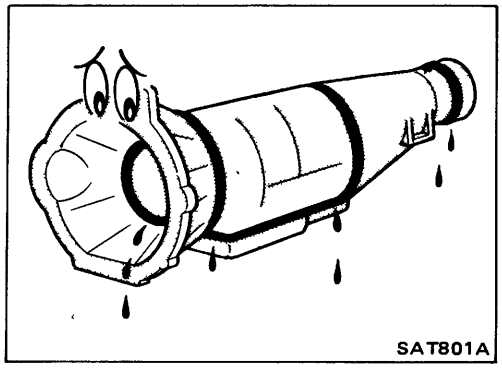
Symptom Chart (Cont'd)

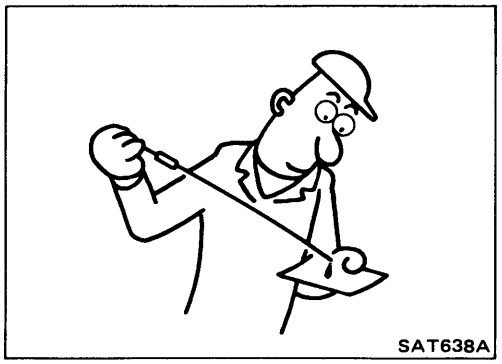
Reference page (AT-)		ON vehicle										OFF vehicle					
	Reference page (AT-)	16, 22	83	83	87	84, 154	84	84	11, 84	11	11	135, 149	183, 187	189, 200	189, 197	193	207
	Numbers are arranged in order of probability. Perform inspections starting with number one and working up. Circled numbers indicate that the transmission must be removed from the vehicle	Fluid level Control cable	Inhibitor switch Throttle sensor (Adjustment)	Revolution sensor and speed sensor Engine revolution signal	Engine idling rpm Line pressure	Control valve assembly Shift solenoid A	Shift solenoid B Line pressure solenoid	Lock-up solenoid Overrun clutch solenoid	Fluid temperature sensor Accumulator N-D	Accumulator 1-2 Accumulator 2-3	Accumulator 3-4 (N-R) Ignition switch and starter	Torque converter Oil pump	Reverse clutch High clutch	Forward clutch Forward one-way clutch	Overrun clutch Low one-way clutch	Low & reverse brake Brake band	Parking components
–	Too sharp a shock in change from "D_3" to "D_4".	. .	. 1	. .	. 2	4 .	. .	. .	. .	. .	3 .	. .	. .	. .	⑥ .	. ⑤	.
–	Almost no shock or clutches slipping in change from "D_1" to "D_2".	1 .	. 2	. .	. 3	5 .	. .	. .	. .	4 .	. .	. .	. .	. .	. .	. ⑥	.
–	Almost no shock or slipping in change from "D_2" to "D_3".	1 .	. 2	. .	. 3	5 .	. .	. .	. .	. 4	. .	. .	. ⑥	. .	. .	. ⑦	.
–	Almost no shock or slipping in change from "D_3" to "D_4".	1 .	. 2	. .	. 3	5 .	. .	. .	. .	. .	4 .	. .	. ⑥	. .	. .	. ⑦	.
–	Vehicle braked by gear change from "D_1" to "D_2".	1 .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	② ④	. .	. ⑤	③ .	.
–	Vehicle braked by gear change from "D_2" to "D_3".	1 .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. ②	.
–	Vehicle braked by gear change from "D_3" to "D_4".	1 .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	④ .	. ③	② .	. .	.
–	Maximum speed not attained. Acceleration poor.	1 .	2 .	. .	. .	5 3	4 .	. .	. .	. .	. .	⑪ ⑩	⑥ ⑦	. .	. .	⑨ ⑧	.
–	Failure to change gear from "D_4" to "D_3".	1 .	. 2	. .	. .	6 4	. 5	. 3	. .	. .	. .	. .	. .	. .	⑧ .	⑦ .	.
–	Failure to change gear from "D_3" to "D_2" or from "D_4" to "D_2".	1 .	. 2	. .	. .	5 3	4 .	. .	. .	. .	. .	. .	. ⑥	. .	. .	. ⑦	.
–	Failure to change gear from "D_2" to "D_1" or from "D_3" to "D_1".	1 .	. 2	. .	. .	5 3	4 .	. .	. .	. .	. .	. .	. ⑦	. .	. ⑥	. ⑧	.
–	Gear change shock felt during deceleration by releasing accelerator pedal.	. .	. 1	. .	. 2	4 .	. .	. 3	. .	. .	. .	. .	. .	. .	. .	. .	.
–	Too high a change point from "D_4" to "D_3", from "D_3" to "D_2", from "D_2" to "D_1".	. .	. 1	2 .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	.
–	Kickdown does not operate when depressing pedal in "D_4" within kickdown vehicle speed.	. .	. 1	2 .	. .	. 3	4 .	. .	. .	. .	. .	. .	. .	. .	. .	. .	.
–	Kickdown operates or engine overruns when depressing pedal in "D_4" beyond kickdown vehicle speed limit.	. .	. 2	1 .	. .	. 3	4 .	. .	. .	. .	. .	. .	. .	. .	. .	. .	.
–	Races extremely fast or slips in changing from "D_4" to "D_3" when depressing pedal.	1 .	. 2	. .	. 3	5 .	. 4	. .	. .	. .	. .	. .	. ⑥	⑦ .	. .	. .	.
–	Races extremely fast or slips in changing from "D_4" to "D_2" when depressing pedal.	1 .	. 2	. .	. 3	6 5	. 4	. .	. .	. .	. .	. .	. .	⑧ .	. .	. ⑦	.
–	Races extremely fast or slips in changing from "D_3" to "D_2" when depressing pedal.	1 .	. 2	. .	. 3	5 .	. 4	. .	8 .	. 0	. .	. .	. ⑨	⑦ .	. .	. ⑥	.
–	Races extremely fast or slips in changing from "D_4" or "D_3" to "D_1" when depressing pedal.	1 .	. 2	. .	. 3	5 .	. 4	. .	. .	. .	. .	. .	. .	⑥ ⑦	. ⑧	. .	.
–	Vehicle will not run in any range	1 2	. .	. .	. 3	. .	. 4	. .	. .	. .	. .	⑨ ⑤	. ⑥	. .	. .	⑧ ⑦	⑩
–	Transmission noise in "D", "2", "1" and "R" ranges.	1 .	. .	. .	. .	. .	. .	. .	. .	. .	. .	② .	. .	. .	. .	. .	.

Symptom Chart (Cont'd)

Reference page (AT-)		ON vehicle									OFF vehicle					
	Reference page (AT-)	16, 22	83	83	87	84, 154	84	84	11, 84	11	11	135, 149	183, 187	189, 200	189, 197	193	207
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78	Failure to change from "D_3" to "2_2" when changing lever into "2" range.	. 7	1 2	. .	. .	6 5	4 .	. 3	. .	. .	. .	. .	. .	. .	⑨ .	. ⑧	.
–	Gear change from "2_2" to "2_3" in "2" range.	. .	1 .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	.
78	Engine brake does not operate in "1" range.	. 2	1 3	4 .	. .	6 5	. .	. 7	. .	. .	. .	. .	. .	. .	⑧ .	⑨ .	.
–	Gear change from "1_1" to "1_2" in "1" range.	. 2	1 .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	.
–	Does not change from "1_2" to "1_1" in "1" range	. .	1 .	2 .	. .	4 3	. .	. 5	. .	. .	. .	. .	. .	. .	⑥ .	⑦ .	.
–	Large shock changing from "1_2" to "1_1" in "1" range.	. .	. .	. .	. .	1 .	. .	. .	. .	. .	. .	. .	. .	. .	. .	② .	.
–	Transmission overheats.	1 .	. 3	. .	2 4	6 .	. 5	. .	. .	. .	. .	⑭⑦	⑧⑨	⑪ .	⑫ .	⑬⑩	.
–	A.T.F. shoots out during operation. White smoke emitted from exhaust pipe during operation.	1 .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	②③	⑤ .	⑥ .	⑦④	.
–	Offensive smell at fluid charging pipe.	1 .	. .	. .	. .	. .	. .	. .	. .	. .	. .	②③	④⑤	⑦ .	⑧ .	⑨⑥	.
–	Torque converter is not locked up.	. .	3 1	2 4	. 6	8 .	. .	7 .	5 .	. .	. .	⑨ .	. .	. .	. .	. .	.
–	Lock-up piston slip	1 .	. 2	. .	. 3	6 .	. 5	4 .	. .	. .	. .	⑦ .	. .	. .	. .	. .	.
74	Lock-up point is extremely high or low.	. .	. 1	2 .	. .	4 .	. .	3 .	. .	. .	. .	. .	. .	. .	. .	. .	.
–	A/T does not shift to "D_4" when driving with overdrive switch "ON".	. .	2 1	3 .	. 8	6 4	. .	. 5	7 .	. .	. .	. .	. .	. .	⑩ .	. ⑨	.
–	Engine is stopped at "R", "D", "2" and "1" ranges.	1 .	. .	. .	. .	5 4	3 .	2 .	. .	. .	. .	. .	. .	. .	. .	. .	.







Preliminary Check (Prior to Road Testing)

FLUID LEAKAGE CHECK

1. Clean area suspected of leaking, — for example, mating surface of converter housing and transmission case.
2. Start engine, apply foot brake, place selector lever in "D" range and wait a few minutes.
3. Stop engine.
4. Check for fresh leakage.

FLUID CONDITION CHECK

Fluid color	Suspected problem
Dark or black with burned odor	Wear of frictional material
Milky pink	Water contamination – Road water entering through filler tube or breather
Varnished fluid, light to dark brown and tacky	Oxidation – Over or under filling – Overheating

FLUID LEVEL CHECK — Refer to section MA.

Road Testing

Perform road tests using "Symptom" chart. Refer to page AT-96.

"P" RANGE

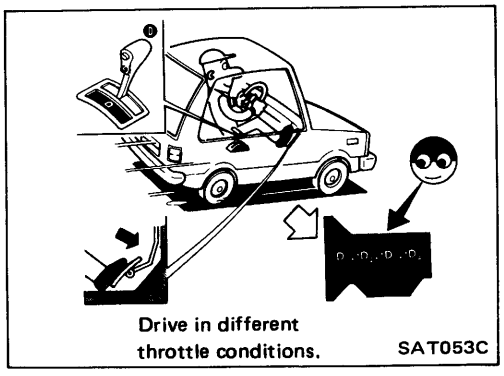
1. Place selector lever in "P" range and start the engine. Stop the engine and repeat the procedure in all ranges, including neutral.
2. Stop vehicle on a slight upgrade and place selector lever in "P" range. Release parking brake to make sure vehicle remains locked.

"R" RANGE

1. Manually move selector lever from "P" to"R", and note shift quality.
2. Drive vehicle in reverse long enough to detect slippage or other abnormalities.

"N" RANGE

1. Manually move selector lever from "R" and "D" to "N" and note quality.
2. Release parking brake with selector lever in "N" range. Lightly depress accelerator pedal to make sure vehicle does not move. (When vehicle is new or soon after clutches have been replaced, vehicle may move slightly. This is not a problem.)

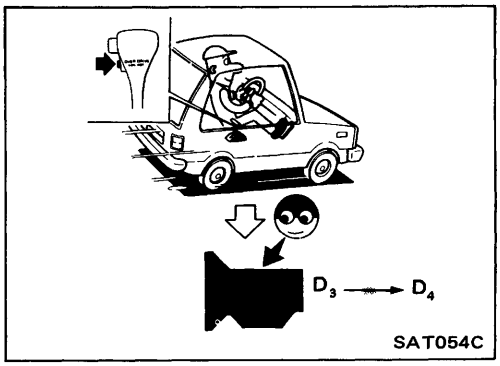


Drive in different throttle conditions. SAT053C

"D" RANGE

1. Manually shift selector lever from "N" to "D" range, and note shift quality.
2. Using the shift schedule as a reference, drive vehicle in "D" range. Record, on symptom chart, respective vehicle speeds at which up-shifting and down-shifting occur. These speeds are to be read at three different throttle positions (light, half and full), respectively. Also determine the timing at which shocks are encountered during shifting and which clutches are engaged.
3. Determine, by observing lock-up pressure, whether lock-up properly occurs while driving vehicle in proper gear position.

Road Testing (Cont'd)



4. Check to determine if shifting to overdrive gear cannot be made while O.D. control switch is "OFF".

5. When vehicle is being driven in the 65 to 80 km/h (40 to 50 MPH) range in "D_3" range at half to light throttle position, fully depress accelerator pedal to make sure it downshifts from 3rd to 2nd gear.
6. When vehicle is being driven in the 35 to 45 km/h (22 to 28 MPH) ("D_2" range) at half to light throttle position, fully depress accelerator pedal to make sure it downshifts from 2nd to 1st gear.

"2" RANGE

1. Shift to "2" range and make sure vehicle begins to move in 1st gear.
2. Increase vehicle speed to make sure it upshifts from 1st to 2nd gear.
3. Further increase vehicle speed. Make sure it does not upshift to 3rd gear.
4. While driving vehicle at the 35 to 45 km/h (22 to 28 MPH) with throttle at half to light position ("2_2" range), fully depress accelerator pedal to make sure it downshifts from 2nd to 1st gear.
5. Allow vehicle to run idle while in "2" range to make sure that it downshifts to 1st gear.
6. Move selector lever to "D" range and allow vehicle to operate at 40 to 50 km/h (25 to 31 MPH). Then, shift to "2" range to make sure it downshifts to 2nd gear.

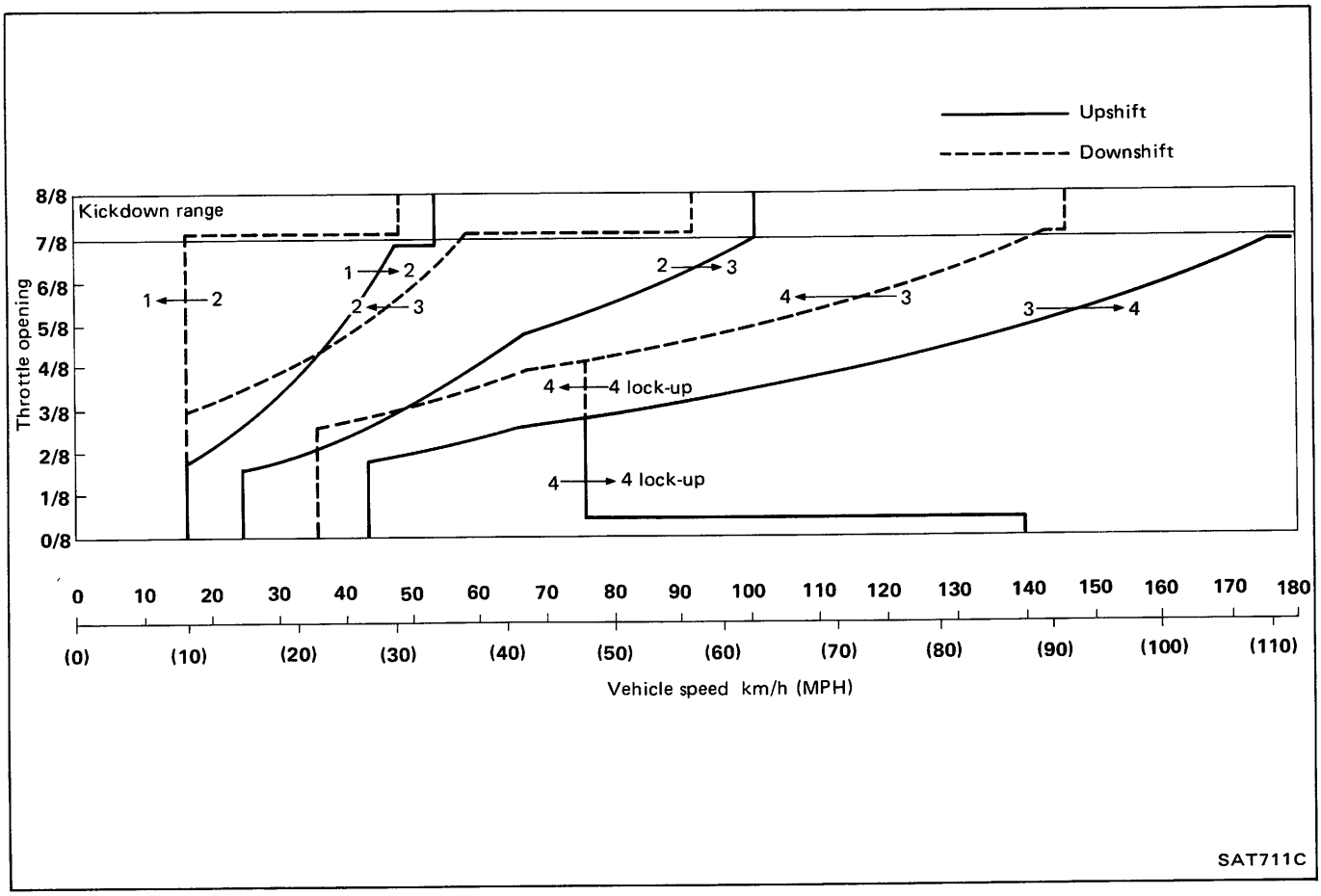
"1" RANGE

1. Place selector lever in "1" range and accelerate vehicle. Make sure it does not shift from 1st to 2nd gear although vehicle speed increases.
2. While vehicle is being driven in "1" range, release accelerator pedal to make sure that engine compression acts as a brake.
3. Place selector lever in "D" or "2" range and allow vehicle to run at 20 to 30 km/h (12 to 19 MPH). Then move selector lever to "1" range to make sure it downshifts to 1st gear.

SHIFT SCHEDULE

Road Testing

KA24E engine model



VEHICLE SPEED WHEN SHIFTING GEARS

KA24E engine

Throttle position	Vehicle speed km/h (MPH)						
	$D_1 \rightarrow D_2$	$D_2 \rightarrow D_3$	$D_3 \rightarrow D_4$	$D_4 \rightarrow D_3$	$D_3 \rightarrow D_2$	$D_2 \rightarrow D_1$	$1_2 \rightarrow 1_1$
Full throttle	53 - 57 (33 - 35)	100 - 108 (62 - 67)	–	147 - 157 (91 - 98)	91 - 99 (57 - 62)	47 - 51 (29 - 32)	41 - 45 (25 - 28)
Half throttle	32 - 36 (20 - 22)	57 - 65 (35 - 40)	114 - 124 (71 - 77)	65 - 75 (40 - 47)	28 - 36 (17 - 22)	12 - 16 (7 - 10)	41 - 45 (25 - 28)

VEHICLE SPEED WHEN PERFORMING AND RELEASING LOCK-UP

KA24E engine

Throttle position	D_4	
	Vehicle speed km/h (MPH)	
	Lock-up "ON"	Lock-up "OFF"
Full throttle	–	–
Half throttle	71 - 79 (44 - 49)	71 - 79 (44 - 49)

Road Testing (Cont'd)

ROAD TEST SYMPTOM CHART

Numbers are arranged in order of probability.
Perform inspections starting with number one and working up.
Circled numbers indicate that the transmission must be removed from the vehicle.

[ ] : Valve expected to be malfunctioning

		ON VEHICLE												
		Oil level and oil quality Control linkage Inhibitor switch and wiring	Throttle wire Engine idling rpm Line pressure	Control valve	4th speed cut valve	Pressure regulator valve	Pressure modifier valve	1-2 shift valve	2-3 shift valve	3-4 shift valve	Accumulator control valve	3-2 downshift valve	2-3 throttle modifier valve
Sharp shocks in shifting from "N" to "D" range		1 2 .	5 3 4	8									
Shift shocks	When shifting from 1st to 2nd or 2nd to 3rd	1 2 .	4 . 3	7									
	When shifting from 3rd to 4th	1 2 .	4 . 3	6									
	When shifting from D to 2 and 1 range. When O.D. switch is set from "ON" to "OFF"	1 2 .	4 . 3	5									
	When shifting from 2nd to 1st in "1" range	1 2 .	4 . 3	5									
Shift slippage when upshifting	When shifting from 1st to 2nd	1 2 .	4 . 3	6									
	When shifting from 2nd to 3rd	1 2 .	4 . 3	6									
	When shifting from 3rd to 4th	1 2 .	4 . 3	6									
Shift slippage with accelerator pedal depressed	When shifting from 4th to 2nd	1 2 .	5 . 3	7									
	When shifting from 4th to 3rd	1 2 .	4 . 3	6									
	When shifting from 4th to 1st and shifting from 3rd to 1st	1 2 .	5 . 3	7									
Poor power/acceleration	When vehicle starts	1 2 .	5 . 3	10									
	When upshifting	1 2 .	4 . 3	8									
No engine braking	When shifting from "D" to "2" and "1" range	1 2 .	4 . 3	6									
	When O.D. switch is set from "ON" to "OFF"	1 2 .	4 . 3	8									
	When shifting from 2nd to 1st in "1" range	1 2 .	4 . 3	6									
Shift quality	Too low a gear change point from 2nd to 3rd and from 3rd to 2nd.	1 . .	4 . 2	5									
	Too high a gear change point from 2nd to 3rd and from 3rd to 2nd.	1 . .	4 . 2	5									
	Too low a gear change point from 2nd to 1st in "1" range.	1 . .	4 . 2	5									
	Too high a gear change point from 2nd to 1st in "1" range.	1 . .	4 . 2	5									

Road Testing (Cont'd)

ON VEHICLE																				OFF VEHICLE						
4-2 relay valve	Lock-up control valve	Throttle valve & detent valve	Manual valve	Kickdown modifier valve	1st reducing valve	Overrun clutch reducing valve	3-2 timing valve	Torque converter relief valve	4-2 sequence valve	Governor pressure	Governor valve	Primary governor valve	Secondary governor valve ①	Secondary governor valve ②	O.D. cancel solenoid Lock-up cancel solenoid	Accumulator N-D Accumulator 1-2 Accumulator 2-3 Accumulator 3-4 (N-R)	Ignition switch and starter motor O.D. control switch and wiring	Torque converter Oil pump	Reverse clutch High clutch	Forward clutch Forward one-way clutch	Overrun clutch Low one-way clutch	Low & reverse clutch Brake band	Parking components
										•	•				• •	6 • • 7	• •	• •	9 •	• •	• •	• •	•
										•	•				• •	• 5 6 •	• •	• •	• •	• •	• •	• •	•
										•	•				• •	• • • 5	• •	• •	• •	• •	8 •	• 7	•
										•	•				• •	• • • •	• •	• •	• 7	• •	• •	• 6	•
										•	•				• •	• • • •	• •	• •	• •	• •	• 6	• •	•
										•	•				• •	• 5 • •	• •	• •	• •	• •	• •	• 7	•
										•	•				• •	• • 5 •	• •	• 8	• •	• •	• •	• 7	•
										•	•				• •	• • • 5	• •	• 8	• •	• •	• •	• 7	•
										4	11				• •	6 8 9 7	• •	12 13	14 15	17 18	19 20	21 16	•
										•	•				• •	• 5 6 7	• •	• 9	• 10	• •	12 •	13 11	•
										4	8				• •	• • 6 •	• •	• • •	• 9	• 11	• •	• 10	•
										•	•				• •	• • 5 •	• •	• • •	• 7	8 •	• •	• •	•
										4	8				• •	• • 6 •	• •	• • •	• •	9 •	• •	• •	•
										•	•				• •	• • 5 •	• •	• • •	• •	• •	7 •	• •	•
										•	•				7 •	• • 5 •	• 6	• • •	• •	• •	9 •	• •	•
										•	•				• •	• • • •	• •	• • •	• •	• •	7 •	8 •	•
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										3	6				• •	• • • •	• •	• • •	• •	• •	• •	• •	•
										3	6				• •	• • • •	• •	• • •	• •	• •	• •	• •	•
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Road Testing (Cont'd)

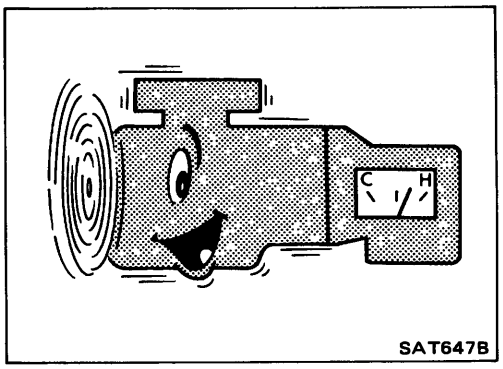
Numbers are arranged in order of probability.
Perform inspections starting with number one and working up.
Circled numbers indicate that the transmission must be removed from the vehicle.

[ ] : Valve expected to be malfunctioning

		ON VEHICLE												
		Oil level and oil quality Control linkage Inhibitor switch and wiring	Throttle wire Engine idling rpm Line pressure	Control valve	4th speed cut valve	Pressure regulator valve	Pressure modifier valve	1-2 shift valve	2-3 shift valve	3-4 shift valve	Accumulator control valve	3-2 downshift valve	2-3 throttle modifier valve
Shift quality	Failure to change gear from 4th to 2nd with accelerator pedal depressed.	1 . .	4 . 2	5									
	Failure to change gear from 3rd to 2nd with accelerator pedal depressed.	1 . .	4 . 2	5									
	Failure to change gear from 1st to 2nd in "D" and "2" range.	1 . .	4 . 2	5									
	Vehicle does not start from "1st" in "D" and "2" range.	1 . .	4 . 2	5									
	Failure to change gear to 3rd and 4th in "D" range.	1 . .	4 . 2	7									
	Changes gear to 1st directly when selector lever is set from "D" to "1" range.	1 . .	4 . 2	5									
	Changes gear to 2nd in "1" range.	1 . .	4 . 2	5									
	Too high or low a change point when lock-up operates.	1 . .	4 . 2	5									
Lock-up quality	Lock-up point is extremely high or low.	1 . .	4 . 2	5									
	Torque converter does not lock-up.	1 . .	4 . 2	5									
	Lock-up is not released when accelerator pedal is released.	1 . .	. . .	.									
Engine does not start in "P" and "N" ranges.		. 2 3	. . .	.									
Engine starts in ranges other than "P" and "N" ranges.		. 2 3	. . .	.									

Road Testing (Cont'd)

ON VEHICLE																					OFF VEHICLE						
4-2 relay valve	Lock-up control valve	Throttle valve & detent valve	Manual valve	Kickdown modifier valve	1st reducing valve	Overrun clutch reducing valve	3-2 timing valve	Torque converter relief valve	4-2 sequence valve	Governor pressure	Governor valve	Primary governor valve	Secondary governor valve ①	Secondary governor valve ②	O.D. cancel solenoid Lock-up cancel solenoid	Accumulator N-D Accumulator 1-2 Accumulator 2-3 Accumulator 3-4 (N-R)	Ignition switch and starter motor O.D. control switch and wiring	Torque converter Oil pump	Reverse clutch High clutch	Forward clutch Forward one-way clutch	Overrun clutch Low one-way clutch	Low & reverse clutch Brake band	Parking components
										3	6				. .	. . . .	. .	. .	. .	. .	. .	. .	.
				–						3	6				. .	. . . .	. .	. .	. .	. .	. .	. .	.
										3	6				. .	. . . .	. .	. .	. .	. .	. .	. .	.
										3	6				. .	. . . .	. .	. .	. .	. .	. .	. .	.
										3	8				6 .	. . . .	. 5	. .	. .	. .	. .	. .	.
										3	6				. .	. . . .	. .	. .	. .	. .	. .	. .	.
										3	6				. .	. . . .	. .	. .	. .	. .	. .	. .	.
										3	6				. .	. . . .	. .	. .	. .	. .	. .	. .	.
										3	6				. .	. . . .	. .	. .	. .	. .	. .	. .	.
										3	6				. .	. . . .	. .	7 .	. .	. .	. .	. .	.
										.	.				. 2	. . . .	. .	. .	. .	. .	. .	. .	.
										.	.				. .	. . . .	1 .	. .	. .	. .	. .	. .	.
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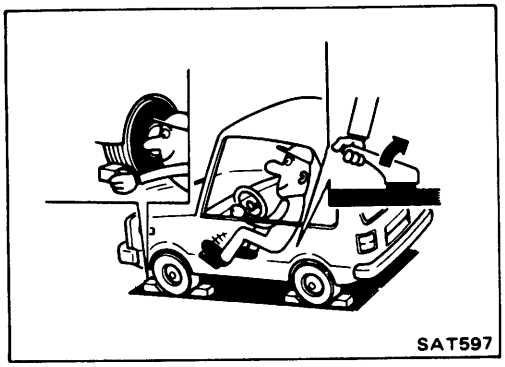


Stall Testing

STALL TEST PROCEDURE

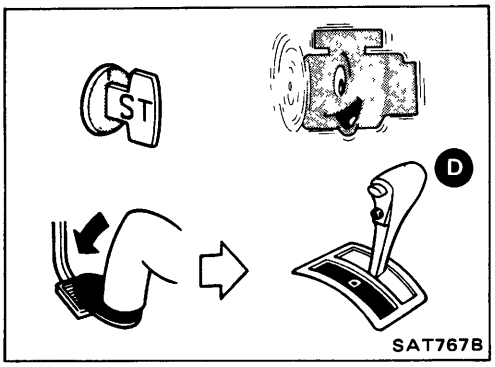
1. Check A/T and engine fluid levels. If necessary, add fluid.
2. Warm up engine until engine oil and A.T.F. reach operating temperature after vehicle has been driven approx. 10 minutes.

A.T.F. operating temperature:
50 - 80°C (122 - 176°F)

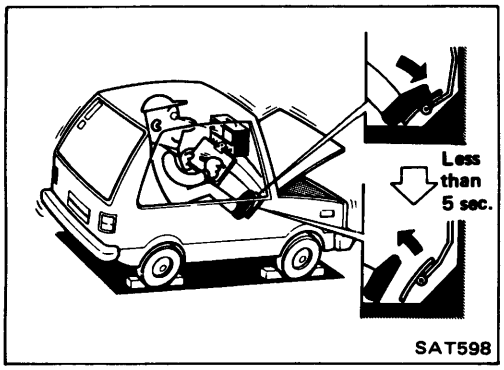


3. Set parking brake and block wheels.
4. Install a tachometer where it can be seen by driver during test.

It is good practice to put a mark on point of specified engine rpm on indicator.



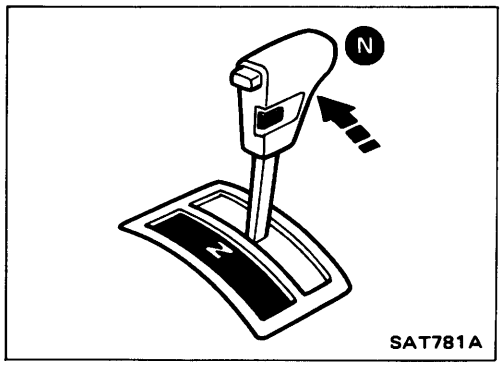
5. Start engine, apply foot brake, and place selector lever in "D" range.



6. Accelerate to wide-open throttle gradually while applying foot brake.
7. Quickly note the engine stall revolution and immediately release throttle.

During test, never hold throttle wide-open for more than 5 seconds.

Stall revolution:
2,100 - 2,300 rpm



8. Shift selector lever to "N".
9. Cool off A.T.F.

Run engine at idle for at least one minute.

10. Perform stall tests in the same manner as in steps 5 through 9 with selector lever in "2", "1" and "R", respectively.

Stall Testing (Cont'd)

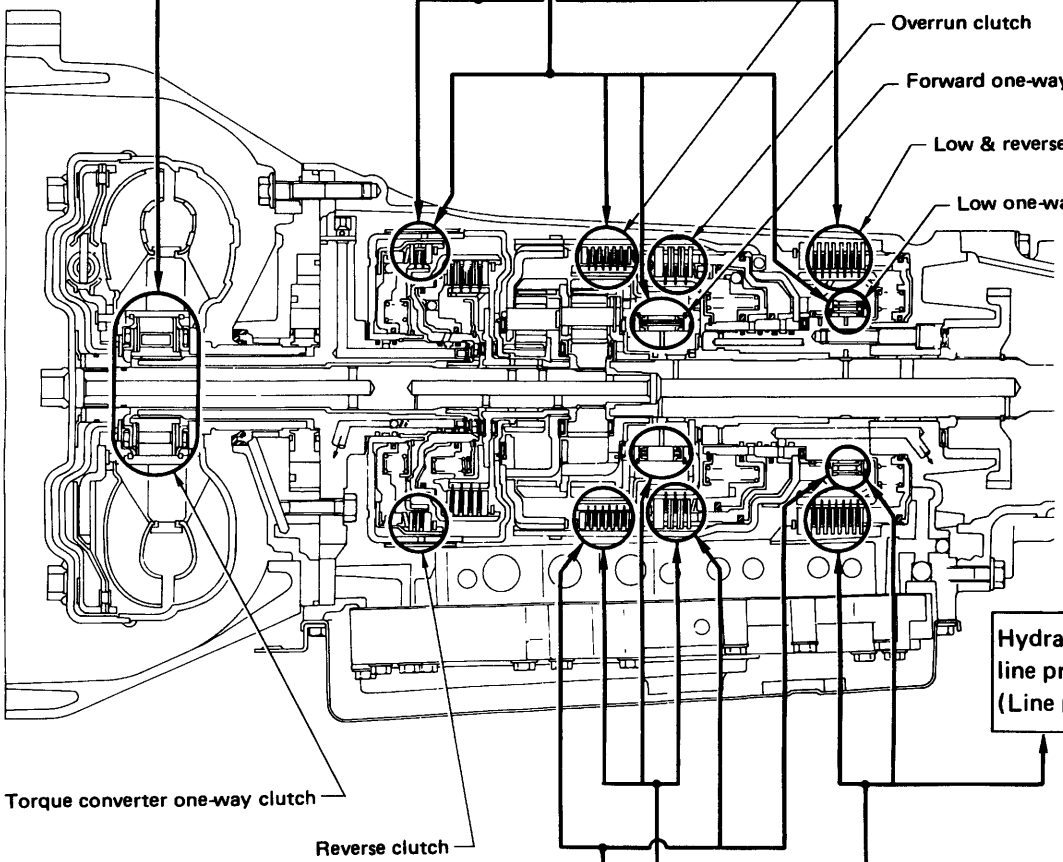
JUDGEMENT OF STALL TEST

Selector lever position	Judgement		
D	L	O	H
2	L	O	H
1	L	O	O
R	L	H	H

O : Stall revolution is normal.
H : Stall revolution is higher than specified.
L : Stall revolution is lower than specified.

Damaged components

Engine

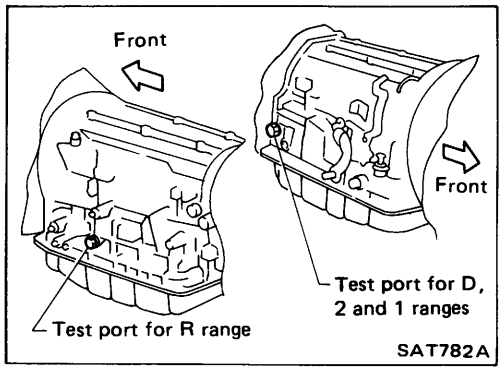


Hydraulic circuit for line pressure control (Line pressure is low.)

Clutches and brakes except high clutch and brake band are O.K. (Condition of high clutch and brake band cannot be confirmed by stall test.)

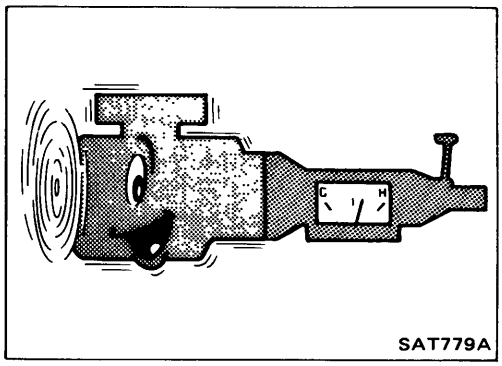
Selector lever position	Judgement			
D	H	H	H	O
2	H	H	H	O
1	O	H	H	O
R	O	O	H	O

SAT107B



Pressure Testing

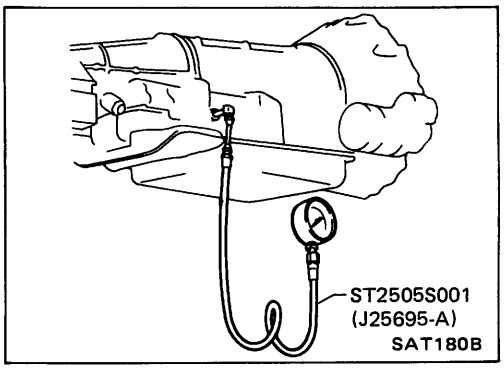
- Location of line pressure test port
- **Line pressure plugs are hexagon headed bolts.**
- **Always replace line pressure plugs as they are self-sealing bolts.**



LINE PRESSURE TEST PROCEDURE

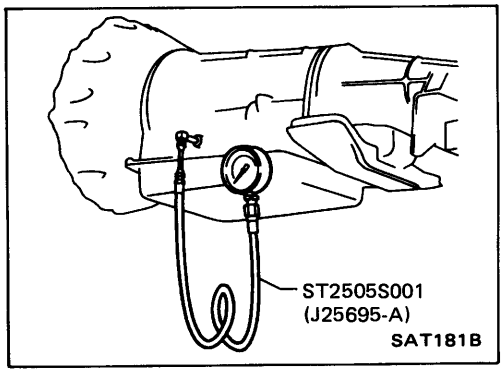
1. Check A/T and engine fluid levels. If necessary, add.
2. Warm up engine until engine oil and A.T.F. reach operating temperature after vehicle has been driven approx. 10 minutes.

   A.T.F. operating temperature:
   50 - 80°C (122 - 176°F)

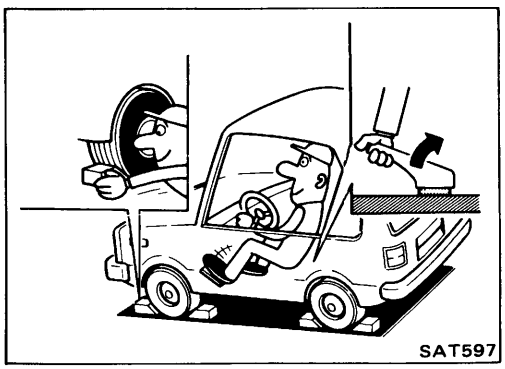


3. Install pressure gauge to line pressure port.

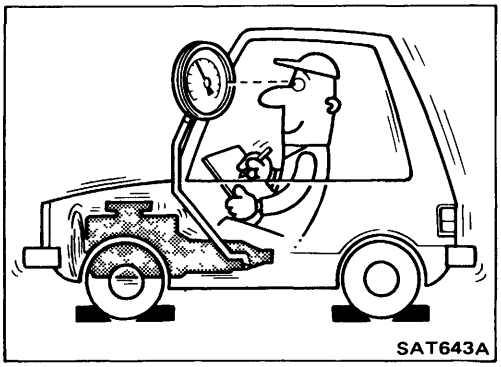
— **D, 2 and 1 ranges** —



— **R range** —



4. Set parking brake and block wheels.
- **Continue to depress brake pedal fully while line pressure test at stall speed is performed.**


SAT643A

Pressure Testing (Cont'd)

5. Start engine and measure line pressure at idle and stall speed.

- **When measuring line pressure at stall speed, follow the stall test procedure.**

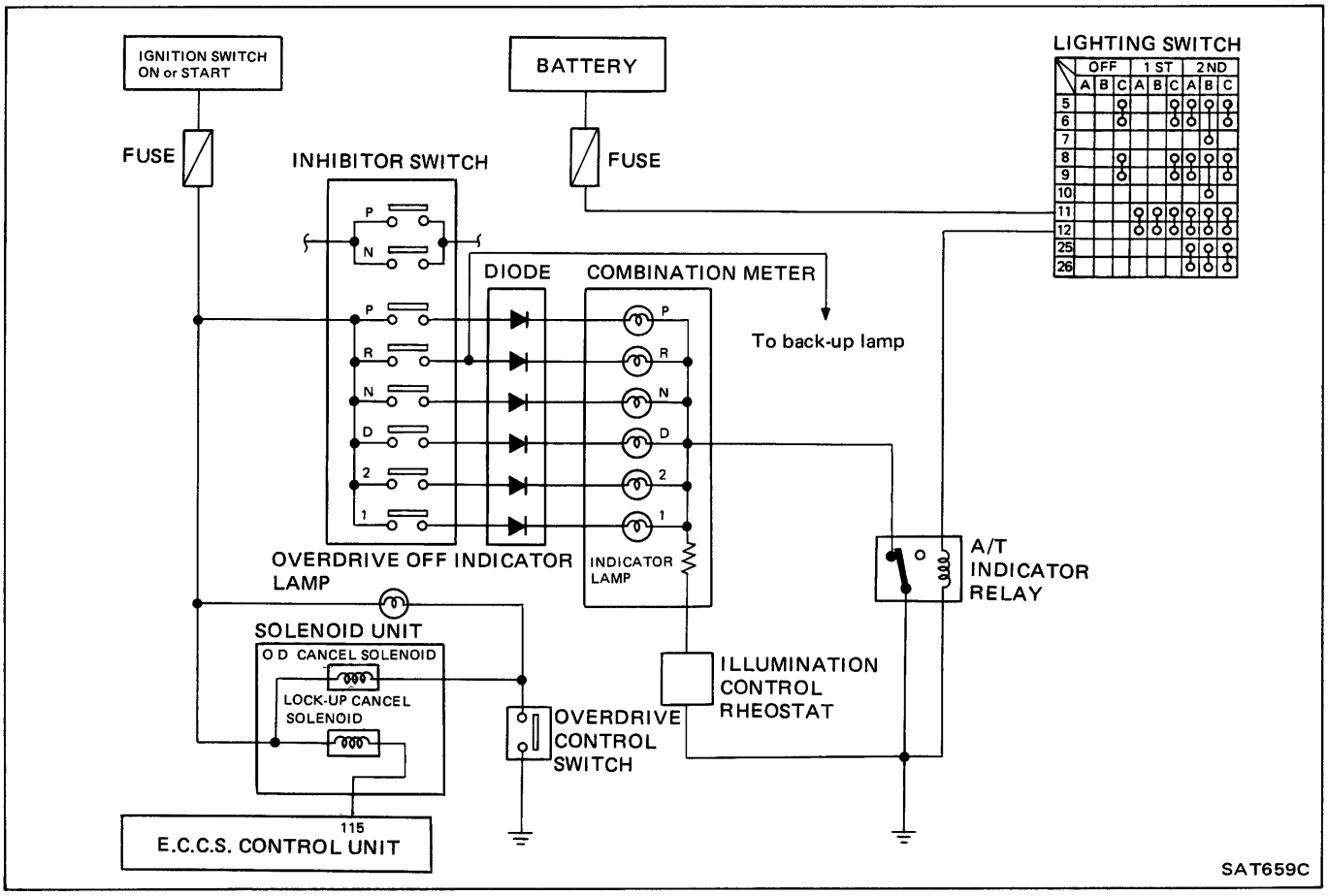
Line pressure:

Engine speed rpm	Line pressure kPa (kg/cm^2, psi)	
	D, 2 and 1 ranges	R range
Idle	422 - 461 (4.3 - 4.7, 61 - 67)	667 - 706 (6.8 - 7.2, 97 - 102)
Stall	883 - 961 (9.0 - 9.8, 128 - 139)	1,393 - 1,471 (14.2 - 15.0, 202 - 213)

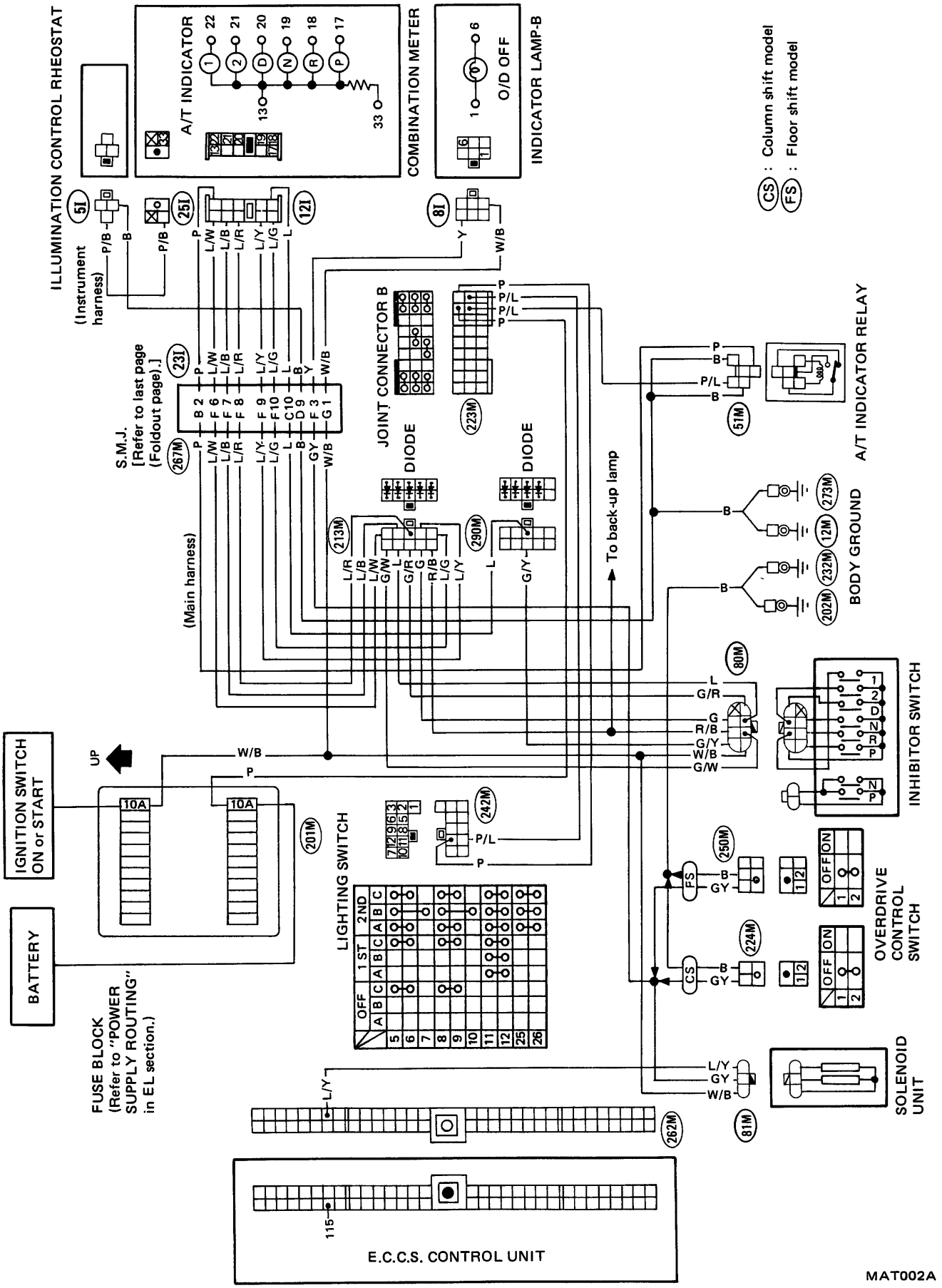
JUDGEMENT OF LINE PRESSURE TEST

	Judgement	Suspected parts
At idle	Line pressure is low in all ranges.	• Oil pump wear • Control piston damage • Pressure regulator valve or plug sticking • Spring for pressure regulator valve damaged • Fluid pressure leakage between oil strainer and pressure regulator valve
	Line pressure is low in particular range.	• Fluid pressure leakage between manual valve and particular clutch. • For example; If line pressure is low in "R" and "1" ranges but is normal in "D" and "2" range, fluid leakage exists at or around low & reverse brake circuit.
	Line pressure is high.	• Mal-adjustment of throttle sensor • Fluid temperature sensor damaged • Line pressure solenoid sticking • Short circuit of line pressure solenoid circuit • Pressure modifier valve sticking • Pressure regulator valve or plug sticking
At stall speed	Line pressure is low.	• Mal-adjustment of throttle sensor • Control piston damaged • Line pressure solenoid sticking • Short circuit of line pressure solenoid circuit • Pressure regulator valve or plug sticking • Pressure modifier valve sticking • Pilot valve sticking

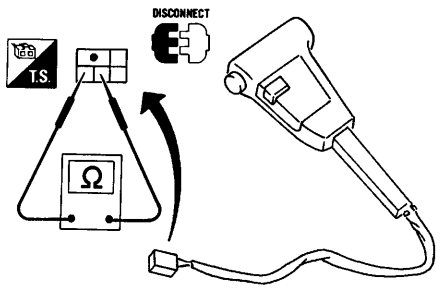
Circuit Diagram



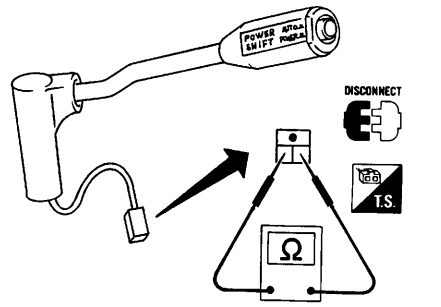
Wiring Diagram



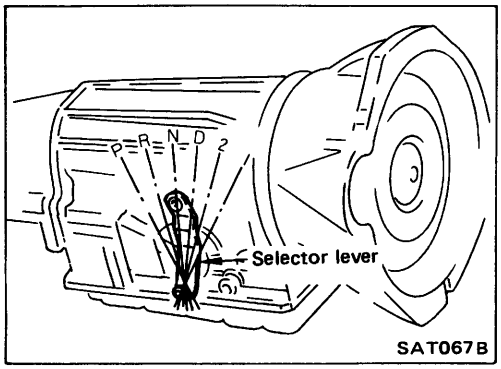
Floor shift models



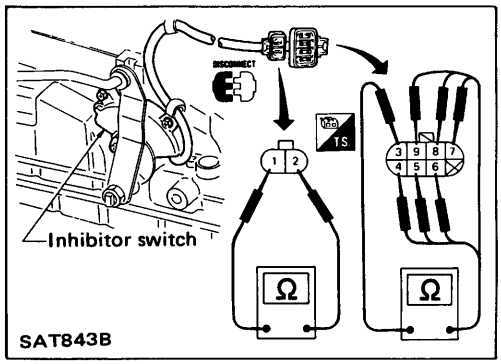
Column shift models



SAT877C



SAT067B



SAT843B

Electrical Components Inspection

OVERDRIVE CONTROL SWITCH

- Check continuity between two terminals.

O.D. switch position	Continuity
ON	No
OFF	Yes

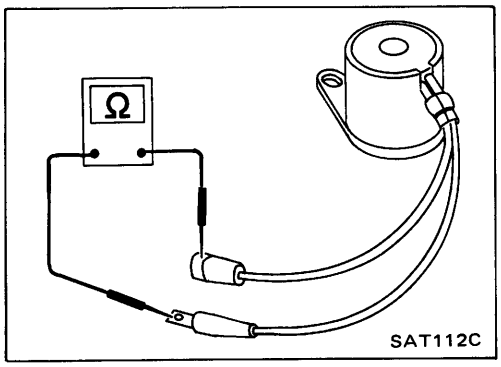
INHIBITOR SWITCH

1. Check continuity between terminals ① and ② between terminals ③ and ④, ⑤, ⑥, ⑦, ⑧, ⑨ while moving selector lever through each range.

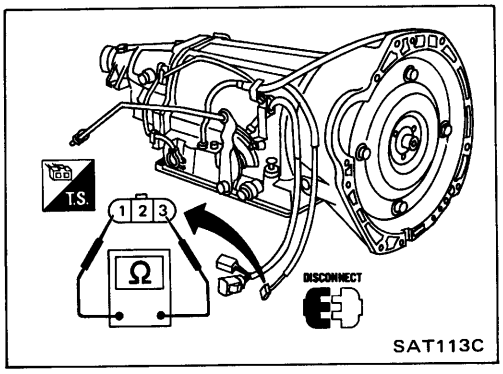
Lever position \ Terminal No.	①	②	③	④	⑤	⑥	⑦	⑧	⑨
P	○	○	○	○					
R			○		○				
N	○	○	○			○			
D			○				○		
2			○					○	
1			○						○

Electrical Components Inspection (Cont'd)

O.D. CANCEL SOLENOID AND LOCK-UP CANCEL SOLENOID



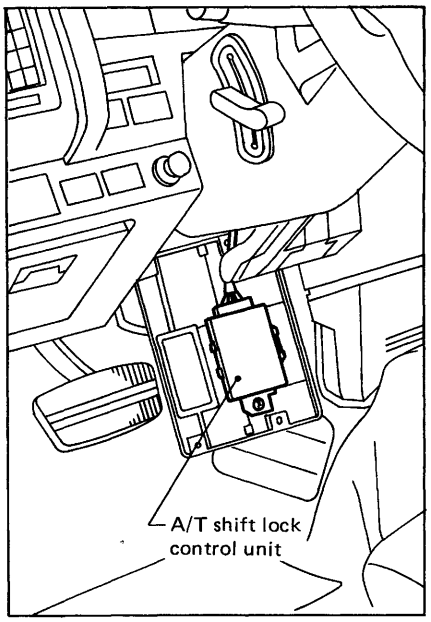
- Check resistance between terminals of each solenoid.
  Resistance: 20 - 30Ω

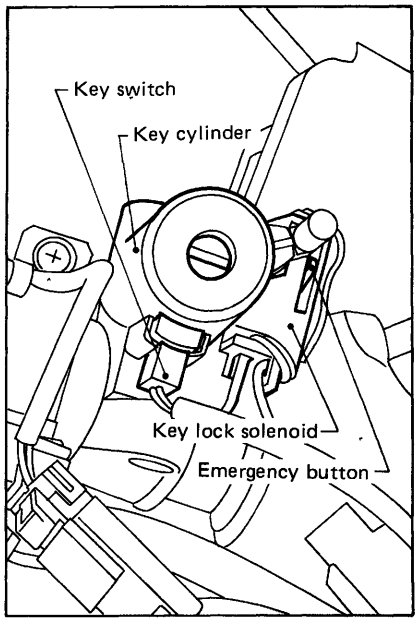


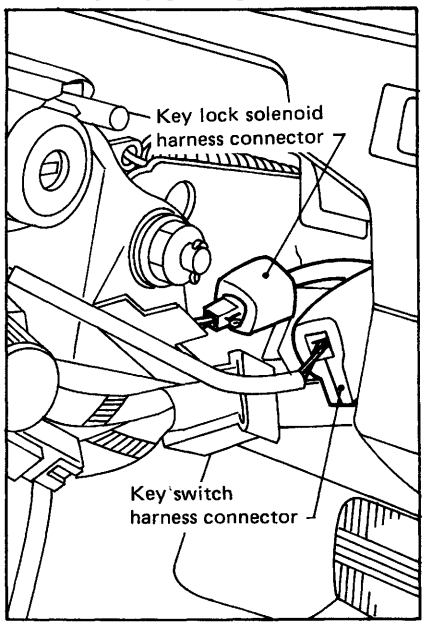
Solenoid	Terminal No.	Resistance
O.D. cancel solenoid	① - ②	20 - 30Ω
Lock-up cancel solenoid	① - ③	

A/T Shift Lock System

SHIFT LOCK ELECTRICAL PARTS LOCATION

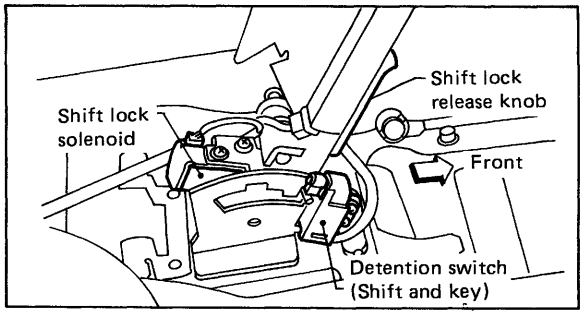




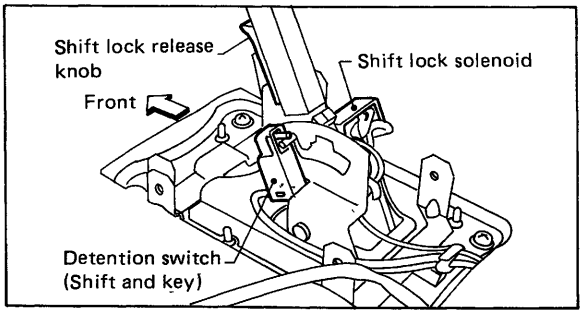


FLOOR SHIFT

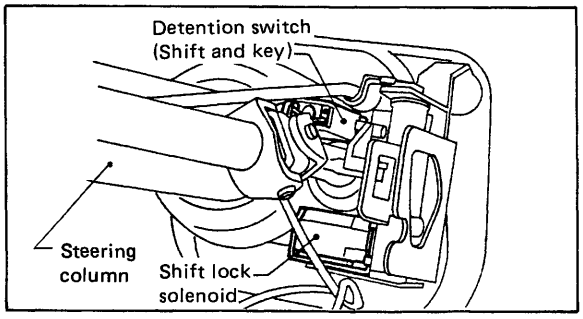
4WD



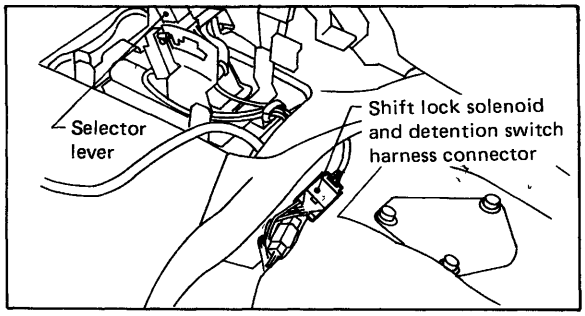
2WD



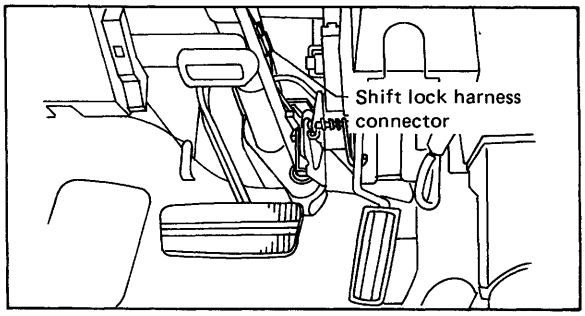
COLUMN SHIFT



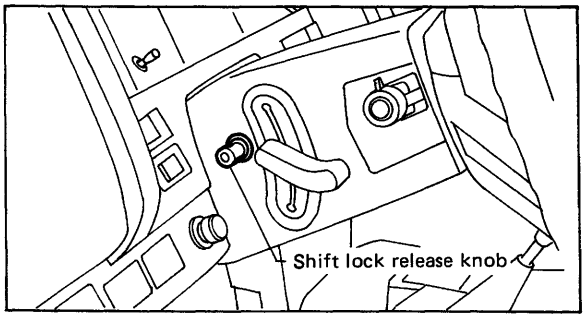
FLOOR SHIFT



COLUMN SHIFT



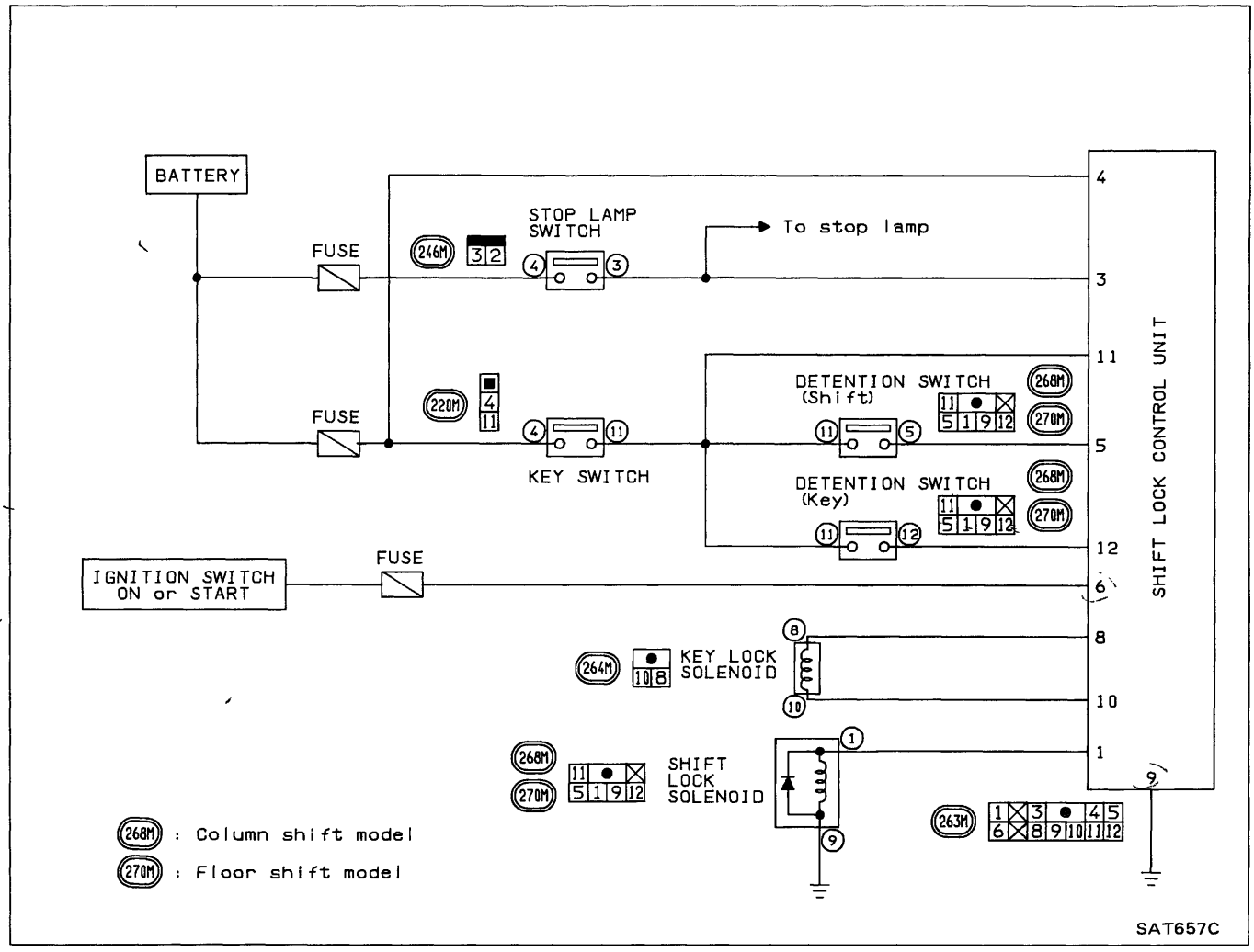
COLUMN SHIFT



SAT726C

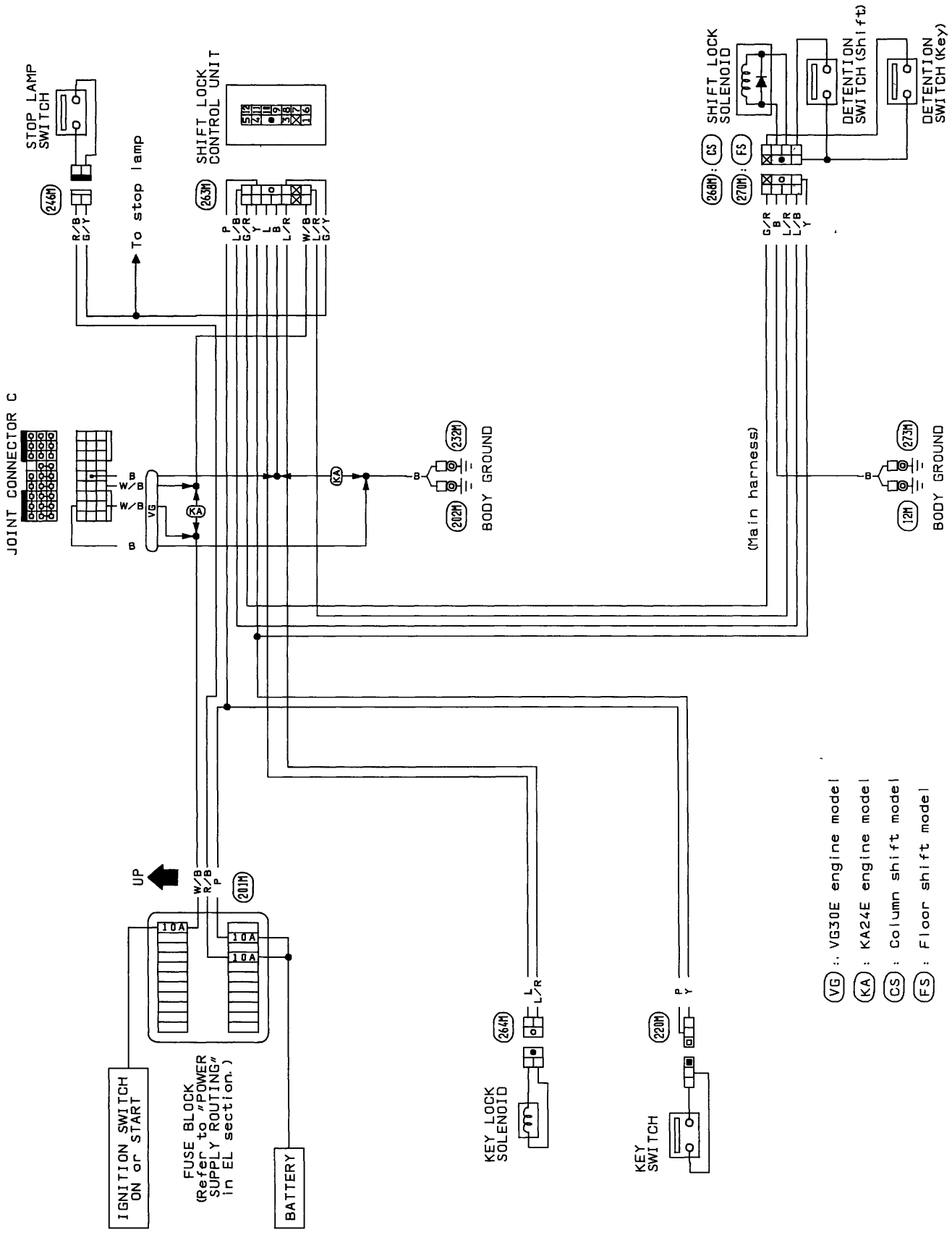
A/T Shift Lock System (Cont'd)

CIRCUIT DIAGRAM FOR QUICK PINPOINT CHECK



A/T Shift Lock System (Cont'd)

WIRING DIAGRAM



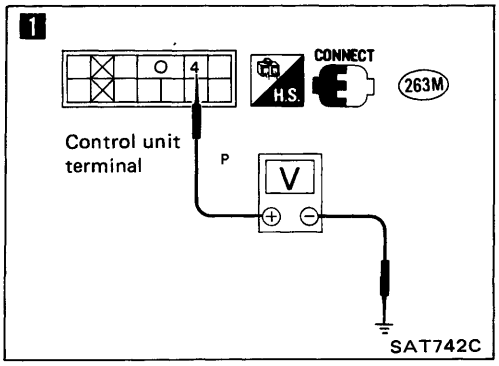
MAT003A

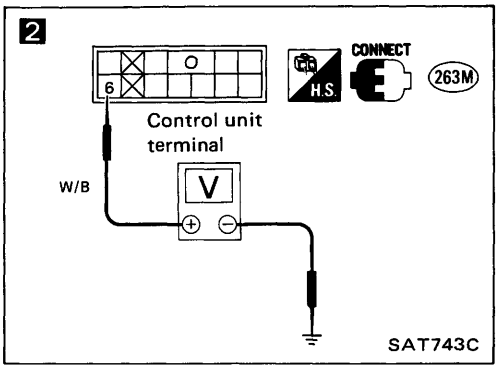
A/T Shift Lock System (Cont'd)

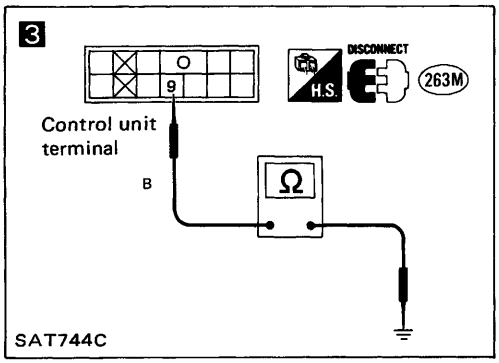
DIAGNOSTIC PROCEDURE 1

SYMPTOM:

Selector lever cannot be moved from "P" range when applying brake pedal or can be moved when releasing brake pedal.
Selector lever can be moved from "P" range when key is removed from key cylinder.

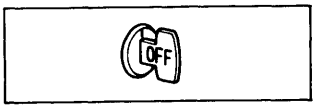






1

CHECK POWER SOURCE.

1. 

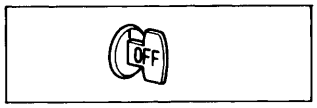
2. Check voltage between control unit harness terminal ④ and ground.
   Battery voltage should exist.

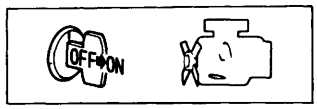
N.G. → Check the following items:
1. Harness continuity between battery and control unit harness terminal ④
2. Fuse

O.K. ↓

2

CHECK IGNITION SIGNAL.

1. 

2. Check voltage between control unit harness terminal ⑥ and ground.
   0V
3. 

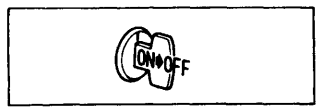
4. Check voltage between control unit harness terminal ⑥ and ground.
   Battery voltage should exist.

N.G. → Check the following items:
1. Harness continuity between battery and control unit harness terminal ⑥
2. Fuse
3. Ignition switch

O.K. ↓

3

CHECK GROUND CIRCUIT FOR CONTROL UNIT.

1. 

2. Disconnect control unit harness connector.
3. Check continuity between control unit harness terminal ⑨ and ground.
   Continuity should exist.

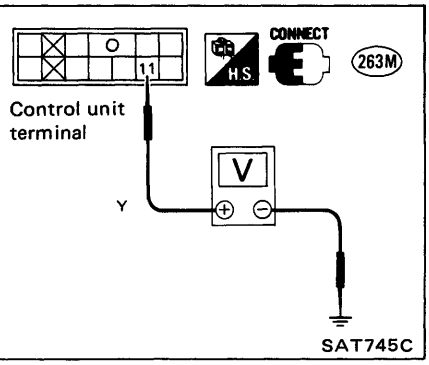
N.G. → Repair harness or connector.

O.K. ↓

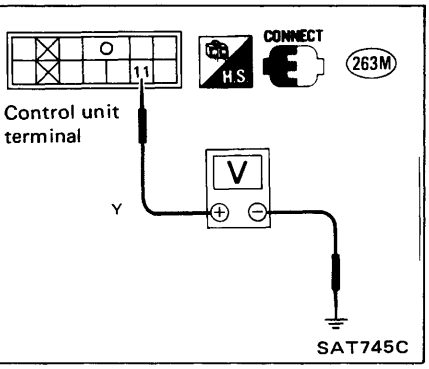
Ⓐ

A/T Shift Lock System (Cont'd)

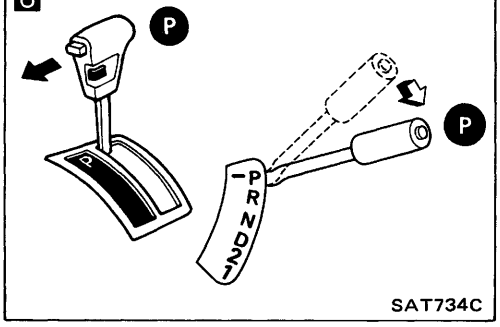
4



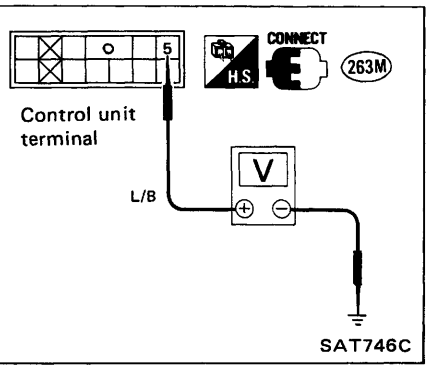
5



6



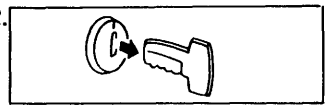
7



Ⓐ

4

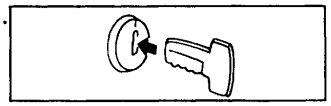
CHECK INPUT SIGNAL (KEY SWITCH).

1. Reconnect control unit harness connector.
2. 
3. Check voltage between control unit terminal ⑪ and ground.
   0V

N.G. → Check key switch. (Refer to "COMPONENT CHECK".)

O.K. ↓

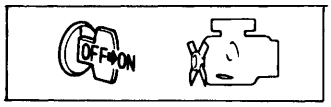
5

1. 
2. Check voltage between control unit harness terminal ⑪ and ground.
   Battery voltage should exist.

N.G. → Check the following items:
1. Harness continuity between control unit harness terminal ⑪ and key switch harness terminal ⑪.
2. Harness continuity between key switch harness terminal ④ and fuse
3. Key switch (Refer to "COMPONENT CHECK".)

O.K. ↓

CHECK INPUT SIGNAL (DETENTION SWITCH–SHIFT).

1. 

6 2. Set selector lever in "P" position and release selector lever button. (release selector lever.)*

7 3. Check voltage between control unit harness terminal ⑤ and ground.
0V

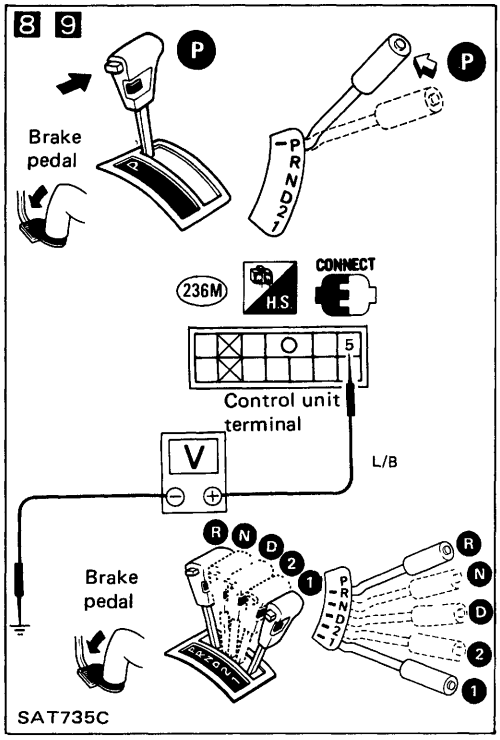
*: Column shift model

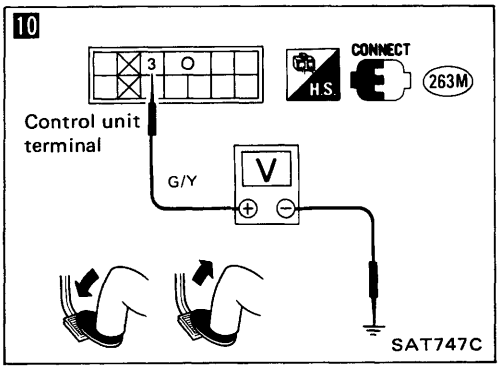
N.G. → Check detention switch–shift. (Refer to "COMPONENT CHECK".)

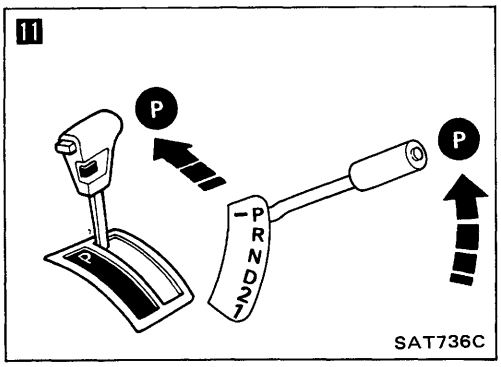
O.K. ↓

Ⓑ

A/T Shift Lock System (Cont'd)



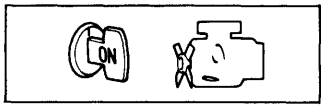




Ⓑ

CHECK INPUT SIGNAL (DETENTION SWITCH–SHIFT).

1.



8 2. Check voltage between control unit harness terminal ⑤ and ground with brake pedal depressed and selector lever button pushed. (selector lever pulled.)*
Battery voltage should exist.

9 3. Check voltage between control unit harness terminal ⑤ and ground with selector lever set in any position except "P".
When selector lever cannot be moved from "P" position with brake pedal depressed, use shift lock release knob.
Battery voltage should exist.

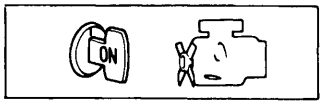
*: Column shift model

N.G. →
Check the following items:
1. Harness continuity between control unit harness terminal ⑤ and detention switch harness terminal ⑤
2. Harness continuity between detention switch harness terminal ⑪ and key switch harness terminal ⑪
3. Detention switch–shift (Refer to "COMPONENT CHECK".)

O.K. ↓

10

CHECK INPUT SIGNAL (STOP LAMP SWITCH).



- Check voltage between control unit harness terminal ③ and ground.

Brake pedal	Voltage
Depressed	Battery voltage
Released	0V

N.G. →
Check the following items:
1. Harness continuity between control unit harness terminal ③ and stop lamp switch harness terminal ③
2. Harness continuity between stop lamp switch harness terminal ② and fuse
3. Stop lamp switch (Refer to "COMPONENT CHECK".)

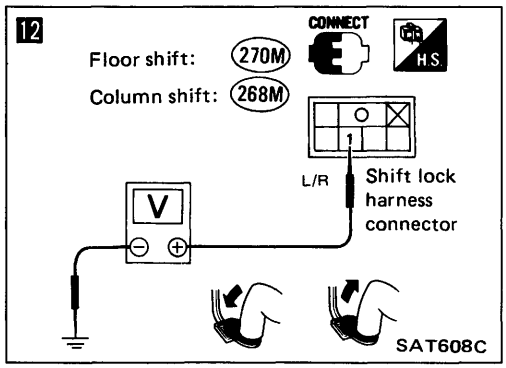
O.K. ↓

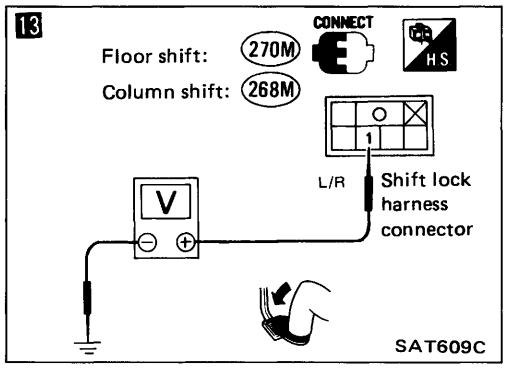
11

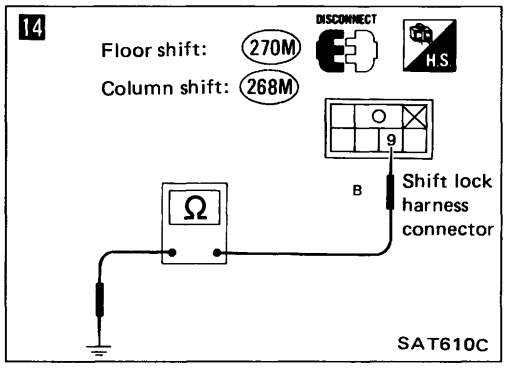
Set selector lever in "P" position.

Ⓒ

A/T Shift Lock System (Cont'd)



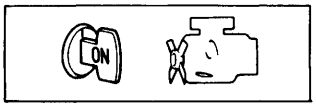




Ⓒ

CHECK OUTPUT SIGNAL (SHIFT LOCK SOLENOID).

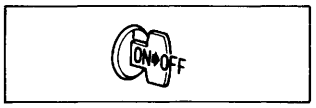
1.



12 2. Check voltage between shift lock harness connector terminal ① and body ground.

Brake pedal	Voltage
Depressed	Battery voltage
Released	0V

3.



13 4. Check voltage between shift lock harness connector terminal ① and ground with brake pedal depressed.
0V

N.G. → Check harness continuity between control unit harness terminal ① and shift lock solenoid harness terminal ①.

O.K. ↓

14

CHECK GROUND CIRCUIT FOR SHIFT LOCK SOLENOID.

1. Disconnect shift lock harness connector.
2. Check continuity between shift lock harness terminal ⑨ and ground.
Continuity should exist.

N.G. → Repair harness or connector.

O.K. ↓

Check shift lock solenoid. (Refer to "COMPONENT CHECK".)

N.G. → Replace A/T shift lock control device assembly.

O.K. ↓

Reconnect shift lock harness connector.



Recheck shift lock operation.

N.G. → 1. Perform control unit input/output signal inspection test.
2. If N.G., recheck harness connector connection.

O.K. ↓

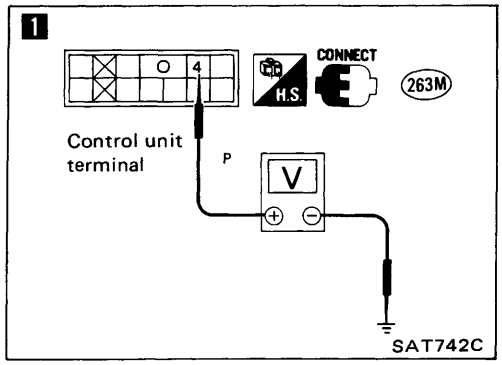
INSPECTION END

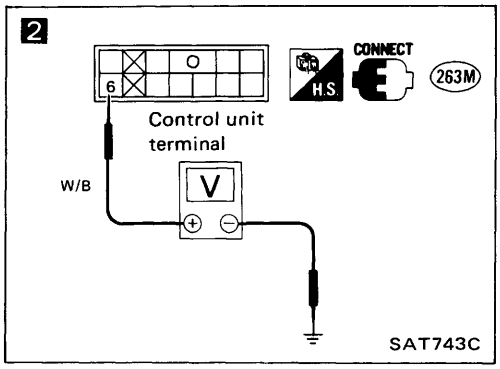
A/T Shift Lock System (Cont'd)

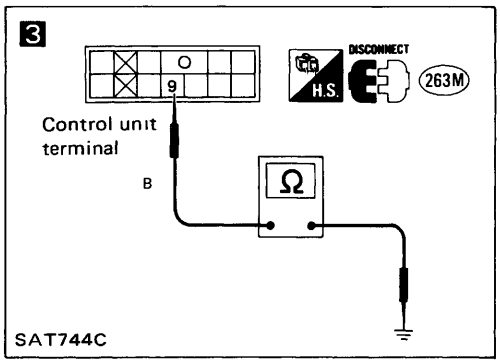
DIAGNOSTIC PROCEDURE 2

SYMPTOM:

Ignition key cannot be removed when selector lever is set to "P" position or can be removed when selector lever is set to any position except "P".

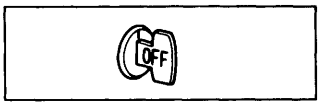






1

CHECK POWER SOURCE.

1. 

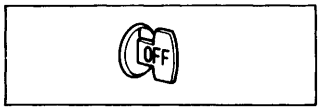
2. Check voltage between control unit harness terminal ④ and ground.
   Battery voltage should exist.

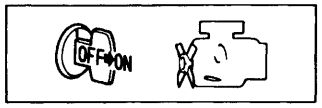
N.G. → Check the following items:
1. Harness continuity between battery and control unit harness terminal ④
2. Fuse

O.K. ↓

2

CHECK IGNITION SIGNAL.

1. 

2. Check voltage between control unit harness terminal ⑥ and ground.
   0V
3. 

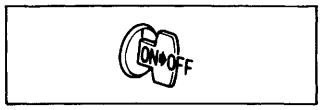
4. Check voltage between control unit harness terminal ⑥ and ground.
   Battery voltage should exist.

N.G. → Check the following items:
1. Harness continuity between battery and control unit harness terminal ⑥
2. Fuse
3. Ignition switch

O.K. ↓

3

CHECK GROUND CIRCUIT FOR CONTROL UNIT.

1. 

2. Disconnect control unit harness connector.
3. Check continuity between control unit harness terminal ⑨ and ground.
   Continuity should exist.

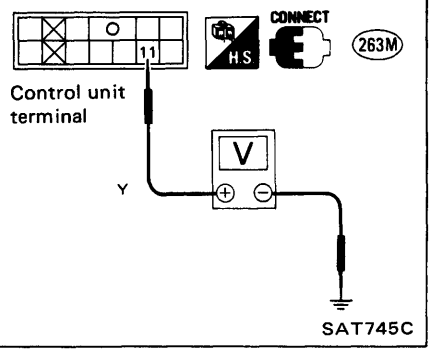
N.G. → Repair harness or connector.

O.K. ↓

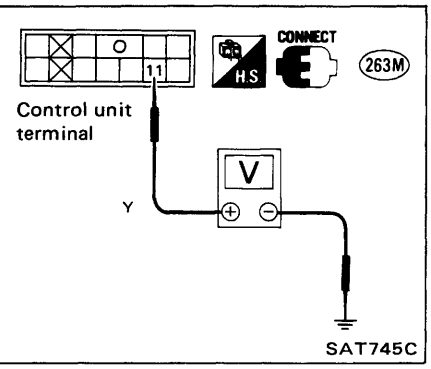
Ⓐ

A/T Shift Lock System (Cont'd)

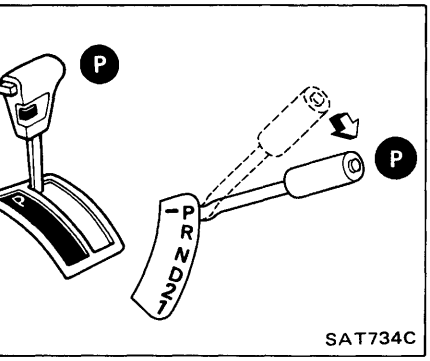
4



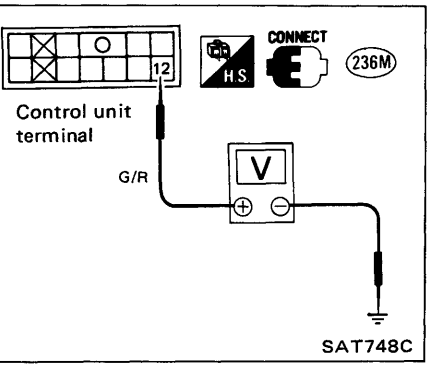
5



6



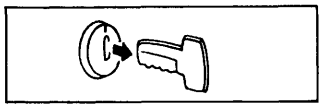
7



Ⓐ

4

CHECK INPUT SIGNAL (KEY SWITCH).

1. Reconnect control unit harness connector.
2. 

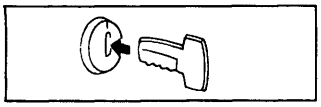
   When ignition key cannot be removed, even if selector lever is in "P" position, use emergency button.
3. Check voltage between control unit terminal ⑪ and ground.

   0V

N.G. → Check key switch. (Refer to "COMPONENT CHECK".)

O.K. ↓

5

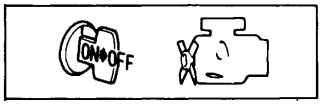
1. 
2. Check voltage between control unit harness terminal ⑪ and ground.

   Battery voltage should exist.

N.G. → Check the following items:
1. Harness continuity between control unit harness terminal ⑪ and key switch harness terminal ⑪.
2. Harness continuity between key switch harness terminal ④ and fuse
3. Key switch (Refer to "COMPONENT CHECK".)

O.K. ↓

CHECK INPUT SIGNAL (DETENTION SWITCH–KEY).

1. 

6 2. Set selector lever in "P" position and release selector lever button. (release selector lever.)*

7 3. Check voltage between control unit harness terminal ⑫ and ground.

0V

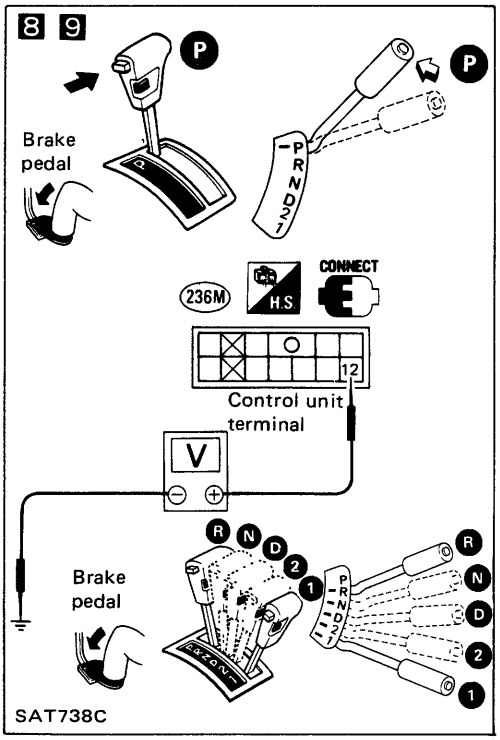
*: Column shift model

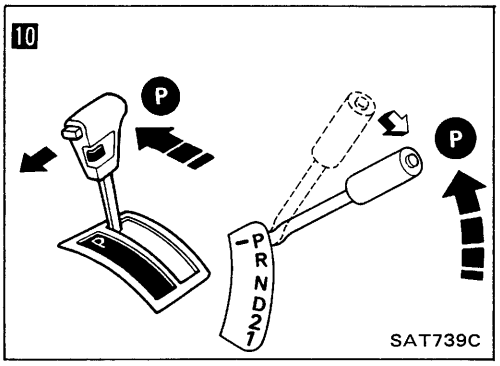
N.G. → Check detention switch–key. (Refer to "COMPONENT CHECK".)

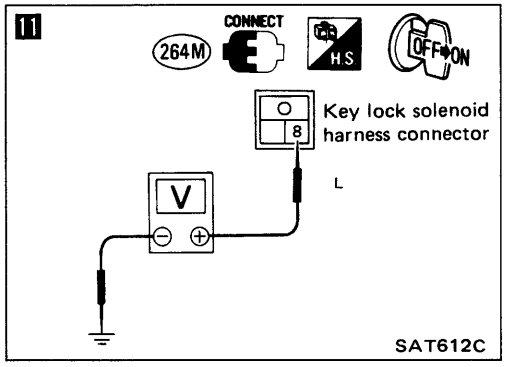
O.K. ↓

Ⓑ

A/T Shift Lock System (Cont'd)

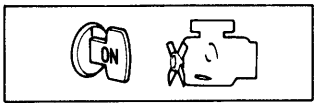






Ⓑ

CHECK INPUT SIGNAL (DETENTION SWITCH–KEY).



8 1. Check voltage between control unit harness terminal ⑫ and ground with brake pedal depressed and selector lever button pushed. (selector lever pulled.)*
Battery voltage should exist.

9 2. Check voltage between control unit harness terminal ⑫ and ground with selector lever set in any position except "P".
Battery voltage should exist.

*: Column shift model

N.G.

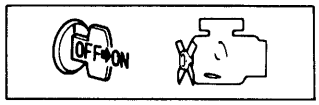
Check the following items:
1. Harness continuity between control unit harness terminal ⑫ and detention switch harness terminal ⑫
2. Harness continuity between detention switch harness terminal ⑪ and key switch harness terminal ⑪
3. Detention switch–key (Refer to "COMPONENT CHECK".)

O.K.

10 Set selector lever in "P" position and release selector lever button. (release selector lever.)*
*: Column shift model



11 **CHECK OUTPUT SIGNAL (KEY LOCK SIGNAL).**



Check voltage between key lock solenoid harness terminal ⑧ and ground at the moment ignition key is turned from OFF to ON.
Battery voltage should exist for approximately 0.1 seconds.

N.G.

Check harness continuity between shift lock solenoid harness terminal ⑧ and control unit harness terminal ⑧.

O.K.

N.G.

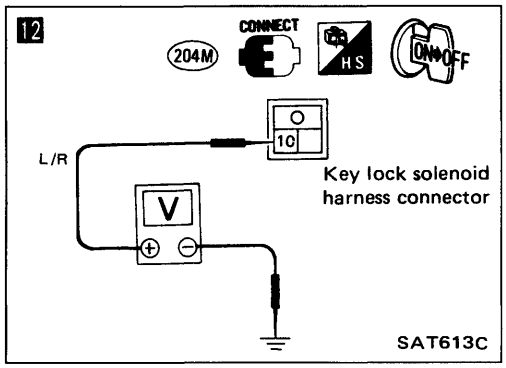
Repair harness or connector.

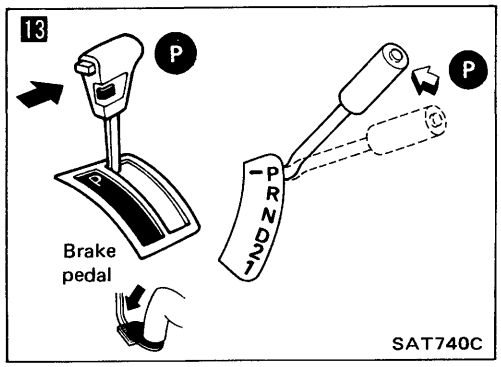
Replace control unit.

O.K.

Ⓒ

A/T Shift Lock System (Cont'd)





Ⓒ

12

CHECK OUTPUT SIGNAL (KEY UNLOCK SIGNAL CAUSED BY IGNITION SIGNAL).

ON•OFF

Check voltage between key lock solenoid harness terminal ⑩ and ground at the moment ignition key is turned from ON to OFF.

Battery voltage should exist for approximately 0.1 seconds.

Check harness continuity between shift lock solenoid harness terminal ⑩ and control unit harness terminal ⑩.

O.K. / N.G.

N.G. → Repair harness or connector.

O.K. → Replace control unit.

O.K.

OFF•ON

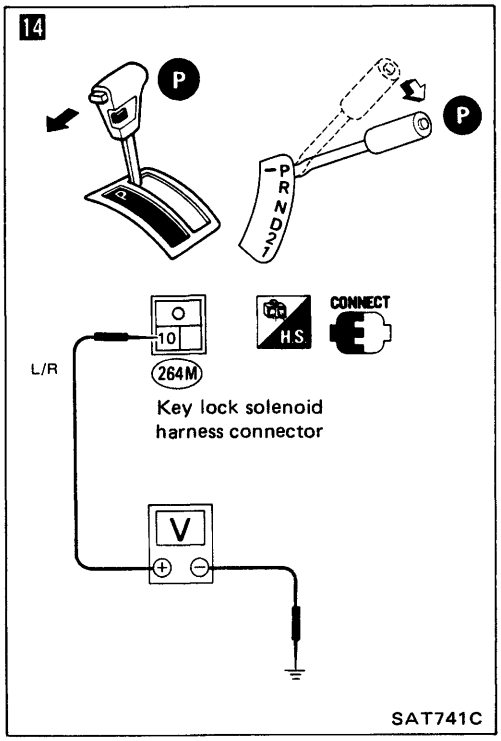
13

1. Push selector lever button with brake pedal depressed. (Floor shift model)
   Pull selector lever with brake pedal depressed. (Column shift model)
2. ON•OFF

When turning ignition key, keep selector lever button pushed and brake pedal depressed. (Floor shift model)
When turning ignition key, keep selector lever pulled and brake pedal depressed. (Column shift model)

Ⓓ

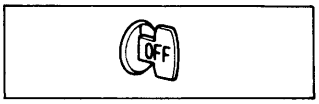
A/T Shift Lock System (Cont'd)



Ⓓ

14

CHECK OUTPUT SIGNAL (KEY UNLOCK SIGNAL CAUSED BY DETENTION SWITCH–KEY).



Check voltage between key lock solenoid harness terminal ⑩ and ground at the moment selector lever button is released. (selector lever is released.)*

Battery voltage should exist for approximately 0.1 seconds.

*: Column shift model

N.G. → Replace control unit.

O.K.

Check key lock solenoid. (Refer to "COMPONENT CHECK".)

N.G. → Replace key lock solenoid.

O.K.

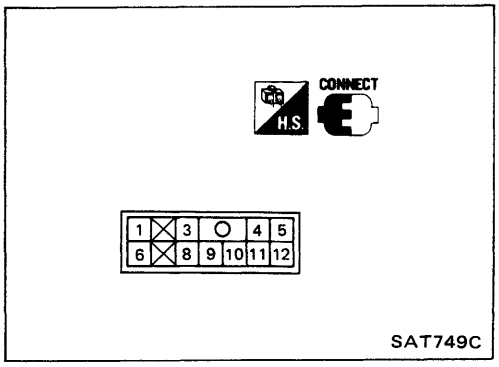
Recheck key lock operation.

N.G. →
1. Perform control unit input/ output signal inspection test.
2. If N.G., recheck harness connector connection.

O.K.

INSPECTION END

A/T Shift Lock System (Cont'd)



SHIFT LOCK CONTROL UNIT INSPECTION

- Measure voltage between each terminal and terminal ⑨ by following "SHIFT LOCK CONTROL UNIT INSPECTION TABLE".
- Pin connector terminal layout.

A/T Shift Lock System (Cont'd)

SHIFT LOCK CONTROL UNIT INSPECTION TABLE (Data are reference values.)

Terminal No. ⊕	Terminal No. ⊖	Item	Condition	Judgement standard
1	9	Shift lock signal	 When selector lever is set in "P" position and brake pedal is depressed	Battery voltage
			Except above	0V
3		Stop lamp switch	When brake pedal is depressed	Battery voltage
			When brake pedal is released	0V
4		Power source		Battery voltage
5		Detention switch (Shift)	When key is inserted into key cylinder and selector lever is set in "P" position with selector lever button released (with selector lever released)*.	0V
			Except above	Battery voltage
6		Ignition signal		Battery voltage
8	10	Key lock signal	When ignition switch is turned from LOCK, OFF or ACC to ON.	Battery voltage (Approximately 0.1 seconds)
			Except above	0V
9	–	Ground	–	–
10	8	Key unlock signal	When selector lever is set in "P" position and ignition key is turned from ON to LOCK, OFF or ACC with selector lever button released (with selector lever released)*.	Battery voltage (Approximately 0.1 seconds)
			Except above	0V
11	9	Key switch	When key is inserted into key cylinder	Battery voltage
			When key is removed from key cylinder	0V
12		Detention switch (Key)	When key is inserted into key cylinder and selector lever is set in "P" position with selector lever button released (with selector lever released)*.	0V
			Except above	Battery voltage

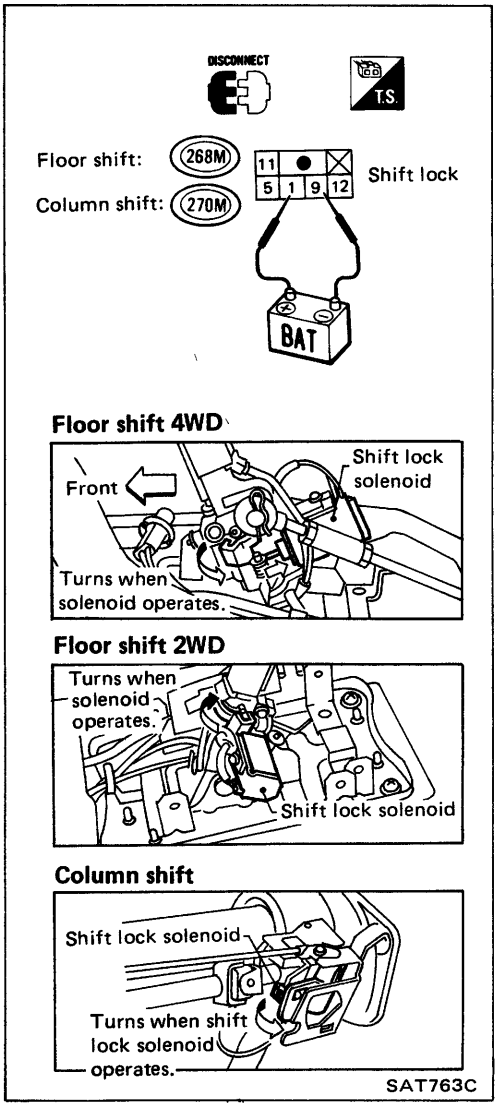
*: Column shift model

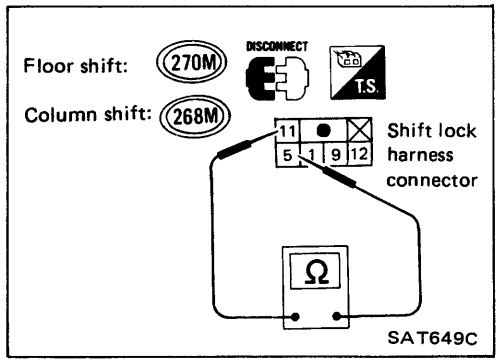
A/T Shift Lock System (Cont'd)

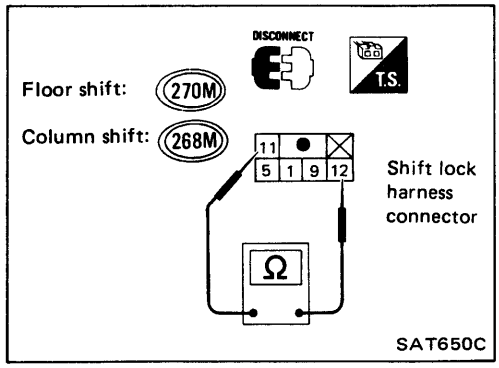
COMPONENT CHECK

Shift lock solenoid

- Check operation by applying battery voltage to shift lock harness connector.







Detention switch — Shift

- Check continuity between terminal ⑤ and ⑪ of shift lock harness connector.

Condition	Continuity
When selector lever is set in "P" position and selector lever button is released. (selector lever is released.)*	No
Except the above	Yes

*: Column shift model

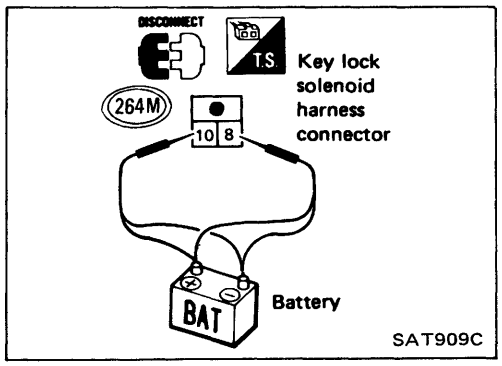
Detention switch — Key

- Check continuity between terminals ⑪ and ⑫ of shift lock harness connector.

Condition	Continuity
When selector lever is set in "P" position and selector lever button is released. (selector lever is released.)*	No
Except the above	Yes

*: Column shift model

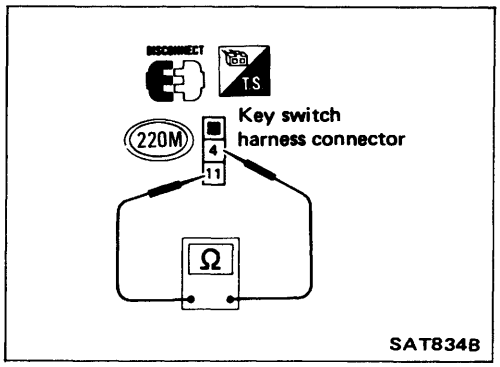
A/T Shift Lock System (Cont'd)



Key lock solenoid

- Check operation by applying battery voltage to key lock solenoid harness connector.

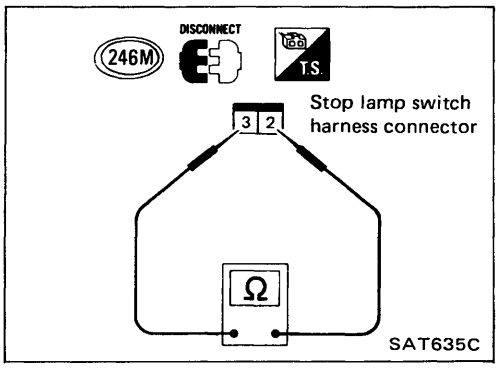
Operating sound must be emitted.



Key switch

- Check continuity between terminals ④ and ⑪ of key switch harness connector.

Condition	Continuity
When key is inserted into key cylinder	Yes
When key is removed from key cylinder	No

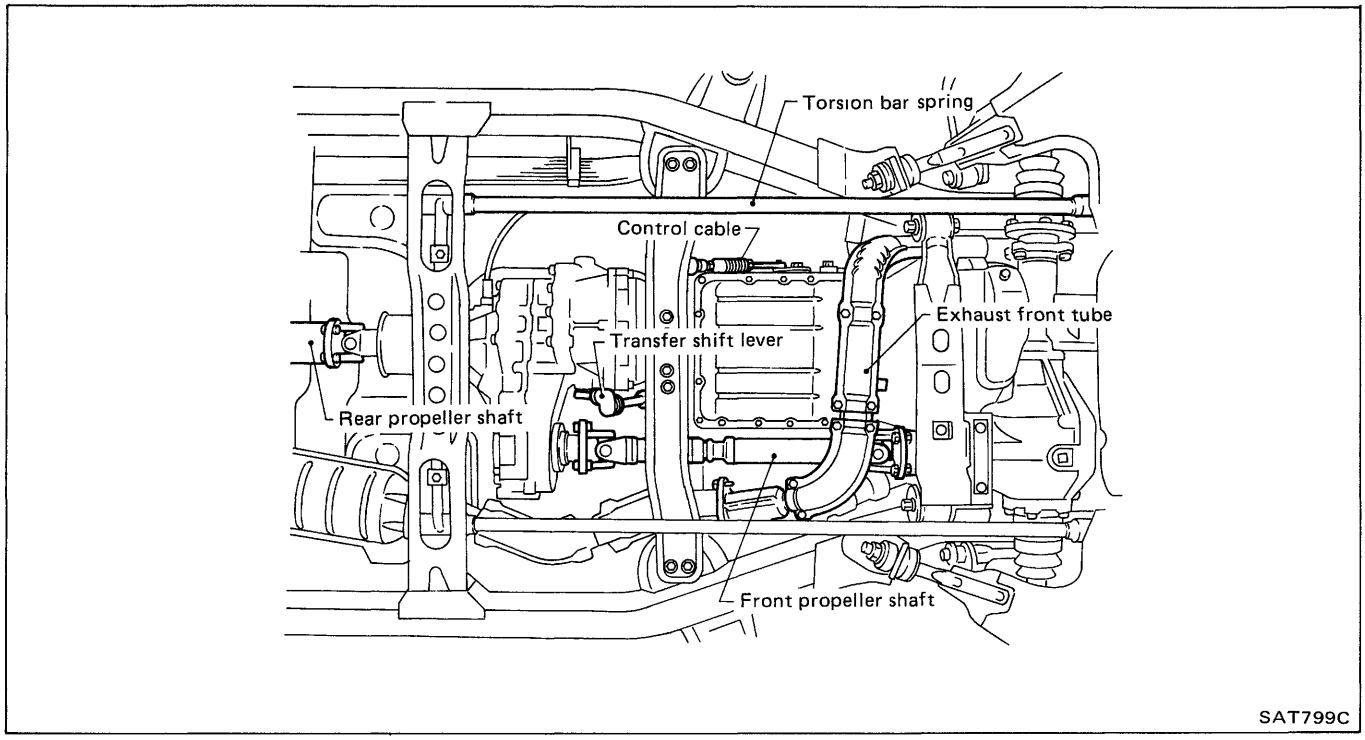


Stop lamp switch

- Check continuity between terminals of stop lamp switch.

Check stop lamp switch after adjusting brake pedal — refer to section BR.

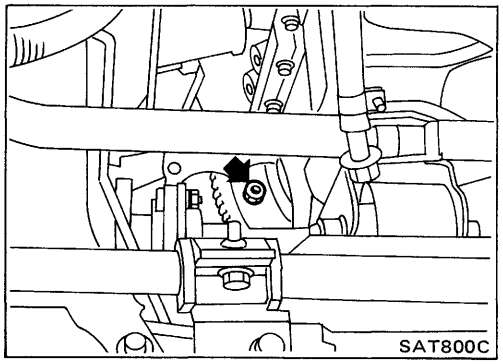
Condition	Continuity
When depressing brake pedal	Yes
When releasing brake pedal is released	No



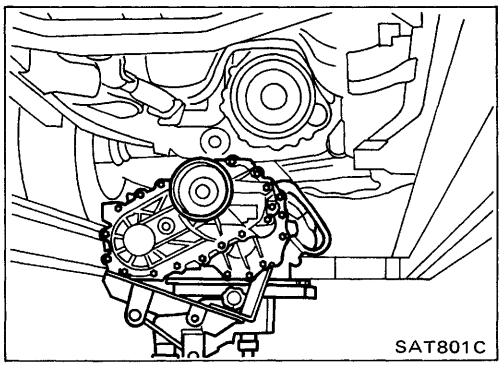
Removal

– 4WD and 2WD model –

- Remove exhaust front tube. (VG30E engine model)
- Remove fluid charging pipe from A/T assembly.
- Remove oil cooler pipe from A/T assembly.
- Plug up openings such as the fluid charging pipe hole, etc.
- Remove propeller shaft.
  – Refer to section PD.
- Remove transfer control linkage from transfer.
- **Insert plug into rear oil seal after removing rear propeller shaft.**
- **Be careful not to damage spline, sleeve yoke and rear oil seal.**
- Remove torsion bar springs. – Refer to section FA. Then remove second crossmember. (4WD model)
- Remove speedometer cable from transfer assembly or A/T assembly.
- Remove A/T control cable from A/T assembly. (4WD model)
- Remove A/T control linkage from selector lever. (2WD model)
- Disconnect A/T harness connectors.
- Remove starter motor.
- Remove gusset securing engine to A/T assembly. (VG30E engine model)
- Remove bolts securing torque converter to drive plate.
  Remove the bolts by turning crankshaft.

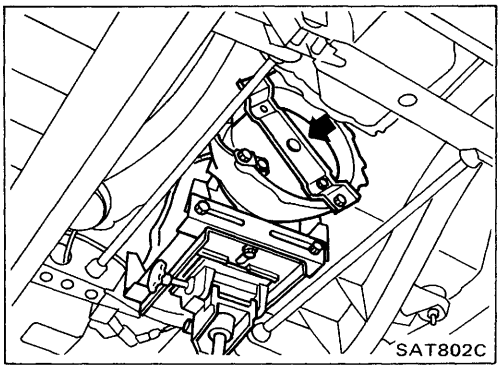


Removal (Cont'd)


SAT801C

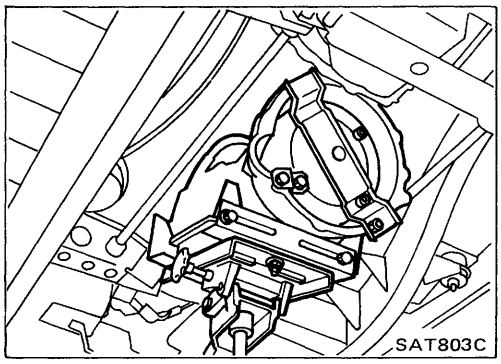
– 4WD model –

- Support A/T and transfer assembly with a jack.
- Remove rear mounting bracket from body and A/T assembly.
- Remove bolts securing A/T assembly to engine.
- Lower A/T assembly with transfer.


SAT802C

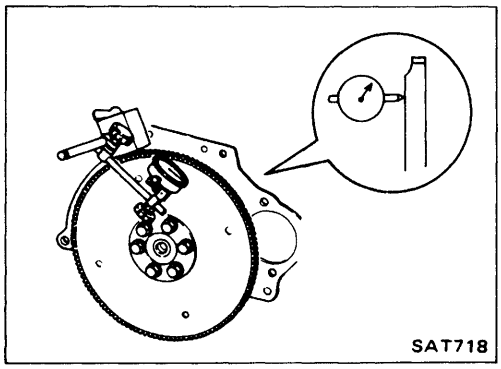
– 2WD model –

- Support A/T assembly with a jack.
- Remove rear mounting bracket from body and A/T assembly.
- Remove bolts securing A/T assembly to engine.
- Pull A/T assembly backwards.
- **Secure torque converter to prevent it from dropping.**
- **Secure A/T assembly to a jack.**


SAT803C

- Slant and lower A/T assembly.

Installation

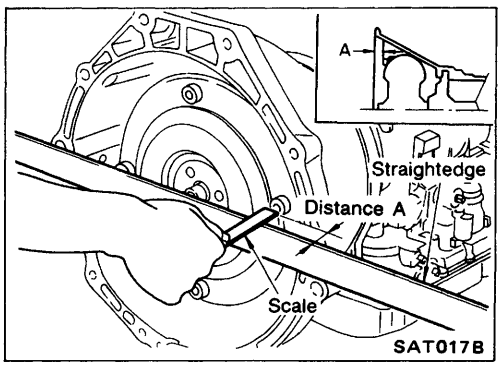

SAT718

- Drive plate runout

  Maximum allowable runout:

  0.5 mm (0.020 in)

  If this runout is out of specification, replace drive plate with ring gear.



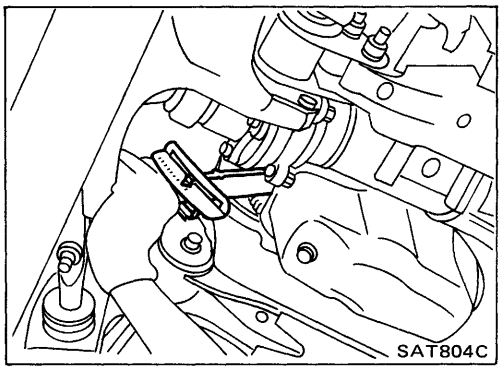
SAT017B

- When connecting torque converter to transmission, measure distance "A" to be certain that they are correctly assembled.

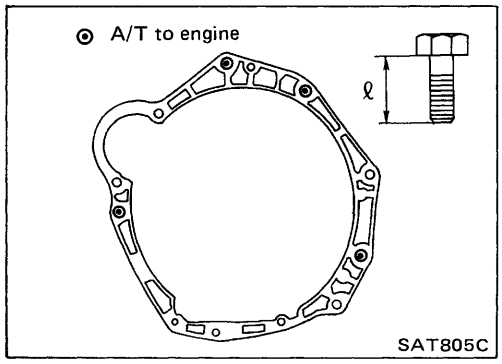
  Distance "A":

  26.0 mm (1.024 in) or more

Installation (Cont'd)



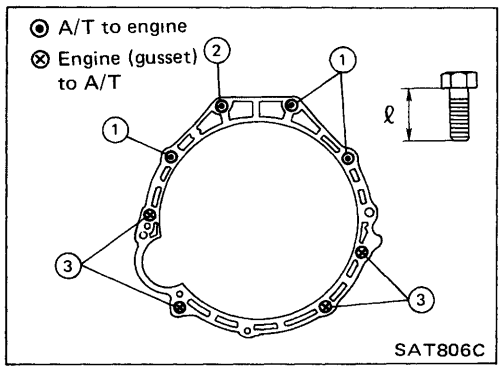
- Install converter to drive plate.
- **After converter is installed to drive plate, rotate crankshaft several turns and check to be sure that transmission rotates freely without binding.**



- Tighten bolts securing transmission.

– KA24E engine model –

Tightening torque N·m (kg-m, ft-lb)	Bolt length "ℓ" mm (in)
39 - 49 (4.0 - 5.0, 29 - 36)	45 (1.77)



– VG30E engine model –

Bolt No.	Tightening torque N·m (kg-m, ft-lb)	Bolt length "ℓ" mm (in)
①	39 - 49 (4.0 - 5.0, 29 - 36)	45 (1.77)
②	39 - 49 (4.0 - 5.0, 29 - 36)	50 (1.97)
③	29 - 39 (3.0 - 4.0, 22 - 29)	25 (0.98)
Gusset to engine	29 - 39 (3.0 - 4.0, 22 - 29)	20 (0.79)

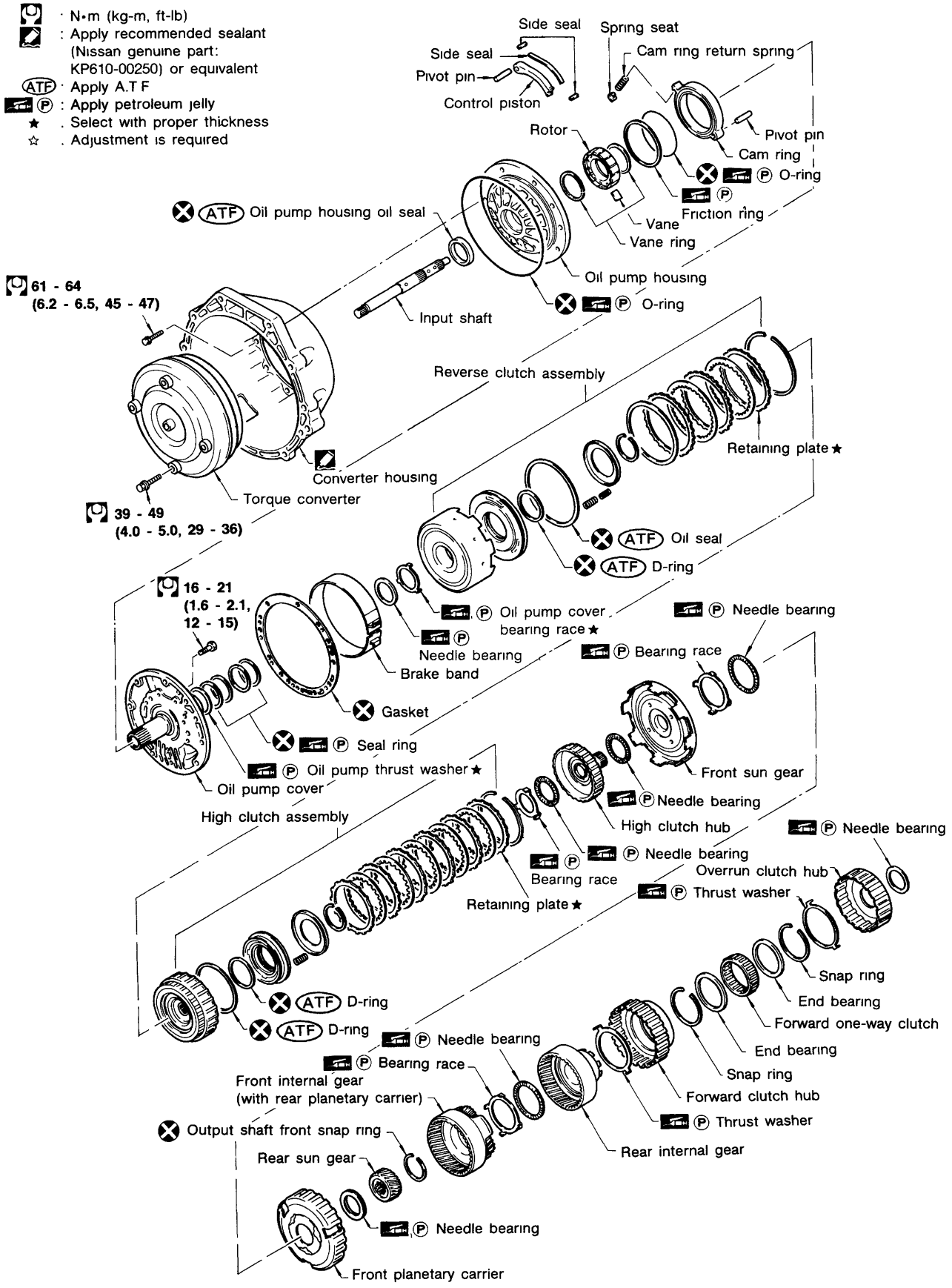


- Reinstall any part removed.
- Check fluid level in transmission.
- Move selector lever through all position to be sure that transmission operates correctly.
  With parking brake applied, rotate engine at idling. Move selector lever through "N" to "D", to "2", to "1" and to "R". A slight shock should be felt by hand gripping selector each time transmission is shifted.
- Perform road test. – Refer to "ROAD TESTING".

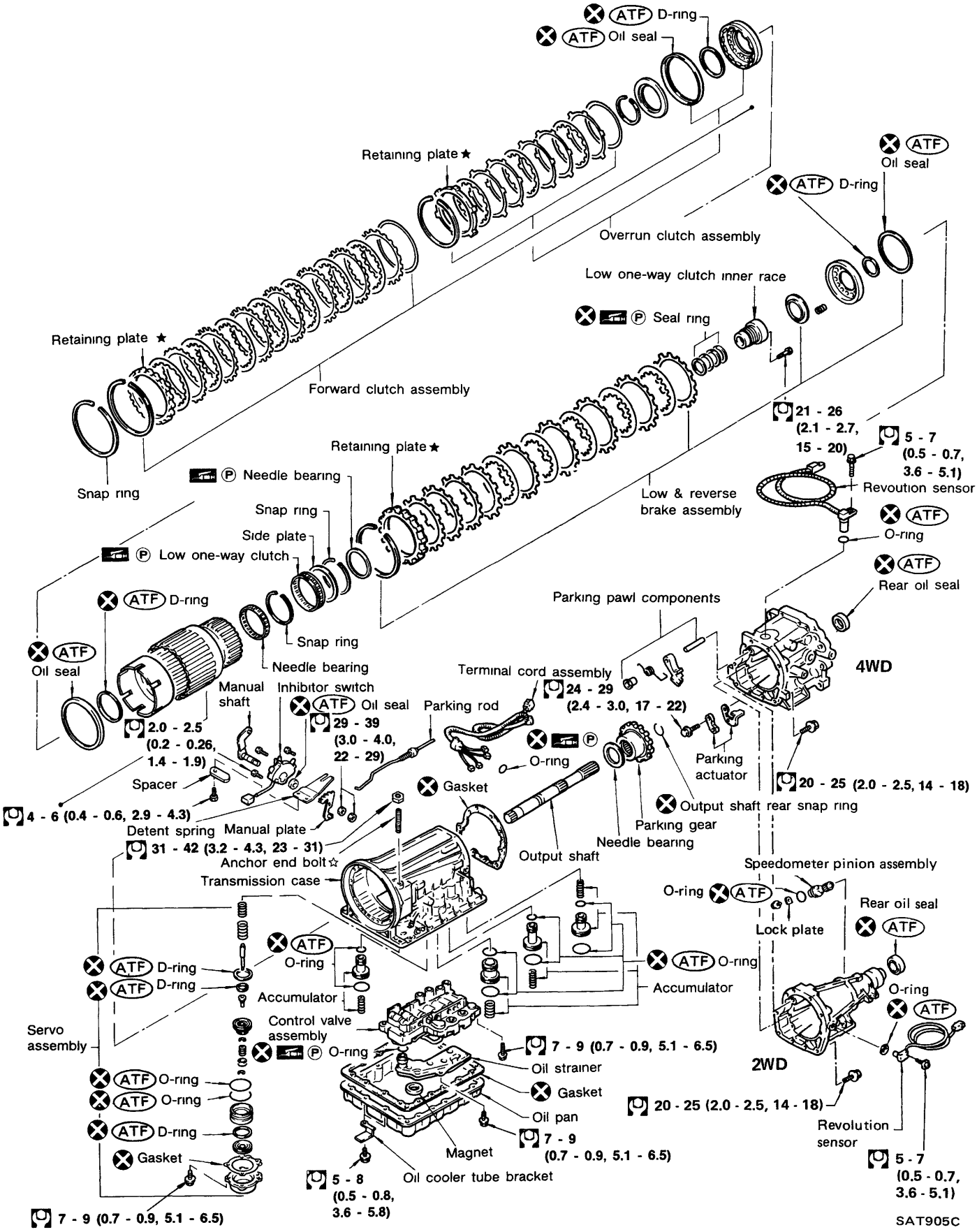
NOTE

RE4R01A

· N•m (kg-m, ft-lb)
: Apply recommended sealant (Nissan genuine part: KP610-00250) or equivalent
(ATF) · Apply A.T.F
(P) : Apply petroleum jelly
★ . Select with proper thickness
☆ . Adjustment is required

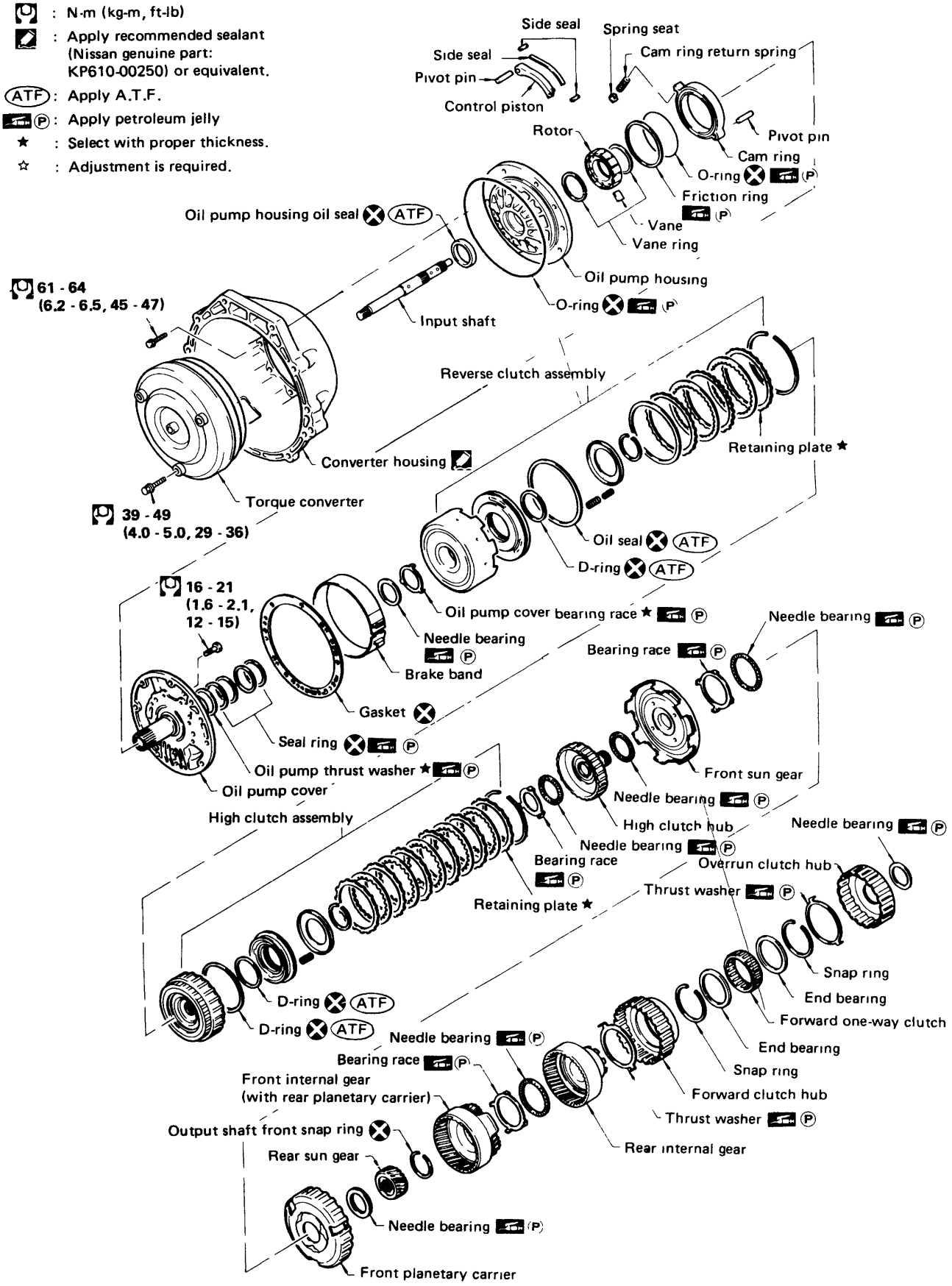


RE4R01A (Cont'd)

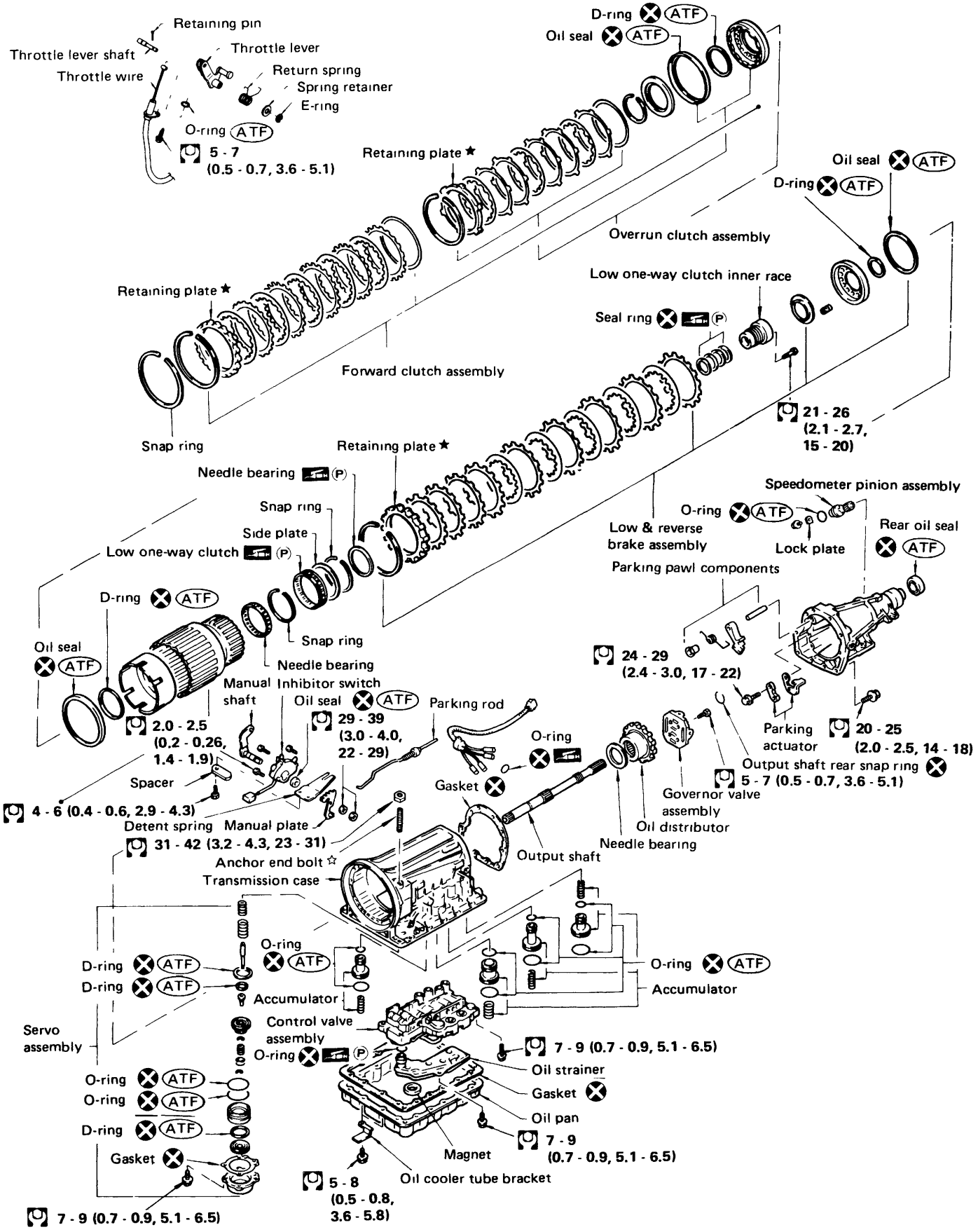


RL4R01A

: N·m (kg-m, ft-lb)
: Apply recommended sealant (Nissan genuine part: KP610-00250) or equivalent.
(ATF): Apply A.T.F.
(P): Apply petroleum jelly
★ : Select with proper thickness.
☆ : Adjustment is required.

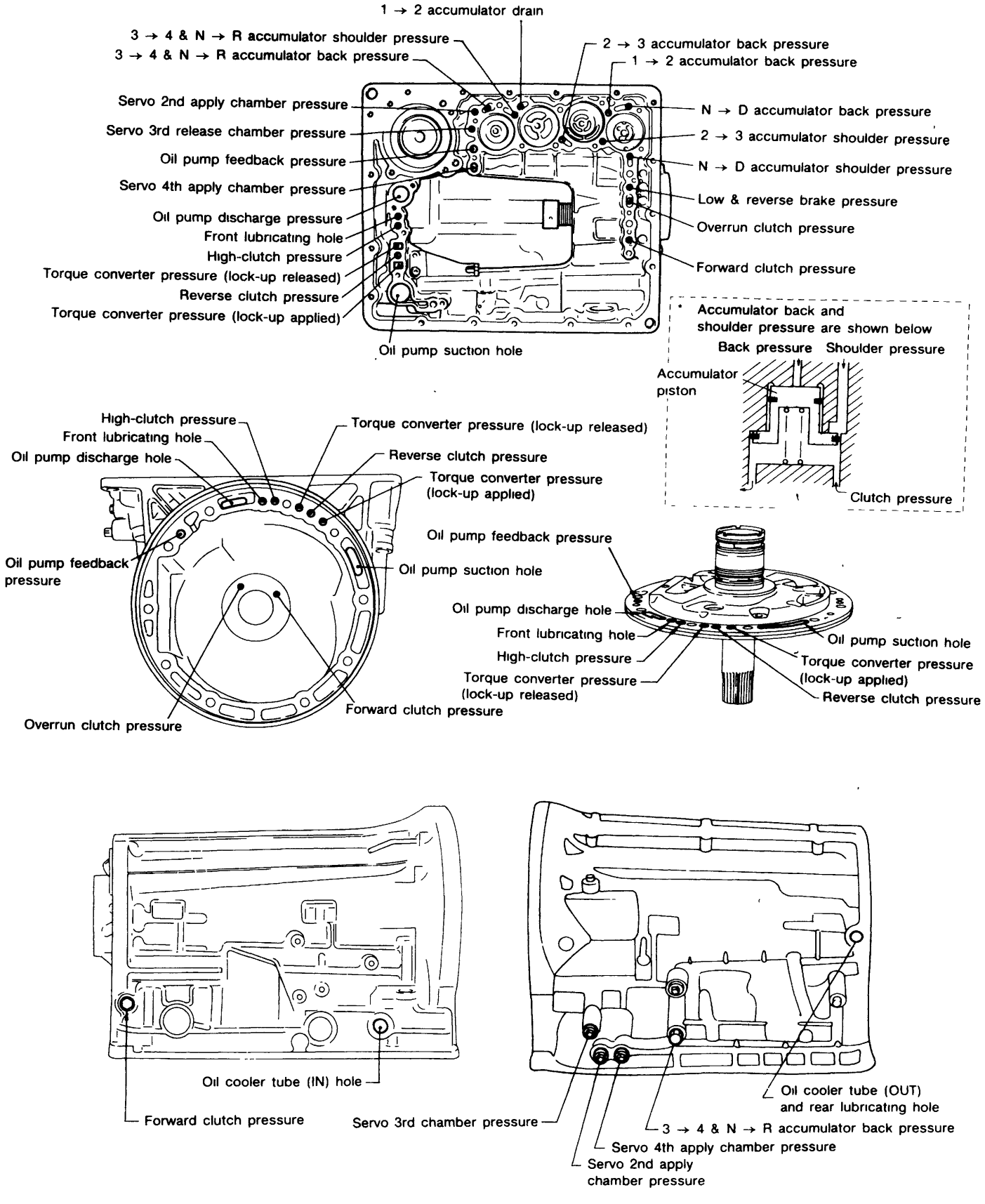


RL4R01A (Cont'd)



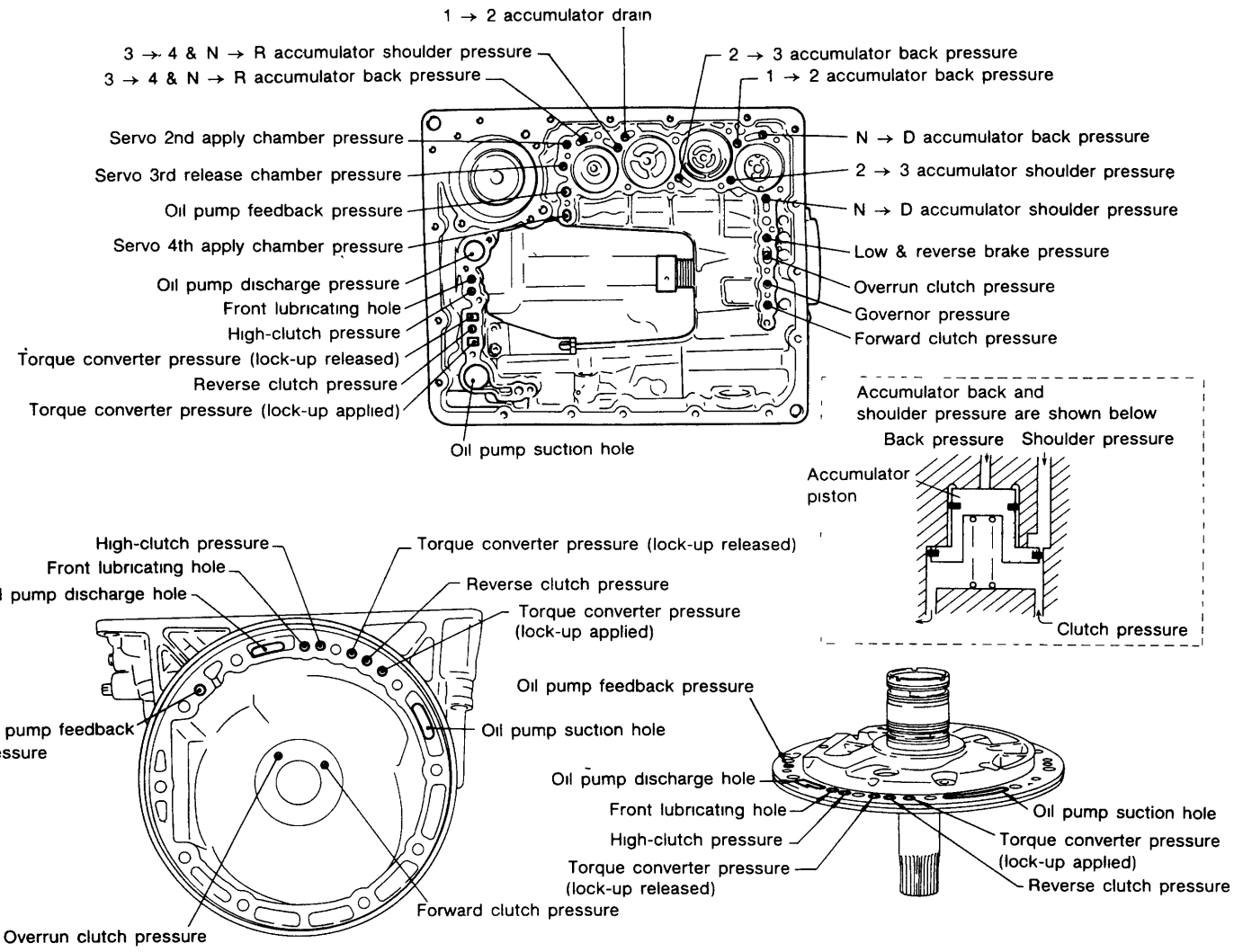
SAT906C

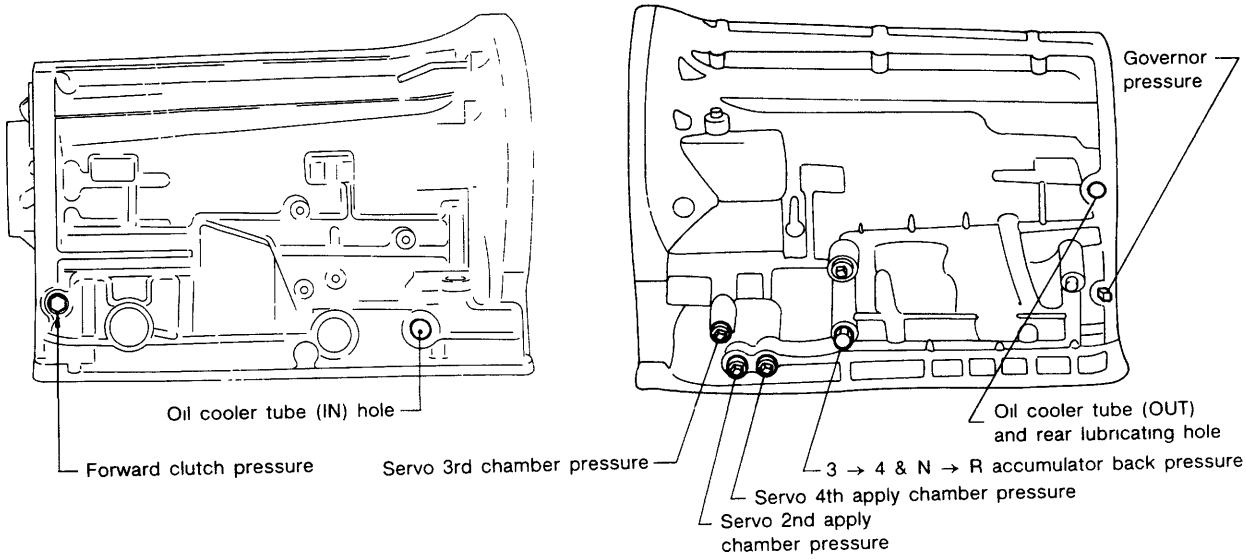
Oil Channel — RE4R01A



SAT185B

Oil Channel — RL4R01A





SAT173C

Locations of Needle Bearings, Thrust Washers and Snap Rings

Outer diameter of snap rings

Item number	Outer diameter mm (in)
②	161.0 (6.34)
③	140.1 (5.52)
④	156.4 (6.16)
⑥	142.0 (5.59)
⑦	159.2 (6.27)

Thrust washers

Item number	Color
①	Black
⑤	White

Outer diameter of needle bearings

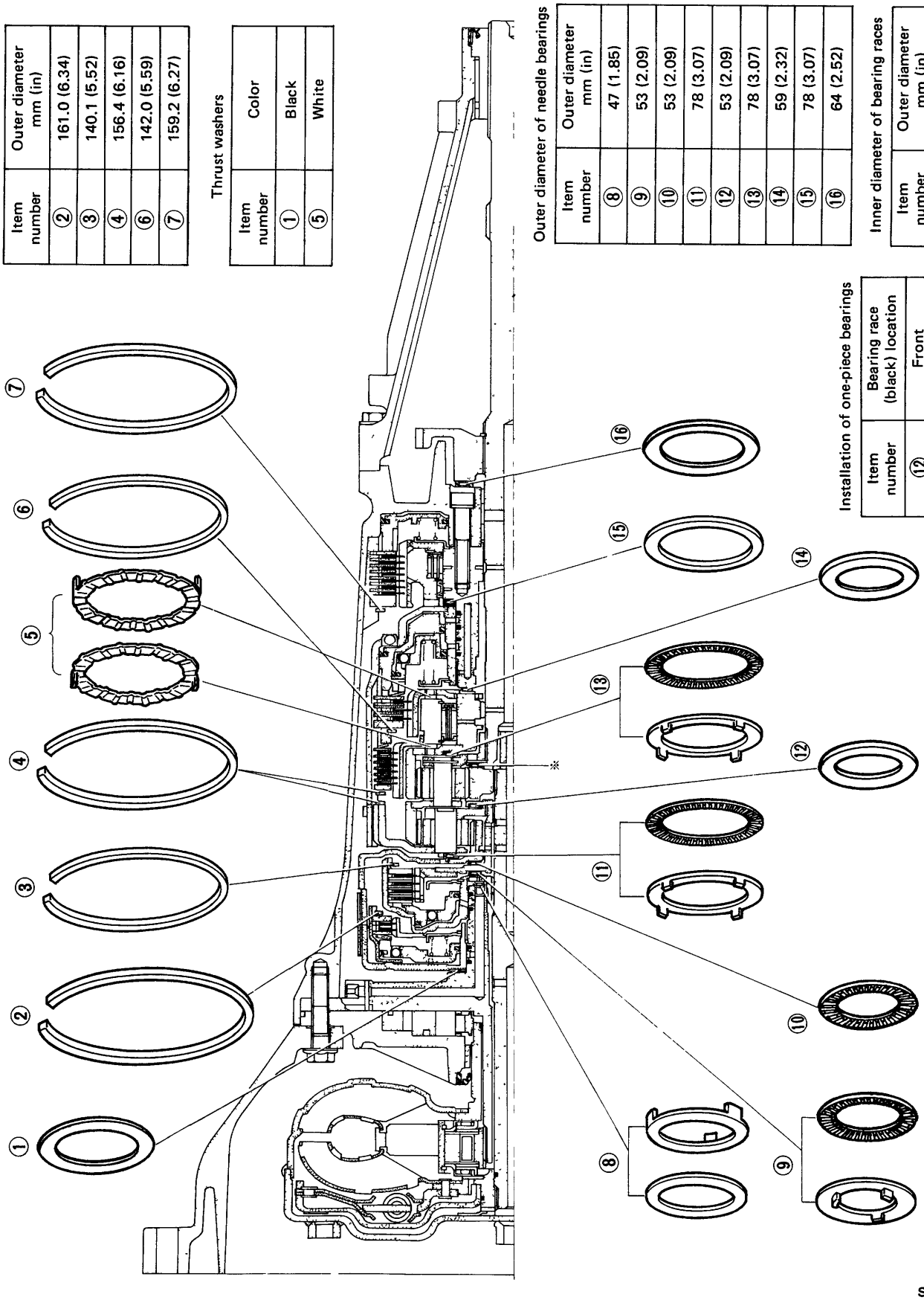
Item number	Outer diameter mm (in)
⑧	47 (1.85)
⑨	53 (2.09)
⑩	53 (2.09)
⑪	78 (3.07)
⑫	53 (2.09)
⑬	78 (3.07)
⑭	59 (2.32)
⑮	78 (3.07)
⑯	64 (2.52)

Inner diameter of bearing races

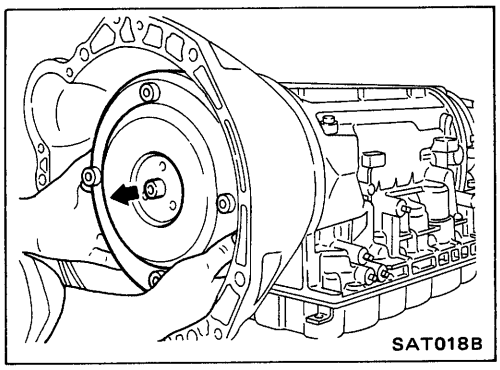
Item number	Outer diameter mm (in)
⑪	58 (2.28)
⑬	58.8 (2.315)

Installation of one-piece bearings

Item number	Bearing race (black) location
⑫	Front
⑮	Rear side
⑯	Rear side



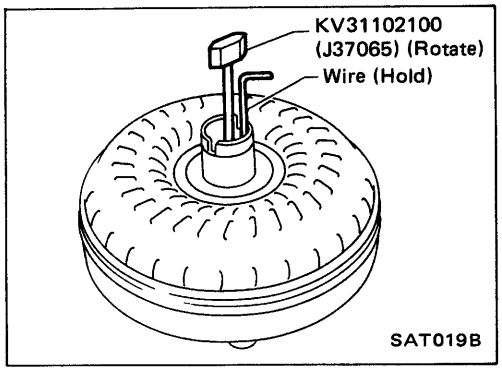
SAT647A



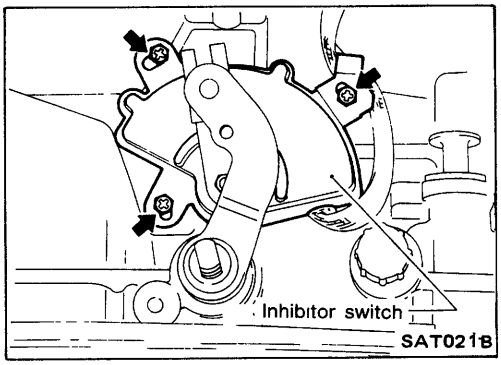
Disassembly

— **RE4R01A and RL4R01A** —

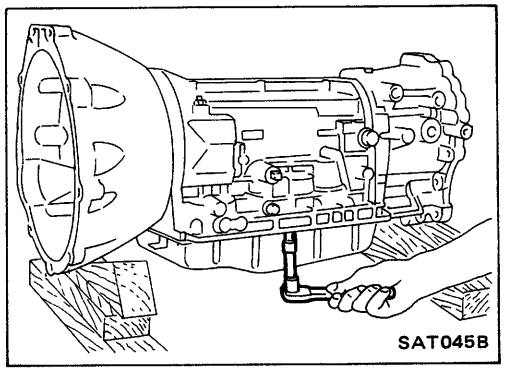
1. Removing torque converter by holding it firmly and turning while pulling straight out.



2. Check torque converter one-way clutch.
a. Insert Tool into spline of one-way clutch inner race.
b. Hook bearing support unitized with one-way clutch outer race with suitable wire.
c. Check that one-way clutch inner race rotates only clockwise with Tool while holding bearing support with wire.

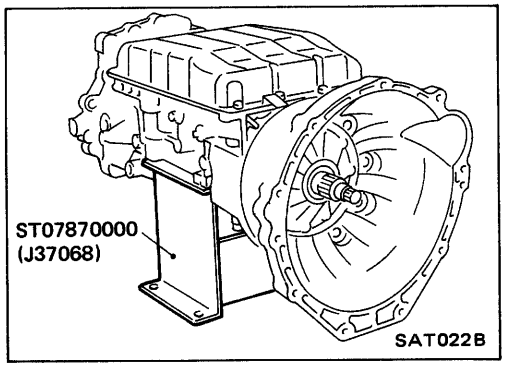


3. Remove inhibitor switch from transmission case.



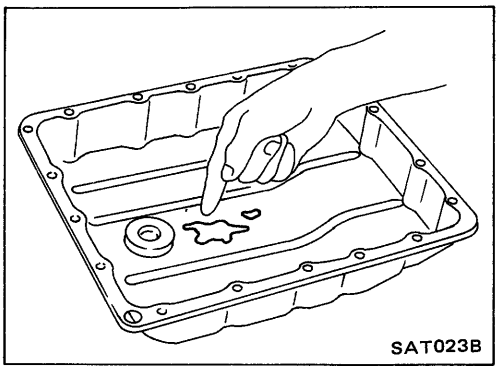
4. Remove oil pan.
a. Drain A.T.F. from adapter case.
b. Raise oil pan by placing wooden blocks under converter housing and adapter case.
c. Separate the oil pan and transmission case.

- **Always place oil pan straight down so that foreign particles inside will not move.**



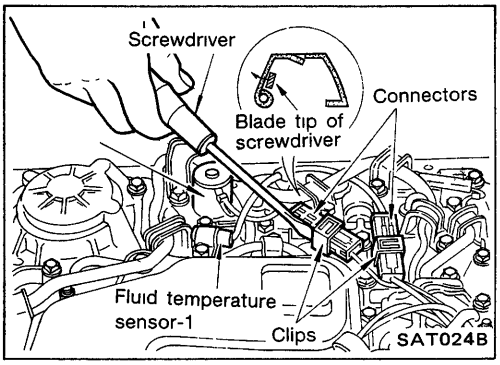
5. Place transmission into Tool with the control valve facing up.

Disassembly (Cont'd)



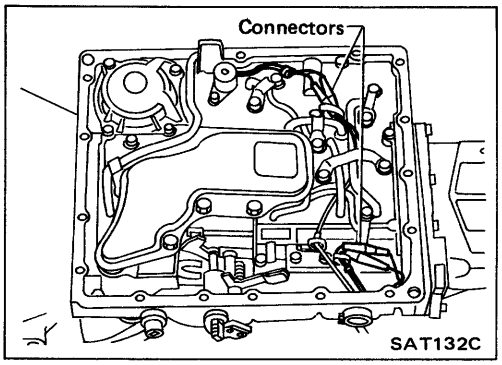
6. Check oil pan and oil strainer for accumulation of foreign particles.
- If materials of clutch facing are found, clutch plates may be worn.
- If metal filings are found, clutch plates, brake bands, etc. may be worn.
- If aluminum filings are found, bushings or aluminum cast parts may be worn.

In above cases, replace torque converter and check unit for cause of particle accumulation.

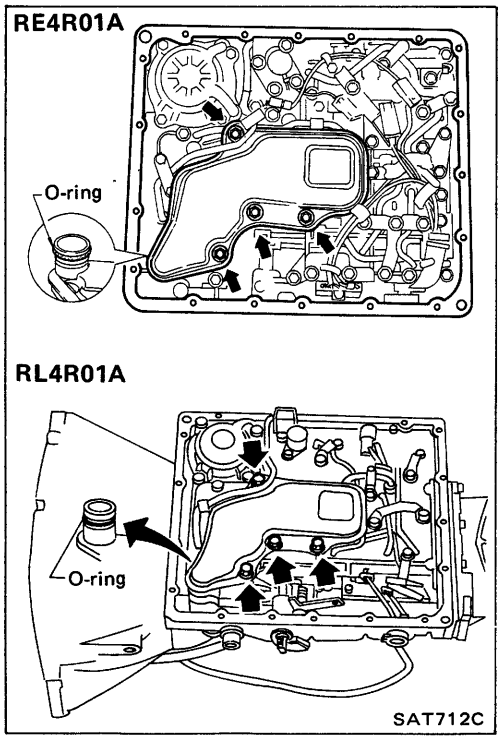


7.

— **RE4R01A** —
- Remove lock-up solenoid and fluid temperature sensor-1 and 2 connectors.
- **Be careful not to damage connector.**



— **RL4R01A** —
- Remove lock-up cancel solenoid and O.D. cancel solenoid connectors.

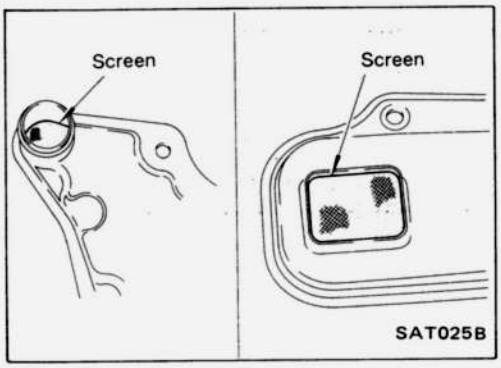


8. Remove oil strainer.

a. Remove oil strainer from control valve assembly. Then remove O-ring from oil strainer.

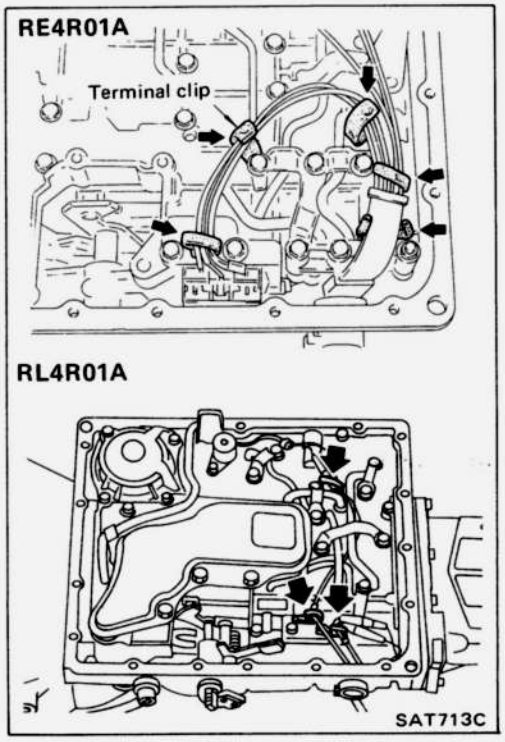
Disassembly (Cont'd)

b. Check oil strainer screen for damage.

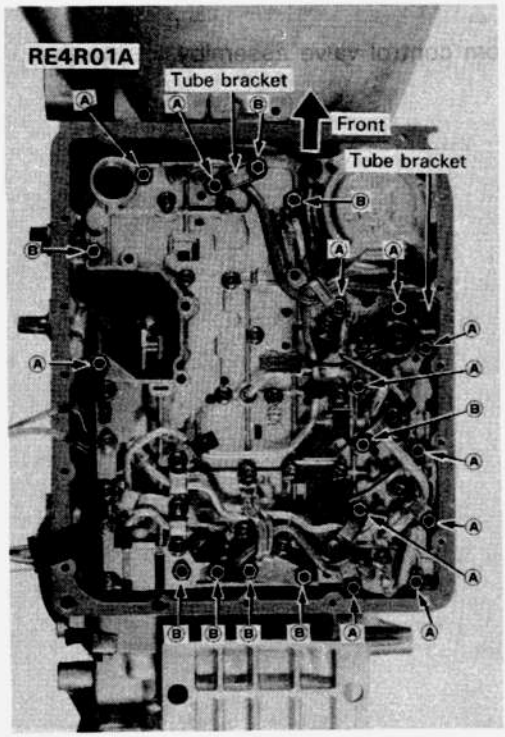


9. Remove control valve assembly.

a. Straighten terminal clips to free terminal cords then remove terminal clips.



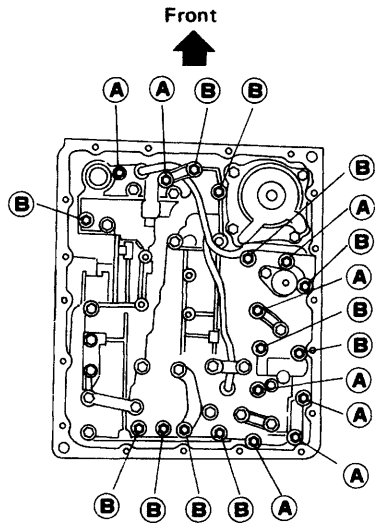
b. Remove bolts Ⓐ and Ⓑ, and remove control valve assembly from transmission.



Bolt	ℓ mm (in)
Ⓐ	33 (1.30)
Ⓑ	45 (1.77)

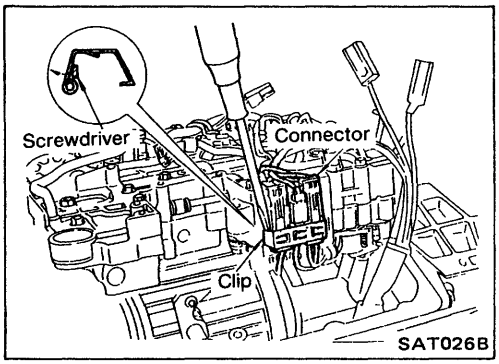
Disassembly (Cont'd)

RL4R01A



SAT714C

Bolt	ℓ mm (in)
Ⓐ	33 (1.30)
Ⓑ	45 (1.77)

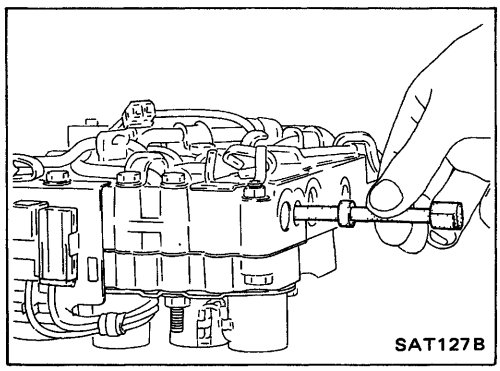


SAT026B

— **RE4R01A** —

c. Remove solenoid connector.

● **Be careful not to damage connector.**



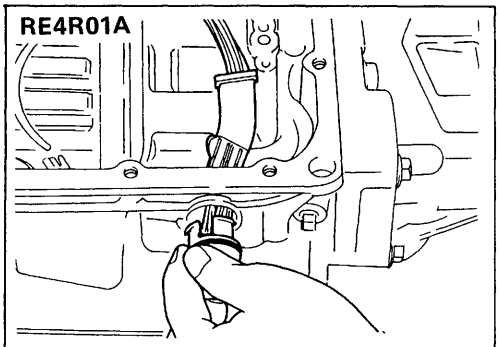
SAT127B

— **RE4R01A and RL4R01A** —

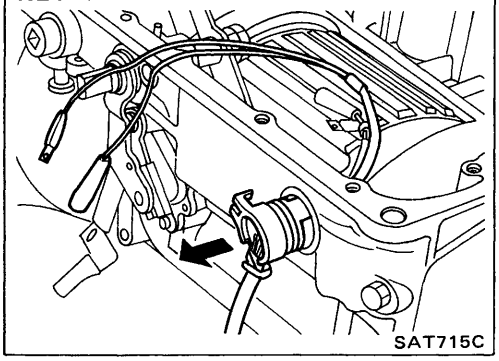
d. Remove manual valve from control valve assemlby.

Disassembly (Cont'd)

RE4R01A

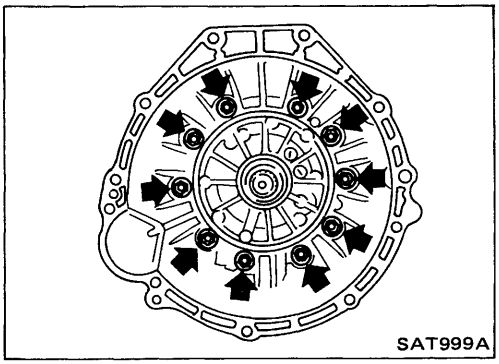


RL4R01A



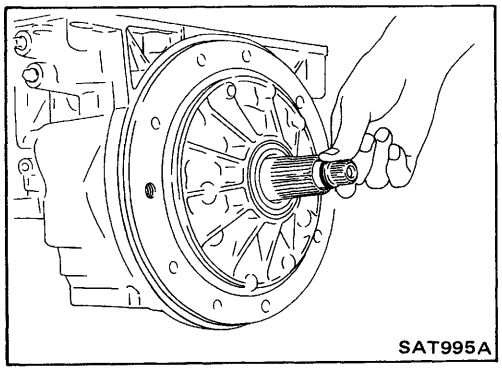
SAT715C

10. Remove terminal cord assembly from transmission case while pushing on stopper.
- **Be careful not to damage cord.**
- **Do not remove terminal cord assembly unless it is damaged.**



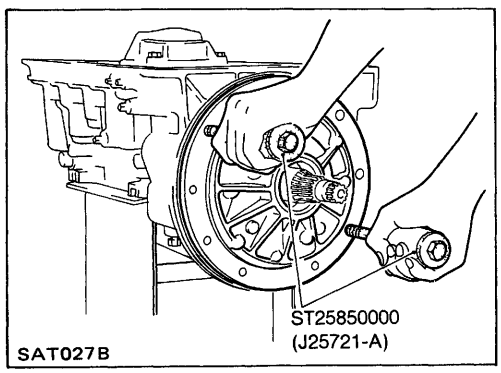
SAT999A

11. Remove converter housing.
a. Remove converter housing from transmission case.
b. Remove traces of sealant.
- **Be careful not to scratch converter housing.**



SAT995A

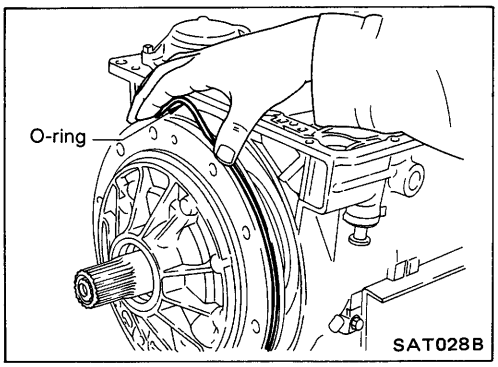
12. Remove O-ring from input shaft.



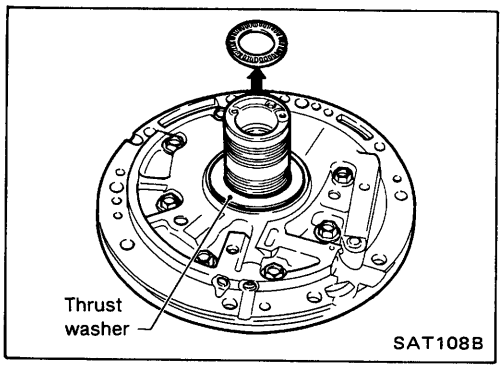
SAT027B

13. Remove oil pump assembly.
a. Attach Tool to oil pump assembly and extract it evenly from transmission case.

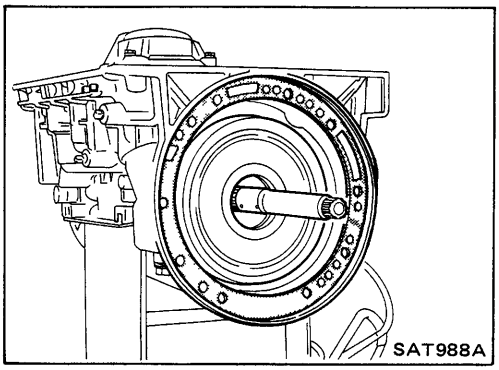
Disassembly (Cont'd)



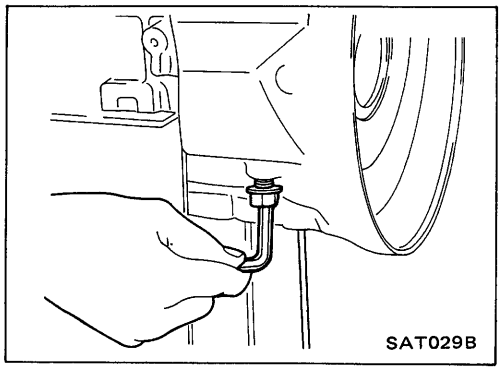
b. Remove O-ring from oil pump assembly.
c. Remove traces of sealant from oil pump housing.
- **Be careful not to scratch pump housing.**



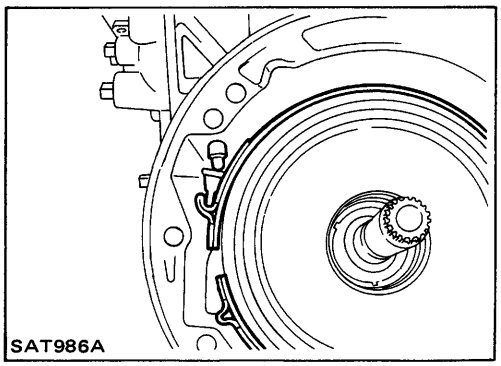
d. Remove needle bearing and thrust washer from oil pump assembly.



14. Remove input shaft and oil pump gasket.

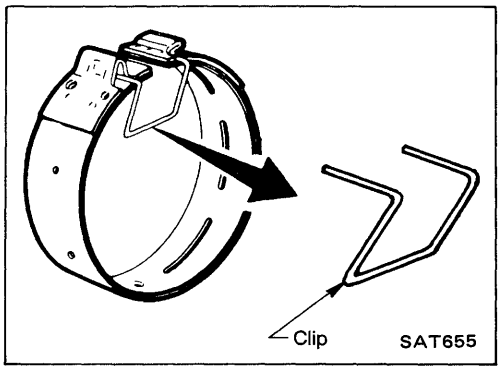


15. Remove brake band and band strut.
a. Loosen lock nut and remove band servo anchor end pin from transmission case.

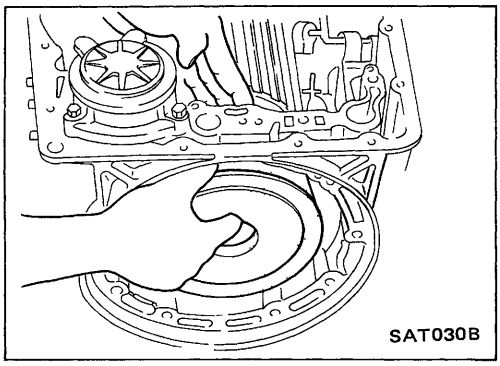


b. Remove brake band and band strut from transmission case.

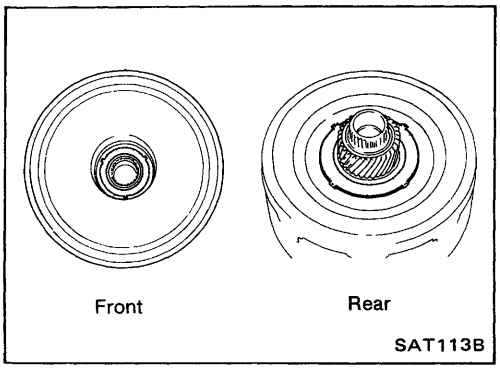
Disassembly (Cont'd)



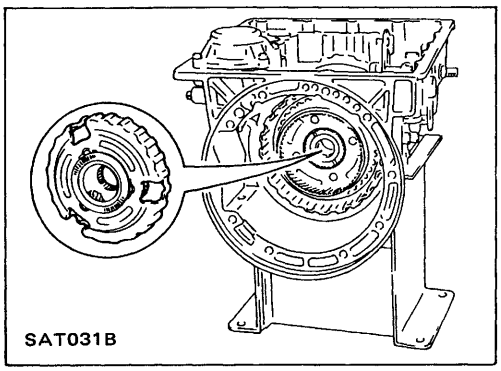
c. Hold brake band in a circular shape with clip.



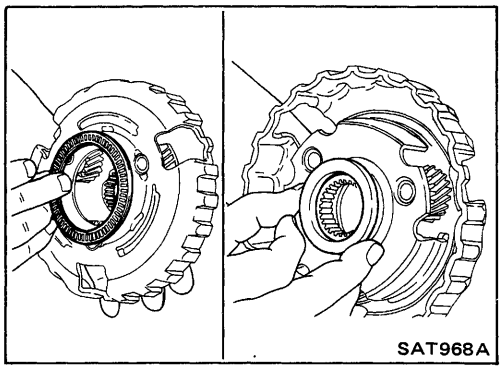
16. Remove front side clutch and gear components.
a. Remove clutch pack (reverse clutch, high clutch and front sun gear) from transmission case.



b. Remove front bearing race from clutch pack.
c. Remove rear bearing race from clutch pack.



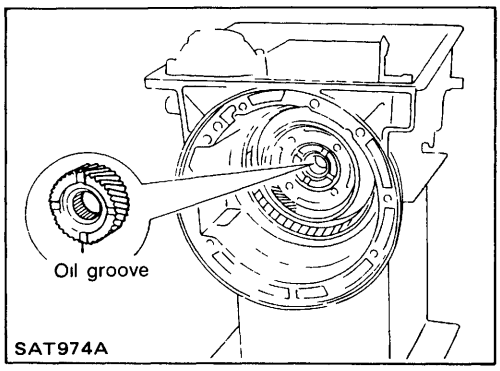
d. Remove front planetary carrier from transmission case.



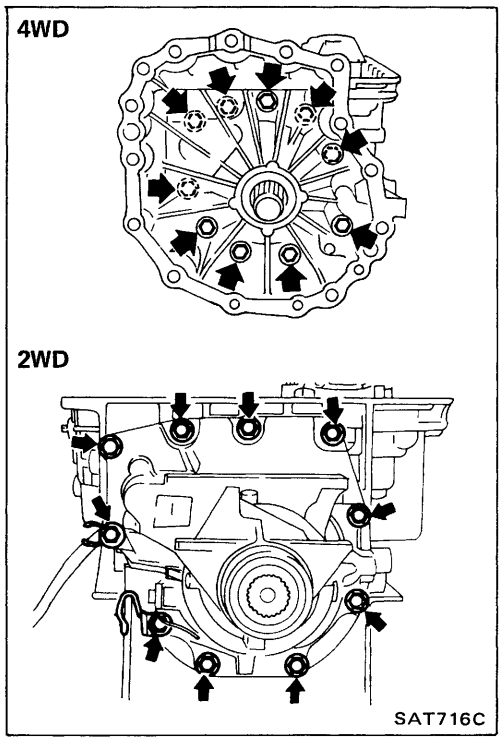
e. Remove front needle bearing from front planetary carrier.
f. Remove rear bearing from front planetary carrier.

Disassembly (Cont'd)

g. Remove rear sun gear from transmission case.

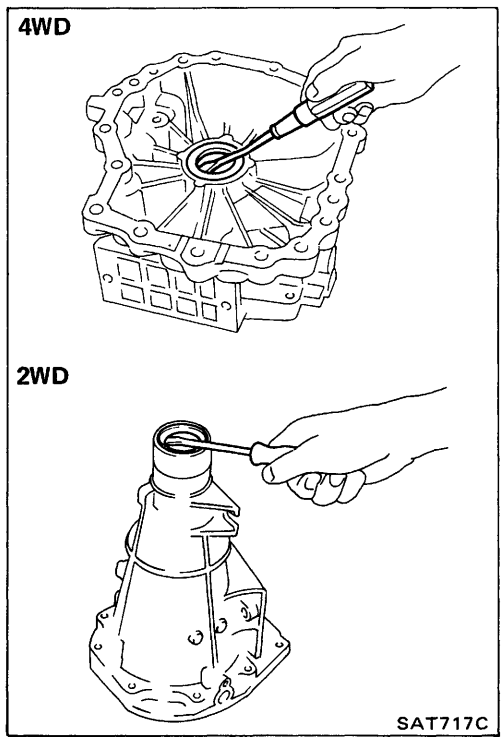


17. Remove rear extension or adapter case.
a. Remove rear extension or adapter case from transmission case.
b. Remove rear extension or adapter case gasket from transmission case.

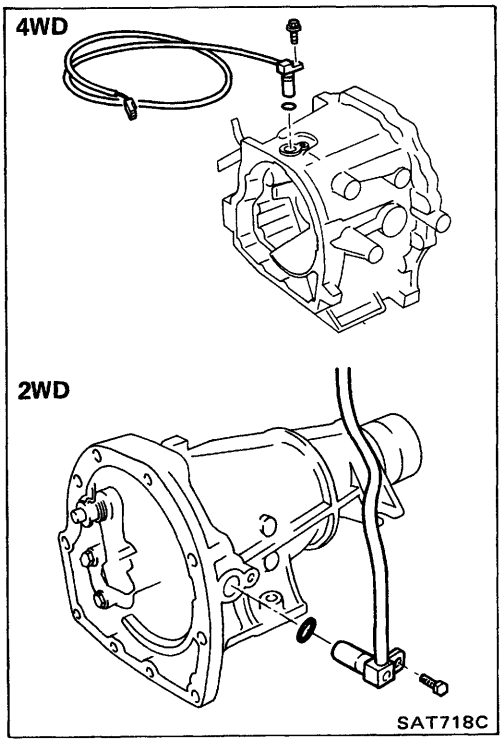


c. Remove oil seal from rear extension or adapter case.

- **Do not remove oil seal unless it is to be replaced.**



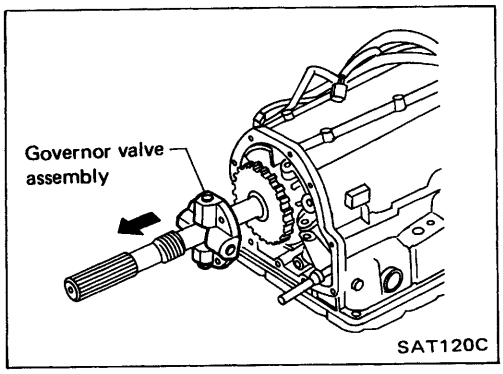
Disassembly (Cont'd)



— **RE4R01A** —

d. Remove revolution sensor from rear extension or adapter case.

e. Remove O-ring from revolution sensor.

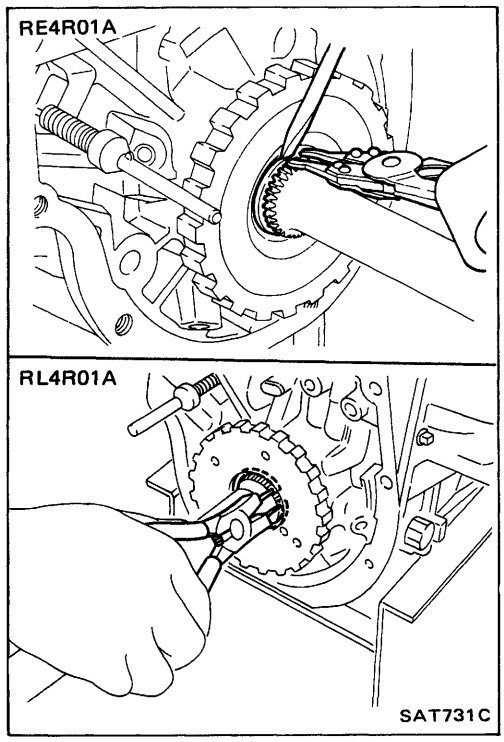


— **RE4R01A and RL4R01A** —

18. Remove output shaft and parking gear.

— **RL4R01A** —

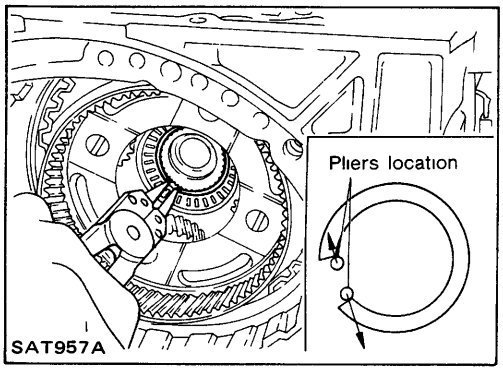
a. Remove governor valve assembly.



— **RE4R01A and RL4R01A** —

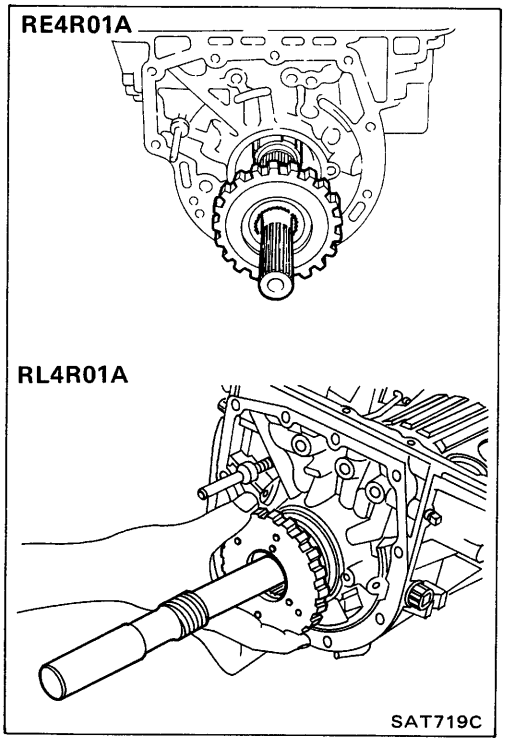
b. Remove rear snap ring from output shaft.

Disassembly (Cont'd)

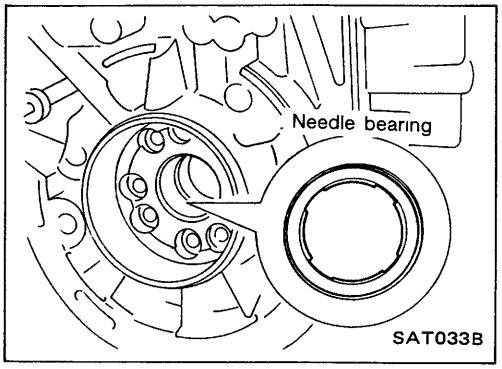


c. Slowly push output shaft all the way forward.
- **Do not use excessive force.**

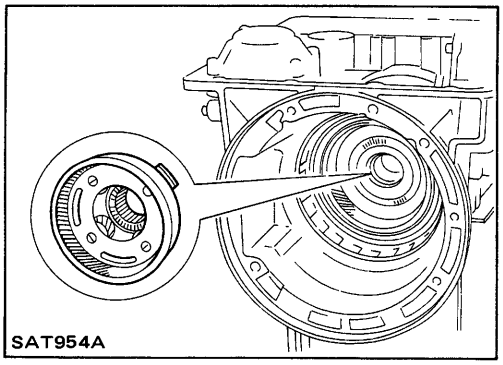
d. Remove snap ring from output shaft.



e. Remove output shaft and parking gear as a unit from transmission case.
f. Remove parking gear from output shaft.

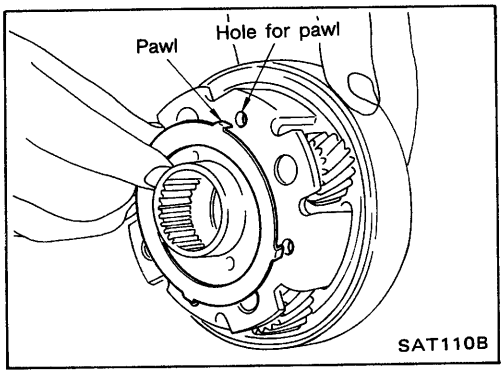


g. Remove needle bearing from transmission case.

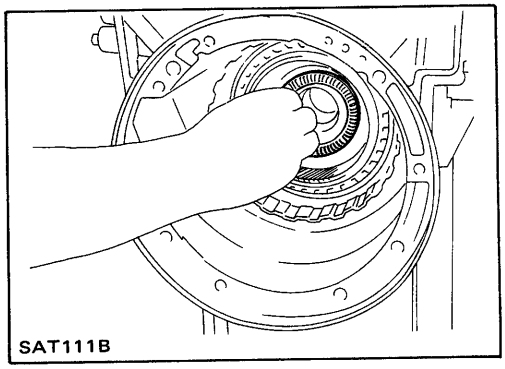


19. Remove rear side clutch and gear components.
a. Remove front internal gear.

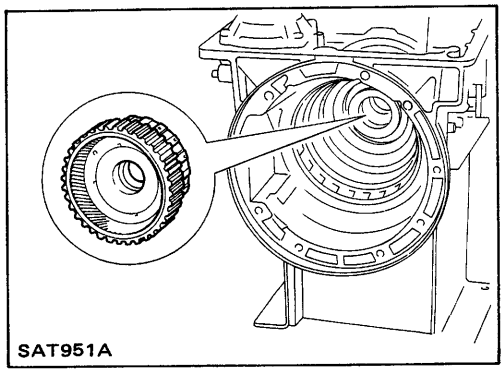
Disassembly (Cont'd)



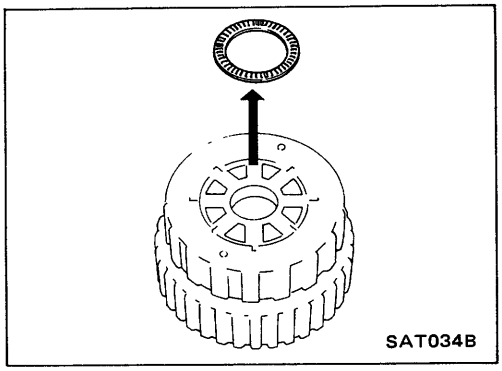
b. Remove bearing race from front internal gear.



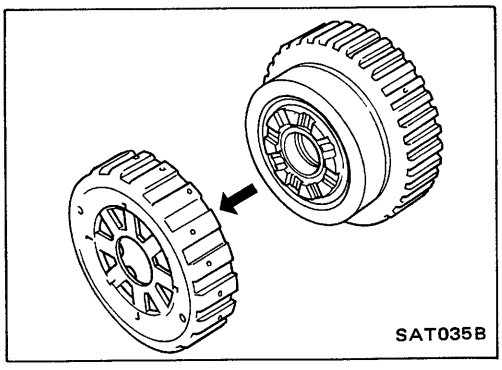
c. Remove needle bearing from rear internal gear.



d. Remove rear internal gear, forward clutch hub and overrun clutch hub as a set from transmission case.

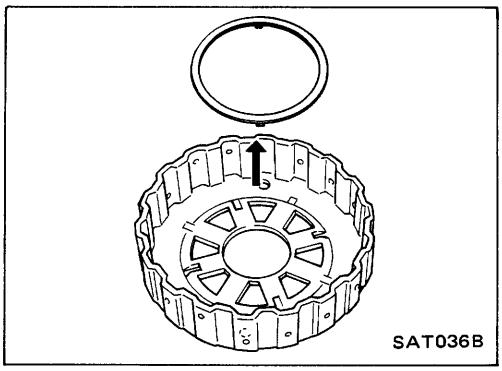


e. Remove needle bearing from overrun clutch hub.

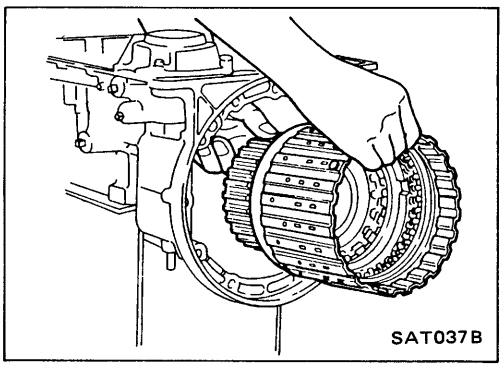


f. Remove overrun clutch hub from rear internal gear and forward clutch hub.

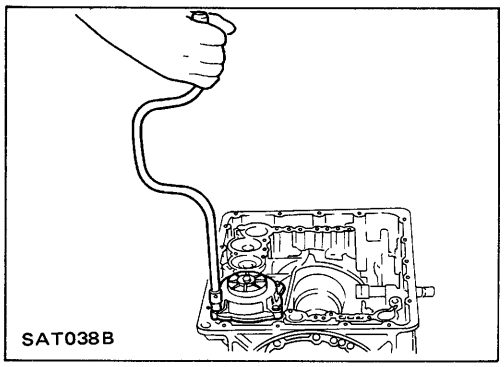
Disassembly (Cont'd)



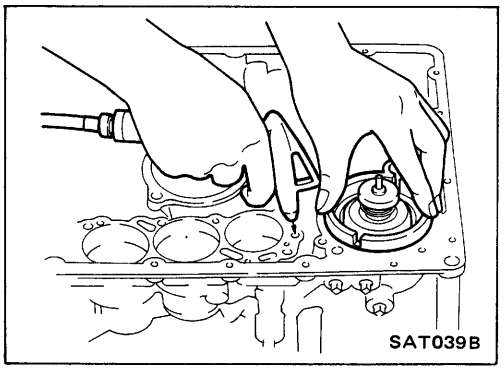
g. Remove thrust washer from overrun clutch hub.



h. Remove forward clutch assembly from transmission case.

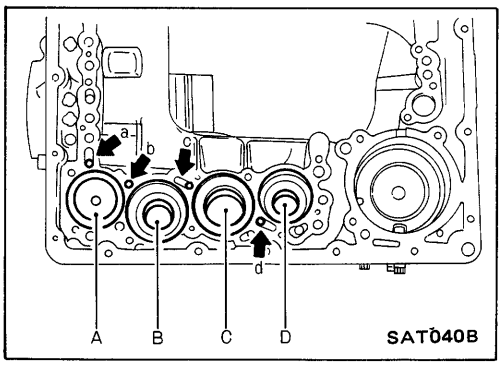


20. Remove band servo and accumulator components.
a. Remove band servo retainer from transmission case.



b. Apply compressed air to oil hole until band servo piston comes out of transmission case.
- **Hold piston with a rag and gradually direct air to oil hole.**

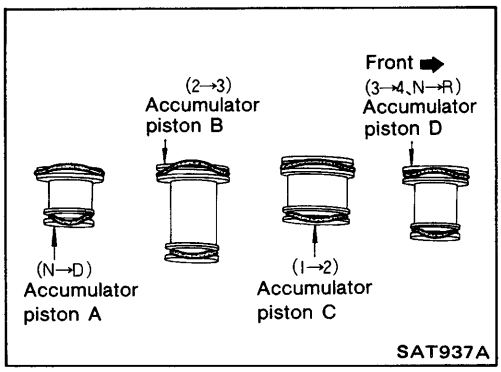
c. Remove return springs.



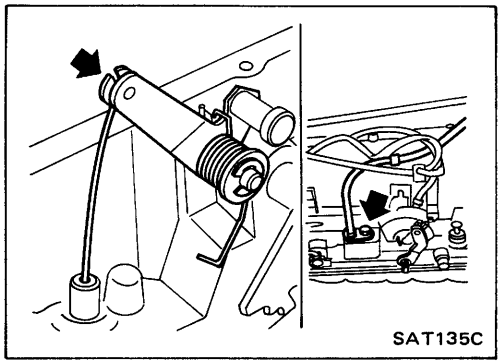
d. Remove springs from accumulator pistons B, C and D.
e. Apply compressed air to each oil hole until piston comes out.
- **Hold piston with a rag and gradually direct air to oil hole.**

Identification of accumulator pistons	A	B	C	D
Identification of oil holes	a	b	c	d

Disassembly (Cont'd)



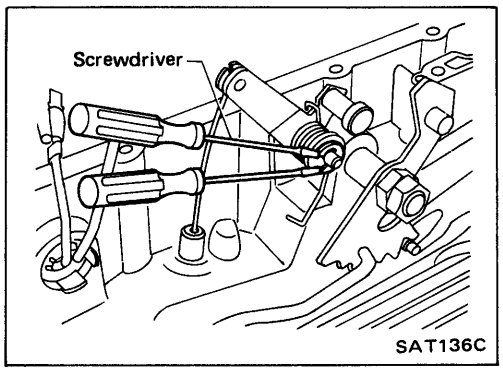
f. Remove O-ring from each piston.



— RL4R01A —

21. Remove throttle wire components if necessary.

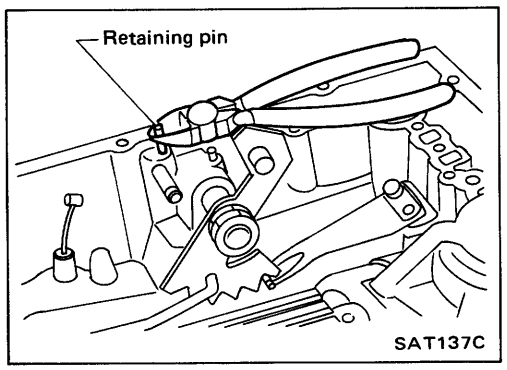
a. Remove throttle wire from A/T assembly.



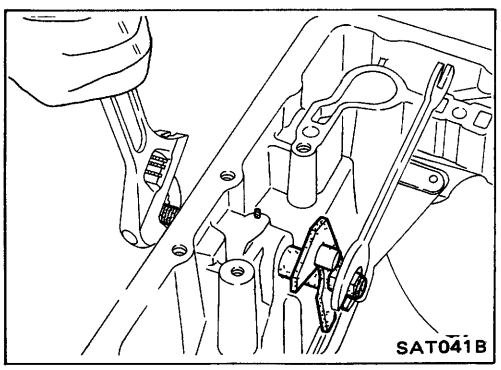
b. Remove throttle lever shaft E-ring.

c. Remove return spring.

d. Remove throttle lever.



e. Remove throttle lever shaft retaining pin and throttle lever shaft.

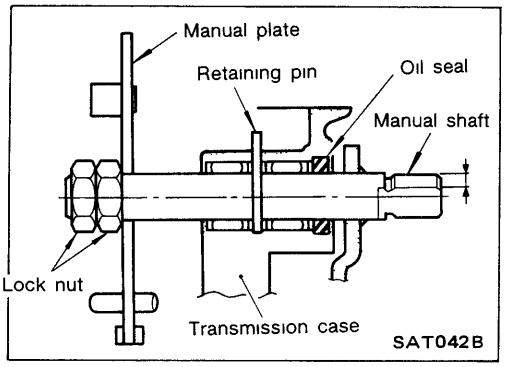


— RE4R01A and RL4R01A —

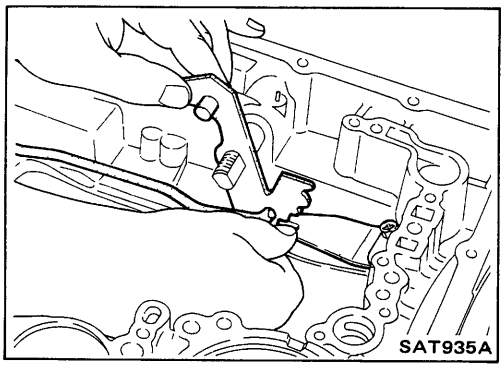
22. Remove manual shaft components, if necessary.

a. Hold width across flats of manual shaft (outside the transmission case) and remove lock nut from shaft.

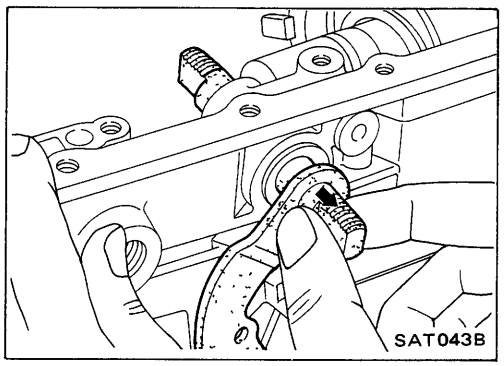
Disassembly (Cont'd)



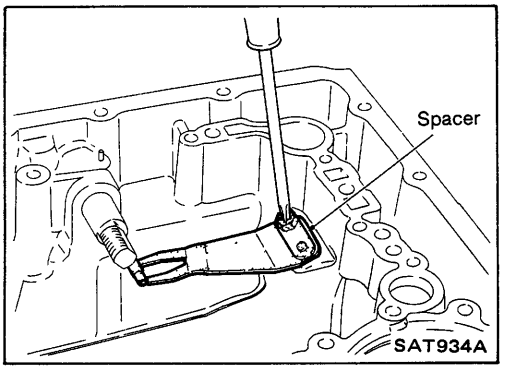
b. Remove retaining pin from transmission case.



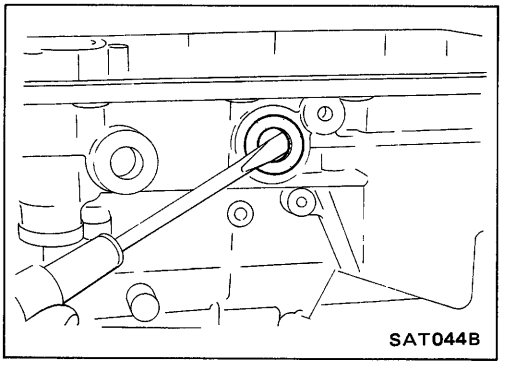
c. While pushing detent spring down, remove manual plate and parking rod from transmission case.



d. Remove manual shaft from transmission case.

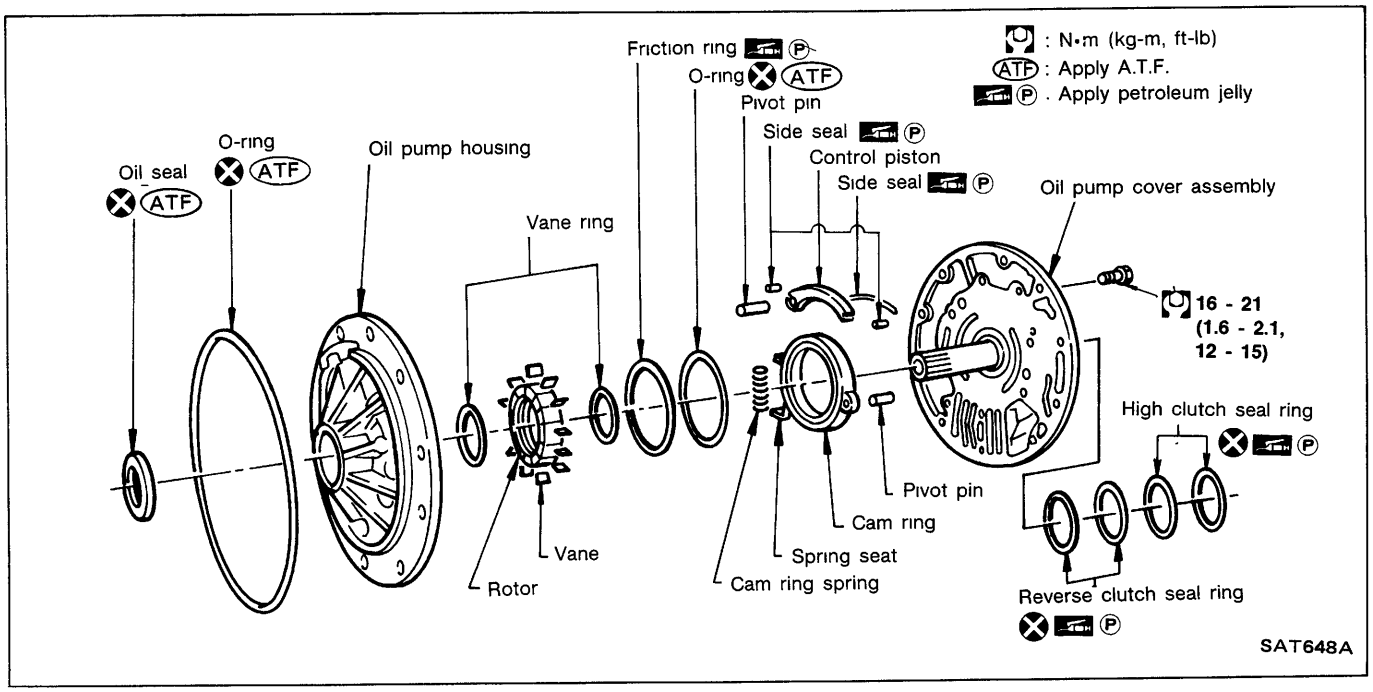


e. Remove spacer and detent spring from transmission case.



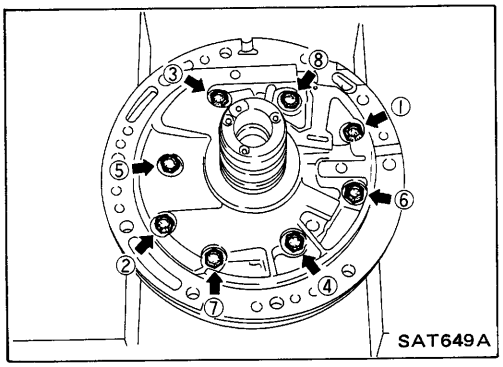
f. Remove oil seal from transmission case.

Oil Pump — RE4R01A and RL4R01A

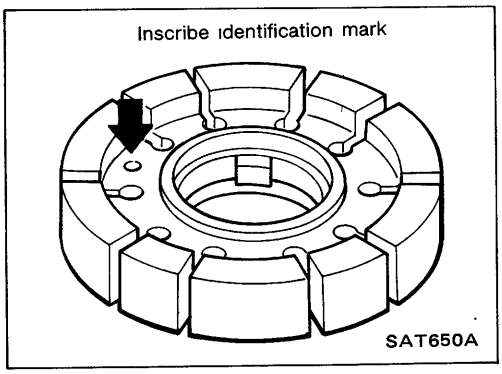


DISASSEMBLY

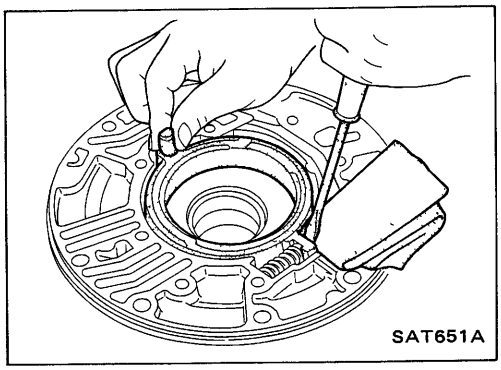
1. Loosen bolts in numerical order and remove oil pump cover.



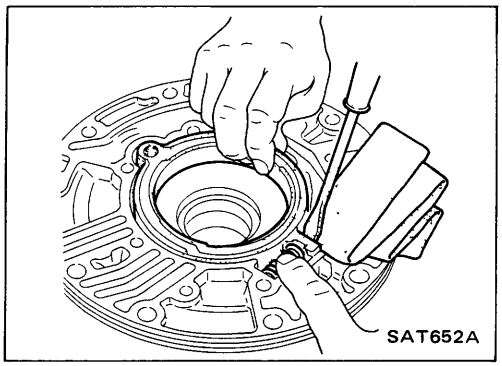
2. Remove rotor, vane rings and vanes.
- **Inscribe a mark on back of rotor for identification of fore-aft direction when reassembling rotor. Then remove rotor.**



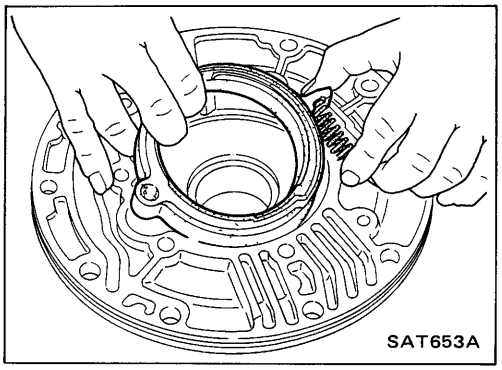
3. While pushing on cam ring remove pivot pin.
- **Be careful not to scratch oil pump housing.**



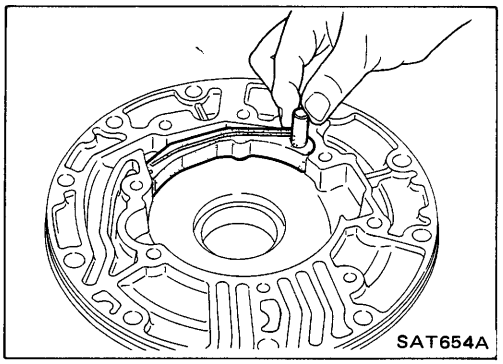
Oil Pump — RE4R01A and RL4R01A (Cont'd)


SAT652A

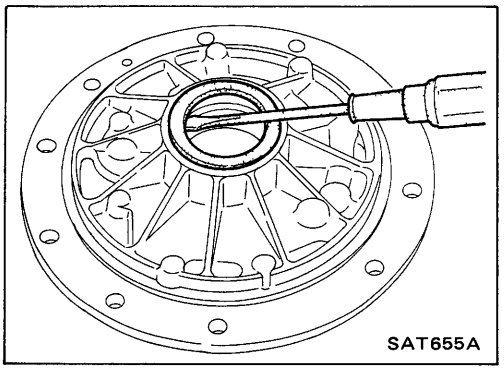
4. While holding cam ring and spring lift out cam ring spring.
- **Be careful not to damage oil pump housing.**
- **Hold cam ring spring to prevent it from jumping.**


SAT653A

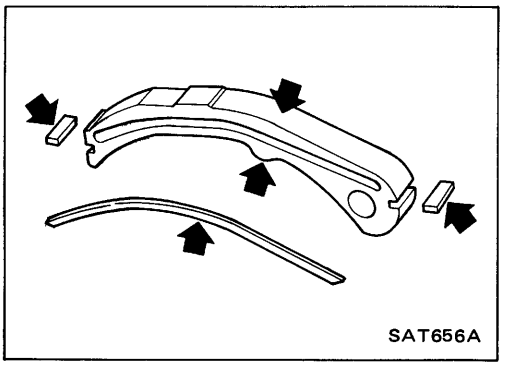
5. Remove cam ring and cam ring spring from oil pump housing.


SAT654A

6. Remove pivot pin from control piston and remove control piston assembly.


SAT655A

7. Remove oil seal from oil pump housing.
- **Be careful not to scratch oil pump housing.**

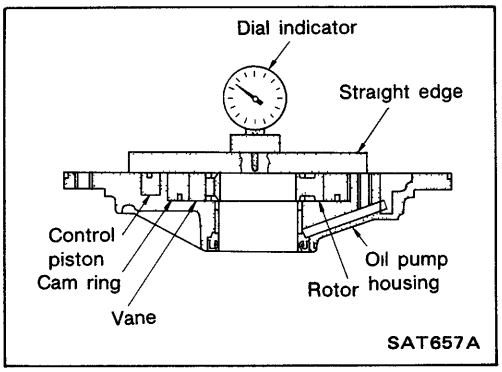

SAT656A

INSPECTION

Oil pump cover, rotor, vanes, control piston, side seals, cam ring and friction ring

- Check for wear or damage.

Oil Pump — RE4R01A and RL4R01A (Cont'd)



Side clearances

- Measure side clearances between end of oil pump housing and cam ring, rotor, vanes and control piston in at least four places along their circumferences. Maximum measured values should be within specified ranges.
- **Before measuring side clearance, check that friction rings, O-ring, control piston side seals and cam ring spring are removed.**

Standard clearance:

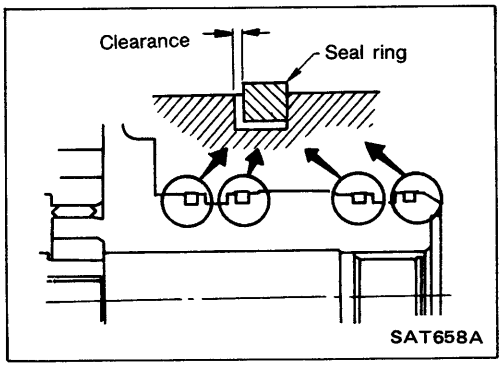
Cam ring

0.01 - 0.024 mm (0.0004 - 0.0009 in)

Rotor, vanes, control piston

0.03 - 0.044 mm (0.0012 - 0.0017 in)

- If not within standard clearance, replace oil pump assembly except oil pump cover assembly.



Seal ring clearance

- Measure clearance between seal ring and ring groove.

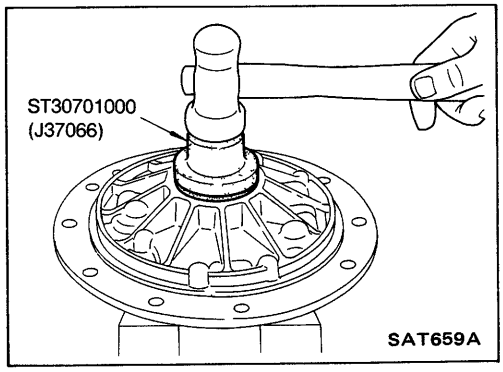
Standard clearance:

0.10 - 0.25 mm (0.0039 - 0.0098 in)

Wear limit:

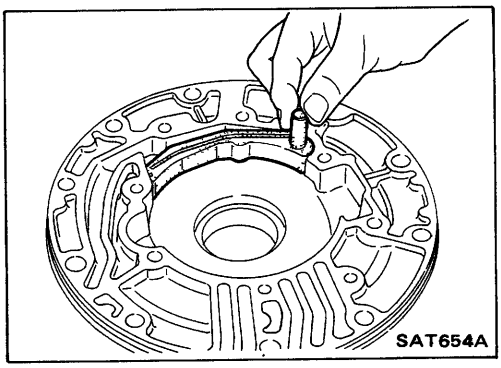
0.25 mm (0.0098 in)

- If not within wear limit, replace oil pump cover assembly.



ASSEMBLY

1. Drive oil seal into oil pump housing.
- **Apply A.T.F. to outer periphery and lip surface.**



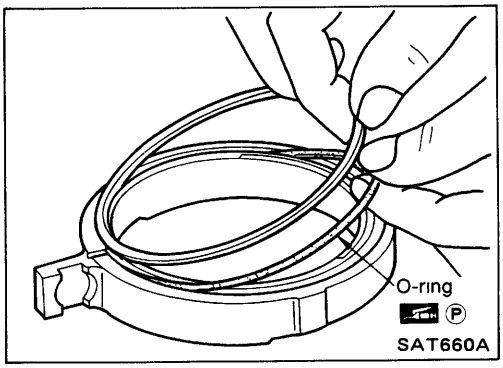
2. Install cam ring in oil pump housing by the following stops.

a. Install side seal on control piston.

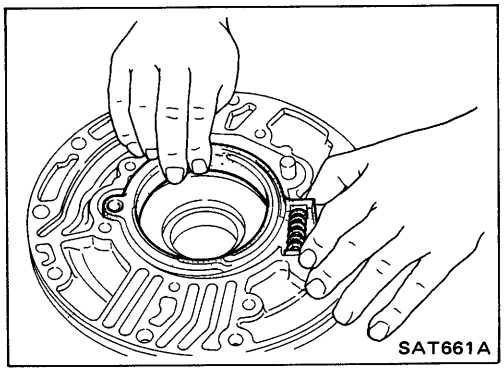
- **Pay attention to its direction — Black surface goes toward control piston.**
- **Apply petroleum jelly to side seal.**

b. Install control piston on oil pump

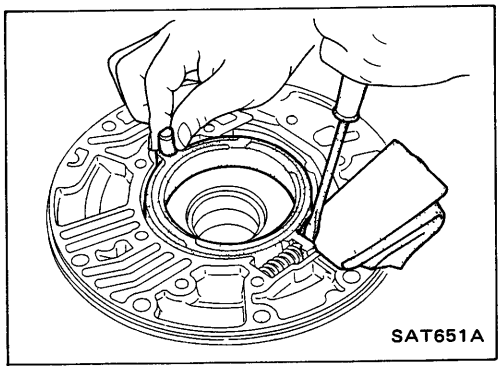
Oil Pump — RE4R01A and RL4R01A (Cont'd)



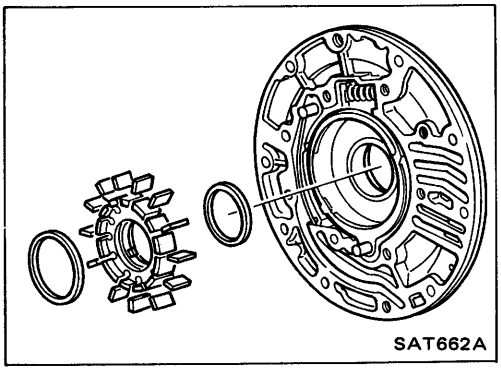
c. Install O-ring and friction ring on cam ring.
- **Apply petroleum jelly to O-ring.**



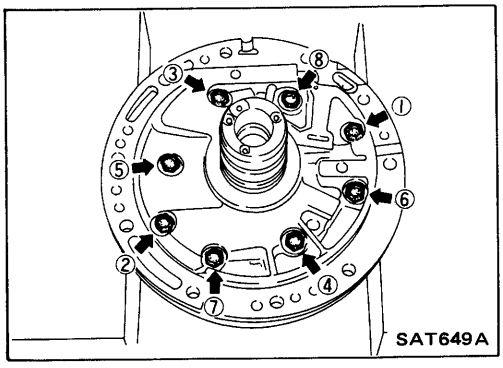
d. Assemble cam ring, cam ring spring and spring seat. Install spring by pushing it against pump housing.



e. While pushing on cam ring install pivot pin.

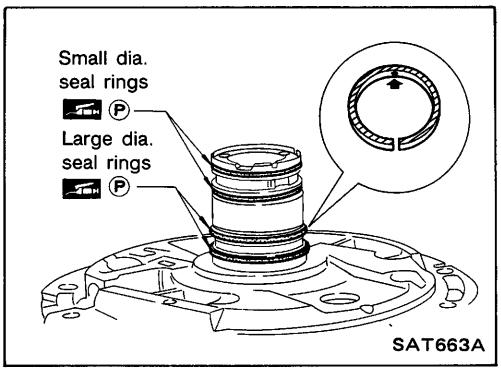


3. Install rotor, vanes and vane rings.
- **Pay attention to direction of rotor.**



4. Install oil pump housing and oil pump cover.
a. Wrap masking tape around splines of oil pump cover assembly to protect seal. Position oil pump cover assembly in oil pump housing assembly, then remove masking tape.
b. Tighten bolts in a criss-cross pattern.

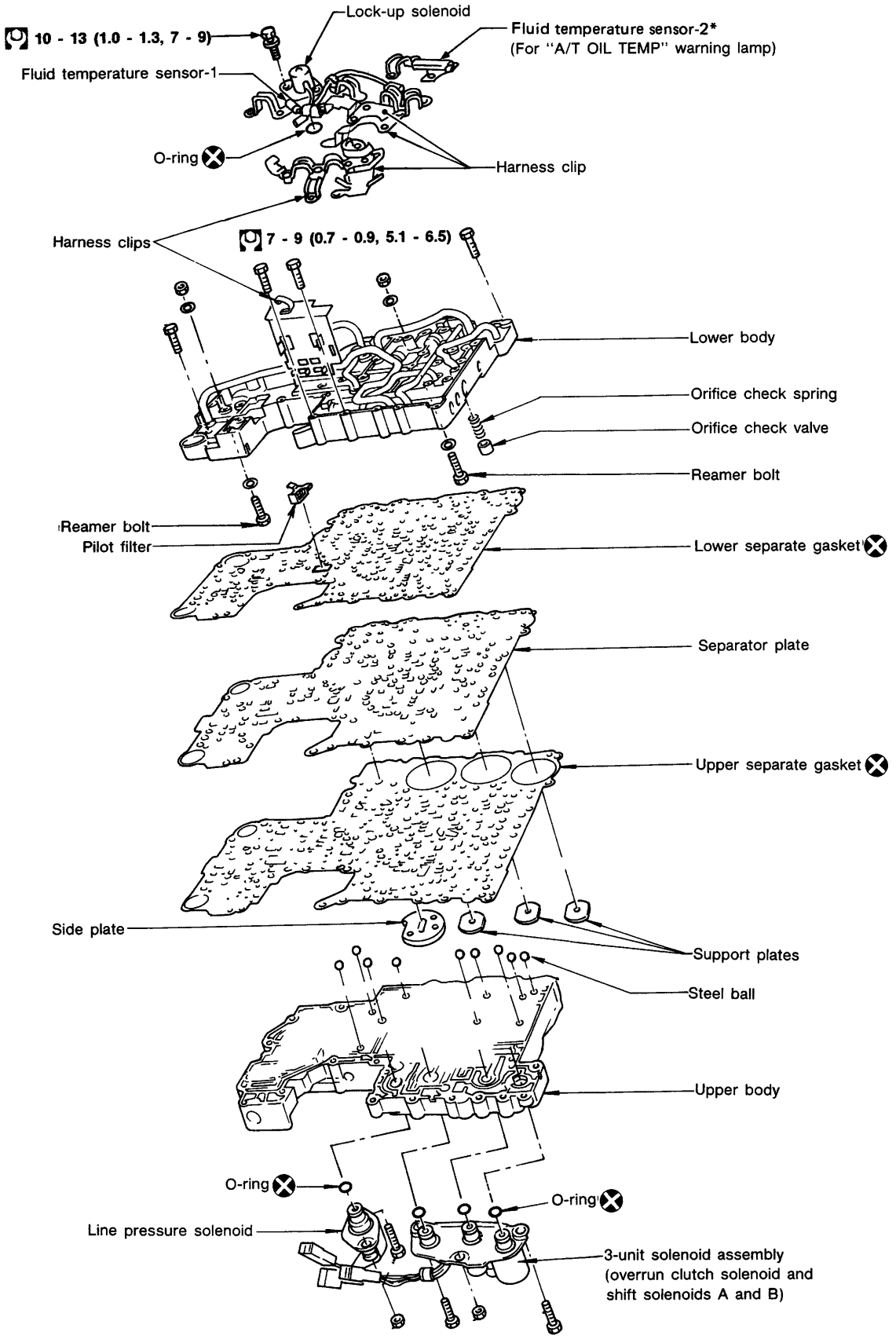
Oil Pump — RE4R01A and RL4R01A (Cont'd)



5. Install seal rings carefully after packing ring grooves with petroleum jelly. Press rings down into jelly to a close fit.

- **Seal rings come in two different diameters. Check fit carefully in each groove.**
  - **Small dia. seal ring:**
    - **No mark**
  - **Large dia. seal ring:**
    - **Yellow mark in area shown by arrow**
- **Do not spread gap of seal ring excessively while installing. It may deform ring.**

Control Valve Assembly — RE4R01A



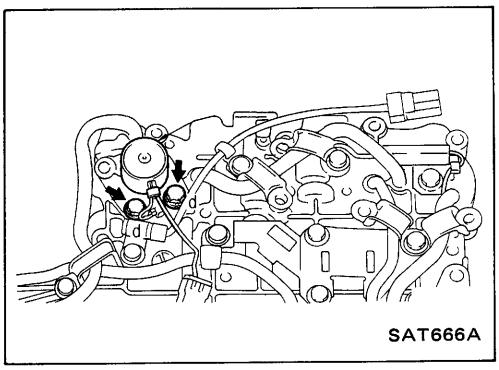
*: 4WD only

: N•m (kg-m, ft-lb)

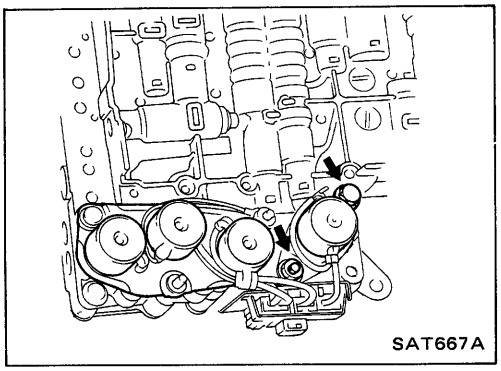
SAT665A

Control Valve Assembly — RE4R01A (Cont'd)

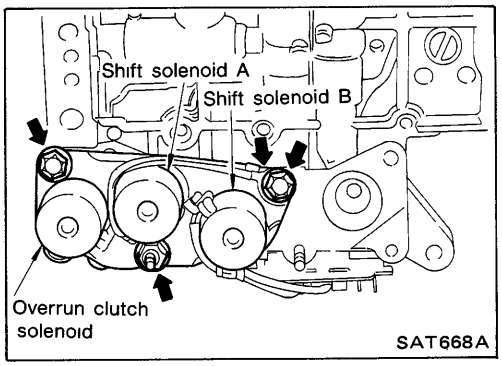
DISASSEMBLY


SAT666A

1. Remove solenoids.
a. Remove lock-up solenoid and side plate from lower body.
b. Remove O-ring from solenoid.

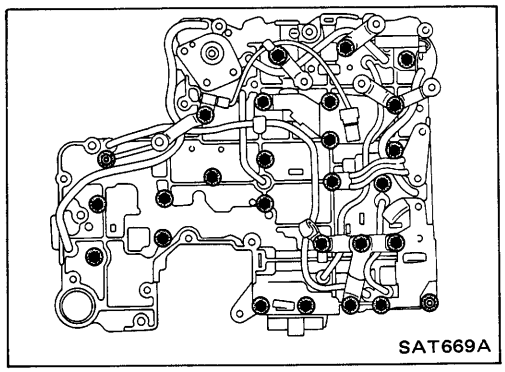

SAT667A

c. Remove line pressure solenoid from upper body.
d. Remove O-ring from solenoid.



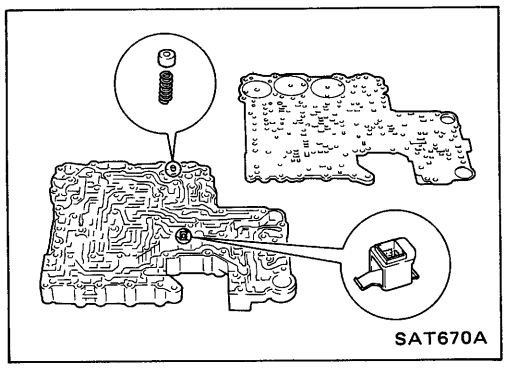
SAT668A

e. Remove 3-unit solenoid assembly from upper body.
f. Remove O-rings from solenoids.


SAT669A

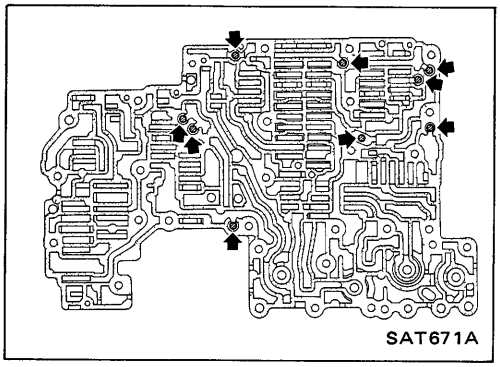
2. Disassemble upper and lower bodies.
a. Place upper body facedown, and remove bolts, reamer bolts and support plates.
b. Remove lower body, separator plate and separate gasket as a unit from upper body.

- **Be careful not to drop pilot filter, orifice check valve, spring and steel balls.**


SAT670A

c. Place lower body facedown, and remove separate gasket and separator plate.
d. Remove pilot filter, orifice check valve and orifice check spring.

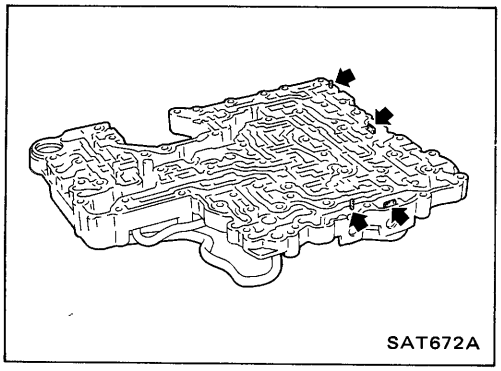
Control Valve Assembly — RE4R01A (Cont'd)


SAT671A

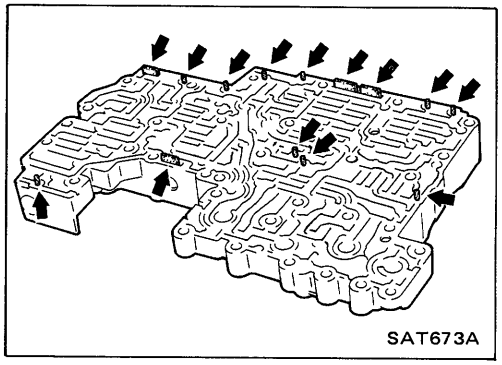
e. Check to see that steel balls are properly positioned in upper body and then remove them from upper body.

INSPECTION

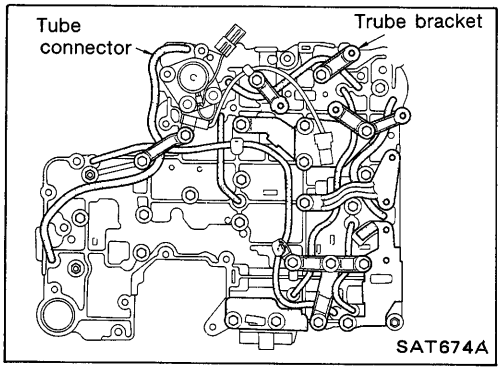
Lower and upper bodies


SAT672A

- Check to see that there are pins and retainer plates in lower body.

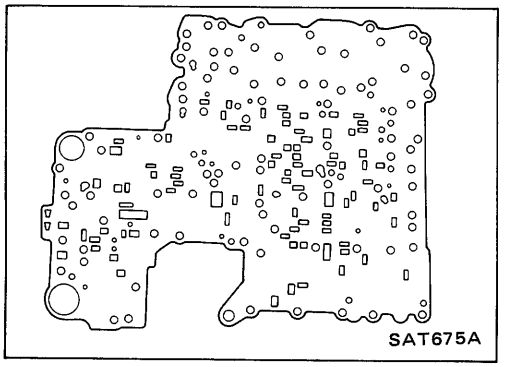

SAT673A

- Check to see that there are pins and retainer plates in upper body.
- **Be careful not to lose these parts.**



SAT674A

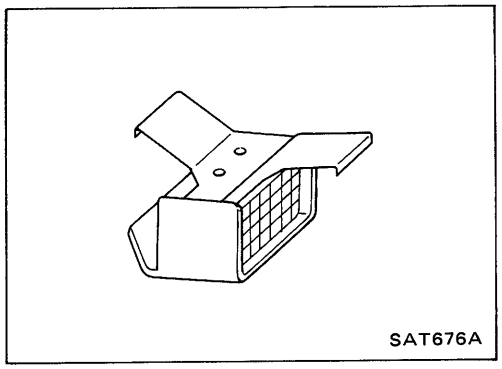
- Check to make sure that oil circuits are clean and free from damage.
- Check tube brackets and tube connectors for damage.


SAT675A

Separator plates

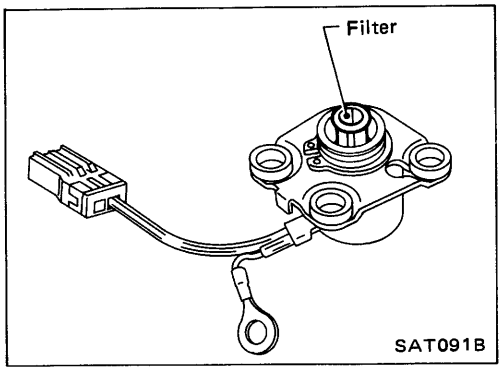
- Check to make sure that separator plate is free of damage and not deformed and oil holes are clean.

Control Valve Assembly — RE4R01A (Cont'd)


SAT676A

Pilot filter

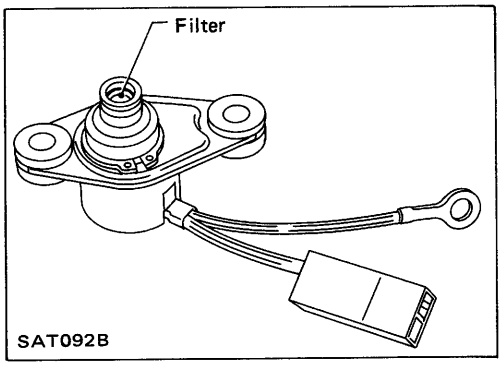
- Check to make sure that filter is not clogged or damaged.



SAT091B

Lock-up solenoid

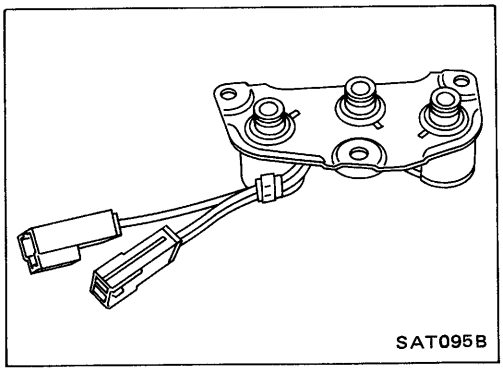
- Check that filter is not clogged or damaged.
- Measure resistance. — Refer to "Electrical Components Inspection".



SAT092B

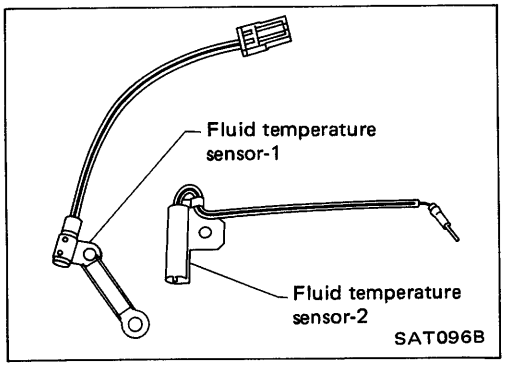
Line pressure solenoid

- Check that filter is not clogged or damaged.
- Measure resistance. — Refer to "Electrical Components Inspection".


SAT095B

3-unit solenoid assembly (Overrun clutch solenoid and shift solenoids A and B)

- Measure resistance of each solenoid. — Refer to "Electrical Components Inspection".



SAT096B

Fluid-temperature sensor –1 and –2

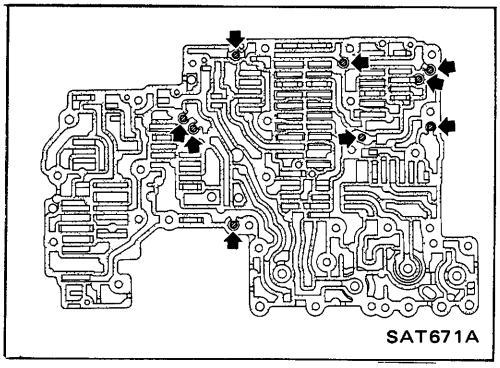
- Measure resistance. — Refer to "Electrical Components Inspection".

Control Valve Assembly — RE4R01A (Cont'd)

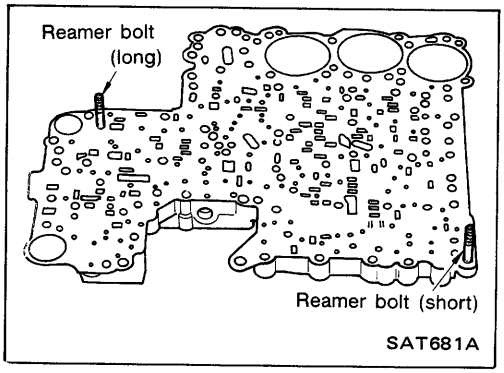
ASSEMBLY

1. Install upper and lower bodies.

a. Place oil circuit of upper body face up. Install steel balls in their proper positions.

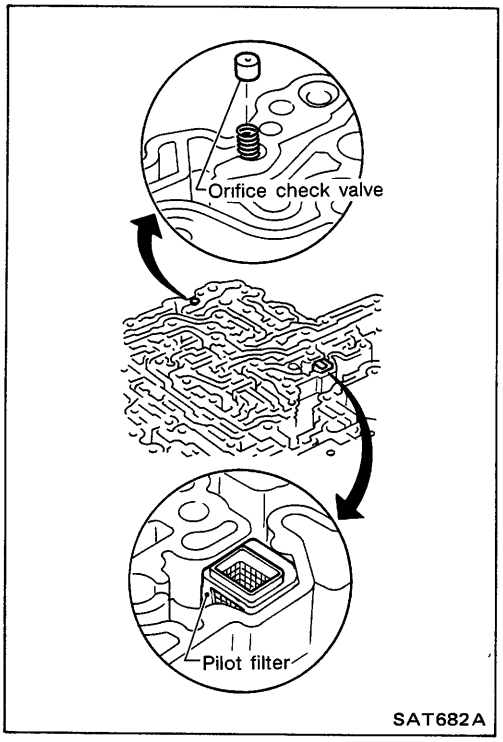

SAT671A

b. Install reamer bolts from bottom of upper body and install separate gaskets.



SAT681A

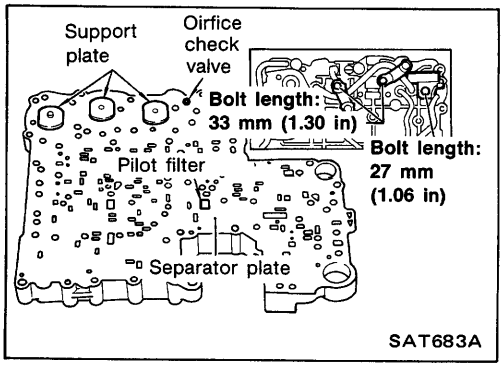
c. Place oil circuit of lower body face up. Install orifice check spring, orifice check valve and pilot filter.



SAT682A

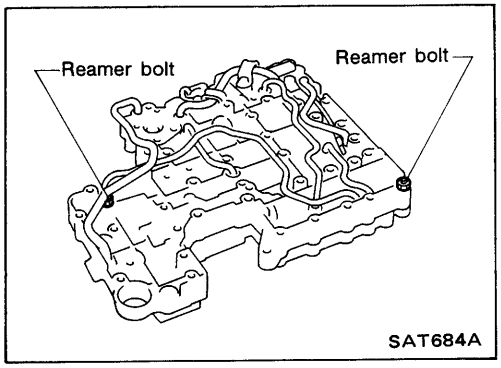
d. Install lower separate gaskets and separator plates on lower body.

e. Install and temporarily tighten support plates, fluid temperature sensor –2 and tube brackets.



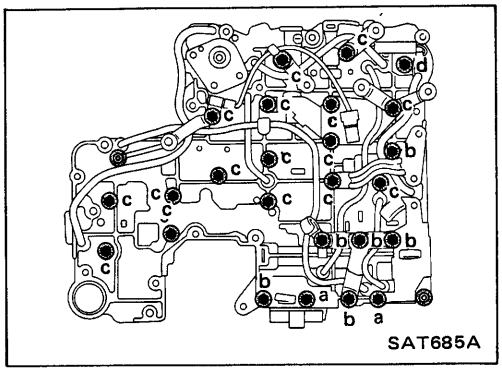
SAT683A

Control Valve Assembly — RE4R01A (Cont'd)



f. Temporarily assemble lower and upper bodies, using reamer bolt as a guide.

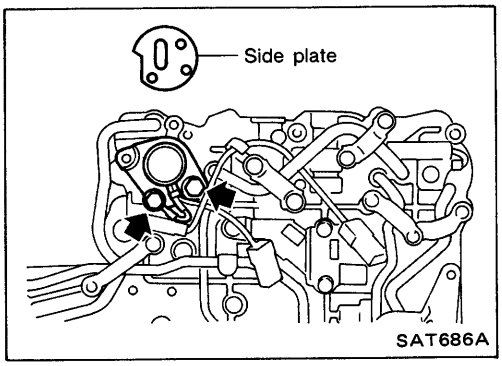
- **Be careful not to dislocate or drop steel balls, orifice check spring, orifice check valve and pilot filter.**



g. Install and temporarily tighten bolts and tube brackets in their proper locations.

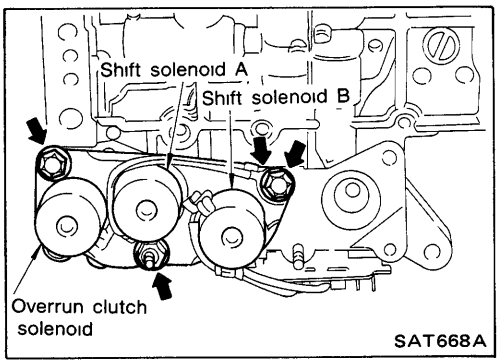
Bolt length and location

Item \ Bolt symbol		a	b	c	d
Bolt length	mm (in)	70 (2.76)	50 (1.97)	33 (1.30)	27 (1.06)

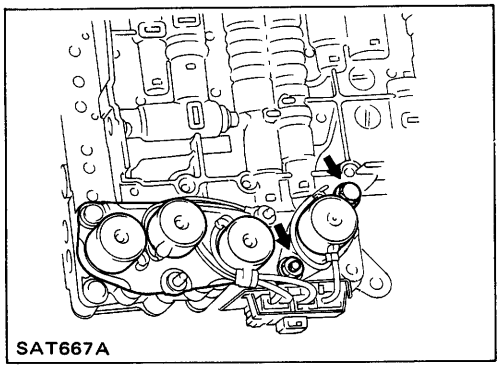


2. Install solenoids.

a. Attach O-ring and install lock-up solenoid and side plates onto lower body.



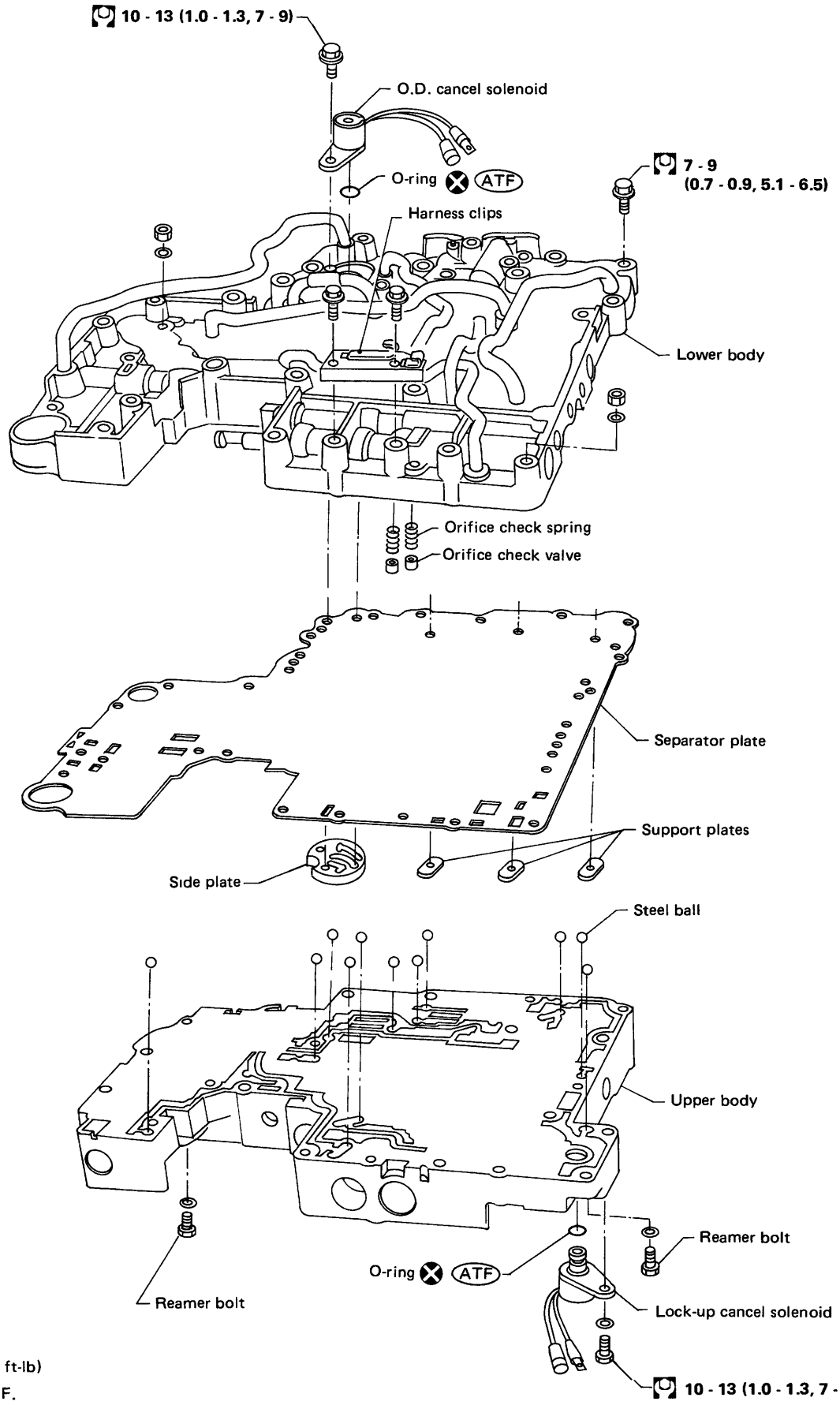
b. Attach O-rings and install 3-unit solenoids assembly onto upper body.



c. Attach O-ring and install line pressure solenoid onto upper body.

3. Tighten all bolts.

Control Valve Assembly — RL4R01A



: N·m (kg-m, ft-lb)
ATF : Apply A.T.F.

SAT122C

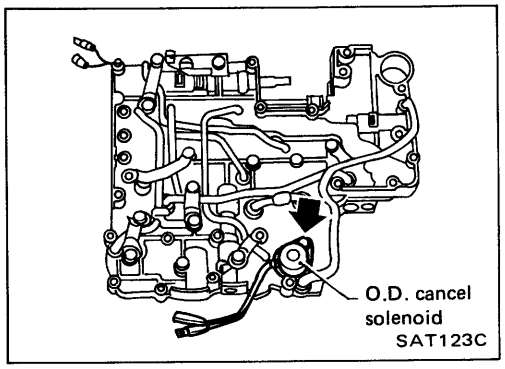
Control Valve Assembly — RL4R01A (Cont'd)

DISASSEMBLY

1. Remove solenoids.

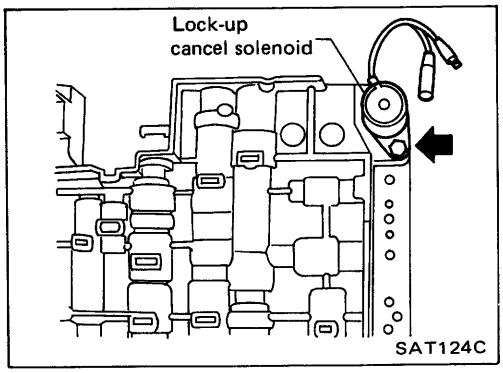
a. Remove O.D. cancel solenoid and side plate from lower body.

b. Remove O-ring from solenoid.



c. Remove lock-up cancel solenoid from upper body.

d. Remove O-ring from solenoid.

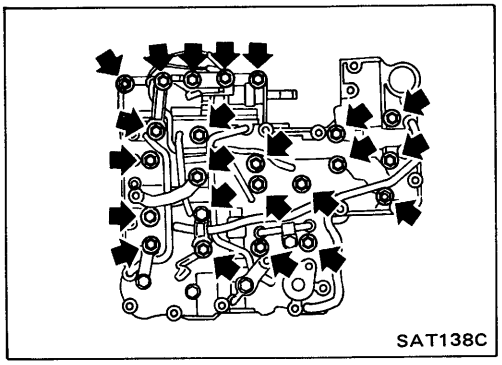


2. Disassemble upper and lower bodies.

a. Place upper body facedown, and remove bolts, reamer bolts and support plates.

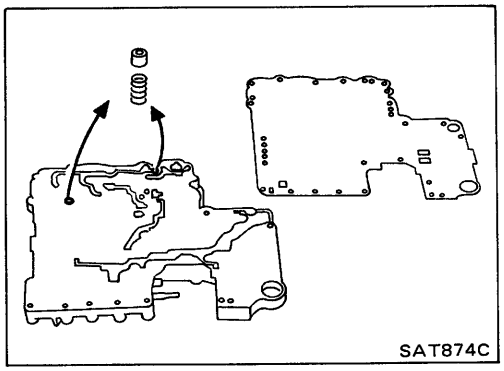
b. Remove lower body, separator plate and separate gasket as a unit from upper body.

- **Be careful not to drop orifice check valve, spring and steel balls.**

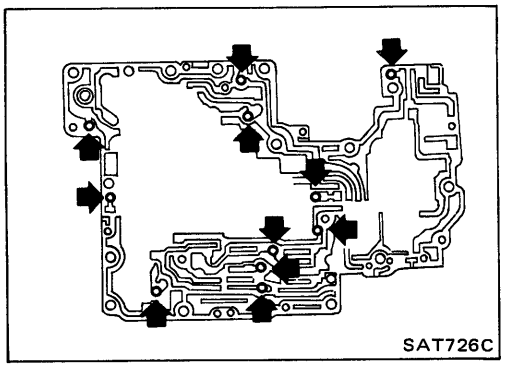


c. Place lower body facedown, and remove separator plate.

d. Remove orifice check valve and orifice check spring.



e. Check to see that steel balls are properly positioned in upper body and then remove them from upper body.

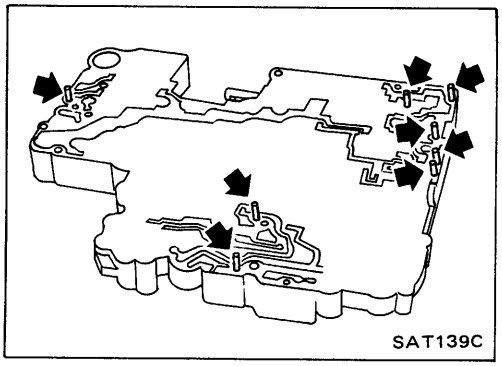


Control Valve Assembly — RL4R01A (Cont'd)

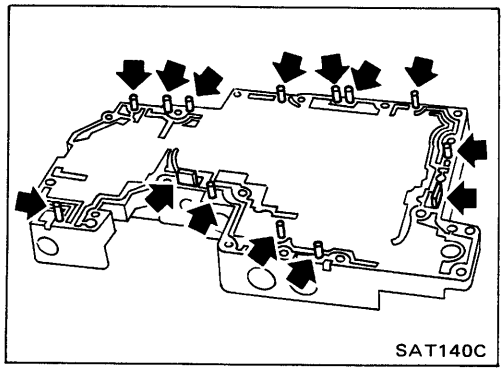
INSPECTION

Lower and upper bodies

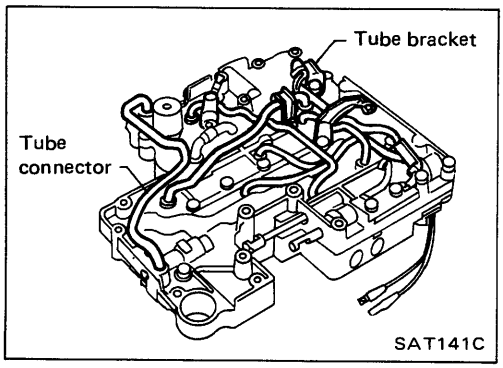
- Check to see that there are pins and retainer plates in lower body.


SAT139C

- Check to see that there are pins and retainer plates in upper body.
- **Be careful not to lose these parts.**


SAT140C

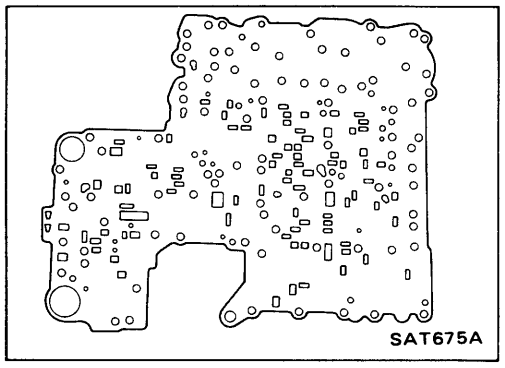
- Check to make sure that oil circuits are clean and free from damage.
- Check tube brackets and tube connectors for damage.



SAT141C

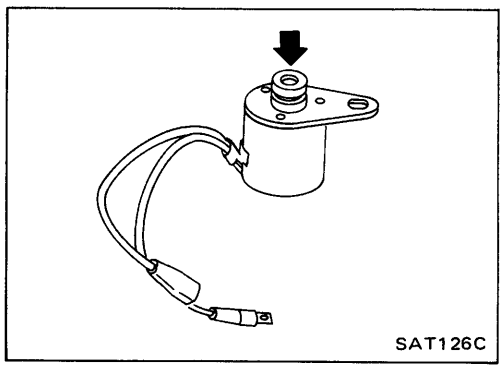
Separator plates

- Check to make sure that separator plate is free of damage and not deformed and oil holes are clean.


SAT675A

O.D. cancel solenoid and lock-up cancel solenoid

- Check that filter is not clogged or damaged.
- Measure resistance. — Refer to "Electrical Components Inspection".

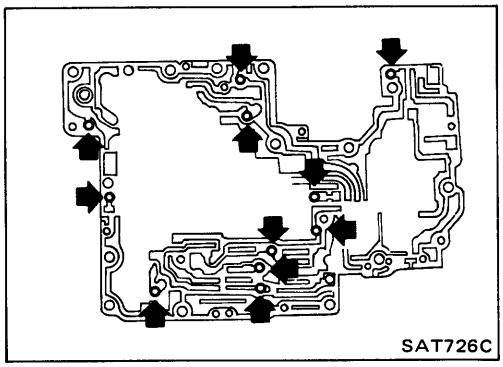

SAT126C

Control Valve Assembly — RL4R01A (Cont'd)

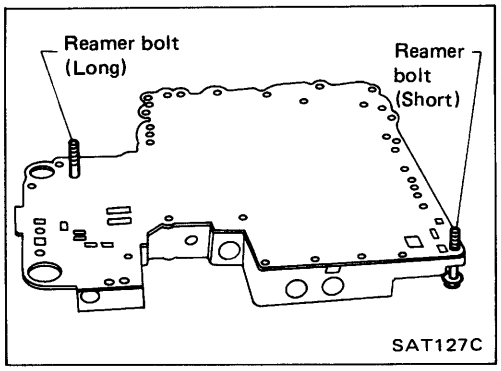
ASSEMBLY

1. Install upper and lower bodies.

a. Place oil circuit of upper body face up. Install steel balls in their proper positions.


SAT726C

b. Install reamer bolts from bottom of upper body and install separate gaskets.



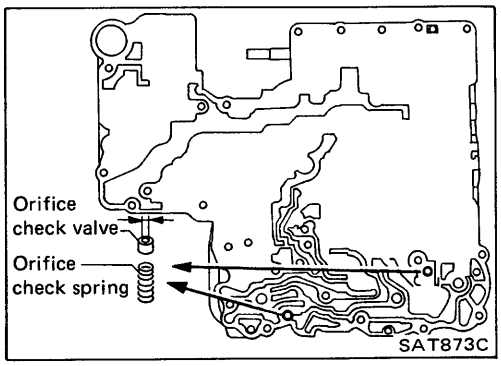
SAT127C

c. Place oil circuit of lower body face up. Install orifice check spring, orifice check valve.

D: mm (in)

① 1.1 (0.043)

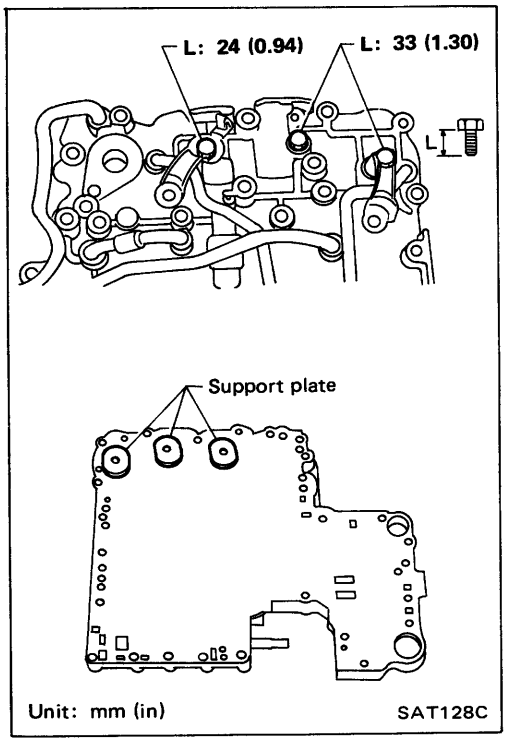
② 2.0 (0.079)



SAT873C

d. Install separator plates on lower body.

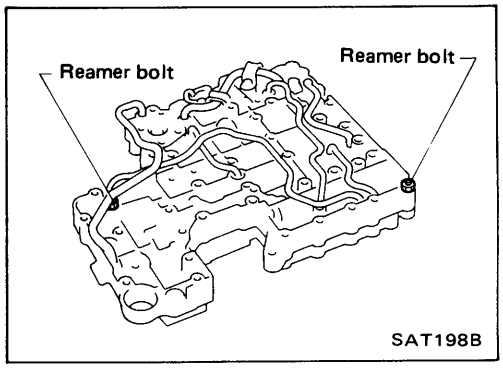
e. Install and temporarily tighten support plates and tube brackets.



Unit: mm (in)

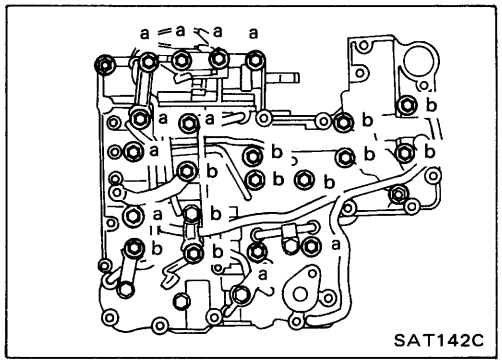
SAT128C

Control Valve Assembly — RL4R01A (Cont'd)



f. Temporarily assemble lower and upper bodies, using reamer bolt as a guide.

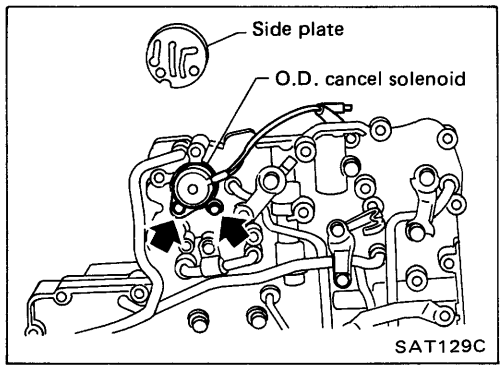
- **Be careful not to dislocate or drop steel balls, orifice check spring and orifice check valve.**



g. Install and temporarily tighten bolts and tube brackets in their proper locations.

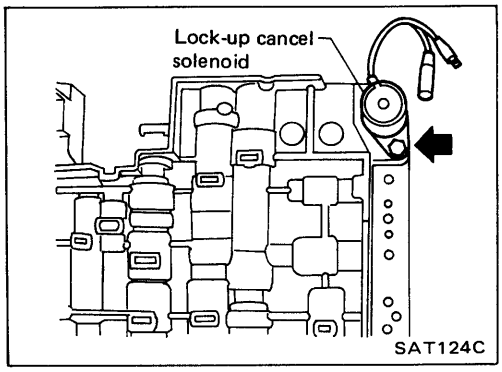
Bolt length and location:

Item \ Bolt symbol		a	b
Bolt length	mm (in)	45 (1.77)	33 (1.30)



2. Install solenoids.

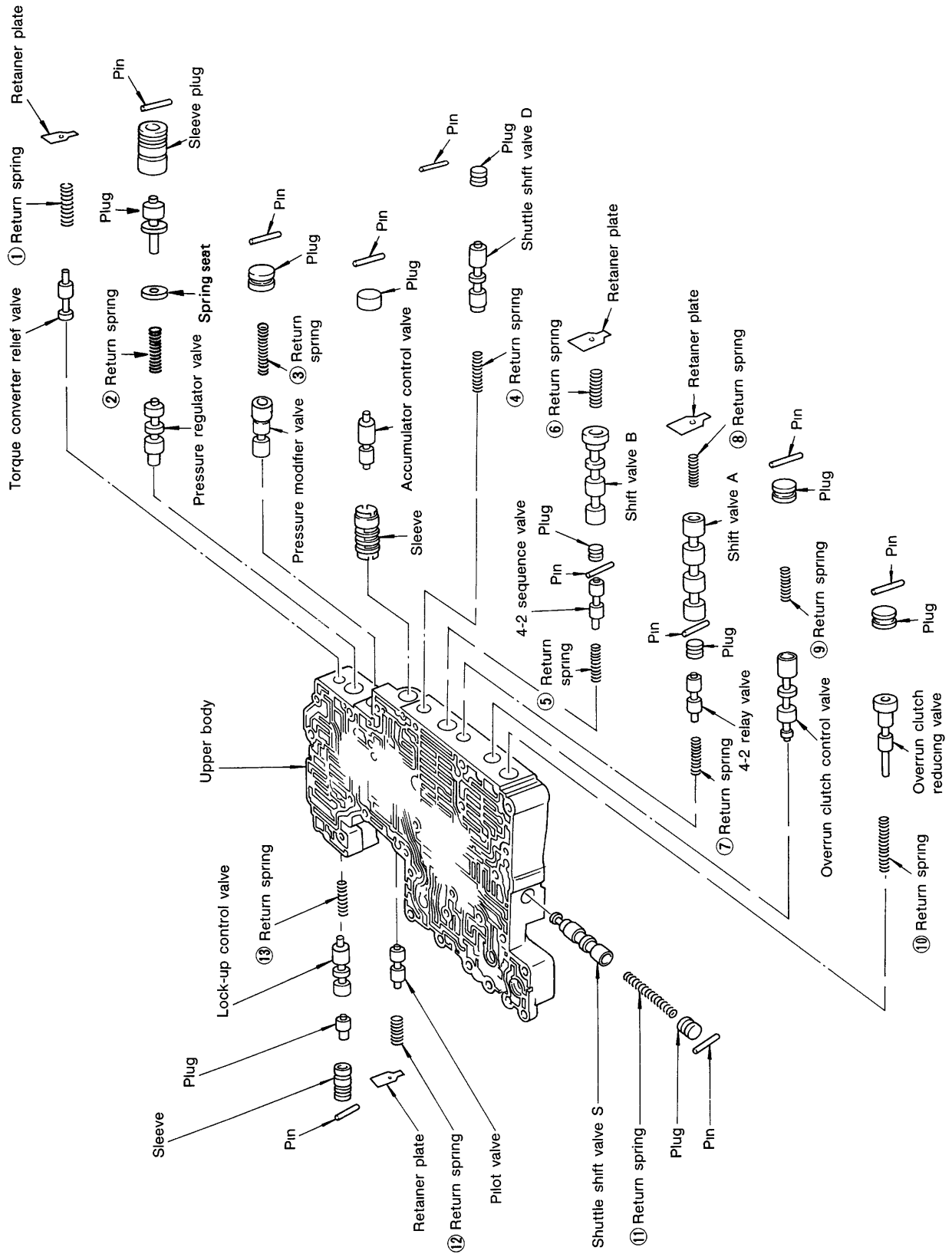
a. Attach O-ring and install O.D. cancel solenoid and side plates onto lower body.



b. Attach O-ring and install lock-up cancel solenoid onto upper body.

3. Tighten bolt.

Control Valve Upper Body — RE4R01A



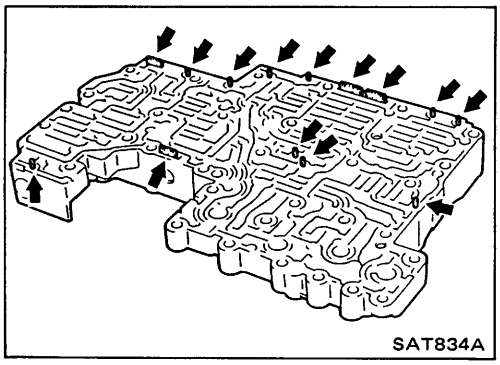
Numbers preceding valve springs correspond with those shown in Spring Chart on page AT-168.

Apply A.T.F. to all components before their installation.

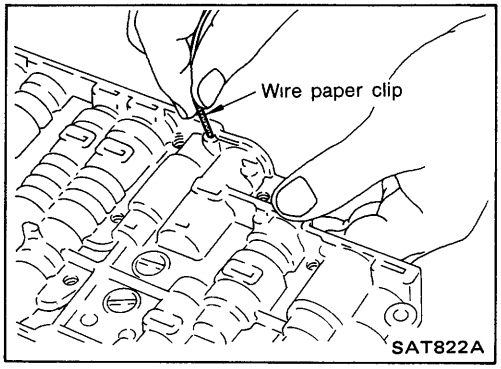
SAT907C

Control Valve Upper Body — RE4R01A (Cont'd)

DISASSEMBLY

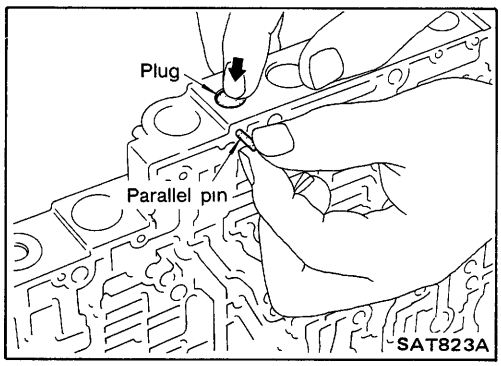

SAT834A

1. Remove valves at parallel pins.
- **Do not use a magnetic hand.**



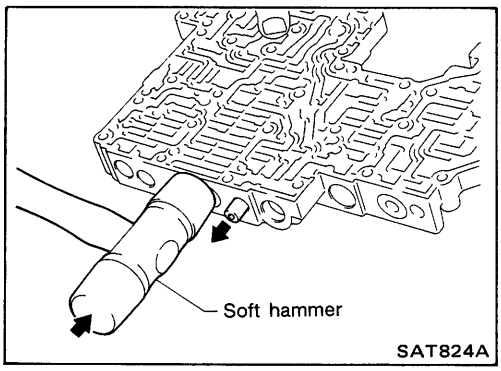
SAT822A

a. Use a wire paper clip to push out parallel pins.



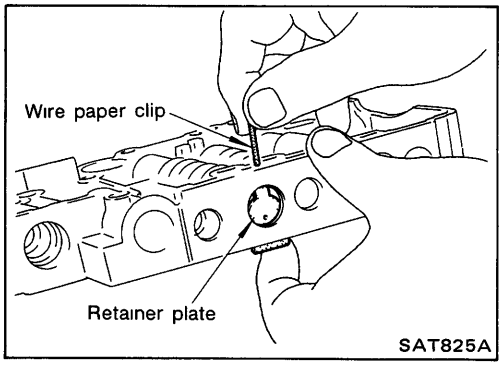
SAT823A

b. Remove parallel pins while pressing their corresponding plugs and sleeves.
- **Remove plug slowly to prevent internal parts from jumping out.**



SAT824A

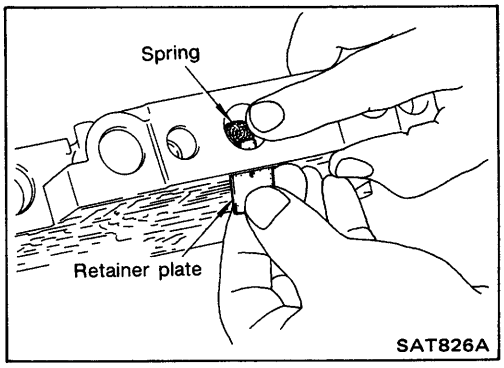
c. Place mating surface of valve facedown, and remove internal parts.
- **If a valve is hard to remove, place valve body facedown and lightly tap it with a soft hammer.**
- **Be careful not to drop or damage valves and sleeves.**



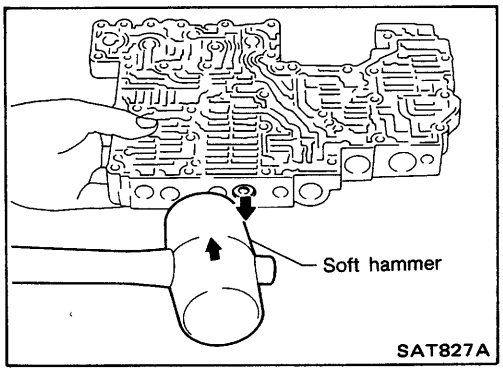
SAT825A

2. Remove valves at retainer plates.
a. Pry out retainer plate with wire paper clip.

Control Valve Upper Body — RE4R01A (Cont'd)

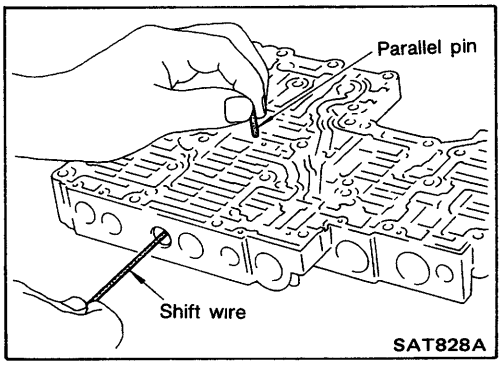


b. Remove retainer plates while holding spring.



c. Place mating surface of valve facedown, and remove internal parts.

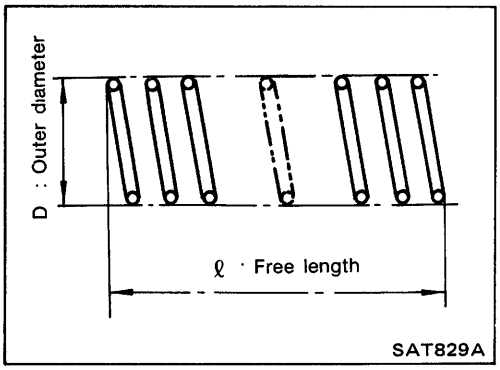
- **If a valve is hard to remove, lightly tap valve body with a soft hammer.**
- **Be careful not to drop or damage valves, sleeves, etc.**



- 4-2 sequence valve and relay valve are located far back in upper body. If they are hard to remove, carefully push them out using stiff wire.
- **Be careful not to scratch sliding surface of valve with wire.**

Control Valve Upper Body — RE4R01A (Cont'd)

INSPECTION



Valve springs

- Measure free length and outer diameter of each valve spring. Also check for damage or deformation.
- Numbers of each valve spring listed in table below are the same as those in the figure on AT-165.

Inspection standard

Unit: mm (in)

Parts / Item		Part No.	ℓ	D
①	Torque converter relief valve spring	31742-41X23	38.0 (1.496)	9.0 (0.354)
②	Pressure regulator valve spring	31742-41X24	44.02 (1.7331)	14.0 (0.551)
③	Pressure modifier valve spring	31742-41X19	31.95 (1.2579)	6.8 (0.268)
④	Shuttle shift valve D spring	31762-41X00	26.5 (1.043)	6.0 (0.236)
⑤	4-2 sequence valve spring	31756-41X00	29.1 (1.146)	6.95 (0.2736)
⑥	Shift valve B spring	31762-41X01	25.0 (0.984)	7.0 (0.276)
⑦	4-2 relay valve spring	31756-41X00	29.1 (1.146)	6.95 (0.2736)
⑧	Shift valve A spring	31762-41X01	25.0 (0.984)	7.0 (0.276)
⑨	Overrun clutch control valve spring	31762-41X03	23.6 (0.929)	7.0 (0.276)
⑩	Overrun clutch reducing valve spring	31742-41X20	32.5 (1.280)	7.0 (0.276)
⑪	Shuttle shift valve S spring	31762-41X04	51.0 (2.008)	5.65 (0.2224)
⑫	Pilot valve spring	31742-41X13	25.7 (1.012)	9.1 (0.358)
⑬	Lock-up control valve spring	31742-41X22	18.5 (0.728)	13.0 (0.512)

- Replace valve springs if deformed or fatigued.

Control valves

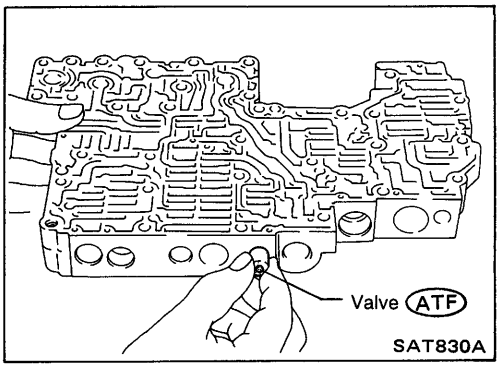
- Check sliding surfaces of valves, sleeves and plugs.

Control Valve Upper Body — RE4R01A (Cont'd)

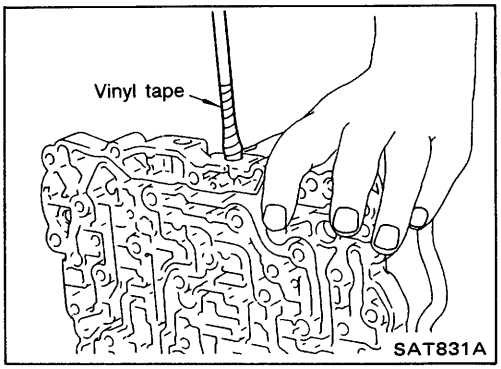
ASSEMBLY

1. Lubricate the control valve body and all valves with A.T.F. Install control valves by sliding them carefully into their bores.

- **Be careful not to scratch or damage valve body.**

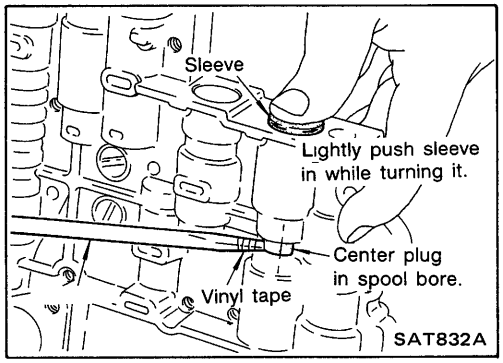


- Wrap a small screwdriver with vinyl tape and use it to insert the valves into proper position.



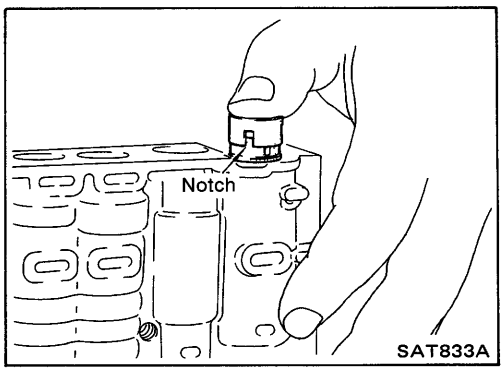
Pressure regulator valve

- If pressure regulator plug is not centered properly, sleeve cannot be inserted into bore in upper body.
  If this happens, use vinyl tape wrapped screwdriver to center sleeve until it can be inserted.
- Turn sleeve slightly while installing.

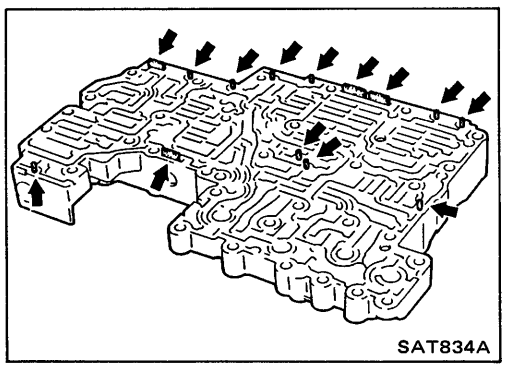


Accumulator control plug

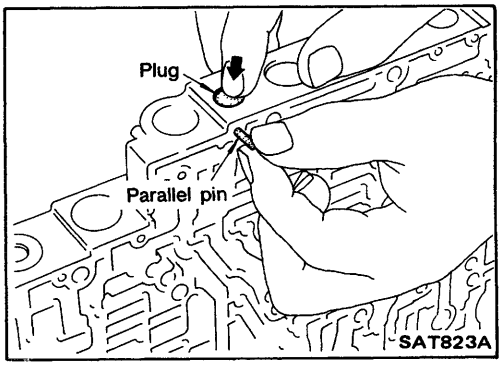
- Align protrusion of accumulator control sleeve with notch in plug.
- Align parallel pin groove in plug with parallel pin, and install accumulator control valve.



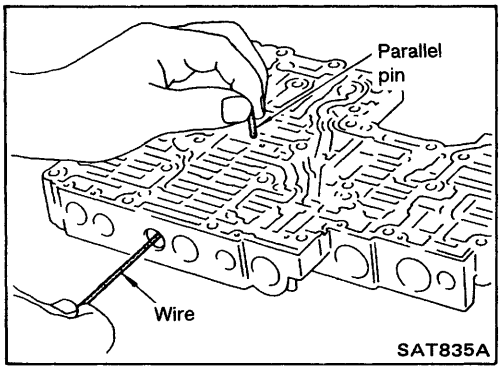
2. Install parallel pins and retainer plates.



Control Valve Upper Body — RE4R01A (Cont'd)

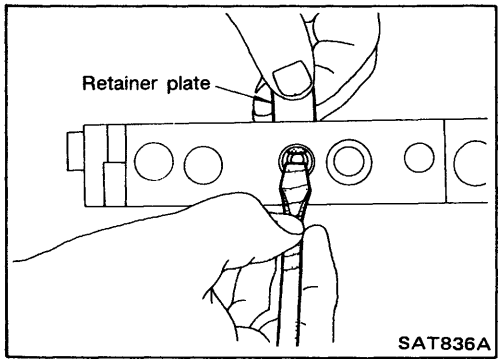


- **While pushing plug, install parallel pin.**



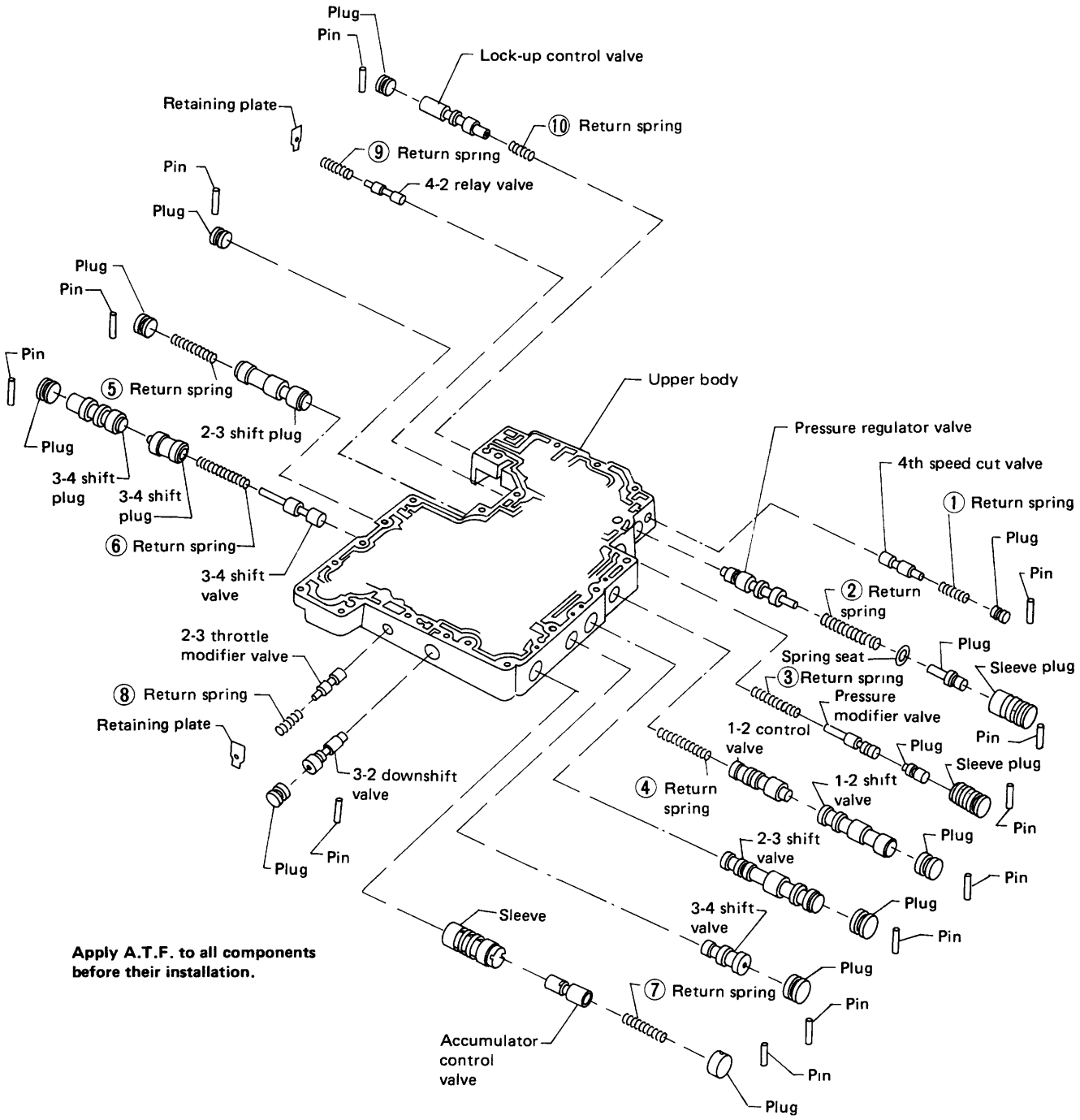
4-2 sequence valve and relay valve

- Push 4-2 sequence valve and relay valve with wire wrapped in vinyl tape to prevent scratching valve body. Install parallel pins.



- Insert retainer plate while pushing spring.

Control Valve Upper Body — RL4R01A



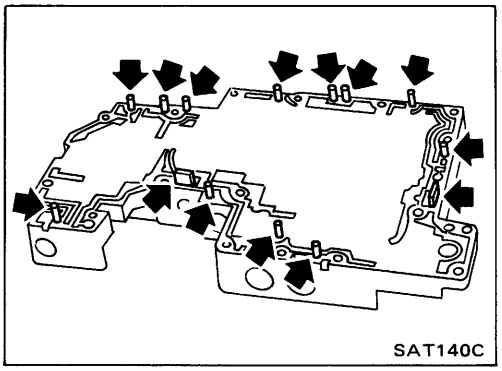
Apply A.T.F. to all components before their installation.

Numbers preceding valve springs correspond with those shown in Spring Chart on page AT-174.

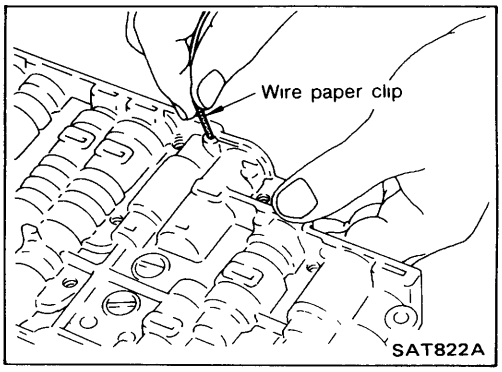
SAT872C

Control Valve Upper Body — RL4R01A (Cont'd)

DISASSEMBLY

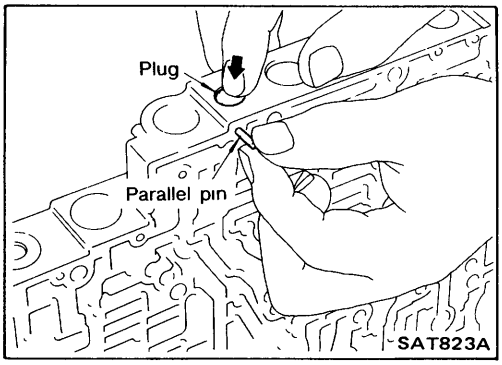

SAT140C

1. Remove valves at parallel pins.
- **Do not use a magnetic hand.**



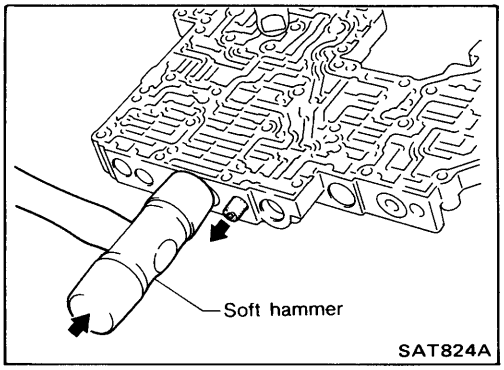
SAT822A

a. Use a wire paper clip to push out parallel pins.



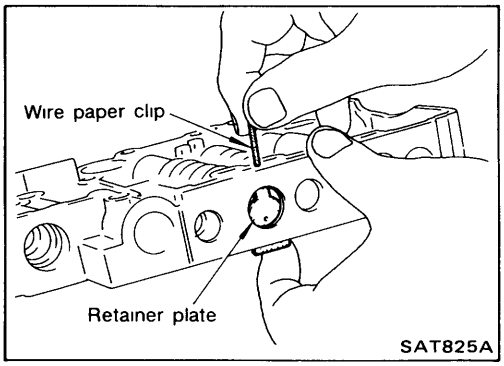
SAT823A

b. Remove parallel pins while pressing their corresponding plugs and sleeves.
- **Remove plug slowly to prevent internal parts from jumping out.**



SAT824A

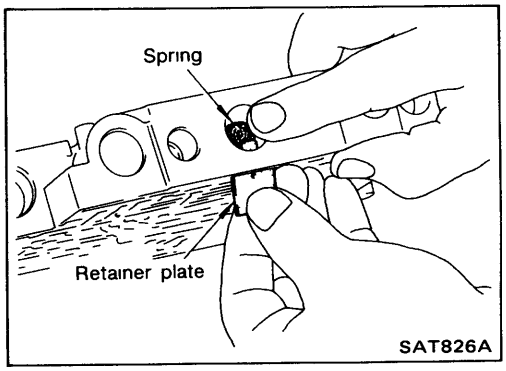
c. Place mating surface of valve facedown, and remove internal parts.
- **If a valve is hard to remove, place valve body facedown and lightly tap it with a soft hammer.**
- **Be careful not to drop or damage valves and sleeves.**



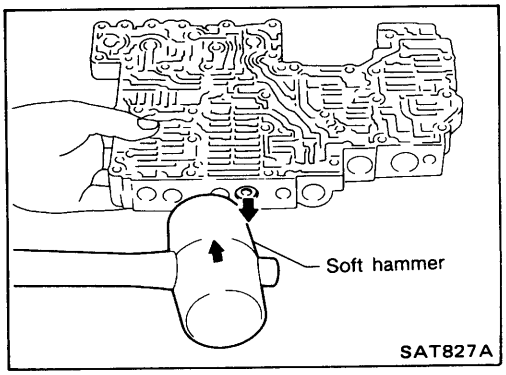
SAT825A

2. Remove valves at retainer plates.
a. Pry out retainer plate with wire paper clip.

Control Valve Upper Body — RL4R01A (Cont'd)

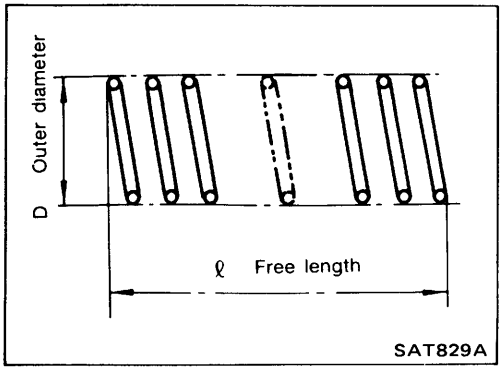


b. Remove retainer plates while holding spring.



c. Place mating surface of valve facedown, and remove internal parts.

- **If a valve is hard to remove, lightly tap valve body with a soft hammer.**
- **Be careful not to drop or damage valves, sleeves, etc.**



Control Valve Upper Body — RL4R01A (Cont'd)

INSPECTION

Valve springs

- Measure free length and outer diameter of each valve spring. Also check for damage or deformation.
- Numbers of each valve spring listed in table below are the same as those in the figure in AT-171.

Inspection standard

Unit: mm (in)

Part / Item		Part No.	ℓ	D
①	4th speed cut valve spring	31756-48X07	23.5 (0.925)	7.0 (0.276)
②	Pressure regulator valve spring	31742-48X00	49.0 (1.929)	12.1 (0.476)
③	Pressure modifier valve spring	31742-48X13	40.83 (1.6075)	8.0 (0.315)
④	1-2 shift valve spring	31762-48X00	43.4 (1.709)	6.0 (0.236)
⑤	2-3 shift valve spring	31762-48X01	42.7 (1.681)	9.0 (0.354)
⑥	3-4 shift valve spring	31762-48X06	44.03 (1.7335)	8.0 (0.315)
⑦	Accumulator control valve spring	31742-48X02	29.3 (1.154)	8.0 (0.315)
⑧	2-3 throttle modifier valve spring	31742-41X21	33.0 (1.299)	6.5 (0.256)
⑨	4-2 relay valve spring	31756-41X00	29.1 (1.146)	6.95 (0.2736)
⑩	Lock-up control valve spring	31742-48X07	20.0 (0.787)	5.45 (0.2146)

- Replace valve springs if deformed or fatigued.

Control valves

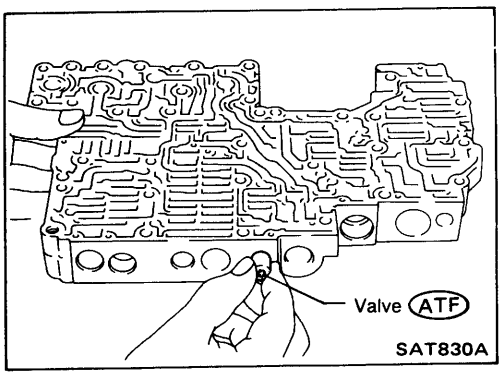
- Check sliding surfaces of valves, sleeves and plugs.

Control Valve Upper Body — RL4R01A (Cont'd)

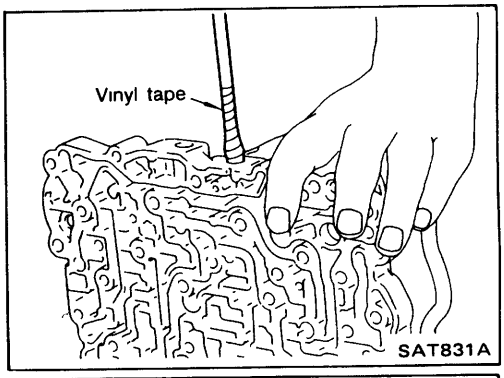
ASSEMBLY

1. Lubricate the control valve body and all valves with A.T.F. Install control valves by sliding them carefully into their bores.

- **Be careful not to scratch or damage valve body.**

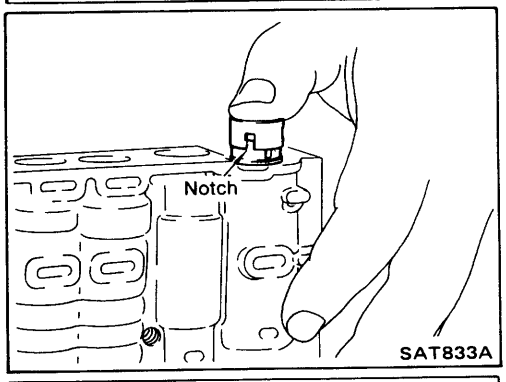


- Wrap a small screwdriver with vinyl tape and use it to insert the valves into proper position.

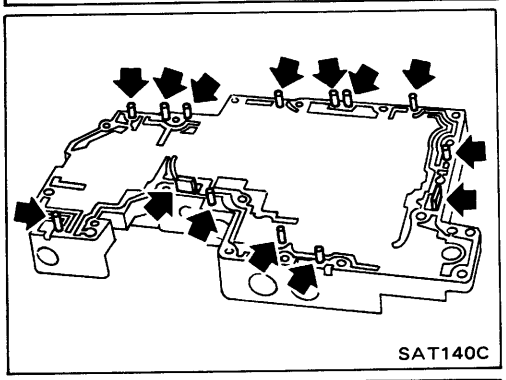


Accumulator control plug

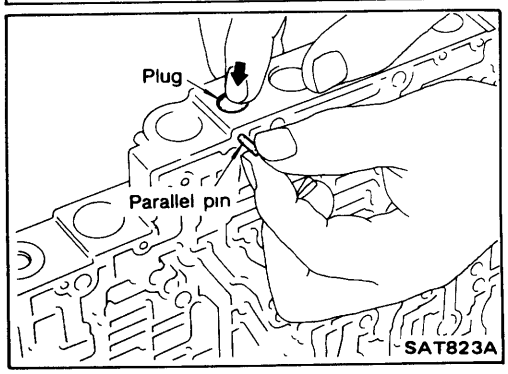
- Align protrusion of accumulator control sleeve with notch in plug.
- Align parallel pin groove in plug with parallel pin, and install accumulator control valve.



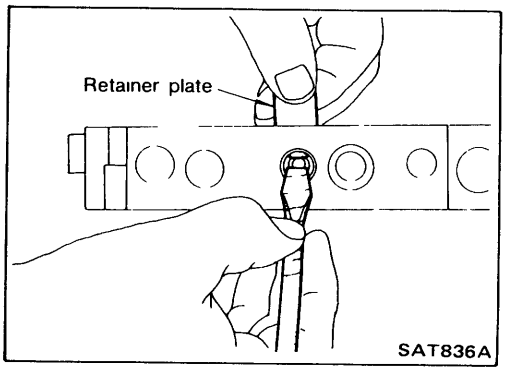
2. Install parallel pins and retainer plates.



- While pushing plug, install parallel pin.

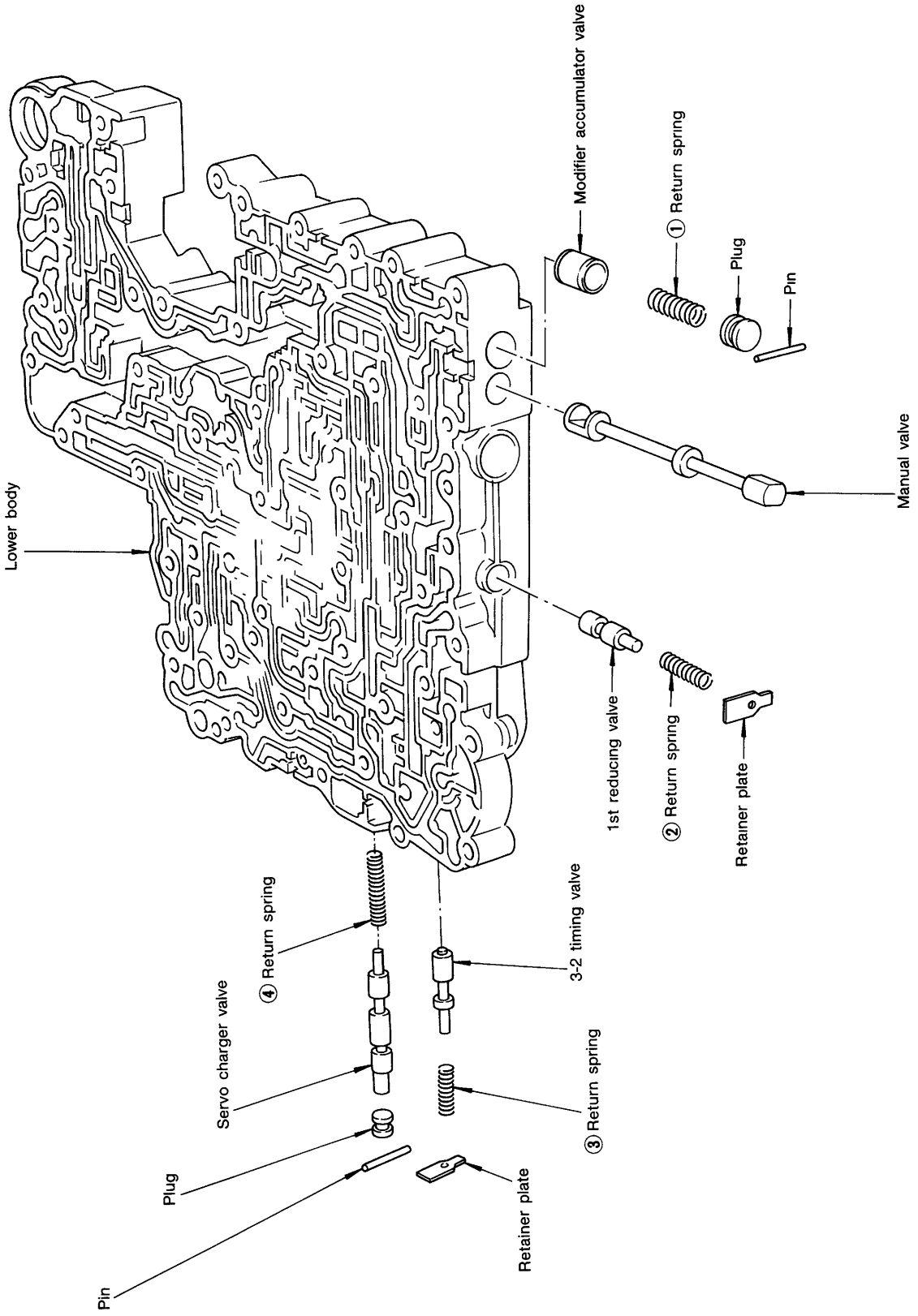


Control Valve Upper Body — RL4R01A (Cont'd)



- Insert retainer plate while pushing spring.

Control Valve Lower Body — RE4R01A

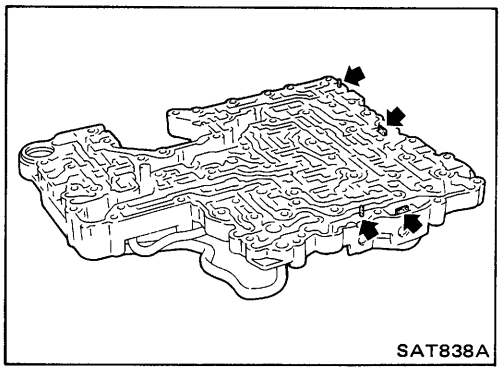


Numbers preceding valve springs correspond with those shown in Spring Chart on page AT-178.

Apply A.T.F. to all components before their installation.

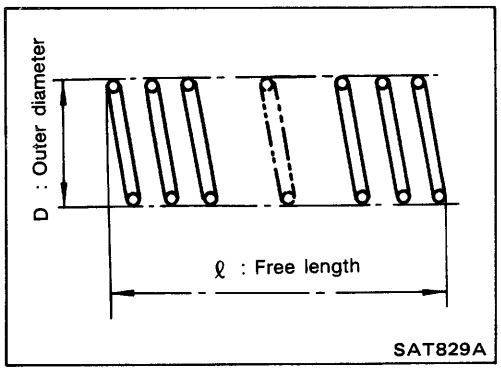
SAT837A

Control Valve Lower Body — RE4R01A (Cont'd)


SAT838A

DISASSEMBLY

1. Remove valves at parallel pins.
2. Remove valves at retainer plates.
   For removal procedures, refer to "DISASSEMBLY" of Control Valve Upper Body.



SAT829A

INSPECTION

Valve springs

- Check each valve spring for damage or deformation. Also measure free length and outer diameter.
- Numbers of each valve spring listed in table below are the same as those in the figure on AT-177.

Inspection standard

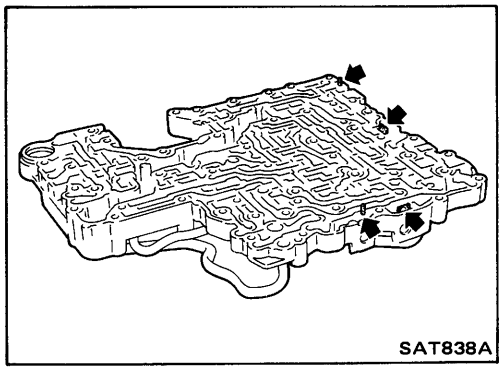
Unit: mm (in)

Parts / Item		Part No.	ℓ	D
①	Modifier accumulator valve spring	31742-41X15	30.5 (1.201)	9.8 (0.386)
②	1st reducing valve spring	31756-41X05	25.4 (1.000)	6.75 (0.2657)
③	3-2 timing valve spring	31742-41X08	20.55 (0.8091)	6.75 (0.2657)
④	Servo charger valve spring	31742-41X06	23.0 (0.906)	6.7 (0.264)

- Replace valve springs if deformed or fatigued.

Control valves

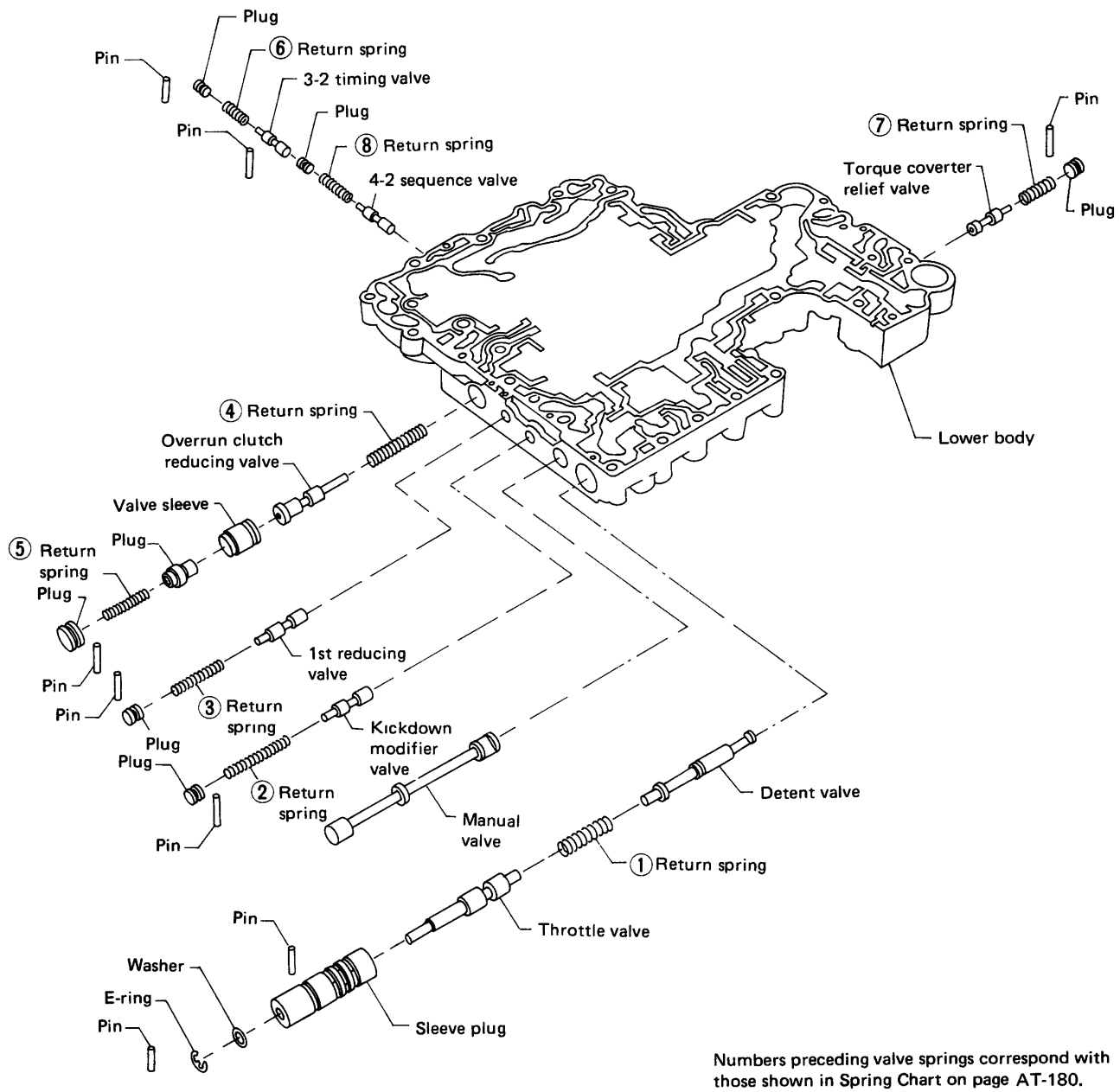
- Check sliding surfaces of control valves, sleeves and plugs for damage.


SAT838A

ASSEMBLY

- Install control valves.
  For installation procedures, refer to "ASSEMBLY" of Control Valve Upper Body.

Control Valve Lower Body — RL4R01A

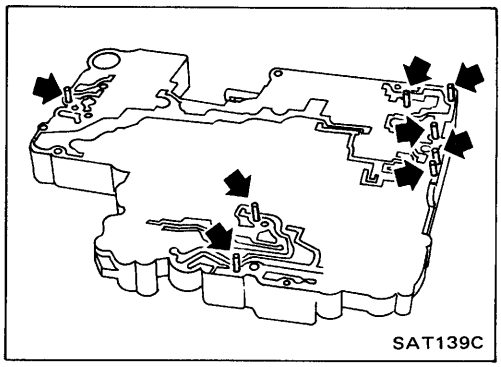


Numbers preceding valve springs correspond with those shown in Spring Chart on page AT-180.

Apply A.T.F. to all components before their installation.

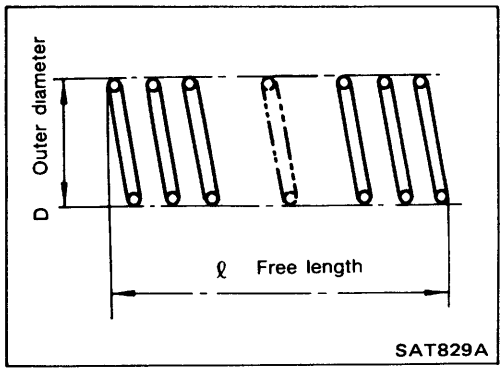
SAT094C

Control Valve Lower Body — RL4R01A (Cont'd)



DISASSEMBLY

1. Remove valves at parallel pins.
2. Remove valves at retainer plates.
   For removal procedures, refer to "DISASSEMBLY" of Control Valve Upper Body.



INSPECTION

Valve springs

- Check each valve spring for damage or deformation. Also measure free length and outer diameter.
- Numbers of each valve spring listed in table below are the same as those in the figure in AT-179.

Inspection standard

Unit: mm (in)

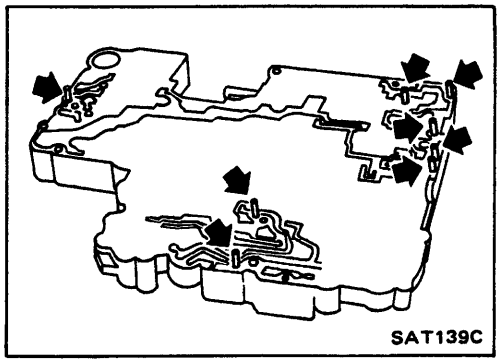
Part	Item	Part No.	ℓ	D
①	Throttle valve & detent valve spring	31802-48X02	34.23 (1.3476)	11.0 (0.433)
②	Kickdown modifier valve spring	31756-48X01	45.3 (1.783)	7.0 (0.276)
③	1st reducing valve spring	31756-48X08	29.7 (1.169)	7.2 (0.283)
④	Overrun clutch reducing valve spring	31742-48X04	45.0 (1.772)	7.45 (0.2933)
⑤	Overrun clutch reducing valve spring	31742-48X05	31.0 (1.220)	5.2 (0.205)
⑥	3-2 timing valve spring	31742-48X15	23.0 (0.906)	7.0 (0.276)
⑦	Torque converter relief valve spring	31742-41X23	38.0 (1.496)	9.0 (0.354)
⑧	4-2 sequence valve spring	31756-41X00	29.1 (1.146)	6.95 (0.2736)

- Replace valve springs if deformed or fatigued.

Control valves

- Check sliding surfaces of control valves, sleeves and plugs for damage.

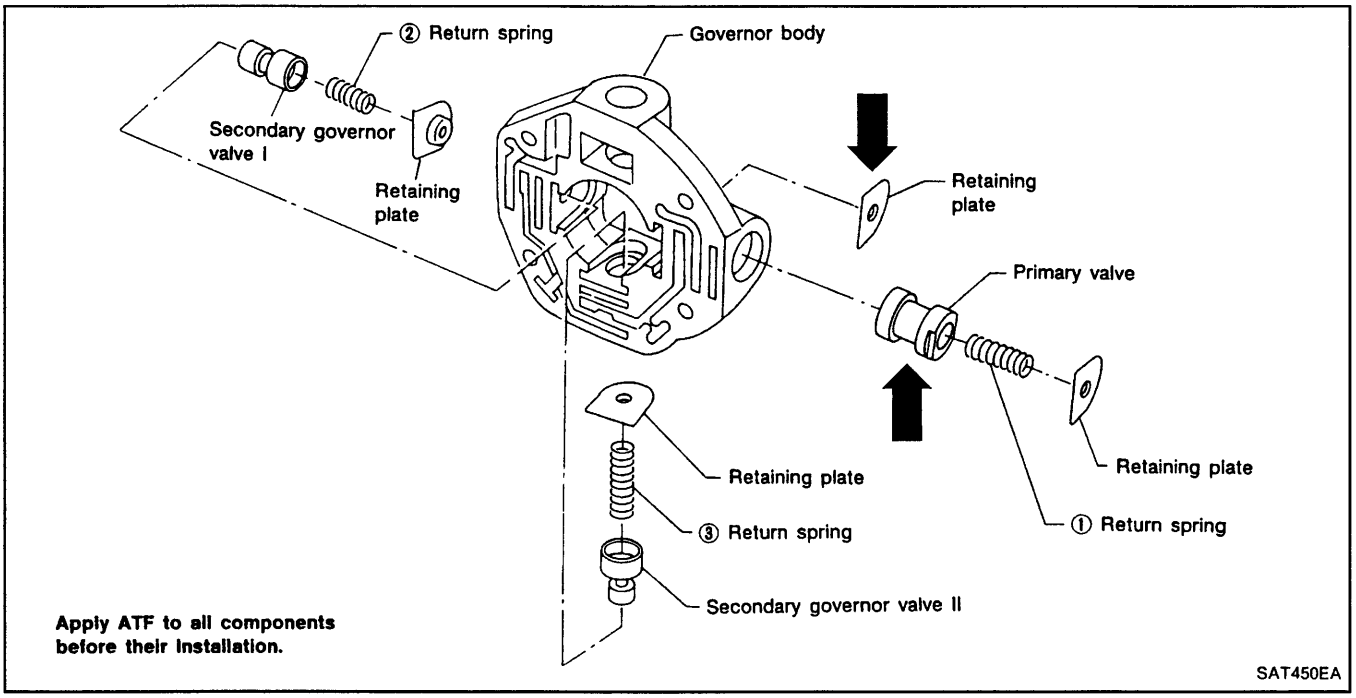
Control Valve Lower Body — RL4R01A (Cont'd)


SAT139C

ASSEMBLY

- Install control valves.
  For installation procedures, refer to "ASSEMBLY" of Control Valve Upper Body.

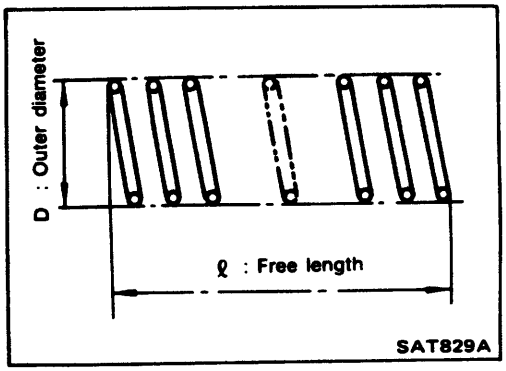
Governor Valve Assembly — RL4R01A



INSPECTION

Governor valves and valve body

- Check governor valves and valve body for indication of burning or scratches.



Valve springs

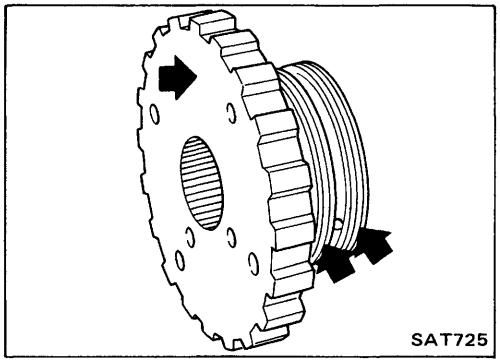
- Measure free length and outer diameter of each valve spring. Also check for damage or deformation.

Governor Valve Assembly — RL4R01A (Cont'd)

Inspection standard

Unit: mm (in)

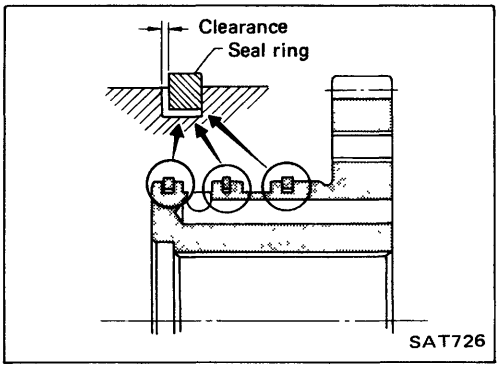
Part / Item		Part No.	ℓ	D
①	Governor valve spring	31742-48X11	19.1 (0.752)	9.05 (0.3563)
②	Governor valve spring I	31742-48X09	30.58 (1.2039)	9.2 (0.362)
③	Governor valve spring II	31742-48X10	16.79 (0.6610)	9.0 (0.354)


SAT725

Oil Distributor

INSPECTION

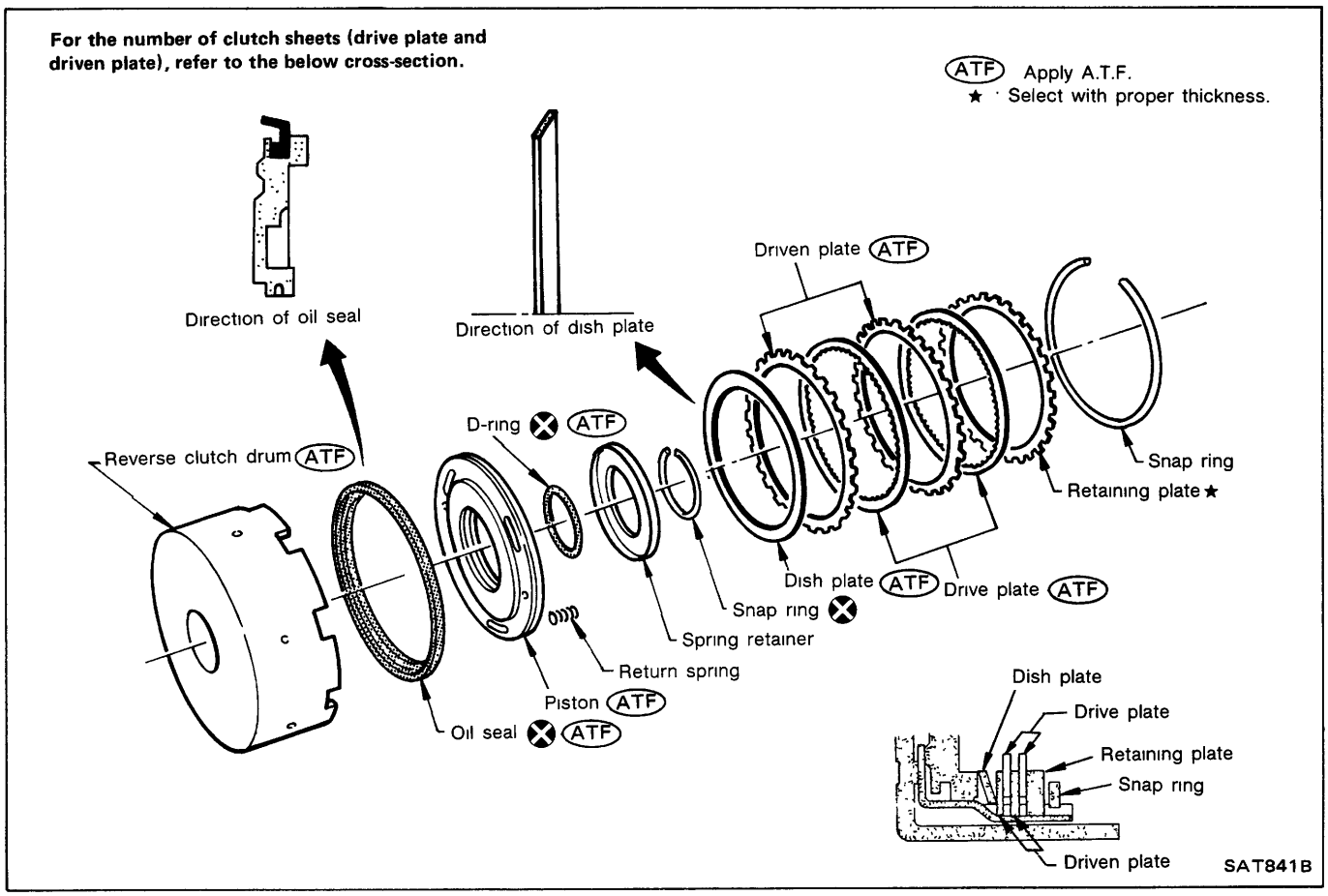
- Check contacting surface of oil distributor and ring groove areas for wear.

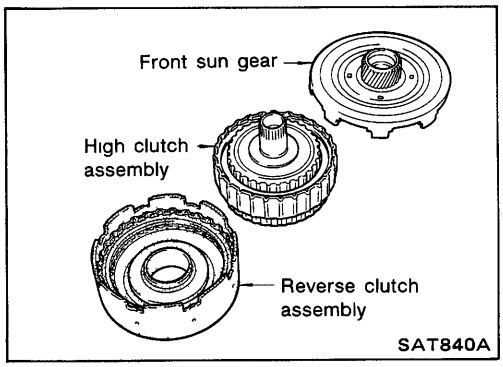


SAT726

- Measure clearance between seal ring and ring groove.
  Standard clearance:
  0.15 - 0.40 mm (0.0059 - 0.0157 in)
  Wear limit:
  0.40 mm (0.0157 in)

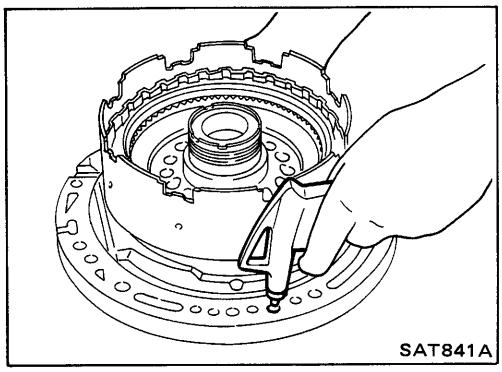
Reverse Clutch — RE4R01A and RL4R01A





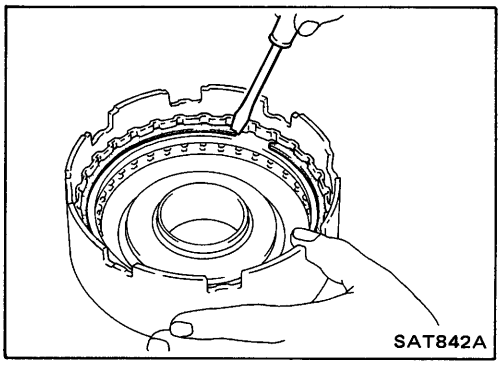
DISASSEMBLY

1. Remove reverse clutch assembly from clutch pack.

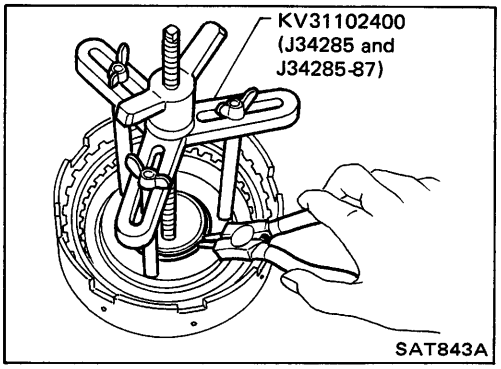


2. Check operation of reverse clutch.
a. Install seal ring onto oil pump cover and install reverse clutch. Apply compressed air to oil hole.
b. Check to see that retaining plate moves to snap ring.
c. If retaining plate does not move to snap ring, D-ring or oil seal may be damaged or fluid may be leaking at piston check ball.

Reverse Clutch — RE4R01A and RL4R01A (Cont'd)


SAT842A

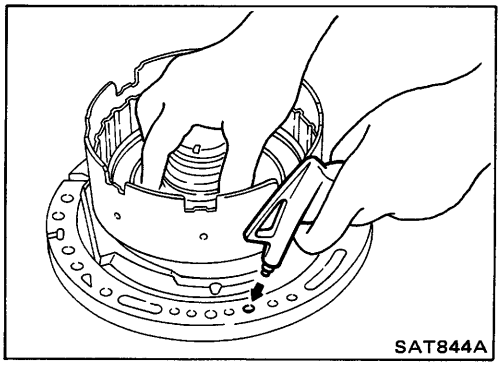
3. Remove drive plates, driven plates, retaining plate, dish plate and snap ring.



SAT843A

4. Remove snap ring from clutch drum while compressing clutch springs.
- **Do not expand snap ring excessively.**

5. Remove spring retainer and return spring.

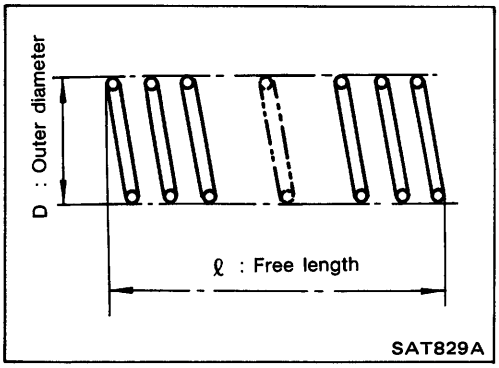

SAT844A

6. Install seal ring onto oil pump cover and install reverse clutch drum. While holding piston, gradually apply compressed air to oil hole until piston is removed.
- **Do not apply compressed air abruptly.**

7. Remove D-ring and oil seal from piston.

INSPECTION

Reverse clutch snap ring and spring retainer
- Check for deformation, fatigue or damage.



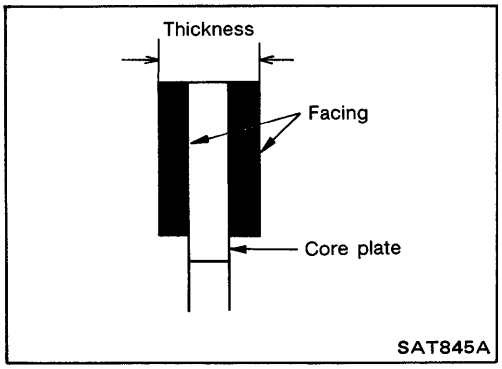
SAT829A

Reverse clutch return springs
- Check for deformation or damage. Also measure free length and outside diameter.

Inspection standard

Unit: mm (in)

Part No.	ℓ	D
31505-41X02	19.69 (0.7752)	11.6 (0.457)



SAT845A

Reverse clutch drive plates
- Check facing for burns, cracks or damage.
- Measure thickness of facing.

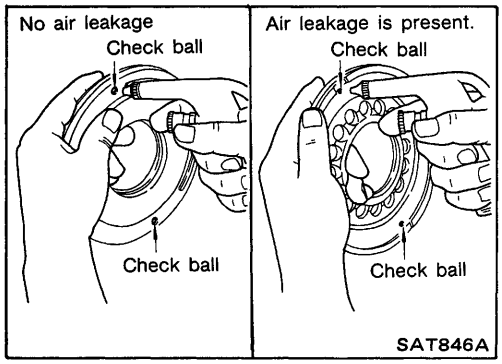
  Thickness of drive plate:

  Standard value: 1.90 - 2.05 mm (0.0748 - 0.0807 in)

  Wear limit: 1.80 mm (0.0709 in)
- If not within wear limit, replace.

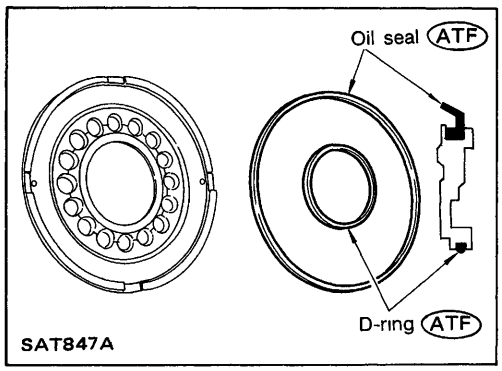
Reverse clutch dish plate
- Check for deformation or damage.

Reverse Clutch — RE4R01A and RL4R01A (Cont'd)



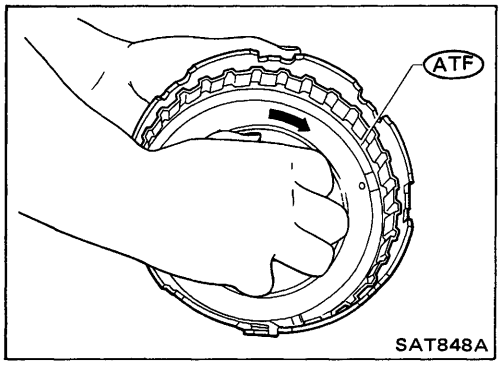
Reverse clutch piston

- Shake piston to assure that balls are not seized.
- Apply compressed air to check ball oil hole opposite the return spring to assure that there is no air leakage.
- Also apply compressed air to oil hole on return spring side to assure that air leaks past ball.

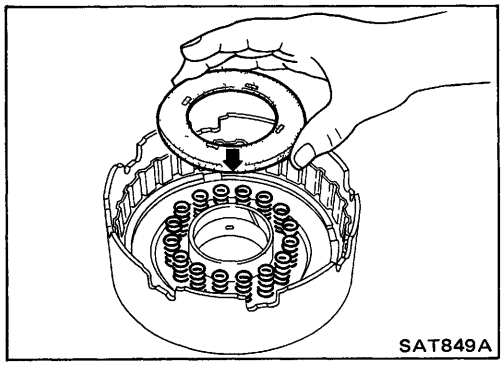


ASSEMBLY

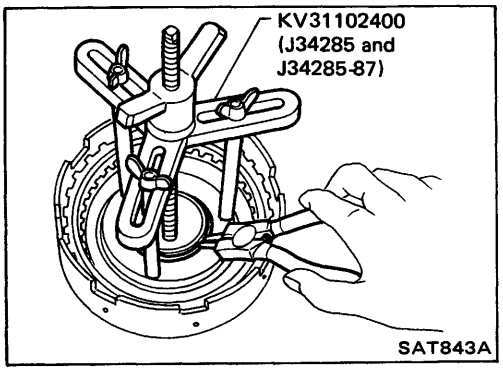
1. Install D-ring and oil seal on piston.
- **Apply A.T.F. to both parts.**



2. Install piston assembly by turning it slowly and evenly.
- **Apply A.T.F. to inner surface of drum.**

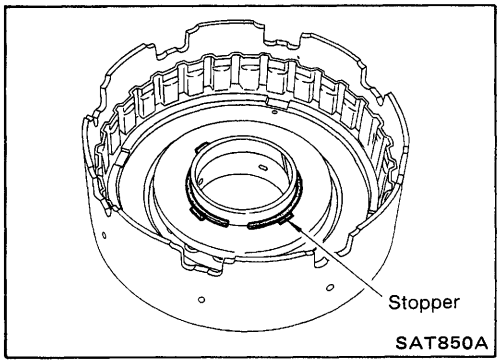


3. Install return springs and spring retainer.

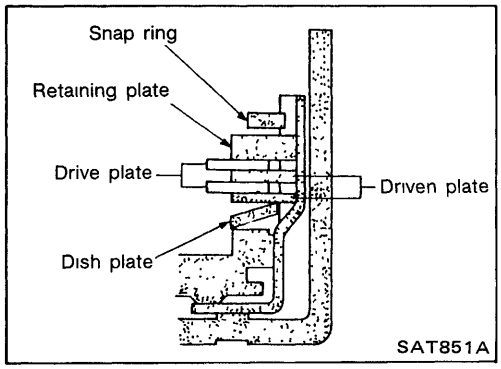


4. Install snap ring while compressing clutch springs.

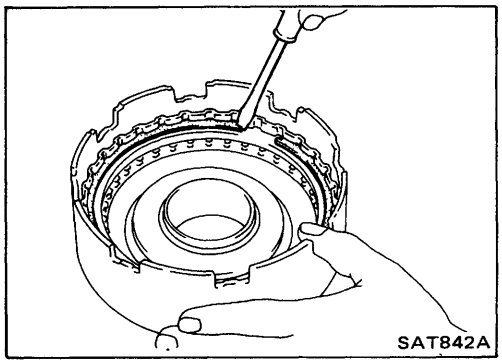
Reverse Clutch — RE4R01A and RL4R01A (Cont'd)



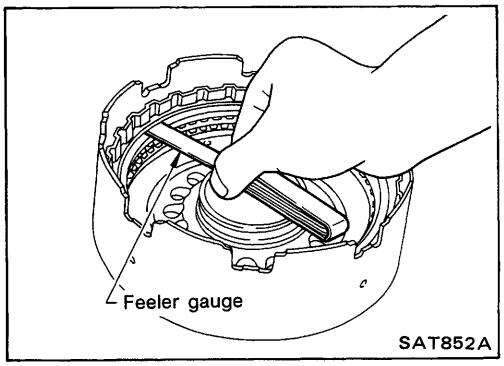
- **Do not align snap ring gap with spring retainer stopper.**



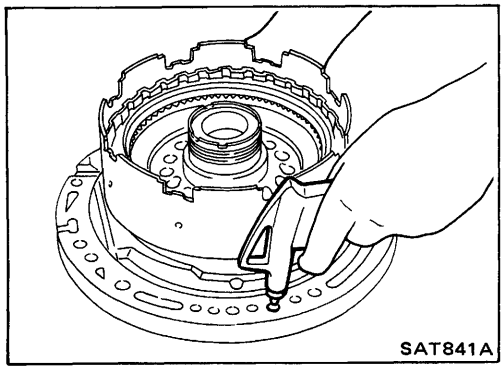
5. Install drive plates, driven plates, retaining plate and dish plate.



6. Install snap ring.



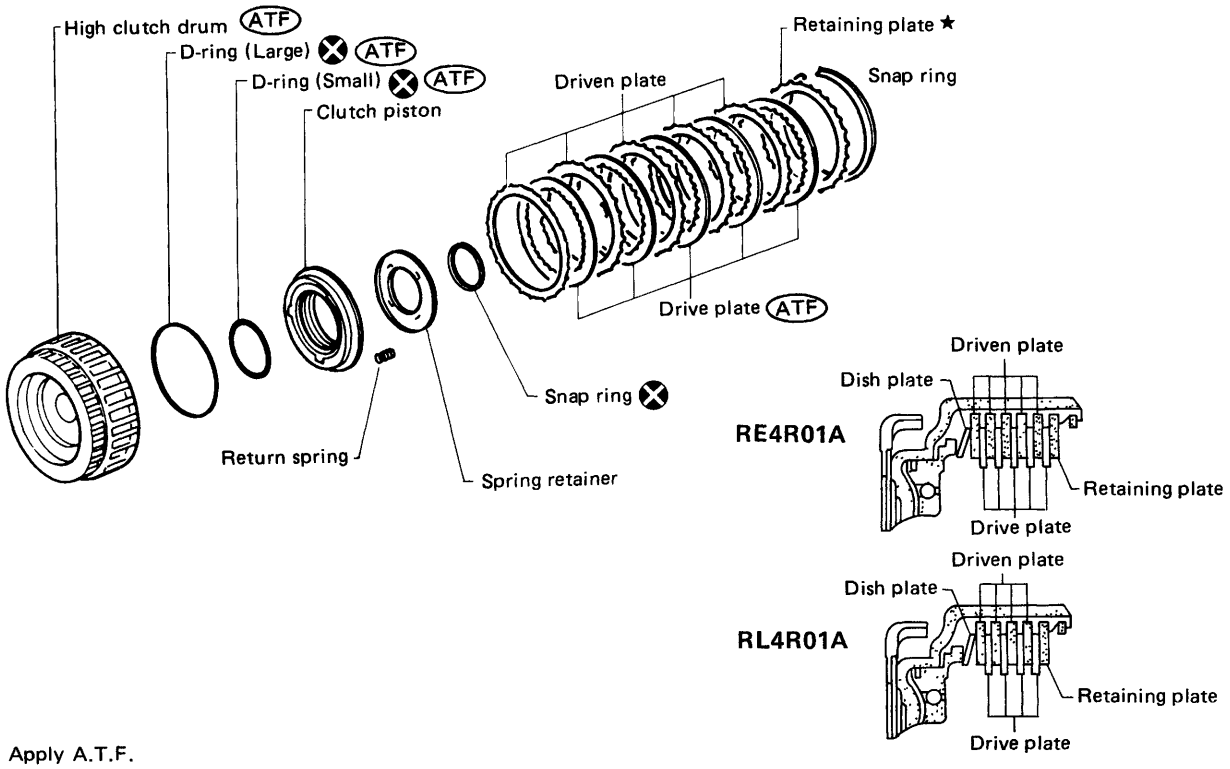
7. Measure clearance between retaining plate and snap ring. If not within allowable limit, select proper retaining plate.
   Specified clearance:
   Standard
   0.5 - 0.8 mm (0.020 - 0.031 in)
   Allowable limit
   1.2 mm (0.047 in)
   Retaining plate:
   Refer to S.D.S.



8. Check operation of reverse clutch.
   Refer to "DISASSEMBLY" of Reverse Clutch.

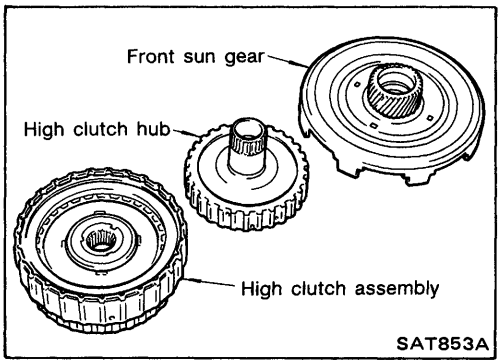
High Clutch — RE4R01A and RL4R01A

For the number of clutch sheets (drive plate and driven plate), refer to the below cross-section.



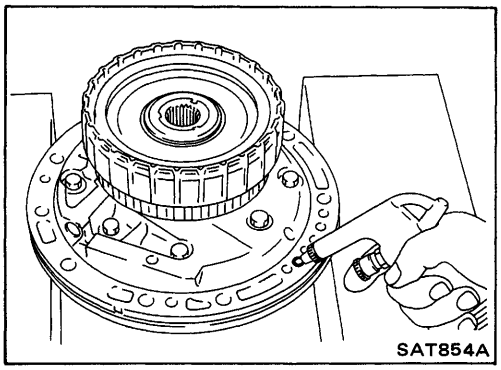
(ATF) : Apply A.T.F.
★ : Select with proper thickness.

SAT728C



SAT853A

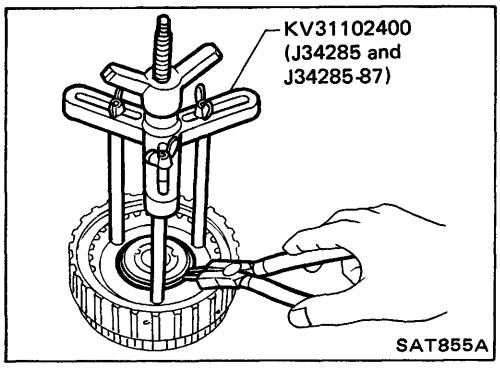
Service procedures for high clutch are essentially the same as those for reverse clutch, with the following exception:



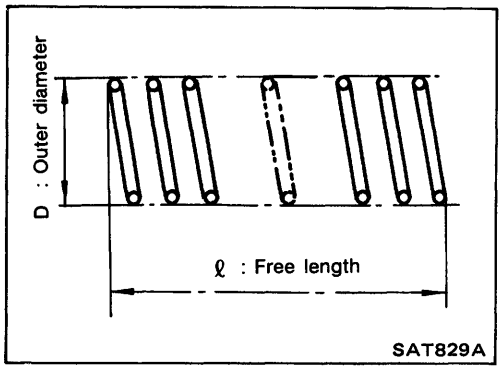
SAT854A

- Check of high clutch operation

High Clutch — RE4R01A and RL4R01A (Cont'd)



- Removal and installation of return spring

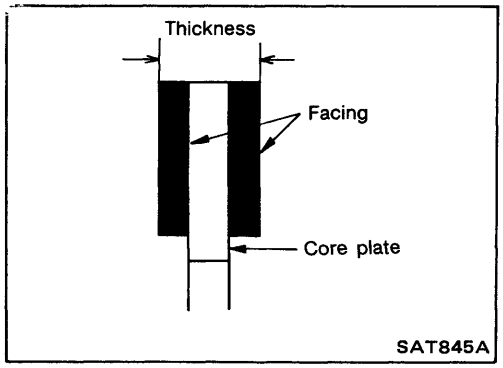


- Inspection of high clutch return springs

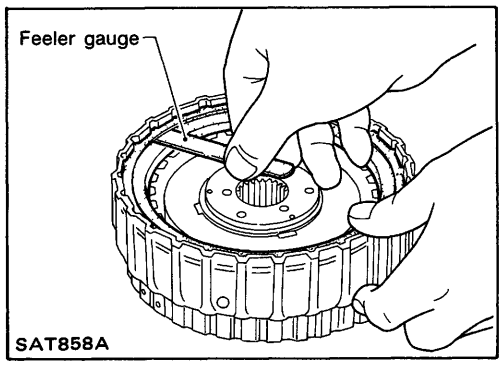
Inspection standard

Unit: mm (in)

Part No.	ℓ	D
31505-21X03	22.06 (0.8685)	11.6 (0.457)



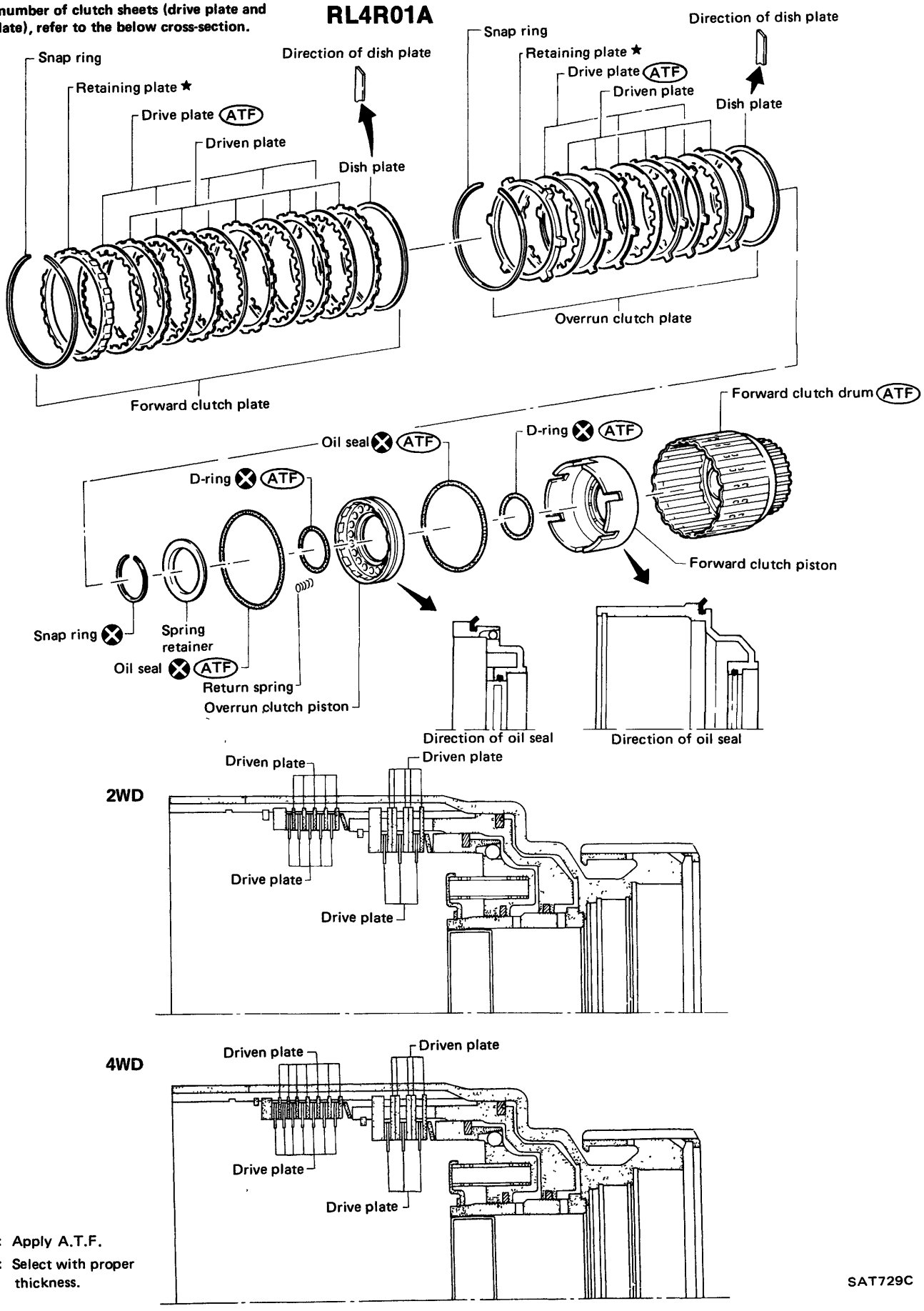
- Inspection of high clutch drive plate
  Thickness of drive plate:
  Standard
  1.52 - 1.67 mm (0.0598 - 0.0657 in)
  Wear limit
  1.40 mm (0.0551 in)



- Measurement of clearance between retaining plate and snap ring
  Specified clearance:
  Standard
  1.8 - 2.2 mm (0.071 - 0.087 in)
  Allowable limit
  2.8 mm (0.110 in)
  Retaining plate:
  Refer to S.D.S.

Forward and Overrun Clutches — RE4R01A and RL4R01A

For the number of clutch sheets (drive plate and driven plate), refer to the below cross-section.



(ATF) : Apply A.T.F.

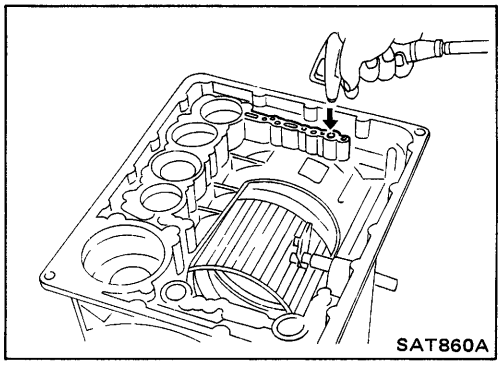
★ : Select with proper thickness.

SAT729C

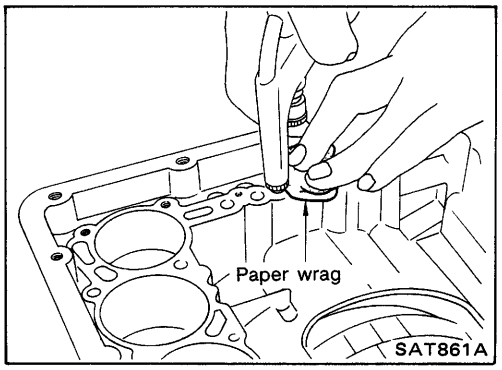
Forward and Overrun Clutches — RE4R01A and RL4R01A (Cont'd)

Service procedures for forward and overrun clutches are essentially the same as those for reverse clutch, with the following exception:

- Check of forward clutch operation.


SAT860A

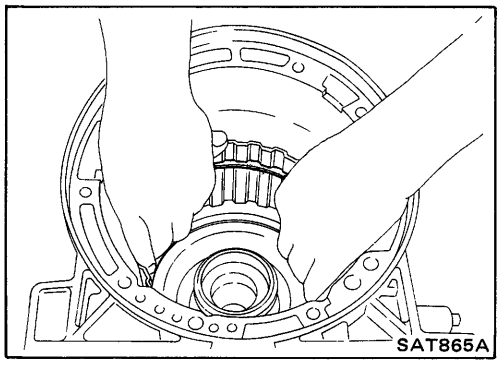
- Check of overrun clutch operation.



SAT861A

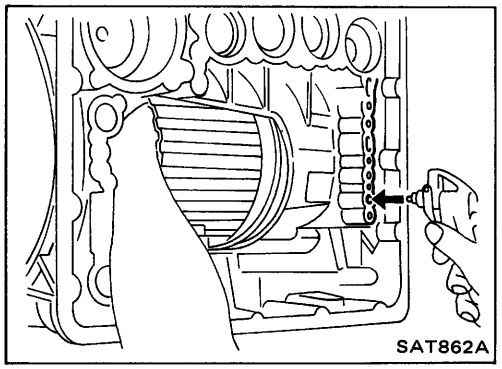
- Removal of forward clutch drum

  Remove forward clutch drum from transmission case by holding snap ring.

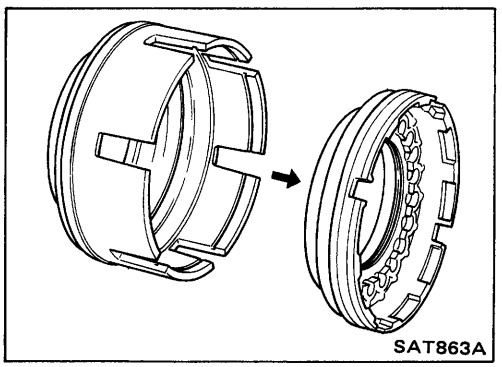

SAT865A

- Removal of forward clutch and overrun clutch pistons

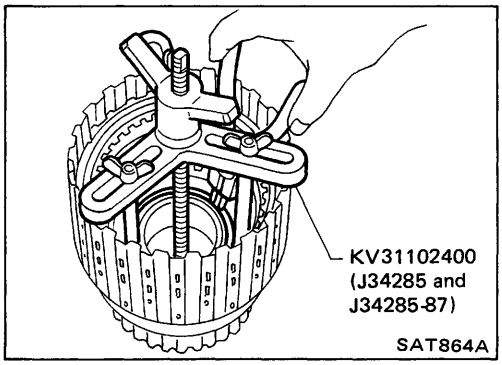
1. While holding overrun clutch piston, gradually apply compressed air to oil hole.


SAT862A

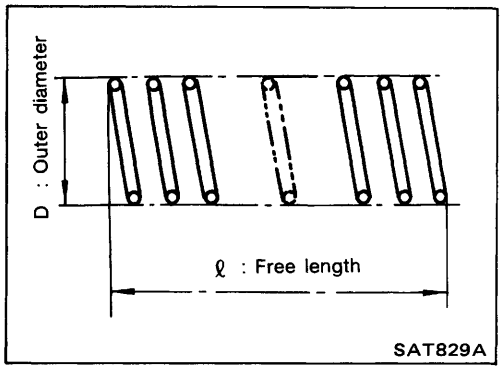
2. Remove overrun clutch from forward clutch.


SAT863A

Forward and Overrun Clutches — RE4R01A and RL4R01A (Cont'd)



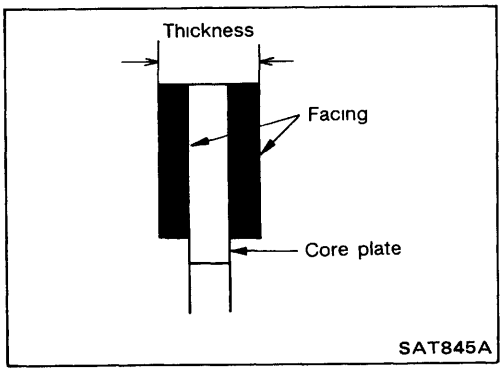
- Removal and installation of return springs



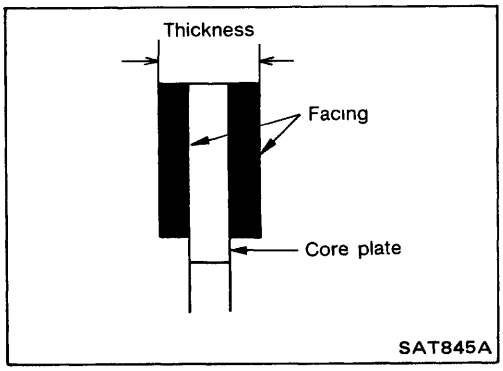
- Inspection of forward clutch and overrun clutch return springs

Inspection standard Unit: mm (in)

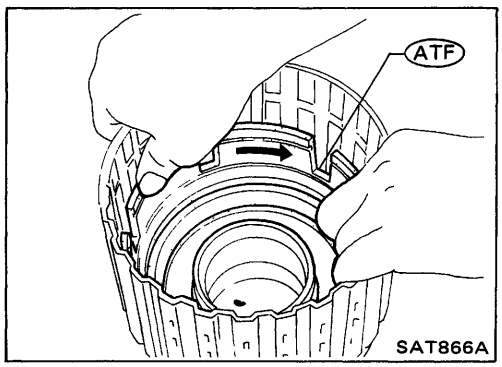
Part No.	ℓ	D
31505-41X01	35.77 (1.4083)	9.7 (0.382)



- Inspection of forward clutch drive plates
  Thickness of drive plate:
  Standard
  1.90 - 2.05 mm (0.0748 - 0.0807 in)
  Wear limit
  1.80 mm (0.0709 in)



- Inspection of overrun clutch drive plates
  Thickness of drive plate:
  Standard
  1.90 - 2.05 mm (0.0748 - 0.0807 in)
  Wear limit
  1.80 mm (0.0709 in)

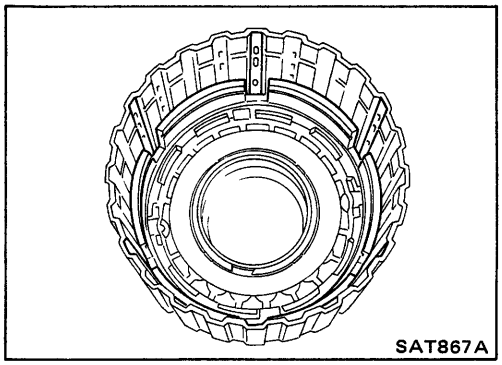


- Installation of forward clutch piston and overrun clutch piston

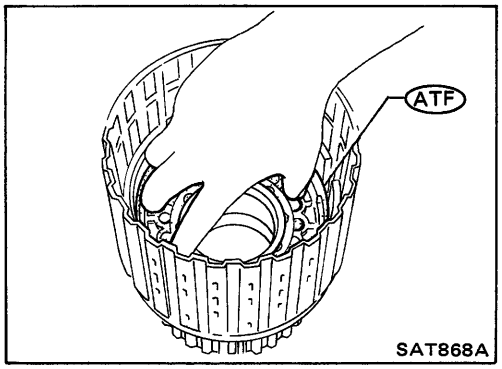
1. Install forward clutch piston by turning it slowly and evenly.

- **Apply A.T.F. to inner surface of clutch drum.**

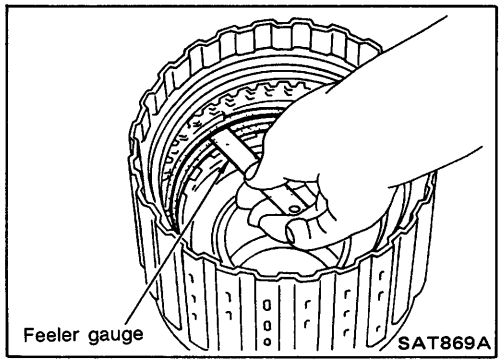
Forward and Overrun Clutches — RE4R01A and RL4R01A (Cont'd)



- **Align notch in forward clutch piston with groove in forward clutch drum.**



2. Install overrun clutch by turning it slowly and evenly.
- **Apply A.T.F. to inner surface of forward clutch piston.**



- Measurement of clearance between retaining plate and snap ring of overrun clutch

Specified clearance:

Standard

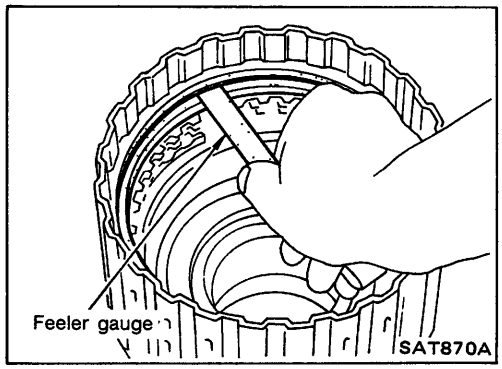
1.0 - 1.4 mm (0.039 - 0.055 in)

Allowable limit

2.0 mm (0.079 in)

Retaining plate:

Refer to S.D.S.



- Measurement of clearance between retaining plate and snap ring of forward clutch

Specified clearance:

Standard

0.45 - 0.85 mm (0.0177 - 0.0335 in)

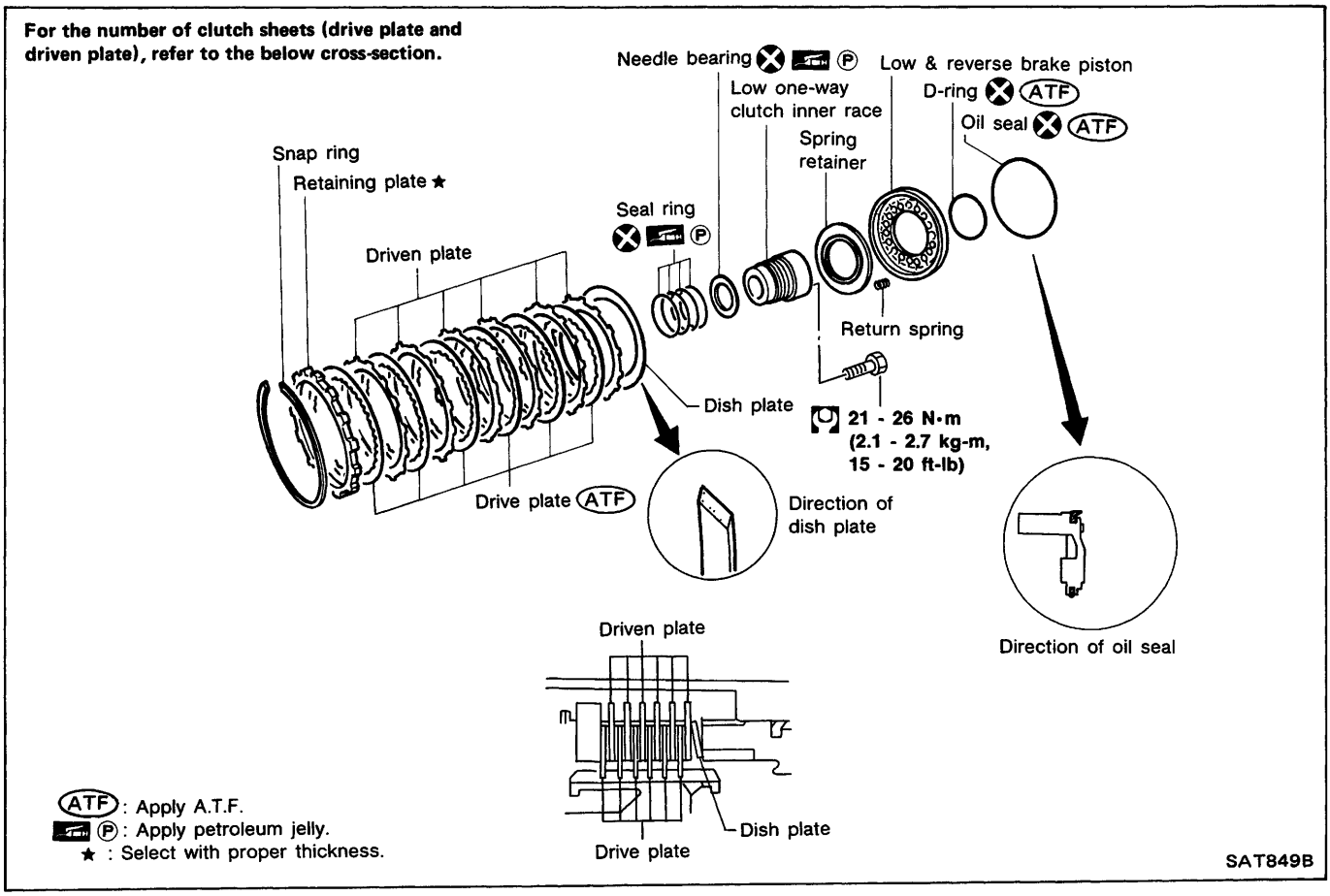
Allowable limit

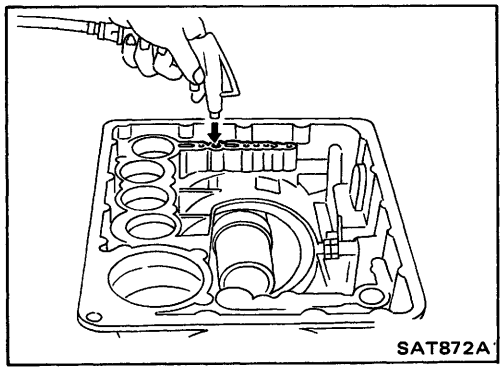
2.25 mm (0.0886 in)

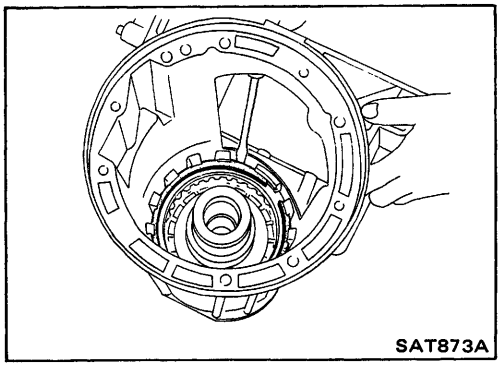
Retaining plate:

Refer to S.D.S.

Low & Reverse Brake — RE4R01A and RL4R01A





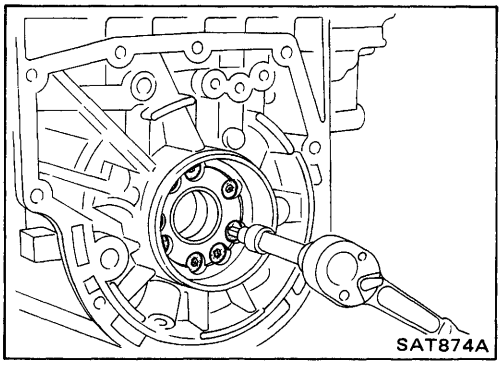


DISASSEMBLY

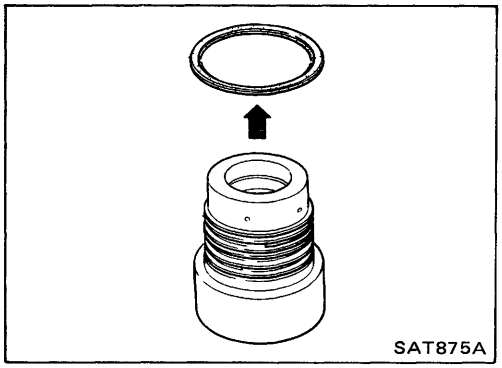
1. Check operation of low & reverse brake.
a. Install seal ring onto oil pump cover and install reverse clutch. Apply compressed air to oil hole.
b. Check to see that retaining plate moves to snap ring.
c. If retaining plate does not move to snap ring, D-ring or oil seal may be damaged or fluid may be leaking at piston check ball.

2. Remove snap ring, low & reverse brake drive plates, driven plates and dish plate.

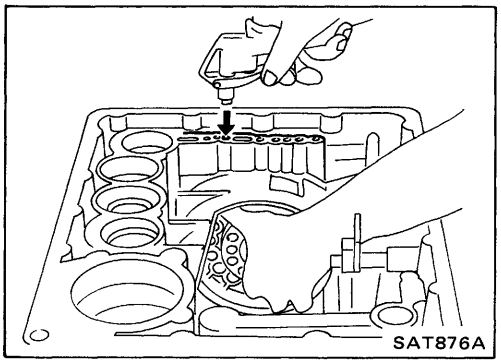
Low & Reverse Brake — RE4R01A and RL4R01A (Cont'd)


SAT874A

3. Remove low one-way clutch inner race, spring retainer and return spring from transmission case.


SAT875A

4. Remove seal rings from low one-way clutch inner race.
5. Remove needle bearing from low one-way clutch inner race.

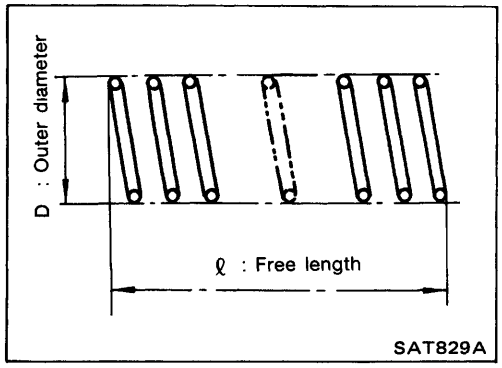

SAT876A

6. Remove low & reverse brake piston using compressed air.
7. Remove oil seal and D-ring from piston.

INSPECTION

Low & reverse brake snap ring and spring retainer

- Check for deformation, or damage.



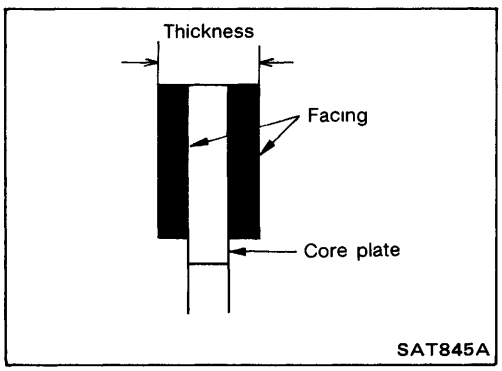
SAT829A

Low & reverse brake return springs

- Check for deformation or damage. Also measure free length and outside diameter.

Inspection standard Unit: mm (in)

Part No.	ℓ	D
31521-21X00	23.7 (0.933)	11.6 (0.457)



SAT845A

Low & reverse brake drive plates

- Check facing for burns, cracks or damage.
- Measure thickness of facing.

Thickness of drive plate:

Standard value

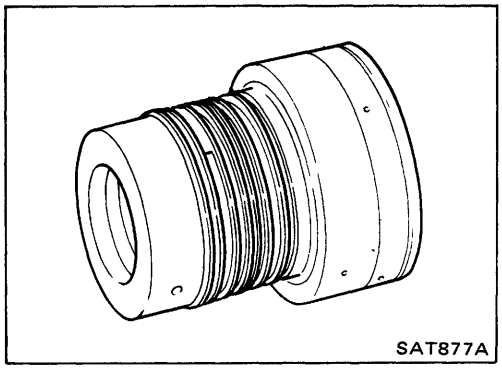
1.90 - 2.05 mm (0.0748 - 0.0807 in)

Wear limit

1.8 mm (0.071 in)

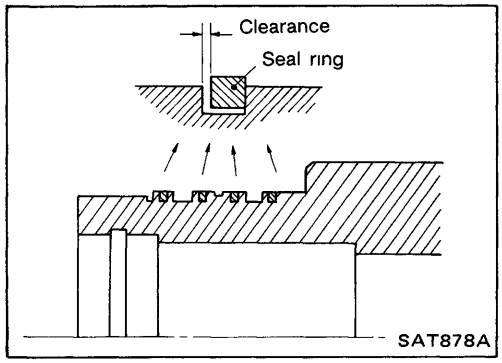
- If not within wear limit, replace.

Low & Reverse Brake — RE4R01A and RL4R01A (Cont'd)


SAT877A

Low one-way clutch inner race

- Check frictional surface of inner race for wear or damage.



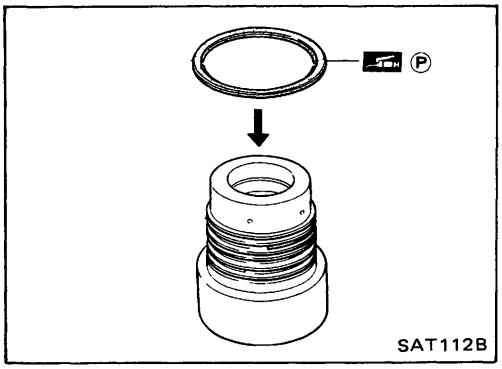
SAT878A

- Install a new seal rings onto low one-way clutch inner race.
- **Be careful not to expand seal ring gap excessively.**
- Measure seal ring-to-groove clearance.

  Inspection standard:

  Standard value: 0.10 - 0.25 mm (0.0039 - 0.0098 in)

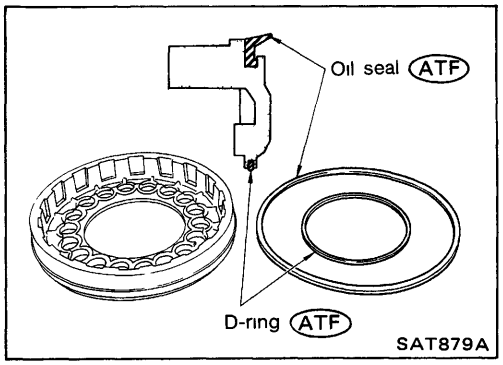
  Allowable limit: 0.25 mm (0.0098 in)
- If not within allowable limit, replace low one-way clutch inner race.



SAT112B

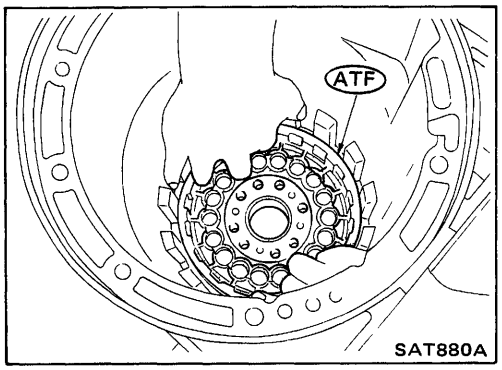
ASSEMBLY

1. Install bearing onto one-way clutch inner race.
- **Pay attention to its direction — Black surface goes to rear side.**
- **Apply petroleum jelly to needle bearing.**



SAT879A

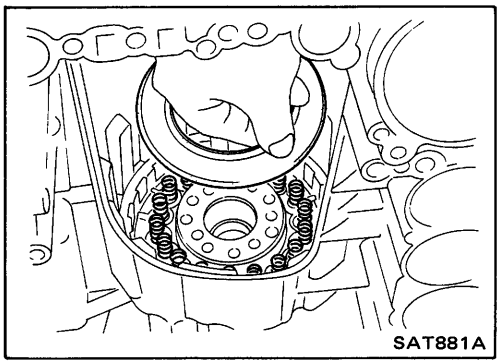
2. Install oil seal and D-ring onto piston.
- **Apply A.T.F. to oil seal and D-ring.**



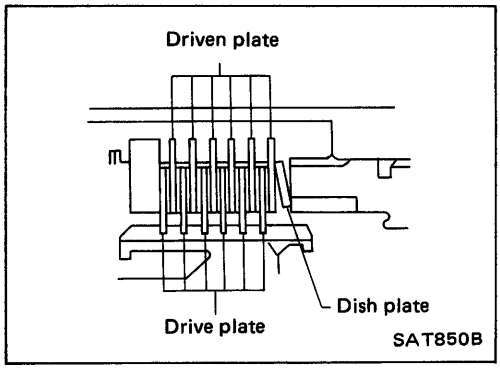
SAT880A

3. Install piston by rotating it slowly and evenly.
- **Apply A.T.F. to inner surface of transmission case.**

Low & Reverse Brake — RE4R01A and RL4R01A (Cont'd)

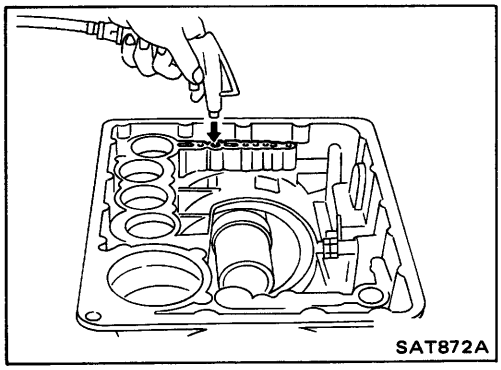

SAT881A

4. Install return springs, spring retainer and low one-way clutch inner race onto transmission case.

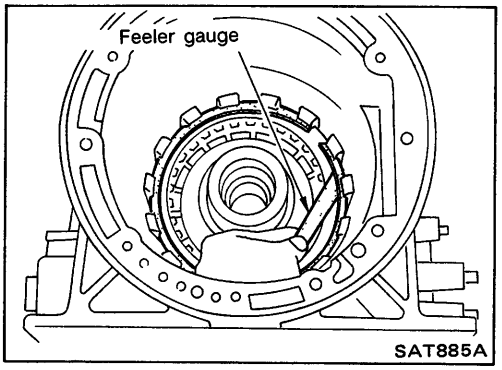


SAT850B

5. Install dish plate low & reverse brake drive plates, driven plates and retaining plate.
6. Install snap ring on transmission case.

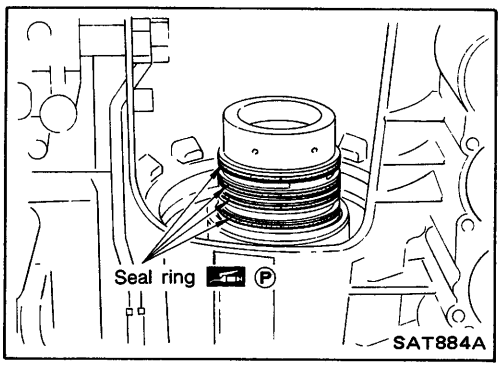

SAT872A

7. Check operation of low & reverse brake clutch piston. Refer to "DISASSEMBLY".



SAT885A

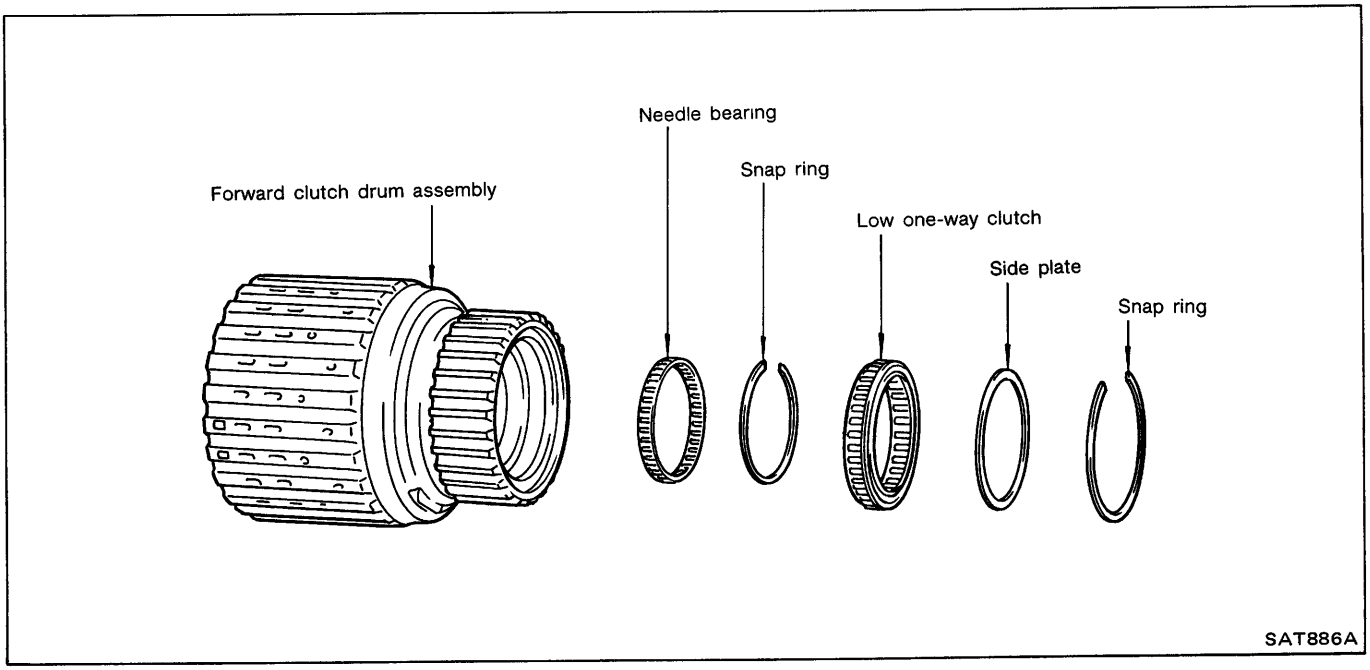
8. Measure clearance between retaining plate and snap ring. If not within allowable limit, select proper retaining plate.
   Specified clearance:
   Standard
   1.1 - 1.5 mm (0.043 - 0.059 in)
   Allowable limit
   2.7 mm (0.106 in)
   Retaining plate:
   Refer to S.D.S.



SAT884A

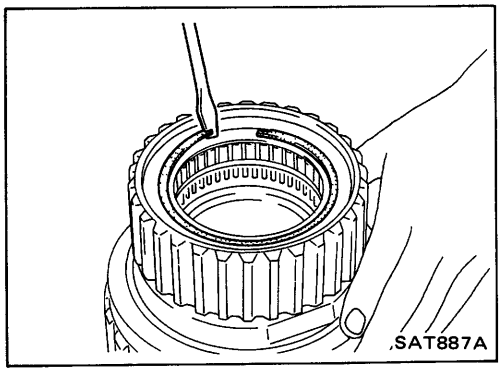
9. Install low one-way clutch inner race seal ring.
- **Apply petroleum jelly to seal ring.**
- **Make sure seal rings are pressed firmly into place and held by petroleum jelly.**

Forward Clutch Drum Assembly — RE4R01A and RL4R01A

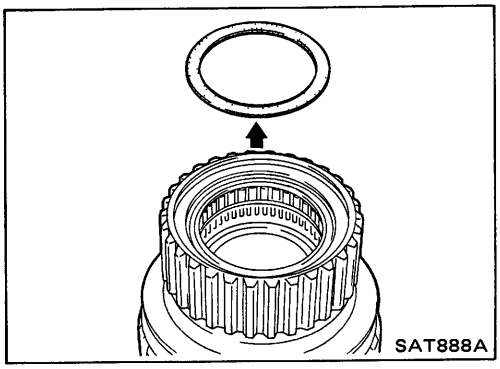


DISASSEMBLY

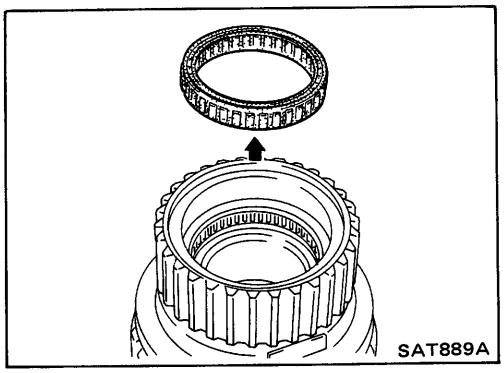
1. Remove snap ring from forward clutch drum.



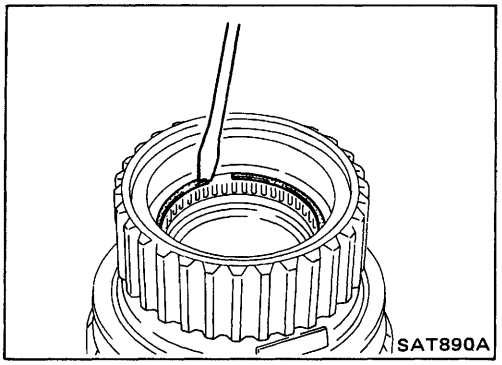
2. Remove side plate from forward clutch drum.



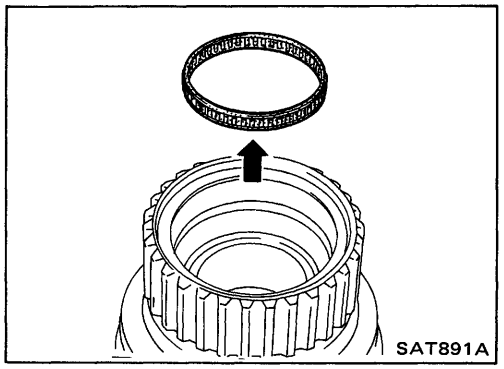
3. Remove low one-way clutch from forward clutch drum.



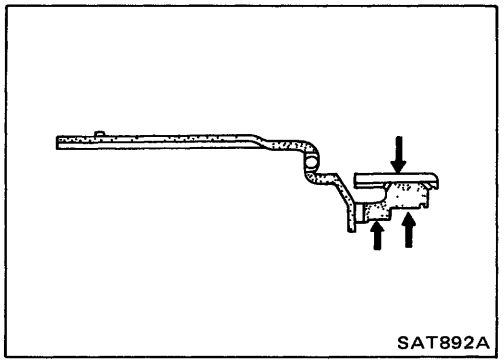
Forward Clutch Drum Assembly — RE4R01A and RL4R01A (Cont'd)


SAT890A

4. Remove snap ring from forward clutch drum.


SAT891A

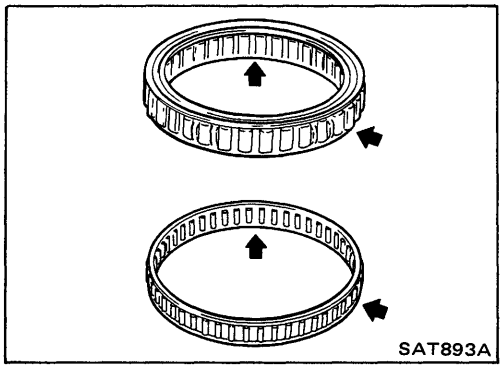
5. Remove needle bearing from forward clutch drum.


SAT892A

INSPECTION

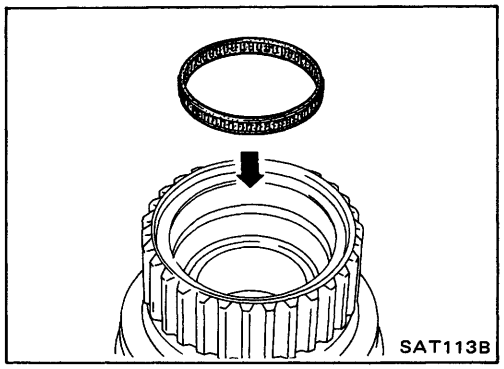
Forward clutch drum

- Check spline portion for wear or damage.
- Check frictional surfaces of low one-way clutch and needle bearing for wear or damage.


SAT893A

Needle bearing and low one-way clutch

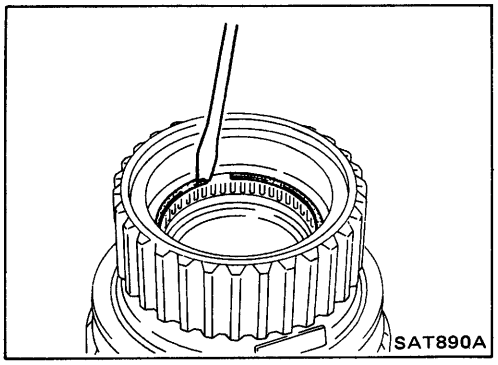
- Check frictional surface for wear or damage.


SAT113B

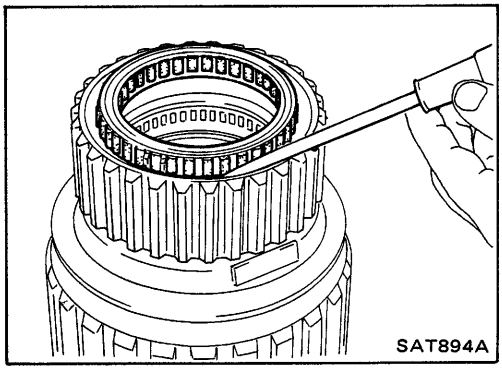
ASSEMBLY

1. Install needle bearing in forward clutch drum.

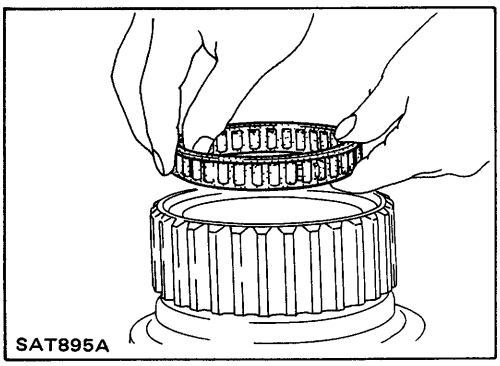
Forward Clutch Drum Assembly — RE4R01A and RL4R01A (Cont'd)


SAT890A

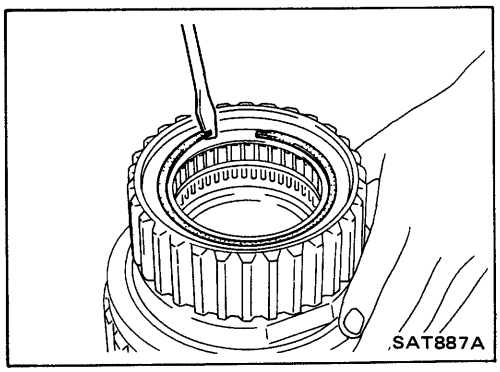
2. Install snap ring onto forward clutch drum.


SAT894A

3. Install low one-way clutch onto forward clutch drum by pushing the roller in evenly.

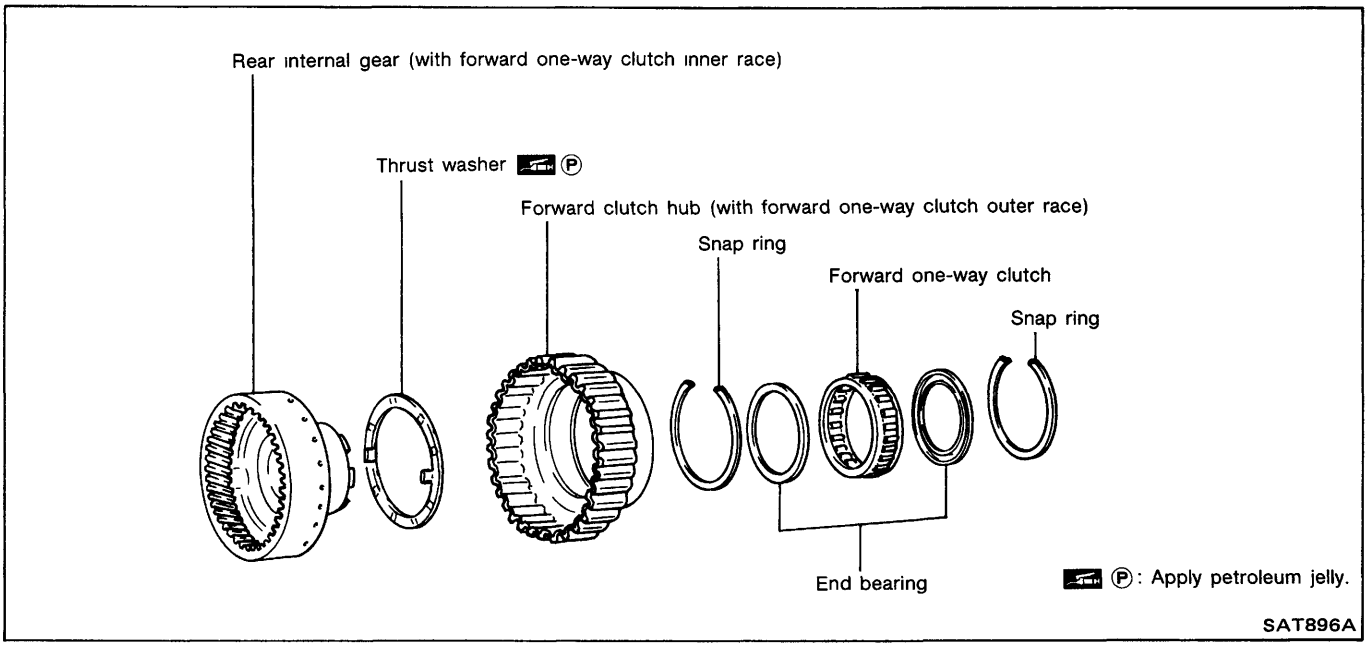

SAT895A

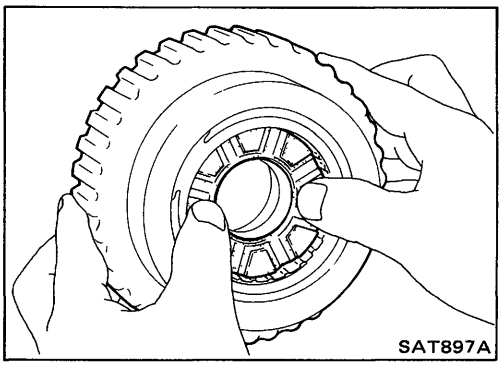
- **Install low one-way clutch with flange facing rearward.**


SAT887A

4. Install side plate onto forward clutch drum.
5. Install snap ring onto forward clutch drum.

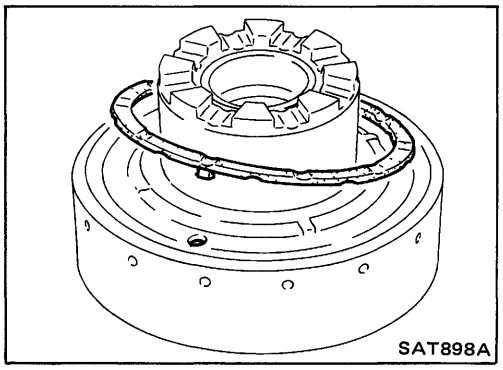
Rear Internal Gear and Forward Clutch Hub — RE4R01A and RL4R01A



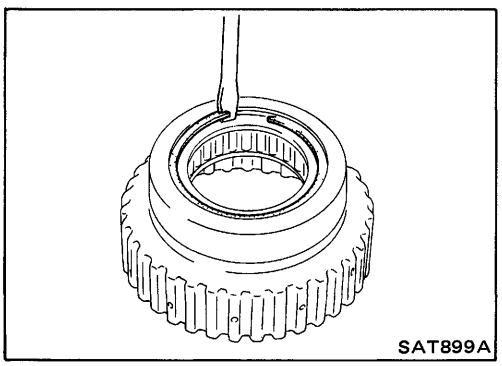


DISASSEMBLY

1. Remove rear internal gear by pushing forward clutch hub forward.

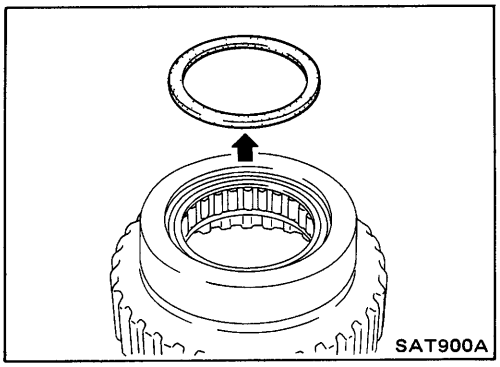


2. Remove thrust washer from rear internal gear.

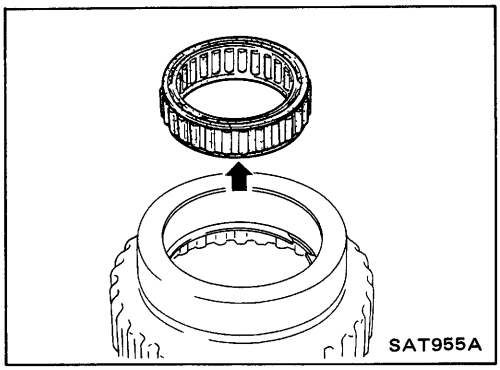


3. Remove snap ring from forward clutch hub.

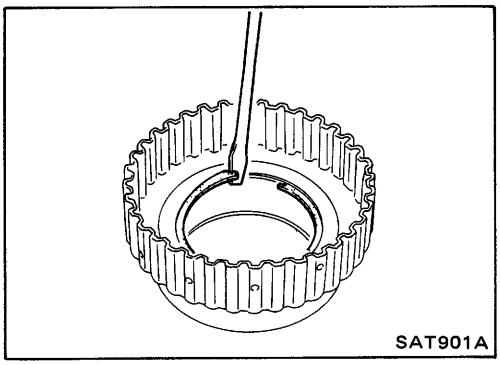
Rear Internal Gear and Forward Clutch Hub — RE4R01A and RL4R01A (Cont'd)


SAT900A

4. Remove end bearing.


SAT955A

5. Remove forward one-way clutch and end bearing as a unit from forward clutch hub.

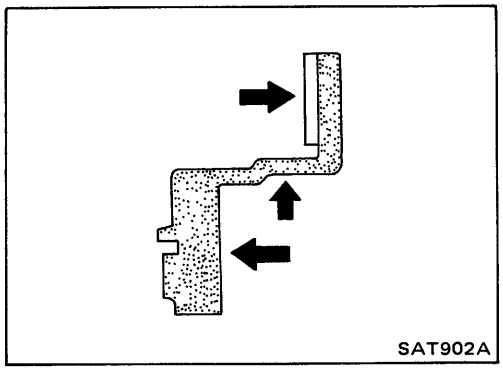

SAT901A

6. Remove snap ring from forward clutch hub.

INSPECTION

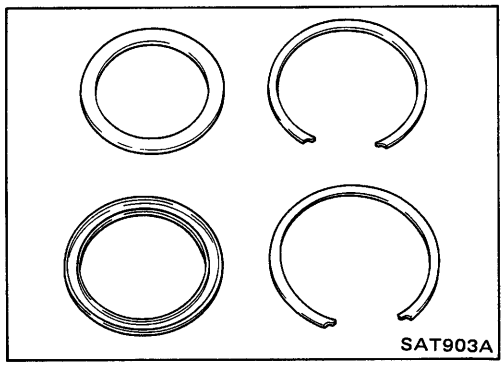
Rear internal gear and forward clutch hub

- Check gear for excessive wear, chips or cracks.
- Check frictional surfaces of forward one-way clutch and thrust washer for wear or damage.
- Check spline for wear or damage.


SAT902A

Snap ring and end bearing

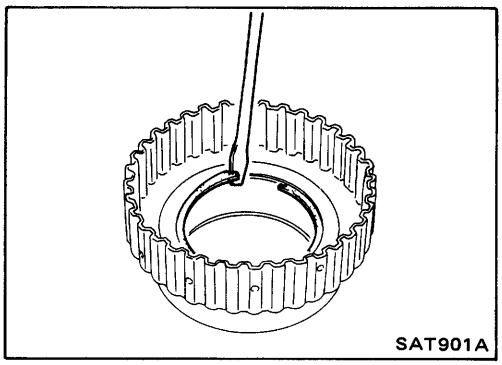
- Check for deformation or damage.


SAT903A

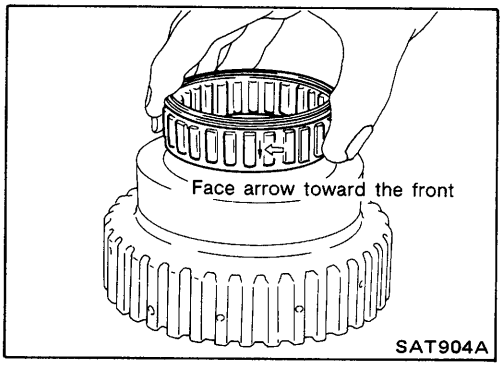
Rear Internal Gear and Forward Clutch Hub — RE4R01A and RL4R01A (Cont'd)

ASSEMBLY

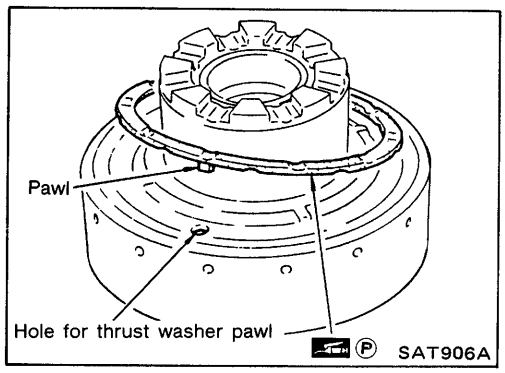
1. Install snap ring onto forward clutch hub.
2. Install end bearing.



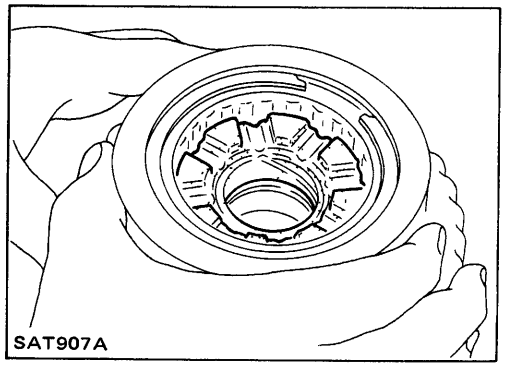
3. Install forward one-way clutch onto clutch hub.
- **Install forward one-way clutch with flange facing rearward.**
4. Install end bearing.
5. Install snap ring onto forward clutch hub.



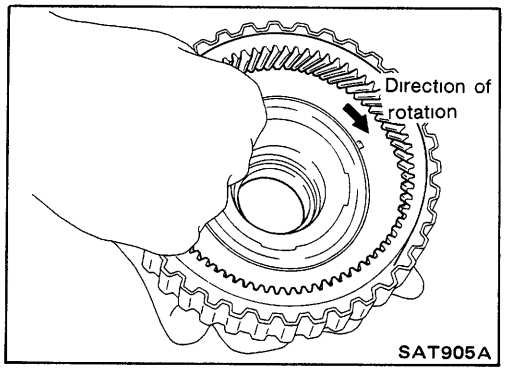
6. Install thrust washer onto rear internal gear.
- **Apply petroleum jelly to thrust washer.**
- **Securely insert pawls of thrust washer into holes in rear internal gear.**



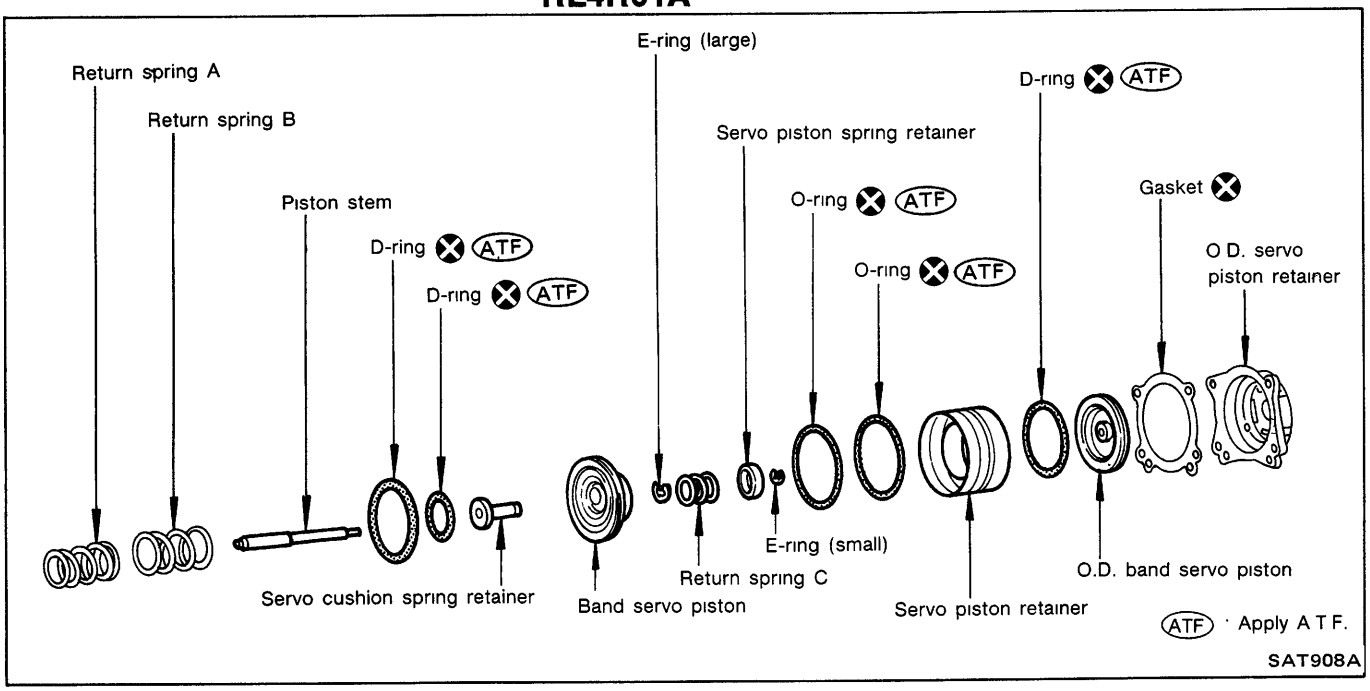
7. Position forward clutch hub in rear internal gear.

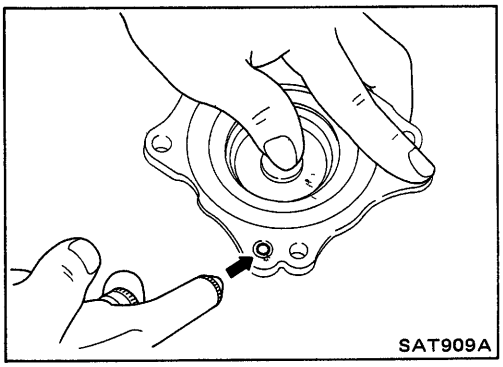


8. After installing, check to assure that forward clutch hub rotates clockwise.



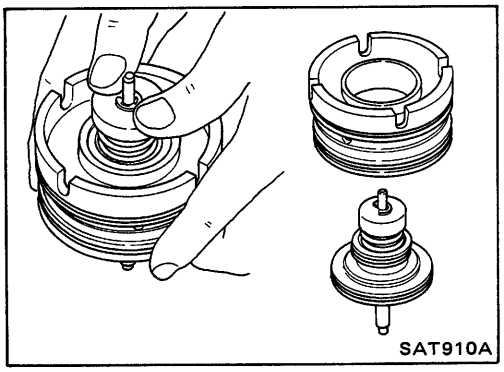
Band Servo Piston Assembly — RE4R01A and RL4R01A



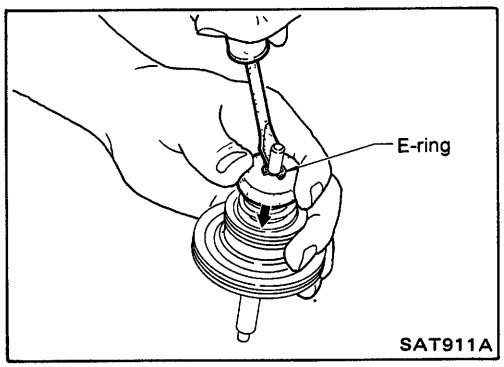


DISASSEMBLY

1. Block one oil hole in O.D. servo piston retainer and the center hole in O.D. band servo piston.
2. Apply compressed air to the other oil hole in piston retainer to remove O.D. band servo piston from retainer.
3. Remove D-ring from O.D. band servo piston.

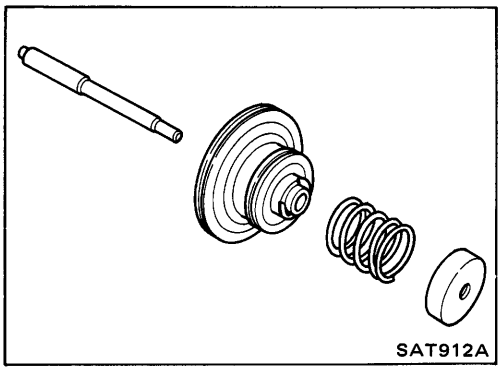


4. Remove band servo piston assembly from servo piston retainer by pushing it forward.

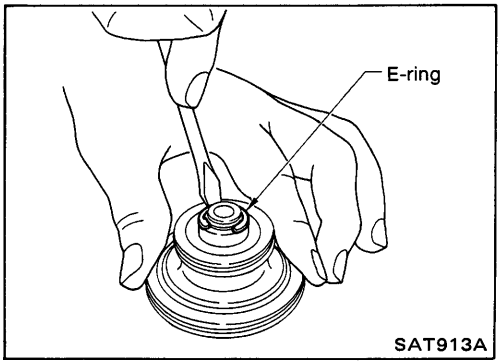


5. Place piston stem end on a wooden block. While pushing servo piston spring retainer down, remove E-ring.

Band Servo Piston Assembly — RE4R01A and RL4R01A (Cont'd)

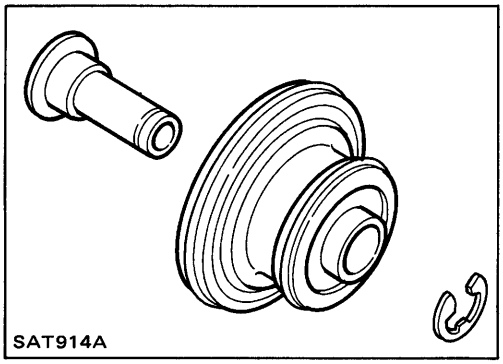

SAT912A

6. Remove servo piston spring retainer, return spring C and piston stem from band servo piston.

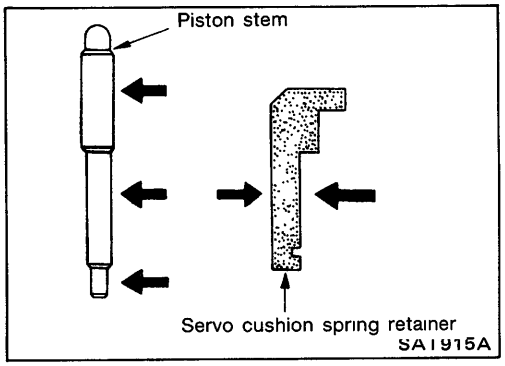


SAT913A

7. Remove E-ring from band servo piston.


SAT914A

8. Remove servo cushion spring retainer from band servo piston.
9. Remove D-rings from band servo piston.
10. Remove O-rings from servo piston retainer.

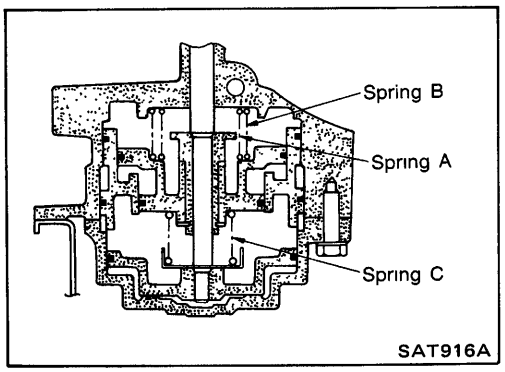


SAT915A

INSPECTION

Pistons, retainers and piston stem

- Check frictional surfaces for abnormal wear or damage.



SAT916A

Return springs

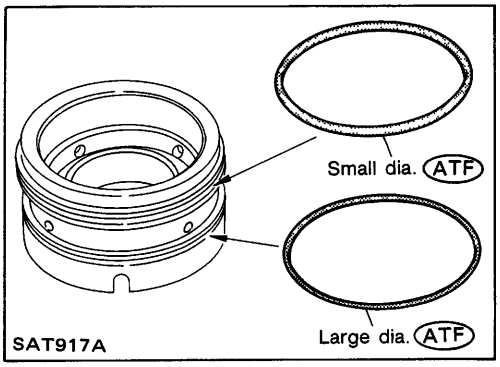
- Check for deformation or damage. Measure free length and outer diameter.

Inspection standard Unit: mm (in)

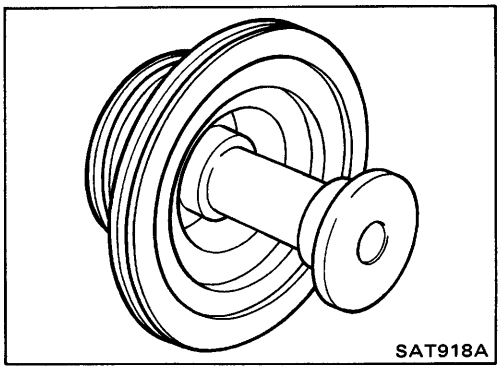
Parts	Free length	Outer diameter
Spring A	45.6 (1.795)	34.3 (1.350)
Spring B	53.8 (2.118)	40.3 (1.587)
Spring C	29.0 (1.142)	27.6 (1.087)

Band Servo Piston Assembly — RE4R01A and RL4R01A (Cont'd)

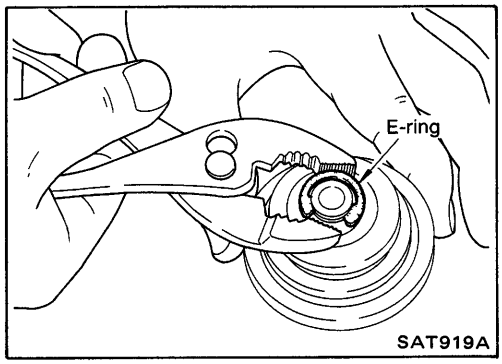
ASSEMBLY



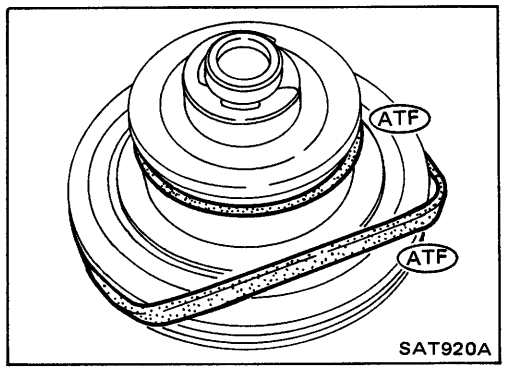
1. Install O-rings onto servo piston retainer.
   - **Apply A.T.F. to O-rings.**
   - **Pay attention to position of each O-ring.**



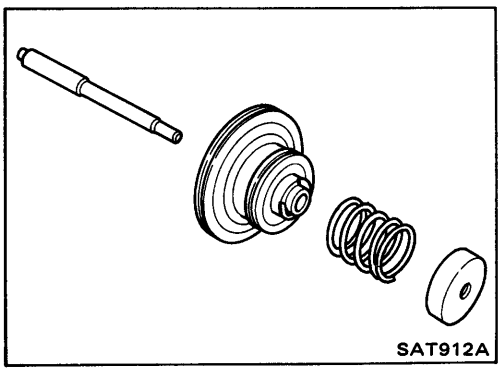
2. Install servo cushion spring retainer onto band servo piston.



3. Install E-ring onto servo cushion spring retainer.

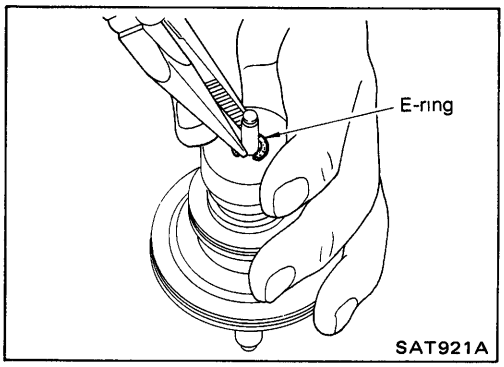


4. Install D-rings onto band servo piston.
   - **Apply A.T.F. to D-rings.**

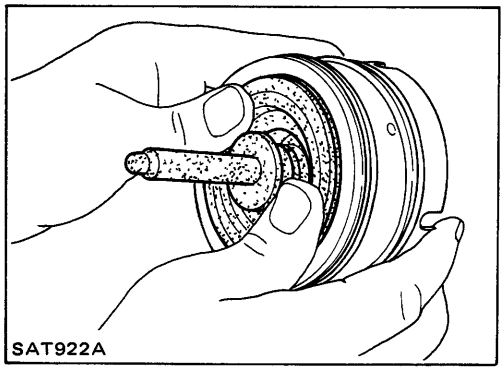


5. Install servo piston spring retainer, return spring C and piston stem onto band servo piston.

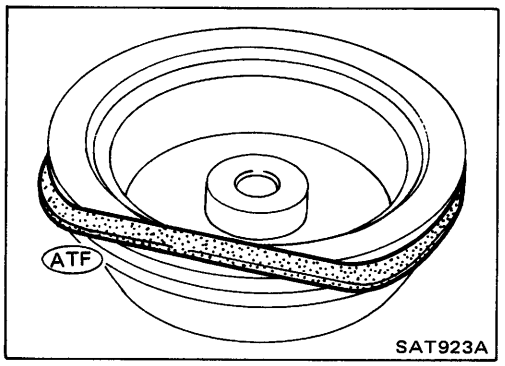
Band Servo Piston Assembly — RE4R01A and RL4R01A (Cont'd)



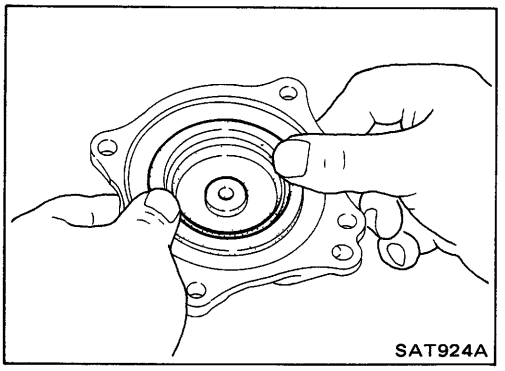
6. Place piston stem end on a wooden block. While pushing servo piston spring retainer down, install E-ring.



7. Install band servo piston assembly onto servo piston retainer by pushing it inward.

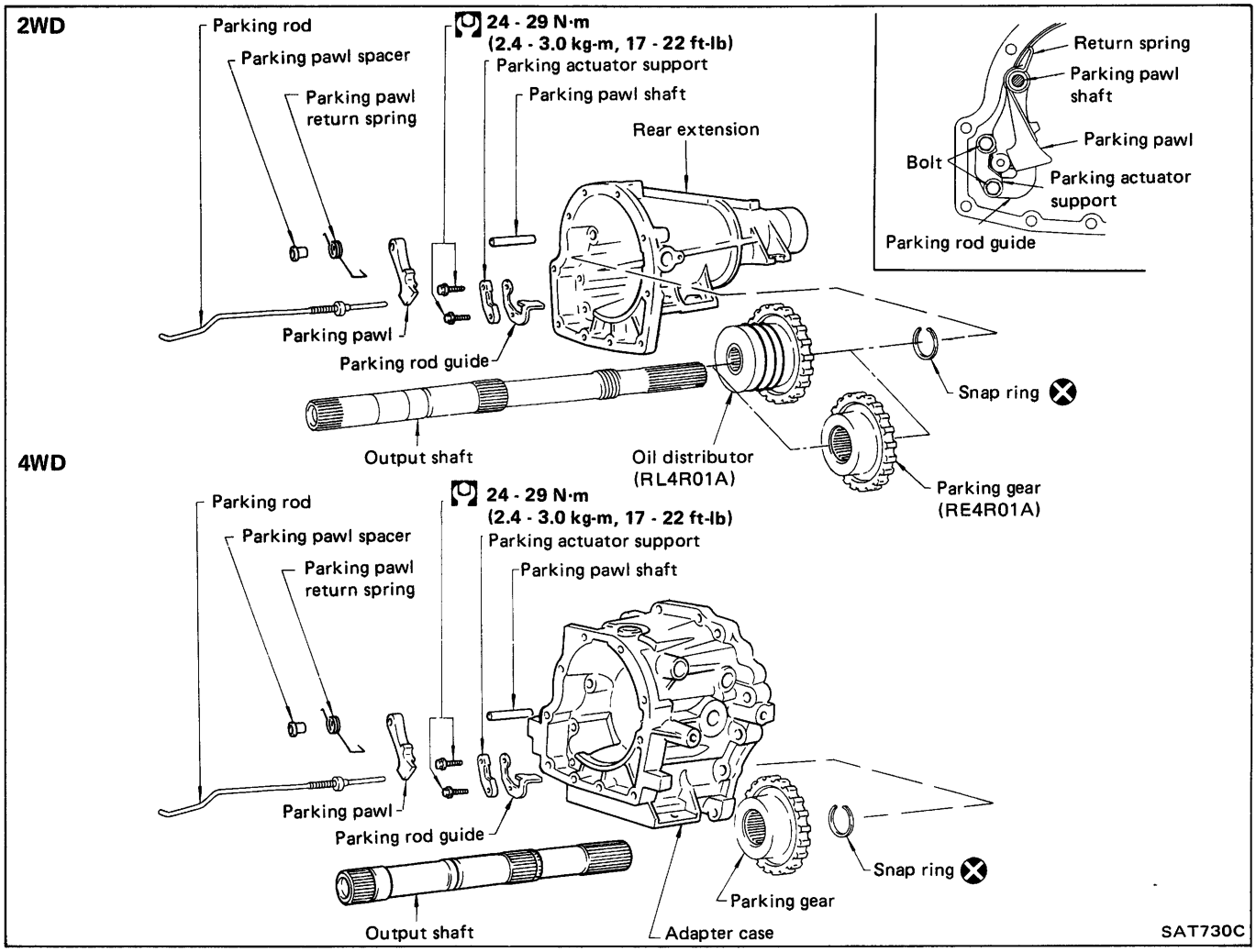


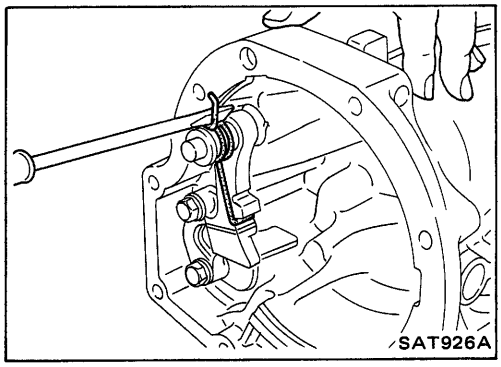
8. Install D-ring on O.D. band servo piston.
- **Apply A.T.F. to D-ring.**



9. Install O.D. band servo piston onto servo piston retainer by pushing it inward.

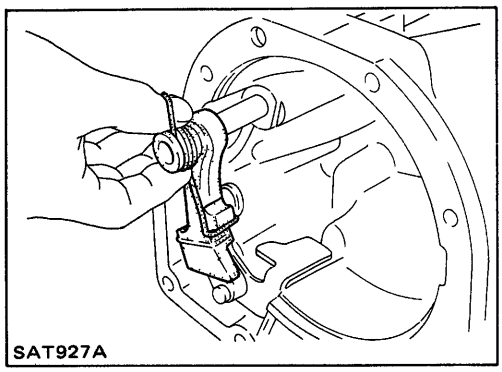
Parking Pawl Components — RE4R01A and RL4R01A





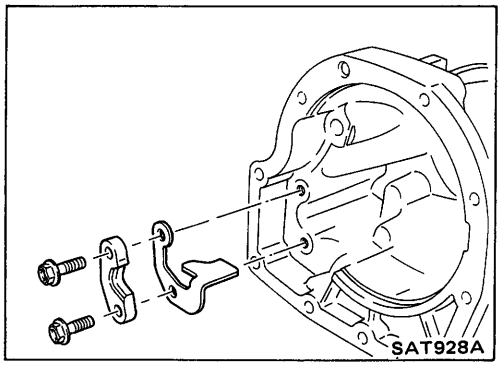
DISASSEMBLY

1. Slide return spring to the front of adapter case flange.



2. Remove return spring, pawl spacer and parking pawl from adapter case.
3. Remove parking pawl shaft from adapter case.

Parking Pawl Components — RE4R01A and RL4R01A (Cont'd)

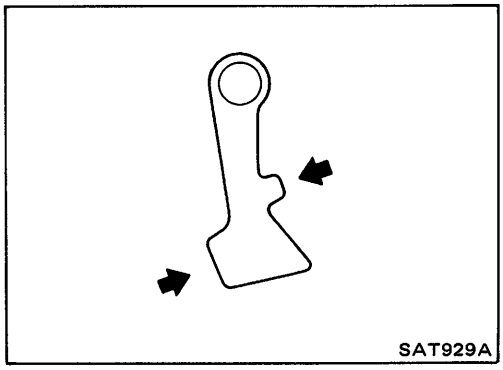

SAT928A

4. Remove parking actuator support and rod guide from adapter case.

INSPECTION

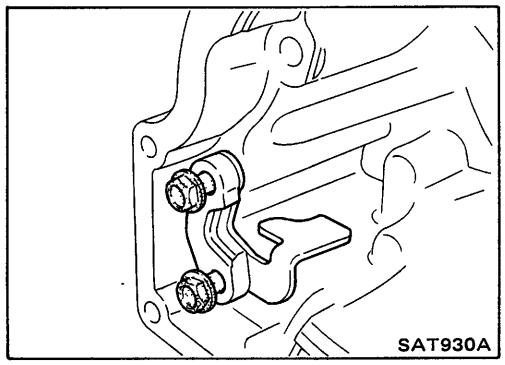
Parking pawl and parking actuator support

- Check contact surface of parking rod for wear.

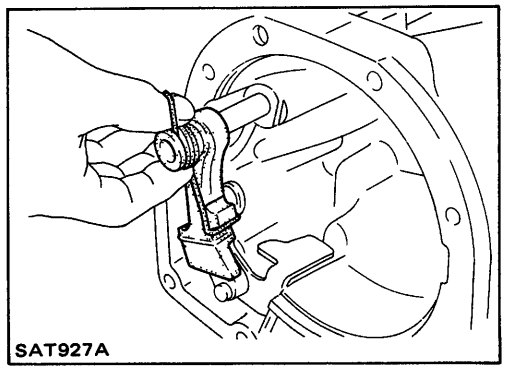

SAT929A

ASSEMBLY

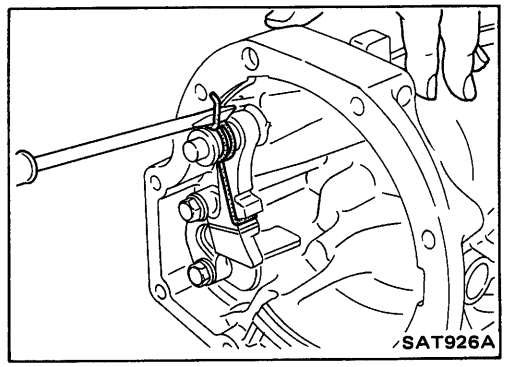
1. Install rod guide and parking actuator support onto adapter case.
2. Insert parking pawl shaft into adapter case.

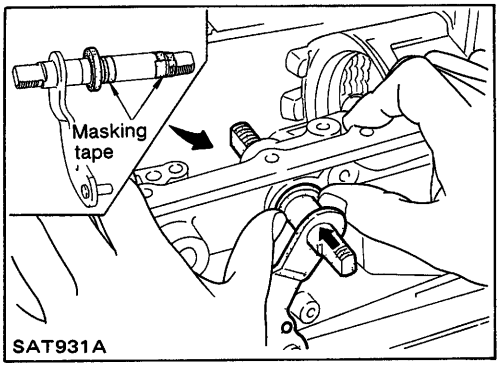

SAT930A

3. Install return spring, pawl spacer and parking pawl onto parking pawl shaft.


SAT927A

4. Bend return spring upward and install it onto adapter case.


SAT926A



Assembly

— RE4R01A and RL4R01A —

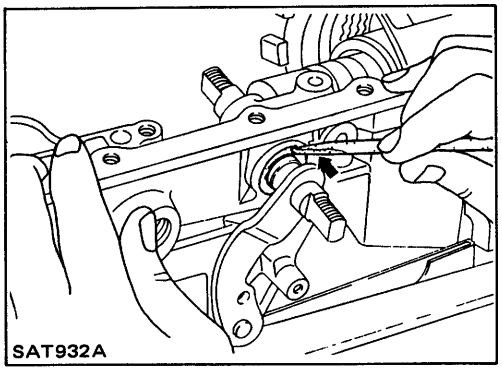
1. Install manual shaft components.

a. Install oil seal onto manual shaft.

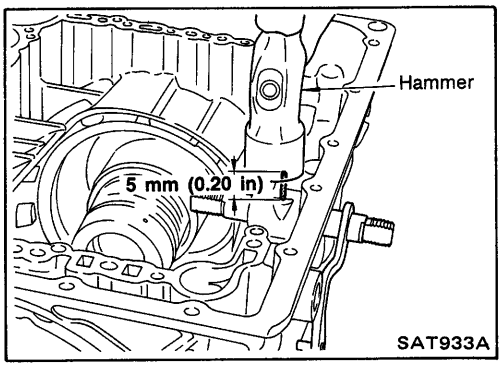
- **Apply A.T.F. to oil seal.**
- **Wrap threads of manual shaft with masking tape.**

b. Insert manual shaft and oil seal as a unit into transmission case.

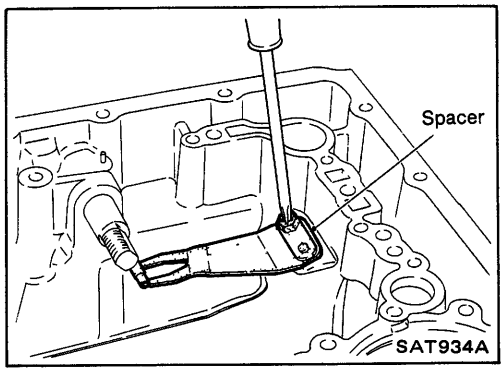
c. Remove masking tape.



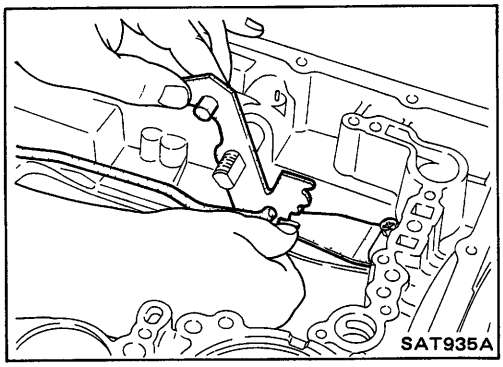
d. Push oil seal evenly and install it onto transmission case.



e. Align groove in shaft with drive pin hole, then drive pin into position as shown in figure at left.

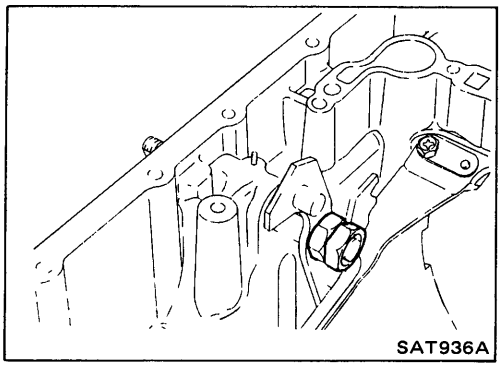


f. Install detent spring and spacer.

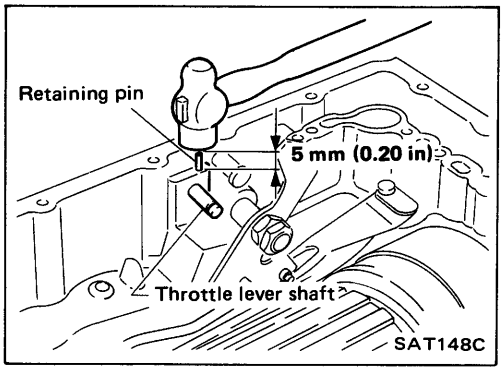


g. While pushing detent spring down, install manual plate onto manual shaft.

Assembly (Cont'd)



h. Install lock nuts onto manual shaft.

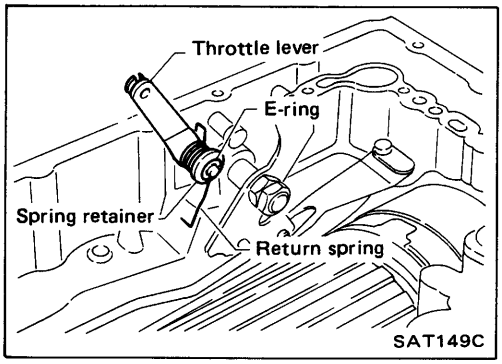


— **RL4R01A** —

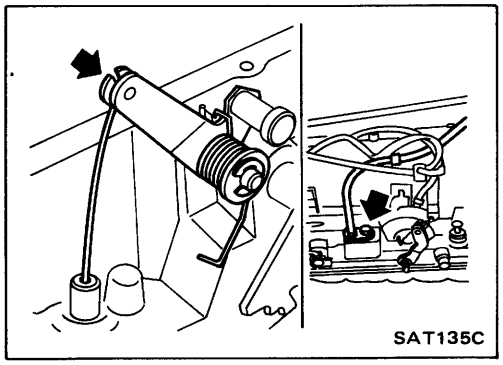
2. Install throttle lever components.

a. Install throttle lever shaft.

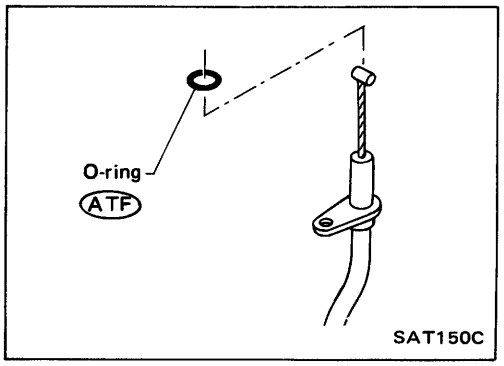
b. Align groove in shaft with drive pin hole, then drive pin into position as shown in figure at left.



c. Install throttle lever, return spring, spring retainer and E-ring.

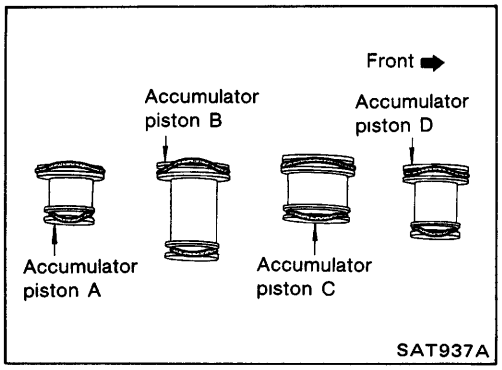


d. Install throttle wire.



- **Apply A.T.F. to O-ring.**

Assembly (Cont'd)



— **RE4R01A and RL4R01A** —

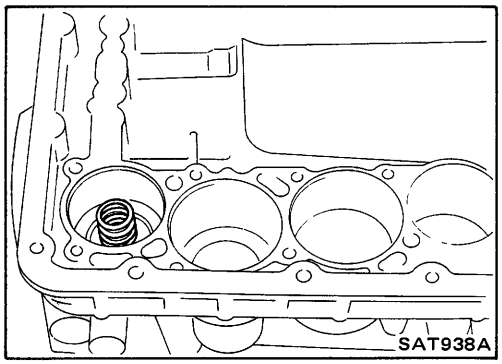
3. Install accumulator piston.

a. Install O-rings onto accumulator piston.

- **Apply A.T.F. to O-rings.**

Accumulator piston O-rings Unit: mm (in)

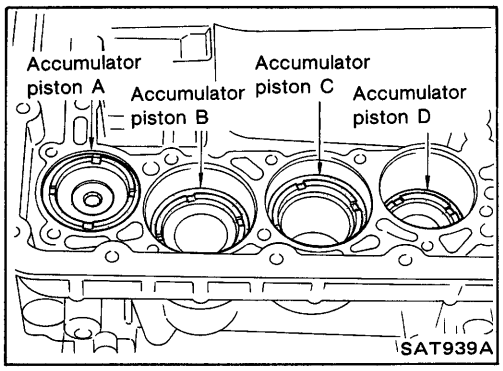
Accumulator	A	B	C	D
Small diameter end	29 (1.14)	32 (1.26)	45 (1.77)	29 (1.14)
Large diameter end	45 (1.77)	50 (1.97)	50 (1.97)	45 (1.77)



b. Install return spring for accumutator A onto transmission case.

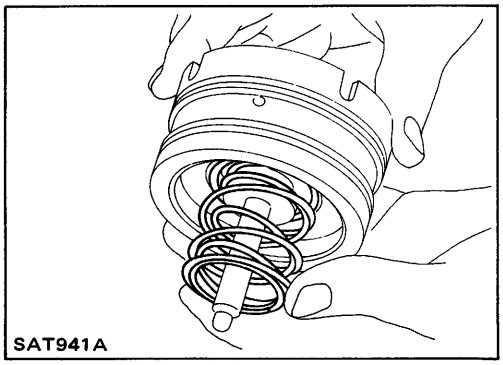
Free length of return spring Unit: mm (in)

Accumulator	A
Free length	43 (1.69)



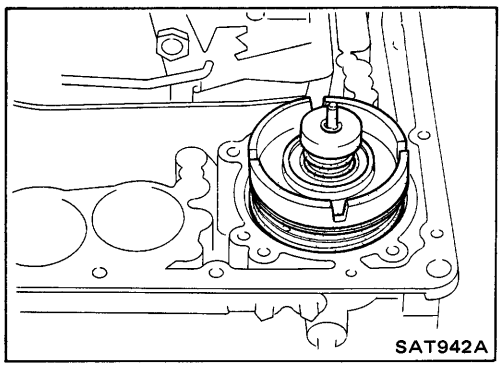
c. Install accumulator pistons A, B, C and D.

- **Apply A.T.F. to transmission case.**



4. Install band servo piston.

a. Install return springs onto servo piston.

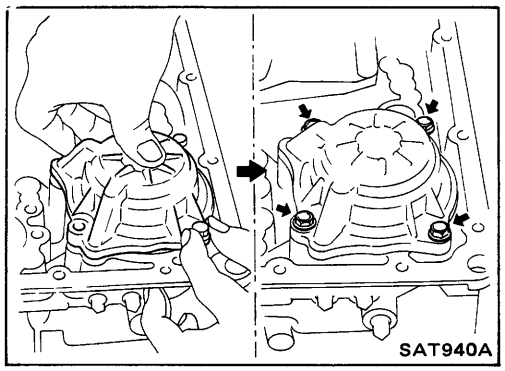


b. Install band servo piston onto transmission case.

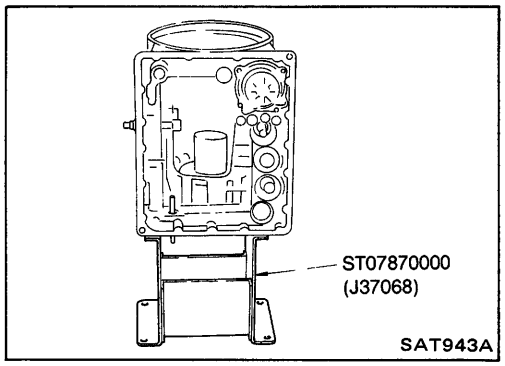
- **Apply A.T.F. to O-ring of band servo piston and transmission case.**

c. Install gasket for band servo onto transmission case.

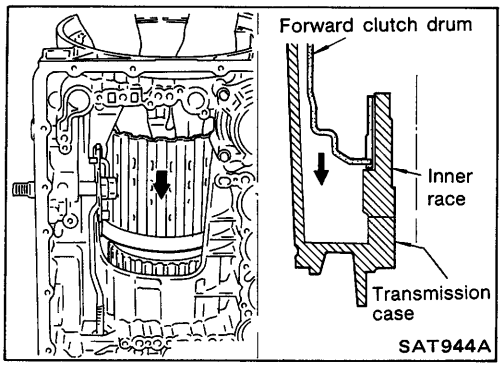
Assembly (Cont'd)



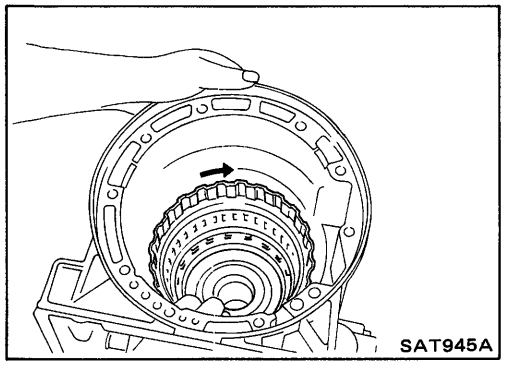
d. Install band servo retainer onto transmission case.



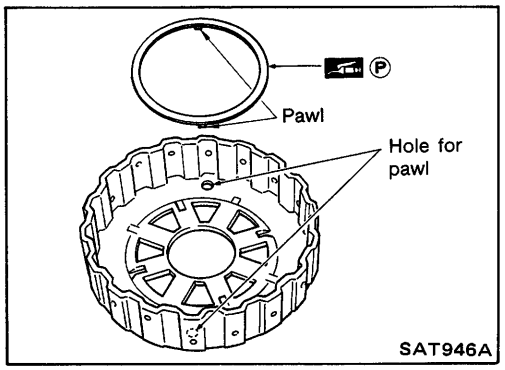
5. Install rear side clutch and gear components.
a. Place transmission case in vertical position.



b. Slightly lift forward clutch drum assembly and slowly rotate it clockwise until its hub passes fully over the clutch inner race inside transmission case.

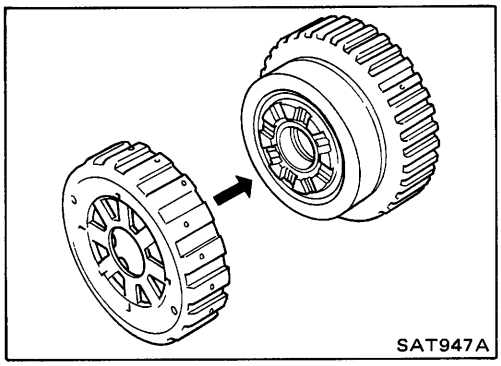


c. Check to be sure that rotation direction of forward clutch assembly is correct.

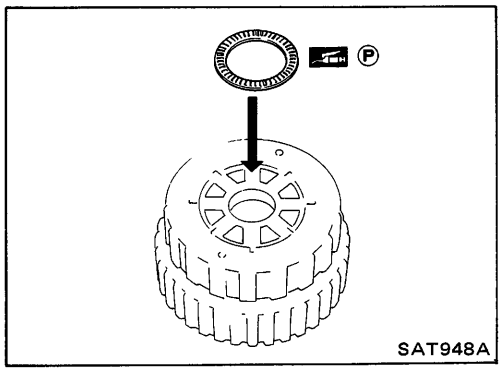


d. Install thrust washer onto front of overrun clutch hub.
- **Apply petroleum jelly to the thrust washer.**
- **Insert pawls of thrust washer securely into holes in overrun clutch hub.**

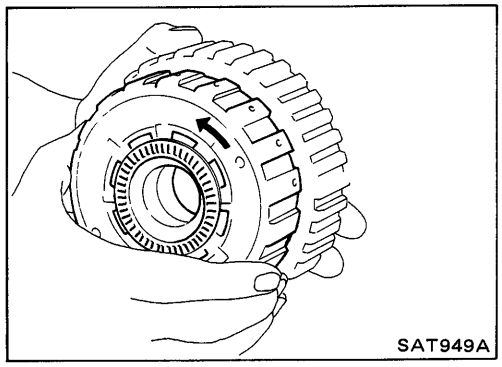
Assembly (Cont'd)



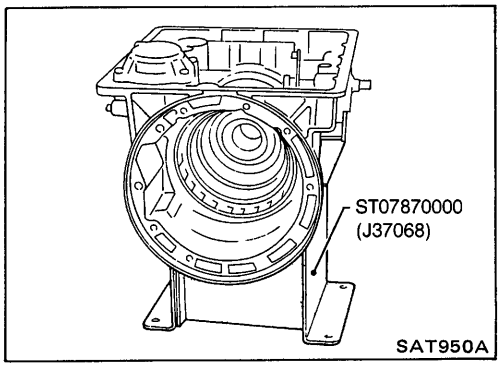
e. Install overrun clutch hub onto rear internal gear assembly.



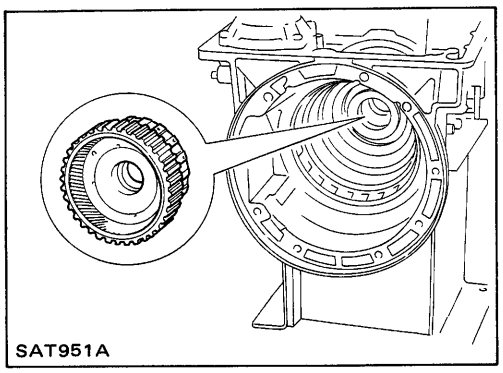
f. Install needle bearing onto rear of overrun clutch hub.
- **Apply petroleum jelly to needle bearing.**



g. Check that overrun clutch hub rotates as shown while holding forward clutch hub.

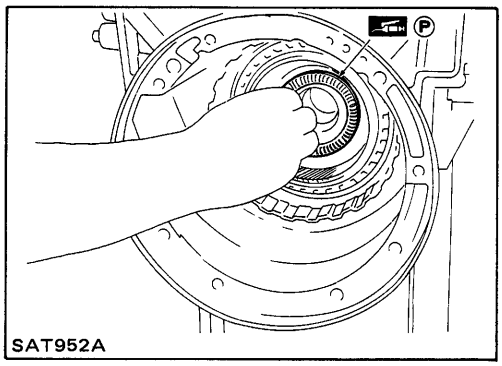


h. Place transmission case into horizontal position.

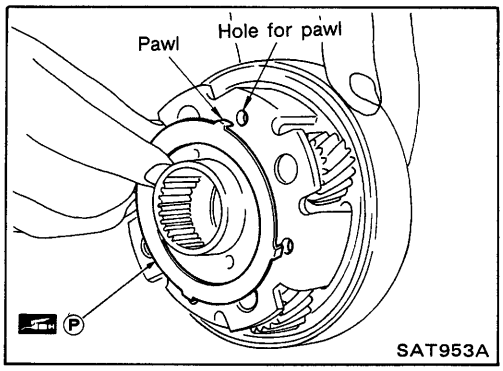


i. Install rear internal gear, forward clutch hub and overrun clutch hub as a unit onto transmission case.

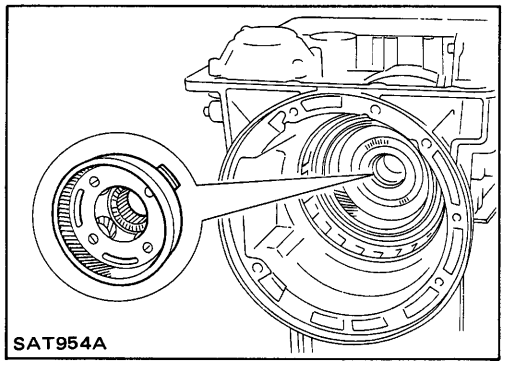
Assembly (Cont'd)



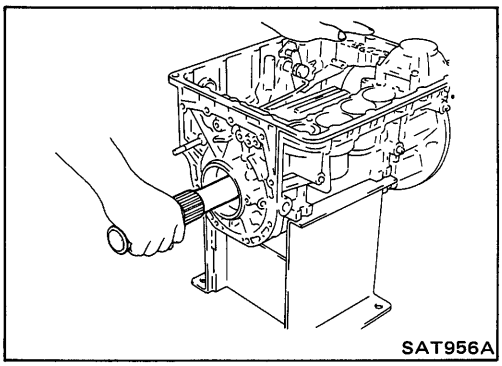
j. Install needle bearing onto rear internal gear.
- **Apply petroleum jelly to needle bearing.**



k. Install bearing race onto rear of front internal gear.
- **Apply petroleum jelly to bearing race.**
- **Securely engage pawls of bearing race with holes in front internal gear.**

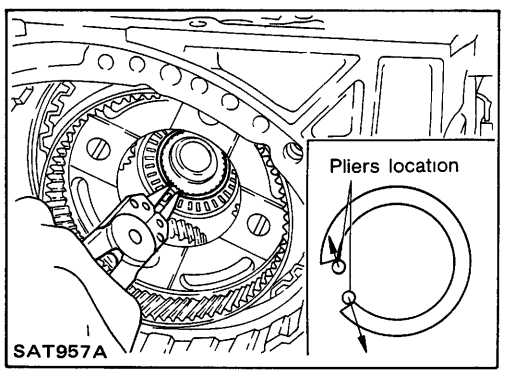


l. Install front internal gear on transmission case.



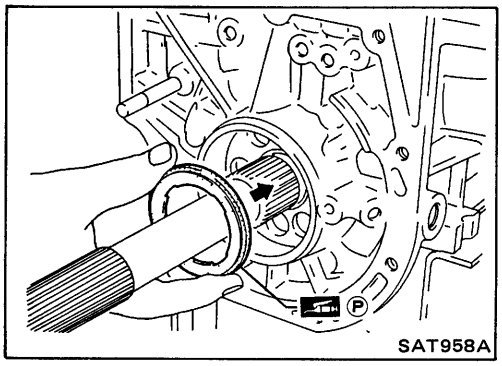
6. Install output shaft and parking gear.

a. Insert output shaft from rear of transmission case while slightly lifting front internal gear.
- **Do not force output shaft against front of transmission case.**

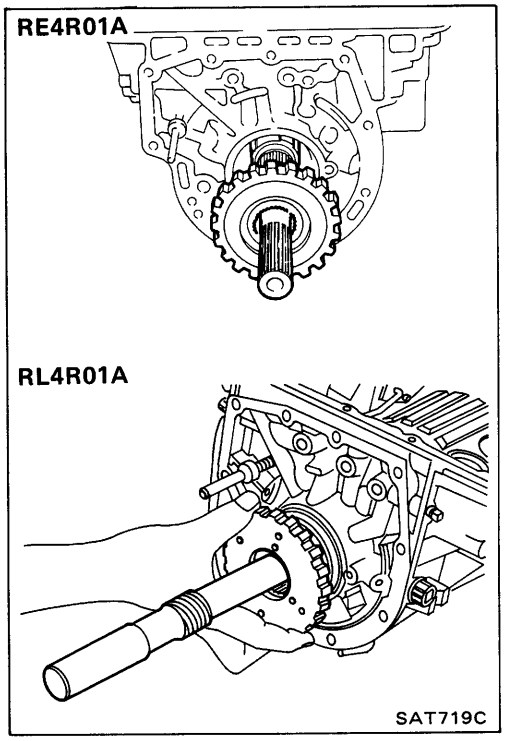


b. Carefully push output shaft against front of transmission case. Install snap ring on front of output shaft.
- **Check to be sure output shaft cannot be removed in rear direction.**

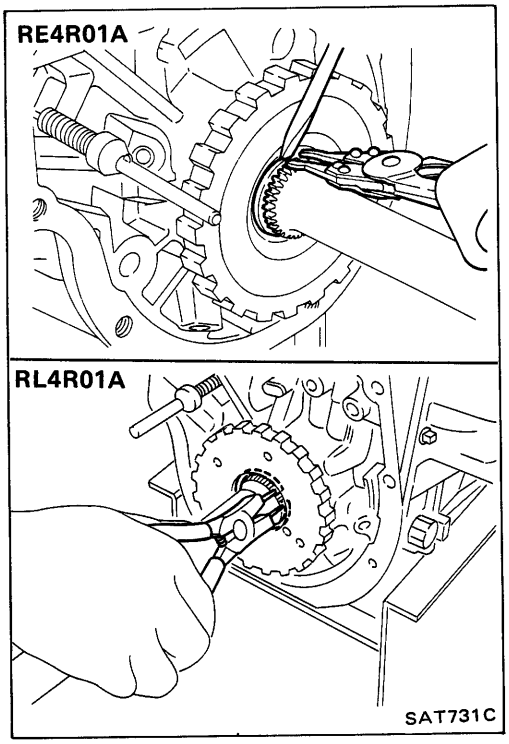
Assembly (Cont'd)



c. Install needle bearing on transmission case.
- **Pay attention to its direction — Black side goes to front.**
- **Apply petroleum jelly to needle bearing.**

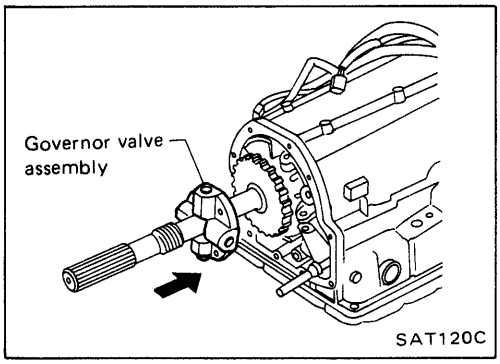


d. Install parking gear on transmission case.



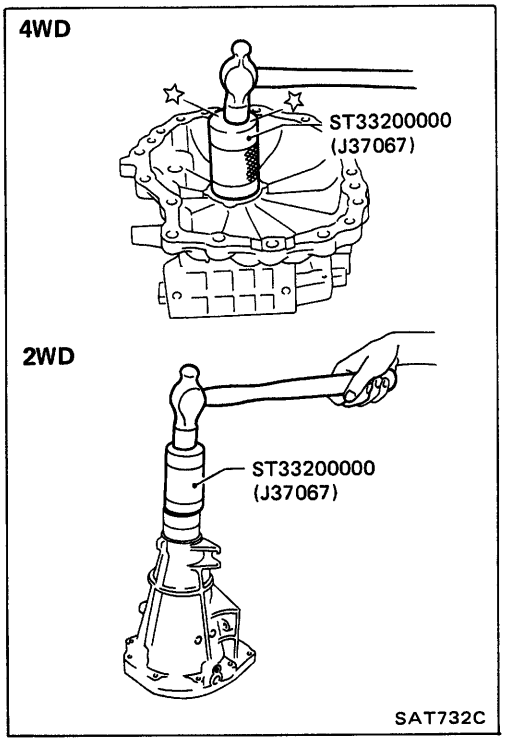
e. Install snap ring on rear of output shaft.
- **Check to be sure output shaft cannot be removed in forward direciton.**

Assembly (Cont'd)



— **RL4R01A** —

f. Install governor valve assembly on oil distributor.

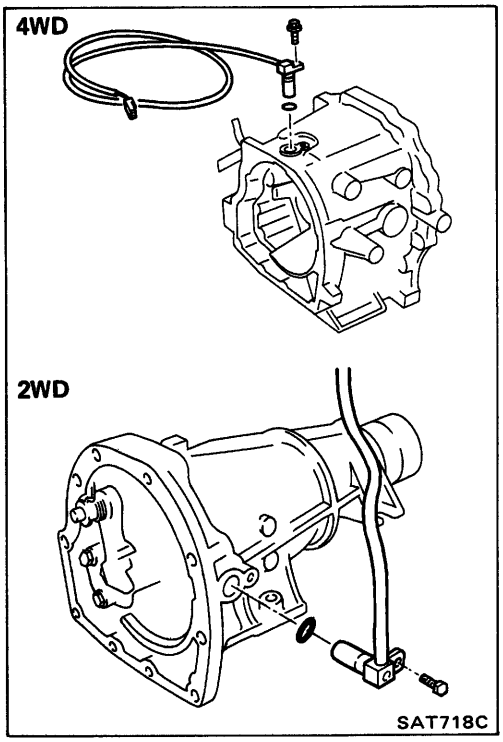


— **RE4R01A and RL4R01A** —

7. Install rear extension or adapter case.

a. Install oil seal on rear extension or adapter case.

- **Apply A.T.F. to oil seal.**



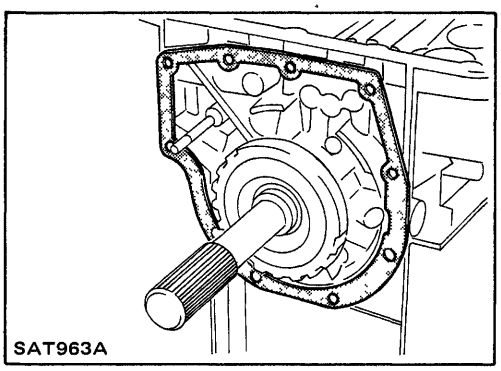
— **RE4R01A** —

b. Install O-ring on revolution sensor.

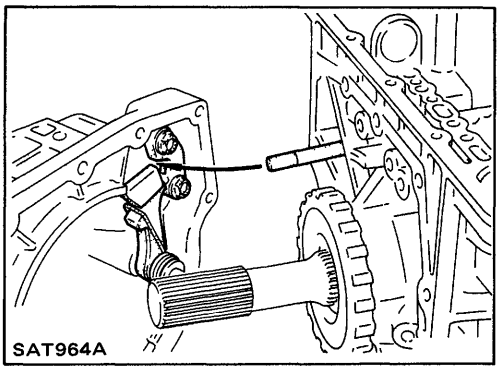
- **Apply A.T.F. to O-ring.**

c. Install revolution sensor on rear extension or adapter case.

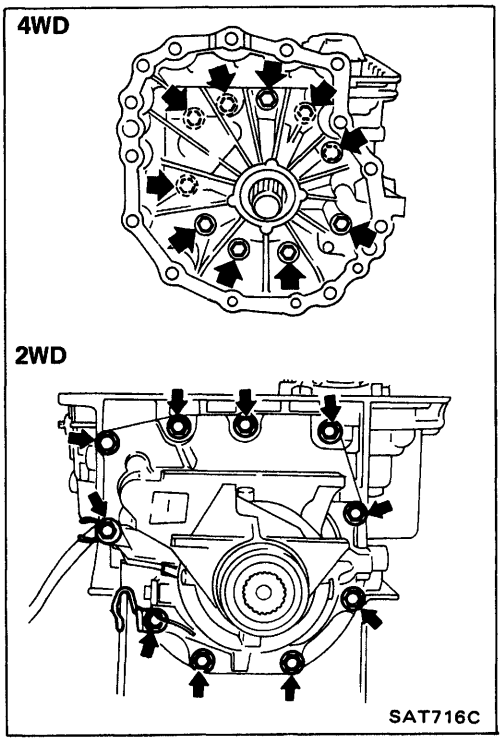
Assembly (Cont'd)


SAT963A

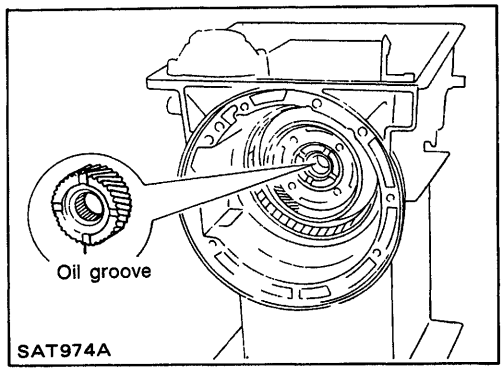
d. Install adapter case gasket or rear extension case gasket on transmission case.


SAT964A

e. Install parking rod on transmission case.

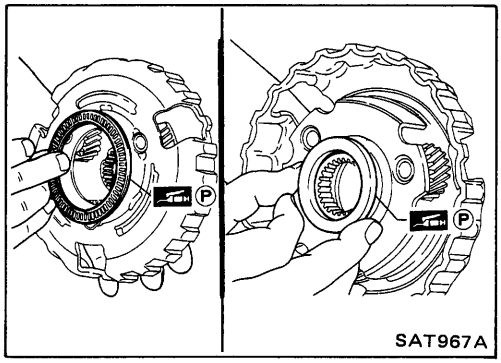


f. Install rear extension or adapter case on transmission case.



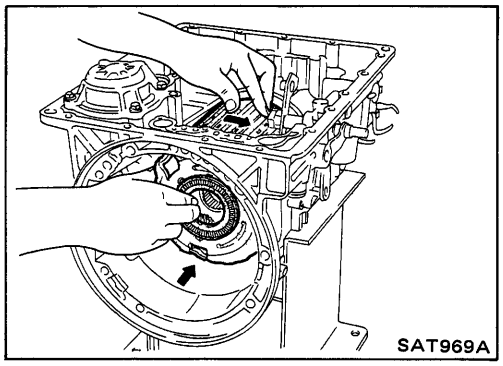
8. Install front side clutch and gear components.
a. Install rear sun gear on transmission case.
- **Pay attention to its direction.**

Assembly (Cont'd)

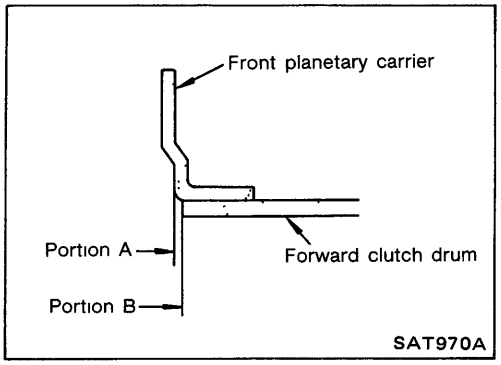


b. Install needle bearing on front of front planetary carrier.
- **Apply petroleum jelly to needle bearing.**

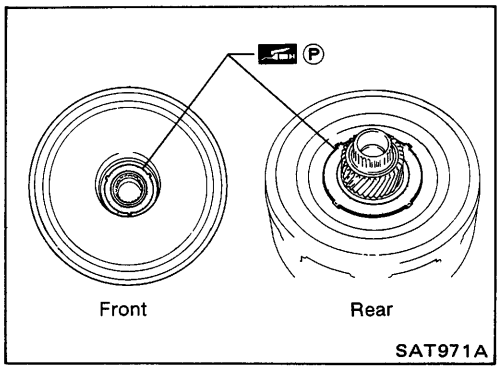
c. Install needle bearing on rear of front planetary carrier.
- **Apply petroleum jelly to bearing.**
- **Pay attention to its direction — Black side goes to front.**



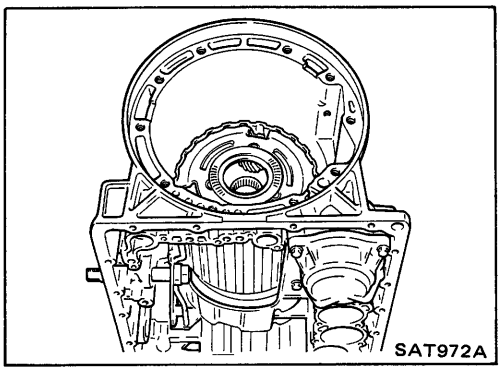
d. While rotating forward clutch drum clockwise, install front planetary carrier on forward clutch drum.



- **Check that portion A of front planetary carrier protrudes approximately 2 mm (0.08 in) beyond portion B of forward clutch assembly.**



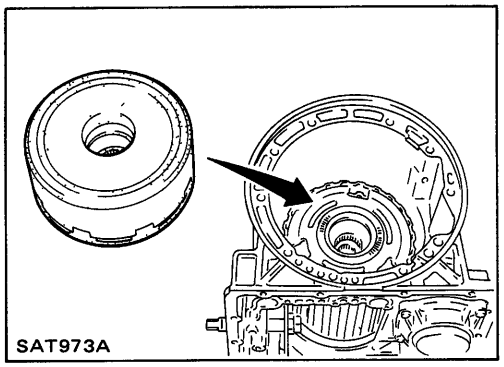
e. Install bearing races on front and rear of clutch pack.
- **Apply petroleum jelly to bearing races.**
- **Securely engage pawls of bearing races with holes in clutch pack.**



f. Place transmission case in vertical position.

Assembly (Cont'd)

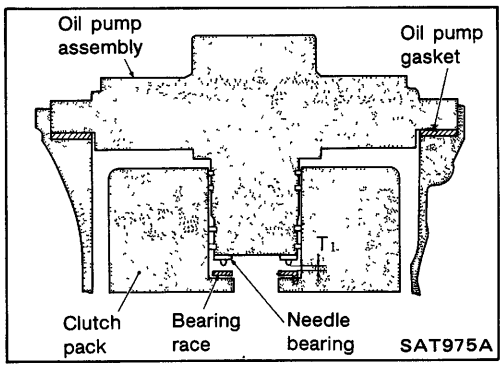
g. Install clutch pack into transmission case.



Adjustment

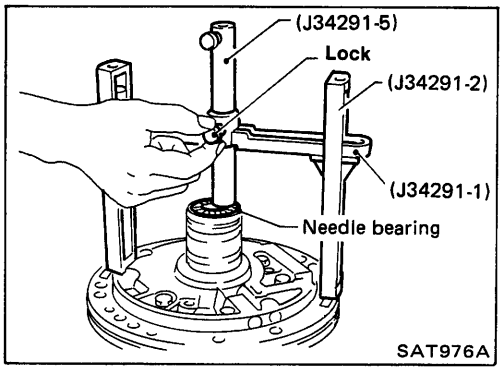
When any parts listed in the following table are replaced, total end play or reverse clutch end play must be adjusted.

Part name \ Item	Total end play	Reverse clutch end play
Transmission case	●	●
Low one-way clutch inner race	●	●
Overrun clutch hub	●	●
Rear internal gear	●	●
Rear planetary carrier	●	●
Rear sun gear	●	●
Front planetary carrier	●	●
Front sun gear	●	●
High clutch hub	●	●
High clutch drum	●	●
Oil pump cover	●	●
Reverse clutch drum	–	●

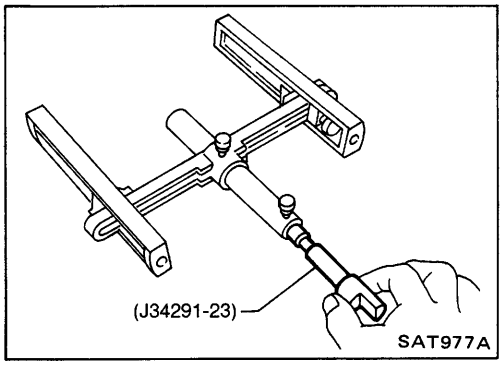


1. Adjust total end play.
   Total end play "T_1":
   0.25 - 0.55 mm (0.0098 - 0.0217 in)

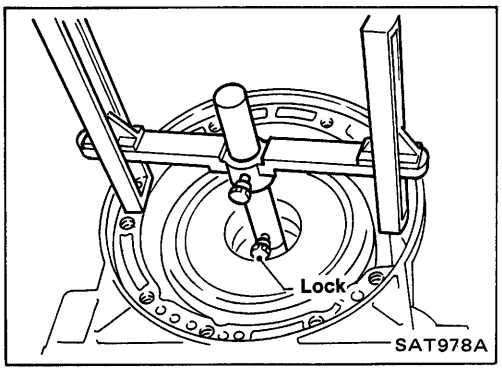
Adjustment (Cont'd)



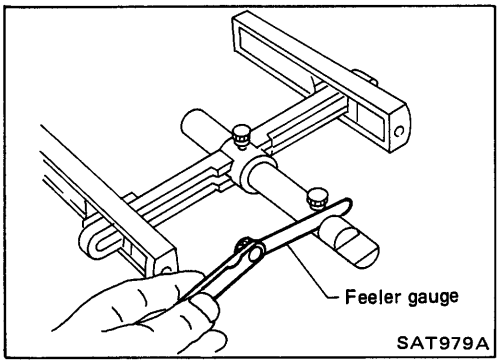
a. With needle bearing installed, place J34291-1 (bridge), J34291-2 (legs) and the J34291-5 (gauging cylinder) onto oil pump. The long ends of legs should be placed firmly on machined surface of oil pump assembly and gauging cylinder should rest on top of the needle bearing. Lock gauging cylinder in place with set screw.



b. Install J34291-23 (gauging plunger) into gauging cylinder.



c. With original bearing race installed inside reverse clutch drum, place shim selecting gauge with its legs on machined surface of transmission case (no gasket) and allow gauging plunger to rest on bearing race. Lock gauging plunger in place with set screw.



d. Remove Tool and use feeler gauge to measure gap between gauging cylinder and gauging plunger. This measurement should give exact total end play.

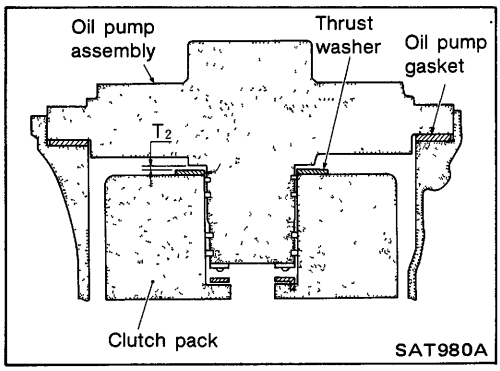
Total end play "T_1":

0.25 - 0.55 mm (0.0098 - 0.0217 in)

- If end play is out of specification, decrease or increase thickness of oil pump cover bearing race as necessary.

Available oil pump cover bearing race:

Refer to S.D.S.

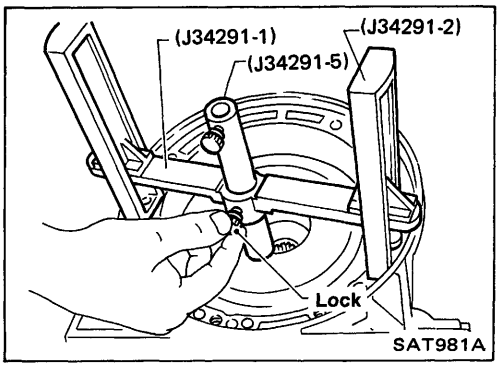


2. Adjust reverse clutch drum end play.

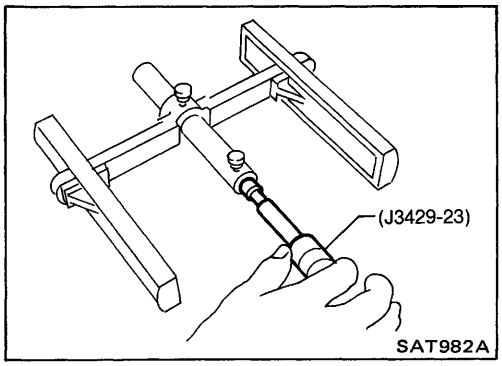
Reverse clutch drum end play "T_2":

0.55 - 0.90 mm (0.0217 - 0.0354 in)

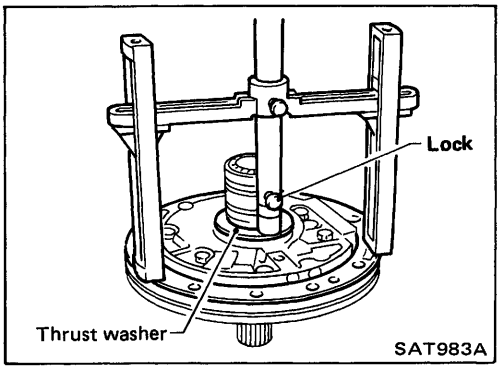
Adjustment (Cont'd)



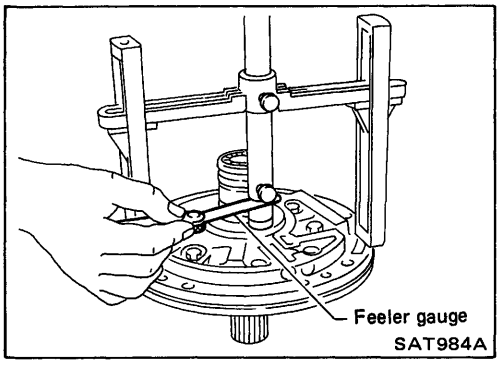
a. Place J34291-1 (bridge), J34291-2 (legs) and J34291-5 (gauging cylinder) on machined surface of transmission case (no gasket) and allow gauging cylinder to rest on front thrust surface of reverse clutch drum. Lock cylinder in place with set screw.



b. Install J34291-23 (gauging plunger) into gauging cylinder.



c. With original thrust washer installed on oil pump, place shim setting gauge legs onto machined surface of oil pump assembly and allow gauging plunger to rest on thrust washer. Lock plunger in place with set screw.



d. Use feeler gauge to measure gap between gauging plunger and gauging cylinder. This measurement should give you exact reverse clutch drum and play.

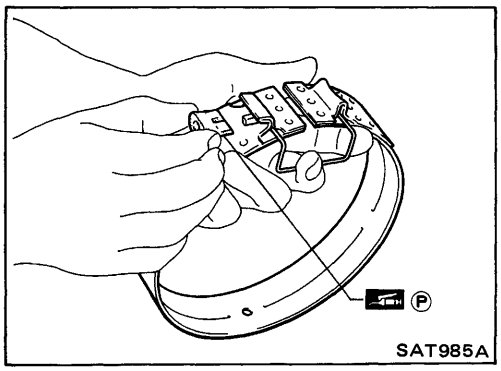
Reverse clutch drum end play "T_2":

0.55 - 0.90 mm (0.0217 - 0.0354 in)

- If end play is out of specification, decrease or increase thickness of oil pump thrust washer as necessary.

Available oil pump thrust washer:

Refer to S.D.S.



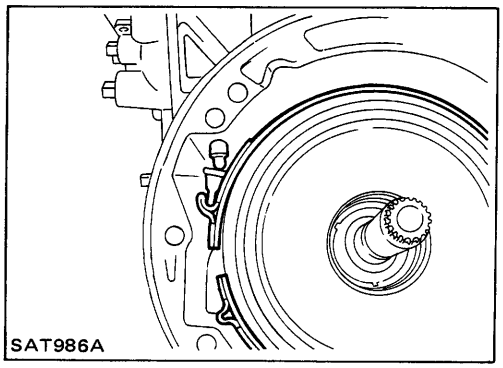
Assembly

1. Place transmission case into horizontal position.
2. Install brake band and band strut.

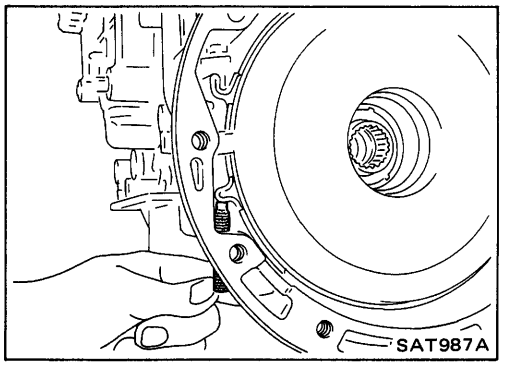
a. Install band strut on brake band.

- **Apply petroleum jelly to band strut.**

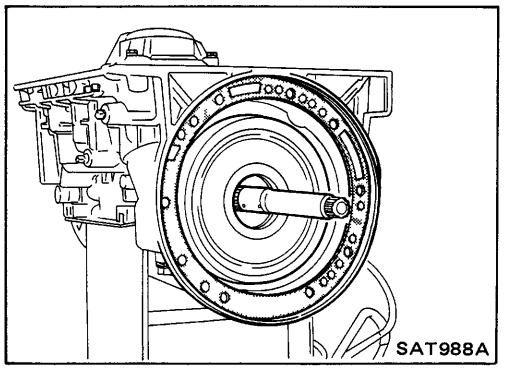
Assembly (Cont'd)



b. Place brake band on periphery of reverse clutch drum, and insert band strut into end of band servo piston stem.

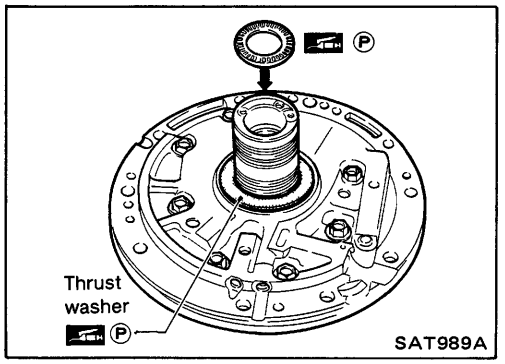


c. Install anchor end bolt on transmission case. Then, tighten anchor end bolt just enough so that reverse clutch drum (clutch pack) will not tilt forward.



3. Install input shaft on transmission case.
- **Pay attention to its direction — O-ring groove side is front.**

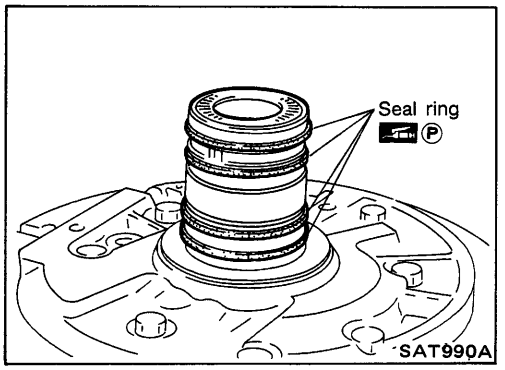
4. Install gasket on transmission case.



5. Install oil pump assembly.

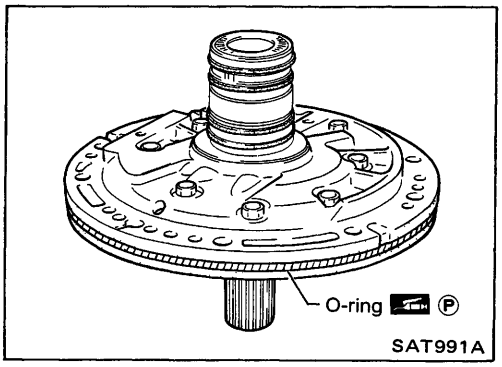
a. Install needle bearing on oil pump assembly.
- **Apply petroleum jelly to the needle bearing.**

b. Install selected thrust washer on oil pump assembly.
- **Apply petroleum jelly to thrust washer.**

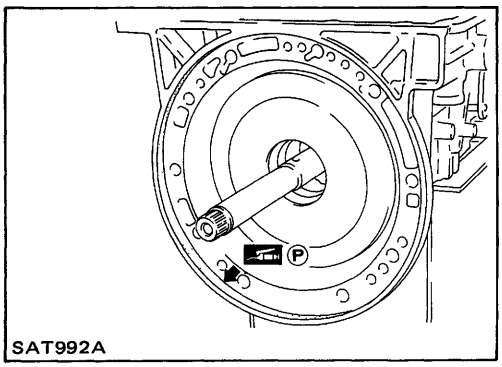


c. Carefully install seal rings into grooves and press them into the petroleum jelly so that they are a tight fit.

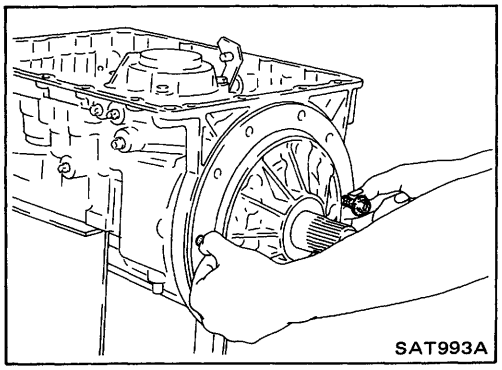
Assembly (Cont'd)



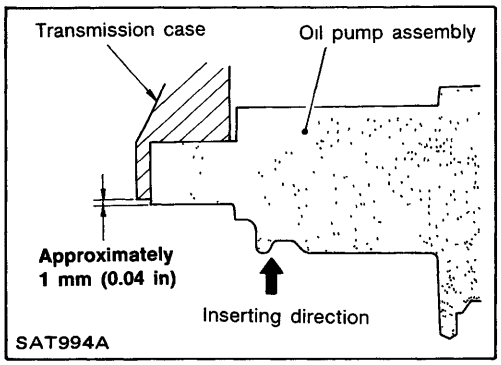
d. Install O-ring on oil pump assembly.
- **Apply petroleum jelly to O-ring.**



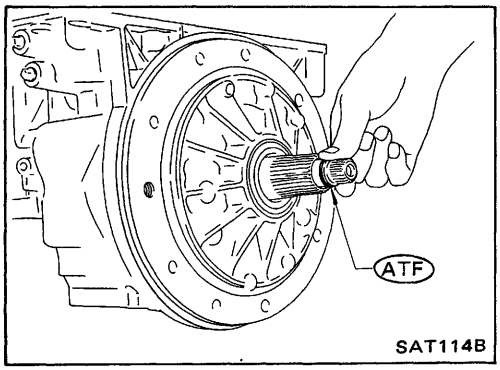
e. Apply petroleum jelly to mating surce of transmission case and oil pump assembly.



f. Install oil pump assembly.
- **Install two converter housing securing bolts in bolt holes in oil pump assembly as guides.**

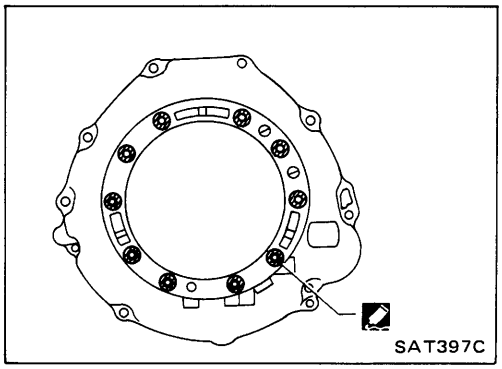


- **Insert oil pump assembly to the specified position in transmission, as shown at left.**

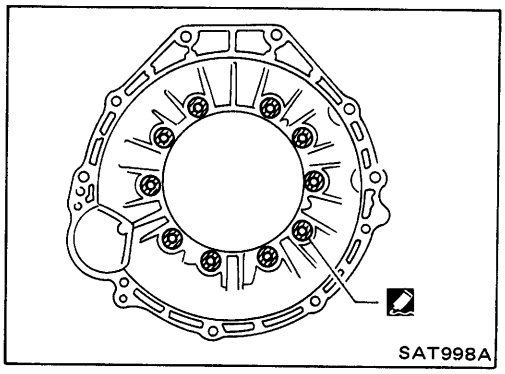


6. Install O-ring on input shaft.
- **Apply A.T.F. to O-rings.**

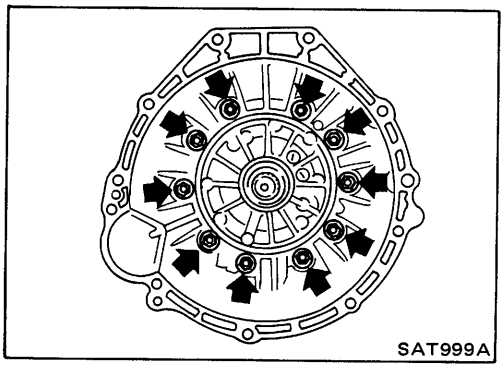
Assembly (Cont'd)


SAT397C

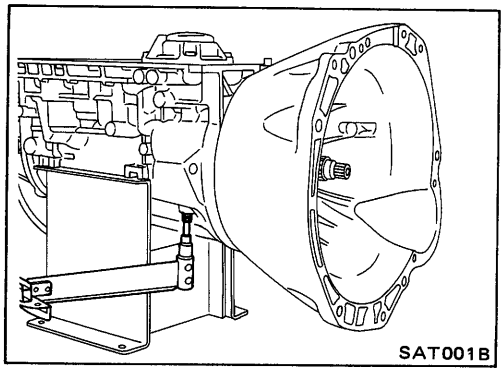
7. Install converter housing.
a. Apply recommended sealant (Nissan genuine part: KP610-00250 or equivalent) to outer periphery of bolt holes in converter housing.
- **Do not apply too much sealant.**


SAT998A

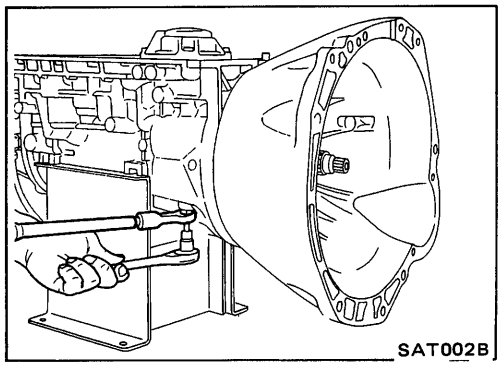
b. Apply recommended sealant (Nissan genuine part: KP610-00250 or equivalent) to seating surfaces of bolts that secure front of converter housing.


SAT999A

c. Install converter housing on transmission case.


SAT001B

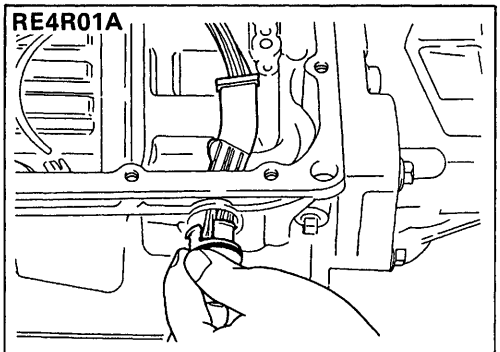
8. Adjust brake band.
a. Tighten anchor end bolt to specified torque.
: Anchor end bolt
4 - 6 N·m
(0.4 - 0.6 kg-m, 2.9 - 4.3 ft-lb)
b. Back off anchor end bolt two and a half turns.


SAT002B

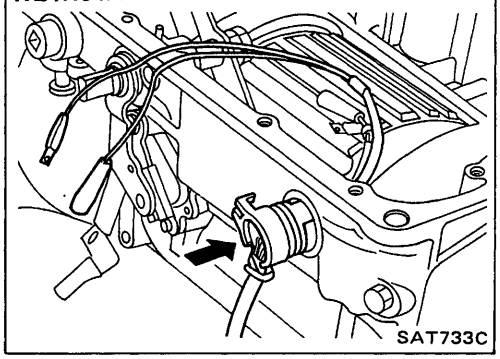
c. While holding anchor end pin, tighten lock nut.

Assembly (Cont'd)

RE4R01A



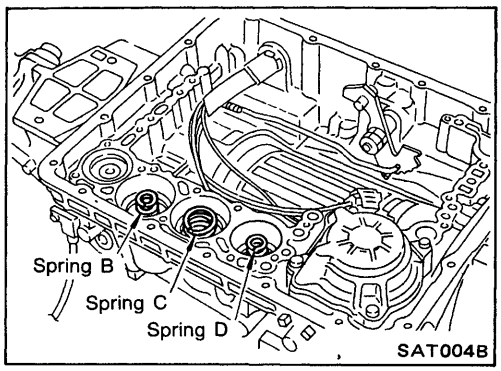
RL4R01A



SAT733C

9. Install terminal cord assembly.
a. Install O-ring on terminal cord assembly.
- **Apply petroleum jelly to O-ring.**

b. Compress terminal cord assembly stopper and install terminal cord assembly on transmission case.

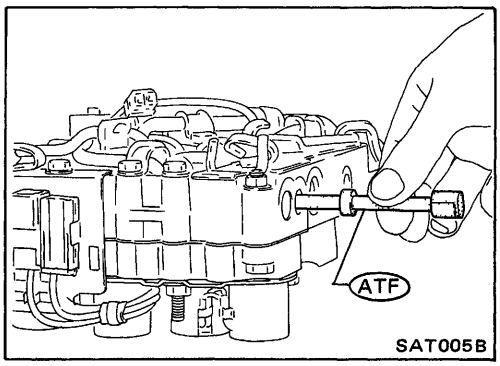


SAT004B

10. Install control valve assembly.
a. Install accumulator piston return springs B, C and D.

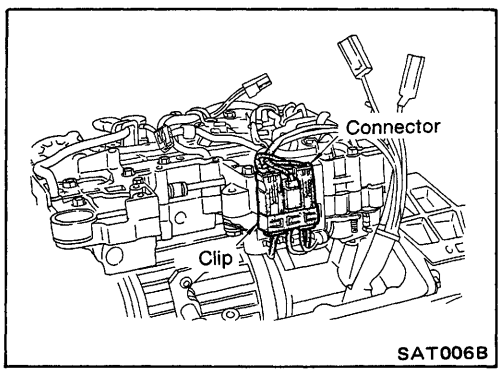
Free length of return springs Unit: mm (in)

Item \ Accumulator	B	C	D
Free length	66 (2.60)	45 (1.77)	58 (2.28)



SAT005B

b. Install manual valve on control valve.
- **Apply A.T.F. to manual valve.**



SAT006B

c. Place control valve assembly on transmission case. Connect solenoid connector for upper body.

— **RE4R01A** —

d. Install connector clip.

Assembly (Cont'd)

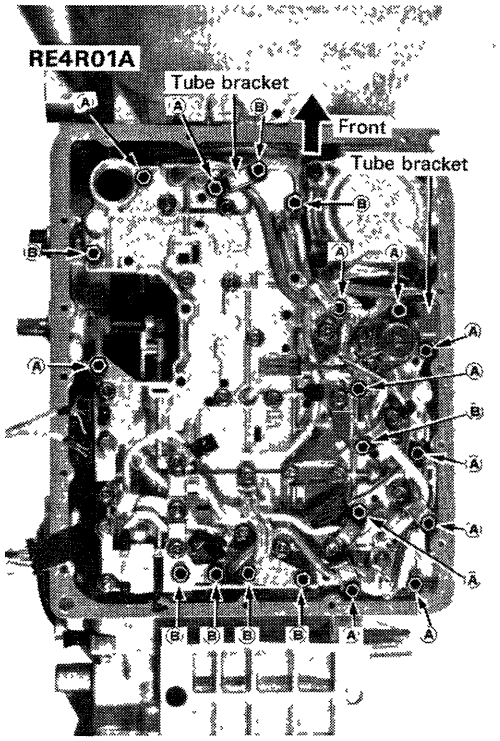
— **RE4R01A and RL4R01A** —

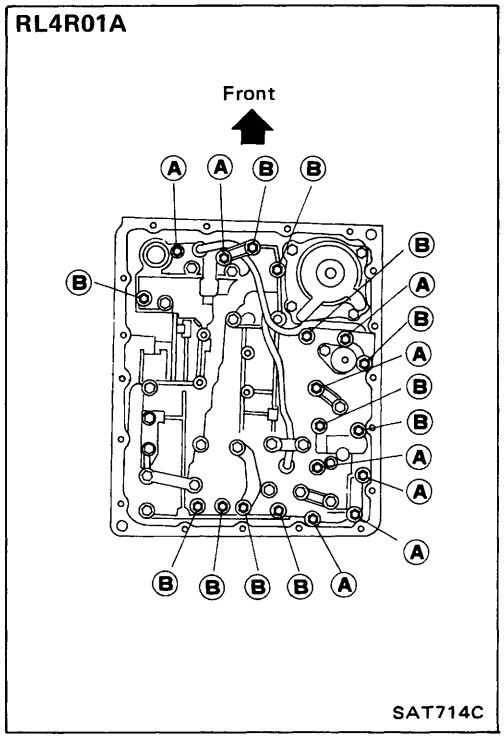
e. Install control valve assembly on transmission case.

f. Install connector tube brackets and tighten bolts Ⓐ and Ⓑ.

- **Check that terminal assembly harness does not catch.**

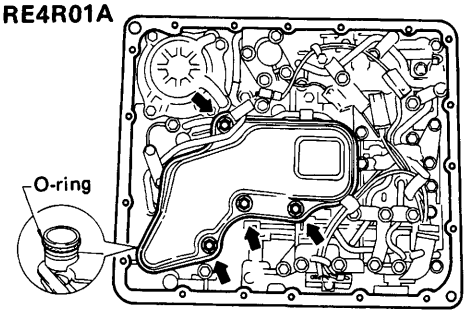
Bolt	ℓ mm (in)
Ⓐ	33 (1.30)
Ⓑ	45 (1.77)



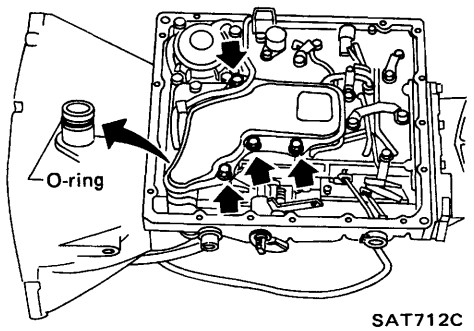


Assembly (Cont'd)

RE4R01A



RL4R01A



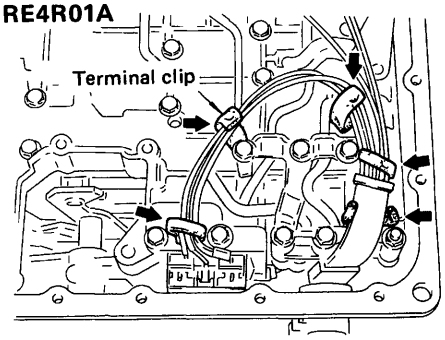
SAT712C

g. Install O-ring on oil strainer.

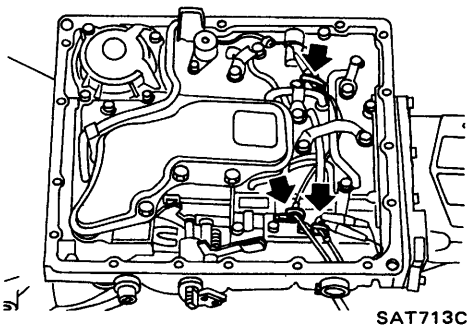
● **Apply petroleum jelly to O-ring.**

h. Install oil strainer on control valve.

RE4R01A

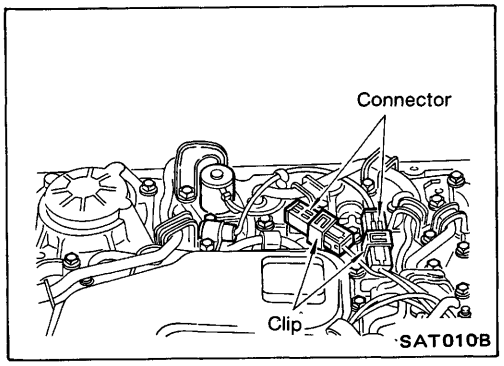


RL4R01A



SAT713C

i. Securely fasten terminal harness with clips.

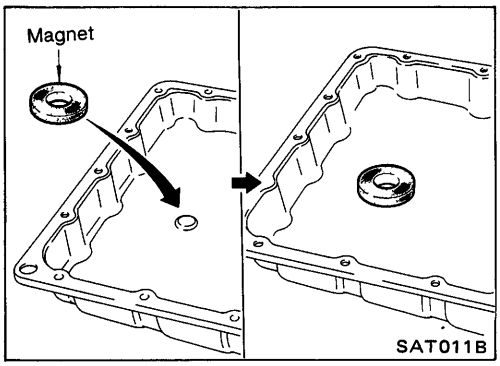


SAT010B

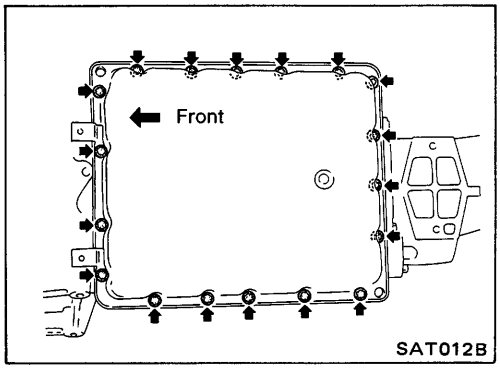
— **RE4R01A** —

j. Install lock-up solenoid and fluid temperature sensor 1 and 2 connectors.

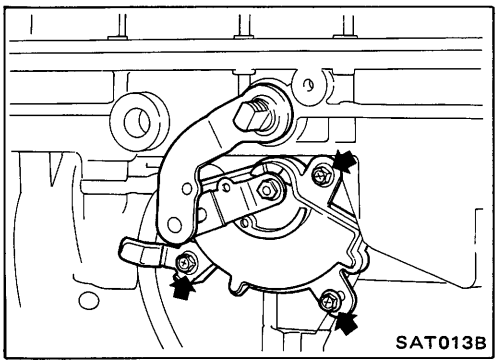
Assembly (Cont'd)



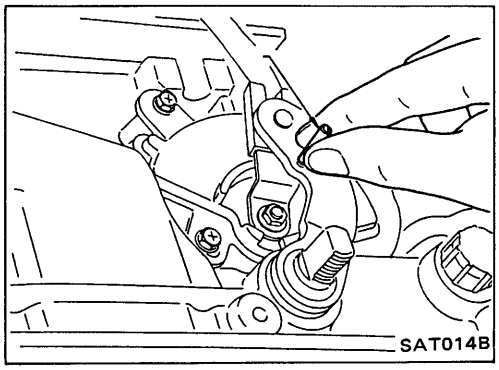
11. Install oil pan.
a. Attach a magnet to oil pan.



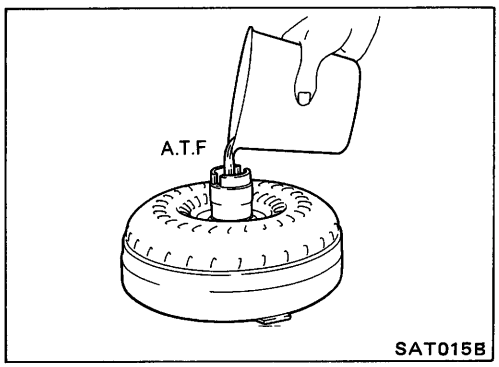
b. Install oil pan gasket on transmission case.
c. Install oil pan and bracket on transmission case.
- **Tighten four bolts in a criss-cross pattern to prevent dislocation of gasket.**



12. Install inhibitor switch.
a. Check that manual shaft is in "1" range.
b. Temporarily install inhibitor switch on manual shaft.
c. Move manual shaft to "N".

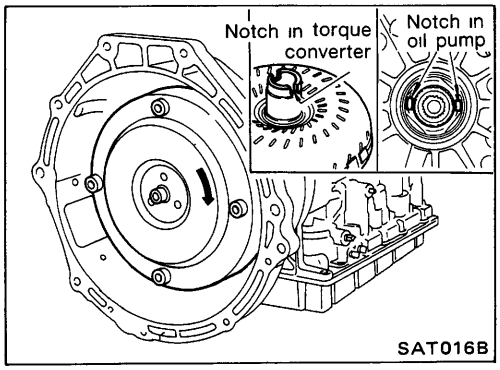


d. Tighten bolts while inserting 4.0 mm (0.157 in) dia. pin vertically into locating holes in inhibitor switch and manual shaft.

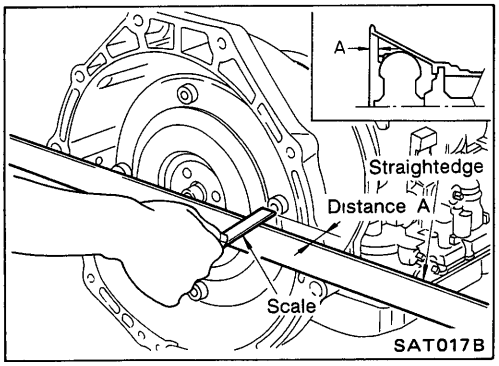


13. Install torque converter.
a. Pour A.T.F. into torque converter.
- **Approximately 2 liters (2-1/8 US qt, 1-3/4 Imp qt) of fluid are required for a new torque converter.**
- **When reusing old torque converter, add the same amount of fluid as was drained.**

Assembly (Cont'd)



b. Install torque converter while aligning notches and oil pump.



c. Measure distance A to check that torque converter is in proper position.

Distance "A":

26.0 mm (1.024 in) or more

General Specifications

Applied model	KA24E engine		VG30E engine	
	Floor shift	Column shift	2WD	4WD
Automatic transmission model	RL4R01A		RE4R01A	
Transmission model code number	49X02	49X03	45X60	45X24
Stall torque ratio	2.0 : 1			
Transmission gear ratio				
1st	2.785			3.027
2nd	1.545			1.619
Top	1.000			1.000
O.D.	0.694			0.694
Reverse	2.272			2.272
Recommended oil	Automatic transmission fluid Type DEXRON™			
Oil capacity ℓ (US qt, Imp qt)	7.9 (8-3/8, 7)			8.5 (9, 7-1/2)

Specifications and Adjustment

VEHICLE SPEED WHEN SHIFTING GEARS

KA24E engine

Throttle position	Vehicle speed km/h (MPH)						
	$D_1 \rightarrow D_2$	$D_2 \rightarrow D_3$	$D_3 \rightarrow D_4$	$D_4 \rightarrow D_3$	$D_3 \rightarrow D_2$	$D_2 \rightarrow D_1$	$1_2 \rightarrow 1_1$
Full throttle	53 - 57 (33 - 35)	100 - 108 (62 - 67)	–	147 - 157 (91 - 98)	91 - 99 (57 - 62)	47 - 51 (29 - 32)	41 - 45 (25 - 28)
Half throttle	32 - 36 (20 - 22)	57 - 65 (35 - 40)	114 - 124 (71 - 77)	65 - 75 (40 - 47)	28 - 36 (17 - 22)	12 - 16 (7 - 10)	41 - 45 (25 - 28)

VG30E engine 2WD

Throttle position	Vehicle speed km/h (MPH)						
	$D_1 \rightarrow D_2$	$D_2 \rightarrow D_3$	$D_3 \rightarrow D_4$	$D_4 \rightarrow D_3$	$D_3 \rightarrow D_2$	$D_2 \rightarrow D_1$	$1_2 \rightarrow 1_1$
Full throttle	48 - 52 (30 - 32)	104 - 112 (65 - 70)	159 - 169 (99 - 105)	154 - 164 (96 - 102)	91 - 99 (57 - 62)	44 - 48 (27 - 30)	38 - 42 (24 - 26)
Half throttle	33 - 37 (21 - 23)	66 - 74 (41 - 46)	104 - 114 (65 - 71)	62 - 72 (39 - 45)	28 - 36 (17 - 22)	10 - 14 (6 - 9)	38 - 42 (24 - 26)

VG30E engine 4WD (Final gear ratio: 4.375)

Throttle position	Vehicle speed km/h (MPH)						
	$D_1 \rightarrow D_2$	$D_2 \rightarrow D_3$	$D_3 \rightarrow D_4$	$D_4 \rightarrow D_3$	$D_3 \rightarrow D_2$	$D_2 \rightarrow D_1$	$1_2 \rightarrow 1_1$
Full throttle	53 - 57 (33 - 35)	99 - 107 (62 - 66)	162 - 172 (101 - 107)	157 - 167 (98 - 104)	92 - 100 (57 - 62)	38 - 42 (24 - 26)	38 - 42 (24 - 26)
Half throttle	32 - 36 (20 - 22)	63 - 71 (39 - 44)	100 - 108 (62 - 67)	63 - 71 (39 - 44)	28 - 36 (17 - 22)	10 - 14 (6 - 9)	38 - 42 (24 - 26)

VG30E engine 4WD (Final gear ratio: 4.625)

Throttle position	Vehicle speed km/h (MPH)						
	$D_1 \rightarrow D_2$	$D_2 \rightarrow D_3$	$D_3 \rightarrow D_4$	$D_4 \rightarrow D_3$	$D_3 \rightarrow D_2$	$D_2 \rightarrow D_1$	$1_2 \rightarrow 1_1$
Full throttle	50 - 54 (31 - 34)	93 - 101 (58 - 63)	150 - 160 (93 - 99)	145 - 155 (90 - 96)	86 - 94 (53 - 58)	38 - 42 (24 - 26)	38 - 42 (24 - 26)
Half throttle	30 - 34 (19 - 21)	59 - 67 (37 - 42)	97 - 107 (60 - 66)	59 - 69 (37 - 43)	32 - 40 (20 - 25)	10 - 14 (6 - 9)	38 - 42 (24 - 26)

VEHICLE SPEED WHEN PERFORMING AND RELEASING LOCK-UP

KA24E engine

Throttle position	D_4	
	Vehicle speed km/h (MPH)	
	Lock-up "ON"	Lock-up "OFF"
Full throttle	—	—
Half throttle	71 - 79 (44 - 49)	71 - 79 (44 - 49)

VG30E engine 4WD (Final gear ratio: 4.375)

Throttle position	O.D. switch [Shift range]	Vehicle speed km/h (MPH)	
		Lock-up "ON"	Lock-up "OFF"
Full throttle	ON [D_4]	162 - 172 (101 - 107)	157 - 167 (98 - 104)
	OFF [D_3]	99 - 107 (62 - 66)	92 - 100 (57 - 62)
Half throttle	ON [D_4]	100 - 108 (62 - 67)	83 - 91 (52 - 57)
	OFF [D_3]	76 - 84 (47 - 52)	71 - 79 (44 - 49)

VG30E engine 2WD

Throttle position	O.D. switch [Shift range]	Vehicle speed km/h (MPH)	
		Lock-up "ON"	Lock-up "OFF"
Full throttle	ON [D_4]	159 - 169 (99 - 105)	154 - 164 (96 - 102)
	OFF [D_3]	104 - 112 (65 - 70)	91 - 99 (57 - 62)
Half throttle	ON [D_4]	104 - 112 (65 - 70)	82 - 90 (51 - 56)
	OFF [D_3]	76 - 84 (47 - 52)	71 - 79 (44 - 49)

VG30E engine 4WD (Final gear ratio: 4.625)

Throttle position	O.D. switch [Shift range]	Vehicle speed km/h (MPH)	
		Lock-up "ON"	Lock-up "OFF"
Full throttle	ON [D_4]	150 - 160 (93 - 99)	145 - 155 (90 - 96)
	OFF [D_3]	93 - 101 (58 - 63)	86 - 94 (53 - 58)
Half throttle	ON [D_4]	97 - 107 (60 - 66)	83 - 91 (52 - 57)
	OFF [D_3]	76 - 84 (47 - 52)	71 - 79 (44 - 49)

STALL REVOLUTION

Engine	Stall revolution rpm
KA24E	2,100 - 2,300
VG30E	2,260 - 2,510

LINE PRESSURE

VG30E engine

Engine speed rpm	Line pressure kPa (kg/cm², psi)	
	D, 2 and 1 ranges	R range
Idle	432 - 471 (4.4 - 4.8, 63 - 68)	667 - 706 (6.8 - 7.2, 97 - 102)
Stall	883 - 961 (9.0 - 9.8, 128 - 139)	1,393 - 1,471 (14.2 - 15.0, 202 - 213)

KA24E engine

Engine speed rpm	Line pressure kPa (kg/cm², psi)	
	D, 2 and 1 ranges	R range
Idle	422 - 461 (4.3 - 4.7, 61 - 67)	667 - 706 (6.8 - 7.2, 97 - 102)
Stall	883 - 961 (9.0 - 9.8, 128 - 139)	1,393 - 1,471 (14.2 - 15.0, 202 - 213)

Specifications and Adjustment (Cont'd)

RETURN SPRINGS
KA24E engine

Unit: mm (in)

Parts \ Item			Part No.	Free length	Outer diameter
Control valve	4th speed cut valve spring		31756-48X07	23.5 (0.925)	7.0 (0.276)
	Pressure regulator valve spring		31742-48X00	49.0 (1.929)	12.1 (0.476)
	Pressure modifier valve spring		31742-48X13	40.83 (1.6075)	8.0 (0.315)
	1-2 shift valve spring		31762-48X00	43.4 (1.709)	6.0 (0.236)
	2-3 shift valve spring		31762-48X01	42.7 (1.681)	9.0 (0.354)
	3-4 shift valve spring		31762-48X06	44.03 (1.7335)	8.0 (0.315)
	Accumulator control valve spring		31742-48X02	29.3 (1.154)	8.0 (0.315)
	3-2 downshift valve spring		–	–	–
	2-3 throttle modifier valve spring		31742-41X21	33.0 (1.299)	6.5 (0.256)
	4-2 relay valve spring		31756-41X00	29.1 (1.146)	6.95 (0.2736)
	Lock-up control valve spring		31742-48X07	20.0 (0.787)	5.45 (0.2146)
	Throttle valve & detent valve spring		31802-48X02	34.23 (1.3476)	11.0 (0.433)
	Kickdown modifier valve spring		31756-48X01	45.3 (1.783)	7.0 (0.276)
	1st reducing valve spring		31756-48X08	29.7 (1.169)	7.2 (0.283)
	Overrun clutch reducing valve spring		31742-48X04	45.0 (1.772)	7.45 (0.2933)
			31742-48X05	31.0 (1.220)	5.2 (0.205)
	3-2 timing valve spring		31742-48X15	23.0 (0.906)	7.0 (0.276)
	Torque converter relief valve spring		31742-41X23	38.0 (1.496)	9.0 (0.354)
	4-2 sequence valve spring		31756-41X00	29.1 (1.146)	6.95 (0.2736)
Governor valve	Governor valve spring	Primary	31742-48X11	19.1 (0.752)	9.05 (0.3563)
		Secondary ①	31742-48X09	30.58 (1.2039)	9.2 (0.362)
		Secondary ②	31742-48X10	16.79 (0.6610)	9.0 (0.354)
Reverse clutch	16 pcs		31505-41X02	19.69 (0.7752)	11.6 (0.457)
High clutch	16 pcs		31505-21X03	22.06 (0.8685)	11.6 (0.457)
Forward clutch (Overrun clutch)	20 pcs		31505-41X01	35.77 (1.4083)	9.7 (0.382)
Low & reverse brake	18 pcs		31521-21X00	23.7 (0.933)	11.6 (0.457)
Band servo	Spring A		31605-41X05	45.6 (1.795)	34.3 (1.350)
	Spring B		31605-41X00	53.8 (2.118)	40.3 (1.587)
	Spring C		31605-41X01	29.0 (1.142)	27.6 (1.087)
Accumulator	Accumulator A		31605-41X02	43.0 (1.693)	–
	Accumulator B		31605-41X10	66.0 (2.598)	–
	Accumulator C		31605-41X04	45.0 (1.772)	–
	Accumulator D		31605-41X06	58.4 (2.299)	–

Specifications and Adjustment (Cont'd)

VG30E engine

Unit: mm (in)

Parts		Item	Part No.	Free length	Outer diameter
Control valve	Upper body	Torque converter relief valve spring	31742-41X23	38.0 (1.496)	9.0 (0.354)
		Pressure regulator valve spring	31742-41X24	44.02 (1.7331)	14.0 (0.551)
		Pressure modifier valve spring	31742-41X19	31.95 (1.2579)	6.8 (0.268)
		Accumulator control valve spring	–	–	–
		Shuttle shift valve D spring	31762-41X00	26.5 (1.043)	6.0 (0.236)
		4-2 sequence valve spring	31756-41X00	29.1 (1.146)	6.95 (0.2736)
		Shift valve B spring	31762-41X01	25.0 (0.984)	7.0 (0.276)
		4-2 relay valve spring	31756-41X00	29.1 (1.146)	6.95 (0.2736)
		Shift valve A spring	31762-41X01	25.0 (0.984)	7.0 (0.276)
		Overrun clutch control valve spring	31762-41X03	23.6 (0.929)	7.0 (0.276)
		Overrun clutch reducing valve spring	31742-41X20	32.5 (1.280)	7.0 (0.276)
		Shuttle shift valve S spring	31762-41X04	51.0 (2.008)	5.65 (0.2224)
		Pilot valve spring	31742-41X13	25.7 (1.012)	9.1 (0.358)
		Lock-up control valve spring	31742-41X22	18.5 (0.728)	13.0 (0.512)
	Lower body	Modifier accumulator valve spring	31742-41X15	30.5 (1.201)	9.8 (0.386)
		1st reducing valve spring	31756-41X05	25.4 (1.000)	6.75 (0.2657)
		3-2 timing valve spring	31742-41X08	20.55 (0.8091)	6.75 (0.2657)
		Servo charger valve spring	31742-41X06	23.0 (0.906)	6.7 (0.264)
Reverse clutch		16 pcs	31505-41X02	19.69 (0.7752)	11.6 (0.457)
High clutch		16 pcs	31505-21X03	22.06 (0.8685)	11.6 (0.457)
Forward clutch (Overrun clutch)		20 pcs	31505-41X01	35.77 (1.4083)	9.7 (0.382)
Low & reverse brake		18 pcs	31521-21X00	23.7 (0.933)	11.6 (0.457)
Band servo		Spring A	31605-41X05	45.6 (1.795)	34.3 (1.350)
		Spring B	31605-41X00	53.8 (2.118)	40.3 (1.587)
		Spring C	31605-41X01	29.0 (1.142)	27.6 (1.087)
Accumulator		Accumulator A	31605-41X02	43.0 (1.693)	–
		Accumulator B	31605-41X10	66.0 (2.598)	–
		Accumulator C	31605-41X09	45.0 (1.772)	–
		Accumulator D	31605-41X06	58.4 (2.299)	–

Specifications and Adjustment (Cont'd)

ACCUMULATOR O-RING

Accumulator	Diameter mm (in)			
	A	B	C	D
Small diameter end	29 (1.14)	32 (1.26)	45 (1.77)	29 (1.14)
Large diameter end	45 (1.77)	50 (1.97)	50 (1.97)	45 (1.77)

CLUTCHES AND BRAKES

Code number	49X02	49X03	45X60	45X24
Reverse clutch				
Number of drive plates	2			
Number of driven plates	2			
Thickness of drive plate mm (in)				
Standard	1.90 - 2.05 (0.0748 - 0.0807)			
Wear limit	1.80 (0.0709)			
Clearance mm (in)				
Standard	0.5 - 0.8 (0.020 - 0.031)			
Allowable limit	1.2 (0.047)			
Thickness of retaining plate	Thickness mm (in)		Part number	
	4.6 (0.181)		31537-21X00	
	4.8 (0.189)		31537-21X01	
	5.0 (0.197)		31537-21X02	
	5.2 (0.205)		31537-21X03	
	5.4 (0.213)		31537-21X04	
	5.6 (0.220)		31567-21X13	
	5.8 (0.228)		31567-21X14	
High clutch				
Number of drive plates	4		5	
Number of driven plates	4		5	
Thickness of drive plate mm (in)				
Standard	1.52 - 1.67 (0.0598 - 0.0657)			
Wear limit	1.40 (0.0551)			
Clearance mm (in)				
Standard	1.8 - 2.2 (0.071 - 0.087)			
Allowable limit	2.8 (0.110)			
Thickness of retaining plate	Thickness mm (in)	Part number	Thickness mm (in)	Part number
	3.6 (0.142)	31537-41X61	3.4 (0.134)	31537-41X71
	3.8 (0.150)	31537-41X62	3.6 (0.142)	31537-41X61
	4.0 (0.157)	31537-41X63	3.8 (0.150)	31537-41X62
	4.2 (0.165)	31537-41X64	4.0 (0.157)	31537-41X63
	4.4 (0.173)	31537-41X65	4.2 (0.165)	31537-41X64
	4.6 (0.181)	31537-41X66	4.4 (0.173)	31537-41X65
	4.8 (0.189)	31537-41X67	4.6 (0.181)	31537-41X66
	5.0 (0.197)	31537-41X68	4.8 (0.189)	31537-41X67

Specifications and Adjustment (Cont'd)

Code number	49X02	49X03	45X60	45X24
Forward clutch Number of drive plates	5			7
Number of driven plates	5			7
Thickness of drive plate mm (in) Standard Wear limit	1.90 - 2.05 (0.0748 - 0.0807) 1.80 (0.0709)			
Clearance mm (in) Standard Allowable limit	0.45 - 0.85 (0.0177 - 0.0335) 2.25 (0.0886)			

Thickness of retaining plate	Thickness mm (in)	Part number	Thickness mm (in)	Part number
	8.0 (0.315)	31537-41X00	4.0 (0.157)	31537-41X07
	8.2 (0.323)	31537-41X01	4.2 (0.165)	31537-41X08
	8.4 (0.331)	31537-41X02	4.4 (0.173)	31537-41X09
	8.6 (0.339)	31537-41X03	4.6 (0.181)	31537-41X10
	8.8 (0.346)	31537-41X04	4.8 (0.189)	31537-41X11
	9.0 (0.354)	31537-41X05	5.0 (0.197)	31537-41X12
	9.2 (0.362)	31537-41X06	5.2 (0.205)	31537-41X13

Code number	49X02	49X03	45X60	45X24
Overrun clutch Number of drive plates	5			
Number of driven plates	3			
Thickness of drive plate mm (in) Standard Wear limit	1.90 - 2.05 (0.0748 - 0.0807) 1.80 (0.0709)			
Clearance mm (in) Standard Allowable limit	1.0 - 1.4 (0.039 - 0.055) 2.0 (0.079)			

Thickness of retaining plate	Thickness mm (in)	Part number
	4.0 (0.157)	31537-41X79
	4.2 (0.165)	31537-41X80
	4.4 (0.173)	31537-41X81
	4.6 (0.181)	31537-41X82
	4.8 (0.189)	31537-41X83
	5.0 (0.197)	31537-41X84
	5.2 (0.205)	31537-41X20

Specifications and Adjustment (Cont'd)

Code number	49X02	49X03	45X60	45X24
Low & reverse brake Number of drive plates	6			
Number of driven plate	6			
Thickness of drive plate mm (in) Standard Wear limit	1.90 - 2.05 (0.0748 - 0.0807) 1.80 (0.0709)			
Clearance mm (in) Standard Allowable limit	0.7 - 1.1 (0.028 - 0.043) 2.7 (0.106)			
Thickness of retaining plate	Thickness mm (in)	Part number	Thickness mm (in)	Part number
	9.0 (0.354) 9.2 (0.362) 9.4 (0.370) 9.6 (0.378) 9.8 (0.386) 10.0 (0.394)	31667-41X05 31667-41X06 31667-41X09 31667-41X10 31667-41X18 31667-41X19	8.6 (0.339) 8.8 (0.346) 9.0 (0.354) 9.2 (0.362) 9.4 (0.370) 9.6 (0.378)	31667-41X03 31667-41X04 31667-41X05 31667-41X06 31667-41X09 31667-41X10
Brake band Anchor end bolt tightening torque N·m (kg-m, ft-lb)	4 - 6 (0.4 - 0.6, 2.9 - 4.3)			
Number of returning revolutions for anchor end bolt	2.5			

OIL PUMP AND LOW ONE-WAY CLUTCH

Oil pump clearance mm (in) Cam ring — oil pump housing Standard	0.01 - 0.024 (0.0004 - 0.0009)
Rotor, vanes and control piston — oil pump housing Standard	0.03 - 0.044 (0.0012 - 0.0017)
Seal ring clearance mm (in) Standard Allowable limit	0.10 - 0.25 (0.0039 - 0.0098) 0.25 (0.0098)

TOTAL END PLAY

Total end play "T_1"	0.25 - 0.55 mm (0.0098 - 0.0217 in)	
Thickness of oil pump cover bearing race	Thickness mm (in)	Part number
	0.8 (0.031)	31429-21X00
	1.0 (0.039)	31429-21X01
	1.2 (0.047)	31429-21X02
	1.4 (0.055)	31429-21X03
	1.6 (0.063)	31429-21X04
	1.8 (0.071)	31429-21X05
	2.0 (0.079)	31429-21X06

OIL DISTRIBUTOR (KA24E engine)

Seal ring — ring groove mm (in) Standard Allowable limit	0.15 - 0.40 (0.0059 - 0.0157) 0.40 (0.0157)

REVERSE CLUTCH DRUM END PLAY

Reverse clutch drum end play "T_2"	0.55 - 0.90 mm (0.0217 - 0.0354 in)	
Thickness of oil pump thrust washer	Thickness mm (in)	Part number
	0.7 (0.028)	31528-21X00
	0.9 (0.035)	31528-21X01
	1.1 (0.043)	31528-21X02
	1.3 (0.051)	31528-21X03
	1.5 (0.059)	31528-21X04
	1.7 (0.067)	31528-21X05
	1.9 (0.075)	31528-21X06

Specifications and Adjustment (Cont'd)

REMOVAL AND INSTALLATION

Manual control linkage Number of returning revolutions for lock nut Column shift	2
Floor shift	1
Lock nut tightening torque N·m (kg-m, ft-lb) 2WD	11 - 15 (1.1 - 1.5, 8 - 11)
4WD	4.4 - 5.9 (0.45 - 0.60, 3.3 - 4.3)
Distance between end of clutch housing and torque converter mm (in)	26.0 (1.024) or more
Drive plate runout limit mm (in)	0.5 (0.020)

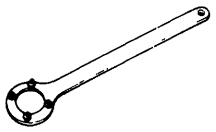
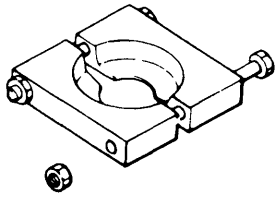
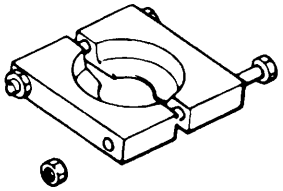
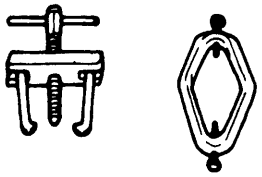
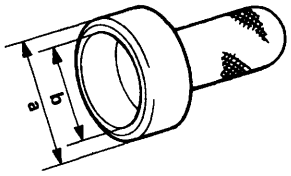
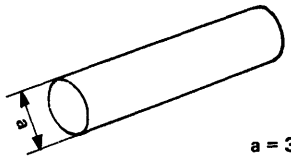
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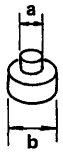
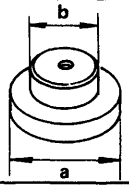
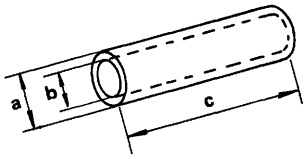
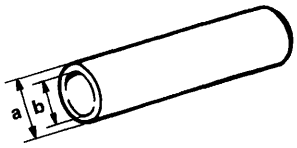
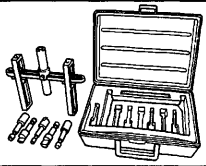
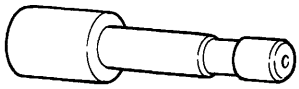
SECTION TF

CONTENTS

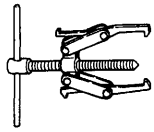
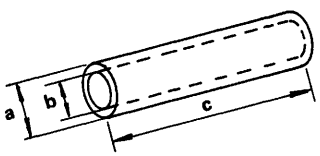
PREPARATION ..... TF- 2
ON-VEHICLE SERVICE ..... TF- 4
REMOVAL AND INSTALLATION ..... TF- 7
TRANSFER GEAR CONTROL ..... TF- 9
MAJOR OVERHAUL TF-10
DISASSEMBLY TF-13
REPAIR FOR COMPONENT PARTS TF-18
ASSEMBLY TF-27
SERVICE DATA AND SPECIFICATIONS (S.D.S.) TF-35

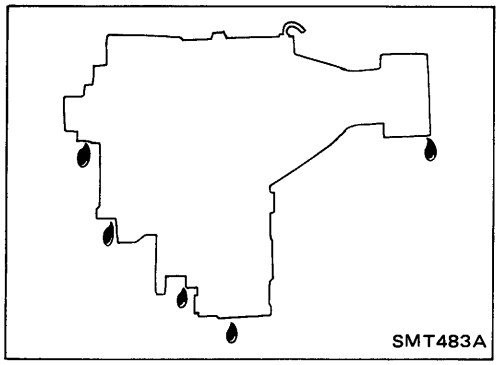
SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.) Tool name	Description	
ST38060002 (J34311) Flange wrench		Removing companion flange nut Installing companion flange nut
ST30021000 (J22912-01) Puller		Removing counter gear front bearing (Use with ST36710010) Removing L & H hub
ST30031000 (J22912-01) Puller		Removing counter gear rear bearing (Use with ST36710010)
ST33290001 (J25810-A) Puller		Removing center case oil seal Removing rear oil seal
ST33051001 (J22888) Puller		Removing companion flange
ST30720000 ① (J25273) 2 (J25405) Drift	 **a = 77 mm (3.03 in) dia.** **b = 55.5 mm (2.185 in) dia.**	① Installing center case oil seal ② Installing rear oil seal
ST36710010 (–) Drift	 **a = 34.5 mm (1.358 in) dia.**	Removing counter gear front bearing (Use with ST30021000) Removing counter gear rear bearing (Use with ST30031000)

Tool number (Kent-Moore No.) Tool name	Description	
ST33061000 (J8107-2) Drift	 a: 28.5 mm (1.122 in) dia. b: 38 mm (1.50 in) dia.	Removing main gear bearing
ST30613000 ① (J25742-3) ② (J34339) Drift	 a: 72 mm (2.83 in) dia. b: 48 mm (1.89 in) dia.	① Installing main gear bearing ② Installing cover oil seal
(J35864) Drift	 a = 26 mm (1.02 in) dia. b = 20 mm (0.79 in) dia. c = 150 mm (5.91 in)	Installing shift shaft oil seal
(J26092) Drift	 a = 44.5 mm (1.752 in) dia. b = 38.5 mm (1.516 in) dia.	Seating counter gear assembly
(J34291) Shim setting gauge set		Selecting counter gear rear bearing shim
(J34291-20) Plunger-shim setting gauge		Selecting counter gear rear bearing shim

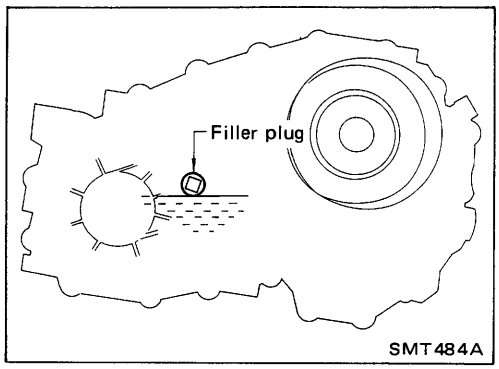
COMMERCIAL SERVICE TOOLS

Tool name	Description	
Puller		Removing front drive shaft front bearing Removing front drive shaft rear bearing Removing main gear bearing
Drift	 ① a = 50 mm (1.97 in) dia. b = 42 mm (1.65 in) dia. c = 180 mm (7.09 in) ② a = 60 mm (2.36 in) dia. b = 50 mm (1.97 in) dia. c = 60 mm (2.36 in)	① Installing mainshaft rear bearing ② Installing L & H hub



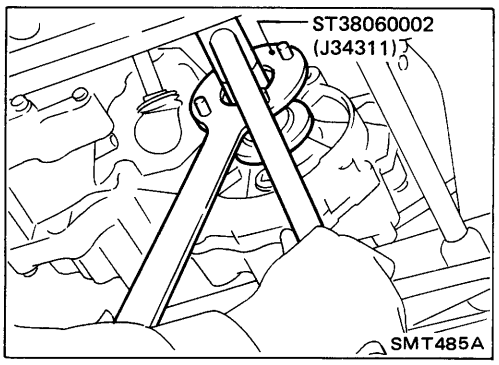
Checking Transfer Oil

- Check transfer for oil leakage.



- Check oil level.

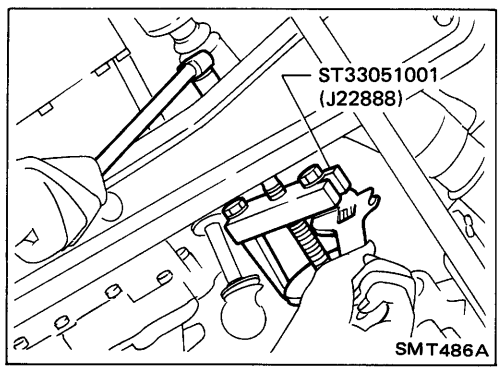
"DEXRON™" type Automatic Transmission Fluid is used for the transfer in the factory.
Never add gear oil (75W-90) to Automatic Transmission Fluid.



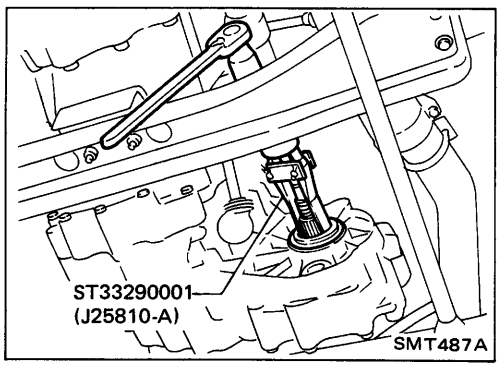
Replacing Oil Seal

CENTER CASE OIL SEAL

1. Remove front propeller shaft. – Refer to PD section.
2. Remove companion flange nut.

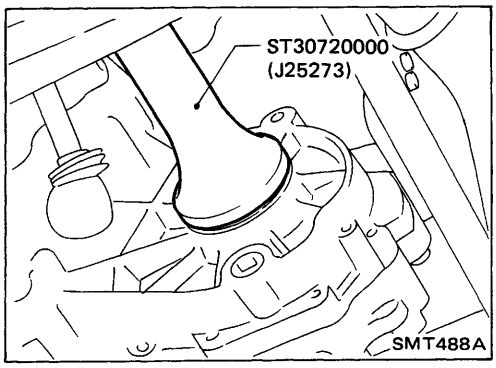


3. Remove companion flange.



4. Remove center case oil seal.

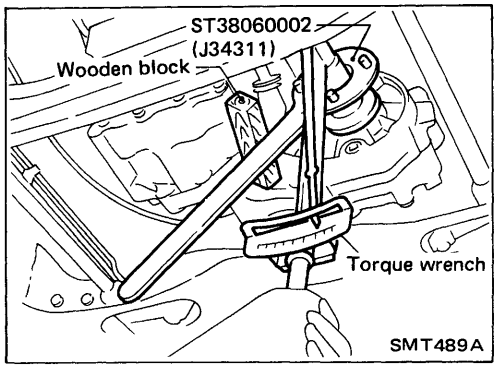
Replacing Oil Seal (Cont'd)



5. Install center case oil seal.

Before installing, apply multi-purpose grease to seal lip.

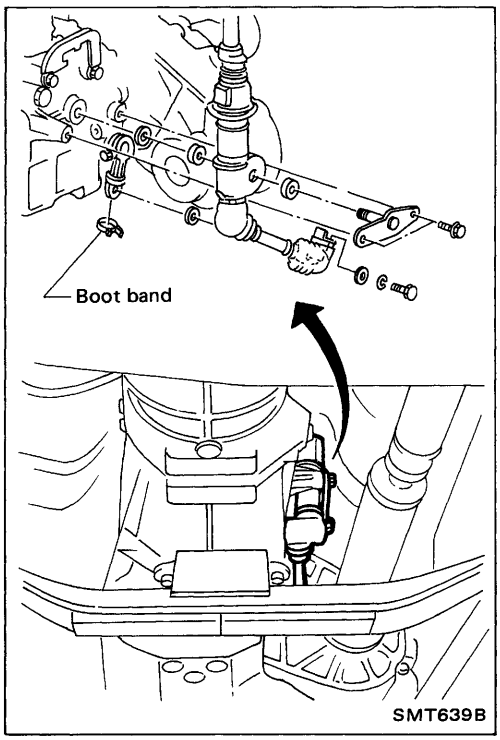
6. Install companion flange.

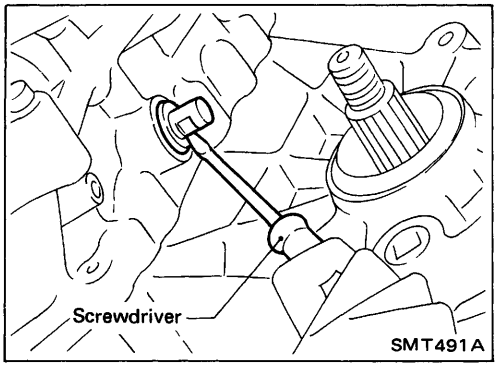


7. Tighten nut to the specified torque.
8. Install front propeller shaft.

SHIFT SHAFT OIL SEAL

1. Remove front propeller shaft. – Refer to PD section.
2. Remove companion flange. – Refer to center case oil seal service on previous page.
3. Remove transfer control lever from transfer outer shift lever. Then remove outer shift lever.

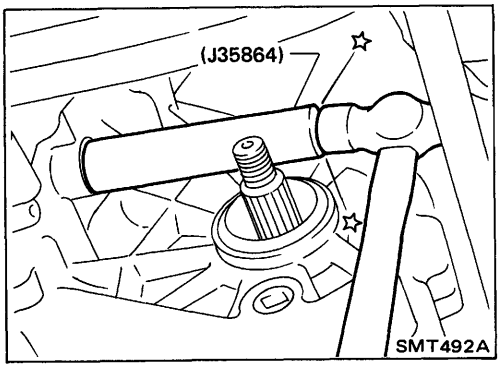




4. Remove shift shaft oil seal.

Be careful not to damage cross shaft.

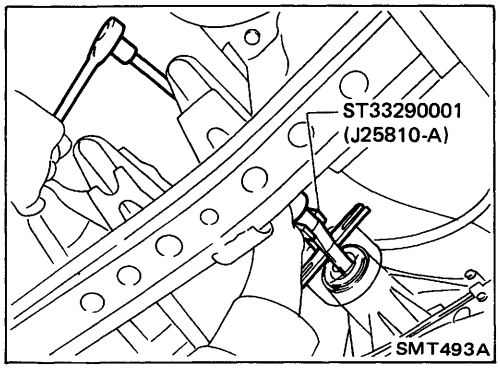
Replacing Oil Seal (Cont'd)



5. Install shift shaft oil seal.

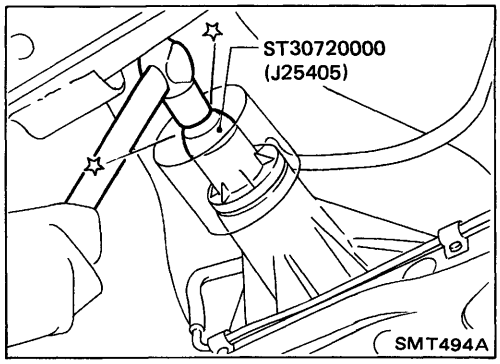
Before installing, apply multi-purpose grease to seal lip.

6. Install transfer control linkage.
7. Install companion flange. – Refer to center case oil seal service on previous page.
8. Install front propeller shaft.



REAR OIL SEAL

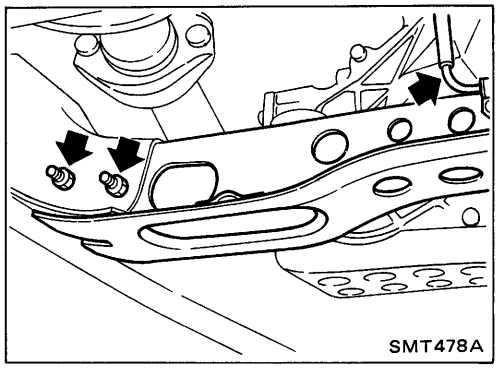
1. Remove rear propeller shaft. – Refer to PD section.
2. Remove rear oil seal.



3. Install rear oil seal.

Before installing apply multi-purpose grease to seal lip.

4. Install rear propeller shaft.


SMT478A

Removal

- Drain oil from transfer and transmission.
- Remove front and rear propeller shaft. – Refer to section PD.
- Insert plug into rear oil seal after removing propeller shaft.

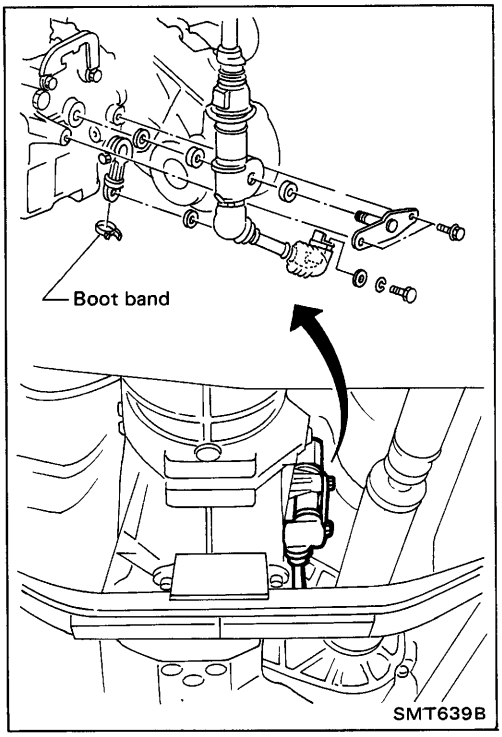
CAUTION:

Be careful not to damage spline, sleeve yoke and rear oil seal, when removing propeller shaft.

- Remove torsion bar spring. – Refer to REMOVAL of Torsion Bar Spring in section FA. Then remove second crossmember.
- Remove transfer control lever from transfer outer shift lever.
- Remove transfer from transmission.

WARNING:

Support transfer while removing it.



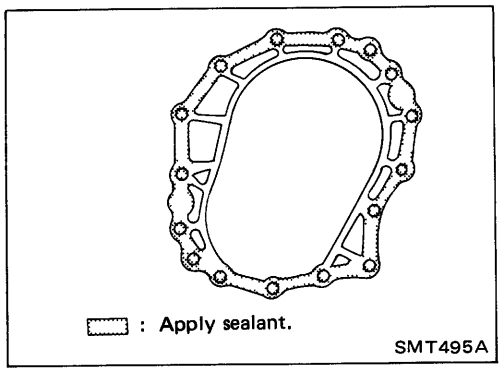
SMT639B

Installation

- Apply recommended sealant to mating surface to transmission. (M/T model only)

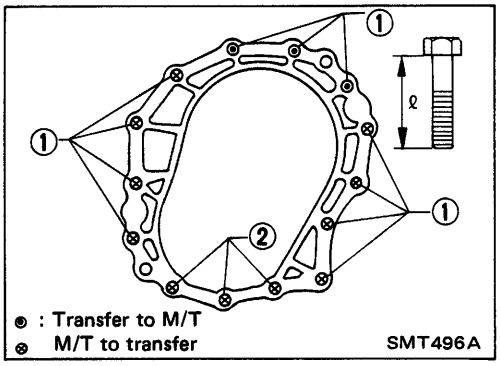
Recommended sealant:

Nissan genuine part (KP610-00250) or equivalent



SMT495A

Installation (Cont'd)



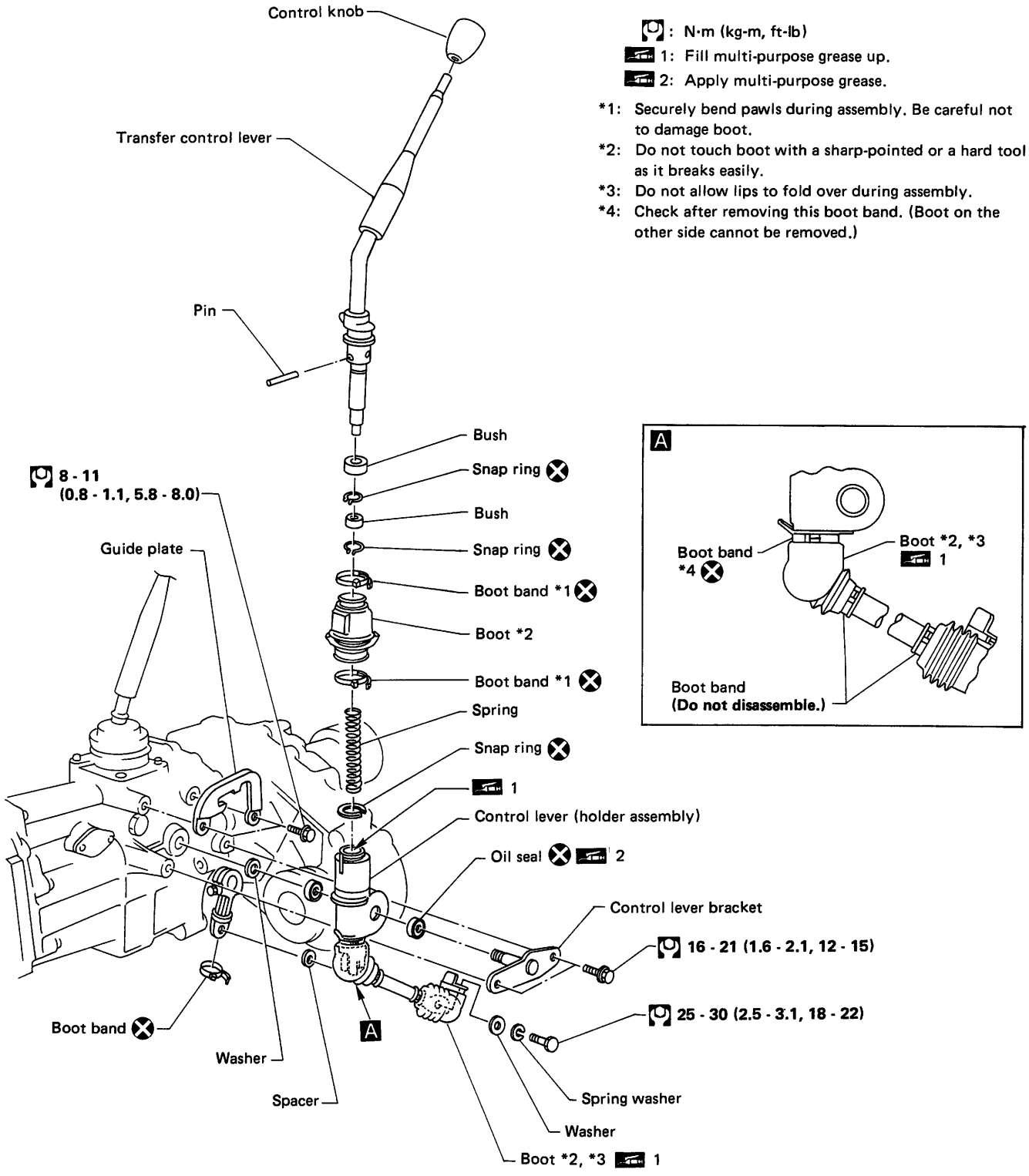
- Tighten bolts securing transfer.

M/T model

Bolt No.	Tightening torque N·m (kg-m, ft-lb)	ℓ mm (in)
①	31 - 41 (3.2 - 4.2, 23 - 30)	45 (1.77)
②	31 - 41 (3.2 - 4.2, 23 - 30)	60 (2.36)

A/T model

Bolt No.	Tightening torque N·m (kg-m, ft-lb)	ℓ mm (in)
①	31 - 41 (3.2 - 4.2, 23 - 30)	60 (2.36)
②	31 - 41 (3.2 - 4.2, 23 - 30)	60 (2.36)

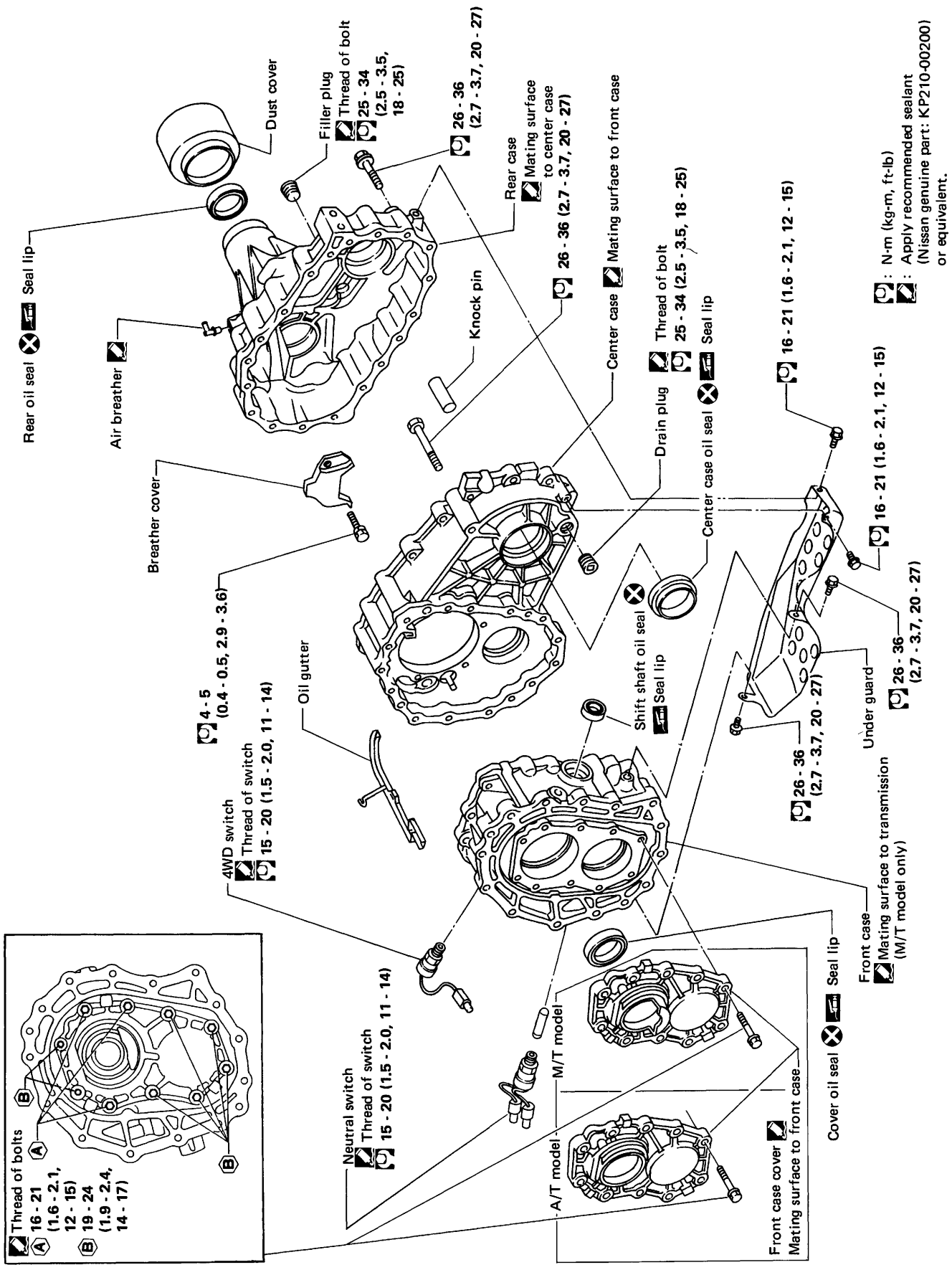


: N·m (kg-m, ft-lb)
1: Fill multi-purpose grease up.
2: Apply multi-purpose grease.

*1: Securely bend pawls during assembly. Be careful not to damage boot.
*2: Do not touch boot with a sharp-pointed or a hard tool as it breaks easily.
*3: Do not allow lips to fold over during assembly.
*4: Check after removing this boot band. (Boot on the other side cannot be removed.)

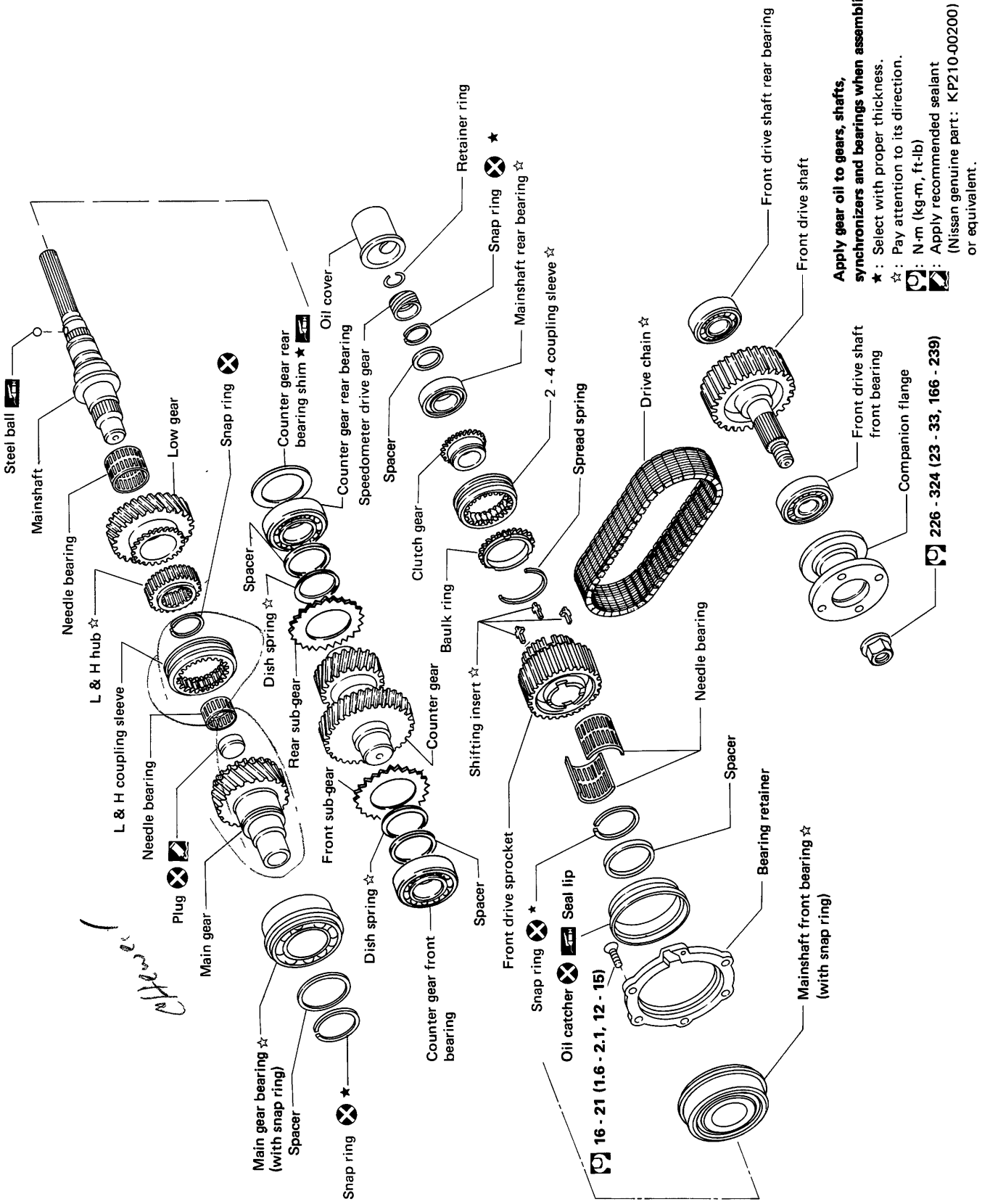
SMT635B

Case Components



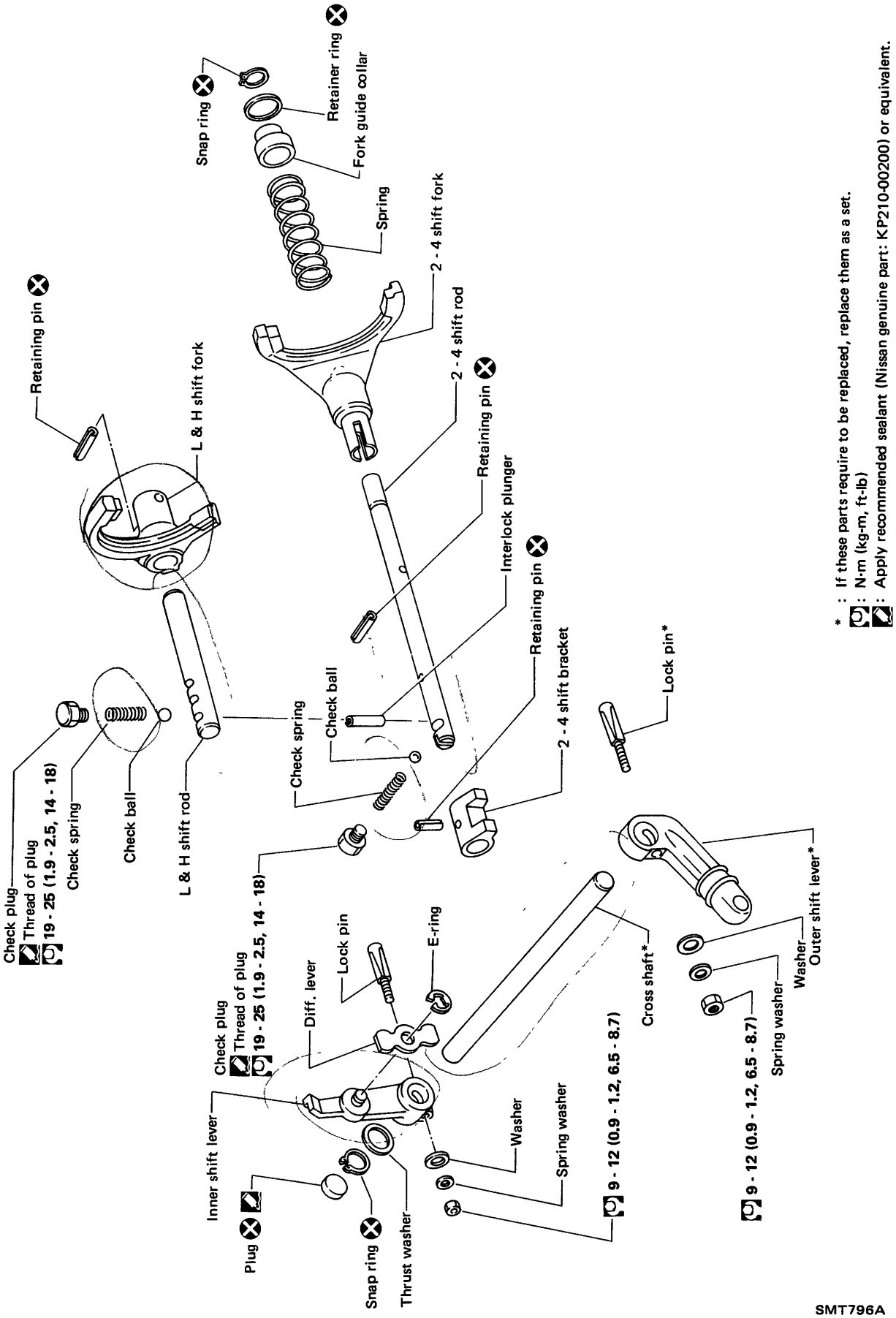
SMT636B

Gear Components



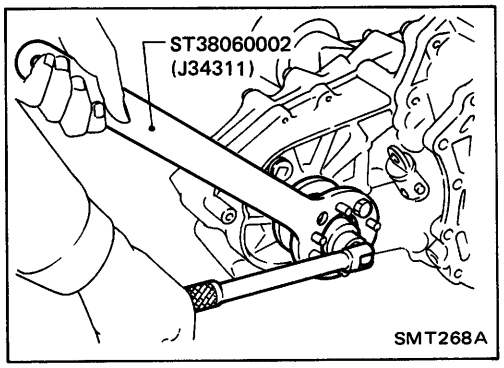
SMT212B

Shift Control Components

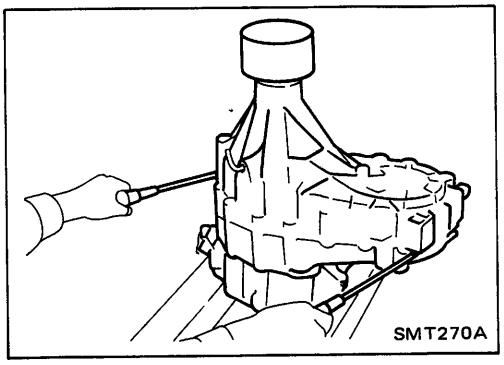


* : If these parts require to be replaced, replace them as a set.
: N·m (kg-m, ft-lb)
: Apply recommended sealant (Nissan genuine part: KP210-00200) or equivalent.

SMT796A

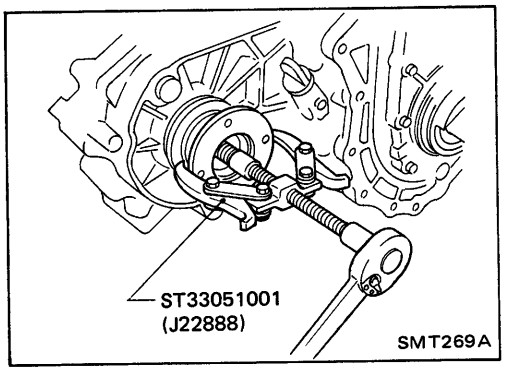


1. Remove nut of companion flange.

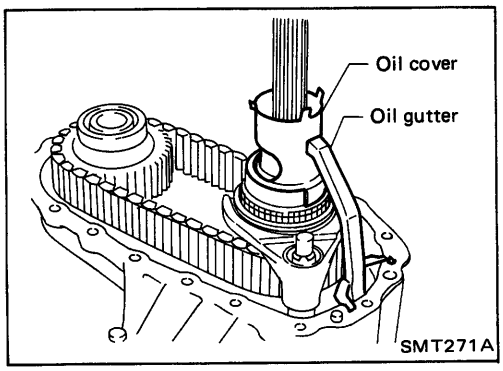


2. Remove rear case.

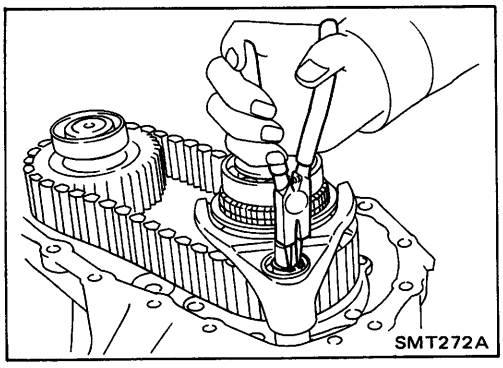
Be careful not to damage the mating surface.



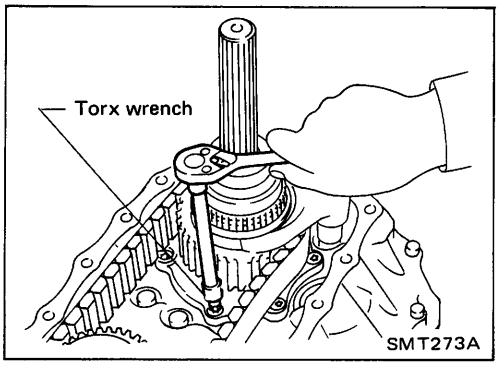
3. Remove companion flange



4. Remove oil cover and oil gutter.

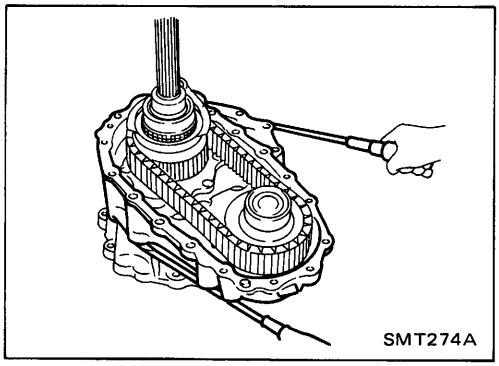


5. Remove snap ring from 2-4 shift rod.

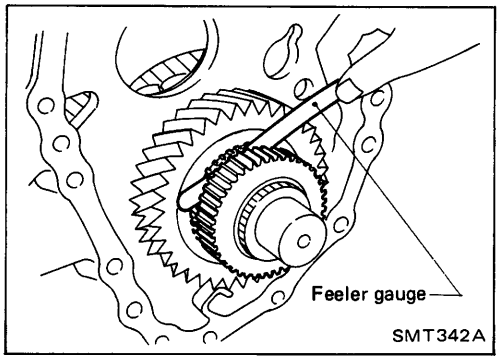


6. Remove bolts securing bearing retainer.

This step is necessary to remove mainshaft from center case.



7. Remove bolts securing center case to front case and then separate center case and front case.

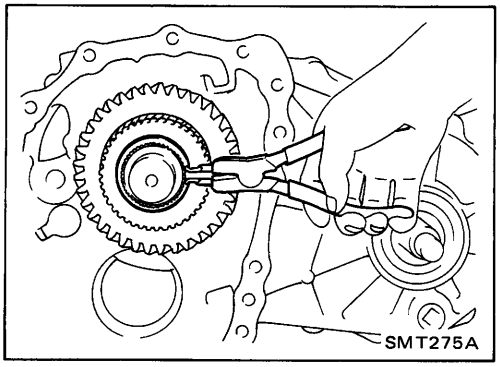


8. Measure end play of low gear.

Standard:

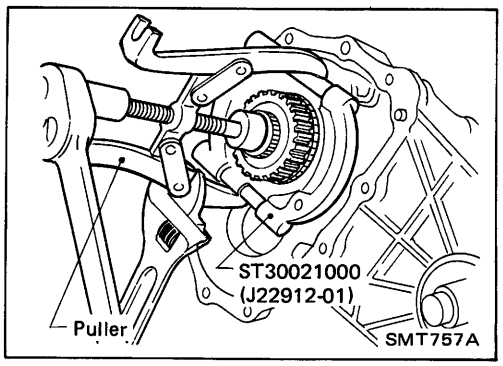
0.2 - 0.35 mm (0.0079 - 0.0138 in)

If end play is beyond the maximum value, check low gear and L & H hub for wear.

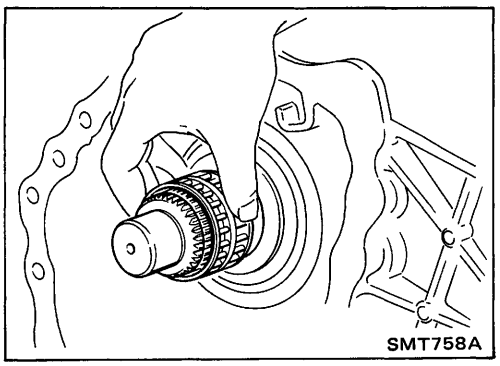


9. Disassemble center case assembly.

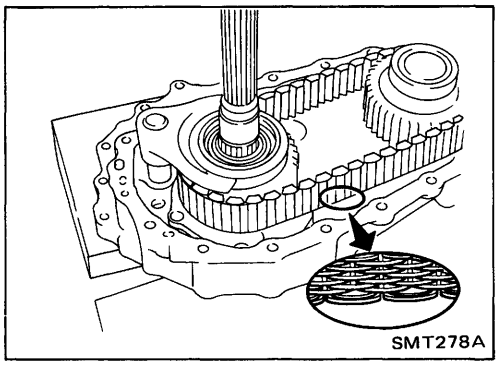
a. Remove snap ring from mainshaft.



b. Pull out low gear with L & H hub.

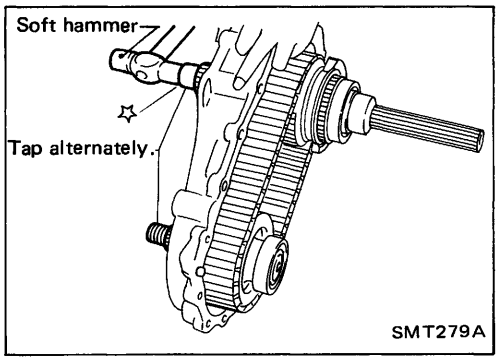


c. Remove needle bearing of low gear.



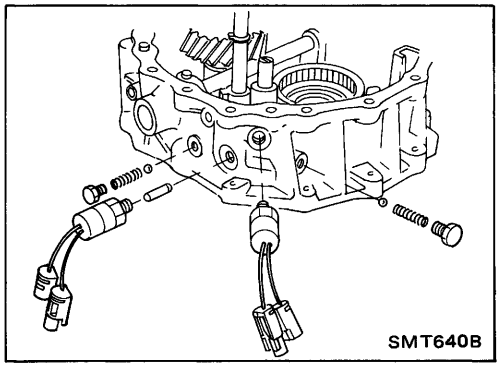
d. Make sure of the direction of the drive chain before removing it. (It must be reinstalled in the same direction.)

Check whether spring part of drive chain is installed on front or rear side.



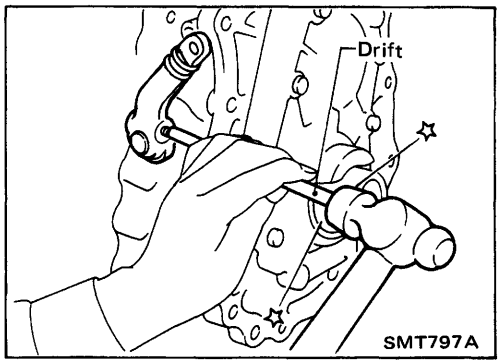
e. Remove mainshaft, front drive and drive chain as a set by tapping front end of mainshaft and front drive shaft alternately.

Be careful not to bend drive chain.

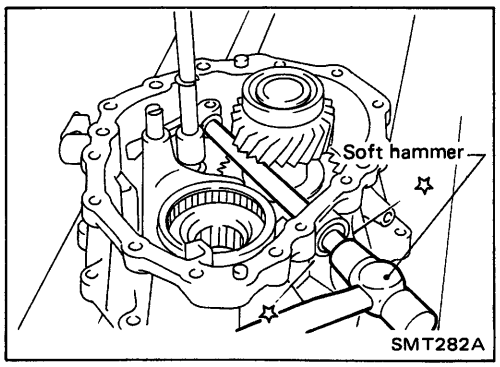


10. Disassemble front case assembly.

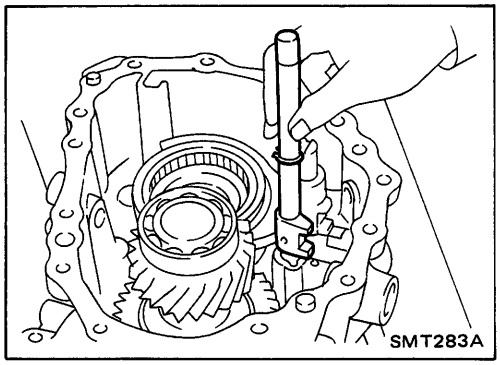
a. Remove switches, check plugs, check springs and check balls.



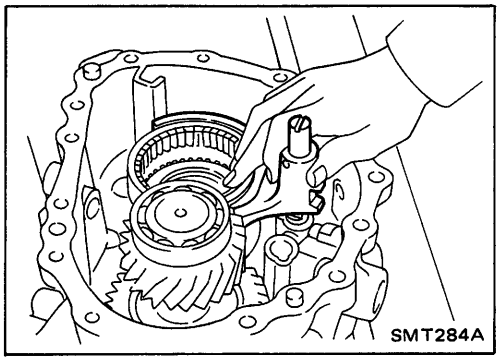
b. Remove outer shift lever.



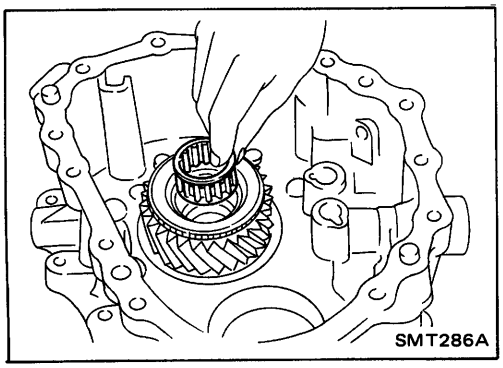
c. Remove lock pin of inner shift lever and drive out cross shaft with plug.



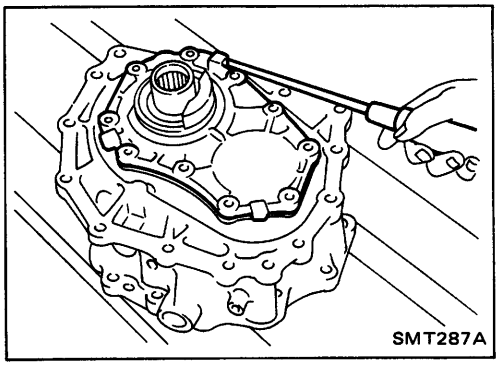
d. Remove 2-4 shift rod.



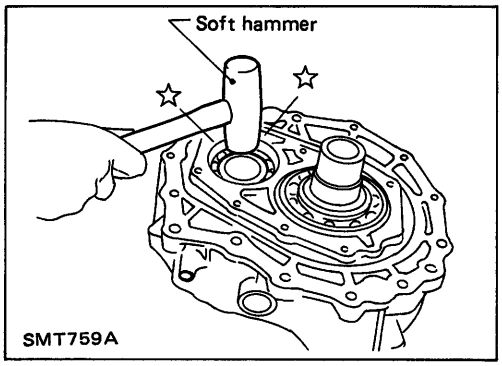
e. Remove L & H shift rod and fork assembly with coupling sleeve.



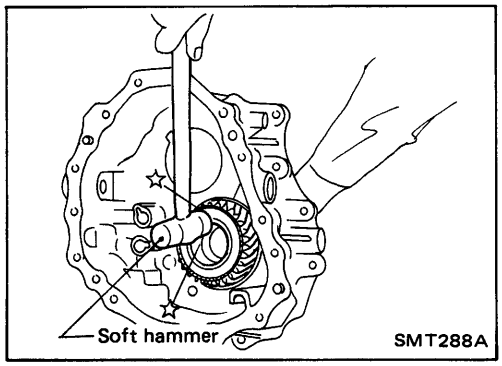
f. Remove needle bearing from main gear.



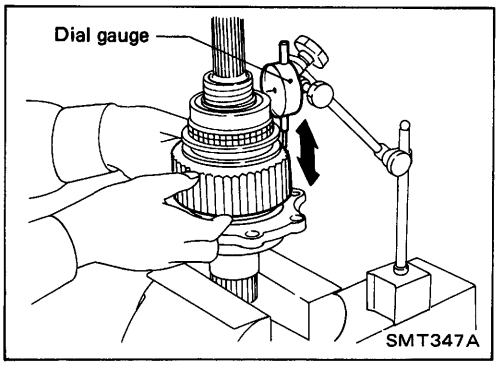
g. Remove bolts securing front case cover and then remove case.



h. Remove counter gear by tapping lightly.



i. Remove main gear by tapping lightly.



Mainshaft

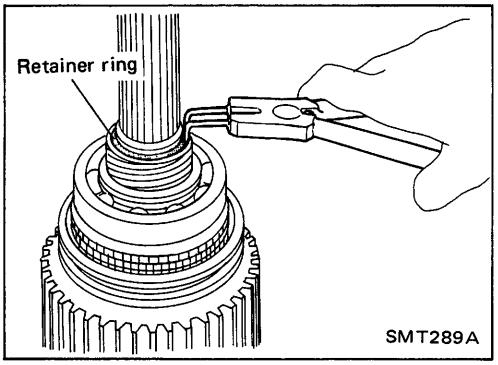
DISASSEMBLY

1. Check end play of front drive sprocket.

Standard:

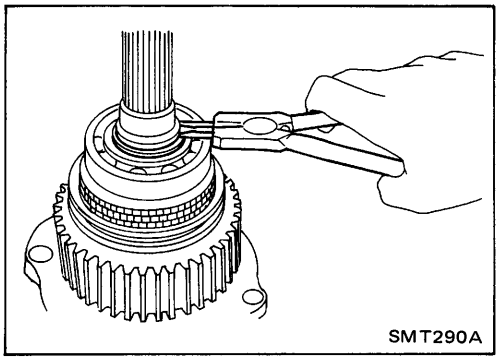
0.2 - 0.35 mm (0.0079 - 0.0138 in)

If end play is beyond the maximum value, check front drive sprocket and clutch gear for wear.

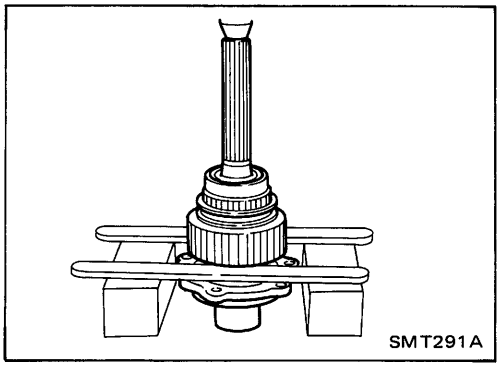


2. Remove retainer ring, speedometer drive gear and steel ball.

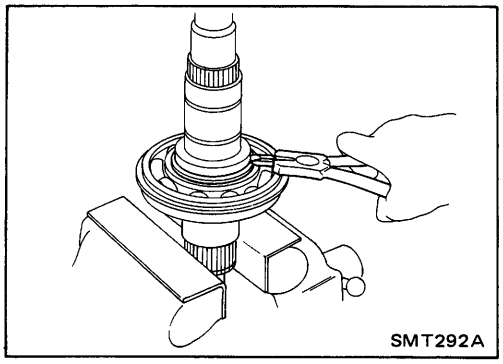
Be careful not to lose the steel ball.



3. Remove snap ring and spacer.



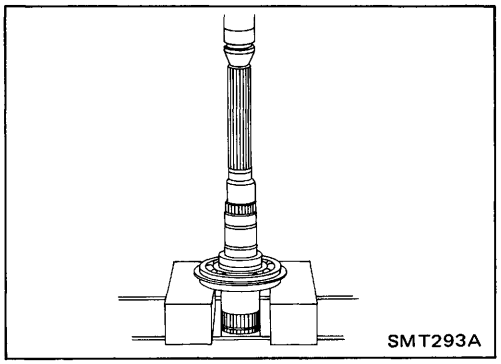
4. Press out front drive sprocket with mainshaft rear bearing and clutch gear together.
5. Remove needle bearing.



6. Remove bearing retainer and then remove snap ring and spacer.

Mainshaft (Cont'd)

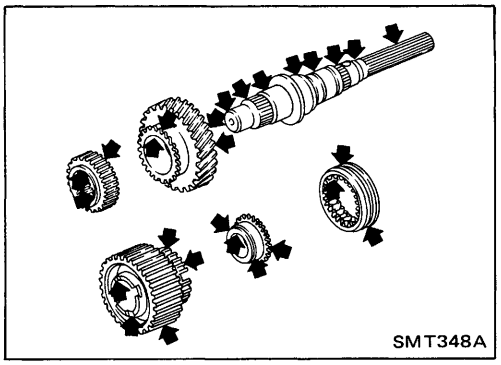
7. Press out mainshaft front bearing from mainshaft.


SMT293A

INSPECTION

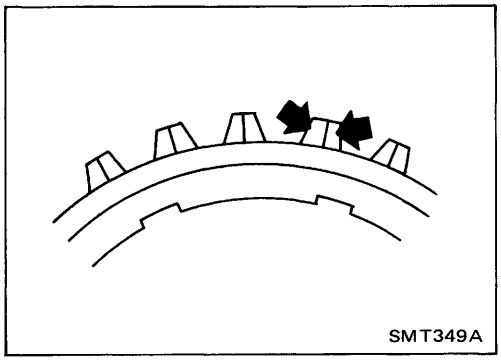
Gear and shaft

- Check gears for excessive wear, chips or cracks.
- Check shaft for cracks, wear or bending.
- Check coupling sleeve for wear or damage.


SMT348A

Baulk ring

- Check baulk ring for cracks or deformation.

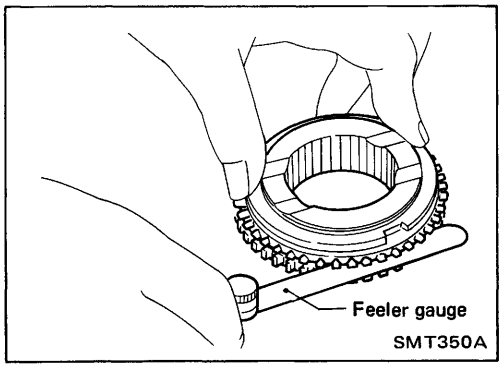

SMT349A

- Measure clearance between baulk ring and gear.

Baulk ring to gear clearance:

Unit: mm (in)

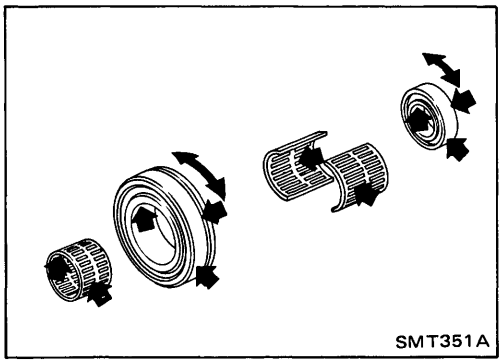
Standard	Wear limit
1.0 - 1.5 (0.039 - 0.059)	0.5 (0.020)



SMT350A

Bearing

- Make sure bearings roll freely and are free from noise, crack, pitting or wear.

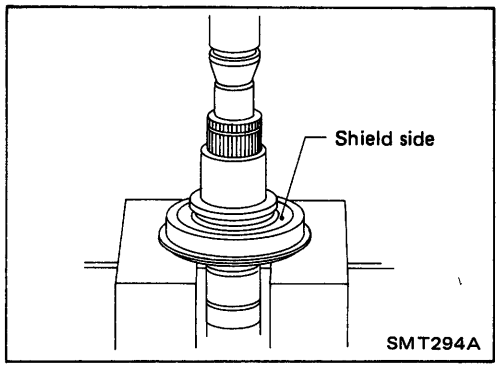

SMT351A

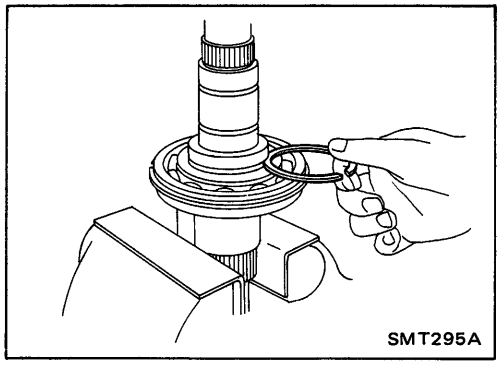
Mainshaft (Cont'd)

ASSEMBLY

1. Press mainshaft front bearing onto mainshaft.

Pay special attention to its direction.





2. Install spacer.
3. Select snap ring with proper thickness and install it.

Allowable clearance between snap ring and groove:
0 - 0.15 mm (0 - 0.0059 in)

Available snap ring

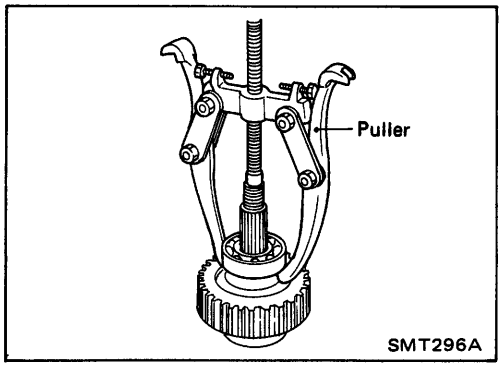
Thickness mm (in)	Part number
3.1 (0.122)	33138-33G10
3.2 (0.126)	33138-33G11
3.3 (0.130)	33138-33G12
3.4 (0.134)	33138-33G13

4. Regarding to further procedures, refer to "ASSEMBLY".

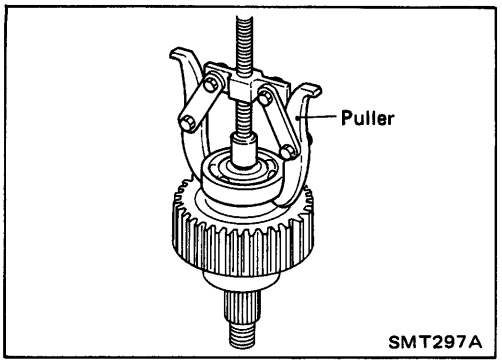
Front Drive Shaft

DISASSEMBLY

- Front drive shaft front bearing



- Front drive shaft rear bearing



Front Drive Shaft (Cont'd)

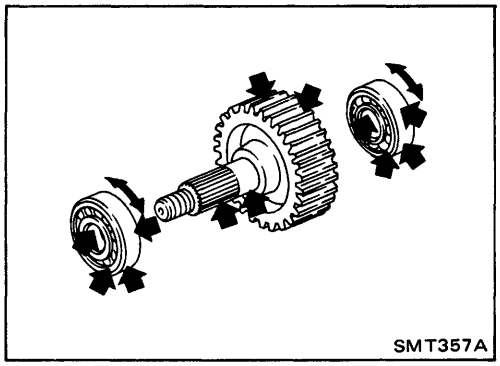
INSPECTION

Sprocket and shaft

- Check sprocket for excessive wear, chips or cracks.
- Check shaft for cracks or wear.

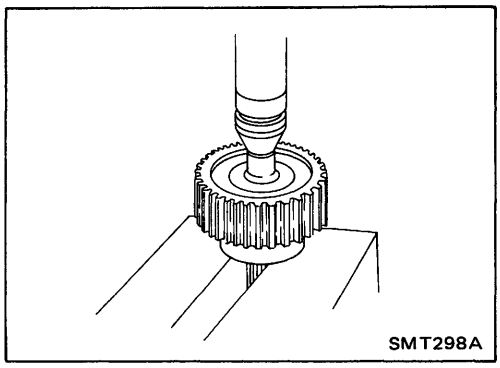
Bearing

- Make sure bearings roll freely and are free from noise, crack, pitting or wear.

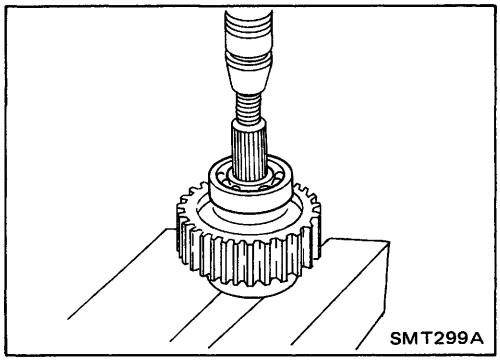

SMT357A

ASSEMBLY

- Press front drive shaft front bearing.


SMT298A

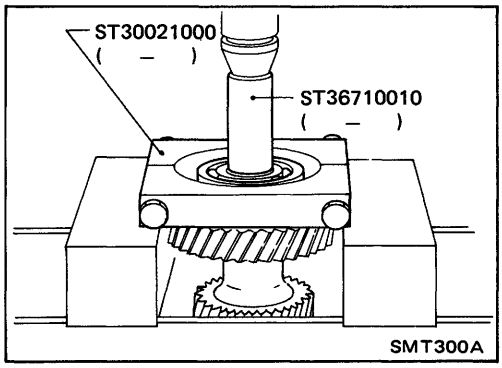
- Press front drive shaft rear bearing.


SMT299A

Counter Gear

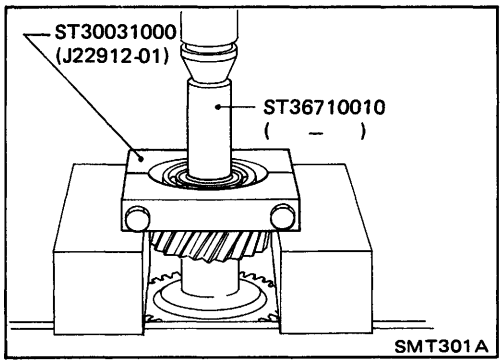
DISASSEMBLY

1. Press out counter gear front bearing and then remove front sub-gear, spacer and dish spring.



SMT300A

2. Press out counter gear rear bearing and then remove rear sub-gear, spacer and dish spring.



SMT301A

Counter Gear (Cont'd)

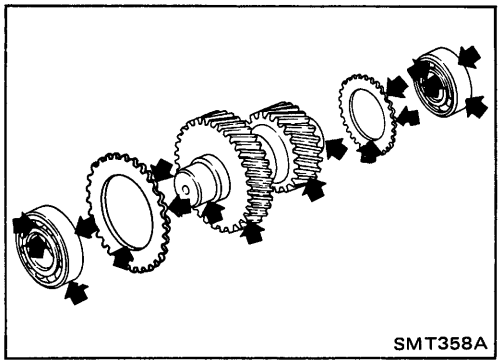
INSPECTION

Gear and shaft

- Check gears for excessive wear, chips or cracks.
- Check shaft for cracks or wear.

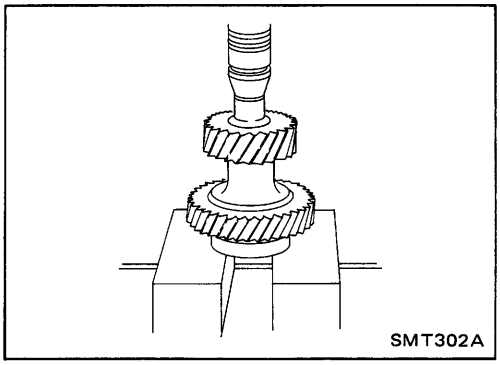
Bearing

- Make sure bearings roll freely and are free from noise, crack, pitting or wear.

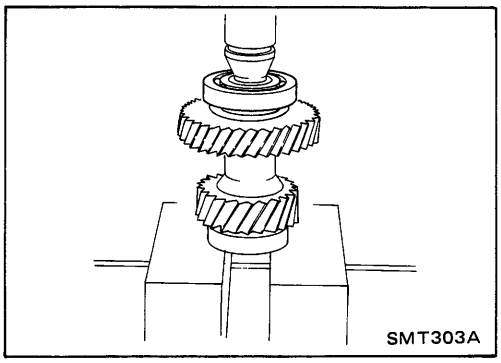

SMT358A

ASSEMBLY

1. Install front sub-gear, dish spring and spacer, and then press on counter gear front bearing.


SMT302A

2. Install rear sub-gear, dish spring and spacer, and then press on counter gear rear bearing.

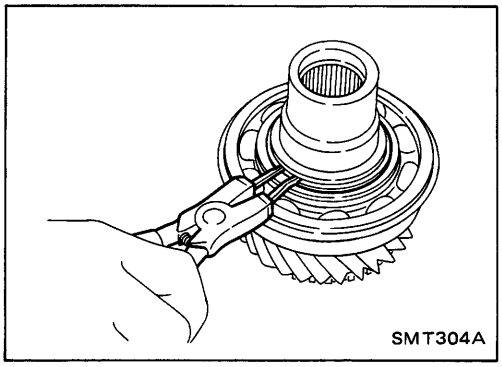

SMT303A

Main Gear

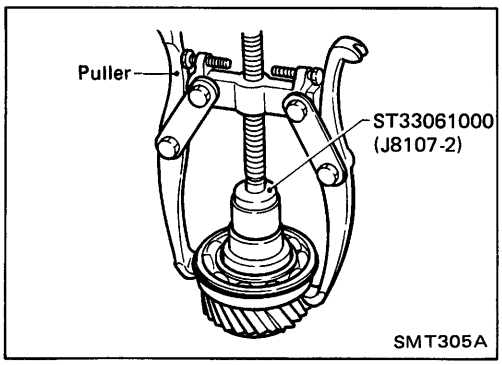
DISASSEMBLY

Main gear bearing

1. Remove snap ring and spacer.

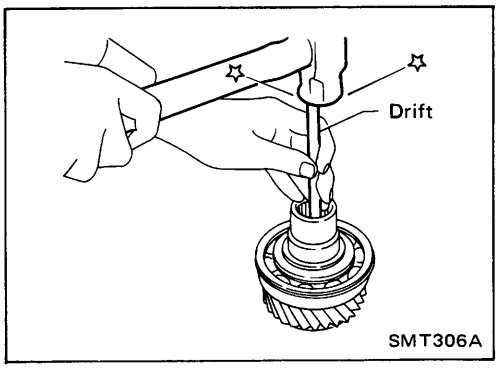

SMT304A

2. Pull out main gear bearing.



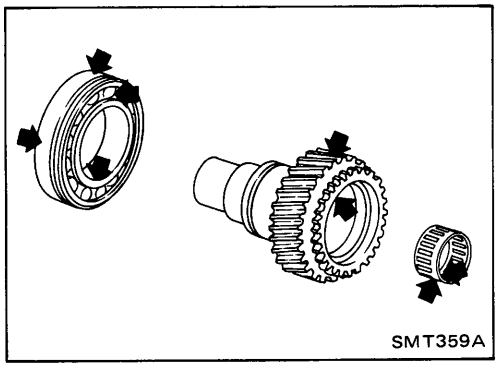
SMT305A

Main Gear (Cont'd)



Plug

Always replace it with new one whenever it is removed.



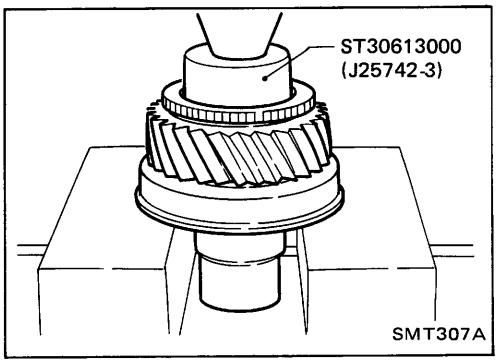
INSPECTION

Gear and shaft

- Check gears for excessive wear, chips or cracks.
- Check shaft for cracks or wear.

Bearing

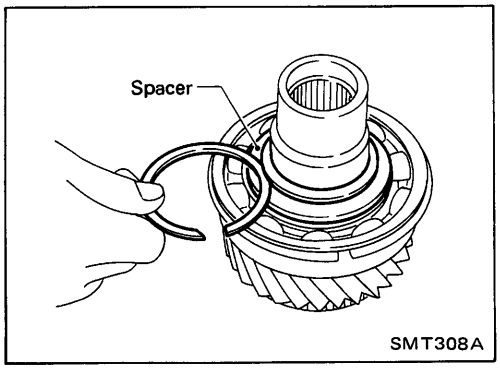
- Make sure bearings roll freely and are free from noise, crack, pitting or wear.



ASSEMBLY

Main gear bearing

1. Press on main gear bearing.
2. Install spacer.



3. Select snap ring with proper thickness and install it.

Allowable clearance between snap ring and groove:

0 - 0.15 mm (0 - 0.0059 in)

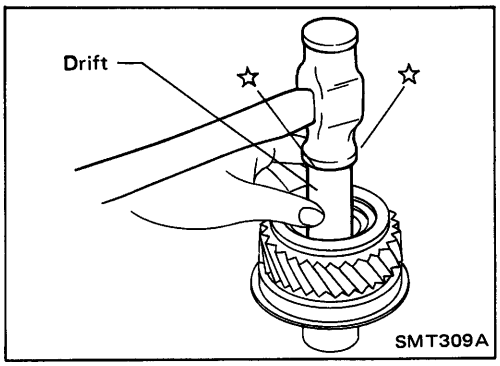
Available snap ring

Thickness mm (in)	Part number
2.6 (0.102)	33114-33G00
2.7 (0.106)	33114-33G01
2.8 (0.110)	33114-33G02
2.9 (0.114)	33114-33G03

Main Gear (Cont'd)

Plug

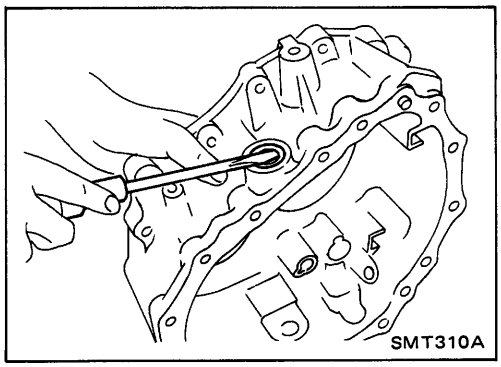
Apply sealant to plug and install it.



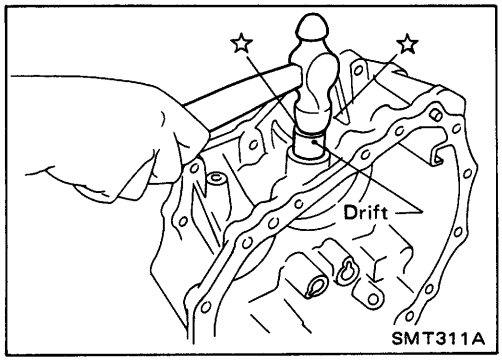
Front Case

SHIFT SHAFT OIL SEAL

Removal



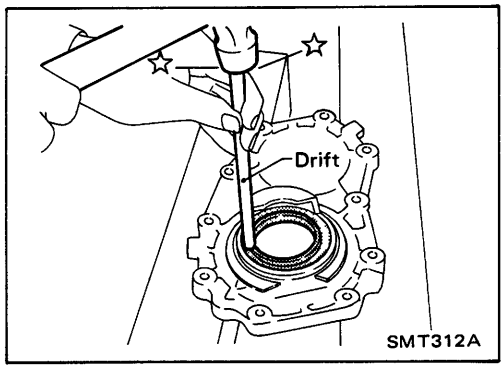
Installation



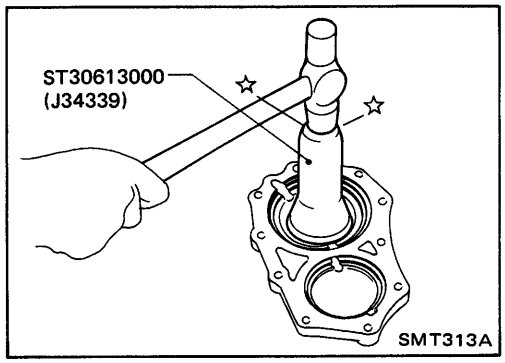
Front Case Cover

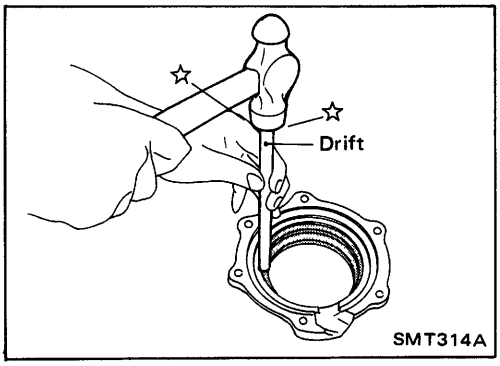
COVER OIL SEAL

Removal



Installation

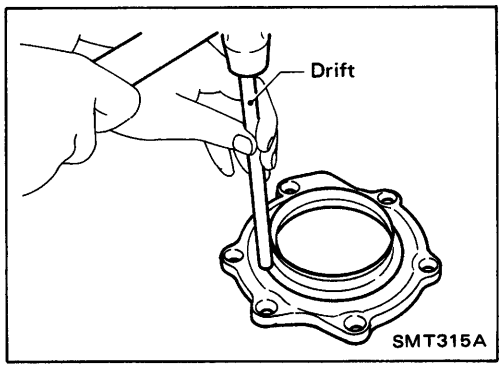




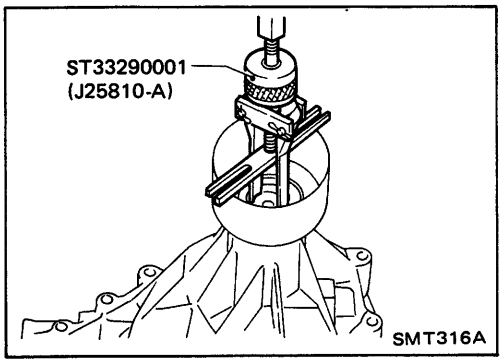
Bearing Retainer

OIL CATCHER

Removal



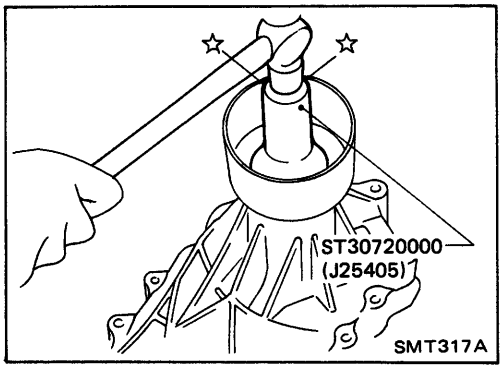
Installation



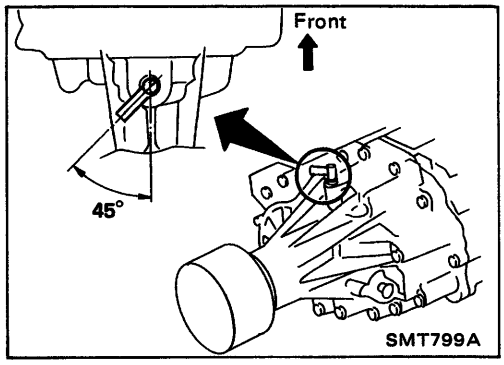
Rear Case

REAR OIL SEAL

Removal

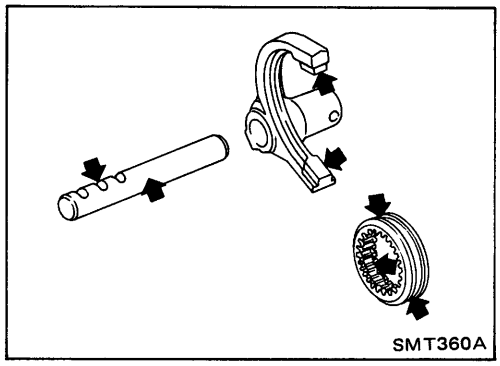


Installation



AIR BREATHER

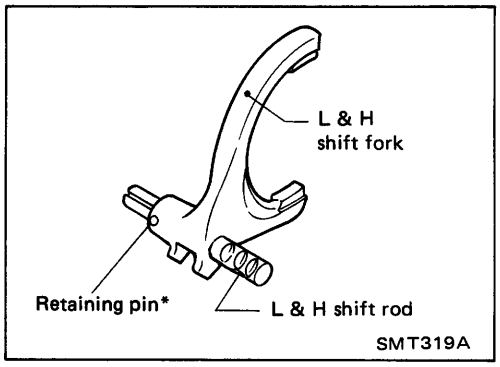
Install as shown in illustration.


SMT360A

Shift Control Components

INSPECTION

- Check contact surface and sliding surface for wear, scratches, projections or other faulty conditions.

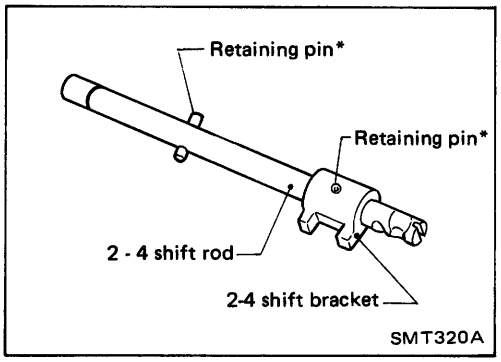


SMT319A

L & H SHIFT ROD & FORK

Assemble as shown in illustration.

* This pin is the same size as the one for 2-4 shift rod.

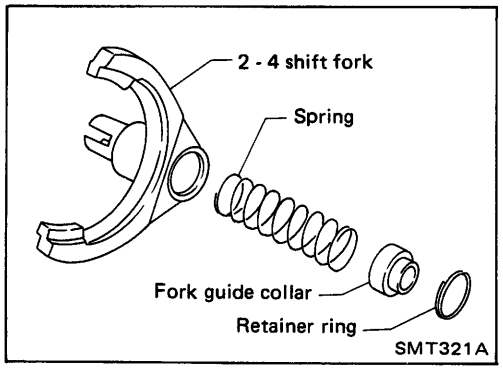


SMT320A

2-4 SHIFT ROD & FORK

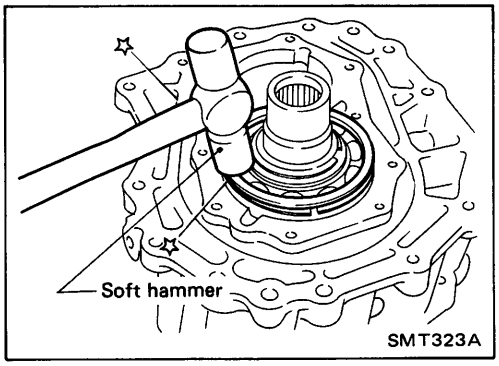
Assemble as shown in illustration.

* These pins are the same size.

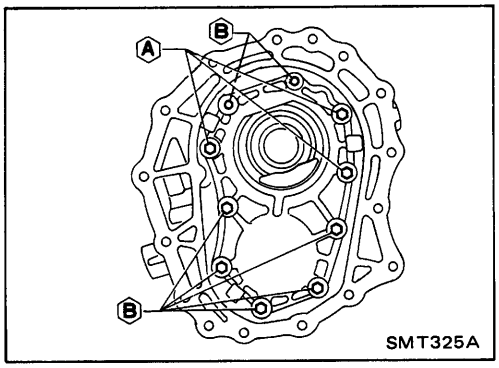


SMT321A

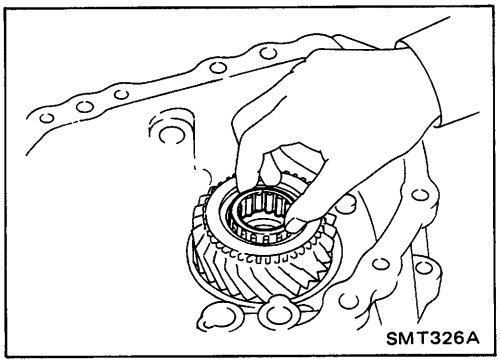
Pay special attention to the direction of fork guide collar.



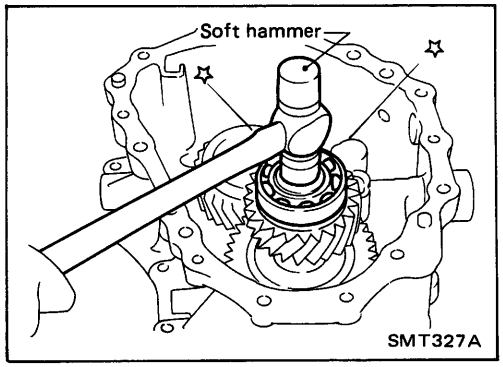
1. Assemble front case.
a. Install main gear assembly by tapping lightly.



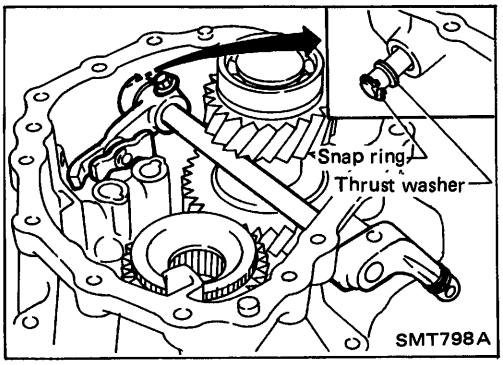
b. Apply sealant to the mating surface and bolts of front case cover and install it on front case.
- **These ten bolts should be coated with sealant.**
- **Tightening torque**
  - Ⓐ : **16 - 21 N·m (1.6 - 2.1 kg-m, 12 - 15 ft-lb)**
  - Ⓑ : **19 - 24 N·m (1.9 - 2.4 kg-m, 14 - 17 ft-lb)**



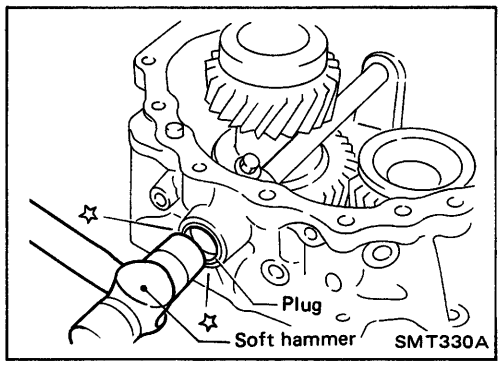
c. Apply gear oil to needle bearing and install it into main gear.



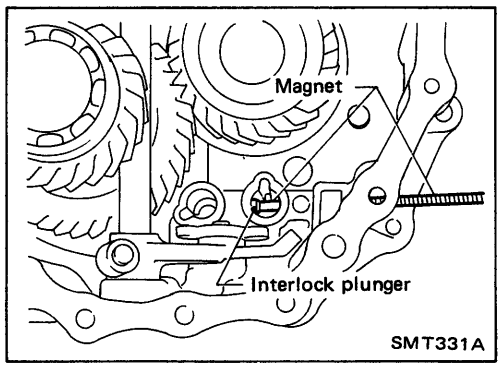
d. Install counter gear assembly by tapping lightly.



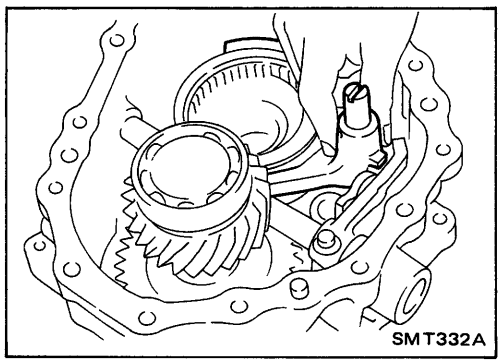
e. Install cross shaft and inner shift lever.
When replacing cross shaft, outer shift lever or lock pin of outer shift lever, replace them as a set.



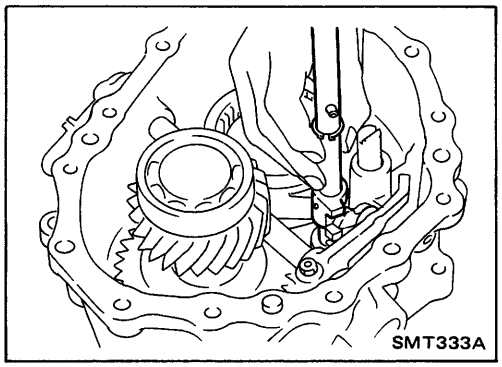
f. Apply sealant to plug and install it into front case.



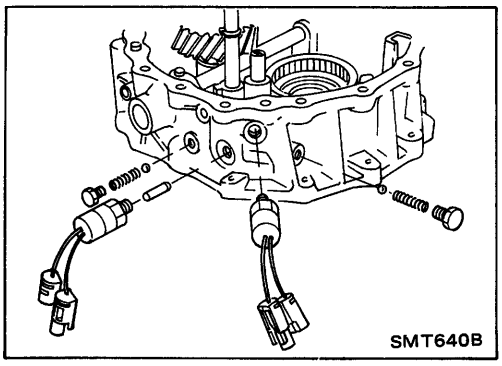
g. Insert interlock plunger into front case.



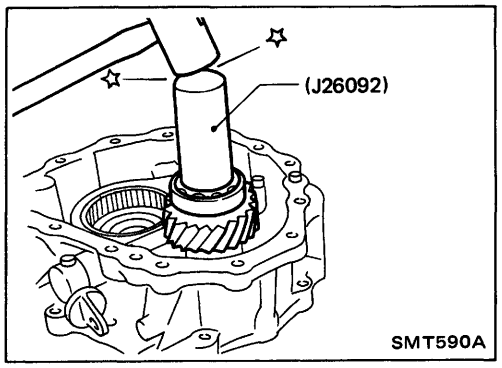
h. Install L & H shift rod and fork assembly with coupling sleeve.



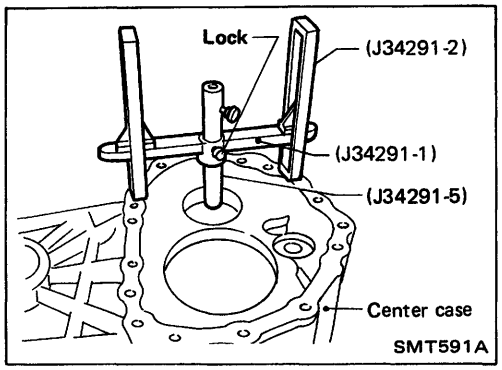
i. Install 2-4 shift rod.



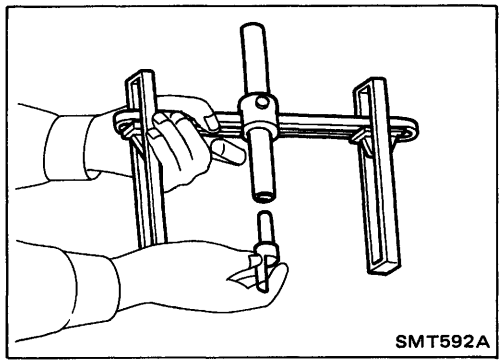
j. Install switches, check balls, check springs and plugs.
Apply sealant to switches and plugs.



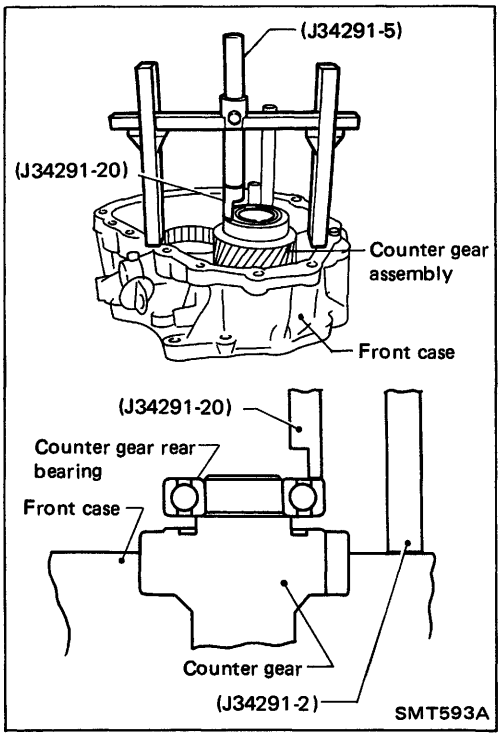
2. Select counter gear rear bearing shim.
a. Seat counter gear assembly.



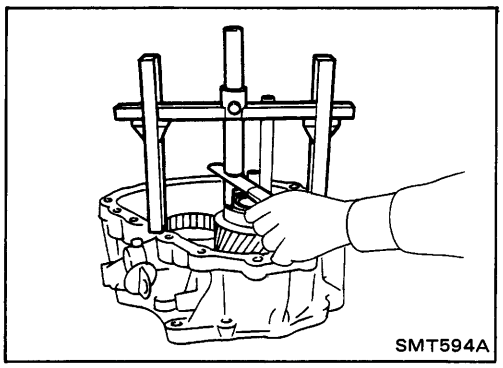
b. Place J34291-1 (bridge), J34291-2 (legs) and J34291-5 (gauging cylinder) on machined surface of center case and allow gauging cylinder to rest on top outer portion of counter gear rear bearing. Lock gauging cylinder in place.



c. Insert J34291-20 (gauging plunger) into J34291-5 (gauging cylinder).



d. Place bridge, legs, gauging cylinder and gauging plunger onto machined surface of front case assembly, and allow gauging plunger to drop until it contacts counter gear rear bearing mating surface.


SMT594A

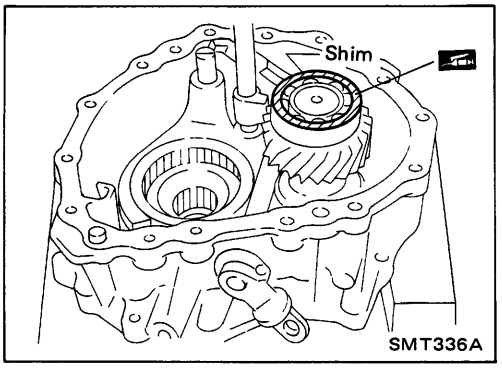
e. Lock gauging plunger in place and use feeler gauge to measure gap between gauging cylinder and gauging plunger.

f. Use measured distance and following chart to select correct shim.

Counter gear end play: 0 - 0.2 mm (0 - 0.008 in)
Counter gear rear bearing shim:

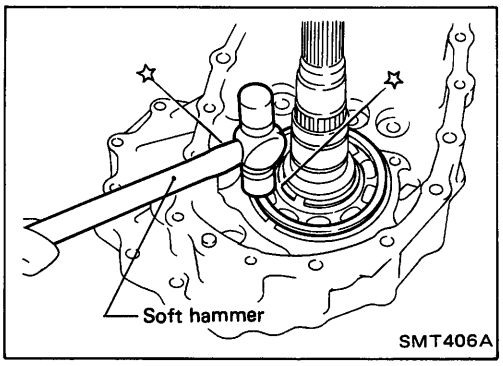
Thickness mm (in)	Part number
0.1 (0.004)	33112-C6900
0.2 (0.008)	33112-C6901
0.3 (0.012)	33112-C6902
0.4 (0.016)	33112-C6903
0.5 (0.020)	33112-33G00
0.6 (0.024)	33112-33G01

g. Select counter gear rear bearing shim.



SMT336A

3. Place suitable shim on counter gear rear bearing with grease.
4. Apply gear oil to each part in front case.

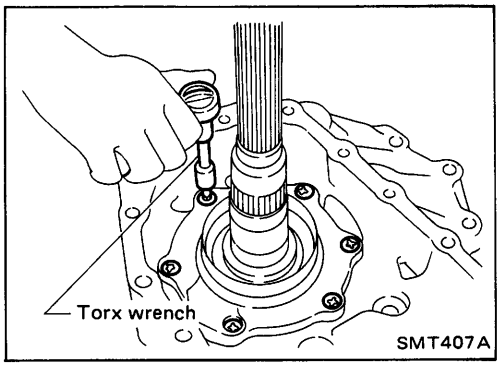


SMT406A

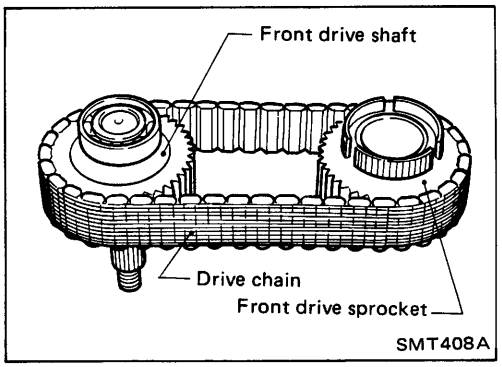
5. Assemble center case assembly.

a. Install mainshaft on center case by tapping lightly.

Apply gear oil to mainshaft front bearing.

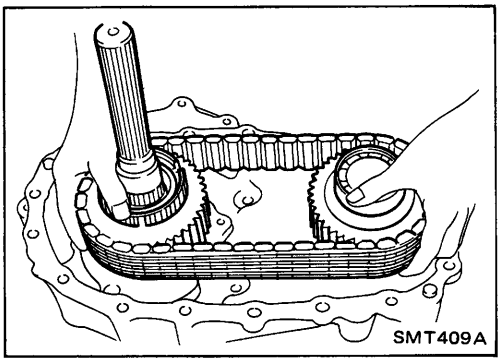


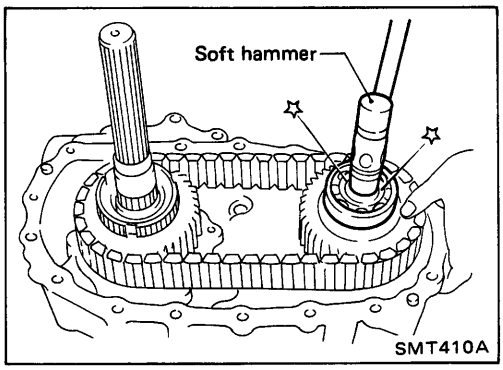
b. Install bearing retainer.



c. Put drive chain onto the front drive sprocket and front drive shaft, and then put them in center case.

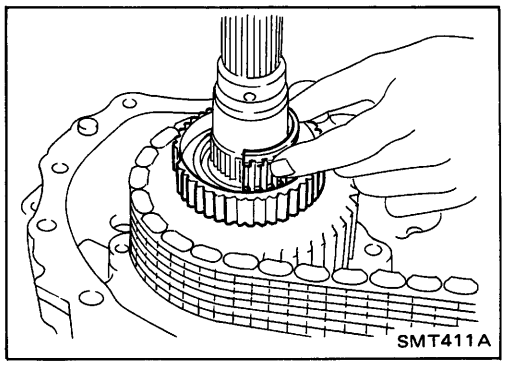
Pay attention to direction of drive chain. (Refer to DISASSEMBLY.)





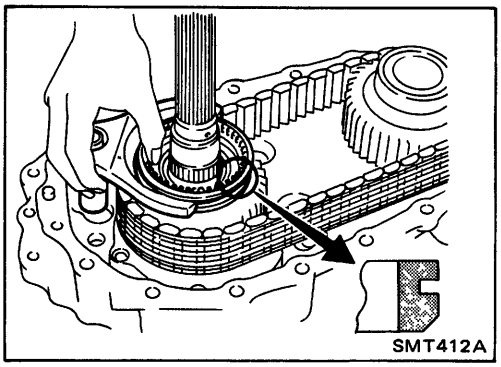
d. Install front drive shaft by tapping lightly.

Make sure shafts are lined up in the case.



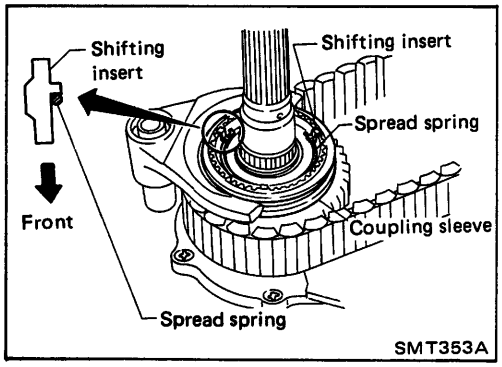
e. Apply gear oil to needle bearings and install them into front drive sprocket.

These needle bearings will be installed more easily if front drive sprocket is rotated while installing them.



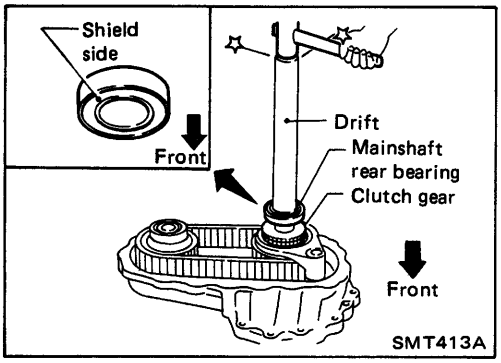
f. Install 2-4 coupling sleeve with 2-4 shift fork.

Pay special attention to direction of coupling sleeve.



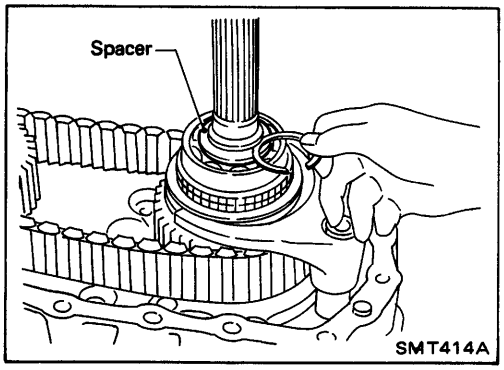
g. Install shifting inserts and spread spring.

Pay special attention to direction of shifting inserts.



h. Install baulk ring and then install clutch gear and mainshaft rear bearing.

Place wooden block under mainshaft in order to protect mainshaft front bearing.



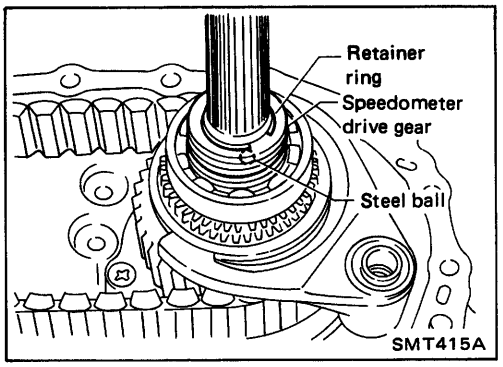
i. Install spacer.

j. Select snap ring with proper thickness and install it.

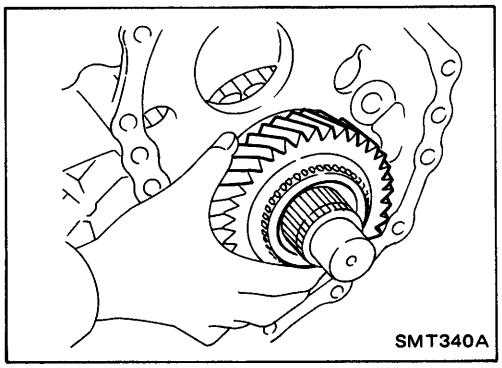
Allowable clearance between snap ring and groove:
0 - 0.15 mm (0 - 0.0059 in)

Available snap ring

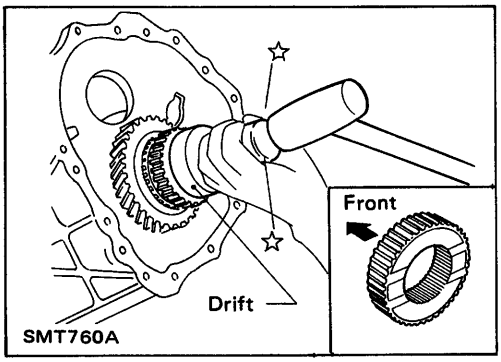
Thickness mm (in)	Part number
1.8 (0.071)	33138-33G20
1.9 (0.075)	33138-33G21
2.0 (0.079)	33138-33G22
2.1 (0.083)	33138-33G23
2.2 (0.087)	33138-33G24



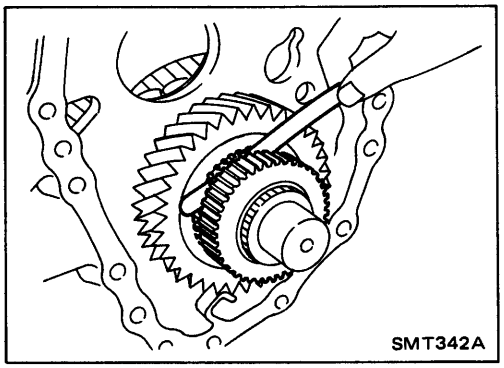
k. Install steel ball, speedometer drive gear and retainer ring.
Steel ball is the smallest of check balls for this unit.



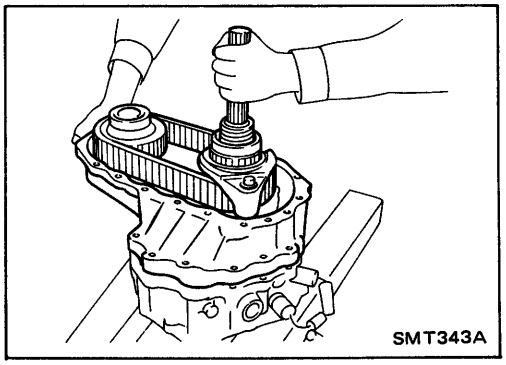
l. Install low gear and its bearing to mainshaft.
Apply gear oil to needle bearing.



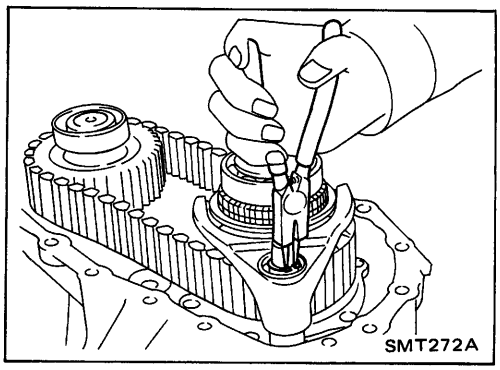
m. Install L & H hub and snap ring to mainshaft.
Pay special attention to direction of L & H hub.



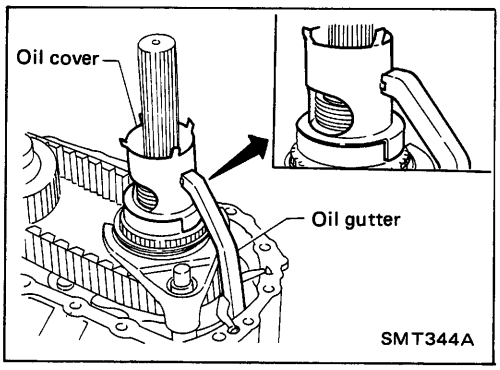
n. Measure end play of low gear.
Standard: 0.2 - 0.35 mm (0.0079 - 0.0138 in)



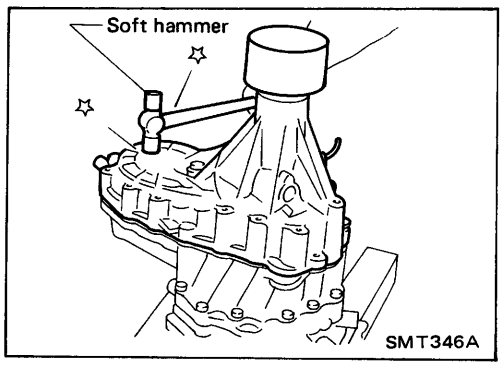
6. Apply sealant to mating surface and put center case assembly onto front case and tighten bolts.



7. Install snap ring to 2-4 shift rod.



8. Install oil gutter and oil cover.
9. Apply gear oil to each part in center case.



10. Apply sealant to mating surface and install rear case on center case.

General Specifications

Transfer model			TX10A
Gear ratio	High		1.000
	Low		2.020
Number of teeth	Main gear		29
	Low gear		37
	Counter gear	High	38
		Low	24
	Front drive sprocket		41
	Front drive shaft		41
Oil capacity	ℓ (US qt, Imp qt)		2.2 (2-3/8, 2)

Inspection and Adjustment

GEAR END PLAY

mm (in)

Front drive sprocket	0.2 - 0.35 (0.0079 - 0.0138)
Low gear	0.2 - 0.35 (0.0079 - 0.0138)
Counter gear	0 - 0.2 (0 - 0.008)

CLEARANCE BETWEEN BAULK RING AND CLUTCH GEAR

mm (in)

Standard	Wear limit
1.0 - 1.5 (0.039 - 0.059)	0.5 (0.020)

AVAILABLE SNAP RING

Mainshaft front bearing

Allowable clearance	0 - 0.15 mm (0 - 0.0059 in)
Thickness mm (in)	Part number
3.1 (0.122)	33138-33G10
3.2 (0.126)	33138-33G11
3.3 (0.130)	33138-33G12
3.4 (0.134)	33138-33G13

Mainshaft rear bearing

Allowable clearance	0 - 0.15 mm (0 - 0.0059 in)
Thickness mm (in)	Part number
1.8 (0.071)	33138-33G20
1.9 (0.075)	33138-33G21
2.0 (0.079)	33138-33G22
2.1 (0.083)	33138-33G23
2.2 (0.087)	33138-33G24

Main gear bearing

Allowable clearance	0 - 0.15 mm (0 - 0.0059 in)
Thickness mm (in)	Part number
2.6 (0.102)	33114-33G00
2.7 (0.106)	33114-33G01
2.8 (0.110)	33114-33G02
2.9 (0.114)	33114-33G03

Inspection and Adjustment (Cont'd)

AVAILABLE SHIM

Counter gear rear bearing

Thickness mm (in)	Part number
0.1 (0.004)	33112-C6900
0.2 (0.008)	33112-C6901
0.3 (0.012)	33112-C6902
0.4 (0.016)	33112-C6903
0.5 (0.020)	33112-33G00
0.6 (0.024)	33112-33G01

PROPELLER SHAFT & DIFFERENTIAL CARRIER

SECTION PD

CONTENTS

PREPARATION ..... PD- 3
PROPELLER SHAFT ..... PD- 8
ON-VEHICLE SERVICE (Final drive) PD-15
REMOVAL AND INSTALLATION (Front final drive) PD-17
REMOVAL AND INSTALLATION (Rear final drive) PD-18

Model R180A

FRONT FINAL DRIVE PD-20
DISASSEMBLY PD-21
INSPECTION PD-26
ADJUSTMENT PD-27
ASSEMBLY PD-34

Model R200A

FRONT FINAL DRIVE PD-40
DISASSEMBLY PD-41
INSPECTION PD-47
ADJUSTMENT PD-48
ASSEMBLY PD-56

Model H190A

REAR FINAL DRIVE PD-63
DISASSEMBLY PD-64
INSPECTION PD-68
LIMITED SLIP DIFFERENTIAL PD-69
ADJUSTMENT PD-76
ASSEMBLY PD-83

Contents (Cont'd)

Model C200

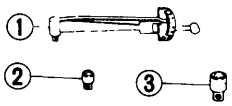
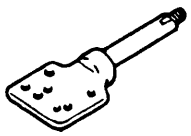
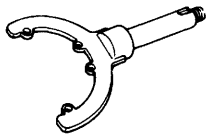
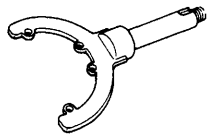
REAR FINAL DRIVE ..... PD- 88
DISASSEMBLY ..... PD- 89
INSPECTION ..... PD- 93
LIMITED SLIP DIFFERENTIAL ..... PD- 94
ADJUSTMENT PD-101
ASSEMBLY PD-108

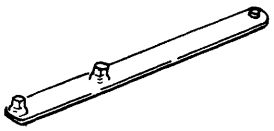
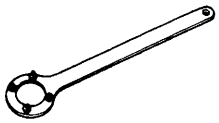
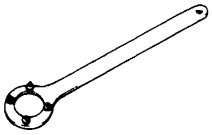
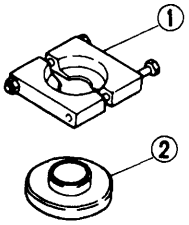
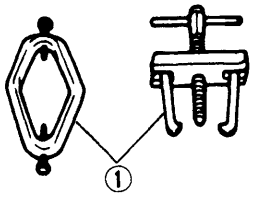
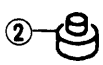
Model H233B

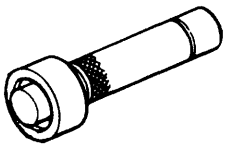
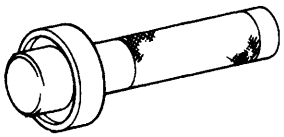
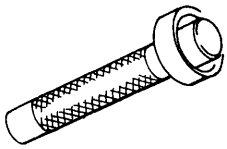
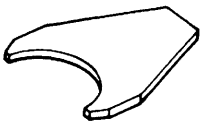
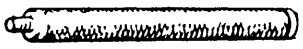
REAR FINAL DRIVE PD-113
DISASSEMBLY PD-115
INSPECTION PD-120
LIMITED SLIP DIFFERENTIAL PD-121
ADJUSTMENT PD-128
ASSEMBLY PD-134

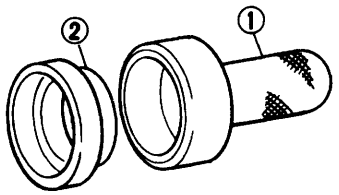
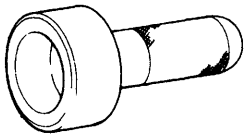
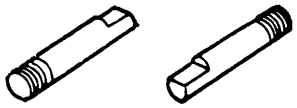
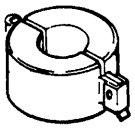
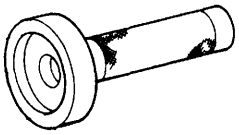
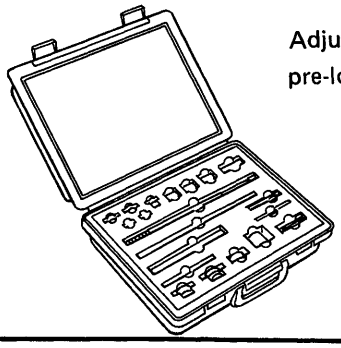
SERVICE DATA AND SPECIFICATIONS (S.D.S.) PD-140

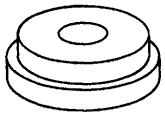
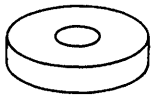
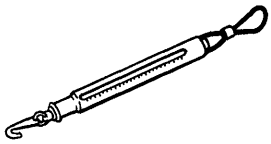
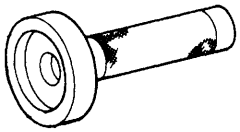
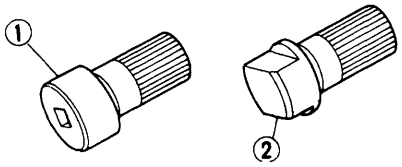
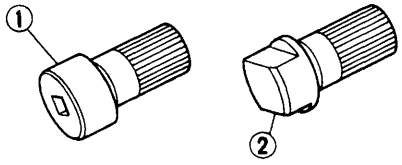
SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.) Tool name	Description	Unit application				
		R180A	R200A	H190A	C200	H233B
ST3127S000 (See J25765-A) Preload gauge ① GG91030000 (J25765) Torque wrench ② HT62940000 (–) Socket adapter ③ HT62900000 (–) Socket adapter	Measuring pinion bearing preload and total preload 	X	X	X	X	X
KV38100800 (–) Differential attachment Equivalent tool (J25604-01)	Mounting final drive 	X	X	–	–	–
ST06310000 (–) Differential attachment Equivalent tool (J25602-01)	Mounting final drive 	–	–	X	–	–
ST06340000 (–) Differential attachment Equivalent tool (J24310)	Mounting final drive 	–	–	–	–	X

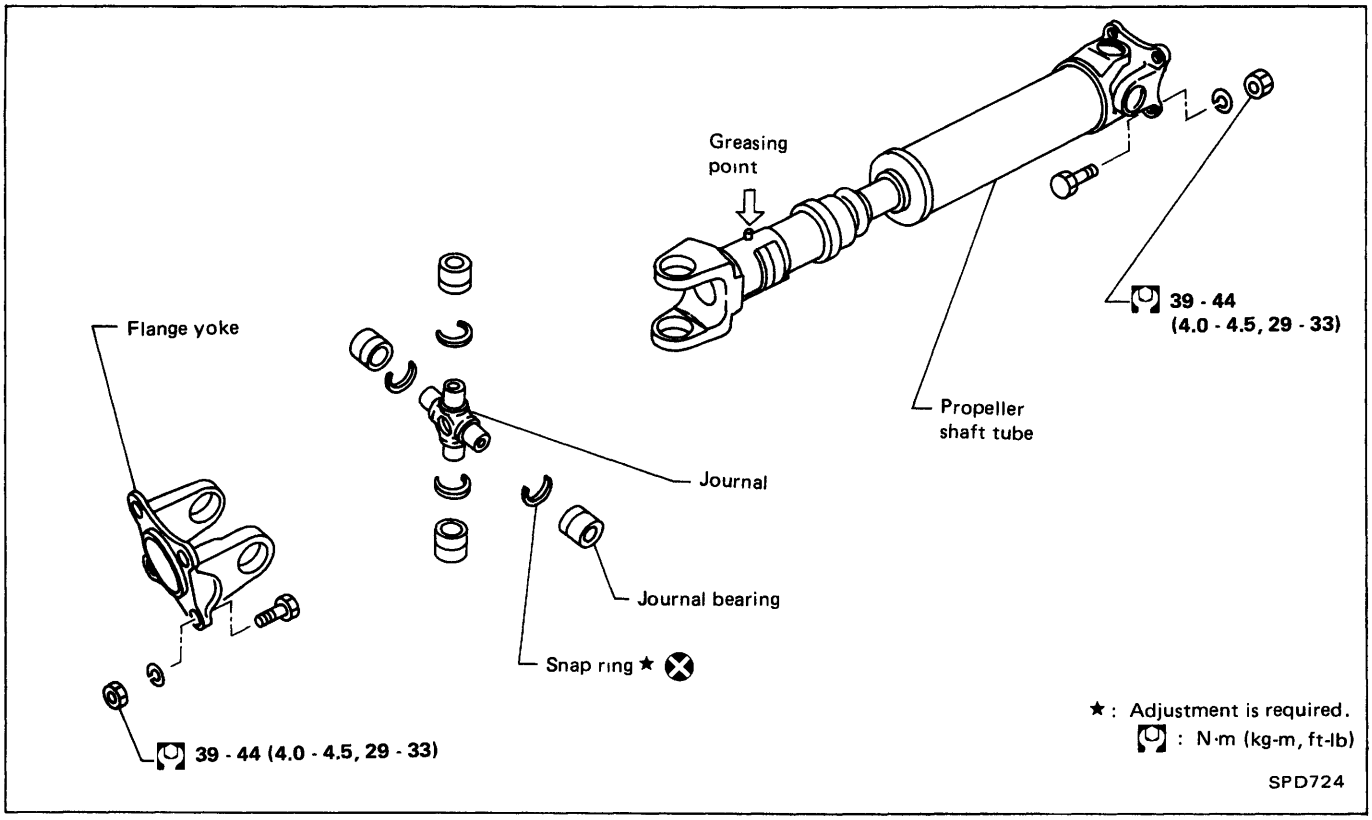
Tool number (Kent-Moore No.) Tool name	Description		Unit application				
			R180A	R200A	H190A	C200	H233B
ST32580000 (J34312) Differential side bearing adjusting nut wrench		Adjusting side bearing preload and backlash (ring gear-drive pinion)	–	–	–	–	X
ST33290001 (J25810-A) Side bearing outer race puller		Removing side bearing outer race and side oil seal	X	–	–	–	–
ST38060002 (J34311) Drive pinion flange wrench		Removing and installing propeller shaft lock nut, and drive pinion lock nut	X	X	X	X (2WD)	–
KV38104700 (J34311) Drive pinion flange wrench		Removing and installing propeller shaft lock nut, and drive pinion lock nut	–	–	–	X (4WD)	X
ST3090S000 (–) Drive pinion rear inner race puller set ① ST30031000 (J22912-01) Puller ② ST30901000 (–) Base Equivalent tool (J26010-01)		Removing and installing drive pinion rear inner cone	X	X	X	X	X
ST3306S001 Differential side bearing puller set ① ST33051001 (–) Body Equivalent tool (J22888) ② ST33061000 (J8107-2) Adapter		Removing and installing differential side bearing inner cone 	X	X	X	X	X

Tool number (Kent-Moore No.) Tool name	Description		Unit application				
			R180A	R200A	H190A	C200	H233B
ST33230000 (J25805-01) Differential side bearing drift		Installing side bearing inner cone	X	–	X	X	–
KV38100300 (J25523) Differential side bearing drift		Installing side bearing inner cone	–	X	–	–	–
ST33190000 (–) Differential side bearing drift Equivalent tool (J25523)		Installing side bearing inner cone	–	–	–	–	X
ST33081000 (–) Side bearing puller adapter		Installing side bearing inner cone	–	–	–	–	X
KV38100600 (J25267) Side bearing spacer drift		Installing side bearing spacer	–	X	–	X	–
ST30611000 (J25742-1) Drift		Installing pinion rear bearing outer race	X	X	X	X	X
ST30621000 (J25742-5) Drift		Installing pinion rear bearing outer race	X	X	X	X	X
ST30701000 (J25742-2) Drift		Installing pinion front bearing outer race	X	–	–	–	–
ST30613000 (J25742-3) Drift		Installing pinion front bearing outer race	–	X	X	X	X

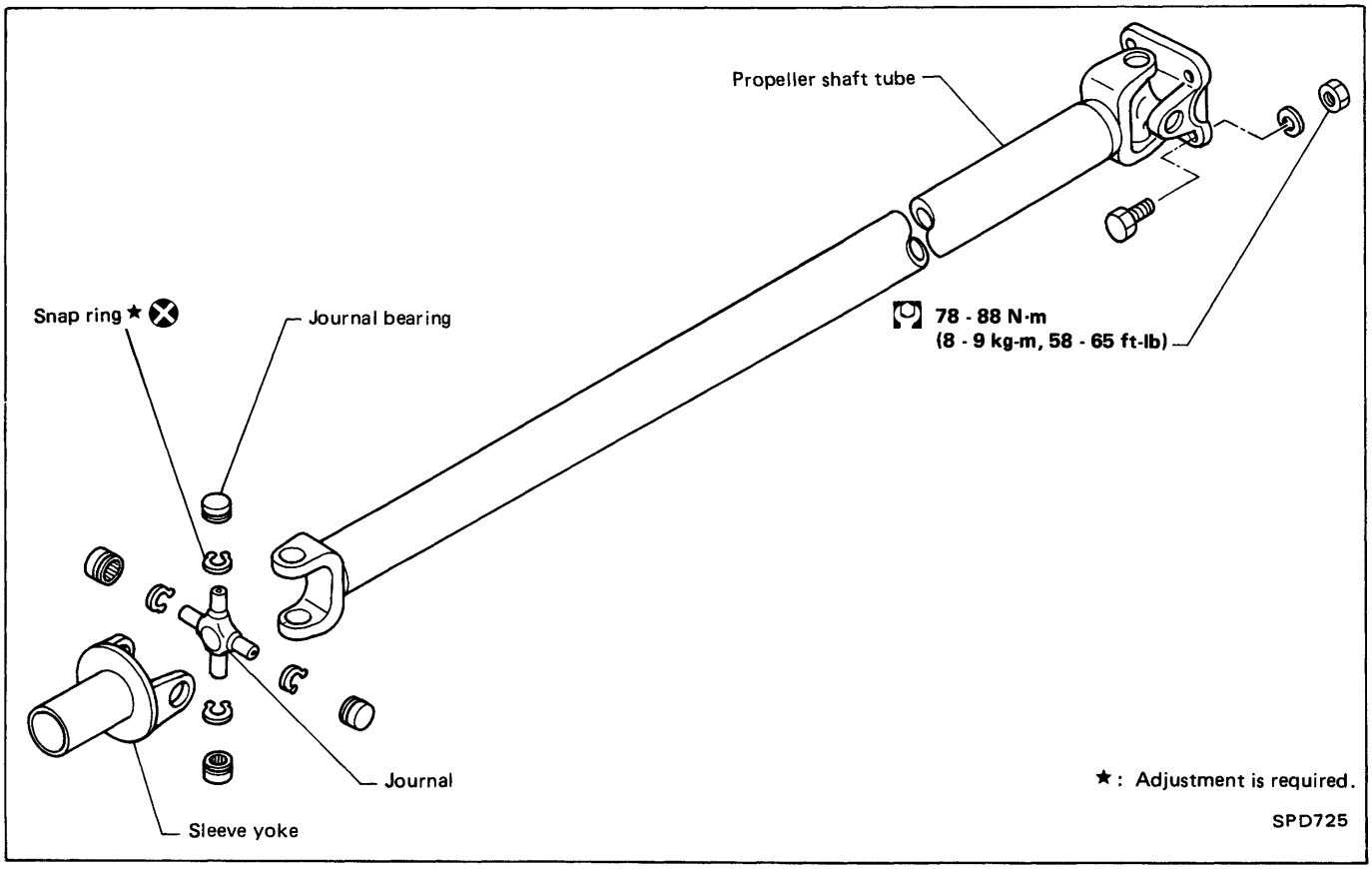
Tool number (Kent-Moore No.) Tool name	Description	Unit application				
		R180A	R200A	H190A	C200	H233B
KV381025S0 (–) Oil seal fitting tool ① ST30720000 (–) Drift bar Equivalent tool (J25405) ② KV38102510 (–) Drift	Installing front oil seal 	X	–	X	–	X
KV38100500 (–) Gear carrier front oil seal drift Equivalent tool (J25273)	Installing front oil seal 	–	X	–	X	–
ST33720000 (J25817) Differential side retainer guide	 Installing side retainer	X	–	–	–	–
ST33270000 (J25809) Side oil seal drift	 Installing side oil seal	X	–	–	–	–
KV38100200 (J26233) Gear carrier side oil seal drift	 Installing side oil seal	–	X	–	–	–
(J34309) Differential shim selector	 Adjusting bearing pre-load and gear height	X	X	X	X	X

Tool number (Kent-Moore No.) Tool name	Description	Unit application				
		R180A	R200A	H190A	C200	H233B
(J25269-4) Side bearing discs (2 Req'd)	 Selecting pinion height adjusting washer	X	X	–	X	–
(J25269-18) Side bearing discs (2 Req'd)	 Selecting pinion height adjusting washer	–	–	X	–	X
(J8129) Spring gauge	 Measuring carrier turning torque	X	X	X	X	X
(J35764) Gear carrier side oil seal drift	 Installing side oil seal	X	–	–	–	–
KV381051S0 (–) Rear axle shaft dummy ① KV38105110 (–) Torque wrench side ② KV38105120 (–) Vice side	 Checking differential torque on limited slip differential	–	–	X	X	–
KV381052S0 (–) Rear axle shaft dummy ① KV38105210 (–) Torque wrench side ② KV38105220 (–) Vice side	 Checking differential torque on limited slip differential	–	–	–	–	X

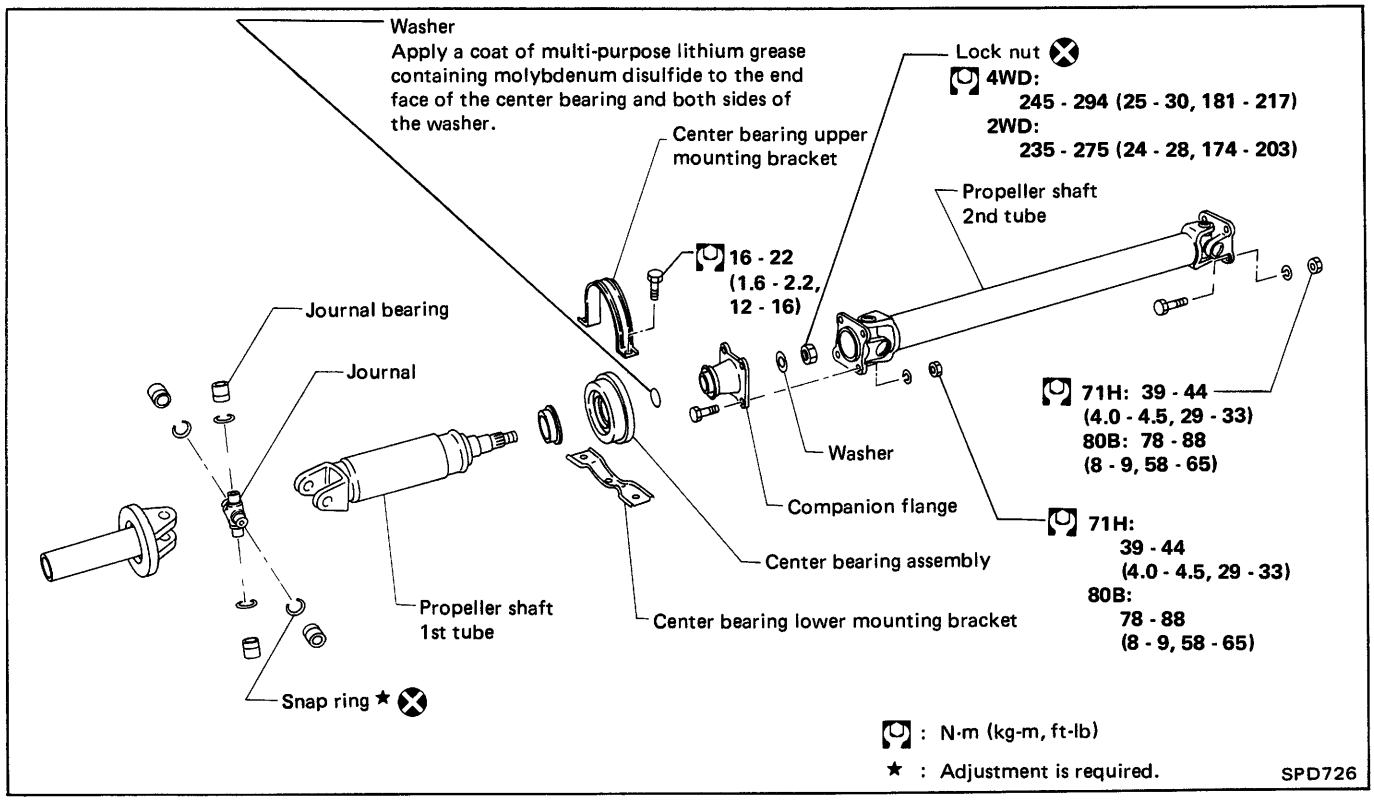
Front propeller shaft (Model 2F71H)



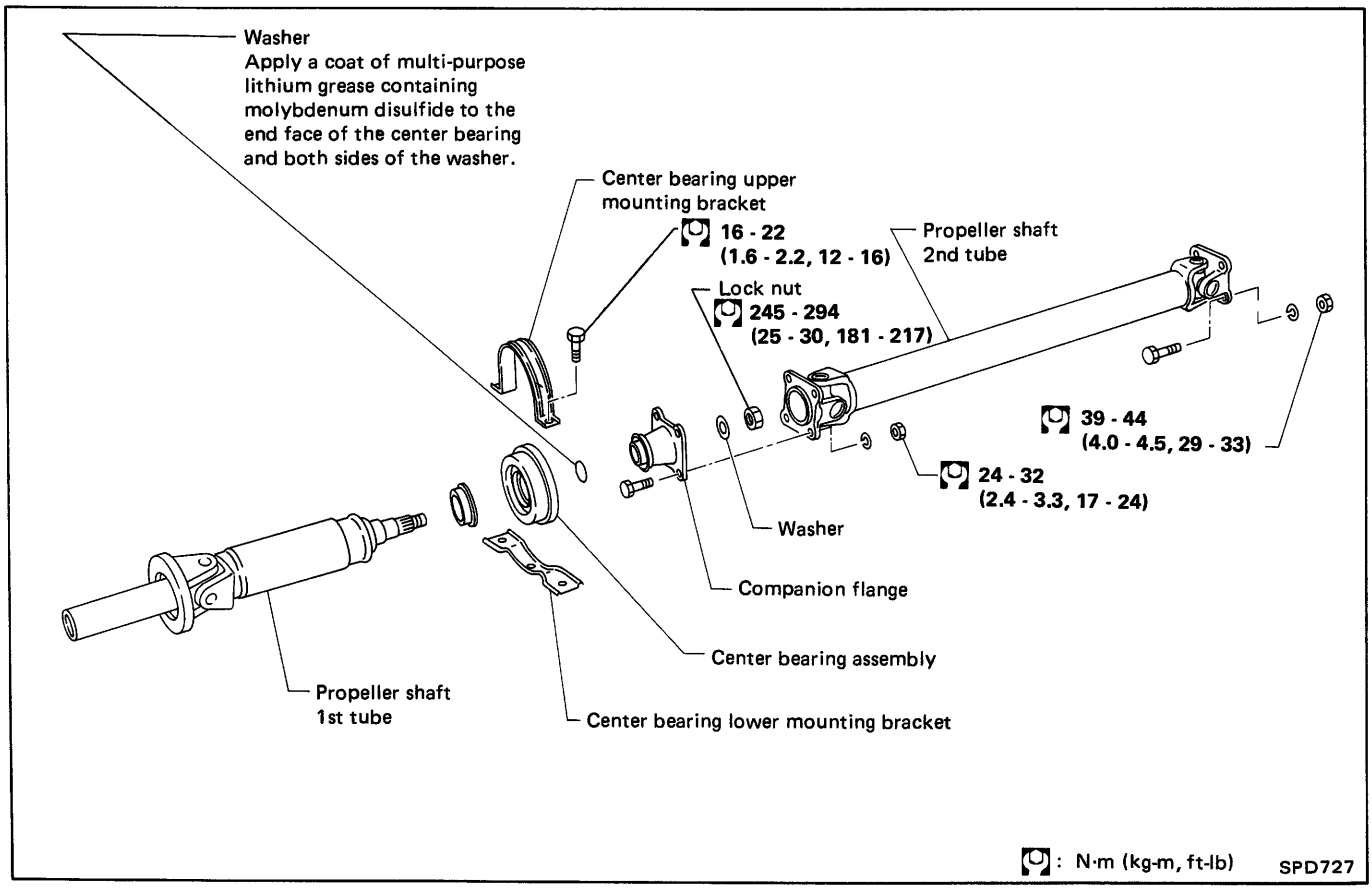
Rear propeller shaft (Model 2S80B)

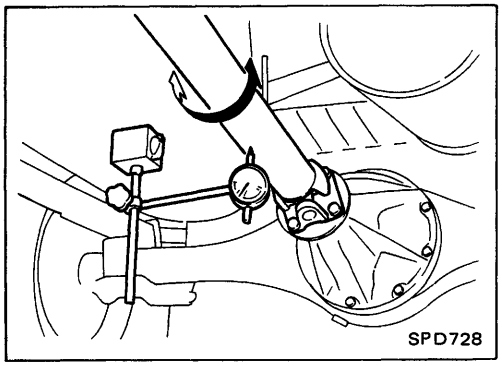


Rear propeller shaft (Model 3S80B)



Rear propeller shaft (Model 3S71A)



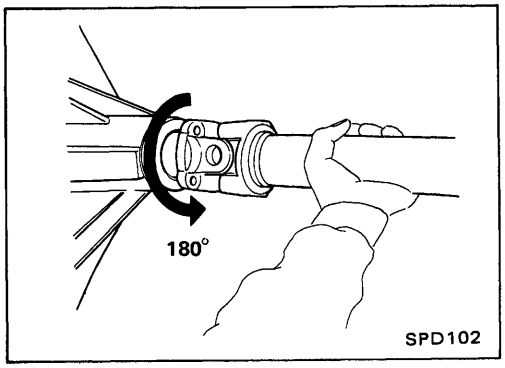

SPD728

On-vehicle Service

PROPELLER SHAFT VIBRATION

If vibration is present at high speed, inspect propeller shaft runout first.

1. Raise rear wheels.
2. Measure propeller shaft runout at several points by rotating final drive companion flange with hands.



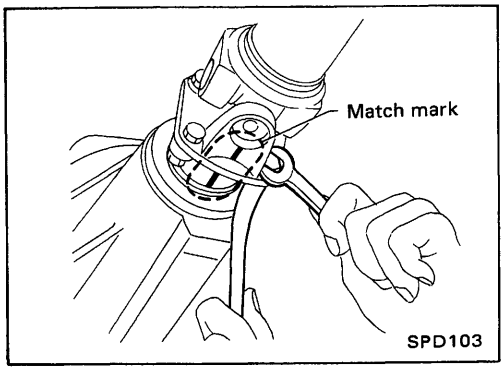
SPD102

3. If runout exceeds specifications, disconnect propeller shaft at final drive companion flange; then rotate companion flange 180 degrees and reconnect propeller shaft.

   Runout limit: 0.6 mm (0.024 in)
4. Check runout again. If runout still exceeds specifications, replace propeller shaft assembly.
5. Perform road test.

APPEARANCE CHECKING

- Inspect propeller shaft tube surface for dents or cracks. If damaged, replace propeller shaft assembly.
- If center bearing is noisy or damaged, replace center bearing.

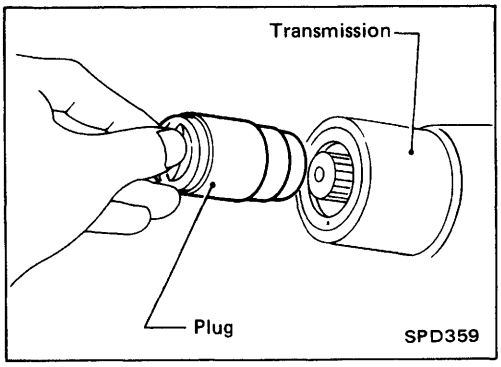


SPD103

Removal and Installation

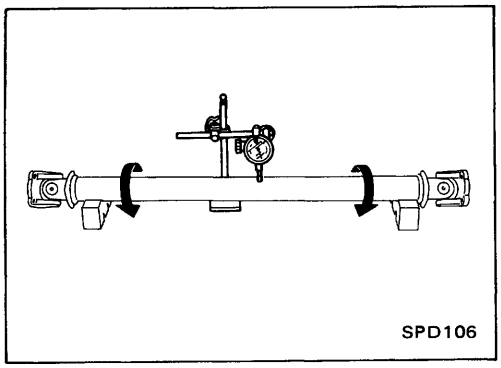
- Put match marks on flanges and separate propeller shaft from final drive.

Removal and Installation (Cont'd)



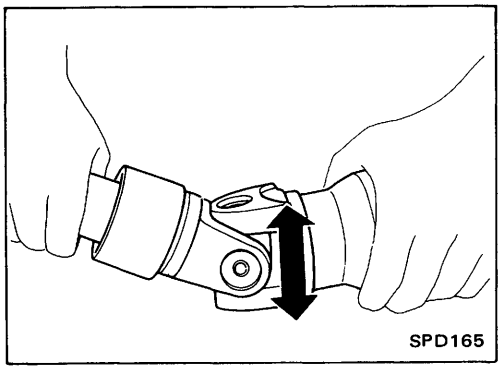
- Draw out propeller shaft from transmission and plug up rear end of transmission rear extension housing.

Inspection



- Inspect propeller shaft runout. If runout exceeds specifications, replace propeller shaft assembly.

  Runout limit: 0.6 mm (0.024 in)



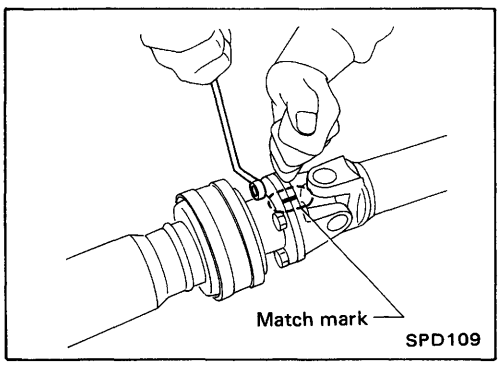
- Inspect journal axial play.
  If the play exceeds specifications, replace propeller shaft assembly.

  Journal axial play:
  0.02 mm (0.0008 in) or less

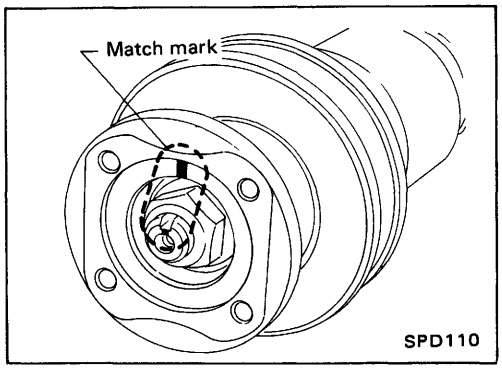
Disassembly

CENTER BEARING

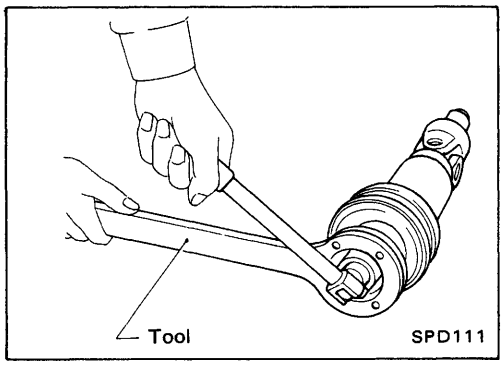
1. Put match marks on flanges, and separate 2nd tube from 1st tube.



2. Put match marks on the flange and shaft.

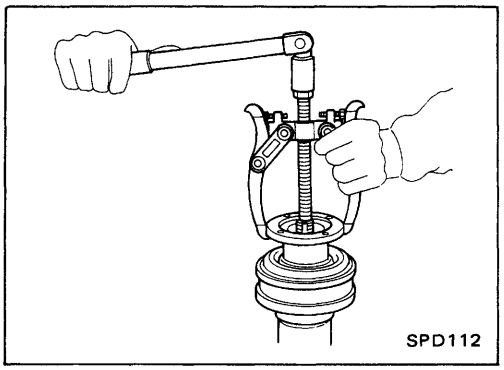


Disassembly (Cont'd)

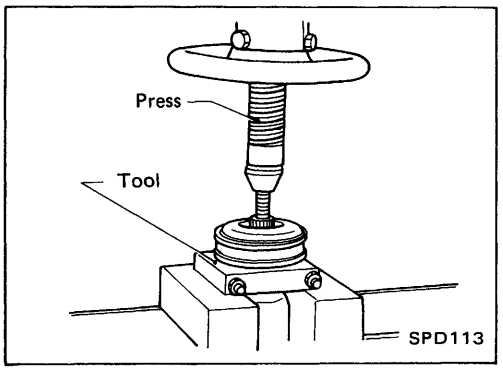


3. Remove locking nut with Tool.

Tool number:
R180A, R200A, H190A, C200
(2WD except Van and Wagon)
ST38060002 (J34311)
C200 (Van and Wagon), H233B
KV38104700 (J34311)



4. Remove companion flange with puller.

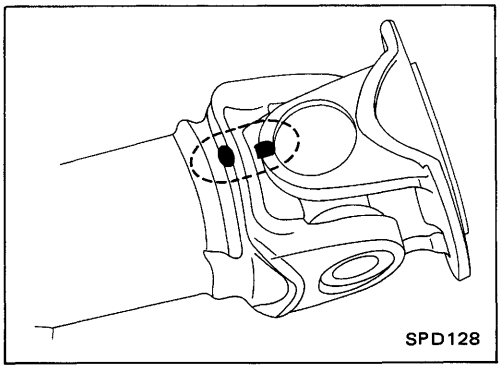


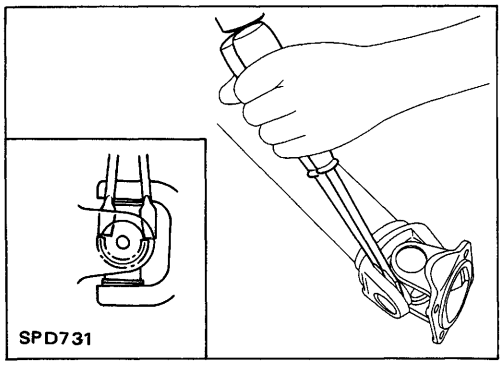
5. Remove center bearing with Tool and press.
Tool number: ST30031000 (J22912-01)

JOURNAL (71H and 80B)

63A: Do not disassemble.

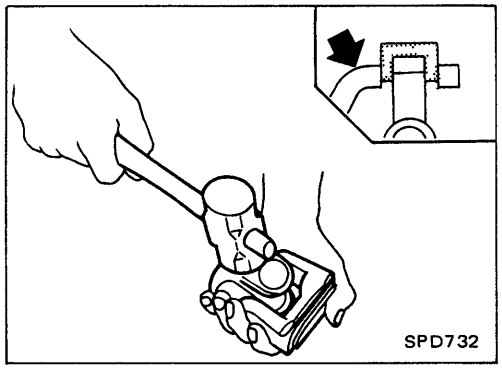
1. Put match marks on shaft and flange or yoke.



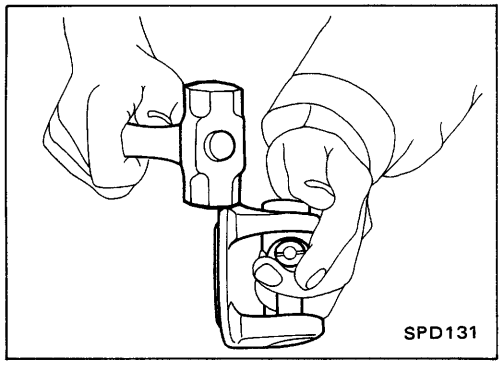


2. Remove snap ring.

Disassembly (Cont'd)



3. Remove pushed out journal bearing by lightly tapping yoke with a hammer, taking care not to damage journal and yoke hole.

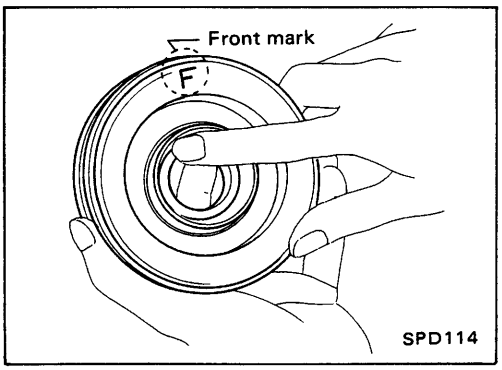


4. Remove bearing at opposite side in above operation.

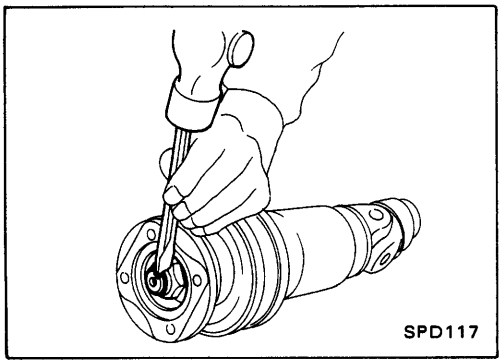
Put marks on disassembled parts so that they can be reinstalled in their original positions from which they were removed.

Assembly

CENTER BEARING

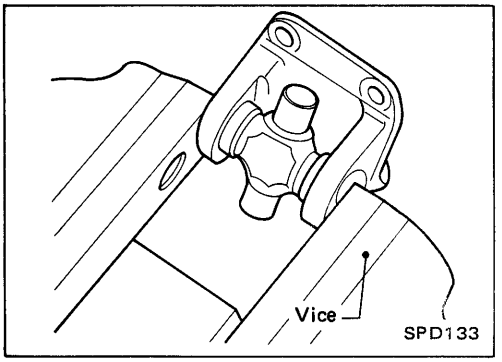


- When installing center bearing, position the "F" mark on center bearing toward front of vehicle.
- **Apply a coat of multi-purpose lithium grease containing molybdenum disulfide to the end face of the center bearing and both sides of the washer.**



- Stake the nut. Always use new one.
- Align match marks when assembling tubes.

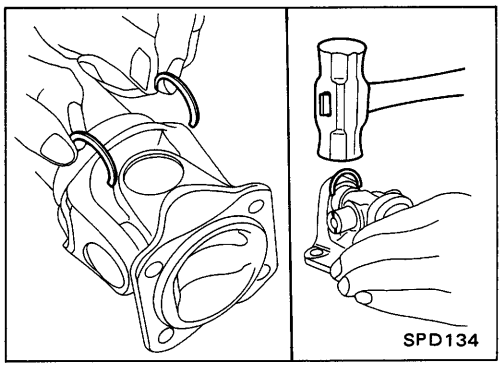
JOURNAL (63H, 71H and 80B)



1. Assemble journal bearing. Apply recommended multi-purpose grease on bearing inner surface.

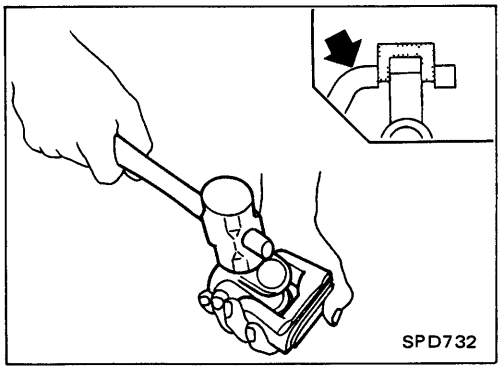
When assembling, be careful that needle bearing does not fall down.

Assembly (Cont'd)

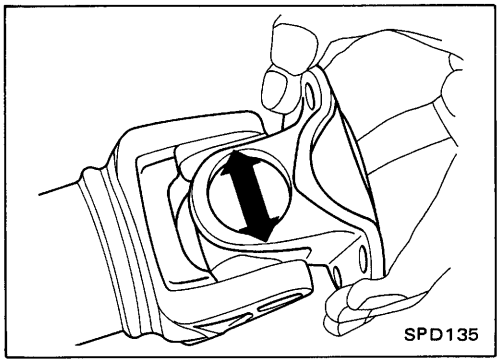


2. Select snap ring that will provide specified play in axial direction of journal, and install them. (Refer to S.D.S.)

Select snap rings with a difference in thickness at both sides within 0.06 mm (0.0024 in).

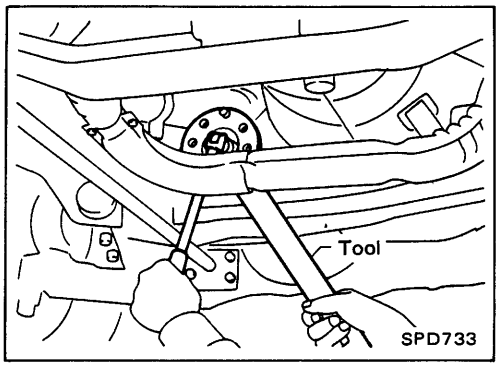


3. Adjust thrust clearance between bearing and snap ring to zero by tapping yoke.



4. Check to see that journal moves smoothly and check for axial play.

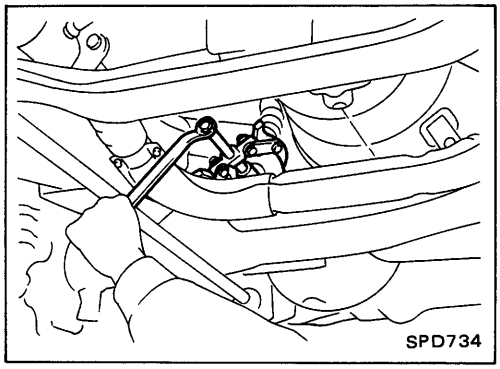
Axial play: 0.02 mm (0.0008 in) or less



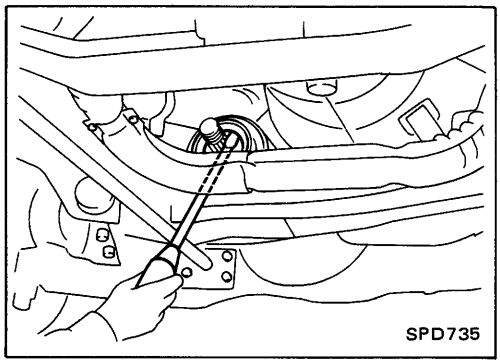
Front Oil Seal Replacement (Front final drive)

1. Remove front propeller shaft.
2. Loosen drive pinion nut.

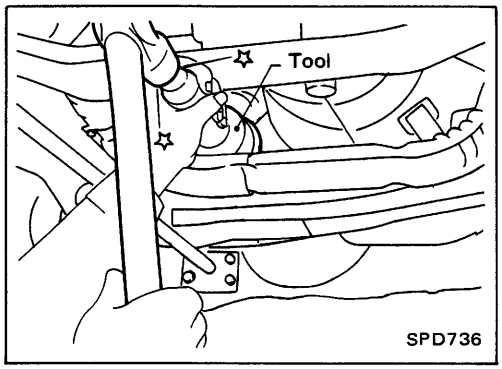
   Tool number: ST38060002 (J34311)



3. Remove companion flange.



4. Remove front oil seal.



5. Apply multi-purpose grease to cavity at sealing lips of oil seal. Press front oil seal into carrier.
6. Install companion flange and drive pinion nut.
7. Install propeller shaft.

   Tool number:

   R180A

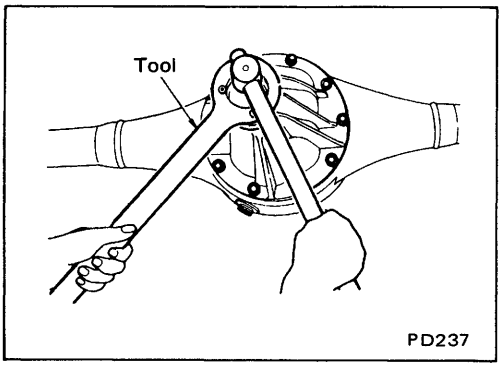
   ST30720000 (–)

   Equivalent tool (J25405)

   R200A

   KV38100500 (–)

   Equivalent tool (J25273)



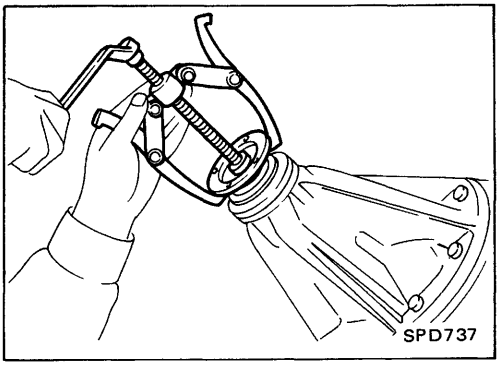
Front Oil Seal Replacement

CAUTION:

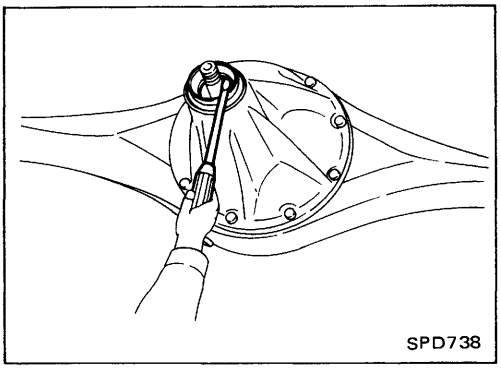
For final drive models using collapsible spacer (H190A, C200) bearing preload must be adjusted whenever companion flange is removed. Therefore, final drive overhaul is required.

1. Remove propeller shaft.
2. Loosen drive pinion nut.

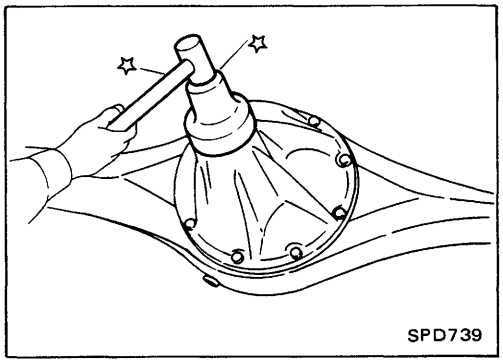
   Tool number: KV38104700 (J34311)



3. Remove companion flange.



4. Remove front oil seal.

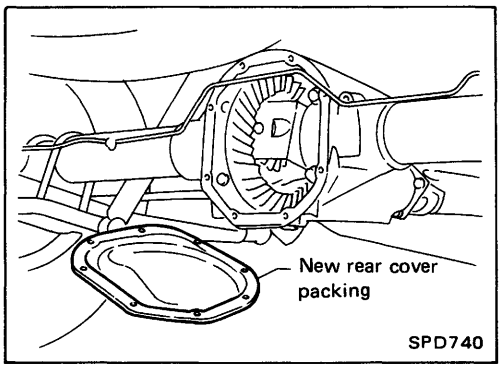


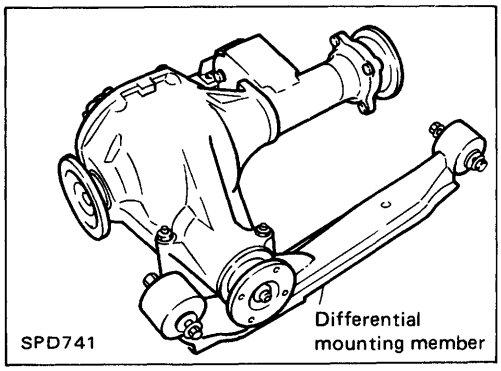
5. Apply multi-purpose grease to cavity at sealing lips of oil seal. Press front oil seal into carrier.

   Tool number: (J25273)
6. Install companion flange and drive pinion nut.
7. Install rear propeller shaft.

Rear Cover Packing Replacement

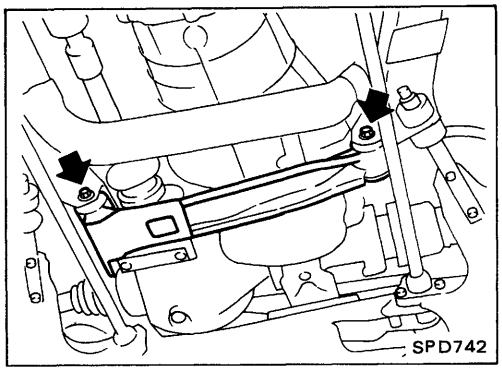
1. Drain gear oil.
2. Remove rear cover and rear cover packing.
3. Install new rear cover packing and rear cover.
4. Fill final drive with recommended gear oil.





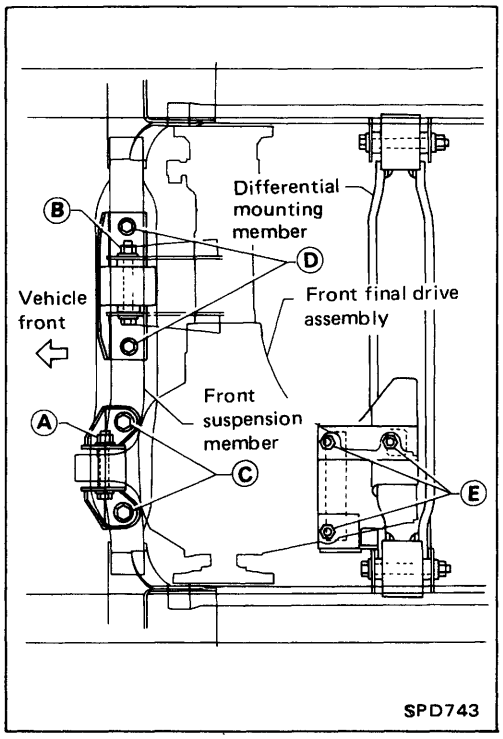
Removal

1. Remove front propeller shaft.
2. Remove drive shaft. Refer to FA section.
3. Remove engine mounting bolts and raise up engine.
4. Remove front final drive together with differential mounting member.



Installation

1. Install front final drive assembly together with differential mounting member.



2. Perform tightening front final drive securing bolts and nuts by following procedure to prevent drive train vibration.
(1) Temporarily tighten nut Ⓐ.
(2) Temporarily tighten nut Ⓑ.
(3) Tighten bolt Ⓒ to the torque of 68 to 87 N·m (6.9 to 8.9 kg-m, 50 to 64 ft-lb).
(4) Tighten bolt Ⓓ to the torque of 68 to 87 N·m (6.9 to 8.9 kg-m, 50 to 64 ft-lb).
(5) Tighten nut Ⓐ to the torque of 68 to 87 N·m (6.9 to 8.9 kg-m, 50 to 64 ft-lb).
(6) Tighten nut Ⓑ to the torque of 68 to 87 N·m (6.9 to 8.9 kg-m, 50 to 64 ft-lb).
(7) Tighten nut Ⓔ to the torque of 68 to 87 N·m (6.9 to 8.9 kg-m, 50 to 64 ft-lb).
3. Install drive shaft. Refer to FA section.
4. Install front propeller shaft.

Removal

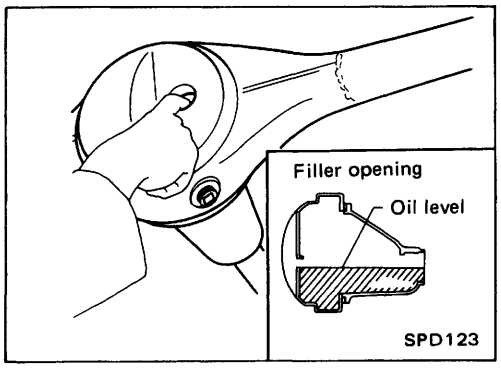
- Remove propeller shaft.

Plug front end of transfer.

- Remove axle shaft.
  Refer to RA section.

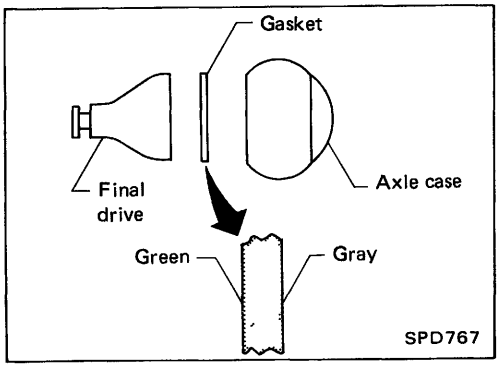
CAUTION:

- **Be careful not to damage spline, sleeve yoke and front oil seal when removing propeller shaft.**

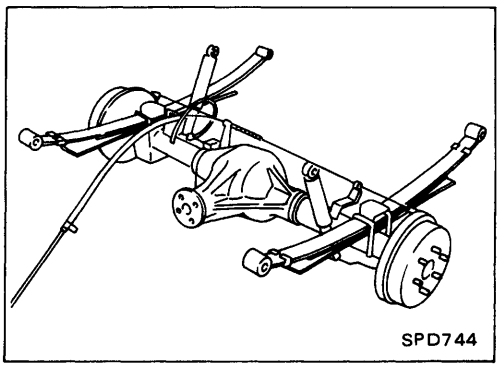


Installation

- Fill final drive with recommended gear oil.



- Pay attention to the direction of gasket (H233B only).


SPD744

Removal

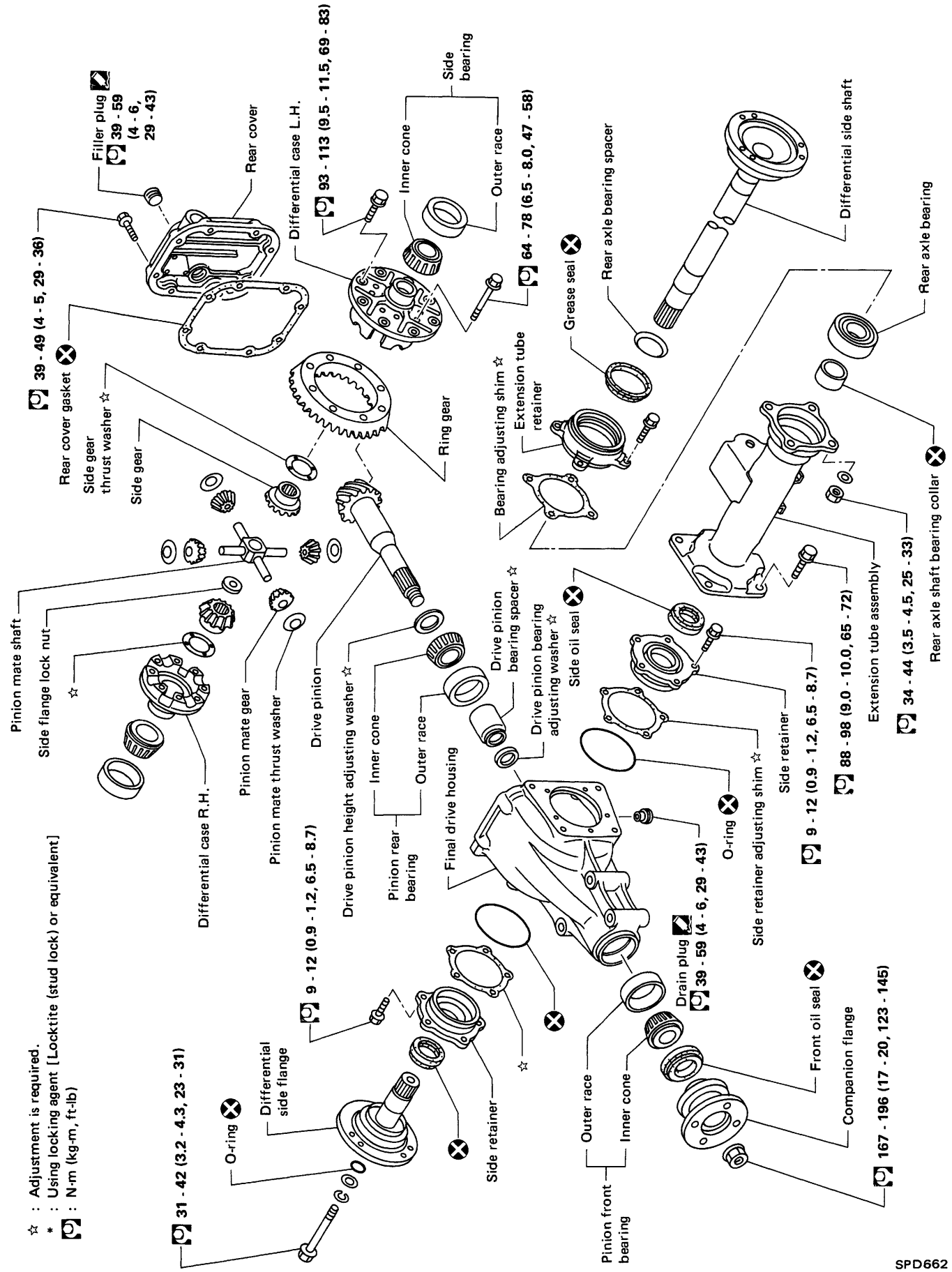
1. Remove rear propeller shaft.

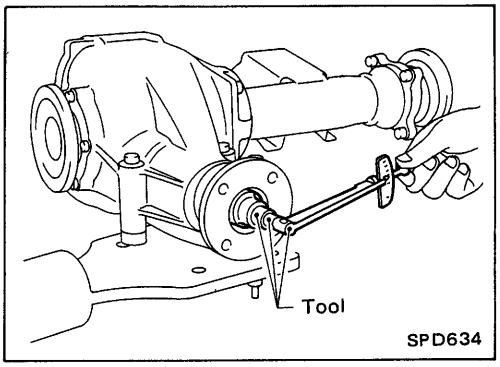
Plug rear end of transmission rear extension housing or transfer.

2. Remove rear axle case assembly with leaf springs. Refer to RA section.
3. Drain gear oil.
4. Draw out axle shafts. Refer to RA section.

Installation

1. Install axle shafts. Refer to RA section.
2. Install rear axle case assembly. Refer to RA section.
3. Install propeller shaft.
4. Fill final drive with recommended gear oil.


☆ : Adjustment is required.
* : Using locking agent [Locktite (stud lock) or equivalent]
: N·m (kg-m, ft-lb)
Filler plug 39 - 59 (4 - 6, 29 - 43)
Rear cover
Differential case L.H.
93 - 113 (9.5 - 11.5, 69 - 83)
Inner cone
Side bearing
Outer race
64 - 78 (6.5 - 8.0, 47 - 58)
39 - 49 (4 - 5, 29 - 36)
Rear cover gasket
Side gear thrust washer ☆
Side gear
Ring gear
Bearing adjusting shim ☆
Extension tube retainer
Grease seal
Rear axle bearing spacer
Differential side shaft
Pinion mate shaft
Side flange lock nut
☆
Differential case R.H.
Pinion mate gear
Pinion mate thrust washer
Drive pinion
Drive pinion height adjusting washer ☆
Inner cone
Pinion rear bearing
Outer race
Final drive housing
Drive pinion bearing spacer ☆
Drive pinion bearing adjusting washer ☆
Side oil seal
Rear axle shaft bearing collar
Rear axle bearing
Extension tube assembly
34 - 44 (3.5 - 4.5, 25 - 33)
88 - 98 (9.0 - 10.0, 65 - 72)
Side retainer
Side retainer adjusting shim ☆
O-ring
9 - 12 (0.9 - 1.2, 6.5 - 8.7)
Drain plug 39 - 59 (4 - 6, 29 - 43)
9 - 12 (0.9 - 1.2, 6.5 - 8.7)
Front oil seal
Companion flange
167 - 196 (17 - 20, 123 - 145)
Pinion front bearing
Outer race
Inner cone
Side retainer
O-ring
Differential side flange
31 - 42 (3.2 - 4.3, 23 - 31)
SPD662



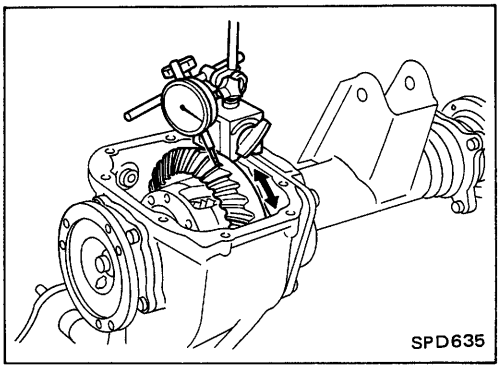
Pre-inspection

Before disassembling final drive, perform the following inspection.

- Total preload

1) Turn drive pinion in both directions several times to set bearing rollers.
2) Check total preload with Tool.

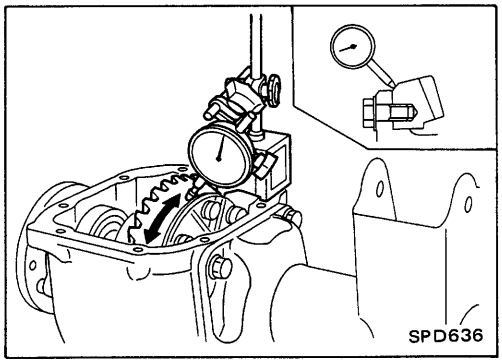
Tool number: ST3127S000 (See J25765-A)
Total preload:
1.2 - 2.3 N·m
(12 - 23 kg-cm, 10 - 20 in-lb)



- Ring gear to drive pinion backlash

Check backlash of ring gear with a dial indicator at several points.

Ring gear-to-drive pinion backlash:
0.13 - 0.18 mm (0.0051 - 0.0071 in)



- Ring gear runout

Check runout of ring gear with a dial indicator.

Runout limit:
0.05 mm (0.0020 in)

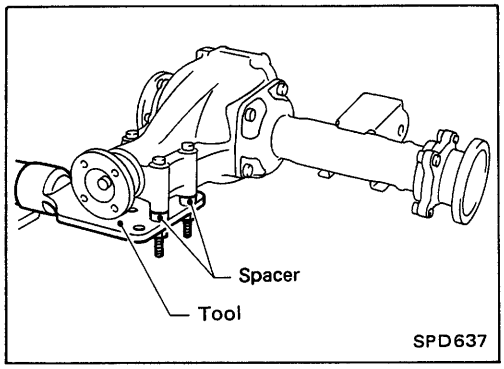
- Tooth contact

Check tooth contact. (Refer to ADJUSTMENT.)

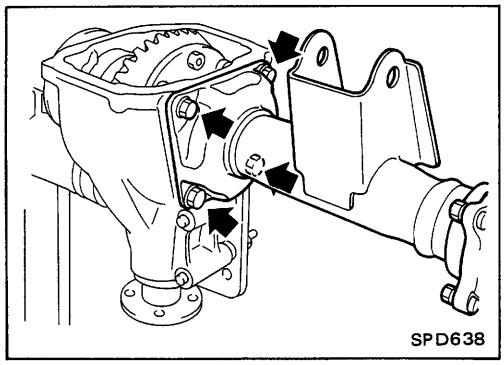
Final Drive Housing

1. Using three spacers [20 mm (0.79 in)], mount final drive assembly on Tool.

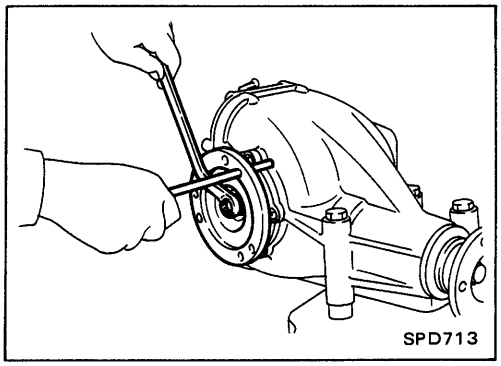
Tool number:
KV38100800 (–)
Equivalent tool (J34310), (J25604)



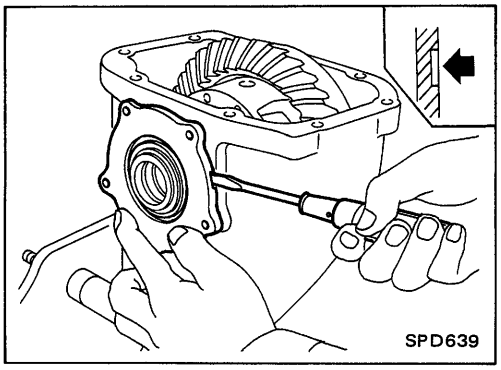
2. Remove extension tube and differential side shaft assembly.



Final Drive Housing (Cont'd)

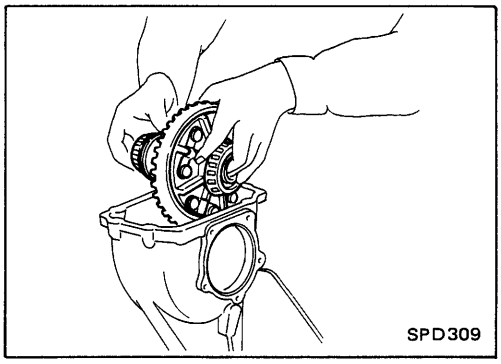


3. Remove differential side flange.

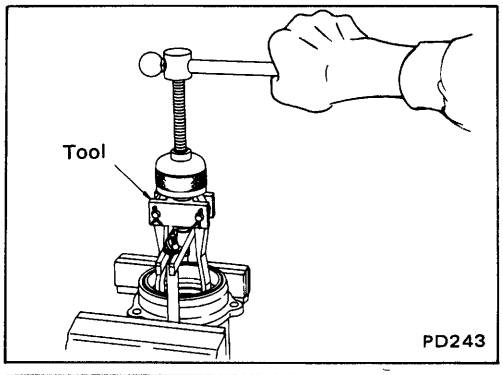


4. Mark side retainers for identification. Remove side retainers.

Be careful not to confuse right and left side retainers and shims.



5. Extract differential case from final drive housing.

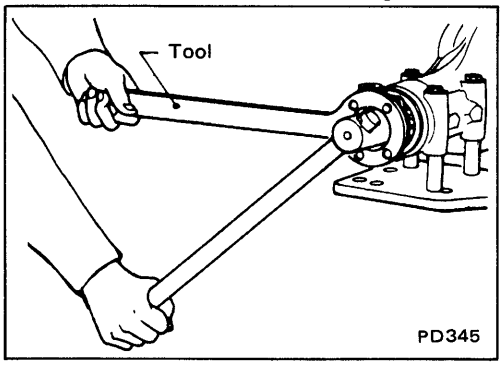


6 Remove side outer races.

Tool number: ST33290001 (J25810-A)

Be careful to keep the side bearing outer races together with their respective inner cones – do not mix them up.

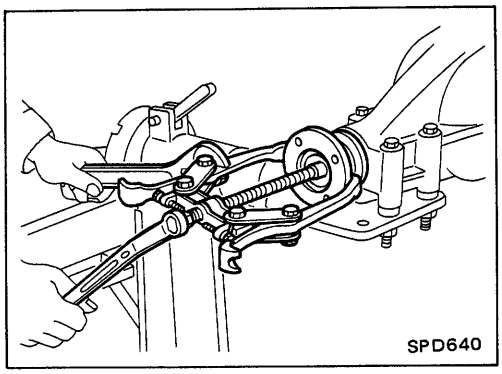
7. Remove side oil seal.



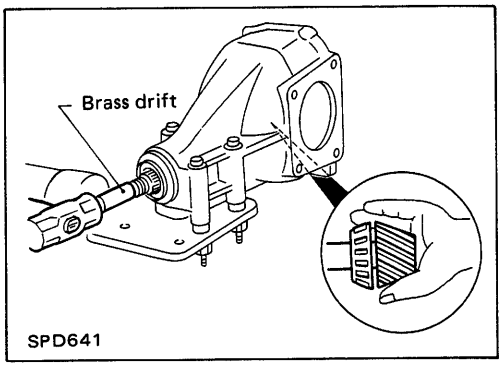
8. Loosen drive pinion nut.

Tool number: ST38060002 (J34311)

Final Drive Housing (Cont'd)

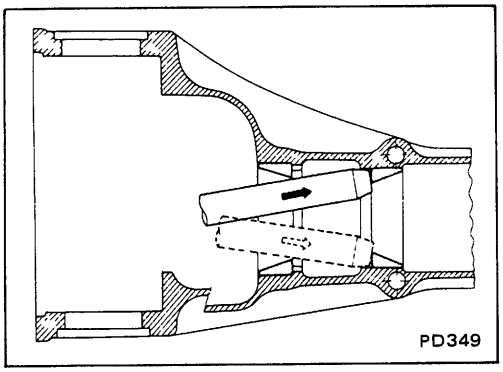

SPD640

9. Remove companion flange with puller.

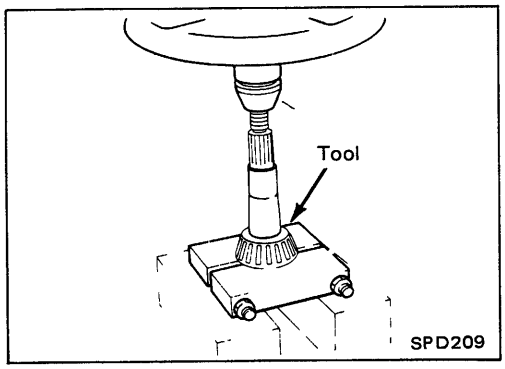


SPD641

10. Take out drive pinion together with pinion rear bearing inner cone, drive pinion bearing spacer and pinion bearing adjusting washer.
11. Remove front oil seal and pinion front bearing inner cone.

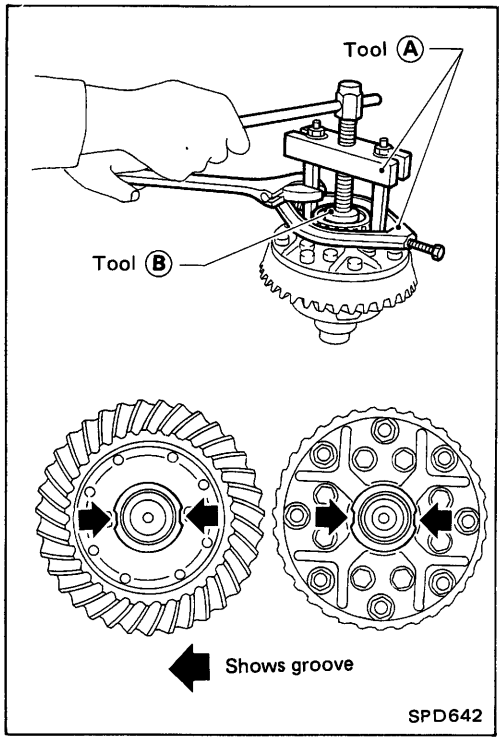

PD349

12. Remove pinion front and rear bearing outer races with brass drift.



SPD209

13. Remove pinion rear bearing inner cone and drive pinion adjusting washer.
    Tool number: ST30031000 (J22912-01)



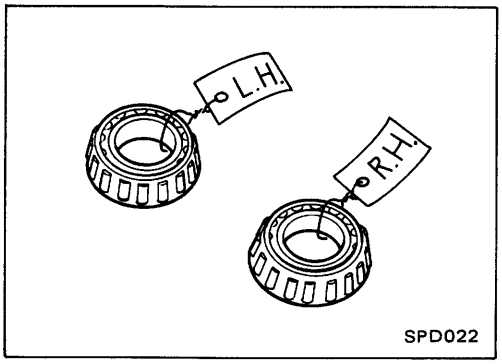
Differential Case

1. Remove side bearing inner cones.

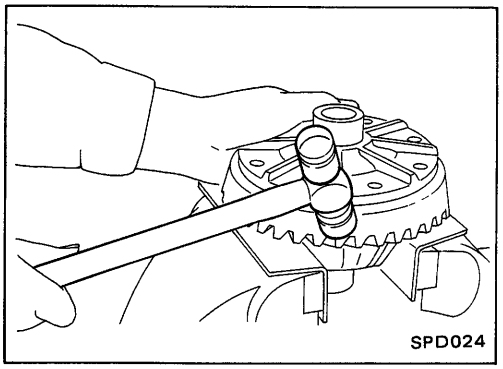
To prevent damage to bearing, engage puller jaws in grooves.

Tool number:

Ⓐ ST33051001 (–)
Equivalent tool (J22888)
Ⓑ ST33061000 (J8107-2)

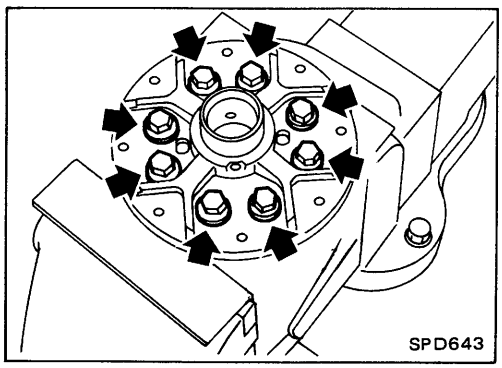


Be careful not to confuse the right and left hand parts.



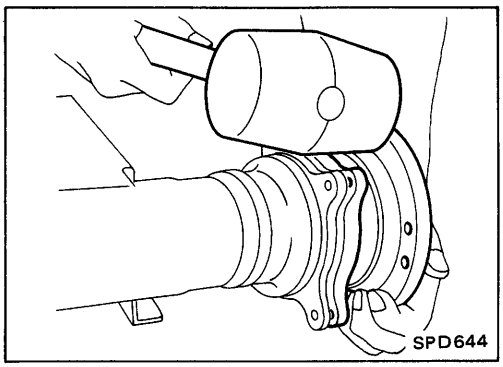
2. Loosen ring gear bolts in a criss-cross fashion.
3. Tap ring gear off differential case with a soft hammer.

Tap evenly all around to keep ring gear from binding.



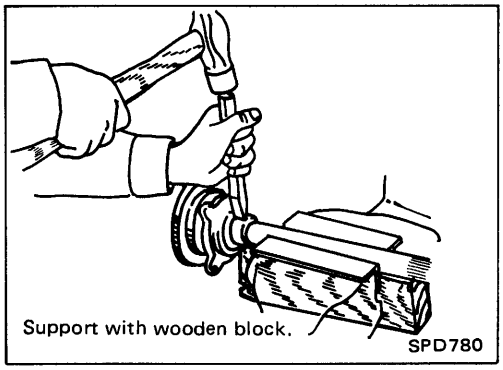
4. Separate differential case L.H. and R.H.

Put match marks on both differential case L.H. and R.H. sides prior to separating them.

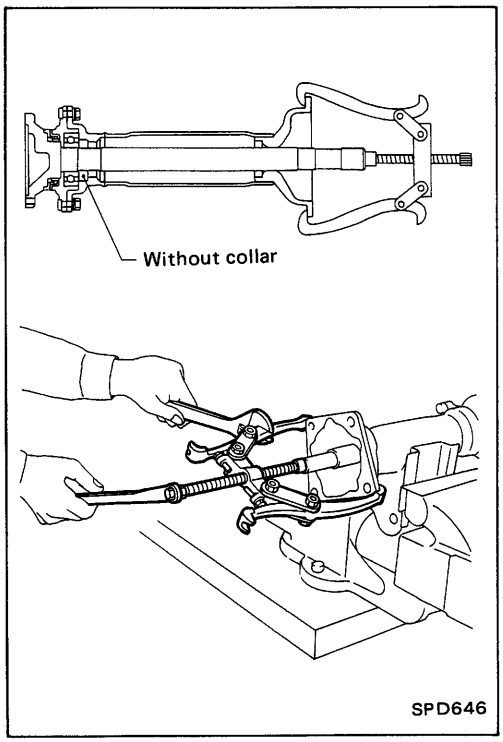

SPD644

Extension Tube and Differential Side Shaft

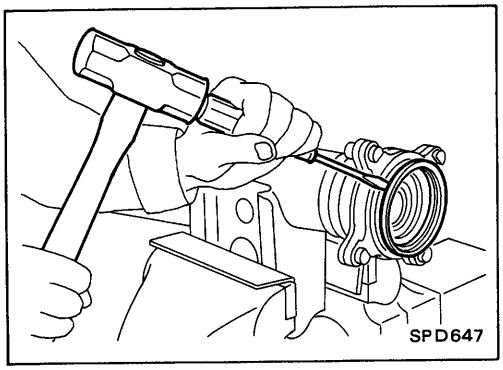
1. Remove differential side shaft assembly from extension tube.



2. Cut rear axle bearing collar with cold chisel. Be careful not to damage differential side shaft.



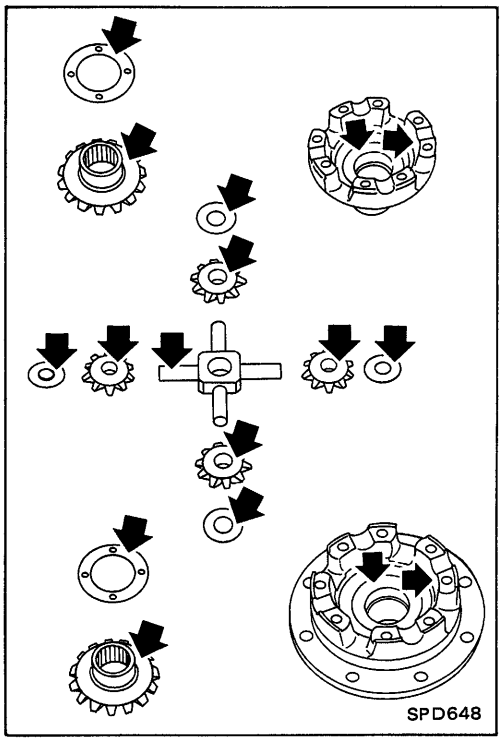
3. Reinstall differential side shaft into extension tube and secure with bolts. Remove rear axle bearing by drawing out differential side shaft from rear axle bearing with puller.


SPD647

4. Remove grease seal.

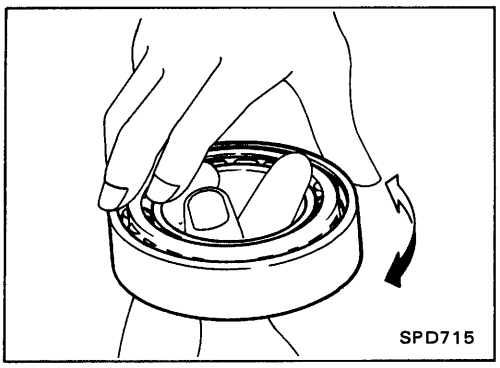
Ring Gear and Drive Pinion

Check gear teeth for scoring, cracking or chipping.
If any damaged part is evident, replace ring gear and drive pinion as a set (hypoid gear set).


SPD648

Differential Case Assembly

Check mating surfaces of differential case, side gears, pinion mate gears, pinion mate shaft and thrust washers.


SPD715

Bearing

1. Thoroughly clean bearing.
2. Check bearings for wear, scratches, pitting or flaking.
   Check tapered roller bearing for smooth rotation. If damaged, replace outer race and inner cone as a set.

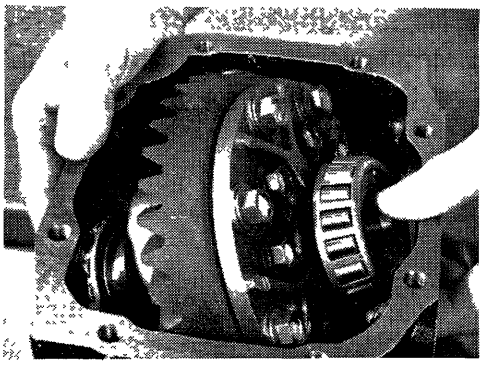
For quiet and reliable final drive operation, the following five adjustments must be made correctly:

1. Side bearing preload.
2. Pinion gear height.
3. Pinion bearing preload.
4. Ring gear-to-pinion backlash. (Refer to ASSEMBLY.)
5. Ring and pinion gear tooth contact pattern.

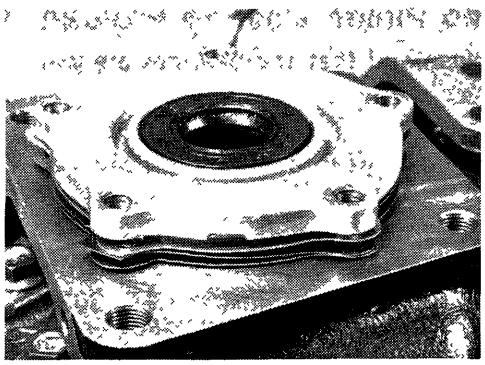
Side Bearing Preload

Note: A selection of carrier side retainer adjusting shims is required for successful completion of this procedure.

1. Make sure all parts are clean and that the bearings are well lubricated with light oil or Dexron type automatic transmission fluid.



2. Install differential carrier and side bearing assembly into the final drive housing.



3. Place all of the original side retainer adjusting shims onto the side bearing retainer that goes at the ring gear end of the carrier.

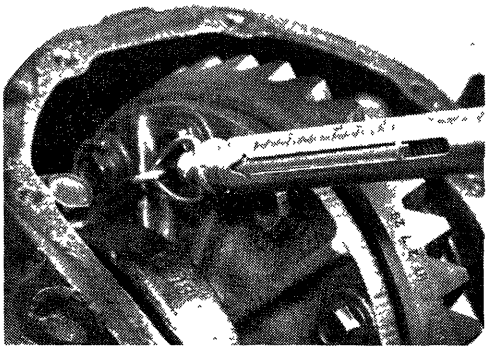


4. Install both bearing retainers onto the final drive housing and torque the retainer bolts.

Bolt torque specification:

9 - 12 N·m (0.9 - 1.2 kg-m, 6.5 - 7.2 ft-lb)

Side Bearing Preload (Cont'd)



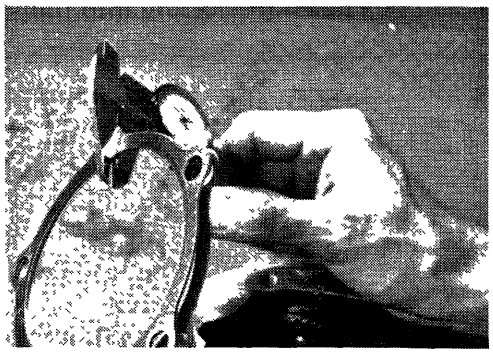
5. Turn the carrier several times to seat the bearings.

6. Measure the carrier turning torque with a spring gauge, J-8129, at the ring gear retaining bolt.

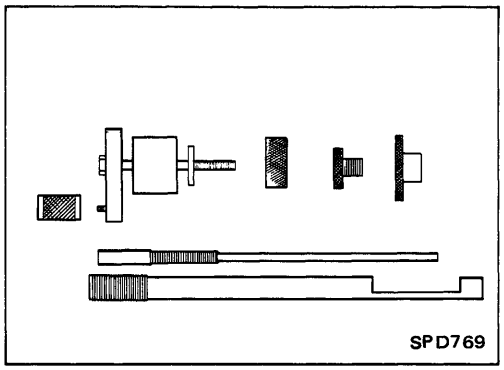
   Turning torque specification:
   34.3 - 39.2 N (3.5 - 4.0 kg, 7.7 - 8.8 lb)
   of pulling force at the ring gear bolt.

7. If the turning torque measured is incorrect, establish the correct bearing preload by adding to or subtracting from the *total* amount of shim thickness.

   - Increase shim thickness to *decrease* turning torque on the carrier.
   - Decrease shim thickness to *increase* turning torque on the carrier.



8. Record the correct, selected *total* thickness of the side retainer adjusting shims, and remove the carrier and bearings from the final drive housing. Save all shims for later re-use.

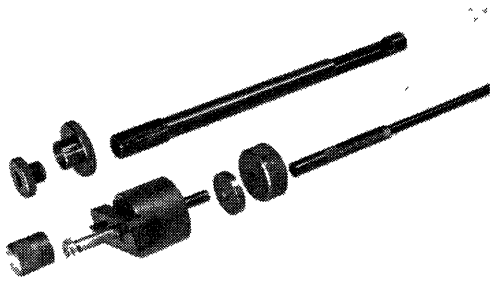


Pinion Gear Height and Pinion Bearing Preload

1. Make sure all parts are clean and that the bearings are well lubricated.

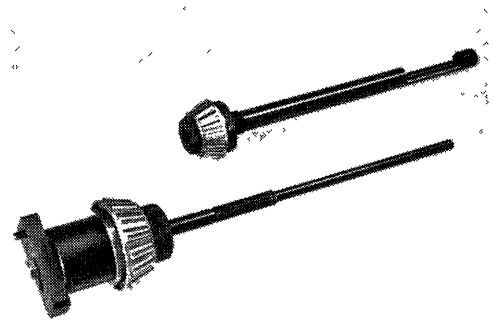
2. Assemble the pinion gear bearings into the pinion pre-load shim selector tool, J-34309.

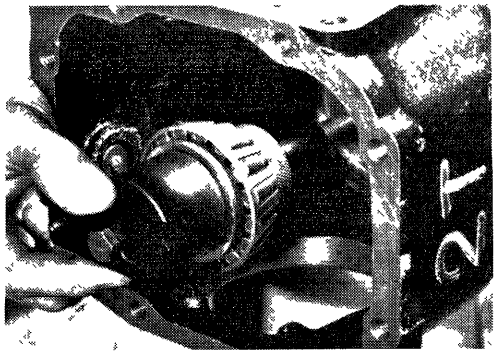
- **Front Pinion Bearing** – make sure the J-34309-3 front pinion bearing seat is secured tightly against the J-34309-2 gauge anvil. Then turn the front pinion bearing pilot, J-34309-7, to secure the bearing in its proper position.



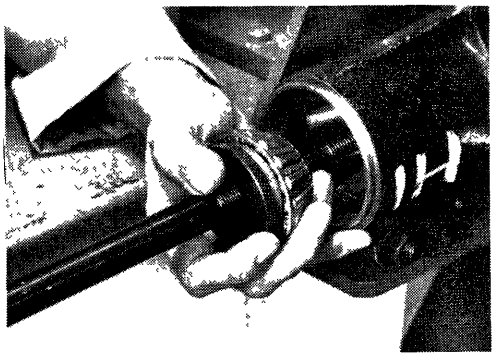
- **Rear Pinion Bearing** – the rear pinion bearing pilot, J-34309-8, is used to center the rear pinion bearing only. The rear pinion bearing locking seat, J-34309-4, is used to lock the bearing to the assembly.

Pinion Gear Height and Pinion Bearing Preload (Cont'd)

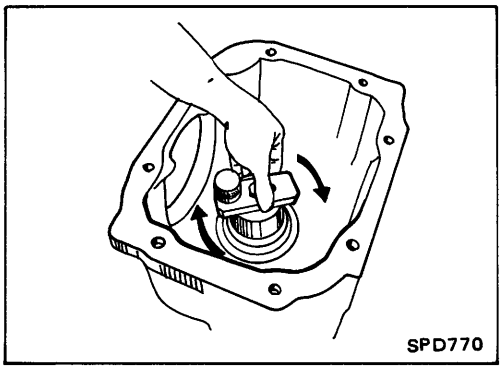




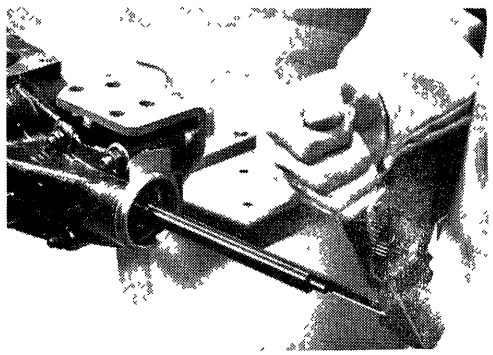
3. Place the pinion preload shim selector tool gauge screw, J34309-1, with the pinion rear bearing inner cone installed, into the final drive housing.



4. Install the J-34309-2 gauge anvil with the front pinion bearing into the final drive housing and assemble it to the J-34309-1 gauge screw. Make sure that the J-34309-16 gauge plate will turn a full 360 degrees, and tighten the two sections by hand.



5. Turn the assembly several times to seat the bearings.



6. Measure the turning torque at the end of the J-34309-2 shaft using torque wrench J-25765-A.

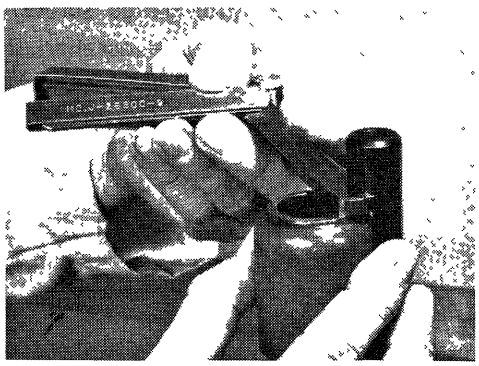
Turning torque specification:
0.6 - 1.0 N·m (6 - 10 kg-cm, 5.2 - 8.7 in-lb)

7. Place the J-34309-10 "R180A" pinion height adapter onto the gauge plate and tighten it by hand.

CAUTION:
Make sure all machined surfaces are clean.

Pinion Gear Height and Pinion Bearing Preload (Cont'd)





PINION BEARING PRELOAD WASHER SELECTION

8. Place the solid pinion bearing adjusting spacer squarely into the recessed portion of the J-34309-2 gauge anvil.

9. Select the correct thickness of pinion bearing preload adjusting washer using a standard gauge of 6 mm (0.24 in) and your J-34309-101 feeler gauge. *The exact total measure you get with the gauges is the thickness of the adjusting washer required.* Select the correct washer from the following chart.

Drive pinion bearing adjusting washer (R180A)

Thickness mm (in)	Part No.
6.59 (0.2594)	38127 01G00
6.57 (0.2587)	38127 01G01
6.55 (0.2579)	38127 01G02
6.53 (0.2571)	38127 01G03
6.51 (0.2563)	38127 01G04
6.49 (0.2555)	38127 01G05
6.47 (0.2547)	38127 01G06
6.45 (0.2539)	38127 01G07
6.43 (0.2531)	38127 01G08
6.41 (0.2524)	38127 01G09
6.39 (0.2516)	38127 01G10
6.37 (0.2508)	38127 01G11
6.35 (0.2500)	38127 01G12
6.33 (0.2492)	38127 01G13
6.31 (0.2484)	38127 01G14

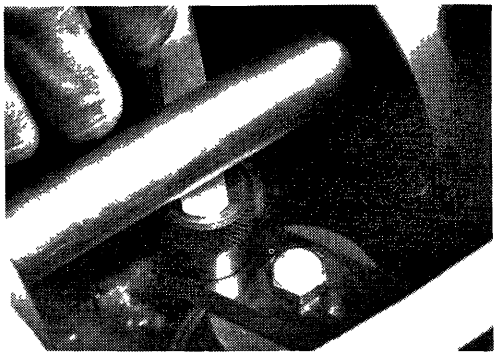
10. Set your selected, correct pinion bearing preload adjusting washer aside for use when assembling the pinion and bearings into the final drive housing.



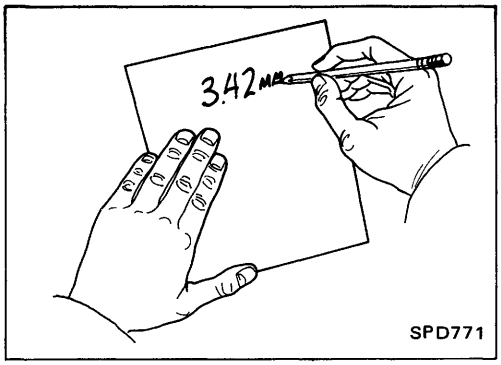
PINION HEIGHT ADJUSTING WASHER SELECTION

11. Position the side bearing discs, J-25269-4, and arbor firmly into the side bearing bores.

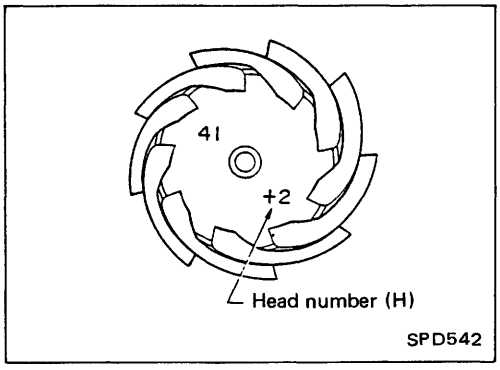
Pinion Gear Height and Pinion Bearing Preload (Cont'd)



12. Select the correct *standard* pinion height adjusting washer thickness using a standard gauge of 3 mm (0.12 in) and your J-34309-101 feeler gauge. Measure the distance between the J-34309-10 "R180A" pinion height adapter and the arbor.



13. Write down your exact total measurement.



14. Correct the pinion height washer size by referring to the "pinion head number."

Note: There are two numbers painted on the pinion gear. The first one refers to the pinion and ring gear as a matched set and should be the same as the number on the ring gear. The second number is the "pinion head height number," and it refers to the ideal pinion height from standard for quietest operation. Use the following chart to determine the correct pinion height washer.

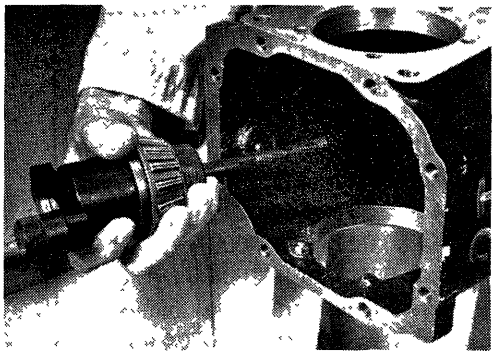
Pinion Head Height Number	Add or Remove from the Standard Pinion Height Washer Thickness Measurement
−6	Add 0.06 mm (0.0024 in)
−5	Add 0.05 mm (0.0020 in)
−4	Add 0.04 mm (0.0016 in)
−3	Add 0.03 mm (0.0012 in)
−2	Add 0.02 mm (0.0008 in)
−1	Add 0.01 mm (0.0004 in)
0	Use the selected washer thickness
+1	Subtract 0.01 mm (0.0004 in)
+2	Subtract 0.02 mm (0.0008 in)
+3	Subtract 0.03 mm (0.0012 in)
+4	Subtract 0.04 mm (0.0016 in)
+5	Subtract 0.05 mm (0.0020 in)
+6	Subtract 0.06 mm (0.0024 in)

Pinion Gear Height and Pinion Bearing Preload (Cont'd)

15. Select the correct pinion height washer from the following chart.

Drive pinion height adjusting washer (R180A)

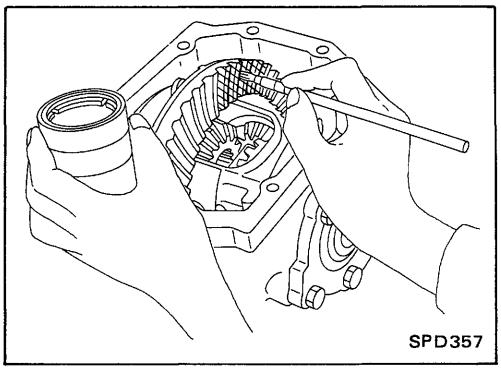
Thickness mm (in)	Part No.
3.09 (0.1217)	38154-B4017
3.12 (0.1228)	38154-B4018
3.15 (0.1240)	38154-B4019
3.18 (0.1252)	38154-B4020
3.21 (0.1264)	38154-E4600
3.24 (0.1276)	38154-E4601
3.27 (0.1287)	38154-E4602
3.30 (0.1299)	38154-E4603
3.33 (0.1311)	38154-E4604
3.36 (0.1323)	38154-E4605
3.39 (0.1335)	38154-E4606
3.42 (0.1346)	38154-E4607
3.45 (0.1358)	38154-E4608
3.48 (0.1370)	38154-E4609
3.51 (0.1382)	38154-E4610
3.54 (0.1394)	38154-E4611
3.57 (0.1406)	38154-E4612
3.60 (0.1417)	38154-E4613
3.63 (0.1429)	38154-E4614
3.66 (0.1441)	38154-E4615



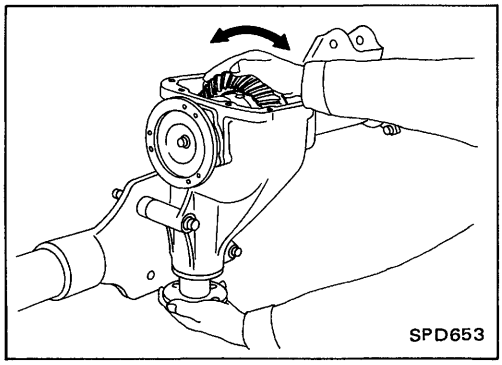
16. Remove the J-34309 pinion preload shim selector tool from the final drive housing and disassemble to retrieve the pinion bearings.

Tooth Contact

Gear tooth contact pattern check is necessary to verify correct relationship between ring gear and drive pinion.
Hypoid gear sets which are not positioned properly in relation to one another may be noisy, or have short life, or both. With a pattern check, the most desirable contact for low noise level and long life can be assured.

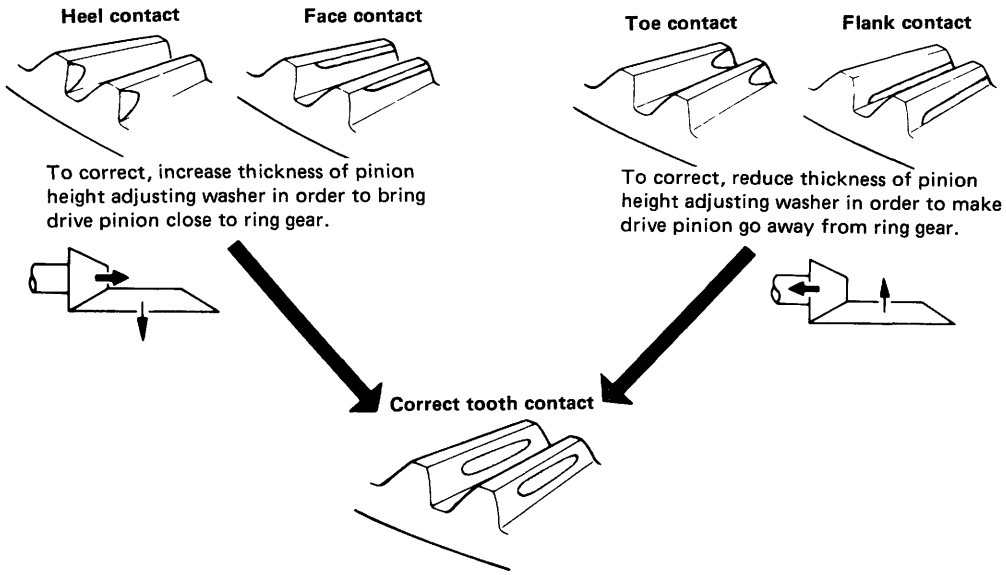

SPD357

1. Thoroughly clean ring gear and drive pinion teeth.
2. Sparingly apply a mixture of powdered ferric oxide and oil or equivalent to 3 or 4 teeth of ring gear drive side.

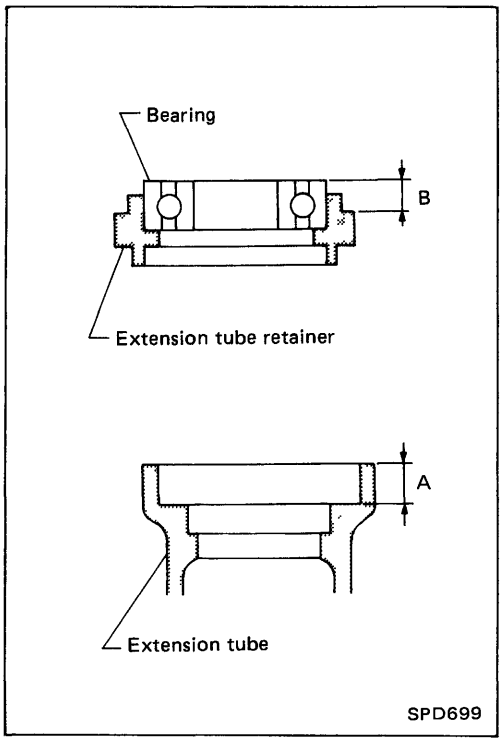

SPD653

3. Hold companion flange steady by hand and rotate the ring gear in both directions.

Usually the pattern will be correct if you have calculated the shims correctly and the backlash is correct.
However, in rare cases you may have to use trial-and-error processes until you get a good tooth contact pattern.
The tooth pattern is the best indication of how well a differential has been set up.



SPD007



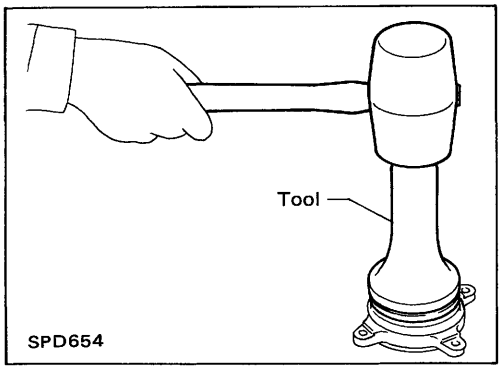
Extension Tube and Differential Side Shaft

1. Measure rear axle bearing end play.

Rear axle bearing end play (A – B):
0.1 mm (0.0039 in) or less

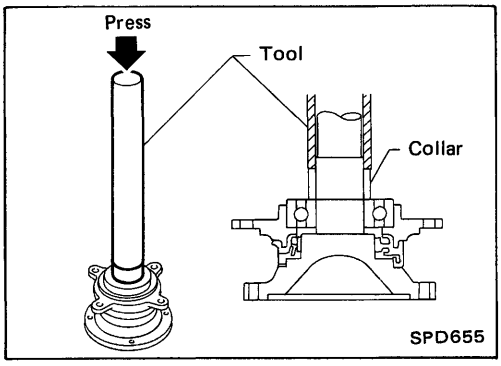
The end play can be adjusted with bearing adjusting shim.

Available bearing adjusting shims:
Refer to S.D.S.

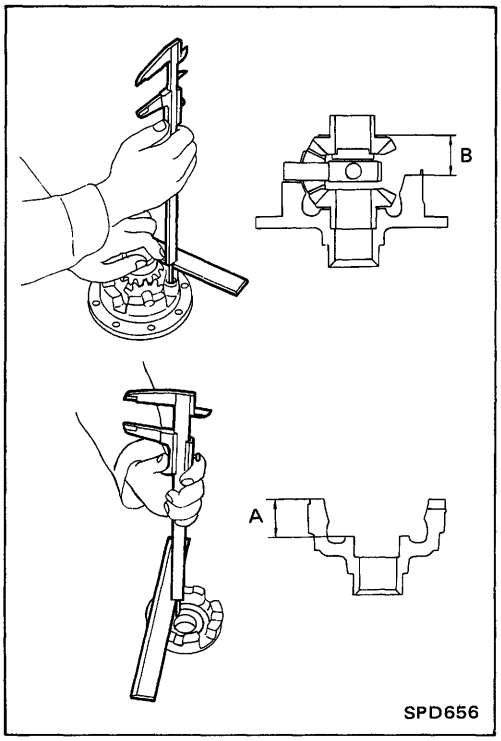


2. Install grease seal.

Tool number: (J35764)



3. Install extension tube retainer, rear axle bearing and rear axle shaft bearing collar on differential side shaft.
4. Install differential side shaft assembly into extension tube.



Differential Case

1. Measure clearance between side gear thrust washer and differential case.

   Clearance between side gear thrust washer and differential case (A – B):

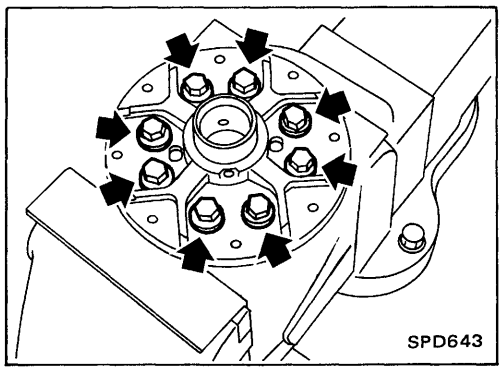
   0.10 - 0.20 mm (0.0039 - 0.0079 in)

   The clearance can be adjusted with side gear thrust washer.

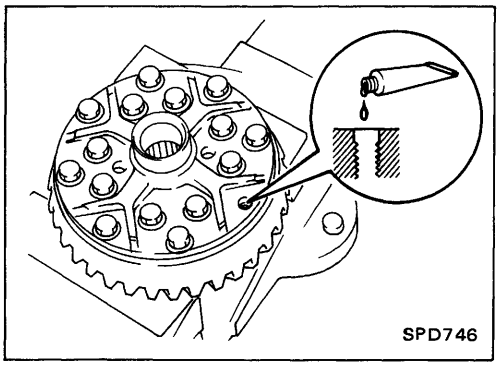
   Available side gear thrust washers:

   Refer to S.D.S.

2. Apply gear oil to gear tooth surfaces and thrust surfaces and check to see they turn properly.

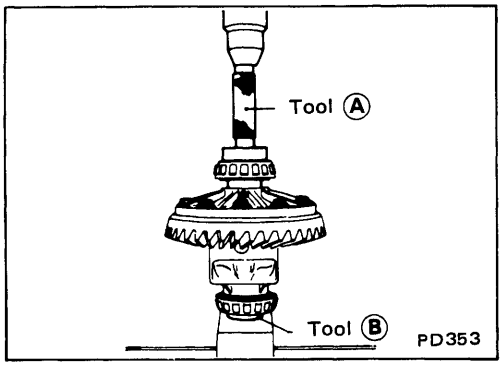


3. Install differential case L.H. and R.H.



4. Place differential case on ring gear.
5. Apply locking agent [Locktite (stud lock) or equivalent] to ring gear bolts, and install them.

Tighten bolts in a criss-cross fashion, lightly tapping bolt head with a hammer.

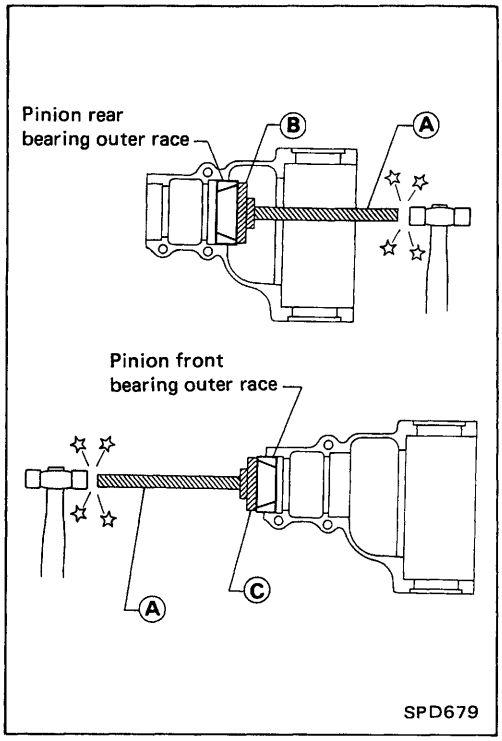


6. Press-fit side bearing inner cones on differential case with Tool.

   Tool number:

   Ⓐ ST33230000 (J25805-01)

   Ⓑ ST33061000 (J8107-2)

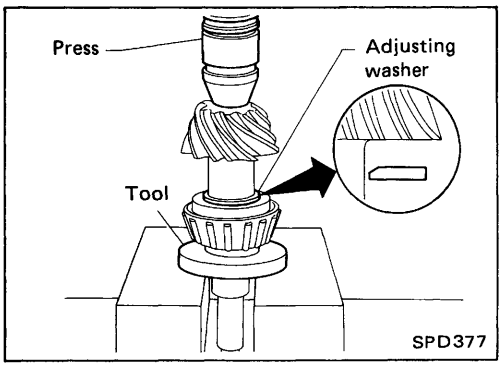


Final Drive Housing

1. Press-fit front and rear bearing outer races with Tools.

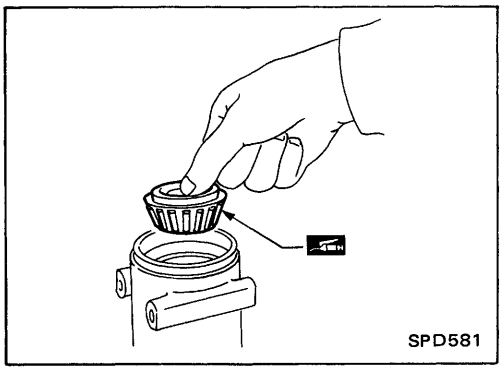
   Tool number:

   Ⓐ ST30611000 (J25742-1)
   Ⓑ ST30621000 (J25742-5)
   Ⓒ ST30701000 (J25742-2)

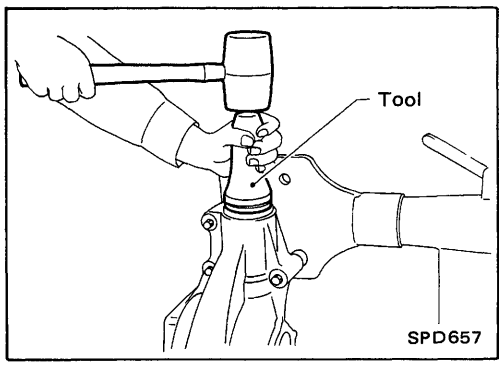


2. Select pinion bearing adjusting washer and drive pinion bearing spacer, referring to ADJUSTMENT.
3. Install drive pinion height adjusting washer in drive pinion, and press-fit pinion rear bearing inner cone in it, using press and Tool.

   Tool number: ST30901000 (—)
   Equivalent tool (J26010-01)



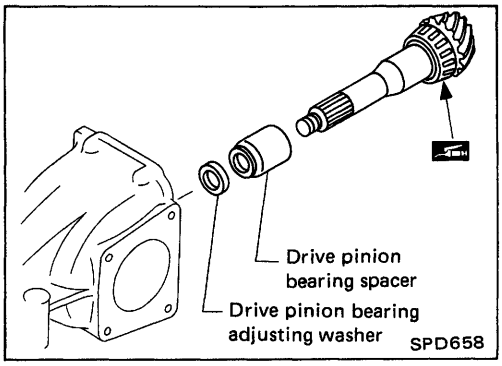
4. Place pinion front bearing inner cone in final drive housing.



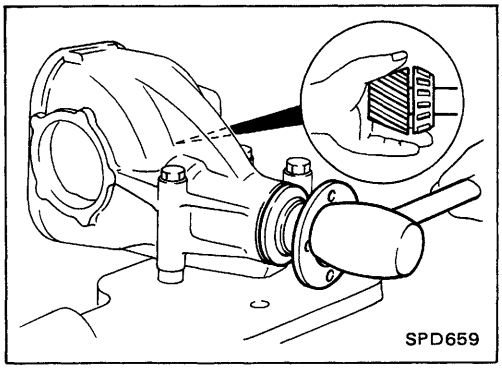
5. Apply multi-purpose grease to cavity at sealing lips of oil seal. Install front oil seal.

   Tool number: ST30720000 (—)
   Equivalent tool (J25405)

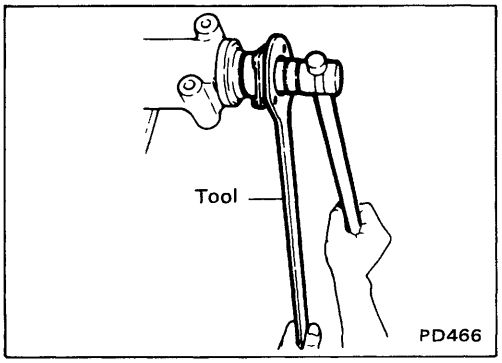
Final Drive Housing (Cont'd)



6. Place drive pinion bearing spacer, pinion bearing adjusting washer and drive pinion in final drive housing.



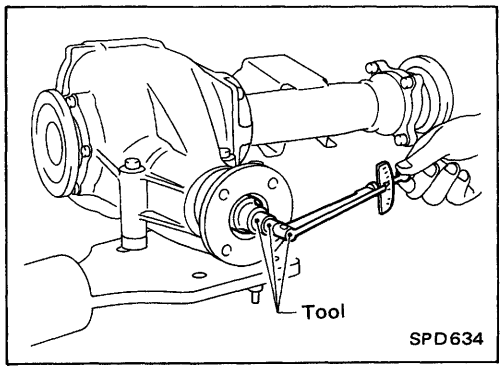
7. Insert companion flange into drive pinion by tapping the companion flange with a soft hammer.



8. Tighten pinion nut to the specified torque.

The threaded portion of drive pinion and pinion nut should be free from oil or grease.

Tool number: ST38060002 (J34311)



9. Turn drive pinion in both directions several revolutions, and measure pinion bearing preload.

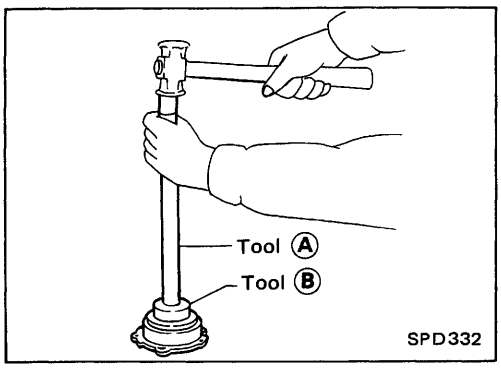
Tool number: ST3127S000 (J25765-A)

Pinion bearing preload:

0.9 - 1.7 N·m

(9 - 17 kg-cm, 7.8 - 14.8 in-lb)

When pinion bearing preload is outside the specifications, replace pinion bearing adjusting washer and spacer with a different thickness.



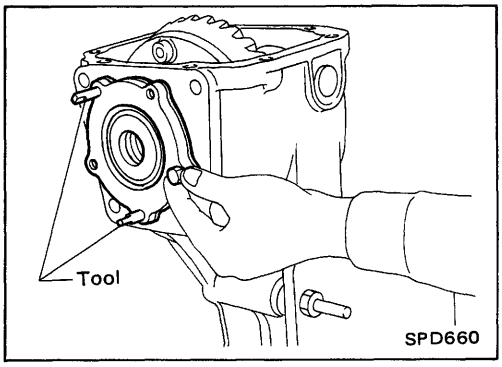
10. Select side retainer adjusting shim.
    Refer to ADJUSTMENT.
11. Press-fit side bearing outer race into side retainer.

Tool number:

Ⓐ ST30611000 (J25742-1)

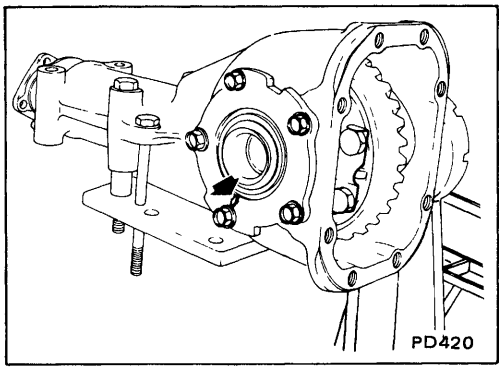
Ⓑ ST30621000 (J25742-5)

Final Drive Housing (Cont'd)

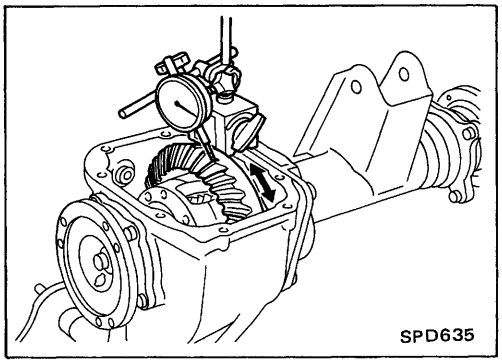


12. Install side oil seal.
13. Install differential case assembly.
14. Place side retainer adjusting shims (Refer to ADJUSTMENT.), and O-ring on side retainer, and install them in final drive housing.

Tool number: ST33720000 (J25817)



- Align arrows stamped on side retainer and final drive housing.

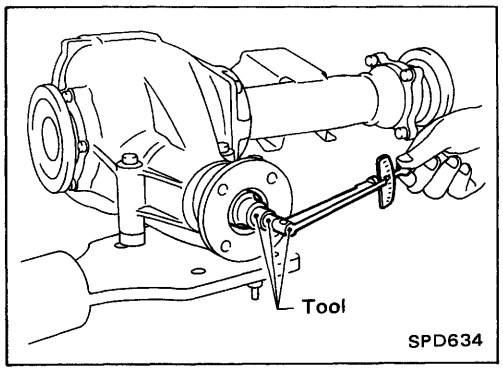


15. Measure ring gear-to-drive pinion backlash with a dial indicator.

Ring gear-to-drive pinion backlash:
0.13 - 0.18 mm (0.0051 - 0.0071 in)

- If backlash is too small, decrease thickness of right shim and increase thickness of left shim by the same amount.
  If backlash is too great, reverse the above procedure.

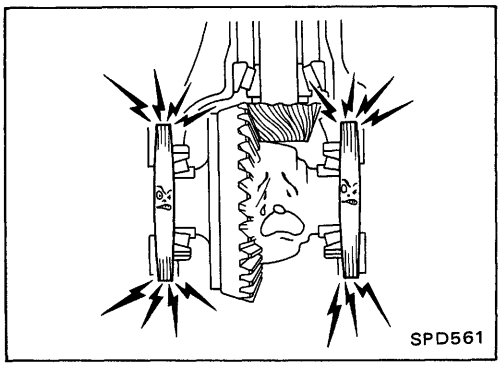
Never change the total amount of shims as it will change the bearing preload.



16. Check total preload with Tool.

When checking preload, turn drive pinion in both directions several times to set bearing rollers.

Tool number: ST3127S000 (See J25765-A)
Total preload:
1.2 - 2.3 N·m
(12 - 23 kg-cm, 10 - 20 in-lb)

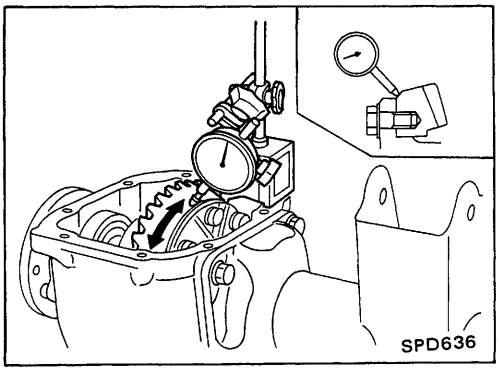


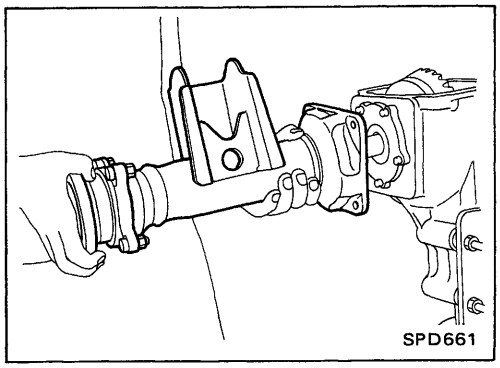
- If preload is too great, add the same amount of shim to each side.
- If preload is too small, remove the same amount of shim from each side.

Never add or remove a different number of shims for each side as it will change ring gear-to-drive pinion backlash.

17. Recheck ring gear-to-drive pinion backlash because increase or decrease in thickness of shims will cause change of ring gear-to-pinion backlash.

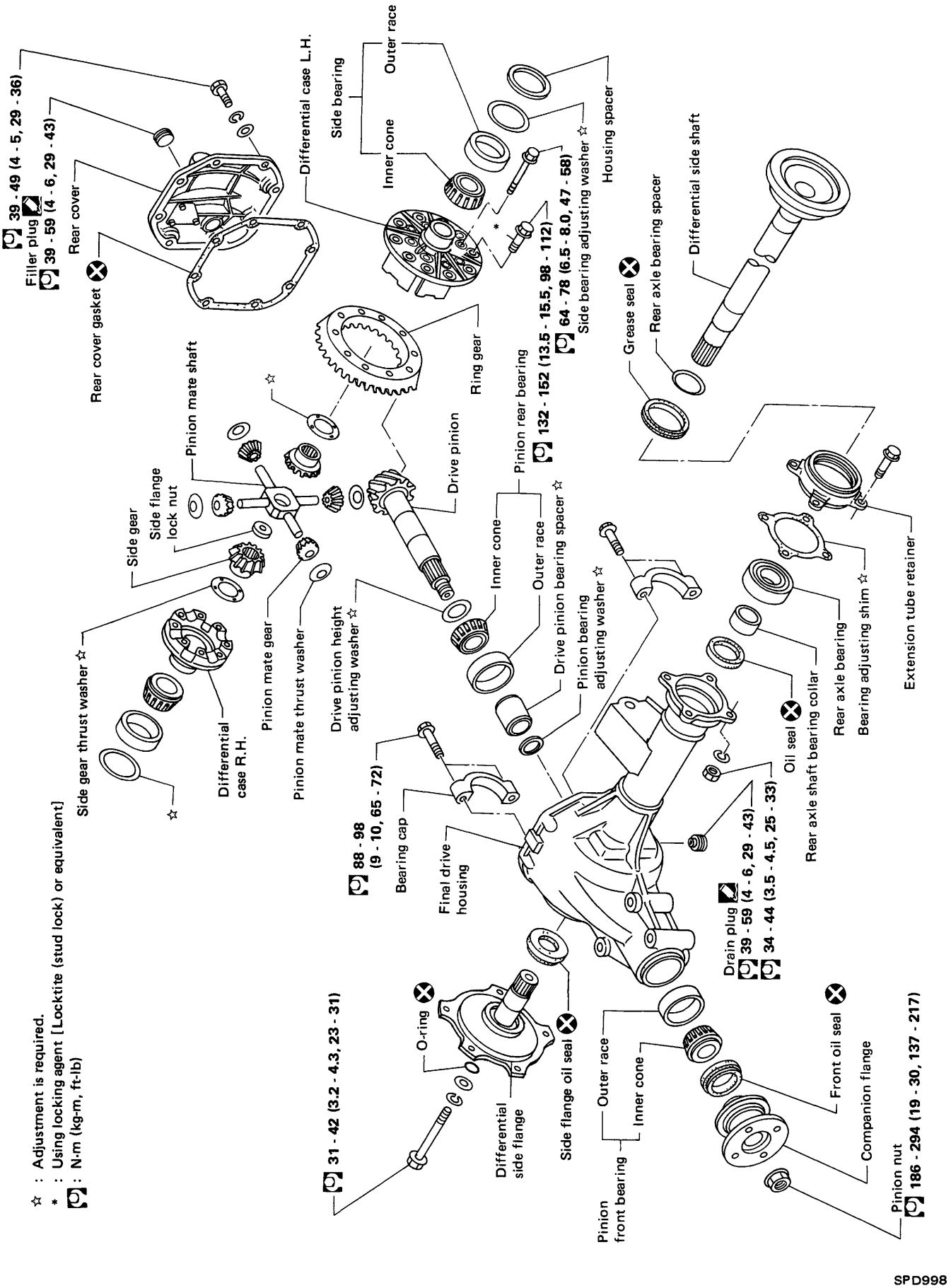
Final Drive Housing (Cont'd)



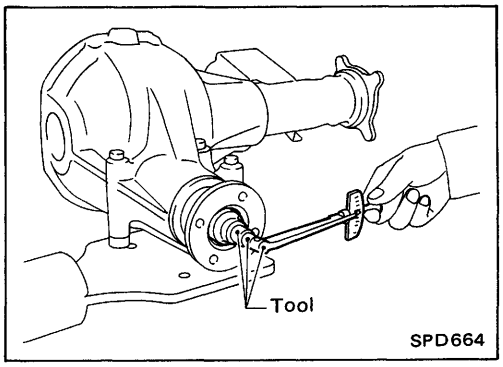


18. Check runout of ring gear with a dial indicator.
    Runout limit:
    0.05 mm (0.0020 in)
- If backlash varies excessively in different places, the variance may have resulted from foreign matter caught between the ring gear and the differential case.
- If the backlash varies greatly when the runout of the ring gear is within a specified range, the hypoid gear set or differential case should be replaced.

19. Check tooth contact.
    Refer to ADJUSTMENT.
20. Install rear cover and gasket.
21. Install extension tube and differential side shaft assembly.


☆ : Adjustment is required.
* : Using locking agent [Locktite (stud lock) or equivalent]
: N·m (kg-m, ft-lb)
39 - 49 (4 - 5, 29 - 36)
Filler plug
39 - 59 (4 - 6, 29 - 43)
Rear cover
Rear cover gasket
Differential case L.H.
Side bearing
Inner cone
Outer race
Housing spacer
Side bearing adjusting washer ☆
64 - 78 (6.5 - 8.0, 47 - 58)
132 - 152 (13.5 - 15.5, 98 - 112)
Pinion rear bearing
Grease seal
Rear axle bearing spacer
Differential side shaft
Pinion mate shaft
Side flange lock nut
Side gear
Side gear thrust washer ☆
Differential case R.H.
Pinion mate gear
Pinion mate thrust washer
Drive pinion height adjusting washer ☆
Drive pinion
Ring gear
Inner cone
Outer race
Drive pinion bearing spacer ☆
Pinion bearing adjusting washer ☆
Extension tube retainer
88 - 98 (9 - 10, 65 - 72)
Bearing cap
Final drive housing
Oil seal
Rear axle shaft bearing collar
Rear axle bearing
Bearing adjusting shim ☆
Drain plug
39 - 59 (4 - 6, 29 - 43)
34 - 44 (3.5 - 4.5, 25 - 33)
31 - 42 (3.2 - 4.3, 23 - 31)
O-ring
Differential side flange
Side flange oil seal
Outer race
Inner cone
Pinion front bearing
Front oil seal
Companion flange
Pinion nut
186 - 294 (19 - 30, 137 - 217)

SPD998



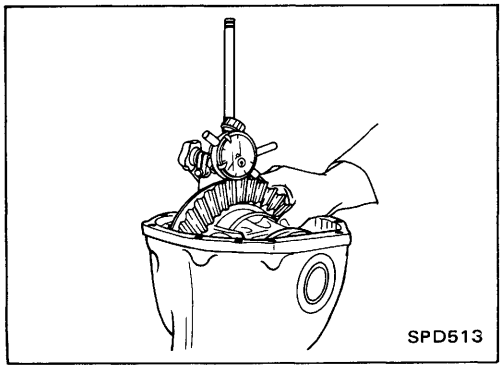
Pre-inspection

Before disassembling final drive, perform the following inspection.

- Total preload

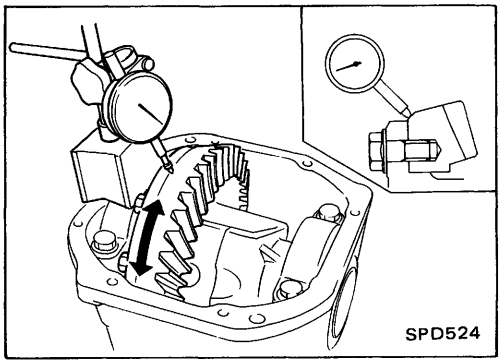
1) Turn drive pinion in both directions several times to set bearing rollers.
2) Check total preload with Tool.

Tool number: ST3127S000 (See J25765-A)
Total preload:
1.4 - 3.1 N·m
(14 - 32 kg-cm, 12 - 28 in-lb)



- Ring gear to drive pinion backlash.
  Check backlash of ring gear with a dial indicator at several points.

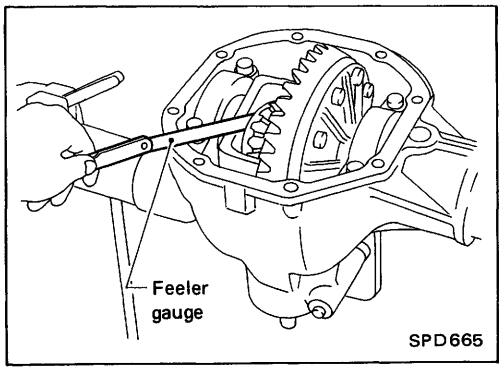
Ring gear-to-drive pinion backlash:
0.13 - 0.18 mm (0.0051 - 0.0071 in)



- Ring gear runout
  Check runout of ring gear with a dial indicator.

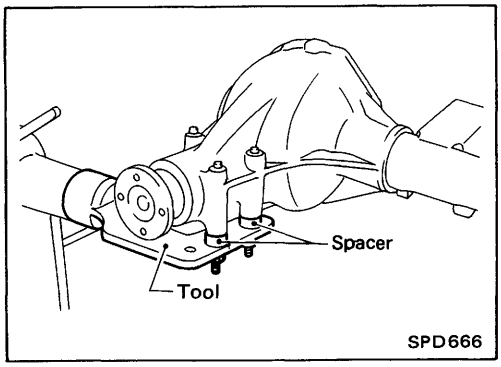
Runout limit:
0.05 mm (0.0020 in)

- Tooth contact
  Check tooth contact. (Refer to ADJUSTMENT.)



- Side gear to pinion mate gear backlash
  Using a feeler gauge, measure clearance between side gear thrust washer and differential case.

Clearance between side gear thrust washer and differential case:
0.10 - 0.20 mm (0.0039 - 0.0079 in)

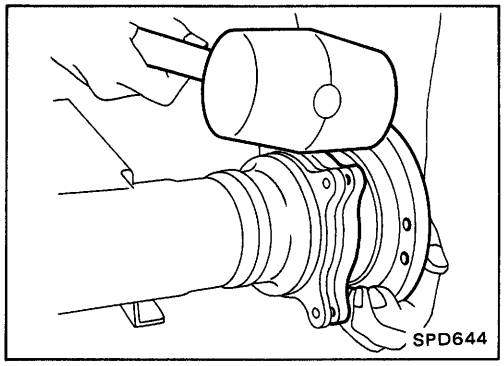


Final Drive Housing

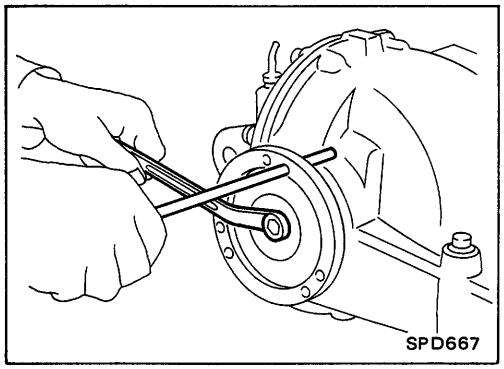
1. Using three spacers [20 mm (0.79 in)], mount final drive assembly on Tool.

Tool number:
KV38100800 (–)
Equivalent tool (J34310), (J25604)

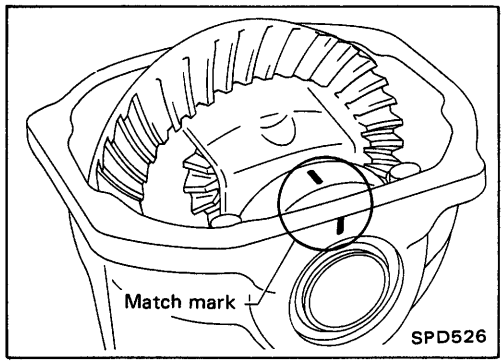
Final Drive Housing (Cont'd)



2. Remove differential side shaft assembly.

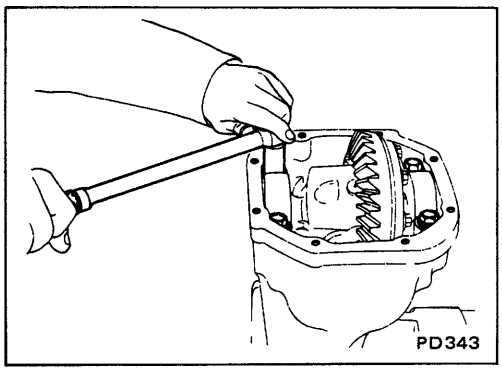


3. Remove differential side flange.

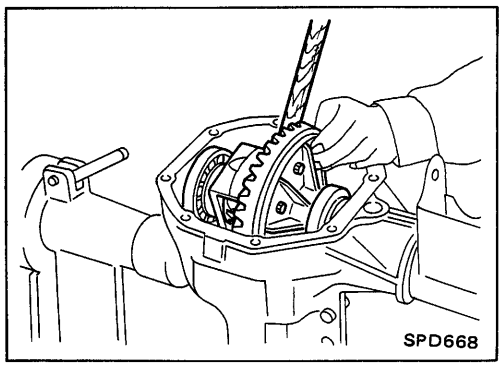


4. Put match marks on one side of side bearing cap with paint or punch to ensure that it is replaced in proper position during reassembly.

Bearing caps are line-bored during manufacture and should be put back in their original places.

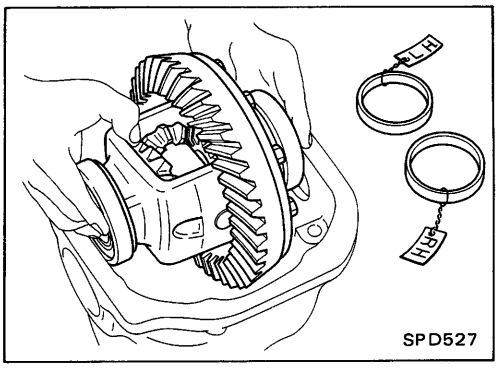


5. Remove side bearing caps.



6. Remove differential case assembly with a pry bar.

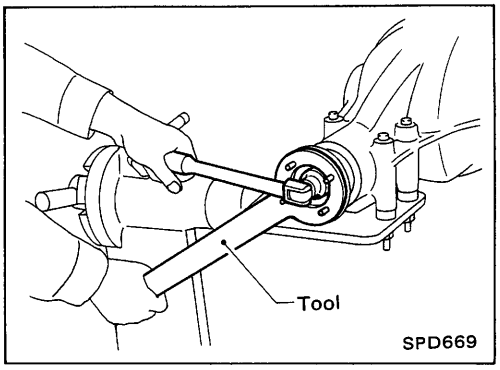
Final Drive Housing (Cont'd)



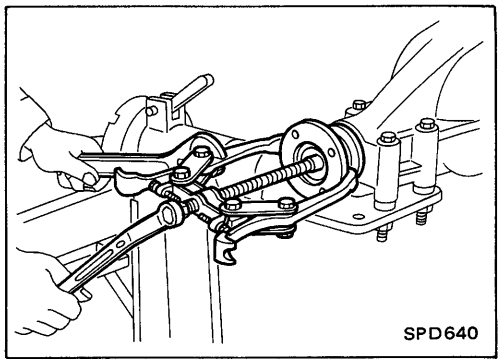
Be careful to keep the side bearing outer races together with their respective inner cones – don't mix them up.

CAUTION:

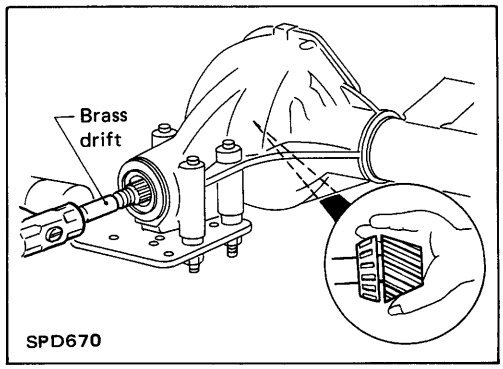
Side bearing spacer is placed on either the left or right depending upon final drive gear ratio. It should be labeled so that it may be replaced correctly.



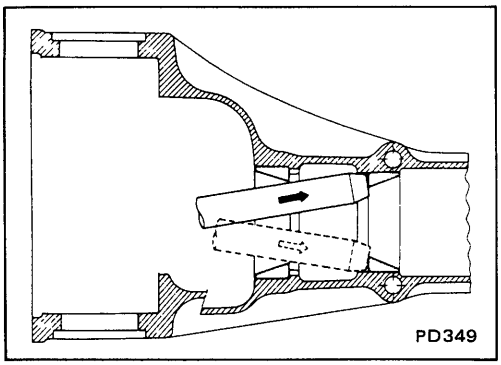
7. Loosen pinion nut.
   Tool number: ST38060002 (J34311)



8. Remove companion flange with puller.

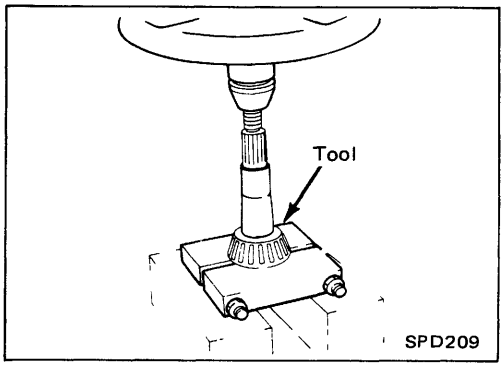


9. Take out drive pinion together with rear bearing inner cone, drive pinion bearing spacer and pinion bearing adjusting washer.
10. Remove front oil seal and pinion front bearing inner cone.



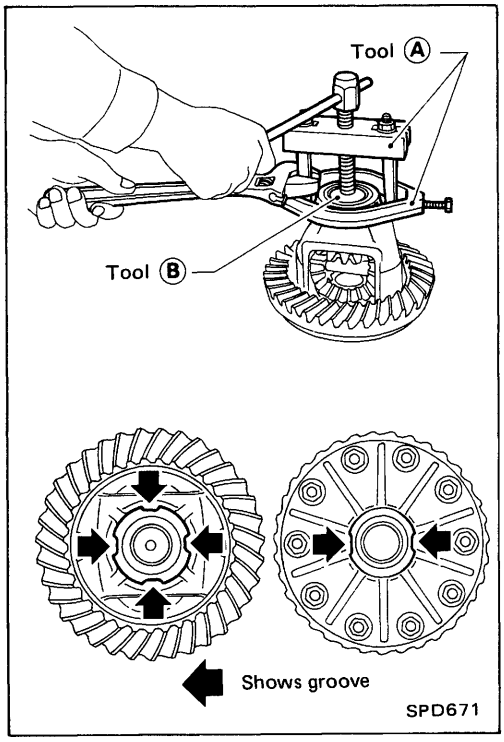
11. Remove pinion bearing outer races with a brass drift.

Final Drive Housing (Cont'd)



12. Remove pinion rear bearing inner cone and drive pinion height adjusting washer.
    Tool number: ST30031000 (J22912-01)

Differential Case

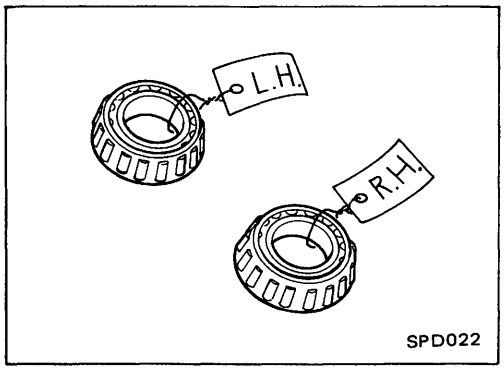


1. Remove side bearing inner cones.

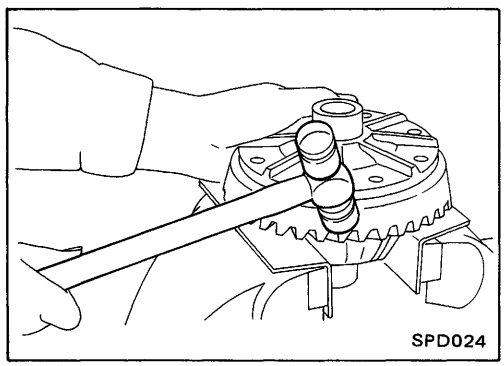
To prevent damage to bearing, engage puller jaws in grooves.

Tool number:

Ⓐ ST33051001 (—)
Equivalent tool (J22888)
Ⓑ ST33061000 (J8107-2)



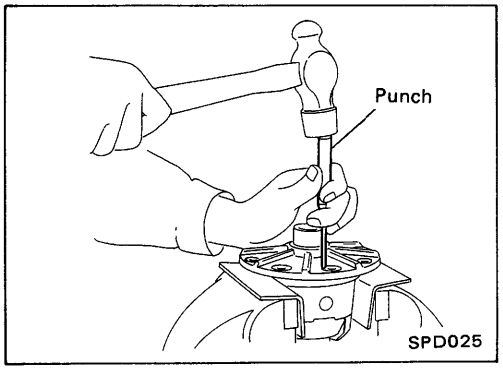
Be careful not to confuse the right and left hand parts.



2. Loosen ring gear bolts in a criss-cross fashion.
3. Tap ring gear off the differential case with a soft hammer.

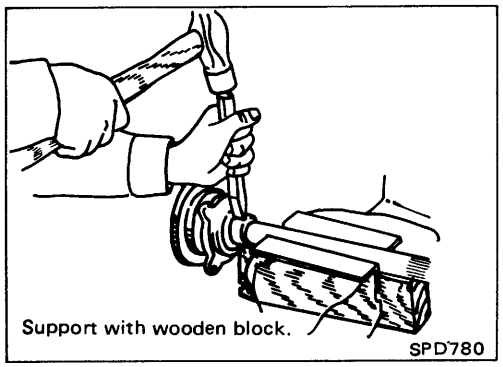
Tap evenly all around to keep ring gear from binding.

Differential Case (Cont'd)

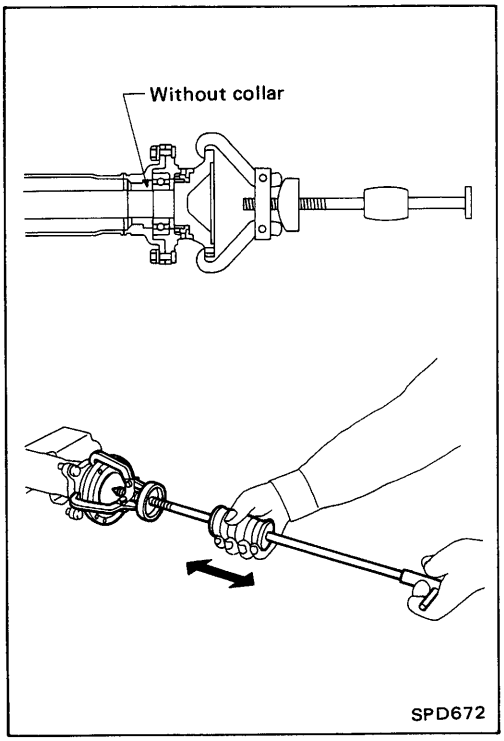


4. Punch off pinion mate shaft lock pin from ring gear side.

Differential Side Shaft

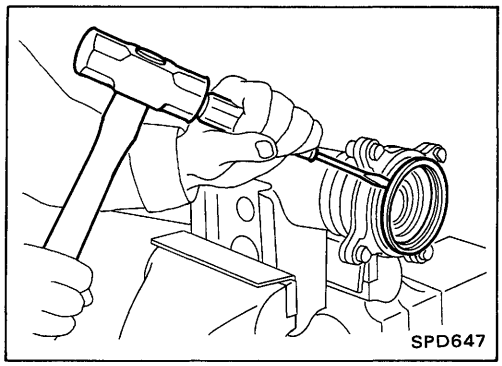


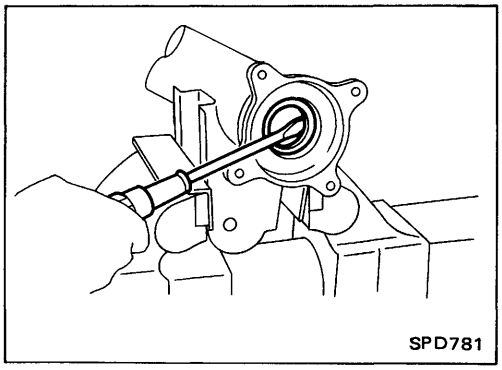
1. Cut collar with cold chisel. Be careful not to damage differential side shaft.



2. Reinstall differential side shaft into extension tube and secure with bolts. Remove rear axle bearing by drawing out differential side shaft from rear axle bearing with puller.

Differential Side Shaft (Cont'd)

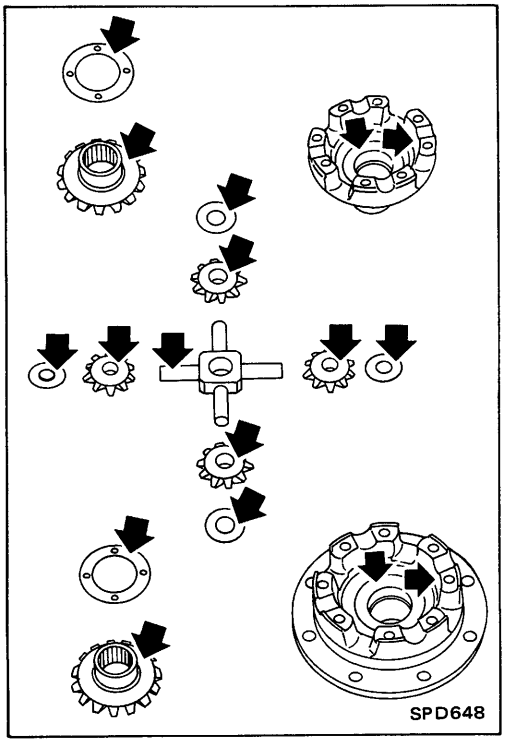

SPD647


SPD781

3. Remove grease seal and oil seal.

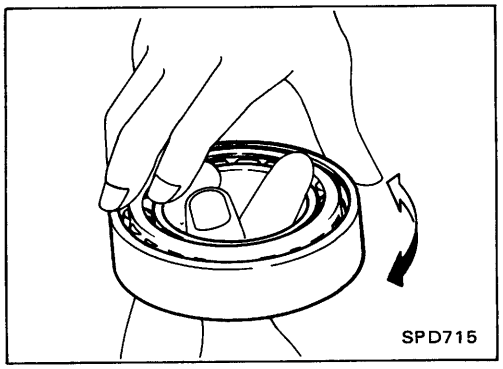
Ring Gear and Drive Pinion

Check gear teeth for scoring, cracking or chipping.
If any damaged part is evident, replace ring gear and drive pinion as a set (hypoid gear set).


SPD648

Differential Case Assembly

Check mating surfaces of differential case, side gears, pinion mate gears, pinion mate shaft and thrust washers.


SPD715

Bearing

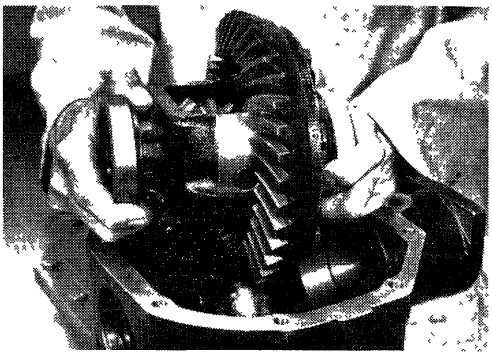
1. Thoroughly clean bearing.
2. Check bearings for wear, scratches, pitting or flaking.
   Check tapered roller bearing for smooth rotation. If damaged, replace outer race and inner cone as a set.

For quiet and reliable final drive operation, the following five adjustments must be made correctly:

1. Side Bearing Preload.
2. Pinion Gear Height.
3. Pinion Bearing Preload.
4. Ring Gear-to-pinion Backlash. (Refer to ASSEMBLY.)
5. Ring and Pinion Gear Tooth Contact Pattern.

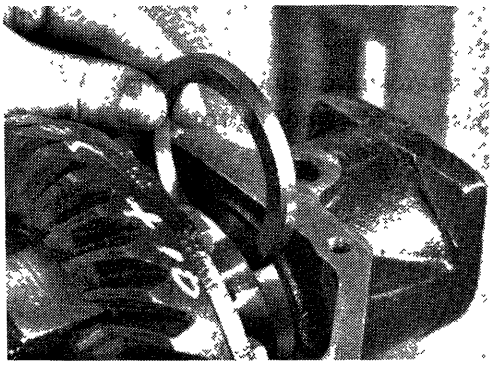
Side Bearing Preload

Note: **A selection of carrier side bearing adjusting washer is required for successful completion of this procedure.**



1. Make sure all parts are clean and that the bearings are well lubricated with light oil or Dexron type automatic transmission fluid.

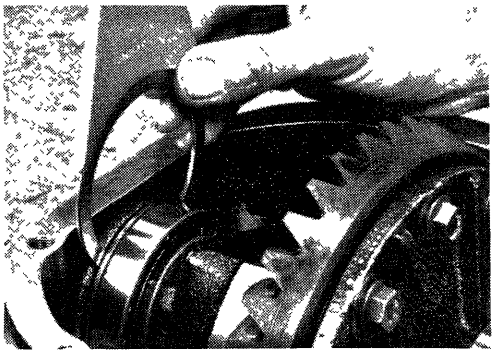
2. Place the differential carrier, with side bearings and bearing races installed, into the final drive housing.



3. Put the side bearing spacer in place.

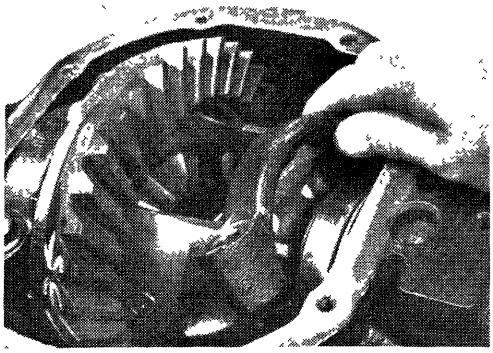
CAUTION:

Side bearing spacer is placed on either the right or left depending upon final drive gear ratio. Be sure to replace it on the correct side.



4. Using the J-25267 side bearing shim installer, place both of the original carrier side bearing preload shims on the carrier end, opposite the ring gear.

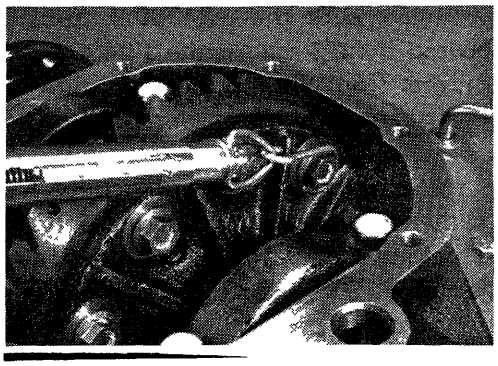
Side Bearing Preload (Cont'd)



5. Install the side bearing caps in their correct locations and torque the bearing cap retaining bolts.

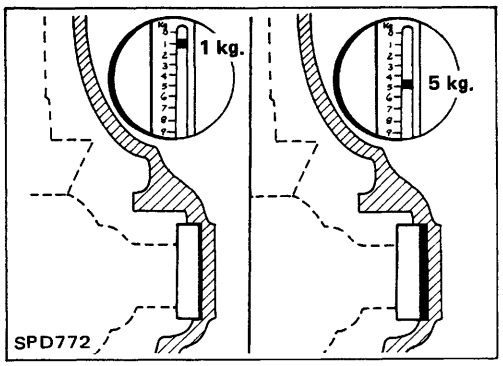
   Specification: 88 - 98 N·m
   (9 - 10 kg-m, 65 - 72 ft-lb)

6. Turn the carrier several times to seat the bearings.



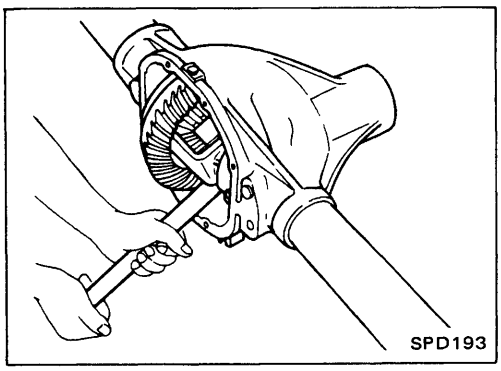
7. Measure the turning torque of the carrier at the ring gear retaining bolts with a spring gauge, J-8129.

   Specification: 34.3 - 39.2 N
   (3.5 - 4 kg, 7.7 - 8.8 lb)
   of pulling force at the ring gear bolt.

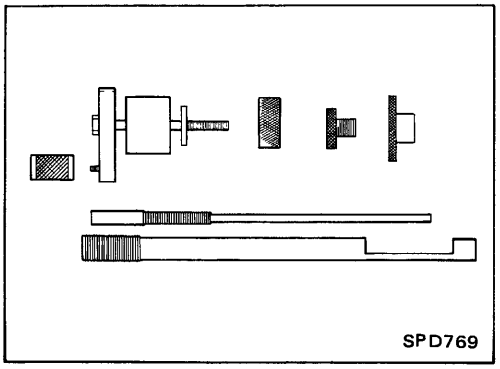


8. If the carrier turning torque is not within the specification range, increase or decrease the *total* thickness of the side bearing adjusting washers until the turning torque is correct. If the turning torque is less than the specified range, install washers of greater thickness; if the turning torque is greater than the specification, install thinner washers. See the S.D.S. section for washer dimensions and part numbers.

9. Record the total amount of washer thickness required for the correct carrier side bearing preload.



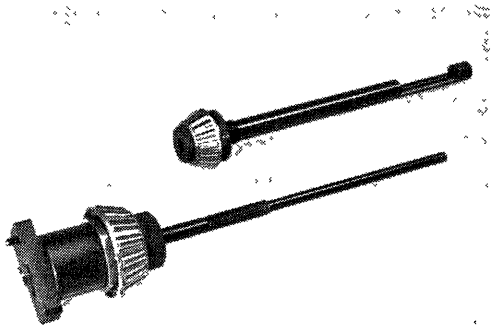
10. Remove the carrier from the final drive housing, saving the selected preload washers for later use during the assembly of the final drive unit.


SPD769

Pinion Gear Height and Pinion Bearing Preload

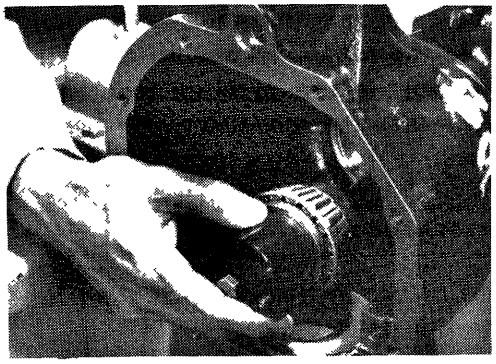
1. Make sure all parts are clean and that the bearings are well lubricated.

2. Assemble the pinion gear bearings into the pinion pre-load shim selector Tool, J-34309.



- **Front Pinion Bearing** — make sure the J-34309-3 front pinion bearing seat is secured tightly against the J-34309-2 gauge anvil. Then turn the front pinion bearing pilot, J-34309-5, to secure the bearing in its proper position.

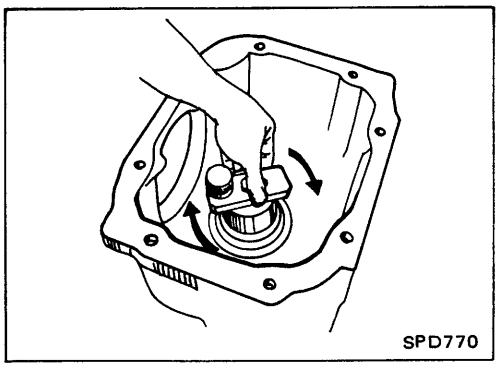
- **Rear Pinion Bearing** — the rear pinion bearing pilot, J-34309-15, is used to center the rear pinion bearing only. The rear pinion bearing locking seat, J-34309-4, is used to lock the bearing to the assembly.



3. Place the pinion preload shim selector Tool, J-34309-1, gauge screw assembly with the pinion rear bearing inner cone installed into the final drive housing.

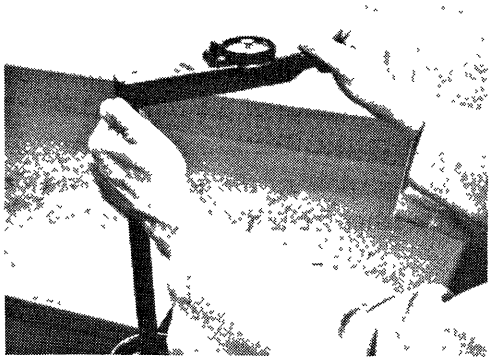


4. Assemble the front pinion bearing inner cone and the J-34309-2 gauge anvil together with the J-34309-1 gauge screw in the final drive housing. Make sure that the pinion height gauge plate, J-34309-16, will turn a full 360 degrees, and tighten the two sections together by hand.


SPD770

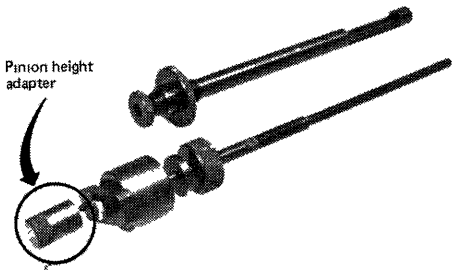
5. Turn the assembly several times to seat the bearings.

Pinion Gear Height and Pinion Bearing Preload (Cont'd)



6. Measure the turning torque at the end of the J-34309-2 gauge anvil using torque wrench J-25765A.

Turning torque specification:
1.0 - 1.3 N·m (10 - 13 kg-cm, 8.7 - 11.3 in-lb)



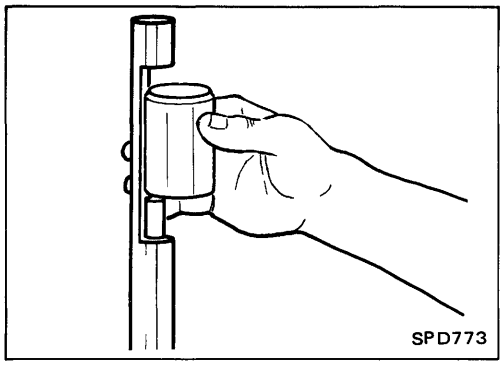
7. Place the J-34309-11 "R200A" pinion height adapter onto the gauge plate and tighten it by hand.

CAUTION:
Make sure all machined surfaces are clean.



PINION BEARING PRELOAD WASHER SELECTION

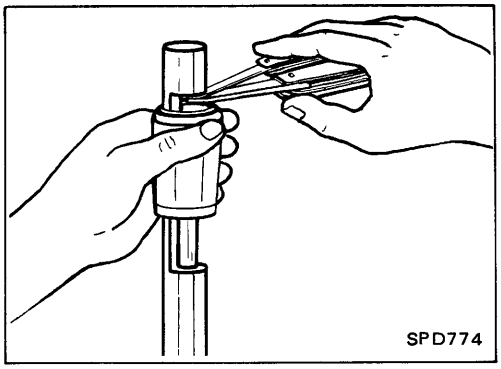
8. Place the solid pinion bearing spacer, small end first, over the J-34309-2 gauge anvil and seat the small end squarely against the tip of the J-34309-1 gauge screw in the tool recessed portion.



Pinion Gear Height and Pinion Bearing Preload (Cont'd)



9. Select the correct thickness of pinion bearing preload adjusting washer using a standard gauge of 3.5 mm (0.138 in) and your J-34309-101 feeler gauge. *The exact measure you get with your gauges is the thickness of the adjusting washer required.* Select the correct washer from the following chart.

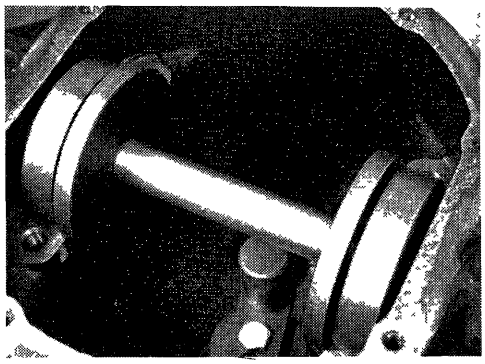


Drive pinion bearing preload adjusting washer (R200A)

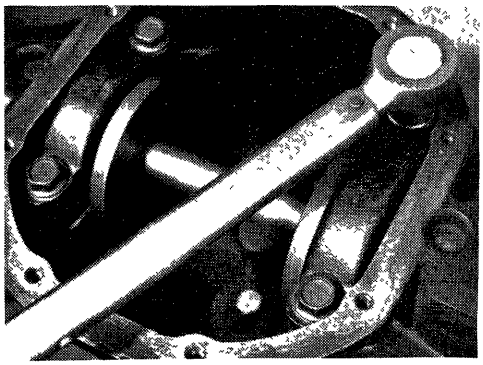
Thickness mm (in)	Part No.
3.80 - 3.82 (0.1496 - 0.1504)	38125-61001
3.82 - 3.84 (0.1504 - 0.1512)	38126-61001
3.84 - 3.86 (0.1512 - 0.1520)	38127-61001
3.86 - 3.88 (0.1520 - 0.1528)	38128-61001
3.88 - 3.90 (0.1528 - 0.1535)	38129-61001
3.90 - 3.92 (0.1535 - 0.1543)	38130-61001
3.92 - 3.94 (0.1543 - 0.1551)	38131-61001
3.94 - 9.96 (0.1551 - 0.1559)	38132-61001
3.96 - 3.98 (0.1559 - 0.1567)	38133-61001
3.98 - 4.00 (0.1567 - 0.1575)	38134-61001
4.00 - 4.02 (0.1575 - 0.1583)	38135-61001
4.02 - 4.04 (0.1583 - 0.1591)	38136-61001
4.04 - 4.06 (0.1591 - 0.1598)	38137-61001
4.06 - 4.08 (0.1598 - 0.1606)	38138-61001
4.08 - 4.10 (0.1606 - 0.1614)	38139-61001

10. Set your selected, correct pinion bearing preload adjusting washer aside for use when assembling the pinion gear and bearings into the final drive.

PINION HEIGHT ADJUSTING WASHER SELECTION



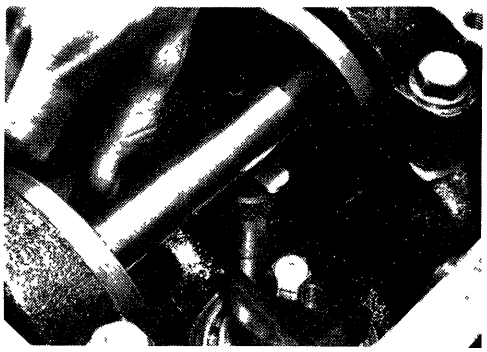
11. Now, position the side bearing discs, J-25269-4, and arbor firmly into the side bearing bores.



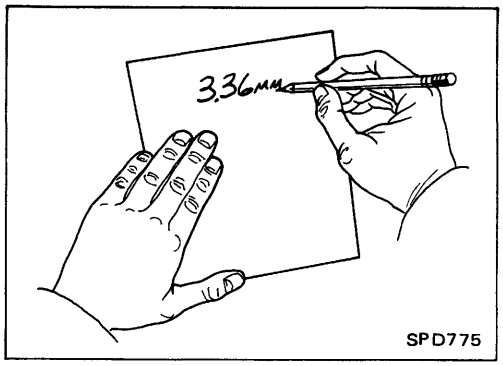
12. Install the side bearing caps and torque the cap bolts.

Specification: 88 - 98 N·m
(9 - 10 kg-m, 65 - 72 ft-lb)

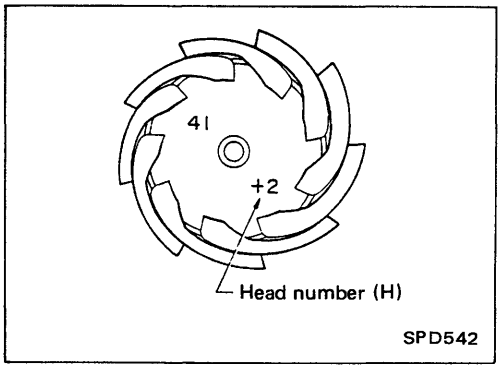
Pinion Gear Height and Pinion Bearing Preload (Cont'd)



13. Select the correct *standard* pinion height adjusting washer thickness by using a standard gauge of 3.0 mm (0.118 in) and your J-34309-101 feeler gauge. Measure the gap between the J-34309-11 "R200A" pinion height adapter and the arbor.



14. Write down your exact total measurement.



15. Correct the pinion height washer size by referring to the "pinion head number."

Note: There are two numbers painted on the pinion gear. The first one refers to the pinion and ring gear as a matched set and should be the same as the number on the ring gear. The second number is the "pinion head height number," and it refers to the ideal pinion height from standard for the quietest operation.

Use the following chart to determine the correct pinion height washer.

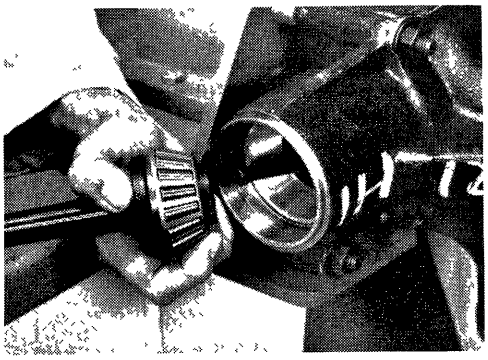
Pinion Head Height Number	Add or Remove from the Standard Pinion Height Washer Thickness Measurement
−6	Add 0.06 mm (0.0024 in)
−5	Add 0.05 mm (0.0020 in)
−4	Add 0.04 mm (0.0016 in)
−3	Add 0.03 mm (0.0012 in)
−2	Add 0.02 mm (0.0008 in)
−1	Add 0.01 mm (0.0004 in)
0	Use the selected washer thickness
+1	Subtract 0.01 mm (0.0004 in)
+2	Subtract 0.02 mm (0.0008 in)
+3	Subtract 0.03 mm (0.0012 in)
+4	Subtract 0.04 mm (0.0016 in)
+5	Subtract 0.05 mm (0.0020 in)
+6	Subtract 0.06 mm (0.0024 in)

Pinion Gear Height and Pinion Bearing Preload (Cont'd)

Select the correct pinion height washer from the following chart.

Drive pinion height adjusting washer (R200A)

Thickness mm (in)	Part No.
3.09 (0.1217)	38154-P6017
3.12 (0.1228)	38154-P6018
3.15 (0.1240)	38154-P6019
3.18 (0.1252)	38154-P6020
3.21 (0.1264)	38154-P6021
3.24 (0.1276)	38154-P6022
3.27 (0.1287)	38154-P6023
3.30 (0.1299)	38154-P6024
3.33 (0.1311)	38154-P6025
3.36 (0.1323)	38154-P6026
3.39 (0.1335)	38154-P6027
3.42 (0.1346)	38154-P6028
3.45 (0.1358)	38154-P6029
3.48 (0.1370)	38154-P6030
3.51 (0.1382)	38154-P6031
3.54 (0.1394)	38154-P6032
3.57 (0.1406)	38154-P6033
3.60 (0.1417)	38154-P6034
3.63 (0.1429)	38154-P6035
3.66 (0.1441)	38154-P6036

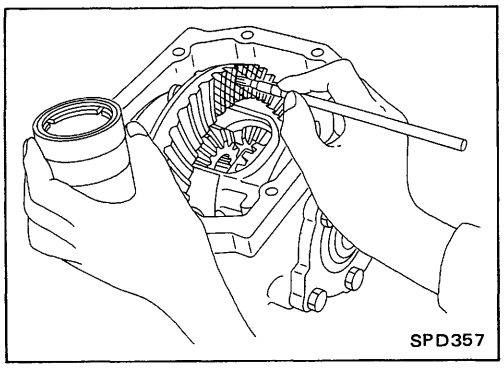


16. Remove the J-34309 pinion preload shim selector tool from the final drive housing and disassemble to retrieve the pinion bearings.

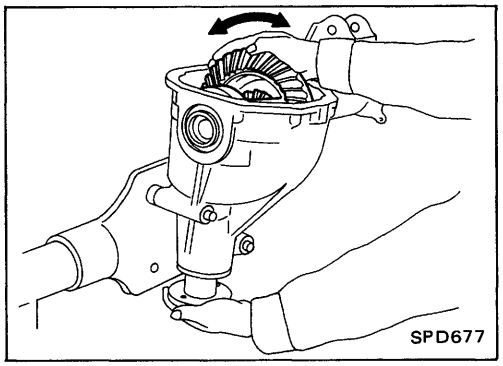
Tooth Contact

Gear tooth contact pattern check is necessary to verify correct relationship between ring gear and drive pinion.

Hypoid gear sets which are not positioned properly in relation to one another may be noisy, or have short life, or both. With a pattern check, the most desirable contact for low noise level and long life can be assured.

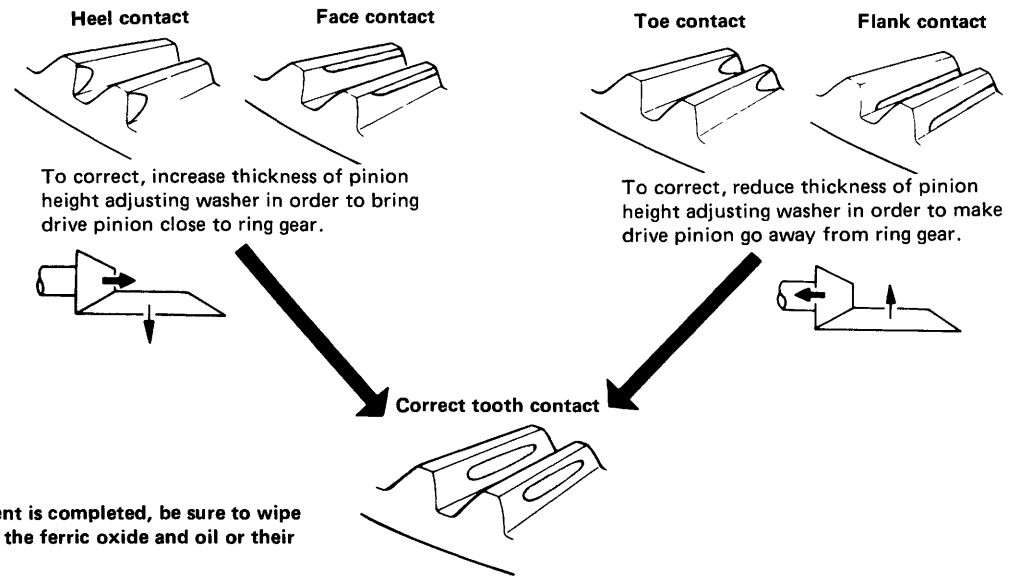

SPD357

1. Thoroughly clean ring gear and drive pinion teeth.
2. Sparingly apply a mixture of powdered ferric oxide and oil or equivalent to 3 or 4 teeth of ring gear drive side.


SPD677

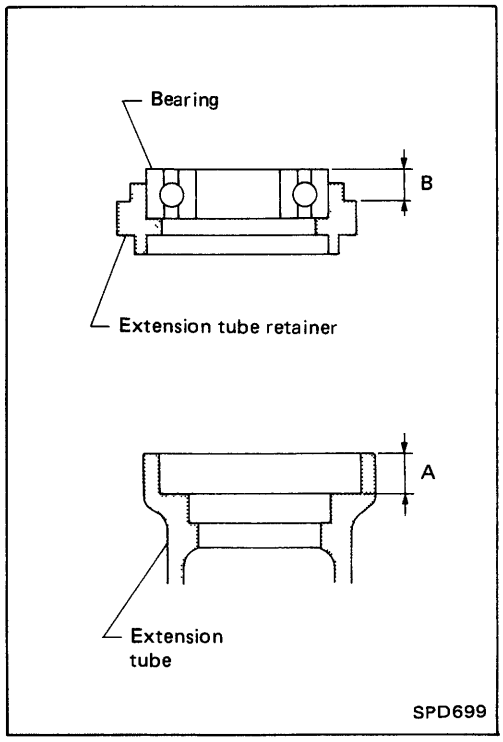
3. Hold companion flange steady by hand and rotate the ring gear in both directions.

Usually the pattern will be correct if you have calculated the shims correctly and the backlash is correct.
However, in rare cases you may have to use trial-and-error processes until you get a good tooth contact pattern.
The tooth pattern is the best indication of how well a differential has been set up.



When adjustment is completed, be sure to wipe off completely the ferric oxide and oil or their equivalent.

SPD007



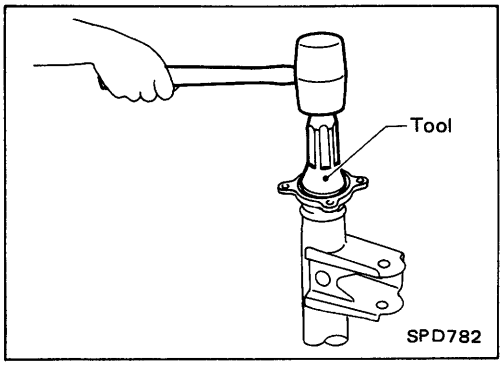
Differential Side Shaft

1. Measure rear axle bearing end play.

   Rear axle bearing end play (A – B):

   0.1 mm (0.0039 in) or less

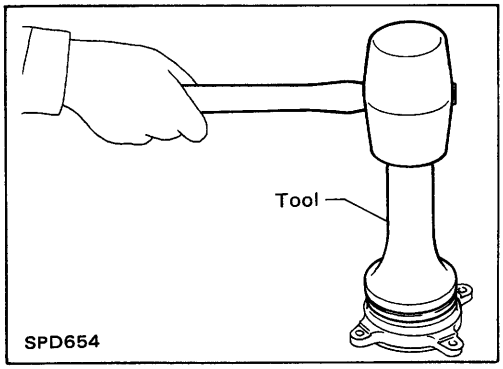
   The end play can be adjusted with bearing adjusting shim. (Refer to S.D.S.)



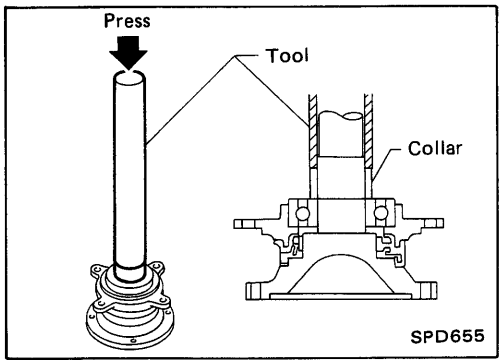
2. Install oil seal and grease seal.

   Tool number: ST33190000 (–)

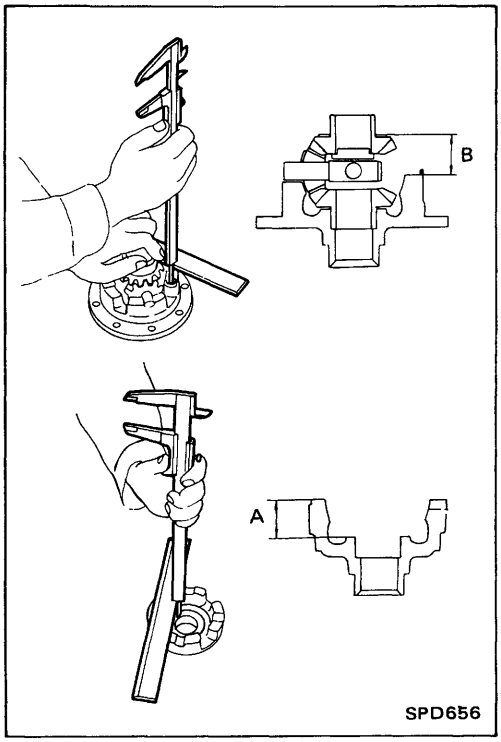
   Equivalent tool (J26233)



Tool number: (J26233)



3. Install extension tube retainer, rear axle bearing and rear axle shaft bearing collar on differential side shaft.



Differential Case

1. Measure clearance between side gear thrust washer and differential case.

   Clearance between side gear thrust washer and differential case (A – B):

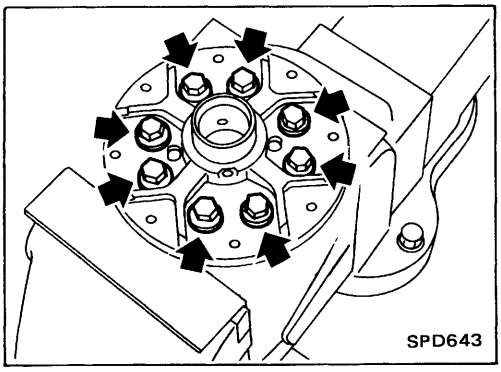
   0.10 - 0.20 mm (0.0039 - 0.0079 in)

   The clearance can be adjusted with side gear thrust washer.

   Available side gear thrust washers:

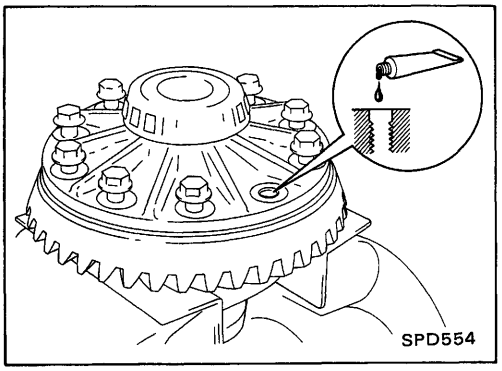
   Refer to S.D.S.

2. Apply gear oil to gear tooth surfaces and thrust surfaces and check to see they turn properly.



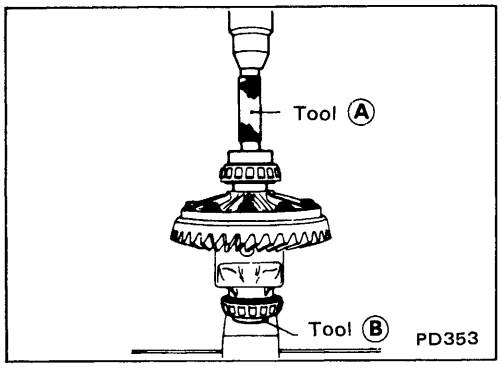
3. Install differential case L.H. and R.H.

Differential Case (Cont'd)



4. Place differential case on ring gear.
5. Apply locking agent [Locktite (stud lock) or equivalent] to ring gear bolts, and install them.

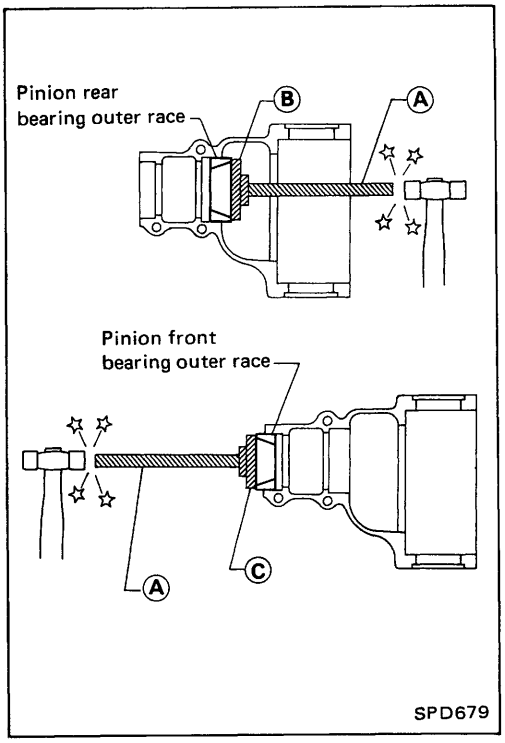
Tighten bolts in a criss-cross fashion, lightly tapping bolt head with a hammer.



6. Press-fit side bearing inner cones on differential case with Tool.

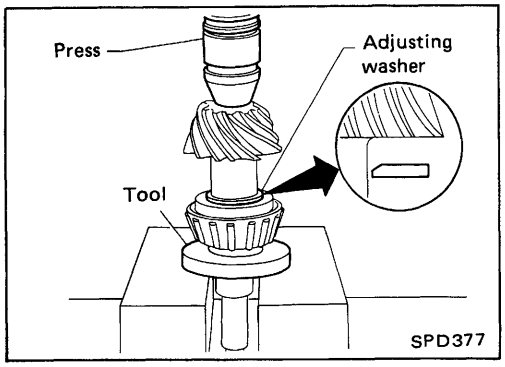
Tool number:
- Ⓐ **KV38100300 (J25523)**
- Ⓑ **ST33061000 (J8107-2)**

Final Drive Housing



1. Press-fit front and rear bearing outer races with Tools.

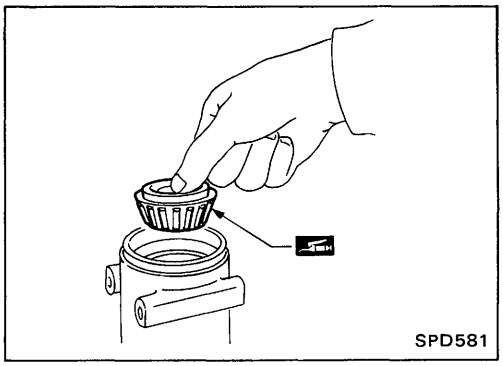
Tool number:
- Ⓐ **ST30611000 (J25742-1)**
- Ⓑ **ST30621000 (J25742-5)**
- Ⓒ **ST30613000 (J25742-3)**



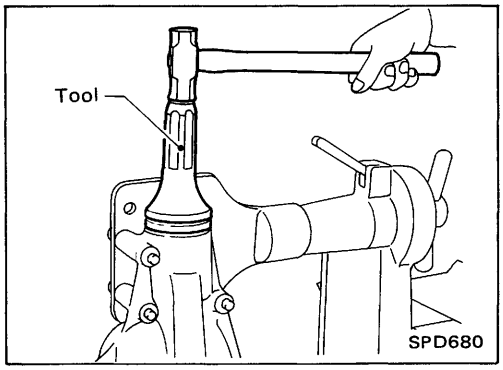
2. Select drive pinion height adjusting washer and pinion bearing adjusting washer, referring to ADJUSTMENT.
3. Install drive pinion height adjusting washer in drive pinion, and press-fit pinion rear bearing inner cone in it, using press and Tool.

Tool number: ST30901000 (—)
Equivalent tool (J26010-01)

Final Drive Housing (Cont'd)

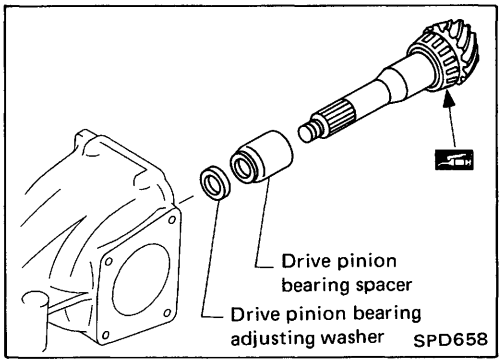


4. Place pinion front bearing inner cone in final drive housing.

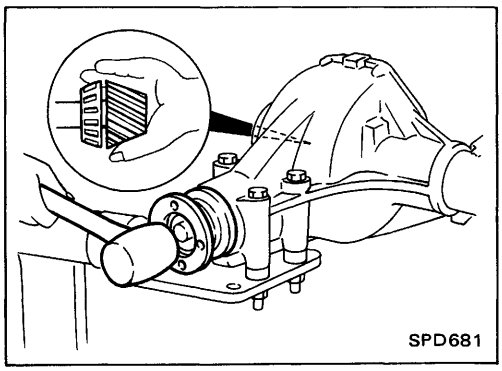


5. Apply multi-purpose grease to cavity at sealing lips of oil seal. Install front oil seal.

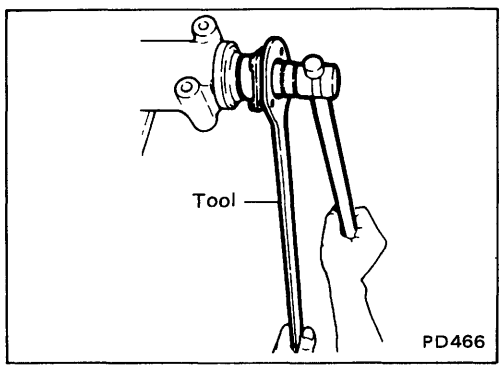
Tool number: KV38100500 (—)
Equivalent tool (J25273)



6. Place drive pinion bearing spacer, drive pinion bearing adjusting washer and drive pinion in final drive housing.



7. Insert companion flange into drive pinion by tapping the companion flange with a soft hammer.

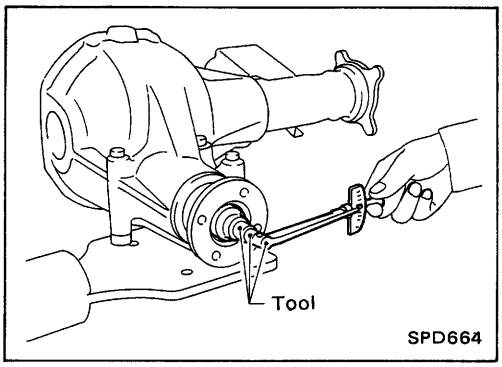


8. Tighten pinion nut to the specified torque.

The threaded portion of drive pinion and pinion nut should be free from oil or grease.

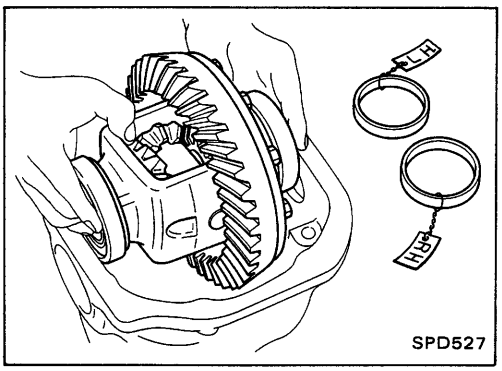
Tool number: ST38060002 (J34311)

Final Drive Housing (Cont'd)

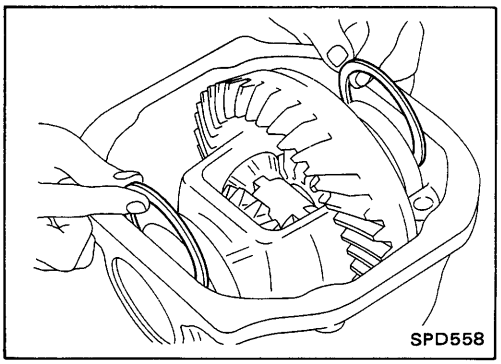


9. Turn drive pinion in both directions several revolutions, and measure pinion bearing preload.
   Tool number: ST3127S000 (See J25765-A)
   Pinion bearing preload:
   1.1 - 1.7 N·m
   (11 - 17 kg-cm, 9.5 - 14.8 in-lb)

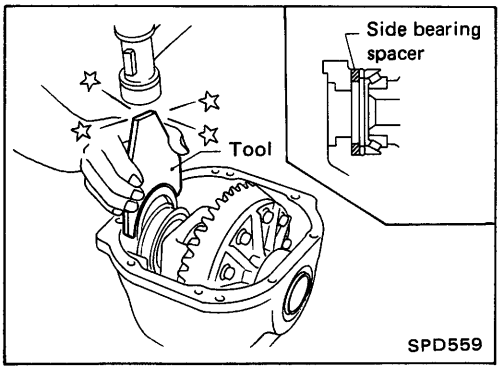
When pinion bearing preload is outside the specifications, replace pinion bearing adjusting washer and spacer with a different thickness.



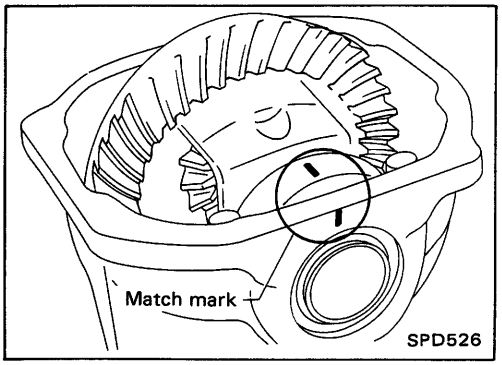
10. Select side bearing adjusting washer.
    Refer to ADJUSTMENT.
11. Install differential case assembly with side bearing outer races into final drive housing.



12. Insert left and right side bearing adjusting washers in place between side bearings and final drive housing.

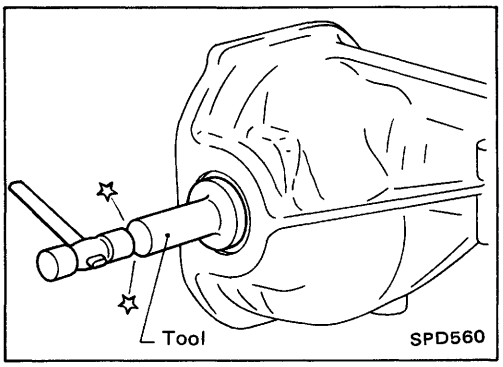


13. Drive in side bearing spacer with Tool.
    Tool number: KV38100600 (J25267)

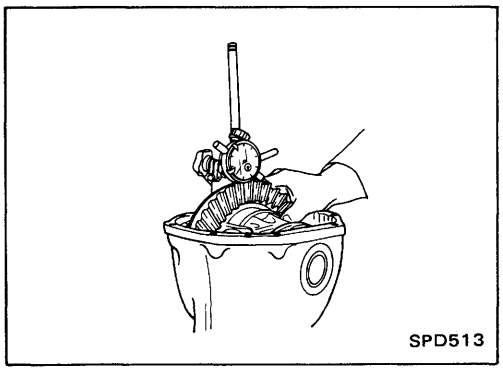


14. Align mark on bearing cap with that on final drive housing and install bearing cap on final drive housing.

Final Drive Housing (Cont'd)



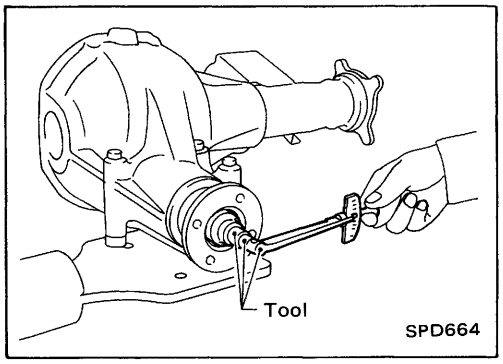
15. Apply multi-purpose grease to cavity at sealing lips of oil seal. Install side oil seal.
    Tool number: KV38100200 (J26233)



16. Measure ring gear-to-drive pinion backlash with a dial indicator.
    Ring gear-to-drive pinion backlash:
    0.13 - 0.18 mm (0.0051 - 0.0071 in)

- If backlash is too small, decrease thickness of right shim and increase thickness of left shim by the same amount.
  If backlash is too great, reverse the above procedure.

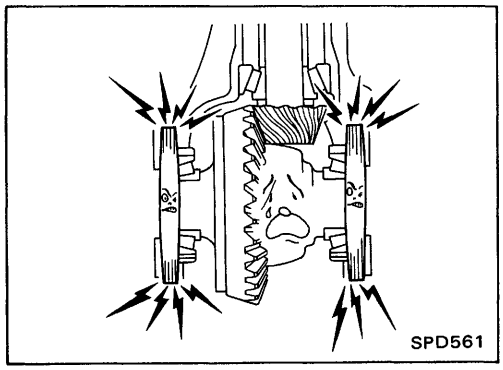
Never change the total amount of shims as it will change the bearing preload.



17. Check total preload with Tool.

When checking preload, turn drive pinion in both directions several times to set bearing rollers.

Tool number: ST3127S000 (See J25765-A)
Total preload:
1.4 - 3.1 N·m
(14 - 32 kg-cm, 12 - 28 in-lb)

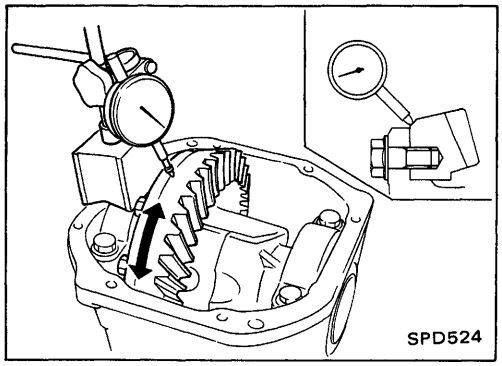


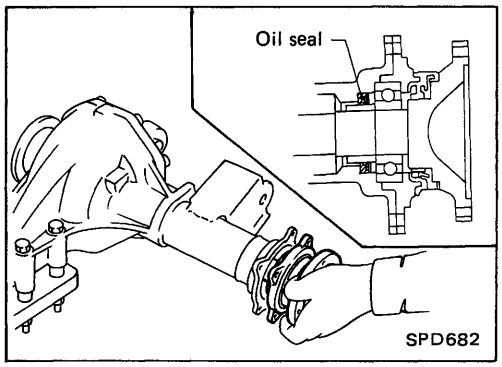
- If preload is too great, remove the same amount of shim from each side.
- If preload is too small, add the same amount of shim to each side.

Never add or remove a different number of shims for each side as it will change ring gear-to-drive pinion backlash.

18. Recheck ring gear-to-drive pinion backlash because increase or decrease in thickness of shims will cause change of ring gear-to-pinion backlash.

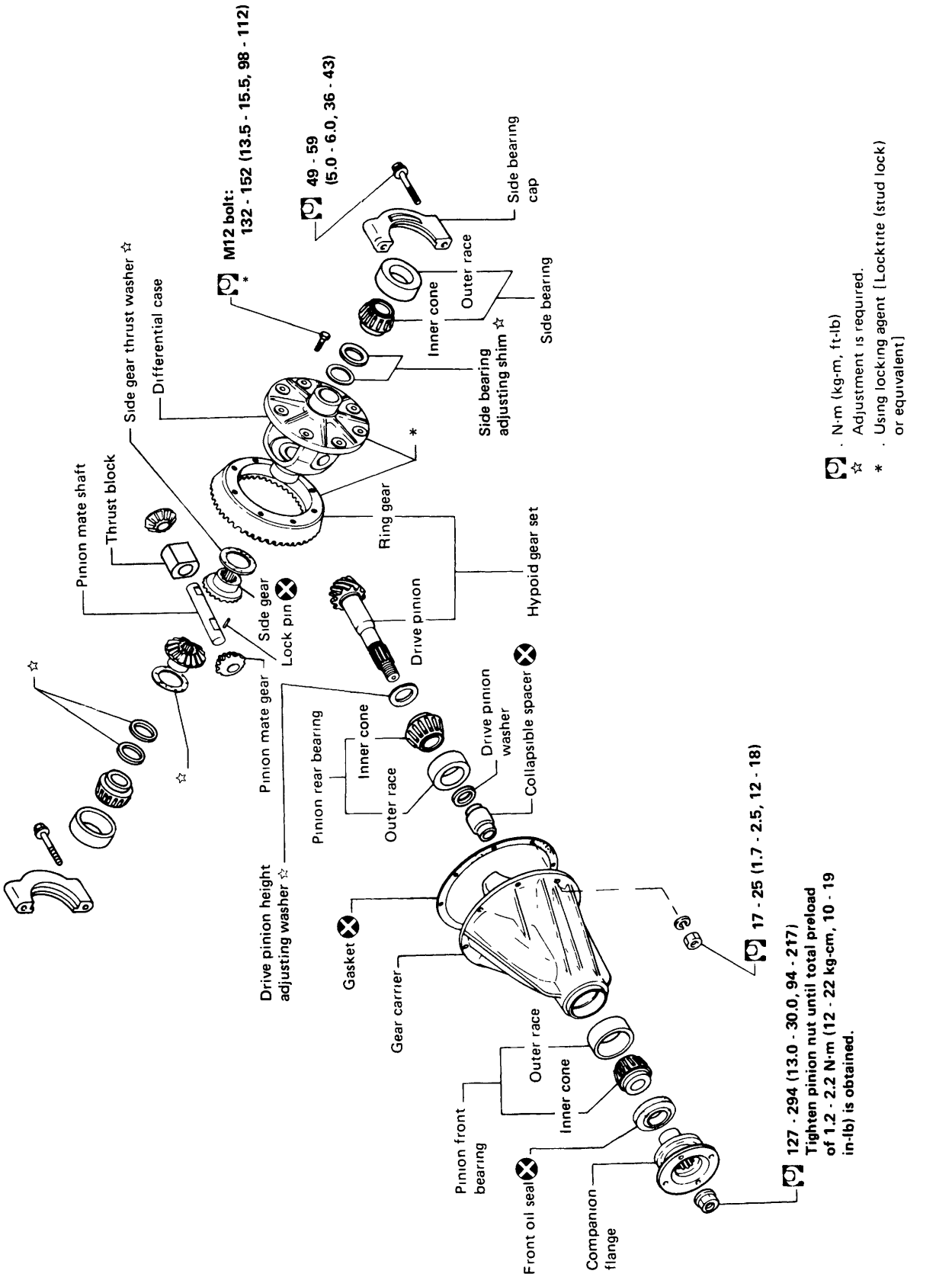
Final Drive Housing (Cont'd)



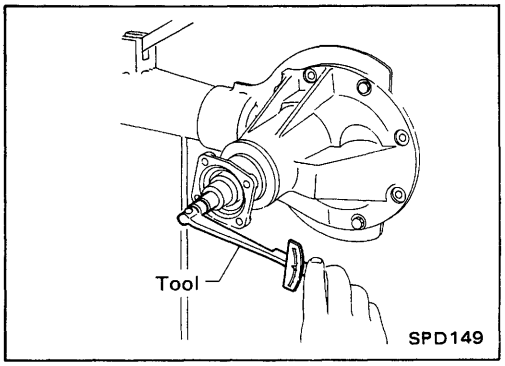


19. Check runout of ring gear with a dial indicator.
    Runout limit:
    0.05 mm (0.0020 in)
- If backlash varies excessively in different places, the variance may have resulted from foreign matter caught between the ring gear and the differential case.
- If the backlash varies greatly when the runout of the ring gear is within a specified range, the hypoid gear set or differential case should be replaced.

20. Check tooth contact.
    Refer to ADJUSTMENT.
21. Install rear cover and gasket.
22. Install differential side shaft assembly.


M12 bolt:
132 - 152 (13.5 - 15.5, 98 - 112)
49 - 59
(5.0 - 6.0, 36 - 43)
Side gear thrust washer ☆
Differential case
Side bearing cap
Outer race
Inner cone
Side bearing
Side bearing adjusting shim ☆
Pinion mate shaft
Thrust block
Side gear
Lock pin
Ring gear
Drive pinion
Hypoid gear set
Pinion mate gear
Drive pinion height adjusting washer ☆
Pinion rear bearing
Inner cone
Outer race
Drive pinion washer
Collapsible spacer
Gasket
Gear carrier
17 - 25 (1.7 - 2.5, 12 - 18)
Outer race
Inner cone
Pinion front bearing
Front oil seal
Companion flange
127 - 294 (13.0 - 30.0, 94 - 217)
Tighten pinion nut until total preload of 1.2 - 2.2 N·m (12 - 22 kg-cm, 10 - 19 in-lb) is obtained.
. N·m (kg-m, ft-lb)
☆ . Adjustment is required.
* . Using locking agent [Locktite (stud lock) or equivalent]

SPD999



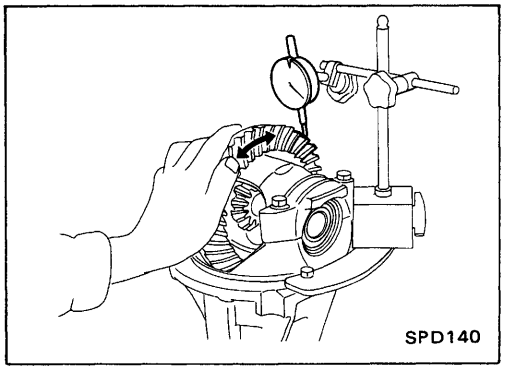
Pre-inspection

Before disassembling final drive, perform the following inspection.

- Total preload

1) Turn drive pinion in both directions several revolutions to seat bearing rollers correctly.
2) Check total preload with Tool.

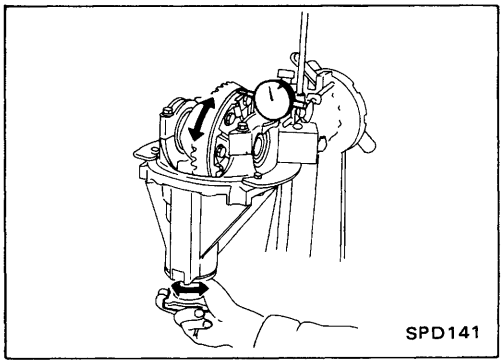
Tool number: ST3127S000 (See J25765-A)
Total preload:
1.2 - 2.2 N·m
(12 - 22 kg-cm, 10 - 19 in-lb)



- Ring gear to drive pinion backlash

Check backlash of ring gear with a dial indicator at several points.

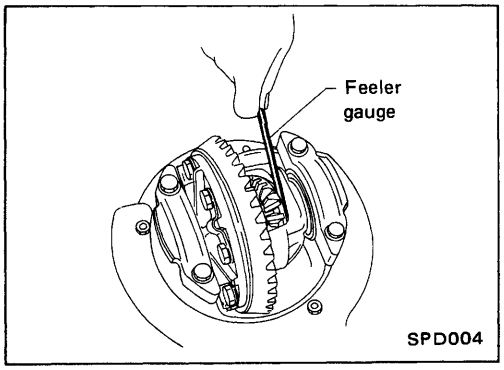
Ring gear-to-drive pinion backlash:
0.15 - 0.20 mm (0.0059 - 0.0079 in)



- Ring gear runout

Check runout of ring gear with a dial indicator.

Runout limit:
0.05 mm (0.0020 in)



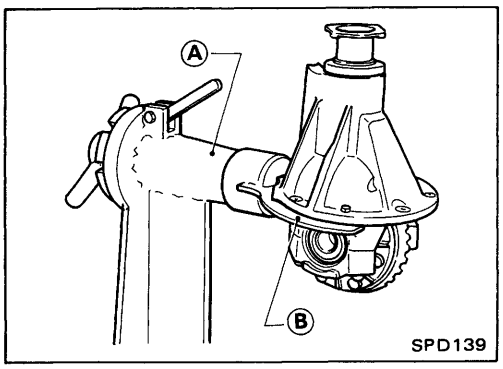
- Tooth contact

Check tooth contact, referring to ADJUSTMENT.

- Side gear to pinion mate gear backlash

Measure clearance between side gear thrust washer and differential case with a feeler gauge.

Clearance between side gear thrust washer and differential case:
0.10 - 0.20 mm (0.0039 - 0.0079 in)

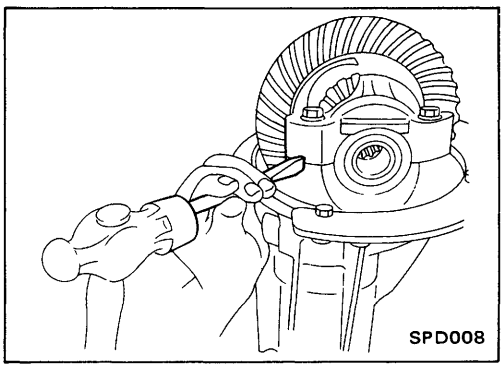


Differential Carrier

1. Mount differential carrier on Tools.

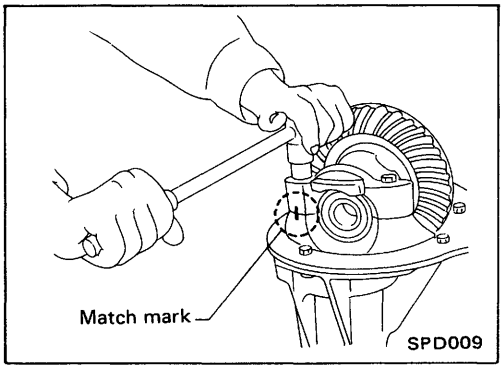
Tool number:
Ⓐ ST0501S000 (—)
Ⓑ ST06310000 (J25602-01)

Differential Carrier (Cont'd)


SPD008

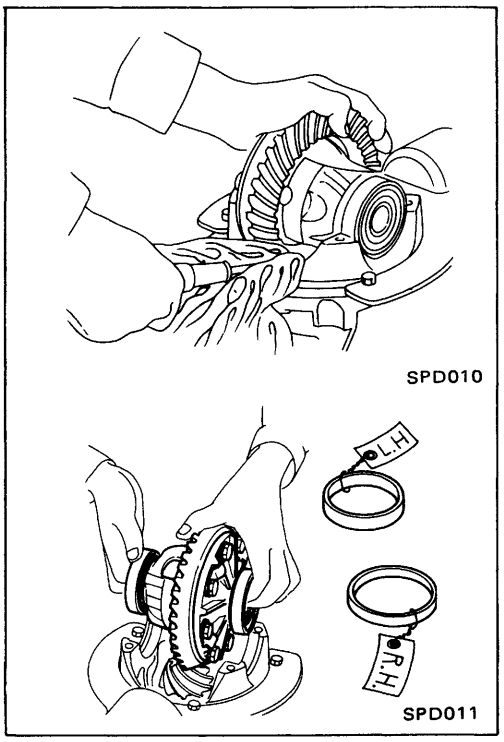
2. Put match marks on one side of side bearing cap with paint or punch to ensure that it is replaced in proper position during reassembly.

Bearing caps are line-bored during manufacture and should be put back in their original places.



SPD009

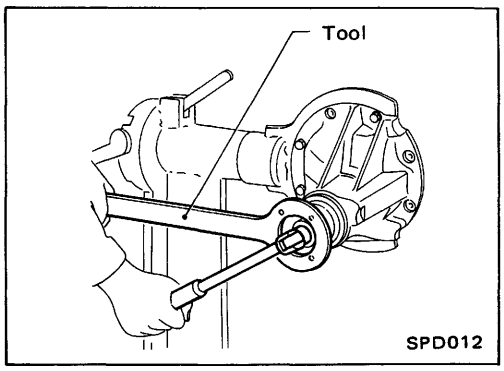
3. Remove side bearing caps.


SPD010

SPD011

4. Remove differential case assembly with a pry bar.

Be careful to keep the side bearing outer races together with their respective inner cones – do not mix them up.

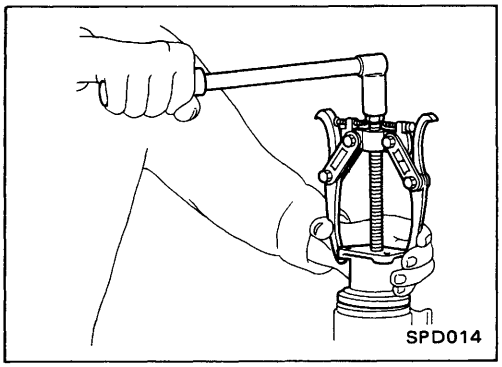


SPD012

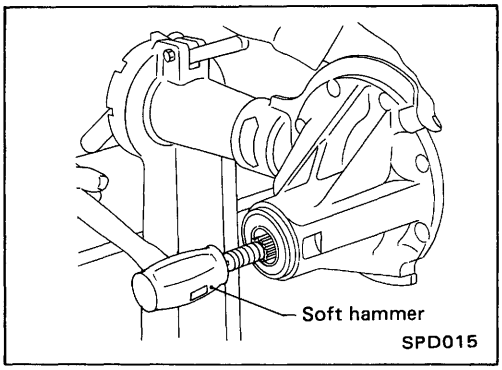
5. Remove drive pinion nut with Tool.

Tool number: ST38060002 (J34311)

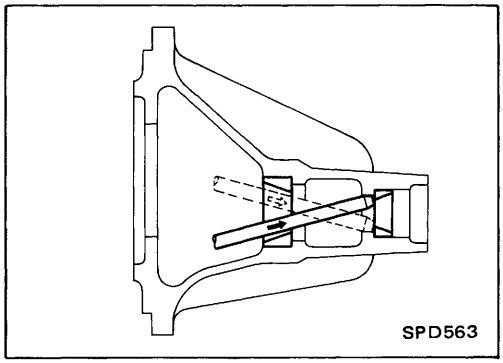
Differential Carrier (Cont'd)



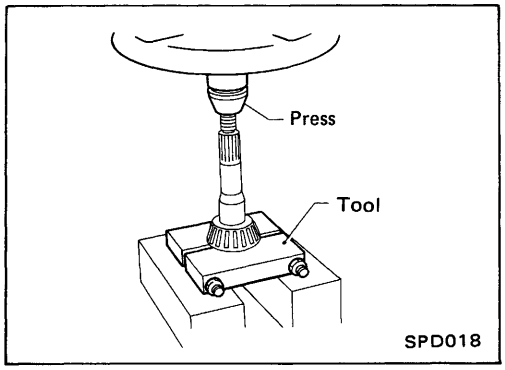
6. Remove companion flange with puller.



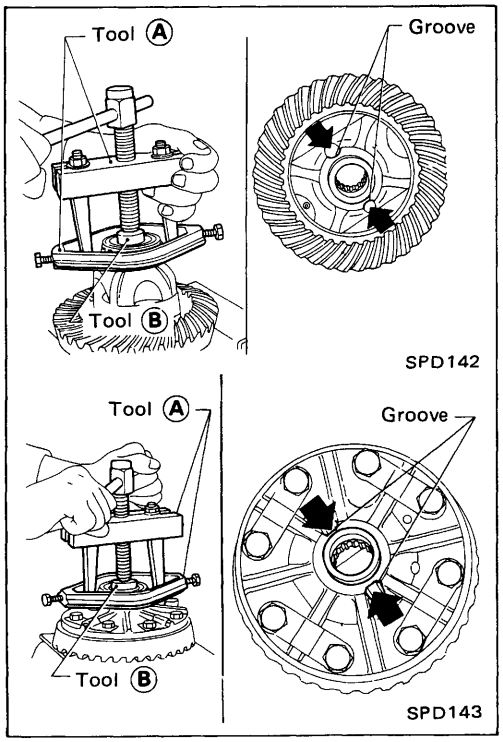
7. Remove drive pinion with soft hammer.
8. Remove oil seal.



9. Remove pinion bearing outer races with a brass drift.



10 Pull out rear bearing inner cone with a press and Tool.
Tool number: ST30031000 (J22912-01)



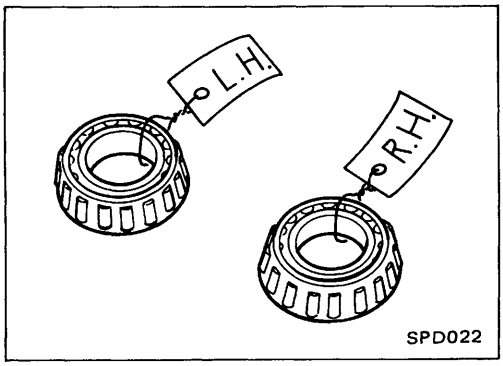
Differential Case

1. Remove side bearing inner cones.

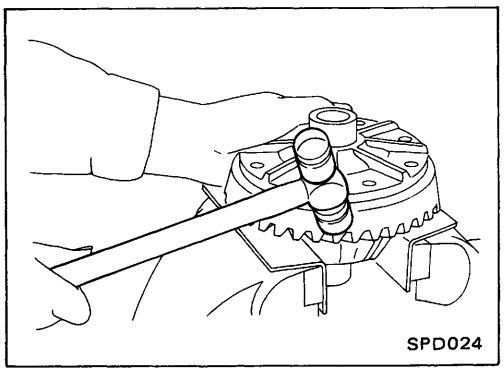
To prevent damage to bearing, engage puller jaws in groove.

Tool number:

Ⓐ ST33051001 (–)
Equivalent tool (J22888)
Ⓑ ST33061000 (J8107-2)

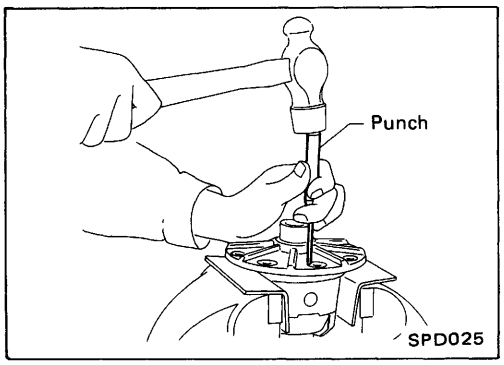


Be careful not to confuse left and right hand parts.



2. Spread out lock straps and loosen ring gear bolts in a criss-cross fashion.
3. Tap ring gear off differential case with a soft hammer.

Tap evenly all around to keep ring gear from binding.

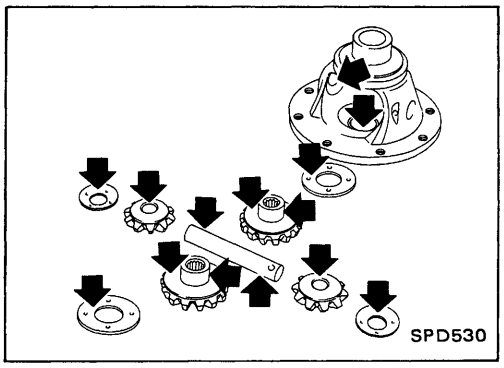


4. Drive out pinion mate shaft lock pin, with Tool from ring gear side.

Lock pin is calked at pin hole mouth on differential case.

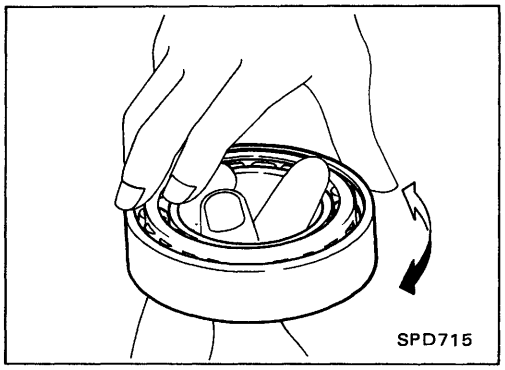
Ring Gear and Drive Pinion

Check gear teeth for scoring, cracking or chipping.
If any damaged part is evident, replace ring gear and drive pinion as a set (hypoid gear set).



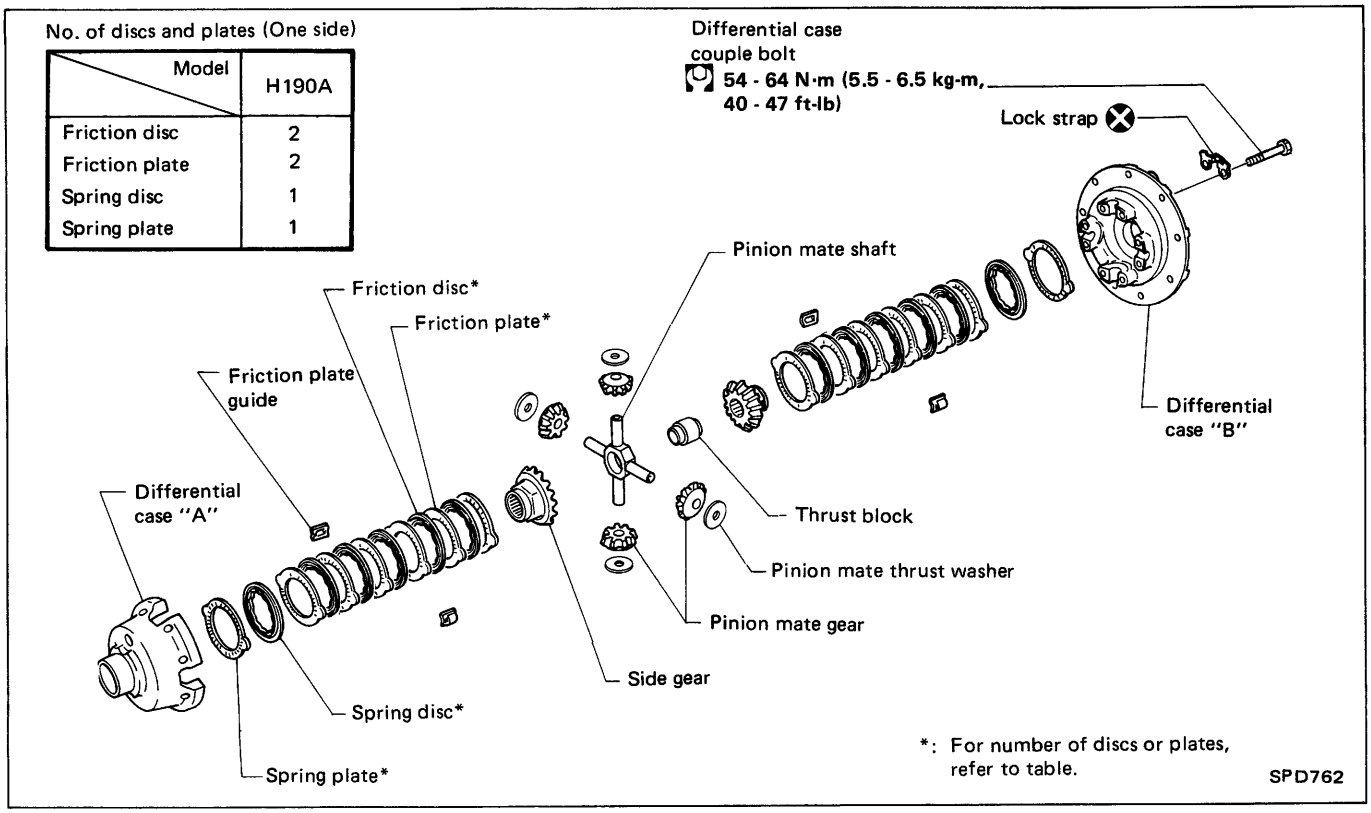
Differential Case Assembly

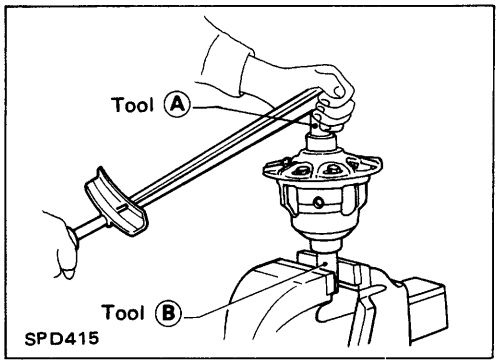
Check mating surfaces of differential case, side gears, pinion mate gears, pinion mate shaft, and thrust washers.



Bearing

1. Thoroughly clean bearing.
2. Check bearings for wear, scratches, pitting or flaking.
   Check tapered roller bearing for smooth rotation. If damaged, replace outer race and inner cone as a set.





CAUTION:

Do not run engine when one wheel (rear) is off the ground.

Preparation for Disassembly

CHECKING DIFFERENTIAL TORQUE

Measure differential torque with Tool.

If it is not within the specifications, inspect components of limited slip differential.

Differential torque:

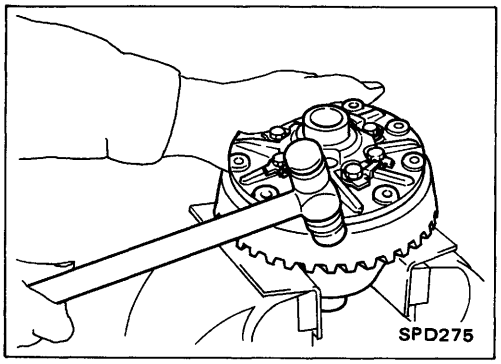
147 - 196 N·m

(15 - 20 kg-m, 108 - 145 ft-lb)

Tool number:

Ⓐ **KV38105110 (–)**

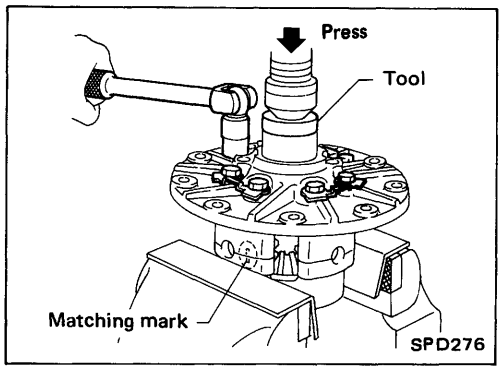
Ⓑ **KV38105120 (–)**



Disassembly

1. Remove side bearing inner cone with Tool.
2. Remove ring gear by spreading out lock straps.
3. Loosen ring gear bolts in a criss-cross fashion.
4. Tap ring gear off gear case with a soft hammer.

Tap evenly all around to keep ring gear from binding.

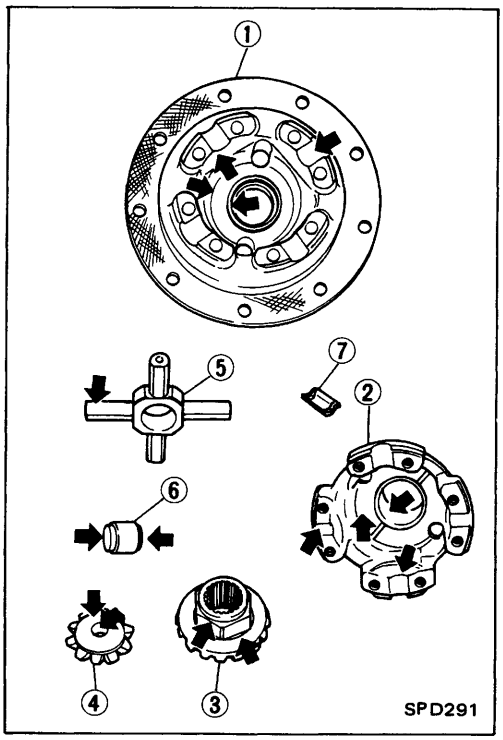


5. Remove differential case by spreading out lock straps.
6. Remove couple bolts on differential cases A and B with a press.

Tool number: ST33081000 (—)

7. Separate differential case A and B.
   Draw out component parts (discs and plates, etc.).

Put marks on gears and pressure rings so that they can be reinstalled in their original positions from which they were removed.



Inspection

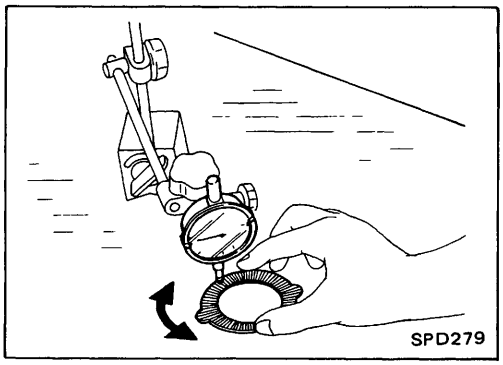
CONTACT SURFACES

1. Clean the disassembled parts in suitable solvent and blow dry with compressed air.
2. If following surfaces are found with burrs or scratches, smooth with oil stone.
   - ① Differential case A
   - ② Differential case B
   - ③ Side gear
   - ④ Pinion mate gear
   - ⑤ Pinion mate shaft
   - ⑥ Thrust block
   - ⑦ Friction plate guide

DISC AND PLATE

1. Clean the discs and plates in suitable solvent and blow dry with compressed air.
2. Inspect discs and plates for wear, nicks and burrs.

Inspection (Cont'd)

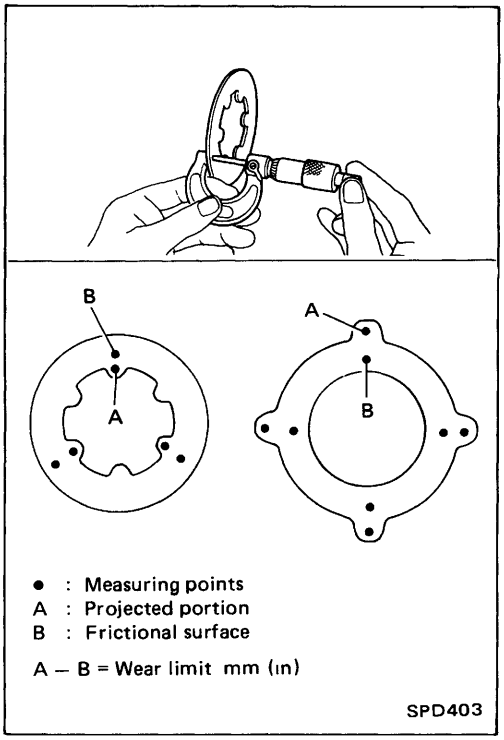


3. To test if friction disc or plate is not distorted, place it on a surface plate and rotate it by hand with indicating finger of dial gauge resting against disc or plate surface.

   Allowable warpage:

   0.05 - 0.20 mm (0.0020 - 0.0079 in)

   If it exceeds limits, replace with a new plate to eliminate possibility of clutch slippage or sticking.

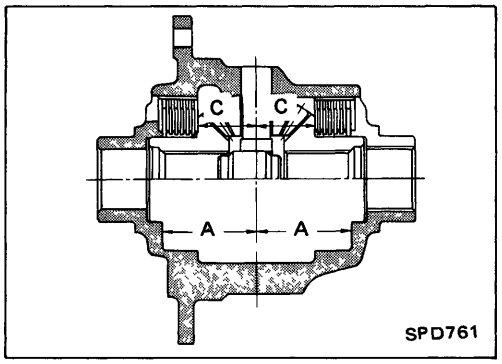


4. Measure frictional surfaces and projected portions of friction disc, friction plate, spring plate, and determine each part's differences to see if the specified wear limit has been exceeded.
5. Measure frictional surfaces and projected portions of friction disc, friction plate; spring plate and spring disc (H233B only).

If any part has worn beyond the wear limit, replace it with a new one that is the same thickness as the projected portion.

Wear limit:

0.1 mm (0.004 in) or less



Adjustment

FRICTION DISC AND FRICTION PLATE END PLAY

End play of friction disc and friction plate can be calculated by using following equation and should be adjusted within following range.

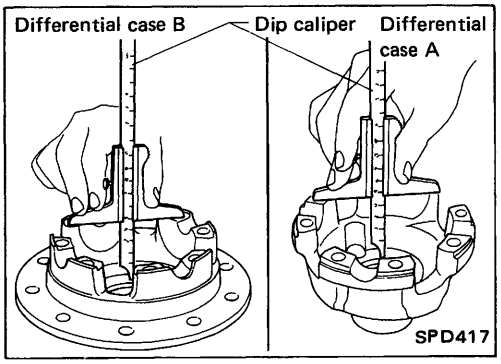
Adjustment can be made by selecting friction disc having two different thicknesses.

End play E:

0.05 - 0.20 mm (0.0020 - 0.0079 in)

$$E = A - (B + C)$$

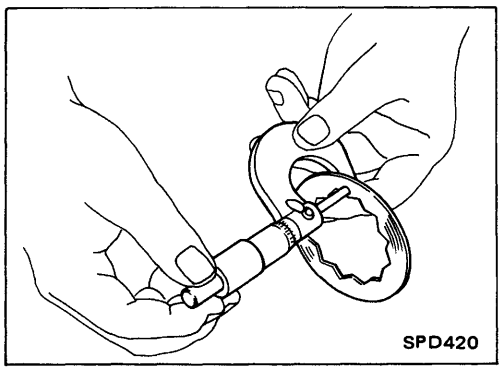
A: Length of differential case contact surface to differential case inner bottom.
B: Total thickness of friction discs, friction plates, spring disc and spring plate in differential case on one side.
C: Length of differential case contact surface to back side of side gear.



1. Measure values of "A".

Standard length A:

45.55 - 45.60 mm (1.7933 - 1.7953 in)



2. Measure thickness of each disc and plate.

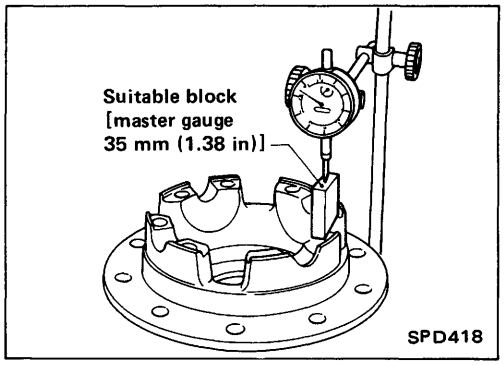
Total thickness "B":

10.38 - 10.62 mm (0.4087 - 0.4181 in)

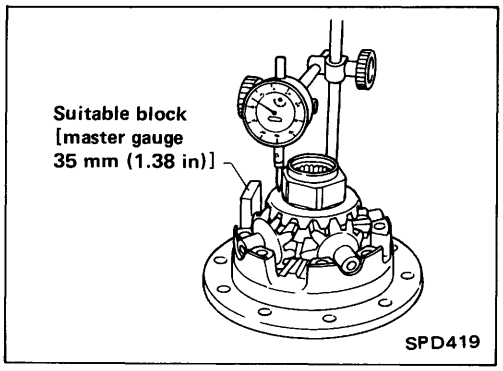
No. of discs and plates (One side)

Model	H190A
Friction disc	2
Friction plate	2
Spring disc	1
Spring plate	1

Adjustment (Cont'd)



3. Measure values of "C".
(1) Attach a dial indicator to the base plate.
(2) Place differential case B on the base plate, and install a master gauge on case B.
Then adjust the dial indicator scale to zero with its tip on the master gauge.



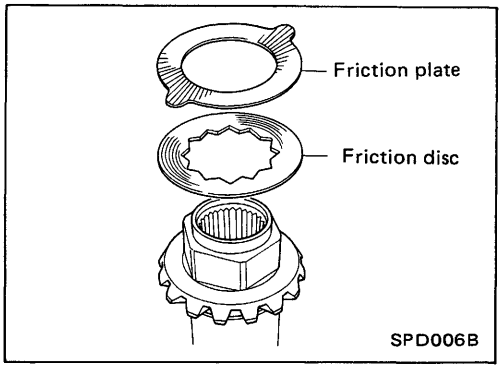
(3) Install pinion mate gears, side gears and pinion mate shaft in differential case B.
(4) Set dial indicator's tip on the side gear, and read the indication.

Example:

E = A – D
= A – (B + C)
= 0.05 to 0.2 mm
A = 45.58 mm
B = 10.4 mm
C = 34.93 mm
D = B + C
B ... 10.4
\+ C ... 34.93
45.33

E = A – D
A ... 45.58
– D ... 45.33
0.25

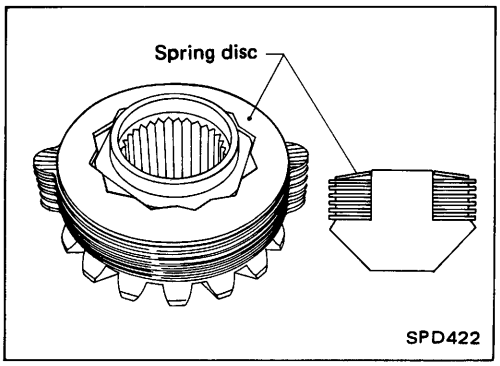
From the above equation, end play of 0.25 mm exceeds the specified range of 0.05 to 0.2 mm.
Select suitable discs and plates to adjust correctly.



Assembly

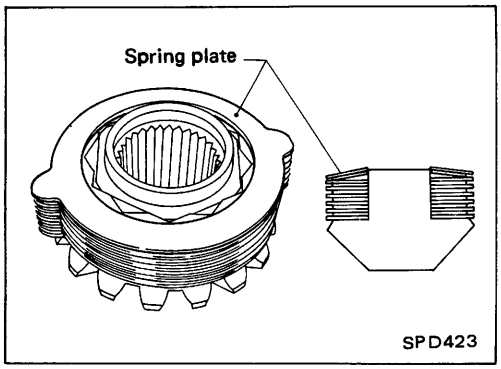
Prior to assembling discs and plates, properly lubricate them by dipping them in limited slip differential oil.
1. Alternately position specified number of friction plates and friction discs on rear of side gear.
Always position a friction plate first on rear of side gear.

Assembly (Cont'd)

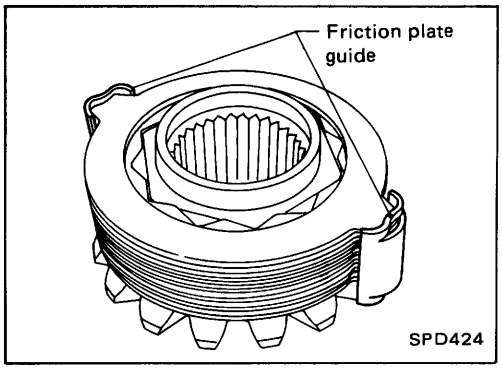


2. Install spring disc.

Align the twelve angular holes in spring disc with the hexagonal area of the side gear.

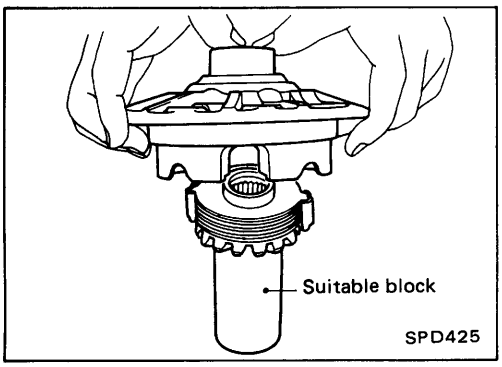


3. Install spring plate.



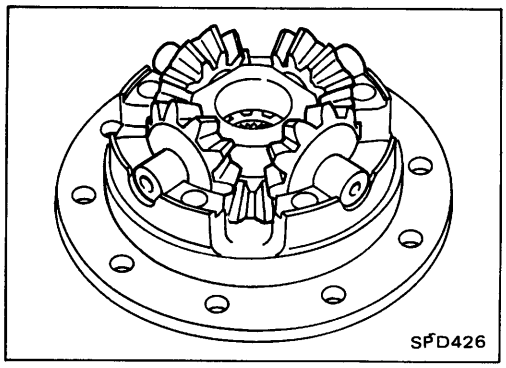
4. Install friction plate guides.

Correctly align the raised portions of friction plates, and apply grease to inner surfaces of friction plate guides to prevent them from falling.



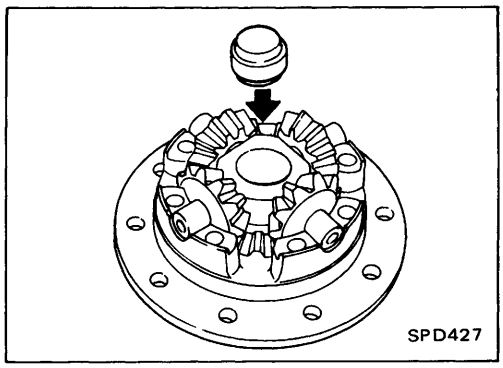
5. Install differential case B over side gear, discs, plates and friction plate guide assembly.

- **Install differential case B while supporting friction plate guides with your middle finger inserted through oil hole in differential case.**
- **Be careful not to detach spring disc from the hexagonal part of the side gear.**

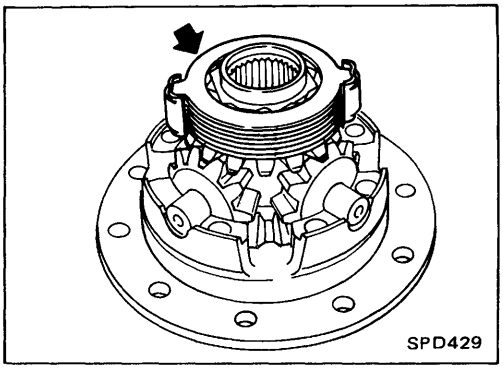


6. Install pinion mate gears and pinion shaft to differential case B.

Assembly (Cont'd)

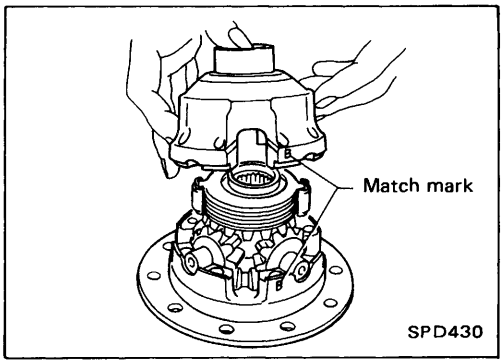

SPD427

7. Install thrust block.


SPD429

8. Install side gear to pinion mate gears.
9. Install each disc and plate.

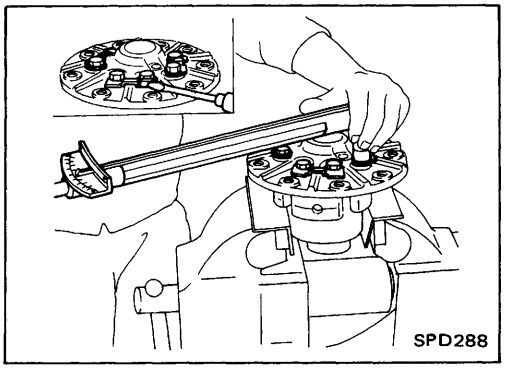
Use same procedures as outlined in steps 1. through 4. above.



SPD430

10. Install differential case A.

Position differential cases A and B by correctly aligning marks stamped on cases.


SPD288

11. Tighten differential case bolts.
12. Place ring gear on differential case and install new lock straps and bolts.

Tighten bolts in a criss-cross fashion, lightly tapping bolt head with a hammer.

Then bend up lock straps to lock the bolts in place.

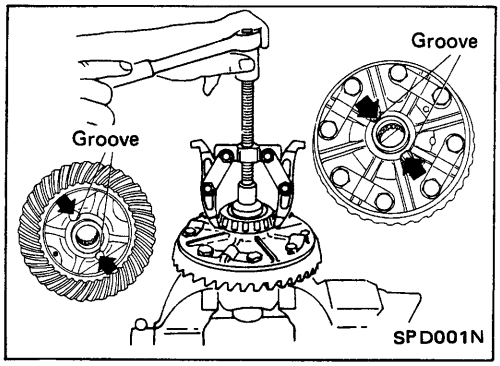
13. Install side bearing inner cone.
14. Check differential torque.

For quiet and reliable final drive operation, the following five adjustments must be made correctly:

1. Side Bearing Preload.
2. Pinion Gear Height.
3. Pinion Bearing Preload. (Refer to ASSEMBLY.)
4. Ring Gear-to-pinion Backlash. (Refer to ASSEMBLY.)
5. Ring and Pinion Gear Tooth Contact Pattern.

Side Bearing Preload

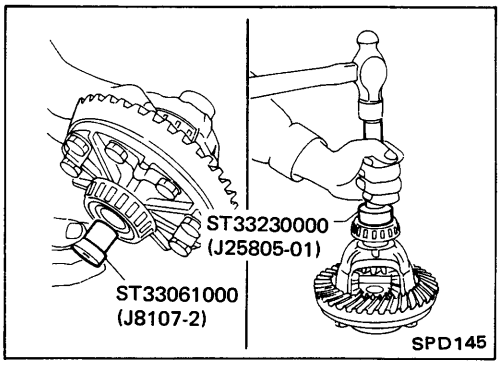
NOTE:
A selection of carrier side bearing preload shims is required for successful completion of this procedure.



1. Make sure all parts are clean and that the bearings are well lubricated with light oil or Dexron type automatic transmission fluid.
2. Attach side bearing puller Tools J-22888 and J-8107-02 to the carrier side bearing and remove the bearings.

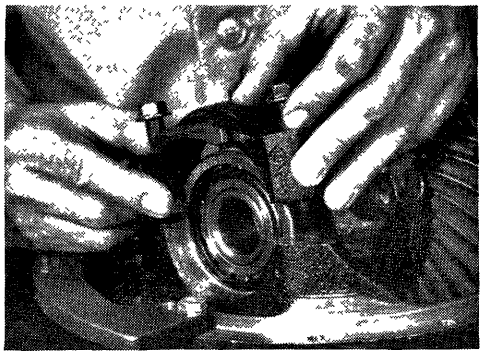


3. Reinstall all of the original side bearing adjusting shims on the carrier side, away from the ring gear.



4. Reinstall the carrier side bearing using Tools J-25805-01 and J-8107-2. Press on the bearings.

Side Bearing Preload (Cont'd)



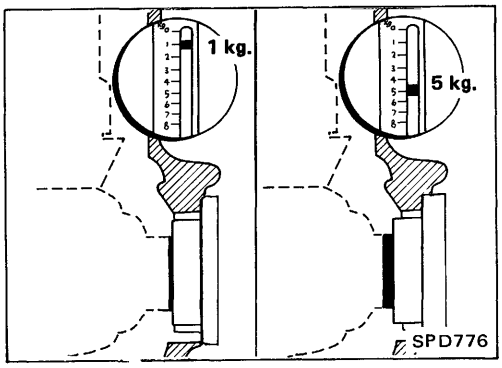
5. Install carrier and bearings into the final drive housing. Install side bearing caps. Torque the bolts and tap on the caps with a soft hammer to seat the bearings.

   Side bearing cap bolt torque:

   Specification 49 - 59 N·m
   (5 - 6 kg-m, 36 - 43 ft-lb)

6. After turning the carrier several times to seat the bearings, measure carrier turning force with spring gauge J-8129.

   Turning force specification:
   34.3 - 39.2 N (3.5 - 4.0 kg, 7.7 - 8.8 lb)
   of pulling force at the ring gear bolt.

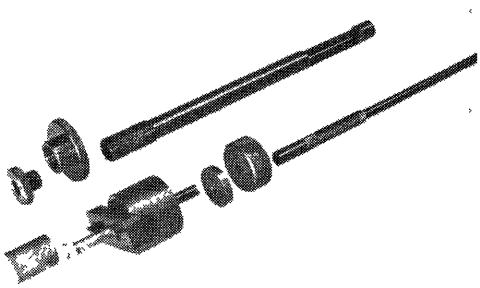


7. If necessary, correct the carrier bearing preload by adding to or subtracting from the *total* amount of shim thickness.

   Add shim thickness to increase turning force on the carrier.

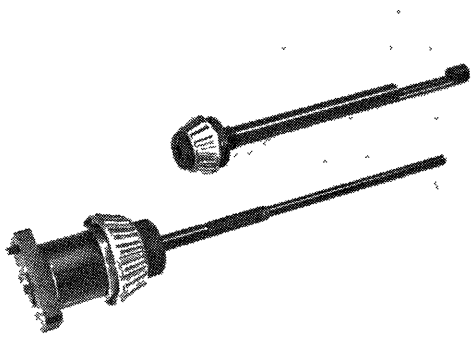
   Subtract shim thickness to decrease turning force on the carrier.

Pinion Gear Height



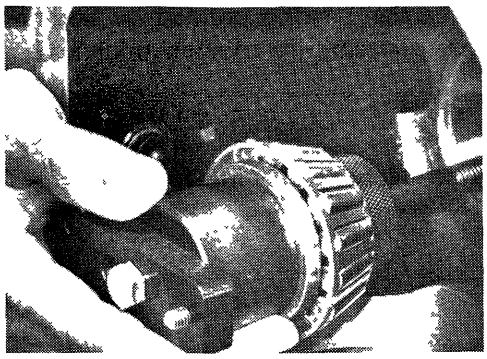
1. Make sure all parts are clean and that the bearings are well lubricated.

2. Assemble the pinion gear bearings into the pinion pre-load shim selector tool, J-34309.

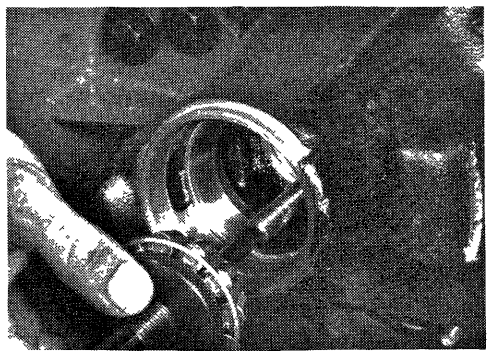


- **Front Pinion Bearing** — make sure the J-34309-3 front pinion bearing is secured tightly against the J-34309 gauge anvil. Then turn the front pinion bearing pilot J-34309-5 to secure the bearing in its proper position.

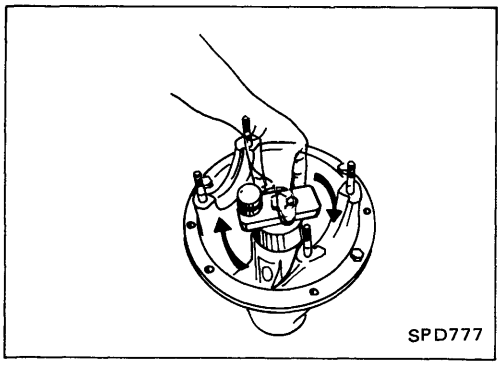
- **Rear Pinion Bearing** — the rear pinion bearing pilot, J-34309-15, is used to center the rear pinion bearing only. The rear pinion bearing locking seat, J-34309-4 is used to lock the bearing to the assembly.



3. Place the pinion pre-load shim selector tool J-34309-1 gauge screw assembly with the pinion rear bearing inner cone installed into the final drive housing.

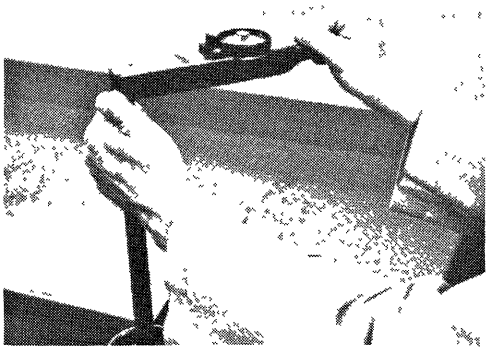


4. Assemble the front pinion bearing inner cone and the J-34309-2 gauge anvil together with the J-34309-1 gauge screw in the final drive housing. Make sure that the pinion height gauge plate, J-34309-16, will turn a full 360 degrees, and tighten the two sections together by hand.



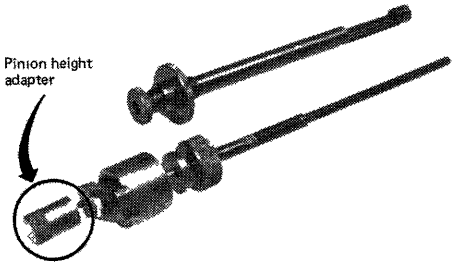
5. Turn the assembly several times to seat the bearings.

Pinion Gear Height (Cont'd)



6. Measure the turning torque at the end of the J-34309-2 gauge anvil using torque wrench J-25765A.

Turning torque specification:
1.0 - 1.3 N·m
(10 - 13 kg-cm, 8.7 - 11.3 in-lb)



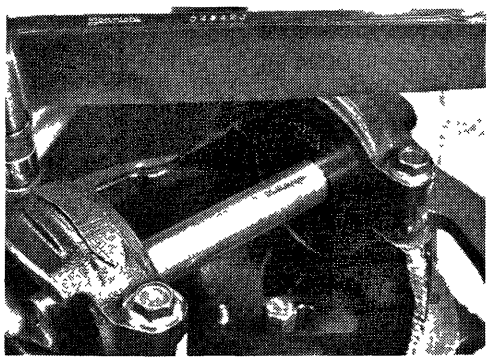
7. Place the J-34309-14 pinion height adapter onto the gauge plate and tighten it by hand.

CAUTION:
Make sure all machined surfaces are clean.

PINION HEIGHT ADJUSTING WASHER SELECTION

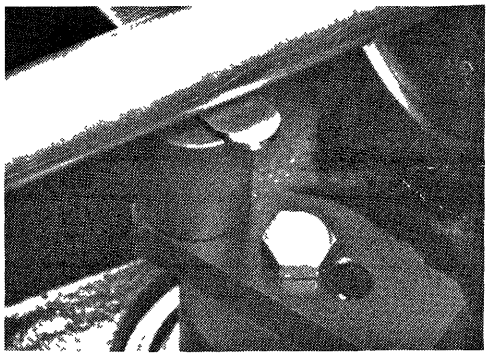


8. Now, position the side bearing discs, J-25269-18, and arbor firmly into the side bearing bores.



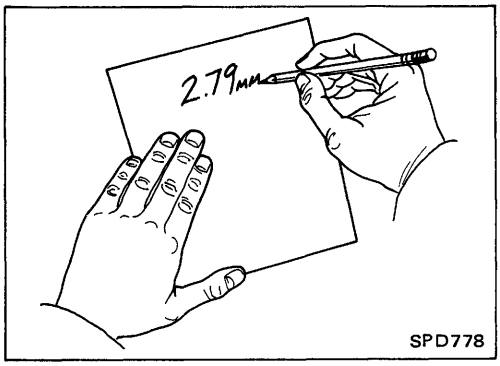
9. Install the side bearing caps and torque the cap bolts.

Specification:
49 - 59 N·m
(5 - 6 kg-m, 36 - 43 ft-lb)

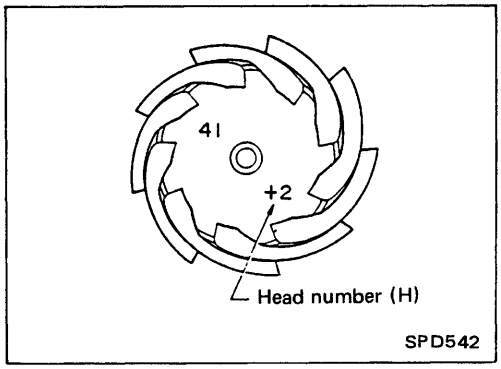


10. Select the correct standard pinion height adjusting washer thickness by using a J-34309-101 feeler gauge. Measure the gap between the J-34309-14 pinion height adapter and the arbor.

Pinion Gear Height (Cont'd)



11. Write down your exact total measurement.



12. Correct the pinion height washer size by referring to the "pinion head number."

NOTE:
There are two numbers painted on the pinion gear. The first one refers to the pinion and ring gear as a matched set and should be the same as the number on the ring gear. The second number is the "pinion head height number," and it refers to the ideal pinion height from standard for the quietest operation.

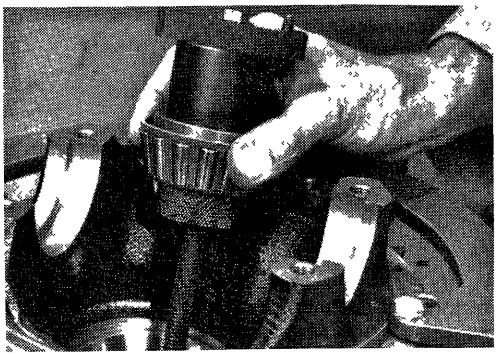
Use the following chart to determine the correct pinion height washer.

Pinion Head Height Number	Add or Remove From the Standard Pinion Height Washer Thickness Measurement
−6	Add 0.06 mm (0.0024 in)
−5	Add 0.05 mm (0.0020 in)
−4	Add 0.04 mm (0.0016 in)
−3	Add 0.03 mm (0.0012 in)
−2	Add 0.02 mm (0.0008 in)
−1	Add 0.01 mm (0.0004 in)
0	Use the selected washer thickness
+1	Subtract 0.01 mm (0.0004 in)
+2	Subtract 0.02 mm (0.0008 in)
+3	Subtract 0.03 mm (0.0012 in)
+4	Subtract 0.04 mm (0.0016 in)
+5	Subtract 0.05 mm (0.0020 in)
+6	Subtract 0.06 mm (0.0024 in)

Pinion Gear Height (Cont'd)

13. Select the correct pinion height washer from the following chart.

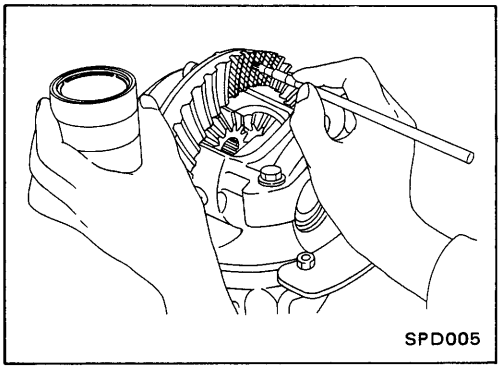
Drive Pinion Height Adjusting Washer H190-ML and H190A	
Thickness mm (in)	**Part No.**
2.58 (0.1016)	38154-P6000
2.61 (0.1028)	38154-P6001
2.64 (0.1039)	38154-P6002
2.67 (0.1051)	38154-P6003
2.70 (0.1063)	38154-P6004
2.73 (0.1075)	38154-P6005
2.76 (0.1087)	38154-P6006
2.79 (0.1098)	38154-P6007
2.82 (0.1110)	38154-P6008
2.85 (0.1122)	38154-P6009
2.88 (0.1134)	38154-P6010
2.91 (0.1146)	38154-P6011
2.94 (0.1157)	38154-P6012
2.97 (0.1169)	38154-P6013
3.00 (0.1181)	38154-P6014
3.03 (0.1193)	38154-P6015
3.06 (0.1205)	38154-P6016
3.09 (0.1217)	38154-P6017
3.12 (0.1228)	38154-P6018
3.15 (0.1240)	38154-P6019
3.18 (0.1252)	38154-P6020



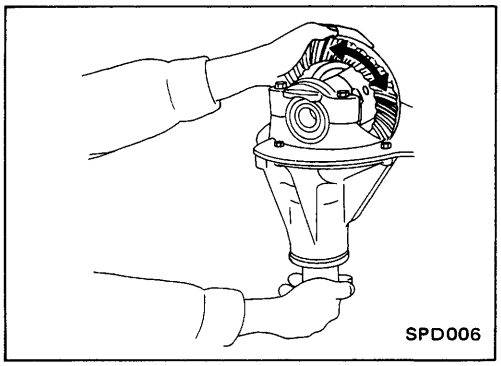
14. Remove the J-34309 pinion preload shim selector tool from the final drive housing and disassemble to retrieve the pinion bearings.

Tooth Contact

Checking of gear tooth contact pattern is necessary to verify correct relationship between ring gear and drive pinion.
Hypoid gear sets which are not positioned properly in relation to one another may be noisy, or have short life, or both. With a pattern check, the most desirable contact for low noise level and long life can be assured.

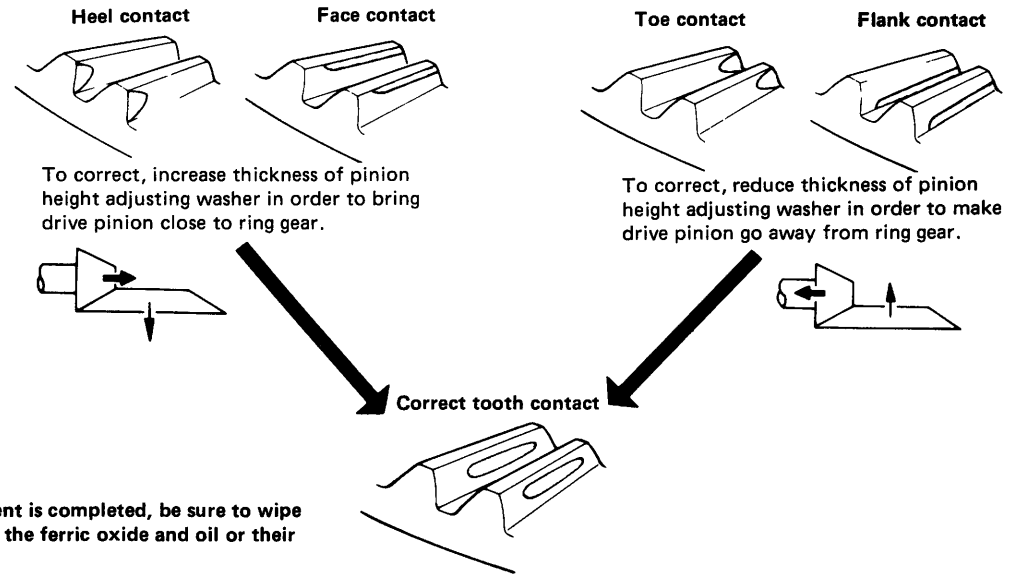

SPD005

1. Thoroughly clean ring gear and drive pinion teeth.
2. Sparingly apply a mixture of powdered ferric oxide and oil or equivalent to 3 or 4 teeth of ring gear drive side.


SPD006

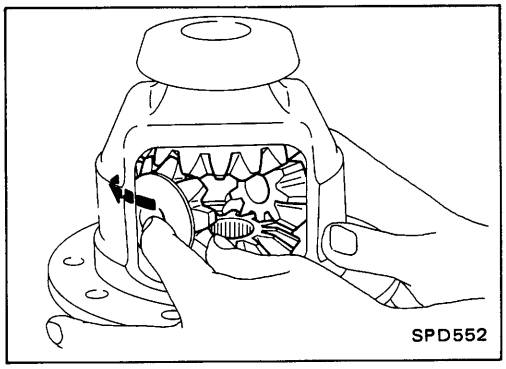
3. Hold companion flange steady by hand and rotate the ring gear in both directions.

Usually the pattern will be correct if you have calculated the shims correctly and the backlash is correct.
However, in rare cases you may have to use trial-and-error processes until you get a good tooth contact pattern.
The tooth pattern is the best indication of how well the final drive has been set up.



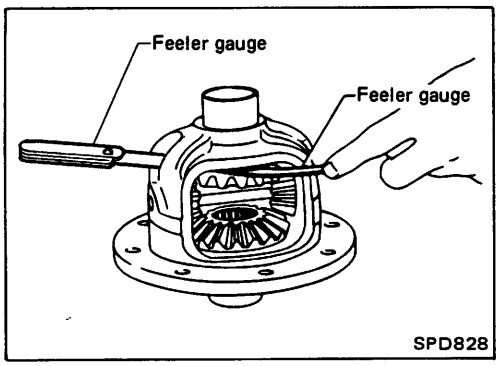
When adjustment is completed, be sure to wipe off completely the ferric oxide and oil or their equivalent.

SPD007


SPD552

Differential Case

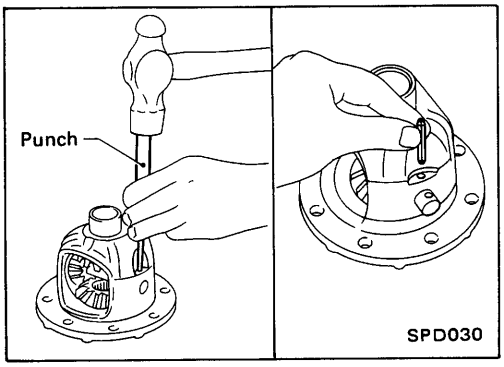
1. Install side gears, pinion mate gears and thrust washers into differential case.



SPD828

2. Fit pinion mate shaft to differential case so that it meets lock pin holes.
3. Adjust backlash between side gear and pinion mate gear by selecting side gear thrust washer. (Refer to S.D.S.)

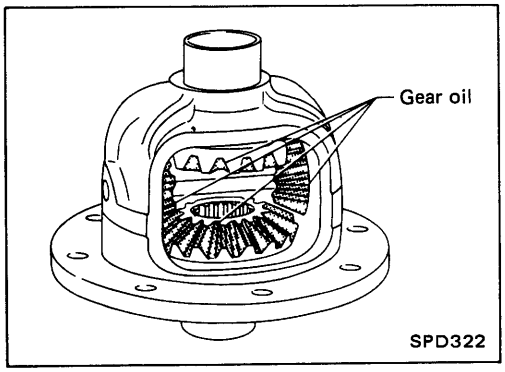
Backlash between side gear and pinion mate gear (Clearance between side gear thrust washer and differential case):
0.10 - 0.20 mm (0.0039 - 0.0079 in)



SPD030

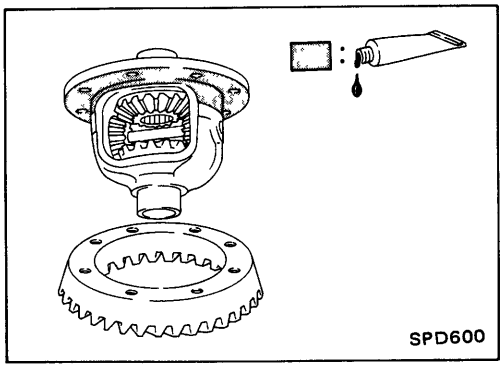
4. Install pinion mate shaft lock pin with a punch.

Make sure lock pin is flush with case.



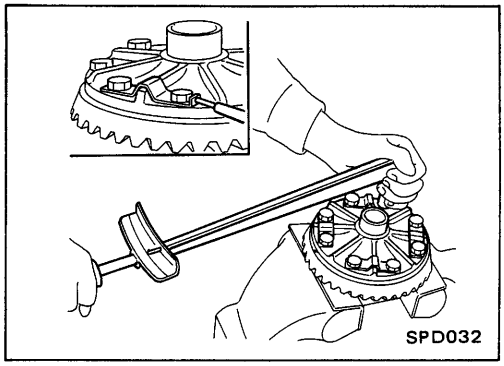
SPD322

5. Apply gear oil to gear tooth surfaces and thrust surfaces and check to see they turn properly.

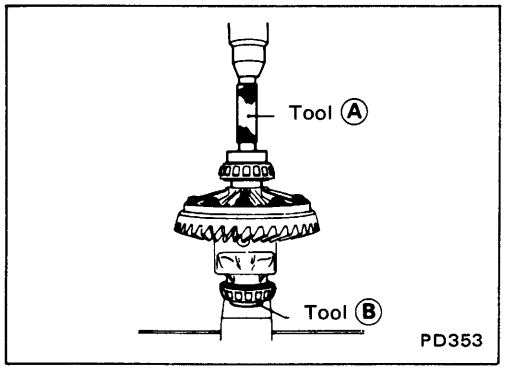

SPD600

6. Apply locking agent [Locktite (stud lock) or equivalent] to contacting surfaces of ring gear and differential case, then place differential case on ring gear.

Differential Case (Cont'd)



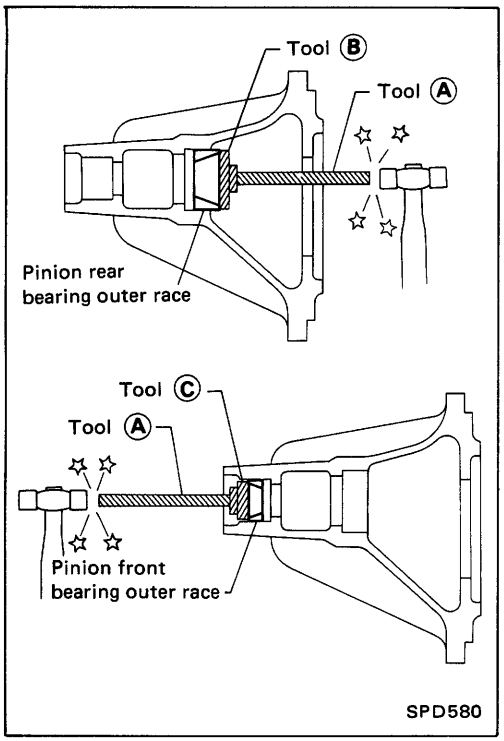
7. Apply a small amount of locking agent (described on previous page) to ring gear bolts.
8. Install new lock straps and ring gear bolts.
- **Tighten bolts in a criss-cross fashion, lightly tapping bolt head with a hammer.**
- **Then bend up lock straps to lock the bolts in place.**



9. Select side bearing adjusting shims.
   Refer to ADJUSTMENT.
10. Install the shims behind each bearing and press on side bearing inner cones with Tool.

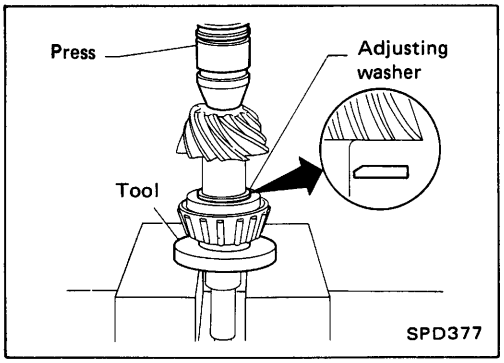
Tool number:
- Ⓐ **ST33230000 (J25805-01)**
- Ⓑ **ST33061000 (J8107-2)**

Differential Carrier



1. Press fit front and rear bearing outer races with Tools.

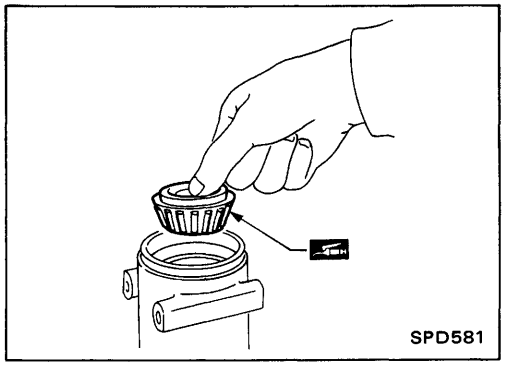
Tool number:
- Ⓐ **ST30611000 (J25742-1)**
- Ⓑ **ST30621000 (–)**
- Ⓒ **ST30613000 (J25742-3)**



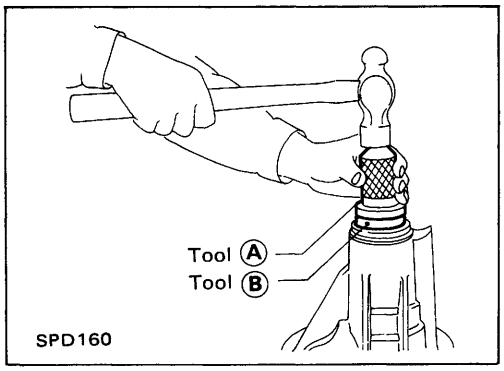
2. Select pinion height adjusting washer, referring to ADJUSTMENT.
3. Install pinion height adjusting washer in drive pinion, and press fit rear bearing inner cone in it with press and Tool.

Tool number: ST30901000 (–)
Equivalent tool (J26010-01)

Differential Carrier (Cont'd)



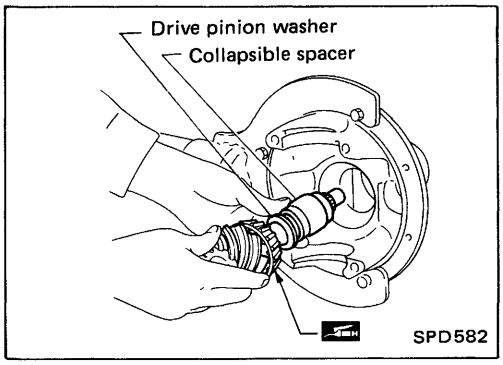
4. Place pinion front bearing inner cone in gear carrier.



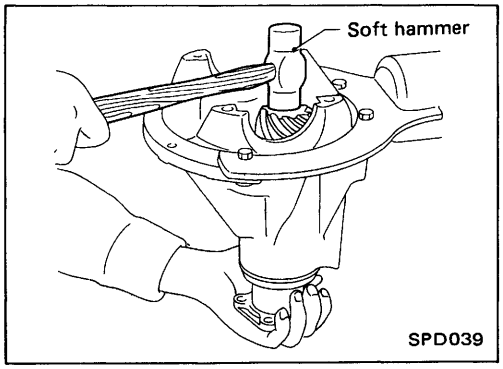
5. Apply multi-purpose grease to cavity at sealing lips of oil seal. Install front oil seal.

Tool number:

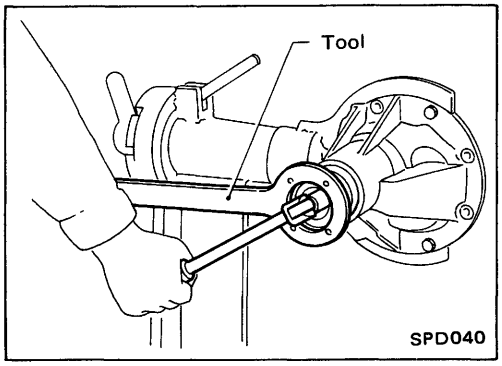
Ⓐ ST30720000 (–)
Equivalent tool (J25405)
Ⓑ KV38102510 (–)



6. Install drive pinion washer, collapsible spacer and drive pinion in gear carrier.



7. Install companion flange and hold it firmly.
Insert pinion into companion flange by tapping its head with a soft hammer.

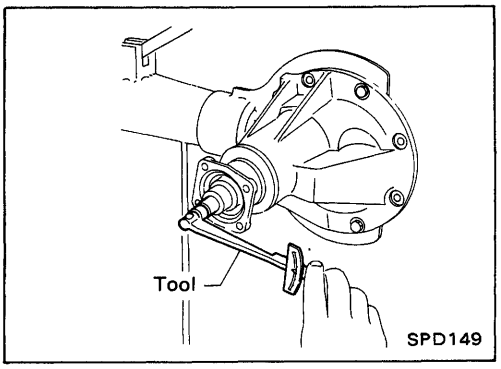


8. Temporarily tighten pinion nut until there is no axial play.

The threaded portion of drive pinion and pinion nut should be free from oil or grease.

Tool number: ST38060002 (J34311)

Differential Carrier (Cont'd)



9. Tighten pinion nut by degrees to the specified preload while checking the preload with Tools.

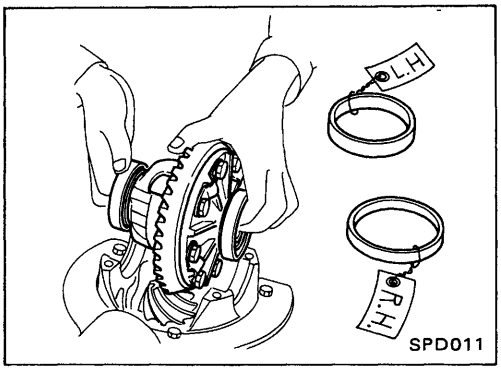
When checking preload, turn drive pinion in both directions several times to seat bearing rollers correctly.

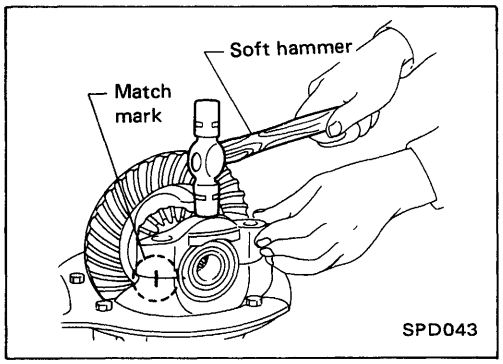
Pinion bearing preload:
1.1 - 1.6 N·m (11 - 16 kg-cm, 9.5 - 13.9 in-lb)
Tool number: ST3127S000 (See J25765-A)

CAUTION:

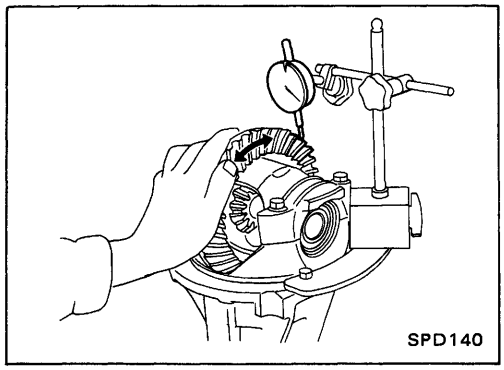
The preload is achieved by using the permanent set of collapsible spacer. So here , if an overpreload results from excessive turning of the pinion nut, the spacer should be replaced by new one.

10. Select side bearing adjusting shim.
    Refer to ADJUSTMENT.
11. Install differential case assembly with side bearing outer races into gear carrier.





12. Align mark on bearing cap with that on gear carrier and install bearing cap on gear carrier.

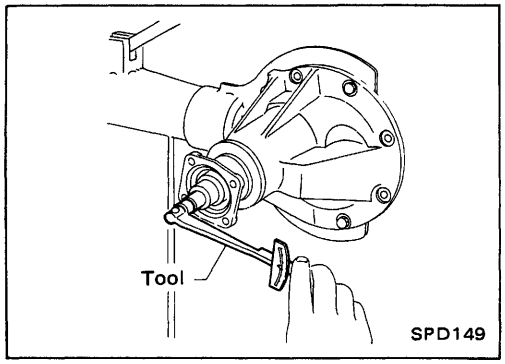


13. Measure ring gear-to-drive pinion backlash with a dial indicator.

Ring gear-to-drive pinion backlash:
0.15 - 0.20 mm (0.0059 - 0.0079 in)

- If backlash is too small, decrease thickness of left shim and increase thickness of right shim by the same amount.
- If backlash is too great, reverse the above procedure.

Never change the total amount of shims as it will change the bearing preload.

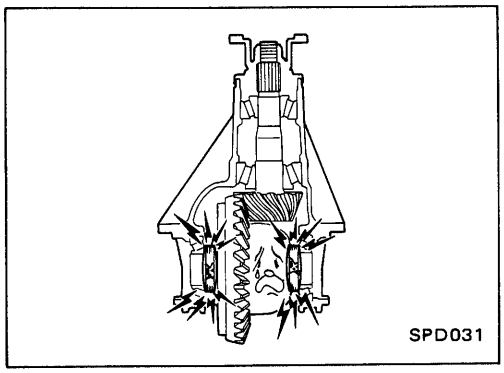


14. Check total preload with Tool.

When checking preload, turn drive pinion in both directions several times to set bearing rollers.

Tool number: ST3127S000 (See J25765-A)
Total preload:
1.2 - 2.2 N·m (12 - 22 kg-cm, 10 - 19 in-lb)

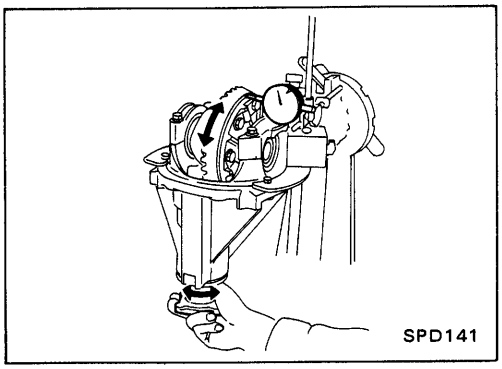
Differential Carrier (Cont'd)


SPD031

- If preload is too great, remove the same amount of shims from each side.
- If preload is too small, add the same amount of shims to each side.

Never add or remove a different number of shims for each side as it will change ring gear-to-drive pinion backlash.

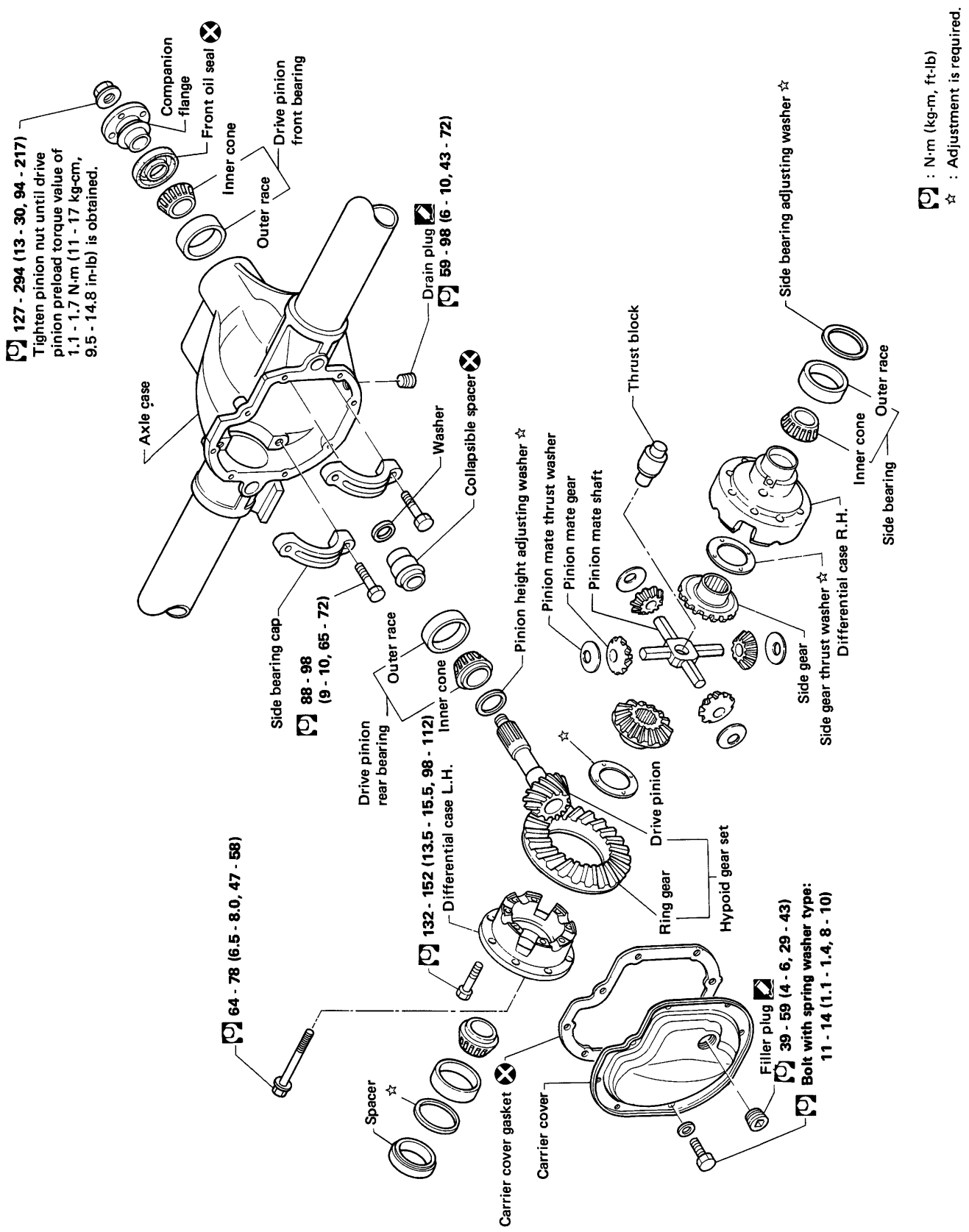
15. Recheck ring gear-to-drive pinion backlash because an increase or decrease in thickness of shims will cause change of ring gear-to-drive pinion backlash.


SPD141

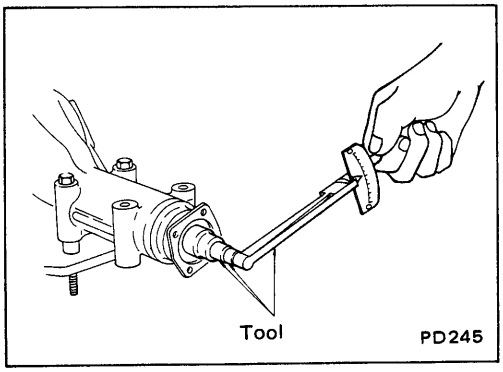
16. Check runout of ring gear with a dial indicator.
    Runout limit: 0.05 mm (0.0020 in)

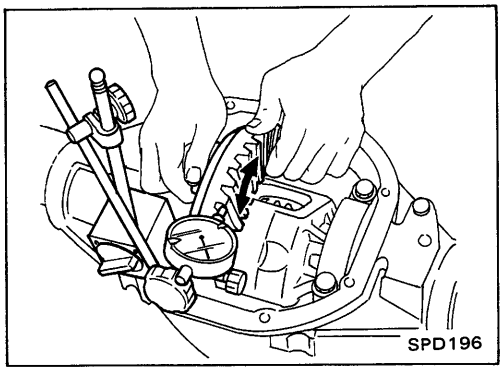
- If backlash varies excessively in different places, the variance may have resulted from foreign matter caught between the ring gear and the differential case.
- If the backlash varies greatly when the runout of the ring gear is within a specified range, the hypoid gear set or differential case should be replaced.

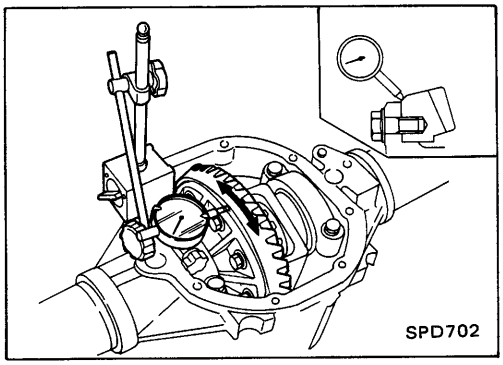
17. Check tooth contact.
    Refer to Adjustment.

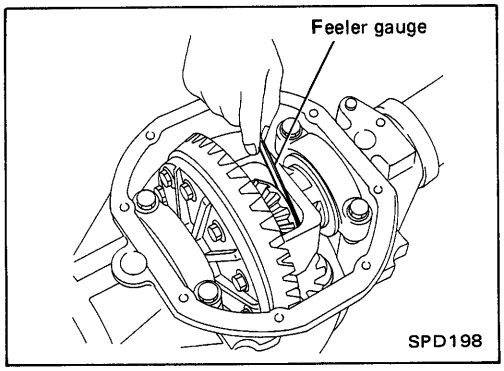

127 - 294 (13 - 30, 94 - 217)
Tighten pinion nut until drive pinion preload torque value of 1.1 - 1.7 N·m (11 - 17 kg-cm, 9.5 - 14.8 in-lb) is obtained.
Companion flange
Front oil seal
Inner cone
Drive pinion front bearing
Outer race
Drain plug
59 - 98 (6 - 10, 43 - 72)
Axle case
Washer
Collapsible spacer
Side bearing cap
88 - 98 (9 - 10, 65 - 72)
Outer race
Drive pinion rear bearing
Inner cone
Pinion height adjusting washer ☆
Pinion mate thrust washer
Pinion mate gear
Pinion mate shaft
Thrust block
Side bearing adjusting washer ☆
Inner cone
Outer race
Side bearing
64 - 78 (6.5 - 8.0, 47 - 58)
132 - 152 (13.5 - 15.5, 98 - 112)
Differential case L.H.
Drive pinion
Ring gear
Hypoid gear set
Side gear
Side gear thrust washer ☆
Differential case R.H.
Spacer ☆
Carrier cover gasket
Carrier cover
Filler plug
39 - 59 (4 - 6, 29 - 43)
Bolt with spring washer type: 11 - 14 (1.1 - 1.4, 8 - 10)
: N·m (kg-m, ft-lb)
☆ : Adjustment is required.

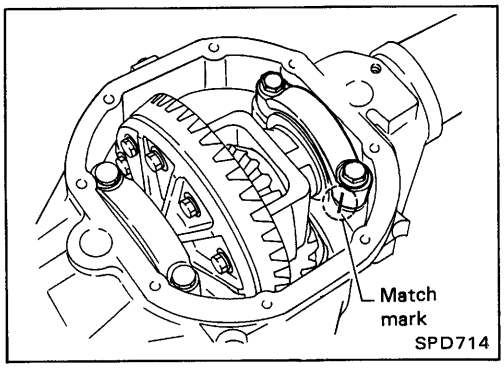
SPD001A











Pre-inspection

Before disassembling final drive, perform the following inspection.

- Total preload

1) Turn drive pinion in both directions several times to set bearing rollers.
2) Check total preload with Tool.

Tool number: ST3127S000 (See J25765-A)
Total preload:
1.2 - 2.3 N·m
(12 - 23 kg-cm, 10 - 20 in-lb)

- Ring gear to drive pinion backlash.
  Check backlash of ring gear with a dial indicator at several points.

Ring gear-to-drive pinion backlash:
0.13 - 0.18 mm (0.0051 - 0.0071 in)

- Ring gear runout
  Check runout of ring gear with a dial indicator.

Runout limit: 0.05 mm (0.0020 in)

- Tooth contact
  Check tooth contact. (Refer to ADJUSTMENT.)
- Side gear to pinion mate gear backlash
  Measure clearance between side gear thrust washer and differential case with a feeler gauge.

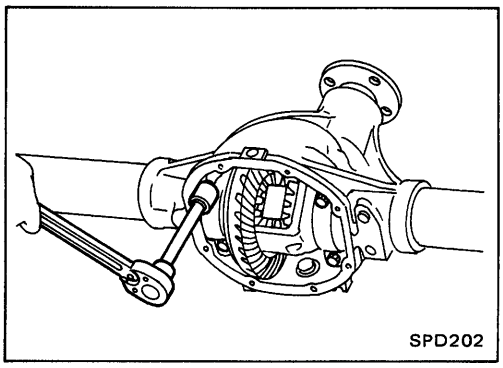
Clearance between side gear thrust washer and differential case:
0.10 - 0.20 mm (0.0039 - 0.0079 in)

Differential Carrier

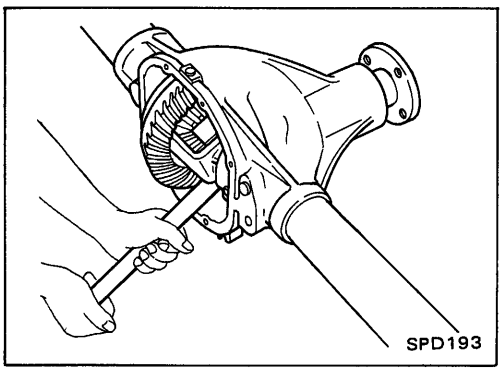
1. Remove rear cover and rear cover gasket.
2. Put match marks on one side of side bearing cap with paint or punch to ensure that it is replaced in proper position during reassembly.

Bearing caps are line-bored during manufacture and should be put back in their original places.

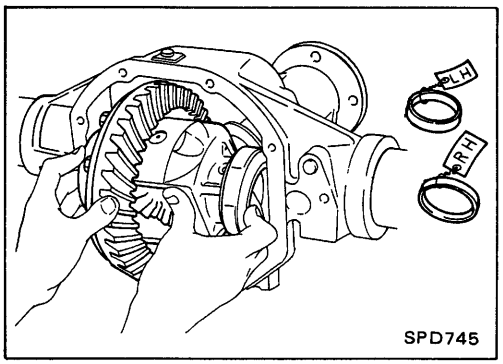
Differential Carrier (Cont'd)



3. Remove side bearing caps.



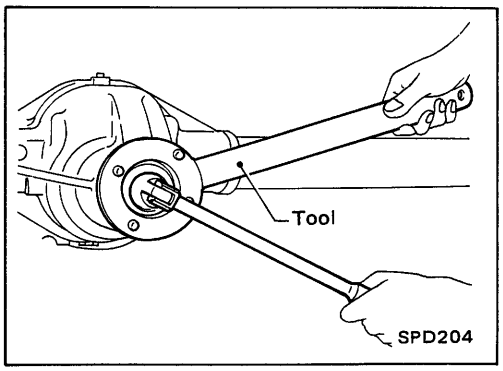
4. Remove differential case assembly with pry bar.



Keep the side bearing outer races together with their respective inner cones – do not mix them up.

CAUTION:

Side bearing spacer is placed on either the left or right depending upon final drive gear ratio. It should be labeled so that it may be replaced correctly.



5. Remove pinion nut with Tool.

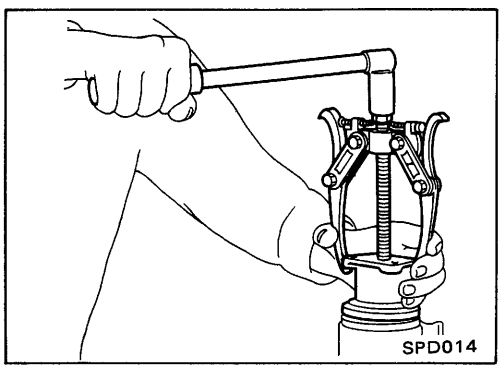
Tool number:

Except Van and Wagon models

ST38060002 (J34311)

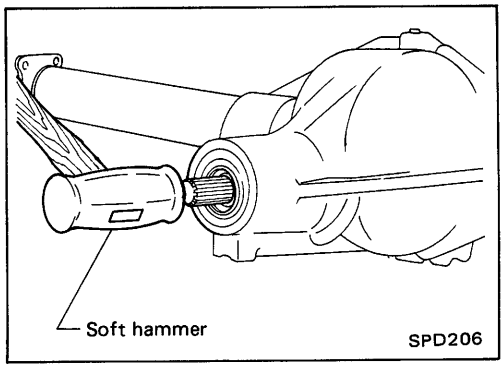
Van and Wagon models

KV38104700 (J34311)

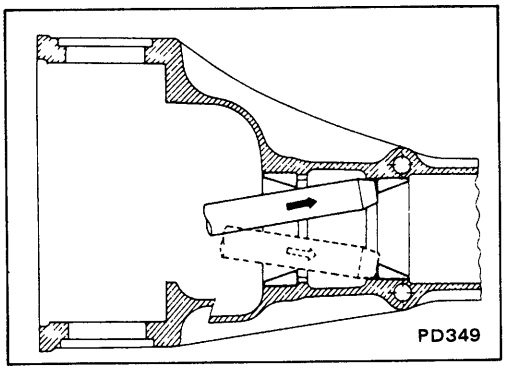


6. Remove companion flange with puller.

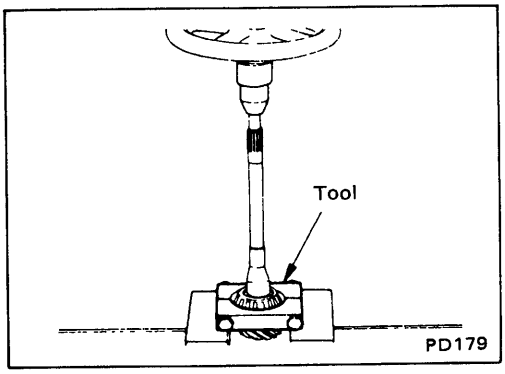
Differential Carrier (Cont'd)



7. Remove drive pinion with soft hammer.
8. Remove front oil seal and pinion front bearing inner cone.



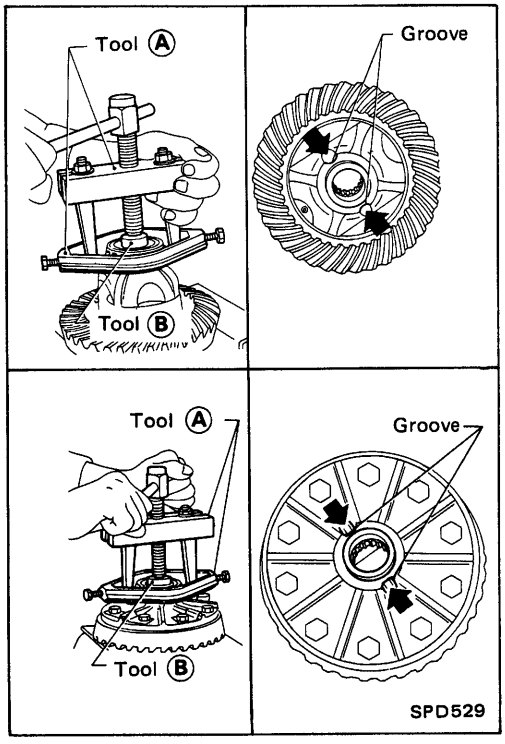
9. Remove side oil seal.
10. Remove pinion bearing outer races with a brass drift.



11. Remove pinion rear bearing inner cone and pinion height adjusting washer.

Tool number: ST30031000 (J22912-01)

Differential Case



1. Remove side bearing inner cones.

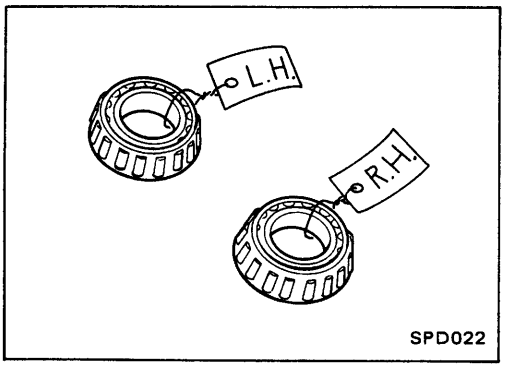
To prevent damage to bearing, engage puller jaws in grooves.

Tool number:

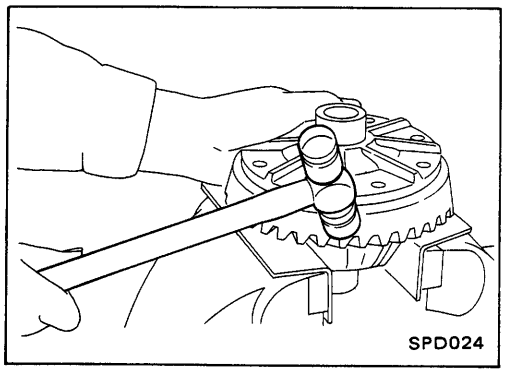
Ⓐ ST33051001 (–)
Equivalent tool (J22888)

Ⓑ ST33061000 (J8107-2)

Differential Case (Cont'd)

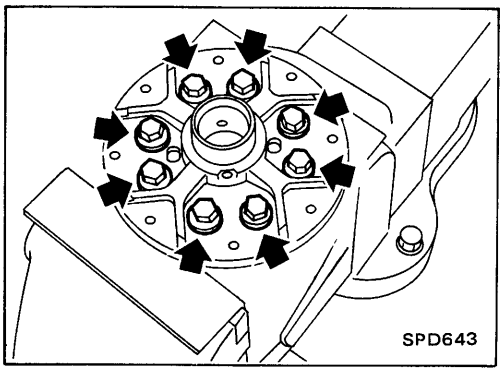


Be careful not to confuse the right and left hand parts.



2. Loosen ring gear bolts in a criss-cross fashion.
3. Tap ring gear off the differential case with a soft hammer.

Tap evenly all around to keep ring gear from binding.

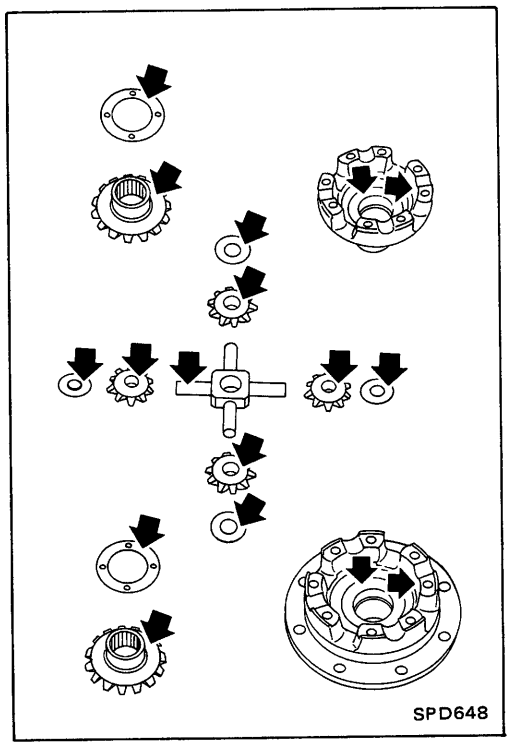


4. Separate differential case L.H. and R.H. (4-pinion type differential case).

Put match marks on both differential case L.H. and R.H. sides prior to separating them.

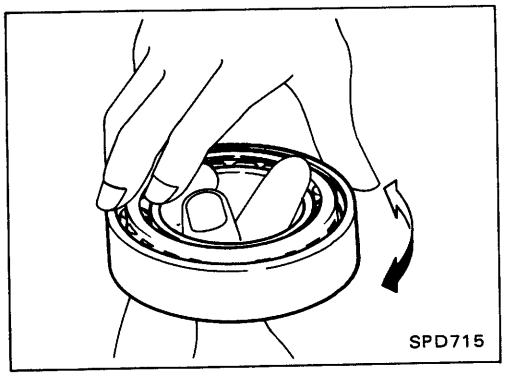
Ring Gear and Drive Pinion

Check gear teeth for scoring, cracking or chipping. If any damaged part is evident, replace ring gear and drive pinion as a set (hypoid gear set).


SPD648

Differential Case Assembly

Check mating surfaces of differential case, side gears, pinion mate gears, pinion mate shaft, thrust block and thrust washers.

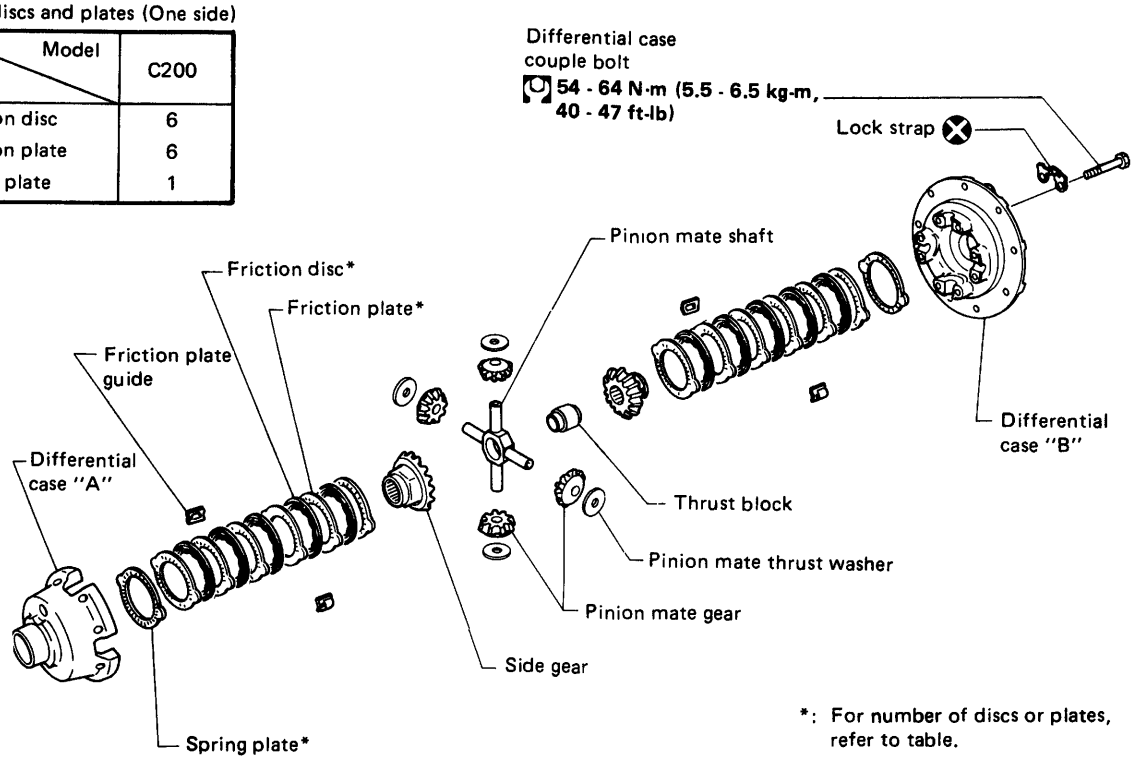

SPD715

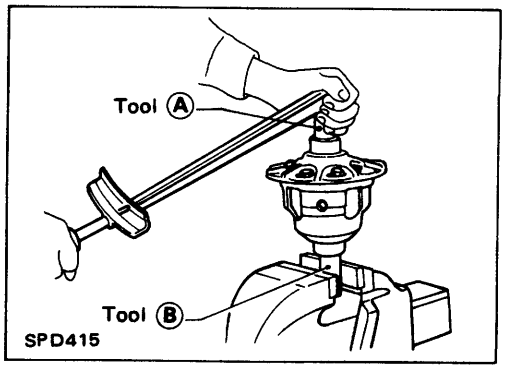
Bearing

1. Thoroughly clean bearing.
2. Check bearings for wear, scratches, pitting or flaking.
   Check tapered roller bearing for smooth rotation. If damaged, replace outer race and inner cone as a set.

No. of discs and plates (One side)

Model	C200
Friction disc	6
Friction plate	6
Spring plate	1





CAUTION:

Do not run engine when one wheel (rear) is off the ground.

Preparation for Disassembly

CHECKING DIFFERENTIAL TORQUE

Measure differential torque with Tool.

If it is not within the specifications, inspect components of limited slip differential.

Differential torque:

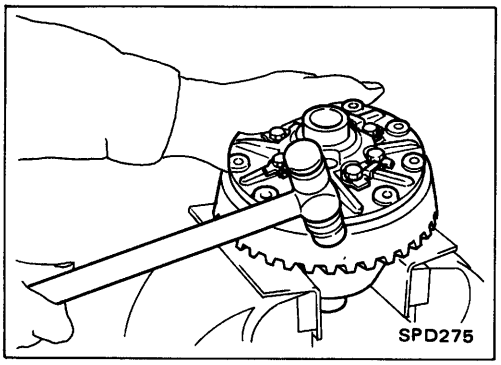
177 - 216 N·m

(18 - 22 kg-m, 130 - 159 ft-lb)

Tool number:

Ⓐ KV38105110 (–)

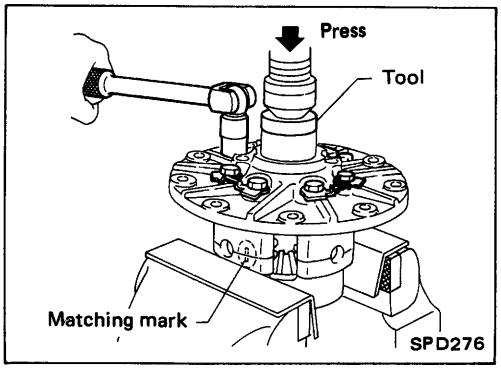
Ⓑ KV38105120 (–)



Disassembly

1. Remove side bearing inner cone with Tool.
2. Remove ring gear by spreading out lock straps.
3. Loosen ring gear bolts in a criss-cross fashion.
4. Tap ring gear off gear case with a soft hammer.

Tap evenly all around to keep ring gear from binding.

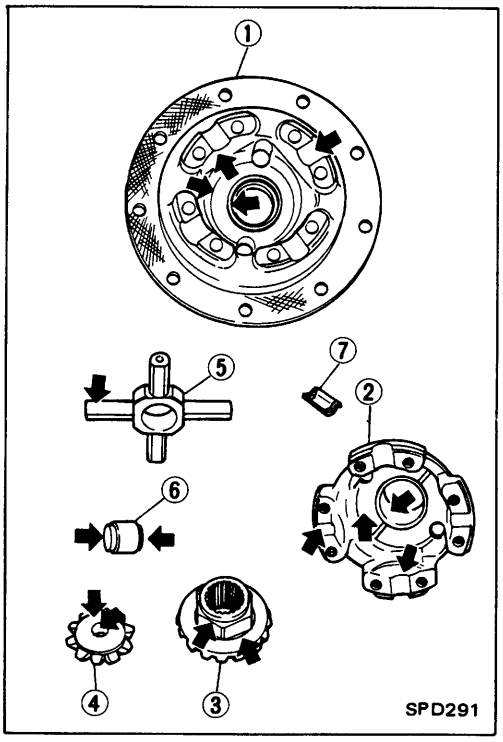


5. Remove differential case by spreading out lock straps.
6. Remove couple bolts on differential cases A and B with a press.

Tool number: ST33081000 (–)

7. Separate differential case A and B.
   Draw out component parts (discs and plates, etc.).

Put marks on gears and pressure rings so that they can be reinstalled in their original positions from which they were removed.



Inspection

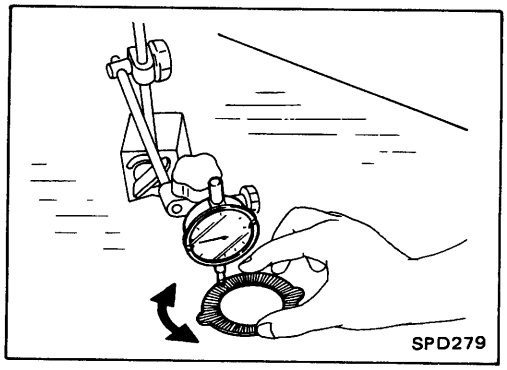
CONTACT SURFACES

1. Clean the disassembled parts in suitable solvent and blow dry with compressed air.
2. If following surfaces are found with burrs or scratches, smooth with oil stone.
   - ① Differential case A
   - ② Differential case B
   - ③ Side gear
   - ④ Pinion mate gear
   - ⑤ Pinion mate shaft
   - ⑥ Thrust block
   - ⑦ Friction plate guide

DISC AND PLATE

1. Clean the discs and plates in suitable solvent and blow dry with compressed air.
2. Inspect discs and plates for wear, nicks and burrs.

Inspection (Cont'd)

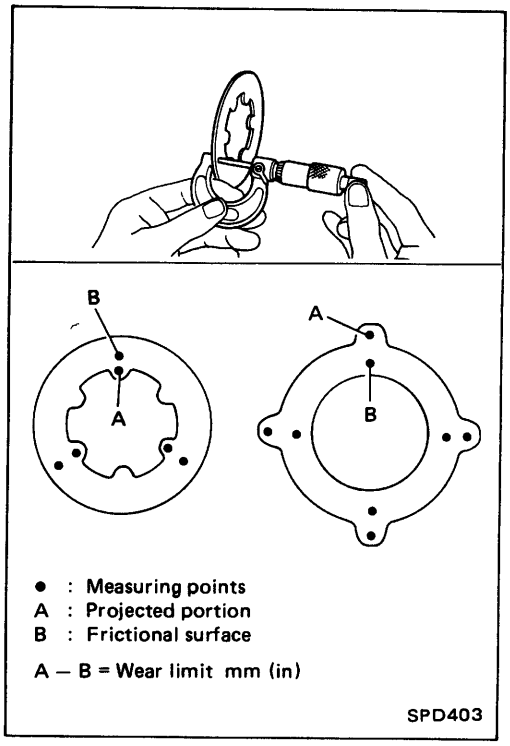


3. To test if friction disc or plate is not distorted, place it on a surface plate and rotate it by hand with indicating finger of dial gauge resting against disc or plate surface.

   Allowable warpage:

   0.05 - 0.15 mm (0.0020 - 0.0059 in)

   If it exceeds limits, replace with a new plate to eliminate possibility of clutch slippage or sticking.

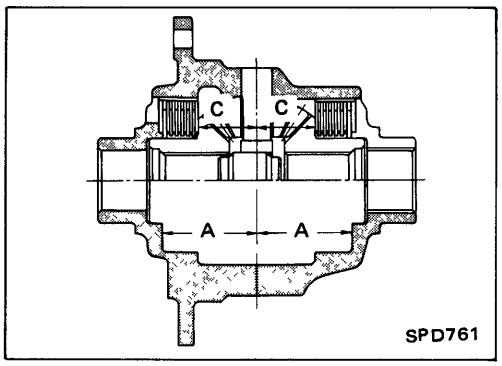


4. Measure frictional surfaces and projected portions of friction disc, friction plate, spring plate, and determine each part's differences to see if the specified wear limit has been exceeded.
5. Measure frictional surfaces and projected portions of friction disc, friction plate; spring plate and spring disc (H233B only).

If any part has worn beyond the wear limit, replace it with a new one that is the same thickness as the projected portion.

Wear limit:

0.1 mm (0.004 in) or less



Adjustment

FRICTION DISC AND FRICTION PLATE END PLAY

End play of friction disc and friction plate can be calculated by using following equation and should be adjusted within following range.

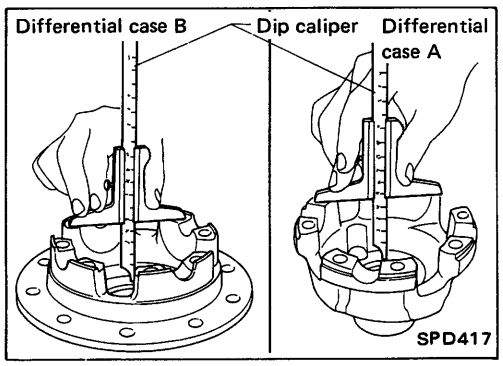
Adjustment can be made by selecting friction disc having two different thicknesses.

End play E:

0.05 - 0.15 mm (0.0020 - 0.0059 in)

$$E = A - (B + C)$$

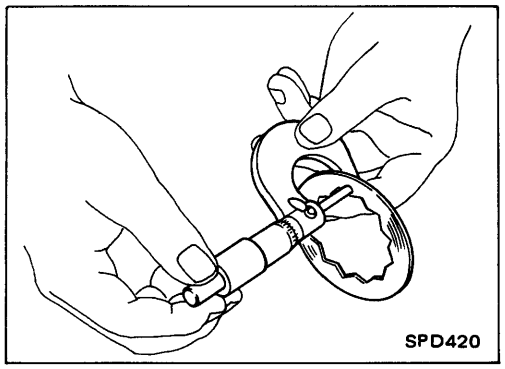
A: Length of differential case contact surface to differential case inner bottom.
B: Total thickness of friction discs, friction plates, spring disc and spring plate in differential case on one side.
C: Length of differential case contact surface to back side of side gear.



1. Measure values of "A".

Standard length A:

49.50 - 49.55 mm (1.9488 - 1.9508 in)



2. Measure thickness of each disc and plate.

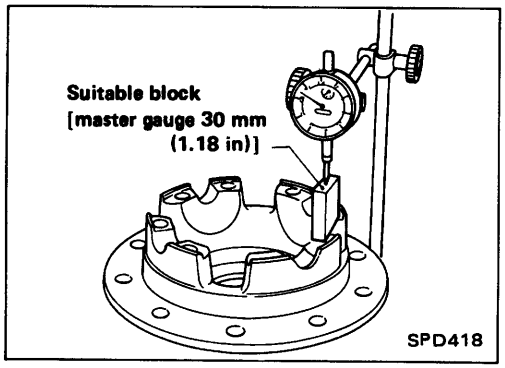
Total thickness "B":

19.24 - 20.26 mm (0.7575 - 0.7976 in)

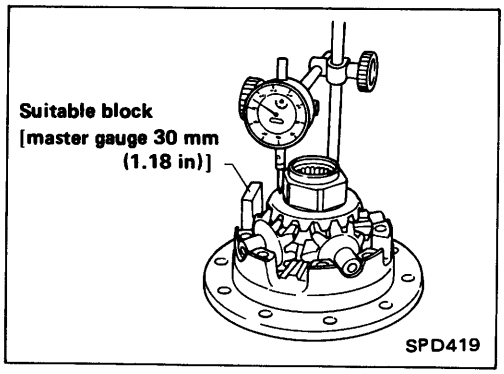
No. of discs and plates (One side)

Model	C200
Friction disc	6
Friction plate	6
Spring plate	1

Adjustment (Cont'd)



3. Measure values of "C".
(1) Attach a dial indicator to the base plate.
(2) Place differential case B on the base plate, and install a master gauge on case B.
Then adjust the dial indicator scale to zero with its tip on the master gauge.



(3) Install pinion mate gears, side gears and pinion mate shaft in differential case B.
(4) Set dial indicator's tip on the side gear, and read the indication.

Example:

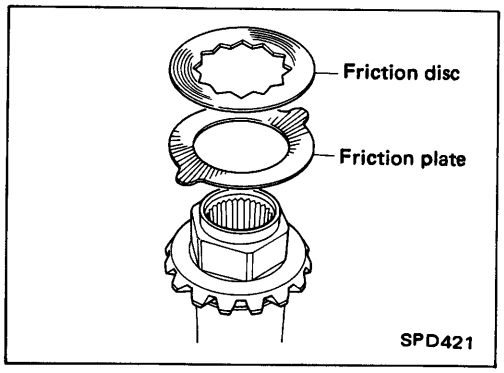
E = A – D
= A – (B + C)
= 0.05 to 0.15 mm
A = 49.52 mm
B = 19.45 mm
C = 29.7 mm
D = B + C

B	... 19.45
+ C	... 29.7
	49.15

E = A – D

A	... 49.52
– D	... 49.15
	0.37

From the above equation, end play of 0.37 mm exceeds the specified range of 0.05 to 0.15 mm.
Select suitable discs and plates to adjust correctly.

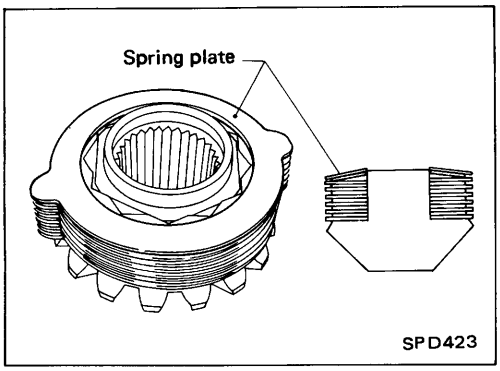


Assembly

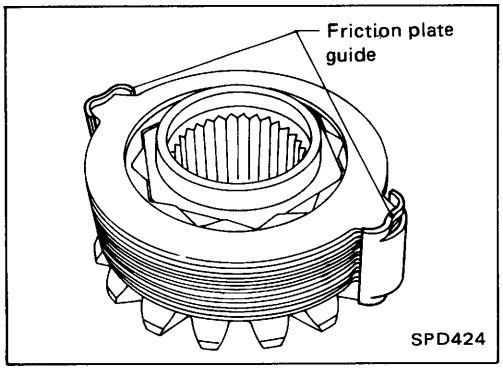
Prior to assembling discs and plates, properly lubricate them by dipping them in limited slip differential oil.
1. Alternately position specified number of friction plates and friction discs on rear of side gear.

Always position a friction plate first on rear of side gear.

Assembly (Cont'd)

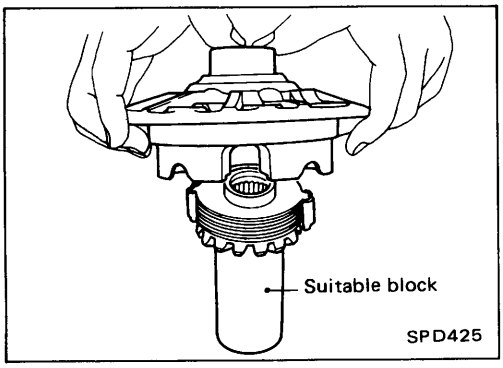


2. Install spring plate.



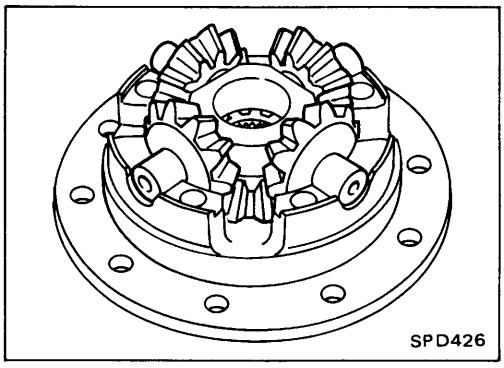
3. Install friction plate guides.

Correctly align the raised portions of friction plates, and apply grease to inner surfaces of friction plate guides to prevent them from falling.

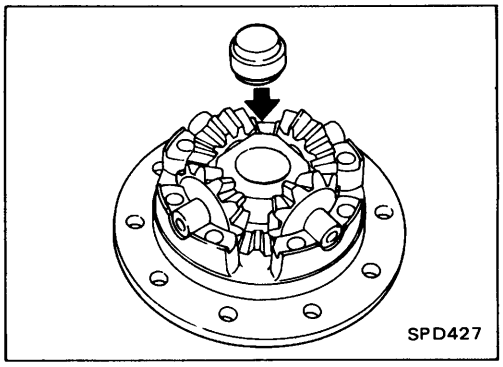


4. Install differential case B over side gear, discs, plates and friction plate guide assembly.

- **Install differential case B while supporting friction plate guides with your middle finger inserted through oil hole in differential case.**
- **Be careful not to detach spring disc from the hexagonal part of the side gear.**

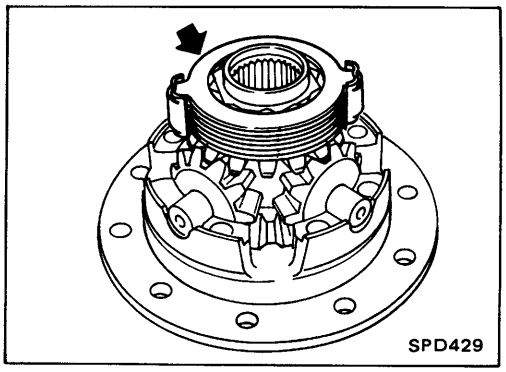


5. Install pinion mate gears and pinion shaft to differential case B.



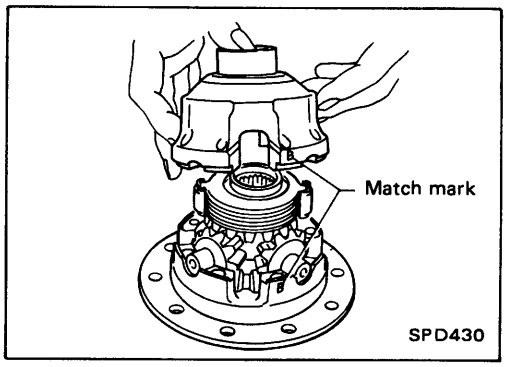
6. Install thrust block.

Assembly (Cont'd)


SPD429

7. Install side gear to pinion mate gears.
8. Install each disc and plate.

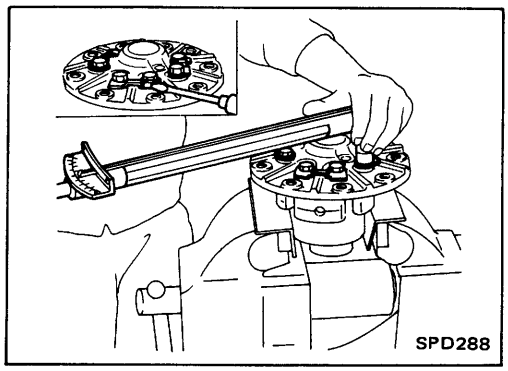
Use same procedures as outlined in steps 1. through 4. above.



SPD430

9. Install differential case A.

Position differential cases A and B by correctly aligning marks stamped on cases.


SPD288

10. Tighten differential case bolts.
11. Place ring gear on differential case and install new lock straps and bolts.

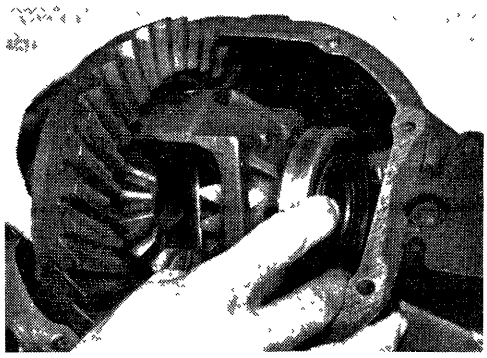
Tighten bolts in a criss-cross fashion, lightly tapping bolt head with a hammer.

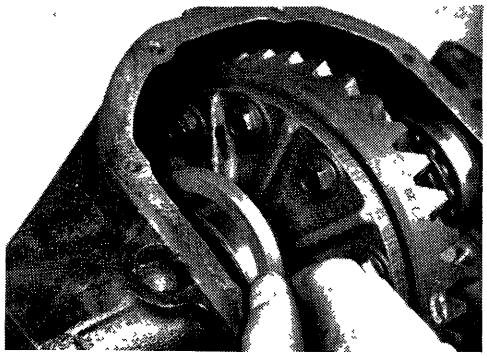
Then bend up lock straps to lock the bolts in place.

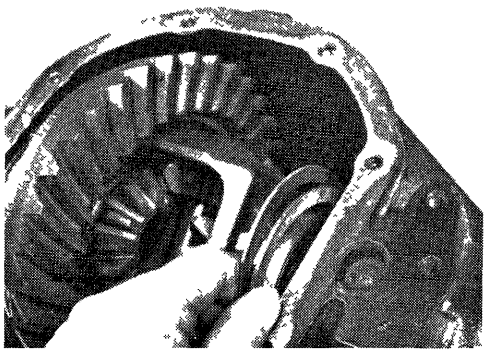
12. Install side bearing inner cone.
13. Check differential torque.

For quiet and reliable final drive operation, the following five adjustments must be made correctly:

1. Side Bearing Preload.
2. Pinion Gear Height.
3. Pinion Bearing Preload. (Refer to ASSEMBLY.)
4. Ring Gear-to-pinion Backlash. (Refer to ASSEMBLY.)
5. Ring and Pinion Gear Tooth Contact Pattern.





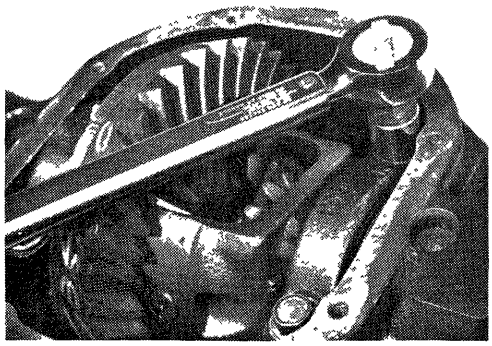


Side Bearing Preload

A selection of carrier side bearing preload shims is required for successful completion of this procedure.

1. Make sure all parts are clean and that the bearings are well lubricated with light oil or Dexron type automatic transmission fluid.
2. Place the differential carrier, with side bearings and bearing races installed, into the final drive housing.
3. Put the side bearing spacer in place on the ring gear end of the carrier.
4. Using the J-25267 side bearing shim installer, place both of the original carrier side bearing preload shims on the carrier end, opposite the ring gear.

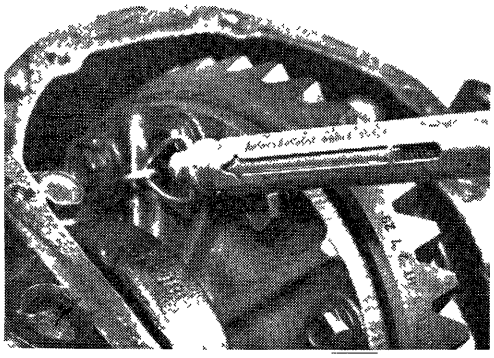
Side Bearing Preload (Cont'd)



5. Install the side bearing caps in their correct locations and torque the bearing cap retaining bolts.

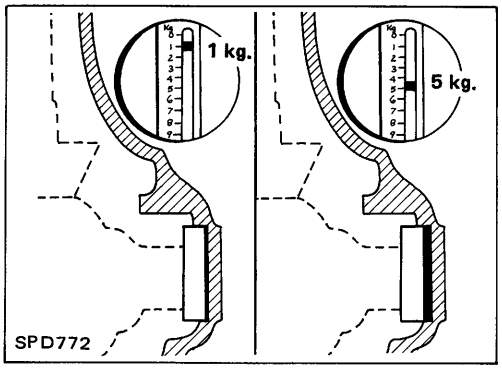
   Specification:
   88 - 98 N·m (9 - 10 kg-m, 65 - 72 ft-lb)

6. Turn the carrier several times to seat the bearings.



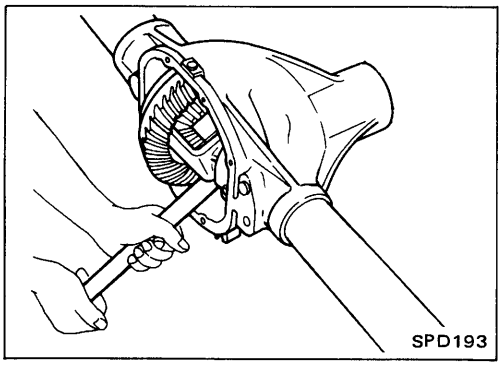
7. Measure the turning torque of the carrier at the ring gear retaining bolts with a spring gauge, J-8129.

   Specification:
   34.3 - 39.2 N (3.5 - 4.0 kg, 7.7 - 8.8 lb)
   of pulling force at the ring gear bolt



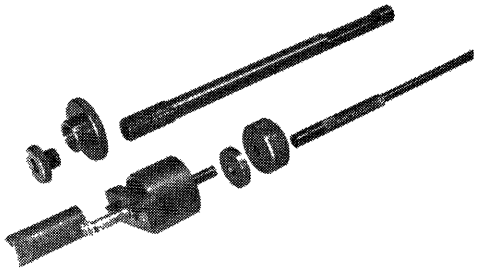
8. If the carrier turning torque is not within the specification range, increase or decrease the total thickness of the side bearing adjusting washers until the turning torque is correct. If the turning torque is less than the specified range, install washers of greater thickness; if the turning torque is greater than the specification, install thinner washers. See the SDS section for washer dimensions and part numbers.

9. Record the total amount of washer thickness required for the correct carrier side bearing preload.



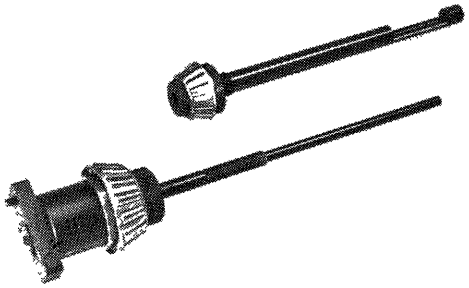
10. Remove the carrier from the final drive housing, saving the selected preload washers for later use during assembly of the final drive unit.

Pinion Gear Height



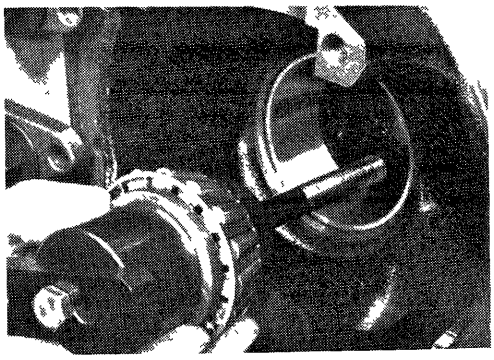
1. Make sure all parts are clean and that the bearings are well lubricated.

2. Assemble the pinion gear bearings into the pinion pre-load shim selector tool, J-34309.

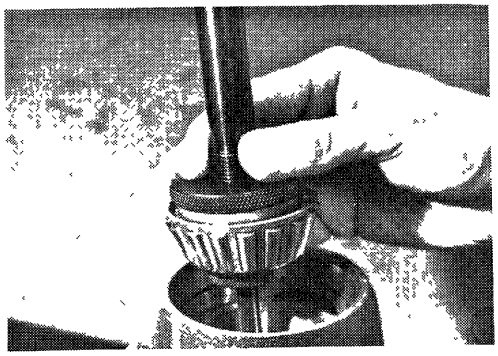


- Front Pinion Bearing — make sure the J-34309-3 front pinion bearing is secured tightly against the J-34309-2 gauge anvil. Then turn the front pinion bearing pilot, J-34309-5, to secure the bearing in its proper position.

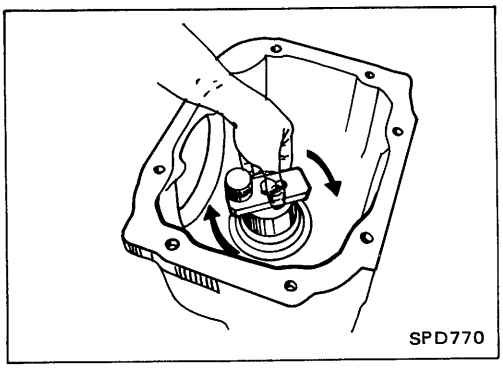
- Rear Pinion Bearing — the rear pinion bearing pilot, J-34309-15, is used to center the rear pinion bearing only. The rear pinion bearing locking seat, J-34309-4 is used to lock the bearing to the assembly.



3. Place the pinion preload shim selector tool J-34309-1 gauge screw assembly with the pinion rear bearing inner cone installed into the final drive housing.

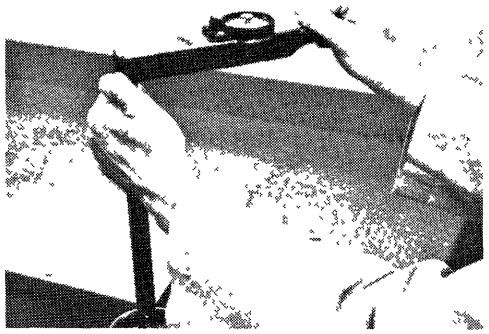


4. Assemble the front pinion bearing inner cone and the J-34309-2 gauge anvil together with the J-34309-1 gauge screw in the final drive housing. Make sure that the pinion height gauge plate, J-34309-16, will turn a full 360 degrees, and tighten the two sections together by hand.



5. Turn the assembly several times to seat the bearings.

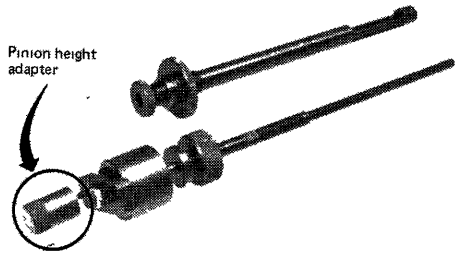
Pinion Gear Height (Cont'd)



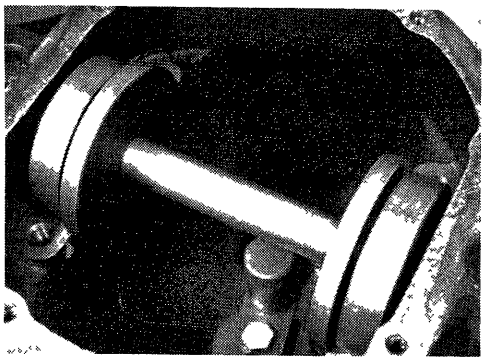
6. Measure the turning torque at the end of the J-34309-2 gauge anvil using torque wrench J-25765A.

   Turning torque specification:
   1.0 - 1.3 N·m
   (10 - 13 kg-cm, 8.7 - 11.3 in-lb)
   with no pinion seal installed.

7. Place the J-34309-11 "C200" pinion height adapter onto the gauge plate and tighten it by hand.

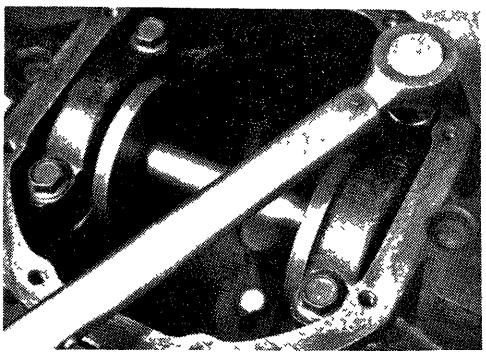


CAUTION:
Make sure all machined surfaces are clean.



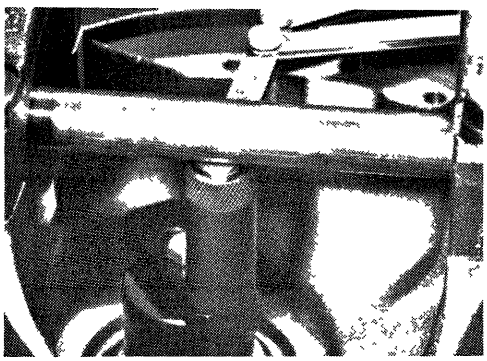
PINION HEIGHT ADJUSTING WASHER SELECTION

8. Now, position the side bearing discs, J-25269-4, and arbor firmly into the side bearing bores.



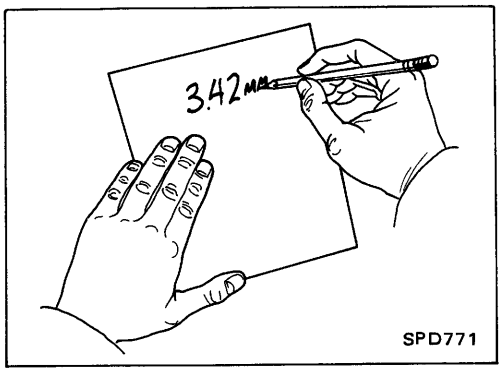
9. Install the side bearing caps and torque the cap bolts.

   Specification:
   88 - 98 N·m (9 - 10 kg-m, 65 - 72 ft-lb)

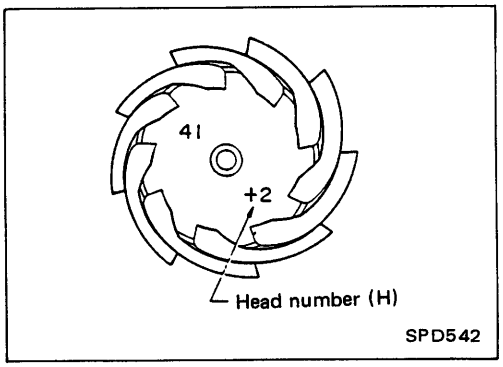


10. Select the correct **standard** pinion height adjusting washer thickness by using a standard gauge of 3.5 mm (0.138 in) and your J-34309-01 feeler gauge. Measure the gap between the J-34309-11 "C200" pinion height adapter and the arbor.

Pinion Gear Height (Cont'd)



11. Write down your exact total measurement.



12. Correct the pinion height washer size by referring to the "pinion head number."

NOTE:
There are two numbers painted on the pinion gear. The first one refers to the pinion and ring gear as a matched set and should be the same as the number on the ring gear. The second number is the "pinion head height number," and it refers to the ideal pinion height from standard for the quietest operation.

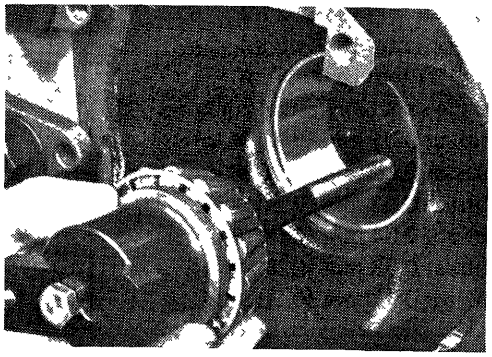
Use the following chart to determine the correct pinion height washer.

Pinion Height Head Number	Add or Remove From the Standard Pinion Height Washer Thickness Measurement
−6	Add 0.06 mm (0.0024 in)
−5	Add 0.05 mm (0.0020 in)
−4	Add 0.04 mm (0.0016 in)
−3	Add 0.03 mm (0.0012 in)
−2	Add 0.02 mm (0.0008 in)
−1	Add 0.01 mm (0.0004 in)
0	Use the selected washer thickness
+1	Subtract 0.01 mm (0.0004 in)
+2	Subtract 0.02 mm (0.0008 in)
+3	Subtract 0.03 mm (0.0012 in)
+4	Subtract 0.04 mm (0.0016 in)
+5	Subtract 0.05 mm (0.0020 in)
+6	Subtract 0.06 mm (0.0024 in)

Pinion Gear Height (Cont'd)

13. Select the correct pinion height washer from the following chart.

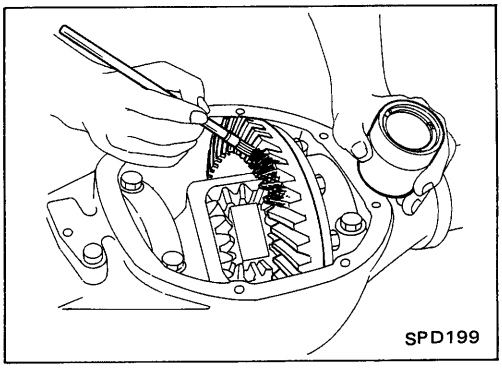
Drive Pinion Height Adjusting Washer C200	
Thickness mm (in)	Part No.
3.09 (0.1217)	38154-P6017
3.12 (0.1228)	38154-P6018
3.15 (0.1240)	38154-P6019
3.18 (0.1252)	38154-P6020
3.21 (0.1264)	38154-P6021
3.24 (0.1276)	38154-P6022
3.27 (0.1287)	38154-P6023
3.30 (0.1299)	38154-P6024
3.33 (0.1311)	38154-P6025
3.36 (0.1323)	38154-P6026
3.39 (0.1335)	38154-P6027
3.42 (0.1346)	38154-P6028
3.45 (0.1358)	38154-P6029
3.48 (0.1370)	38154-P6030
3.51 (0.1382)	38154-P6031
3.54 (0.1394)	38154-P6032
3.57 (0.1406)	38154-P6033
3.60 (0.1417)	38154-P6034
3.63 (0.1429)	38154-P6035
3.66 (0.1441)	38154-P6036



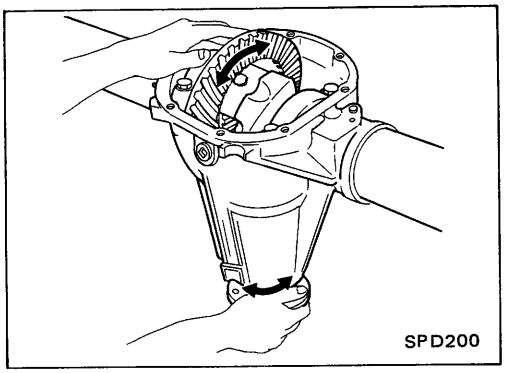
14. Remove the J-34309 pinion preload shim selector tool from the final drive housing and disassemble to retrieve the pinion bearings.

Tooth Contact

Checking gear tooth contact pattern is necessary to verify correct relationship between ring gear and drive pinion.
Hypoid gear sets which are not positioned properly in relation to one another may be noisy, or have short life, or both. With a pattern check, the most desirable contact for low noise level and long life can be assured.

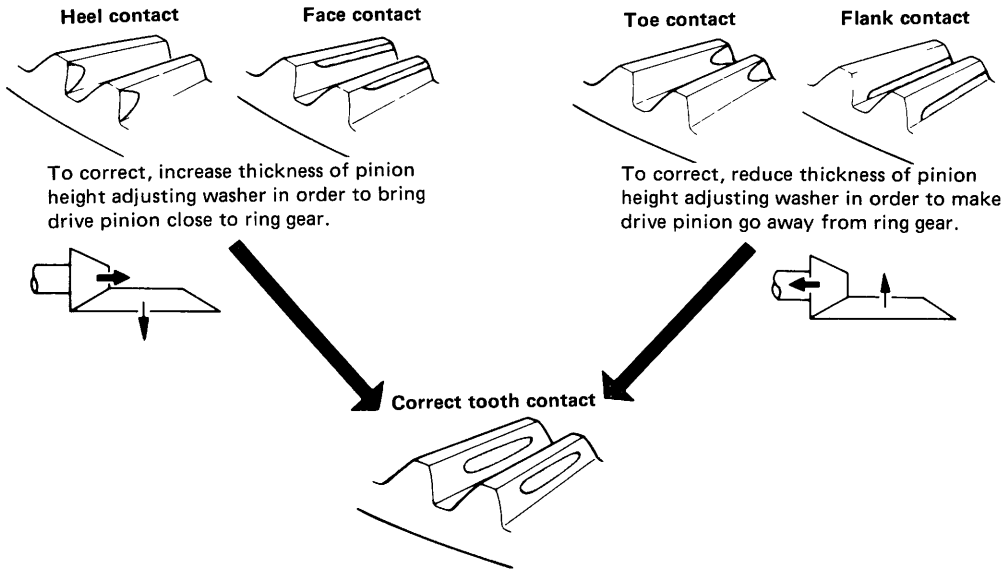

SPD199

1. Thoroughly clean ring gear and drive pinion teeth.
2. Sparingly apply a mixture of powdered ferric oxide and oil or equivalent to 3 or 4 teeth of ring gear drive side.

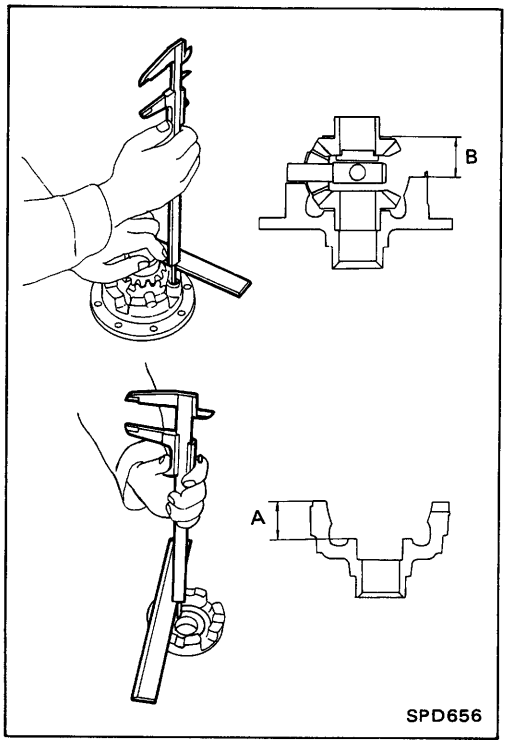

SPD200

3. Hold companion flange steady by hand and rotate the ring gear in both directions.

Usually the pattern will be correct if you have calculated the shims correctly and the backlash is correct.
However, in rare cases you may have to use trial-and-error processes until you get a good tooth contact pattern.
The tooth pattern is the best indication of how well the final drive has been set up.



SPD007

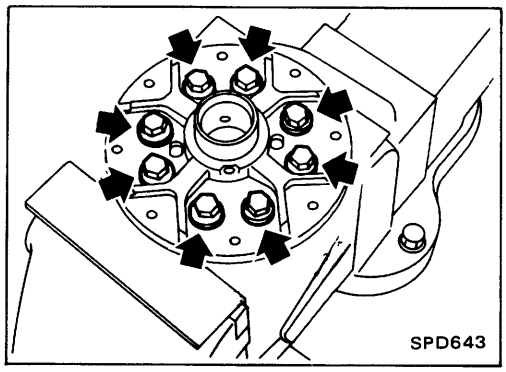


Differential Case

1. Measure clearance between side gear thrust washer and differential case.

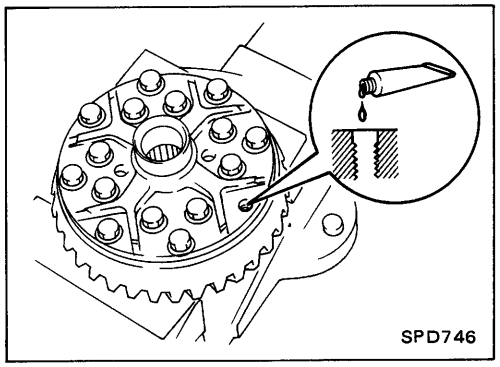
   Clearance between side gear thrust washer and differential case (A – B):
   0.10 - 0.20 mm (0.0039 - 0.0079 in)

   The clearance can be adjusted with side gear thrust washer. (Refer to S.D.S.)
2. Apply gear oil to gear tooth surfaces and thrust surfaces and check to see they turn properly.



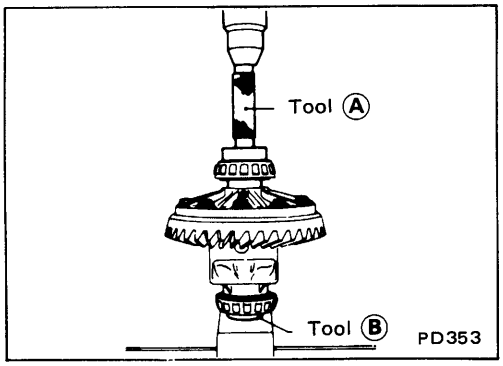
3. Install differential case L.H. and R.H.
4. Install differential case on ring gear.

Differential Case (Cont'd)



5. Place differential case on ring gear.
6. Apply locking agent [Locktite (stud lock) or equivalent] to ring gear bolts, and install them.

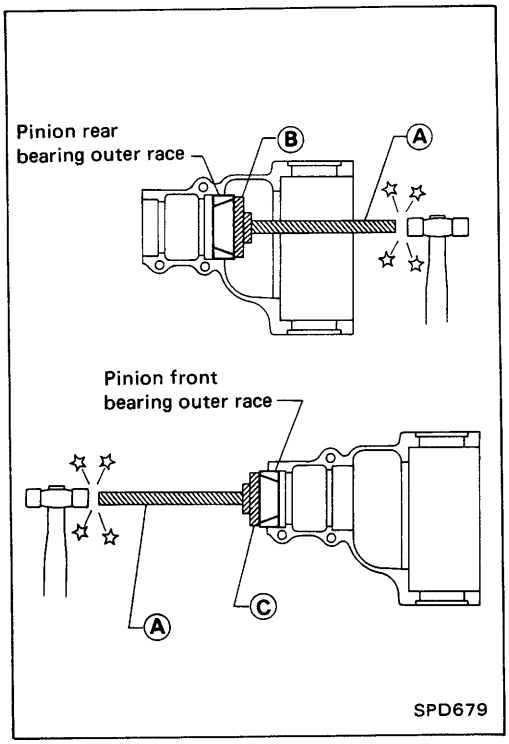
Tighten bolts in a criss-cross fashion, lightly tapping bolt head with a hammer.



7. Press-fit side bearing inner cones on differential case with Tool.

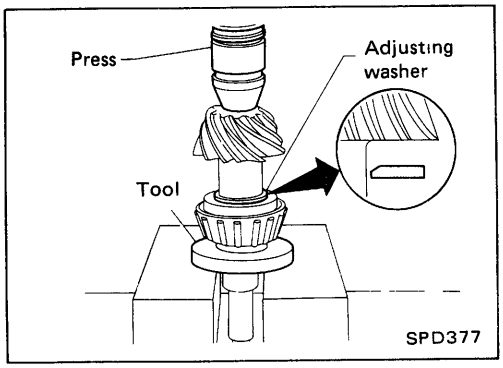
Tool number:
Ⓐ ST33230000 (J25805-01)
Ⓑ ST33061000 (J8107-2)

Differential Carrier



1. Press-fit front and rear bearing outer races with Tools.

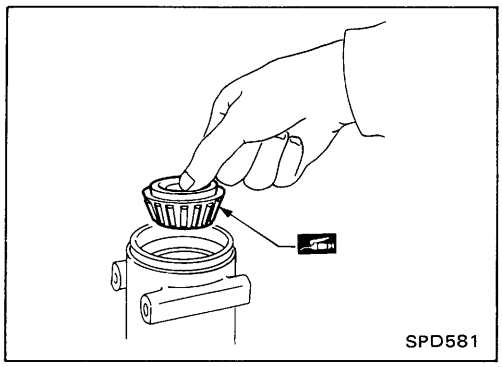
Tool number:
Ⓐ ST30611000 (J25742-1)
Ⓑ ST30621000 (J25742-5)
Ⓒ ST30613000 (J25742-3)



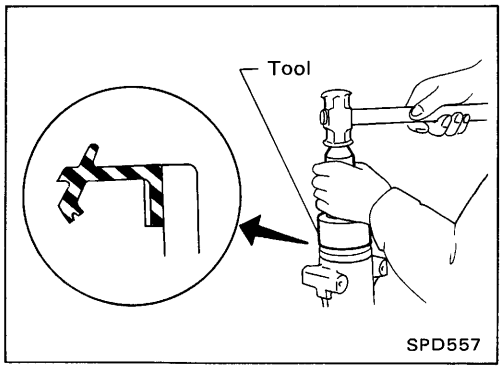
2. Select pinion height adjusting washer, referring to Adjustment.
3. Install pinion height adjusting washer in drive pinion, and press-fit rear bearing inner cone in it, with press and Tool.

Tool number: ST30901000 (—)
Equivalent tool (J26010-01)

Differential Carrier (Cont'd)

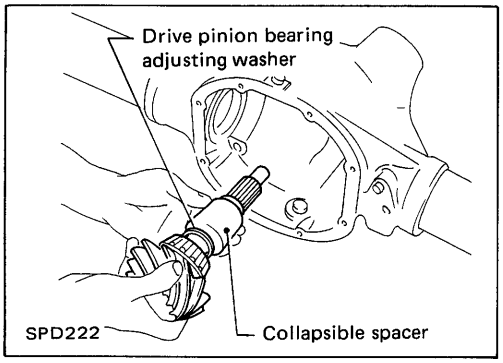


4. Place pinion front bearing inner cone in gear carrier.

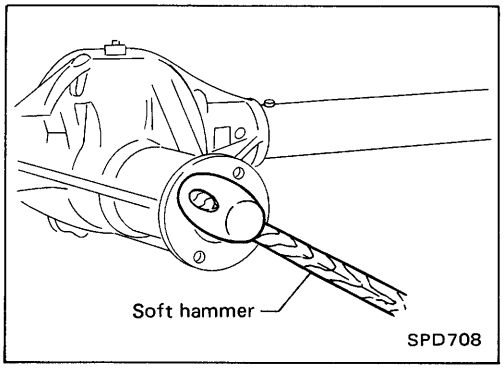


5. Apply multi-purpose grease to cavity at sealing lips of oil seal. Install front oil seal.

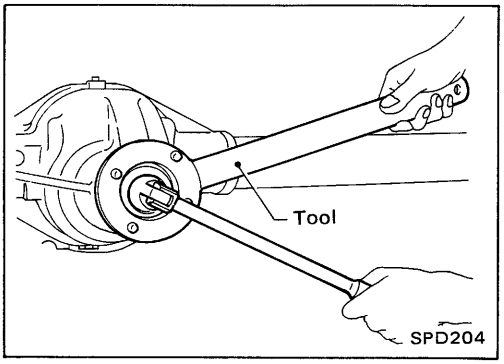
Tool number: KV38100500 (—)
Equivalent tool (J25273)



6. Place drive pinion bearing spacer, drive pinion bearing adjusting washer and drive pinion in gear carrier.



7. Insert companion flange into drive pinion by tapping the companion flange with a soft hammer.

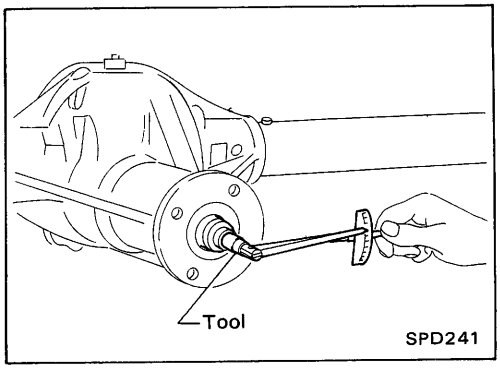


8. Tighten pinion nut to 127 N·m (13 kg-m, 94 ft-lb).

The threaded portion of drive pinion and pinion nut should be free from oil or grease.

Tool number: KV38104700 (J34311)

Differential Carrier (Cont'd)



9. Tighten the pinion nut by very small degrees until the specified preload is achieved. When checking the preload, turn the drive pinion in both directions several times to set the bearing rollers.

   Tool number: ST3127S000 (See J25765-A)

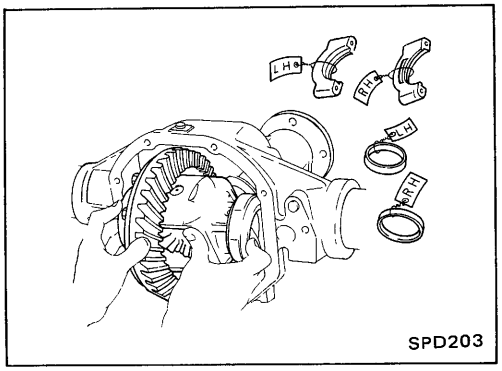
   Pinion bearing preload:

   1.1 - 1.7 N·m

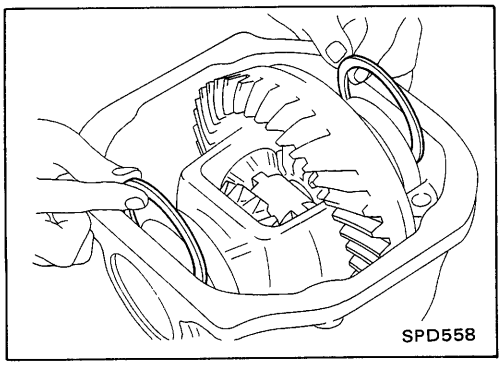
   (11 - 17 kg-cm, 9.5 - 14.8 in-lb)

This procedure will have to be repeated if:

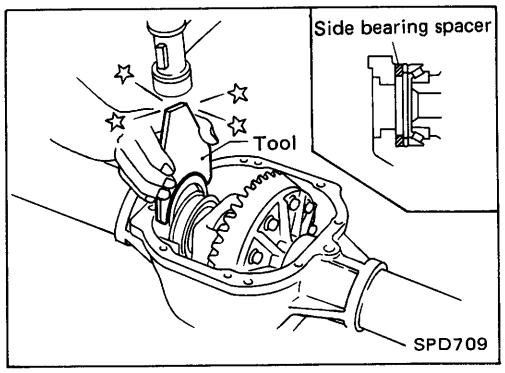
- **Maximum preload is achieved before the minimum pinion nut torque is reached.**
- **Minimum preload is not achieved before maximum pinion nut torque is reached.**



10. Select side bearing adjusting washer.
    Refer to Adjustment.
11. Install differential case assembly with side bearing outer races into gear carrier.

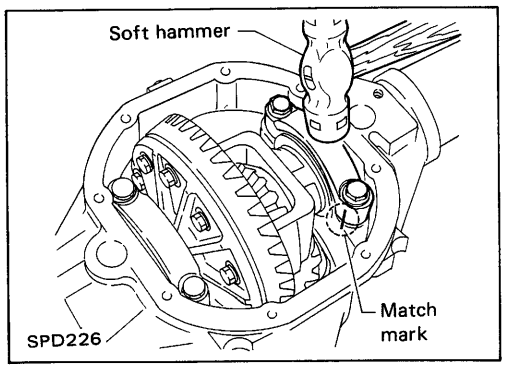


12. Insert left and right side bearing adjusting washers in place between side bearing and carrier.



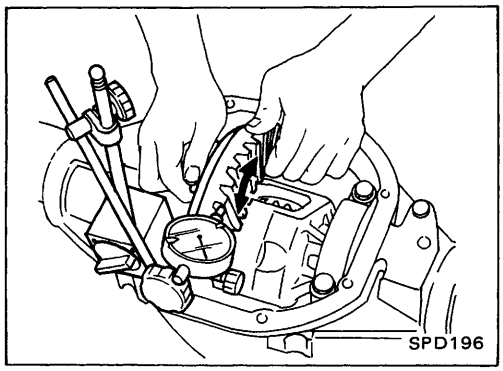
13. Drive in side bearing spacer with Tool.

    Tool number: KV38100600 (J25267)



14. Align mark on bearing cap with that on gear carrier and install bearing cap on gear carrier.

Differential Carrier (Cont'd)

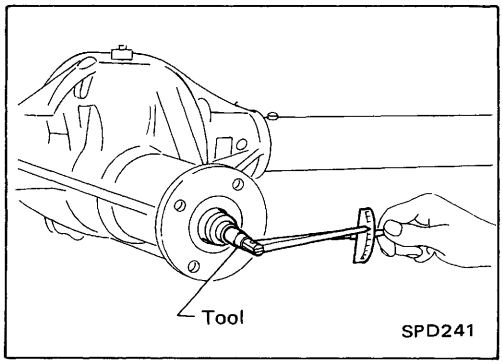


15. Measure ring gear-to-drive pinion backlash with a dial indicator.

Ring gear-to-drive pinion backlash:
0.13 - 0.18 mm
(0.0051 - 0.0071 in)

- If backlash is too small, decrease thickness of right shim and increase thickness of left shim by the same amount.
  If backlash is too great, reverse the above procedure.

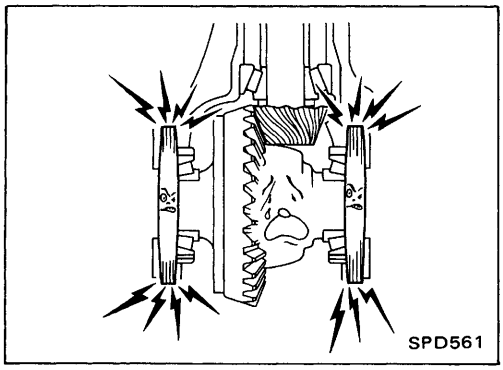
Never change the total amount of shims as it will change the bearing preload.



16. Check total preload with Tool.

When checking preload, turn drive pinion in both directions several times to seat bearing rollers correctly.

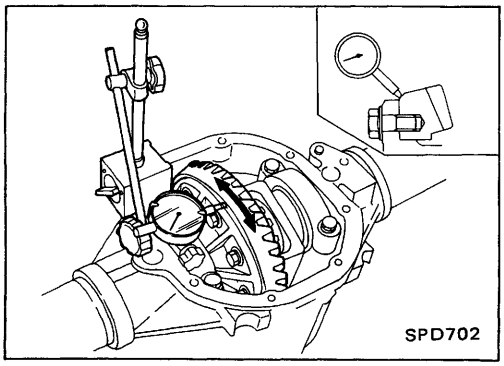
Total preload:
1.2 - 2.3 N·m
(12 - 23 kg-cm, 10 - 20 in-lb)
Tool number: ST3127S000 (See J25765-A)



- If preload is too great, remove the same amount of shim from eash side.
- If preload is too small, add the same amount of shim to each side.

Never add or remove a different number of shims for each side as it will change ring gear-to-drive pinion backlash.

17. Recheck ring gear-to-drive pinion backlash because increase or decrease in thickness of shims will cause change of ring gear-to-pinion backlash.



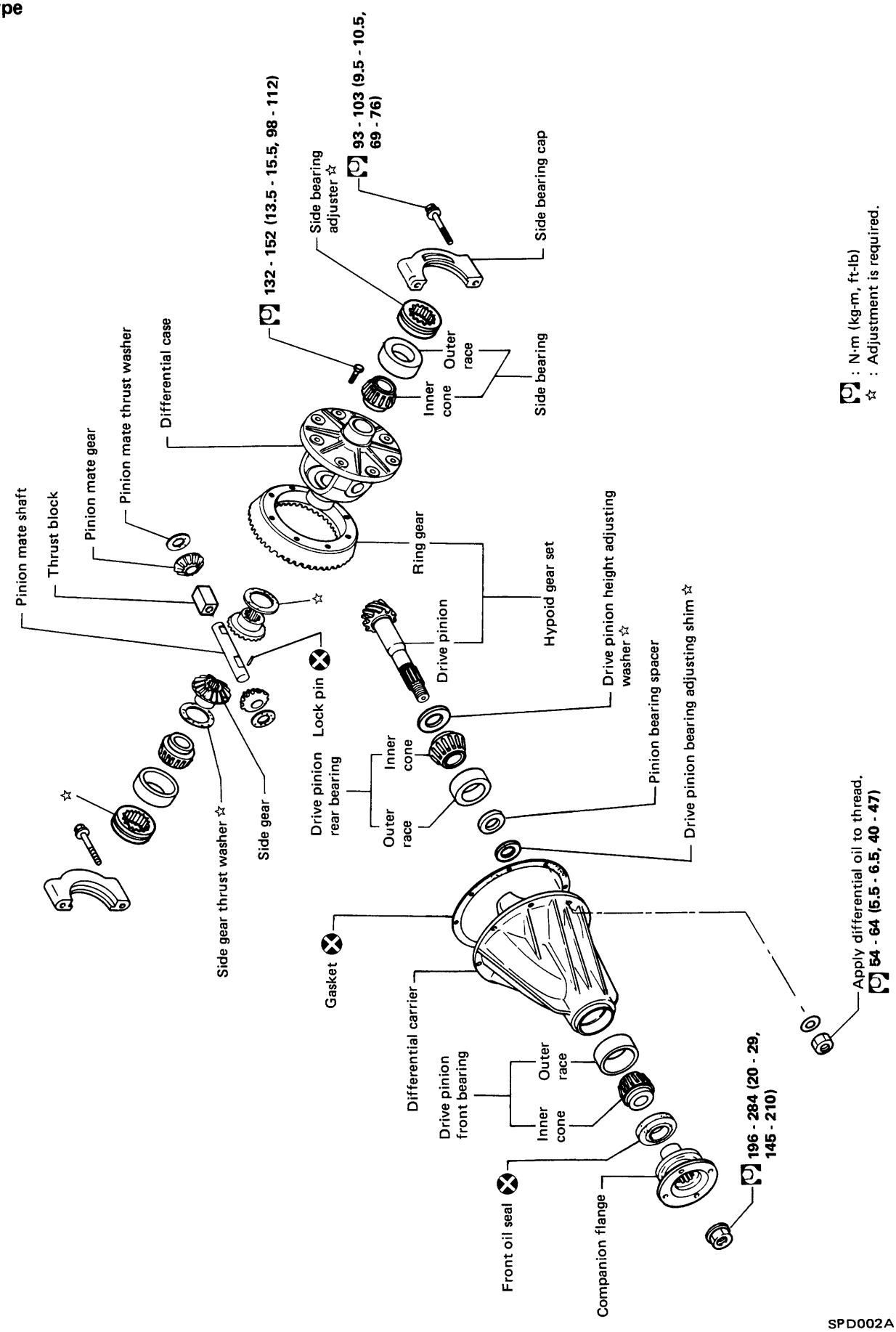
18. Check runout of ring gear with a dial indicator.

Runout limit:
0.05 mm (0.0020 in)

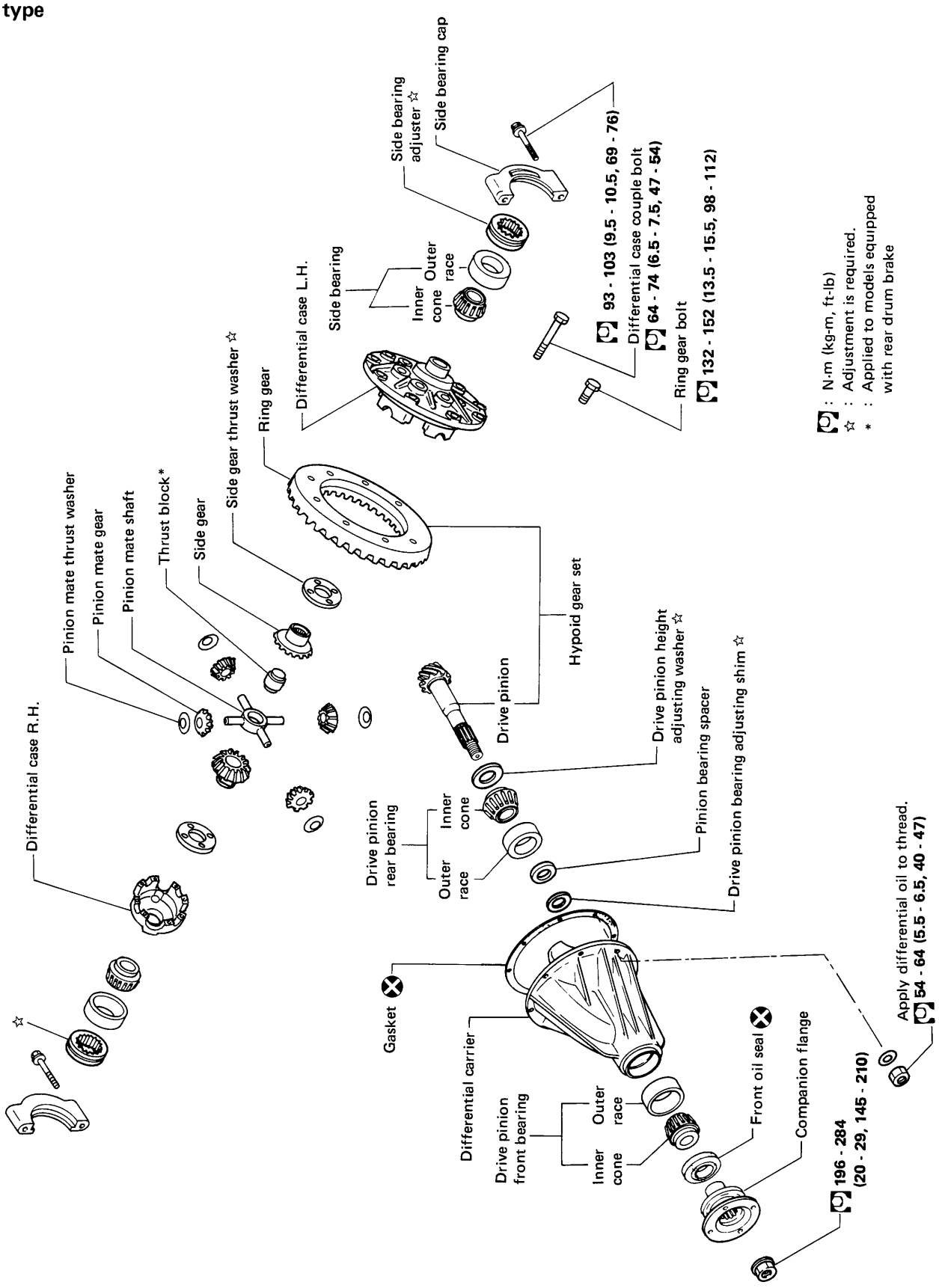
- If backlash varies excessively in different places, the variance may have resulted from foreign matter caught between the ring gear and the differential case.
- If the backlash varies greatly when the runout of the ring gear is within a specified range, the hypoid gear set or differential case should be replaced.

19. Check tooth contact.
    Refer to Adjustment.
20. Install rear cover and gasket.

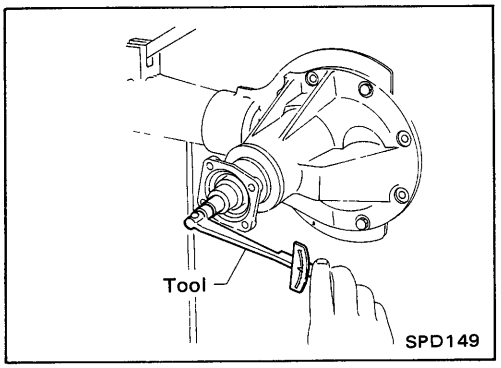
2-pinion type



4-pinion type



SPD003A



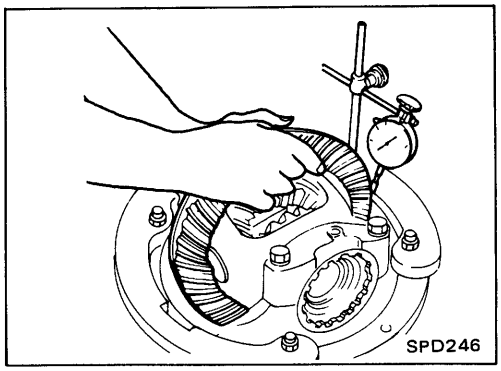
Pre-inspection

Before disassembling final drive, perform the following inspection.

- Total preload

1) Turn drive pinion in both directions several times to seat bearing rollers correctly.
2) Check total preload with Tool.

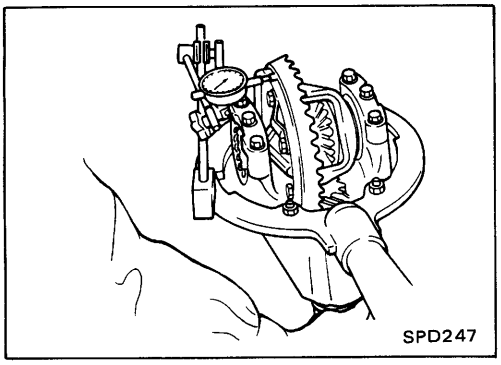
Total preload:
1.7 - 2.5 N·m
(17 - 25 kg-cm, 15 - 22 in-lb)
Tool number: ST3127S000 (See J25765-A)



- Ring gear to drive pinion backlash

Check backlash of ring gear with a dial indicator at several points.

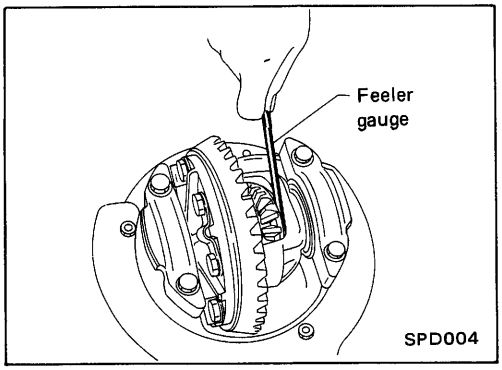
Ring gear-to-drive pinion backlash:
0.15 - 0.20 mm (0.0059 - 0.0079 in)



- Ring gear runout

Check runout of ring gear with a dial indicator.

Runout limit:
0.08 mm (0.0031 in)



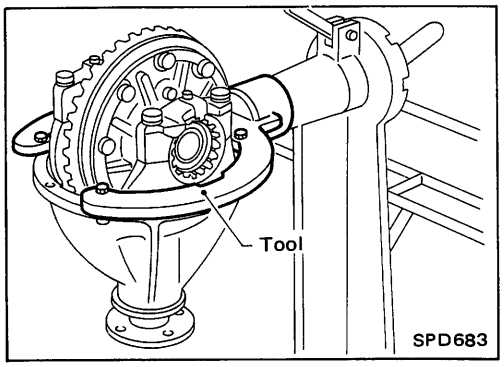
- Tooth contact

Check tooth contact, referring to ADJUSTMENT.

- Side gear to pinion mate gear backlash

Measure clearance between side gear thrust washer and differential case with a feeler gauge.

Clearance between side gear thrust washer and differential case:
0.10 - 0.20 mm (0.0039 - 0.0079 in)

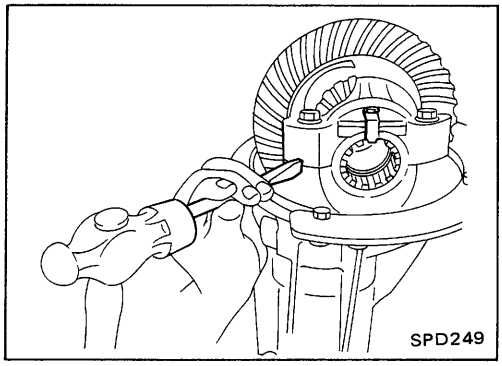


Differential Carrier

1. Mount final drive assembly on Tool.

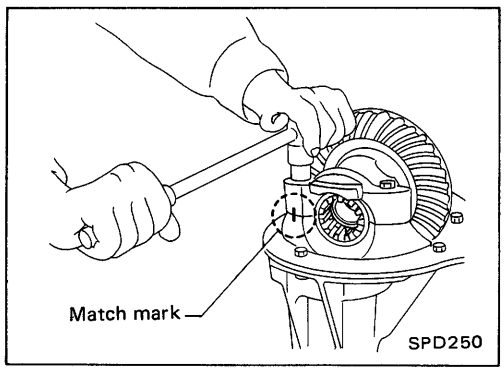
Tool number: ST06340000 (—)
Equivalent tool (J25602-3), (J34310)

Differential Carrier (Cont'd)

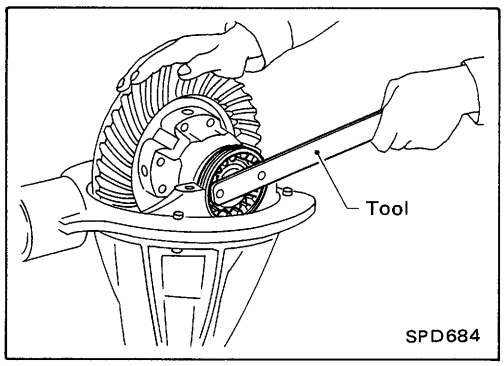


2. Put match marks on one side of side bearing cap with paint or punch to ensure that it is replaced in proper position during reassembly.

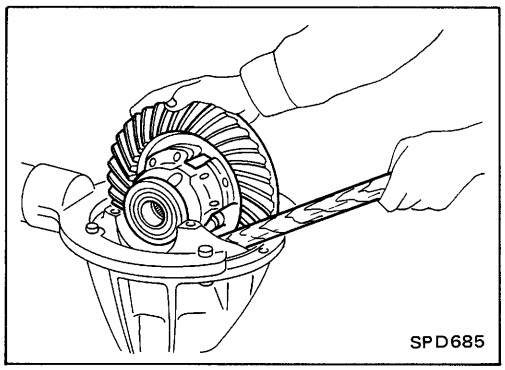
Bearing caps are line-bored during manufacture and should be put back in their original places.



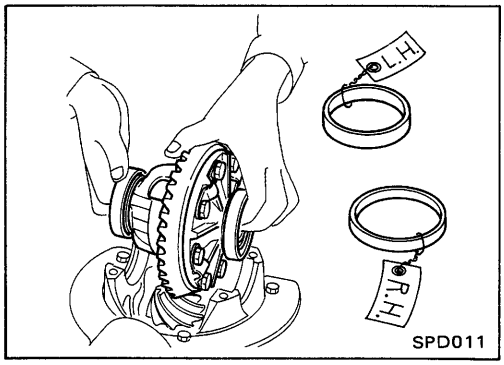
3. Remove side lock fingers and side bearing caps.



4. Remove side bearing adjuster with Tool.
   Tool number: ST32580000 (J34312)

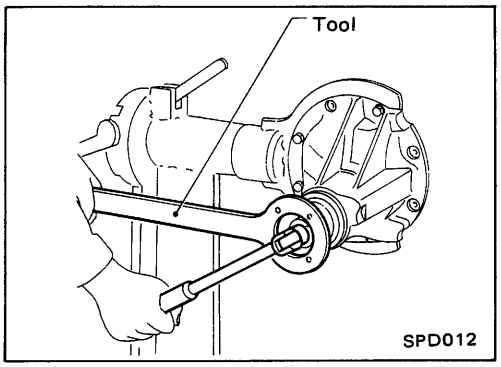


5. Remove differential case assembly with a pry bar.

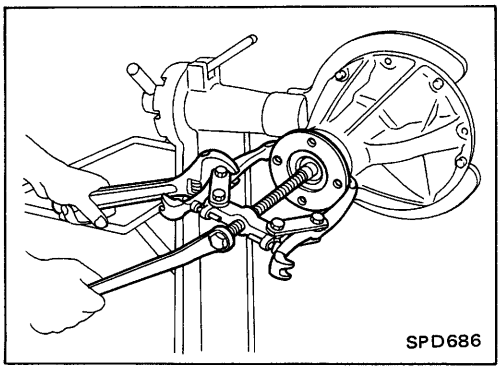


Be careful to keep the side bearing outer races together with their respective inner cones – do not mix them up.

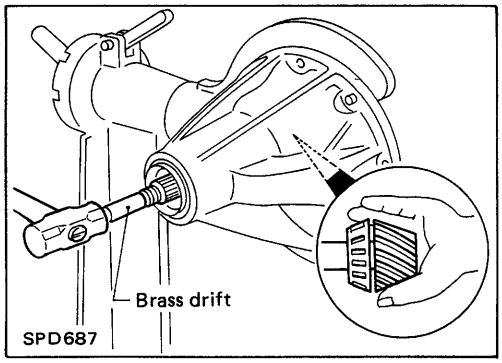
Differential Carrier (Cont'd)



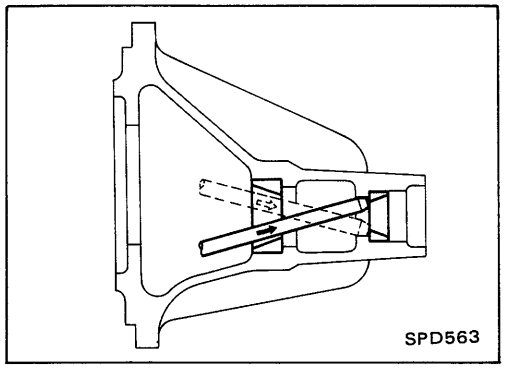
6. Remove drive pinion nut with Tool.
   Tool number: KV38104700 (J34311)



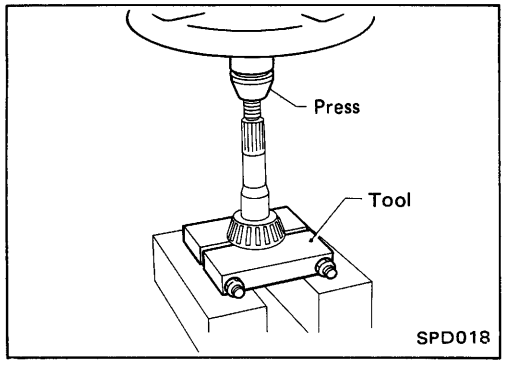
7. Remove companion flange with puller.



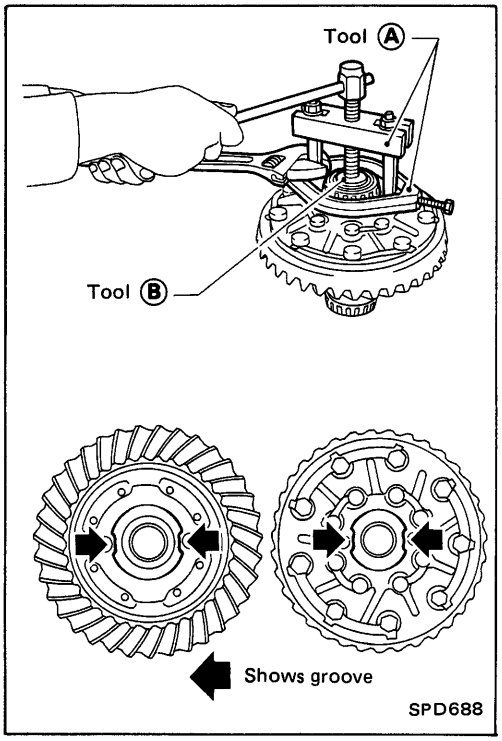
8. Take out drive pinion together with pinion rear bearing inner cone, drive pinion bearing spacer and pinion bearing adjusting shim.



9. Remove front oil seal and pinion front bearing inner cone.
10. Remove pinion bearing outer races with a brass drift.



11. Remove pinion rear bearing inner cone and drive pinion adjusting washer.
    Tool number: ST30031000 (J22912-01)



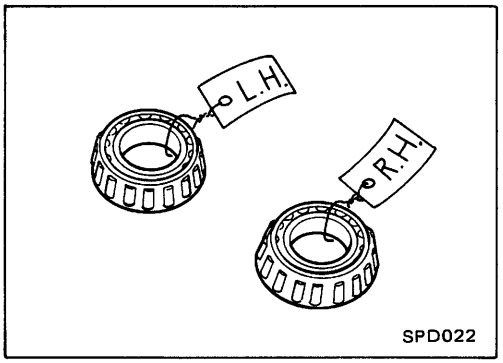
Differential Case

1. Remove side bearing inner cones.

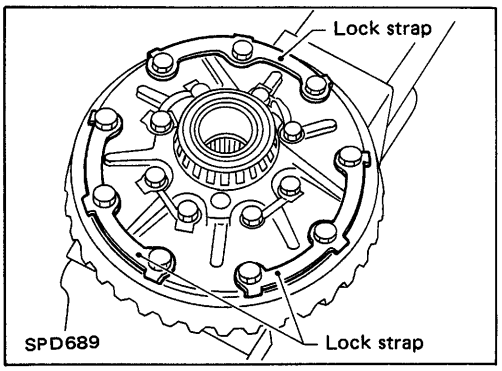
To prevent damage to bearing, engage puller jaws in groove.

Tool number:

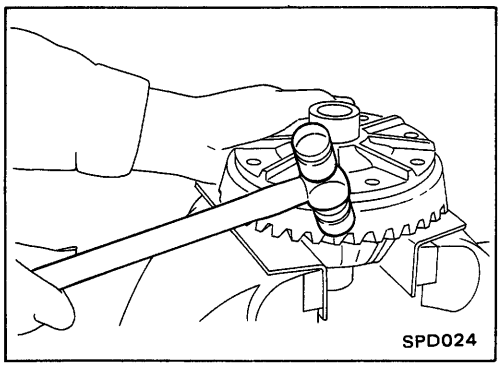
Ⓐ ST33051001 (–)
Equivalent tool (J22888)
Ⓑ ST33061000 (J8107-2)



Be careful not to confuse left and right hand parts.



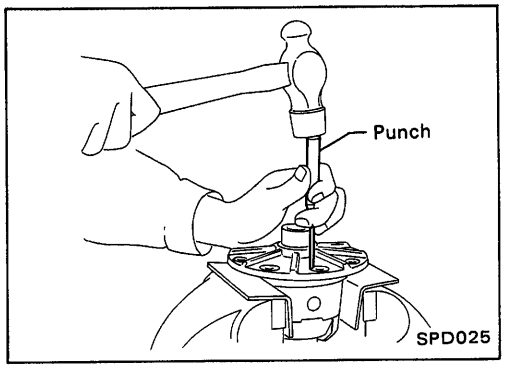
2. Spread out lock straps and loosen ring gear bolts in a criss-cross fashion.



3. Tap ring gear off differential case with a soft hammer.

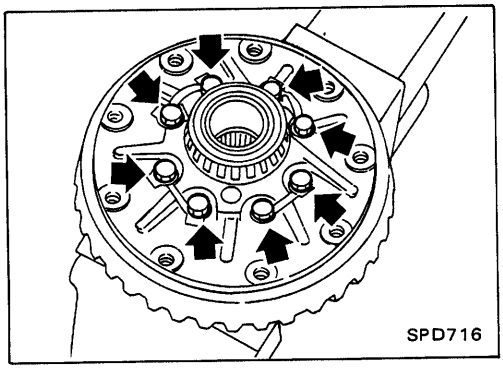
Tap evenly all around to keep ring gear from binding.

Differential Case (Cont'd)



4. Drive out pinion mate shaft lock pin, with Tool from ring gear side (2-pinion type differential case).

Lock pin is calked at pin hole mouth on differential case.



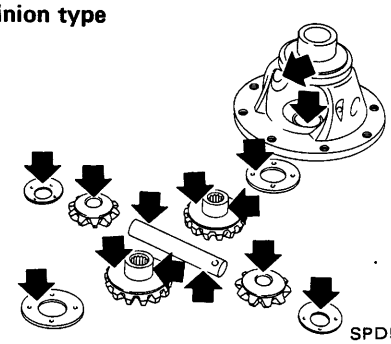
5. Separate differential case L.H. and R.H. (4-pinion type differential case).

Put match marks on both differential case L.H. and R.H. sides prior to separating them.

Ring Gear and Drive Pinion

Check gear teeth for scoring, cracking or chipping.
If any damaged part is evident, replace ring gear and drive pinion as a set (hypoid gear set).

2-pinion type

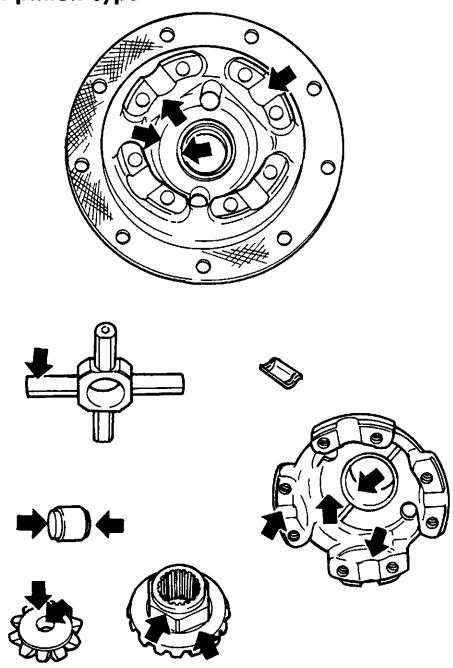


SPD530

Differential Case Assembly

Check mating surfaces of differential case, side gears, pinion mate gears, pinion mate shaft, and thrust washers.

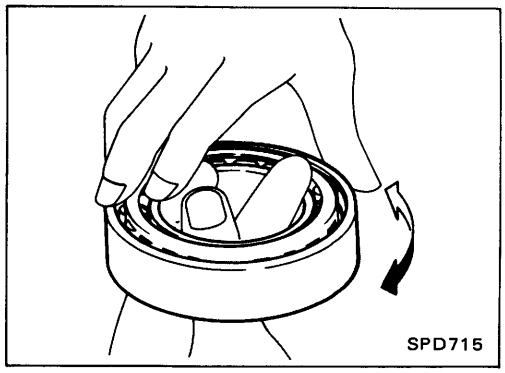
4-pinion type



SPD717

Bearing

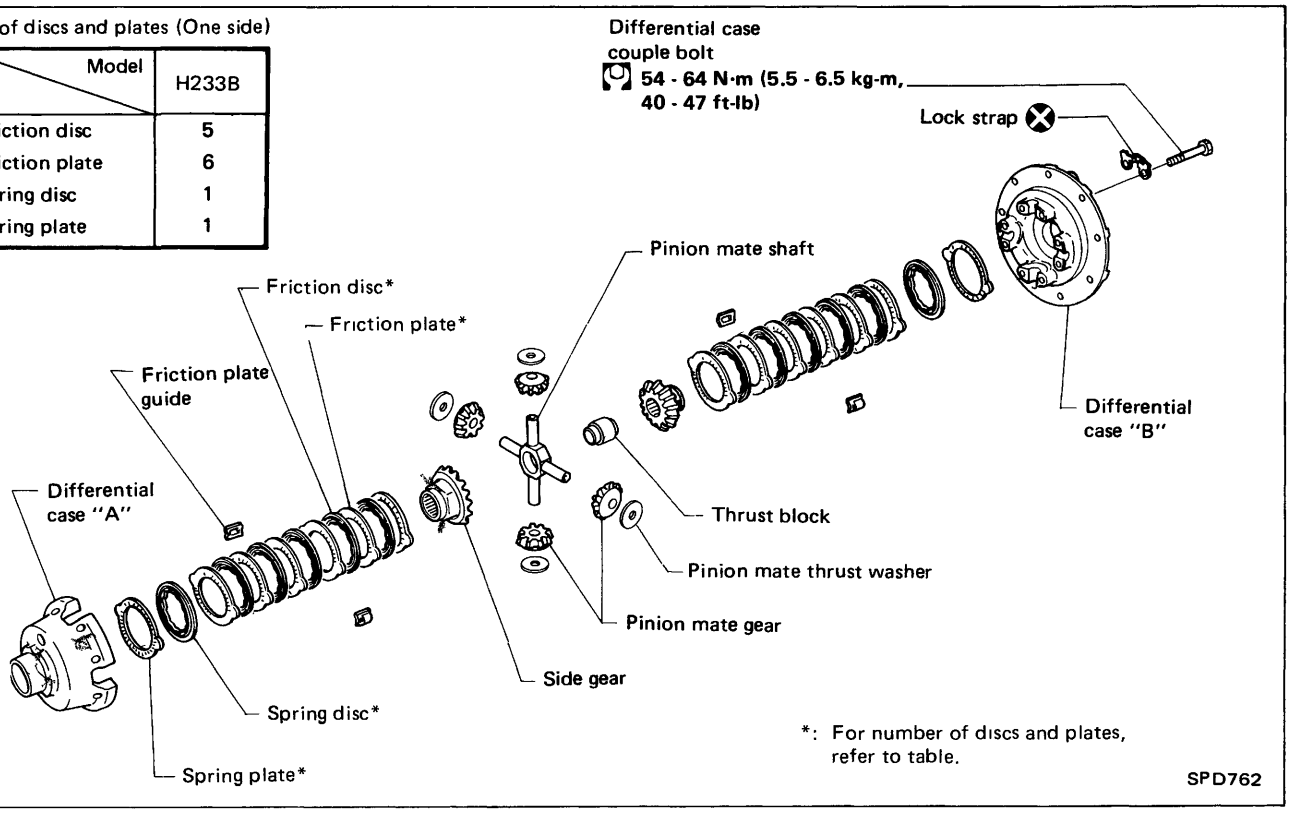
1. Thoroughly clean bearing.
2. Check bearings for wear, scratches, pitting or flaking.
   Check tapered roller bearing for smooth rotation. If damaged, replace outer race and inner cone as a set.

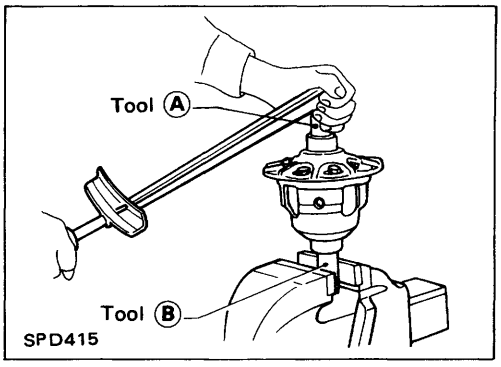


SPD715

No. of discs and plates (One side)

Model	H233B
Friction disc	5
Friction plate	6
Spring disc	1
Spring plate	1





CAUTION:

Do not run engine when one wheel (rear) is off the ground.

Preparation for Disassembly

CHECKING DIFFERENTIAL TORQUE

Measure differential torque with Tool.

If it is not within the specifications, inspect components of limited slip differential.

Differential torque:

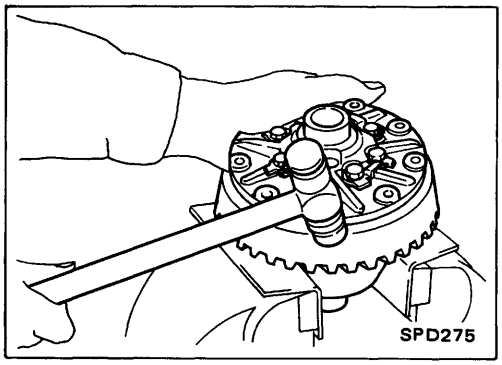
353 - 392 N·m

(36 - 40 kg-m, 260 - 289 ft-lb)

Tool number:

Ⓐ KV38105210 (–)

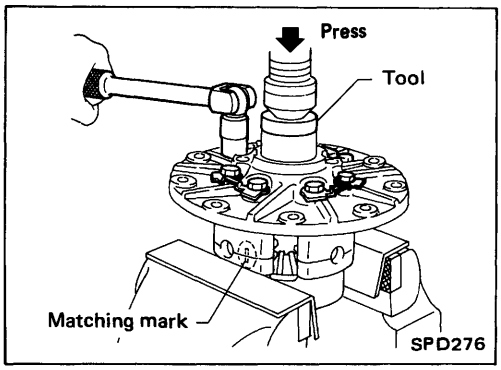
Ⓑ KV38105220 (–)



Disassembly

1. Remove side bearing inner cone with Tool.
2. Remove ring gear by spreading out lock straps.
3. Loosen ring gear bolts in a criss-cross fashion.
4. Tap ring gear off gear case with a soft hammer.

Tap evenly all around to keep ring gear from binding.

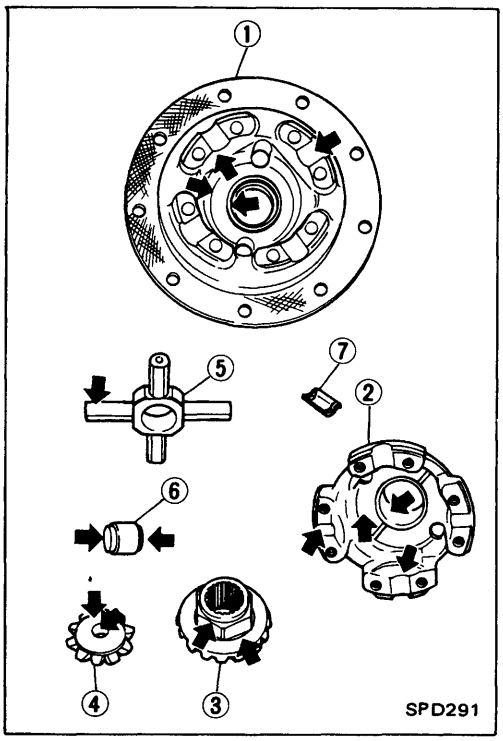


5. Remove differential case by spreading out lock straps.
6. Remove couple bolts on differential cases A and B with a press.

Tool number: ST33081000 (—)

7. Separate differential case A and B.
   Draw out component parts (discs and plates, etc.).

Put marks on gears and pressure rings so that they can be reinstalled in their original positions from which they were removed.



Inspection

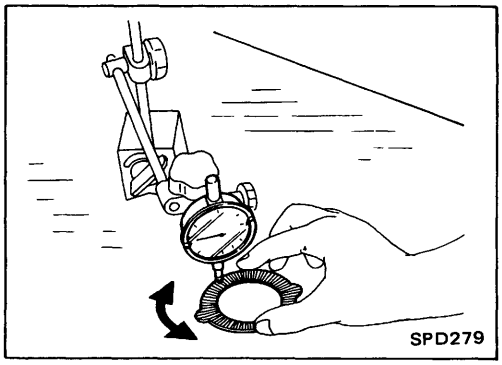
CONTACT SURFACES

1. Clean the disassembled parts in suitable solvent and blow dry with compressed air.
2. If following surfaces are found with burrs or scratches, smooth with oil stone.
   - ① Differential case A
   - ② Differential case B
   - ③ Side gear
   - ④ Pinion mate gear
   - ⑤ Pinion mate shaft
   - ⑥ Thrust block
   - ⑦ Friction plate guide

DISC AND PLATE

1. Clean the discs and plates in suitable solvent and blow dry with compressed air.
2. Inspect discs and plates for wear, nicks and burrs.

Inspection (Cont'd)

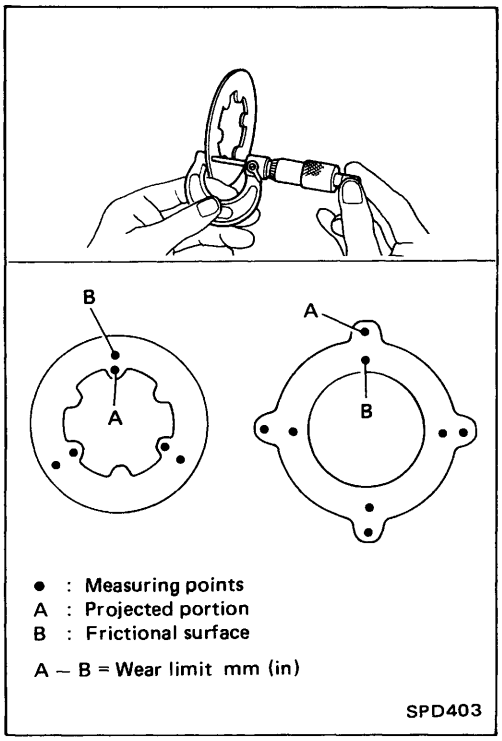


3. To test if friction disc or plate is not distorted, place it on a surface plate and rotate it by hand with indicating finger of dial gauge resting against disc or plate surface.

   Allowable warpage:

   0.05 - 0.15 mm (0.0020 - 0.0059 in)

   If it exceeds limits, replace with a new plate to eliminate possibility of clutch slippage or sticking.

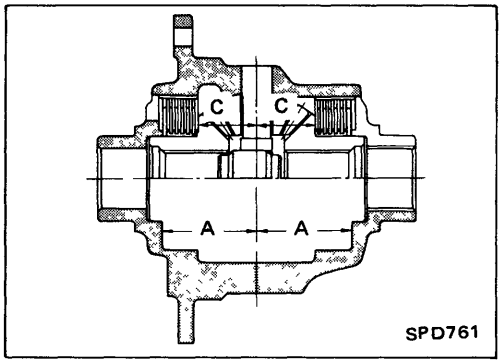


4. Measure frictional surfaces and projected portions of friction disc, friction plate, spring plate, and determine each part's differences to see if the specified wear limit has been exceeded.
5. Measure frictional surfaces and projected portions of friction disc, friction plate; spring plate and spring disc (H233B only).

If any part has worn beyond the wear limit, replace it with a new one that is the same thickness as the projected portion.

Wear limit:

0.1 mm (0.004 in) or less



Adjustment

FRICTION DISC AND FRICTION PLATE END PLAY

End play of friction disc and friction plate can be calculated by using following equation and should be adjusted within following range.

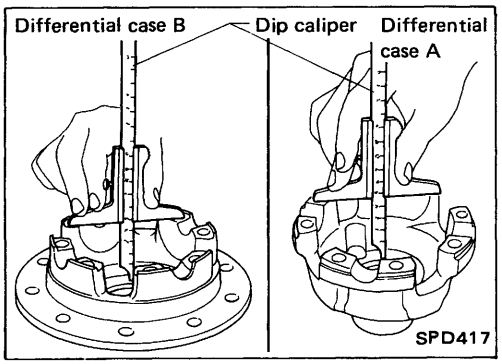
Adjustment can be made by selecting friction disc having two different thicknesses.

End play E:

0.05 - 0.15 mm (0.0020 - 0.0059 in)

$$E = A - (B + C)$$

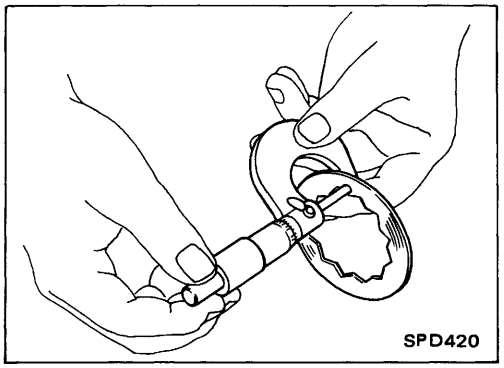
A: Length of differential case contact surface to differential case inner bottom.
B: Total thickness of friction discs, friction plates, spring disc and spring plate in differential case on one side.
C: Length of differential case contact surface to back side of side gear.



1. Measure values of "A".

Standard length A:

49.50 - 49.55 mm (1.9488 - 1.9508 in)



2. Measure thickness of each disc and plate.

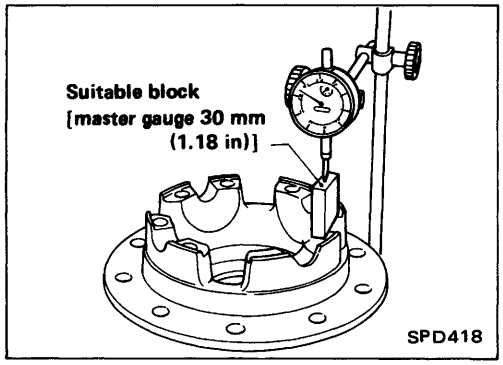
Total thickness "B":

19.24 - 20.26 mm (0.7575 - 0.7976 in)

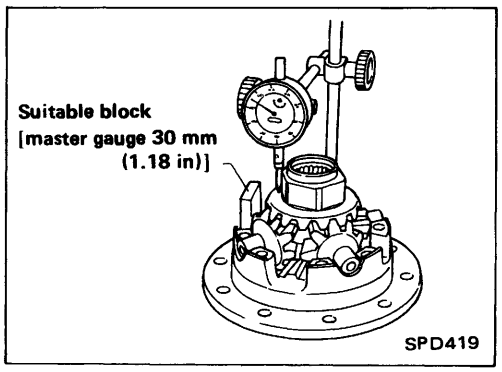
No. of discs and plates (One side)

Model	H233B
Friction disc	5
Friction plate	6
Spring disc	1
Spring plate	1

Adjustment (Cont'd)



3. Measure values of "C".
(1) Attach a dial indicator to the base plate.
(2) Place differential case B on the base plate, and install a master gauge on case B.
Then adjust the dial indicator scale to zero with its tip on the master gauge.



(3) Install pinion mate gears, side gears and pinion mate shaft in differential case B.
(4) Set dial indicator's tip on the side gear, and read the indication.

Example:

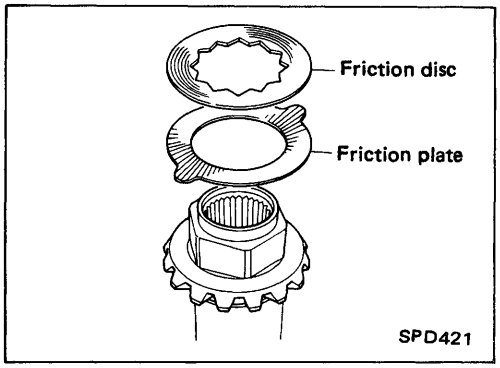
E = A – D
= A – (B + C)
= 0.05 to 0.15 mm
A = 49.52 mm
B = 19.45 mm
C = 29.7 mm
D = B + C

B	... 19.45
+ C	... 29.7
	49.15

E = A – D

A	... 49.52
– D	... 49.15
	0.37

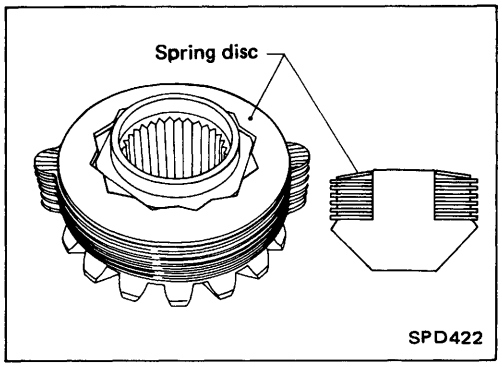
From the above equation, end play of 0.37 mm exceeds the specified range of 0.05 to 0.15 mm.
Select suitable discs and plates to adjust correctly.



Assembly

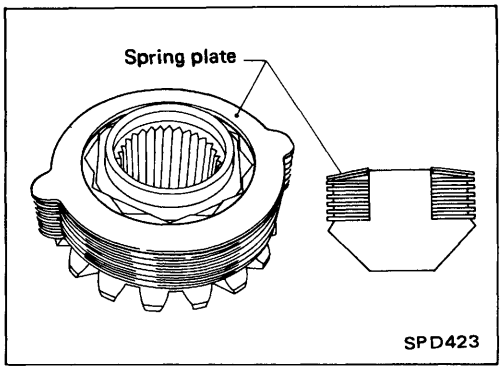
Prior to assembling discs and plates, properly lubricate them by dipping them in limited slip differential oil.
1. Alternately position specified number of friction plates and friction discs on rear of side gear.
Always position a friction plate first on rear of side gear.

Assembly (Cont'd)

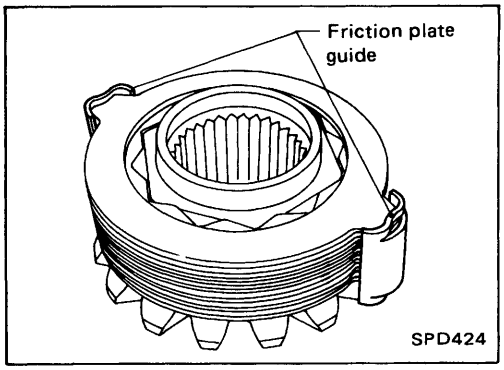


2. Install spring disc.

Align the twelve angular holes in spring disc with the hexagonal area of the side gear.

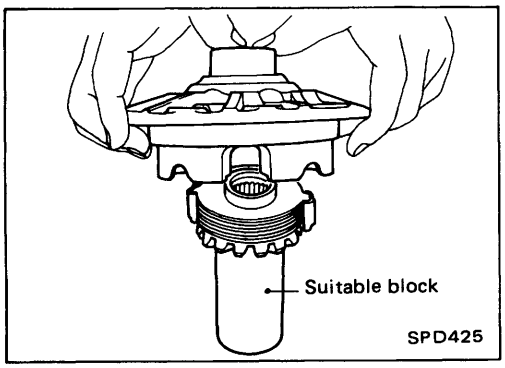


3. Install spring plate.



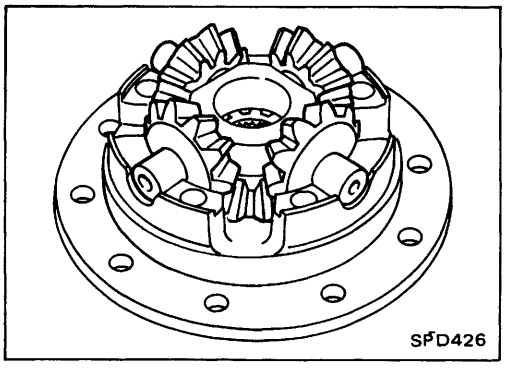
4. Install friction plate guides.

Correctly align the raised portions of friction plates, and apply grease to inner surfaces of friction plate guides to prevent them from falling.



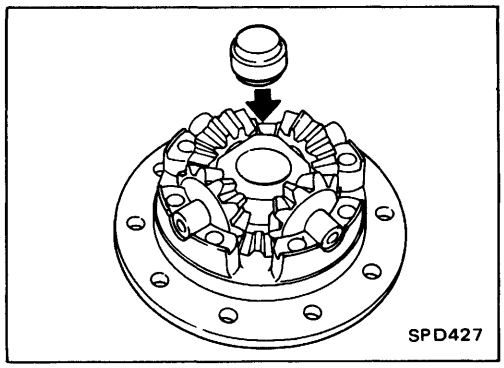
5. Install differential case B over side gear, discs, plates and friction plate guide assembly.

- **Install differential case B while supporting friction plate guides with your middle finger inserted through oil hole in differential case.**
- **Be careful not to detach spring disc from the hexagonal part of the side gear.**

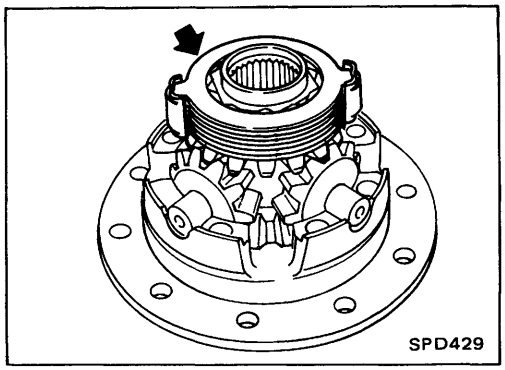


6. Install pinion mate gears and pinion shaft to differential case B.

Assembly (Cont'd)

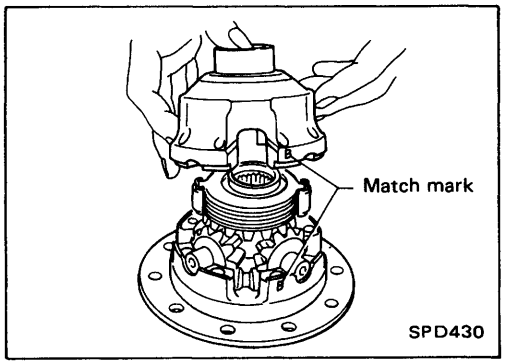

SPD427

7. Install thrust block.


SPD429

8. Install side gear to pinion mate gears.
9. Install each disc and plate.

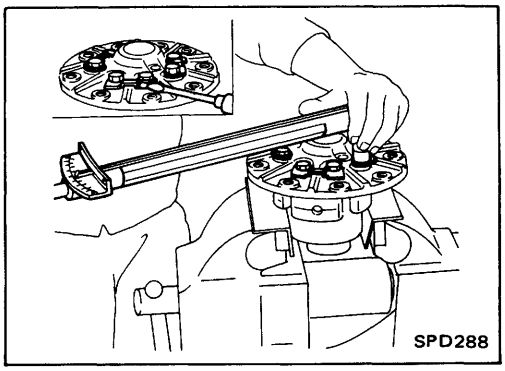
Use same procedures as outlined in steps 1. through 4. above.



SPD430

10. Install differential case A.

Position differential cases A and B by correctly aligning marks stamped on cases.


SPD288

11. Tighten differential case bolts.
12. Place ring gear on differential case and install new lock straps and bolts.

Tighten bolts in a criss-cross fashion, lightly tapping bolt head with a hammer.

Then bend up lock straps to lock the bolts in place.

13. Install side bearing inner cone.
14. Check differential torque.

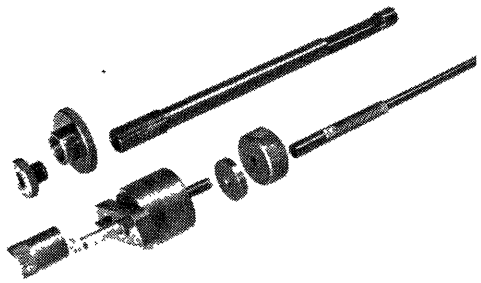
For quiet and reliable final drive operation, the following five adjustments must be made correctly:

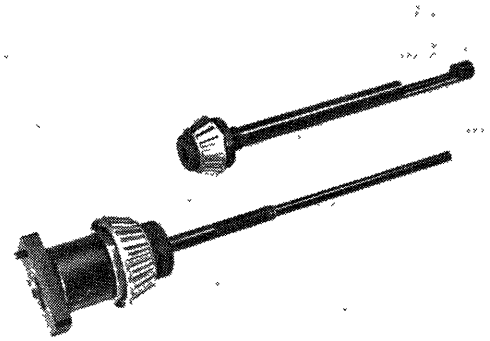
1. Pinion Bearing Preload.
2. Pinion Gear Height.
3. Side Bearing Preload.
4. Ring Gear-to-pinion Backlash. (Refer to ASSEMBLY.)
5. Ring and Pinion Gear Tooth Contact Pattern.

Pinion Bearing Preload and Pinion Gear Height

1. Make sure all parts are clean and that the bearings are well lubricated.

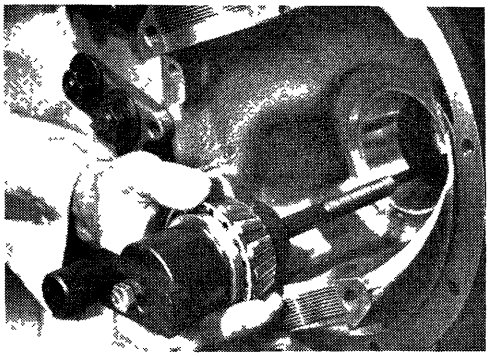
2. Assemble the pinion gear bearings into the pinion pre-load shim selector tool, J-34309.





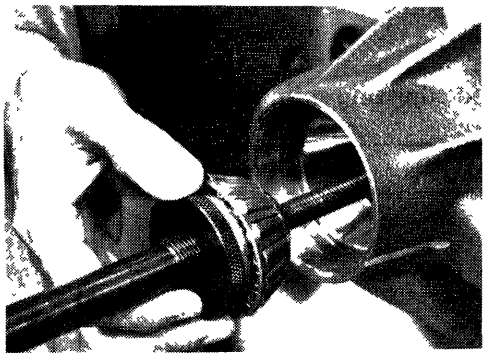
- **Rear Pinion Bearing** – the rear pinion bearing pilot, J-34309-8, is used to center the rear pinion bearing only. The rear pinion bearing locking seat, J-34309-4, is used to lock the bearing to the assembly.

- **Front Pinion Bearing** – make sure the J-34309-3, front pinion bearing seat is secured tightly against the J-34309-2 gauge anvil. Then turn the front pinion bearing pilot, J-34309-5, to secure the bearing in its proper position.



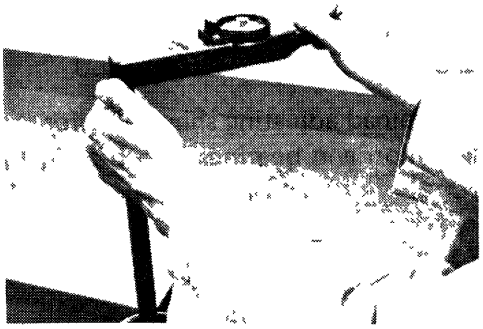
3. Place the pinion preload shim selector tool gauge screw assembly, J-34309-1, with the pinion rear bearing inner cone installed, into the final drive housing.

Pinion Bearing Preload and Pinion Gear Height (Cont'd)



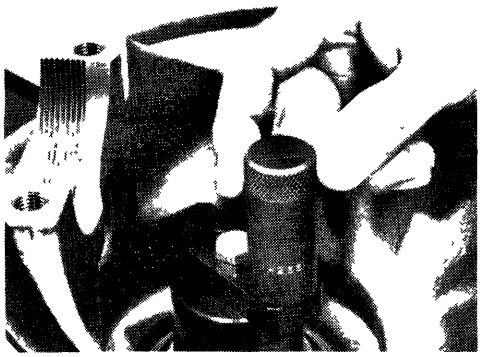
4. Install the J-34309-2 gauge anvil with the front pinion bearing into the final drive housing and assemble it to the J-34309-1 gauge screw. Make sure that the J-34309-16 gauge plate will turn a full 360 degrees, and tighten the two sections by hand to set bearing pre-load.

5. Turn the assembly several times to seat the bearings.



6. Measure the turning torque at the end of the J-34309-2 gauge anvil using torque wrench J-25765A.

   Turning torque specification:
   0.4 - 0.9 N·m (4 - 9 kg-cm, 3.5 - 7.8 in-lb)



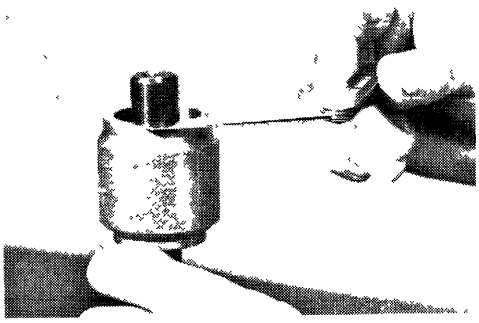
7. Place the J-34309-12 "H233B" pinion height adapter onto the gauge plate and tighten it by hand.

   CAUTION:
   Make sure all machined surfaces are clean.

PINION BEARING PRELOAD WASHER SELECTION



8. Place the solid pinion bearing adjusting spacer squarely into the recessed portion of the J-34309-2 gauge anvil. Rest its end on the J-34309-1 gauge screw.



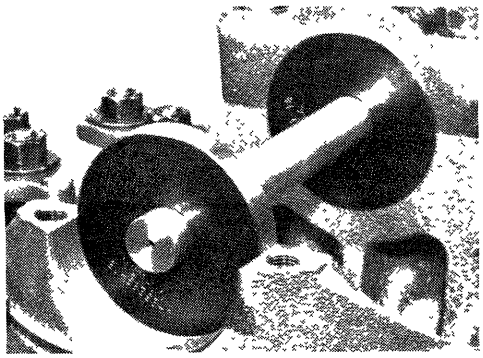
9. Select the correct thickness of pinion bearing preload adjusting washer using your J-34309-101 feeler gauge. *The exact measurement you get with your feeler gauge is the thickness of the adjusting shim required.* Select the correct shim from the following chart.

Pinion Bearing Preload and Pinion Gear Height (Cont'd)

Drive pinion bearing preload adjusting shim (H233B)

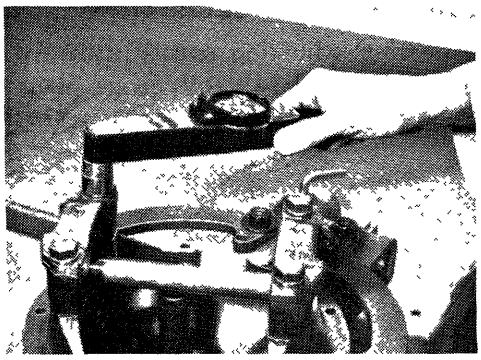
Thickness mm (in)	Part Number
0.40 (0.0157)	24127-4301P
0.45 (0.0177)	24127-4302P
0.50 (0.0197)	24127-4303P
0.55 (0.0217)	24127-4304P
0.60 (0.0236)	24127-4305P
0.65 (0.0256)	24127-4306P
0.70 (0.0276)	24127-4307P
0.75 (0.0295)	24127-4308P

10. Set correct pinion bearing preload adjusting shim aside for use when assembling the pinion and bearings into the final drive housing.



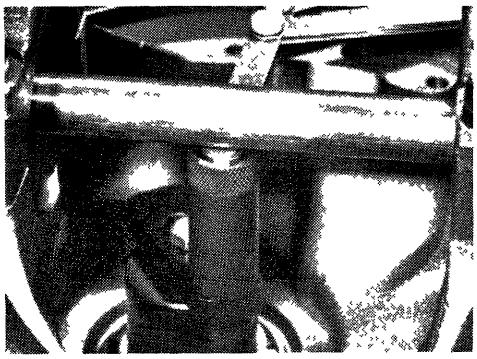
PINION HEIGHT ADJUSTING WASHER SELECTION

11. Position the J-25269-18 side bearing discs and the arbor into the side bearing bores.



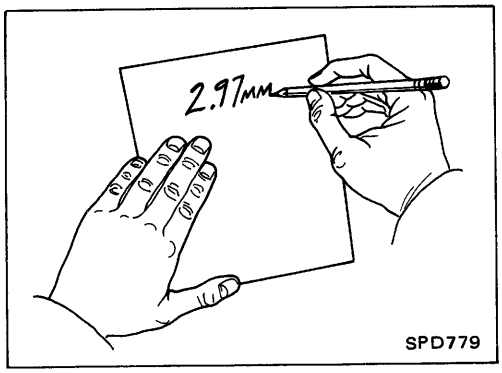
12. Install the bearing caps and torque the bolts.

    Specification:
    93 - 103 N·m (9.5 - 10.5 kg-m, 69 - 76 ft-lb)



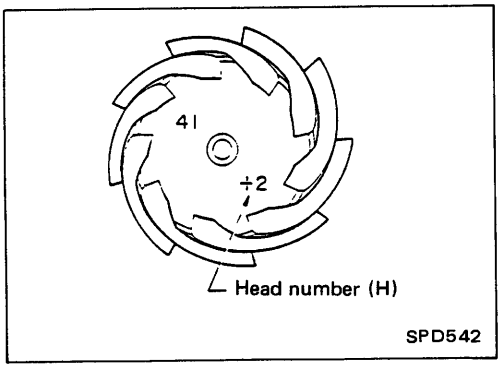
13. Select the correct *standard* pinion height adjusting washer thickness using a standard gauge of 2.5, 3.0, or 3.5 mm (0.098, 0.118, or 0.138 in) and your J-34309-101 feeler gauge. Measure the distance between the J-34309-12 "H233B" pinion height adapter and the arbor.

Pinion Bearing Preload and Pinion Gear Height (Cont'd)



SPD779

14. Write down your exact total measurement.



SPD542

15. Correct the pinion height washer size by referring to the "pinion head height number."

Note: There are two numbers painted on the pinion gear. The first one refers to the pinion and ring gear as a matched set and should be the same as the number on the ring gear. The second number is the "pinion head height number," and it refers to the ideal pinion height from standard for the quietest operation. Use the following chart to determine the correct pinion height washer.

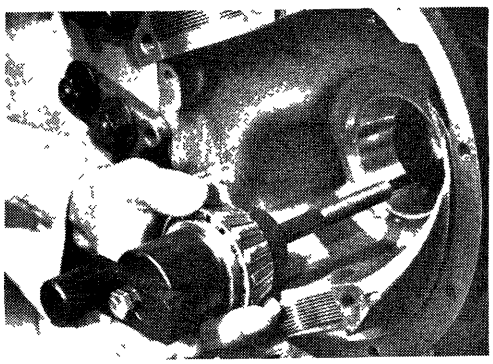
Pinion Head Height Number	Add or Remove from the Selected Standard Pinion Height Washer Thickness Measurement
−6	Add 0.06 mm (0.0024 in)
−5	Add 0.05 mm (0.0020 in)
−4	Add 0.04 mm (0.0016 in)
−3	Add 0.03 mm (0.0012 in)
−2	Add 0.02 mm (0.0008 in)
−1	Add 0.01 mm (0.0004 in)
0	Use the selected washer thickness
+1	Subtract 0.01 mm (0.0004 in)
+2	Subtract 0.02 mm (0.0008 in)
+3	Subtract 0.03 mm (0.0012 in)
+4	Subtract 0.04 mm (0.0016 in)
+5	Subtract 0.05 mm (0.0020 in)
+6	Subtract 0.06 mm (0.0024 in)

Pinion Bearing Preload and Pinion Gear Height (Cont'd)

16. Select the correct pinion height washer from the following chart.

Drive pinion height adjusting washer (H233B)

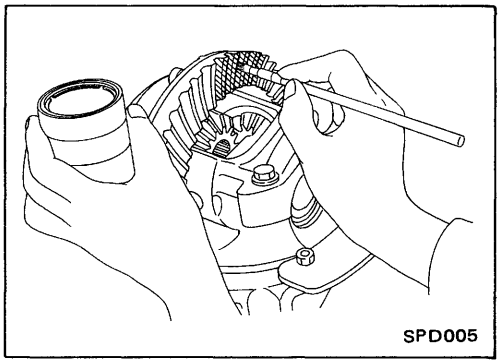
Thickness mm (in)	Part number
2.58 (0.1016)	38151-01J00
2.61 (0.1028)	38151-01J01
2.64 (0.1039)	38151-01J02
2.67 (0.1051)	38151-01J03
2.70 (0.1063)	38151-01J04
2.73 (0.1075)	38151-01J05
2.76 (0.1087)	38151-01J06
2.79 (0.1098)	38151-01J07
2.82 (0.1110)	38151-01J08
2.85 (0.1122)	38151-01J09
2.88 (0.1134)	38151-01J10
2.91 (0.1146)	38151-01J11
2.94 (0.1157)	38151-01J12
2.97 (0.1169)	38151-01J13
3.00 (0.1181)	38151-01J14
3.03 (0.1193)	38151-01J15
3.06 (0.1205)	38151-01J16
3.09 (0.1217)	38151-01J17
3.12 (0.1228)	38151-01J18
3.15 (0.1240)	38151-01J19
3.18 (0.1252)	38151-01J60
3.21 (0.1264)	38151-01J61
3.24 (0.1276)	38151-01J62
3.27 (0.1287)	38151-01J63
3.30 (0.1299)	38151-01J64
3.33 (0.1311)	38151-01J65
3.36 (0.1323)	38151-01J66
3.39 (0.1335)	38151-01J67
3.42 (0.1346)	38151-01J68
3.45 (0.1358)	38151-01J69
3.48 (0.1370)	38151-01J70
3.51 (0.1382)	38151-01J71
3.54 (0.1394)	38151-01J72
3.57 (0.1406)	38151-01J73
3.60 (0.1417)	38151-01J74
3.63 (0.1429)	38151-01J75
3.66 (0.1441)	38151-01J76



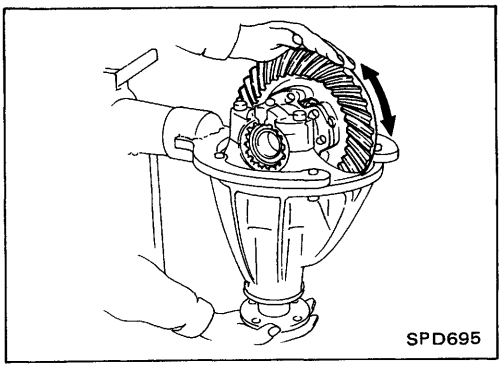
17. Remove the J-34309 pinion preload shim selector tool from the final drive housing and disassemble to retrieve the pinion bearings.

Tooth Contact

Gear tooth contact pattern check is necessary to verify correct relationship between ring gear and drive pinion.
Hypoid gear sets which are not positioned properly in relation to one another may be noisy, or have short life or both. With a pattern check, the most desirable contact for low noise level and long life can be assured.

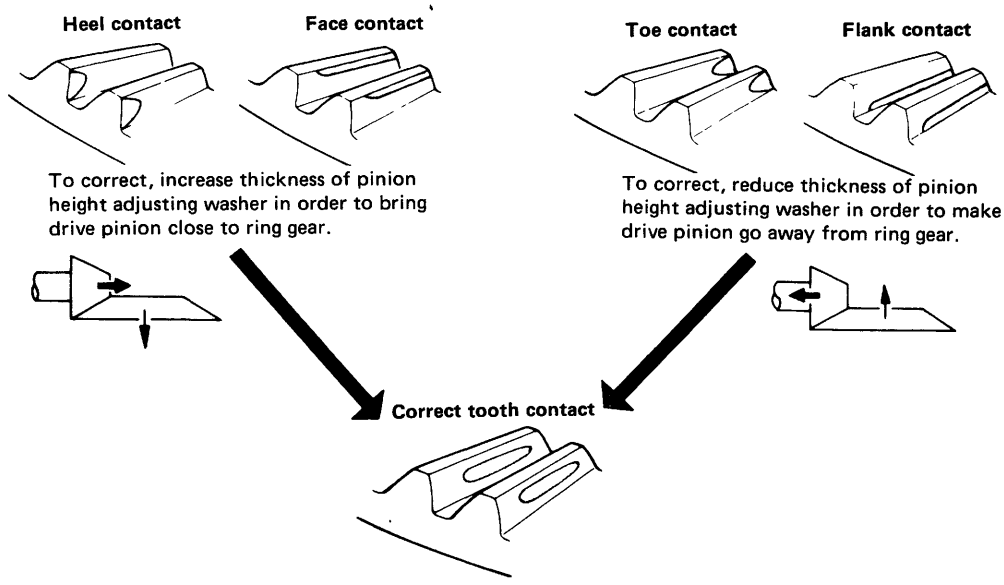

SPD005

1. Thoroughly clean ring gear and drive pinion teeth.
2. Sparingly apply a mixture of powdered ferric oxide and oil or equivalent to 3 or 4 teeth of ring gear drive side.

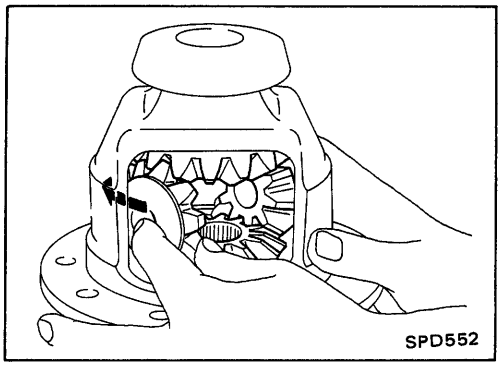

SPD695

3. Hold companion flange steady by hand and rotate the ring gear in both directions.

Usually the pattern will be correct if you have calculated the shims correctly and the backlash is correct.
However, in rare cases you may have to use trial-and-error processes until you get a good tooth contact pattern.
The tooth pattern is the best indication of how well a differential has been set up.

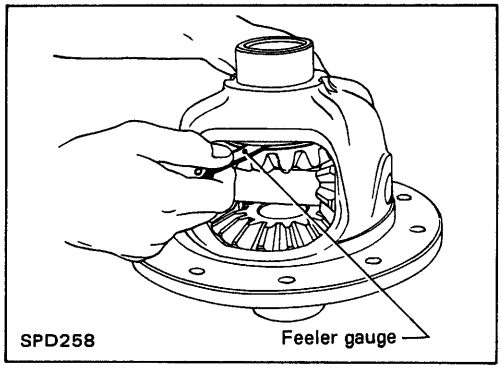


SPD007



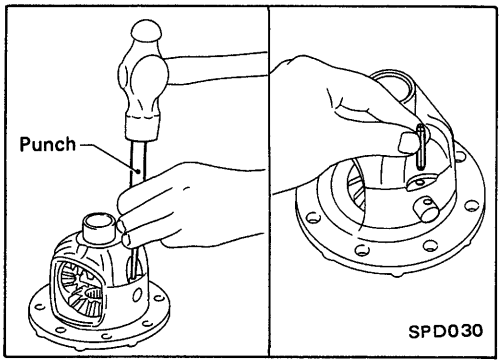
Differential Case —2-pinion type—

1. Install side gears, pinion mate gears and thrust washers into differential case.



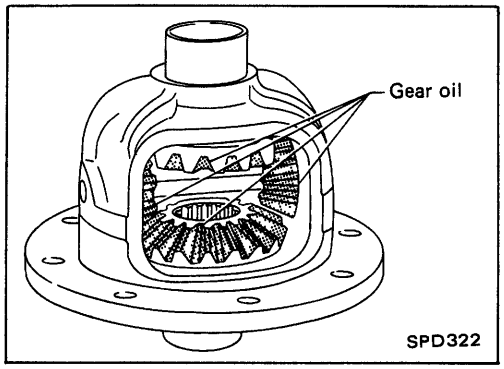
2. Fit pinion mate shaft to differential case so that it meets lock pin holes.
3. Adjust backlash between side gear and pinion mate gear by selecting side gear thrust washer. (Refer to S.D.S.)

Backlash between side gear and pinion mate gear (Clearance between side gear thrust washer and differential case):
0.10 - 0.20 mm (0.0039 - 0.0079 in)



4. Install pinion mate shaft lock pin with a punch.

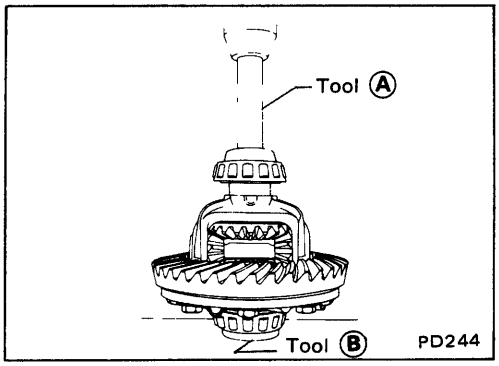
Make sure lock pin is flush with case.



5. Apply gear oil to gear tooth surfaces and thrust surfaces and check to see they turn properly.
6. Install differential case assembly on ring gear.

Tighten bolts in a criss-cross fashion, lightly tapping bolt head with a hammer.

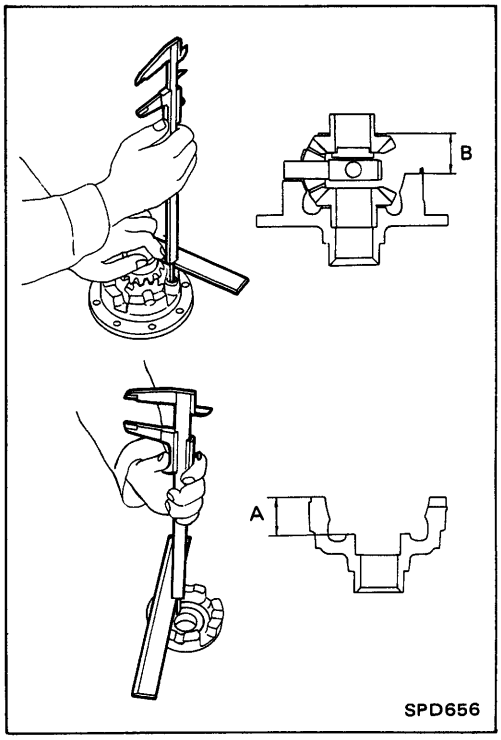
Differential Case —2-pinion type— (Cont'd)



7. Press-fit side bearing inner cones on differential case with Tool.

Tool number:
Ⓐ ST33190000 (–)
Equivalent tool (J25523)
Ⓑ ST33081000 (–)

Differential Case —4-pinion type—

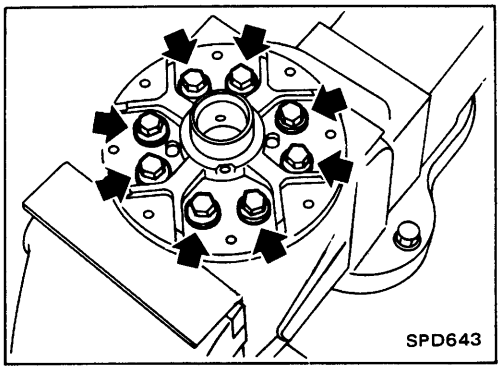


1. Measure clearance between side gear thrust washer and differential case.

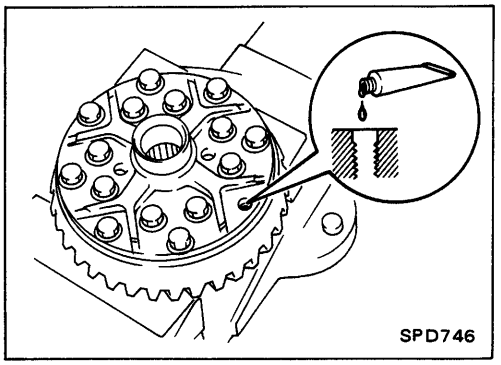
Clearance between side gear thrust washer and differential case (A – B):
0.10 - 0.20 mm (0.0039 - 0.0079 in)

The clearance can be adjusted with side gear thrust washer. (Refer to S.D.S.)

2. Apply gear oil to gear tooth surfaces and thrust surfaces and check to see they turn properly.



3. Install differential case L.H. and R.H.
4. Install differential case on ring gear.



5. Place differential case on ring gear.
6. Apply locking agent [Locktite (stud lock) or equivalent] to ring gear bolts, and install them.

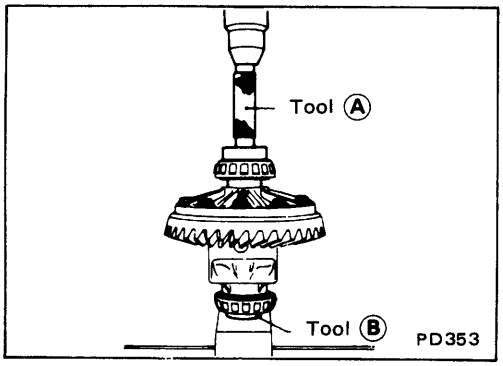
Tighten bolts in a criss-cross fashion, lightly tapping bolt head with a hammer.

Differential Case —4-pinion type— (Cont'd)

7. Press-fit side bearing inner cones on differential case with Tool.

Tool number:

Ⓐ **ST33190000 (—)**
Equivalent tool (J25523)
Ⓑ **ST33081000 (—)**

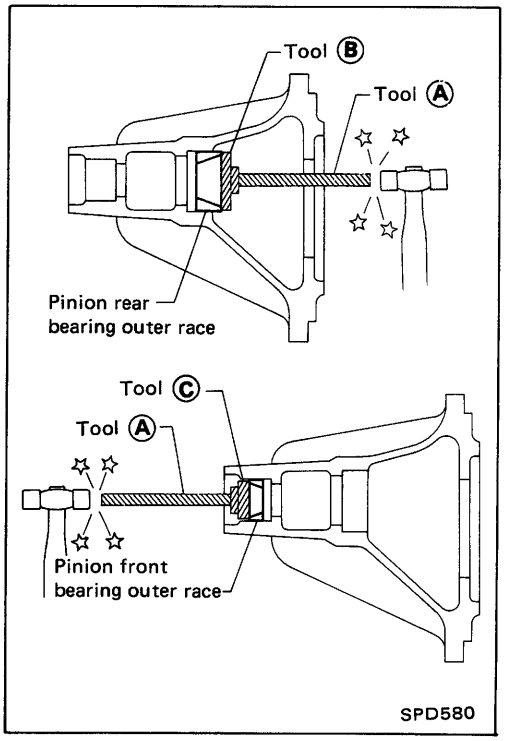


Differential Carrier

1. Press-fit front and rear bearing outer races with Tools.

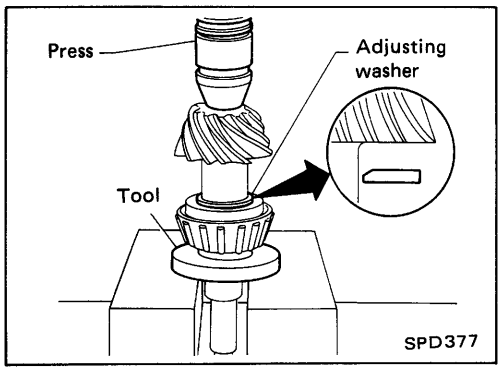
Tool number:

Ⓐ **ST30611000 (J25742-1)**
Ⓑ **ST30621000 (J25742-5)**
Ⓒ **ST30613000 (J25742-3)**

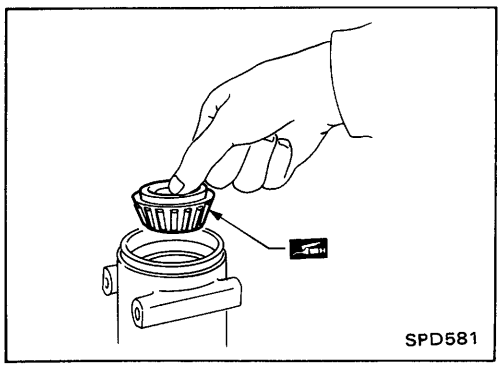


2. Select drive pinion adjusting washer, referring to ADJUSTMENT.
3. Install drive pinion adjusting washer in drive pinion, and press-fit pinion rear bearing inner cone in it with press and Tool.

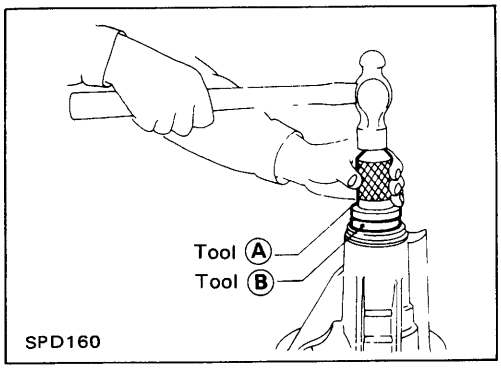
Tool number: ST30901000 (—)
Equivalent tool (J26010-01)



4. Place pinion front bearing inner cone in gear carrier.



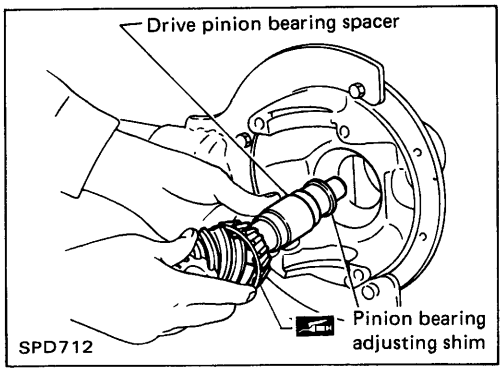
Differential Carrier (Cont'd)



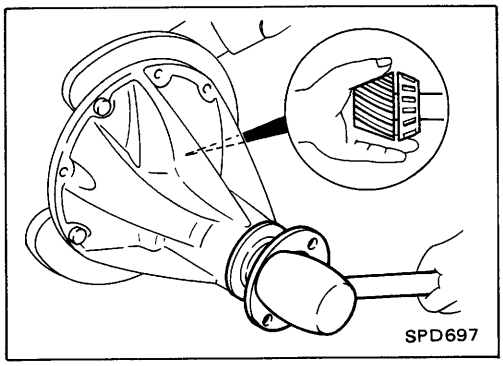
5. Apply multi-purpose grease to cavity at sealing lips of oil seal. Install front oil seal.

Tool number:

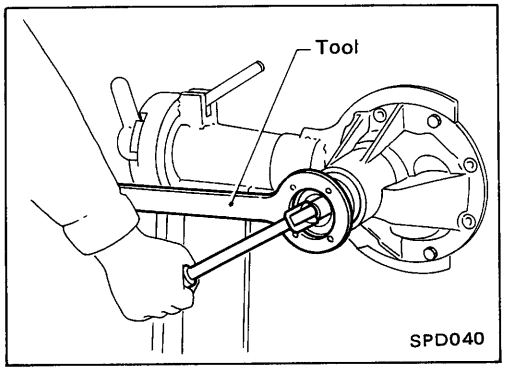
Ⓐ ST30720000 (—)
Equivalent tool (J25405)
Ⓑ KV38102510 (—)



6. Install drive pinion bearing spacer, pinion bearing adjusting shim and drive pinion in gear carrier.



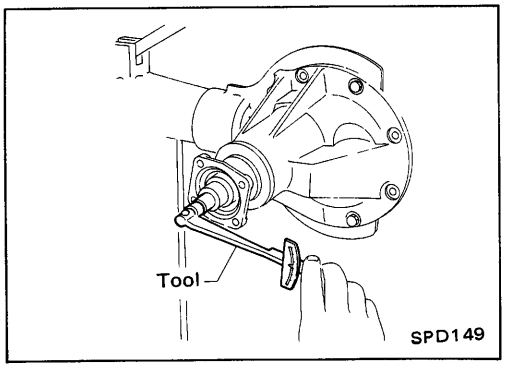
7. Insert companion flange into drive pinion by tapping the companion flange with a soft hammer.



8. Tighten pinion nut to the specified torque.

The threaded portion of drive pinion and pinion nut should be free from oil or grease.

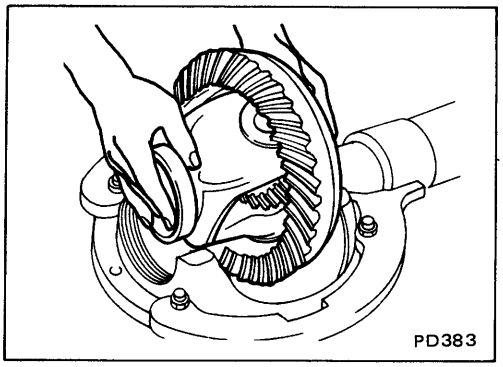
Tool number: KV38104700 (J34311)



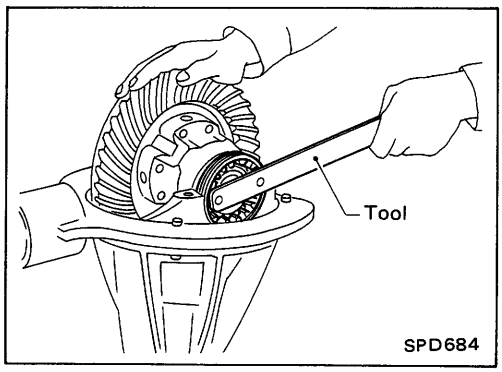
9. Turn drive pinion in both directions several times, and measure pinion bearing preload.

Tool number: ST3127S000 (See J25765-A)
Pinion bearing preload (Without front oil seal):
1.2 - 1.5 N·m
(12 - 15 kg-cm, 10 - 13 in-lb)

Differential Carrier (Cont'd)

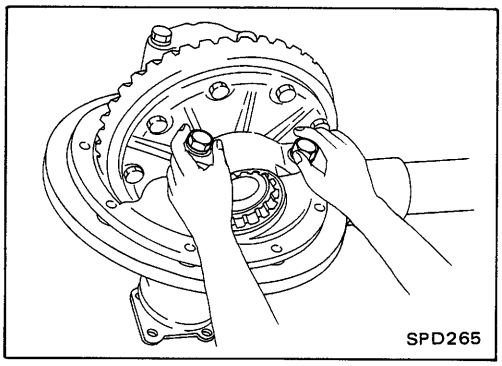

PD383

10. Install differential case assembly with side bearing outer races into gear carrier.

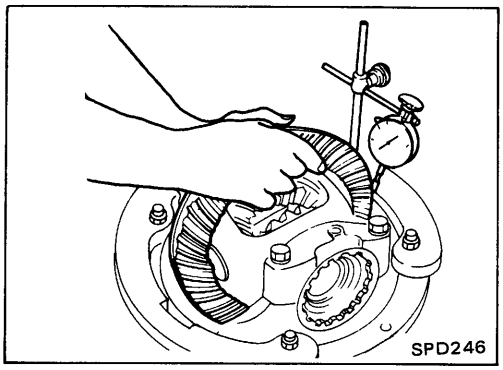


SPD684

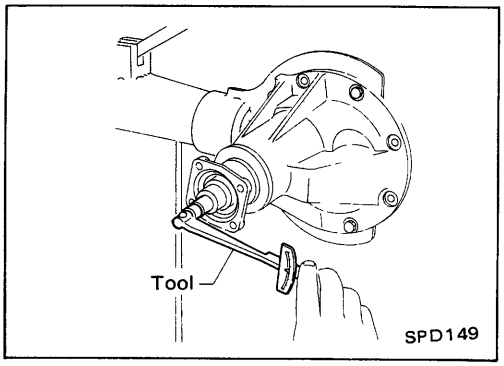
11. Position side bearing adjusters on gear carrier with threads properly engaged; screw in adjusters lightly at this stage of assembly.
    Tool number: ST32580000 (J34312)


SPD265

12. Align mark on bearing cap with that on gear carrier and install bearing cap on gear carrier.
- Do not tighten at this point to allow further tightening of side bearing adjusters.


SPD246

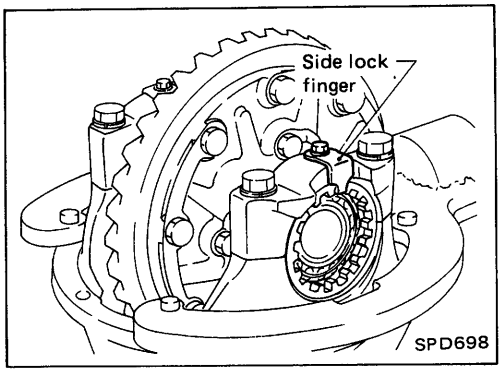
13. Tighten both right and left side bearing adjusters alternately and measure ring gear backlash and total preload at the same time. Adjust right and left side bearing adjusters by tightening them alternately so that proper ring gear backlash and total preload can be obtained.
    Ring gear-to-drive pinion backlash:
    0.15 - 0.20 mm (0.0059 - 0.0079 in)



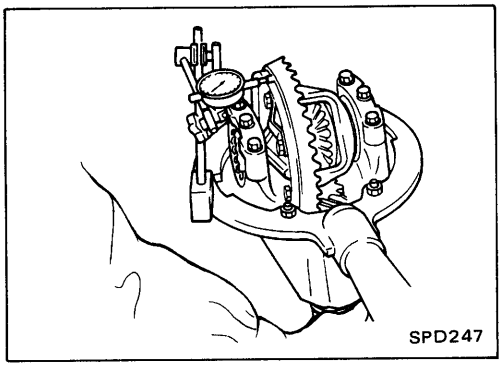
SPD149

- **When checking preload, turn drive pinion in both directions several times to set bearing rollers.**
  Tool number: ST3127S000 (See J25765-A)
  Total preload:
  1.7 - 2.5 N·m
  (17 - 25 kg-cm, 15 - 22 in-lb)

Differential Carrier (Cont'd)



14. Tighten side bearing cap bolts.
15. Install side lock finger in place to prevent rotation during operation.



16. Check runout of ring gear with a dial indicator.

    Runout limit: 0.08 mm (0.0031 in)

- If backlash varies excessively in different places, the variance may have resulted from foreign matter caught between the ring gear and the differential case.
- If the backlash varies greatly when the runout of the ring gear is within a specified range, the hypoid gear set or differential case should be replaced.

17. Check tooth contact. (Refer to ADJUSTMENT.)

Propeller Shaft

GENERAL SPECIFICATIONS

2WD models

Engine	KA24E				VG30E			
Wheel base	Standard		Long		Standard		Long	
Transmission	M/T	A/T	M/T	A/T	M/T	A/T	M/T	A/T
Propeller shaft model	3S71A				3S80B			
Number of joints	3							
Coupling method with transmission	Sleeve type							
Type of journal bearings	Shell type (non-disassembly type)				Solid type (disassembly type)			
Distance between yokes mm (in)	71 (2.80)				80 (3.15)			
Shaft length (Spider to spider) mm (in) 1st	665 (26.18)	565 (22.24)	665 (26.18)	565 (22.24)	690 (27.17)	590 (23.23)	690 (27.17)	590 (23.23)
2nd	680 (26.77)		980 (38.58)		660 (25.98)		960 (37.80)	
Shaft outer diameter mm (in) 1st	75 (2.95)							
2nd	65 (2.56)							

4WD models

Location	Front		Rear			
Wheel base	–		Standard		Long	
Engine	–		KA24E	VG30E	KA24E	VG30E
Transmission	M/T	A/T	–			
Propeller shaft model	2F71H		2S80B		3S80B	
Number of joints	2				3	
Coupling method with transmission	Flange type		Sleeve type			
Type of journal bearings	Solid type (disassembly type)					
Distance between yokes mm (in)	71 (2.80)		80 (3.15)			
Shaft length (Spider to spider) mm (in) 1st	542 (21.34)	540 (21.26)	970 (38.19)	950 (37.40)	430 (16.93)	
2nd	–				839 (33.03)	819 (32.24)
Shaft outer diameter mm (in) 1st	65 (2.56)	50.8 (2.00)	65 (2.56)	75 (2.95)	65 (2.56)	75 (2.95)
2nd	–				65 (2.56)	75 (2.95)

Propeller Shaft (Cont'd)

SERVICE DATA

Unit: mm (in)

Propeller shaft runout limit	0.6 (0.024)
Journal axial play	0.02 (0.0008) or less

Snap ring (80B)

Unit: mm (in)

Thickness	Color	Part number
1.99 (0.0783)	White	37146-C9400
2.02 (0.0795)	Yellow	37147-C9400
2.05 (0.0807)	Red	37148-C9400
2.08 (0.0819)	Green	37149-C9400
2.11 (0.0831)	Blue	37150-C9400
2.14 (0.0843)	Light brown	37151-C9400
2.17 (0.0854)	Black	37152-C9400
2.20 (0.0866)	No paint	37153-C9400

Snap ring (71H)

Unit: mm (in)

Thickness	Color	Part number
1.99 (0.0783)	White	37146-01G00
2.02 (0.0795)	Yellow	37147-01G00
2.05 (0.0807)	Red	37148-01G00
2.08 (0.0819)	Green	37149-01G00
2.11 (0.0831)	Blue	37150-01G00
2.14 (0.0843)	Light brown	37151-01G00
2.17 (0.0854)	Pink	37152-01G00
2.20 (0.0866)	No paint	37153-01G00

Differential Carrier

GENERAL SPECIFICATIONS

2WD models

Engine	KA24E		VG30E				
Vehicle type	–		Truck				Van & Wagon
Transmission	M/T	A/T	M/T	A/T	M/T	A/T	–
Body type	–		Except Heavy duty		Heavy duty		–
Final drive model Rear	H190*1		H233B				
Number of pinions	2				4		
Gear ratio	3.545	3.700		3.900	4.625	4.375	4.375 4.625*2
Number of teeth (Ring gear/drive pinion)	39/11	37/10		39/10	37/8	35/8	35/8 37/8*2
Oil capacity (Approx.) ℓ (US qt, Imp qt)	1.5 (1-5/8, 1-3/8)		2.8 (3, 2-1/2)				

*1: L.S.D. is optional as sport package.
*2: Optional tire (P235/75) equipped models.

4WD models

Engine	KA24E	VG30E		
Transmission	–	M/T	A/T	
Vehicle grade	–	–	Except SE	SE
Final drive model Front	R180A	R200A		
Rear	C200*1	H233B*1		
Gear ratio	4.111	4.375	4.375 4.625*2	4.625
Number of pinions Front	4			
Rear	4			
Number of teeth (Ring gear/drive pinion)	37/9	35/8	35/8 37/8*2	37/8
Oil capacity (Approx.) ℓ (US qt, Imp qt) Front	1.3 (1-3/8, 1-1/8)	1.5 (1-5/8, 1-3/8)		
Rear	1.3 (1-3/8, 1-1/8)	2.8 (3, 2-1/2)		

*1: L.S.D. is optional as sport package.
*2: Optional tire (31 x 10.5R15LT and P235/75) equipped models.

Final Drive

INSPECTION AND ADJUSTMENT (R180A)

Ring gear runout

Ring gear runout limit mm (in)	0.05 (0.0020)

Axle bearing adjustment

Axle bearing end play mm (in)	0 - 0.1 (0 - 0.004)

Available axle bearing adjusting shims

Thickness mm (in)	Part number
0.10 (0.0039)	38233-01G11
0.20 (0.0079)	38233-01G12
0.30 (0.0118)	38233-01G13
0.40 (0.0157)	38233-01G14

Side gear adjustment

Side gear backlash (Clearance between side gear and differential case) mm (in)	0.10 - 0.20 (0.0039 - 0.0079)

Available side gear thrust washers

Thickness mm (in)	Part number
0.775 (0.0305)	38424-W2000
0.825 (0.0325)	38424-W2001
0.875 (0.0344)	38424-W2002
0.925 (0.0364)	38424-W2003
0.975 (0.0384)	38424-W2004

Side bearing adjustment

Differential carrier assembly turning resistance N (kg, lb)	34.3 - 39.2 (3.5 - 4.0, 7.7 - 8.8)

Available side retainer adjusting shims

Thickness mm (in)	Part number
0.20 (0.0079)	38453-01G00
0.25 (0.0098)	38453-01G01
0.30 (0.0118)	38453-01G02
0.40 (0.0157)	38453-01G03
0.50 (0.0197)	38453-01G04

Total preload adjustment

Total preload N·m (kg-cm, in-lb)	1.2 - 2.3 (12 - 23, 10 - 20)
Ring gear backlash mm (in)	0.13 - 0.18 (0.0051 - 0.0071)

Drive pinion height adjustment

Available pinion height adjusting washers

Thickness mm (in)	Part number
3.09 (0.1217)	38154-B4017
3.12 (0.1228)	38154-B4018
3.15 (0.1240)	38154-B4019
3.18 (0.1252)	38154-B4020
3.21 (0.1264)	38154-E4600
3.24 (0.1276)	38154-E4601
3.27 (0.1287)	38154-E4602
3.30 (0.1299)	38154-E4603
3.33 (0.1311)	38154-E4604
3.36 (0.1323)	38154-E4605
3.39 (0.1335)	38154-E4606
3.42 (0.1346)	38154-E4607
3.45 (0.1358)	38154-E4608
3.48 (0.1370)	38154-E4609
3.51 (0.1382)	38154-E4610
3.54 (0.1394)	38154-E4611
3.57 (0.1406)	38154-E4612
3.60 (0.1417)	38154-E4613
3.63 (0.1429)	38154-E4614
3.66 (0.1441)	38154-E4615

Drive pinion preload adjustment

Drive pinion preload N·m (kg-cm, in-lb) With front oil seal	1.1 - 1.7 (11 - 17, 9.5 - 14.8)

Available drive pinion bearing adjusting washers

Thickness mm (in)	Part number
6.59 (0.2594)	38127-01G00
6.57 (0.2587)	38127-01G01
6.55 (0.2579)	38127-01G02
6.53 (0.2571)	38127-01G03
6.51 (0.2563)	38127-01G04
6.49 (0.2555)	38127-01G05
6.47 (0.2547)	38127-01G06
6.45 (0.2539)	38127-01G07
6.43 (0.2531)	38127-01G08
6.41 (0.2524)	38127-01G09
6.39 (0.2516)	38127-01G10
6.37 (0.2508)	38127-01G11
6.35 (0.2500)	38127-01G12
6.33 (0.2492)	38127-01G13
6.31 (0.2484)	38127-01G14

Available drive pinion bearing adjusting spacers

Length mm (in)	Part number
52.20 (2.0551)	38130-78500
52.40 (2.0630)	38131-78500
52.60 (2.0709)	38132-78500
52.80 (2.0787)	38133-78500
53.00 (2.0866)	38134-78500
53.20 (2.0945)	38135-78500

Final Drive (Cont'd)

INSPECTION AND ADJUSTMENT (R200A)

Ring gear runout

Ring gear runout limit mm (in)	0.05 (0.0020)

Side gear adjustment

Side gear backlash (Clearance between side gear and differential case) mm (in)	0.10 - 0.20 (0.0039 - 0.0079)

Available side gear thrust washers

Thickness mm (in)	Part number
0.775 (0.0305)	38424-E3000
0.825 (0.0325)	38424-E3001
0.875 (0.0344)	38424-E3002
0.925 (0.0364)	38424-E3003

Side bearing adjustment

Differential carrier assembly turning resistance N (kg, lb)	34.3 - 39.2 (3.5 - 4.0, 7.7 - 8.8)

Available side bearing adjusting washers

Thickness mm (in)	Part number
2.00 (0.0787)	38453-N3100
2.05 (0.0807)	38453-N3101
2.10 (0.0827)	38453-N3102
2.15 (0.0846)	38453-N3103
2.20 (0.0866)	38453-N3104
2.25 (0.0886)	38453-N3105
2.30 (0.0906)	38453-N3106
2.35 (0.0925)	38453-N3107
2.40 (0.0945)	38453-N3108
2.45 (0.0965)	38453-N3109
2.50 (0.0984)	38453-N3110
2.55 (0.1004)	38453-N3111
2.60 (0.1024)	38453-N3112

Total preload adjustment

Total preload N·m (kg-cm, in-lb)	1.4 - 3.1 (14 - 32, 12 - 28)
Ring gear backlash mm (in)	0.13 - 0.18 (0.0051 - 0.0071)

Drive pinion height adjustment

Available pinion height adjusting washers

Thickness mm (in)	Part number
3.09 (0.1217)	38154-P6017
3.12 (0.1228)	38154-P6018
3.15 (0.1240)	38154-P6019
3.18 (0.1252)	38154-P6020
3.21 (0.1264)	38154-P6021
3.24 (0.1276)	38154-P6022
3.27 (0.1287)	38154-P6023
3.30 (0.1299)	38154-P6024
3.33 (0.1311)	38154-P6025
3.36 (0.1323)	38154-P6026
3.39 (0.1335)	38154-P6027
3.42 (0.1346)	38154-P6028
3.45 (0.1358)	38154-P6029
3.48 (0.1370)	38154-P6030
3.51 (0.1382)	38154-P6031
3.54 (0.1394)	38154-P6032
3.57 (0.1406)	38154-P6033
3.60 (0.1417)	38154-P6034
3.63 (0.1429)	38154-P6035
3.66 (0.1441)	38154-P6036

Drive pinion preload adjustment

Drive pinion preload N·m (kg-cm, in-lb) With front oil seal	1.1 - 1.7 (11 - 17, 9.5 - 14.8)

Available drive pinion bearing adjusting washers

Thickness mm (in)	Part number
3.80 - 3.82 (0.1496 - 0.1504)	38125-61001
3.82 - 3.84 (0.1504 - 0.1512)	38126-61001
3.84 - 3.86 (0.1512 - 0.1520)	38127-61001
3.86 - 3.88 (0.1520 - 0.1528)	38128-61001
3.88 - 3.90 (0.1528 - 0.1535)	38129-61001
3.90 - 3.92 (0.1535 - 0.1543)	38130-61001
3.92 - 3.94 (0.1543 - 0.1551)	38131-61001
3.94 - 3.96 (0.1551 - 0.1559)	38132-61001
3.96 - 3.98 (0.1559 - 0.1567)	38133-61001
3.98 - 4.00 (0.1567 - 0.1575)	38134-61001
4.00 - 4.02 (0.1575 - 0.1583)	38135-61001
4.02 - 4.04 (0.1583 - 0.1591)	38136-61001
4.04 - 4.06 (0.1591 - 0.1598)	38137-61001
4.06 - 4.08 (0.1598 - 0.1606)	38138-61001
4.08 - 4.10 (0.1606 - 0.1614)	38139-61001

Available drive pinion bearing adjusting spacers

Length mm (in)	Part number
54.50 (2.1457)	38165-B4000
54.80 (2.1575)	38165-B4001
55.10 (2.1693)	38165-B4002
55.40 (2.1811)	38165-B4003
55.70 (2.1929)	38165-B4004
56.00 (2.2047)	38165-61001

Final Drive (Cont'd)

INSPECTION AND ADJUSTMENT (H190A)

Ring gear runout

Ring gear runout limit mm (in)	0.05 (0.0020)

Side gear adjustment

Side gear backlash (Clearance between side gear and differential case) mm (in)	0.10 - 0.20 (0.0039 - 0.0079)

Available side gear thrust washers

Conventional models

Thickness mm (in)	Part number
0.775 (0.0305)	38424-E3000
0.825 (0.0325)	38424-E3001
0.875 (0.0344)	38424-E3002
0.925 (0.0364)	38424-E3003

L.S.D. models

Thickness mm (in)	ID color	Part number
1.50 (0.0591)	None	38424-41W00
1.60 (0.0630)	White	38424-41W01
1.70 (0.0669)	Yellow	38424-41W02

– Additional service for limited slip differential model –
Differential torque adjustment

Differential torque N·m (kg-m, ft-lb)	147 - 196 (15 - 20, 108 - 145)
Number of discs and plates (One side)	
Friction disc	2
Friction plate	2
Spring disc	1
Spring plate	1
Wear limit of plate and disc mm (in)	0.1 (0.004)
Allowable warpage mm (in) Friction disc and plate	0.05 - 0.20 (0.0020 - 0.0079)

Available discs and plates

Part name	Thickness mm (in)	Part number
Friction disc	1.73 - 1.77 (0.0681 - 0.0697)	38433-N9000
	1.83 - 1.87 (0.0720 - 0.0736)	38433-N9001
Friction plate	1.73 - 1.77 (0.0681 - 0.0697)	38432-N9000
Spring disc	1.74 - 1.76 (0.0685 - 0.0693)	38436-N3210
Spring plate	1.74 - 1.76 (0.0685 - 0.0693)	38435-N3210

Drive pinion height adjustment

Available drive pinion preload adjusting washers

Thickness mm (in)	Part number
2.58 (0.1016)	38154-P6000
2.61 (0.1028)	38154-P6001
2.64 (0.1039)	38154-P6002
2.67 (0.1051)	38154-P6003
2.70 (0.1063)	38154-P6004
2.73 (0.1075)	38154-P6005
2.76 (0.1087)	38154-P6006
2.79 (0.1098)	38154-P6007
2.82 (0.1110)	38154-P6008
2.85 (0.1122)	38154-P6009
2.88 (0.1134)	38154-P6010
2.91 (0.1146)	38154-P6011
2.94 (0.1157)	38154-P6012
2.97 (0.1169)	38154-P6013
3.00 (0.1181)	38154-P6014
3.03 (0.1193)	38154-P6015
3.06 (0.1205)	38154-P6016
3.09 (0.1217)	38154-P6017
3.12 (0.1228)	38154-P6018
3.15 (0.1240)	38154-P6019
3.18 (0.1252)	38154-P6020

Drive pinion preload adjustment

Drive pinion preload N·m (kg-cm, in-lb) With front oil seal	1.1 - 1.6 (11 - 16, 9.5 - 13.9)

Side bearing adjustment

Differential carrier assembly turning resistance N (kg, lb)	34.3 - 39.2 (3.5 - 4.0, 7.7 - 8.8)

Available side bearing adjusting shims

Thickness mm (in)	Part number
0.05 (0.0020)	38453-61200
0.07 (0.0028)	38454-61200
0.10 (0.0039)	38455-61200
0.20 (0.0079)	38456-61200
0.50 (0.0197)	38457-61200

Total preload adjustment

Total preload N·m (kg-cm, in-lb)	1.2 - 2.2 (12 - 22, 10 - 19)
Ring gear backlash mm (in)	0.15 - 0.20 (0.0059 - 0.0079)

Final Drive (Cont'd)

INSPECTION AND ADJUSTMENT (C200)

Ring gear runout

Ring gear runout limit mm (in)	0.05 (0.0020)

Side gear adjustment

Side gear backlash (Clearance between side gear and differential case) mm (in)	0.10 - 0.20 (0.0039 - 0.0079)

Available side gear thrust washers

Thickness mm (in)	Part number
0.775 (0.0305)	38424-E3000
0.825 (0.0325)	38424-E3001
0.875 (0.0344)	38424-E3002
0.925 (0.0364)	38424-E3003

– Additional service for limited slip differential model –

Differential torque adjustment

Differential torque N·m (kg-m, ft-lb)	177 - 216 (18 - 22, 130 - 159)
Number of discs and plates (One side)	
Friction disc	6
Friction plate	6
Spring disc	0
Spring plate	1
Wear limit of plate and disc mm (in)	0.1 (0.004)
Allowable warpage of friction disc and plate mm (in)	0.05 - 0.15 (0.0020 - 0.0059)

Available disc and plates

Part name	Thickness mm (in)	Part number
Friction disc	1.48 - 1.52 (0.0583 - 0.0598)	38433-C6002 (Standard type)
	1.58 - 1.62 (0.0622 - 0.0638)	38433-C6003 (Adjusting type)
Friction plate	1.48 - 1.52 (0.0583 - 0.0598)	38432-C6001
Spring plate	1.48 - 1.52 (0.0583 - 0.0598)	38435-C6011

Total preload adjustment

Total preload N·m (kg-cm, in-lb)	1.2 - 2.3 (12 - 23, 10 - 20)
Ring gear backlash mm (in)	0.13 - 0.18 (0.0051 - 0.0071)

Drive pinion height adjustment

Available drive pinion preload adjusting washers

Thickness mm (in)	Part number
3.09 (0.1217)	38154-P6017
3.12 (0.1228)	38154-P6018
3.15 (0.1240)	38154-P6019
3.18 (0.1252)	38154-P6020
3.21 (0.1264)	38154-P6021
3.24 (0.1276)	38154-P6022
3.27 (0.1287)	38154-P6023
3.30 (0.1299)	38154-P6024
3.33 (0.1311)	38154-P6025
3.36 (0.1323)	38154-P6026
3.39 (0.1335)	38154-P6027
3.42 (0.1346)	38154-P6028
3.45 (0.1358)	38154-P6029
3.48 (0.1370)	38154-P6030
3.51 (0.1382)	38154-P6031
3.54 (0.1394)	38154-P6032
3.57 (0.1406)	38154-P6033
3.60 (0.1417)	38154-P6034
3.63 (0.1429)	38154-P6035
3.66 (0.1441)	38154-P6036

Drive pinion preload adjustment

Drive pinion preload N·m (kg-cm, in-lb) With front oil seal	1.1 - 1.7 (11 - 17, 9.5 - 14.8)

Side bearing adjustment

Differential carrier assembly turning resistance N (kg, lb)	34.3 - 39.2 (3.5 - 4.0, 7.7 - 8.8)

Available side retainer adjusting shims

Thickness mm (in)	Part number
2.00 (0.0787)	38453-N3100
2.05 (0.0807)	38453-N3101
2.10 (0.0827)	38453-N3102
2.15 (0.0846)	38453-N3103
2.20 (0.0866)	38453-N3104
2.25 (0.0886)	38453-N3105
2.30 (0.0906)	38453-N3106
2.35 (0.0925)	38453-N3107
2.40 (0.0945)	38453-N3108
2.45 (0.0965)	38453-N3109
2.50 (0.0984)	38453-N3110
2.55 (0.1004)	38453-N3111
2.60 (0.1024)	38453-N3112

Final Drive (Cont'd)

INSPECTION AND ADJUSTMENT (H233B)

Ring gear runout

Ring gear runout limit mm (in)	0.08 (0.0031)

Side gear adjustment

Side gear backlash (Clearance between side gear and differential case) mm (in)	0.10 - 0.20 (0.0039 - 0.0079)

Available side gear thrust washers

Thickness mm (in)	Part number
1.75 (0.0689)	38424-T5000
1.80 (0.0709)	38424-T5001
1.85 (0.0728)	38424-T5002

– Additional service for limited slip differential model –

Differential torque adjustment

Differential torque N·m (kg-m, ft-lb)	353 - 392 (36 - 40, 260 - 289)
Number of discs and plates (One side)	
Friction disc	5
Friction plate	6
Spring disc	1
Spring plate	1
Wear limit of plate and disc mm (in)	0.1 (0.004)
Allowable warpage of friction disc and plate mm (in)	0.05 - 0.15 (0.0020 - 0.0059)

Available discs and plates

Part name	Thickness mm (in)	Part number
Friction disc	1.48 - 1.52 (0.0583 - 0.0598)	38433-C6000 (Standard type)
	1.58 - 1.62 (0.0622 - 0.0638)	38433-C6001 (Adjusting type)
Friction plate	1.48 - 1.52 (0.0583 - 0.0598)	38432-C6000
Spring disc	1.48 - 1.52 (0.0583 - 0.0598)	38436-C6000
Spring plate	1.48 - 1.52 (0.0583 - 0.0598)	38435-C6010

Drive pinion height adjustment

Available pinion height adjusting washers

Thickness mm (in)	Part number
2.58 (0.1016)	38151-01J00
2.61 (0.1028)	38151-01J01
2.64 (0.1039)	38151-01J02
2.67 (0.1051)	38151-01J03
2.70 (0.1063)	38151-01J04
2.73 (0.1075)	38151-01J05
2.76 (0.1087)	38151-01J06
2.79 (0.1098)	38151-01J07
2.82 (0.1110)	38151-01J08
2.85 (0.1122)	38151-01J09
2.88 (0.1134)	38151-01J10
2.91 (0.1146)	38151-01J11
2.94 (0.1157)	38151-01J12
2.97 (0.1169)	38151-01J13
3.00 (0.1181)	38151-01J14
3.03 (0.1193)	38151-01J15
3.06 (0.1205)	38151-01J16
3.09 (0.1217)	38151-01J17
3.12 (0.1228)	38151-01J18
3.15 (0.1240)	38151-01J19
3.18 (0.1252)	38151-01J60
3.21 (0.1264)	38151-01J61
3.24 (0.1276)	38151-01J62
3.27 (0.1287)	38151-01J63
3.30 (0.1299)	38151-01J64
3.33 (0.1311)	38151-01J65
3.36 (0.1323)	38151-01J66
3.39 (0.1335)	38151-01J67
3.42 (0.1346)	38151-01J68
3.45 (0.1358)	38151-01J69
3.48 (0.1370)	38151-01J70
3.51 (0.1382)	38151-01J71
3.54 (0.1394)	38151-01J72
3.57 (0.1406)	38151-01J73
3.60 (0.1417)	38151-01J74
3.63 (0.1429)	38151-01J75
3.66 (0.1441)	38151-01J76

Final Drive (Cont'd)

Drive pinion preload adjustment

Drive pinion preload N·m (kg-cm, in-lb) Without front oil seal	1.2 - 1.5 (12 - 15, 10 - 13)

Available front drive pinion bearing adjusting shims

Thickness mm (in)	Part number
2.31 (0.0909)	38125-82100
2.33 (0.0917)	38126-82100
2.35 (0.0925)	38127-82100
2.37 (0.0933)	38128-82100
2.39 (0.0941)	38129-82100
2.41 (0.0949)	38130-82100
2.43 (0.0957)	38131-82100
2.45 (0.0965)	38132-82100
2.47 (0.0972)	38133-82100
2.49 (0.0980)	38134-82100
2.51 (0.0988)	38135-82100
2.53 (0.0996)	38136-82100
2.55 (0.1004)	38137-82100
2.57 (0.1012)	38138-82100
2.59 (0.1020)	38139-82100

Available drive pinion bearing adjusting spacers

Length mm (in)	Part number
4.50 (0.1772)	38165-76000
4.75 (0.1870)	38166-76000
5.00 (0.1969)	38167-76000
5.25 (0.2067)	38166-01J00
5.50 (0.2165)	38166-01J10

Total preload adjustment

Total preload N·m (kg-cm, in-lb)	1.7 - 2.5 (17 - 25, 15 - 22)
Ring gear backlash mm (in)	0.15 - 0.20 (0.0059 - 0.0079)

FRONT AXLE & FRONT SUSPENSION

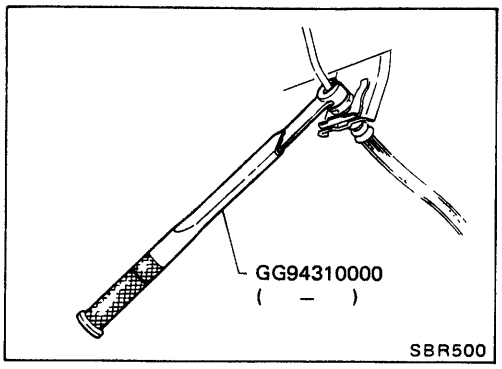
SECTION FA

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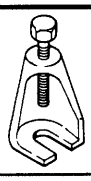
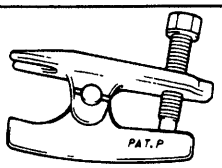
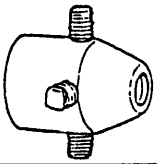
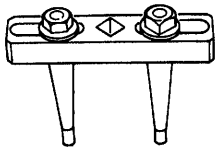
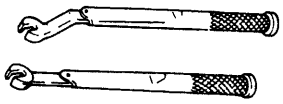
When you read wiring diagrams:

- **Read GI section, "HOW TO READ WIRING DIAGRAMS".**
- **See EL section, "POWER SUPPLY ROUTING" for power distribution circuit.**



(1) When installing each rubber part, final tightening must be carried out under unladen condition* with tires on ground.
    * Fuel, raidator coolant and engine oil full. Spare tire, jack, hand tools and mats in designated positions.
(2) When removing each suspension part, check wheel alignment and adjust if necessary.
(3) Use Tool when removing or installing brake tubes.

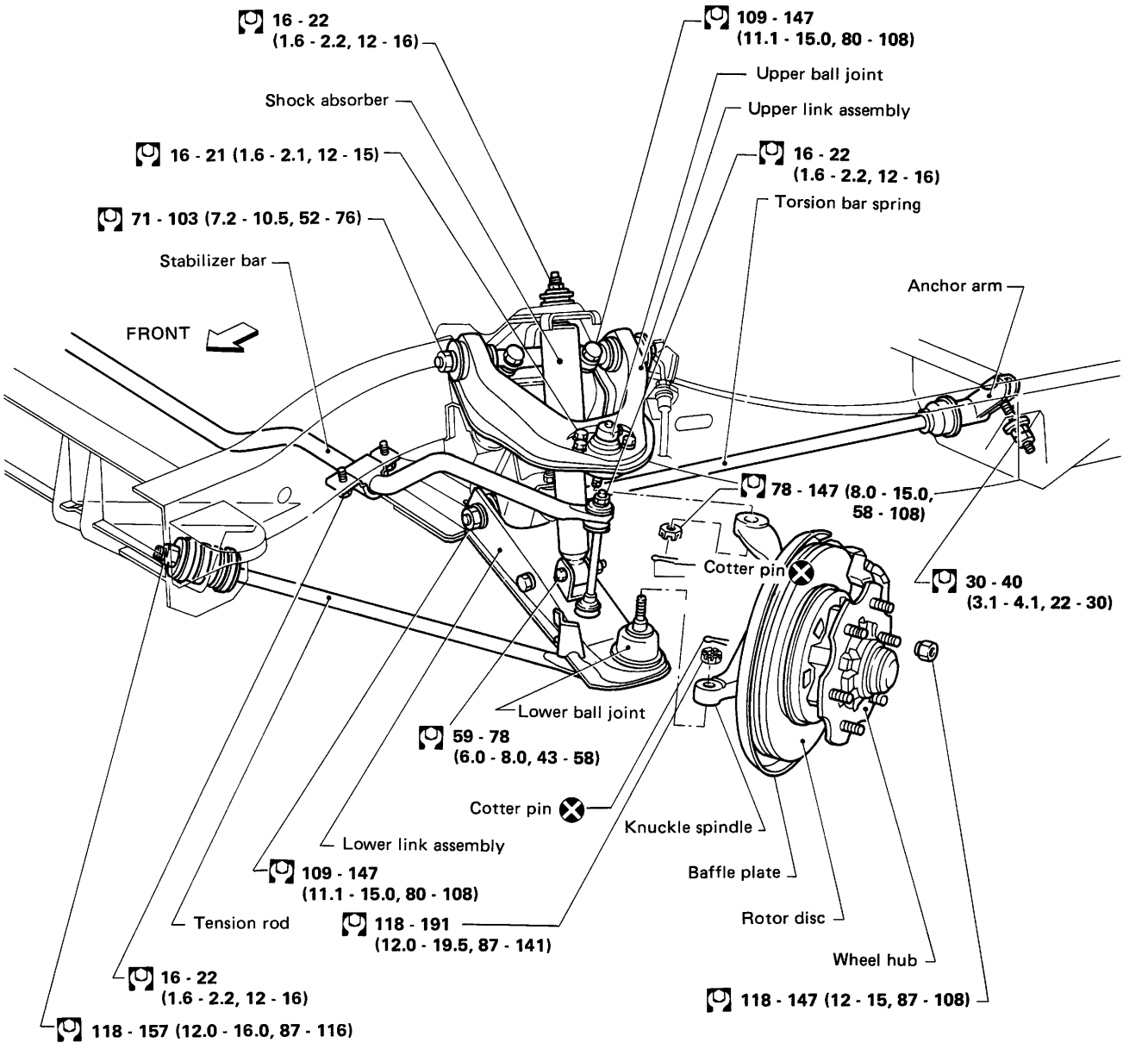
SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.) Tool name	Description		Unit application	
			2WD Trucks	Except 2WD Trucks
ST29020001 (J24319-01) Gear arm puller		Removing ball joint for knuckle spindle	X	X
HT72520000 (J25730-A) Ball joint remover		Removing tie-rod outer end	X	X
KV401021S0 (–) Bearing race drift		Installing wheel bearing outer race	X	–
KV40105400 (J36001) Wheel bearing lock nut wrench		Removing or installing wheel bearing lock nut	–	X
GG94310000 (–) Flare nut torque wrench		Removing and installing brake piping	X	X

2WD TRUCKS

When installing each rubber part, final tightening must be carried out under unladen condition* with tires on ground.

*** Fuel, radiator coolant and engine oil full. Spare tire, jack, hand tools and mats in designated positions.**

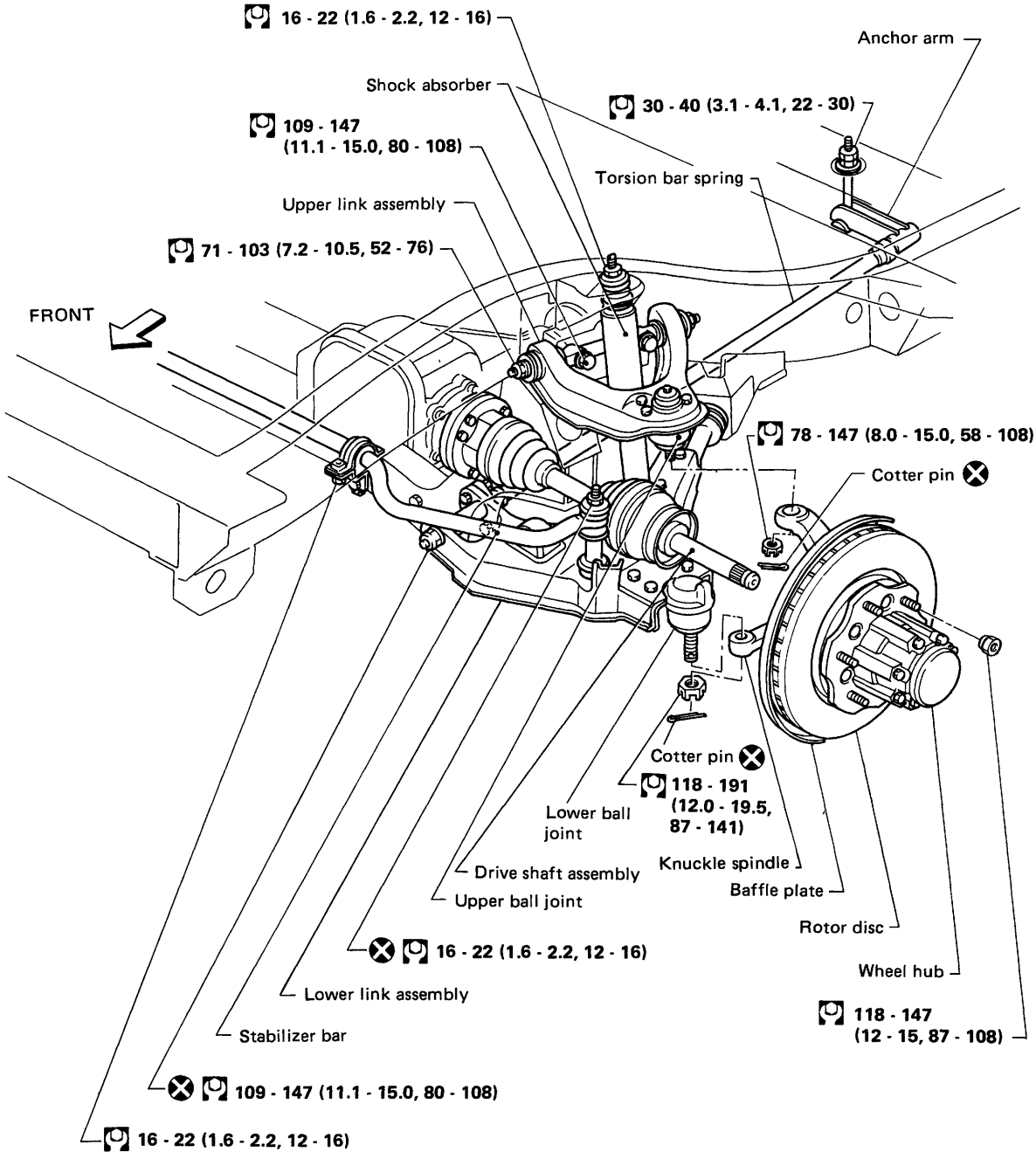


SFA872A

4WD

When installing each rubber part, final tightening must be carried out under unladen condition* with tires on ground.

*** Fuel, radiator coolant and engine oil full. Spare tire, jack, hand tools and mats in designated positions.**



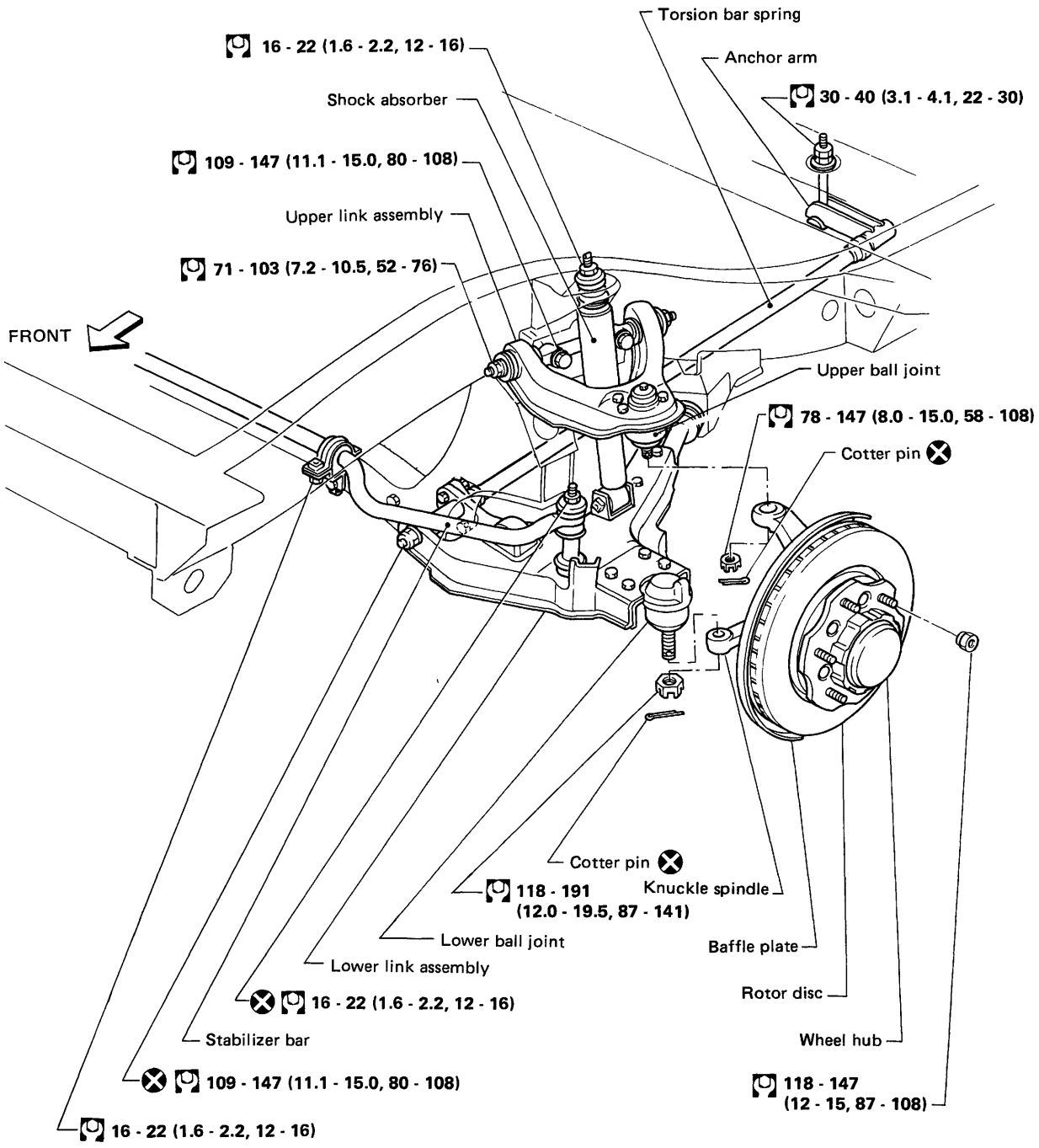
: N·m (kg-m, ft-lb)

SFA873A

2WD PATHFINDER

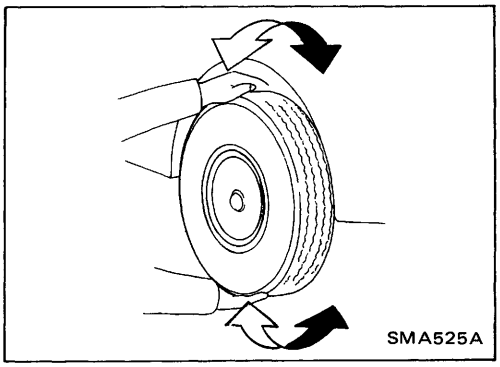
When installing each rubber part, final tightening must be carried out under unladen condition* with tires on ground.

*** Fuel, radiator coolant and engine oil full. Spare tire, jack, hand tools and mats in designated positions.**



: N·m (kg-m, ft-lb)

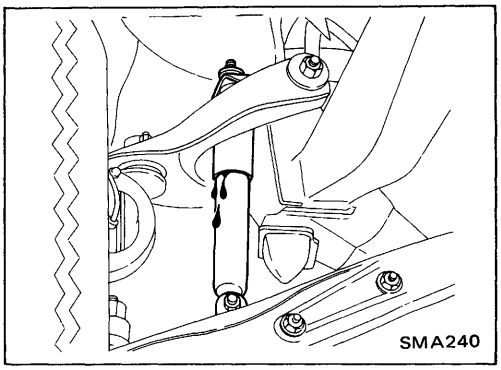
SFA874A


SMA525A

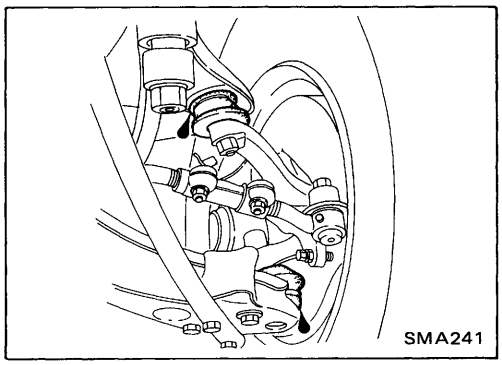
Front Axle and Front Suspension Parts

- Check front axle and front suspension parts for looseness, cracks, wear or other damage.

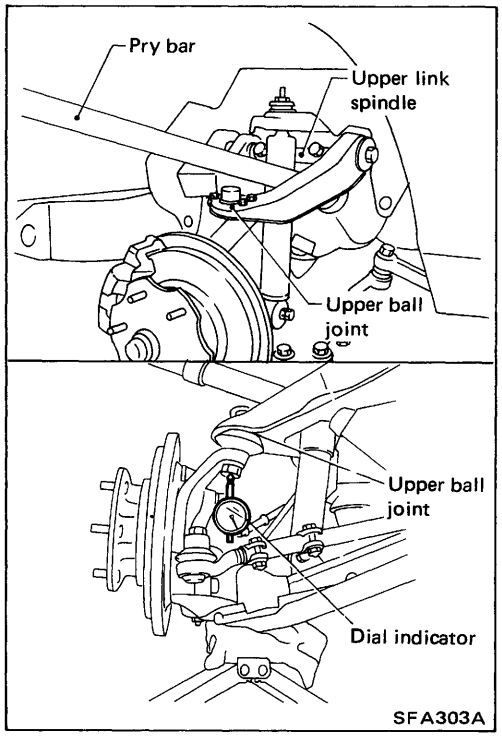
(1) Shake each front wheel.
(2) Make sure that cotter pin is inserted.
(3) Retighten all nuts and bolts to the specified torque.
Refer to FRONT SUSPENSION.
(4) Check front axle and front suspension parts for wear, cracks or other damage.


SMA240

- Check shock absorber for oil leakage or other damage.


SMA241

- Check suspension ball joint for grease leakage and ball joint dust cover for cracks or other damage.

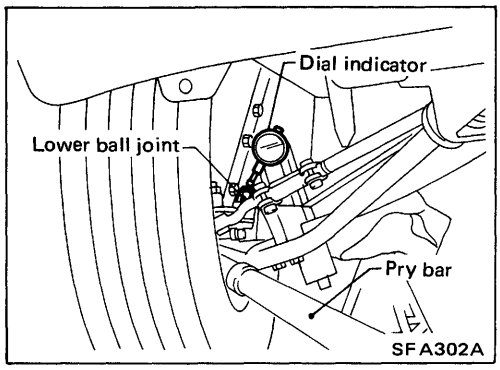


SFA303A

- Check ball joint for vertical end play.
Upper ball joint:
1.6 mm (0.063 in) or less

(1) Jack up front of vehicle and set the stands.
(2) Clamp dial indicator onto transverse link and place indicator tip on lower edge of brake caliper.
(3) Make sure front wheels are straight and brake pedal is depressed.
(4) Place a pry bar between transverse link and inner rim of road wheel.
(5) While pushing and releasing pry bar, observe maximum dial indicator value.
(6) If ball joint movement is beyond specifications, remove and recheck it.

Front Axle and Front Suspension Parts (Cont'd)



Lower ball joint:

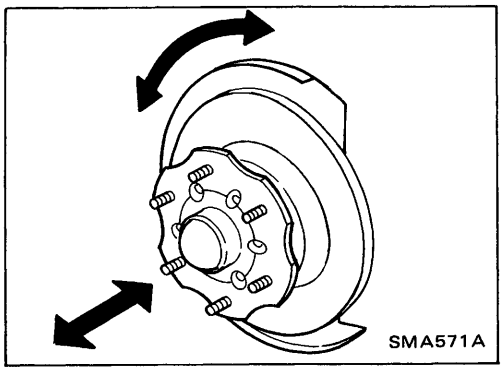
[2WD Trucks]

1.6 mm (0.063 in) or less

[Except 2WD Trucks]

0.5 mm (0.020 in) or less

(1) Jack up front of vehicle and set the stands.
(2) Remove road wheel.
(3) Clamp dial indicator onto upper link and place indicator tip on knuckle near ball joint.
(4) Jack up lower link [Approx. 20 mm (0.79 in).]
(5) Place a pry bar between upper link and upper link spindle.
(6) While pushing and releasing pry bar, observe maximum dial indicator value.
(7) If ball joint movement is beyond specifications, remove and recheck it.



Front Wheel Bearing

- Check that wheel bearings operate smoothly.
- Check axial end play.

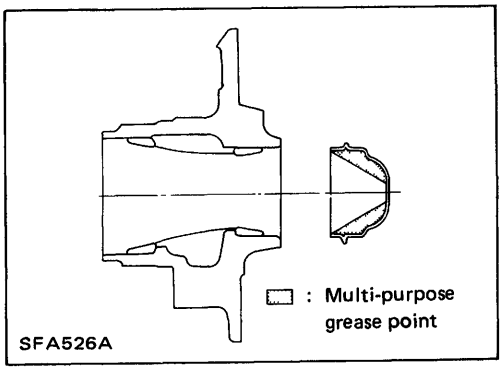
  Axial end play: 0 mm (0 in)
- Adjust wheel bearing preload if there is any axial end play or wheel bearing does not turn smoothly.

PRELOAD ADJUSTMENT (2WD Trucks)

Adjust wheel bearing preload after wheel bearing has been replaced or front axle has been reassembled.

Adjust wheel bearing preload as follows.

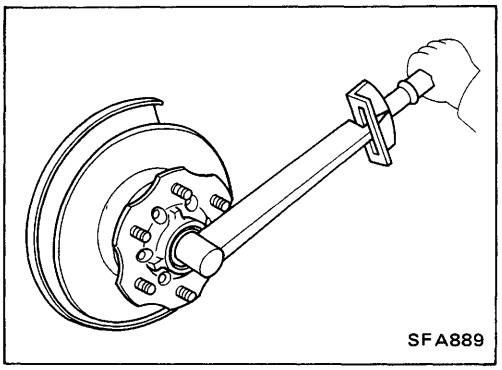
1. Before adjustment, thoroughly clean all parts to prevent dirt entry.



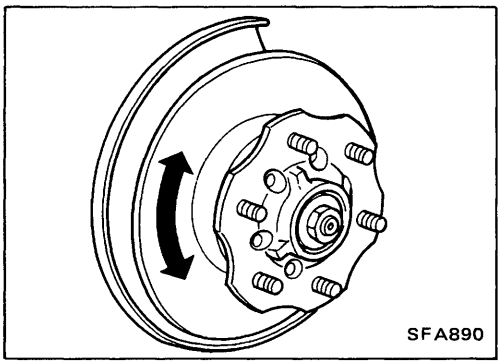
2. Apply multi-purpose grease sparingly to the following parts:

- Rubbing surface of spindle
- Contact surface between lock washer and outer wheel bearing
- Hub cap (as shown at left)
- Grease seal lip

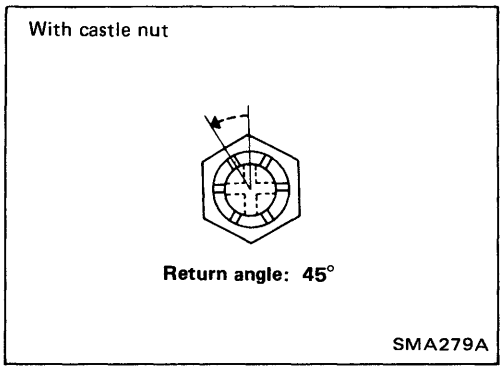
Front Wheel Bearing (Cont'd)


SFA889

3. Tighten wheel bearing lock nut to the specified torque.
   [O] : 34 - 39 N·m (3.5 - 4.0 kg-m, 25 - 29 ft-lb)

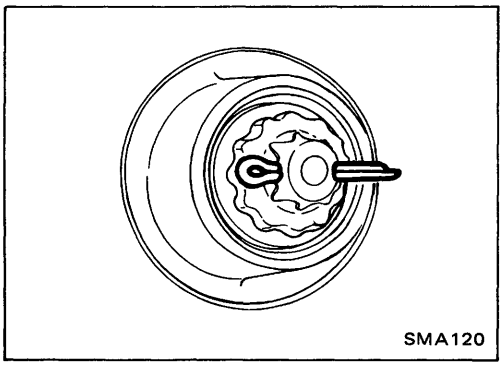

SFA890

4. Turn wheel hub several times in both directions to seat wheel bearing correctly.
5. Again tighten wheel bearing lock nut to the specified torque.
   [O] : 34 - 39 N·m (3.5 - 4.0 kg-m, 25 - 29 ft-lb)

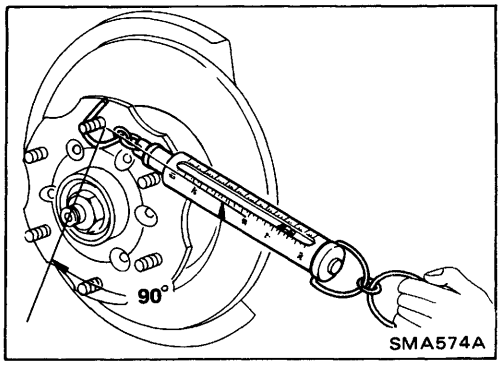


SMA279A

6. Turn back wheel bearing lock nut 45 degrees.


SMA120

7. Fit adjusting cap and new cotter pin. Align cotter pin slot by loosening nut 15 degrees or less.

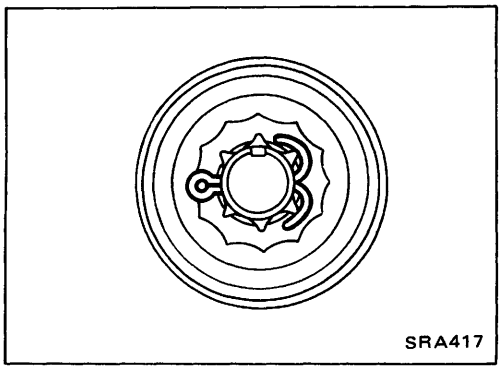


SMA574A

8. Measure wheel bearing preload and axial end play.
   Axial end play: 0 mm (0 in)
   Wheel bearing preload
   (As measured at wheel hub bolt):
   [New grease seal]
   9.8 - 28.4 N (1.0 - 2.9 kg, 2.2 - 6.4 lb)
   [Used grease seal]
   9.8 - 23.5 N (1.0 - 2.4 kg, 2.2 - 5.3 lb)

Repeat above procedures until correct bearing preload is obtained.

Front Wheel Bearing (Cont'd)


SRA417

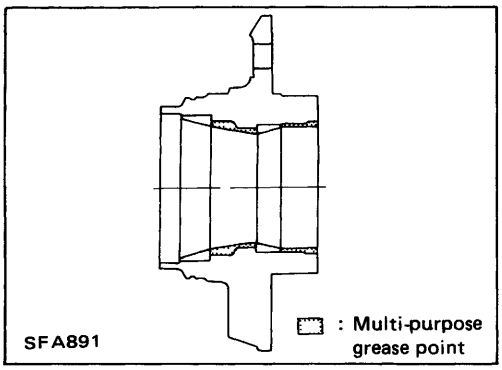
9. Spread cotter pin.
10. Install hub cap.

PRELOAD ADJUSTMENT (Except 2WD Trucks)

Adjust wheel bearing preload after wheel bearing has been replaced or front axle has been reassembled.

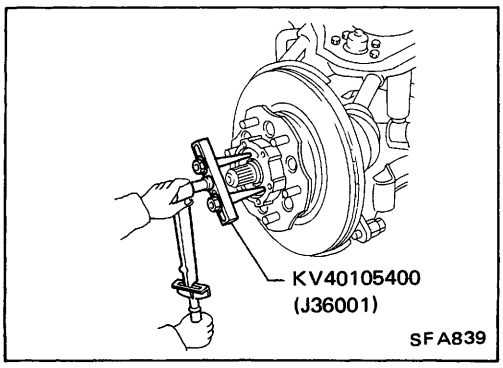
Adjust wheel bearing preload as follows:

1. Before adjustment, thoroughly clean all parts to prevent dirt entry.



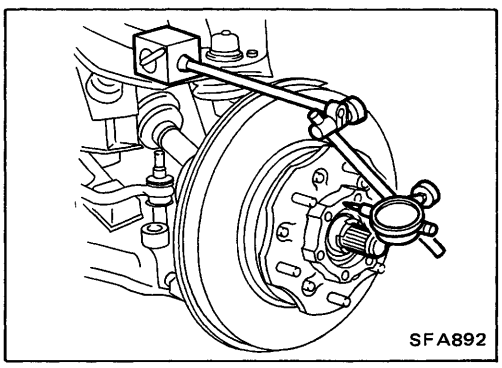
SFA891

2. Apply multi-purpose grease sparingly to the following parts:
- Threaded portion of spindle
- Contact surface between wheel bearing washer and outer wheel bearing
- Grease seal lip
- Wheel hub (as shown at left)



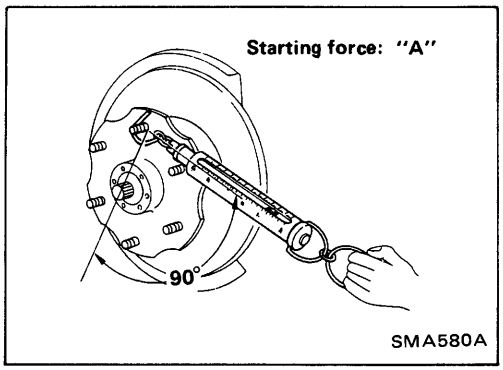
SFA839

3. Tighten wheel bearing lock nut with Tool.
   : 78 - 98 N·m
   (8 - 10 kg-m, 58 - 72 ft-lb)
4. Turn wheel hub several times in both directions.
5. Loosen wheel bearing lock nut so that torque becomes 0 N·m (0 kg-m, 0 ft-lb).
6. Retighten wheel bearing lock nut with Tool.
   : 0.5 - 1.5 N·m
   (0.05 - 0.15 kg-m, 0.4 - 1.1 ft-lb)

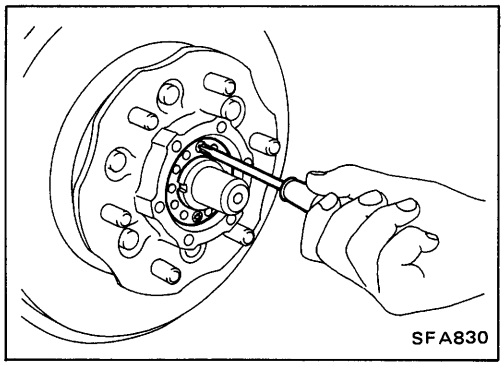

SFA892

7. Turn wheel hub several times in both directions.
8. Retighten wheel bearing lock nut with Tool.
   : 0.5 - 1.5 N·m
   (0.05 - 0.15 kg-m, 0.4 - 1.1 ft-lb)
9. Measure wheel bearing axial end play.
   Axial end play: 0 mm (0 in)

Front Wheel Bearing (Cont'd)



10. Measure starting force "A" at wheel hub bolt.



11. Install lock washer by tightening the lock nut within 15 to 30 degrees.
12. Turn wheel hub several times in both directions to seat wheel bearing correctly.
13. Measure starting force "B" at wheel hub bolt. Refer to procedure 10.
14. Wheel bearing preload "C" can be calculated as shown below.

$$C = B - A$$

Wheel bearing preload "C":
7.06 - 20.99 N
(0.72 - 2.14 kg, 1.59 - 4.72 lb)

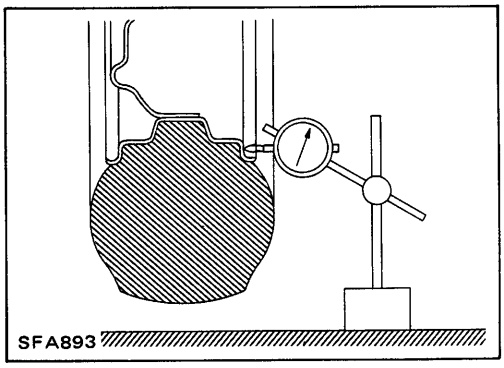
15. Repeat above procedures until correct axial end play and wheel bearing preload are obtained.
16. Install free-running hub and brake pads.

Front Wheel Alignment

Before checking front wheel alignment, be sure to make a preliminary inspection.

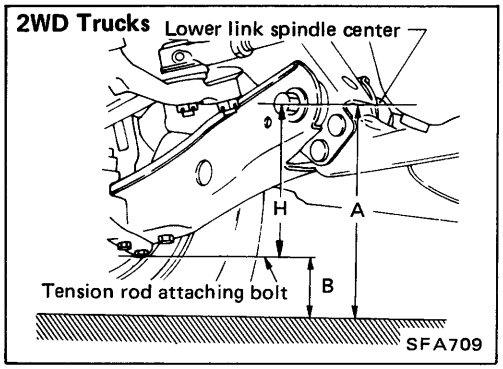
PRELIMINARY INSPECTION

1. Check the tires for wear and proper inflation.

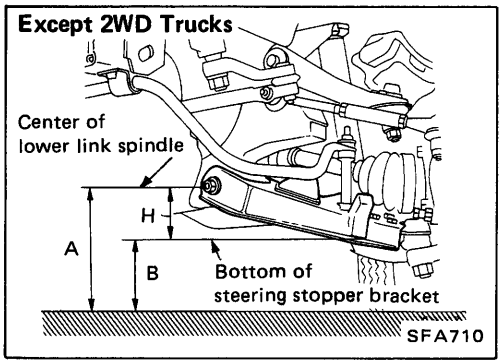


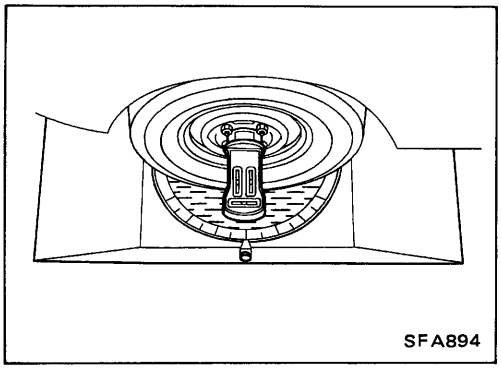
2. Check the wheel runout.
   Wheel runout:
   Refer to S.D.S.
3. Check the front wheel bearings for looseness.
4. Check the front suspension for looseness.
5. Check the steering linkage for loosensss.
6. Check that the front shock absorbers work properly by using the standard bounce test.

Front Wheel Alignment (Cont'd)



7. Measure vehicle height (Unladen): H = A – B mm (in)
   Refer to S.D.S.
(1) Exercise the front suspension by bouncing the front of the vehicle 4 or 5 times to ensure that the vehicle is in a neutral height attitude.
(2) Measure wheel alignment.
   (Refer to ALLOWABLE LIMIT on S.D.S.)
(3) If wheel alignment is not as specified, adjust vehicle posture.
   (Refer to ADJUSTING RANGE on S.D.S.)
(4) Adjust wheel alignment.
   (Refer to ADJUSTING RANGE on S.D.S.)

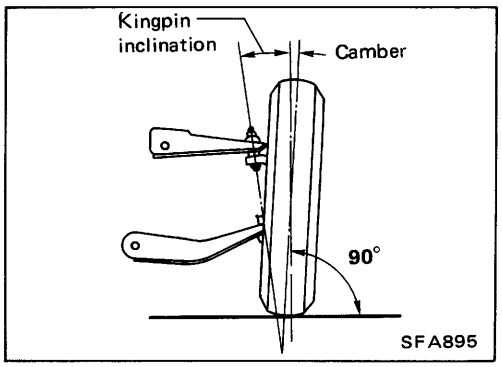




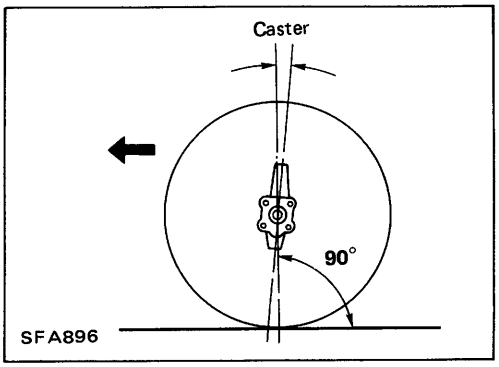
CAMBER, CASTER AND KINGPIN INCLINATION

Before checking camber, caster or kingpin inclination, move vehicle up and down on turning radius gauge to minimize friction. Ensure that vehicle is in correct posture.

- **Measure camber, caster and kingpin inclination of both right and left wheels with a suitable alignment gauge and adjust in accordance with the following procedures.**

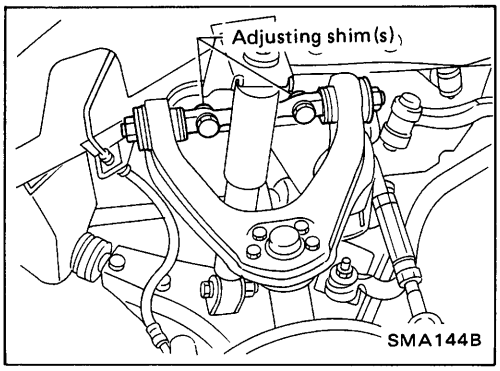


Camber (Unladen):
Refer to S.D.S.
Kingpin inclination (Unladen):
Refer to S.D.S.



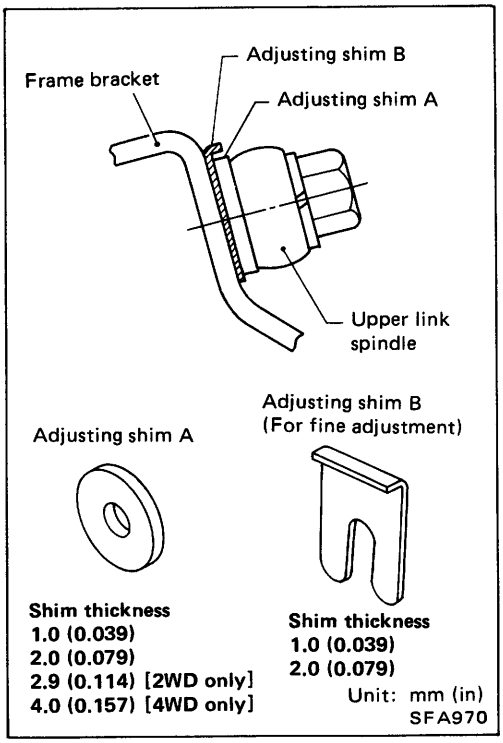
Caster (Unladen):
Refer to S.D.S.

Front Wheel Alignment (Cont'd)



ADJUSTMENT

Both camber and caster angles are adjusted by increasing or decreasing the number of adjusting shims inserted between upper link spindle and frame.



Before removing or installing adjusting shim(s), be sure to place a jack under lower link.

Adjusting shim standard thickness:

2WD Trucks

2.9 mm (0.114 in)

Except 2WD Trucks

4.0 mm (0.157 in)

- **Do not use three or more shims at one place.**
- **When installing shim B, always face the pawl towards spindle and insert them from bracket side. Use only one shim in a place.**
- **Total thickness of shims must be within 8.0 mm (0.315 in).**
- **Difference of total thickness of the front and rear must be within 2.0 mm (0.079 in).**
- **Determine thickness and number of shims necessary for adjusting camber and caster, in acoordance with the following graph.**

[Example]

(1) When service data value minus measured value is equal to:

Caster angle: –30'

Camber angle: +30'

(2) Obtain the intersecting point of lines in accordance with the graph.

(3) Choose shims which are nearest to the intersecting point.

(4) For the above example:

2WD Trucks:

Add 2.0 mm (0.079 in) shim on front side.

Add 3.0 mm (0.118 in) shim on rear side.

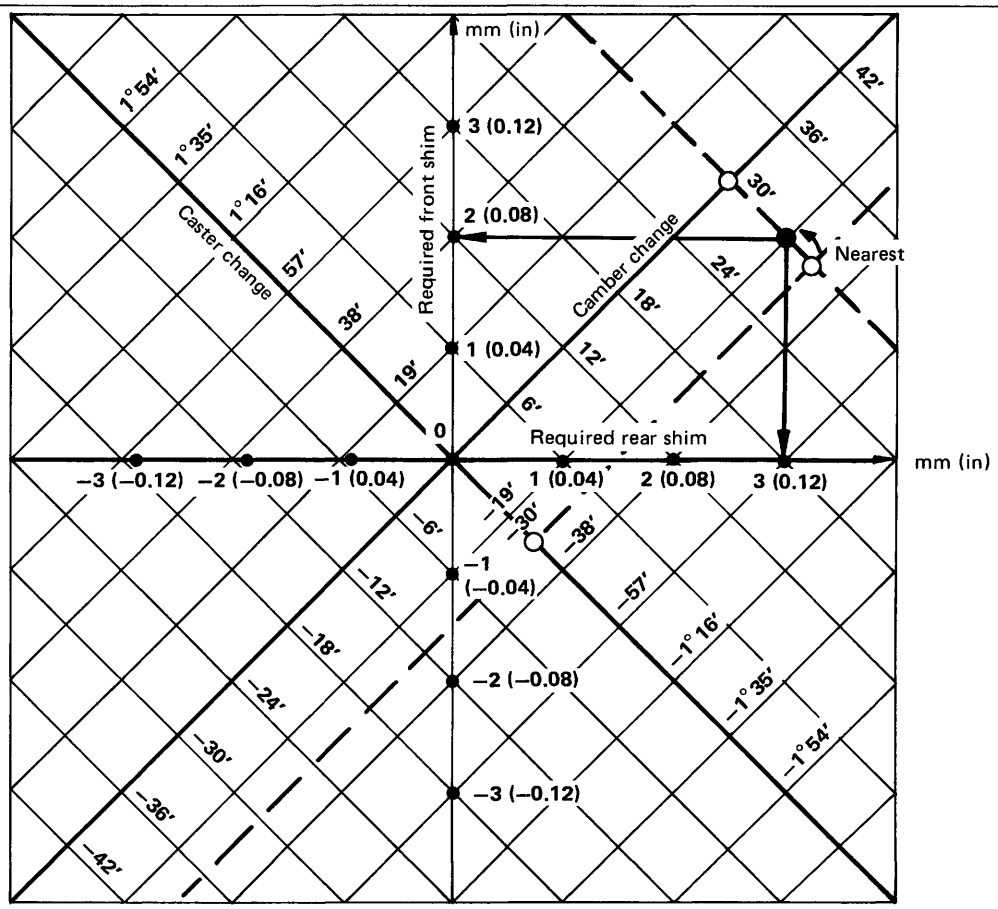
Except 2WD Trucks:

Add 1.0 mm (0.039 in) shim on front side.

Add 3.0 mm (0.118 in) shim on rear side.

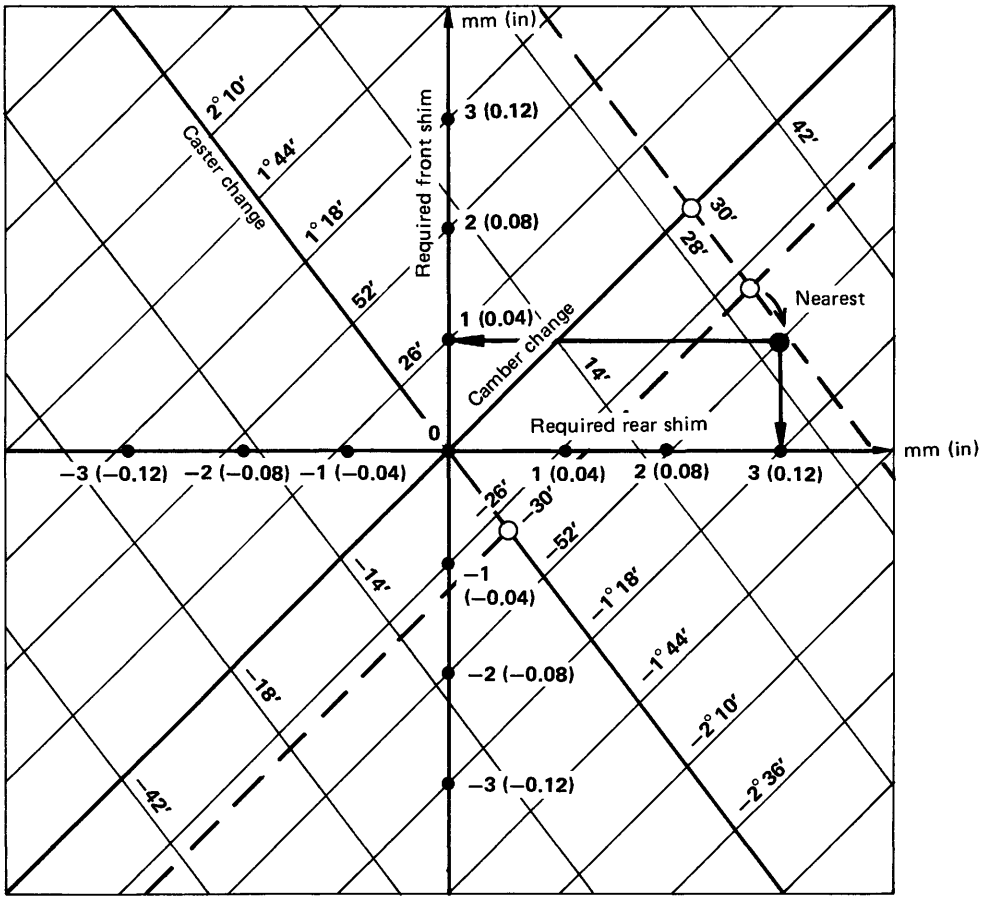
Front Wheel Alignment (Cont'd)

2WD Trucks



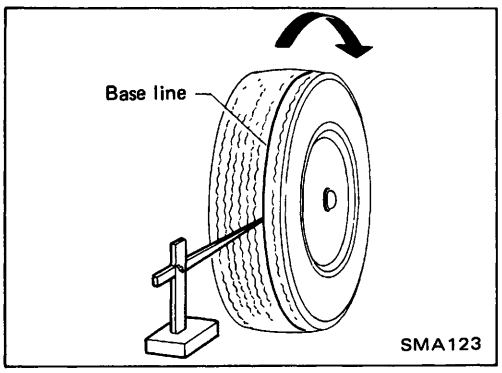
SFA878A

Except 2WD Trucks



SFA879A

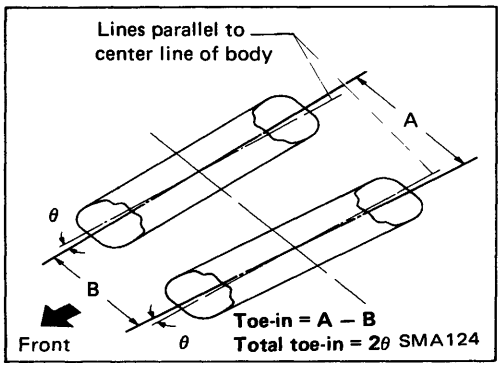
Front Wheel Alignment (Cont'd)



TOE-IN

1. Mark a base line across the tread.

After lowering front of vehicle, move it up and down to eliminate friction, and set steering wheel in straight ahead position.

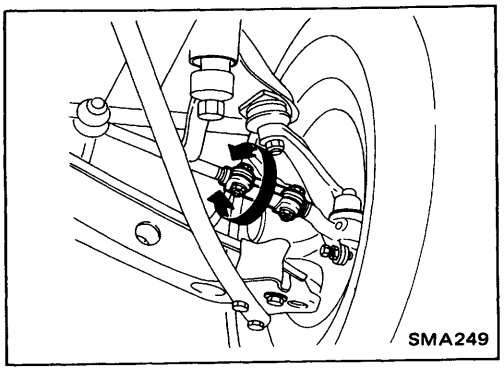


2. Measure toe-in.

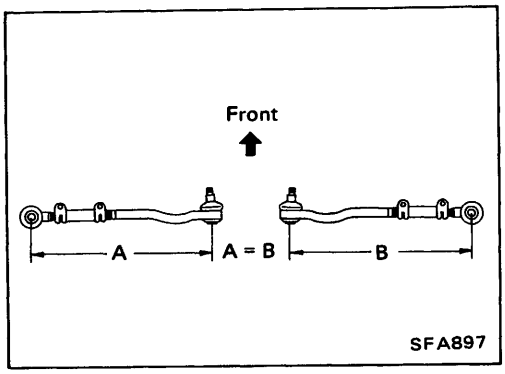
Measure distance "A" and "B" at the same height as hub center.

Toe-in (Unladen):

Refer to S.D.S.



3. Adjust toe-in by varying the length of steering tie-rods.
(1) Loosen clamp bolts or lock nuts.
(2) Adjust toe-in by turning the left and right tie-rod tubes an equal amount.



Make sure that the tie-rod bars are screwed into the tie-rod tube more than 35 mm (1.38 in).

Make sure that the tie-rods are the same length.

Standard length (A = B):

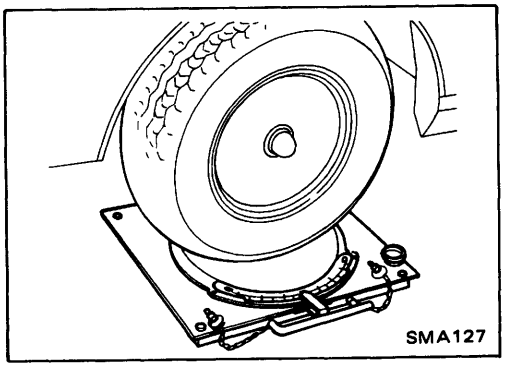
2WD Trucks

344 mm (13.54 in)

Except 2WD Trucks

281 mm (11.06 in)

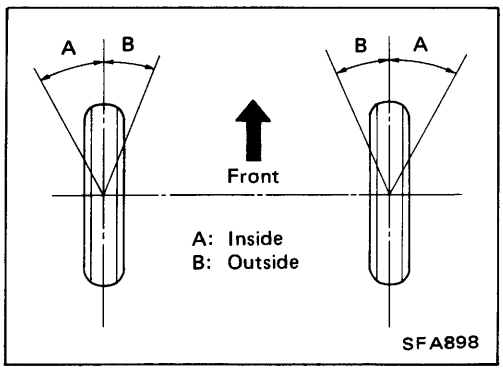
(3) Tighten clamp bolts or lock nuts, then torque them.



FRONT WHEEL TURNING ANGLE

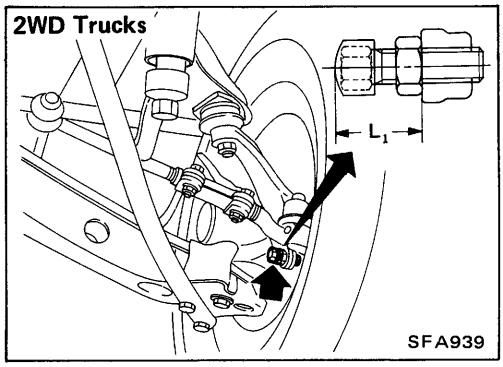
1. Set wheels in straight ahead position and then move vehicle forward until front wheels rest on turning radius gauge properly.

Front Wheel Alignment (Cont'd)



2. Rotate steering wheel all the way right and left; measure turning angle.

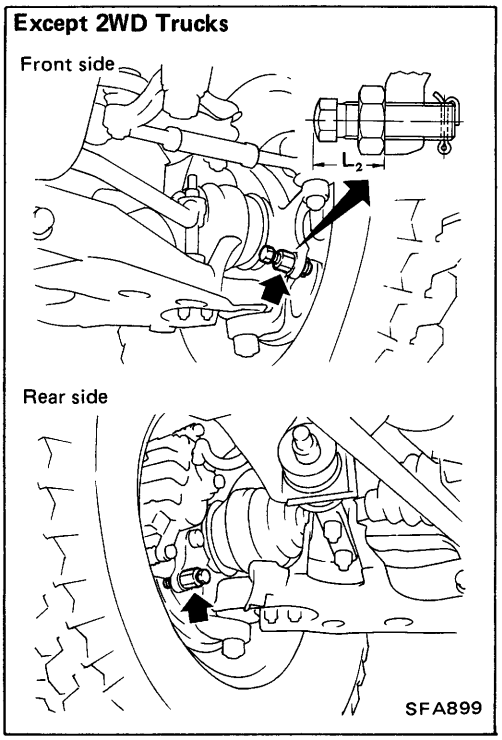
Wheel turning angle: Refer to S.D.S.



3. Adjust by stopper bolt if necessary.

[2WD Trucks]

Standard length "L_1": 20 mm (0.79 in)



[Except 2WD Trucks]

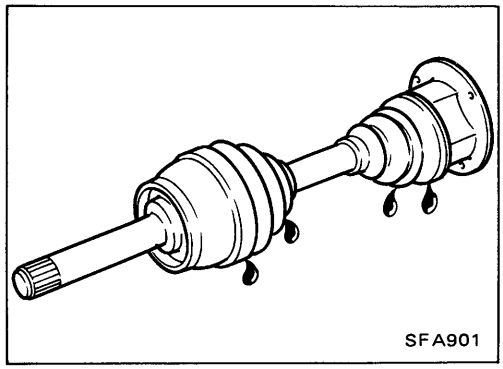
Standard length "L_2":

26.5 mm (1.043 in)

[Except tire size: 31x10.5R15]

37.5 mm (1.476 in)

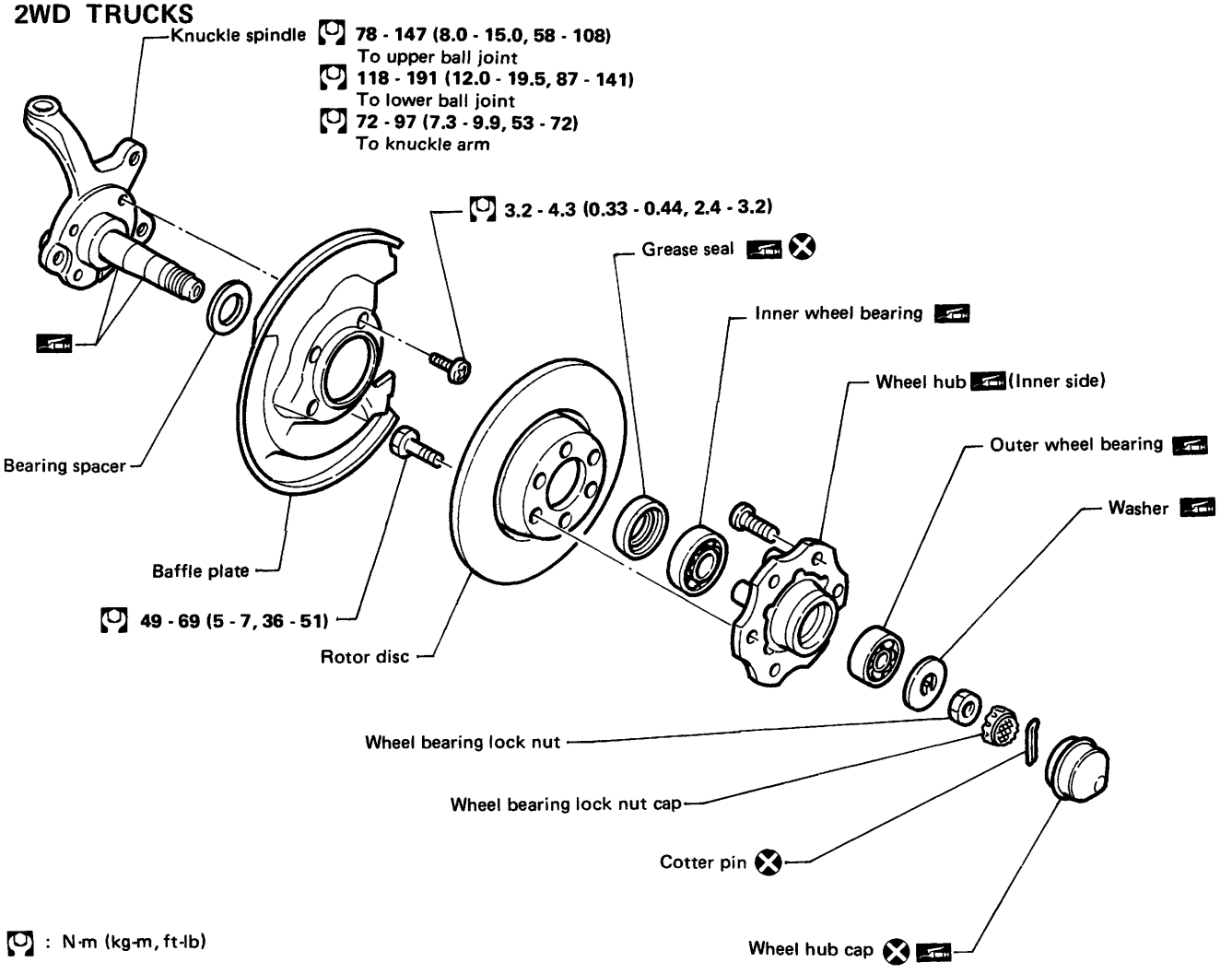
[Tire size: 31x10.5R15]



Drive Shaft

- Check for grease leakage or other damage.

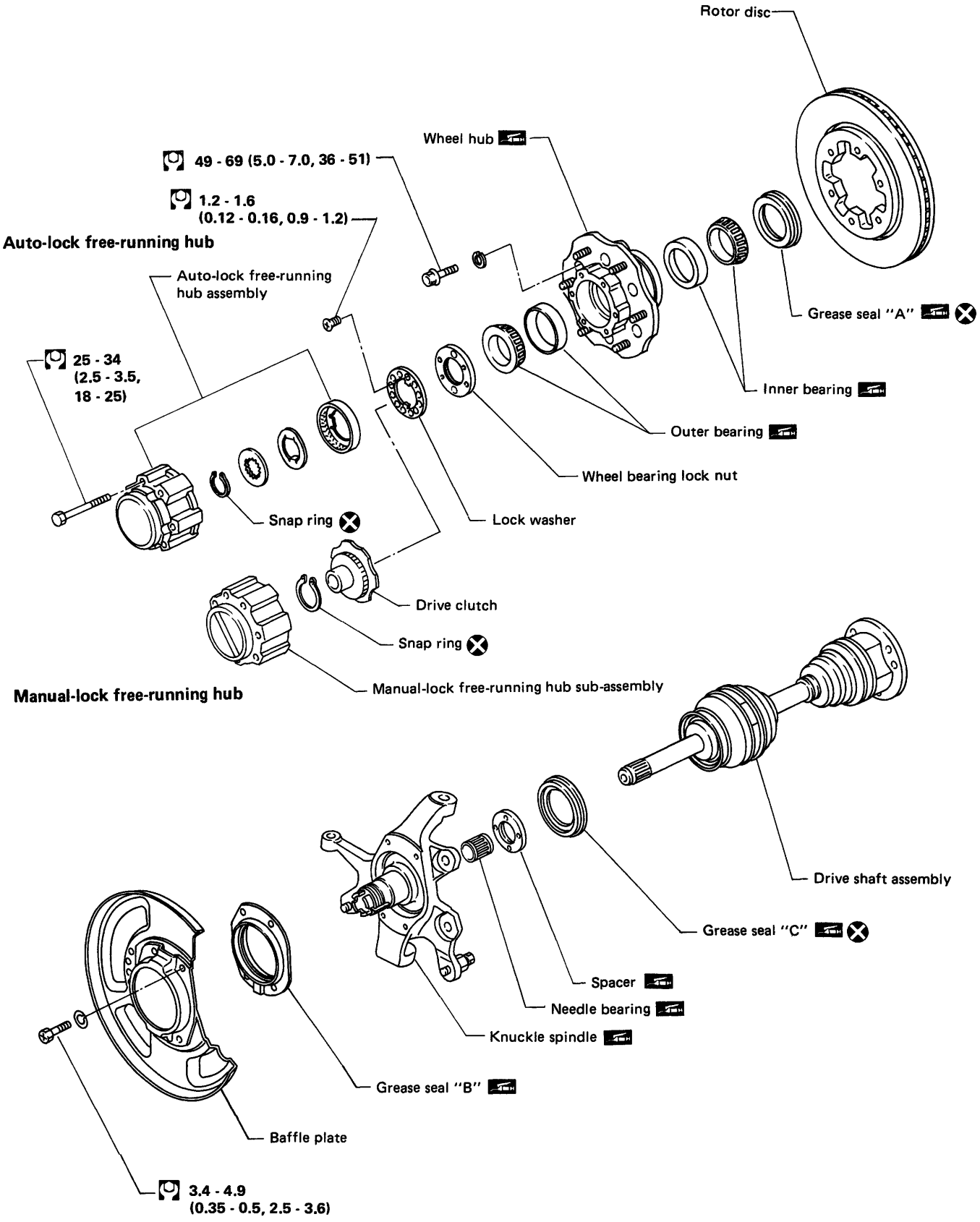
2WD TRUCKS



: N·m (kg-m, ft-lb)

SFA925

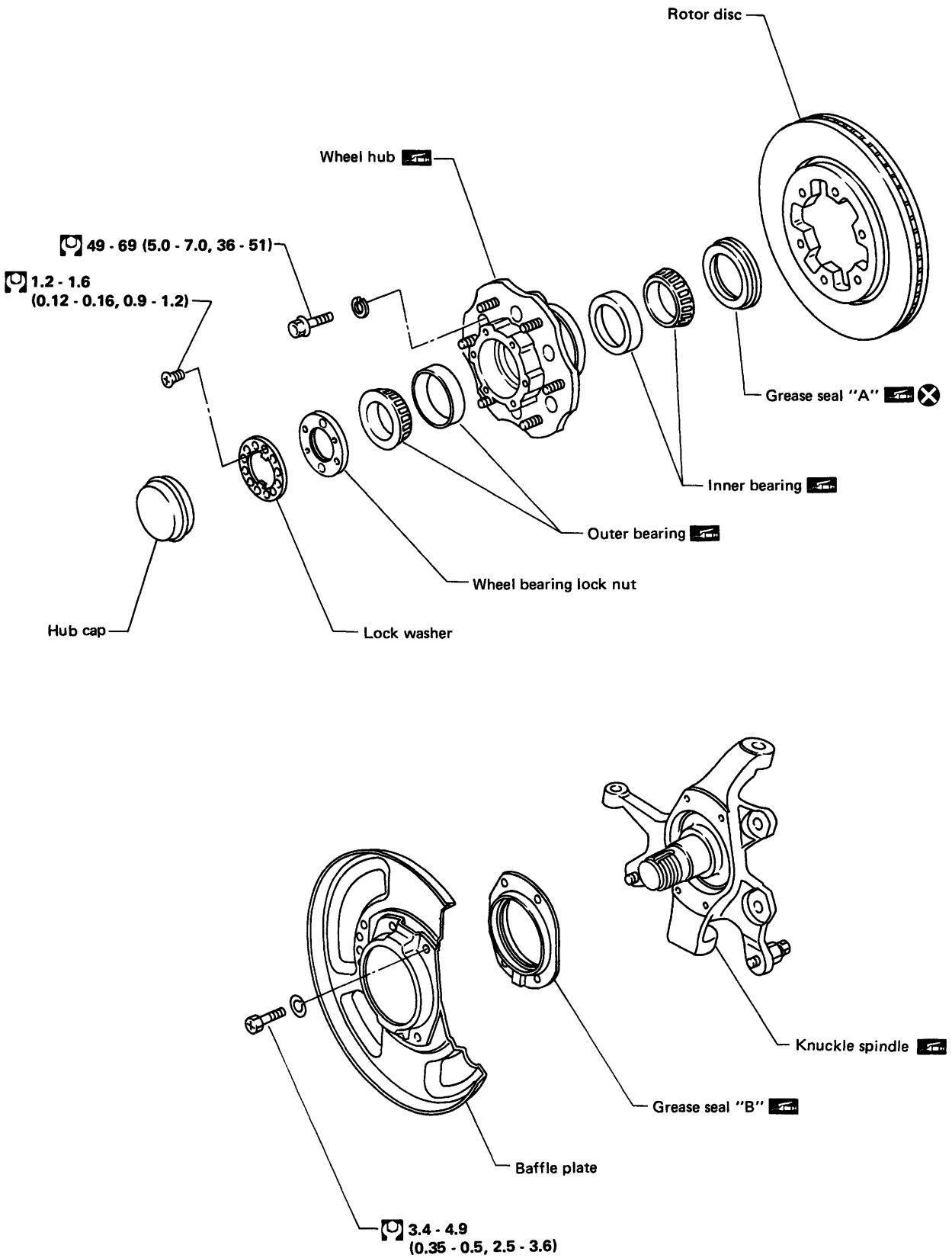
4WD



: N·m (kg-m, ft-lb)

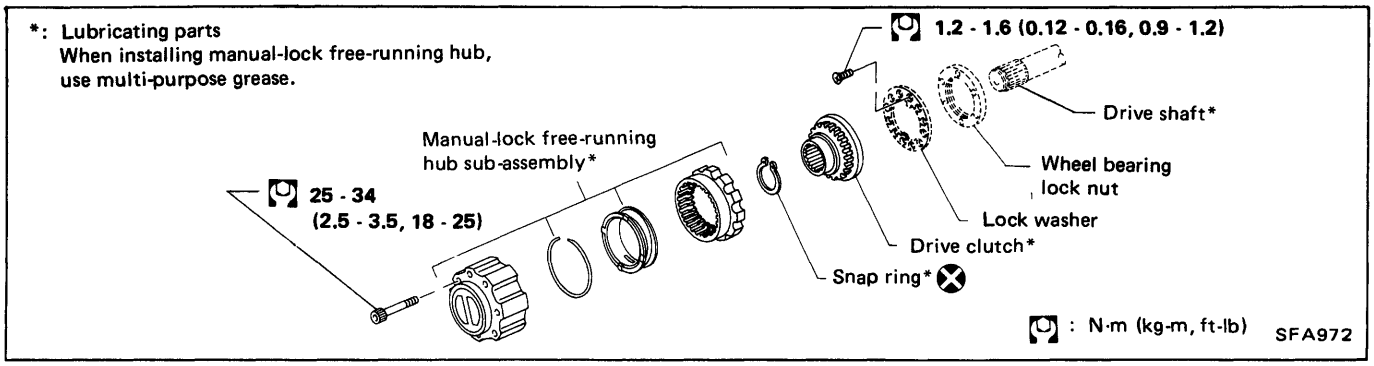
SFA825

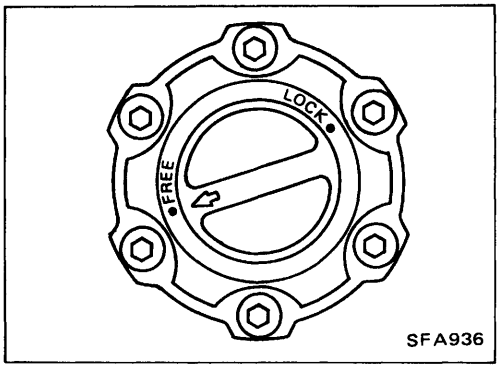
2WD PATHFINDER



: N·m (kg-m, ft-lb)

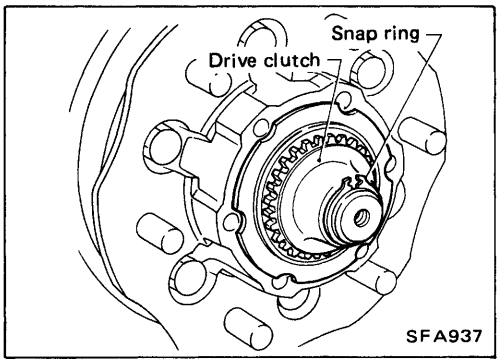
SFA711A





Removal and Installation

- Set knob of manual-lock free-running hub in position "Free".
- Remove manual-lock free-running hub with brake pedal depressed.



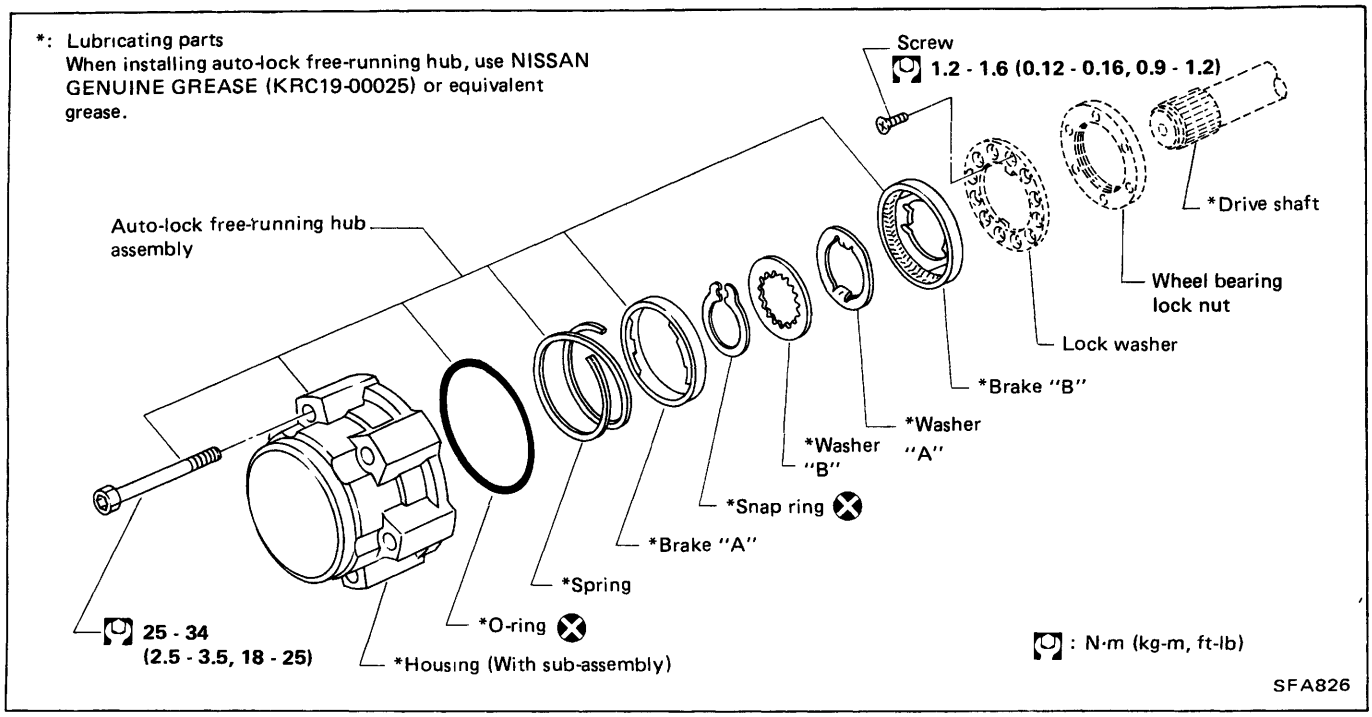
- Remove snap ring and then draw out drive clutch.
- When installing manual-lock free-running hub, make sure the position is in "Free".

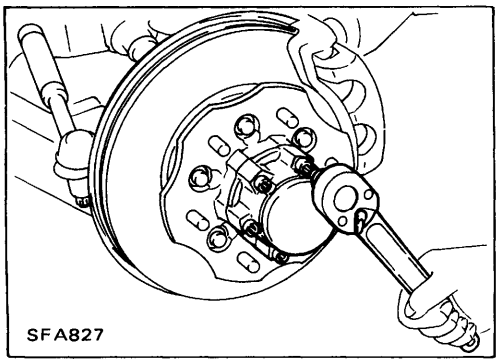
Apply multi-purpose grease to the parts shown in the above illustration.

- Check operation of manual-lock free-running hub after installing it.

Inspection

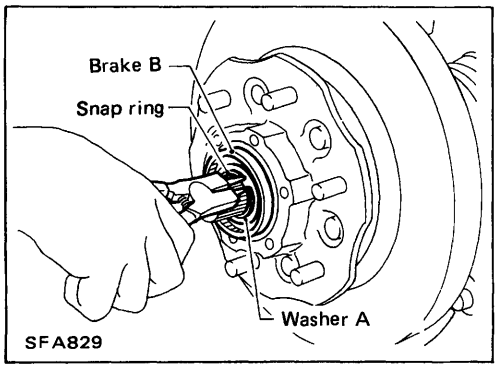
- Check that knob moves smoothly and freely.
- Check that the clutch moves smoothly in the body.





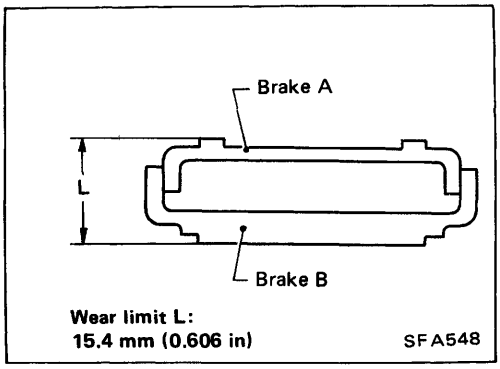
Removal and Installation

- Set auto-lock free-running hub in position "Free".
- Remove auto-lock free-running hub with brake pedal depressed.



- Remove snap ring.
- Remove washer B, washer A and brake B.
- After installing auto-lock free-running hub, check operation it.

When installing it, apply recommended grease to the parts shown in the above illustration.



Inspection

Thoroughly clean parts with cleaning solvent and dry with compressed air.

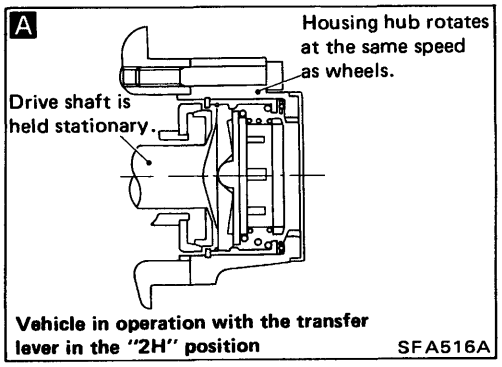
Brake "A" and "B"

Measure the thickness "L" of brake "A" and "B".

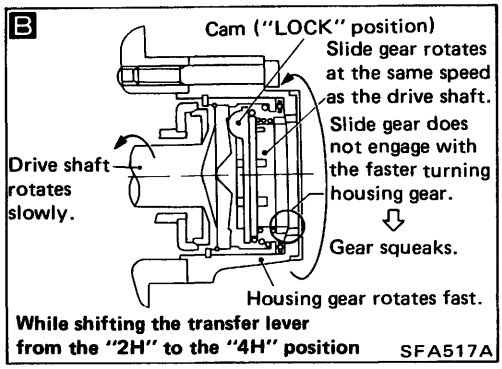
If thickness is less than the specified limit, replace brake "A" and "B" as a set.

Trouble-shooting

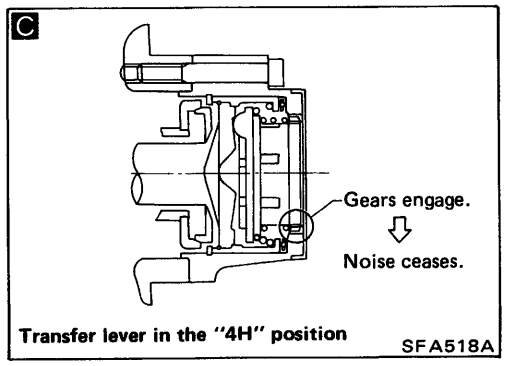
Noise occurring in the auto hub under any of the conditions described below is not indicative of a problem. Noise can be eliminated by properly operating the transfer lever or the vehicle.



Vehicle in operation with the transfer lever in the "2H" position SFA516A



While shifting the transfer lever from the "2H" to the "4H" position SFA517A



Transfer lever in the "4H" position SFA518A

Noise

Was the transfer lever shifted from the "2H" to the "4H" position while the vehicle was operated at a speed greater than 40 km/h (25 MPH)?

Yes → Shifting the transfer lever from the "2H" to the "4H" position in high-speed operation (Fig. A → Fig. B), is sometimes difficult. At this point, a clattering occurs in the auto hub. If shifting is stopped halfway, the drive shaft no longer rotates and the cam is held in the "LOCK" position (Fig. B). In this case, the noise will continue until the vehicle is stopped. When this occurs, decrease vehicle speed to less than 40 km/h (25 MPH), return the transfer lever to the "2H" position once and then re-shift to the "4H" position. Gears will then be engaged and the noise will cease (Fig. C).

No

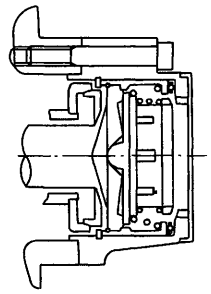
Was the transfer lever shifted from the "2H" to the "4H" position while the vehicle was operated at a speed less than 40 km/h (25 MPH)?

Yes → When noise occurs in the auto hub while shifting from the "2H" to the "4H" position (Fig. A → Fig. B), do not stop shifting halfway. When shifted to the "4H" position, the "4WD" pilot lamp will come on to indicate that the gears are engaged properly and that the vehicle is set in the 4WD mode. Noise will then cease (Fig. C). If shifting is stopped halfway, noise will continue. In such a case, return the transfer lever to the "2H" position once and re-shift it to the "4H" position. Gears will then be engaged and the noise will cease (Fig. C). (If the lever is left in the "2H" position, the noise will continue until the vehicle is stopped.)

No

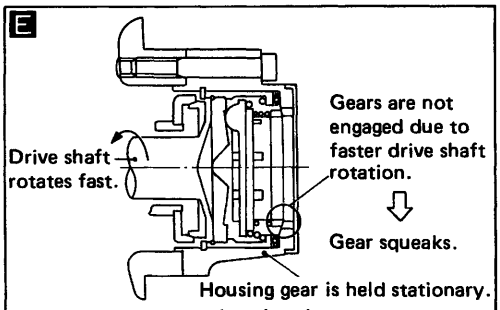
Trouble-shooting (Cont'd)

D



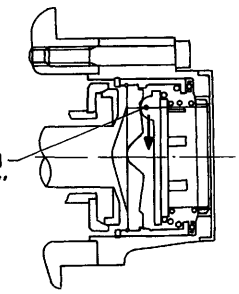
Vehicle stoppage SFA519A

E



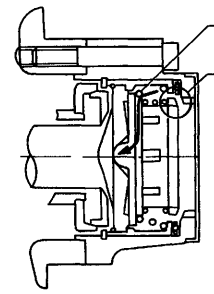
Abrupt standing start/acceleration while rear wheels are slipping SFA520A

F



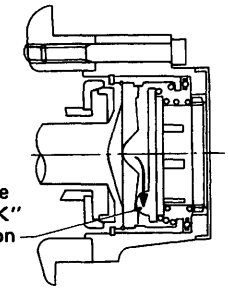
Vehicle starting to back up SFA521A

G



Gears in "unlocked" condition SFA522A

H



Gears engaged in reverse SFA523A

Was the vehicle started after the transfer lever was shifted from the "2H" to the "4H" or "4L" position?

Yes → A clicking noise can sometimes occur in the auto hub when the gears are engaged. This is not a problem.
Noise can be encountered during rapid acceleration while rear wheels are slipping on snowy roads, muddy roads, slopes, etc. (Fig. D → Fig. E).
In such a case, release the accelerator pedal to reduce engine speed. Gears will then be engaged and the noise will cease (Fig. C).

No

Was the vehicle backed up when the transfer lever was in the "4H" or the "4L" position, or was the vehicle backed up while on a downgrade when the transfer lever was in the "4H" or the "4L" position?

Yes → When backing up the vehicle with the transfer in the "4H" or the "4L" position, auto-hub gears sometimes disengage but soon reengage (Fig. F → Fig. G → Fig. H) with a clicking noise. This is not a problem.
Noise will also occur if the vehicle is accelerated rapidly while the gears are disengaged. In such a case, release the accelerator pedal once to decrease engine speed. Gears will then be engaged and the noise will cease (Fig. C).

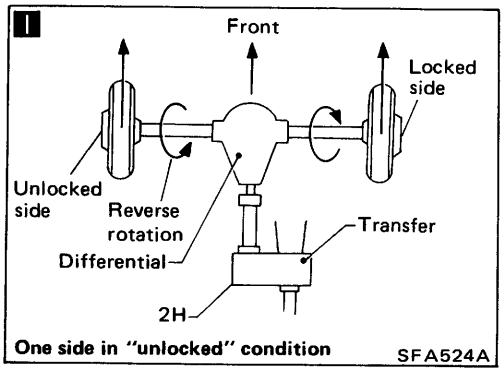
No

Was the vehicle turned on a dry pavement, when the transfer lever was in the "4H" or the "4L" position?

Yes → Under these conditions, noise occurs in tires (creaking) or in the power train (rattling) — not in the auto hub.
Avoid driving in the conditions described above as it may lead to tire wear.

No

Trouble-shooting (Cont'd)

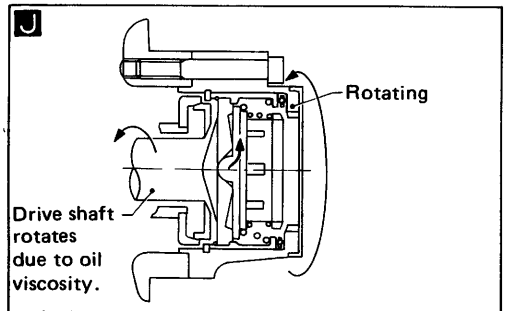


One side in "unlocked" condition SFA524A

Was the vehicle moved in one direction after the vehicle was driven in another direction when the transfer lever was in the "4H" or the "4L" position and then returned to the "2H" position?

Yes → Auto-hub gears will disengage with a resultant noise (clicking). If the distance the vehicle is moved in the opposite direction is short [less than 1 m (3 ft)] or if the rotation angle of the left and right wheels is not the same (as in rounding a corner), gears on one side will disengage (Fig. I). Under this condition, a noise (crushing, etc.) might occur while driving in the "2H" position. If only gears on one side are unlocked, the locked drive shaft rotates at the same speed as wheels; however, the unlocked drive shaft is made to rotate in the reverse direction by the differential. This forces the auto hub's slide gear to lock in the reverse direction. As a result, noise occurs.
If this happens, slowly move the vehicle straight back approximately 2 to 3 m (7 to 10 ft) with the transfer lever in the "2H" position to disengage the gears on the other side.

No ↓



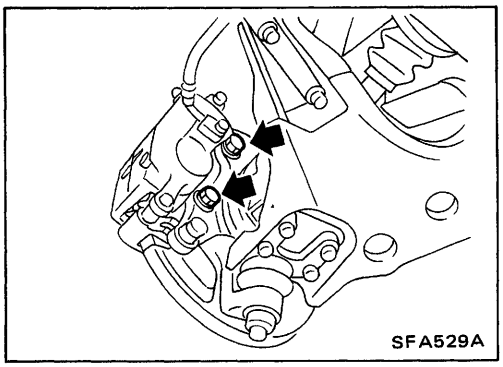
Vehicle operating in extremely cold weather with transfer lever in the "2H" position SFA525A

Was the vehicle driven with the transfer lever in the "2H" position in extremely cold weather?

Yes → In extremely cold weather (areas), the viscosity of differential oil is greater than in moderate weather. When the auto hubs are unlocked with the transfer lever set to the "2H" position, one auto hub can sometimes remain locked.
This causes noise during operation. Noise can also occur in the auto hub when the front propeller shaft is rotated due to the viscosity resistance of the transfer fluid (Fig. J).
In such a case, drive in the "4H" position for approximately 10 minutes until the vehicle warms up, and return the transfer lever to the "2H" position to eliminate the noise.

No ↓

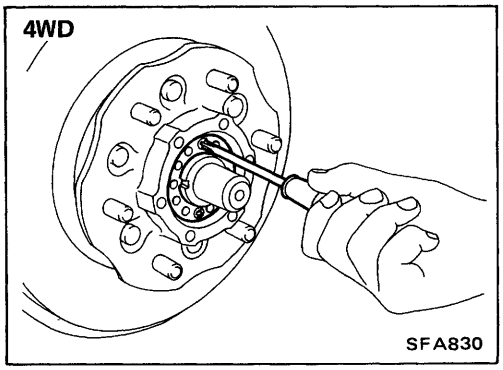
Disassemble and check the auto hub.
(Refer to page FA-21.)


SFA529A

Removal and Installation

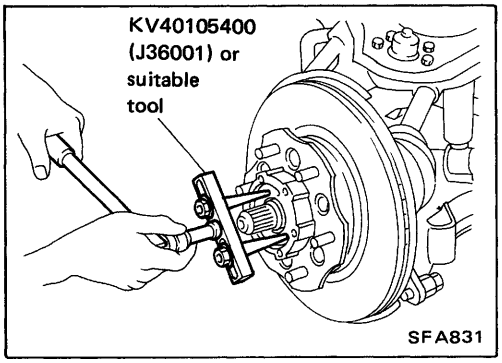
- Remove free-running hub assembly.
  Refer to FRONT AXLE (4WD) — Auto-lock Free-running Hub or Manual-lock Free-running Hub.
- Remove brake caliper assembly.

Brake hose does not need to be disconnected from brake caliper.
Be careful not to depress brake pedal, or piston will pop out.
Make sure brake hose is not twisted.



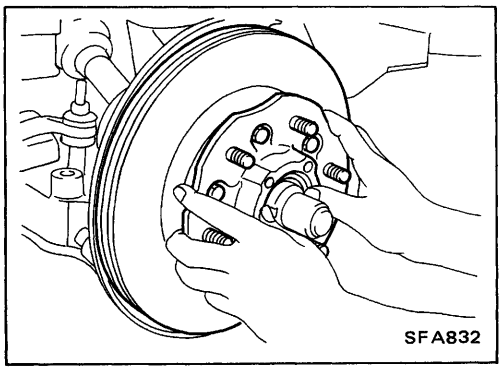
SFA830

- Remove lock washer. — 4WD and 2WD PATHFINDER —



SFA831

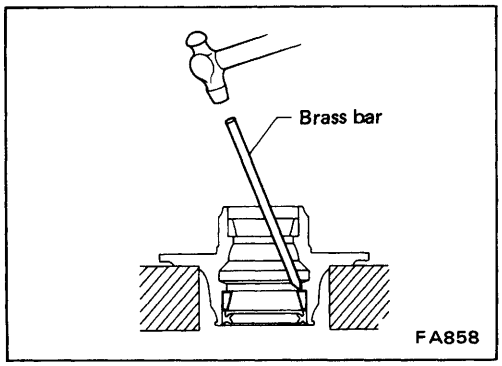
- Remove wheel bearing lock nut.
  2WD Trucks: With suitable tool
  Except 2WD Trucks: With Tool


SFA832

- Remove wheel hub and wheel bearing.

Be careful not to drop outer bearing.

- After installing wheel hub and wheel bearing, adjust wheel bearing preload.
  Refer to PRELOAD ADJUSTMENT of Front Wheel Bearing in CHECK AND ADJUSTMENT — On-vehicle.



FA858

Disassembly

- Remove bearing outer races with suitable brass bar.

Inspection

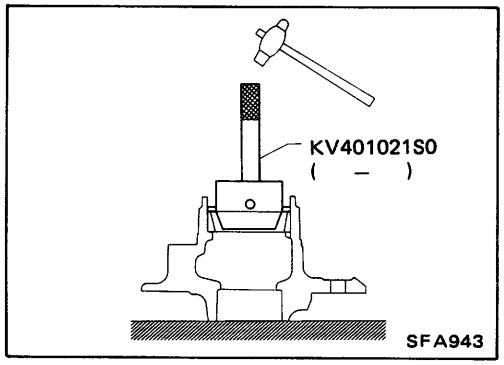
Throughly clean wheel bearings and wheel hub.

WHEEL BEARING

- Make sure wheel bearing rolls freely and is free from noise, crack, pitting or wear.

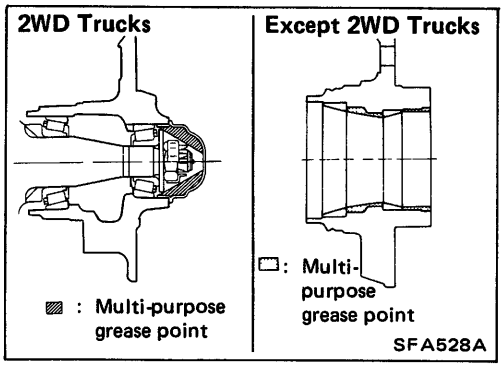
WHEEL HUB

- Check wheel hub for crack by using a magnetic exploration or dyeing test.

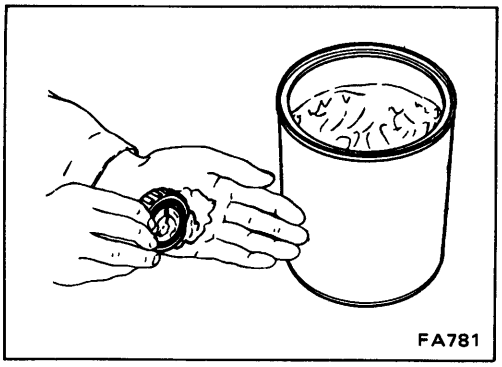


Assembly

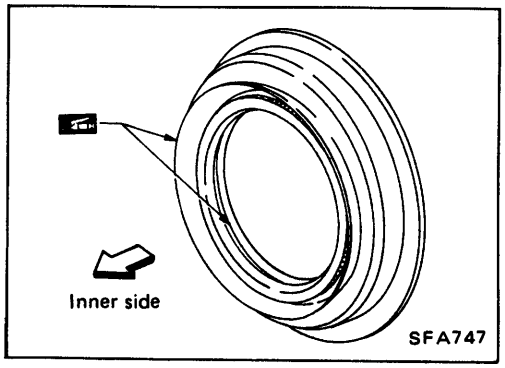
- Install bearing outer race with Tool until it seats in hub.



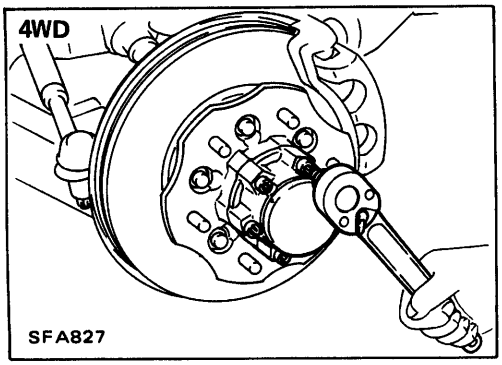
- Pack multi-purpose grease to hub and hub cap.



- Apply multi-purpose grease to each bearing cone.

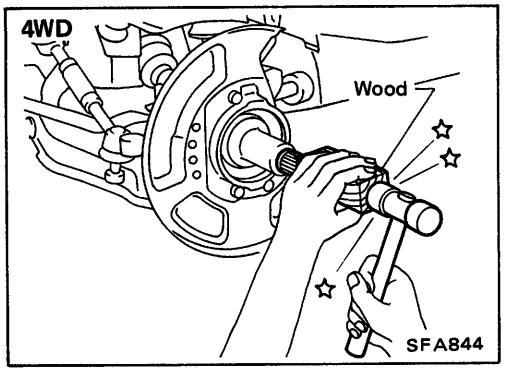


- Pack grease seal lip with multi-purpose grease, then install it into wheel hub with suitable drift.

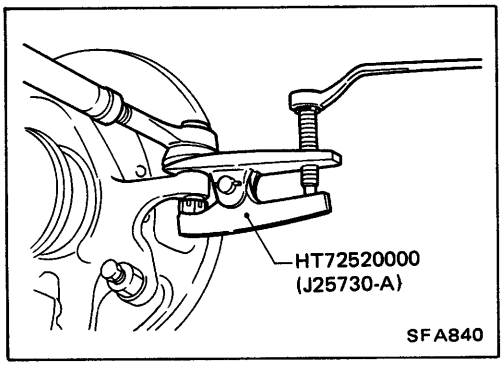


Removal

- Remove free-running hub assembly. — 4WD —
  Refer to FRONT AXLE (4WD) — Auto-lock Free-running Hub or Manual-lock Free-running Hub.

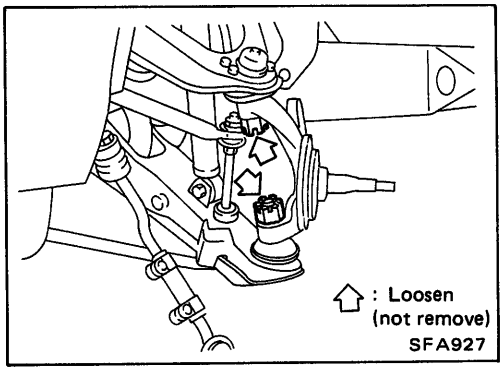


- Separate drive shaft from knuckle spindle by slightly tapping drive shaft end. — 4WD —



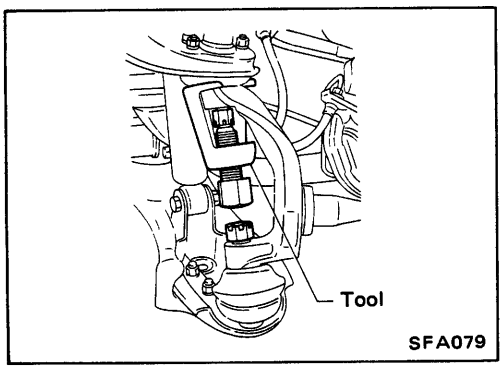
- Separate tie-rod from knuckle spindle with Tool.

Install stud nut conversely on stud bolt so as not to damage stud bolt.



- Separate knuckle spindle from ball joints.

(1) Loosen (not remove) upper and lower ball joint tightening nuts.



(2) Separate knuckle spindle from upper and lower ball joint studs with Tool.

During above operation, never remove ball joint nuts which are loosened in step (1) above.

Tool:

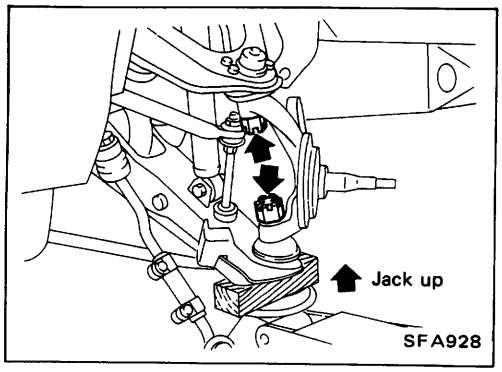
2WD Trucks

ST29020001 (J24319-01)

Except 2WD Trucks

HT72520000 (J25730-A)

Removal (Cont'd)



(3) Remove ball joint tightening nuts.
Support lower link with jack.
(4) Remove knuckle spindle from upper and lower links.

Inspection

KNUCKLE SPINDLE

- Check knuckle spindle for deformation, cracks or other damage by using a magnetic exploration or dyeing test.

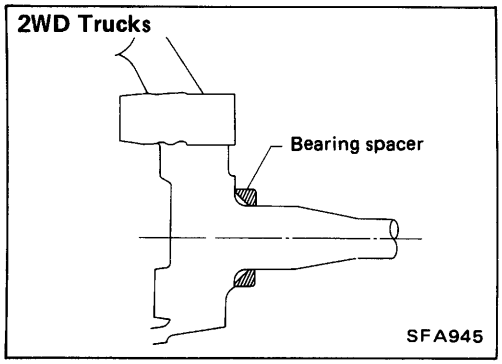
BEARING SPACER –2WD Trucks –

- Check bearing spacer for damage.

NEEDLE BEARING – 4WD –

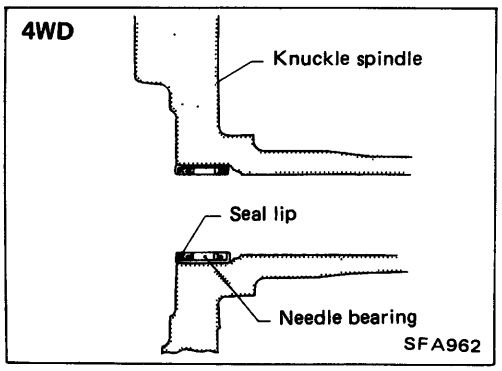
- Check needle bearing for wear, scratches, pitting, flaking and burn marks.

Installation



- Install bearing spacer onto knuckle spindle. –2WD Trucks –

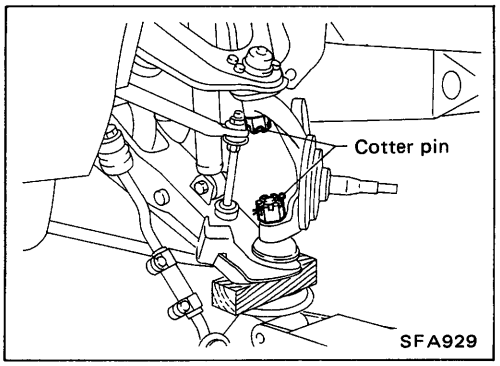
Make sure that bearing spacer is facing in proper direction.
Apply multi-purpose grease.



- Install needle bearing into knuckle spindle. – 4WD –

Make sure that needle bearing is facing in proper direction.
Apply multi-purpose grease.

Installation (Cont'd)

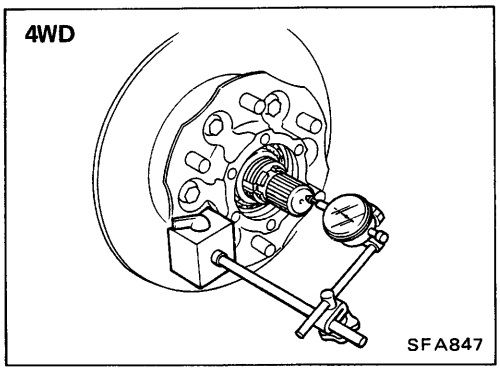


- Install knuckle spindle to upper and lower ball joints with lower link jacked up.

CAUTION:

Make sure that oil or grease does not come into contact with tapered areas of ball joint and knuckle spindle and threads of ball joint.

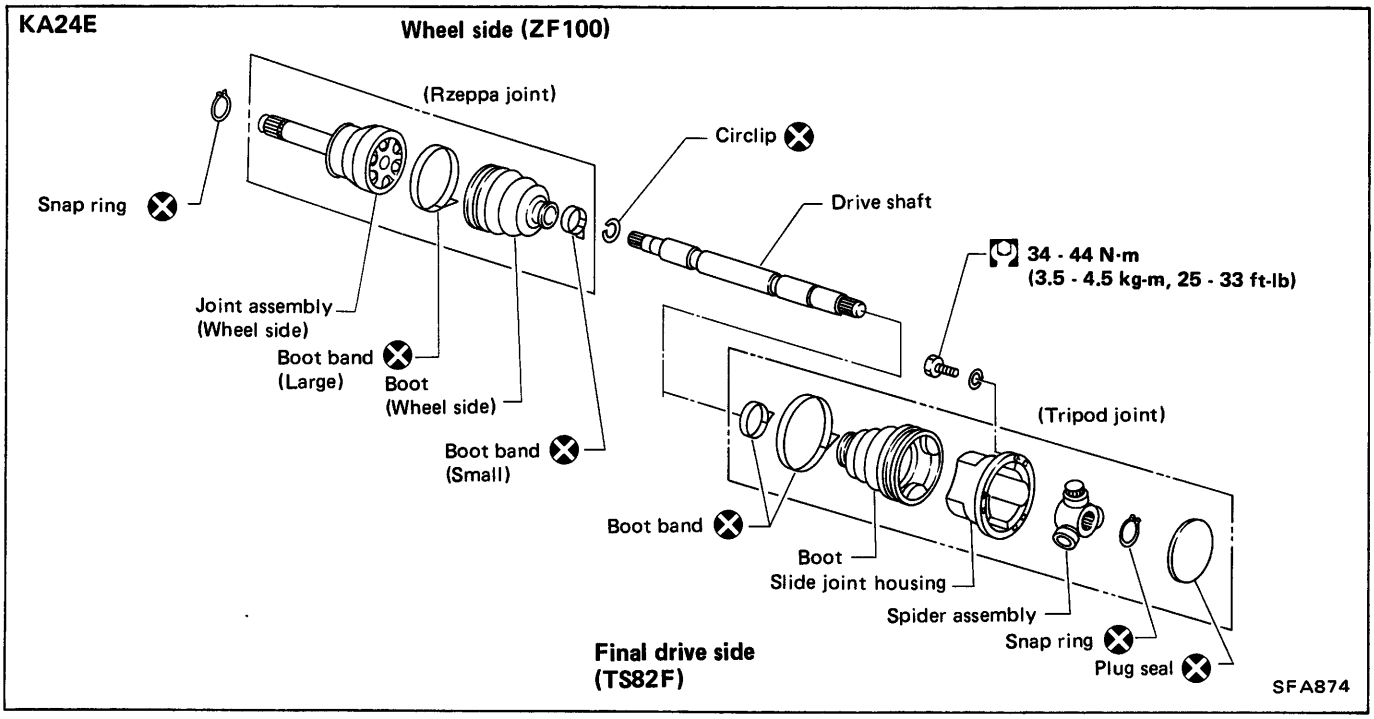
- After installing knuckle spindle, adjust wheel bearing preload. Refer to PRELOAD ADJUSTMENT of Front Wheel Bearing in CHECK AND ADJUSTMENT — On-vehicle.

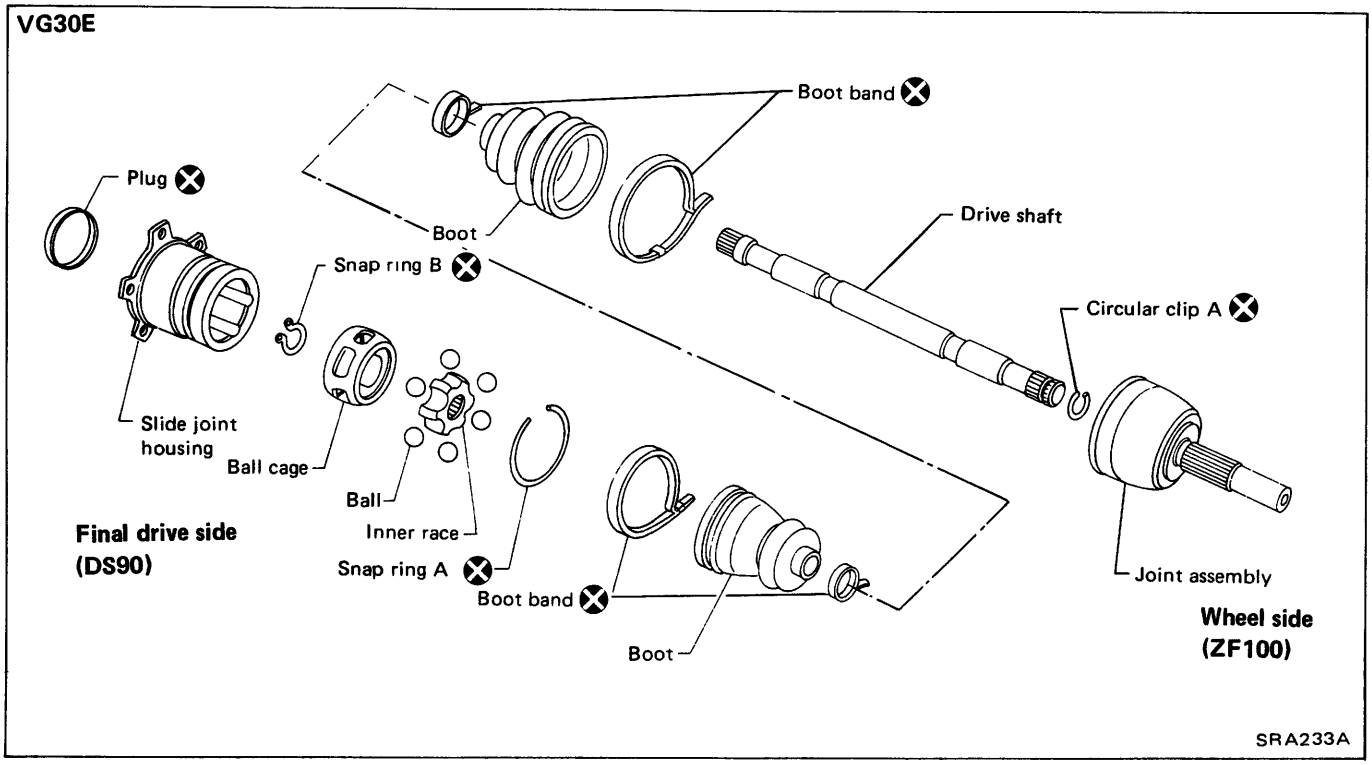


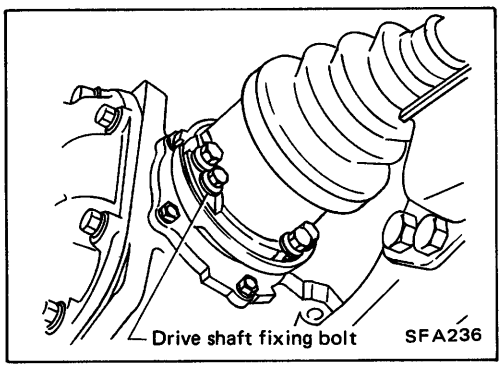
- After installing drive shaft, check drive shaft axial end play.

Do not reuse snap ring once it has been removed.

Refer to FRONT AXLE (4WD) — Drive shaft.


KA24E
Wheel side (ZF100)
(Rzeppa joint)
Circlip
Snap ring
Drive shaft
34 - 44 N·m
(3.5 - 4.5 kg-m, 25 - 33 ft-lb)
Joint assembly
(Wheel side)
Boot band
(Large)
Boot
(Wheel side)
Boot band
(Small)
(Tripod joint)
Boot band
Boot
Slide joint housing
Spider assembly
Snap ring
Plug seal
Final drive side
(TS82F)
SFA874


VG30E
Boot band
Plug
Boot
Drive shaft
Snap ring B
Circular clip A
Slide joint
housing
Ball cage
Ball
Inner race
Snap ring A
Boot band
Boot
Joint assembly
Final drive side
(DS90)
Wheel side
(ZF100)
SRA233A

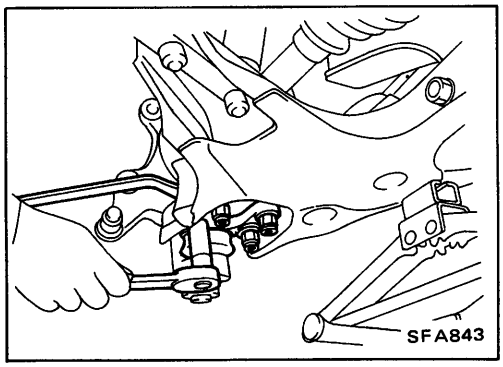


Removal

1. Remove bolts fixing drive shaft to final drive.

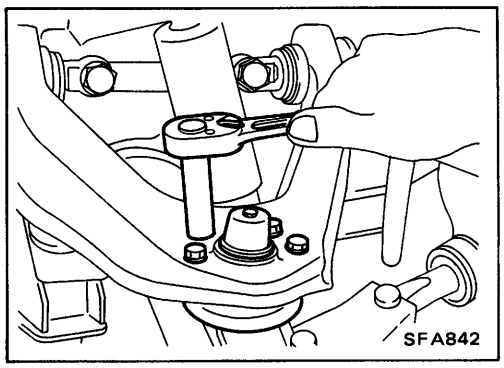
2. Remove free-running hub assembly with brake pedal depressed. Refer to FRONT AXLE (4WD) – Auto-lock Free-running Hub or Manual-lock Free-running Hub.
   - Remove brake caliper assembly without disconnecting brake hydraulic line.

   Make sure that brake hose is not twisted.
   - Remove tie-rod ball joint. Refer to FRONT AXLE (4WD) – Knuckle Spindle.

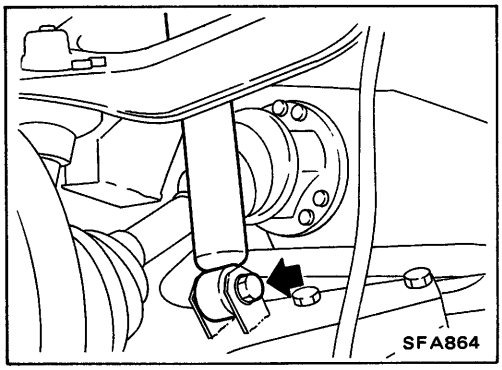


3. Remove nuts fixing lower ball joint on lower link.

   Support lower link with jack.

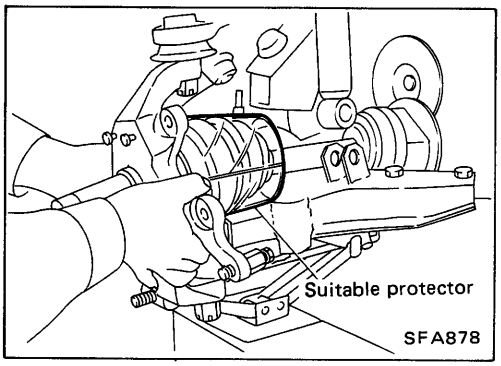


4. Remove upper ball joint fixing bolt.



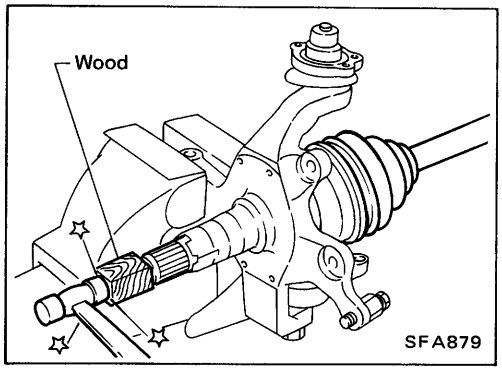
5. Remove shock absorber lower bolt.

Removal (Cont'd)



6. Remove drive shaft with knuckle.

Cover drive shaft boot with a suitable protector.

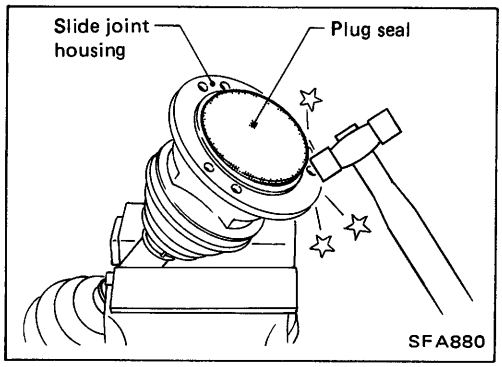


7. Separate drive shaft from knuckle by slightly tapping it.

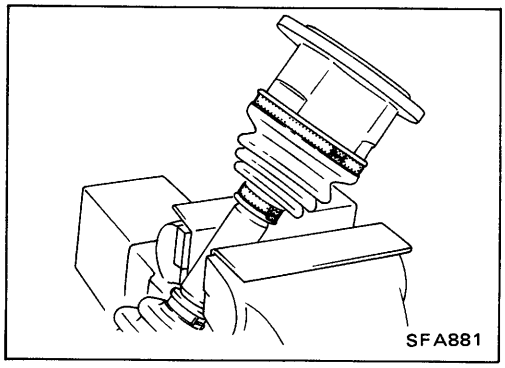
Disassembly

FINAL DRIVE SIDE

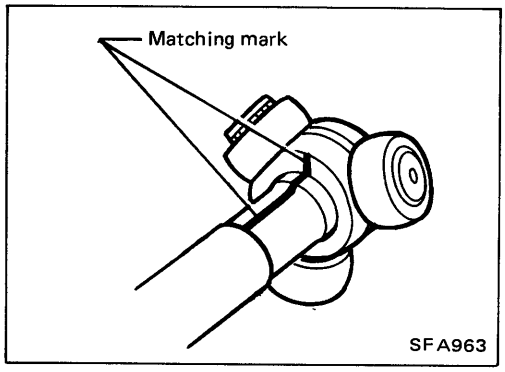
– TS82F type –



1. Remove plug seal from slide joint housing by lightly tapping around slide joint housing.

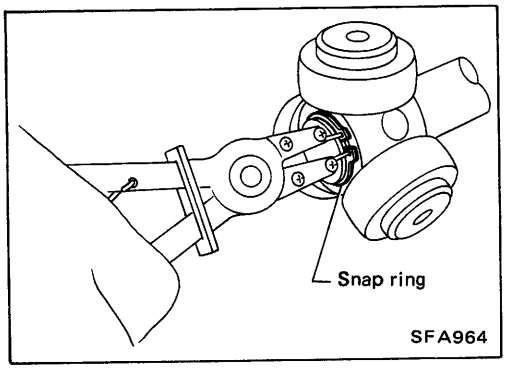


2. Remove boot bands.

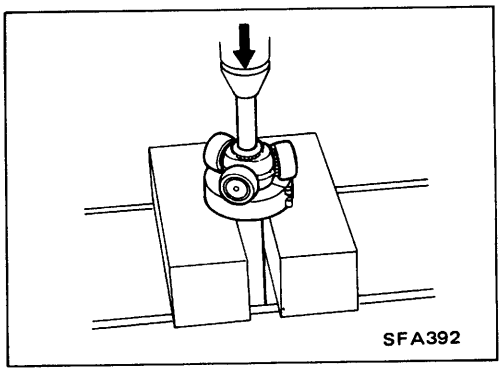


3. Move boot and slide joint housing toward wheel side, and put matching marks.

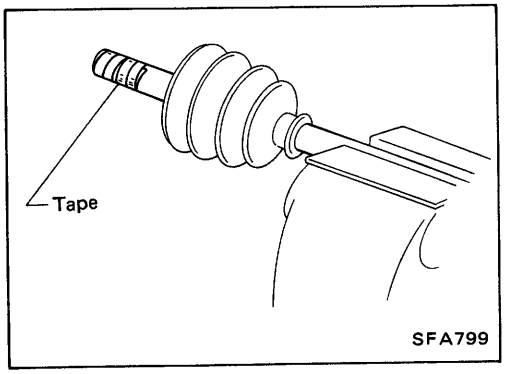
Disassembly (Cont'd)



4. Pry off snap ring.



5. Detach spider assembly with press.

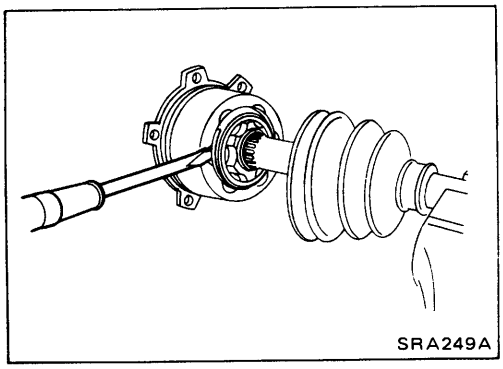


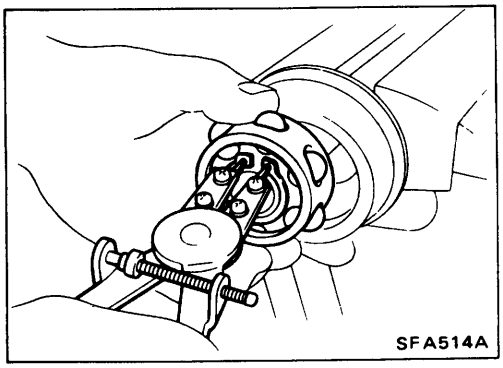
6. Draw out boot.

Cover drive shaft serration with tape so as not to damage the boot.

— DS90 type —

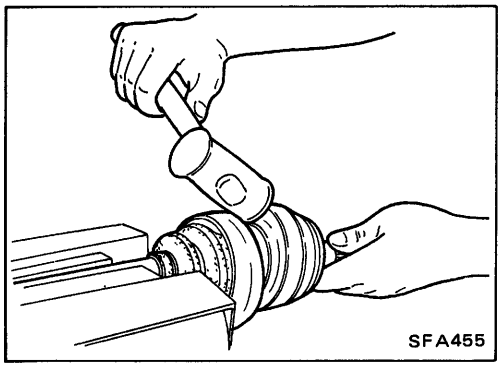
1. Remove boot bands.
2. Put matching marks on slide joint housing and inner race, before separating joint assembly.
3. Pry off snap ring "A" with a screwdriver, and pull out slide joint housing.





4. Put matching marks on inner race and drive shaft.
5. Pry off snap ring "B", then remove ball cage, inner race and balls as a unit.
6. Draw out boot.

Cover drive shaft serration with tape so as not to damage the boot.


SFA455

Disassembly (Cont'd)

WHEEL SIDE (ZF100)

CAUTION:

The joint on the wheel side cannot be disassembled.

- Before separating joint assembly, put matching marks on drive shaft and joint assembly.
- Separate joint assembly with suitable tool.

Be careful not to damage threads on drive shaft.

- Remove boot bands.

Inspection

Thoroughly clean all parts in cleaning solvent, and dry with compressed air. Check parts for evidence of deformation or other damage.

DRIVE SHAFT

Replace drive shaft if it is twisted or cracked.

BOOT

Check boot for fatigue, cracks, or wear. Replace boot with new boot bands.

JOINT ASSEMBLY (Final drive side)

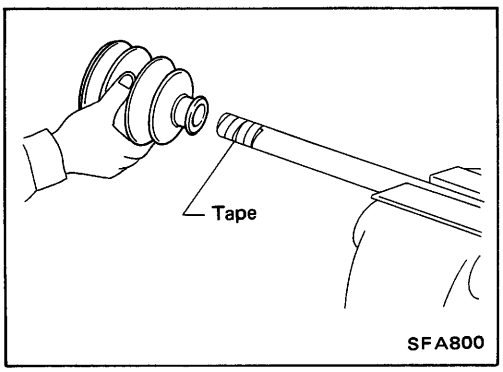
- Replace any parts of double offset joint which show signs of scorching, rust, wear or excessive play.
- Check serration for deformation. Replace if necessary.
- Check slide joint housing for any damage. Replace if necessary.

JOINT ASSEMBLY (Wheel side)

Replace joint assembly if it is deformed or damaged.

Assembly

- **After drive shaft has been assembled, ensure that it moves smoothly over its entire range without binding.**
- **Use NISSAN GENUINE GREASE or equivalent after every overhaul.**



SFA800

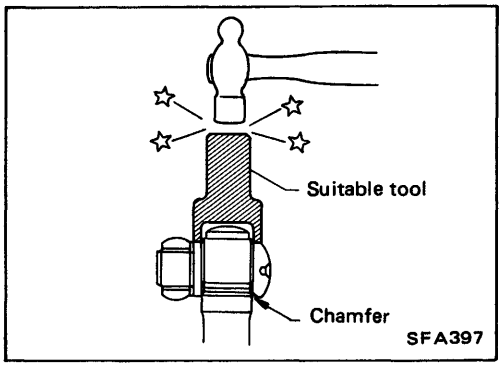
FINAL DRIVE SIDE

– TS82F type –

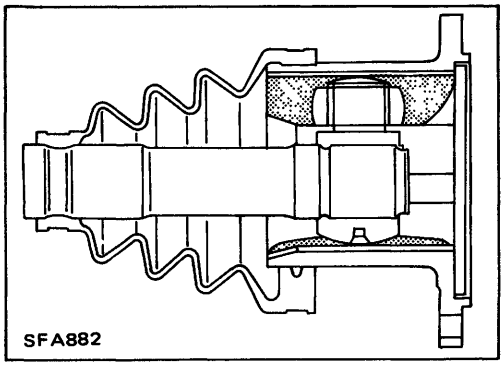
1. Install new small boot band, boot and side joint housing to drive shaft.

Cover drive shaft serration with tape so as not to damage boot during installation.

Assembly (Cont'd)

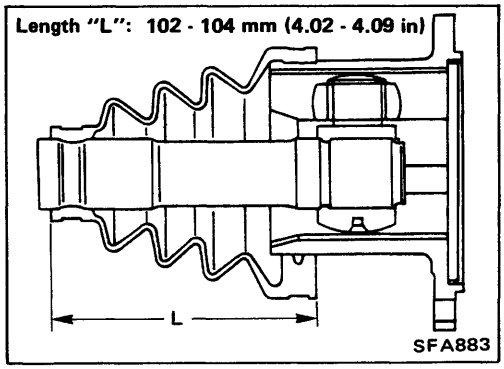


2. Install spider assembly securely, ensuring marks are properly aligned.
- **Press-fit with spider assembly serration chamfer facing shaft.**
3. Install new snap ring.



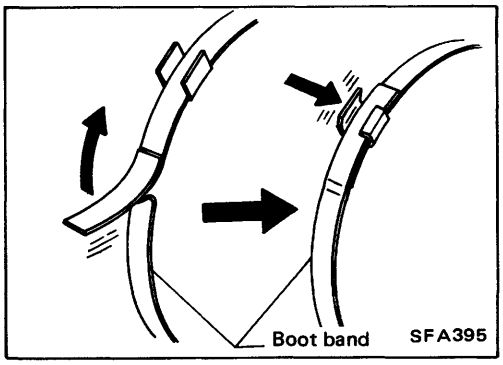
4. Pack with grease.

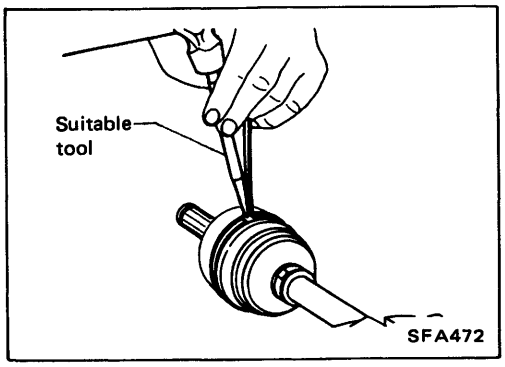
Specified amount of grease:
150 - 160 g (5.29 - 5.64 oz)



5. Set boot so that it does not swell and deform when its length is "L".

Make sure that boot is properly installed on the drive shaft groove.

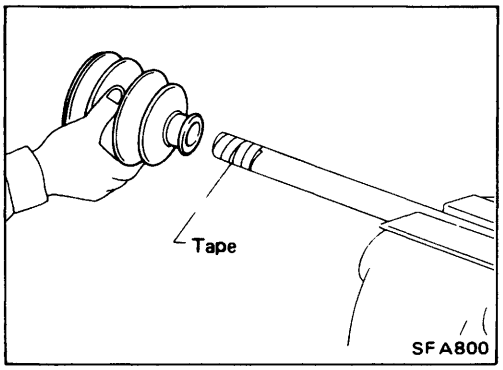




6. Lock new larger boot band securely with a suitable tool, then lock new smaller boot band.
7. Install new plug seal to slide joint housing by lightly tapping it.

Apply sealant to mating surface of plug seal.

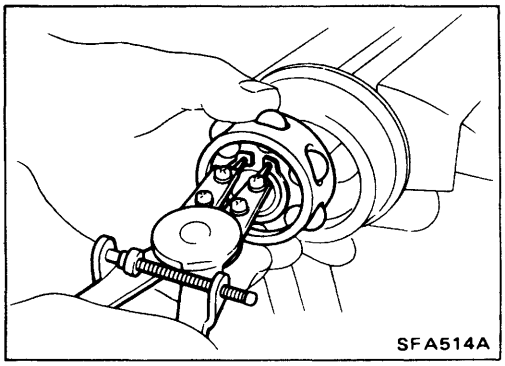
Assembly (Cont'd)



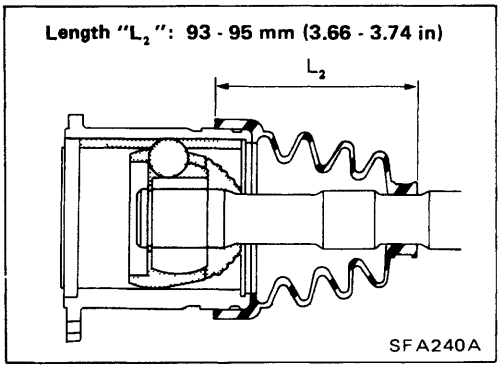
— DS90 type —

1. Install boot and new small boot band on drive shaft.

Cover drive shaft serration with tape so as not to damage boot during installation.



2. Securely install ball cage, inner race and balls as a unit, making sure the marks which were made during disassembly are properly aligned.
3. Install new snap ring "B".

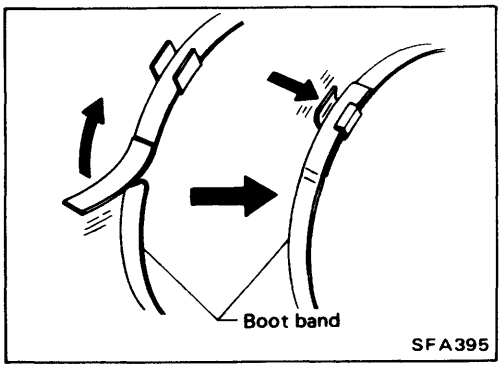


4. Pack drive shaft with specified amount of grease.

Specified amount of grease:
180 - 200 g (6.35 - 7.05 oz)

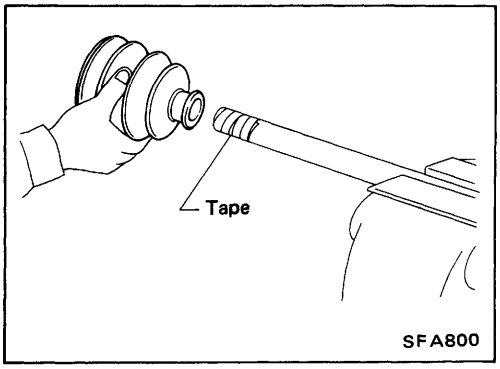
5. Install slide joint housing, then install new snap ring "A".
6. Set boot so that it does not swell and deform when its length is "L_2".

Make sure that boot is properly installed on the drive shaft groove.



7. Lock new larger and smaller boot bands securely with a suitable tool.

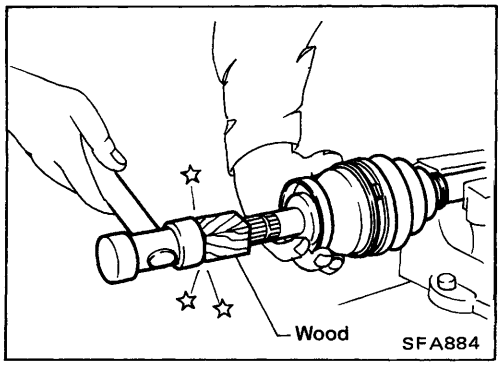
Assembly (Cont'd)



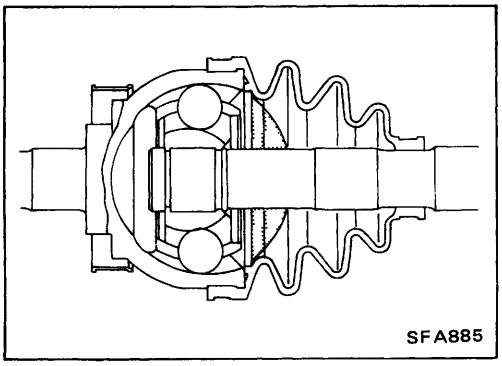
WHEEL SIDE (ZF100)

1. Install new small boot band and boot on drive shaft.

Cover drive shaft serration with tape so as not to damage boot during installation.

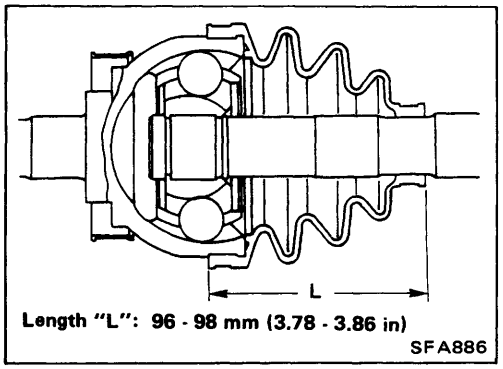


2. Set joint assembly onto drive shaft by lightly tapping it. Install joint assembly securely, ensuring marks which were made during disassembly are properly aligned.



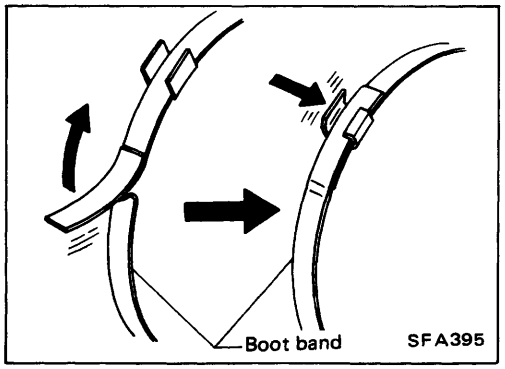
3. Pack drive shaft with specified amount of grease.

Specified amount of grease:
210 - 220 g (7.41 - 7.76 oz)

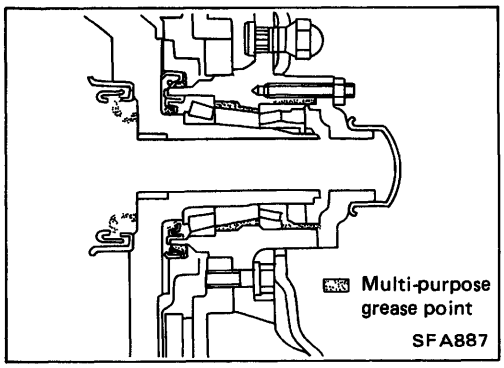


4. Set boot so that it does not swell and deform when its length is "L".

Make sure that boot is properly installed on the drive shaft groove.

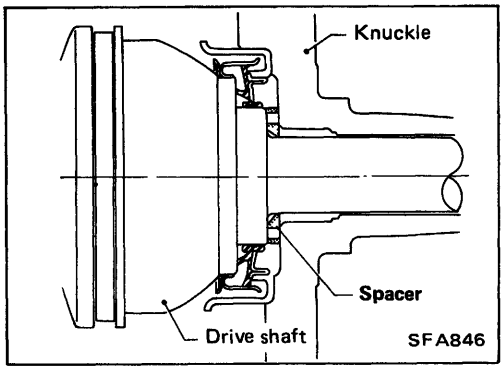


5. Lock new larger boot band securely with a suitable tool.
6. Lock new smaller boot band.



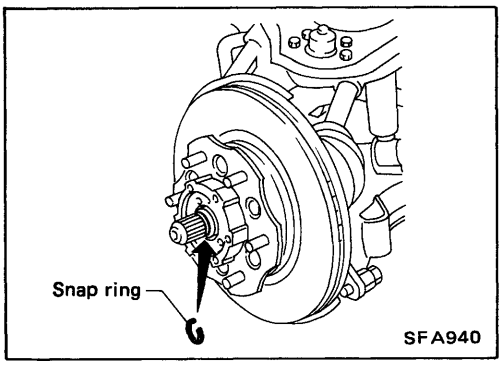
Installation

- Apply multi-purpose grease.



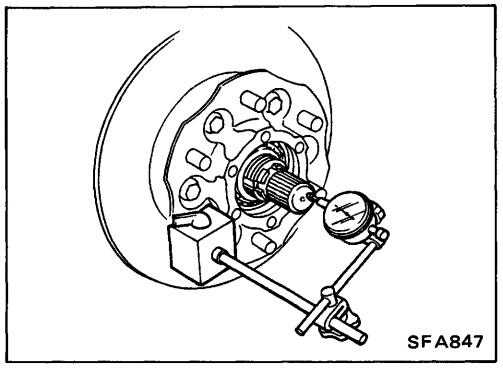
- Install bearing spacer onto drive shaft.

Make sure that bearing spacer is facing in proper direction.



- When installing drive shaft, adjust drive shaft axial end play by selecting a suitable snap ring.

(1) Temporarily install new snap ring on drive shaft in the same thickness as it was installed before removal.



(2) Set dial gauge on drive shaft end.

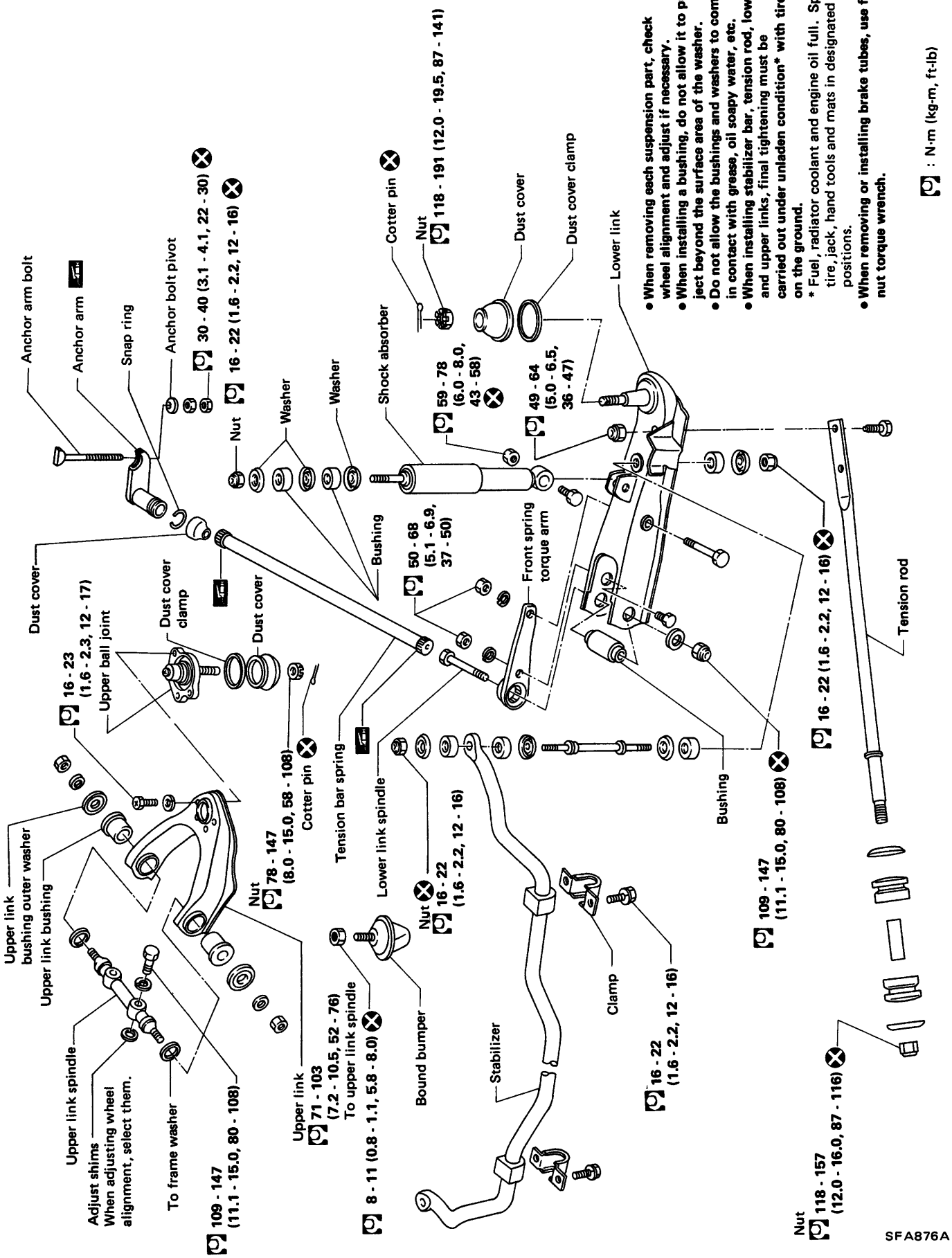
(3) Measure axial end play of drive shaft.

Axial end play: 0.1 - 0.3 mm (0.004 - 0.012 in)

(4) If axial end play is not within the specified limit, select another snap ring.

1.1 mm (0.043 in)	**1.3 mm (0.051 in)**
1.5 mm (0.059 in)	**1.7 mm (0.067 in)**
1.9 mm (0.075 in)	**2.1 mm (0.083 in)**
2.3 mm (0.091 in)	

2WD Trucks



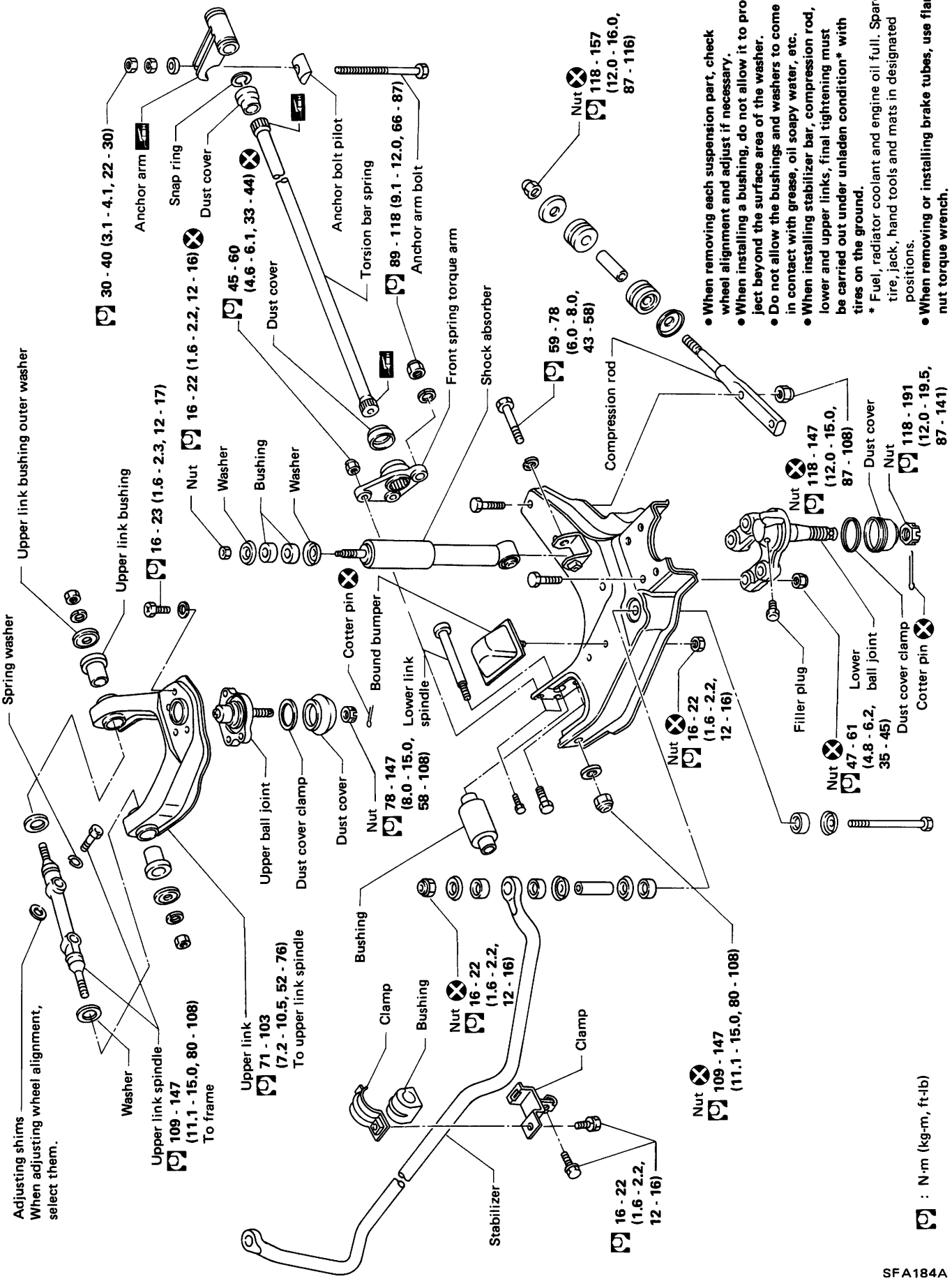
- When removing each suspension part, check wheel alignment and adjust if necessary.
- When installing a bushing, do not allow it to project beyond the surface area of the washer.
- Do not allow the bushings and washers to come in contact with grease, oil soapy water, etc.
- When installing stabilizer bar, tension rod, lower and upper links, final tightening must be carried out under unladen condition* with tires on the ground.

* Fuel, radiator coolant and engine oil full. Spare tire, jack, hand tools and mats in designated positions.

- When removing or installing brake tubes, use flare nut torque wrench.

: N·m (kg-m, ft-lb)

Except 2WD Trucks

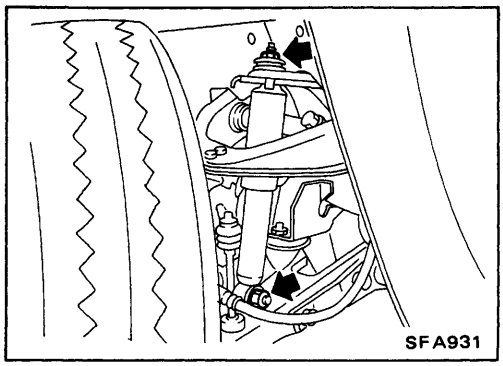


- **When removing each suspension part, check wheel alignment and adjust if necessary.**
- **When installing a bushing, do not allow it to project beyond the surface area of the washer.**
- **Do not allow the bushings and washers to come in contact with grease, oil soapy water, etc.**
- **When installing stabilizer bar, compression rod, lower and upper links, final tightening must be carried out under unladen condition* with tires on the ground.**

* Fuel, radiator coolant and engine oil full. Spare tire, jack, hand tools and mats in designated positions.

- **When removing or installing brake tubes, use flare nut torque wrench.**

SFA184A


SFA931

Shock Absorber

REMOVAL AND INSTALLATION

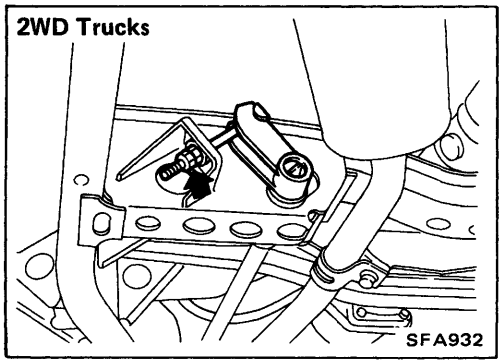
When removing and installing shock absorber, do not allow oil or grease to come into contact with rubber parts.

INSPECTION

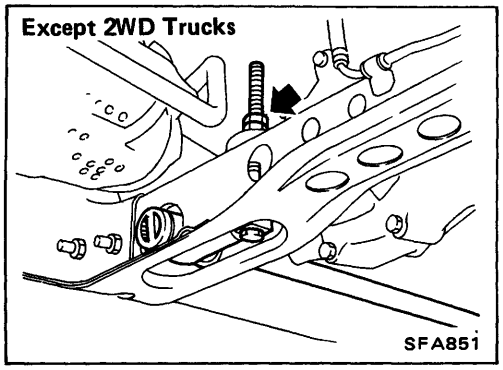
Wash all parts, except for nonmetallic parts, clean with suitable solvent and dry with compressed air.

Blow dirt and dust off of nonmetallic parts with compressed air.

- Check for oil leakage and cracks. Replace if necessary.
- Check piston rod for cracks, deformation or other damage. Replace if necessary.
- Check rubber parts for wear, cracks, damage or deformation. Replace if necessary.



SFA932

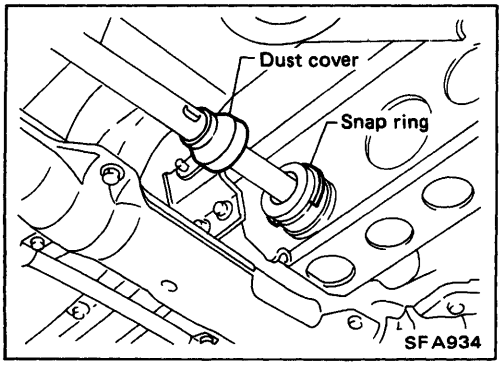


SFA851

Torsion Bar Spring

REMOVAL

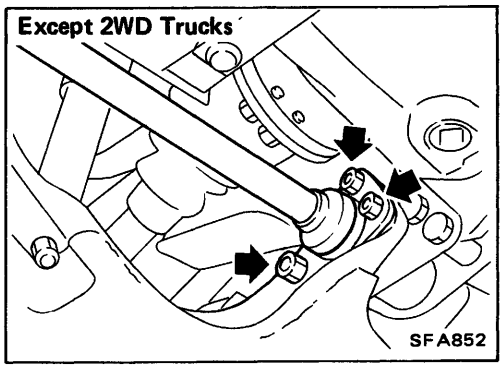
- Remove adjusting nut.



SFA934

- Move dust cover, then detach snap ring from anchor arm.
- Pull out anchor arm rearward, then withdraw torsion bar spring rearward. – 2WD Trucks –
- Remove torque arm. – 2WD Trucks –

Torsion Bar Spring (Cont'd)



- Remove torque arm fixing nuts, then withdraw torsion bar spring forward with torque arm. – Except 2WD Trucks –

INSPECTION

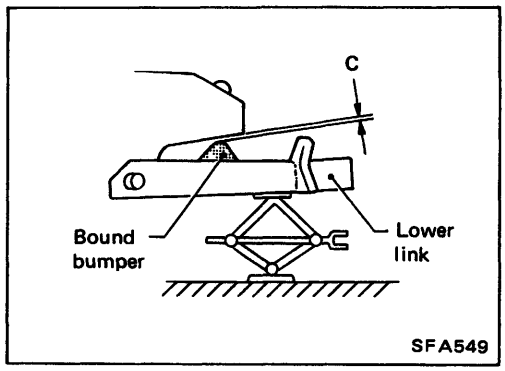
- Check torsion bar spring for wear, twist, bend and other damage.
- Check serrations of each part for cracks, wear, twist and other damage.
- Check dust cover for cracks.

INSTALLATION AND ADJUSTMENT

Adjustment of anchor arm adjusting nut is in tightening direction only.

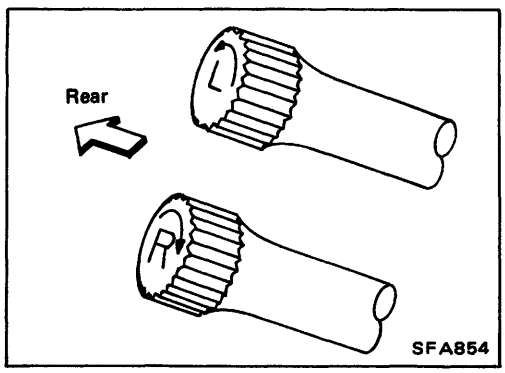
Do not adjust by loosening anchor arm adjusting nut.

1. Install torque arm to lower link. – 2WD Trucks –
2. Coat multi-purpose grease on the serration of torsion bar spring.



3. Place lower link in the position where bound buffer clearance "C" is 0.

   Clearance "C": 0 mm (0 in)

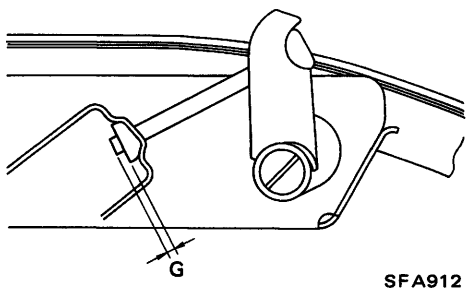


4. Install torsion bar spring. – 2WD Trucks –
- Install torsion bar spring with torque arm. – Except 2WD Trucks –

Be sure to install right and left torsion bar springs correctly.

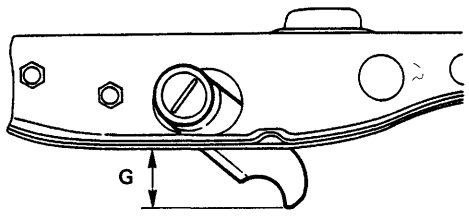
Torsion Bar Spring (Cont'd)

2WD Trucks



SFA912

Except 2WD Trucks



SFA853

5. Set anchor arm.

Standard length "G":

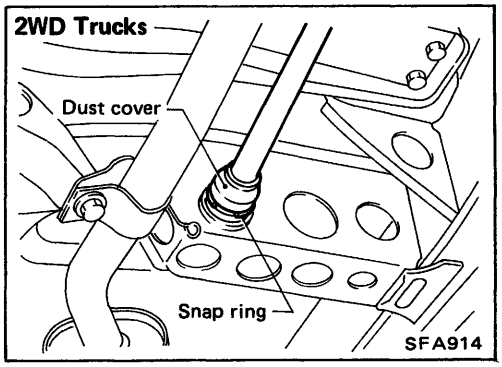
2WD Trucks

6 - 18 mm (0.24 - 0.71 in)

Except 2WD Trucks

50 - 60 mm (1.97 - 2.36 in)

2WD Trucks



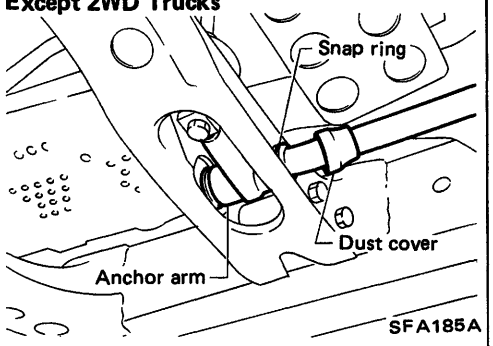
SFA914

6. Install snap ring to anchor arm and dust cover.

–2WD Trucks–

Make sure that snap ring is properly installed on the anchor arm groove.

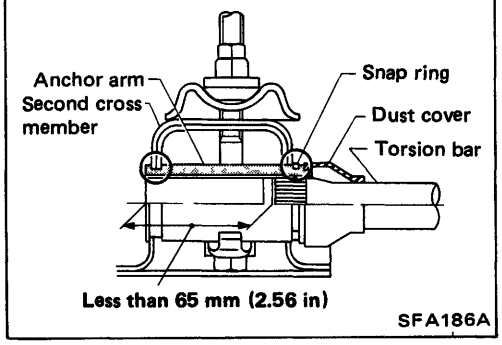
Except 2WD Trucks



SFA185A

–Except 2WD Trucks–

Make sure that snap ring and anchor arm are properly installed.



SFA186A

Torsion Bar Spring (Cont'd)

7. Tighten anchor arm adjusting nut to get L dimension.

Standard length "L":

2WD Trucks

For Heavy Duty, Cab & Chassis and STD models

35 mm (1.38 in)

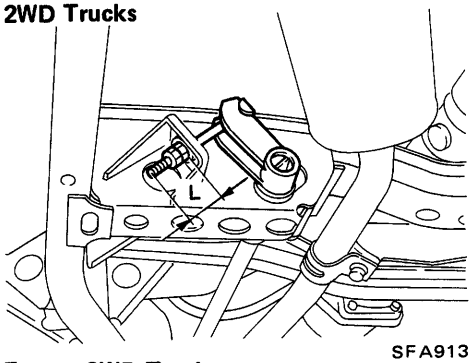
Except above models

49 mm (1.93 in)

Except 2WD Trucks

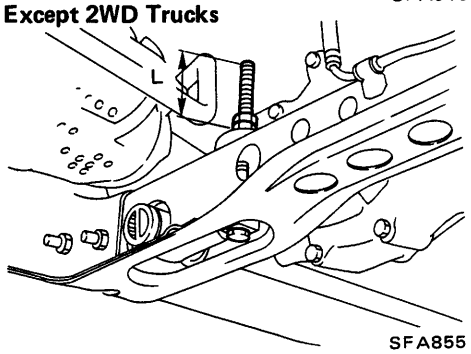
77 mm (3.03 in)

2WD Trucks

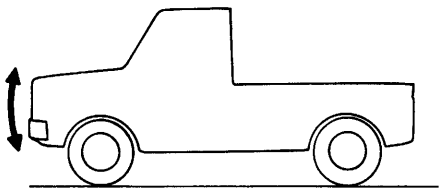


SFA913

Except 2WD Trucks



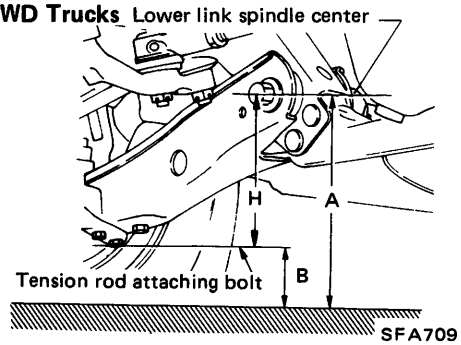
SFA855



SFA965

8. Bounce vehicle with tires on ground (Unladen) to eliminate friction of suspension.

2WD Trucks Lower link spindle center



SFA709

9. Measure vehicle posture "H".

H = A – B mm (in) "Unladen"

Refer to S.D.S.

(1) Exercise the front suspension by bouncing the front of the vehicle 4 or 5 times to ensure that the vehicle is in a neutral height attitude.

(2) Measure vehicle posture ... Dimension "H".

(Refer to ALLOWABLE LIMIT on S.D.S.)

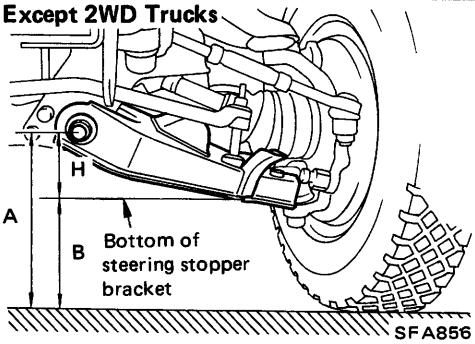
(3) If height of the vehicle is not as specified, adjust vehicle posture.

(Refer to ADJUSTING RANGE on S.D.S.)

(4) Check wheel alignment if necessary.

(Refer to ALLOWABLE LIMIT on S.D.S.)

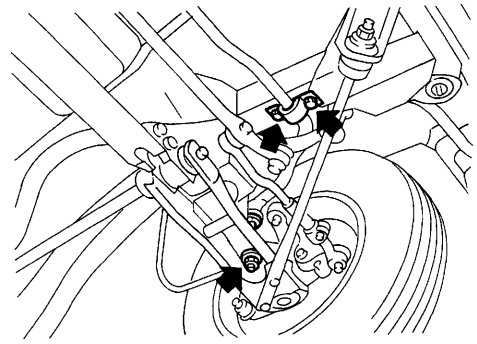
Except 2WD Trucks



SFA856

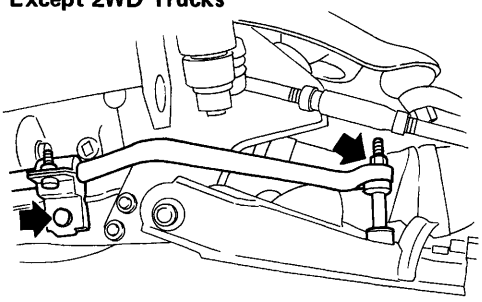
10. If "H" dimension is not within the specified value, readjust vehicle posture using anchor arm adjusting nut.

2WD Trucks



SFA915

Except 2WD Trucks



SFA857

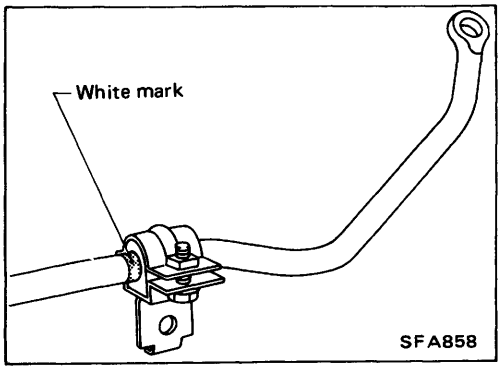
Stabilizer Bar

REMOVAL

- Remove stabilizer bar connecting bolt and a clamp bolt.

INSPECTION

- Check stabilizer bar for twist and deformation.
  Replace if necessary.
- Check rubber bushing for cracks, wear or deterioration.
  Replace if necessary.



SFA858

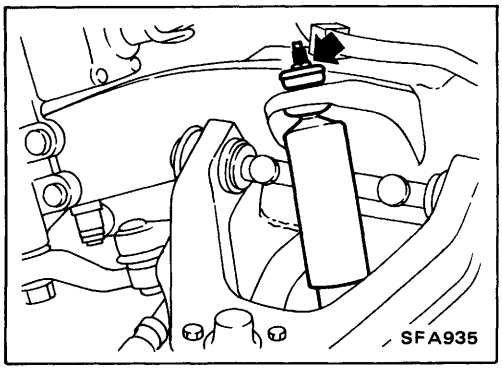
INSTALLATION

- Install bushing outside white mark painted on stabilizer.

Upper Link

REMOVAL

- Remove shock absorber upper fixing nut.

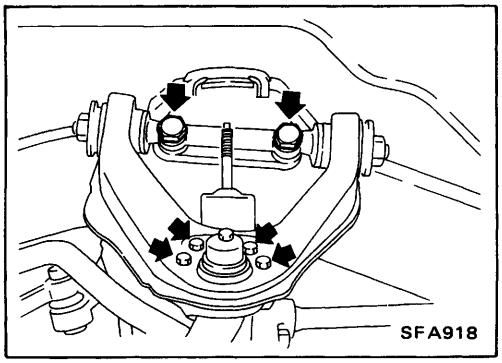


SFA935

- Remove bolts fixing upper ball joint on upper link.

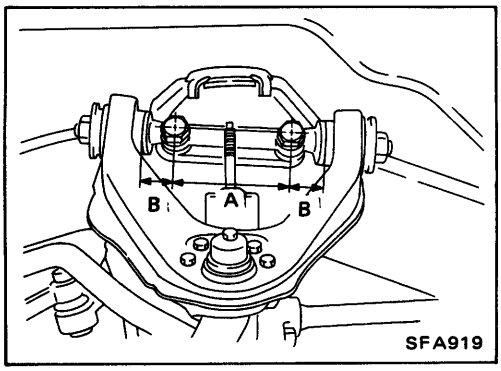
Support lower link with jack.

- Remove upper link spindle fixing bolts.



SFA918

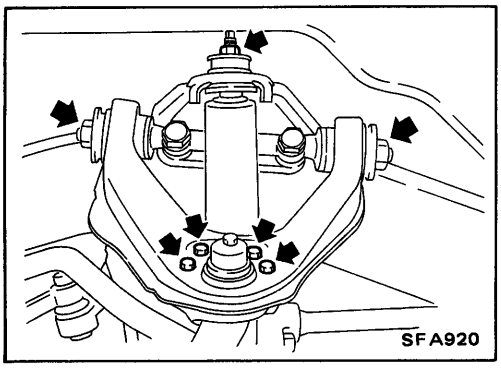
Upper Link (Cont'd)



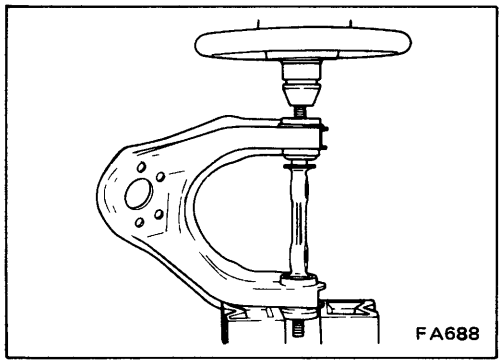
INSTALLATION

- Tighten upper link spindle with camber adjusting shims.
- After fitting, check dimensions "A" and "B".

  A: 110 mm (4.33 in)
  B: 32 mm (1.26 in)



- Install upper ball joint on upper link.
- Install schock absorber upper fixing nut.
- Tighten upper link spindle lock nuts under unladen condition with tires on ground.
- After installing, check wheel alignment. Adjust if necessary. Refer to Front Wheel Alignment of CHECK AND ADJUSTMENT – On-vehicle.

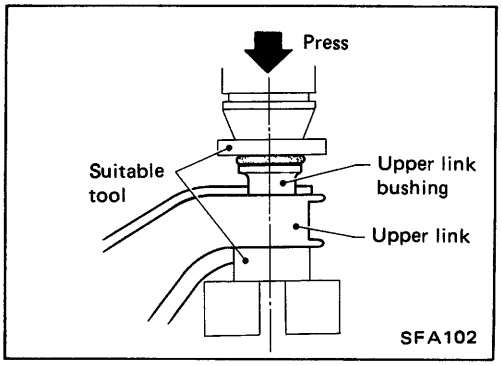


DISASSEMBLY

- Press out upper link spindle with bushings.

INSPECTION

- Check upper link spindle and rubber bushings for damage. Replace if necessary.
- Check upper link for deformation or cracks. Replace if necessary.

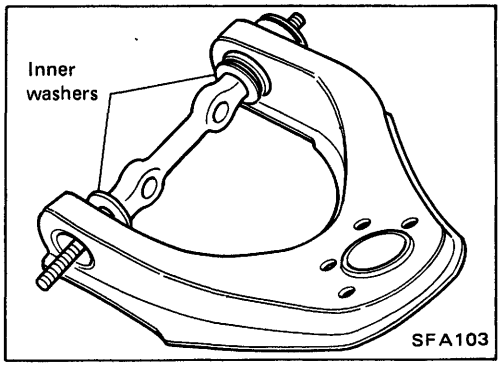


ASSEMBLY

- Apply soapsuds to rubber bushing.
- Press upper link bushing.

Press bushing so that flange of bushing securely contacts end surface of upper link collar.

Upper Link (Cont'd)

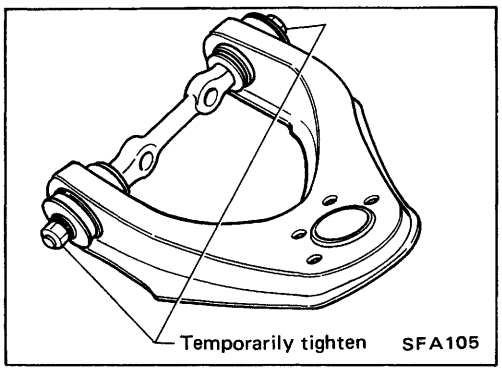


- Insert upper link spindle and inner washers.

Install inner washers with rounded edges facing inward.

- Press another bushing.

Press bushing so that flange of bushing securely contacts end surface of upper link collar.



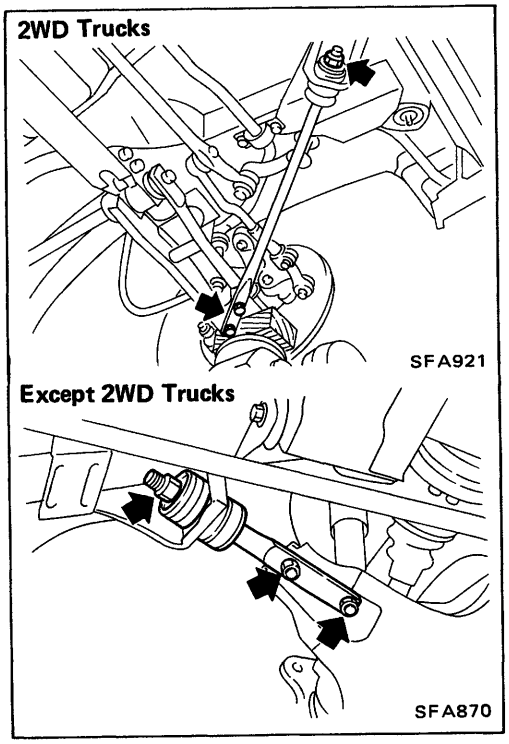
- Temporarily tighten nuts.

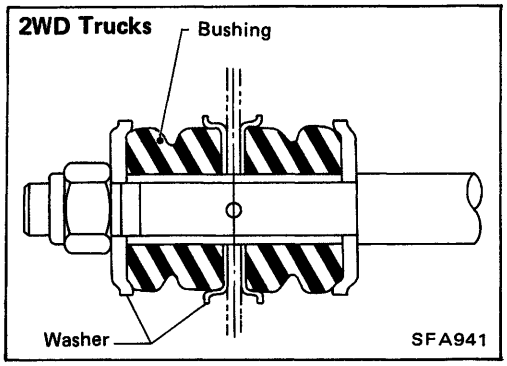
Tension Rod or Compression Rod

REMOVAL AND INSTALLATION

- Remove fixing nuts on lower link and frame.

Support lower link with jack.

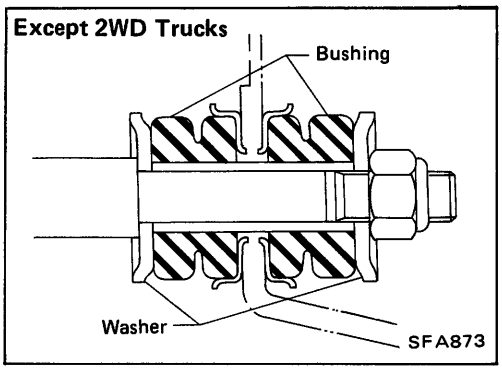




- Install tension rod. – 2WD Trucks –

Make sure that bushings and washers are installed properly.

Tension Rod or Compression Rod (Cont'd)

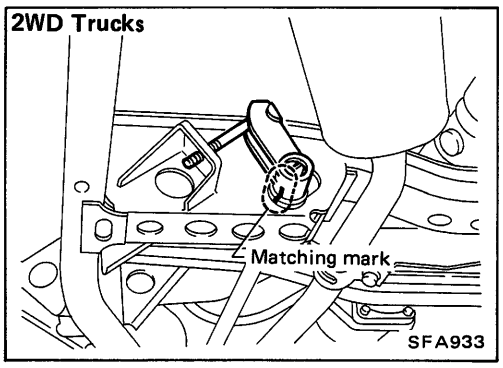


- Install compression rod. — Except 2WD Trucks —

Make sure that bushings and washers are installed properly.

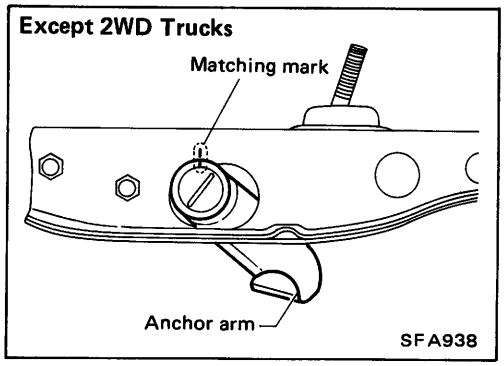
Lower Link

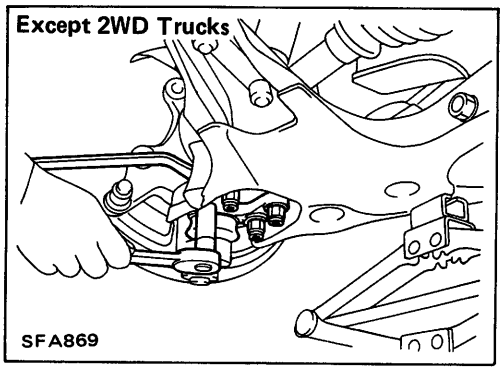
REMOVAL AND INSTALLATION



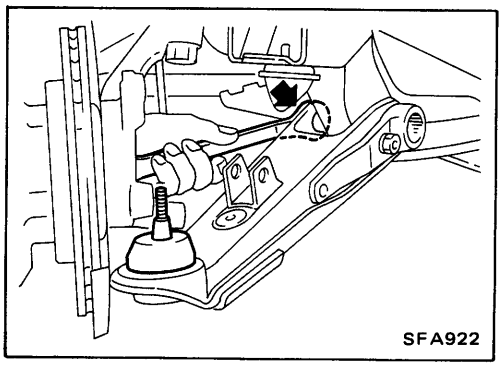
- Remove torsion bar spring. Refer to REMOVAL of Torsion Bar Spring.

Make matching mark on anchor arm and crossmember when loosening adjusting nut until there is no tension on torsion bar spring.



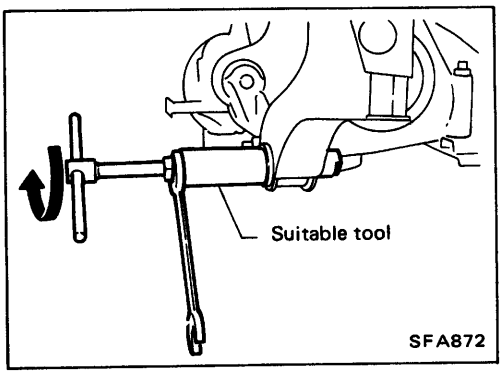


- Separate lower link ball joint from knuckle spindle. — 2WD Trucks —
  Refer to FRONT AXLE — Knuckle Spindle.
- Separate lower ball joint from lower link. — Except 2WD Trucks —



- Remove front lower link fixing nut.

Lower Link (Cont'd)



- Remove bushing of lower link spindle from frame with suitable tool.
- When installing bushing, apply soapy water on bushing.
- After installing lower link, adjust wheel alignment and vehicle height. Refer to Front Wheel Alignment of CHECK AND ADJUSTMENT – On-vehicle.

INSPECTION

Lower link and lower link spindle

- Check lower link and lower link spindle for deformation or cracks. Replace if necessary.

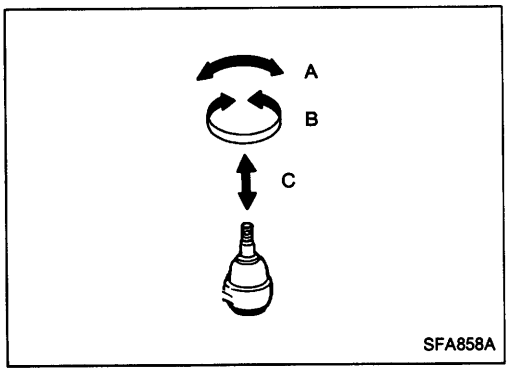
Lower link bushing

- Check bushing for distorsion or other damage. Replace if necessary.

Upper Ball Joint and Lower Ball Joint

REMOVAL AND INSTALLATION

- Separate knuckle spindle from upper and lower links. Refer to FRONT AXLE – Knuckle Spindle.



INSPECTION

- Check ball joint for turning torque "A".

  Upper ball joint:

  31.87 - 199.38 N

  (3.25 - 20.33 kg, 7.17 - 44.83 lb)

  Lower ball joint:

  [2WD Trucks]

  13.63 - 54.43 N

  (1.39 - 5.55 kg, 3.06 - 12.24 lb)

  [Except 2WD Trucks]

  0 - 67.7 N

  (0 - 6.9 kg, 0 - 15.2 lb)

  If turning torque A is not within above specifications, replace ball joint assembly.

Upper Ball Joint and Lower Ball Joint (Cont'd)

- Check ball joint for turning torque "B".

  Upper ball joint:

  1.0 - 4.9 N·m

  (10 - 50 kg-cm, 8.7 - 43.4 in-lb)

  Lower ball joint:

  [2WD Trucks]

  1.0 - 3.9 N·m

  (10 - 40 kg-cm, 8.7 - 34.7 in-lb)

  [Except 2WD Trucks]

  0 - 4.9 N·m

  (0 - 50 kg-cm, 0 - 43 in-lb)

  If turning torque B is not within above specifications, replace ball joint assembly.

- Check ball joint for vertical end play "C".

  Upper ball joint:

  1.6 mm (0.063 in) or less

  Lower ball joint:

  [2WD Trucks]

  1.6 mm (0.063 in) or less

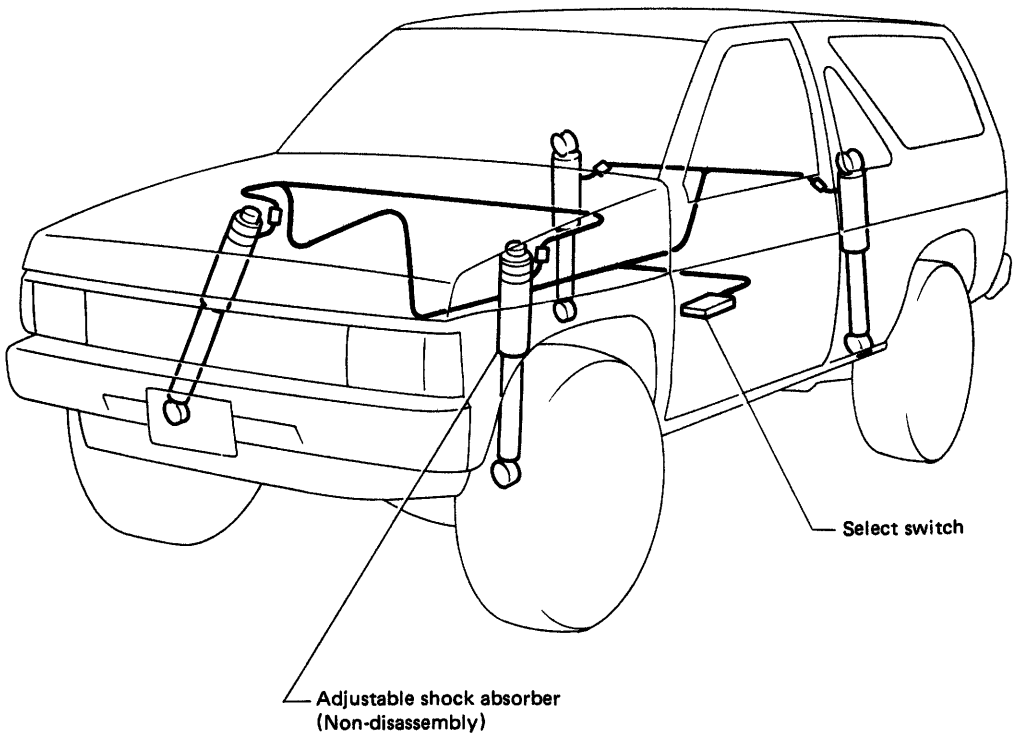
  [Except 2WD Trucks]

  0.5 mm (0.020 in) or less

  Replace ball joint if movement is beyond specifications.

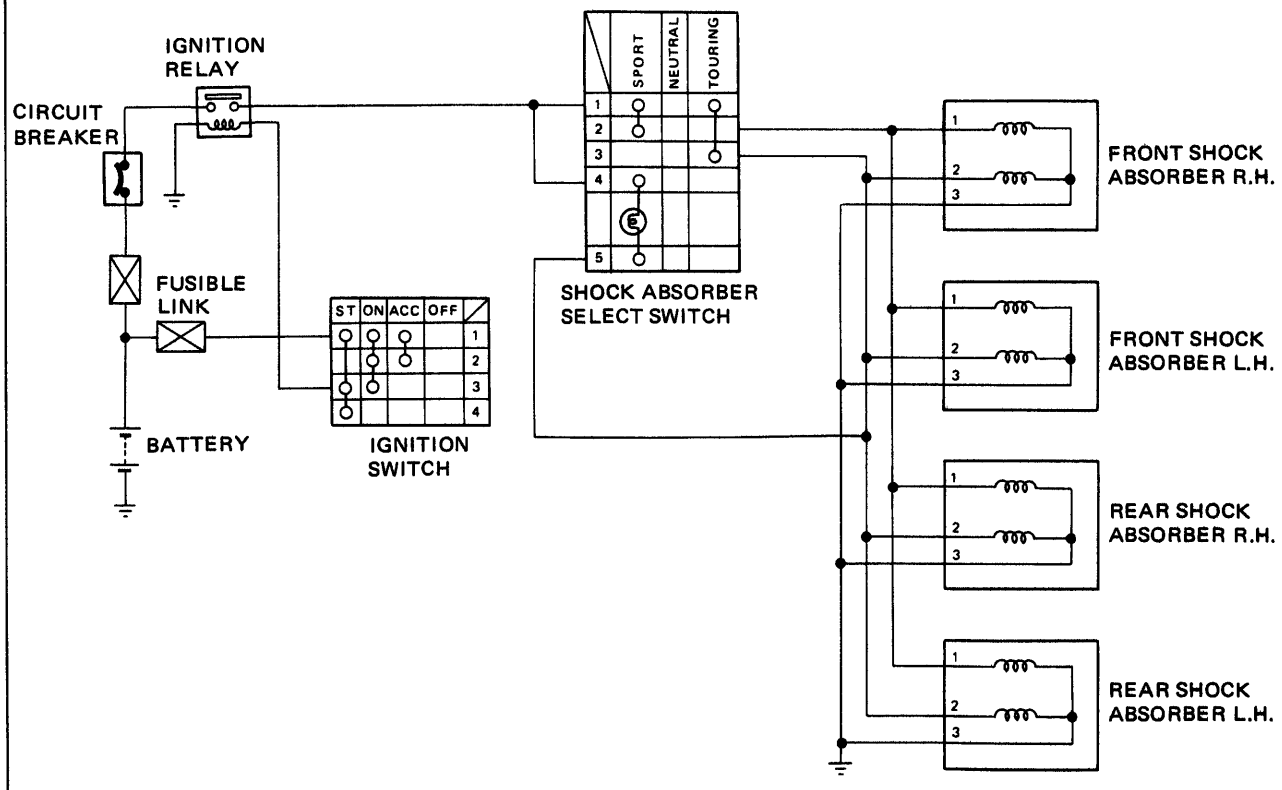
- Check dust cover for damage.
  Replace dust cover and dust cover clamp if necessary.

Description



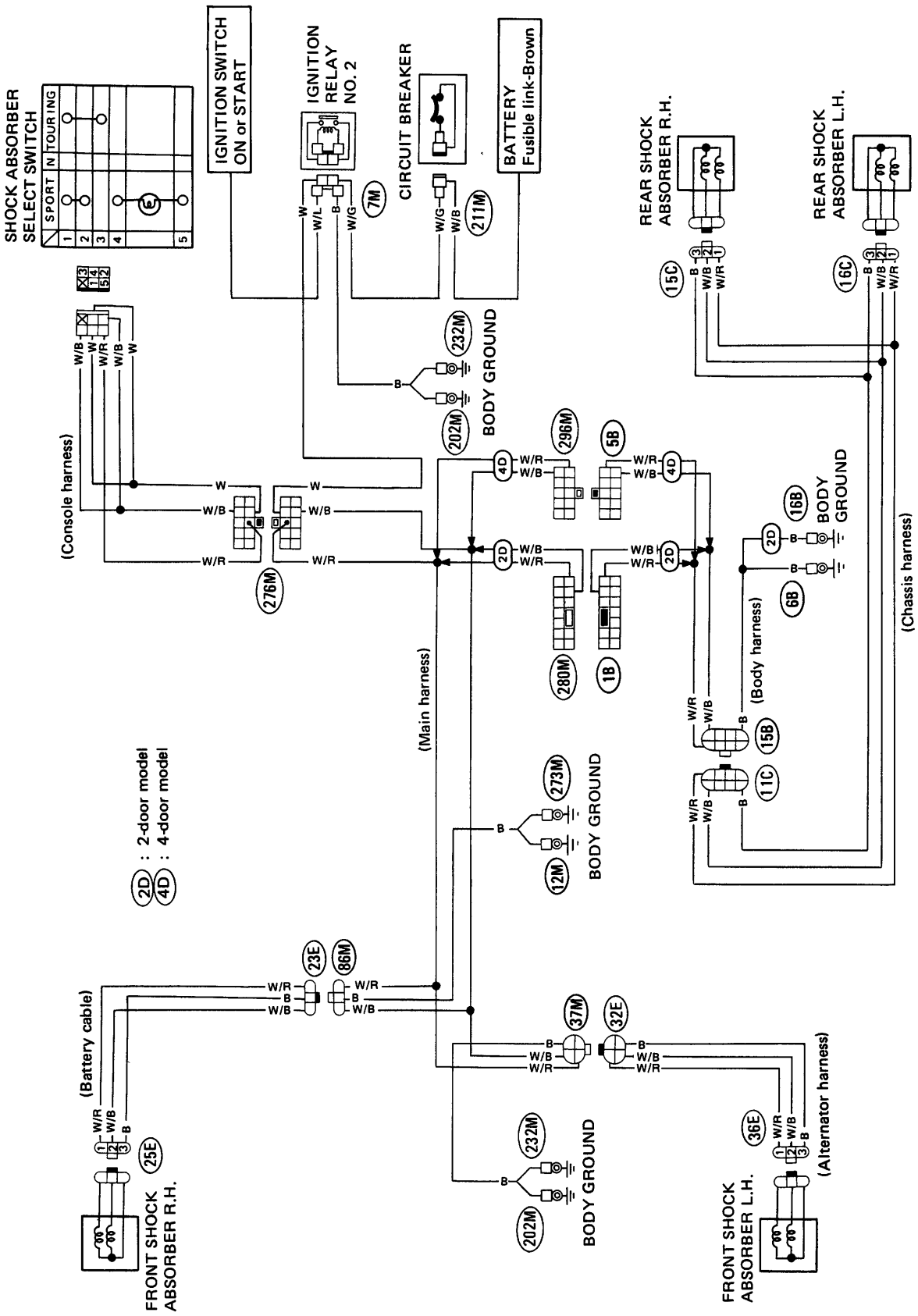
SFA177A

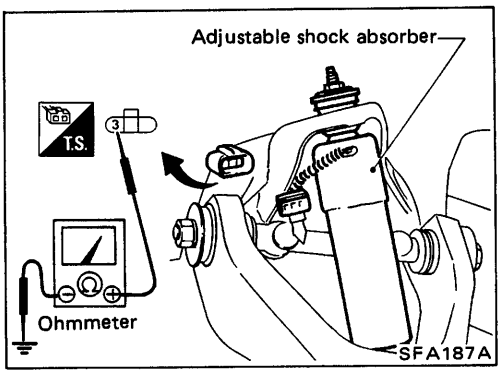
Schematic

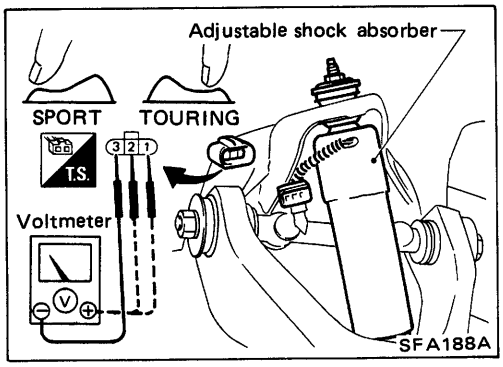


SFA833A

Wiring Diagram







Terminal check

POWER SUPPLY CIRCUIT CHECK

1. Disconnect adjustable shock absorber connector.
2. Check for continuity between terminal ③ and body ground.

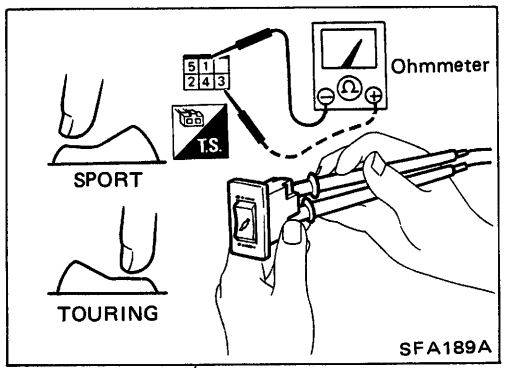
Ohmmeter terminal		Continuity
(+)	(−)	
③	Body ground	Yes

3. Connect a voltmeter from terminal side.
4. Measure voltage across terminal ③ and terminals ② & ①.

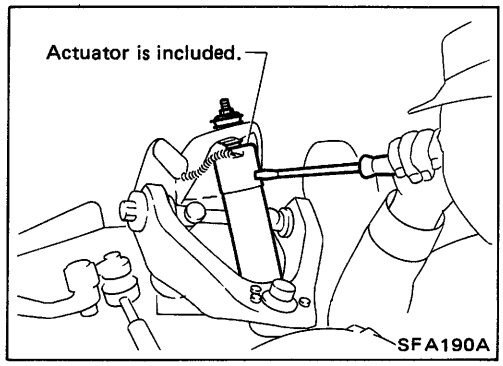
Voltmeter		Voltage	Select switch position
(+)	(−)		
①	③	Approx. 12V	Push the SPORT end of the switch continuously.
		0	Release the switch.
②		Approx. 12V	Push the TOURING end of the switch continuously.
		Approx. 12V	Release the switch.

SELECT SWITCH CHECK

1. Disconnect select switch connector, then connect an ohmmeter to switch.
2. Check for continuity between terminals at each switch position.



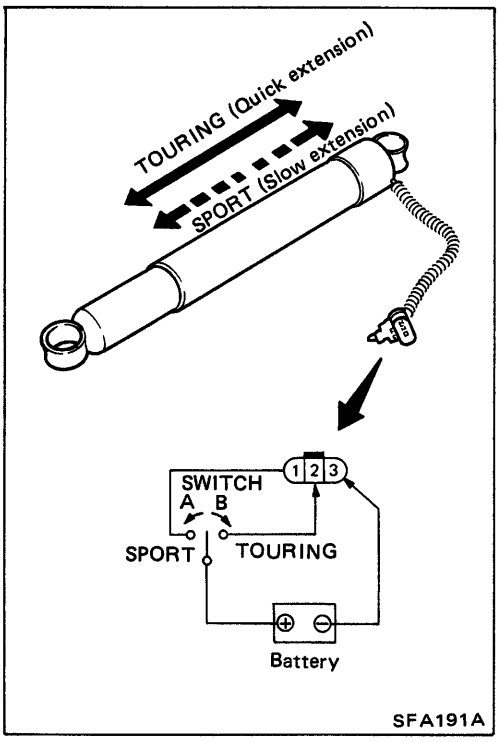
Switch position \ Terminal	①	②	③	④	⑤
NEUTRAL					
SPORT	○	○		○—Ω—○	
TOURING	○		○	Approx. 20Ω	



Shock Absorber Check

[Method A]

Attach a suitable tool to the shock absorber. Check operating sound of the actuator when the select switch is moved from one position (SPORT) to the other (TOURING) and vice versa.



Shock Absorber Check (Cont'd)

[Method B]

1. Compress the shock absorber as much as possible.
2. Apply battery voltage across terminals (③ and ① , ③ and ②) of the shock absorber.
3. Check if speed varies with expansion of the shock absorber when switching to A side and B side.
   If speed changes, the actuator is functioning properly. (In other words, oil passages in the shock absorber are properly switched by the actuator.)

General Specifications

TORSION BAR SPRING

Applied model	Truck			Van & Wagon
	2WD		4WD	
	Except Heavy duty	Heavy duty		
Spring diameter x length mm (in)	22.6 x 885 (0.890 x 34.84)	24.4 x 885 (0.961 x 34.84)	26.0 x 1,205 (1.024 x 47.44)	26.0 x 1,230 (1.024 x 48.43)
Spring constant N/mm (kg/mm, lb/in)	23.5 (2.4, 134)	30.4 (3.1, 174)	32.4 (3.3, 185)	

SHOCK ABSORBER

Applied model	Truck				Van & Wagon		
	2WD		4WD				
	Except Heavy duty	Heavy duty	Except Canada	Canada			
Shock absorber type	Non-adjustable					Adjustable	
						Touring	Sport
Damping force [at 0.3 m (1.0 ft)/sec.] N (kg, lb)							
Expansion	569 - 804 (58 - 82, 128 - 181)	1,089 - 1,461 (111 - 149, 245 - 329)	1,599 - 2,128 (163 - 217, 359 - 478)	1,687 - 2,236 (172 - 228, 379 - 503)	2,373 - 3,119 (242 - 318, 534 - 701)	2,491 - 3,295 (254 - 336, 560 - 741)	2,972 - 3,933 (303 - 401, 668 - 884)
Compression	216 - 333 (22 - 34, 49 - 75)	314 - 471 (32 - 48, 71 - 106)	559 - 814 (57 - 83, 126 - 183)	432 - 647 (44 - 66, 97 - 146)	765 - 1,098 (78 - 112, 172 - 247)	716 - 1,069 (73 - 109, 161 - 240)	1,334 - 1,903 (136 - 194, 300 - 428)

STABILIZER BAR

Applied model	2WD Truck	Except 2WD Truck
Stabilizer bar diameter mm (in)	23.0 (0.906)	24.0 (0.945)

TENSION ROD OR COMPRESSION ROD

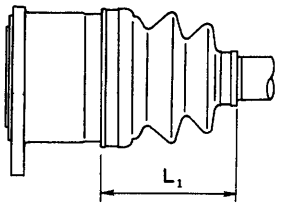
Applied model	2WD Truck	Except 2WD Truck
Rod diameter mm (in)	22.0 (0.866)	23.5 (0.925)

General Specifications (Cont'd)

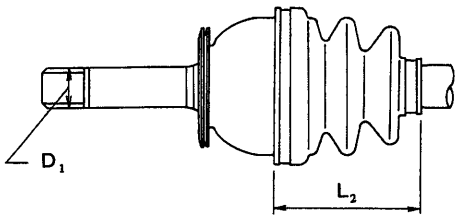
DRIVE SHAFT (4WD models)

Applied model	KA24E	VG30E
Drive shaft joint type Final drive side	TS82F	DS90
Wheel side	ZF100	ZF100
Fixed joint axial end play limit mm (in)	0.1 (0.004)	
Diameter mm (in) Wheel side (D_1)	28.0 (1.102)	29.0 (1.142)
Grease Quality	Nissan genuine grease or equivalent	
Capacity g (oz) Final drive side	150 - 160 (5.29 - 5.64)	165 - 175 (5.82 - 6.17)
Wheel side	210 - 220 (7.41 - 7.76)	
Boot length mm (in) Final drive side (L_1)	102 - 104 (4.02 - 4.09)	92.9 - 94.9 (3.657 - 3.736)
Wheel side (L_2)	96 - 98 (3.78 - 3.86)	

Final drive side



Wheel side



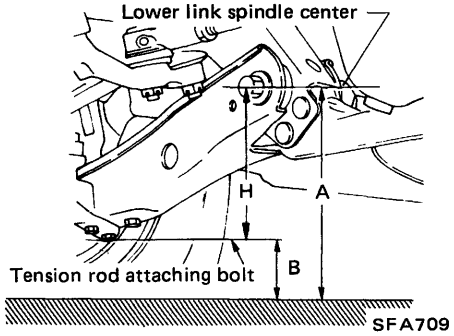
SFA877A

Inspection and Adjustment

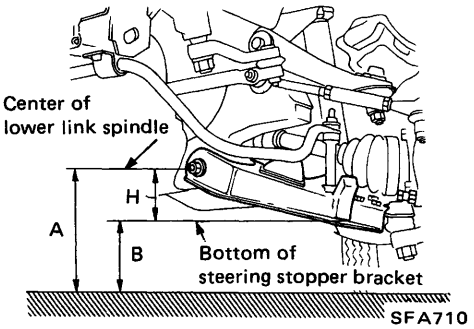
WHEEL ALIGNMENT (Unladen*1)

Applied model		ALLOWABLE LIMIT		ADJUSTING RANGE	
		2WD Truck	Except 2WD Truck	2WD Truck	Except 2WD Truck
Camber	degree	–0°20′ to 1°10′	–0°05′ to 1°25′	–0°5′ to 0°55′	0°10′ - 1°10′
Caster	degree	–0°23′ to 1°07′	33′ - 2°03′	–0°8′ to 0°52′	0°48′ - 1°48′
Kingpin inclination	degree	8°20′ - 9°50′	7°21′ - 8°51′	8°35′ - 9°35′	7°36′ - 8°36′
Camber, caster, and kingpin inclination difference between both sides	degree	45′		30′	
Total toe-in					
Bias tire	mm (in)	3 - 7 (0.12 - 0.28)	3 - 7 (0.12 - 0.28)	4 - 6 (0.16 - 0.24)	4 - 6 (0.16 - 0.24)
	degree	15′ - 35′	15′ - 35′	20′ - 30′	20′ - 30′
Radial tire	mm (in)	1 - 5 (0.04 - 0.20)	2 - 6 (0.08 - 0.24)	2 - 4 (0.08 - 0.16)	3 - 5 (0.12 - 0.20)
	degree	7′ - 27′	12′ - 32′	12′ - 22′	17′ - 27′
Front wheel turning angle (Full turn*2)	degree				
Except 31 x 10.5R15 tire					
Inside		34° - 38°	31° - 35°	36° - 38°	33° - 35°
Outside		31° - 35°	29° - 33°	33° - 35°	31° - 33°
31 x 10.5R15 tire					
Inside		–	25° - 29°	–	27° - 29°
Outside		–	23° - 27°	–	25° - 29°
Vehicle posture					
Lower arm pivot height (H)	mm (in)	108 - 118 (4.25 - 4.65)	41 - 51 (1.61 - 2.01)	111 - 115 (4.37 - 4.53)	44 - 48 (1.73 - 1.89)

2WD Trucks



Except 2WD Trucks



*1: Fuel, radiator coolant and engine oil full. Spare tire, jack, hand tools and mats in designated positions.
*2: On power steering models, wheel turning force (at circumference of steering wheel) of 98 to 147 N (10 to 15 kg, 22 to 33 lb) with engine idle.

WHEEL BEARING

2WD Trucks

Wheel bearing axial end play mm (in)	0 (0)
Wheel bearing lock nut Tightening torque N·m (kg-m, ft-lb)	34 - 39 (3.5 - 4.0, 25 - 29)
Return angle degree	45°
Wheel bearing starting torque At wheel hub bolt With new grease seal N (kg, lb)	9.8 - 28.4 (1.0 - 2.9, 2.2 - 6.4)
With used grease seal N (kg, lb)	9.8 - 23.5 (1.0 - 2.4, 2.2 - 5.3)

Except 2WD Trucks

Wheel bearing lock nut Tightening torque N·m (kg-m, ft-lb)	78 - 98 (8 - 10, 58 - 72)
Retightening torque after loosening wheel bearing lock nut N·m (kg-m, ft-lb)	0.5 - 1.5 (0.05 - 0.15, 0.4 - 1.1)
Axial end play mm (in)	0 (0)
Starting force at wheel hub bolt N (kg, lb)	A
Turning angle degree	15° - 30°
Starting force at wheel hub bolt N (kg, lb)	B
Wheel bearing preload at wheel hub bolt N (kg, lb) B–A	7.06 - 20.99 (0.72 - 2.14, 1.59 - 4.72)

WHEEL RUNOUT

Wheel type	Aluminum	Steel		
		15 inches	14 inches	
			Painted	Plated
Radial runout limit mm (in)	0.3 (0.012)	0.8 (0.031)	0.5 (0.020)	1.2 (0.047)
Lateral runout limit mm (in)	0.3 (0.012)	0.8 (0.031)	0.8 (0.031)	1.2 (0.047)

DRIVE SHAFT

Drive shaft axial end play mm (in)	0.1 - 0.3 (0.004 - 0.012)

Drive shaft end snap ring

Thickness mm (in)	Part No.
1.1 (0.043)	39253-31G10
1.3 (0.051)	39253-31G11
1.5 (0.059)	39253-31G12
1.7 (0.067)	39253-31G13
1.9 (0.075)	39253-31G14
2.1 (0.083)	39253-31G15
2.3 (0.091)	39253-31G16

UPPER BALL JOINT

Applied model	2WD Trucks	Except 2WD Trucks
Turning torque "A" (Measuring point: cotter pin hole of ball stud) N (kg, lb)	31.87 - 199.38 (3.25 - 20.33, 7.17 - 44.83)	
Turning torque "B" N·m (kg-cm, in-lb)	1.0 - 4.9 (10 - 50, 8.7 - 43.4)	
Vertical end play limit "C" mm (in)	1.6 (0.063)	

LOWER BALL JOINT

Applied model	2WD Trucks	Except 2WD Trucks
Turning torque "A" (Measuring point: cotter pin hole of ball stud) N (kg, lb)	13.63 - 54.43 (1.39 - 5.55, 3.06 - 12.24)	0 - 67.7 (0 - 6.9, 0 - 15.2)
Turning torque "B" N·m (kg-cm, in-lb)	1.0 - 3.9 (10 - 40, 8.7 - 34.7)	0 - 4.9 (0 - 50, 0 - 43)
Vertical end play limit "C" mm (in)	1.6 (0.063)	0.5 (0.020)

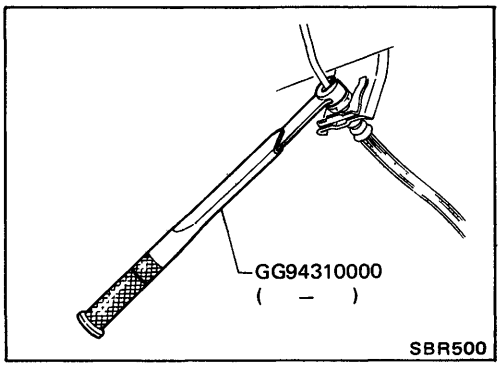
REAR AXLE & REAR SUSPENSION

SECTION RA

CONTENTS

PRECAUTIONS AND PREPARATION ..... RA- 2
REAR AXLE AND REAR SUSPENSION ..... RA- 4
CHECK AND ADJUSTMENT — On-vehicle ..... RA- 6
REAR AXLE — Drum Brake Type ..... RA- 7
REAR AXLE — Disc Brake Type RA-12
REAR SUSPENSION — Leaf Spring Type RA-16
REAR AXLE AND REAR SUSPENSION — 5-link Type RA-21
REAR SUSPENSION — 5-link Type RA-22
SERVICE DATA AND SPECIFICATIONS (S.D.S.) RA-25

* For adjustable shock absorber, refer to FA section.

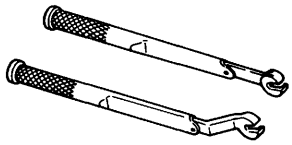
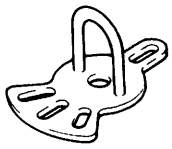
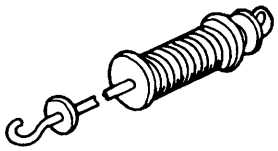
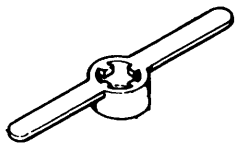
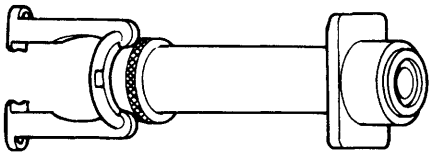
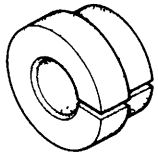


Precautions

- When installing each rubber part, final tightening must be carried out under unladen condition* with tires on ground.
  *: Fuel, radiator coolant and engine oil full. Spare tire, jack, hand tools and mats in designated positions.
- Use Tool when removing or installing brake tubes.
- When removing each suspension part, check wheel alignment and adjust if necessary.

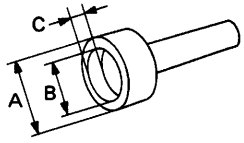
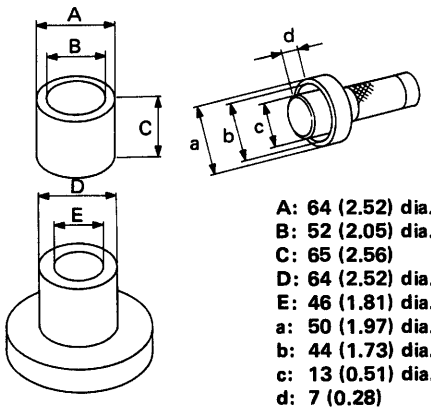
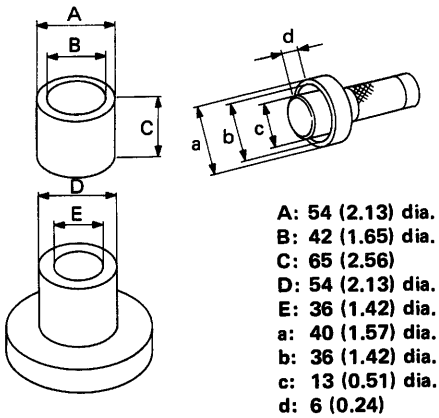
Preparation

SPECIAL SERVICE TOOLS

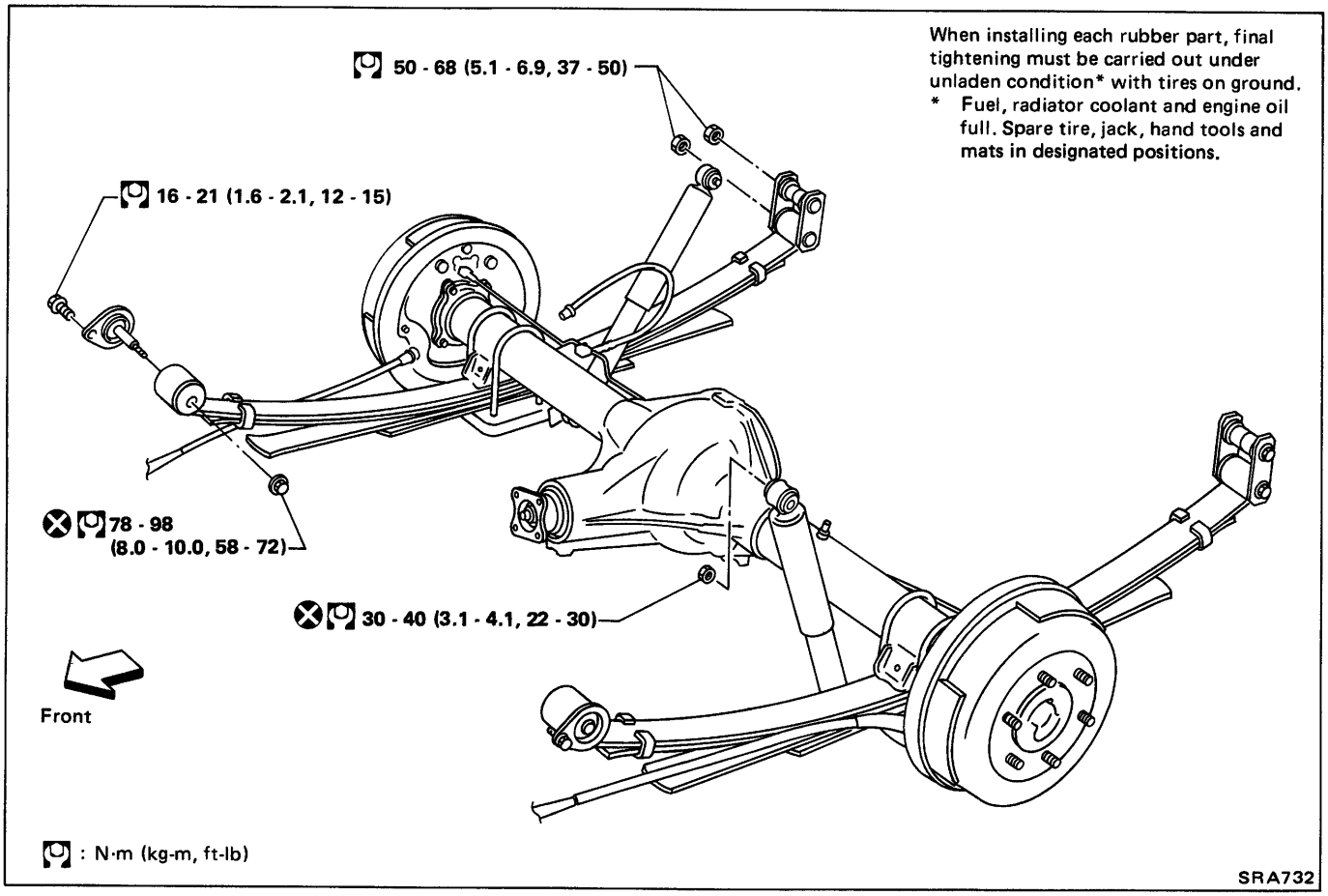
Tool number (Kent-Moore No.) Tool name	Description	
GG94310000 (–) Flare nut torque wrench		Removing or installing brake piping
KV40101000 (J25604-01) Axle stand		Removing rear axle shaft
ST36230000 (J25840-A) Sliding hammer		Removing rear axle shaft
ST38020000 (–) Bearing lock nut wrench		Removing wheel bearing lock nut
HT72480000 (J25852-B) Rear axle shaft bearing puller		Removing wheel bearing
ST37840000 (–) Rear axle shaft guide		Installing rear axle shaft

Preparation (Cont'd)

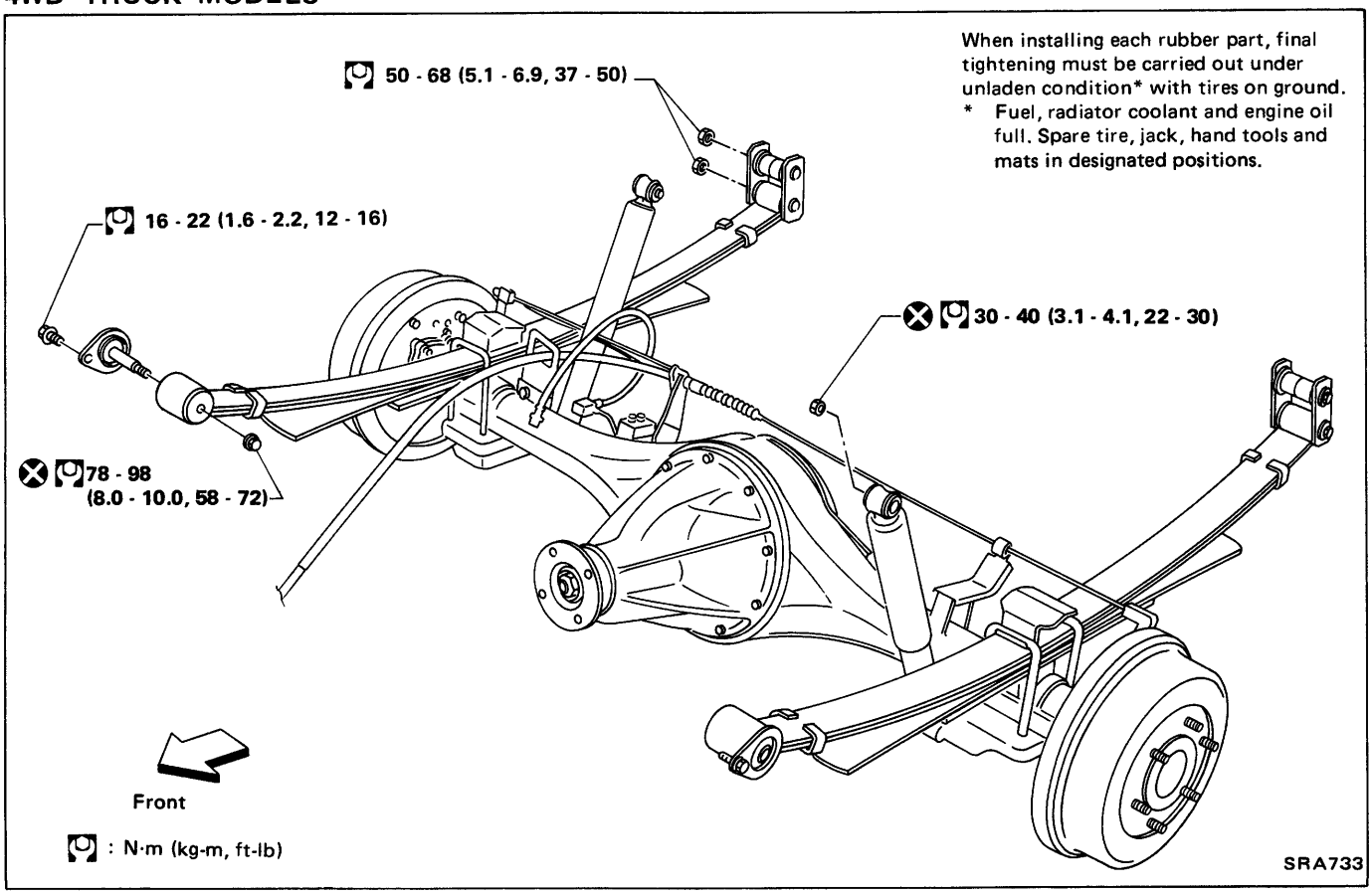
COMMERCIAL SERVICE TOOLS

Tool name	Description		Unit application	
			Leaf	5-link
Rear axle oil seal drift		Installing oil seal A: 74 mm (2.91 in) dia. B: 68 mm (2.68 in) dia. C: 10 mm (0.39 in)	X	X
Drift-lower and upper links bushing		Removing or installing lower and upper links bushing A: 64 (2.52) dia. B: 52 (2.05) dia. C: 65 (2.56) D: 64 (2.52) dia. E: 46 (1.81) dia. a: 50 (1.97) dia. b: 44 (1.73) dia. c: 13 (0.51) dia. d: 7 (0.28) Unit: mm (in)	–	X
Drift-panhard rod bushing		Removing or installing panhard rod bushing A: 54 (2.13) dia. B: 42 (1.65) dia. C: 65 (2.56) D: 54 (2.13) dia. E: 36 (1.42) dia. a: 40 (1.57) dia. b: 36 (1.42) dia. c: 13 (0.51) dia. d: 6 (0.24) Unit: mm (in)	–	X

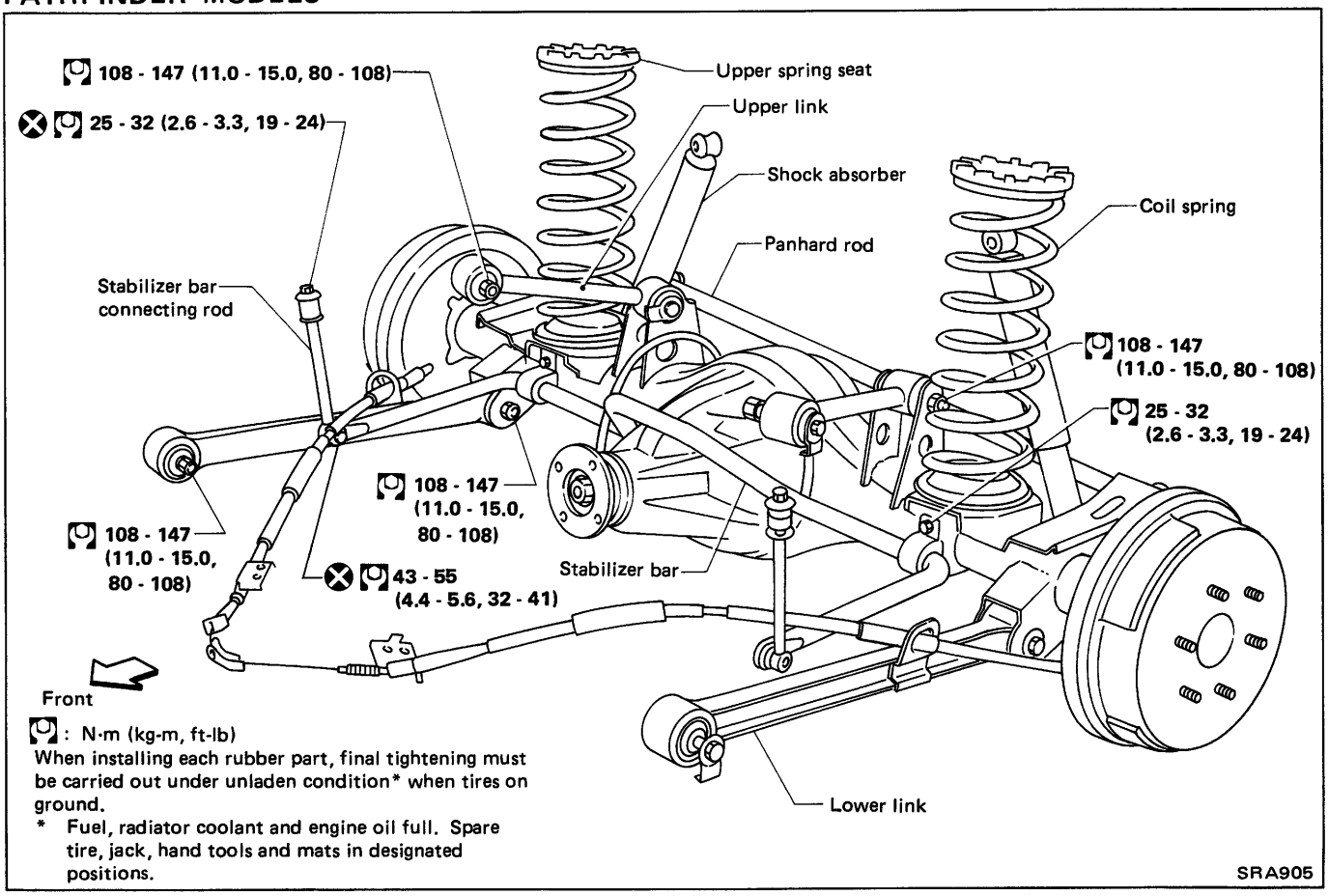
2WD TRUCK MODELS

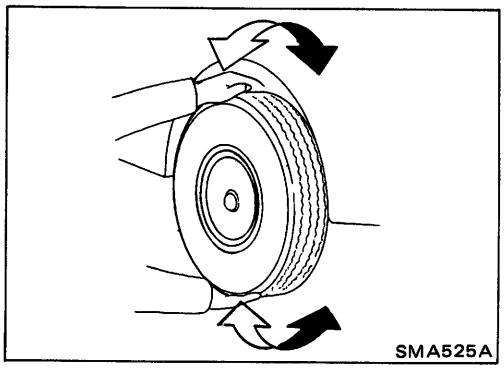


4WD TRUCK MODELS



PATHFINDER MODELS

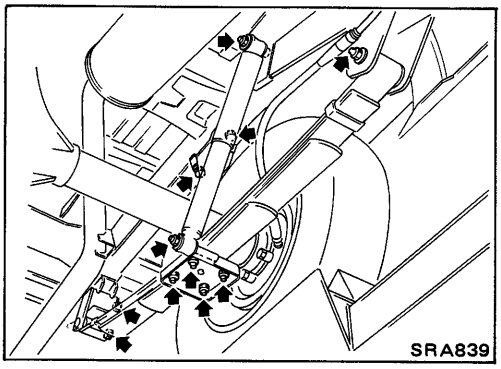



SMA525A

Rear Axle and Rear Suspension Parts

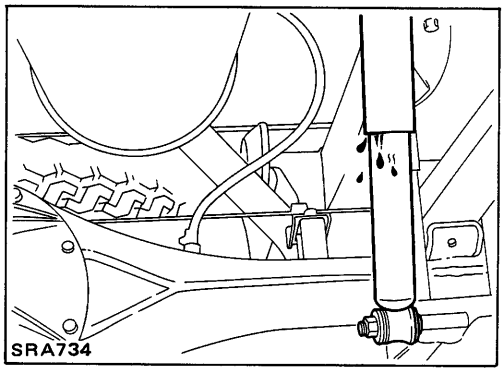
Check rear axle and rear suspension parts for looseness, wear or damage.

- Shake each rear wheel to check for excessive play.

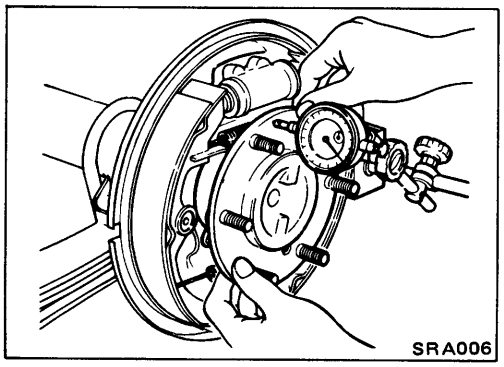

SRA839

- Retighten all nuts and bolts to the specified torque.

  Tightening torque: Refer to REAR SUSPENSION.


SRA734

- Check shock absorber for oil leakage or other damage.


SRA006

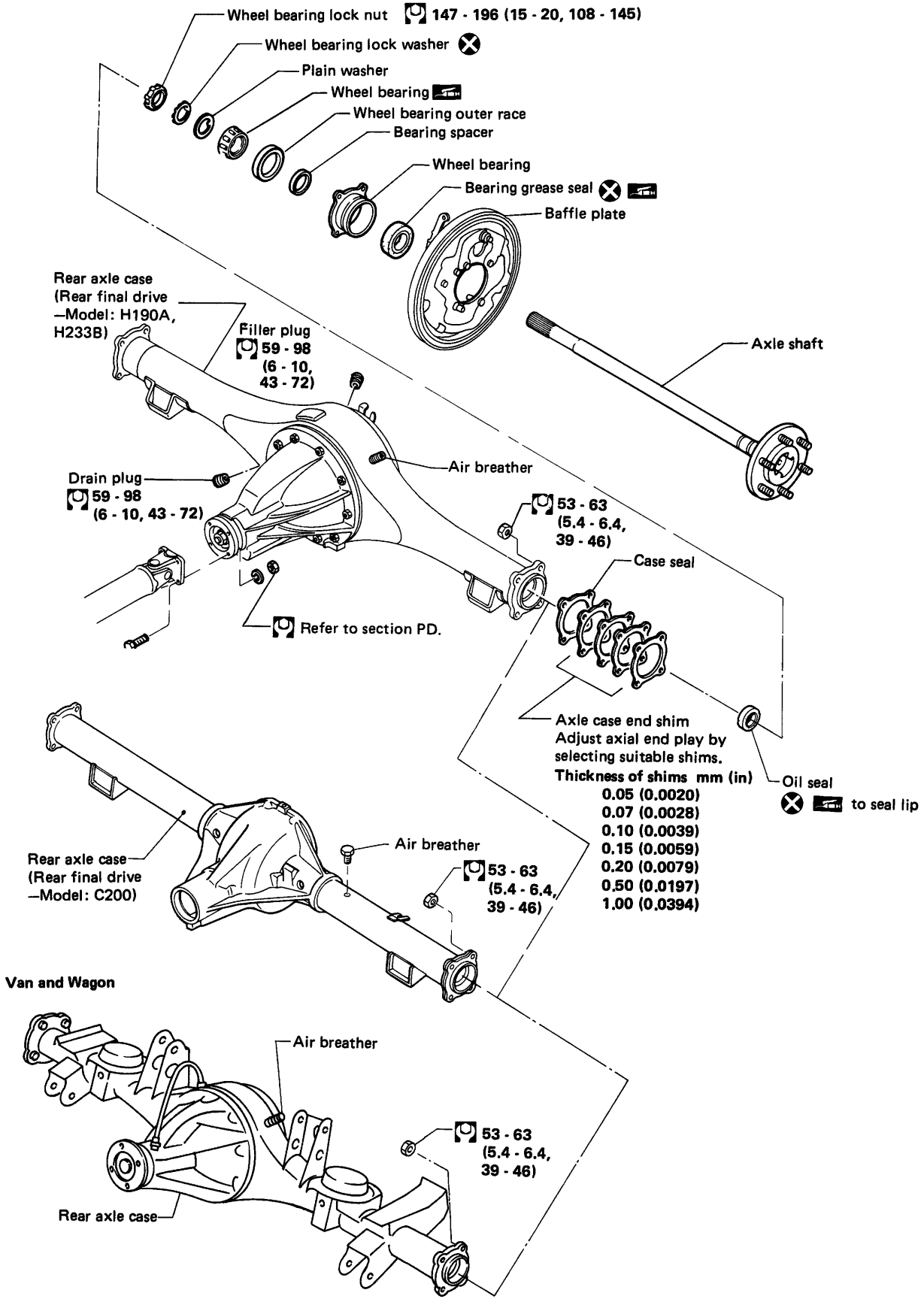
Rear Wheel Bearing

- Check that wheel bearings operate smoothly.
- Check axial end play.

  Axial end play:

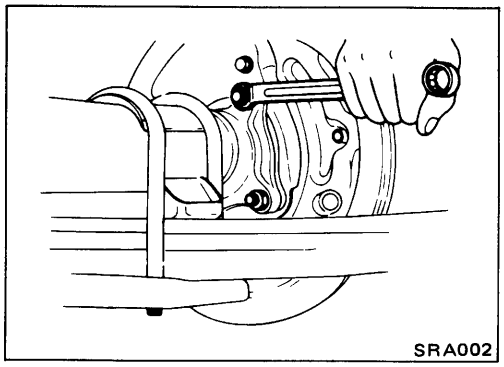
  Refer to S.D.S.

Components



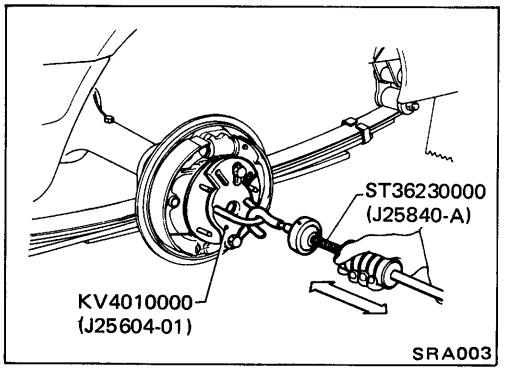
: N·m (kg-m, ft-lb)

SRA934


SRA002

Removal

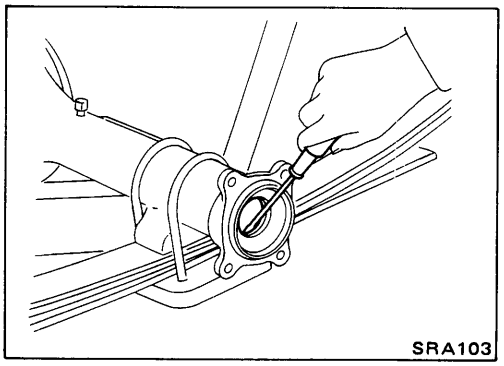
- Disconnect parking brake cable and brake tube.
- Remove nuts securing wheel bearing cage with baffle plate.



SRA003

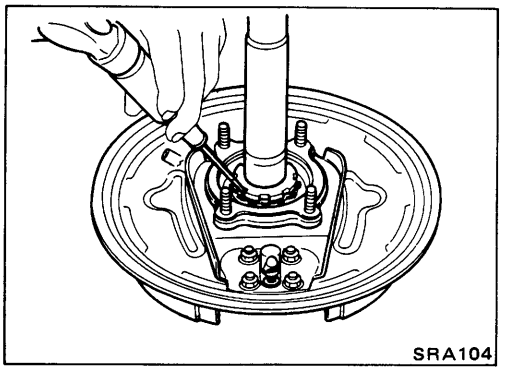
- Draw out axle shaft with Tool.

When drawing out axle shaft, be careful not to damage oil seal.

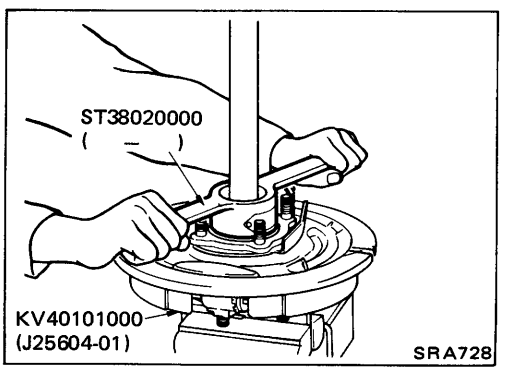

SRA103

- Remove oil seal.

Do not reuse oil seal once it is removed.
Always install new one.


SRA104

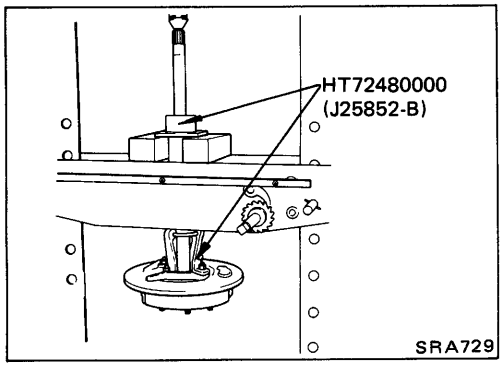
- Unbend lock washer with a screwdriver.



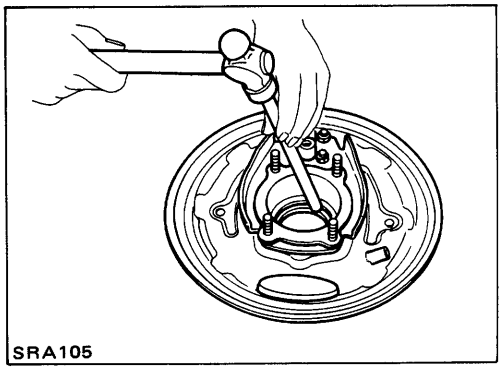
SRA728

- Remove bearing lock nut with Tool.

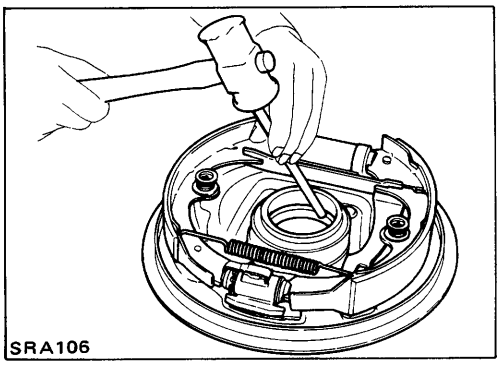
Removal (Cont'd)



- Remove wheel bearing together with bearing cage and baffle plate from axle shaft.



- Remove grease seal in bearing cage with suitable bar.



- Remove wheel bearing outer race with a brass drift.

Inspection

AXLE SHAFT

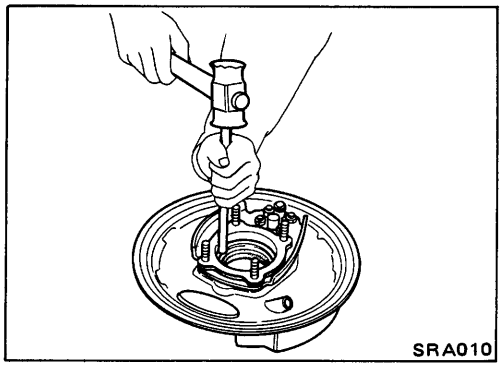
- Check axle shaft for straightness, cracks, damage, wear or distortion. Replace if necessary.

WHEEL BEARING

- Make sure wheel bearing rolls freely and is free from noise, cracks, pitting or wear.

AXLE CASE

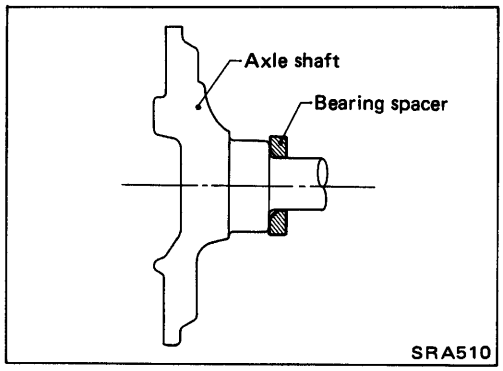
- Check axle case for yield, deformation or cracks. Replace if necessary.


SRA010

Installation

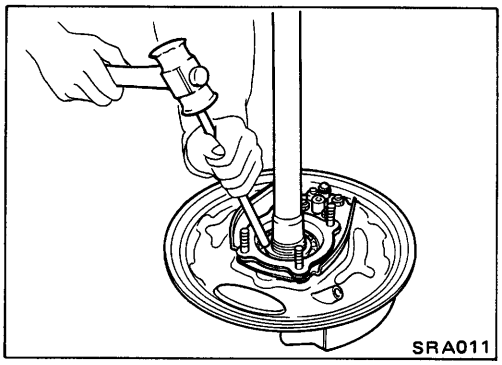
- Install wheel bearing outer race with a brass drift.
- Install a new grease seal in bearing cage.

After installing new grease seal, coat sealing lip with multi-purpose grease.



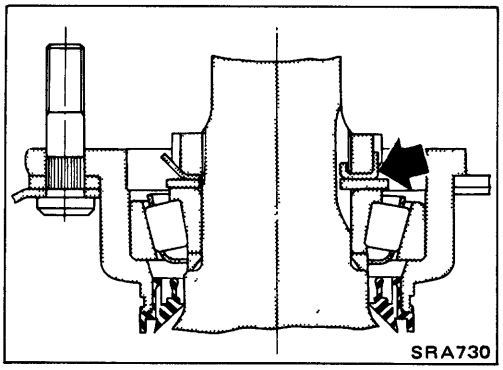
SRA510

- Install bearing spacer with chamfer side facing axle shaft flange.


SRA011

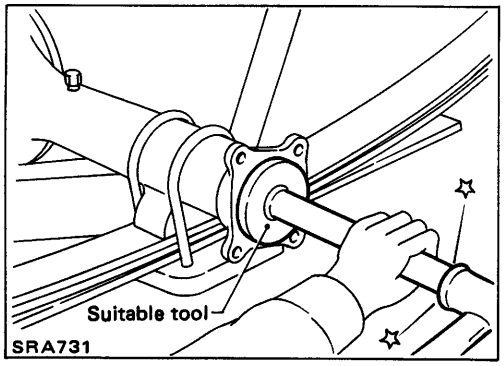
- Install wheel bearing inner race with a brass drift.

Coat each bearing cone with multi-purpose grease.


SRA730

- Install plain washer and a new wheel bearing lock washer.
- Tighten wheel bearing lock nut.

Fit wheel bearing lock washer lip in wheel bearing lock nut groove correctly by tightening lock nut. Be sure to bend it up.

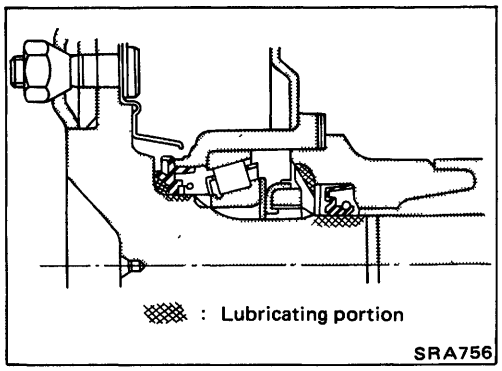


SRA731

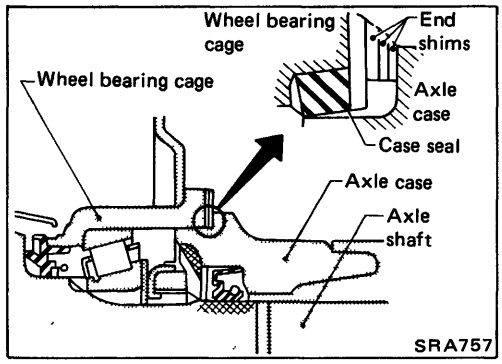
- Install a new oil seal with suitable tool.

After installing new oil seal, coat sealing lip with multi-purpose grease.

Installation (Cont'd)



- **Apply recess of axle case end with multi-purpose grease.**
- **Apply gear oil to the spline of axle shaft. Coat seal surface of axle shaft with multi-purpose grease (as shown left).**



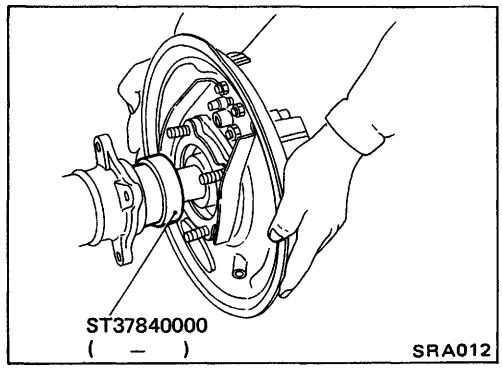
- Adjust axial end play.

(1) Select end shims.

Standard thickness: 1.5 mm (0.059 in)

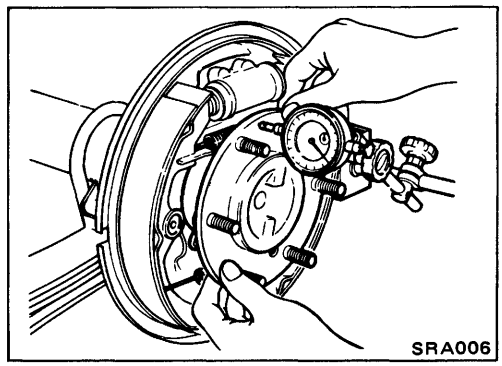
Axle case end shim: Refer to S.D.S.

Do not insert end shims between case seal and bearing cage.



(2) Insert axle shaft with Tool as a guide.

When inserting axle shaft, be careful not to damage oil seal.



(3) Measure end play of axle shaft.

Axial end play:

Servicing one side axle

0.02 - 0.15 mm (0.0008 - 0.0059 in)

Servicing both side axles

On first axle (right or left)

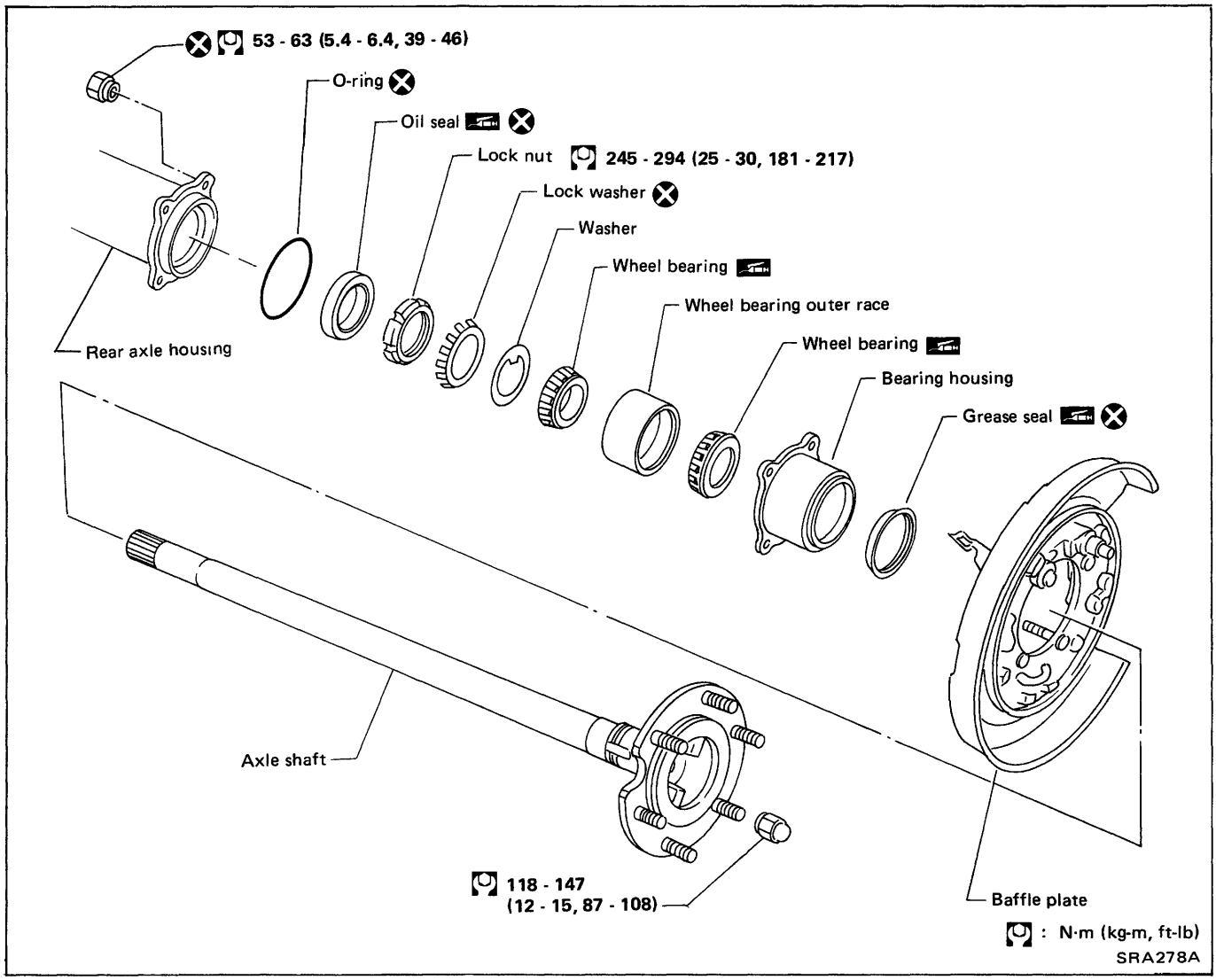
0.30 - 0.90 mm (0.0118 - 0.0354 in)

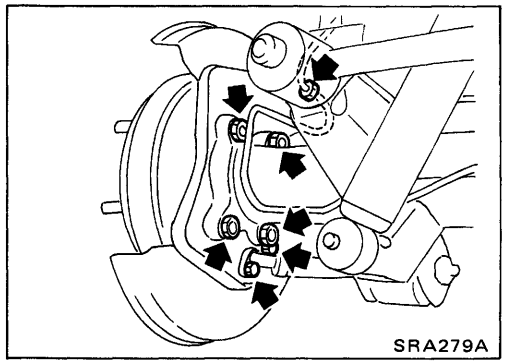
On second axle

0.02 - 0.15 mm (0.0008 - 0.0059 in)

(4) If axial end play is not within the specified limit, reselect axle case end shims.

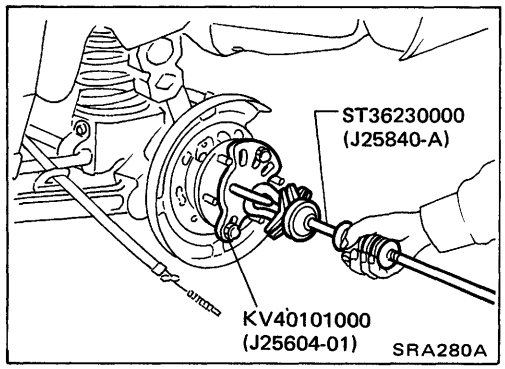
While adjusting axial end play, be careful not to damage oil seal.





Removal

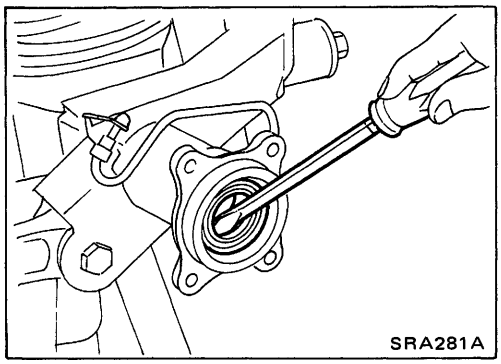
- Remove brake caliper assembly and rotor.
- Disconnect parking brake cable and brake tube.
- Remove nuts securing bearing housing to baffle plate.



- Draw out axle shaft with Tool.

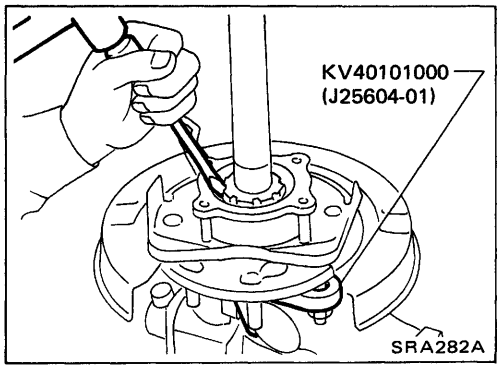
When drawing out axle shaft, be careful not to damage oil seal.

Removal (Cont'd)



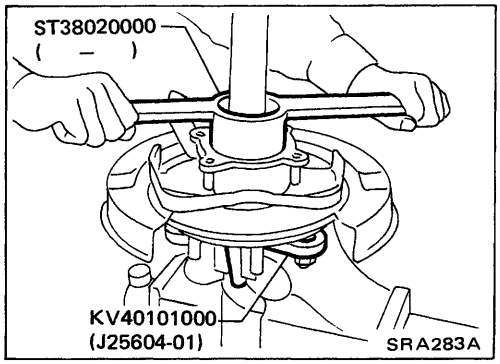
- Remove oil seal.

Do not reuse oil seal once it is removed.
Always install new one.

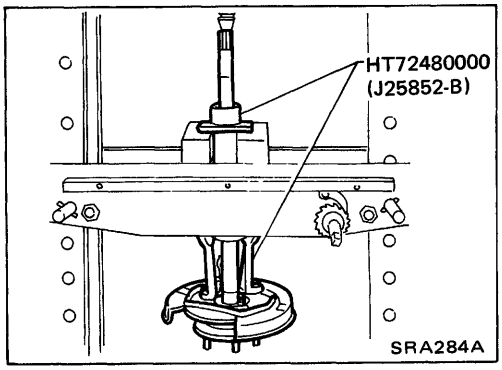


- Unbend lock washer with a screwdriver.

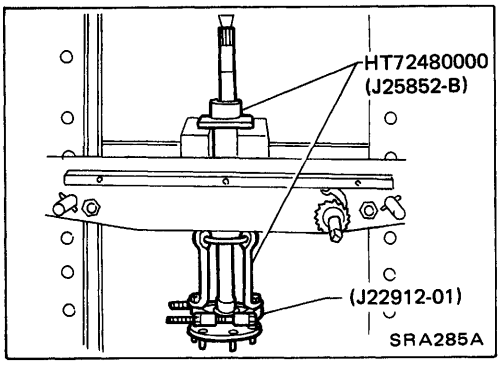
Do not reuse once removed lock washer.
Always install new one.



- Remove bearing lock nut with Tool.

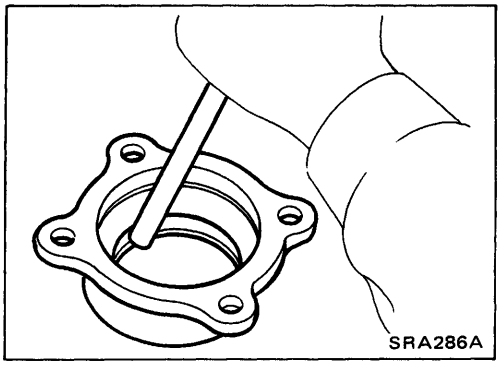


- Remove wheel bearing together with bearing housing and baffle plate from axle shaft.

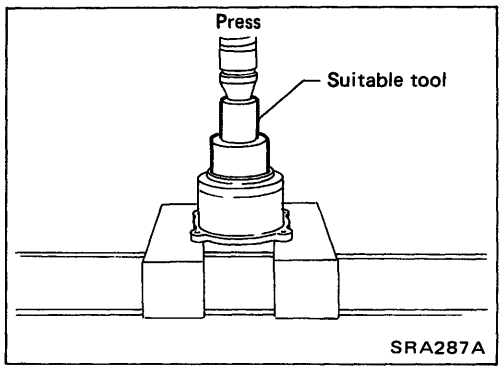


- Remove wheel bearing outer side inner race from axle shaft.

Removal (Cont'd)



- Remove grease seal in bearing housing with suitable bar.



- Remove wheel bearing outer race with a suitable tool.

Inspection

AXLE SHAFT

Check axle shaft for straightness, cracks, damage, wear or distortion. Replace if necessary.

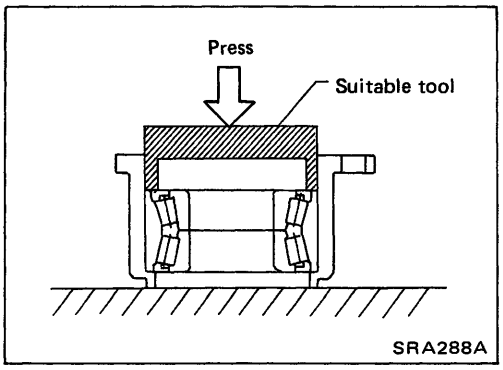
BEARING HOUSING

Check bearing housing for deformation or cracks. Replace if necessary.

REAR AXLE HOUSING

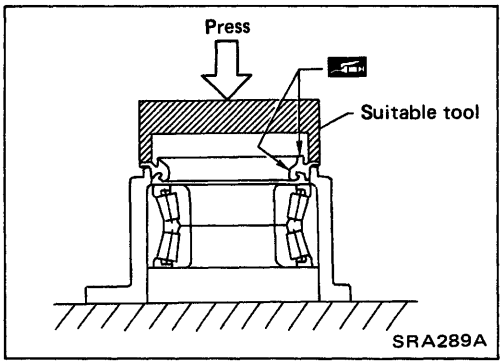
Check rear axle housing for yield, deformation or cracks. Replace if necessary.

Installation



- Press new wheel bearing until it bottoms end face of bearing housing.

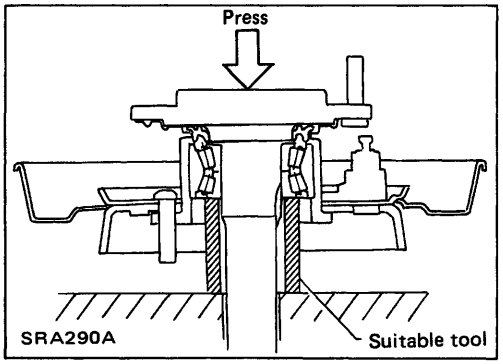
Always press outer race of wheel bearing during installation.



- Press new grease seal until it bottoms end face of bearing housing.

After installing new grease seal, coat sealing lip with multi-purpose grease.

Installation (Cont'd)

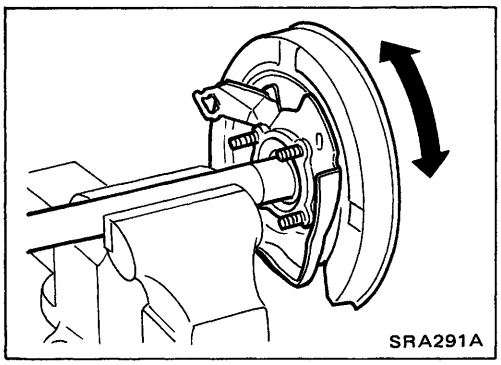


- Install baffle plate over bearing housing and press axle shaft into inner race of wheel bearing.

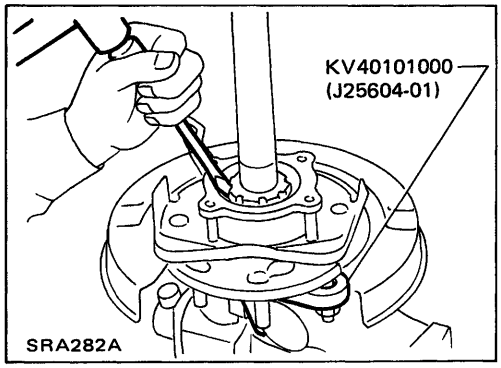
Be careful not to damage or deform grease seal.

- Before installing lock nut, apply a coat of wheel bearing grease to its seat. Tighten lock nut to specified torque.

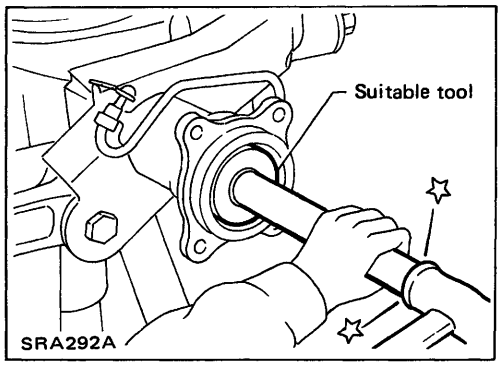
: 245 - 294 N·m
(25 - 30 kg-m, 181 - 217 ft-lb)



- Turn bearing housing (with respect to axle shaft) two or three times. It must turn smoothly.



- Lock lock nut by bending one portion of lock washer.



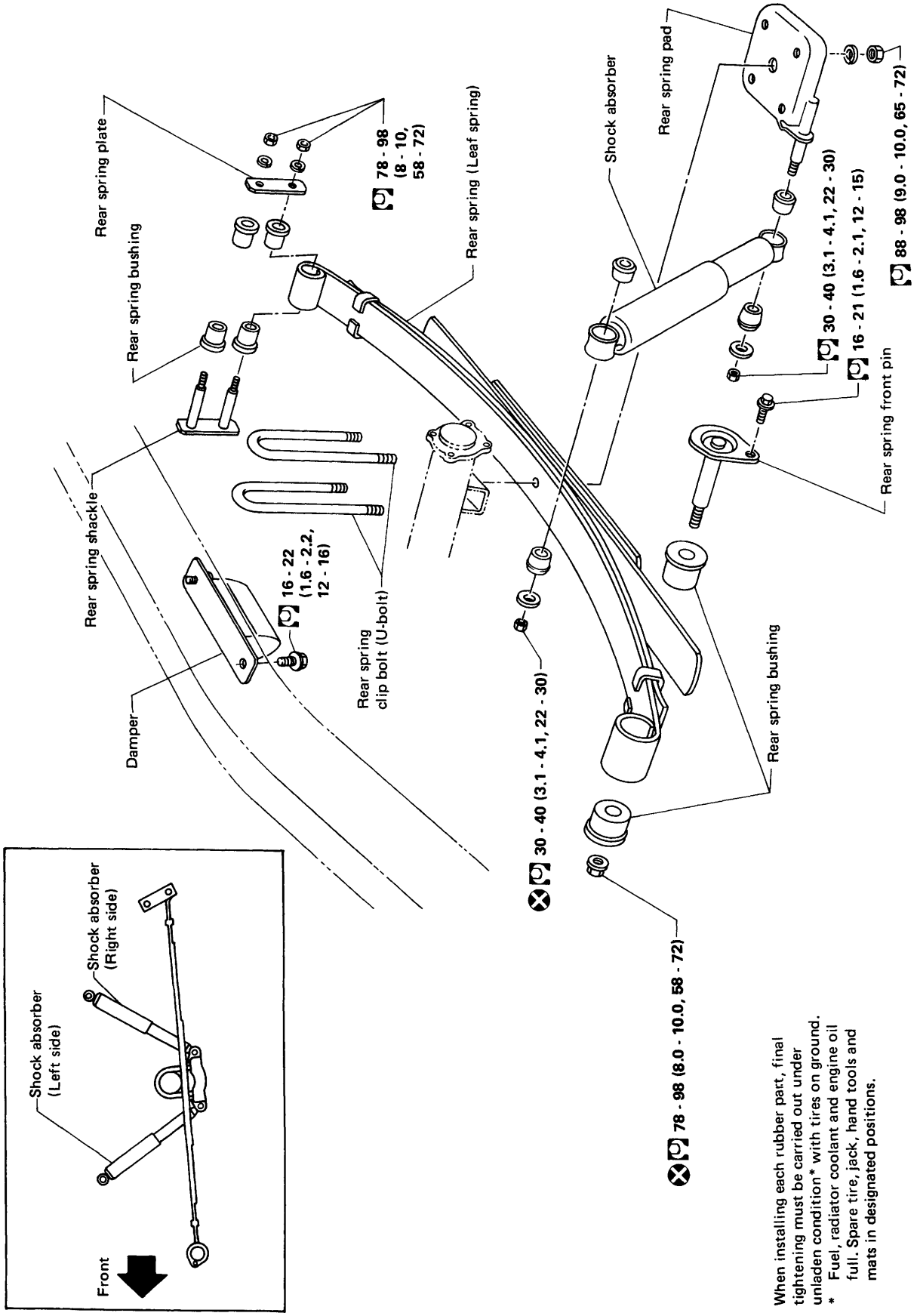
- Install new oil seal to rear axle housing using a suitable tool.

After installing new oil seal, coat sealing lip with multi-purpose grease.

- Position axle shafts in rear axle housing.

Be careful not to damage oil seal.

2WD models

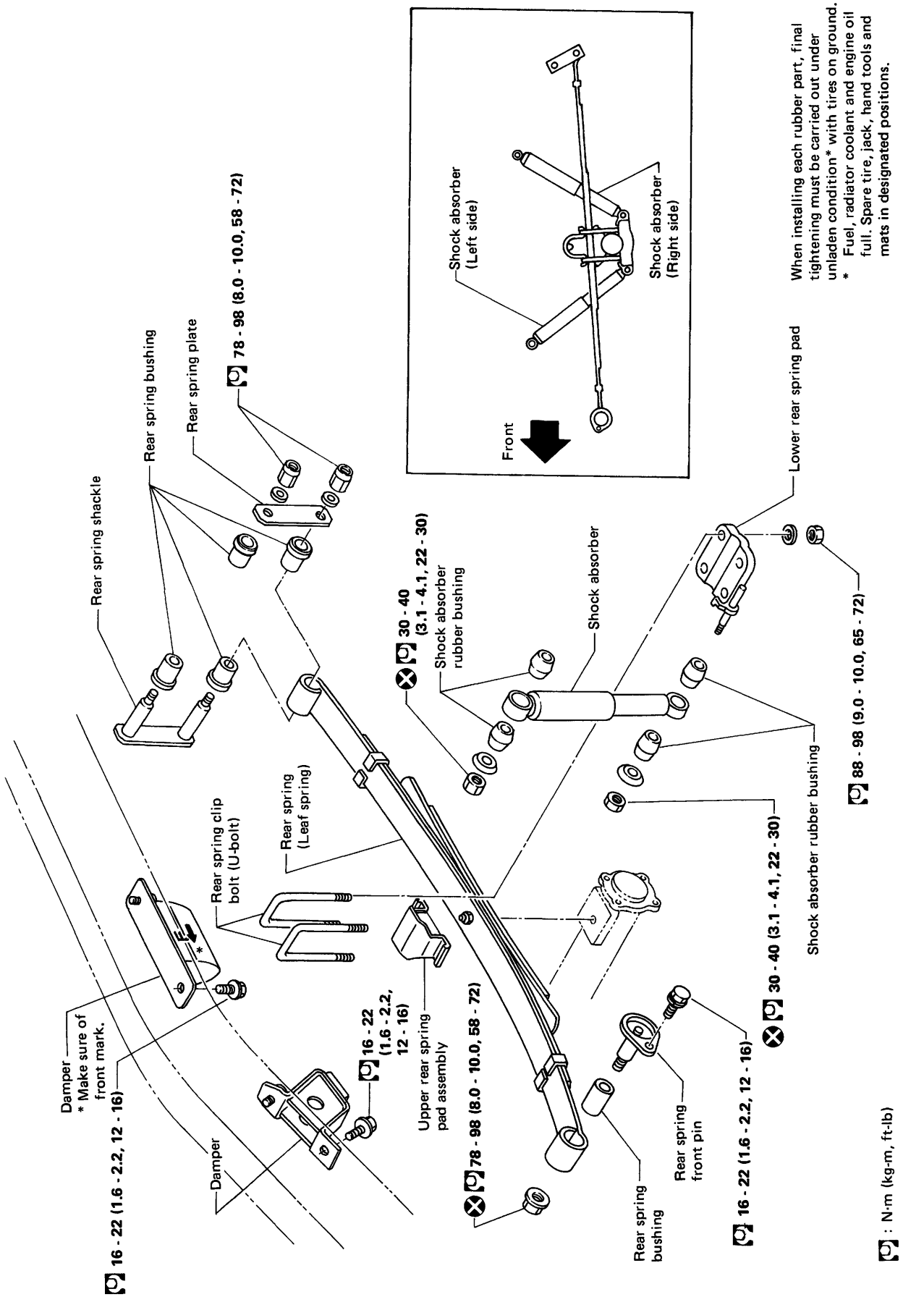


When installing each rubber part, final tightening must be carried out under unladen condition* with tires on ground.
* Fuel, radiator coolant and engine oil full. Spare tire, jack, hand tools and mats in designated positions.

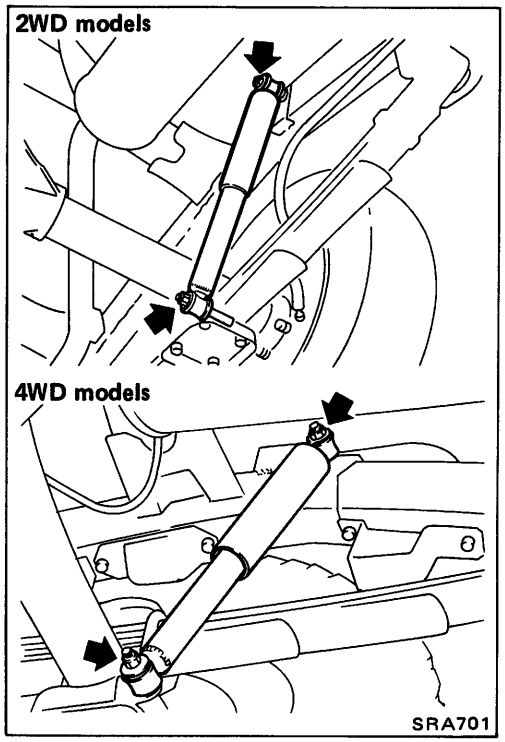
: N·m (kg-m, ft-lb)

SRA068A

4WD models



SRA315A



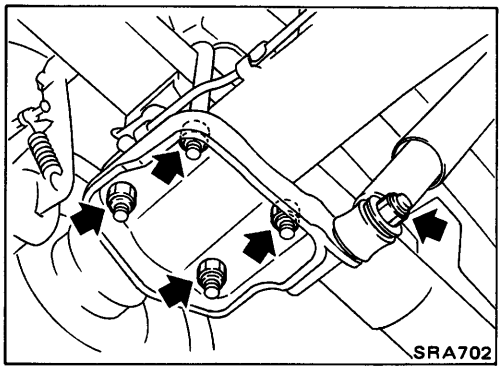
Shock Absorber

REMOVAL AND INSTALLATION

- Remove shock absorber by disconnecting upper and lower end.

INSPECTION

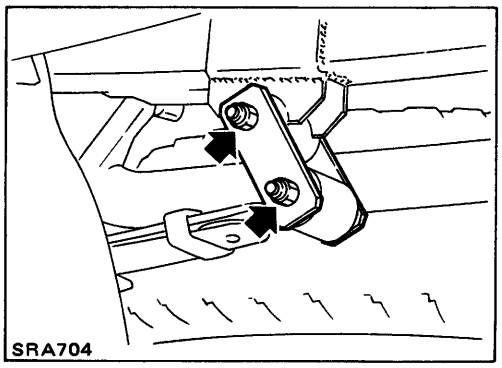
- If oil leakage, cracks of deformation occurs, replace shock absorber assembly.
- If rubber bushings are cracked or deformed, replace rubber bushings.



Leaf Spring

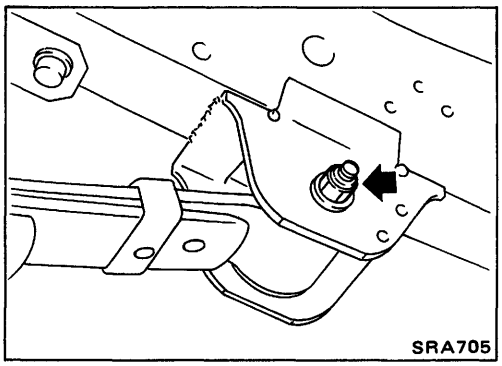
REMOVAL AND INSTALLATION

- Disconnect shock absorber lower end, and remove U-bolts.



- Disconnect spring shackle.

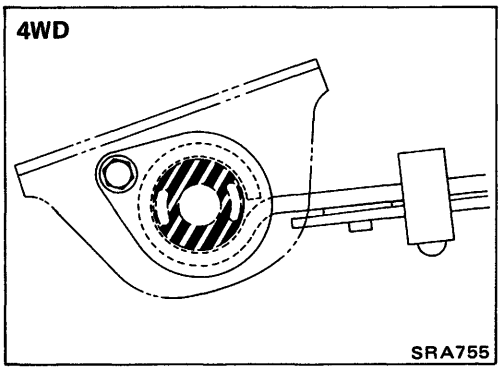
Leaf Spring (Cont'd)


SRA705

- Disconnect front pin.

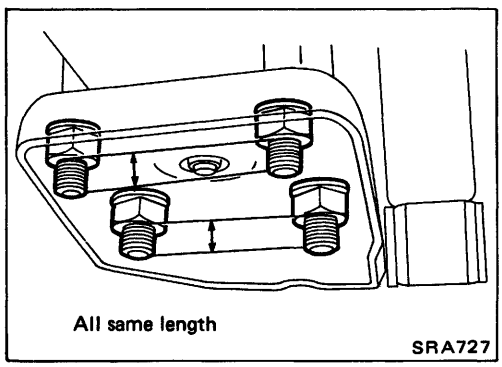
INSPECTION

- Check leaf spring for cracks. Replace if necessary.
- Check front bracket and pin, shackle, U-bolts and spring pad for wear, cracks, straightness or damaged threads. Replace if necessary.



SRA755

- Check all bushings for deformation or cracks. Replace if necessary.
  [4WD: Rear spring front bushing]
  Make sure that front bushing is properly installed.



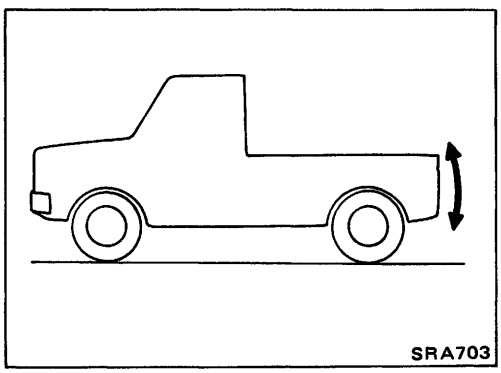
SRA727

INSTALLATION

- Apply soapsuds to rubber bushing.
- Install spring shackle and front pin, and finger tighten the nuts.
- Install spring pad and nuts under reaf spring or axle case.
- Tighten U-bolt mounting nuts diagonally.

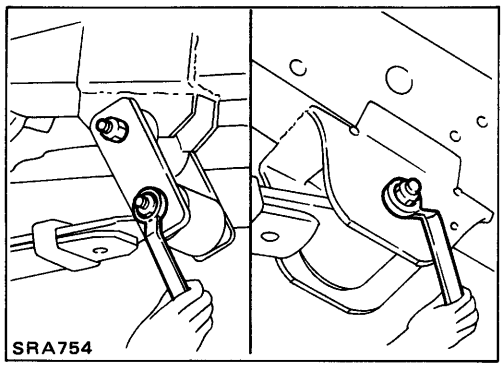
Tighten U-bolts so that the lengths of all U-bolts under spring pad are the same.

- Install shock absorber, and finger tighten the nuts.


SRA703

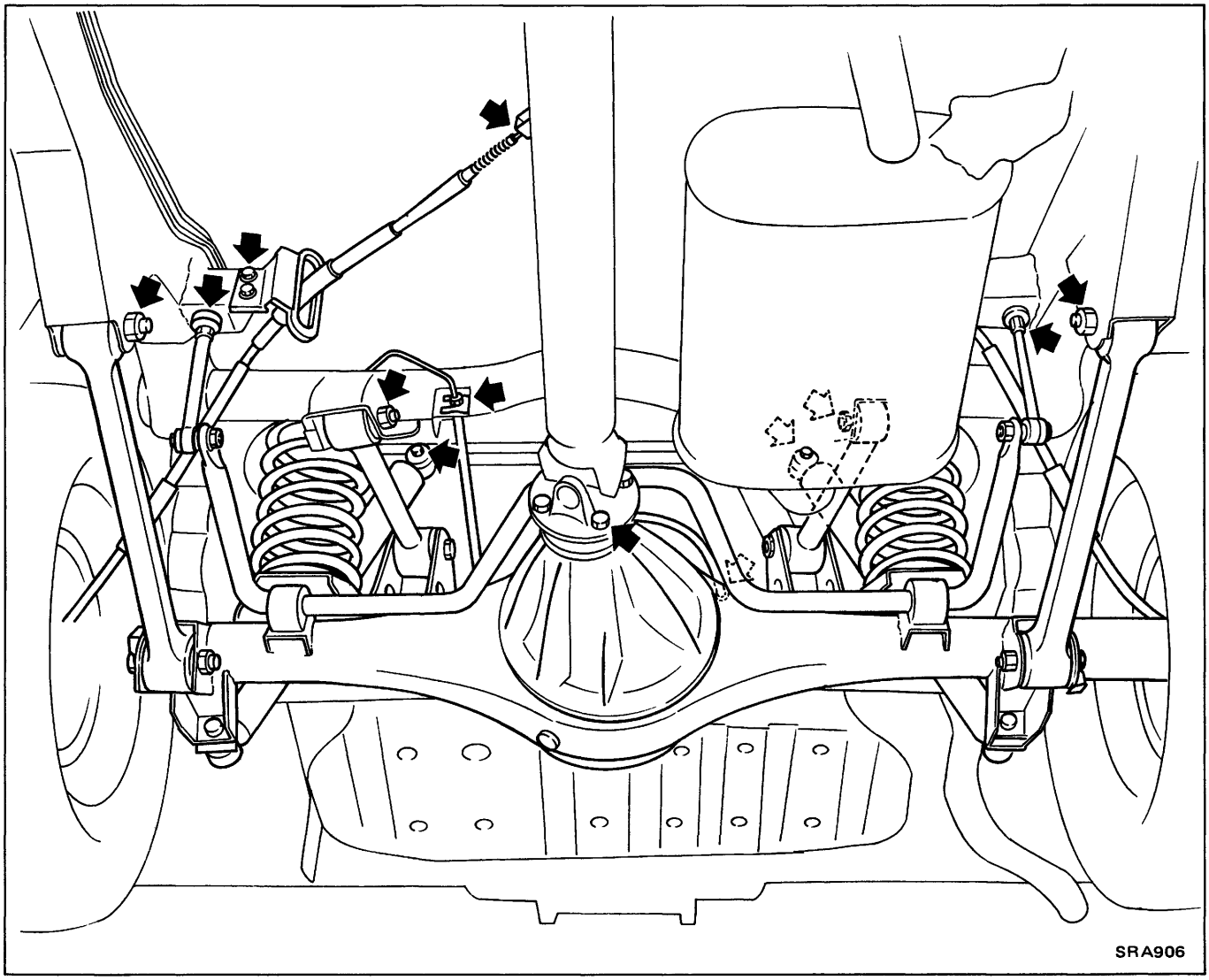
- Remove stands and bounce the vehicle to stabilize suspension. (Unladen)

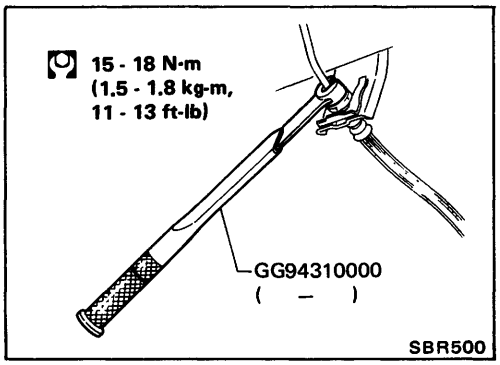
Leaf Spring (Cont'd)

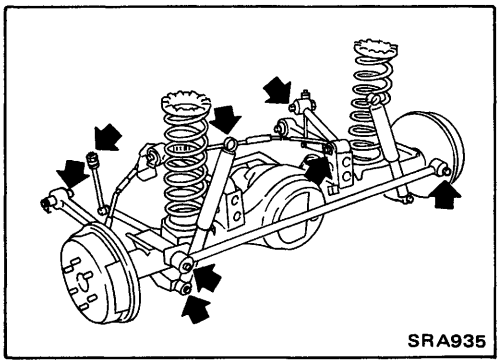


- Tighten spring shackle nuts, front pin nuts and shock absorber nuts.

Removal and Installation







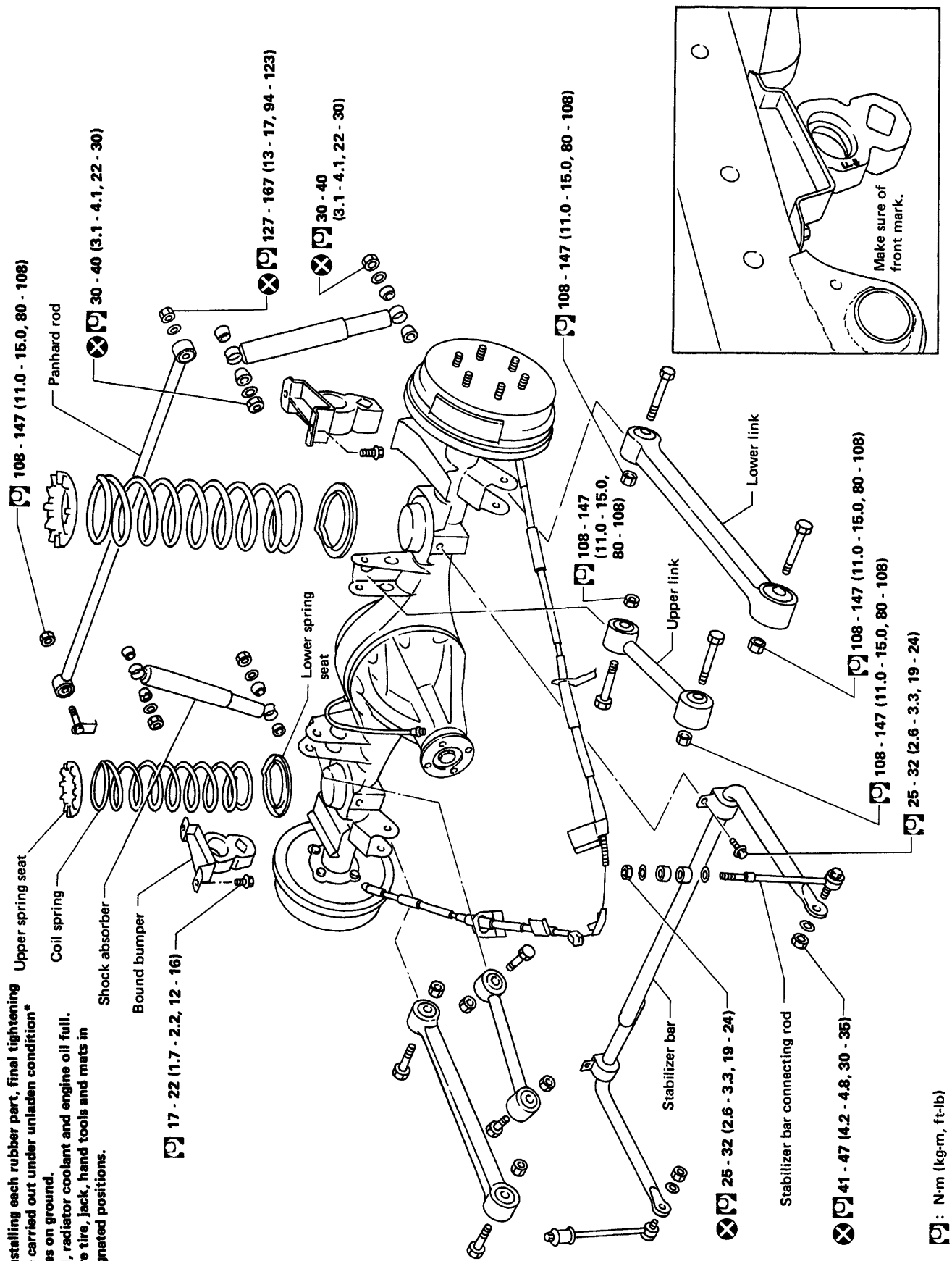
- Disconnect brake hydraulic line and parking brake cable.

CAUTION:

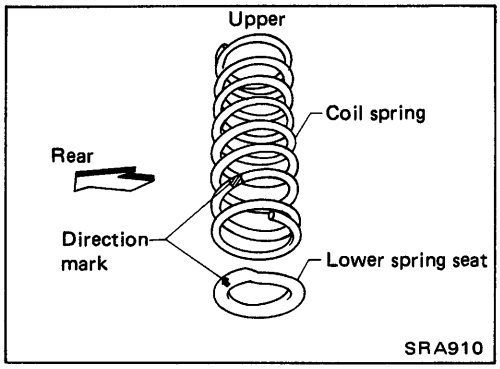
Use Tool when removing or installing brake tubes.

- Remove stabilizer bar from body.
- Remove upper links and lower links from body.
- Remove panhard rod from body.
- Disconnect propeller shaft. Refer to section PD.
- Remove upper end nuts of shock absorber.

Final tightening for rubber parts requires to be carried out under unladen condition with tires on ground.


When installing each rubber part, final tightening must be carried out under unladen condition* with tires on ground.
* Fuel, radiator coolant and engine oil full. Spare tire, jack, hand tools and mats in designated positions.
Upper spring seat
Coil spring
Shock absorber
Bound bumper
17 - 22 (1.7 - 2.2, 12 - 16)
108 - 147 (11.0 - 15.0, 80 - 108)
Panhard rod
30 - 40 (3.1 - 4.1, 22 - 30)
127 - 167 (13 - 17, 94 - 123)
30 - 40 (3.1 - 4.1, 22 - 30)
Lower spring seat
108 - 147 (11.0 - 15.0, 80 - 108)
108 - 147 (11.0 - 15.0, 80 - 108)
Upper link
Lower link
108 - 147 (11.0 - 15.0, 80 - 108)
108 - 147 (11.0 - 15.0, 80 - 108)
25 - 32 (2.6 - 3.3, 19 - 24)
Stabilizer bar
25 - 32 (2.6 - 3.3, 19 - 24)
Stabilizer bar connecting rod
41 - 47 (4.2 - 4.8, 30 - 35)
Make sure of front mark.
: N·m (kg-m, ft-lb)

SRA297A



Coil Spring and Shock Absorber

REMOVAL AND INSTALLATION

- Refer to Removal and Installation of REAR AXLE AND REAR SUSPENSION — 5-link Type.

When installing coil spring and lower spring seat, pay attention to its direction.

Be sure spring rubber seat is not twisted and has not slipped off when installing coil spring.

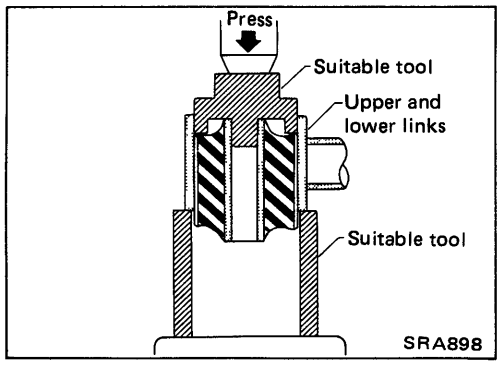
INSPECTION

- Check coil spring for yield, deformation or cracks.
- Check coil spring specifications. Refer to S.D.S.
- Check shock absorber for oil leakage, cracks or deformation.
- Check shock absorber specifications. Refer to S.D.S.
- Check all rubber parts for wear, cracks or deformation. Replace if necessary.

Upper Link, Lower Link and Panhard Rod

INSPECTION

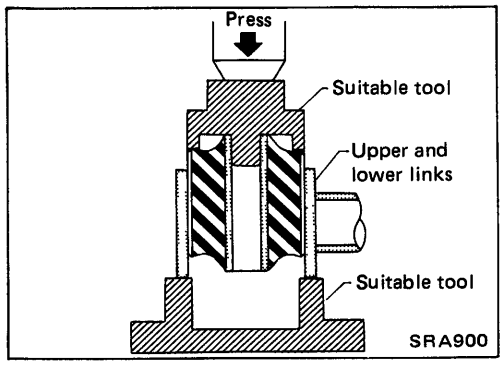
Check for cracks, distortion or other damage. Replace if necessary.



BUSHING REPLACEMENT

Check for cracks or other damage. Replace with suitable tool if necessary.

- Remove bushing with suitable tool.



When installing bushing, apply a coating of 1% soap water to outer wall of bushing.

Always install new bushing.

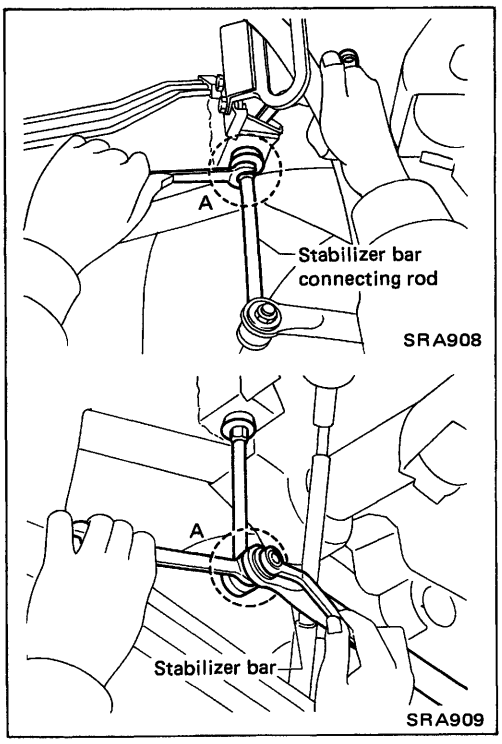
Do not tap end face of bushing directly with a hammer.

Upper Link, Lower Link and Panhard Rod (Cont'd)

INSTALLATION

When installing each link, pay attention to direction of bolts and nuts.

When installing each rubber part, final tightening must be carried out under unladen condition with tires on ground.



Stabilizer Bar

REMOVAL AND INSTALLATION

- When removing and installing stabilizer bar, fix portion A.

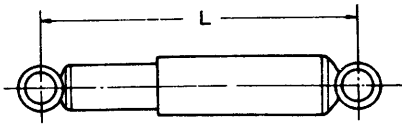
General Specifications

LEAF SPRING AND SHOCK ABSORBER (Trucks)

Applied model	2WD			4WD
	Except Heavy duty		Heavy duty	
	U.S.A.	Canada		
Leaf spring Spring length x width mm (in)	1,200 x 60 (47.24 x 2.36)			
Spring thickness - number of leaves mm (in)	7 (0.28) - 2 13 (0.51) - 1	7 (0.28) - 2 12 (0.47) - 2	8 (0.31) - 2 14 (0.55) - 2	7 (0.28) - 1 8 (0.31) - 1 12 (0.47) - 1 13 (0.51) - 1
Free camber "S" mm (in)	174.9 (6.89)	169.1 (6.66)	138.7 (5.46)	103.8 (4.09)
Spring constant N/mm (kg/mm, lb/in)	20.9 - 58.0 (2.13 - 5.91, 119.3 - 331.0)	22.3 - 76.5 (2.27 - 7.80, 127.1 - 436.8)	32.6 - 114.7 (3.32 - 11.70, 185.9 - 655.2)	24.2 - 90.2 (2.47 - 9.20, 138.3 - 515.2)
Shock absorber Shock absorber type	Non-adjustable			
Maximum length mm (in)	508 (20.00)			528 (20.79)
Damping force [at 0.3 m (1.0 ft)/sec.] N (kg, lb) Expansion	667 - 902 (68 - 92, 150 - 203)		834 - 1,128 (85 - 115, 187 - 254)	1,471 - 1,961 (150 - 200, 331 - 441)
Compression	157 - 275 (16 - 28, 35 - 62)			265 - 422 (27 - 43, 60 - 95)



SRA111

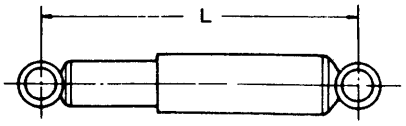


RA260

General Specifications (Cont'd)

COIL SPRING AND SHOCK ABSORBER (Van & Wagon models)

Coil spring			
Wire diameter mm (in)	13.2 (0.520)		
Coil diameter mm (in)	117.2 (4.61)		
Free length mm (in)	417.0 (16.42)		
Spring constant N/mm (kg/mm, lb/in)	25.5 (2.6, 146)		
Identification color	White x 1, Blue x 1		
Shock absorber			
Shock absorber type	Non-adjustable	Adjustable	
Maximum length mm (in)	586 (23.07)	585 (23.03)	
Damping force [at 0.3 m (1.0 ft/sec.)] N (kg, lb)		TOURING	SPORT
Expansion	834 - 1,128 (85 - 115, 187 - 254)	922 - 1,236 (94 - 126, 207 - 278)	1,304 - 1,736 (133 - 177, 293 - 390)
Compression	353 - 530 (36 - 54, 79 - 119)		579 - 853 (59 - 87, 130 - 192)



RA260

STABILIZER BAR (Van & Wagon models)

Stabilizer bar diameter mm (in)	25.0 (0.984)

Inspection and Adjustment

WHEEL BEARING (Drum brake models)

Total end play mm (in)	0.02 - 0.15 (0.0008 - 0.0059)	
	Thickness mm (in)	Part number
Available rear axle case end shims	0.05 (0.0020)	43086-P0110
	0.07 (0.0028)	43087-P0110
	0.10 (0.0039)	43088-P0110
	0.15 (0.0059)	43086-B9500
	0.20 (0.0079)	43089-P0110
	0.50 (0.0197)	43090-P0110
	1.00 (0.0394)	43036-01G00

WHEEL BEARING (Disc brake models)

Total end play mm (in)	0 (0)
Bearing preload measured at bearing cage under load of 32,363 N (3,300 kg, 7,277 lb) N (kg, lb)	6.9 - 48.1 (0.7 - 4.9, 1.5 - 10.8)

BRAKE SYSTEM

SECTION BR

CONTENTS

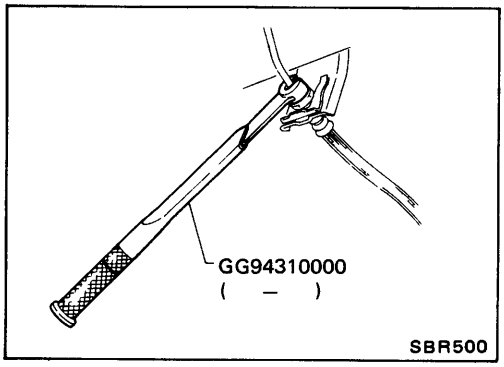
PRECAUTIONS AND PREPARATION ..... BR- 2
CHECK AND ADJUSTMENT ..... BR- 3
BRAKE HYDRAULIC LINE ..... BR- 4
BRAKE PEDAL AND BRACKET ..... BR- 7
BRAKE BOOSTER ..... BR- 9
VACUUM PIPING BR-10
MASTER CYLINDER BR-12
LOAD SENSING VALVE BR-13
FRONT DISC BRAKE (CL28VA and CL28VD) BR-15
REAR DRUM BRAKE (LT30 and LT26B) BR-20
REAR DISC BRAKE (AD14VB) BR-24
PARKING DRUM BRAKE (DS19HB) – (AD14VB) Model BR-29
PARKING BRAKE CONTROL BR-31
SERVICE DATA AND SPECIFICATIONS (S.D.S.) BR-34

Precautions

- Recommended fluid is brake fluid "DOT 3".
- Never reuse drained brake fluid.
- Be careful not to splash brake fluid on painted areas.
- To clean or wash all parts of master cylinder, disc brake caliper and wheel cylinder, use clean brake fluid.
- Never use mineral oils such as gasoline or kerosene. They will ruin the rubber parts of the hydraulic system.

WARNING:

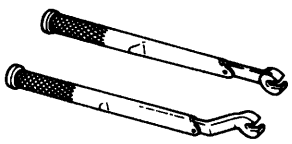
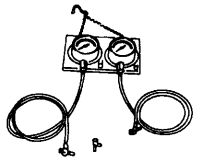
- Clean pad and shoe dust using a dust collector after cleaning with waste cloth.

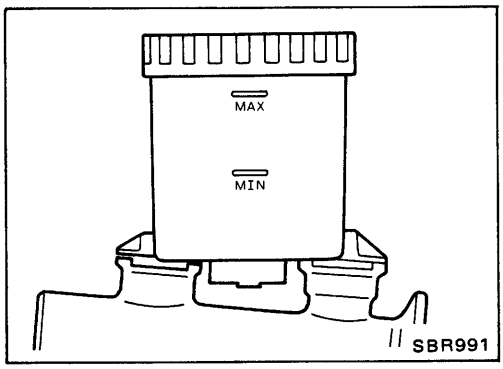


- Use Tool when removing and installing brake tube.

Preparation

SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.) Tool name	Description	
GG94310000 (–) Flare nut torque wrench		Removing and installing each brake piping
KV991V0010 (–) Brake fluid pressure gauge		Measuring brake fluid pressure

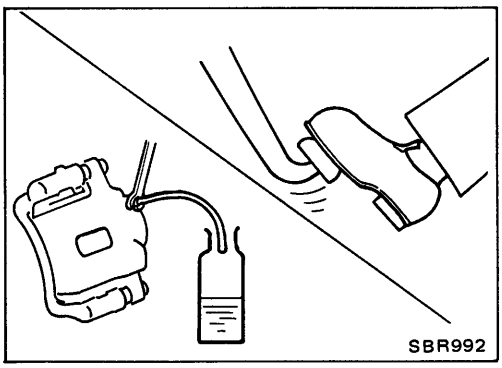


Checking Brake Fluid Level

- Check fluid level in reservoir tank. It should be between Max. and Min. lines on reservoir tank.
- If fluid level is extremely low, check brake system for leaks.

Checking Brake System

- Check brake lines (tubes and hoses) for evidence of cracks, deterioration or other damage. Replace any damaged parts.
  If leakage occurs around joints, retighten or, if necessary, replace damaged parts.
- Be sure to check for oil leakage by fully depressing brake pedal.

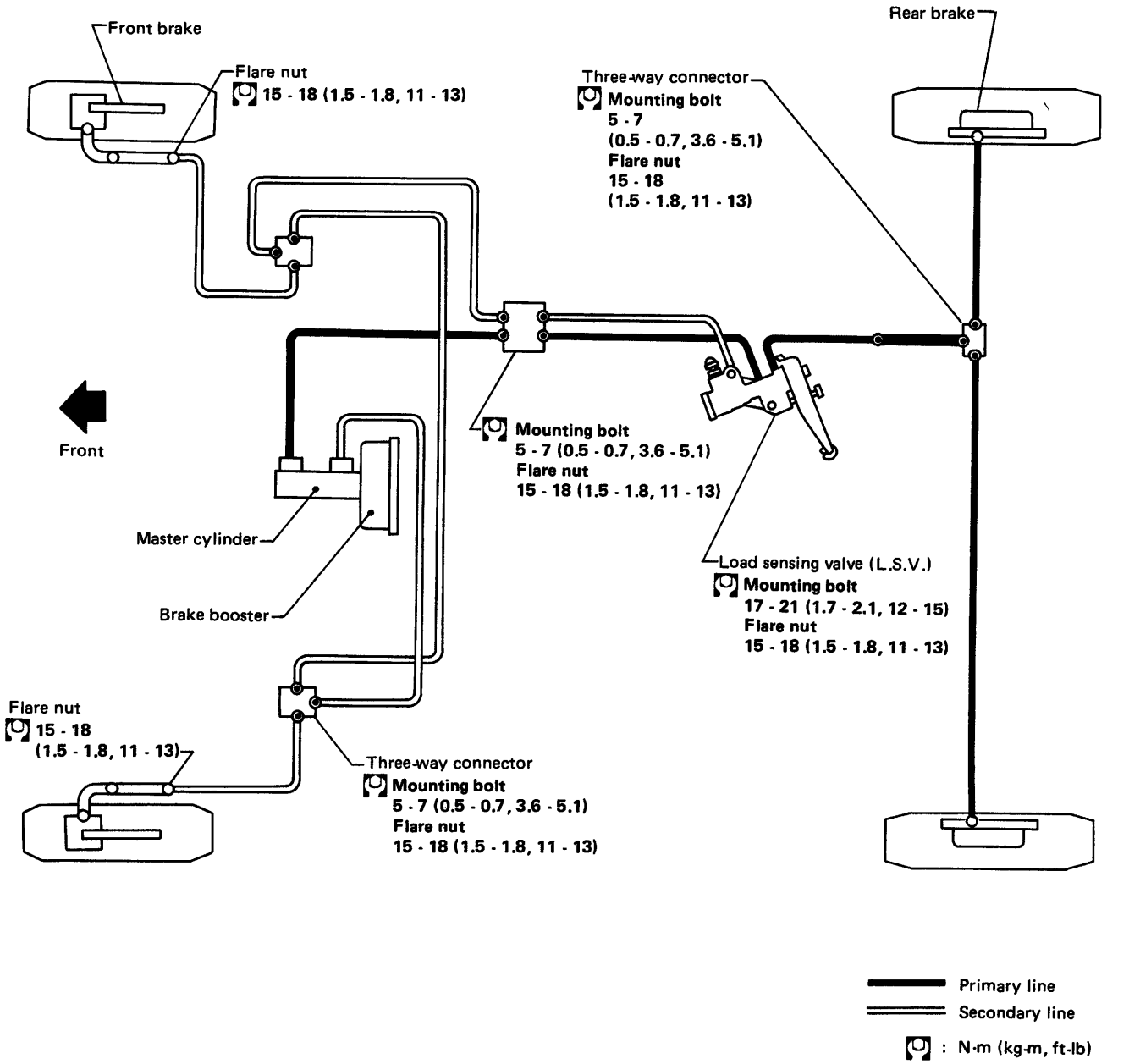


Changing Brake Fluid

1. Drain brake fluid in each air bleeder valve.
2. Refill until new brake fluid comes out of each air bleeder valve.
   Use same procedure as in bleeding hydraulic system to refill brake fluid.
   Refer to Bleeding Procedure of BRAKE HYDRAULIC LINE.

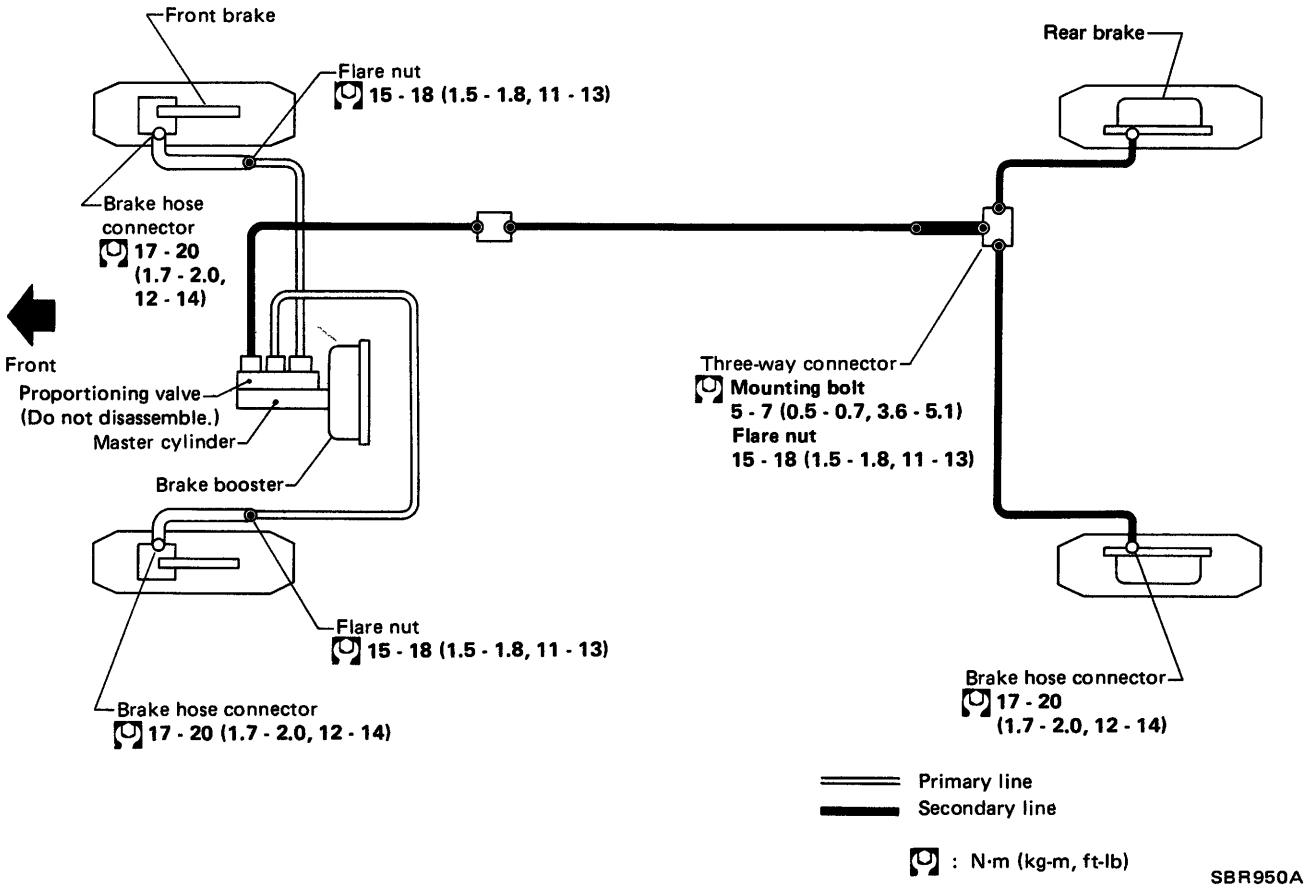
- **Refill with recommended brake fluid "DOT 3".**
- **Never reuse drained brake fluid.**
- **Be careful not to splash brake fluid on painted areas.**

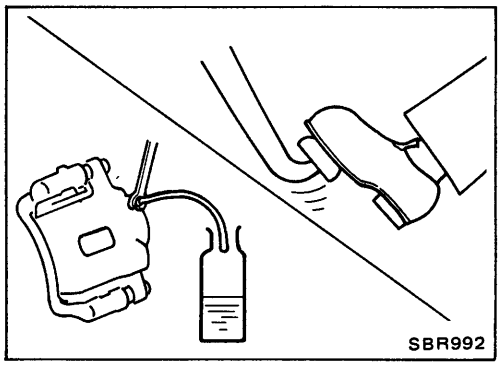
Model equipped with L.S.V.



SBR169A

Model equipped with proportioning valve




SBR992

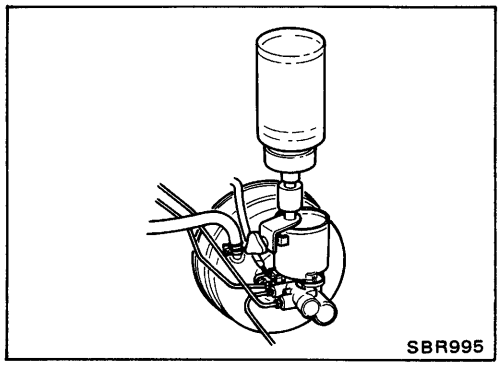
Bleeding Procedure

Model not equipped with L.S.V.

- Bleed air according to the following procedure:
  Left rear wheel cylinder → Right rear wheel cylinder → Left front caliper → Right front caliper

Model equipped with L.S.V.

- Bleed air according to the following procedure:
  L.S.V. air bleeder → Left rear wheel cylinder → Right rear wheel cylinder → Left front caliper → Right front caliper

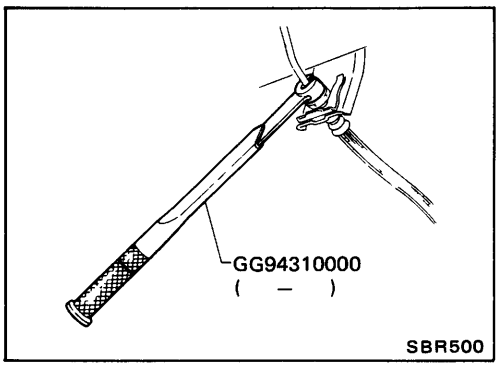

SBR995

- Connect a transparent vinyl tube to air bleeder valve of L.S.V., caliper or wheel cylinder.
- Carefully monitor brake fluid level at master cylinder during bleeding operation.
- Tighten air bleeder to the specified torque.

Removal and Installation

CAUTION:

a. Use Tool when removing and installing brake tube.



SBR500

b. Cover openings to prevent entrance of dirt whenever disconnecting hydraulic line.

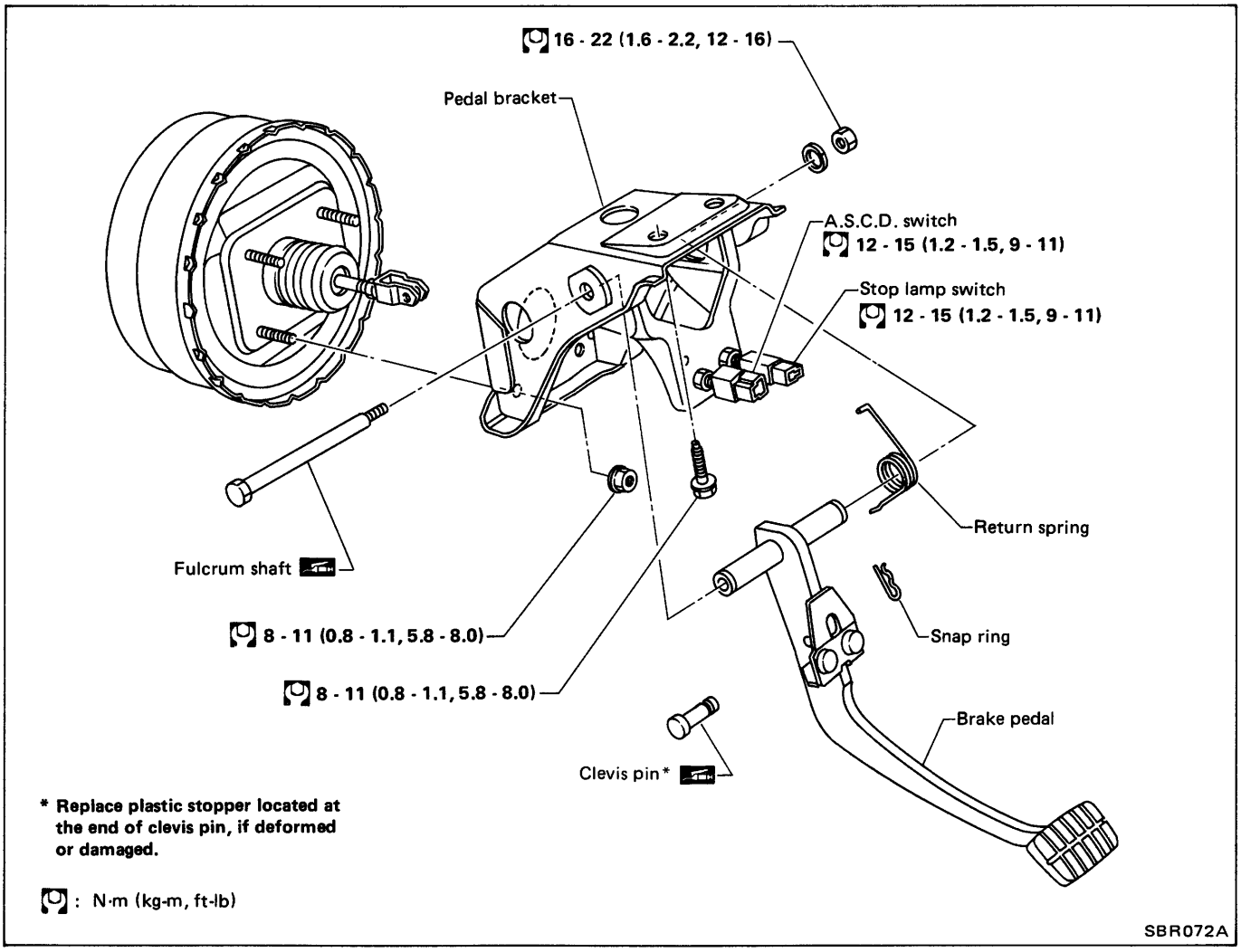
- To remove brake hose, first remove flare nut securing brake tube to hose, then withdraw lock spring. Next disconnect the other side.
- All hoses must be free from excessive bending, twisting and pulling.
- After installing brake lines, be sure to check for oil leakage by fully depressing brake pedal.

Inspection

Check brake lines (tubes and hoses) for evidence of cracks, deterioration or other damage. Replace any damaged parts.

If leakage occurs around joints, retighten or, if necessary, replace damaged parts.

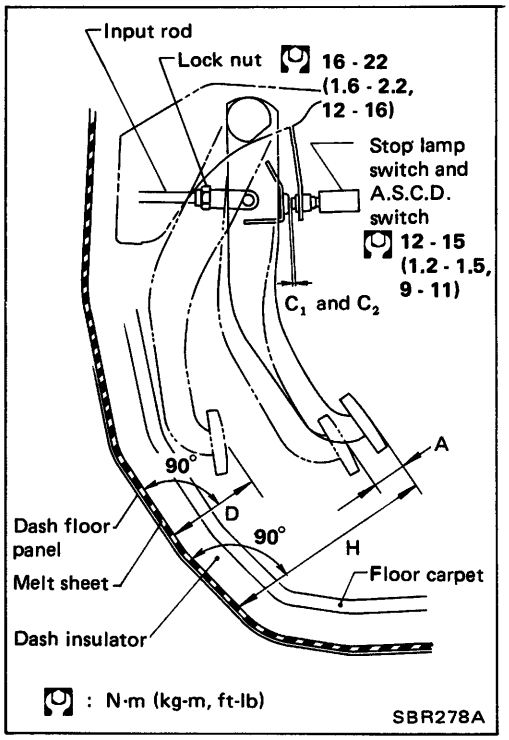
Removal and Installation

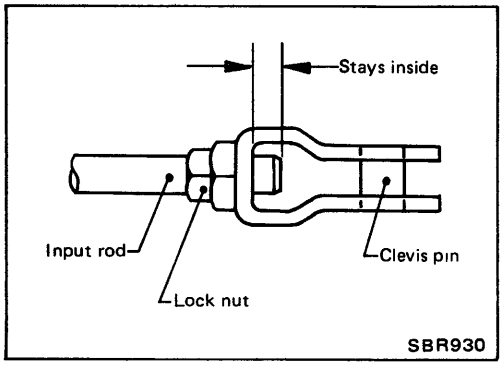


Inspection

Check brake pedal for the following items.

- Brake pedal bend
- Clevis pin deformation
- Crack of any welded portion





Adjustment

Check brake pedal free height from melt sheet. Adjust if necessary.

H: **Free height**
Refer to S.D.S.

D: **Depressed height**
Refer to S.D.S.
Under force of 490 N (50 kg, 110 lb) with engine running

C_1: **Clearance between pedal stopper and threaded end of stop lamp switch**
0.3 - 1.0 mm (0.012 - 0.039 in)

C_2: **Clearance between pedal stopper and threaded end of A.S.C.D. switch**
0.3 - 1.0 mm (0.012 - 0.039 in)

A: **Pedal free play**
1 - 3 mm (0.04 - 0.12 in)

1. Adjust pedal free height with brake booster input rod. Then tighten lock nut.

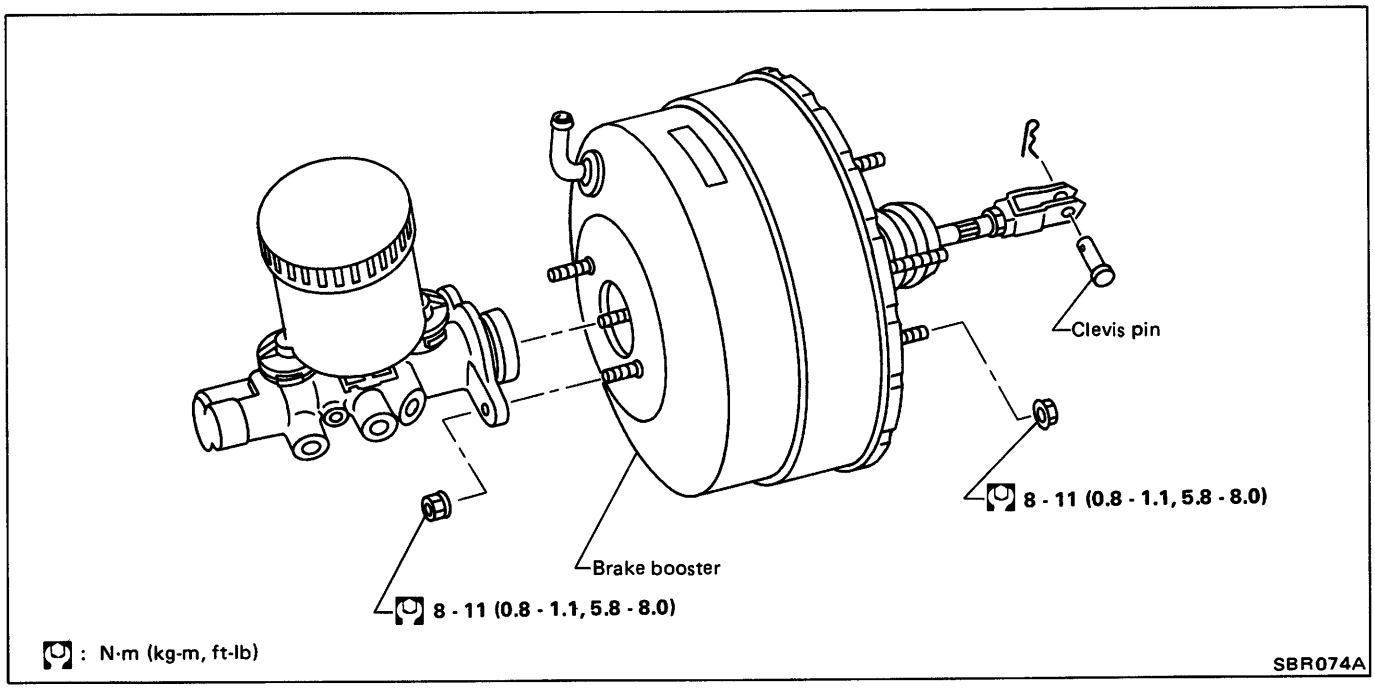
Make sure that the tip of input rod stays inside.

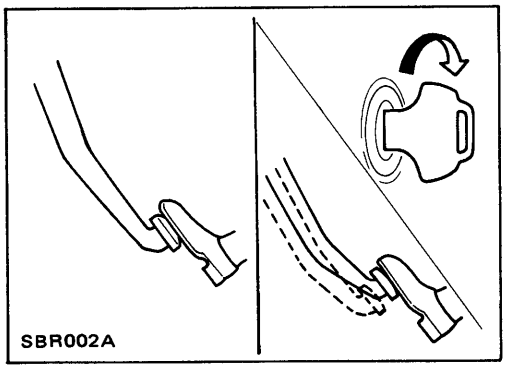
2. Adjust clearance "C_1" and "C_2" with stop lamp switch and A.S.C.D. switch respectively. Then tighten lock nuts.
3. Check pedal free play.

Make sure that stop lamp is off when pedal is released.

4. Check brake pedal depressed height with engine running.
   If depressed height is below the specified value, check brake system for leaks, accumulation of air or any damage components such as master cylinder, wheel cylinder, etc. Make the necessary repairs, if necessary.

Removal and Installation





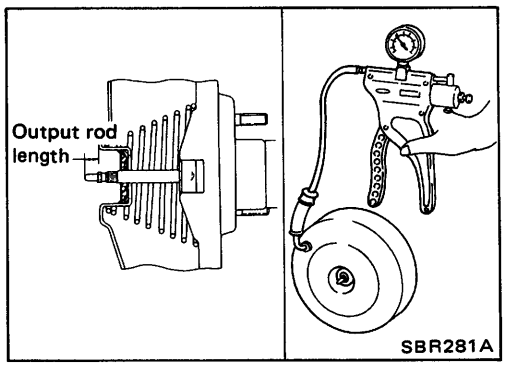
Inspection

OPERATING CHECK

- Depress brake pedal several times with engine off, then check that there is no change in pedal stroke.
- Depress brake pedal, then start engine. If pedal goes down slightly, operation is normal.

AIRTIGHT CHECK

- Start engine, then stop it in one or two minutes. Depress brake pedal several times slowly. If pedal goes further down the first time and gradually rises after second or third time, the booster is airtight.
- Depress brake pedal while engine is running, then stop engine with pedal depressed. If there is no change in pedal stroke for thirty seconds, brake booster is airtight.



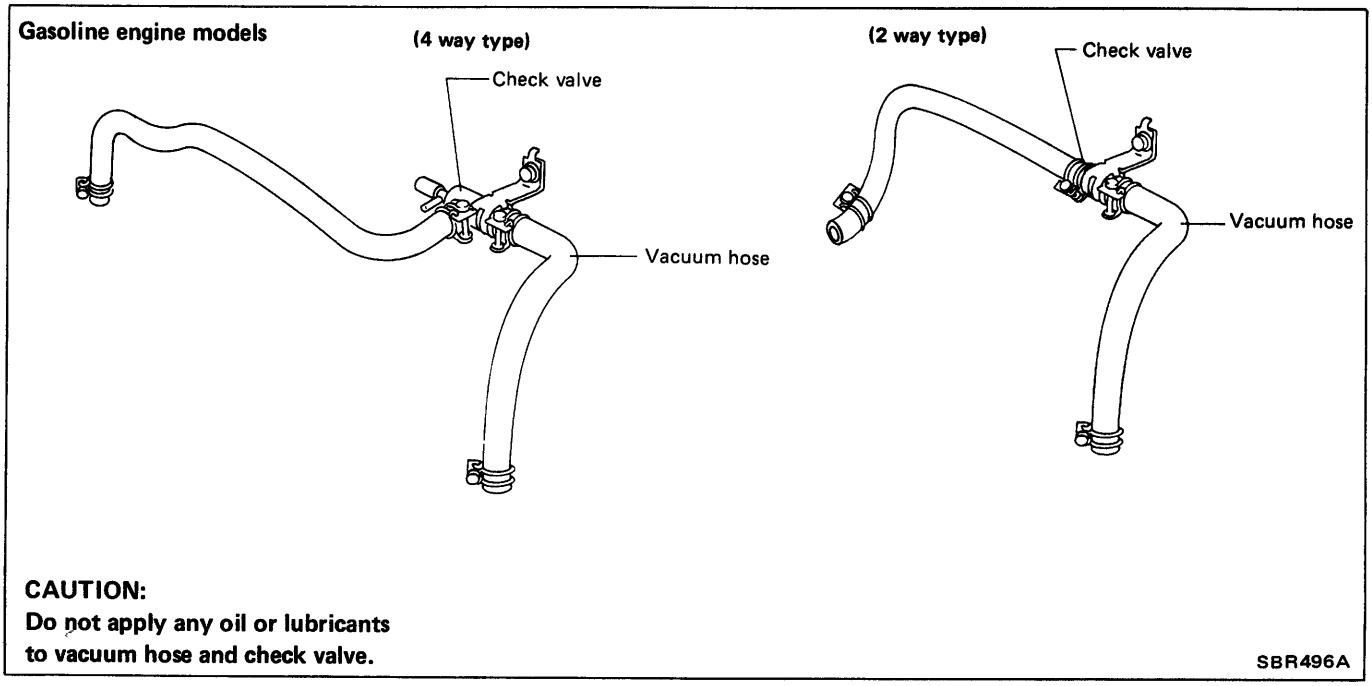
OUTPUT ROD LENGTH CHECK

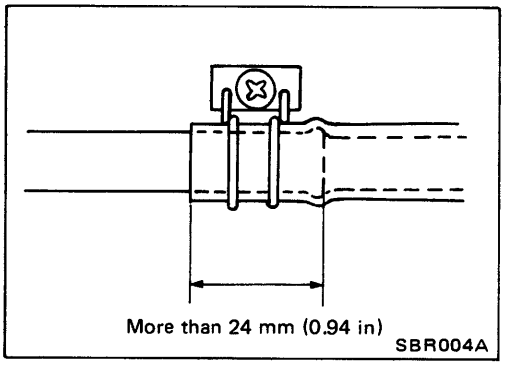
1. Supply brake booster with vacuum of −66.7 kPa (−500 mmHg, −19.69 inHg) using a handy vacuum pump.
2. Check output rod length.

Specified length:

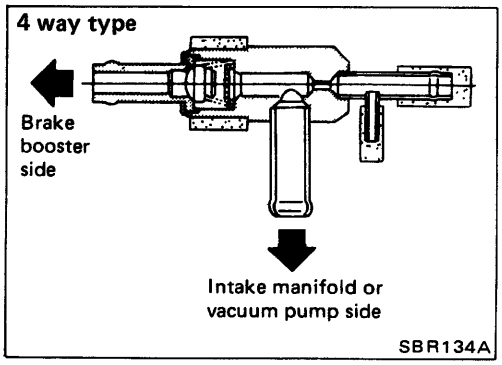
10.275 - 10.525 mm (0.4045 - 0.4144 in)

Removal and Installation

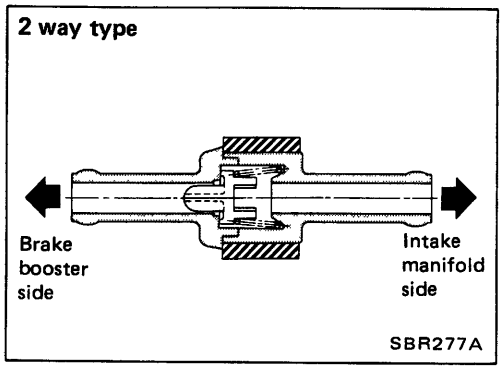


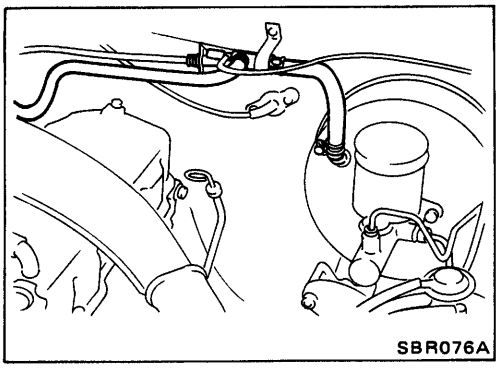


- Insert vacuum tube into vacuum hose more than 24 mm (0.94 in).



- Install check valve properly paying attention to its direction.

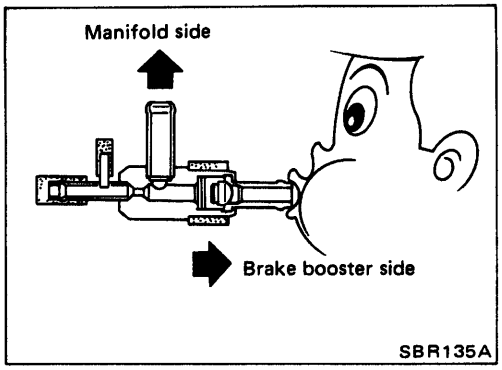



SBR076A

Inspection

HOSES AND CONNECTORS

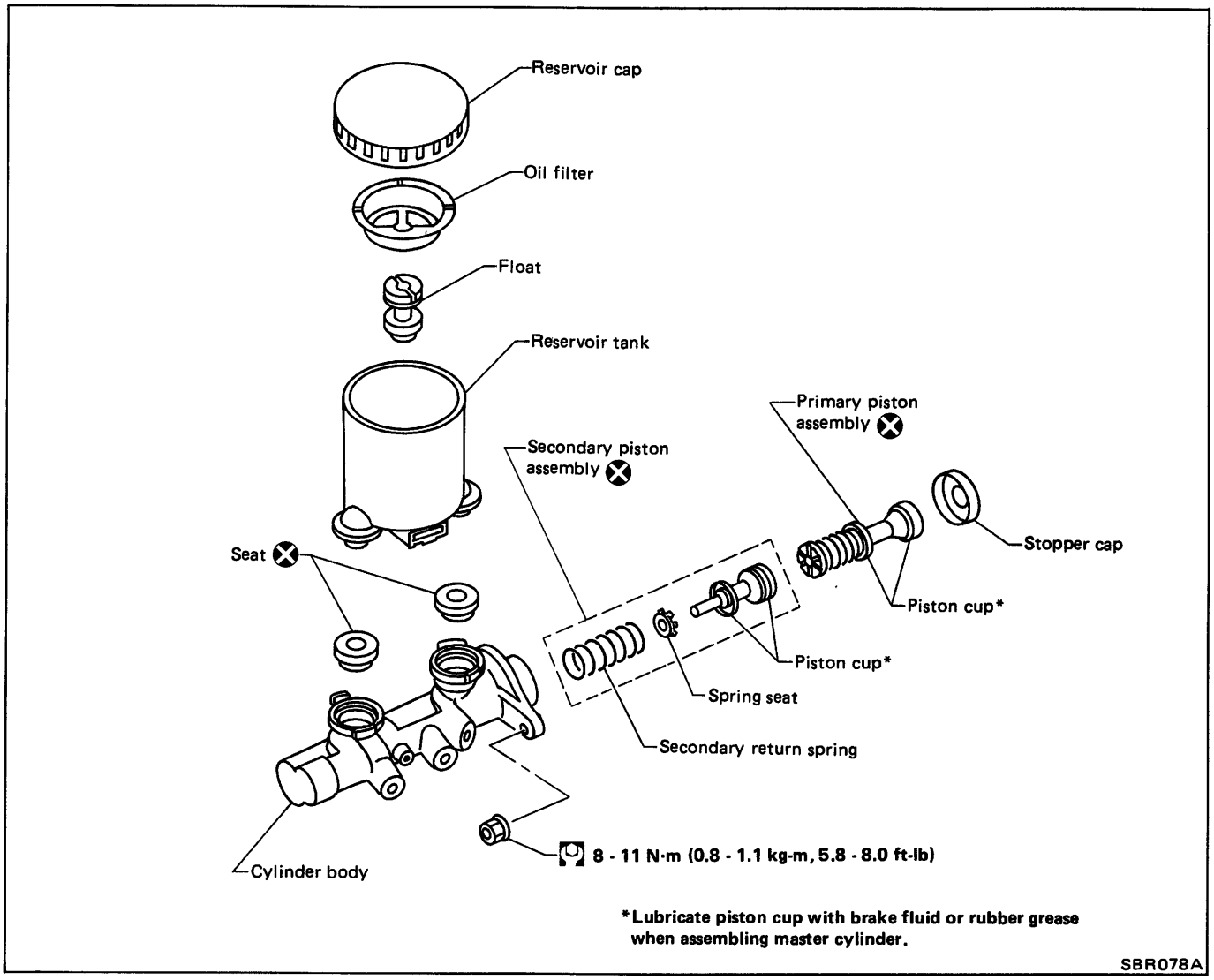
- Check condition of vacuum hoses and connectors.
- Check vacuum hoses for air tightness.

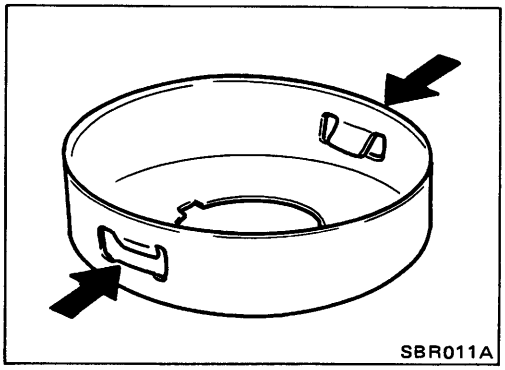


SBR135A

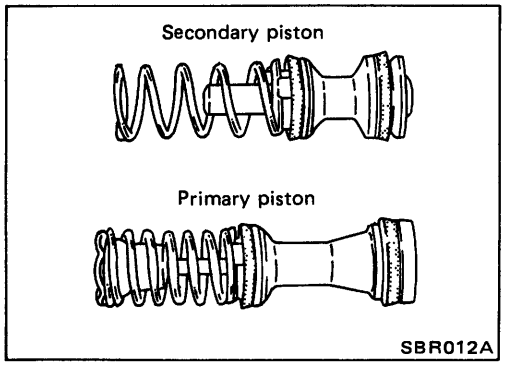
CHECK VALVE

- If valve does not open, replace check valve with a new one when pressure is applied to the brake booster side of check valve.



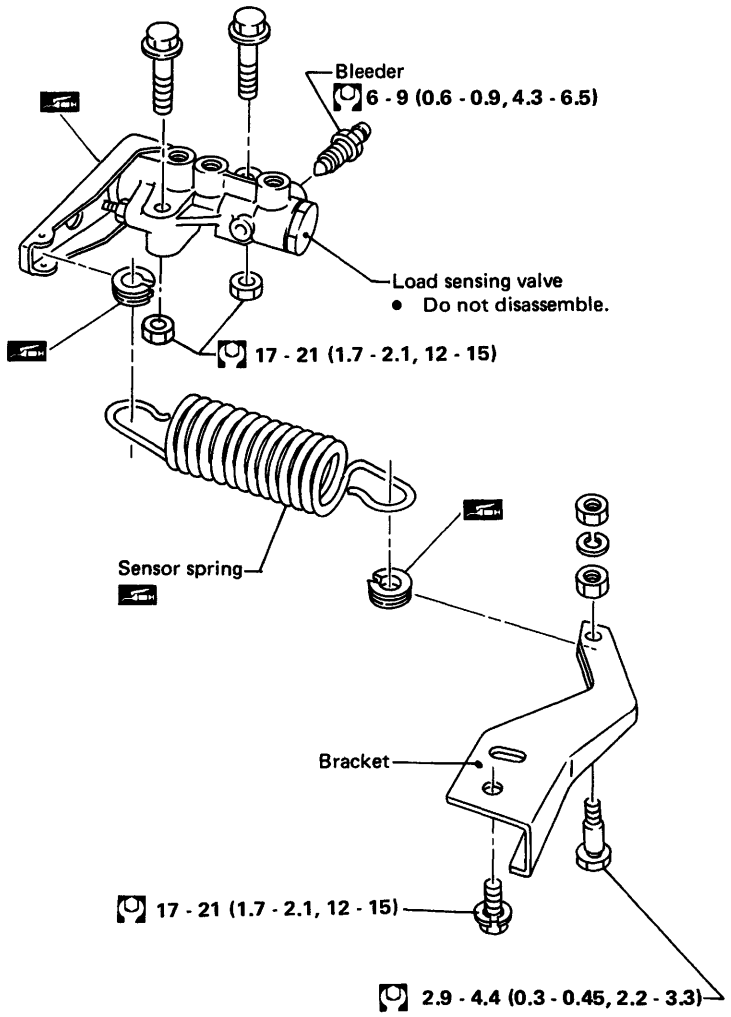


- Replace stopper if the claw is damaged or deformed.
- Bend claws inside when installing stopper.



- Replace piston assembly when disassembled.
- Pay attention to the direction of piston cups.
- Check parts for wear or damage. Replace if any of the above conditions are observed.

Load Sensing Valve

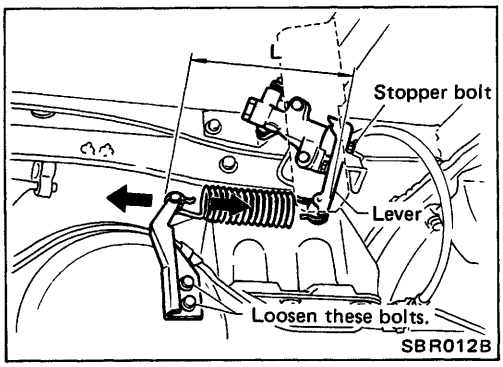


: N·m (kg-m, ft-lb)

SBR123A

- Do not reuse Load Sensing Valve once it is disassembled.
- Replace damaged Load Sensing Valve as an assembly.
- When disassembling, apply multi-purpose grease to all rubbing areas.

Inspection (L.S.V.)



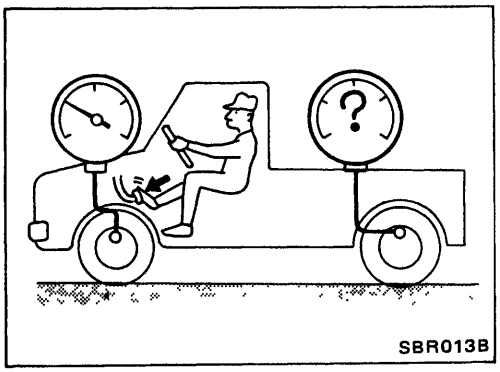
SBR012B

1. Ensure vehicle is unladen condition*.
   * Fuel, radiator coolant and engine oil full. Spare tire, jack, hand tools and mats in designated positions.
2. Have a driver sit in the driver's seat and one person sit on the rear end. Then have the person on the rear end slowly get off the vehicle. This is necessary to stabilize suspension deflection.
3. Attach a lever to the stopper bolt, and adjust length "L" as follows:

   Length "L":

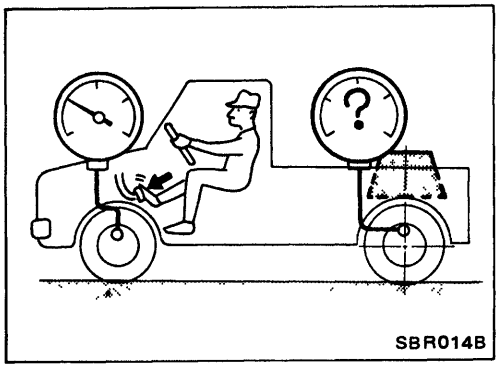
   Approx. 189 mm (7.44 in)

Inspection (L.S.V.) (Cont'd)


SBR013B

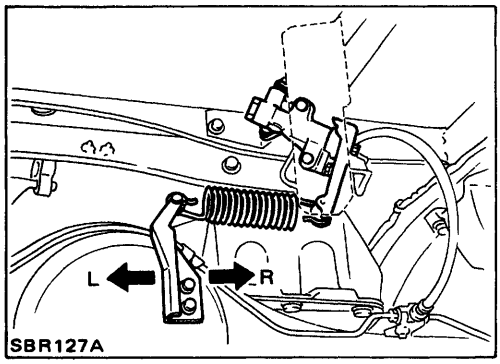
4. Install pressure gauge to front and rear brake.
   Tool number: KV991V0010 (–)
5. Raise front brake pressure to 9,807 kPa (100 kg/cm^2, 1,422 psi) and check rear brake pressure.
   Rear brake pressure:
   Refer to table below.

If rear brake pressure is not within specification, adjust bracket. (Refer to step 3.)


SBR014B

6. Set weight slowly on axle center.
   Weight: 100 kg (221 lb)
7. Raise front brake pressure to 9,807 kPa (100 kg/cm^2, 1,422 psi) and check rear brake pressure.
   Rear brake pressure:
   Refer to table below.

If rear brake pressure is not within specification, adjust bracket as follows:



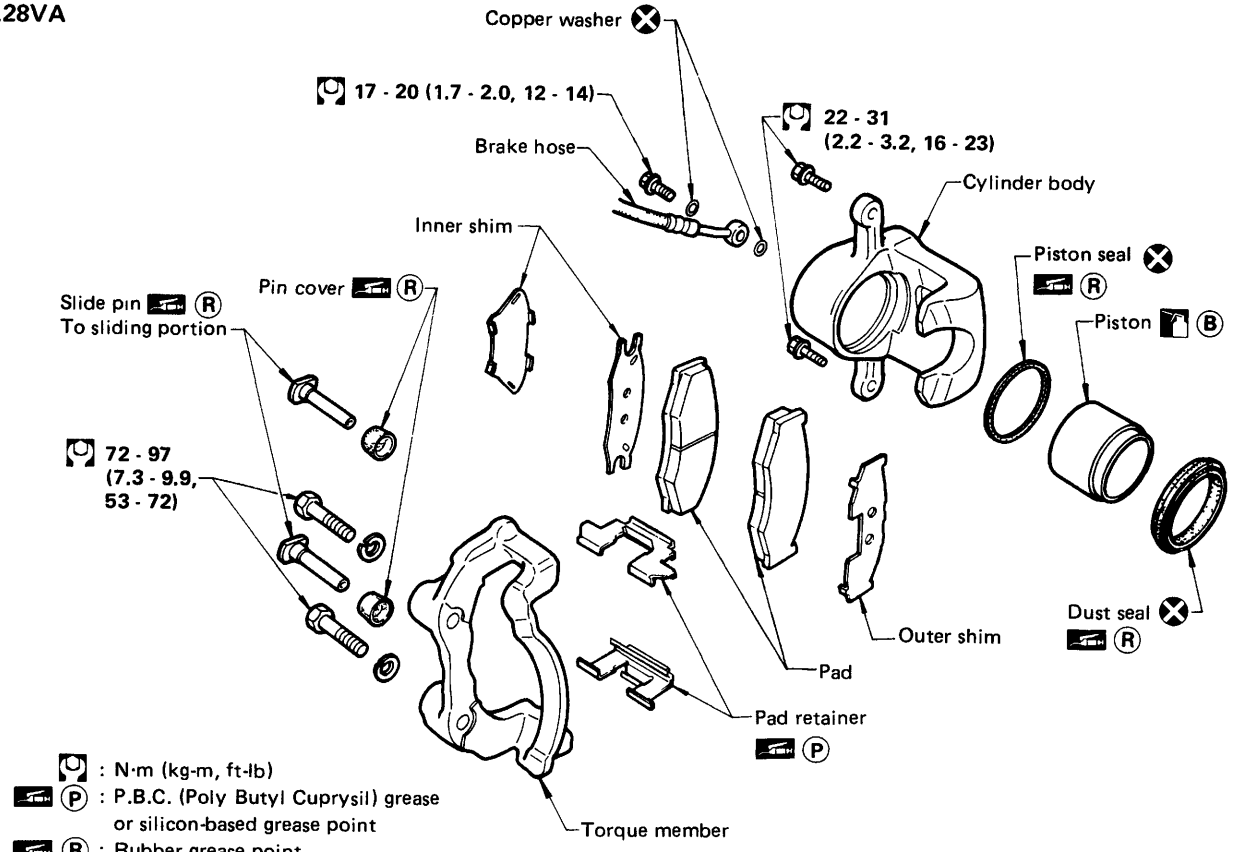
SBR127A

8. Adjust bracket to direction of L when rear brake pressure is above specification.
9. Adjust bracket to direction of R when rear brake pressure is below specification.
   Repeat step 7. until rear brake pressure is within specification.

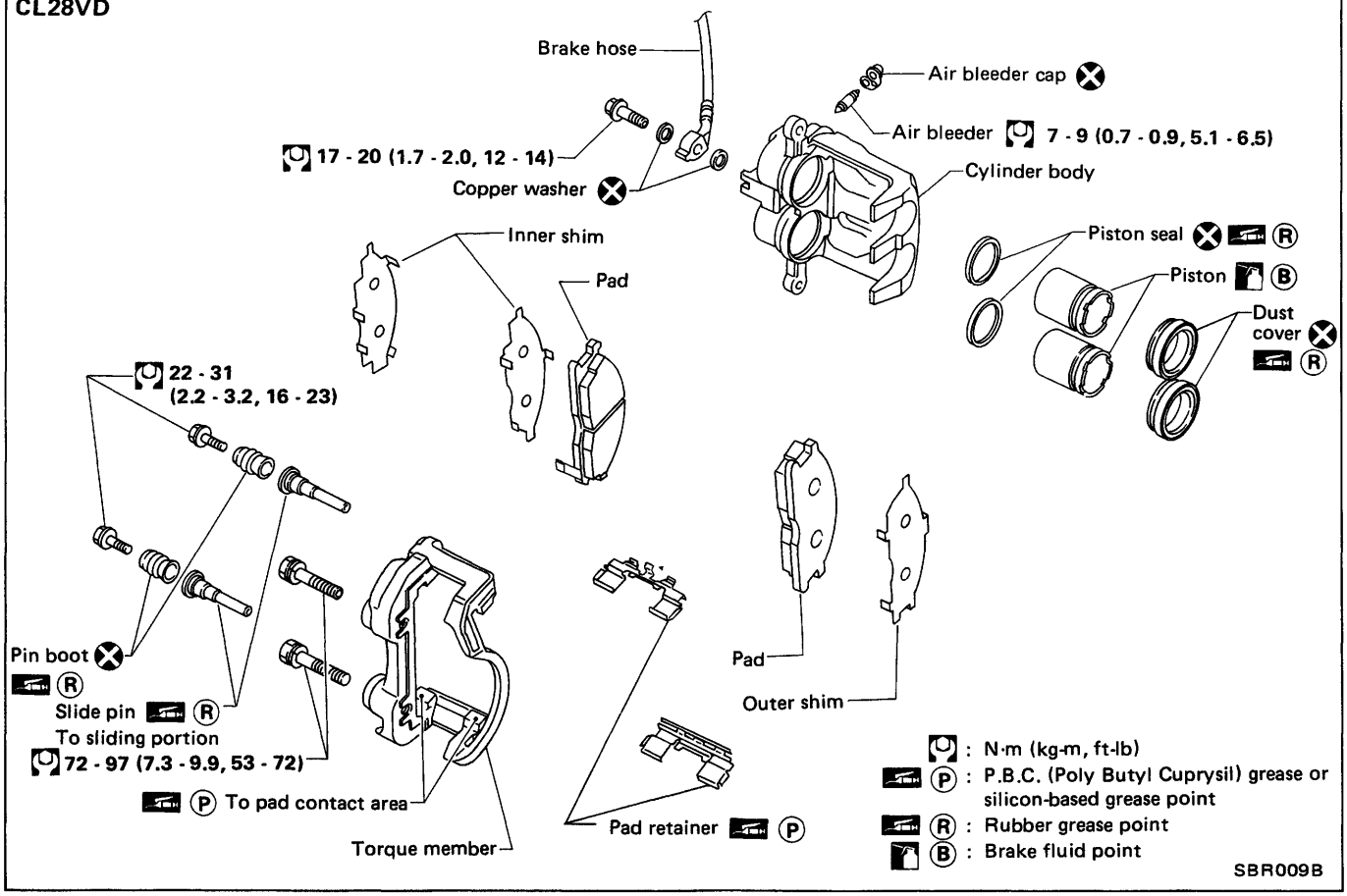
Unit: kPa (kg/cm^2, psi)

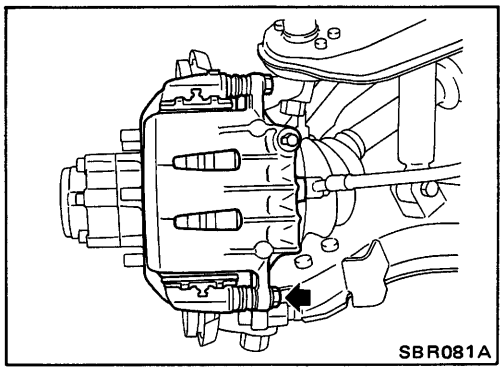
U.S.A.				Canada			
Except Heavy duty		Heavy duty		Except Heavy duty		Heavy duty	
Without weight	With weight	Without weight	With weight	Without weight	With weight	Without weight	With weight
2,256 - 3,040 (23 - 31, 327 - 441)	4,904 - 6,865 (50 - 70, 711 - 995)	2,256 - 3,040 (23 - 31, 327 - 441)	4,413 - 6,375 (45 - 65, 640 - 924)	2,256 - 3,040 (23 - 31, 327 - 441)	3,629 - 5,590 (37 - 57, 526 - 811)	2,256 - 3,040 (23 - 31, 327 - 441)	4,413 - 6,375 (45 - 65, 640 - 924)

CL28VA



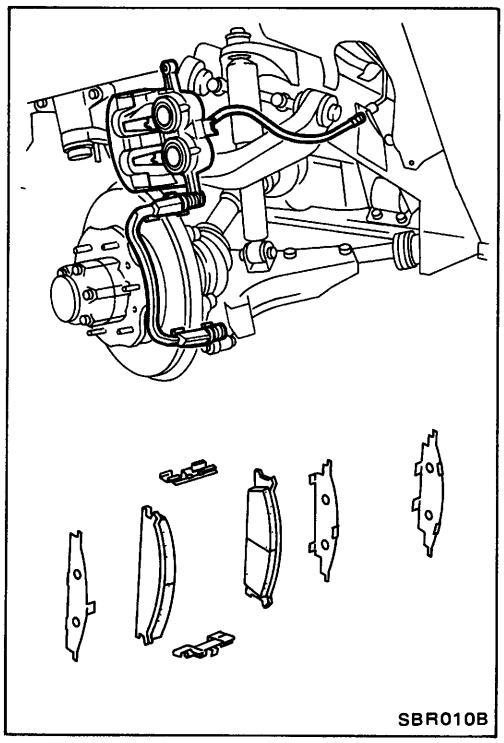
CL28VD




SBR081A

Pad Replacement

1. Remove pin bolt.


SBR010B

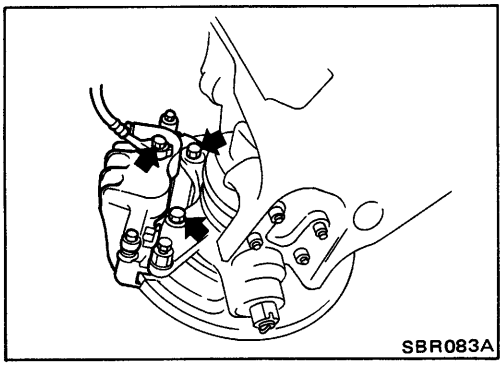
2. Swing cylinder body upward. Then remove pad retainers, and inner and outer shims.

CAUTION:

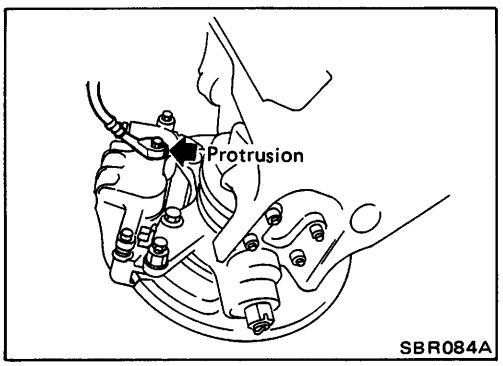
- **When cylinder body is swung up, do not depress brake pedal because piston will pop out.**
- **Be careful not to damage dust cover or get oil on rotor. Always replace shims when replacing pads.**

Removal and Installation

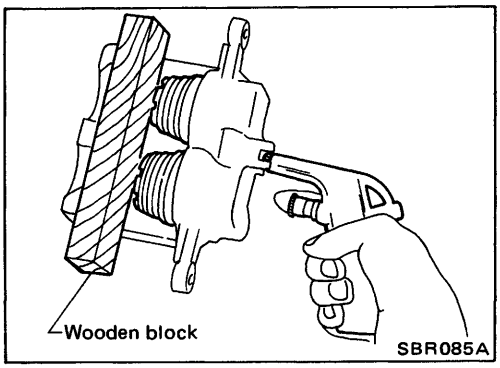
- Remove torque member fixing bolts and union bolt.


SBR083A

- Install brake hose to caliper securely.

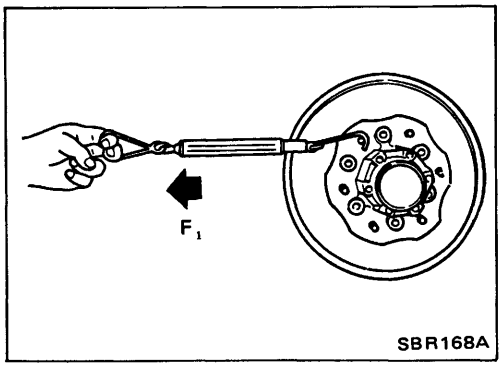


SBR084A



Disassembly

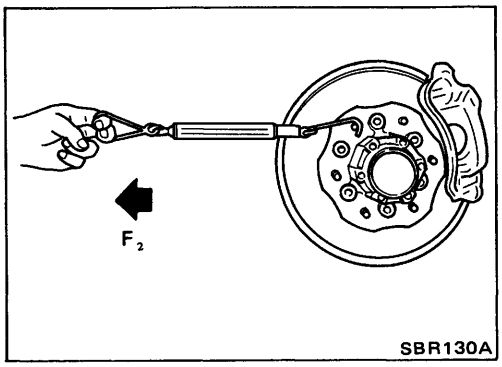
Push out piston with dust cover with compressed air.
For CL28VD (2-piston type), use a wooden block so that the 2 pistons come out evenly.



Inspection

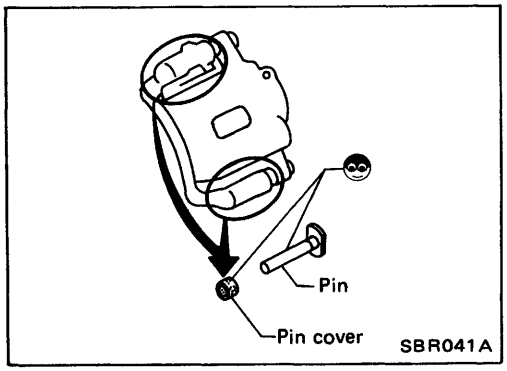
INSPECTION OF BRAKE DRAG FORCE

(1) Swing cylinder body upward.
(2) Make sure that wheel bearing is adjusted properly. Refer to section FA.
(3) Measure rotating force (F_1).



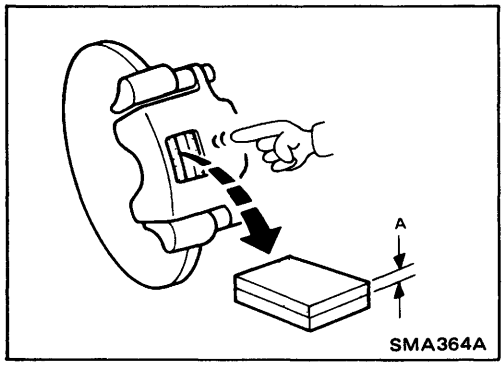
(4) Install caliper with pads to the original position.
(5) Depress brake pedal for 5 seconds.
(6) Release brake pedal, rotate disc rotor 10 revolutions.
(7) Measure rotating force (F_2).
(8) Calculate brake drag force by subtracting F_1 from F_2.

Maximum brake drag force ($F_2 - F_1$):
103.0 N (10.5 kg, 23.2 lb)



If it is not within specification, check pins and pin boots in caliper.

- **Make sure that wheel bearing is adjusted properly.**
- **Disc pads and disc rotor must be dried.**



DISC PAD

Check disc pad for wear or damage.

Pad wear limit (A):
2.0 mm (0.079 in)

Inspection (Cont'd)

CYLINDER BODY

- Check inside surface of cylinder for score, rust, wear, damage or presence of foreign materials. If any of the above conditions are observed, replace cylinder body.
- Minor damage from rust or foreign materials may be eliminated by polishing the surface with a fine emery paper. Replace cylinder body if necessary.

CAUTION:

Use brake fluid to clean. Never use mineral oil.

PISTON

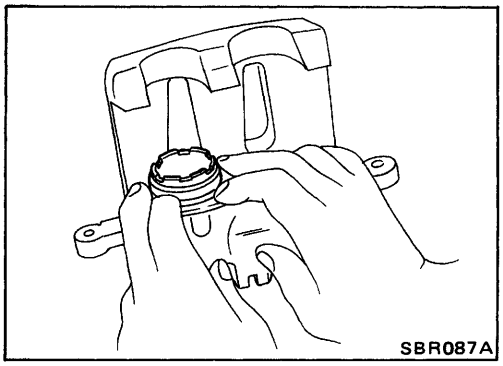
Check piston for score, rust, wear, damage or presence of foreign materials. Replace if any of the above conditions are observed.

CAUTION:

Piston sliding surface is plated. Do not polish with emery paper even if rust or foreign materials are stuck to sliding surface.

PIN, PIN BOLT AND PIN BOOT

Check for wear, cracks or other damage. Replace if any of the above conditions are observed.

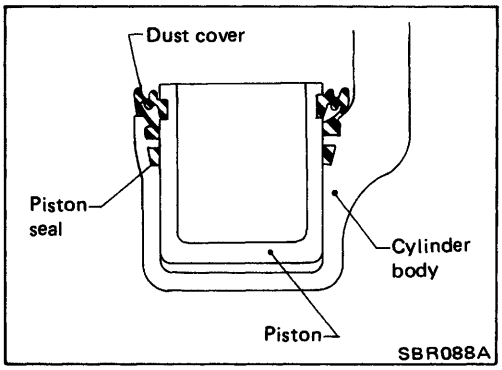

SBR087A

Assembly

- Insert piston seal into groove on cylinder body.
- With dust seal fitted to piston, install piston into cylinder body.

CAUTION:

- **Secure dust seal properly.**

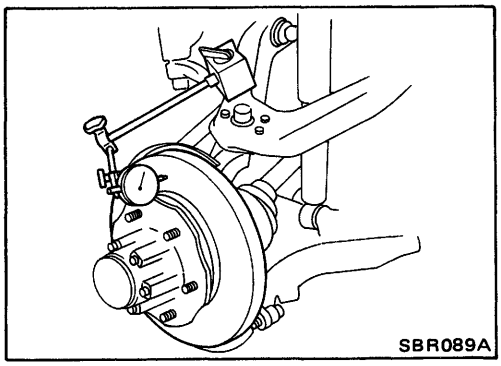


Rotor Inspection

RUBBING SURFACE

Check rotor for roughness, cracks or chips.

Rotor Inspection (Cont'd)

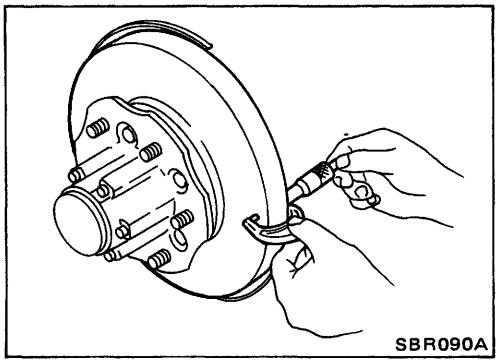

SBR089A

RUNOUT

Make sure that axial end play is within the specifications before measuring. Refer to section FA.

Rotor repair limit:

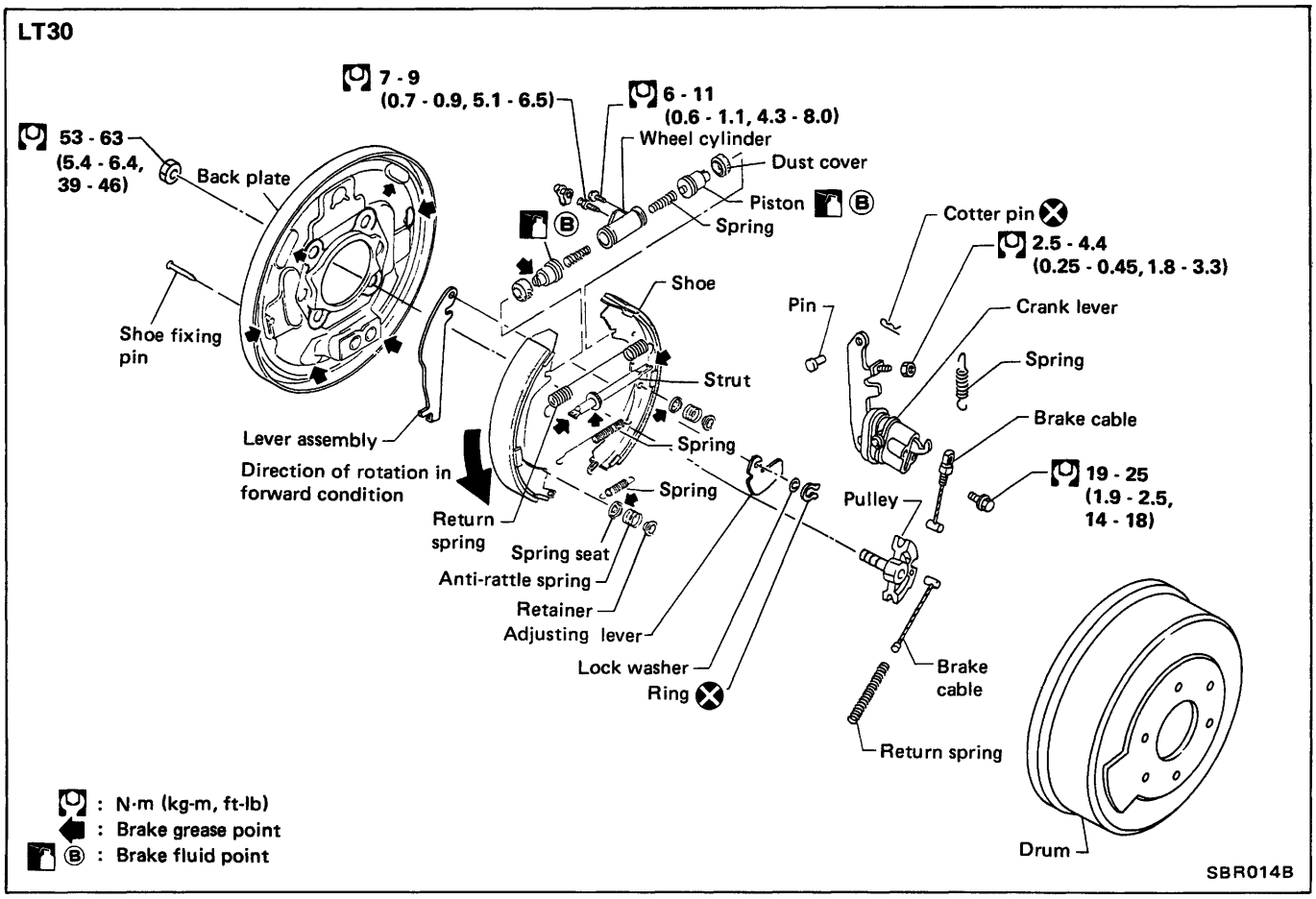
Maximum runout
(Total indicator reading at center of rotor pad contact surface)
0.07 mm (0.0028 in)

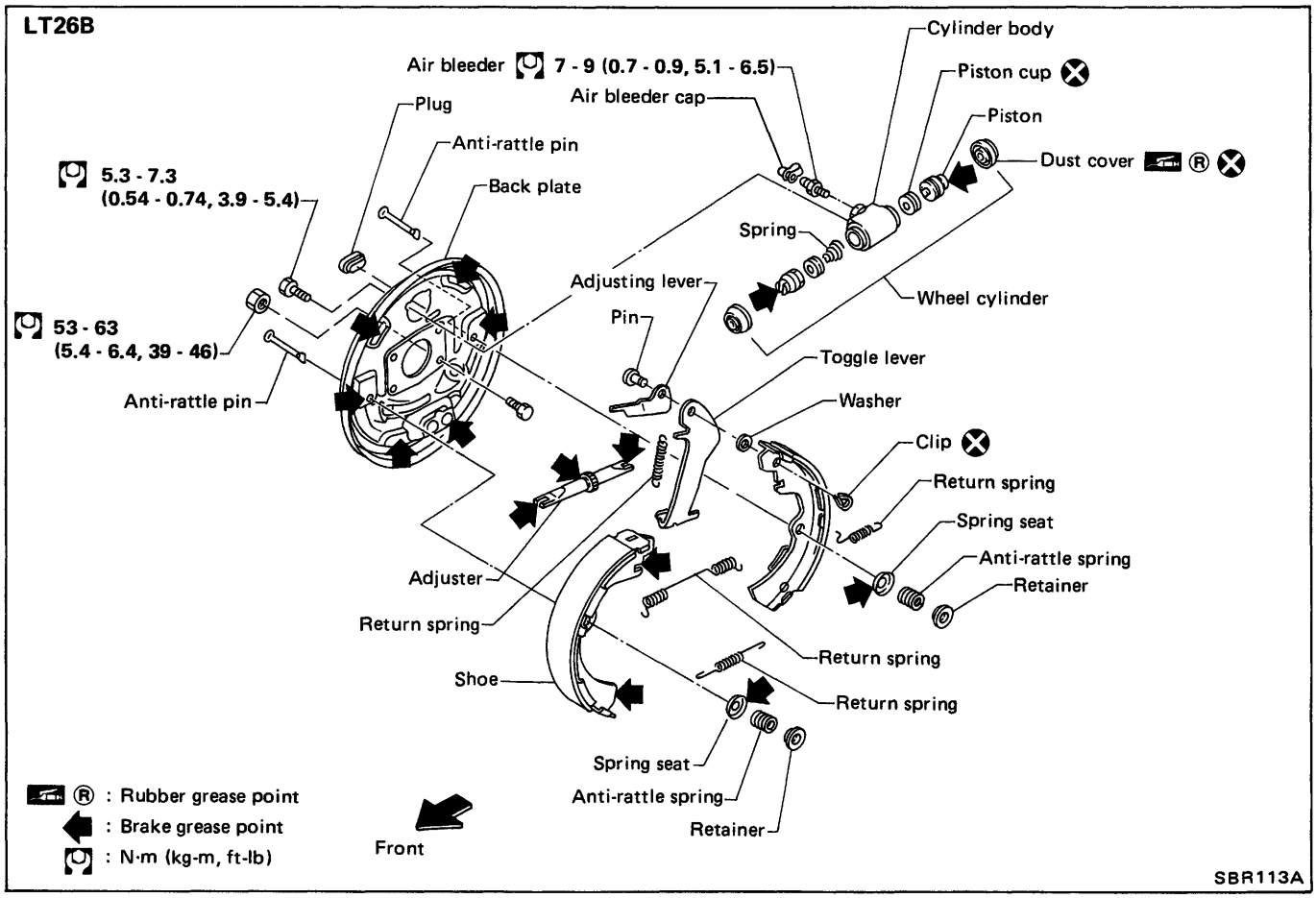

SBR090A

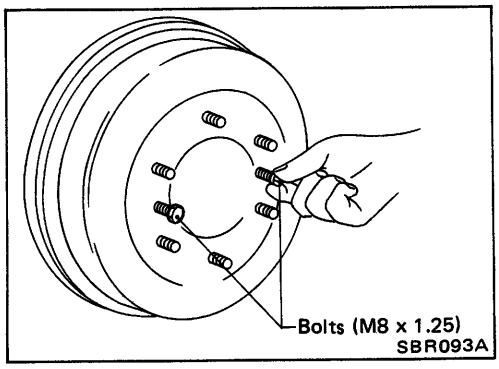
THICKNESS

Rotor repair limit:

Minimum thickness
CL28VA 20.0 mm (0.787 in)
CL28VD 24.0 mm (0.945 in)

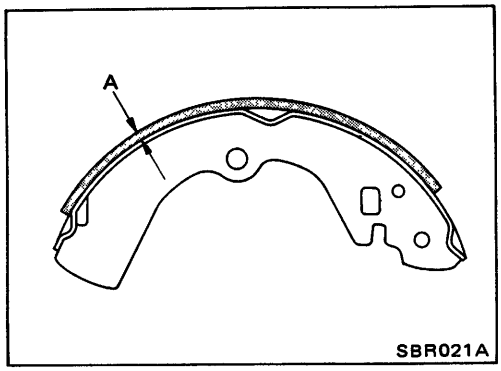

LT30
7 - 9 (0.7 - 0.9, 5.1 - 6.5)
6 - 11 (0.6 - 1.1, 4.3 - 8.0)
53 - 63 (5.4 - 6.4, 39 - 46)
Back plate
Wheel cylinder
Dust cover
Piston
Spring
Cotter pin
2.5 - 4.4 (0.25 - 0.45, 1.8 - 3.3)
Shoe
Pin
Crank lever
Shoe fixing pin
Strut
Spring
Spring
Brake cable
Lever assembly
Direction of rotation in forward condition
Spring
19 - 25 (1.9 - 2.5, 14 - 18)
Pulley
Return spring
Spring seat
Anti-rattle spring
Retainer
Adjusting lever
Lock washer
Ring
Brake cable
Return spring
Drum
: N·m (kg-m, ft-lb)
: Brake grease point
Ⓑ : Brake fluid point
SBR014B


LT26B
Cylinder body
Air bleeder
7 - 9 (0.7 - 0.9, 5.1 - 6.5)
Piston cup
Air bleeder cap
Plug
Piston
Anti-rattle pin
Dust cover Ⓡ
5.3 - 7.3 (0.54 - 0.74, 3.9 - 5.4)
Back plate
Spring
Adjusting lever
Wheel cylinder
53 - 63 (5.4 - 6.4, 39 - 46)
Pin
Toggle lever
Anti-rattle pin
Washer
Clip
Return spring
Spring seat
Anti-rattle spring
Retainer
Adjuster
Return spring
Return spring
Shoe
Return spring
Spring seat
Anti-rattle spring
Retainer
Front
Ⓡ : Rubber grease point
: Brake grease point
: N·m (kg-m, ft-lb)
SBR113A



Brake Drum Removal

- Release parking brake control lever fully.
- Tighten two bolts gradually if brake drum is hard to remove.



Shoe Replacement

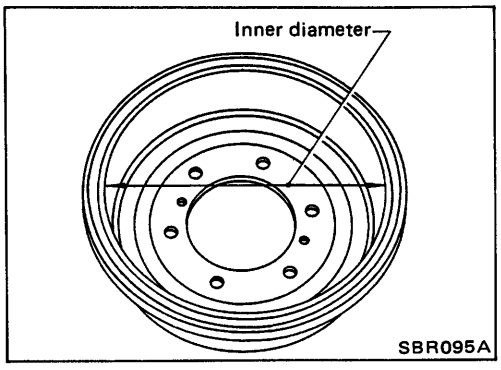
- Measure lining thickness.

Lining wear limit (A):
1.5 mm (0.059 in)

Before installing new shoes, rotate nut until adjuster rod is at its shortest point.
After installation is completed, adjust shoe-to-drum clearance.

Wheel Cylinder Inspection

Check parts for score, wear or damage. Replace if any of the above conditions are observed.



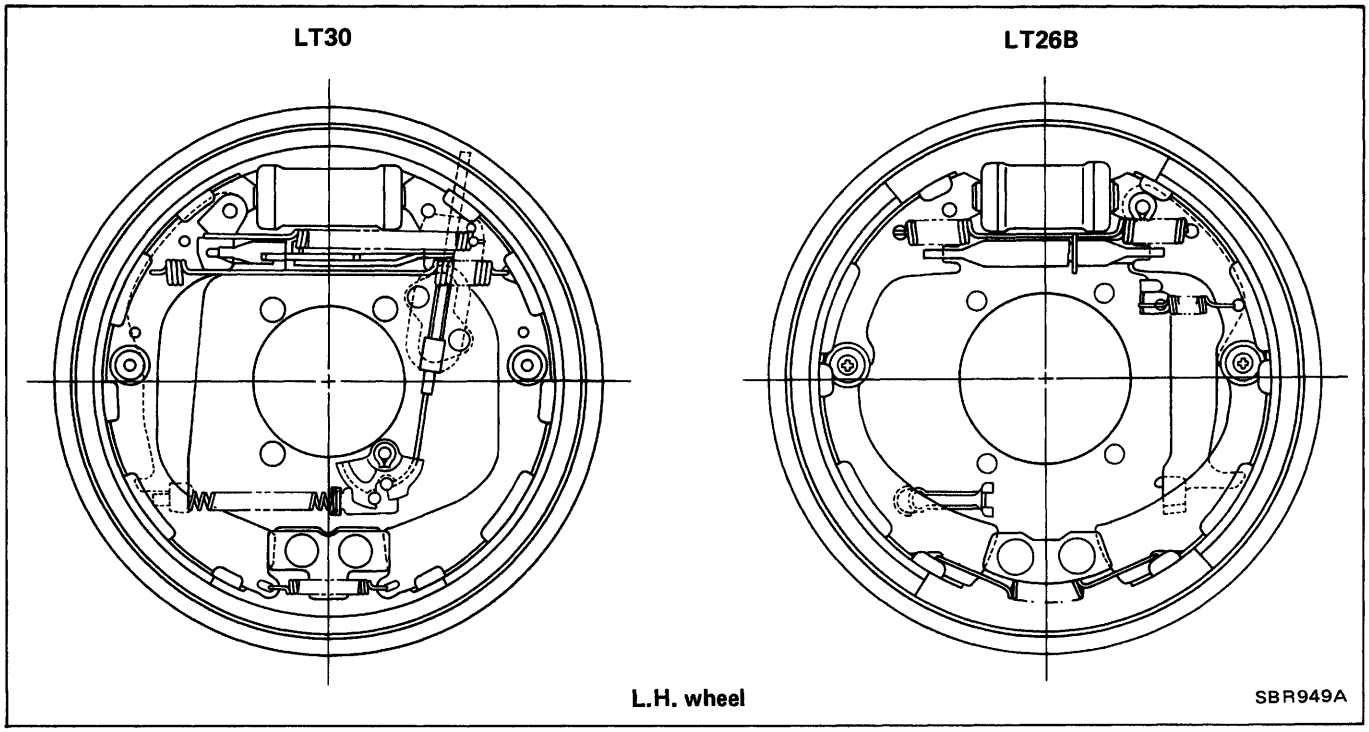
Drum Inspection

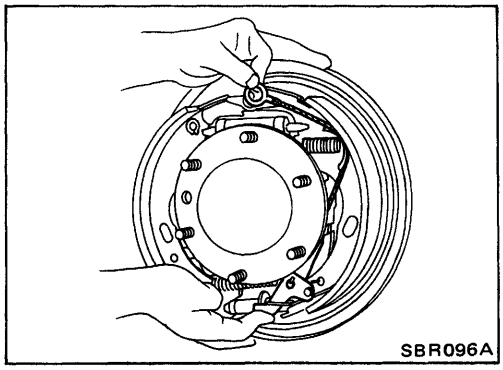
Maximum inner diameter (Repair limit):
LT26B 261.5 mm (10.30 in)
LT30 296.5 mm (11.67 in)

- Contact surface should be finefinished with No. 120 to 150 emery paper.
- Using a drum racer, lathe brake drum if it shows score marks, partial wear or stepped wear.
- After brake drum has been completely reconditioned or replaced, check drum and shoes for proper contact pattern.

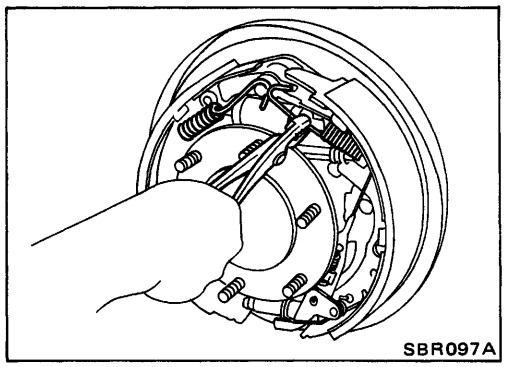
Shoe Installation

- Install all the parts by referring to the figure below.



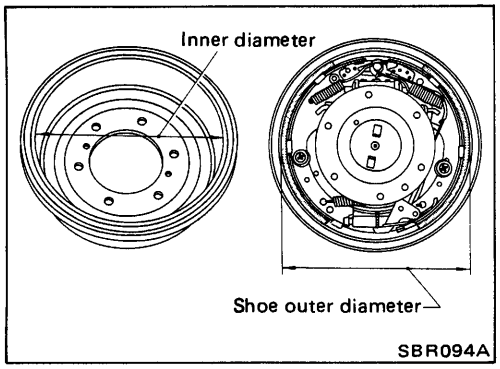


- Place adjuster cable by pulling adjusting lever upward.

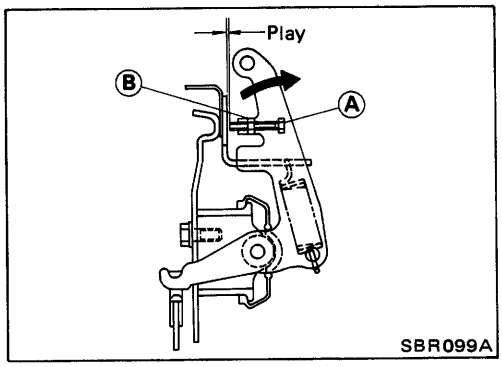


- Install return springs.

Shoe Installation (Cont'd)

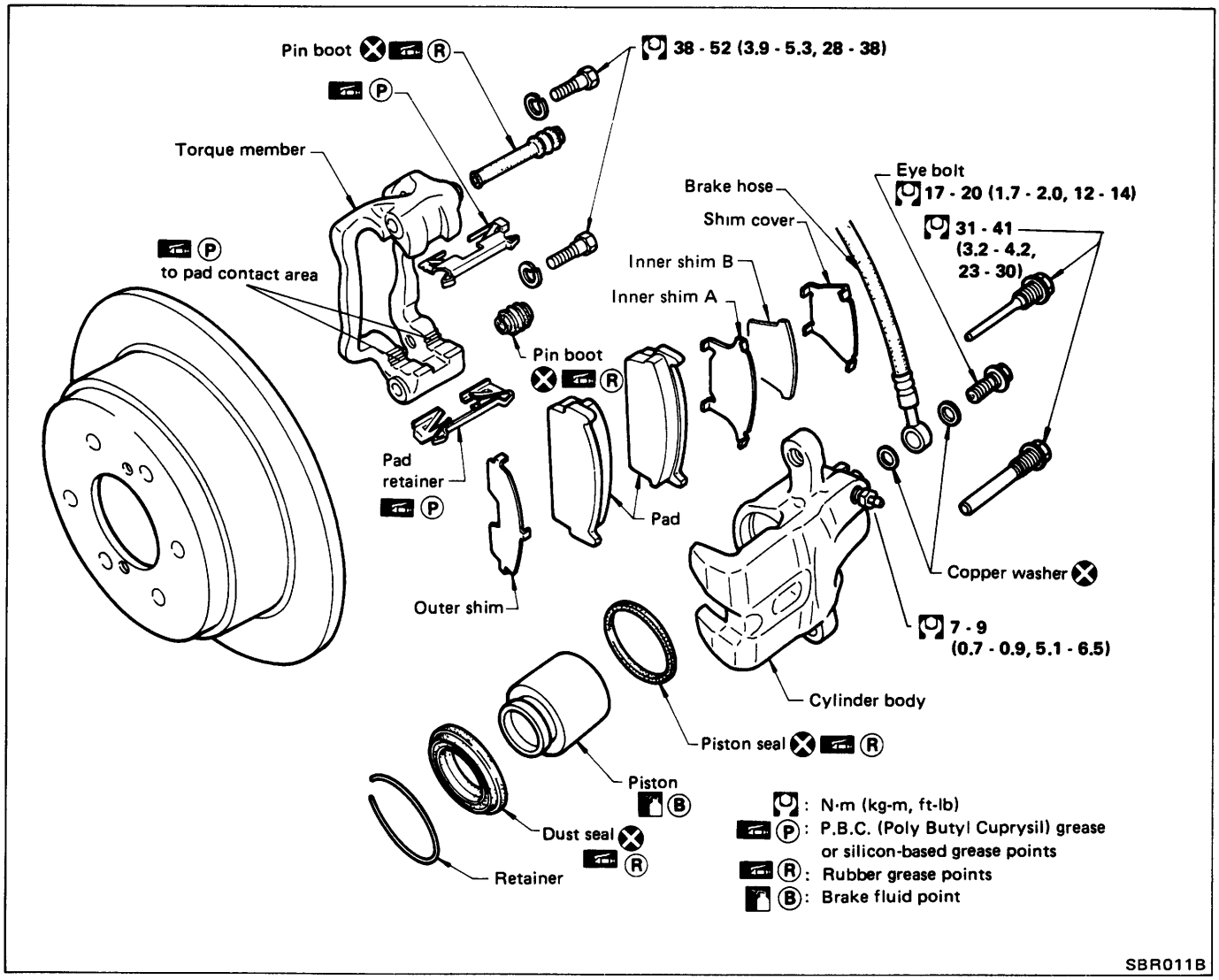


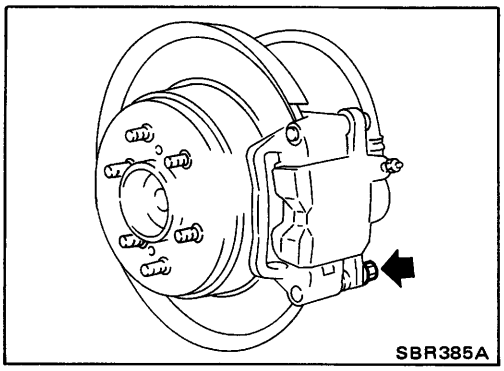
When installing, measure inner diameter of the drum and adjust so that shoe outer diameter at its center is smaller than drum inner diameter by 0.25 to 0.4 mm (0.0098 to 0.0157 in) by rotating the adjuster. Then operate parking brake lever to adjust shoe clearance.



LT30 model

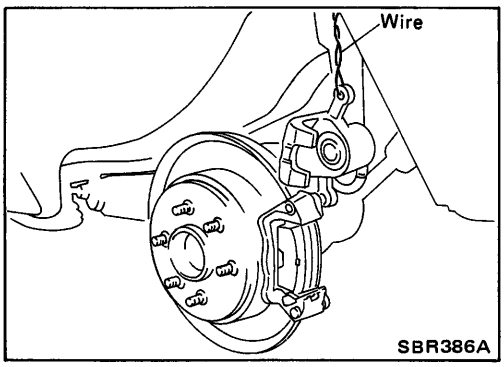
- After installing crank lever on back plate, make sure that there is no play between crank lever and back plate. If play exists, adjust bolt Ⓐ and lock nut Ⓑ.





Pad Replacement

1. Remove guide pin.

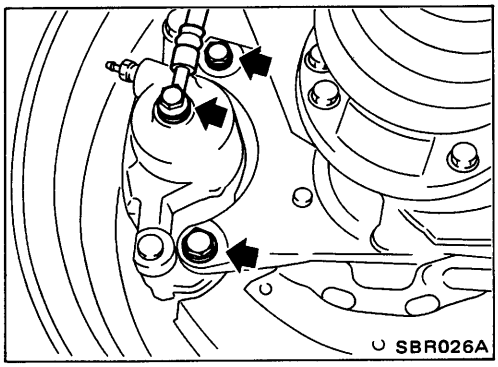


2. Swing cylinder body upward. Then remove pad retainer and inner and outer shims.

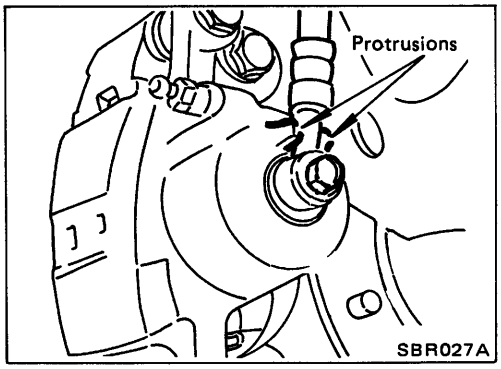
CAUTION:

- **When cylinder body is swung up, do not depress brake pedal because piston will pop out.**
- **Be careful not to damage dust seal or get oil on rotor. Always replace shims when replacing pads.**

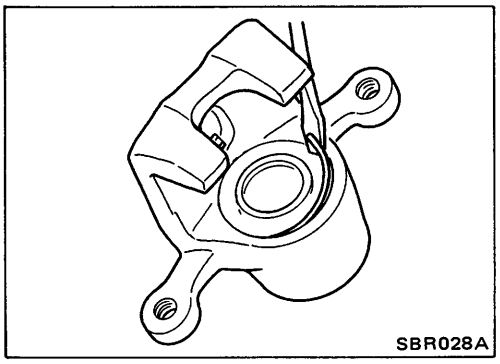
Removal and Installation



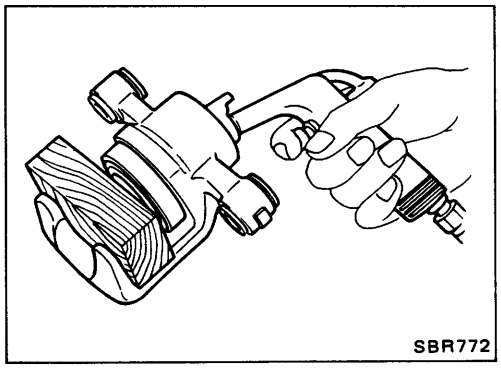
- Remove torque member fixing bolts and eye bolt.



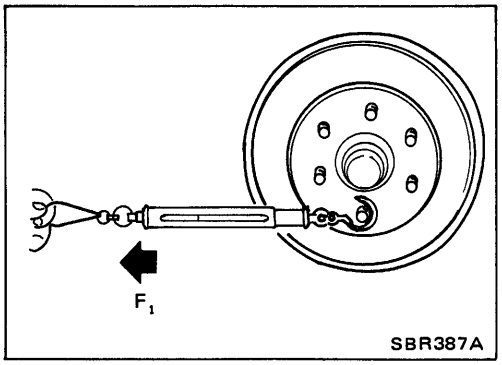
- Install brake hose to caliper securely.



- Remove retainer with a screwdriver.



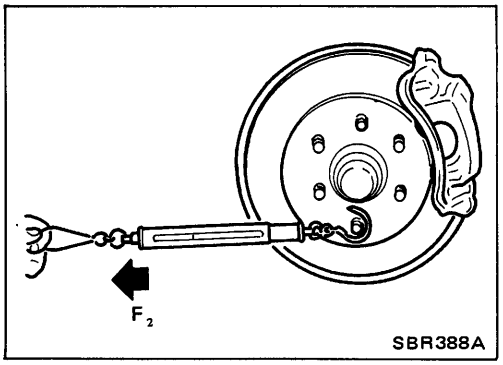
- Push out piston with dust seal with compressed air.



Inspection

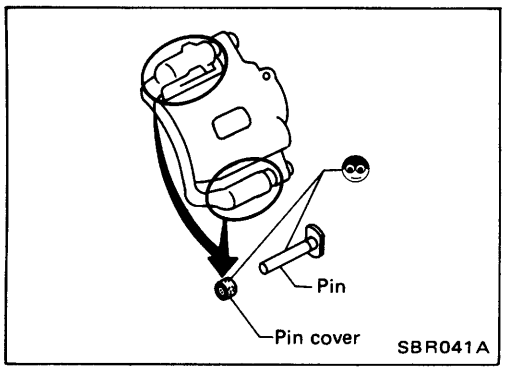
INSPECTION OF BRAKE DRAG FORCE

(1) Swing cylinder body upward.
(2) Make sure that wheel bearing is adjusted properly. Refer to section RA.
(3) Measure rotating force (F_1).



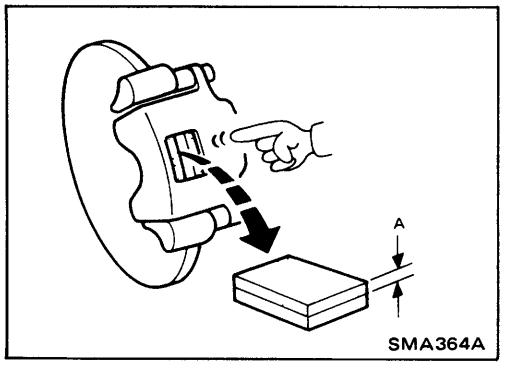
(4) Install caliper with pads to the original position.
(5) Depress brake pedal for 5 seconds.
(6) Release brake pedal, rotate disc rotor 10 revolutions.
(7) Measure rotating force (F_2).
(8) Calculate brake drag force by subtracting F_1 from F_2.

Maximum brake drag force ($F_2 - F_1$):
103.0 N (10.5 kg, 23.2 lb)



If it is not within specification, check pins and pin boots in caliper.

- Make sure that wheel bearing is adjusted properly.
- Disc pads and disc rotor must be dried.



DISC PAD

Check disc pad for wear or damage.

Pad wear limit (A):
2.0 mm (0.079 in)

CYLINDER BODY

- Check inside surface of cylinder body for score, rust, wear, damage or presence of foreign materials. If any of the above conditions are observed, replace cylinder body.
- Minor damage from rust or foreign materials may be eliminated by polishing surface with a fine emery paper. Replace cylinder body if necessary.

CAUTION:
Use brake fluid to clean. Never use mineral oil.

Inspection (Cont'd)

PISTON

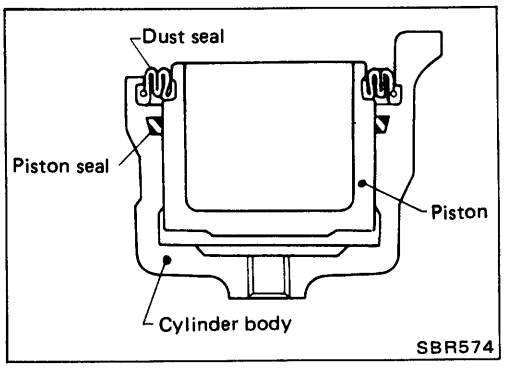
Check piston for score, rust, wear, damage or presence of foreign materials. Replace if any of the above conditions are observed.

CAUTION:

Piston sliding surface is plated. Do not polish with emery paper even if rust or foreign materials are stuck to sliding surface.

PIN, PIN BOLT, RETAINER, PISTON SEAL, DUST SEAL AND PIN BOOT

Check for wear, cracks or other damage. Replace if any of the above conditions are observed.



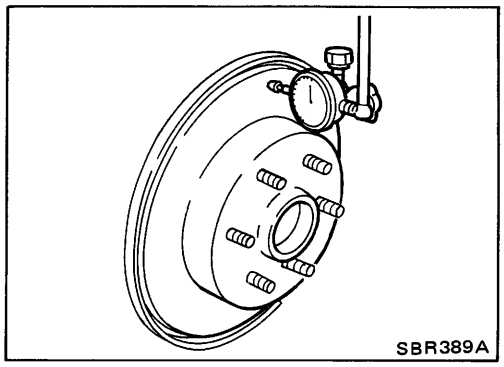
Assembly

- With dust seal fitted to piston, insert dust seal into groove on cylinder body and install piston.
- Properly secure dust seal.

Rotor Inspection

RUBBING SURFACE

Check rotor for roughness, cracks or chips. Repair or replace if necessary.


SBR389A

RUNOUT

Make sure that axial end play is within the specifications before measuring. Refer to section RA.

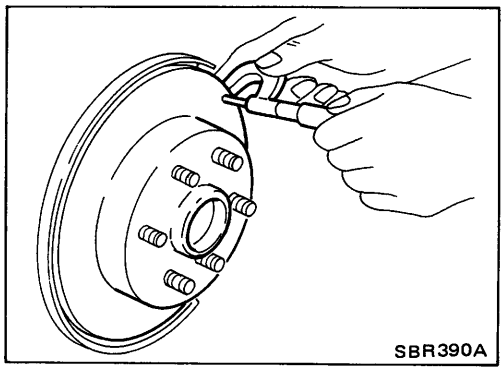
Then check runout with a dial gauge.

Rotor repair limit

Maximum runout

(Total indicator reading at center of rotor pad contact surface)

0.07 mm (0.0028 in)

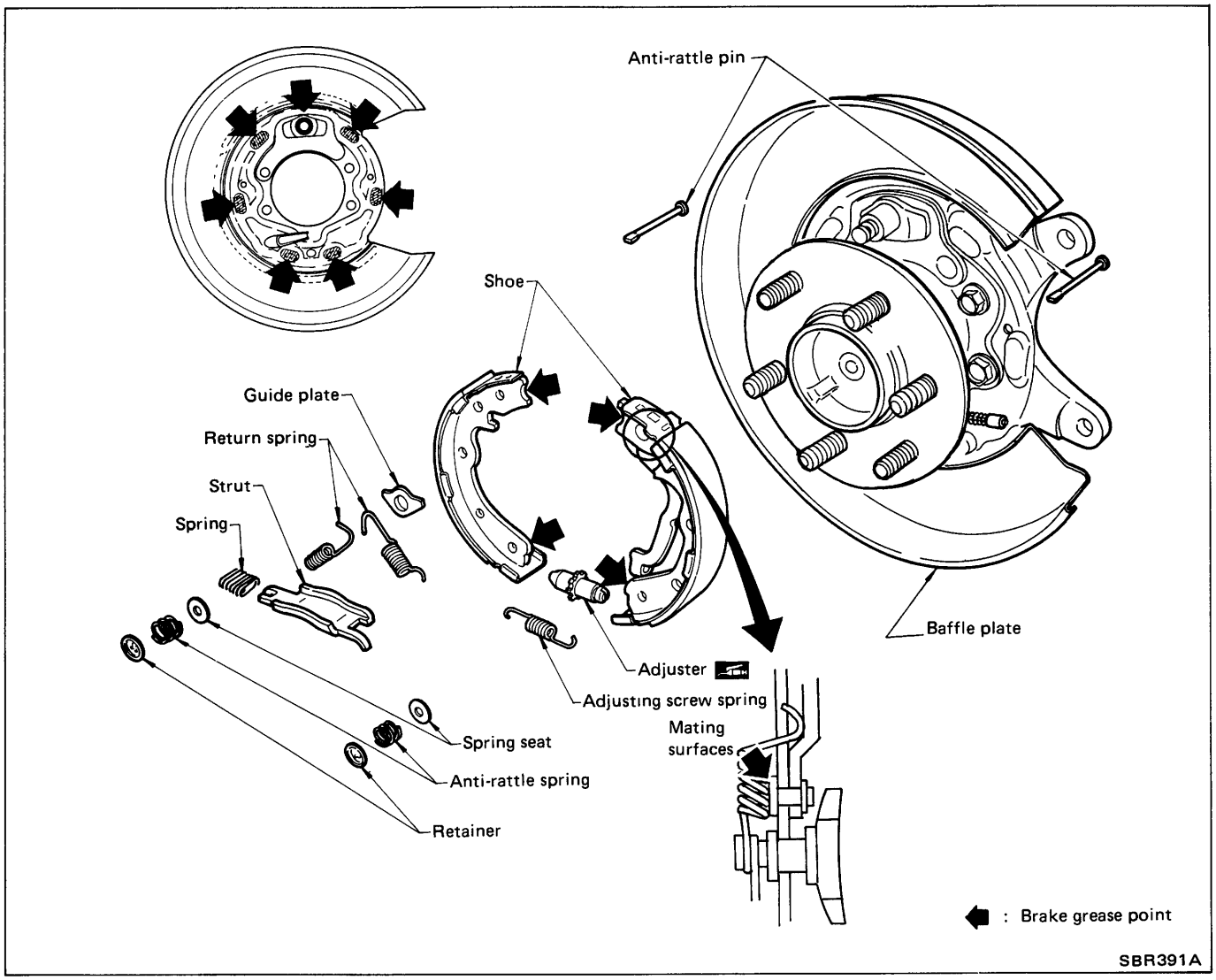

SBR390A

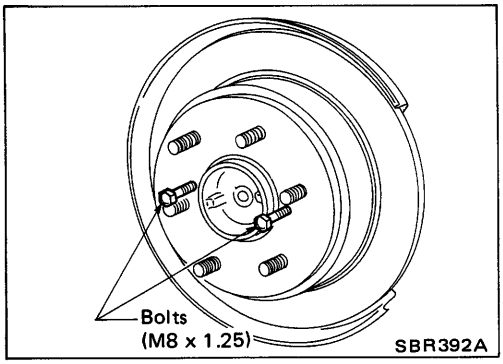
THICKNESS

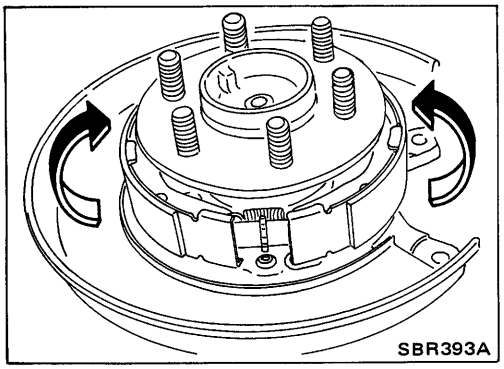
Rotor repair limit:

Minimum thickness

16.0 mm (0.630 in)







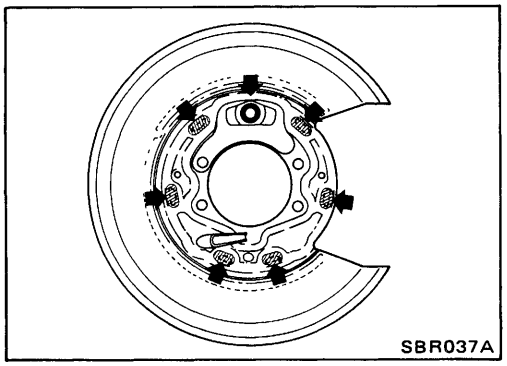
Shoe Replacement

1. Remove disc rotor (With parking brake drum).
   Tighten two bolts gradually if disc rotor is hard to remove.

2. After removing retainer, remove spring.

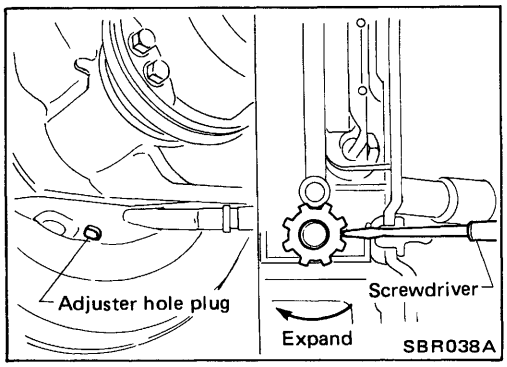
Be careful not to damage parking brake cable when separating it.

Shoe Replacement (Cont'd)


SBR037A

3. Apply brake grease to the contact areas shown at left.

Shoe Clearance Adjustment



1. Remove adjuster hole plug, and turn down adjuster wheel with a screwdriver until shoe touches brake drum.

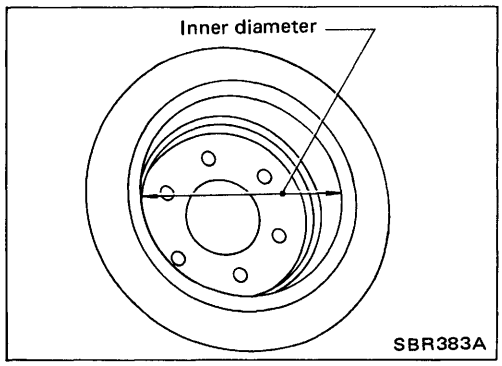
Make sure that parking control lever is released completely.

2. Return adjuster wheel 7 to 8 latches.
3. Install adjuster hole plug, and make sure that there is no drag between shoes and brake drum when rotating disc rotor.

Breaking in Drum and Lining

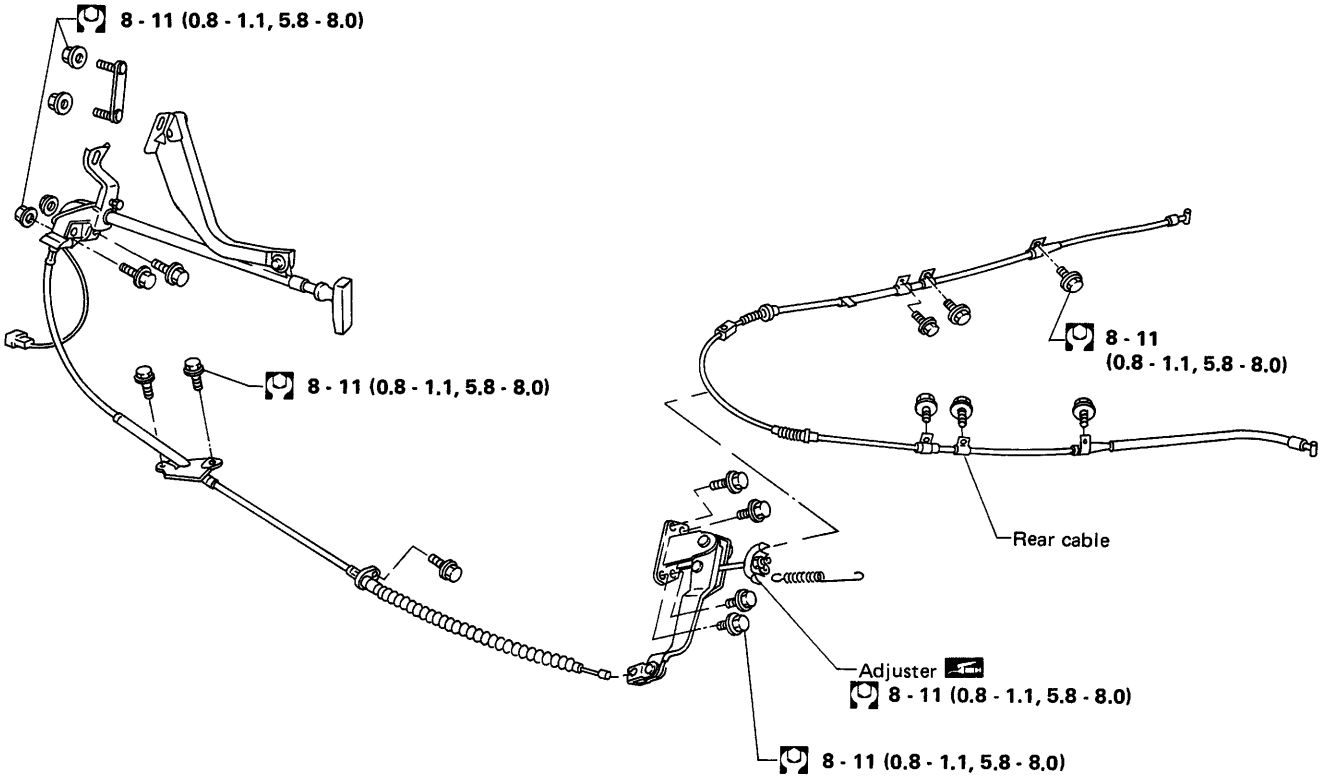
1. Set transfer lever in the "2H" position. Using either low or 2nd transmission speed, drive the unloaded vehicle at approximately 30 km/h (19 MPH) on a safe, level and dry road.
2. Depress the release button of parking brake lever, then pull the lever with a force of 98 N (10 kg, 22 lb).
3. While holding the lever back, continue to drive the vehicle 100 m (328 ft).
4. Repeat steps 1 through 3 two or three times.

Drum Inspection

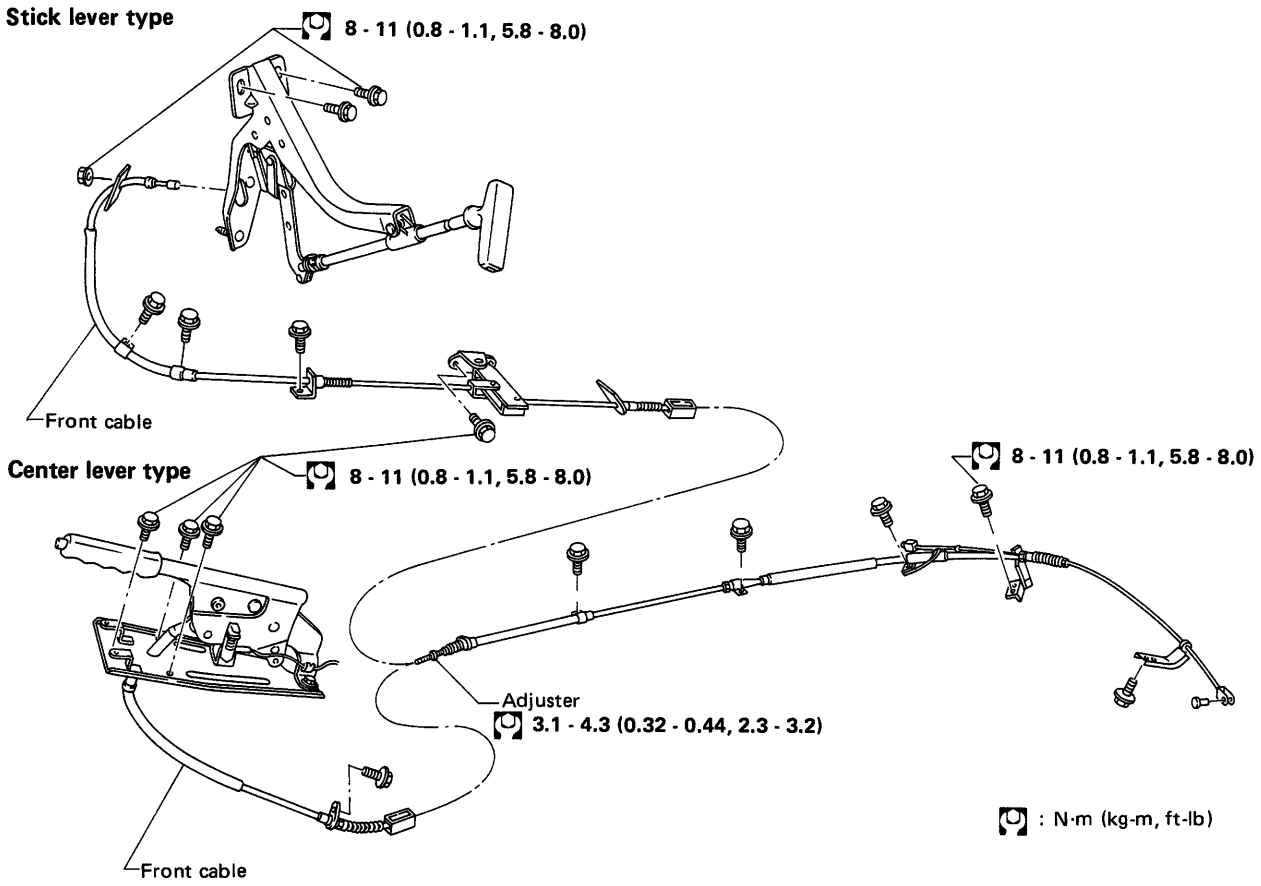


Maximum inner diameter (Repair limit):
191.0 mm (7.52 in)

TRUCK-2WD

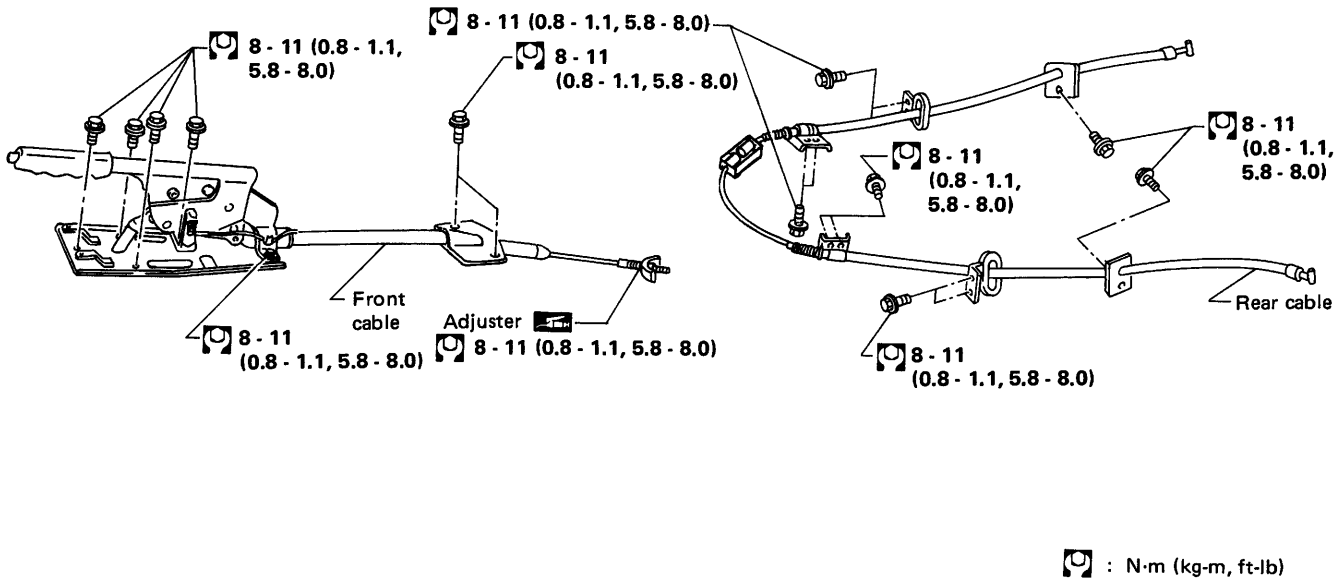


TRUCK-4WD



SBR100A

VAN & WAGON

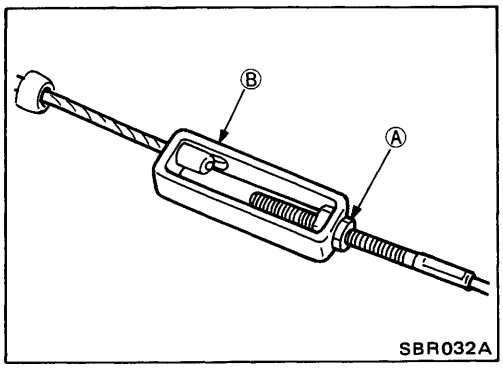


Removal and Installation

- Be careful not to damage cable.
- Make sure there is no free play after installation.

Inspection

- Check control lever for wear or other damage. Replace if necessary.
- Check wires for discontinuity or deterioration. Replace if necessary.
- Check warning lamp and switch. Correct if necessary.
- Check part at each connecting portion and, if found deformed or damaged, replace.

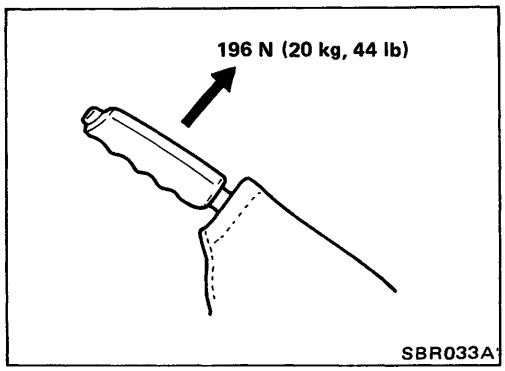


Adjustment

Adjust control lever stroke as follows:

For disc in drum brake type, shoe clearance adjustment must be done before adjusting parking brake control.

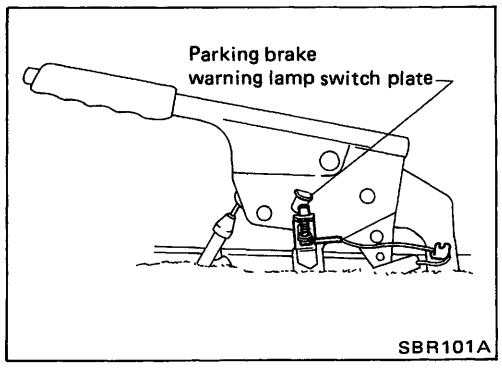
1. Loosen lock nut (A), rotate adjuster (B).
2. Tighten lock nut (A).



3. Pull control lever with specified amount of force. Check lever stroke and ensure smooth operation.

Number of notches:

Truck	
Center lever type	**10 - 12**
Stick lever type	**10 - 12 (2WD)**
	9 - 11 (4WD)
Van & Wagon	
Center lever type	**7 - 9**



4. Bend parking brake warning lamp switch plate so that brake warning light comes on when ratchet at parking brake lever is pulled "A" notches and goes out when fully released.

Number of notches "A":

Center lever type	**2**
Stick lever type	**1**

General Specifications

Applied model	Truck				Van & Wagon	
	2WD			4WD	Standard	Option for SE grade
	KA24E	VG30E				
	–	Except Heavy duty	Heavy duty			
Front brake Brake model	CL28VA	CL28VD				
Cylinder bore diameter x number of pistons mm (in)	60.6 (2.386) x 1	42.8 (1.685) x 2				
Pad length x width x thickness mm (in)	IN: 126.5 x 43 x 11 (4.98 x 1.69 x 0.43) OUT: 129 x 43 x 11 (5.08 x 1.69 x 0.43)	144.6 x 48.5 x 10 (5.69 x 1.909 x 0.39)				
Rotor outer diameter x thickness mm (in)	250 x 22 (9.84 x 0.87)	260 x 26 (10.24 x 1.02)		277 x 26 (10.91 x 1.02)		
Rear brake Brake model	LT26B			LT30A	LT26B	AD14VB
Cylinder bore diameter x number of pistons mm (in)	22.22 (7/8)	20.64 (13/16)				42.83 (1.6862)
Lining or pad length x width x thickness mm (in)	249.6 x 50 x 5.5 (9.83 x 1.97 x 0.217)			296 x 50 x 6.1 (11.65 x 1.97 x 0.240)	249.6 x 50 x 5.5 (9.83 x 1.97 x 0.217)	100.8 x 25.3 x 10 (3.97 x 0.996 x 0.39)
Drum inner diameter or rotor outer diameter x thickness mm (in)	260.0 (10.24)			295.0 (11.61)	260.0 (10.24)	286 x 18 (11.26 x 0.71)
Parking brake Brake model	–					DS19HB
Lining length x width x thickness mm (in)	–					182.3 x 30 x 3 (7.18 x 1.18 x 0.12)
Drum inner diameter mm (in)	–					190.0 (7.48)
Master cylinder Bore diameter mm (in)	23.81 (15/16)					
Control valve Valve model	Proportioning valve within master cylinder	Linkage type load sensing valve		Proportioning valve within master cylinder		
Split point [kPa (kg/cm², psi)] x reducing ratio	2,452 (25, 356) x 0.1	(Valiable) x 0.1	(Valiable) x 0.23	1,961 (20, 284) x 0.1	2,452 (25, 356) x 0.2	3,923 (40, 569) x 0.4
Brake booster Booster model	M195T					M215T
Diaphragm diameter mm (in)	Pri.: 180 (7.09) Sec.: 205 (8.07)					Pri.: 230 (9.06) Sec.: 205 (8.07)
Recommended brake fluid	DOT 3					

Inspection and Adjustment

DISC BRAKE

Unit: mm (in)

Brake model	CL28VA	CL28VD	AD14VB
Pad wear limit Minimum thickness	2.0 (0.079)		
Rotor repair limit Minimum thickness	20.0 (0.787)	24.0 (0.945)	16.0 (0.630)
Maximum runout	0.07 (0.0028)		

DRUM BRAKE

Unit: mm (in)

Brake model	LT26B	LT30A
Lining wear limit Minimum thickness	1.5 (0.059)	
Drum repair limit Maximum inner diameter	261.5 (10.30)	296.5 (11.67)
Out-of-round limit	0.03 (0.0012)	
Runout limit	0.05 (0.0020)	

PARKING DRUM BRAKE

Unit: mm (in)

Brake model	DS17H
Lining wear limit Minimum thickness	1.5 (0.059)
Drum repair limit Maximum inner diameter	191.0 (7.52)
Brake shoe adjustment Returning notches	7 - 8

BRAKE BOOSTER

Output rod length "A" mm (in)	10.275 - 10.525 (0.4045 - 0.4144)

BRAKE PEDAL

Unit: mm (in)

Free height "H" M/T A/T	 209 - 219 (8.23 - 8.62) 212 - 222 (8.35 - 8.74)
Depressed height "D" [under force of 490 N (50 kg, 110 lb) with engine running]	120.0 (4.72)
Clearance "C" between pedal stopper and threaded end of stop lamp switch or A.S.C.D. switch	0.3 - 1.0 (0.012 - 0.039)
Pedal free play At clevis	1.0 - 3.0 (0.039 - 0.118)
At pedal pad	4 - 12 (0.16 - 0.47)

PARKING BRAKE CONTROL

Control type	Center lever	Stick lever
Lever stroke [under force of 196 N (20 kg, 44 lb)]	10 - 12*1 7 - 9*2	10 - 12*3 9 - 11*4
Lever stroke when warning switch comes on	2	1

*1: Truck models.
*2: Van and Wagon models.
*3: 2WD models.
*4: 4WD models.

STEERING SYSTEM

SECTION ST

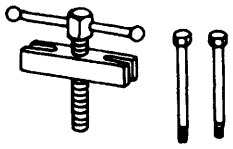
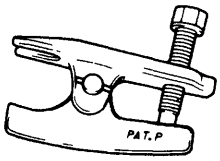
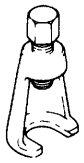
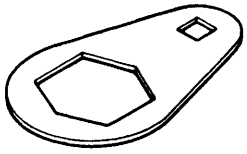
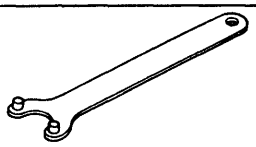
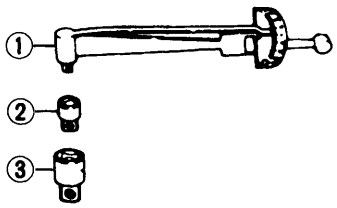
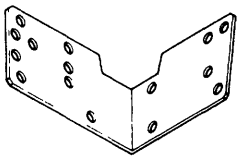
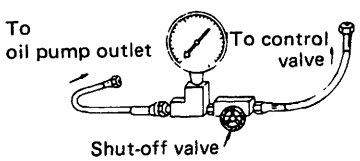
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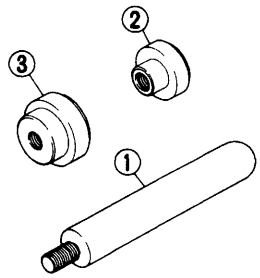
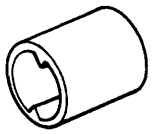
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POWER STEERING GEAR (Model: PB56S) ST-21
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SERVICE DATA AND SPECIFICATIONS (S.D.S.) ST-44

- Before disassembly, thoroughly clean the outside of the unit.
- Disassembly should be done in a clean work area. It is important to prevent the internal parts from becoming contaminated by dirt or other foreign matter.
- When disassembling parts, be sure to place them in order on a part rack so they can be reinstalled in their proper positions.
- Use nylon cloths or paper towels to clean the parts; common shop rags can leave lint that might interfere with their operation.
- Before inspection or reassembly, carefully clean all parts with a general purpose, non-flammable solvent.
- Before assembly, apply a coat of recommended A.T.F.* to hydraulic parts. Vaseline may be applied to O-rings and seals. Do not use any grease.
- Replace all gaskets, seals and O-rings. Avoid damaging O-rings, seals and gaskets during installation. Perform functional tests whenever designated.

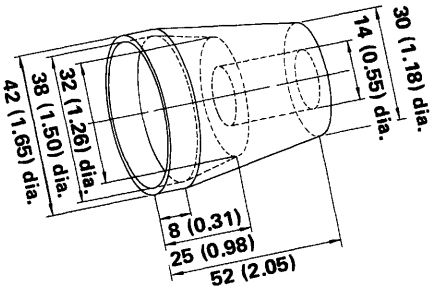
  *: Automatic transmission fluid

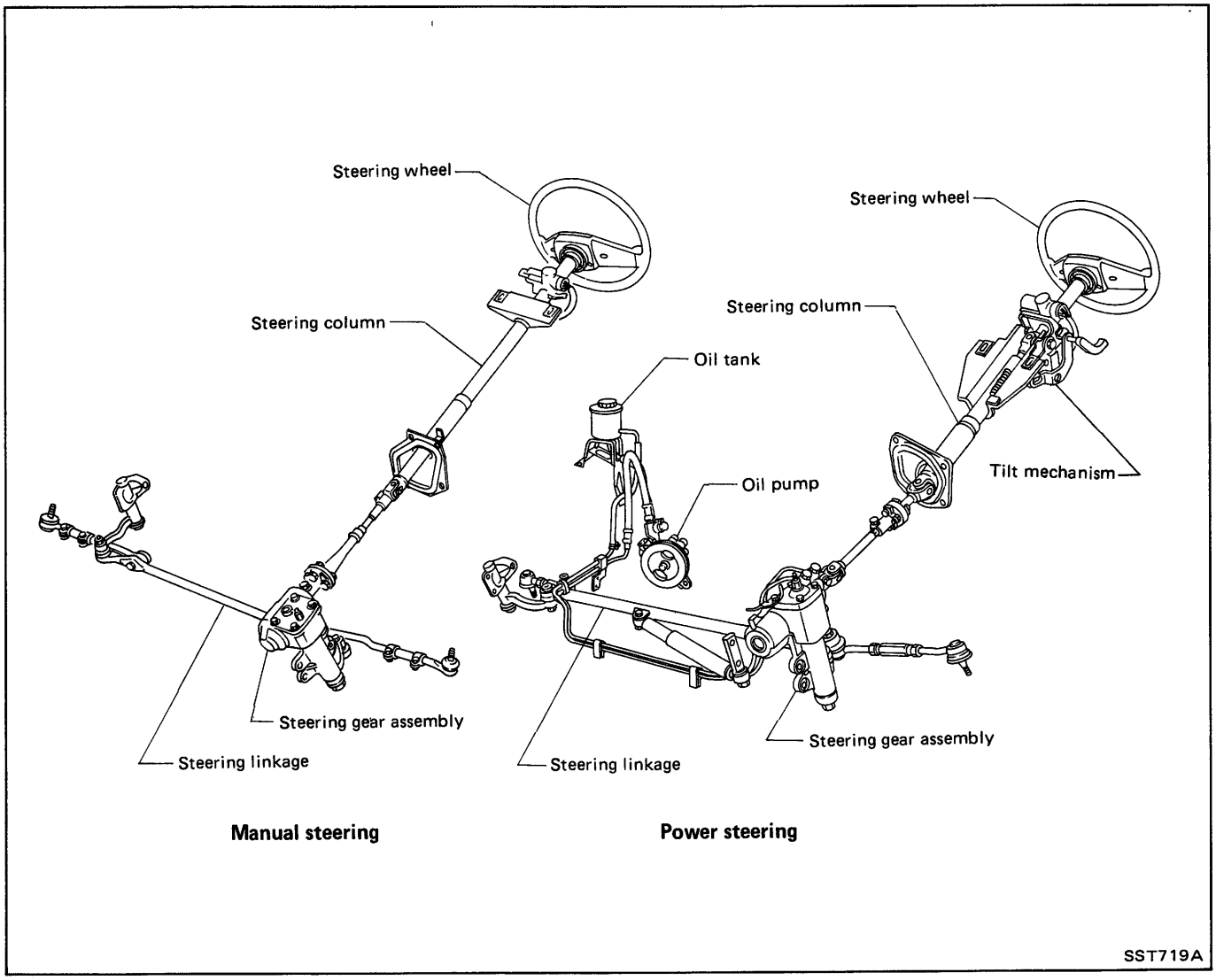
SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.) Tool name	Description		Unit application	
			Manual steering	Power steering
ST27180001 (J25726-A) Steering wheel puller		Removing steering wheel	X	X
HT72520000 (J25730-A) Ball joint remover		Removing ball joint and swivel joint	X	X
ST29020001 (J24319-01) Steering gear arm puller		Removing pitman arm	X	X
KV48101500 (J28802) Lock nut wrench			X	–
KV48101400 (J28803) Adjusting plug wrench		Adjusting and tightening lock nut	X	–
ST3127S000 (See J25765-A) ① GG91030000 (J25765-A) Torque wrench ② HT62940000 (–) Socket adapter ③ HT62900000 (–) Socket adapter		Measuring turning torque	X	X
KV48100301 (–) Strut & steering gearbox attachment		Steering gear is installed.	X	X
ST270910000* (J26357) Pressure gauge		Measuring oil pressure	–	X

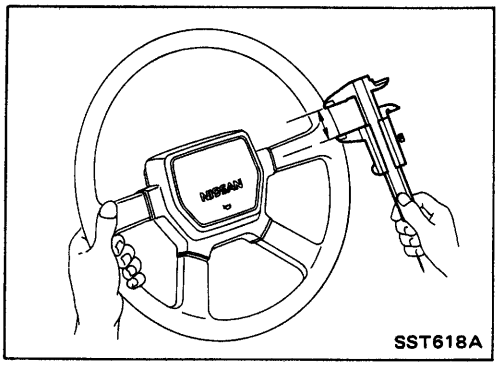
Tool number (Kent-Moore No.) Tool name	Description	Unit application	
		Manual steering	Power steering
KV481009S0 (–) Oil seal drift set ① KV48100910 (–) Drift ② KV48100920 (J26367) Adapter ③ KV48100930 (J26367) Adapter	Installing oil seal 	–	X
KV48100700 (J26364) Torque adapter	Adjusting worm bearing preload 	X	X

COMMERCIAL SERVICE TOOL

Tool name	Description	Unit application	
		Manual steering	Power steering
Boot band attachment	Installing boot band  Unit: mm (in) SST671A	X	X



Manual steering **Power steering**



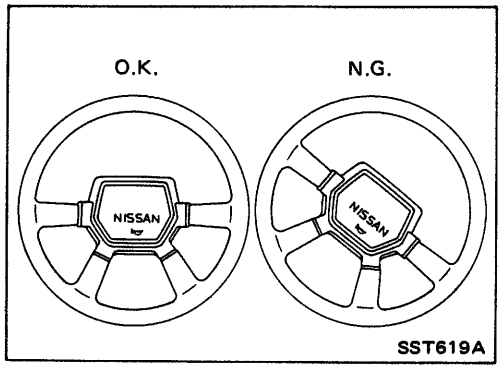
Checking Steering Wheel Play

- With wheels in a straight ahead position and check steering wheel play.

  Steering wheel play:

  35 mm (1.38 in) or less

- If it is not within specification, check backlash of steering gear, tie-rod outer and inner ball joints.



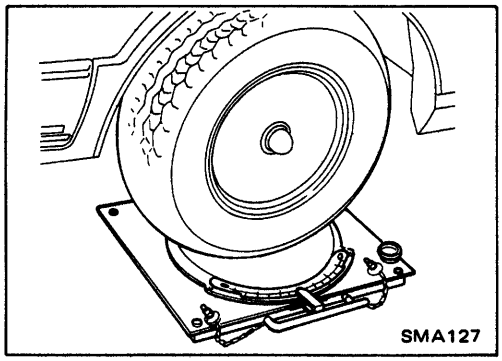
Checking Neutral Position on Steering Wheel

Pre-checking

- Verify that the steering gear is centered before removing the steering wheel.

Checking

- Check that the steering wheel is in the neutral position when driving straight-ahead.
- If it is not in the neutral position, remove the steering wheel and reinstall it correctly in the neutral position.
- If the neutral position is between two serrated teeth, loosen tie-rod lock nut and move tie-rod in the opposite direction by the same amount on both left and right sides to compensate for error in the neutral position.



Checking Front Wheel Turning Angle

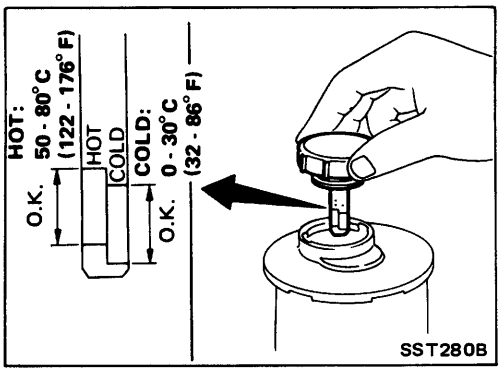
- Rotate steering wheel all the way right and left; measure turning angle.

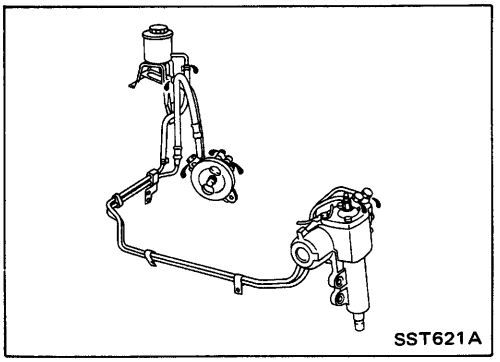
  Turning angle:

  Refer to section FA for S.D.S.

Checking and Adjusting Drive Belts (Power steering)

- **Refer to section MA for Drive Belt Inspection.**





Checking Fluid Level (Power steering)

Check fluid level.

Fluid level should be checked using "HOT" range on dipstick at fluid temperatures of 50 to 80°C (122 to 176°F) or using "COLD" range on dipstick at fluid temperatures of 0 to 30°C (32 to 86°F).

CAUTION:

- **Do not overfill.**
- **Recommended fluid is Automatic Transmission Fluid "DEXRON™" type.**

Checking Fluid Leakage (Power steering)

Check lines for proper attachment, leaks, cracks, damage, loose connections, chafing and deterioration.

1. Run engine at idle speed or 1,000 rpm.
   Make sure temperature of fluid in oil tank rises to 60 to 80°C (140 to 176°F).
2. Turn steering wheel right-to-left several times.
3. Hold steering wheel at each "lock" position for five seconds and carefully check for fluid leakage.

CAUTION:

Do not hold steering wheel at lock position for more than fifteen seconds at a time.

4. If fluid leakage at connectors is noticed, loosen flare nut and then retighten.

Do not overtighten connector as this can damage O-ring, washer and connector.

Bleeding Hydraulic System (Power steering)

1. Raise front end of vehicle until wheels clear ground.
2. While adding fluid, quickly turn steering wheel fully to right and left until it lightly touches steering stoppers.

CAUTION:

Do not hold steering wheel in lock position for more than fifteen seconds.

   Repeat steering wheel operation until fluid level no longer decreases.

3. Start engine.
   Repeat step 2 above.

- Imcomplete air bleeding will cause the following to occur. When this happens, bleed air again.

① Generation of air bubbles in reservoir tank
② Generation of clicking noise in oil pump
③ Excessive buzzing in oil pump

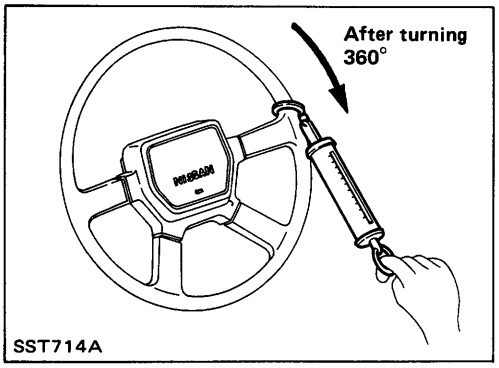
Bleeding Hydraulic System (Power steering) (Cont'd)

In steering while the vehicle is stationary, or when moving wheel slowly, fluid noise may be caused in the valve or oil pump. This type of fluid noise is inherent in an integral power steering system, and it will not affect performance or durability of the system.

Checking Steering Wheel Turning Torque (Power steering)

1. Park vehicle on a level, dry surface and set parking brake.
2. Bring power steering fluid up to adequate operating temperature. [Make sure temperature of fluid is approximately 60 to 80°C (140 to 176°F)].

Tires need to be inflated to normal pressure.



3. Check steering wheel turning force when steering wheel has been turned 360° from neutral position.

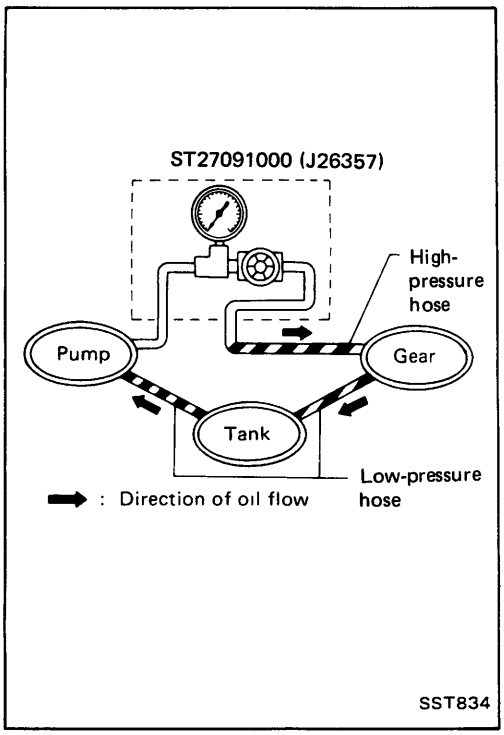
Steering wheel turning force:

PB48S-type

24.5 - 29.4 N (2.5 - 3.0 kg, 5.5 - 6.6 lb)

PB56S-type

39 N (4 kg, 9 lb) or less



Checking Hydraulic System (Power steering)

Before starting, check belt tension, driving pulley and tire pressure.

1. Set Tool. Open shut-off valve. Then bleed air. (See "Bleeding Hydraulic System".)
2. Run engine.
   Make sure temperature of fluid in tank rises to 60 to 80°C (140 to 176°F).

WARNING:

Warm up engine with shut-off valve fully opened. If engine is started with shut-off valve closed, oil pressure in oil pump will increase to relief pressure, resulting in an abnormal rise in oil temperature.

3. Check pressure with steering wheel fully turned to left and right positions.

Checking Hydraulic System (Power steering) (Cont'd)

CAUTION:

Do not hold steering wheel at lock position for more than fifteen seconds.

Oil pump standard pressure:
7,649 - 8,238 kPa
(78 - 84 kg/cm^2 , 1,109 - 1,194 psi) at idling

4. If oil pressure is below the standard, slowly close shut-off valve and check pressure.
- When pressure becomes standard, gear is damaged.
- When pressure remains beyond standard, pump is damaged.

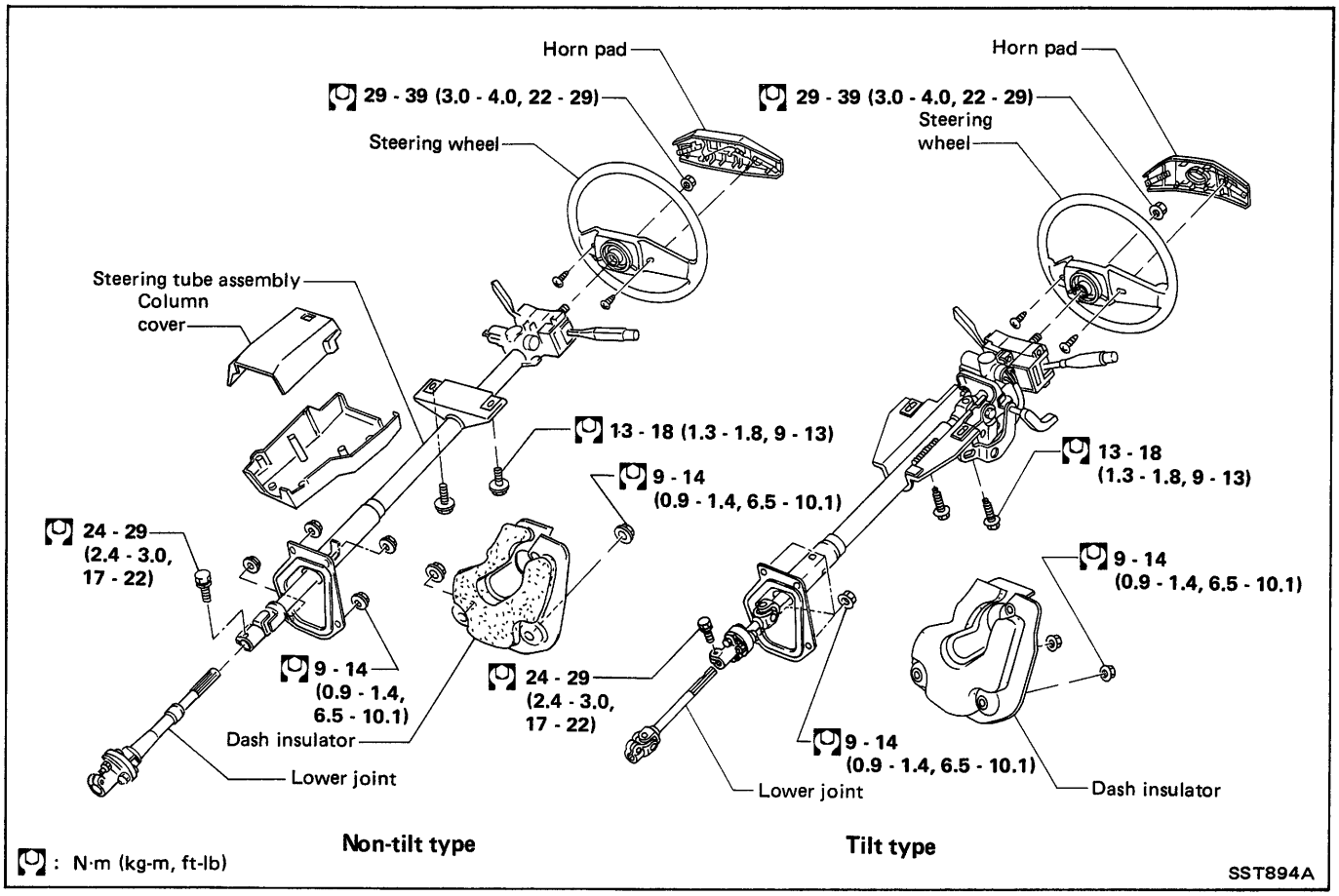
5. If oil pressure is higher than the standard level, pump is damaged.

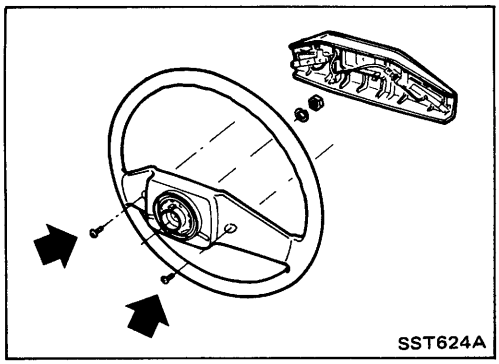
CAUTION:

Do not close shut-off valve for more than fifteen seconds.

6. After checking hydraulic system, remove Tool and add fluid as necessary, then completely bleed air out of system.

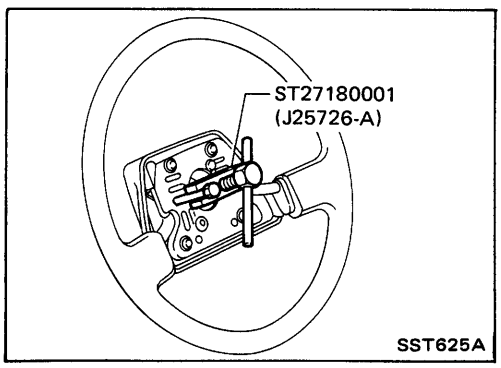
Removal and Installation





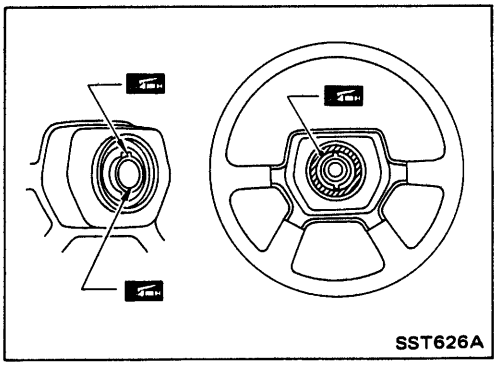
STEERING WHEEL

- Remove two screws from the rear of steering wheel.



- Remove steering wheel with Tool.

Removal and Installation (Cont'd)

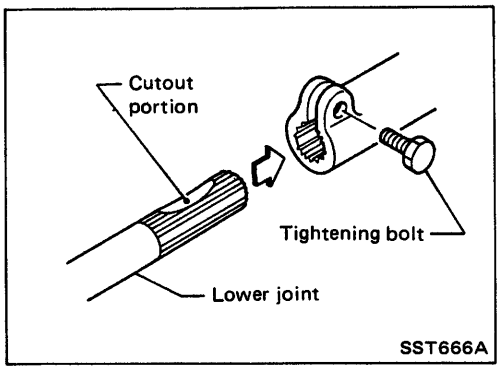

SST626A

- When installing steering wheel, apply multi-purpose grease to entire surface of turn signal cancel pin (both portions) and also to horn contact slip ring.

- Install steering wheel on column shaft in a straight-ahead position.
- After installing, turn steering wheel to make sure it moves smoothly and that the number of turns from the straight forward position to left and right locks are equal.

STEERING COLUMN

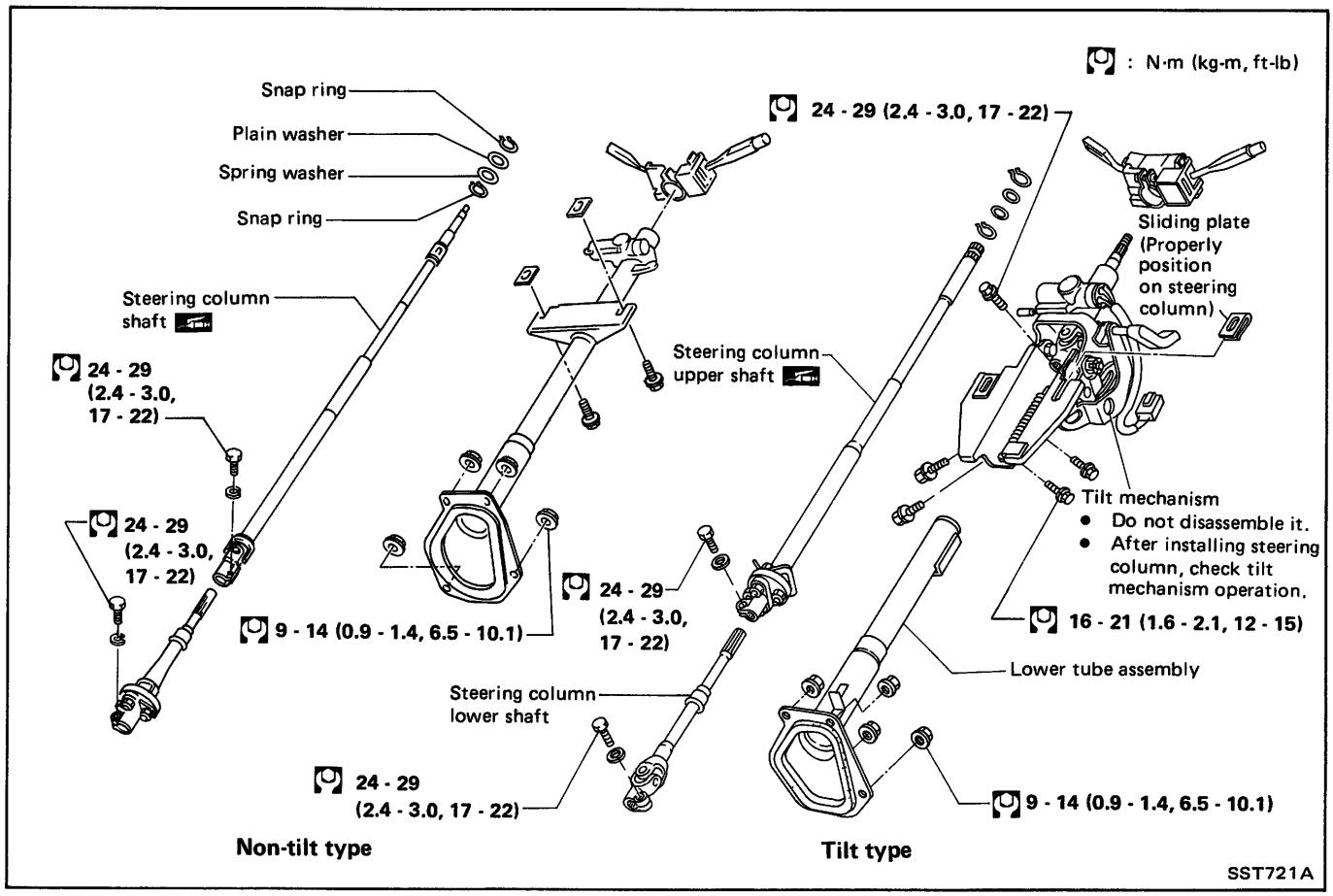
- When installing steering column, finger-tighten all lower bracket and clamp retaining bolts; then retighten them securely. Make sure that undue stress is not applied to steering column.

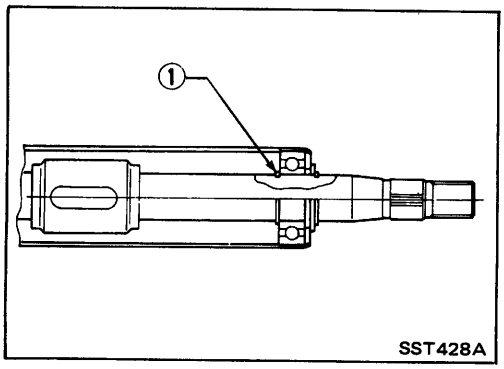


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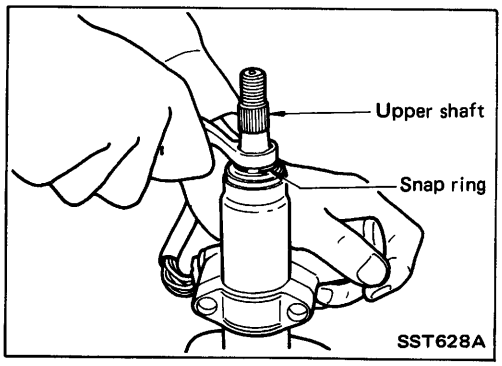
- When fitting steering lower joint, be sure tightening bolt faces cutout portion perfectly.

Disassembly and Assembly



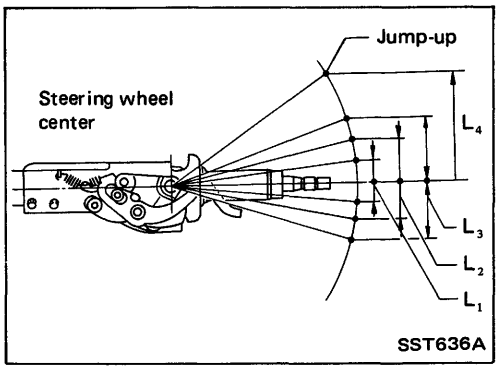


- When disassembling and assembling, unlock steering lock with key.
- Ensure that rounded surface of snap ring faces toward bearing when snap ring is installed.
- Install snap ring ① before inserting shaft into jacket tube.

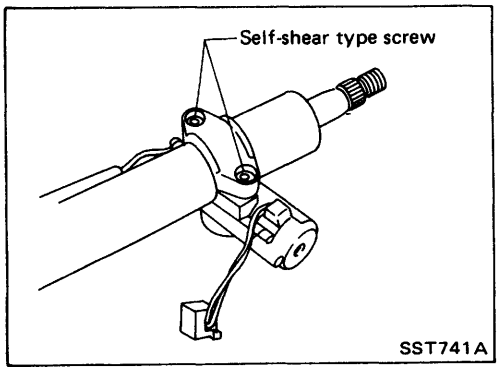


- Install snap ring on upper shaft with tool.

Disassembly and Assembly (Cont'd)

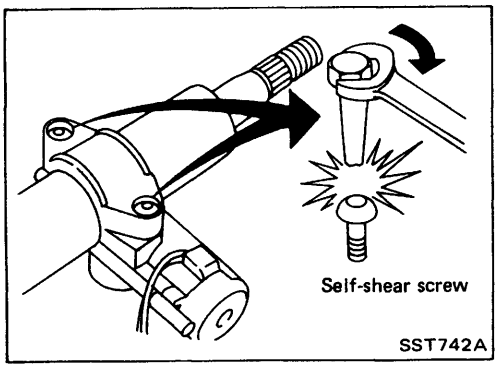


- Tilt type
  After installing steering column, check tilt mechanism operation.
  L_1 : 8.7 mm (0.343 in)
  L_2 : 17.3 mm (0.681 in)
  L_3 : 26.0 mm (1.024 in)
  L_4 : 100.0 mm (3.937 in)

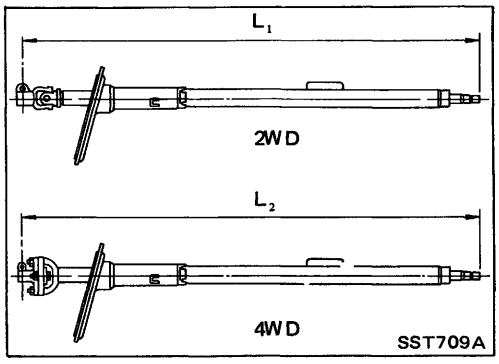


- Steering lock

a) Break self-shear type screws with a drill or other appropriate tool.



b) Install self-shear type screws and then cut off self-shear type screw heads.



Inspection

- When steering wheel can not be rotated smoothly, check the steering column for the following matters and replace damaged parts.

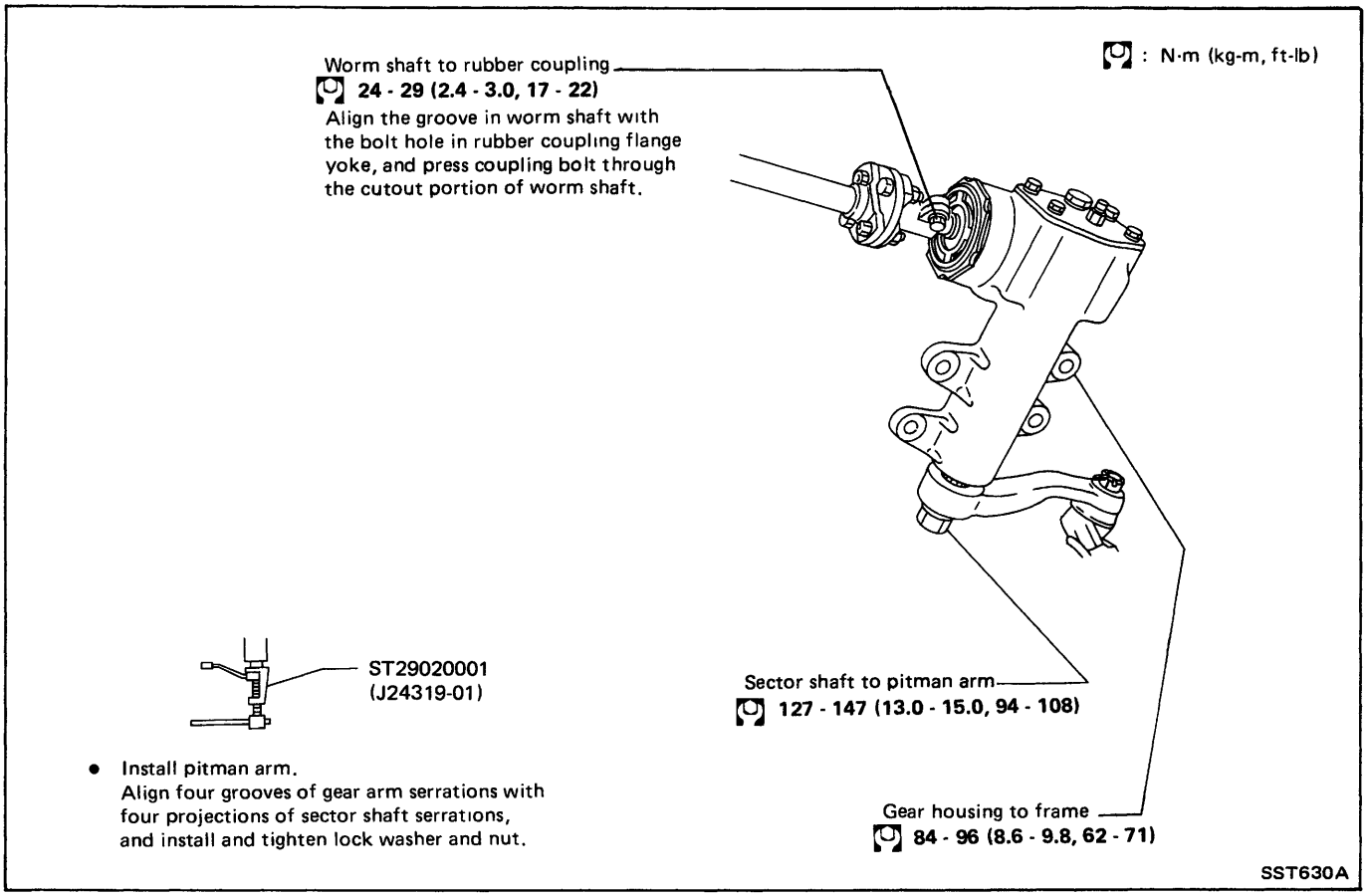
(1) Check column bearings for damage or unevenness. Lubricate with recommended multi-purpose grease or replace steering column as an assembly, if necessary.

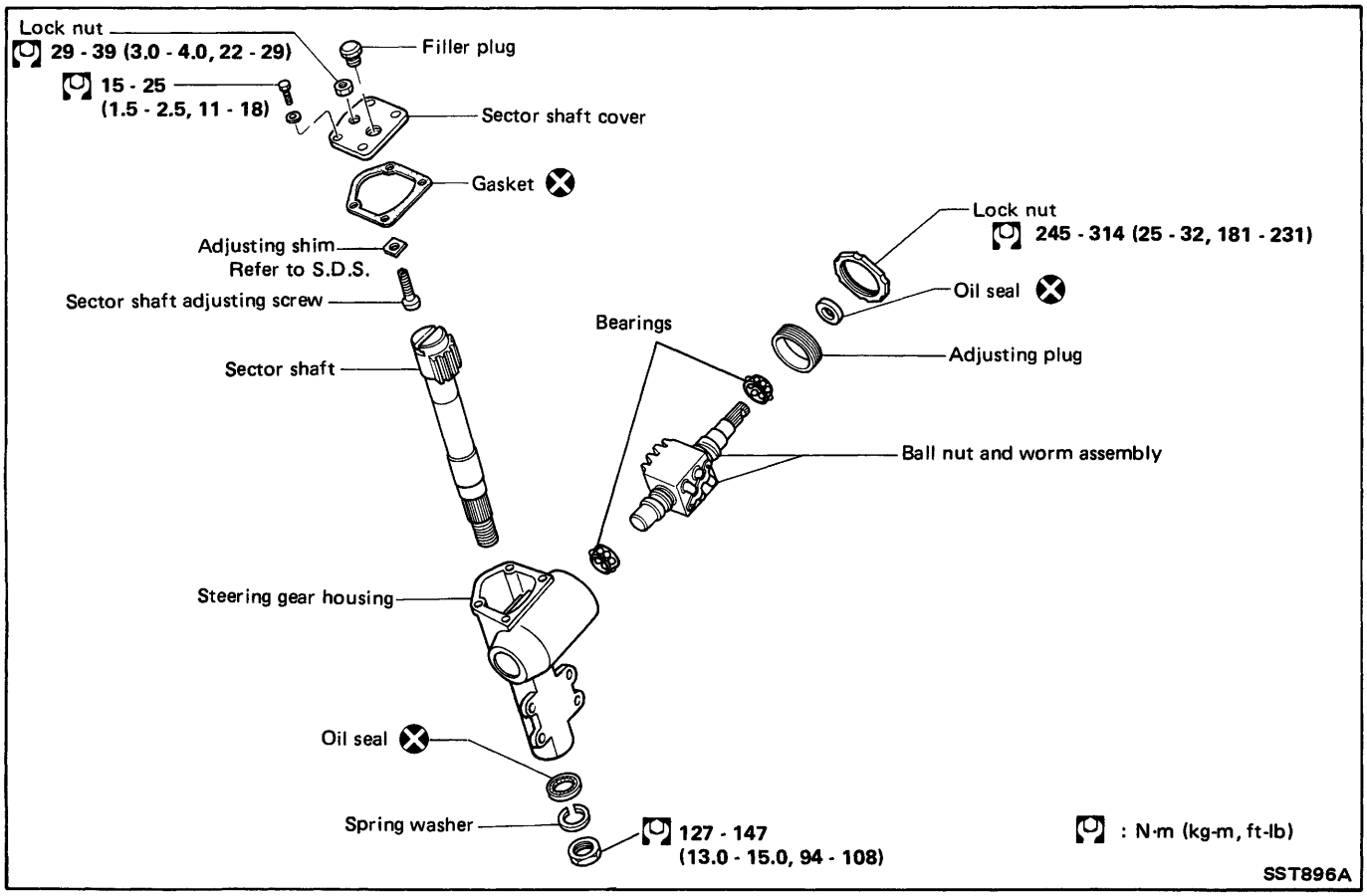
(2) Check jacket tube for deformation or breakage. Replace if necessary.

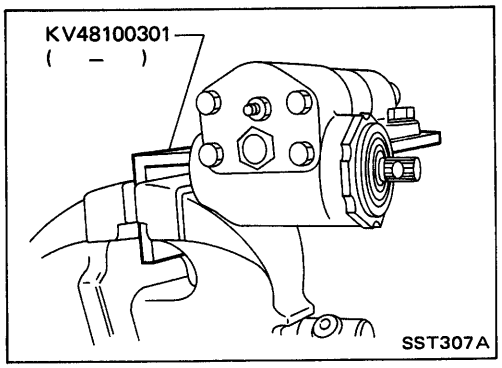
- When the vehicle is involved in a light collision, check dimension "L". If it is not within specifications, replace steering column as an assembly.

Column length "L_1 & L_2":
L_1 = 918.0 - 919.6 mm (36.14 - 36.20 in)
L_2 = 886.1 - 887.7 mm (34.89 - 34.95 in)

Removal and Installation

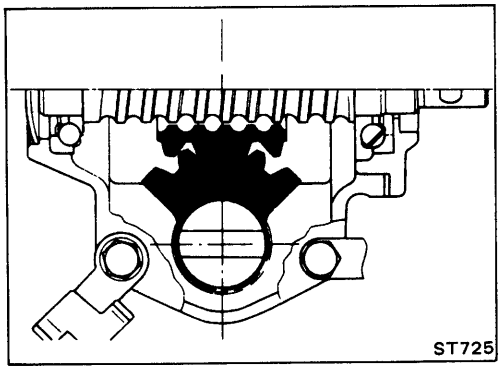






Disassembly

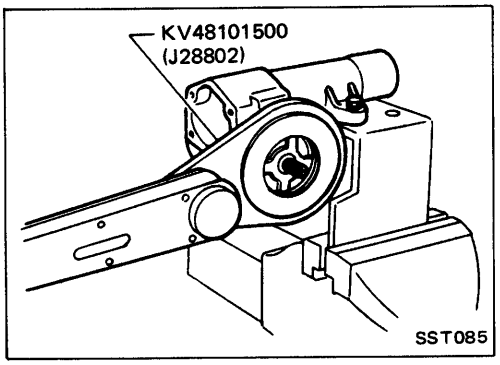
1. Place steering gear in a vise with Tool.



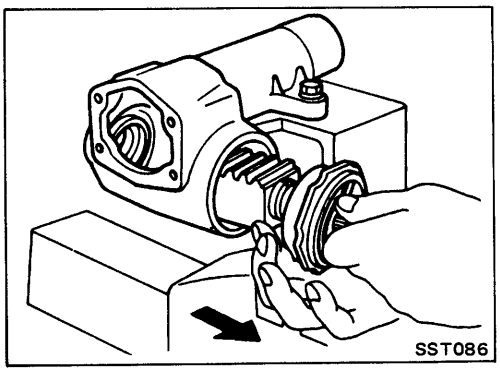
2. Set worm gear in a straight-ahead position.
3. Remove sector shaft with sector shaft cover.

CAUTION:

a. **When pulling sector shaft out, be careful not to damage oil seal or associated parts.**
b. **Set worm gear in a straight-ahead position.**
c. **Do not remove sector shaft needle bearings from steering gear housing. If necessary, replace gear housing assembly.**



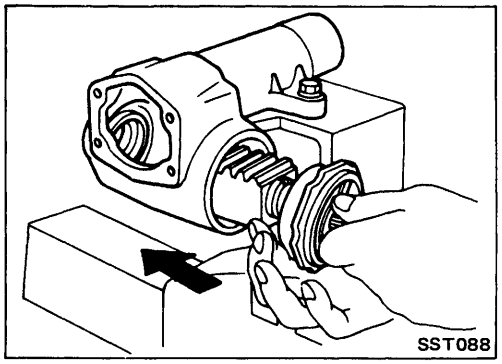
4. Loosen adjusting plug lock nut with Tool.



5. Draw out worm gear with worm bearing.

CAUTION:

a. **Be careful not to allow ball nut to run down to either end of worm.**
   Ends of ball guides will be damaged if nut is rotated until it stops at end of worm.
b. **Do not detach ball nut from worm shaft assembly.**
   If necessary, replace entire unit as an assembly.
c. **Do not remove sector shaft needle bearings from steering gear housing.**
   If necessary, replace entire gear housing as an assembly.

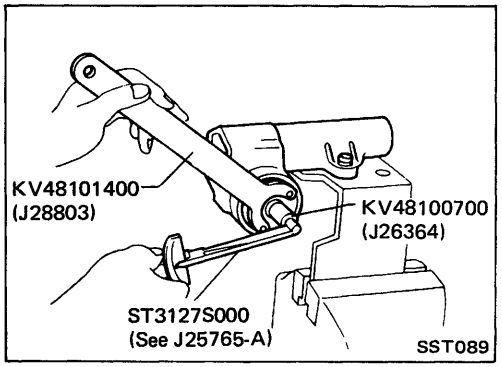


Assembly and Adjustment

Fill space between sealing lips of new sector shaft and adjusting plug oil seals with multi-purpose grease.

WORM BEARING PRELOAD

1. Fit worm gear assembly with worm bearing in gear housing.

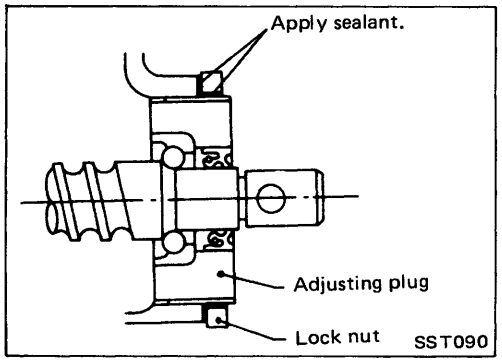


2. Adjust worm bearing preload with Tools.

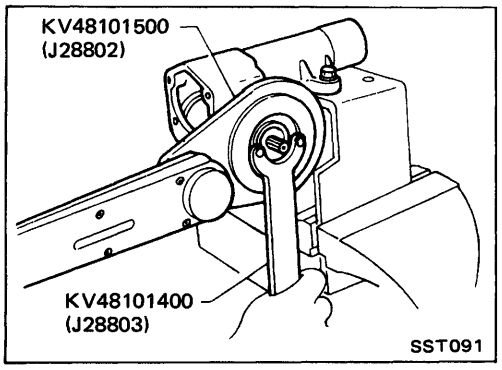
CAUTION:

- **Always adjust worm bearing preload by turning adjusting plug in "tighten" direction.**
- **Rotate worm shaft a few turns in both directions to settle down worm bearing and measure preload.**

Worm bearing preload (without oil seal):
0.20 - 0.59 N·m
(2.0 - 6.0 kg-cm, 1.7 - 5.2 in-lb)

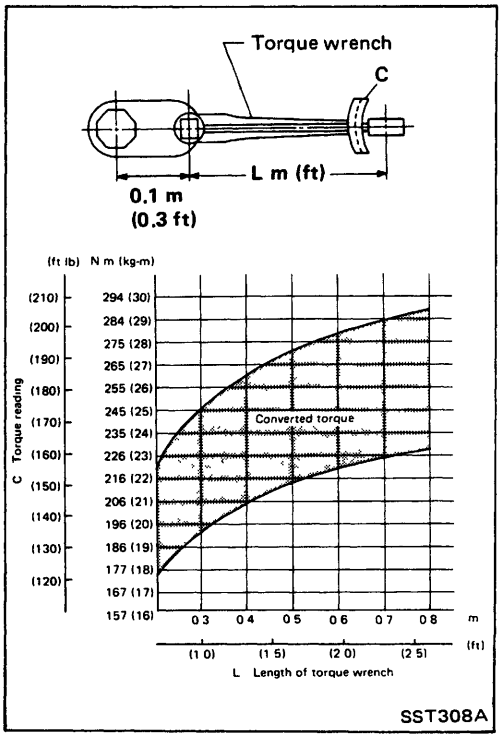


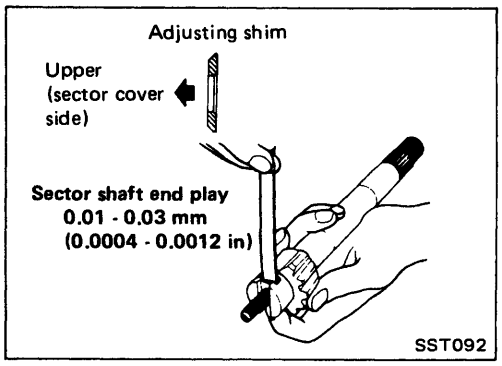
3. Apply suitable sealant around lock nut inner surface.



4. Tighten lock nut using Tools.
5. After tightening lock nut, check worm bearing preload to make sure it is within specification.

Assembly and Adjustment (Cont'd)

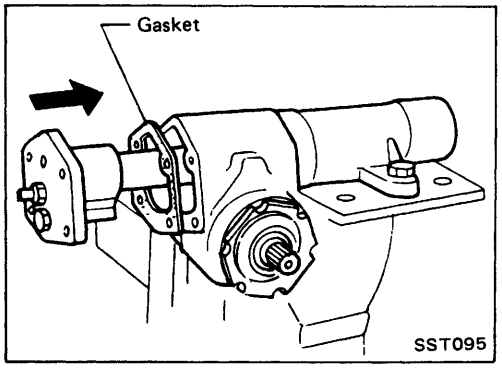




SECTOR SHAFT END PLAY

Select suitable adjusting shim and adjust end play between sector shaft and adjusting screw.

Sector shaft end play:
0.01 - 0.03 mm (0.0004 - 0.0012 in)
Sector shaft adjusting screw shims:
Refer to S.D.S.

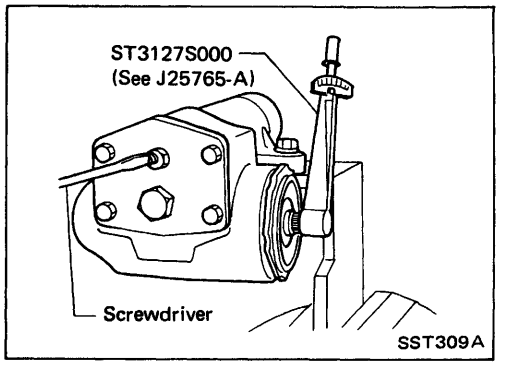


STEERING GEAR PRELOAD AND BACKLASH

1. Set worm gear in a straight-ahead position.

Carefully insert sector shaft in place, using care not to scratch oil seal.

2. Adjust adjusting screw until sector shaft just contacts ball nut. Temporarily tighten lock nut.
3. Lubricate contacting portion of sector shaft and ball nut with gear oil or bearing grease.



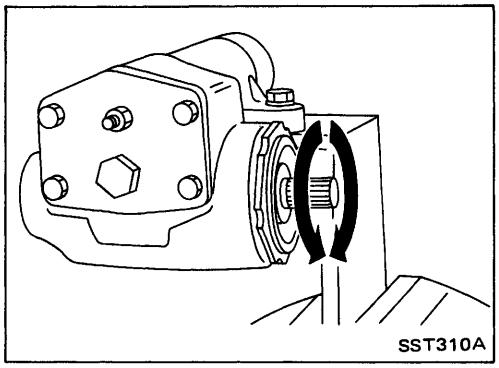
4. Tighten adjusting screw further to increase worm gear preload, and lock with lock nut.

Preload increment:
0.2 - 0.4 N·m (2 - 4 kg-cm, 1.7 - 3.5 in-lb)

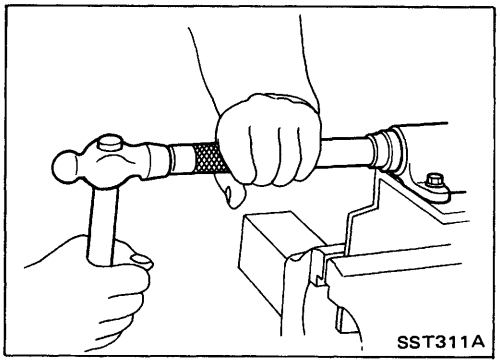
CAUTION:

- **Always adjust steering gear preload by turning adjusting screw in "tighten" direction.**
- **Rotate worm gear a few turns in both directions to settle down steering gear.**

Assembly and Adjustment (Cont'd)


SST310A

5. Turn worm gear several times by hand to properly break in worm bearing.
6. Check steering gear preload. If not within specification, readjust it.

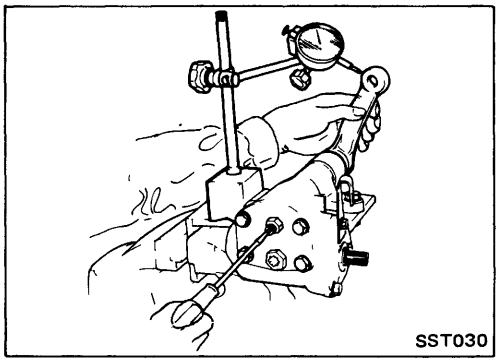

SST311A

7. Drive oil seal into place.

Before pressing oil seal, coat seal contacting face of oil seal with gear fluid.

8. Measure total preload.

Steering gear total preload (with oil seals):
New parts
0.83 - 1.23 N·m
(8.5 - 12.5 kg-cm, 7.4 - 10.9 in-lb)
Used parts
0.59 - 0.98 N·m
(6.0 - 10.0 kg-cm, 5.2 - 8.7 in-lb)


SST030

9. Check backlash.
   Measure backlash at pitman arm top end in straight-ahead position.

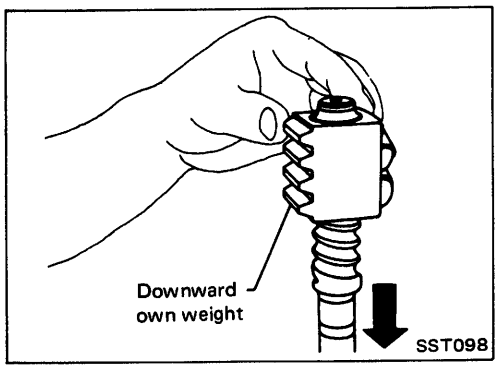
Backlash (in straight-ahead position):
New gear: 0.1 mm (0.004 in) or less
Used gear: 0.3 mm (0.012 in) or less

Inspection

Wash clean all the disassembled parts in solvent and check for condition.

SECTOR SHAFT

1. Check gear tooth surface for pitting, burrs, cracks or any other damage, and replace if necessary.
2. Check sector shaft for distortion on its serration, and replace if necessary. Also check gear housing for deformation.



Inspection (Cont'd)

STEERING WORM ASSEMBLY

1. Inspect ball nut gear tooth surface, and replace if pitting, burrs, wear or any other damage is found.
2. Ball nut must rotate smoothly on worm gear. If found too tight, assembly should be replaced. Check rotation of ball nut as follows:

(1) Move ball nut to either end of worm gear, and gradually stand worm shaft and ball nut assembly until ball nut moves downward on worm gear under its own weight.

(2) If ball nut does not move freely over entire stroke, replace assembly.

Be careful not to damage ball nut guide tube while check is being made.

CAUTION:

Be careful not to allow ball nut to run down to either end of worm.

BEARING

1. Inspect worm bearing for wear, pitting or any other damage. Replace as required.

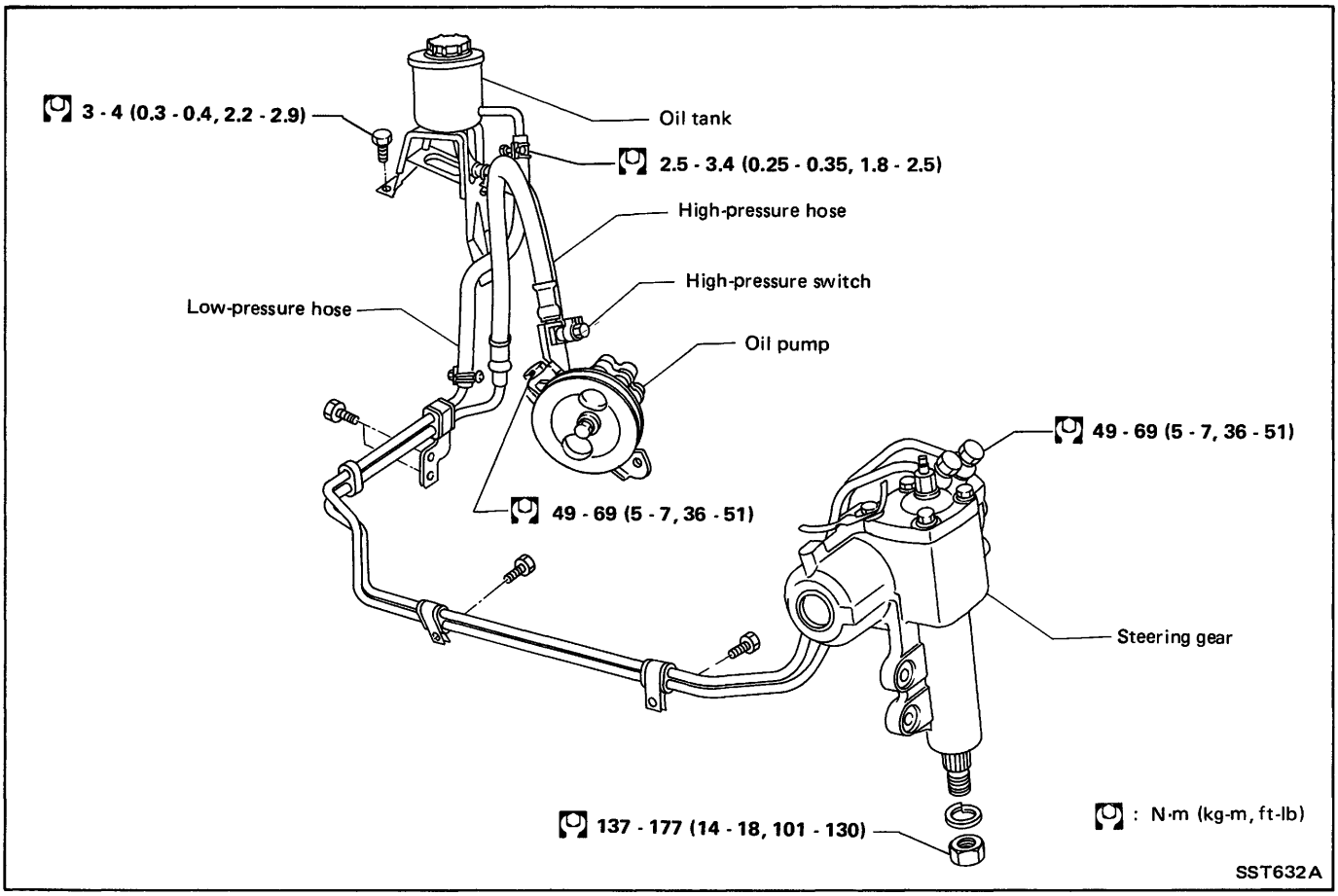
When replacing worm bearing, replace it as a set of bearing and outer race.

2. If sector shaft needle bearings are worn or damaged, replace as an assembly of gear housing and bearings.

OIL SEALS

- Discard any oil seal which has once been removed.
- Replace oil seal if sealing lip is deformed or cracked.
- Discard oil seal if spring is fatigued or dislocated.

Description



This power steering adopts spool valve control which was developed in a technical tie-up with the ZF Company.

Only the sealing parts can be replaced. The remaining parts must be replaced as an assembly.

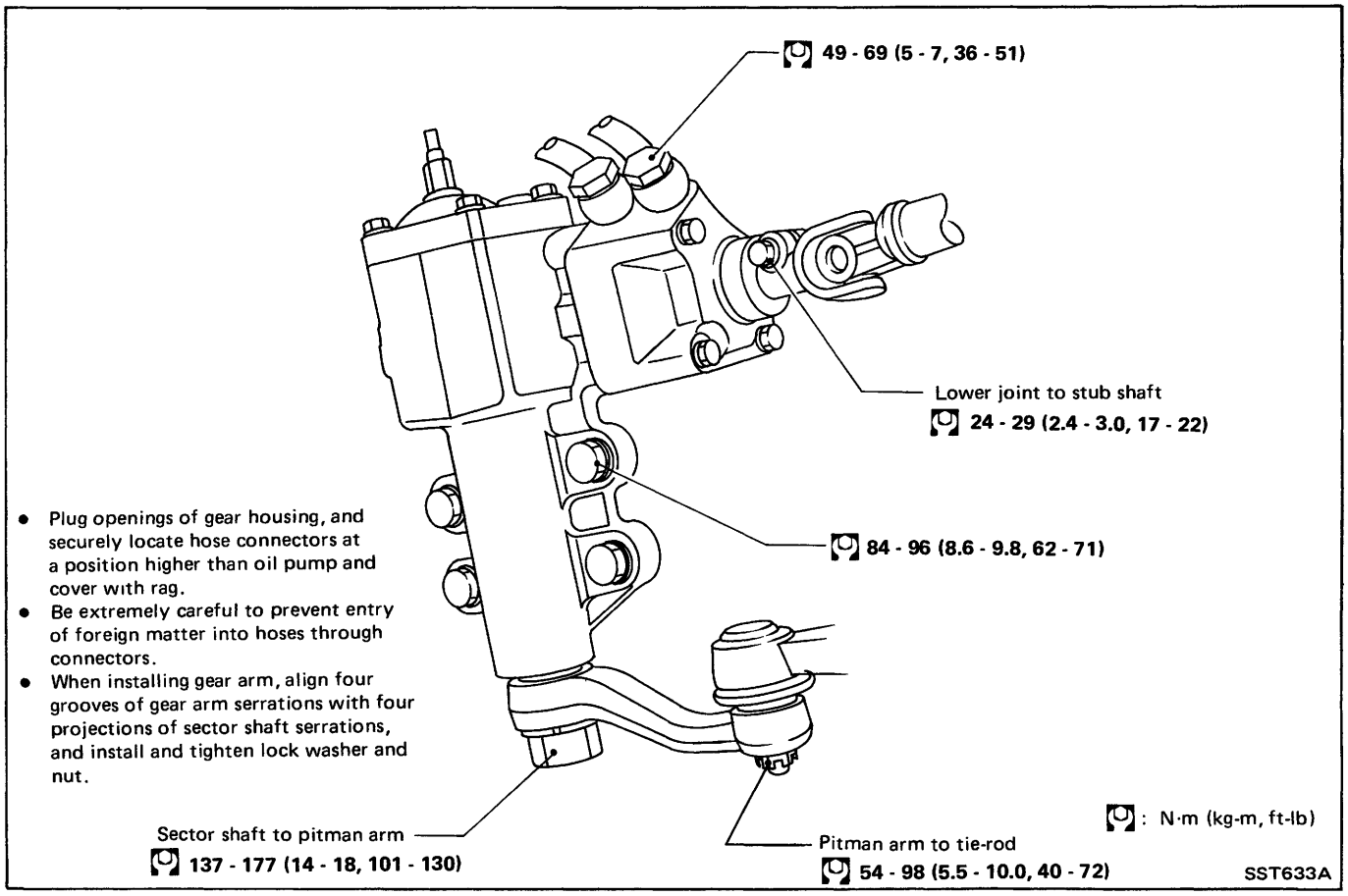
CAUTION:

a. **The parts which can be disassembled are strongly restricted, and never disassemble other parts than the specified ones.**
b. **Disassembly should be performed in a place as clean as possible.**
c. **Hands should be cleaned before disassembly.**
d. **Do not use a rag. Be sure to use nylon or paper cloth.**
e. **Be sure to follow procedures and cautions indicated in the Service Manual.**

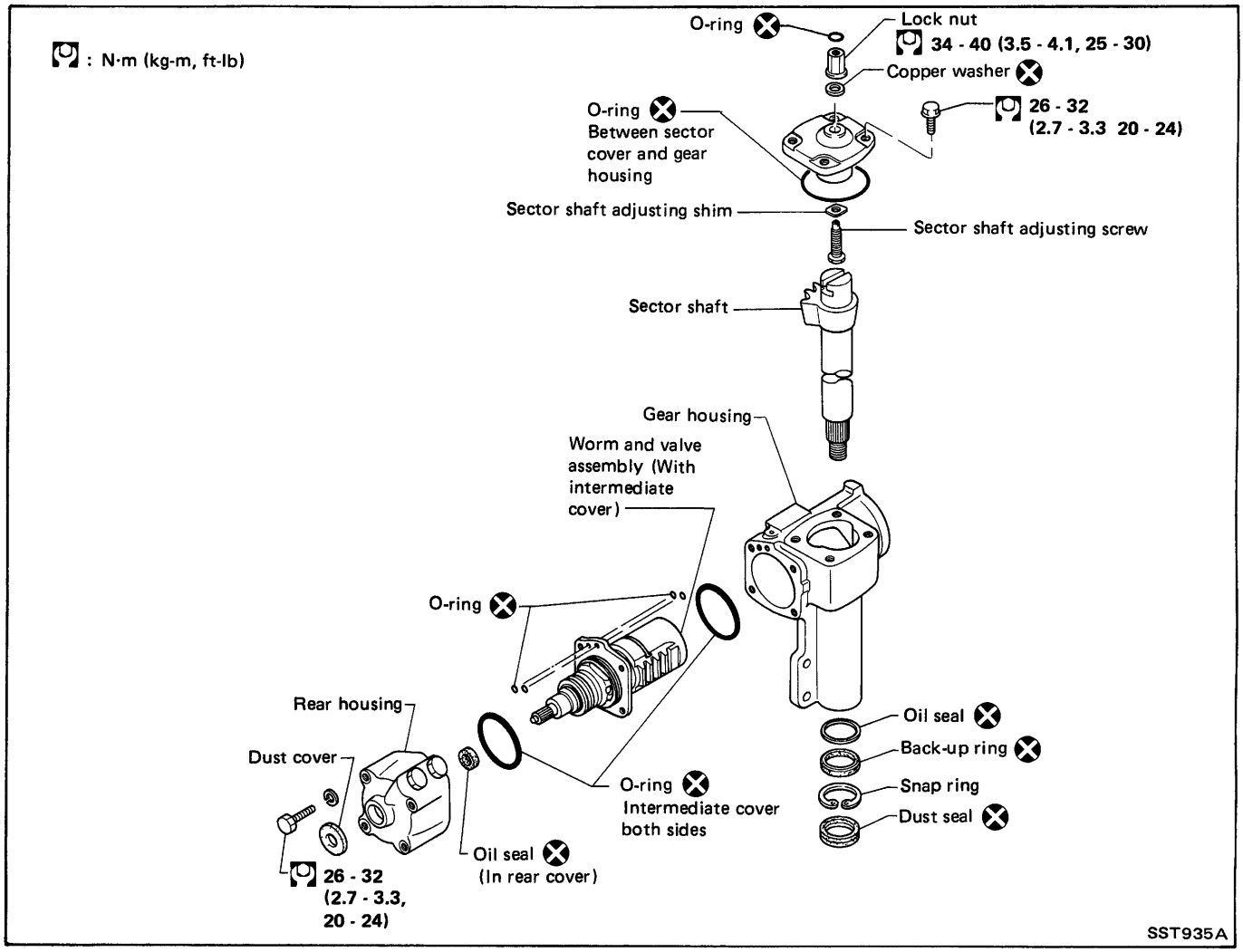
Removal

Before removing, clean exteriors or gear housing and oil pump with steam and dry with compressed air.

STEERING GEAR



Power Steering Gear Component



Inspection and Adjustment

Before disassembling power steering gear component parts, make sure there is no oil leakage around sealing portion and check steering turning torque as follows:

Check sealing portion.

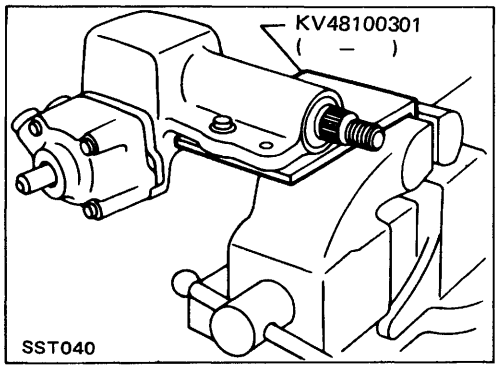
- Adjusting screw nut O-ring
- Sector shaft cover O-ring
- Sector shaft oil seal
- Rear cover oil seal and O-ring
- Rear housing O-ring
- Gear housing O-ring

Discard any oil seal and O-ring which have once been removed.

Replace oil seal and O-ring if sealing surface is deformed or cracked.

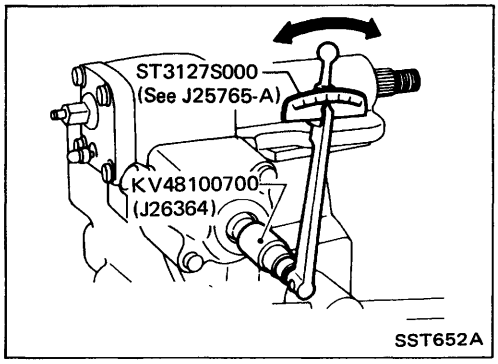
Inspection and Adjustment (Cont'd)

TURNING TORQUE MEASUREMENT



1. Measure turning torque at 360° position.

(1) Install steering gear on Tool.



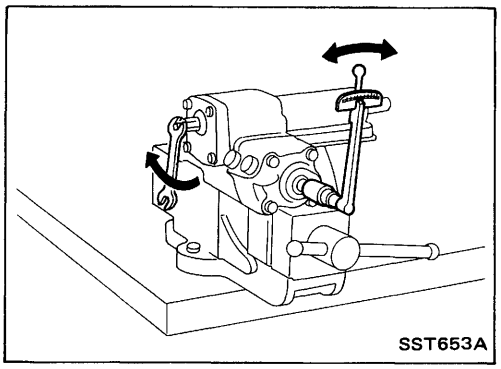
(2) Turn stub shaft all the way to right and left several times.

(3) Measure turning torque at 360° position from straight-ahead position with Tools.

Turning torque at 360°:

0.7 - 1.2 N·m

(7 - 12 kg-cm, 6.1 - 10.4 in-lb)



(4) Measure turning torque at straight-ahead position.

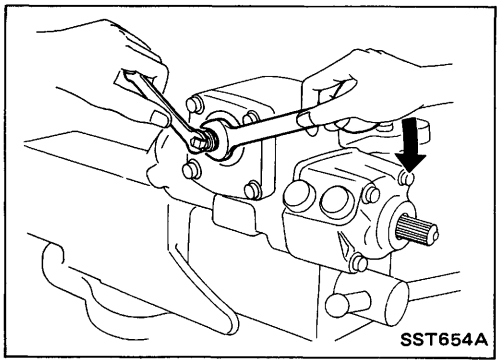
Straight-ahead position is a position where stub shaft is turned 2.14 turns (two full turns and 50°) from lock position.

Turning torque at straight-ahead position:

0.1 - 0.4 N·m

(1 - 4 kg-cm, 0.9 - 3.5 in-lb) higher than at 360°

If they are not within specifications, adjust turning torque by turning sector shaft adjusting screw.



2. Tighten adjusting screw lock nut with tools.

Disassembly

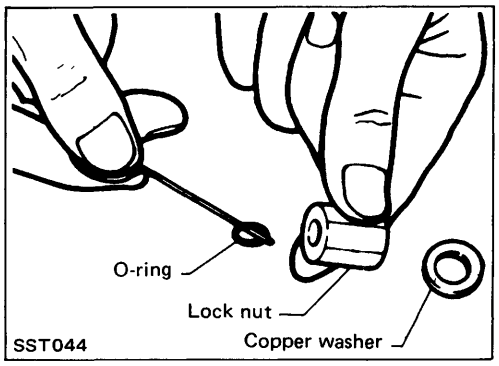
Before disassembly, measure turning torque.

If they are not within specifications, replace steering gear assembly.

CAUTION:

Each oil sealing parts, dust cover, copper wahser and snap ring once removed must not be used again.

Disassembly (Cont'd)



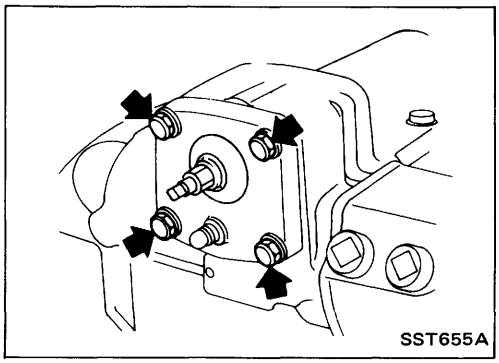
ADJUSTING SCREW LOCK NUT O-RING

Remove adjusting screw lock nut, and replace O-ring.

SECTOR SHAFT OIL SEAL AND DUST SEAL

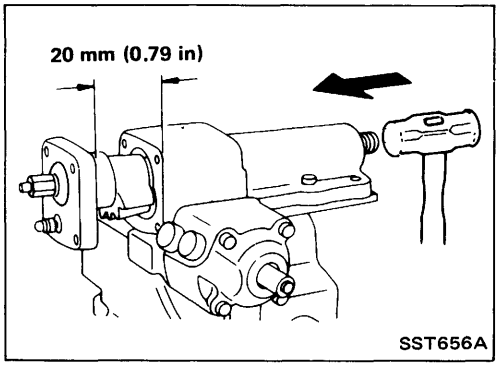
1. Set stub shaft in a straight-ahead position.

Straight-ahead position is a position where stub shaft is turned 2.14 turns (two full turns and 50°) from lock position.



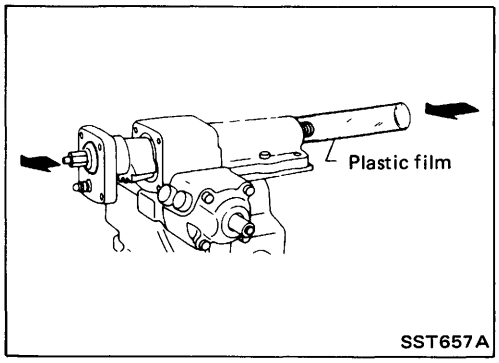
2. Disconnect sector shaft cover bolt.

Do not turn lock nut unless necessary; otherwise it will damage O-ring, resulting in an oil leak.



3. Draw out sector shaft.

Knock out end of sector shaft approximately 20 mm (0.79 in).



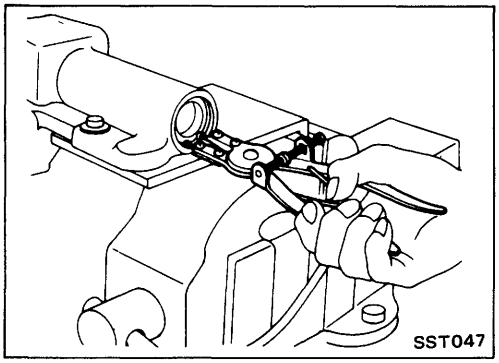
4. Connect a roll of plastic film to sector shaft.

Plastic film:
Thickness 0.1 mm (0.004 in)
Length x width
200 x 200 mm (7.87 x 7.87 in)

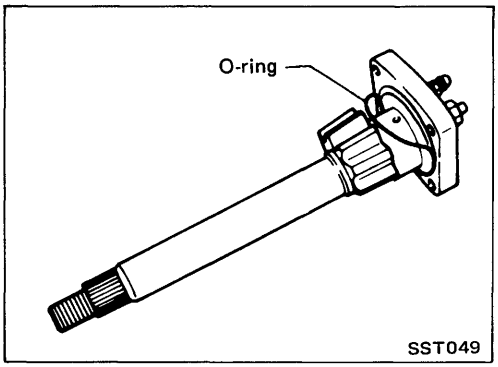
5. Pull out sector shaft by hand.

Attach plastic film to needle bearings located at two places inside gear housing while simultaneously pulling out sector shaft so that bearings will not drop into housing.

Disassembly (Cont'd)

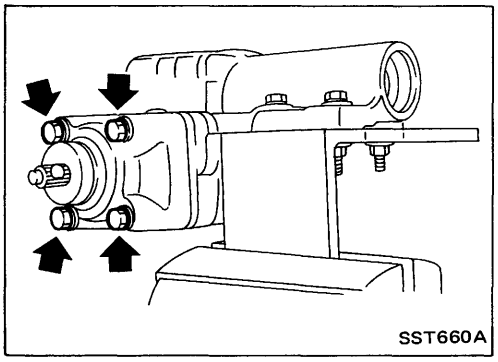


6. Remove gear housing dust seal.
7. Remove snap ring.

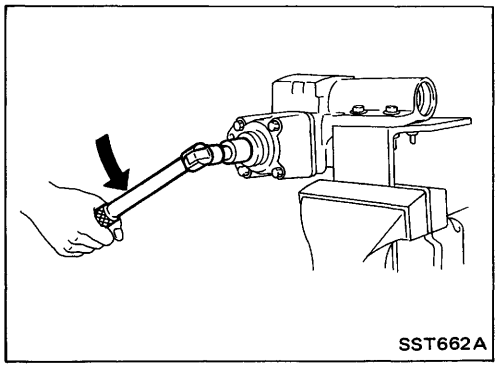


8. Remove back-up ring and oil seal.
9. Remove O-ring.

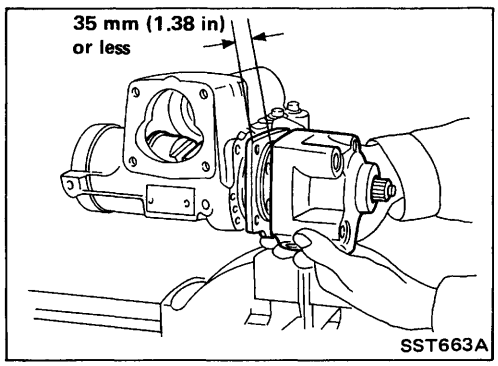
REAR HOUSING O-RING



1. Remove sector shaft.
2. Loosen (do not remove) rear housing bolts.



3. Turn stub shaft counterclockwise slightly to raise intermediate cover through piston.

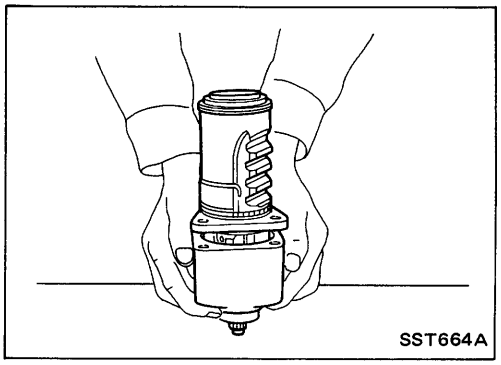


4. Remove rear housing together with worm gear assembly.

CAUTION:

a. **When worm assembly is removed, piston may turn and come off under its own weight. Hold piston to prevent it from turning.**
   If piston-to-rear housing clearance exceeds 35 mm (1.38 in) by loosening, recirculating ball will be out of groove of worm; do not reinstall piston but replace the entire assembly.
b. **Take care not to damage teflon ring at piston end when removing.**

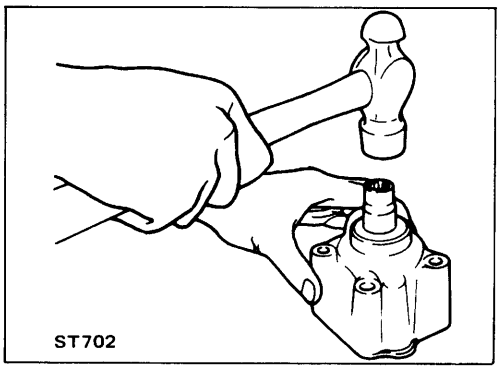
Disassembly (Cont'd)



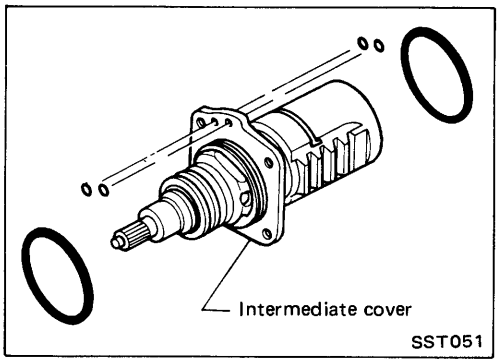
5. Remove rear housing, turn worm assembly upside down, and lightly tap stub shaft end on top of workbench.

CAUTION:

- **Do not strike shaft with a hammer or pry it with a screwdriver.**
- **Do not disassemble worm and valve.**



6. Remove rear housing oil seal with tool.



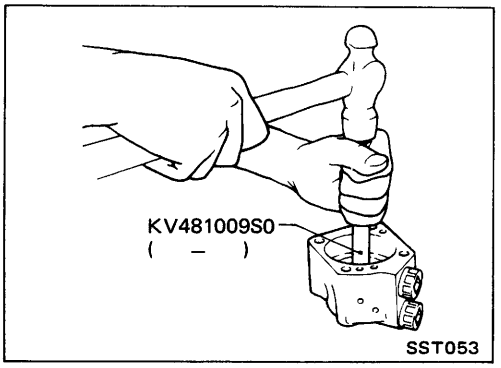
7. Remove O-ring on both sides of intermediate cover.

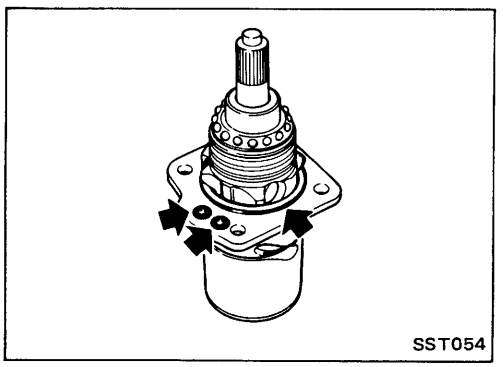
Assembly

Rear housing seal and intermediate cover (between worm and valve)

1. Install new rear housing oil seal with Tool.

Before installing oil seal, apply multi-purpose grease to lips.

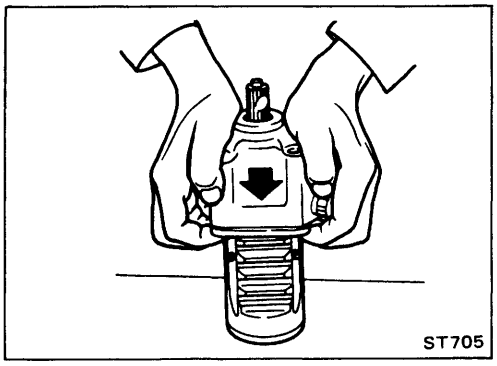




2. Install new O-rings on both sides of intermediate cover.

- **Apply a thin coat of vaseline to new O-rings prior to their installation.**
- **Be careful not to install wrong O-rings as some of them resemble in size.**

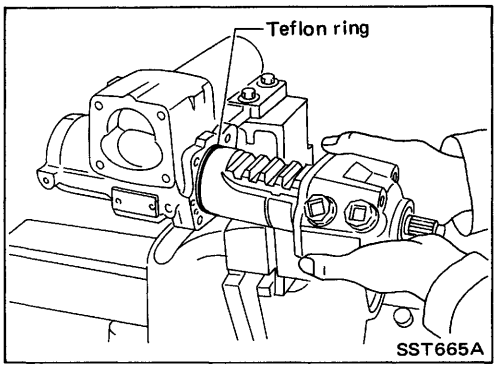
Assembly (Cont'd)



3. Fit rear housing onto intermediate cover with worm gear assembly.

CAUTION:

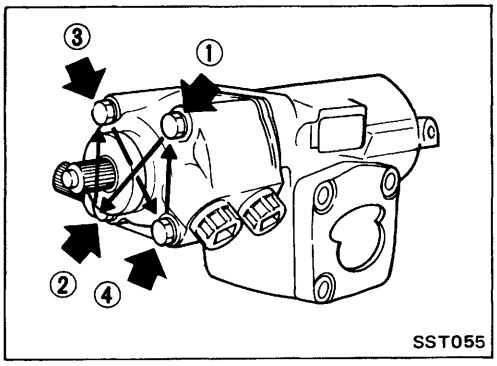
- **Do not tilt ball bearing on rear cover side.**
- **Make sure that O-rings are not protruding or extruding.**
- **Be careful not to separate worm and stub shaft.**
- **Wrap vinyl tape around serration of stub shaft to prevent oil seal lip from being damaged during insertion.**



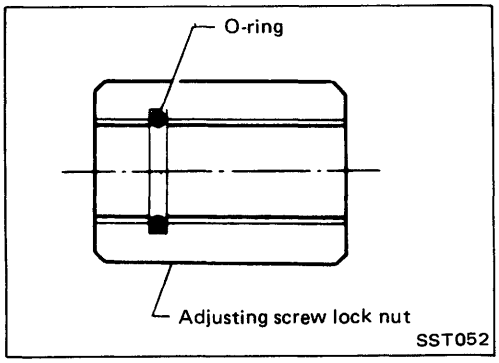
4. Install worm gear assembly with rear housing and intermediate cover into gear housing.

CAUTION:

- **Apply a thin coat of A.T.F. inside gear housing and piston before insertion.**
- **Be sure that teflon ring at piston end is not damaged during insertion of gear housing. If it is damaged, replace entire assembly.**
- **Be sure that teflon ring settles in its correct position.**



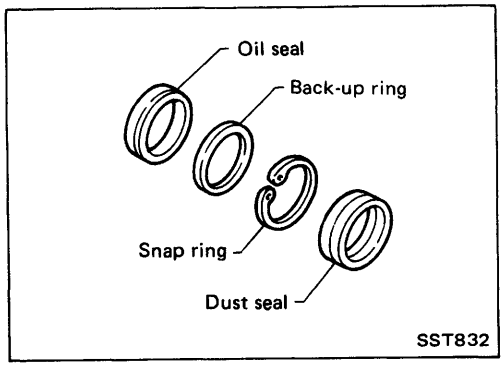
5. Gradually tighten rear housing bolts in a criss-cross fashion.



ADJUSTING SCREW LOCK NUT O-RING

Insert new O-ring into adjusting screw lock nut.

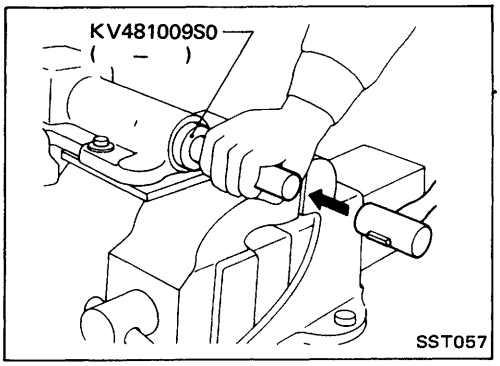
- **Before inserting, apply a thin coat of vaseline to O-ring.**
- **Insert O-ring to make sure it fits into groove.**



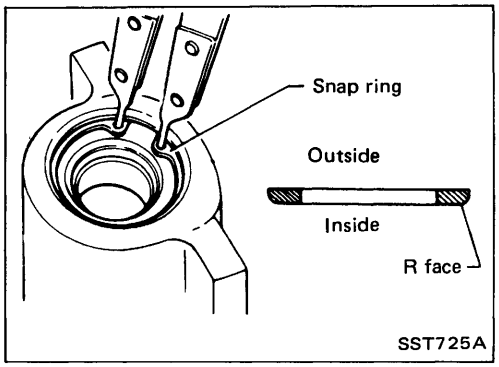
SECTOR SHAFT OIL SEAL

- **When installing, be sure to use new oil seal, dust seal, back-up ring and snap ring.**
- **Before installing, apply a thin coat of vaseline to new oil seal and dust seal.**

Assembly (Cont'd)



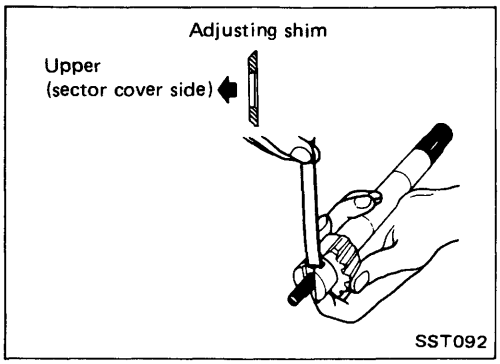
1. Press new oil seal and then install back-up ring with Tool.



2. Install a new snap ring into gear housing.

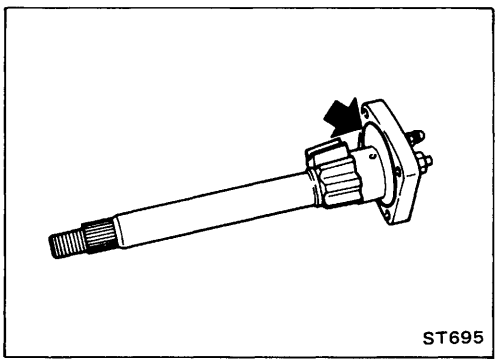
CAUTION:

a. **Turn snap ring to make sure it fits into groove.**
b. **Always install snap ring with R face facing inward.**



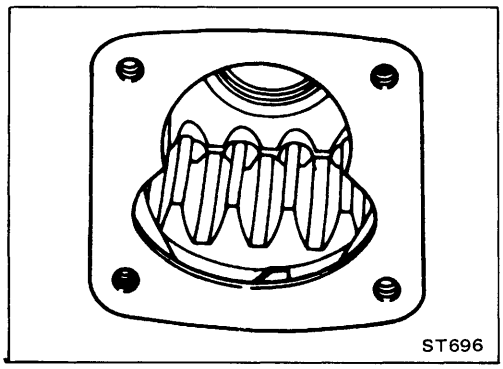
3. Select suitable adjusting shim and adjust end play between sector shaft and adjusting screw.

Sector shaft end play:
0.01 - 0.03 mm (0.0004 - 0.0012 in)
Sector shaft adjusting screw shims:
Refer to S.D.S.



4. Fit new O-ring into sector shaft cover.

- **Before installing, apply a thin coat of vaseline to O-ring.**
- **Make certain that O-ring is installed properly, and not damaged by sector shaft.**



SECTOR SHAFT

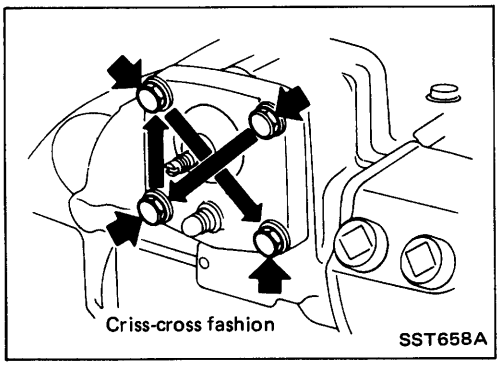
1. Set piston rack at straight-ahead position.

Turn piston rack about 10° to 15° toward yourself with your finger.
This is for smooth insertion of sector gear.

Assembly (Cont'd)

2. Gradually insert sector shaft into gear housing.

When inserting sector shaft, simultaneously pull out plastic film so that bearings will not drop into housing.



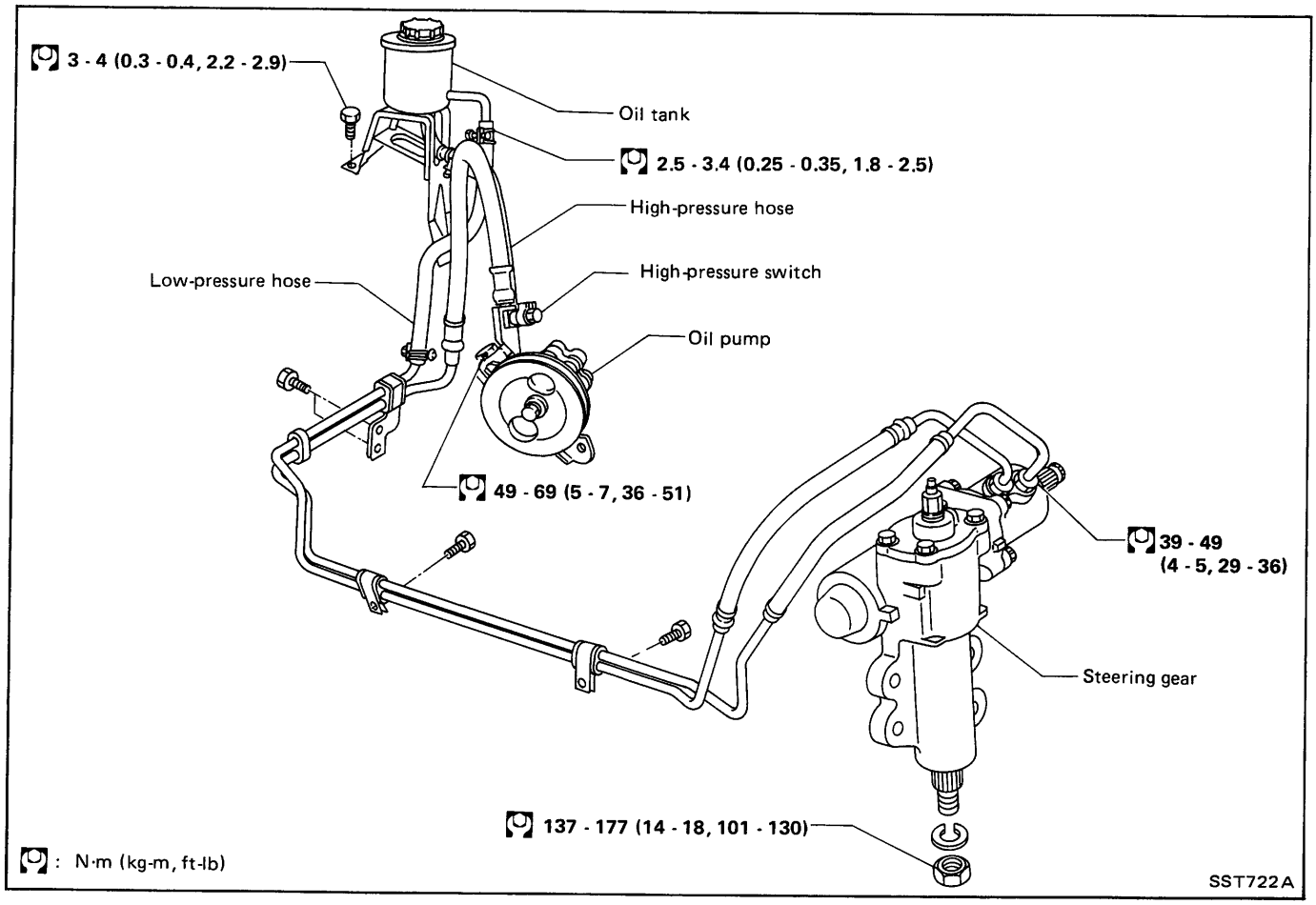
3. Tighten sector shaft cover bolts.

4. Check turning torque and steering gear preload.

Refer to Inspection and Adjustment.

- **If there is more than 0.2 N·m (2 kg-cm, 1.7 in-lb) difference between values of turning torque before and after disassembly, it must be assumed that some new problem has occurred. It will be necessary to replace the entire assembly.**

Description



This power steering adopts spool valve control which was developed in a technical tie-up with the ZF Company.

Only the sealing parts can be replaced. The remaining parts must be replaced as an assembly.

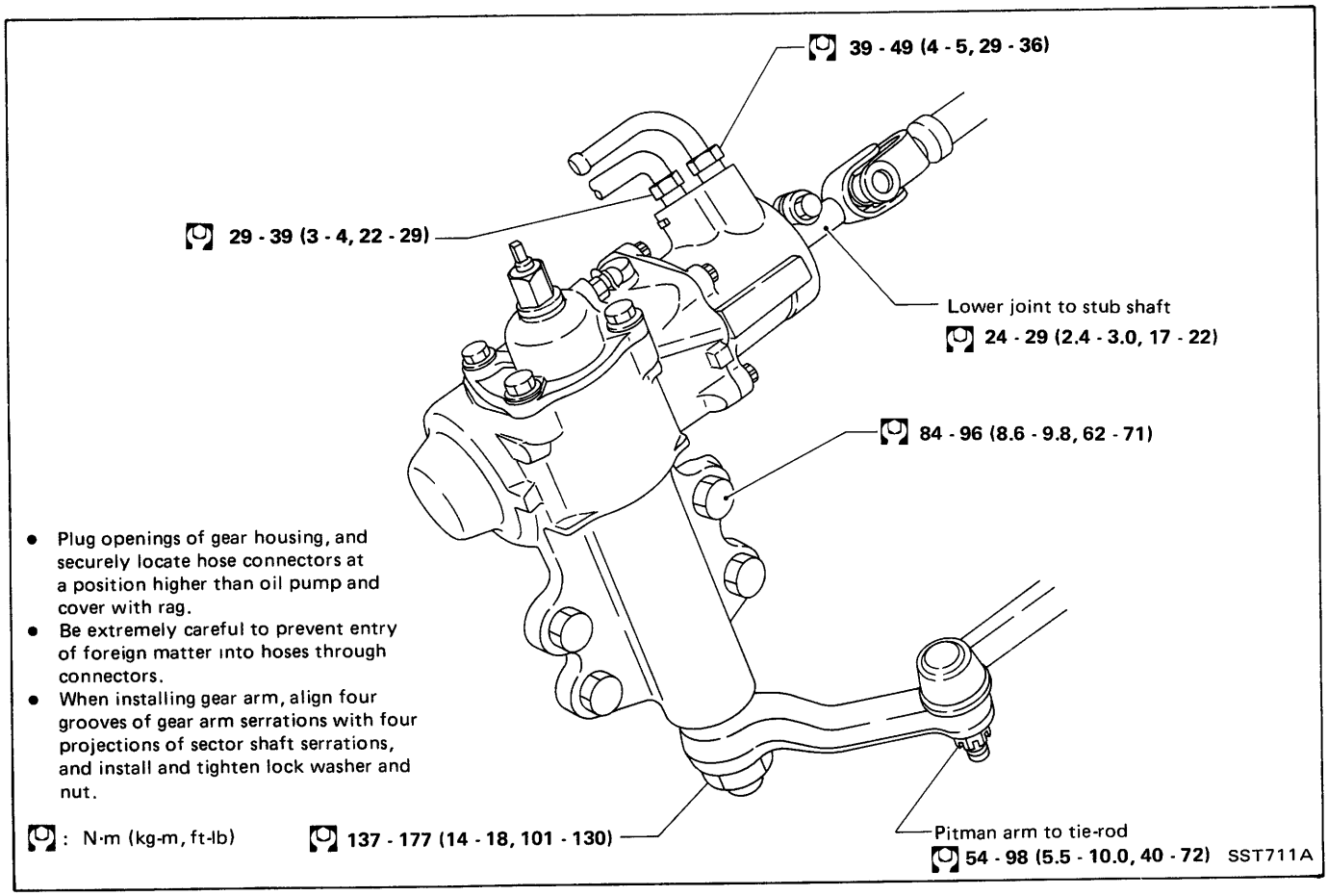
CAUTION:

a. **The parts which can be disassembled are strongly restricted, and never disassemble other parts than the specified ones.**
b. **Disassembly should be performed in a place as clean as possible.**
c. **Hands should be cleaned before disassembly.**
d. **Do not use a rag. Be sure to use nylon or paper cloth.**
e. **Be sure to follow procedures and cautions indicated in the Service Manual.**

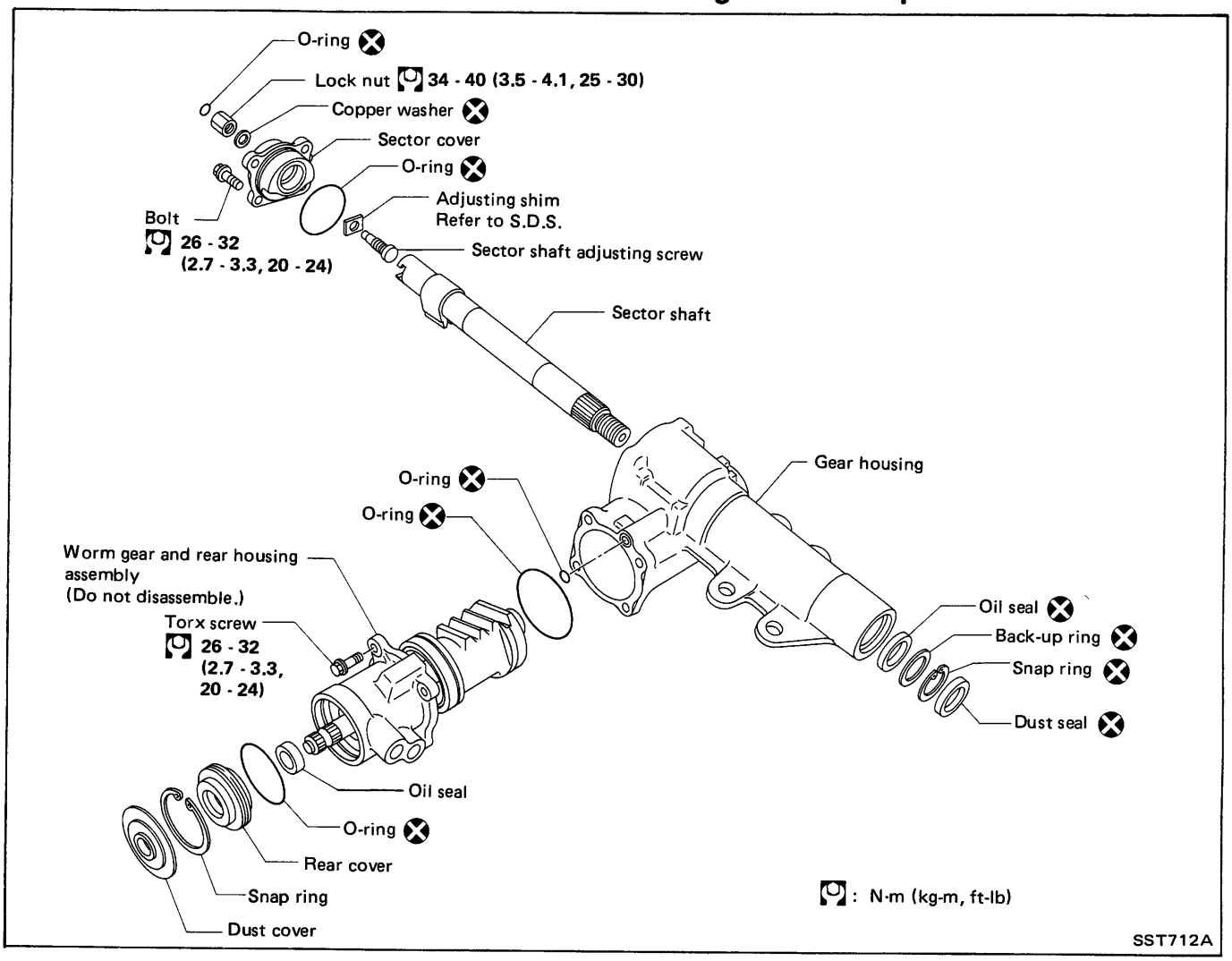
Removal

Before removing, clean exteriors or gear housing and oil pump with steam and dry with compressed air.

STEERING GEAR



Power Steering Gear Component



Inspection and Adjustment

Before disassembling power steering gear component parts, make sure there is no oil leakage around sealing portion and check steering turning torque as follows:

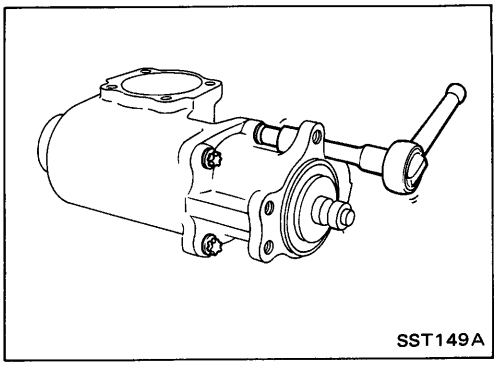
Check sealing portion.

- Adjusting screw nut O-ring
- Sector shaft cover O-ring
- Sector shaft oil seal
- Rear cover oil seal and O-ring
- Rear housing O-ring
- Gear housing O-ring

Discard any oil seal and O-ring which have once been removed.

Replace oil seal and O-ring if sealing surface is deformed or cracked.

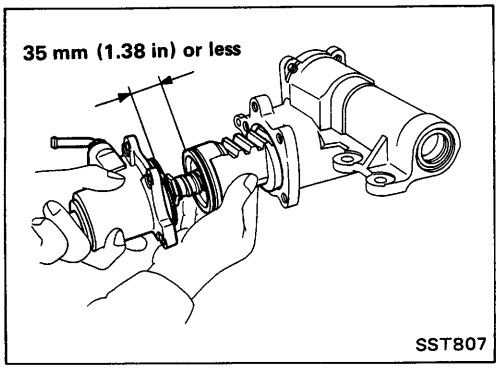
Servicing procedures for PB48S model are almost the same as those for PB56S model. Except for Disassembly and Assembly sections, refer to POWER STEERING GEAR (Model: PB56S).


SST149A

Disassembly

REAR HOUSING O-RING

1. Remove sector shaft. Refer to steps 1 through 5 in "Disassembly of Sector Shaft Oil Seal in POWER STEERING GEAR (Model: PB56S)".
2. Remove torx screws.

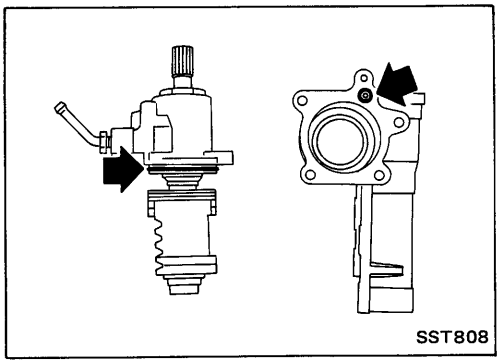


SST807

3. Remove rear housing together with worm gear assembly.

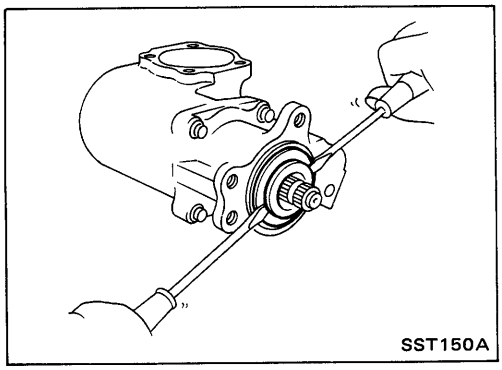
CAUTION:

a. **When worm assembly is removed, piston may turn and come off under its own weight. Hold piston to prevent it from turning.**
   If piston-to-rear housing clearance exceeds 35 mm (1.38 in) by loosening recirculating ball will be out of groove of worm; do not reinstall piston but replace the entire assembly.
b. **Take care not to damage teflon ring at piston end when removing.**
4. Remove O-rings.

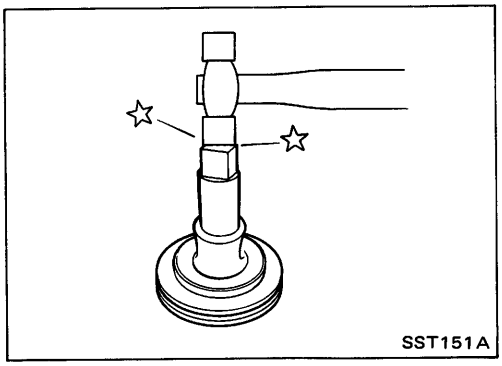

SST808

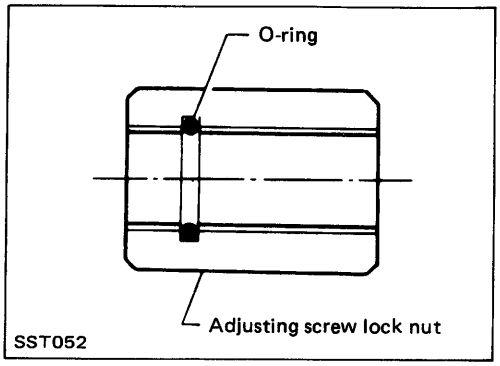
REAR COVER O-RING AND OIL SEAL

1. Remove snap ring, then rear cover.


SST150A

2. Remove O-ring and oil seal.


SST151A

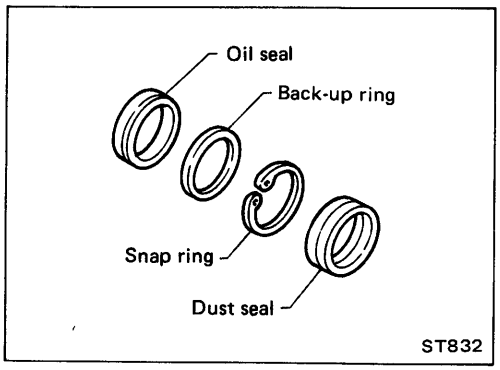


Assembly

ADJUSTING SCREW LOCK NUT O-RING

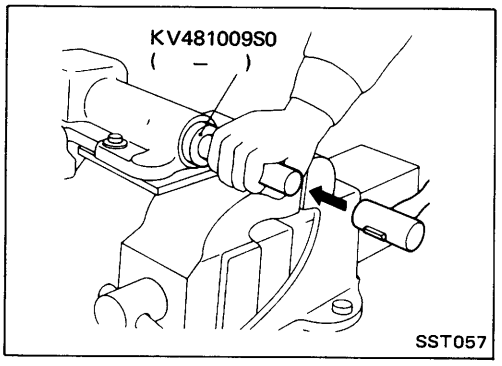
Insert new O-ring into adjusting screw lock nut.

- **Before inserting, apply a thin coat of vaseline to O-ring.**
- **Insert O-ring to make sure it fits into groove.**

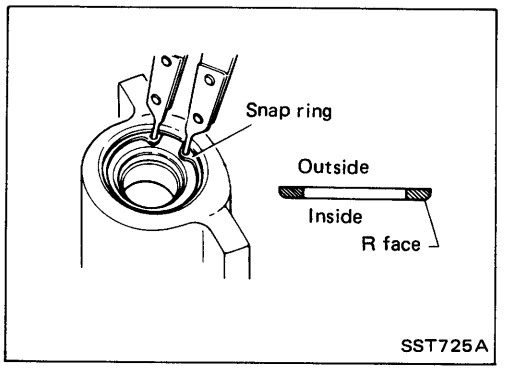


SECTOR SHAFT OIL SEAL

- **When installing, be sure to use new oil seal, dust seal, back-up ring and snap ring.**
- **Before installing, apply a thin coat of vaseline to new oil seal and dust seal.**



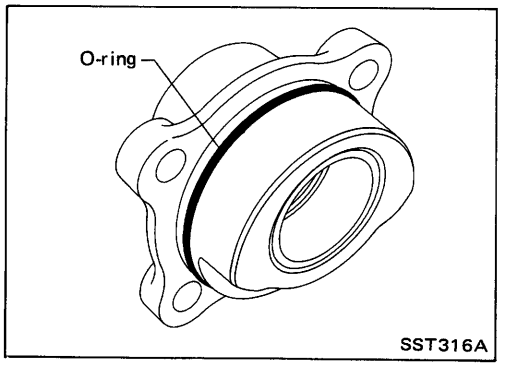
1. Press new oil seal and then install back-up ring with Tool.



2. Install a new snap ring into gear housing.

CAUTION:

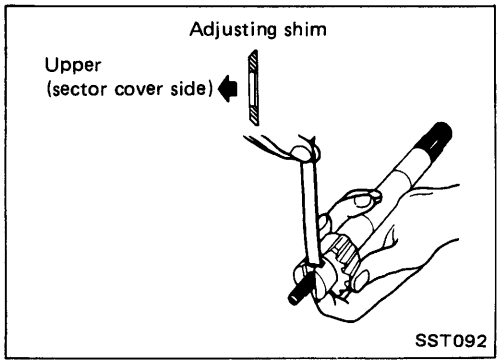
a. **Turn snap ring to make sure it fits into groove.**
b. **Always install snap ring with R face facing inward.**



3. Press a new dust seal.
4. Fit new O-ring into sector shaft cover.

- **Before installing, apply a thin coat of vaseline to O-ring.**
- **Make certain that O-ring is installed properly, and not damaged by sector shaft.**

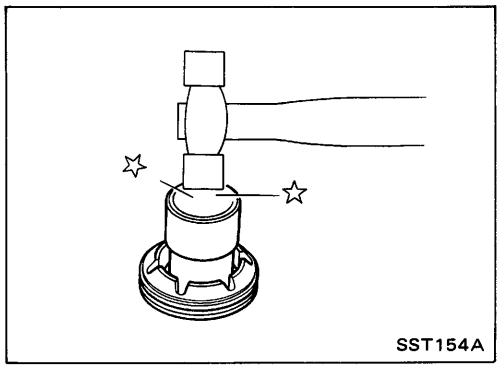
Assembly (Cont'd)



SECTOR SHAFT END PLAY

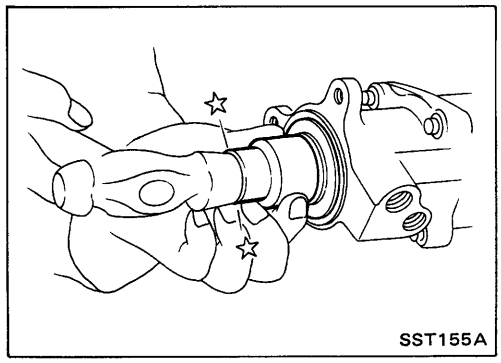
Select suitable adjusting shim and adjust end play between sector shaft and adjusting screw.

Sector shaft end play:
0.01 - 0.03 mm (0.0004 - 0.0012 in)
Sector shaft adjusting screw shims:
Refer to S.D.S.



REAR COVER O-RING AND OIL SEAL

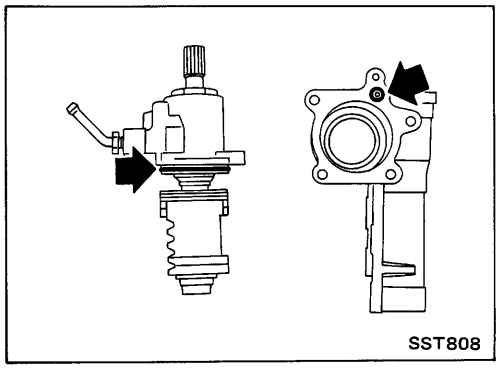
1. Install new O-ring and oil seal.



2. Install rear cover, then snap ring.

CAUTION:

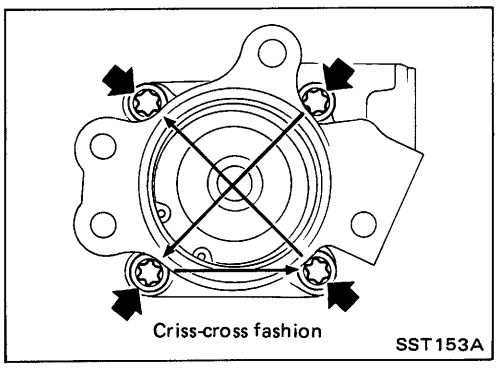
a. **Turn snap ring to make sure it fits into grooves.**
b. **Always install snap ring with its rounded edge facing rear cover.**



REAR HOUSING O-RING

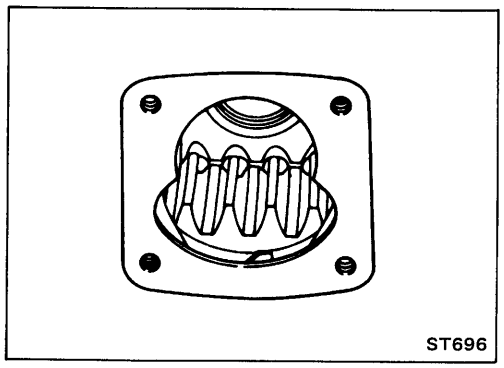
1. Install new O-rings.

a. **Before installing, apply a thin coat of vaseline to O-ring.**
b. **Make sure O-ring is installed correctly and is not damaged by worm gear.**



2. Gradually insert worm gear and rear housing assembly into gear housing, being careful not to damage oil seal and O-rings.
3. Install torx screws.

Assembly (Cont'd)


ST696

SECTOR SHAFT

1. Set piston rack at straight-ahead position.

Turn piston rack about 10° to 15° toward yourself with your finger.

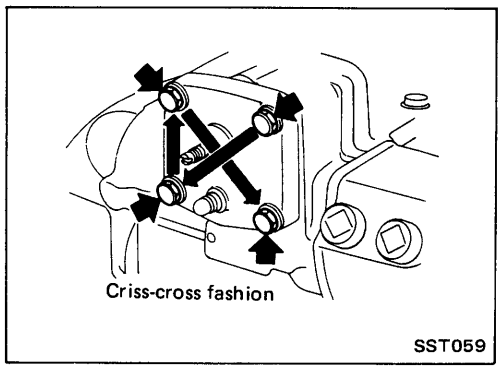
This is for smooth insertion of sector gear.

2. Wrap vinyl tape around serration area of sector shaft.

The reason is that vinyl tape prevents oil seal lip from being damaged during insertion.

3. Gradually insert sector shaft into gear housing, being careful not to damage oil seal.

When inserting sector shaft into gear housing, remove plastic film. Be careful not to drop bearings into gear housing.



SST059

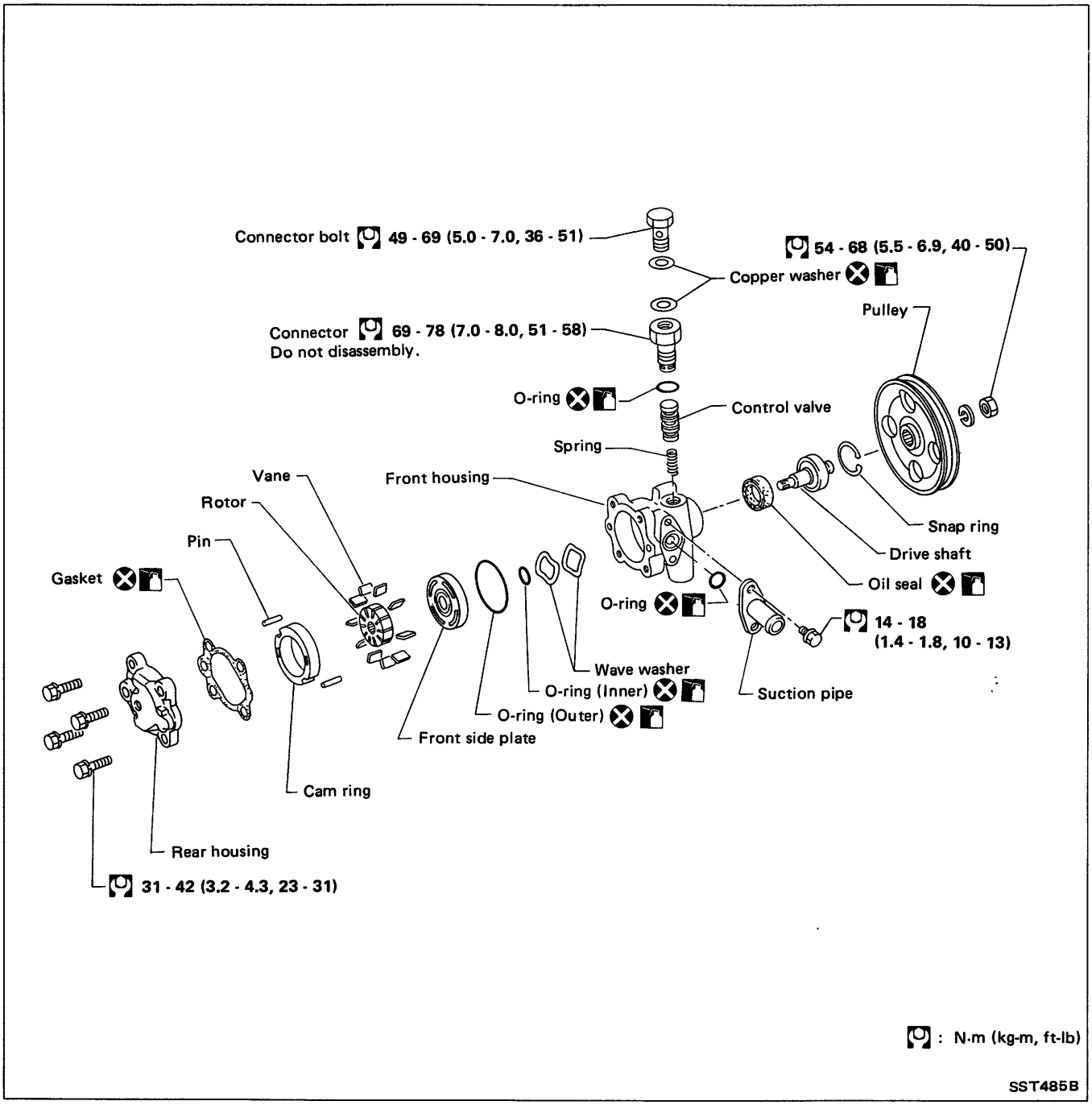
4. Tighten sector shaft cover bolts.

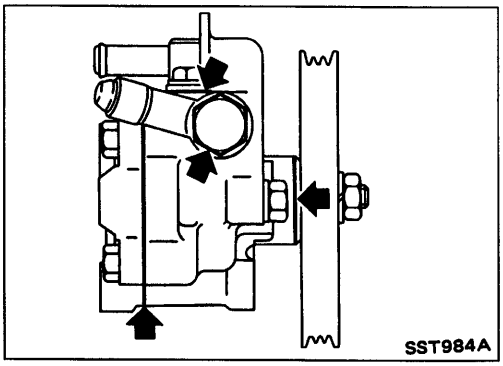
5. Check turning torque and steering gear preload.

Refer to Inspection and Adjustment of POWER STEERING GEAR (Model: PB56S)

- **If there is a great difference between values of turning torque before and after diassembly, it must be assumed that some new problem has occurred. It will be necessary to replace the entire assembly.**

Disassembly and Assembly





Pre-disassembly Inspection

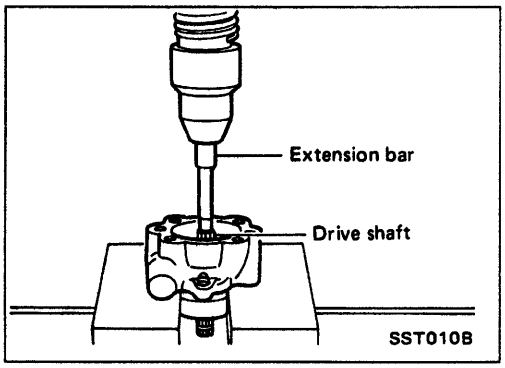
Disassemble the power steering oil pump only if the following items are found.

- Oil leak from any point shown in the figure.
- Deformed or damaged pulley.
- Poor performance.

Disassembly

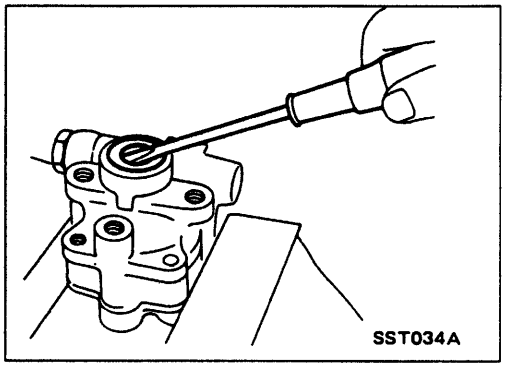
CAUTION:

- **Parts which can be disassembled are strictly limited. Never disassemble parts other than those specified.**
- **Disassemble in as clean a place as possible.**
- **Clean your hands before disassembly.**
- **Do not use rags; use nylon cloths or paper towels.**
- **Follow the procedures and cautions in the Service Manual.**
- **When disassembling and reassembling, do not let foreign matter enter or contact the parts.**



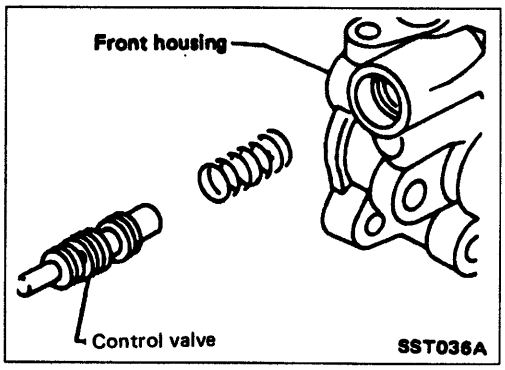
- Remove snap ring, then draw drive shaft out.

Be careful not to drop drive shaft.



- Remove oil seal.

Be careful not to damage front housing.

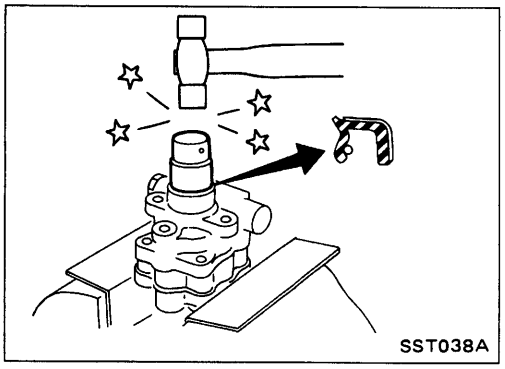


- Remove connector.

Be careful not to drop control valve.

Inspection

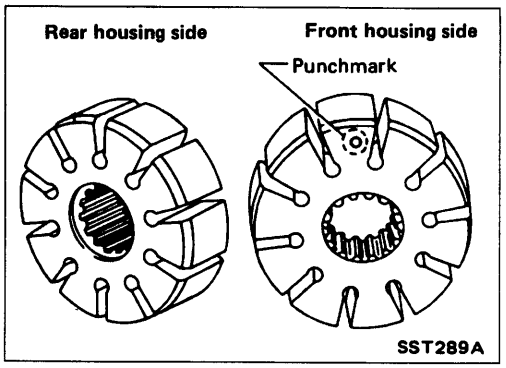
Inspect each component part for wear, deformation, scratches, and cracks. If damage is found, replace the part.


SST038A

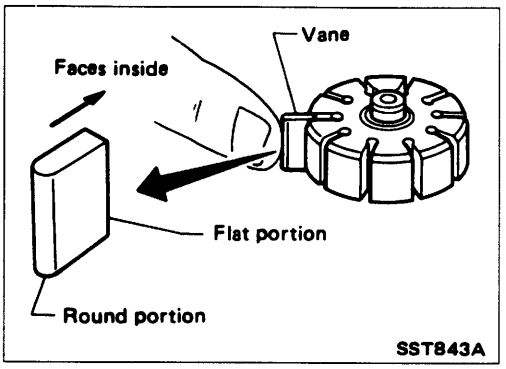
Assembly

Assemble oil pump, noting the following instructions.

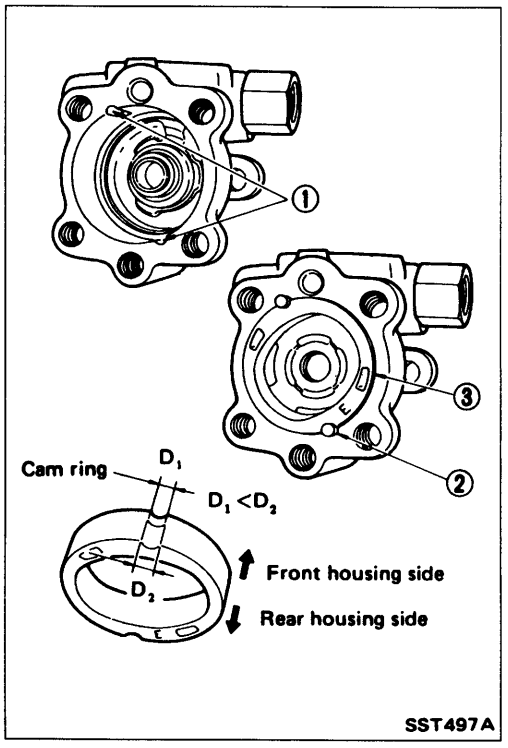
- Make sure O-rings and oil seal are properly installed.
- Always install new O-rings and oil seal.
- Be careful of oil seal direction.
- Cam ring, rotor and vanes must be replaced as a set if necessary.
- Coat each part with A.T.F. when assembling.



- Pay attention to the direction of rotor.

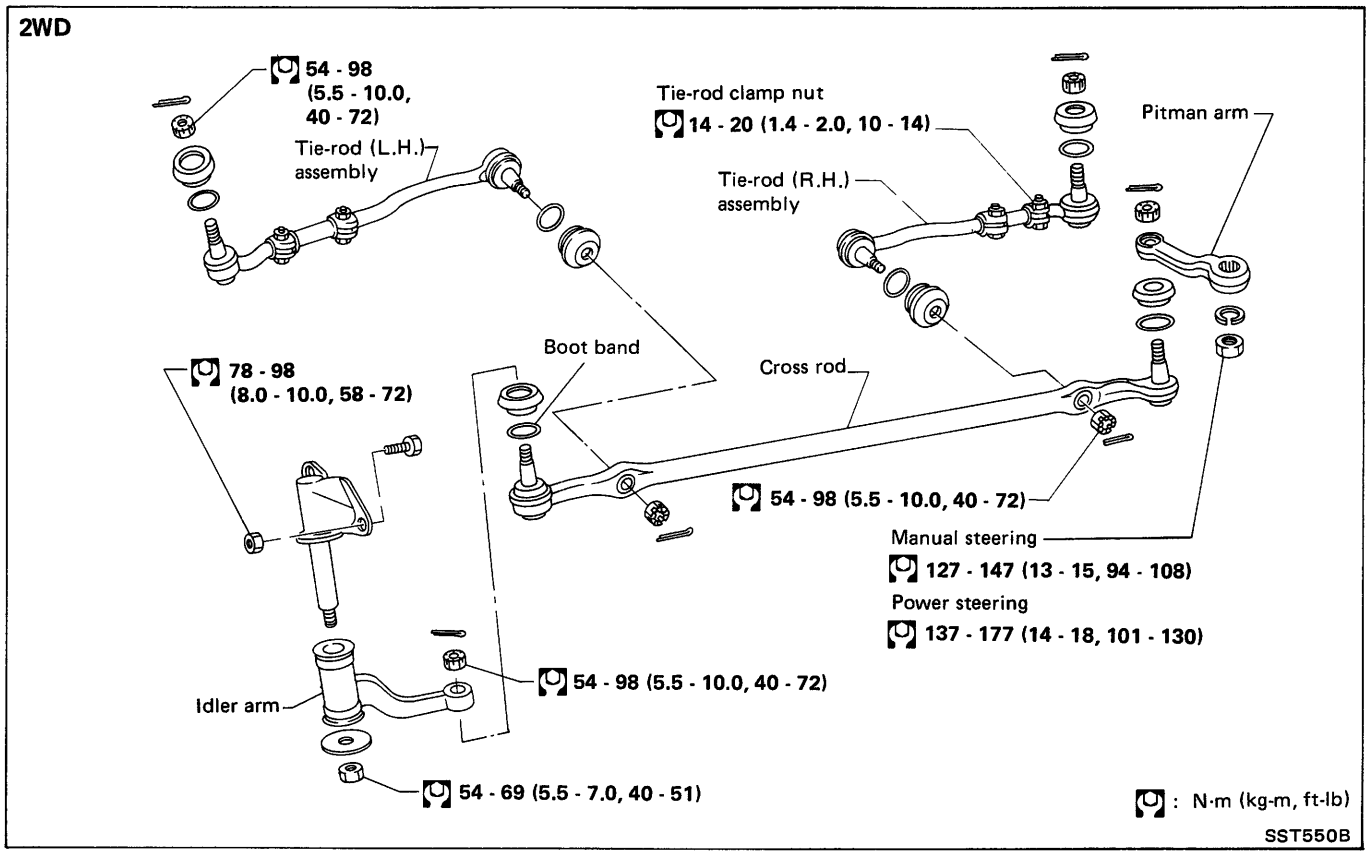


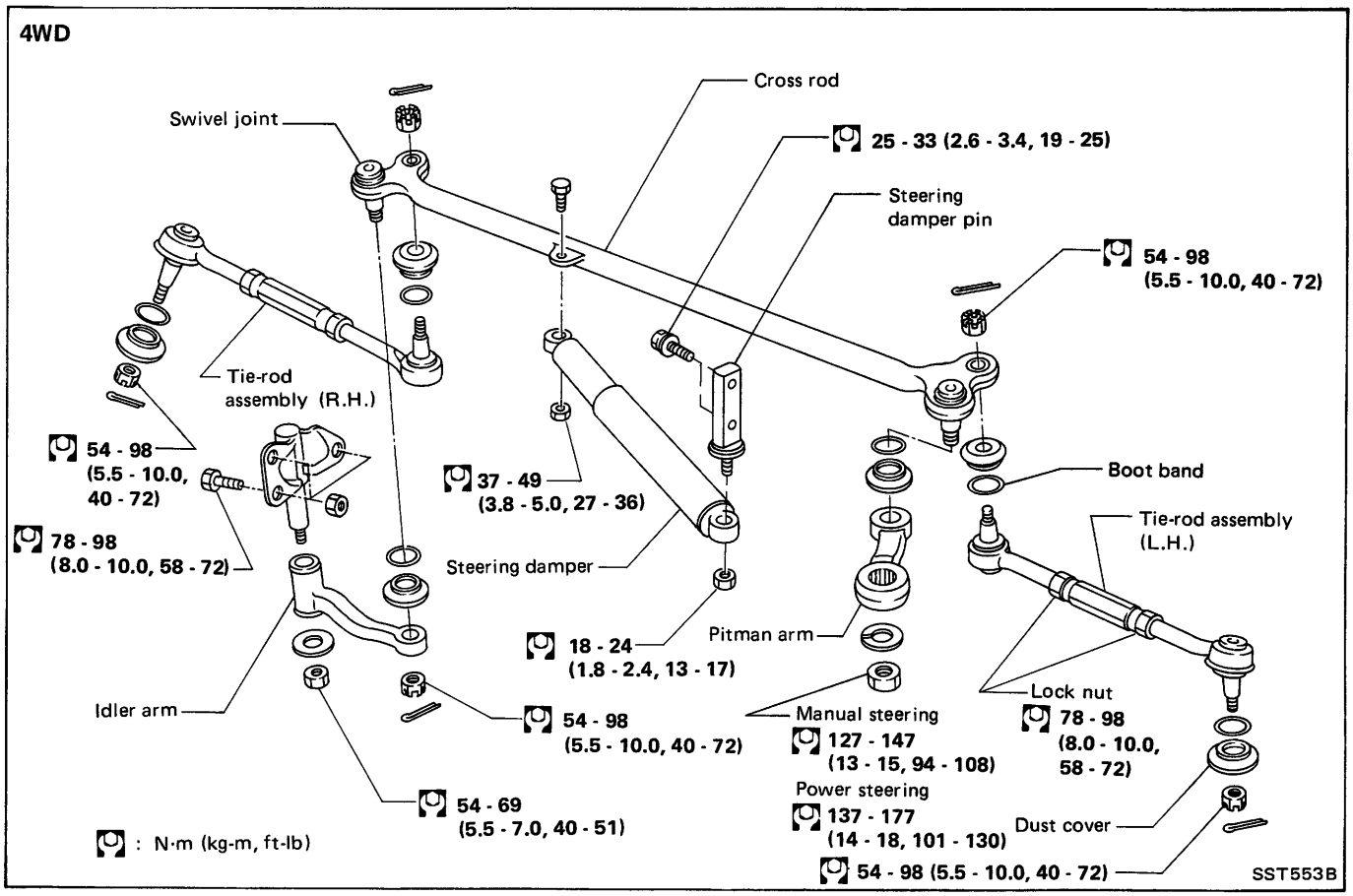
- When assembling vanes to rotor, rounded surfaces of vanes must face cam ring side.



- Insert pin ② into pin groove ① of front housing and front side plate. Then install cam ring ③ as shown at left.

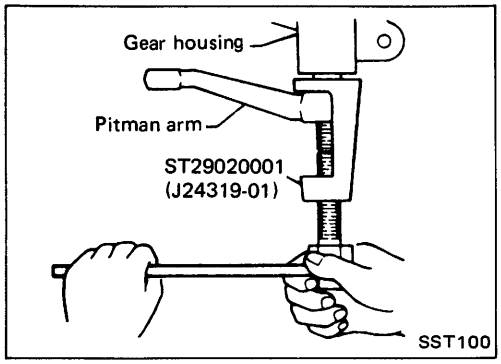
Removal and Installation



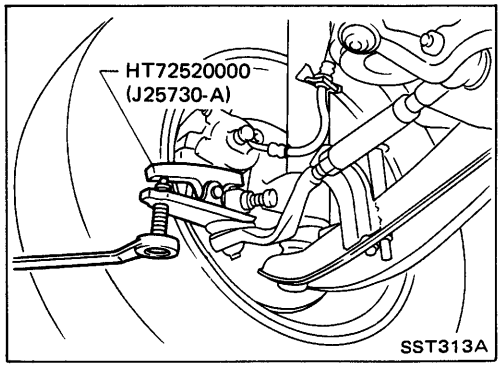


Removal and Installation (Cont'd)

Remove gear arm with Tool.



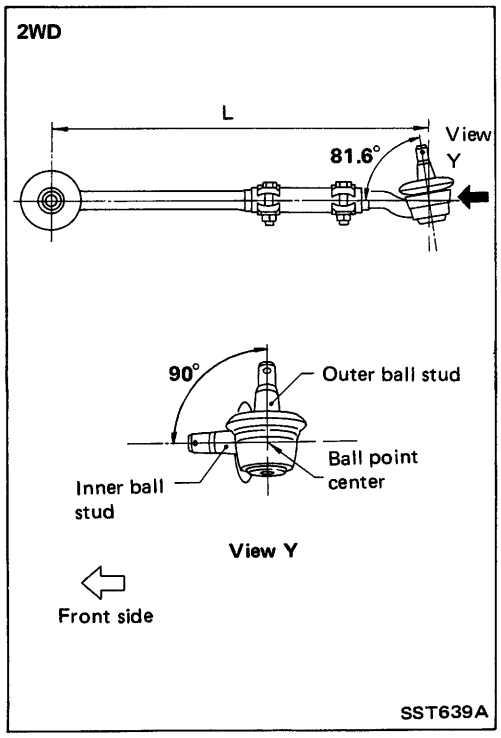
Remove tie-rod from knuckle arm with Tool.



Disassembly

IDLER ARM ASSEMBLY

- Apply coat of multi-purpose grease to bushing.
- Press bushing into idler body, and insert shaft of idler bracket carefully until bushing protrudes.



CROSS ROD AND TIE-ROD

1. When tie-rod ball joints and tie-rod bar are separated, adjust tie-rod length correctly.
   Adjustment should be done between ball stud centers.
   L: Standard
   344 mm (13.54 in) ... 2WD
2. Lock tie-rod clamp nut so that ball joint on outer ball stud is as follows with respect to that on inner ball stud.

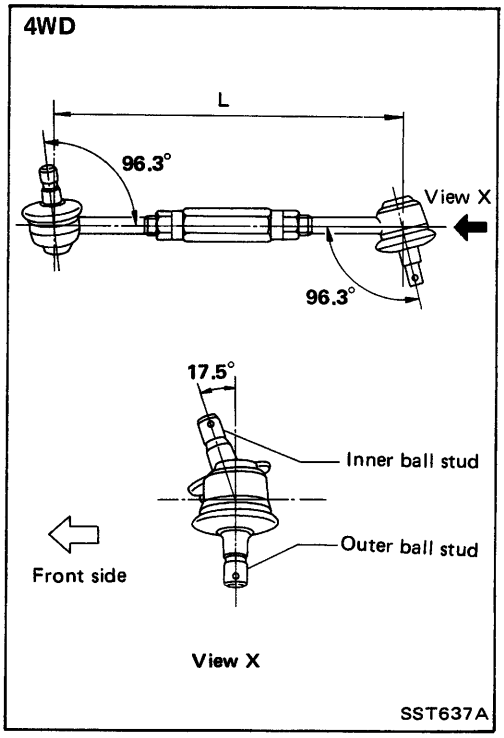
CAUTION:

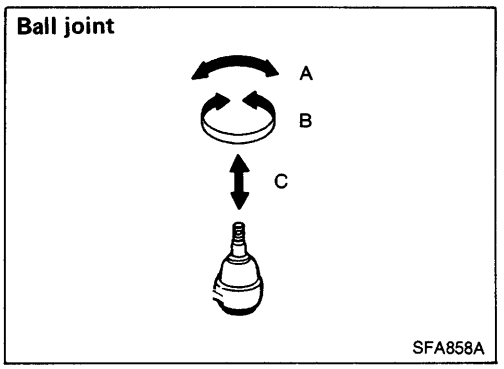
Make sure that tie-rod bars are screwed into tie-rod tube more than 35 mm (1.38 in).

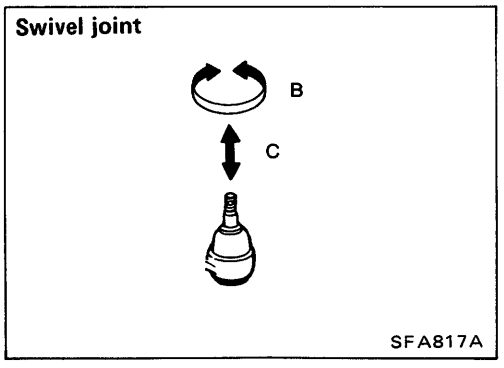
Disassembly (Cont'd)

L: Standard
281 mm (11.06 in) ... 4WD

CAUTION:
Make sure that tie-rod bars are screwed into tie-rod tube more than 35 mm (1.38 in).







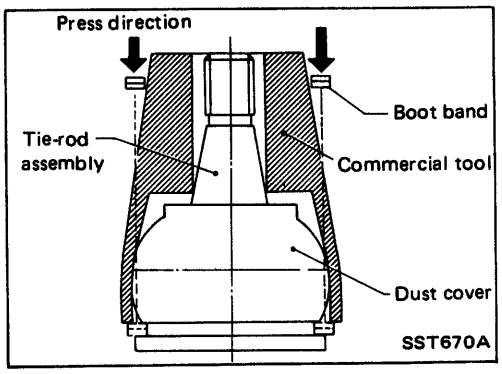
Inspection

BALL JOINT AND SWIVEL JOINT

1. Check joints for play. If ball or swivel stud is worn and play in axial direction is excessive or joint is hard to swing, replace as a complete unit.
   Swinging force (Measure point: Cotter pin hole) "A":
   Ball joint
   10.8 - 108.9 N
   (1.1 - 11.1 kg, 2.4 - 24.5 lb)
   Rotating torque "B":
   0.5 - 4.9 N·m
   (5 - 50 kg-cm, 4.3 - 43.4 in-lb)
   Axial end play "C":
   Ball joint
   0.1 - 0.8 mm (0.004 - 0.031 in)
   Swivel joint
   0.1 - 1.0 mm (0.004 - 0.039 in)
2. Check condition of dust cover. If it is cracked excessively, replace dust cover.

- When replacing dust cover, be careful not to damage it.
- Lubricate joint with multi-purpose grease, if necessary.

Inspection (Cont'd)



- When installing boot band with *commercial tool, be careful not to overexpand it.

  *** Refer to PREPARATION.**

CAUTION:

Be careful not to apply grease or oil to taper of joint.

IDLER ARM ASSEMBLY

- Check rubber bushing of idler arm for breakage, wear or play, and if necessary replace.
- Lubricate idler arm assembly with recommended multi-purpose grease, if necessary.
  When lubricating, refer to BALL JOINT AND SWIVEL JOINT.

CROSS ROD AND TIE-ROD

Check tie-rod and cross rod for breakage, bend or crack, and replace with a new one if necessary.

STEERING DAMPER

Check for oil leakage and measure damping force of damper, and replace if necessary.

Damping force:
at 0.3 m (1.0 ft)/sec
1,942 N (198 kg, 437 lb)
. . . Extended direction
1,775 N (181 kg, 399 lb)
. . . Compressed direction

FIXING LOCATION

- Check fixing location (nuts and cotter pins) for looseness, play or breakage.
- When looseness or play is found, check for wear on tapered portion of joints, gear arm of idler arm.
- When reassembling each joint, use new cotter pins.

General Specifications

Steering column type (Collapsible)	Manual steering	Power steering	
Steering gear type	B56S	PB48S	PB56S
Turns of steering wheel on the vehicle (Lock-to-lock)	4.9 (2WD) 5.0 (4WD) 3.9*1	3.7	3.4 2.5*1
Steering gear ratio	22	16.5	15
Steering damper (4WD) [at 0.3 m (1.0 ft)/sec.] N (kg, lb)	1,942 (198, 437)*2 1,775 (181, 399)*3		

*1: 4WD: Tire size ... 10.50R15
*2: Extended direction
*3: Compressed direction

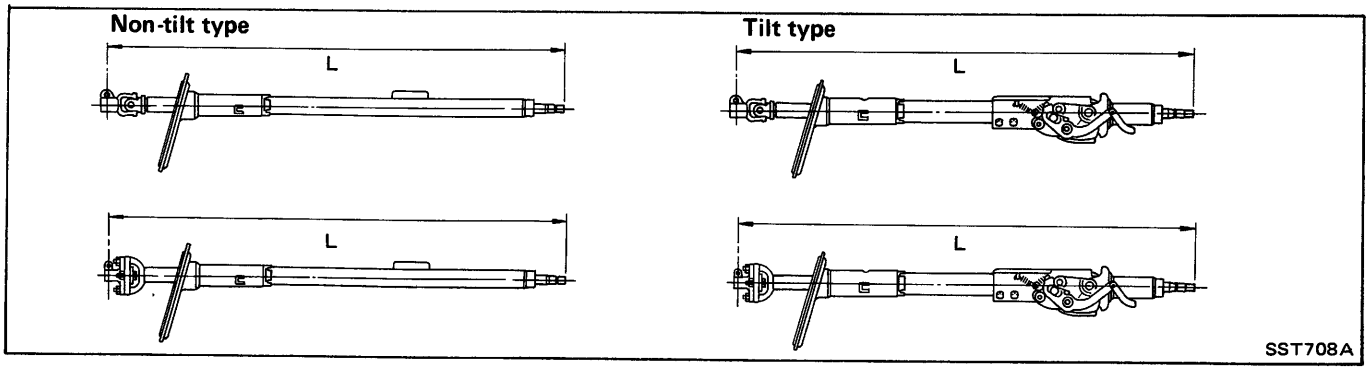
Steering wheel axial play mm (in)	0 (0)
Steering wheel play mm (in)	35 (1.38) or less

Inspection and Adjustment

STEERING COLUMN

Unit: mm (in)

	Dimension "L"
2WD model	918.0 - 919.6 (36.14 - 36.20)
4WD model	886.1 - 887.7 (34.89 - 34.95)



Inspection and Adjustment (Cont'd)

MANUAL STEERING GEAR (Model: B56S)

Worm bearing preload (Without oil seal) N·m (kg-cm, in-lb)	0.20 - 0.59 (2.0 - 6.0, 1.7 - 5.2)	
Steering gear preload (With oil seal) N·m (kg-cm, in-lb) New parts	0.83 - 1.23 (8.5 - 12.5, 7.4 - 10.9)	
Used parts	0.59 - 0.98 (6.0 - 10.0, 5.2 - 8.7)	
Backlash at pitman arm top end (in a straight-ahead position) mm (in) New gear	0 - 0.1 (0 - 0.004)	
Used gear	0 - 0.3 (0 - 0.012)	
End play (Between sector shaft and adjusting screw) mm (in)	0.01 - 0.03 (0.0004 - 0.0012)	
Adjusting shim thickness	Thickness mm (in)	Part number
	1.575 - 1.600 (0.0620 - 0.0630)	48213-B0100
	1.550 - 1.575 (0.0610 - 0.0620)	48214-B0100
	1.525 - 1.550 (0.0600 - 0.0610)	48215-B0100
	1.500 - 1.525 (0.0591 - 0.0600)	48216-B0100
	1.475 - 1.500 (0.0581 - 0.0591)	48217-B0100
	1.450 - 1.475 (0.0571 - 0.0581)	48218-B0100
Oil capacity ℓ (US pt, Imp pt)	Approx. 0.33 (3/4, 5/8)	

STEERING LINKAGE

Applied model	2WD	4WD
Relay-rod swivel joint Rotating torque N·m (kg-cm, in-lb)	—	0.5 - 4.9 (5 - 50, 4.3 - 43.4)
Axial end play mm (in)	—	0.1 - 1.0 (0.004 - 0.039)
Tie-rod & relay-rod ball joint Swinging force at cotter pin hole N (kg, lb)	10.8 - 107.9 (1.1 - 11.0, 2.4 - 24.3)	
Rotating torque N·m (kg-cm, in-lb)	0.5 - 4.9 (5 - 50, 4.3 - 43.4)	
Axial end play mm (in)	0.1 - 0.8 (0.004 - 0.031)	
Tie-rod standard length (L) mm (in)	344 (13.54)	281 (11.06)

POWER STEERING SYSTEM (Model: PB48S, PB56S)

Steering wheel turning force (at 360° from neutral position and circumference of steering wheel) N (kg, lb)	24.5 - 29.4 (2.5 - 3.0, 5.5 - 6.6) 39 (4, 9) or less*	
Oil pump pressure kPa (kg/cm², psi)	7,649 - 8,238 (78 - 84, 1,109 - 1,194) at idling	
Fluid capacity mℓ (US fl oz, Imp fl oz)	Approximately 900 - 1,000 (30.4 - 33.8, 31.7 - 35.2)	
Normal operating temperature °C (°F)	60 - 80 (140 - 176)	
Steering gear turning torque N·m (kg-cm, in-lb) 360° position from straight-ahead position	0.7 - 1.2 (7 - 12, 6.1 - 10.4) 0.4 - 1.2 (4 - 12, 3.5 - 10.4)*	
Straight-ahead position (As compared with steering wheel turned 360°)	0.1 - 0.4 (1 - 4, 0.9 - 3.5) higher 0.2 - 0.4 (2 - 4, 1.7 - 3.5) higher*	
Backlash at pitman arm top end (in a straight-ahead position) mm (in)	0 - 0.1 (0 - 0.004)	
End play (Between sector shaft and adjusting screw) mm (in)	0.01 - 0.03 (0.0004 - 0.0012)	
Adjusting shim thickness	Thickness mm (in)	Part number
	1.575 - 1.600 (0.0620 - 0.0630)	48213-B0100
	1.550 - 1.575 (0.0610 - 0.0620)	48214-B0100
	1.525 - 1.550 (0.0600 - 0.0610)	48215-B0100
	1.500 - 1.525 (0.0591 - 0.0600)	48216-B0100
	1.475 - 1.500 (0.0581 - 0.0591)	48217-B0100
	1.450 - 1.475 (0.0571 - 0.0581)	48218-B0100

*Model: PB56S-type

SECTION BF

CONTENTS

GENERAL SERVICING (Including all clips and fasteners for using this model) ..... BF- 2
BODY END ..... BF- 6
DOOR (Including "Power Window" & "Power Door Lock") BF-12
INTERIOR AND EXTERIOR (In EXTERIOR, including "Weatherstrips") BF-20
INSTRUMENT (Including "Center Console") BF-34
SEAT BF-35
WINDSHIELD AND WINDOWS BF-38
SUN ROOF BF-46
MIRROR (Including wiring diagram) BF-47
CAB AND REAR BODY BF-48
BODY ALIGNMENT BF-53

When you read wiring diagrams:
- **Read GI section, "HOW TO READ WIRING DIAGRAMS".**
- **See EL section, "POWER SUPPLY ROUTING" for power distribution circuit.**

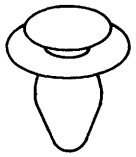
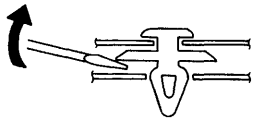
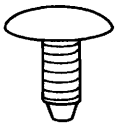
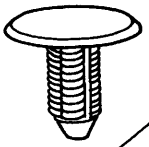
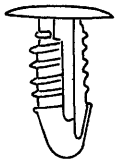
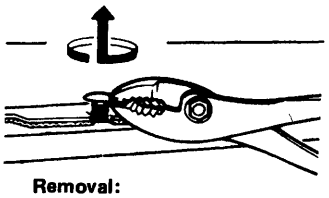
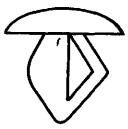
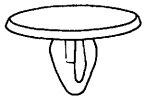
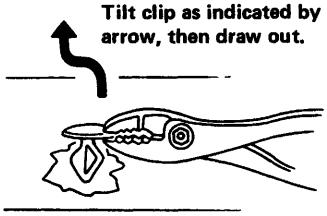
★ **For seat belt, refer to MA section.**

Precautions

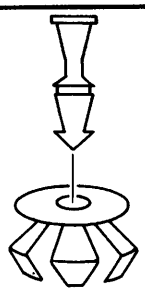
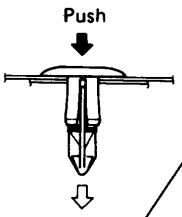
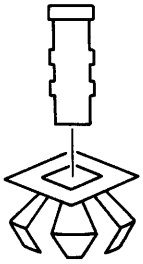
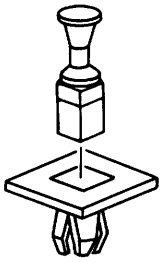
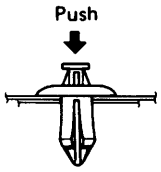
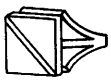
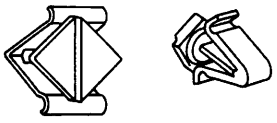
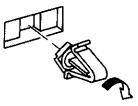
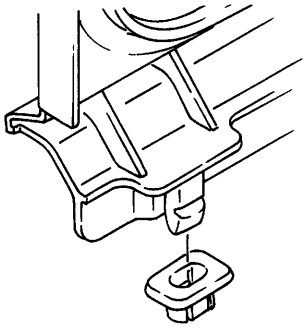
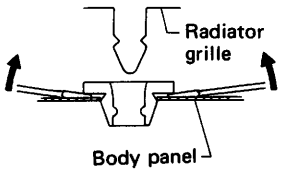
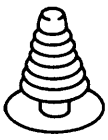
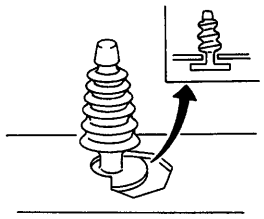
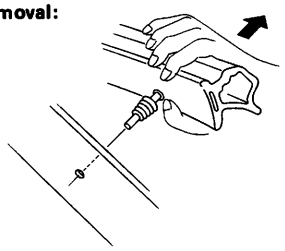
- When removing or installing various parts, place a cloth or padding onto the vehicle body to prevent scratches.
- Handle trim, molding, instruments, grille, etc. carefully during removing or installation. Be careful not to soil or damage them.
- Apply sealing compound where necessary when installing parts.
- When applying sealing compound, be careful that the sealing compound does not protrude from parts.
- When replacing any metal parts (for example body outer panel, members, etc.), be sure to take rust prevention measures.

Clip and Fastener

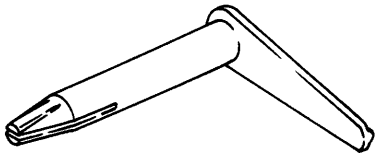
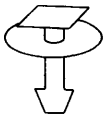
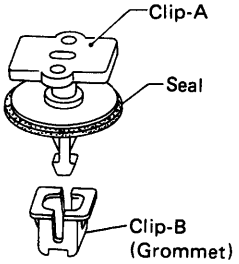
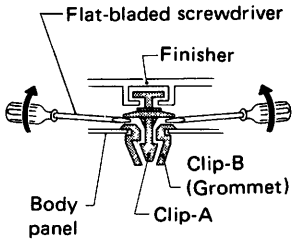
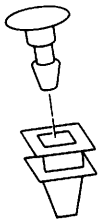
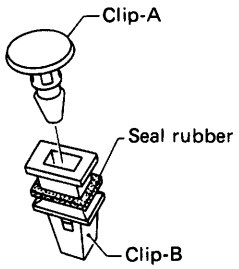
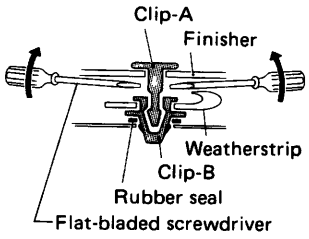
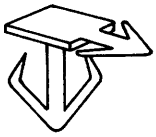
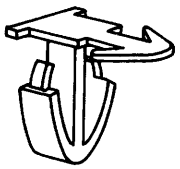
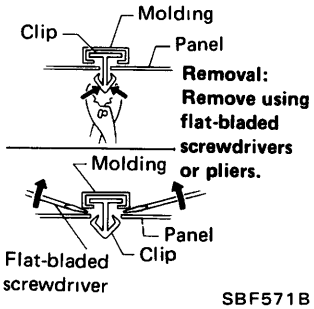
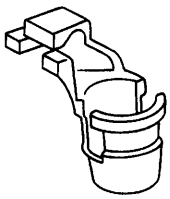
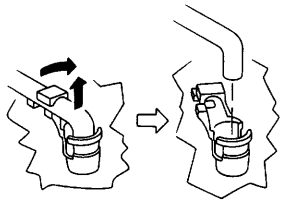
- Clips and fasteners in BF section correspond to the following numbers and symbols.
- Replace any clips and/or fasteners which are damaged during removal or installation.

No.	Symbol	Shape	Removal & Installation
C101	 SBF092B	 SBF109B	**Removal:** **Remove by bending up with a flat-bladed screwdriver.**  SBF094B
C102	 SBF113B	 SBF114B  SBF137B	 **Removal:** **Pull up by rotating** SBF115B
C105	 SBF141B	 SBF142B	**Removal:** **Tilt clip as indicated by arrow, then draw out.**  SBF143B

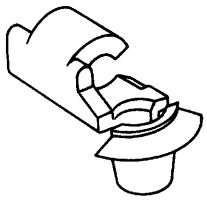
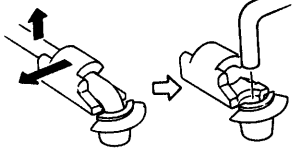
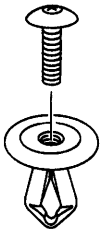
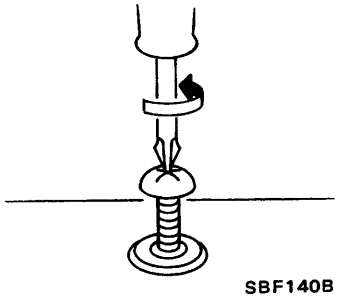
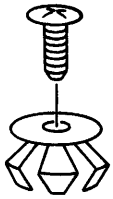
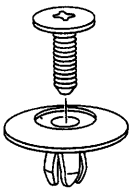
Clip and Fastener (Cont'd)

No.	Symbol	Shape	Removal & Installation
C203	 SBF318C	 SBF319C	Push center pin to catching position. (Do not remove center pin by hitting it.) 
C204	 SBF321C	 SBF322C	 Installation: SBF708E
CG101	 SBF144B	 SBF145B	Removal:  Rotate 45° to remove.  Removal: Installation:  SBF085B
CG104	 SBF351C		Removal: Remove by bending up with flat-bladed screwdrivers.  SBF352C
CE103	 SBF103B	 SBF104B	Removal:  SBF147B

Clip and Fastener (Cont'd)

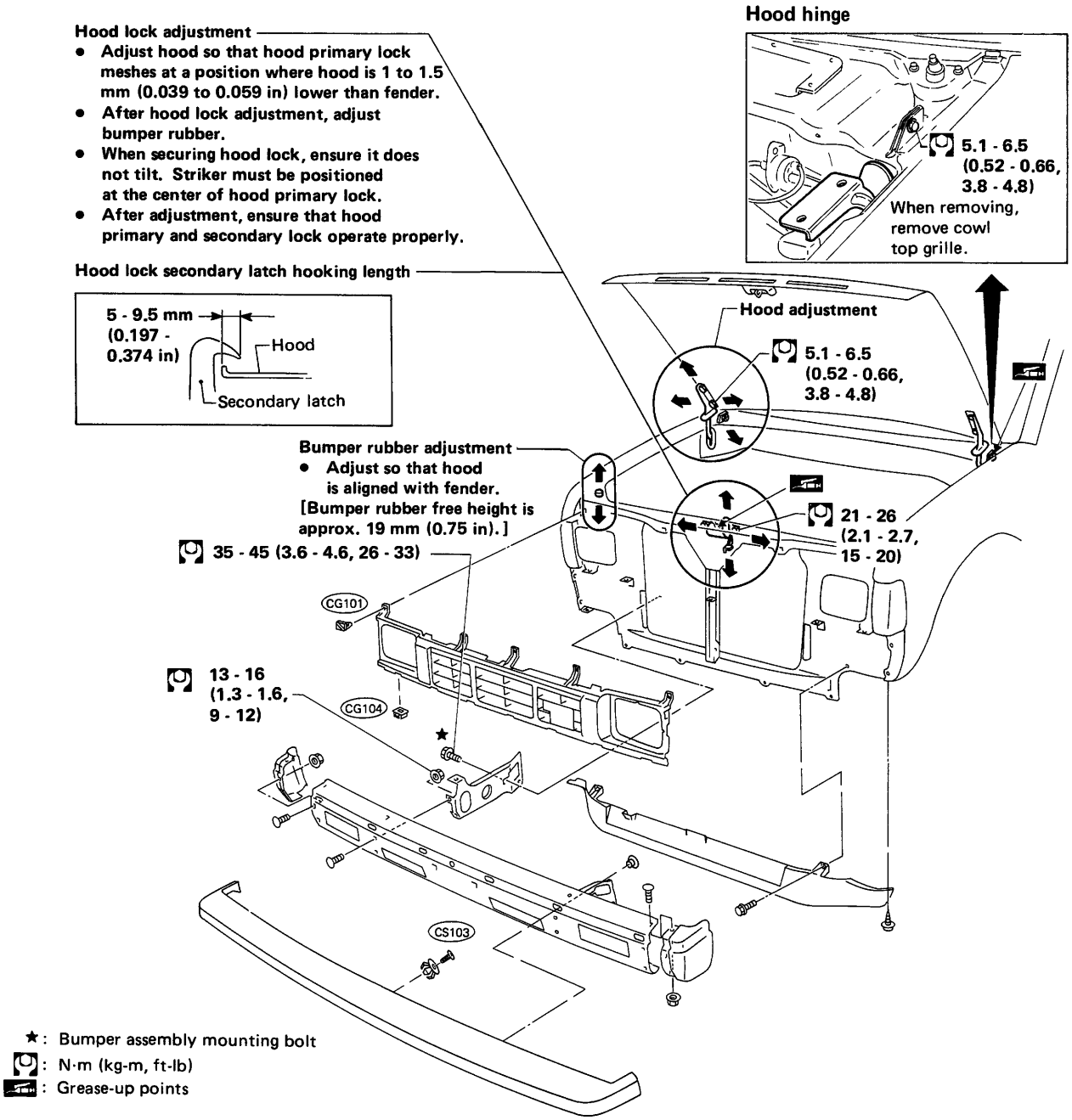
No.	Symbol	Shape	Removal & Installation
CE114	 SBF353C		—
CF109	 SBF650B	 SBF651B	**Removal:**  SBF652B
CF110	 SBF647B	 SBF648B	**Removal:**  SBF649B
CF114	 SBF316C	 SBF317C	 SBF571B
CR103	 SBF768B		**Removal:** **Holder portion of clip must be spread out to remove rod.**  SBF770B

Clip and Fastener (Cont'd)

No.	Symbol	Shape	Removal & Installation
CR104	 SBF860B		**Removal:** **Holder portion of clip must be spread out to remove rod.**  SBF861B
CS102	 SBF138B	 SBF139B	**Removal:** **Screw out with a Phillips screwdriver.**  SBF140B
CS103	 SBF363B	 SBF364B	

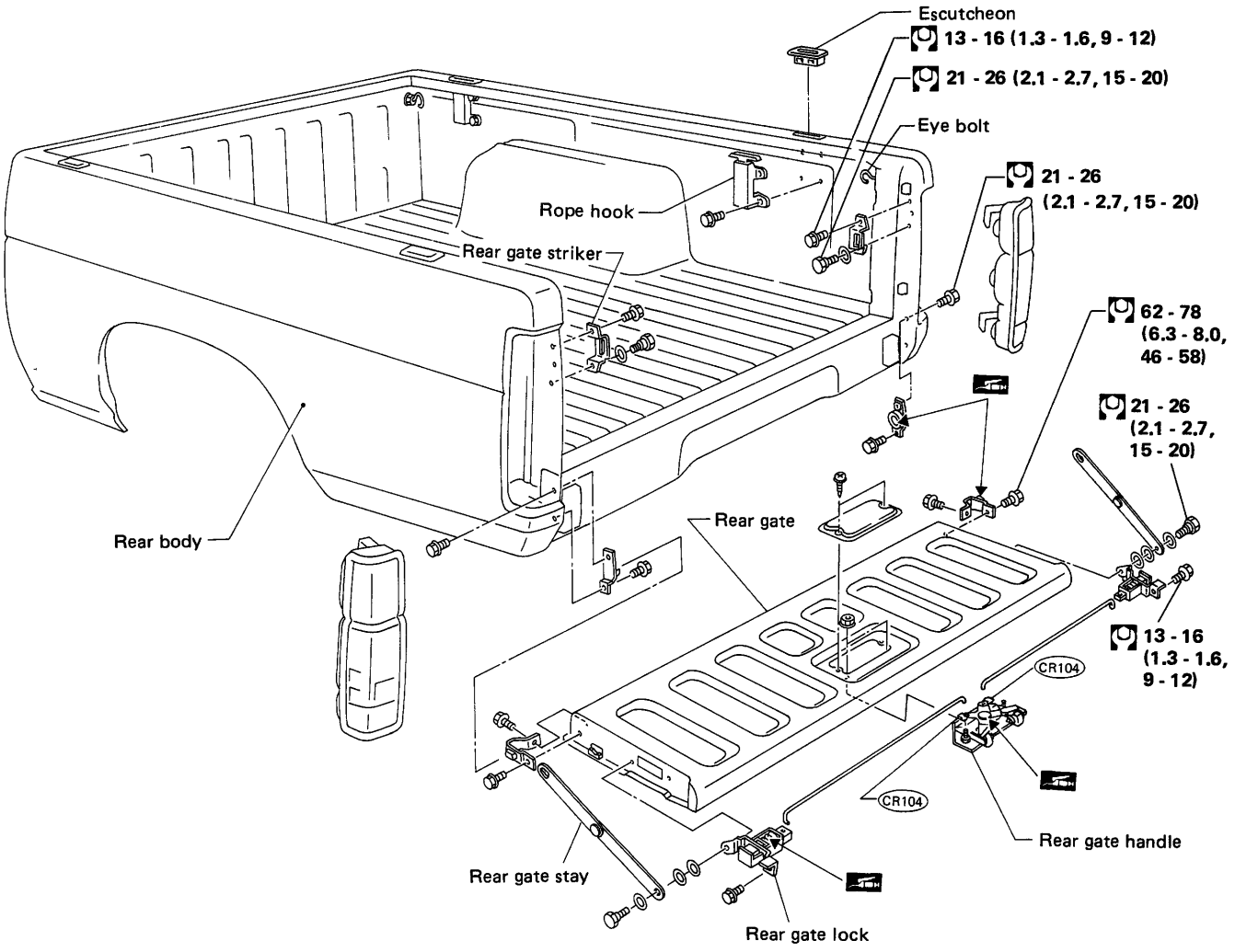
Front End

- Hood adjustment: Adjust at hinge portion.
- Hood lock adjustment: After adjusting, check hood lock control operation. Apply a coat of grease to hood locks engaging mechanism.
- Hood opener: Do not attempt to bend cable forcibly. Doing so increases effort required to unlock hood.
- Bumper finisher: It is made of plastic, so do not use excessive force and take care to keep oil away from it.



SBF804D

Rear End—TRUCK



: N·m (kg-m, ft-lb)
: Grease-up points

SBF273E

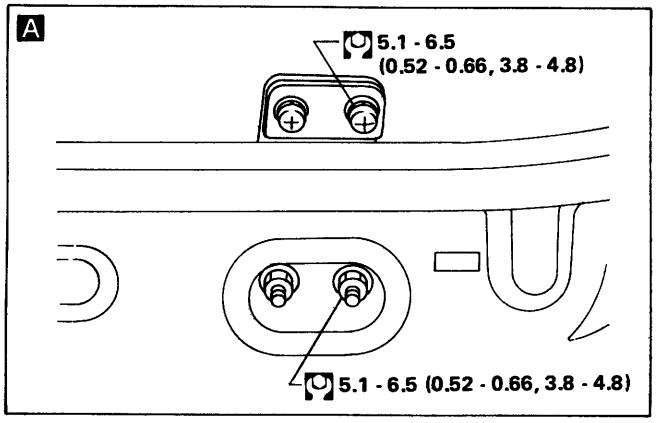
Body Rear End—VAN & WAGON

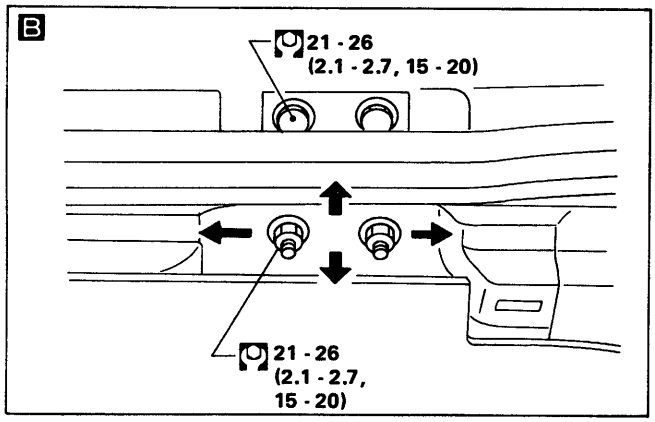
- Back door lock system adjustment: Adjust lock & striker so that they are in the center. After adjustment, check back door lock operation.
- Back door hatch lock system adjustment: Adjust lock & striker so that they are in the center. After adjustment, check back door hatch lock operation.

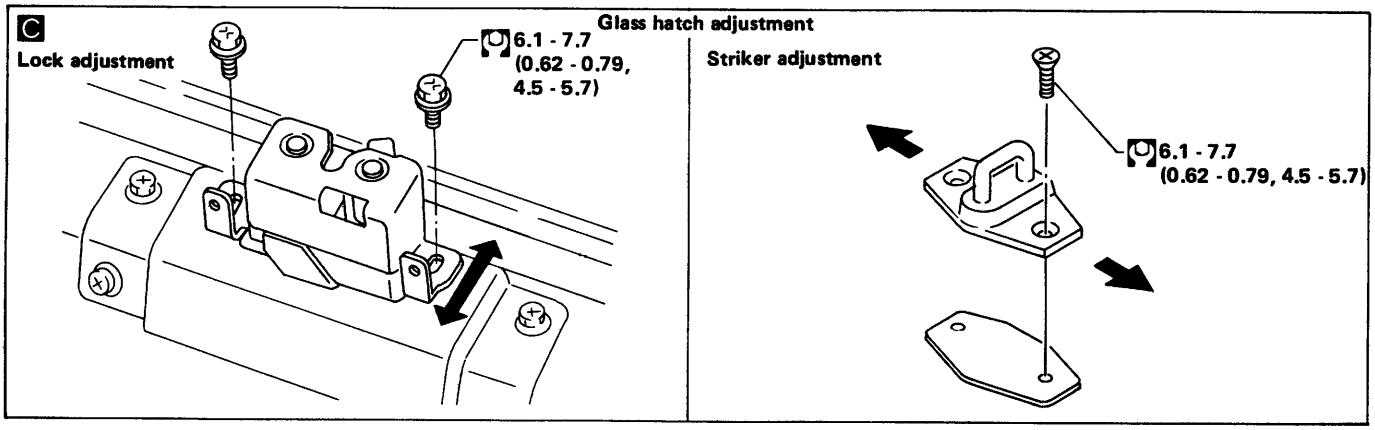
WARNING:

a. Be careful not to scratch back door stay and/or back door hatch stay when installing back door and/or back door hatch. A scratched stay may cause gas leakage.

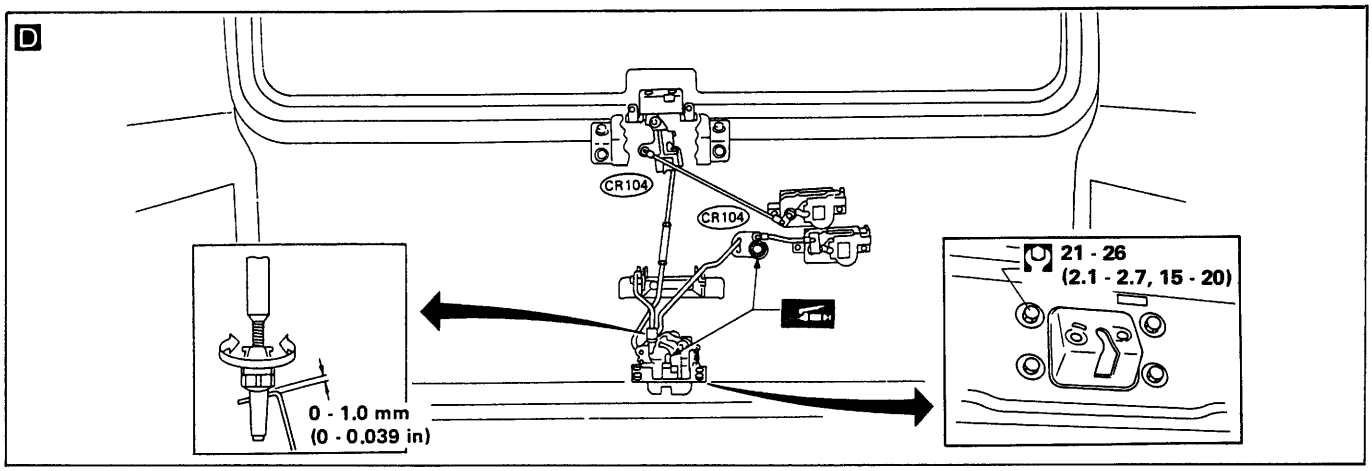
b. The contents of the back door stay and back door hatch stay are under pressure. Do not take apart, puncture, apply heat or allow fire near them.

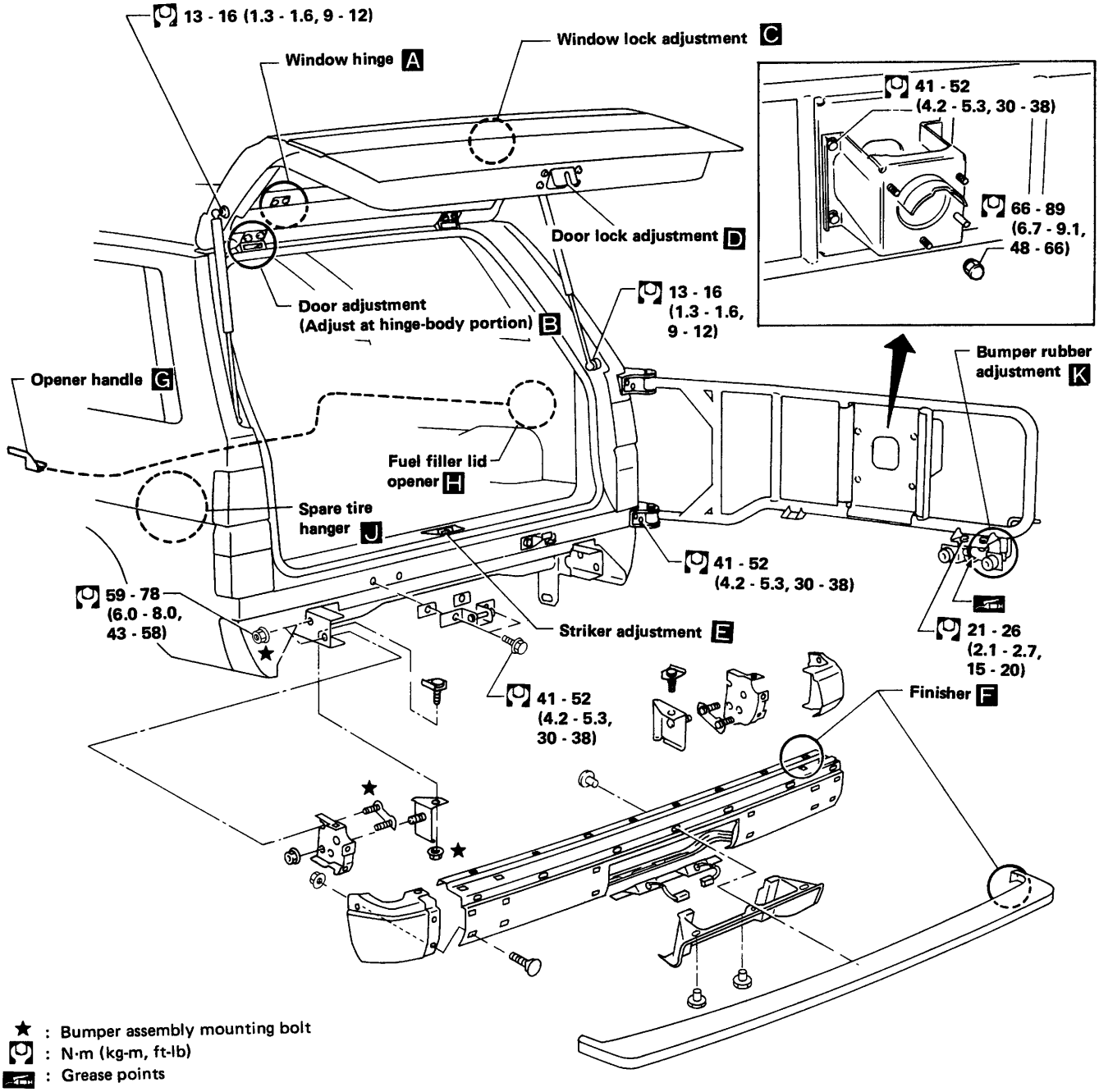






Body Rear End—VAN & WAGON (Cont'd)

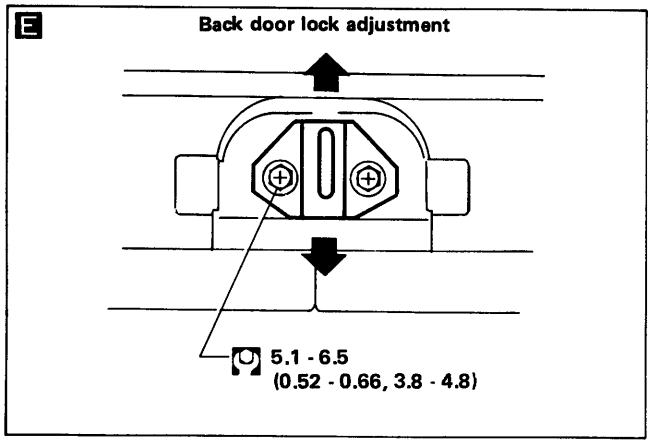




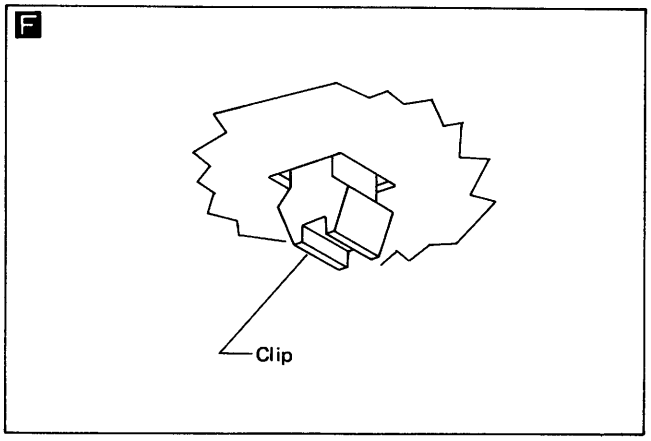
★ : Bumper assembly mounting bolt
: N·m (kg-m, ft-lb)
: Grease points

Body Rear End—VAN & WAGON (Cont'd)

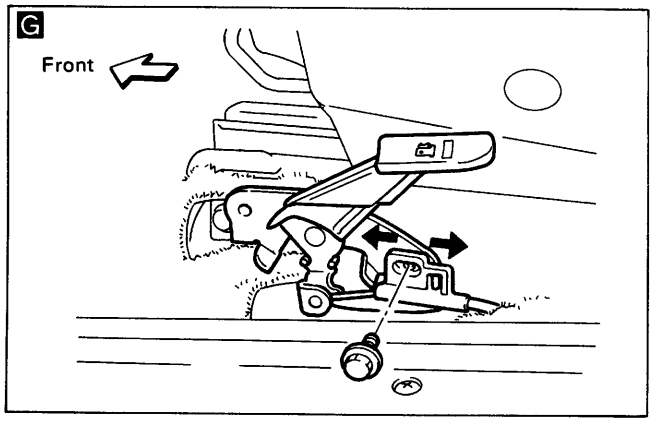
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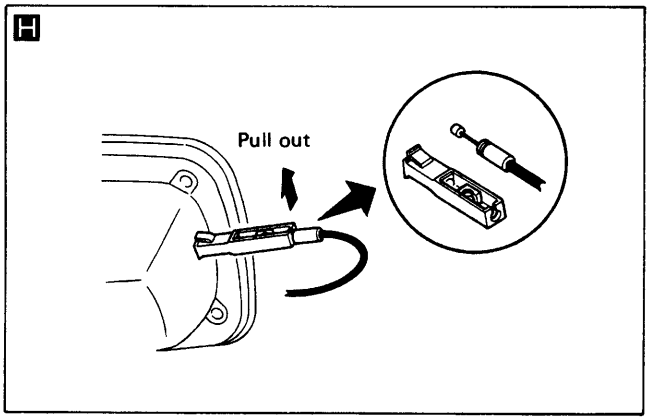
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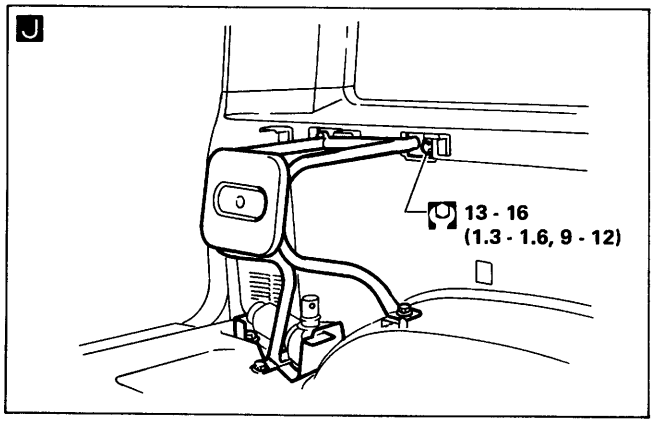
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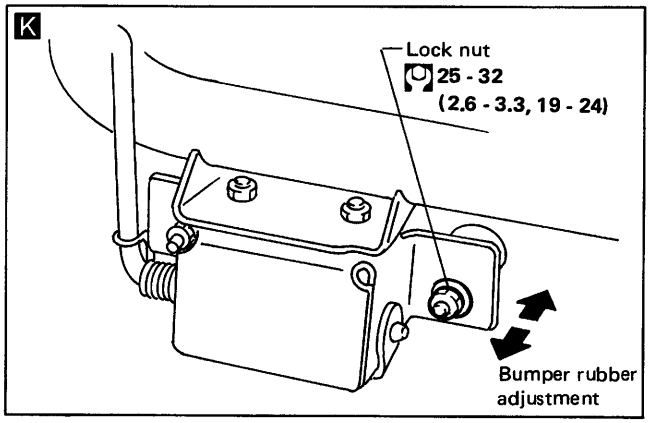
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J

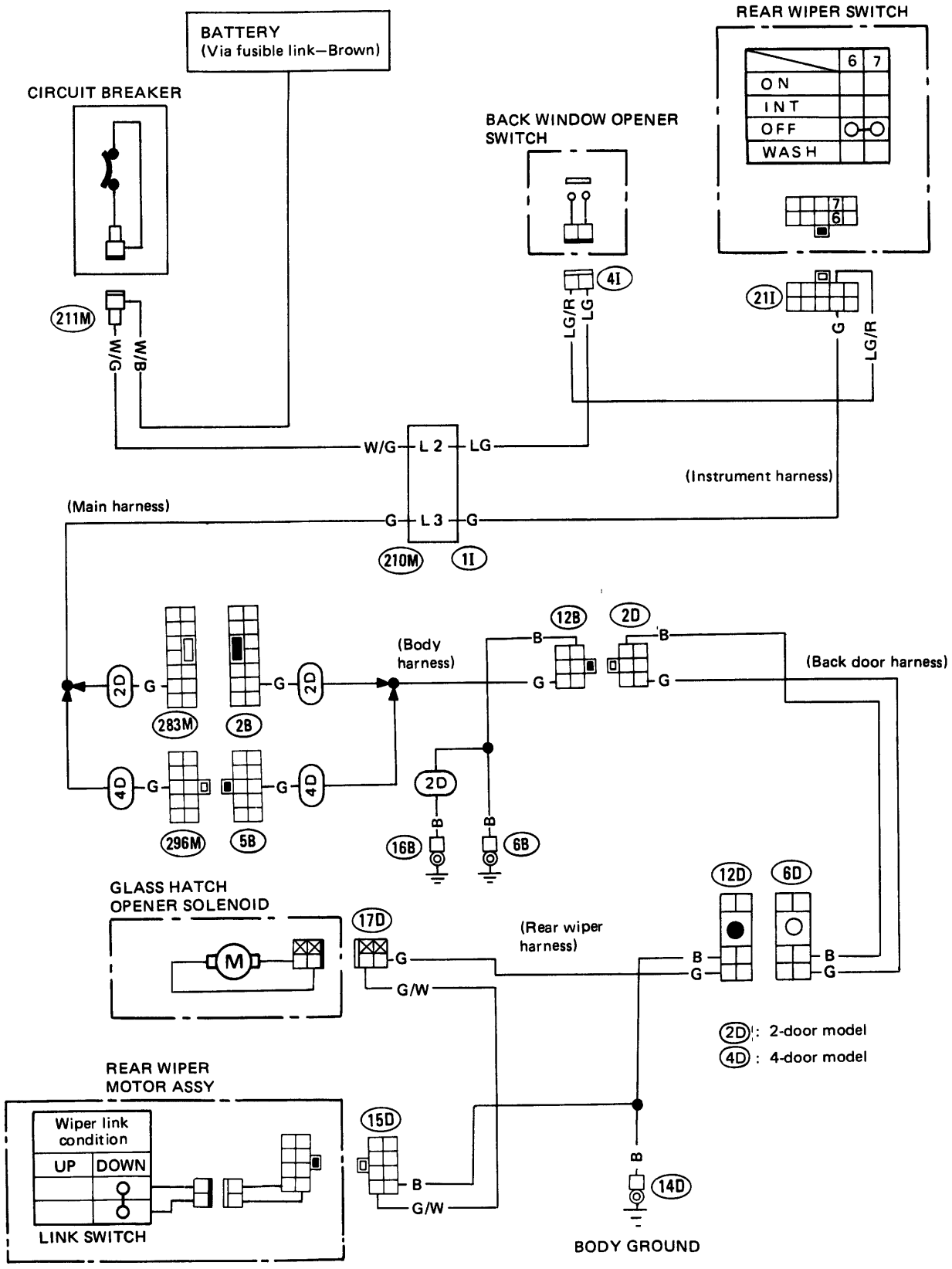


K



Back Door Window Opener—WAGON

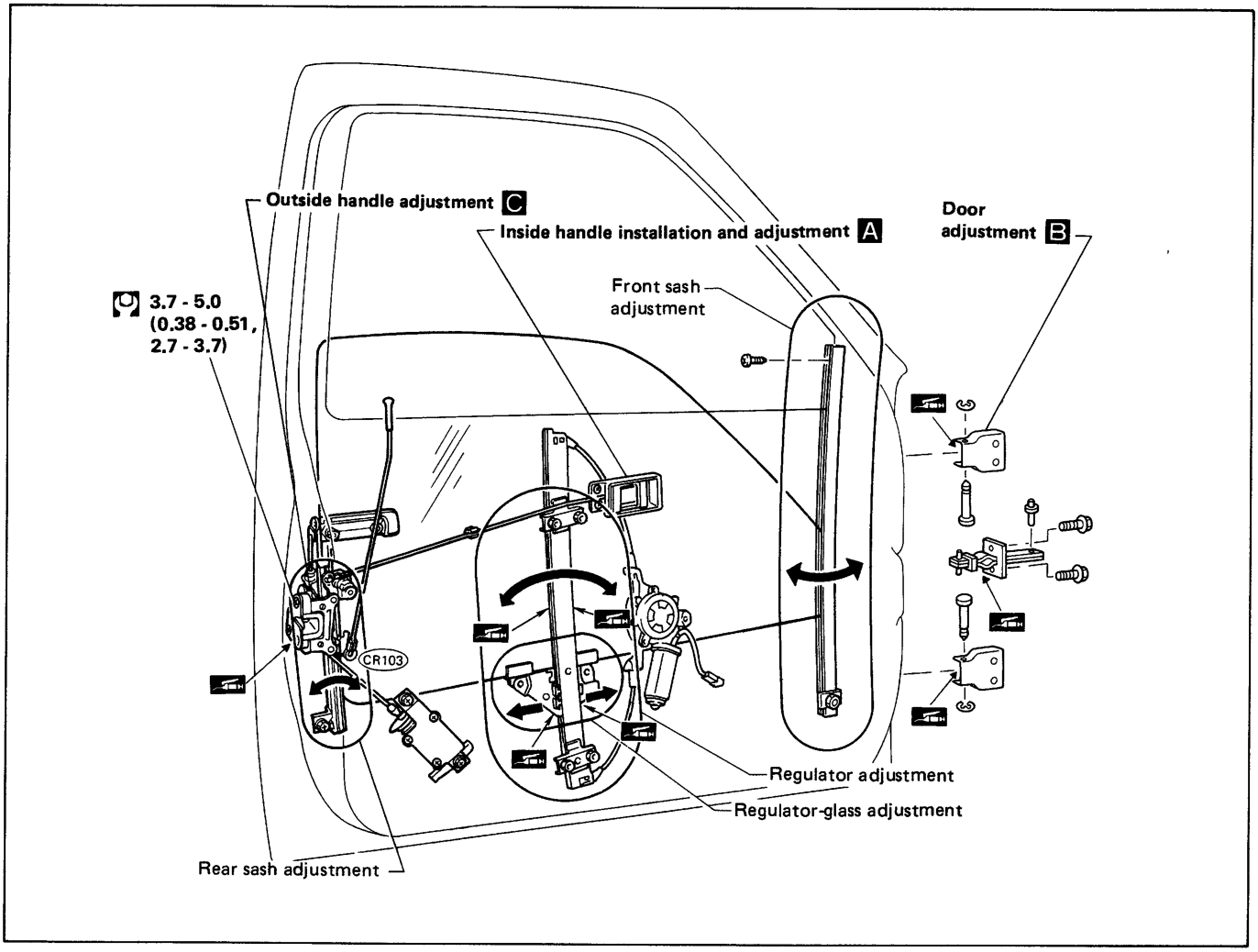
WIRING DIAGRAM

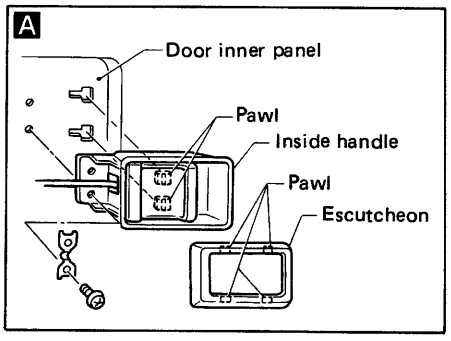


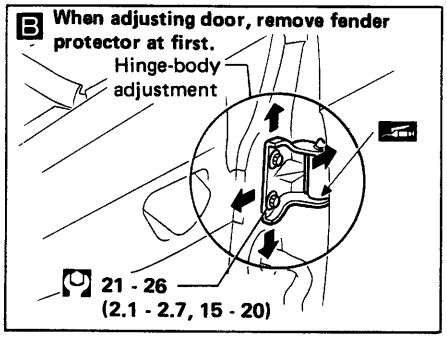
MBF003A

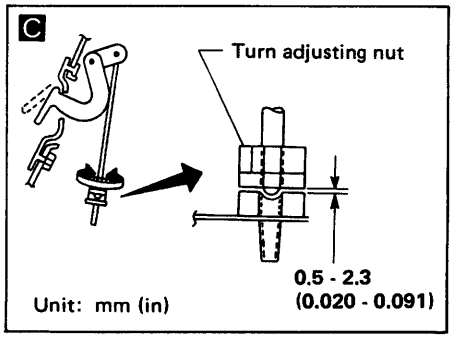
Door

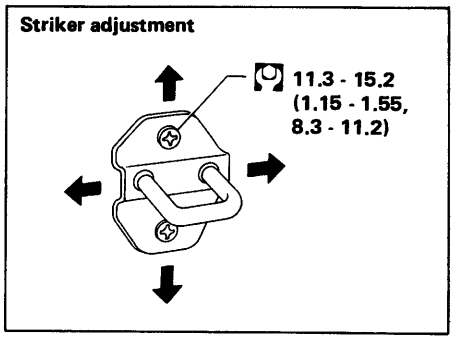
- After adjusting door or door lock, make sure door locks properly.











: N·m (kg-m, ft-lb)
: Grease-up points

SBF501F

Power Door Lock

DOOR LOCK TIMER INSPECTION

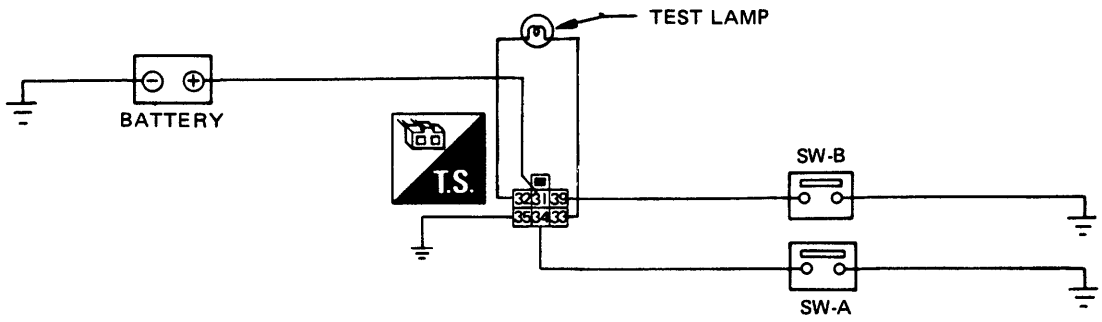
TESTING OPERATION

Input signal	SW-A operation	OFF	Turns ON	ON	Turns OFF	OFF	OFF	OFF	Turns ON	Turns OFF
	SW-B operation	OFF	OFF	OFF	OFF	Turns ON	ON	Turns OFF	After SW-A operation, immediately turns ON	Turns OFF
Output signal	Test lamp operation	OFF	ON (Approx. 1.0 sec.) → OFF	OFF	OFF	ON (Approx. 1.0 sec.) → OFF	OFF	OFF	ON → OFF → ON → OFF	OFF

- Carry out the complete inspection in this chart from left to right.
- Do not carry out any switch operations that are not described in the above chart so as to avoid breaking the door lock timer.

Lighting period of test lamp differs according to SW-B operation. Moreover, test lamp may come on once or it may not come on at all. If this occurs, do not judge it faulty solely from this step, but use other steps to make final judgement.

INSPECTION CIRCUIT (This test circuit must be wired by the technician.)



DOOR LOCK TIMER

	CIRCUIT CONNECTIONS
31	Power source (BAT)
32	To/From actuators (Lock power source & Unlock ground)
33	To/From actuators (Lock ground & Unlock power source)
34	To lock-unlock switches (Input signal for lock)
35	Ground
39	To lock-unlock switches (Input signal for unlock)

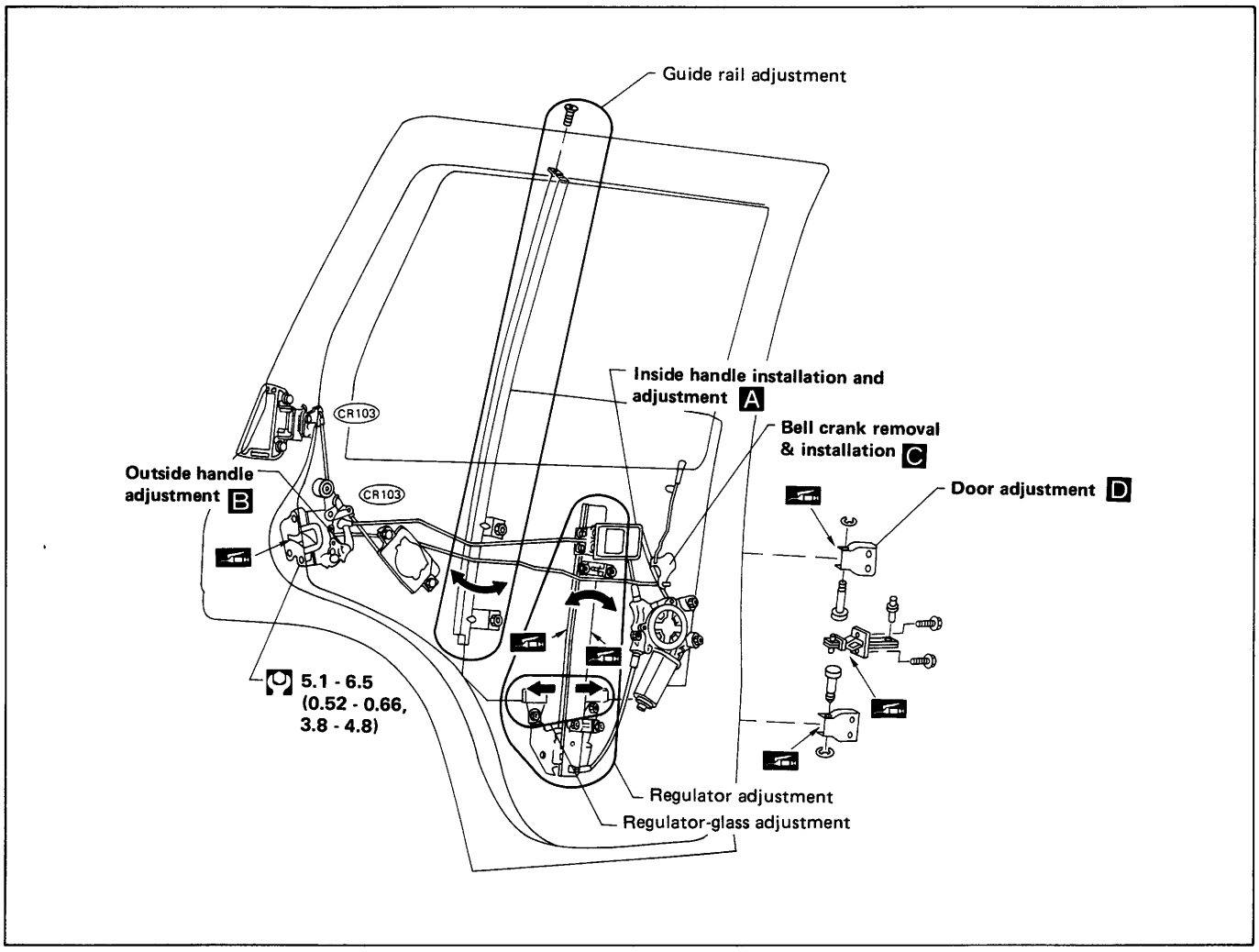
SBF622F

CIRCUIT BREAKER

The circuit breaker is the same as the one for Power Window system.
So refer to "Power Window".

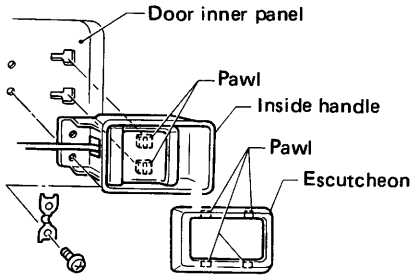
Rear Door — 4-door VAN & WAGON

- After adjusting door or door lock, make sure door locks properly.



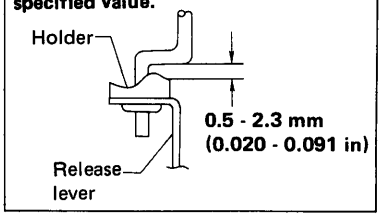
Rear Door — 4-door VAN & WAGON (Cont'd)

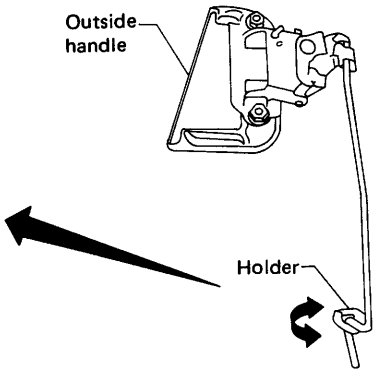
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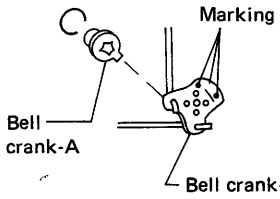
B **Outside handle adjustment**

Turn holder until the clearance between holder & rod is the specified value.

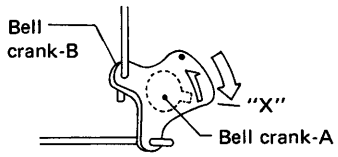




C

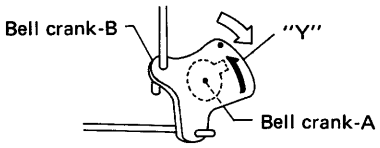


Removal:



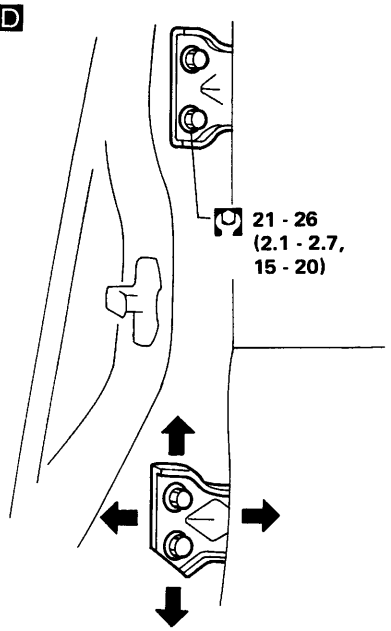
Turn bell crank-A counter-clockwise (as indicated by the white arrow) to position "X".

Installation:

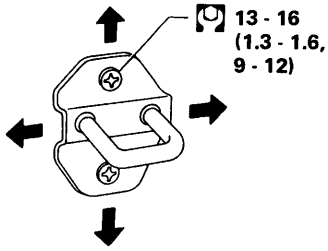


Turn bell crank-A counter-clockwise to position "Y".

D



Striker adjustment



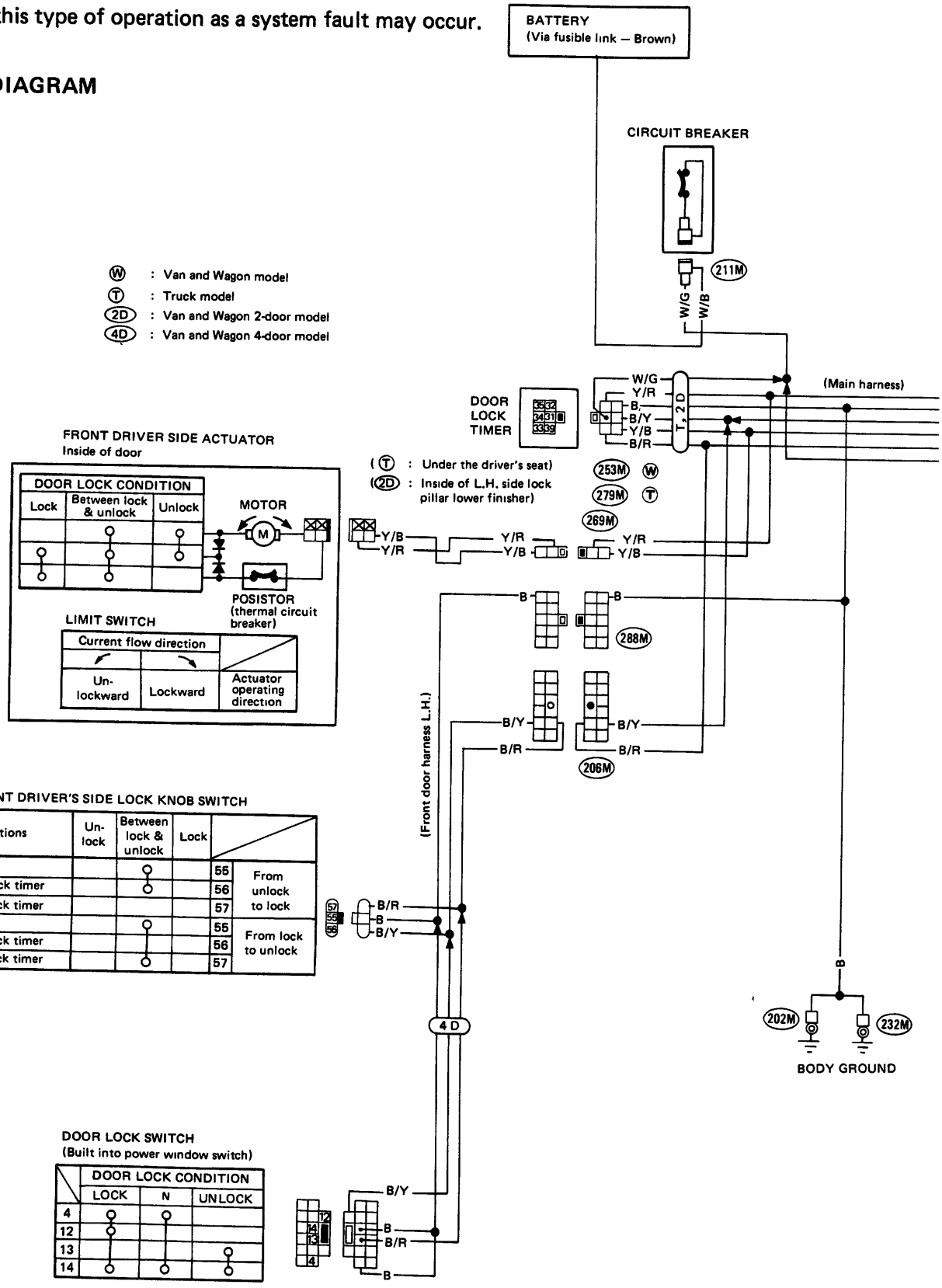
: N·m (kg-m, ft-lb)
: Grease-up points

SBF579F

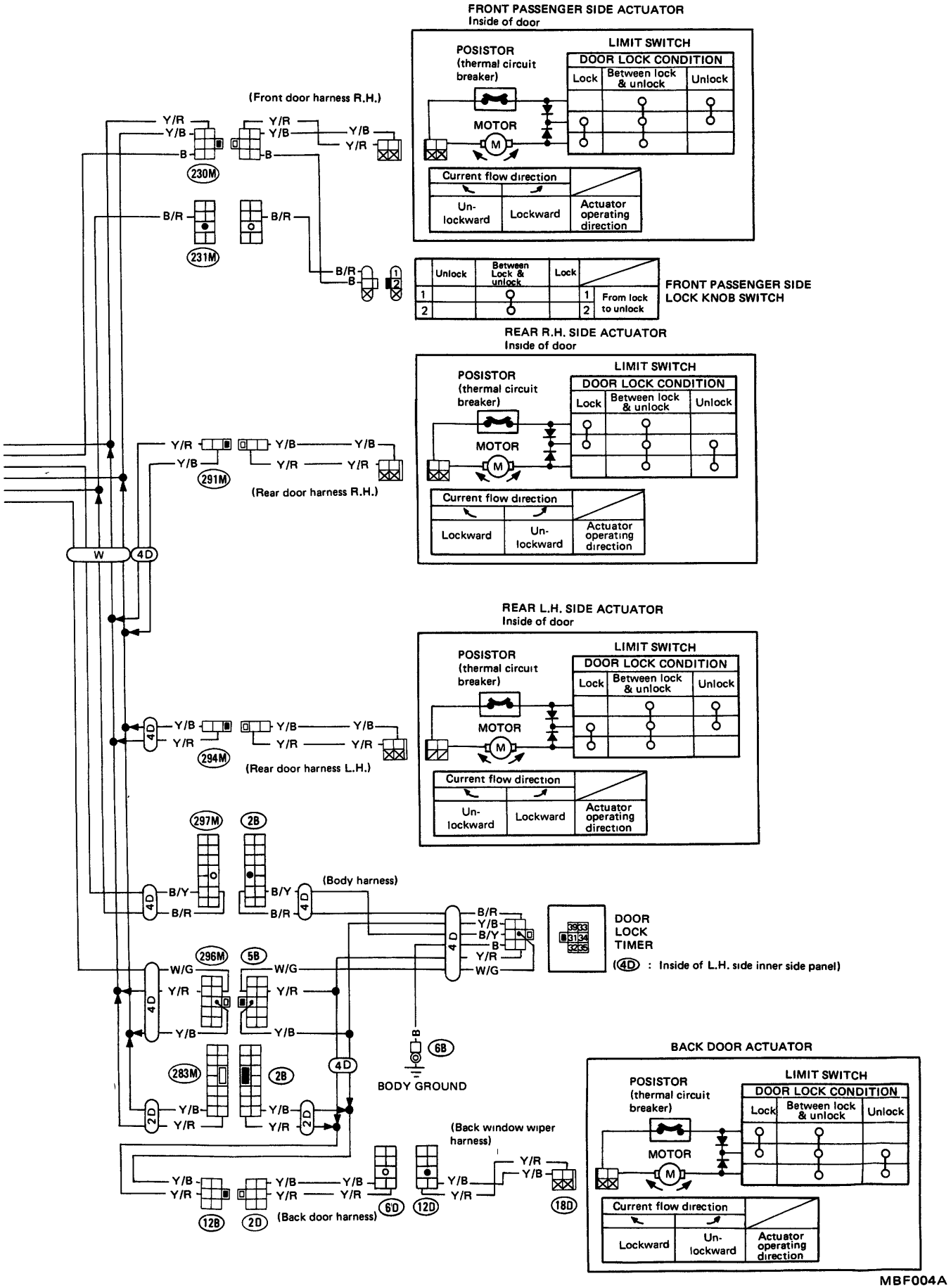
Power Door Lock (Cont'd)

- When Lock-Unlock (Unlock-Lock) is repeated more than two or three times rapidly using the door lock-&-unlock switch connected to driver side door lock knob, the door may either be locked or unlocked by itself, or the actuator may not be activated. This depends on the Lock-Unlock operation period and other conditions.
  Avoid this type of operation as a system fault may occur.

WIRING DIAGRAM



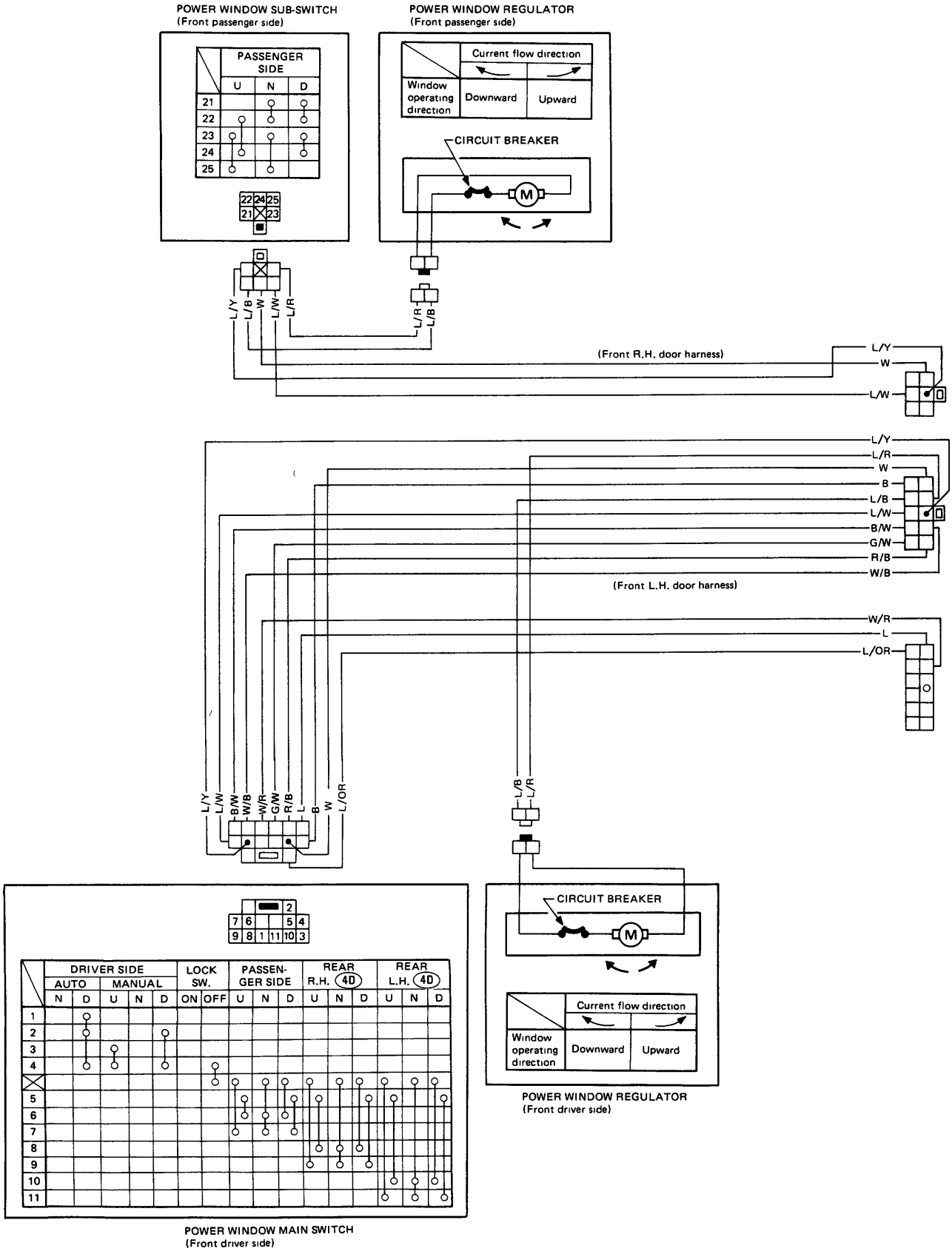
Power Door Lock (Cont'd)



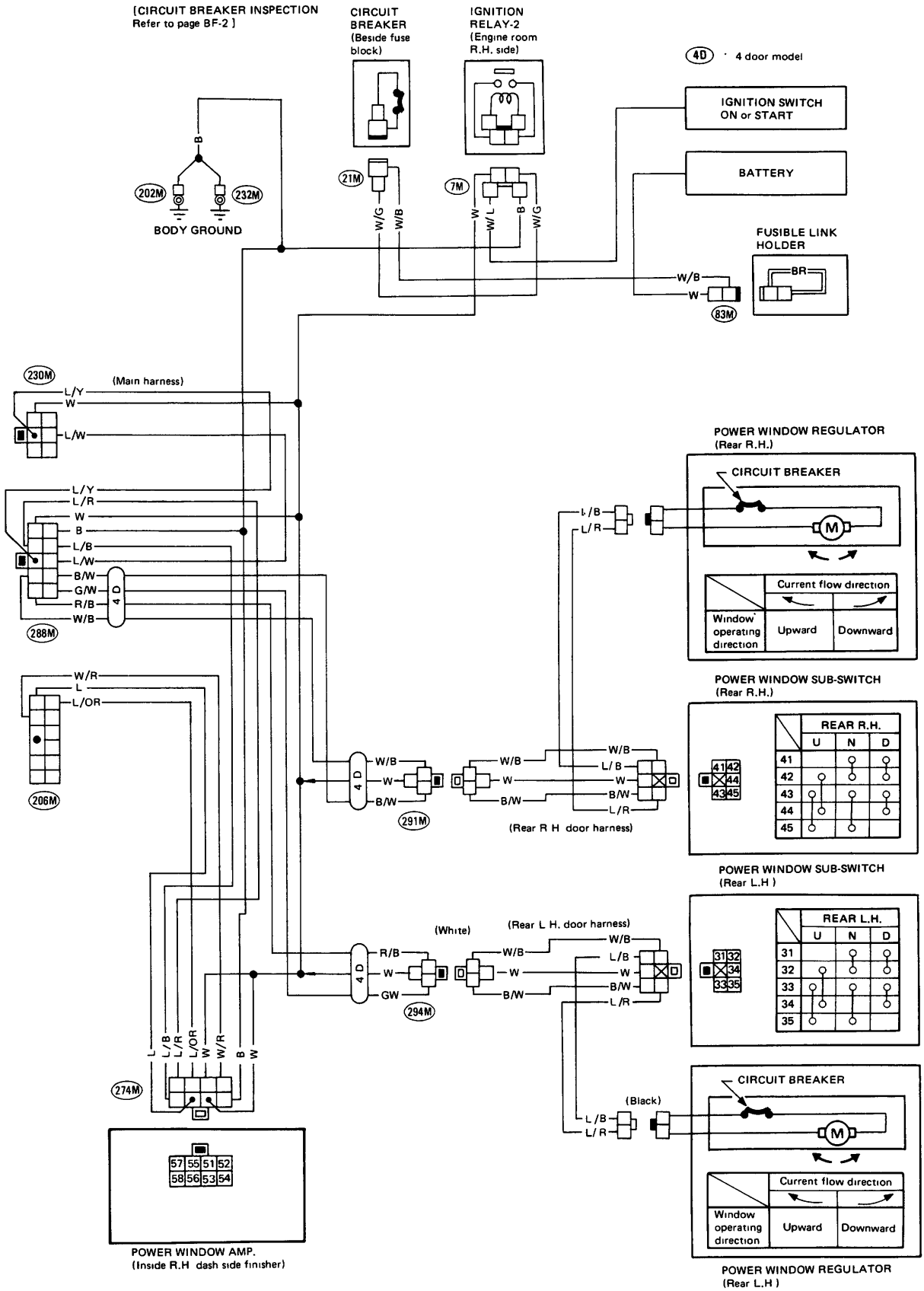
MBF004A

Power Window

WIRING DIAGRAM



Power Window (Cont'd)



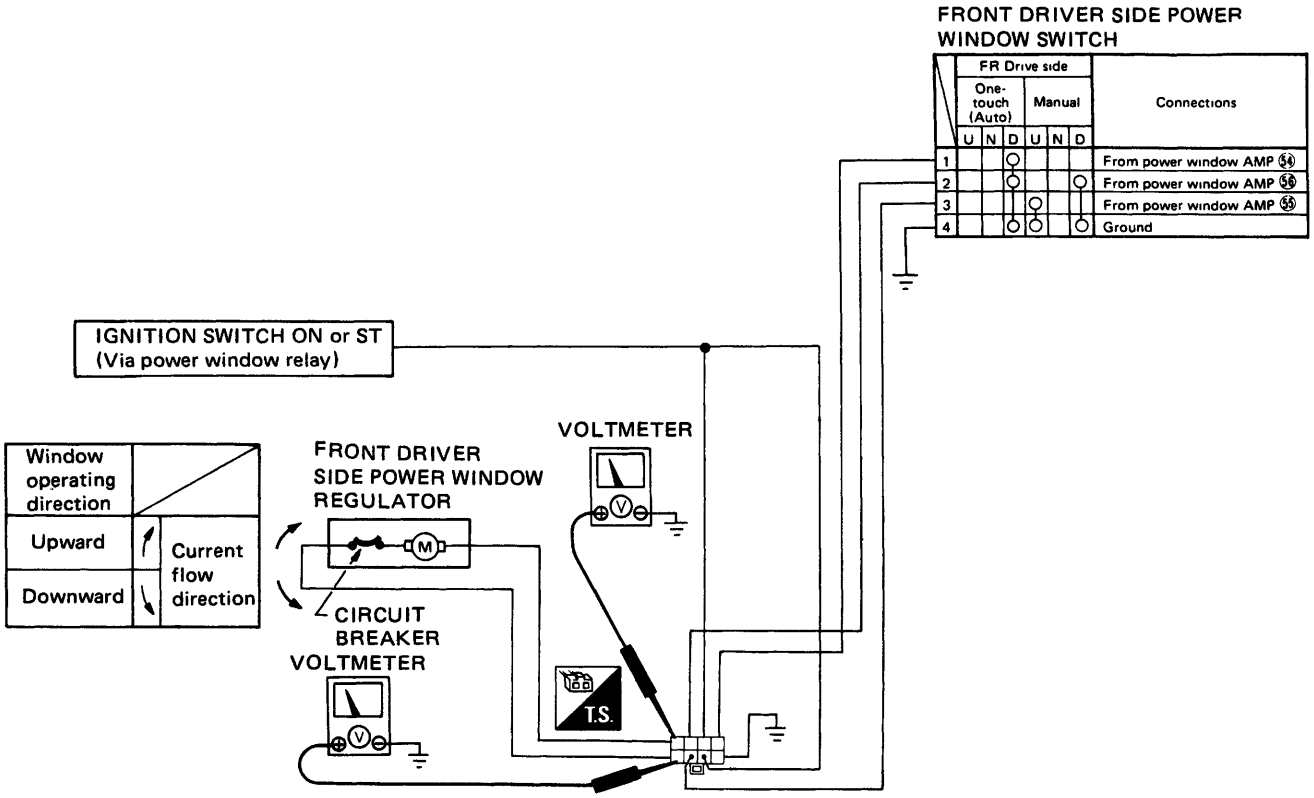
SBF586F

Power Window (Cont'd)

ONE-TOUCH (Auto) OPERATION

Power window system is designed to fully close the driver's window automatically by one-touch (Auto) operation of driver's door window switch. Stopping the window at the fully open or closed position is done by power window amp. operation

Power window amp. inspection



AMP. OPERATION



	Connections		Operations					
			Manual operation			One-touch (Auto) Operation		
51	Power source (IGN)		12V	12V	12V	12V	12V	12V
52	Ground		Ground	Ground	Ground	Ground	Ground	Ground
53	Input signal	From ignition SW (ON or ST)	ON or ST	ON or ST	ON or ST	ON or ST	ON or ST	ON or ST
54	Input signal	To FR driver side power window SW (AUTO) 1	OFF	OFF	OFF	OFF	ON	OFF
55	Input signal	To FR driver side power window SW (UP) 3	OFF	ON	OFF	OFF	OFF	OFF
56	Input signal	To FR driver side power window SW (DOWN) 2	OFF	OFF	ON	OFF	ON	OFF
57	Output signal	FR driver side regulator (Upward power source)	Approx 0V	Approx. over 9V	Approx. 0V	Approx. 0V	Approx. 0V	Approx. 0V
58	Output signal	FR driver side regulator (Downward power source)	Approx 0V	Approx. 0V	Approx. over 9V	Approx. 0V	Aprrox over 9V	Approx. over 9V

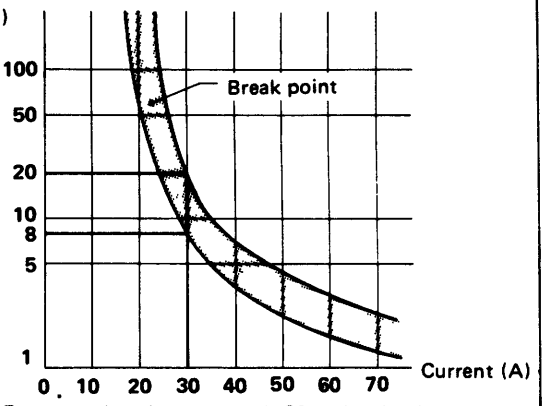
Regulator Operating Condition	Stop	Upward operation	Downward operation	Stop	Starting	Keeping operation until fully open, then stops automatically.
					Downward operation	

Carry out this operation check in this chart from left to right continuously.

POWER WINDOW AMP. – Inside of R.H. side dash side finisher

Power Window (Cont'd)

CIRCUIT BREAKER INSPECTION



For example, when current is 30A, the circuit is broken within 8 to 20 seconds.

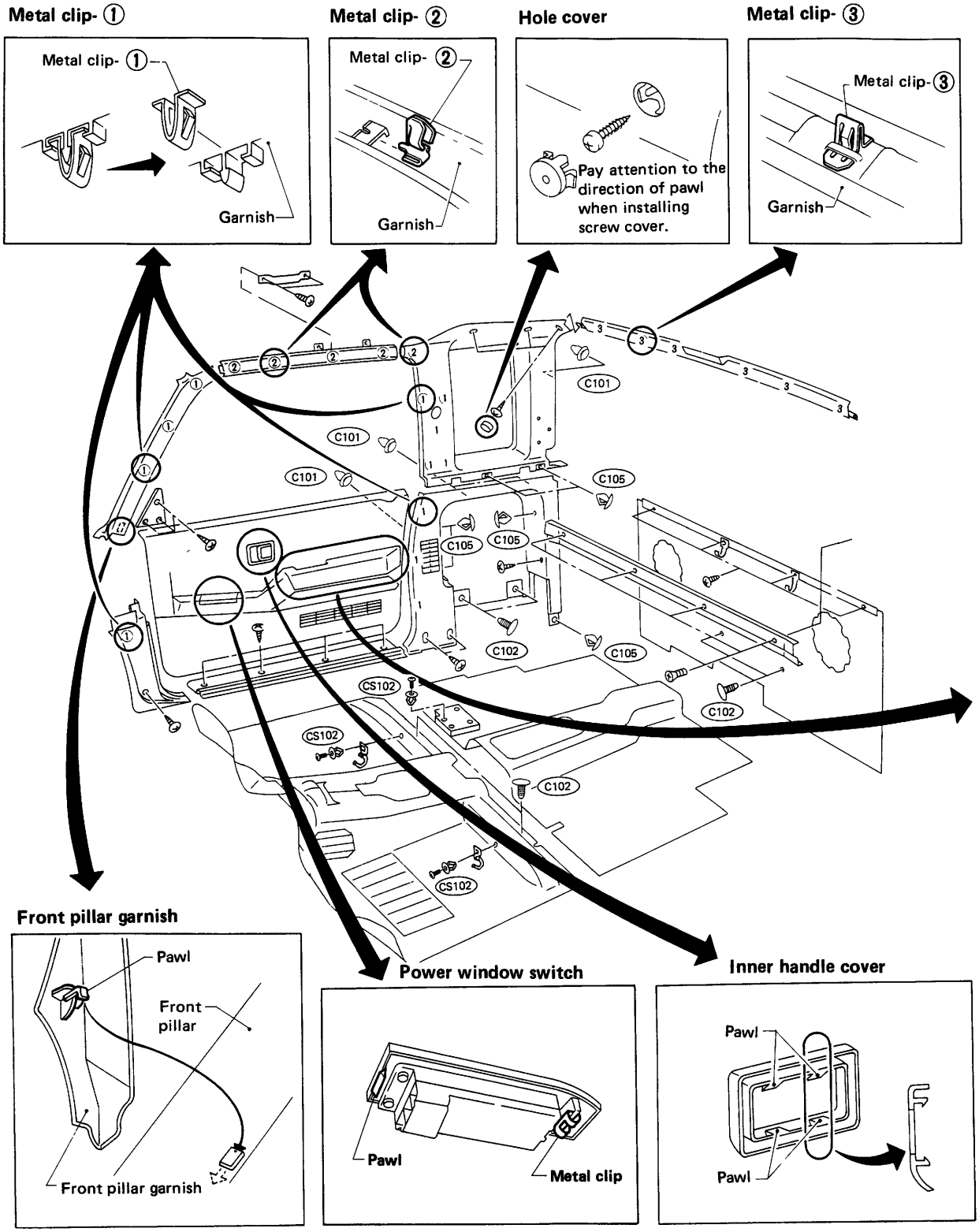
SBF560B

Interior—TRUCK

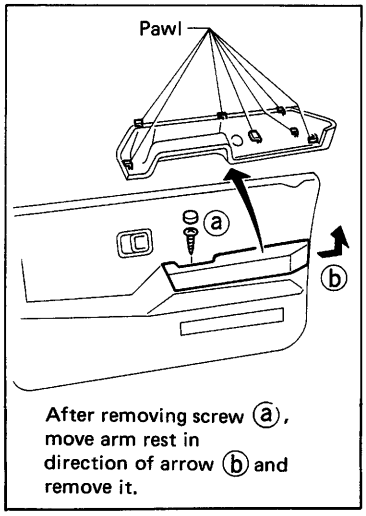
- Apply sealing compound where necessary while installing parts.
- When applying sealing compound, be careful that the sealing compound does not protrude from parts.

SIDE AND FLOOR TRIM — Passenger room

King Cab



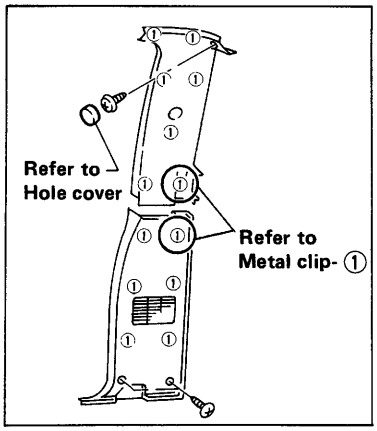
Door arm rest



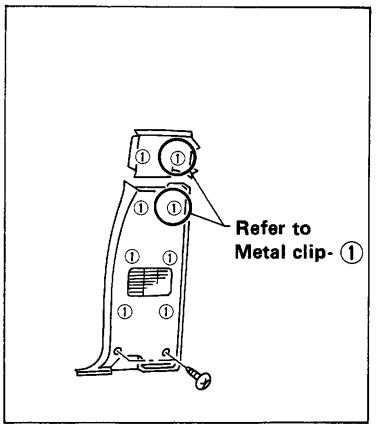
After removing screw ⓐ, move arm rest in direction of arrow ⓑ and remove it.

Regular Cab-Basically the same as King Cab

Center pillar garnish - Type I



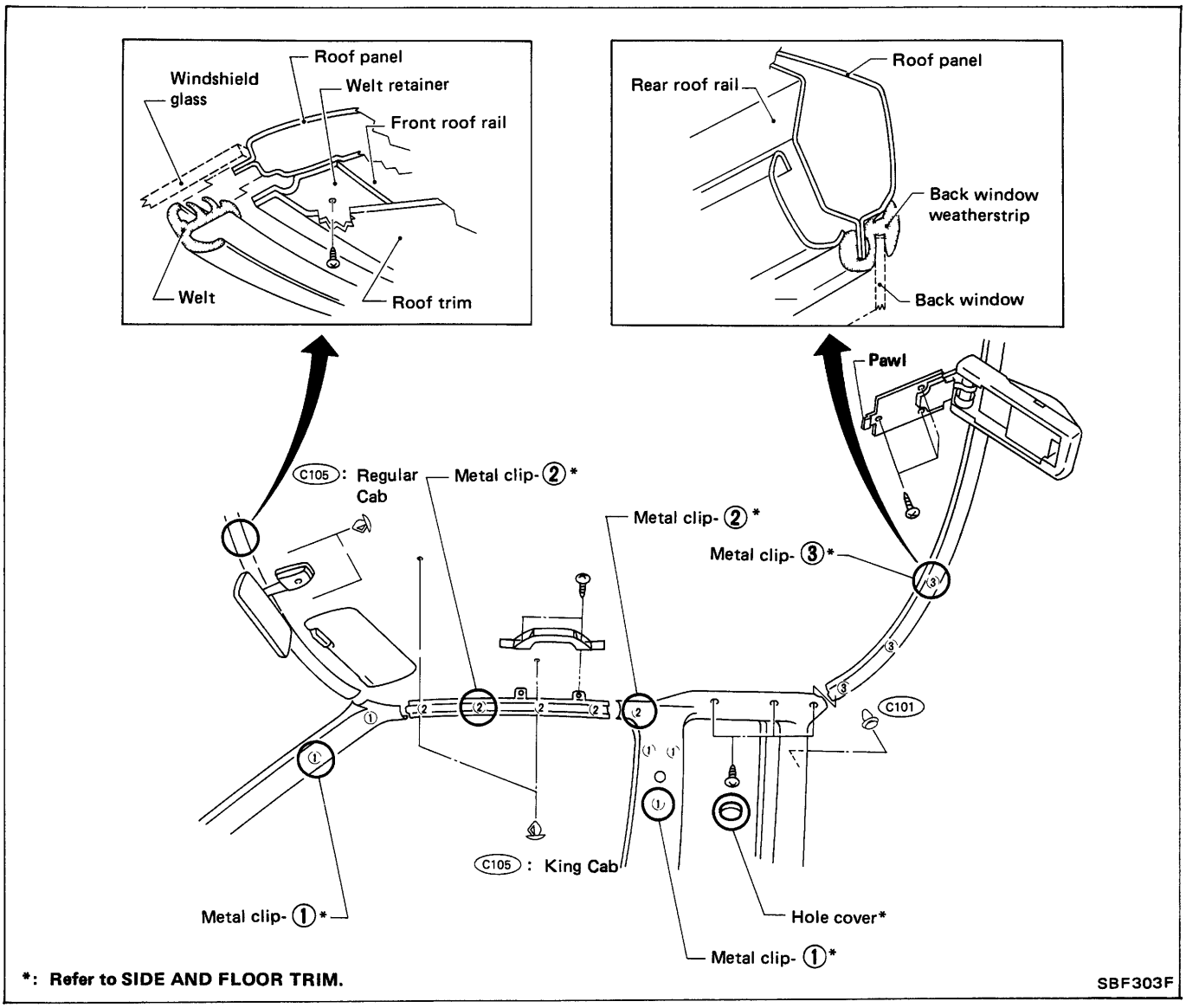
Center pillar garnish - Type II



SBF302F

Interior—TRUCK (Cont'd)

ROOF TRIM – Type I

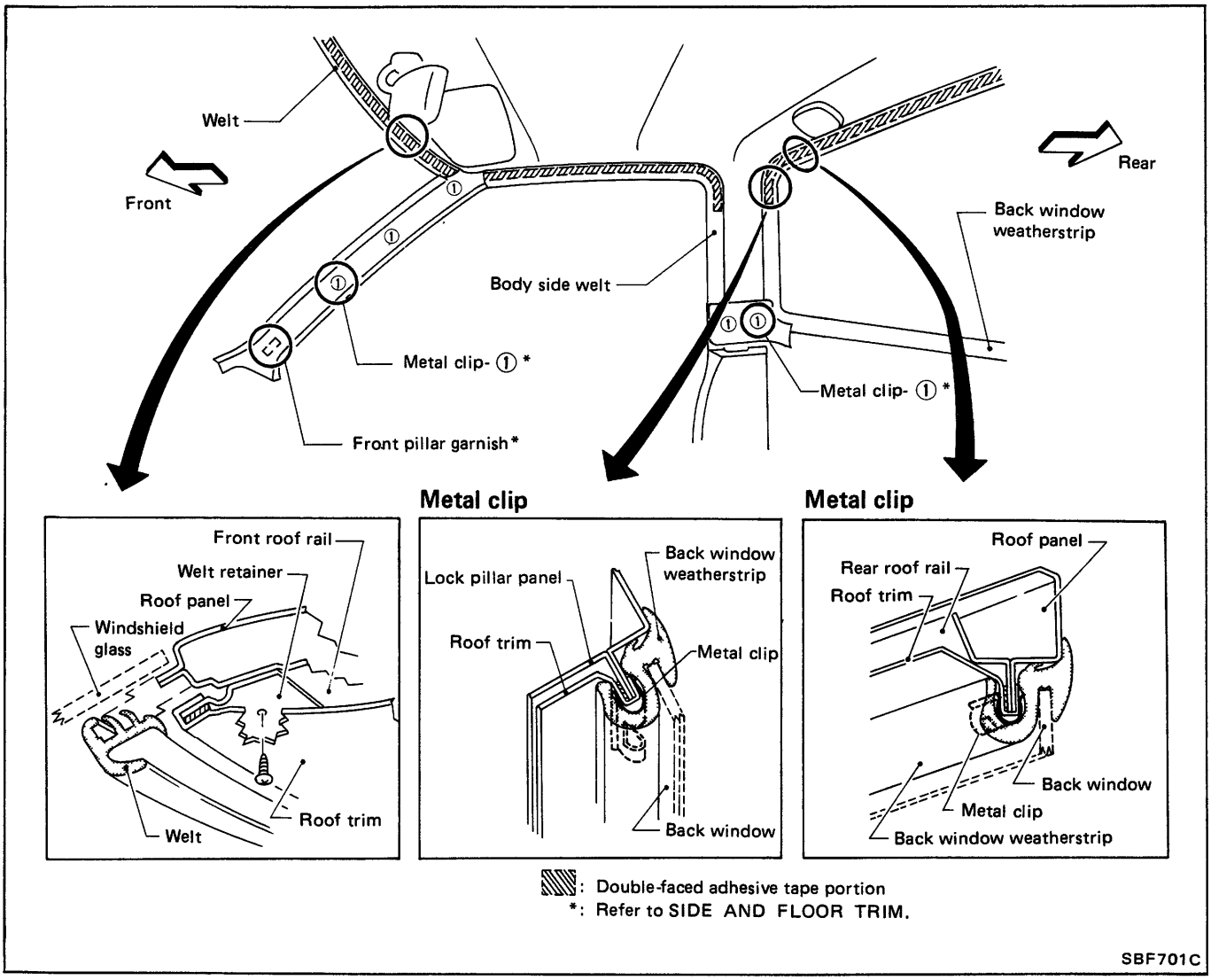


*: Refer to SIDE AND FLOOR TRIM.

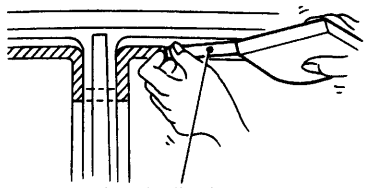
SBF303F

Interior—TRUCK (Cont'd)

ROOF TRIM – Type II

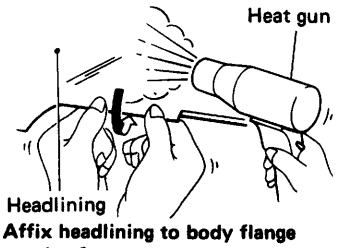


Roof trim installation



Double-faced adhesive tape
Affix double-faced adhesive tape to body flange and install securely.

SBF996A



Affix headlining to body flange starting from corner portion.

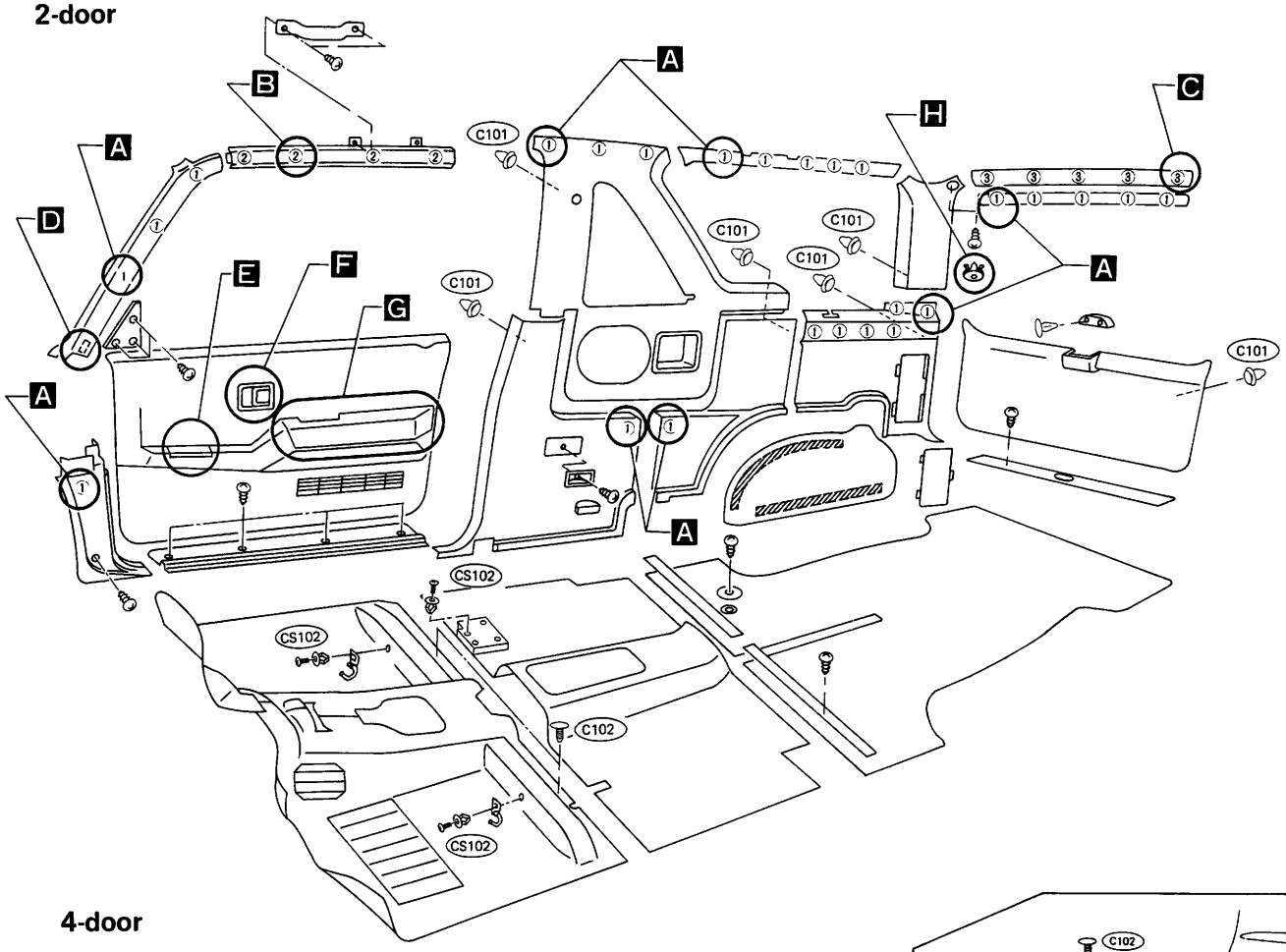
SBF001B

Interior—VAN & WAGON

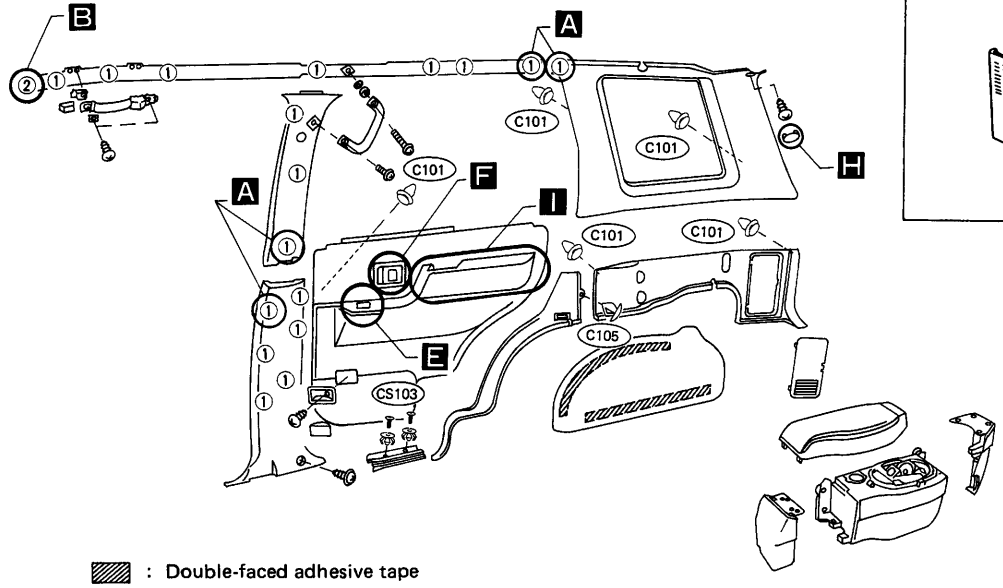
- Apply sealing compound where necessary while installing parts.
- When applying sealing compound, be careful that the sealing compound does not protrude from parts.

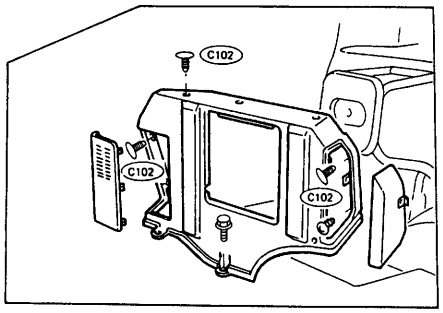
SIDE AND FLOOR TRIM

2-door



4-door



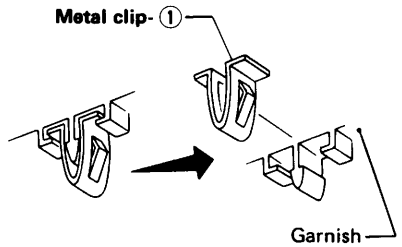


: Double-faced adhesive tape

Interior—VAN & WAGON (Cont'd)

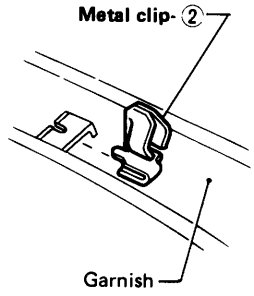
Metal clip- ①

A



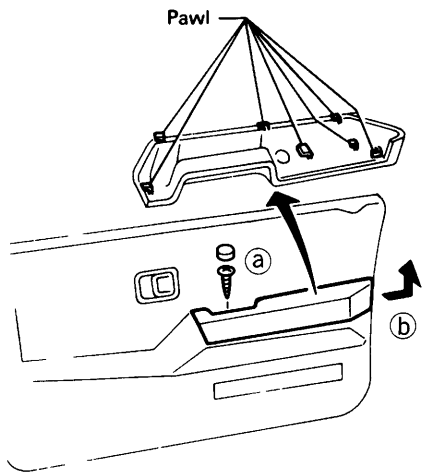
Metal clip- ②

B



Door arm rest (Front)

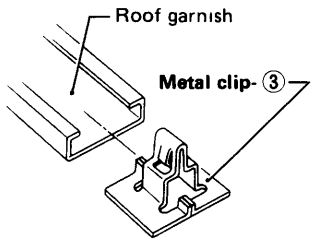
G



After removing screw ⓐ move arm rest in direction of arrow ⓑ and remove it.

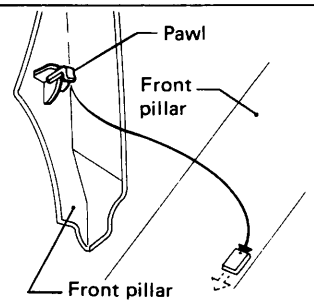
Metal clip- ③

C



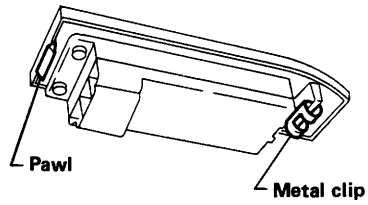
Front pillar garnish

D



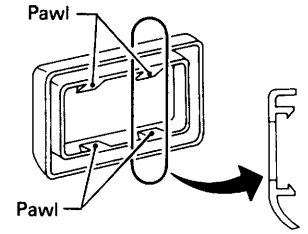
Power window switch

E



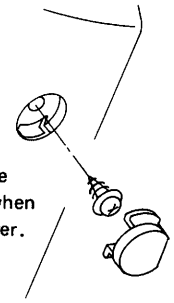
Inner handle cover

F



Hole cover

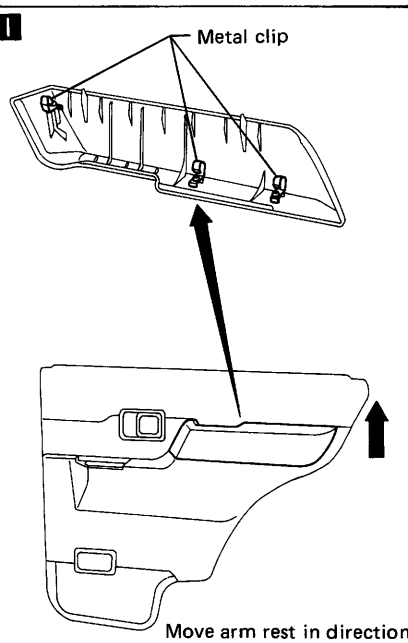
H



Pay attention to the direction of pawl when installing screw cover.

Door arm rest (Rear)

I

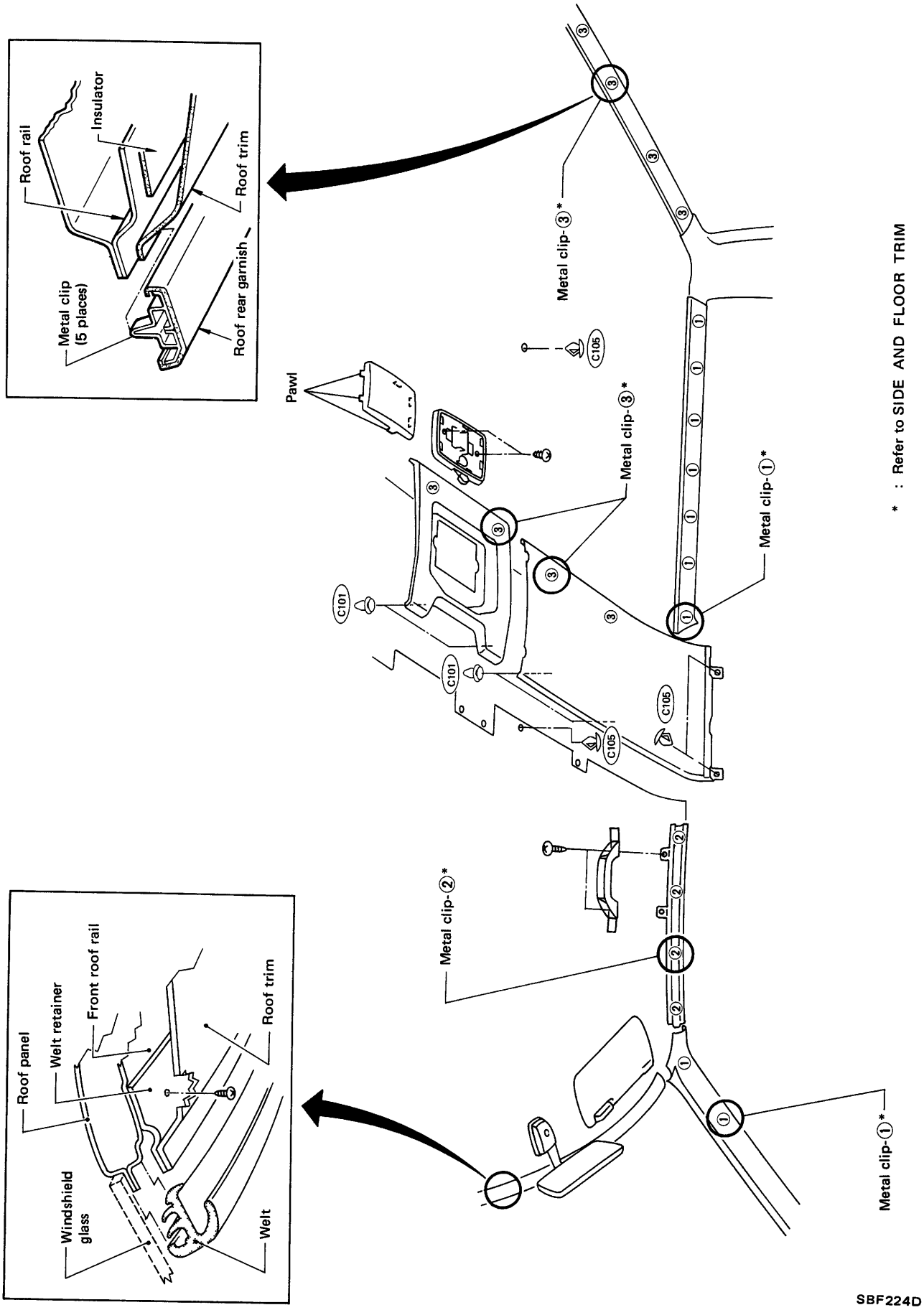


Move arm rest in direction of arrow and remove it.

SBF623F

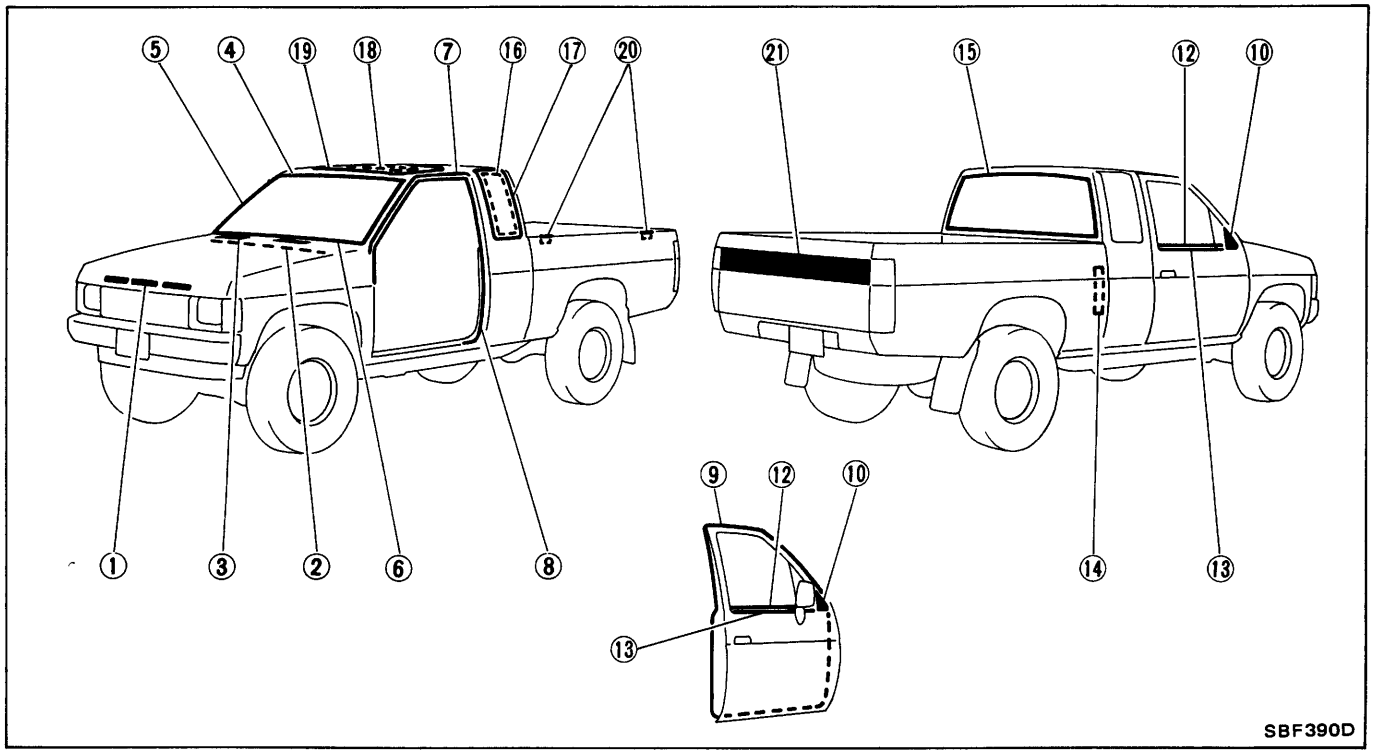
Interior—VAN & WAGON (Cont'd)

ROOF TRIM

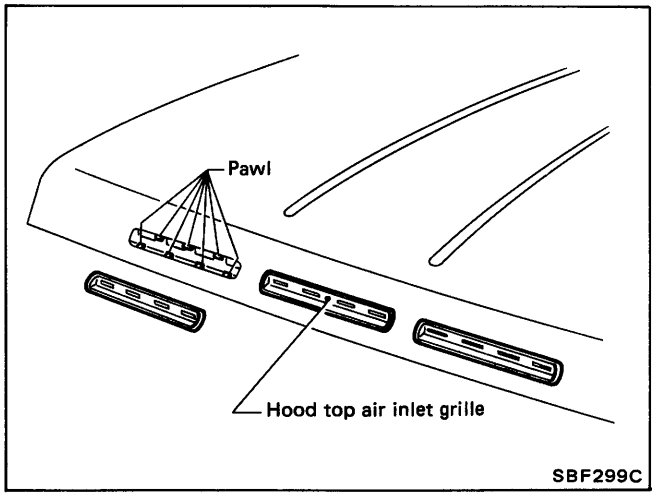


Exterior—TRUCK

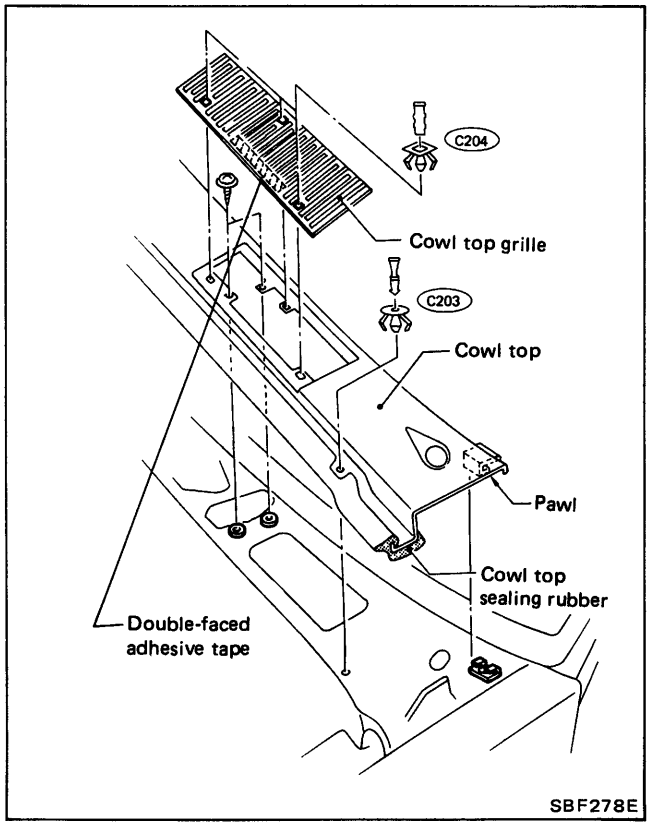
- Apply sealing compound where necessary while installing parts.
- When applying sealing compound, be careful that the sealing compound does not protrude from parts.



① Hood top air inlet grille



② ③ Cowl top sealing rubber & grille

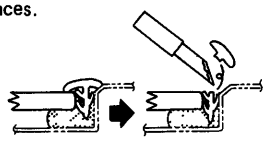


Exterior—TRUCK (Cont'd)

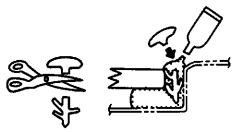
④ Windshield upper molding

Method 1

Cut off top portion of molding and clean glass and panel surfaces.



Apply sealant to top portion of molding.



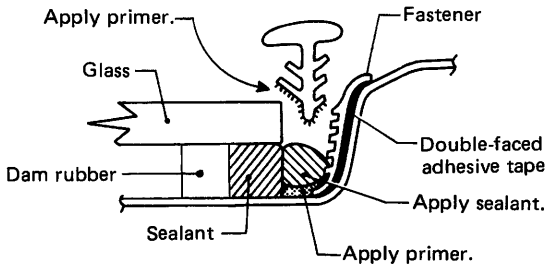
Cut off lower portion of new molding



Finish well to give it a good appearance.

Method 2

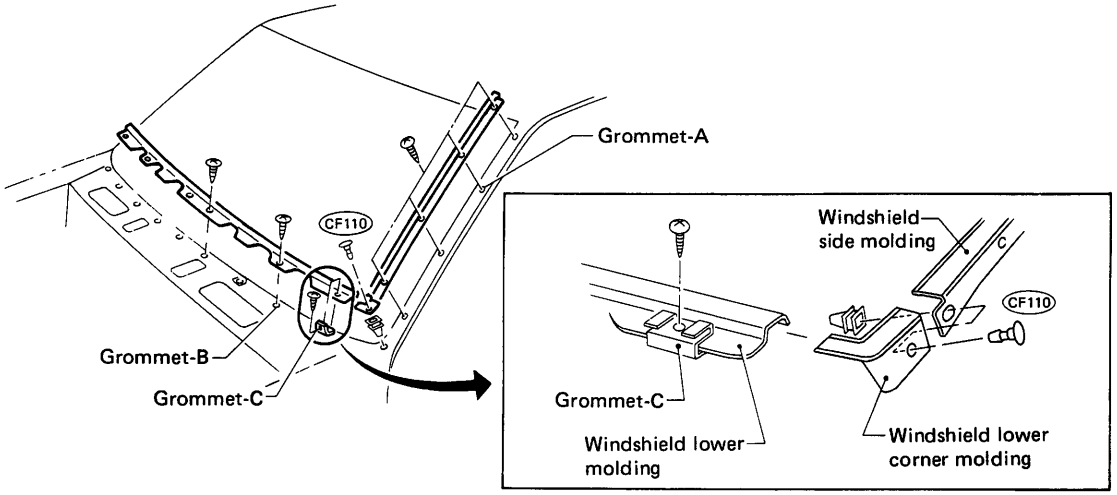
1. Cut off sealant at glass end.
2. Clean the side on which panel was mounted.
3. Set molding fastener and apply sealant & primer to body panel, and apply primer to molding.



4. Install molding by aligning the molding mark located on center with vehicle center.
   Be sure to install tightly so that there is no gap around the corner.

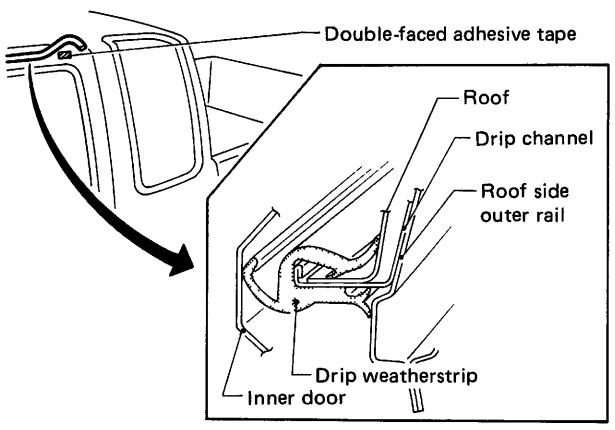
SBF301C

⑤ ⑥ Windshield side & lower molding



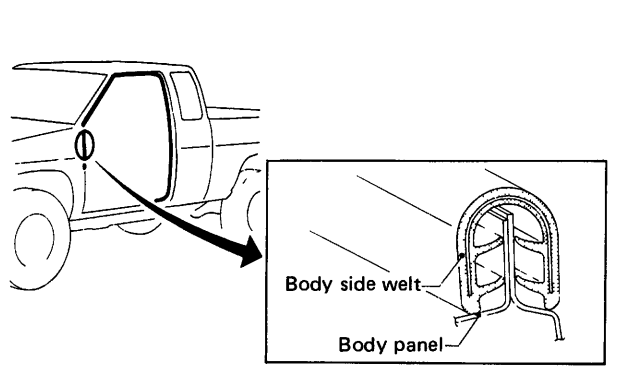
SBF781D

⑦ Drip weatherstrip



SBF303C

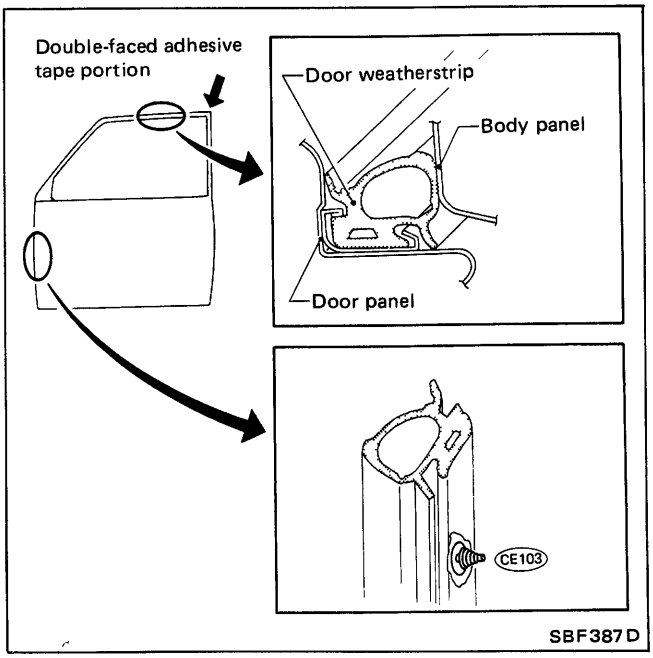
⑧ Body side welt



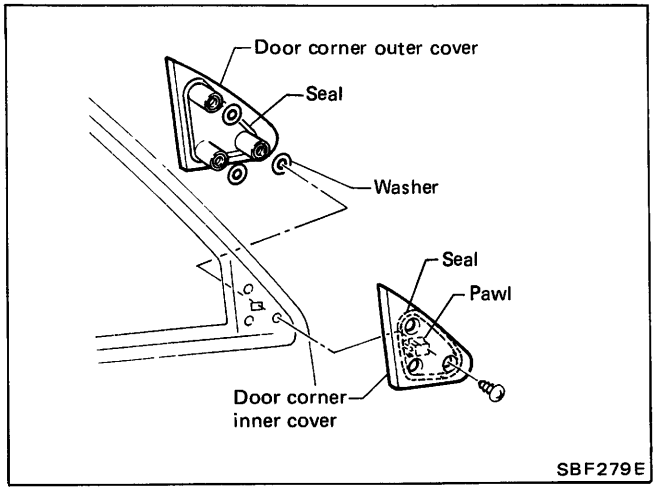
SBF810D

Exterior—TRUCK (Cont'd)

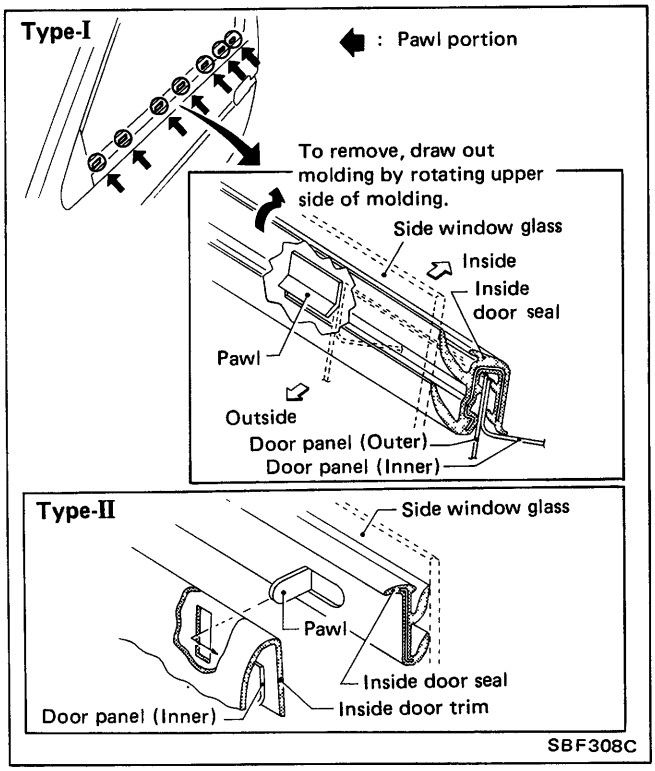
⑨ Door weatherstrip



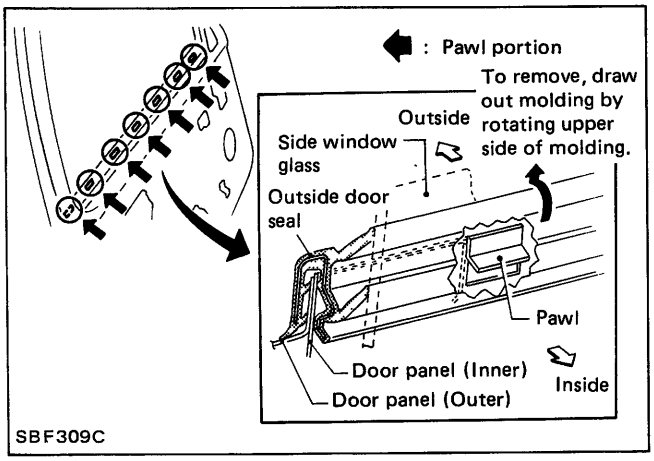
⑩ Door corner cover



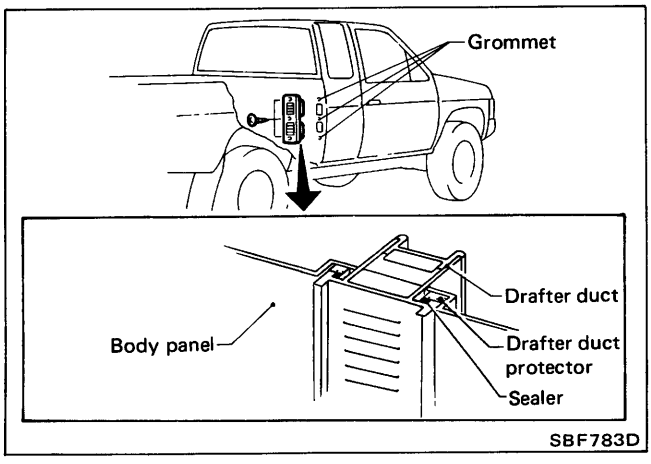
⑫ Door waist inner seal



⑬ Door waist outer seal

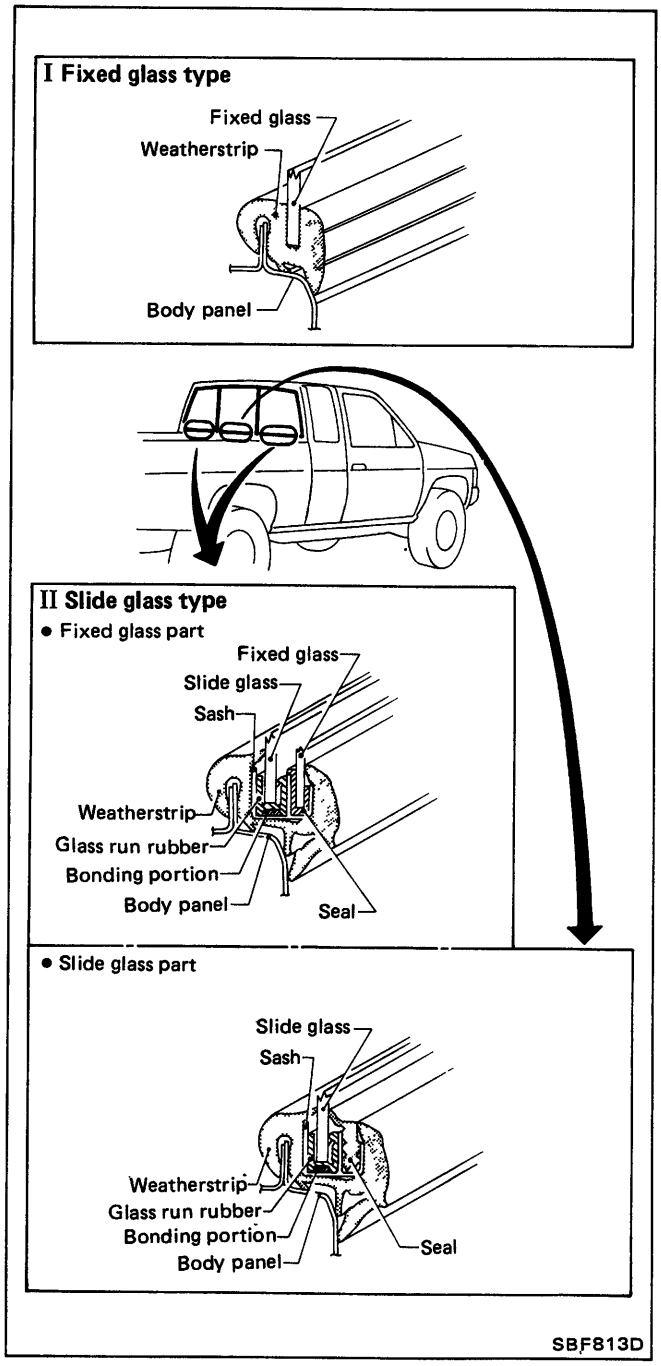


⑭ Drafter duct

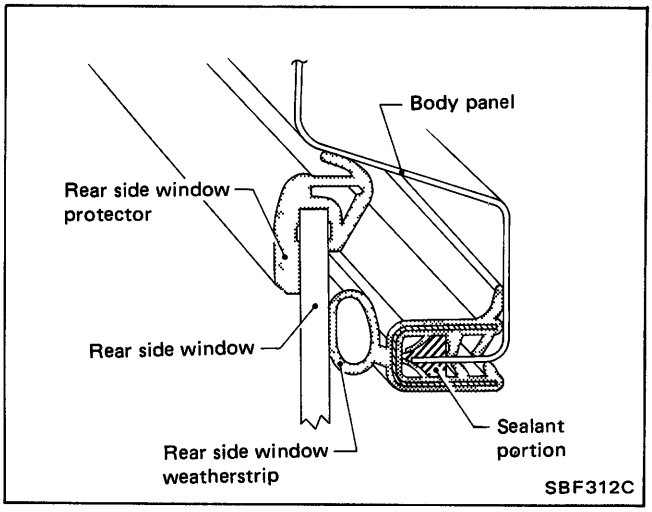


Exterior—TRUCK (Cont'd)

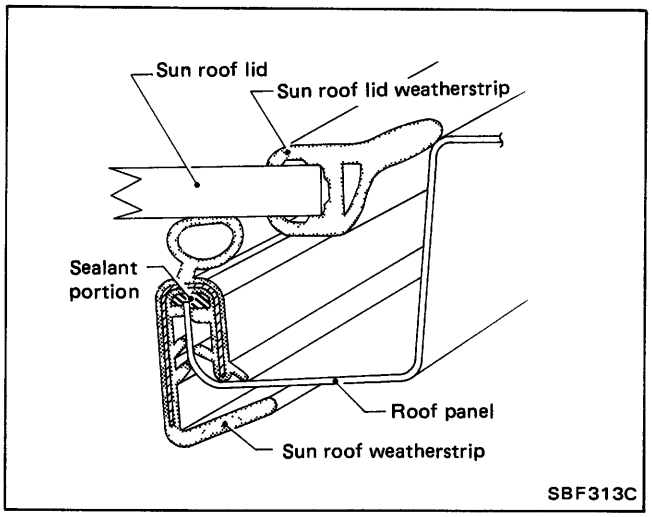
⑮ Back window



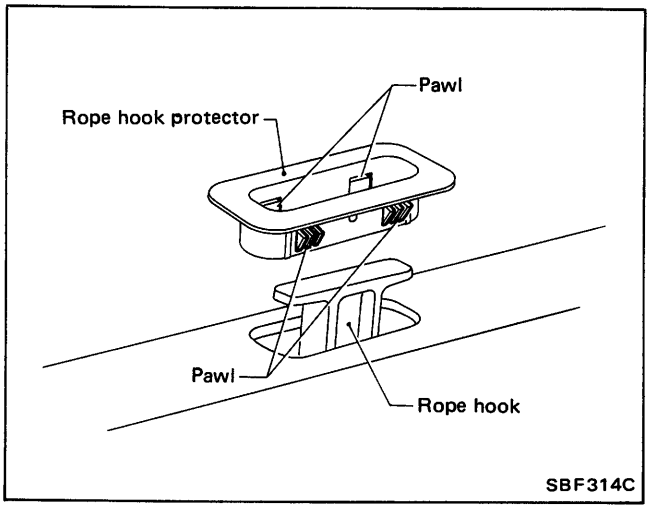
⑯ ⑰ Rear side window weatherstrip and rear side window protector



⑱ ⑲ Sun roof weatherstrip and lid protector

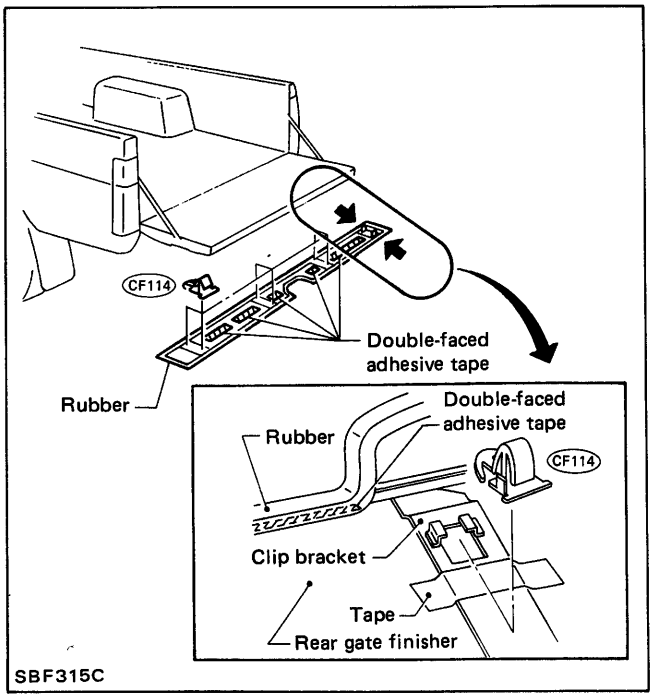


⑳ Rope hook protector



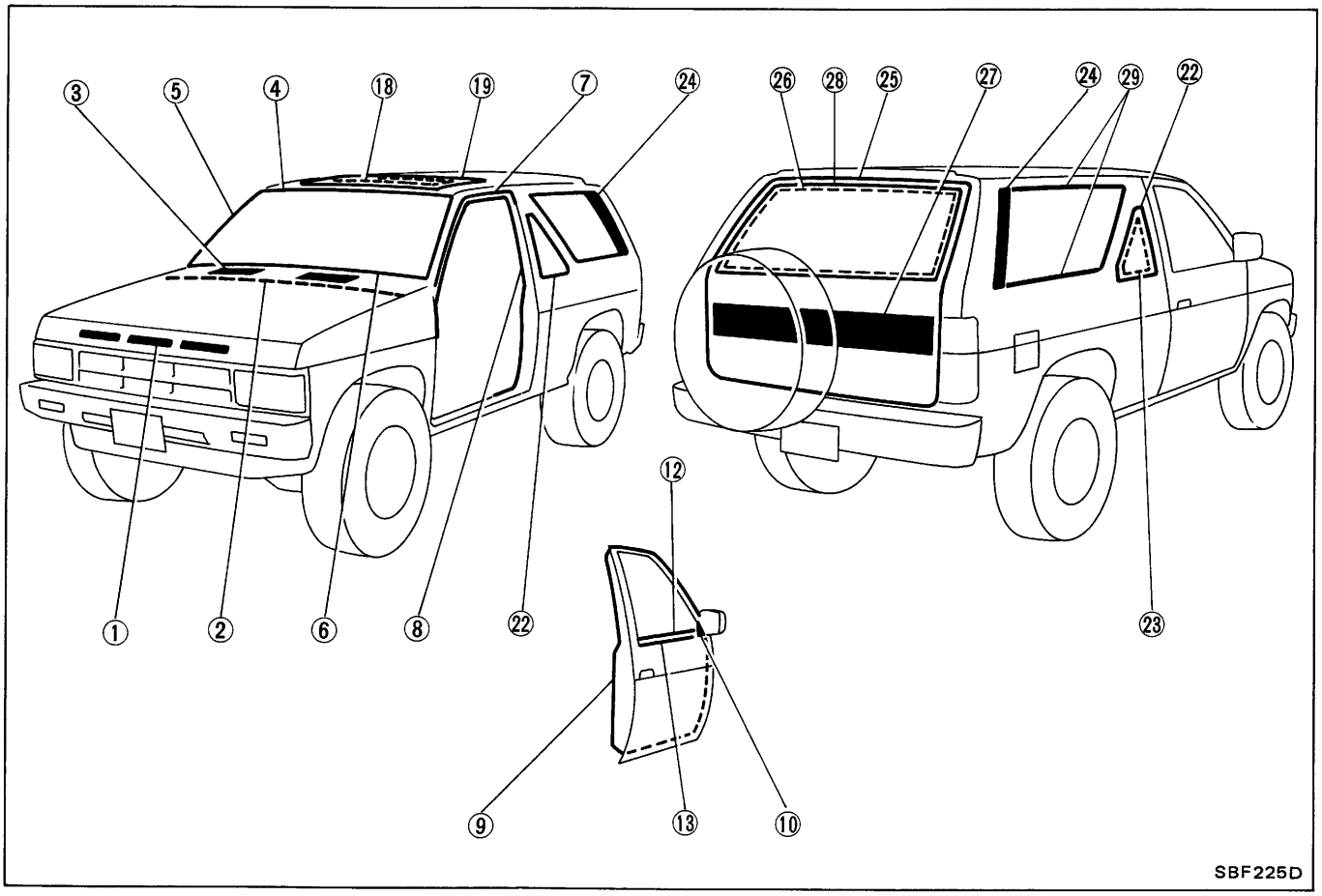
Exterior—TRUCK (Cont'd)

㉑ Rear gate finisher



Exterior—VAN & WAGON

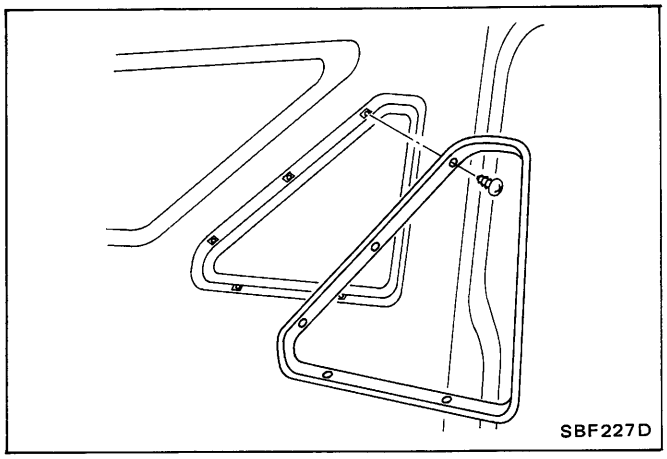
- Apply sealing compound where necessary while installing parts.
- When applying sealing compound, be careful that the sealing compound does not protrude from parts.



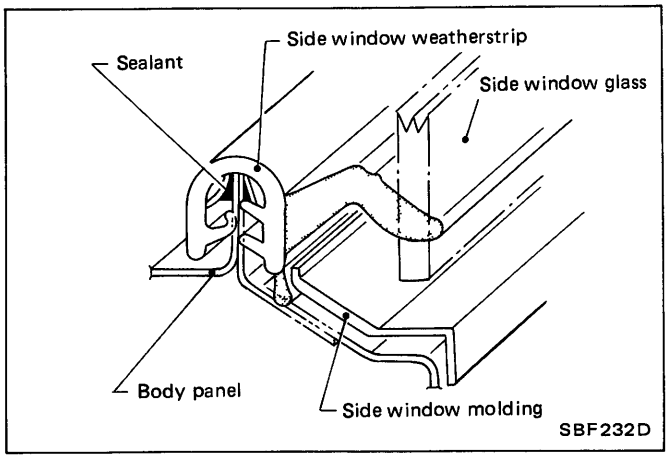
Parts name	Remarks
① Hood top air inlet grille ② ③ Cowl top sealing rubber & grille ④ Windshield upper molding ⑤ ⑥ Windshield side & lower molding ⑦ Drip weatherstrip ⑧ Body side welt & seal ⑨ Door weatherstrip ⑩ Door corner cover ⑫ Door waist inner seal ⑬ Door waist outer seal ⑱ ⑲ Sun roof weatherstrip and lid protector	Basically the same as TRUCK. Refer to the applicable sections on the preceding pages.
㉒ Side window grille ㉓ Side window weatherstrip ㉔ Air outlet grille ㉕ Back door weatherstrip ㉖ Back door window weatherstrip ㉗ Back door finisher	Refer to following description.
㉘ Back door window molding ㉙ 2nd side window molding	Basically the same as ④ windshield upper molding. Refer to the applicable sections on the preceding pages.

Exterior—VAN & WAGON (Cont'd)

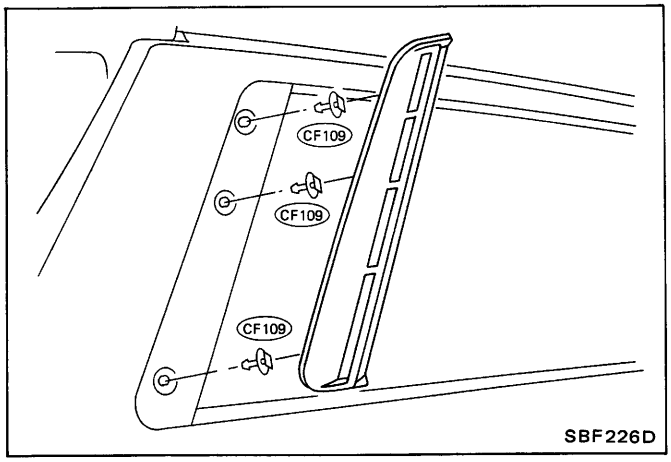
㉒ Side window grille



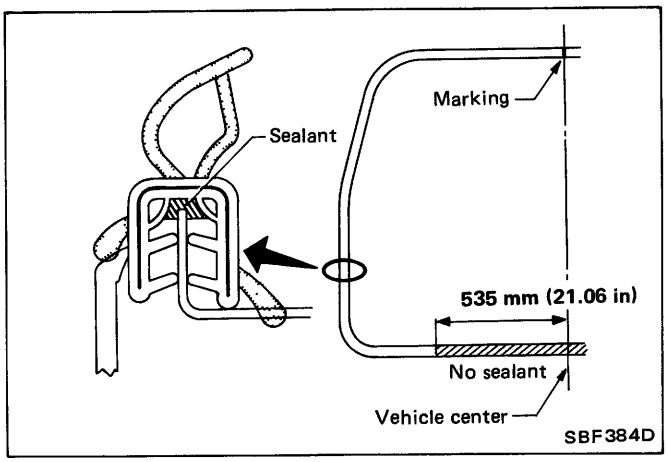
㉓ Side window weatherstrip



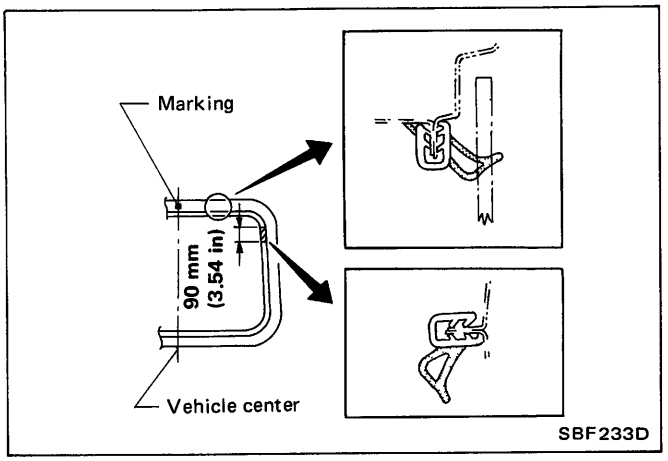
㉔ Air outlet grille



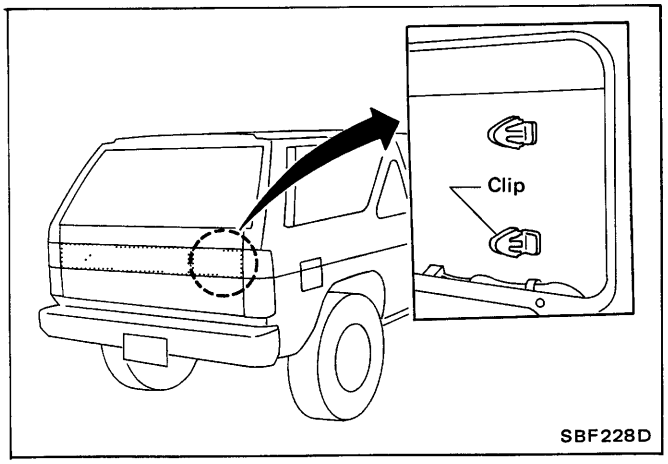
㉕ Back door weatherstrip



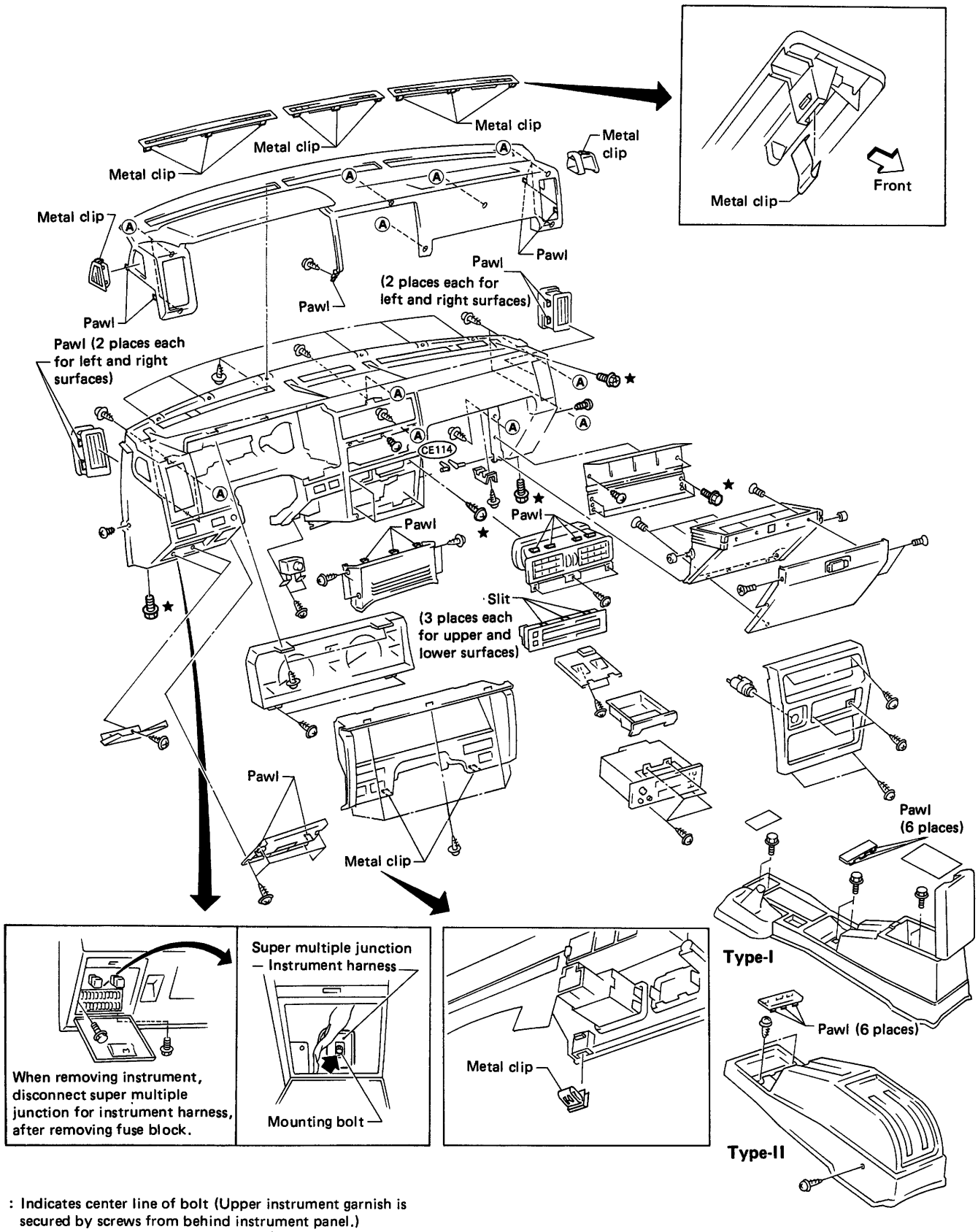
㉖ Back door window weatherstrip



㉗ Back door finisher



- These parts are made of plastic, so do not use excessive force and be careful not to damage it.
- When removing instrument assembly, remove front pillar garnish.



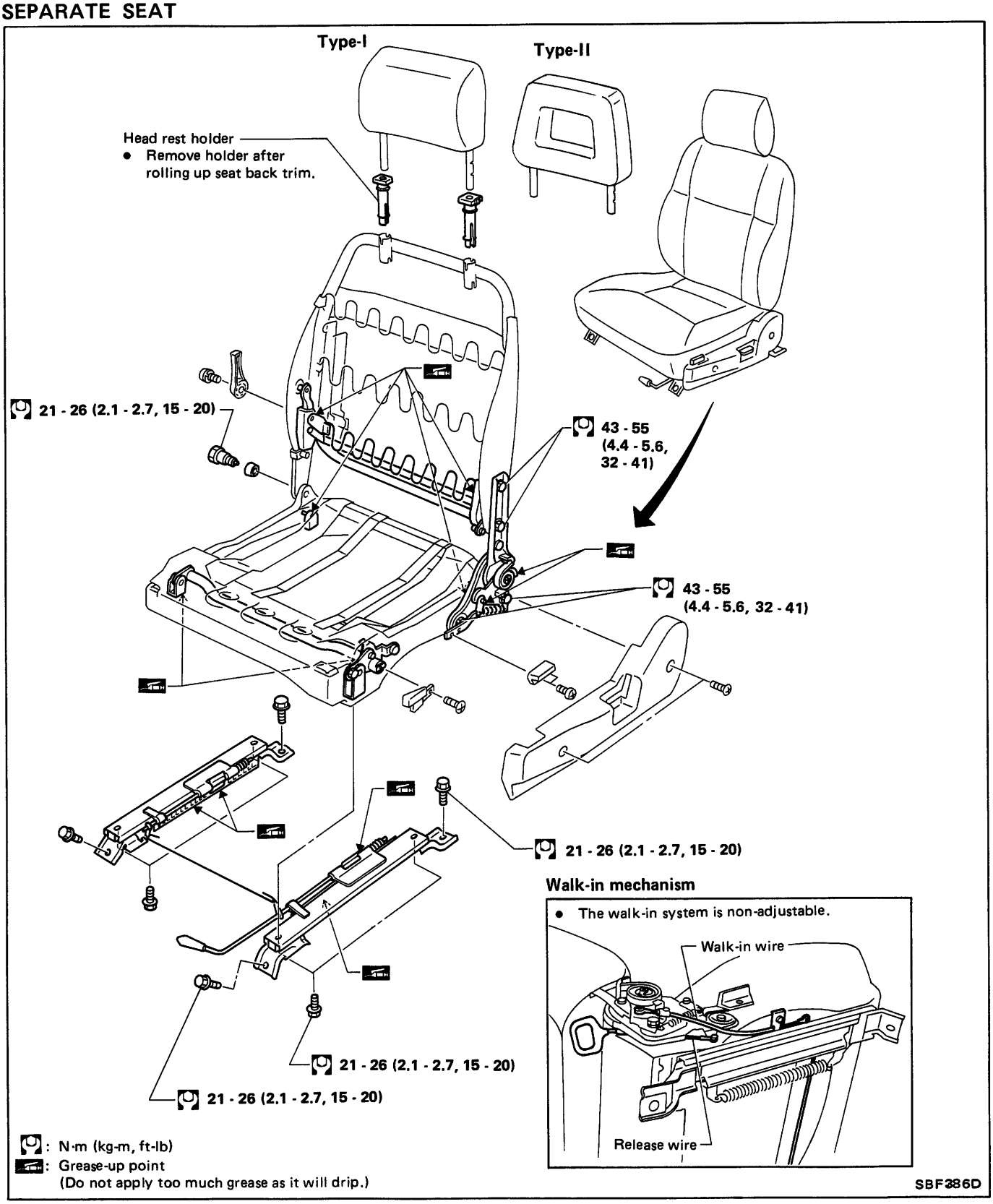
Ⓐ : Indicates center line of bolt (Upper instrument garnish is secured by screws from behind instrument panel.)
★ : Instrument assembly mounting screw

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- When removing or installing the seat trim, carefully handle it to keep dirt out and avoid damage.

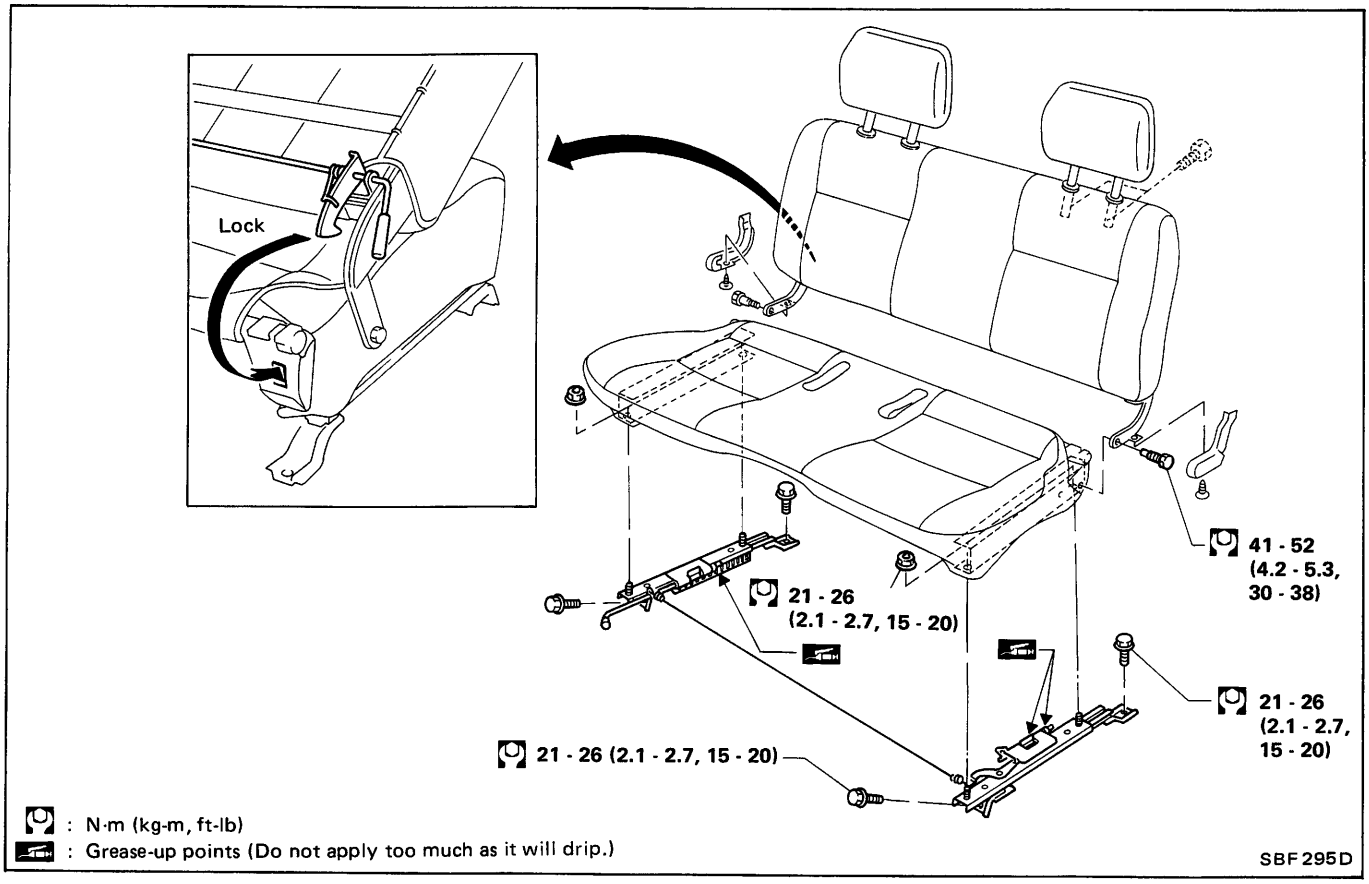
Front Seat

SEPARATE SEAT

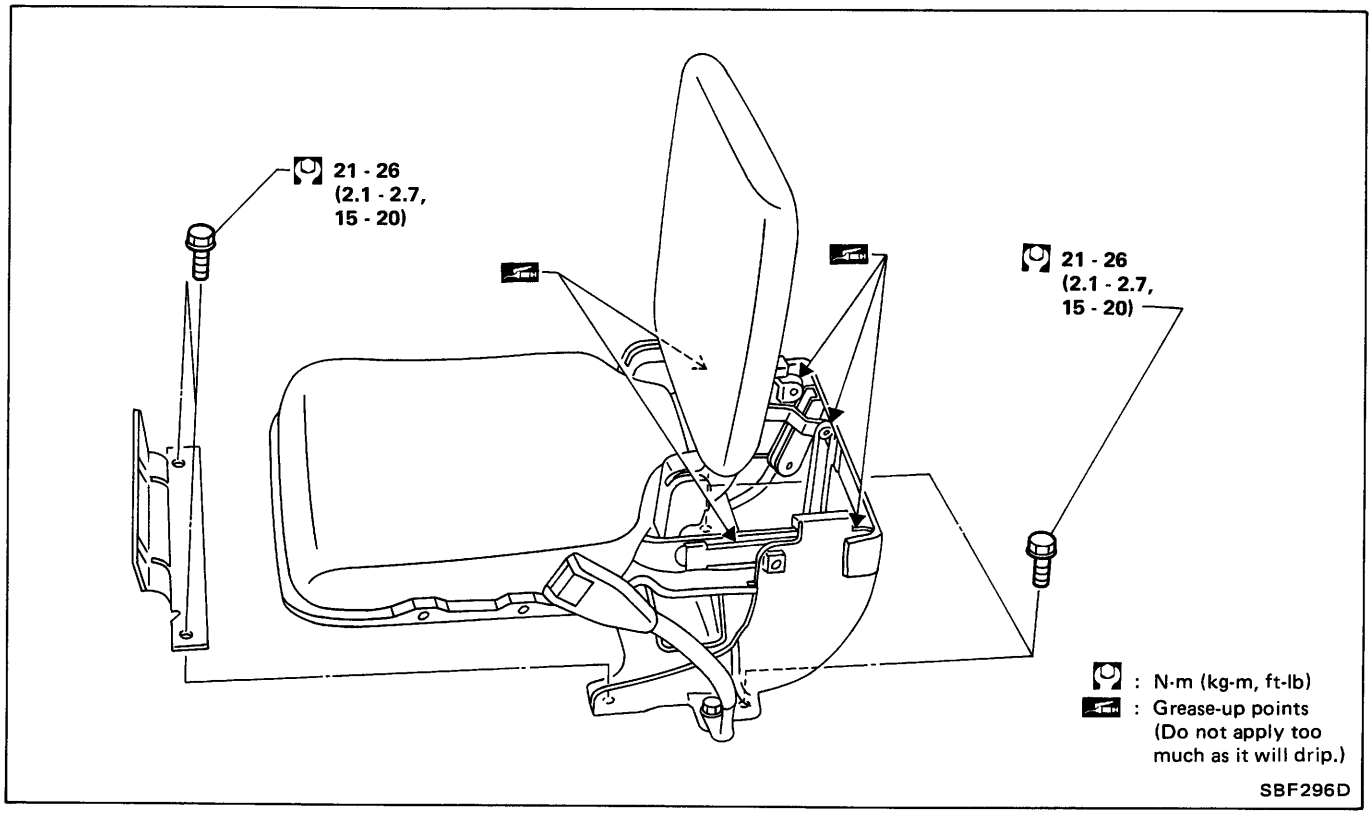


Front Seat (Cont'd)

BENCH SEAT – TRUCK

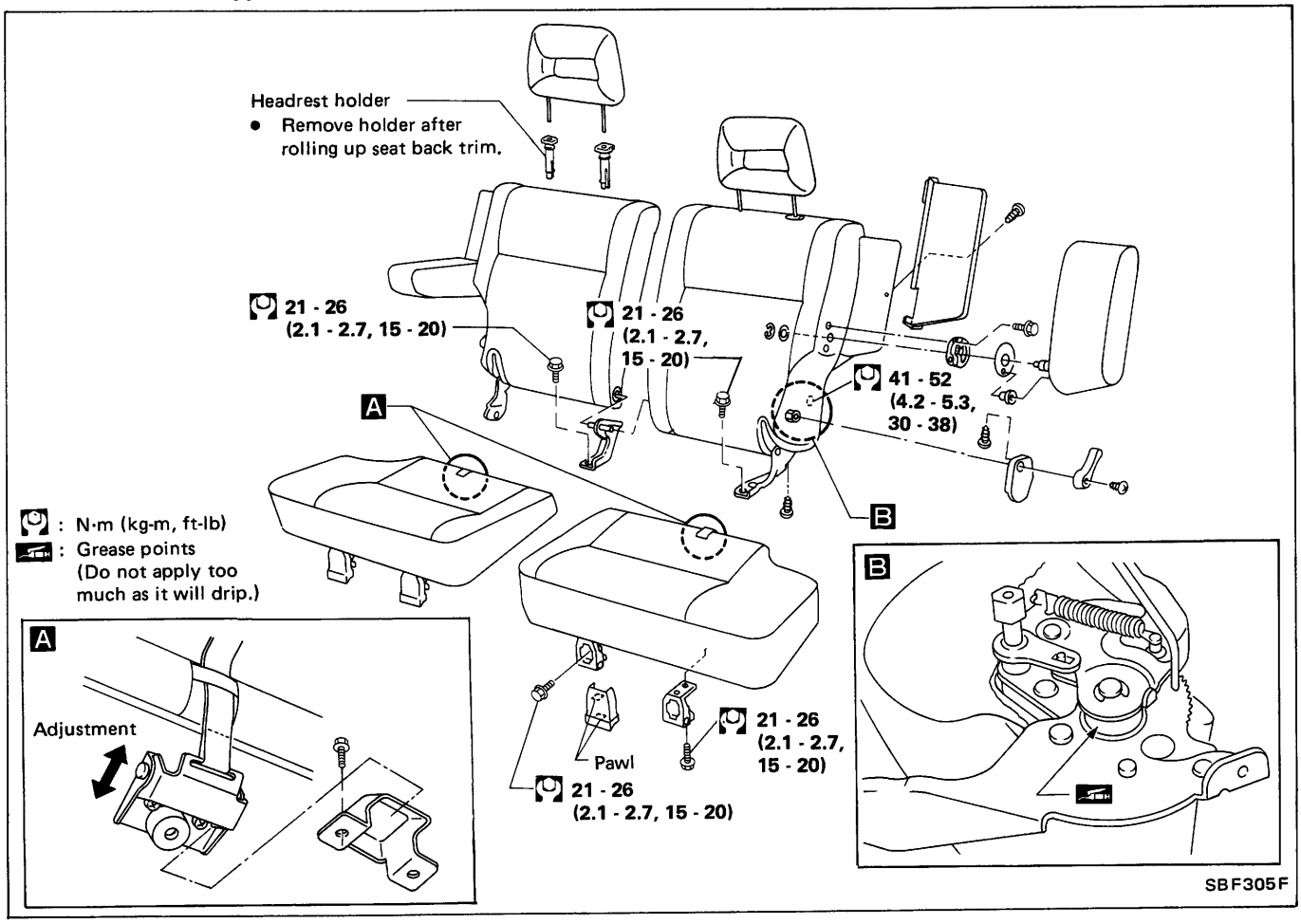


Jump Seat—King Cab Model

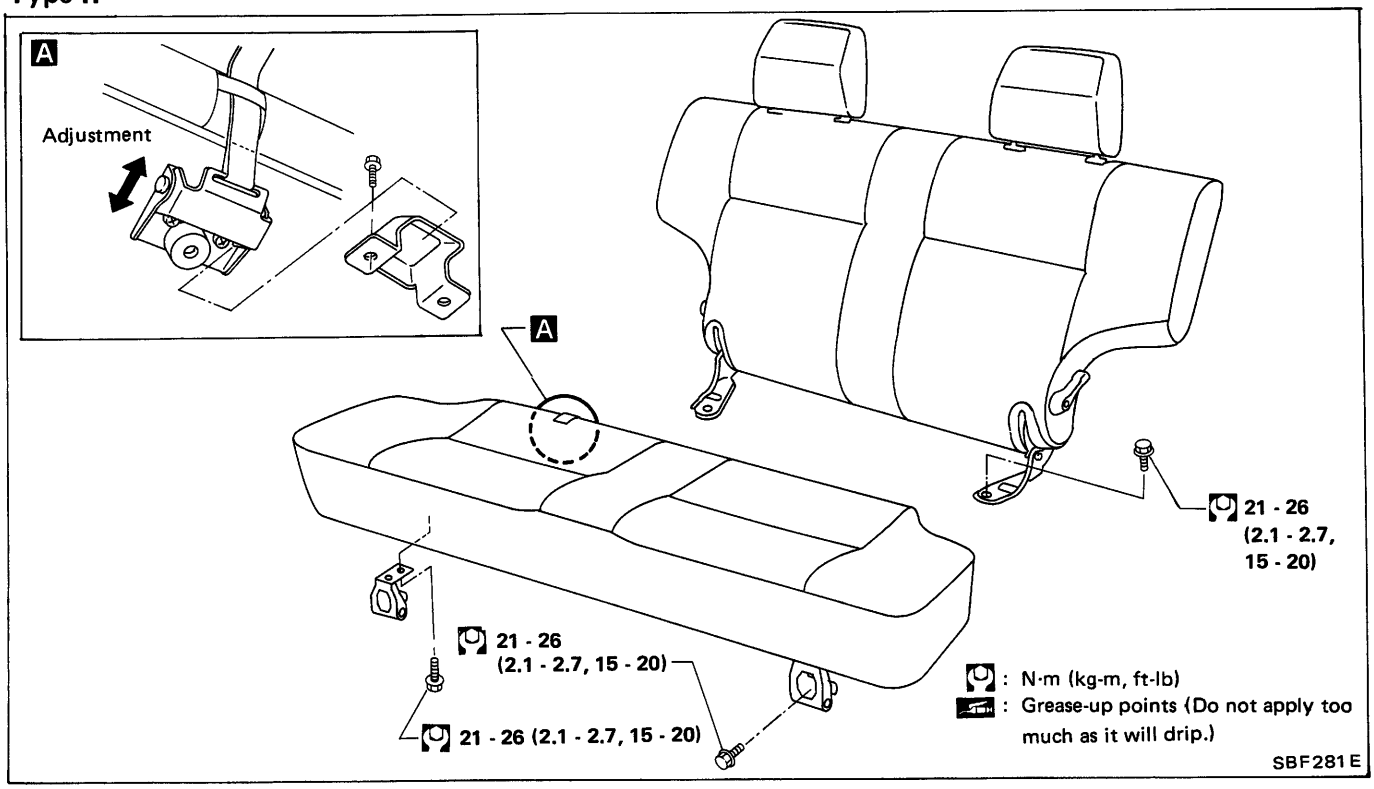


Rear Seat—VAN & WAGON

REAR SEAT – Type I



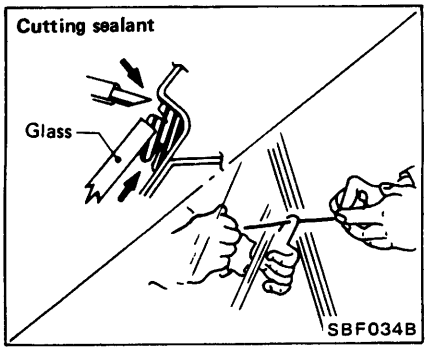
Type-II



Windshield and Back Door Window

REMOVAL

After removing moldings, remove glass.

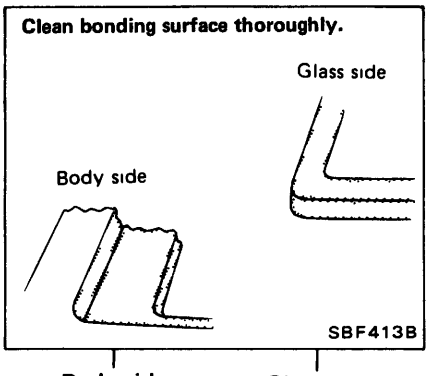


CAUTION:
Be careful not to scratch glass during removal.

INSTALLATION

- **Use genuine Nissan Sealant kit or equivalent. Follow instructions furnished with it.**
- **After installation, the vehicle should remain stationary for about 24 hours.**
- **Do not use sealant which is more than 12 months past its production date.**
- **Do not leave cartridge unattended with its cap open.**
- **Keep primers and sealant in a cool, dry place. Nissan recommends that they are stored in a refrigerator.**
- **Be sure to install moldings.**

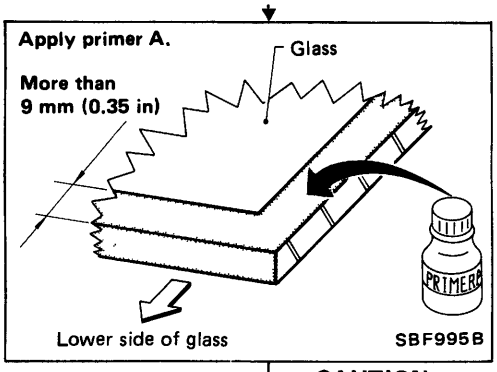
WARNING:
Keep heat or open flames away as primers are flammable.



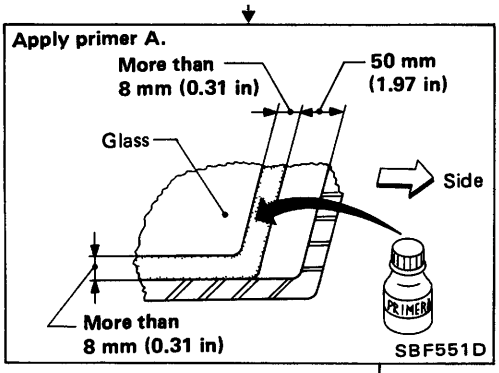
Body side **Glass side**

Windshield | Back door window

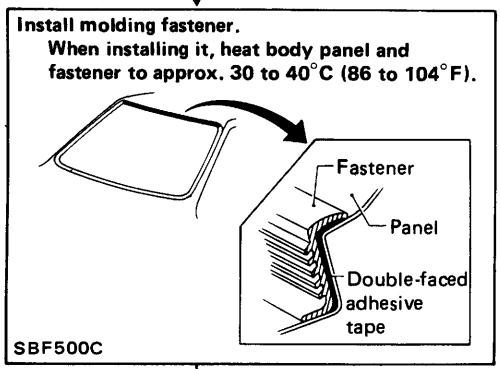
Windshield

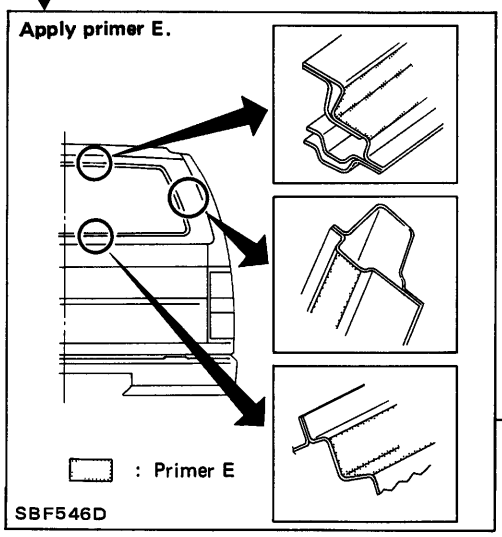


Back door window



CAUTION:
Allow primers to dry for 10 to 15 minutes before proceeding to the next step.





Ⓐ Ⓑ Ⓒ

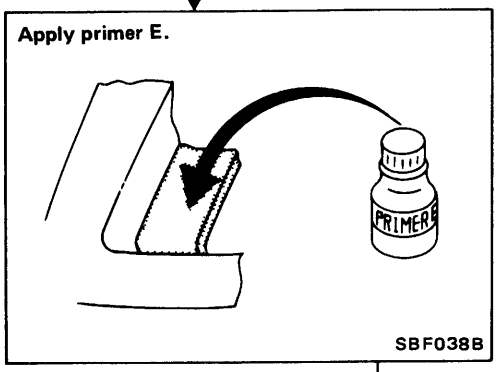
Windshield and Back Door Window (Cont'd)

Ⓐ Windshield

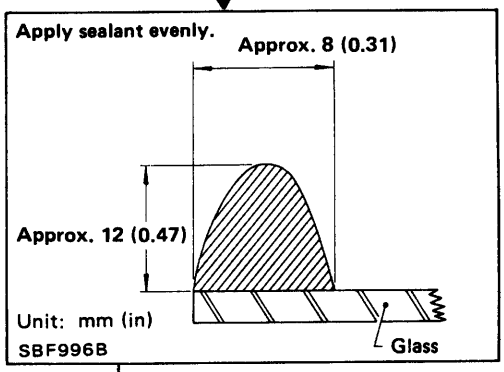
Ⓑ Back door window

Ⓒ

Apply primer E.



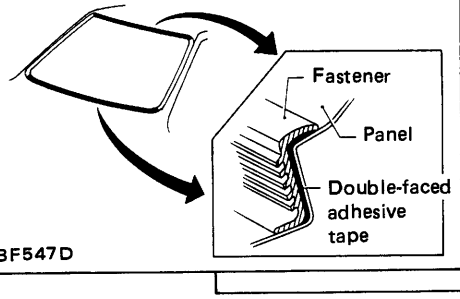
Apply sealant evenly.



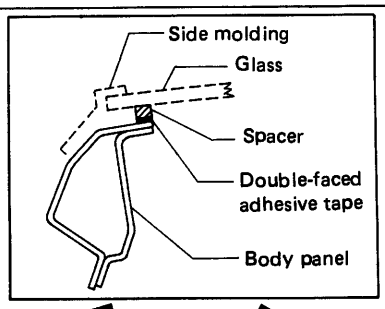
CAUTION:
Allow primers to dry for 10 to 15 minutes before proceeding to the next step.

CAUTION:
Windshield glass should be installed within 15 minutes of applying sealant: sealant starts to harden 15 minutes after it is applied.

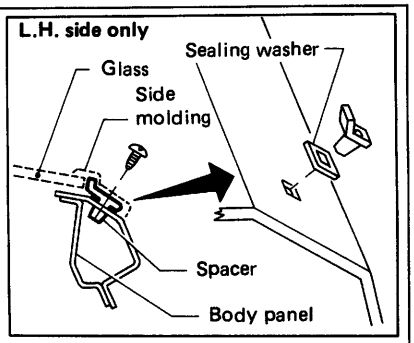
Install molding fastener.
When installing it, heat body panel and fastener to approx. 30 to 40°C (86 to 104°F).

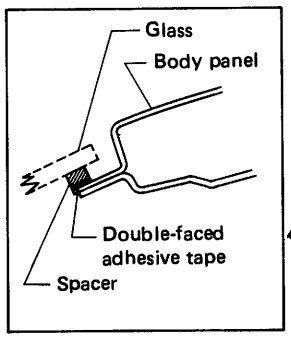


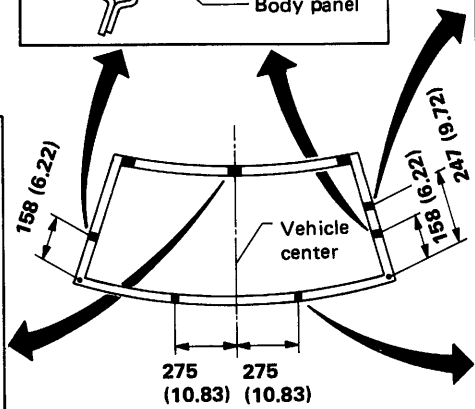
Install spacers to panel.

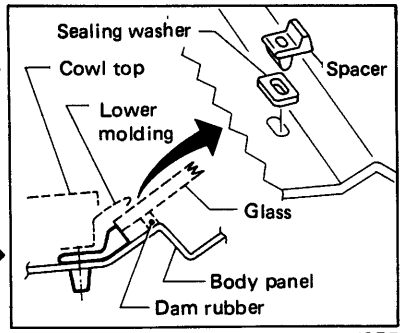


L.H. side only









Unit: mm (in)

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Ⓓ Ⓔ Ⓕ

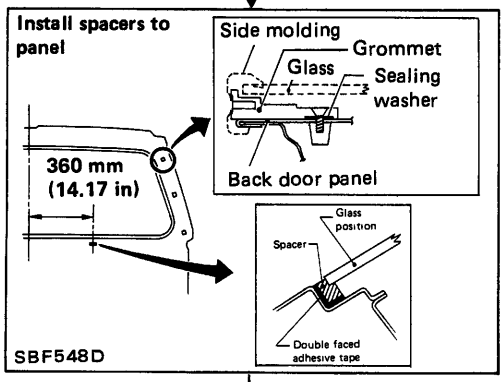
Windshield and Back Door Window (Cont'd)

Ⓓ Windshield

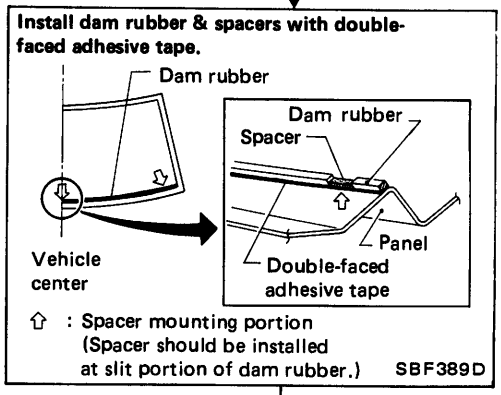
Ⓔ Back door window

Ⓕ

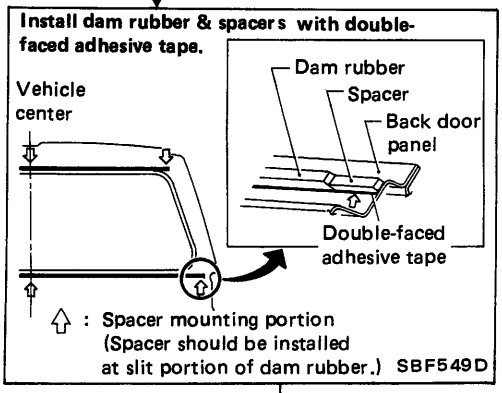
Install spacers to panel



Install dam rubber & spacers with double-faced adhesive tape.



Install dam rubber & spacers with double-faced adhesive tape.

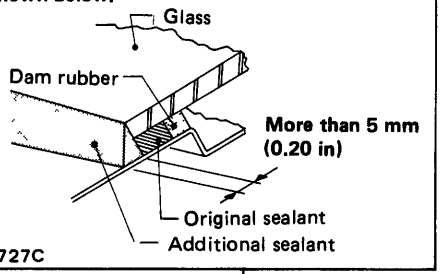


Set glass in position and press glass lightly and evenly.

Windshield

Back door window

Apply sealant additionally to lower portion of glass and make it uniform as shown below.



Ⓖ

Windshield and Back Door Window (Cont'd)

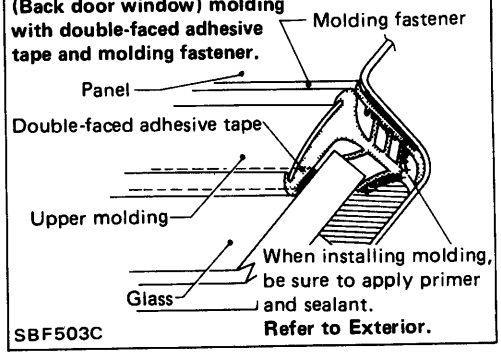
Ⓖ

Check for water leakage.

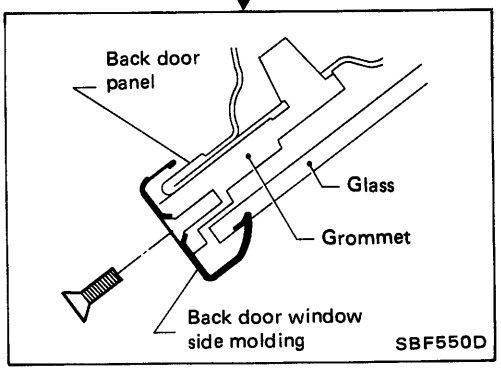
Back door window

Windshield

Install upper and lower (Back door window) molding with double-faced adhesive tape and molding fastener.



Refer to Exterior.



Install side and lower moldings.

Refer to Exterior.

CAUTION:
Molding must be installed securely so that it is in position and leaves no gap.

Windshield and Back Door Window (Cont'd)

DRYING TIME OF SEALANT

Chart below shows time required for sealant to dry desired hardness.

Unit: Days

Temperature °C (°F) \ Relative humidity %	90	50	25
25 (77)	1.2	2.2	4.0
5 (41)	2.6	7.0	11.9

CAUTION:

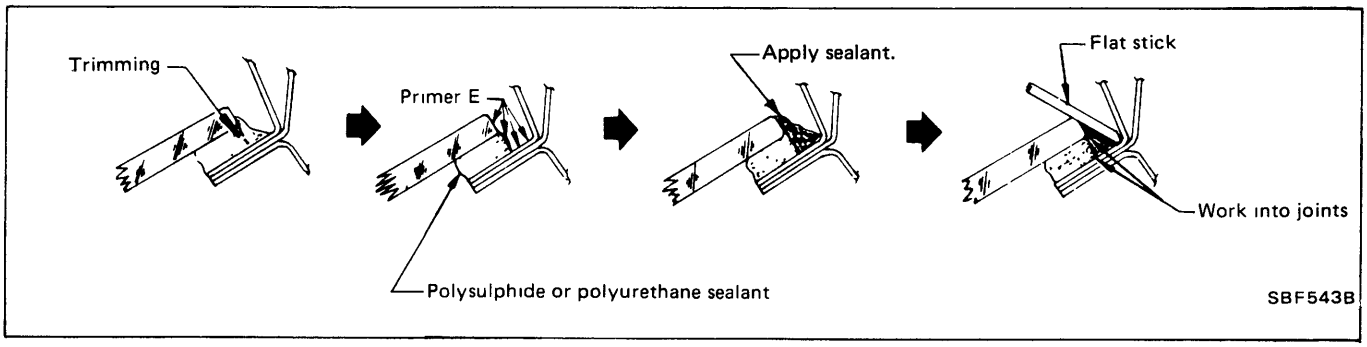
Advise the user of the fact that vehicle should not be driven on rough roads or surfaces until sealant has properly vulcanized.

REPAIRING WATER LEAKS

Leaks can be repaired without removing and reinstalling glass.

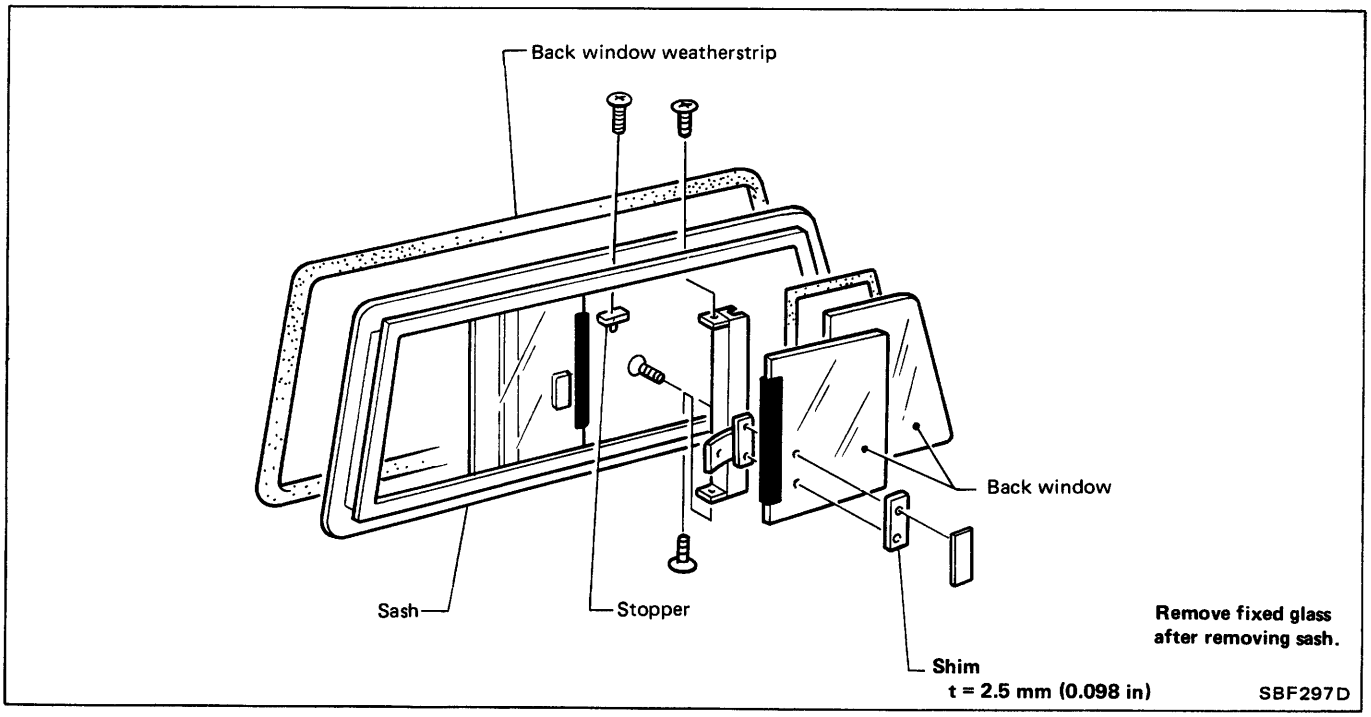
If water is leaking between caulking material and body or between glass and caulking material, determine the extent of the leak by applying water while pushing glass outward.

To stop the leak, apply primer and then sealant to the leak point.

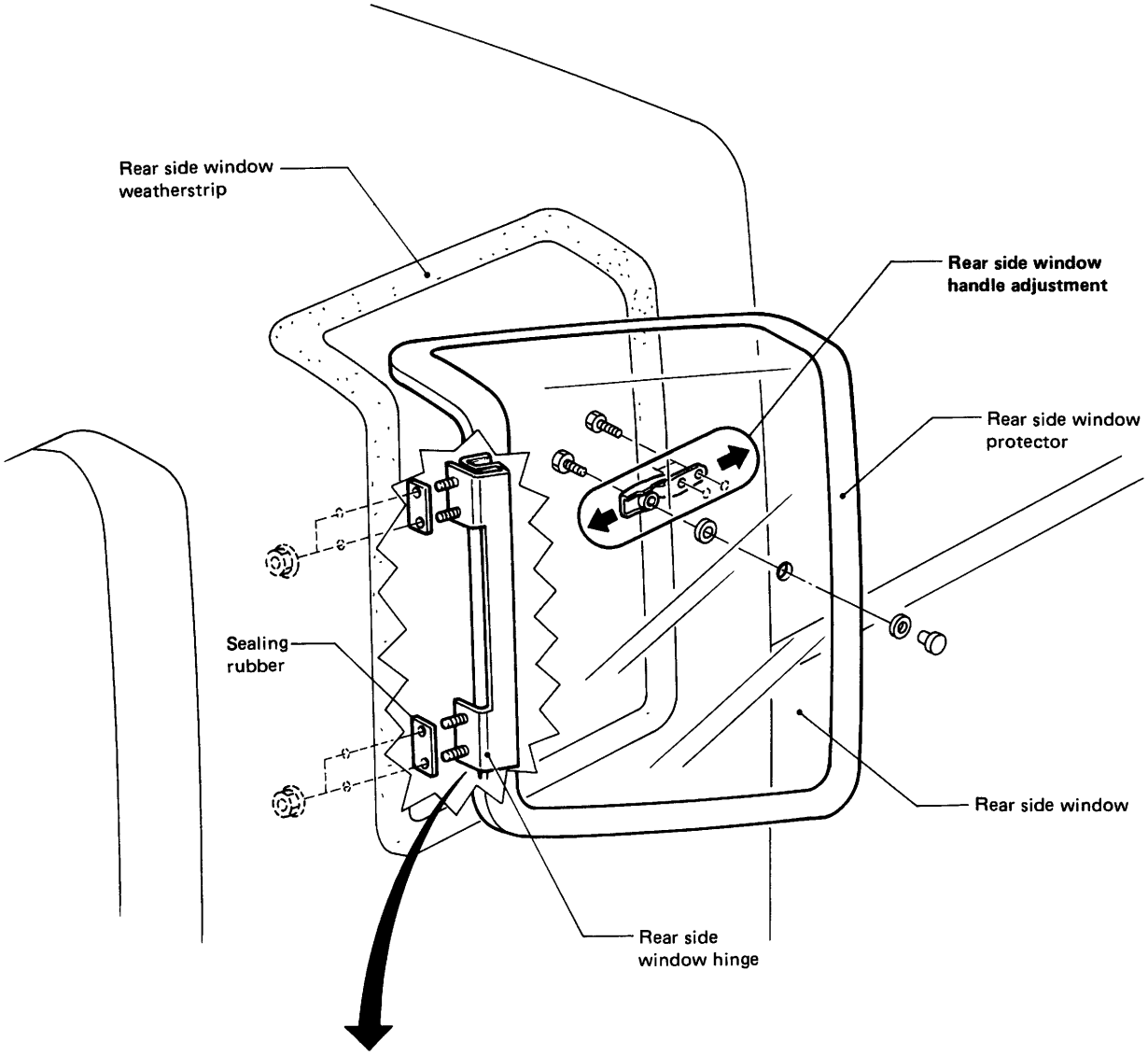


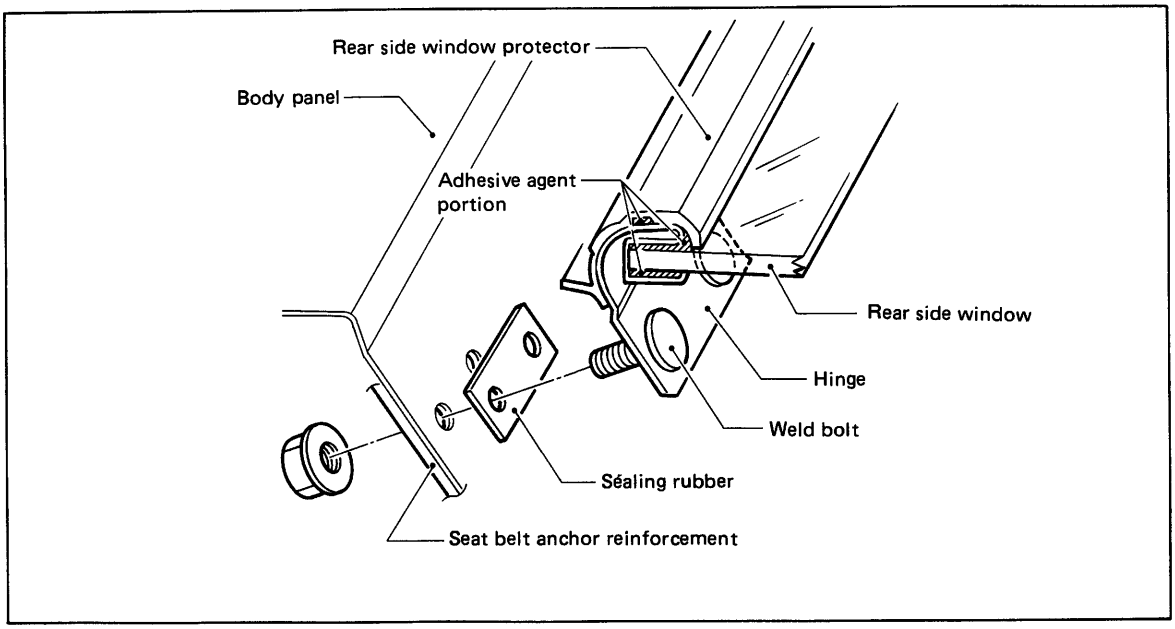
Back Window—TRUCK

- Window glass is held in place by weatherstripping. For details regarding weatherstrip, refer to "Exterior".
- Apply sealant to clearances between vehicle body panel and weatherstrip as necessary.



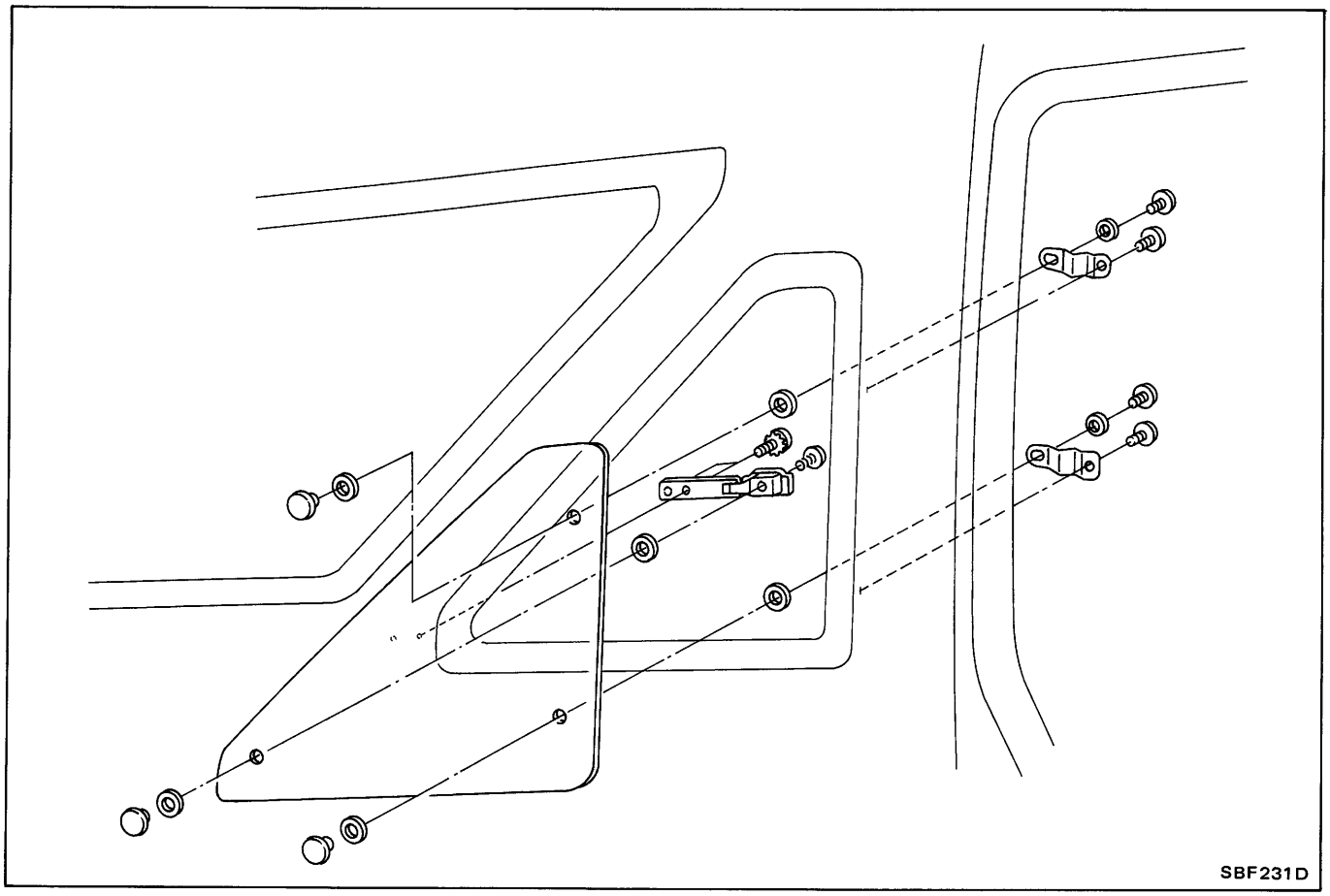
Rear Side Window—TRUCK





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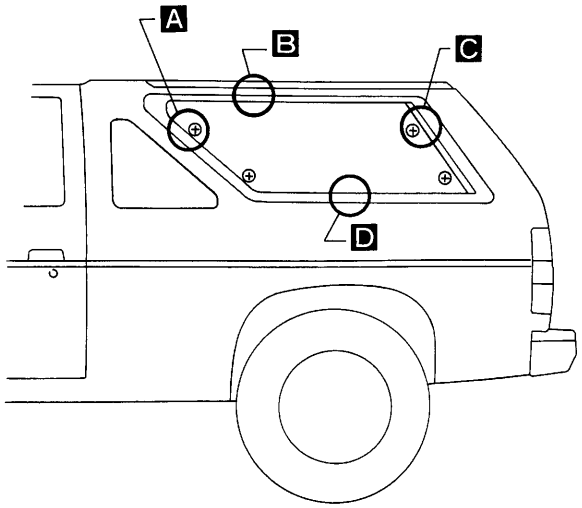
Rear Side Window — 2-door VAN & WAGON



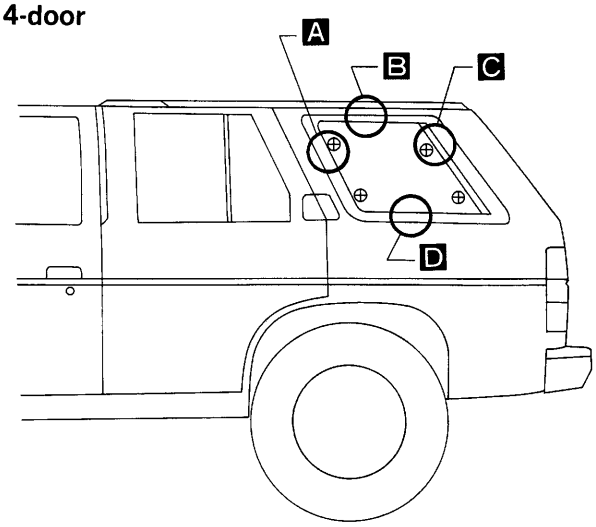
Rear Side Window (2nd)—VAN & WAGON

- The drying period for sealant is the same as that of windshield and back door window. Refer to "DRYING TIME OF SEALANT".

2-door

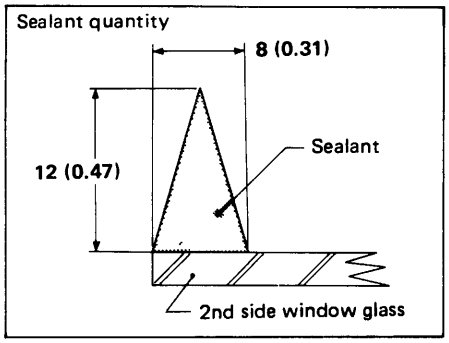


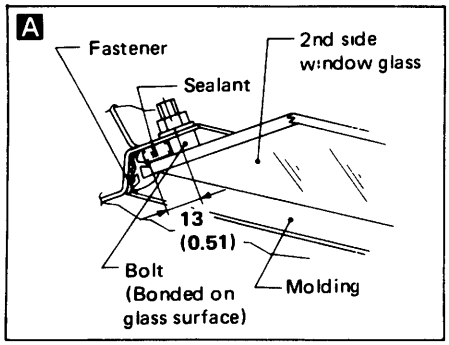
4-door

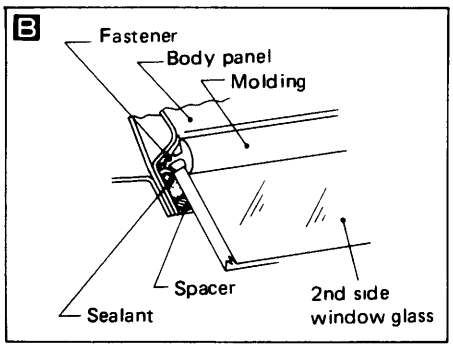


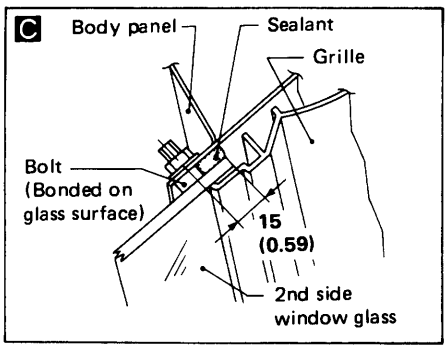
⊕ : BOLT

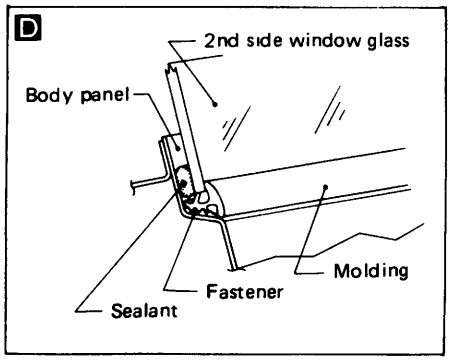
Unit: mm (in)



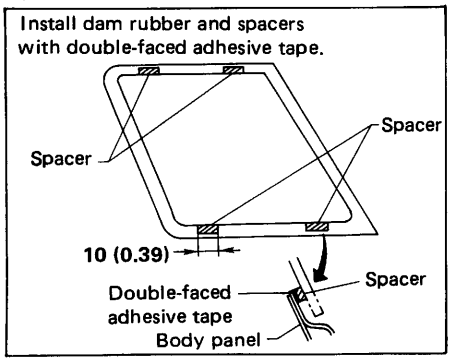




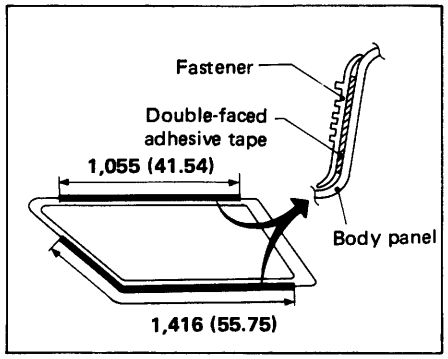




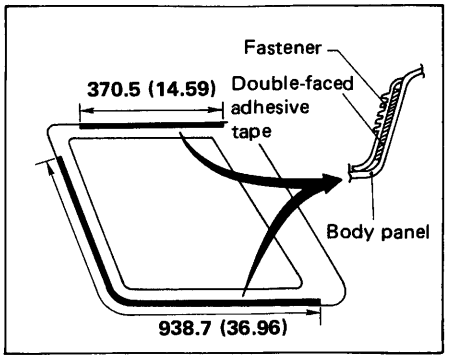
Spacer



Fastener – 2-door

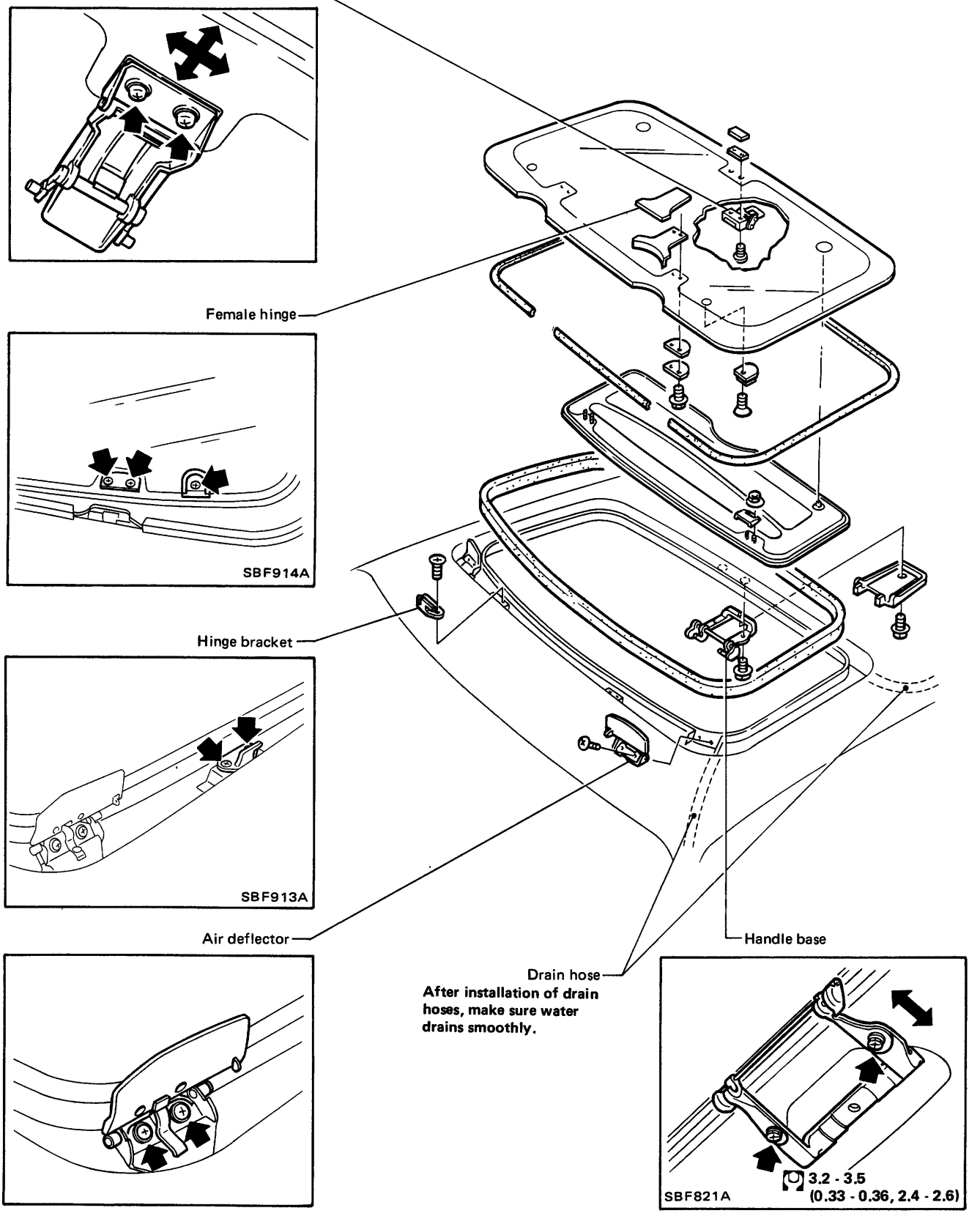


Fastener – 4-door



SBF624F

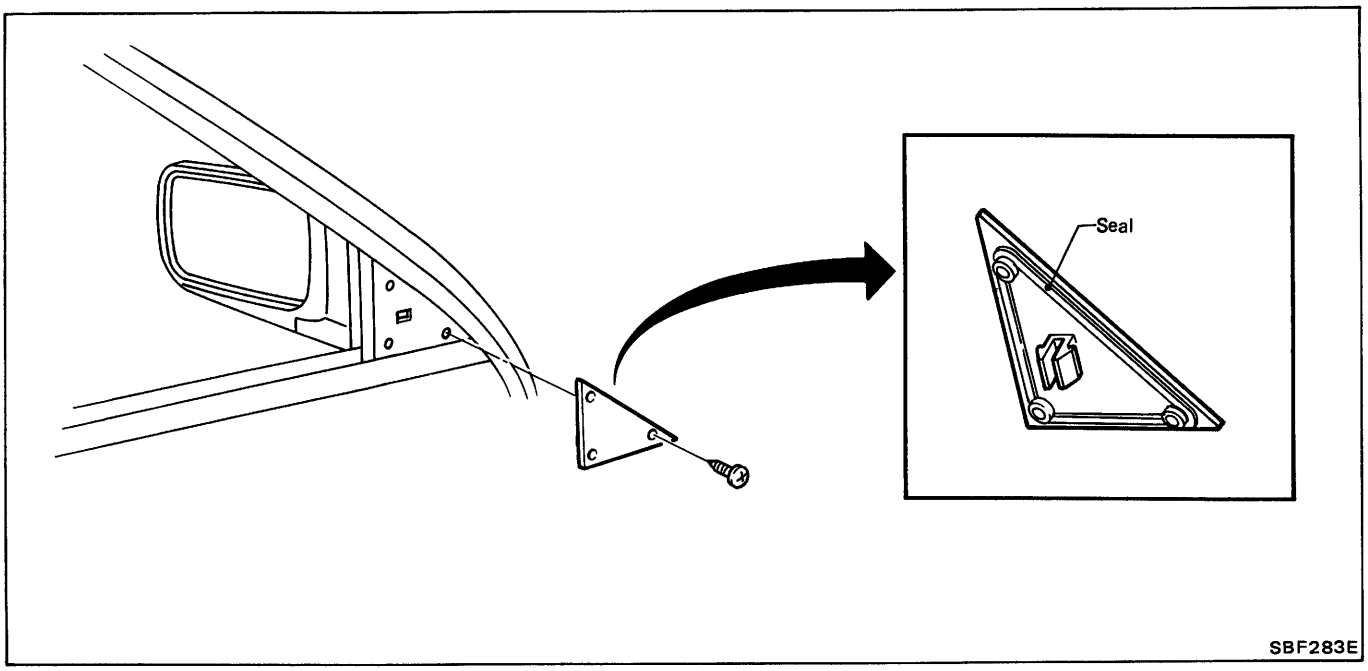
Service Procedure



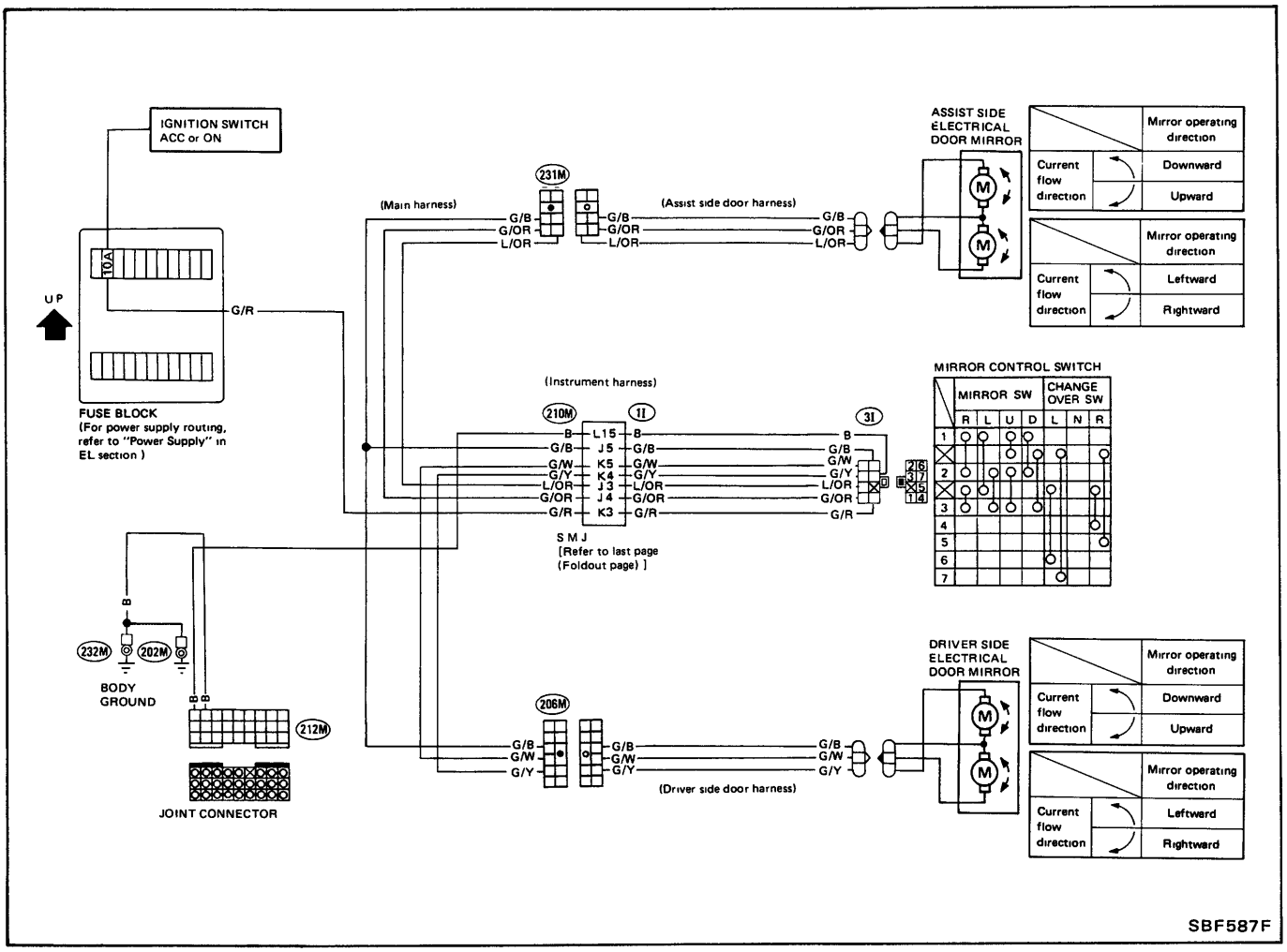
: N·m (kg-m, ft-lb)

SBF282E

Door Mirror



ELECTRICAL REMOTE CONTROL DOOR MIRROR WIRING DIAGRAM



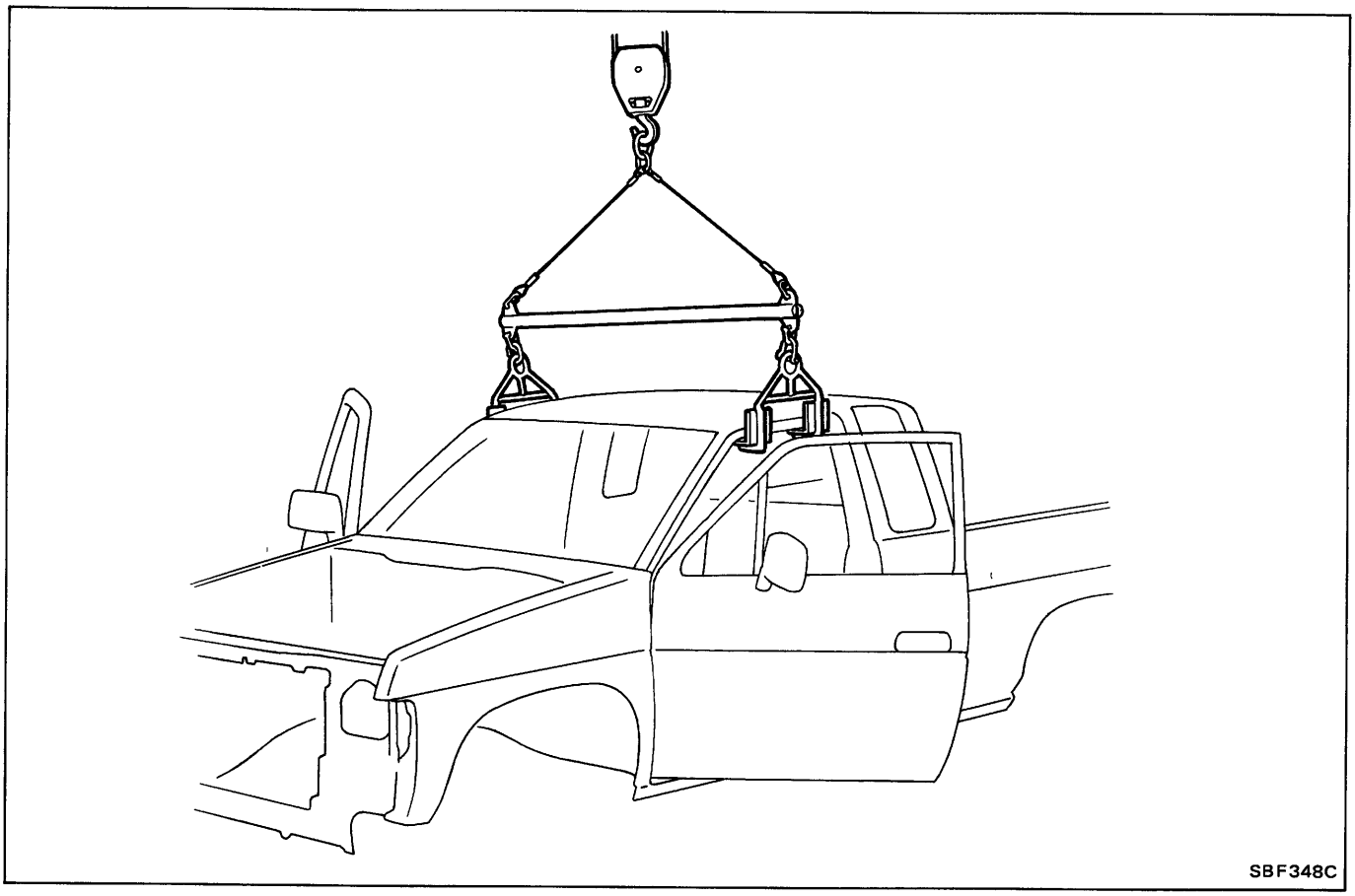
Cab Body—TRUCK

- Remove following parts in engine room at least.

(1) Main harness and other wiring harness

- Disconnect brake and clutch line in engine compartment.
- Remove following parts under body at least.

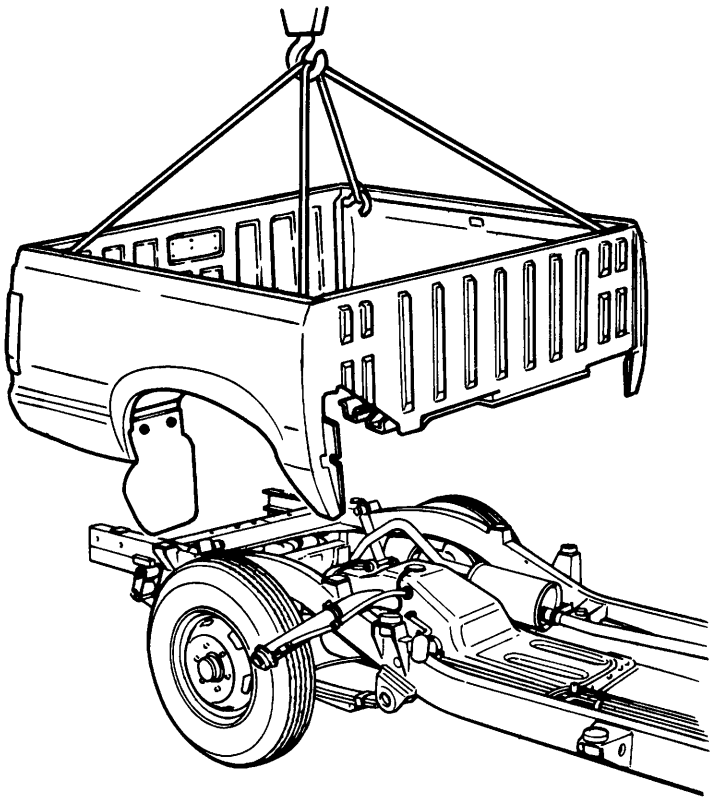
(1) Transmission and transfer control levers
(2) Hand brake control lever and cable
(3) Main harness and other wiring harness



Rear Body—TRUCK

- Remove following parts at least.

(1) Rear combination lamp and license plate lamp harness.
(2) Fuel filler tube fixing screws.



SBF723C

Cab Body—VAN & WAGON

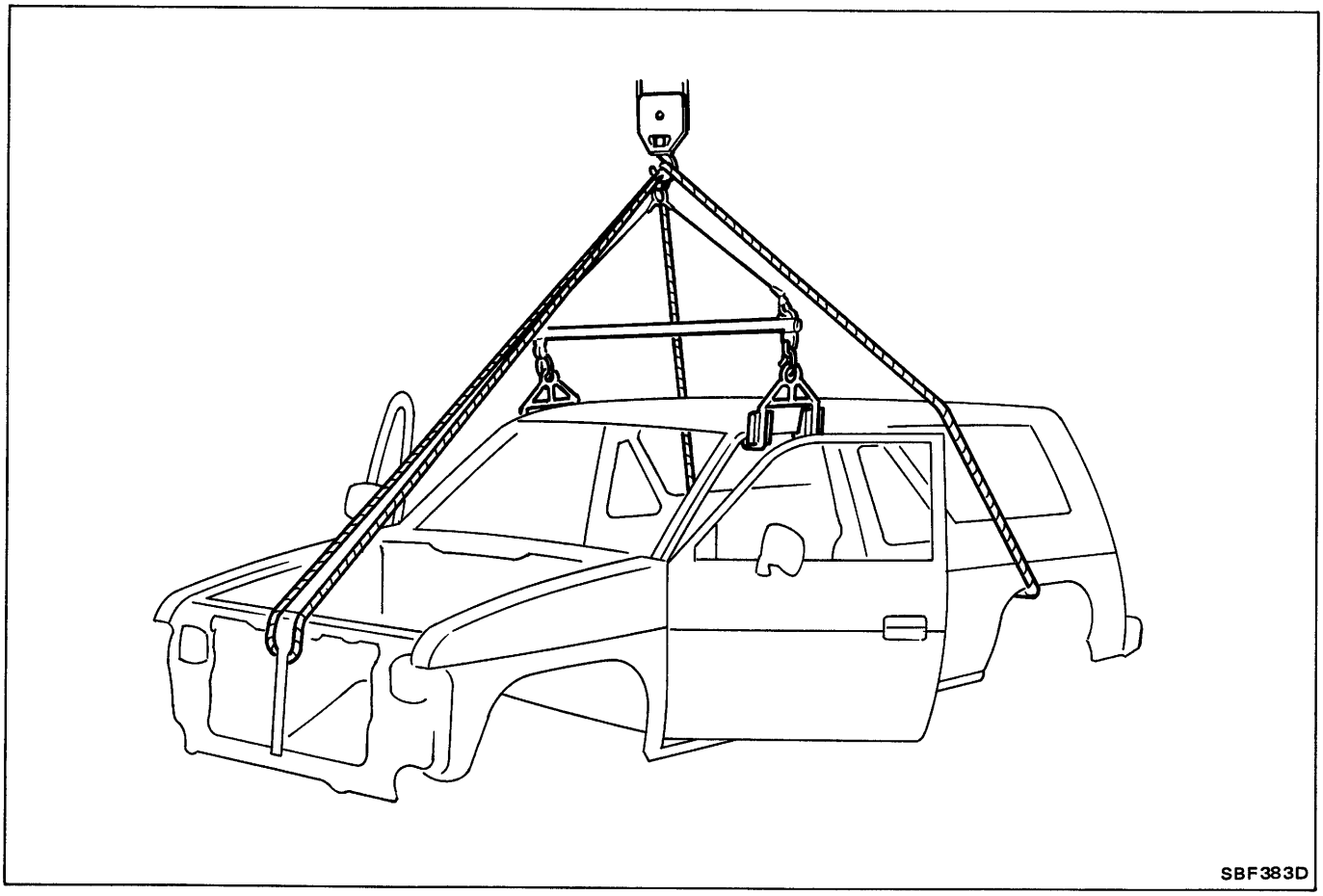
- Remove following parts in engine room at least.

(1) Main harness and other wiring harness

- Disconnect brake and clutch line in engine compartment.
- Remove following parts under body at least.

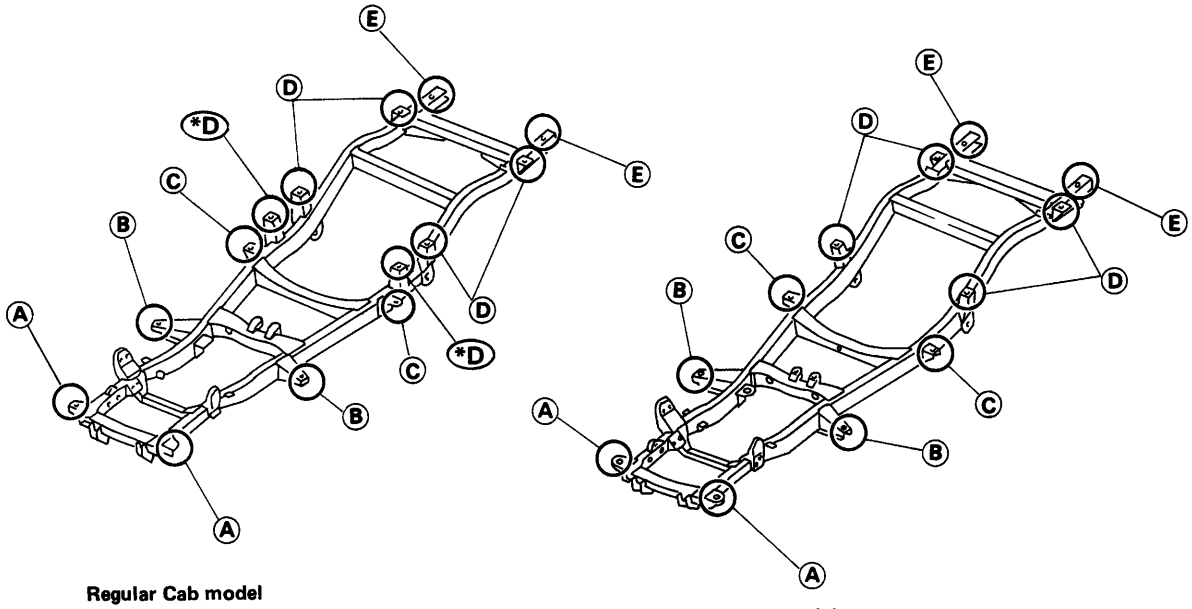
(1) Transmission and transfer control levers
(2) Hand brake control lever and cable
(3) Main harness and other wiring harness

- Remove seat belt anchor bolt.



Body Mounting—TRUCK

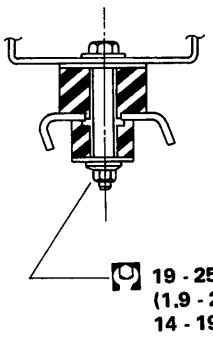
When removing, be sure to replace bolts and nuts (sealant applied bolts or self-lock nuts are used for all mounting).



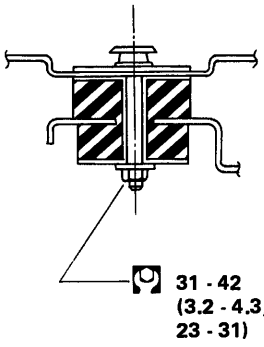
Regular Cab model

King Cab model

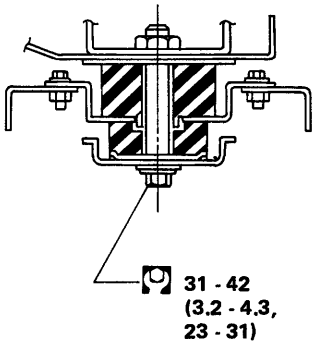
*D : Except for short wheelbase model (This bracket is not used for body mounting.)



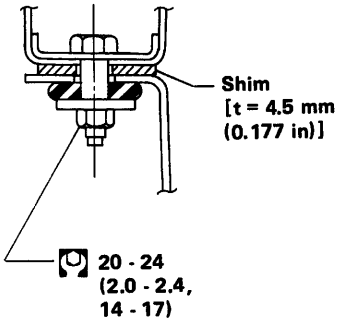
Section A



Section B

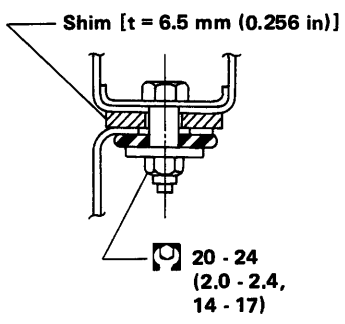


Section C



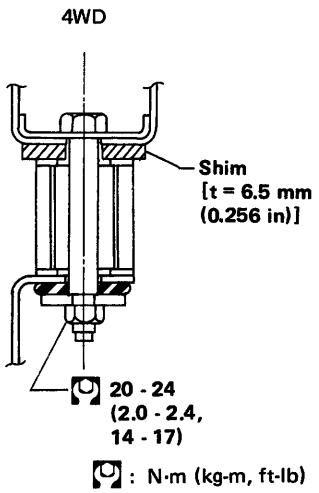
Section D

2WD



Section E

4WD

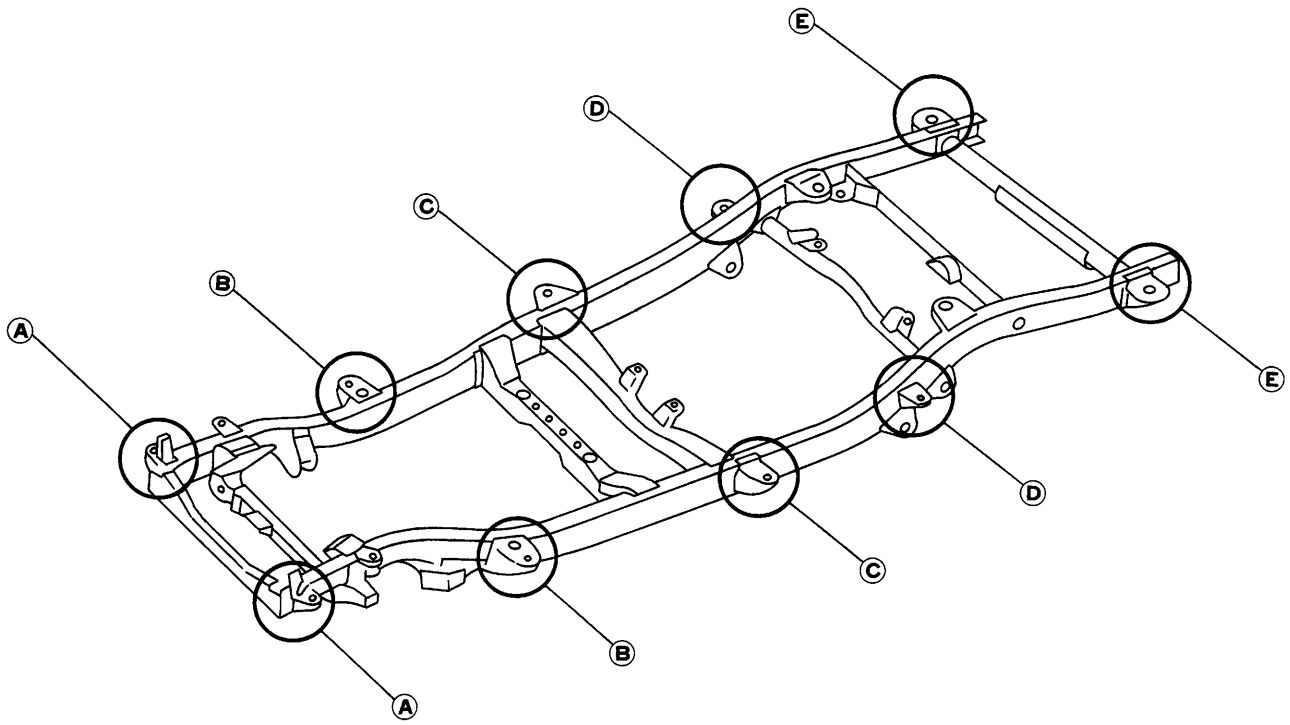


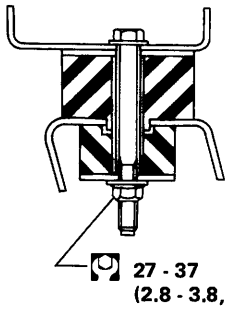
: N·m (kg-m, ft-lb)

SBF350C

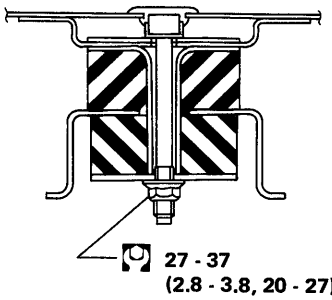
Body Mounting—VAN & WAGON

When removing, be sure to replace bolts and nuts (sealant applied bolts or self-lock nuts are used for all mounting).

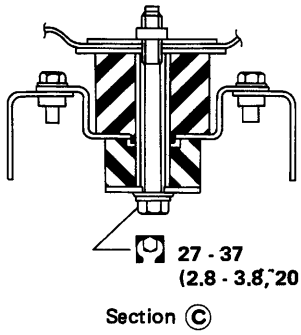




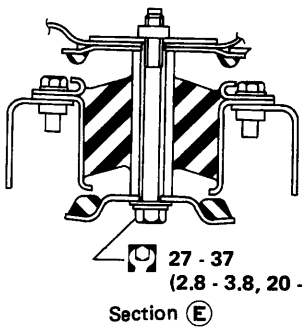
Section (A)



Section (B) and (D)



Section (C)



Section (E)

: N·m (kg-m, ft-lb)

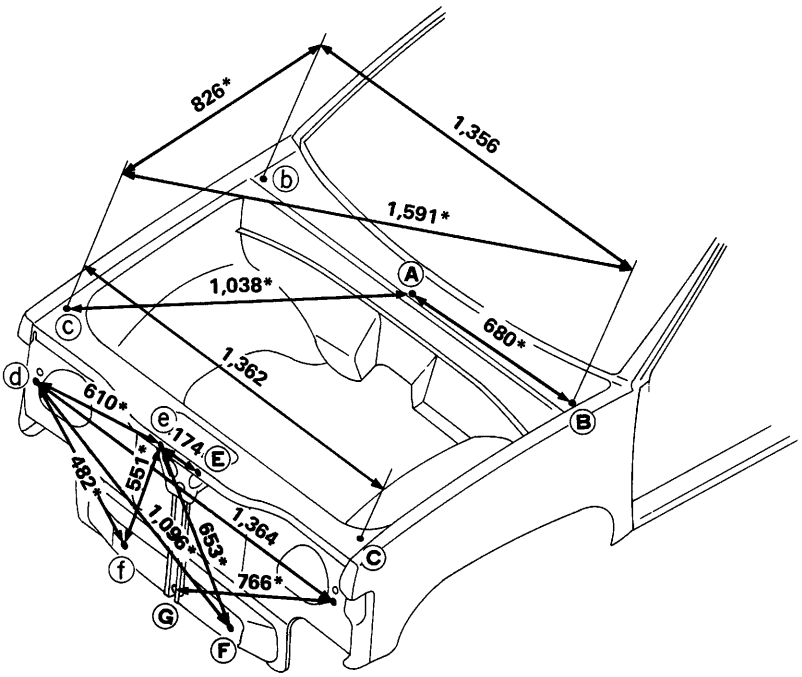
SBF379D

- All dimensions indicated in figures are actual ones.
- When a tram tracking gauge is used, adjust both pointers to equal length and check the pointers and gauge itself to make sure there is no free play.
- When a measuring tape is used, check to be sure there is no elongation, twisting or bending.
- Measurements should be taken at the center of the mounting holes.
- An asterisk (*) following the value at the measuring point indicates that the measuring point on the other side is symmetrically the same value.
- Measurement points
  The coordinates of the measurement points are the distances measured from the respective dimension lines in the directions of "x", "y" and "z".
  Dimension lines: "x" line – Center line of vehicle
  "y" line – Center line of front axle (Any measurement point in front of the dimension line refers to a minus "–" value.)
  "z" line – Datum line (Any measurement point under the dimension line refers to a minus "–" value.)

2W	: 2WD	2W.SB	: Short wheelbase (2WD)
4W	: 4WD	2W.LB	: Long wheelbase (2WD)
SB	: Short wheelbase	4W.SB	: Short wheelbase (4WD)
LB	: Long wheelbase	4W.LB	: Long wheelbase (4WD)
R	: Regular Cab		
K	: King Cab		
RL	: Regular Cab (Long wheelbase)		

Engine Compartment

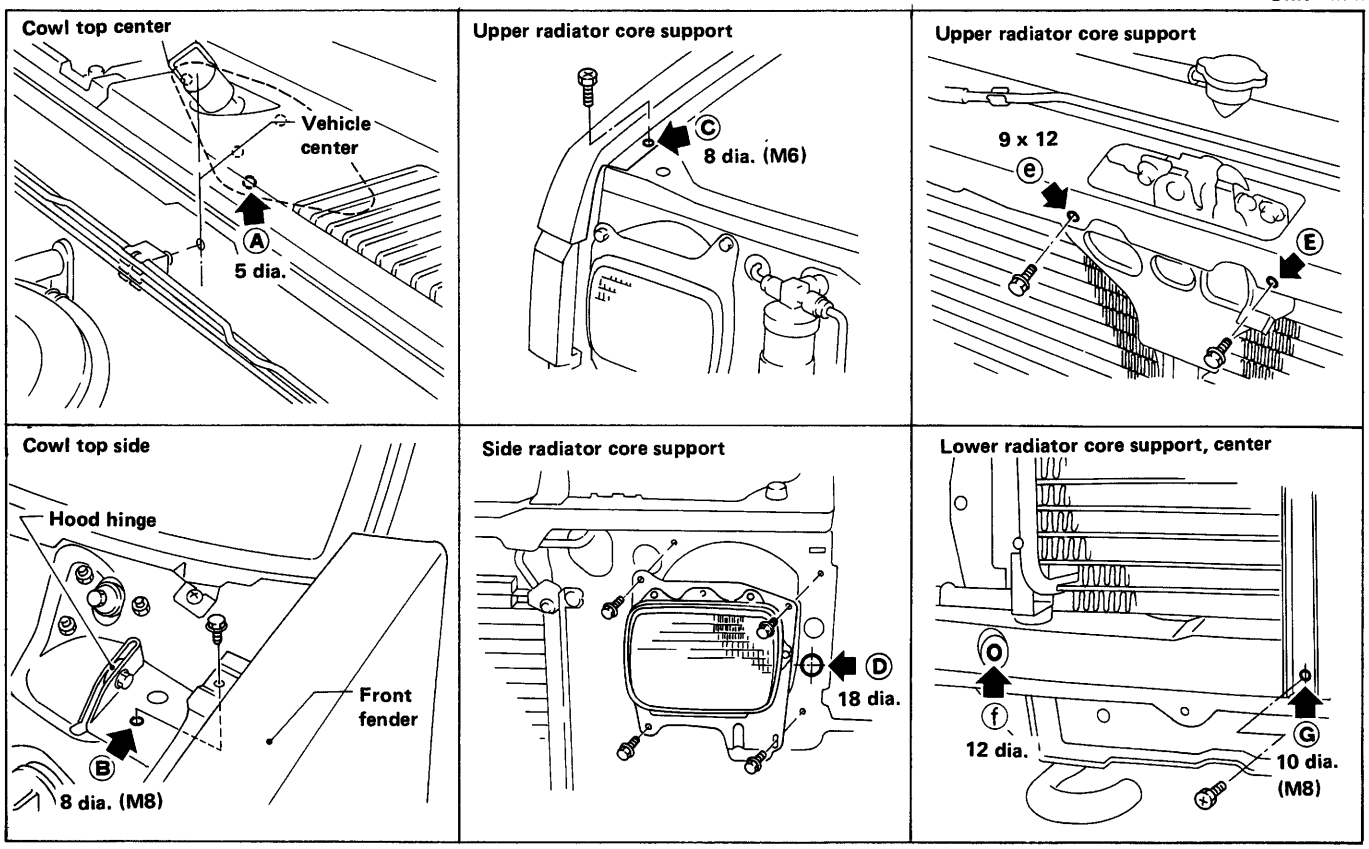
MEASUREMENT



Unit: mm

DETAILED MEASUREMENT POINTS

Unit: mm

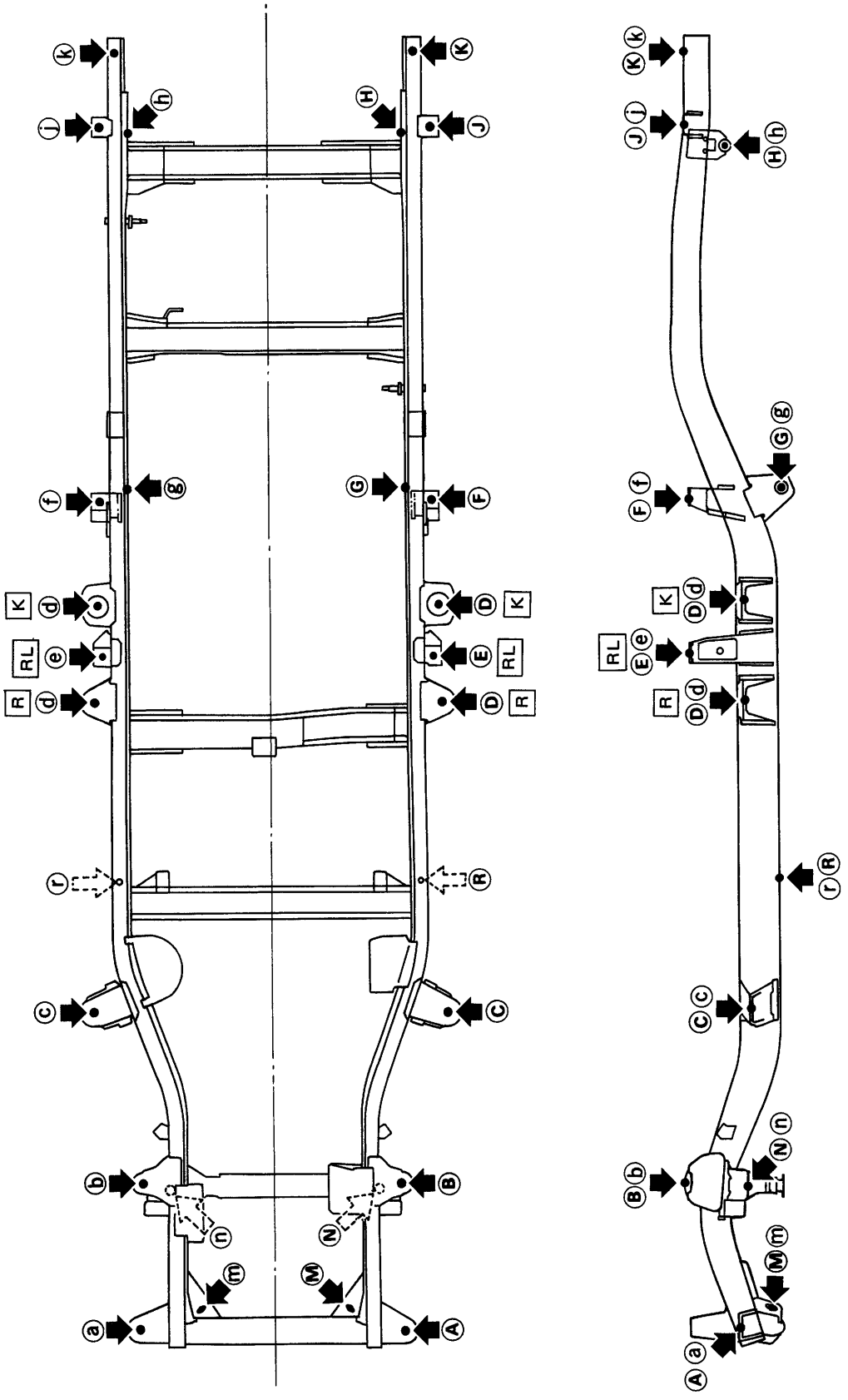


Underbody—TRUCK

MEASUREMENT POINTS

2WD models

R : Regular Cab
K : King Cab
RL : Regular Cab (Long wheelbase)

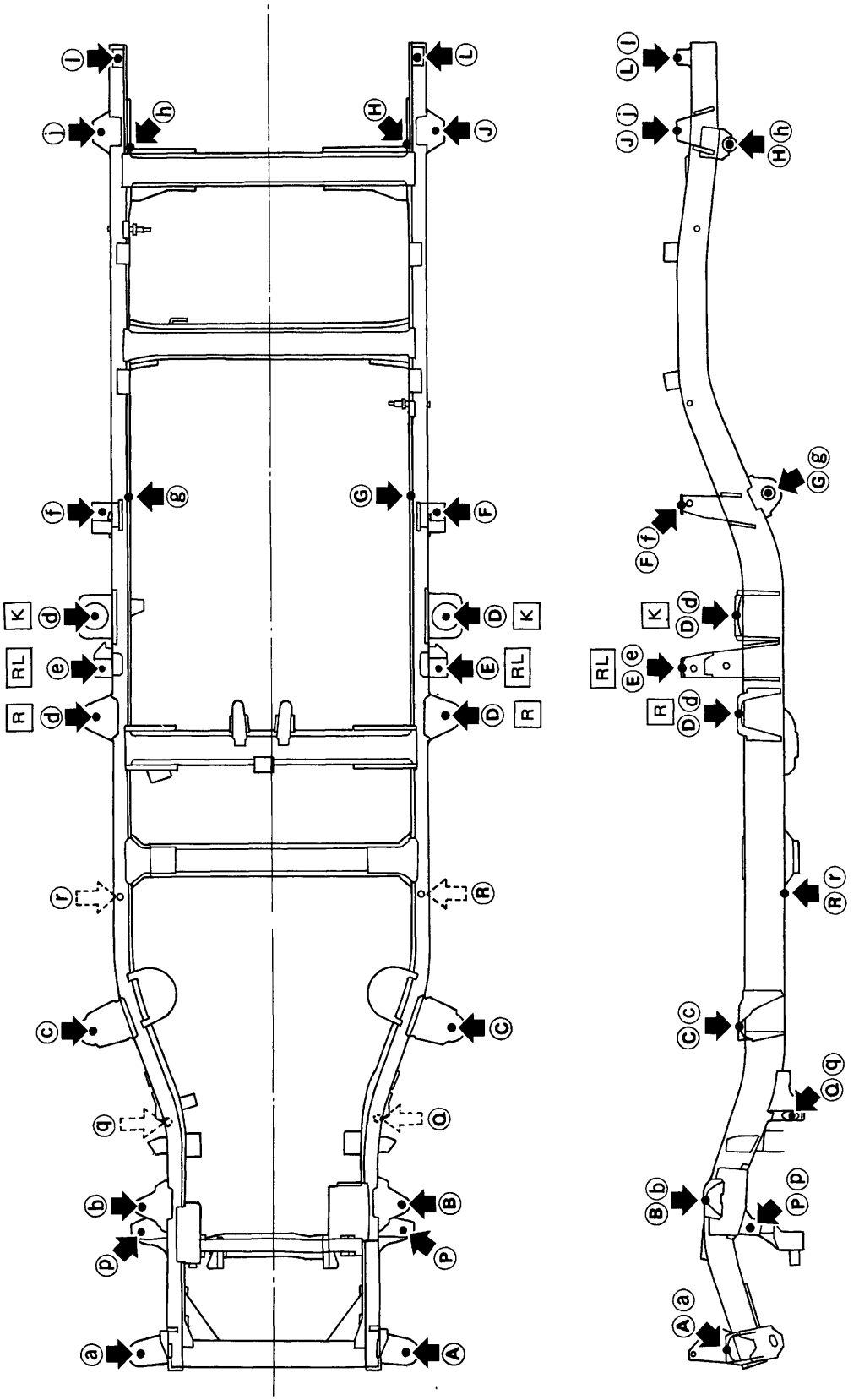


SBF698C

Underbody—TRUCK (Cont'd)

MEASUREMENT POINTS
4WD models

R : Regular Cab
K : King Cab
RL : Regular Cab (Long wheelbase)



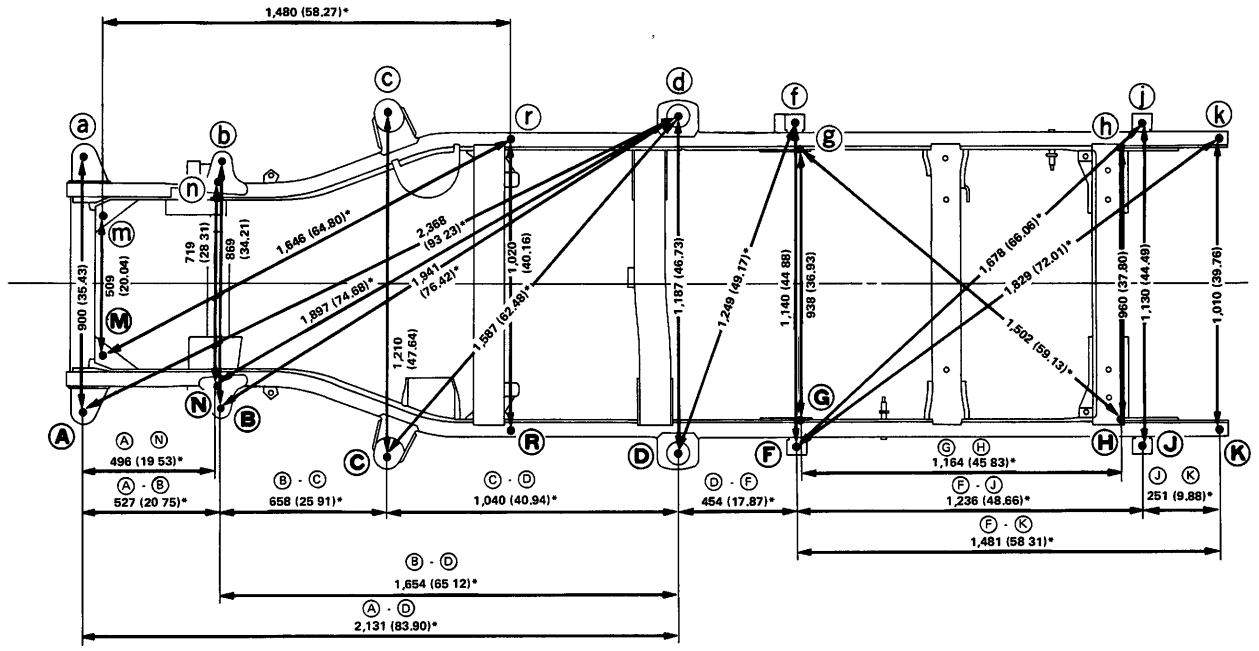
SBF300D

Underbody—TRUCK (Cont'd)

MEASUREMENT

2WD models

Regular Cab (Short wheelbase) ⓜ ⓡ

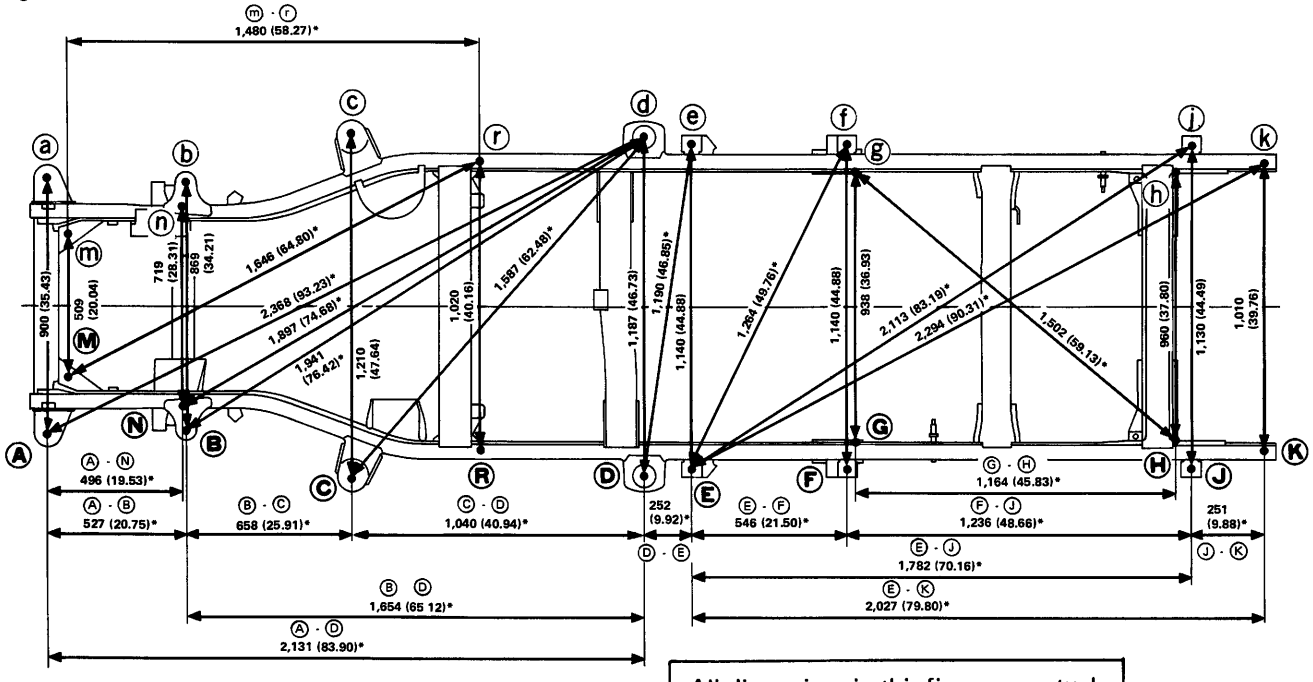


All dimensions in this figure are actual ones.
There are no projected dimensions.

Unit: mm (in)

SBF700C

Regular Cab (Long wheelbase)



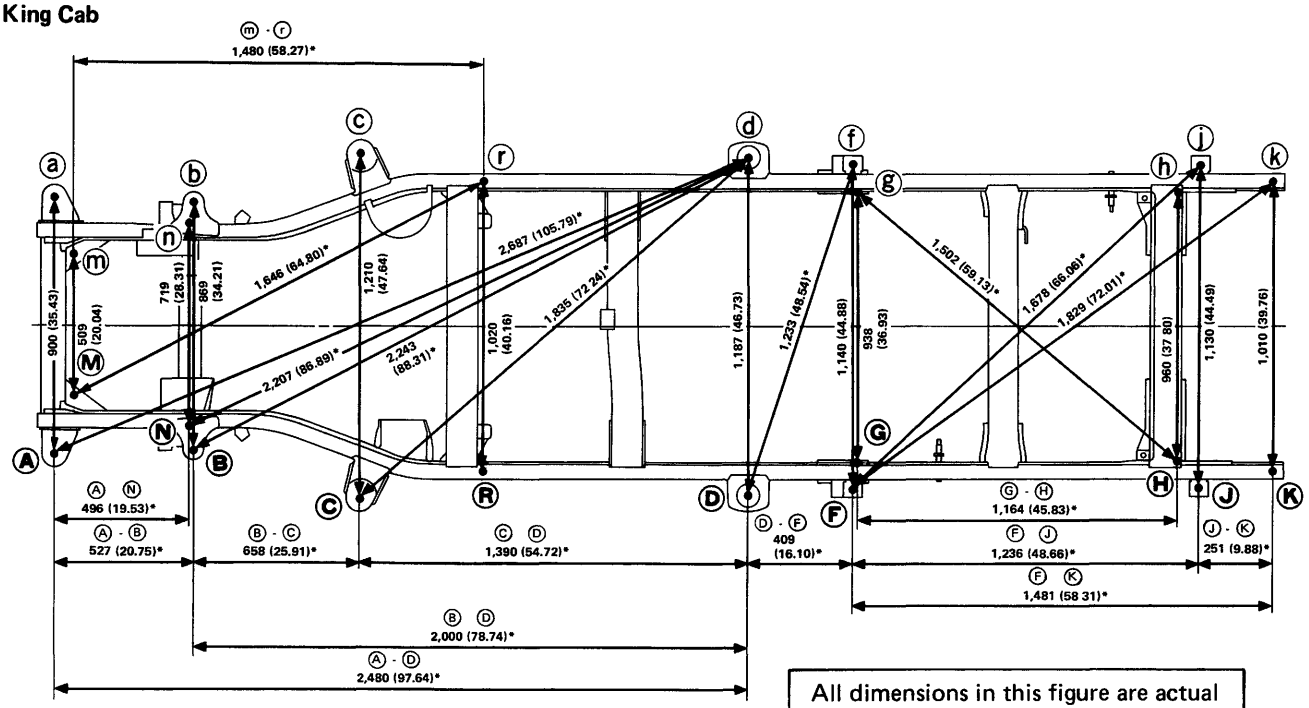
All dimensions in this figure are actual ones.
There are no projected dimensions.

Unit: mm (in)

SBF661C

Underbody—TRUCK (Cont'd)

King Cab



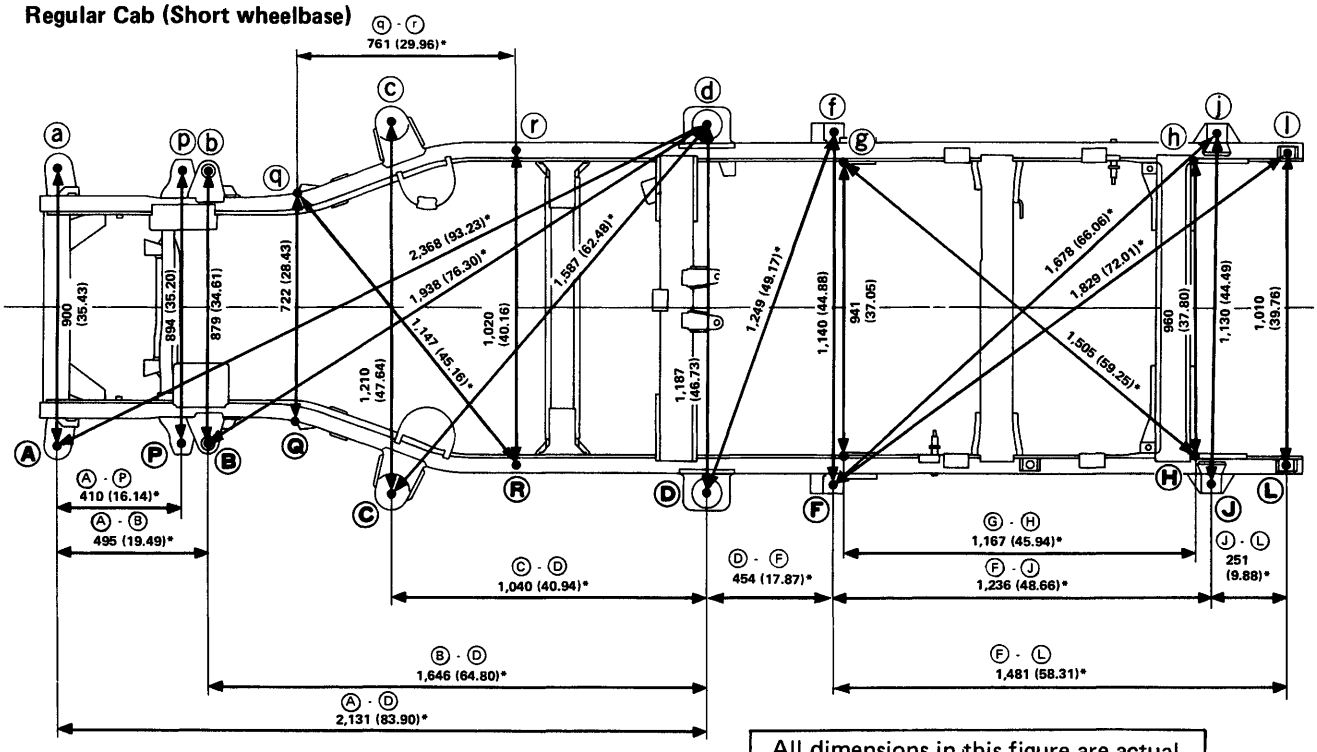
All dimensions in this figure are actual ones.
There are no projected dimensions.

Unit: mm (in)

SBF662C

4WD models

Regular Cab (Short wheelbase)



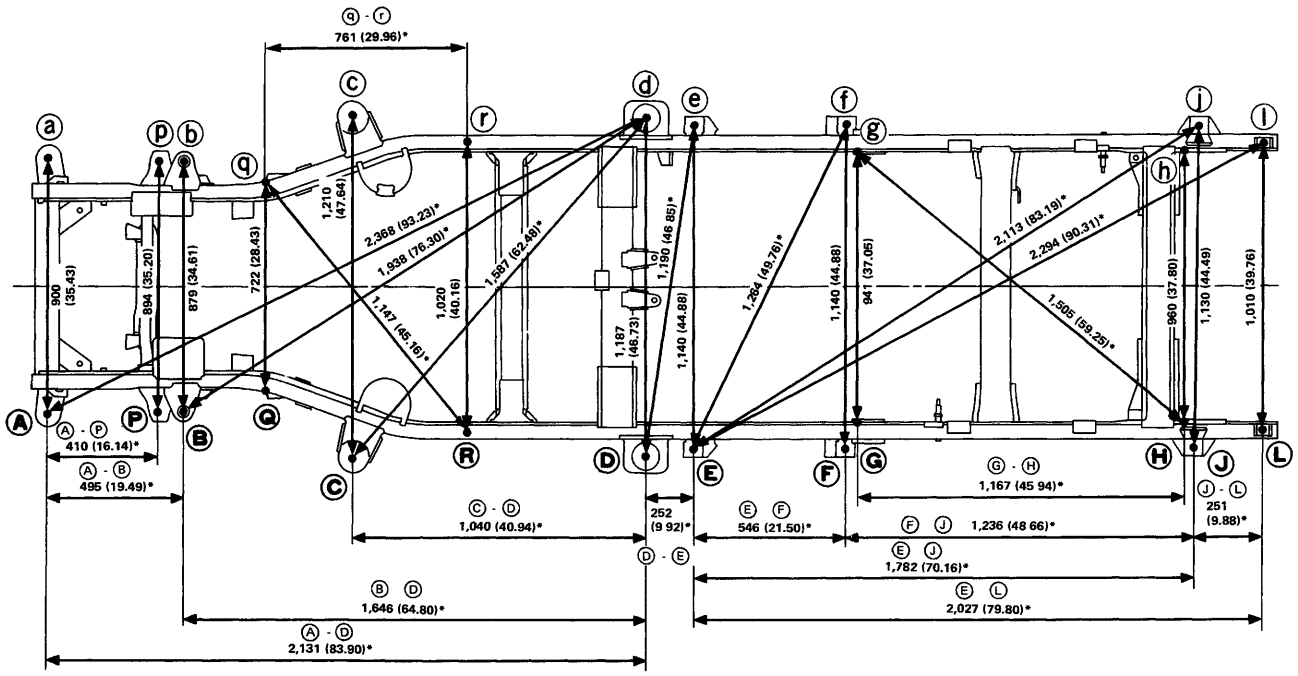
All dimensions in this figure are actual ones.
There are no projected dimensions.

Unit: mm (in)

SBF301D

Underbody—TRUCK (Cont'd)

Regular Cab (Long wheelbase)

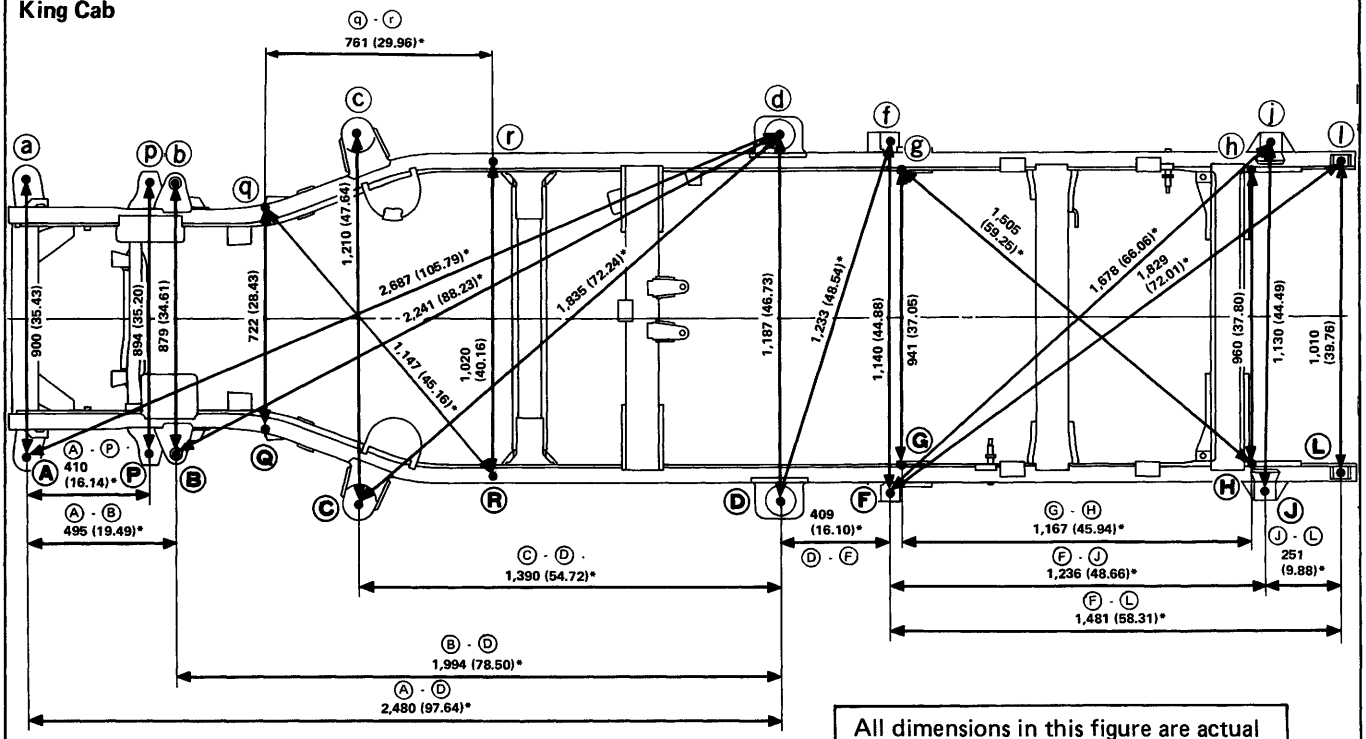


All dimensions in this figure are actual ones.
There are no projected dimensions.

Unit: mm (in)

SBF302D

King Cab



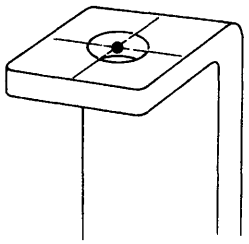
All dimensions in this figure are actual ones.
There are no projected dimensions.

Unit: mm (in)

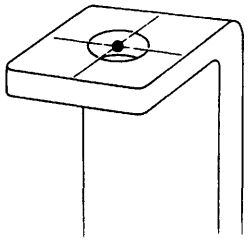
SBF303D

Underbody—TRUCK (Cont'd)

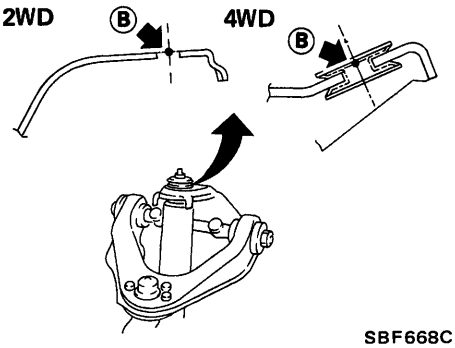
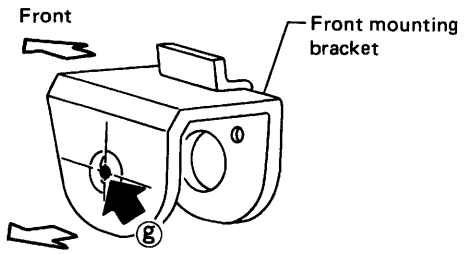
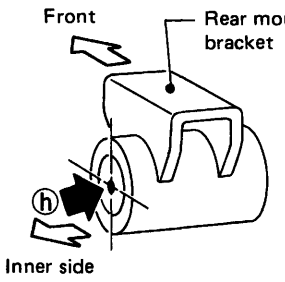
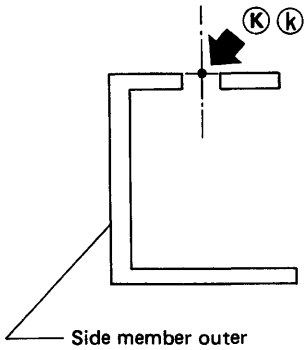
DETAILED MEASUREMENT POINTS

Points	Hole dia. mm (in)	Detailed points		Coordinates mm (in) "x"	Coordinates mm (in) "y"	Coordinates mm (in) "z"
Ⓐ ⓐ	24 (0.94)	Center of hole on top of bracket  SBF274B	Cab body or rear body mounting insulator mounting hole	450.0 (17.72)	−488.5 (−19.23)	[2W]: 21.2 (0.835) [4W]: 71.2 (2.803)
Ⓒ ⓒ	28 (1.10)			605.0 (23.82)	597.5 (23.52)	[2W]: −28.2 (−1.110) [4W]: 21.8 (0.858)
Ⓓ ⓓ	85 (3.35)			593.5 (23.37)	[R]: 1,637.0 (64.45) [K]: 1,987.0 (78.23)	[2W]: −15.0 (−0.591) [4W]: 35.0 (1.378)
Ⓔ ⓔ	18 (0.71)			[RL]: 570.0 (22.44)	[RL]: 1,804.0 (71.02)	[2W]: 171.8 (6.76) [4W]: 221.8 (8.73)
Ⓕ ⓕ	18 (0.71)			570.0 (22.44)	[SB]: 2,050.0 (80.71) [LB]: 2,350.0 (92.52)	[2W]: 171.8 (6.76) [4W]: 221.8 (8.73)

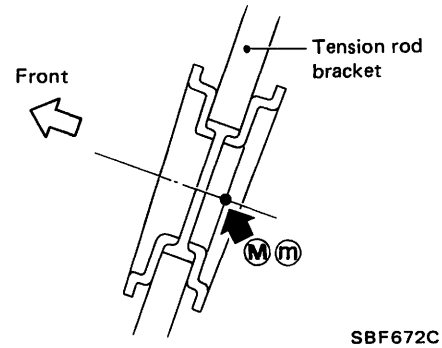
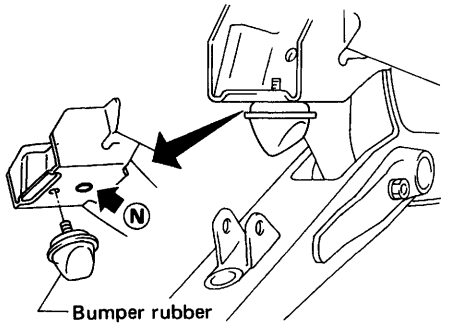
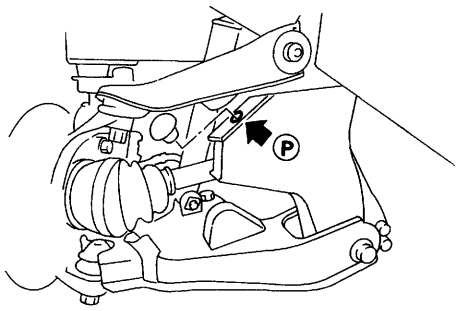
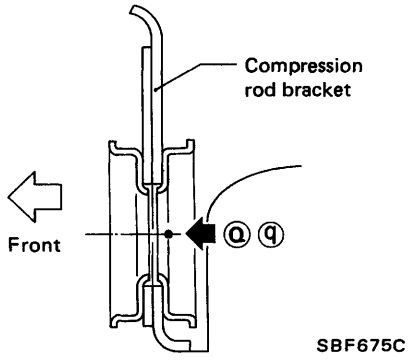
Underbody—TRUCK (Cont'd)

Points	Hole dia. mm (in)	Detailed points		Coordinates mm (in)		
				"x"	"y"	"z"
Ⓙ Ⓘ	18 (0.71)	Center of hole on top of bracket  SBF274B	Cab body or rear body mounting insulator mounting hole	565.0 (22.24)	SB : 3,286.0 (129.37) LB : 3,586.0 (141.18)	2W : 171.8 (6.76) 4W : 221.8 (8.73)
Ⓛ Ⓘ	22 (0.87)			505.0 (19.88)	SB : 3,530.0 (138.98) LB : 3,830.0 (150.79)	220.0 (8.66)

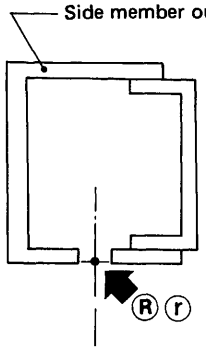
Underbody—TRUCK (Cont'd)

Points	Hole dia. mm (in)	Detailed points		Coordinates mm (in) "x"	"y"	"z"
Ⓑ ⓑ	[2W]: 15 (0.59) [4W]: 15.3 (0.602)	 SBF668C	Hole for front shock absorber mounting at the bracket	[2W]: 434.7 (17.11) [4W]: 439.7 (17.31)	[2W]: 5.6 (0.220) [4W]: 1.4 (0.055)	[2W]: 203.2 (8.00) [4W]: 142.0 (5.59)
Ⓖ ⓖ	12 (0.47)	 SBF669C	Hole for rear spring front mounting at the bracket	[2W]: 469.0 (18.46) [4W]: 470.5 (18.52)	[2W.SB]: 2,059.0 (81.06) [2W.LB]: 2,359.0 (92.87) [4W.SB]: 2,080.0 (81.89) [4W.LB]: 2,380.0 (93.70)	[2W]: −152.0 (−5.98) [4W]: −86.0 (−3.386)
Ⓗ ⓗ	33 (1.30)	 SBF670C	Hole for rear spring rear mounting at the bracket	480.0 (18.90)	[2W.SB]: 3,209.0 (126.34 [2W.LB]: 3,509.0 (138.15 [4W.SB]: 3,240.0 (127.56 [4W.LB]: 3,540.0 (139.37)	[2W]: 30.0 (1.181) [4W]: 43.0 (1.693)
Ⓚ ⓚ	22 (0.87)	 SBF671C	Hole for body mounting at rear of side member outer	505.0 (19.88)	[SB]: 3,530.0 (138.98) [LB]: 3,830.0 (150.79)	170.0 (6.69)

Underbody—TRUCK (Cont'd)

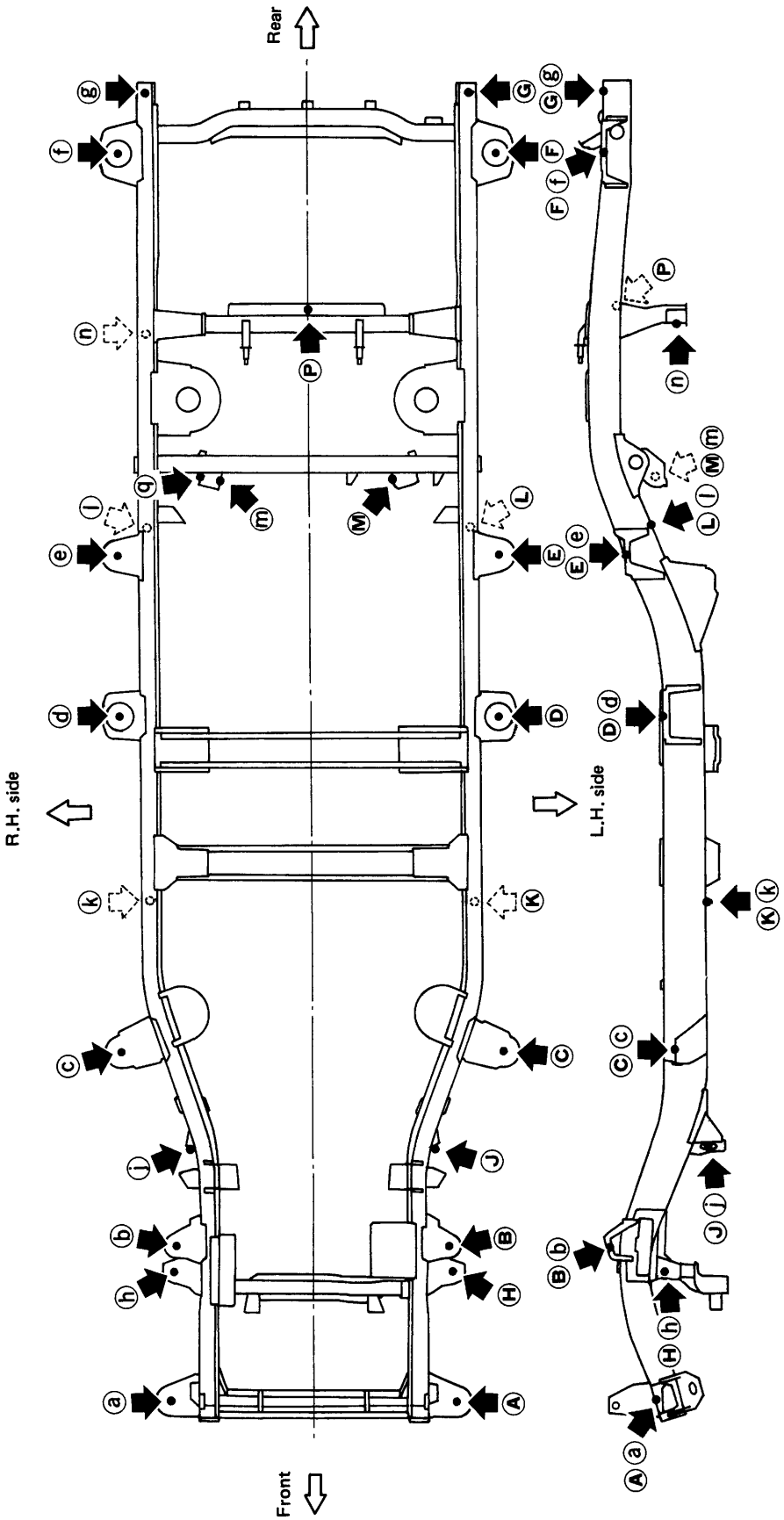
Points	Hole dia. mm (in)	Detailed points		Coordinates mm (in)		
				"x"	"y"	"z"
Ⓜ ⓜ	27 (1.06)	 SBF672C	Hole for tension rod mounting at the bracket	254.6 (10.02)	−417.1 (−16.42)	−92.3 (−3.634)
Ⓝ ⓝ	9 (0.35)	 SBF673C	Hole for locating at bound bumper bracket	359.5 (14.15)	−3.2 (−0.126)	−23.5 (−0.925)
Ⓟ ⓟ	10.5 (0.413)	 SBF674C	Hole for rebound bumper mounting at lower link bracket	447.0 (17.60)	−88.0 (−3.465)	−14.9 (−0.587)
Ⓠ ⓠ	27 (1.06)	 SBF675C	Hole for compression rod mounting at the bracket	361.1 (14.22)	294.5 (11.59)	−158.9 (−6.26)

Underbody—TRUCK (Cont'd)

Points	Hole dia. mm (in)	Detailed points		Coordinates mm (in)		
				"x"	"y"	"z"
Ⓡ ⓡ	13 (0.51)	 SBF676C	Hole for waxing at lower side of side member outer	510.0 (20.08)	1,040.0 (40.94)	−135.0 (−5.31)

Underbody—VAN & WAGON

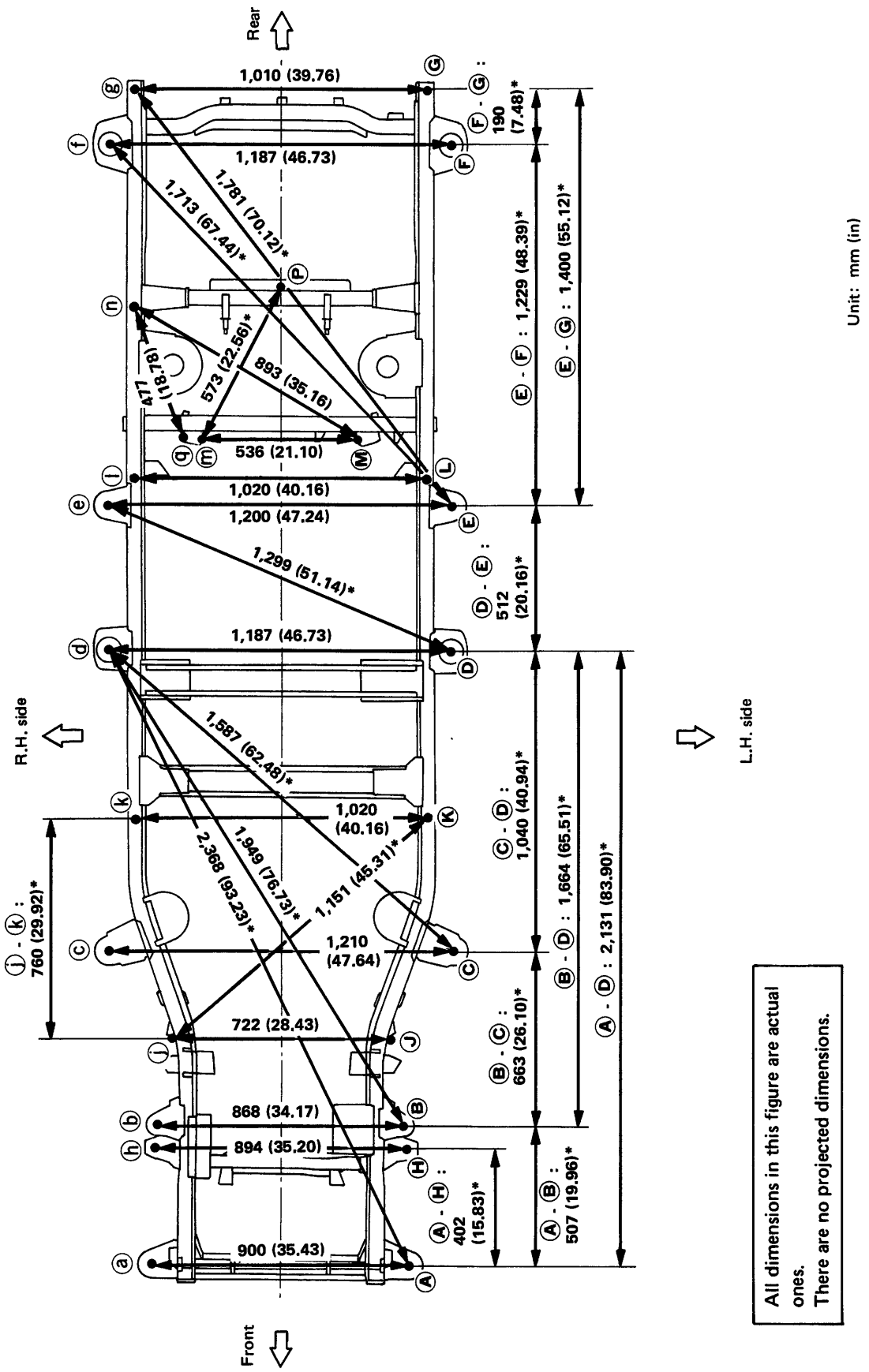
MEASUREMENT POINTS



SBF234D

Underbody—VAN & WAGON (Cont'd)

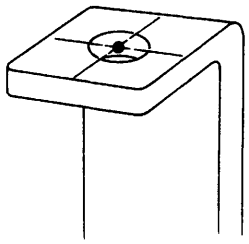
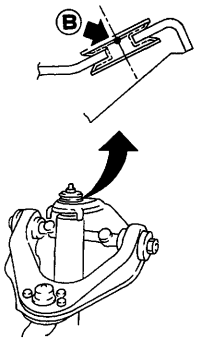
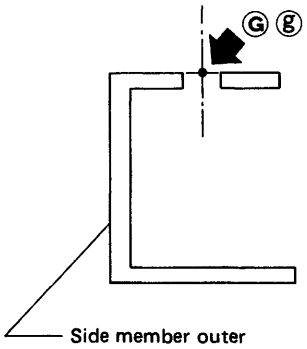
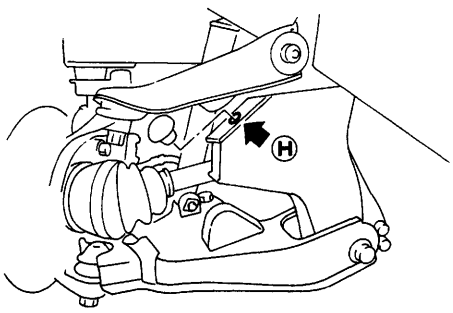
MEASUREMENT



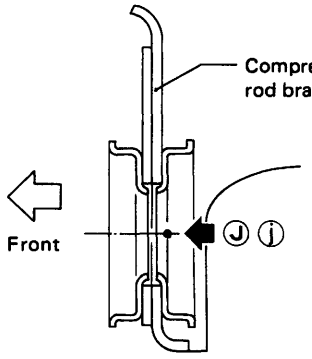
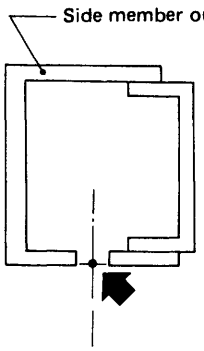
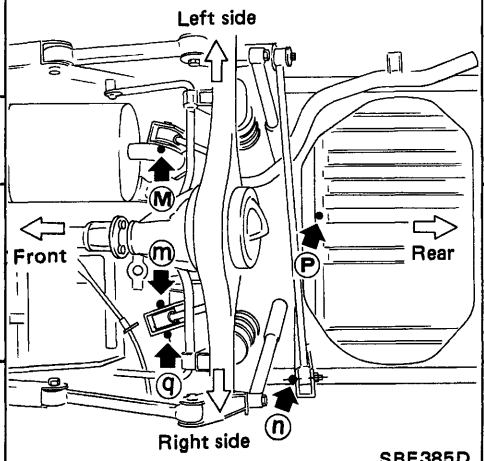
SBF380D

Underbody—VAN & WAGON (Cont'd)

DETAILED MEASUREMENT POINTS

Points	Hole dia. mm (in)	Detailed points		Coordinates mm (in) "x"	"y"	"z"
Ⓐ ⓐ	24 (0.94)	Center of hole on top of bracket  SBF274B	Hole for body mounting insulator mounting	450.0 (17.72)	−488.5 (−19.23)	21.2 (0.835)
Ⓒ ⓒ	28 (1.10)			605.0 (23.82)	597.5 (23.52)	−28.2 (−1.110)
Ⓓ ⓓ	85 (3.35)			593.5 (23.37)	1,637.0 (65.87)	−15 (−0.591)
Ⓔ ⓔ	28 (1.10)			600.0 (23.62)	2,135.0 (84.05)	104.7 (4.12)
Ⓕ ⓕ	85 (3.35)			593.5 (23.37)	3,362.0 (132.36)	170 (6.69)
Ⓑ ⓑ	13 (0.51)	 SBF381D	Hole for front shock absorber mounting at the bracket	434.0 (17.09)	−7.7 (−0.303)	181.9 (7.16)
Ⓖ ⓖ	25 (0.98)	 Side member outer SBF671C	Hole for body mounting at rear of side member outer	505.0 (19.88)	3,530.0 (138.98)	170.0 (6.69)
Ⓗ ⓗ	10.5 (0.413)	 SBF674C	Hole for rebound bumper mounting at lower link bracket	447.0 (17.60)	−88.0 (−3.465)	−14.9 (−0.587)

Underbody—VAN & WAGON (Cont'd)

Points	Hole dia. mm (in)	Detailed points		Coordinates mm (in)		
				"x"	"y"	"z"
Ⓙ ⓙ	27 (1.06)	 SBF675C	Hole for compression rod mounting at the bracket	361.1 (14.22)	294.5 (11.59)	−158.9 (−6.26)
Ⓚ ⓚ	13 (0.51)	 SBF676C	Hole for waxing at lower side of side member outer	510.0 (20.08)	1,040.0 (40.94)	−135.0 (−5.31)
Ⓛ ⓛ	13 (0.51)		Hole at lower side of side member outer	510.0 (20.08)	2,210.0 (87.01)	17.2 (0.677)
Ⓜ ⓜ	14 (0.55)	 SBF385D	Hole for upper link mounting at the bracket	268.0 (10.55)	2,381.6 (93.76)	5.0 (0.197)
ⓠ	14 (0.55)			332.0 (13.07)	2,396.4 (94.35)	5.0 (0.197)
ⓝ	14 (0.55)		Hole for panhard rod mounting at front portion of the bracket	496 (19.53)	2,840.5 (111.83)	−55 (−2.17)
Ⓟ	11 (0.43)		Hole for fuel tank mounting at vehicle center	0.0 (0.00)	2,878.0 (113.31)	106.0 (4.17)

HEATER & AIR CONDITIONER

SECTION HA

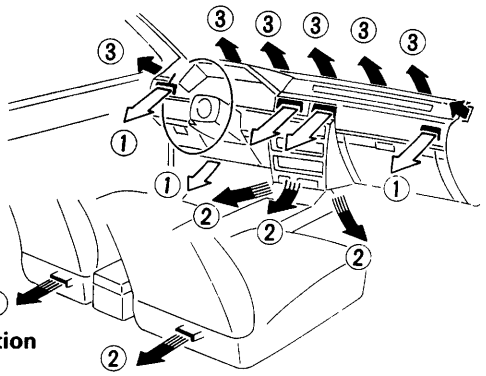
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When you read wiring diagrams:

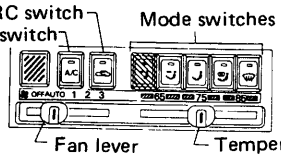
- Read GI section, "HOW TO READ WIRING DIAGRAMS".
- See EL section, "POWER SUPPLY ROUTING" for power distribution circuit.

Air Flow

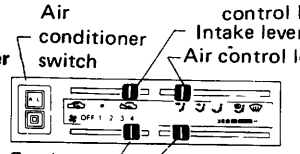


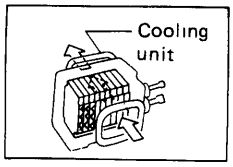
Ventilation

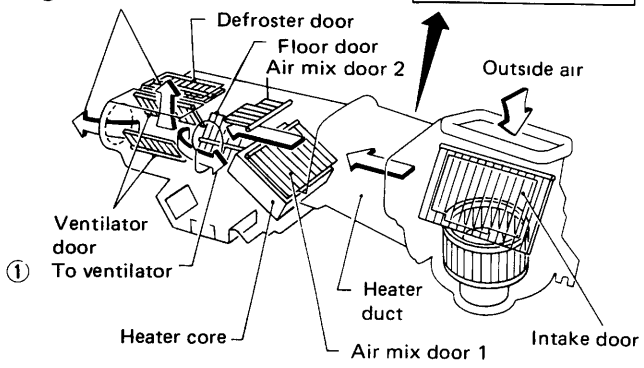
For auto air conditioner



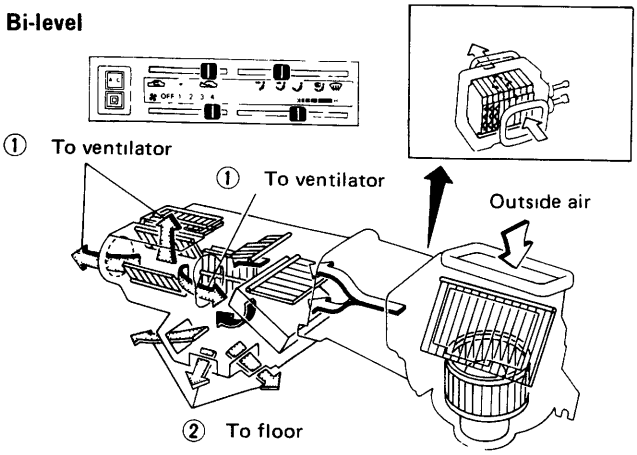
For manual air conditioner



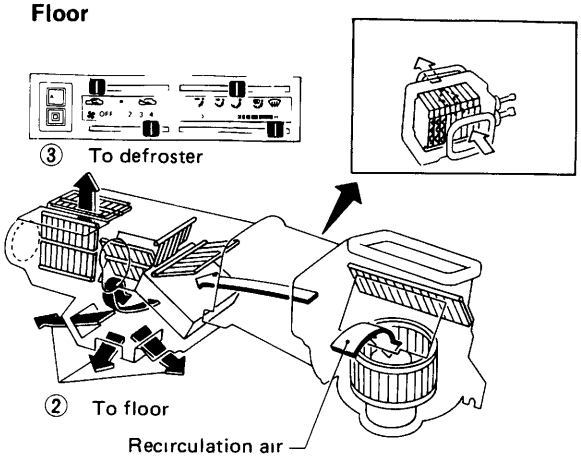




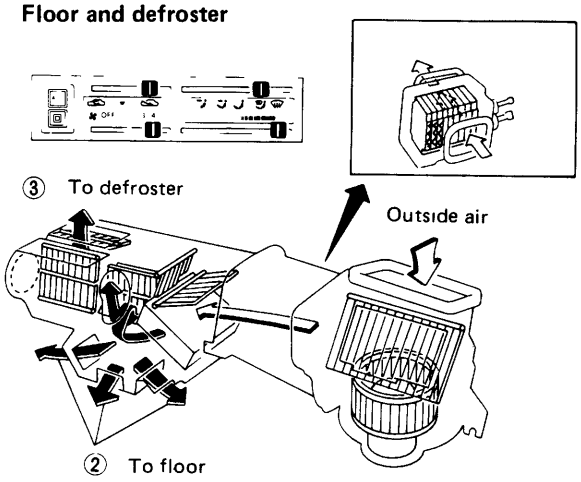
Bi-level



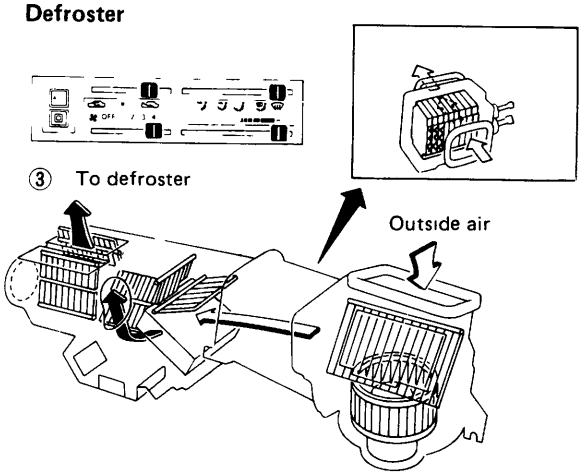
Floor



Floor and defroster



Defroster



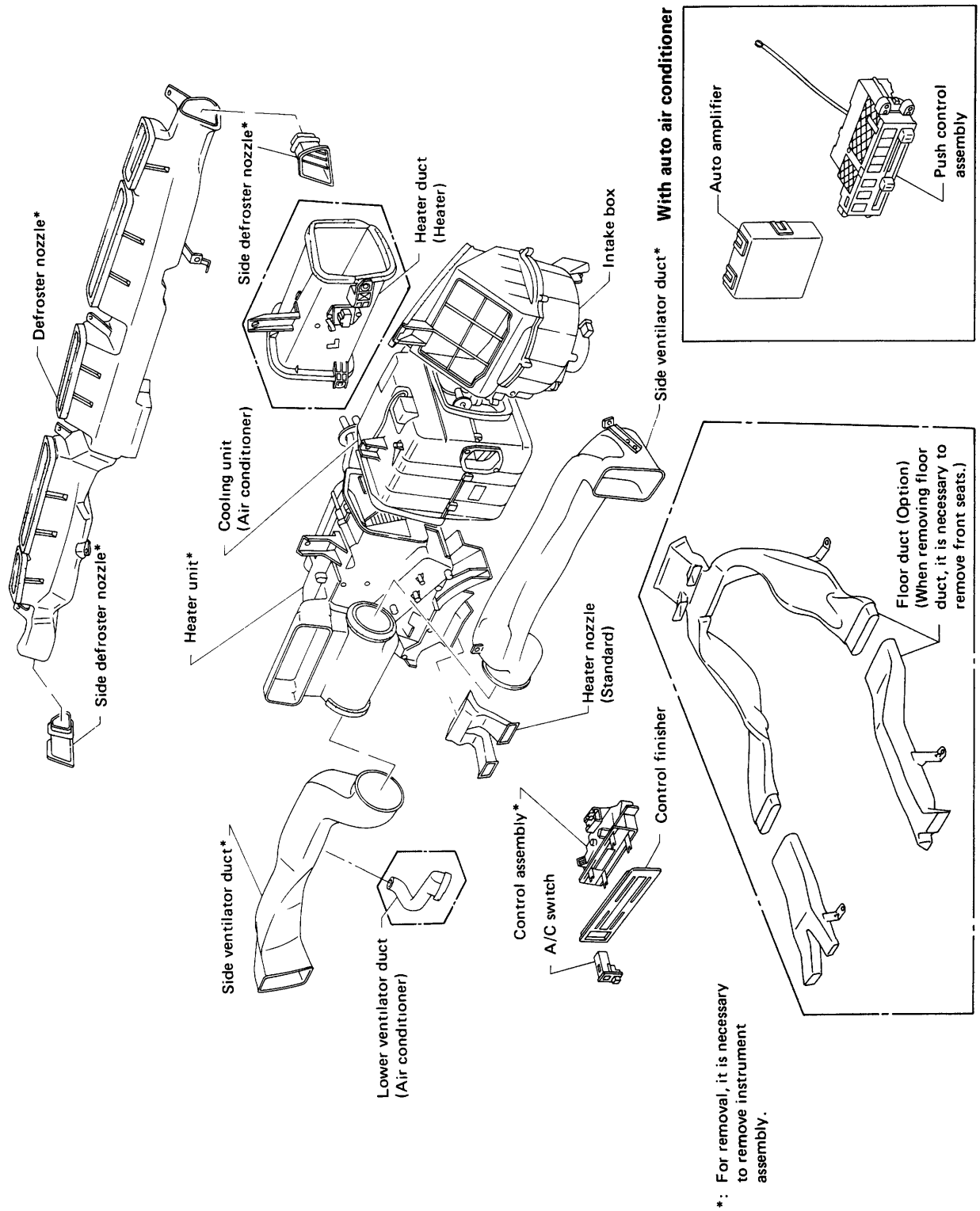
: Air passed through heater core

: Air not passed through heater core

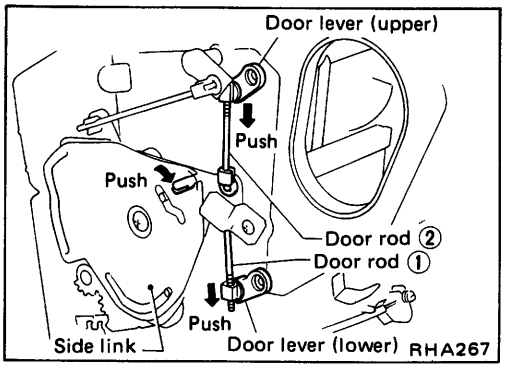
: Mixed air (+)

RHA492B

Component Layout



RHA493B

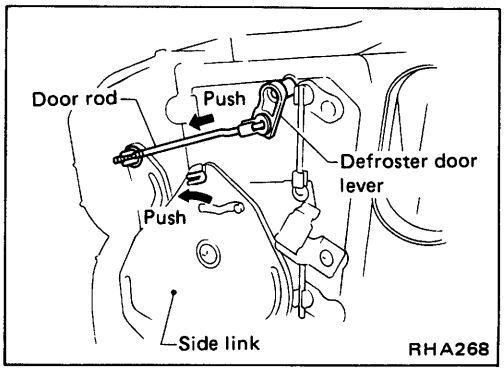


Control Cable and Rod Adjustment

- **When adjusting ventilator door rod and defroster door rod, first disconnect air control cable from side link. Reconnect and readjust air control cable.**

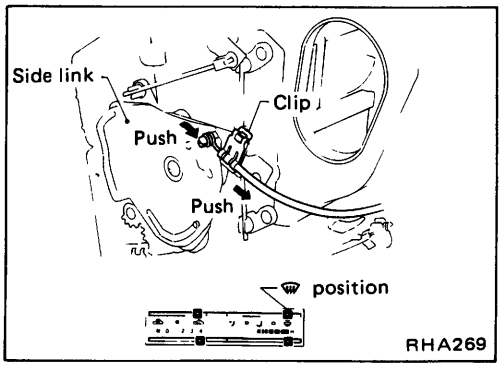
VENTILATOR DOOR CONTROL ROD

1. Move side link in direction of arrow.
2. With upper and lower ventilator door levers held in the direction of the arrow, connect rods ① and ② to their corresponding ventilator door levers in that order.



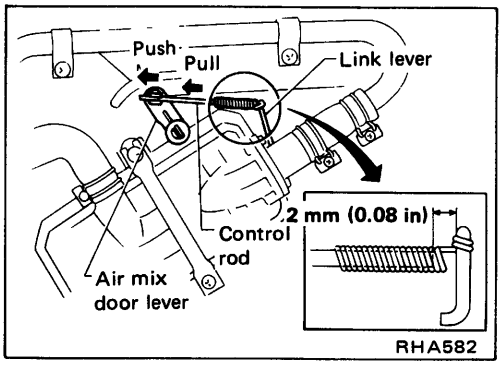
DEFROSTER DOOR CONTROL ROD

1. Move side link in direction of arrow.
2. Connect rod to side link while pushing defroster door lever in direction of arrow.



AIR CONTROL CABLE

- Clamp the cable while pushing cable outer and side link in direction of arrow.

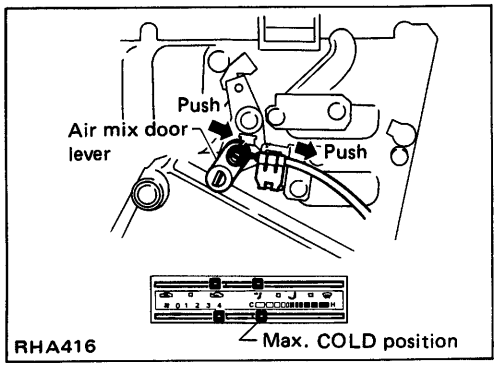


WATER COCK CONTROL ROD

- **When adjusting water cock control rod, first disconnect temperature control cable from air mix door lever and then adjust control rod. Reconnect temperature control cable and readjust it. (Refer to next item.)**

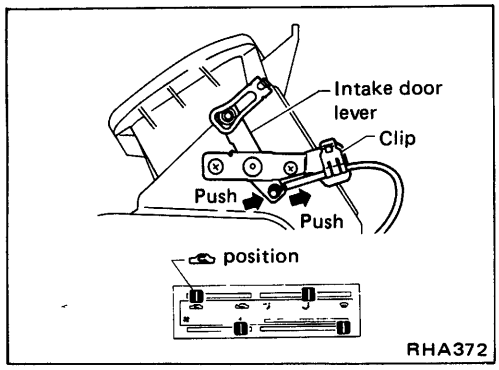
1. Push air mix door lever in direction of arrow.
2. Pull control rod of water cock in direction of arrow so as to make clearance of about 2 mm (0.08 in) between ends of rod and link lever and connect the rod to door lever.

Control Cable and Rod Adjustment (Cont'd)



TEMPERATURE CONTROL CABLE

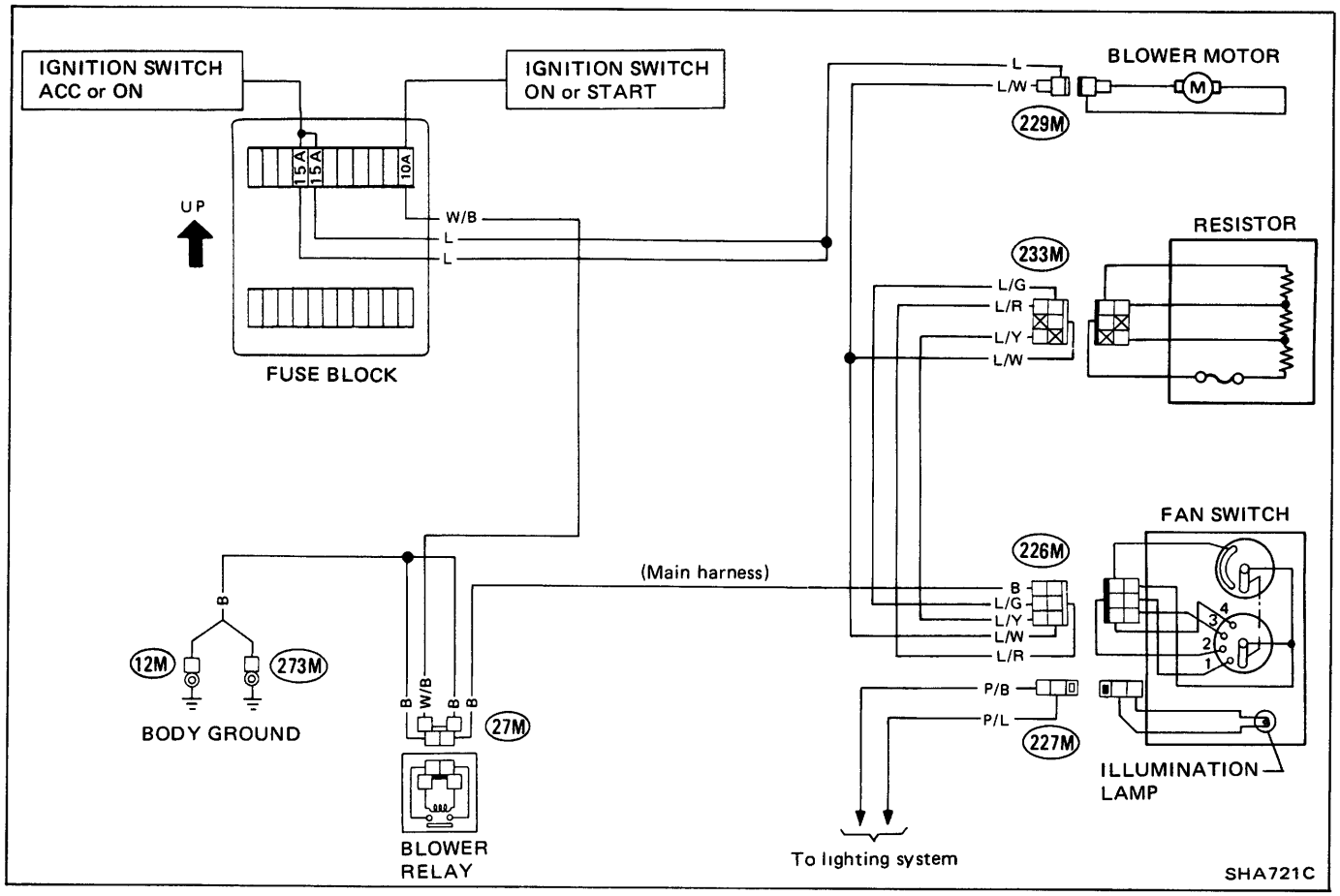
- Clamp the cable while pushing cable outer and air mix door lever in direction of arrow.



INTAKE DOOR CONTROL CABLE

- Clamp the cable while pushing cable outer and intake door lever in direction of arrow.

Wiring Diagram

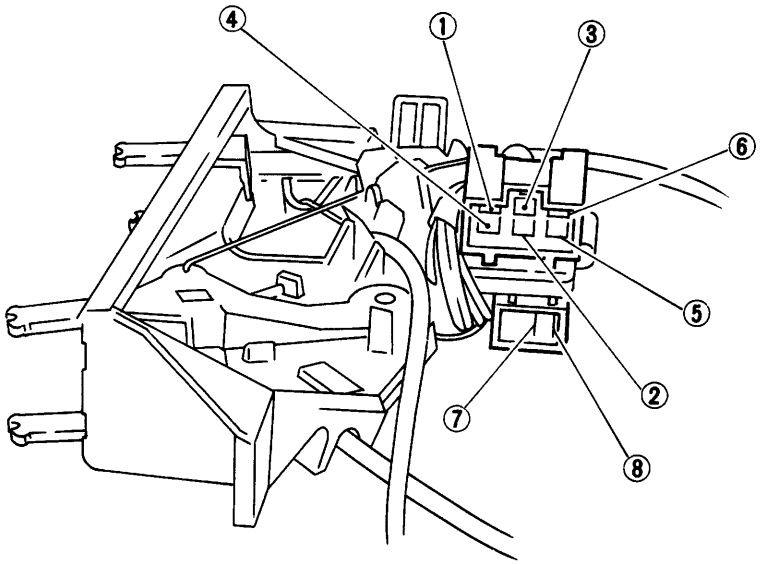


Fan Switch Check

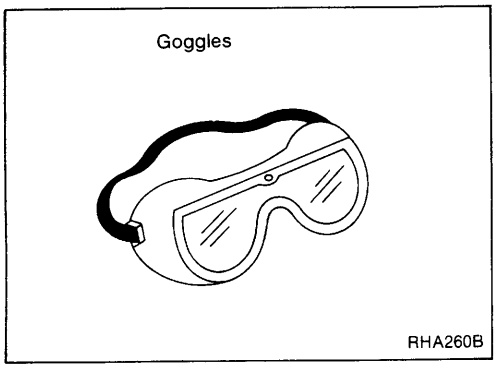
Fan switch

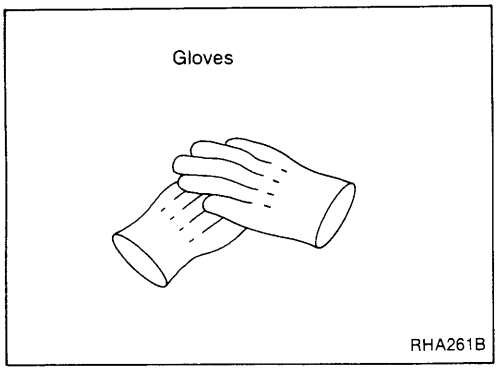
LEVER POSITION / TERMINAL	OFF	1	2	3	4
1					○
2		○			○
3			○		○
4				○	○
5		○	○	○	○
6		○	○	○	○
7	○	○	○	○	○
8	○	○	○	○	○

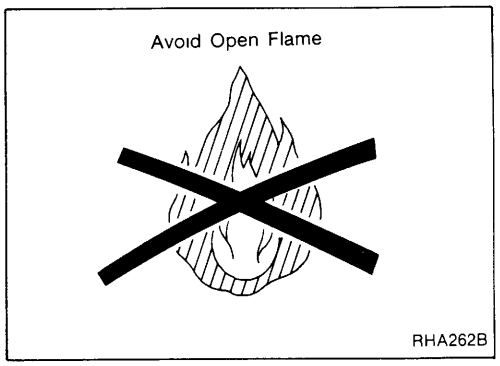
Illumination lamp

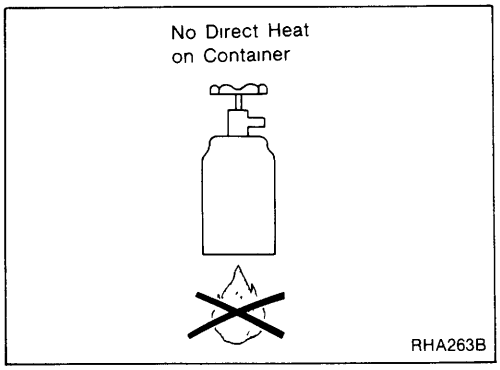


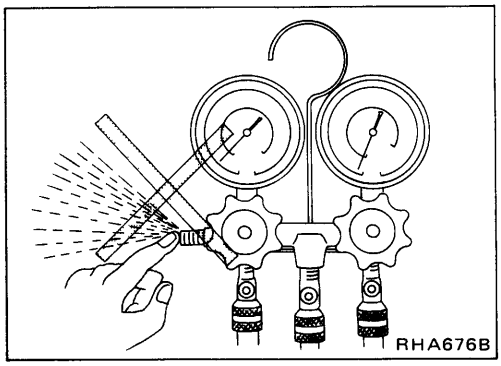
RHA374











Precautions

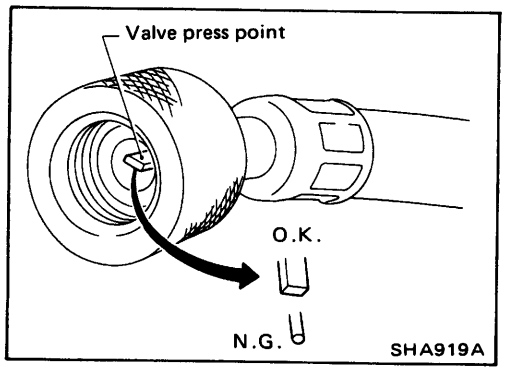
PRECAUTIONS FOR THE HANDLING OF REFRIGERANT

- **Always wear eye protection when working around the system.**
- **Always be careful that refrigerant does not come in contact with your skin.**
- **Keep refrigerant containers stored below 40°C (104°F) and never drop from high places.**
- **Work in well-ventilated area because refrigerant gas evaporates quickly and breathing may become difficult due to the lack of oxygen.**
- **Keep refrigerant away from open flames because poisonous gas will be produced if it burns.**
- **Do not increase can temperature beyond 40°C (104°F) in charging.**
- **Do not heat refrigerant container with an open flame. There is a danger that container will explode.**

CAUTION:

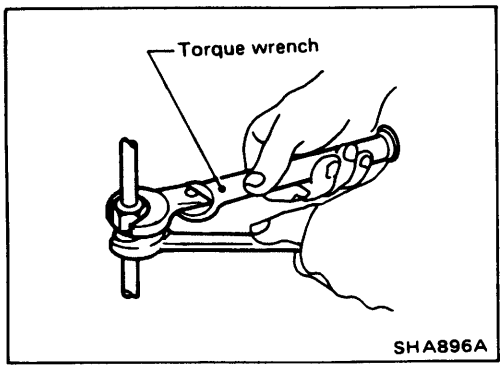
- **Do not use stream to clean surface of condenser or evaporator. Be sure to use cold water or compressed air.**
- **Compressed air must never be used to clean a dirty line.**

- **Do not release refrigerant into the atmosphere.**



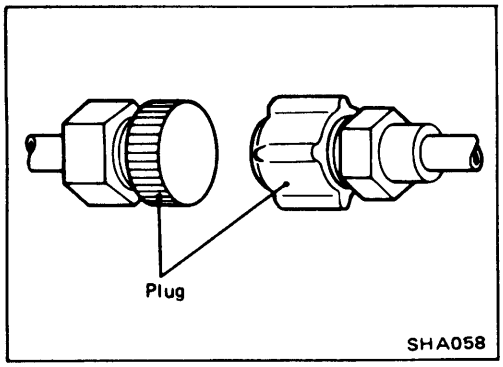
- **Do not use manifold gauge whose press point shape is different from that shown. Otherwise, insufficient evacuating may occur.**

- **Do not over-tighten service valve cap.**
- **Do not allow refrigerant to rush out. Otherwise, compressor oil will be discharged along with refrigerant.**

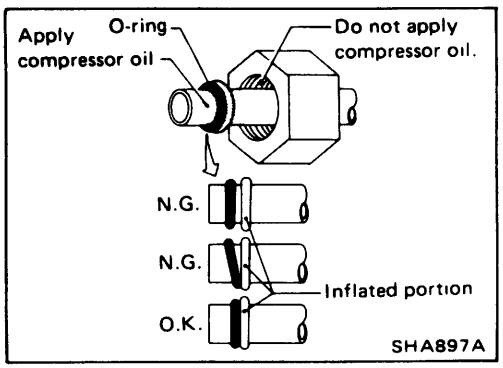


WARNING:
Gradually loosen discharge side hose fitting, and remove it after remaining pressure has been released.
CAUTION:
When replacing or cleaning refrigerant cycle components, observe the following.

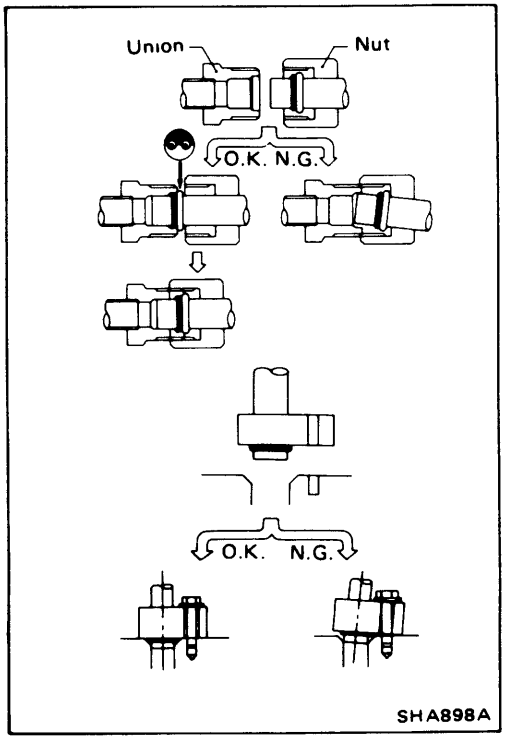
- **Do not leave compressor on its side or upside down for more than 10 minutes, as compressor oil will enter low pressure chamber.**
- **When connecting tubes, always use a torque wrench.**



- **After disconnecting tubes, plug all openings immediately to prevent entrance of dirt and moisture.**

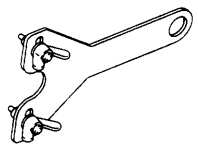
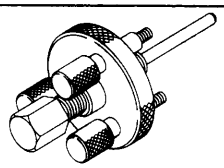
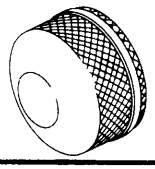


- **Always replace used O-rings.**
- **When connecting tube, apply compressor oil to portions shown in illustration. Be careful not to apply oil to threaded portion.**
- **O-ring must be closely attached to inflated portion of tube.**

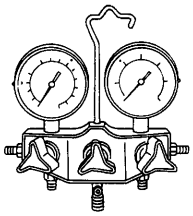
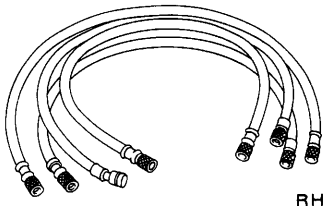
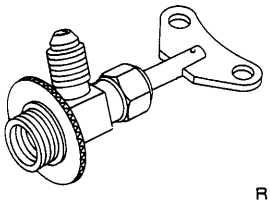
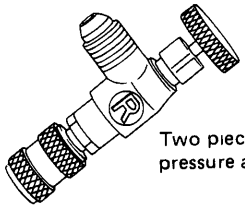
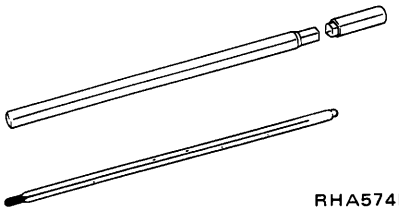
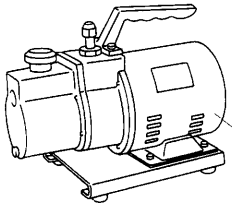


- **After inserting tube into union until O-ring is no longer visible, tighten nut to specified torque.**
- **After connecting line, conduct leak test and make sure that there is no leakage from connections. When the gas leaking point is found, disconnect that line and replace the O-ring. Then tighten connections of seal seat to the specified torque.**

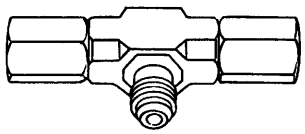
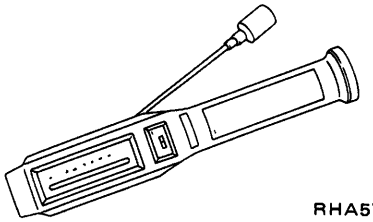
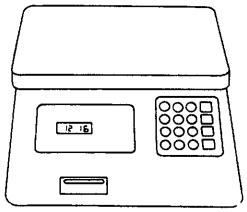
SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.) Tool name	Description	
KV99231162 (–) Clutch disc wrench		Removing shaft nut and clutch disc
KV99232340 (–) Clutch disc puller		Removing clutch disc
KV99234330 (–) Pulley installer		Installing pulley

Service Tools

Tool name	Description	
Manifold gauge (3-valve type)	 RHA570B	Discharging, evacuating and charging refrigerant
Charging hose (Four)	 RHA571B	Discharging, evacuating and checking refrigerant
Charge valve	 RHA572B	Discharging and charging refrigerant
Adapter valve	 Two pieces on each high pressure and low pressure line RHA573B	Evacuating and charging
Thermometer	 RHA574B	Checking temperature
Vacuum pump	 RHA575B	Evacuating refrigerant

Service Tools (Cont'd)

Tool name	Description
Joint adapter (T-type)	Charging refrigerant  RHA576B
Gas leak detector	Checking refrigerant leaks  RHA577B
Charging cylinder	Checking amount of refrigerant and charging refrigerant  RHA578B
Weight scale	Checking amount of refrigerant  RHA579B

For details of such handling methods, refer to the Instruction Manual attached to each of the service tools.

Service Tools (Cont'd)

HANDLING METHOD AND STRUCTURE

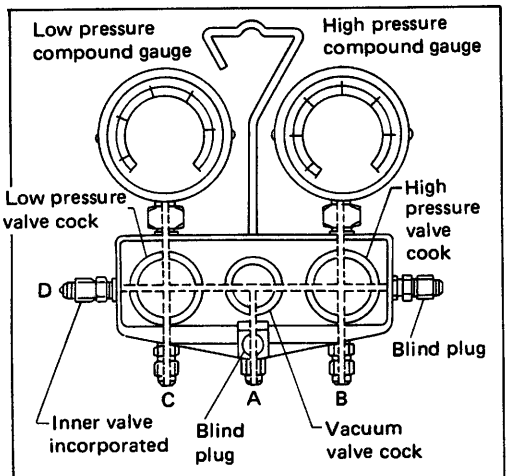
Manifold gauge

The manifold gauge is used to measure the operating pressure accurately in the high pressure and low pressure lines of the refrigerating system.

The high pressure gauge measures from –101.3 kPa (–760 mmHg, –29.92 inHg) to 2,942 kPa (30 kg/cm^2, 427 psi), and the low pressure gauge measures generally from –101.3 kPa (–760 mmHg, –29.92 inHg) to 1,471 kPa (15 kg/cm^2, 213 psi).

CAUTION:

- **When installing the gauge to the refrigerating system, use utmost care not to mistake high pressure and low pressure line connections. (Wrong connections will lead to a damaged gauge.)**
- **Before evacuating, confirm that the gauge has a negative pressure scale. (If not, the gauge will be damaged.)**



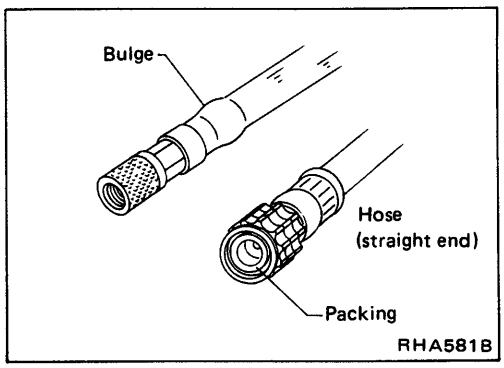
Center joint (A):
Use for evacuating.
High pressure side joint (B):
Connect to high pressure side service valve of refrigerating system.
Low pressure side joint (C):
Connect to low pressure side service valve of refrigerating system.
Refrigerant joint (D):
Use for charging refrigerant.
RHA580B

Charging hose

1. Completely tighten the high pressure valve, low pressure valve and vacuum pump valve cocks of the gauge manifold.
2. Connect the charging hoses to the high and low pressure lines.
3. Connect the charging hose fitted with a valve core to the refrigerant canister.
4. Connect the charging hose to the vacuum pump.

The high and low pressure hoses are color coded to prevent wrong connection.

High pressure line hose	Red
Low pressure line hose	Yellow
Refrigerant canister hose	Blue or green (with valve core)
Vacuum pump hose	Blue or green

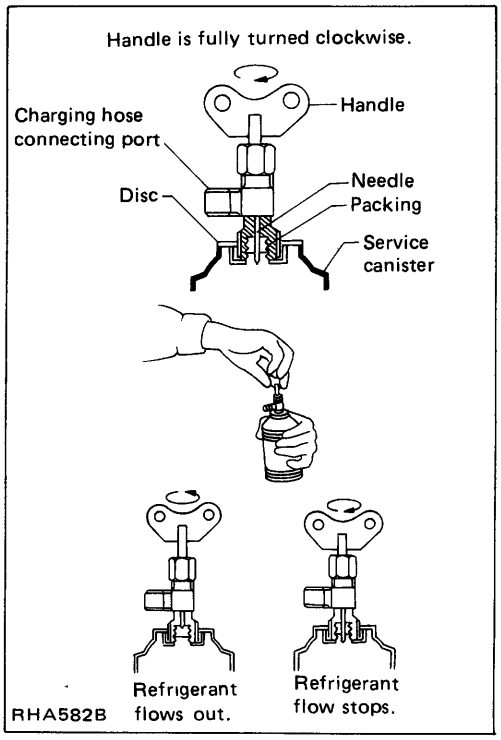


RHA581B

CAUTION:

- **Check each hose for cracks. If found, discard the hose.**
- **Do not use any hose if bulges are found.**
- **Check the rubber packing. If any deterioration or cracks are found, replace it with a new one.**

Service Tools (Cont'd)



Charge valve

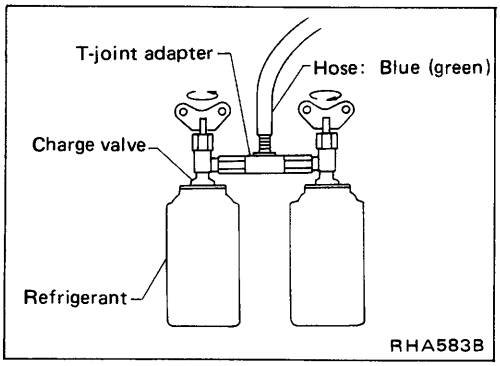
The charge valve is used to charge the refrigerant into the system from the service canister through the gauge manifold.

Attach this valve to the head of a service canister by screwing it on. Then turn the handle clockwise to pierce the canister to allow the refrigerant to flow into the refrigerating system.

CAUTION:

Check the packing for any sign of deterioration or cracks. If any abnormalities are found, replace it with a new one.

1. Turn the charge valve handle counterclockwise to fully retract the needle, and then attach the charge valve to the service canister. Note that leakage will occur if the charge valve is attached to the canister without retracting the needle.
2. Securely fit the charge valve to the head of the service canister by turning it. Then turn the handle slowly clockwise to make a hole in the canister with the needle.
3. Turn the handle counterclockwise to retract the needle, and the refrigerant will flow into the gauge manifold through the hole. To stop the flow of the refrigerant, turn the handle clockwise to close the hole with the needle.

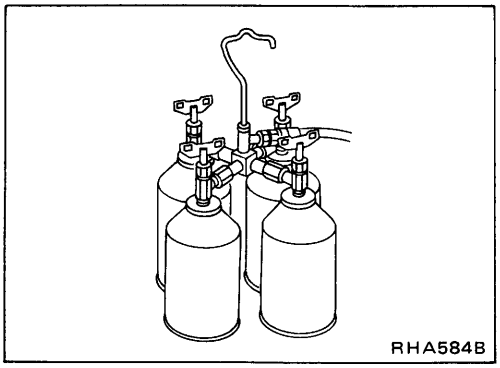


Connecting T-joint adapter

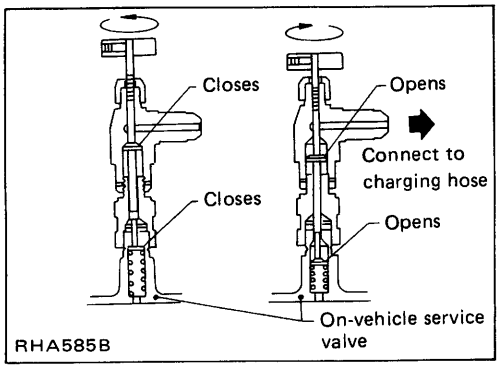
The T-joint adapter is used to connect two refrigerant canisters so that air purging and the accompanying discharge of refrigerant into the atmosphere can be eliminated when recharging the refrigerant. If only one service canister is sufficient to charge the refrigeration system, do not use this T-joint adapter.

1. Turn the handle of each charge valve fully counterclockwise, and attach the valve to a refrigerant canister.
2. Connect the T-joint adapter to both charge valves so that two refrigerant canisters are connected as shown.
3. Connect the charging hose with valve core to the T-joint adapter. Connect the valve core end of the charging hose to the manifold gauge.

If more than three service canisters are needed for charging, use a cross joint adapter to connect four service canisters.



Service Tools (Cont'd)



Installing the adapter valve

Install the adapter valve to each of the high pressure and low pressure service valves so that air purging from the charging hose can be omitted. This also ensures that refrigerant leakage upon disconnection of the hose can be prevented.

1. Before connecting the adapter valve to the on-vehicle service valve, turn the adapter valve handle fully counterclockwise to retract the pin.

CAUTION:

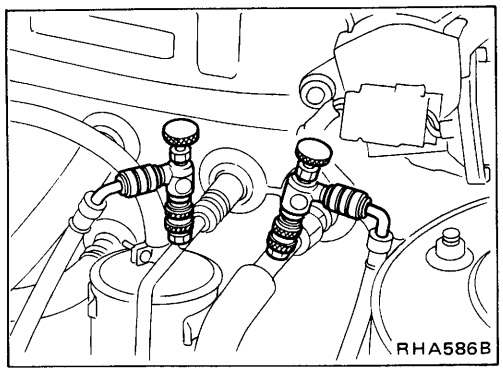
Check the packing for any sign of deterioration or cracks. If any abnormality is found, replace the packing with new.

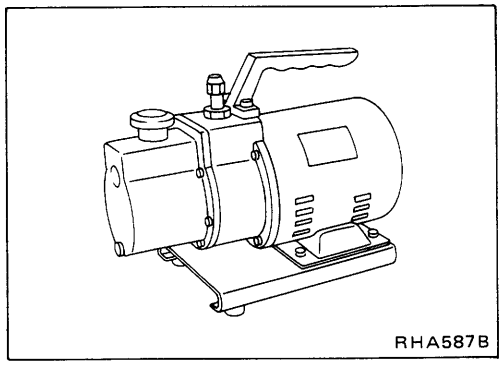
2. Connect the charging hose to the adapter valve.

Turning the handle clockwise will cause the on-vehicle service valve pin to be pushed open by the adapter valve pin, thus opening the refrigerant passage.

Turning the handle counterclockwise will close the passage.

Before removing the adapter valve from the on-vehicle service valve, be sure to fully turn the handle counterclockwise to shut off the refrigerant passage.

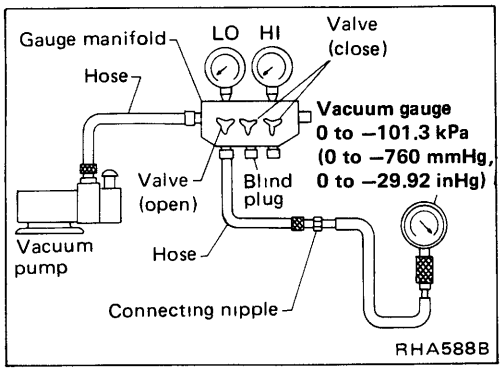




Vacuum pump

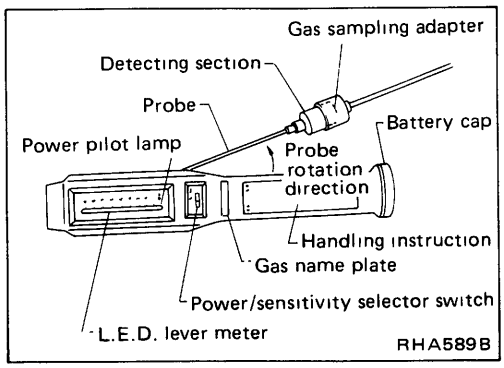
The vacuum pump is used to purge air and moisture from the inside of the refrigeration system by evacuation, thereby ensuring proper functioning of the air conditioner system.

Check the vacuum pump to see that the vacuum pump capacity is greater than –100.0 kPa (–750 mmHg, –29.53 inHg).



Vacuum pump performance check procedure

1. Connect the vacuum gauge to the system.
2. Run the vacuum pump, and check to see that the needle pointers of the gauge manifold and vacuum gauge move smoothly, indicating a similar value.
3. After running the vacuum pump for two or three minutes, read the vacuum gauge. The measured value indicates the capacity of the refrigeration system.



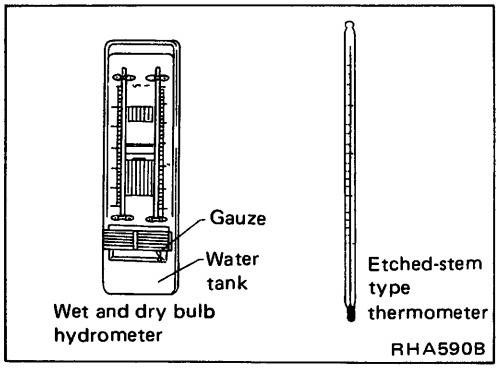
Gas leak detector

The gas leak detector is used to check whether the refrigeration system is leaking. The detector is available in two types; halide torch or electrical. The features of these gas leak detectors are listed on the next page.

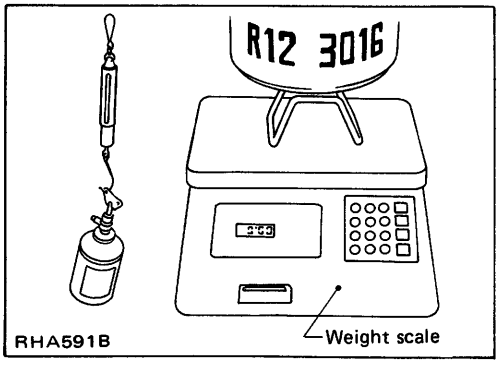
Service Tools (Cont'd)

Type		Detection ability	Features
Halide torch		200 g (7.05 oz)/year (thin green)	• Low price • Low sensitivity • Less safe because of the use of flame for detection
Electrical	Discharge type (Suction type)	3 - 50 g (0.11 - 1.76 oz)/year	• Easy handling • Medium sensitivity • Each point needs two or more seconds for detection.
	Positive ion emission type (Suction type)	2 g (0.07 oz)/year	• High sensitivity • High price • Warm-up time is needed because a heater is incorporated.
Other simple checking method: Change in vacuum when evacuating		1 kg (2 lb)/month; if 13.3 kPa (100 mmHg, 3.94 inHg) change in vacuum is detected in 10 minutes.	• Can be used easily in refrigerant charging operation. • Detection ability is very low with vacuum gauge in gauge manifold.

- **Leakage inspection of a refrigeration system needs a sensitivity greater than 20 g (0.71 oz)/year.**
- **The actual amount of leak is estimated at 5 to 10 times the detected amount.**
- **Insufficient cooling may be felt if leakage exceeds 150 to 200 g (5.29 to 7.05 oz).**

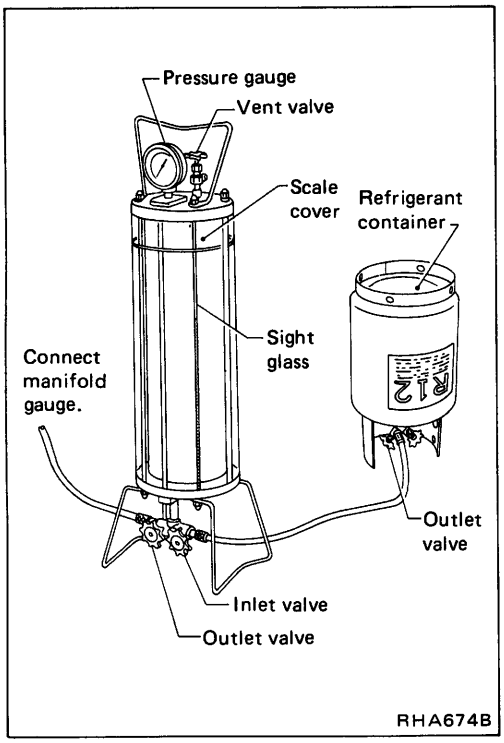


Temperature gauge
Use to check the air conditioner performance. An etched stem type thermometer may be used. A hygrometer must also be used because the air conditioner performance depends on the humidity.



Scale
Measure the weight of the refrigerant to determine how much the refrigerant is charged.

Service Tools (Cont'd)



Charging cylinder

The charging cylinder is used to correctly measure the amount of refrigerant to be charged.

Features

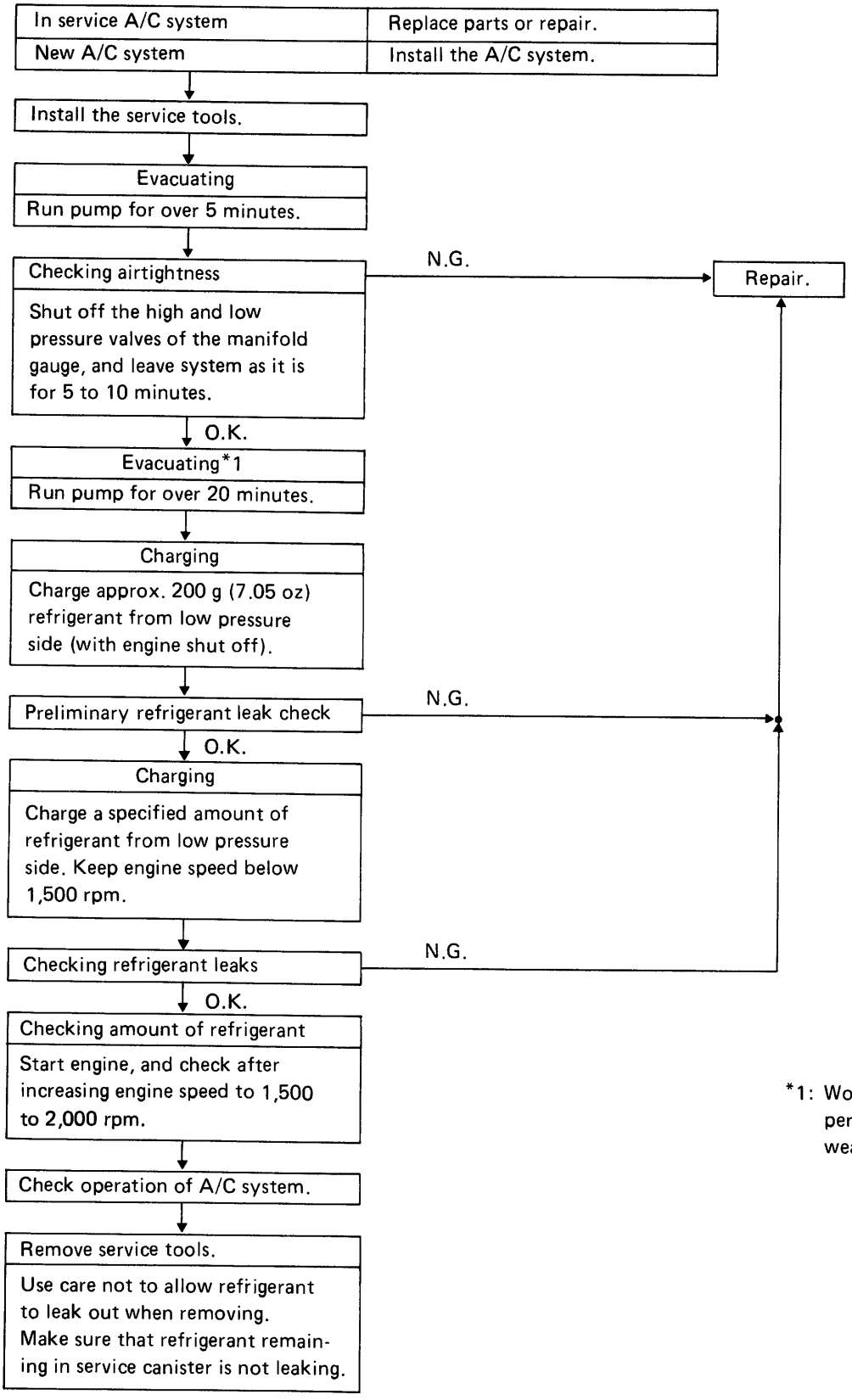
- With the charging cylinder, the operator can measure correctly the amount of refrigerant to be charged into the system.
- Change in the refrigerant volume due to a change in temperature and pressure can be supplemented, and this ensures correct charging of refrigerant.

CAUTIONS:

- **Never attempt to carry the charging cylinder containing refrigerant.**
- **Do not put the charging cylinder in a hot place. If the temperature and pressure of the refrigerant in the cylinder increase, the safety valve will be pushed open and the refrigerant will be released into the atmosphere.**
- **Do not expose the cylinder to the direct sunlight.**
- **Do not over-charge the refrigerant so that it exceeds the maximum limit of the cylinder.**
- **Do not charge the cylinder with more refrigerant than is needed.**

Refrigerant Charging Procedure

WORK PROCEDURE

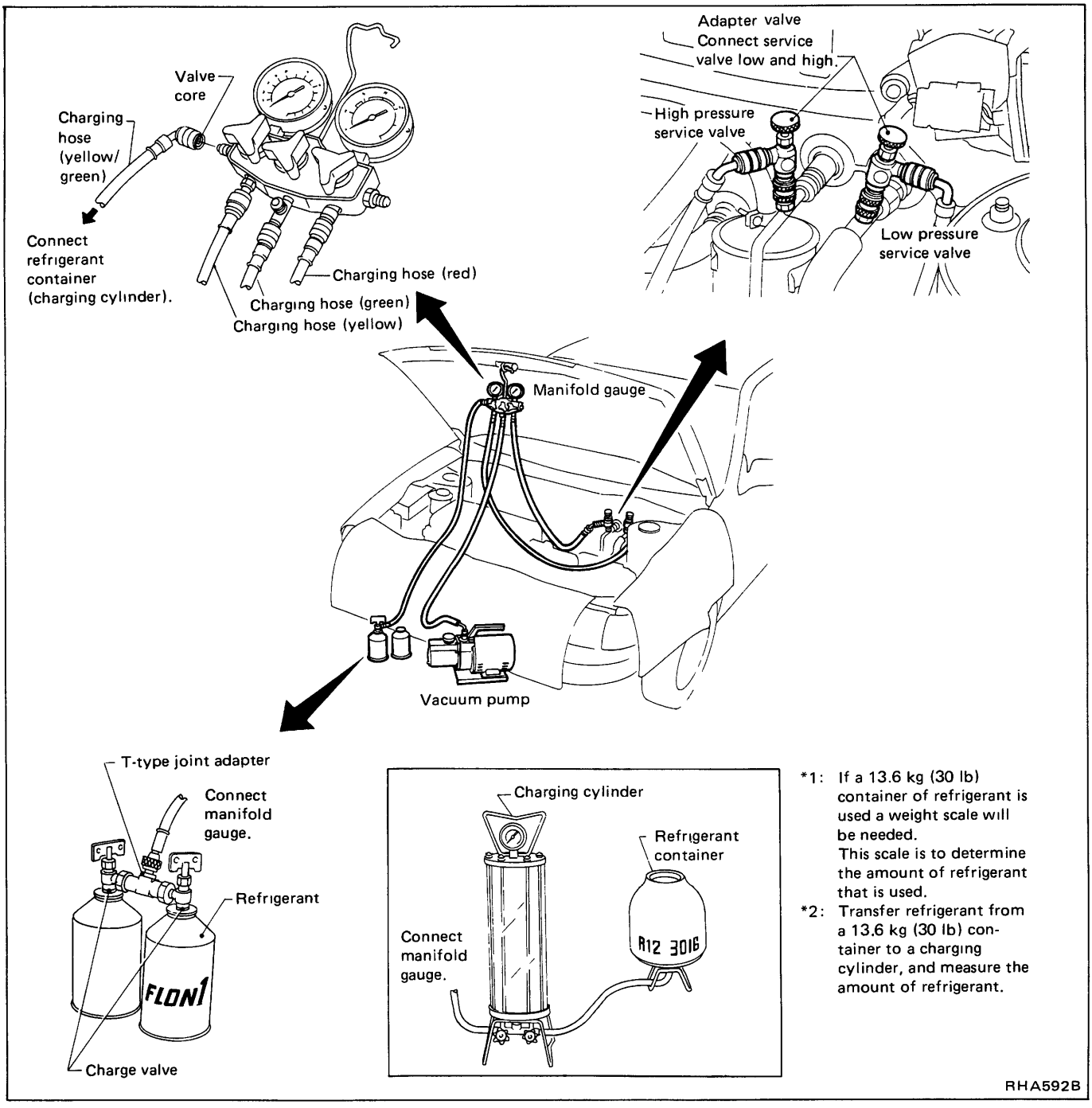


*1: Working operation depends upon the performance of the pump and the weather.

Refrigerant Charging Procedure (Cont'd)

SETTING OF SERVICE TOOLS

Make sure that the service tools are set as indicated below and that no refrigerant is leaking.



*1: If a 13.6 kg (30 lb) container of refrigerant is used a weight scale will be needed.
This scale is to determine the amount of refrigerant that is used.

*2: Transfer refrigerant from a 13.6 kg (30 lb) container to a charging cylinder, and measure the amount of refrigerant.

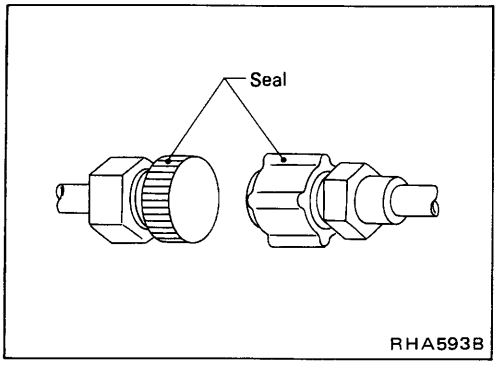
RHA592B

Evacuation

Why evacuation is needed

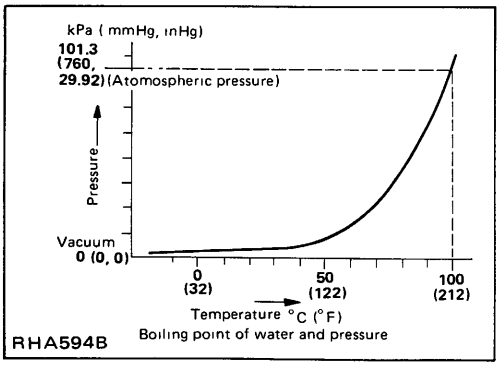
When installing a car air conditioner, it is essential to completely remove air and water from the inside of the refrigeration system beforehand. This process is called evacuation. If the air conditioner is operated without completely removing these substances, the following abnormalities may result.

- Poor cooling due to reduction in the thermal exchange rate in condenser
- Moisture recirculating together with the refrigerant through the refrigeration system freezes at the port of the cold expansion valve. This impedes the normal refrigerant flow, thus lowering the cooling efficiency.
- The refrigerant reacts with water chemically, generating corrosive hydrochloric acid thus causing corrosion to the refrigeration system components.



CAUTION:

- **When installing an air conditioner in the vehicle, the pipes must be connected as the final stage of the operation. The seal caps of the pipes and other components must not be removed until their removal is required for connection.**
- **Before installing any air conditioner component that has been stored in a cool location to a vehicle that has been exposed to the hot sun, leave the component as it is for some time in a hot location with its seal cap unremoved. This step is necessary to prevent condensation of moisture inside the cold component.**
- **Thoroughly remove moisture from the refrigeration system before charging the refrigerant.**



Relation between boiling point of water and atmospheric pressure

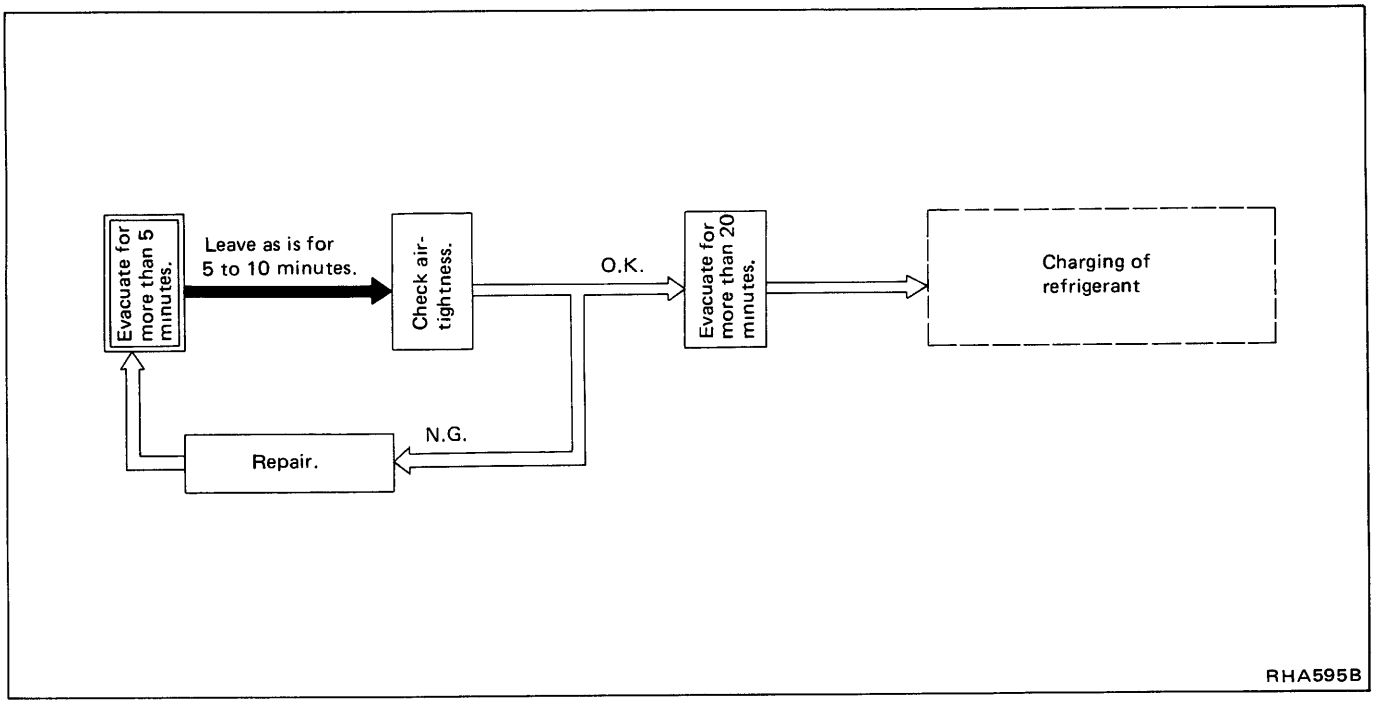
Water boils at 100°C (212°F) under normal atmospheric pressure. The boiling point lowers with the atmospheric pressure. This characteristic of water is utilized to purge it from the system. The pressure inside the refrigeration system is lowered by a vacuum pump so that water can evaporate at a normal temperature. The water vapor is then discharged to the outside together with the air.

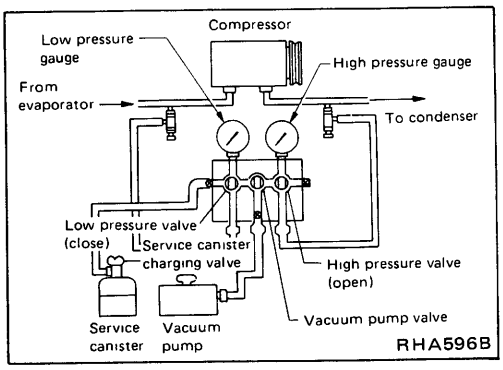
Evacuation (Cont'd)

Vacuum pump

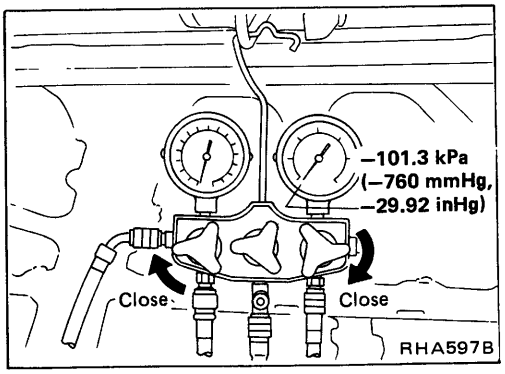
The degree of evacuation greatly affects the cooling capacity of the air conditioner and the service life of the refrigeration system components. However, use of a vacuum pump having insufficient capacity results in prolonged evacuation. It is necessary to use a vacuum pump with a sufficiently large capacity and also to maintain the pump to ensure its original pumping capacity.

EVACUATION PROCEDURE

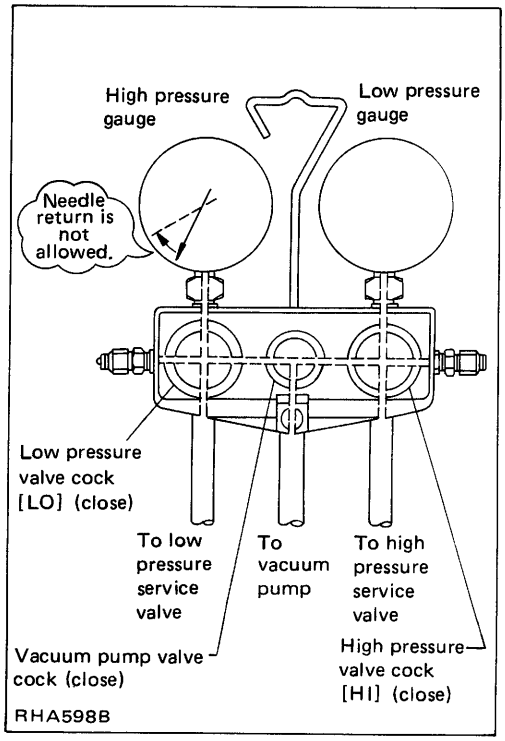




1. Completely tighten the low pressure and high pressure adapter valves.
   Tightening of the valves opens the service canister valve.
2. Open the high and low pressure valves and vacuum pump valve of the gauge manifold.
3. Run the vacuum pump.



4. Perform evacuation for more than five minutes to stabilize the vacuum inside the system. Check to ensure that the low pressure gauge indicates –98.6 to –101.3 kPa (–740 to –760 mmHg, –29.13 to –29.92 inHg).
5. Shut off the high and low pressure valves and vacuum pump valve of the gauge manifold.



Evacuation (Cont'd)

CHECKING AIR TIGHTNESS

1. Shut off the high and low pressure valves and vacuum pump valve of the gauge manifold, and leave the system as it is for 5 to 10 minutes.
2. Make sure that the needle of the low pressure gauge will not move back toward the atmospheric pressure side (gauge pressure 0).

If any reverse movement is noted, it indicates poor system airtightness. Service the system until airtightness is complete.
If pressure changes approx. 13.3 kPa (100 mmHg, 3.94 inHg) in 10 minutes, the refrigerant in the system will be exhausted in about one month.

MAINTENANCE

If inadequate airtightness is detected, check and service the following portions:

Leak from pipe joints	Leak from gauge manifold
• Contaminated, damaged, or deformed O-ring • No oil applied when connecting pipe • Excessive or insufficient tightening of pipe joint	• Malfunctioning hose • Improper installation of gauge • Malfunctioning valve • Malfunctioning packing

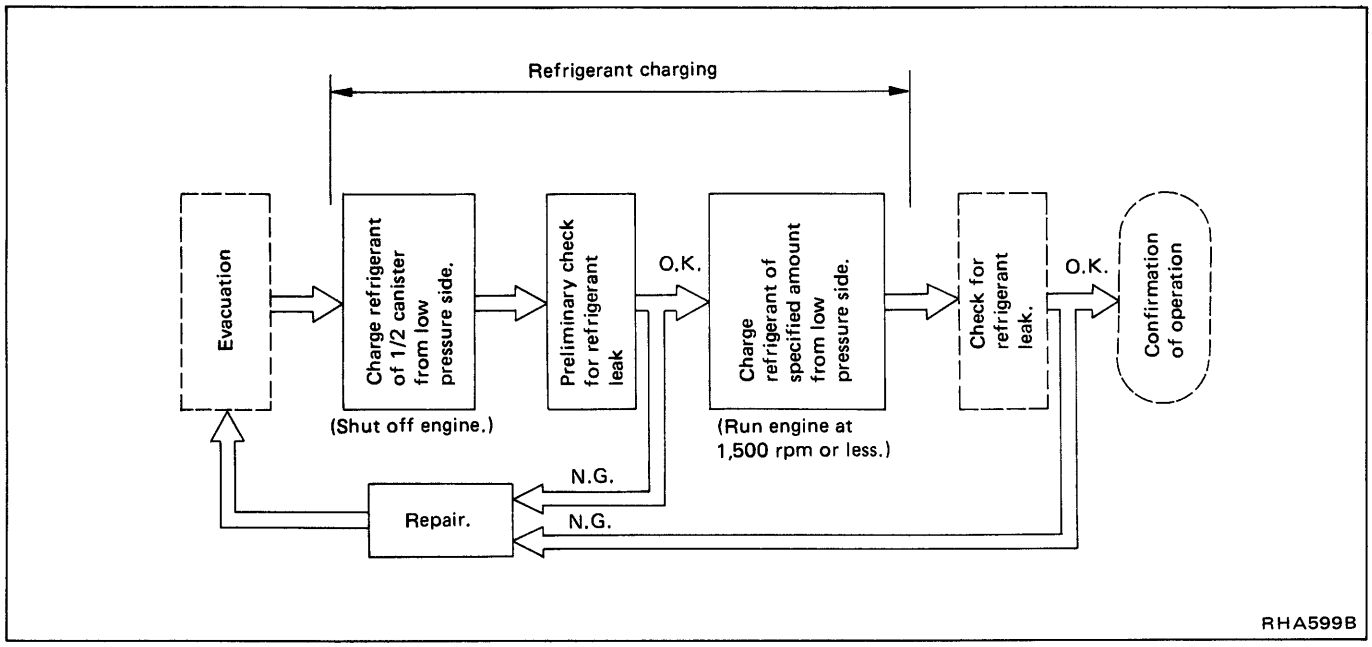
EVACUATION

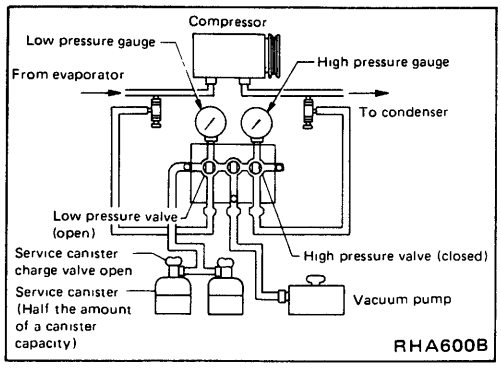
If no abnormality is found during the airtightness check, perform evacuation again for more than 20 minutes.

1. Run the vacuum pump.
2. Open the high and low pressure valve and vacuum pump valve of the gauge manifold.
3. Evacuate for more than 20 minutes.
4. Close the high and low pressure valves and vacuum pump valve of the gauge manifold.

Charging Refrigerant

WORK PROCEDURE





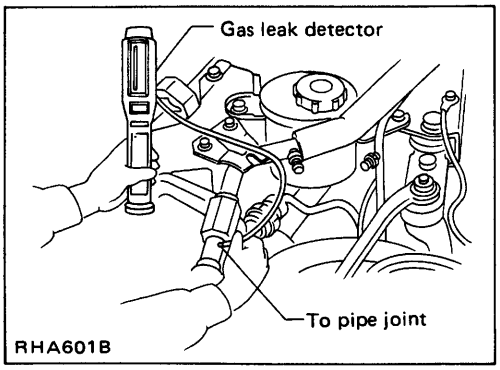
PRELIMINARY CHARGING PROCEDURE

This operation is performed to check the refrigerant leakage and to protect the compressor.

1. Turn the charge valve handle to open a hole in the service canister to allow the refrigerant to flow through the gauge manifold.
2. Open the low pressure valve of the gauge manifold, and charge the refrigerant into the system from the low pressure side.
3. After charging approx. 200 g (7.05 oz) of refrigerant, shut off the low pressure valve.

CAUTION:

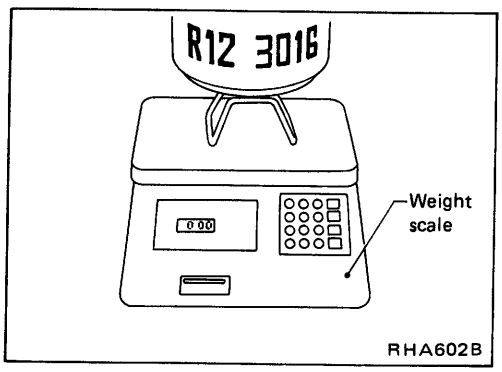
- **The refrigerant charging operation must be performed after shutting off the engine. If the compressor is operated with an insufficient amount of refrigerant, the compressor may seize up due to a lack of return of the compressor oil.**
- **Do not shake nor hold the refrigerant canister upside down.**



PRELIMINARY CHECK FOR REFRIGERANT LEAKS

1. Make sure that the gauge manifold valve is closed.
2. Check for refrigerant leak from each connector in the system using the leak detector.

At this point, the pressure in the system is not high. Only large amounts of refrigerant leak due to loose pipe joints, etc. can be detected.



Charging Refrigerant (Cont'd)

CHARGING REFRIGERANT

1. Make sure that the valves of the gauge manifold are closed.
2. Start the engine, and run the compressor.
3. Slowly open the low pressure valve of the gauge manifold.
4. Charge the specified amount of refrigerant.

The charged amount of refrigerant can be determined by subtracting the weight of the canister measured after charging from its weight measured before charging.

WARNING:

Never attempt to open the high pressure valve while the engine is running. If opened, the pressure in the refrigerant canister will increase, thus causing an explosion.

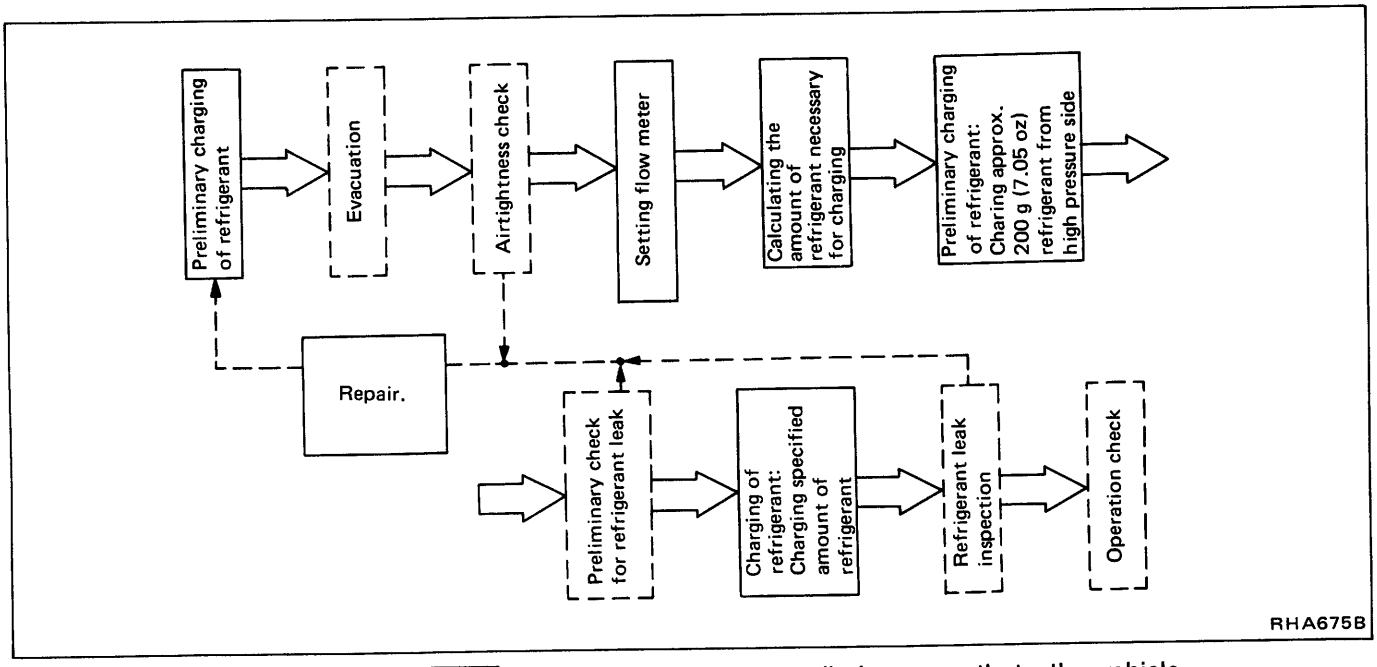
CHARGING REFRIGERANT WITHOUT USING T-JOINT ADAPTER

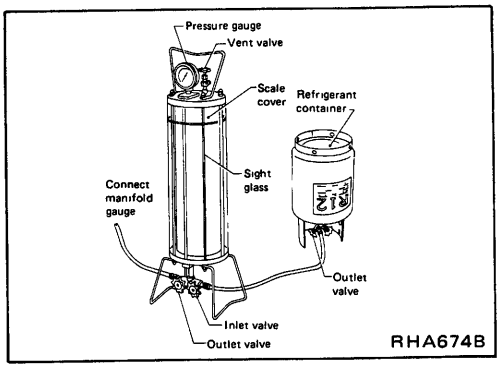
If the service canister used for charging is empty, replace the canister with a new one, and proceed as follows:

1. Make sure by shaking the canister that no refrigerant is left inside.
2. Shut off all the valves of the gauge manifold.
3. Disconnect the charge valve from the emptied canister, and attach it to a new service canister.
4. Run the vacuum pump, and open the vacuum valve (center) of the gauge manifold to purge air from the inside of the hose.
5. Run the vacuum pump for approx. 30 seconds.
6. Shut off the vacuum valve (center) and stop the vacuum pump.
7. Unseal the new canister, and open the charge valve.
8. Open the low pressure valve to charge the refrigerant into the system.

Charging Refrigerant — Charging cylinder

WORK PROCEDURE



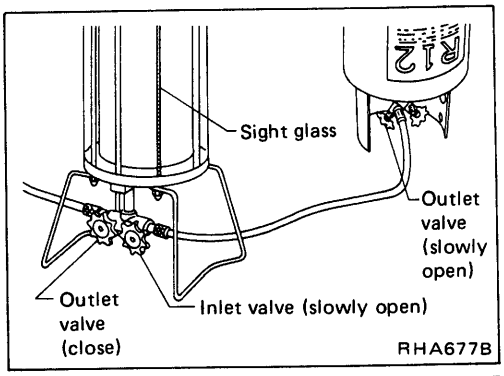


Install the charging cylinder correctly to the vehicle.
Refer to "SETTING OF SERVICE TOOLS" in "Refrigerant Charging Procedure".

PRELIMINARY CHARGING OF REFRIGERANT-1

1. Make sure that the inlet and outlet valves of the charging cylinder are closed.
2. Slowly open the outlet valve of a refrigerant container [13.6 kg (30 lb)].
3. Slowly open the inlet valve of the charging cylinder.

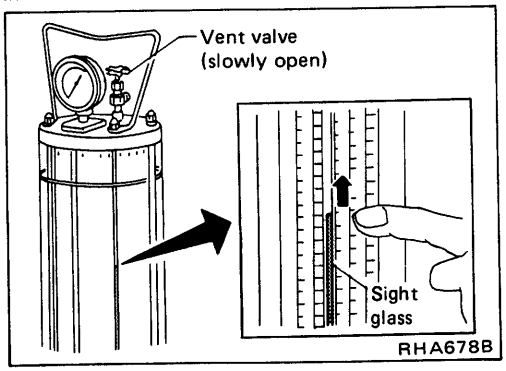
The refrigerant will flow into the sight glass of the charging cylinder as the valve is opened.

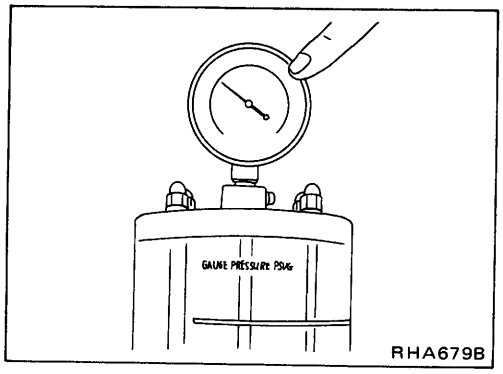


4. Slowly open the upper vent valve to release pressure from the charging cylinder. While doing so, continue charging until the required amount of refrigerant is reached.

The refrigerant volume changes with the temperature and pressure. It is necessary to charge refrigerant with a little more than the required amount (indicated on the sight glass).
Refer to the CAUTION label attached on the vehicle, or to the Service Manual.

5. Close the inlet valve and upper vent valve of the charging cylinder.





Charging Refrigerant — Charging cylinder (Cont'd)

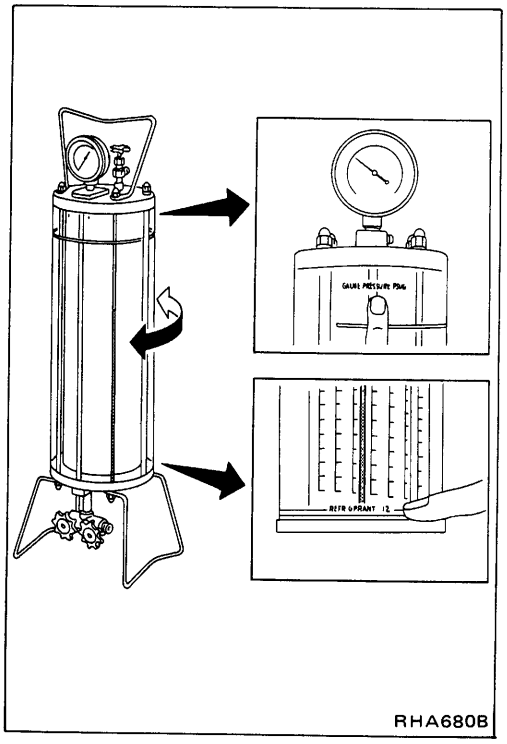
6. Turn on the heater switch (the charging cylinder is provided with a heater.)

The refrigerant charging time can be reduced by heating the refrigerant to increase its pressure. In this case, do not allow the pressure in the cylinder to rise higher than 1,030 kPa (10.5 kg/cm^2, 150 psi). (If pressure rises above this level, turn off the heater.)

The pressure in the charging cylinder can be measured by the upper pressure gauge.

EVACUATION AND AIRTIGHTNESS CHECK

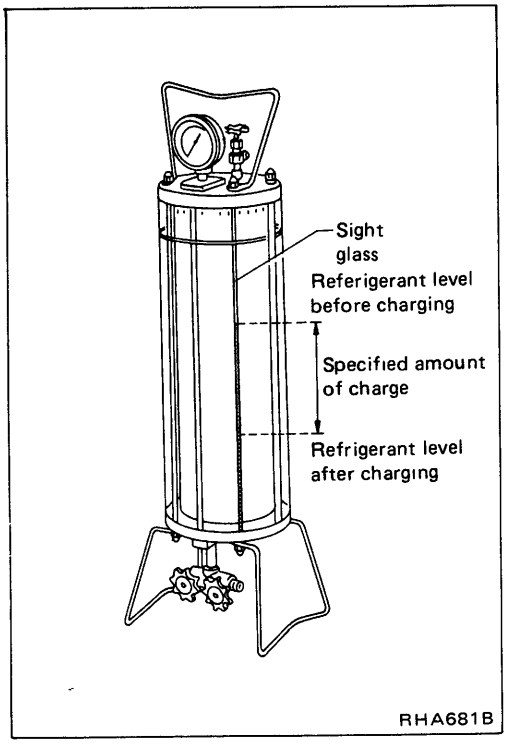
Refer to "EVACUATION" and "CHECKING AIRTIGHTNESS" in "Evacuation".



SETTING OF FLOW METER

1. Rotate the charging cylinder main body until the scale for R12 is at the correct position on the sight glass.
2. Read the charging cylinder pressure gauge.
3. Rotate the charging cylinder so that the scale of the charging cylinder agrees with the pressure value indicated on the pressure gauge.
4. Open the outlet valve of the charging cylinder.

Charging Refrigerant — Charging cylinder (Cont'd)



RHA681B

CALCULATING CHARGING AMOUNT OF REFRIGERANT

1. Record the amount of refrigerant in the sight glass before charging.
2. Subtract the required amount of refrigerant (charge quantity specified for the vehicle) from the amount of refrigerant recorded in step 1. Charge refrigerant into the system until the remaining value equals to the value indicated on the sight glass.

Example:

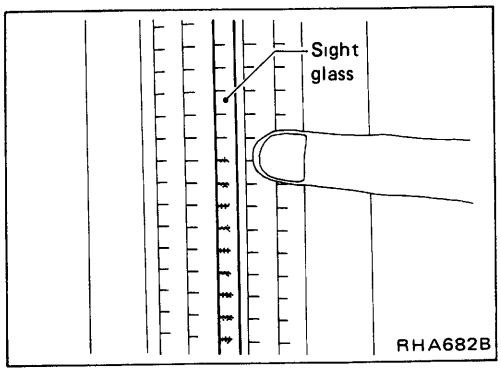
Level in sight glass: 3 lb 8 oz

Charge specification (from Service Manual) 2.0 - 2.4 lb.

Calculate charge quantity into lb and oz as follows: 1 lb = 16 oz, and 0.1 lb = 1.6 oz, so that 2.0 lb = 32 oz, 2.4 lb = 32 + (4 x 1.6) = 32 + 6.4 = 38.4, round off to 38. Therefore our charge quantity will be between 32 and 38 oz, or 2 lb 0 oz to 2 lb 6 oz.

Subtract 2 lb 6 oz from the level in the sight glass (3 lb 8 oz) = 1 lb 2 oz.

This will be our ending point.



RHA682B

PRELIMINARY CHARGING OF REFRIGERANT-2

1. Slowly open the high pressure side valve of the manifold gauge to charge refrigerant from the high pressure side.
2. Close the high pressure valve after charging approx. 200 g (7.05 oz) refrigerant.

CAUTION:

The refrigerant in the charging cylinder is kept in the liquid state, so the refrigerant should be charged from high pressure side. Do not start the engine with the high pressure valve kept open.

PRELIMINARY CHECK FOR REFRIGERANT LEAKS

Refer to "PRELIMINARY CHECK FOR REFRIGERANT LEAKS" in "Charging Refrigrant".

CHARGING REFRIGERANT

1. Slowly open the high pressure valve of the manifold gauge, and charge the calculated amount of refrigerant in "CALCULATING CHARGING AMOUNT OF REFRIGERANT".

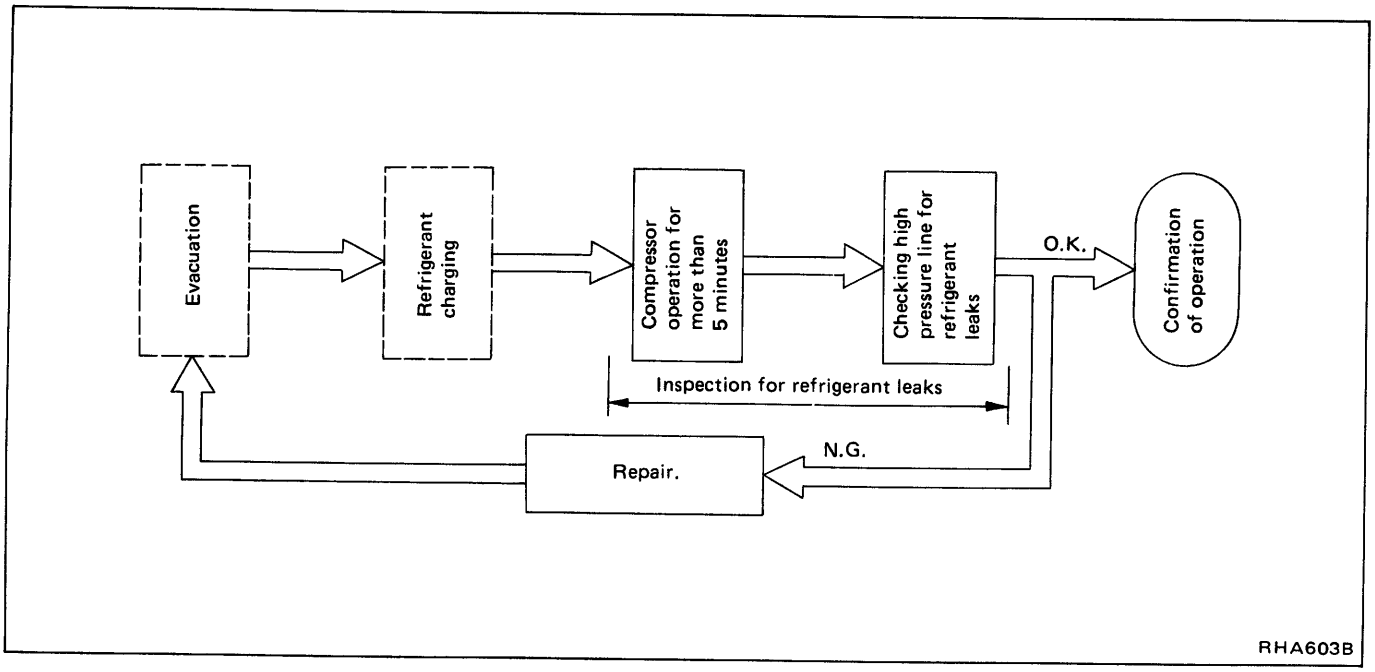
CAUTION:

The refrigerant in the charging cylinder is kept in the liquid state, so the refrigerant should be charged from high pressure side. Do not start the engine with the high pressure valve kept open.

2. Close the high pressure valve of the manifold gauge.
3. Make sure that the calculated amount of refrigerant is in the sight glass.
4. Close the charging cylinder outlet valve.
5. Turn off the heater if it is on (when using heater equipped type).

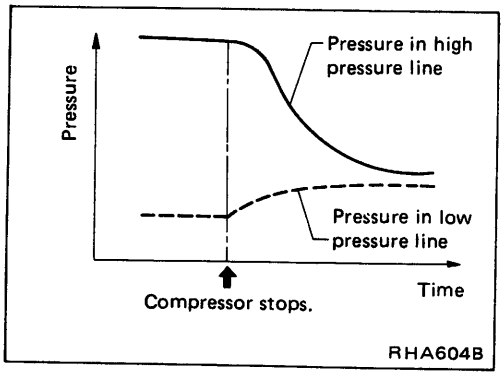
Inspection for Refrigerant Leaks

WORK PROCEDURE



To facilitate inspection for refrigerant leaks, establish the following conditions:

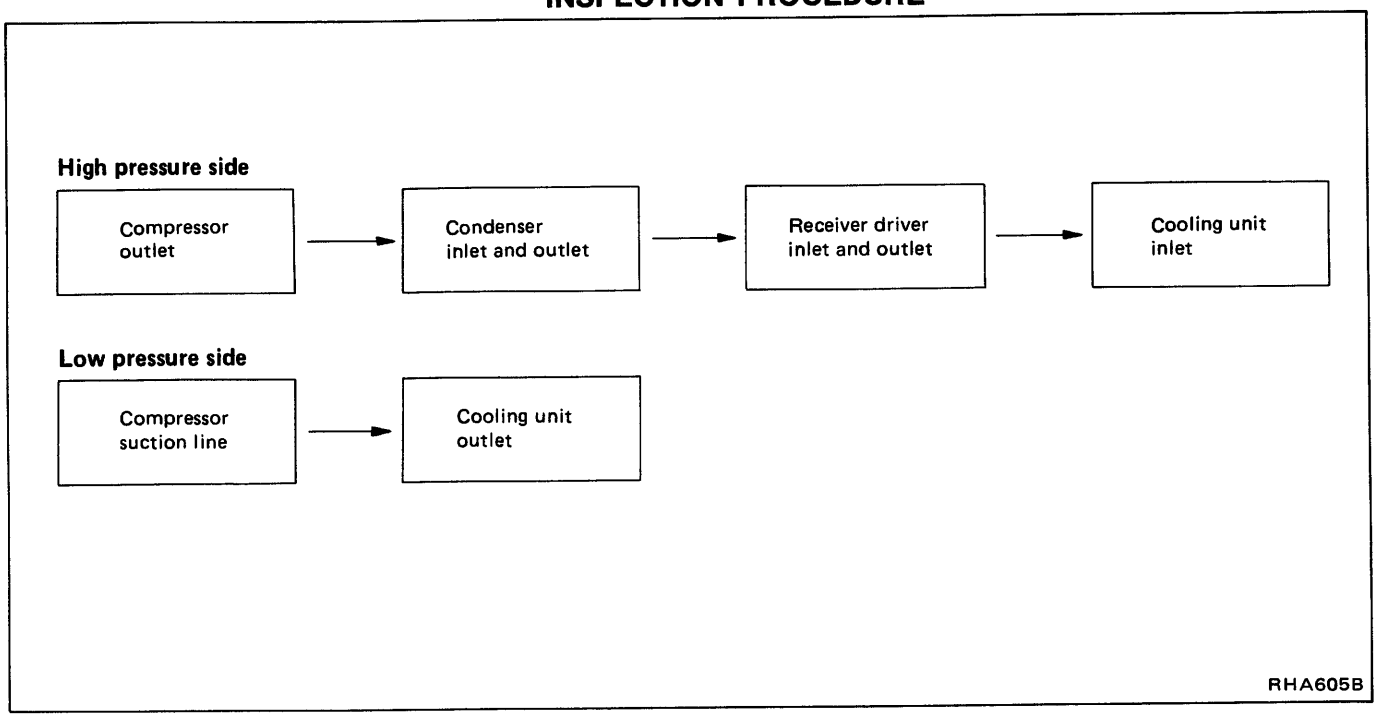
- Start the engine.
- Run the air conditioner.
- Set the blower fan control to MAX.
- Set the temperature control to FULL COLD.
- Run the refrigerant system for more than 5 minutes after setting the above-mentioned conditions (to circulate the refrigerant through the system).



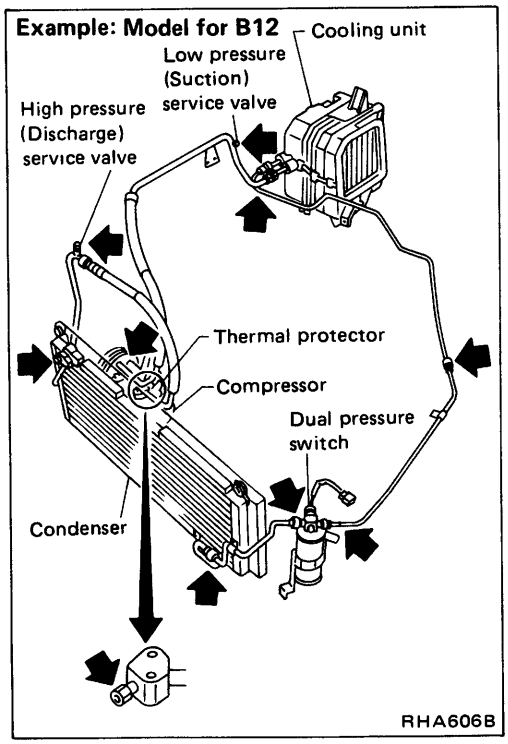
Refrigerant leaks should be checked immediately after stopping the engine, beginning with the high pressure line, using a gas leak tester. This is because the pressure in the high pressure line drops gradually after the refrigerant circulation stops while the pressure in the low pressure line rises gradually as shown in the graph. Leaks can be detected easily when pressure is high.

Inspection for Refrigerant Leaks (Cont'd)

INSPECTION PROCEDURE



To prevent detecting errors, make sure that there is no refrigerant vapor or tobacco smoke in the vicinity of the vehicle. It is also necessary to shield the vehicle from the wind so that the leaking refrigerant is not blown away.



INSPECTION POINTS

Check carefully each of the pipe joints. To check, wipe the portion to be checked with waste cloth, and move the tester probe all around the joint.

Compressor
Check the shaft seals and bolt holes, and also around the magnet clutch.

Receiver drier
Check the pressure valve, safety valve and the fusible plug mounts.

Service valve (Charge port)
Check all around the charge valve.
Ensure that the charge port valve is not loose.
The service valve cap must be attached to the valve (to prevent leak).
Also check that there are no foreign objects inside the cap.

Inside of cooling unit
To check, insert the leak tester probe into the drain hose immediately after stopping the engine. (Keep the probe inserted for more than 10 seconds.)

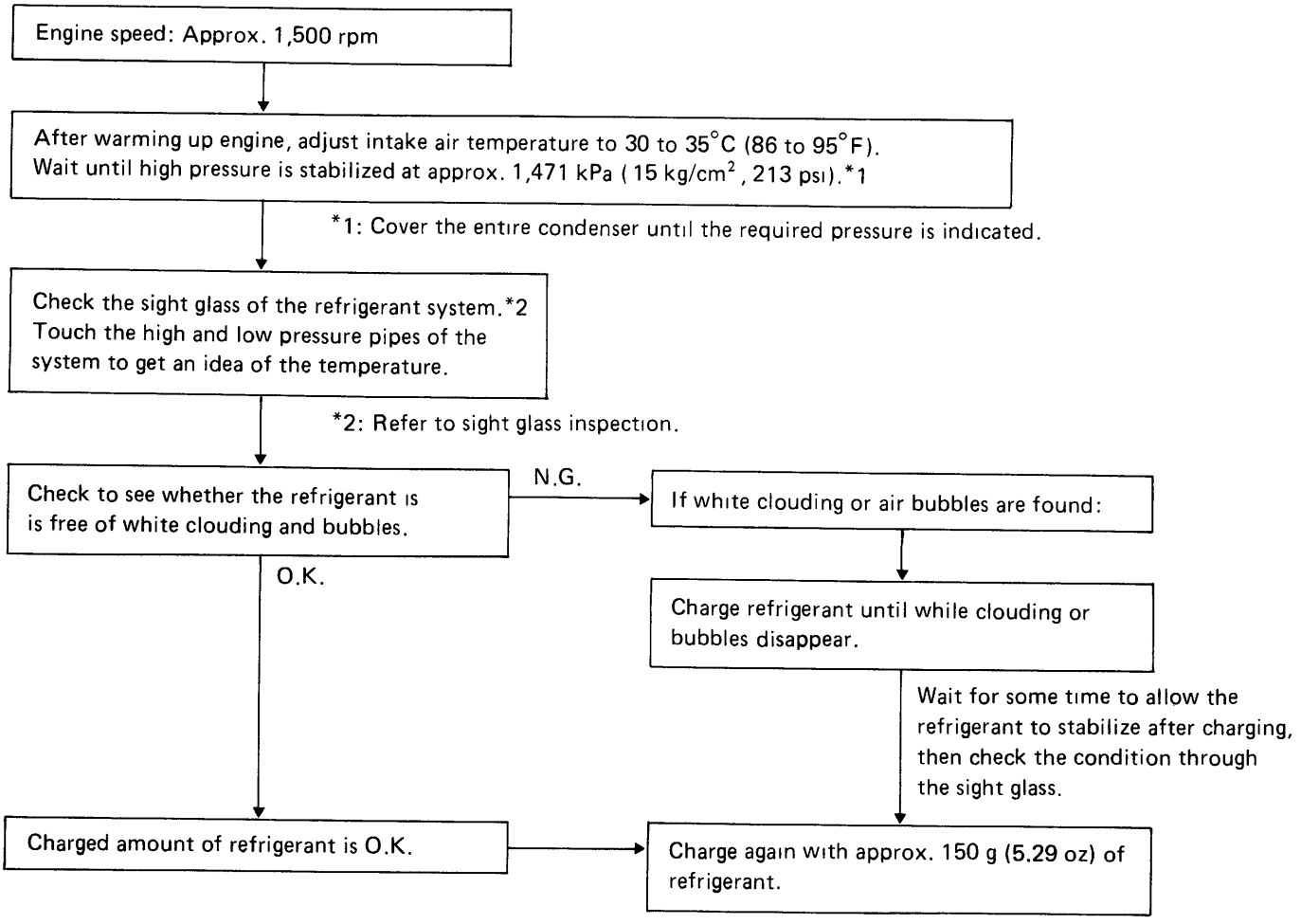
Confirmation of Amount of Charged Refrigerant

The amount of refrigerant charged into the system can be observed through the sight glass by watching the flow of the refrigerant and by reading the high pressure and low pressure manifold gauges under the following conditions:

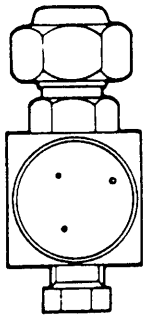
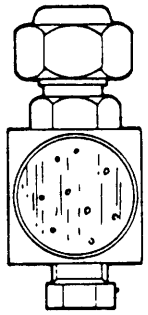
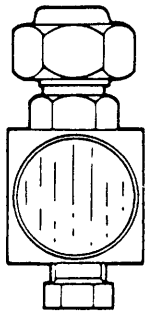
CONDITIONS

- Doors:
  Close completely.
- Window glasses:
  Close completely.
- Intake door position:
  RECIRC
- Mode door position:
  VENT
- Blower fan:
  HI
- TEMP control:
  Optional (Set so that intake air temperature is 30 to 35°C (86 to 95°F).
- AIR CON switch:
  ON
- Engine speed:
  Approx. 1,500 rpm

WORK PROCEDURE

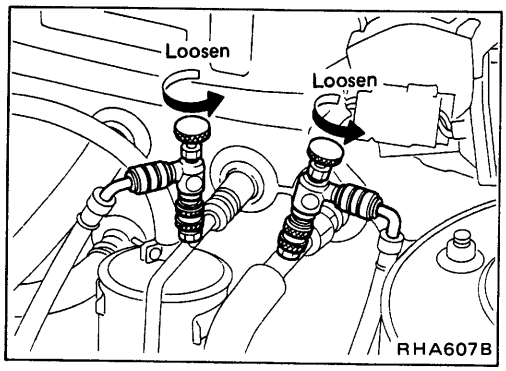


Confirmation of Amount of Charged Refrigerant (Cont'd)

Amount of charge / Check item	Appropriate	Refrigerant is insufficient	Almost no refrigerant	Overcharged, or air in system
Temperature of high and low pressure pipes	High pressure side is hot while low pressure side is cold.	High pressure side is warm and low pressure side is somewhat cold.	No difference is felt between high and low pressure sides.	High pressure side is very hot.
Flow of refrigerant viewed through sight glass	Mostly transparent. Occasionally some bubbles are seen when engine rpm is increased or decreased. 	Bubbles are always flowing. Refrigerant is cloudy. 	Nothing is visible. 	If overcharged, no bubbles are seen. If there is air in the system, large bubbles are seen.
Pressure	Normal high pressure: 1,373 - 1,765 kPa (14 - 18 kg/cm², 199 - 256 psi) Normal low pressure: 147 - 294 kPa (1.5 - 3 kg/cm², 21 - 43 psi)	Both high and low pressure values are insufficient.	High pressure value is very small.	Both high and low pressure values are excessive.
Action to take	**Air bubbles may be generated when the receiver drier strainer is clogged, or when the expansion valve is opened excessively.**	Add refrigerant after checking for leaks.	Check the refrigerant system.	Stop the compressor and extract excessive refrigerant. If air is found, perform evacuation, then charge the specified amount of refrigerant.

CAUTION:

The condition of bubbles seen through the sight glass as well as the intake and discharge pressures are influenced by the ambient temperature, wind velocity, weather, and by the air temperature in front of the condenser, etc.



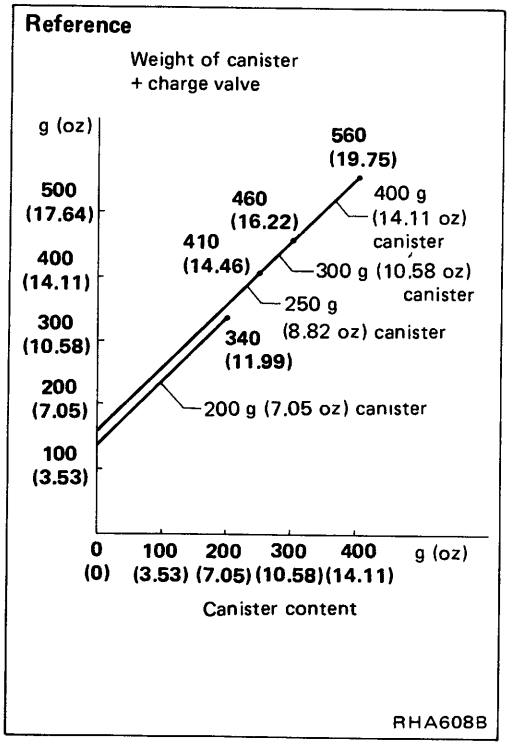
Recovery Procedure

REMOVAL OF REFRIGERANT CHARGING DEVICE

1. Completely loosen the adapter valves of the low pressure and high pressure lines.
   The inner valve of the adapter valve will prevent the refrigerant from leaking out.
2. Remove both the high-pressure and low-pressure side adapter valves from the on-vehicle service valve.

If adapter valve is not used for charging, proceed as follows to minimize the refrigerant discharge into the atmosphere.

3. Loosen the nut of the low pressure charging hose while pressing it against the service valve to prevent refrigerant leakage.
4. After loosening the nut, quickly remove the charge valve from the service valve.
5. Wait until the high pressure gauge indication drops to below 981 kPa (10 kg/cm^2, 142 psi), then similarly disconnect the high pressure charging hose.



DISPOSAL OF RESIDUAL REFRIGERANT

Secureky shut off each of the charge valves, adapter valves and manifold gauge valves to prevent the residual refrigerant from leaking out. Keep these valves in a safe location for the next charging.

The amount of refrigerant remaining in a service canister can be estimated from the Table shown here. It is recommended that a label be attached indicating the remaining amount in the canister.

Refrigeration Cycle

REFRIGERANT FLOW

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 evaporation through the evaporator coil is controlled by an externally equalized expansion valve, located inside the evaporator case.

FREEZE PROTECTION

The compressor cycles 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.

REFRIGERANT SYSTEM PROTECTION

Dual-pressure switch

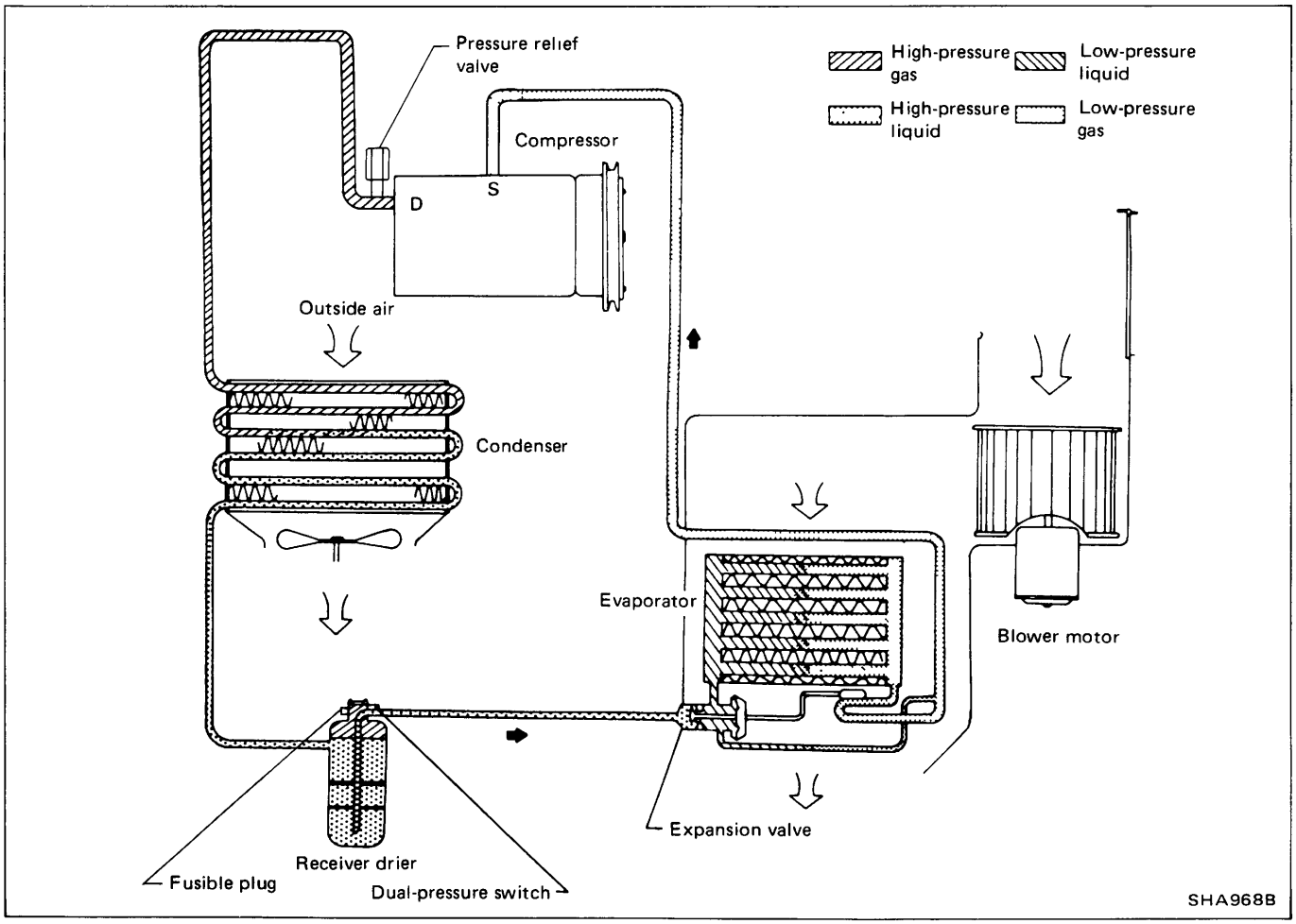
The refrigerant system is protected against excessively high or low pressures by the dual-pressure switch, located on the receiver drier. If the system pressure rises above, or falls below the specifications, the dual-pressure switch opens to interrupt the compressor operation

Fusible plug

Open at temperature above 105°C (221°F), thereby discharging refrigerant to the atmosphere. If this plug is melted and opened, check the refrigerant line and replace receiver drier.

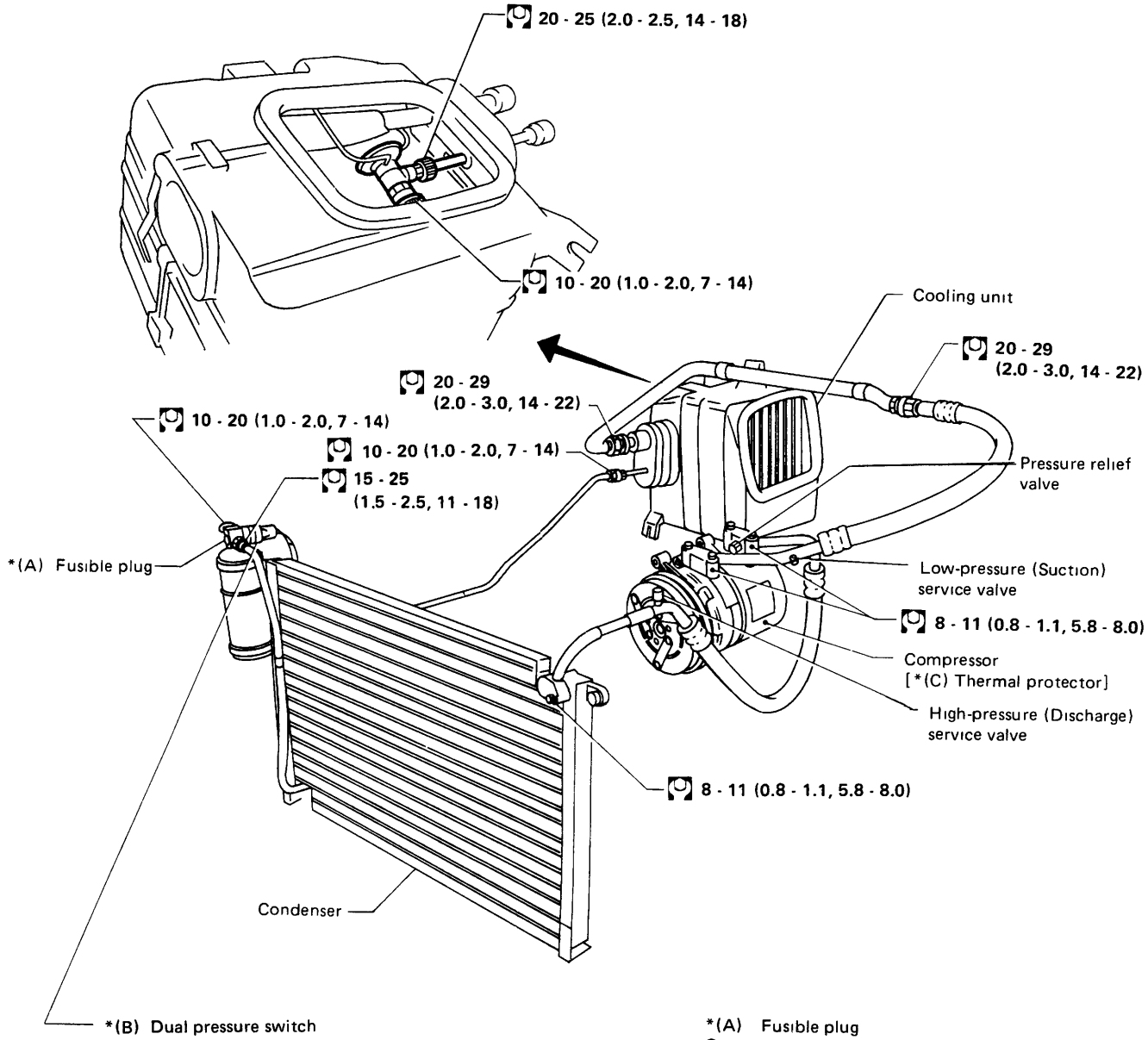
Pressure relief valve

The refrigerant system is also protected by a pressure relief valve, located on the end of high flexible hose near compressor. When the pressure of refrigerant in the system increases to an abnormal level [more than 3,727 kPa (38 kg/cm^2, 540 psi)], the release port on the pressure relief valve automatically opens and releases refrigerant into the atmosphere.



Refrigerant Lines

VG ENGINE MODEL



: N·m (kg-m, ft-lb)

*(C) Thermal protector

Temperature in compressor	°C (°F)	Operation
Increasing to approx.	145 - 155 (293 - 311)	Turns OFF
Decreasing to approx	130 - 140 (266 - 284)	Turns ON

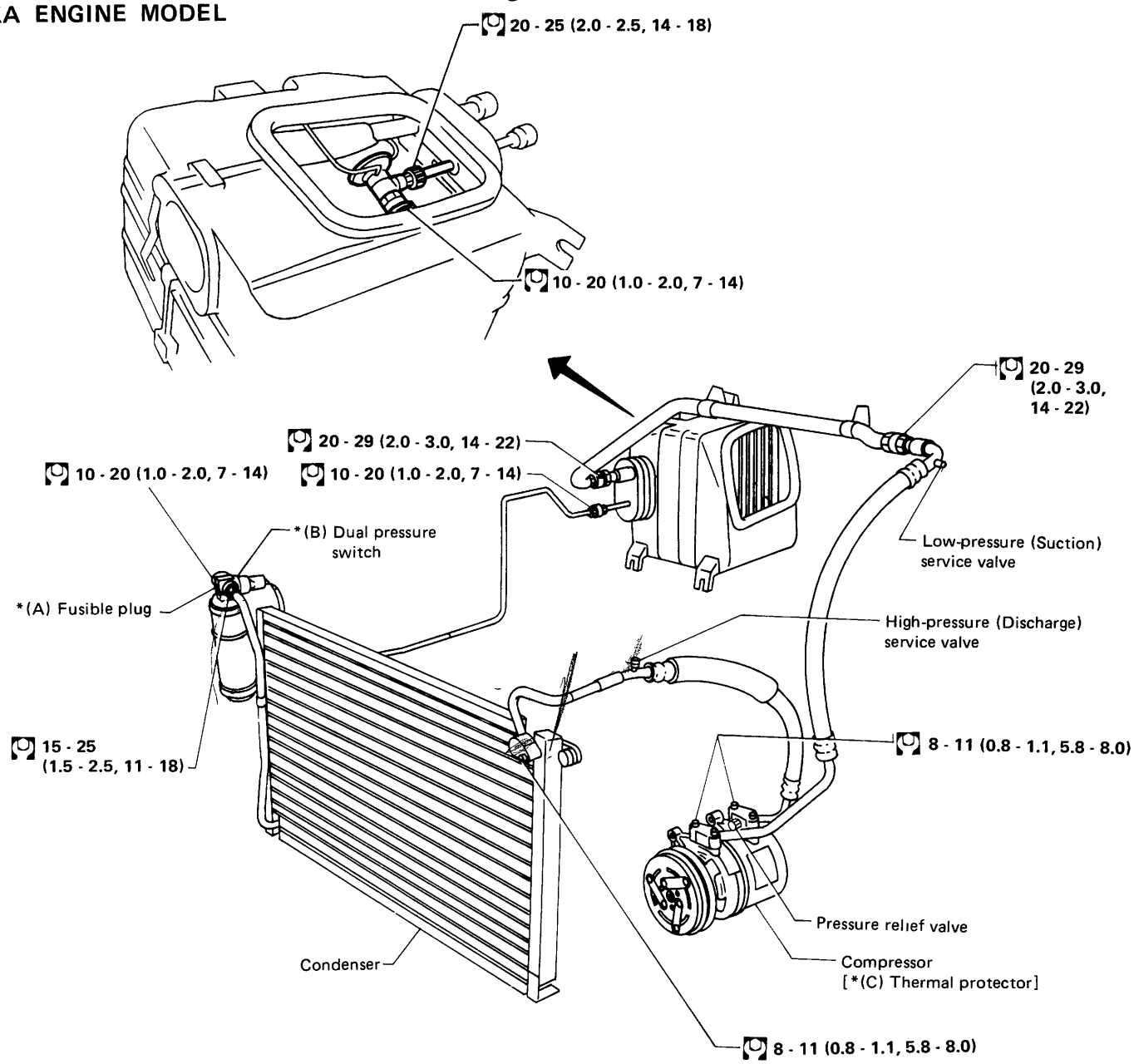
*(A) Fusible plug
Open at temperatures above 105°C (221°F), thereby discharging refrigerant to the atmosphere.
If this plug is melted and opened, check the refrigerant line and replace receiver drier.

*(B) Dual pressure switches
- Low-pressure side
  Turns OFF at pressures below 177 to 216 kPa (1.8 to 2.2 kg/cm², 26 to 31 psi), cutting compressor power supply, and turns ON at pressures above 177 to 235 kPa (1.8 to 2.4 kg/cm², 26 to 34 psi).
- High-pressure side
  Turns OFF at pressures above 2,452 to 2,844 kPa (25 to 29 kg/cm², 356 to 412 psi), cutting compressor power supply, and turns ON at pressures below 1,373 to 1,667 kPa (14 to 17 kg/cm², 199 to 242 psi).

RHA495B

Refrigerant Lines (Cont'd)

KA ENGINE MODEL



: N·m (kg-m, ft-lb)

*(A) Fusible plug
Open at temperatures above 105°C (221°F), thereby discharging refrigerant to the atmosphere.
If this plug is melted and opened, check the refrigerant line and replace receiver drier.

*(B) Dual pressure switches
- Low-pressure side
  Turns OFF at pressures below 177 to 216 kPa (1.8 to 2.2 kg/cm², 26 to 31 psi), cutting compressor power supply, and turns ON at pressures above 177 to 235 kPa (1.8 to 2.4 kg/cm², 26 to 34 psi).
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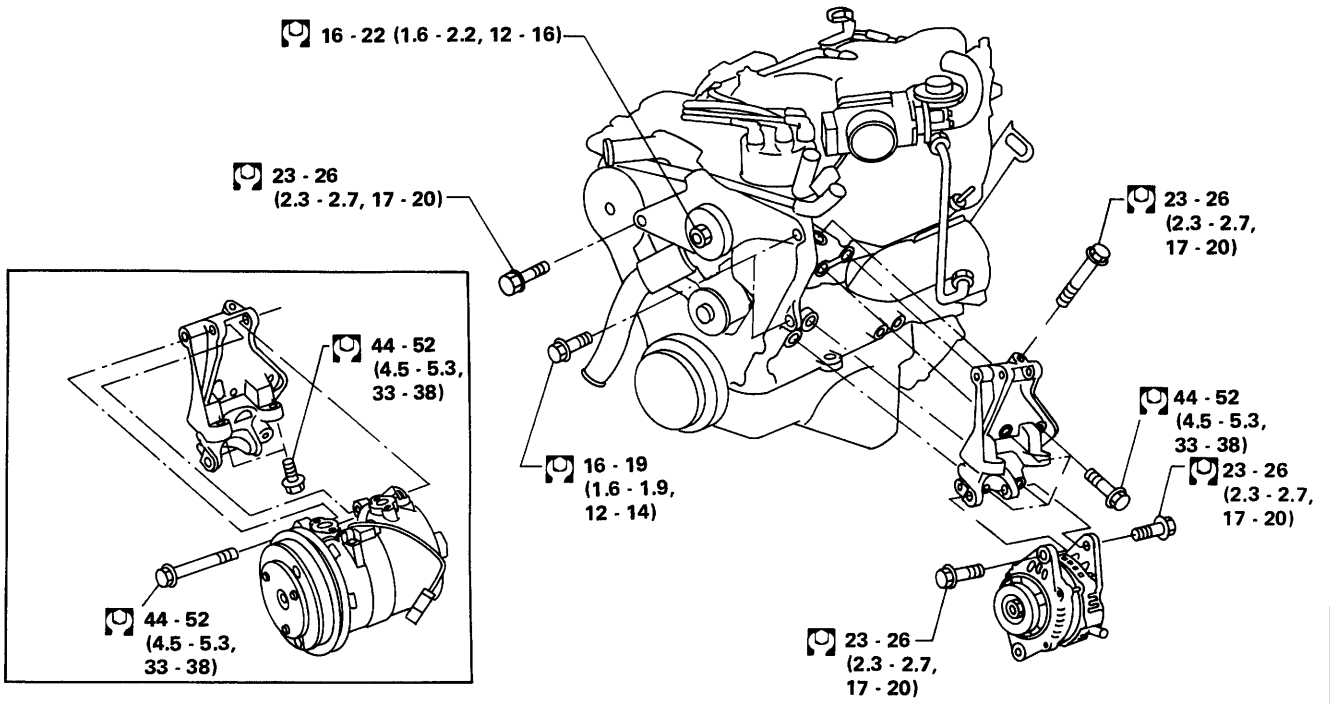
*(C) Thermal protector

Temperature in compressor	°C (°F)	Operation
Increasing to approx.	145 - 155 (293 - 311)	Turns OFF
Decreasing to approx.	130 - 140 (266 - 284)	Turns ON

RHA496B

Compressor Mounting

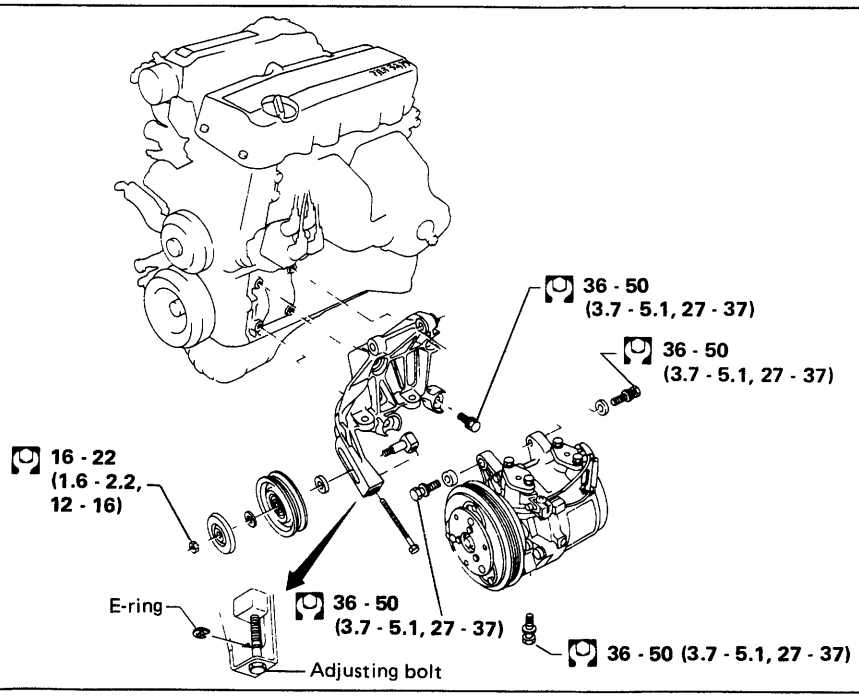
VG engine model



: N·m (kg-m, ft-lb)

RHA497B

KA engine model



: N·m (kg-m, ft-lb)

RHA395A

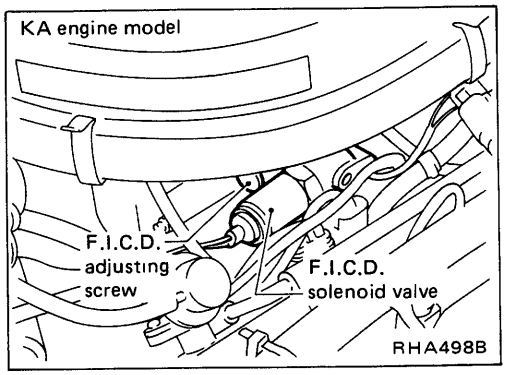
Idle Speed Adjusting

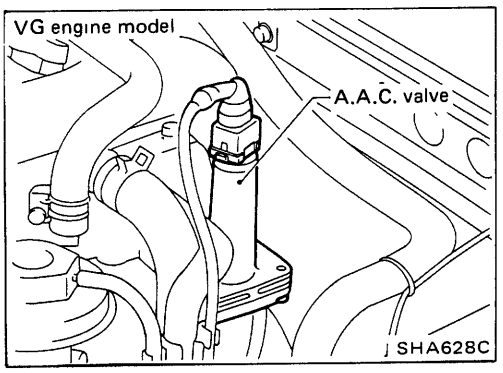
FAST IDLE CONTROL DEVICE (F.I.C.D.)

1. Warm up engine completely.
2. Make sure engine is at correct idling speed with air conditioner in OFF position.

   Idling speed (Air conditioner: OFF):

   Refer to S.D.S. (MA section).
3. Set engine speed with air conditioner in ON position (when F.I.C.D. is actuated) to following procedure.





Engine rpm
(Air conditioner: ON):

Unit: rpm

Transmission	Engine model	
	VG30E	KA24E
Manual	750 - 850	800 - 900
Automatic (In "N" range)		

Performance Chart

TEST CONDITION

Testing must be performed as follows:

Vehicle location:	Indoors or in the shade (in a well ventilated place)
Doors:	Closed
Door window:	Open
Hood:	Open
TEMP. lever position:	Max. COLD
Air control lever position:	(Ventilation)
INTAKE lever position:	(Recirculation)
FAN lever position:	4
Engine speed:	1,500 rpm
Time required before starting testing after air conditioner starts operating:	More than 10 minutes

TEST READING

VG engine model

Recirculating-to-discharge air temperature table

Inside air (Recirculating air) at blower assembly inlet		Discharge air temperature at center ventilator °C (°F)
Relative humidity %	Air temperature °C (°F)	
50 - 60	20 (68)	5.4 - 7.0 (42 - 45)
	25 (77)	9.4 - 11.6 (49 - 53)
	30 (86)	13.6 - 16.4 (56 - 62)
	35 (95)	17.8 - 21.0 (64 - 70)
60 - 70	20 (68)	7.0 - 9.0 (45 - 48)
	25 (77)	11.6 - 14.2 (53 - 58)
	30 (86)	16.4 - 19.4 (62 - 67)
	35 (95)	21.0 - 24.6 (70 - 76)

Ambient air temperature-to-compressor pressure table

Ambient air		High-pressure (Discharge side) kPa (kg/cm^2, psi)	Low-pressure (Suction side) kPa (kg/cm^2, psi)
Relative humidity %	Air temperature °C (°F)		
50 - 70	20 (68)	1,000 - 1,196 (10.2 - 12.2, 145 - 173)	88 - 137 (0.9 - 1.4, 13 - 20)
	25 (77)	1,216 - 1,451 (12.4 - 14.8, 176 - 210)	118 - 177 (1.2 - 1.8, 17 - 26)
	30 (86)	1,412 - 1,706 (14.4 - 17.4, 205 - 247)	157 - 216 (1.6 - 2.2, 23 - 31)
	35 (95)	1,618 - 1,961 (16.5 - 20.0, 235 - 284)	186 - 255 (1.9 - 2.6, 27 - 37)
	40 (104)	1,824 - 2,216 (18.6 - 22.6, 264 - 321)	226 - 294 (2.3 - 3.0, 33 - 43)

Performance Chart (Cont'd)

KA engine model

Recirculating-to-discharge air temperature table

Inside air (Recirculating air) at blower assembly inlet		Discharge air temperature at center ventilator °C (°F)
Relative humidity %	Air temperature °C (°F)	
50 - 60	20 (68)	7.2 - 8.6 (45 - 47)
	25 (77)	11.0 - 12.8 (52 - 55)
	30 (86)	14.6 - 16.8 (58 - 62)
	35 (95)	18.4 - 21.0 (56 - 70)
60 - 70	20 (68)	8.6 - 10.4 (47 - 51)
	25 (77)	12.8 - 14.8 (55 - 59)
	30 (86)	16.8 - 19.2 (62 - 67)
	35 (95)	21.0 - 23.6 (70 - 74)

Ambient air temperature-to-compressor pressure table

Ambient air		High-pressure (Discharge side) kPa (kg/cm^2, psi)	Low-pressure (Suction side) kPa (kg/cm^2, psi)
Relative humidity %	Air temperature °C (°F)		
50 - 70	20 (68)	941 - 1,157 (9.6 - 11.8, 137 - 168)	118 - 167 (1.2 - 1.7, 17 - 24)
	25 (77)	1,118 - 1,353 (11.4 - 13.8, 162 - 196)	137 - 196 (1.4 - 2.0, 20 - 28)
	30 (86)	1,295 - 1,569 (13.2 - 16.0, 188 - 228)	157 - 226 (1.6 - 2.3, 23 - 33)
	35 (95)	1,471 - 1,795 (15.0 - 18.3, 213 - 260)	186 - 255 (1.9 - 2.6, 27 - 37)
	40 (104)	1,628 - 2,001 (16.6 - 20.4, 236 - 290)	216 - 284 (2.2 - 2.9, 31 - 41)

Checking and Adjusting

The oil used to lubricate the compressor is circulating with the refrigerant.
Whenever replacing any component of the system or a large amount of gas leakage occurs, add oil to maintain the original amount of oil.

OIL CAPACITY

Unit: mℓ (US fl oz, Imp fl oz)

Applied model	All models
Capacity	
Total in system	200 (6.8, 7.0)
Amount of oil which can be drained	70 - 120 (2.4 - 4.1, 2.5 - 4.2)*
Compressor (Service parts) charging amount	200 (6.8, 7.0)

*: All oil cannot be drained from system.

OIL RETURN OPERATION

Before checking and adjusting oil level, operate compressor at engine idling speed, with controls set for maximum cooling and high blower speed, for 20 to 30 minutes in order to return oil to compressor.

CHECKING AND ADJUSTING FOR USED COMPRESSOR

1. After oil return operation, stop the engine and discharge refrigerant and then remove compressor from the vehicle.
2. Drain compressor oil from compressor discharge port and measure the amount.

Oil is sometimes hard to extract when compressor is cooled. Remove oil while compressor is warm [maintained to 40 to 50°C (104 to 122°F)].

3. If the amount is less than 70 mℓ (2.4 US fl oz, 2.5 Imp fl oz), some refrigerant may have leaked out. Conduct leak tests on connections of each system, and if necessary, repair or replace malfunctioning parts.
4. Check the purity of the oil and then adjust oil level following the procedure below.

   (a) When oil is clean;

Unit: mℓ (US fl oz, Imp fl oz)

Amount of oil drained	Adjusting procedure
Above 70 (2.4, 2.5)*	Oil level is right. Pour in same amount of oil as was drained out.
Below 70 (2.4, 2.5)	Oil level may be low. Pour in 70 mℓ (2.4 US fl oz, 2.5 Imp fl oz) of oil.

*: If amount of oil drained is much greater than under normal circumstances, flush air conditioner system with refrigerant. Then pour in 200 mℓ (6.8 US fl oz, 7.0 Imp fl oz) of oil into air conditioner system.

   (b) When oil contains chips or other foreign material;
   After air conditioner system has been flushed with refrigerant, replace receiver drier. Then pour in 200 mℓ (6.8 US fl oz, 7.0 Imp fl oz) of oil into air conditioner system.

CHECKING AND ADJUSTING FOR COMPRESSOR REPLACEMENT

200 mℓ (6.8 US fl oz, 7.0 Imp fl oz) of oil is charged in compressor (service parts). So it is necessary to drain the proper amount of oil from new compressor. Follow the procedure below.

1. After oil return operation, drain compressor oil from used compressor and measure the amount.
   (It is the same procedure as CHECKING AND ADJUSTING FOR USED COMPRESSOR.)

Checking and Adjusting (Cont'd)

2. Check the purity of the oil and then adjust oil level following the procedure below.

   (a) When oil is clean;

Unit: mℓ (US fl oz, Imp fl oz)

Amount of oil drained from used compressor	Draining amount of oil from new compressor
Above 70 (2.4, 2.5)*	200 (6.8, 7.0) – [Amount of oil drained + 20 (0.7, 0.7)]
Below 70 (2.4, 2.5)	110 (3.7, 3.9)

*: If amount of oil drained is greater than under normal circumstances, flush air conditioner system with refrigerant. Then install new compressor [200 mℓ (6.8 US fl oz, 7.0 Imp fl oz) of oil is charged in compressor service parts.]

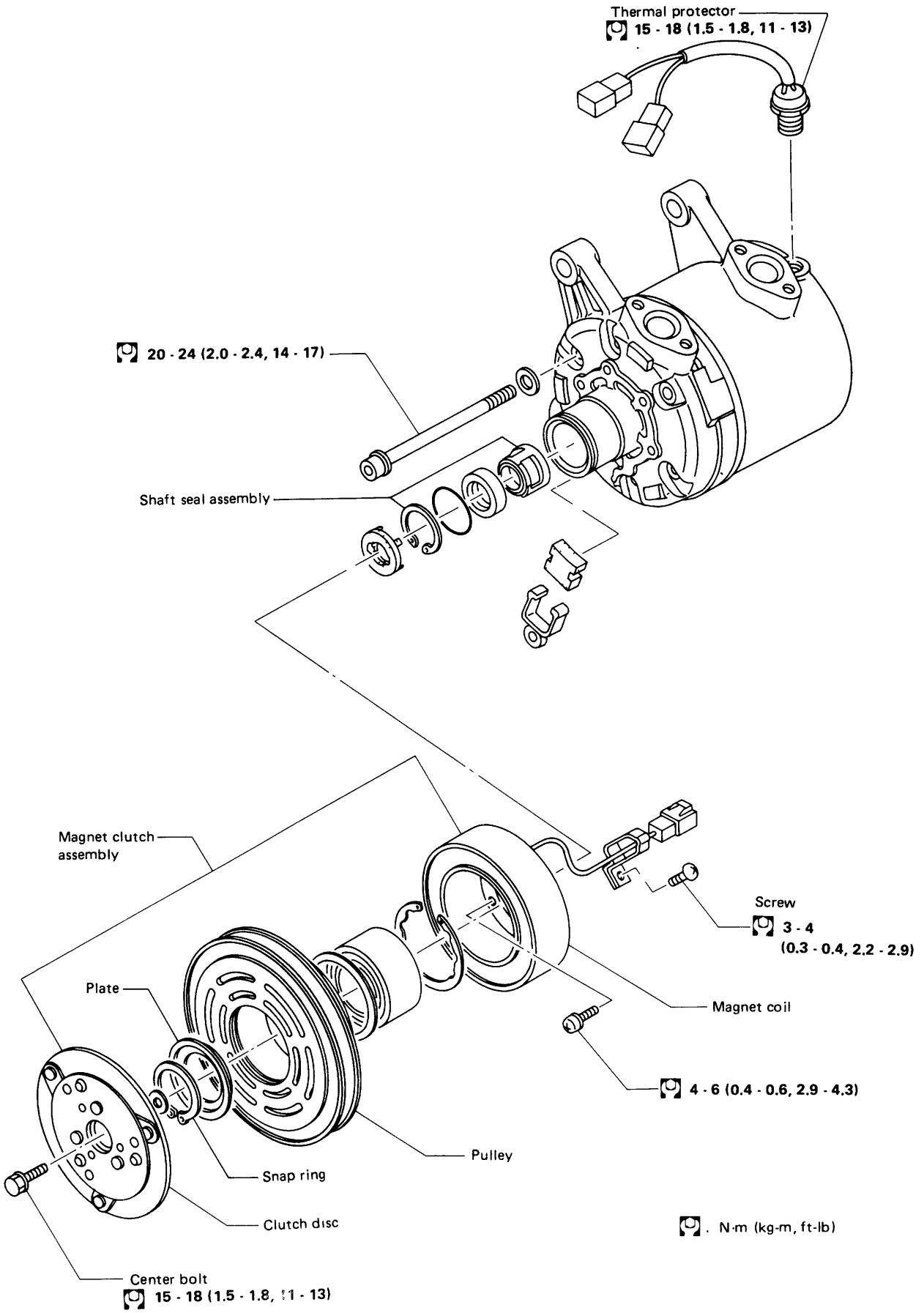
Example: Unit: mℓ (US fl oz, Imp fl oz)

Amount of oil drained from used compressor	Draining amount of oil from new compressor
90 (3.0, 3.2)	90 (3.0, 3.2)
50 (1.7, 1.8)	110 (3.7, 3.9)

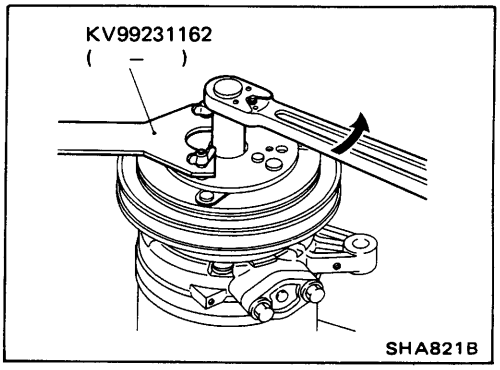
   (b) When oil contains chips or foreign material; After air conditioner system has been flushed with refrigerant, replace receiver drier. Then install new compressor [200 mℓ (6.8 US fl oz, 7.0 Imp fl oz) of oil is charged in compressor service parts.].

Precautions

- Plug all openings to prevent moisture and foreign matter from entering.
- Do not leave compressor on its side or upside down for more than 10 minutes.
- When replacing or repairing compressor, check compressor oil level in system.
- When replacing with a new compressor, drain specified oil from new compressor. Refer to COMPRESSOR OIL.
- Be sure there is no oil or dirt on frictional surface of clutch disc and pulley.
- When replacing compressor clutch, be careful not to scratch shaft or bend pulley.
- When replacing compressor clutch assembly, do not forget BREAK-IN OPERATION.
- When storing a compressor, be sure to fill it with refrigerant to prevent rust formation. Add refrigerant at the low-pressure side and purge air at the high-pressure side, while rotating shaft by hand.


Thermal protector
15 - 18 (1.5 - 1.8, 11 - 13)
20 - 24 (2.0 - 2.4, 14 - 17)
Shaft seal assembly
Magnet clutch assembly
Screw
3 - 4 (0.3 - 0.4, 2.2 - 2.9)
Plate
Magnet coil
4 - 6 (0.4 - 0.6, 2.9 - 4.3)
Pulley
Snap ring
Clutch disc
Center bolt
15 - 18 (1.5 - 1.8, 11 - 13)
. N·m (kg-m, ft-lb)

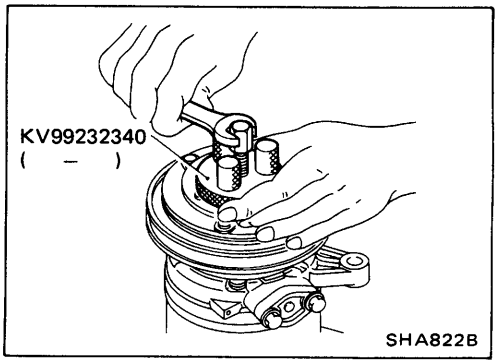
RHA402



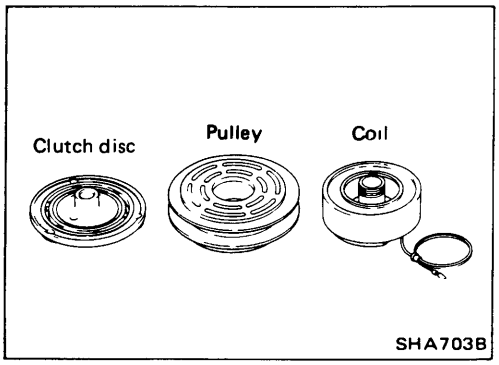
Compressor Clutch

REMOVAL

- When removing center bolt, hold clutch disc with clutch disc wrench.



- Using clutch disc puller clutch disc can be removed easily.



INSPECTION

Clutch disc

If the contact surface shows signs of damage due to excessive heat, the clutch disc and pulley should be replaced.

Pulley

Check the appearance of the pulley assembly. If the contact surface of the pulley shows signs of excessive grooving due to slippage, both the pulley and clutch disc should be replaced. The contact surfaces of the pulley assembly should be cleaned with a suitable solvent before reinstallation.

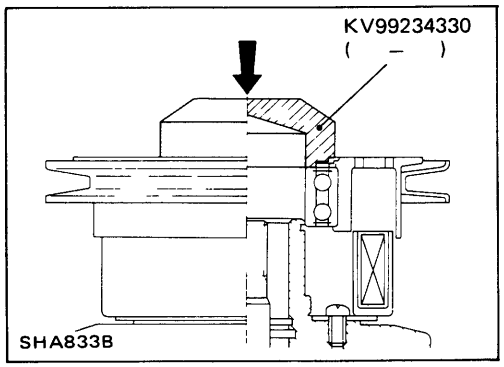
Coil

Check coil for loose connection or cracked insulation.

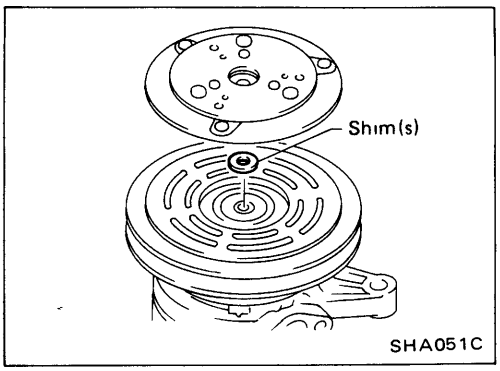
INSTALLATION

- Position coil assembly on compressor body. Be sure that the electrical terminals are reassembled in the original position. Install and tighten coil mounting screws evenly.

Compressor Clutch (Cont'd)

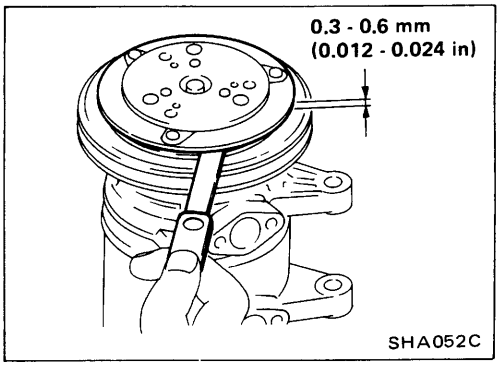


- Press pulley assembly onto the neck of coil assembly using pulley installer.
- Wipe oil thoroughly off the clutch surface.



ADJUSTMENT

- Select adjusting shim(s) which give(s) the correct clearance between pulley and clutch disc.
- Using a plastic mallet, tape clutch disc in place on drive shaft.
- Do not use excessive force with a plastic mallet or in a press, or internal damages may result.
- Place spring washer and center bolt onto drive shaft. Tighten center bolt to drive clutch wheel onto drive shaft.



- Check clearance around the entire periphery of clutch disc.

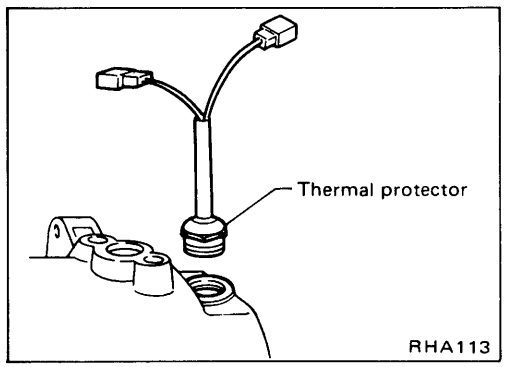
  Disc-to-pulley clearance:

  0.3 - 0.6 mm (0.012 - 0.024 in)

  If the specified clearance is not obtained, replace adjusting spacer and readjust.

BREAK-IN OPERATION

When replacing compressor clutch assembly, do not forget break-in operation, accomplished by engaging and disengaging the clutch about thirty times. Break-in operation raises the level of transmitted torque.

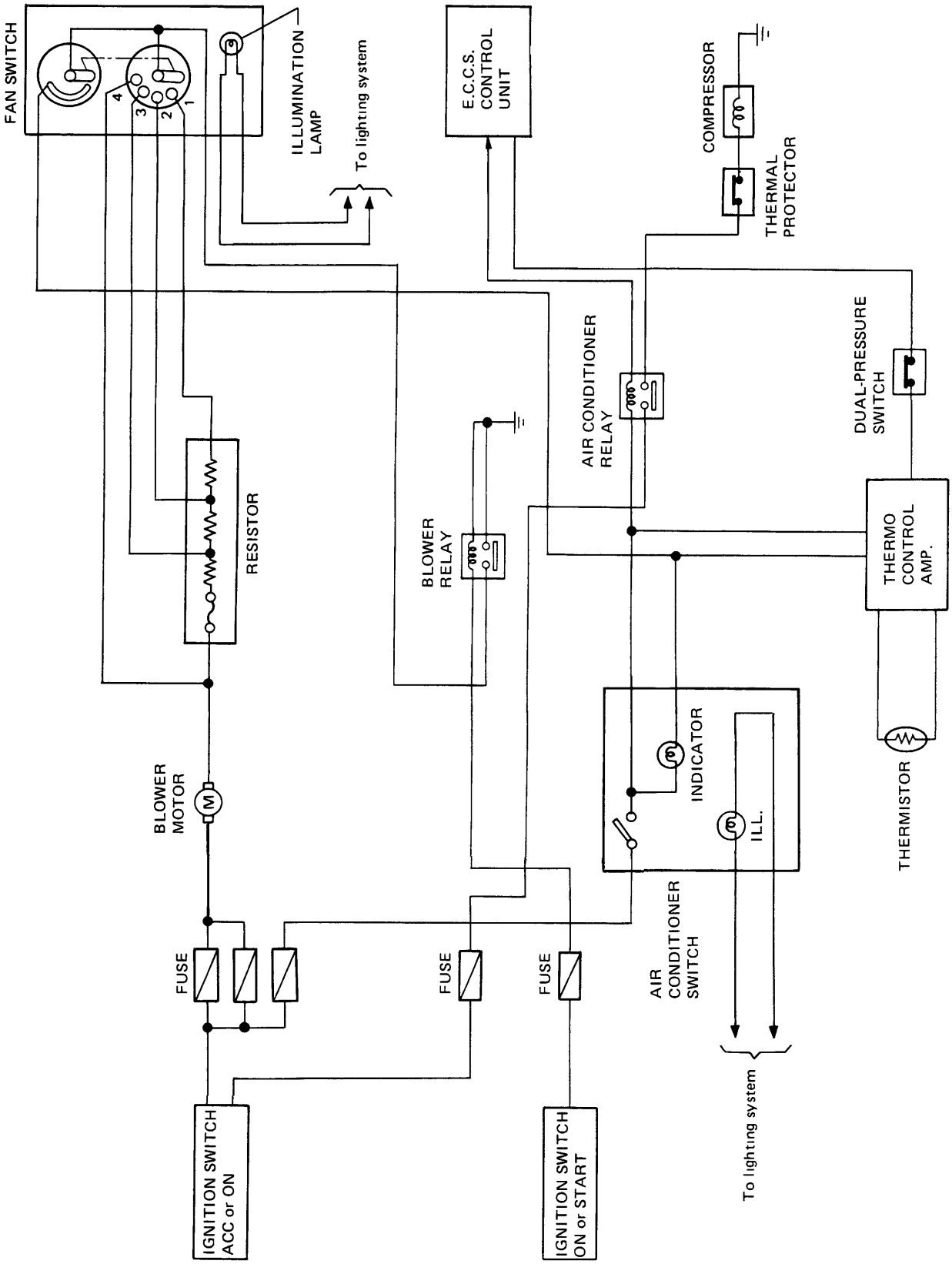


Thermal Protector

INSPECTION

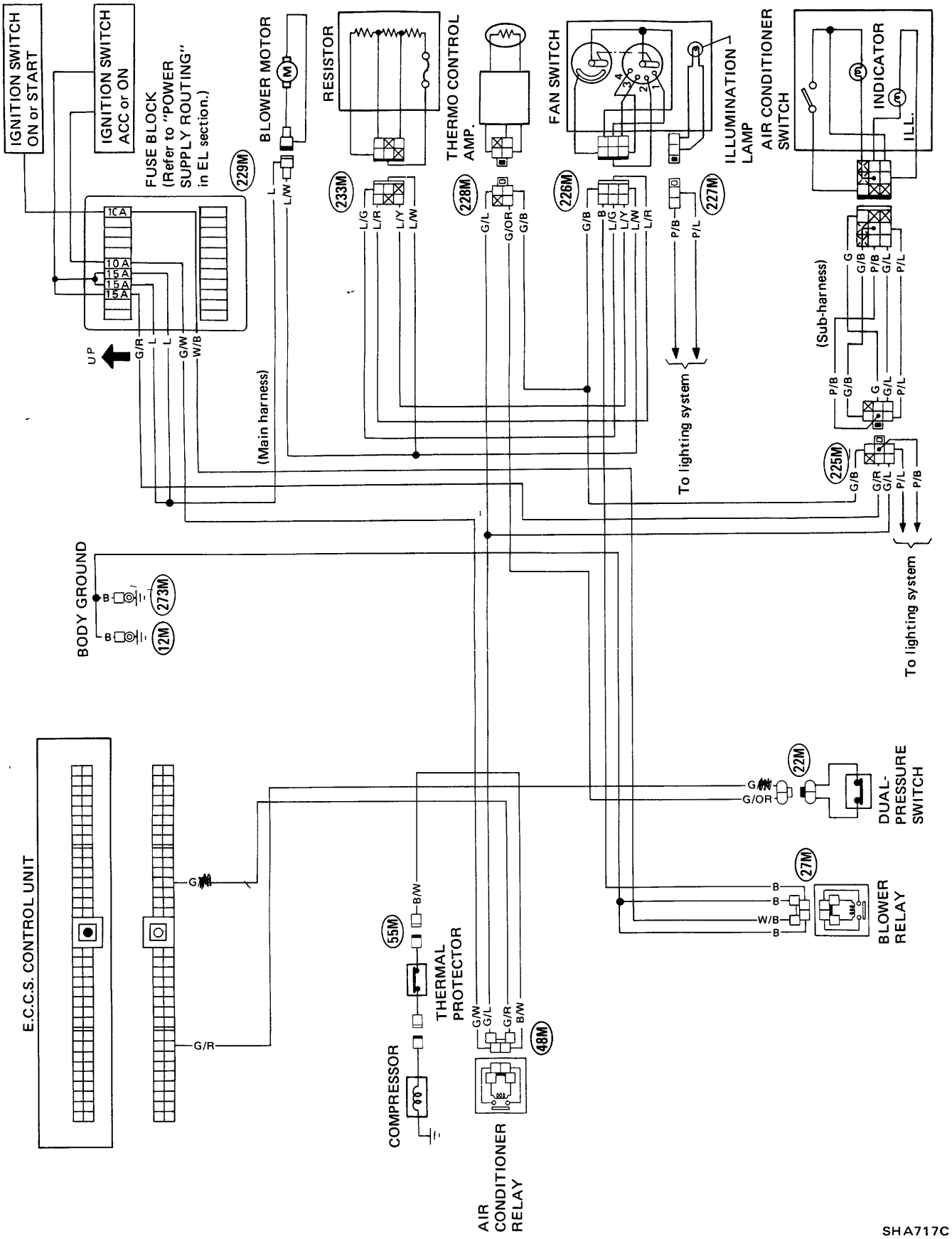
- When servicing, do not allow foreign matter to get into compressor.
- Check continuity between two terminals.

Schematic



SHA716C

Wiring Diagram



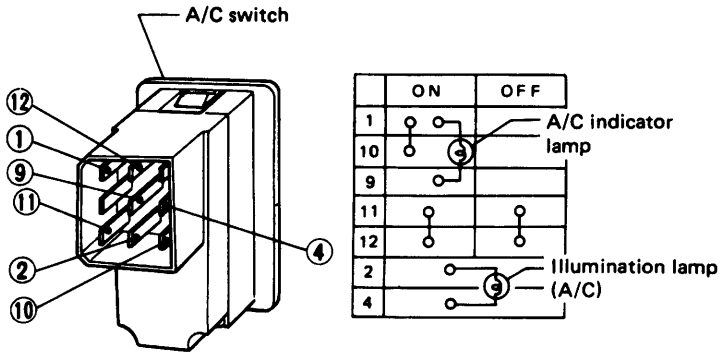
Inspection

FAN SWITCH

Refer to page HA-6.

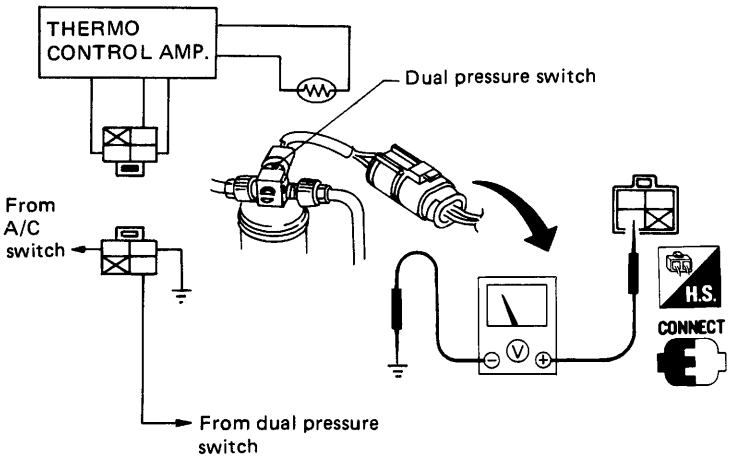
A/C SWITCH

A/C switch



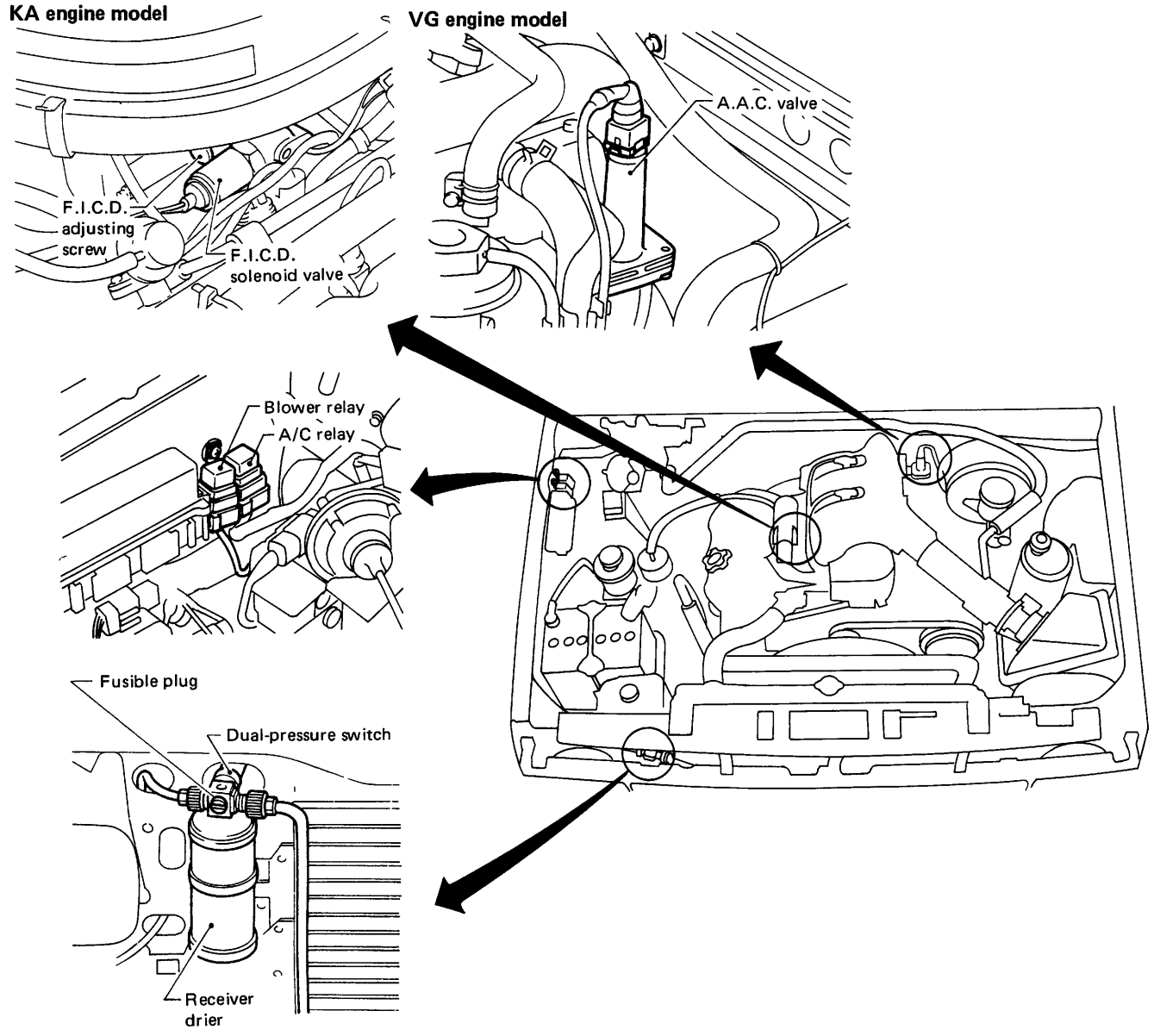
RHA274

THERMO CONTROL AMP.



Evaporator outlet air temperature °C (°F)	Thermo amp. operation	Tester
Decreasing to 0.1 - 0.9 (32 - 34)	Turn OFF	Approx. 12 V
Increasing to 2.5 - 3.5 (37 - 38)	Turn ON	Approx. 0 V

RHA351A


KA engine model
VG engine model
F.I.C.D. adjusting screw
F.I.C.D. solenoid valve
A.A.C. valve
Blower relay
A/C relay
Fusible plug
Dual-pressure switch
Receiver drier
A/C switch
Cooling unit
Thermo control amp.
Resistor

SHA715C

Introduction

The automatic temperature control (ATC) system provides automatic regulation of the discharged air temperature and the discharged air volume (Blower speed).
The air outlet door, intake door and compressor magnet clutch are controlled by the manual operation of each switch.

Features

Air mix door control (Automatic temperature control)
The air mix door is automatically controlled so that in-vehicle temperature will reach, and be maintained at the operator selected "set temperature". For a given set temperature, the air mix door position will depend on: Ambient temperature, in-vehicle temperature, amount of sunload, set temperature and A/C switch signals.

Fan speed control
When the fan control switch is in the Auto position, the blower speed is automatically controlled, depending on: Ambient temperature, in-vehicle temperature, amount of sunload, set temperature, and A/C switch signals. It is also controlled by the manual operation of the fan control switch.

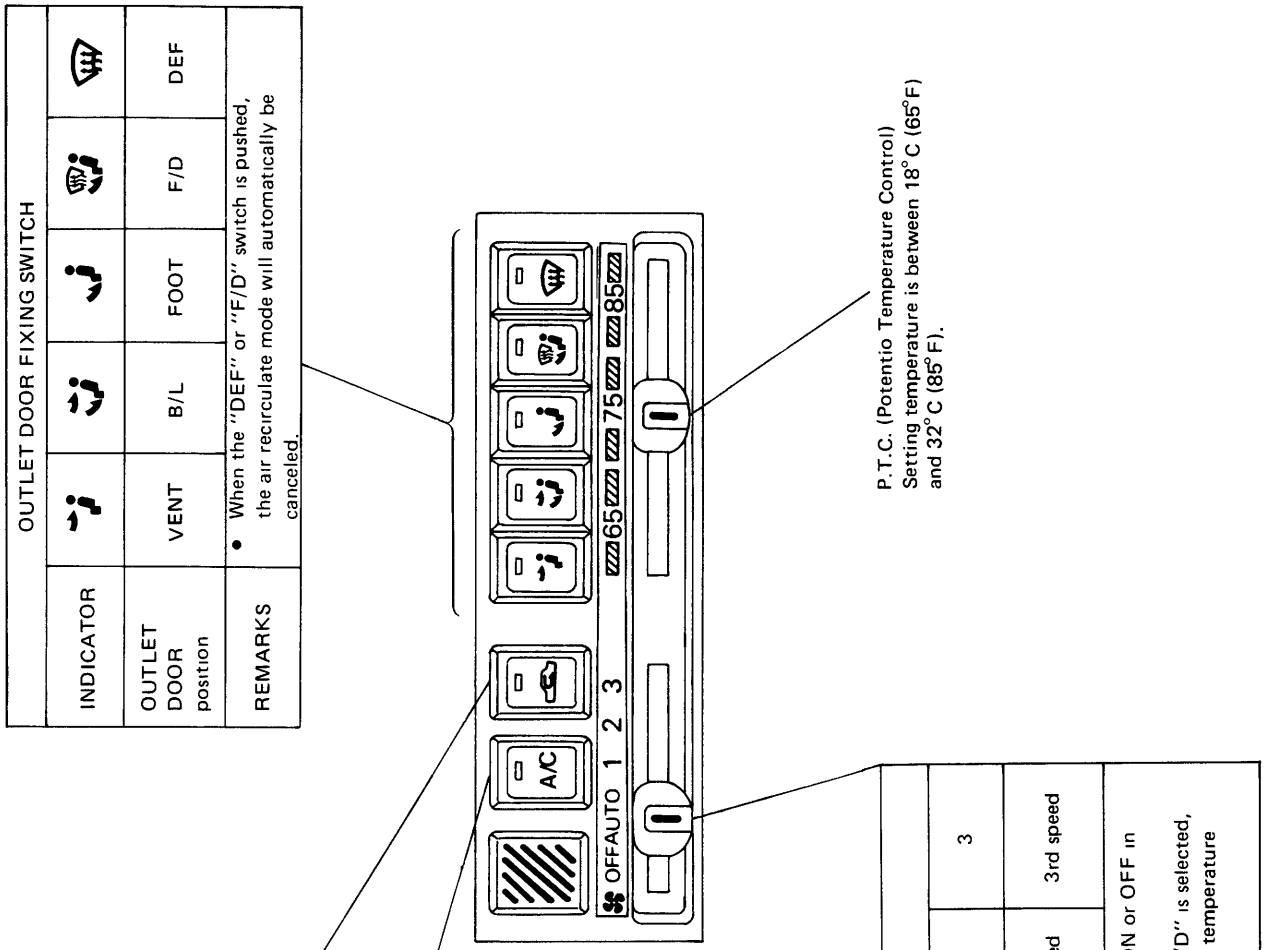
Starting fan speed control
When engine coolant temperature is low, the air outlet door position is detected by the microswitch and if this is set in B/L, FOOT or FOOT/DEF blower speed is controlled to prevent a large amount of cold air from being discharged into the floor area.

Outlet door control
This can be selected by operation of the mode switch.

Intake door control
This can be selected by changing the REC switch position.

Compressor magnet clutch control
When the A/C switch is ON, the thermistor detects evaporator temperature. The thermo control amplifier controls clutch ON/OFF operation depending on the evaporator temperature.

Control Operation



OUTLET DOOR FIXING SWITCH					
INDICATOR					
OUTLET DOOR position	VENT	B/L	FOOT	F/D	DEF
REMARKS	• When the "DEF" or "F/D" switch is pushed, the air recirculate mode will automatically be canceled.				

RECIRC SWITCH		
INDICATOR	ON	OFF
INTAKE DOOR position	RECIRCULATED AIR	FRESH AIR

A/C SWITCH		
INDICATOR	ON	OFF
COMPRESSOR	ON	OFF
REMARKS	• Compressor turns ON or OFF according to thermo control amp. operation. • When the "DEF" switch is pushed, the comperssor will automatically turn on.	

FAN SPEED FIXING SWITCH						
FAN SWITCH position	OFF	AUTO	1	2	3	
FAN SPEED	OFF	AUTO-MATIC CONTROL	1st speed	2nd speed	3rd speed	
REMARKS	• Fan speed changes in 3 or 4 steps with A/C switch ON or OFF in auto mode. • When starting up from cold, if "B/L", "FOOT", "F/D" is selected, the blower speed will be fixed in "Lo" until coolant temperature rises.					

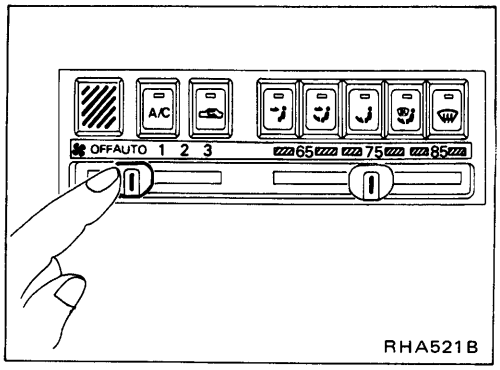
SHA475C

Operation Check

The purpose of the operational check is to confirm that the system operates as it should. The systems which will be checked are the blower, mode (discharge air), intake air, temperature decrease, temperature increase and A/C switch.

CONDITIONS:

Engine running at normal operating temperature.

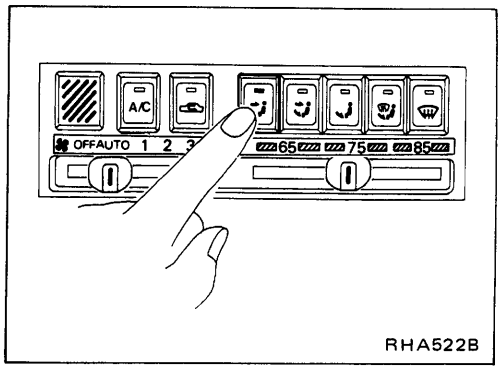


RHA521B

PROCEDURE:

1. Check blower

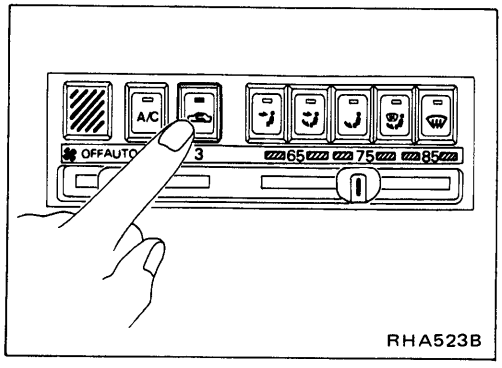
1) Slide FAN speed lever to AUTO.
   Blower should operate on AUTO speed.
2) Then slide lever to 1-speed.
3) Continue checking blower speed until all three speeds are checked.
4) Leave blower on 3-speed.



RHA522B

2. Check discharge air

1) Press the button.
2) Make sure indicator is ON and all discharge air comes out of face vent.
3) Press the button.
4) Make sure indicator is ON and all discharge air comes out of face vents and foot vents.
5) Press the button.
6) Make sure indicator is ON and all discharge air comes out of the foot vents, with some air from the defroster vents.
7) Press the button.
8) Make sure indicator is ON and all discharge air comes out of the defroster and foot vents.
9) Press the button.
10) Make sure indicator is ON and all discharge air comes out of the defroster vents only.
11) Confirm that the compressor clutch is engaged (visual inspection).

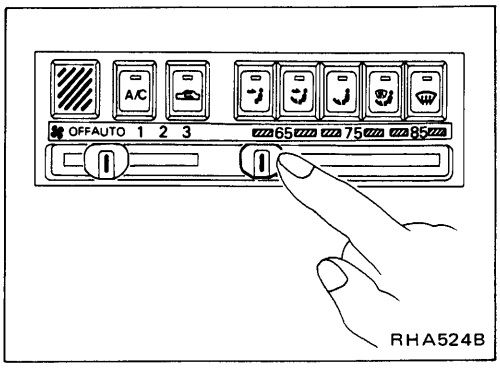


RHA523B

3. Check recirc

1) Press button.
2) Make sure indicator is ON.
3) Listen for intake door position change (you should hear blower sound change slightly).

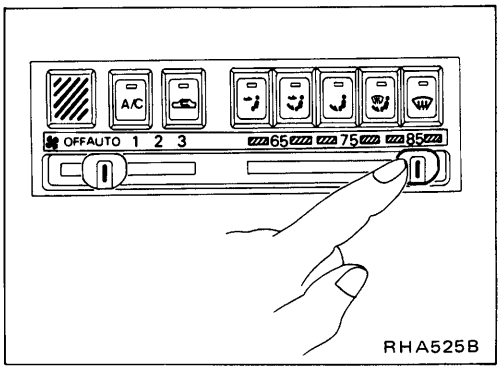
Operation Check (Cont'd)



RHA524B

4. Check temperature decrease

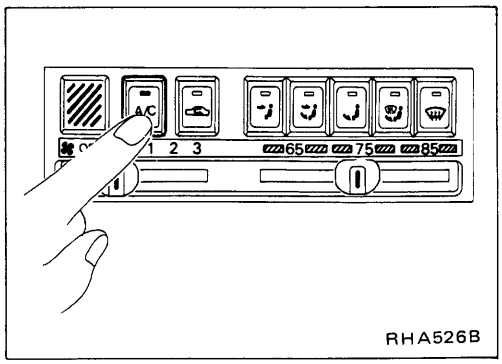
1) Slide temperature lever to full cold.
2) Check for cold air at discharge air outlets.



RHA525B

5. Check temperature increase

1) Slide temperature lever to full hot.
2) Check for hot air at discharge air outlets.



RHA526B

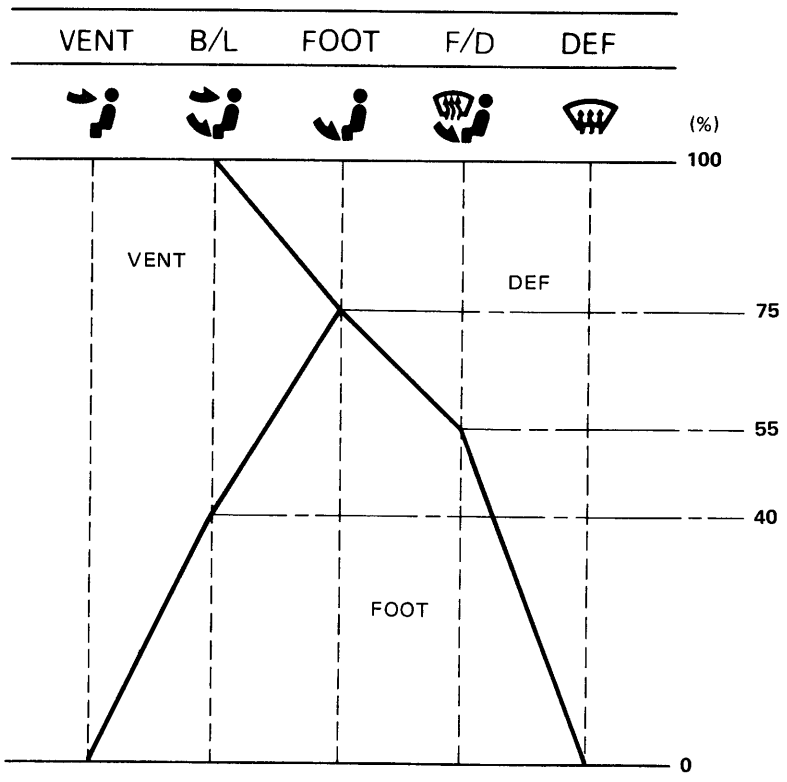
6. Check A/C switch

Move the fan control lever to the desired (AUTO or 1 to 3-speed) position and push the air conditioner button to turn ON the air conditioner.

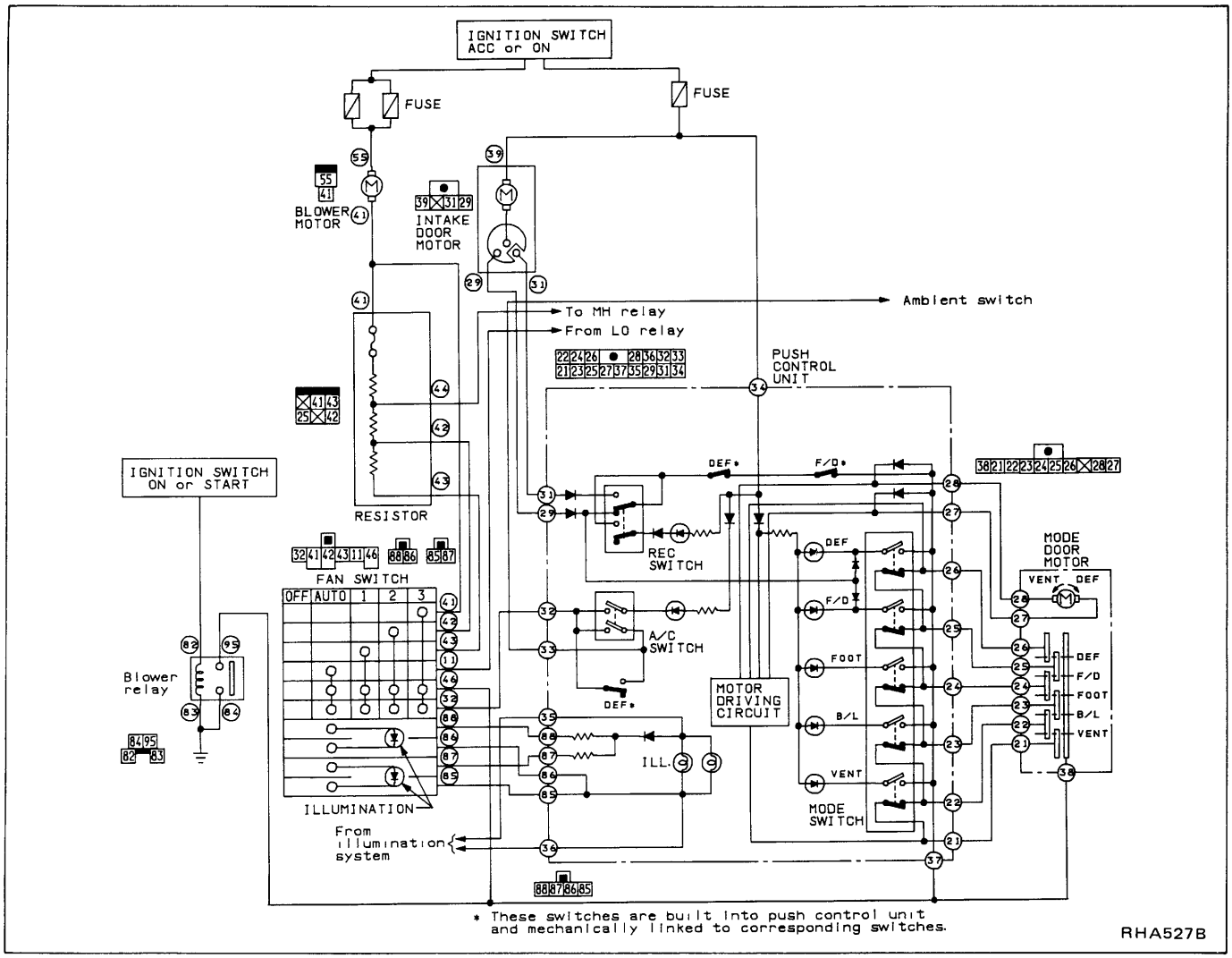
The indicator light will come on when air conditioner is ON.

Air Flow

AIR DISTRIBUTION



Push Control System



This push control system operates the intake and mode door motors to activate their corresponding doors.

SWITCHES AND THEIR CONTROL FUNCTIONS

Switch		Indicator illuminates							Air outlet	Intake air	Compressor
		A/C									
A/C		○									ON*1
Mode			○						VENT		
				○					B/L		
					○				FOOT		
						○			F/D	FRE	
							○		DEF	FRE	ON*1
								○*2		REC*2	

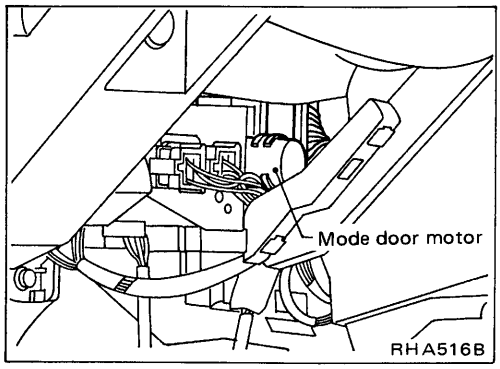
*1: Compressor is operated by thermo control amp.
*2: Depending on mode switch position

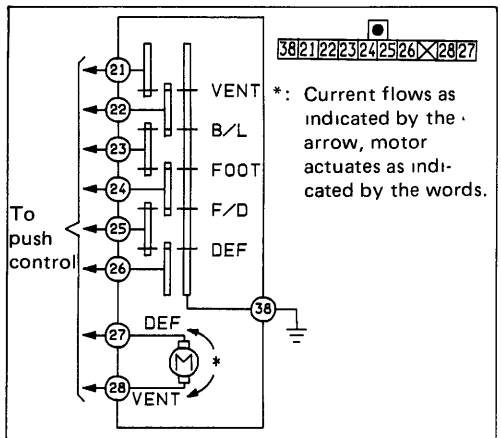
Push Control System (Cont'd)

MODE DOOR MOTOR

The mode door motor is located on the left side of the heater unit. Through the side link it opens and closes the vent, foot and defroster doors.

When one mode switch is pushed, the position switch built into it reads the corresponding mode to determine the direction of motor rotation. As soon as the desired mode is set, the position switch stops the motor.





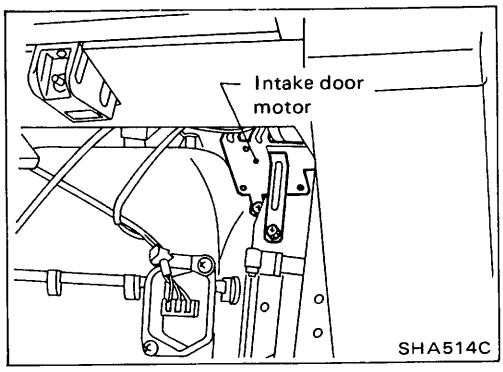
Terminal No.		Mode door motor	
㉗	㉘	Mode door operation	Direction of linkage rotation
⊖	⊖	Stop	Stop
⊖	⊕	VENT → DEF	Clockwise
⊕	⊖	DEF → VENT	Counter-clockwise

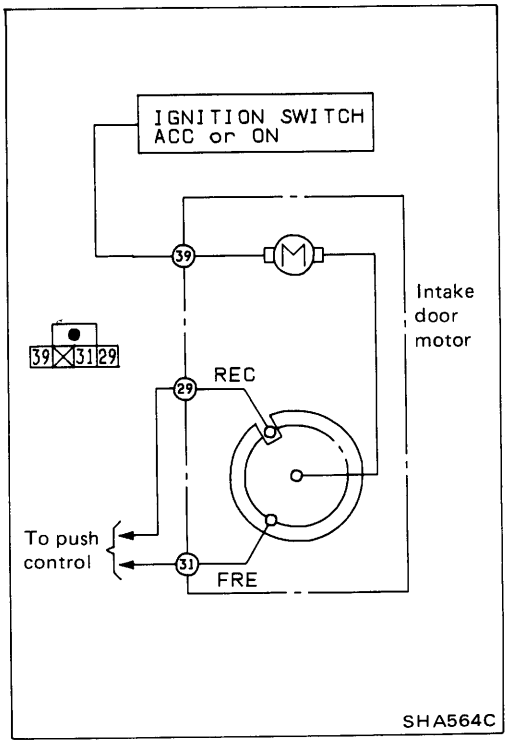
SHA563C

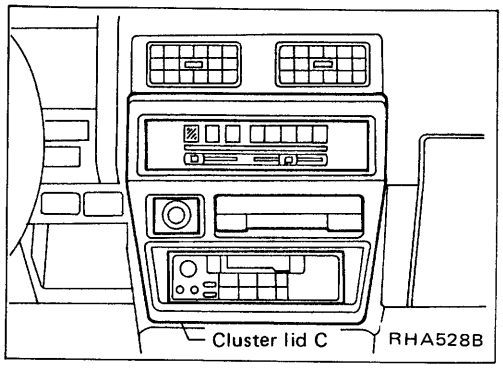
Push Control System (Cont'd)

INTAKE DOOR MOTOR

The intake door motor is installed on the intake unit. When the door position is determined by pushing the "REC" switch on the control panel, the motor rotates and the air inlet is changed.

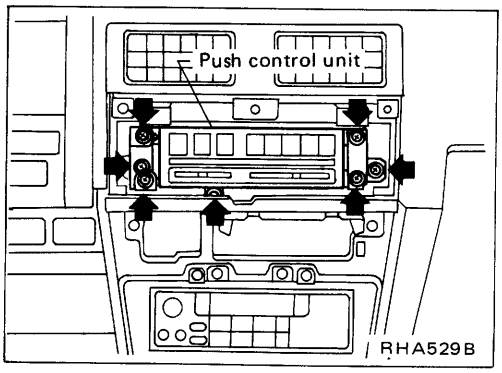






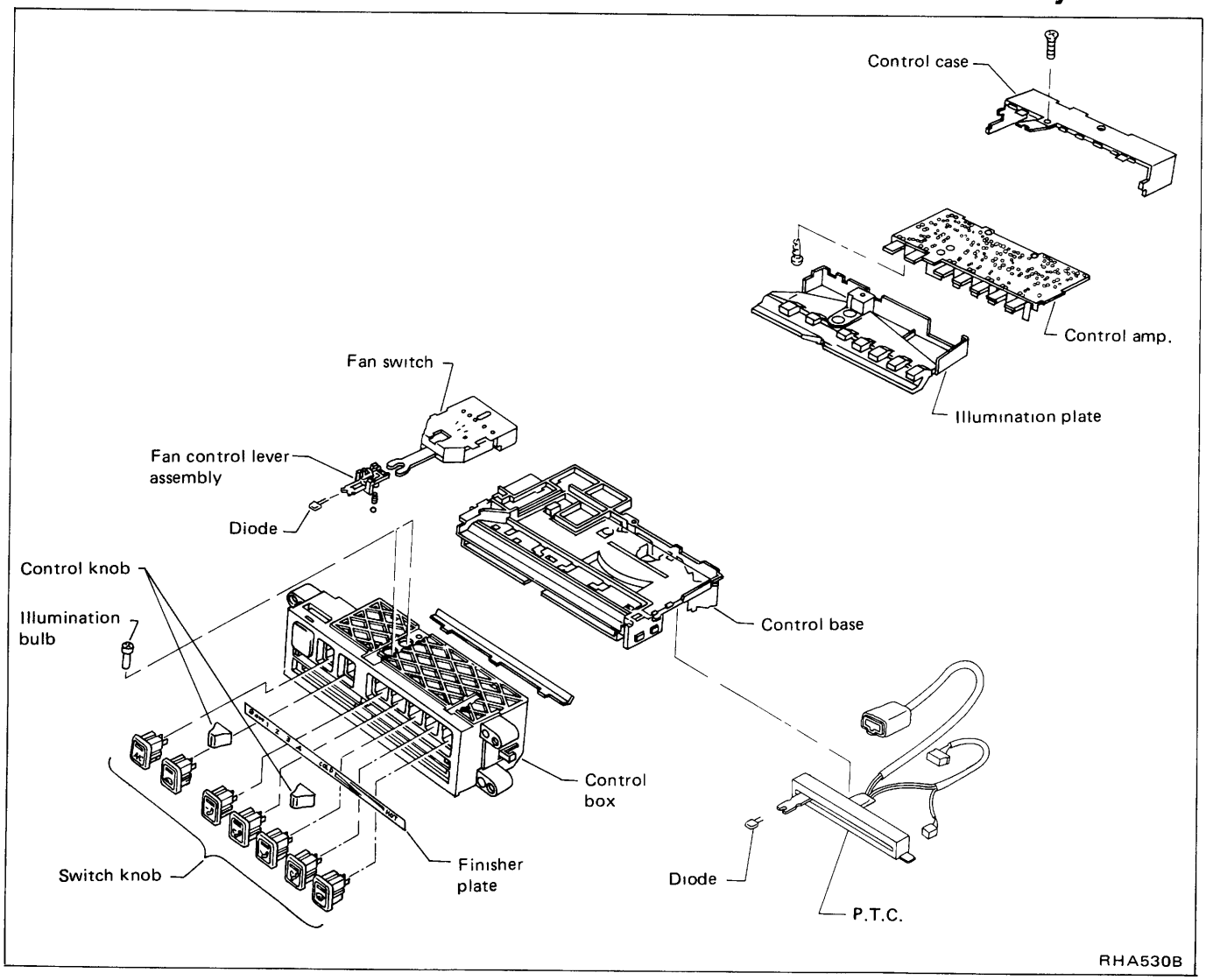
Removal and Installation

1. Remove cluster lid C.

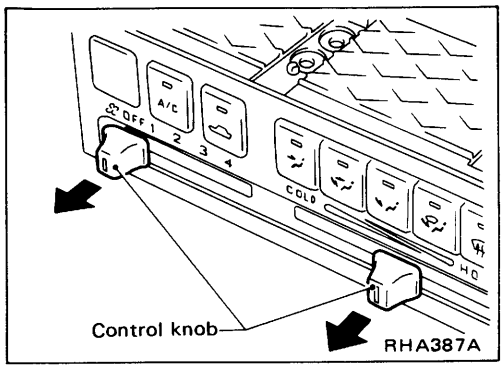


2. Remove audio (radio).
3. Remove seven screws of push control unit and BRKT.
4. Disconnect push control unit, in-vehicle sensor and P.T.C. harness connectors.
5. Remove push control unit.
6. Installation is in the reverse order of removal.

Overhaul — Push control unit assembly

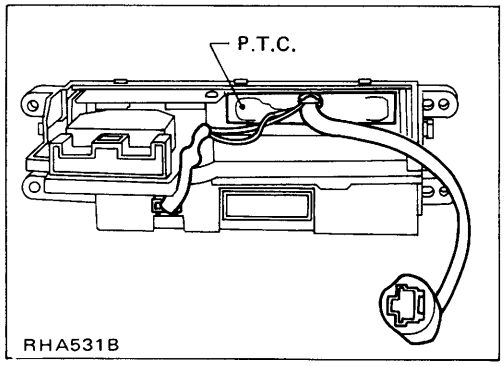


Overhaul — Push control unit assembly (Cont'd)

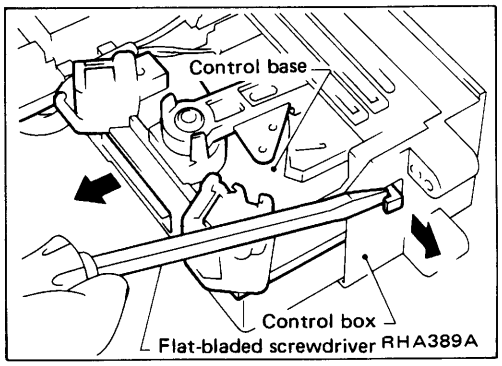


1. Remove control knobs.

Wrap knobs with a cloth and pull in direction indicated by arrow as shown in figure at left. Be careful not to scratch knobs during removal.

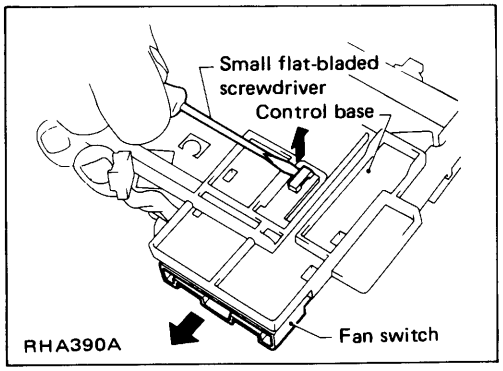


2. Remove P.T.C. and disconnect illumination harness connectors.



3. Remove control base.

Undo hook at each end of control box and remove control base from control box by moving it in direction indicated by arrow.

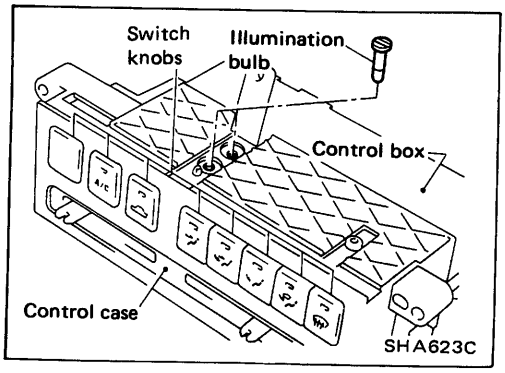


4. Remove fan switch.

5. Remove illumination bulb.

Wrap finisher with a cloth and remove knobs using pliers or similar tool. Be careful not to scratch finisher's surface.

Overhaul — Push control unit assembly (Cont'd)



6. Remove switch knobs.
7. Remove control case.
8. Remove illumination plate.

Be careful not to scratch control amp. when removing illumination plate.

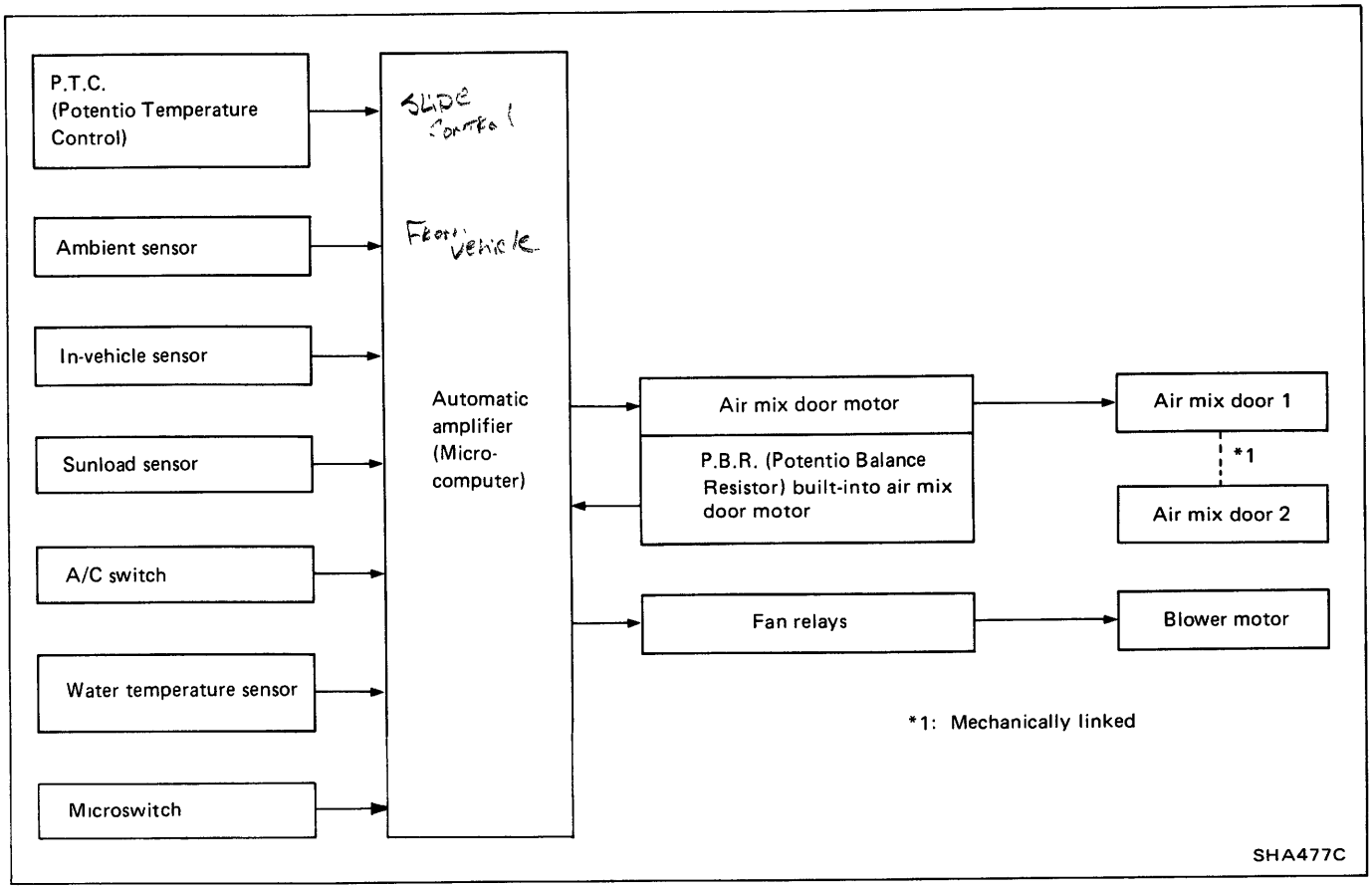
9. Remove finisher plate.
10. Remove control amp.

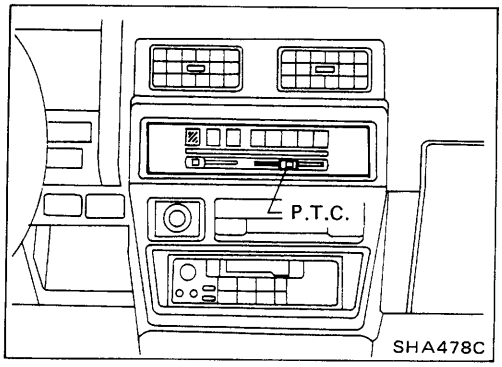
Be careful not to damage substrate when removing.

11. Disconnect temperature control cable.
12. Installation is in reverse order of removal.

Overview of Control System

The control system consists of a) input sensors and switches, b) the automatic amplifier (microcomputer), and c) outputs. The relationship of these components is shown in the diagram below.

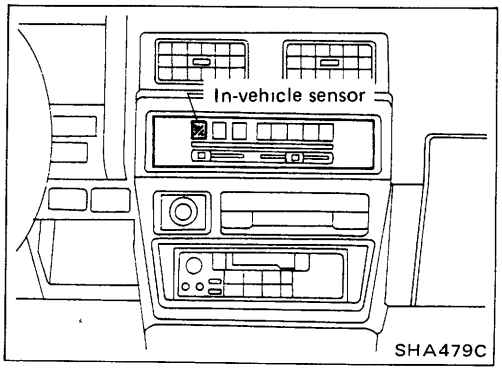




Control System Input Components

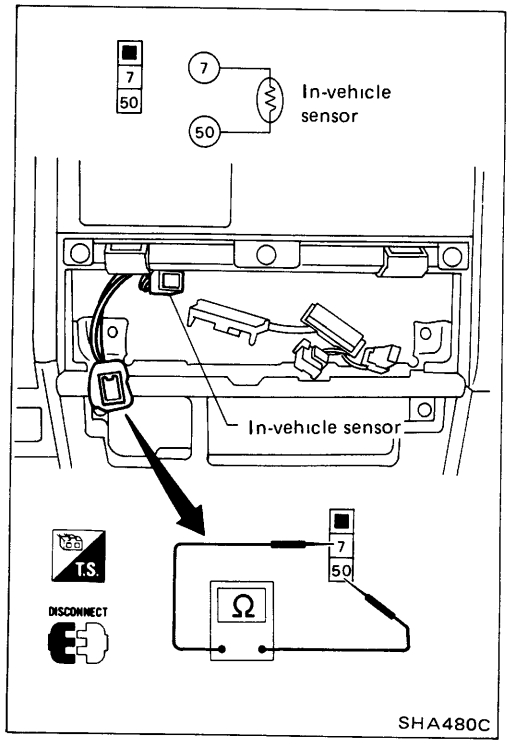
POTENTIO TEMPERATURE CONTROL (P.T.C.)

The P.T.C. is built into the control unit. It has a variable resistance which changes according to the set temperature. This resistance is connected to the temperature lever.



IN-VEHICLE SENSOR

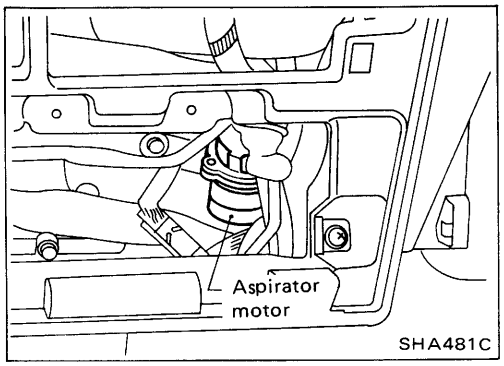
The in-vehicle sensor is attached to the left side of the control unit. It converts variations in the temperature of the compartment air drawn in by the aspirator into a resistance value, which is then input into the auto amplifier.



After disconnecting in-vehicle sensor harness connector, measure resistance between terminals ⑦ and ⑤⓪ at sensor harness side, using the table below.

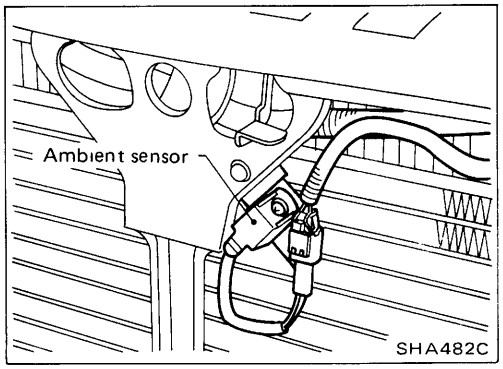
Temperature °C (°F)	Resistance kΩ
0 (32)	6.19
5 (41)	4.95
10 (50)	3.99
15 (59)	3.24
20 (68)	2.65
25 (77)	2.19
30 (86)	1.81
35 (95)	1.51
40 (104)	1.27

Control System Input Components (Cont'd)



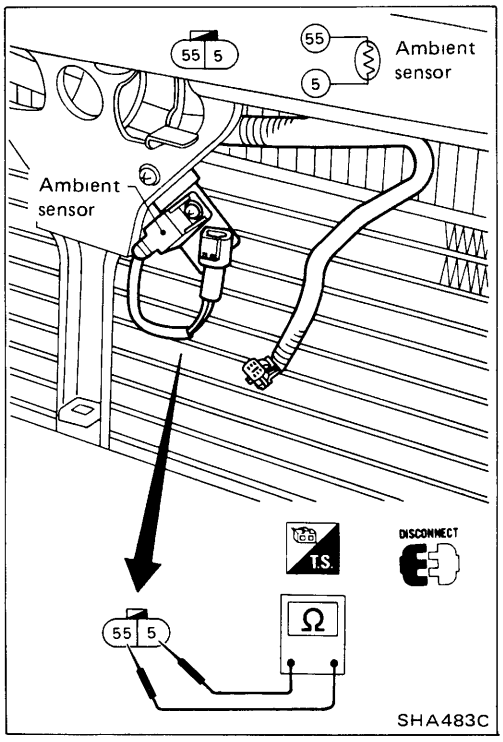
ASPIRATOR MOTOR

The aspirator motor is located the heater unit. The aspirator motor continuously draws compartment air into the in-vehicle sensor while the ignition switch is ON.



AMBIENT SENSOR

The ambient sensor is located on the hood lock stay. It detects the ambient temperature and converts it into a resistance value, which is then input into the auto amplifier.



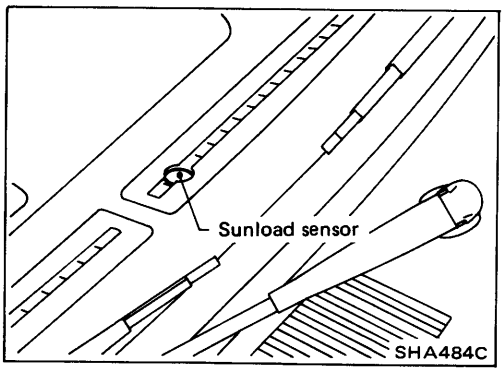
After disconnecting ambient sensor harness connector, measure resistance between terminals ⑤ and ⑤⑤ at sensor harness side, using the table below.

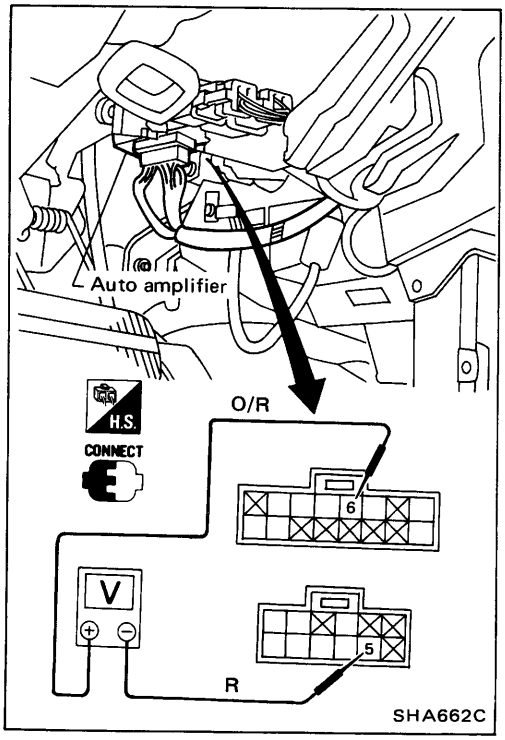
Temperature °C (°F)	Resistance kΩ
−20 (−4)	9.93
−10 (14)	5.57
0 (32)	3.26
10 (50)	1.98
20 (68)	1.25
25 (77)	1.00
30 (86)	0.81
40 (104)	0.54

Control System Input Components (Cont'd)

SUNLOAD SENSOR

The sunload sensor is located on the center defroster grille. It detects sunload entering through the windshield by means of a photo diode and converts it into a current value which is then input to the auto amplifier.

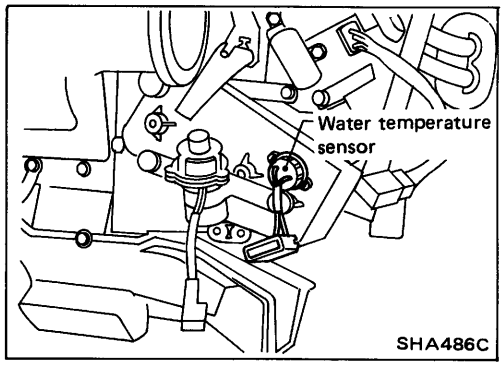




Measure voltage between terminals ⑤ and ⑥ at auto air conditioner harness side, using the table below.

Input current mA	Output voltage V
0	5.00
0.1	4.09
0.2	3.18
0.3	2.27
0.4	1.36
0.5	0.45

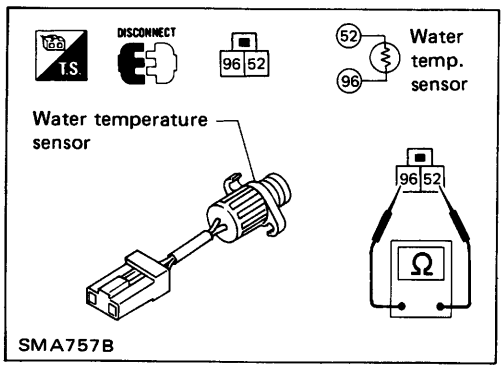
- **When checking sunload sensor, select a place where sun shines directly on it.**



WATER TEMPERATURE SENSOR

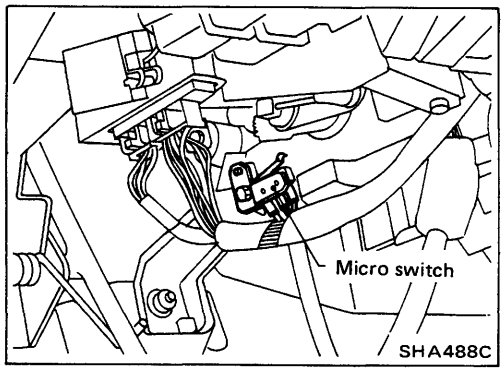
The water temperature sensor is attached to the heater unit and is in contact with the heater core assy. It detects engine coolant temperature through the heater core and converts it into a resistance value, which is then input into the auto amplifier. When the VENT switch or DEF switch is ON, signals from the water temperature sensor are not input into the auto amplifier.

After disconnecting water temperature sensor harness connector, measure resistance between terminals ⑫ and ⑯ at sensor harness side, using the table below.



Temperature °C (°F)	Resistance kΩ
0 (32)	3.99
10 (50)	2.54
20 (68)	1.67
30 (86)	1.12
40 (104)	0.78
50 (122)	0.55
60 (140)	0.40
70 (158)	0.29
80 (176)	0.22

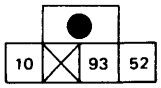
Control System Input Components (Cont'd)

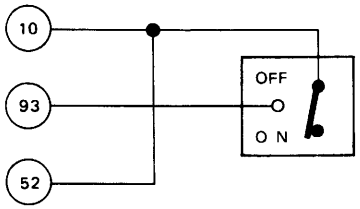


MICRO SWITCH

The microswitch is installed around the side link of the heater unit and operates the link in response to the position of the mode switch.

The operation of this microswitch is as shown below:

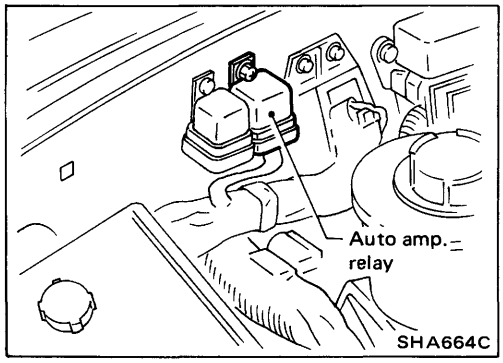




Microswitch operation

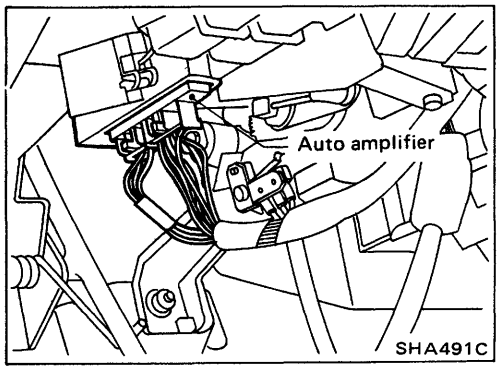
MODE		VENT	B/L	FOOT	FOOT / DEF	DEF
Terminal No.	⑩	○ ○	○	○	○	○ ○
	⑨③	○				○
	⑤②	○	○	○	○	○

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AUTO AMP. RELAY

The auto amp. relay is located on the left side of the engine room. When the A/C switch and fan switch are ON, the auto amp. relay operates and transmits A/C operation signals to the auto amplifier.



Control System Auto Amplifier (Auto amp.)

The auto amplifier has a built-in microcomputer which processes the information sent from the various sensors needed for air conditioner operation. The air-mix door motor and blower motor are then controlled.
Signals from the various switches and the Potentio Temperature Control (P.T.C.) are directly entered into the auto amplifier.

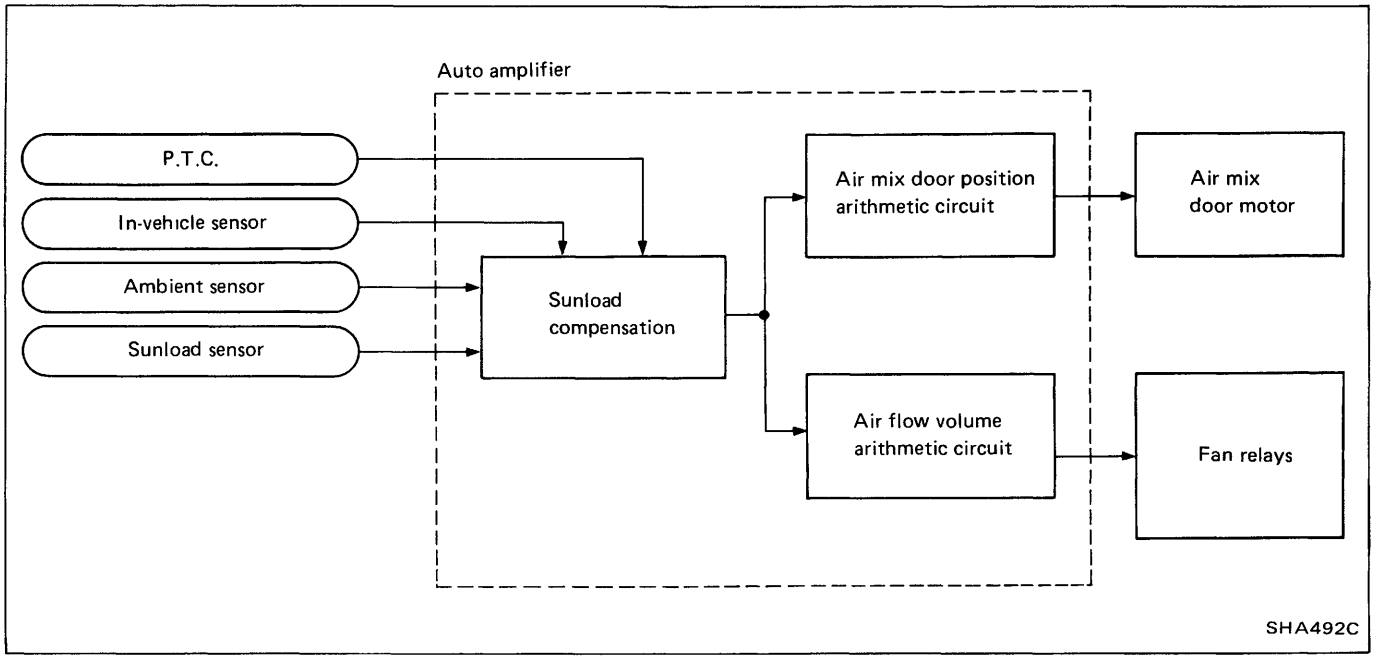
SUNLOAD INPUT PROCESS

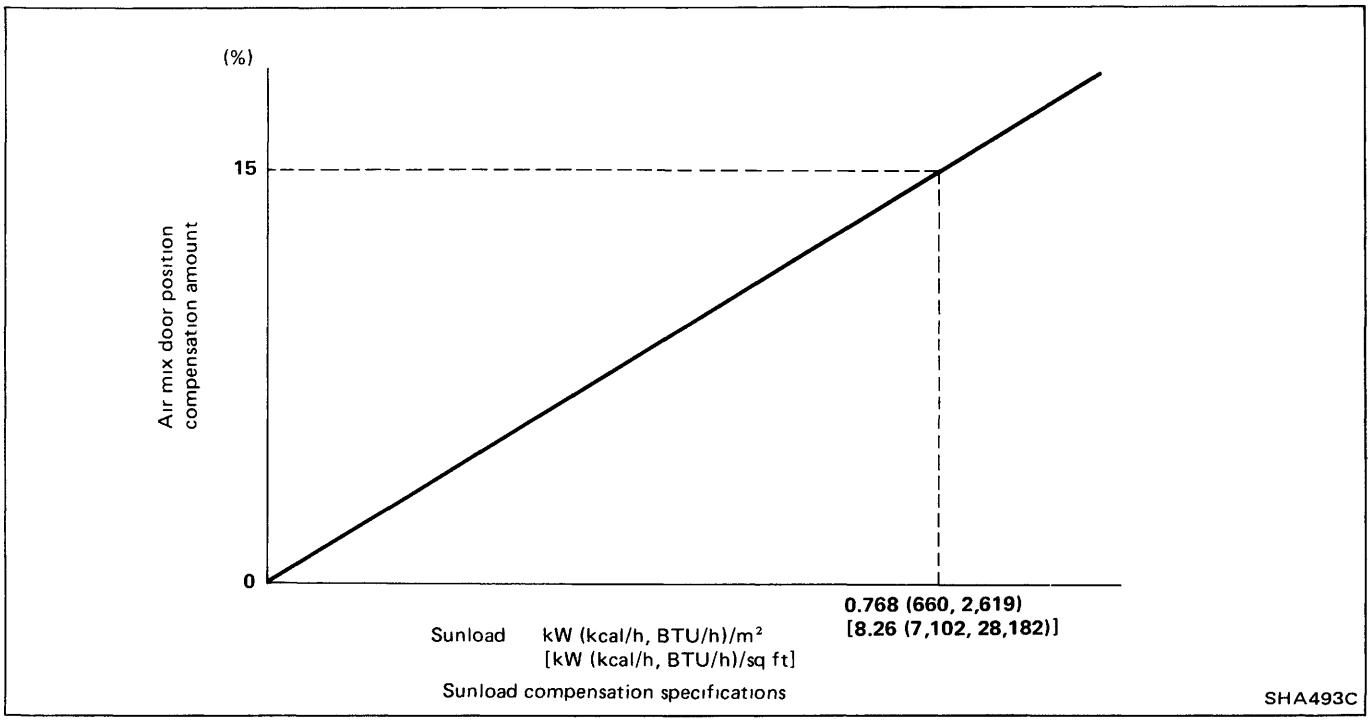
The auto amp. also includes a processing circuit which "averages" the variations in detected sunload over a period of time. This prevents drastic swings in the A.T.C. system operation due to small of quick variations in detected sunload.
For example, consider driving along a road bordered by an occasional group of large trees. The sunload detected by the sunload sensor will vary whenever the trees obstruct the sunlight. The processing circuit averages the detected sunload over a period of time, so that the (insignificant) effect of the trees momentarily obstructing the sunlight does not cause any change in the A.T.C. system operation. On the other hand, shortly after entering a long tunnel, the system will recognize the change in sunload, and the system will react accordingly.

Control System Auto Amplifier (Cont'd)

SUNLOAD COMPENSATION

The auto amplifier compensates for sunload by altering the air mix door position and air flow volume according to the amount of sunload detected by the sunload sensor. When the amount of sunload is great, the air mix door is moved toward the "COLD" side. Along with this air mix door movement, air flow volume will also be changed.



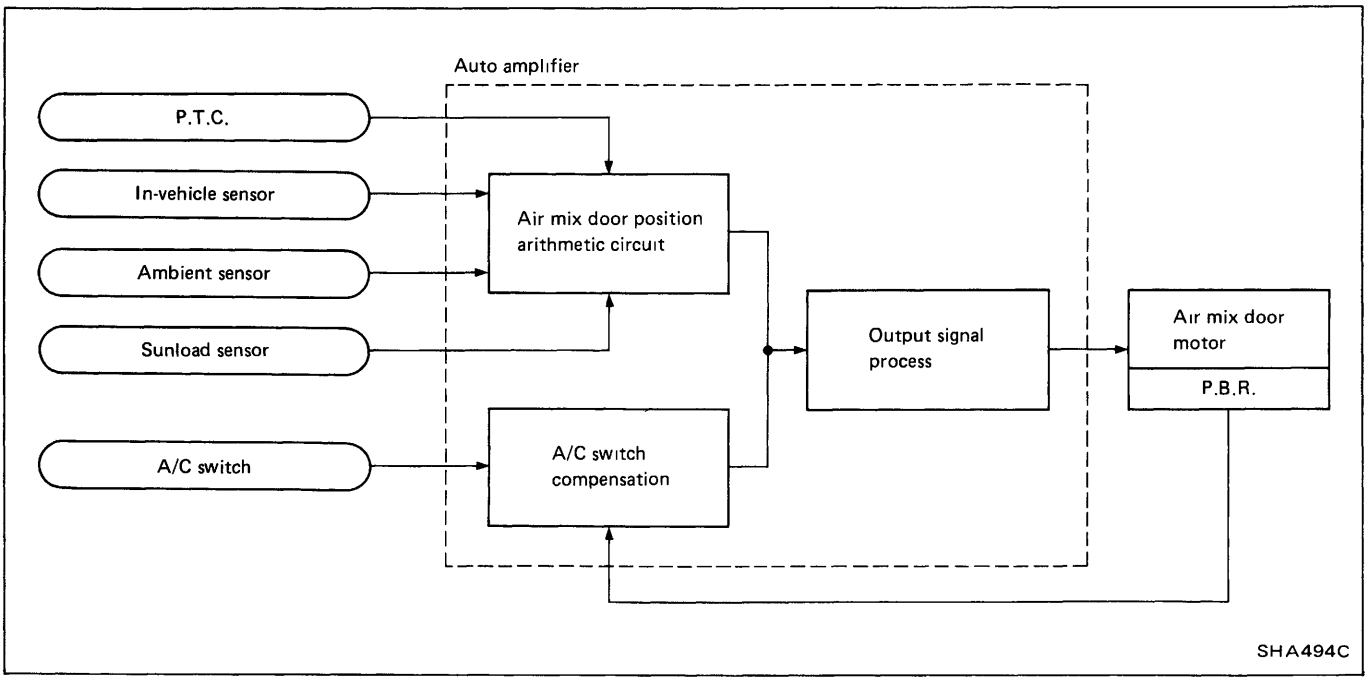


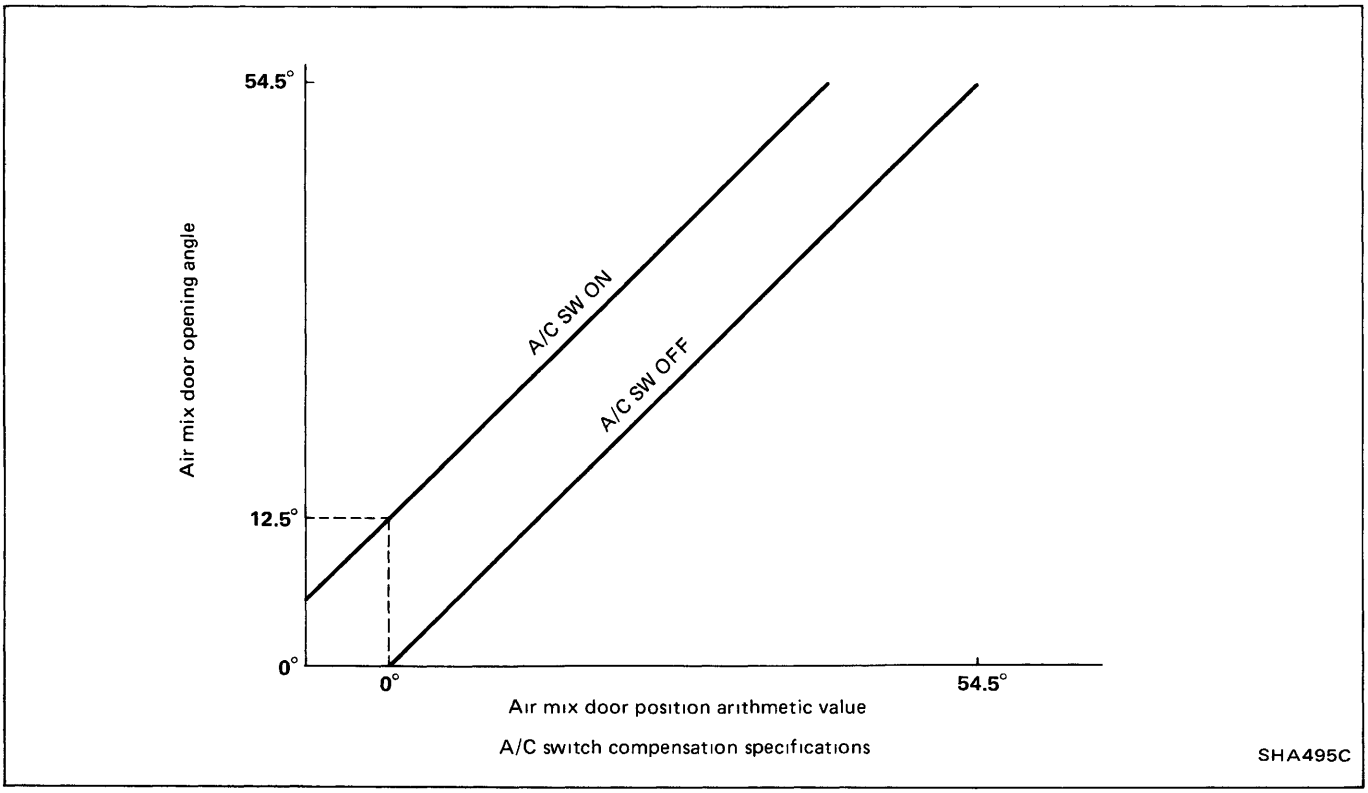
Control System Auto Amplifier (Cont'd)

A/C SWITCH COMPENSATION

The auto amplifier alters the air mix door position and air flow volume according to a signal emitted from the A/C switch.

When the A/C switch is "ON", the auto amplifier compensates for the PBR's input signal and moves the air mix door toward the "HOT" side.





Control System Output Components

AIR MIX DOOR CONTROL (Automatic temperature control)

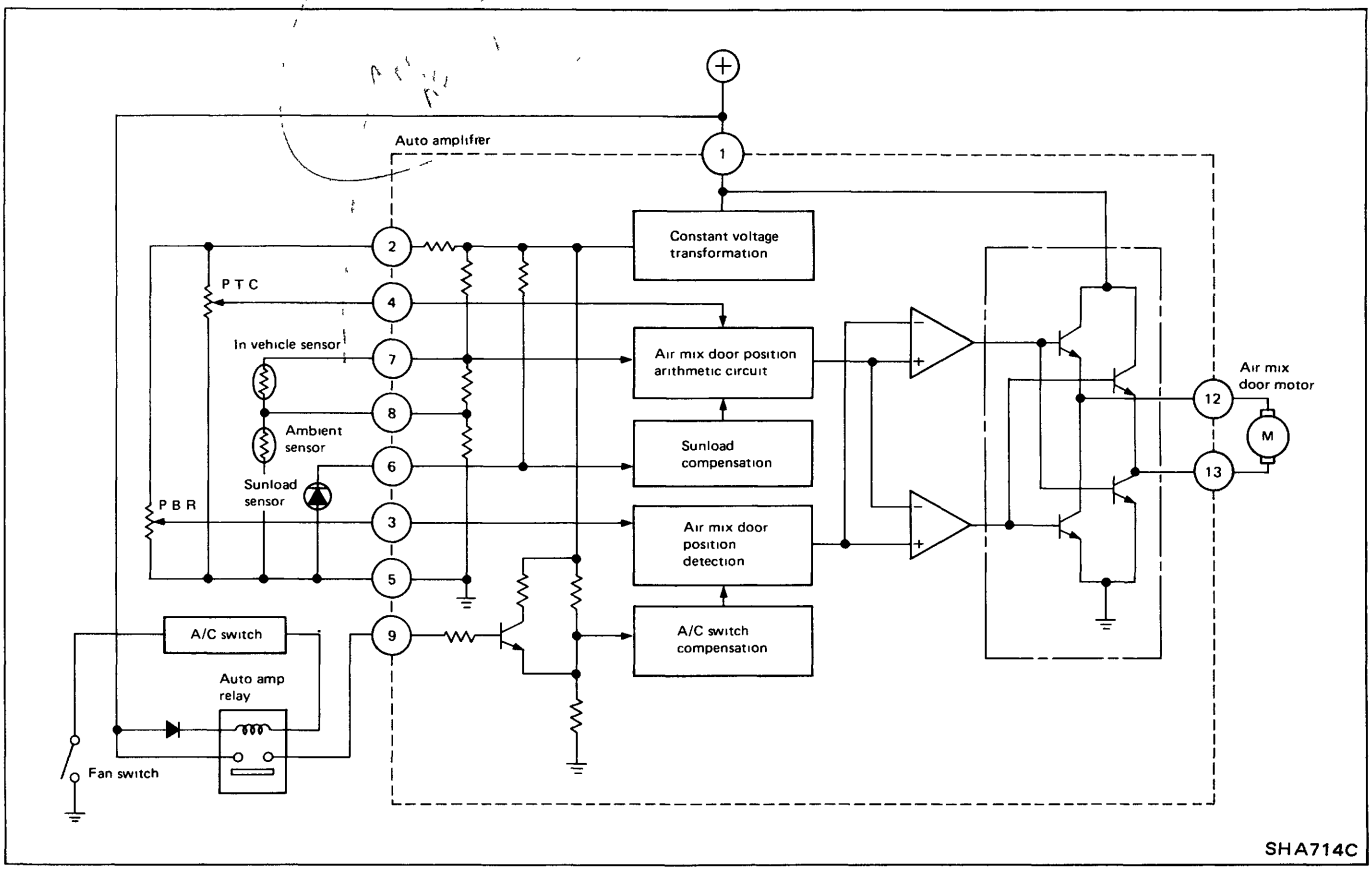
Component parts

Air mix door control system components are:

1) Auto amplifier
2) Ambient sensor
3) In-vehicle sensor
4) Sunload sensor
5) Air mix door motor (P.B.R.)
6) A/C switch

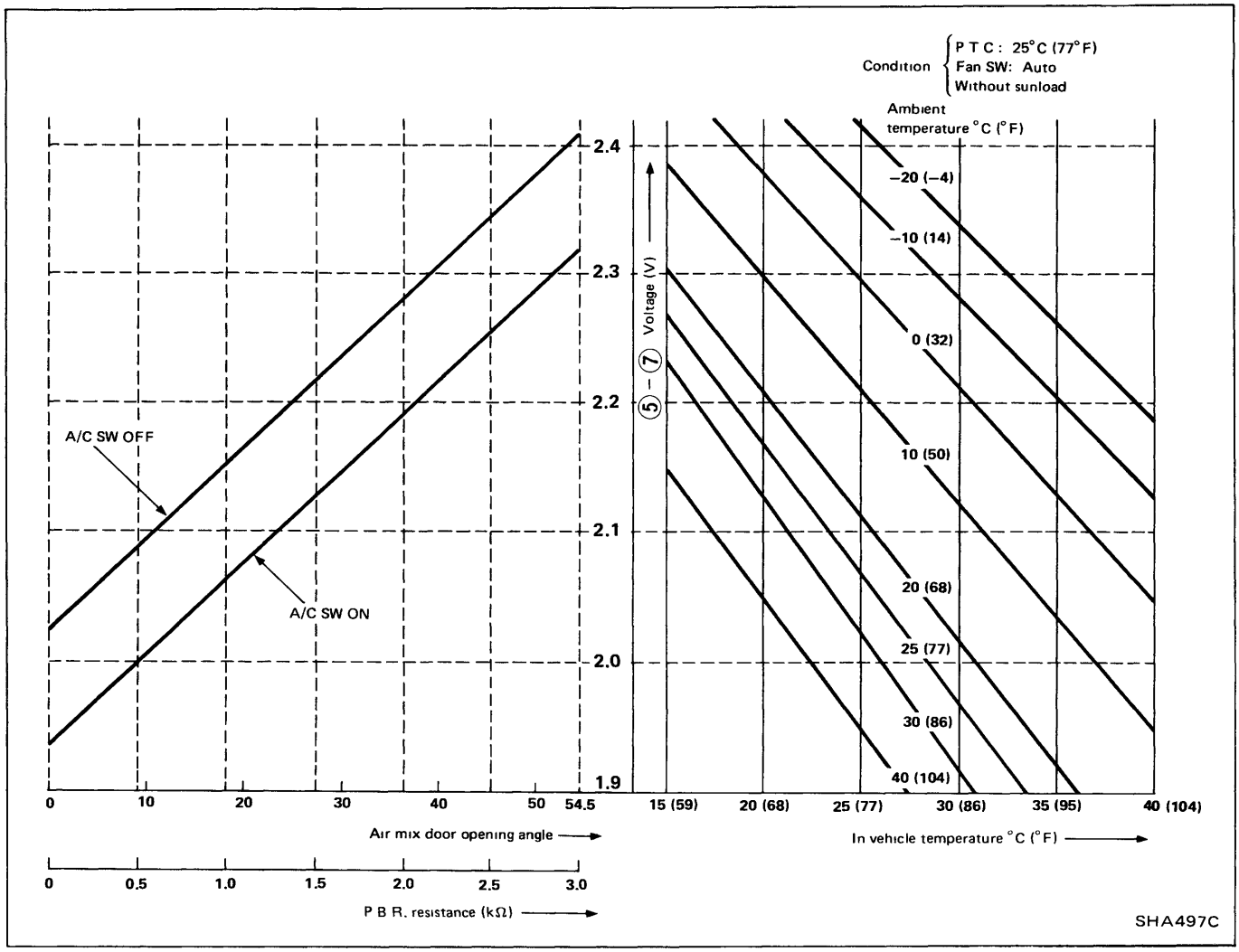
System operation

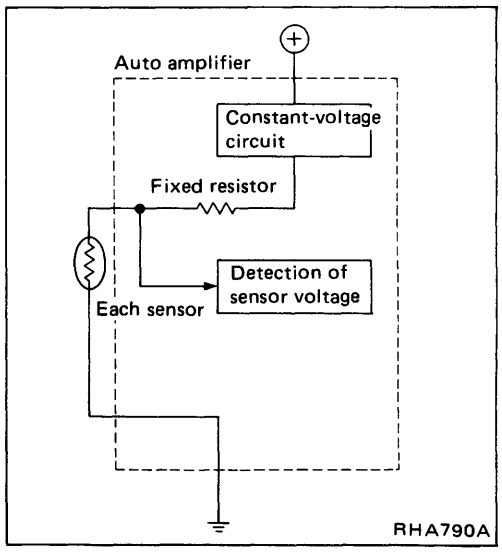
The air mix door is automatically controlled so that in-vehicle temperature is maintained to the set temperature. The temperature set by the P.T.C. (Potentio Temperature Control) and the temperature detected by the in-vehicle sensor and ambient sensor are compensated by the sunload sensor signal. The auto amplifier then determines the air-mix door position. The air mix door position detected by the P.B.R. is compensated by the ON-OFF operation of the A/C switch. The air mix door position determined by the auto amplifier is compared with that detected by the P.B.R. The auto amplifier then transmits the signal to the air mix door motor in order to activate it.



Control System Output Components (Cont'd)

Air mix door control specifications



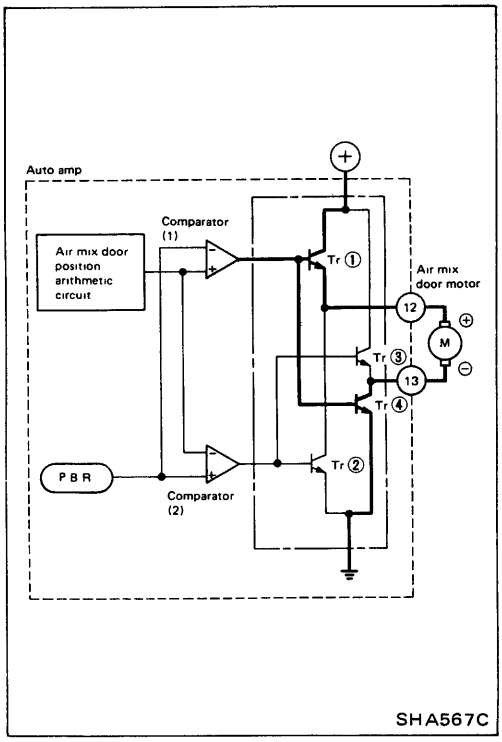


SENSOR INPUT PROCESS

The auto amplifier detects the voltage produced by each sensor, the P.B.R. and fixed resistor. The fixed resistor is built into the auto amplifier. 12-volt power voltage is first converted to approximately 5 volts by the constant voltage circuit where it is then applied to the ground line of the auto amplifier via the fixed resistor and the sensor. In this manner, the auto amplifier monitors the voltages of the fixed resistor, each sensor and the P.B.R. to determine sensor input.

Control System Output Components (Cont'd)

OPERATION OF AIR MIX DOOR MOTOR



SHA567C

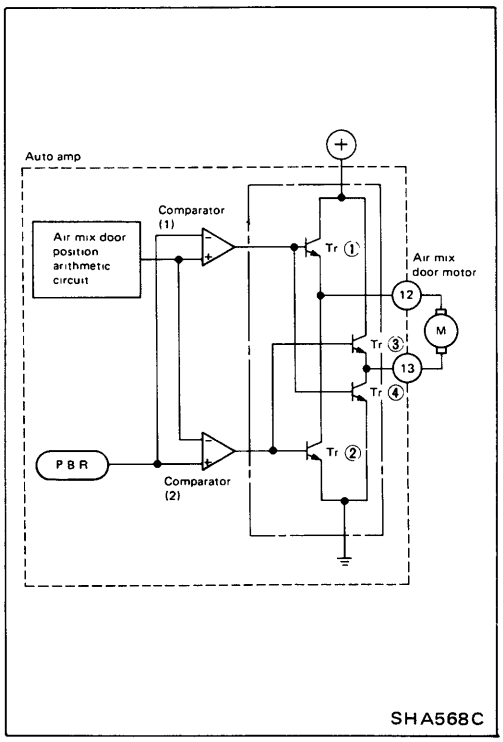
- Example ①

  When the temperature in the vehicle is lower than the set temperature.

  When the temperature in the vehicle is low, in-vehicle sensor resistance is great and the input voltage to the auto amplifier becomes great. As a result, the voltage from the air mix door position arithmetic circuit also becomes great.

  When this voltage is greater than the voltage from the P.B.R., comparator (1), Tr ① and Tr ④ turn ON.

  Accordingly terminal No. (12) becomes ⊕ and terminal No. (13) becomes ⊖. The air mix door motor rotates clockwise and the air mix door moves toward the "HOT" side.

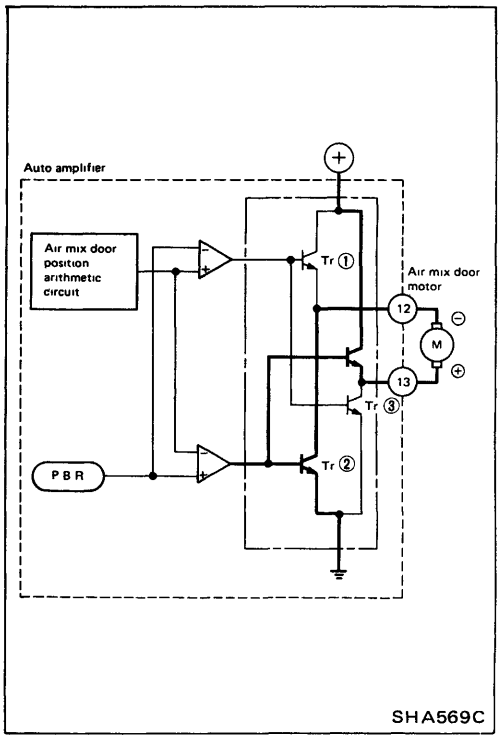


SHA568C

As the air mix door moves toward the "HOT" side, the voltage from the P.B.R. becomes greater and consequently becomes equal to that from the air mix door position arithmetic circuit. As a result, comparator (1) turns OFF and the air mix door motor stops.

Control System Output Components (Cont'd)

OPERATION OF AIR MIX DOOR MOTOR (Cont'd)



SHA569C

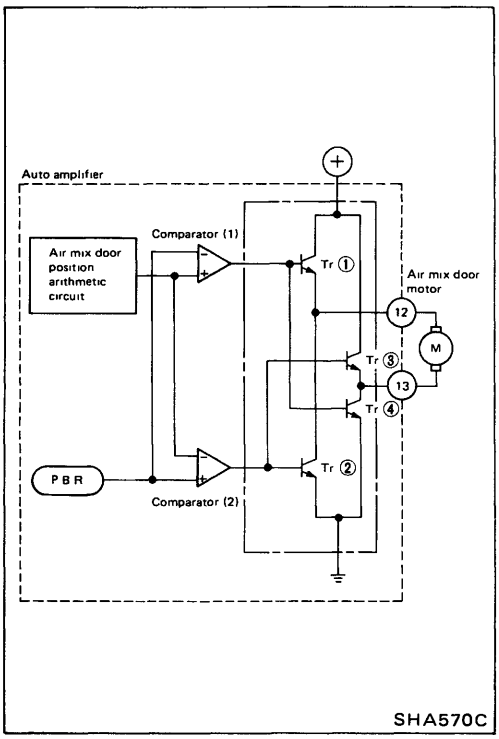
- Example ②

  When the temperature in the vehicle is higher than the set temperature.

  When the temperature in the vehicle is high, in-vehicle sensor resistance is small and the input voltage to the auto amplifier becomes small. As a result, the voltage from the air mix door position arithmetic circuit also becomes small.

  When this voltage is smaller than the voltage from the P.B.R., comparator (2) Tr ②, and Tr ③ turn ON.

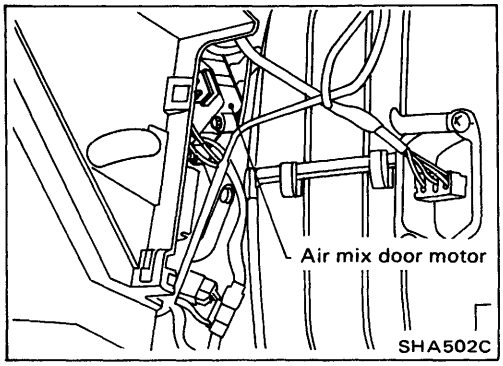
  Accordingly terminal No. (13) becomes ⊕ and terminal No. (12) becomes ⊖. The air mix door motor rotates counterclockwise and the air mix door moves toward the "COLD" side.



SHA570C

As the air mix door moves toward the "COLD" side, the voltage from the P.B.R. becomes smaller and consequently becomes equal to that from the air mix door position arithmetic circuit. As a result, comparator (2) turns OFF and the air mix door stops.

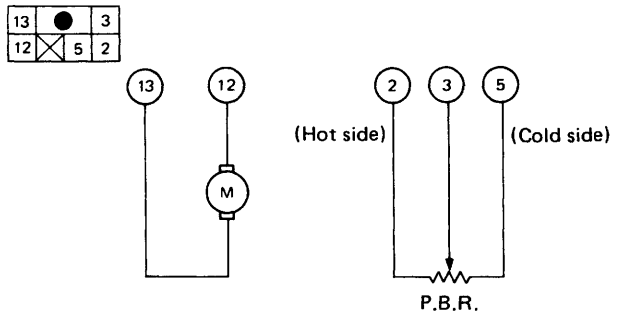
Control System Output Components (Cont'd)



AIR MIX DOOR MOTOR

The air mix door motor is attached to the heater unit. It rotates so that the air mix door is opened to a position set by the auto amplifier. Motor rotation is conveyed through a shaft. The air mix door position is then fed back to the auto amplifier by the P.B.R. built into the air mix door motor.

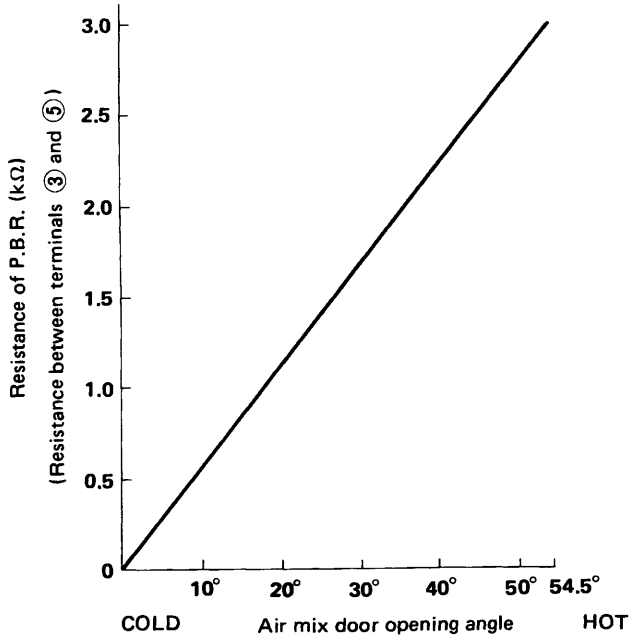
Air mix door motor operation



12	13	Air mix door operation	Direction of lever movement
⊕	⊖	COLD → HOT	Clockwise (Toward passenger compartment)
⊖	⊖	STOP	STOP
⊖	⊕	HOT → COLD	Counterclockwise (Toward engine compartment)

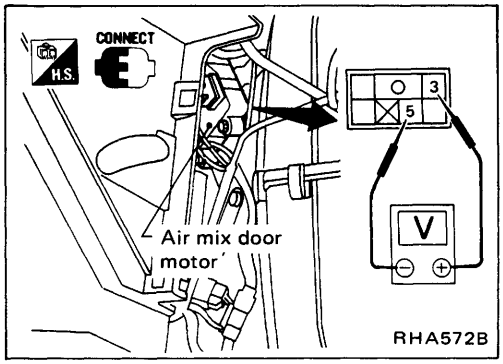
SHA665C

Characteristic P.B.R.



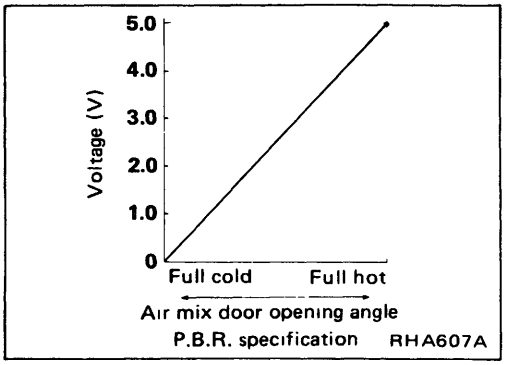
SHA504C

Control System Output Components (Cont'd)



P.B.R.

Measure voltage between terminals ③ and ⑤ at vehicle harness side.



Ignition switch: ON

- Ensure tester pointer deflects smoothly when P.T.C. is moved from 18°C (65°F) to 32°C (85°F) and vice versa.

Control System Output Components (Cont'd)

FAN SPEED CONTROL

Component parts

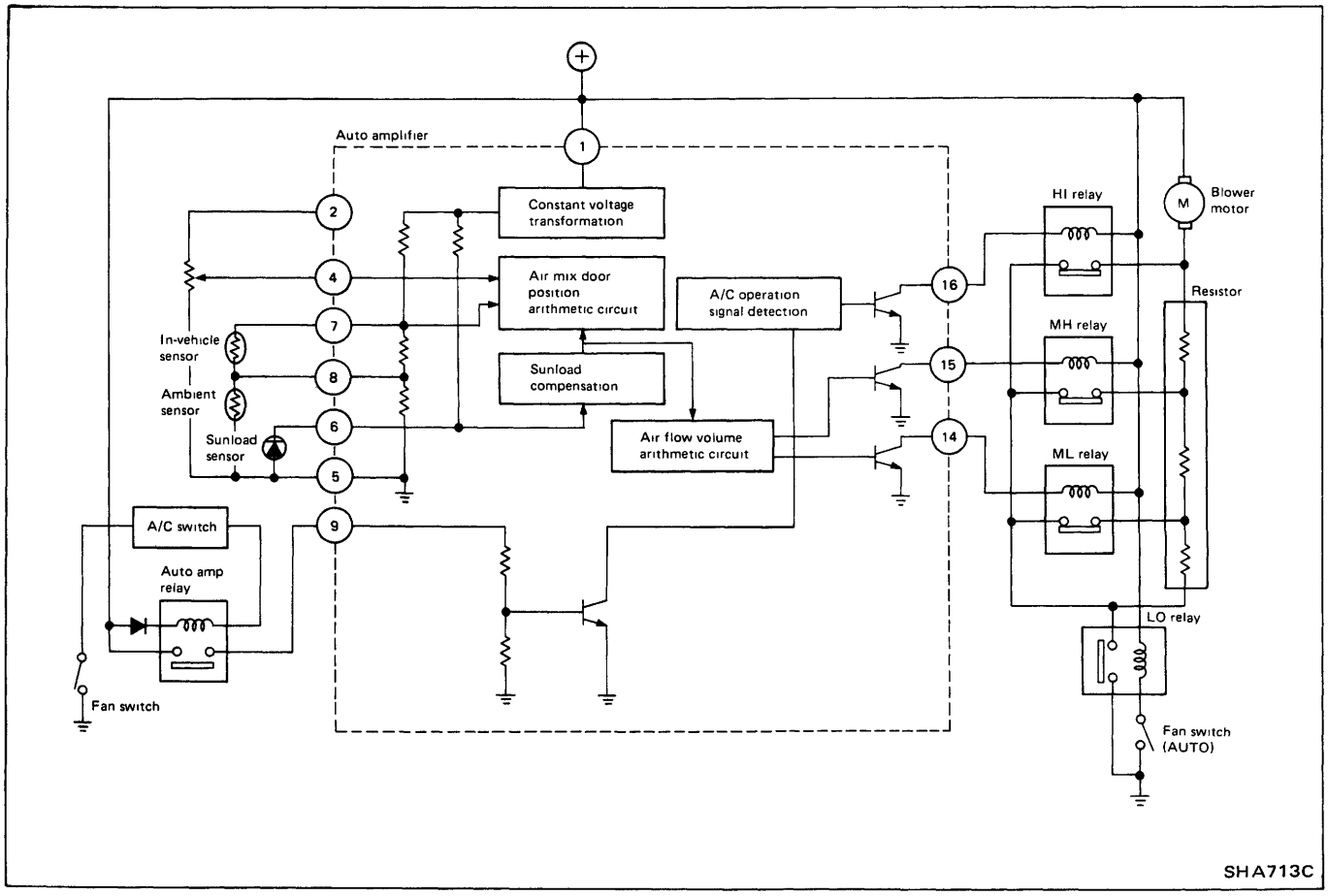
Fan speed control system components are:

1) Auto amplifier
2) In-vehicle sensor
3) Ambient sensor
4) Sunload sensor
5) Auto amp. relay
6) A/C switch
7) Fan switch
8) Blower motor
9) Resistance

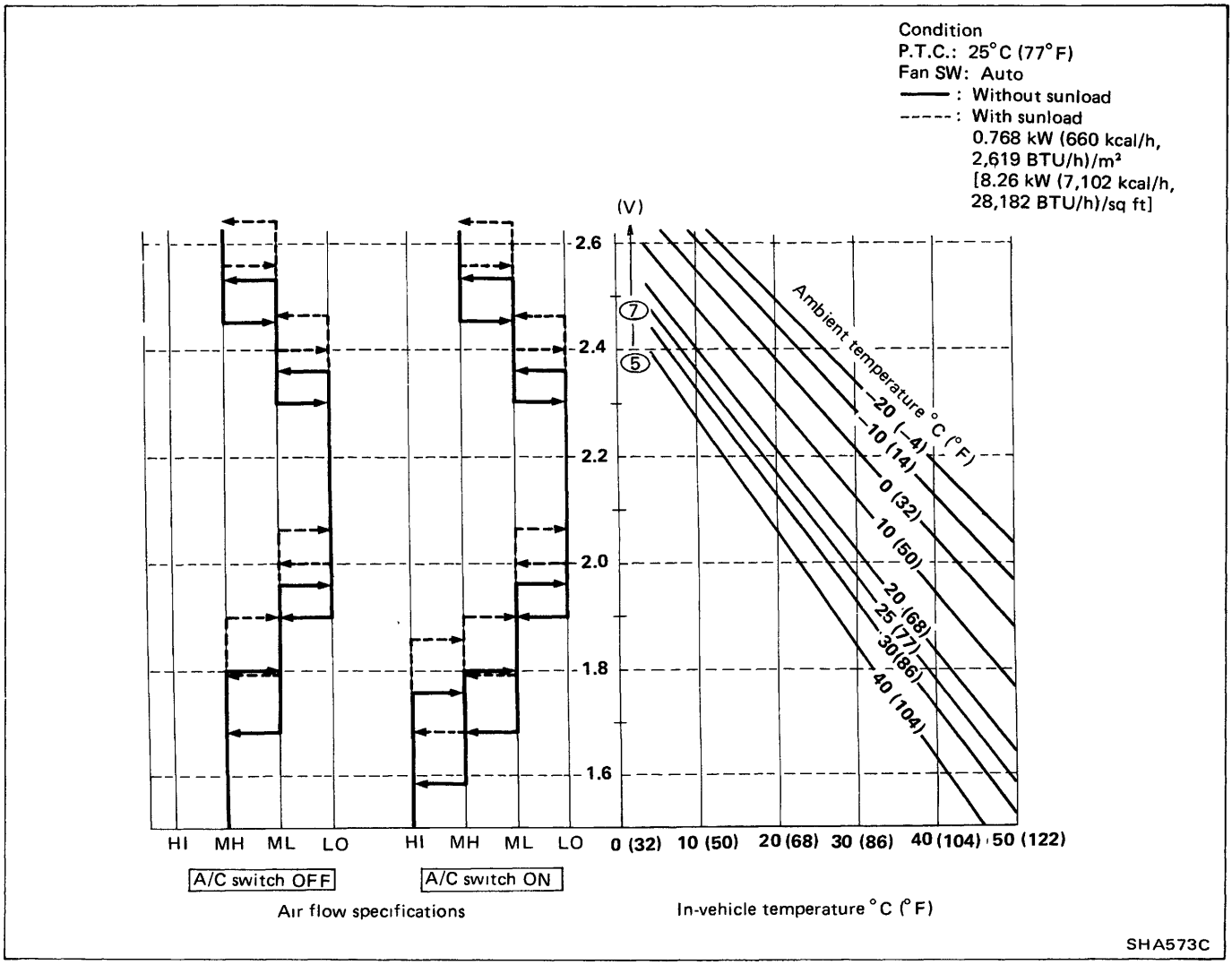
System operation

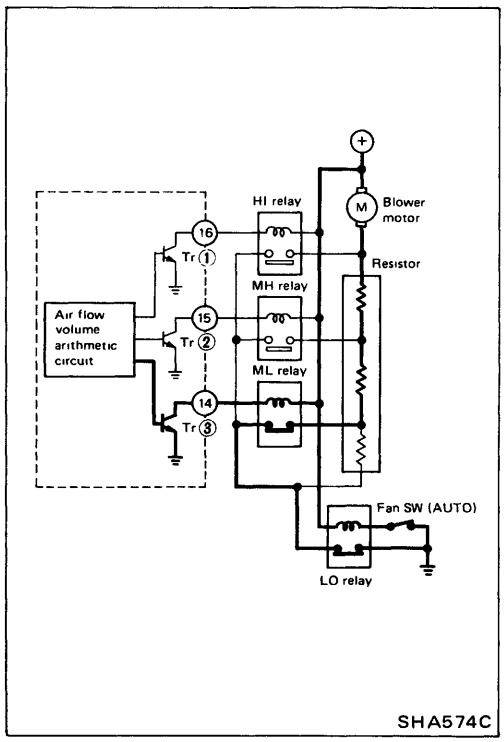
Blower fan speed is automatically controlled so that the in-vehicle temperature is maintained to the set temperature.

The temperature set by the P.T.C. (Potentio Temperature Control) and the temperature detected by the in-vehicle sensor and ambient sensor are compensated by the sunload sensor signal. The auto amplifier then determines fan speed from the ON-OFF operation of the A/C switch. The fan speed decision by the auto amplifier activates the fan relay and the blower fan motor rotates. When the A/C switch is ON, fan speed is activated in 4 steps, HI, MH, ML, and LO. When the A/C switch is OFF, fan speed is activated in 3 steps, MH, ML, and LO.



Control System Output Components (Cont'd)



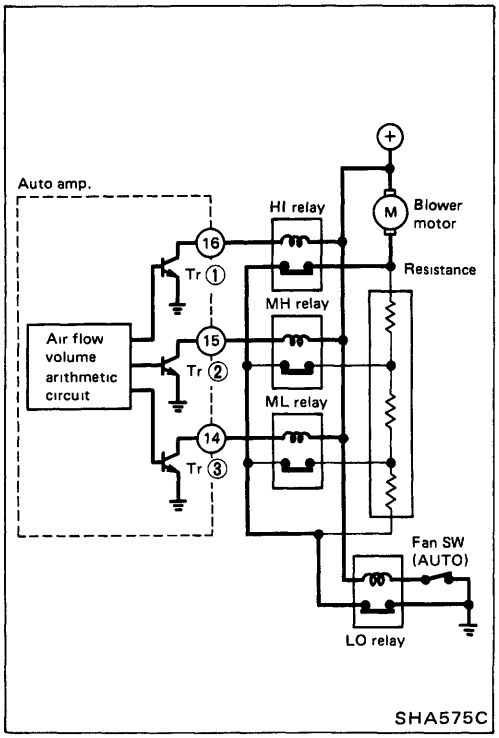


Signals from each sensor, PTC, A/C switch etc. are sent to the air flow volume arithmetic circuit in the auto amplifier. Air flow volume is determined by this circuit.

(1) When the air flow volume is set to ML

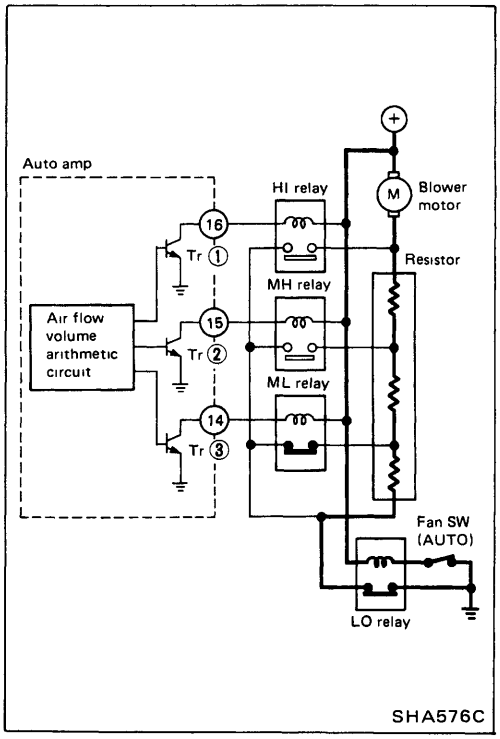
The air flow volume arithmetic circuit gives current to Tr ③, which turns the ML relay on. Thus, the blower motor rotates in the ML condition.

Control System Output Components (Cont'd)



(2) When set to HI

The air flow volume arithmetic circuit gives current to Tr ①, which turns the HI relay on. Thus, the blower motor rotates in the HI condition. Also, Tr ② and Tr ③ are receiving current and as a result the ML and MH relays are on.



(3) When set to LO

The air flow volume arithmetic circuit does not give any current to Tr ①, ② nor ③.

Only the LO relay turns on and so the blower motor rotates in the LO condition.

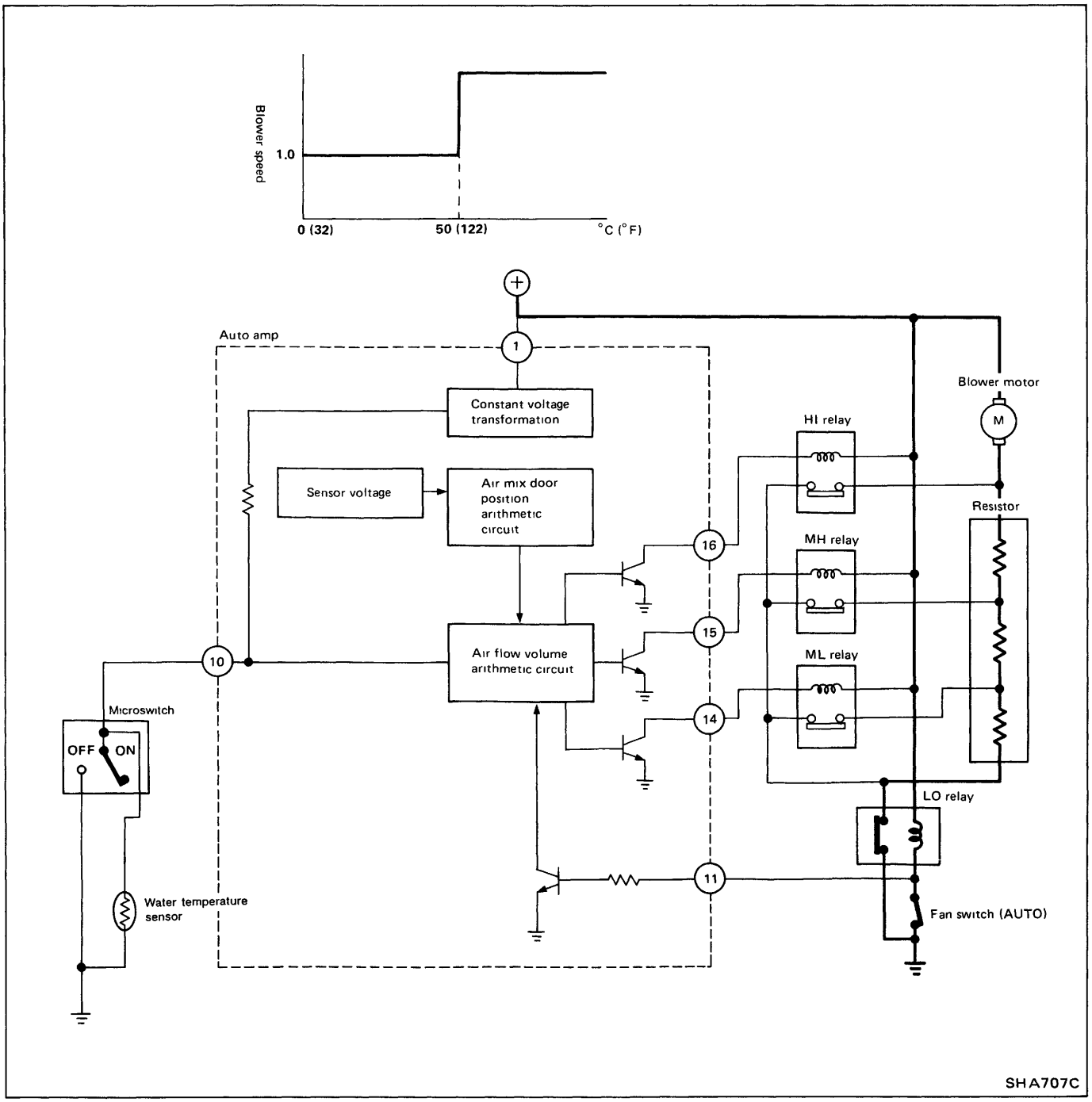
Control System Output Components (Cont'd)

STARTING FAN SPEED CONTROL

The starting fan control system is so designed to prevent excess cold air from being expelled after the engine is started when the engine coolant temperature is low.

The component parts related to this system are the water temperature sensor microswitch, fan relays, blower motor, resistance and auto amplifier.

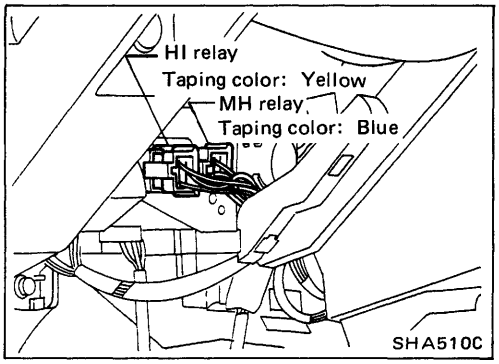
When the fan switch is set to AUTO, the microswitch to ON (either B/L, FOOT or FOOT/DEF) and the engine coolant temperature is below 50°C (122°F), the speed of the blower motor is fixed in the LO position.

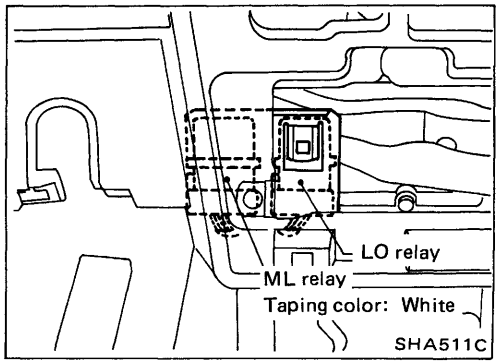


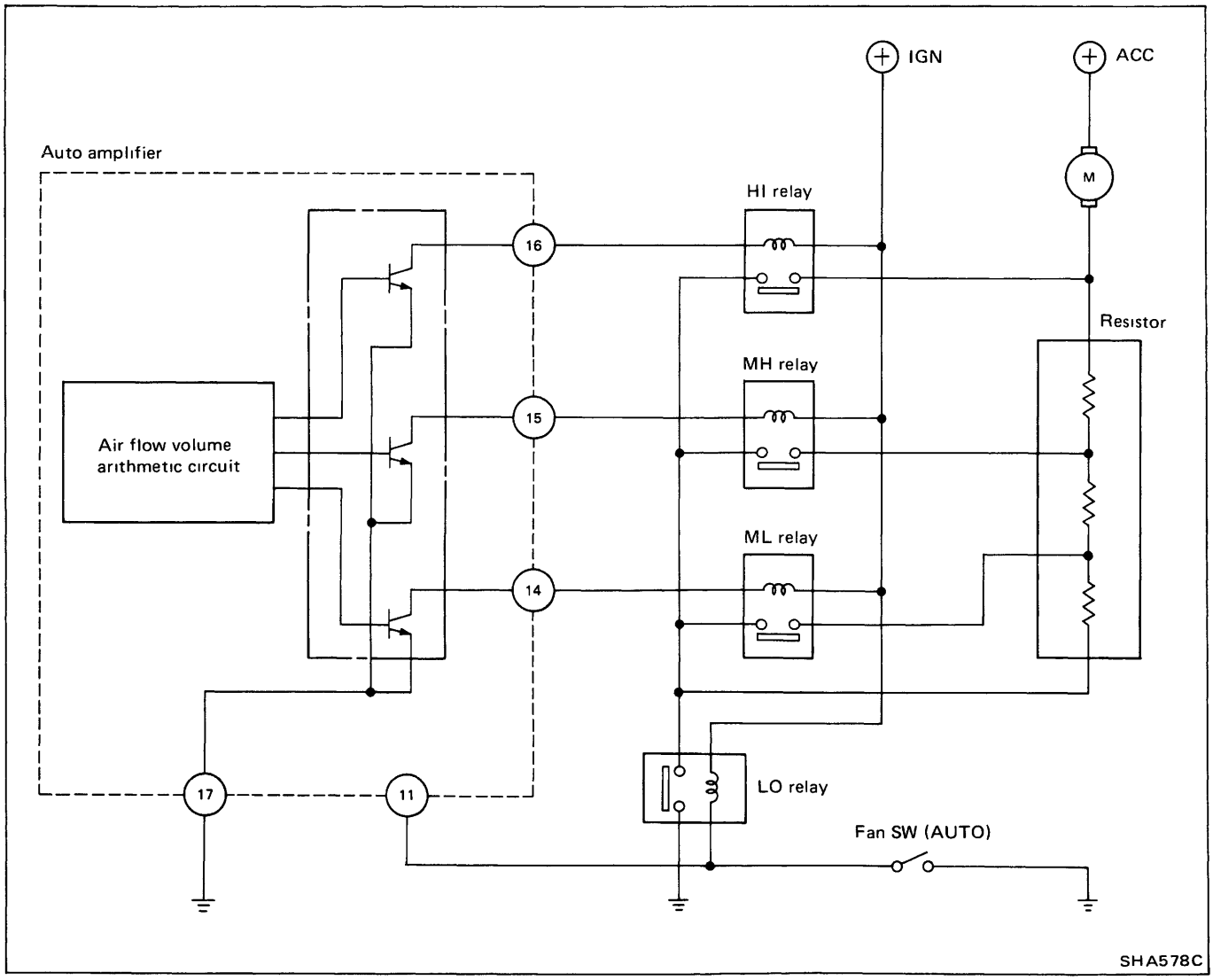
Control System Output Components (Cont'd)

FAN RELAY

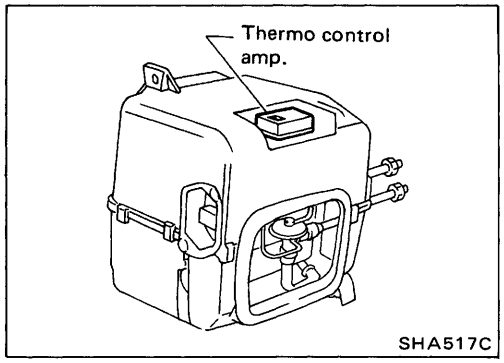
The LO and ML fan relays are located on the auto amplifier bracket, and the MH and HI fan relays are installed on the back side of the audio unit. Each fan relay operates according to the air flow volume determined by the auto amplifier. The blower motor then operates accordingly.





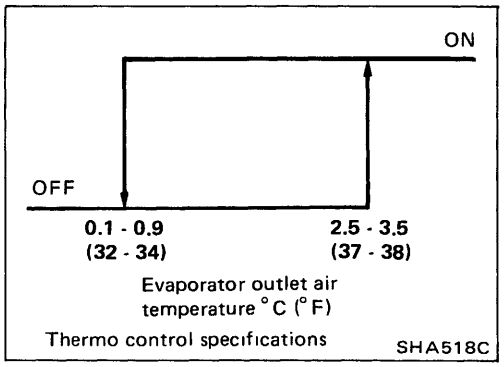


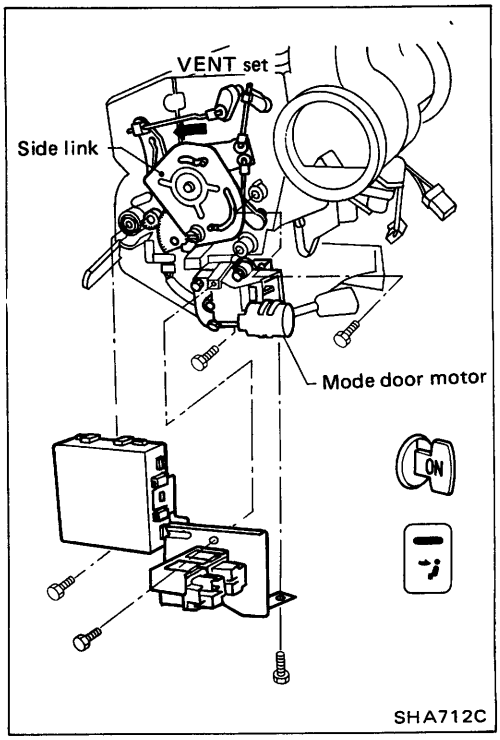
Control System Output Components (Cont'd)



THERMO CONTROL AMP.

The thermo control amplifier is installed on the top of the cooling unit. It detects the temperature of the evaporator using a thermistor and turns the compressor on or off.

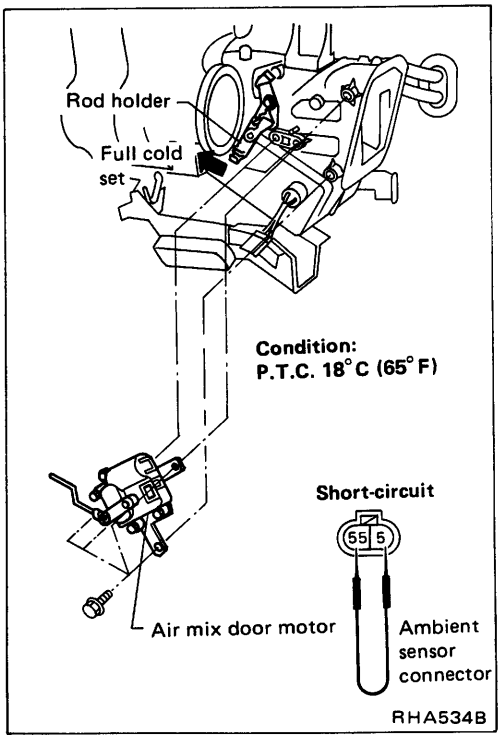




Control Rod Adjustment

MODE DOOR

1. Remove auto amplifier and relay bracket.
2. Move side link by hand and hold mode door in VENT mode.
3. Install mode door motor on heater unit and connect it to the auto A/C harness.
4. Turn ignition switch to ON.
5. Turn VENT switch ON.
6. Attach mode door motor rod to side link rod holder.
7. Turn DEF switch ON. Check that side link operates at the fully-open position. Also turn VENT switch ON to check that side link operates at the fully-open position.

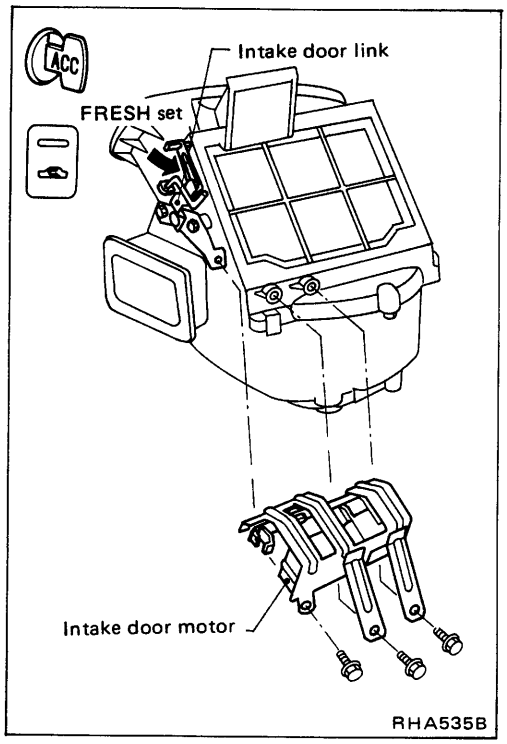


AIR MIX DOOR

1. Install air mix door motor on heater unit and connect it to the auto A/C harness.
2. Disconnect ambient sensor harness connector and connect terminals No. ⑤ and ㊺ with a jumper cable.
3. Set P.T.C. at 18°C (65°F) and air mix door motor at "full cold".
4. Move air mix door lever by hand and hold it at the full-cold position.
5. Attach air mix door lever to rod holder.
6. Check that air mix door operates properly when P.T.C. is moved from 18 to 32°C (65 to 85°F).

Control Rod Adjustment (Cont'd)

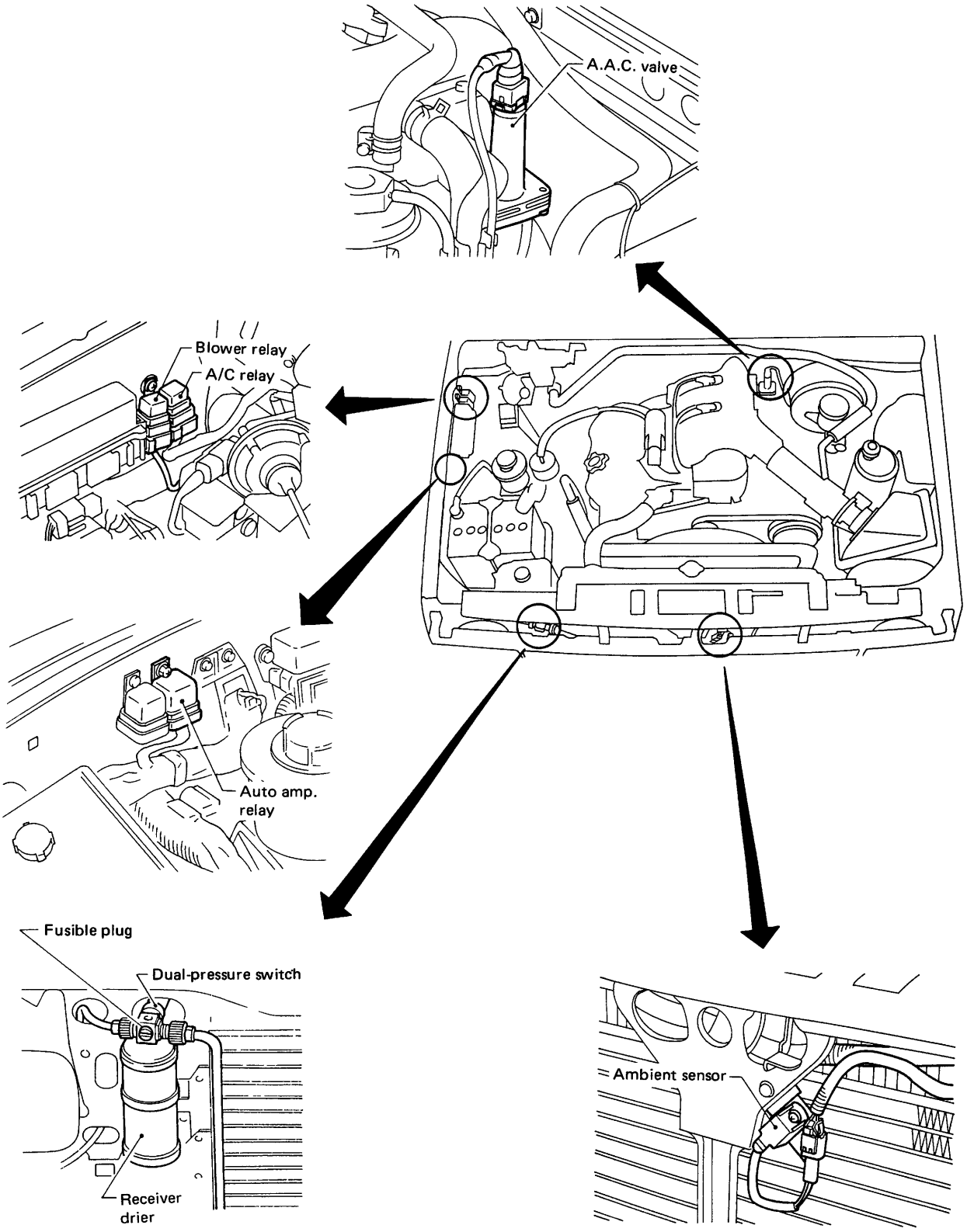
INTAKE DOOR



1. Connect intake door motor harness connector before installing to intake door motor.
2. Turn ignition switch to ACC.
3. Turn REC switch OFF.
4. Set intake door lever in FRE and install intake door motor on intake unit.
5. Check that intake door operates properly when REC switch is turned ON and OFF.

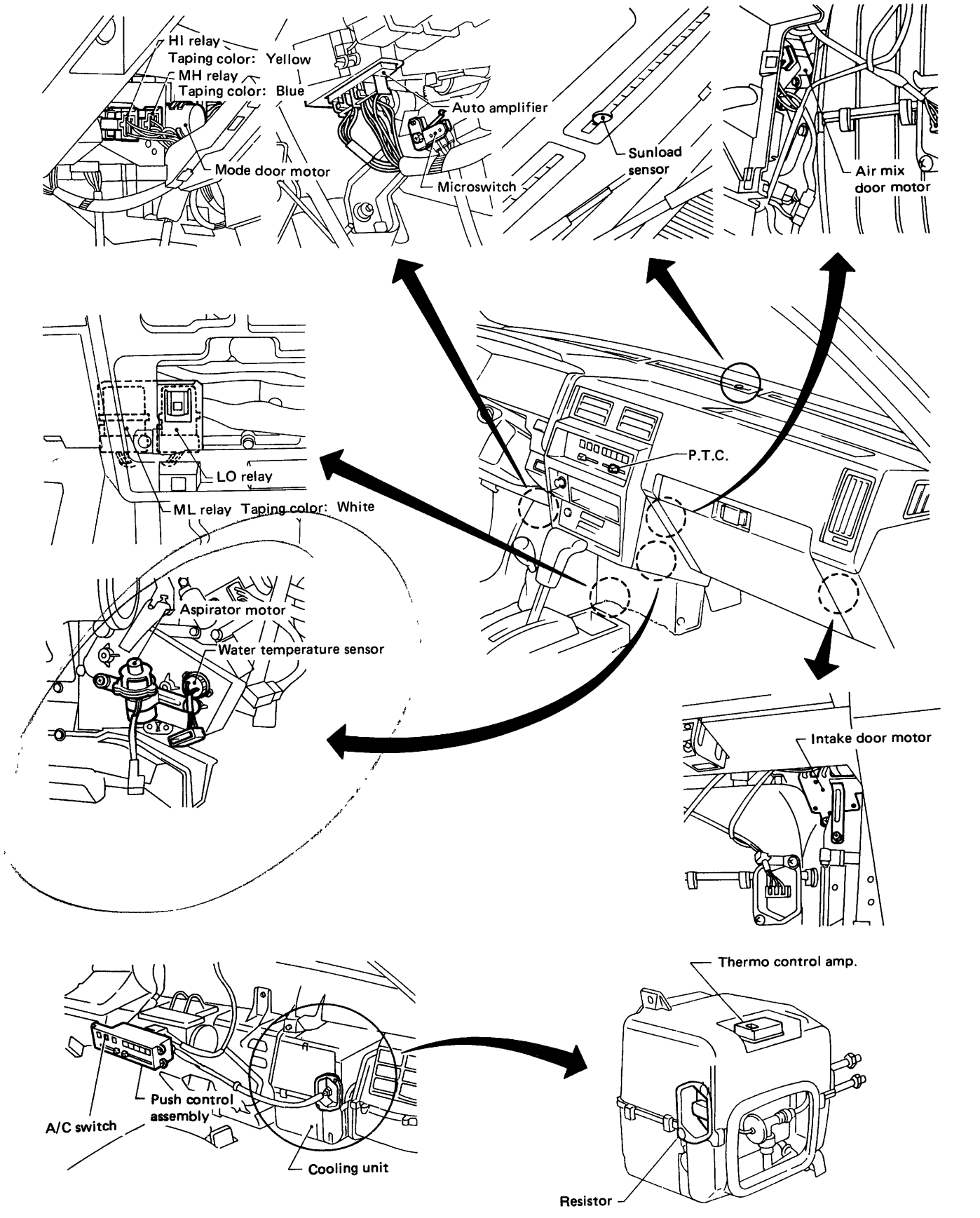
NOTE

Engine compartment



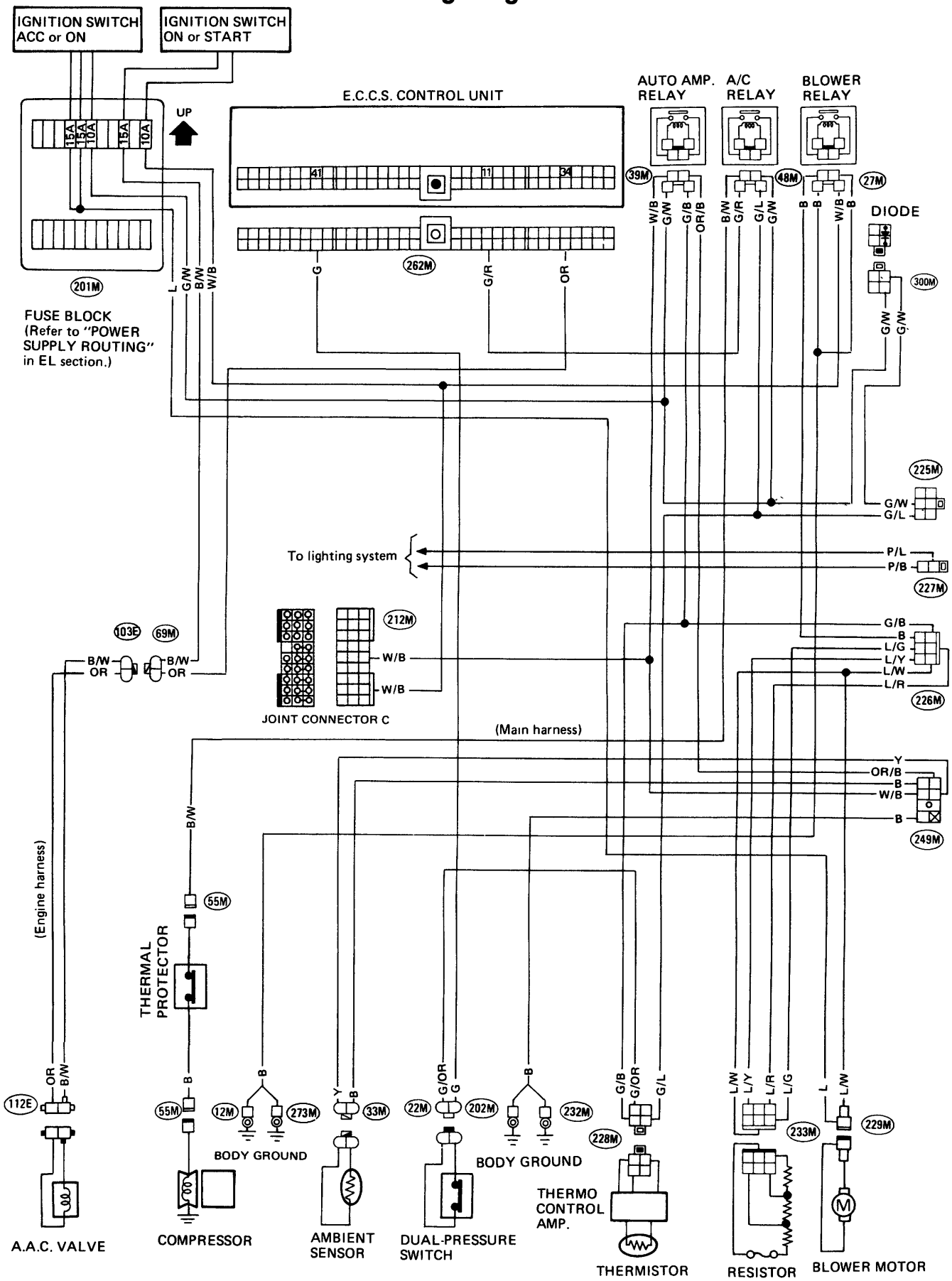
SHA706C

Passenger compartment

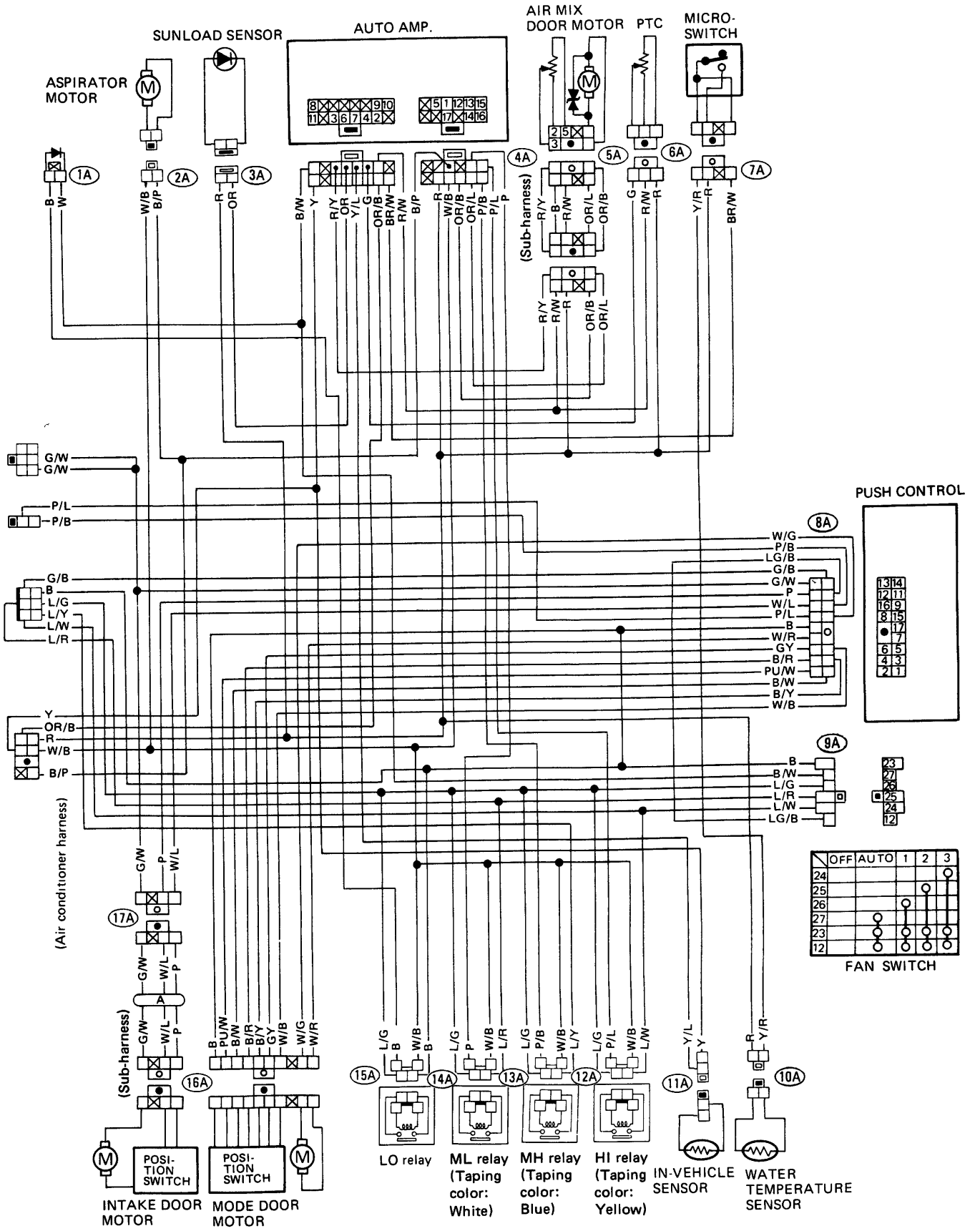


SHA666C

Wiring Diagram



Wiring Diagram (Cont'd)



Ⓐ : A/C kit only

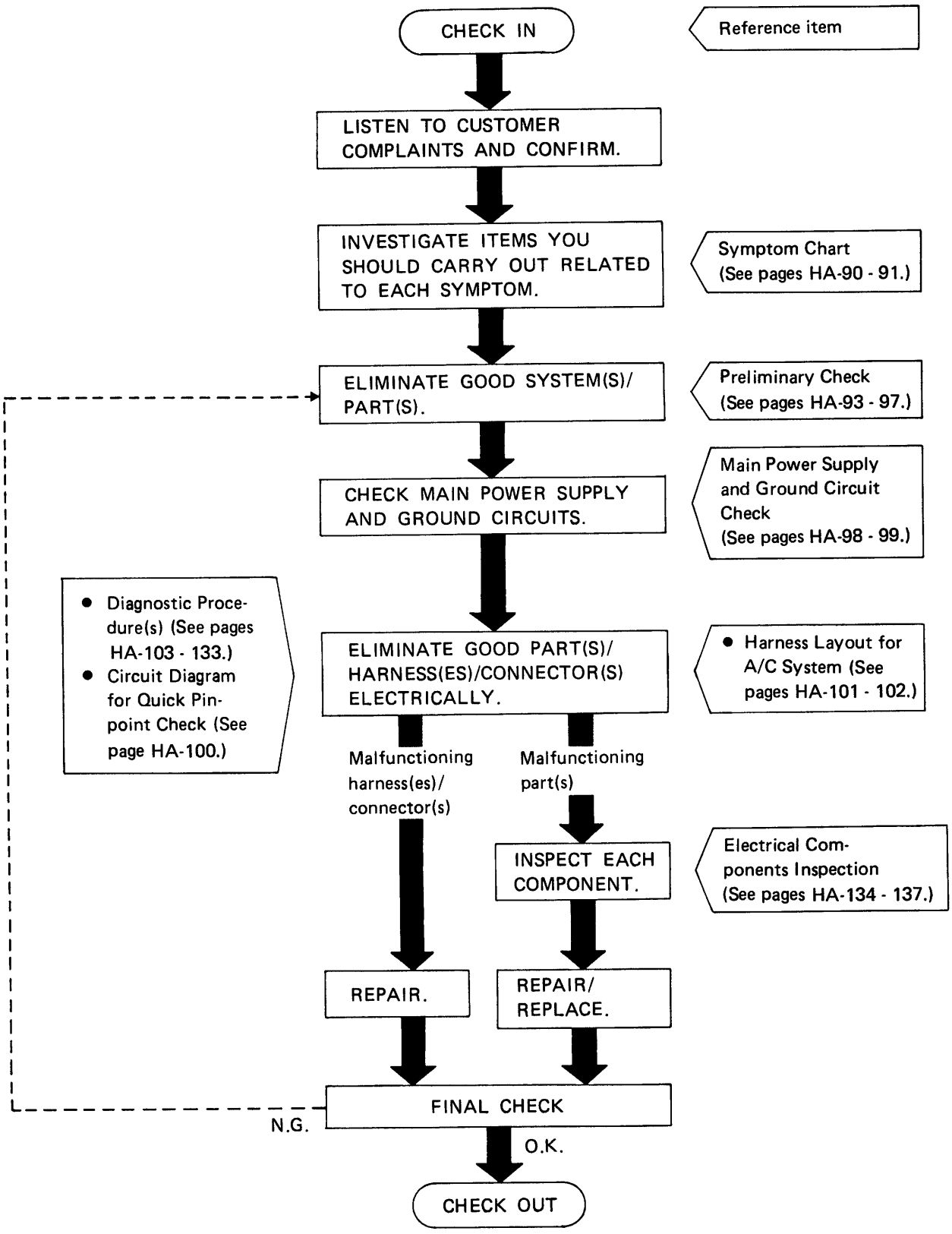
RHA770B

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Electrical Components Inspection HA-134

How to Perform Trouble Diagnoses for Quick and Accurate Repair

WORK FLOW



Symptom Chart

DIAGNOSTIC TABLE

PROCEDURE	Preliminary Check					Diagnostic Procedure														Main Power Supply and Ground Circuit Check				
REFERENCE PAGE	HA-93	HA-94	HA 95	HA-96	HA 97	HA 103 - 104	HA-105 - 106	HA-107 - 108	HA-109 110	HA-111	HA-112 114	HA 115 - 116	HA 117 - 118	HA-119	HA 120 - 124	HA-125	HA-126	HA 127	HA-128 129	HA 130 - 133	HA-98	HA-98	HA-98	HA-98	HA 99
SYMPTOM	Preliminary check 1	Preliminary check 2	Preliminary check 3	Preliminary check 4	Preliminary check 5	Diagnostic Procedure 1	Diagnostic Procedure 2	Diagnostic Procedure 3	Diagnostic Procedure 4	Diagnostic Procedure 5	Diagnostic Procedure 6	Diagnostic Procedure 7	Diagnostic Procedure 8	Diagnostic Procedure 9	Diagnostic Procedure 10	Diagnostic Procedure 11	Diagnostic Procedure 12	Diagnostic Procedure 13	Diagnostic Procedure 14	Diagnostic Procedure 15	15A Fuses	10A Fuse	10A Fuse	Push control unit	Auto amp
A/C does not blow cold air		❶				○									○						○	○	○	○	○
Blower motor does not rotate at all. (Fan switch [AUTO] [1] [2] [3])		❶				❷															○		○		
Blower motor does not rotate at all when the fan speed is in AUTO (It operates in 1, 2, or 3-speed ~~only~~)							❶														○		○		○
Blower motor fan speed does not change when fan speed is in AUTO. (Fan speed is fixed in HI or MH)								❶													○		○		○
Blower motor fan speed does not change when fan speed is in AUTO. (Fan speed is fixed in LO.)									❶												○		○		○
Starting fan speed control does not operate										❶													○		○
There is too much difference between setting temp on P.T C and in-vehicle temp		❶									❷											○	○		○
Air mix door motor does not operate normally		❶										❷											○		○
Air outlet does not change				❶									❷									○			
Intake door does not change in VENT, B/L or FOOT mode														❶								○			
Intake door is not set at "FRESH" in DEF or F/D mode	❶													○								○			
Magnet clutch does not engage with A/C switch and fan switch are ON		❶													❷							○	○		
Magnet clutch does not engage in DEF mode		❶	❷												○							○	○		
Ambient sensor circuit is open or shorted																❶							○		○
In-vehicle sensor circuit is open or shorted																	❶						○		○
Sunload sensor circuit is open or shorted																		❶					○		○
Water temperature sensor circuit is open or shorted																			❶				○		○
Illumination or indicators of push control unit do not come on																				○		○	○		
Noise					❶																				

❶, ❷ · The number means checking order.
○ As for checking order, refer to each flow chart (It depends on malfunctioning portion.)

Symptom Chart (Cont'd)

Electrical Components Inspection

	HA-134	Blower motor	Resistor	Push control unit: A/C switch	Push control unit: REC switch	Push control unit: VENT switch	Push control unit: B/L switch	Push control unit: FOOT switch	Push control unit: F/D switch	Push control unit: DEF switch	Push control unit: Fan switch	Push control unit: P T C.	Air mix door motor	P B R.	Mode door motor	Intake door motor	Auto amp	Ambient sensor	In-vehicle sensor	Sunload sensor	Water temperature sensor	A/C relay	Auto amp relay	Blower relay	LO relay	ML relay	MH relay	HI relay	Thermo control amp.	Dual-pressure switch	Compressor: Magnet clutch	Compressor: Thermal protector	E.C.C.S. control unit	Illumination system	Knob illumination	Microswitch	Aspirator motor	Harness
	HA-134	○	○	○							○	○	○	○	○	○	○	○	○	○		○		○						○	○	○						○
	HA-134	○	○								○													○							○	○						○
	HA-135		○								○						○								○	○												○
	—										○						○				○						○	○										○
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Checking Resistor

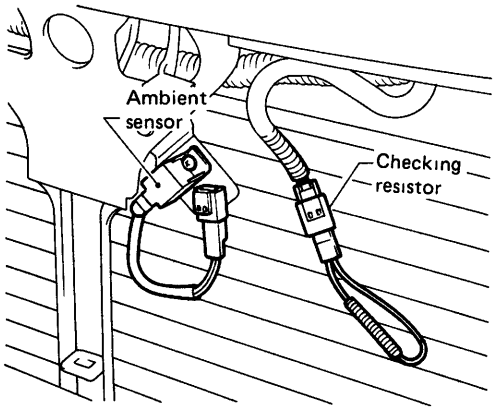
Checking resistors are used for trouble diagnoses of blower motor operation and air mix door motor operation. Use checking resistor when inspecting portions with C/R *1, C/R *2 in flow chart.

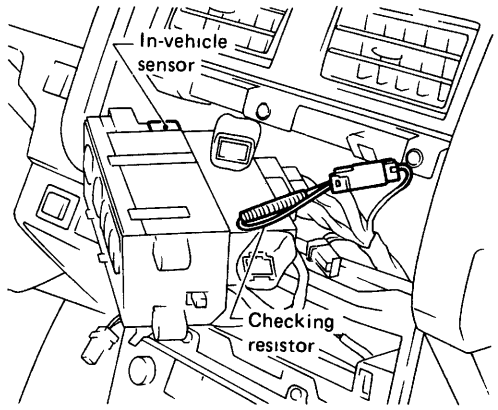
CAUTION:

Select checking resistors which have resistance values corresponding with those indicated in table below, and connect to respective sensors.

	Checking resistor	Ambient sensor	In-vehicle sensor	Wattage
Blower motor operation check	C/R *1	1,000Ω	1,500Ω	1/4W
Air mix door motor operation check	C/R *2		2,490Ω	

1. Disconnect ambient sensor and in-vehicle sensor harness connectors.
2. Connect checking resistor as shown in figure.
3. Turn ignition switch ON.
4. Turn A/C switch ON.
5. Turn VENT switch ON.
6. Keep sunload sensor away from sunlight by covering it.



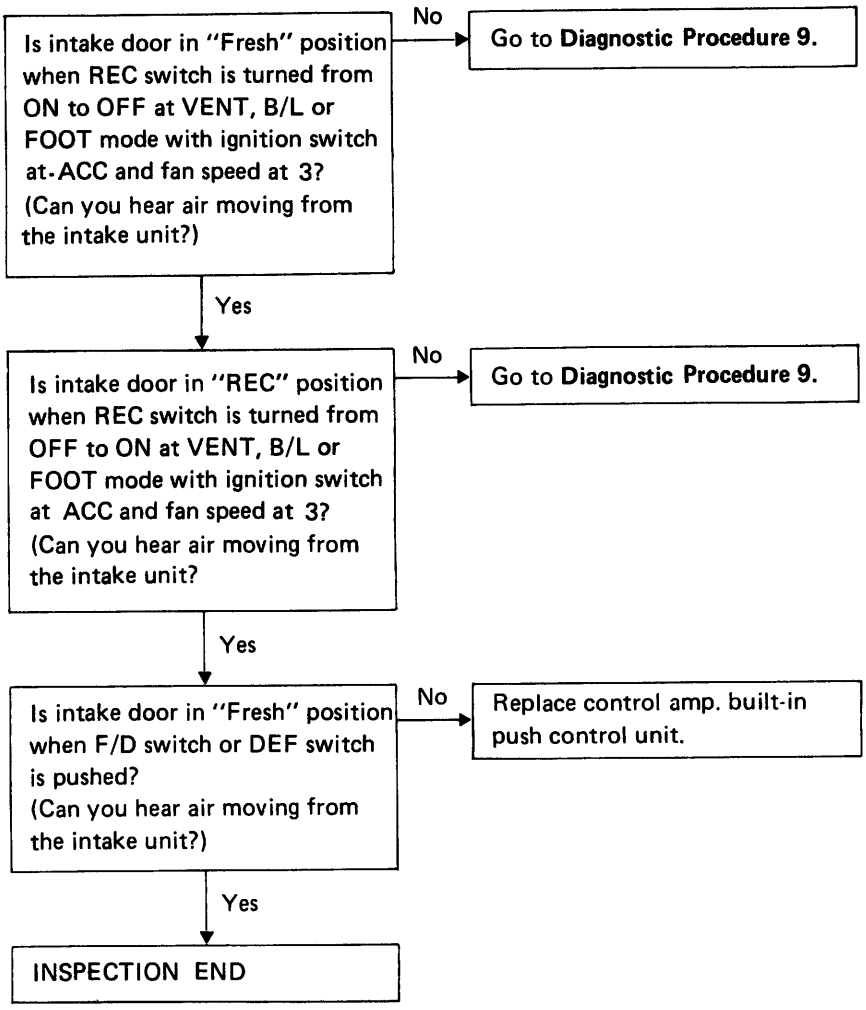


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Preliminary Check

PRELIMINARY CHECK 1

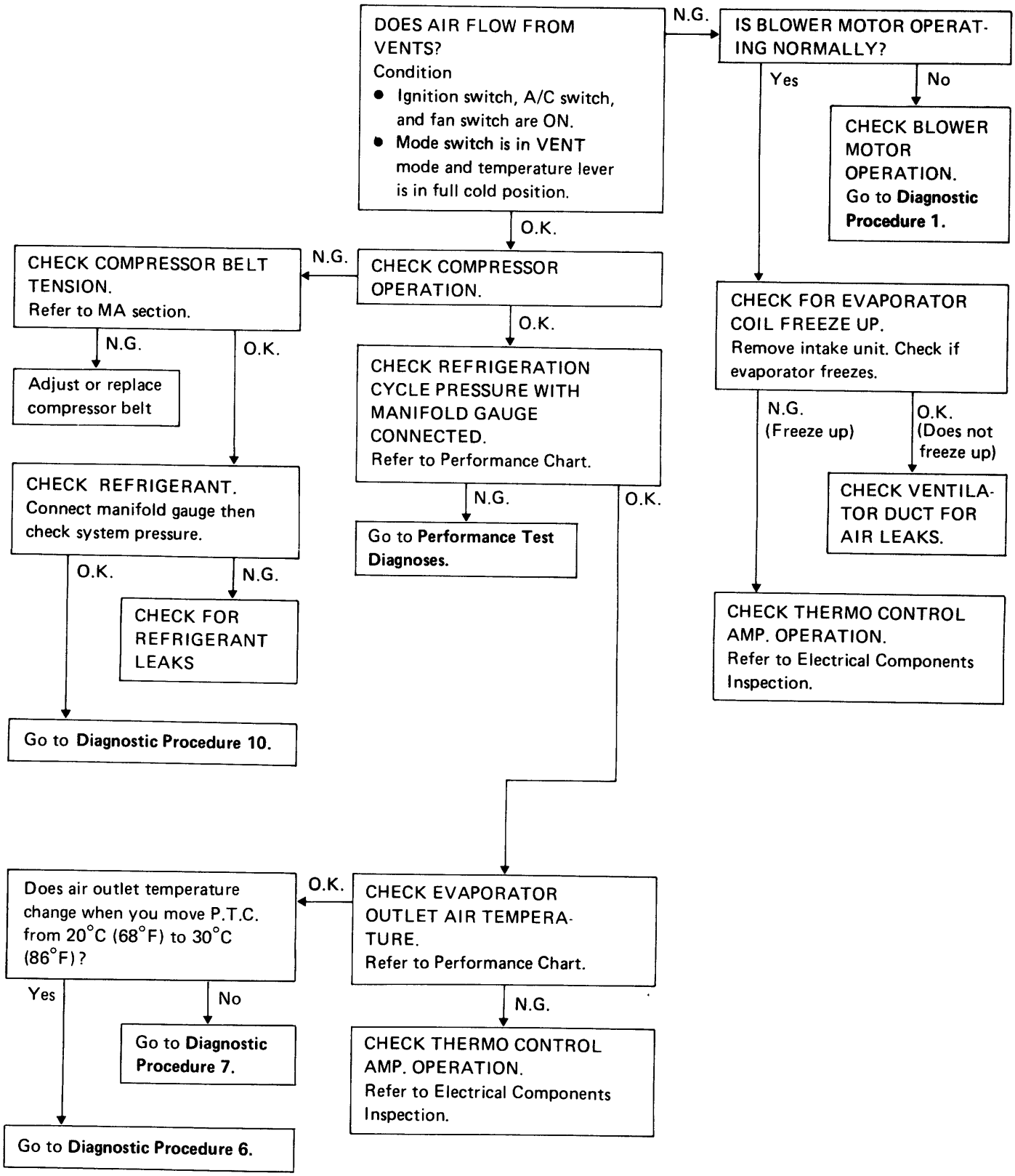
Intake door is not set at "FRESH" in DEF or F/D mode.



Preliminary Check (Cont'd)

PRELIMINARY CHECK 2

A/C does not blow cold air.

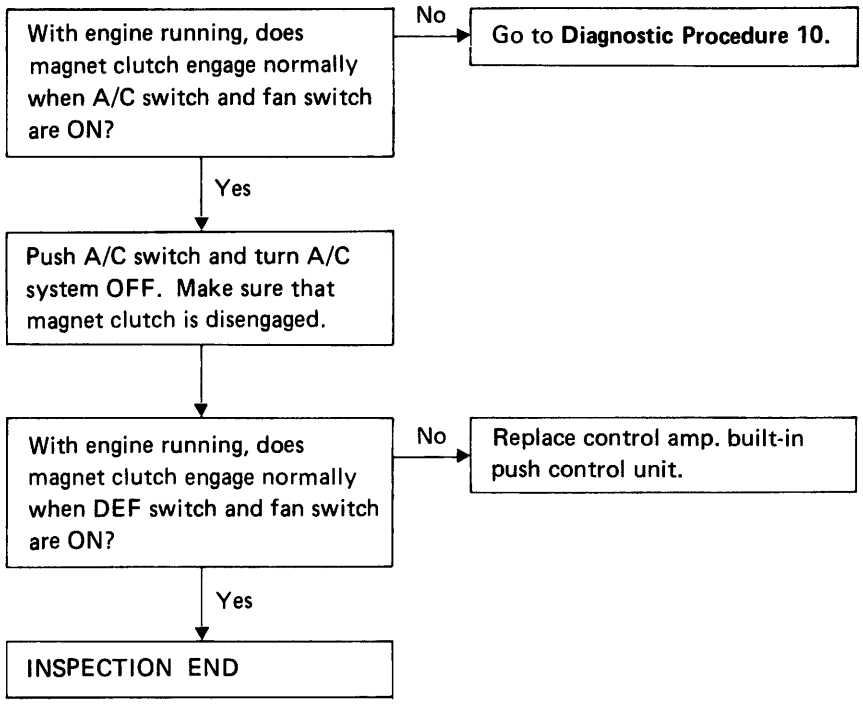


Preliminary Check (Cont'd)

PRELIMINARY CHECK 3

Magnet clutch does not engage in DEF mode.

- **Perform PRELIMINARY CHECK 2 before referring to the following flow chart.**



Preliminary Check (Cont'd)

PRELIMINARY CHECK 4

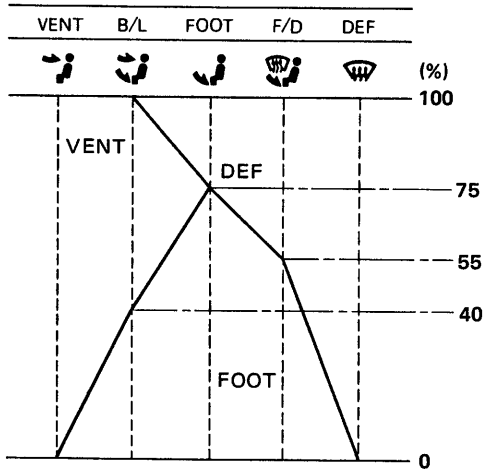
Air outlet does not change.

DOES AIR COME OUT FROM EACH DUCT NORMALLY WHEN EACH MODE SWITCH IS PUSHED WITH IGNITION SWITCH AT ACC?

No → Go to **Diagnostic Procedure 8.**

Switch (Mode)	Indicator illuminates	Air outlet
	○	VENT
	○	FOOT & VENT
	○	FOOT & DEF
	○	FOOT & DEF
	○	DEF

Air distribution ratios



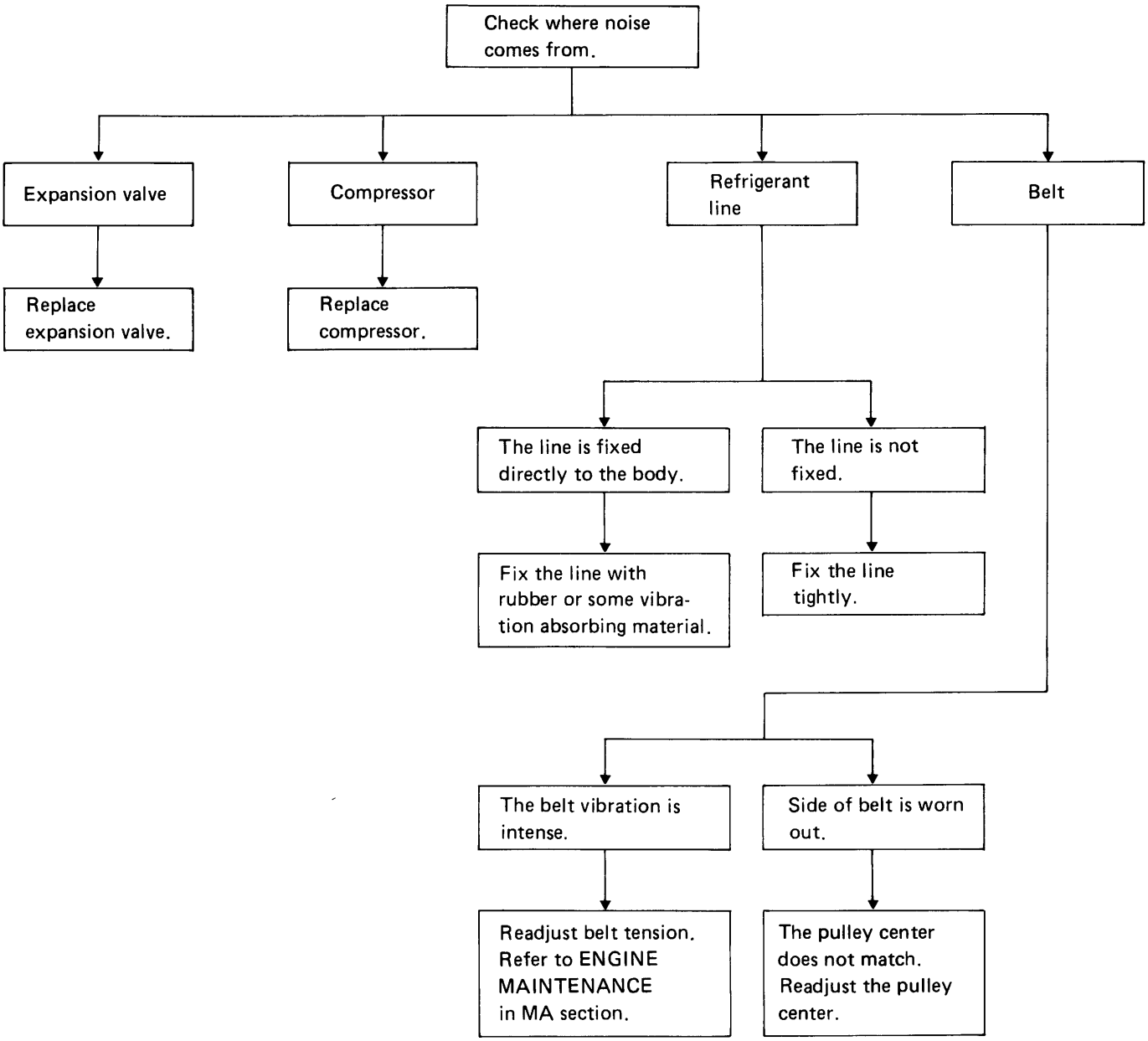
Yes

INSPECTION END

Preliminary Check (Cont'd)

PRELIMINARY CHECK 5

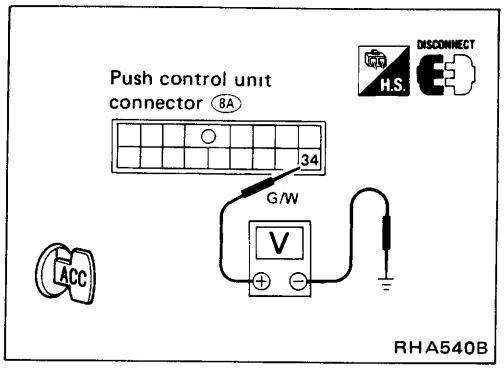
Noise



Main Power Supply and Ground Circuit Check

POWER SUPPLY CIRCUIT CHECK FOR AUTO A/C SYSTEM

Check power supply circuit for auto air conditioning system.
Refer to "POWER SUPPLY ROUTING" in EL section and A/C ELECTRICAL CIRCUIT — Auto Air Conditioner.

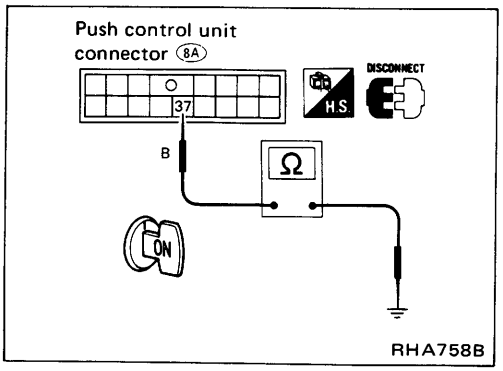


PUSH CONTROL UNIT CHECK

Check power supply circuit for push control unit with ignition switch at ACC.

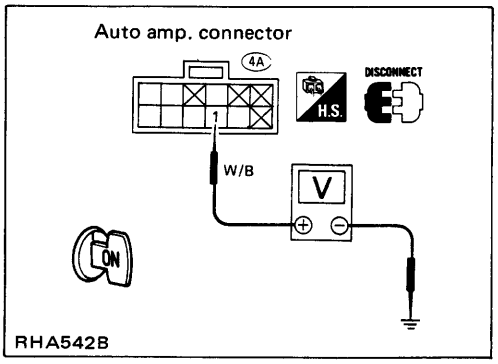
1. Disconnect push control unit harness connector.
2. Connect voltmeter from harness side.
3. Measure voltage across terminal No. (34) and body ground.

Voltmeter terminal		Voltage
⊕	⊖	
(34)	Body ground	Approx. 12V



Check body ground circuit for push control unit with ignition switch ON.

1. Disconnect push control unit harness connector.
2. Connect ohmmeter from harness side.
3. Check for continuity between terminal No. (37) and body ground.



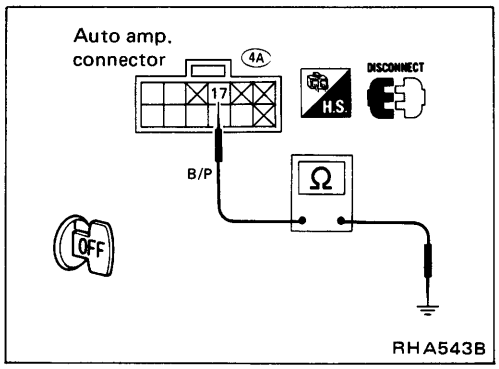
Main Power Supply and Ground Circuit Check (Cont'd)

AUTO AMP. CHECK

Check power supply circuit for auto amp. with ignition switch ON.

1. Disconnect auto amp. harness connector.
2. Connect voltmeter from harness side.
3. Measure voltage across terminal No. ① and body ground.

Voltmeter terminal		Voltage
⊕	⊖	
①	Body ground	Approx. 12V

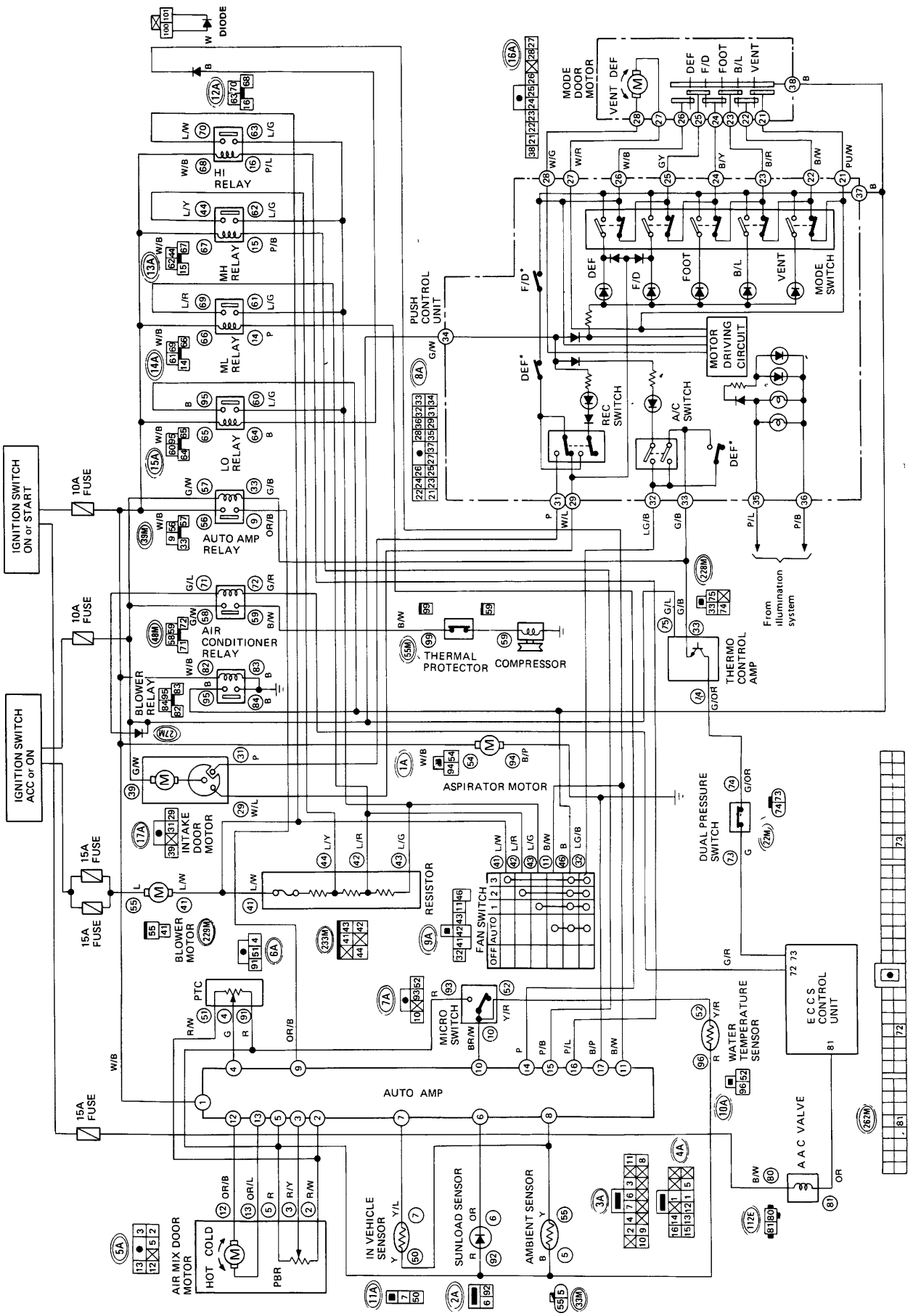


Check body ground circuit for auto amp. with ignition switch OFF.

1. Disconnect auto amp. harness connector.
2. Connect ohmmeter from harness side.
3. Check for continuity between terminal No. ⑰ and body.

Ohmmeter terminal		Continuity
⊕	⊖	
⑰	Body ground	Yes

Circuit Diagram for Quick Pinpoint Check

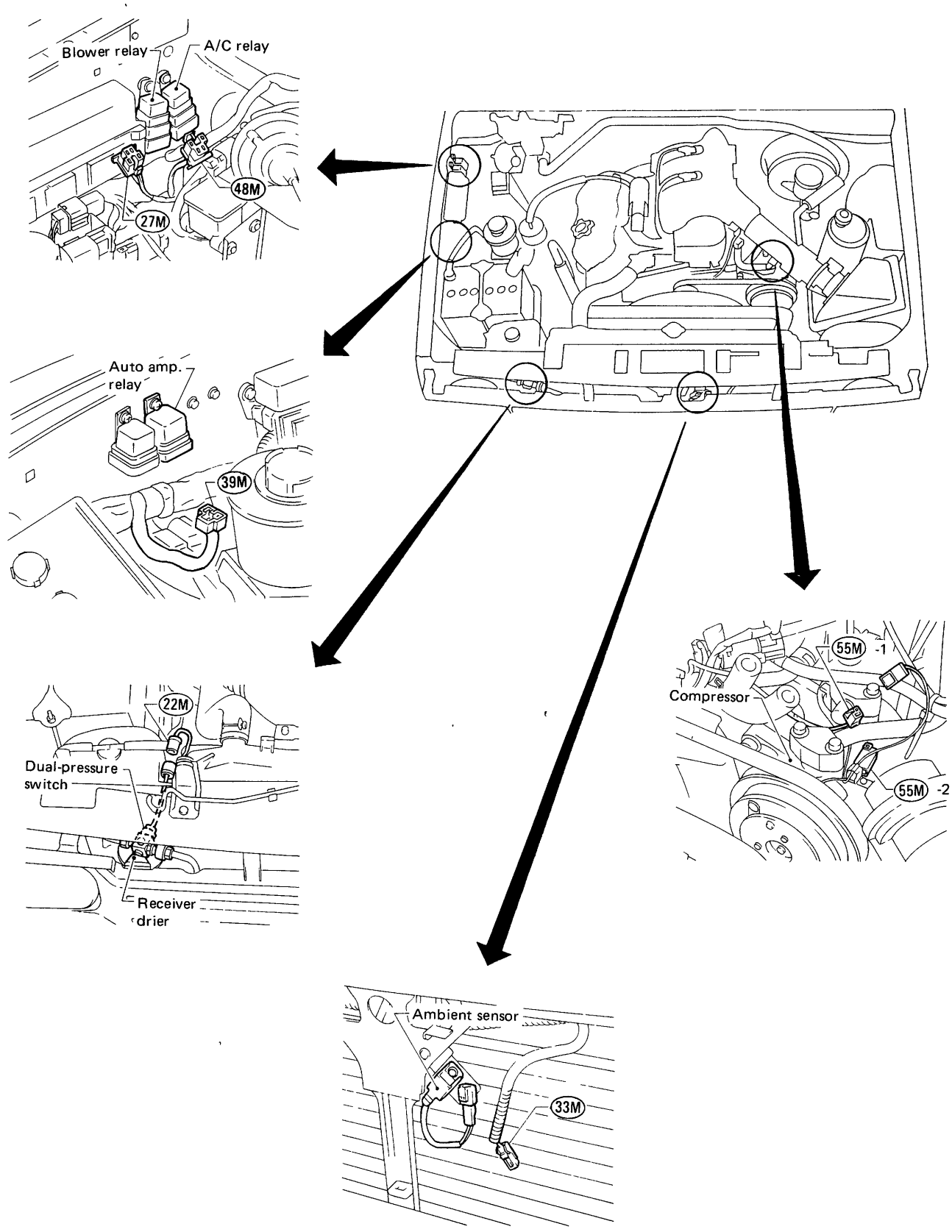


- All connectors shown in this illustration are unit side connectors.
- The unit side connectors with a double circle "◎" are connected to the harness side connectors shown in the "Harness Layout for A/C System". (See pages HA-101 - 102.)
- The terminal numbers in the connector coincide with the circuit numbers surrounded by a single circle "○".
- *: These switches are built in push control unit and mechanically linked to corresponding switches.

RHA771B

Harness Layout for A/C System

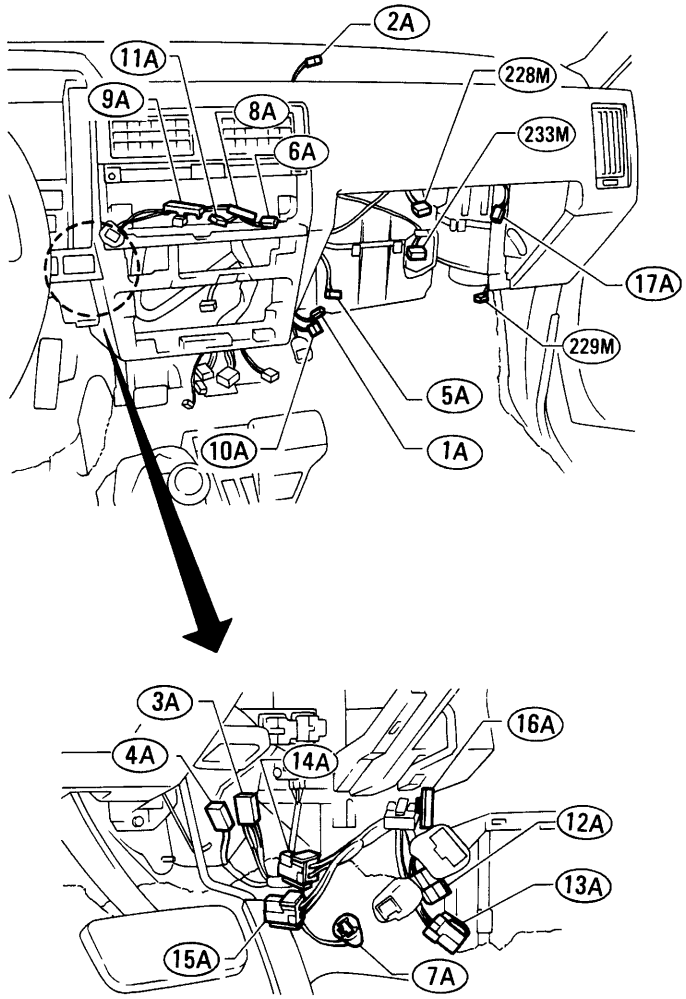
Engine compartment



SHA711C

Harness Layout for A/C System (Cont'd)

Passenger compartment



Main harness

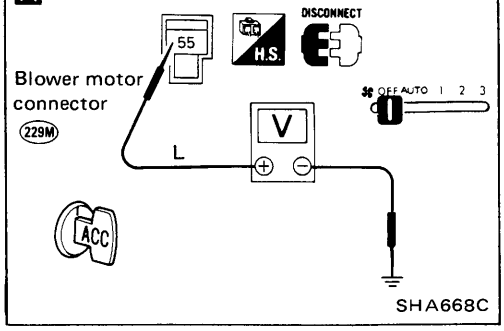
- (22M) : Dual-pressure switch
- (27M) : Blower relay
- (33M) : Ambient sensor
- (48M) : A/C relay
- (55M) : Compressor
- (228M) : Thermo control amp.
- (229M) : Blower motor
- (233M) : Resistor

A/C harness

- (1A) : Aspirator motor
- (2A) : Sunload sensor
- (3A) : Auto amp.
- (4A) : Auto amp.
- (5A) : Air mix door motor
- (6A) : P.T.C.
- (7A) : Microswitch
- (8A) : Push control unit
- (9A) : Fan switch
- (10A) : Water temperature sensor
- (11A) : In-vehicle sensor
- (12A) : LO relay
- (13A) : ML relay (Taping color: White)
- (14A) : MH relay (Taping color: Blue)
- (15A) : HI relay (Taping color: Yellow)
- (16A) : Mode door motor
- (17A) : Intake door motor

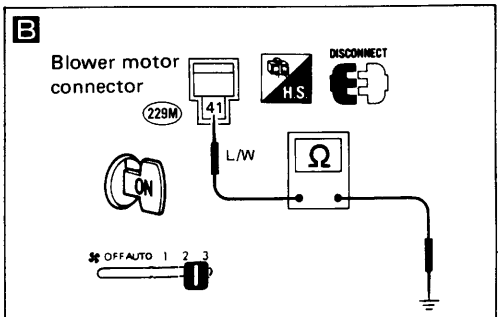
SHA667C

A



SHA668C

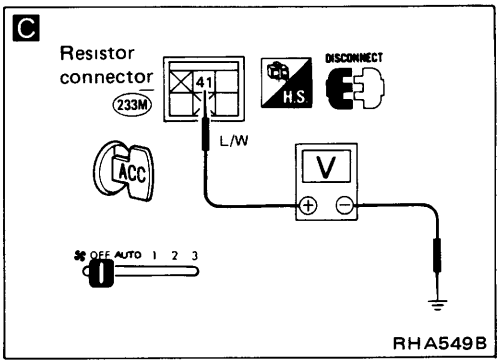
B



Continuity should exist.

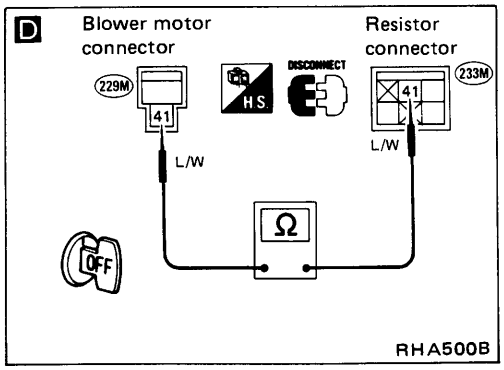
RHA548B

C



RHA549B

D



RHA500B

Diagnostic Procedure 1

SYMPTOM: Blower motor does not rotate at all. (Fan switch "AUTO", "1", "2", "3")

- **Perform PRELIMINARY CHECK 2 before referring to the following flow chart.**

A

CHECK POWER SUPPLY FOR BLOWER MOTOR.
Disconnect blower motor harness connector.
Do approx. 12 volts exist between blower motor harness terminal No. (55) and body ground?

N.G. → Check 15A fuses at fuse block. (Refer to "POWER SUPPLY ROUTING" in EL section and A/C ELECTRICAL CIRCUIT.)

O.K. ↓

B

Check circuit continuity between blower motor harness terminal No. (41) and body ground.

N.G. → Reconnect blower motor harness connector.

O.K. ↓

CHECK BLOWER MOTOR. (Refer to Electrical Components Inspection.)

N.G. ↓

Replace blower motor.

C

CHECK BLOWER MOTOR CIRCUIT BETWEEN BLOWER MOTOR AND RESISTOR.
Do approx. 12 volts exist between resistor harness terminal No. (41) and body ground?

N.G. → Disconnect blower motor and resistor harness connectors.

D Note

Check circuit continuity between blower motor harness terminal No. (41) and resistor harness terminal No. (41).

O.K. ↓

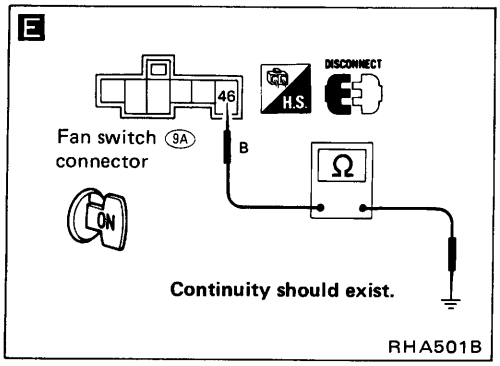
(A)

(Go to next page.)

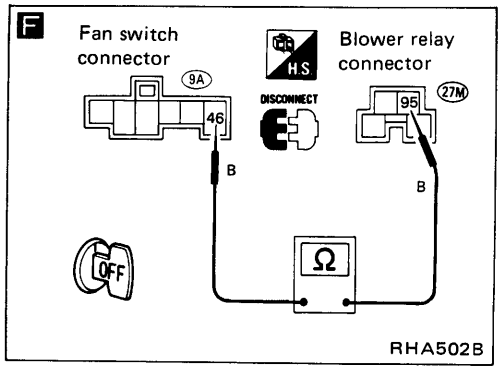
Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

Diagnostic Procedure 1 (Cont'd)

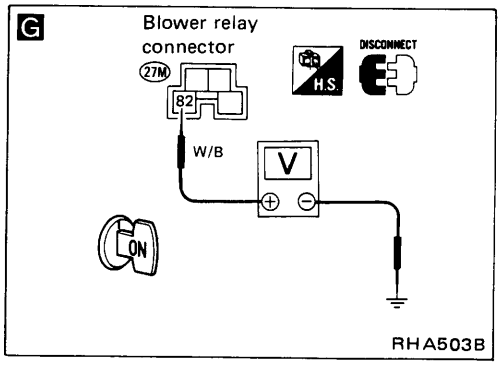
E



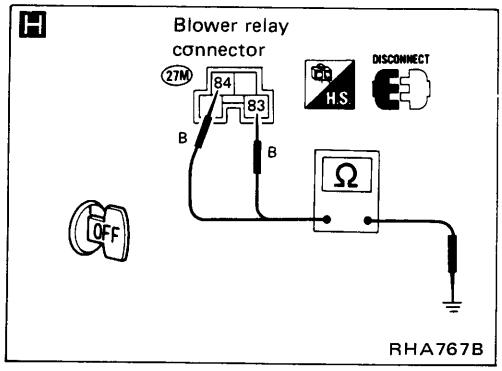
F



G



H



Ⓐ

CHECK RESISTOR AFTER DISCONNECTING IT.
(Refer to Electrical Components Inspection.)

N.G. → Replace resistor.

O.K.

CHECK FAN SWITCH AFTER DISCONNECTING IT.
(Refer to Electrical Components Inspection.)

N.G. → Replace fan switch.

O.K.

E Note

Check circuit continuity between fan switch harness terminal No. 46 and body ground.

N.G. → Disconnect blower relay harness connector.

O.K.

Replace blower motor.

F Note

Check circuit continuity between fan switch harness terminal No. 46 and blower relay harness terminal No. 95.

O.K.

G

CHECK POWER SUPPLY FOR BLOWER RELAY.
Do approx. 12 volts exist between blower relay harness terminal No. 82 and body ground?

N.G. → Check 10A fuse at fuse block. (Refer to POWER SUPPLY ROUTING" in EL section and A/C ELECTRICAL CIRCUIT.)

O.K.

H Note

Check circuit continuity between blower relay harness terminal No. 83, 84 and body ground.

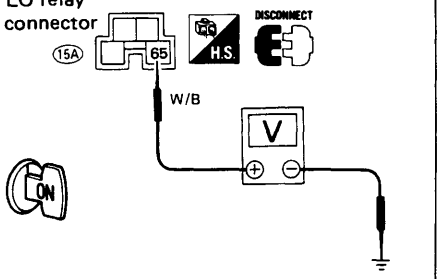
O.K.

CHECK BLOWER RELAY AFTER DISCONNECTING IT.
(Refer to Electrical Components Inspection.)

N.G. → Replace blower relay.

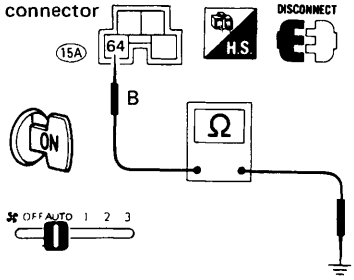
Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

A



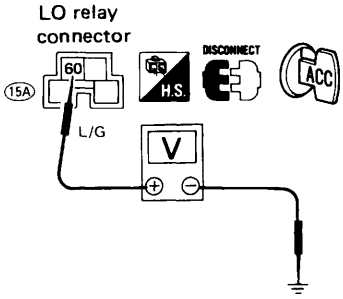
RHA506B

B



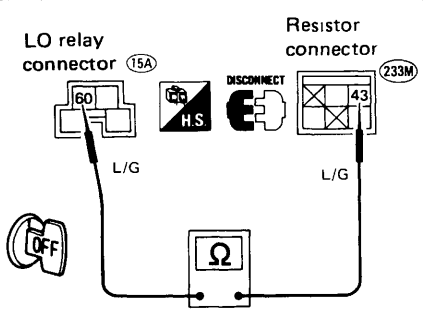
SHA669C

C



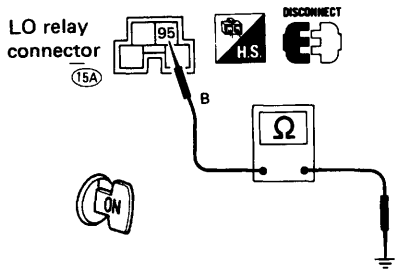
RHA508B

D



RHA509B

E



RHA511B

Diagnostic Procedure 2

SYMPTOM: Blower motor does not rotate at all when fan speed is in AUTO. (It operates in 1, 2, or 3-speed only.)

A

CHECK POWER SUPPLY FOR LO RELAY.
Disconnect LO relay harness connector.
Do approx. 12 volts exist between LO relay harness terminal No. (65) and body ground?

N.G. → Check 10A fuse at fuse block. (Refer to "POWER SUPPLY ROUTING" in EL section and A/C ELECTRICAL CIRCUIT.)

O.K. ↓

B

Check circuit continuity between LO relay harness terminal No. (64) and body ground.

N.G. → Disconnect fan switch harness connector.

Ⓐ

(Go to next page.)

O.K. ↓

C

CHECK POWER SUPPLY FOR LO RELAY.
Do approx. 12 volts exist between LO relay harness terminal No. (60) and body ground?

N.G. → D Note: Check circuit continuity between resistor harness terminal No. (43) and LO relay harness terminal No. (60).

O.K. ↓

E Note

Check circuit continuity between LO relay harness terminal No. (95) and body ground.

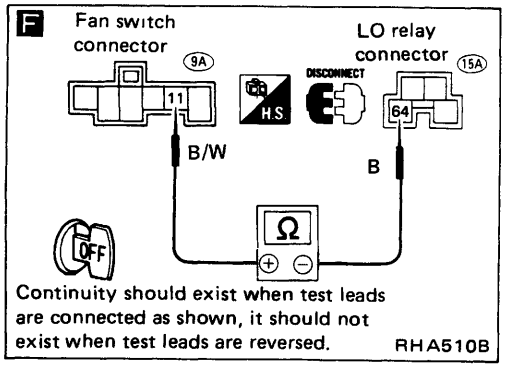
O.K. ↓

CHECK LO RELAY AFTER DISCONNECTING IT.
(Refer to Electrical Components Inspection.)

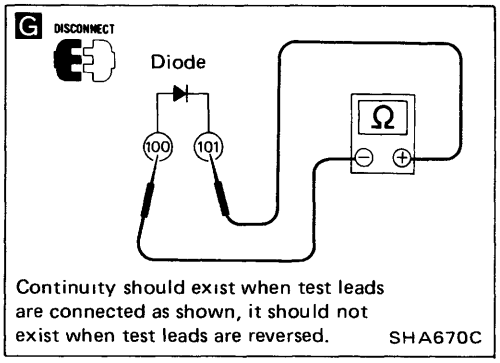
N.G. → Replace LO relay.

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

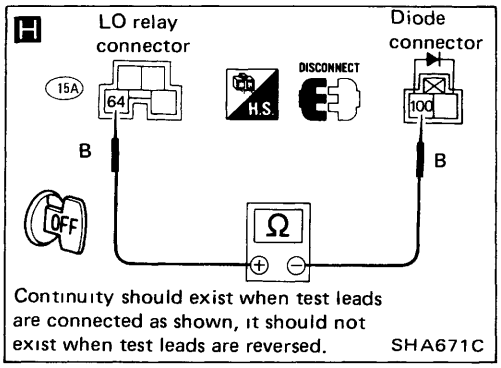
Diagnostic Procedure 2 (Cont'd)



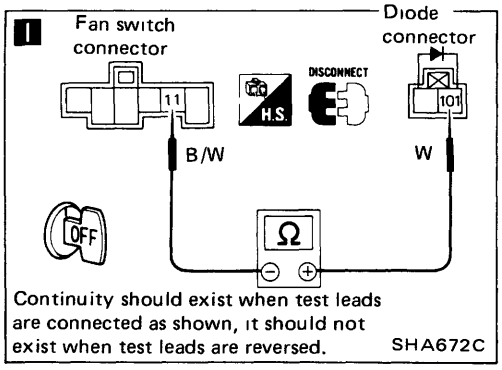
Continuity should exist when test leads are connected as shown, it should not exist when test leads are reversed. RHA510B



Continuity should exist when test leads are connected as shown, it should not exist when test leads are reversed. SHA670C



Continuity should exist when test leads are connected as shown, it should not exist when test leads are reversed. SHA671C



Continuity should exist when test leads are connected as shown, it should not exist when test leads are reversed. SHA672C

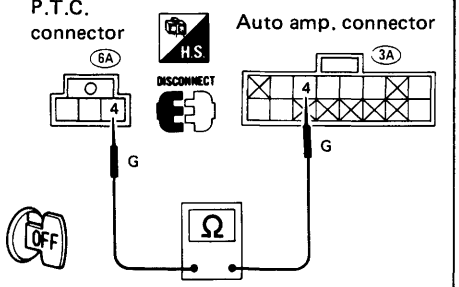
Ⓐ

F Check circuit continuity between LO relay harness terminal No. ⑥④ and fan switch harness terminal No. ⑪.

- O.K. → **G** CHECK DIODE AFTER DISCONNECTING IT.
  - O.K. → **H** Check circuit continuity between LO relay harness terminal No. ⑥④ and diode harness terminal No. ⑩⓪. (Note)
    - O.K. → **I** Check circuit continuity between diode harness terminal No. ⑩① and fan switch harness terminal No. ⑪. (Note)
    - N.G. → Replace diode.
  - N.G. → Replace diode.
- N.G. → CHECK FAN SWITCH AFTER DISCONNECTING IT. (Refer to Electrical Components Inspection.)
  - N.G. → Replace fan switch.

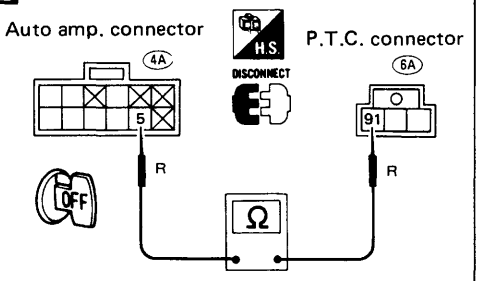
Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

A



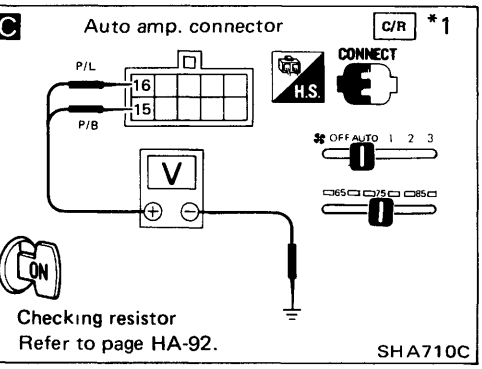
RHA512B

B



RHA513B

C



Checking resistor
Refer to page HA-92.

SHA710C

Diagnostic Procedure 3

SYMPTOM: Blower motor fan speed does not change when fan speed is in AUTO. (Fan speed is fixed in HI or MH.)

C/R *1

CHECK AUTO AMP. AND P.T.C.
Connect checking resistor. (Refer to page HA-92.)
Does blower motor fan speed change when you move P.T.C. from 20°C (68°F) to 30°C (86°F)?

N.G. → A

O.K. ↓

CHECK SENSOR CIRCUIT.

	How to repair
Ambient sensor circuit	Go to Diagnostic Procedure 11.
In-vehicle sensor circuit	Go to Diagnostic Procedure 12.

A Note

CHECK P.T.C. CIRCUIT BETWEEN P.T.C. AND AUTO AMP.
Disconnect P.T.C. and auto amp. harness connectors.
Check circuit continuity between P.T.C. harness terminal No. ④ and auto amp. harness terminal No. ④.

O.K. ↓

B Note

Check circuit continuity between P.T.C. harness terminal No. ⑨① and auto amp. harness terminal No. ⑤.

O.K. ↓

CHECK P.T.C.
(Refer to Electrical Components Inspection.)

O.K. → Reconnect P.T.C. harness connector.

N.G. → Replace P.T.C.

C C/R *1

CHECK AUTO AMP.
Connect checking resistor. (Refer to page HA-92.)
Do approx. 12 volts exist between auto amp. harness terminal No. ⑮, ⑯ and body ground?

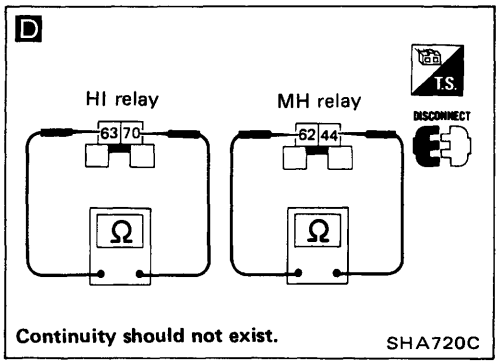
N.G. → Replace auto amp.

O.K. ↓

Ⓐ
(Go to next page.)

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

Diagnostic Procedure 3 (Cont'd)



Ⓐ

D

CHECK HI OR MH RELAY AFTER DISCONNECTING IT.
Check continuity not exist between HI relay terminal No. ⑥③ and ⑦⓪.
Check continuity not exist between MH relay terminal No. ④④ and ⑥②.

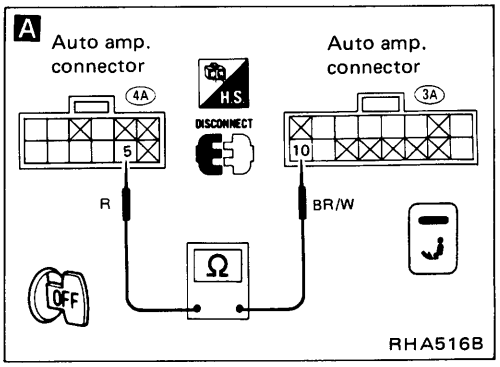
N.G. → Replace HI relay or MH relay.

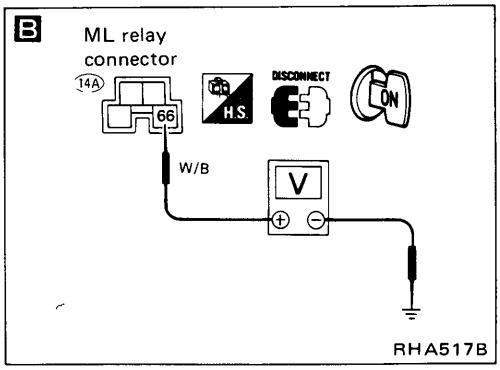
O.K. ↓

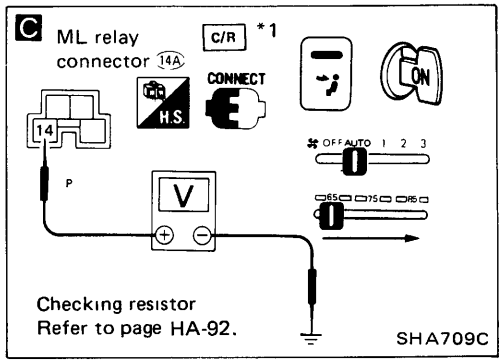
Note

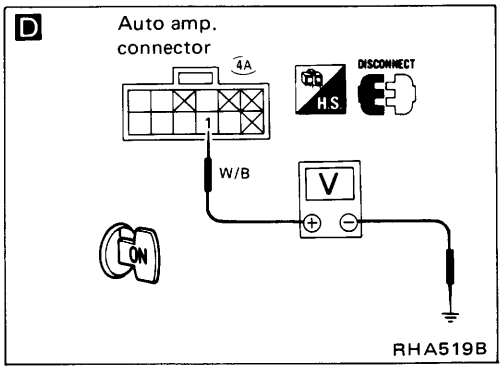
Does continuity exist between blower motor harness terminal No. ④① and HI relay or MH relay. terminal No. ⑦⓪ ?
Does continuity exist between resistor harness terminal No. ④④ and MH relay harness terminal No. ④④ ?

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.









Diagnostic Procedure 4

SYMPTOM: Blower motor fan speed does not change when fan speed is in AUTO. (Fan speed is fixed in LO.)

A

CHECK WATER TEMPERATURE SENSOR.
Disconnect auto amp. harness connector.
Is resistance between auto amplifier terminal No. ⑩ and ⑤ lower than approx. 940Ω?

O.K. → **B**

N.G. →

CHECK WATER TEMPERATURE SENSOR CIRCUIT.
Go to **Diagnostic Procedure 14.**

B

CHECK POWER SUPPLY FOR ML RELAY
Disconnect ML relay.
Do approx. 12 volts exist between ML relay harness terminal No. ⑯ and body ground?

O.K. →

Reconnect ML relay.

N.G. →

Check 10A fuse at fuse block. (Refer to "POWER SUPPLY ROUTING" in EL section and A/C ELECTRICAL CIRCUIT.)

C C/R *1

CHECK AUTO AMP.
Connect checking resistor. (Refer to page HA-92.)
Do approx. 0 volts exist between ML relay harness terminal No. ⑭ and body ground when you move P.T.C. from 20°C (68°F) to 30°C (86°F)?

N.G. →

Replace ML relay.

O.K. →

D

CHECK POWER SUPPLY FOR AUTO AMP.
Disconnect auto amp. harness connector.
Do approx. 12 volts exist between auto amp. harness terminal No. ① and body ground?

N.G. →

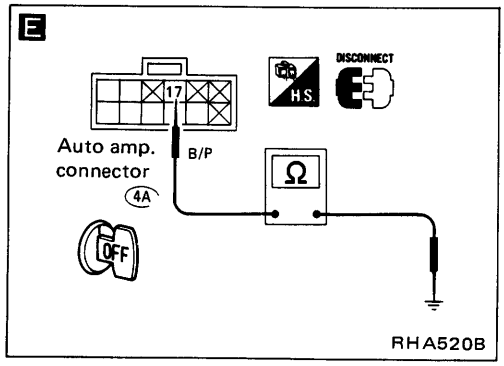
Check 10A fuse at fuse block. (Refer to "POWER SUPPLY ROUTING" in EL section and A/C ELECTRICAL CIRCUIT.)

O.K. →

Ⓐ

(Go to next page.)

Diagnostic Procedure 4 (Cont'd)



Ⓐ

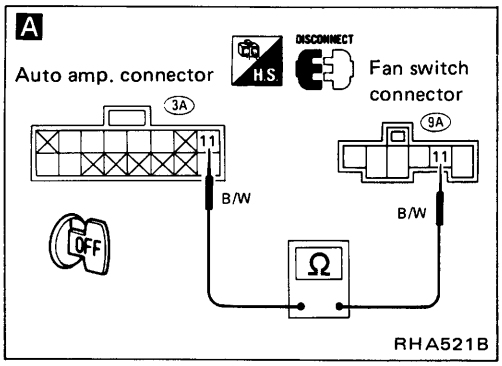
E

Note

CHECK BODY GROUND CIRCUIT FOR AUTO AMP.
Does continuity exist between auto amp. harness terminal No. ⑰ and body ground?

Replace auto amp.

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.



Diagnostic Procedure 5

SYMPTOM: Starting fan speed control does not operate.

CHECK WATER TEMPERATURE SENSOR CIRCUIT.
Go to **Diagnostic Procedure 14.**

N.G. → Replace auto amp. or water temperature sensor or micro-switch.

O.K. ↓

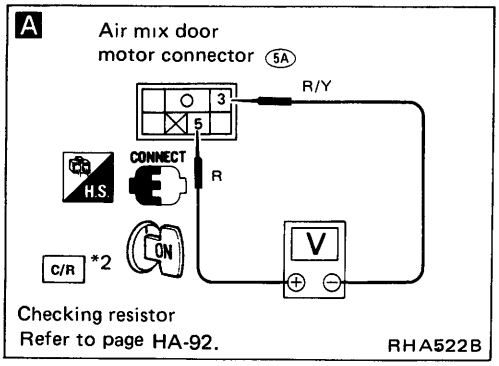
A Note

CHECK BODY GROUND CIRCUIT FOR AUTO AMP.
Disconnect auto amp. and fan switch harness connector.
Check circuit continuity between auto amp. harness terminal No. ⑪ and fan switch harness terminal No. ⑪.

O.K. ↓

Replace auto amp.

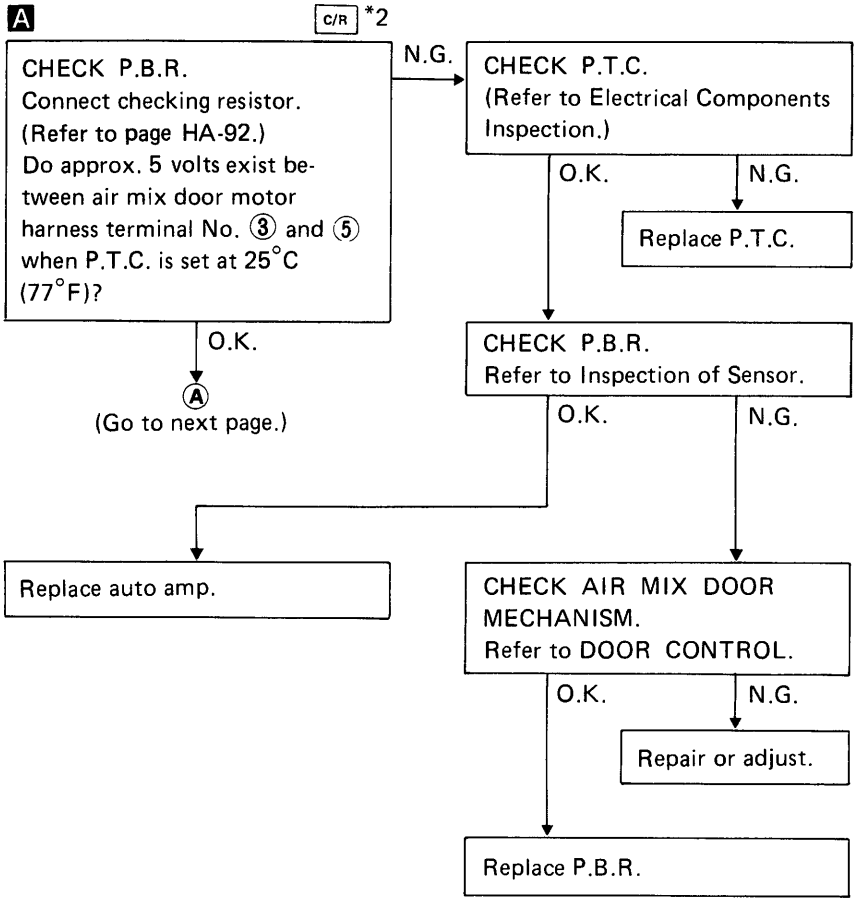
Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.



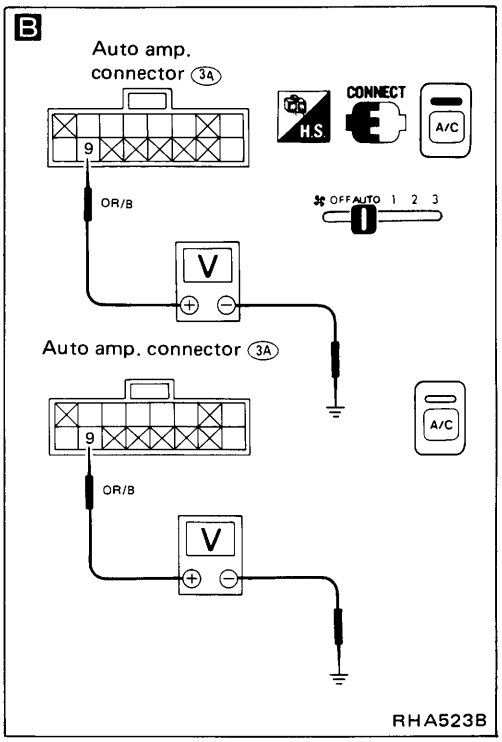
Diagnostic Procedure 6

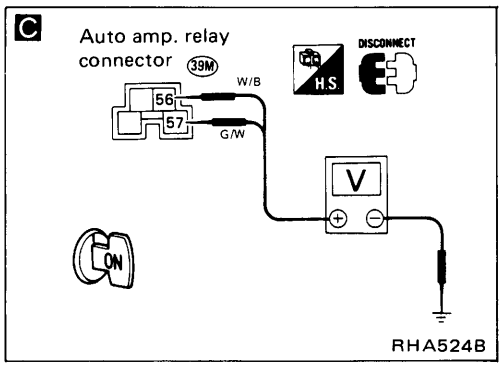
SYMPTOM: There is too much difference between setting temp. on P.T.C. and in-vehicle temp.

- **Perform PRELIMINARY CHECK 2 before referring to the following flow chart.**



Diagnostic Procedure 6 (Cont'd)





Ⓐ

CHECK ASPIRATOR MOTOR OPERATION.
Does aspirator motor rotate?
(Refer to Electrical Components Inspection.)

N.G. → Ⓒ (Go to next page.)

O.K. ↓

CHECK IN-VEHICLE SENSOR AND AMBIENT SENSOR.
(Refer to Inspection of Sensor.)

N.G. → Replace in-vehicle sensor or ambient sensor.

O.K. ↓

CHECK SUNLOAD SENSOR.
Go to **Diagnostic Procedure 13.**

N.G. → Replace sunload sensor or auto amp.

O.K. ↓

B

CHECK AUTO AMP. OPERATION.
Do approx. 12 volts exist between auto amp. harness terminal No. ⑨ and body ground when A/C switch is ON?
Do approx. 0 volts exist between auto amp. harness terminal No. ⑨ and body ground when A/C switch is OFF?

N.G. → C

O.K. ↓

Replace auto amp.

C

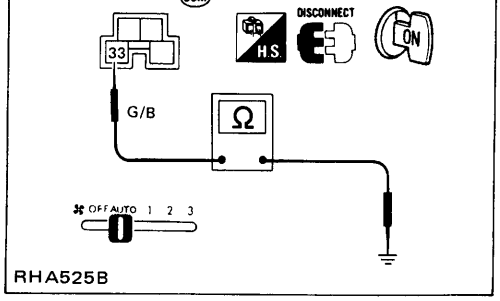
CHECK POWER SUPPLY FOR AUTO AMP. RELAY.
Disconnect auto amp. relay.
Do approx. 12 volts exist between auto amp. relay harness terminal No. ⑯, ⑰ and body ground?

O.K. ↓ Ⓑ (Go to next page.)

N.G. → Check 10A fuses at fuse block.
(Refer to "POWER SUPPLY ROUTING" in EL section and A/C ELECTRICAL CIRCUIT.)

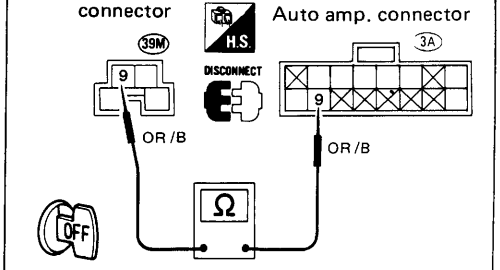
Diagnostic Procedure 6 (Cont'd)

D Auto amp. relay connector (39M)



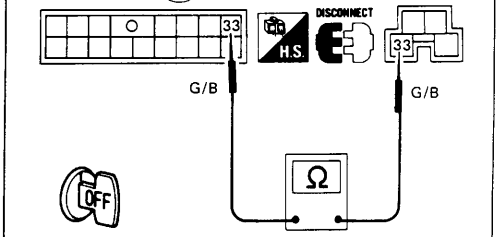
RHA525B

E Auto amp. relay connector (39M) Auto amp. connector (3A)



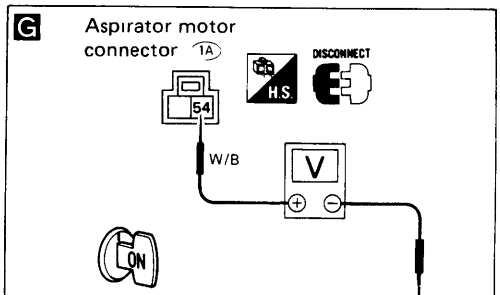
RHA526B

F Push control unit connector (8A) Auto amp. relay connector (39M)



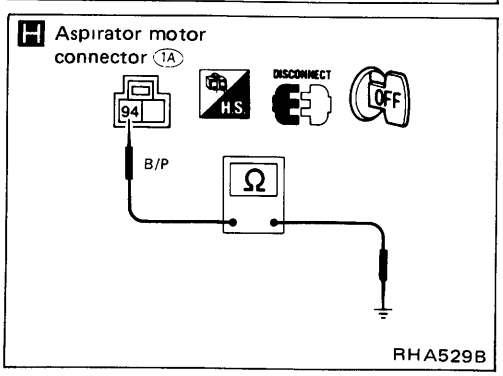
RHA527B

G Aspirator motor connector (1A)



RHA528B

H Aspirator motor connector (1A)



RHA529B

(B)

D CHECK COIL SIDE CIRCUIT OF AUTO AMP. RELAY.
Does continuity exist between auto amp. relay harness terminal No. (33) and body ground?

N.G. → **F** Note: Check circuit continuity between auto amp. relay harness terminal No. (33) and push control unit harness terminal No. (33).

O.K. ↓

CHECK AUTO AMP. RELAY AFTER DISCONNECTING IT.
(Refer to Electrical Components Inspection.)

O.K. ↓

E Note: Check circuit continuity between auto amp. relay harness terminal No. (9) and auto amp. harness terminal No. (9)

N.G. → Replace auto amp. relay.

(C)

G CHECK POWER SUPPLY FOR ASPIRATOR MOTOR.
Disconnect aspirator motor harness connector.
Do approx. 12 volts exist between aspirator motor harness terminal No. (54) and body ground?

N.G. → Check 10A fuse at fuse block. (Refer to "POWER SUPPLY ROUTING" in EL section and A/C ELECTRICAL CIRCUIT.)

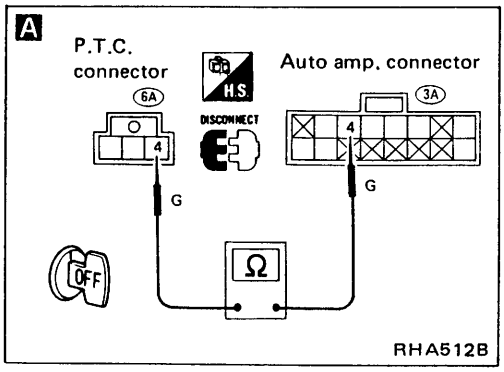
O.K. ↓

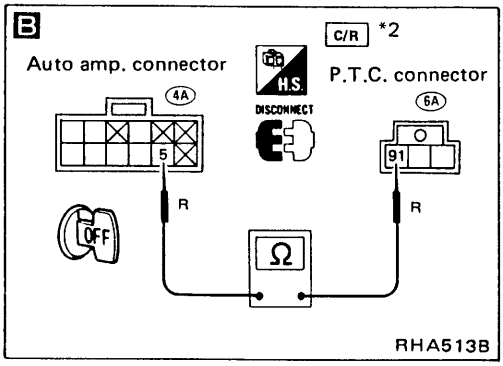
H Note: CHECK BODY GROUND CIRCUIT FOR ASPIRATOR MOTOR.
Does continuity exist between aspirator motor harness terminal No. (94) and body ground?

O.K. ↓

Replace aspirator motor.

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.





Diagnostic Procedure 7

SYMPTOM: Air mix door motor does not operate normally.

- **Perform PRELIMINARY CHECK 2 before referring to the following flow chart.**

C/R *2

CHECK AUTO AMP. AND P.T.C.
Connect checking resistor.
(Refer to page HA-92.)
Does air outlet temperature change when you move P.T.C. from 20°C (68°F) to 30°C (86°F)?

N.G. → A

A — Note

CHECK P.T.C. CIRCUIT BETWEEN P.T.C. AND AUTO AMP.
Disconnect P.T.C. and auto amp. harness connectors.
Check circuit continuity between P.T.C. harness terminal No. ④ and auto amp. harness terminal No. ④.

O.K. → B — Note

Check circuit continuity between P.T.C. harness terminal No. ⑨① and auto amp. harness terminal No. ⑤.

O.K.

O.K. ↓

CHECK SENSOR CIRCUIT.

	How to repair
Ambient sensor circuit	Go to Diagnostic Procedure 11.
In-vehicle sensor circuit	Go to Diagnostic Procedure 12.

CHECK P.T.C.
(Refer to Electrical Components Inspection.)

N.G. → Replace P.T.C.

O.K. ↓

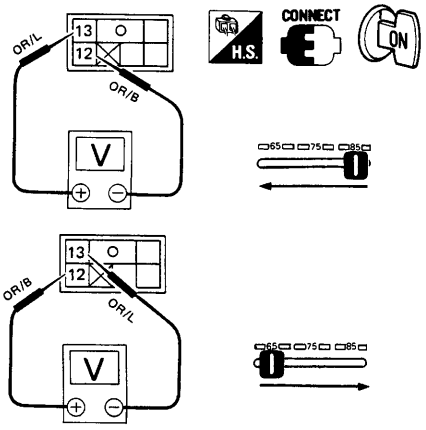
Ⓐ
(Go to next page.)

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

Diagnostic Procedure 7 (Cont'd)

C

Air mix door motor connector (5A)



SHA708C

Ⓐ

C

C/R *2

CHECK FOR OUTPUT OF AUTO AMP.
Connect checking resistor.
Do approx. 10.5 volts exist between air mix door motor harness terminals No. ⑫ and ⑬ when you move P.T.C. from 20°C (68°F) to 30°C (86°F) or when you move P.T.C. from 30°C (86°F) to 20°C (68°F)?

Air mix door operation	Terminal No. ⑫	Terminal No. ⑬	Voltage
Cold → Hot	⊕	⊖	Approx. 10.5V
Hot → Cold	⊖	⊕	Approx. 10.5V
Stop	⊖	⊖	0V

N.G. → Disconnect auto amp. and air mix door motor harness connectors.

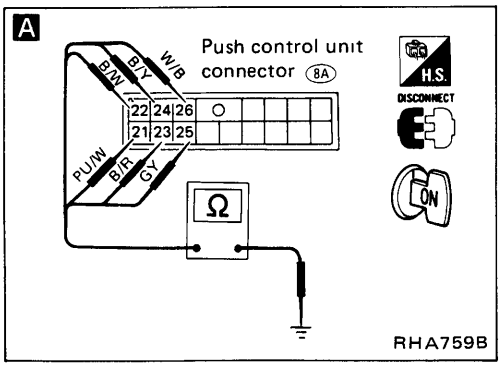
Note

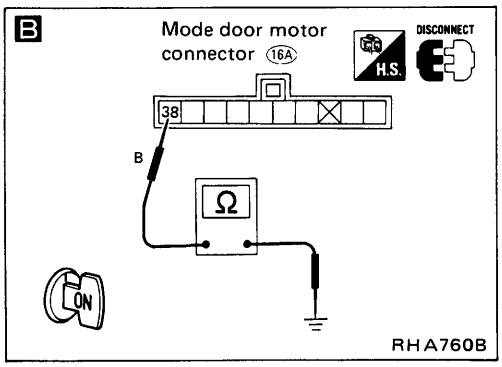
Check circuit continuity between auto amp. harness terminal No. ⑫ (⑬) and air mix door motor harness terminal No. ⑫ (⑬).

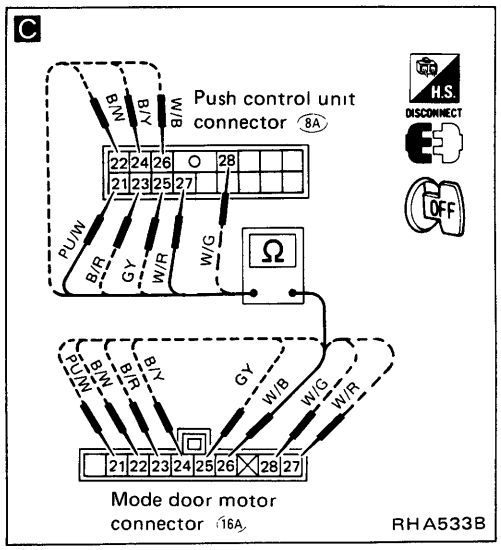
O.K. → Replace auto amp.

O.K. → Replace air mix door motor.

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.







Diagnostic Procedure 8

SYMPTOM: Air outlet does not change.

- **Perform PRELIMINARY CHECK 4 and Main Power Supply and Ground Circuit Check before referring to the following flow chart.**

A

CHECK MODE DOOR MOTOR POSITION SWITCH.

1. Turn VENT switch ON with ignition switch at ON position.
2. Turn ignition switch OFF. Disconnect push control unit connector.
3. Check if continuity exists between each terminal No. (21) or (22) on push control unit harness connector and body ground.
4. Using above procedures, check for continuity in any other mode, as indicated in chart.

Mode switch	Terminal No ⊕	Terminal No ⊖	Continuity
VENT	(21) or (22)	Body ground	Yes
B/L	(22) or (23)		
FOOT	(23) or (24)		
F/D	(24) or (25)		
DEF	(25) or (26)		

N.G. → Disconnect mode door motor harness connector.

O.K. ↓

CHECK SIDE LINK.
Refer to DOOR CONTROL – Auto Air Conditioner.

B

CHECK BODY GROUND CIRCUIT FOR MODE DOOR MOTOR.
Does continuity exist between mode door motor harness terminal No. (38) and body ground?

N.G. → (return to Disconnect mode door motor harness connector.)

O.K. ↓

C

Note

Check circuit continuity between each terminal on push control unit and on mode door motor.

Terminal No. (+) Push control unit	Terminal No. (−) Mode door motor	Continuity
(21)	(21)	Yes
(22)	(22)	
(23)	(23)	
(24)	(24)	
(25)	(25)	
(26)	(26)	
(27)	(27)	
(28)	(28)	

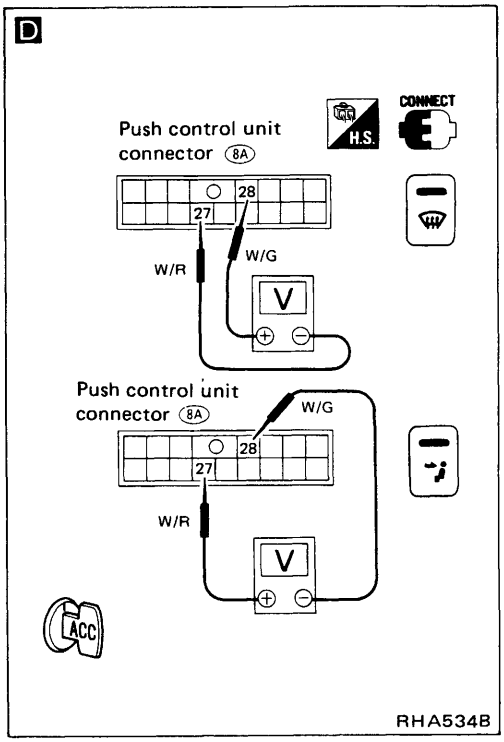
O.K. ↓

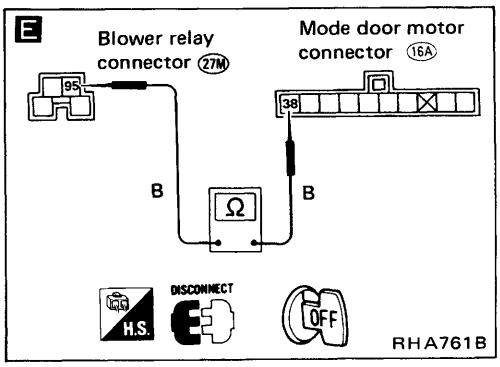
Ⓐ Ⓑ

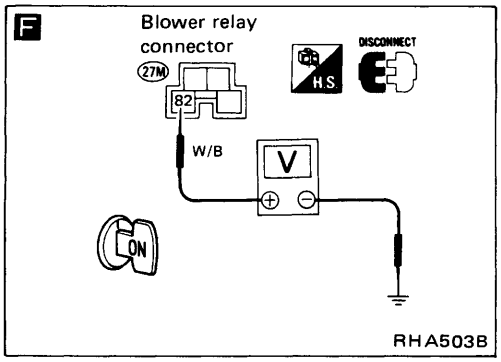
(Go to next page.)

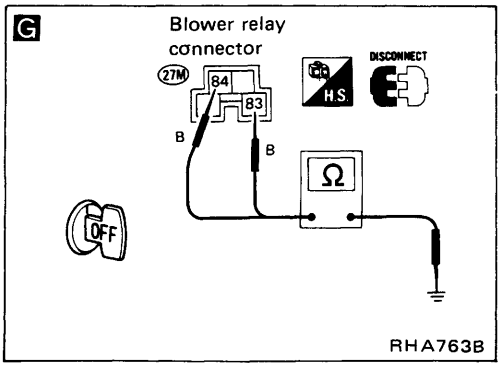
Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

Diagnostic Procedure 8 (Cont'd)









Ⓐ

Reconnect push control unit and mode door motor harness connectors.

D

CHECK FOR OUTPUT OF PUSH CONTROL UNIT.
Do approx. 12 volts exist between push control unit harness terminal No. ㉗ and ㉘ when mode is switched from "VENT" to "DEF" or when mode is switched from "DEF" to "VENT"?

Terminal No.		Mode door motor	
㉗	㉘	Mode door operation	Direction of linkage rotation
⊖	⊖	Stop	Stop
⊖	⊕	VENT → DEF	Clockwise
⊕	⊖	DEF → VENT	Counterclockwise

N.G. → Replace control amp. built-in push control unit.

O.K. ↓

Replace mode door motor.

Ⓑ

Disconnect blower relay harness connector.

E Note

Check circuit continuity between mode door motor harness terminal No. ㊳ and blower relay harness terminal No. ㊺.

O.K. ↓

F

CHECK POWER SUPPLY FOR BLOWER RELAY.
Do approx. 12 volts exist between blower relay harness terminal No. ㉜ and body ground?

O.K. → G Note

Check circuit continuity between blower relay harness terminal No. ㉝, ㉞ and body ground.

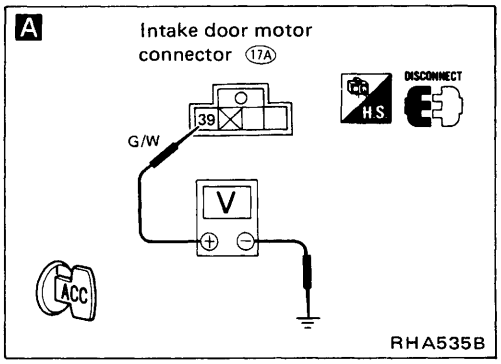
O.K. ↓

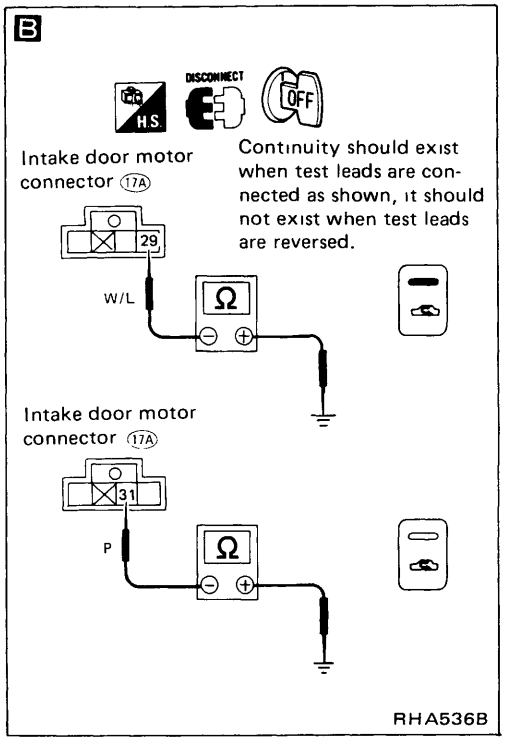
CHECK BLOWER RELAY AFTER DISCONNECTING IT. (Refer to Electrical Components Inspection.)

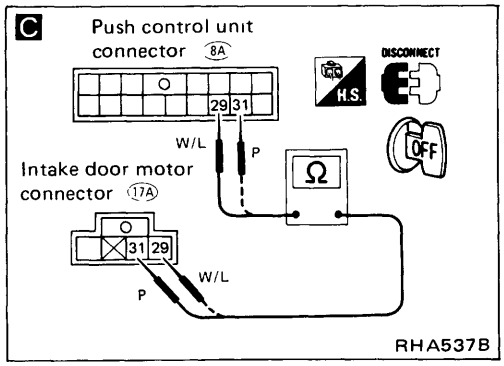
N.G. → Replace blower relay.

N.G. → Check 10A fuse at fuse block. (Refer to POWER SUPPLY ROUTING" in EL section and A/C ELECTRICAL CIRCUIT.)

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.







Diagnostic Procedure 9

SYMPTOM: Intake door does not change in VENT, B/L or FOOT mode.

- **Perform PRELIMINARY CHECK 1 and Main Power Supply and Ground Circuit Check before referring to the following flow chart.**

A

CHECK POWER SUPPLY FOR INTAKE DOOR MOTOR.
Disconnect intake door motor harness connector.
Do apporx. 12 volts exist between intake door motor harness terminal No. (39) and body ground?

N.G. → Check 10A fuses at fuse block. (Refer to "POWER SUPPLY ROUTING" in EL section and A/C ELECTRICAL CIRCUIT.)

O.K. ↓

B

CHECK BODY GROUND CIRCUIT FOR INTAKE DOOR MOTOR.
Does continuity exist between intake door motor harness terminal No. (29) and body ground when REC switch is ON?
Does continuity exist between intake door motor harness terminal No. (31) and body ground when REC switch is OFF?

N.G. → Disconnect push control unit harness connector.

C Note

Check circuit continuity between push control unit harness terminal No. (29) ((31)) and intake door motor harness terminal No. (29) ((31))?

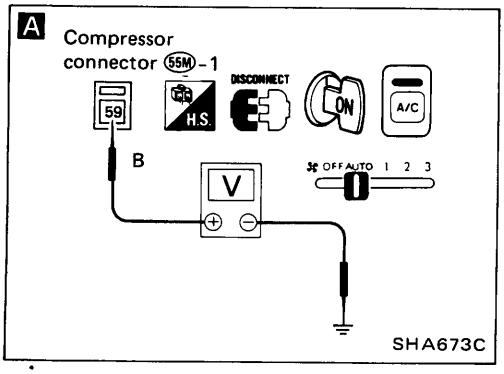
O.K. ↓

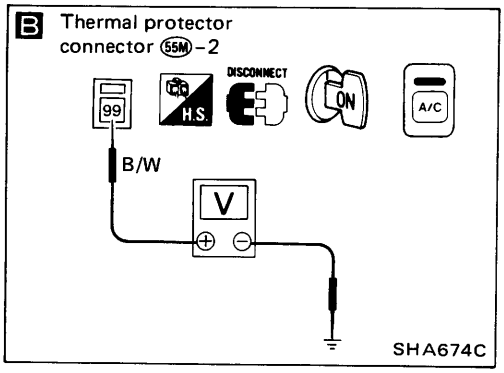
Replace control amp. built-in push control unit.

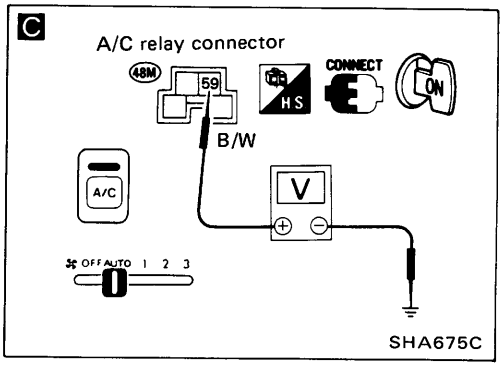
O.K. ↓

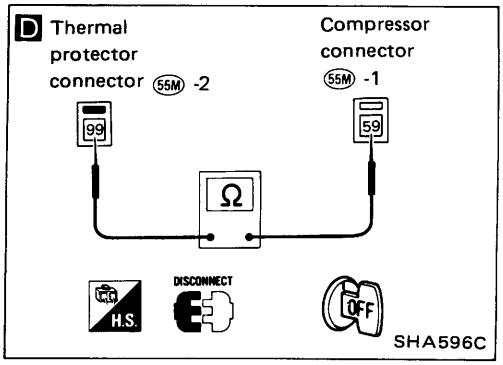
Replace intake door motor.

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.









Diagnostic Procedure 10

SYMPTOM: Magnet clutch does not engage with A/C switch and fan switch ON.

- **Perform PRELIMINARY CHECK 2 before referring to the following flow chart.**

A

CHECK POWER SUPPLY FOR COMPRESSOR.
Disconnect compressor harness connector.
Do approx. 12 volts exist between compressor harness terminal No. (59) and body ground?

N.G. → **B**

CHECK POWER SUPPLY FOR THERMAL PROTECTOR.
Disconnect thermal protector harness connector.
Do approx. 12V exist between thermal protector harness terminal No. (99) and body ground?

N.G. → **C**

CHECK A/C RELAY OPERATION.
Do approx. 12 volts exist between A/C relay harness terminal No. (59) and body ground?

O.K. → (A) (Go to next page.)

N.G. → (B) (Go to next page.)

O.K. → Check magnet clutch coil.

O.K. → Replace magnet clutch.
Refer to COMPRESSOR – Model DKV-14C (DIESEL-KIKI make).

O.K. → **D**

Note

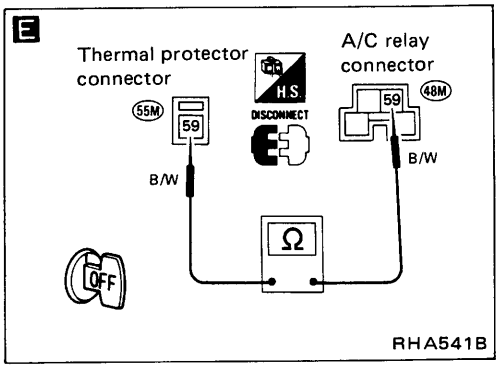
CHECK THERMAL PROTECTOR.
Check circuit continuity between thermal protector harness terminal No. (99) and compressor harness terminal No. (59).

N.G. → Replace thermal protector.

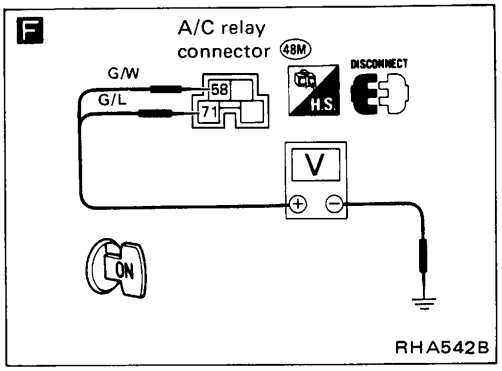
Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

Diagnostic Procedure 10 (Cont'd)

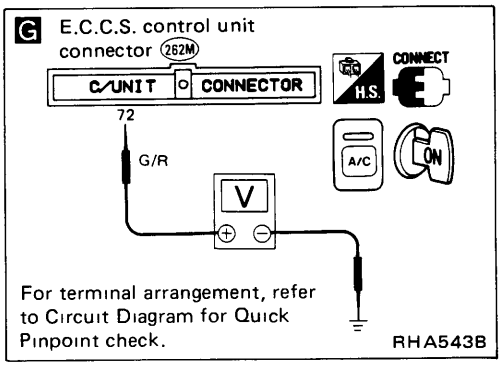
E



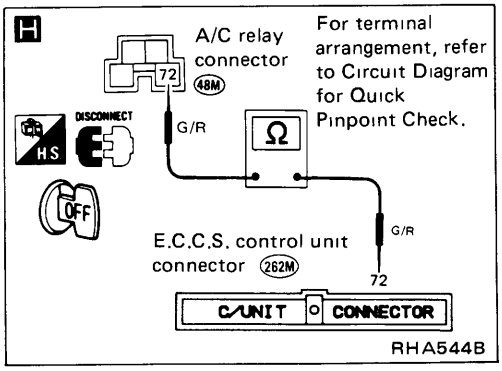
F



G



H



Ⓐ

Disconnect A/C relay harness connector.

E — Note

Check circuit continuity between A/C relay harness terminal No. 59 and thermal protector harness terminal No. 59.

Ⓑ

F

CHECK POWER SUPPLY FOR A/C RELAY.
Disconnect A/C relay.
Do approx. 12 volts exist between A/C relay harness terminal No. 58, 71 and body ground?

O.K. → Ⓑ

N.G. → CHECK POWER SUPPLY CIRCUIT AND 10A FUSE AT FUSE BLOCK. (Refer to "POWER SUPPLY ROUTING" in EL section and A/C ELECTRICAL CIRCUIT.)

CHECK A/C RELAY AFTER DISCONNECTING IT. (Refer to Electrical Components Inspection.)

N.G. → Replace A/C relay.

O.K. →

Reconnect A/C relay.

G

CHECK COIL SIDE CIRCUIT OF A/C RELAY.
Do approx. 12 volts exist between E.C.C.S. control unit harness terminal No. 72 and body ground?

N.G. →

H — Note

Check circuit continuity between A/C relay harness terminal No. 72 and E.C.C.S control unit harness terminal No. 72.

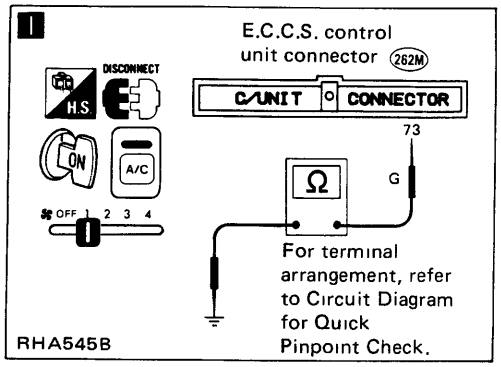
O.K. →

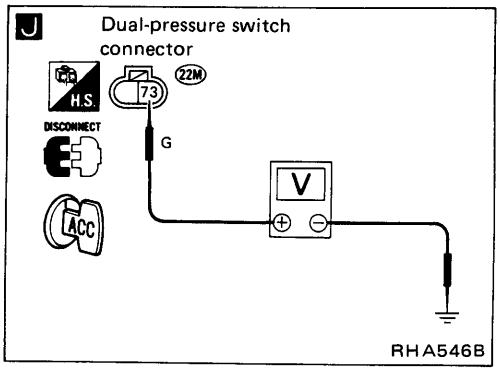
Ⓒ

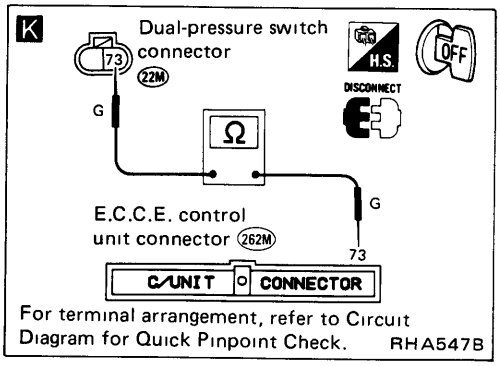
(Go to next page.)

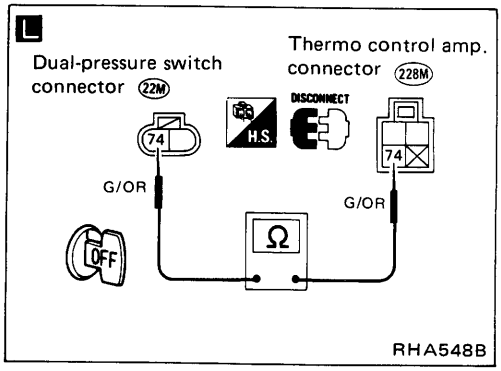
Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

Diagnostic Procedure 10 (Cont'd)









Ⓒ

I CHECK COIL SIDE CIRCUIT OF A/C RELAY.
Disconnect E.C.C.S. control unit harness connector.
Does continuity exist between E.C.C.S. control unit harness terminal No. ⑦③ and body ground?

N.G. → Reconnect E.C.C.S. control unit harness connector.

O.K. ↓

CHECK E.C.C.S. CONTROL UNIT.
Refer to EF & EC section.

J CHECK DUAL-PRESSURE SWITCH CIRCUIT BETWEEN DUAL-PRESSURE SWITCH AND E.C.C.S. CONTROL UNIT.
Disconnect dual-pressure switch harness connector.
Do approx. 8 to 9 volts exist between dual-pressure switch harness terminal No. ⑦③ and body ground?

O.K. ↓

N.G. → Disconnect E.C.C.S. control unit harness connector.

K Note
Check circuit continuity between E.C.C.S. control unit harness terminal No. ⑦③ and dual-pressure switch harness terminal No. ⑦③.

CHECK DUAL-PRESSURE SWITCH
(Refer to Electrical Components Inspection.)

N.G. → Replace dual-pressure switch.

O.K. ↓

Disconnect thermo control amp. harness connector.

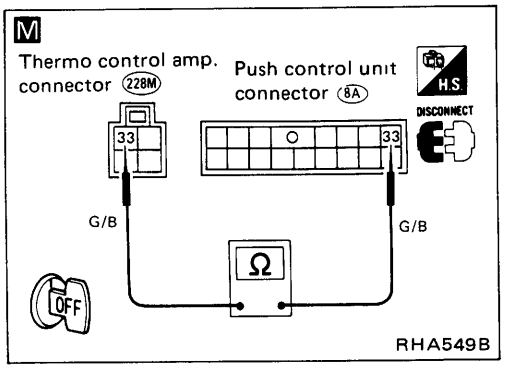
L Note
Check circuit continuity between dual-pressure switch harness terminal No. ⑦④ and thermo control amp. harness terminal No. ⑦④.

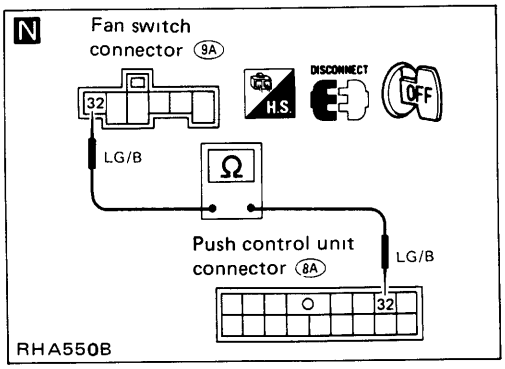
Ⓓ

(Go to next page.)

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

Diagnostic Procedure 10 (Cont'd)





Ⓓ

CHECK THERMO CONTROL AMP.
(Refer to Electrical Components Inspection.)

N.G. → Replace thermo control amp.

O.K.

Disconnect push control unit harness connector.

M Note

Check circuit continuity between thermo control amp. harness terminal No. ㉝ and push control unit harness terminal No. ㉝.

CHECK A/C SWITCH OF PUSH CONTROL UNIT.
(Refer to Electrical Components Inspection.)

N.G. → Replace control amp. built into push control unit.

O.K.

Disconnect fan switch harness connector.

N Note

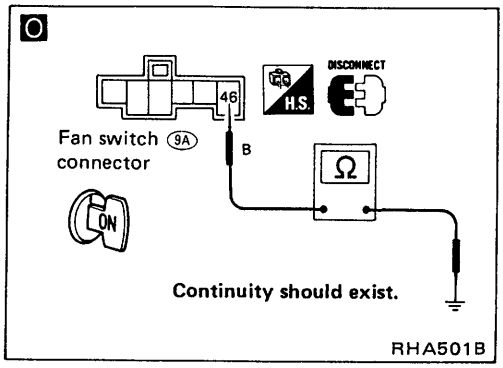
Check circuit continuity between push control unit harness terminal No. ㉜ and fan switch harness terminal No. ㉜.

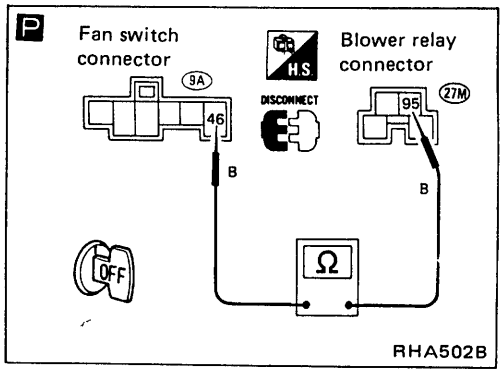
Ⓔ

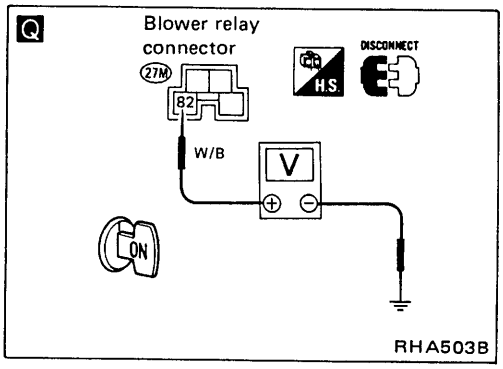
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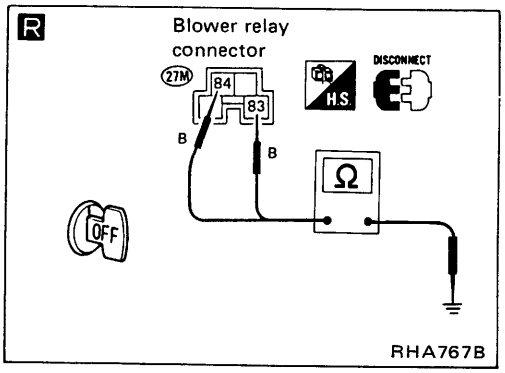
Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

Diagnostic Procedure 10 (Cont'd)









(E)

O

Check circuit continuity between fan switch harness terminal No. (46) and body ground.

N.G. → Disconnect blower relay harness connector.

P

Note

Check circuit continuity between fan switch harness terminal No. (46) and blower relay harness terminal No. (95).

O.K.

O.K. → Replace blower motor.

Q

CHECK POWER SUPPLY FOR BLOWER RELAY.
Do approx. 12 volts exist between blower relay harness terminal No. (82) and body ground?

N.G. → Check 10A fuse at fuse block. (Refer to "POWER SUPPLY ROUTING" in EL section and A/C ELECTRICAL CIRCUIT.)

O.K.

R

Note

Check circuit continuity between blower relay harness terminal No. (83), (84) and body ground.

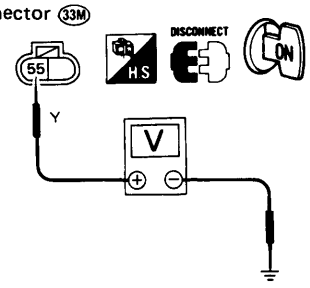
O.K.

CHECK BLOWER RELAY AFTER DISCONNECTING IT.
(Refer to Electrical Components Inspection.)

N.G. → Replace blower relay.

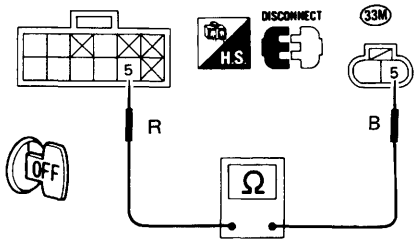
Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

A Ambient sensor connector (33M)



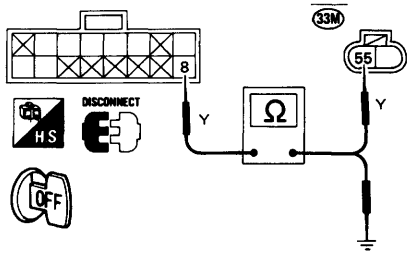
RHA551B

B Auto amp. connector (4A) Ambient sensor connector (33M)



SHA676C

C Auto amp. connector (3A) Ambient sensor connector (33M)



RHA553B

Diagnostic Procedure 11

SYMPTOM: Ambient sensor circuit is open or shorted.

A

CHECK AMBIENT SENSOR CIRCUIT BETWEEN AMBIENT SENSOR AND AUTO AMP.
Disconnect ambient sensor harness connector.
Do approx. 5 volts exist between ambient sensor harness terminal No. (55) and body ground?

N.G. → Disconnect auto amp. harness connector.

C Note

Check circuit continuity between auto amp. harness terminal No. (8) and ambient sensor harness terminal No. (55), and between auto amp. harness terminal No. (8) and body ground.

O.K. → Replace auto amp.

O.K. → Disconnect auto amp. harness connector.

B Note

Check circuit continuity between ambient sensor harness terminal No. (5) and auto amp. harness terminal No. (5).

O.K. →

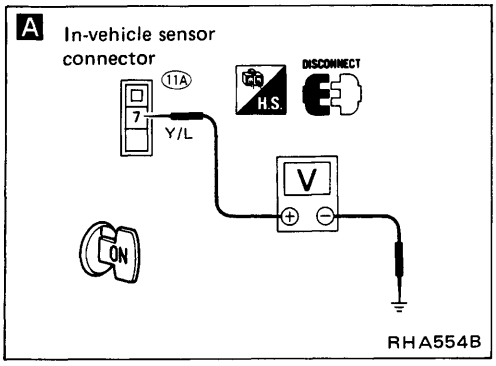
CHECK AMBIENT SENSOR. (Refer to Electrical Components Inspection.)

N.G. → Replace ambient sensor.

O.K. → Replace auto amp.

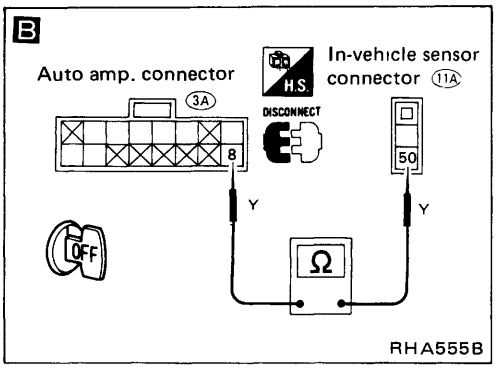
Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

A In-vehicle sensor connector



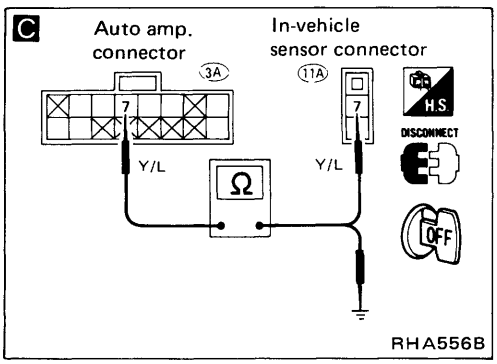
RHA554B

B Auto amp. connector — In-vehicle sensor connector 11A



RHA555B

C Auto amp. connector — In-vehicle sensor connector



RHA556B

Diagnostic Procedure 12

SYMPTOM: In-vehicle sensor circuit is open or shorted.

A

CHECK IN-VEHICLE SENSOR CIRCUIT BETWEEN IN-VEHICLE SENSOR AND AUTO AMP.
Disconnect in-vehicle sensor harness connector.
Do approx. 5 volts exist between in-vehicle sensor harness terminal No. ⑦ and body ground?

N.G. → Disconnect auto amp. harness connector.

C Note

Check circuit continuity between auto amp. harness terminal No. ⑦ and in-vehicle sensor harness terminal No. ⑦, and between auto amp. harness terminal No. ⑦ and body ground.

O.K. → Replace auto amp.

O.K. → Disconnect auto amp. harness connector.

B Note

Check circuit continuity between in-vehicle sensor harness terminal No. ⑤⓪ and auto amp. harness terminal No. ⑧.

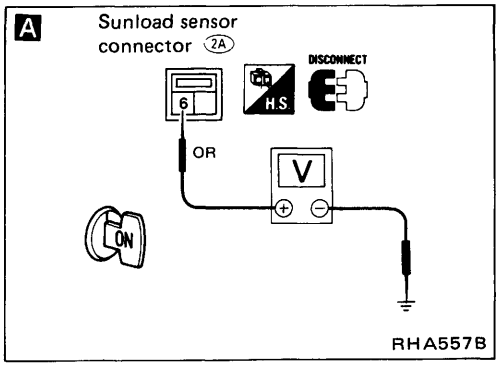
O.K.

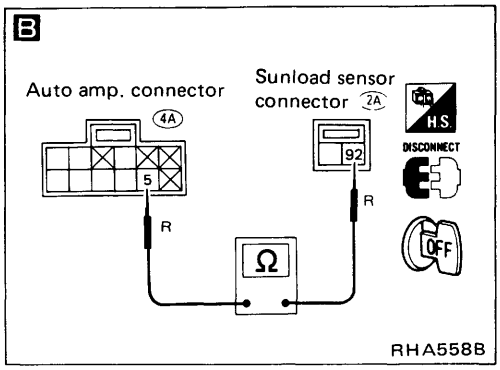
CHECK IN-VEHICLE SENSOR. (Refer to Electrical Components Inspection.)

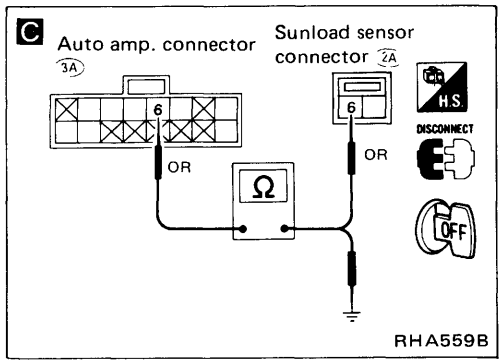
N.G. → Replace in-vehicle sensor.

O.K. → Replace auto amp.

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.







Diagnostic Procedure 13

SYMPTOM: Sunload sensor circuit is open or shorted.

A

CHECK SUNLOAD SENSOR CIRCUIT BETWEEN SUNLOAD SENSOR AND AUTO AMP.
Disconnect sunload sensor harness connector.
Do approx. 5 volts exist between sunload sensor harness terminal No. ⑥ and body ground?

N.G. → Disconnect auto amp. harness connector

C Note

Check circuit continuity between auto amp. harness terminal No. ⑥ and sunload sensor harness terminal No. ⑥ and between auto amp. harness terminal No. ⑥ and body ground.

O.K. → Replace auto amp.

O.K. → Disconnect auto amp. harness connector.

B Note

Check circuit continuity between sunload sensor harness terminal No. ⑫ and auto amp. harness terminal No. ⑤

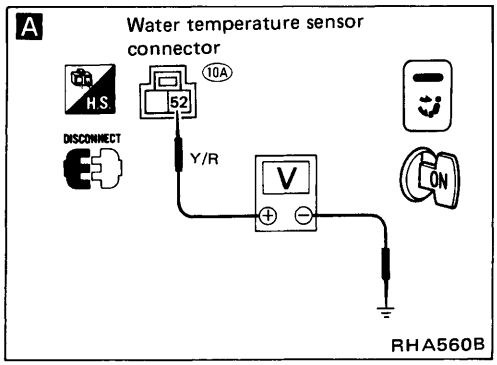
O.K. →

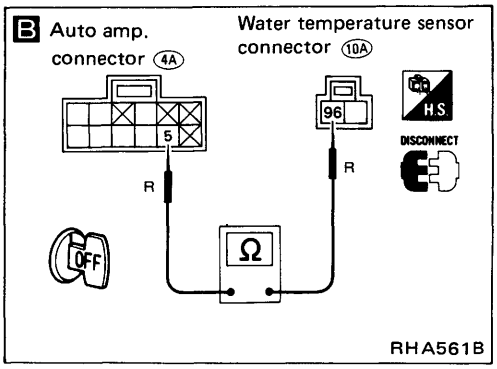
CHECK SUNLOAD SENSOR. (Refer to Electrical Components Inspection.)

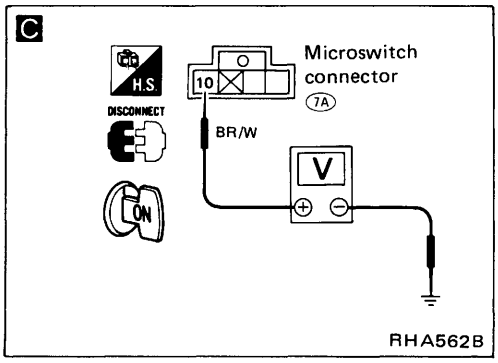
N.G. → Replace sunload sensor.

O.K. → Replace auto amp.

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.







Diagnostic Procedure 14

SYMPTOM: Water temperature sensor circuit is open or shorted.

A

CHECK WATER TEMPERATURE SENSOR CIRCUIT BETWEEN WATER TEMPERATURE SENSOR AND AUTO AMP.
Disconnect water temperature harness connector.
Do approx. 5 volts exist between water temperature sensor harness terminal No. 52 and body ground?

N.G. → Disconnect microswitch harness connector.

C

Do approx. 5 volts exist between microswitch harness terminal No. 10 and body ground?

O.K. → Ⓐ (Go to next page.)

N.G. → Ⓑ (Go to next page.)

O.K. ↓

Disconnect auto amp. harness connector.

B Note

Check circuit continuity between water temperature sensor harness terminal No. 96 and auto amp. harness terminal No. 5.

O.K. ↓

CHECK WATER TEMPERATURE SENSOR.
(Refer to Electrical Components Inspection.)

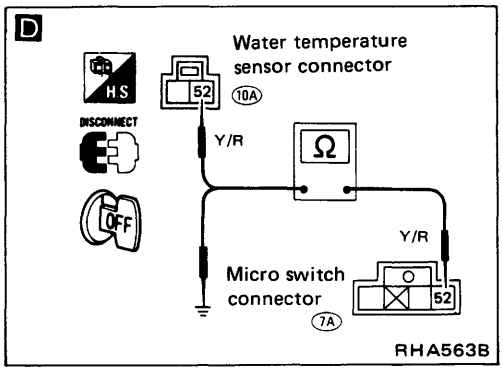
N.G. → Replace water temperature sensor.

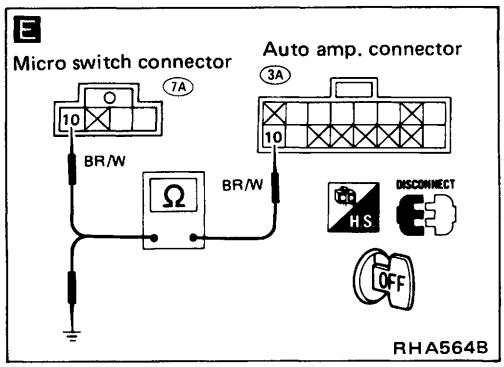
O.K. ↓

Replace auto amp.

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

Diagnostic Procedure 14 (Cont'd)





Ⓐ

CHECK MICRO SWITCH
(Refer to Control System Input Components.)

O.K. → D Note: Check circuit continuity between water temperature sensor harness terminal No. 52 and micro switch harness terminal No. 52 and between micro switch harness terminal No. 52 and body ground.

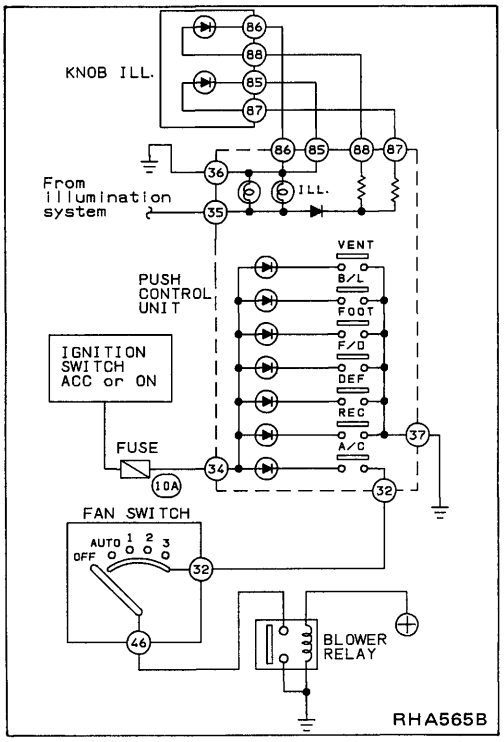
N.G. → Replace micro switch.

Ⓑ

E Note: Check circuit continuity between auto amp. harness terminal No. 10 and micro switch harness terminal No. 10 and between auto amp. harness terminal No. 10 and body ground.

O.K. → Replace auto amp.

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.



Diagnostic Procedure 15

SYMPTOM: Illumination or indicators of push control unit do not come on.

- **Perform Main Power Supply and Ground Circuit Check before referring to the following flow chart.**

Turn ignition switch and lighting switch ON.

CHECK ILLUMINATION AND INDICATORS.

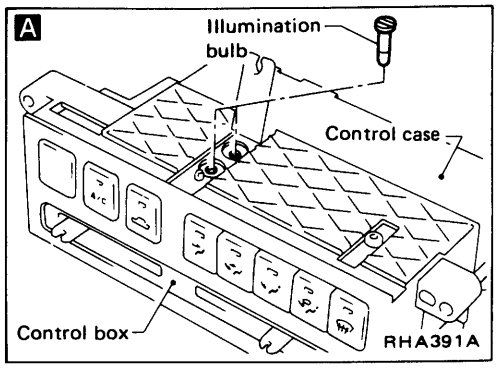
- Turn A/C, REC and fan switches ON.
- Push VENT, B/L, FOOT, F/D and DEF switches in order.
- Check for incidents and follow the repairing methods as shown:

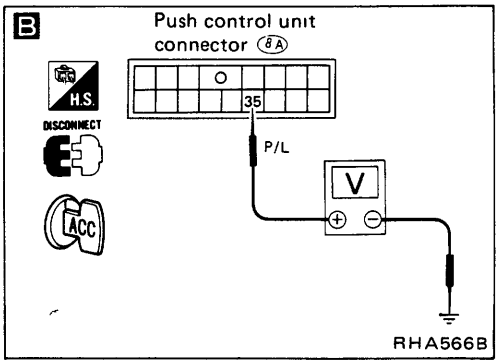
INCIDENTS								
ILL. / Push control unit	VENT	B/L	FOOT	F/D	DEF	REC	A/C	"How to repair"
X	O	O	O	O	O	O		Go to DIAGNOSTIC PROCEDURE 15-1.
	O	O	O	O	O	O	X	Go to DIAGNOSTIC PROCEDURE 15-2.
O	X	X	X	X	X	X		Go to DIAGNOSTIC PROCEDURE 15-3.
	Δ							Replace control amp built into push control unit.
O	X	X	X	X	X	X	O	Replace control amp. built into push control unit.
	X	X	X	X	X	X	O	Go to DIAGNOSTIC PROCEDURE 15-4.

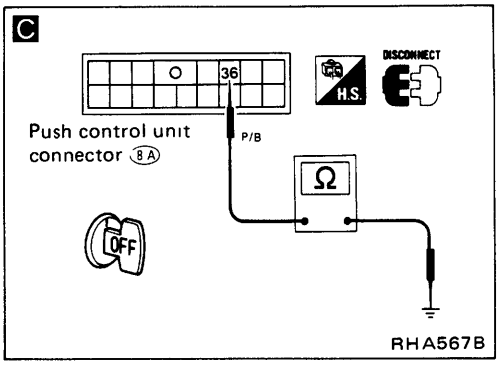
O: Illumination or indicator comes on.
X: Illumination or indicator does not come on
Δ: Some indicators for VENT, B/L, FOOT, F/D, DEF or REC come on.

Diagnostic Procedure 15 (Cont'd)

DIAGNOSTIC PROCEDURE 15-1







CHECK THE OTHER ILLUMINATION SYSTEMS EXCEPT FOR A/C SYSTEM.
Do the other illumination come on with ignition switch and lighting switch ON?

N.G. → CHECK ILLUMINATION SYSTEM.
Refer to Illumination/Wiring Diagram in EL section.

O.K. ↓

Turn ignition switch and lighting switch OFF.

A

CHECK ILLUMINATION BULB.
Remove push control unit and disconnect harness connectors.
Remove illumination bulb(s) and check them.

N.G. → Replace illumination bulb(s).

O.K. ↓

B

CHECK POWER SUPPLY FOR ILLUMINATION WITH LIGHTING SWITCH ON.
Do approx. 12 volts exist between push control unit harness terminal No. (35) and body ground?

N.G. → CHECK POWER SUPPLY FOR A/C ILLUMINATION SYSTEM.
Refer to Illumination/Wiring Diagram in EL section.

O.K. ↓

C

CHECK BODY GROUND CIRCUIT FOR ILLUMINATION.
Does continuity exist between push control unit harness terminal No. (36) and body ground?

Note

O.K. ↓

Replace control amp. built-in push control unit.

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

Diagnostic Procedure 15 (Cont'd)

DIAGNOSTIC PROCEDURE 15-2

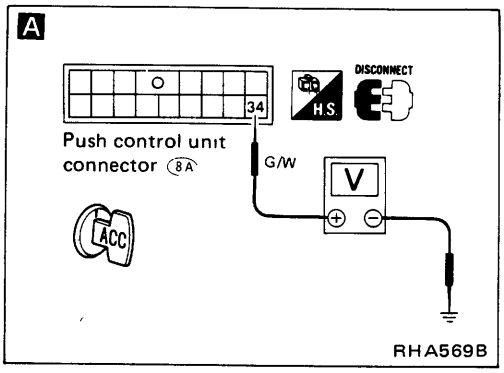
CHECK MAGNET CLUTCH OPERATION.
Does magnet clutch operate normally when engine ON, A/C switch, fan switch are ON?

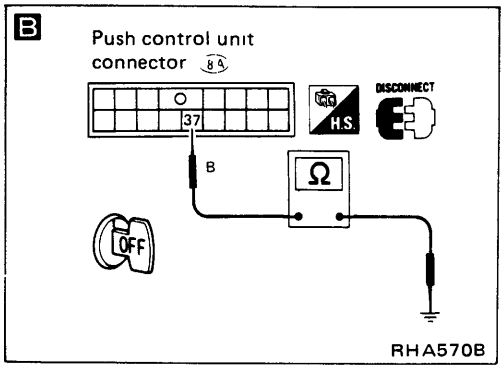
N.G. → Go to Diagnostic Procedure 10.

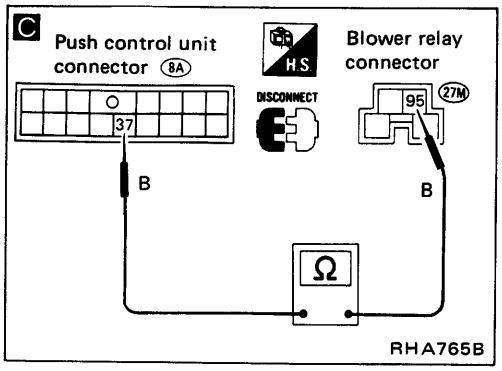
O.K. ↓

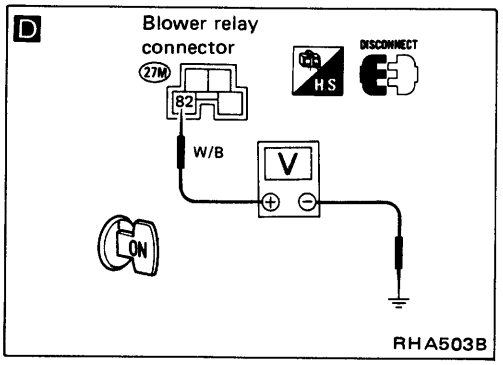
Replace control amp. built-in push control unit.

DIAGNOSTIC PROCEDURE 15-3









Turn ignition switch and lighting switch OFF.

↓

Disconnect push control unit harness connector.

↓

A

CHECK POWER SUPPLY FOR PUSH CONTROL UNIT.
Do approx. 12 volts exist between push control unit harness terminal No. (34) and body ground?

N.G. → Check 10A fuse at fuse block. (Refer to "POWER SUPPLY ROUTING" in EL section and A/C ELECTRICAL CIRCUIT.)

O.K. ↓

B

CHECK BODY GROUND CIRCUIT FOR PUSH CONTROL UNIT.
Does continuity exist between push control unit harness terminal No. (37) and body ground?

N.G. → Disconnect blower relay harness connector.

O.K. ↓

Replace control amp. built-in push control unit.

C

Note

Check circuit continuity between push control unit harness terminal No. (37) and blower relay harness terminal No. (95).

O.K. ↓

D

CHECK POWER SUPPLY FOR BLOWER RELAY.
Do approx. 12 volts exist between blower relay harness terminal No. (82) and body ground?

N.G. → Check 10A fuse at fuse block. (Refer to POWER SUPPLY ROUTING" in EL section and A/C ELECTRICAL CIRCUIT.)

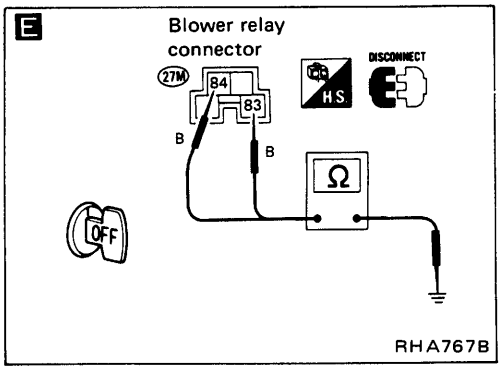
O.K. ↓

Ⓐ

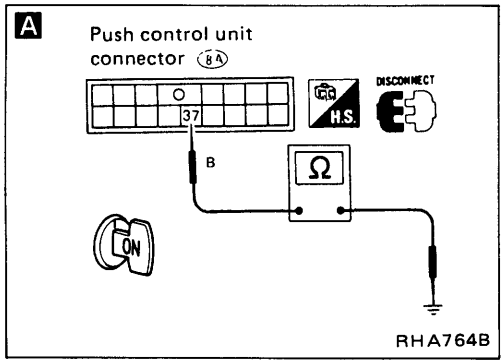
Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

Diagnostic Procedure 15 (Cont'd)

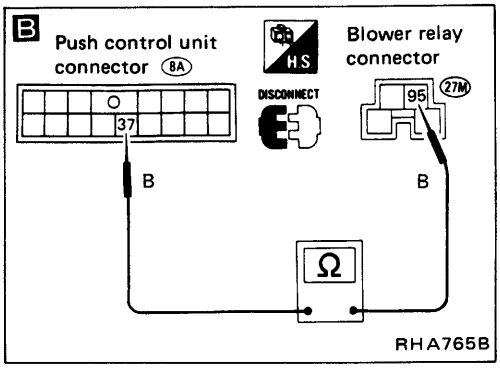
E



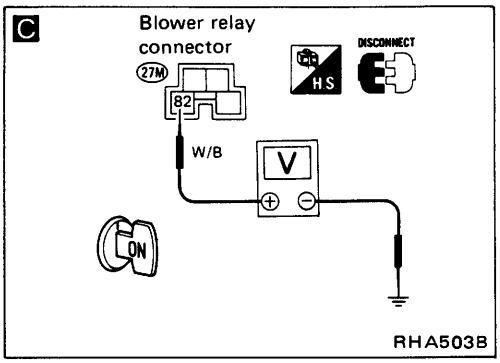
A



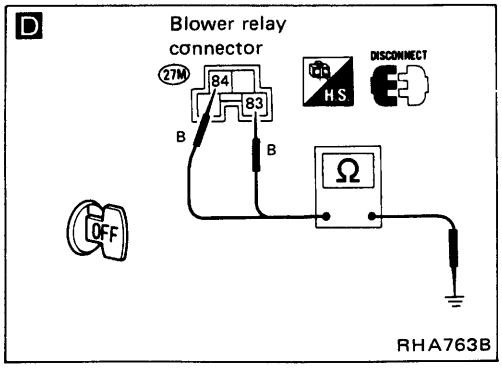
B



C



D



Ⓐ

E Note

Check circuit continuity between blower relay harness terminal No. ⑧③, ⑧④ and body ground.

↓ O.K.

CHECK BLOWER RELAY AFTER DISCONNECTING IT. (Refer to Electrical Components Inspection.)

N.G. → Replace blower relay.

DIAGNOSTIC PROCEDURE 15-4

Turn ignition switch and lighting switch OFF.

↓

Disconnect push control unit harness connector.

↓

A

CHECK BODY GROUND CIRCUIT FOR PUSH CONTROL UNIT.
Does continuity exist between push control unit harness terminal No. ㊲ and body ground?

N.G. → Disconnect blower relay harness connector.

↓

B Note

Check circuit continuity between push control unit harness terminal No. ㊲ and blower relay harness terminal No. ⑨⑤.

O.K.

↓ O.K.

Replace control amp. built-in push control unit.

C

CHECK POWER SUPPLY FOR BLOWER RELAY.
Do approx. 12 volts exist between blower relay harness terminal No. ⑧② and body ground?

N.G. → Check 10A fuse at fuse block. (Refer to POWER SUPPLY ROUTING" in EL section and A/C ELECTRICAL CIRCUIT.)

↓ O.K.

D Note

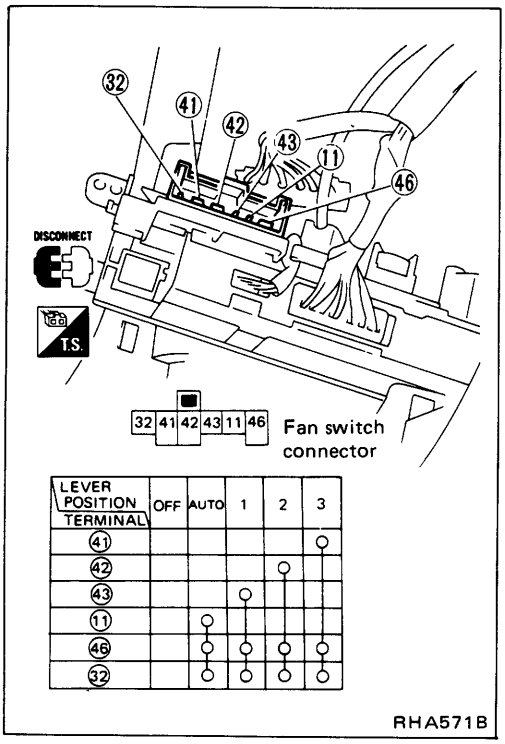
Check circuit continuity between blower relay harness terminal No. ⑧③, ⑧④ and body ground.

↓ O.K.

CHECK BLOWER RELAY AFTER DISCONNECTING IT. (Refer to Electrical Components Inspection.)

N.G. → Replace blower relay.

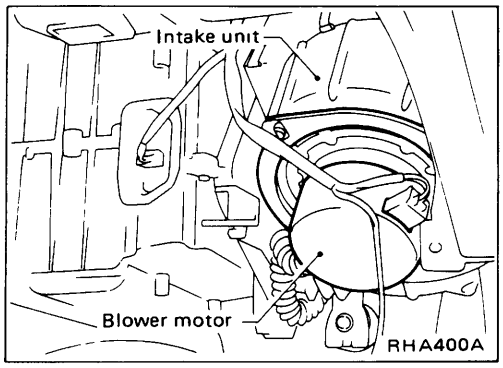
Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.



Electrical Components Inspection

FAN SWITCH

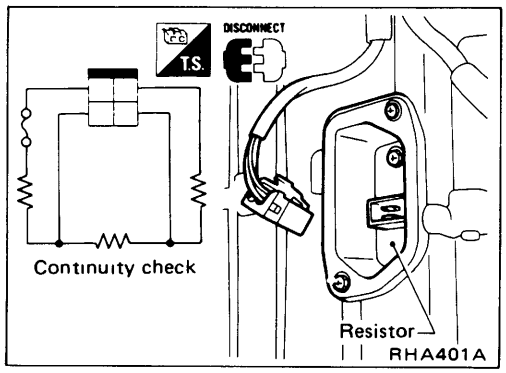
Check continuity between terminals at each switch position.



BLOWER MOTOR

Confirm smooth rotation of the blower motor.

- Ensure that there are no foreign particles inside the intake unit.



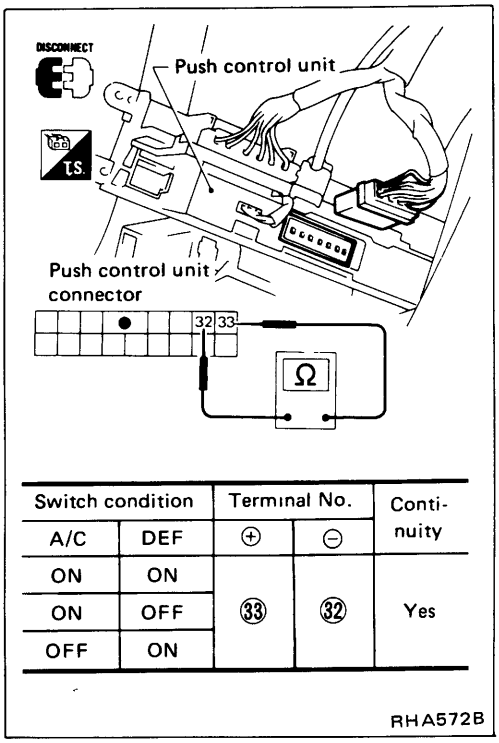
BLOWER RESISTOR

Check continuity between terminals.

Electrical Components Inspection (Cont'd)

A/C SWITCH

Check continuity between terminals at each switch position.



Switch condition		Terminal No.		Continuity
A/C	DEF	⊕	⊖	
ON	ON	33	32	Yes
ON	OFF			
OFF	ON			

RHA572B

DUAL-PRESSURE SWITCH

- **Refer to Refrigerant Lines.**

THERMO CONTROL AMP.

- **Refer to page HA-48.**

THERMAL PROTECTOR

- **Refer to Refrigerant Lines.**

IN-VEHICLE SENSOR

- **Refer to page HA-62.**

AMBIENT SENSOR

- **Refer to page HA-63.**

SUNLOAD SENSOR

- **Refer to page HA-64.**

WATER TEMPERATURE SENSOR

- **Refer to page HA-64.**

MICROSWITCH

- **Refer to page HA-65.**

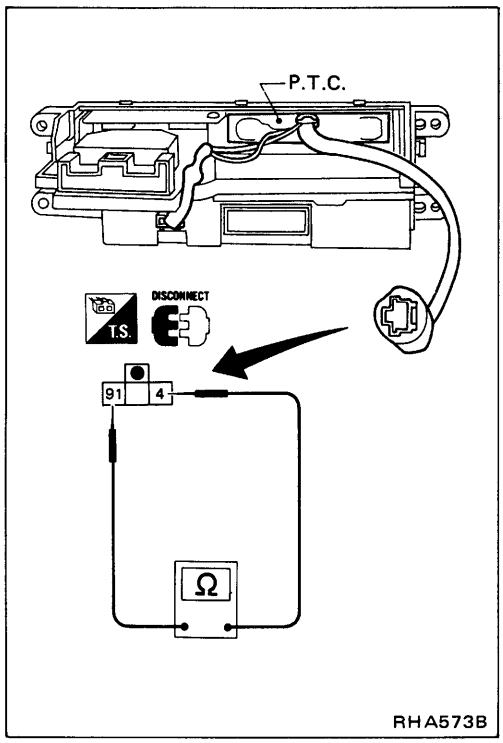
P.B.R.

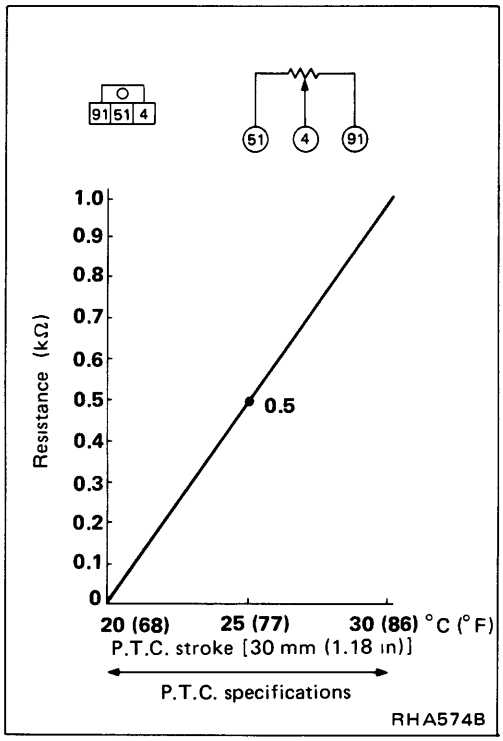
- **Refer to page HA-74.**

Electrical Components Inspection (Cont'd)

P.T.C.

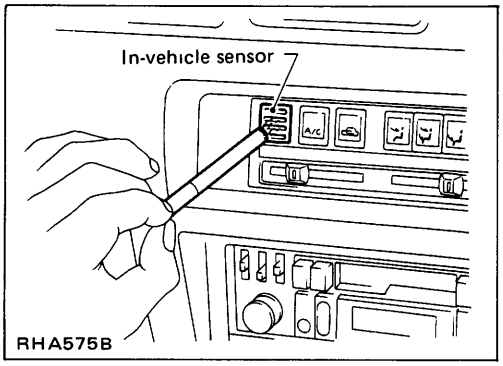
After disconnecting P.T.C. harness connector, measure resistance between terminals ④ and ⑨① at P.T.C. harness side.





ASPIRATOR MOTOR

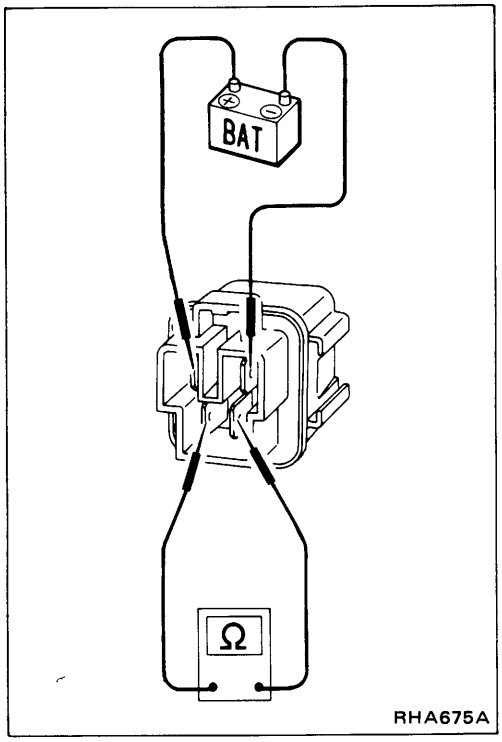
Check that smoke is properly sucked into in-vehicle sensor when a lighted cigarette is moved close to the sensor.



Electrical Components Inspection (Cont'd)

AUTO AMP. RELAY, BLOWER RELAY AND FAN RELAY

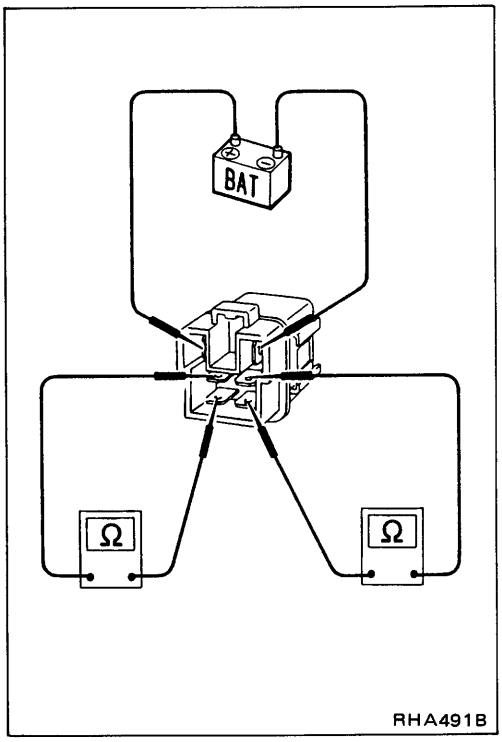
Check circuit continuity between terminals by supplying 12 volts to coil side terminal of auto amp. relay, blower relay and fan relay.



RHA675A

A/C RELAY

Check circuit continuity between terminals by supplying 12 volts to coil side terminal of A/C relay.



RHA491B

General Specifications

COMPRESSOR

Model	DKV-14C
Type	Vane rotary
Displacement cm^3 (cu in)/Rev	140 (8.54)
Direction of rotation	Clockwise (Viewed from drive end)
Drive belt	A type

LUBRICATION OIL

Model	DIESEL-KIKI make DKV-14C
Type	SUNISO 5GS
Capacity mℓ (US fl oz, Imp fl oz) Total in system	200 (6.8, 7.0)
Amount of oil which can be drained	70 - 120 (2.4 - 4.1, 2.5 - 4.2)
Compressor (Service parts) charging amount	200 (6.8, 7.0)

REFRIGERANT

Type		R-12
Capacity	kg (lb)	0.8 - 0.9 (1.8 - 2.0)

Inspection and Adjustment

ENGINE IDLING SPEED

When A/C is ON (F.I.C.D. is actuated)

Unit: rpm

Transmission	Engine model	
	VG30E	KA24E
Manual	750 - 850	800 - 900
Automatic (In "N" range)		

BELT TENSION

Refer to Checking Drive Belts (MA section).

COMPRESSOR

Model	DKV-14C
Clutch disc-to-pulley clearance mm (in)	0.3 - 0.6 (0.012 - 0.024)

Tightening Torque

COMPRESSOR INSTALLATION

	VG engine model			KA engine model		
	N·m	kg-m	ft-lb	N·m	kg-m	ft-lb
Compressor bracket to cylinder block	44 - 52	4.5 - 5.3	33 - 38	36 - 50	3.7 - 5.1	27 - 37
Compressor to compressor bracket	44 - 52	4.5 - 5.3	33 - 38	36 - 50	3.7 - 5.1	27 - 37
Idler pulley to compressor bracket	–	–	–	16 - 22	1.6 - 2.2	12 - 16
Idler pulley to idler pulley bracket	16 - 22	1.6 - 2.2	12 - 16	–	–	–
Idler pulley bracket to cylinder block (L.H.)	16 - 19	1.6 - 1.9	12 - 14	–	–	–
Idler pulley bracket to cylinder block (R.H.)	23 - 26	2.3 - 2.7	17 - 20	–	–	–

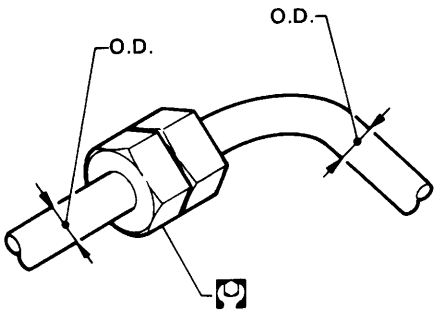
COMPRESSOR

Model	DKV-14C		
	N·m	kg-m	ft-lb
Center bolt	15 - 18	1.5 - 1.8	11 - 13
Thermal protector	15 - 18	1.5 - 1.8	11 - 13
Coil mounting screw	4 - 6	0.4 - 0.6	2.9 - 4.3

REFRIGERANT LINE

When connecting lines made of different material, basically use the lower tightening torque of the two.

Union type (pipe to pipe)

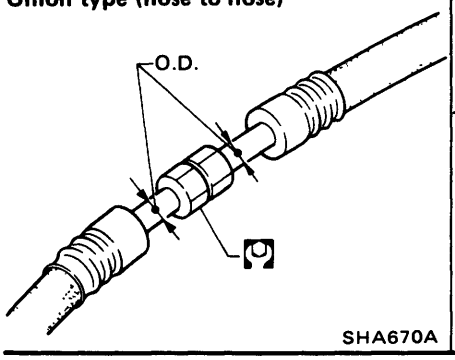


SHA669A

Pipe O.D. mm (in)	Material					
	Steel or copper			Aluminum		
	N·m	kg-m	ft-lb	N·m	kg-m	ft-lb
6 (1/4)	10 - 20	1.0 - 2.0	7 - 14	–	–	–
8 (5/16)	15 - 25	1.5 - 2.5	11 - 18	10 - 20	1.0 - 2.0	7 - 14
10 (3/8)	15 - 25	1.5 - 2.5	11 - 18	10 - 20	1.0 - 2.0	7 - 14
12 (1/2)	20 - 29	2.0 - 3.0	14 - 22	15 - 25	1.5 - 2.5	11 - 18
16 (5/8)	25 - 34	2.5 - 3.5	18 - 25	20 - 29	2.0 - 3.0	14 - 22
19 (3/4)	25 - 34	2.5 - 3.5	18 - 25	20 - 29	2.0 - 3.0	14 - 22

Tightening Torque (Cont'd)

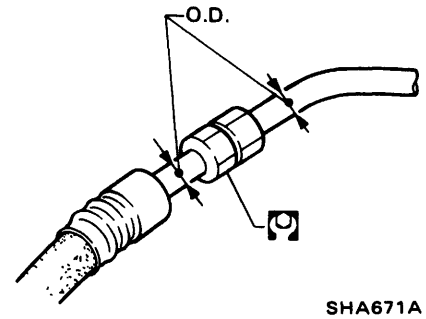
Union type (hose to hose)



SHA670A

Pipe O.D. mm (in)	Material					
	Steel or copper			Aluminum		
	N·m	kg-m	ft-lb	N·m	kg-m	ft-lb
6 (1/4)	10 - 20	1.0 - 2.0	7 - 14	–	–	–
8 (5/16)	15 - 25	1.5 - 2.5	11 - 18	10 - 20	1.0 - 2.0	7 - 14
10 (3/8)	15 - 25	1.5 - 2.5	11 - 18	10 - 20	1.0 - 2.0	7 - 14
12 (1/2)	25 - 34	2.5- 3.5	18 - 25	20 - 29	2.0 - 3.0	14 - 22
16 (5/8)	25 - 34	2.5 - 3.5	18 - 25	20 - 29	2.0 - 3.0	14 - 22

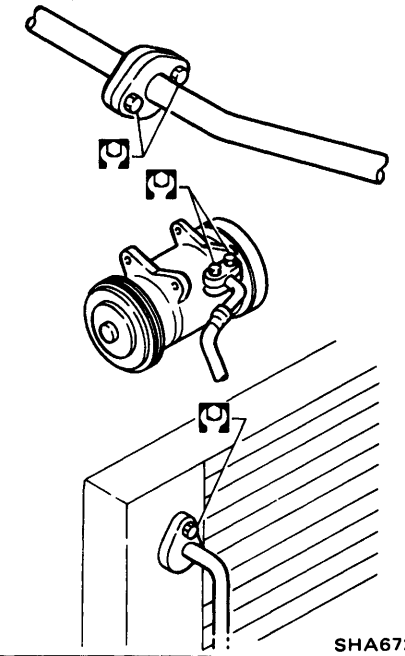
Union type (hose to pipe)



SHA671A

- Use tightening torque for flexible hose.

Plate type


SHA672A

Bolt type				Tightening torque		
Grade	Nominal size	Bolt diameter mm	Pitch mm	N·m	kg-m	ft-lb
4T	M6	6.0	1.0	3 - 4	0.3 - 0.4	2.2 - 2.9
	M8	8.0	1.25	8 - 11	0.8 - 1.1	5.8 - 8.0
	M10	10.0	1.5	16 - 22	1.6 - 2.2	12 - 16
7T	M6	6.0	1.0	6 - 7	0.6 - 0.7	4.3 - 5.1
	M8	8.0	1.25	14 - 18	1.4 - 1.8	10 - 13
	M10	10.0	1.5	25 - 35	2.6 - 3.6	19 - 26

ELECTRICAL SYSTEM

SECTION EL

When you read wiring diagrams:
- Read GI section, "HOW TO READ WIRING DIAGRAMS".

CONTENTS

HARNESS CONNECTOR ..... EL- 2
STANDARDIZED RELAY ..... EL- 3
POWER SUPPLY ROUTING ..... EL- 5
BATTERY ..... EL- 7
STARTING SYSTEM ..... EL- 15
STARTING SYSTEM — Starter — ..... EL- 18
CHARGING SYSTEM ..... EL- 30
CHARGING SYSTEM — Alternator — ..... EL- 32
COMBINATION SWITCH ..... EL- 37
HEADLAMP ..... EL- 39
EXTERIOR LAMP ..... EL- 44
INTERIOR LAMP ..... EL- 50
METER AND GAUGES ..... EL- 54
WARNING LAMPS AND CHIME ..... EL- 61
WIPER AND WASHER ..... EL- 68
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AUTOMATIC SPEED CONTROL DEVICE (A.S.C.D.) ..... EL- 80
LOCATION OF ELECTRICAL UNITS ..... EL- 88
HARNESS LAYOUT ..... EL- 91
SPECIAL SERVICE TOOL EL-106
SUPER MULTIPLE JUNCTION (S.M.J.) EL-107

WIRING DIAGRAM REFERENCE CHART

E.C.C.S. ..... EF & EC SECTION
A/T CONTROL SYSTEM ..... AT SECTION
ADJUSTABLE SHOCK ABSORBER ... FA SECTION
POWER WINDOW ..... BF SECTION
POWER DOOR LOCK ..... BF SECTION
BACK DOOR WINDOW OPENER ..... BF SECTION
DOOR MIRROR ..... BF SECTION
HEATER AND AIR CONDITIONER ... HA SECTION

Description

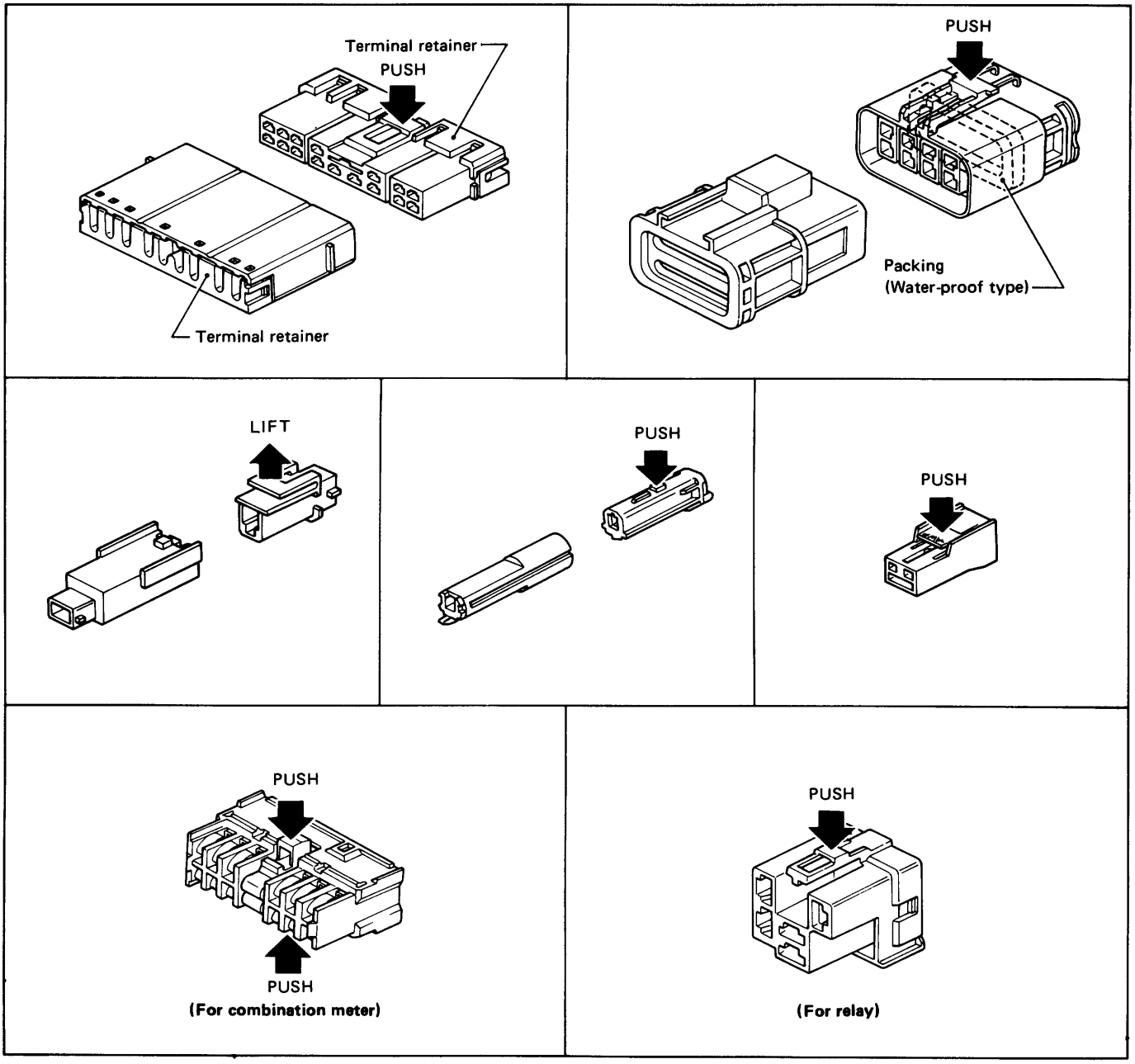
HARNESS CONNECTOR

- All harness connectors prevent accidental looseness or disconnection.
- The connector can be disconnected by pushing or lifting the locking section.

CAUTION:

Do not pull the harness when disconnecting the connector.

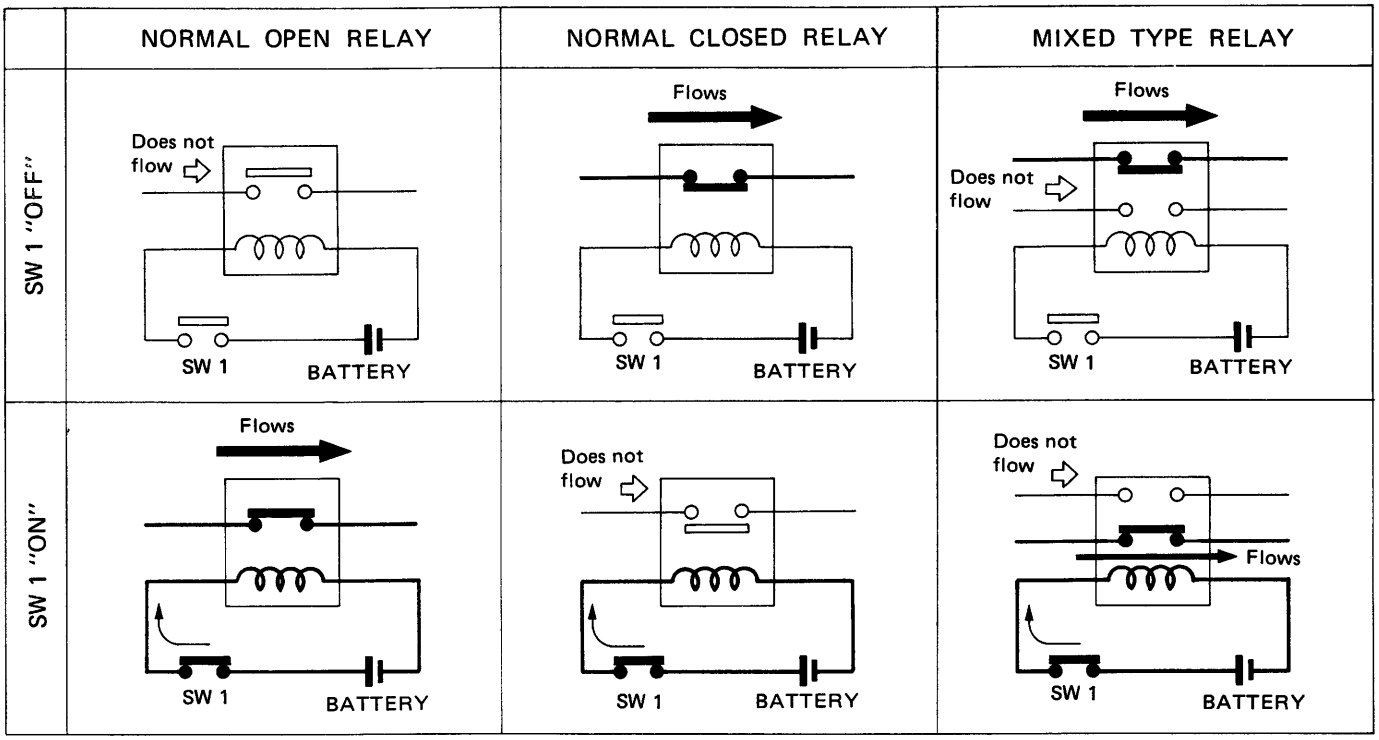
[Example]



SEL769D

Normal Open, Normal Closed and Mixed Type Relays

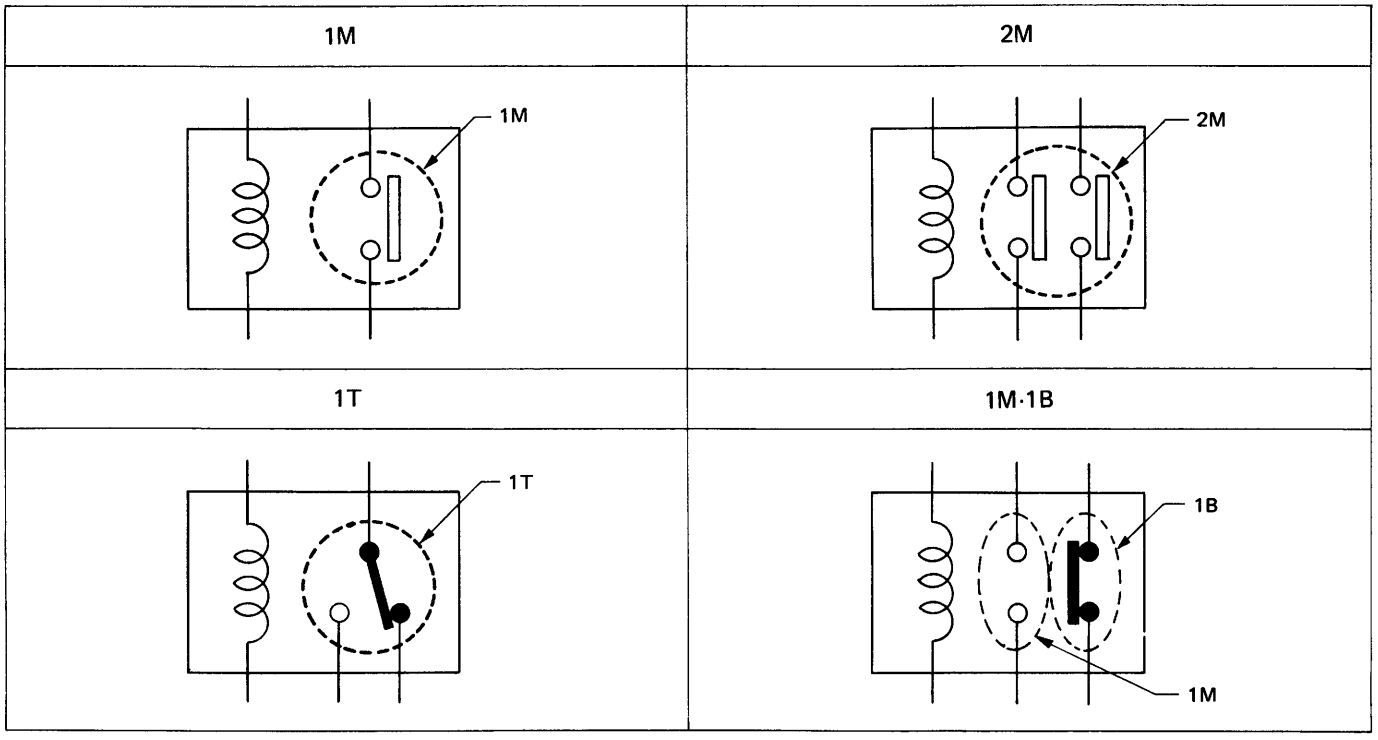
Relays can mainly be divided into three types: normal open, normal closed and mixed type relays.



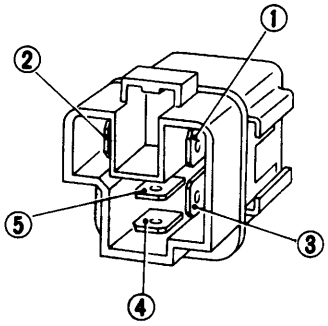
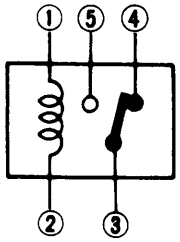
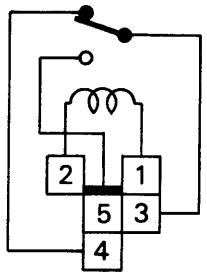
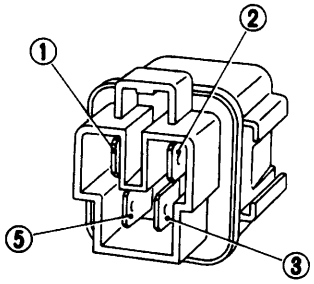
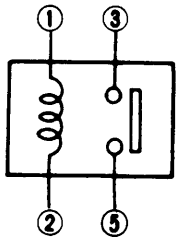
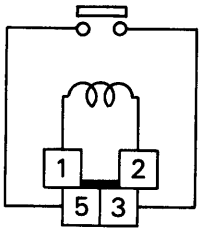
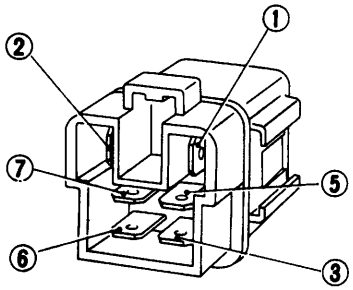
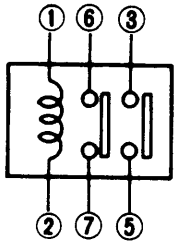
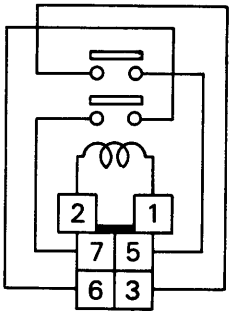
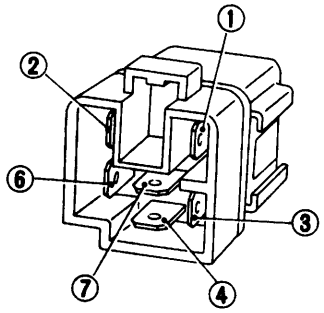
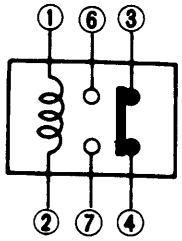
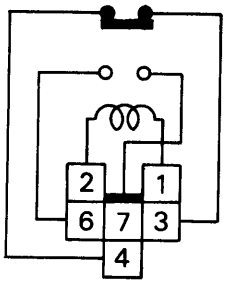
SEL881H

Type of Standardized Relays

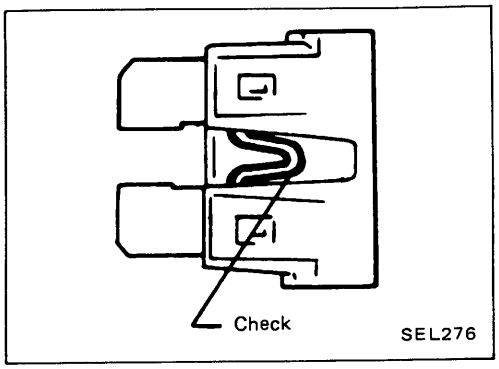
1M ..... 1 Make
1T ..... 1 Transfer
2M ..... 2 Make
1M·1B ..... 1 Make 1 Break

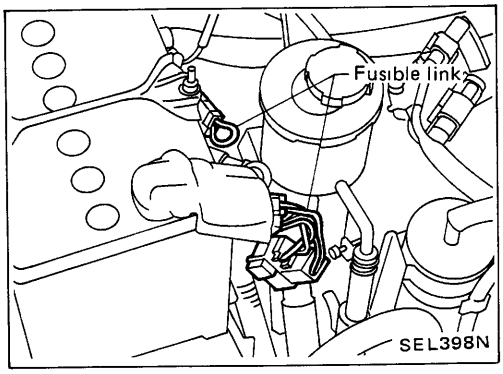


SEL882H

Type	Outer view	Circuit	Connector symbol and connection	Case color
1T				BLACK
1M				BLUE or GREEN
2M				BROWN
1M·1B				GRAY

SEL883H





Fuse

a. If fuse is blown, be sure to eliminate cause of problem before installing new fuse.
b. Use fuse of specified rating. Never use fuse of more than specified rating.
c. Do not install fuse in oblique direction; always insert it into fuse holder properly.
d. Remove fuse for clock if vehicle is not used for a long period of time.

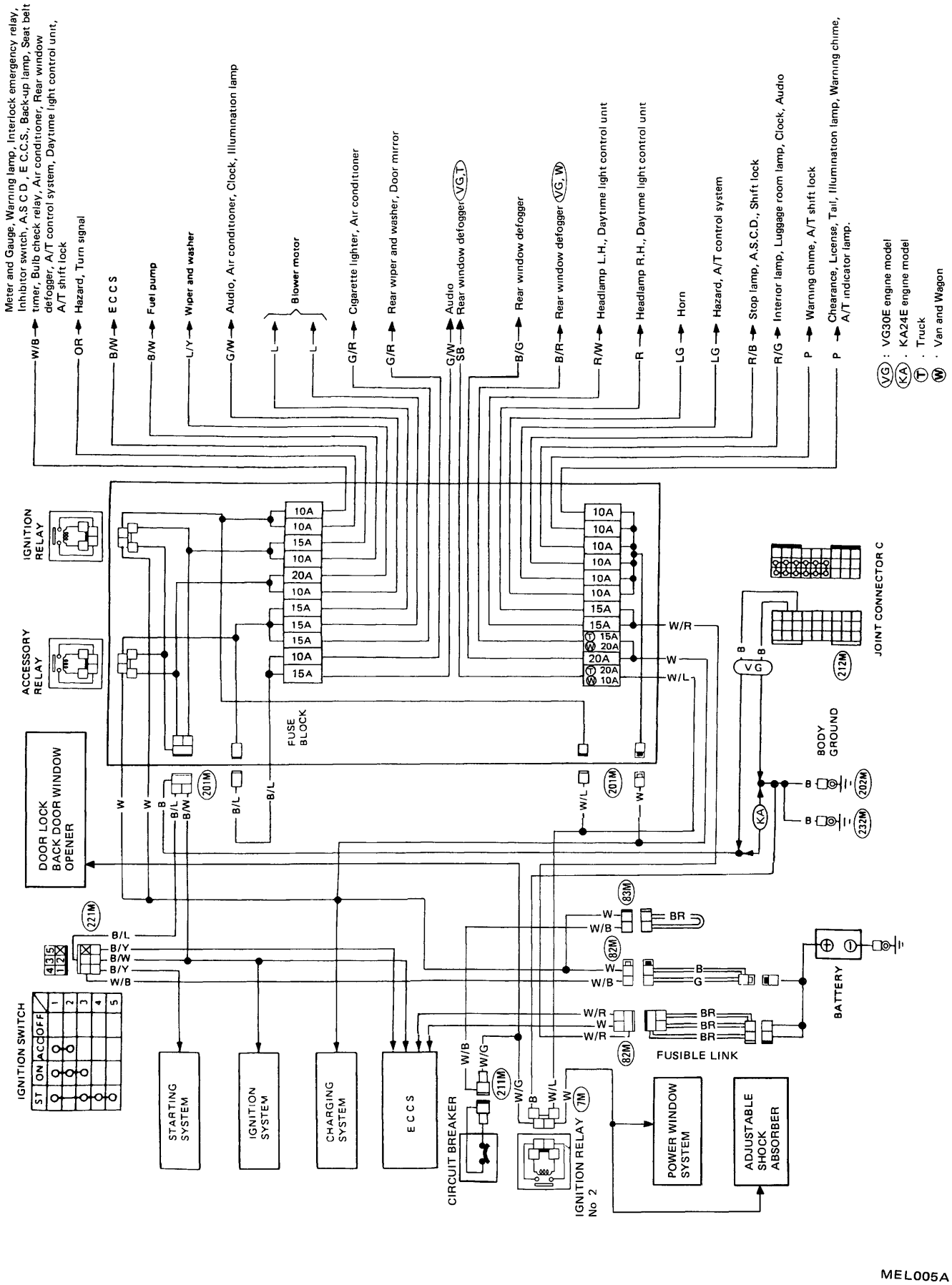
Fusible Link

A melted fusible link can be detected either by visual inspection or by feeling with finger tip. If its condition is questionable, use circuit tester or test lamp.

CAUTION:

a. If fusible link should melt, it is possible that critical circuit (power supply or large current carrying circuit) is shorted. In such a case, carefully check and eliminate cause of problem.
b. Never wrap periphery of fusible link with vinyl tape. Extreme care should be taken with this link to ensure that it does not come into contact with any other wiring harness or vinyl or rubber parts.

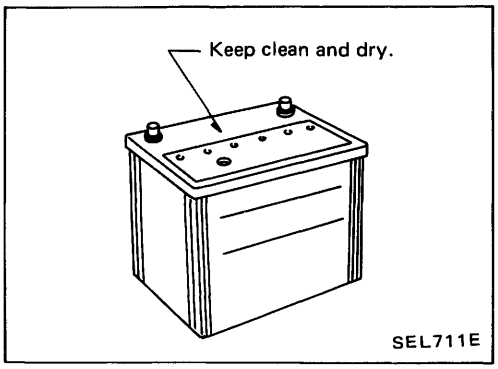
Wiring Diagram



MEL005A

CAUTION:

a. **If it becomes necessary to start the engine with a booster battery and jumper cables, use a 12-volt booster battery.**
b. **After connecting battery cables, ensure that they are tightly clamped to battery terminals for good contact.**
c. **Never add distilled water through the hole used to check specific gravity.**

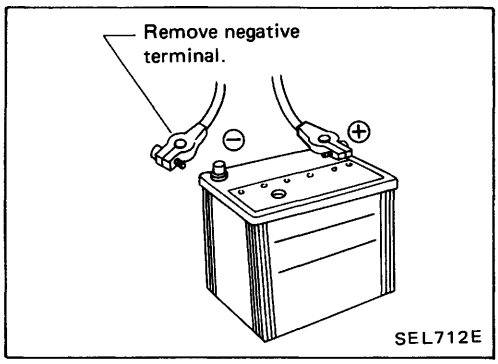


How to Handle Battery

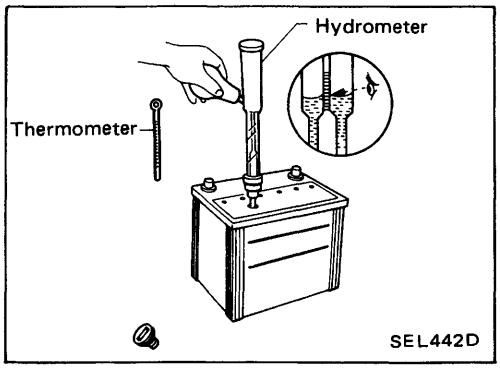
METHODS OF PREVENTING OVER-DISCHARGE

The following precautions must be taken to prevent over-discharging a battery.

- The battery surface (particularly its top) should always be kept clean and dry.
  If the top surface of a battery is wet with electrolyte or water, leakage current will cause the battery to discharge. Always keep the battery clean and dry.



- When the vehicle is not going to be used over a long period of time, disconnect the negative battery terminal. (If the vehicle has an extended storage switch, turn it off.)



- Check the charge condition of the battery.
  Periodically check the specific gravity of the electrolyte. Keep a close check on charge condition to prevent over-discharge.

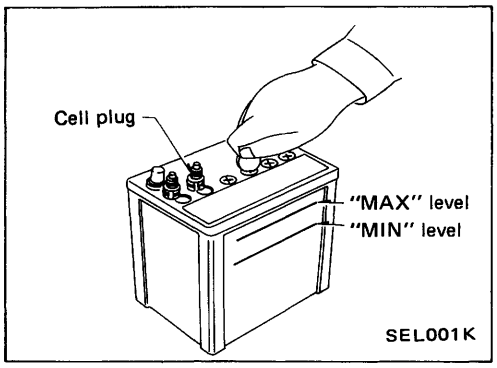
How to Handle Battery (Cont'd)

CHECKING ELECTROLYTE LEVEL

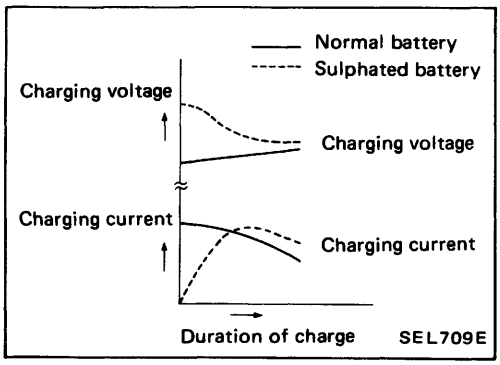
WARNING:

Do not allow battery fluid to come in contact with skin, eyes, fabrics, or painted surfaces. After touching a battery, do not touch or rub your eyes until you have thoroughly washed your hands. If the acid contacts the eyes, skin or clothing, immediately flush with water for 15 minutes and seek medical attention.

Normally the battery does not require additional water. However, when the battery is used under severe conditions, adding distilled water may be necessary during the battery life.



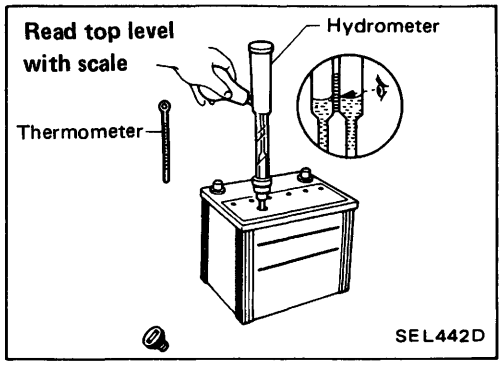
- Remove the cell plug using a suitable tool.
- Add distilled water up to the MAX level.



SULPHATION

When a battery has been left unattended for a long period of time and has a specific gravity of less than 1.100, it will be completely discharged, resulting in sulphation on the cell plates.

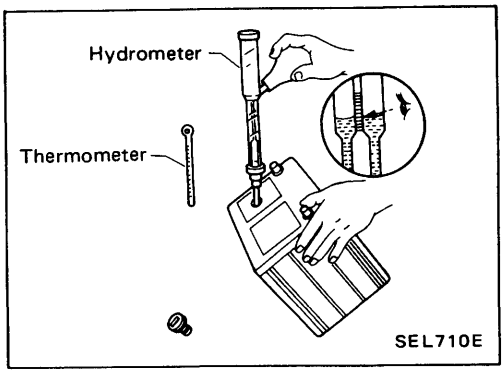
Compared with a battery discharged under normal conditions, the current flow in a "sulphated" battery is not as smooth although its voltage is high during the initial stage of charging, as shown in the figure at the left.



SPECIFIC GRAVITY CHECK

1. Read hydrometer and thermometer indications at eye level.

How to Handle Battery (Cont'd)

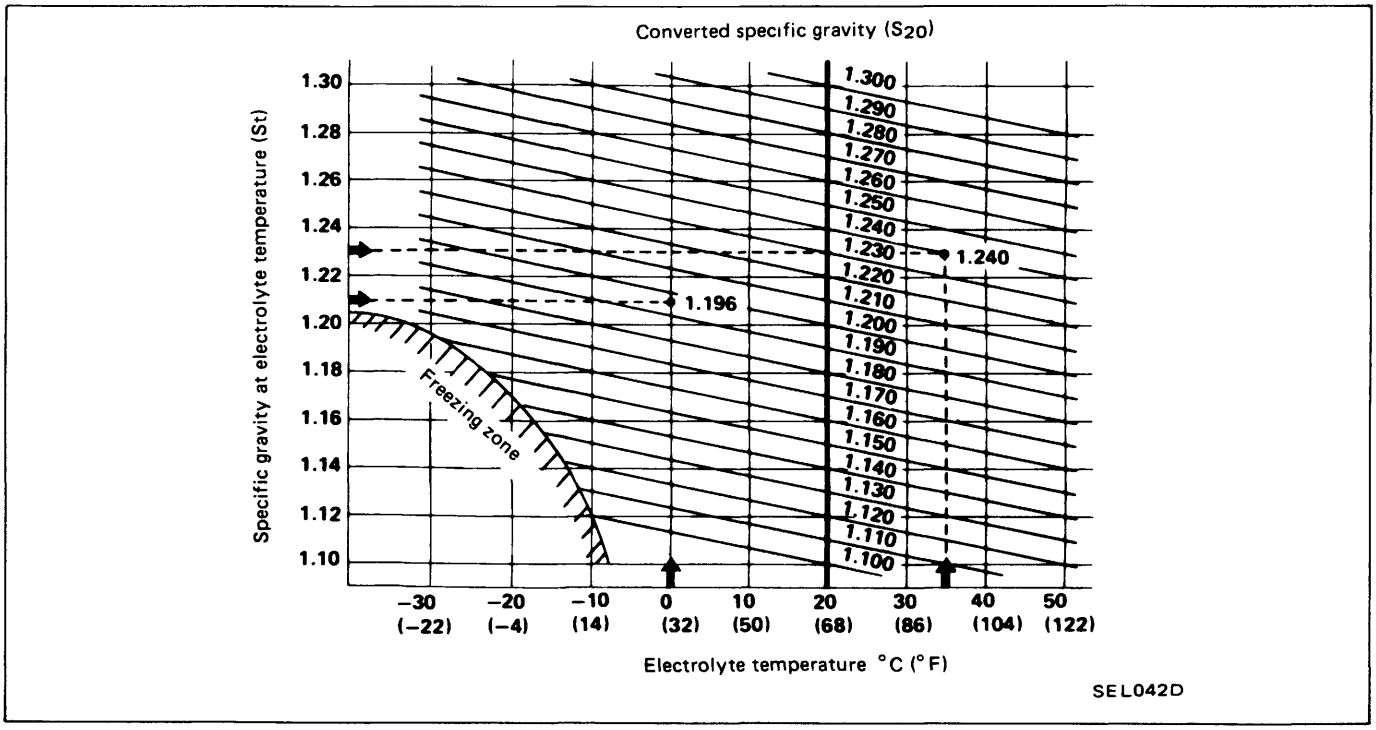


- When electrolyte level is too low, tilt battery case to raise it for easy measurement.

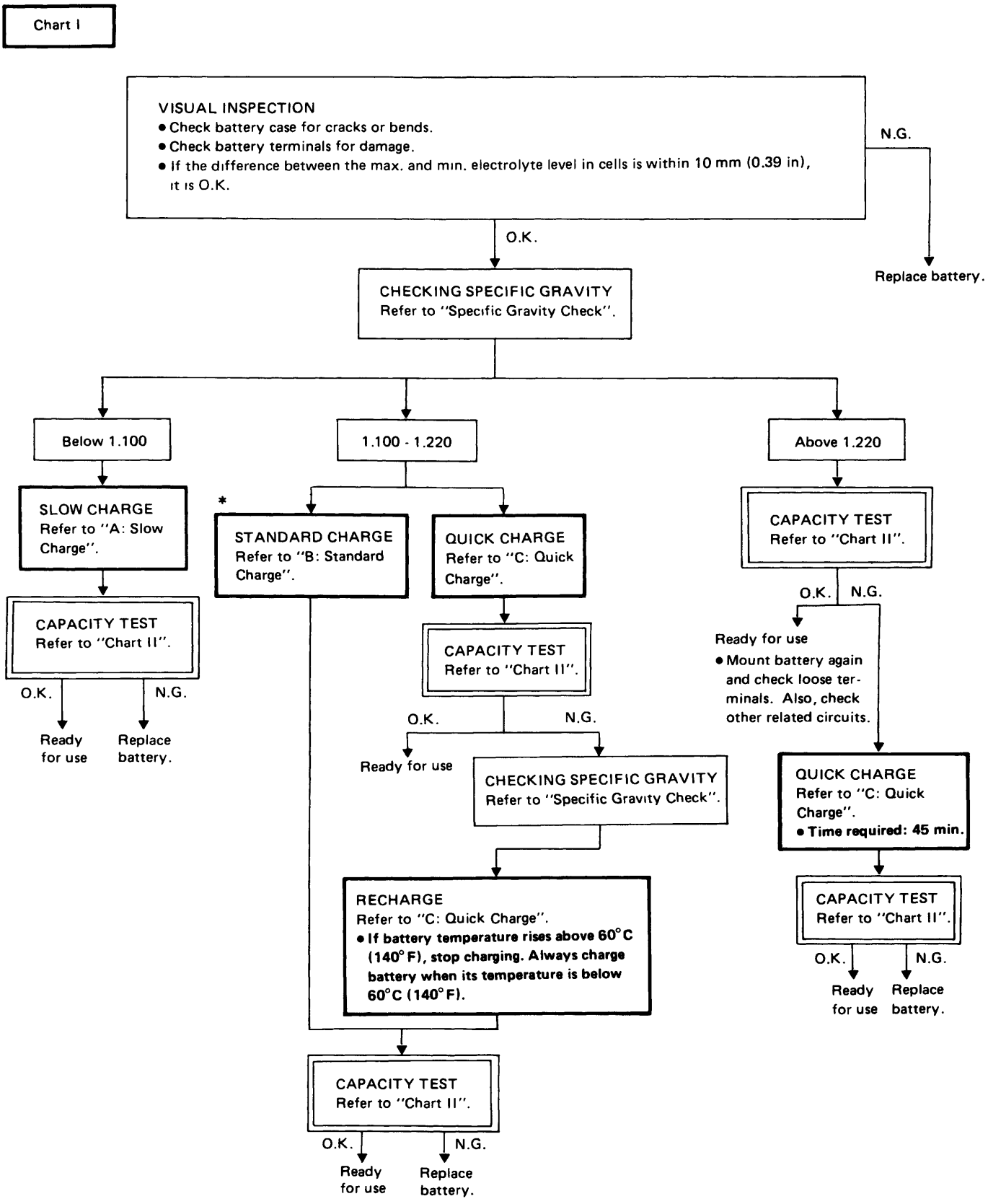
2. Convert into specific gravity at 20°C (68°F).

Example:

- When electrolyte temperature is 35°C (95°F) and specific gravity of electrolyte is 1.230, converted specific gravity at 20°C (68°F) is 1.240.
- When electrolyte temperature is 0°C (32°F) and specific gravity of electrolyte is 1.210, converted specific gravity at 20°C (68°F) is 1.196.



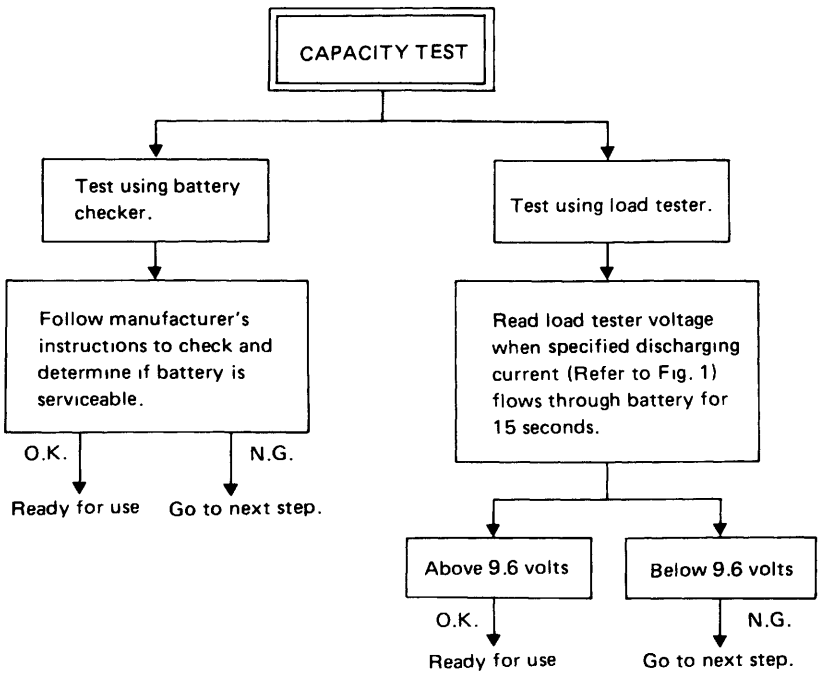
Battery Test and Charging Chart



* "STANDARD CHARGE" is recommended in case that the vehicle is in storage after charging.

Battery Test and Charging Chart (Cont'd)

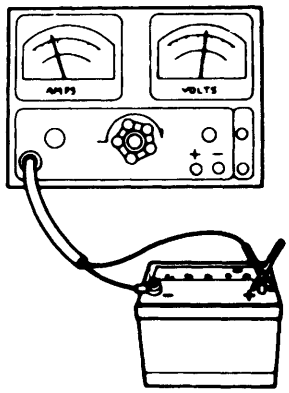
Chart II



- Check battery type and determine the specified current using the following table.

Fig. 1 DISCHARGING CURRENT (Load tester)

Type	Current (A)
28B19R(L)	90
34B19R(L)	99
46B24R(L)	135
55B24R(L)	135
50D23R(L)	150
55D23R(L)	180
65D26R(L)	195
80D26R(L)	195
75D31R(L)	210
95D31R(L)	240
95E41R(L)	300
130E41R(L)	330



SEL697B

Battery Test and Charging Chart (Cont'd)

A: SLOW CHARGE

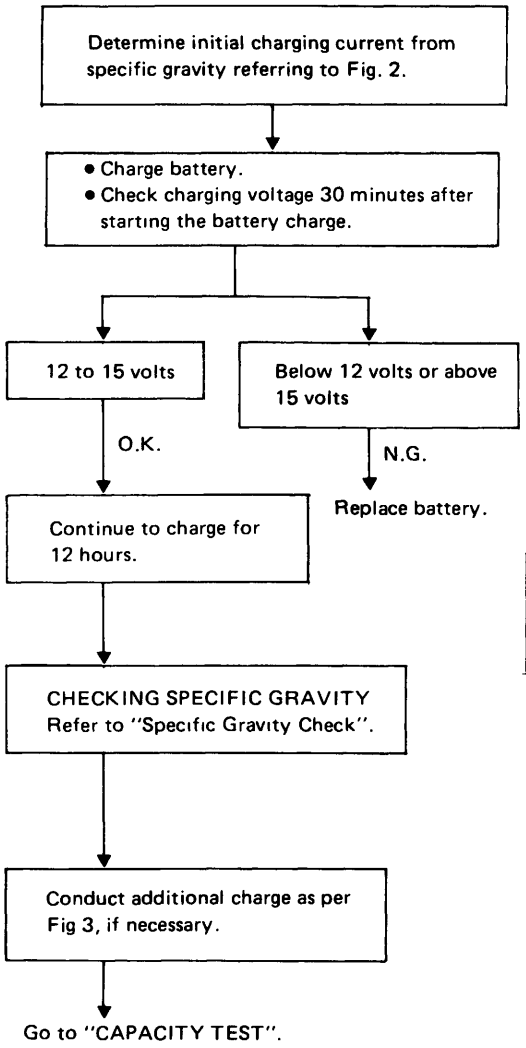
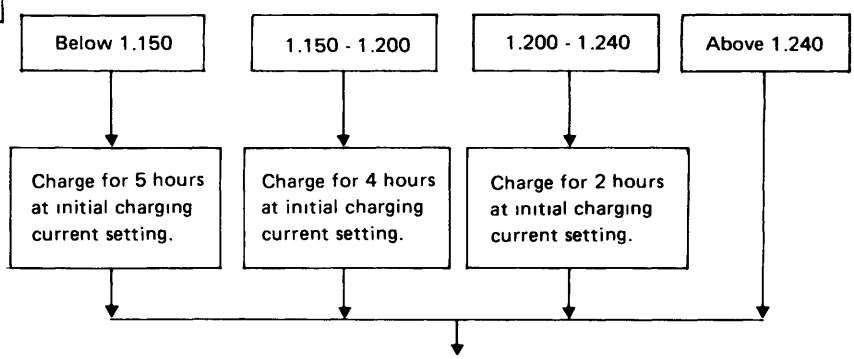


Fig. 2 INITIAL CHARGING CURRENT SETTING (Slow charge)

BATTERY TYPE / CONVERTED SPECIFIC GRAVITY	28B19R(L) 34B19R(L)	46B24R(L) 55B24R(L)	50D23R(L) 55D23R(L)	65D26R(L) 80D26R(L)	75D31R(L)	95D31R(L) 95E41R(L)	130E41R(L)
Below 1.100	4.0 (A)	5.0 (A)	7.0 (A)	8.0 (A)	9.0 (A)	10.0 (A)	14.0 (A)

- Check battery type and determine the specified current using the table shown above.
- After starting charging, adjustment of charging current is not necessary.

Fig. 3 ADDITIONAL CHARGE (Slow charge)



CAUTION:

a. **Set charging current to value specified in Fig. 2. If charger is not capable of producing specified current value, set its charging current as close to that value as possible.**
b. **Keep battery away from open flame while it is being charged.**
c. **When connecting charger, connect leads first, then turn on charger. Do not turn on charger first, as this may cause a spark.**
d. **If battery temperature rises above 60°C (140°F), stop charging. Always charge battery when its temperature is below 60°C (140°F).**

Battery Test and Charging Chart (Cont'd)

B: STANDARD CHARGE

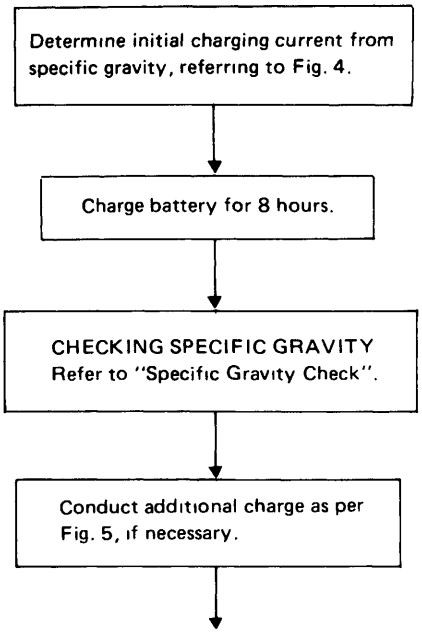
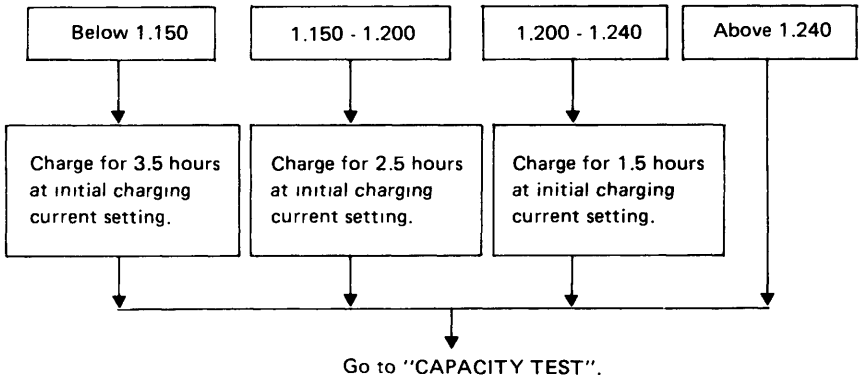


Fig. 4 INITIAL CHARGING CURRENT SETTING
(Standard charge)

BATTERY TYPE / CONVERTED SPECIFIC GRAVITY	28B19R(L) 34B19R(L)	46B24R(L) 55B24R(L)	50D23R(L) 55D23R(L)	65D26R(L) 80D26R(L)	75D31R(L)	95D31R(L) 95E41R(L)	130E41R(L)
1.100 - 1.130	4.0 (A)	5.0 (A)	6.0 (A)	7.0 (A)	8.0 (A)	9.0 (A)	13.0 (A)
1.130 - 1.160	3.0 (A)	4.0 (A)	5.0 (A)	6.0 (A)	7.0 (A)	8.0 (A)	11.0 (A)
1.160 - 1.190	2.0 (A)	3.0 (A)	4.0 (A)	5.0 (A)	6.0 (A)	7.0 (A)	9.0 (A)
1.190 - 1.220	2.0 (A)	2.0 (A)	3.0 (A)	4.0 (A)	5.0 (A)	5.0 (A)	7.0 (A)

- Check battery type and determine the specified current using the table shown above.
- After starting charging, adjustment of charging current is not necessary.

Fig. 5 ADDITIONAL CHARGE (Standard charge)



CAUTION:

a. **Do not use standard charge method on a battery whose specific gravity is less than 1.100.**
b. **Set charging current to value specified in Fig. 4. If charger is not capable of producing specified current value, set its charging current as close to that value as possible.**
c. **Keep battery away from open flame while it is being charged.**
d. **When connecting charger, connect leads first, then turn on charger. Do not turn on charger first, as this may cause a spark.**
e. **If battery temperature rises above 60°C (140°F), stop charging. Always charge battery when its temperature is below 60°C (140°F).**

Battery Test and Charging Chart (Cont'd)

C: QUICK CHARGE

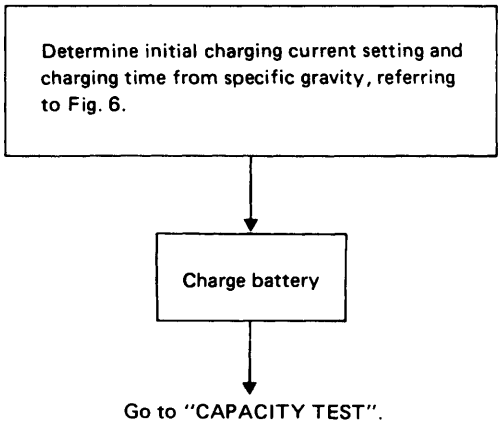


Fig. 6 INITIAL CHARGING CURRENT SETTING AND CHARGING TIME (Quick charge)

BATTERY TYPE / CURRENT [A] / CONVERTED SPECIFIC GRAVITY	28B19R(L) 34B19R(L)	46B24R(L) 55B24R(L) 50D23R(L)	55D23R(L) 65D26R(L) 80D26R(L)	75D31R(L) 95D31R(L) 95E41R(L)	130E41R(L)
	10 (A)	15 (A)	20 (A)	30 (A)	40 (A)
1.100 - 1.130	2.5 hours				
1.130 - 1.160	2.0 hours				
1.160 - 1.190	1.5 hours				
1.190 - 1.220	1.0 hours				
Above 1.220	0.75 hours (45 min.)				

- Check battery type and determine the specified current using the table shown above.
- After starting charging, adjustment of charging current is not necessary.

CAUTION:

a. **Do not use quick charge method on a battery whose specific gravity is less than 1.100.**
b. **Set initial charging current to value specified in Fig. 6. If charger is not capable of producing specified current value, set its charging current as close to that value as possible.**
c. **Keep battery away from open flame while it is being charged.**
d. **When connecting charger, connect leads first, then turn on charger. Do not turn on charger first, as this may cause a spark.**
e. **Be careful of a rise in battery temperature because a large current flow is required during quick-charge operation.**
   If battery temperature rises above 60°C (140°F), stop charging. Always charge battery when its temperature is below 60°C (140°F).
f. **Do not exceed the charging time specified in Fig. 6, because charging battery over the charging time can cause deterioration of the battery.**

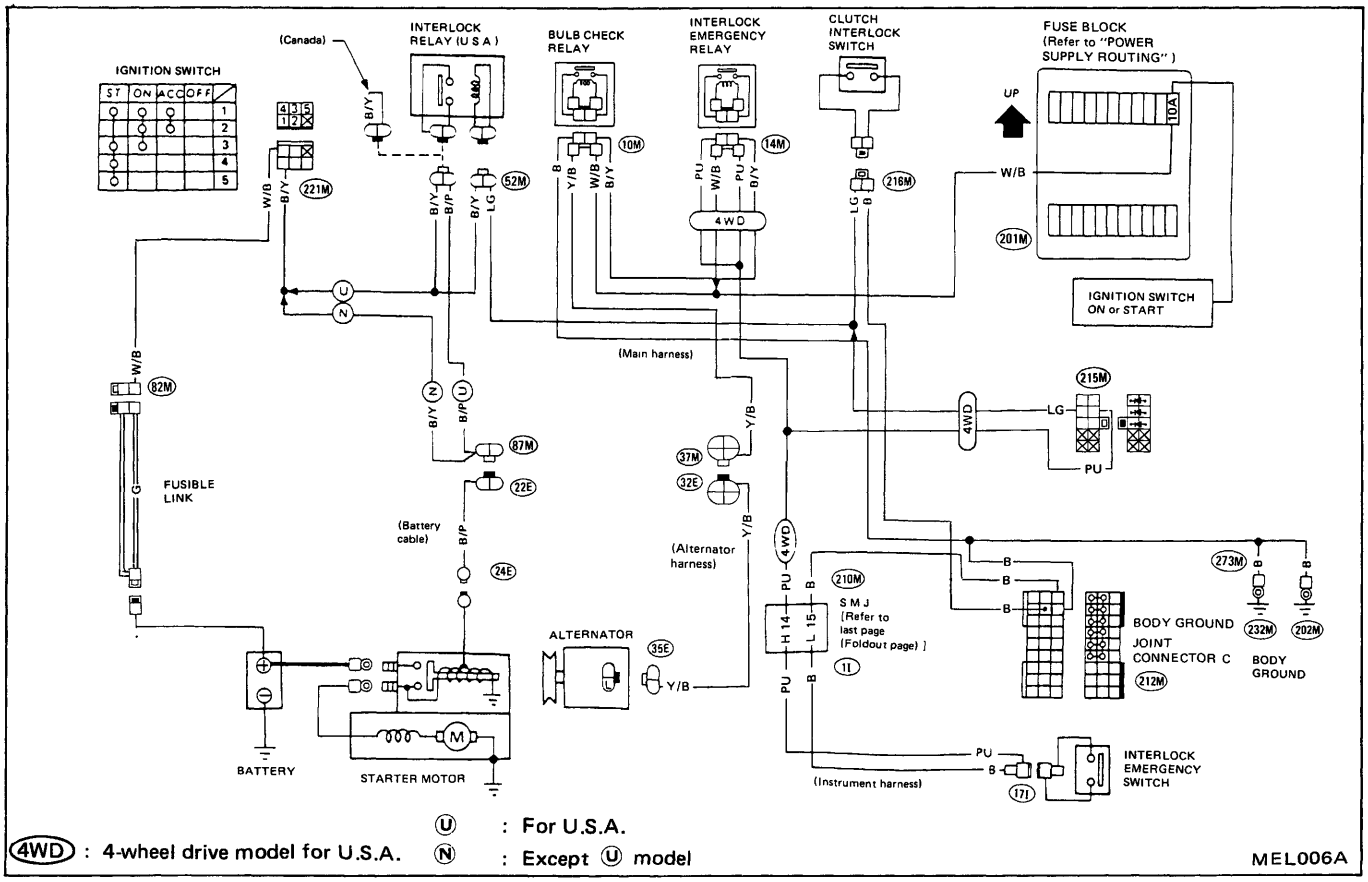
Service Data and Specifications (S.D.S.)

Applied area		U.S.A.	Canada	Canada & U.S.A. option
Engine		All	KA24E	VG30E
Type		55D23R	65D26R	75D31R
Capacity	V-AH	12-60	12-65	12-70

Wiring Diagram

VG30E ENGINE MODEL

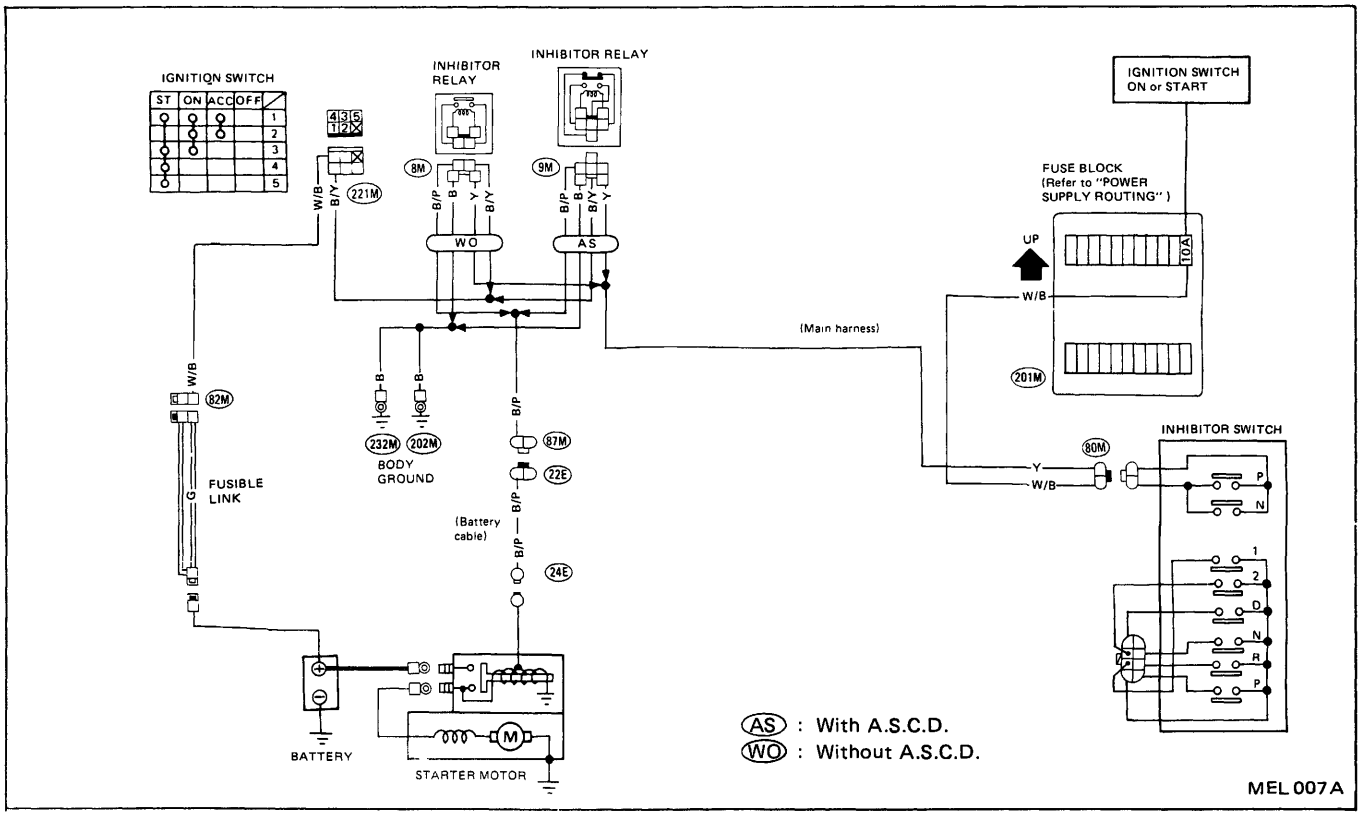
M/T model



(U) : For U.S.A.
(N) : Except (U) model
(4WD) : 4-wheel drive model for U.S.A.

MEL006A

A/T model



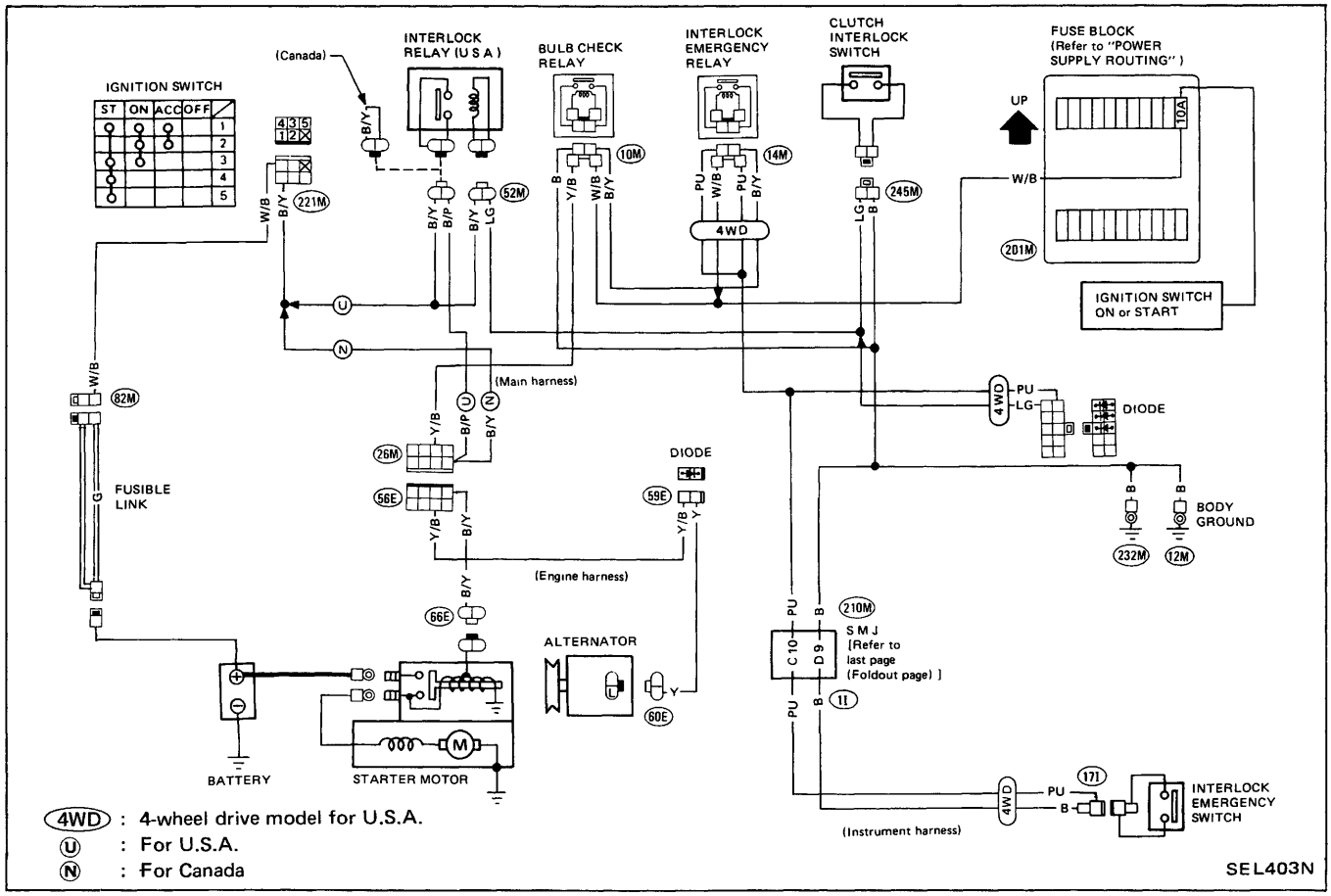
(AS) : With A.S.C.D.
(WO) : Without A.S.C.D.

MEL007A

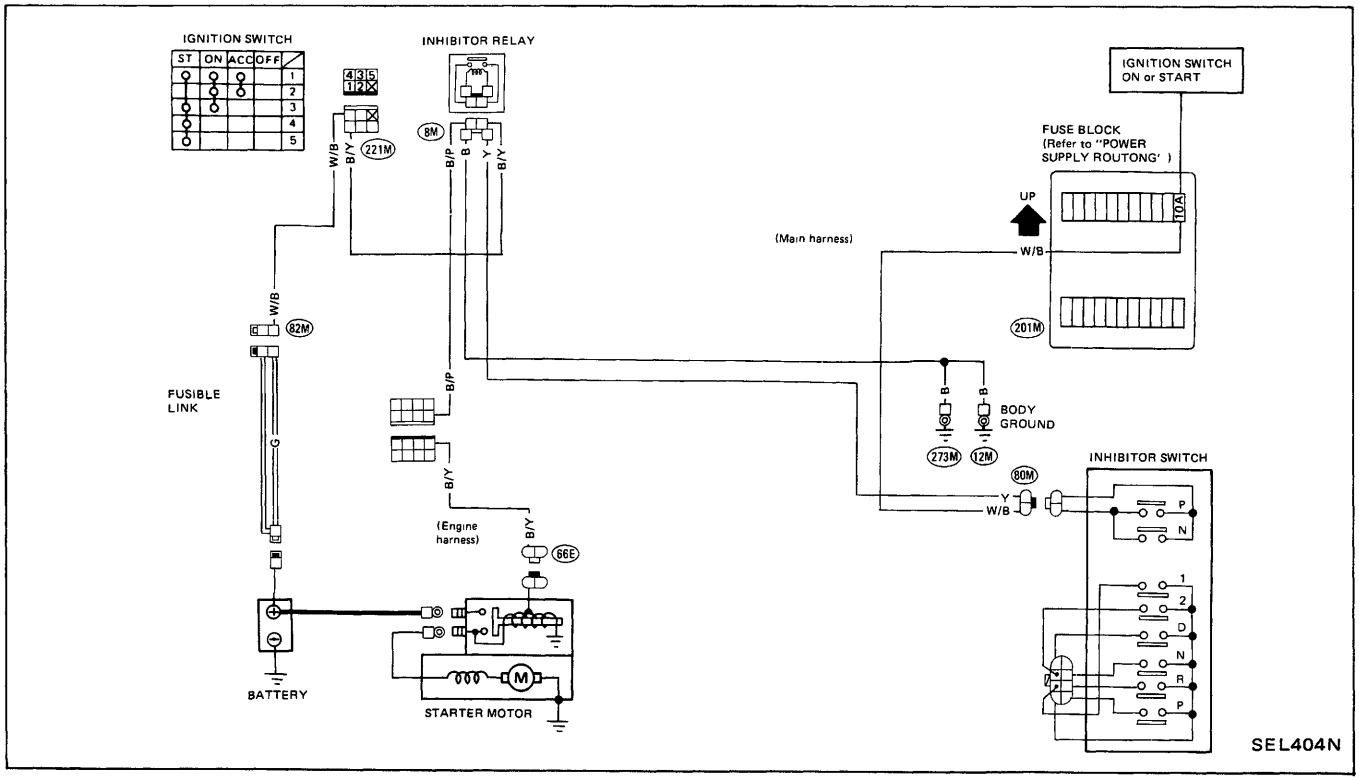
Wiring Diagram (Cont'd)

KA24E ENGINE MODEL

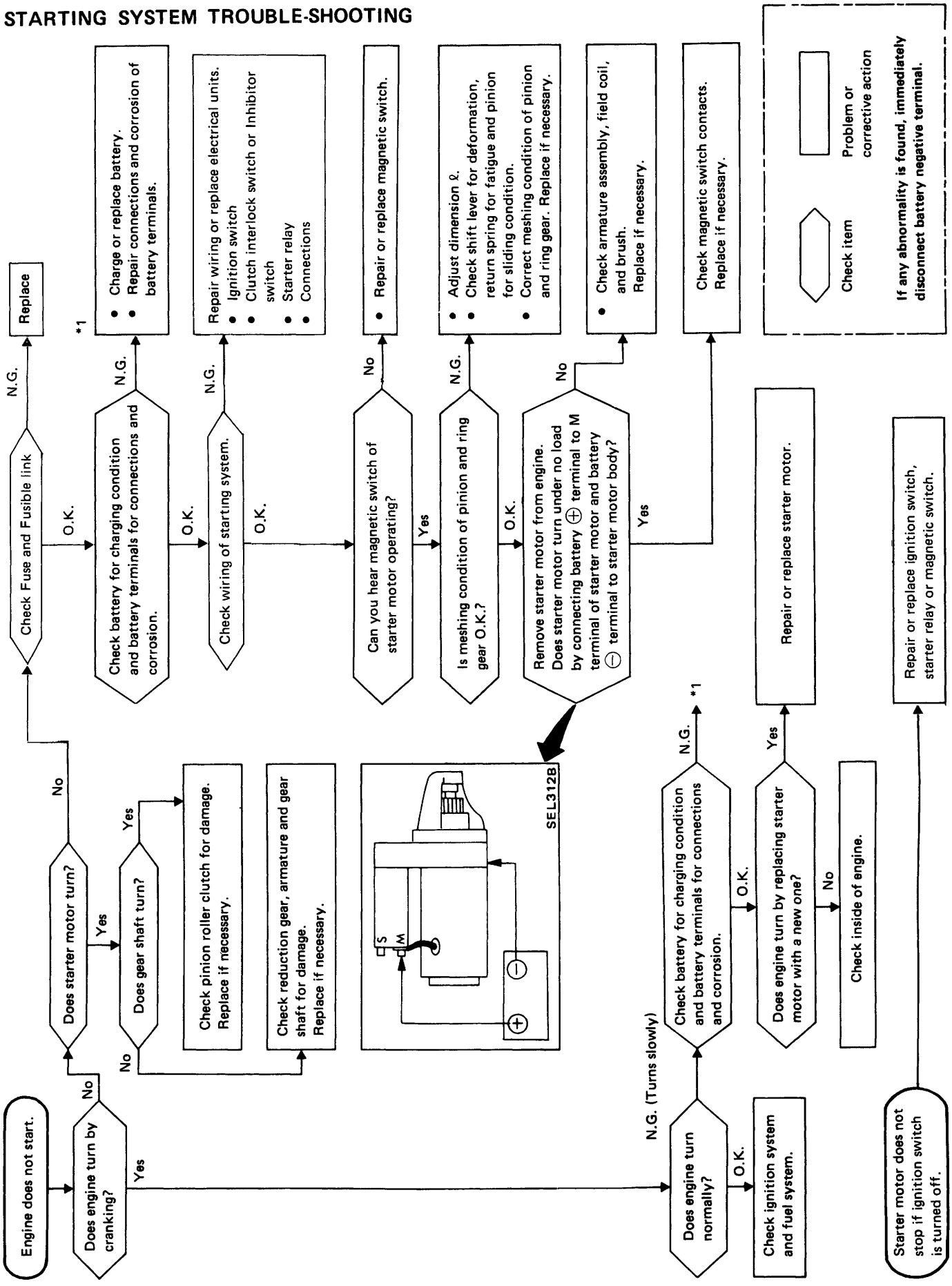
M/T model



A/T model

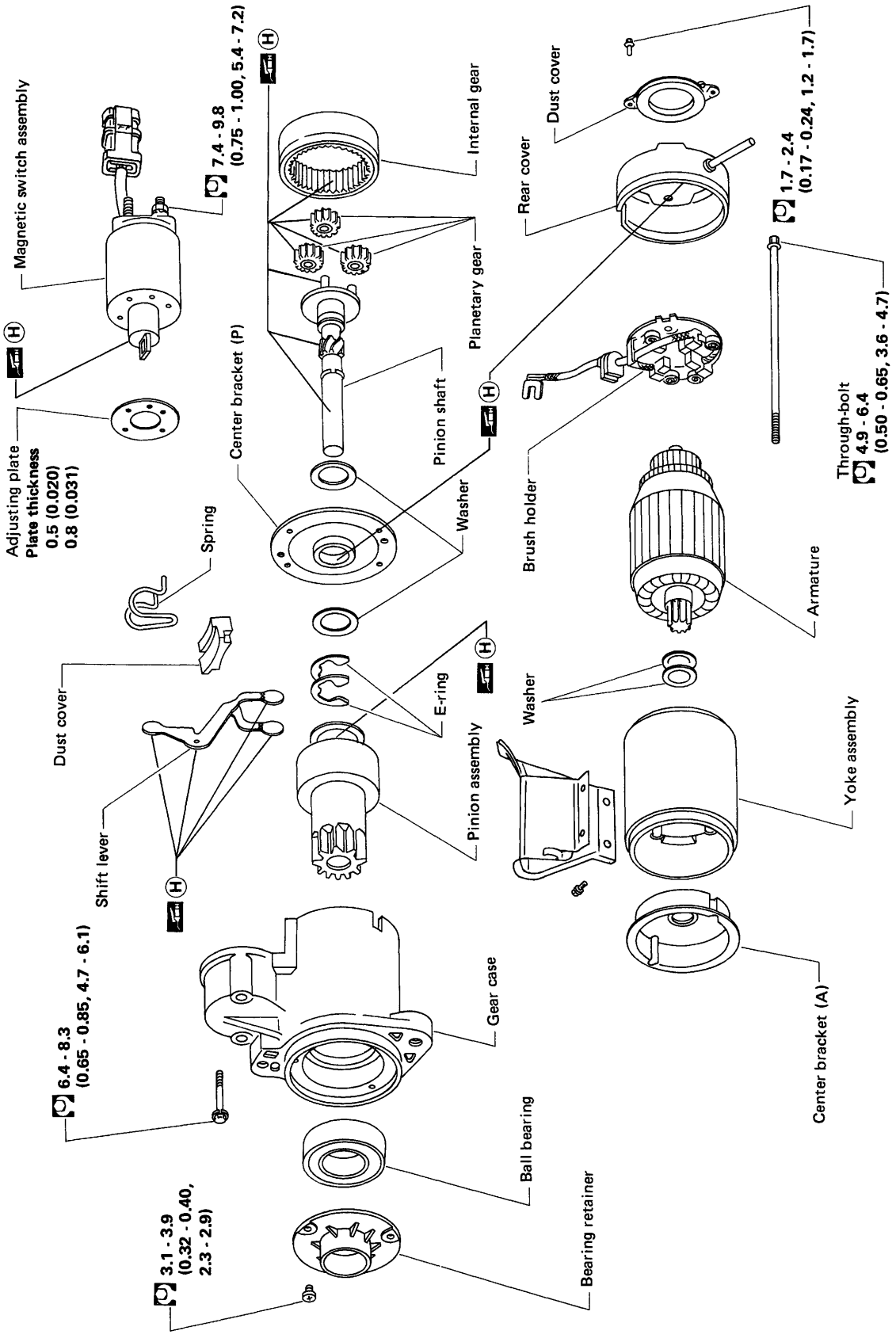


STARTING SYSTEM TROUBLE-SHOOTING



Construction

S114-528

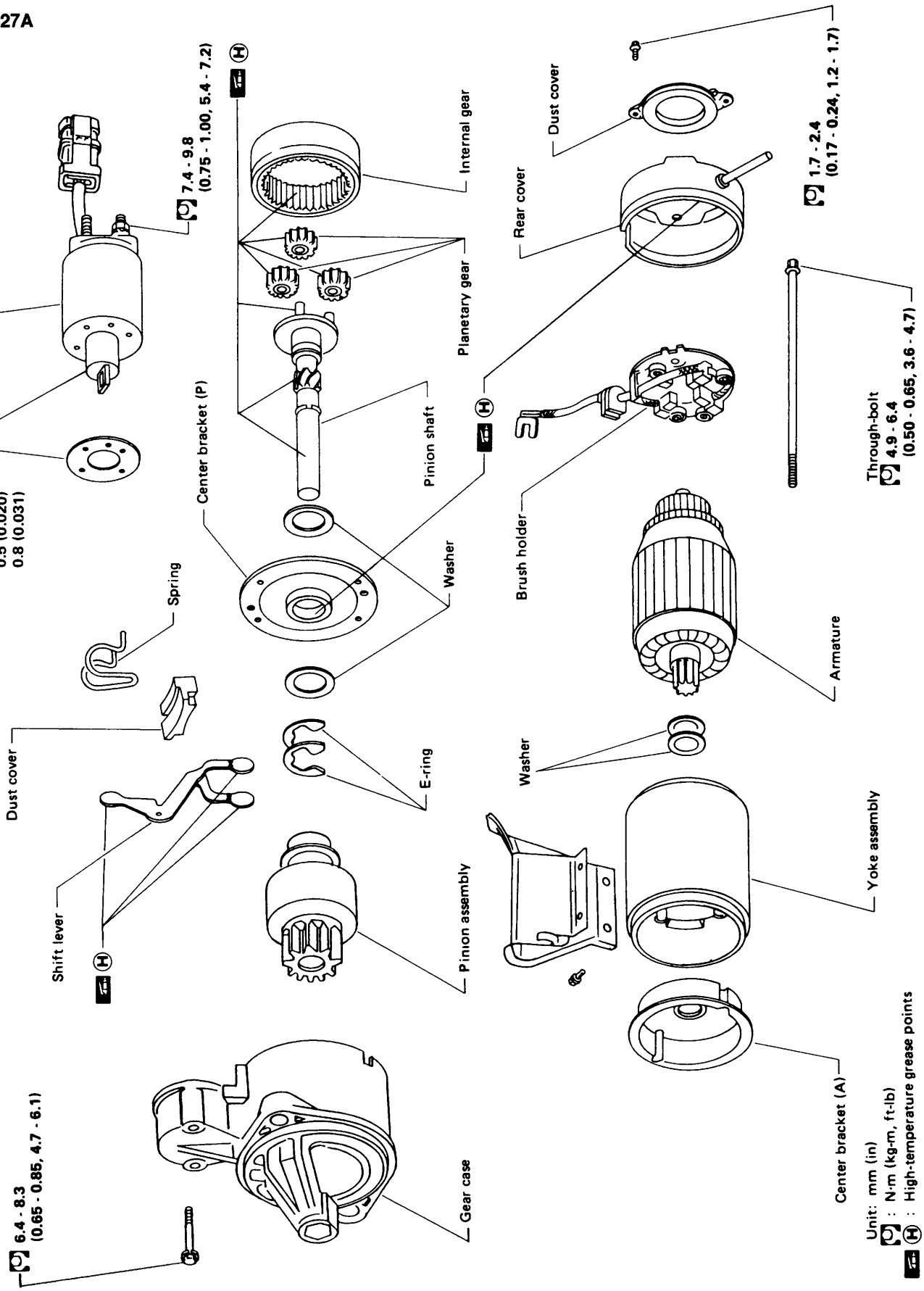


Unit: mm (in)
: N·m (kg-m, ft-lb)
Ⓗ : High-temperature grease points

SEL723I

Construction (Cont'd)

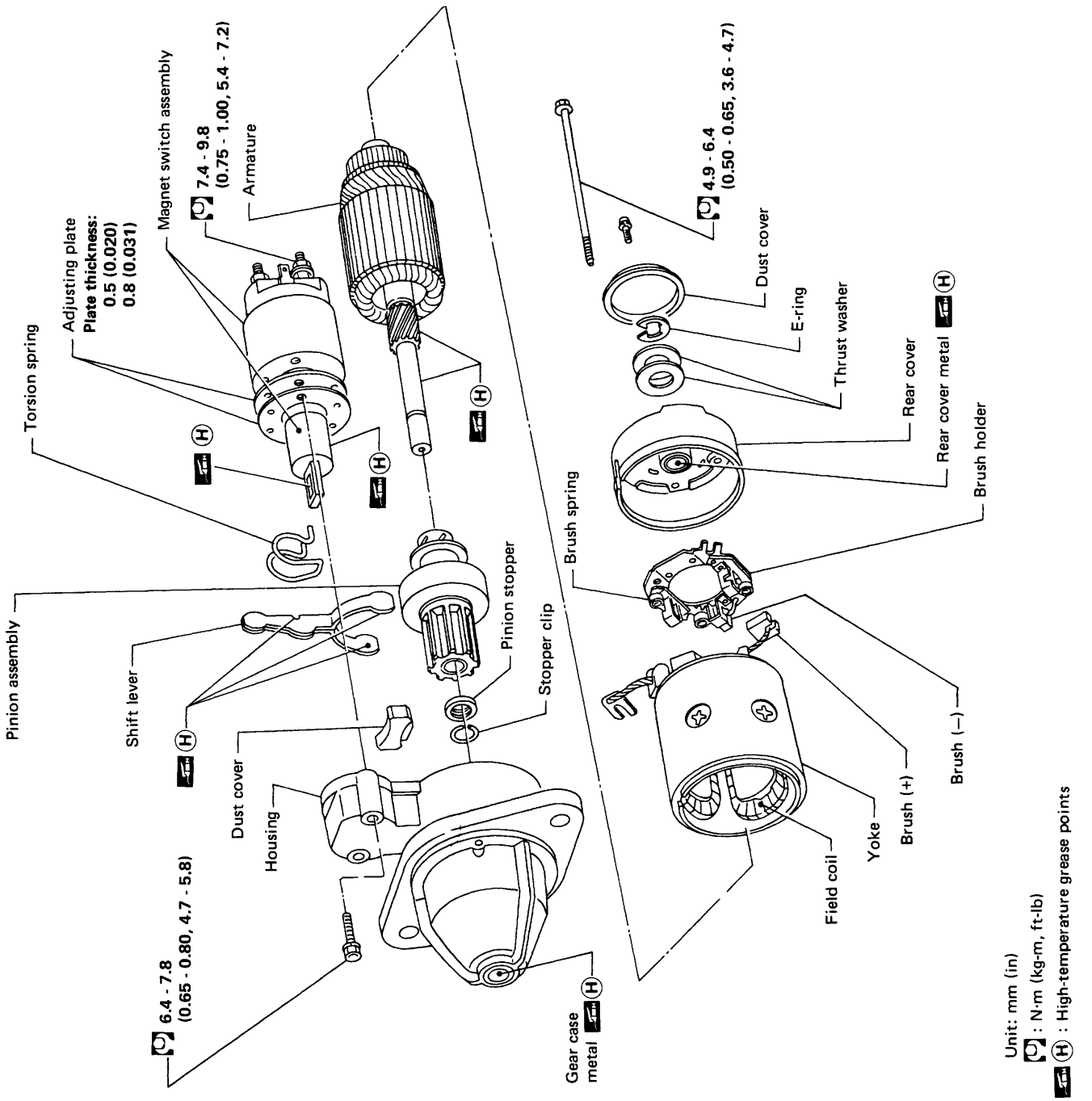
S114-527A



SEL647J

Construction (Cont'd)

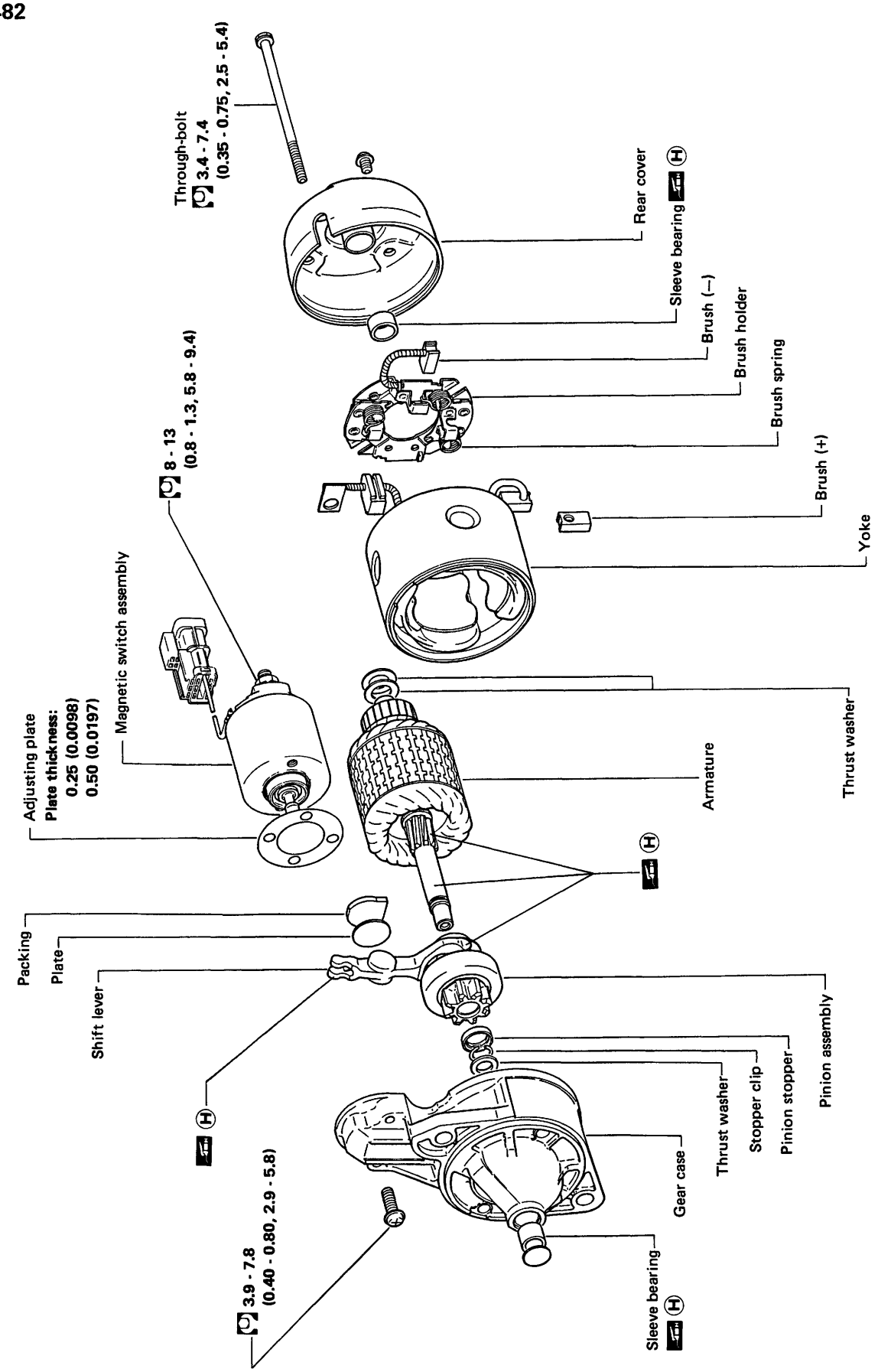
S114-607



SEL245C

Construction (Cont'd)

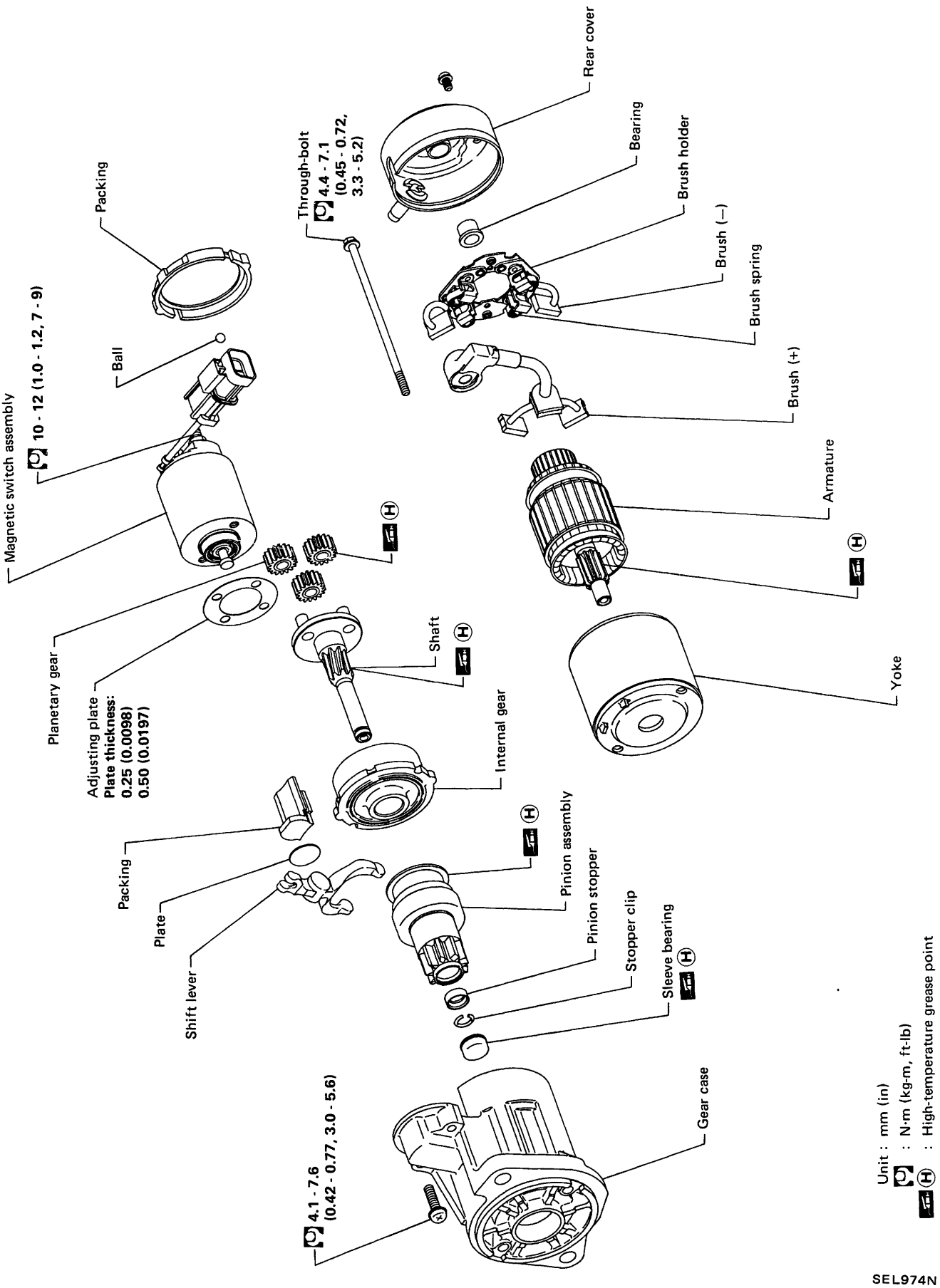
M3T38482



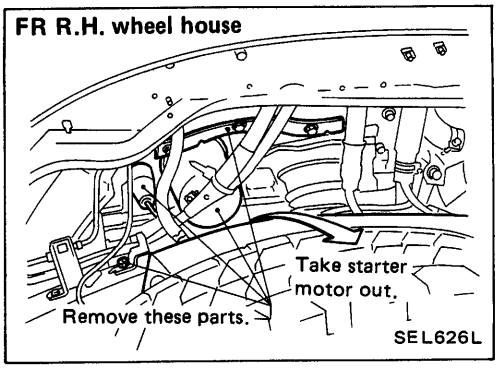
SEL317I

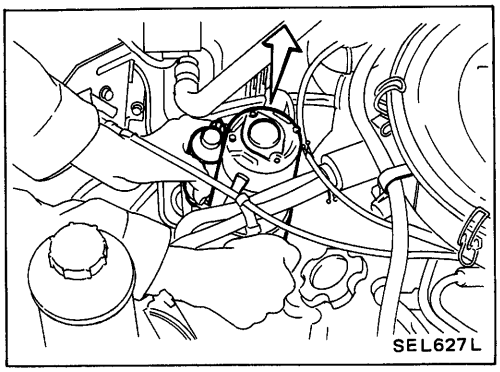
Construction (Cont'd)

M1T60281



SEL974N





Removal and Installation (VG30E engine model)

4WD TRUCK

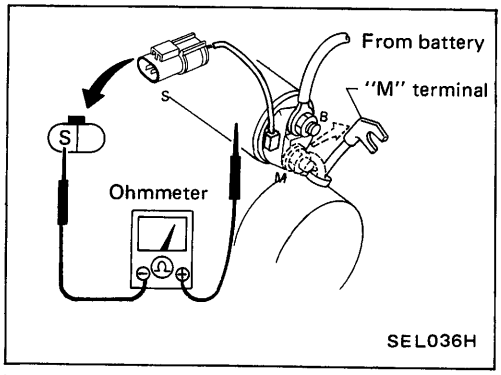
Remove the following parts to make room and take out starter through the clearance between body and frame.

- FR R.H. splash guard
- Oil pressure switch connector
- Oil filter
- Exhaust manifold heat insulater
- Fuel tube retainer bolt

EXCEPT 4WD TRUCK

Remove following parts to make room and take out starter from the cylinder head side area.

- FR R.H. wheel
- FR R.H. splash guard
- Exhaust manifold heat insulater
- Exhaust manifold
- Oil Filter
- Oil pressure switch connector

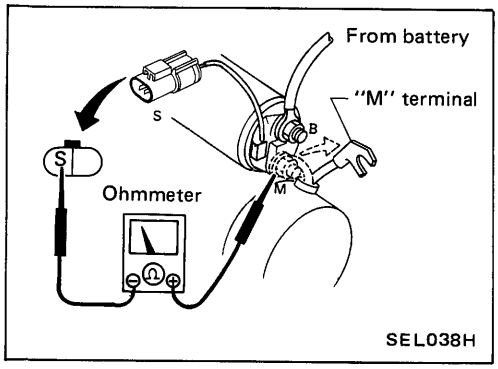


Magnetic Switch Check

- Before starting to check, disconnect battery ground cable.
- Disconnect "M" terminal of starter motor.

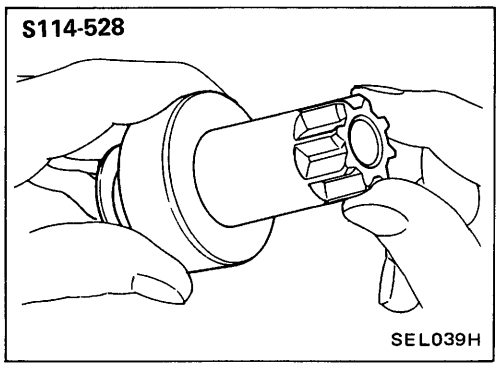
1. Continuity test (between "S" terminal and switch body).

- No continuity ... Replace.



2. Continuity test (between "S" terminal and "M" terminal).

- No continuity ... Replace.



Pinion/Clutch Check

1. Check to see if pinion locks in one direction and rotates smoothly in the opposite direction.

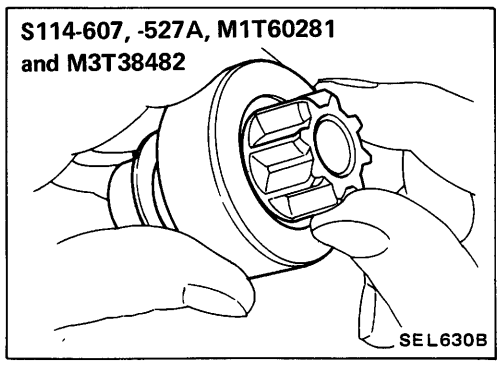
- If it does not lock (or locks) in either direction or unusual resistance is evident ... Replace.

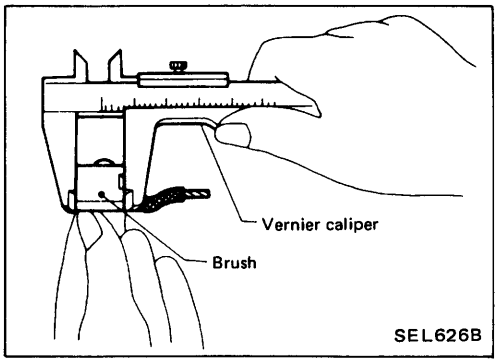
2. Inspect pinion teeth.

- Replace pinion if teeth are worn or damaged. (Also check condition of ring gear teeth.)

3. Inspect reduction gear teeth.

- Replace reduction gear if teeth are worn or damaged. (Also check condition of armature shaft gear teeth.)





Brush Check

BRUSH

Check wear of brush.

Wear limit length:

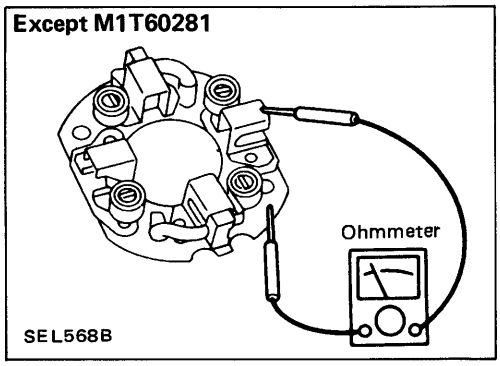
Refer to "Service Data and Specifications."

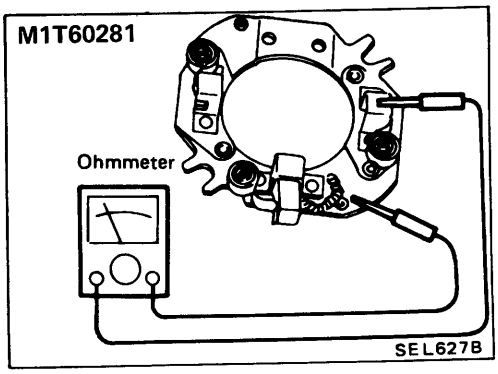
- Excessive wear ... Replace.

Brush Check (Cont'd)

BRUSH HOLDER

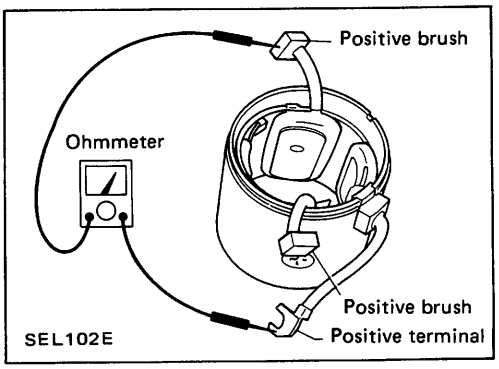
1. Perform insulation test between brush holder (positive side) and its base (negative side).
   - Continuity exists ... Replace.
2. Check brush to see if it moves smoothly.
   - If brush holder is bent, replace it; if sliding surface is dirty, clean.



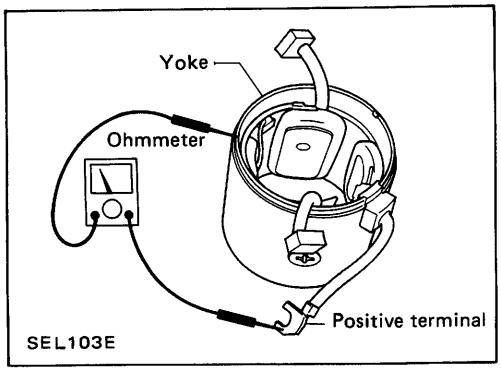


Field Coil Check

1. Continuity test (between field coil positive terminal and positive brushes).
   - No continuity ... Replace yoke.

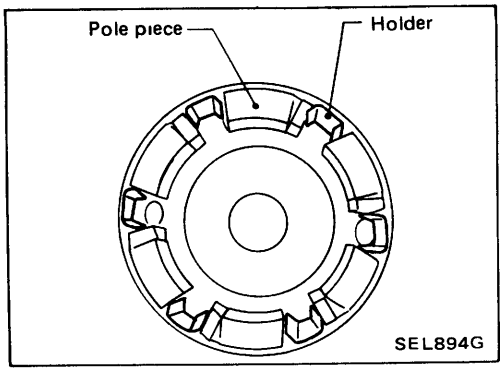


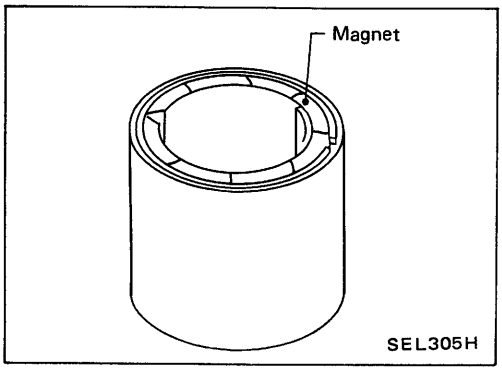
2. Insulation test (between field coil positive terminal and yoke).
   - Continuity exists ... Replace yoke.



Pole Piece Check (M1T60281)

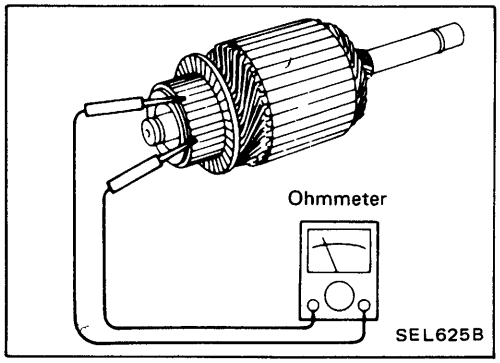
Pole piece is secured to yoke by bonding agent. Check pole piece to see that it is secured to yoke and for any cracks. Replace malfunctioning parts as an assembly.
Holder may move slightly as it is only inserted and not bonded.
Do not strike yoke with a hammer.





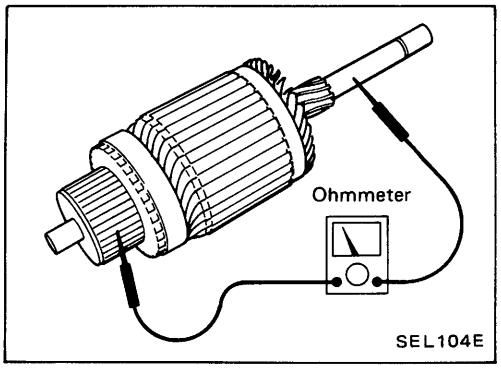
Yoke Assembly Check (S114-528)

Check magnet for cracks. If there is any crack, replace malfunctioning parts as an assembly.

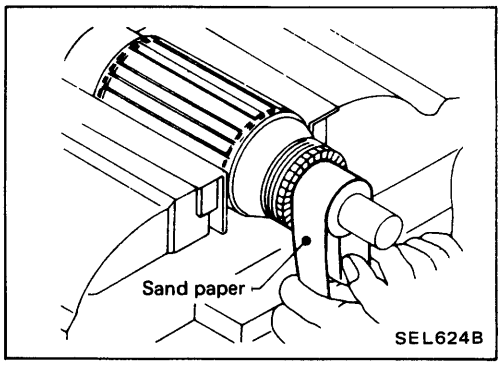


Armature Check

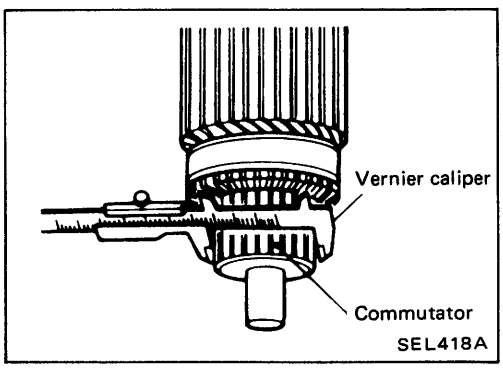
1. Continuity test (between two segments side by side).
   - No continuity ... Replace.



2. Insulation test (between each commutator and shaft).
   - Continuity exists ... Replace.

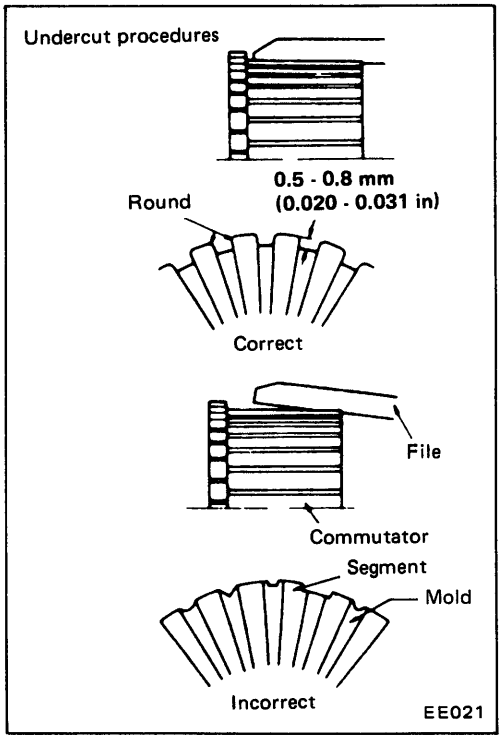


3. Check commutator surface.
   - Rough ... Sand lightly with No. 500 - 600 sandpaper.



4. Check diameter of commutator.
   Commutator minimum diameter:
   Refer to "Service Data and Specifications."
   - Less than specified value ... Replace.

Armature Check (Cont'd)



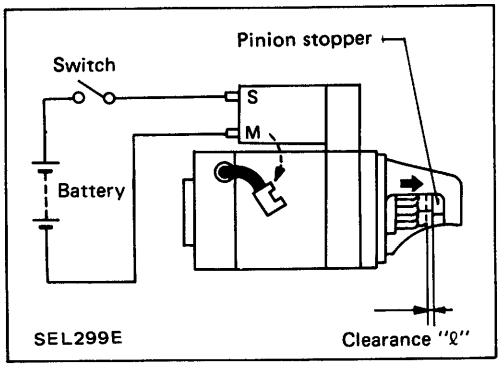
5. Check depth of insulating mold from commutator surface.
   - Less than 0.2 mm (0.008 in) ... Undercut to 0.5 - 0.8 mm (0.020 - 0.031 in)

Assembly

Carefully observe the following instructions.

HIGH-TEMPERATURE GREASE POINT

- Rear cover metal
- Gear case metal
- Center bracket metal
- Frictional surface of pinion
- Moving portion of shift lever
- Plunger of magnetic switch
- Reduction gear



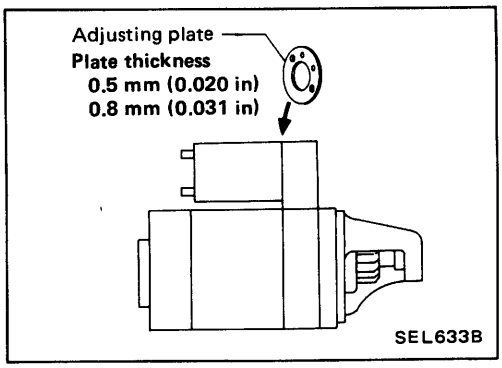
PINION PROTRUSION LENGTH ADJUSTMENT

S114-607, -527A and M3T38482

With pinion driven out by magnetic switch, push pinion back to remove slack and measure clearance "ℓ" between the front edge of the pinion and the pinion stopper.

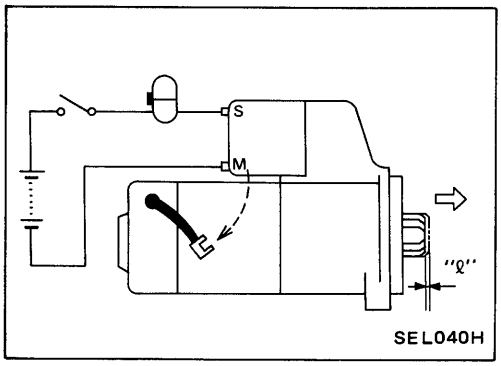
Clearance "ℓ":

Refer to Service Data and Specifications.



- Not in the specified value ... Adjust with adjusting plate.

Assembly (Cont'd)

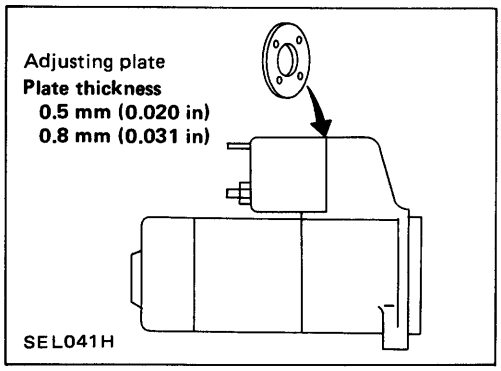


S114-528

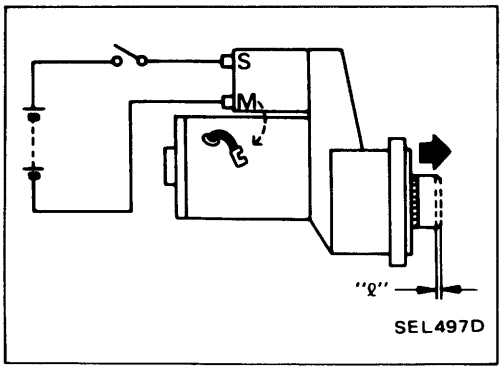
Measure movement "ℓ" in height of pinion when pinion is pushed out with magnetic switch energized and when pinion is pulled out by hand until it touches stopper.

Movement "ℓ":

Refer to Service Date and Specifications.



- Not in the specified value ... Adjust with adjusting plate.

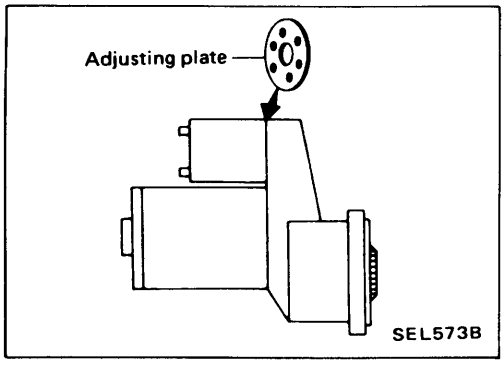


M1T60281

Compare movement " ℓ " in height of pinion when it is pushed out with magnetic switch energized and when it is pulled out by hand until it touches stopper.

Movement " ℓ ":

Refer to S.D.S.



- Not in the specified value ... Adjust by adjusting plate.

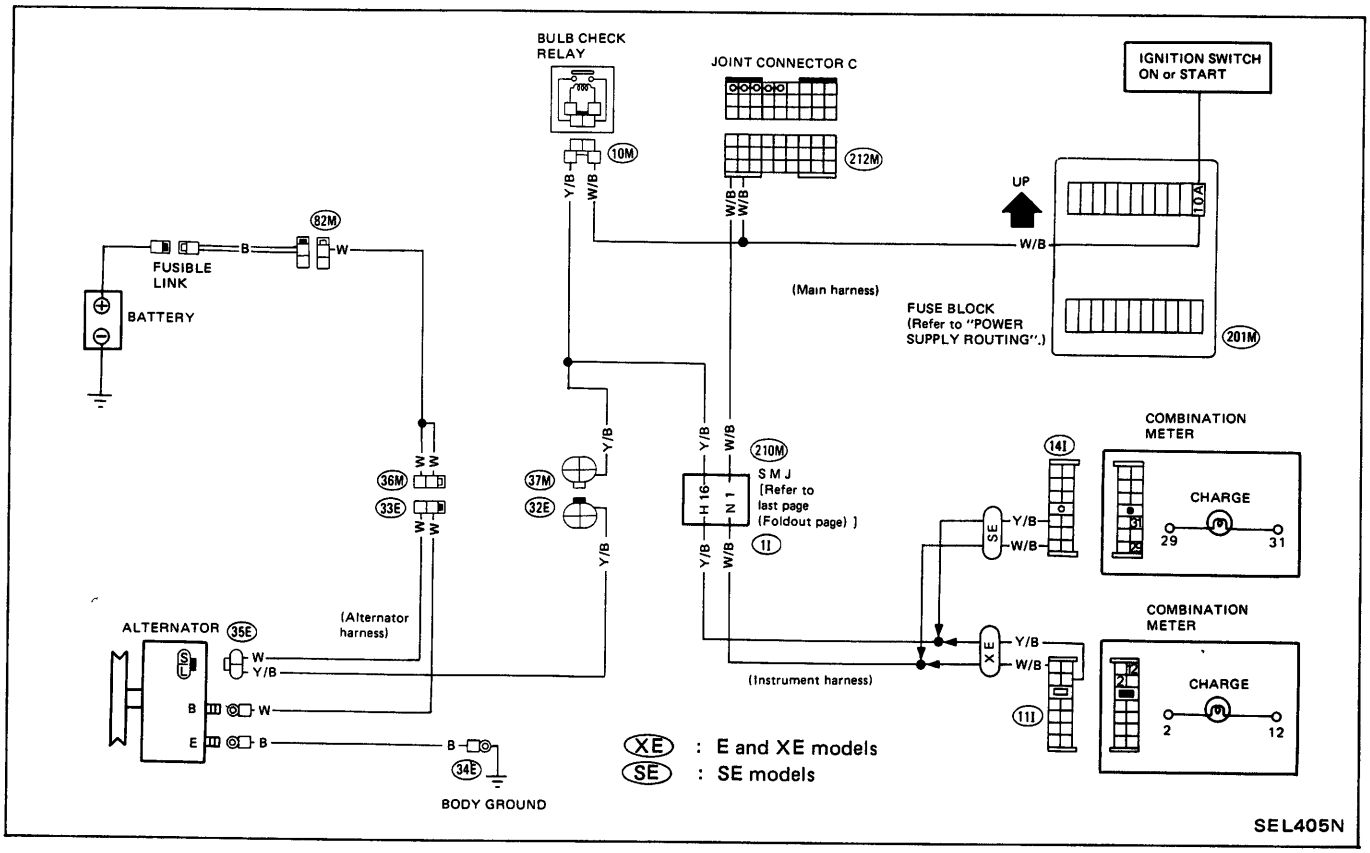
Service Data and Specifications (S.D.S.)

STARTER

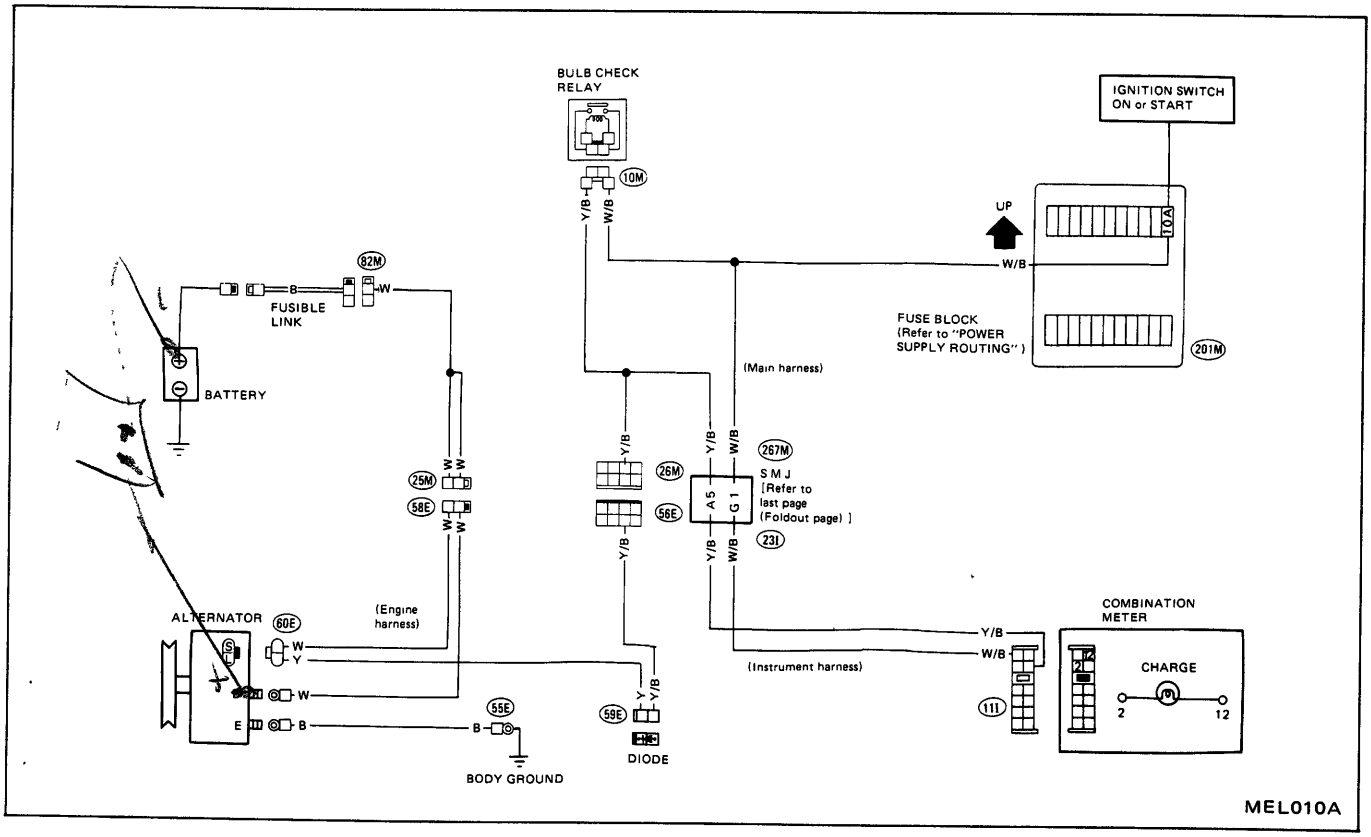
Type	S114-528	S114-607		M3T38482	S114-527A	M1T60281
	HITACHI			MITSUBISHI	HITACHI	MITSUBISHI
	Reduction	Non-reduction			Reduction	
Applied model	VG30E	KA24E				
		U.S.A.				CANADA
		2WD M/T			2WD A/T and 4WD	
System voltage V	12					
No-load Terminal voltage V	11.0	11.5			11.0	
Current A	Less than 90	Less than 100		Less than 60	Less than 90	50 - 75
Revolution rpm	More than 2,650	More than 7,000		More than 6,500	More than 2,950	3,000 - 4,000
Minimum diameter of commutator mm (in)	More than 32 (1.26)	More than 39 (1.54)		More than 31.4 (1.236)	More than 32 (1.26)	More than 28.8 (1.134)
Minimum length of brush mm (in)	11 (0.43)			11.5 (0.453)	11 (0.43)	12 (0.47)
Brush spring tension N (kg, lb)	17.7 - 21.6 (1.8 - 2.2, 4.0 - 4.9)			13.7 - 25.5 (1.4 - 2.6, 3.1 - 5.7)	17.7 - 21.6 (1.8 - 2.2, 4.0 - 4.9)	13.7 - 25.5 (1.4 - 2.6, 3.1 - 5.7)
Movement "ℓ" in height of pinion assembly mm (in)	—					0.5 - 2.0 (0.020 - 0.079)
Clearance of bearing metal and armature shaft mm (in)	0.03 - 0.3 (0.0012 - 0.0118)	Less than 0.2 (0.008)		—	0.2 (0.008)	—
Clearance "ℓ" between pinion front edge and pinion stopper mm (in)	0.05 - 1.5 (0.0020 - 0.0591)	0.3 - 2.5 (0.012 - 0.098)		0.5 - 2.0 (0.020 - 0.079)	0.3 - 1.5 (0.012 - 0.059)	—

Wiring Diagram

VG30E ENGINE MODEL



KA24E ENGINE MODEL

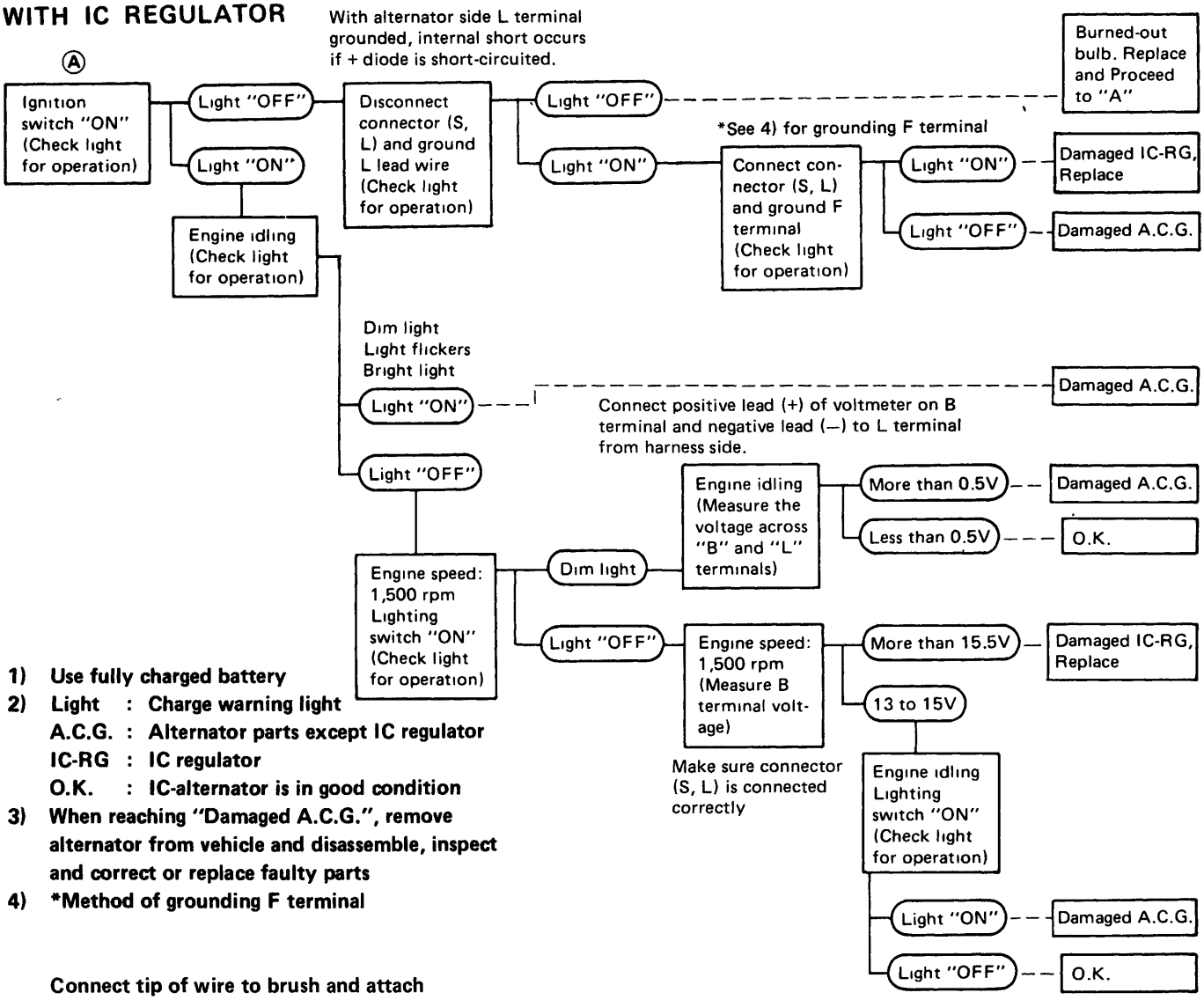


Trouble-shooting

Before conducting an alternator test, make sure that the battery is fully charged. A 30-volt voltmeter and suitable test probes are necessary for the test. The alternator can be checked easily by referring to the Inspection Table.

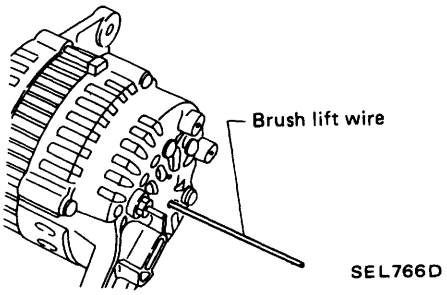
Before starting trouble-shooting, inspect the fusible link.

WITH IC REGULATOR



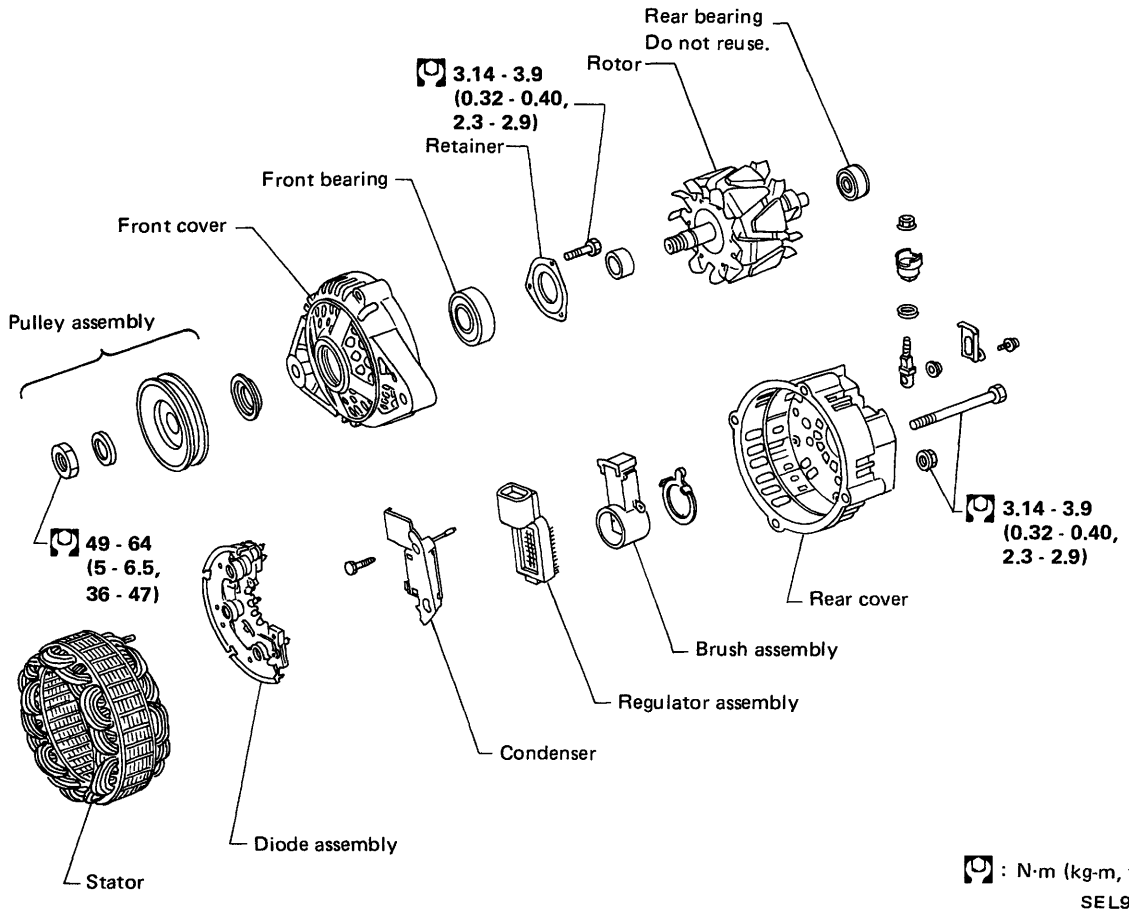
1) **Use fully charged battery**
2) **Light : Charge warning light**
   A.C.G. : Alternator parts except IC regulator
   IC-RG : IC regulator
   O.K. : IC-alternator is in good condition
3) **When reaching "Damaged A.C.G.", remove alternator from vehicle and disassemble, inspect and correct or replace faulty parts**
4) ***Method of grounding F terminal**

Connect tip of wire to brush and attach wire to alternator body.



5) **Terminals "S", "L", "BAT" and "E" are marked on rear cover of alternator.**

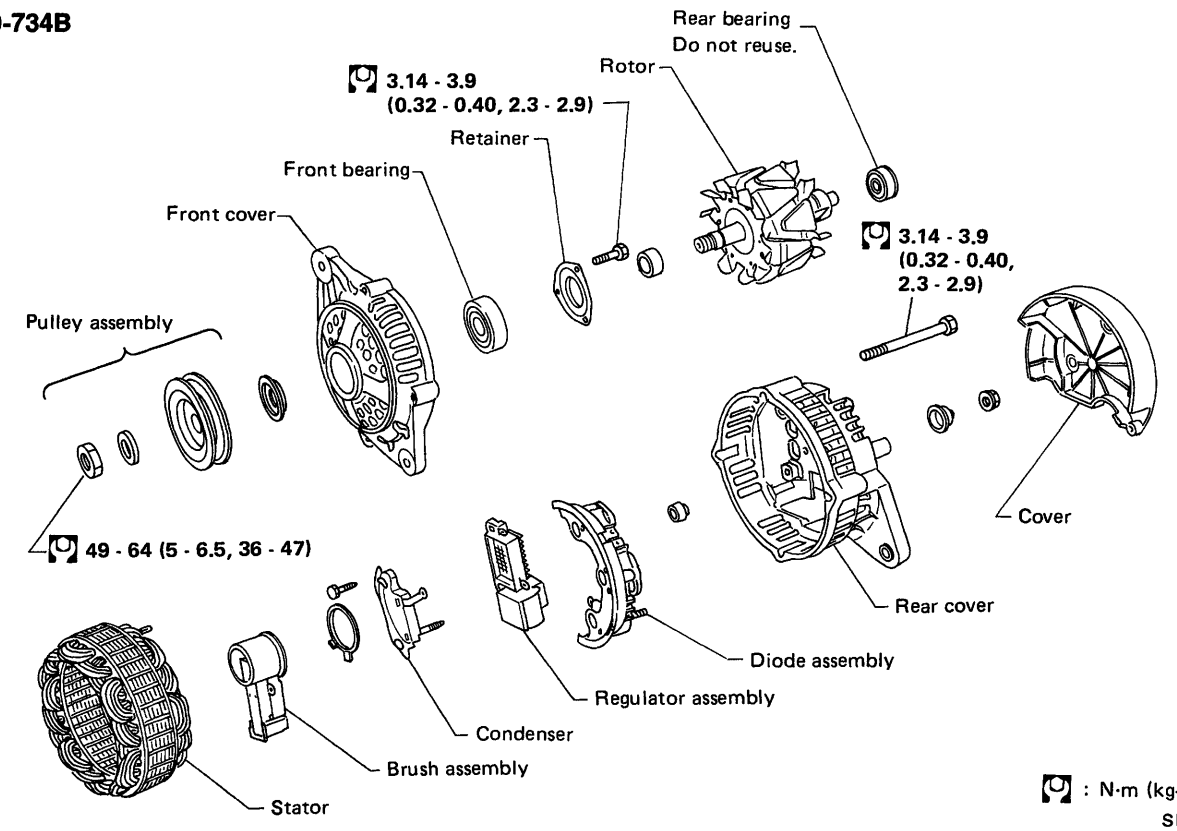
LR160-723



: N·m (kg-m, ft-lb)

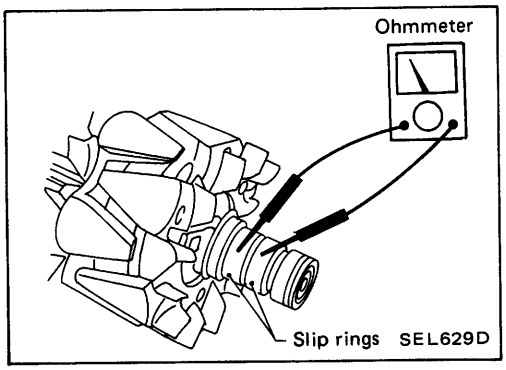
SEL957N

LR170-734B



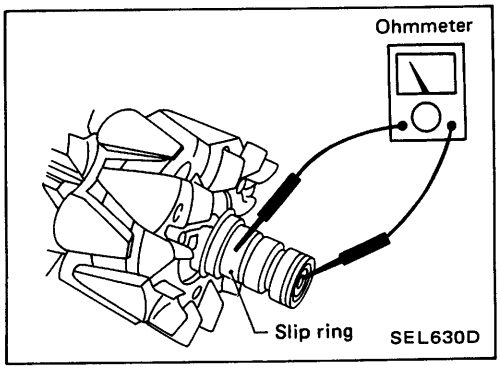
: N·m (kg-m, ft-lb)

SEL958N



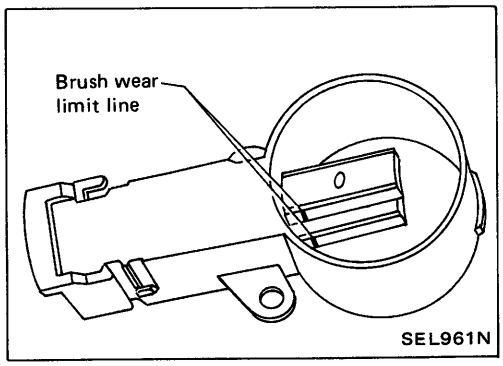
Rotor Slip Ring Check

1. Continuity test
   - No continuity ... Replace rotor.



2. Insulator test
   - Continuity exists ... Replace rotor.
3. Check slip ring for wear.

   Slip ring minimum outer diameter:
   Refer to "Service Data and Specifications."

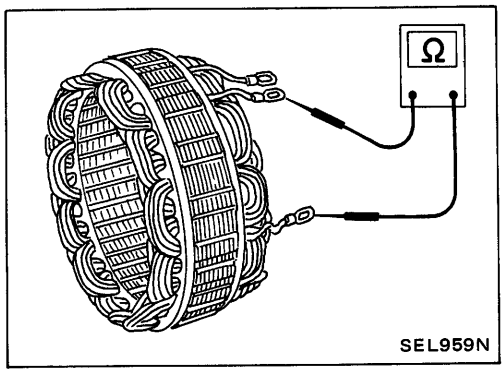


Brush Check

Check brush as follows:

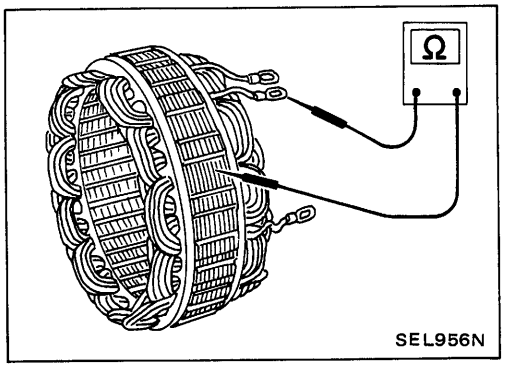
1. Smooth movement
2. Wear

If either of the above conditions occur, replace brush assembly.



Stator Check

1. Continuity test
   - No continuity ... Replace stator.



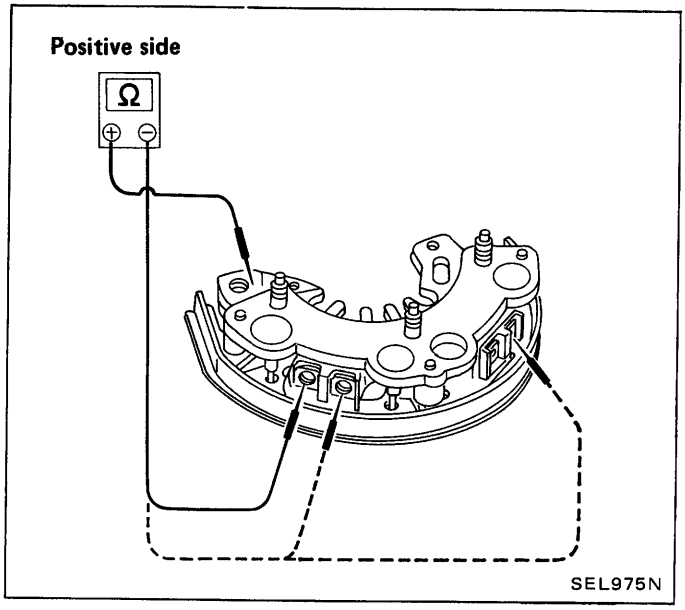
2. Ground test
   - Continuity exists ... Replace stator.

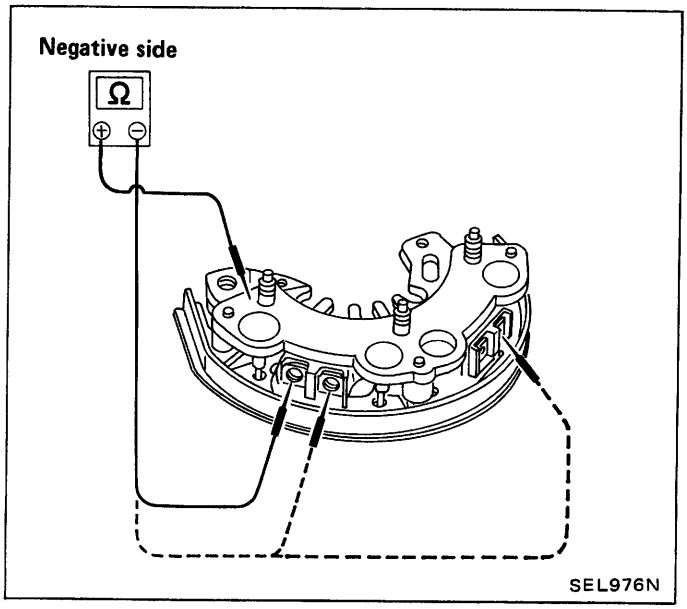
Diode Check

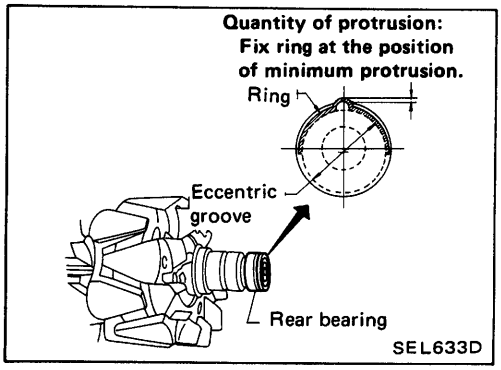
DIODES

- Use an ohmmeter to check condition of diodes as indicated in chart below.
- If any of the test results is not satisfactory, replace diode assembly.

	Ohmmeter probes		Continuity
	Positive ⊕	Negative ⊖	
Diodes check (Positive side)	Positive diode plate	Diode terminals	Yes
	Diode terminals	Positive diode plate	No
Diodes check (Negative side)	Negative diode plate	Diode terminals	No
	Diode terminals	Negative diode plate	Yes





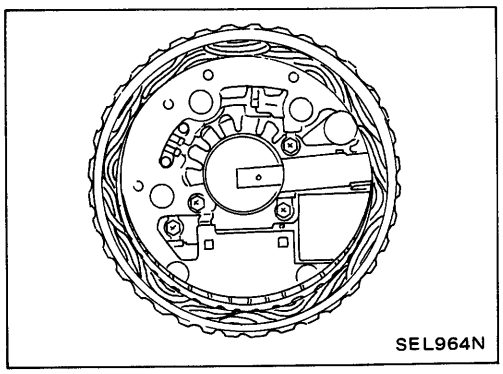


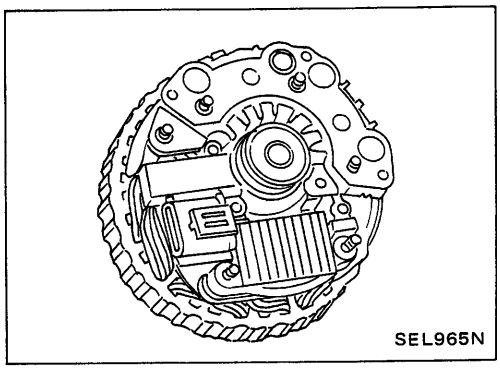
Assembly

RING FITTING IN REAR BEARING

- Fix ring into groove in rear bearing so that it is as close to the adjacent area as possible.

Assembly (Cont'd)


SEL964N


SEL965N

REAR COVER INSTALLATION

(1) Fit brush assembly, diode assembly, regulator assembly and stator.

(2) Push brushes up with fingers and install them to rotor.

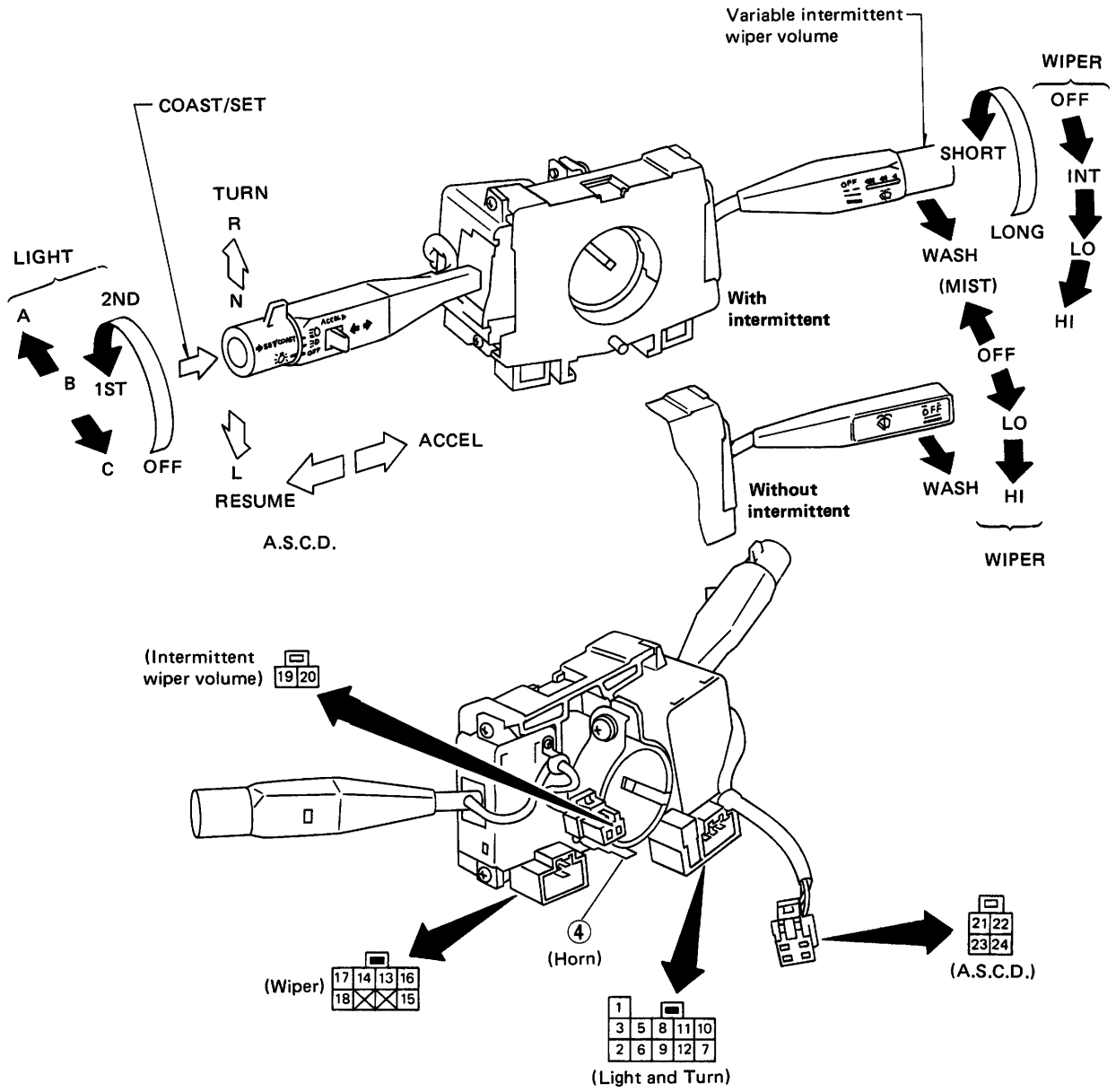
Take care not to damage slip ring sliding surface.

Service Data and Specifications (S.D.S.)

ALTERNATOR

Applied model	VG30E	KA24E
Type	LR170 - 734B	LR160-723
Nominal rating V-A	12 - 70	12 - 60
Ground polarity	Negative	
Minimum revolution under no-load (When 13.5 volts is applied) rpm	Less than 950	
Hot output current (When 13.5 volts is applied) A/rpm	More than 22/1,300 More than 50/2,500 More than 67/5,000	More than 17/1,300 More than 48/2,500 More than 57/5,000
Regulated output voltage V	14.1 - 14.7	
Minimum length of brush mm (in)	6 (0.24)	
Slip ring minimum outer diameter mm (in)	More than 26.0 (1.024)	

Check



LIGHT SWITCH

	OFF			1ST			2ND		
	A	B	C	A	B	C	A	B	C
5			○			○	○	○	○
6			○			○	○		○
7								○	
8			○			○	○	○	○
9			○			○	○		○
10								○	
11				○	○	○	○	○	○
12				○	○	○	○	○	○

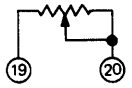
WIPER SWITCH

	OFF	INT	LO	HI	WASH
13	○	○			
14	○	○	○		
15		○			
16				○	
17		○	○	○	○
18					○

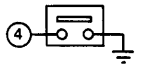
	MIST	OFF	LO	HI	WASH
13		○			
14	○	○	○		
15					
16				○	
17	○		○	○	○
18					○

	OFF	LO	HI	WASH
13	○			
14	○	○		
15				
16			○	
17		○	○	○
18				○

INTERMITTENT WIPER VOLUME



HORN SWITCH



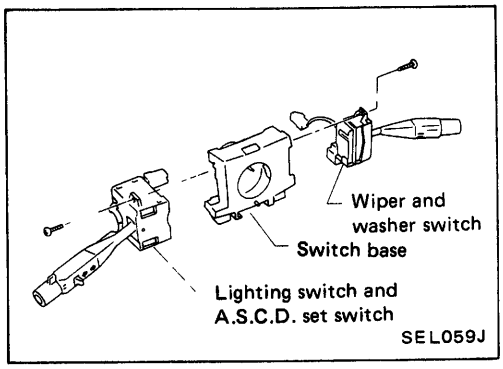
A.S.C.D. SET SWITCH

	COAST/SET	RESUME	ACCEL
21	○	○	○
22	○		
23		○	
24			○

	R	N	L
1	○		○
2	○		
3			○

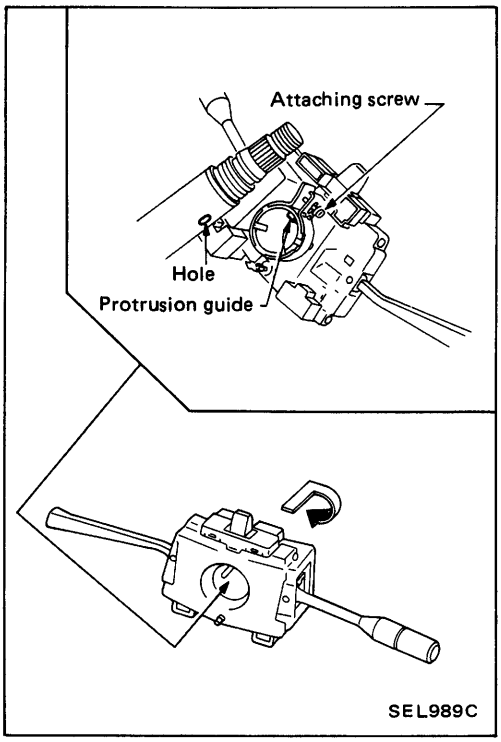
TURN SIGNAL SWITCH

SEL407N



Replacement

- Lighting switch, wiper & washer switch and A.S.C.D. set switch can be replaced without removing combination switch base.



- To remove combination switch base, remove base attaching screw and turn after pushing on it.

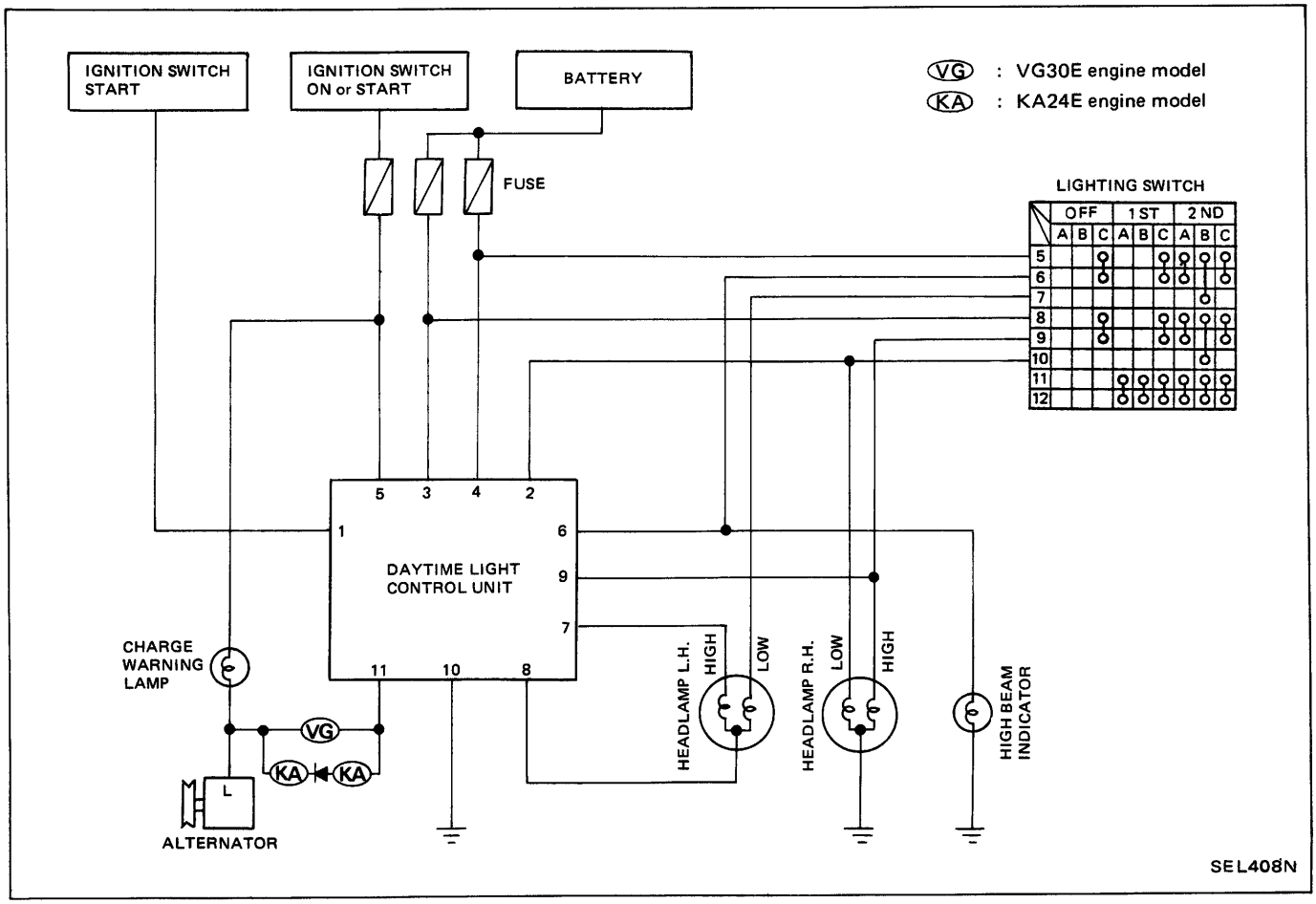
Operation (Daytime light system for Canada)

After starting the engine with the lighting switch in the "OFF" position or "1ST" position, the headlamp high beam automatically turns on. Lighting switch operations other than the above are the same as conventional light systems.

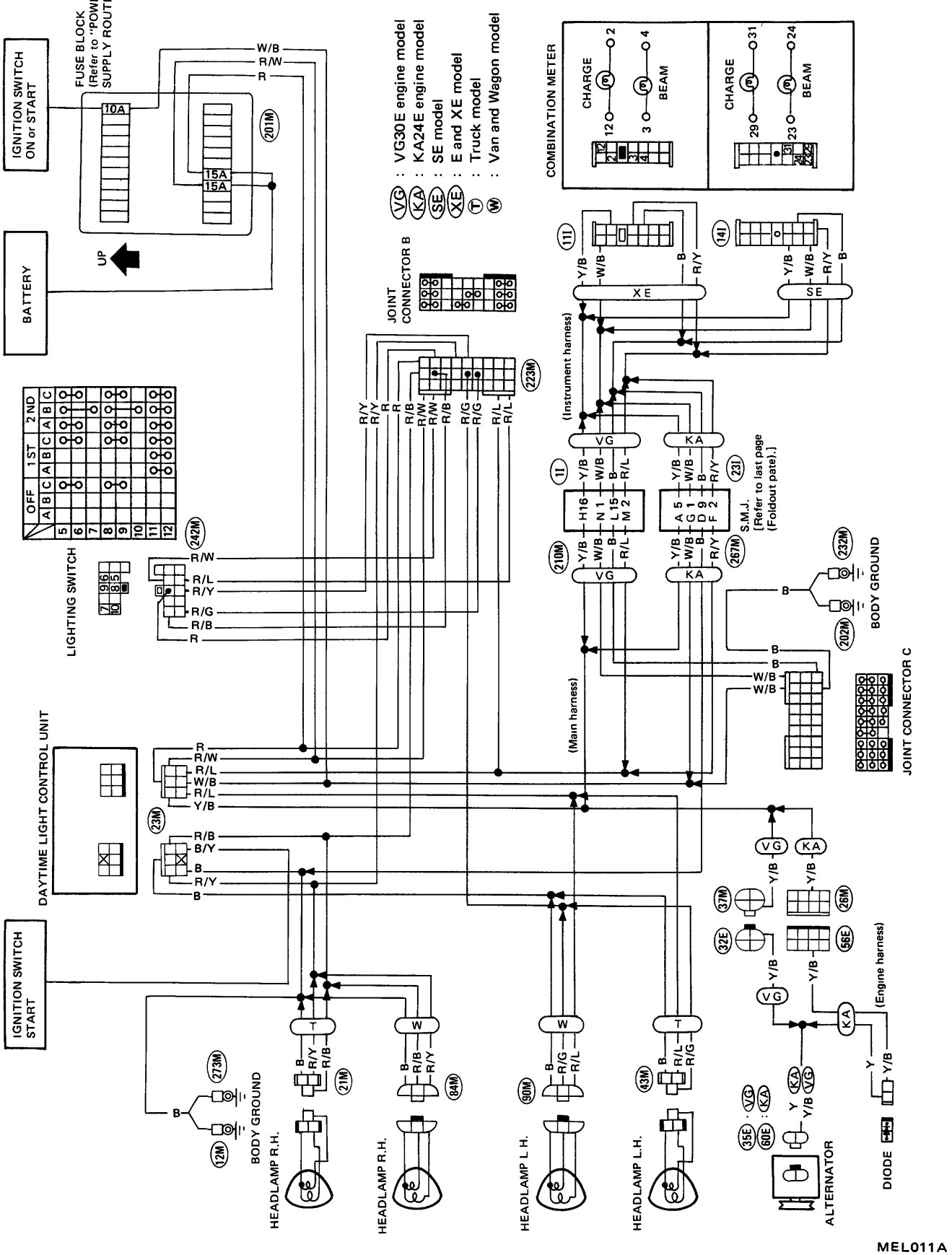
Engine		With engine stopped									With engine running								
Lighting switch		OFF			1ST			2ND			OFF			1ST			2ND		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Headlamp	High beam	X	X	O	X	X	O	O	X	O	△	△	O	△	△	O	O	X	O
	Low beam	X	X	X	X	X	X	X	O	X	X	X	X	X	X	X	X	O	X
Clearance and tail lamp		X	X	X	O	O	O	O	O	O	X	X	X	O	O	O	O	O	O
License and instrument illumination lamp		X	X	X	O	O	O	O	O	O	X	X	X	O	O	O	O	O	O

O : Lamp "ON"
X : Lamp "OFF"
△ : Lamp dims.
□ : Added functions

Schematic (Daytime light system for Canada)

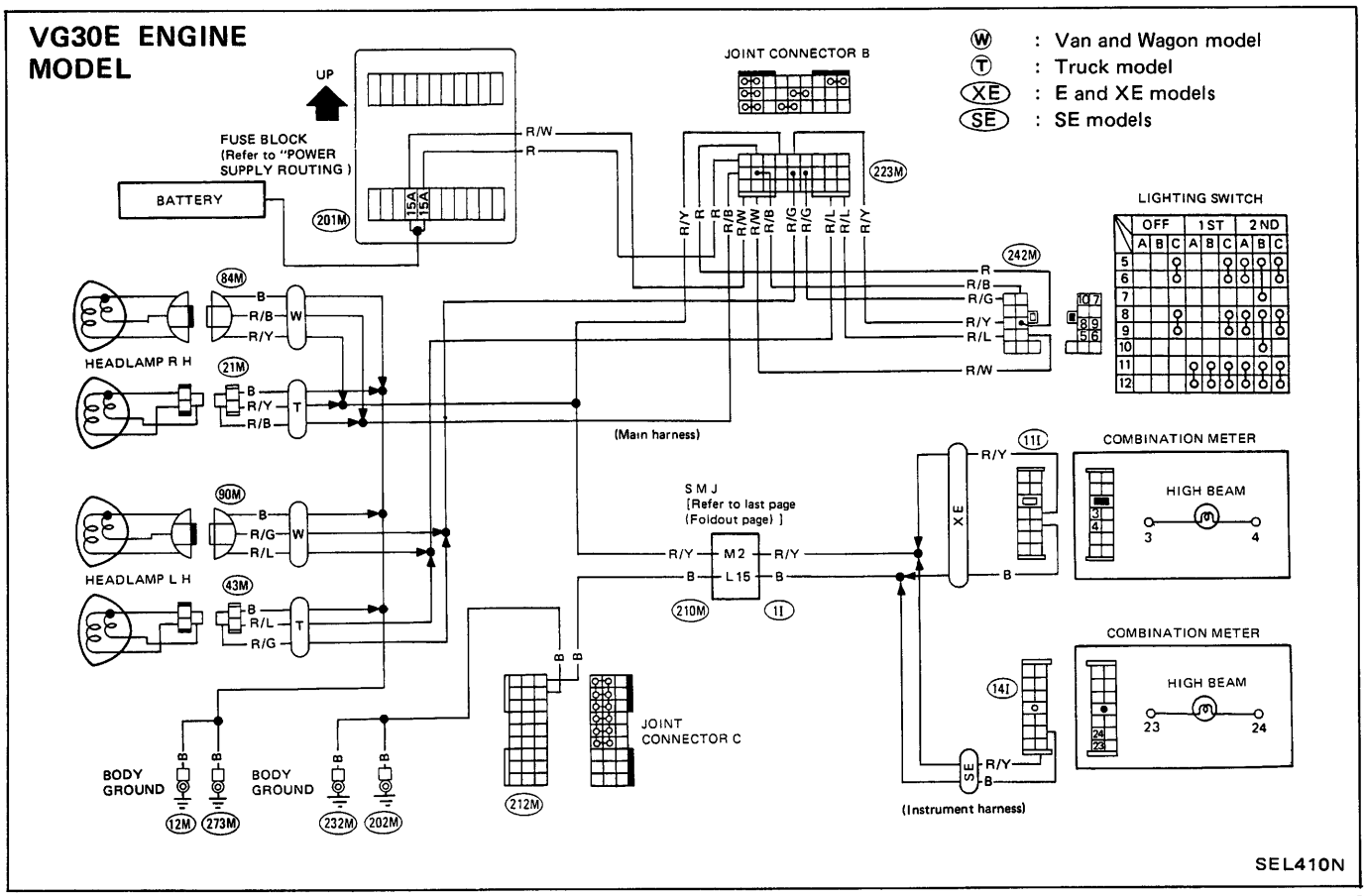


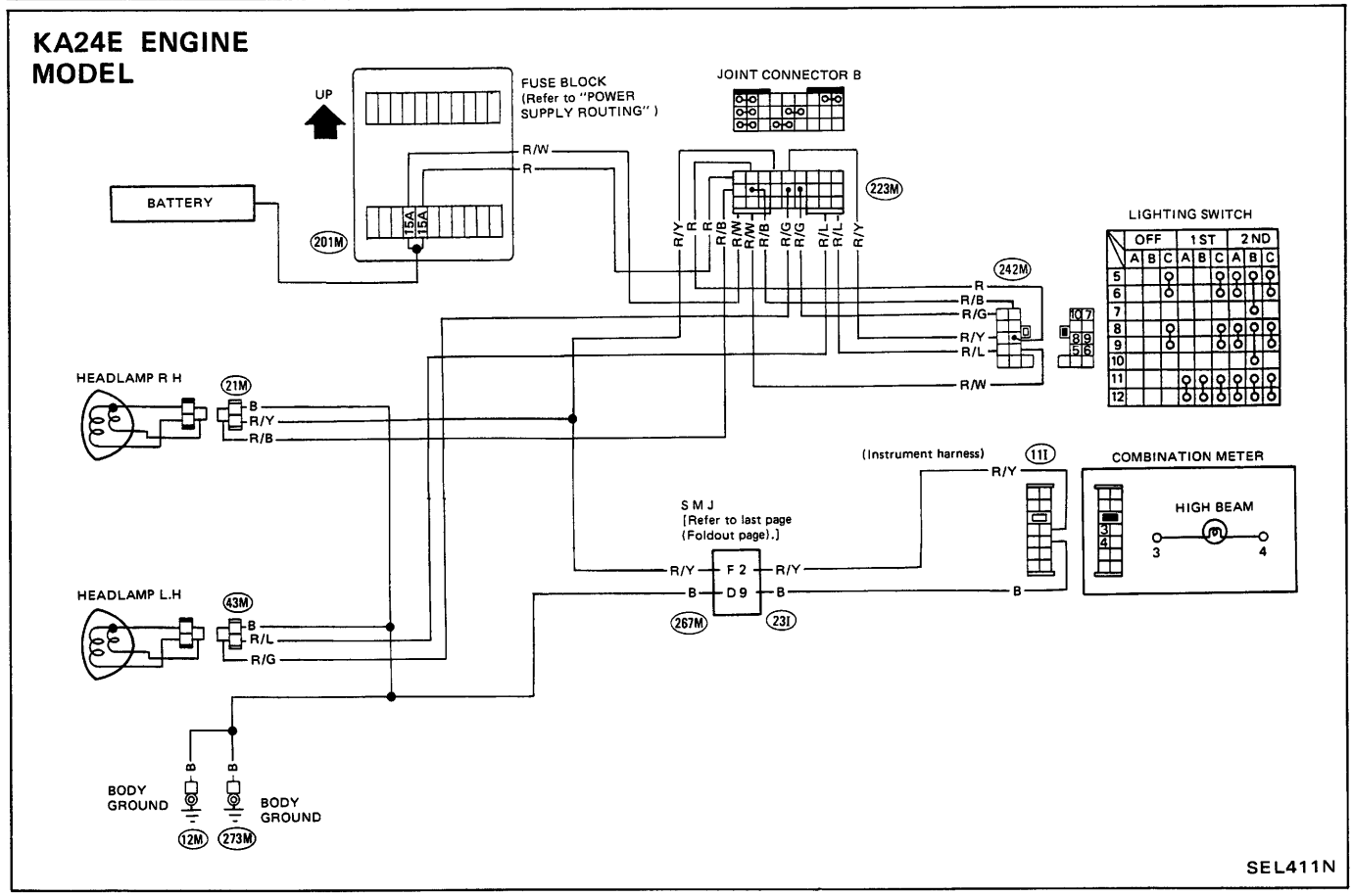
Wiring Diagram (Daytime light system for Canada)



MEL011A

Wiring Diagram (Except for Canada)





Aiming Adjustment

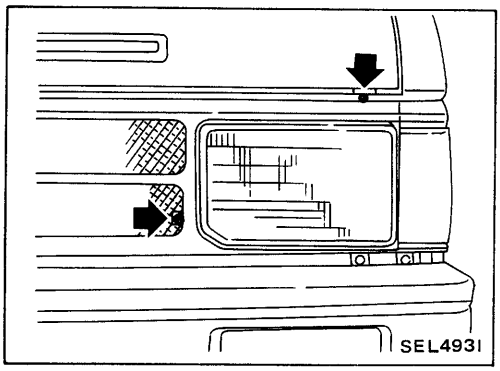
When performing headlamp aiming adjustment, use an aiming machine, aiming wall screen or headlamp tester. For operating instructions of any aimer, it should be in good repair, calibrated and used according to respective operation manuals supplied with the unit.

If any aimer is not available, aiming adjustment can be done as follows:

For details, refer to the regulations in your own country.

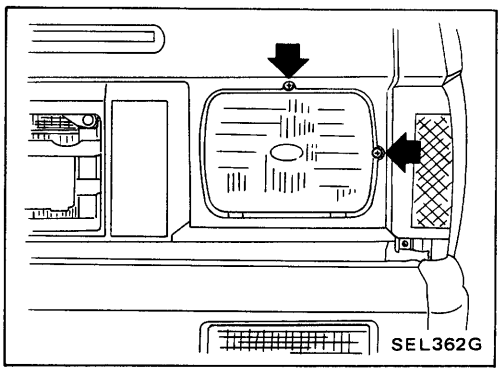
CAUTION:

a. **Keep all tires inflated to correct pressures.**
b. **Place vehicle and tester on one and same flat surface.**
c. **See that there is no load in vehicle (coolant, engine oil filled up to correct level and full fuel tank) other than the driver (or equivalent weight placed in driver's position).**



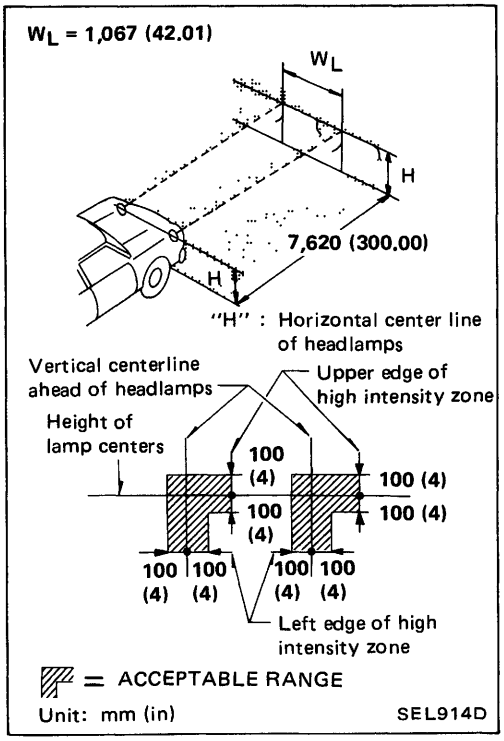
LOW BEAM

1. Turn headlamp low beam on.
2. Use adjusting screws to perform aiming adjustment.



- **Before adjusting headlamps, remove covers.**
- **First tighten the adjust screw all the way and then make adjustment by loosening the screw.**

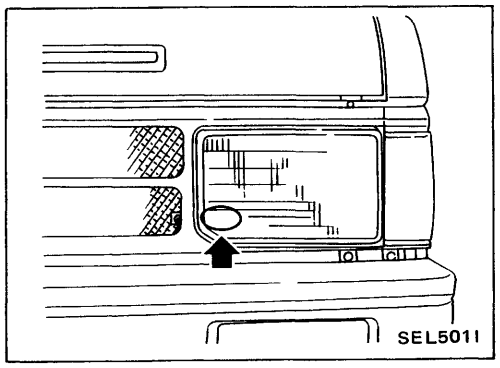
Aiming Adjustment (Cont'd)



- **Adjust headlamps so that upper edge and left edge of high intensity zone are within the acceptable range as shown at left.**
- **Dotted lines in illustration show center of headlamp.**

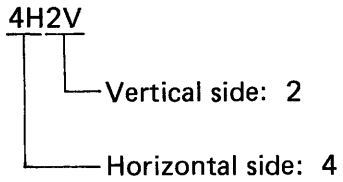
"H": Horizontal center line of headlamps

"W_L": Distance between each headlamp center



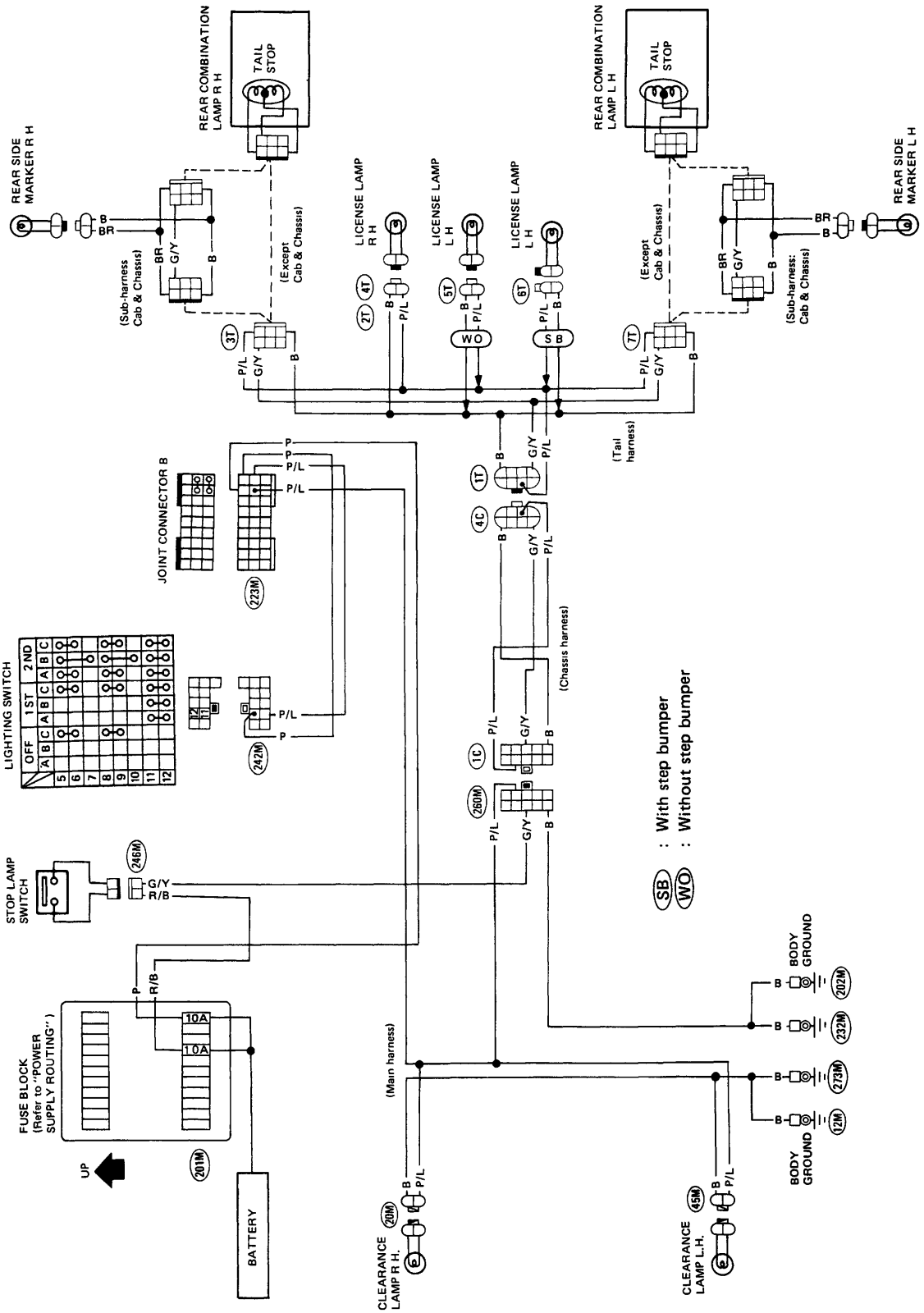
When using a mechanical aimer, adjust adapter legs to the data marked on the headlamps.

Example:



Clearance, License, Tail and Stop Lamps/Wiring Diagram

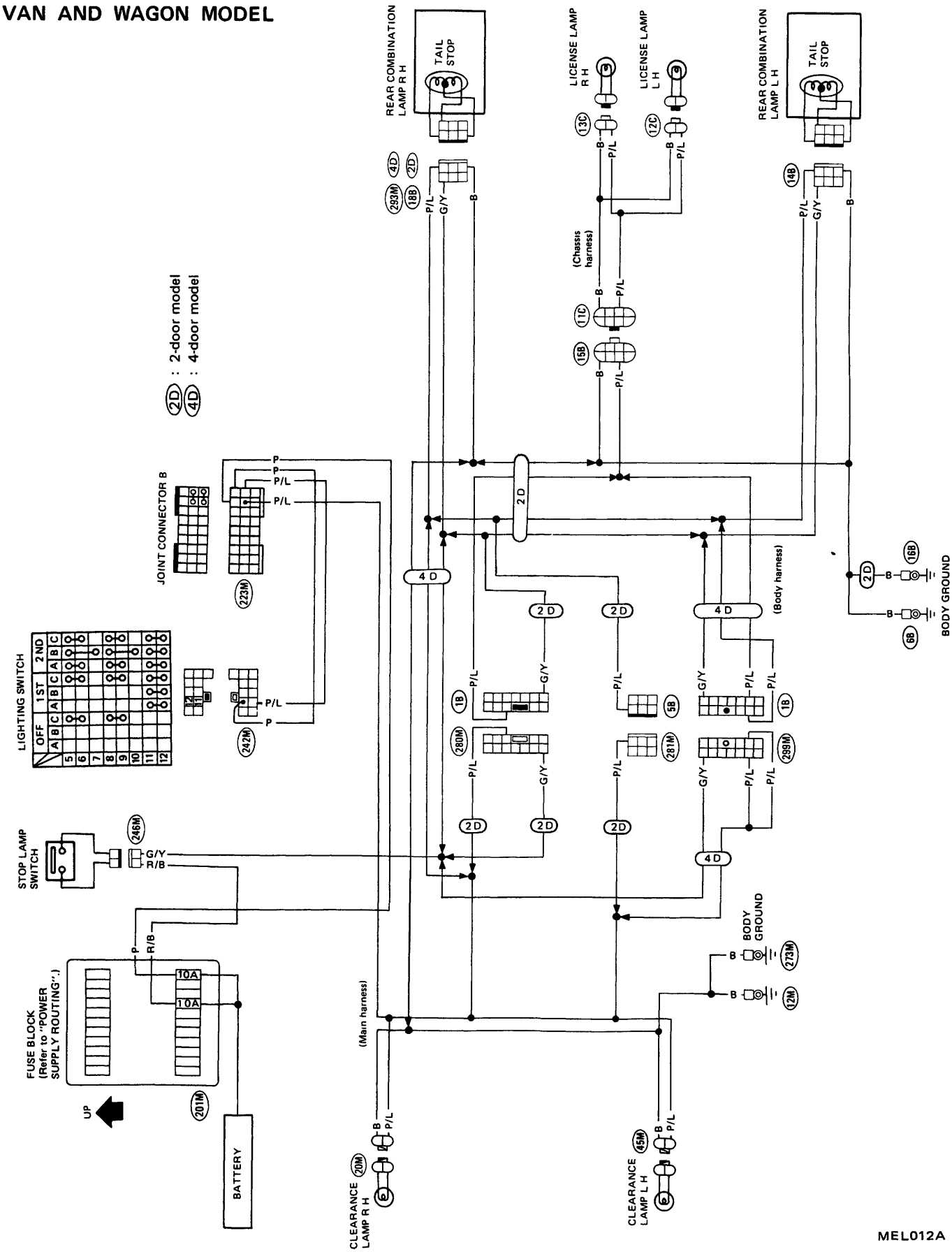
TRUCK MODEL



SEL412N

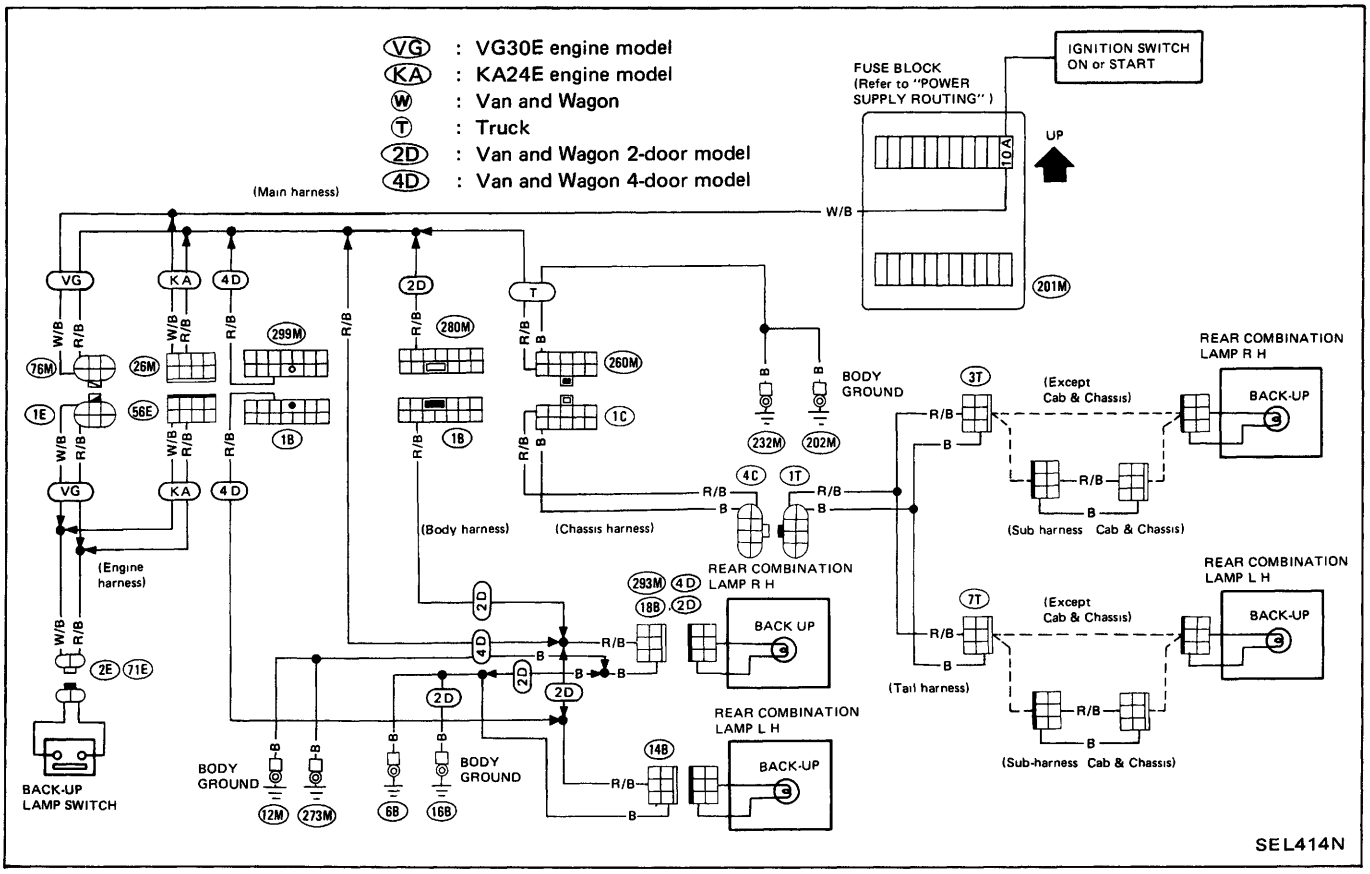
Clearance, License, Tail and Stop Lamps/Wiring Diagram (Cont'd)

VAN AND WAGON MODEL

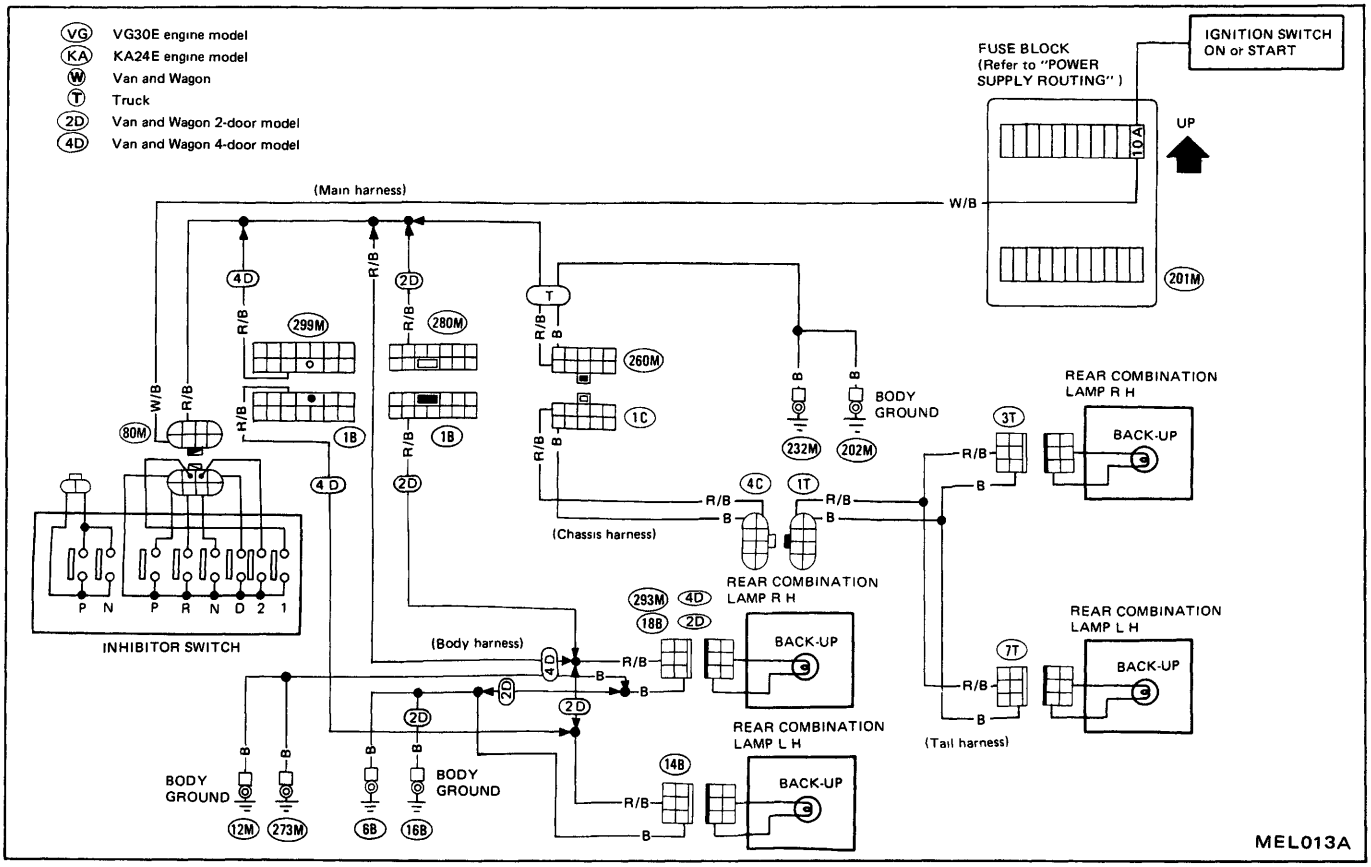


Back-up Lamp/Wiring Diagram

M/T MODEL

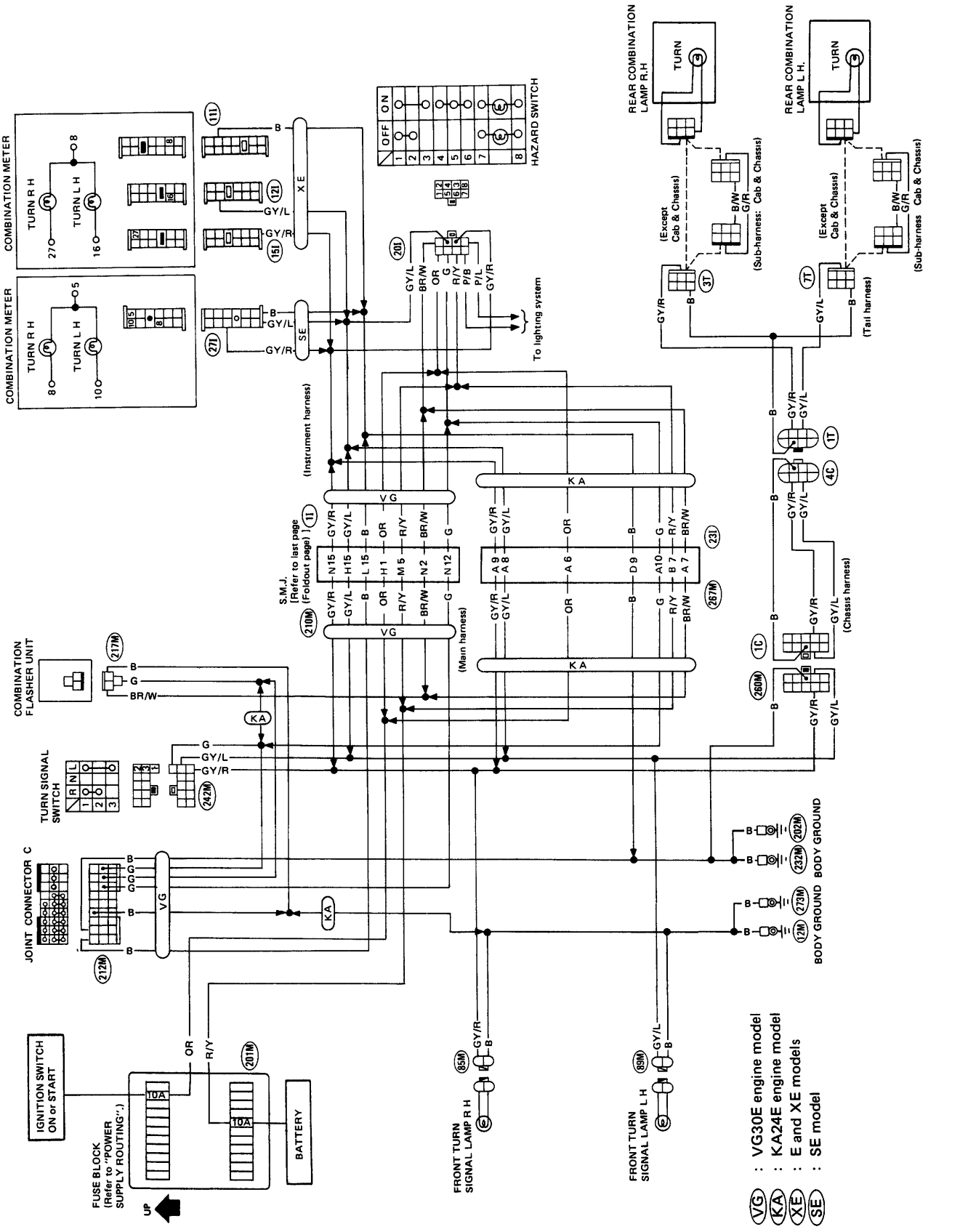


A/T MODEL



Turn Signal and Hazard Warning Lamps/Wiring Diagram

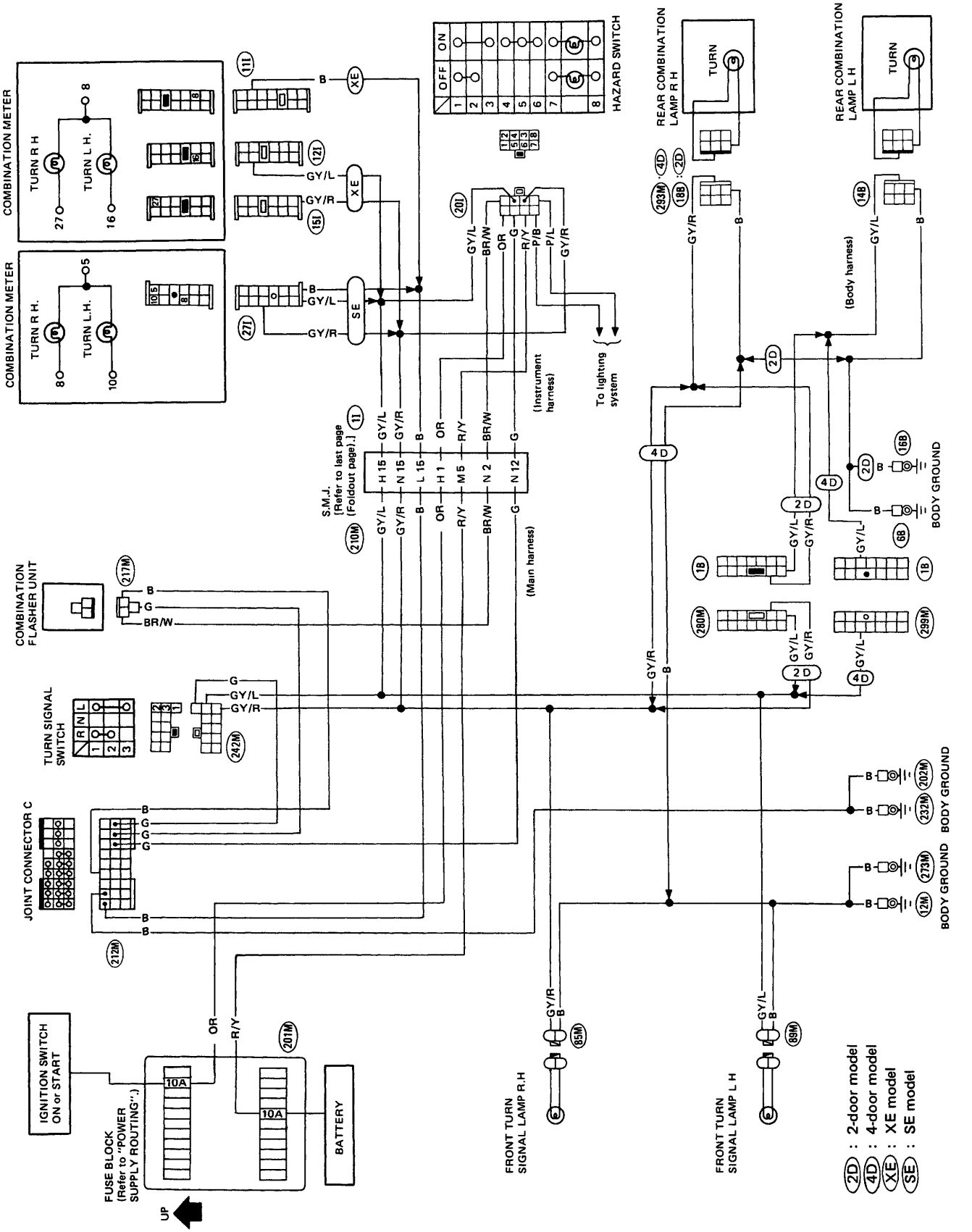
TRUCK MODEL



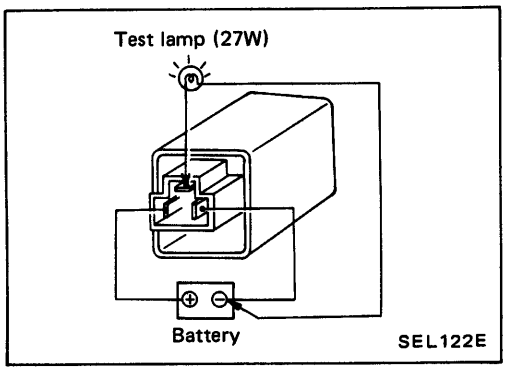
SEL416N

Turn Signal and Hazard Warning Lamps/Wiring Diagram (Cont'd)

VAN AND WAGON MODEL



SEL417N



Combination Flasher Unit Check

- Before checking, ensure that bulbs meet specifications.
- Connect a battery and test lamp to the combination flasher unit, as shown. Combination flasher unit is properly functioning if it blinks when power is supplied to the circuit.

Bulb Specifications

HEADLAMPS

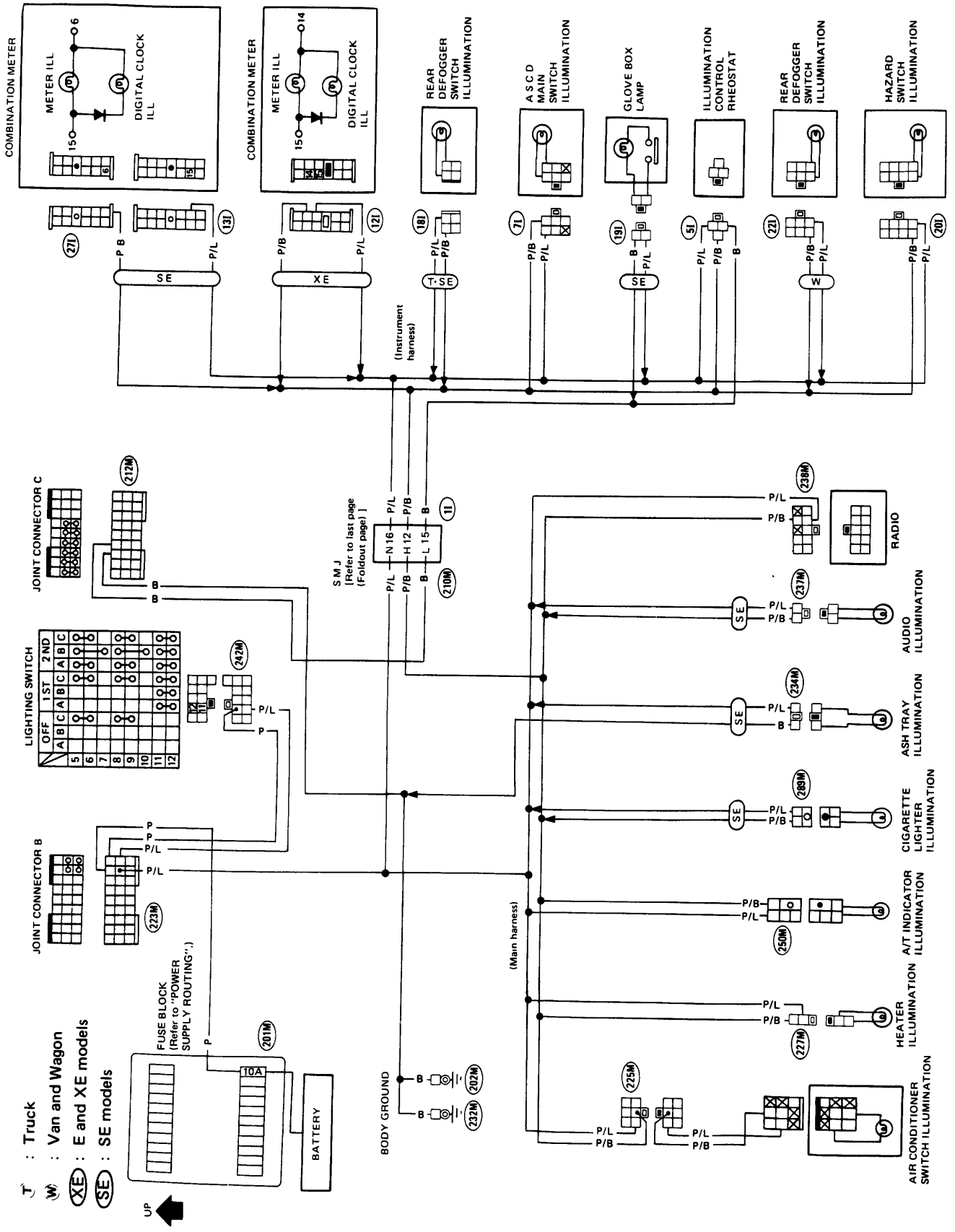
	Wattage (W)	Bulb No.
Conventional bulb	65/55	H6052
Halogen bulb	65/35	H6054

OTHER LAMPS

	Wattage (W)	Bulb No.
Front turn signal lamp	27	1156
Front clearance lamp	3.8	194
Rear combination lamp		
Turn signal	27	1156
Stop/Tail	27/8	1157
Back-up	27	1156
Rear side marker lamp	3.4	158
License plate lamp	3.8 or 5	194 (For 3.8W lamp)
Interior lamp	10	–

Illumination/Wiring Diagram

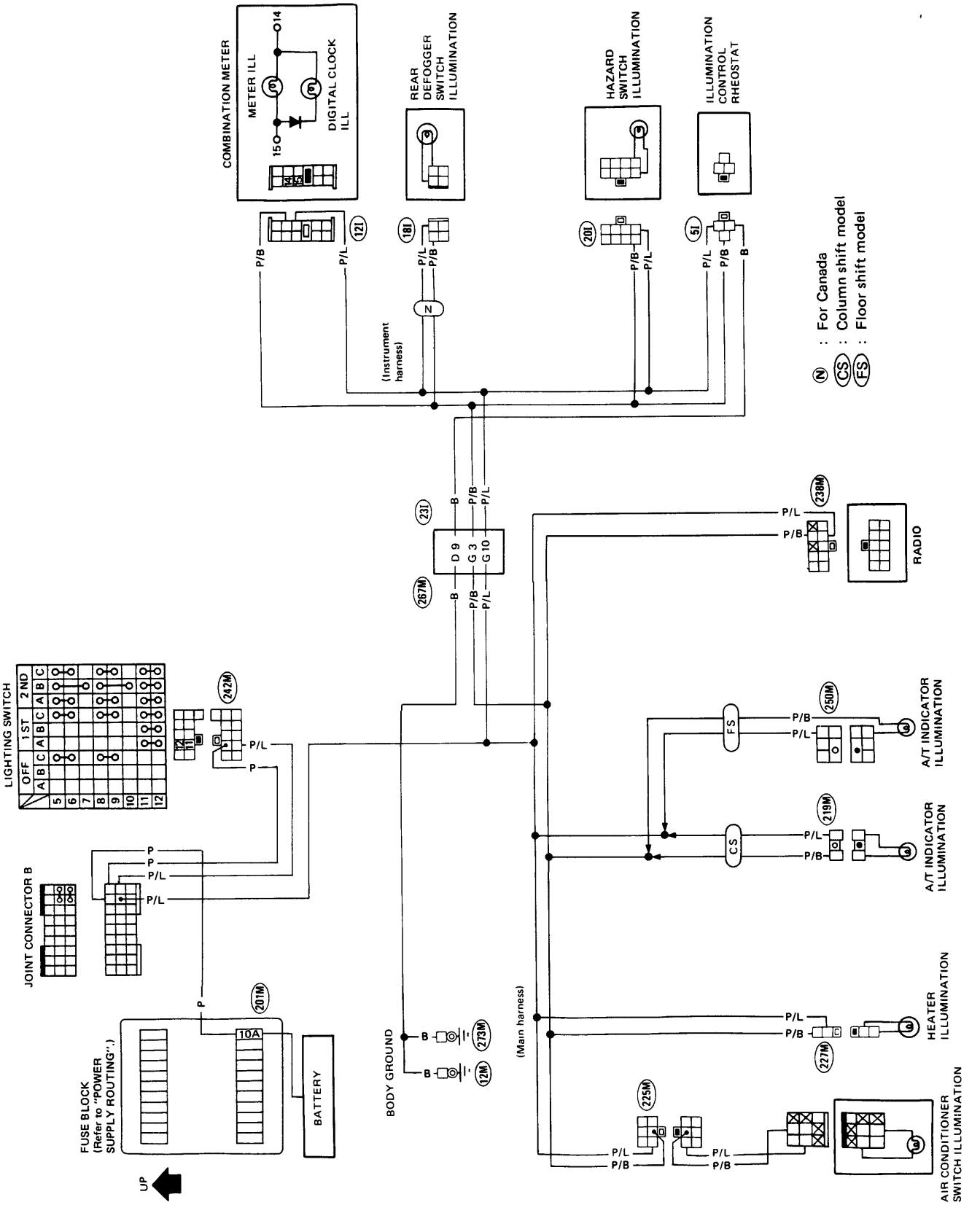
EXCEPT TRUCK WITH KA24E ENGINE



MEL014A

Illumination/Wiring Diagram (Cont'd)

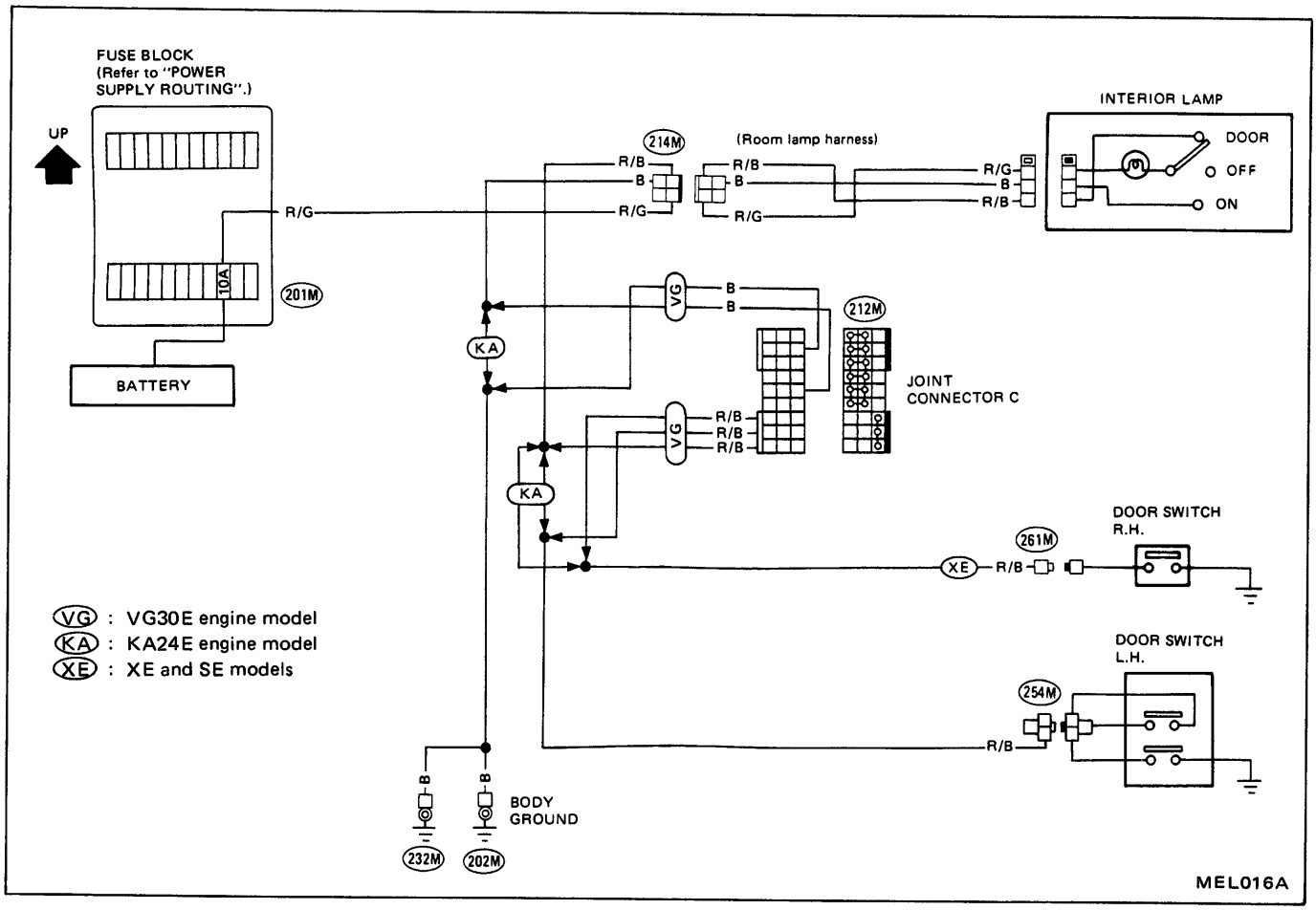
TRUCK WITH KA24E ENGINE



MEL015A

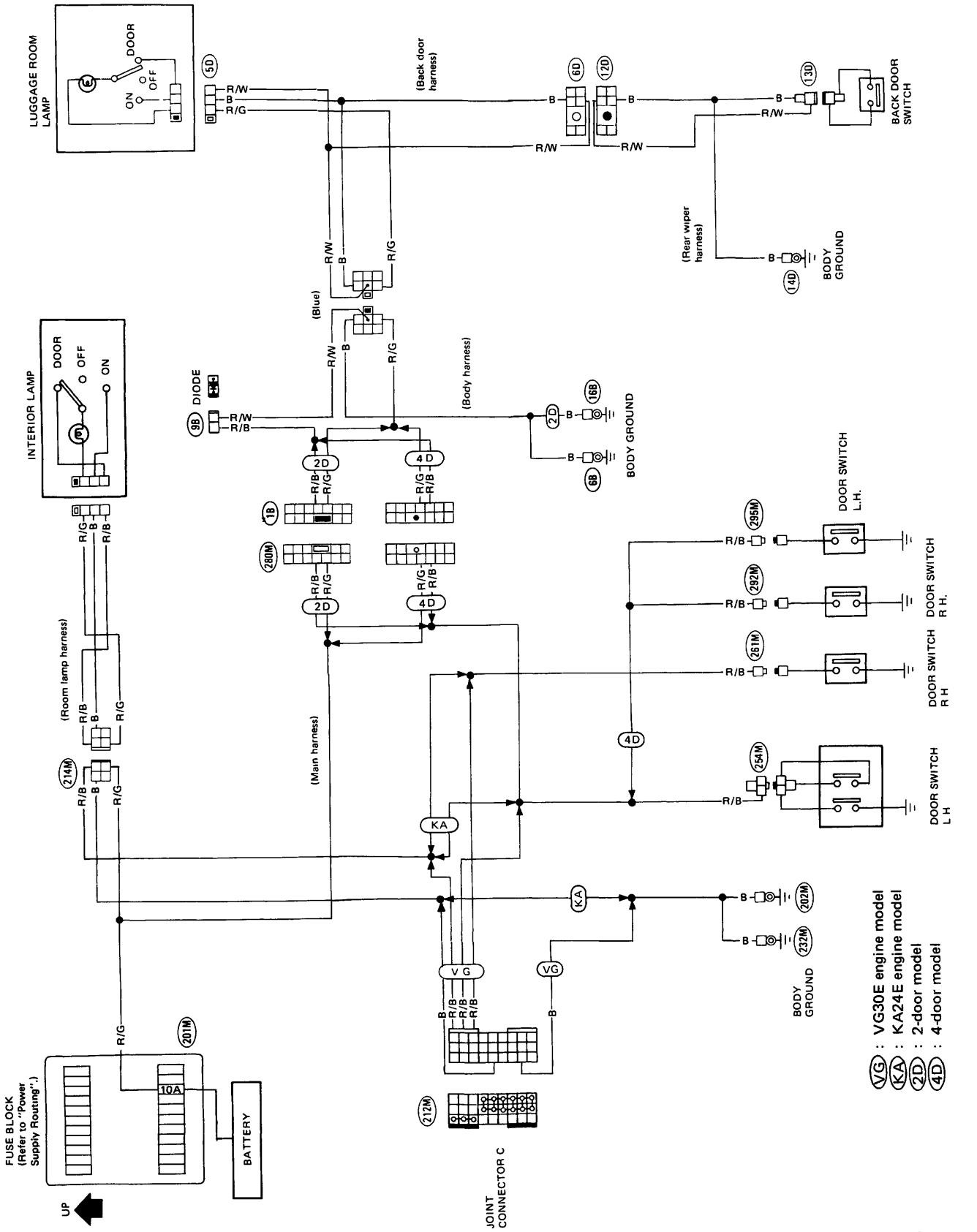
Interior Lamp/Wiring Diagram

TRUCK MODEL



Interior Lamp/Wiring Diagram (Cont'd)

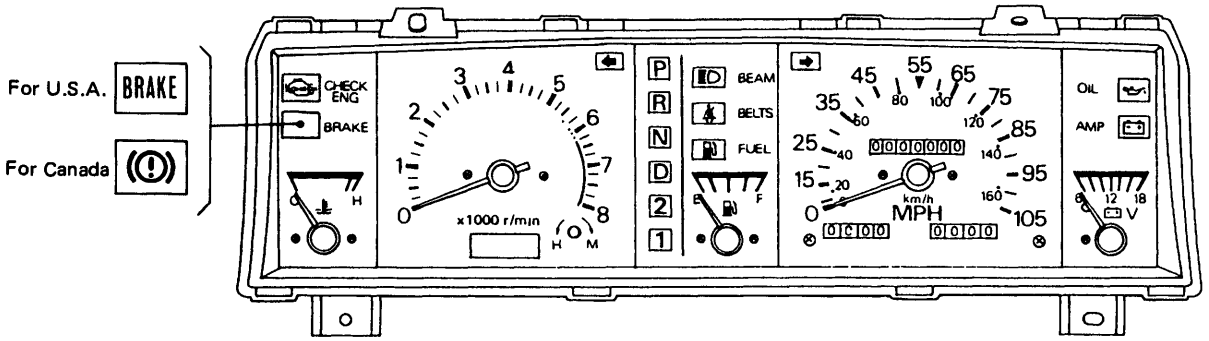
VAN AND WAGON MODEL

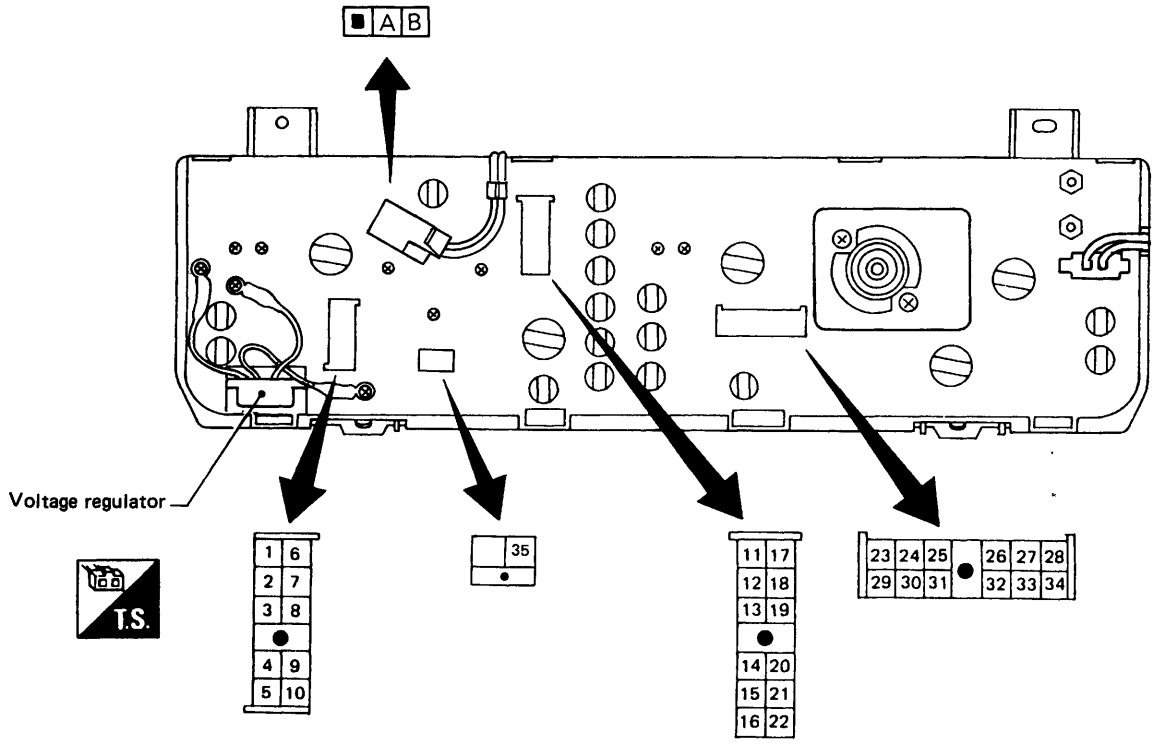


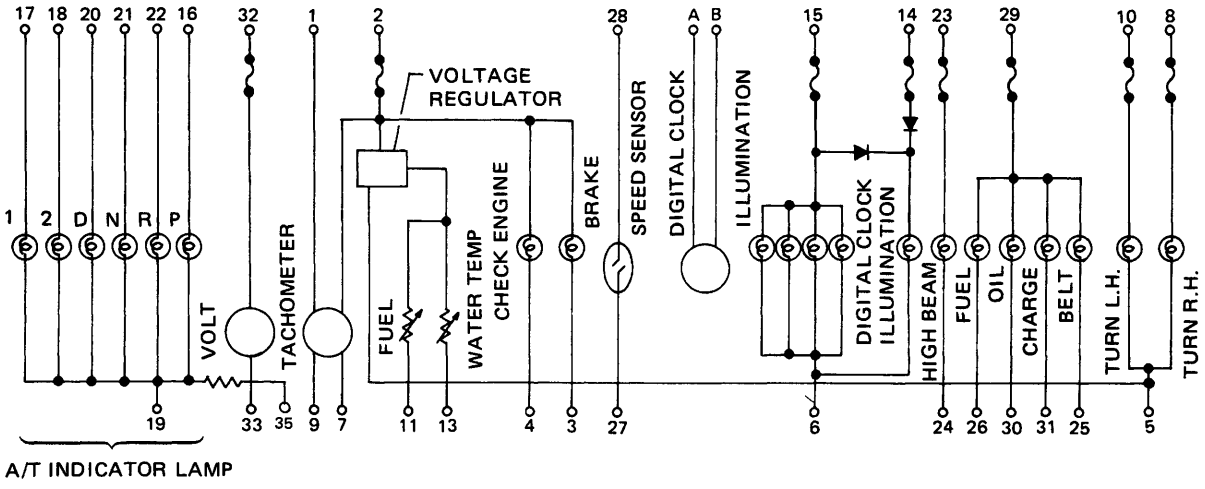
MEL017A

Combination Meter

SE MODEL



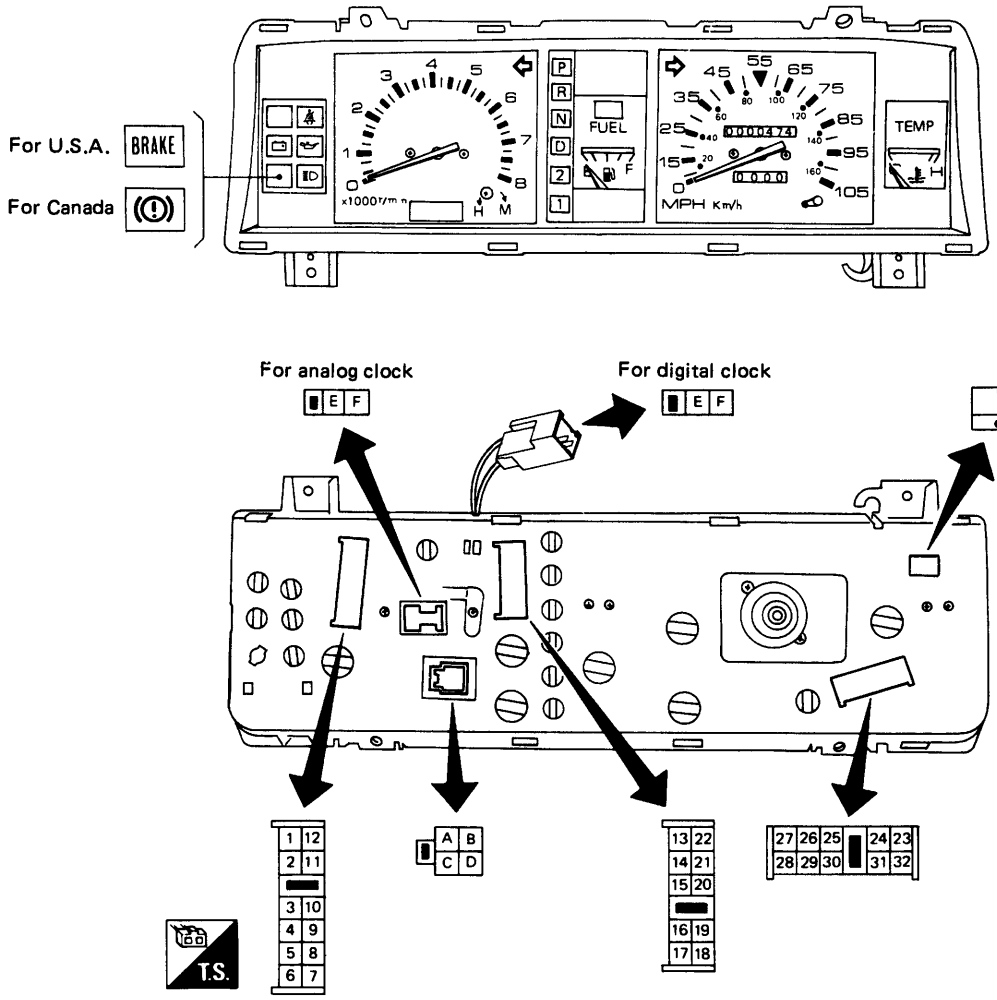




SEL422N

Combination Meter (Cont'd)

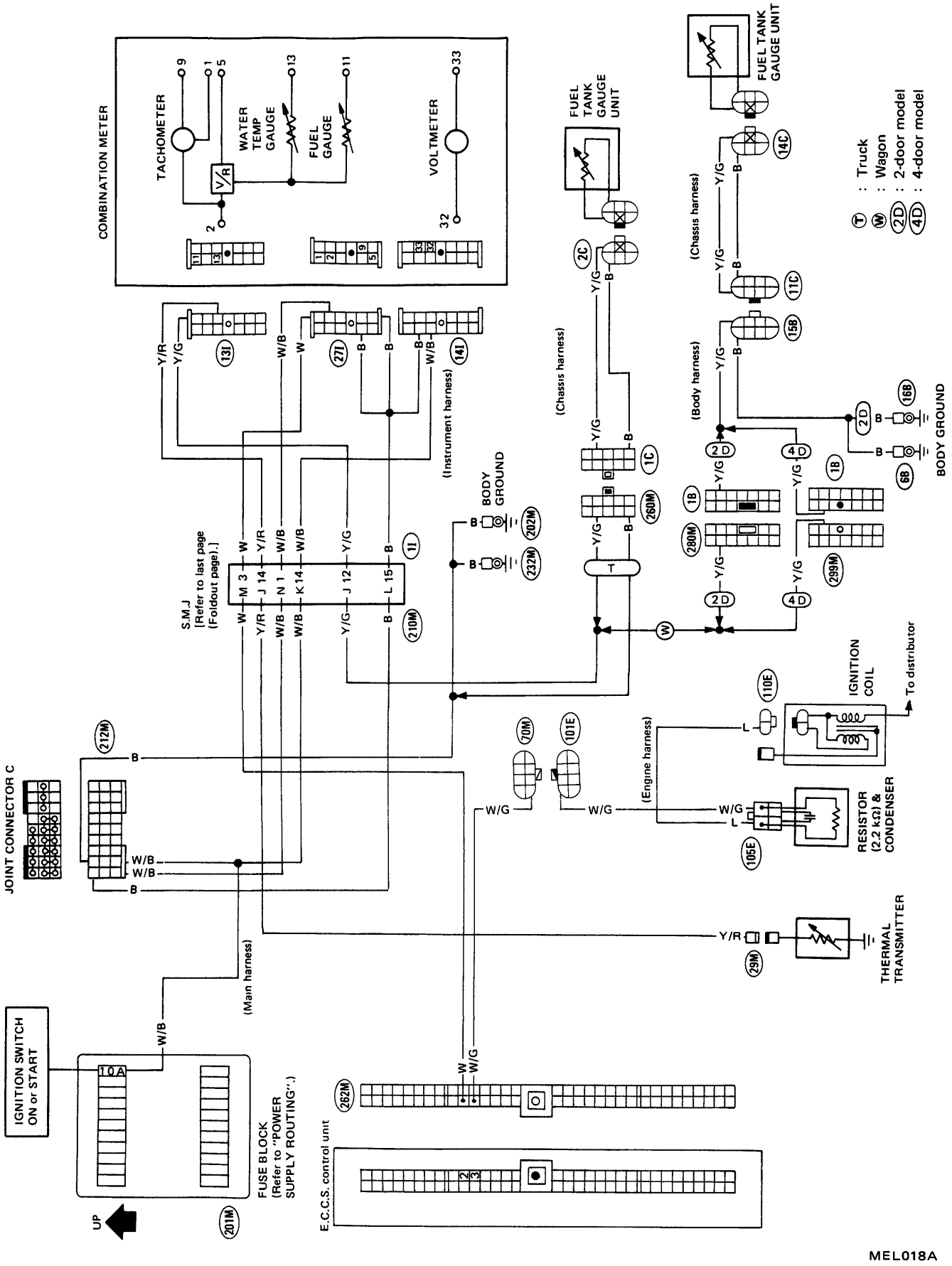
E AND XE MODEL



SEL423N

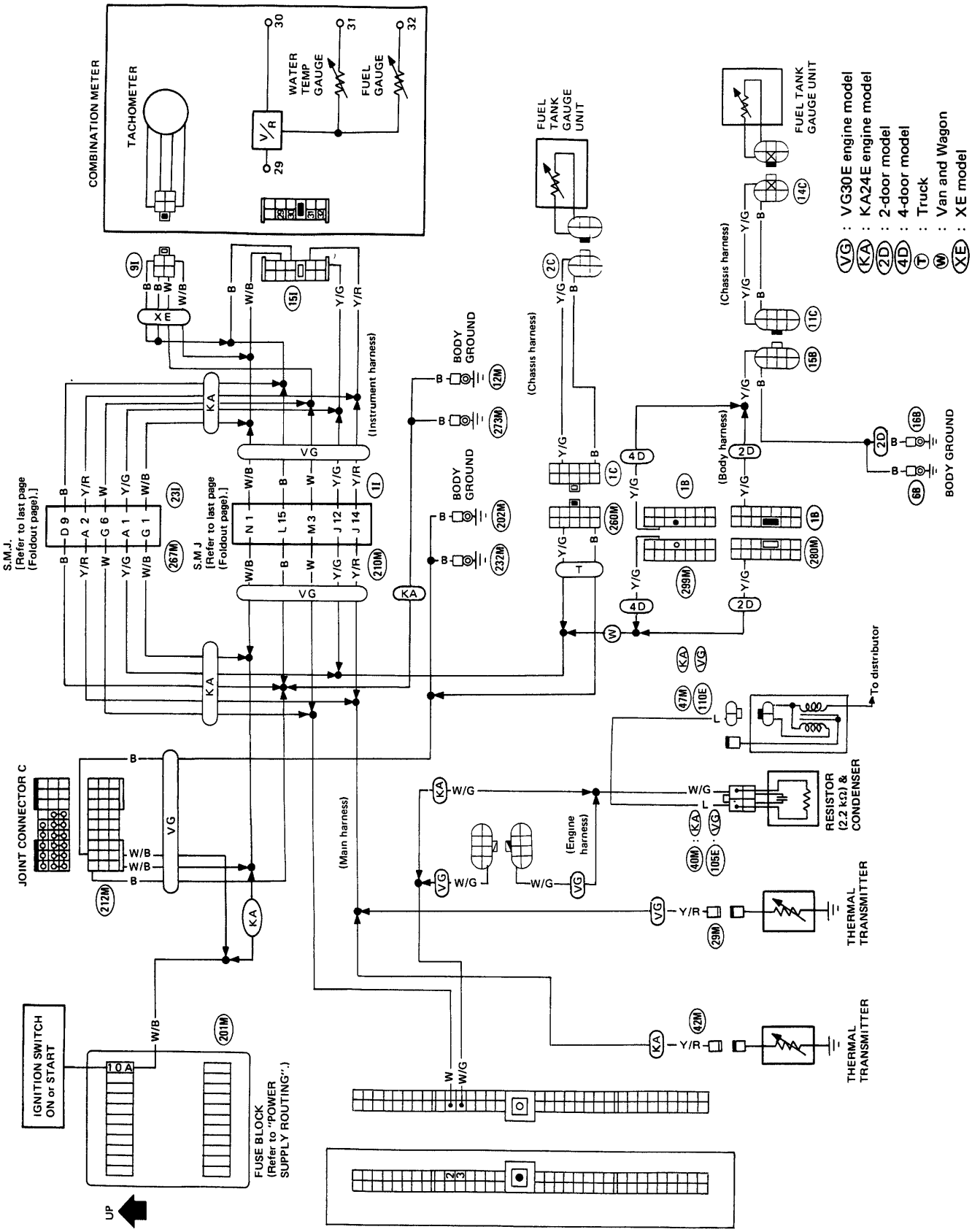
Wiring Diagram

SE MODEL



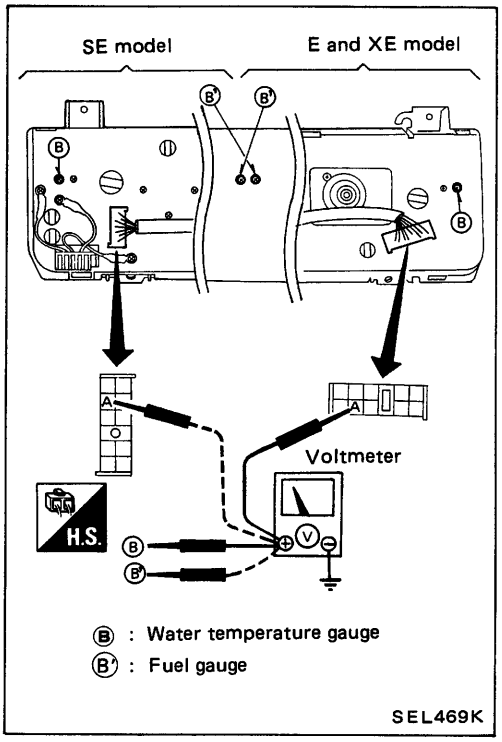
Wiring Diagram (Cont'd)

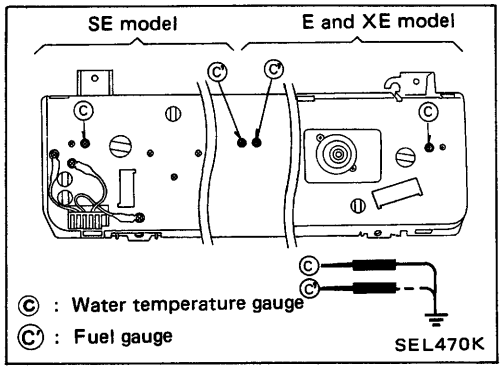
E AND XE MODEL

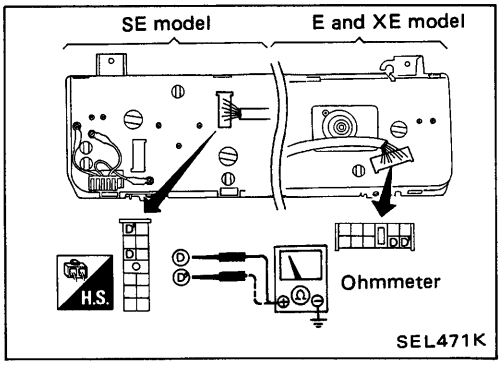


MEL019A

Inspection/Fuel Gauge and Water Temperature Gauge







INSPECTION START

O.K.

CHECK POWER SOURCE
1) Turn ignition switch "ON".
2) Check voltage between terminal Ⓐ and ground.
Battery voltage should exist.

N.G. → Check the following items.
1) Harness continuity between Battery terminal and combination meter
2) Ignition relay
3) Fusible link and fuse
4) Ignition switch

O.K.

CHECK OUTPUT VOLTAGE
1) Turn ignition switch "ON".
2) Check voltage between terminal Ⓑ and ground.
Approx. 8 volts should exist.

N.G. → Check the following items.
1) Printed circuit of combination meter
2) Voltage regulator

O.K.

CHECK GAUGE OPERATION
1) Turn ignition switch "ON".
2) Connect terminal Ⓒ and ground with wire for **less than 10 seconds.**
3) Check operation of gauge.
Gauge should move smoothly to full scale.

N.G. → Repair or Replace gauge.

O.K.

Check harness continuity between component and combination meter Ⓓ.

N.G. → Repair or Replace.

O.K.

CHECK COMPONENT.
Check gauge units and harness.
Refer to "Fuel Tank Gauge Unit Check" or "Thermal Transmitter Check".

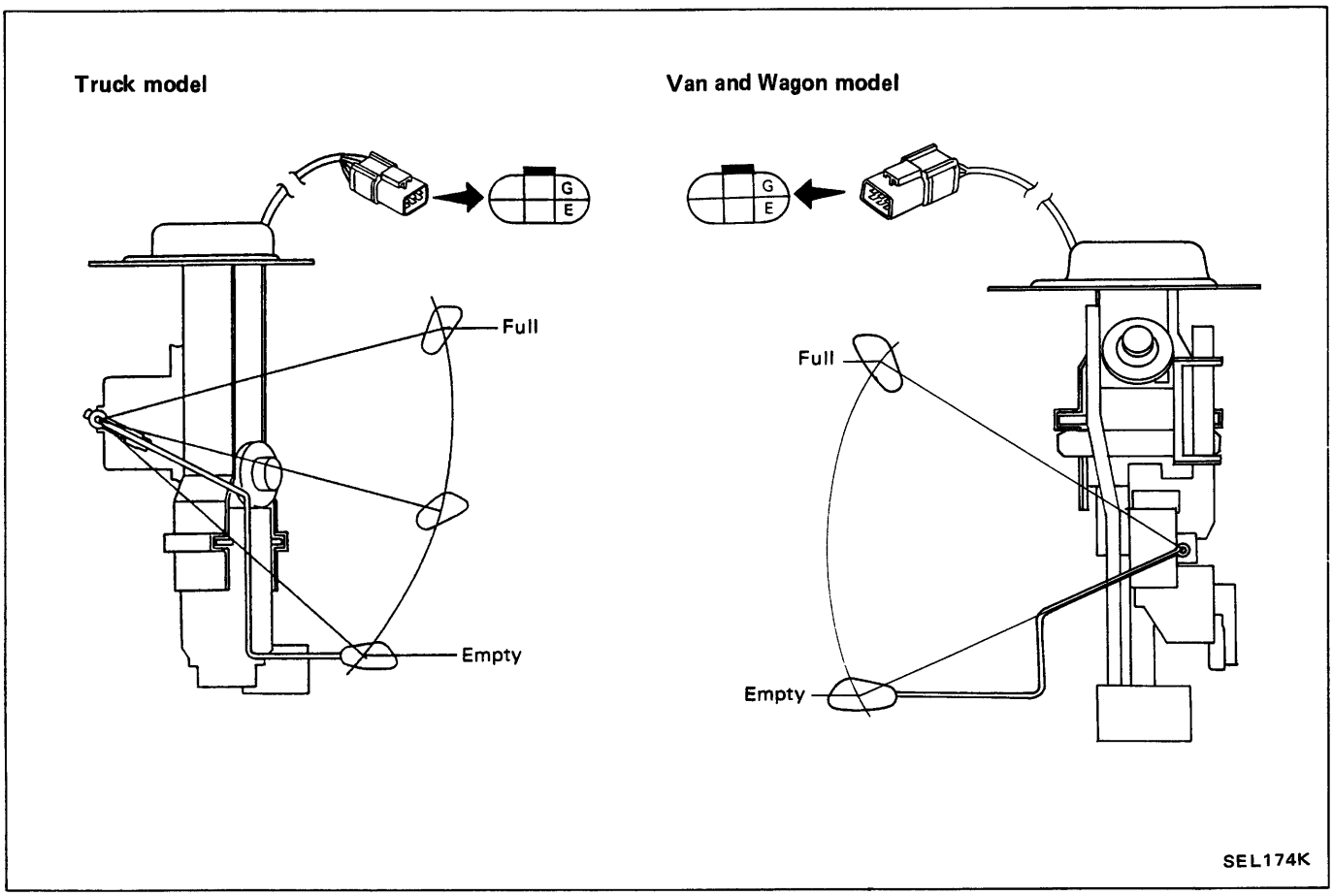
N.G. → Repair or Replace.
Refer to FE section. (Fuel gauge)

O.K.

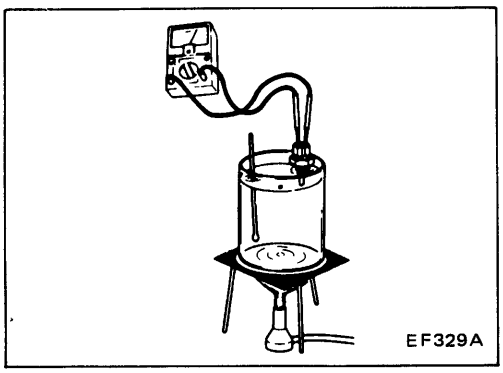
Reinstall any part removed.

INSPECTION END

Fuel Tank Gauge Unit Check



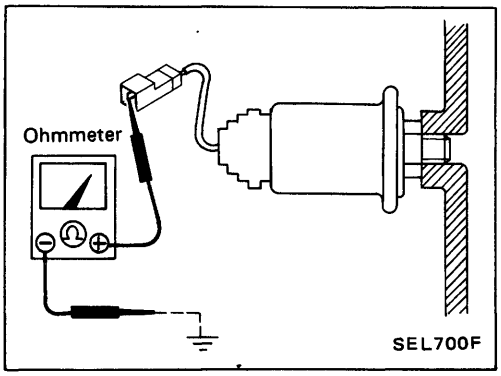
Ohmmeter (+)	Ohmmeter (−)	Model	Float position	Resistance value
Ⓖ	Ⓔ	Truck	Full	Approx. 3.8 - 8.5Ω
			Empty	Approx. 83.6 - 93.6Ω
		Van and Wagon	Full	Approx. 6.7 - 8.5Ω
			Empty	Approx. 86.6 - 93.7Ω



Thermal Transmitter Check

Check the resistance between the terminals of thermal transmitter and body ground.

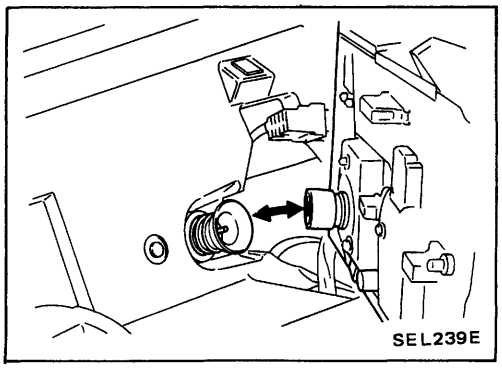
Water temperature	Resistance
60°C (140°F)	Approx. 70 - 90Ω
100°C (212°F)	Approx. 21 - 24Ω



Oil Pressure Switch Check

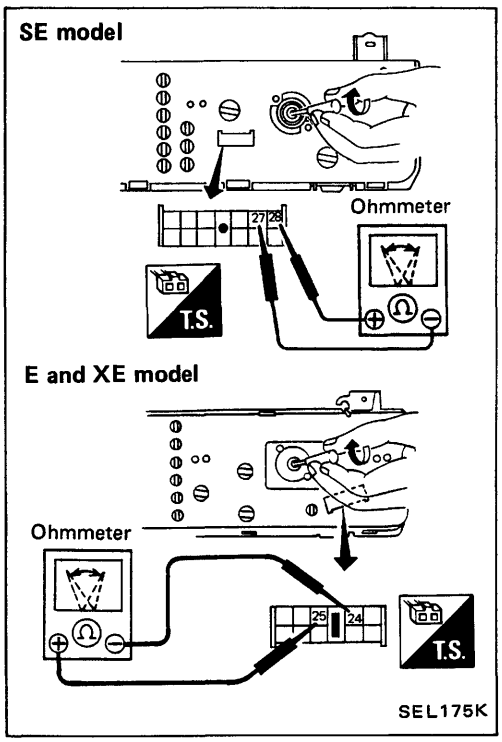
Check the continuity between the terminals of oil pressure switch and body ground.

Oil pressure kPa (kg/cm^2, psi)	Operation
More than 10 - 20 (0.1 - 0.2, 1.4 - 2.8)	ON
Less than 10 - 20 (0.1 - 0.2, 1.4 - 2.8)	OFF



Speedometer Cable Removal and Installation

Combination meter and speedometer cable can be joined together simply by inserting combination meter.



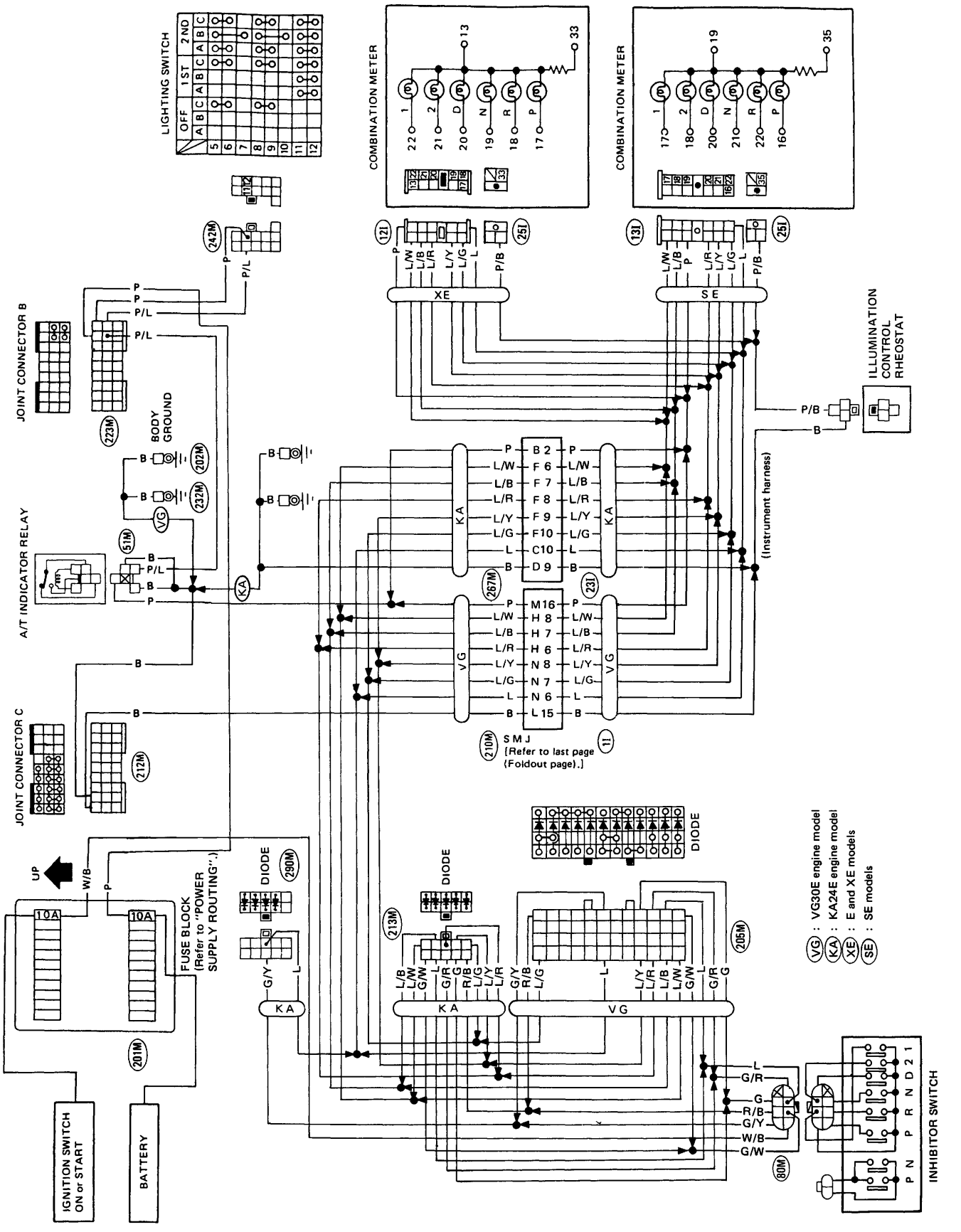
Speed Sensor Signal Check

- A speed sensor is built into the speedometer.

1. Turn speedometer slowly using a small screwdriver.
2. Check continuity of speed sensor circuit.

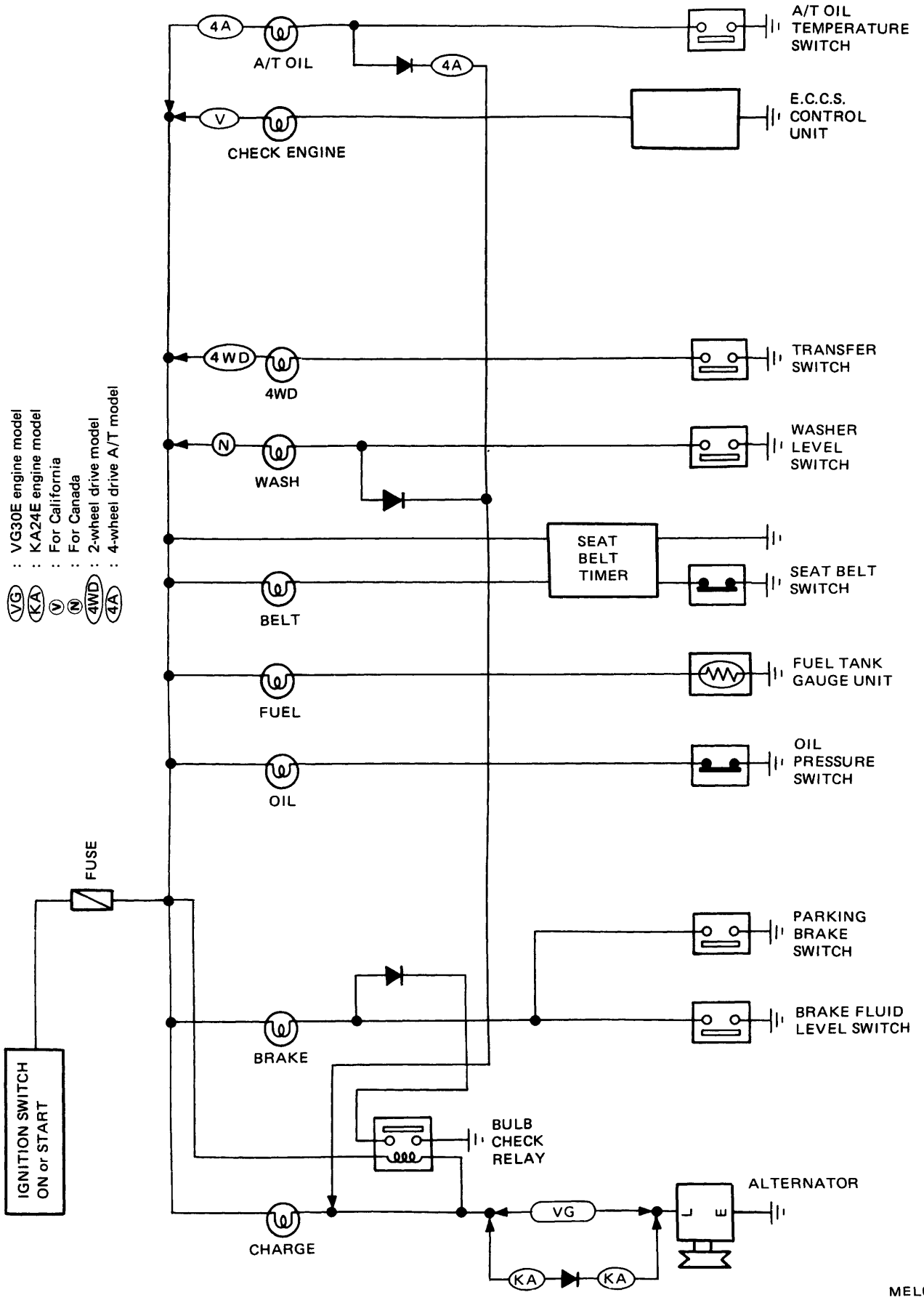
Continuity exists two times for each turn ... O.K.

A/T Indicator Lamp/Wiring Diagram



MEL020A

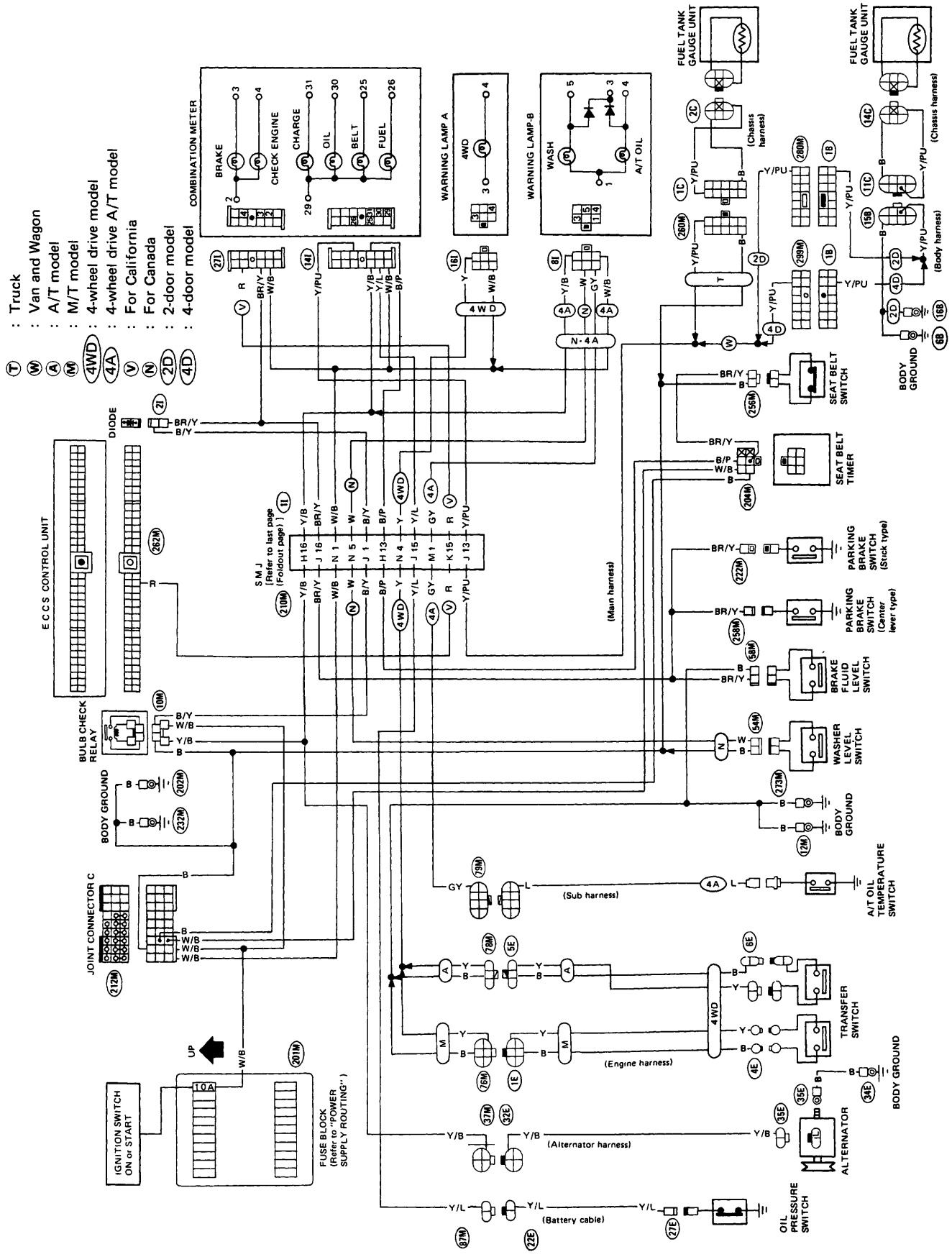
Warning Lamps/Schematic



MEL021A

Warning Lamps/Wiring Diagram

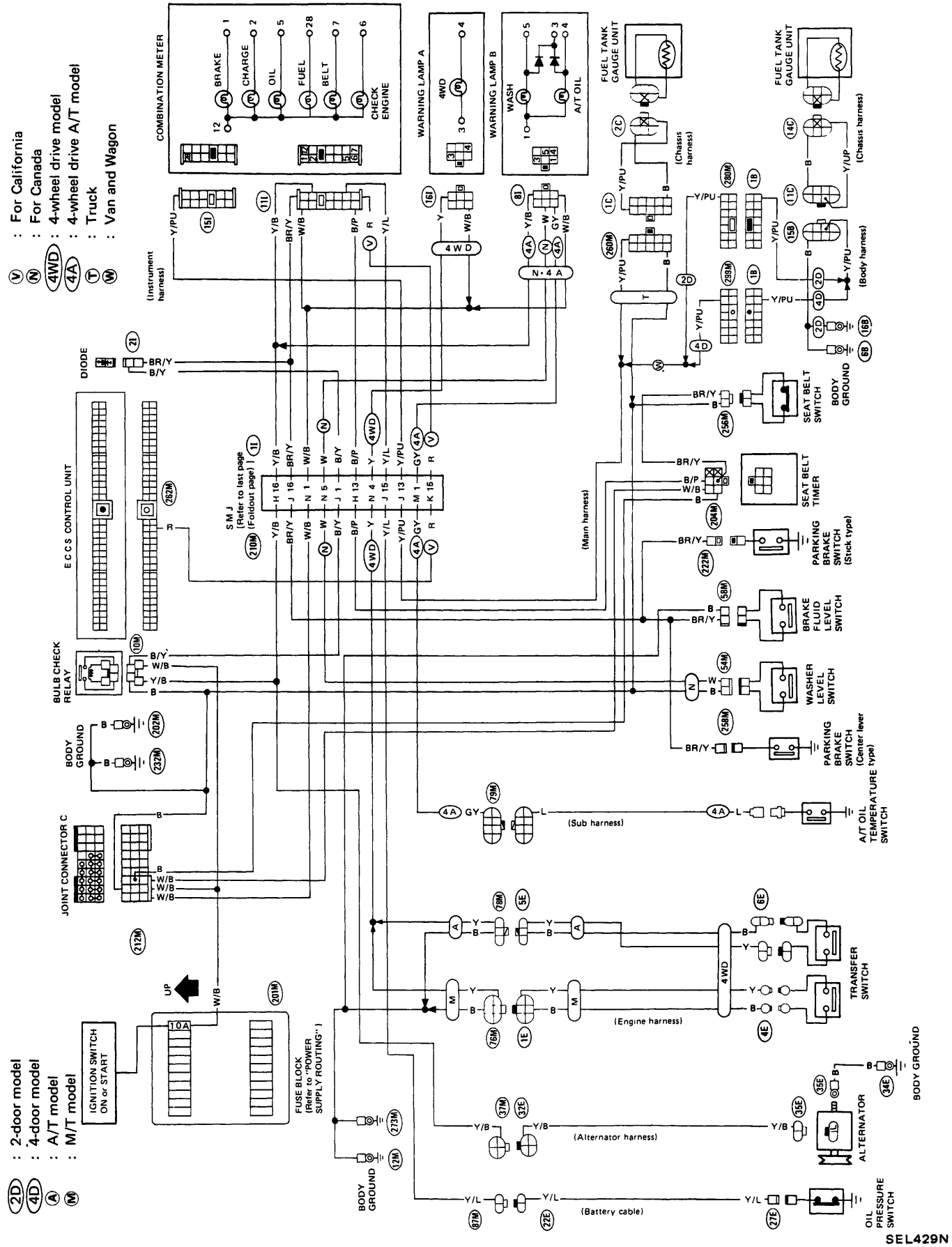
SE MODEL WITH VG30E ENGINE



SEL428N

Warning Lamps/Wiring Diagram (Cont'd)

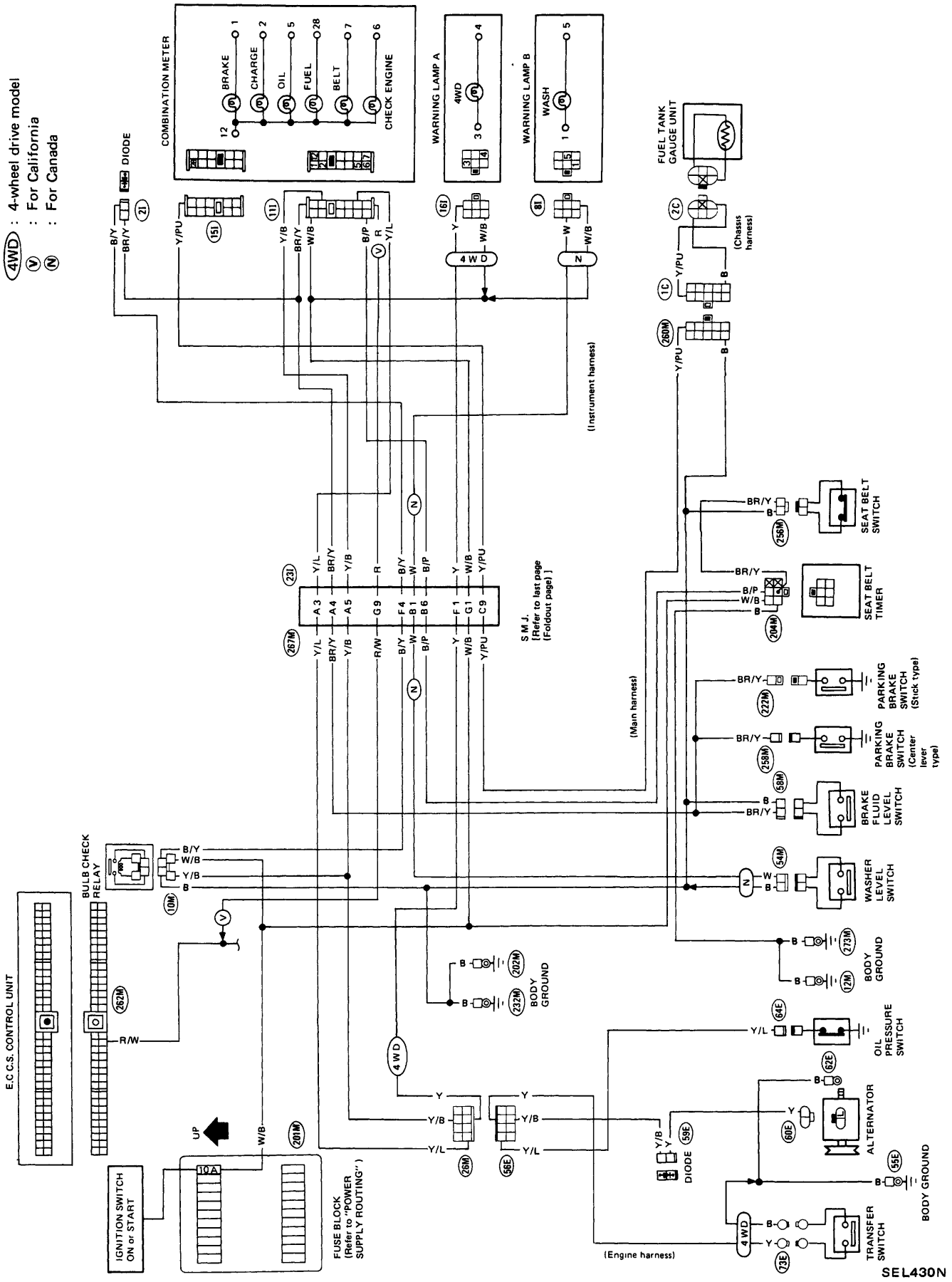
E AND XE MODEL WITH VG ENGINE



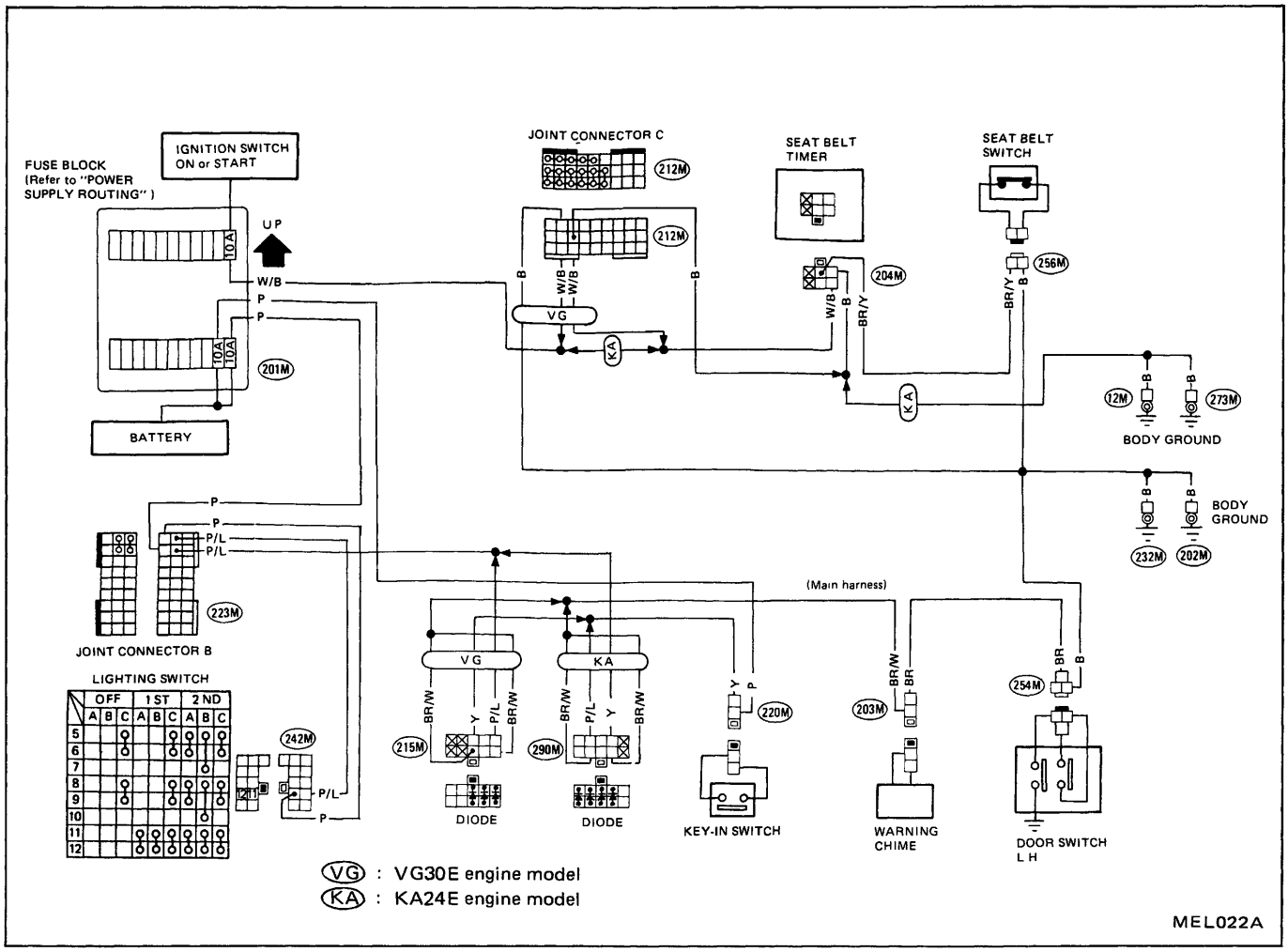
SEL429N

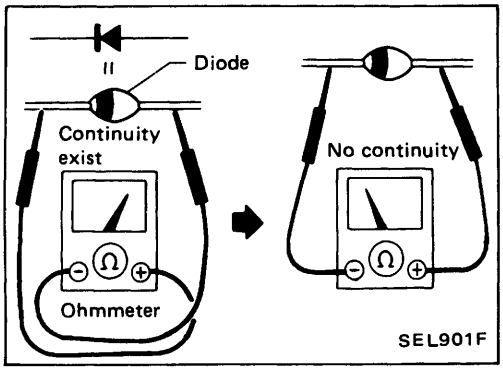
Warning Lamps/Wiring Diagram (Cont'd)

KA24E ENGINE MODEL



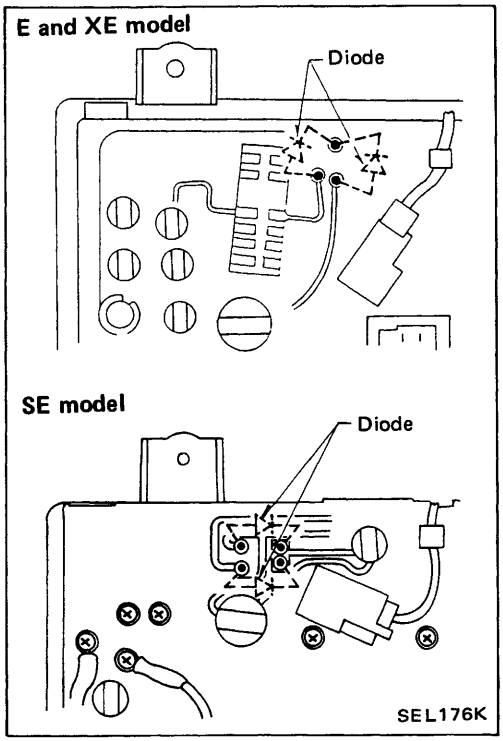
Warning Chime/Wiring Diagram



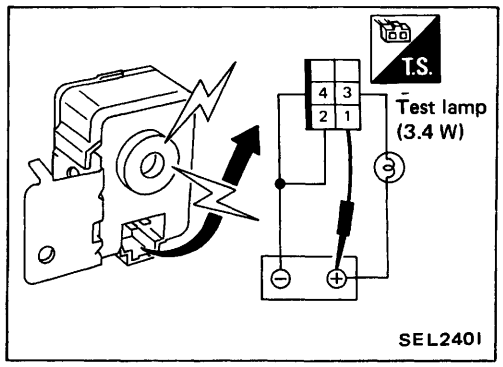


Diode Check

- Check continuity using an ohmmeter.
- Diode is functioning properly if test results are as shown in the figure on the left.

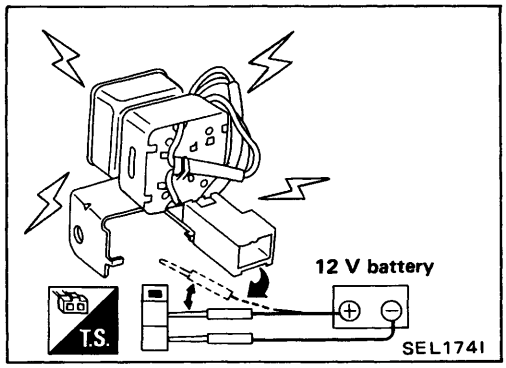


- Diodes for clock illumination lamp are built into the combination meter printed circuit.



Seat Belt Timer Check

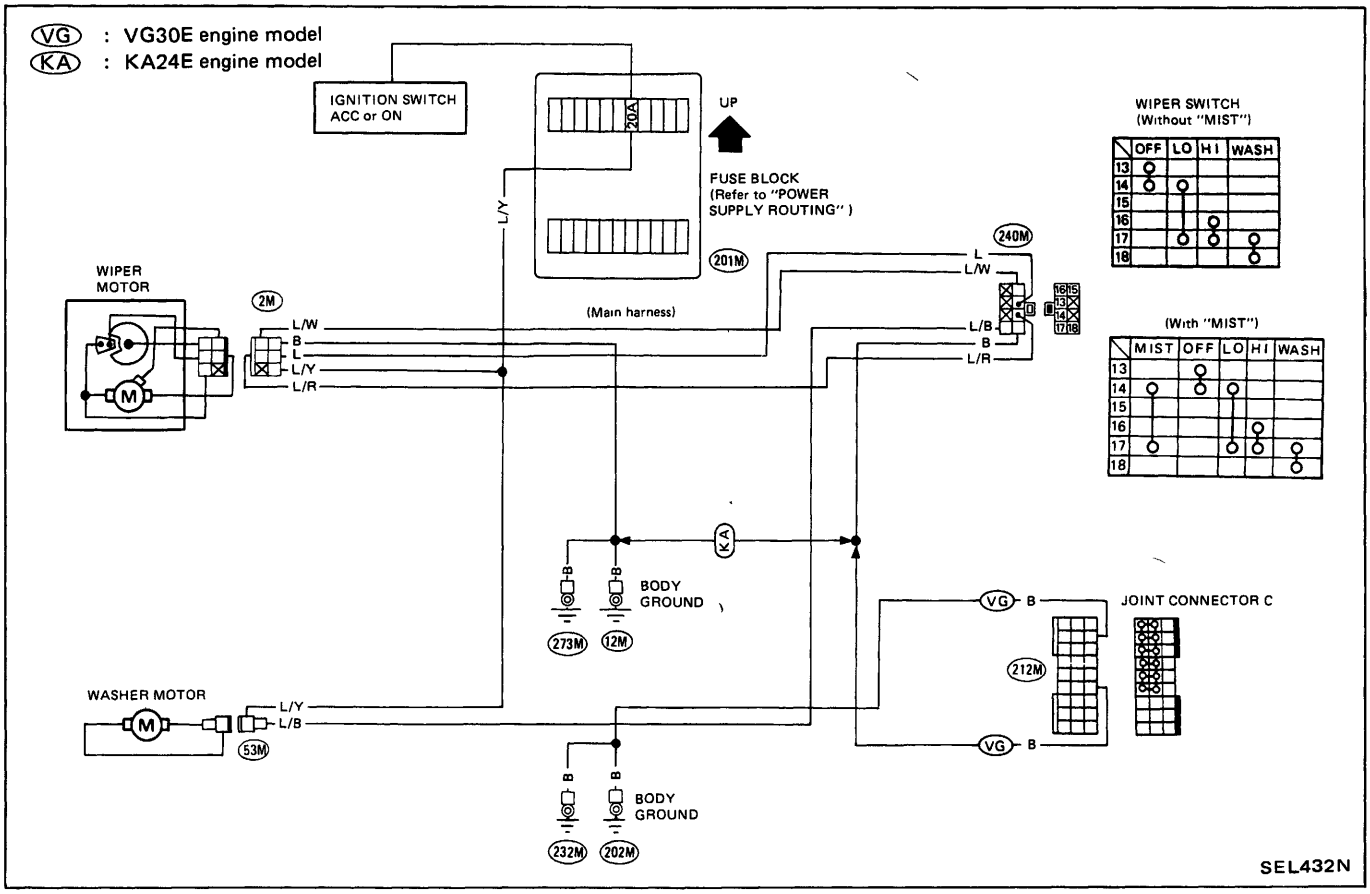
Connect as shown in the figure to the left.
If chime and test lamp come on for 4-8 seconds when connecting terminal ① to battery ⊕ terminal, seat belt timer is normal.



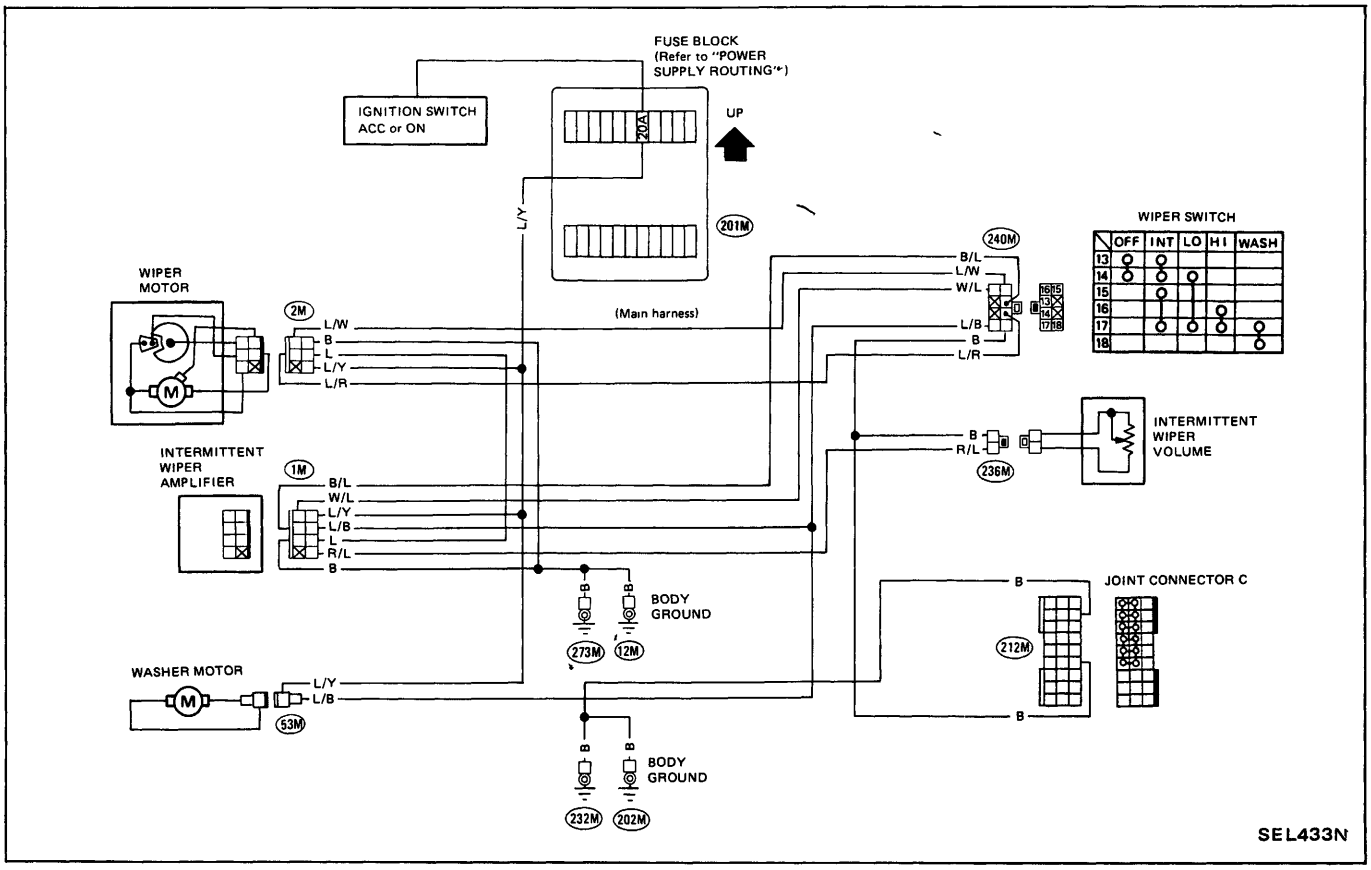
Warning Chime Check

WITHOUT INTERMITTENT WIPER

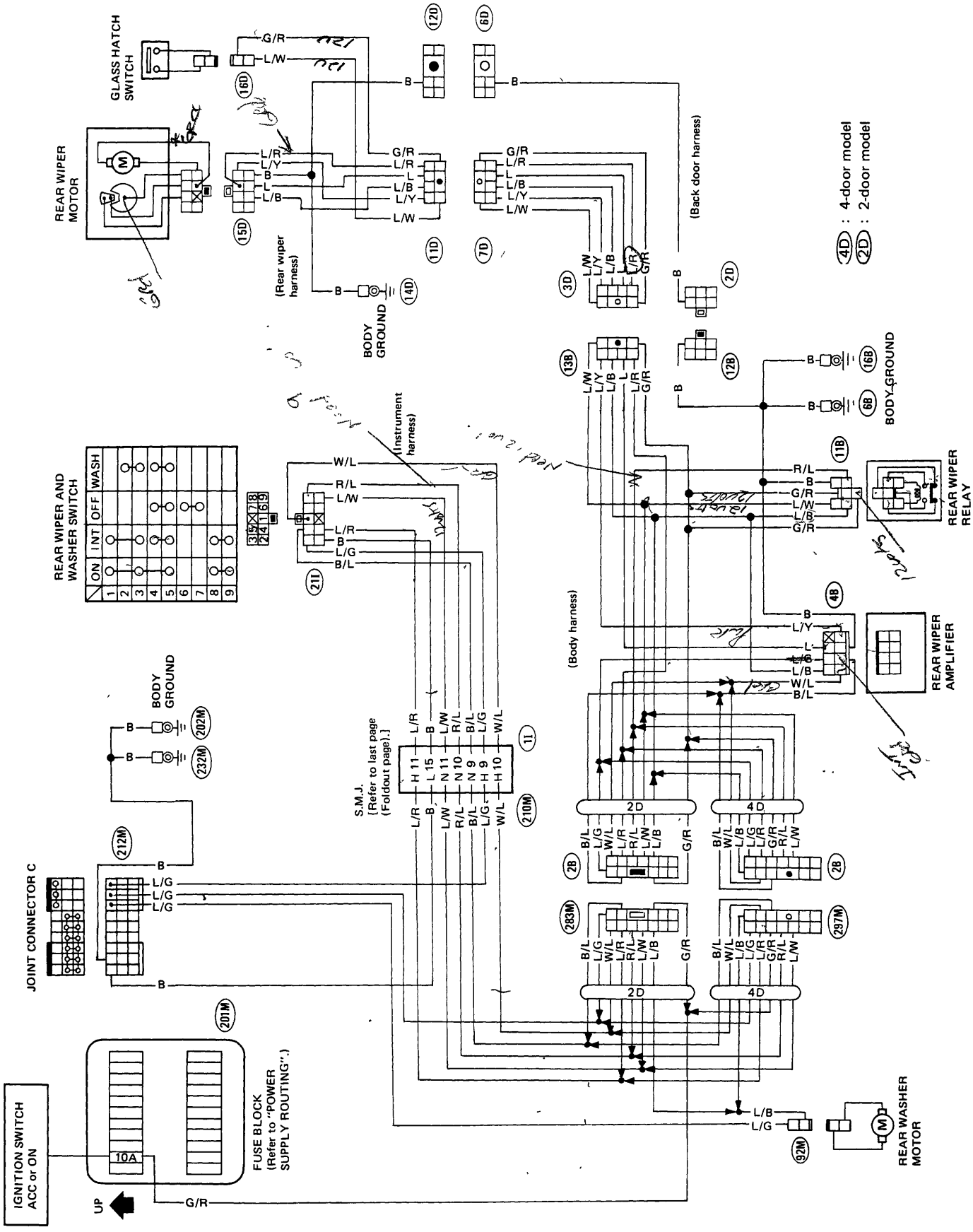
Front Wiper and Washer/Wiring Diagram



WITH INTERMITTENT WIPER



Rear Wiper and Washer/Wiring Diagram



SEL434N

Windshield Wiper Installation

Adjustment

1. Prior to wiper arm installation, turn on wiper switch to operate wiper motor and then turn it "OFF" (Auto Stop).
2. Lift the blade up and then set it down onto glass surface to set the blade center to clearance "C" immediately before tightening nut.
3. Eject washer fluid. Turn on wiper switch to operate wiper motor and then turn it "OFF".
4. Ensure that wiper blades stop within clearance "C".
   Clearance "C": 20 - 30 mm (0.79 - 1.18 in)

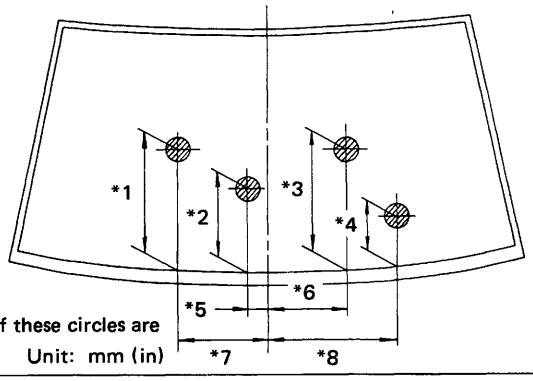
Installation

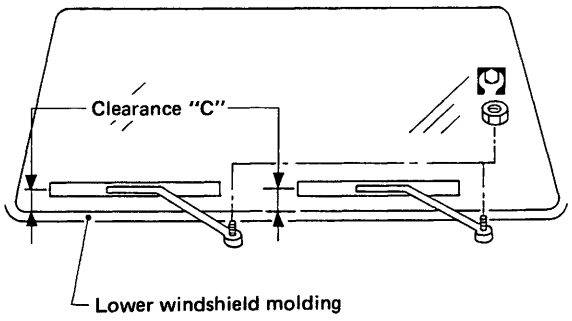
- Tighten windshield wiper arm nuts to specified torque.
  : 13 - 18 N·m (1.3 - 1.8 kg-m, 9 - 13 ft-lb)

Front wiper and washer

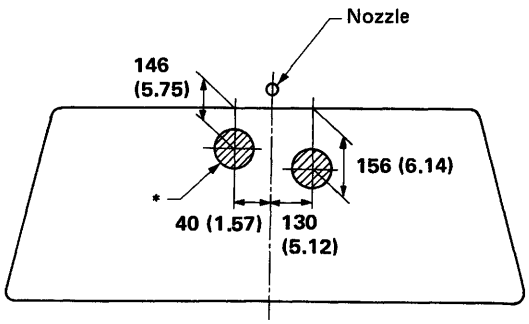
*1:	470 (18.50)
*2:	215 (8.46)
*3:	380 (14.96)
*4:	180 (7.09)
*5:	60 (2.36)
*6:	225 (8.86)
*7:	255 (10.04)
*8:	460 (18.11)

* All the diameters of these circles are less than 60 (2.36).



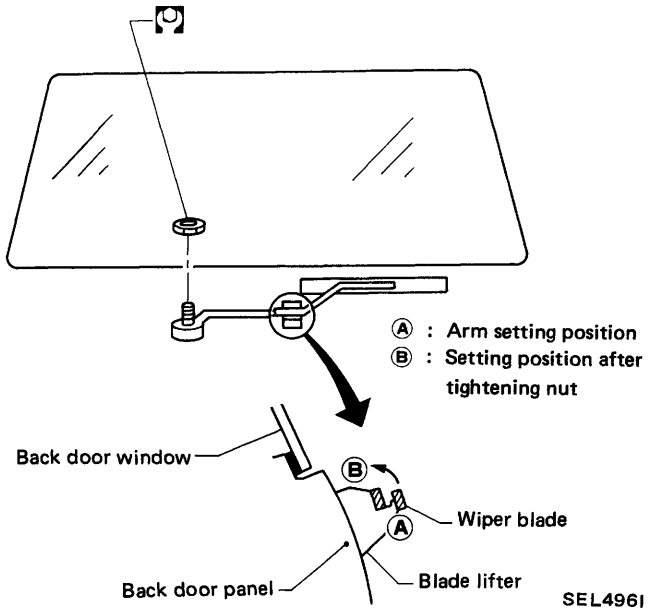


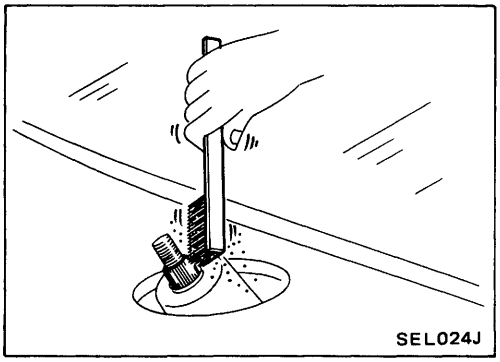
Rear wiper and washer



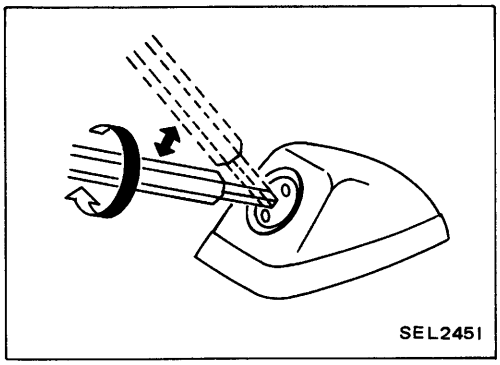
* All the diameters of these circles are less than 100 (3.94).

Unit: mm (in)





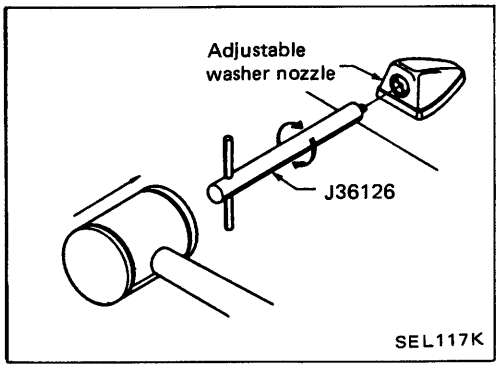
- **Before reinstalling wiper arm, clean up the pivot area as illustrated. This will reduce possibility of wiper arm looseness.**


SEL245I

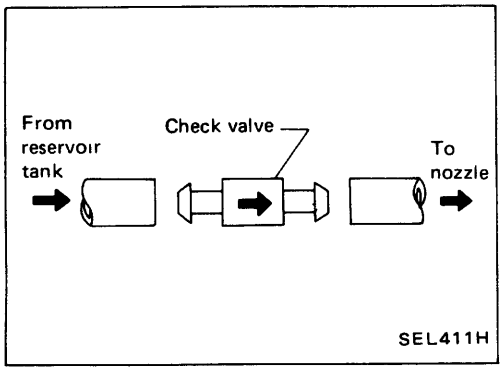
Washer Nozzle Adjustment

- Using Tool J36126, adjust windshield washer nozzle to correct its spray pattern.

Before attempting to turn the nozzle, gently tap the end of the tool to free the nozzle.
This will prevent "rounding out" the small female square in the center of the nozzle.



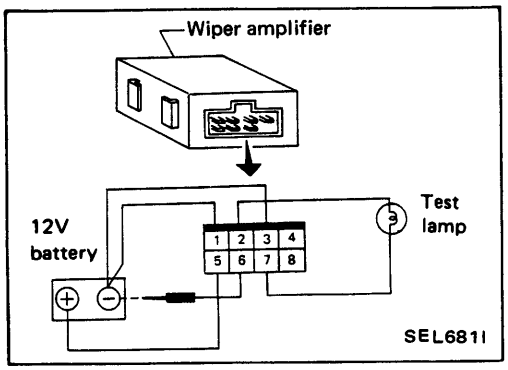
SEL117K



SEL411H

Check Valve

- A check valve is provided in the washer fluid line. Be careful not to connect check valve to washer tube in the wrong direction.

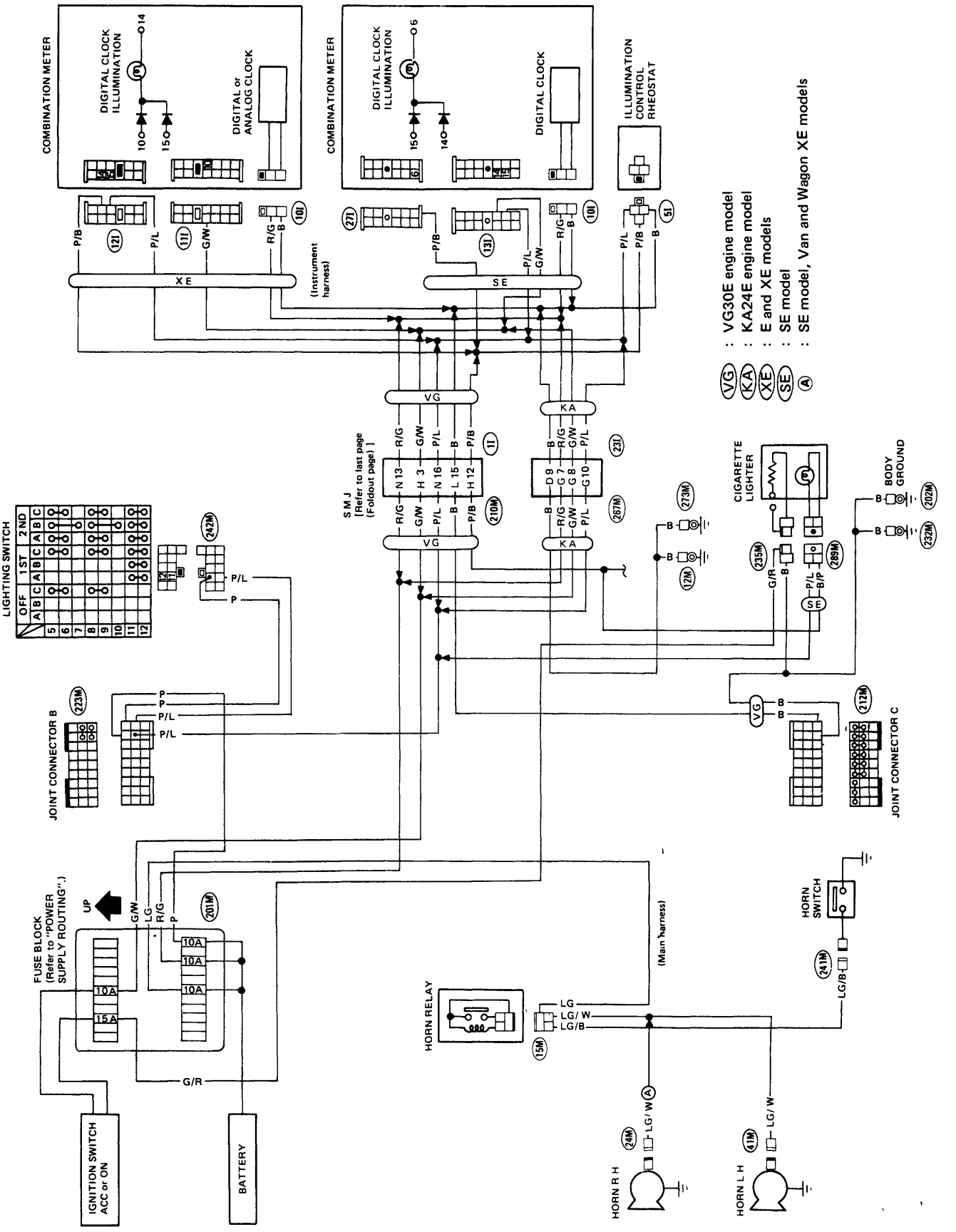


SEL681I

Wiper Amplifier Check

1. Connect as shown in the figure to the left.
2. If test lamp comes on when connected to terminal ⑥ and battery ground, wiper relay is normal.

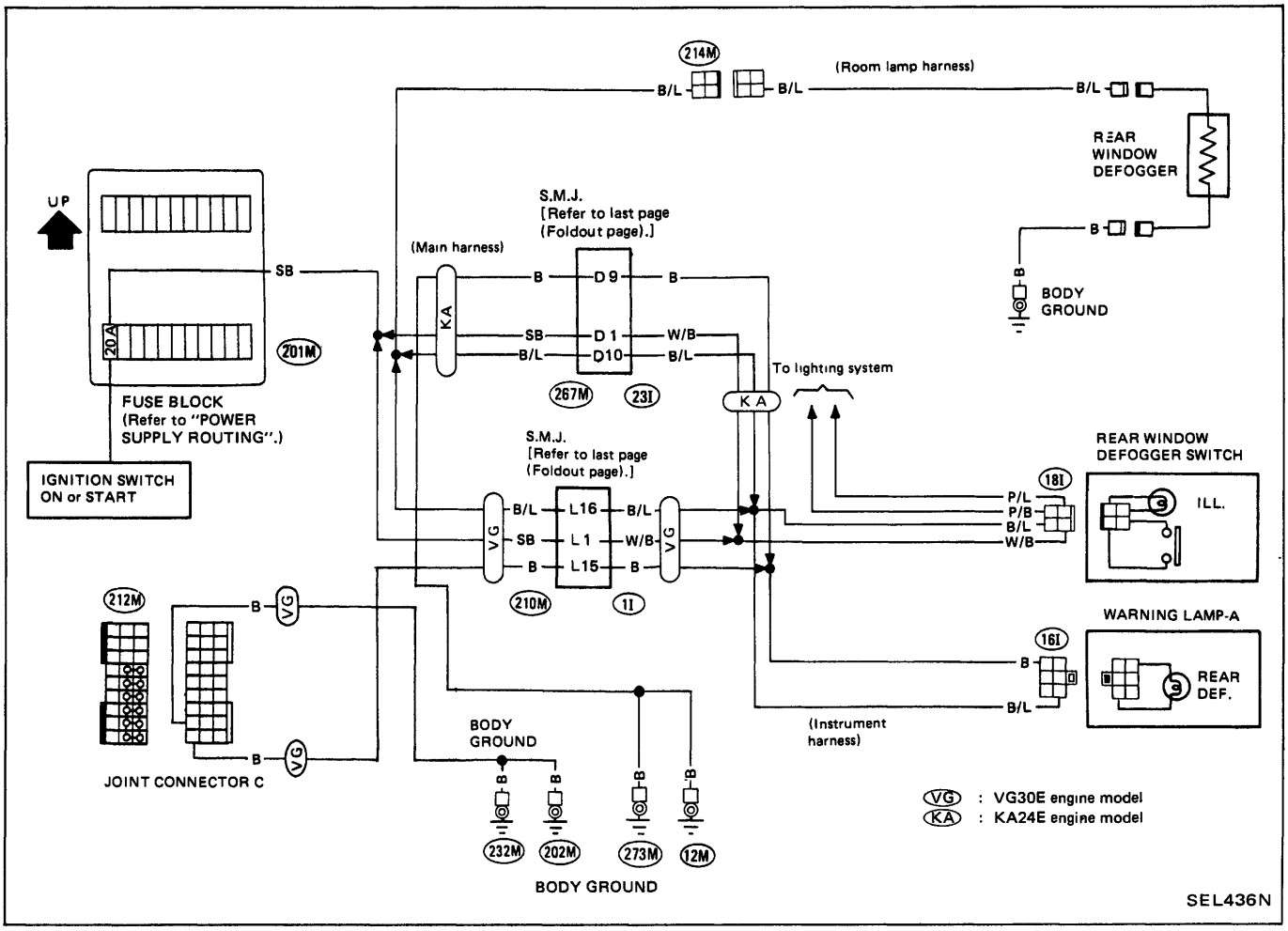
Wiring Diagram



SEL435N

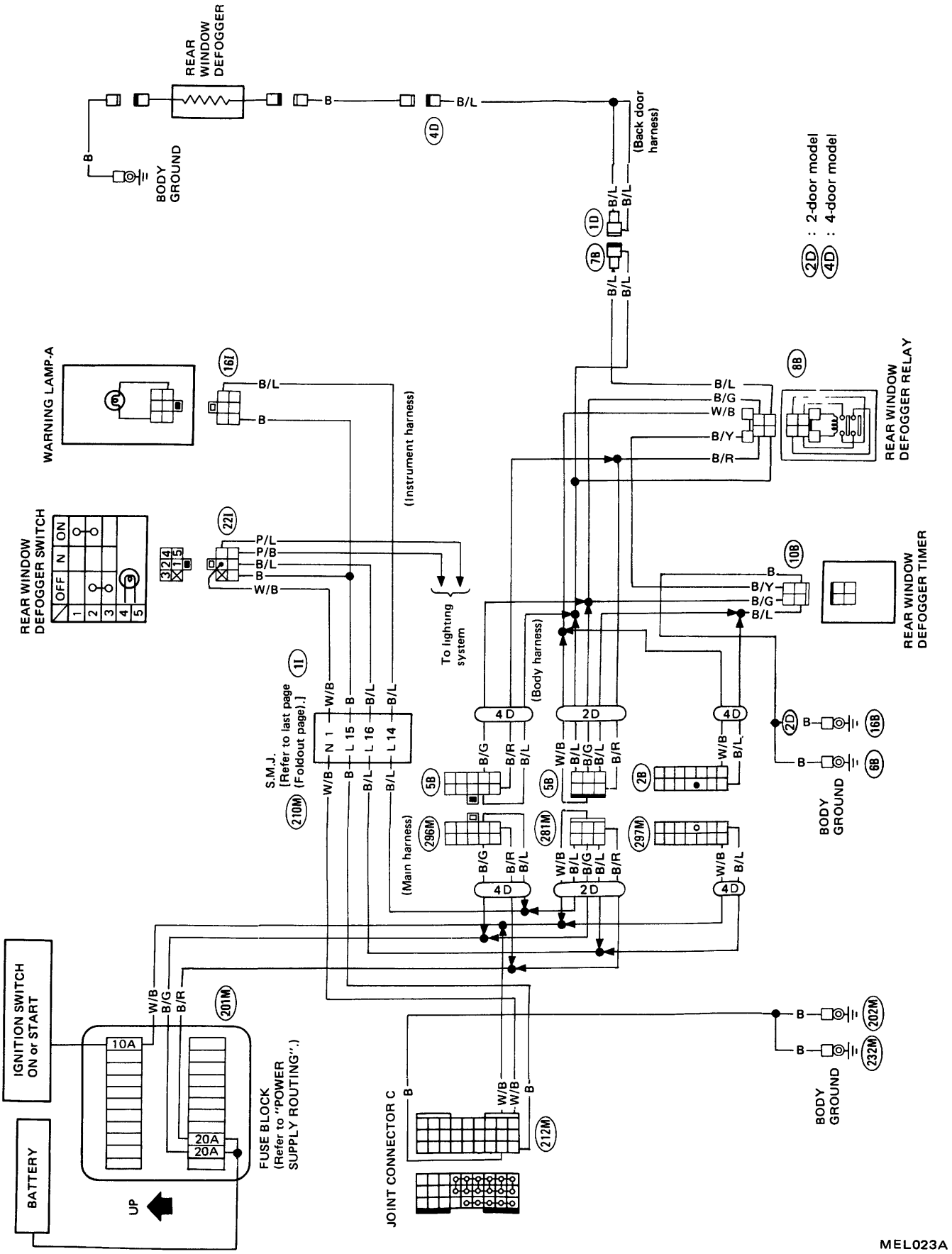
Wiring Diagram

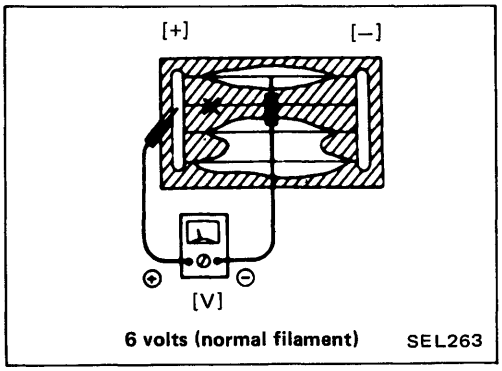
TRUCK MODEL



Wiring Diagram (Cont'd)

VAN AND WAGON MODEL

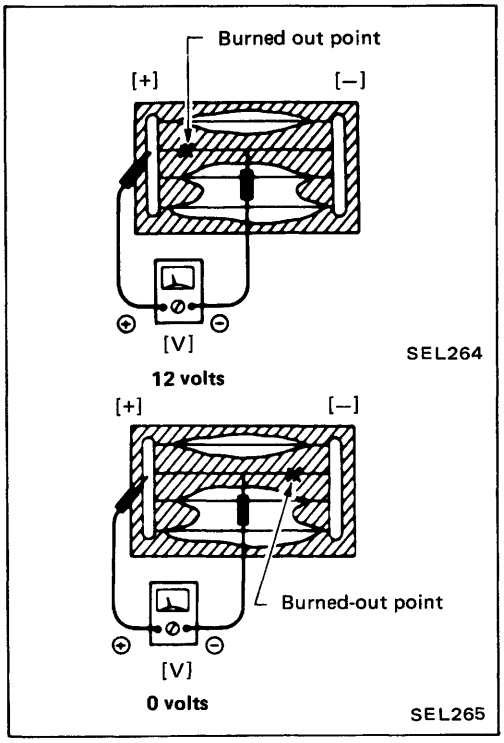




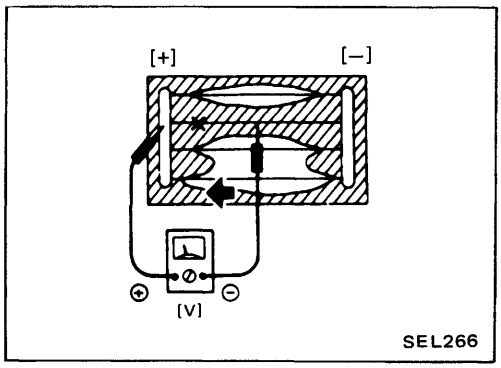
6 volts (normal filament) SEL263

Filament Check

1. Attach probe circuit tester (in volt range) to middle portion of each filament.



2. If a filament is burned out, circuit tester registers 0 or 12 volts.

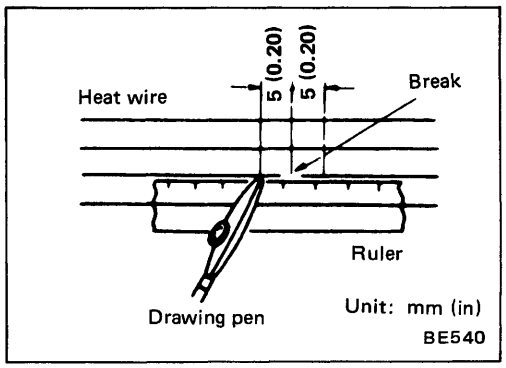


3. To locate burned out point, move probe to left and right along filament to determine point where tester needle swings abruptly.

Filament Repair

REPAIR EQUIPMENT

1. Conductive silver composition (Dupont No. 4817 or equivalent)
2. Ruler 30 cm (11.8 in) long
3. Drawing pen
4. Heat gun
5. Alcohol
6. Cloth

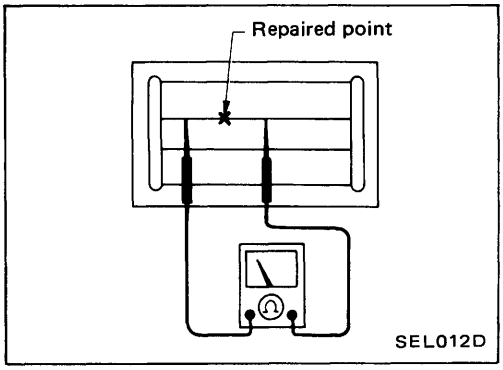


REPAIRING PROCEDURE

1. Wipe broken heat wire and its surrounding area clean with a cloth dampened in alcohol.
2. Apply a small amount of conductive silver composition to tip of drawing pen.

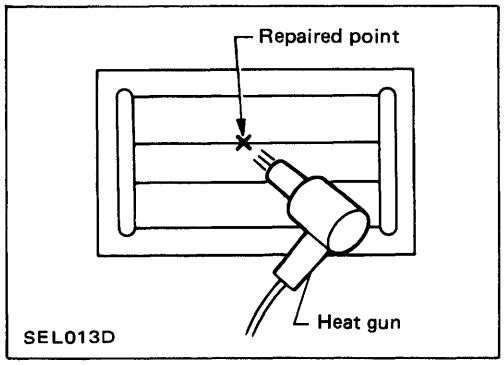
Shake silver composition container before use.

3. Place ruler on glass along broken line. Deposit conductive silver composition on break with drawing pen. Slightly overlap existing heat wire on both sides [preferably 5 mm (0.20 in)] of the break.



4. After repair has been completed, check repaired wire for continuity. This check should be conducted 10 minutes after silver compositon is deposited.

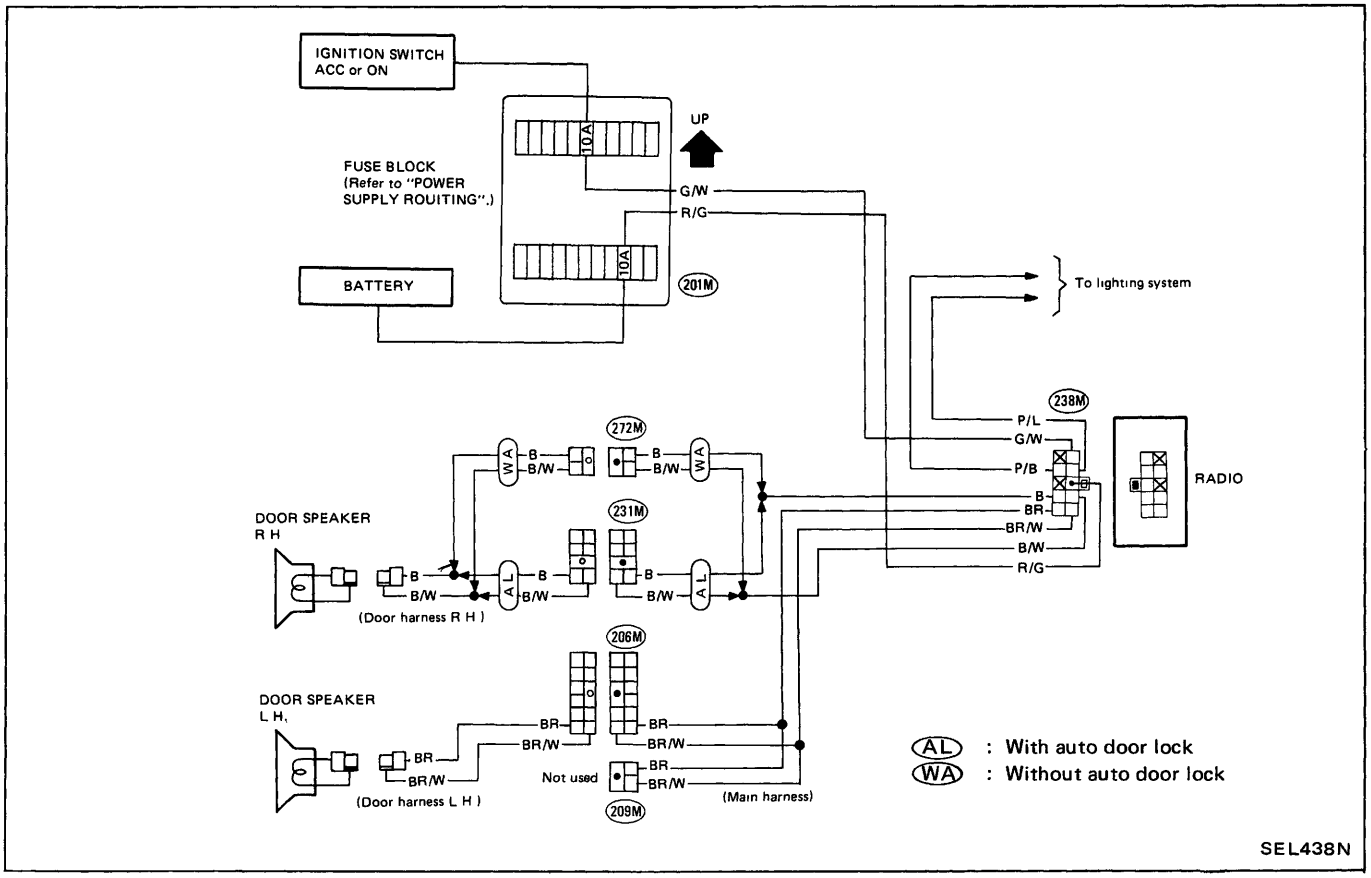
Do not touch repaired area while test is being conducted.



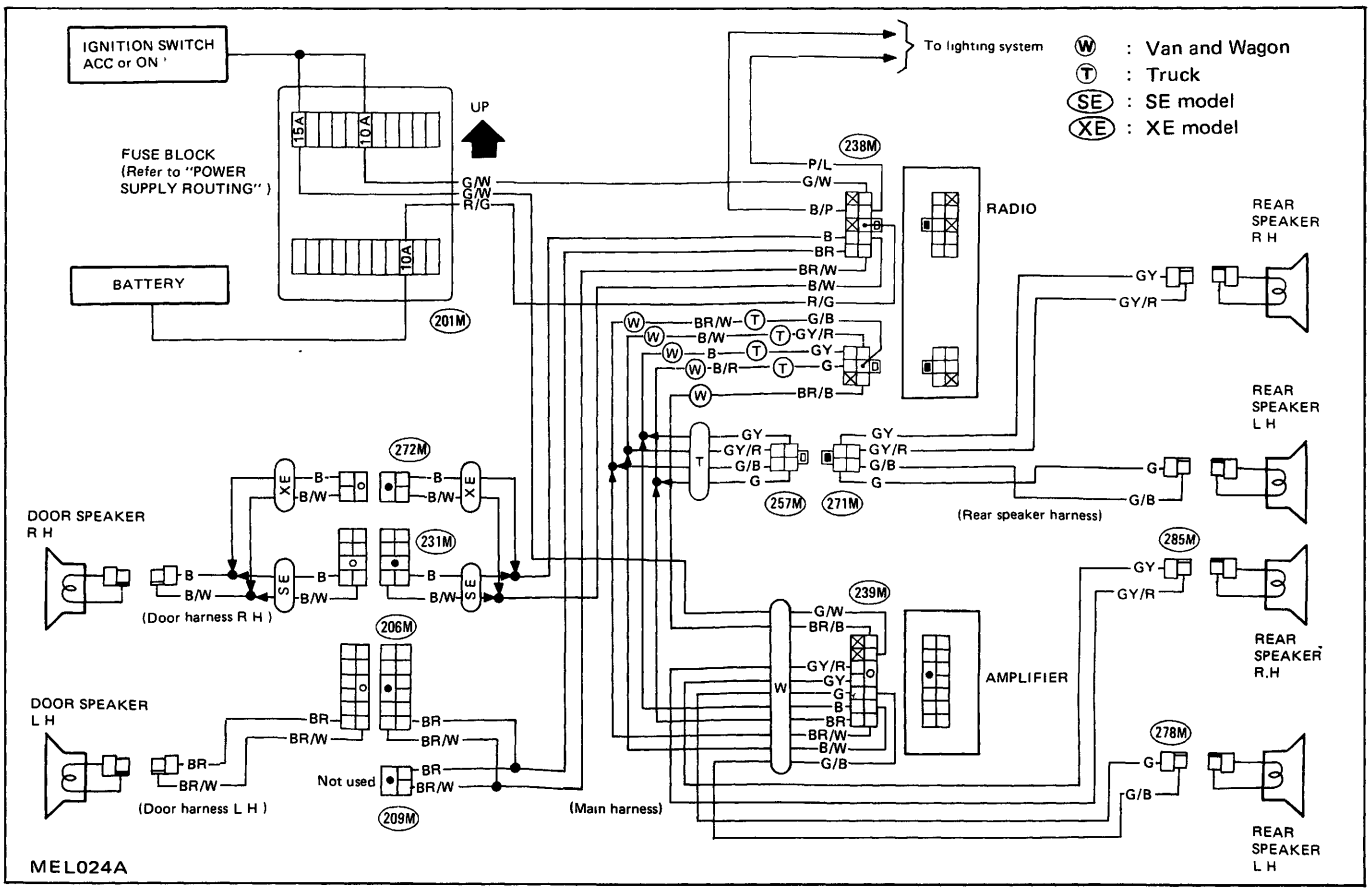
5. Apply a constant stream of hot air directly to the repaired area for approximately 20 minutes with a heat gun. A minimum distance of 3 cm (1.2 in) should be kept between repaired area and hot air outlet. If a heat gun is not available, let the repaired area dry for 24 hours.

Audio/Wiring Diagram

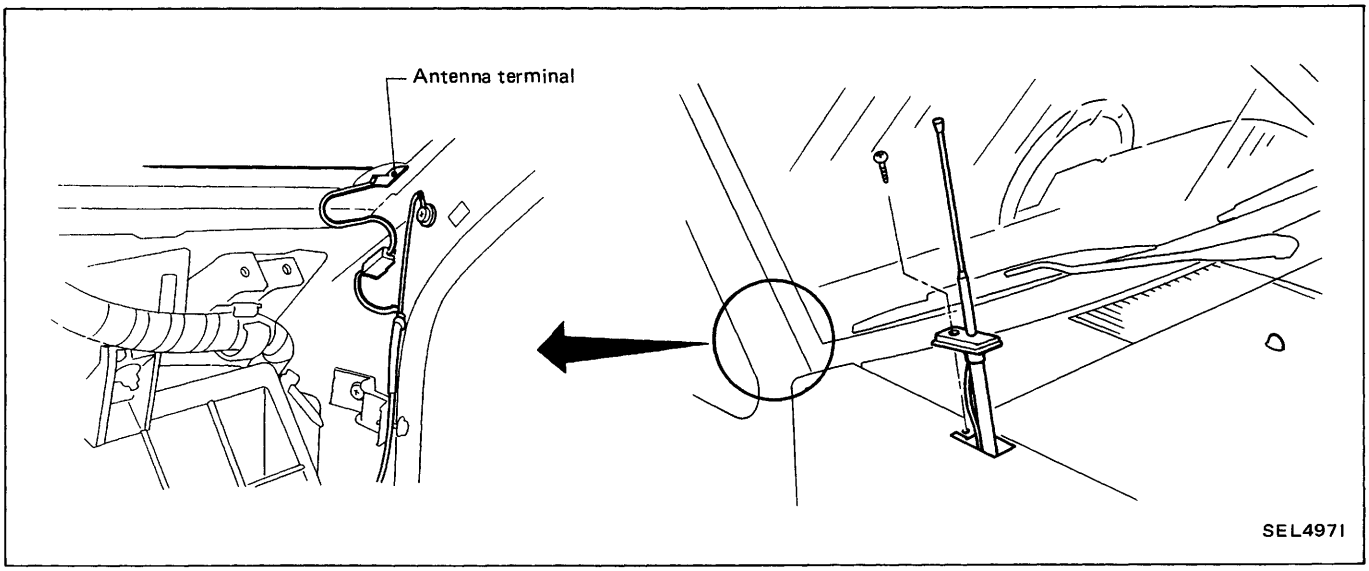
1- OR 2-SPEAKER TYPE

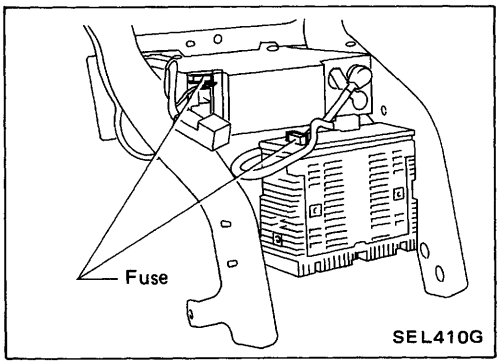


4-SPEAKER TYPE

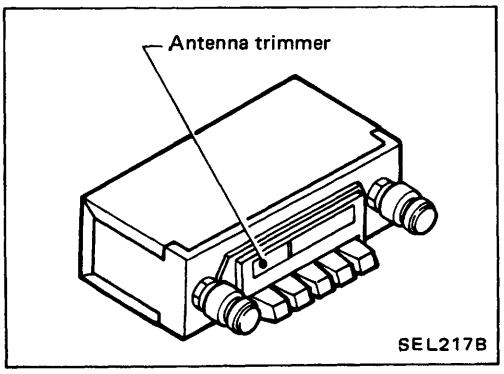


Location of Antenna





Radio Fuse Check



Antenna Trimmer Adjustment

The antenna trimmer should be adjusted in the following cases:

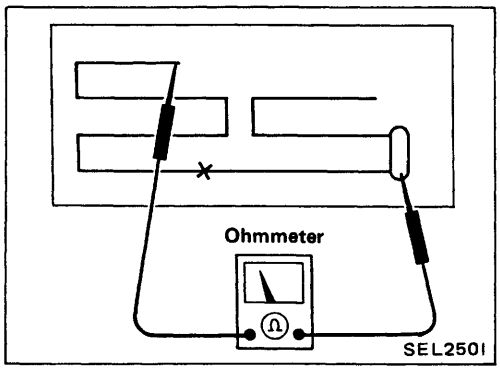
- Fading and weak MW (AM) reception.
- After installation of new antenna, feeder cable or radio receiver.

Before adjusting, be sure to check harness and antenna feeder cable connectors for proper connection.

1. Extend antenna completely.
2. Turn radio on, and turn volume control to increase speaker volume.
3. Tune in the weakest station (barely audible) on dial at the range around 14 (1,400 kHz).
4. Turn antenna trimmer to left or right slowly, and set it in the position where reception is strongest.

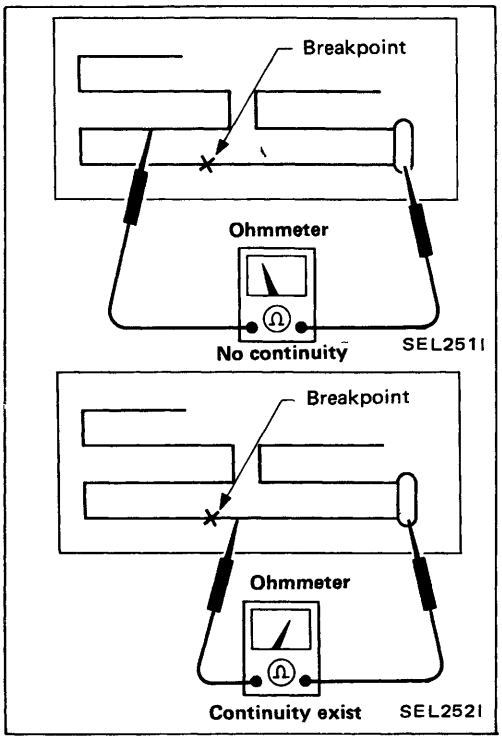
CAUTION:

Do not turn antenna trimmer more than one-half turn.

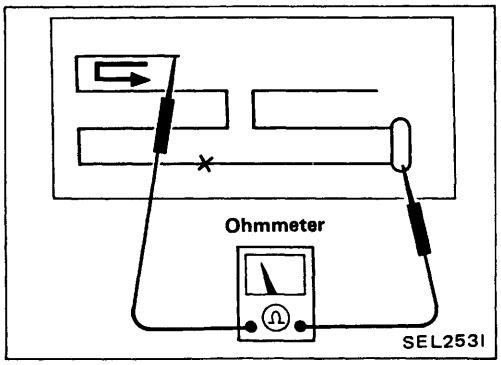


Element Check

1. Attach probe circuit tester (in ohm range) to antenna terminal on each side.



2. If an element is broken, no continuity will exist.

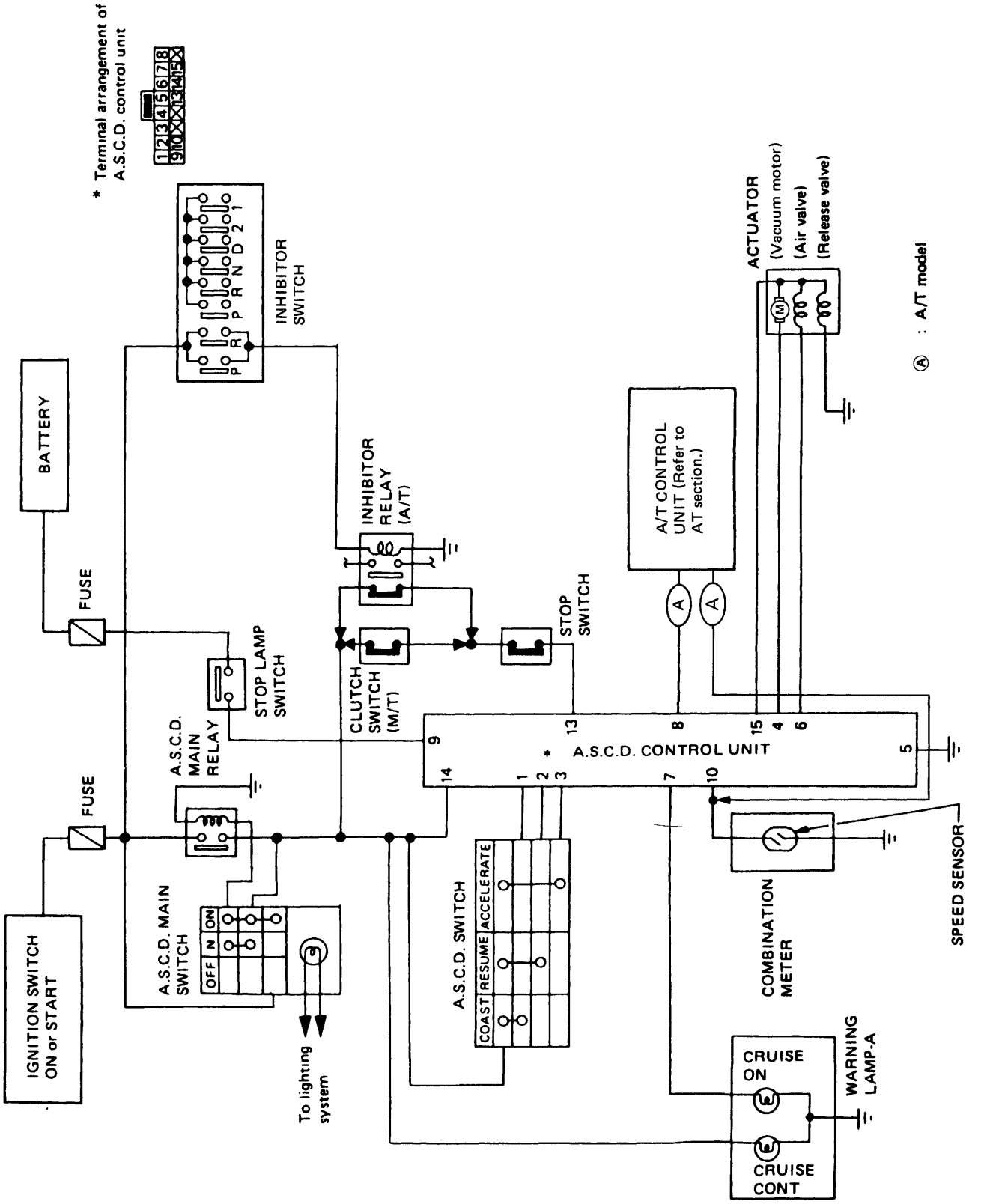


3. To locate broken point, move probe to left and right along element to determine point where tester needle swings abruptly.

Element Repair

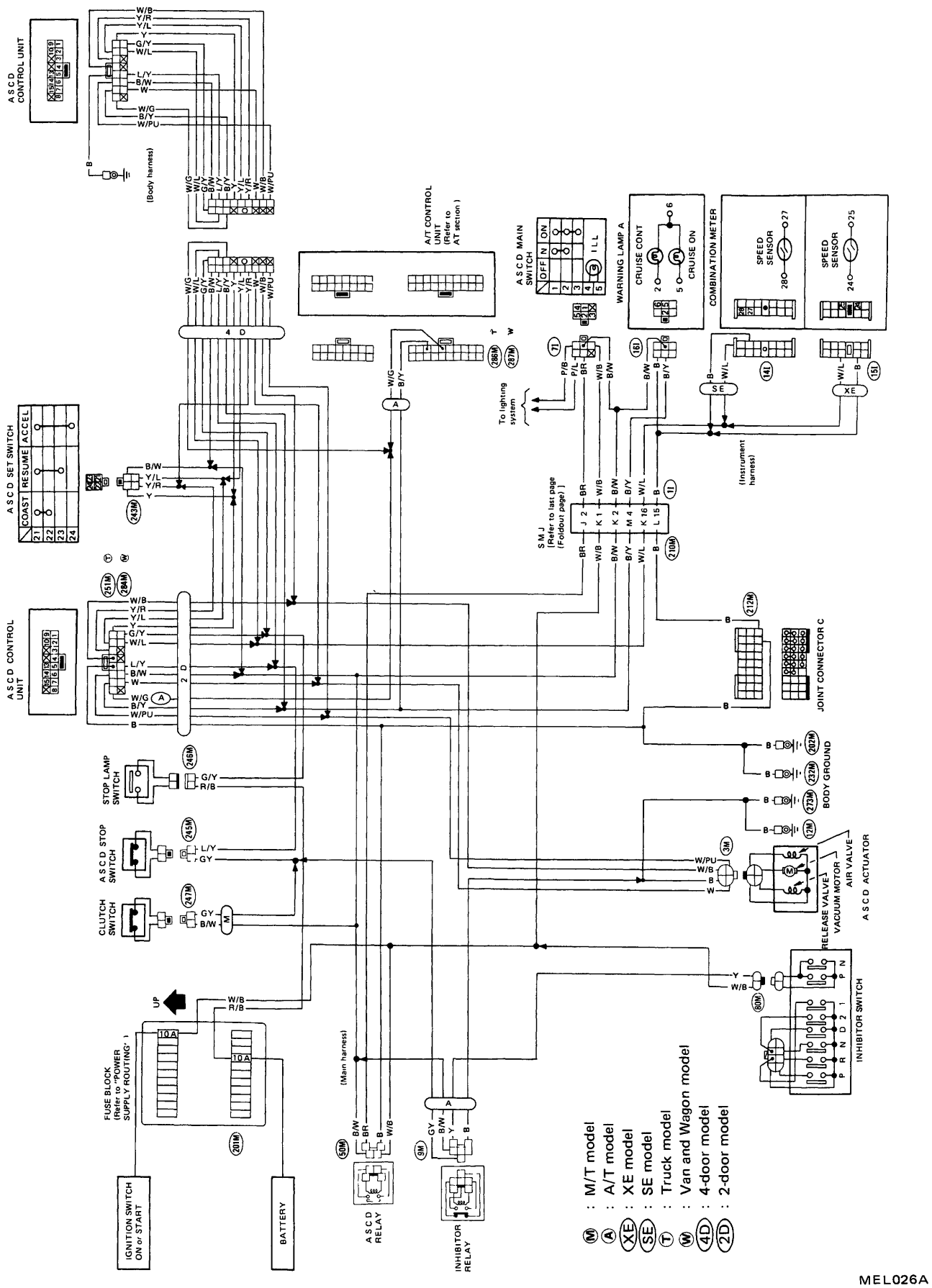
Refer to REAR WINDOW DEFOGGER "Filament Repair".

Schematic



MEL025A

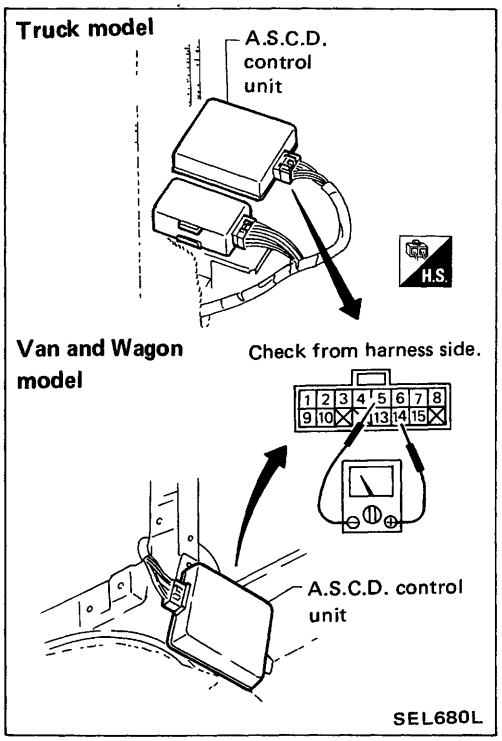
Wiring Diagram



MEL026A

Trouble-shooting

Symptom		Refer to TROUBLE-SHOOTING PROCEDURE.
A.S.C.D. control unit cannot be set properly.		1
Resume switch will not operate.		2
Accelerate switch will not operate.		3
Engine hunts.		4
Large difference between set vehicle speed and actual speed.		5
A/T model only	• When A.S.C.D. is set while vehicle is operating in "O.D." range, O.D. will be cancelled and shifting to O.D. cannot be made thereafter. • O.D. will not be cancelled even if actual vehicle speed is 6 km/h (4 MPH) lower than set speed. (Set speed cannot be maintained.) • O.D. will not be cancelled even if accelerator switch is turned "ON".	6



PREPARATION FOR TROUBLE-SHOOTING

1. Remove driver's side dash cover. (Truck model)
   Remove L.H. side rear side trim (Van and Wagon model).
2. Remove A.S.C.D. control unit with harness connected.
3. Perform check from harness side using circuit tester, with harness connector connected.

POWER SUPPLY CIRCUIT CHECK

- Measure voltage across ⑭ and ⑤
  Approx. 12 [V] ..... O.K.

Trouble-shooting (Cont'd)

1	A.S.C.D. control unit cannot be set properly.

Turn A.S.C.D. main switch "OFF" and then "ON" to make sure indicator illuminates.

- O.K. → Check power supply circuit for A.S.C.D. control unit.
- N.G. → Check A.S.C.D. main switch and A.S.C.D. main relay.

Check power supply circuit for A.S.C.D. control unit.

- O.K. → Check A.S.C.D. set switch circuit for A.S.C.D. control unit.
- N.G. → Check stop switch, clutch switch (M/T model), inhibitor relay and inhibitor switch (A/T model).
  - O.K. → Check harness between A.S.C.D. power supply circuit.

Check A.S.C.D. set switch circuit for A.S.C.D. control unit.

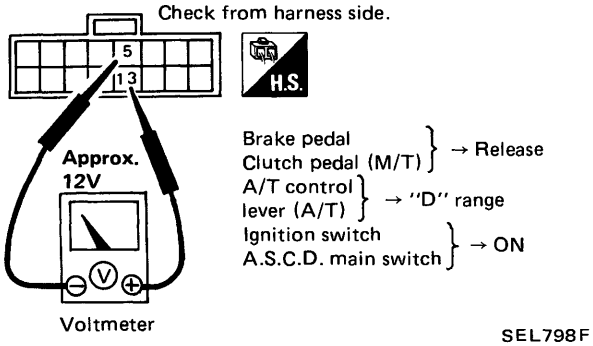
- O.K. → Go to "A.S.C.D. Actuator Check".
- N.G. → Check A.S.C.D. set switch, and harness between control unit and set switch.

Go to "A.S.C.D. Actuator Check".

- O.K. → * (Next page)
- N.G. → Replace actuator.

POWER SUPPLY CIRCUIT CHECK

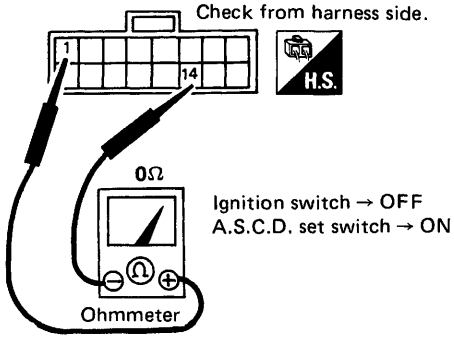
1. Release brake and clutch pedals.
2. Turn ignition switch to "ON".
3. Connect voltmeter from harness side.
4. Turn A.S.C.D. main switch to "ON".
5. Check voltage between ⑬ and ⑤.



SEL798F

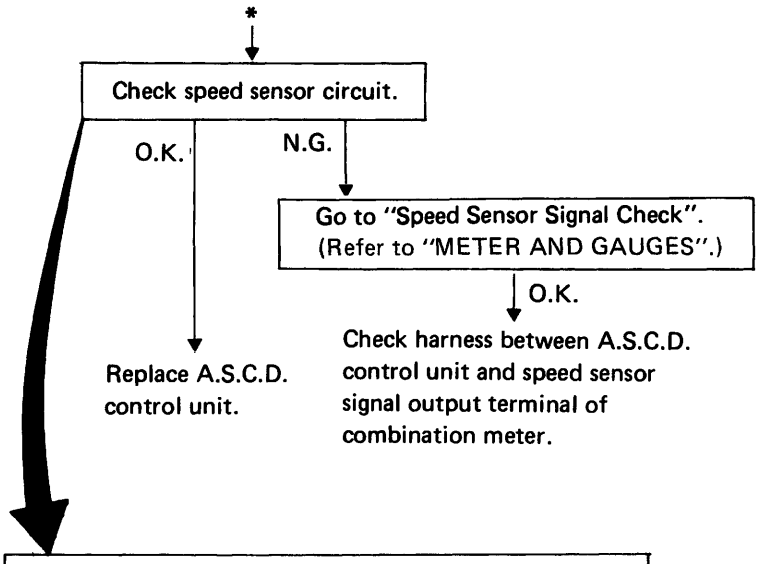
SET SWITCH CIRCUIT CHECK

1. Turn ignition switch to "OFF".
2. Connect ohmmeter from harness side.
3. Push A.S.C.D. set switch.
4. Check continuity between ① and ⑭.



SEL799F

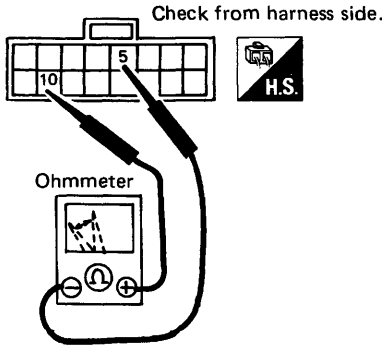
Trouble-shooting (Cont'd)



SPEED SENSOR CIRCUIT CHECK

1. Turn ignition switch to "OFF".
2. Disconnect speedometer cable from transmission.
3. Connect an ohmmeter between ⑩ and ⑤ from harness side.
4. Turn ignition switch to "ON".
5. Slowly turn speedometer cable pinion by hand to make sure ohmmeter pointer deflects.

- **Ohmmeter pointer deflects twice per rotation of pinion.**



SEL800F

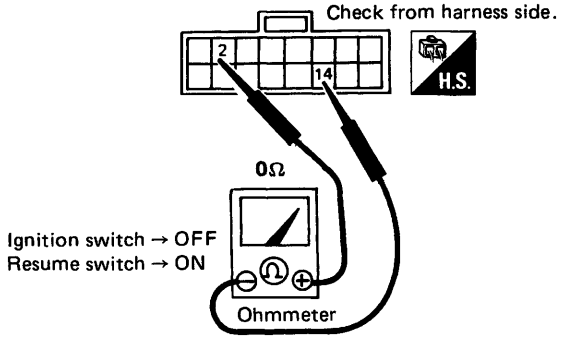
Trouble-shooting (Cont'd)

2	Resume switch will not operate.

Check resume switch circuit.
- O.K. → Replace A.S.C.D. control unit.
- N.G. → Check resume switch.

RESUME SWITCH CIRCUIT CHECK

1. Turn ignition switch to "OFF".
2. Connect ohmmeter from harness side.
3. Turn resume switch to "ON".
4. Check continuity between ② and ⑭



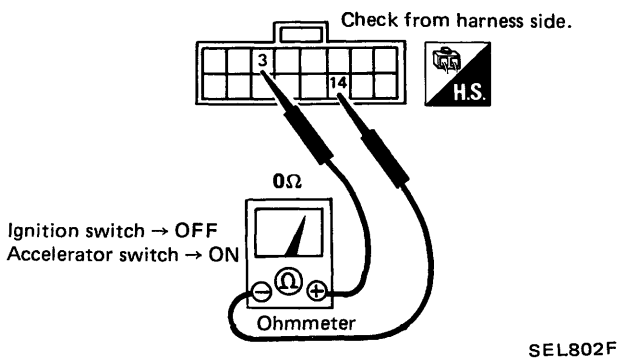
SEL801F

3	Accelerate switch will not operate.

Check accelerate switch circuit.
- O.K. → Replace A.S.C.D. control unit.
- N.G. → Check accelerate switch.

ACCELERATE SWITCH CIRCUIT CHECK

1. Turn ginition switch to "OFF".
2. Connect ohmmeter from harness side.
3. Turn accelerate switch to "ON".
4. Check continuity between ③ and ⑭



SEL802F

4	Engine hunts.

Check vacuum hose for breakage, cracks or fracture.
- O.K. → Does A.S.C.D. wire move smoothly?
- N.G. → Repair or replace hose.

Does A.S.C.D. wire move smoothly?
- O.K. → Go to "Actuator Check".
- N.G. → Repair or replace wire.

Go to "Actuator Check".
- O.K. → Replace A.S.C.D. control unit.
- N.G. → Replace actuator.

5	Large difference between set vehicle speed and actual speed.

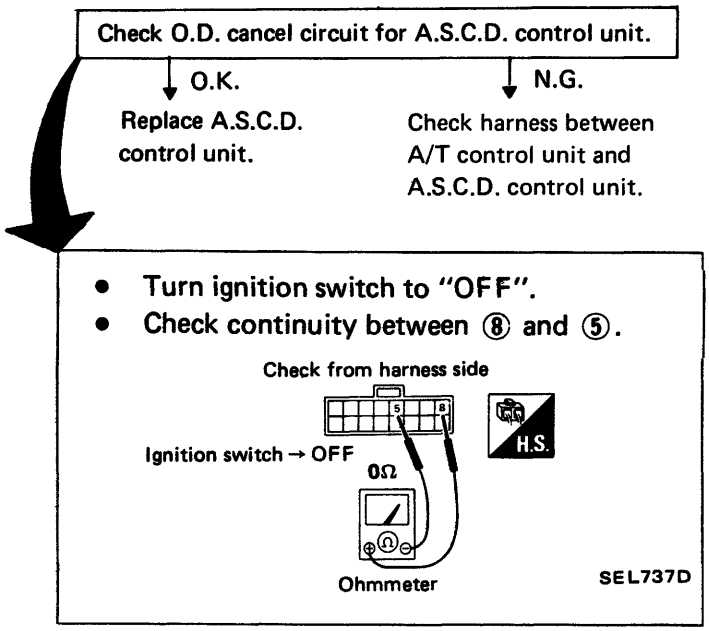
Check A.S.C.D. wire and actuator move smoothly.
- O.K. → Check vacuum hose for breakage, cracks or fracture.
- N.G. → Replace wire or actuator.

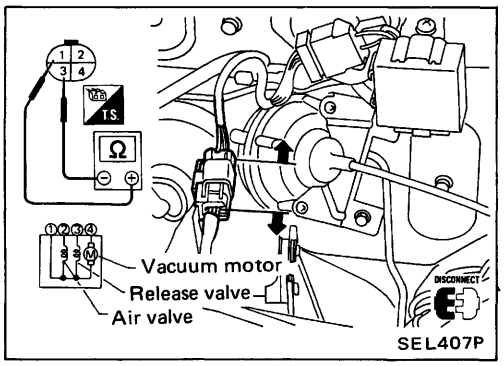
Check vacuum hose for breakage, cracks or fracture.
- O.K. → Go to "Actuator Check".
- N.G. → Repair or replace hose.

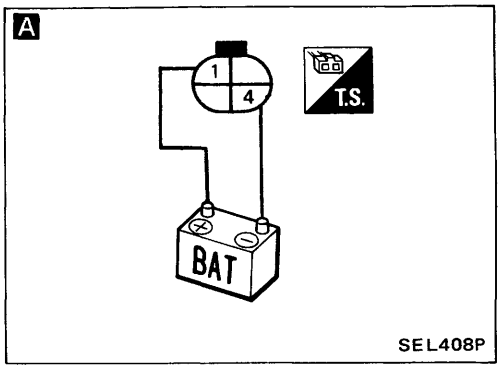
Go to "Actuator Check".
- O.K. → Replace A.S.C.D. control unit.
- N.G. → Replace actuator.

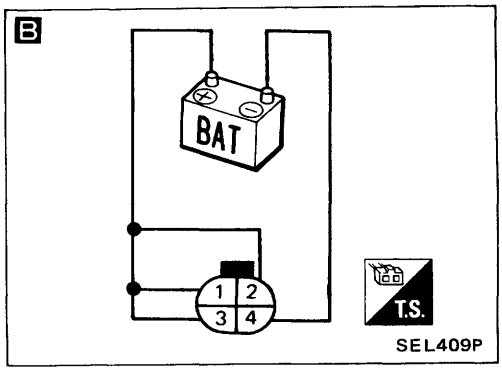
Trouble-shooting (Cont'd)

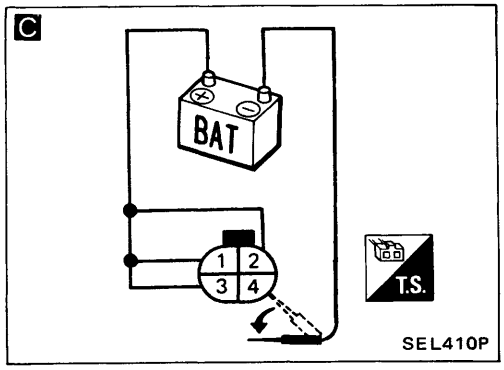
6	A/T model only	• When A.S.C.D. is set while vehicle is operating in "O.D." range, O.D. will be cancelled and shifting to O.D. cannot be made thereafter. • O.D. will not be cancelled even if actual car speed is 6 km/h (4 MPH) lower than set speed. (Set speed cannot be maintained.) • O.D. will not be cancelled even if accelerator switch is turned "ON".

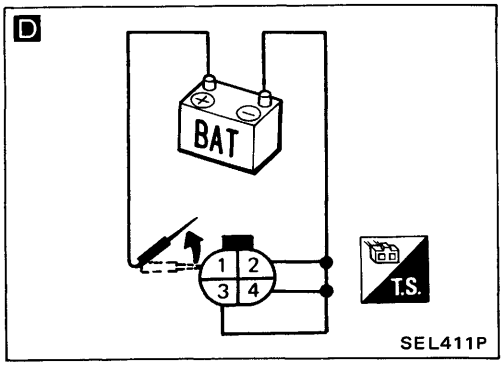






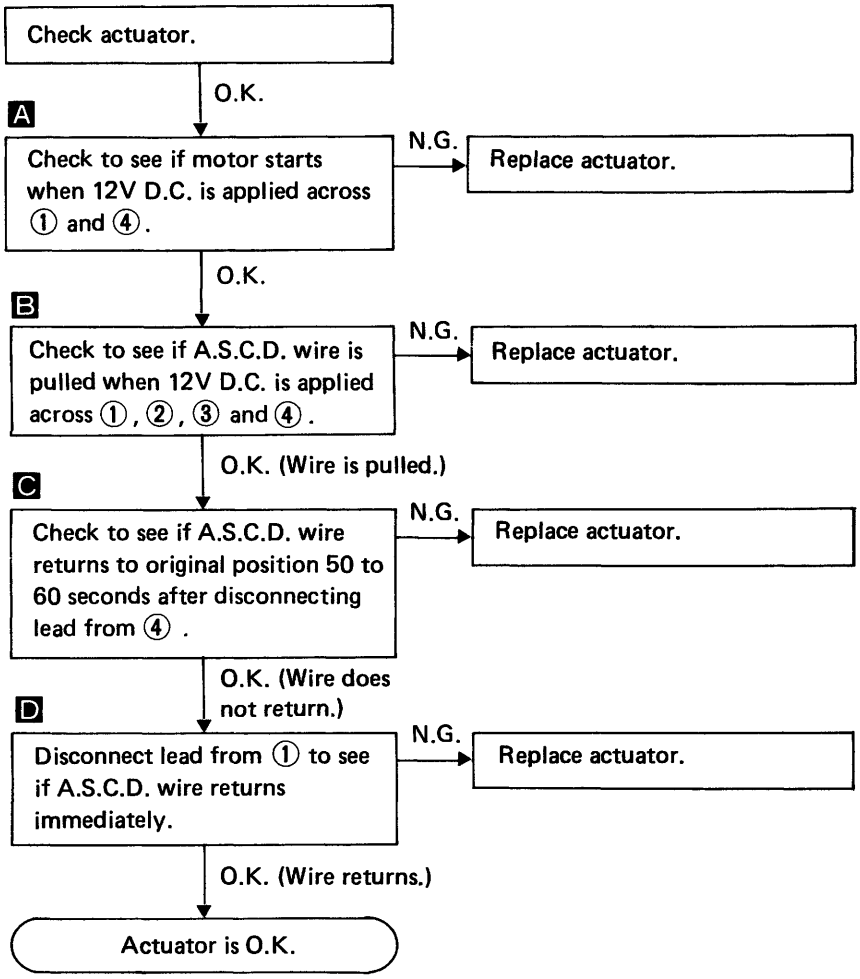






Actuator Check

1. Disconnect connector of actuator from main harness.
2. Check actuator operations as shown.



A.S.C.D. Wire Adjustment

CAUTION:

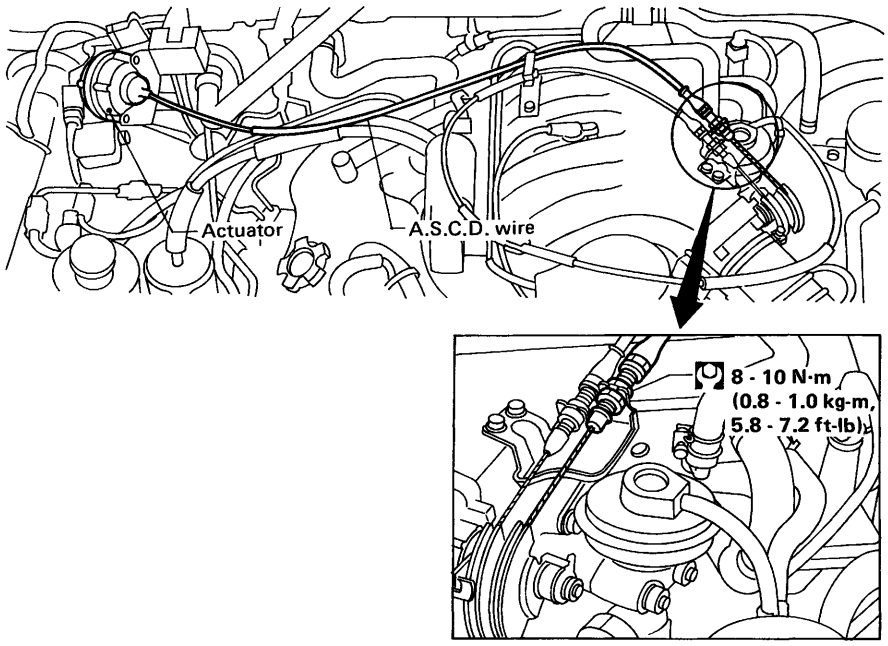
- **Be careful not to twist A.S.C.D. wire when removing it.**
- **Do not tense A.S.C.D. wire excessively during adjustment.**

After confirming that accelerator wire is properly adjusted, adjust the tension of A.S.C.D. wire in the following manner:

(1) After adjusting the length of the accel wire, turn a securing nut by 1/2 to 1 turn from throttle open starting position to the wire loosening direction to fix. (Must be securing carried out to prevent response delay of operation of the A.S.C.D.)

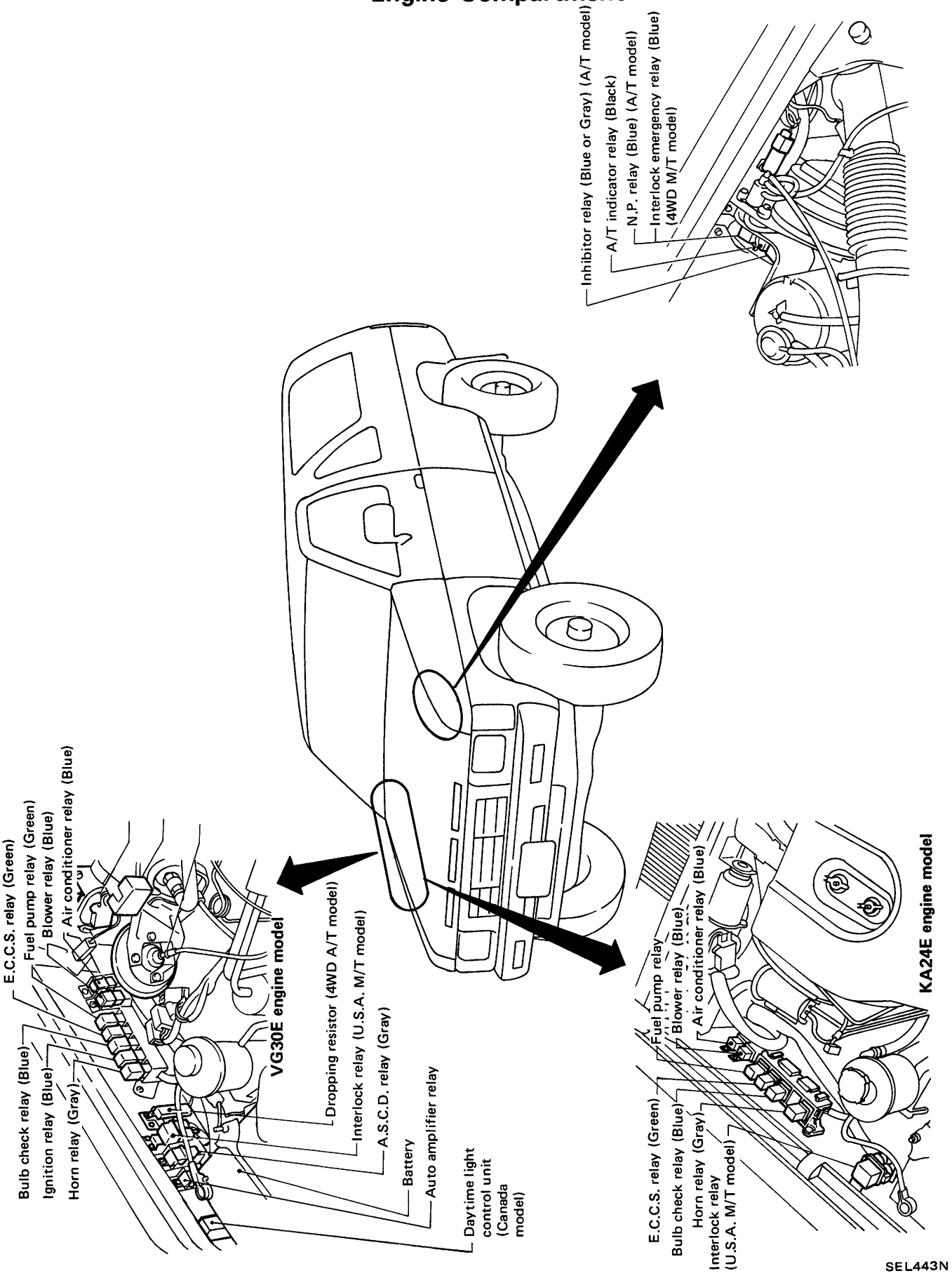
(2) Securely tighten lock nut to hold adjusting nut in place.

- For A.S.C.D. stop switch and clutch switch adjustment, refer to BR and CL sections.



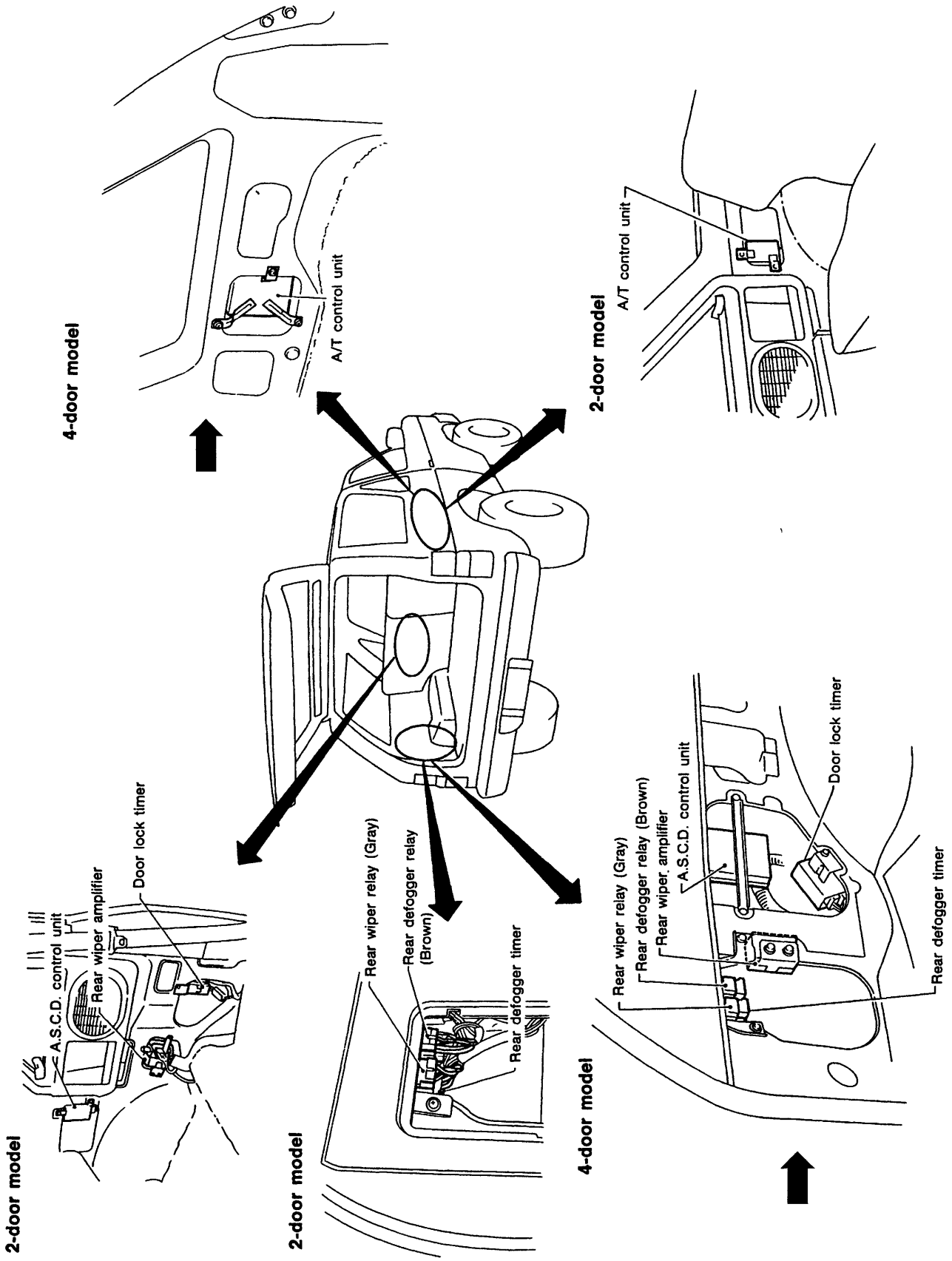
SEL442N

Engine Compartment



Passenger Compartment (Cont'd)

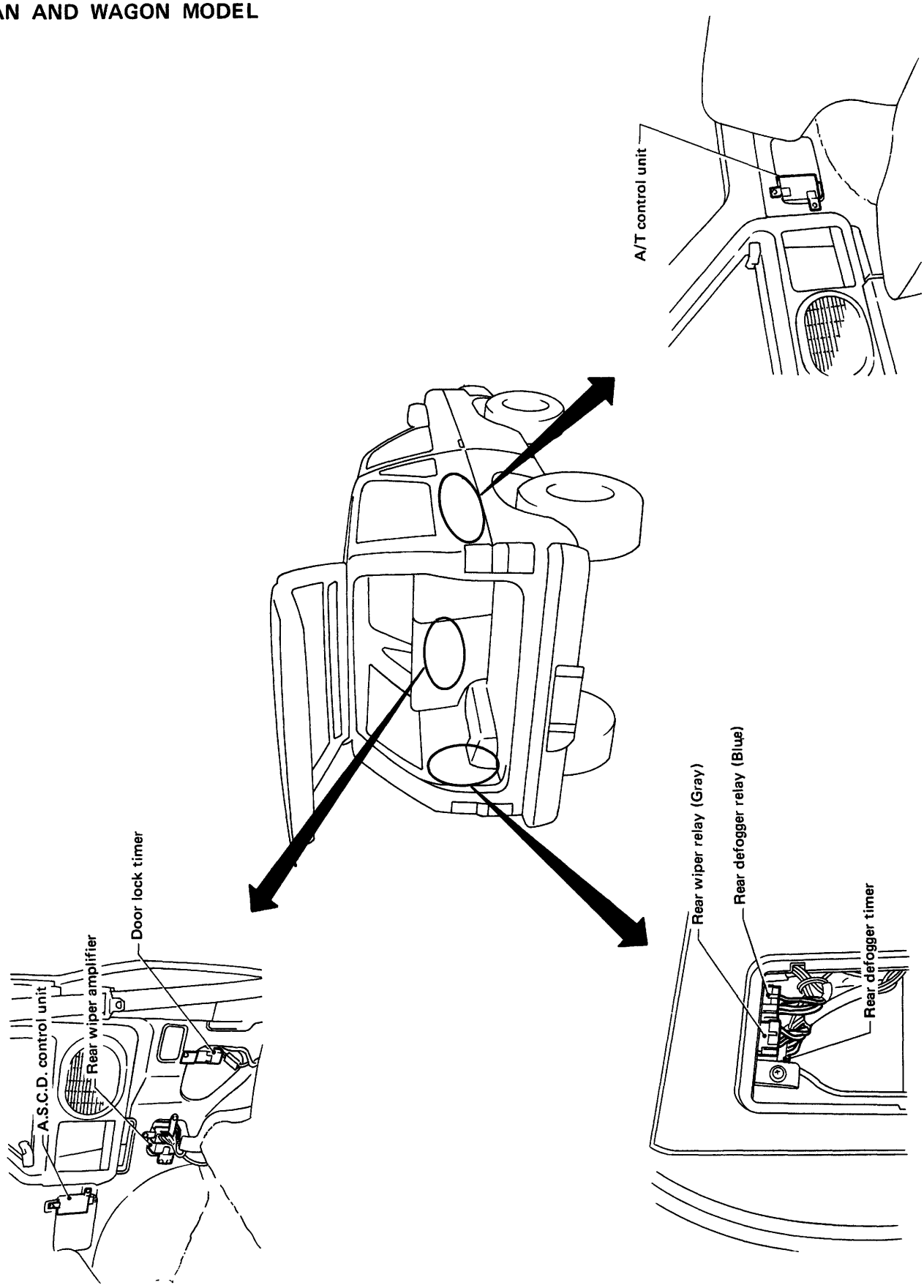
VAN AND WAGON MODEL



SEL441U

Passenger Compartment (Cont'd)

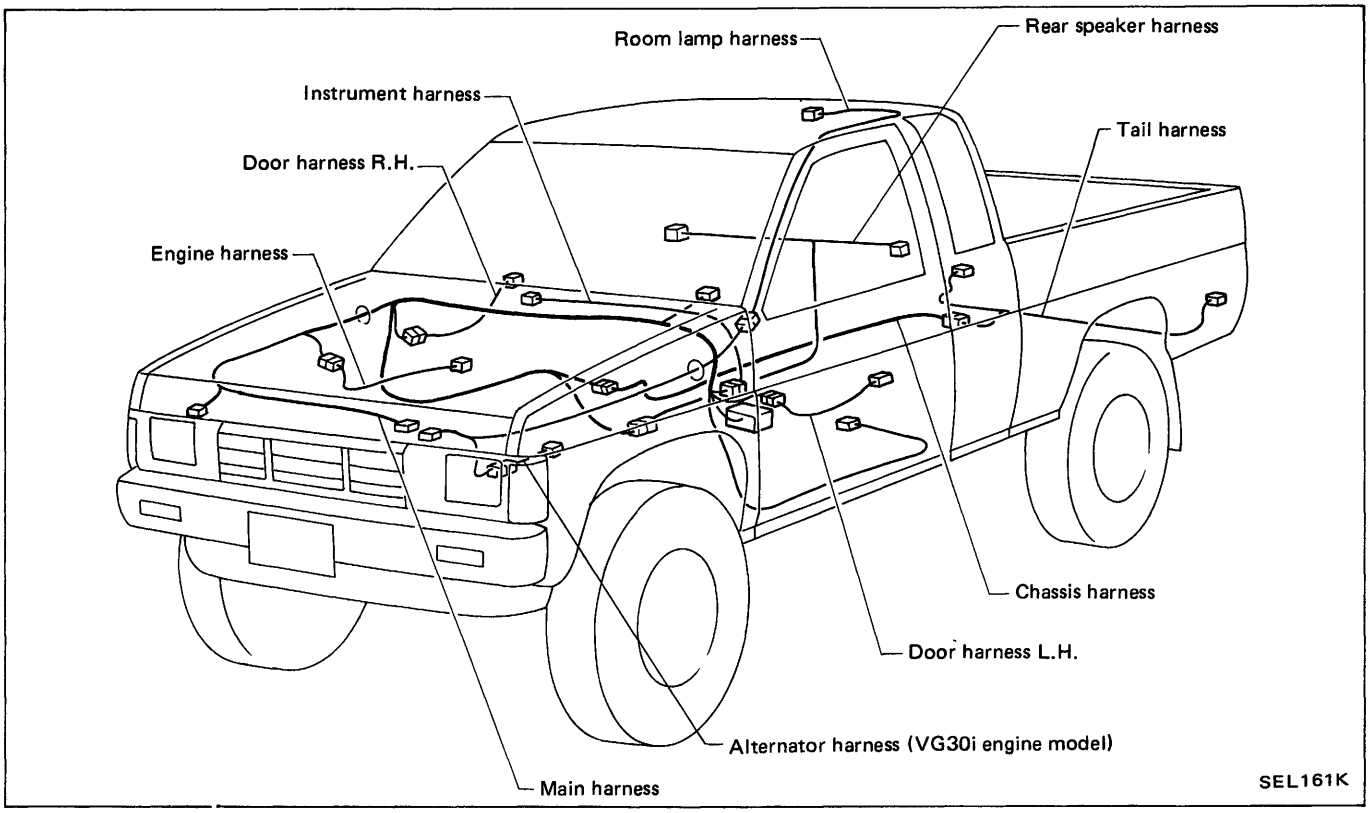
VAN AND WAGON MODEL



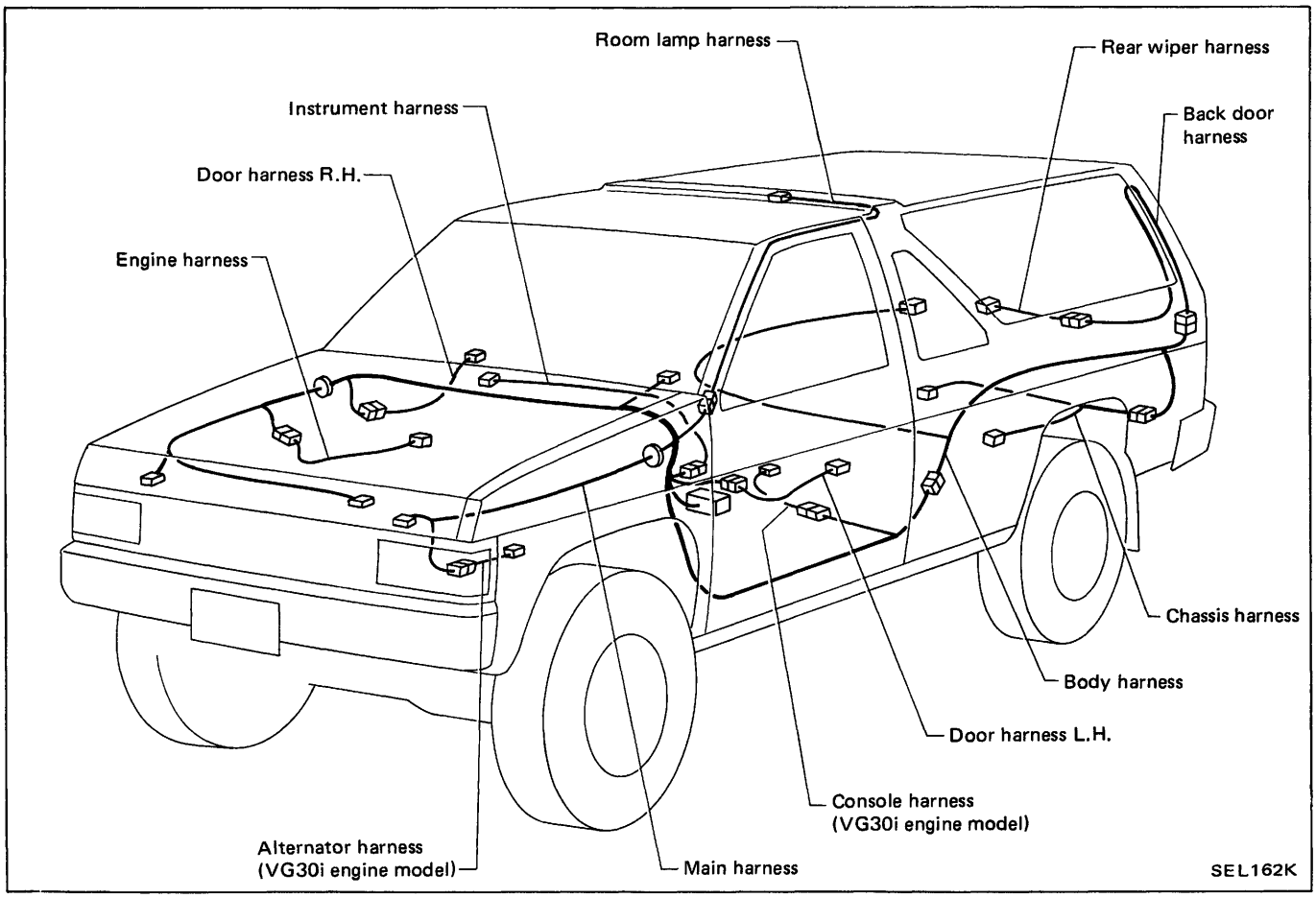
SEL500I

Outline

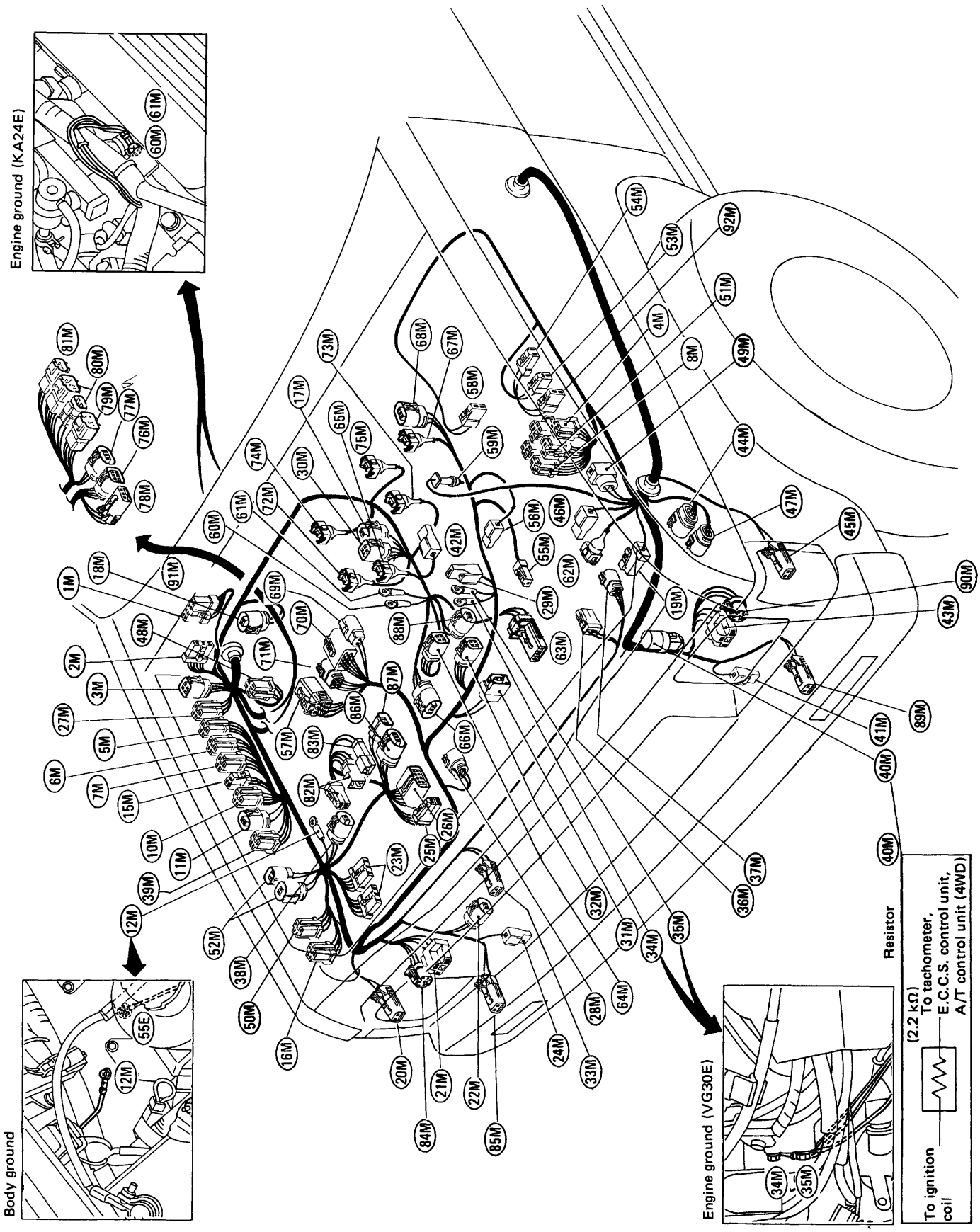
TRUCK MODEL



VAN AND WAGON MODEL



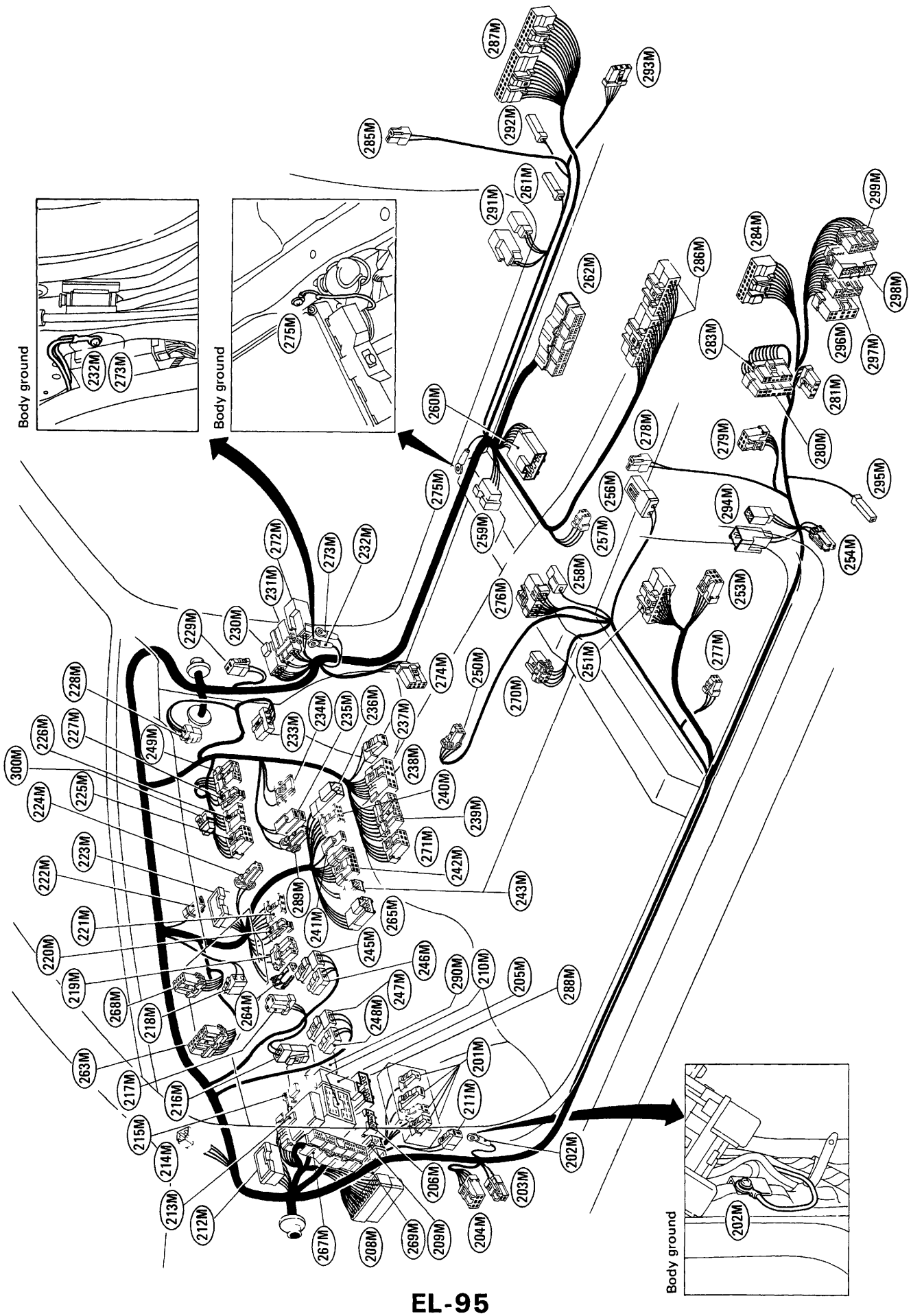
Main Harness



(1M) : Intermittent wiper amplifier (Van and Wagon)
(2M) : Wiper motor
(3M) : A.S.C.D. actuator (VG30E engine model)
(4M) : N·P relay (VG30E engine A/T model)
(5M) : Fuel pump relay
(6M) : Main relay
(7M) : Ignition relay No. 2
(8M) : Inhibitor relay (A/T model without A.S.C.D.)
(9M) : Inhibitor relay (A/T model with A.S.C.D.)
(10M) : Bulb check relay
(11M) : Dropping resistor (4WD A/T model)
(12M) : Body ground
(14M) : Interlock emergency relay (M/T model for U.S.A.)
Adapter harness (A/T model)
[Truck STD, engine E, 2WD SE (without A.S.C.D) and Van for Canada]
(15M) : Horn relay
(16M) : N·P relay (KA24E engine A/T model)
(17M) : Exhaust gas temperature sensor (KA24E engine model)
(18M) : Air temperature sensor (KA24E engine model)
(19M) : Compressor (KA24E engine model)
(20M) : Side marker lamp R.H. (C)
Clearance lamp R.H. (B)
(21M) : Headlamp R.H. (C)
(22M) : Low-pressure switch
(23M) : D.T.R.L. control unit
(24M) : Horn R.H.
(25M) : To (58E) (KA24E engine A/T model)
(26M) : To (56E) (KA24E engine M/T model)
(27M) : Blower relay
(28M) : Power steering oil pressure switch (VG30E engine model)
(29M) : Thermal transmitter (VG30E engine model)
(30M) : Crank angle sensor (KA24E engine model)
(31M) : Cylinder head temperature sensor (VG30E engine model)
(32M) : Crank angle sensor (VG30E engine model)
(33M) : Ambient sensor (VG30E engine model)
(34M) : Engine ground (VG30E engine model)
(35M) : Engine ground (VG30E engine model)
(36M) : To (33E) (VG30E engine model)
(37M) : To (32E) (VG30E engine model)
(38M) : To (57E) (KA24E engine model)
(39M) : Auto amplifier relay (VG30E engine model)
(40M) : Resistor & condenser (KA24E engine model)
(41M) : Horn L.H.
(42M) : Thermal transmitter (KA24E engine model)
(43M) : Headlamp L.H. (C)
(44M) : Power transistor (KA24E engine model)
(45M) : Side marker lamp L.H. (C)
Clearance lamp L.H. (B)
(46M) : Distributor (KA24E engine model)
(47M) : Ignition coil (KA24E engine model)
(48M) : Air conditioner relay
(49M) : A.I.V. solenoid (KA24E engine model)
(50M) : A.S.C.D. relay (VG30E engine model)
(51M) : A/T indicator relay
(52M) : Interlock relay (M/T model for U.S.A.)
(53M) : Washer motor
(54M) : Washer level switch
(55M) : Compressor (VG30E engine model)
(56M) : Distributor (VG30E engine model)
(57M) : To (104E) (VG30E engine model)
(58M) : Brake fluid level switch
(59M) : Exhaust gas sensor (KA24E engine model)
(60M) : Engine ground (KA24E engine model)
(61M) : Engine ground (KA24E engine model)
(62M) : Air flow meter (VG30E engine model)
(63M) : Air flow meter (KA24E engine model)
(64M) : A.A.C. F.I.C.D. valve (KA24E engine model)
(65M) : Water temperature sensor (KA24E engine model)
(66M) : Throttle sensor (KA24E engine model)
(67M) : Throttle valve switch (VG30i engine model)
(68M) : Throttle sensor (VG30i engine model)
(69M) : To (103E) (VG30E engine model)
(70M) : To (101E) (VG30E engine model)
(71M) : To (102E) (VG30E engine model)
(72M) : Injector solenoid (KA24E engine model)
(73M) : Injector solenoid (KA24E engine model)
(74M) : Injector solenoid (KA24E engine model)
(75M) : Injector solenoid (KA24E engine model)
(76M) : To (1E) (VG30E engine model)
(77M) : Exhaust gas sensor (VG30E engine model)
(78M) : To (5E) (VG30E engine model)
(79M) : To sub harness (4WD A/T model)
(80M) : Inhibitor switch (4WD A/T model)
(81M) : Revolution sensor (4WD A/T model)
(82M) : Fusible link
(83M) : Fusible link
(84M) : Headlamp R.H. (B)
(85M) : Front turn signal lamp R.H. 9b0
(86M) : To (23E) (VG30E engine model(Van and Wagon)
(87M) : To (22E) (VG30E engine model)
(88M) : E.G.R. cut solenoid (KA24E engine model)
(89M) : Front turn signal lamp L.H. (B)
(90M) : Headlamp L.H. (B)
(92M) : Rear washer motor (Van and Wagon)
(B) : Van, Wagon and Truck for U.S.A. and VG30E engine 2WD E model
(C) : Truck for Canada and VG30E engine 2WD model for U.S.A.

SEL445N

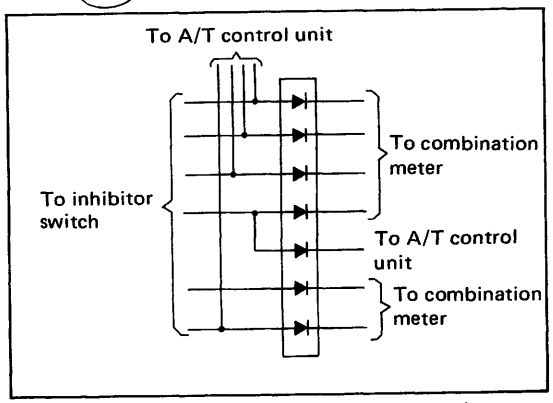
Main Harness (Cont'd)



(201M) : Fuse block
(202M) : Body ground
(203M) : Warning chime
(204M) : Seat belt timer
(205M) : Diode (VG30E engine model)
(206M) : To door harness L.H. (VG30E engine model)
(208M) : Check connector
(209M) : To door harness L.H. (White)
(210M) : To (11) (S.M.J.) (VG30E engine model)
(211M) : Circuit breaker (VG30E engine model)
(212M) : Joint connector C (VG30E engine model)
(213M) : Diode (KA24E engine A/T model)
(214M) : To room lamp harness
(215M) : Diode (VG30E engine M/T model)
(216M) : Clutch interlock switch (M/T model)
(217M) : Combination flasher unit
(218M) : Kickdown switch (A/T model)
(219M) : A/T indicator illumination (Column shift A/T model)
(220M) : Key-in switch
(221M) : Ignition switch
(222M) : Parking brake switch (Stick type)
(223M) : Joint connector B(VG30E enigne model)
(224M) : Overdrive control switch (Column shift A/T model)
(225M) : Air conditioner switch
(226M) : Fan switch
(227M) : Heater illumination
(228M) : Thermo control amplifier
(229M) : Blower motor
(230M) : To door harness R.H. (VG30E engine model)
(231M) : To door harness R.H. (VG30E engine model)
(232M) : Body ground
(233M) : Resistor
(234M) : Ash tray illumination
(235M) : Cigarette lighter
(236M) : Intermittent wiper volume
(237M) : Audio illumination
(238M) : Radio
(239M) : Amplifier (Van and Wagon)
(240M) : Wiper switch
(241M) : Horn switch
(242M) : Lighting switch
(243M) : A.S.C.D. switch (VG30E engine model)
(245M) : A.S.C.D. stop switch (VG30E engine model)
(246M) : Stop lamp switch
(247M) : A.S.C.D. clutch switch (VG30E engine M/T model)
(248M) : Clutch switch (M/T model)
(249M) : Air conditioner sub harness (VG30E engine model)
(250M) : Overdrive control switch and A/T indicator lamp (Floor shift A/T model)
(251M) : A.S.C.D. control unit (VG30E engine Truck model)
(253M) : Door lock timer (Truck)
(254M) : Door switch L.H.
(256M) : Seat belt switch
(257M) : To rear speaker harness (Truck)
(258M) : Parking brake switch (Center lever type)
(259M) : Joint connector A
(260M) : To (1C) (Truck)
(261M) : Door switch R.H.
(262M) : E.C.C.S. control unit
(263M) : Shift lock unit (A/T model)
(264M) : Key solenoid (A/T model)
(265M) : A.S.C.D. light switch
(267M) : To (23I) (KA24E engine model)
(268M) : Shift lock solenoid (KA24E engine model)
(269M) : To door harness L.H.
(270M) : Shift lock solenoid (VG30E engine model)
(271M) : Audio amplifier
(272M) : To door harness R.H.
(273M) : Body ground
(274M) : Power window amplifier
(275M) : Body ground
(276M) : To console harness (VG30E engine Van and Wagon model)
(277M) : Heating seat (VG30E engine Van and Wagon model)
(278M) : Rear speaker L.H. (Van and Wagon)
(279M) : Door lock timer (Van and Wagon)
(280M) : To (1B) (Van and Wagon 2-door model)
(281M) : To (5B) (Van and Wagon 2-door model)
(283M) : To (2B) (Van and Wagon 2-door model)
(284M) : A.S.C.D. control unit (VG30E engine Van and Wagon model)
(285M) : Rear speaker R.H. (Van and Wagon)
(286M) : A/T control unit (A/T Truck model)
(287M) : A/T control unit (A/T Van and Wagon model)
(288M) : To door harness L.H. (VG30E engine model)
(289M) : Cigarette lighter illumination

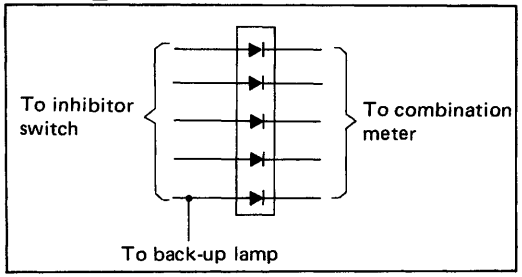
(290M) : Diode (KA24E engine model)
(291M) : To door harness R.H. (Van and Wagon 4-door model)
(292M) : Door switch (Van and Wagon 4-door model)
(293M) : Rear combination lamp (Van and Wagon 4-door model)
(294M) : To door harness L.H. (Van and Wagon 4-door model)
(295M) : Door switch (Van and Wagon 4-door model)
(296M) : To (5B) (Van and Wagon 4-door model)
(297M) : To (2B) (Van and Wagon 4-door model)
(298M) : To (3B) (Van and Wagon 4-door model)
(299M) : To (1B) (Van and Wagon 4-door model)
(300M) : Diode

Diode (205M) (VG30E engine model)



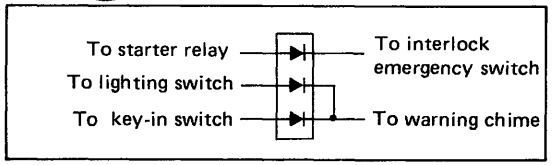
(For A/T control and indicator system)

Diode (213M) (KA24E engine A/T model)



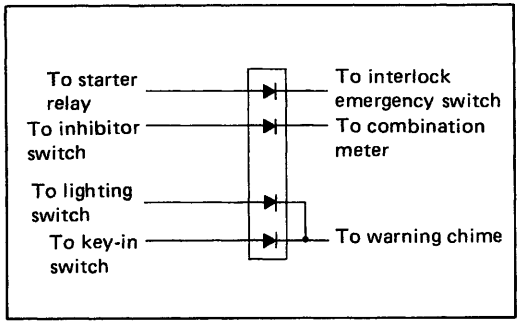
(For A/T control and indicator system)

Diode (215M) (VG30E engine model)



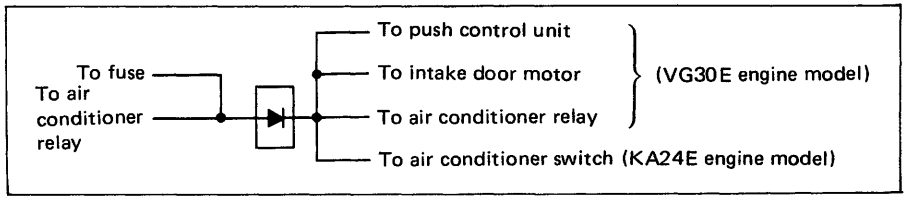
(For starting and warning chime system)

Diode (290M) (KA24E engine model)



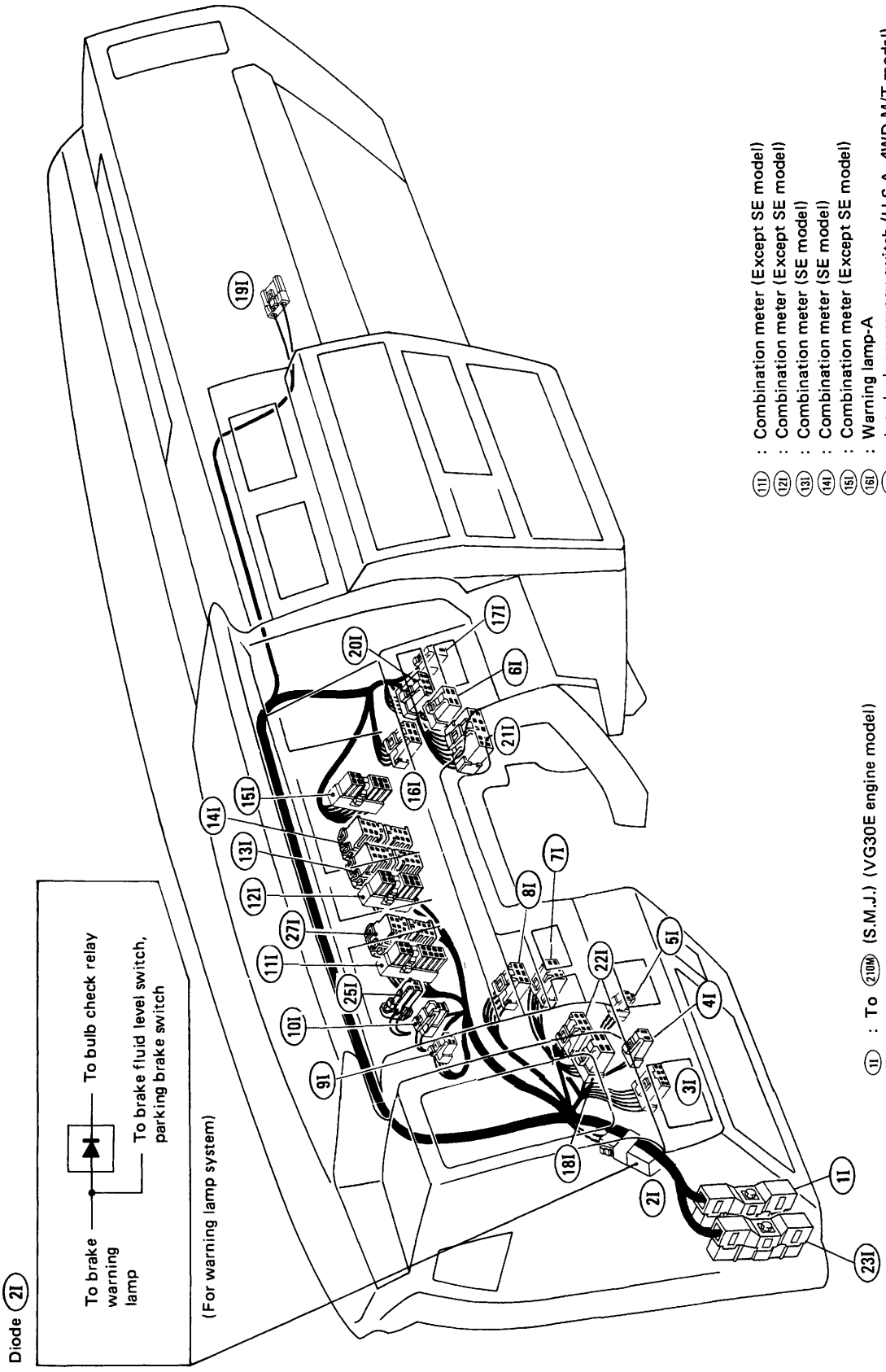
(For starting and warning chime system)

Diode (300M)



SEL446N

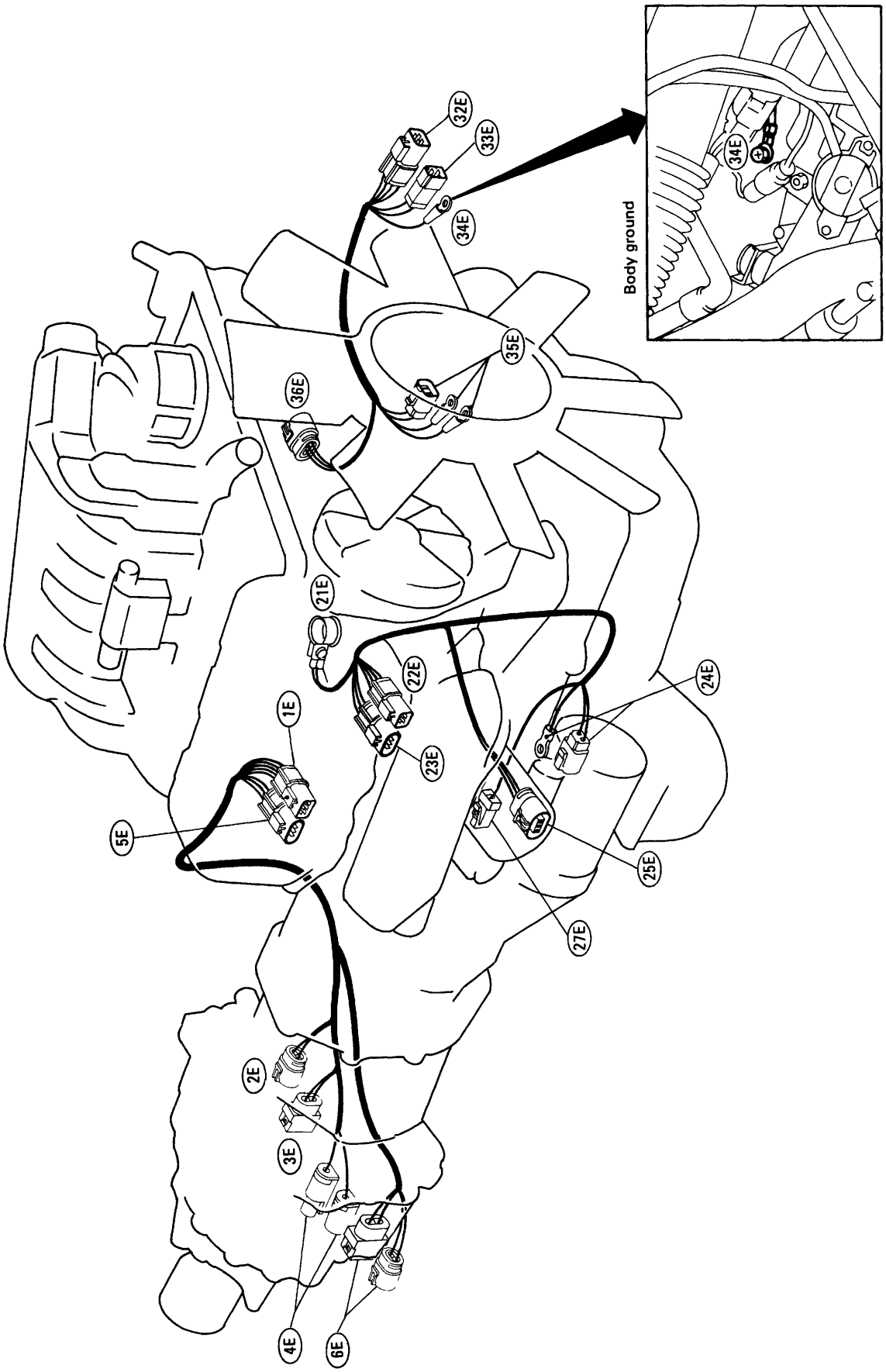
Instrument Harness



SEL447N

Engine Harness

VG30E ENGINE



Battery cable

- 21E : Battery
- 22E : To 87M
- 23E : To 86M (Van and Wagon)
- 24E : Starter motor
- 25E : Front shock absorber R.H. (Van and Wagon)
- 27E : Oil pressure switch

Alternator harness

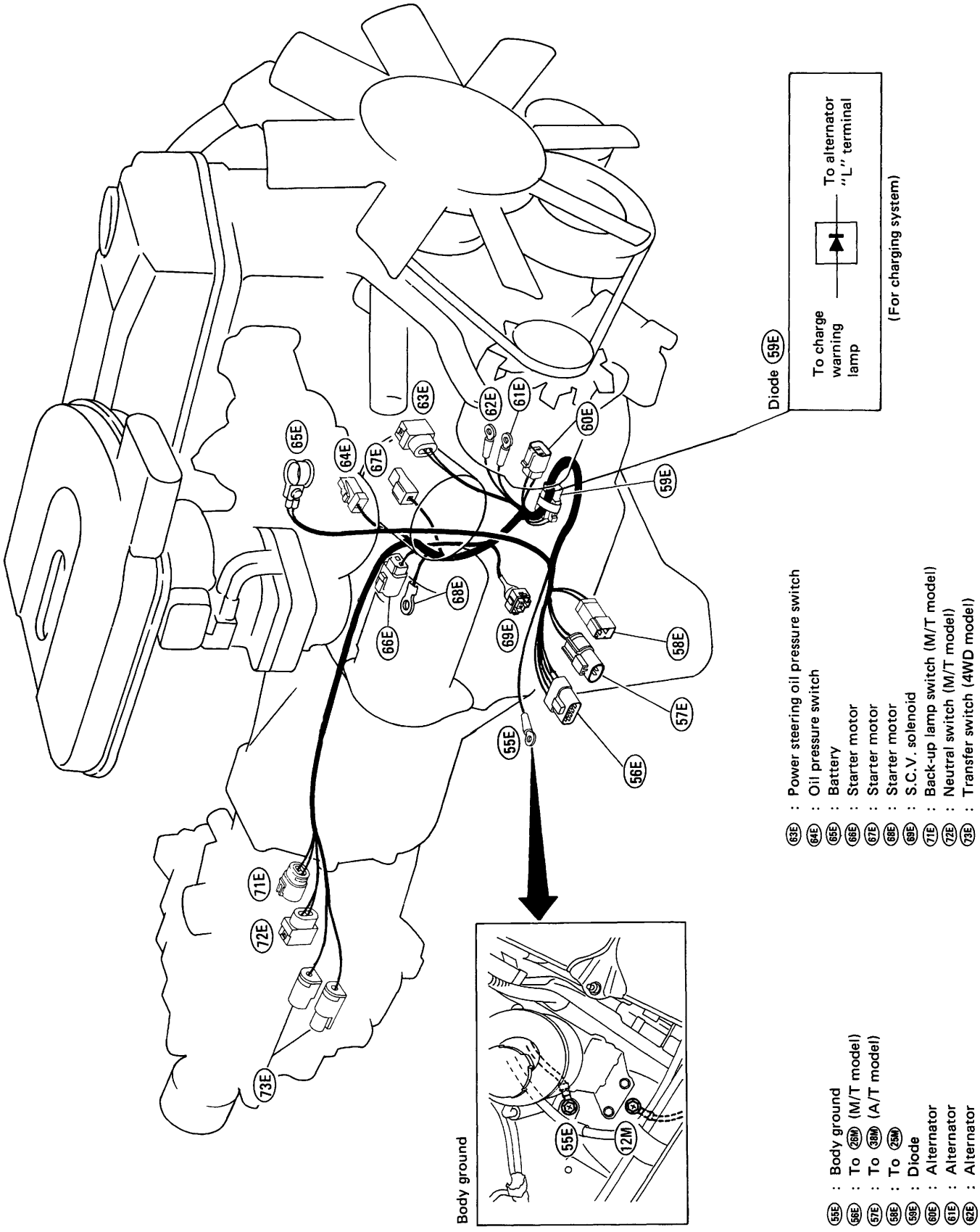
- 32E : To 37M
- 33E : To 36M
- 34E : Body ground
- 35E : Alternator
- 36E : Front shock absorber L.H. (Van and Wagon)

- 1E : To 78M (M/T model)
- 2E : Back-up lamp switch (M/T model)
- 3E : Neutral switch (M/T model)
- 4E : Transfer switch (4WD M/T model)
- 5E : To 78M (4WD A/T model)
- 6E : Transfer switch (4WD A/T model)

SEL448N

Engine Harness (Cont'd)

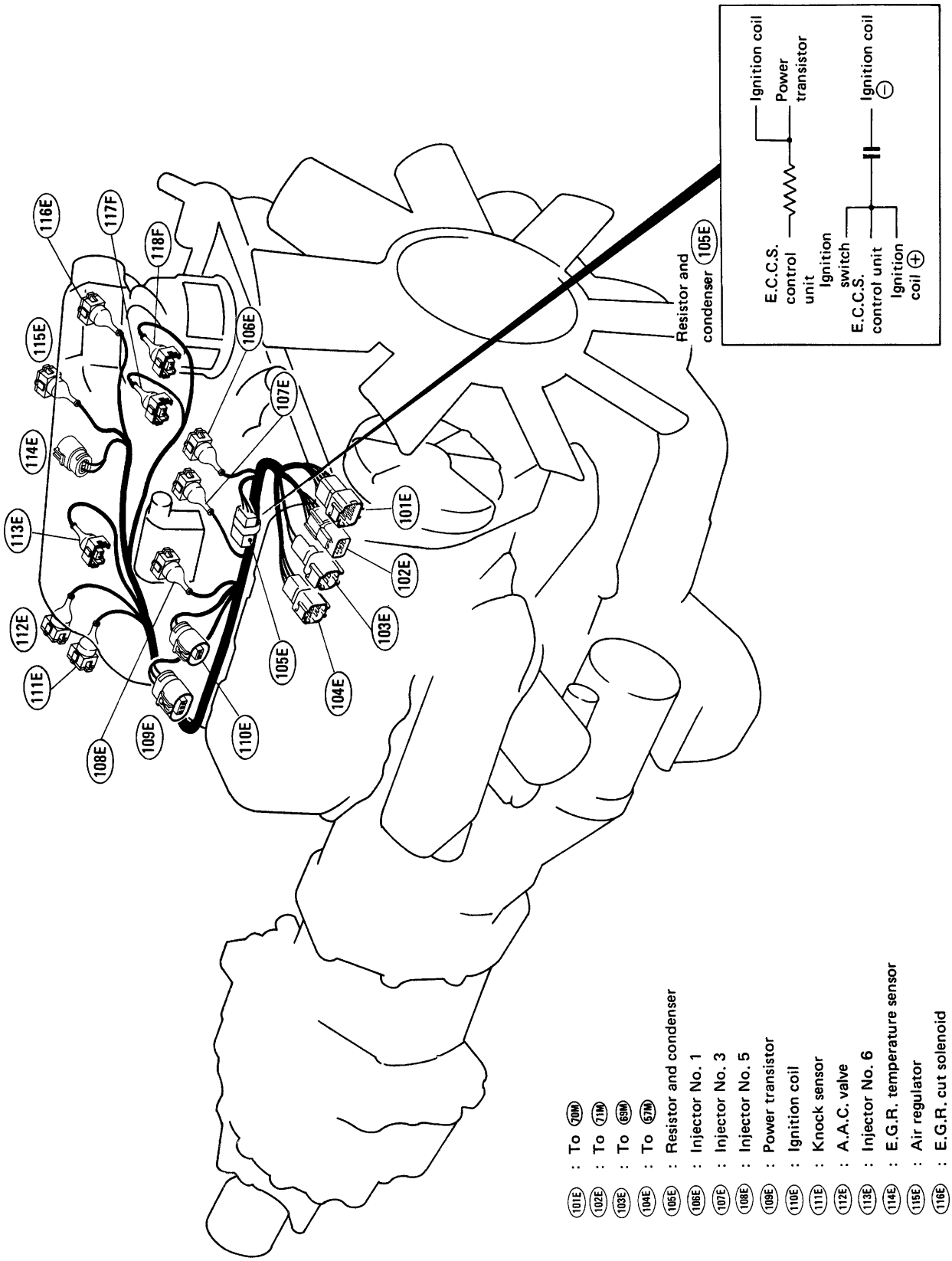
KA24E ENGINE



SEL449N

Engine control Harness

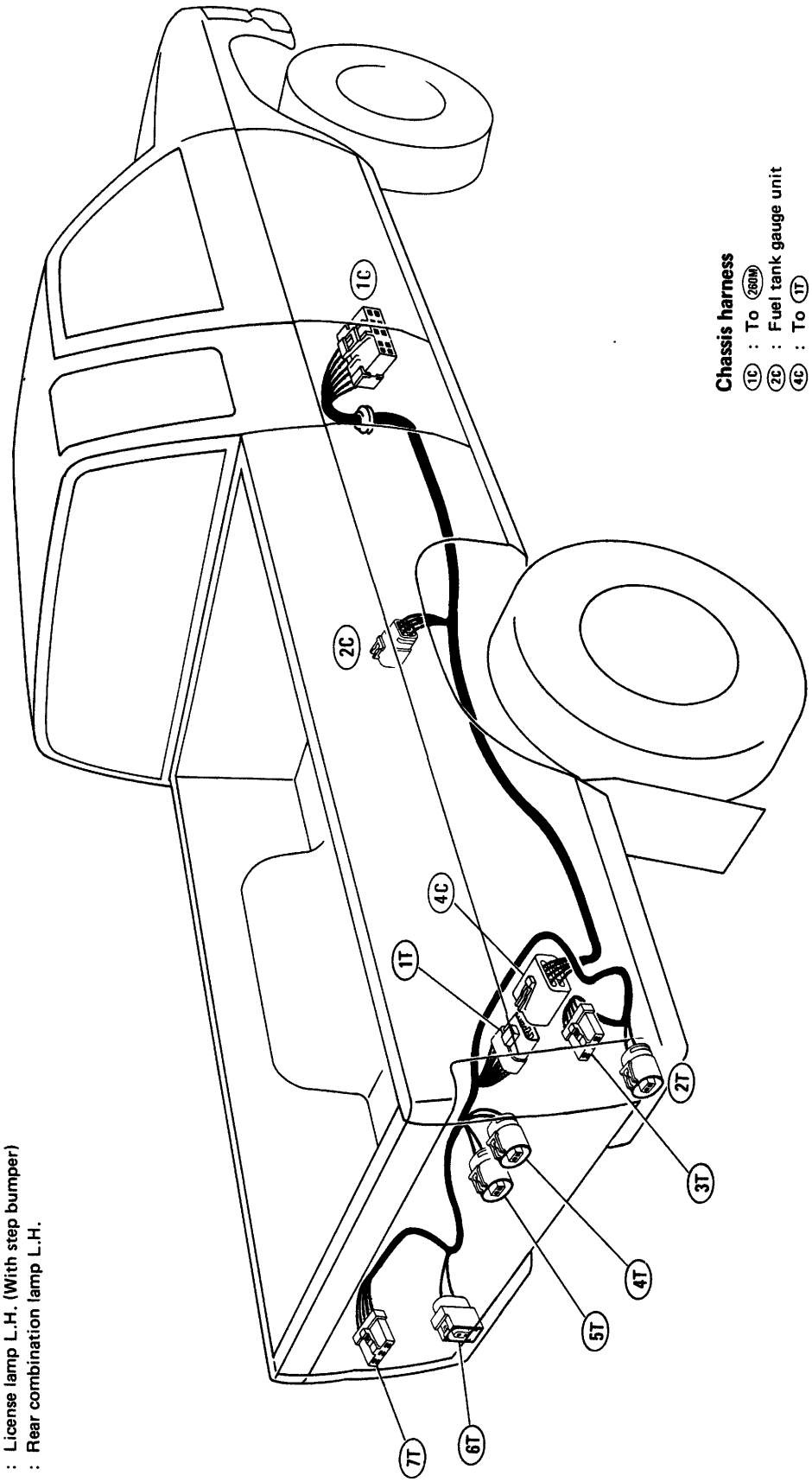
VG30E ENGINE



SEL450N

Chassis and Tail Harness

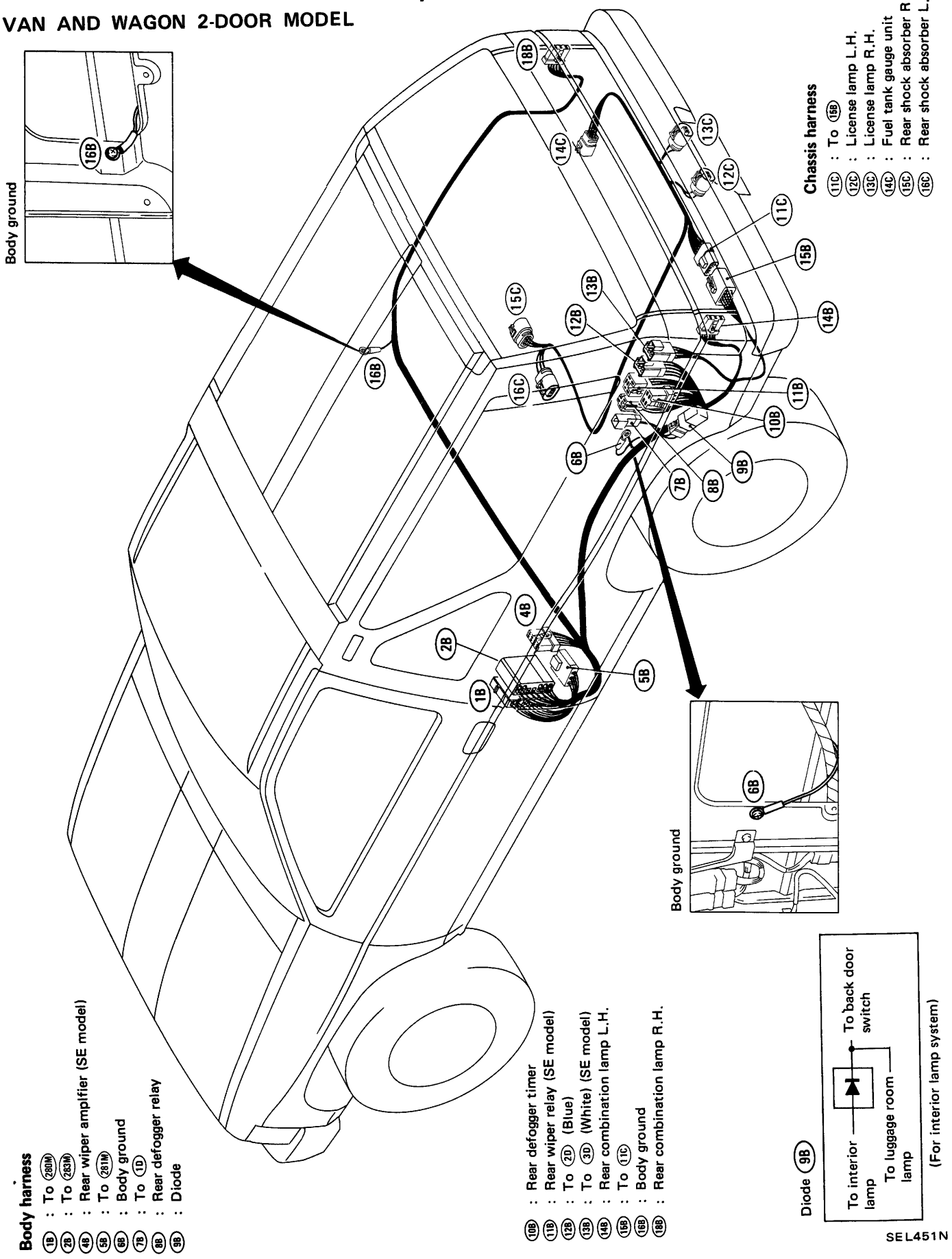
TRUCK MODEL



SEL168K

Body and Chassis Harness

VAN AND WAGON 2-DOOR MODEL



Body harness

- 1B : To 280M
- 2B : To 283M
- 4B : Rear wiper amplifier (SE model)
- 5B : To 281M
- 6B : Body ground
- 7B : To 1D
- 8B : Rear defogger relay
- 9B : Diode

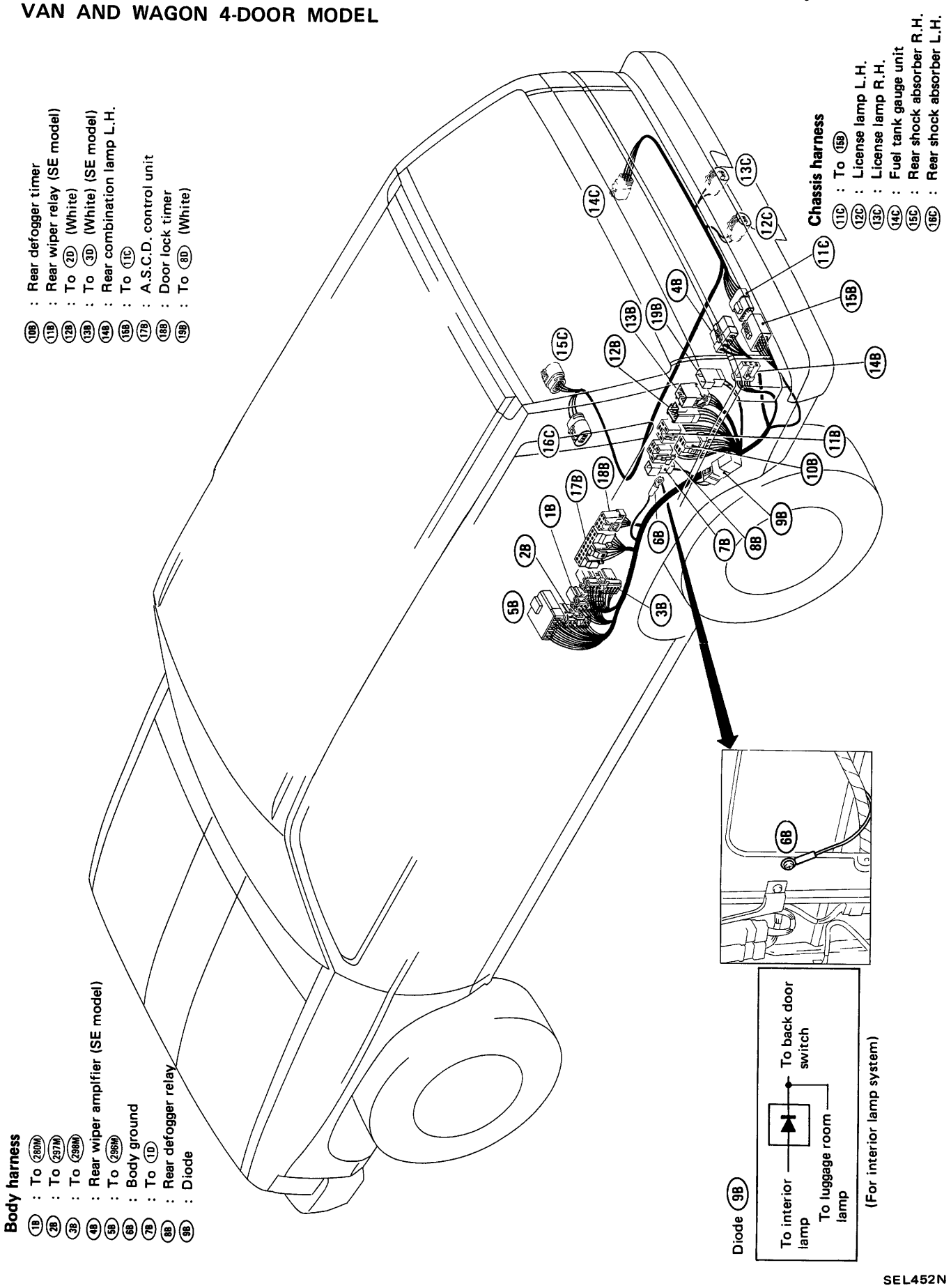
- 10B : Rear defogger timer
- 11B : Rear wiper relay (SE model)
- 12B : To 2D (Blue)
- 13B : To 3D (White) (SE model)
- 14B : Rear combination lamp L.H.
- 15B : To 11C
- 16B : Body ground
- 18B : Rear combination lamp R.H.

Chassis harness

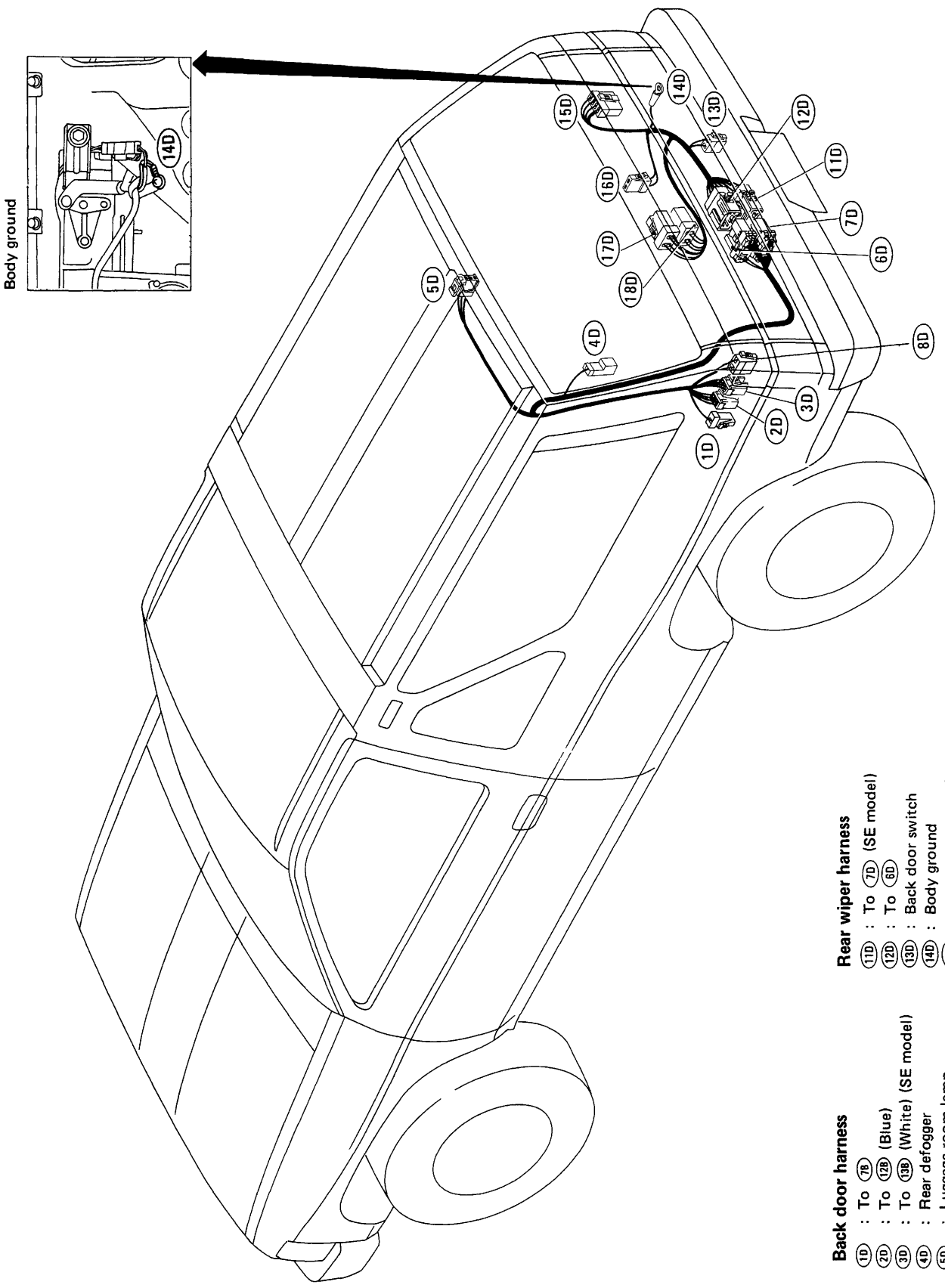
- 11C : To 15B
- 12C : License lamp L.H.
- 13C : License lamp R.H.
- 14C : Fuel tank gauge unit
- 15C : Rear shock absorber R.H.
- 16C : Rear shock absorber L.H.

Body and Chassis Harness (Cont'd)

VAN AND WAGON 4-DOOR MODEL



Back Door and Rear Wiper Harness



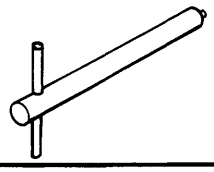
Back door harness

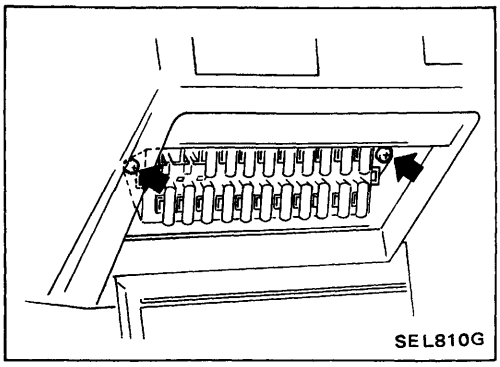
- (1D) : To (7B)
- (2D) : To (12B) (Blue)
- (3D) : To (13B) (White) (SE model)
- (4D) : Rear defogger
- (5D) : Luggage room lamp
- (6D) : To (12D)
- (7D) : To (11D) (SE model)
- (8D) : To (18B)

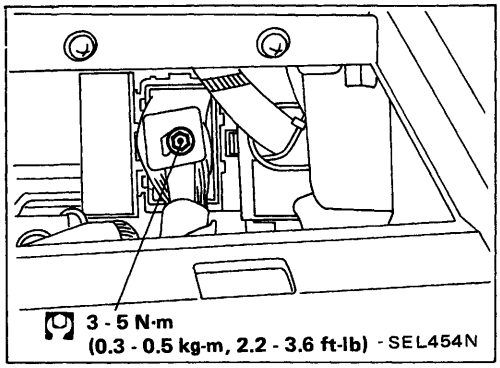
Rear wiper harness

- (11D) : To (7D) (SE model)
- (12D) : To (6D)
- (13D) : Back door switch
- (14D) : Body ground
- (15D) : Rear wiper motor (SE model)
- (16D) : Glass hatch switch (SE model)
- (17D) : Glass hatch opener solenoid (SE model)
- (18D) : Door lock actuator (SE model)

SEL453N

Tool number	Tool name
(J36126)	Washer nozzle adjusting tool 


SEL810G



REMOVAL

- Remove fuse block retaining screws to gain access to S.M.J.
- Slide fuse block to the side, and remove S.M.J. retaining bolts to detach S.M.J.

INSTALLATION

To install S.M.J., tighten bolts until orange "fulltight" mark appears and then retighten to specified torque as required.

: 3 - 5 N·m (0.3 - 0.5 kg-m, 2.2 - 3.6 ft-lb)

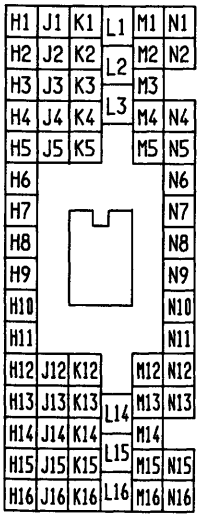
CAUTION:

Do not overtighten bolts, otherwise, bolts may be damaged.

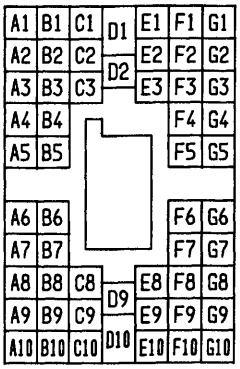
Terminal Arrangement (Model D21 series)

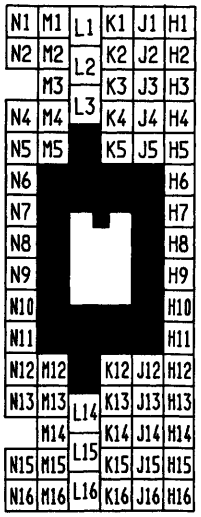
MAIN HARNESS

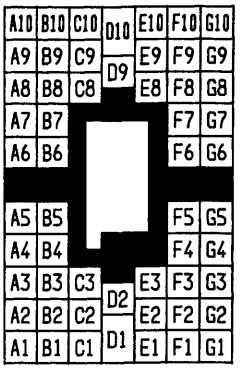
VG30E engine model



KA24E engine model

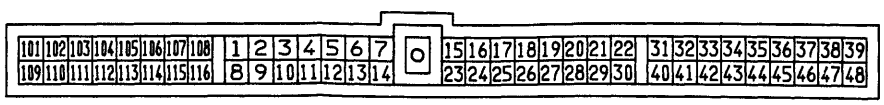






INSTRUMENT HARNESS

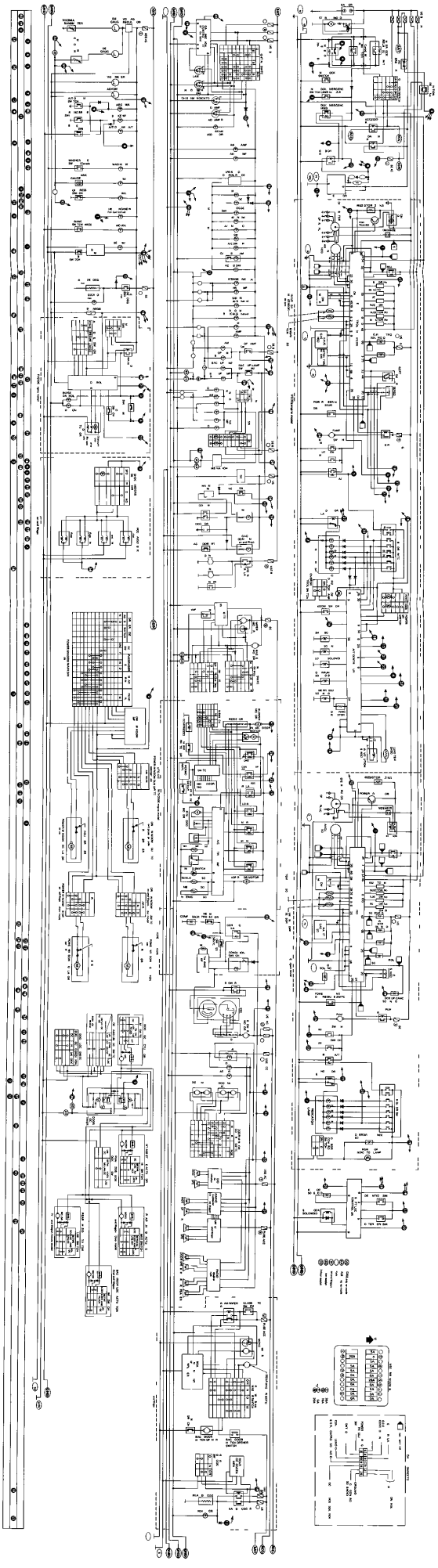
E.C.C.S. CONTROL UNIT



View from harness side

SEL455N

1990 NISSAN TRUCK/PATHFINDER
CIRCUIT DIAGRAM



INCH TO METRIC CONVERSION TABLE

(Rounded-off for automotive use)

inches	mm	inches	mm
.100	2.54	.610	15.49
.110	2.79	.620	15.75
.120	3.05	.630	16.00
.130	3.30	.640	16.26
.140	3.56	.650	16.51
.150	3.81	.660	16.76
.160	4.06	.670	17.02
.170	4.32	.680	17.27
.180	4.57	.690	17.53
.190	4.83	.700	17.78
.200	5.08	.710	18.03
.210	5.33	.720	18.29
.220	5.59	.730	18.54
.230	5.84	.740	18.80
.240	6.10	.750	19.05
.250	6.35	.760	19.30
.260	6.60	.770	19.56
.270	6.86	.780	19.81
.280	7.11	.790	20.07
.290	7.37	.800	20.32
.300	7.62	.810	20.57
.310	7.87	.820	20.83
.320	8.13	.830	21.08
.330	8.38	.840	21.34
.340	8.64	.850	21.59
.350	8.89	.860	21.84
.360	9.14	.870	22.10
.370	9.40	.880	22.35
.380	9.65	.890	22.61
.390	9.91	.900	22.86
.400	10.16	.910	23.11
.410	10.41	.920	23.37
.420	10.67	.930	23.62
.430	10.92	.940	23.88
.440	11.18	.950	24.11
.450	11.43	.960	24.38
.460	11.68	.970	24.64
.470	11.94	.980	24.89
.480	12.19	.990	25.15
.490	12.45	1.000	25.40
.500	12.70	2.000	50.80
.510	12.95	3.000	76.20
.520	13.21	4.000	101.60
.530	13.46	5.000	127.00
.540	13.72	6.000	152.40
.550	13.97	7.000	177.80
.560	14.22	8.000	203.20
.570	14.48	9.000	228.60
.580	14.73	10.000	254.00
.590	14.99	20.000	508.00
.600	15.24		

METRIC TO INCH CONVERSION TABLE

(Rounded-off for automotive use)

mm	inches	mm	inches
1	.0394	51	2.008
2	.079	52	2.047
3	.118	53	2.087
4	.157	54	2.126
5	.197	55	2.165
6	.236	56	2.205
7	.276	57	2.244
8	.315	58	2.283
9	.354	59	2.323
10	.394	60	2.362
11	.433	61	2.402
12	472	62	2.441
13	.512	63	2.480
14	.551	64	2.520
15	.591	65	2.559
16	.630	66	2.598
17	.669	67	2.638
18	.709	68	2.677
19	.748	69	2.717
20	.787	70	2.756
21	.827	71	2.795
22	.866	72	2.835
23	.906	73	2.874
24	.945	74	2.913
25	.984	75	2.953
26	1.024	76	2.992
27	1.063	77	3.031
28	1.102	78	3.071
29	1.142	79	3.110
30	1.181	80	3.150
31	1.220	81	3.189
32	1.260	82	3.228
33	1.299	83	3.268
34	1.339	84	3.307
35	1.378	85	3.346
36	1.417	86	3.386
37	1.457	87	3.425
38	1.496	88	3.465
39	1.535	89	3.504
40	1.575	90	3.543
41	1.614	91	3.583
42	1.654	92	3.622
43	1.693	93	3.661
44	1.732	94	3.701
45	1.772	95	3.740
46	1.811	96	3.780
47	1.850	97	3.819
48	1.890	98	3.858
49	1.929	99	3.898
50	1.969	100	3.937

QUICK REFERENCE CHART : TRUCK/PATHFINDER 1990

ENGINE TUNE-UP DATA VG30E

Model		VG30E		
Idle speed rpm	M/T	750±50		
	A/T (in "N" position)	750±50		
Ignition timing (B.T.D.C. at idle speed)		15°±2° See page EF & EC-26		
Spark plug (Standard type)		BKR6EY		
Drive belt deflection (Cold) mm (in)		Used belt		Deflection of new belt
		Limit	Deflection after adjustment	
Alternator		12 (0.47)	6 - 8 (0.24 - 0.31)	5 - 7 (0.20 - 0.28)
Air conditioner compressor		16 (0.63)	9 - 11 (0.35 - 0.43)	7 - 9 (0.28 - 0.35)
Power steering oil pump		17 (0.67)	11 - 13 (0.43 - 0.51)	9 - 11 (0.35 - 0.43)
Applied pushing force N (kg, lb)		98 (10, 22)		

ENGINE TUNE-UP DATA KA24E

Model		KA24E		
Idle speed rpm	M/T	800±50		
	A/T (in "N" position)	800±50		
Ignition timing (B.T.D.C. at idle speed)		10°±2° See page EF & EC-189		
Dash pot touch speed rpm		A/T: 1,600 - 2,000		
Valve clearance (Hot) mm (in)	Intake	0.30 (0.012)		
	Exhaust	0.30 (0.012)		
Spark plug (Standard type)		BPR5ES		
Drive belt deflection (Cold) mm (in)		Used belt		Set deflection of new belt
		Limit	Adjust	
Alternator		16 (0.63)	9 - 11 (0.35 - 0.43)	7 - 9 (0.28 - 0.35)
Air conditioner compressor		13 (0.51)	8 - 10 (0.31 - 0.39)	6 - 8 (0.24 - 0.31)
Power steering oil pump		16 (0.63)	10 - 12 (0.39 - 0.47)	8 - 10 (0.31 - 0.39)
Applied pushing force N (kg, lb)		98 (10, 22)		

WHEEL ALIGNMENT (Unladen*1)

Applied model		ALLOWABLE LIMIT		ADJUSTING RANGE	
		2WD Truck	Except 2WD Truck	2WD Truck	Except 2WD Truck
Camber	degree	−0°20′ to 1°10′	−0°05′ to 1°25′	−0°05′ to 0°55′	0°10′ - 1°10′
Caster	degree	−0°23′ to 1°07′	33′ - 2°03′	−0°08′ to 0°52′	0°48′ - 1°48′
Kingpin inclination	degree	8°20′ - 9°50′	7°21′ - 8°51′	8°35′ - 9°35′	7°36′ - 8°36′
Total toe-in Bias tire	mm (in)	3 - 7 (0.12 - 0.28)	3 - 7 (0.12 - 0.28)	4 - 6 (0.16 - 0.24)	4 - 6 (0.16 - 0.24)
	degree	15′ - 35′	15′ - 35′	20′ - 30′	20′ - 30′
Radial tire	mm (in)	1 - 5 (0.04 - 0.20)	2 - 6 (0.08 - 0.24)	2 - 4 (0.08 - 0.16)	3 - 5 (0.12 - 0.20)
	degree	7′ - 27′	12′ - 32′	12′ - 22′	17′ - 27′

*1: Tankful of fuel, radiator coolant and engine oil full.
Spare tire, jack, hand tools, mats in designated positions.

CLUTCH PEDAL

Unit: mm (in)

Height	VG30E: 227 - 237 (8.94 - 9.33) KA24E: 236 - 246 (9.29 - 9.69)
Free play	1.0 - 3.0 (0.039 - 0.118)

BRAKE

Unit: mm (in)

Disc brake Pad minimum thickness	2.0 (0.079)
Rotor repair limit Runout	0.07 (0.0028) or less
Minimum thickness	20.0 (0.787), CL28VA 24.0 (0.945), CL28VD 16.0 (0.630), AD14VB
Drum brake Lining minimum thickness	1.5 (0.059)
Drum repair limit Maximum inner diameter	261.5 (10.30), LT26B 296.5 (11.67), LT30A 191.0 (7.52), DS17H
Pedal free height M/T model	209 - 219 (8.23 - 8.62)
A/T model	212 - 222 (8.35 - 8.74)
Pedal depressed height*1	120 (4.72) or more

*1: Under force of 490 N (50 kg, 110 lb) with engine running

FRONT WHEEL BEARING

Item \ Model	2WD		4WD	
Tightening torque N-m (kg-m, ft-lb)	34 - 39 (3.5 4.0, 25 - 29)		–	
Return angle degree	45°		–	
Preload (At hub bolt) N (kg, lb)	New seal	9.8 - 28.4 (1.0 - 2.9, 2.2 - 6.4)	Wheel bearing lock nut Tightening torque N-m (kg-m, ft-lb)	78 - 98 (8 - 10, 58 - 72)
			Retightening torque after loosening wheel bearing lock nut N-m (kg-m, ft-lb)	0.5 - 1.5 (0.05 - 0.15, 0.4 - 1.1)
			Axial end play mm (in)	0 (0)
	Used seal	9.8 - 23.5 (1.0 - 2.4, 2.2 - 5.3)	Starting force at wheel hub bolt N (kg, lb)	A
			Turning angle degree	15° - 30°
			Starting force at wheel hub bolt N (kg, lb)	B
			Wheel bearing preload at wheel hub bolt B − A N (kg, lb)	7.06 - 20.99 (0.72 - 2.14, 1.59 - 4.72)

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