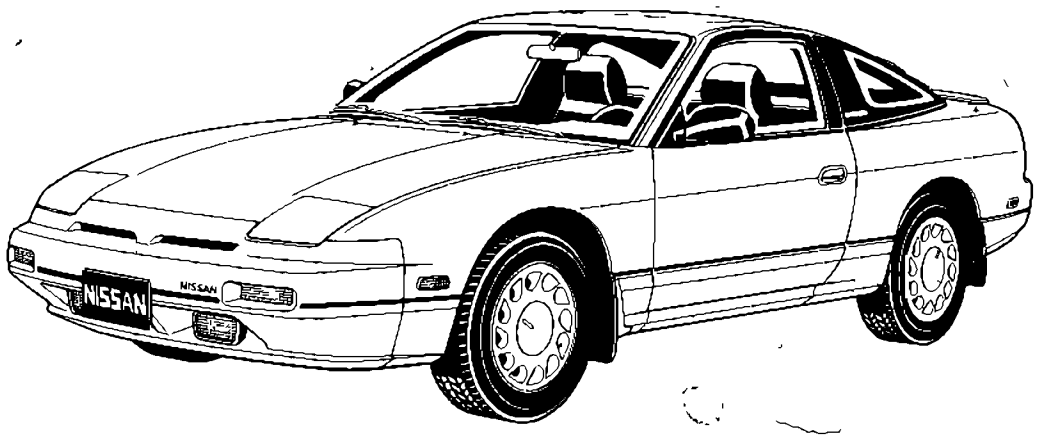
NISSAN 240SX

1989



SERVICE MANUAL

NISSAN 240SX

MODEL S13 SERIES

QUICK REFERENCE INDEX

GENERAL INFORMATION	GI
MAINTENANCE	MA
ENGINE MECHANICAL	EM
ENGINE LUBRICATION & COOLING SYSTEMS	LC
ENGINE FUEL & EMISSION CONTROL SYSTEM	EF&EC
ENGINE CONTROL, FUEL & EXHAUST SYSTEM	FE
CLUTCH	CL
MANUAL TRANSMISSION	MT
AUTOMATIC TRANSMISSION	AT
PROPELLER SHAFT & DIFFERENTIAL CARRIER	PD
FRONT AXLE & FRONT SUSPENSION	FA
REAR AXLE & REAR SUSPENSION	RA
BRAKE SYSTEM	BR
STEERING SYSTEM	ST
BODY	BF
HEATER & AIR CONDITIONER	HA
ELECTRICAL SYSTEM	EL

© 1988 NISSAN MOTOR CO., LTD. Printed in U.S.A.

Not to be reproduced in whole or in part without the prior written permission of Nissan Motor Company Ltd., Tokyo, Japan.

FOREWORD

This manual contains maintenance and repair procedures for the 1989 Nissan 240SX.

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

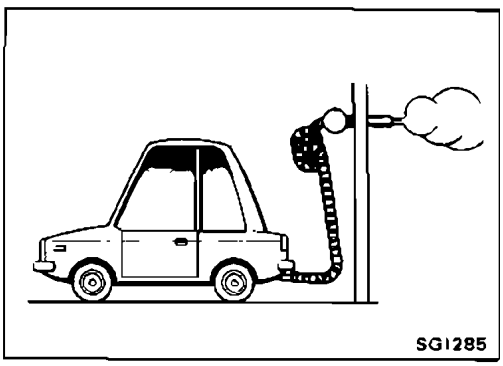
GI

SECTION GI

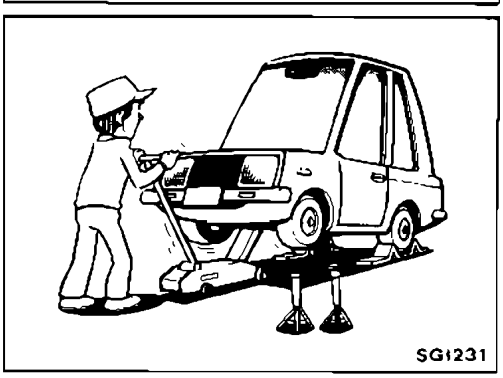
CONTENTS

PRECAUTIONS ..... GI- 2
HOW TO USE THIS MANUAL ..... GI- 5
HOW TO READ WIRING DIAGRAMS ..... GI- 7
HOW TO FOLLOW FLOW CHART IN TROUBLE DIAGNOSES GI-10
IDENTIFICATION INFORMATION GI-13
LIFTING POINTS AND TOW TRUCK TOWING GI-17
TIGHTENING TORQUE OF STANDARD BOLTS GI-20

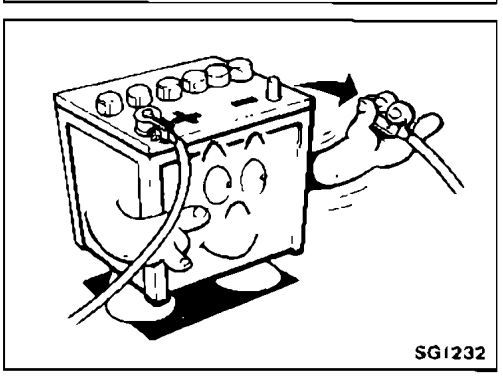
Observe the following precautions to ensure safe and proper servicing. These precautions are not described in each individual section.


SGI285

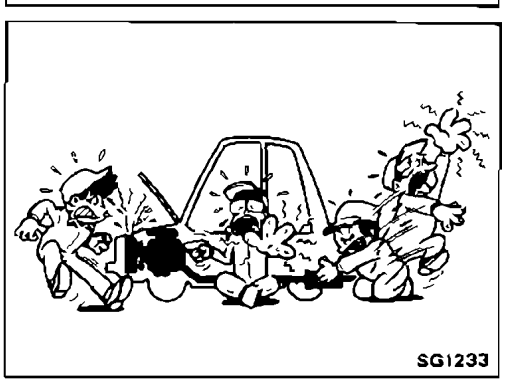
1. Do not operate the engine for an extended period of time without proper exhaust ventilation.
   Keep the work area well ventilated and free of any inflammable materials. Special care should be taken when handling any inflammable or poisonous materials, such as gasoline, refrigerant gas, etc. When 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

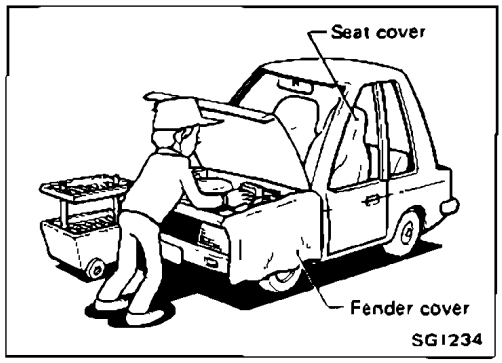
2. Before jacking up the vehicle, apply wheel chocks or other tire blocks to the wheels to prevent the vehicle from moving. After jacking up the vehicle, support the vehicle weight with safety stands at the points designated for proper lifting and towing before working on the vehicle.
   These operations should be done on a level surface.
3. When removing a heavy component such as the engine or transaxle/transmission, be careful not to lose your balance and drop them. Also, do not allow them to strike adjacent parts, especially the brake tubes and master cylinder.


SGI232

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.

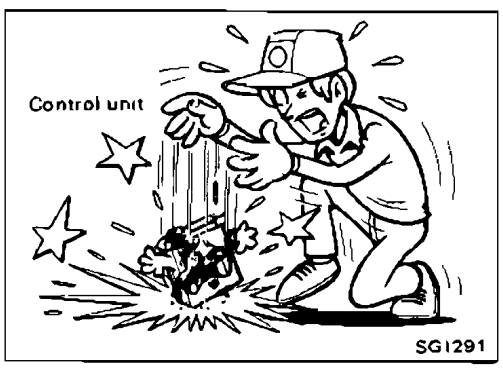

SGI233

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.



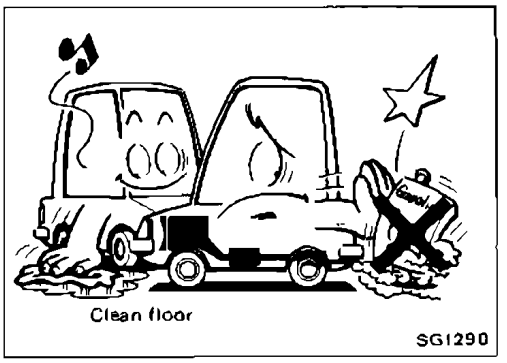
6. Before servicing the vehicle, protect fenders, upholstery and carpeting with appropriate covers.
   Take caution that keys, buckles or buttons on your person do not scratch the paint.

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. with new ones.
9. Replace inner and outer races of tapered roller bearings and needle bearings as a set.
10. Arrange the disassembled parts in accordance with their assembled locations and sequence.
11. Do not touch the terminals of electrical components which use microcomputers (such as electronic control units).
    Static electricity may damage internal electronic components.
12. After disconnecting vacuum or air hoses, attach a tag to indicate the proper connection.
13. Use only the lubricants specified in MA section.
14. Use approved bonding agent, sealants or their equivalents when required.
15. Use tools and recommended special tools where specified for safe and efficient service repairs.
16. When repairing the fuel, oil, water, vacuum or exhaust systems, 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 Catalyst

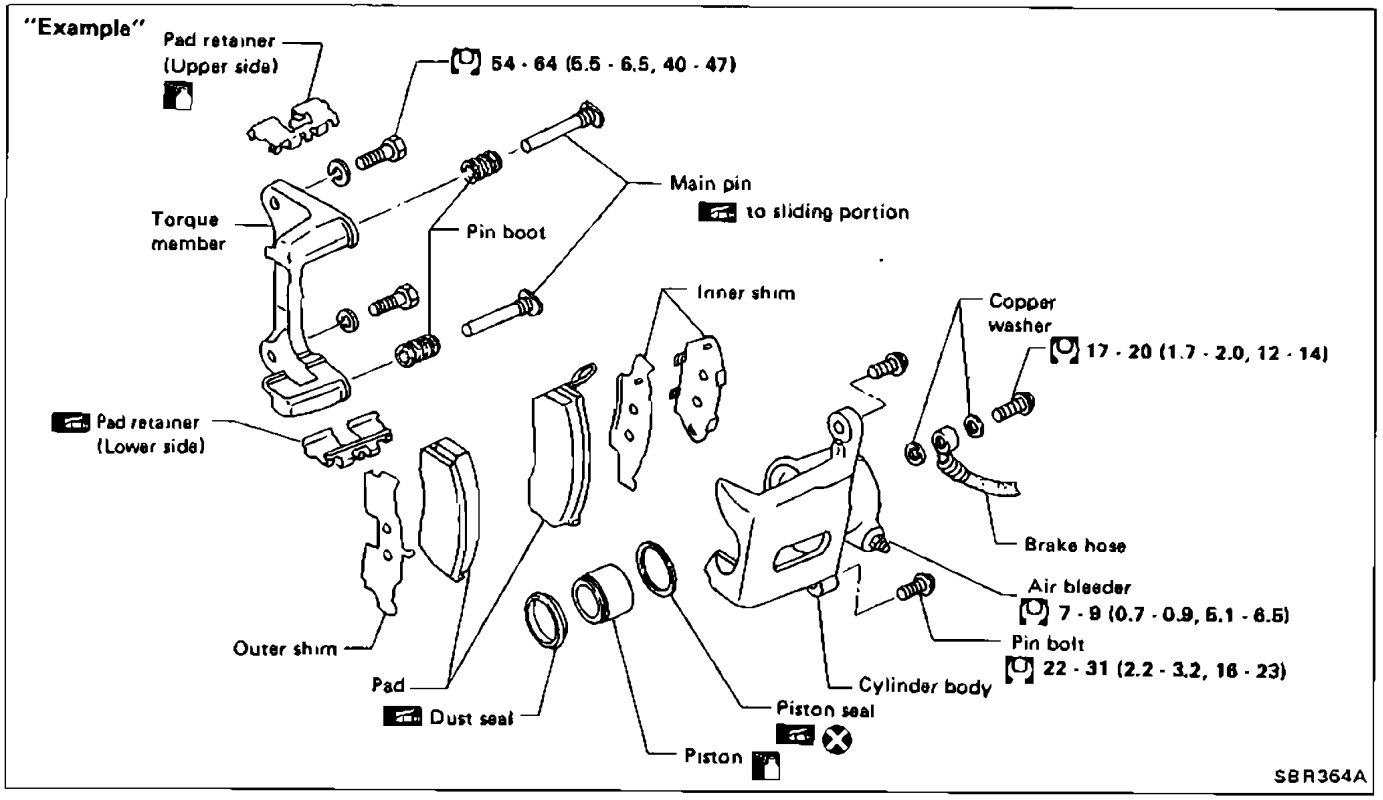
If a large amount of unburned fuel flows into the converter, the converter temperature will be excessively high. To prevent this, follow the procedure below:

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.

Precautions for Fuel

Unleaded gasoline of
at least 87 AKI number (RON 91)

1. **A QUICK REFERENCE INDEX**, a black tab (e.g. BR) 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. "BR-5").
5. **THE LARGE ILLUSTRATIONS** are exploded views (See below) and contain tightening torques, lubrication points and other information necessary to perform repairs.
   The illustrations should be used in reference to service matters only. When ordering parts, refer to the appropriate **PARTS CATALOG**.



6. **THE SMALL ILLUSTRATIONS** show 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 illustrations.
   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 followings **SYMBOLS AND ABBREVIATIONS** are used:

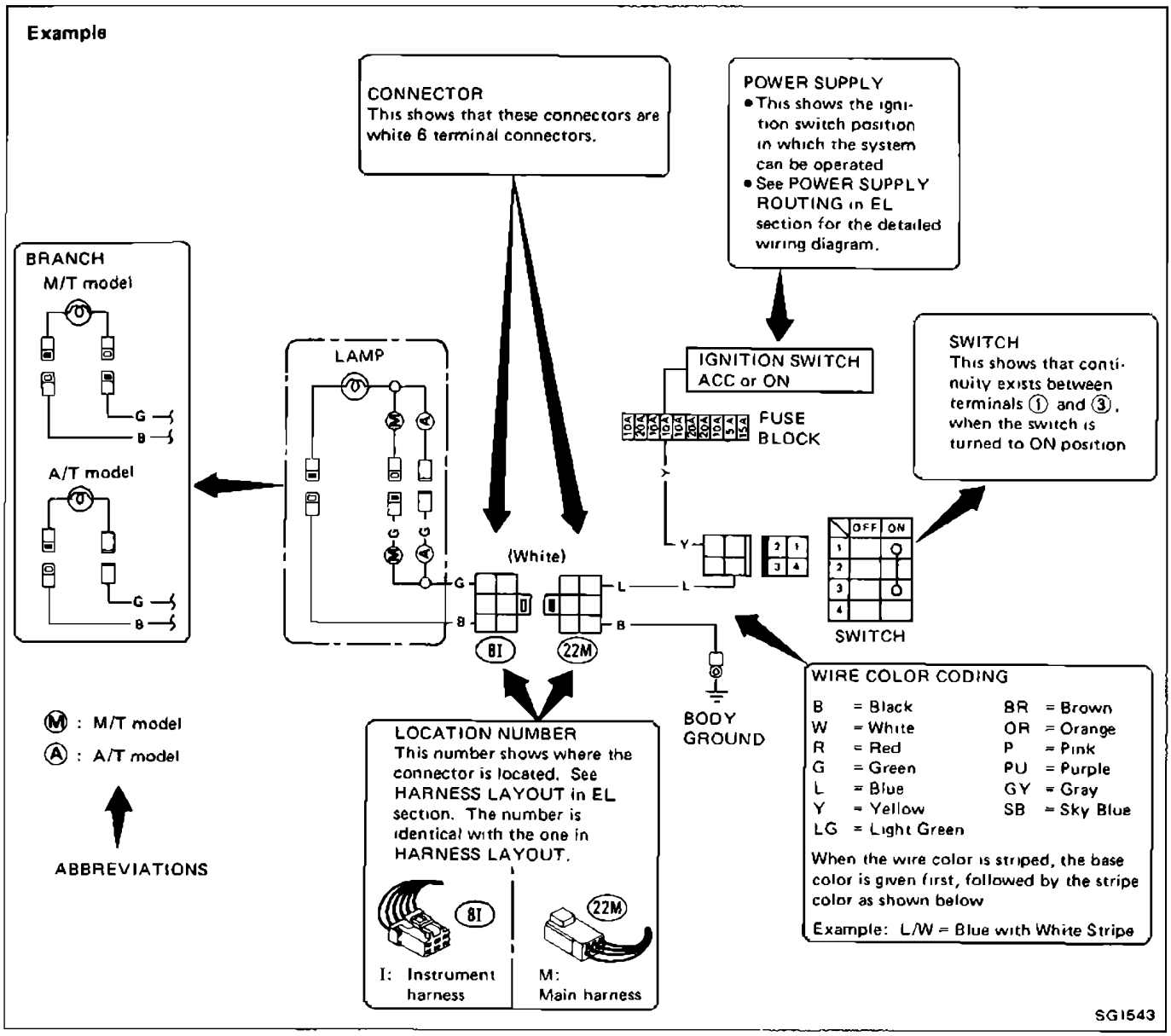
	:	Tightening torque
	:	Should be lubricated with grease. Unless otherwise indicated, use recommended multi-purpose grease.
	:	Should be lubricated with oil.
	:	Sealing point
	:	Checking point
	:	Always replace after every disassembly.
(P)	:	Apply petroleum jelly.
(ATF)	:	Apply A.T.F.
★	:	Select with proper thickness.
☆	:	Adjustment is required.
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
L.H.D.	:	Left-Hand Drive
R.H.D.	:	Right-Hand Drive
A.T.F.	:	Automatic Transmission Fluid
D_1	:	Drive range 1st gear
D_2	:	Drive range 2nd gear
D_3	:	Drive range 3rd gear
D_4	:	Drive range 4th gear
O.D.	:	Overdrive
2_2	:	2nd range 2nd gear
2_1	:	2nd range 1st gear
1_2	:	1st range 2nd gear
1_1	:	1st range 1st gear

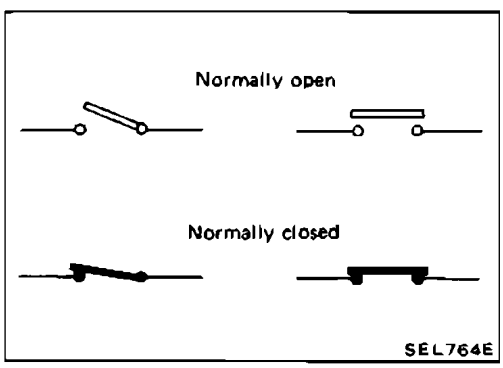
8. The **UNITS** given in this manual are primarily expressed as the SI UNIT (International System of Unit), and alternatively expressed in the metric system and in the yard/pound system.
   "**Example**"
   Tightening torque:
   59 - 78 N·m (6.0 - 8.0 kg-m, 43 - 58 ft-lb)
9. **TROUBLE DIAGNOSES** are included in sections dealing with complicated components.
10. **SERVICE DATA AND SPECIFICATIONS** are 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.

- **WARNING indicates the possibility of personal injury if instructions are not followed.**
- **CAUTION indicates the possibility of component damage if instructions are not followed.**
- **BOLD TYPED STATEMENTS except WARNING and CAUTION give you helpful information.**

WIRING DIAGRAM

Symbols used in WIRING DIAGRAM are shown below:



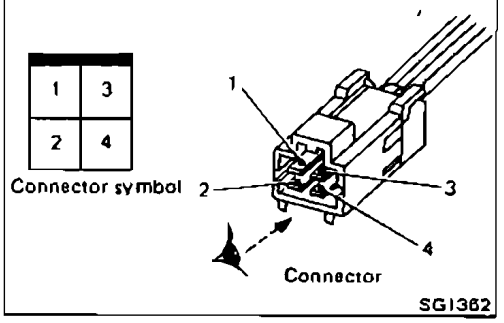


SWITCH POSITIONS

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

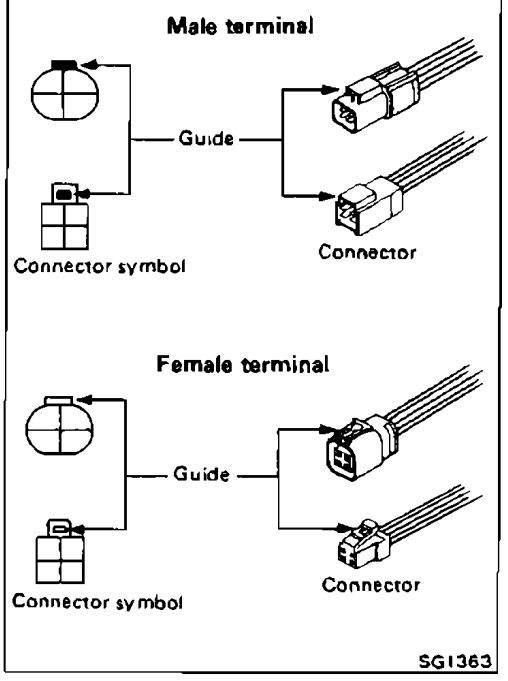
Example



CONNECTOR SYMBOLS

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

Example

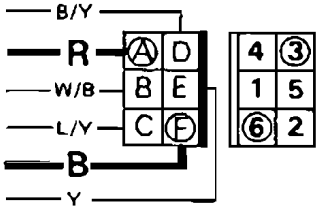


- Male and female terminals
  Connector guides for male terminals are shown in black and female terminals in white in wiring diagrams.

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

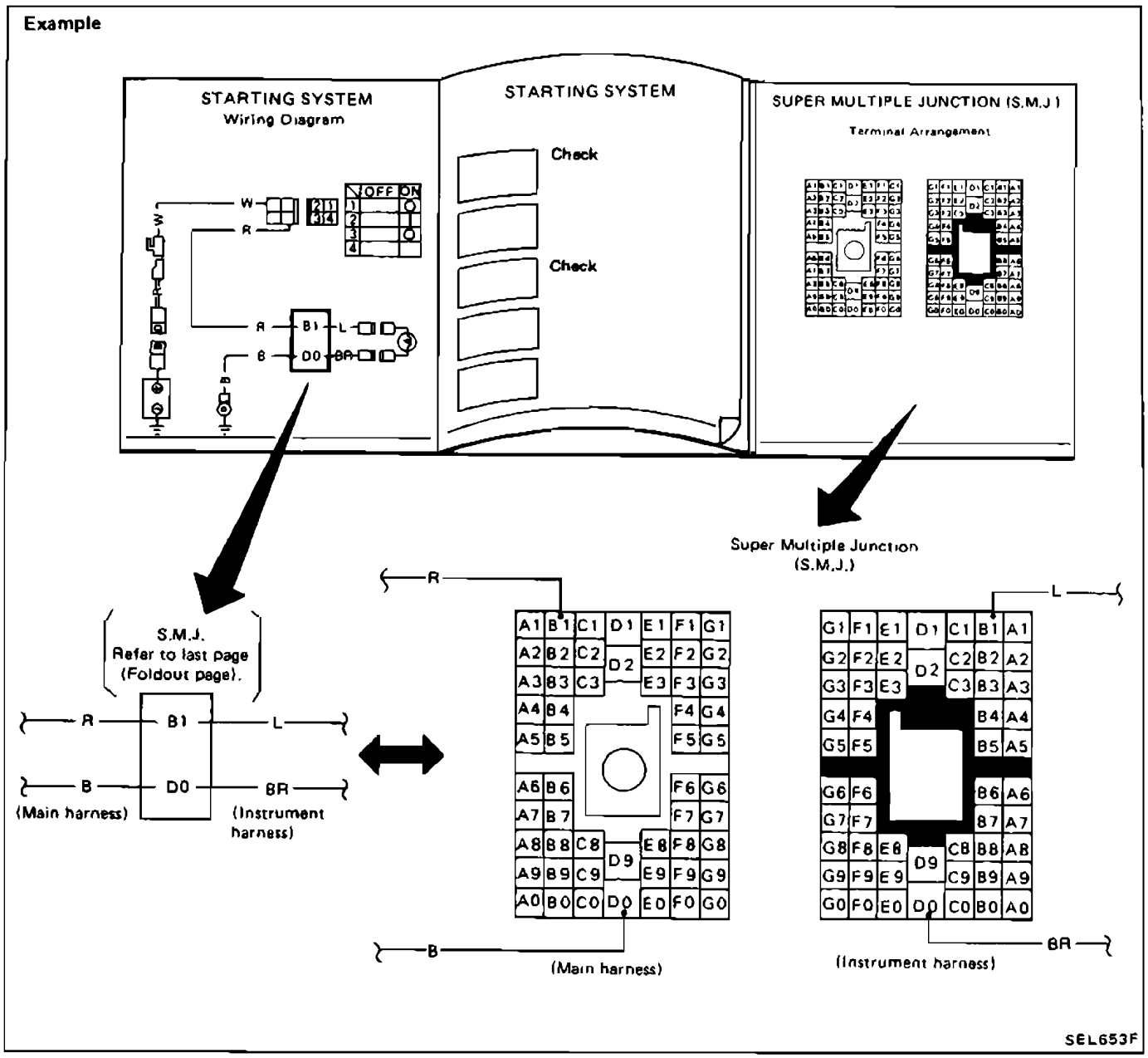
Example: Wiper switch in LO position
Continuity circuit: Red wire – Ⓐ terminal – ③ terminal – Wiper switch (● – ●: LO) – ⑥ terminal – Ⓕ terminal – Black wire

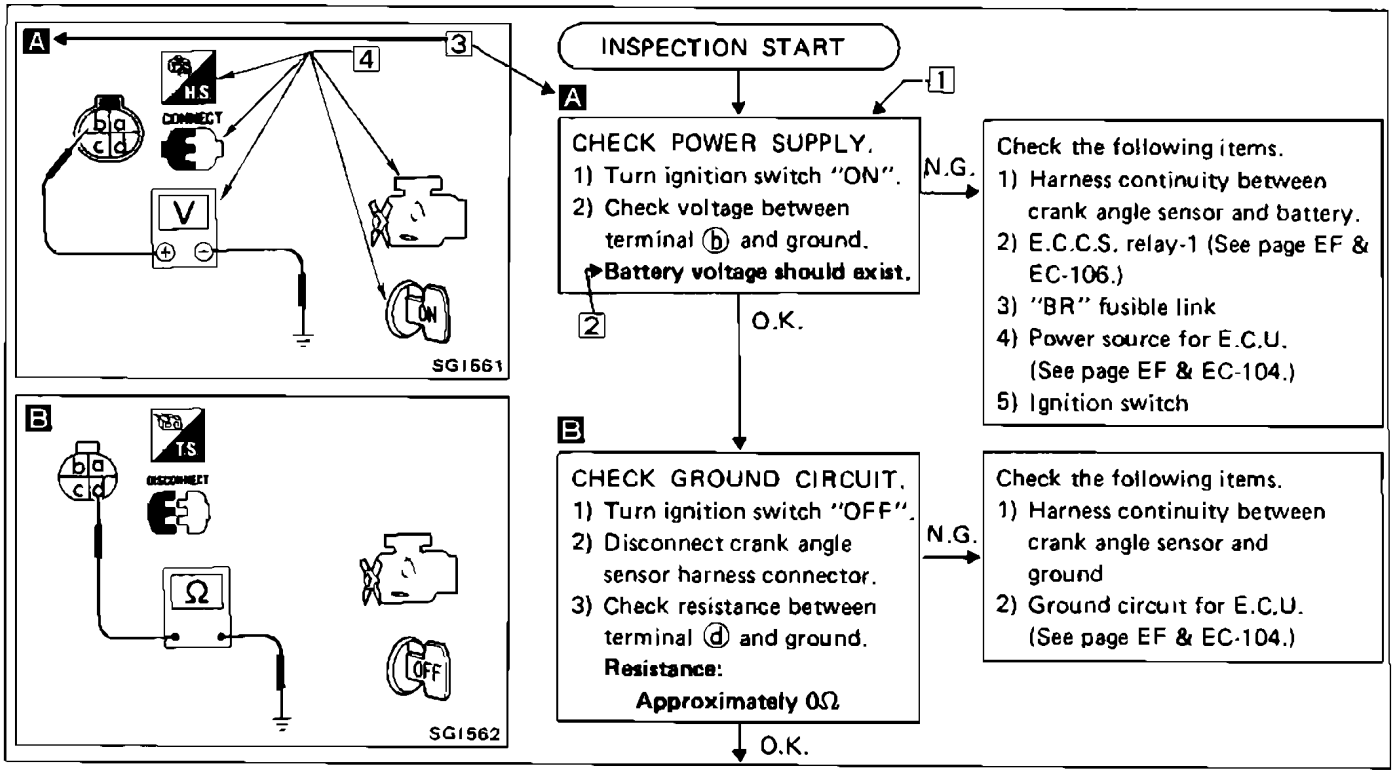
SGI365

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





NOTICE

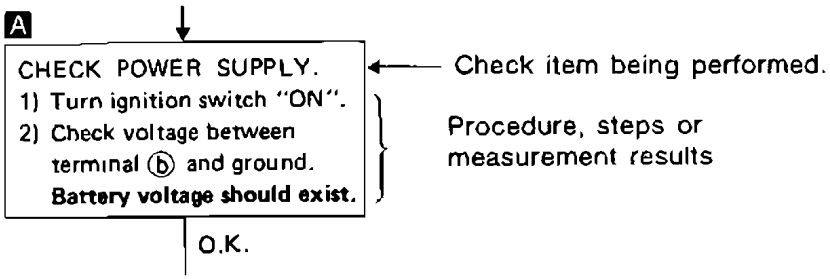
The flow chart indicates work procedures required to diagnose problems effectively. Observe the following instructions before diagnosing.

1) **Use the flow chart after locating probable causes of a problem following the "Preliminary Check" or the "Symptom Chart".**
2) **After repairs, re-check that the problem has been completely eliminated.**
3) **Refer to Component Parts Location and Harness Layout for the Systems described in each section for identification/location of components and harness connectors.**
4) **Refer to the Circuit Diagram for Quick Pin Point Check. If you must perform circuit continuity between harness connectors more detail, such as in case of sub harness is used, refer to Wiring Diagram and Harness Layout in EL section for identification of harness connectors.**
5) **When checking circuit continuity, ignition switch should be "OFF".**
6) **Before checking voltage at connectors, check battery voltage.**
7) **After accomplishing the Diagnostic Procedures and Electrical Components Inspection, make sure that all harness connectors are reconnected as it was.**

HOW TO FOLLOW THIS FLOW CHART

1 Work and diagnostic procedure

Start to diagnose a problem using procedures indicated in enclosed blocks, as shown in the following example.



2 Measurement results

Required results are indicated in bold type in the corresponding block, as shown below.

These have the following meanings:

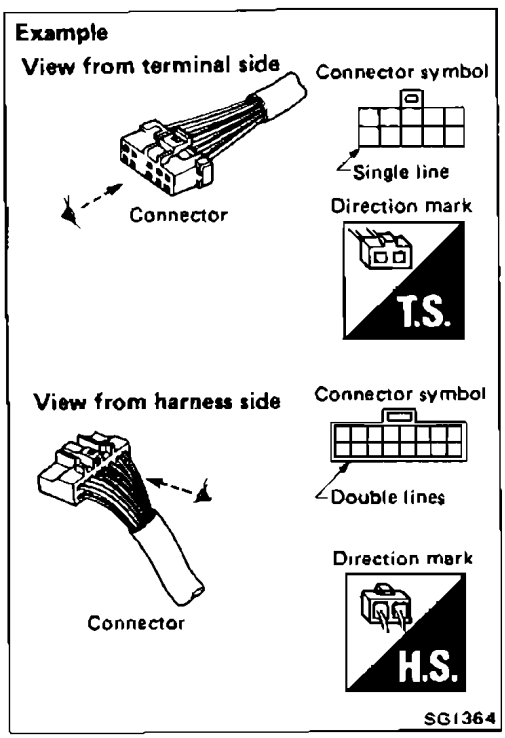
Battery voltage → 11 - 14V or approximately 12V
Voltage: Approximately 0V → Less than 1V

3 Cross reference of work symbols in the text and illustrations

Illustrations are provided as visual aids for work procedures. For example, symbol A indicated in the left upper portion of each illustration corresponds with the symbol in the flowchart for easy identification. More precisely, the procedure under the "CHECK POWER SUPPLY" outlined previously is indicated by an illustration A .

4 Symbols used in illustrations

Symbols included in illustrations refer to measurements or procedures. Before diagnosing a problem, familiarize yourself with each symbol.



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.

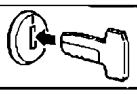
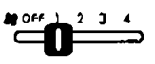
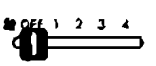
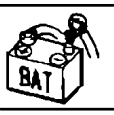
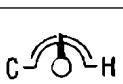
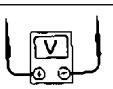
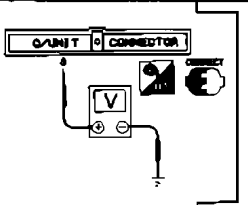
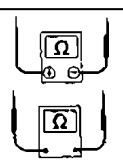
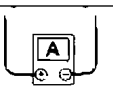
T.S. : **View from terminal side ... T.S.**

- **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 a double line.**

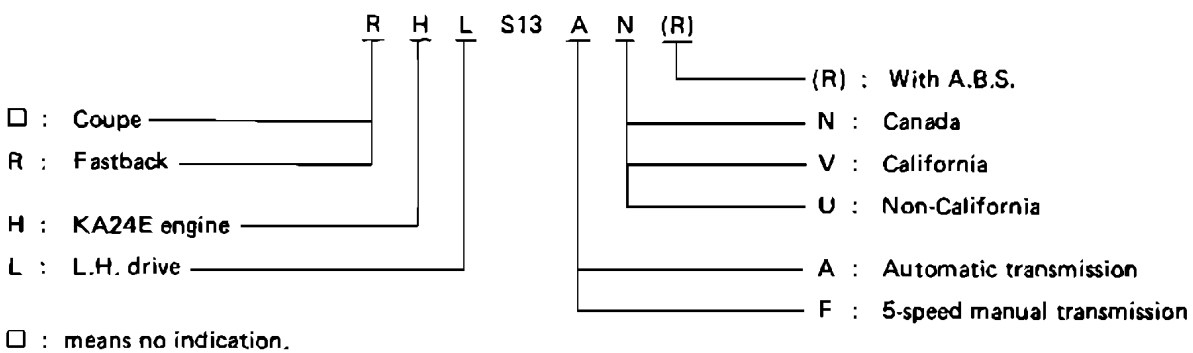
Key to symbols signifying measurements or procedures

Symbol	Symbol explanation	Symbol	Symbol explanation
	Check after disconnecting the connector to be measured.		A/C switch is "OFF"
	Check after connecting the connector to be measured.		A/C switch is "ON".
	Insert key into ignition switch.		REC switch is "ON".
	Turn ignition switch to "OFF" position.		REC switch is "OFF".
	Turn ignition switch to "ON" position.		DEF switch is "ON".
	Turn ignition switch to "START" position.		VENT switch is "ON".
	Turn ignition switch from "OFF" to "ACC" position.		Fan switch is "ON". (At any position except for "OFF" position)
	Turn ignition switch from "ACC" to "OFF" position.		Fan switch is "OFF"
	Turn ignition switch from "OFF" to "ON" position.		Apply battery voltage directly to components.
	Turn ignition switch from "ON" to "OFF" position.		Drive vehicle.
	Do not start engine, or check with engine stopped.		Disconnect battery negative cable.
	Start engine, or check with engine running		Depress brake pedal.
	Apply parking brake.		Release brake pedal.
	Release parking brake.		Depress accelerator pedal.
	Check after engine is warmed up sufficiently.		Release accelerator pedal.
	Voltage should be measured with a voltmeter.		Pin terminal check for S.M.J type E.C.U. and A/T control unit connectors. **For details regarding the terminal arrangement, refer to the foldout page.**
	Circuit resistance should be measured with an ohmmeter.		
	Current should be measured with an ammeter.		

Model Variation

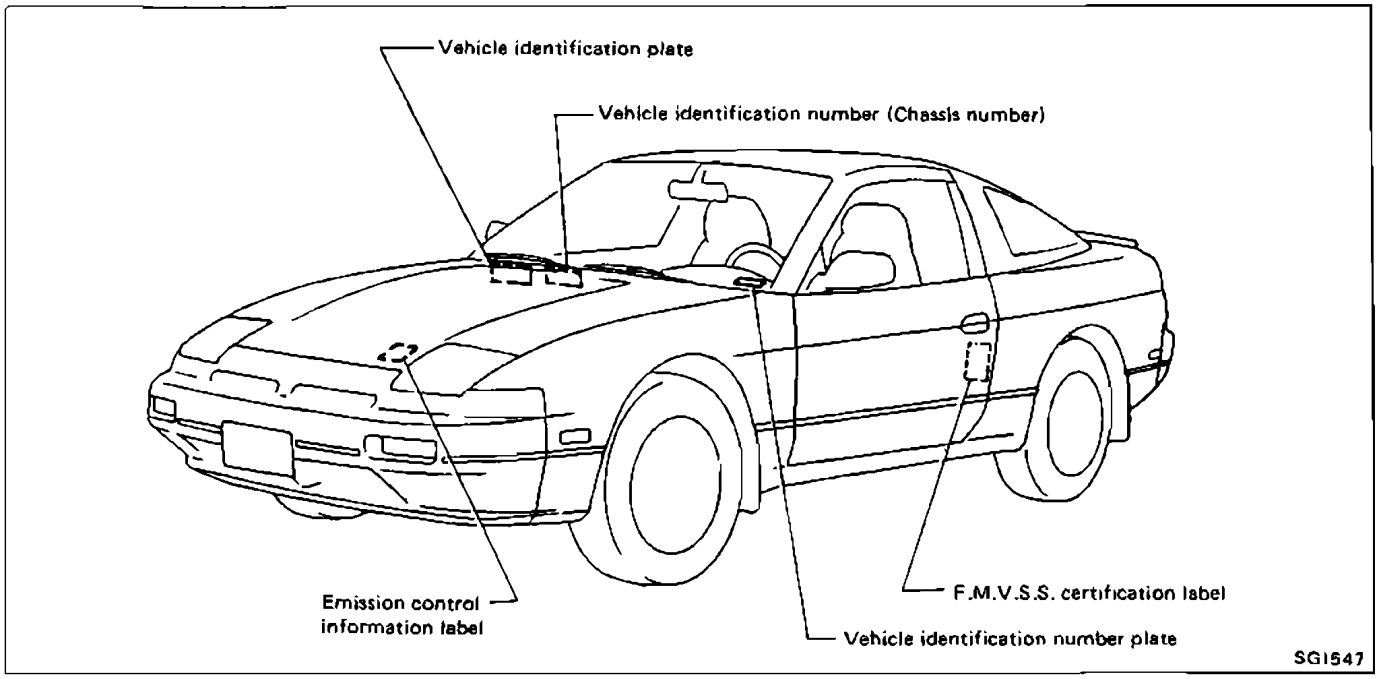
Destination	Body	Model	Engine	Transmission	Differential carrier
Non-California	Coupe	HLS13FU	KA24E	FS5W71C	R200
	Fastback	RHLS13FU			
	Coupe	HLS13AU		RE4R01A	
	Fastback	RHLS13AU			
California	Coupe	HLS13FV		FS5W71C	
	Fastback	RHLS13FV			
	Coupe	HLS13AV		RE4R01A	
	Fastback	RHLS13AV			
Canada	Coupe	HLS13FN		FS5W71C	
	Fastback	RHLS13FN			
	Coupe	HLS13AN		RE4R01A	
	Fastback	RHLS13AN			

Prefix and suffix designations:



□ : means no indication.

Identification Number



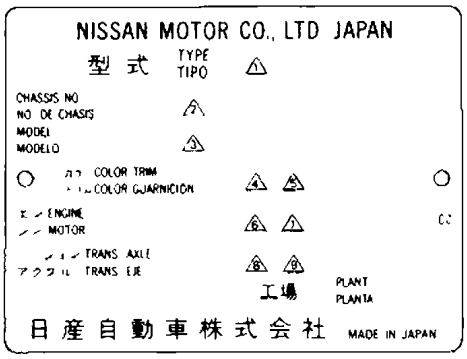
VEHICLE IDENTIFICATION NUMBER ARRANGEMENT

JN1 H S 3 6 P X K W 000051

- Manufacturer
  - JN1: Nissan passenger vehicle
- Engine type
  - H: KA24E
- Vehicle line
  - S: NISSAN 240SX
- Model change (0 to 9)
- Body type
  - 4: Coupe
  - 6: Fastback
- Restraint system
  - S: Standard
  - P: Automatic
- Check digit (0 to 9 or X)
  - The code for the check digit is determined by mathematical computation.
- Model year
  - K: 1989 year model
- Manufacture plant
  - W: Kyushu
- Vehicle serial number

Identification Number (Cont'd)

IDENTIFICATION PLATE

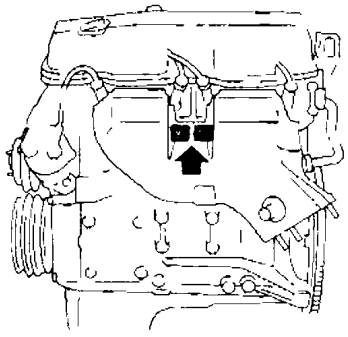


SGI315

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

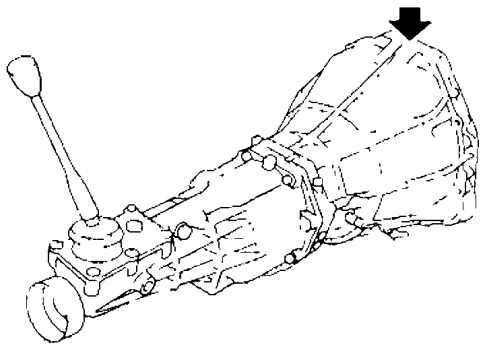
ENGINE SERIAL NUMBER

KA24E engine



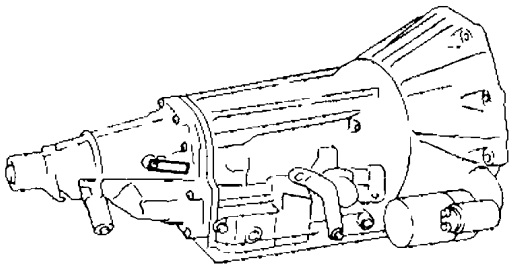
TL1006M

MANUAL TRANSMISSION NUMBER



SGI274

AUTOMATIC TRANSMISSION NUMBER



SGI513

Dimensions

Unit: mm (in)

	Coupe	Fastback
Overall length	4,520 (178.0)	4,520 (178.0)
Overall width	1,690 (66.5)	1,690 (66.5)
Overall height	1,290 (50.8)	1,290 (50.8)
Front tread	1,465 (57.7)	1,465 (57.7)
Rear tread	1,460 (57.5)	1,460 (57.5)
Wheelbase	2,475 (97.4)	2,475 (97.4)

Wheels and Tires

Road wheel	Steel		6-JJx15
	Aluminum		6-JJx15
	Offset	mm (in)	40 (1.57)
Tire size	Conventional		195/60R15 86H 205/60R15 89H*
	Spare		T125/70D15

*: Option

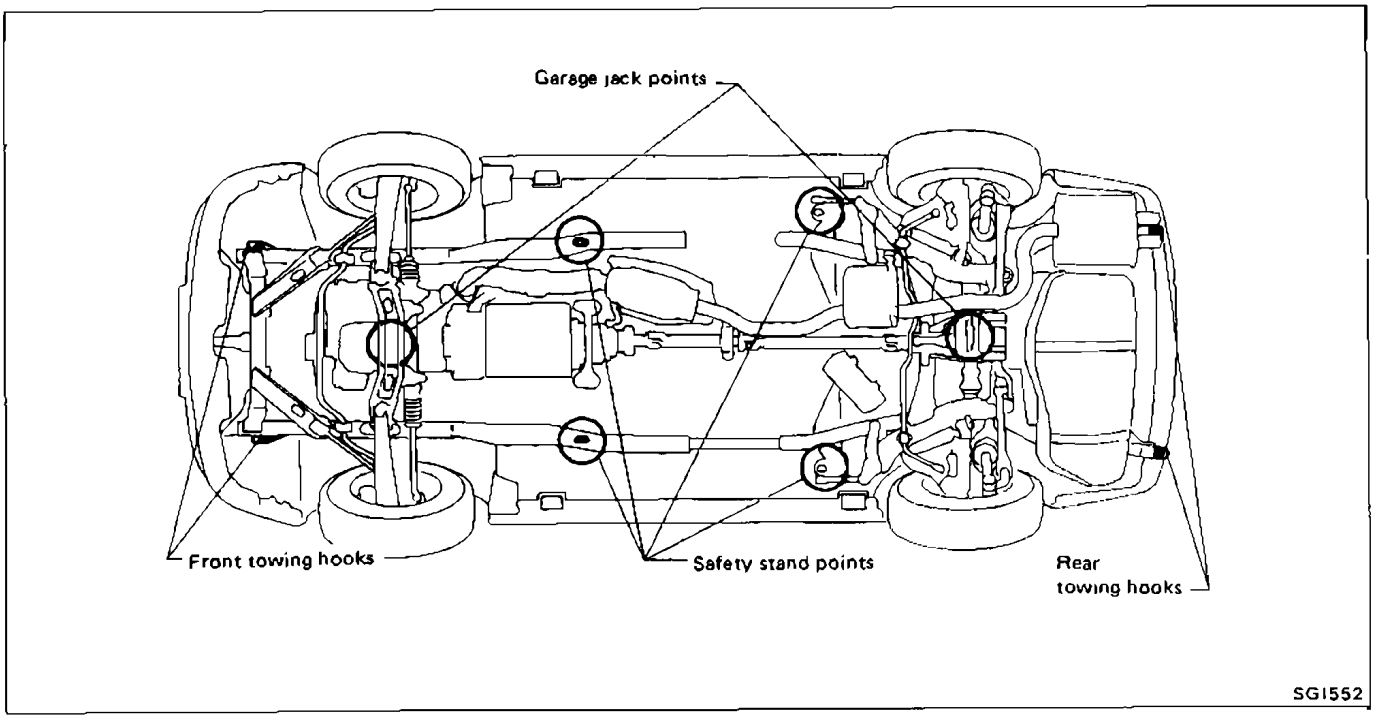
Garage Jack and Safety Stand

WARNING:

- **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.**
- **Place wheel chocks at the front wheels when the rear wheels are raised and place wheel chocks at the rear wheels when the front wheels are raised.**

CAUTION:

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

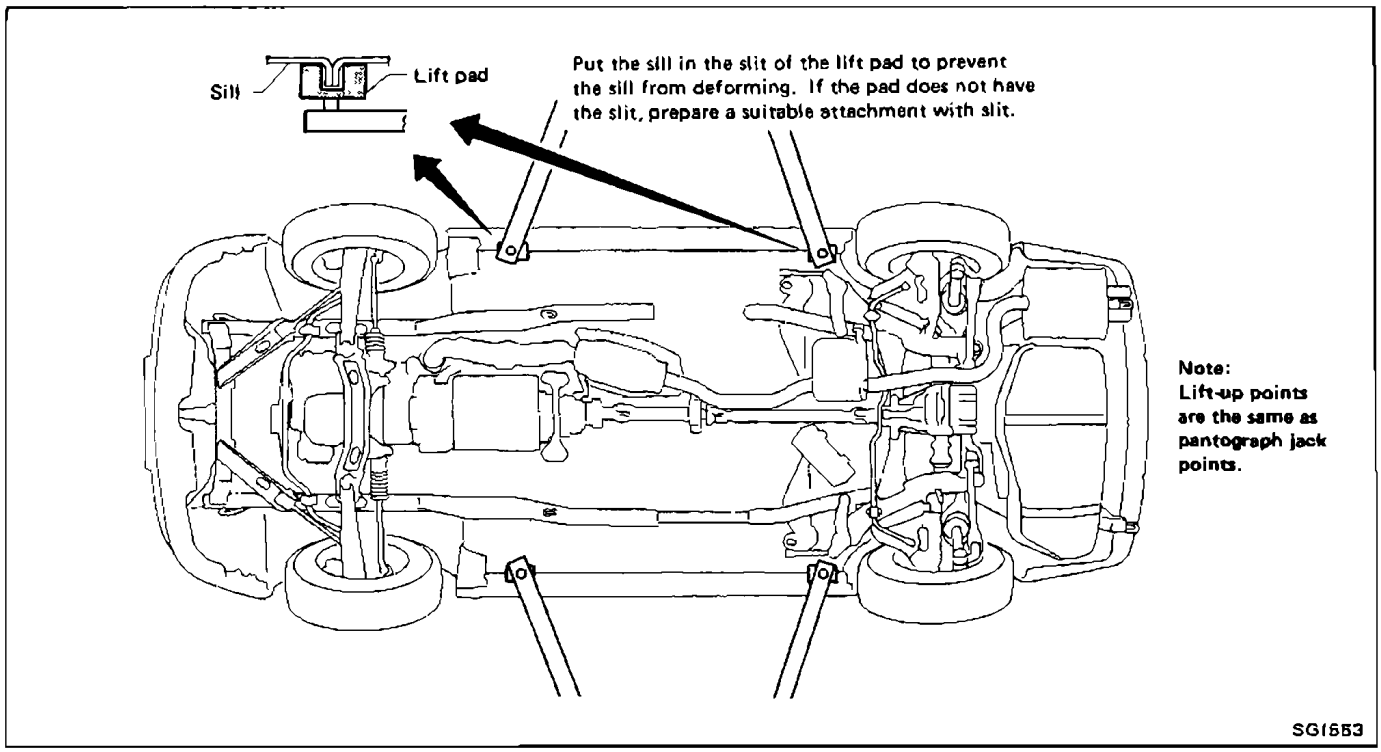


2-pole Lift

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.

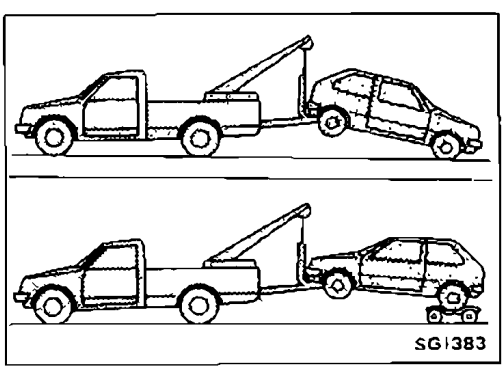
When setting the lift arm, do not allow the arm to contact the brake tubes and fuel lines.



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.**
- **When towing with the rear wheels on the ground, release the parking brake and move the gearshift lever to neutral ("N" position).**



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

Tow Truck Towing (Cont'd)

TOWING AN AUTOMATIC TRANSMISSION MODEL WITH FOUR WHEELS ON GROUND OR TOWING WITH FRONT WHEELS RAISED (With rear wheels on ground)

Observe the following restricted towing speeds and distances.

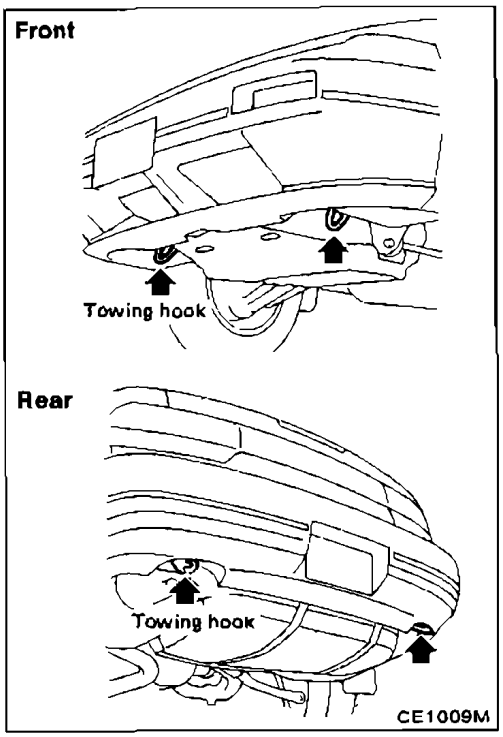
Speed:

Below 50 km/h (30 MPH)

Distance:

Less than 65 km (40 miles)

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



TOWING POINT

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	26	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

M 6
- 6 — Nominal diameter of bolt threads (Unit: mm)
- M — Metric screw threads

MAINTENANCE

SECTION MA

MA

CONTENTS

PERIODIC MAINTENANCE ..... MA- 2
GENERAL MAINTENANCE ..... MA- 4
RECOMMENDED LUBRICANTS AND FLUIDS ..... MA- 6
ENGINE MAINTENANCE ..... MA- 8
CHASSIS AND BODY MAINTENANCE MA-14
SERVICE DATA AND SPECIFICATIONS (S.D.S.) MA-20

The following charts show the normal maintenance schedule. Under severe driving conditions, additional or more frequent maintenance will be required. Refer to **"Maintenance under severe driving conditions"**.

The periodic maintenance schedule is repeated beyond the last mileage and period shown by returning to the first 15,000 miles (24,000 km) or 12 months.

EMISSION CONTROL SYSTEM MAINTENANCE

MAINTENANCE OPERATION		MAINTENANCE INTERVAL					
Perform at number of miles, kilometers or months, whichever comes first.	Miles x 1,000	7.5	15	30	45	60	Reference page
	(km x 1,000)	(12)	(24)	(48)	(72)	(96)	
	Months	6	12	24	36	48	
Drive belts	See NOTE (1).					I*	MA-8
Air cleaner filter		Replace every 30,000 miles (48,000 km).					MA-10
Vapor lines				I*		I*	MA-13
Fuel lines				I*		I*	MA-9
Fuel filter	See NOTE (2)*.						MA-10
Engine coolant				R		R	MA-8
Egnine oil		R	Then replace every 7,500 miles (12,000 km) or 6 months.				MA-11
Engine oil filter (Use Nissan PREMIUM type or equivalent.)		R	Then replace every second oil change.				MA-11
Spark plugs			Replace every 30,000 miles (48,000 km).				MA-12
Ignition wires			Inspect every 3 years.*				MA-12

CHASSIS AND BODY MAINTENANCE

MAINTENANCE OPERATION		MAINTENANCE INTERVAL				
Perform at number of miles, kilometers or months, whichever comes first.	Miles x 1,000	15	30	45	60	Reference page
	(km x 1,000)	(24)	(48)	(72)	(96)	
	Months	12	24	36	48	
Break lines & cables		I	I	I	I	MA-16
Brake pads & discs		I	I	I	I	MA-17
Manual and automatic transmission & differential gear oil		I	I	I	I	MA-14, 15, 16
Steering gear & linkage, and axle & suspension parts			I		I	MA-18, FA-4, RA-4
Exhaust system		I	I	I	I	MA-14

NOTE:

(1) After 60,000 miles (96,000 km) or 48 months, inspect every 15,000 miles (24,000 km).

(2) 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.

(3) 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.

MAINTENANCE UNDER SEVERE DRIVING CONDITIONS

The maintenance intervals shown on the preceding pages are for normal operating conditions. If the vehicle is mainly operated under severe driving conditions as shown below, more frequent maintenance is required to be performed on the following items as shown in the table.

Severe driving conditions

A — Repeated short trips less than 5 miles (8 km) and outside temperatures remain below freezing
B — Extensive idling and/or low speed driving for a long distance such as police, taxi or door-to-door delivery use
C — Driving in dusty conditions
D — Driving on rough, muddy, or salt spread roads
E — Towing a trailer, using a camper or a car-top carrier

Driving condition	Maintenance item	Maintenance operation	Maintenance interval	Reference page
. . C . .	Air cleaner filter	R	More frequently	MA-10
A B C D E	Engine oil & oil filter	R	Every 3,000 miles (5,000 km) or 3 months	MA-11
A . C D E	Brake pads & discs	I	Every 7,500 miles (12,000 km) or 6 months	MA-17
. . . D E	Manual and automatic transmission & differential gear oil	R	Every 30,000 miles (48,000 km) or 24 months	MA-14, 15, 16
. . . D .	Steering gear & linkage, and axle & suspension parts	I	Every 7,500 miles (12,000 km) or 6 months	MA-18, FA-4, RA-4
. . C D .	Steering linkage ball joints & front suspension ball joints	I		MA-18,FA-4
A . . D E	Exhaust system	I		MA-14

Maintenance operations: I = Inspect. Correct or replace if necessary. R = Replace.

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-18
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-17 FA-6 RA-6
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. Lubricate 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-19
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 restrains 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-19

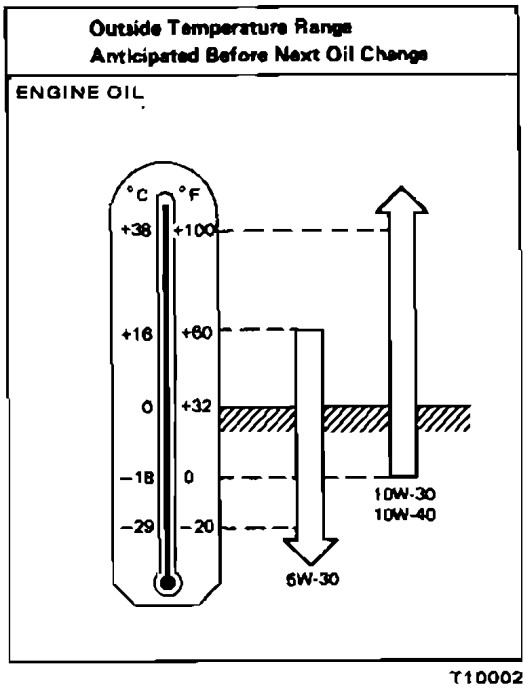
Item	Reference page
Clutch pedal Make sure the pedal operates smoothly and check that it has the proper free travel.	CL-5
Brakes Check that the brake does not pull the vehicle to one side when applied.	–
Brake pedal Check the pedal for smooth operation and make sure it has the proper distance under it when depressed fully. Check the brake booster function.	BR-7
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.	BR-23
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-9
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-14, 16
Engine drive belts Make sure that no belt is frayed, worn, cracked or oily.	MA-8
Engine oil level Check the level on the dipstick after parking the vehicle on a level spot and turning off the engine.	MA-11
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-18
Automatic transmission fluid level Check the level on the dipstick after putting the selector lever in "P" with the engine idling.	MA-15
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-14
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.	–

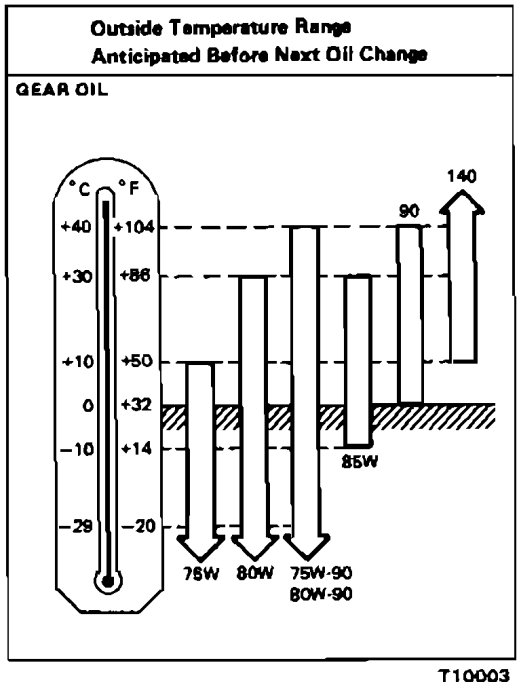
Lubricants and Fluids

	Capacity (Approximate)			Recommended lubricants and fluids
	US measure	Imp measure	Liter	
Engine oil (Refill)				
With oil filter	3-3/4 qt	3-1/8 qt	3.5	Genuine Nissan Motor Oil*1 or equivalent (Energy Conserving Oils of API SF or SG)*2, *3
Without oil filter	3-3/8 qt	2-7/8 qt	3.2	
Cooling system (with reservoir tank)	7-1/8 qt	5-7/8 qt	6.7	Anti-freeze coolant (Ethylene glycol base)
Reservoir tank	3/4 qt	5/8 qt	0.7	
Manual transmission oil	5-1/8 pt	4-1/4 pt	2.4	API GL-4*2
Differential gear oil	2-3/4 pt	2-1/4 pt	1.3	API GL-5*2
Automatic transmission fluid	8-3/4 qt	7-1/4 qt	8.3	Genuine Nissan ATF*1 or equivalent Type DEXRON™
Power steering fluid	1 qt	3/4 qt	0.9	Type DEXRON™
Brake fluid	–	–	–	Genuine Nissan Brake Fluid*1 or equivalent DOT 3 (US FMVSS No. 116)
Multi-purpose grease	–	–	–	NLGI No. 2 (Lithium soap base)

*1: Available in mainland U.S.A. through you Nissan dealer.
*2: For further details, see "SAE Viscosity Number".
*3: Energy Conserving Oils
These oils can be identified by such labels as energy conserving, energy saving, improved fuel economy, etc.

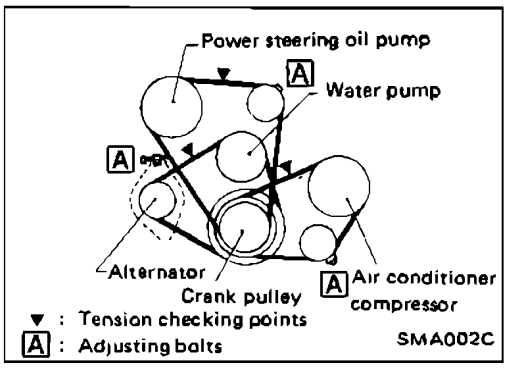
SAE Viscosity Number





10W-30 is preferable if the ambient temperature is above −18°C (0°F). 20W-40 and 20W-50 are usable if the ambient temperature is above 10°C (50°F) for all seasons.

80W-90 is preferable if the ambient temperature is below 40°C (104°F).



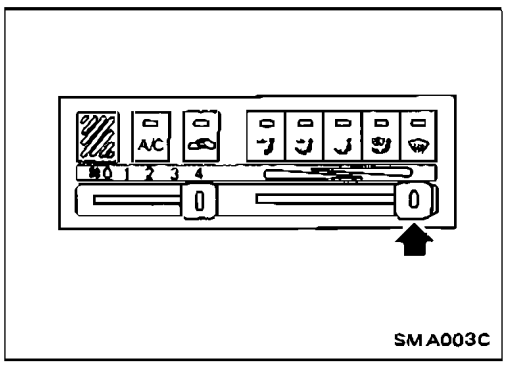
Checking Drive Belts

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)

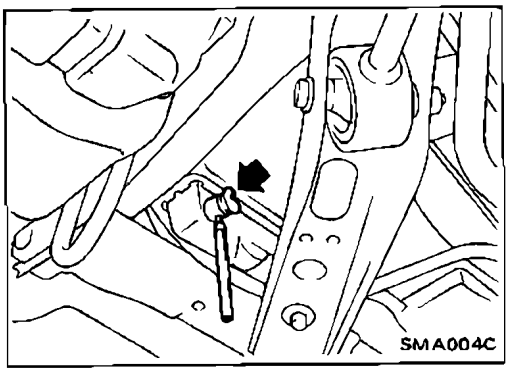
	Used belt deflection		Set deflection of new belt
	Limit	Adjusted deflection	
Alternator	11 (0.43)	7 - 8 (0.28 - 0.31)	6 - 7 (0.24 - 0.28)
Air conditioner compressor	12 (0.47)	7 - 8 (0.28 - 0.31)	6 - 7 (0.24 - 0.28)
Power steering oil pump	13 (0.51)	8 - 9 (0.31 - 0.35)	7 - 8 (0.28 - 0.31)
Applied pushing force	98 N (10 kg, 22 lb)		



Changing Engine Coolant

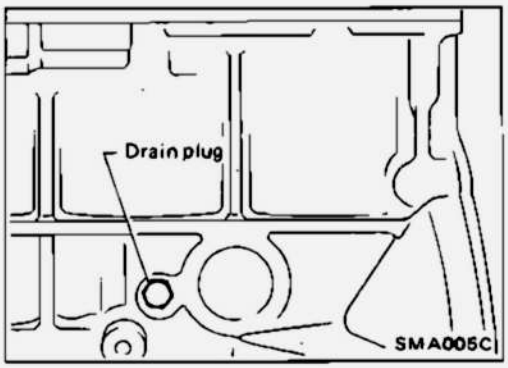
WARNING:
To avoid being scalded, never change the coolant when the engine is hot.

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

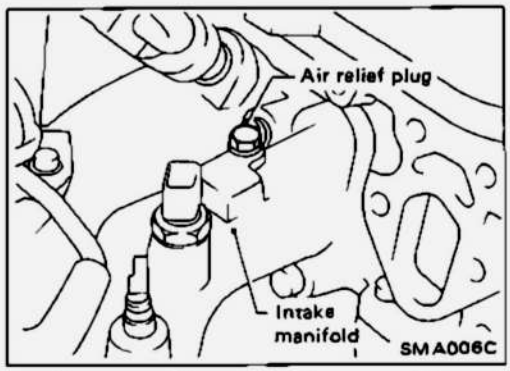


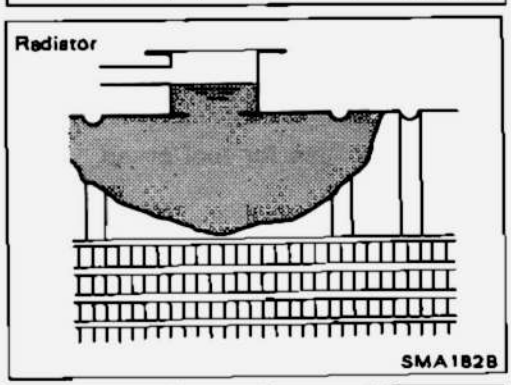
2. Open drain cock at the bottom of radiator, and remove radiator cap.

Changing Engine Coolant (Cont'd)



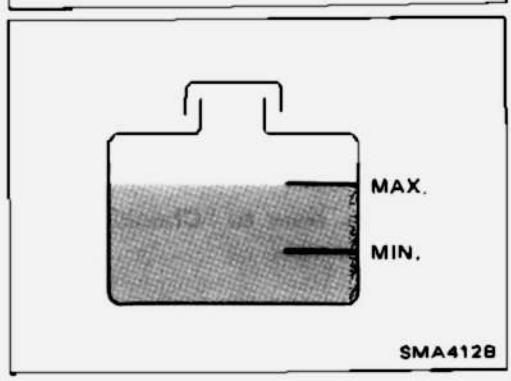
3. Remove cylinder block drain plug.
4. Close drain cock and tighten drain plug securely.
- **Apply sealant to the thread of drain plug.**
  (O): 34 - 44 N·m
  (3.5 - 4.5 kg-m, 25 - 33 ft-lb)
5. Open air relief plug.
6. Fill radiator with water and close air relief plug and radiator cap.
7. Run engine 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.
    Coolant capacity. (With reservoir tank)
    6.7 ℓ (7-1/8 US qt, 5-7/8 Imp qt)

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

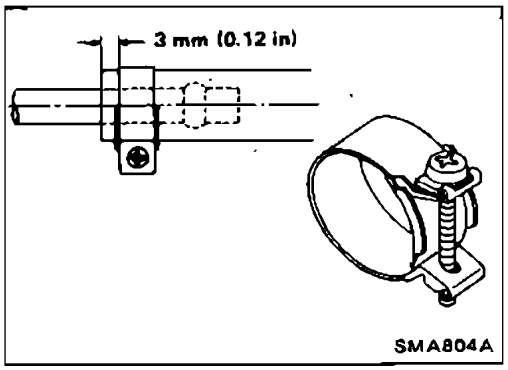


14. Close air relief plug.
15. Remove reservoir tank, drain coolant, then clean reservoir tank.
16. Install reservoir tank and fill it with coolant up to "MAX" level and then install radiator cap.
17. Run engine and warm it up sufficiently.
18. Race engine 2 or 3 times under no-load.
19. Stop engine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

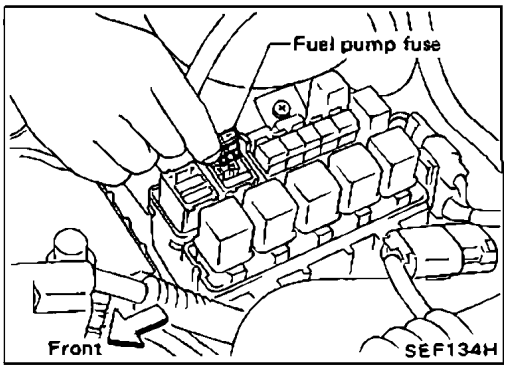
Checking Fuel Lines (Cont'd)



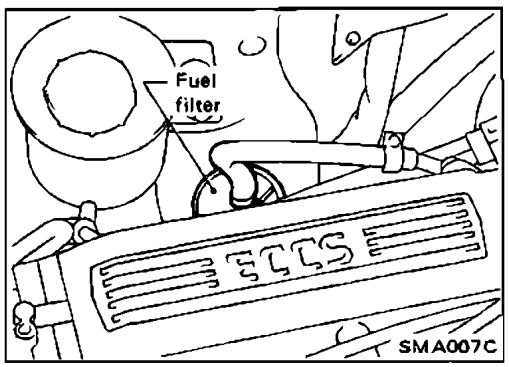
CAUTION:
Tighten high-pressure rubber hose clamp so that clamp end is 3 mm (0.12 in) from hose end.
Ensure that screw does not contact adjacent parts.

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.

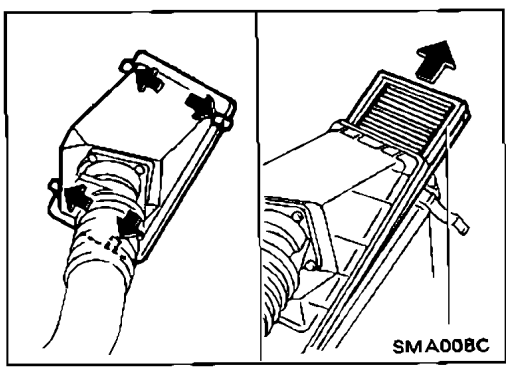


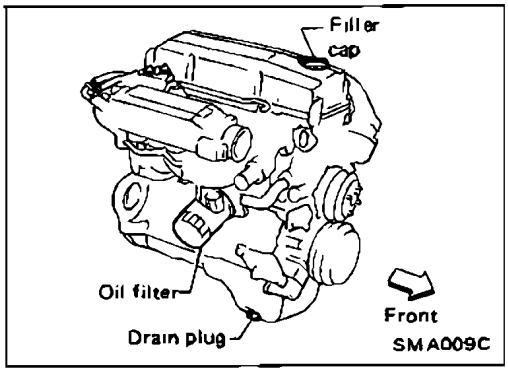
5. Loosen fuel hose clamps.
6. Replace fuel filter.

- **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.

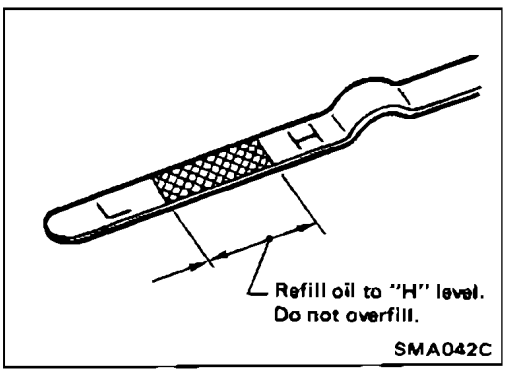
Refill oil capacity (Approximate):

Unit: liter (US qt, Imp qt)

With oil filter change	3.5 (3-3/4, 3-1/8)
Without oil filter change	3.2 (3-3/8, 2-7/8)

CAUTION:

- **Be sure to clean drain plug and install with new washer.**
  Drain plug:
  [O]: 29 - 39 N·m
  (3.0 - 4.0 kg-m, 22 - 29 ft-lb)
- **Use recommended engine oil.**



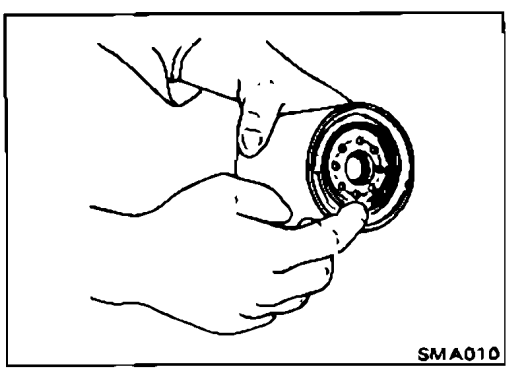
4. Check oil level.
5. Start engine and check area around drain plug and oil filter for oil leakage.
6. Run engine for a few minutes, then turn it off. After several minutes, check oil level.

Changing Oil Filter

1. Remove oil filter with a suitable tool.

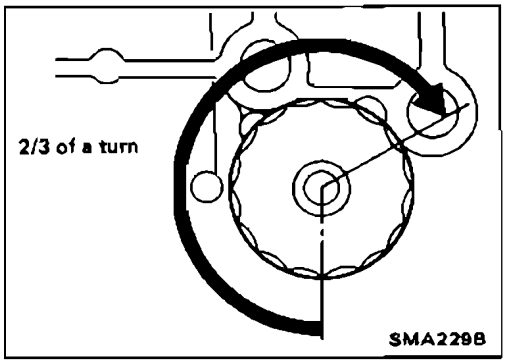
WARNING:

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.

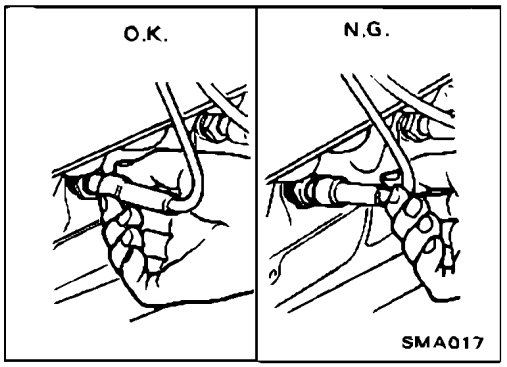
Changing Oil Filter (Cont'd)



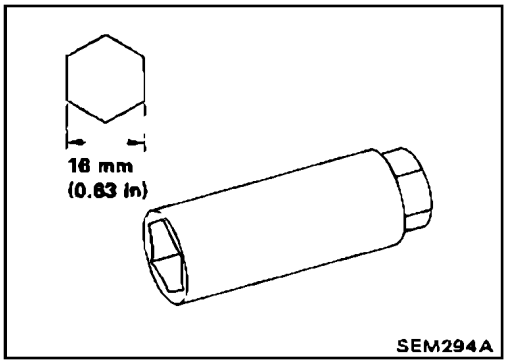
3. Screw in the oil filter until a slight resistance is felt, then tighten additionally more than 2/3 turn.
4. Add engine oil.

Refer to Changing Engine Oil.

Changing Spark Plugs

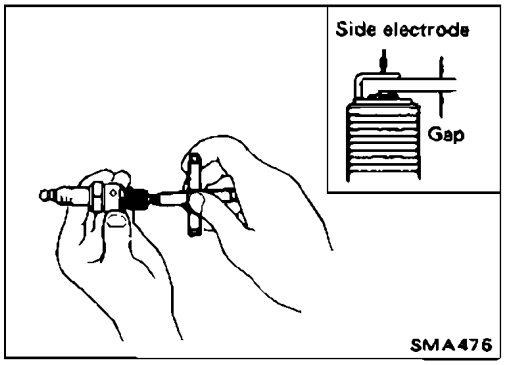


1. Disconnect ignition wires from spark plugs at boot. Do not pull on the wire.



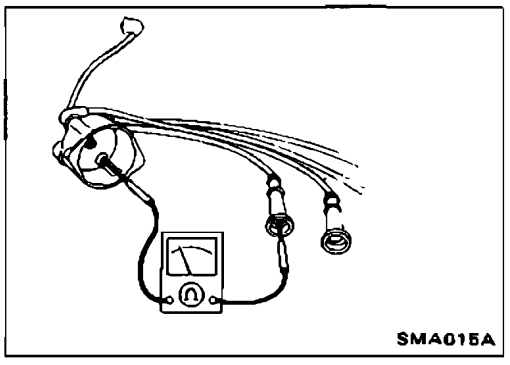
2. Remove spark plugs with spark plug wrench.

Spark plug:
Standard type
ZFR5D-11
Hot type
ZFR4D-11
Cold type
ZFR6D-11

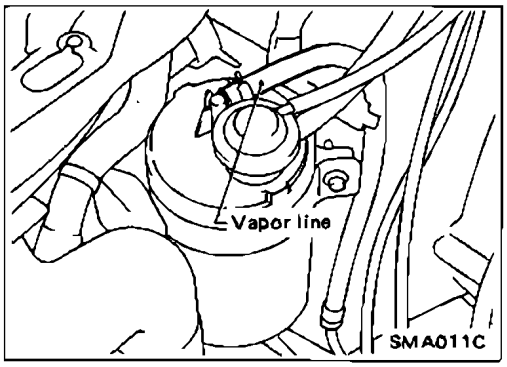


3. Check plug gap of each new spark plug.
   Gap: 1.0 - 1.1 mm (0.039 - 0.043 in)
4. Install spark plugs. Reconnect ignition wires according to nos. indicated on them.
   Spark plug:
   [O]: 20 - 29 N·m
   (2.0 - 3.0 kg-m, 14 - 22 ft-lb)

Checking Ignition Wires

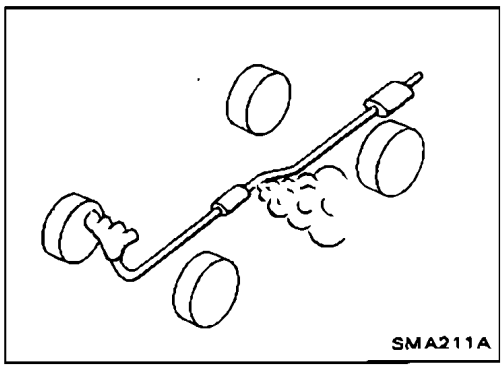


1. Inspect wires for cracks, damage, burned terminals and for improper fit.
2. Measure the resistance of wires and check for intermittent breaks by shaking them.
   Resistance: Less than 30 kΩ
   If it exceeds the limit, replace the ignition wire with a new one.



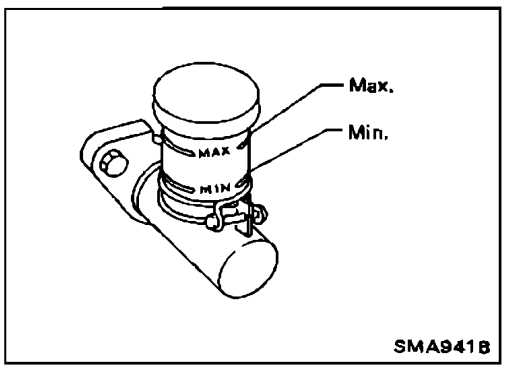
Checking Vapor Lines

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.


SMA211A

Checking Exhaust System

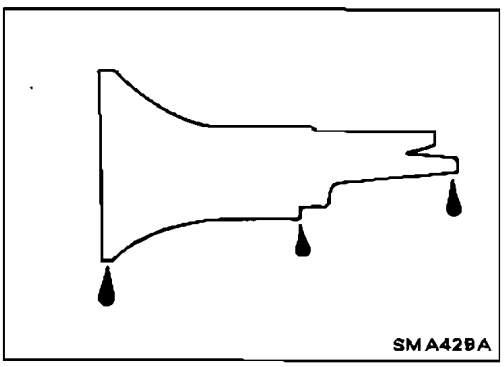
- Check exhaust pipes, muffler and mounting for improper attachment and for leaks, cracks, damage, loose connections, chafing and deterioration.



SMA941B

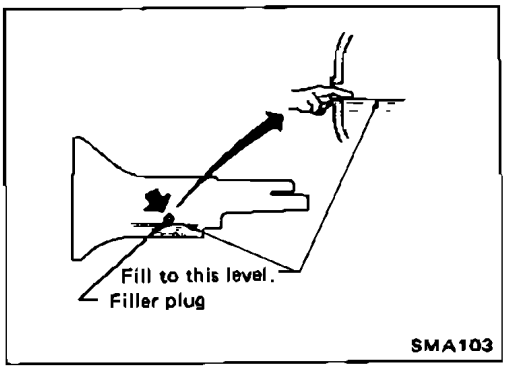
Checking Clutch Fluid Level and Leaks

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


SMA428A

Checking M/T Oil

1. Check for oil leakage.



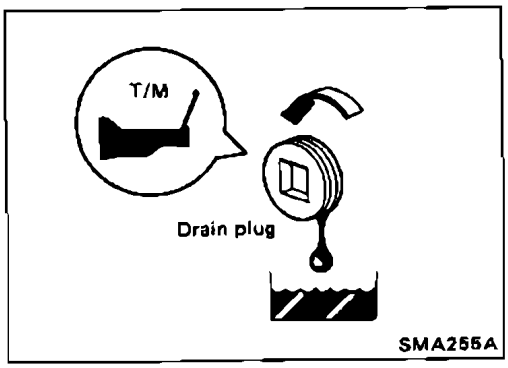
SMA103

2. If leakage is found, check oil level.

Never start engine while checking oil level.

Filler plug:

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



SMA255A

Changing M/T Oil

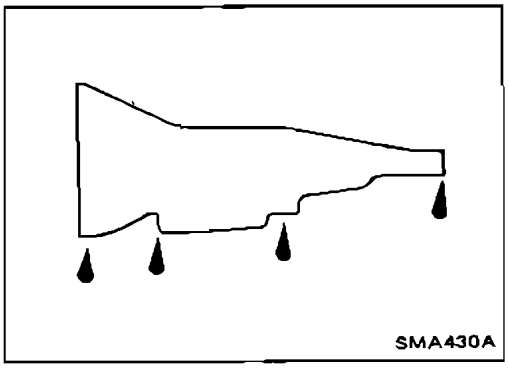
1. Drain oil and refill with new gear oil.
2. Check oil level.

Oil capacity:

2.4 ℓ (5-1/8 US pt, 4-1/4 Imp pt)

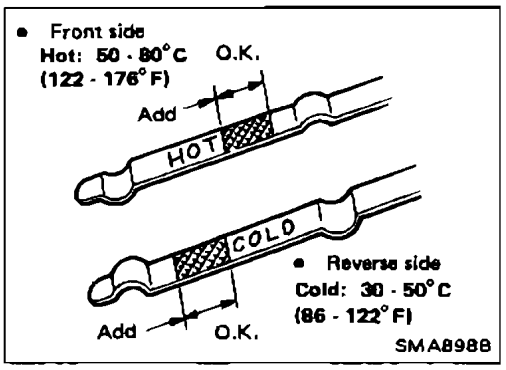
Drain plug:

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


SMA430A

Checking A/T Fluid

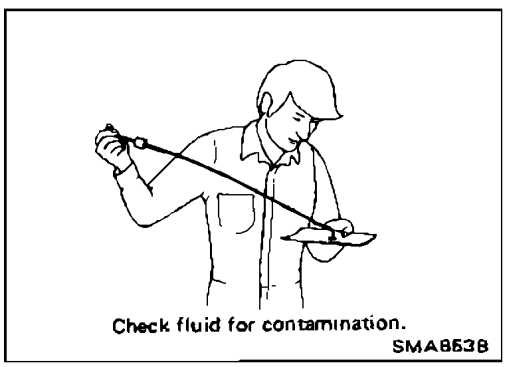
1. Check for fluid leakage.



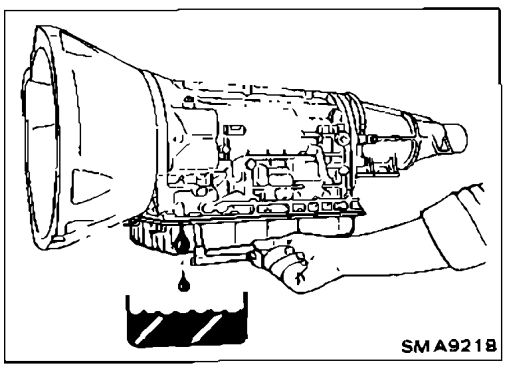
SMA898B

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.


Check fluid for contamination.
SMA853B

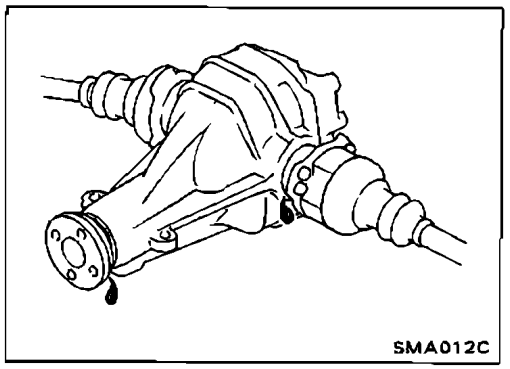
3. Check fluid condition.
   Check fluid for contamination. If fluid is very dark or smells burned, or contains frictional material (clutches, band, etc.), check operation of A/T.
   Refer to section AT for checking operation of A/T.


SMA921B

Changing A/T Fluid

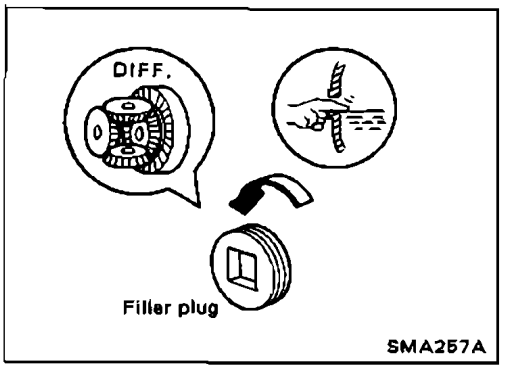
1. Drain fluid by removing oil pan.
2. Replace gasket with new one.
3. Refill with fluid and then check fluid level.

   Oil capacity (With torque converter):
   8.3 ℓ (8-3/4 US qt, 7-1/4 Imp qt)


SMA012C

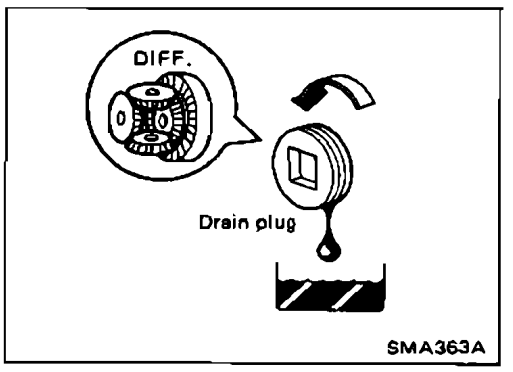
Checking Differential Gear Oil

1. Check differential carrier for oil leakage.



SMA257A

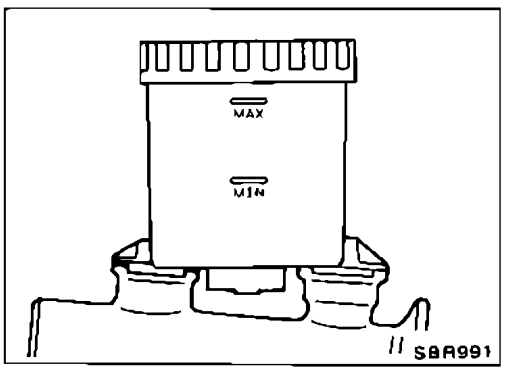
2. If leakage is found, check oil level.
   Filler plug:
   (O): 59 - 98 N·m (6 - 10 kg-m, 43 - 72 ft-lb)



SMA363A

Changing Differential Gear Oil

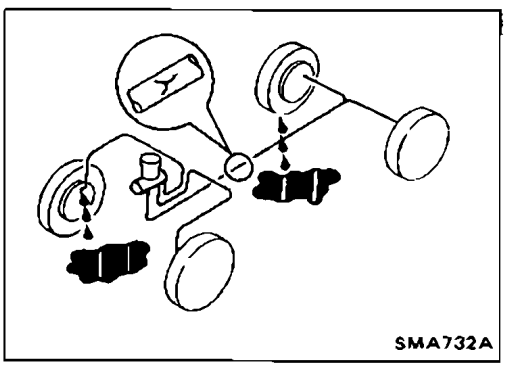
1. Drain oil and refill with new gear oil.
2. Check oil level.
   Oil capacity:
   1.3 ℓ (2-3/4 US pt, 2-1/4 Imp pt)
   Drain plug:
   (O): 59 - 98 N·m (6 - 10 kg-m, 43 - 72 ft-lb)



SBR991

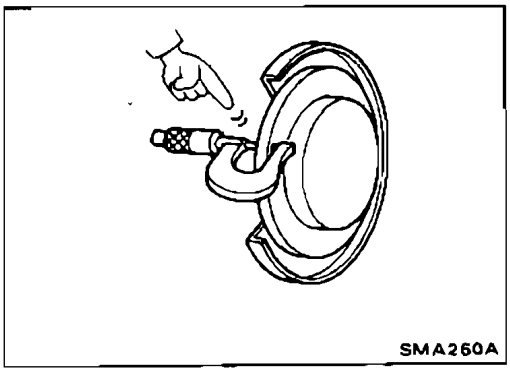
Checking Brake Fluid Level and Leaks

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


SMA732A

Checking Brake Lines and Cables

- Check brake fluid lines and parking brake cables for improper attachment and for leaks, chafing, abrasions, deterioration, etc.


SMA260A

Checking Disc Brake

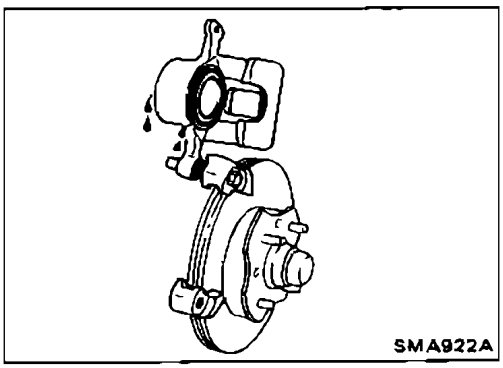
- Check condition of disc brake components.

ROTOR

- Check condition and thickness.

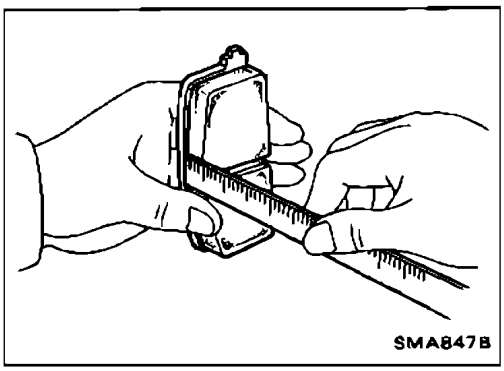
Unit: mm (in)

	Front	Rear
Disc brake type	CL22VB	CL9H
Standard thickness	20.0 (0.787)	9.0 (0.354)
Minimum thickness	18.0 (0.709)	8.0 (0.315)


SMA922A

CALIPER

- Check operation and for leakage.


SMA847B

PAD

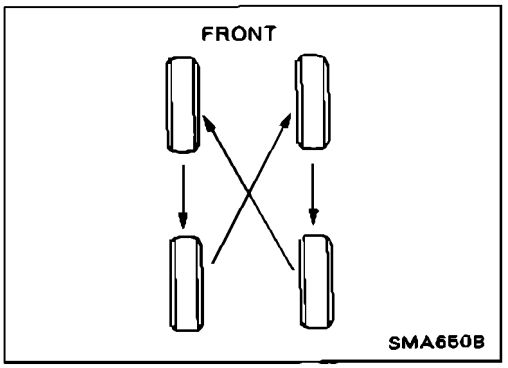
- Check for wear or damage.

Unit: mm (in)

	Front	Rear
Disc brake type	CL22VB	CL9H
Standard thickness	10.0 (0.394)	9.5 (0.374)
Minimum thickness	2.0 (0.079)	

Balancing Wheels

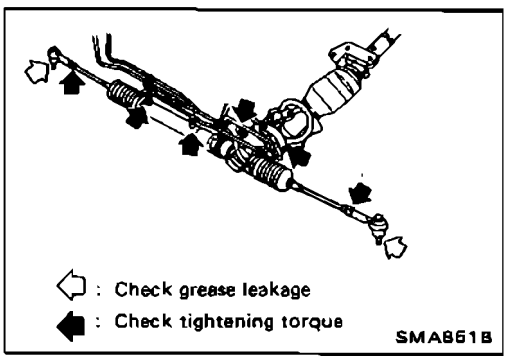
- Adjust wheel balance using road wheel center.
  Wheel balance (Maximum allowable unbalance at rim flange):
  Refer to S.D.S.
  Tire balancing weight: Refer to S.D.S.



Tire Rotation

- **Do not include the T-type spare tire when rotating the tires.**

Wheel nuts:
(O): 98 - 118 N·m
(10.0 - 12.0 kg-m, 72 - 87 ft-lb)



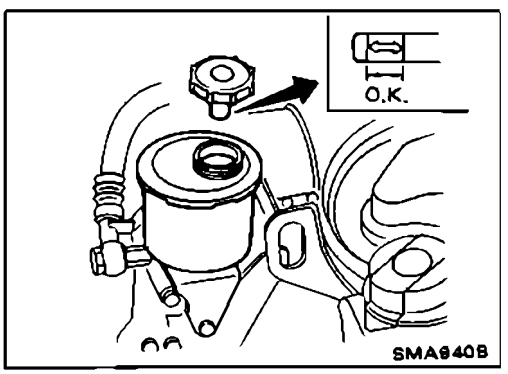
Checking Steering Gear and Linkage

STEERING GEAR

- Check gear housing and boots for looseness, damage or grease leakage.
- Check connection with steering column for looseness.

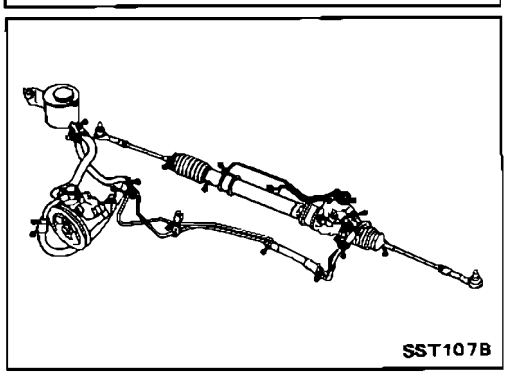
STEERING LINKAGE

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



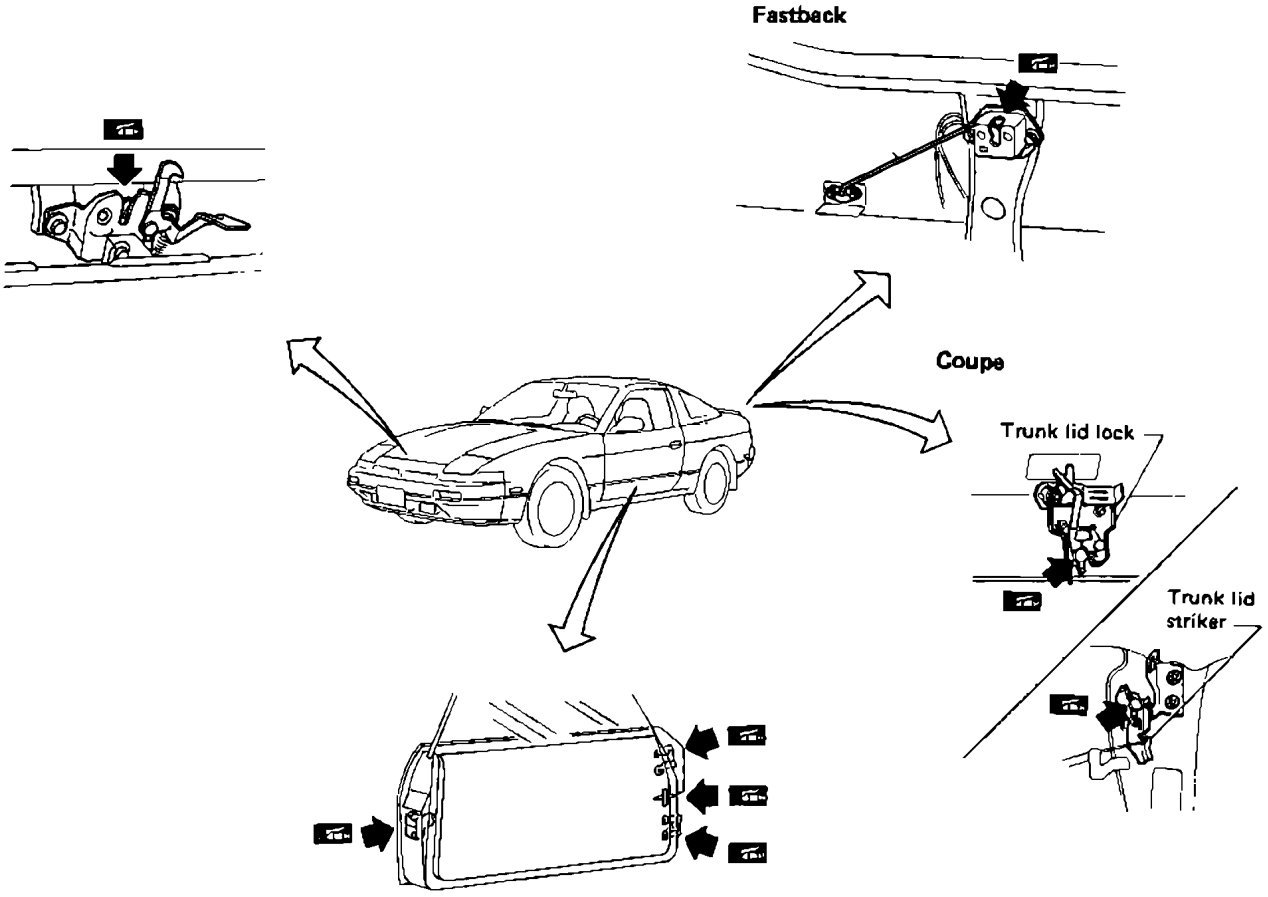
Checking Power Steering Fluid and Lines

- Check fluid level, when the fluid is cold.



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

LUBRICATING LOCKS, HINGES AND HOOD LATCHES



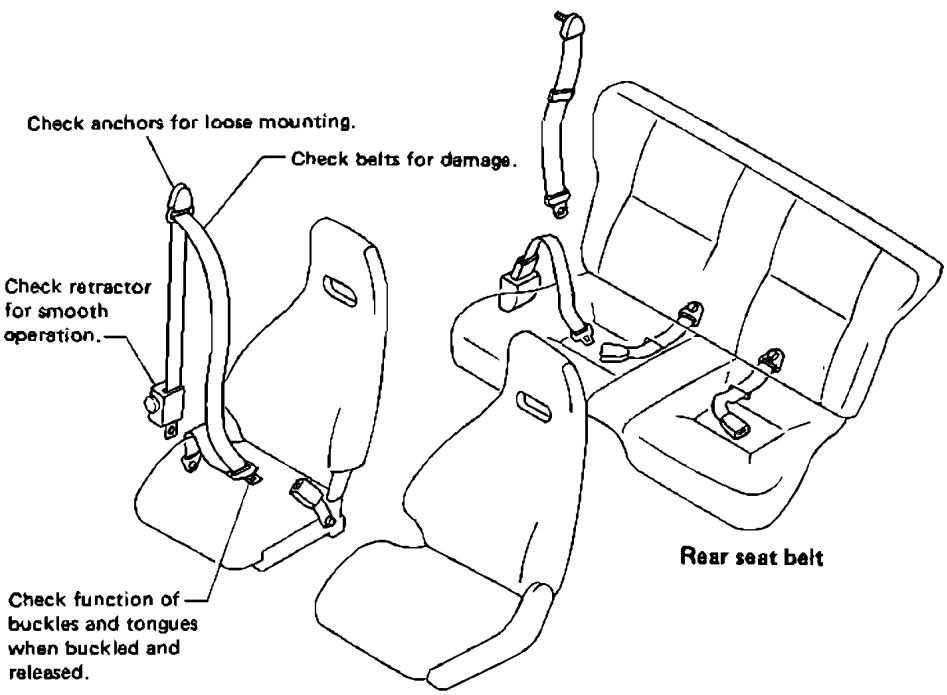
SMA999B

CHECKING SEAT BELTS, BUCKLES, RETRACTORS, ANCHORS AND ADJUSTERS

CAUTION:

1. All seat belt assemblies, including retractors and attaching hardwares such as guide rail set, etc., should be inspected after any collision. Nissan recommends that all seat belt assemblies in use during a collision be replaced unless the collision was minor and the belts show no damage and continue to operate properly. Seat belt assemblies not in use during a collision should also be inspected and replaced if either damage or improper operation is noted.
2. If the condition of any component of a seat belt is questionable, do not have seat belt repaired, but replaced 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
24 - 31 N·m
(2.4 - 3.2 kg-m, 17 - 23 ft-lb)
For automatic seat belt, refer to BF section.



SMA001C

Engine Maintenance

INSPECTION AND ADJUSTMENT

Drive belt deflection

Unit: mm (in)

	Used belt deflection		Set deflection of new belt
	Limit	Adjusted deflection	
Alternator	11 (0.43)	7 - 8 (0.28 - 0.31)	6 - 7 (0.24 - 0.28)
Air conditioner compressor	12 (0.47)	7 - 8 (0.28 - 0.31)	6 - 7 (0.24 - 0.28)
Power steering oil pump	13 (0.51)	8 - 9 (0.31 - 0.35)	7 - 8 (0.28 - 0.31)
Applied pushing force	98 N (10 kg, 22 lb)		

Oil capacity (Refill)

Unit: ℓ (US qt, Imp qt)

With oil filter	3.5 (3-3/4, 3-1/8)
Without oil filter	3.2 (3-3/8, 2-7/8)

Coolant capacity

Unit: ℓ (US qt, Imp qt)

With reservoir tank	6.7 (7-1/8, 5-7/8)

Spark plug

Standard type	ZFR5D-11
Hot type	ZFR4D-11
Cold type	ZFR6D-11
Plug gap	1.0 - 1.1 mm (0.039 - 0.043 in)

Ignition wire

Resistance kΩ	Less than 30

TIGHTENING TORQUE

Unit	N·m	kg-m	ft-lb
Spark plug	20 - 29	2.0 - 3.0	14 - 22
Drain plug			
Engine block	34 - 44	3.5 - 4.5	25 - 33
Oil pan	29 - 39	3.0 - 4.0	22 - 29

Chassis and Body Maintenance

INSPECTION AND ADJUSTMENT

Clutch

Unit: mm (in)

Pedal free height "H"	186 - 196 (7.32 - 7.72)
Pedal free play "A"	1.0 - 3.0 (0.039 - 0.118)

Front axle and front suspension (Unladen)*

Camber	degree	−1°30' to 0°
Caster	degree	6°00' - 7°30'
Toe-in	mm (in)	0 - 2 (0 - 0.08)
(Total toe-in)	degree	0' - 12'
Kingpin inclination	degree	12°30' - 14°00'
Front wheel turning angle Full turn Inside/outside	degree	39° - 43°/33°

*: Tankful of fuel, radiator coolant and engine oil full. Spare tire, jack, hand tools, mats in designated position.

Rear axle and rear suspension (Unladen)*

Camber	degree	−1°36' to −0°36'
Toe-out	mm (in)	0 - 5 (0 - 0.20)
(Total toe-out)	degree	0' - 28'

*: Tankful of fuel, radiator coolant and engine oil full. Spare tire, jack, hand tools, mats in designated position.

Wheel bearing

	Front	Rear
Wheel bearing axle end play mm (in)	0.03 (0.0012) or less	0.05 (0.0020) or less
Wheel bearing lock nut Tightening torque N·m (kg-m, ft-lb)	147 - 216 (15 - 22, 108 - 159)	235 - 314 (24 - 32, 174 - 231)

Brake

Unit: mm (in)

Disc brake Pad Standard thickness CL22VB	10.0 (0.394)
CL9H	9.5 (0.374)
Minimum thickness CL22VB	2.0 (0.079)
CL9H	2.0 (0.079)
Rotor Standard thickness CL22VB	20.0 (0.787)
CL9H	9.0 (0.354)
Minimum thickness CL22VB	18.0 (0.709)
CL9H	8.0 (0.315)
Pedal Free height M/T	177 - 187 (6.97 - 7.36)
A/T	186 - 196 (7.32 - 7.72)
Free play	1 - 3 (0.04 - 0.12)
Depressed height (under force of 490 N (50 kg, 110 lb) with engine running)	100 (3.94) or more
Parking brake Number of notches (at pulling force 196 N (20 kg, 44 lb))	6 - 8

Wheel balance

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

TIGHTENING TORQUE

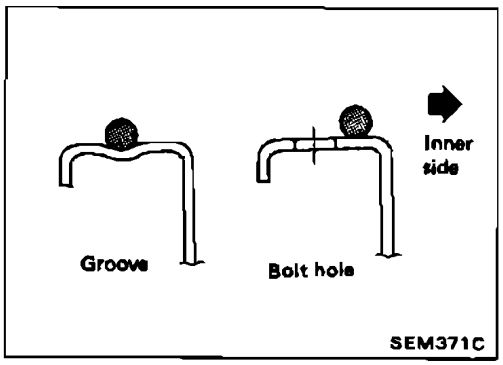
Unit	N-m	kg-m	ft-lb
Clutch			
Pedal stopper lock nut	16 - 22	1.6 - 2.2	12 - 16
Clutch switch lock nut	12 - 15	1.2 - 1.5	9 - 11
Manual transmission			
Drain and filler plugs	25 - 34	2.5 - 3.5	18 - 25
Final drive			
Drain plug	59 - 98	6 - 10	43 - 72
Filler plug	59 - 98	6 - 10	43 - 72
Front axle and front suspension			
Tie-rod lock nut	37 - 46	3.8 - 4.7	27 - 34
Camber adjusting pin	124 - 143	12.6 - 14.6	91 - 106
Rear axle and rear suspension			
Toe adjusting pin	69 - 88	7.0 - 9.0	51 - 65
Camber adjusting pin	69 - 88	7.0 - 9.0	51 - 65
Brake system			
Air bleed valve	7 - 9	0.7 - 0.9	5.1 - 6.5
Brake lamp switch lock nut	12 - 15	1.2 - 1.5	9 - 11
Brake booster input rod lock nut	16 - 22	1.6 - 2.2	12 - 16
Wheel and tire			
Wheel nut	98 - 118	10.0 - 12.0	72 - 87

ENGINE MECHANICAL

SECTION EM

CONTENTS

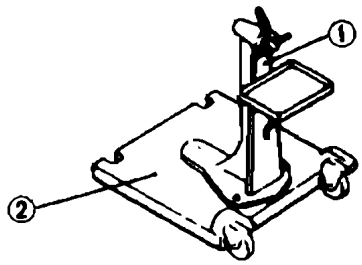
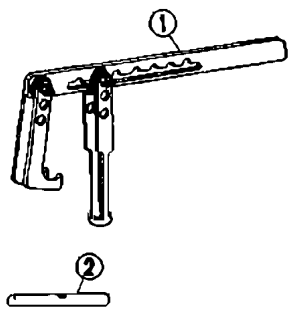
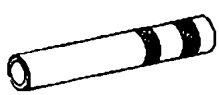
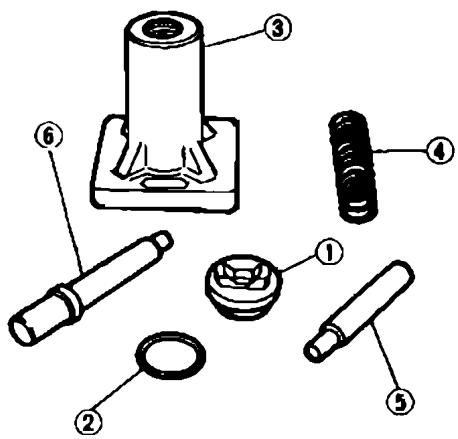
PRECAUTION ..... EM- 2
PREPARATION ..... EM- 3
OUTER COMPONENT PARTS ..... EM- 6
COMPRESSION PRESSURE ..... EM- 7
OIL PAN ..... EM- 8
TIMING CHAIN EM-10
OIL SEAL REPLACEMENT EM-16
CYLINDER HEAD EM-18
ENGINE REMOVAL EM-32
CYLINDER BLOCK EM-34
SERVICE DATA AND SPECIFICATIONS (S.D.S.) EM-46

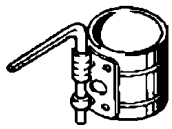
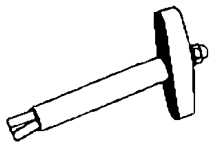
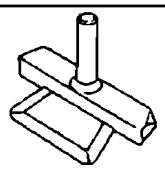
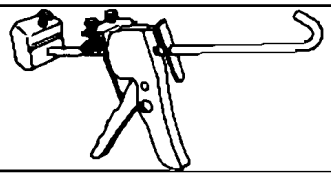
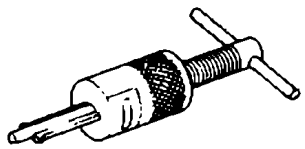


LIQUID GASKET APPLICATION PROCEDURE

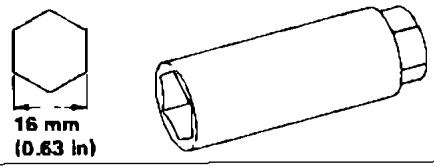
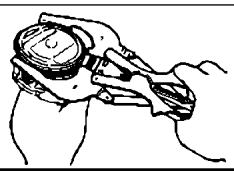
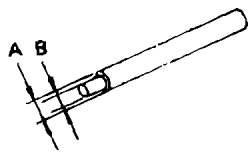
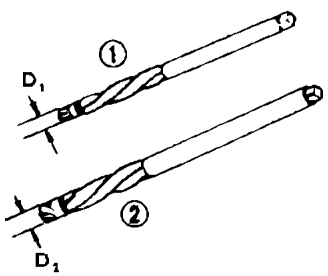
a. Before applying liquid gasket, remove all traces of old liquid gasket from mating surface using a scraper.
b. Apply a continuous bead of liquid gasket to mating surface. (Use Genuine Liquid Gasket or equivalent.)
c. Be sure liquid gasket is 3.5 to 4.5 mm (0.138 to 0.177 in) wide (for oil pan).
  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

SPECIAL SERVICE TOOLS

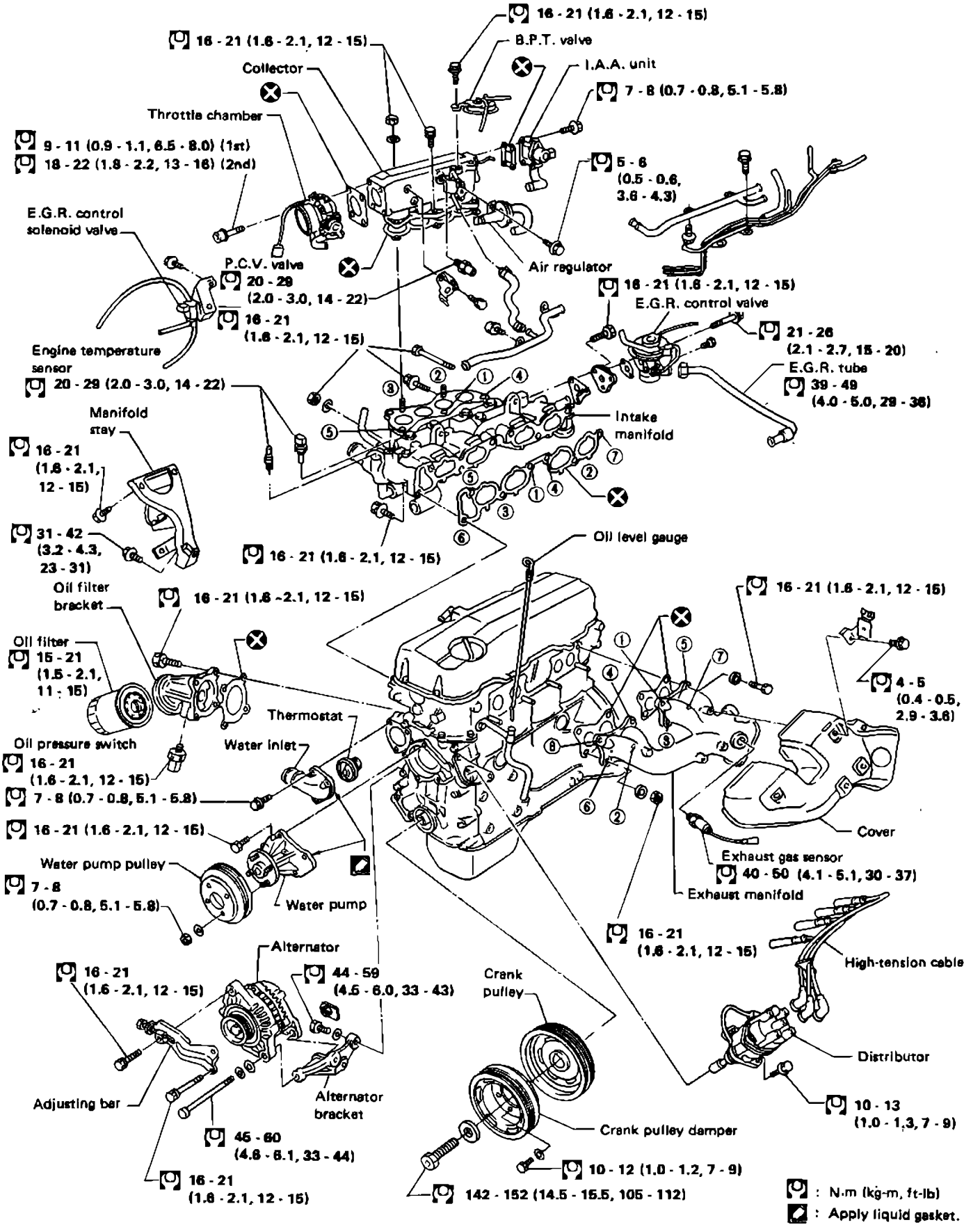
Tool number (Kent-Moore No.) Tool name	Description	
ST0501S000 (–) Engine stand assembly ① ST05011000 (–) Engine stand ② ST05012000 (–) Base		Disassembling and assembling
KV10105001 (–) Engine attachment		
KV101092S0 (–) Valve spring compressor ① KV10109210 (–) Compressor ② KV10109220 (–) Adapter		Disassembling and assembling valve components
KV109B0010 (–) Valve oil seal drift		Installing valve oil seal
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

Tool number (Kent-Moore No.) Tool name	Description	
EM03470000 (J8037) Piston ring compressor		Installing piston assembly into cylinder bore
(J36467) Valve oil seal remover		Displacement valve oil seal
KV10111100 (–) Seal cutter		Removing oil pan
WS39930000 (–) Tube presser		Pressing the tube of liquid gasket
ST16610001 (J23907) Pilot bushing puller		

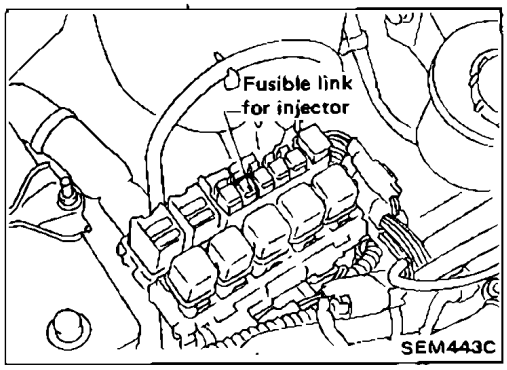
COMMERCIAL SERVICE TOOLS

Tool name	Description	
Spark plug wrench		Removing and installing spark plug
Pulley holder		Holding camshaft pulley while tightening or loosening camshaft bolt
Valve seat cutter set		Finishing valve seat dimensions
Piston ring expander		Removing and installing piston ring
Valve guide drift		Removing and installing valve guide **Diameter:** mm (in) Intake: A 10.5 (0.413), B 6.6 (0.260) Exhaust: A 11.5 (0.453), B 7.6 (0.299)
Valve guide reamer		Reaming valve guide (①) or hole for oversize valve guide (②) **Diameter:** mm (in) Intake: D_1 7 (0.28), D_2 11.2 (0.441) Exhaust: D_1 8 (0.31), D_2 12.2 (0.480)

KA24E ENGINE

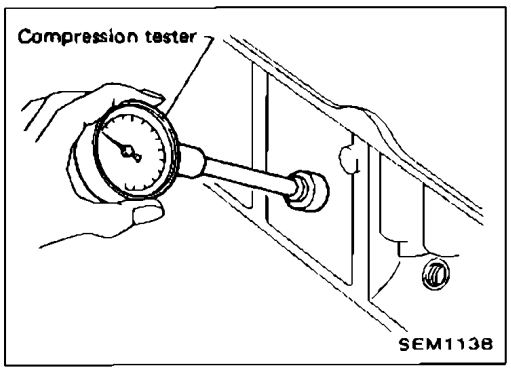


SEM336C



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.**

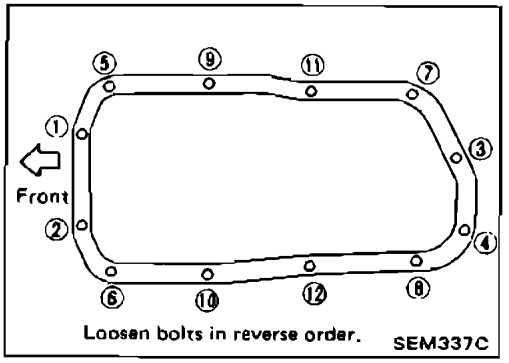
Compression pressure:
kPa (kg/cm², psi)/rpm
Standard
1,324 (13.5, 192)/300
Minimum
981 (10, 142)/300
Difference limit between cylinders
98 (1.0, 14)/300

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.

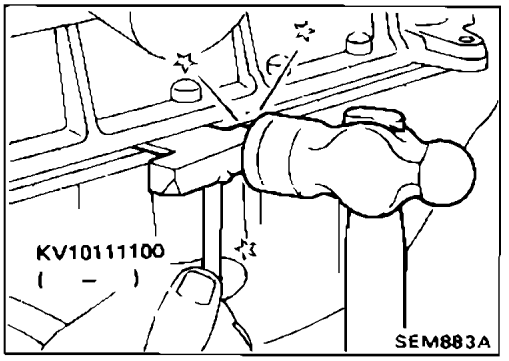
- **If adding oil helps compression, piston rings may be worn or damaged. If so, replace piston rings after checking piston.**
- **If pressure stays low, a valve may be sticking or seating improperly. Inspect and repair valve and valve seat. (Refer to S.D.S.) If valve or valve seat is damaged excessively, 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.

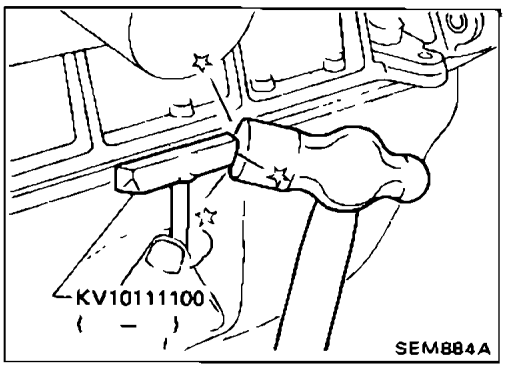


5. Remove oil pan bolts.



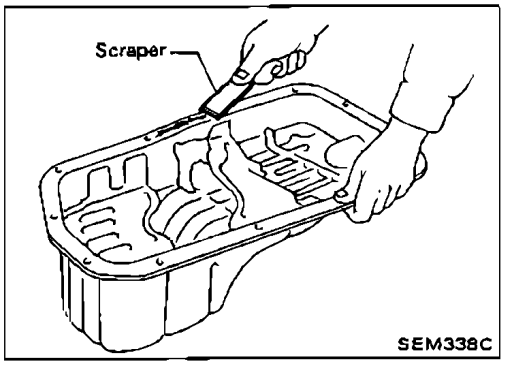
6. Remove oil pan.
(1) Insert Tool between cylinder block and oil pan.

- **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.**



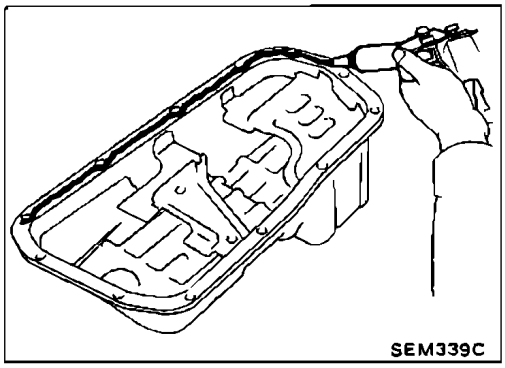
(2) Slide Tool by tapping its side with a hammer, and remove oil pan.

7. Pull out oil pan from front side.

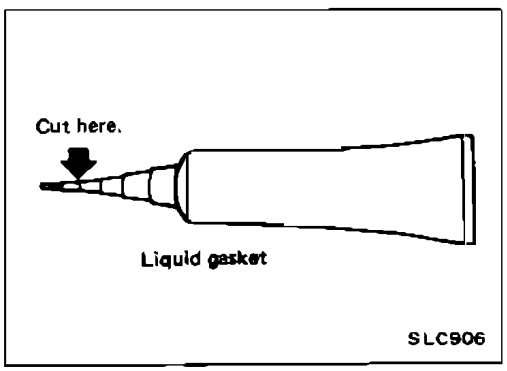


Installation

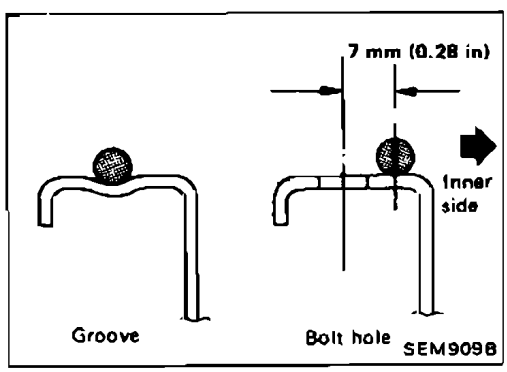
1. Before installing oil pan, remove all traces of liquid gasket from mating surface using a scraper.
- Also remove traces of liquid gasket from mating surface of cylinder block.



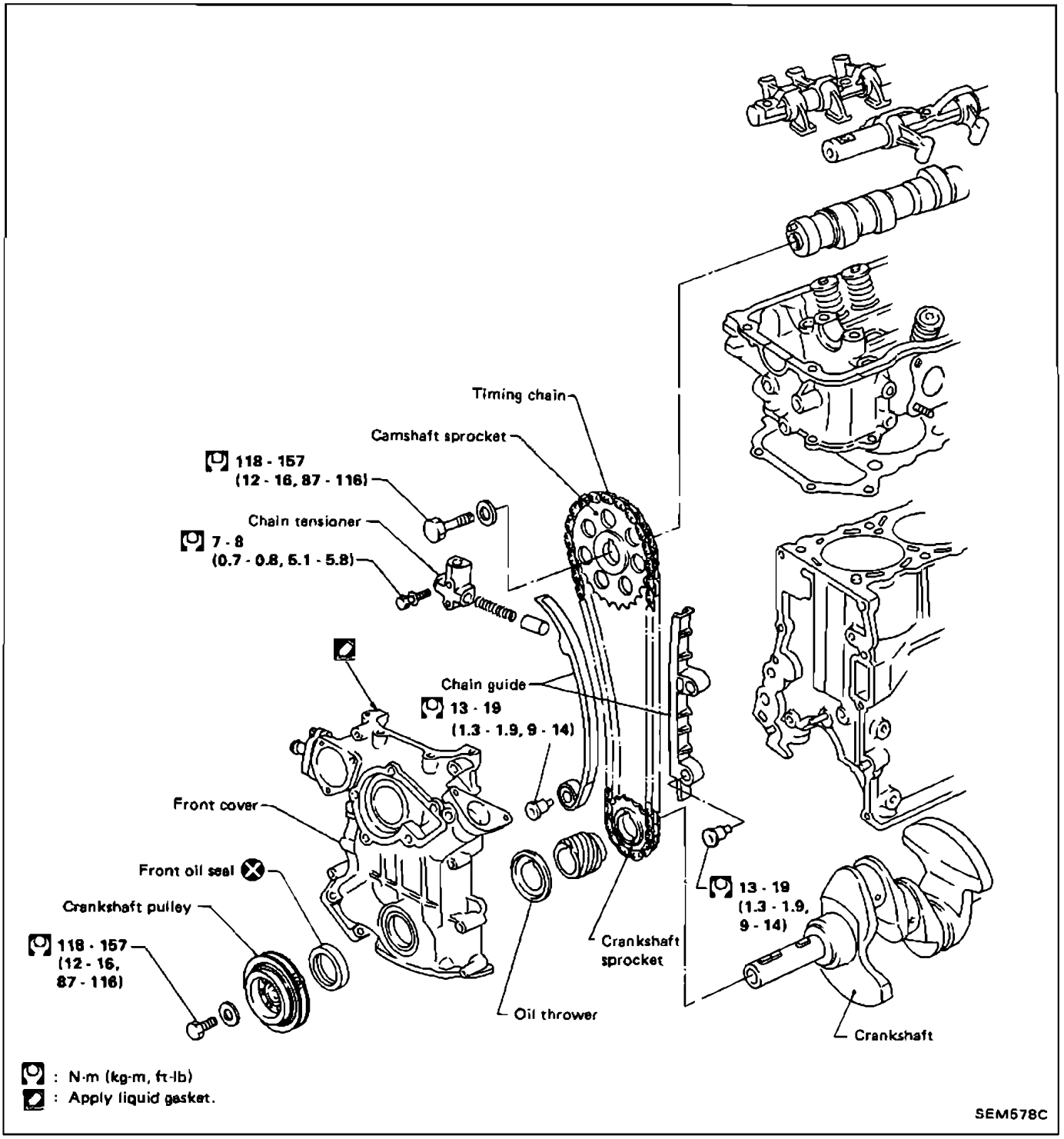
2. Apply a continuous bead of liquid gasket to mating surface of oil pan.
- **Use Genuine Liquid Gasket or equivalent.**



- 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.**

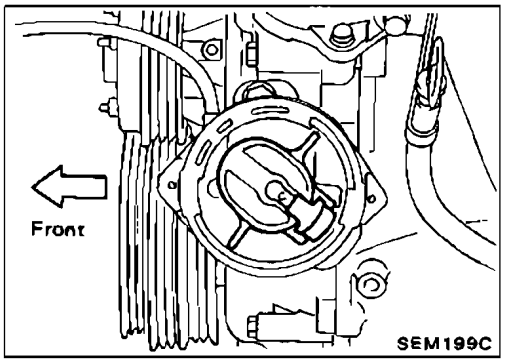


CAUTION:

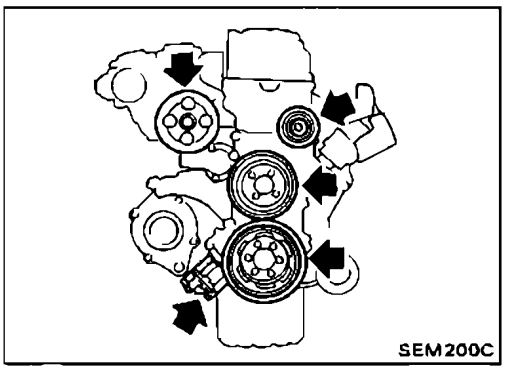
- **After removing timing chain, do not turn crankshaft and camshaft separately, or valves will strike piston heads.**

Removal

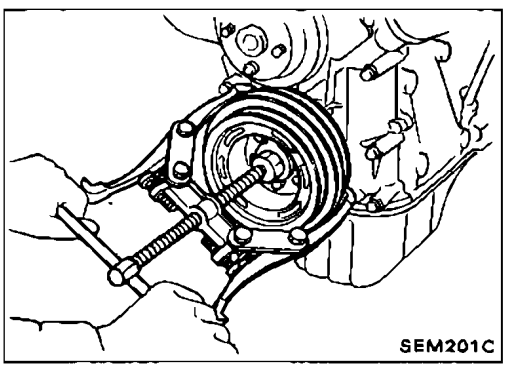
1. Disconnect battery terminal.
2. Drain coolant from radiator.
3. Remove radiator shroud and cooling fan.
4. Remove the following belts.
- Power steering drive belt
- Compressor drive belt
- Alternator drive belt

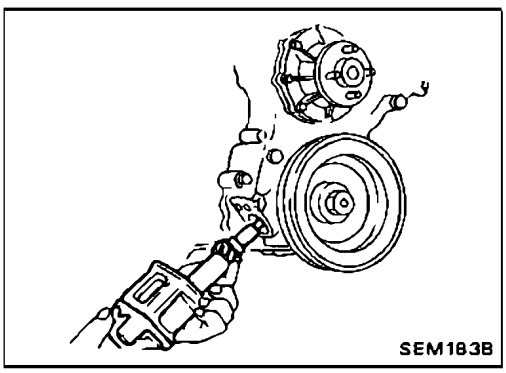


5. Remove all spark plugs.
6. Set No. 1 piston at T.D.C. on its compression stroke.

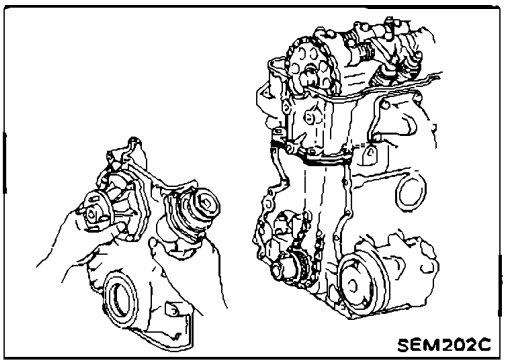


7. Remove the following parts.
- Power steering pump, idler pulley and power steering pump brackets
- Compressor idler pulley
- Crankshaft pulley
- Oil pump with pump drive spindle
- Rocker cover

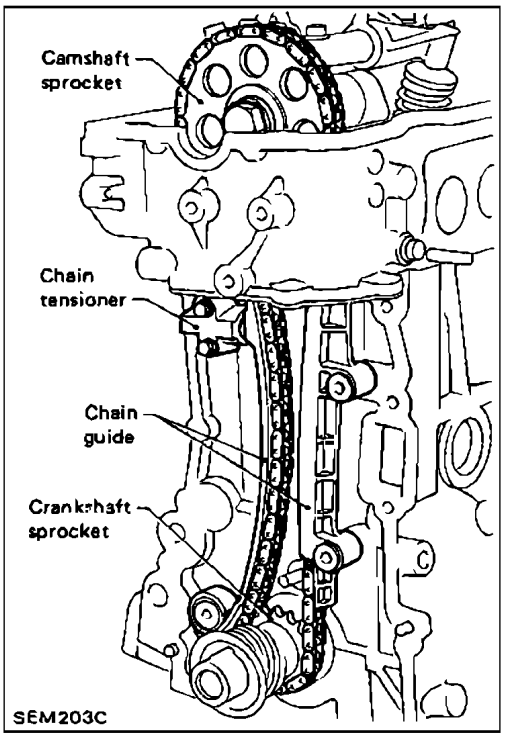




Removal (Cont'd)


SEM202C

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

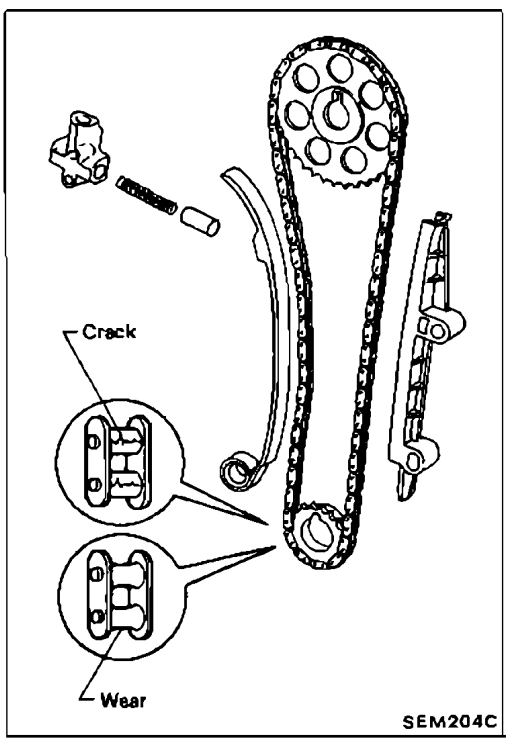


SEM203C

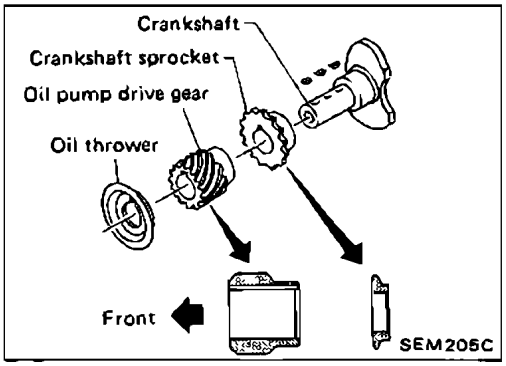
10. Remove the following parts.
- Chain tensioner
- Chain guides
- Timing chain and sprocket
- Oil thrower, oil pump drive gear and crankshaft sprocket

Inspection

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

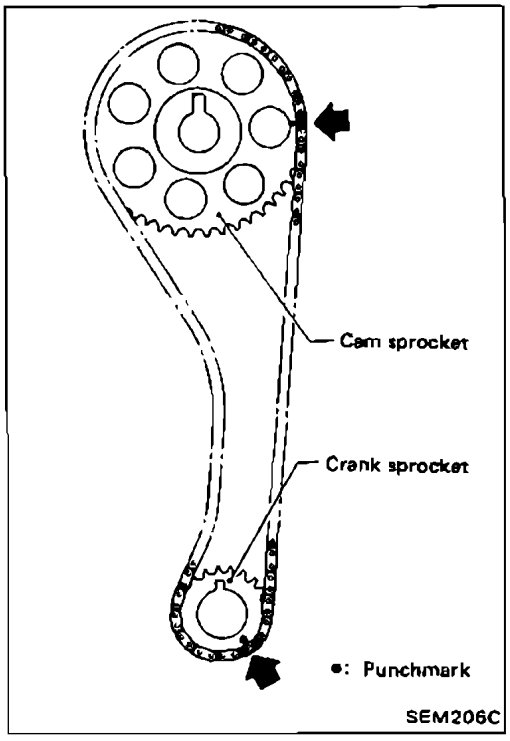


SEM204C

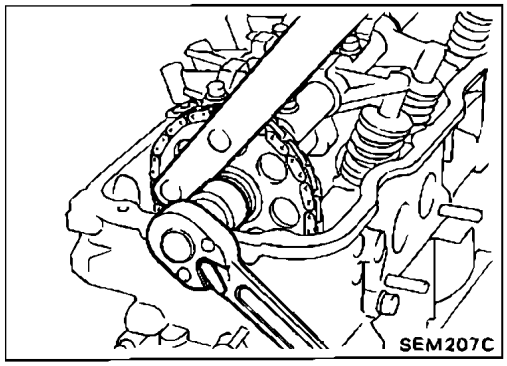


Installation

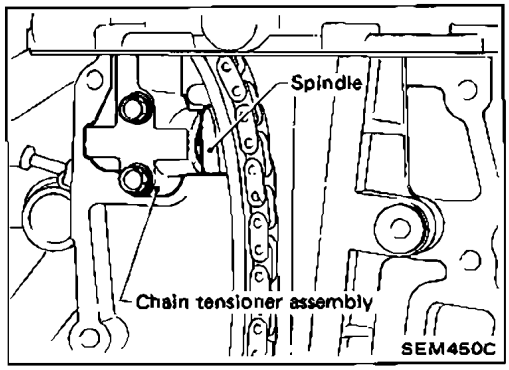
1. Install crankshaft sprocket, oil pump drive gear and oil thrower.
- **Make sure that mating marks of crankshaft sprocket face engine front.**



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.**

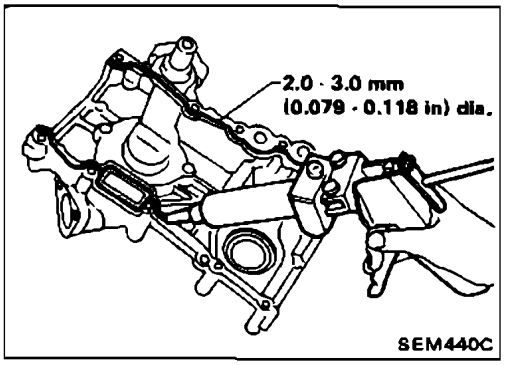


5. Tighten camshaft sprocket bolt.

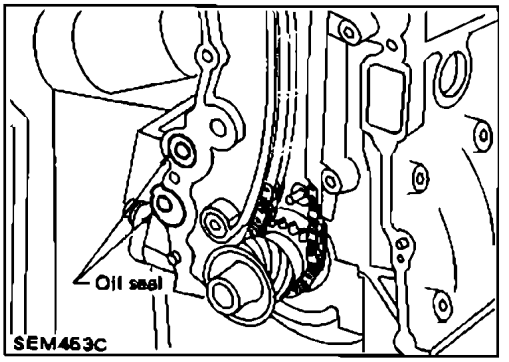


6. Install chain guide and chain tensioner.

Installation (Cont'd)

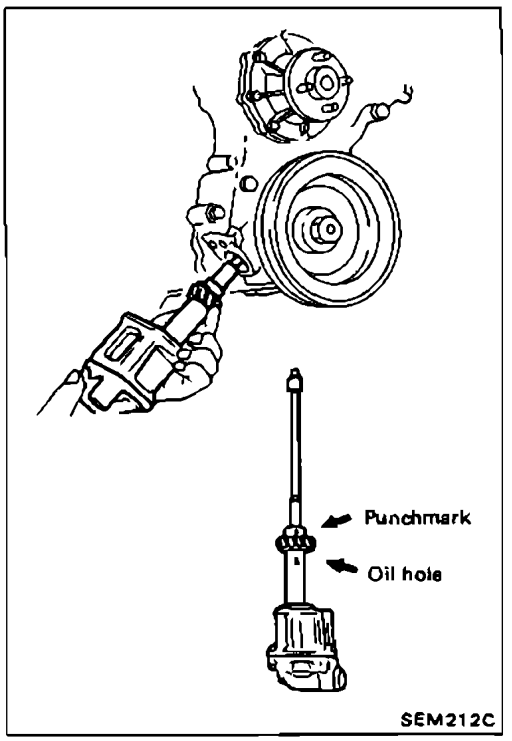


7. Apply liquid gasket to front cover.
8. Apply lithium grease to sealing lip of crankshaft oil seal.



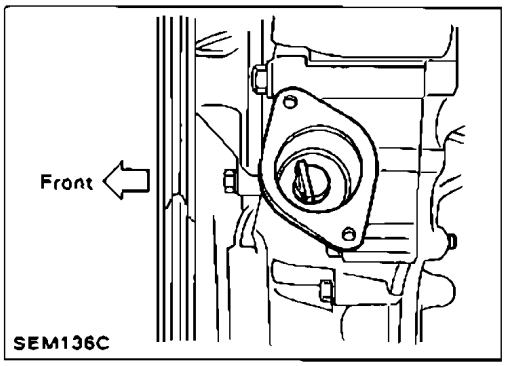
9. Install front cover.
- **Be careful not to damage cylinder head gasket.**
- **Do not forget oil seal.**

10. Install rubber plug. (Refer to "Installation" of CYLINDER HEAD.)
11. Install oil pan. (Refer to OIL PAN.)

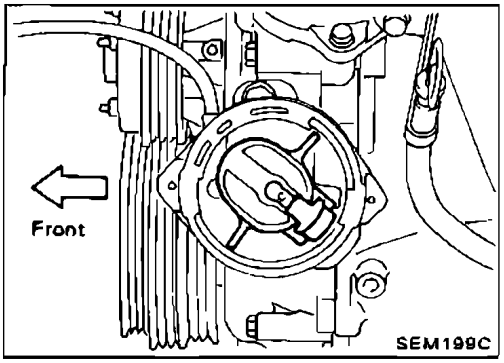


12. Install oil pump and distributor driving spindle with new gasket in front cover.
(1) Assemble oil pump and driving spindle, aligning punchmark on driving spindle with oil hole.

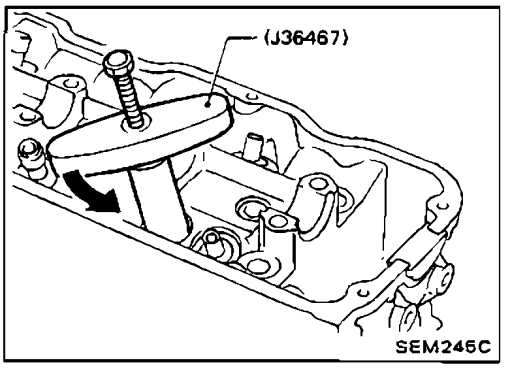
Installation (Cont'd)



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



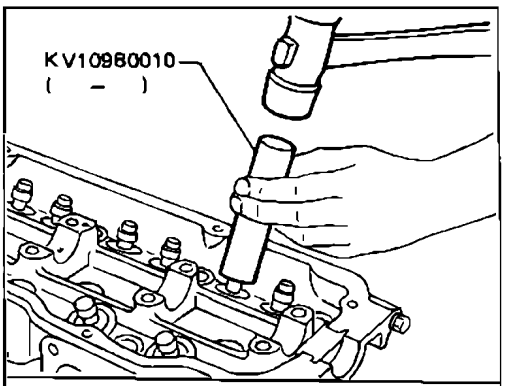
13. Install distributor.
14. Make sure that No. 1 piston is set at T.D.C. and that distributor rotor is set at No. 1 cylinder spark position.



VALVE OIL SEAL

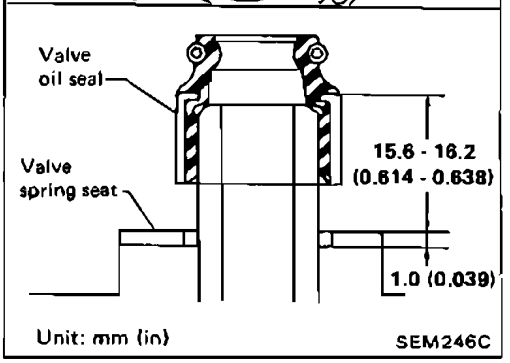
1. Remove rocker cover.
2. Remove rocker shaft assembly.
3. Remove valve spring and valve oil seal with Tool or suitable tool.

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

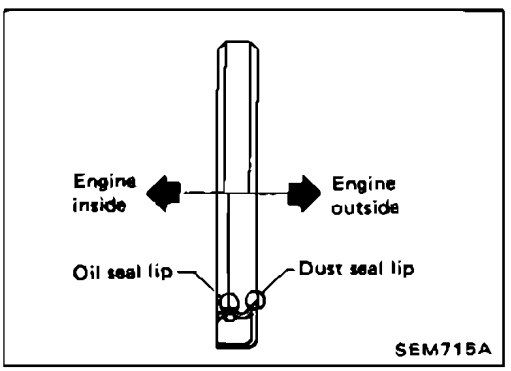


4. Apply engine oil to new valve oil seal and install it with Tool.

Before installing valve oil seal, install valve spring seat.



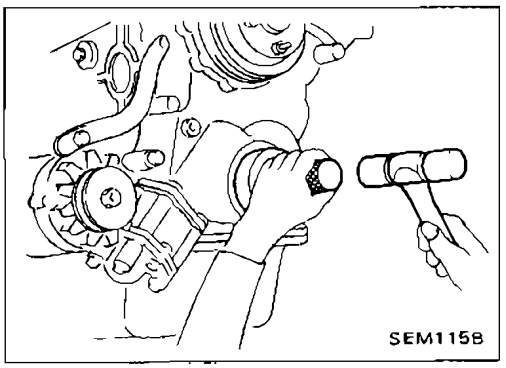
OIL SEAL INSTALLING DIRECTION



FRONT OIL SEAL

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

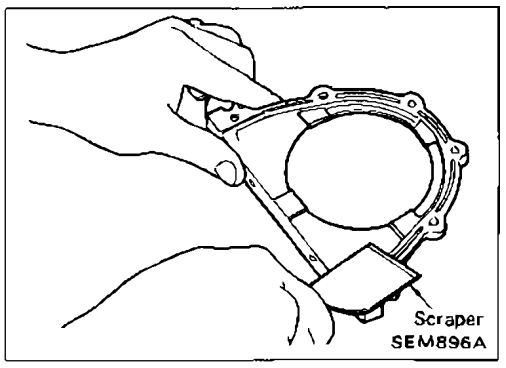
Be careful not to damage crankshaft.



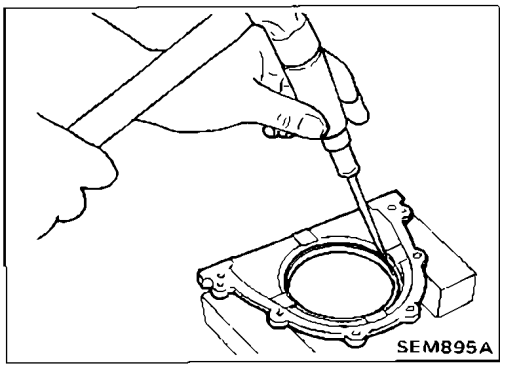
3 Apply engine oil to new oil seal and install it using suitable tool.

REAR OIL SEAL

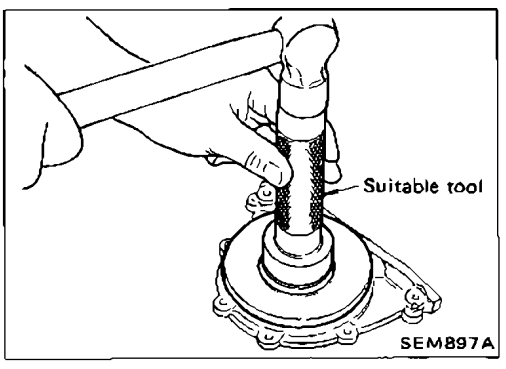
1. Remove flywheel or drive plate.
2. Remove rear oil seal retainer.
3. Remove traces of liquid gasket using scraper.



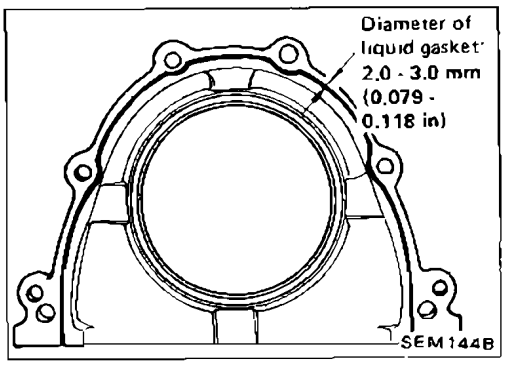
4. Remove rear oil seal from retainer.

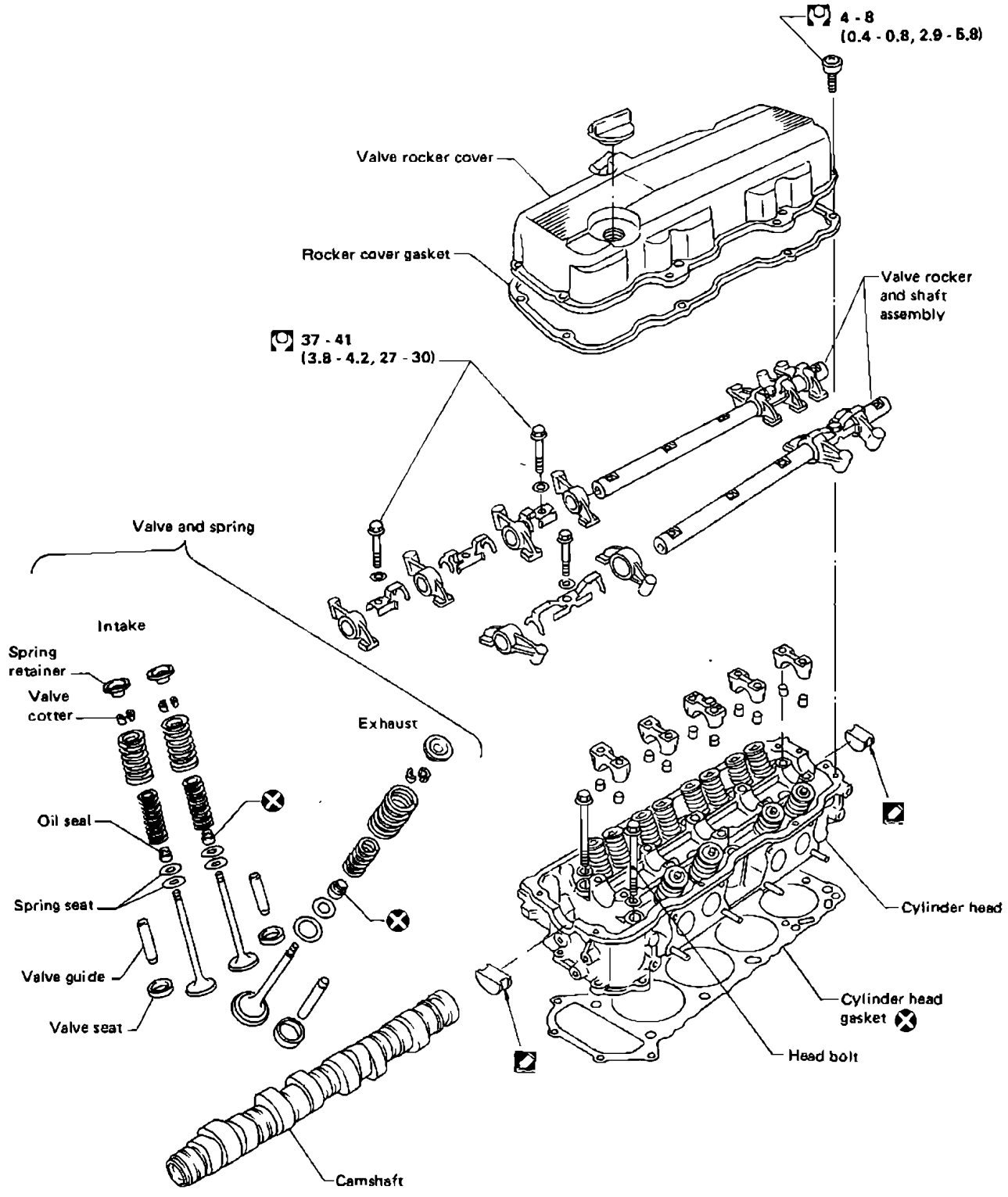


5. Apply engine oil to new oil seal and install it using suitable tool.



6. Apply liquid gasket to rear oil seal retainer.



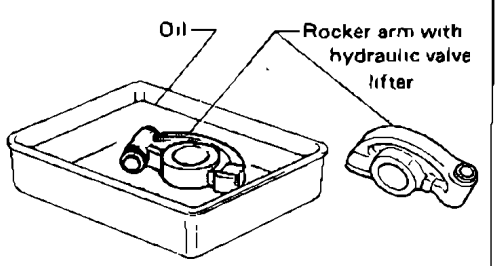


: N·m (kg-m, ft-lb)

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.

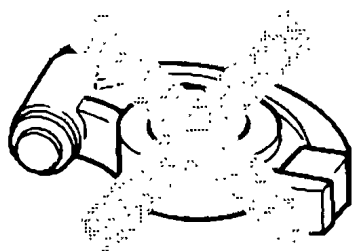
O.K.



SEM878B

- 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.

N.G.



SEM868B

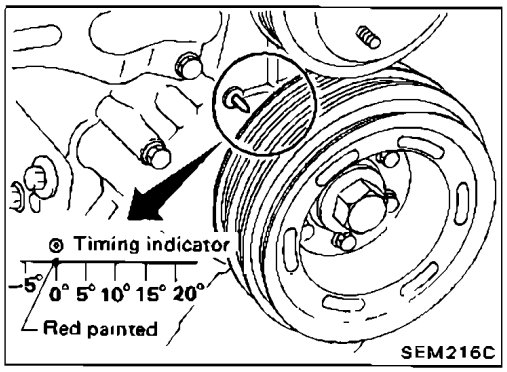
- Do not disassemble hydraulic valve lifter.
- Attach tags to valve lifters so as not to mix them up.

Removal

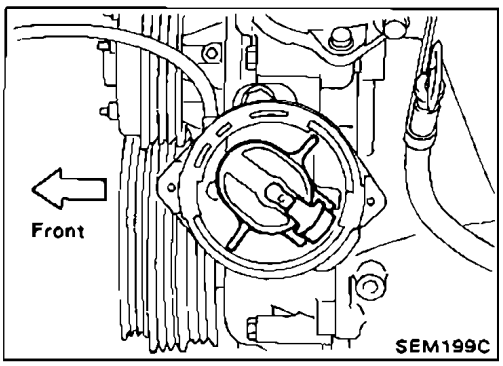
1. Drain coolant from radiator and drain plug of block.
2. Remove the following parts.
- Power steering drive belt
- Power steering pump, idler pulley and power steering brackets
- Vacuum hoses of S.C.V. and pressure control solenoid valve
- Accelerator wire bracket
3. Disconnect E.G.R. tube from exhaust 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.

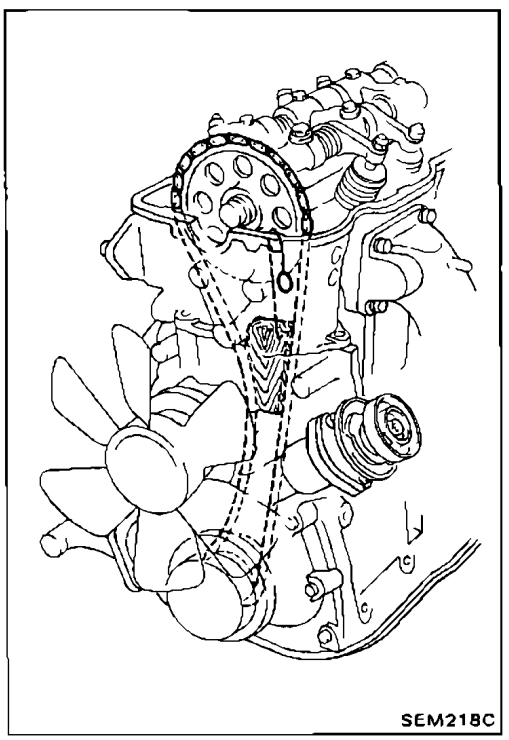
When removing rocker cover, do not hit rocker cover against rocker arm.

Removal (Cont'd)

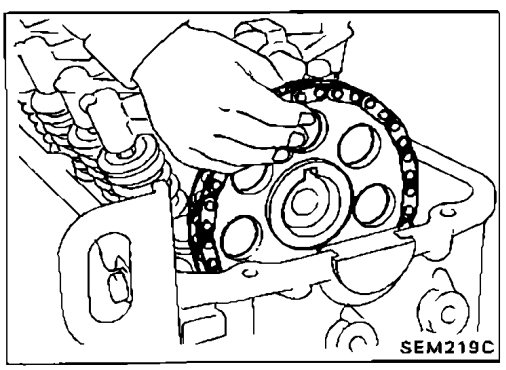


7. Set No. 1 piston at T.D.C. on its compression stroke.



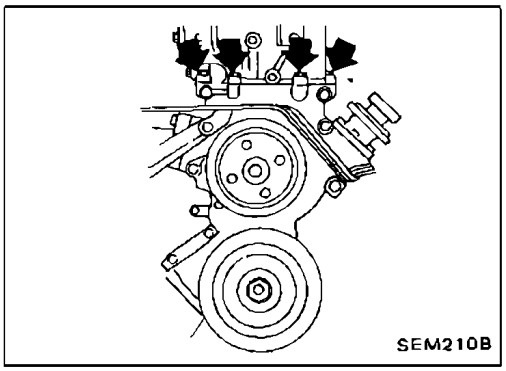


8. Loosen camshaft sprocket bolt.
- Support timing chain by using Tool as shown in figure.

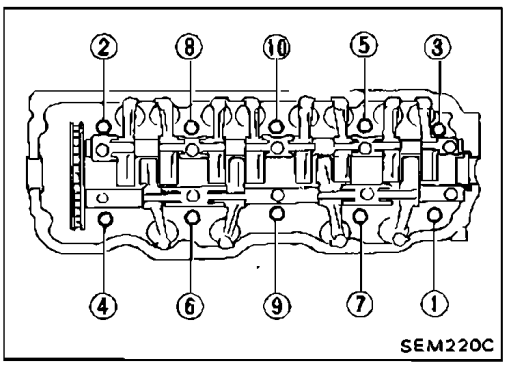


9. Remove camshaft sprocket

Removal (Cont'd)

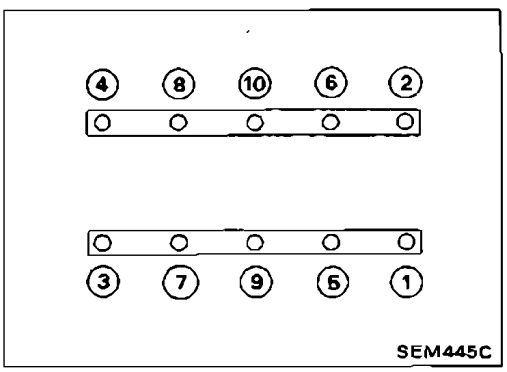


10. Remove front cover tightening bolts to cylinder head.



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

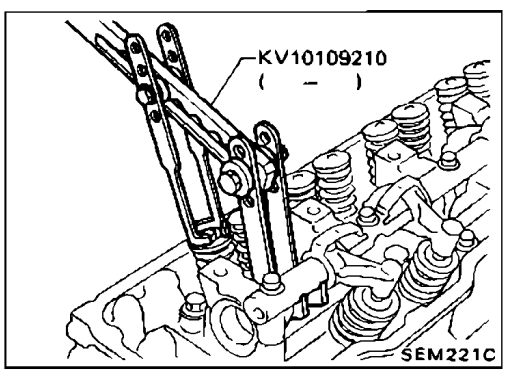
1. Remove rocker shaft assembly.

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

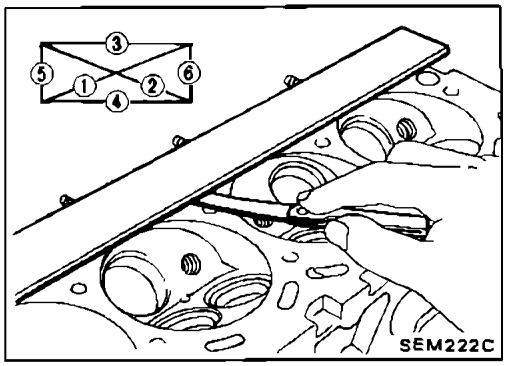
b. Bolts should be loosened in two or three steps.

2. Remove camshaft.

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



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)

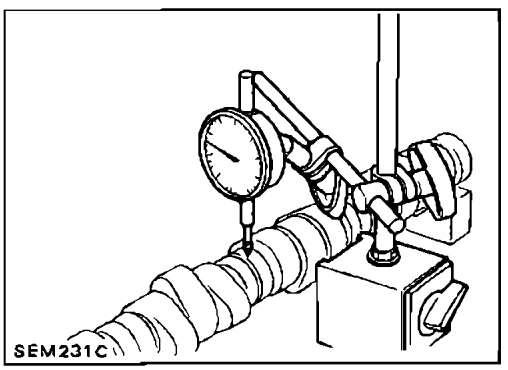
After resurfacing cylinder head, check that camshaft rotates freely by hand. If resistance is felt, cylinder head must be replaced.

Nominal cylinder head height:

98.8 - 99.0 mm (3.890 - 3.898 in)

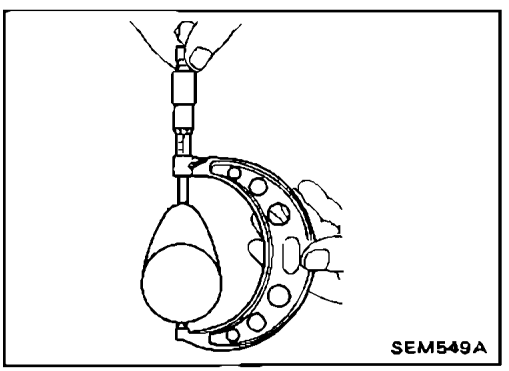
CAMSHAFT VISUAL CHECK

Check camshaft for scratches, seizure and wear.



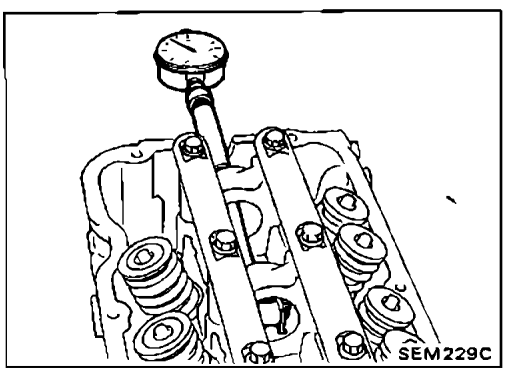
CAMSHAFT RUNOUT

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

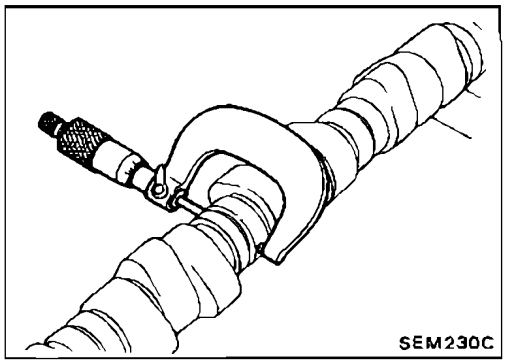
1. Measure camshaft cam height.
   Standard cam height:
   44.839 - 45.029 mm (1.7653 - 1.7728 in)
   Cam wear limit:
   0.2 mm (0.008 in)
2. If wear is beyond the limit, replace camshaft.



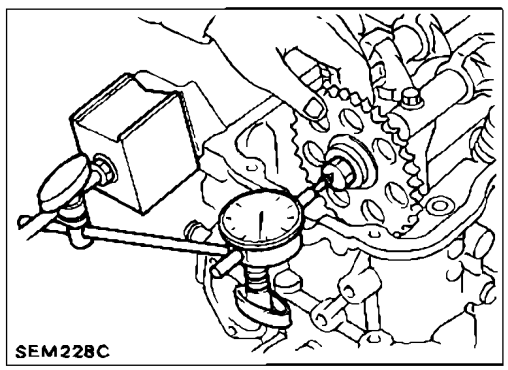
CAMSHAFT JOURNAL CLEARANCE

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)

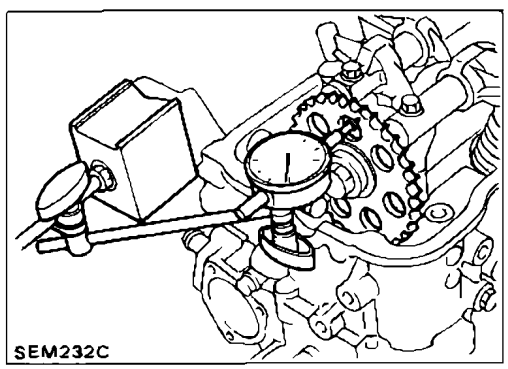


3. Measure outer diameter of camshaft journal.
   Standard outer diameter:
   32.935 - 32.955 mm (1.2967 - 1.2978 in)
4. If clearance exceeds the limit, replace camshaft and/or cylinder head.
   Camshaft journal clearance:
   Standard
   0.045 - 0.090 mm (0.0018 - 0.0035 in)
   Limit
   0.12 mm (0.0047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



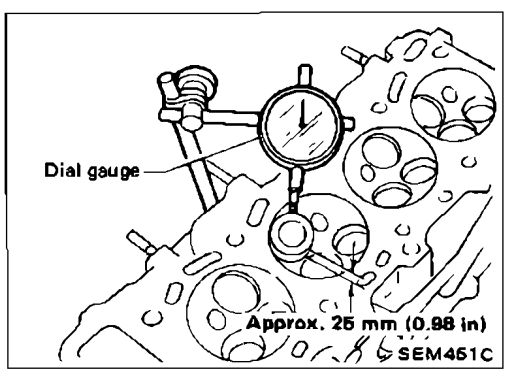
CAMSHAFT END PLAY

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)



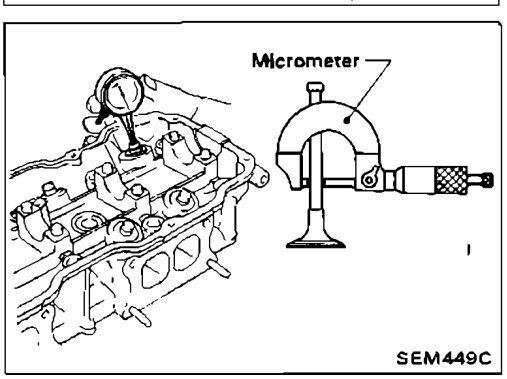
CAMSHAFT SPROCKET RUNOUT

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.



VALVE GUIDE CLEARANCE

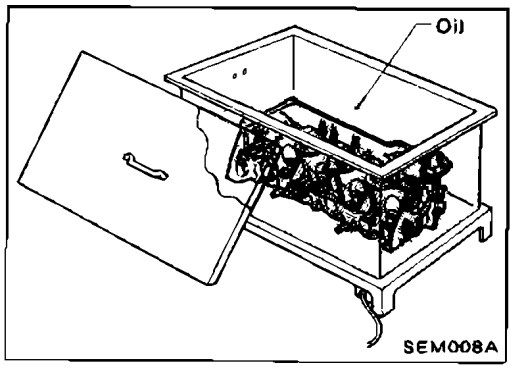
1. Measure valve deflection in a right-angled direction with camshaft. (Valve and valve guide mostly wear in this direction.)
   Valve deflection limit (Dial gauge reading):
   0.15 mm (0.0059 in)



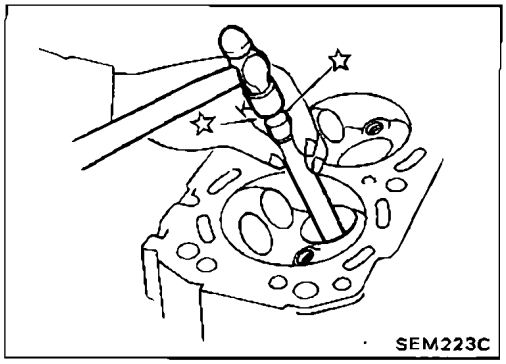
2. If it exceeds the limit, check valve to valve guide clearance.
a. Measure valve stem diameter and valve guide inner diameter.
b. Check that clearance is within specification.
   Valve to valve guide clearance:
   Standard
   0.020 - 0.053 mm
   (0.0008 - 0.0021 in) (Intake)
   0.040 - 0.070 mm
   (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)

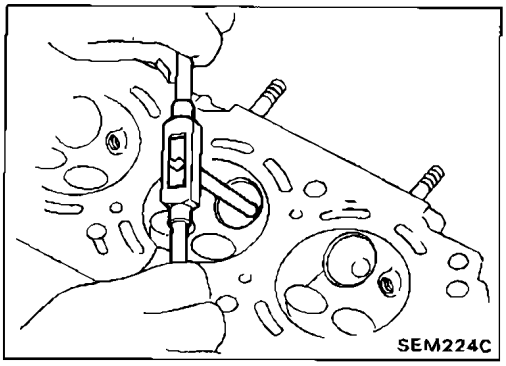
VALVE GUIDE REPLACEMENT



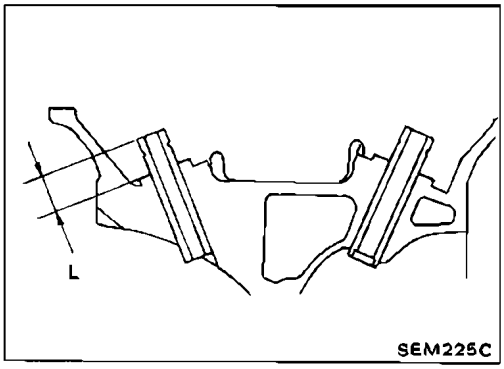
1. To remove valve guide, heat cylinder head to 150 to 160°C (302 to 320°F).



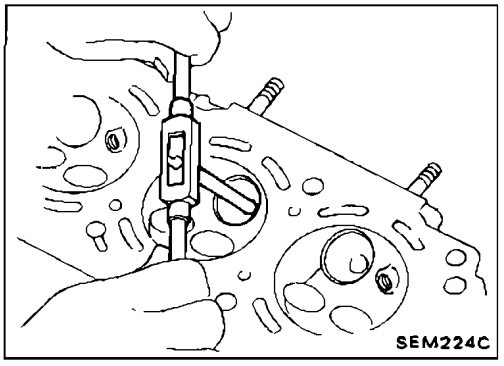
2. Drive out valve guide with a press [under a 20 kN (2 t, 2.2 US ton, 2.0 Imp ton) pressure] or hammer and suitable tool.



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)



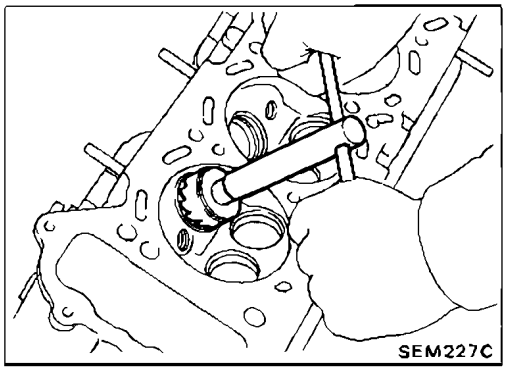
4. Heat cylinder head to 150 to 160°C (302 to 320°F) and press service valve guide onto cylinder head.
   Projection "L":
   14.9 - 15.1 mm (0.587 - 0.594 in)



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)

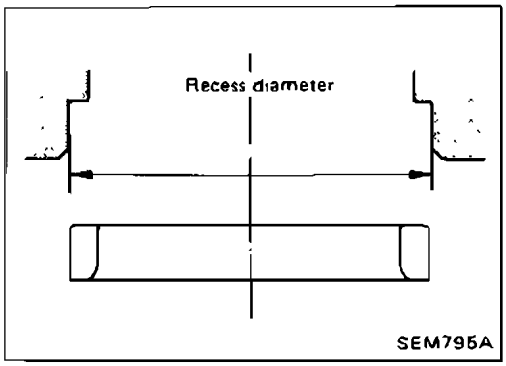
VALVE SEATS


SEM227C

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.**

REPLACING VALVE SEAT FOR SERVICE PARTS

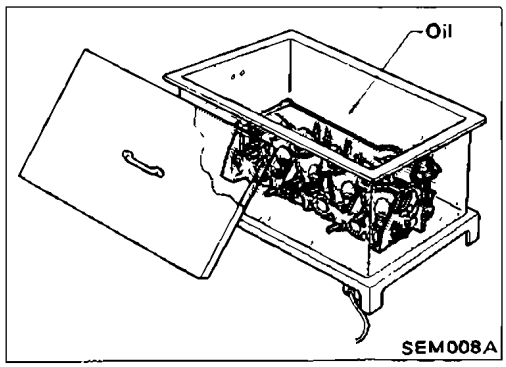


SEM795A

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.

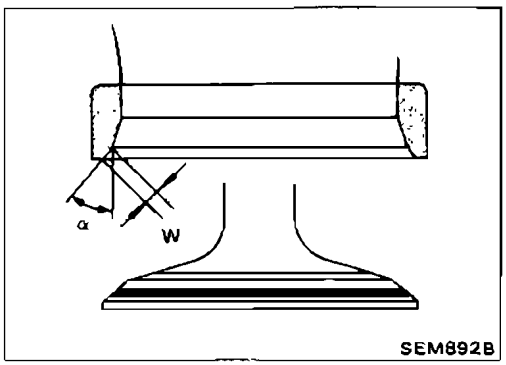
   Reaming bore for service valve seat
   Oversize [0.5 mm (0.020 in)]:
   Intake
   36.500 - 36.516 mm (1.4370 - 1.4376 in)
   Exhaust
   42.500 - 42.516 mm (1.6732 - 1.6739 in)

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).

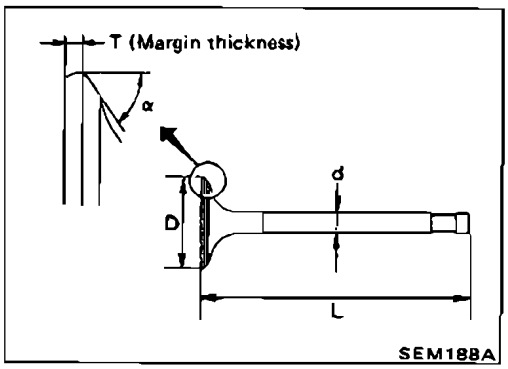


SEM892B

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)

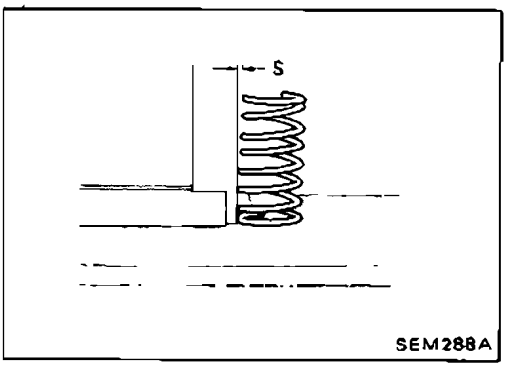


SEM188A

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

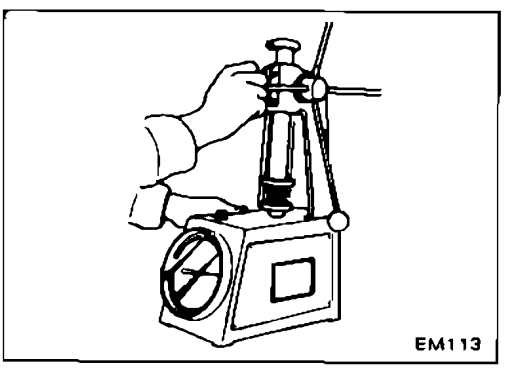
VALVE SPRING

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

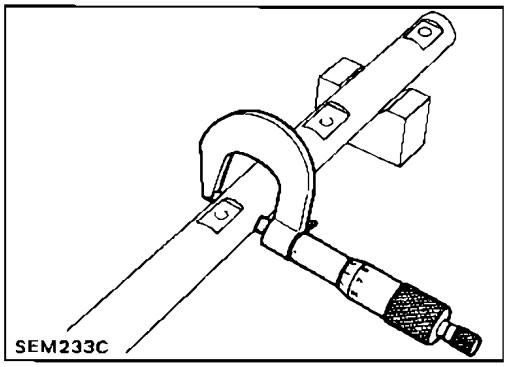
Check valve spring pressure.

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.

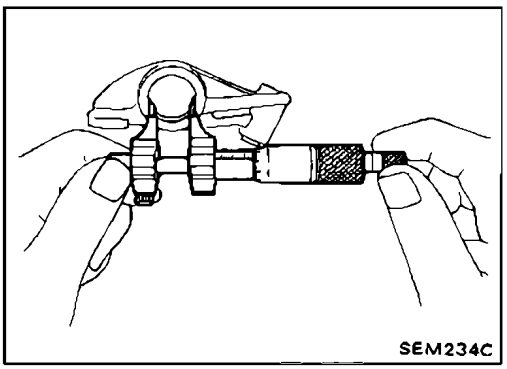
Inspection (Cont'd)

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)

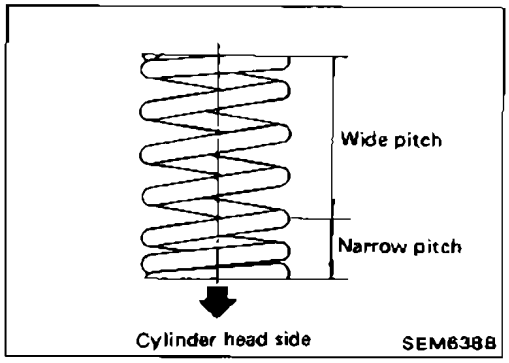


3. Check inner diameter of rocker arm.

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)

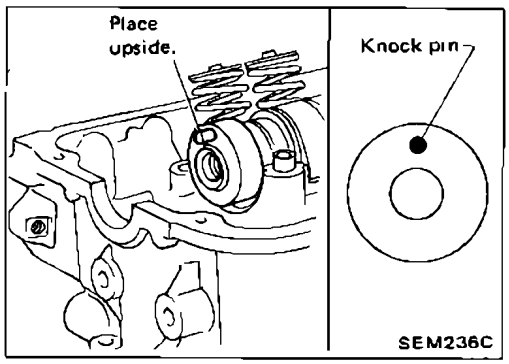
- **Keep rocker arm with hydraulic valve lifter standing to prevent air from entering hydraulic valve lifter when checking.**

Assembly



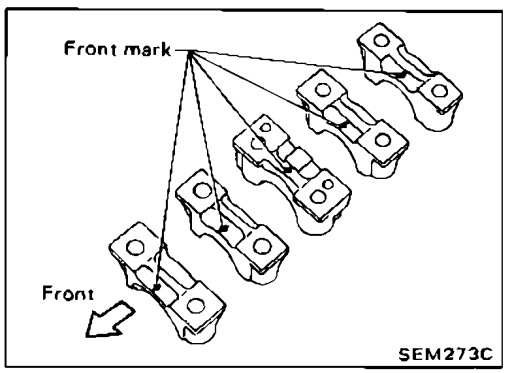
1. Install valve component parts.

- **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.

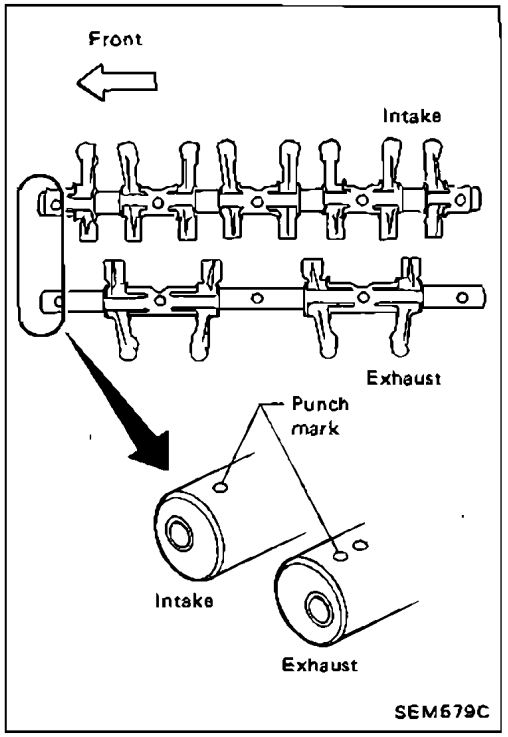


3. Install camshaft brackets.

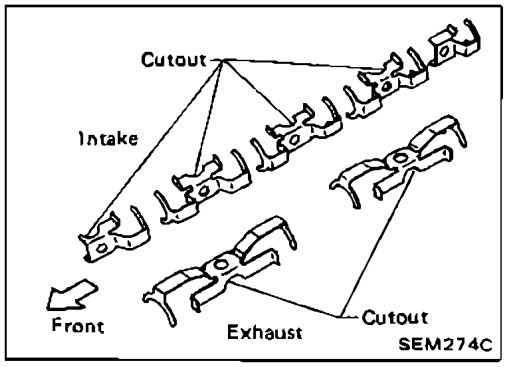
Front mark is punched on the camshaft bracket.

Assembly (Cont'd)

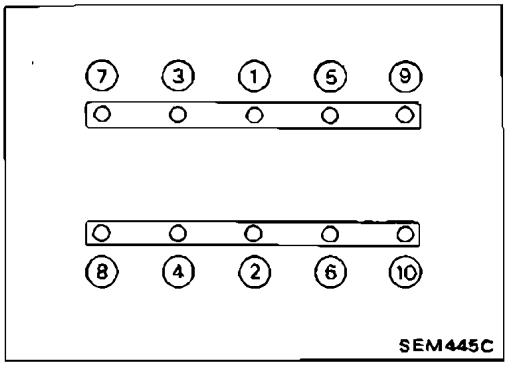
4. Install rocker shaft with rocker arms.

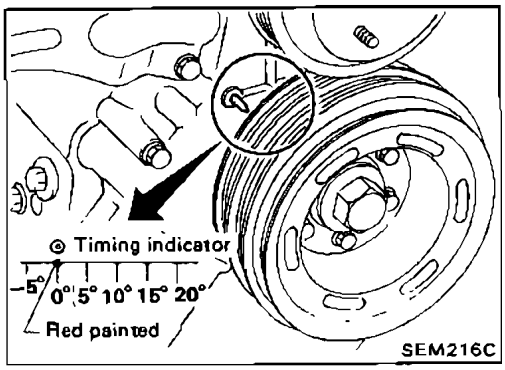


- Install retainer with cutout facing direction shown in figure at left.



5. Tighten bolts as shown in figure at left.

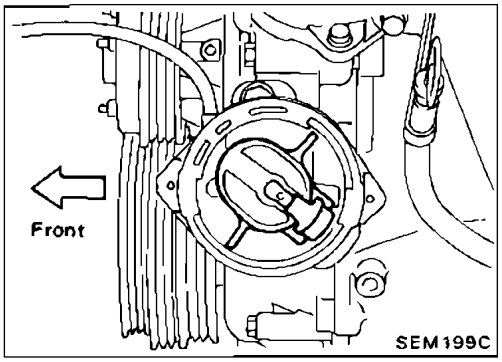




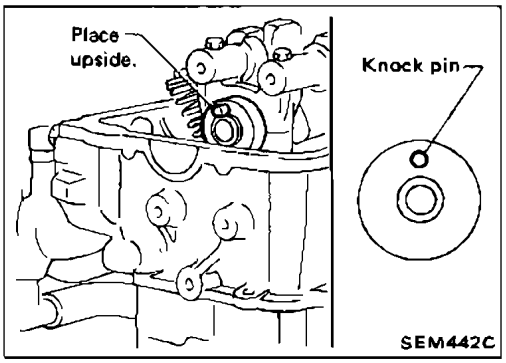
Installation

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.



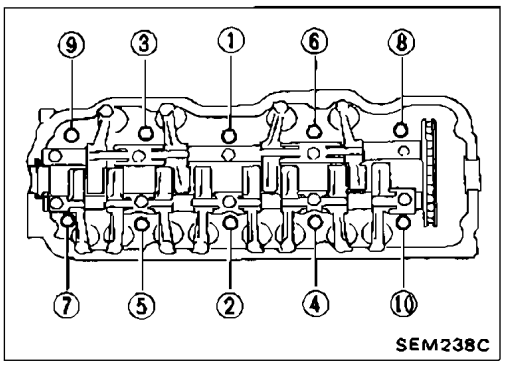
(2) Confirm that knock pin on camshaft is set at the top.



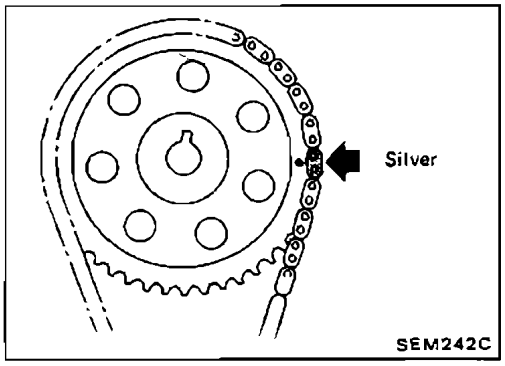
2. Install cylinder head with new gasket and tighten cylinder head bolts in numerical order.

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

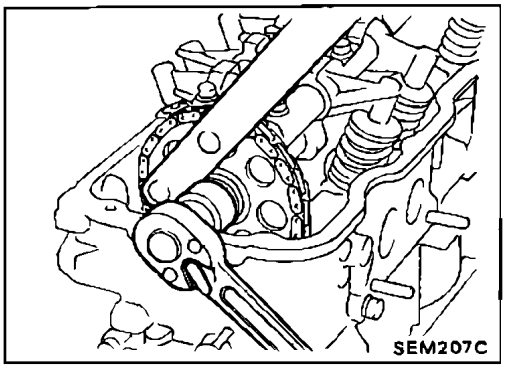
(1) Tighten all bolts to 29 N·m (3.0 kg-m, 22 ft-lb).
(2) Tighten all bolts to 78 N·m (8.0 kg-m, 58 ft-lb).
(3) Loosen all bolts completely.
(4) Tighten all bolts to 29 N·m (3.0 kg-m, 22 ft-lb).
(5) Turn all bolts 80 to 85 degrees clockwise with an angle wrench, or if an angle wrench is not available,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



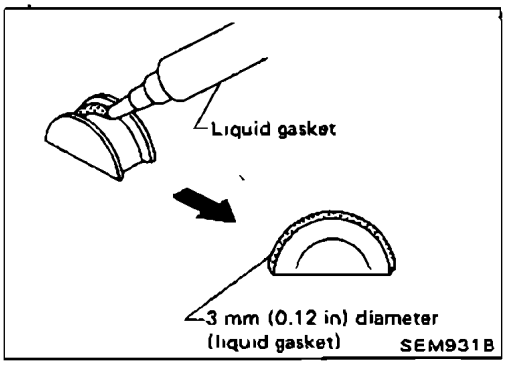
Installation (Cont'd)



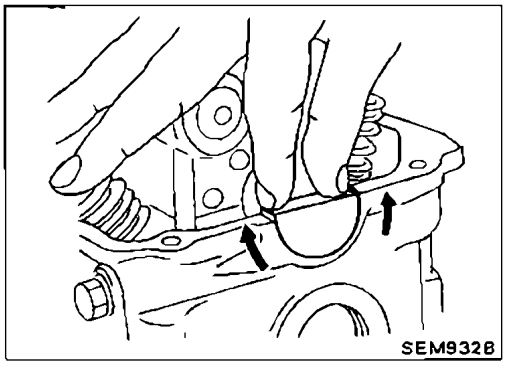
3. Set chain on camshaft sprocket by aligning each mating mark. Then install camshaft sprocket to camshaft.



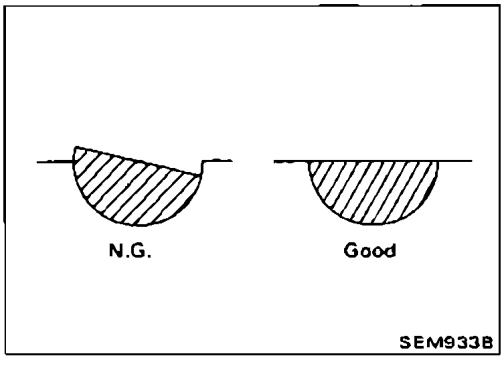
4. Tighten camshaft sprocket bolt.



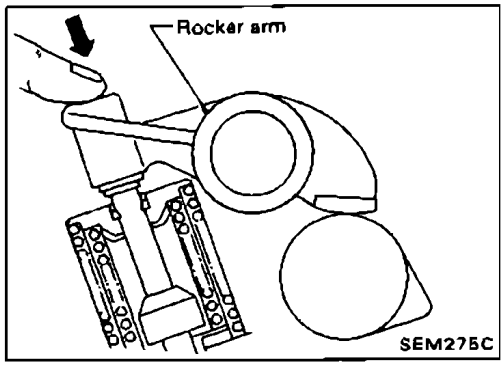
5. Install rubber plugs as follows:
(1) Apply liquid gasket to rubber plugs.
- **Rubber plugs should be replaced with new ones.**
- **Rubber plugs should be installed within 5 minutes of applying liquid gasket.**



(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.**



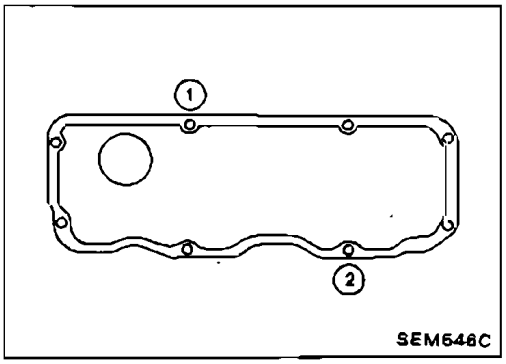
Installation (Cont'd)



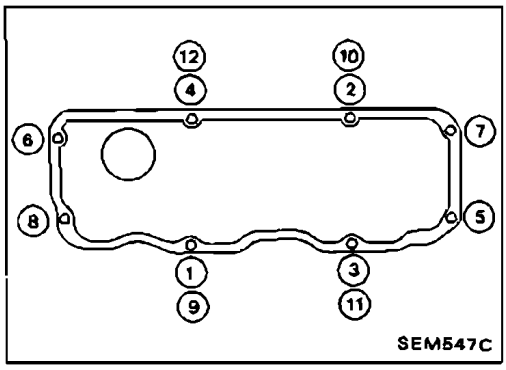
6. Check hydraulic valve lifter.
(1) Push hydraulic valve lifter forcefully with your finger.
- **Be sure to check it with rocker arm in its free position.**

(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).

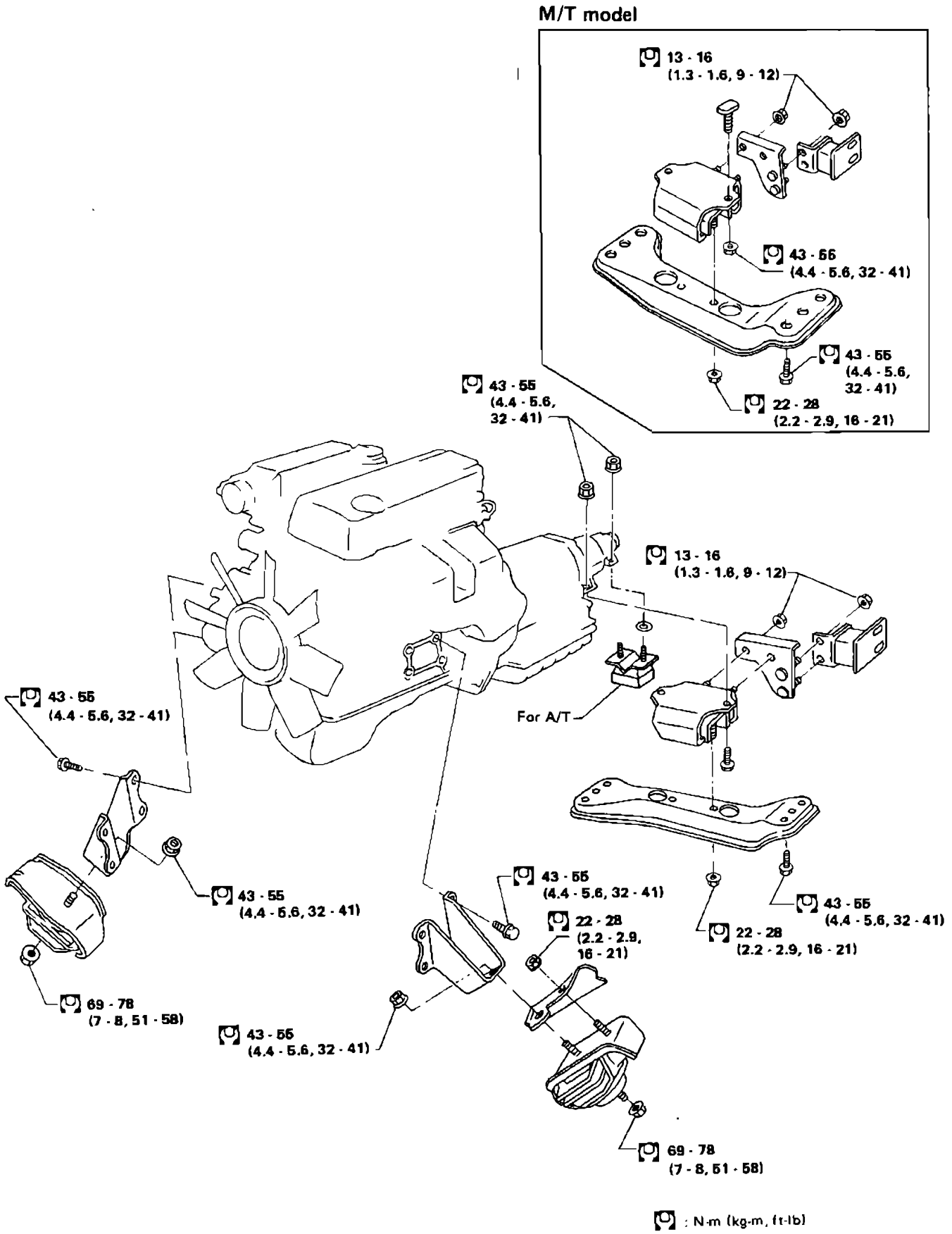
7. Install rocker cover.
- **Be sure to avoid interference between rocker cover and rocker arm.**



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.


M/T model
13 - 16
(1.3 - 1.6, 9 - 12)
43 - 55
(4.4 - 5.6, 32 - 41)
43 - 55
(4.4 - 5.6,
32 - 41)
22 - 28
(2.2 - 2.9, 16 - 21)
43 - 55
(4.4 - 5.6,
32 - 41)
13 - 16
(1.3 - 1.6, 9 - 12)
For A/T
43 - 55
(4.4 - 5.6, 32 - 41)
43 - 55
(4.4 - 5.6, 32 - 41)
69 - 78
(7 - 8, 51 - 58)
43 - 55
(4.4 - 5.6, 32 - 41)
43 - 55
(4.4 - 5.6, 32 - 41)
22 - 28
(2.2 - 2.9,
16 - 21)
43 - 55
(4.4 - 5.6, 32 - 41)
22 - 28
(2.2 - 2.9, 16 - 21)
69 - 78
(7 - 8, 51 - 58)
: N·m (kg-m, ft-lb)

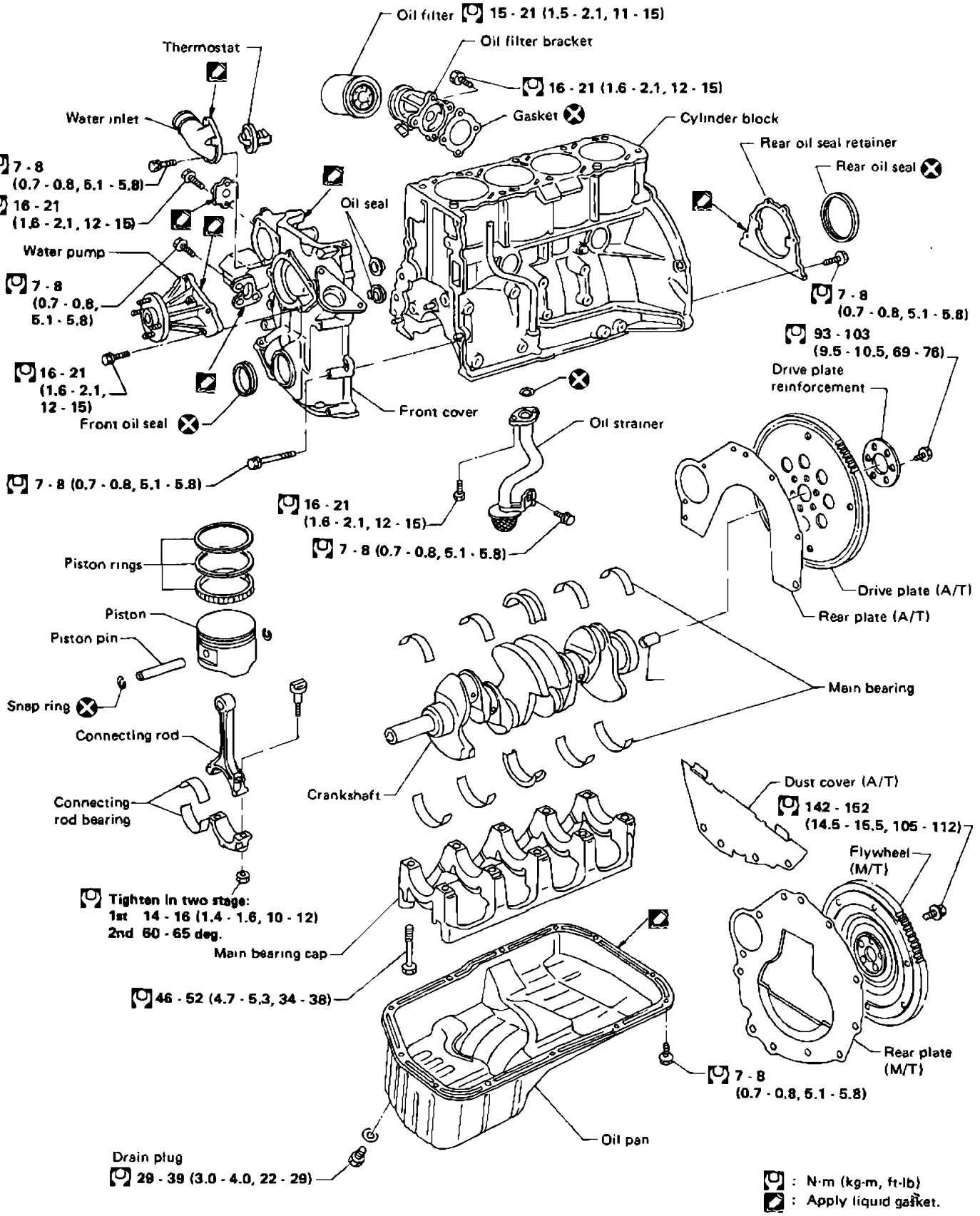
SEM271C

WARNING:

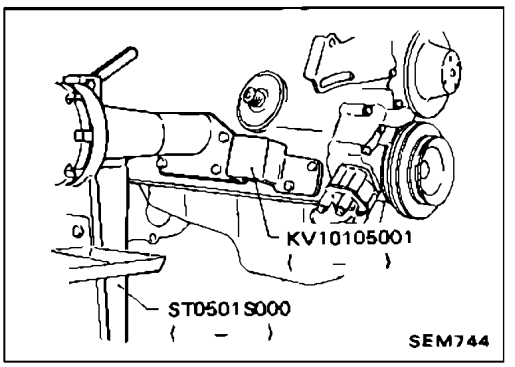
a. Situate vehicle on a flat and solid surface.
b. Place chocks at front and back of rear wheels.
c. Do not remove engine until exhaust system has completely cooled off.
   Otherwise, you may burn yourself and/or fire may break out in fuel line.
d. For safety during subsequent steps, the tension of wires 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
Thermostat
Water inlet
Cylinder block
Rear oil seal retainer
Rear oil seal
7 - 8 (0.7 - 0.8, 5.1 - 5.8)
16 - 21 (1.6 - 2.1, 12 - 15)
Oil seal
Water pump
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)
Drive plate (A/T)
Rear plate (A/T)
Piston rings
Piston
Piston pin
Snap ring
Main bearing
Connecting rod
Crankshaft
Connecting rod bearing
Dust cover (A/T)
142 - 152 (14.5 - 15.5, 105 - 112)
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)
7 - 8 (0.7 - 0.8, 5.1 - 5.8)
Rear plate (M/T)
Oil pan
Drain plug
29 - 39 (3.0 - 4.0, 22 - 29)
: N·m (kg-m, ft-lb)
: Apply liquid gasket.

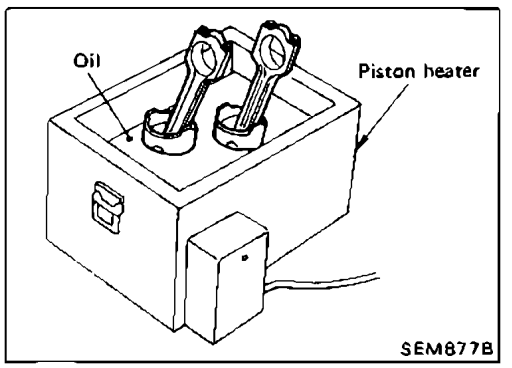
SEM247C



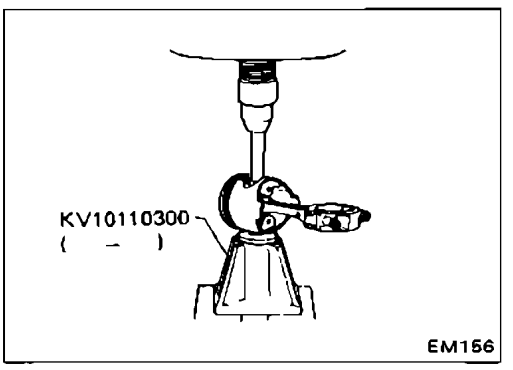
Disassembly

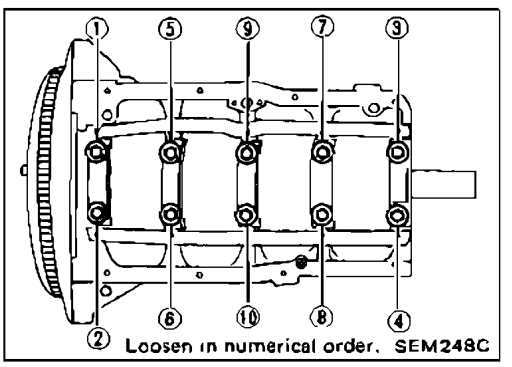
PISTON AND CRANKSHAFT

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



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



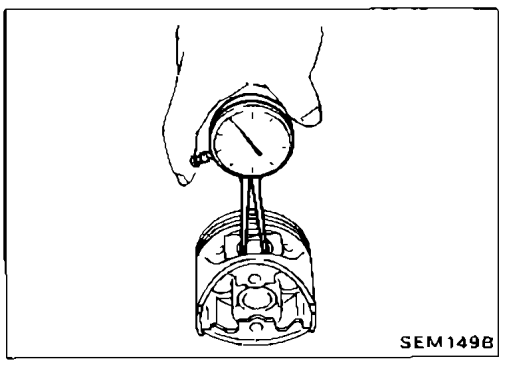


8. Remove main bearing beam and crankshaft.
- **Before removing main bearing beam, measure crankshaft end play.**
- **Bolts should be loosened in two or three steps.**

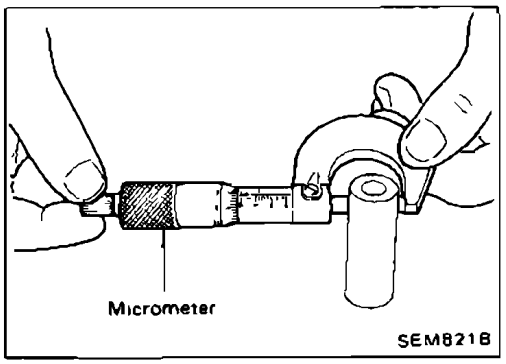
Inspection

PISTON AND PISTON PIN CLEARANCE

1. Measure inner diameter of piston pin hole "dp".
   Standard diameter "dp":
   20.987 - 20.999 mm (0.8263 - 0.8267 in)

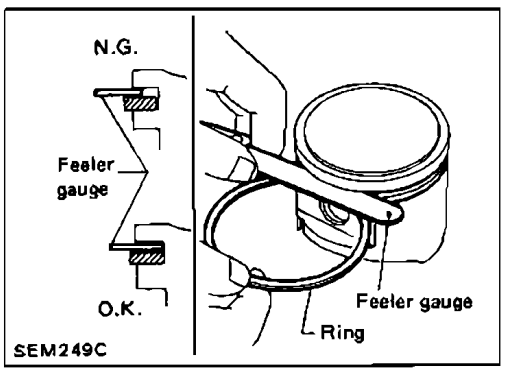


Inspection (Cont'd)



2. Measure outer diameter of piston pin "Dp".
   Standard diameter "Dp":
   20.989 - 21.001 mm (0.8263 - 0.8268 in)
3. Calculate interference fit of piston pin to piston.
   dp – Dp = 0 - 0.004 mm (0 - 0.0002 in)

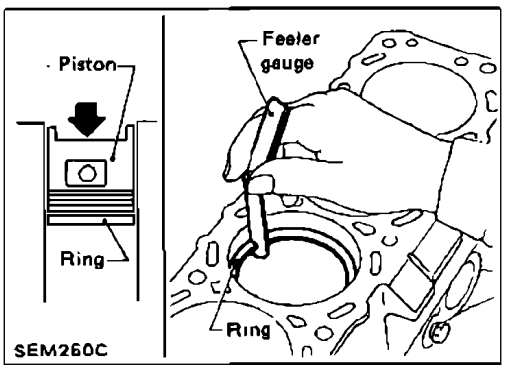
If it exceeds the above value, replace piston assembly with pin.



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.

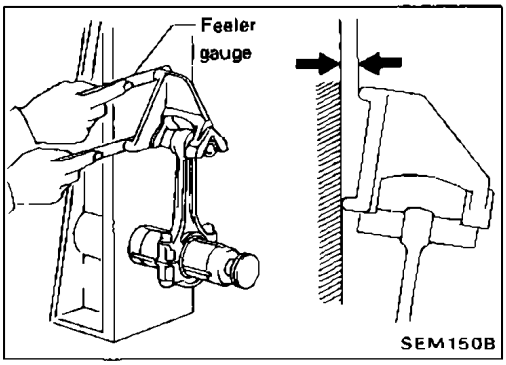


PISTON RING END GAP

End gap:
Top ring
0.28 - 0.43 mm (0.0110 - 0.0169 in)
2nd ring
0.45 - 0.60 mm (0.0177 - 0.0236 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 - 0.60 mm (0.0079 - 0.0236 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.

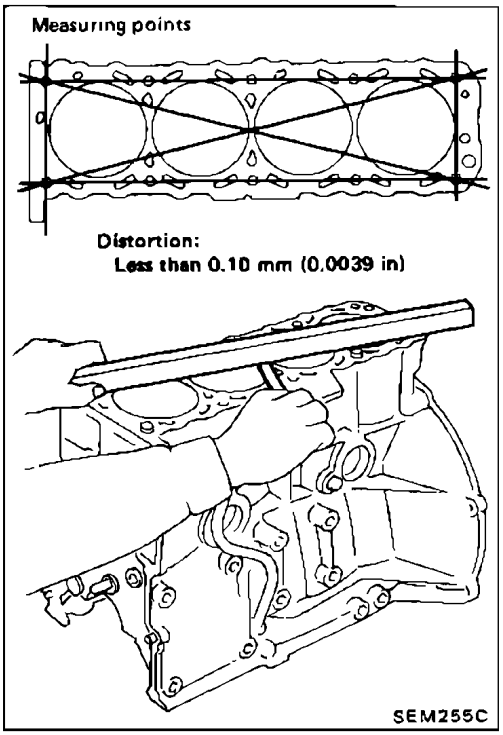
Inspection (Cont'd)



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.

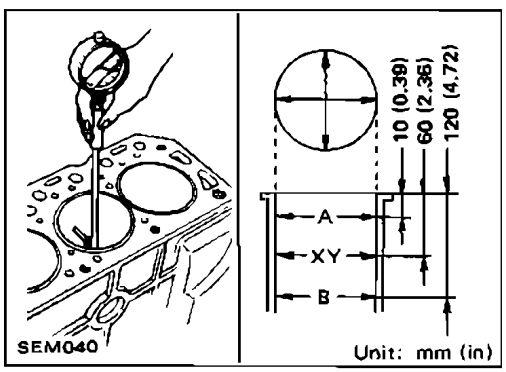


CYLINDER BLOCK DISTORTION AND WEAR

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.



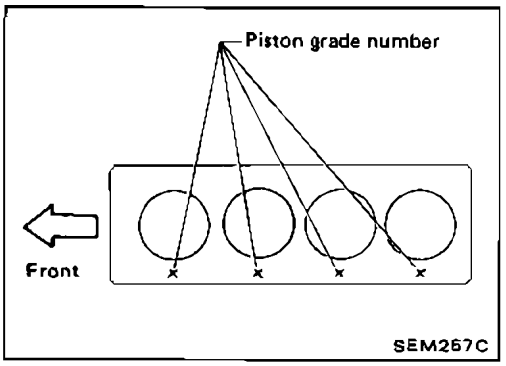
PISTON-TO-BORE CLEARANCE

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)

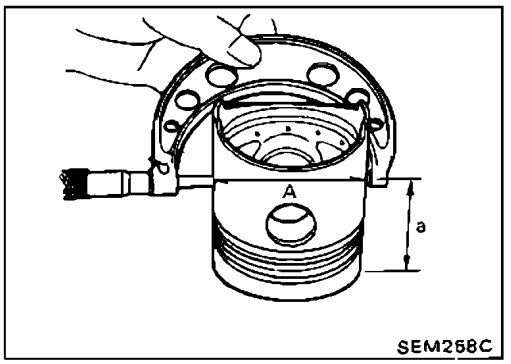
If it exceeds the limit, rebore all cylinders. Replace cylinder block if necessary.

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

Inspection (Cont'd)



- **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)
5. Determine piston oversize according to amount of cylinder wear.

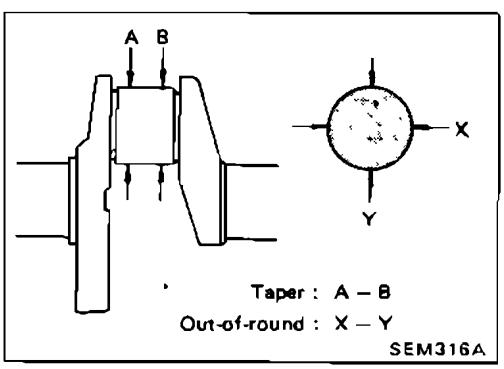
Oversize pistons are available for service. Refer to S.D.S.

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.

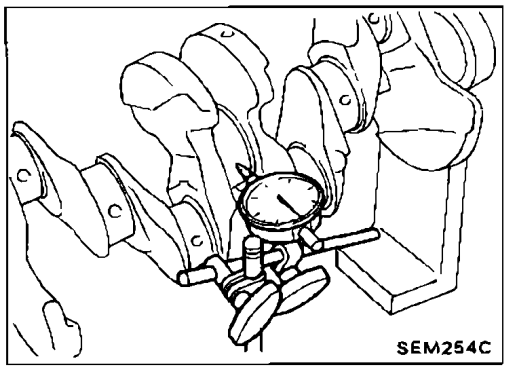
- **Measurement should be done after cylinder bore cools down.**



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)

Inspection (Cont'd)

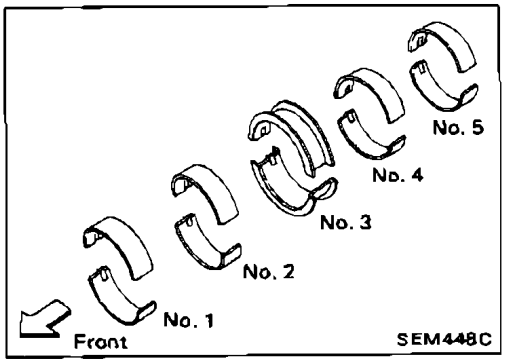


3. Measure crankshaft runout.
   Runout (Total indicator reading):
   Less than 0.10 mm (0.0039 in)

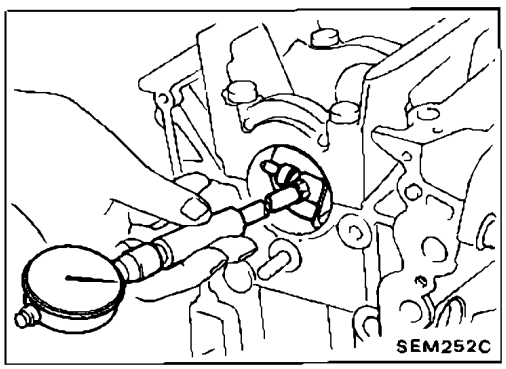
BEARING CLEARANCE

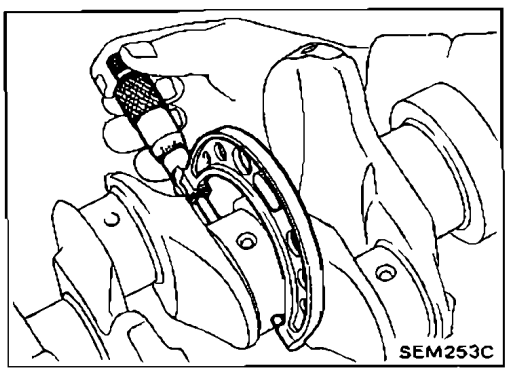
Method A (Using bore gauge and micrometer)
Main bearing

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

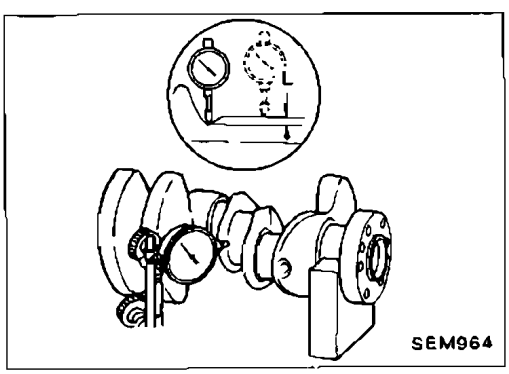


2. Install main bearing cap to cylinder block.
Tighten all bolts in correct order in two or three stages. Refer to "Assembly".
3. Measure inner diameter "A" of each main bearing.



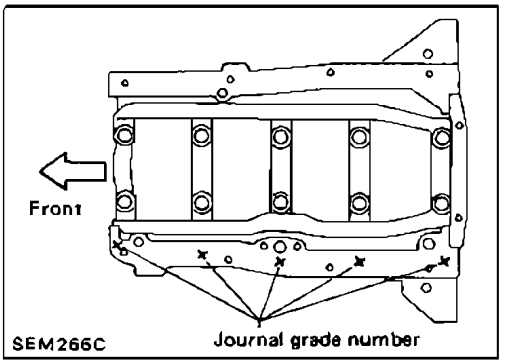


4. Measure outer diameter "Dm" of each crankshaft main journal.
5. Calculate main bearing clearance.
   Main bearing clearance = A – Dm
   Standard:
   0.020 - 0.047 mm (0.0008 - 0.0019 in)
   Limit: 0.1 mm (0.004 in)
6. If it exceeds the limit, replace bearing.
7. If clearance cannot be adjusted within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

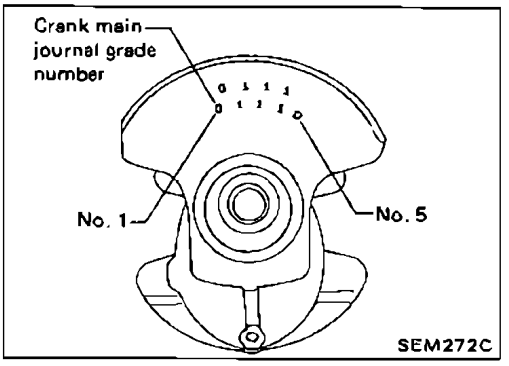


a. When grinding crankshaft journal, confirm that "L" dimension in fillet roll is more than the specified limit.
   "L": 0.1 mm (0.004 in)
b. Refer to S.D.S. for grinding crankshaft and available service parts.

Inspection (Cont'd)



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.



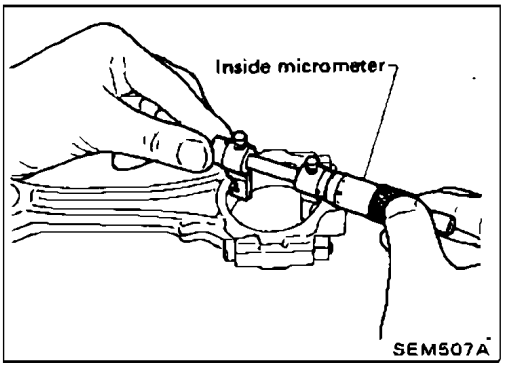
b. Grade number of each crankshaft main journal is punched on crankshaft.

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

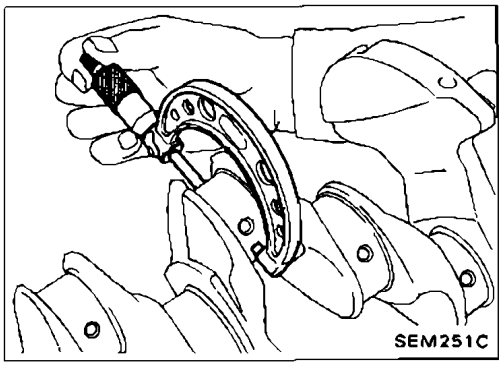


Connecting rod bearing (Big end)
1. Install connecting rod bearing to connecting rod and cap.
2. Install connecting rod cap to connecting rod.

Tighten bolts to the specified torque.

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

Inspection (Cont'd)


SEM251C

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

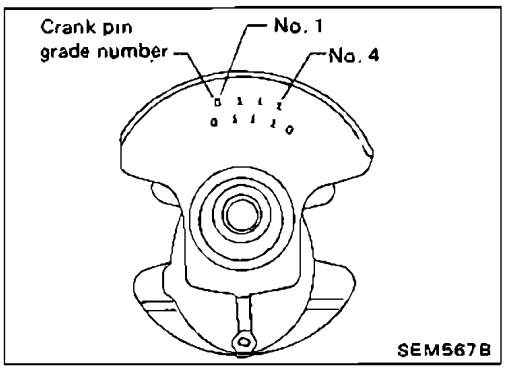
Connecting rod bearing clearance = C – Dp

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".

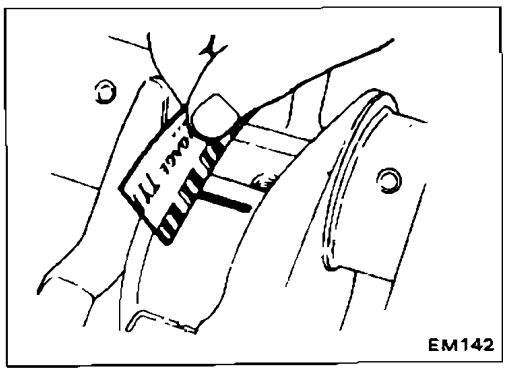


SEM567B

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

Connecting rod bearing grade number:

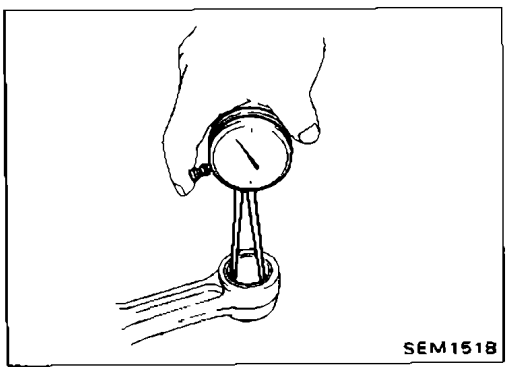
Crank pin grade number	Connecting rod bearing grade number
0	0
1	1
2	2


EM142

Method B (Using plastigauge)

CAUTION:

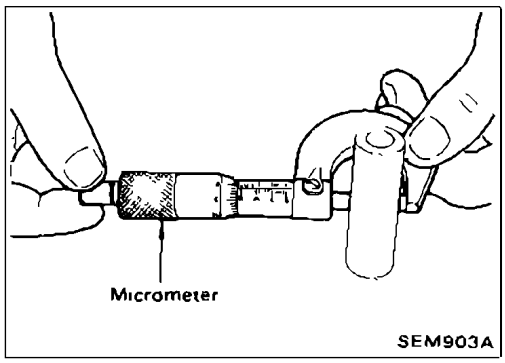
- **Do not turn crankshaft or connecting rod while plastigage is being inserted.**
- **When bearing clearance exceeds the specified limit, ensure that the proper bearing has been installed. Then if excessive bearing clearance exists, use a thicker main bearing or undersized bearing so that the specified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


SEM151B

CONNECTING ROD BUSHING CLEARANCE (Small end)

1. Measure inner diameter "C" of bushing.

Inspection (Cont'd)

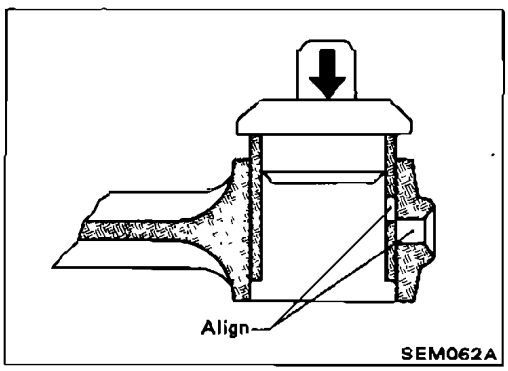


2. Measure outer diameter "Dp" of piston pin.
3. Calculate connecting rod bearing clearance.

C – Dp =
0.005 - 0.017 mm (0.0002 - 0.0007 in) (Standard)
0.023 mm (0.0009 in) (Limit)

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

REPLACEMENT OF CONNECTING ROD BUSHING (Small end)



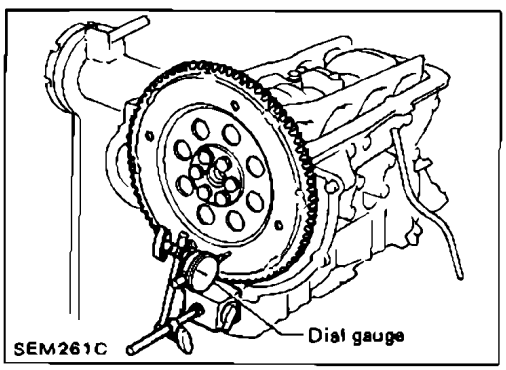
1. Drive in small end bushing until it is flush with end surface of rod.

Be sure to align the oil holes.

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

Clearance between small end bushing and piston pin:
0.005 - 0.017 mm (0.0002 - 0.0007 in)

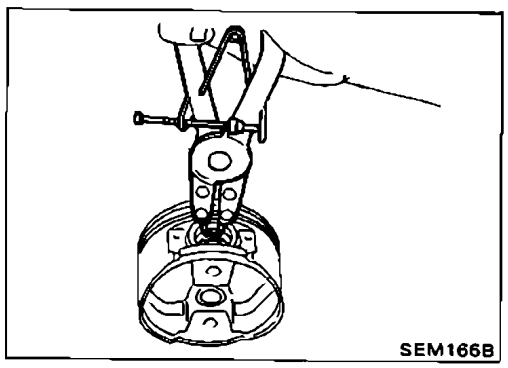
FLYWHEEL/DRIVE PLATE RUNOUT



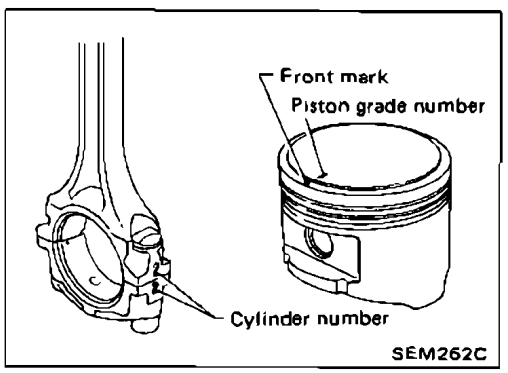
Runout (Total indicator reading):
Flywheel (M/T model)
Less than 0.1 mm (0.004 in)
Drive plate (A/T model)
Less than 0.1 mm (0.004 in)

Assembly

PISTON



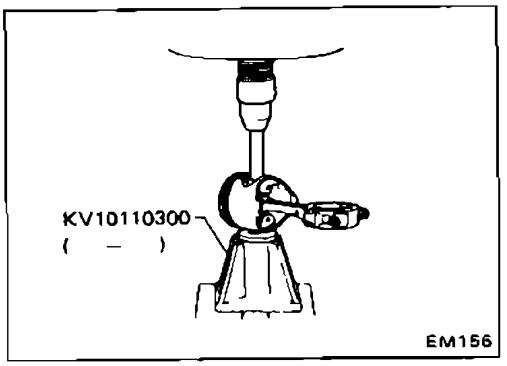
1. Install new snap ring on one side of piston pin hole.

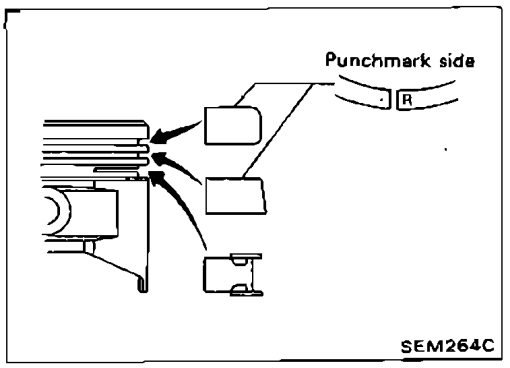


2. Heat piston to 60 to 70°C (140 to 158°F) and assemble piston, piston pin, connecting rod and new snap ring.

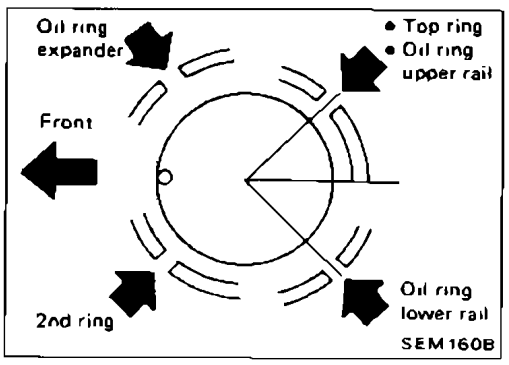
- **Align the direction of piston and connecting rod.**
- **Numbers stamped on connecting rod and cap correspond to each cylinder.**
- **After assembly, make sure connecting rod swings smoothly.**

Assembly (Cont'd)





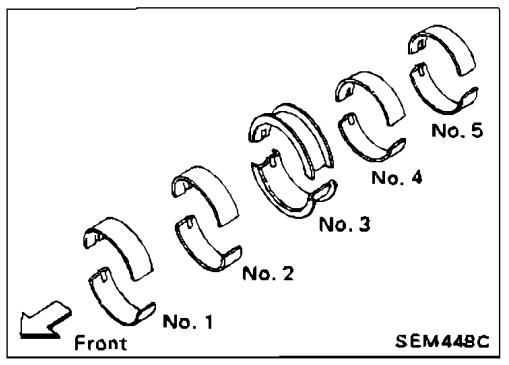
3. Set piston rings as shown.

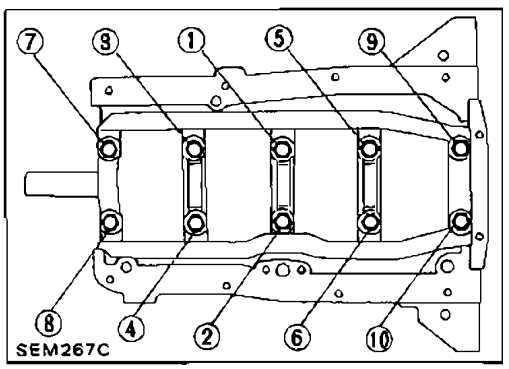


CRANKSHAFT

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.**

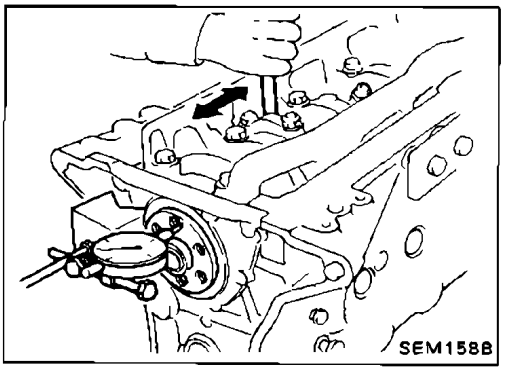




2. Install crankshaft and main bearing beam and tighten bolts to the specified torque.

- **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:

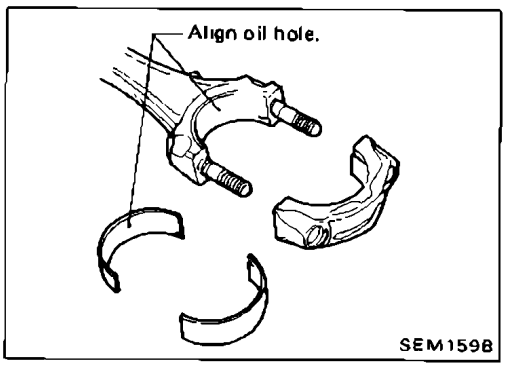
Standard

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.

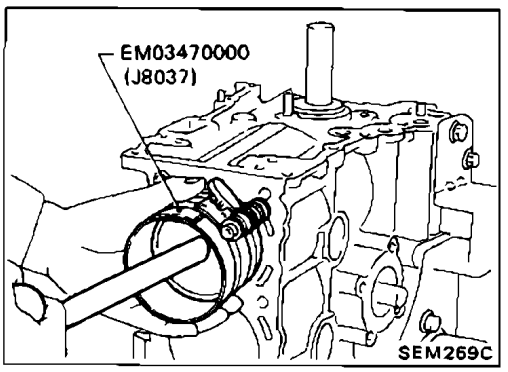


4. Install connecting rod bearings in connecting rods and connecting rod caps.

- Confirm that correct bearings are used.

Refer to "Inspection".

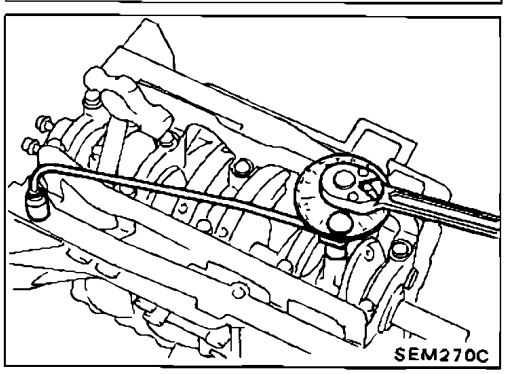
- Install bearings so that oil hole in connecting rod aligns with oil hole of bearing.



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.**

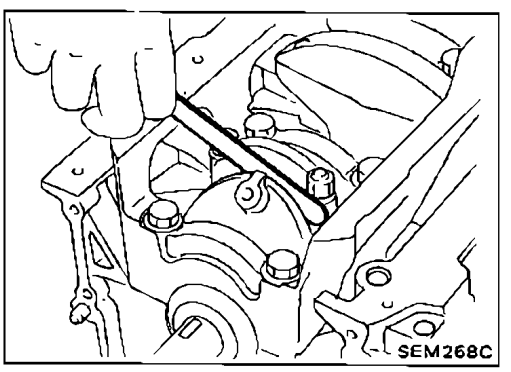


b. Install connecting rod bearing caps.
Tighten connecting rod bearing cap nuts to the specified torque.

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

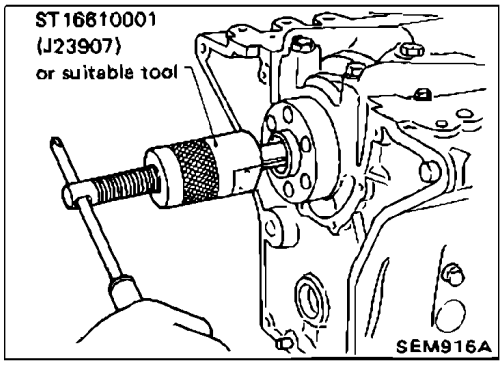
0.6 mm (0.024 in)

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

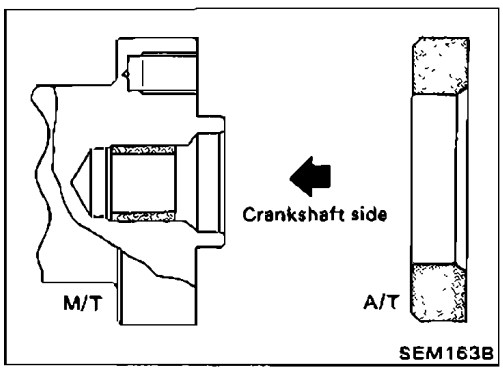
Assembly (Cont'd)

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

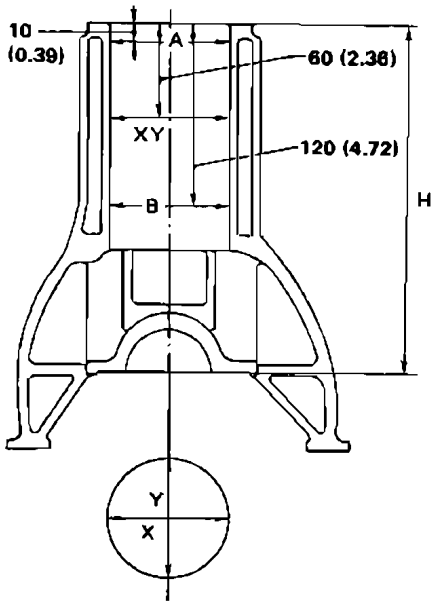
Engine model	KA24E
Cylinder arrangement	4, in-line
Displacement cm^3 (cu in)	2,389 (145.78)
Bore x stroke mm (in)	89 x 96 (3.50 x 3.78)
Valve arrangement	O.H.C.
Firing order	1-3-4-2
Number of piston rings	
Compression	2
Oil	1
Number of main bearings	5
Compression ratio	9.1

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

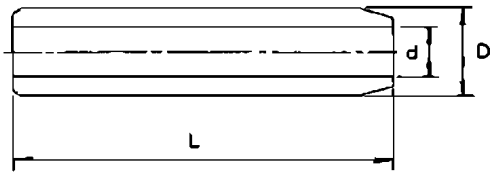
Unit: mm (in)

	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)

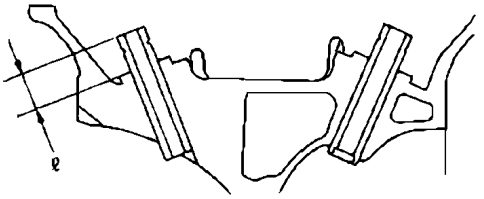
* Total amount of cylinder head resurfacing and cylinder block resurfacing

Inspection and Adjustment (Cont'd)

VALVE GUIDE



SEM571B



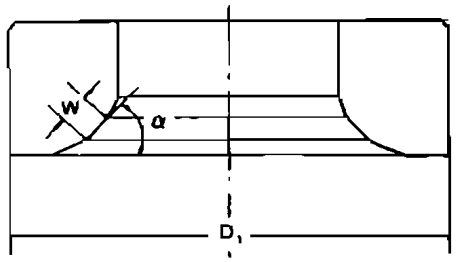
SEM225C

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)				–

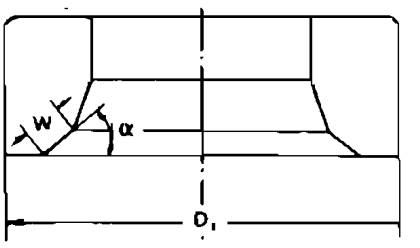
Inspection and Adjustment (Cont'd)

Standard



SEM177

Service



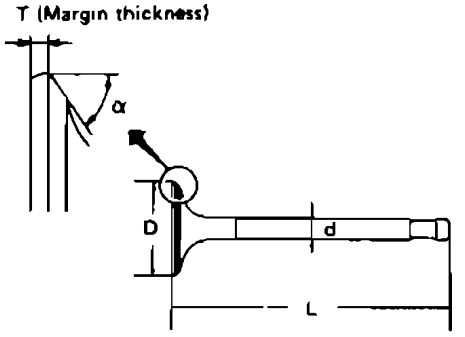
SEM178

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)	

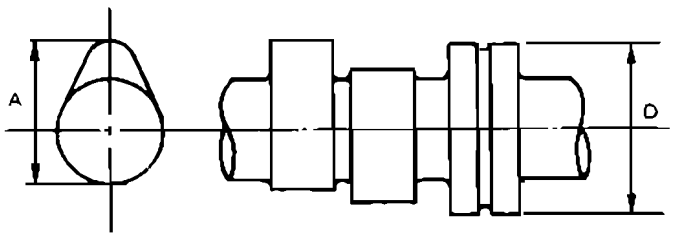
VALVE SPRING

Unit: mm (in)

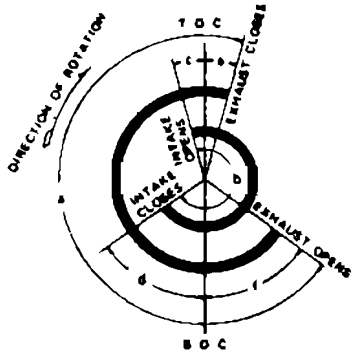
		Standard		Limit	
		Intake	Exhaust	Intake	Exhaust
Free height (H)	Outer	57.44 (2.2614)	53.21 (2.0949)	–	–
	Inner	53.34 (2.1000)	47.95 (1.8878)	–	–
Pressure N (kg, lb) at height	Outer	604.1 (61.6, 135.8) at 37.6 (1.480)	640.4 (65.3, 144.0) at 34.1 (1.343)	567.8 (57.9, 127.7) at 37.6 (1.480)	620.8 (63.3, 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)		10.4 (0.409)	–
Wear limit of cam height		–	0.2 (0.008)
Camshaft journal to bearing clearance		0.045 - 0.090 (0.0018 - 0.0036)	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

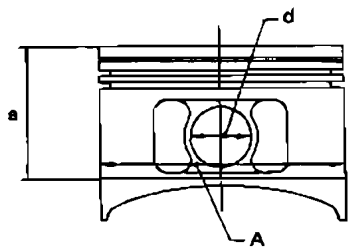
Unit: mm (in)

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)		20.987 - 20.999 (0.8263 - 0.8267)	
Piston-to-cylinder bore clearance		0.020 - 0.040 (0.0008 - 0.0016)	

Piston pin

Unit: mm (in)

	Standard	Limit
Piston pin outer diameter	20.989 - 21.001 (0.8263 - 0.8268)	–
Interference fit of piston pin to piston pin hole	0 - 0.004 (0 - 0.0002)	–
Piston pin to connecting rod bearing clearance	0.005 - 0.017 (0.0002 - 0.0007)	0.023 (0.0009)

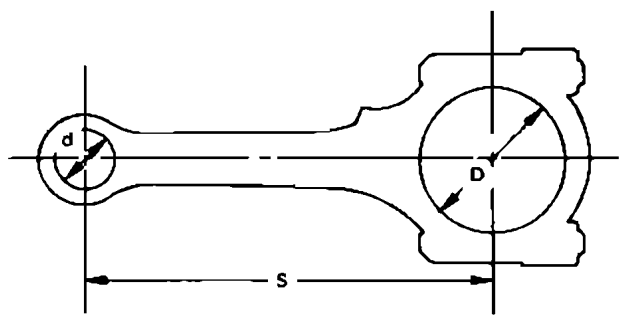
Piston ring

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)	0.1 (0.004)
Ring gap	Top	0.28 - 0.43 (0.0110 - 0.0169)	0.5 (0.020)
	2nd	0.45 - 0.60 (0.0177 - 0.0236)*1 0.55 - 0.70 (0.0217 - 0.0276)*2	0.5 (0.020)
	Oil (rail ring)	0.20 - 0.60 (0.0079 - 0.0236)	0.5 (0.020)

*1: R or T is punched on the ring.
*2: N is punched on the ring.

CONNECTING ROD



SEM570A

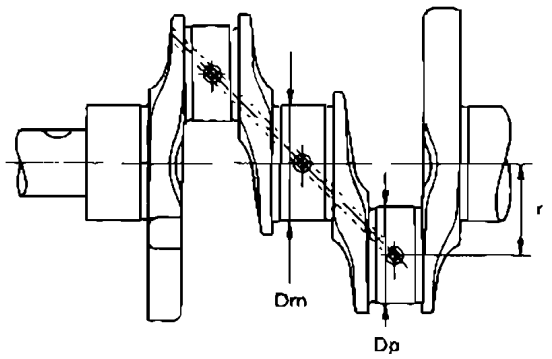
Unit: mm (in)

	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)
Piston pin bushing inner diameter (d)*	21.000 - 21.012 (0.8268 - 0.8272)	–
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)

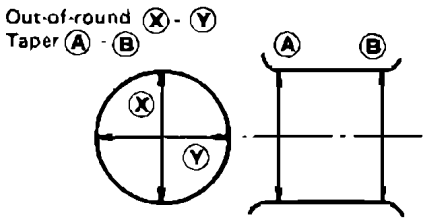
* Without bearing

Inspection and Adjustment (Cont'd)

CRANKSHAFT



SEM394



EM715

Unit: mm (in)

Main journal diameter (Dm)	Grade	No. 0	59.967 - 59.975 (2.3609 - 2.3612)
		No. 1	59.959 - 59.967 (2.3606 - 2.3609)
		No. 2	59.951 - 59.959 (2.3603 - 2.3606)
Pin journal diameter (Dp)	Grade	No. 0	49.968 - 49.974 (1.9672 - 1.9675)
		No. 1	49.962 - 49.968 (1.9670 - 1.9672)
		No. 2	49.956 - 49.962 (1.9668 - 1.9670)
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 roll		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

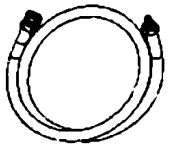
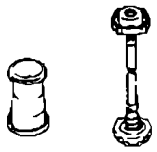
ENGINE LUBRICATION & COOLING SYSTEMS

SECTION LC

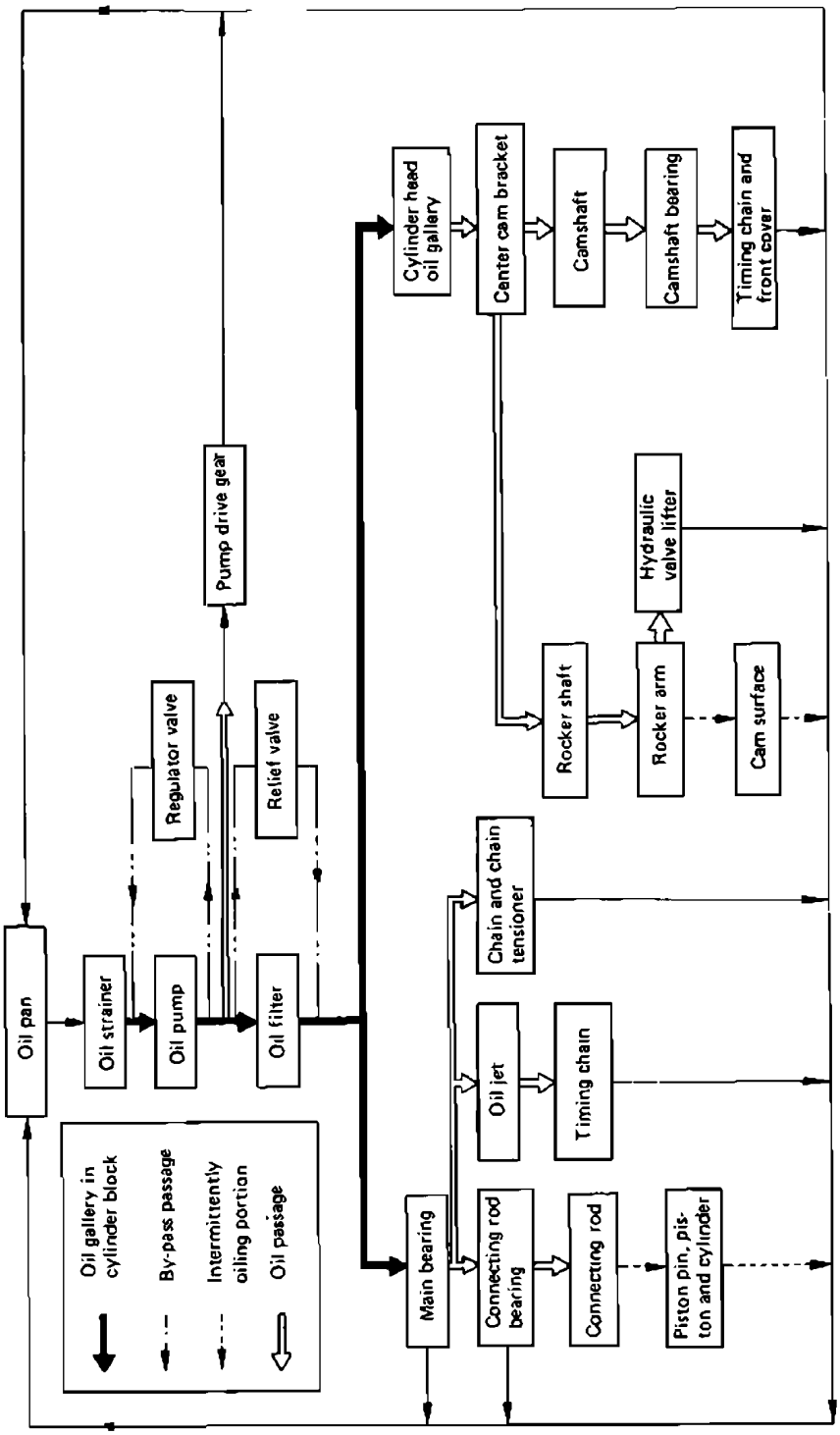
CONTENTS

PREPARATION ..... LC- 2
ENGINE LUBRICATION SYSTEM ..... LC- 3
ENGINE COOLING SYSTEM ..... LC- 7
CONDENSER FAN MOTOR ELECTRICAL CIRCUIT LC-12
SERVICE DATA AND SPECIFICATIONS (S.D.S.) LC-16

SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.) Tool name	Description	
ST25051001 (J25695-1) Oil pressure gauge		
ST25052000 (J25695-2) Hose		Adapting oil pressure gauge to cylinder block
EG17650301 (–) Radiator cap tester adapter		Adapting radiator cap tester to radiator filler neck

Lubrication Circuit

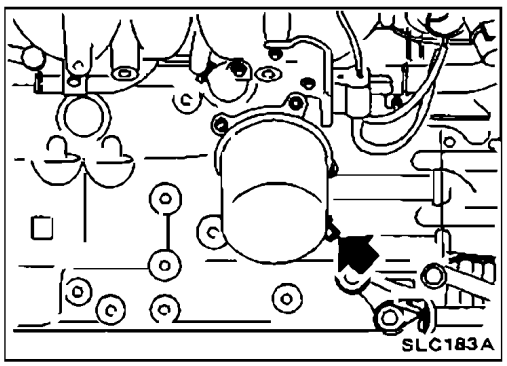


SLC182A

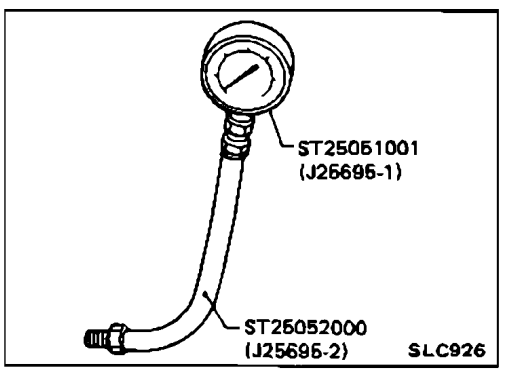
Oil Pressure Check

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.



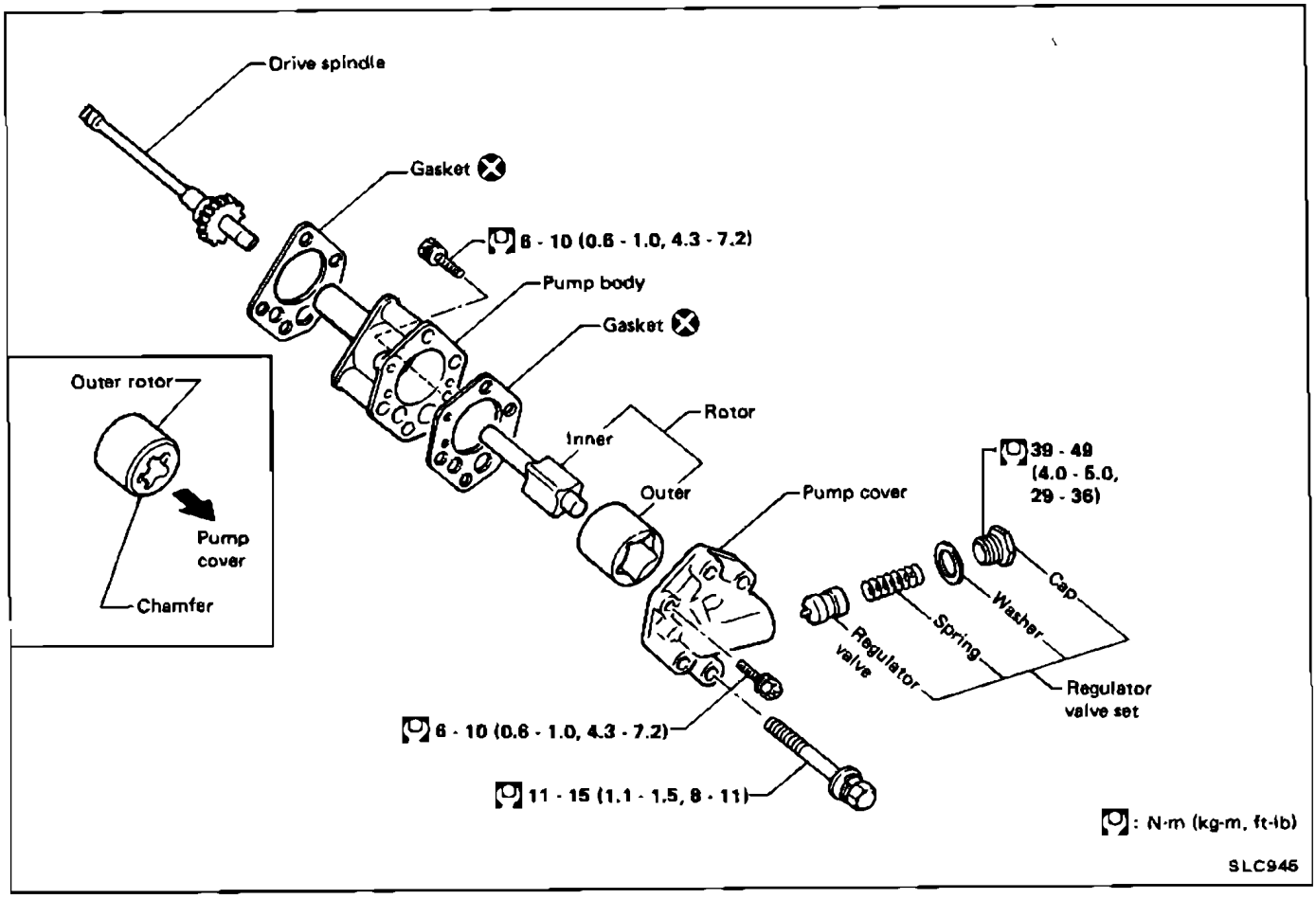
3. Install pressure gauge.
4. Start engine and warm it up to normal operating temperature.
5. Check oil pressure with engine running under no-load.

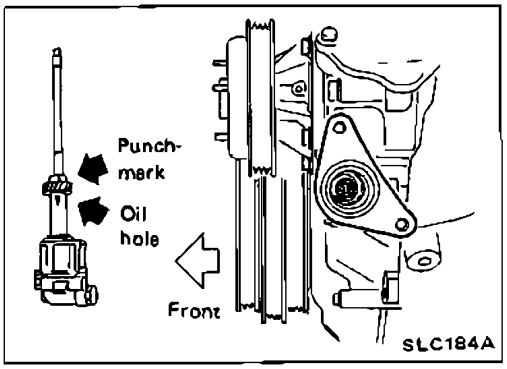
Engine rpm	Approximate discharge pressure kPa (kg/cm^2, psi)
Idle speed	More than 78 (0.8, 11)
3,000	412 - 481 (4.2 - 4.9, 60 - 70)

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

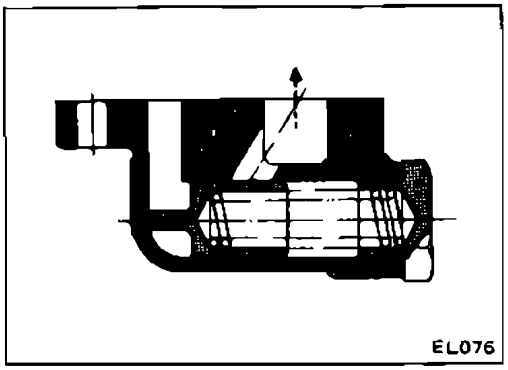
6. Install oil pressure switch with sealant.

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.**



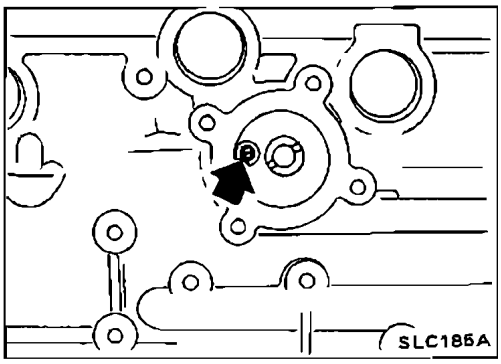
REGULATOR VALVE INSPECTION

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.

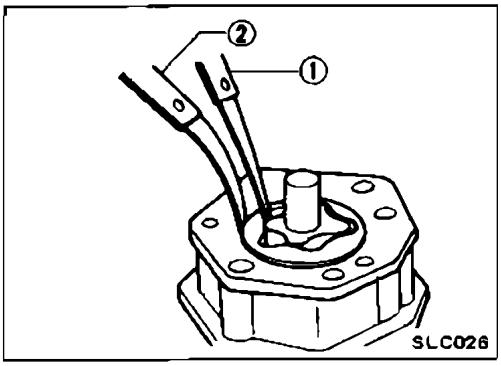
Oil Pump (Cont'd)

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.

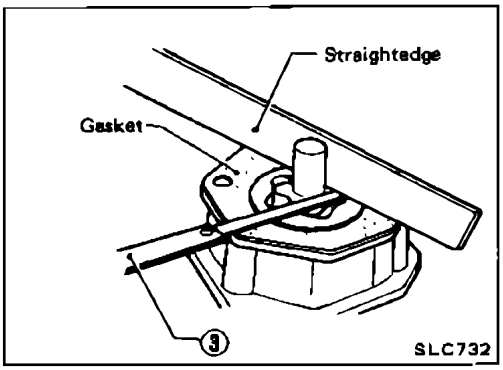
OIL PUMP INSPECTION



Using a feeler gauge, check the following clearance.

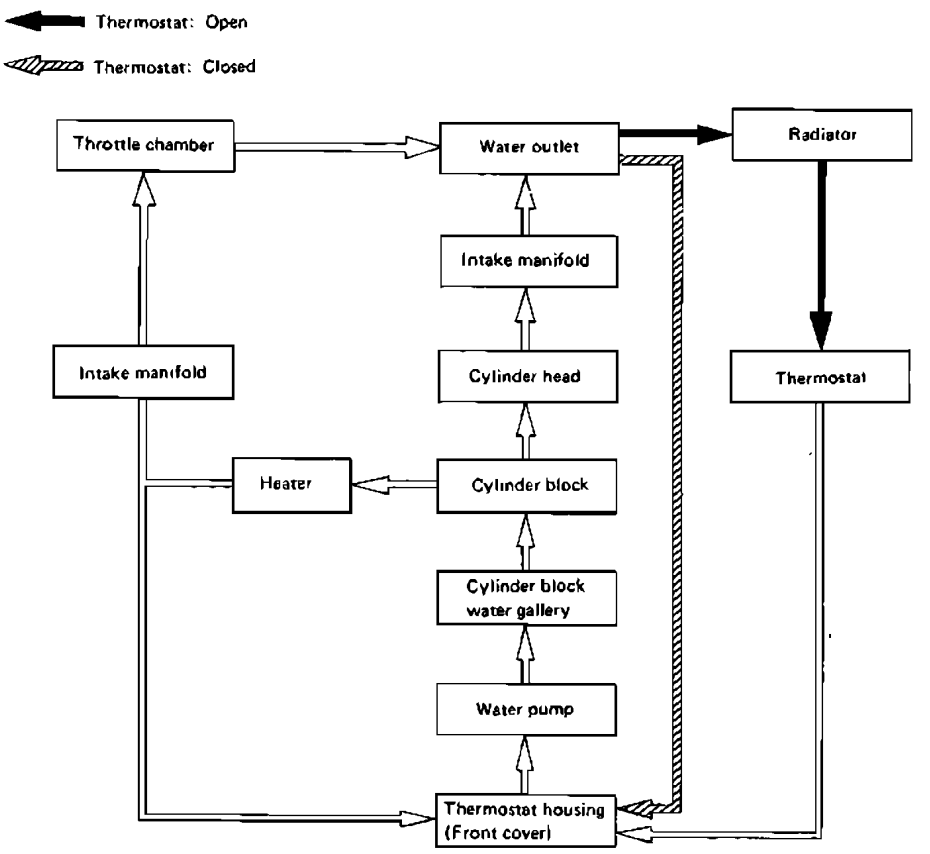
Unit: mm (in)

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



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.

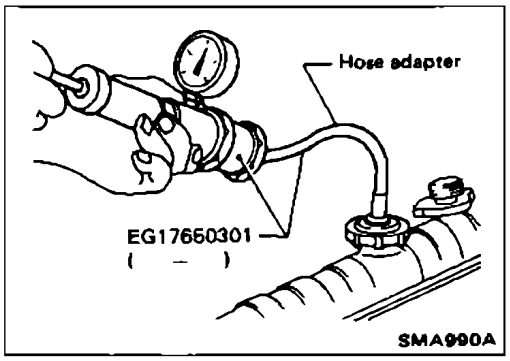
Wrap a thick cloth around cap and carefully remove the cap by turning it a quarter turn to allow built-up pressure to escape and then turn the cap all the way off.

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

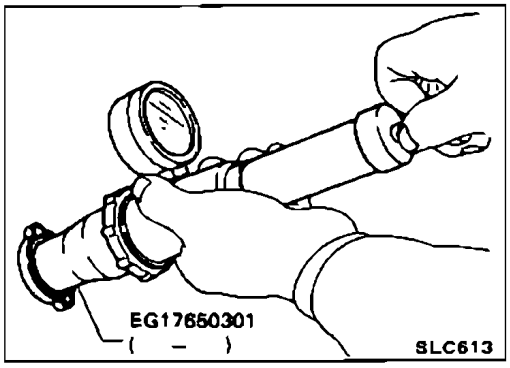


To check for leakage, apply pressure to the cooling system with a tester.

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

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

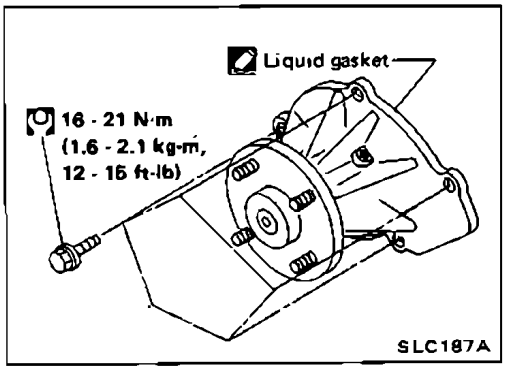
CHECKING RADIATOR CAP



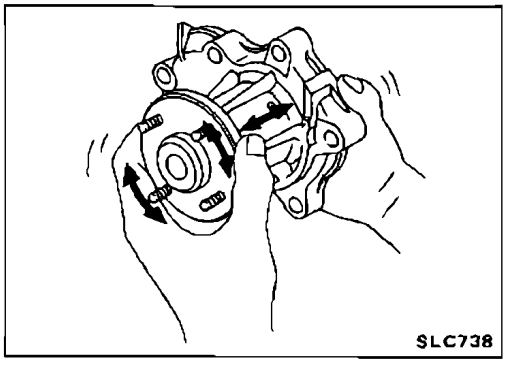
To check radiator cap, apply pressure to cap with a tester.

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

Water Pump

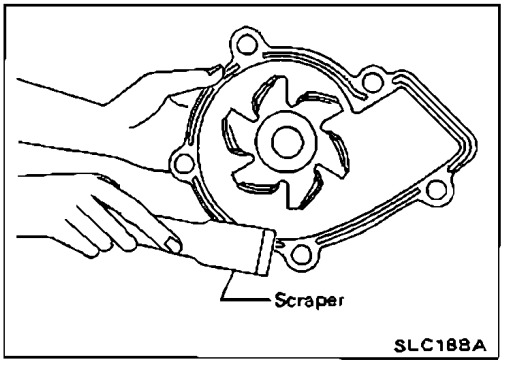


INSPECTION



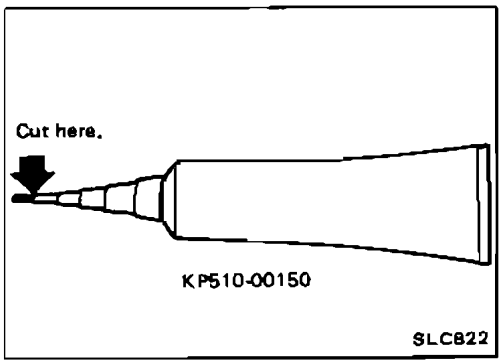
Check for excessive end play and rough operation.

INSTALLATION

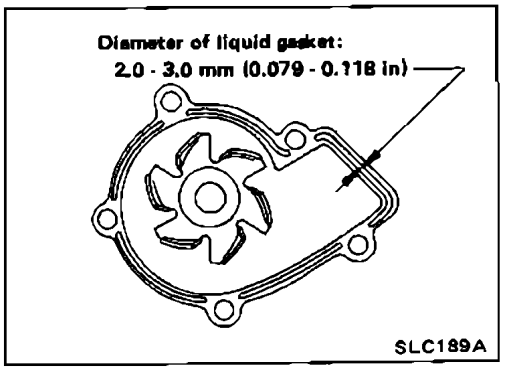


- Remove liquid gasket from mating surface of pump housing using a scraper.
  Be sure liquid gasket in grooves is also removed.
- Remove liquid gasket from mating surface of cylinder block.
- Clean all traces of liquid gasket using white gasoline.

Water Pump (Cont'd)



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

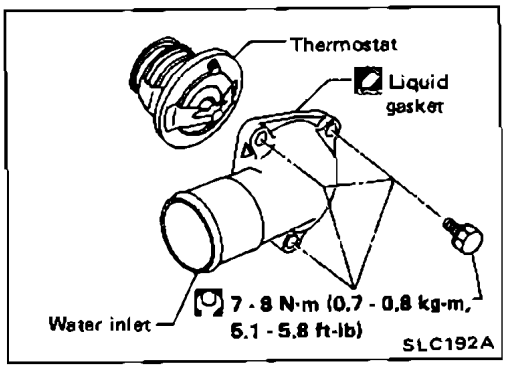


- Apply a continuous bead of liquid gasket to mating surface of pump housing as shown.

a. Be sure diameter of liquid gasket is within 2.0 to 3.0 mm (0.079 to 0.118 in) dia. range.

b. Attach pump housing to cylinder block within five minutes of applying liquid gasket.

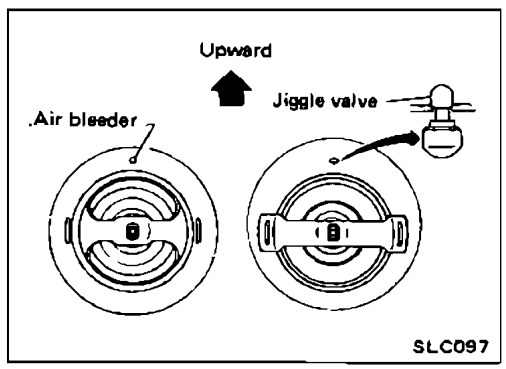
c. After installing pump housing, wait at least 30 minutes before starting engine.



Thermostat

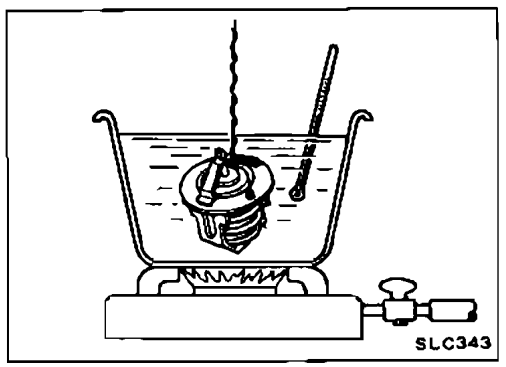
INSPECTION

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)

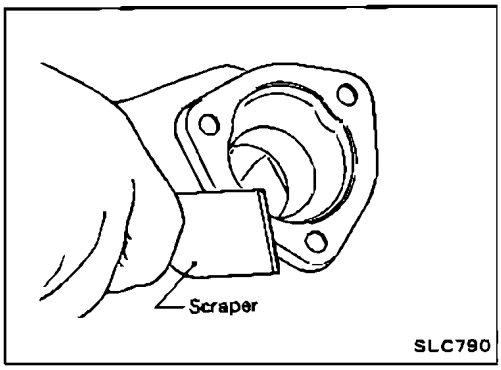


3. Then check if valve closes at 5°C (9°F) below valve opening temperature.

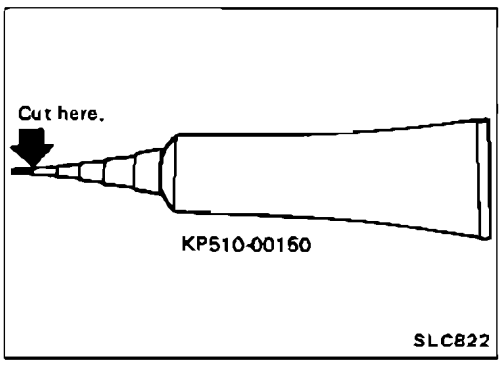
- **After installation, run engine for a few minutes, and check for leaks.**

Thermostat (Cont'd)

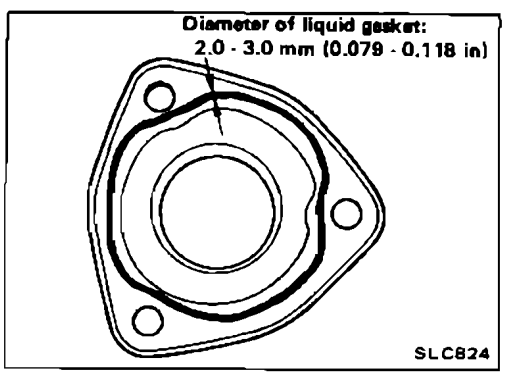
INSTALLATION



- 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.



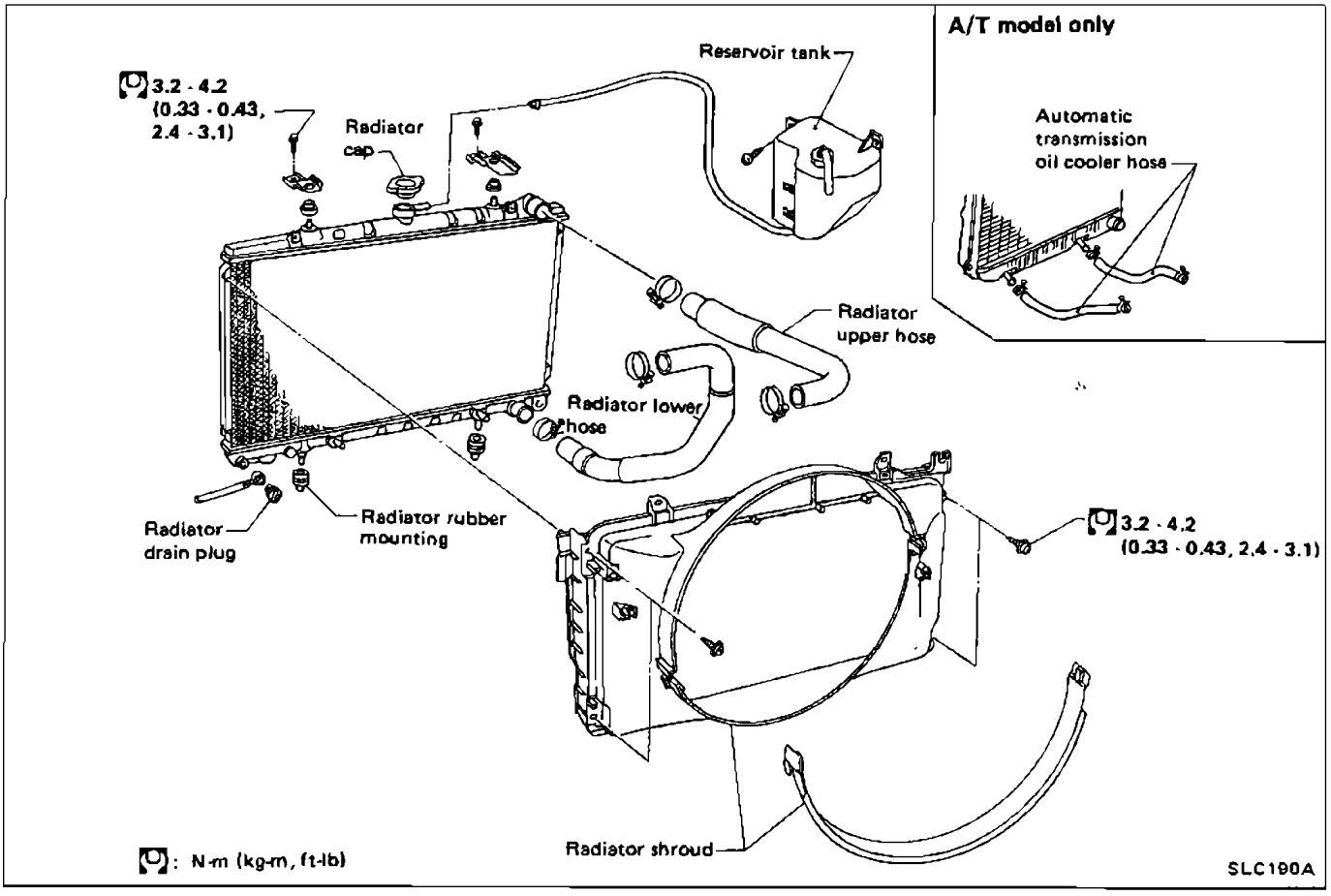
- Cut off tip of nozzle of liquid gasket tube at point shown in figure.
- Use Genuine Liquid Gasket or equivalent.



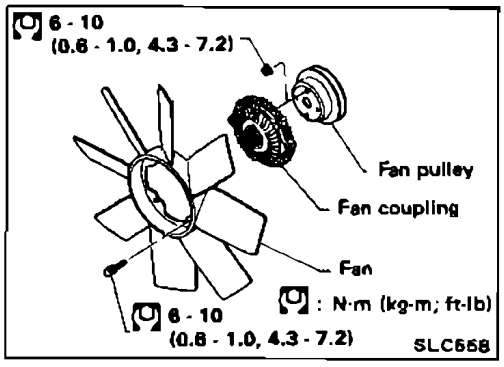
- Apply a continuous bead of liquid gasket to mating surface of water inlet.

a. **Be sure diameter of liquid gasket is within 2.0 to 3.0 mm (0.079 to 0.118 in).**
b. **Attach water inlet to cylinder block within five minutes after applying liquid gasket.**
c. **After installing water inlet, wait at least 30 minutes before refilling coolant and starting engine.**

Radiator

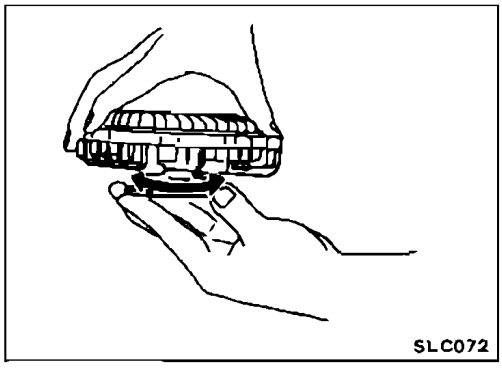


CAUTION:
When filling radiator with coolant, refer to MA section.



Cooling Fan

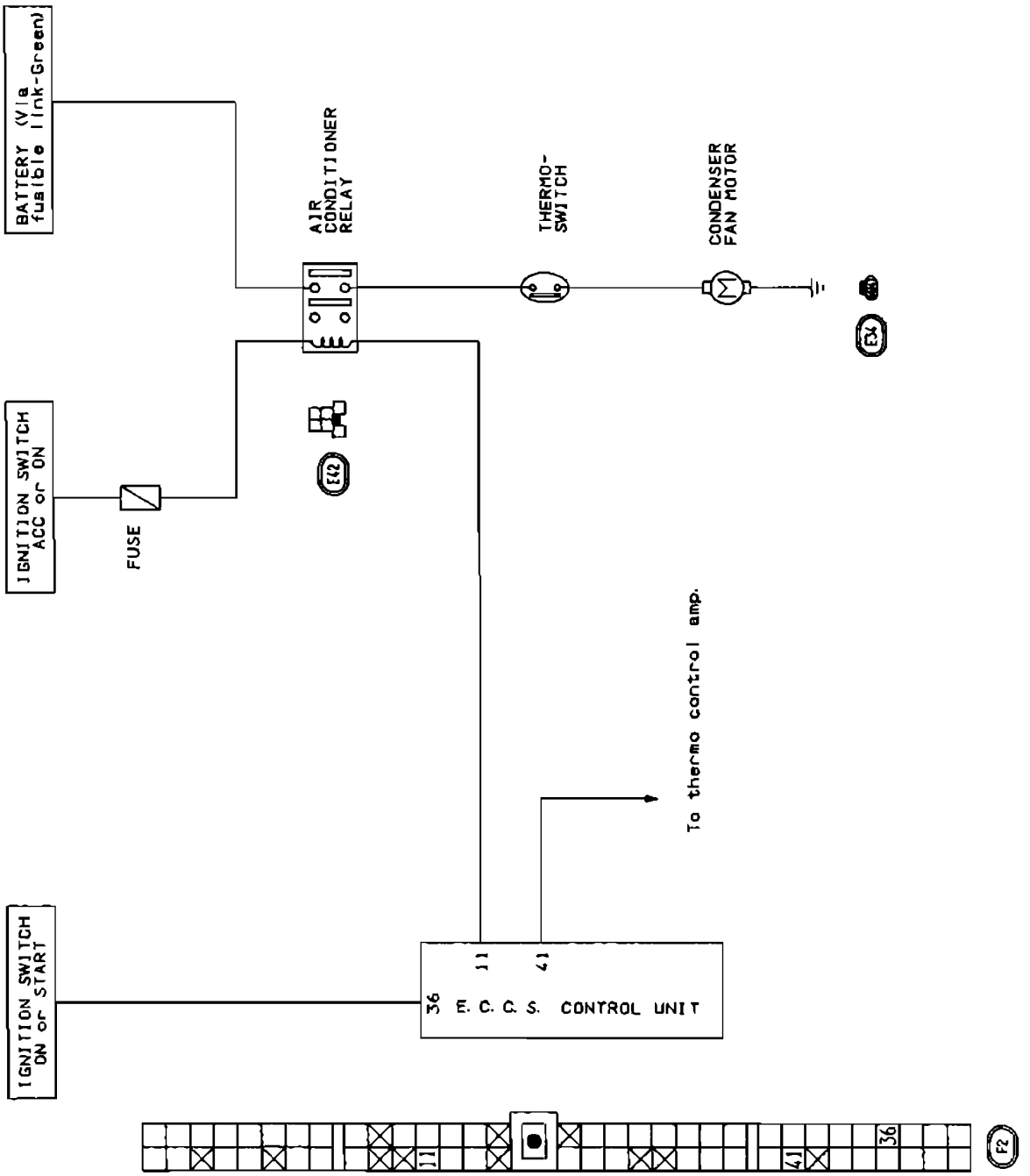
DISASSEMBLY AND ASSEMBLY



INSPECTION

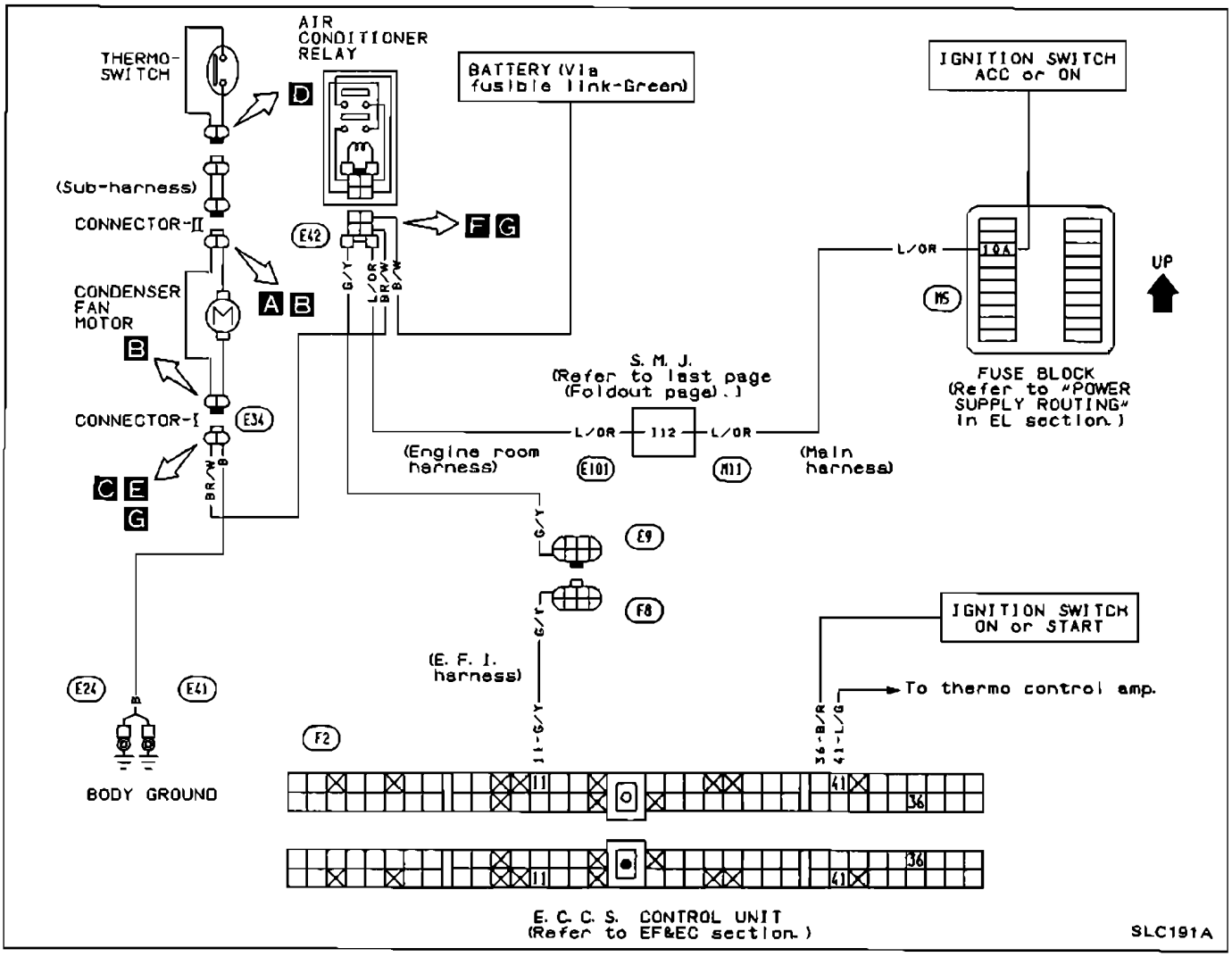
Check fan coupling for rough operation, oil leakage or bent bimetal.

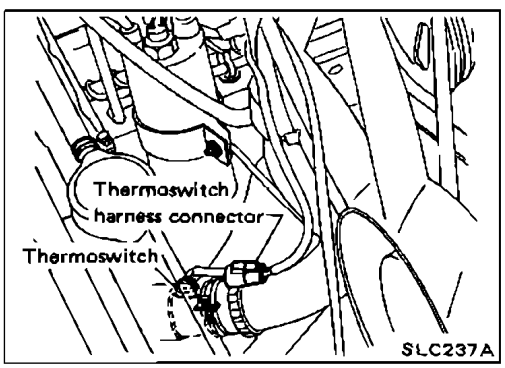
Schematic

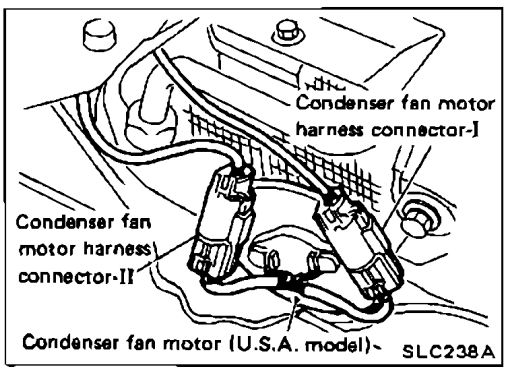


SLC236A

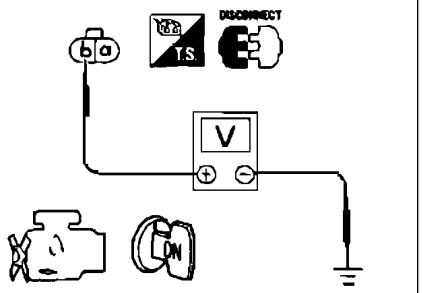
Wiring Diagram





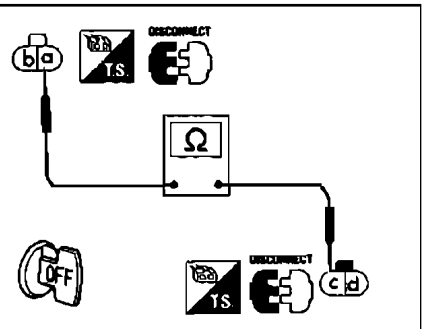


A



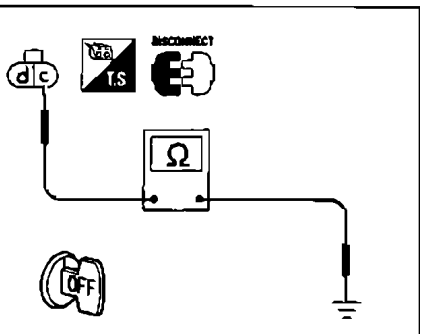
SLC239A

B



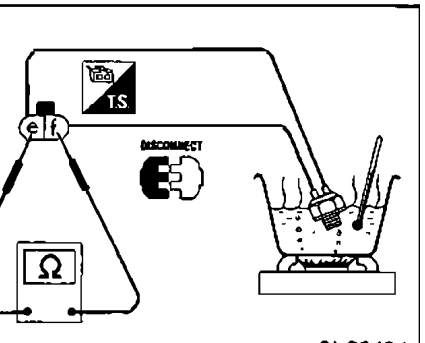
SLC240A

C



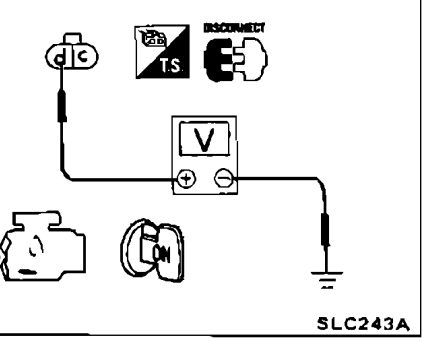
SLC241A

D



SLC242A

E



SLC243A

Trouble Diagnosis

Even though air conditioner operates normally under high engine temperature conditions [above 98°C (208°F)] the condenser fan motor does not rotate.

A

CHECK POWER SUPPLY (Motor side).
1) Disconnect condenser fan motor harness connector-II.
2) Turn ignition switch, air conditioner switch and blower switch "ON".
3) Check voltage between fan motor harness connector-II terminal ⓑ and ground.

Battery voltage should exist.

O.K. → **B**

N.G. → **E**

B

CHECK CONDENSER FAN MOTOR.
1) Turn ignition and air conditioner switch "OFF".
2) Disconnect condenser fan motor harness connector-I.
3) Check continuity between connector-II terminal ⓐ and connector-I terminal ⓒ.

Continuity should exist.

If N.G. replace condenser fan motor.

O.K. → **C**

C

CHECK GROUND CIRCUIT.
Check harness continuity between motor harness connector-I terminal ⓒ and ground.

Continuity should exist.

If N.G., repair harness.

O.K. → **D**

D

CHECK THERMOSWITCH.
Check continuity between thermoswitch terminals ⓔ and ⓕ.

Condition	Continuity
Above 92 - 98°C (198 - 208°F)	Yes
Below 92 - 98°C (198 - 208°F)	No

O.K.

Check sub-harness for thermoswitch continuity. If N.G., repair or replace them.

E

CHECK POWER SUPPLY (Motor side).
1) Turn ignition switch "OFF"
2) Disconnector fan motor harness connector-I.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓓ and ground.

Battery voltage should exist.

O.K.

Repair or replace harness between terminals ⓑ and ⓓ.

N.G. → **F**

F

CHECK POWER SUPPLY (Relay side).
1) Turn ignition "OFF".
2) Disconnect air conditioner relay.
3) Turn ignition "ON".
4) Check voltage between terminals ②, ⑥ and ground.

Battery voltage should exist.

⑥ is N.G.

Check the followings:
- Harness continuity between terminal ⑥ and battery ⊕ terminal.
- "G" fusible link

If N.G. replace them.

O.K.

CHECK RELAY.
Refer to HA section.

② is N.G.

Check the followings:
- Harness continuity between terminal ② and battery ⊕ terminal
- Fuse
- Ignition switch

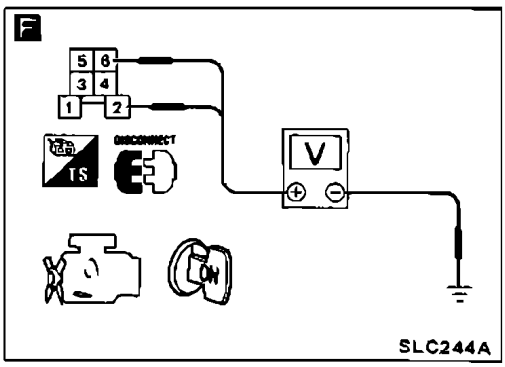
O.K. → ⊕

N.G.

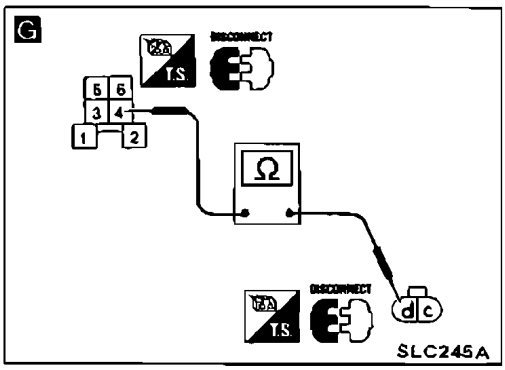
Replace relay.

Trouble Diagnosis (Cont'd)

F



G



O.K.

G

CHECK HARNESS CONTINUITY.
1) Turn ignition switch "OFF".
2) Check continuity between relay harness connector terminal ④ and fan motor harness connector-I terminal ⓓ.

Continuity should exist.

N.G. → **Repair or replace harness or connectors between terminals ④ and ⓓ.**

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
ENGINE AND EMISSION CONTROL OVERALL SYSTEM ..... EF & EC- 4
ENGINE AND EMISSION CONTROL PARTS DESCRIPTION ..... EF & EC- 9
ENGINE AND EMISSION CONTROL SYSTEM DESCRIPTION ..... EF & EC- 16
IDLE SPEED/IGNITION TIMING/IDLE MIXTURE RATIO INSPECTION ..... EF & EC- 26
TROUBLE DIAGNOSES ..... EF & EC- 31
FUEL INJECTION CONTROL SYSTEM INSPECTION ..... EF & EC-153
EVAPORATIVE EMISSION CONTROL SYSTEM ..... EF & EC-155
CRANKCASE EMISSION CONTROL SYSTEM ..... EF & EC-157
SERVICE DATA AND SPECIFICATIONS (S.D.S.) ..... EF & EC-158

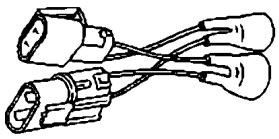
When you read wiring diagrams:

- **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".

E.C.C.S. Wiring Diagram — See pull-out following EL section.

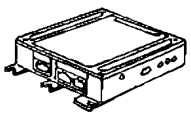
SPECIAL SERVICE TOOL

Tool number (Kent-Moore No.) Tool name	Description	
EG11160000 (—) Ignition coil adapter harness		Measuring engine speed

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.
- Do not apply undue force to mounting bracket.
- Before connecting or disconnecting E.C.U. connector, make sure red and green LEDs are off after turning ignition key off.
- Always install the properly specified E.C.U. on car; otherwise, erroneous engine operation may result.
- Disconnect connector by pulling it (not the harness) straight out.
- Before connecting connector, make sure all pins are straight.

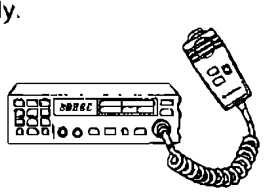
WIRELESS EQUIPMENT
- When installing a C.B. ham radio or a mobile phone, be sure to observe the following, as installation location may affect the electronic control systems.

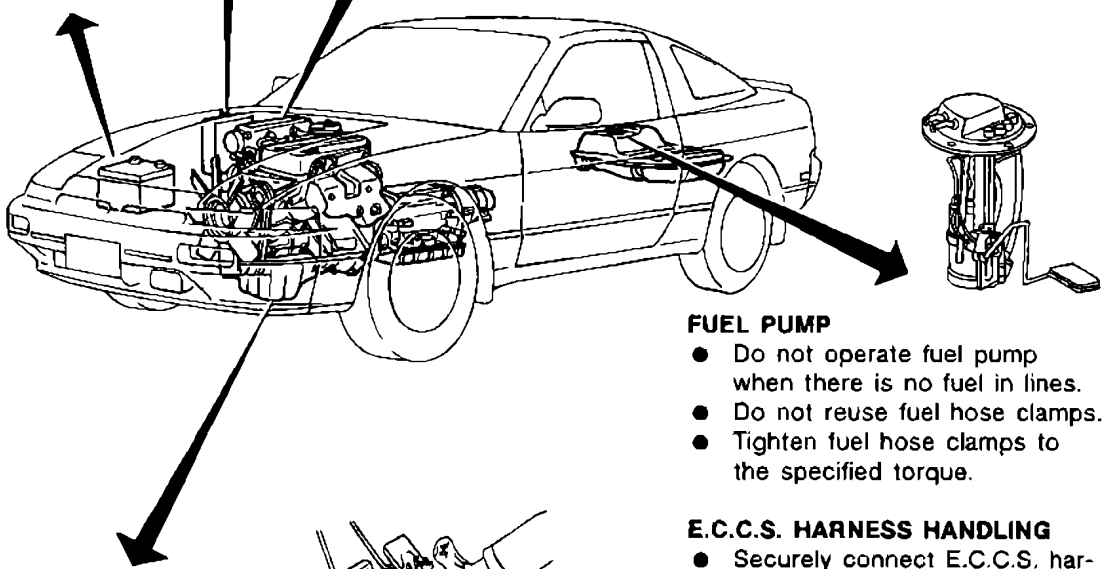
1) Keep antenna as far as possible away from electronic control units.
2) Keep antenna feeder line more than 20 cm (7.9 in) away from harness of electronic controls. Do not let them run parallel for a long distance.
3) Adjust antenna and feeder line so that standing-wave ratio can be kept smaller.
4) Be sure to ground radio to vehicle body.



BATTERY
- Always use a 12 volt battery as a power source.
- Do not disconnect battery cables while the engine is running.
- Do not reverse polarity of battery when connecting it. Otherwise, E.C.U. and/or injectors may be burned.

INJECTOR
- Do not disconnect injector harness connectors with engine running.
- Do not apply battery power directly to injectors; otherwise injectors will be damaged.





FUEL PUMP
- Do not operate fuel pump when there is no fuel in lines.
- Do not reuse fuel hose clamps.
- Tighten fuel hose clamps to the specified torque.

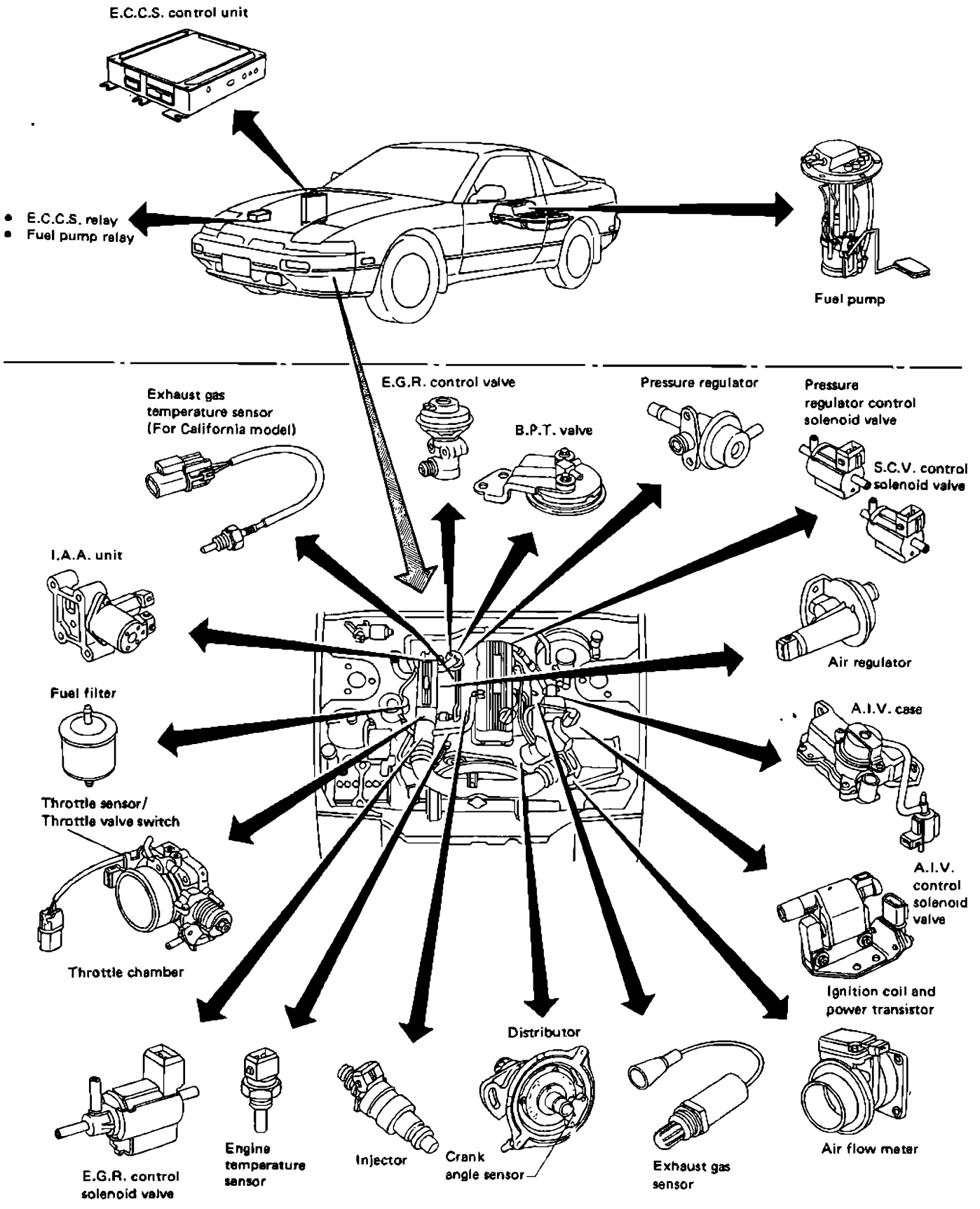
E.C.C.S. PARTS HANDLING
- Handle air flow meter carefully to avoid damage.
- Do not disassemble air flow meter.
- Do not clean air flow meter with detergent.
- Do not jolt or jar the crank angle sensor.

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.

E.C.C.S. HARNESS HANDLING
- Securely connect E.C.C.S. harness connectors.
  A poor connection can cause extremely high voltage to develop in the coil and condenser, 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.

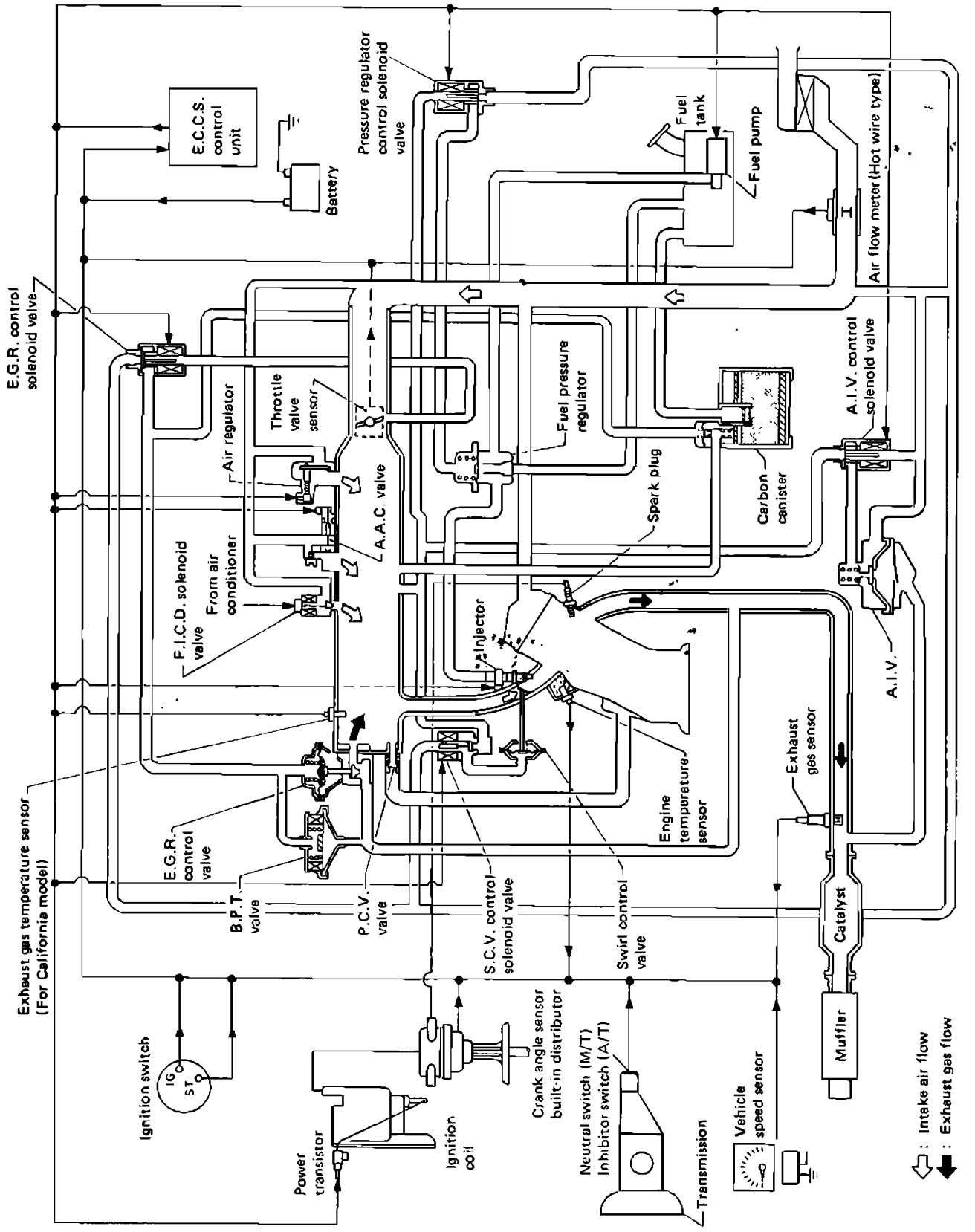
SEF121H

E.C.C.S. Component Parts Location



SEF122H

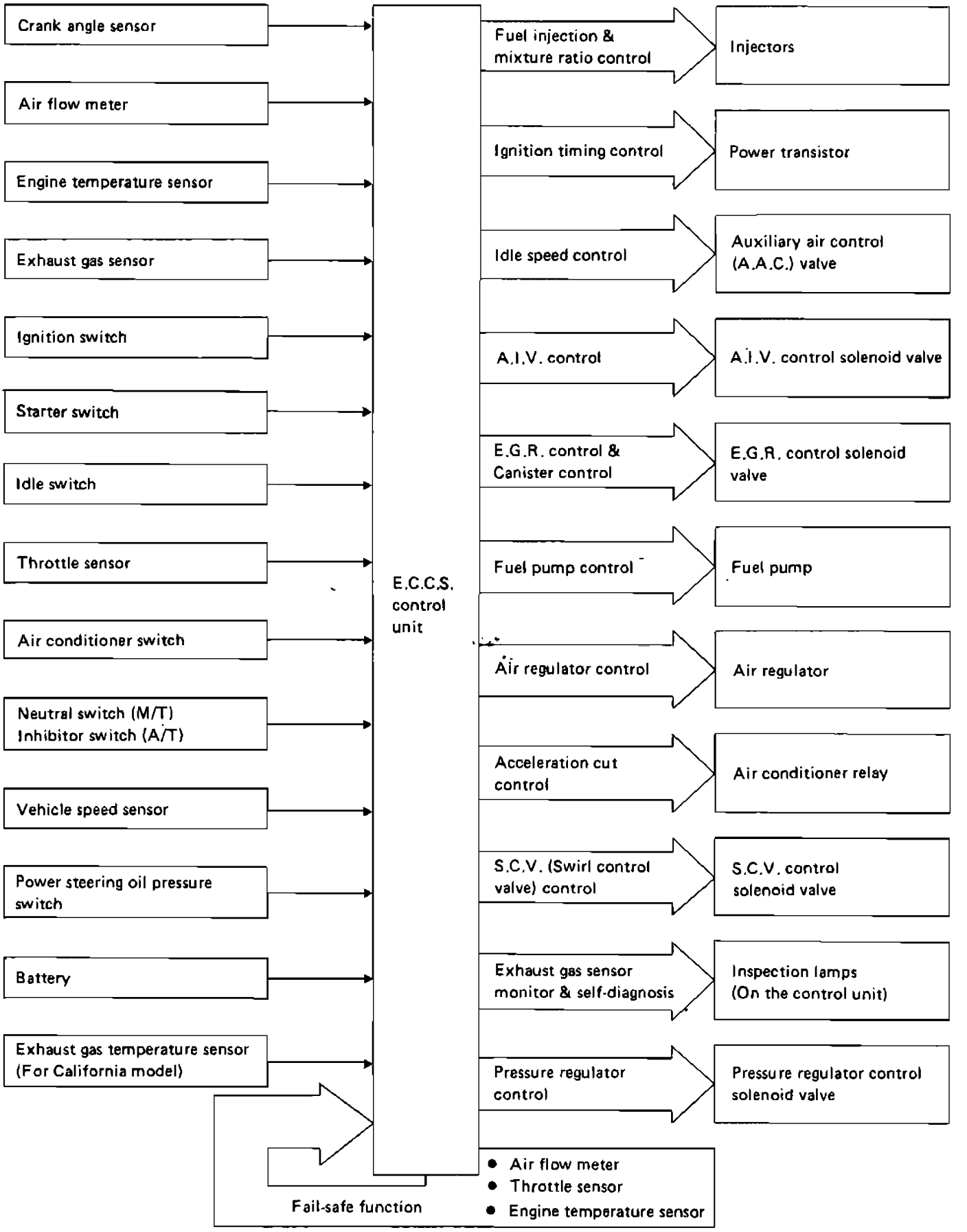
System Diagram



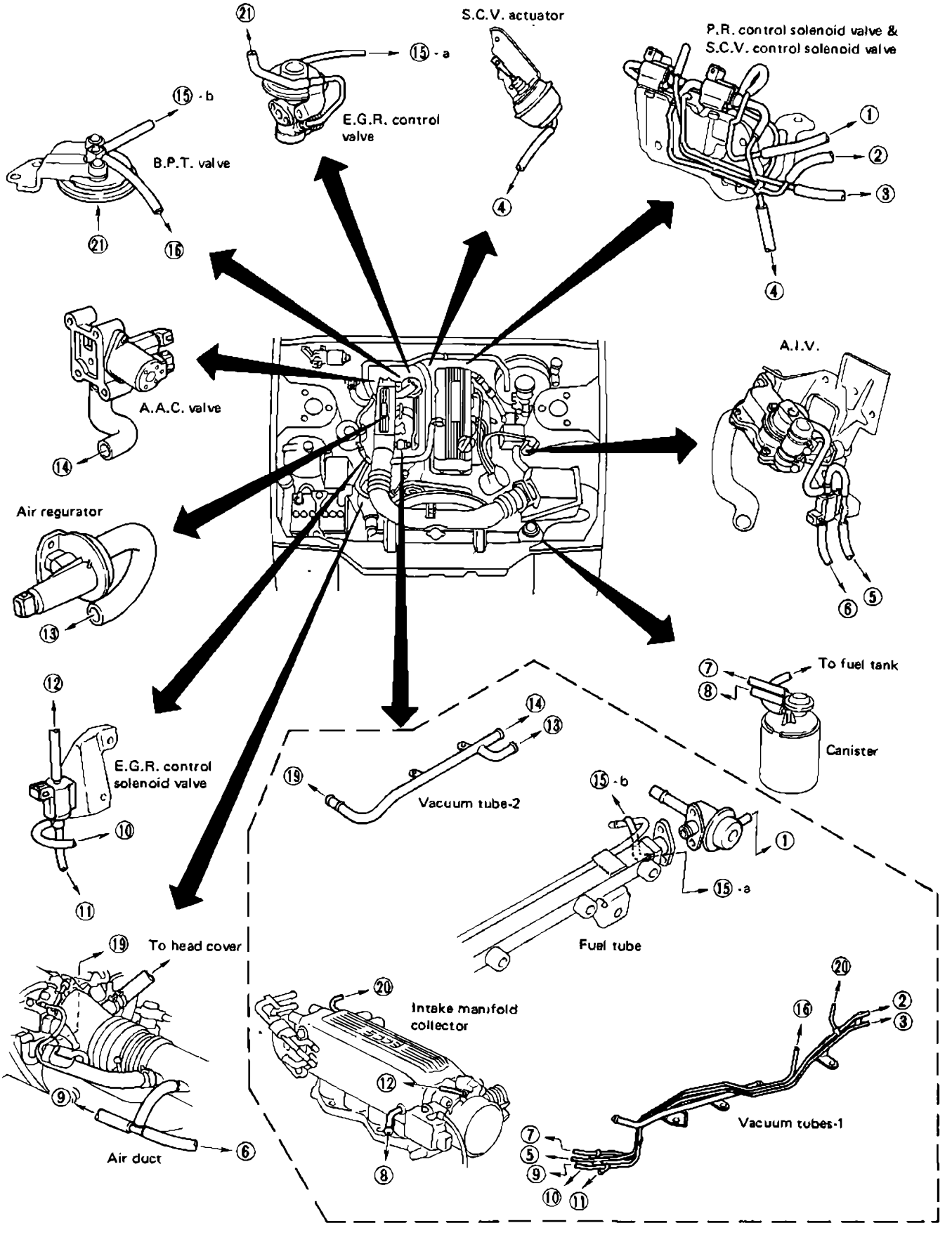
SEF123H

System Chart

E.C.C.S. CONTROL SYSTEM

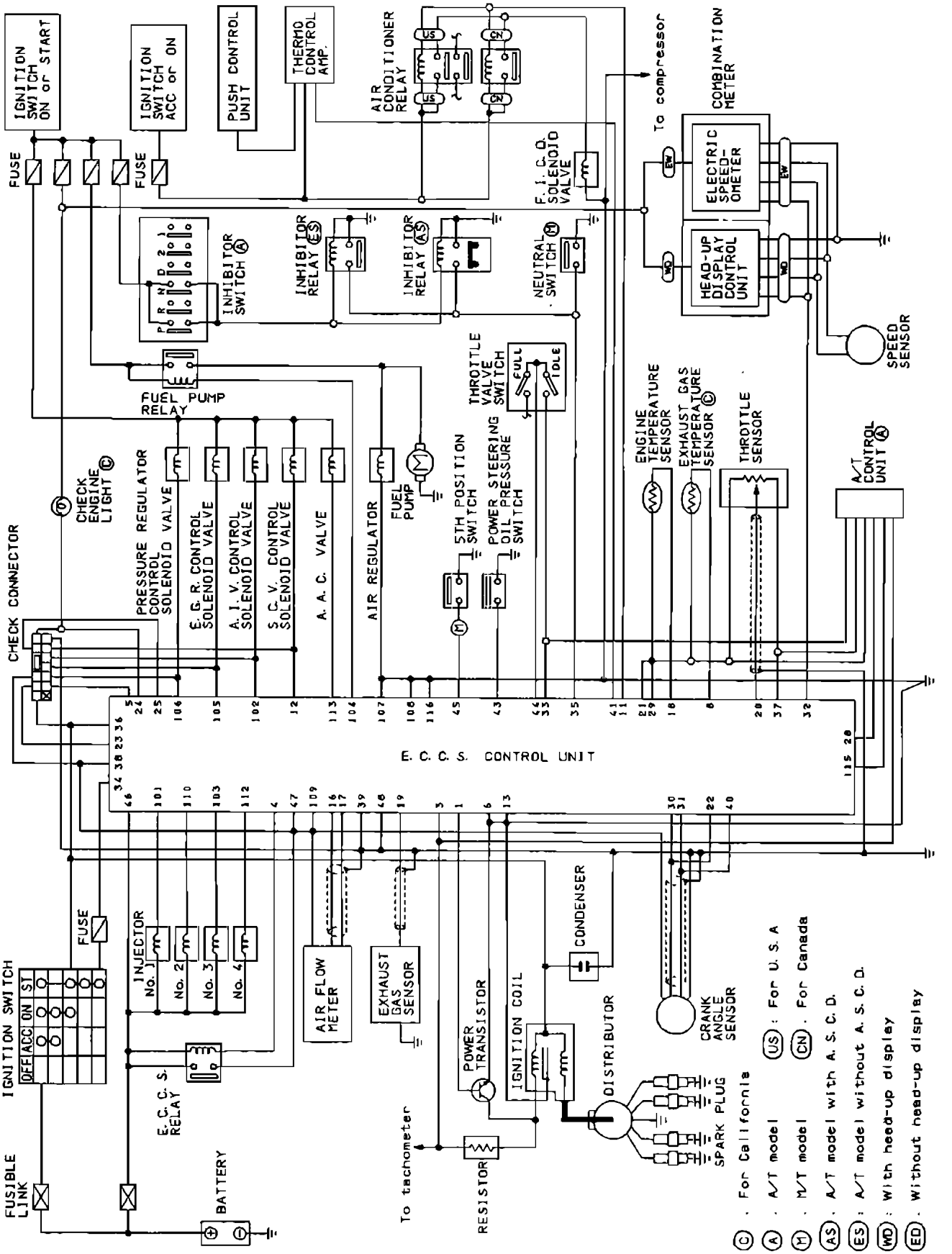


Vacuum Hose Drawing



Circuit Diagram

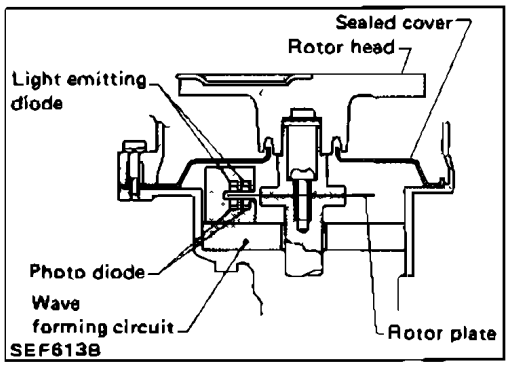
(For Wiring Diagram — see pull-out following page EL-118.)



SEF307H

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.

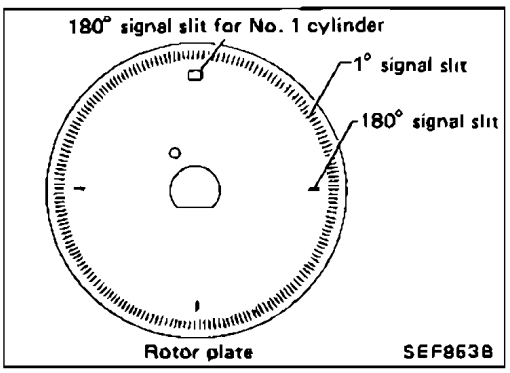


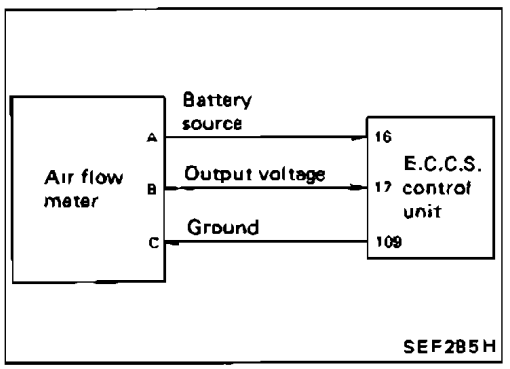
Crank Angle Sensor

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.

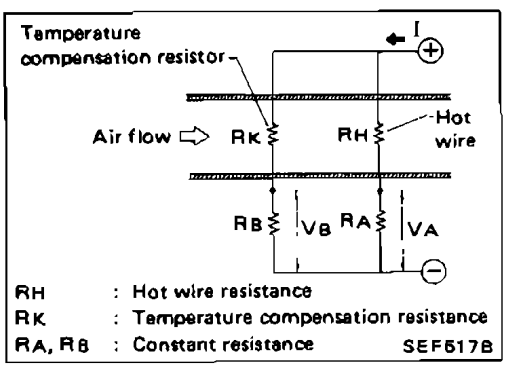


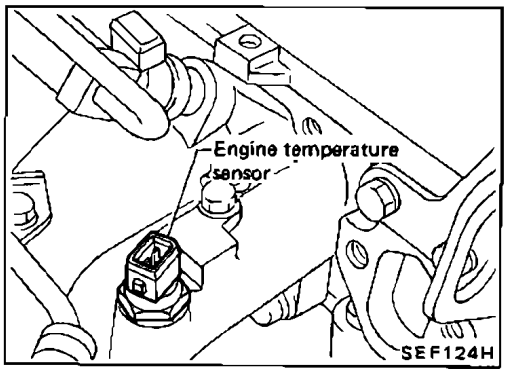


Air Flow Meter

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.

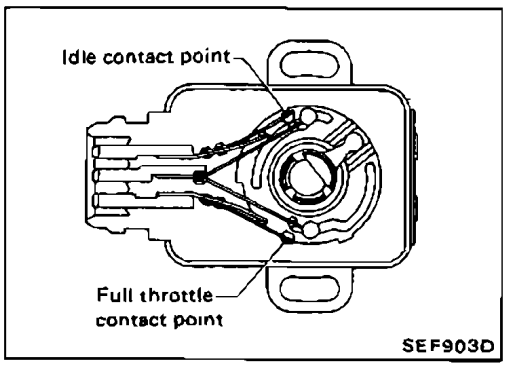
The airflow past the hot wire removes the heat from the hot wire. The temperature of the hot wire is very sensitive to the mass flow rate. The higher the temperature of the hot wire, the greater its resistance value. This temperature change (resistance) is determined by the mass air flow rate. The control 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.





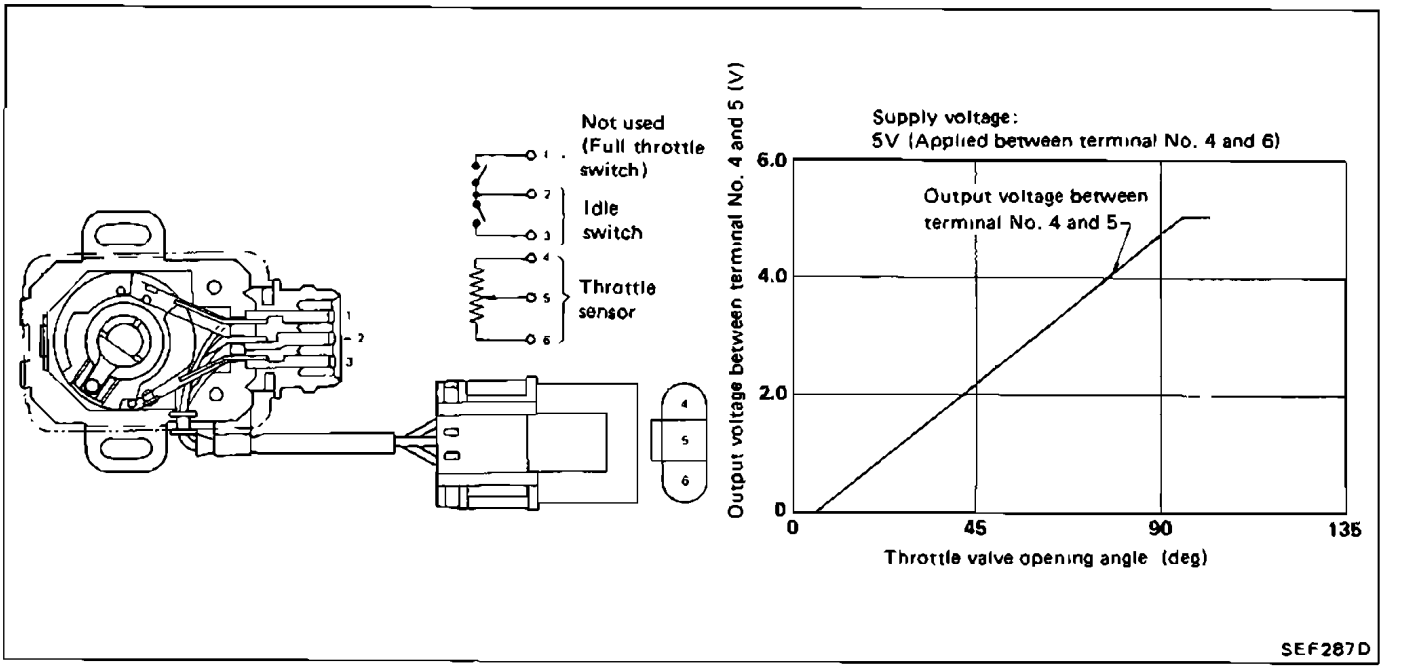
Engine Temperature Sensor

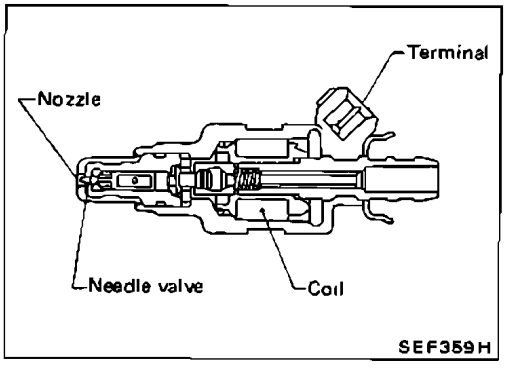
The engine temperature sensor detects the engine temperature, which is dependent on engine coolant temperature, and transmits a signal to the E.C.U.
The temperature sensing unit employs a thermistor which is sensitive to the change in temperature. Electrical resistance of the thermistor decreases in response to the temperature rise.



Throttle Sensor & Soft/Hard Idle Switch

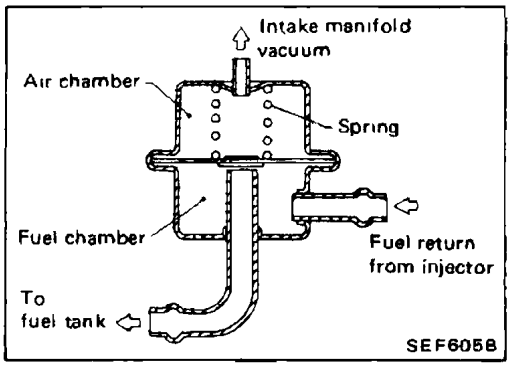
The throttle sensor responds to the accelerator pedal movement. This sensor is a kind of potentiometer which transforms the throttle valve position into output voltage, and emits the voltage signal to the E.C.U. In addition, the sensor detects the opening and closing speed of the throttle valve and feeds 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" and 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.





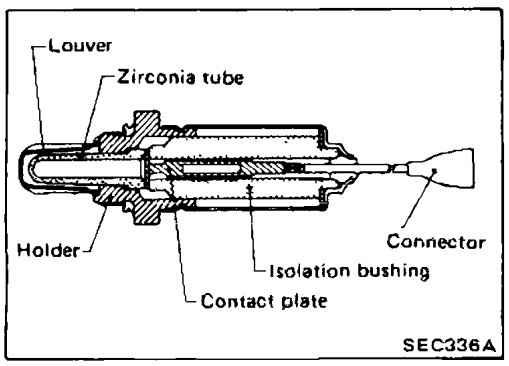
Fuel Injector

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 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.



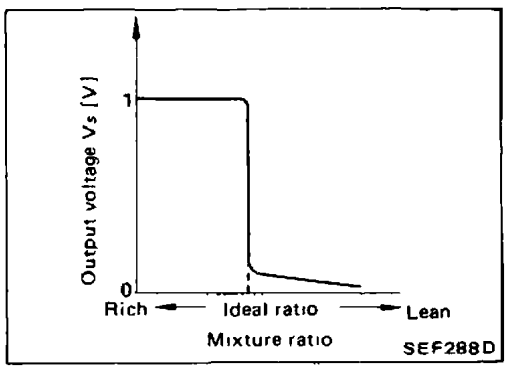
Pressure Regulator

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.



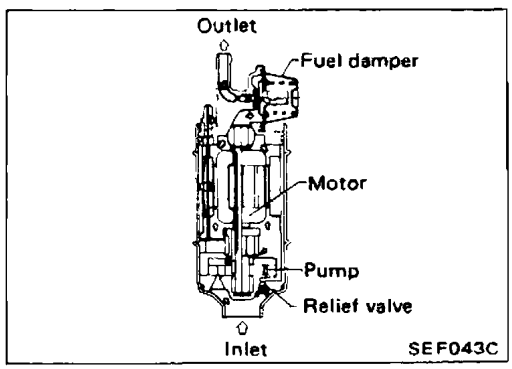
Exhaust Gas Sensor

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.



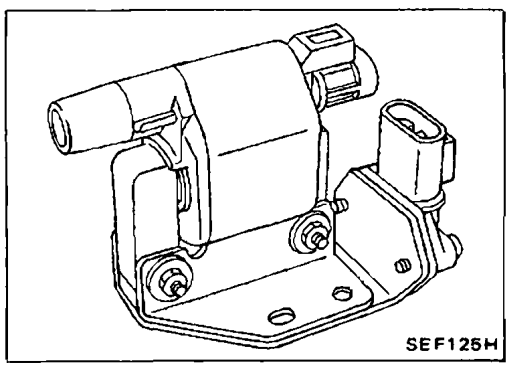
Fuel Pump

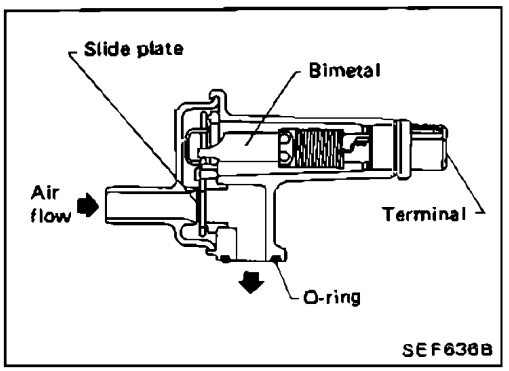
The fuel pump with a fuel damper is a submergible type, and are located in the fuel tank.



Power Transistor

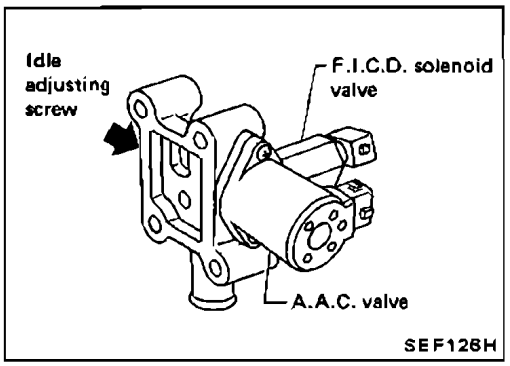
The ignition signal from the E.C.U. is amplified by the power transistor, which turns the ignition coil primary circuit on and off, inducing the proper high voltage in the secondary circuit. The ignition coil is a small, molded type.





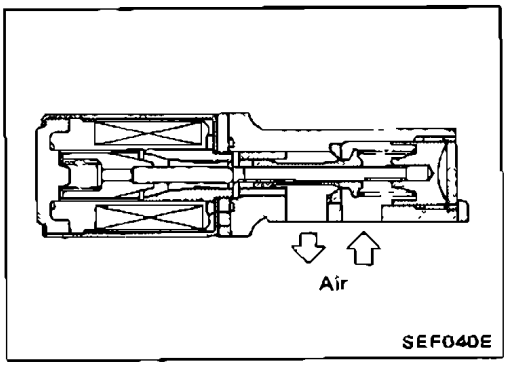
Air Regulator

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.



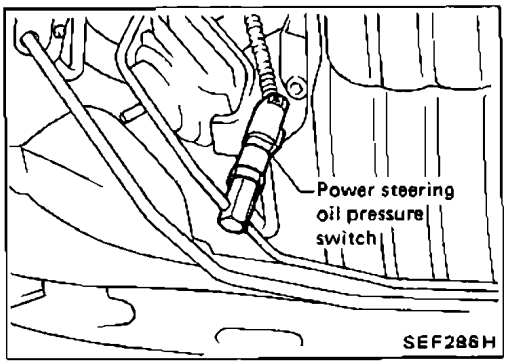
Idle Air Adjusting (I.A.A.) Unit

The I.A.A. unit is made up of the A.A.C. valve, F.I.C.D. solenoid valve and idle adjust screw. It receives the signal from the E.C.U. and controls the idle speed at the preset value.
The F.I.C.D. solenoid valve compensates for changes in idle speed caused by the operation of the air compressor. A vacuum control valve is also installed in this unit to prevent an abnormal rise in intake manifold vacuum pressure during deceleration.



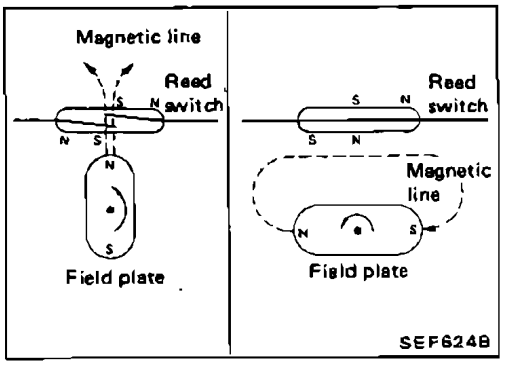
Auxiliary Air Control (A.A.C.) Valve

The E.C.U. actuates the A.A.C. valve by an ON/OFF pulse. The longer that ON pulse is received, the larger the amount of air that will flow through the A.A.C. valve.



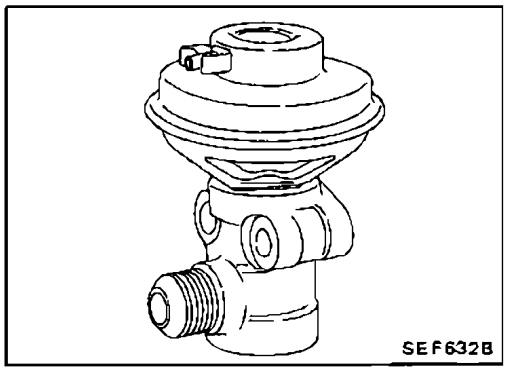
Power Steering Oil Pressure Switch

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 I.S.C. valve.



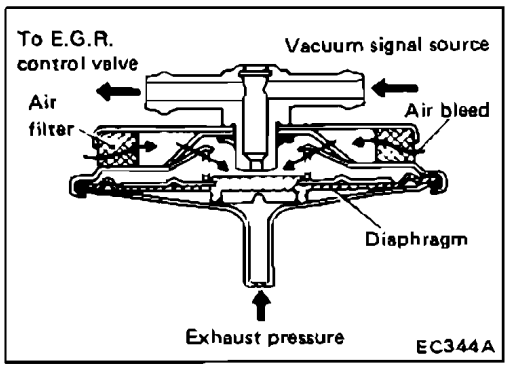
Vehicle Speed Sensor

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.


SEF632B

E.G.R. Control Valve

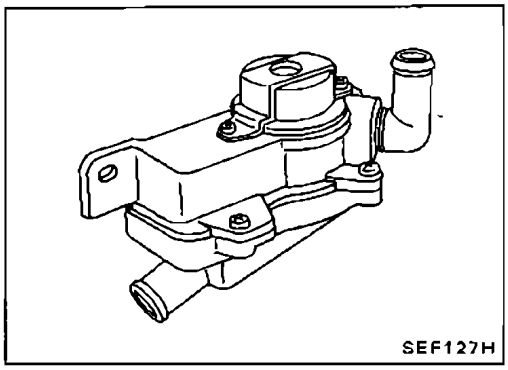
The E.G.R. control valve controls the quantity of exhaust gas to be led to the intake manifold through vertical movement of the taper valve connected to the diaphragm, to which vacuum is applied in response to the opening of the throttle valve.



EC344A

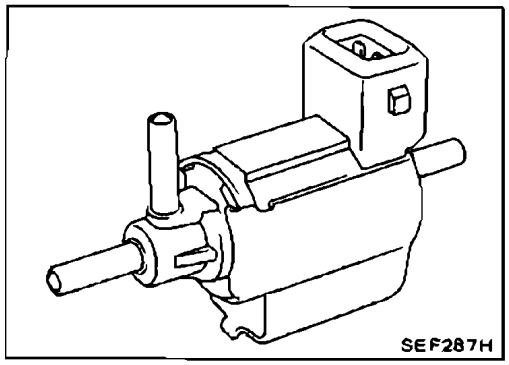
B.P.T. Valve

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.


SEF127H

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

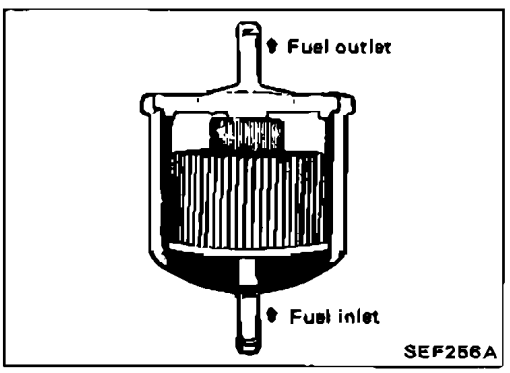
The E.G.R. system is controlled only by the E.C.U. At both low- and high-speed engine revolutions, the solenoid valve turns on and accordingly the E.G.R. valve cuts the exhaust gas leading to the intake manifold.

Pressure Regulator (P.R.) Control Solenoid Valve

The solenoid valve responds to the ON/OFF signal from the E.C.U. When it is off, a vacuum signal from the intake manifold is fed into the pressure regulator. When the control unit sends an ON signal, the coil pulls the plunger downward and cuts the vacuum signal.

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

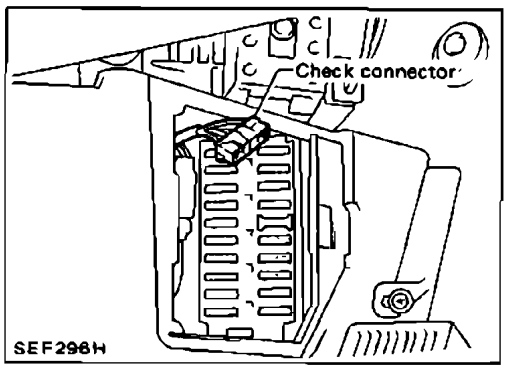
The specially designed fuel filter has a metal case in order to withstand high fuel pressure.

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.

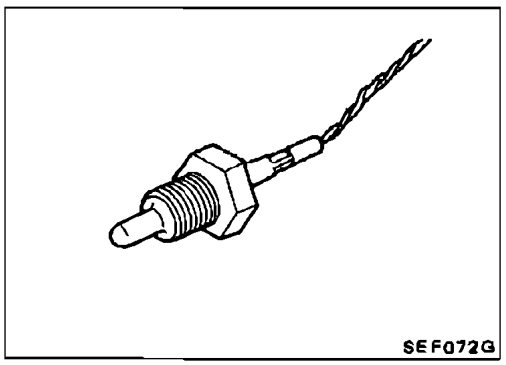
The vacuum in the intake passage upstream of the throttle valve increases in response to the amount of the intake air

When the vacuum of the intake passage is higher than a preset value, the 2nd purge control valve opens and the absorbed gases are sucked into the intake passage for combustion purposes.



Check Connector for E.C.C.S. Checker Box

The check connector for E.C.C.S. checker box is beside fuse box.

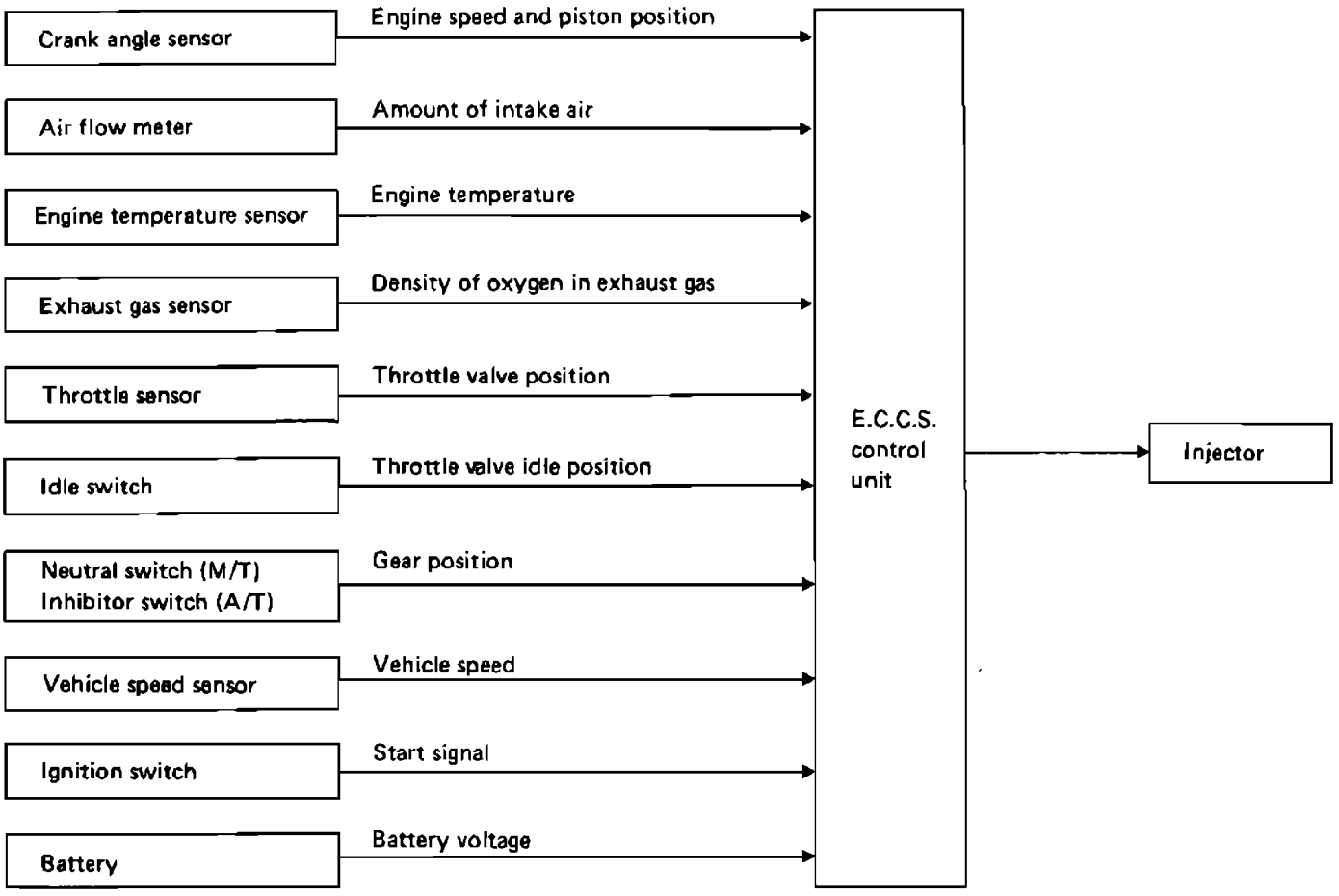


Exhaust Gas Temperature Sensor (For California model)

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.

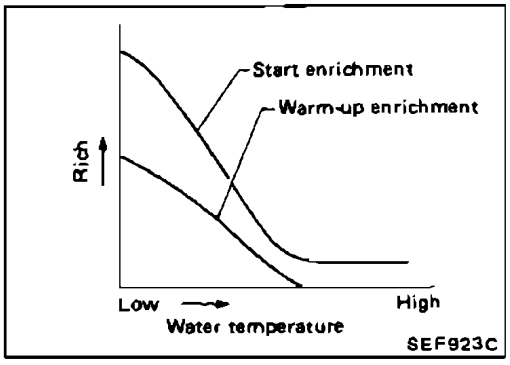
Fuel Injection Control

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

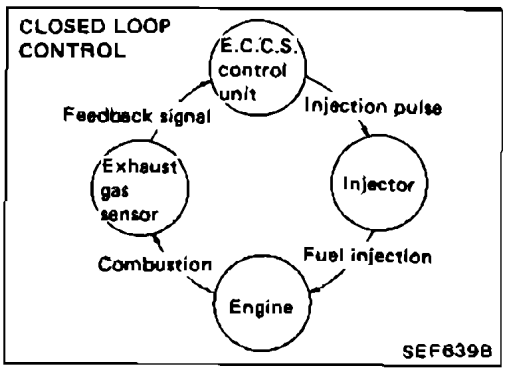
In addition, the amount of fuel injection is compensated for to improve engine performance under various operating conditions as listed below:

<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.

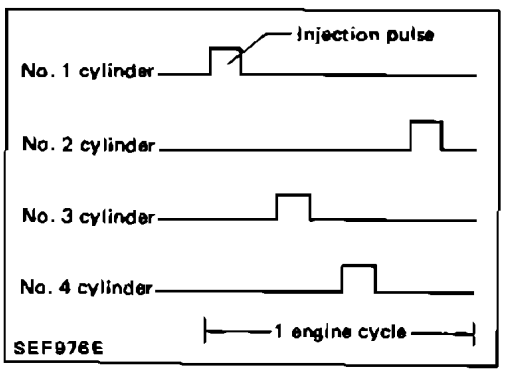
This stage refers to the closed-loop control condition. The open-loop control condition refers to that under which the E.C.U. detects any of the following conditions and feedback control stops in order to maintain stabilized fuel combustion.

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

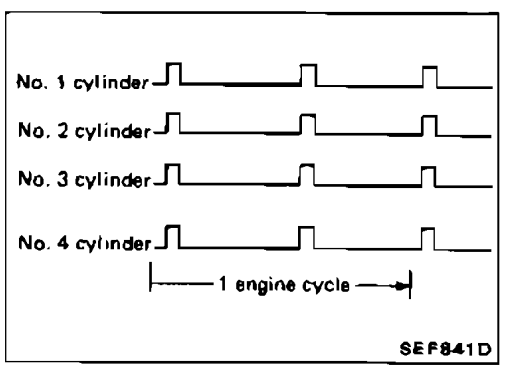
The mixture ratio feedback control system monitors the mixture ratio signal transmitted from the exhaust gas sensor. This feedback signal is then sent to the E.C.U. to control the amount of fuel injection to provide a basic mixture ratio as close to the theoretical mixture ratio as possible. However, 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.

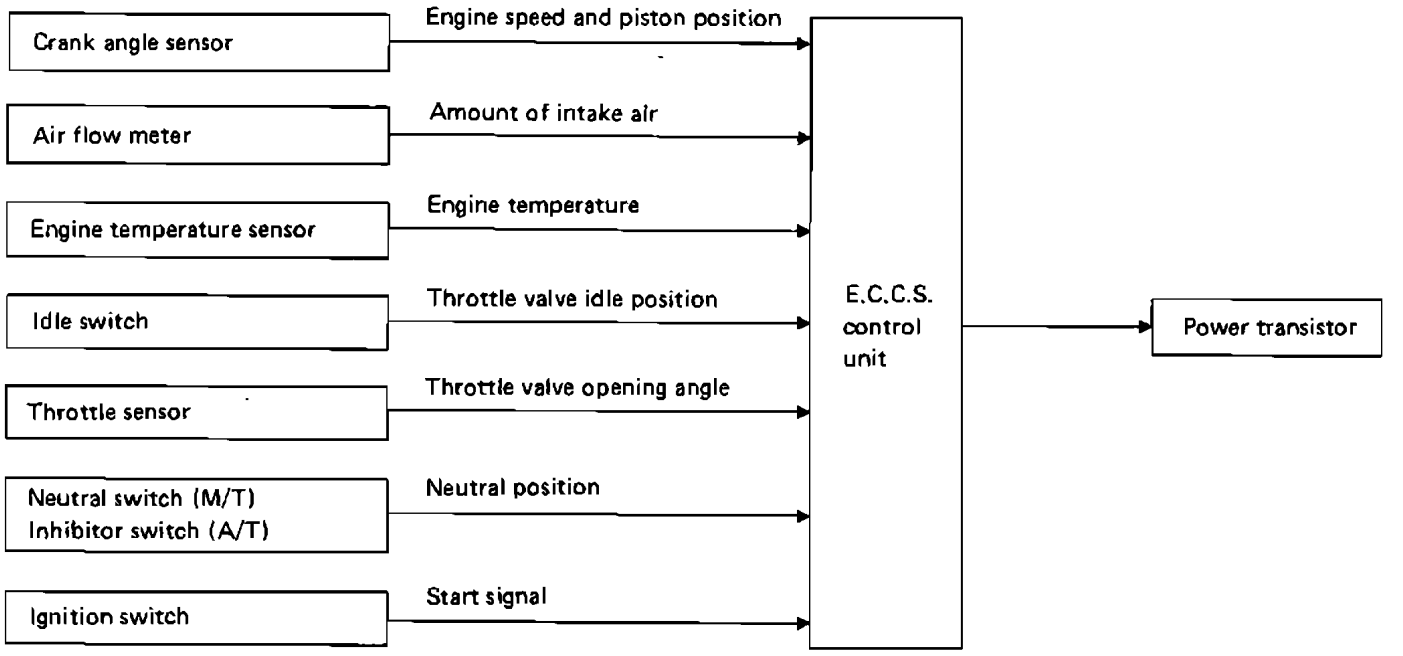
Fuel Injection Control (Cont'd)

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

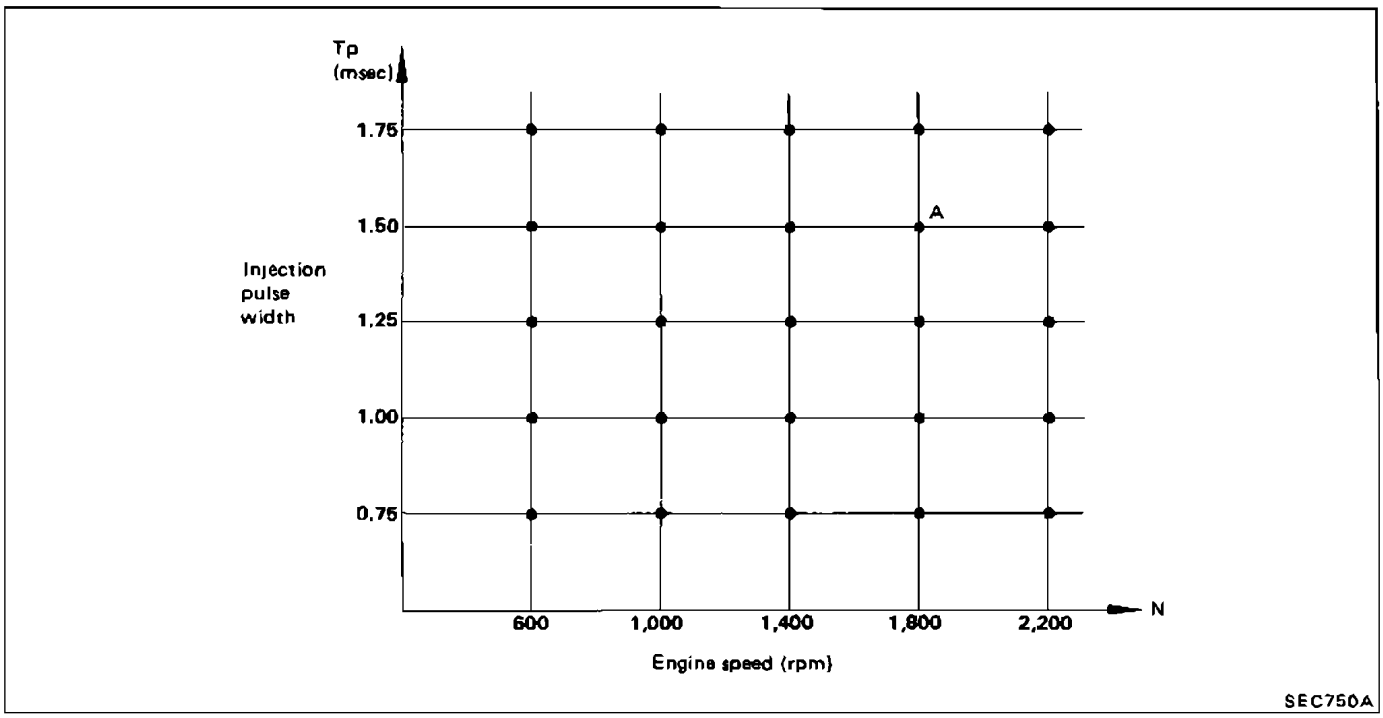
The ignition timing is controlled by the E.C.U. in order to maintain the best air-fuel ratio in response to every running condition of the engine.
The ignition timing data is stored in the ROM located in the E.C.U., in the form of the map shown below.
The E.C.U. detects information such as the injection 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,

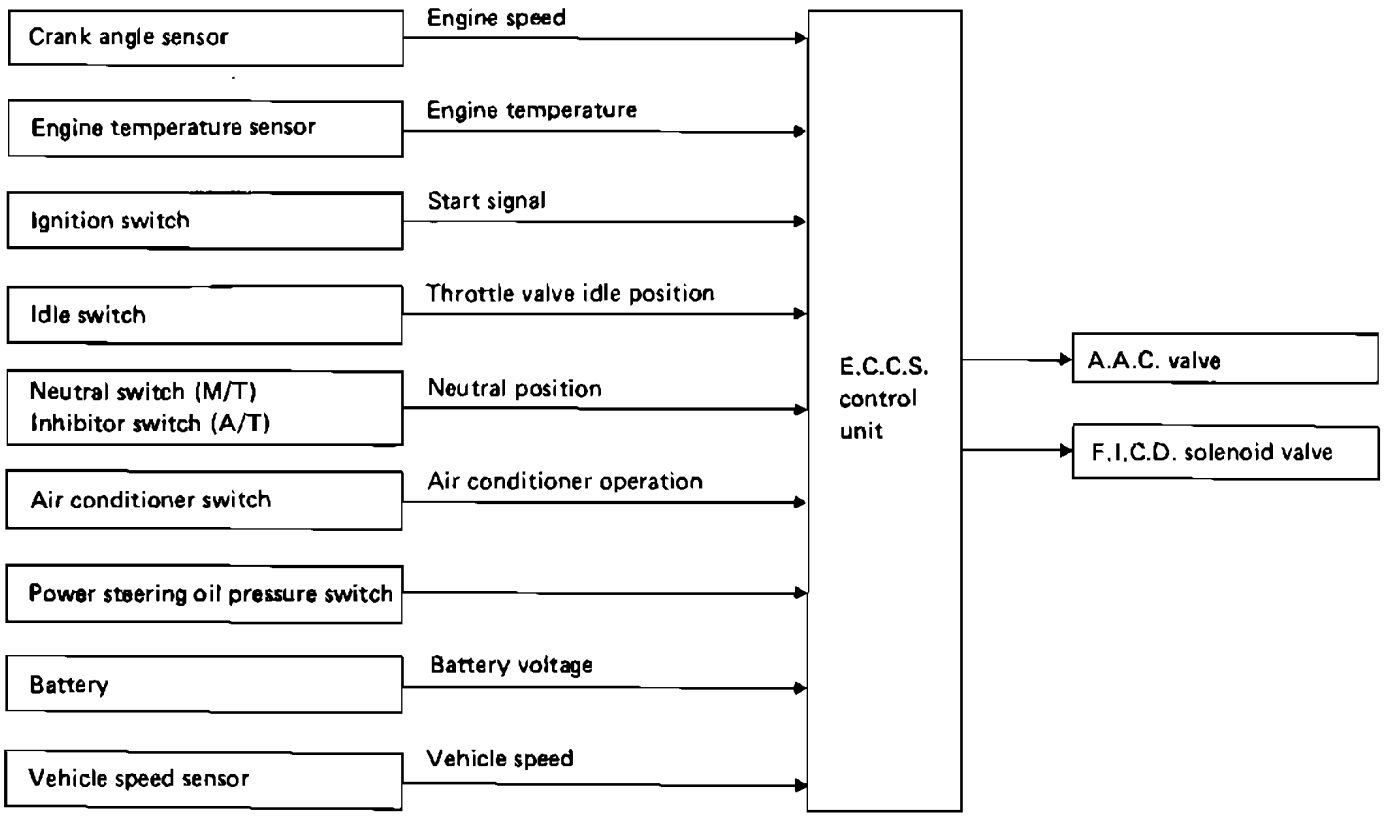
1 At starting
2 During warm-up
3 At idle
4 At low battery voltage
5 During swirl control valve operates
6 Hot engine operation
7 At acceleration

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

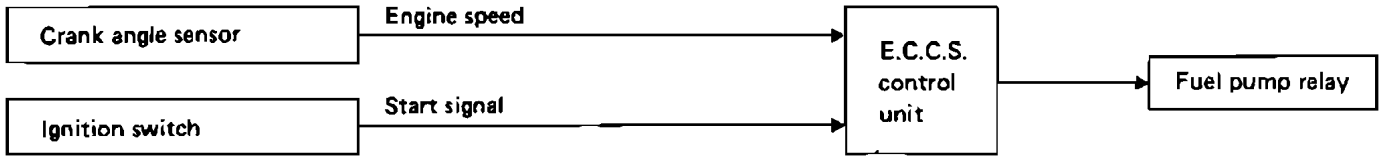


SYSTEM DESCRIPTION

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 at a rate of 100 to 200 Hz 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



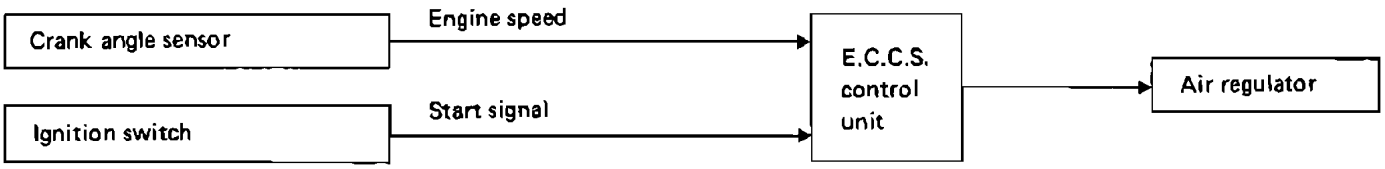
SYSTEM DESCRIPTION

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 Regulator Control

INPUT/OUTPUT SIGNAL LINE



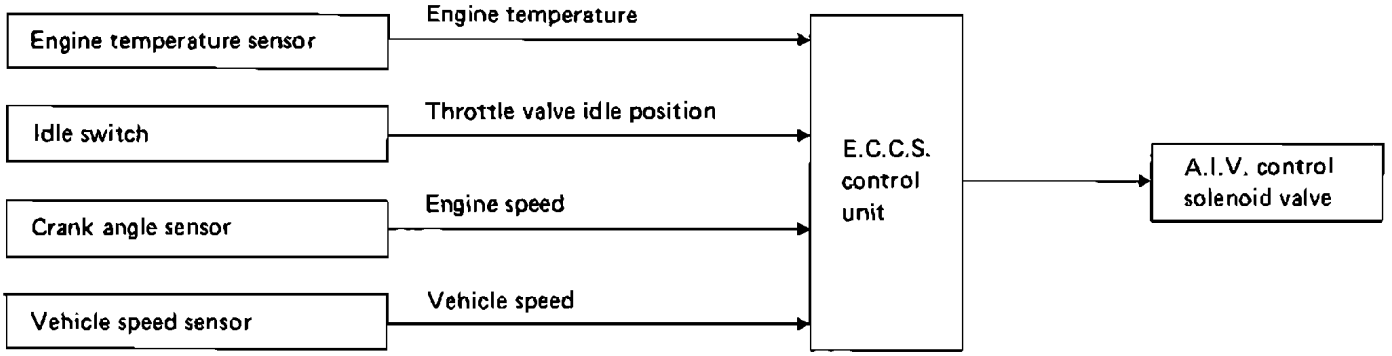
SYSTEM DESCRIPTION

The air regulator is controlled by the E.C.U. at the same time as fuel pump ON-OFF control.

Condition	Air regulator operation
Ignition switch is turned to ON	Operates for 5 seconds
While engine is running and cranking	Operates
When engine is stopped	OFF in 1 second
Except as shown above	OFF

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.

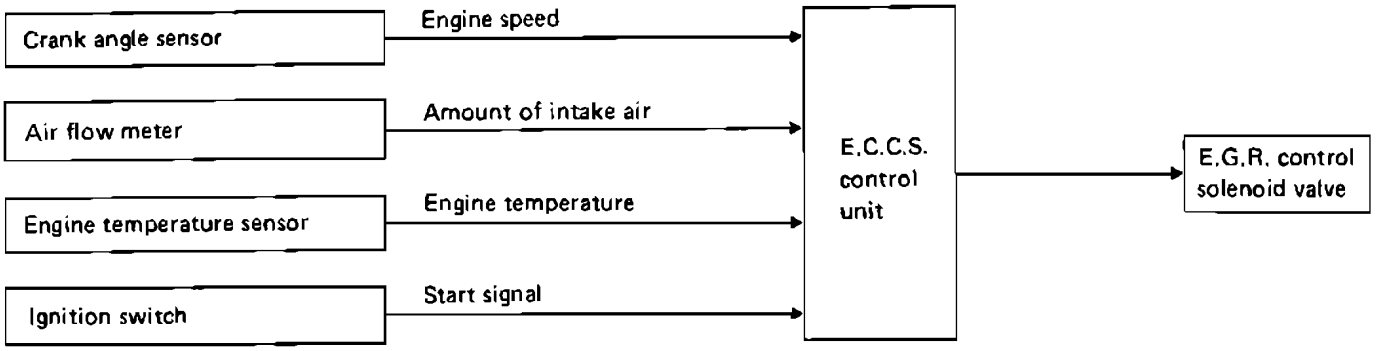
The air induction valve is controlled by the E.C.C.S. control unit, corresponding to the engine temperature. When the engine is cold, the A.I.V. control system operates to reduce HC and CO.

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 105 (221)	
Idle & heavy load conditions			
Other conditions			OFF

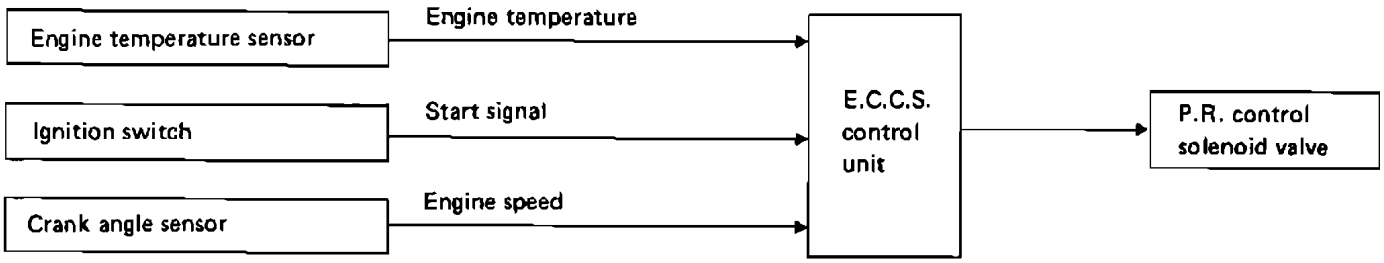
E.G.R. system operation

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			
Above 60 (140) Below 105 (221)	High	Closed	Partially open	OFF	Operates

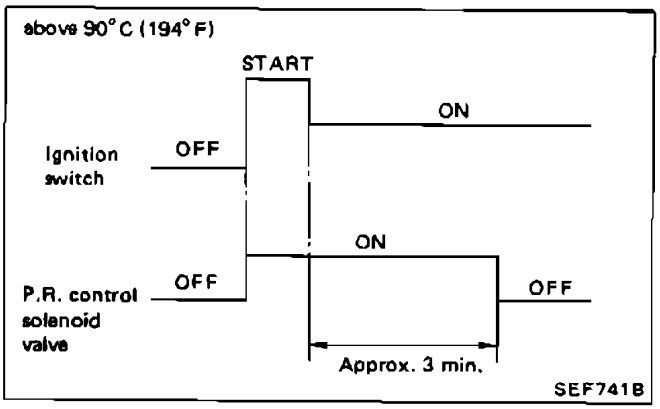
Fuel Pressure Regulator Control

INPUT/OUTPUT SIGNAL LINE



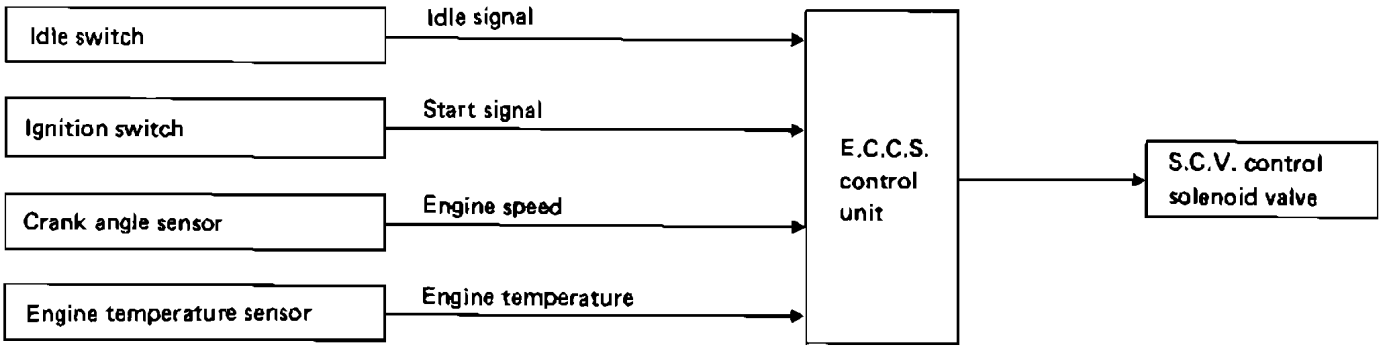
SYSTEM DESCRIPTION

The fuel "pressure-up" control system briefly increases fuel pressure for improved starting performance of a hot engine. Under normal operating conditions, manifold vacuum is applied to the fuel pressure regulator. When starting the engine, however, the E.C.U. allows current to flow through the ON/OFF solenoid valve in the control vacuum line, opening this line to the atmosphere. As a result, atmospheric pressure is applied, throttling the fuel passage to increase fuel pressure.



Swirl Control Valve (S.C.V.) Control

INPUT/OUTPUT SIGNAL LINE



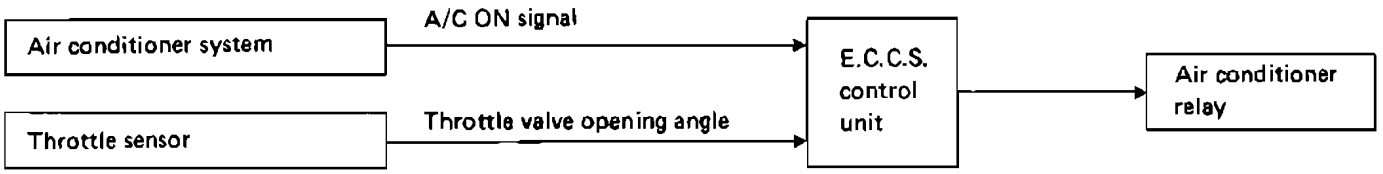
SYSTEM DESCRIPTION

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.

Idle switch	Water temperature	Engine rpm	Solenoid valve	S.C.V.
ON	Above 35°C (95°F)	Below 1,400	ON	Close
Except above			OFF	Open

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.)

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.

PREPARATION

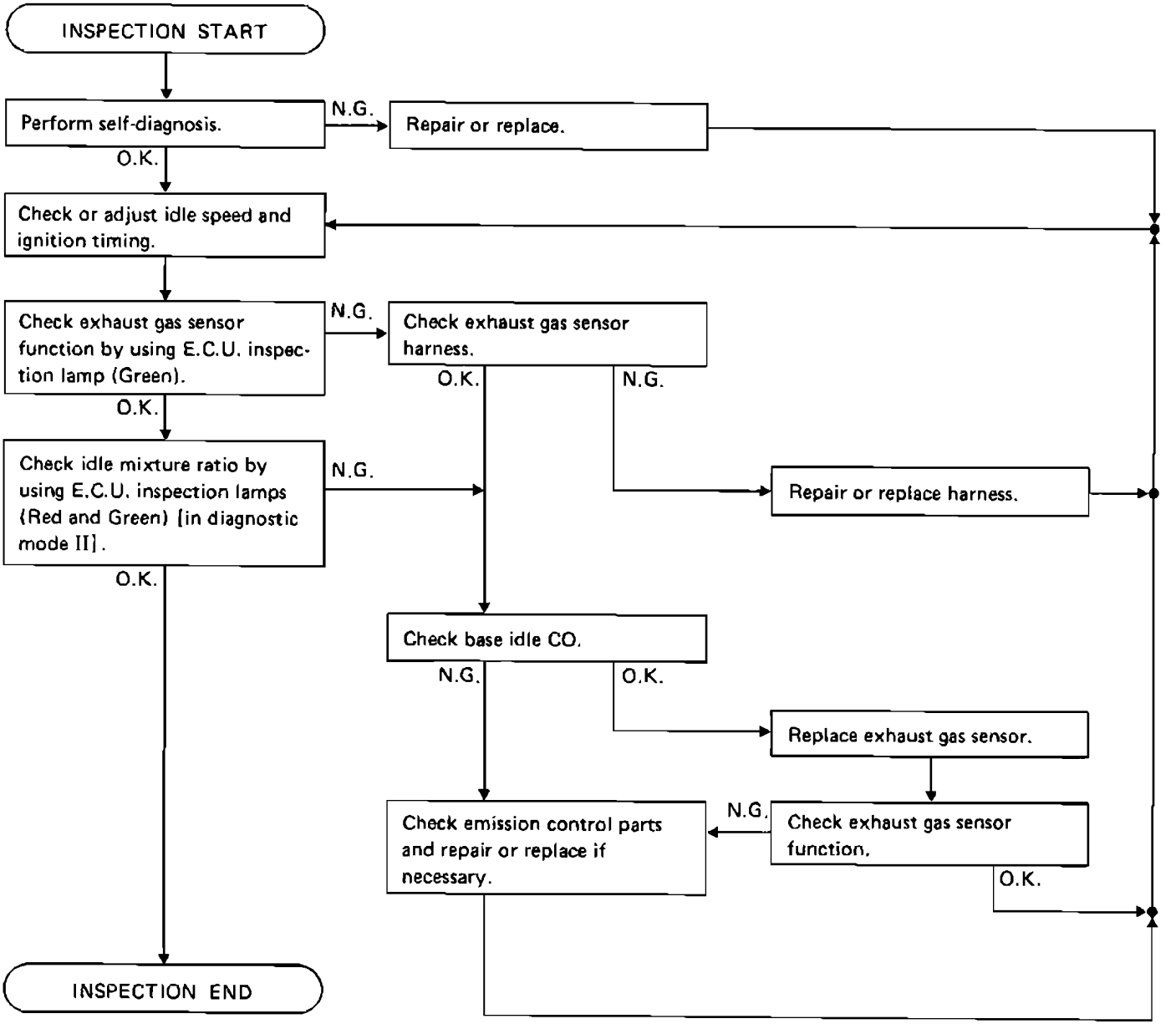
1. Make sure that the following parts are in good order.
- Battery
- Ignition system
- Engine oil and coolant levels
- Fuses
- E.C.U. harness connector
- Vacuum hoses
- Air intake system
  (Oil filler cap, oil level gauge, etc.)
- Fuel pressure
- A.I.V. hose
- Engine compression
- E.G.R. control valve operation
- Throttle valve and throttle valve switch

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.

WARNING:

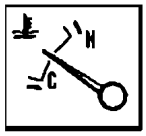
a. When checking or adjustment, move selector lever to "N" position, set parking brake and chock rear wheels.
b. After the adjustment has been made, remove wheel chocks.

Overall inspection sequence



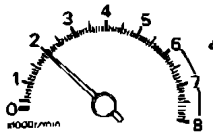
INSPECTION START

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 valve switch operation



SEF457C

Start engine and warm it up until water temperature indicator points to the middle of gauge.



SEF477B

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.

O.K. — N.G.

N.G. → Check, correct or replace malfunctioning parts.

Does engine run smoothly?

Yes — No

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.

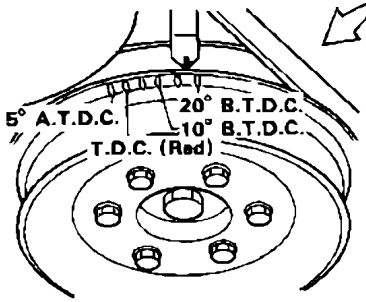
M/T: 750±50 rpm
A/T: 750±50 rpm (in "N" position)

O.K. — N.G.

Check ignition timing with a timing light.

15°±2° B.T.D.C.

O.K. — N.G.



SMA189A

N.G. → Disconnect throttle sensor harness connector.

Ensure that engine speed is below 800 rpm.

O.K. — N.G.

N.G. → Adjust idle speed to less than 800 rpm by turning idle speed adjusting screw.

Ⓐ Ⓑ Ⓒ

Ⓐ

Ⓑ

Check ignition timing with a timing light.

15°±2° B.T.D.C.

O.K.

N.G.

Adjust ignition timing by turning distributor after loosening bolt which secures distributor.

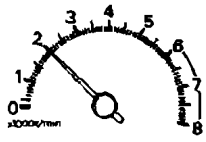
15°±2° B.T.D.C.

Adjust idle speed by turning idle speed adjusting screw.

M/T: 700±50 rpm
A/T: 700±50 rpm (in "N" position)

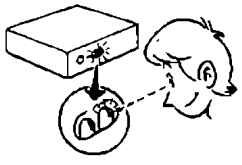
Connect throttle sensor harness connector.

Ⓒ



SEF477B

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.

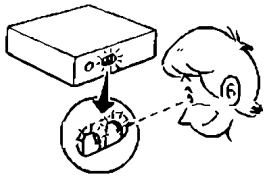
O.K.

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



SEF292H

Ⓓ

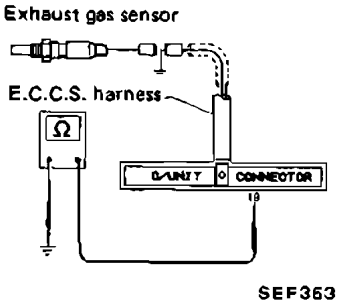
Ⓔ

Ⓒ

Ⓔ

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.



SEF363H

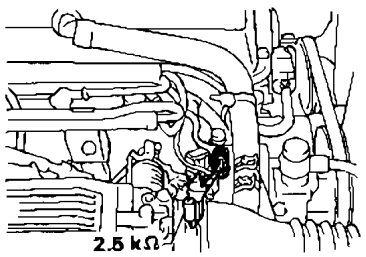
O.K.

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.

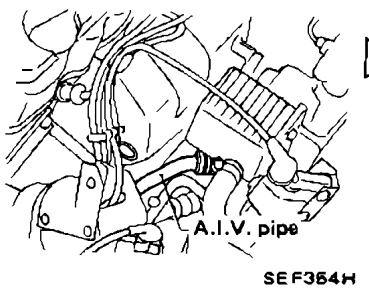
- Disconnect engine temperature sensor harness connector.
- Connect a resistor (2.5 kΩ) between terminals of engine temperature sensor harness connector.
- Disconnect A.I.V. hose and install a suitable plug in A.I.V. pipe.
- Connect battery ground cable.



SEF361H

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.



SEF364H

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.

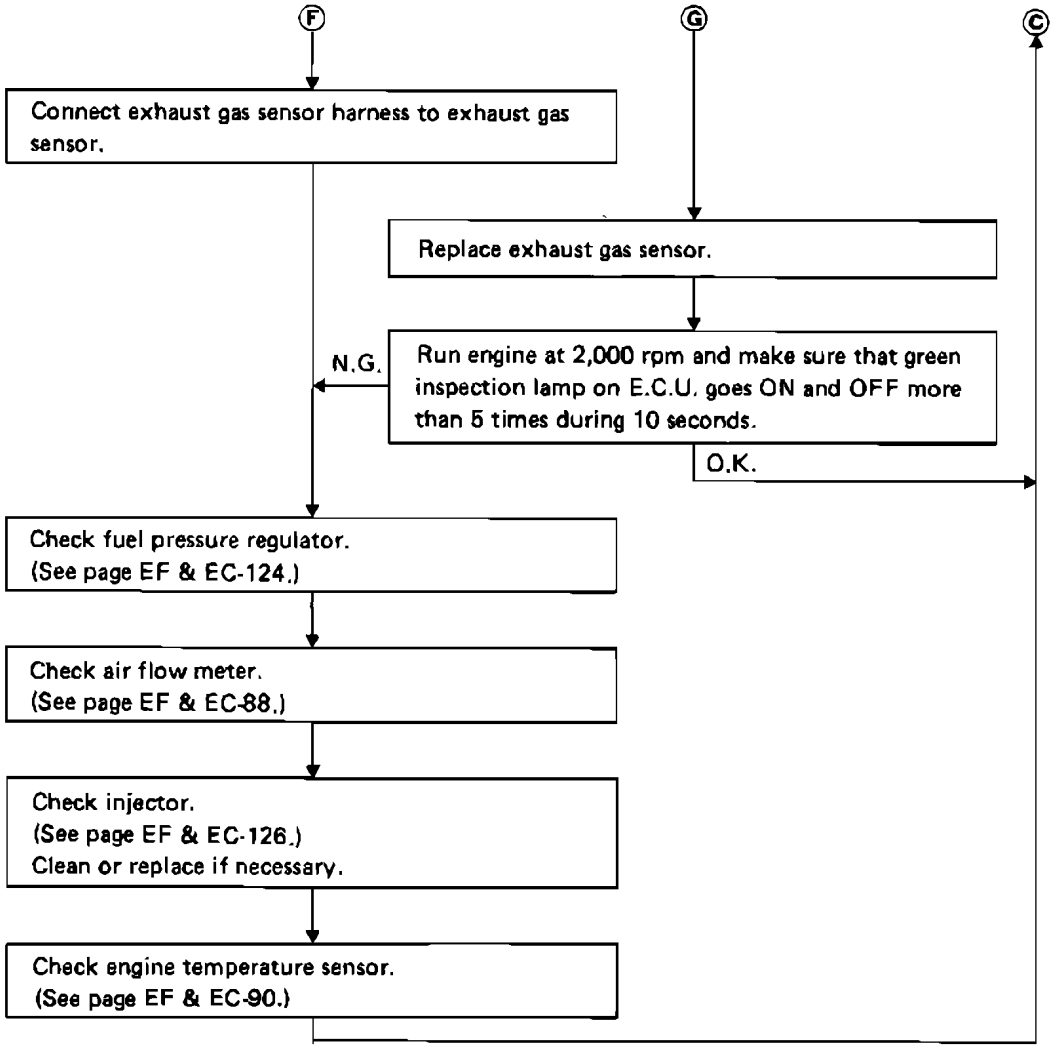
Ⓕ

Ⓖ

Ⓓ

Ⓒ

Ⓒ


Ⓕ
Ⓖ
Ⓒ
Connect exhaust gas sensor harness to exhaust gas sensor.
Replace exhaust gas sensor.
Run engine 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.
Check fuel pressure regulator.
(See page EF & EC-124.)
Check air flow meter.
(See page EF & EC-88.)
Check injector.
(See page EF & EC-126.)
Clean or replace if necessary.
Check engine temperature sensor.
(See page EF & EC-90.)

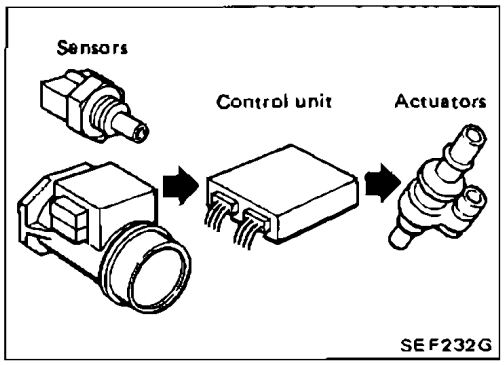
Contents

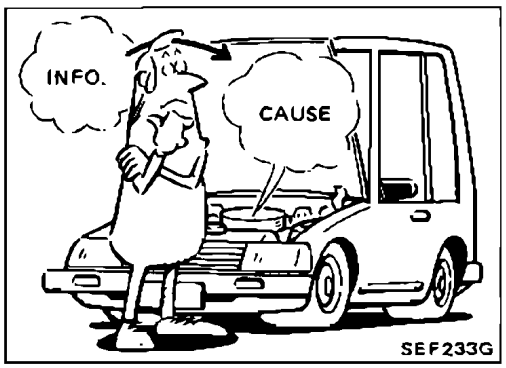
How to Perform Trouble Diagnoses for Quick and Accurate Repair ..... EF & EC- 33
Diagnostic Table ..... EF & EC- 37
1. Impossible to start — no combustion ..... EF & EC- 38
2. Impossible to start — partial combustion ..... EF & EC- 39
3. Impossible to start — partial combustion (not affected by throttle position) ..... EF & EC- 40
4. Impossible to start — partial combustion (throttle position changes combustion quality) ..... EF & EC- 41
5. Hard to start — before warm-up ..... EF & EC- 42
6. Hard to start — after warm-up ..... EF & EC- 43
7. Hard to start — every time ..... EF & EC- 44
8. Hard to start — morning after a rainy day ..... EF & EC- 45
9. Abnormal idling — no fast idle ..... EF & EC- 46
10. Abnormal idling — low idle (after warm-up) ..... EF & EC- 47
11. Abnormal idling — high idle (after warm-up) ..... EF & EC- 48
12. Unstable idling — before warm-up ..... EF & EC- 49
13. Unstable idling — after warm-up ..... EF & EC- 50
14. Poor driveability — stumble (while accelerating) ..... EF & EC- 51
15. Poor driveability — surge (while cruising) ..... EF & EC- 52
16. Poor driveability — lack of power ..... EF & EC- 53
17. Poor driveability — detonation ..... EF & EC- 54
18. Engine stall — during start-up ..... EF & EC- 55
19. Engine stall — while idling ..... EF & EC- 56
20. Engine stall — while accelerating ..... EF & EC- 57
21. Engine stall — while cruising ..... EF & EC- 58
22. Engine stall — while decelerating/just after stopping ..... EF & EC- 59
23. Engine stall — while loading (power steering, air conditioner, headlamps, etc.) ..... EF & EC- 60
24. Backfire — through the intake ..... EF & EC- 61
25. Backfire — through the exhaust ..... EF & EC- 62

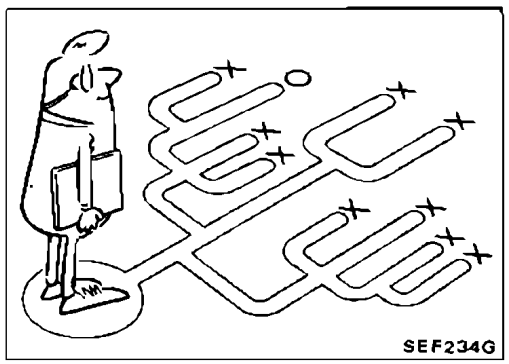
Self-diagnosis — Description ..... EF & EC- 63
Self-diagnosis — Mode I (Exhaust gas sensor monitor) ..... EF & EC- 67
Self-diagnosis — Mode II (Mixture ratio feedback control monitor) ..... EF & EC- 67
Self-diagnosis — Mode III (Self-diagnostic system) ..... EF & EC- 68
Self-diagnosis — Mode IV (Switches ON/OFF diagnostic system) ..... EF & EC- 74
Self-diagnosis — Mode V (Real-time diagnostic system) ..... EF & EC- 76
Diagnostic Procedure ..... EF & EC- 82
Diagnostic Procedure 1
MAIN POWER SUPPLY AND GROUND CIRCUIT ..... EF & EC- 84
Self-diagnostic item
Diagnostic Procedure 2
CRANK ANGLE SENSOR ..... EF & EC- 86
Diagnostic Procedure 3
AIR FLOW METER ..... EF & EC- 88
Diagnostic Procedure 4
ENGINE TEMPERATURE SENSOR ..... EF & EC- 90
Diagnostic Procedure 5
VEHICLE SPEED SENSOR ..... EF & EC- 92
Diagnostic Procedure 6
IGNITION SIGNAL ..... EF & EC- 94
Diagnostic Procedure 7
ENGINE CONTROL UNIT ..... EF & EC- 98
Diagnostic Procedure 8
E.G.R. FUNCTION ..... EF & EC-100
Diagnostic Procedure 9
EXHAUST GAS SENSOR ..... EF & EC-104
Diagnostic Procedure 10
EXHAUST GAS TEMPERATURE SENSOR ..... EF & EC-106

Contents (Cont'd)

Diagnostic Procedure 11
THROTTLE SENSOR ..... EF & EC-110
Diagnostic Procedure 12
INJECTOR LEAK ..... EF & EC-114
Switch ON/OFF diagnostic item
Diagnostic Procedure 13
IDLE SWITCH ..... EF & EC-116
Diagnostic Procedure 14
START SWITCH ..... EF & EC-118
Not self-diagnostic item
Diagnostic Procedure 15
FUEL PUMP ..... EF & EC-120
Diagnostic Procedure 16
PRESSURE REGULATOR (P.R.) CONTROL SOLENOID VALVE ..... EF & EC-124
Diagnostic Procedure 17
INJECTORS ..... EF & EC-126
Diagnostic Procedure 18
SWIRL CONTROL VALVE (S.C.V.) CONTROL SOLENOID VALVE ..... EF & EC-128
Diagnostic Procedure 19
AIR REGULATOR ..... EF & EC-130
Diagnostic Procedure 20
AUXILIARY AIR CONTROL (A.A.C.) VALVE ..... EF & EC-134
Diagnostic Procedure 21
I.A.A. CONTROL (F.I.C.D. CONTROL) ..... EF & EC-136
Diagnostic Procedure 22
AIR INDUCTION VALVE (A.I.V.) CONTROL SOLENOID VALVE ..... EF & EC-138
Diagnostic Procedure 23
NEUTRAL SWITCH, INHIBITOR SWITCH AND INHIBITOR RELAY ..... EF & EC-140
Electrical Components Inspection ..... EF & EC-142







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.

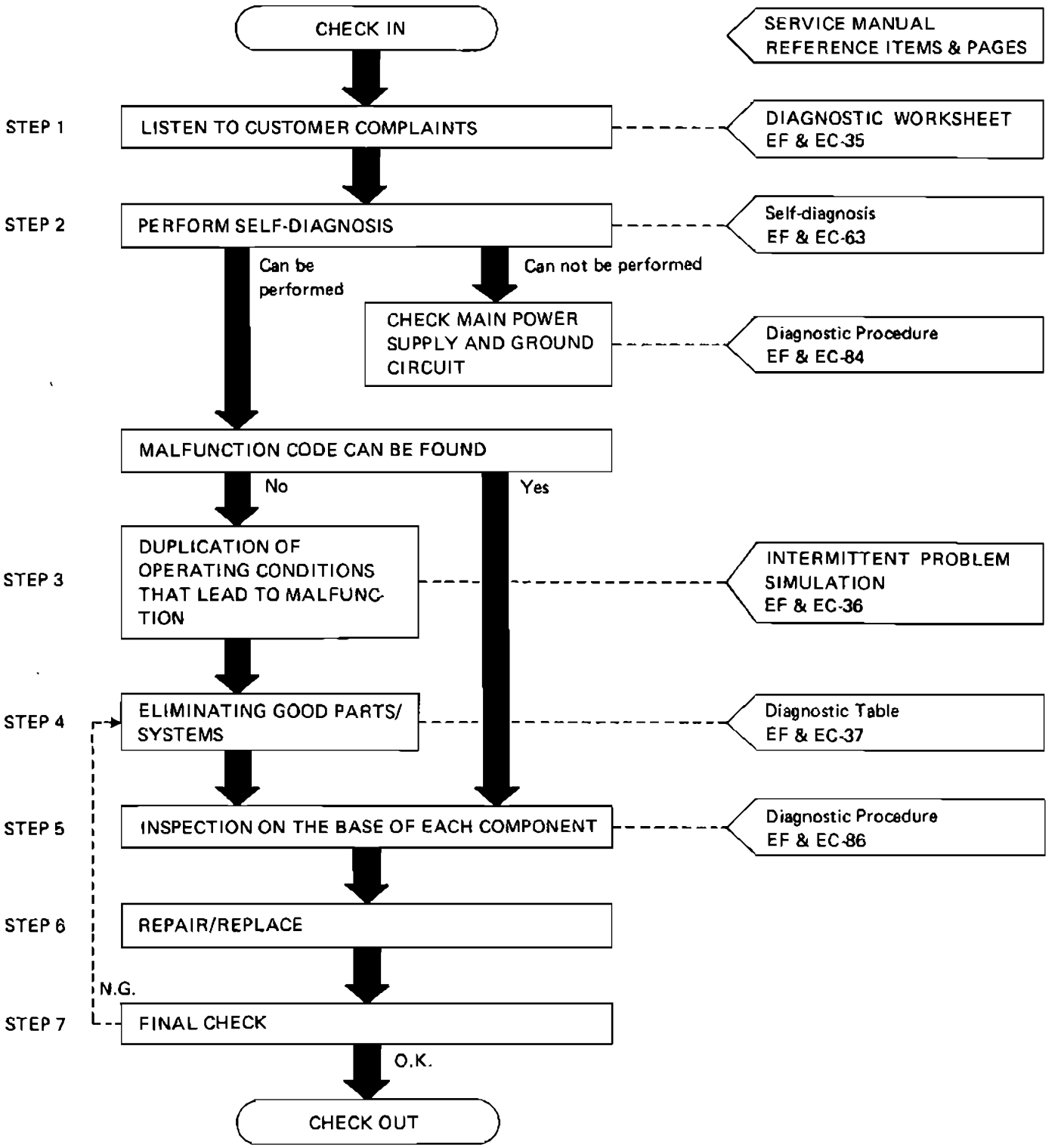
A visual check only may not find the cause of the problems. A road test with a circuit tester connected to a suspected circuit should be performed.

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



How to Perform Trouble Diagnoses for Quick and Accurate Repair (Cont'd)

KEY POINTS

WHAT ..... Vehicle & engine model
WHEN ..... Date, Frequencies
WHERE ..... Road conditions
HOW ..... Operating conditions, Weather conditions, Symptoms

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.

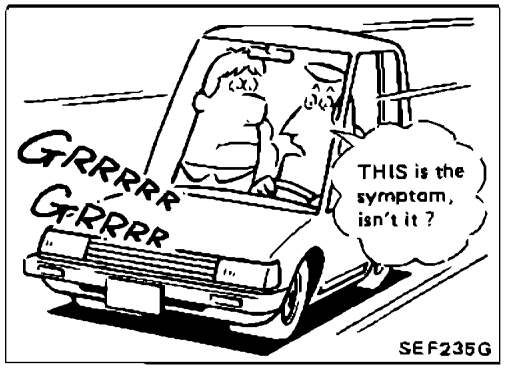
In general, feelings for a problem depend on each customer. It is important to fully understand the symptoms or under what conditions a customer complains..

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	○	○		○			○

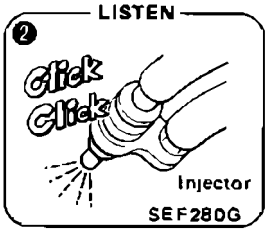
SERVICE PROCEDURE

❶ LISTEN

Listen for fuel pump operating sound.

N.G. → Check fuel pump and/or related circuits. [See page EF & EC-120.]

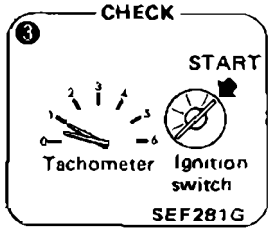
❷ LISTEN



Listen for injector operating sound.

N.G. → Check injector circuit. [See page EF & EC-126.]

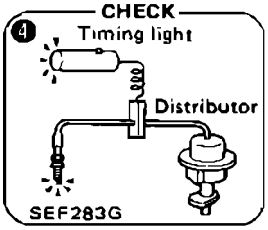
❸ CHECK



Make sure tachometer needle moves when cranking.

N.G. →

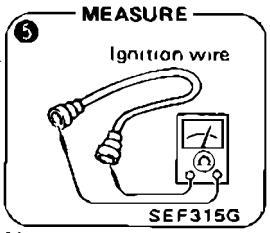
❹ CHECK



Check flashes of timing light for weakness.

N.G. →

❺ MEASURE

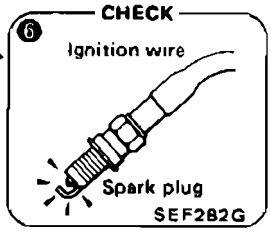


Measure resistance of suspect wires.

N.G → Replace the wire.

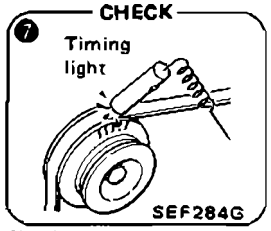
O.K. →

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.]

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

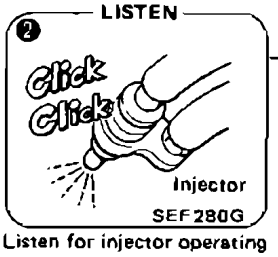
❶ **LISTEN**

Listen for fuel pump operating sound.

N.G. → Check fuel pump and/or related circuits. [See page EF & EC-120.]

O.K. →

❷ **LISTEN**

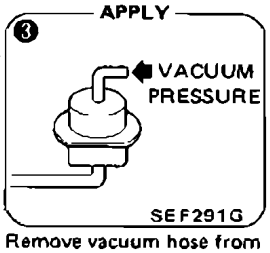


Listen for injector operating sound.

N.G. → Check injector circuit. [See page EF & EC-126.]

O.K. →

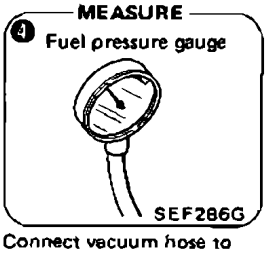
❸ **APPLY**



Remove vacuum hose from pressure regulator, and apply vacuum and/or pressure, and try to start.

Improved →

❹ **MEASURE** Fuel pressure gauge

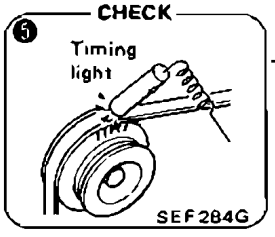


Connect vacuum hose to pressure regulator and measure fuel pressure.

↓

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
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

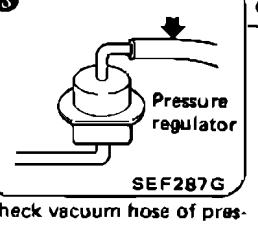
❶ **LISTEN**

Listen for injector operating sound.

N.G. → Check injector circuit. [See page EF & EC-126.]

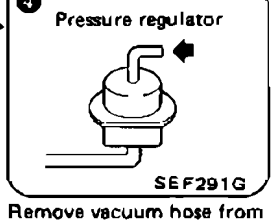
O.K. ↓

❸ **CHECK**



Check vacuum hose of pressure regulator for clogging.

O.K. → ❹ **REMOVE**



Remove vacuum hose from pressure regulator, and try to start.

Improved → ❺ **MEASURE** Fuel pressure

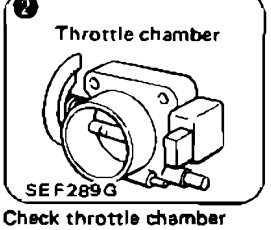
Connect vacuum hose to pressure regulator and measure fuel pressure.

→ Check mixture ratio feedback system. [See page EF & EC-26.]

N.G. ↓

Repair or replace the hose.

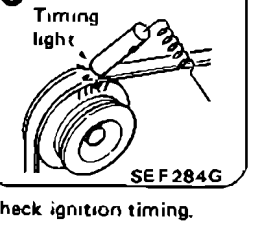
❷ **CHECK** Throttle chamber



Check throttle chamber ports and valve for clogging.

N.G. → Clean the ports and/or throttle valve.

❻ **CHECK**

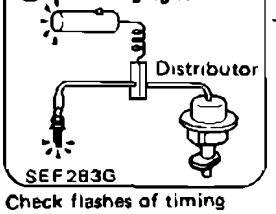


Check ignition timing.

N.G. ↓

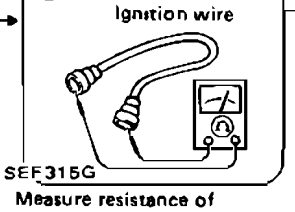
Adjust ignition timing. [See page EF & EC-26.]

❼ **CHECK** Timing light



Check flashes of timing light for weakness.

N.G. → ❽ **MEASURE** Ignition wire

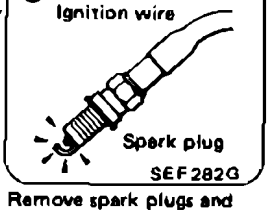


Measure resistance of suspect ignition wires.

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-118.]

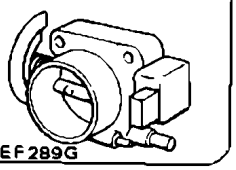
Diagnostic Table (Cont'd)

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)		○		
	Air regulator (stuck closed)			○	
	Idle speed control valve				○
CONTROL SYSTEM	Engine temperature sensor				○
	Idle switch				○
	Neutral switch				○

SERVICE PROCEDURE

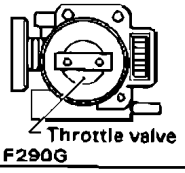
❶ CHECK — Throttle chamber



Check throttle chamber ports for clogging.

N.G. → Clean the ports.

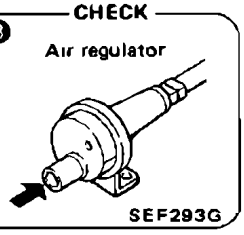
❷ CHECK — Throttle chamber



Check throttle valve for clogging.

N.G. → Clean the valve.

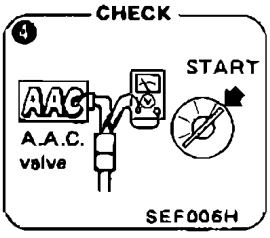
❸ CHECK — Air regulator



Make sure air regulator stays open before warm-up

N.G. → Check air regulator and/or its circuit. [See page EF & EC-130.]

❹ CHECK



Check terminal voltage of A.A.C. valve while cranking.

N.G. → Check idle speed control circuit. [See page EF & EC-134.]

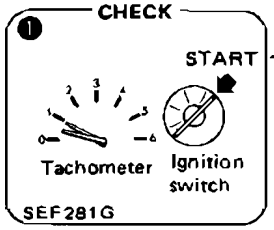
Diagnostic Table (Cont'd)

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	Air regulator			○		
CONTROL SYSTEM	Engine temperature sensor					○
	Idle switch				○	
	Neutral switch	○				
OTHERS	Starter (operation too slow)	○				
	Battery (voltage too low)	○	○			

SERVICE PROCEDURE

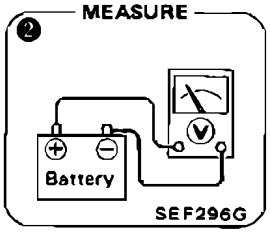
❶ CHECK



N.G. →

Make sure tachometer indicates about 300 rpm while cranking.

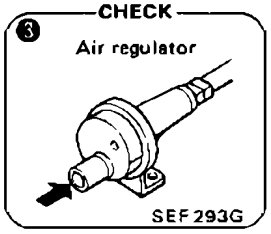
❷ MEASURE



N.G. (less than 12V) → Charge the battery.

Measure battery voltage.

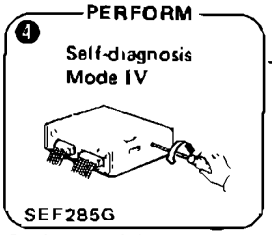
❸ CHECK



N.G. → Check air regulator and/or its circuit. [See page EF & EC-130.]

Make sure air regulator stays open before warm-up.

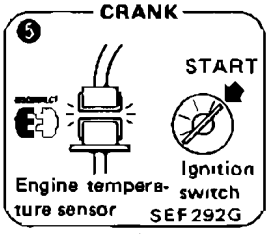
❹ PERFORM



N.G. → Check the malfunctioning switches and/or circuits. [See page EF & EC-118 (start signal), page EF & EC-118 (idle switch).]

Perform self-diagnosis Mode IV (for start signal and idle switch).

❺ CRANK



N.G. → Check sensor circuit. [See page EF & EC-90.]

Start with engine temperature sensor connector disconnected.

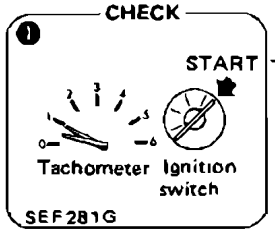
Diagnostic Table (Cont'd)

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

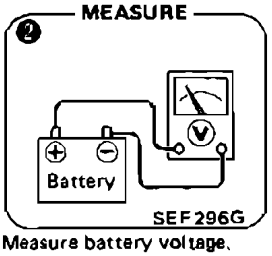
❶ CHECK



Make sure tachometer indicates about 300 rpm while cranking.

N.G. →

❷ MEASURE

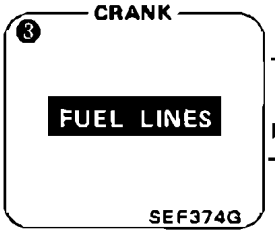


Measure battery voltage.

N.G. (less than 12V) ↓

Charge the battery.

❸ CRANK



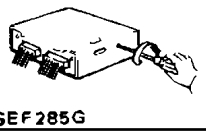
Cool fuel lines with wet rags, etc. and try to start.

No change → Proceed to other steps.

Improved → Proceed to other steps. If everything is O.K., check fuel vapor pressure.

❹ PERFORM

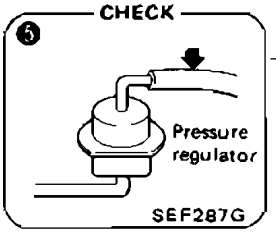
Self-diagnosis Mode IV



Perform self-diagnosis Mode IV (for start signal).

N.G. → Check starter circuit. [See page EF & EC-118.]

❺ CHECK



Check vacuum hose of pressure regulator for clogging.

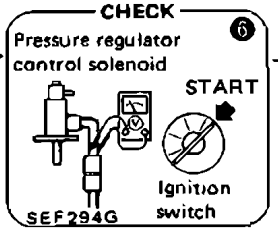
N.G. ↓

Repair or replace the hose.

O.K. →

❻ CHECK

Pressure regulator control solenoid

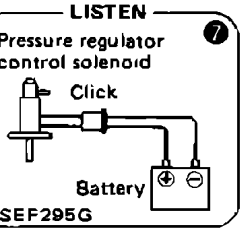


Check terminal voltage of pressure regulator control solenoid while cranking.

N.G. →

❼ LISTEN

Pressure regulator control solenoid



Listen for clicking sound from pressure regulator control solenoid when applying battery voltage.

N.G. ↓ Replace the solenoid.

O.K. ↓ Check the solenoid circuit. [See page EF & EC-124.]

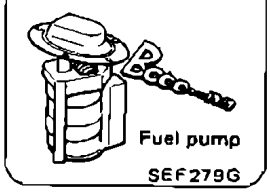
Diagnostic Table (Cont'd)

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												
	Idle switch												○
	Neutral switch		○										
OTHERS	Starter (operation too slow)		○										
	Battery (voltage too low)		○	○									

SERVICE PROCEDURE

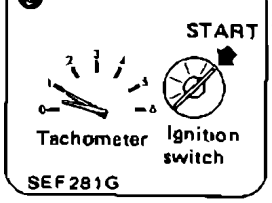
❶ **LISTEN**



Listen for fuel pump operating sound.

N.G. → Check fuel pump and/or related circuits. [See page EF & EC-120.]

❷ **CHECK**



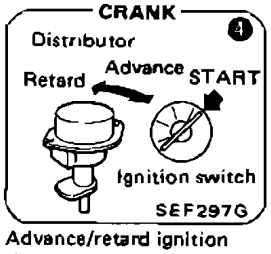
Make sure tachometer indicates about 300 rpm while cranking.

N.G. → ❸ **MEASURE** Battery

Measure battery voltage.

N.G. → Charge the battery.

❹ **CRANK**

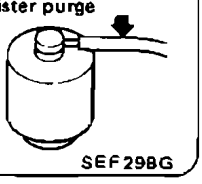


Advance/retard ignition timing and try to start.

No change → Proceed to other steps.

Improved → Check mixture ratio feedback system. [See page EF & EC-26.]

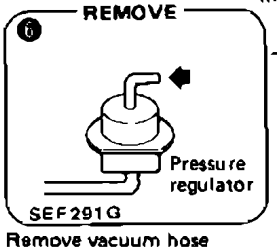
❺ **CHECK** Canister purge



Check vacuum hose of canister for air leaks.

N.G. → Repair or replace the hose.

❻ **REMOVE**



Remove vacuum hose from pressure regulator, and try to start.

❼ **MEASURE** Fuel pressure

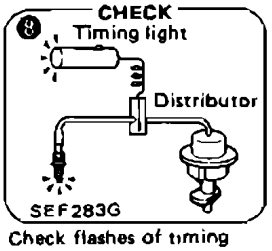
Connect vacuum hose to pressure regulator and measure fuel pressure.

❷ **PERFORM** Self-diagnosis Mode IV

Perform self-diagnosis Mode IV (for idle switch).

N.G. → Check the malfunctioning circuits. [See page EF & EC-116 (idle switch).]

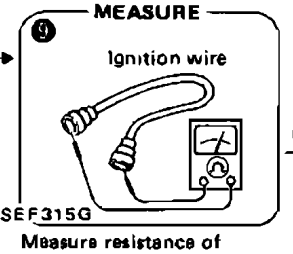
❽ **CHECK** Timing light



Check flashes of timing light for weakness.

N.G. → Replace the wires.

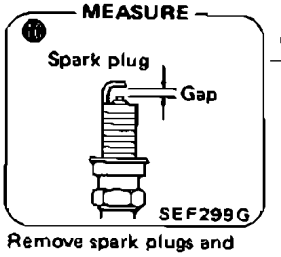
❾ **MEASURE** Ignition wire



Measure resistance of suspect ignition wires.

O.K. →

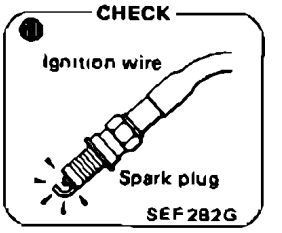
❿ **MEASURE** Spark plug — Gap



Remove spark plugs and measure their gaps.

O.K. →

⓫ **CHECK** Ignition wire



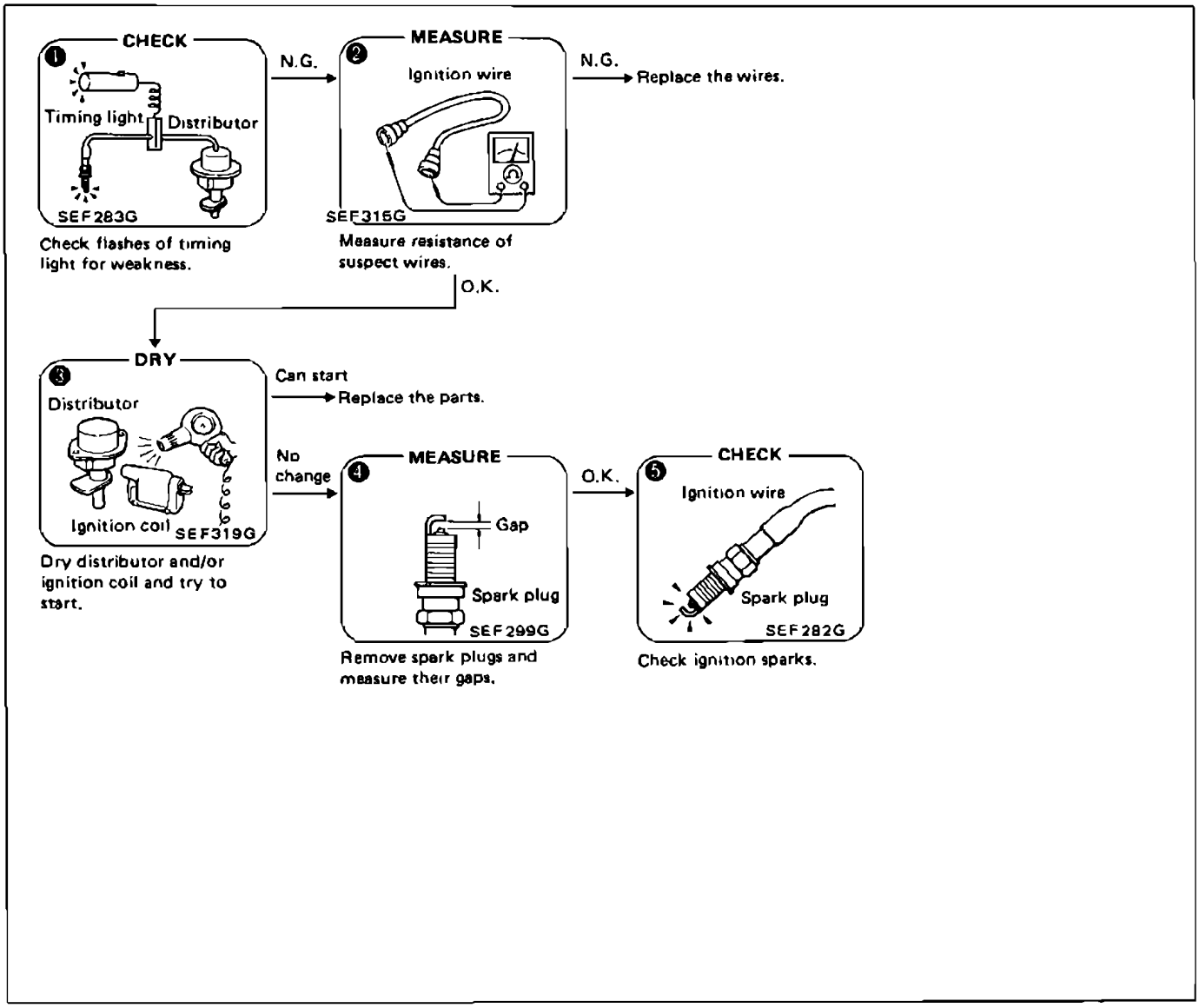
Check ignition sparks.

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)	O	O			O
IGNITION SYSTEM	Power transistor	O				O
	Ignition coil	O		O		O
	Center cable (ignition leaks)	O				O
	Ignition wires (ignition leaks)	O	O			O
	Distributor cap (ignition leaks)	O		O		O
	Spark plugs (improper gap)				O	O

SERVICE PROCEDURE



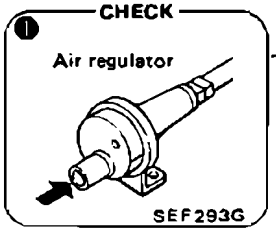
Diagnostic Table (Cont'd)

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)		○			
	Air regulator (stuck closed)	○				
CONTROL SYSTEM	Engine temperature sensor					○

SERVICE PROCEDURE

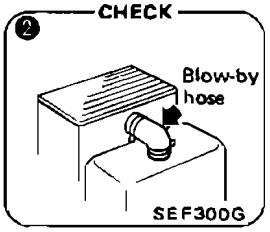
❶ CHECK



N.G. → Check air regulator and/or its circuit. [See page EF & EC-130.]

Make sure air regulator stays open before warm-up.

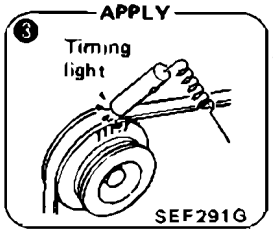
❷ CHECK



N.G. → Clean or replace the hose.

Check blow-by hose for clogging.

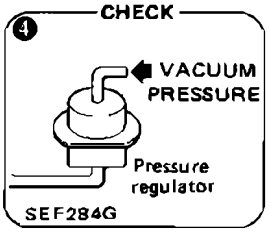
❸ APPLY



Improved → Adjust ignition timing. [See page EF & EC-26.]

Check ignition timing.

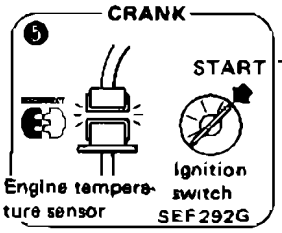
❹ CHECK



N.G. → Check mixture ratio feedback system. [See page EF & EC-26.]

Apply vacuum pressure to pressure regulator after disconnecting vacuum hose, and check idling.

❺ CRANK



N.G. → Check sensor circuit. [See page EF & EC-90.]

Start with engine temperature sensor connector disconnected.

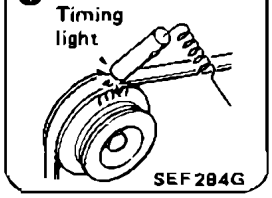
Diagnostic Table (Cont'd)

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

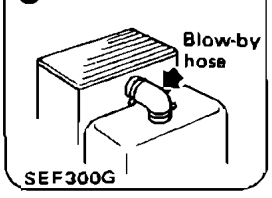


Check ignition timing.

N.G.

Adjust ignition timing. [See page EF & EC-26.]

❷ CHECK

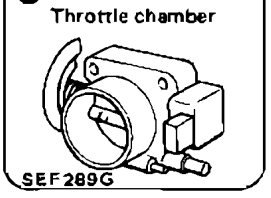


Check blow-by hose for clogging.

N.G.

Clean or replace the hose.

❸ CHECK

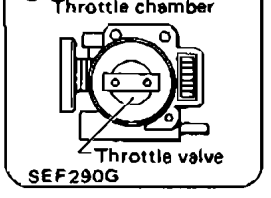


Check throttle chamber ports for clogging.

N.G.

Clean the ports.

❹ CHECK

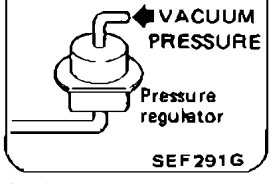


Check throttle valve for clogging.

N.G.

Clean the valve.

❺ APPLY

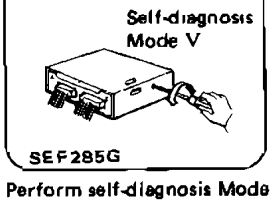


Apply vacuum pressure to pressure regulator after disconnecting vacuum hose, and check idling.

Improved → Check mixture ratio feedback system. [See page EF & EC-26.]

No change → Check load signal circuit. [See EL section.]

❻ PERFORM

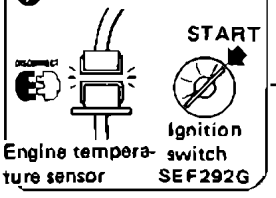


Perform self-diagnosis Mode V (for air flow meter).

N.G.

Check the malfunctioning parts and/or circuits. [See page EF & EC-88 (air flow meter), page EF & EC-90 (engine temperature sensor).]

❼ RUN



N.G.

Start and run engine with engine temperature sensor connector disconnected.

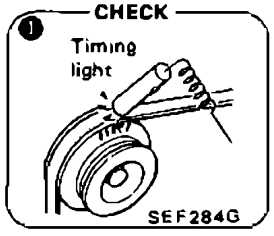
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 11 | **Abnormal idling – high idle (after warm-up)**

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼	❽	❾	❿
SPECIFICATIONS	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)		○								
	Air regulator (stuck open)			○							
	Idle speed control valve (remaining ON)							○			
	F.I.C.D. solenoid (remaining ON)								○		
CONTROL SYSTEM	Engine temperature sensor										○
	Idle switch (remaining OFF)							○		○	
	Load switches (remaining ON)							○	○		
OTHERS	Battery (voltage too low)										

SERVICE PROCEDURE

❶ CHECK

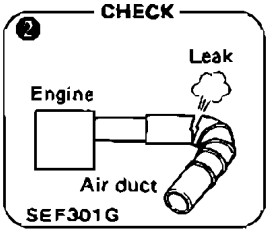


Check ignition timing.

N.G. ↓

Adjust ignition timing. [See page EF & EC-26.]

❷ CHECK



Check intake system for air leaks.

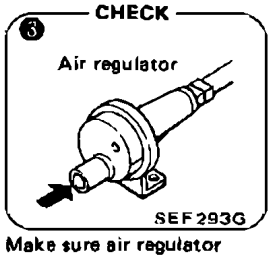
O.K. ↓

N.G. ↓

Check throttle wire for rough sliding.

Repair/replace the part.

❸ CHECK

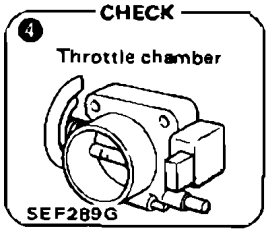


Make sure air regulator stays closed after warm-up.

N.G. ↓

Check air regulator and/or its circuit. [See page EF & EC-130.]

❹ CHECK

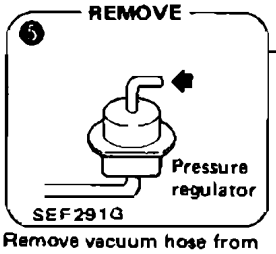


Check throttle chamber ports and valve for clogging.

N.G. ↓

Clean the ports and/or throttle valve.

❺ REMOVE



Remove vacuum hose from pressure regulator, and try to start.

Improved →

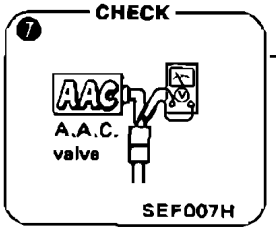
❻ MEASURE

Fuel pressure

Connect vacuum hose to pressure regulator and measure fuel pressure.

Check mixture ratio feedback system. [See page EF & EC-26.]

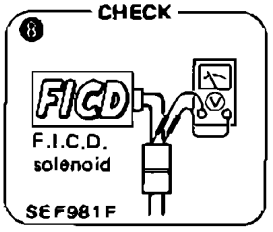
❼ CHECK



Check terminal voltage of A.A.C. valve while idling.

N.G. → Check the part and/or circuit. [See page EF & EC-134.]

❽ CHECK



Check terminal voltage of F.I.C.D. solenoid while idling.

Check the part and/or circuit. [See HA section.]

❾ PERFORM

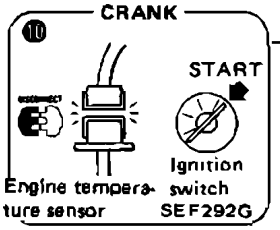
Self-diagnosis Mode IV

Perform self-diagnosis Mode IV (for idle switch).

N.G. ↓

Check the idle switch circuit. [See page EF & EC-116.]

❿ CRANK



Start with engine temperature sensor connector disconnected.

N.G. → Check sensor circuit. [See page EF & EC-90.]

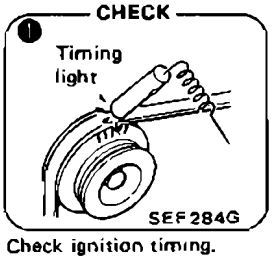
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 12 | Unstable idling — before warm-up

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼
SPECIFICATIONS	Mixture ratio		○	○				
	Ignition timing	○						
INTAKE SYSTEM	Air regulator (not open enough)		○					
	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

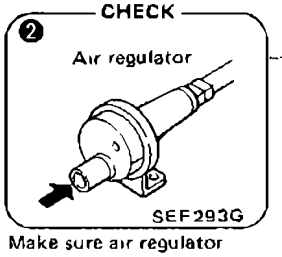
❶ CHECK



Check ignition timing.

N.G. → Adjust ignition timing. [See page EF & EC-26.]

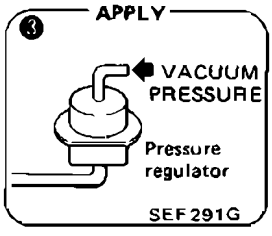
❷ CHECK



Make sure air regulator stays open before warm-up.

N.G. → Check air regulator and/or its circuit [See page EF & EC-130.]

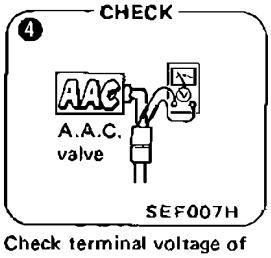
❸ APPLY



Apply vacuum pressure to pressure regulator after disconnecting vacuum hose, and check idling.

Improved → Check mixture ratio feedback system. [See page EF & EC-26.]

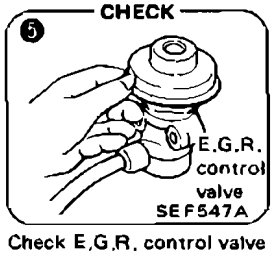
❹ CHECK



Check terminal voltage of A.A.C. valve while idling.

Does not turn ON → Check its circuit. [See page EF & EC-134.]

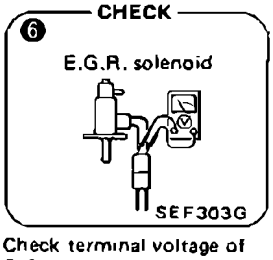
❺ CHECK



Check E.G.R. control valve for operation.

Stays lifted →

❻ CHECK

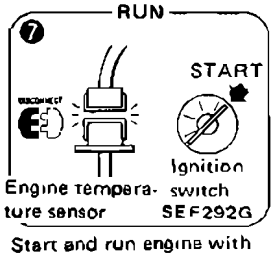


Check terminal voltage of E.G.R. solenoid while idling.

N.G. ↓

Check the solenoid circuit. [See page EF & EC-100.]

❼ RUN



Start and run engine with engine temperature sensor connector disconnected.

N.G. → Check sensor circuit. [See page EF & EC-90.]

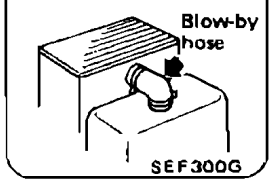
Diagnostic Table (Cont'd)

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	Idle switch												○
	Load switches												
E.G.R. SYSTEM	E.G.R. control valve										○		
	E.G.R. solenoid										○	○	

SERVICE PROCEDURE

❶ CHECK

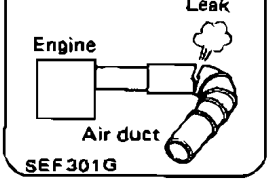


Check blow-by hose for leaks.

N.G.

Repair/replace the hose.

❷ CHECK

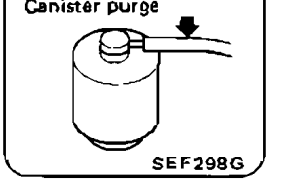


Check intake system for air leaks.

N.G.

Repair/replace the part.

❸ CHECK

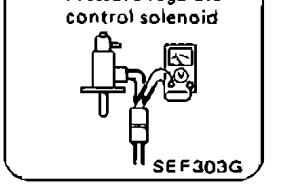


Check purge line for leaks.

N.G.

Repair/replace the hose.

❹ CHECK

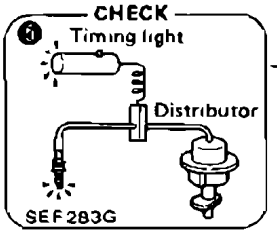


Check terminal voltage of the solenoid while idling.

N.G.

Check the solenoid circuit. [See page EF & EC-124.]

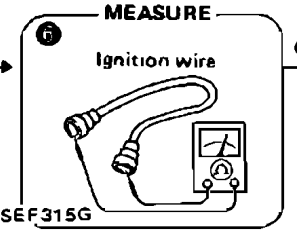
❺ CHECK



Check flashes of timing light for weakness.

N.G. →

❻ MEASURE



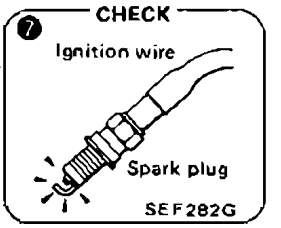
Measure resistance of suspect wires.

N.G.

Replace the wire.

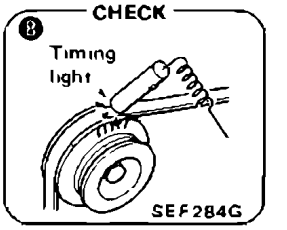
O.K. →

❼ CHECK



Remove spark plugs and check their ignition sparks.

❽ CHECK

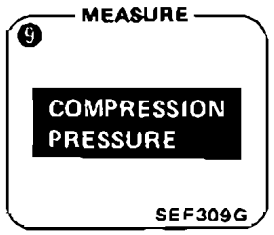


Check ignition timing

N.G.

Adjust ignition timing. [See page EF & EC-26.]

❾ MEASURE

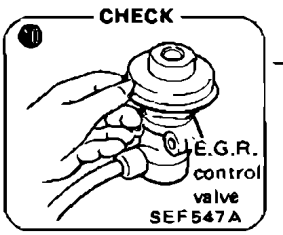


Measure compression pressure.

N.G.

Check cylinder head and gasket. [See EM section.]

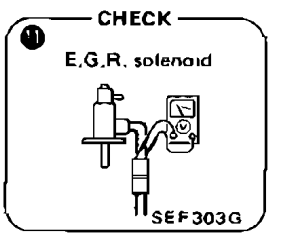
❿ CHECK



Check E.G.R. control valve for operation.

Stays lifted →

⓫ CHECK

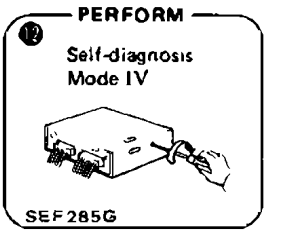


Check terminal voltage of E.G.R. solenoid while idling

N.G.

Check the solenoid circuit. [See page EF & EC-100.]

⓬ PERFORM



Perform self-diagnosis Mode IV (for idle switch).

N.G.

Check the idle switch circuit. [See page EF & EC-116.]

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									○
	Idle switch (remaining OFF)					○				
OTHERS	Fuel (poor quality)									

SERVICE PROCEDURE

❶ CHECK — Timing light, Distributor — SEF283G
N.G. →
Check flashes of timing light for weakness.

❷ MEASURE — Ignition wire — SEF315G
N.G. → Replace the wires.
O.K. →
Measure resistance of suspect wires.

❸ CHECK — Ignition wire, Spark plug — SEF282G
Remove spark plugs and check their ignition sparks.

❹ CHECK — Leak, Engine, Air duct — SEF301G
N.G. → Repair/replace the part.
Check intake system for air leaks.

❺ PERFORM — Self-diagnosis Mode IV — SEF285G
N.G. → Check the idle switch circuit. [See page EF & EC-116.]
Perform self-diagnosis Mode IV (for idle switch).

❻ REMOVE — Pressure regulator — SEF291G
Improved →
Remove vacuum hose from pressure regulator, and try to drive.

❼ MEASURE — Fuel pressure gauge — SEF286G
→ Check mixture ratio feedback system. [See page EF & EC-26.]
Connect vacuum hose to pressure regulator and measure fuel pressure while driving.

❽ PERFORM — Self-diagnosis Mode V — SEF285G
N.G. → Check the malfunctioning parts and/or circuits. [See page EF & EC-88 (air flow meter).]
Perform self-diagnosis Mode V (for air flow meter).

❾ DISCONNECT — Exhaust gas sensor — SEF307G
Improved → Replace the sensor.
No change → Check mixture ratio feedback system. [See page EF & EC-26.]
Disconnect exhaust gas sensor connector, and try to drive.

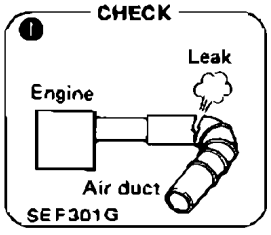
Diagnostic Table (Cont'd)

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								○	
	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

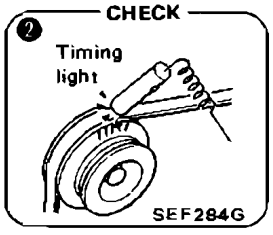


Check intake system for air leaks.

N.G.

Repair/replace the part.

❷ CHECK

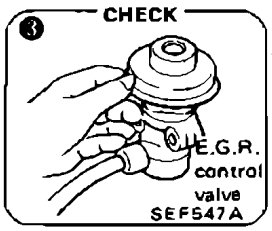


Check ignition timing.

N.G.

Adjust ignition timing. [See page EF & EC-26.]

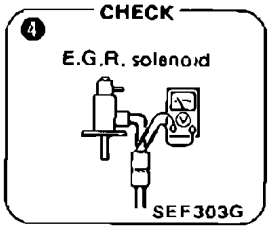
❸ CHECK



Stays lifted

Check E.G.R. control valve for operation.

❹ CHECK

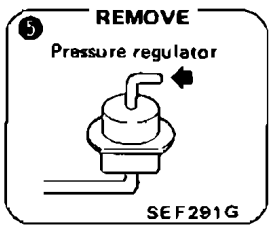


Check terminal voltage of E.G.R. solenoid.

N.G.

Check the solenoid circuit. [See page EF & EC-100.]

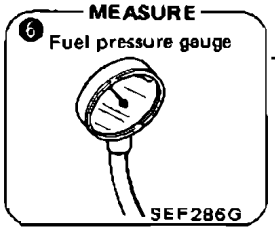
❺ REMOVE



Improved

Remove vacuum hose from pressure regulator, and try to drive.

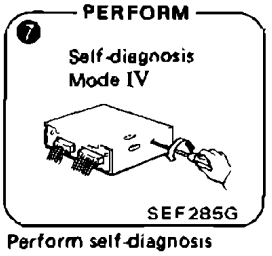
❻ MEASURE



Check mixture ratio feedback system. [See page EF & EC-26.]

Connect vacuum hose to pressure regulator and measure fuel pressure while driving

❼ PERFORM

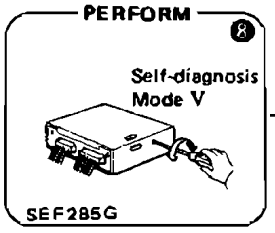


Perform self-diagnosis Mode IV (for idle switch).

N.G.

Check the idle switch circuit. [See page EF & EC-116.]

❽ PERFORM

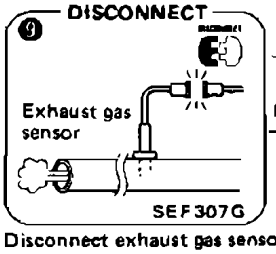


N.G.

Check the malfunctioning parts and/or circuits. [See page EF & EC-86 (crank angle sensor), page EF & EC-88 (air flow meter), page EF & EC-94 (ignition signal).]

Perform self-diagnosis Mode V (for crank angle sensor, air flow meter, ignition signal.)

❾ DISCONNECT



Improved

Replace the sensor.

No change

Check mixture ratio feedback system. [See page EF & EC-26.]

Disconnect exhaust gas sensor connector, and try to drive.

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-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 V
SEF285G
Perform self-diagnosis Mode V (for air flow meter).
N.G.
Check the malfunctioning parts and/or circuit.
[See page EF & EC-88.]

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-26.]

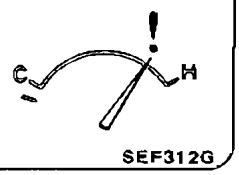
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 17 Poor driveability – detonation

POSSIBLE CAUSES		❶	❷	❸	❹	❺
SPECIFICATIONS	Mixture ratio (too lean)			O	O	
	Fuel pressure (low)			O		
	Ignition timing (too advanced)		O			
FUEL SYSTEM	Fuel filter (clogged)				O	
	Fuel line (clogged)				O	
	Injectors (clogged)				O	
CONTROL SYSTEM	Crank angle sensor (improper 1°-signals)					O
	Air flow meter					O
	Engine temperature sensor					O
OTHERS	Water temperature (too high)	O				
	Fuel (low octane rating, poor quality)					

SERVICE PROCEDURE

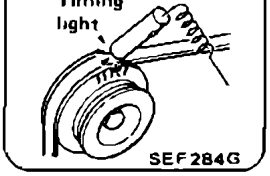
❶ CHECK — Water temperature



Too high → Check cooling system. [See LC section.]

Check water temperature.

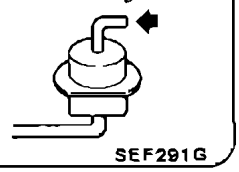
❷ CHECK — Timing light



N.G. → Adjust ignition timing. [See page EF & EC-26.]

Check ignition timing.

❸ REMOVE — Pressure regulator



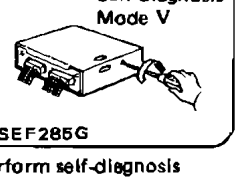
Improved →

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-86 (crank angle sensor), page EF & EC-88 (air flow meter).]

Perform self-diagnosis Mode V (for crank angle sensor and air flow meter).

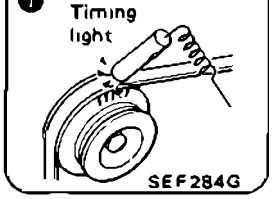
Diagnostic Table (Cont'd)

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

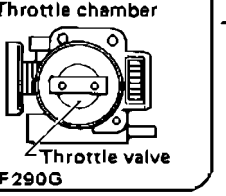
❶ **CHECK** — Timing light



Check ignition timing.

N.G. → Adjust ignition timing. [See page EF & EC-26.]

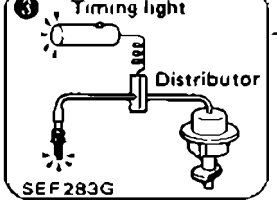
❷ **CHECK** — Throttle chamber



Check throttle valve for rough movement.

N.G. → Repair/replace the part.

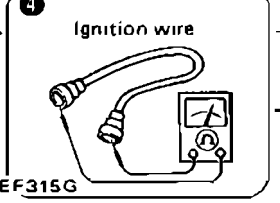
❸ **CHECK** — Timing light



Check flashes of timing light for weakness.

N.G. →

❹ **MEASURE** — Ignition wire

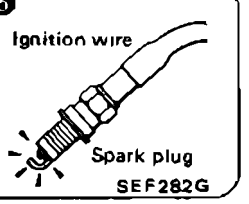


Measure resistance of ignition wires.

N.G. → Replace the wires.

O.K. →

❺ **CHECK** — Ignition wire



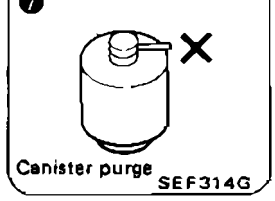
Remove spark plugs and check their ignition sparks.

❻ **MEASURE** — COMPRESSION PRESSURE

Measure compression pressure.

Check cylinder head and gasket. [See EM section.]

❼ **TRY**

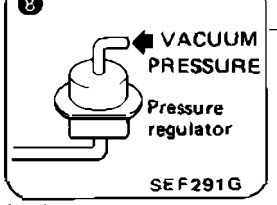


Shut evaporated fuel to intake valve and try to drive.

Improved → Replace the canister and/or the hoses.

No change →

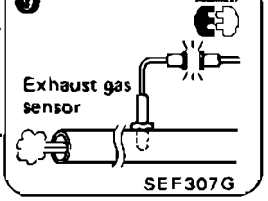
❽ **APPLY** — VACUUM PRESSURE



Apply vacuum pressure to pressure regulator after disconnecting vacuum hose, and try to drive.

Improved → Check mixture ratio feedback system. [See page EF & EC-26.]

❾ **DISCONNECT**



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.

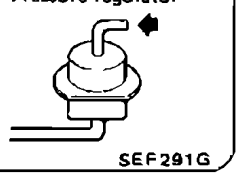
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 19 Engine stall — while idling

POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻	❼	❽	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)			○				○		
	F.I.C.D. solenoid (improper operation)			○					○	
CONTROL SYSTEM	Idle switch (remaining OFF)									○
	Neutral switch (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-26.]

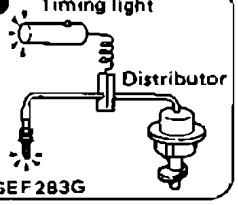
❸ **MEASURE** Tachometer

Measure idle speed.

↓ N.G.

Adjust idle speed. [See page EF & EC-26.]

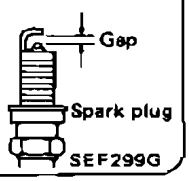
❹ **CHECK** Timing light



Check flashes of timing light for weakness.

N.G. →

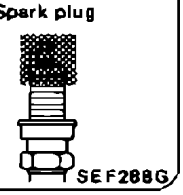
❺ **CHECK**



Remove spark plugs and check their gaps and tips.

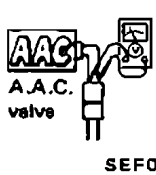
and/or

❻ **CHECK** Spark plug



Check spark plugs for being foul or wet with fuel.

❼ **CHECK**

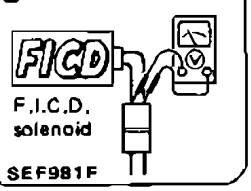


Check terminal voltages of A.A.C. valve.

↓ N.G.

Check the part and/or circuit. [See page EF & EC-134.]

❽ **CHECK**

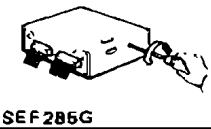


Check terminal voltage of F.I.C.D. solenoid.

↓ N.G.

Check the part and/or circuit. [See HA section.]

❾ **PERFORM** Self-diagnosis Mode IV



Perform self-diagnosis Mode IV (for idle switch).

N.G. → Check the idle switch circuit. [See page EF & EC-116.]

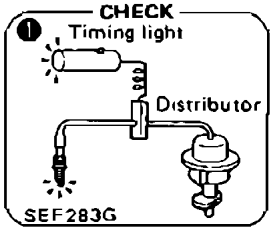
Diagnostic Table (Cont'd)

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					○	○	

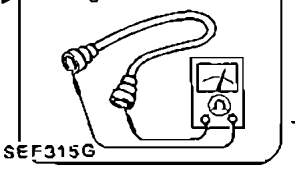
SERVICE PROCEDURE

❶ **CHECK** Timing light



Check flashes of timing light for weakness during acceleration.

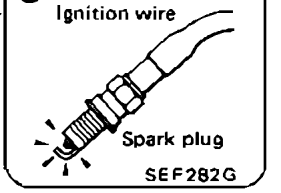
N.G. → ❷ **MEASURE** Ignition wire



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 **MEASURE**

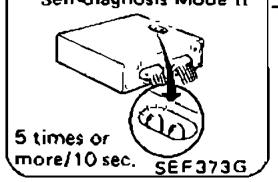
COMPRESSION PRESSURE

SEF309G

Measure compression pressure.

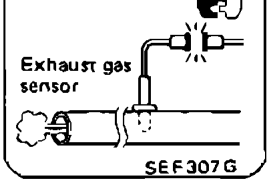
N.G. → Check cylinder head and gasket. [See EM section.]

❺ **CHECK** Self-diagnosis Mode II



Check mixture ratio by flashes of inspection lamps.

N.G. → ❻ **DISCONNECT**

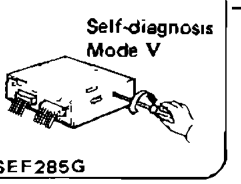


Disconnect exhaust gas sensor connector, and try to drive

Improved → Replace the sensor.

No change → Check mixture ratio feedback system. [See page EF & EC-26.]

❼ **PERFORM** Self-diagnosis Mode V



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-86 (crank angle sensor), page EF & EC-88 (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, Distributor — SEF283G

Check flashes of timing light for weakness at constant engine revolution. (1,000 - 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 Move V — SEF285G

Perform self-diagnosis Mode V (for air flow meter and crank angle sensor).

N.G. → Check the circuits. [See page EF & EC-86 (crank angle sensor), page EF & EC-88 (air flow meter).]

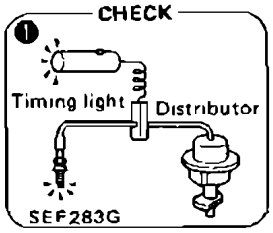
Diagnostic Table (Cont'd)

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

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-94 (ignition siglal), page EF & EC-86 (crank angle sensor).]

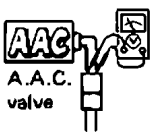
❸ MEASURE

Tachometer

Measure idle speed.

N.G → Adjust idle speed. [See page EF & EC-26.]

❹ CHECK

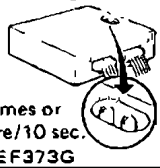


Check terminal voltage of A.A.C. valve.

Left OFF → Check the circuit. [See page EF & EC-134.]

❺ CHECK

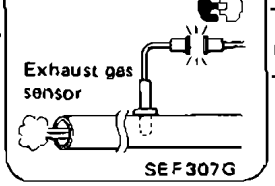
Self-diagnosis Mode II



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	❺
SPECIFICATIONS	Ignition timing		O			
	Idle speed (too low)	O				
INTAKE SYSTEM	Idle speed control valve (remaining OFF)	O		O		
	F.I.C.D. solenoid (remaining OFF)	O			O	
CONTROL SYSTEM	Idle switch (remaining OFF)	O				O
	Load switches (remaining OFF)	O		O	O	

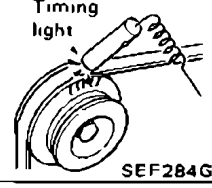
SERVICE PROCEDURE

❶ MEASURE
Tachometer

Measure idle speed

N.G. → Adjust idle speed. [See page EF & EC-26.]

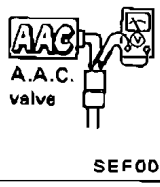
❷ CHECK
Timing light



Check ignition timing.

N.G. → Adjust ignition timing. [See page EF & EC-26.]

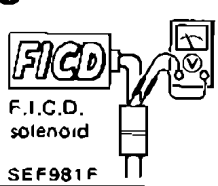
❸ CHECK



Check terminal voltage of A.A.C. valve.

N.G → Check the part and/or circuit. [See page EF & EC-134.]

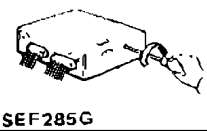
❹ CHECK



Check terminal voltage of F.I.C.D. solenoid

→ Check the part and/or circuit. [See HA section.]

❺ PERFORM
Self-diagnosis Mode IV



Perform self-diagnosis Mode IV (for idle switch).

N.G. → Check the idle switch circuit. [See page EF & EC-116.]

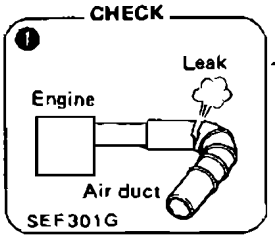
Diagnostic Table (Cont'd)

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

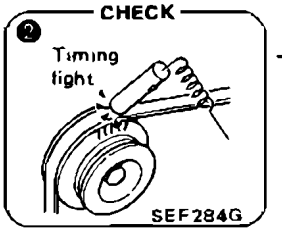
❶ CHECK



Check intake system for air leaks.

N.G. → Repair/replace the part.

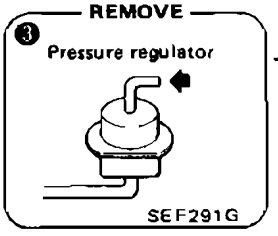
❷ CHECK



Check ignition timing.

N.G. → Adjust ignition timing. [See page EF & EC-26.]

❸ REMOVE



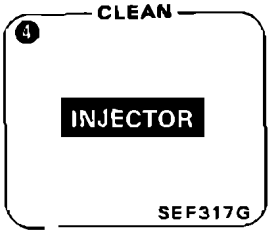
Remove vacuum hose from pressure regulator, and try to drive.

Improved → Check mixture ratio feedback system. [See page EF & EC-26.]

No change ↓

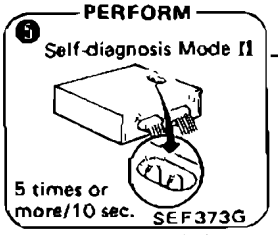
or

❹ CLEAN



Clean the injector.

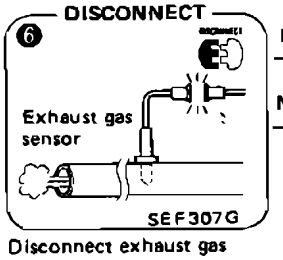
❺ PERFORM



Check mixture ratio by flashes of inspection lamps.

N.G. →

❻ DISCONNECT

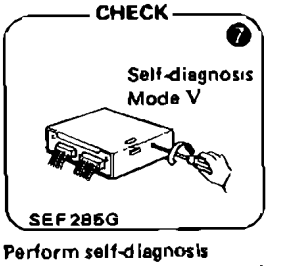


Disconnect exhaust gas sensor connector, and try to drive.

Improved → Replace the sensor.

No change → Check mixture ratio feedback system. [See page EF & EC-26.]

❼ CHECK



Perform self-diagnosis Mode V (for air flow meter).

N.G. ↓

Check the circuits. [See page EF & EC-88 (air flow meter).]

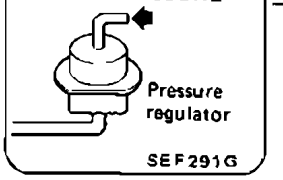
Diagnostic Table (Cont'd)

SYMPTOM & CONDITION 25 Backfire – through the exhaust

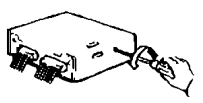
POSSIBLE CAUSES		❶	❷	❸	❹	❺	❻
SPECIFICATIONS	Mixture ratio (too rich)	O	O				
FUEL SYSTEM	Injectors (fuel leaks)		O				
IGNITION SYSTEM	(missing)				O		
INTAKE SYSTEM	Air cleaner element (clogged)	O					
	A.I.V. (always operating)					O	
	A.I.V. solenoid (remaining ON)					O	O
CONTROL SYSTEM	Idle switch (remaining OFF)			O			

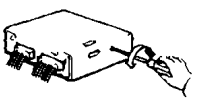
SERVICE PROCEDURE

❶ CHECK
AIR CLEANER ELEMENT
SEF320G
N.G. → Replace the element.
Check air cleaner element for clogging.

❷ APPLY PRESSURE


SEF291G
Improved → Check mixture ratio feedback system. [See page EF & EC-26.]
Apply pressure to pressure regulator after disconnecting vacuum hose, and try to drive.

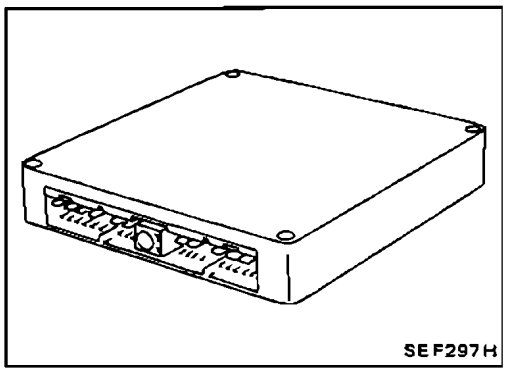
❸ PERFORM
Self-diagnosis Mode IV

SEF285G
N.G. → Check idle switch and/or its circuit. [See page EF & EC-116.]
Perform self-diagnosis Mode IV (for idle switch).

❹ PERFORM
Self-diagnosis Mode V

SEF285G
N.G. → Check the malfunctioning part and/or circuit. [See page EF & EC-94 (ignition signal).]
Perform self-diagnosis Mode V (for ignition signal).

❺ CHECK
A.I.V.
SEF375G
Keeps flowing →
Check secondary air to exhaust system.

❻ CHECK
A.I.V. solenoid

SEF372G
Left ON → Check the solenoid circuit. [See page EF & EC-138.]
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.

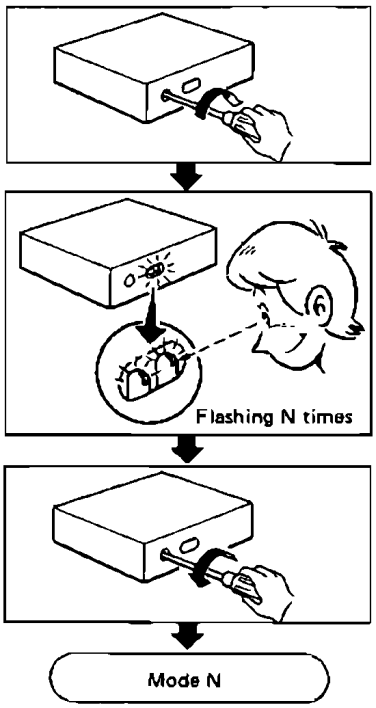
1. **Mode I (Exhaust gas sensor monitor)**
- During closed-loop operation:
  The green inspection lamp turns ON when a lean condition is detected and goes OFF under rich condition.
- During open-loop operation condition:
  The green inspection lamp remains OFF or ON.

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)**
  This mode is the same as the former self-diagnosis in self-diagnosis mode.

4. **Mode IV (Switches ON/OFF diagnostic system)**
  During this mode, the inspection lamps monitor the switch ON-OFF condition.
- 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.

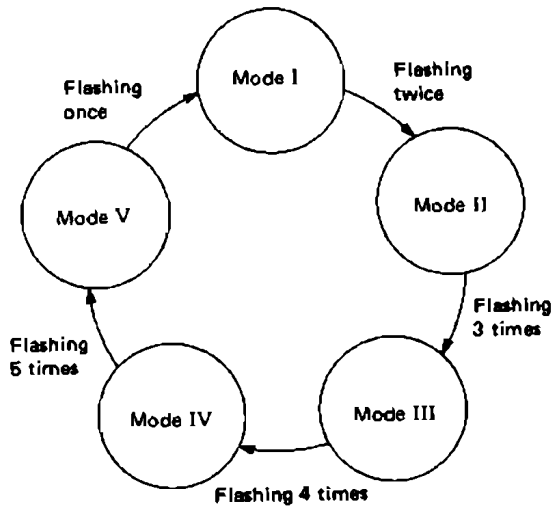


SEF288H

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.**

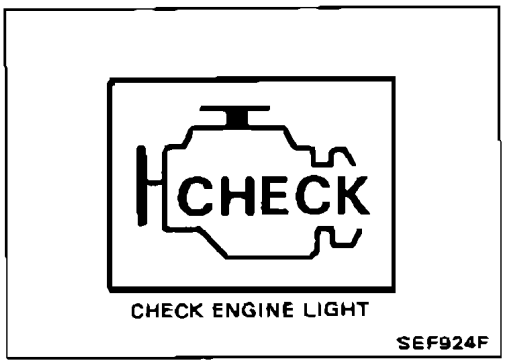
The stored memory will be lost if:

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 (For California only)



CHECK ENGINE LIGHT
SEF924F

This vehicle has a check engine light on the instrument panel. This light comes ON under the following conditions:

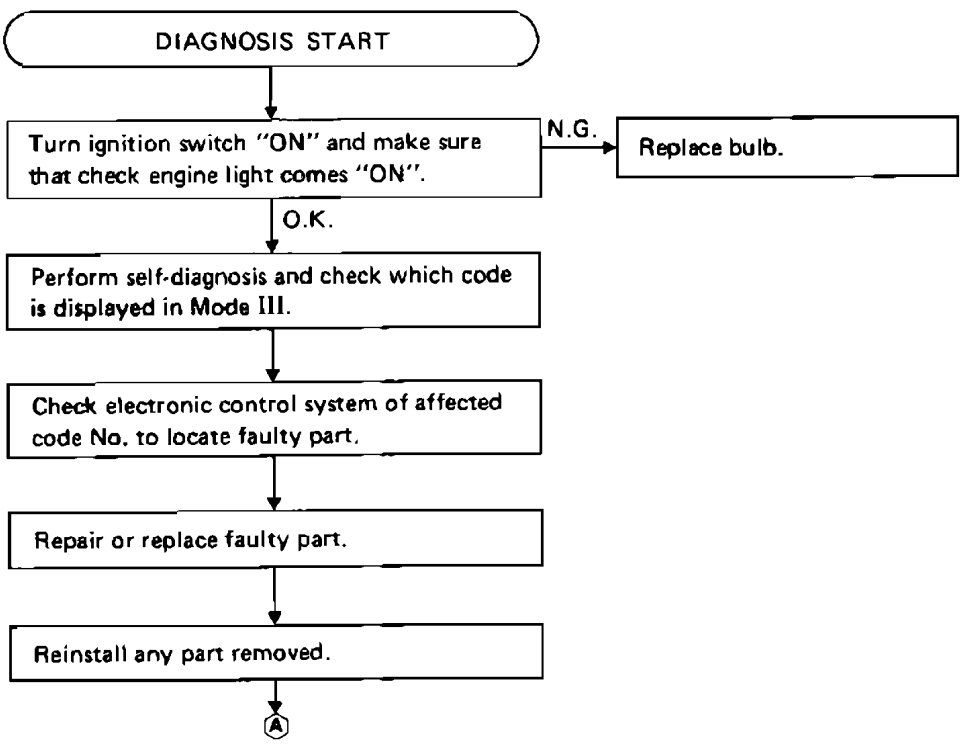
1) When ignition switch is turned "ON" (for bulb check).
2) When systems related to emission performance malfunction in Mode I (with engine running).

- **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.**

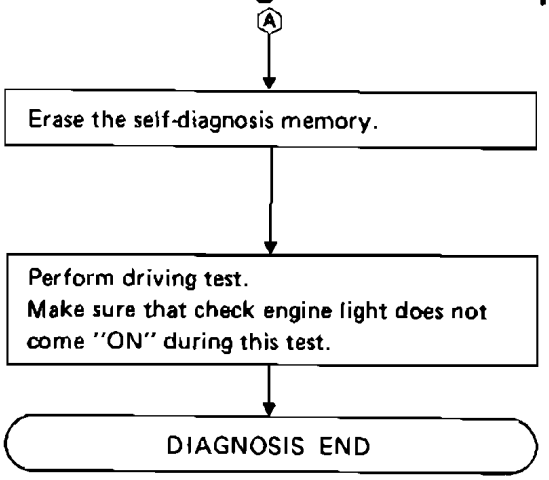
3) Check engine light will come "ON" only when malfunction is sensed.
   The check engine light will turn off when normal operation is resumed. Mode III memory must be cleared as the contents remain stored.

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-104.

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
				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.**

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	–
43	Throttle sensor circuit	X	X
45	Injector leak	X	–
55	No malfunction in the above circuit	X	X

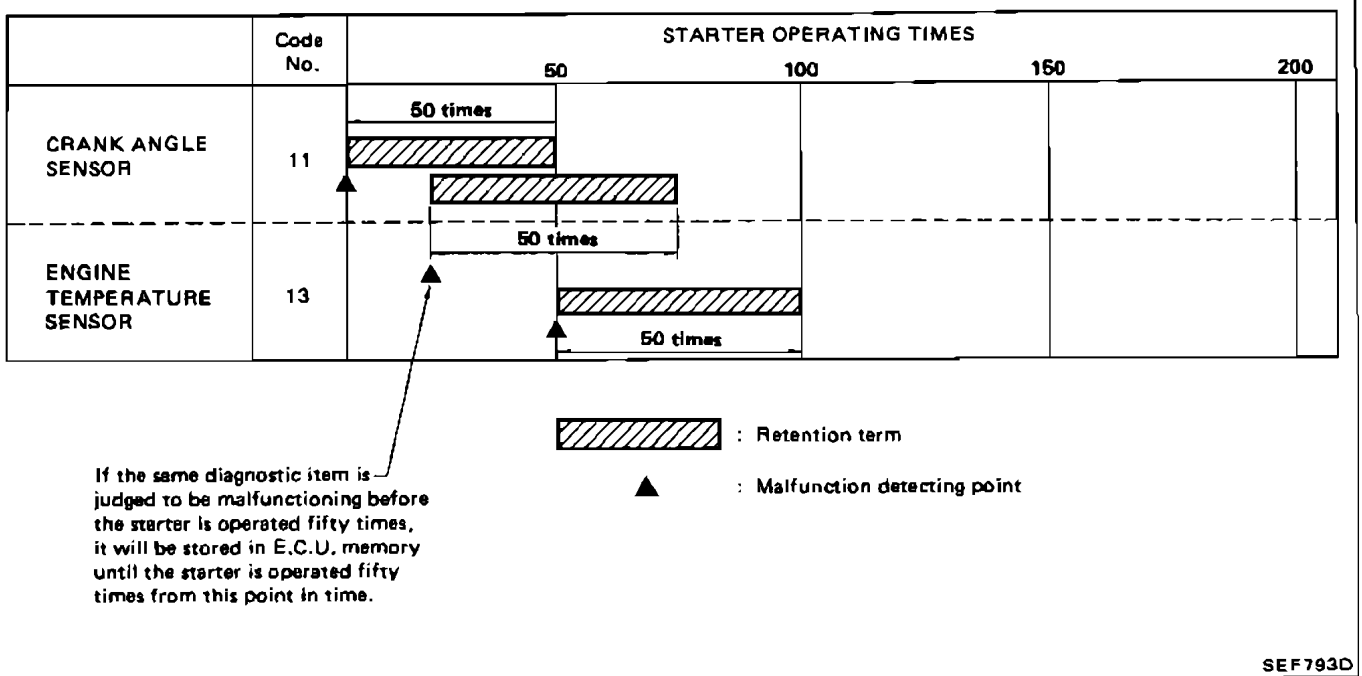
X: Available –: Not available

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.

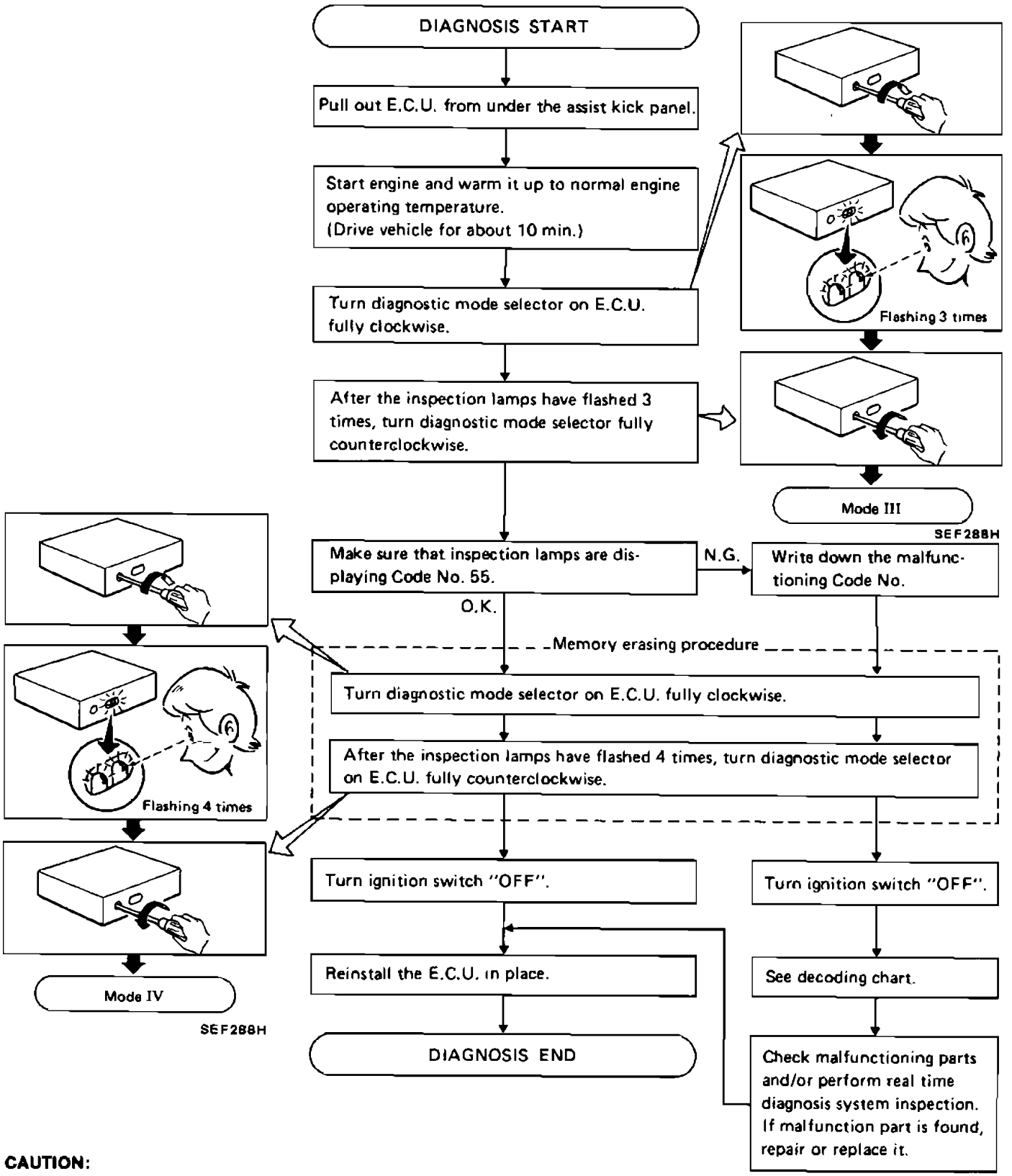
RETENTION TERM CHART (Example)



SEF793D

Self-diagnosis — Mode III (Self-diagnostic system) (Cont'd)

SELF-DIAGNOSTIC PROCEDURE

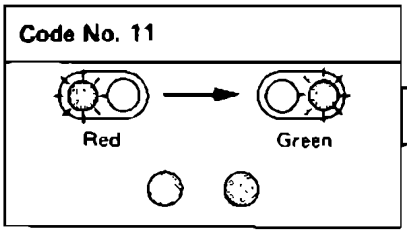


CAUTION:

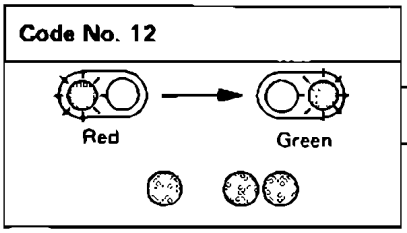
- **During display of a code number in self-diagnosis mode (Mode III), if another diagnostic mode is to be performed, be sure to note the malfunction code number before turning diagnostic mode selector on E.C.U. fully clockwise. When selecting an alternative, select the diagnosis mode after turning switch "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)

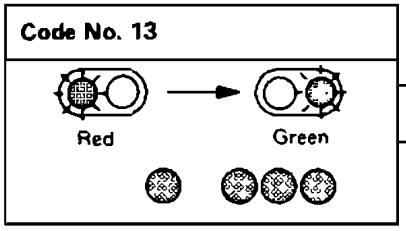
DECODING CHART

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-86.

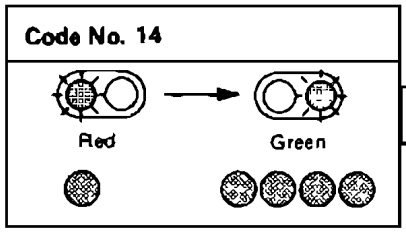
SEF042F

DISPLAY CODE	MALFUNCTIONING CIRCUIT OR PARTS	CONTROL UNIT SHOWS A MALFUNCTION SIGNAL WHEN THE FOLLOWING CONDITIONS ARE DETECTED.
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-88.

SEF043F

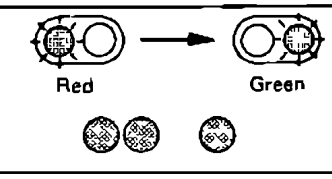
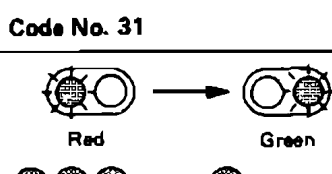
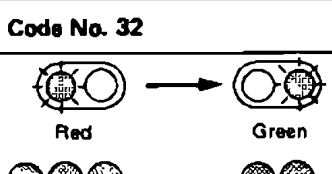
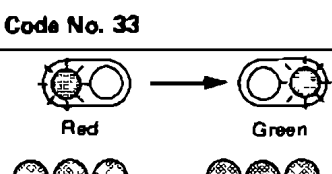
DISPLAY CODE	MALFUNCTIONING CIRCUIT OR PARTS	CONTROL UNIT SHOWS A MALFUNCTION SIGNAL WHEN THE FOLLOWING CONDITIONS ARE DETECTED.
ENGINE TEMPERATURE SENSOR (CHECK) Code No. 13 	Engine temperature sensor circuit	• The engine temperature sensor circuit is open or shorted. (An abnormally high or low output voltage is entered.) SYSTEM INSPECTION See page EF & EC-90.

SEF044F

DISPLAY CODE	MALFUNCTIONING CIRCUIT OR PARTS	CONTROL UNIT SHOWS A MALFUNCTION SIGNAL WHEN THE FOLLOWING CONDITIONS ARE DETECTED.
VEHICLE SPEED SENSOR (CHECK) Code No. 14 	Vehicle speed sensor circuit	• Signal circuit is open. SYSTEM INSPECTION See page EF & EC-92.

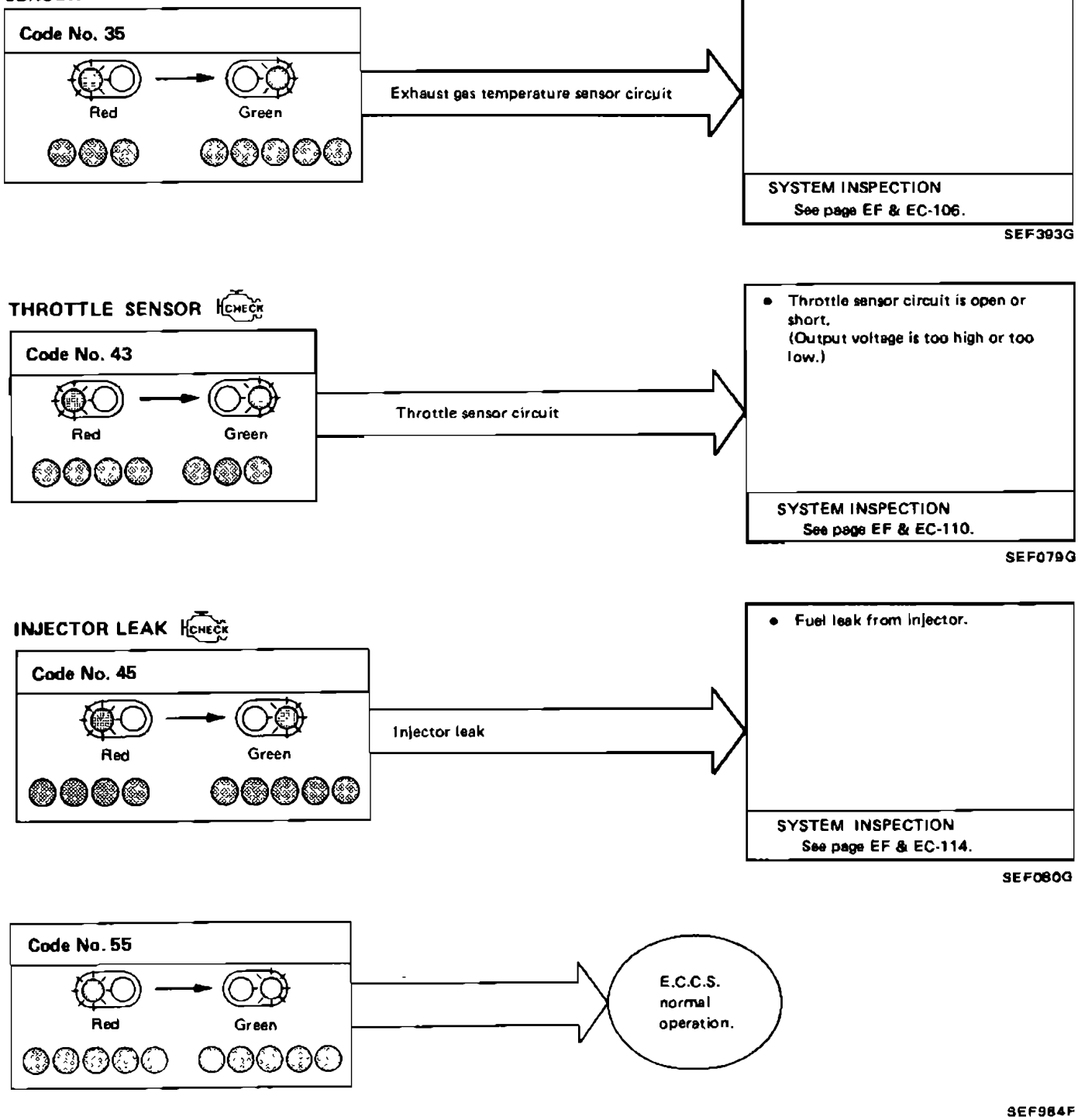
SEF074G

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-94.
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-98.
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-100.
SEF077G		
EXHAUST GAS SENSOR CHECK **Code No. 33** 	Exhaust gas sensor circuit	• Signal circuit is open. SYSTEM INSPECTION See page EF & EC-104.
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-106.
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-110.
INJECTOR LEAK (CHECK)		
Code No. 45	Injector leak	• Fuel leak from injector. SYSTEM INSPECTION See page EF & EC-114.
Code No. 55		E.C.C.S. normal operation.



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.

- Idle switch
- Starter switch
- Vehicle speed sensor

(1) 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)

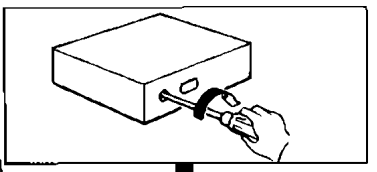
SELF-DIAGNOSTIC PROCEDURE

DIAGNOSIS START

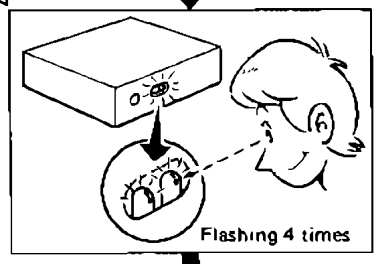
Pull out E.C.U. from under the assist kick panel.

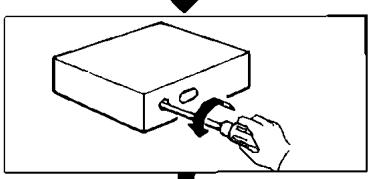
Turn ignition switch "ON".

Turn diagnostic mode selector on E.C.U. fully clockwise.



After the inspection lamps have flashed 4 times, turn diagnostic mode selector fully counterclockwise.

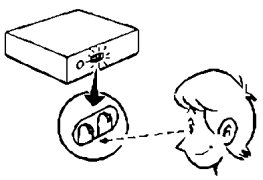




Mode IV

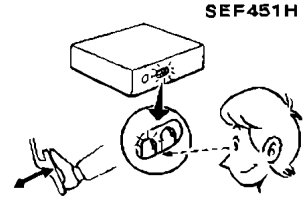
SEF288H

Make sure that a red inspection lamp goes "OFF".



SEF451H

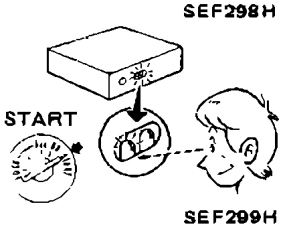
Make sure that a red inspection lamp goes "ON" when depressing accelerator pedal. — N.G. → Check idle switch circuit.



SEF298H

O.K.

Make sure that a red inspection lamp goes "ON" during turning ignition switch "START"*. — N.G. → Check starter signal circuit.



SEF299H

O.K.

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 the E.C.U. in place.

DIAGNOSIS END

CAUTION:

- **For safety, do not drive rear wheels at higher speed than required.**

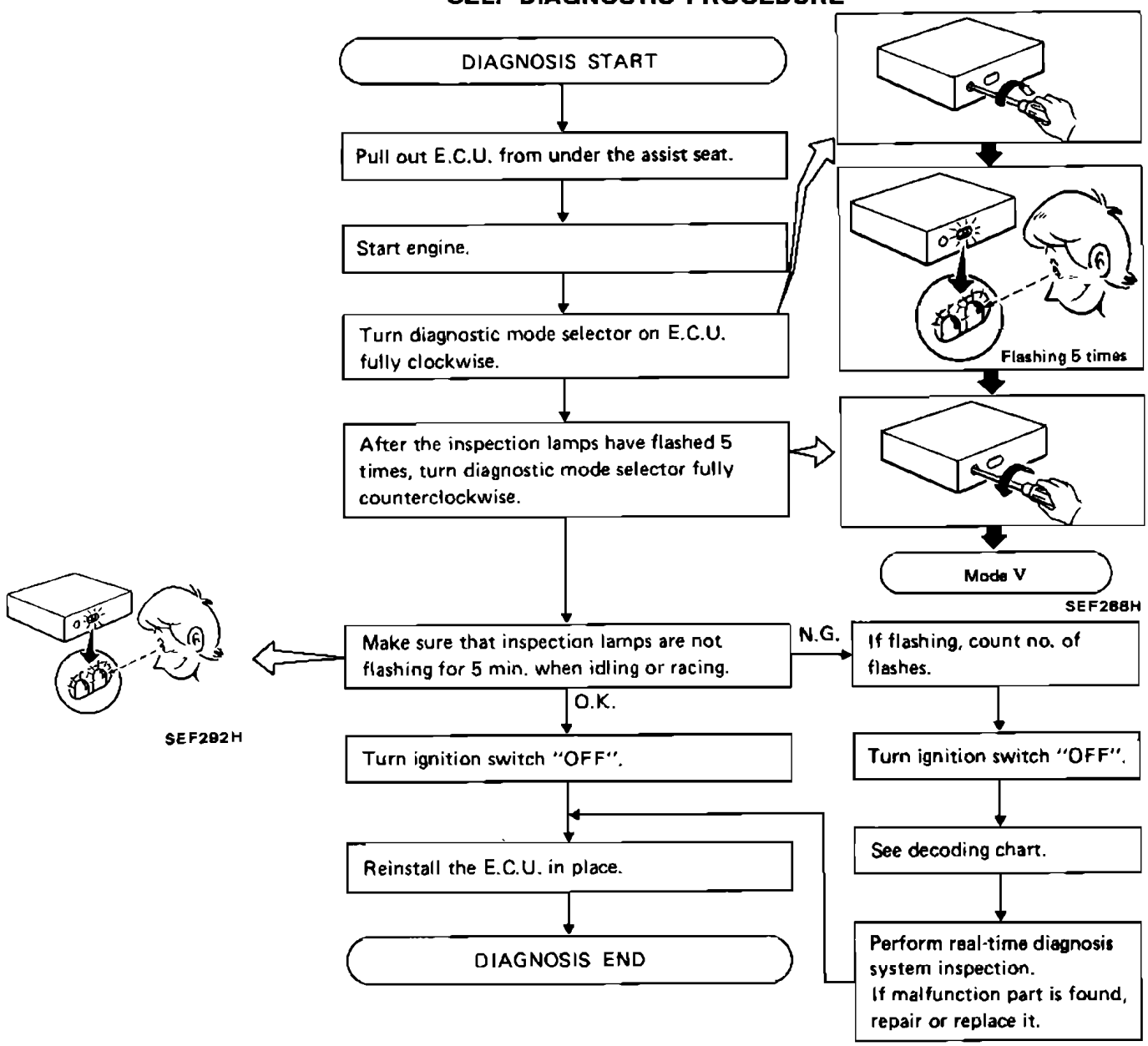
Self-diagnosis — Mode V (Real-time diagnostic system)

In real-time diagnosis, if the following items are judged to be working incorrectly, a malfunction will be indicated immediately.

- Crank angle sensor (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.

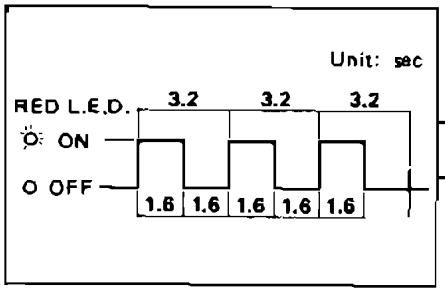
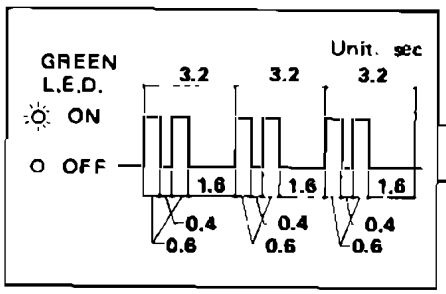
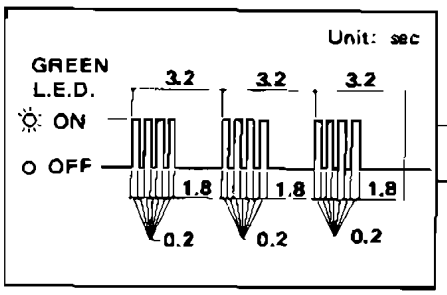
SELF-DIAGNOSTIC PROCEDURE



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, multipla, momentary noise signals enter. REAL-TIME DIAGNOSTIC INSPECTION See page EF & EC-86.
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-88.
SEF048F		
IGNITION SIGNAL		
	Malfunction of ignition signal	• Signal from the primary ignition coil momentarily drops off. REAL-TIME DIAGNOSTIC INSPECTION See page EF & EC-94.
SEF049F		

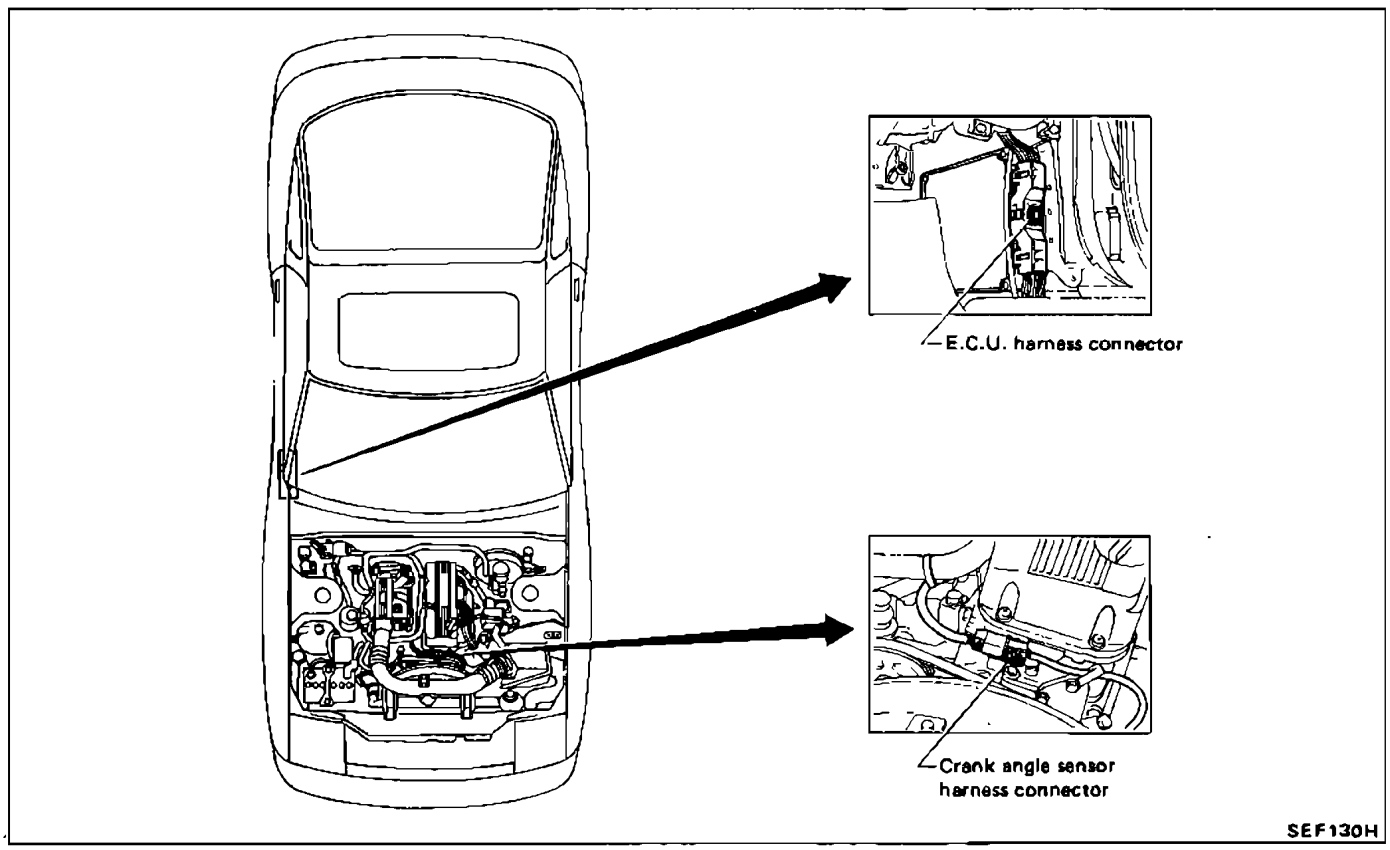
Self-diagnosis — Mode V (Real-time diagnostic system) (Cont'd)

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.

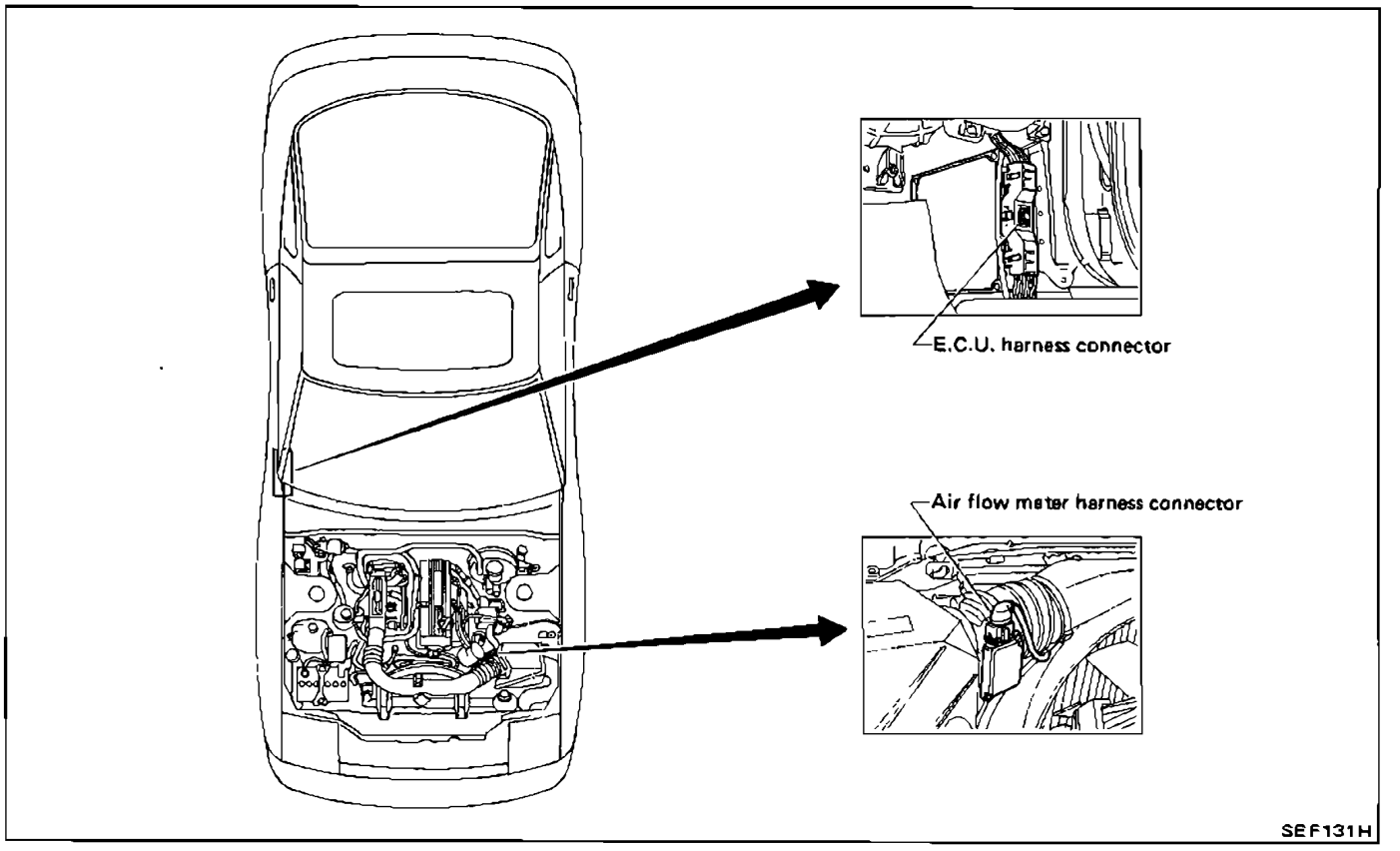


Self-diagnosis — Mode V (Real-time diagnostic system) (Cont'd)

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.

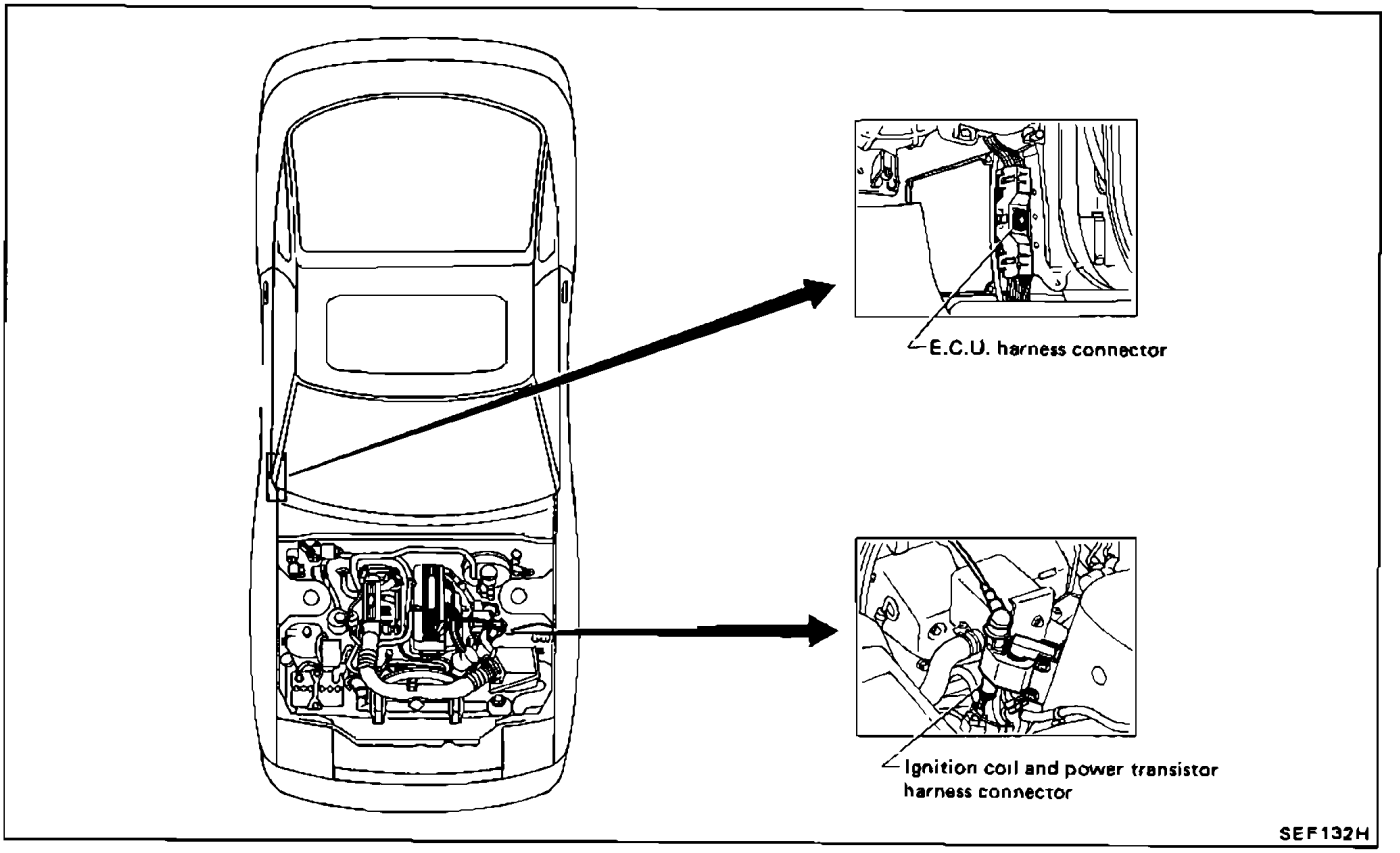


Self-diagnosis — Mode V (Real-time diagnostic system) (Cont'd)

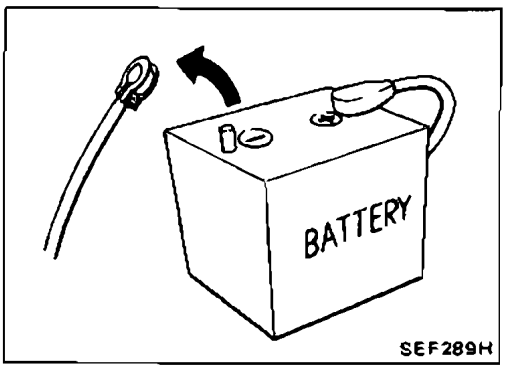
Ignition Signal

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.



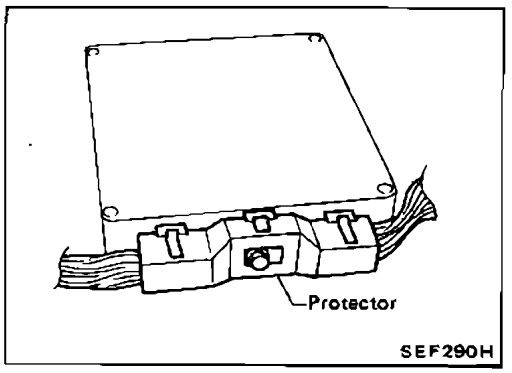
NOTE



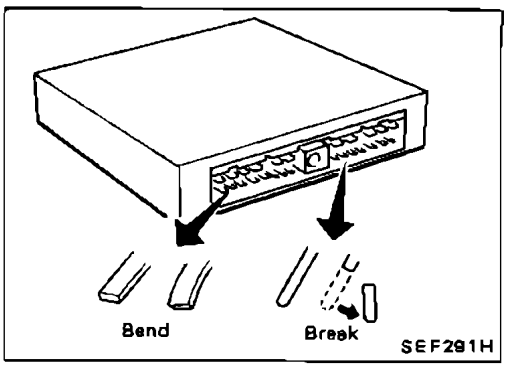
Diagnostic Procedure

CAUTION:

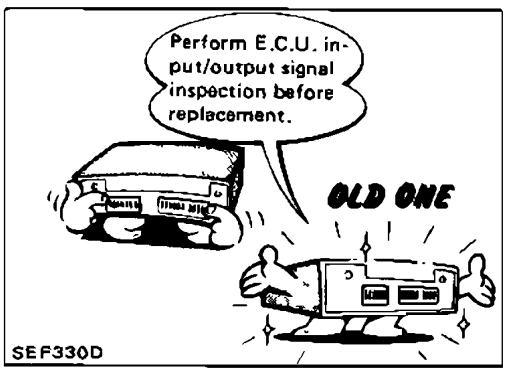
1. **Before connecting or disconnecting the E.C.U. harness connector to or from any E.C.U., be sure to turn the ignition switch to the "OFF" position and disconnect the negative battery terminal in order not to damage E.C.U. as battery voltage is applied to E.C.U. even if ignition switch is turned off. Failure to do so may damage the E.C.U.**



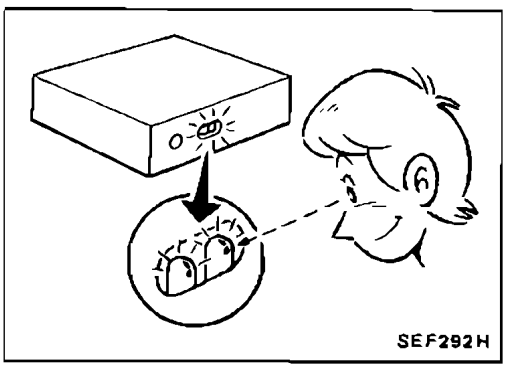
2. **When performing E.C.U. input/output signal inspection, remove connector protector to insert tester probe into connector.**



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.**

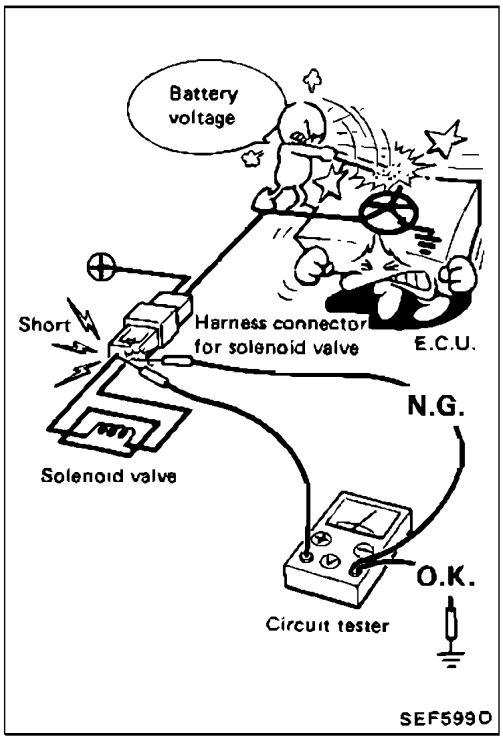


5. **Before replacing E.C.U., perform E.C.U. input/output signal inspection and make sure whether the E.C.U. unit functions properly or not. (See page EF & EC-142.)**



6. **After performing this "Diagnostic Procedure", perform E.C.C.S. self-diagnosis and driving test.**

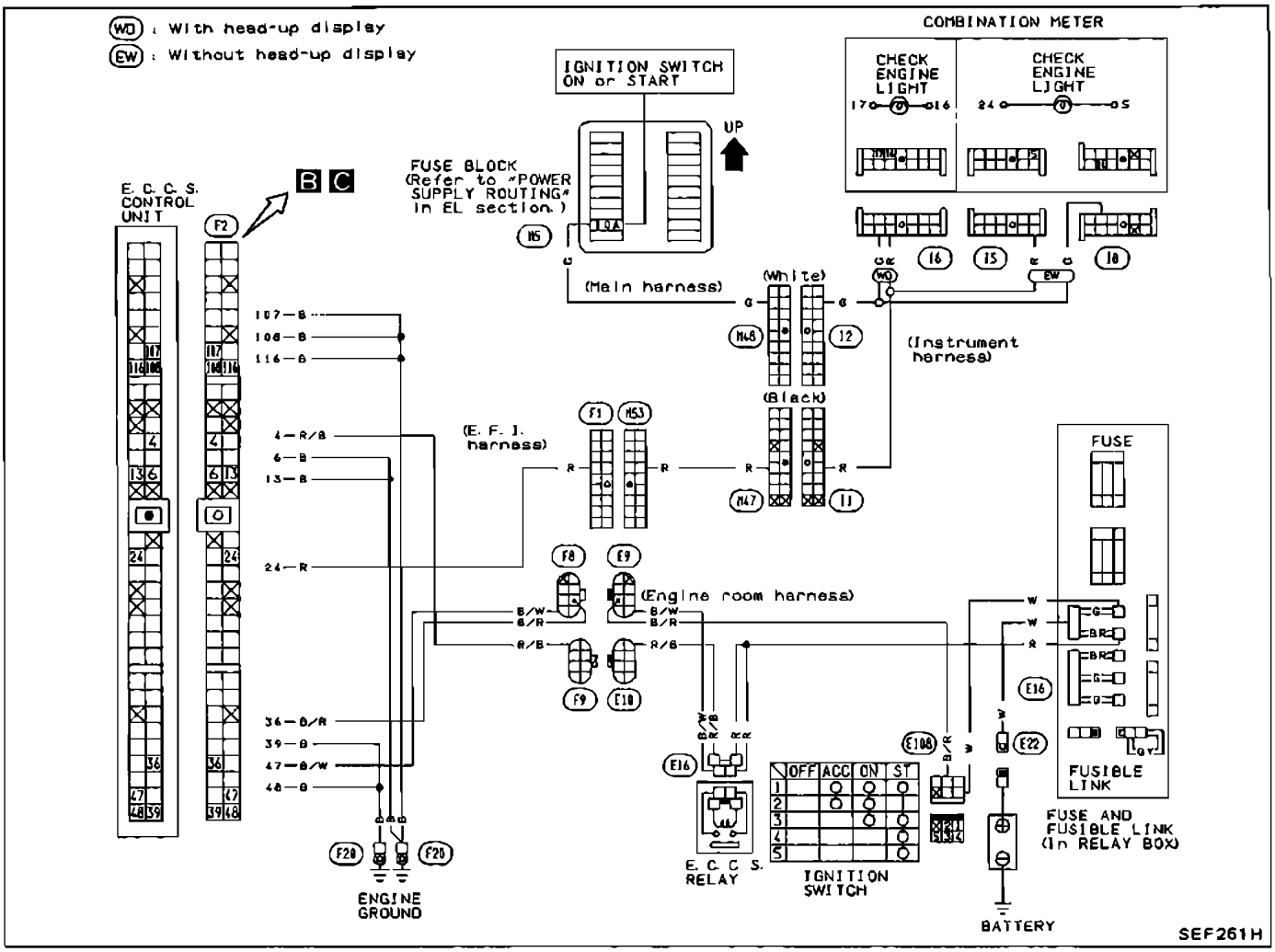
Diagnostic Procedure (Cont'd)



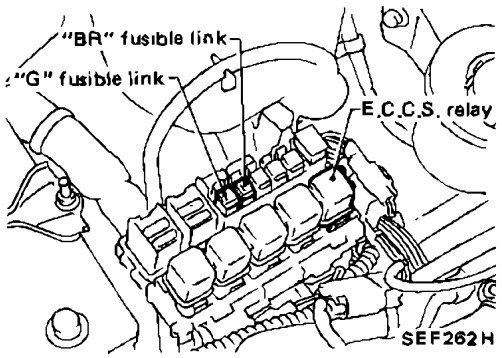
7. **When measuring E.C.U. controlled components supply voltage with a circuit tester, separate one tester probe from the other.**
   If the two tester probes accidentally make contact with each other during measurement, the circuit will be shorted, resulting in damage to the control unit power transistor.

Diagnostic Procedure 1

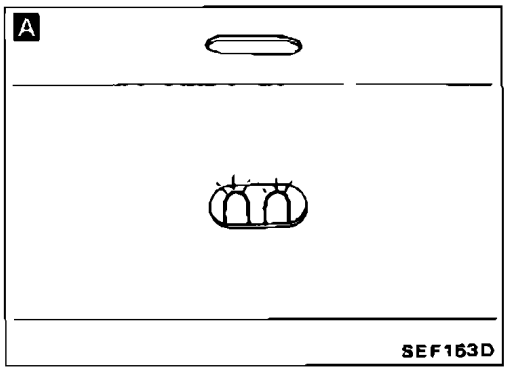
MAIN POWER SUPPLY AND GROUND CIRCUIT



Component location

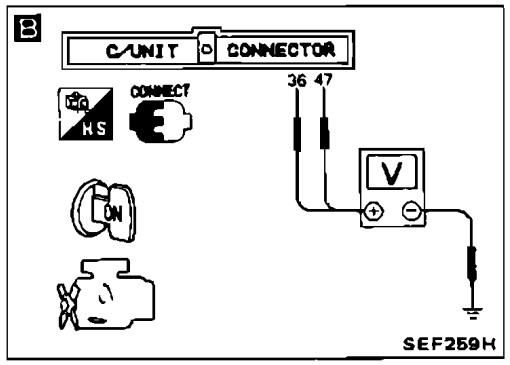


A



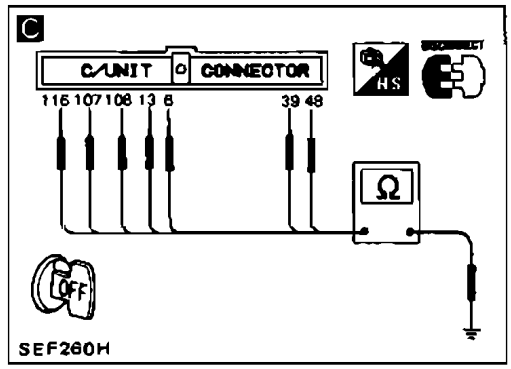
SEF153D

B



SEF259H

C



SEF260H

INSPECTION START

CHECK DIAGNOSTIC MODE ON THE E.C.U.
Verify that diagnostic mode selector on the E.C.U. is turned "OFF".

O.K.

A

CHECK POWER SOURCE FOR E.C.U.
1) Turn ignition switch "ON".
2) Verify that red and green inspection lamps on the E.C.U. illuminate.

N.G. → B

B

Check voltage between E.C.U. terminals ㊱, ㊼ and ground.
Battery voltage should exist.

㊼ N.G. / ㊱ N.G.

Check following items.
1) "G" fusible link
2) Harness or connectors between terminal ㊱ and battery.
3) Ignition switch
If N.G., replace affected parts.

Check following items.
1) "BR" fusible link
2) Harness or connectors between terminal ㊼ and battery
3) Harness or connectors between terminal ④ and battery
4) E.C.C.S. relay
(See page EF & EC-147.)

O.K.

C

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check continuity between terminals ⑥, ⑬, ㊴, ㊽, ⑩⑦, ⑩⑧, ⑪⑥ and ground.
Continuity should exist.

N.G. → Check harness continuity between E.C.U. and engine ground.

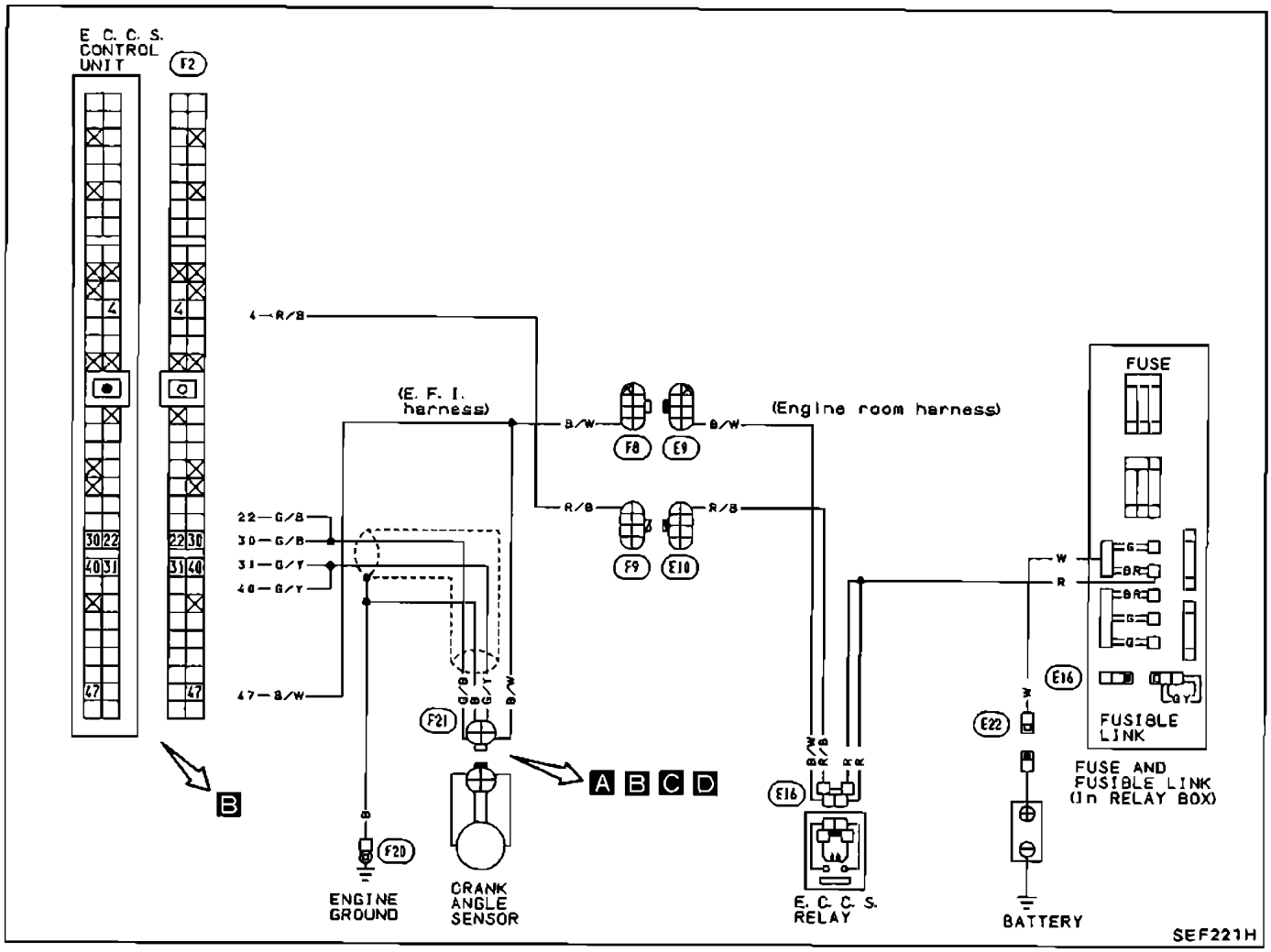
O.K.

Reinstall any part removed.

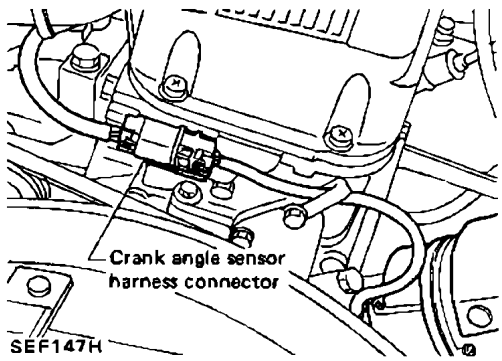
INSPECTION END

Diagnostic Procedure 2

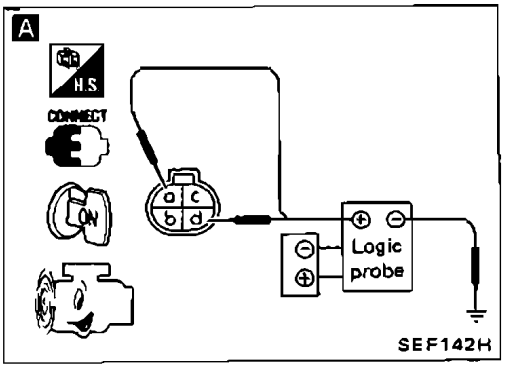
CRANK ANGLE SENSOR (Code No. 11)



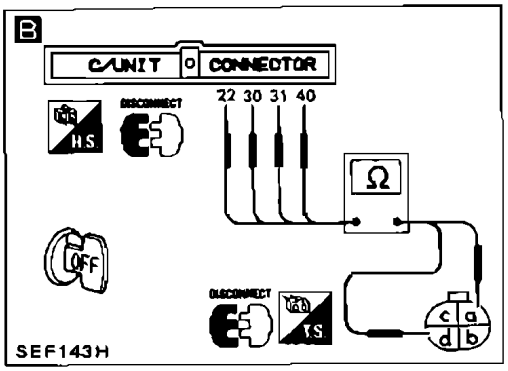
Component location



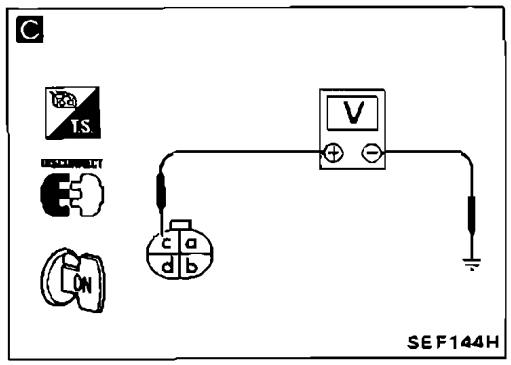
A



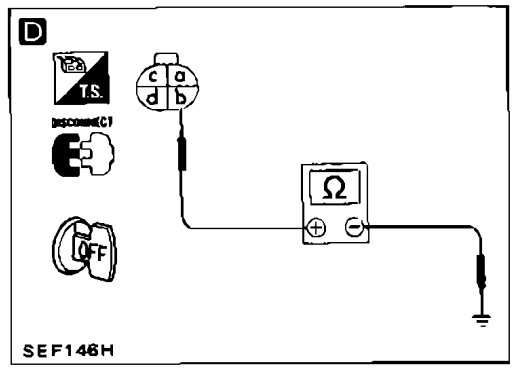
B



C



D



INSPECTION START

A

CHECK E.C.U. INPUT SIGNAL (Crank angle sensor side).
1) Start engine.
2) Check that pulse signals exist in crank angle sensor harness connector terminals ⓐ and ⓓ with logic probe.
Pulse signals should exist.
ⓐ : **180° signal**
ⓓ : **1° signal**

O.K. → **B**

N.G. ↓ **C**

B

CHECK HARNESS CONTINUITY BETWEEN CRANK ANGLE SENSOR AND E.C.U.
1) Stop engine.
2) Disconnect crank angle sensor harness connector.
3) Disconnect E.C.U. harness connector.
4) Check continuity between terminals ⓐ and ㉒, ㉚.
5) Check continuity between terminals ⓓ and ㉛, ㊵.
Continuity should exist.

N.G. ↓

Repair harness or connectors between crank angle sensor and E.C.U.

C

CHECK POWER SUPPLY (Crank angle sensor side).
1) Stop engine.
2) Disconnect crank angle sensor harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓒ and ground.
Battery voltage should exist.

N.G. → Repair or replace harness or connectors between crank angle sensor harness connector terminal ⓒ and E.C.U. harness connector terminal ㊼.

O.K. ↓ **D**

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check resistance between terminal ⓑ and ground.
Continuity should exist.

N.G. → 1) Repair harness or connectors.
2) Check engine ground.

O.K. ↓

CHECK COMPONENTS.
Check crank angle sensor.
(See page EF & EC-147.)

N.G. → Replace crank angle sensor.

O.K. ↓

Reinstall any part removed.

↓

Erase the self-diagnosis memory.

↓

Perform driving test and then perform self-diagnosis (Mode-III) again.

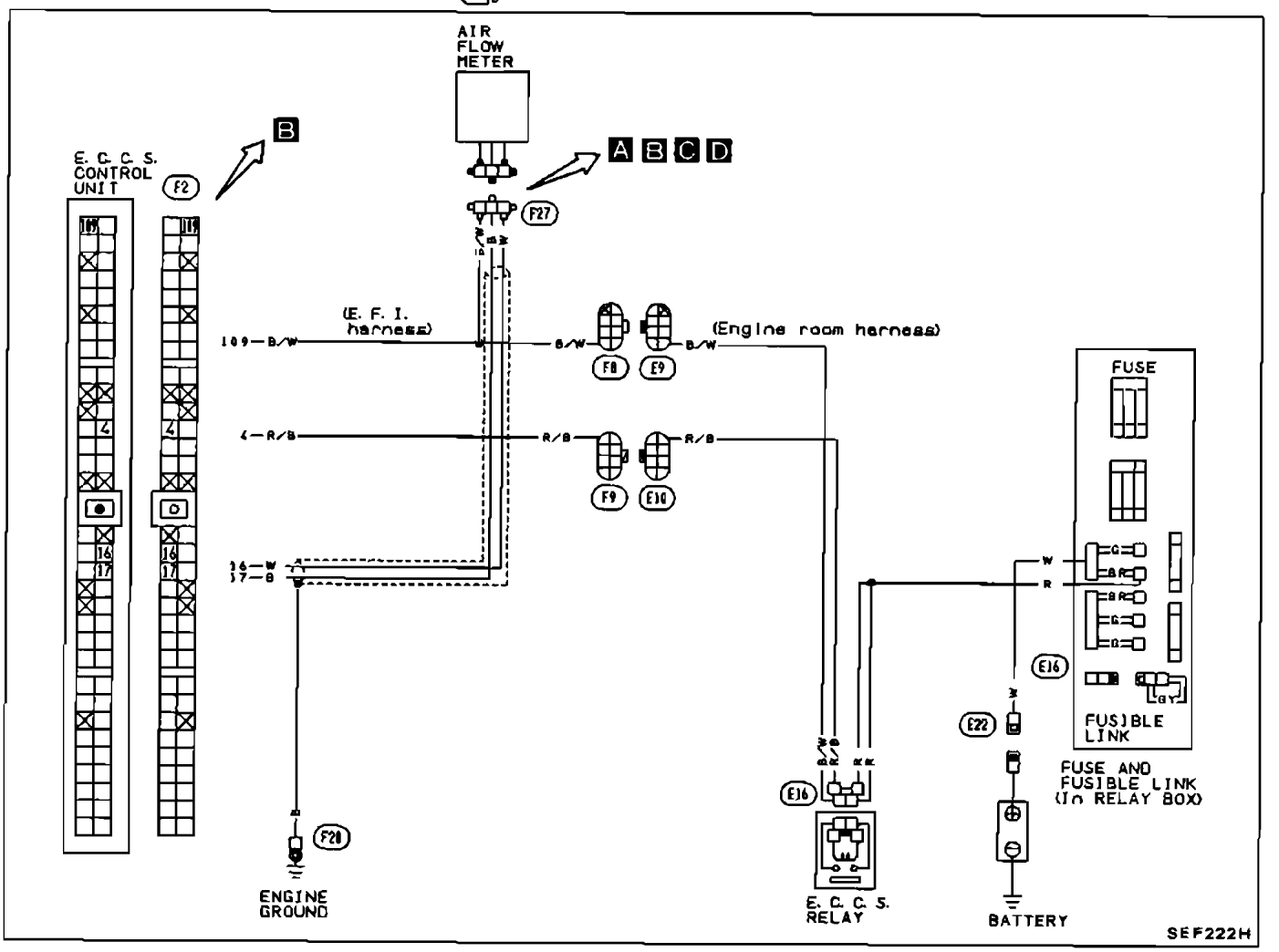
N.G. → 1) Perform E.C.U. input/output signal inspection test.
2) If N.G., recheck the E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K. ↓

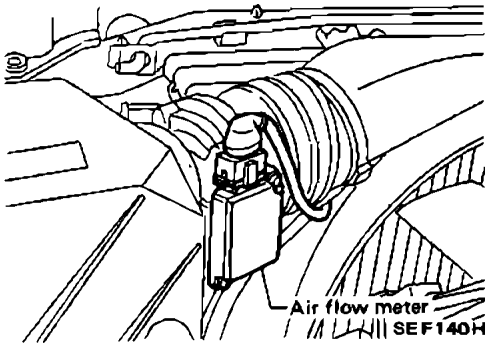
INSPECTION END

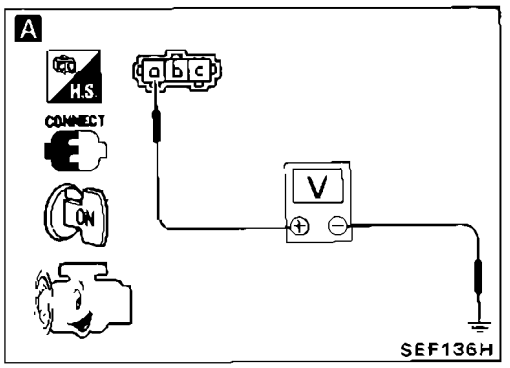
Diagnostic Procedure 3

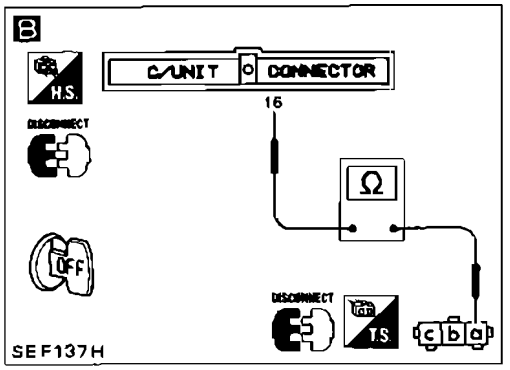
AIR FLOW METER (Code No. 12) CHECK

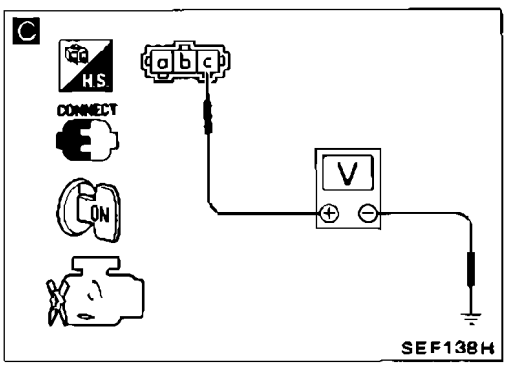


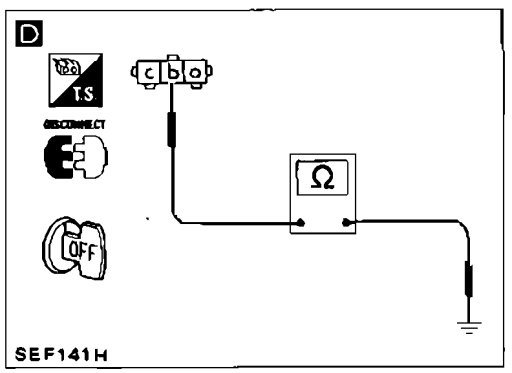
Component location











INSPECTION START

A

CHECK E.C.U. INPUT SIGNAL (Air flow meter side).
1) Start engine.
2) Check that voltage between air flow meter harness connector terminal ⓐ and ground changes by racing engine with accelerator pedal.
Output voltage should change.
1.0 - Approximately 3.0V

O.K. → **B**

CHECK HARNESS CONTINUITY BETWEEN AIR FLOW METER AND E.C.U.
1) Stop engine.
2) Disconnect air flow meter harness connector.
3) Disconnect E.C.U. harness connector.
4) Check continuity between terminals ⓐ and ⑯.
Continuity should exist.

N.G. →

Repair or replace harness or connectors between terminals ⓐ and ⑯.

N.G. ↓

C

CHECK POWER SUPPLY (Air flow meter side).
1) Stop engine.
2) Disconnect air flow meter harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓒ and ground.
Battery voltage should exist.

N.G. → Repair or replace harness or connectors between air flow meter harness connector terminal ⓒ and E.C.U. harness connector terminal ⑩⑨.

O.K. ↓

D

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check resistance between terminal ⓑ and ground.
Resistance:
Approximately 0Ω

N.G. → 1) Repair or replace harness or connectors between terminals ⓑ and ⑰.
2) Check engine ground.

O.K. ↓

CHECK COMPONENTS.
Check air flow meter.
(See page EF & EC-147.)

N.G. → Replace air flow meter.

O.K. ↓

Reinstall any part removed.

↓

Erase the self-diagnosis memory.

↓

Perform driving test and then perform self-diagnosis again.

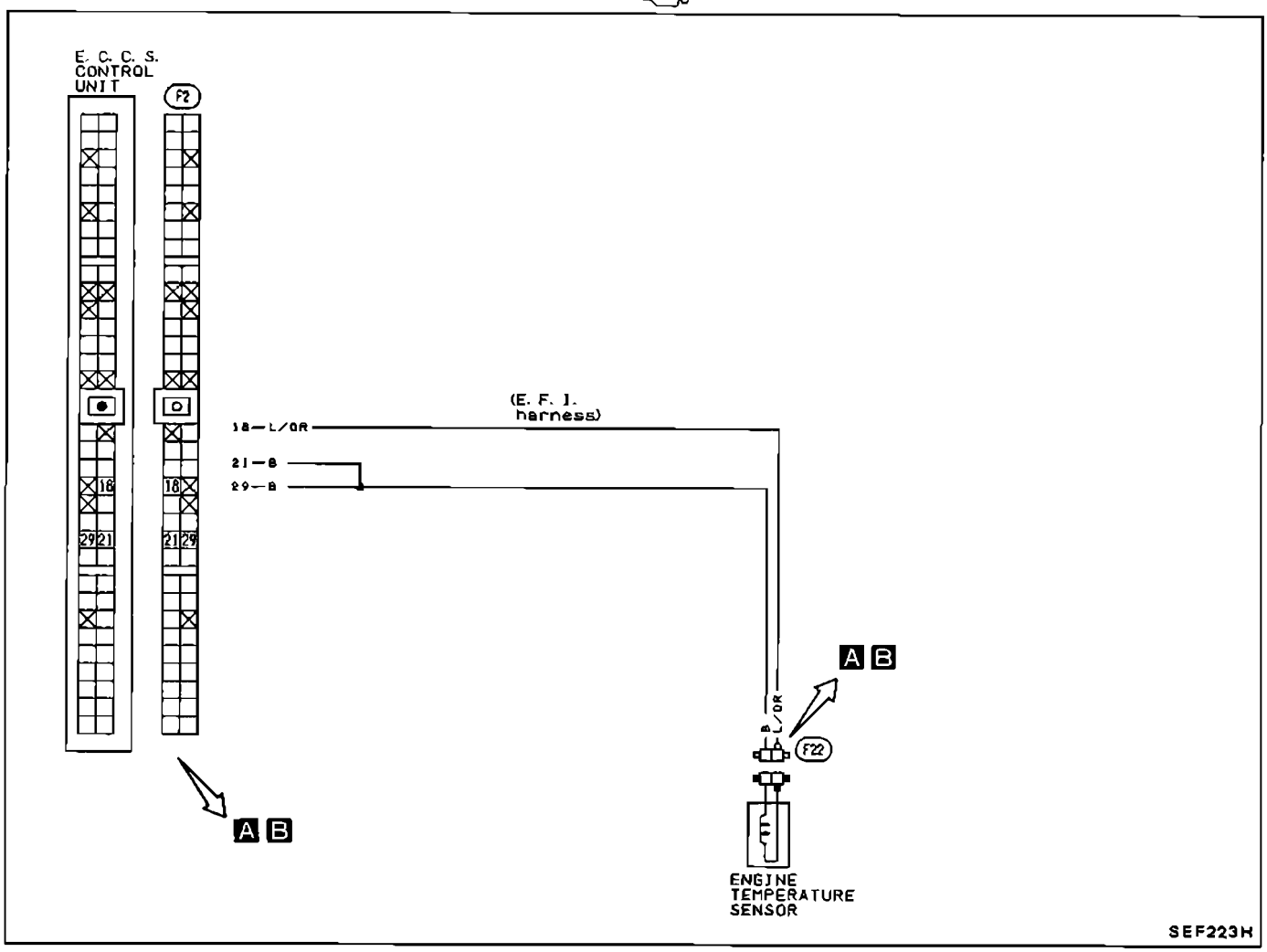
N.G. → 1) Perform E.C.U. input/output signal inspection test.
2) If N.G., recheck the E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K. ↓

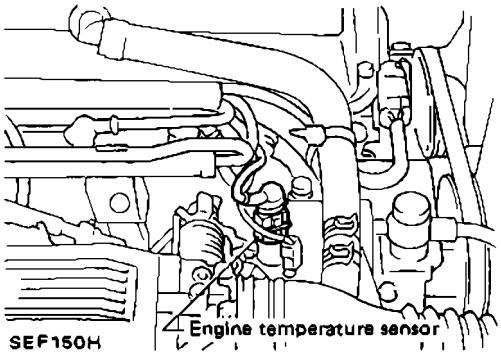
INSPECTION END

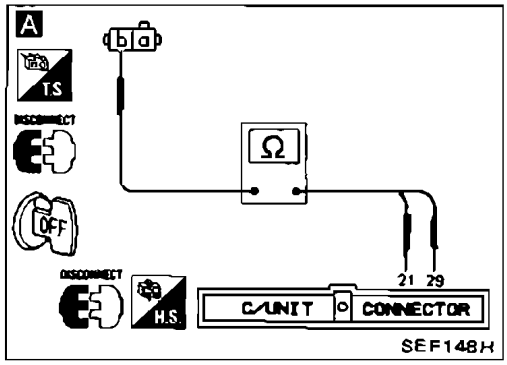
Diagnostic Procedure 4

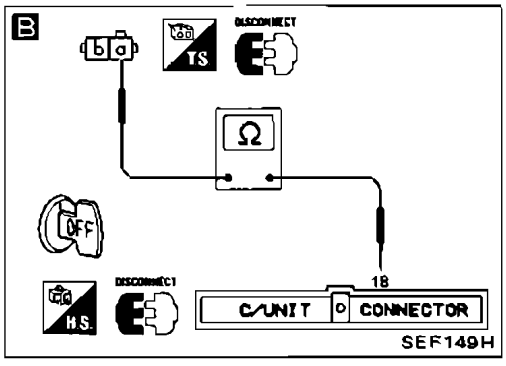
ENGINE TEMPERATURE SENSOR (Code No. 13) CHECK



Component location







INSPECTION START

CHECK COMPONENTS.
Check engine temperature sensor.
(See page EF & EC-147.)

N.G. → Replace engine temperature sensor.

O.K.

A

CHECK GROUND CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check continuity between engine temperature sensor terminal ⓑ and E.C.U. terminals ㉑, ㉙.
Continuity should exist.

N.G. →
1) Repair harness or connectors between terminals ⓑ and ㉑, ㉙.
2) Check engine ground.

O.K.

B

CHECK INPUT SIGNAL CIRCUIT.
Check continuity between terminals ⓐ and ⑱.
Continuity should exist.

N.G. → Repair or replace harness or connectors between terminals ⓐ and ⑱.

O.K.

Reinstall any part removed.

Erase the self-diagnosis memory.

Perform driving test and then perform self-diagnosis (Mode-III) again.

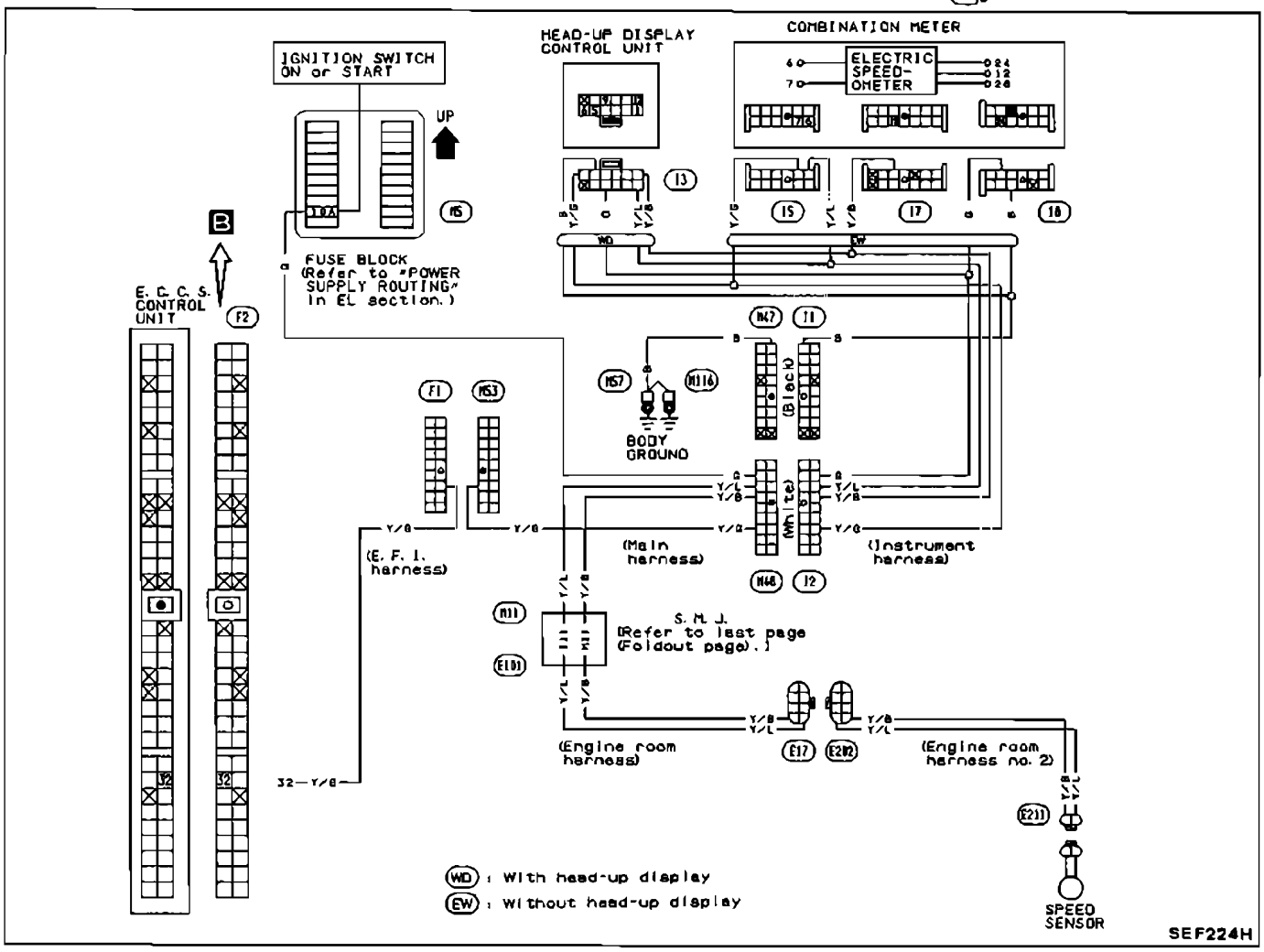
N.G. →
1) Perform E.C.U. input/output signal inspection test.
2) If N.G., recheck the E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

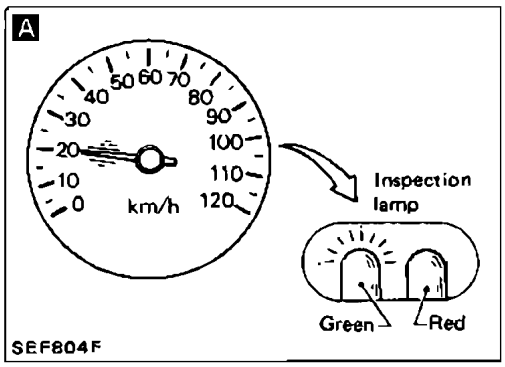
O.K.

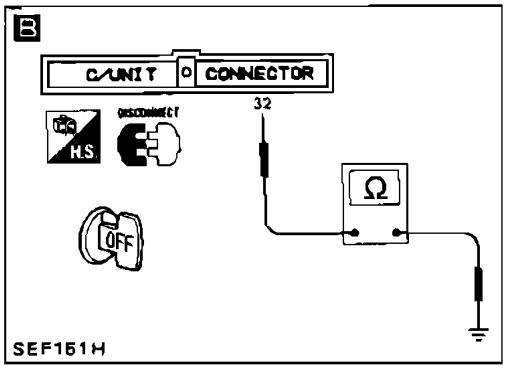
INSPECTION END

Diagnostic Procedure 5

VEHICLE SPEED SENSOR (Switch ON/OFF diagnostic item) (Code No. 14) CHECK







INSPECTION START

Is speedometer working properly? — No → CHECK VEHICLE SPEED SENSOR AND SPEEDOMETER UNIT. (See EL section.)

Yes

A

CHECK INPUT SIGNAL.
1) Perform switch ON/OFF diagnosis (in Mode IV).
2) Make sure green inspection lamp on E.C.U. comes "ON" when vehicle speed reaches 20 km/h (12 MPH).

O.K. → INSPECTION END

N.G.

B

CHECK CONTINUITY BETWEEN E.C.U. AND VEHICLE SPEED SENSOR.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check continuity between E.C.U. terminal ㉜ and ground by rotating rear wheel by hand.
Continuity should come and go.

N.G. → Repair or replace harness or connectors.

O.K.

Reinstall any part removed.

Erase the self-diagnosis memory. Make sure Code No. 55 is displayed in Mode III.

1) Perform switch ON/OFF diagnosis (in Mode IV) again.
2) Make sure green inspection lamp on E.C.U. comes "ON" when vehicle speed reaches 20 km/h (12 MPH).

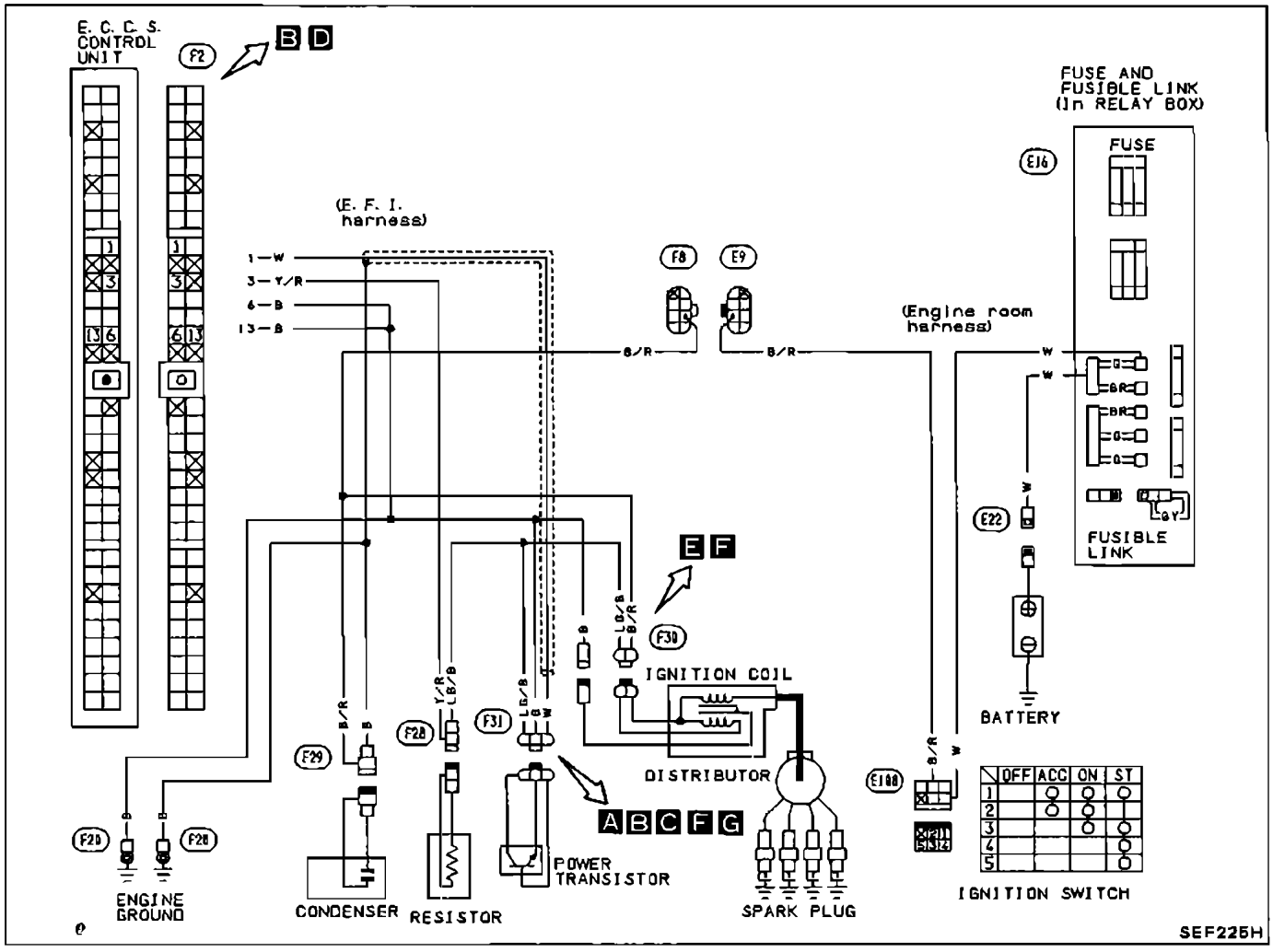
N.G. → 1) Perform self-diagnosis and find malfunction code.
2) According to displayed code No., perform diagnosis.

O.K.

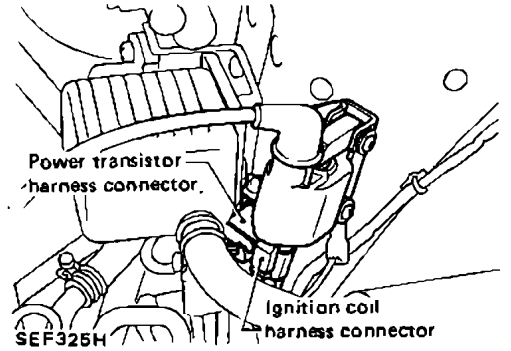
INSPECTION END

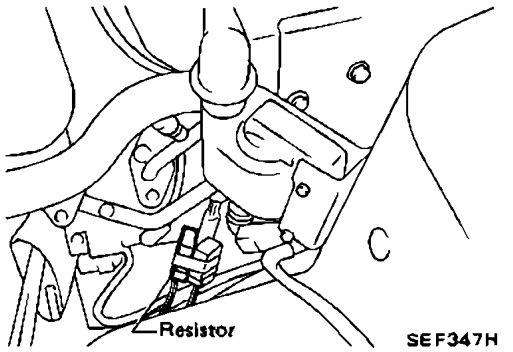
Diagnostic Procedure 6

IGNITION SIGNAL (Code No. 21)

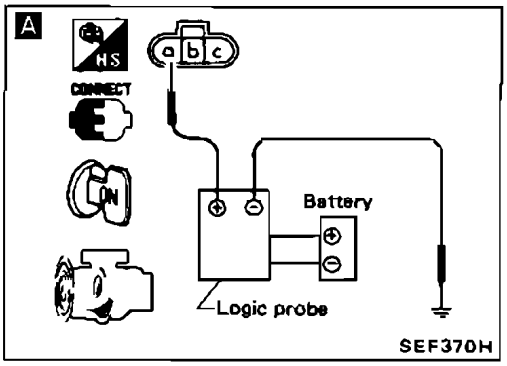


Component location



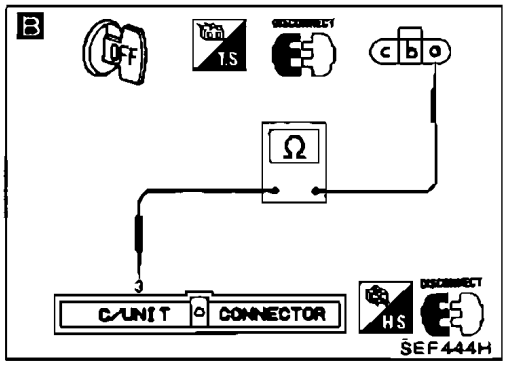


A



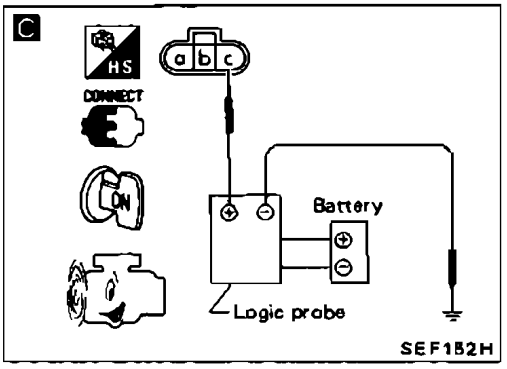
SEF370H

B



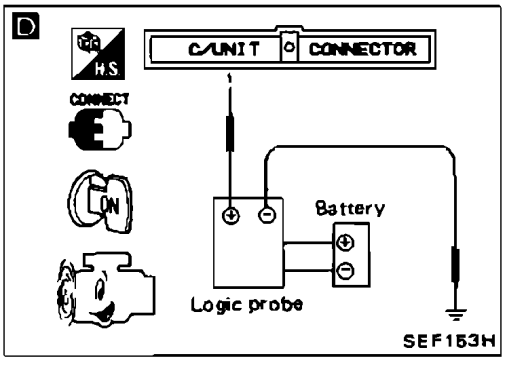
SEF444H

C



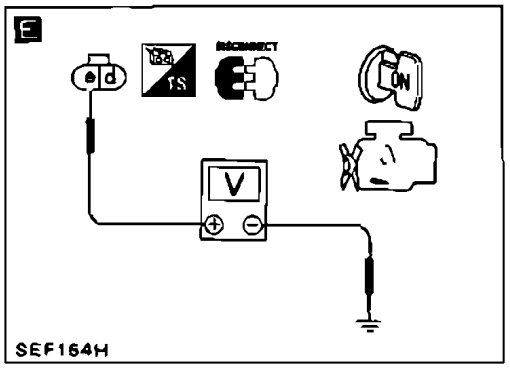
SEF152H

D



SEF153H

E



SEF164H

INSPECTION START

A

CHECK E.C.U. INPUT SIGNAL (Power transistor side).
1) Start engine.
2) Verify that pulse signal exists between power transistor harness connector terminal ⓐ and ground with logic probe.
Pulse signal should exist.

O.K. → **B**

CHECK E.C.U. INPUT LINE.
1) Stop engine.
2) Disconnect harness connectors from power transistor and E.C.U.
3) Check continuity between terminals ⓐ and ⑧.
Continuity should exist.
If N.G., check following.
- Resistor
- Harness or connector

N.G. ↓

C

CHECK E.C.U. OUTPUT SIGNAL (Power transistor side).
Verify that pulse signal exists between power transistor harness connector terminal ⓒ and ground with logic probe.
Pulse signal should exist.

N.G. → **D**

CHECK E.C.U. OUTPUT SIGNAL (E.C.U. side).
Verify that pulse signal exists between E.C.U. harness connector terminal ① and ground with logic probe.
Pulse signal should exist.
If N.G., check the E.C.U. pin terminals for damage or the E.C.U. harness connection.

O.K. ↓

Repair harness, connector, or resistor between terminals ⓒ and ①.

O.K. ↓

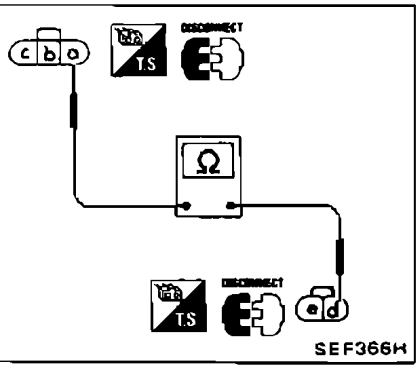
E

CHECK POWER SUPPLY.
1) Stop engine.
2) Disconnect harness connector from ignition coil.
3) Turn ignition switch "ON".
4) Check voltage between ignition coil harness connector terminal ⓔ and ground.
Battery voltage should exist.

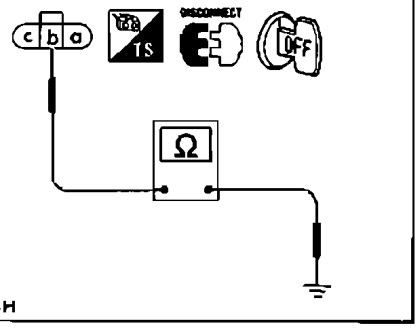
N.G. → CHECK HARNESS CONTINUITY BETWEEN BATTERY AND IGNITION COIL.
Check the following items.
- Harness
- "G" fusible link
- Ignition switch

O.K. ↓

F



G



F

CHECK HARNESS CONTINUITY BETWEEN IGNITION COIL AND POWER TRANSISTOR.
1) Turn ignition switch "OFF".
2) Disconnect power transistor harness connector.
3) Check continuity between ignition coil harness connector terminal ⓓ and power transistor harness connector terminal ⓐ.

N.G. → Repair or replace harness between ⓓ and ⓐ.

O.K. ↓

G

CHECK GROUND CIRCUIT.
Check continuity between power transistor harness connector terminal ⓑ and ground.
Continuity should exist.

N.G. → 1) Repair harness or connectors.
2) Check continuity.
3) Check engine ground.

O.K. ↓

CHECK COMPONENTS.
Check ignition coil and power transistor.
(See page EF & EC-148.)

N.G. → Replace ignition coil or power transistor.

O.K. ↓

Reinstall any part removed.

↓

Erase the self-diagnosis memory.

↓

Perform driving test and then perform self-diagnosis again.

N.G. → 1) Perform E.C.U. input/output signal inspection test.
2) If N.G., recheck the E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

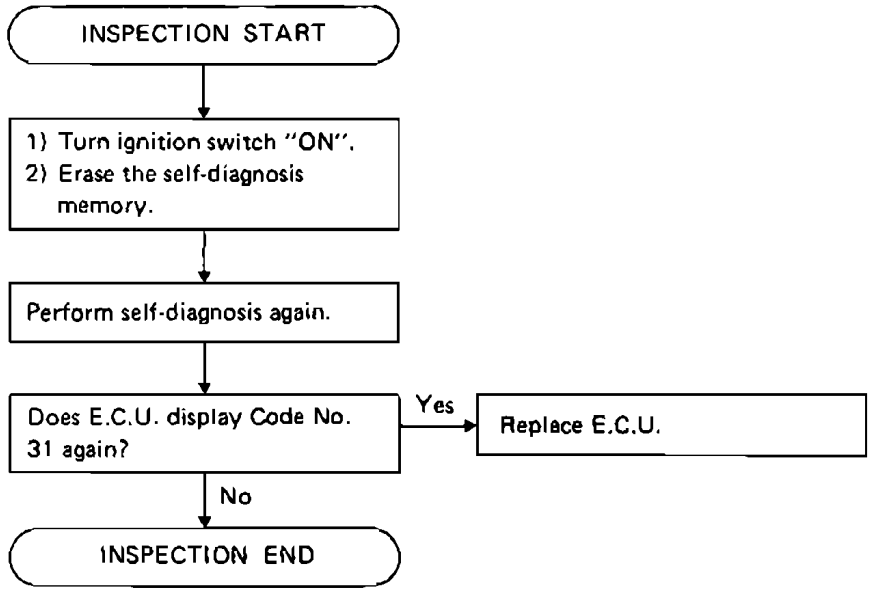
O.K. ↓

INSPECTION END

NOTE

Diagnostic Procedure 7

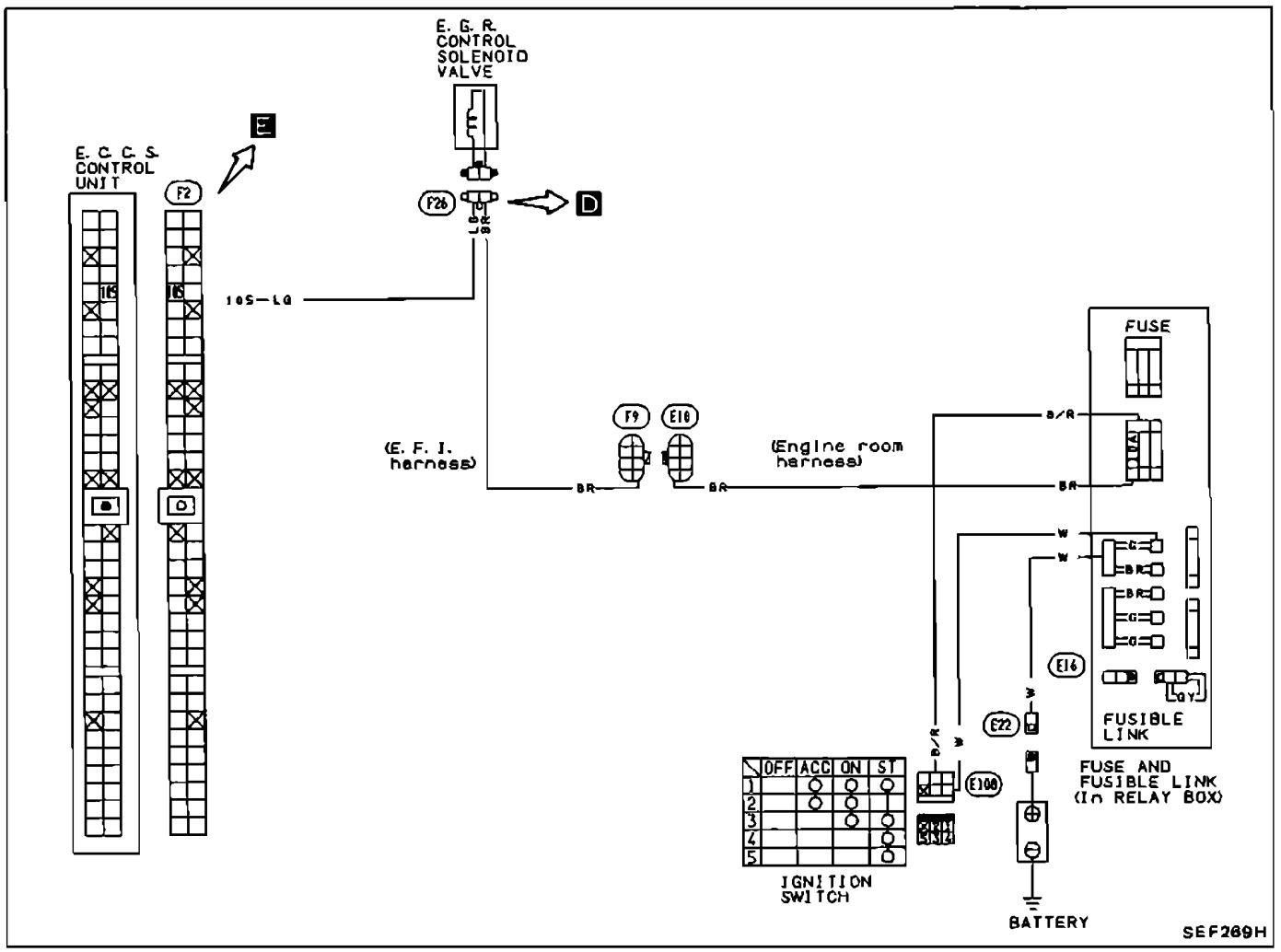
ENGINE CONTROL UNIT (Code No. 31) CHECK



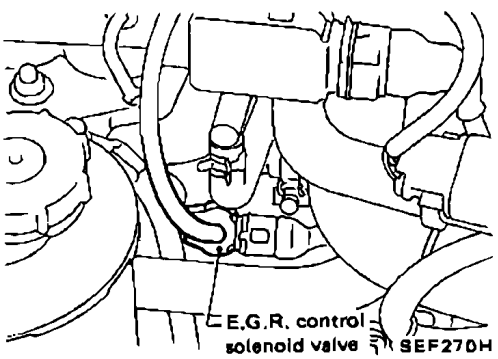
NOTE

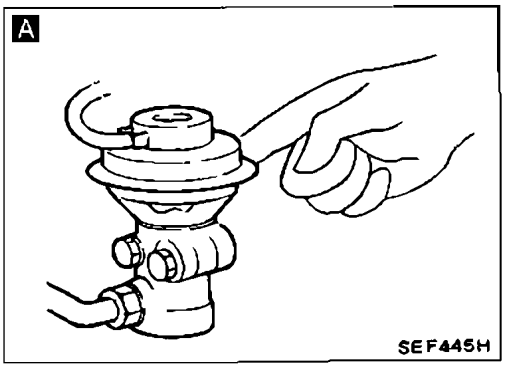
Diagnostic Procedure 8

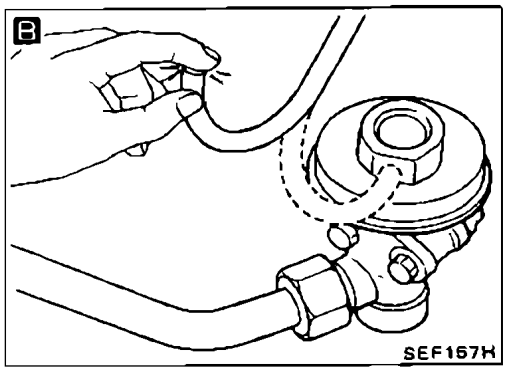
E.G.R. FUNCTION (Code No. 32) [Not self-diagnostic item (For non-California models)]

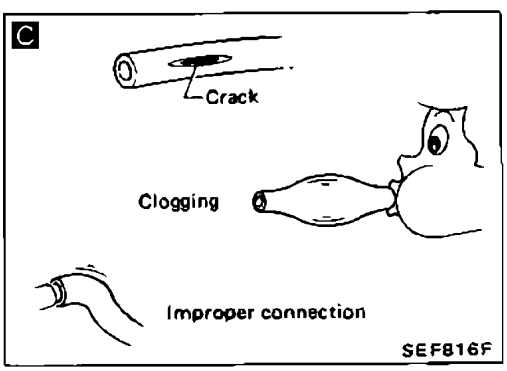


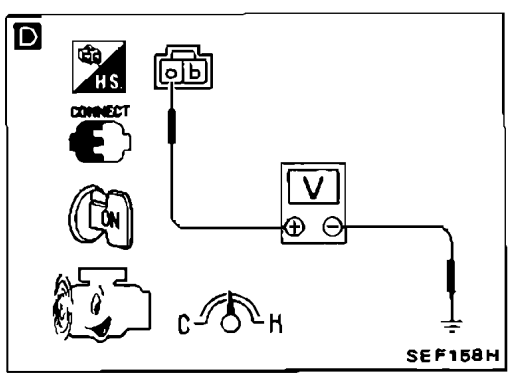
Component location

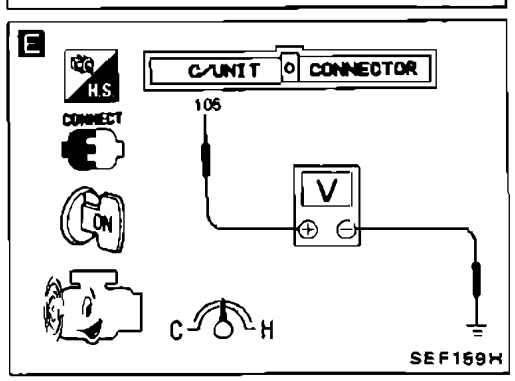












INSPECTION START

A

CHECK E.G.R. CONTROL VALVE OPERATION.
1) Start engine and warm it up sufficiently.
2) Make sure E.G.R. control valve spring responds to your touch (use your fingers) and also when engine is raced.

Responds → INSPECTION END

Does not respond ↓

B

CHECK VACUUM SOURCE TO E.G.R. CONTROL VALVE.
1) Stop engine.
2) Disconnect vacuum hose connected to E.G.R. control valve and B.P.T. valve.
3) Start engine.
4) Make sure vacuum exists when racing engine.

O.K. → CHECK COMPONENT.
Check E.G.R. control valve.
(See page EF & EC-148.)
N.G. → Replace E.G.R. control valve.

N.G. ↓

C

CHECK VACUUM HOSE.
1) Stop engine.
2) Check vacuum hose for clogging, cracks, and proper connections.

N.G. → If necessary, replace vacuum hose or reconnect vacuum hose firmly.

O.K. ↓

D

CHECK E.C.U. OUTPUT SIGNAL (Solenoid side).
1) Start engine and warm it up sufficiently.
2) Check voltage betwen E.G.R. control solenoid valve harness connector terminal ⓐ and ground.

Engine condition	Voltage
Idle	Battery voltage
Racing	Temporarily drops to 0 - 1V

N.G. → **E**

CHECK E.C.U. OUTPUT SIGNAL (E.C.U. side).
Check voltage between E.C.U. harness connector terminal (105) and ground.

Engine condition	Voltage
Idle	Battery voltage
Racing	Temporarily drops to 0 - 1V

If N.G., check the E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K. ↓

Repair harness or connectors between terminals ⓐ and (105).

O.K. ↓

⊕

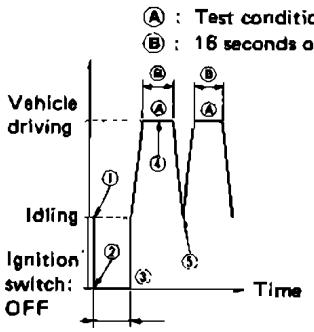
F

Test condition

Drive vehicle under the following conditions with a suitable shift position.

- **Engine speed:**
  3,100±300 rpm (A/T)
  3,000±400 rpm (M/T)
- **Intake manifold vacuum:**
  −42.7±8.0 kPa
  (−320±60 mmHg, −12.60±2.36 inHg)

Driving mode

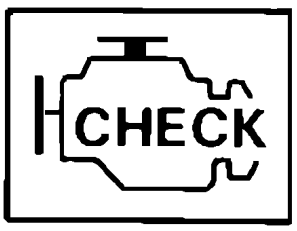


Until green and red inspection lamps go off.

① Start engine and warm it up sufficiently.
② Turn off ignition switch and keep it off until green and red inspection lamps go off.
③ Start engine and make sure that air conditioner switch and rear defogger are turned "OFF" during driving test.
④ Shift to suitable gear position and drive in "Test condition" for at least 16 seconds.
⑤ Decrease engine revolution to less than 2,000 rpm.
⑥ Repeat steps ④ through ⑤ at least 1 time.

SEF037H

G



CHECK ENGINE LIGHT

SEF924F

CHECK COMPONENT.
1) Stop engine.
2) Check E.G.R. control solenoid valve. (See page EF & EC-149.)

N.G. → Replace E.G.R. control solenoid valve.

O.K.

CHECK COMPONENT.
Check E.G.R. control valve and B.P.T. valve.
(See page EF & EC-148.)

N.G. → Valve spring may be stuck.
Clean if necessary.
If this does not correct trouble, replace E.G.R. control valve.

O.K. For California

O.K. For non-California → INSPECTION END

Check resistance of exhaust gas temperature sensor.
(See page EF & EC-149.)

Reinstall any part removed.

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 check engine light does not come "ON" during driving test.

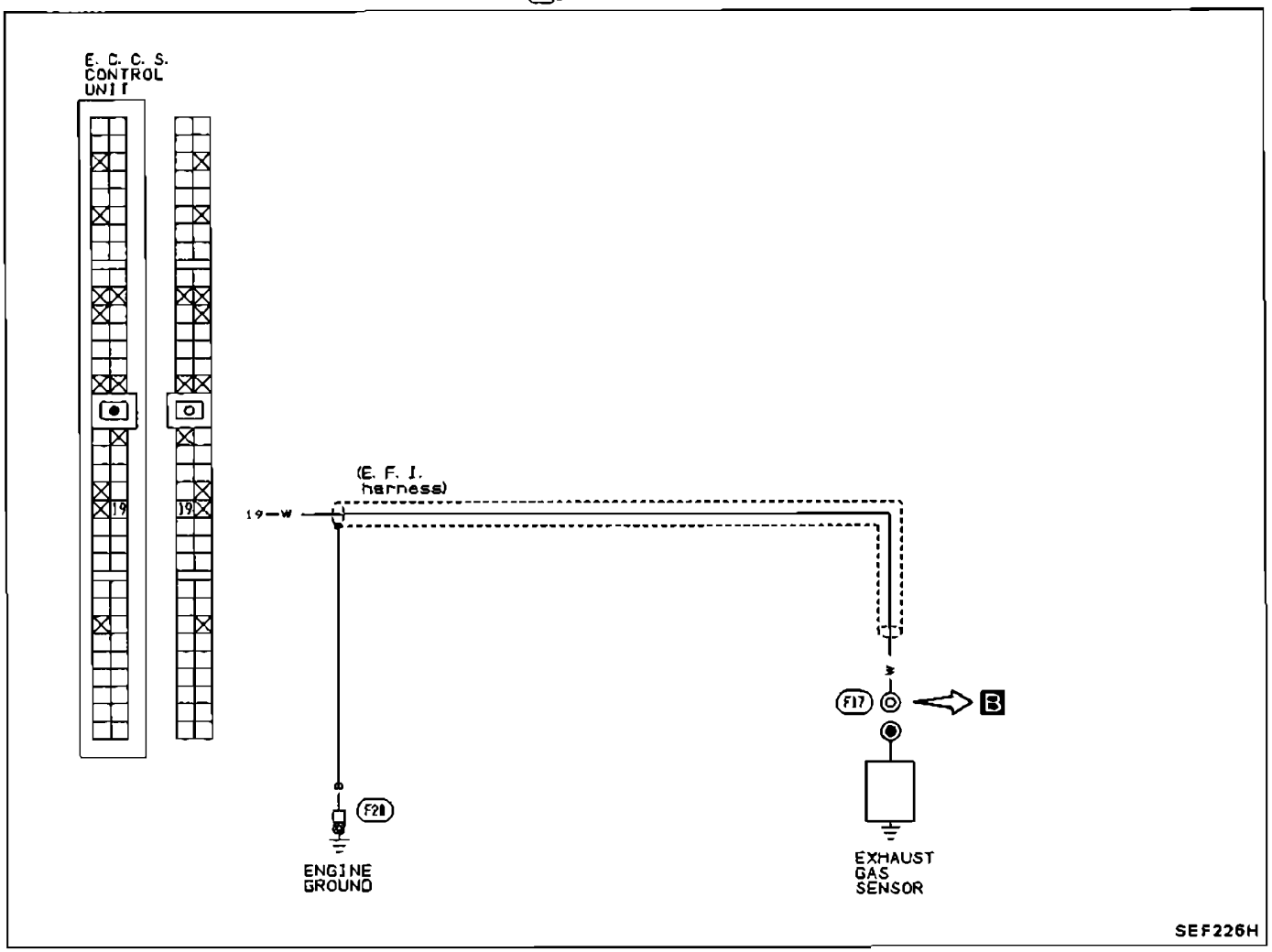
Comes "ON" → Perform self-diagnosis and find malfunction code. According to displayed code No., perform diagnosis.

Does not come "ON" → INSPECTION END

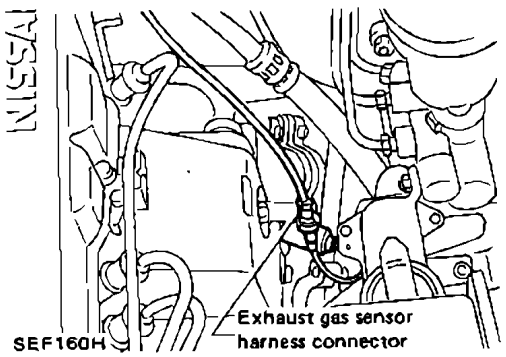
NOTE

Diagnostic Procedure 9

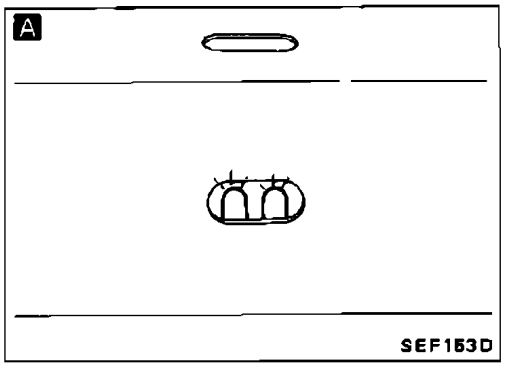
EXHAUST GAS SENSOR (Code No. 33) CHECK



Component location

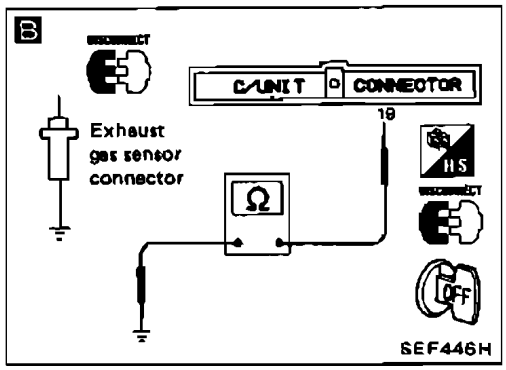


A



SEF153D

B



SEF446H

INSPECTION START

A

CHECK INPUT SIGNAL.
1) Start engine and warm it up sufficiently.
2) Make sure green inspection lamp on E.C.U. blinks at 2,000 rpm.

O.K. → INSPECTION END

N.G.

B

CHECK EXHAUST GAS SENSOR CIRCUIT.
1) Stop engine.
2) Disconnect E.C.U. harness connector.
3) Disconnect exhaust gas sensor harness connector.
4) Connect a jumper wire from exhaust gas sensor harness connector to ground.
5) Check continuity between E.C.U. harness connector terminal ⑲ and ground.
Continuity should exist.

N.G. → Repair or replace harness.

O.K.

Replace exhaust gas sensor.

Reinstall any part removed.

Erase the self-diagnosis memory. Make sure Code No. 55 is displayed in Mode III.

1) Start engine and warm it up sufficiently.
2) Set diagnosis mode to Mode I.
3) Make sure that green inspection lamp on E.C.U. goes on and off periodically more than 5 times during 10 seconds at 2,000 rpm.

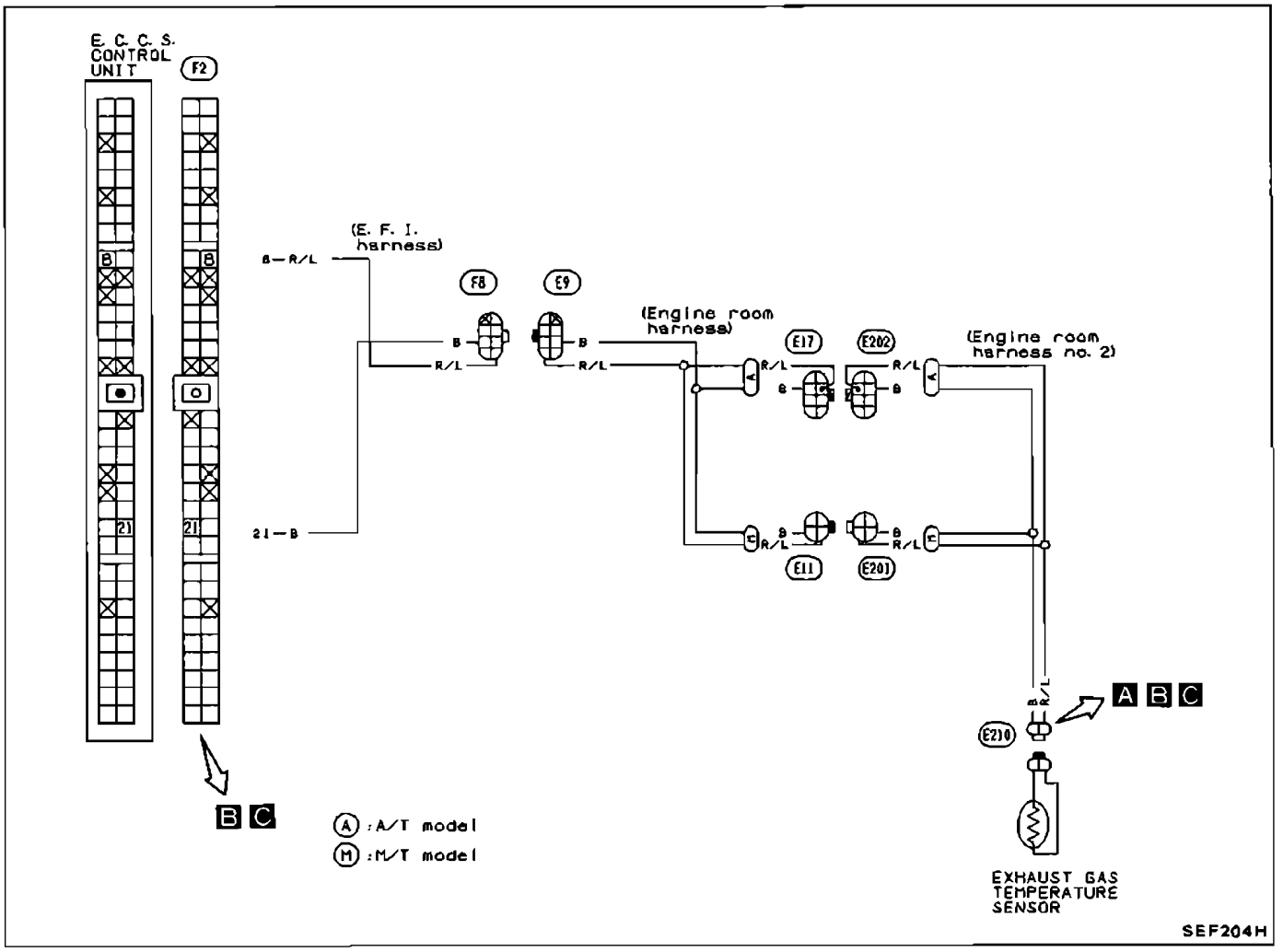
N.G. → Perform IDLE SPEED/IGNITION TIMING/IDLE MIXTURE RATION INSPECTION. (See page EF & EC-26.)

O.K.

INSPECTION END

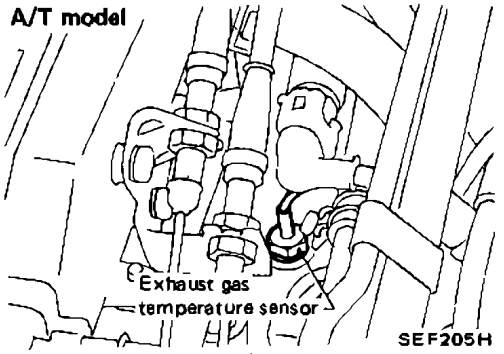
Diagnostic Procedure 10

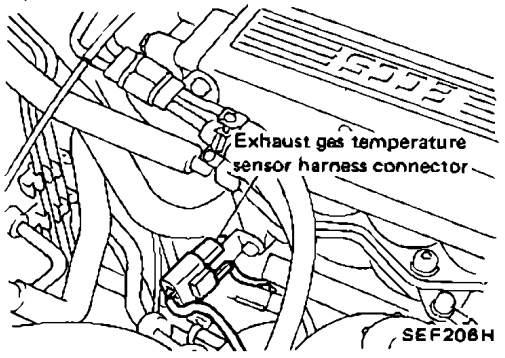
EXHAUST GAS TEMPERATURE SENSOR (Code No. 35) CHECK



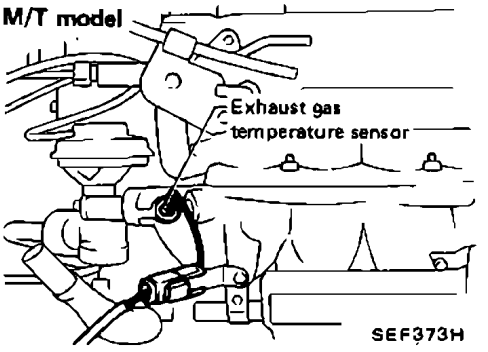
Component location

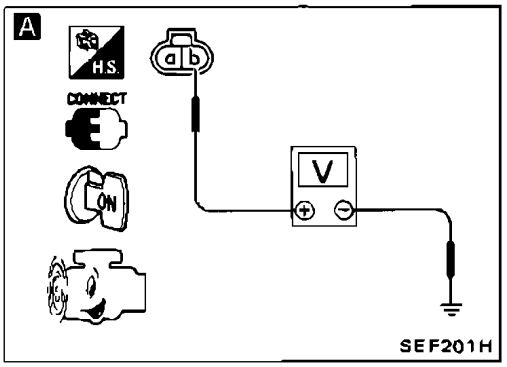
A/T model

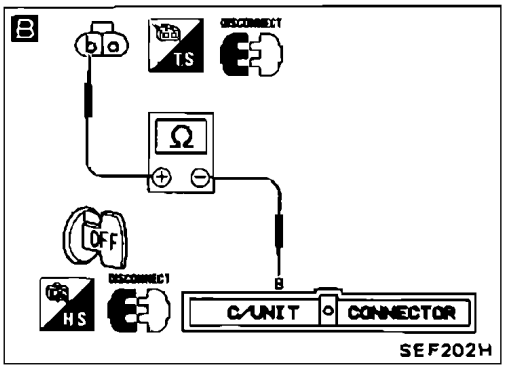


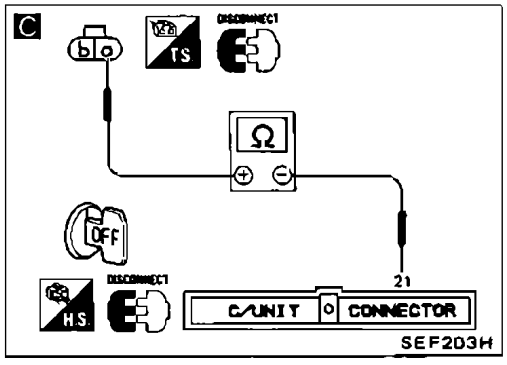


M/T model









INSPECTION START

A

CHECK INPUT SIGNAL
(Exhaust gas temperature sensor side).

1) Start engine and warm it up sufficiently.
2) Keep engine speed at approximately 2,000 rpm.
3) Check voltage between exhaust gas temperature sensor harness connector terminal ⓑ and ground under the following conditions.

Condition	Voltage
When vacuum is not applied to E.G.R. control valve	1.0 - 2.0V
When vacuum is applied to E.G.R. control valve	0 - 1.0V

A sufficient vacuum applied with a hand vacuum pump may cause the engine to stall.

O.K. → ⊕⊕

N.G. ↓

B

CHECK HARNESS CONTINUITY BETWEEN E.C.U. AND EXHAUST GAS TEMPERATURE SENSOR.

1) Stop engine.
2) Disconnect E.C.U. harness connector.
3) Disconnect exhaust gas temperature sensor harness connector.
4) Check continuity between terminals ⓑ and ⑧.
Continuity should exist.

N.G. → 1) Check harness and middle harness connector connection between terminals ⓑ and ⑧.
2) If necessary, repair or replace harness.

O.K. ↓

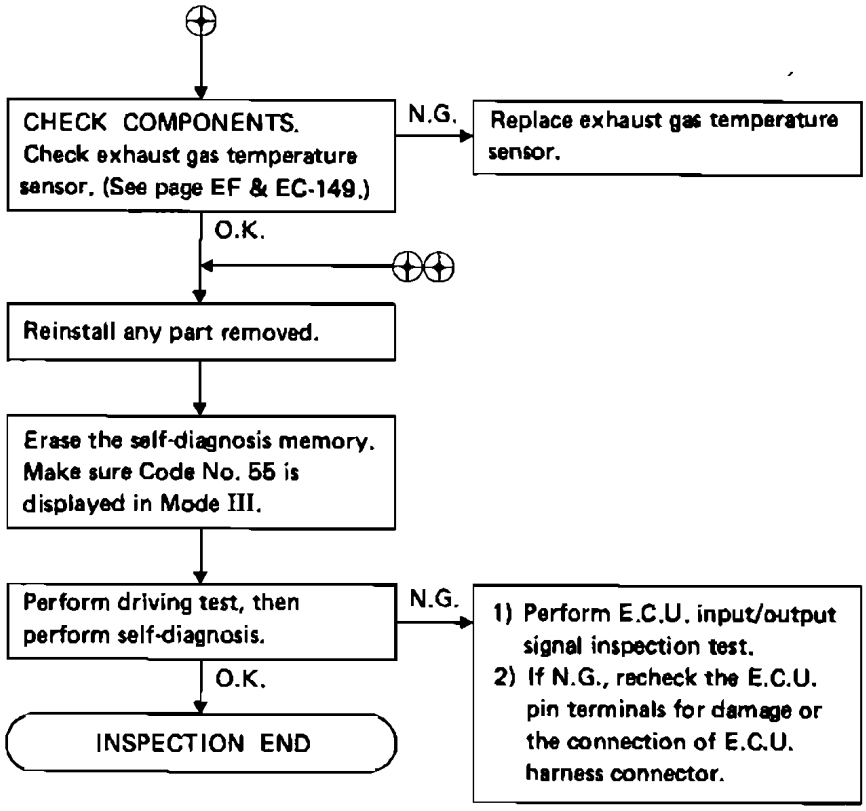
C

CHECK GROUND CIRCUIT.
Check continuity between terminals ⓐ and ㉑.
Continuity should exist.

N.G. → 1) Check middle harness connector connection.
2) If necessary, repair or replace harness.

O.K. ↓

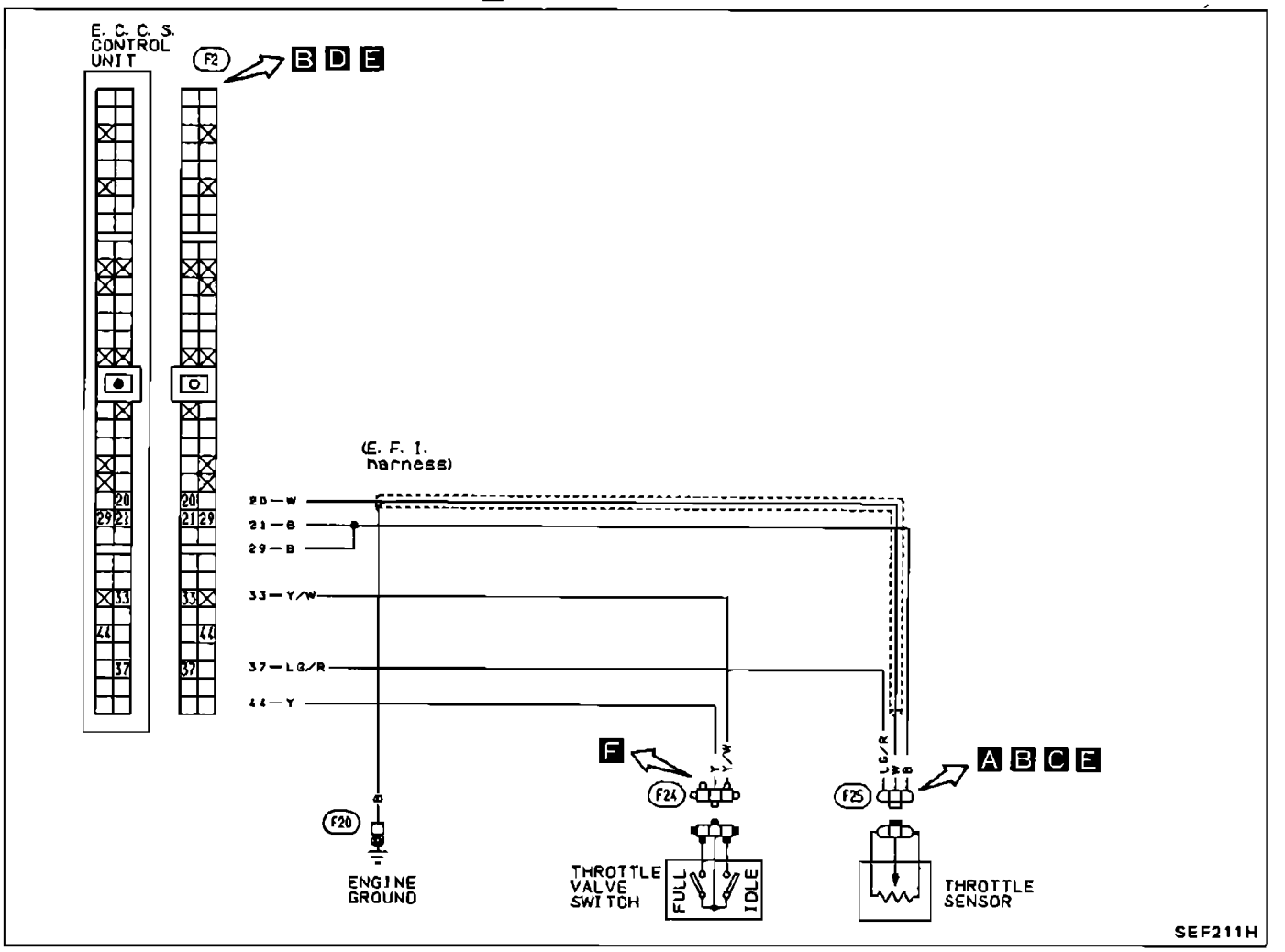
⊕


CHECK COMPONENTS.
Check exhaust gas temperature sensor. (See page EF & EC-149.)
N.G.
Replace exhaust gas temperature sensor.
O.K.
Reinstall any part removed.
Erase the self-diagnosis memory. Make sure Code No. 55 is displayed in Mode III.
Perform driving test, then perform self-diagnosis.
N.G.
1) Perform E.C.U. input/output signal inspection test.
2) If N.G., recheck the E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.
O.K.
INSPECTION END

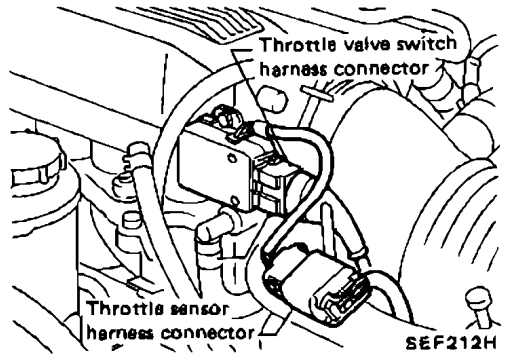
NOTE

Diagnostic Procedure 11

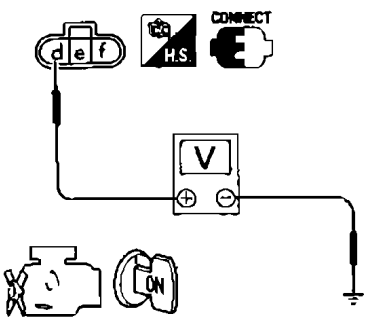
THROTTLE SENSOR (Code No. 43) CHECK



Component location

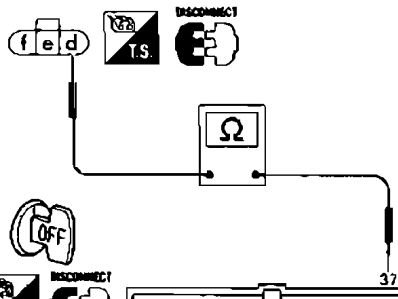


A



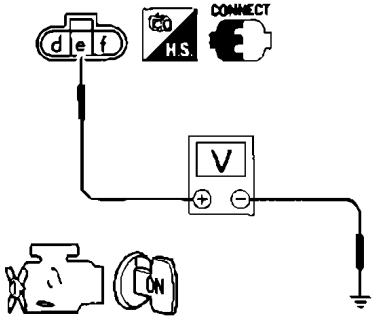
SEF207H

B



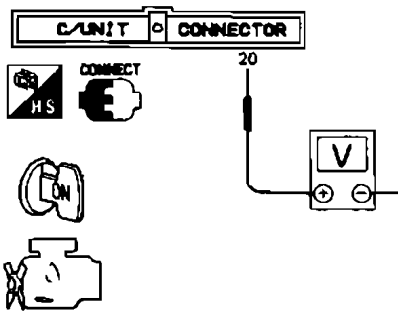
SEF208H

C



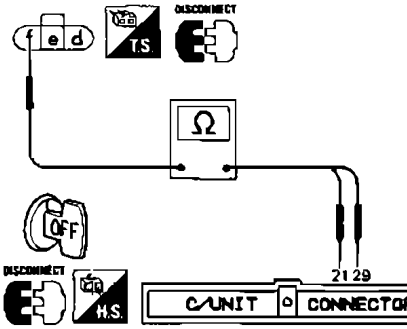
SEF209H

D



SEF387H

E



SEF210H

INSPECTION START

A

CHECK POWER SOURCE.
1) Turn ignition switch "ON".
2) Check voltage between terminal ⓓ and ground.
Voltage:
Approximately 5.0V

N.G. → **B**

HARNESS CONTINUITY BETWEEN THROTTLE SENSOR HARNESS CONNECTOR AND E.C.U.
1) Turn ignition switch "OFF".
2) Disconnect throttle sensor harness connector.
3) Disconnect E.C.U. harness connector.
4) Check continuity between terminals ⓓ and ㊲.
Continuity should exist.
If N.G., repair or replace harness or connector.

O.K. ↓

C

CHECK INPUT SIGNAL
(Throttle sensor side).
Make sure that voltage between terminal ⓔ and ground changes when accelerator pedal is depressed.
Voltage:
Approximately 0.5 - 4.0V

O.K. → **D**

CHECK INPUT SIGNAL
(E.C.U. side).
Make sure that voltage between terminal ⑳ and ground changes when accelerator pedal is depressed.
Voltage:
Approximately 0.5 - 4.0V

O.K. ↓

Repair or replace harness or connectors between terminals ⓔ and ⑳.

N.G. ↓

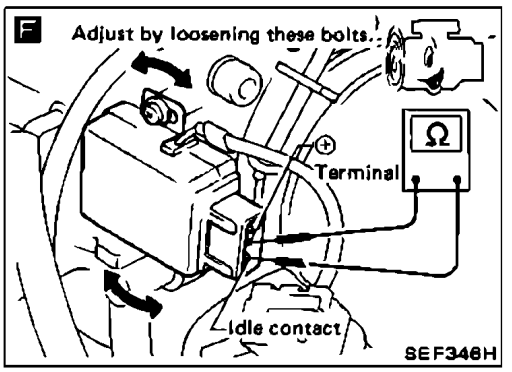
E

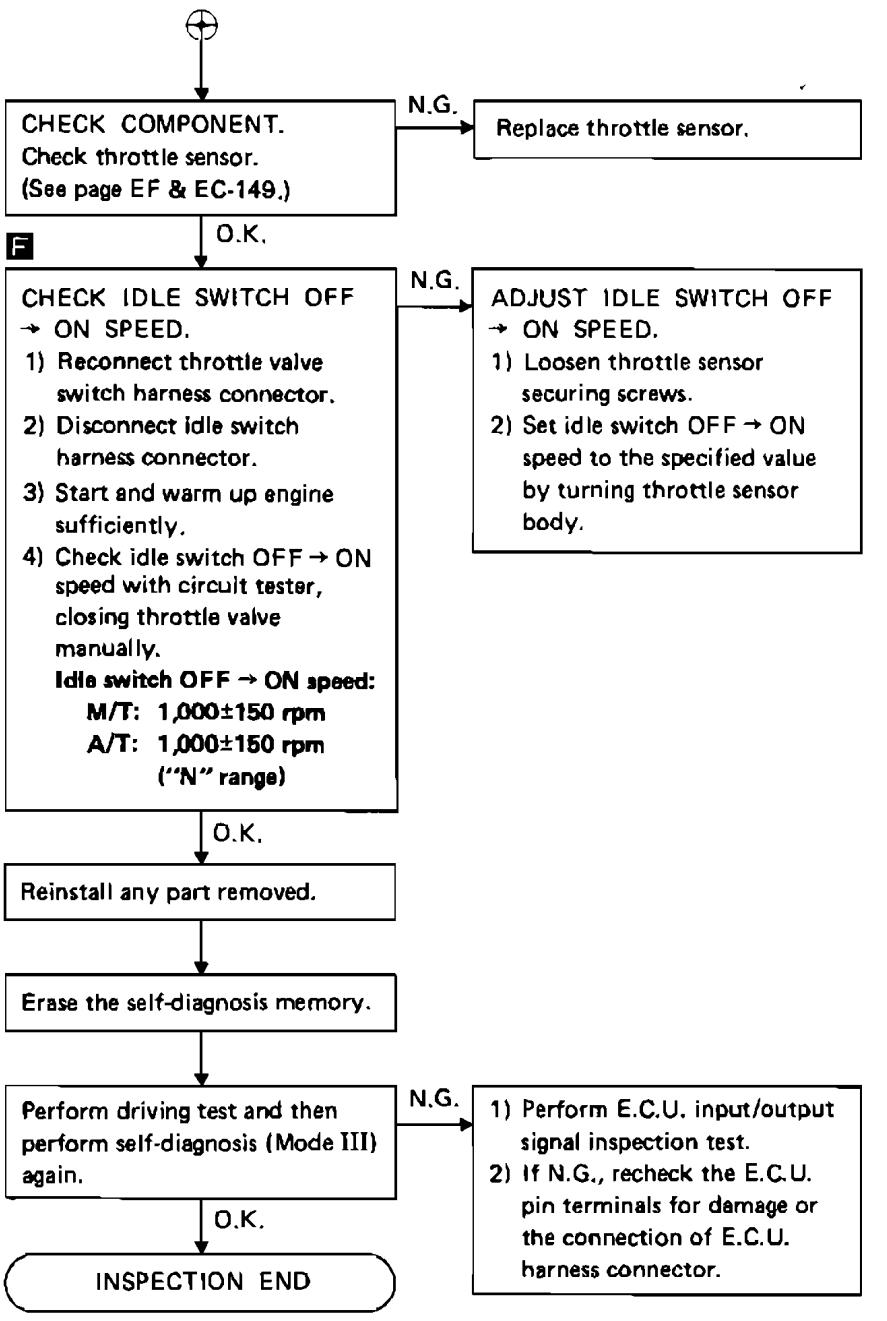
CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF" and disconnect E.C.U. harness connector.
2) Disconnect throttle sensor harness connector.
3) Check continuity between terminal ⓕ and E.C.U. terminals ㉑, ㉙.
Continuity should exist.

N.G. →

1) Check harness continuity between throttle sensor and ground.
2) E.C.U. ground circuit.

O.K. ↓

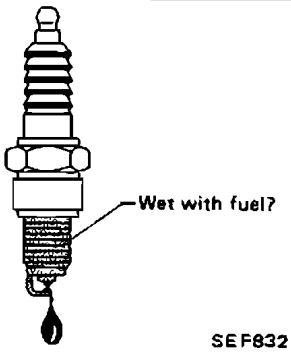

F
Adjust by loosening these bolts.
Terminal
Idle contact
SEF346H


CHECK COMPONENT.
Check throttle sensor.
(See page EF & EC-149.)
N.G.
Replace throttle sensor.
O.K.
F
CHECK IDLE SWITCH OFF → ON SPEED.
1) Reconnect throttle valve switch harness connector.
2) Disconnect idle switch harness connector.
3) Start and warm up engine sufficiently.
4) Check idle switch OFF → ON speed with circuit tester, closing throttle valve manually.
Idle switch OFF → ON speed:
M/T: 1,000±150 rpm
A/T: 1,000±150 rpm
("N" range)
N.G.
ADJUST IDLE SWITCH OFF → ON SPEED.
1) Loosen throttle sensor securing screws.
2) Set idle switch OFF → ON speed to the specified value by turning throttle sensor body.
O.K.
Reinstall any part removed.
Erase the self-diagnosis memory.
Perform driving test and then perform self-diagnosis (Mode III) again.
N.G.
1) Perform E.C.U. input/output signal inspection test.
2) If N.G., recheck the E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.
O.K.
INSPECTION END

NOTE

INJECTOR LEAK (Code No. 45)

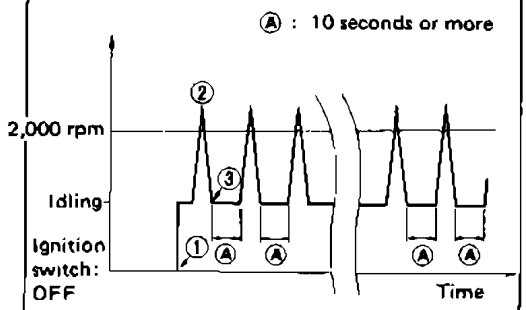
A



SEF832F

B

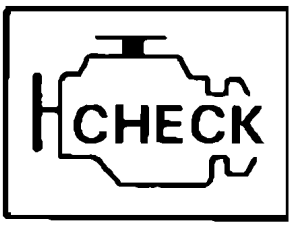
Engine racing mode



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

Diagnostic Procedure 12

INSPECTION START

Start engine and warm it up sufficiently.

Make sure engine runs smoothly at idle after warming.

- Runs smoothly → Race engine two or three times under no-load, then run engine at idle speed.
- Does not run smoothly → Set the diagnosis mode selector of E.C.U. to Mode I.

Set the diagnosis mode selector of E.C.U. to Mode I.

Check if the green inspection lamp stays off during 10 seconds at idle condition.

- Stays off → A
- Does not stay off → Check mixture ratio feedback system. (See page EF & EC-26.)

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.

- Do not blink → Check idle CO%. (See page EF & EC-26.)
- Blinks → INSPECTION END

A

1) Stop engine.
2) Remove all spark plugs from intake manifold. Are plugs wet with fuel?

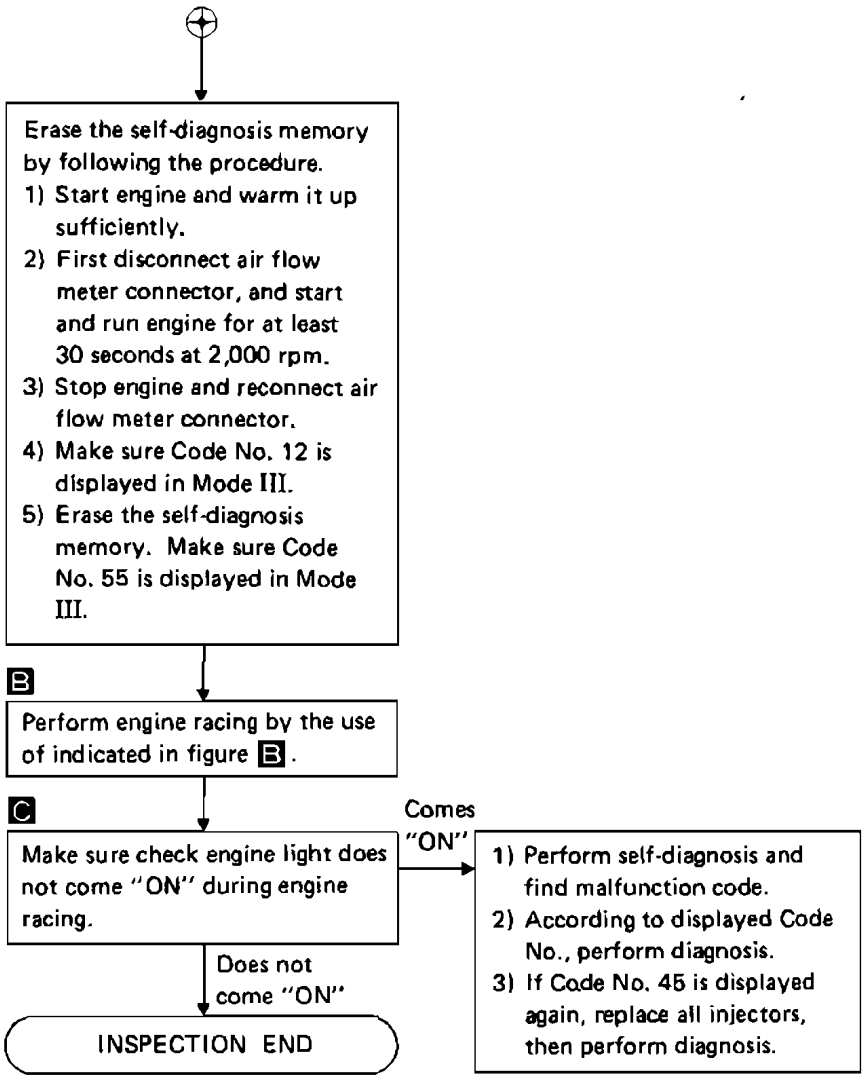
- Yes → Replace the injector in which cylinder spark plug is wet with fuel.
- No →

Remove injector assembly. (See page EF & EC-154.) Keep all injectors connected to injector tube.

Turn ignition switch "ON". Make sure fuel does not drip from injector.

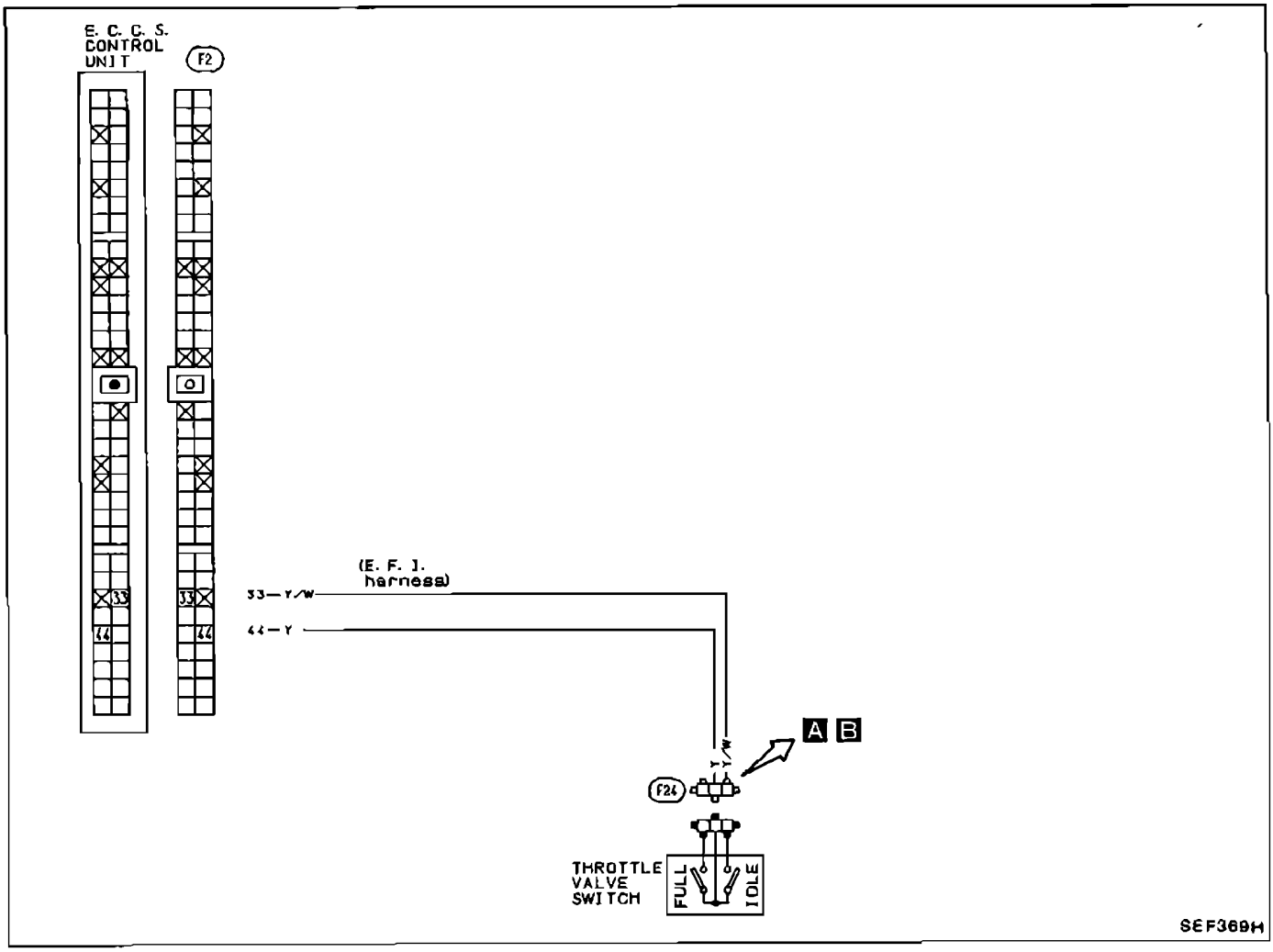
- Drips → Replace the injectors where fuel is dripping from.
- Does not drip →

Reinstall any part removed.

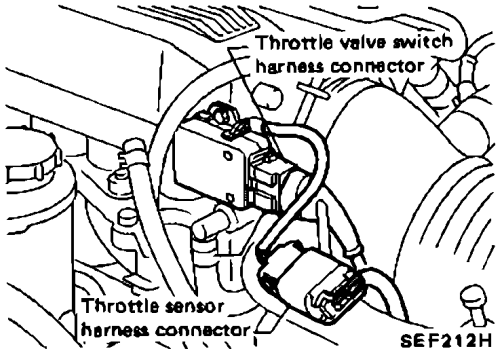

Erase the self-diagnosis memory by following the procedure.
1) Start engine and warm it up sufficiently.
2) First disconnect air flow meter connector, and start and run engine for at least 30 seconds at 2,000 rpm.
3) Stop engine and reconnect air flow meter connector.
4) Make sure Code No. 12 is displayed in Mode III.
5) Erase the self-diagnosis memory. Make sure Code No. 55 is displayed in Mode III.
B
Perform engine racing by the use of indicated in figure B.
C
Make sure check engine light does not come "ON" during engine racing.
Comes "ON"
1) Perform self-diagnosis and find malfunction code.
2) According to displayed Code No., perform diagnosis.
3) If Code No. 45 is displayed again, replace all injectors, then perform diagnosis.
Does not come "ON"
INSPECTION END

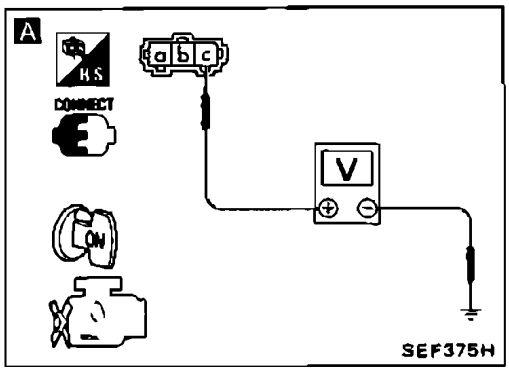
Diagnostic Procedure 13

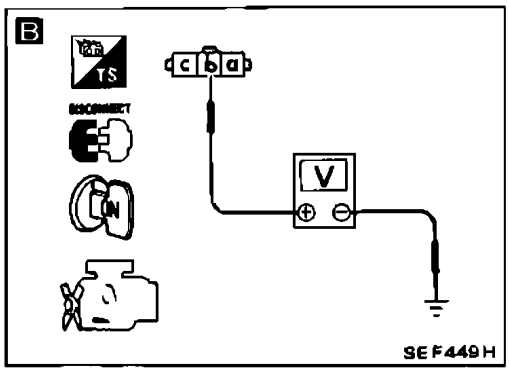
IDLE SWITCH (Switch ON/OFF diagnostic item)



Component location







INSPECTION START

Perform switch ON/OFF diagnosis (in Mode IV).

O.K. → INSPECTION END

N.G.

A

CHECK E.C.U. INPUT SIGNAL.
1) Turn ignition switch "ON".
2) Check voltage between throttle valve switch harness connector terminal ⓒ and ground.

Accelerator pedal condition	Voltage
Fully closed	Approximately 8 - 10V
Open	0V

O.K. → Repair or replace harness or connector between throttle valve switch harness connector terminal ⓒ and E.C.U. harness connector terminal ㉝.

N.G.

B

CHECK POWER SUPPLY.
1) Turn ignition switch "OFF".
2) Disconnect throttle valve switch harness connector.
3) Turn ignition switch "ON".
4) Check voltage terminal ⓑ and ground.
Battery voltage should exist.

O.K. → Check continuity of harness or connectors between throttle valve switch harness connector terminal ⓑ and E.C.U. harness connector terminal ㊹.
If N.G., repair or replace them.

N.G.

CHECK COMPONENT.
Check idle switch.

N.G. → Replace throttle valve sensor/switch.

O.K.

ADJUST IDLE SWITCH.
(See page EF & EC-112.)

Perform switch ON/OFF diagnosis (in Mode IV).

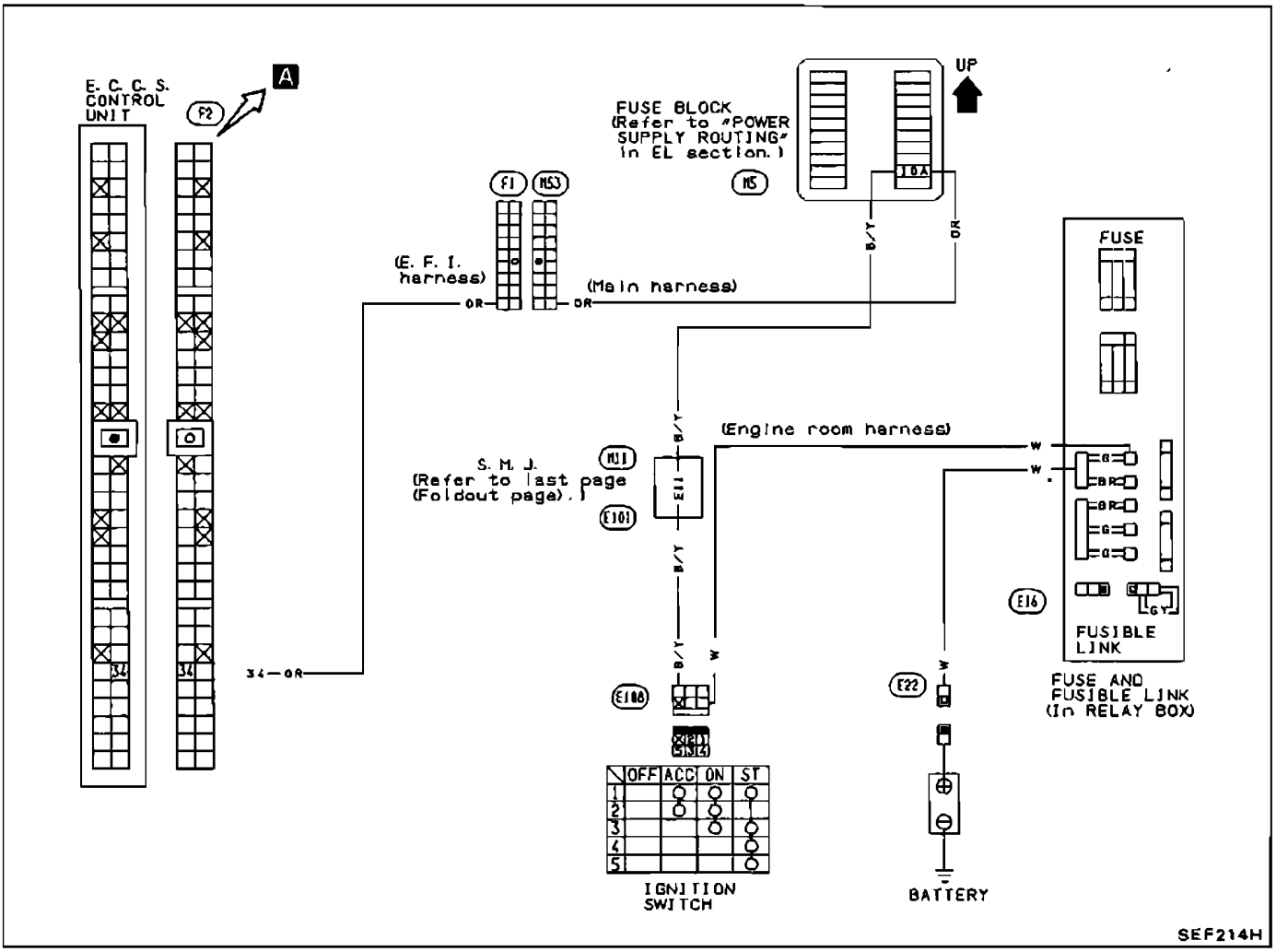
N.G. → Replace E.C.U.

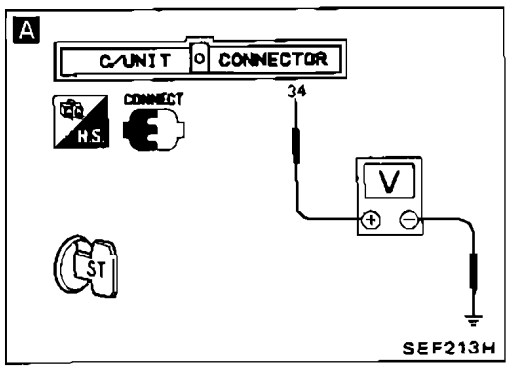
O.K.

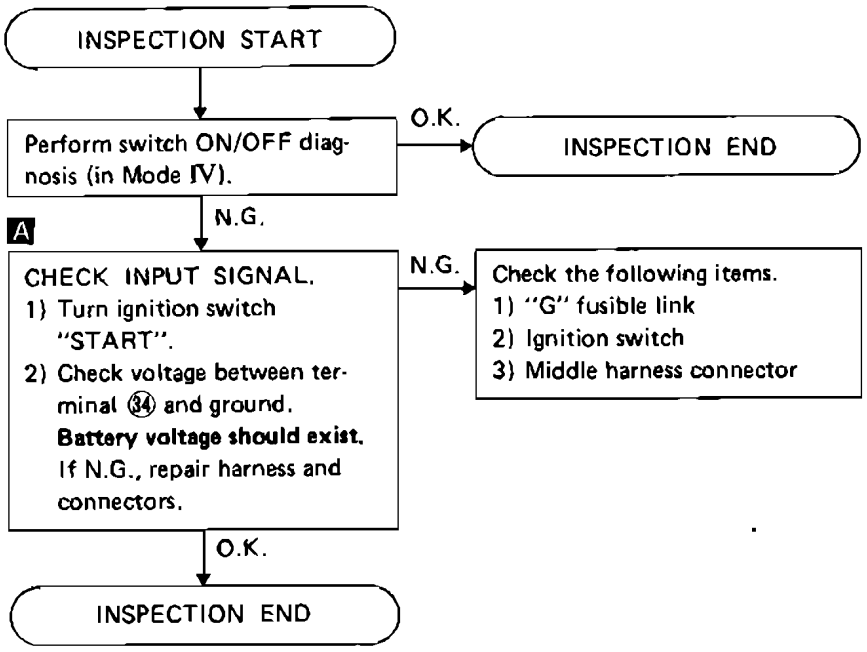
INSPECTION END

Diagnostic Procedure 14

START SIGNAL (Switch ON/OFF diagnostic item)

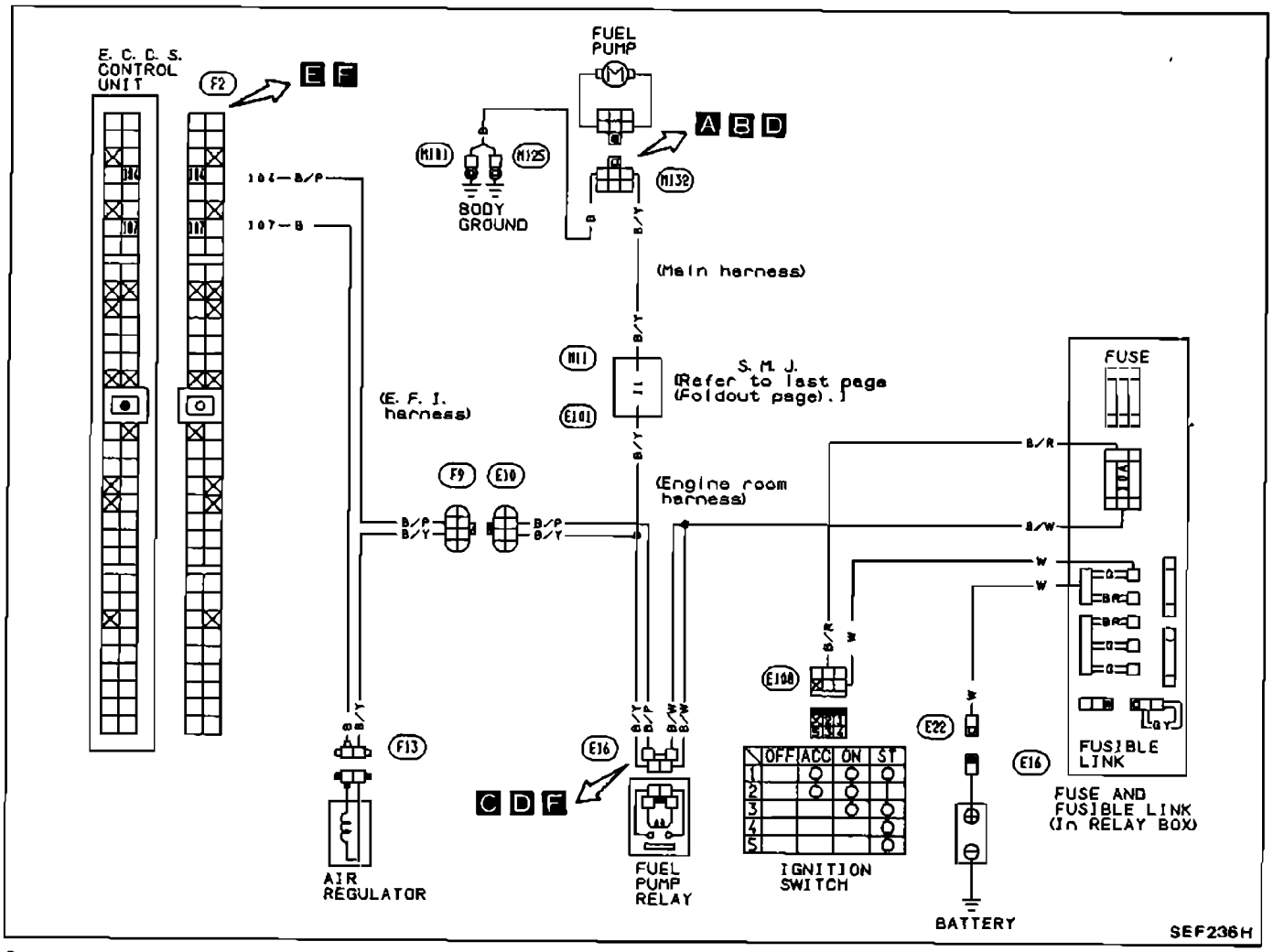



A
C/UNIT
CONNECTOR
34
CONNECT
M.S.
V
ST
SEF213H


INSPECTION START
Perform switch ON/OFF diagnosis (in Mode IV).
O.K.
INSPECTION END
N.G.
A
CHECK INPUT SIGNAL.
1) Turn ignition switch "START".
2) Check voltage between terminal ㉞ and ground.
Battery voltage should exist.
If N.G., repair harness and connectors.
N.G.
Check the following items.
1) "G" fusible link
2) Ignition switch
3) Middle harness connector
O.K.
INSPECTION END

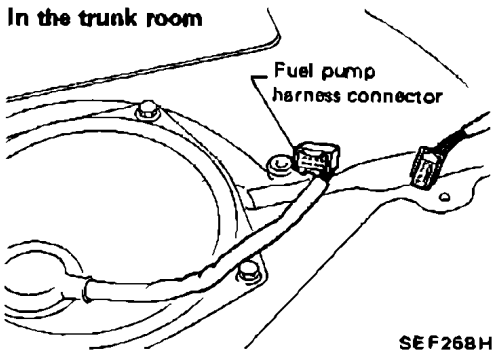
Diagnostic Procedure 15

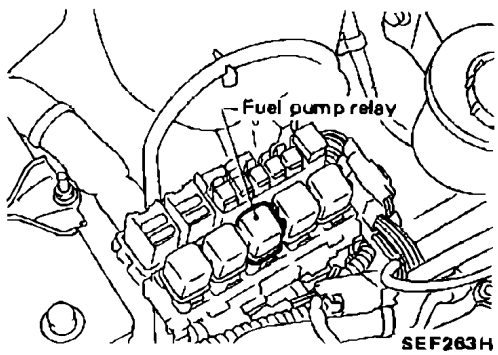
FUEL PUMP (Not self-diagnostic item)

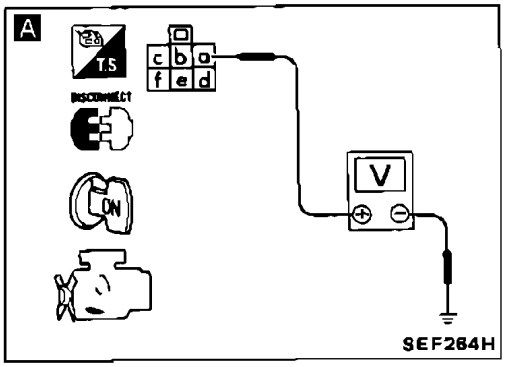


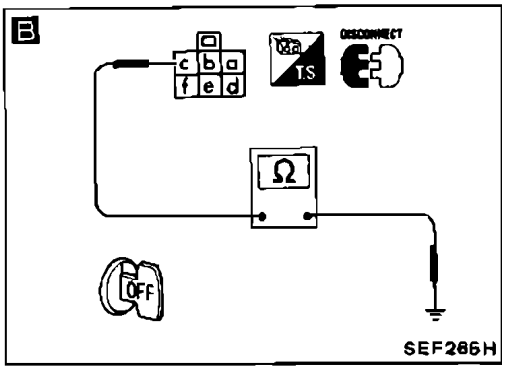
Component location

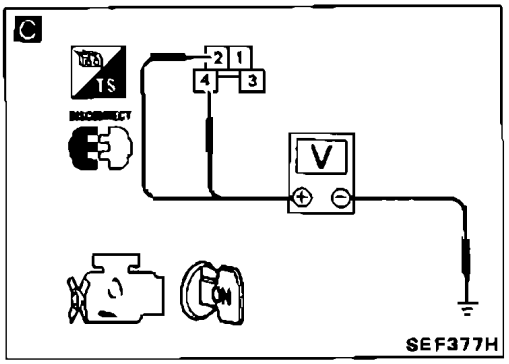
In the trunk room

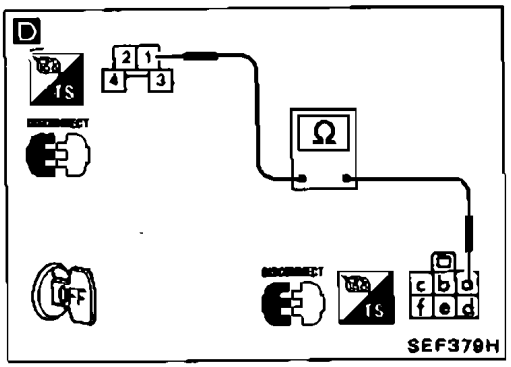












INSPECTION START

A

CHECK POWER SUPPLY
(Fuel pump side).
1) Disconnect fuel pump harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓐ and ground.
Battery voltage indication should appear for 5 seconds after turning ignition switch "ON".

O.K. → CHECK COMPONENTS.
1) Turn ignition "OFF".
2) Check fuel pump.
(See page EF & EC-149.)
If N.G., replace fuel pump.

O.K. ↓

B

CHECK GROUND CIRCUIT.
Check continuity between terminal ⓒ and ground.
Continuity should exist.
If N.G., repair harness or connectors.

N.G. ↓

C

CHECK POWER SUPPLY
(Relay side).
1) Turn ignition switch "OFF".
2) Disconnect fuel pump relay.
3) Turn ignition switch "ON".
4) Check voltage between terminals ②, ④ and ground.
Battery voltage should exist.

N.G. → CHECK HARNESS CONTINUITY BETWEEN BATTERY AND FUEL PUMP RELAY.
Check following.
- Harness or connectors
- "BR" fusible link

O.K. ↓

CHECK COMPONENTS.
1) Turn ignition "OFF".
2) Check fuel pump relay.
(See page EF & EC-150.)

N.G. → Replace fuel pump relay.

O.K. ↓

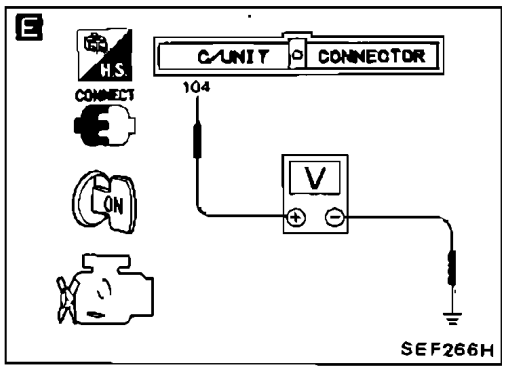
D

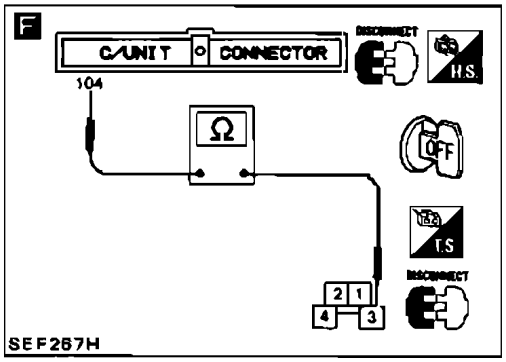
CHECK HARNESS CONTINUITY.
Check continuity between relay harness connector terminal ① and fuel pump harness connector terminal ⓐ.

N.G. → Repair or replace harness or connectors between terminals ① and ⓐ.

O.K. ↓

⊕





E

CHECK E.C.U. OUTPUT SIGNAL (E.C.U. side).

1) Reconnect fuel pump harness connector and fuel pump relay.
2) Turn ignition switch "ON".
3) Check voltage between E.C.U. harness connector (104) and ground.

Battery voltage indication should appear after 5 seconds.

N.G. →

F

CHECK HARNESS CONTINUITY.

1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check continuity between terminal (104) and relay harness connector terminal (3).

Continuity should exist.

If N.G., repair or replace harness and connectors between terminals (104) and (3).

O.K. ↓

Recheck the E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

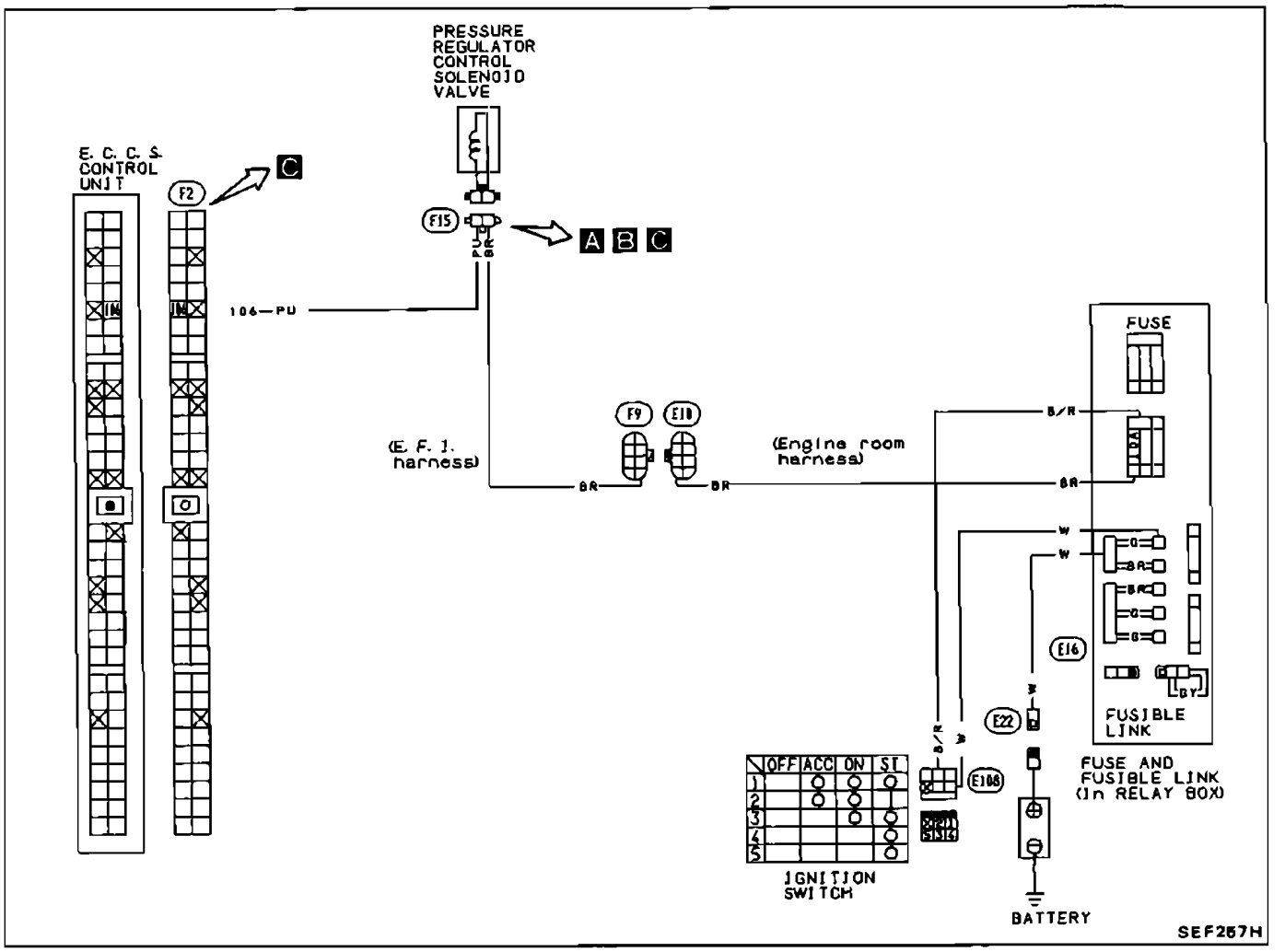
O.K. ↓

INSPECTION END

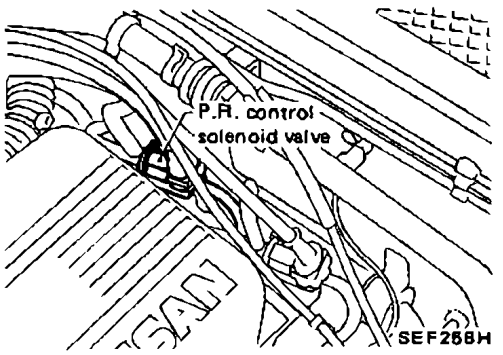
NOTE

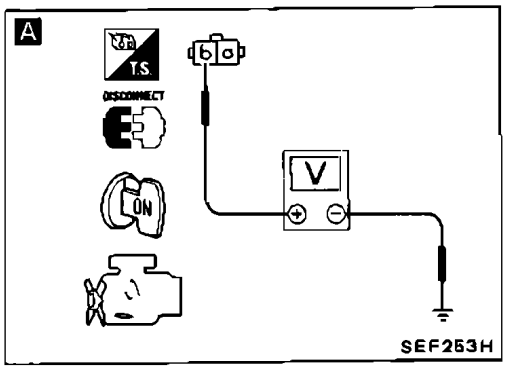
Diagnostic Procedure 16

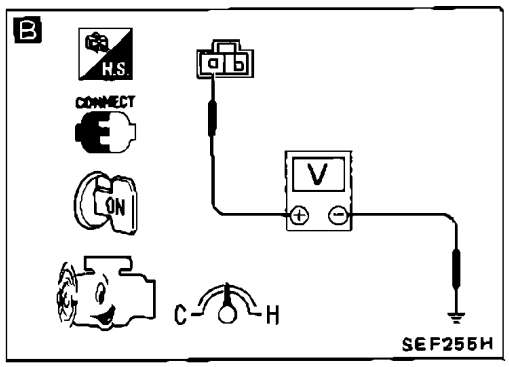
PRESSURE REGULATOR (P.R.) CONTROL SOLENOID VALVE (Not self-diagnostic item)

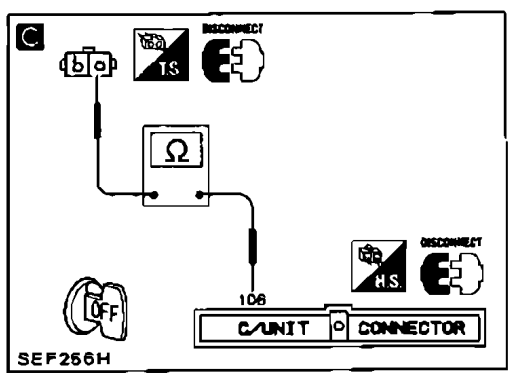


Component location









INSPECTION START

A

CHECK POWER SOURCE.
1) Disconnect P.R. control solenoid valve harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓑ and ground.
Battery voltage should exist.

N.G. → CHECK HARNESS CONTINUITY BETWEEN P.R. CONTROL SOLENOID VALVE AND BATTERY.
Check following.
- Fuse
- Ignition switch
- Harness or connectors

O.K.

CHECK COMPONENTS.
1) Turn ignition switch "OFF".
2) Check P.R. control solenoid valve. (See page EF & EC-149.)

N.G. → Replace P.R. control solenoid valve.

O.K.

B

CHECK OUTPUT SIGNAL.
1) Reconnect P.R. control solenoid valve harness connector.
2) Start engine and warm it up sufficiently (until more than 90°C (194°F) of coolant temperature).
3) Turn ignition switch "OFF" and then start engine again.
4) Check voltage between terminals ⓐ and ground.
Voltage:
0.5 - 1.0V (for 3 minutes after starting)

N.G. → C

CHECK HARNESS CONTINUITY BETWEEN P.R. CONTROL SOLENOID VALVE AND E.C.U.
1) Stop engine.
2) Disconnect P.R. control solenoid valve harness connector.
3) Disconnect E.C.U. harness connector.
4) Check continuity between terminals ⓐ and (106).
Continuity should exist.
If N.G., repair harness or connector.

O.K.

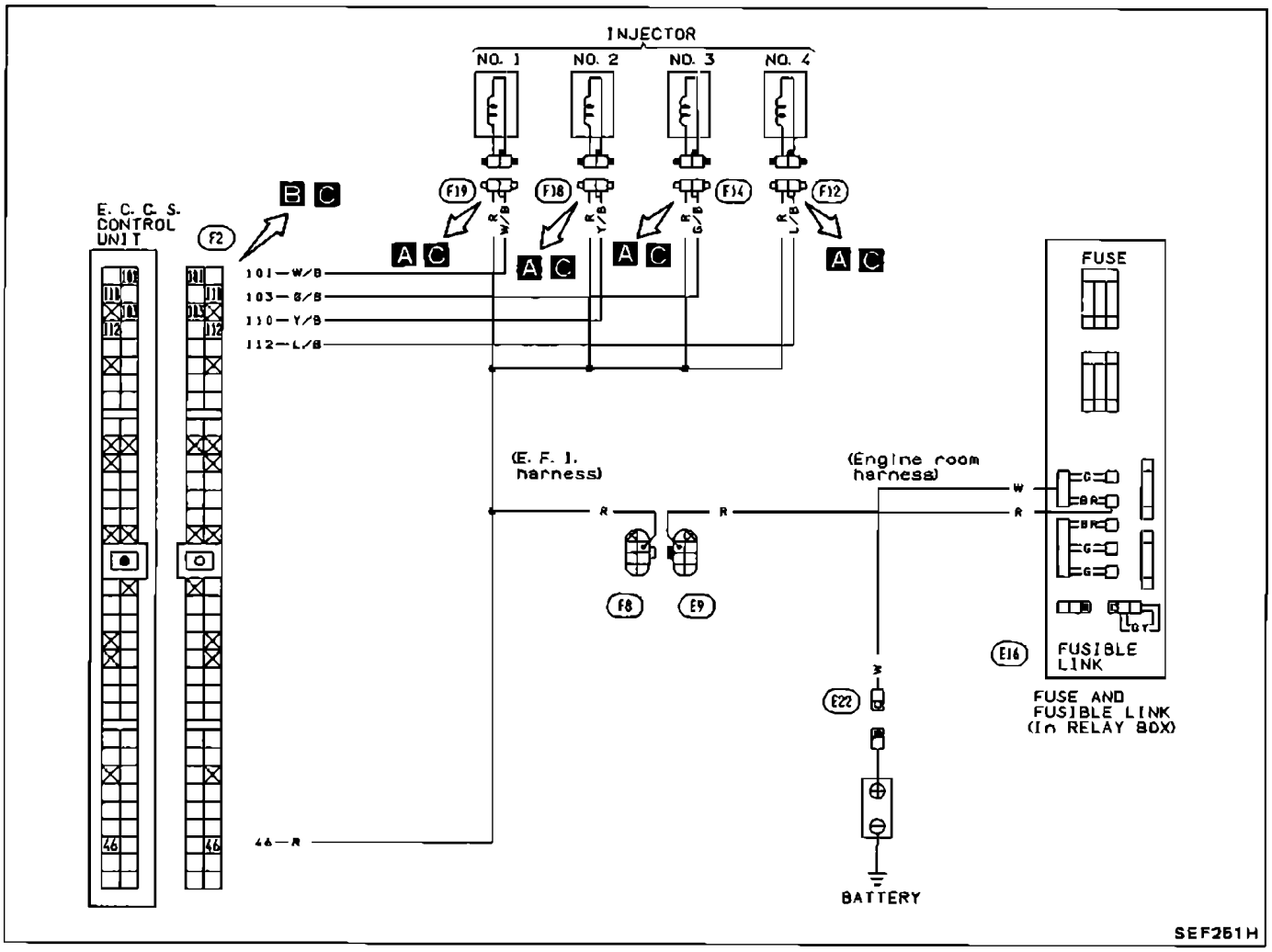
1) Perform E.C.U. input/output signal inspection test.
2) If N.G., recheck the E.C.U. pin terminal (106) for damage or the connection of E.C.U. harness connector.

O.K.

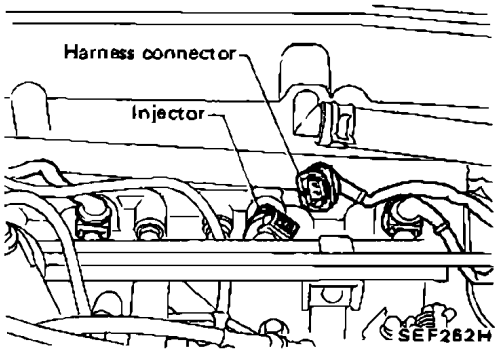
INSPECTION END

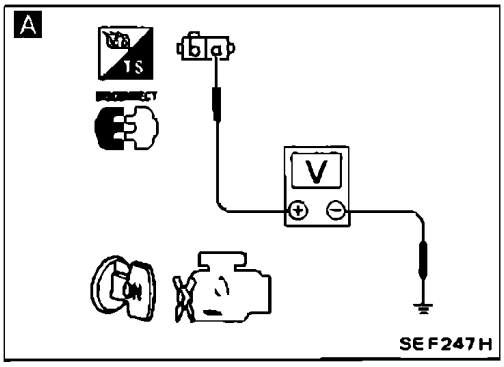
Diagnostic Procedure 17

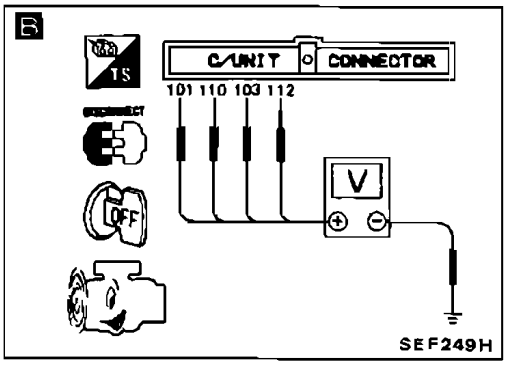
INJECTORS (Not self-diagnostic item)

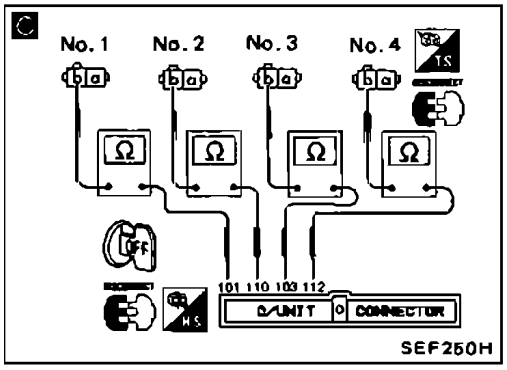


Component location









INSPECTION START

A

CHECK POWER SOURCE
(Injector side).
1) Disconnect injector harness connectors.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓐ and ground.
Battery voltage should exist.

N.G. → CHECK HARNESS CONTINUITY BETWEEN INJECTORS AND BATTERY.
Check following.
- "G" fusible link
- Harness

O.K. ↓

CHECK COMPONENTS.
1) Turn ignition "OFF".
2) Check injectors.
(See page EF & EC-150.)

N.G. → Replace injectors.

O.K. ↓

B

CHECK OUTPUT SIGNAL.
1) Reconnect injector harness connector.
2) Start engine and warm it up sufficiently.
3) Check voltage between E.C.U. terminals (101), (103), (110), (112) and ground.
Battery voltage should exist.

N.G. → C

CHECK HARNESS CONTINUITY BETWEEN INJECTORS AND E.C.U.
1) Stop engine.
2) Disconnect injector harness connectors.
3) Disconnect E.C.U. harness connector.
4) Check continuity between terminals ⓑ (No. 1) and (101), ⓑ (No. 2) and (110), ⓑ (No. 3) and (103), ⓑ (No. 4) and (112).
Continuity should exist.
If N.G., repair harness or connector.

O.K. ↓

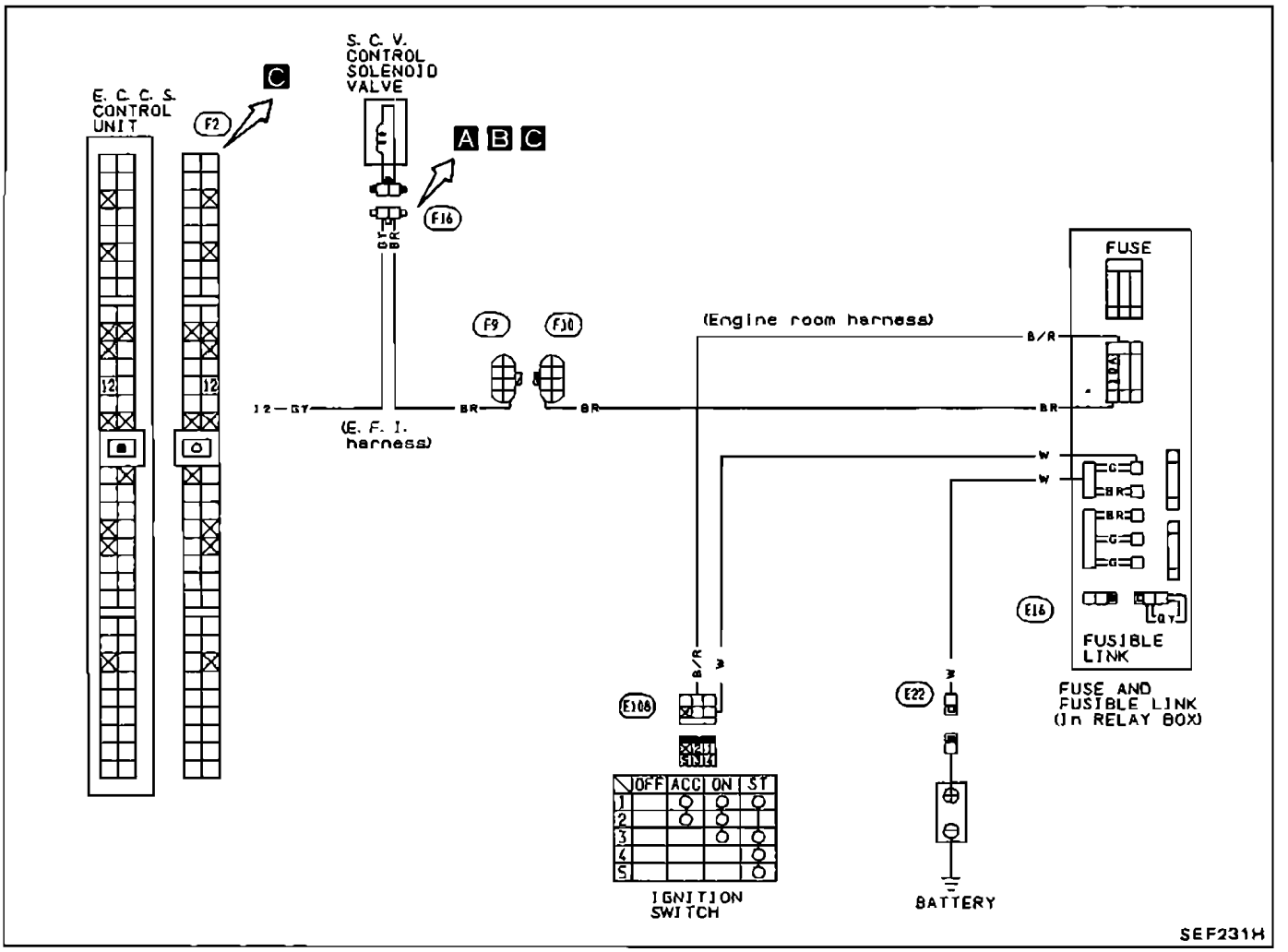
Recheck the E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K. ↓

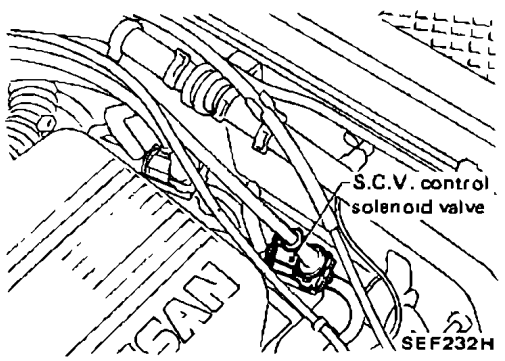
INSPECTION END

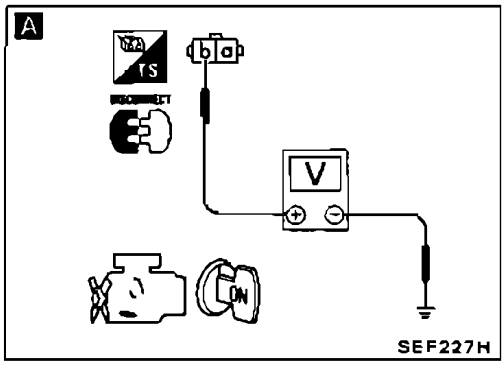
Diagnostic Procedure 18

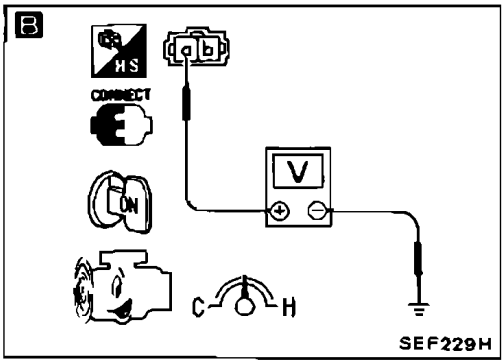
SWIRL CONTROL VALVE (S.C.V.) CONTROL SOLENOID VALVE (Not self-diagnostic item)

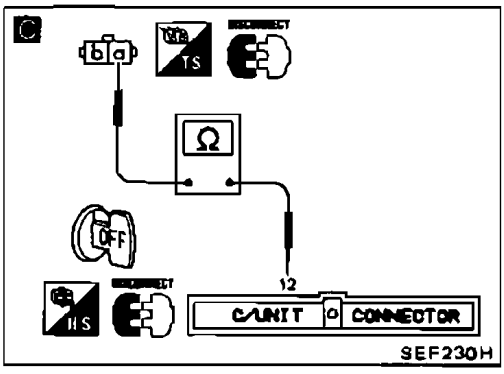


Component location









INSPECTION START

A

CHECK POWER SOURCE.
1) Disconnect S.C.V. control solenoid valve harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓑ and ground.
Battery voltage should exist.

N.G. → CHECK HARNESS CONTINUITY FOR POWER SOURCE.
Check following.
- "G" fusible link
- Ignition switch
- Harness

O.K.

CHECK COMPONENTS.
1) Turn ignition switch "OFF".
2) Check S.C.V. control solenoid valve. (See page EF & EC-149.)

N.G. → Replace S.C.V. control solenoid valve.

O.K.

B

CHECK OUTPUT SIGNAL.
1) Reconnect S.C.V. control solenoid valve harness connector.
2) Start engine and warm it up sufficiently.
3) Check voltage between terminal ⓐ and ground.

Engine speed	Voltage between terminal ⓐ and ground
Less than approx. 1,400 rpm	0.5 - 1.0V
More than approx. 1,400 rpm	Battery voltage

N.G. → C

C

CHECK HARNESS CONTINUITY BETWEEN SOLENOID AND E.C.U.
1) Stop engine.
2) Disconnect S.C.V. control solenoid valve harness connector and E.C.U. harness connector.
3) Check continuity between terminals ⓐ and ⑫.
Continuity should exist.
If N.G., repair or replace harness or connector.

O.K.

1) Perform E.C.U. input/output signal inspection test. (Terminal ⑫)
2) If N.G., recheck the E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K.

CHECK COMPONENT.
Check swirl control valve and actuator. (See page EF & EC-150.)

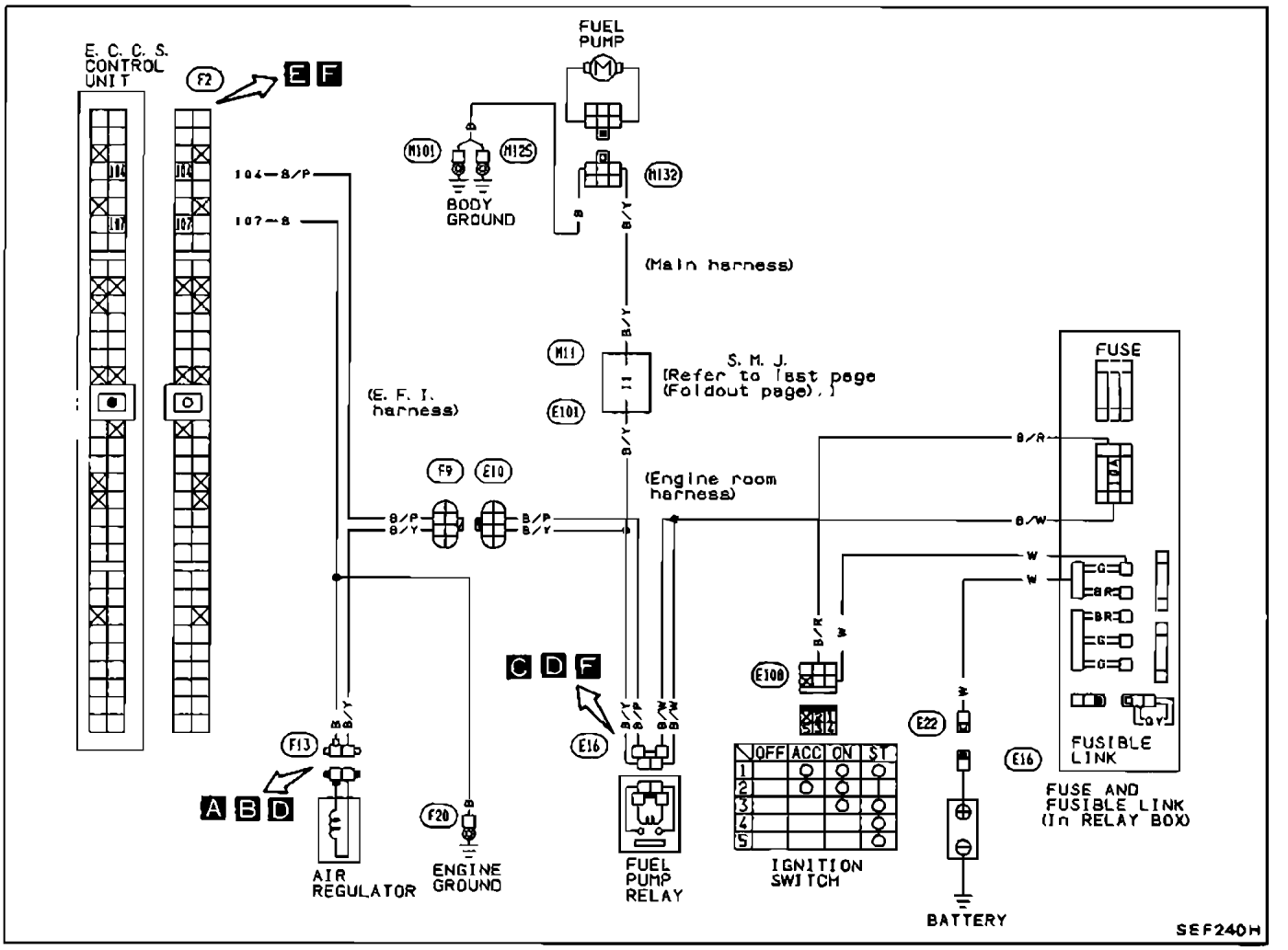
N.G. → Replace swirl control valve or actuator.

O.K.

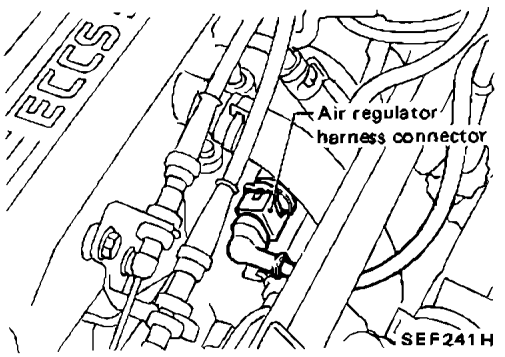
INSPECTION END

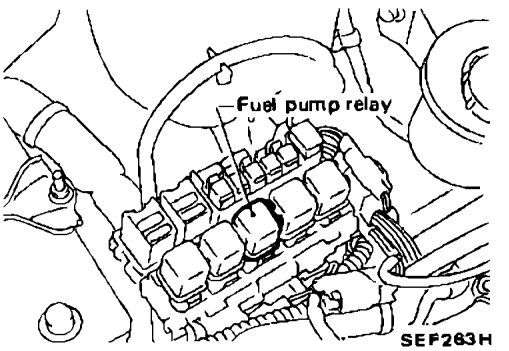
Diagnostic Procedure 19

AIR REGULATOR (Not self-diagnostic item)

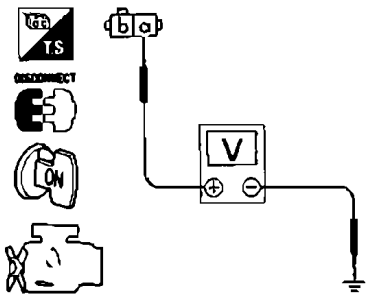


Component location

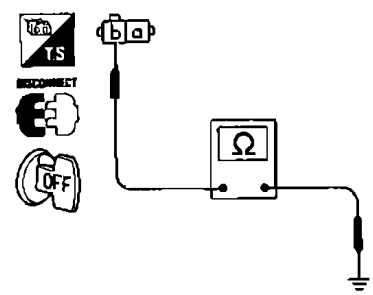




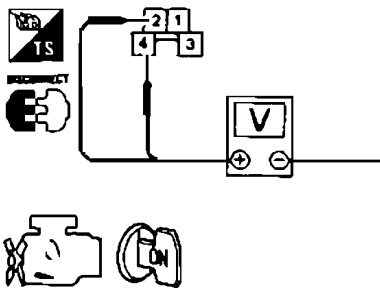
A



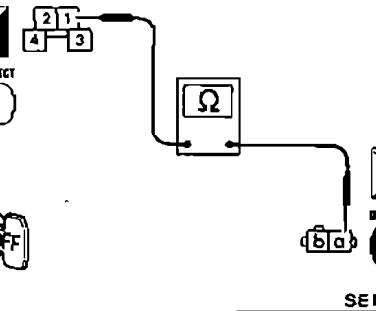
B



C



D



INSPECTION START

A

CHECK POWER SUPPLY
(Air regulator side).
1) Disconnect air regulator harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓐ and ground.
Battery voltage indication should appear for 5 seconds after turning ignition switch "ON".

O.K. →

CHECK COMPONENTS.
1) Turn ignition "OFF".
2) Check fuel pump relay.
(See page EF & EC-150.)
If N.G. replace air regulator.

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check continuity between terminal ⓑ and ground.
Continuity should exist.
If N.G., repair harness or connectors.

N.G.

C

CHECK POWER SUPPLY
(Relay side).
1) Turn ignition switch "OFF".
2) Disconnect fuel pump relay.
3) Turn ignition switch "ON".
4) Check voltage between terminals ②, ④ and ground.
Battery voltage should exist.

N.G. →

CHECK HARNESS CONTINUITY BETWEEN BATTERY AND FUEL PUMP RELAY.
Check following.
- Harness or connectors
- "BR" fusible link
- Fuse

O.K.

CHECK COMPONENTS.
1) Turn ignition "OFF"
2) Check fuel pump relay.
(See page EF & EC-150.)

N.G. →

Replace fuel pump relay.

O.K.

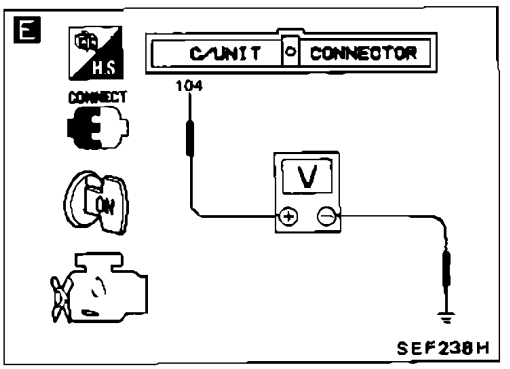
D

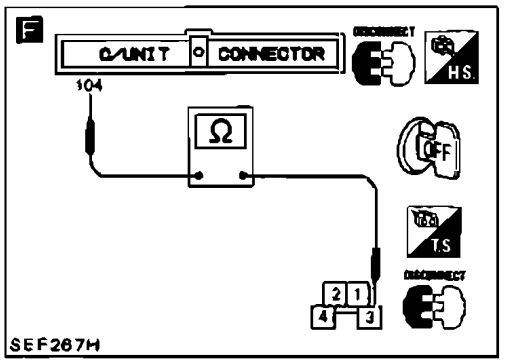
CHECK HARNESS CONTINUITY.
Check continuity between relay harness connector terminal ① and fuel pump harness connector terminal ⓐ.

N.G. →

Repair or replace harness or connectors between terminals ① and ⓐ.

O.K.





E

CHECK E.C.U. OUTPUT SIGNAL (E.C.U. side).

1) Reconnect fuel pump harness connector and fuel pump relay.
2) Turn ignition switch "ON".
3) Check voltage between E.C.U. harness connector (104) and ground.

Battery voltage indication should appear after 5 seconds.

N.G. →

O.K. ↓

INSPECTION END

F

CHECK HARNESS CONTINUITY.

1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check continuity between terminal (104) and relay harness connector terminal (3).

Continuity should exist.

If N.G., repair or replace harness and connectors between terminal (104) and (3).

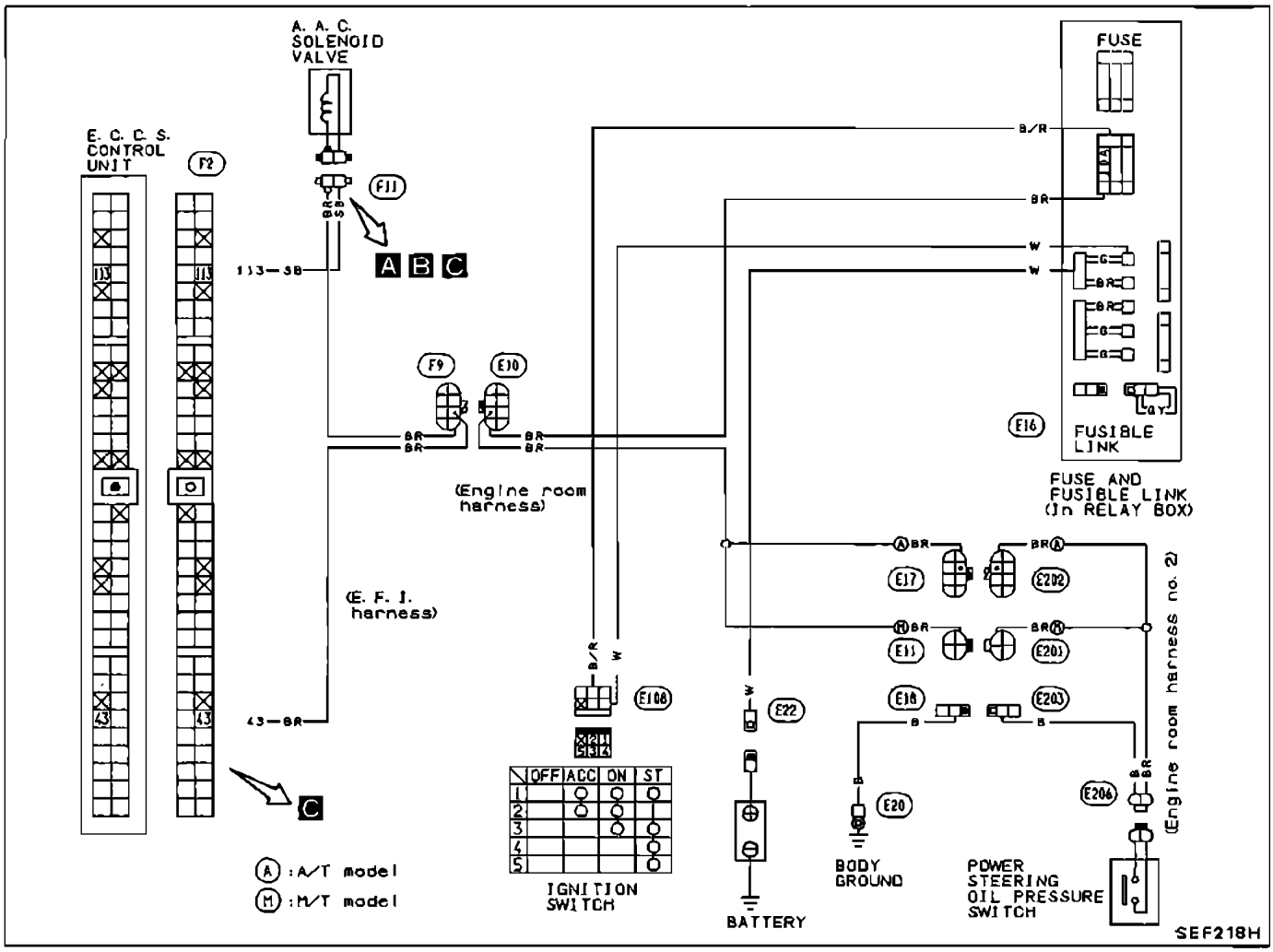
O.K. ↓

Recheck the E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

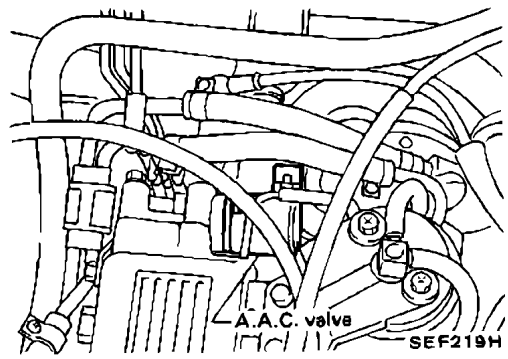
NOTE

Diagnostic Procedure 20

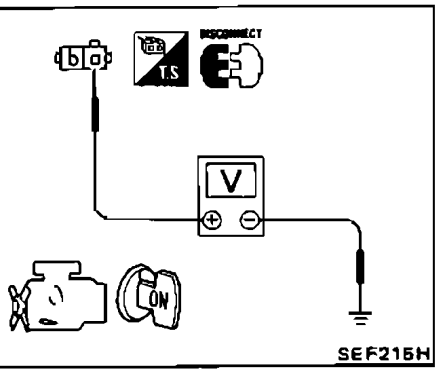
AUXILIARY AIR CONTROL (A.A.C.) VALVE (Not self-diagnostic item)



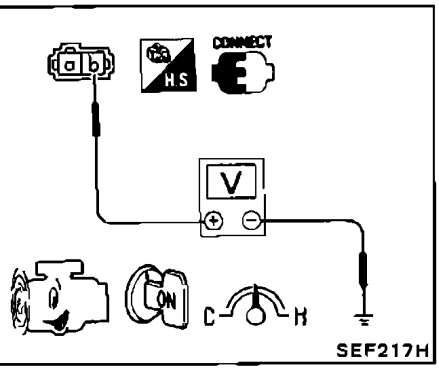
Component location



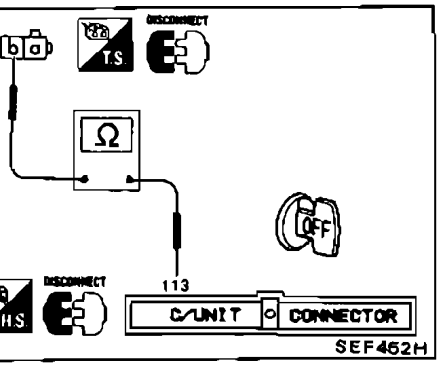
A



B



C



INSPECTION START

CHECK COMPONENTS.
Check A.A.C. valve.
(See page EF & EC-150.)

N.G. → Replace A.A.C. valve.

O.K.

A

CHECK POWER SOURCE.
1) Disconnect A.A.C. valve harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓐ and ground.
Battery voltage should exist.
If N.G., repair harness or connectors.

N.G. → CHECK CONTINUITY BETWEEN A.A.C. VALVE AND BATTERY.
Check following.
- Fuse
- "G" fusible link
- Ignition switch
- Harness or connectors

O.K.

B

CHECK INPUT SIGNAL.
1) Turn ignition switch "OFF".
2) Reconnect A.A.C. valve harness connector.
3) Start engine and warm it up sufficiently.
4) Check voltage between terminal ⓑ and ground.
Voltage:
Approximately 7 - 10V

N.G. → C

CHECK CONTINUITY BETWEEN E.C.U. AND A.A.C. VALVE.
1) Stop engine.
2) Disconnect E.C.U. harness connector.
3) Disconnect A.A.C. valve harness connector.
4) Check continuity between terminals (113) and ⓑ.
Continuity should exist.
If N.G., repair or replace harness connectors.

O.K.

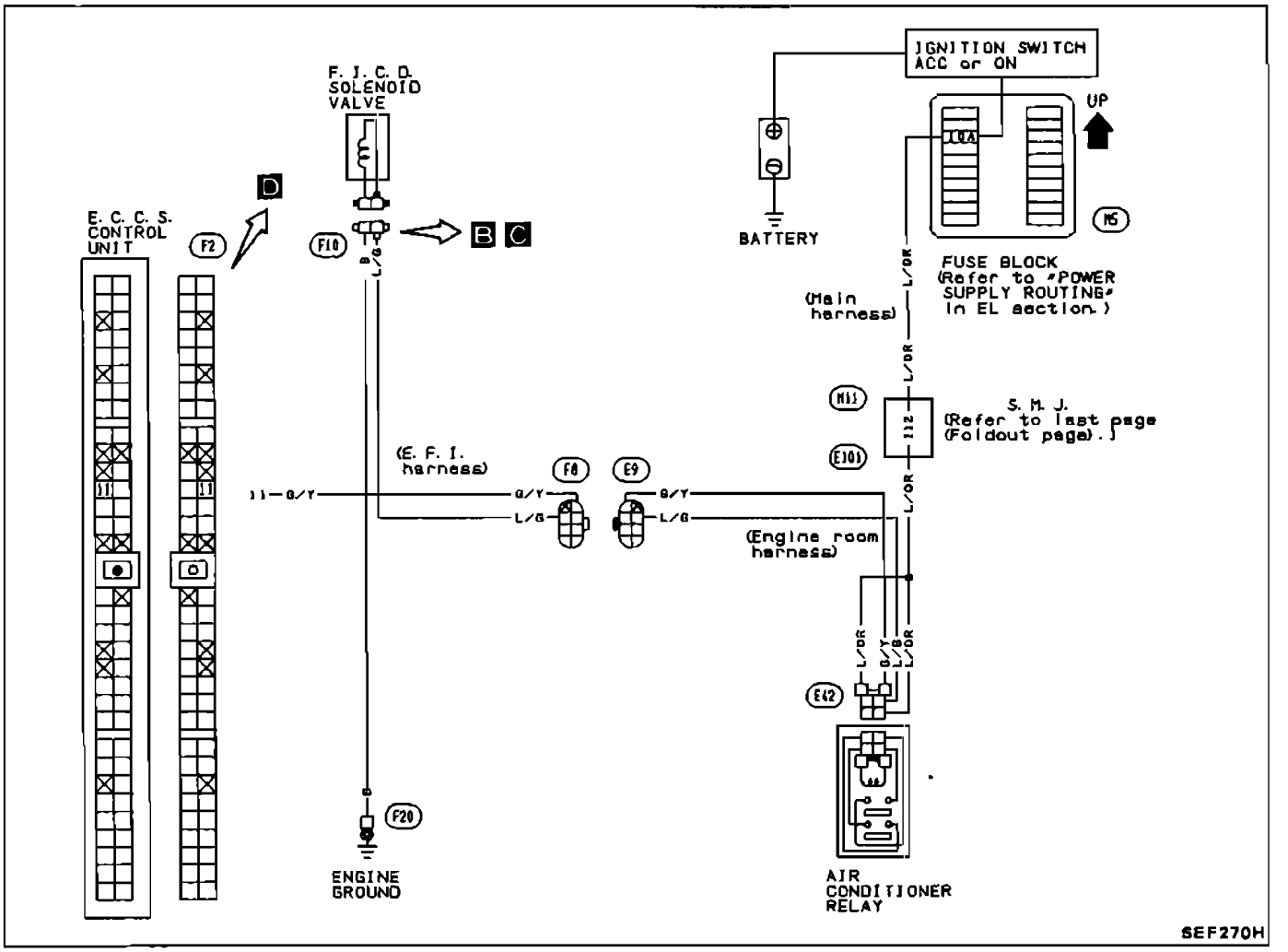
1) Perform E.C.U. input/output signal inspection test. (Terminal (113).)
2) If N.G. recheck the E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K.

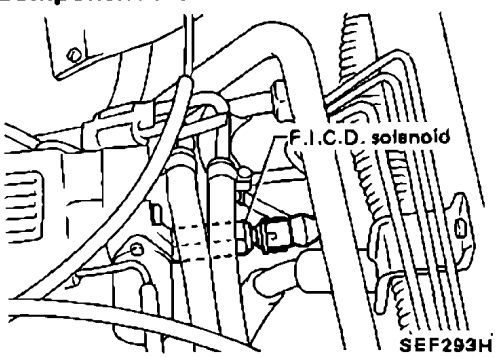
INSPECTION END

Diagnostic Procedure 21

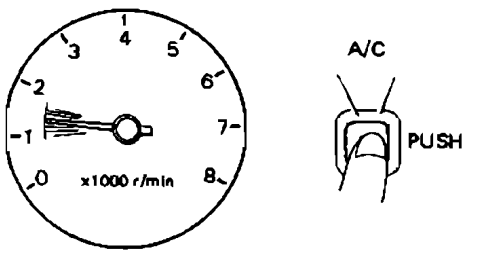
I.A.A. CONTROL (F.I.C.D. CONTROL) (Not self-diagnostic item)



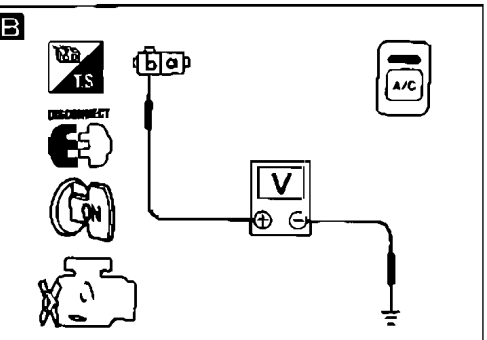
Component location



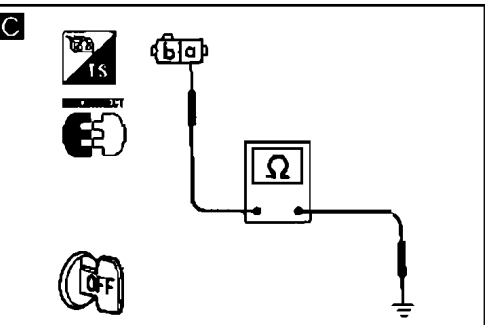
A



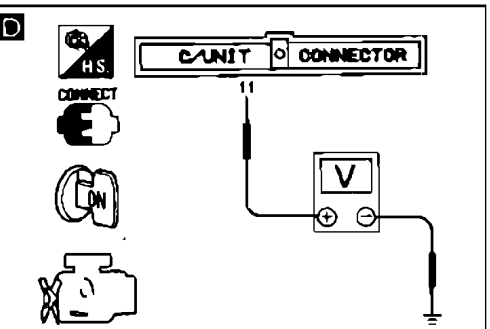
B



C



D



INSPECTION START

A

CHECK INPUT SIGNAL.
1) Start engine and warm it up sufficiently.
2) Does engine revolution rise when air conditioner switch is turned "ON"?

Yes → CHECK IDLE SPEED WHEN AIR CONDITIONER SWITCH IS "ON".
M/T: 1,000±50 rpm
A/T: 1,000±50 rpm (at "N" range)
If out of specification, adjust idle speed.
(See page EF & EC-26.)
O.K. → INSPECTION END

No

B

CHECK POWER SOURCE.
1) Stop engine.
2) Disconnect F.I.C.D. solenoid valve harness connector.
3) Turn ignition switch and air conditioner switch "ON".
4) Check voltage between terminal ⓑ and ground.
Battery voltage should exist.

O.K. → CHECK COMPONENTS.
Check F.I.C.D. solenoid valve.
(See page EF & EC-151.)
If N.G., repair or replace F.I.C.D. solenoid valve.
O.K. →

C

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check continuity between terminal ⓐ and ground.
Continuity should exist.
If N.G., repair harness or connectors.

N.G.

CHECK COMPONENTS.
1) Turn ignition switch "OFF".
2) Check air conditioner relay.
(See HA section.)

N.G. → Replace air conditioner relay.

O.K.

D

CHECK OUTPUT SIGNAL.
1) Reconnect F.I.C.D. solenoid valve harness connector.
2) Turn ignition switch "ON".
3) Check voltage between E.C.U. terminal ⑪ and ground.

A/C switch	Voltage
ON	0.5 - 1.0V
OFF	Battery voltage

N.G. → CHECK HARNESS CONTINUITY BETWEEN BATTERY AND E.C.U.
Check following.
- Fuse
- Ignition switch
- Harness or connectors.

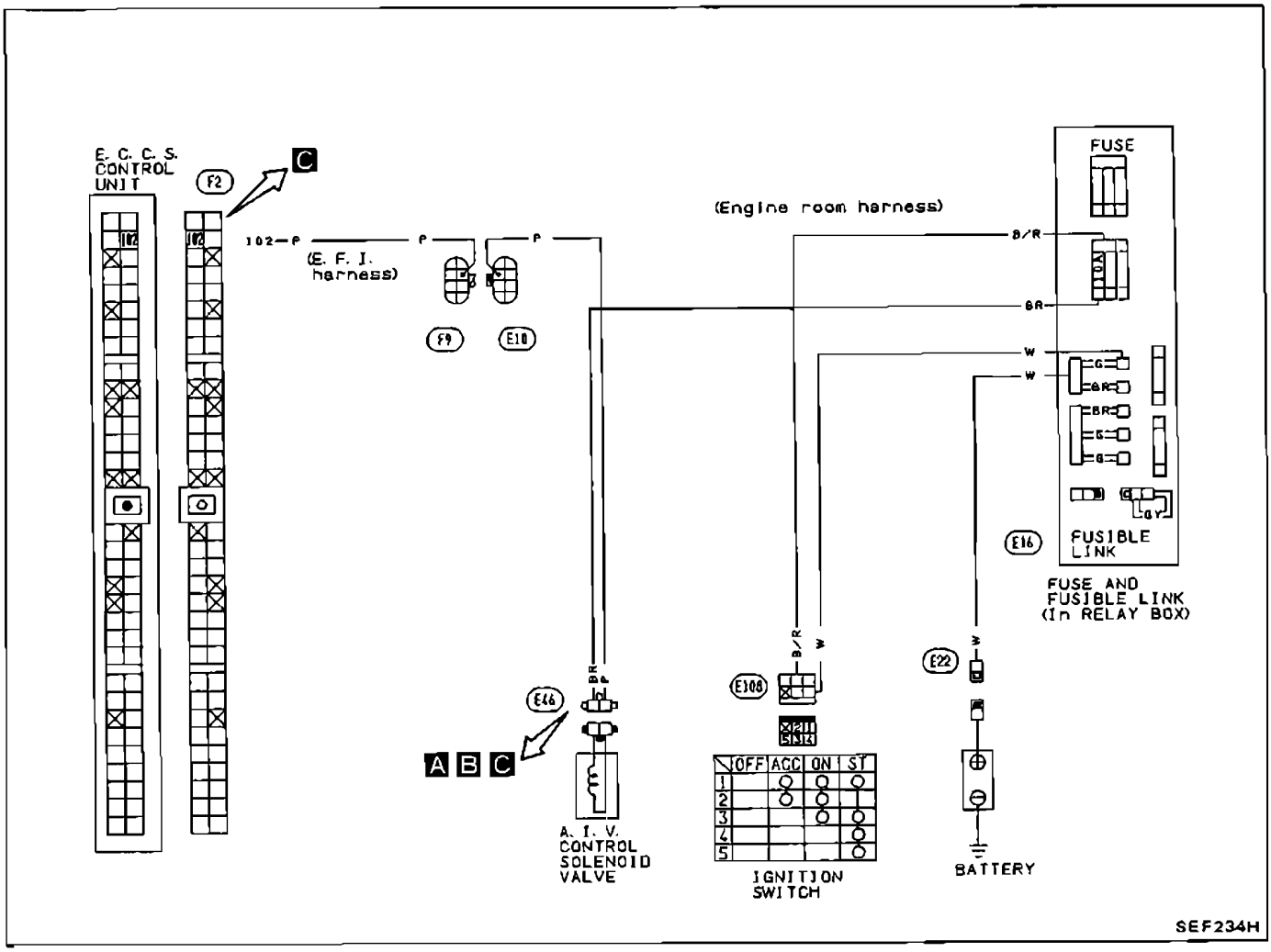
O.K. → Recheck the E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K.

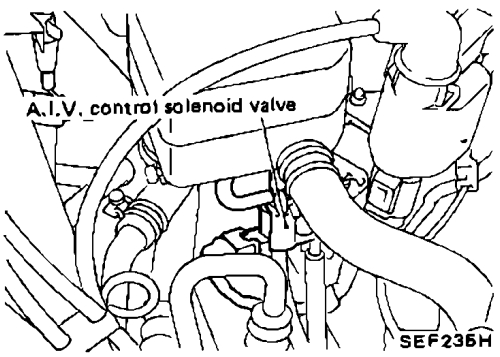
INSPECTION END

Diagnostic Procedure 22

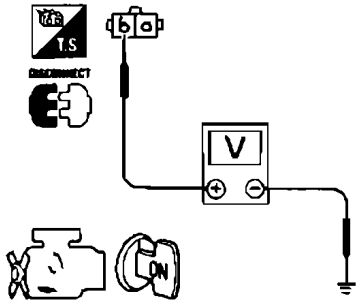
AIR INDUCTION VALVE (A.I.V.) CONTROL SOLENOID VALVE (Not self-diagnostic item)



Component location

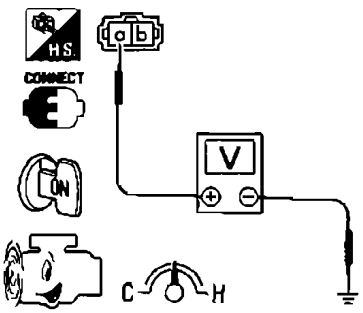


A



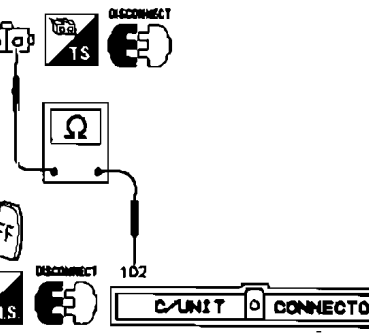
SEF227H

B



SEF229H

C



SEF233H

INSPECTION START

A

CHECK POWER SOURCE.
1) Disconnect A.I.V. control solenoid valve harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓑ and ground.
Voltage: Battery voltage

N.G. → CHECK HARNESS CONTINUITY BETWEEN A.I.V. CONTROL SOLENOID VALVE AND BATTERY.
Check harness or connector.

O.K.

CHECK COMPONENTS.
1) Turn ignition switch "OFF".
2) Check A.I.V. control solenoid valve. (See page EF & EC-149.)

N.G. → Replace A.I.V. control solenoid valve.

O.K.

B

CHECK OUTPUT SIGNAL.
1) Reconnect A.I.V. control solenoid valve harness connector.
2) Start engine and warm it up sufficiently.
3) Check voltage between terminal ⓐ and ground.

Accelerator pedal position	Voltage
Released	0.5 - 1.0V
Depressed	Battery voltage

N.G. → C

C

CHECK HARNESS CONTINUITY BETWEEN A.I.V. CONTROL SOLENOID VALVE AND E.C.U.
1) Stop engine.
2) Disconnect A.I.V. control solenoid valve harness connector.
3) Disconnect E.C.U. harness connector.
4) Check continuity between terminals ⓐ and ⑩②.
Continuity should exist.
If N.G., repair harness or connector.

1) Perform E.C.U. input/output signal inspection test.
2) If N.G., recheck the E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K.

CHECK COMPONENT.
Check air induction valve.
(See page EF & EC-151.)

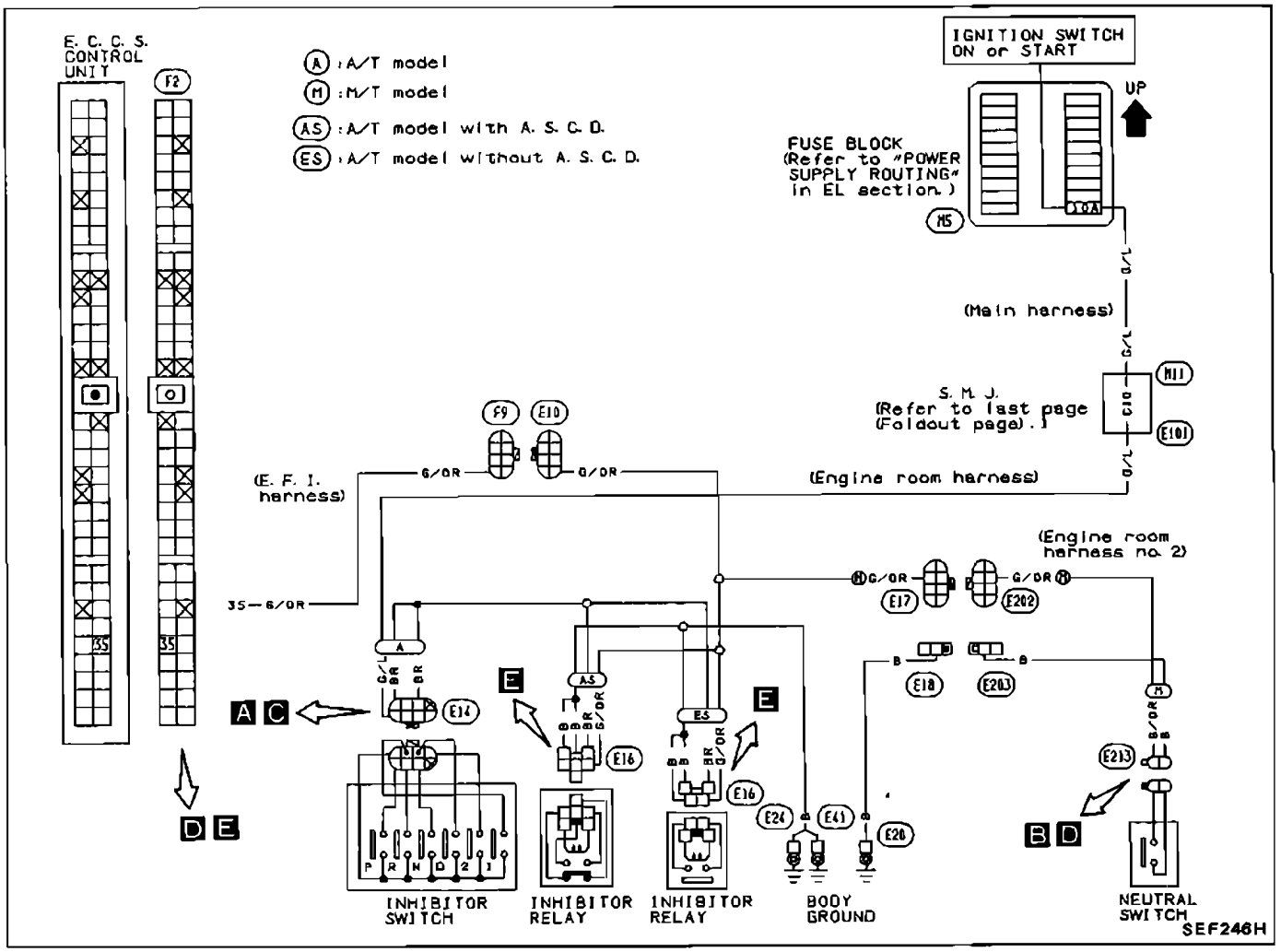
N.G. → Replace air induction valve.

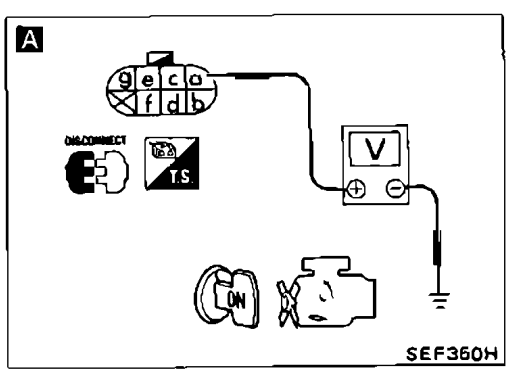
O.K.

INSPECTION END

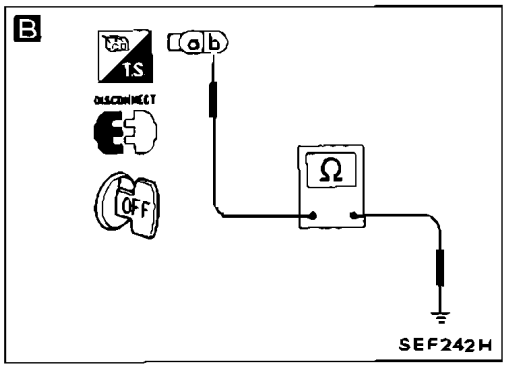
Diagnostic Procedure 23

NEUTRAL SWITCH, INHIBITOR SWITCH AND INHIBITOR RELAY (Not self-diagnostic item)

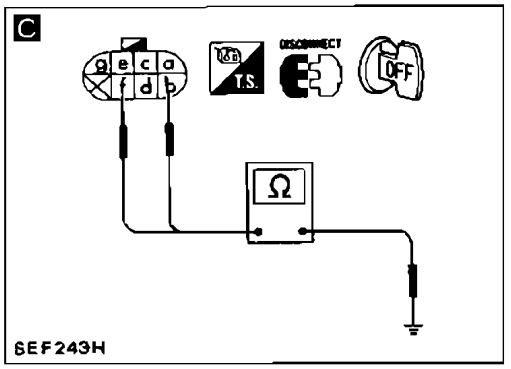




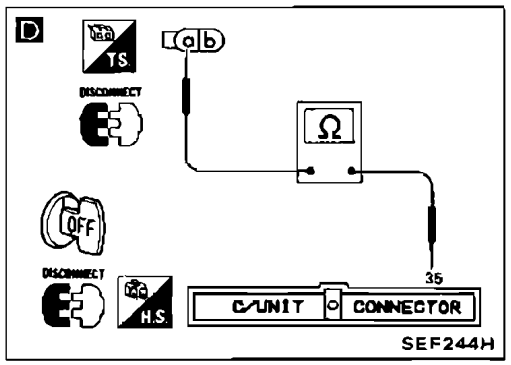
B



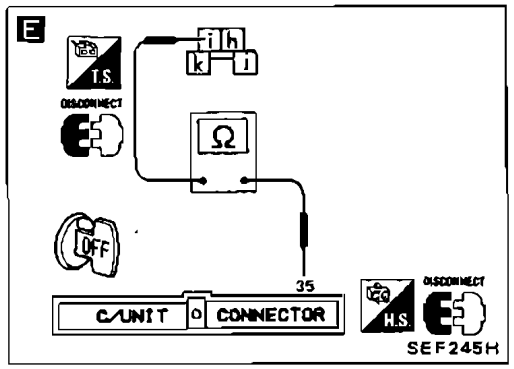
C



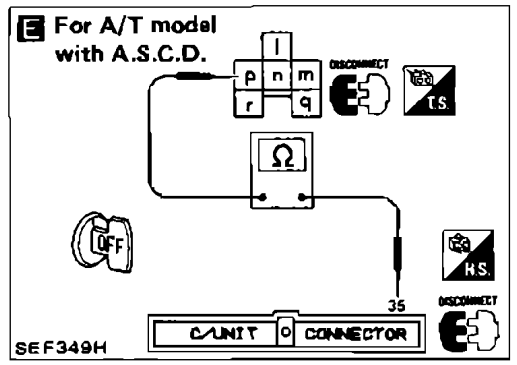
D



E



E For A/T model with A.S.C.D.



INSPECTION START

CHECK COMPONENTS.
Check neutral switch (M/T) or inhibitor switch and inhibitor relay (A/T).
(See page EF & EC-152.)

N.G. → Replace switch or relay.

O.K. (A/T) → A

O.K. (M/T)

A

CHECK POWER SUPPLY FOR INHIBITOR SWITCH.
1) Turn ignition switch "ON".
2) Check voltage between terminal ⓐ and ground.
Battery voltage should exist.

O.K. → CHECK CONTINUITY BETWEEN SWITCH AND GROUND.

N.G. →
Check the following.
- Harness continuity
- Fuse
- S.M.J.

If N.G., repair or replace.

CHECK CONTINUITY BETWEEN SWITCH AND GROUND.

B M/T model
Check continuity between terminal ⓑ and ground.

C A/T model
1) Turn ignition switch "OFF".
2) Check continuity between terminals ⓑ, ⓕ and ground.
Continuity should exist.

N.G. → Repair or replace harness or connector.

O.K. → CHECK CONTINUITY BETWEEN SWITCH (M/T), RELAY (A/T) AND E.C.U.

N.G. → Repair or replace harness or connector.

D M/T model
Check continuity between ⓐ and ㉟.

E A/T model
Check continuity between inhibitor relay connector
ⓘ and ㉟
ⓟ and ㉟. **(A.S.C.D. model)**
Continuity should exist.

O.K. → INSPECTION END

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
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 - 1V
		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	1.0 - 2.0V
		Engine is running. └ E.G.R. system is operating.	0 - 1.0V
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)
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)

Electrical Components Inspection (Cont'd)

*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 - 5.0V 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
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	Idle switch (⊖ side)	Ignition switch "ON" └ Throttle valve: idle position	Approximately 9 - 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 (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.	8 - 9V
44	Idle switch (⊕ side)	Ignition switch "ON" └ Throttle valve: idle position	Approximately 9 - 10V
		Ignition switch "ON" └ Throttle valve: Except idle position	BATTERY VOLTAGE (11 - 14V)
45	5th position switch (M/T models)	Ignition switch "ON" └ Gear is in 5th position.	0V
		Ignition switch "ON" └ Gear is except in 5th position.	6 - 8V
46	Power supply (Back-up)	Ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)

Electrical Components Inspection (Cont'd)

*Data are reference values.

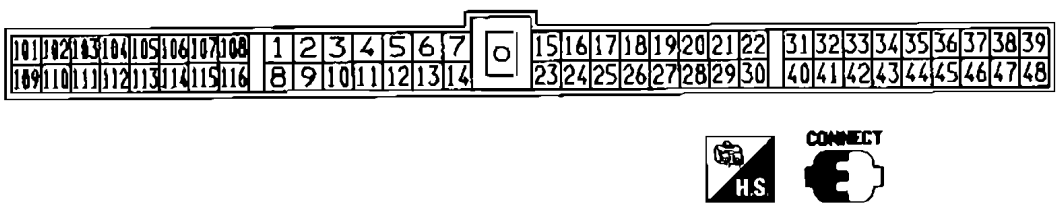
TERMINAL NO.	ITEM	CONDITION	*DATA
101	Injector No. 1	Engine is running.	BATTERY VOLTAGE (11 - 14V)
103	Injector No. 3		
110	Injector No. 2		
112	Injector No. 4		
102	A.I.V. control solenoid valve	Engine is running. └ Idle speed	0 - 1.0V
		Engine is running. ├ Accelerator pedal is depressed. └ After warming up	BATTERY VOLTAGE (11 - 14V)
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)
105	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.

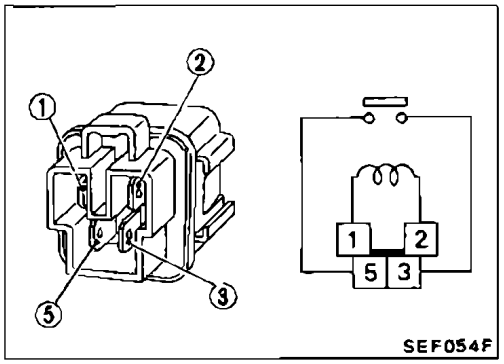
TERMINAL NO.	ITEM	CONDITION	*DATA
106	Pressure regulator control solenoid valve	Stop and restart engine after warming it up. └ Water temperature is above 90°C (194°F)	0 - 1.0V (for 3 minutes after ignition switch is turned off.)
			BATTERY VOLTAGE (After 3 minutes)
		Stop and restart engine after warming it up. └ Water temperature is below 90°C (194°F)	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. PIN CONNECTOR TERMINAL LAYOUT



SEF419H

Electrical Components Inspection (Cont'd)

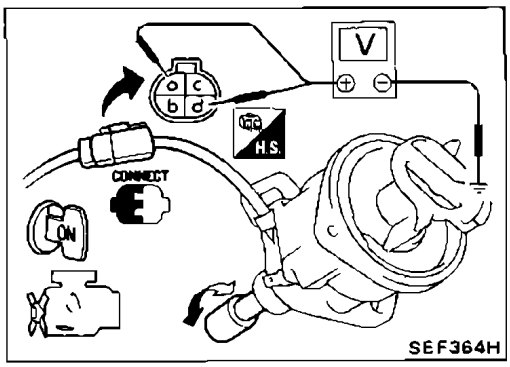


SEF054F

E.C.C.S. RELAY

Check continuity between terminals ③ and ⑤.

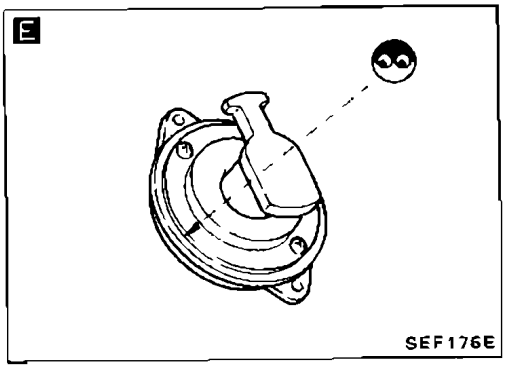
Condition	Continuity
12V direct current supply between terminals ① and ②	Yes
No supply	No



SEF364H

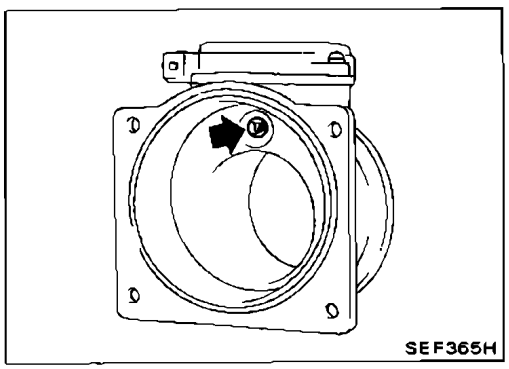
CRANK ANGLE SENSOR

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.



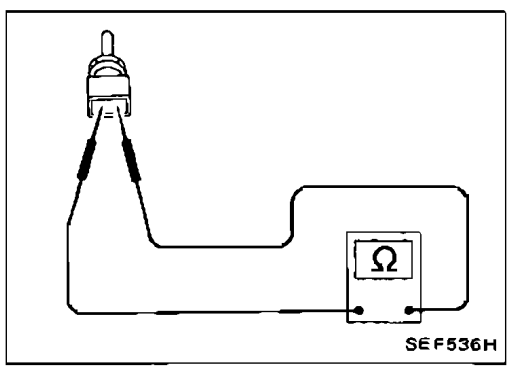
SEF176E

4. Visually check rotor plate for damage or dust.


SEF365H

AIR FLOW METER

- Visually check hot wire air passage for dust.



SEF536H

ENGINE TEMPERATURE SENSOR

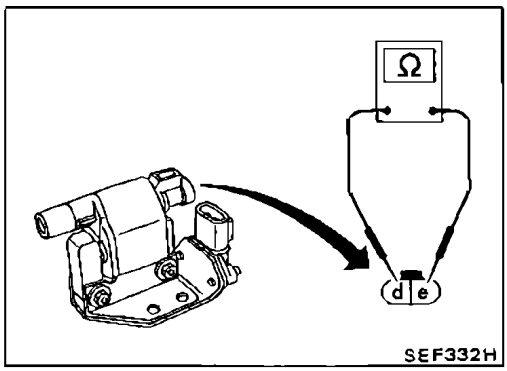
Check engine temperature sensor resistance.

Temperature °C (°F)	Resistance kΩ
20 (68)	2.1 - 2.9
80 (176)	0.30 - 0.33

Electrical Components Inspection (Cont'd)

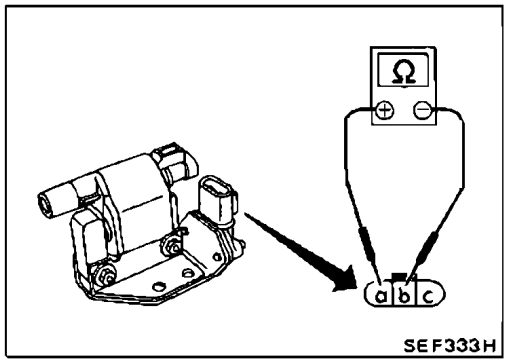
IGNITION COIL

Check ignition coil resistance.



SEF332H

Terminal	Resistance
ⓓ - ⓔ	Approximately 0.7Ω

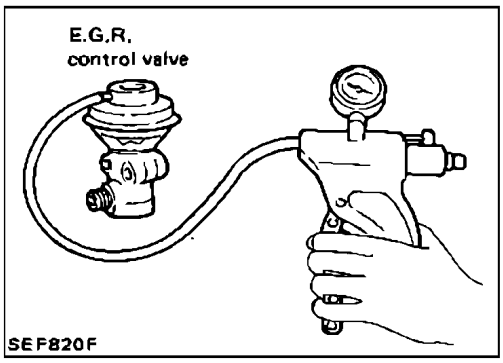


SEF333H

POWER TRANSISTOR

Check continuity between power transistor terminals.

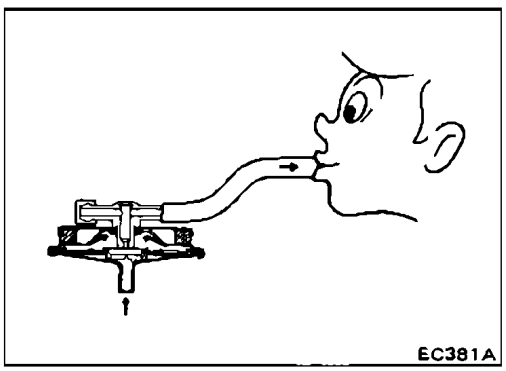
Terminal No.	Tester polarity	Continuity
ⓐ	⊕	No
ⓑ	⊖	
ⓐ	⊖	Yes
ⓑ	⊕	
ⓐ	⊕	No
ⓒ	⊖	
ⓐ	⊖	Yes
ⓒ	⊕	



SEF820F

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.

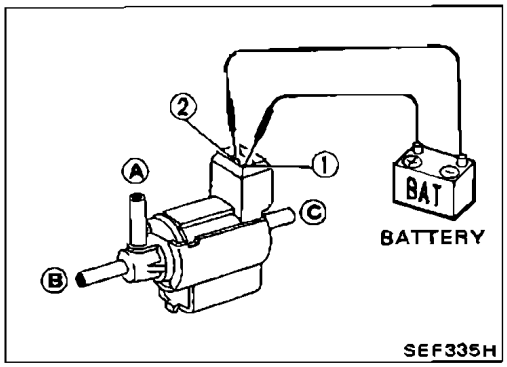

EC381A

B.P.T. VALVE

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)

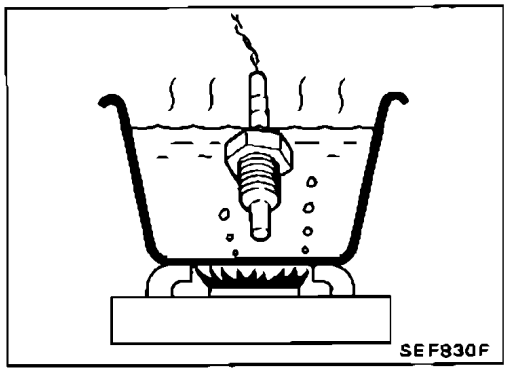
E.G.R. CONTROL SOLENOID VALVE, A.I.V. CONTROL SOLENOID VALVE, P.R. CONTROL SOLENOID VALVE AND S.C.V. CONTROL SOLENOID VALVE



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

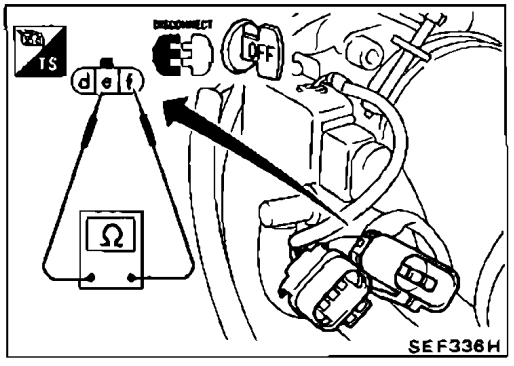


Check resistance change and resistance value at 100°C (212°F).

- **Resistance should decrease in response to temperature increase.**

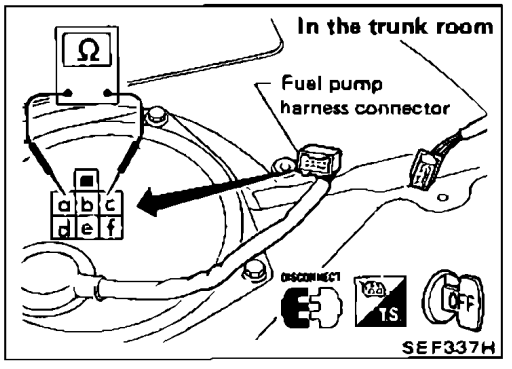
Resistance: 100°C (212°F)
85.3 ± 8.53 kΩ

THROTTLE SENSOR



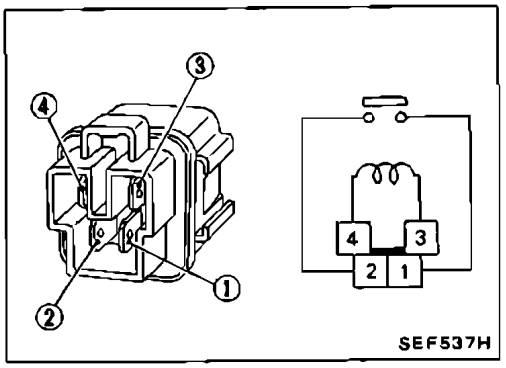
Make sure that resistance between terminals ⓔ and ⓕ changes when opening throttle valve manually.
Resistance should change.

FUEL PUMP



Check continuity between terminals ⓐ and ⓒ.
Continuity should exist.

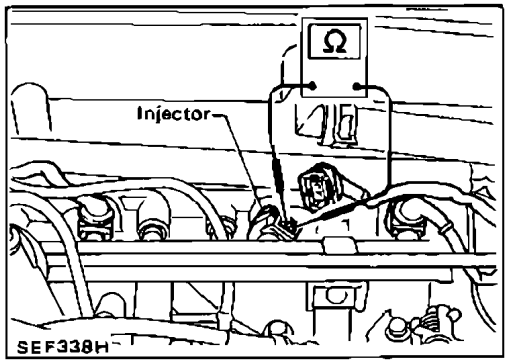
Electrical Components Inspection (Cont'd)



FUEL PUMP RELAY

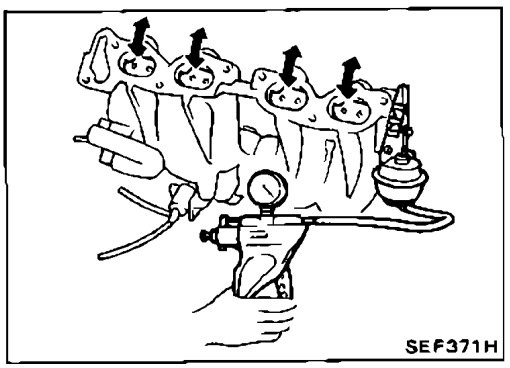
Check continuity between terminals ① and ②.

Condition	Continuity
12V direct current supply between terminals ③ and ④	Yes
No supply	No



INJECTORS

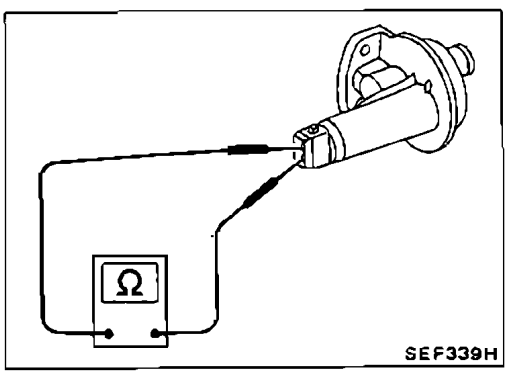
- Check injector resistance.
  Resistance:
  Approximately 10 - 15Ω
- Remove injector and check nozzle for clogging.



SWIRL CONTROL VALVE

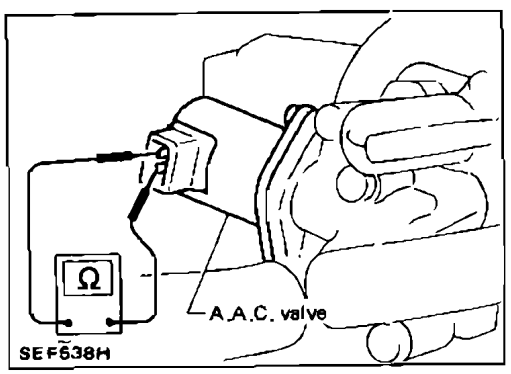
Supply vacuum to actuator and check swirl control valve operation.

Condition	Swirl control valve
Supply vacuum to actuator	Close
No supply	Open



AIR REGULATOR

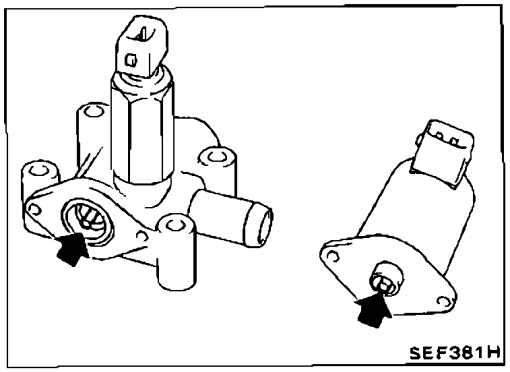
- Check air regulator resistance.
  Resistance:
  Approximately 75Ω
- Check air regulator for clogging.



A.A.C. VALVE

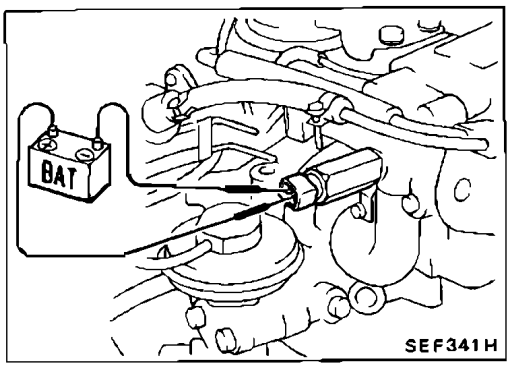
- Check A.A.C. valve resistance.
  Resistance:
  Approximately 10Ω

Electrical Components Inspection (Cont'd)

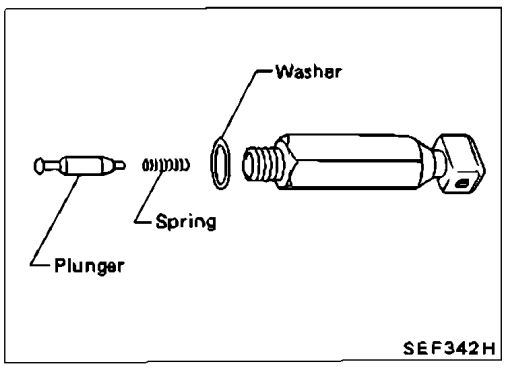


- Check plunger for seizure or sticking.
- Check spring for broken.

F.I.C.D. SOLENOID VALVE



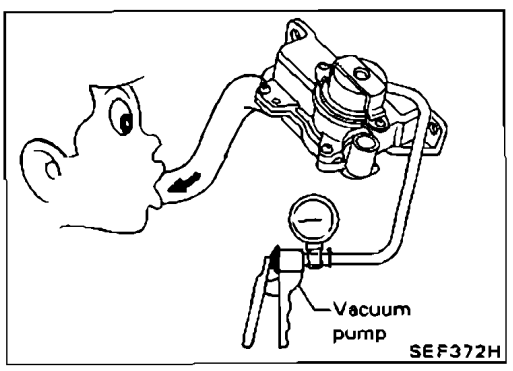
- Check that clicking sound is heard when applying 12V dirct current to terminals.



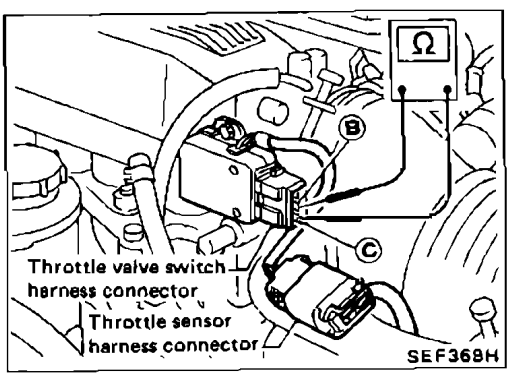
- Check plunger for seizure or sticking.
- Check for broken spring.

AIR INDUCTION VALVE

Apply vacuum to vacuum motor, suck or blow hose to make sure that air flows only towards the air induction side.



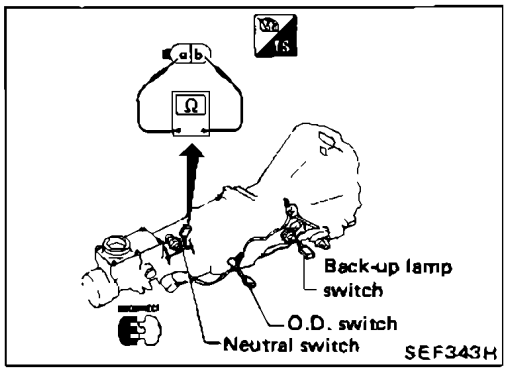
IDLE SWITCH



- Check continuity between terminals Ⓑ and Ⓒ while moving throttle valve.

Accelerator pedal condition	Continuity
Fully closed	Yes
Open	No

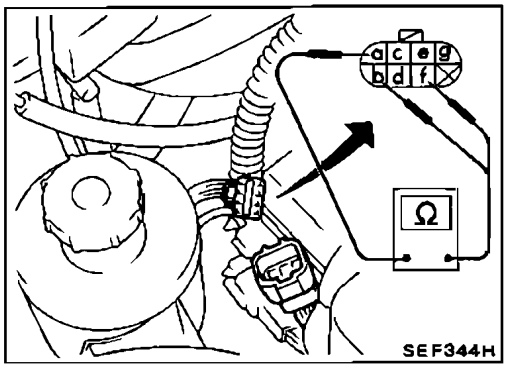
Electrical Components Inspection (Cont'd)



NEUTRAL SWITCH

- Check continuity between terminals ⓐ and ⓑ.

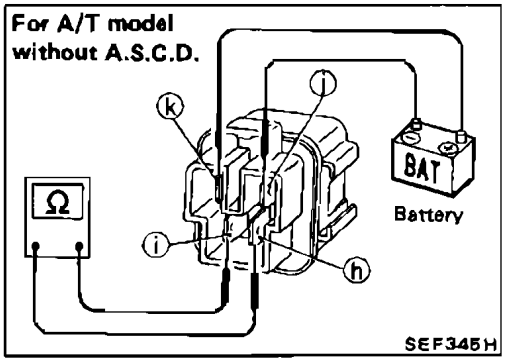
Conditions	Continuity
Shift to Neutral	Yes
Shift to other position	No



INHIBITOR SWITCH

Check continuity between terminals ⓐ and ⓑ, ⓕ.

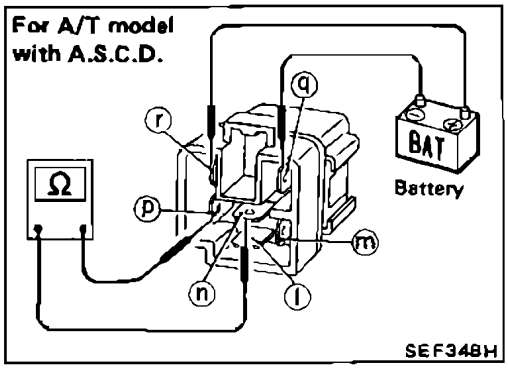
Conditions	Continuity between terminals ⓐ and ⓑ	Continuity between terminals ⓐ and ⓕ
Shift to "P" position	Yes	No
Shift to "N" position	No	Yes
Shift to positions other than "P" and "N"	No	No

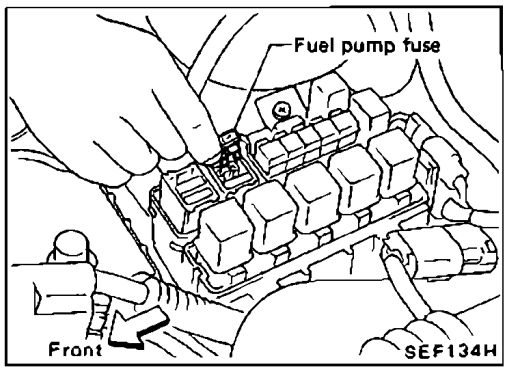


INHIBITOR RELAY

- Check continuity between terminals ⓗ and ⓘ (Without A.S.C.D.), ⓝ and Ⓟ (With A.S.C.D.).

Condition	Continuity between terminals Ⓐ and Ⓑ (Without A.S.C.D.), Ⓒ and Ⓓ (With A.S.C.D.)
12V direct current supply between terminals ⓙ and ⓚ (Without A.S.C.D.), ⓠ and ⓡ (Without A.S.C.D.)	Yes
No supply	No

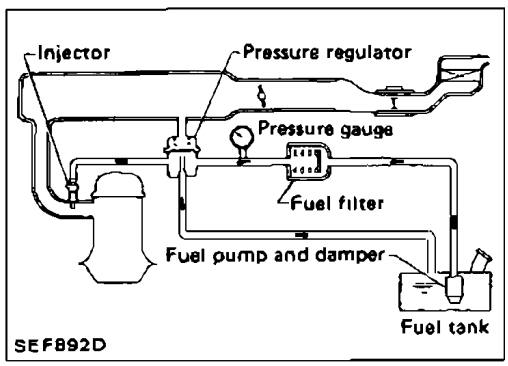




Releasing Fuel Pressure

Before disconnecting fuel line, release fuel pressure from fuel line to eliminate danger.

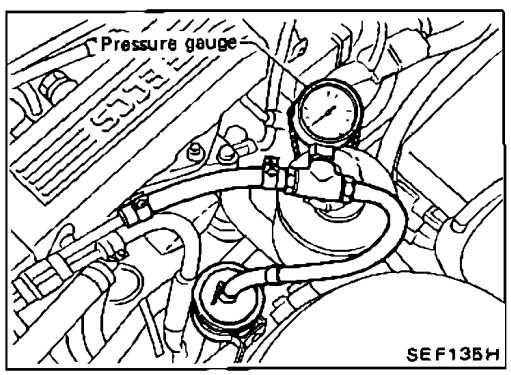
1. Remove fuel pump fuse.
2. Start engine.
3. After engine stalls, crank it two or three times to release all fuel pressure.
4. Turn ignition switch off and reconnect fuel pump fuse.



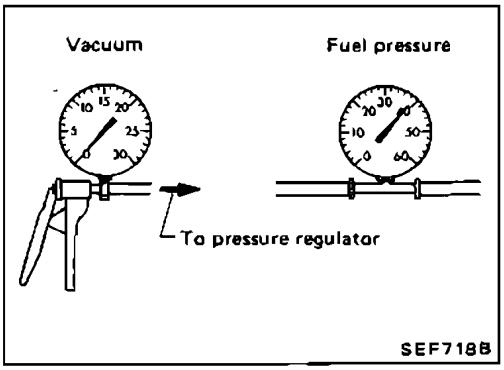
Fuel Pressure Check

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

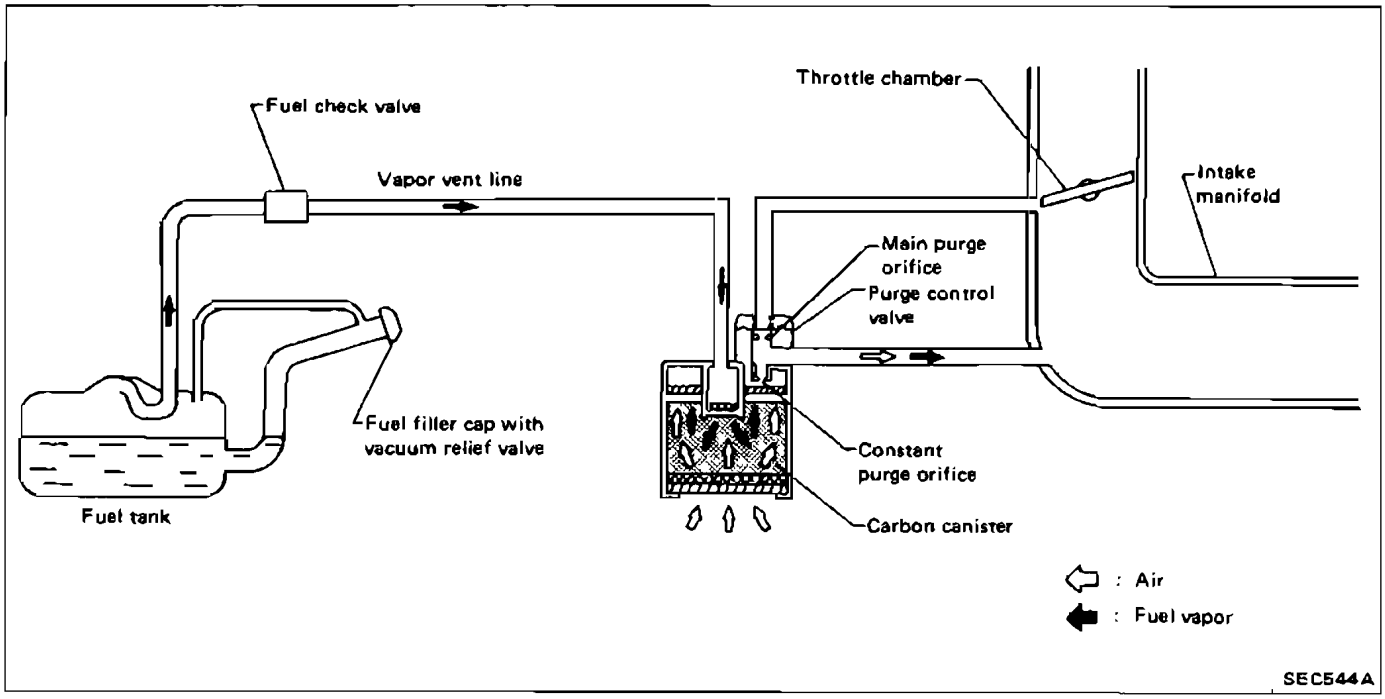
1. Release fuel pressure to zero.
2. Remove or disconnect the following:
- B.P.T. valve
- Fuel tube securing bolts
3. Remove injectors with fuel tube assembly.
4. Remove injector from fuel tube.
5. Install injector as follows:
1) Clean exterior of injector tail piece.
2) Use new O-rings.

CAUTION:

After properly connecting injectors to fuel tube, check connection for fuel leakage.

6. Assemble injectors with fuel pipe to intake manifold.

Description

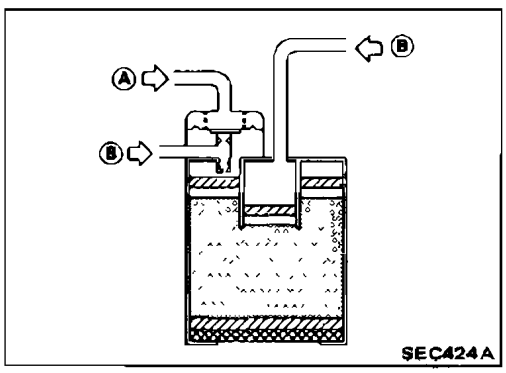


The evaporative emission control system is used to reduce hydrocarbons emitted to the atmosphere from the fuel system. This reduction of hydrocarbons is accomplished by activated charcoals in the carbon canister.

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

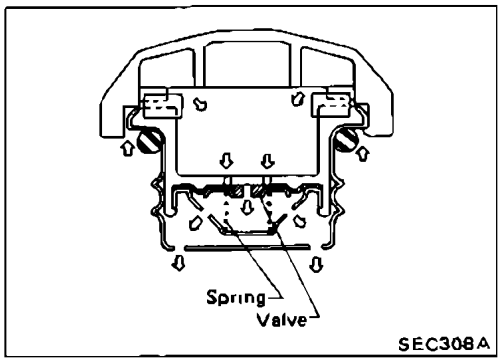
CARBON CANISTER

Check carbon canister as follows:

Ⓐ : Blow air and ensure that there is no leakage.
Ⓑ : Blow air and ensure that there is leakage.

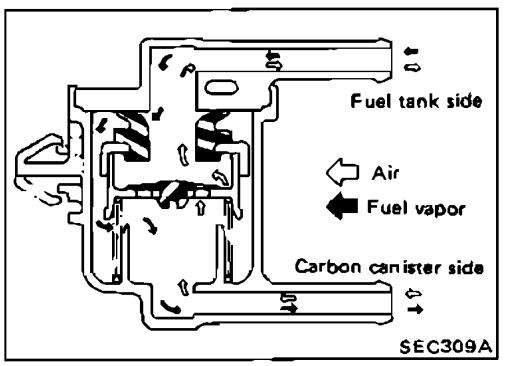
Inspection (Cont'd)

FUEL TANK VACUUM RELIEF VALVE

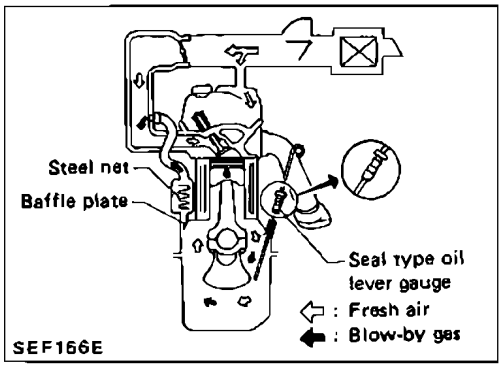


1. Wipe valve housing clean.
2. Inhale air through the cap. A slight resistance accompanied by valve clicks indicates that valve is in good mechanical condition. Note also that, by further inhaling air, the resistance should disappear with valve clicks.
3. If valve is clogged or if no resistance is felt, replace cap as an assembly.

FUEL CHECK VALVE

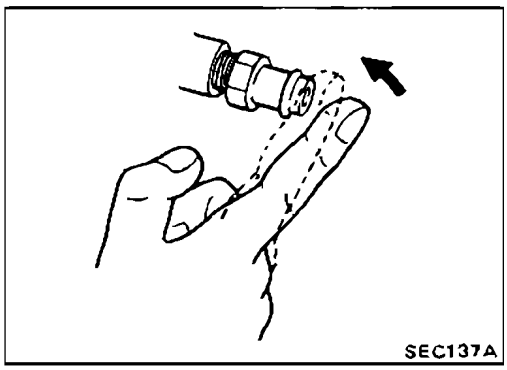


1. Blow air through connector on fuel tank side.
   A considerable resistance should be felt and a portion of air flow should be directed toward the canister.
2. Blow air through connector on canister side.
   Air flow should be smoothly directed toward fuel tank.
3. If fuel check valve is suspected of not properly functioning in steps 1 and 2 above, replace it.



Description

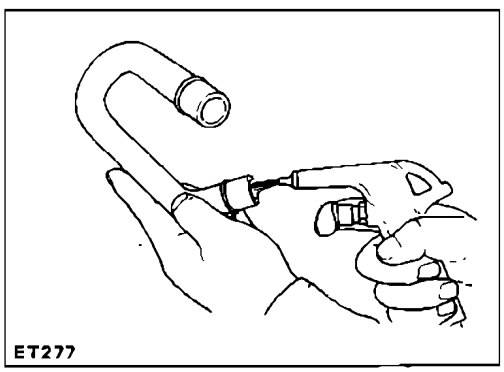
This system returns blow-by gas to both the intake manifold and air cleaner.
The positive crankcase ventilation (P.C.V.) valve is provided to conduct crankcase blow-by gas to the intake manifold.
During partial throttle operation of the engine, the intake manifold sucks the blow-by gas through the P.C.V. 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.	16±2
IDLE SPEED	rpm	M/T 750±50 A/T 750±50 (in "N" position)

Inspection and Adjustment

ENGINE TEMPERATURE SENSOR Thermistor resistance kΩ	20°C (68°F)	80°C (176°F)
	2.1 - 2.9	0.30 - 0.33
IDLE SWITCH Engine speed when idle switch is changed from "OFF" to "ON" rpm	M/T 1,000±150 A/T 1,000±150 (in "N" position)	
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 Thermistor resistance kΩ	100°C (212°F)	
	85.3±8.53	

ENGINE CONTROL, FUEL & EXHAUST SYSTEMS

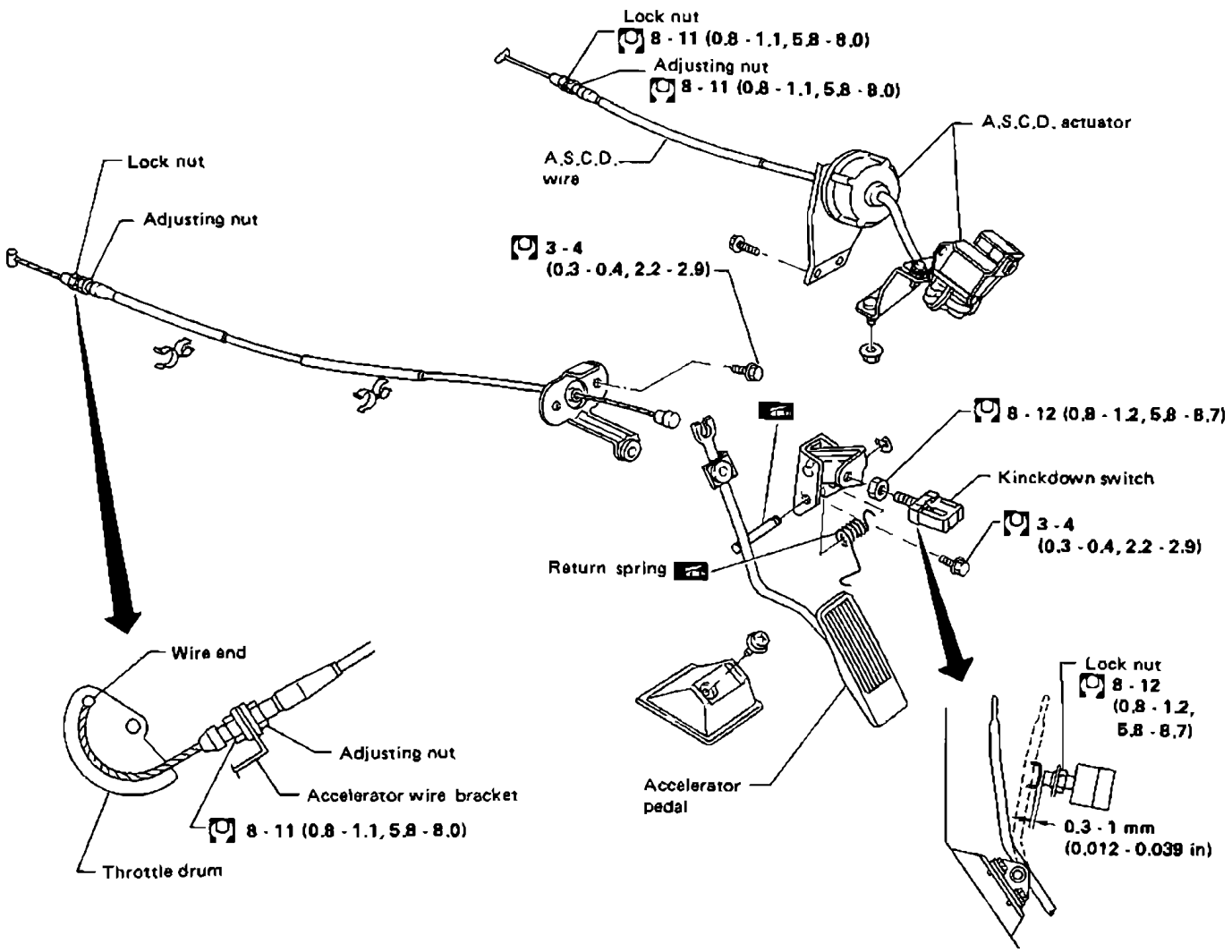
SECTION FE

CONTENTS

ENGINE CONTROL SYSTEM FE-2
FUEL SYSTEM FE-3
EXHAUST SYSTEM FE-4

Accelerator Control System

- When removing accelerator wire, make a mark to indicate lock nut's initial position.
- Check that throttle valve fully opens when accelerator pedal is fully depressed and that it returns to idle position when pedal is released.
- Adjust accelerator wire according to the following procedure.
  Tighten "adjusting nut" until "throttle drum" starts to move.
  From that position turn back "adjusting nut" 1.5 to 2 turns, and fasten it with a lock nut.
- Check accelerator control parts for improper contact with any adjacent parts.
- When connecting accelerator wire, be careful not to twist or scratch its inner wire.



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

SFE012A

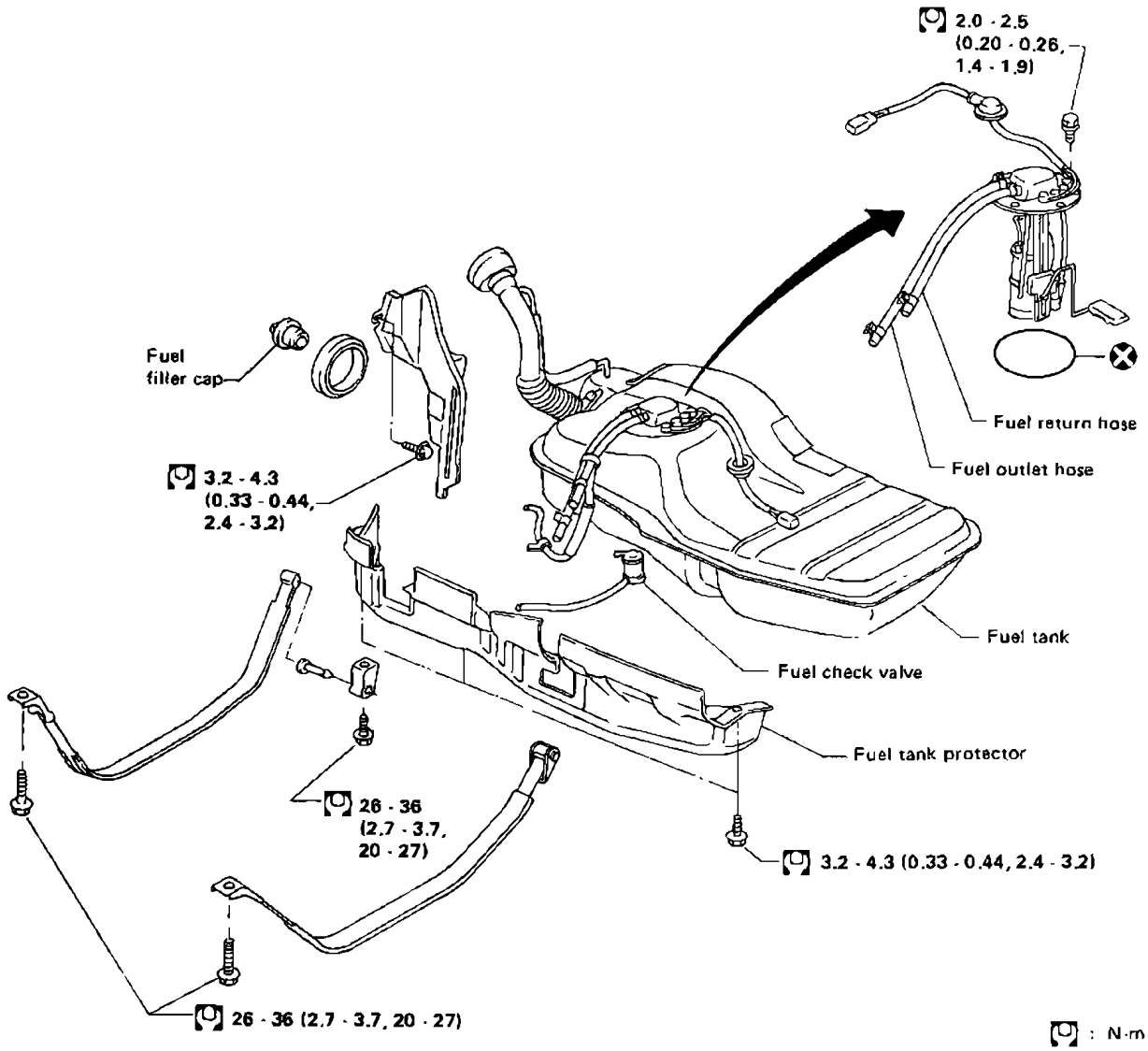
WARNING:

When replacing fuel line parts, be sure to observe the following:

- **Put a "CAUTION: INFLAMMABLE" sign in workshop.**
- **Do not smoke while servicing fuel system. Keep open flames and sparks away from work area.**
- **Be sure to disconnect battery ground cable before conducting operations.**
- **Put drained fuel in an explosion-proof container and put lid on securely.**

CAUTION:

- **For electric fuel pump model, before disconnecting fuel hose, release fuel pressure from fuel line. Refer to "Fuel Filter Replacement" in MA section.**
- **Do not disconnect any fuel line unless absolutely necessary.**
- **Plug hose and pipe openings to prevent entry of dust or dirt.**
- **Always replace O-ring and clamps with new ones.**
- **Do not kink or twist hose and tube when they are installed.**
- **Do not tighten hose clamps excessively to avoid damaging hoses.**
- **When installing fuel check valve, be careful of its designated direction. (Refer to section EF & EC.)**
- **Run engine and check for leaks at connections.**

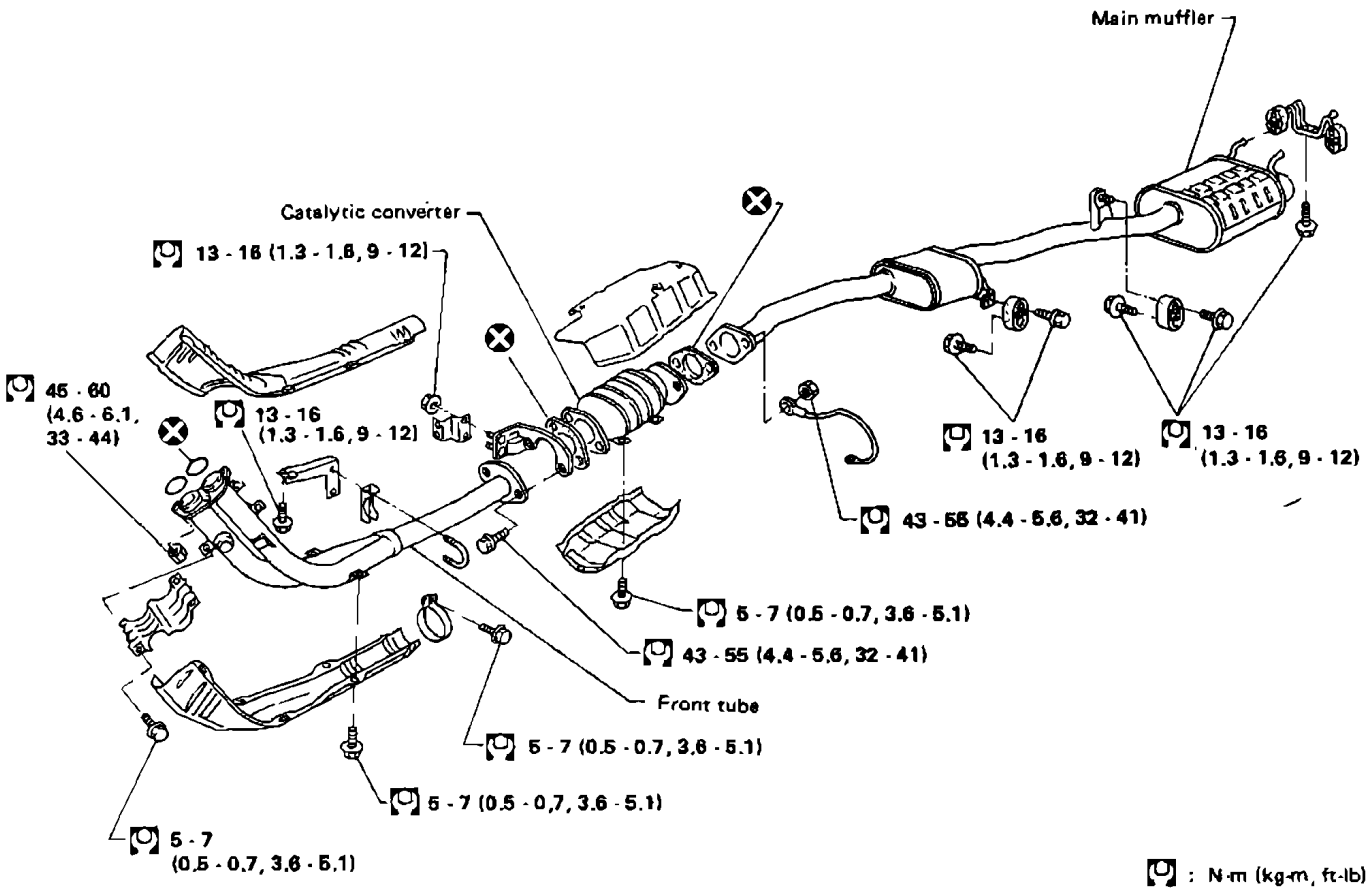


: N·m (kg-m, ft-lb)

SFE013A

CAUTION:

- Always replace exhaust gaskets with new ones when disassembling.
- Check all tube connections for exhaust gas leaks, and entire system for unusual noises, with engine running.
- After installation, check that mounting brackets and mounting insulator are free from undue stress. If any of above parts are not installed properly, excessive noise or vibration may be transmitted to vehicle body.

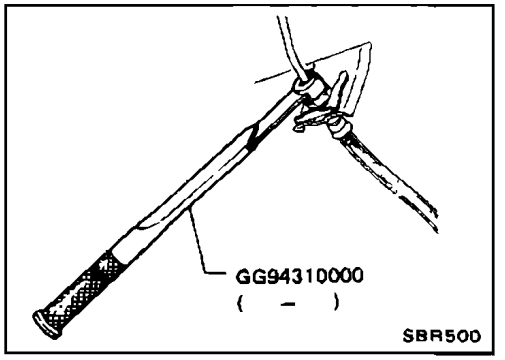


SFE014A

SECTION CL

CONTENTS

PRECAUTIONS AND PREPARATION ..... CL- 2
CLUTCH SYSTEM ..... CL- 4
INSPECTION AND ADJUSTMENT ..... CL- 5
HYDRAULIC CLUTCH CONTROL ..... CL- 7
CLUTCH RELEASE MECHANISM CL-10
CLUTCH DISC AND CLUTCH COVER CL-12
SERVICE DATA AND SPECIFICATIONS (S.D.S.) CL-14



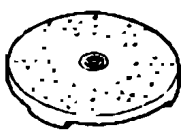
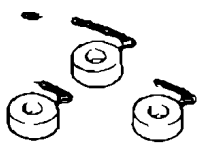
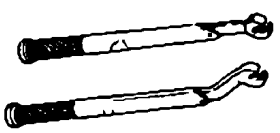
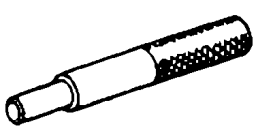
Precautions

- **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.**
- **Use new brake fluid to clean or wash all parts of master cylinder, operating cylinder and clutch damper.**
- **Never use mineral oils such as gasoline or kerosene. It will ruin the rubber parts of the hydraulic system.**

WARNING:
After cleaning the clutch disc, wipe it with a dust collector. Do not use compressed air.

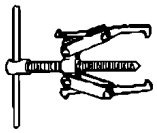
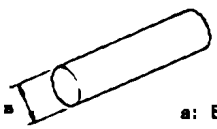
Preparation

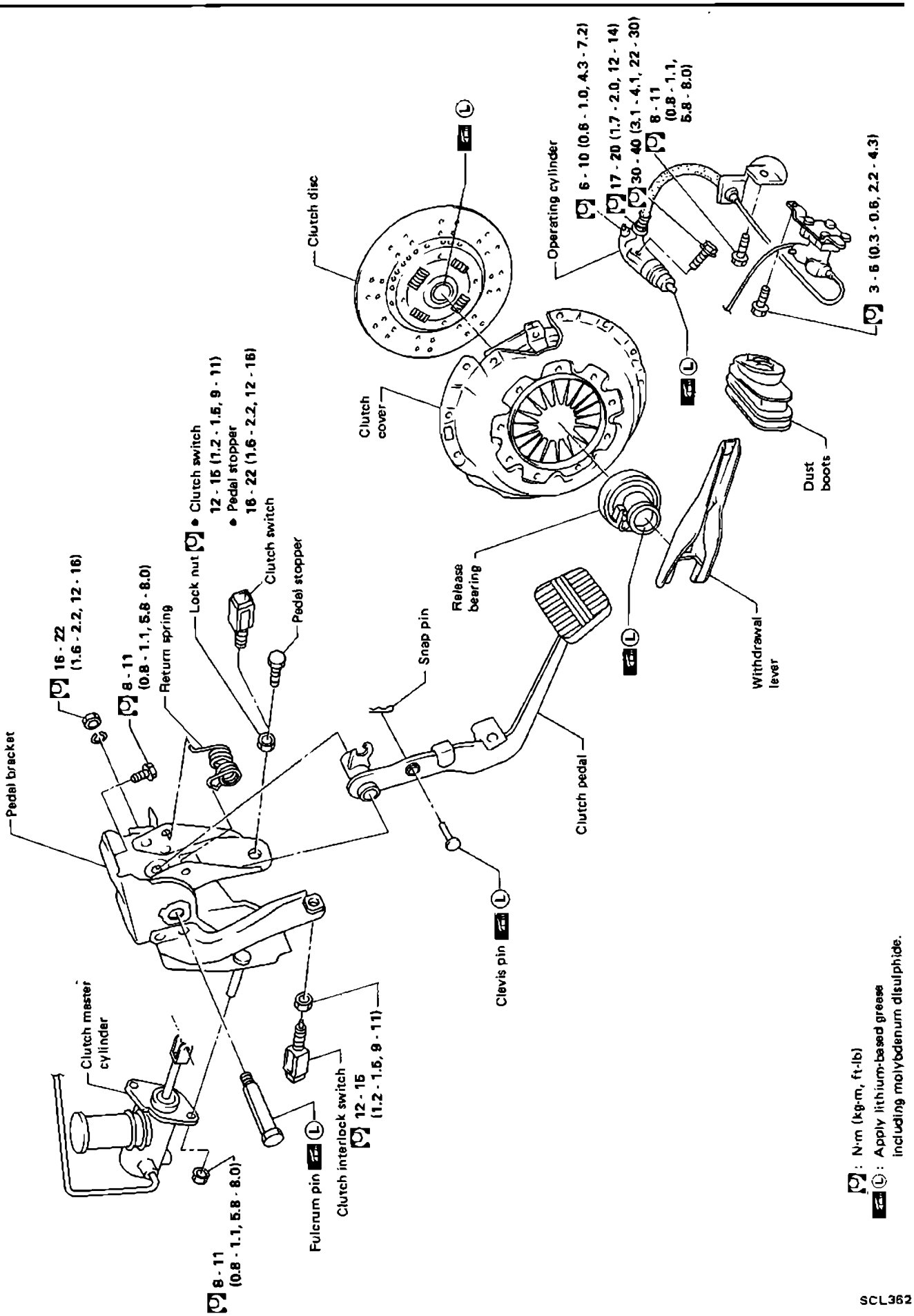
SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.) Tool name	Description	
ST20050010 (–) Base plate		Inspecting diaphragm spring of clutch cover
ST20050100 (–) Distance piece		Inspecting diaphragm spring of clutch cover
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

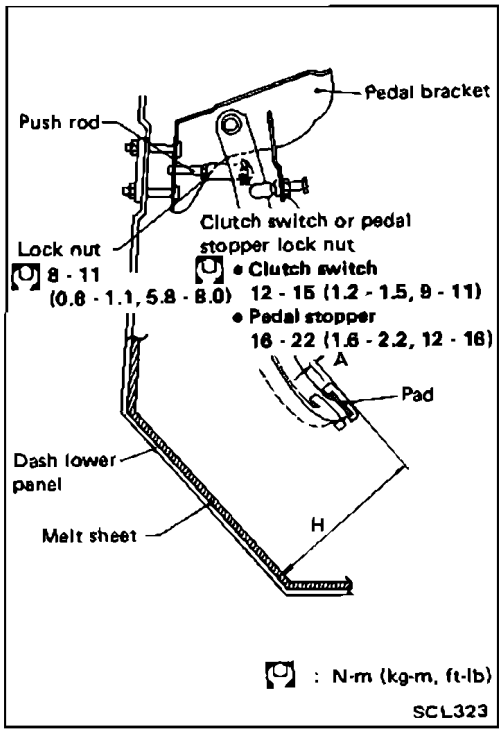
Preparation (Cont'd)

COMMERCIAL SERVICE TOOLS

Tool name	Description	
Bearing puller		Removing release bearing
Bearing drift	 a: 50 mm (1.97 in) dia.	Installing release bearing


Clutch disc
Operating cylinder
6 - 10 (0.6 - 1.0, 4.3 - 7.2)
17 - 20 (1.7 - 2.0, 12 - 14)
30 - 40 (3.1 - 4.1, 22 - 30)
8 - 11 (0.8 - 1.1, 5.8 - 8.0)
3 - 6 (0.3 - 0.6, 2.2 - 4.3)
Clutch cover
Dust boots
Release bearing
Withdrawal lever
Clutch pedal
Snap pin
Clevis pin
Pedal bracket
16 - 22 (1.6 - 2.2, 12 - 16)
8 - 11 (0.8 - 1.1, 5.8 - 8.0)
Return spring
Lock nut
Clutch switch
12 - 15 (1.2 - 1.5, 9 - 11)
Pedal stopper
16 - 22 (1.6 - 2.2, 12 - 16)
Clutch switch
Pedal stopper
Clutch master cylinder
8 - 11 (0.8 - 1.1, 5.8 - 8.0)
Fulcrum pin
Clutch interlock switch
12 - 15 (1.2 - 1.5, 9 - 11)
: N·m (kg-m, ft-lb)
: Apply lithium-based grease including molybdenum disulphide.

SCL362

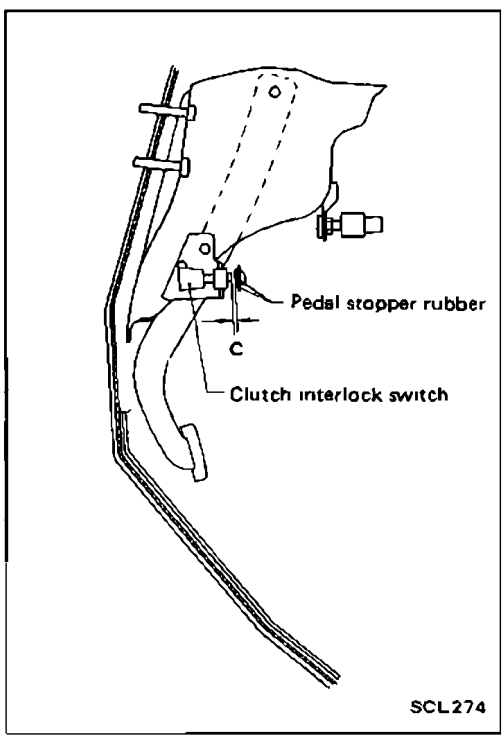


Adjusting Clutch Pedal

1. Adjust pedal height with pedal stopper or clutch switch.
   Pedal height "H":
   186 - 196 mm (7.32 - 7.72 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)

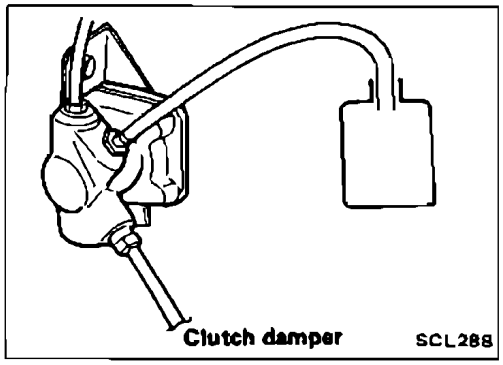
Pedal free play means the following total measured at position of pedal pad:

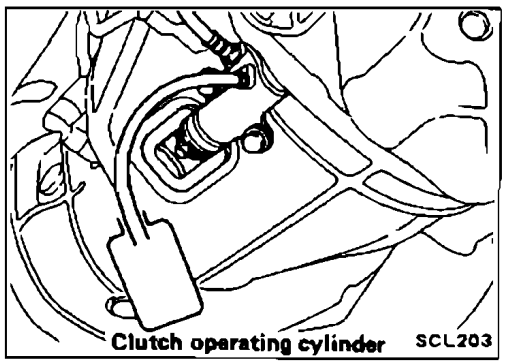
- **Play due to clevis pin and clevis pin hole in clutch pedal.**
- **Play due to piston and push rod.**



— U.S.A. model only —

3. Adjust clearance "C" between pedal stopper rubber and threaded end of clutch interlock switch while depressing clutch pedal fully.
   Clearance C:
   1.0 - 2.0 mm (0.039 - 0.079 in)





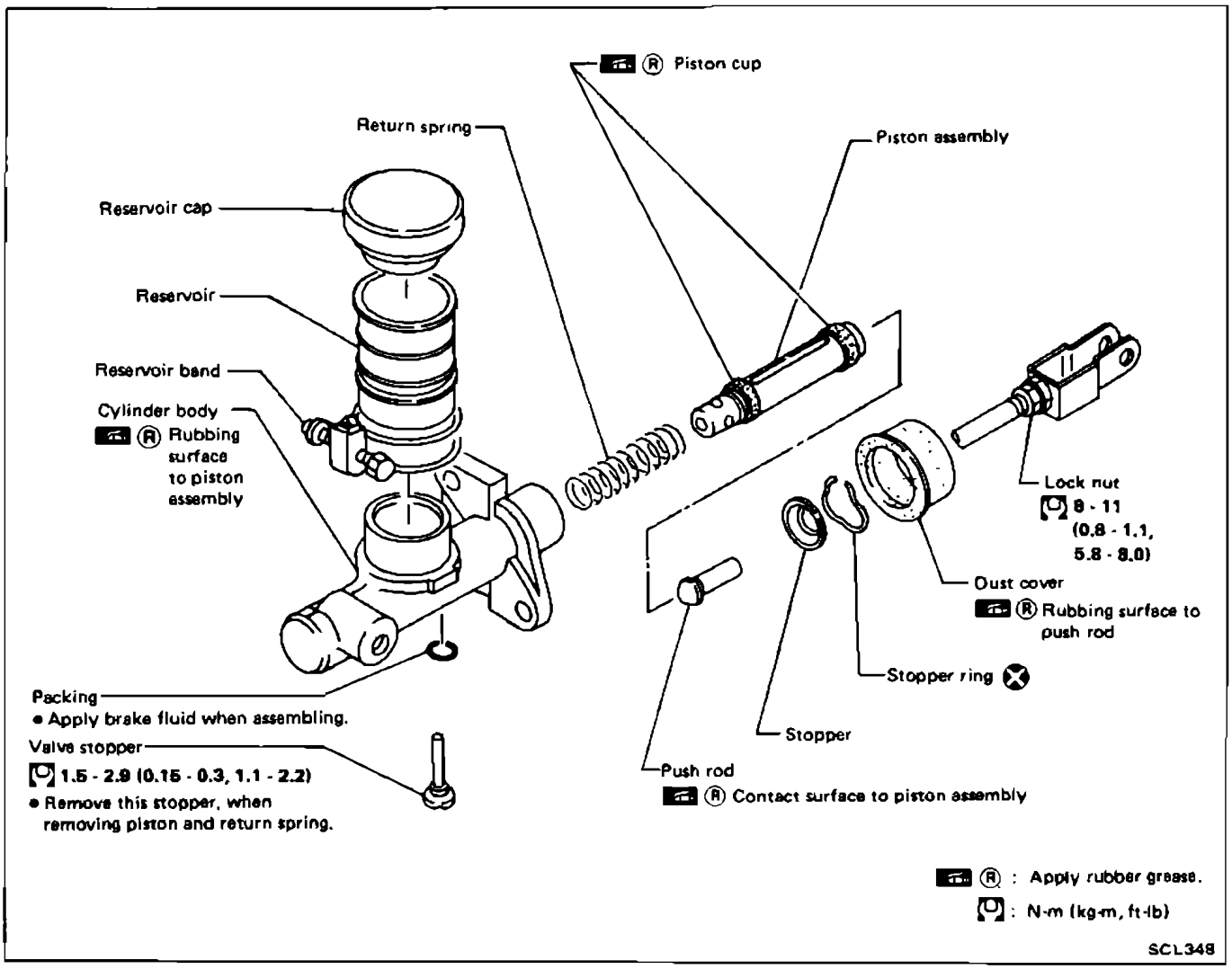
Bleeding Procedure

Bleed air according to the following procedure.
Clutch damper → Clutch operating cylinder

- Carefully monitor fluid level at master cylinder during bleeding operation.

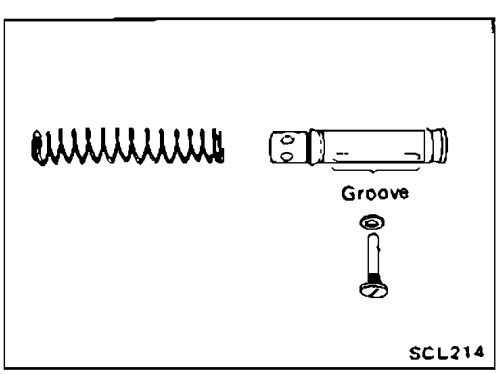
1. Top up reservoir with recommended brake fluid.
2. Connect a transparent vinyl tube to air bleeder valve.
3. Fully depress clutch pedal several times.
4. With clutch pedal depressed, open bleeder valve to release air.
5. Close bleeder valve.
6. Repeat steps 3 through 5 above until brake fluid flows from air bleeder valve without air bubbles.

Clutch Master Cylinder



DISASSEMBLY AND ASSEMBLY

- Push piston into cylinder body with screwdriver when removing and installing valve stopper.



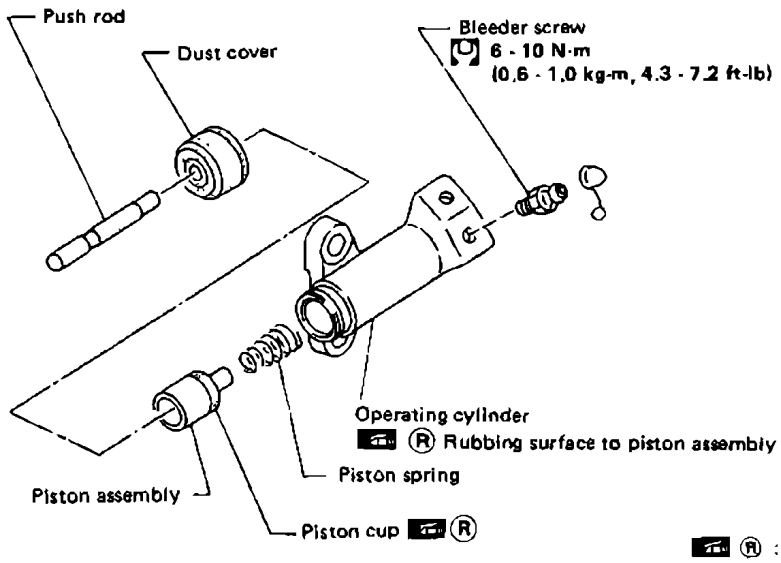
- Align groove of piston assembly and valve stopper when installing valve stopper.
- Check direction of piston cups.

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.

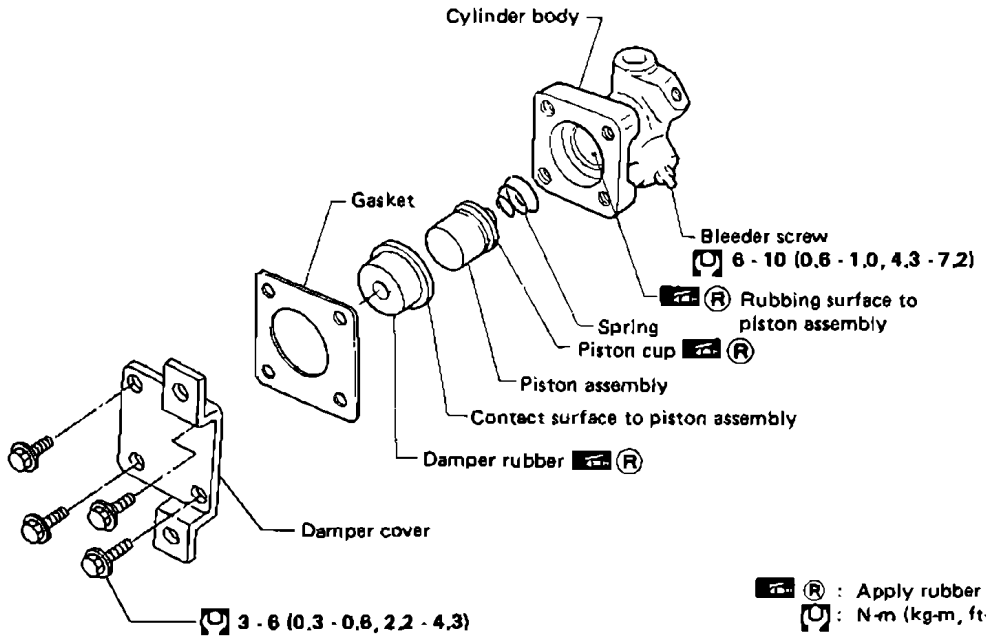
Operating Cylinder



INSPECTION

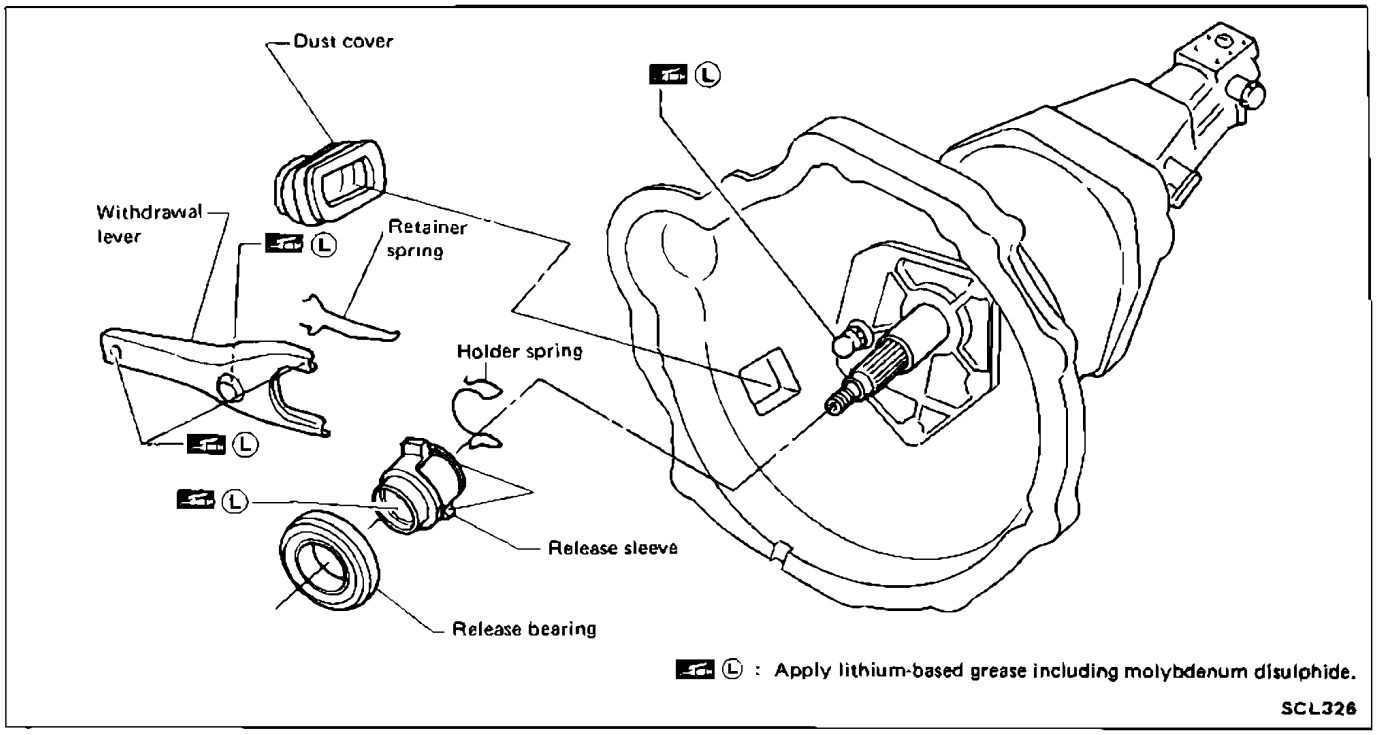
- Check rubbing surface of cylinder for wear, rust or damage. Replace if necessary.
- Check piston with piston cup for wear or damage. Replace if necessary.
- Check piston spring for wear or damage. Replace if necessary.
- Check dust cover for cracks, deformation or damage. Replace if necessary.

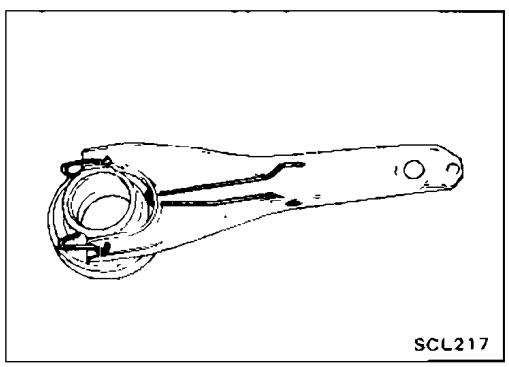
Clutch Damper



INSPECTION

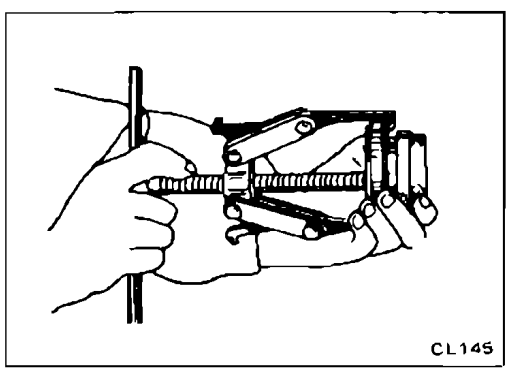
- Check cylinder and piston rubbing surface for uneven wear, rust or damage. Replace if necessary.
- Check damper rubber and piston cup for cracks, deformation or damage. Replace if necessary.



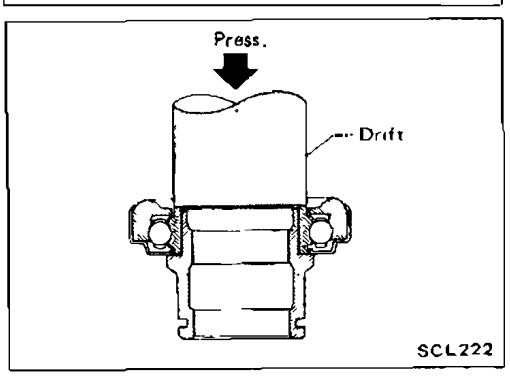


REMOVAL AND INSTALLATION

- Install retainer spring and holder spring.



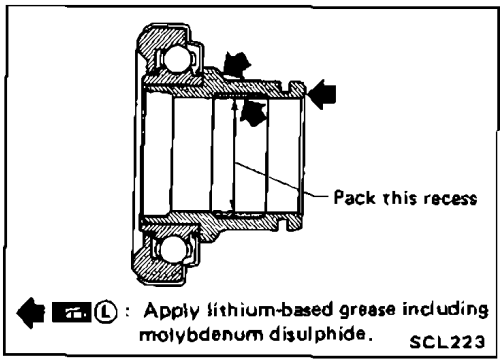
- Remove release bearing.



- Install release bearing with suitable drift.

INSPECTION

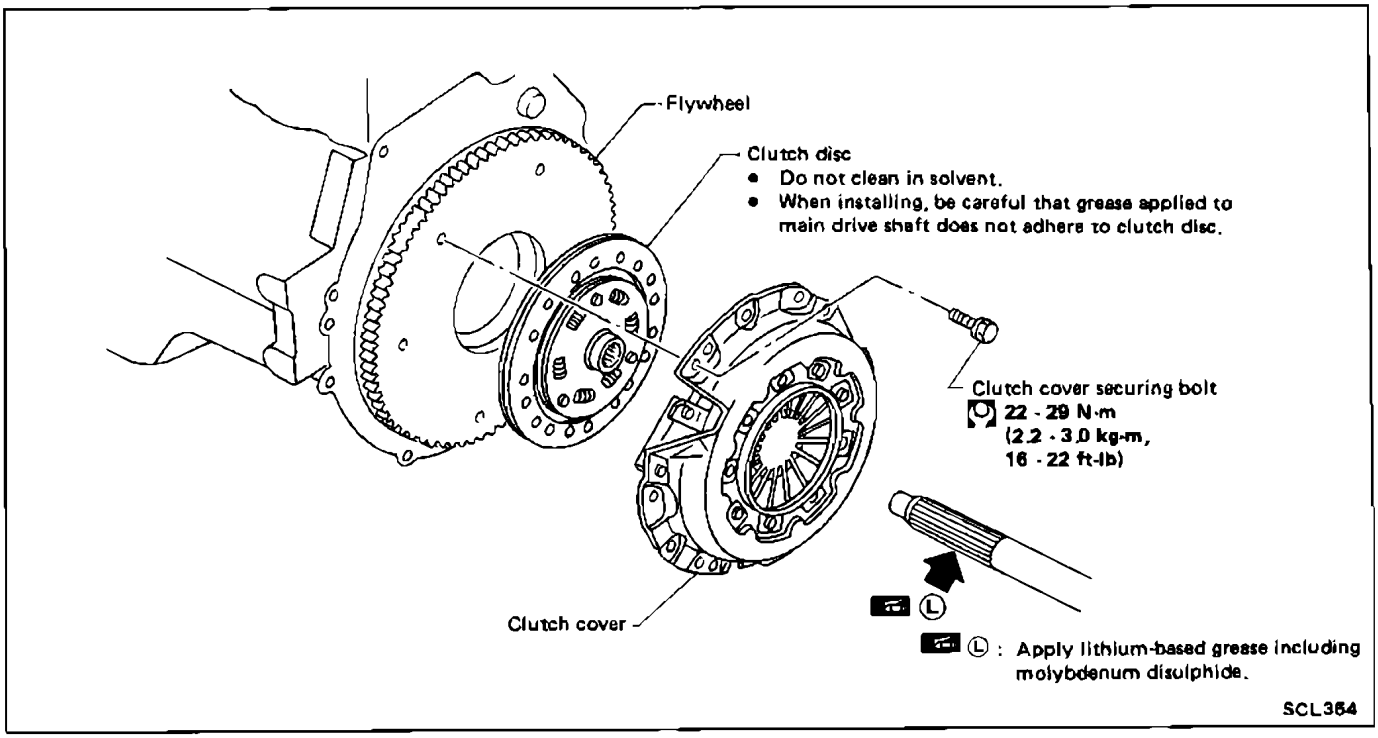
- Check release bearing to see that it rolls freely and is free from noise, cracks, pitting or wear. Replace if necessary.
- Check release sleeve and withdrawal lever rubbing surface for wear, rust or damage. Replace if necessary.

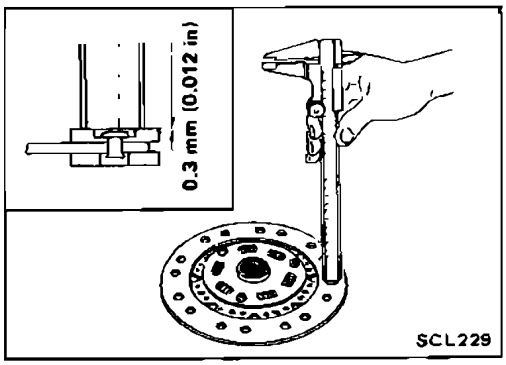


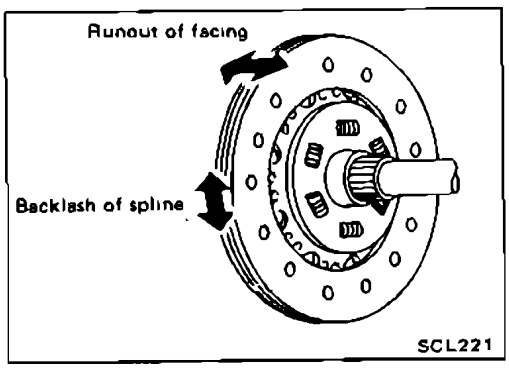
LUBRICATION

- Apply recommended grease to contact surface and rubbing surface.

Too much lubricant might damage clutch disc facing.







Clutch Disc

INSPECTION

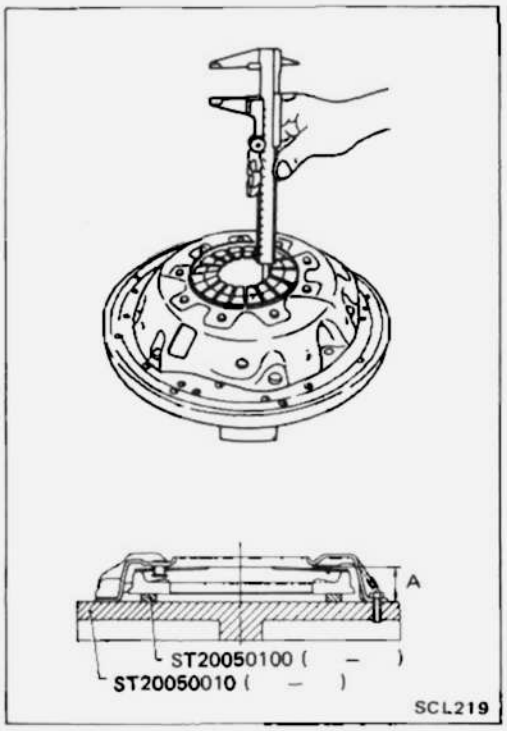
- Check clutch disc for wear of facing.
  Wear limit of facing surface to rivet head:
  0.3 mm (0.012 in)

- Check clutch disc for backlash of spline and runout of facing.
  Maximum backlash of spline (at outer edge of disc):
  0.9 mm (0.035 in)
  Runout limit:
  1.0 mm (0.039 in)
  Distance of runout check point (from hub center):
  107.5 mm (4.23 in)
- Check clutch disc for burns, discoloration or oil or grease leakage. Replace if necessary.

INSTALLATION

- Apply recommended grease to contact surface of spring portion.

Too much lubricant might damage clutch disc facing.

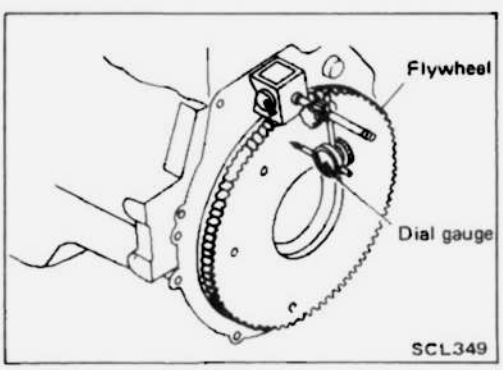


Clutch Cover and Flywheel

INSPECTION AND ADJUSTMENT

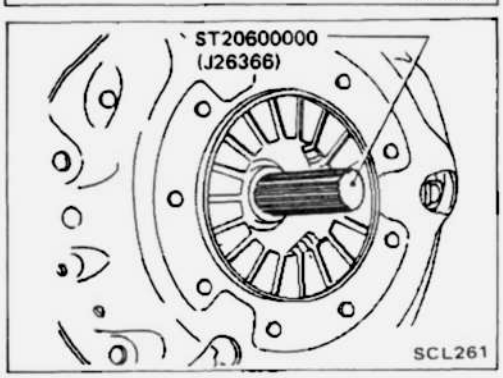
- Set Tool and check height and unevenness of diaphragm spring.
  Diaphragm spring height "A":
  33.0 - 35.0 mm (1.299 - 1.378 in)
- Check thrust rings for wear or damage by shaking cover assembly and listening for chattering noise, or lightly hammering on rivets for a slightly cracked noise. Replace 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 with Tool.
  Uneven limit:
  0.7 mm (0.028 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 CONTROL SYSTEM

Type of clutch control	Hydraulic

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	225LTD
Facing size (Outer dia. x inner dia. x thickness) mm (in)	225 x 150 x 3.5 (8.86 x 5.91 x 0.138)
Thickness of disc assembly With load mm (in)	7.6 - 8.0 (0.299 - 0.315) with 5,394 N (550 kg, 1,213 lb)

CLUTCH COVER

Model	C225S
Full load N (kg, lb)	4,413 (450, 992)

Inspection and Adjustment

CLUTCH PEDAL

Unit: mm (in)

Pedal height "H*"	186 - 196 (7.32 - 7.72)
Pedal free play (Backlash at clevis)	1.0 - 3.0 (0.039 - 0.118)
Clearance between pedal stopper rubber and threaded end of clutch interlock	1.0 - 2.0 (0.039 - 0.079)

*: Measured from surface of melt sheet to pedal pad

CLUTCH DISC

Unit: mm (in)

Model	225LTD
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)	107.5 (4.23)
Maximum backlash of spline (at outer edge of disc)	0.9 (0.035)

CLUTCH COVER

Unit: mm (in)

Model	C225S
Diaphragm spring height	33.0 - 35.0 (1.299 - 1.378)
Uneven limit of diaphragm spring toe height	0.7 (0.028)

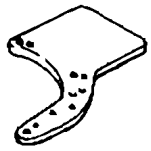
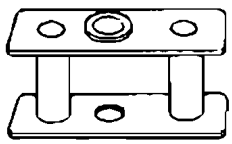
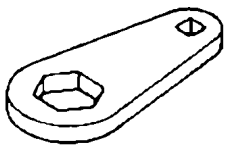
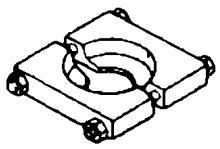
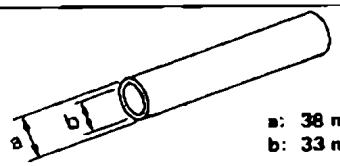
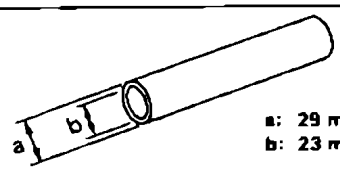
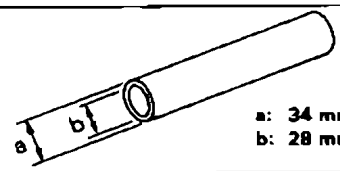
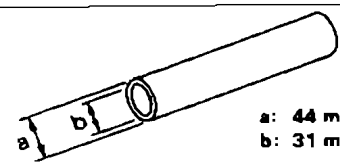
MANUAL TRANSMISSION

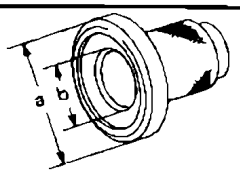
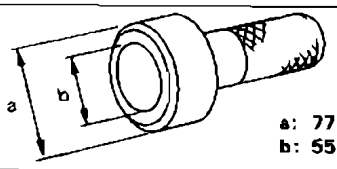
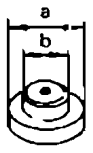
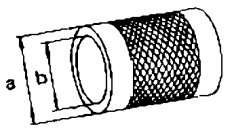
SECTION MT

CONTENTS

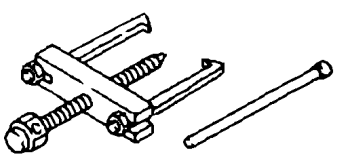
PREPARATION ..... MT- 2
ON-VEHICLE SERVICE ..... MT- 4
REMOVAL AND INSTALLATION ..... MT- 5
MAJOR OVERHAUL ..... MT- 6
DISASSEMBLY ..... MT- 9
INSPECTION MT-14
ASSEMBLY MT-16
SERVICE DATA AND SPECIFICATIONS (S.D.S.) MT-26

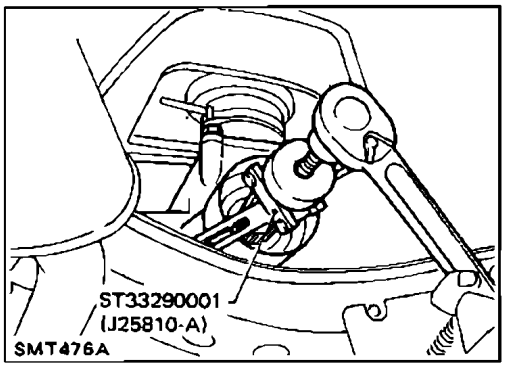
SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.) Tool name	Description	
ST23810001 (—) Adapter setting plate		Fixing adapter plate with gear assembly
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 Measuring wear of baulk rings
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 Installing 3rd & 4th synchronizer assembly

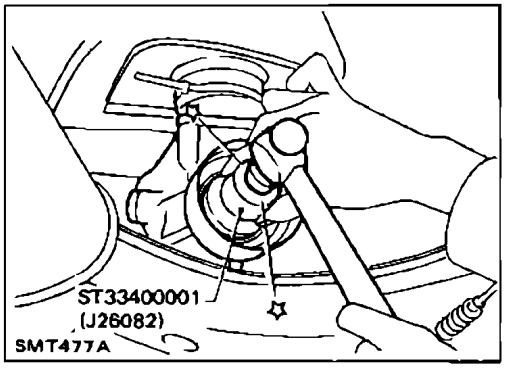
COMMERCIAL SERVICE TOOL

Tool name	Description	
Puller		Removing counter bearings, counter drive and O.D. gears

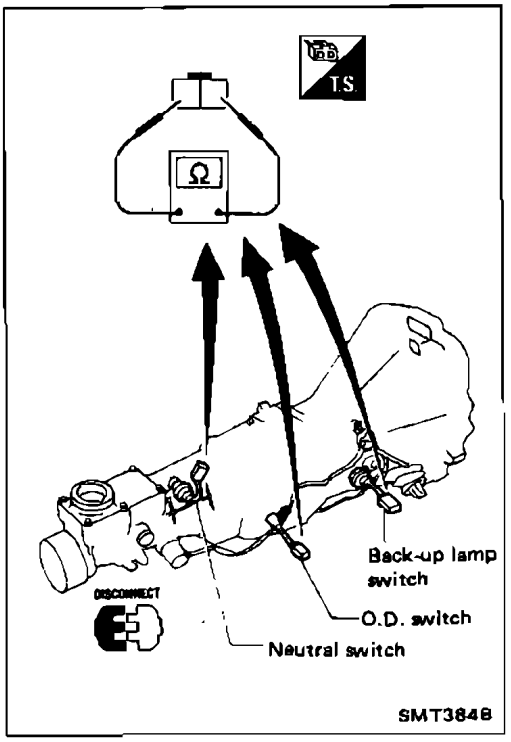


Replacing Rear Oil Seal

REMOVAL



INSTALLATION



Check of Position Switch

BACK-UP LAMP SWITCH

- Check continuity.

Gear position	Continuity
Reverse	Yes
Except reverse	No

NEUTRAL SWITCH

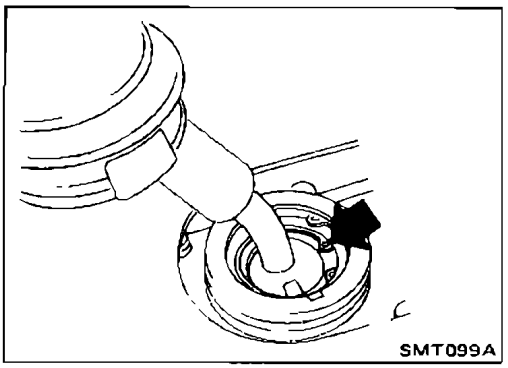
- Check continuity.

Gear position	Continuity
Neutral	Yes
Except neutral	No

O.D. SWITCH

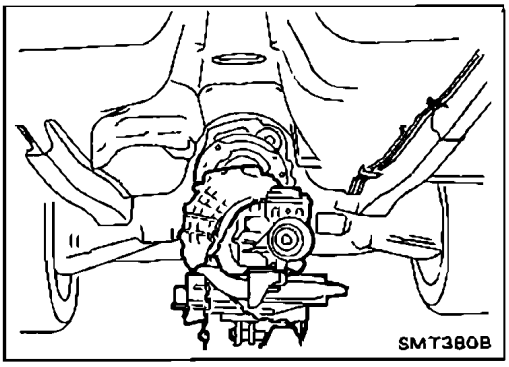
- Check continuity.

Gear position	Continuity
5th	Yes
Except 5th	No

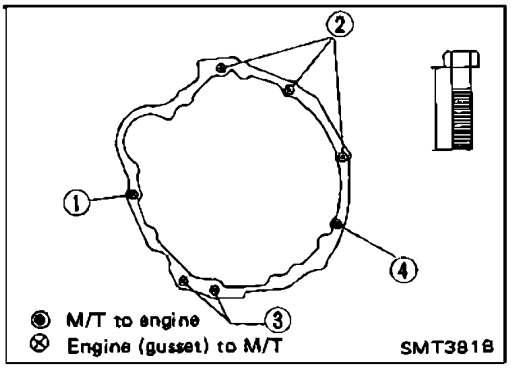


Removal

- Remove shift lever.



- Remove propeller shaft. — Refer to section PD.
- **Insert plug into rear oil seal after removing propeller shaft.**
- **Be careful not to damage spline, sleeve yoke and rear oil seal, when removing propeller shaft.**
- Support engine by placing a jack under oil pan.
- **Do not place jack under oil pan drain plug.**
- Remove transmission from engine.
- **Support manual transmission, while removing it.**

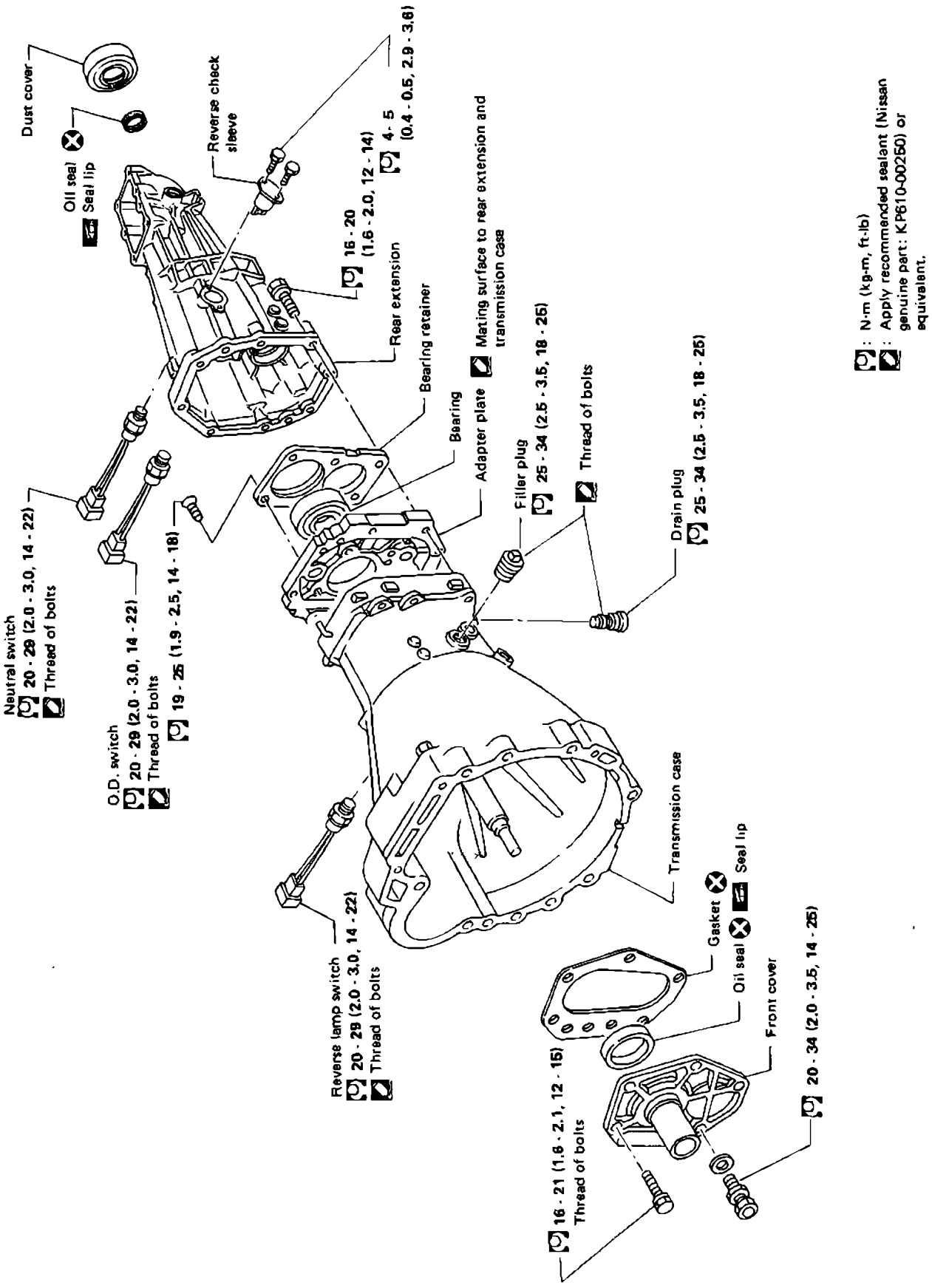


Installation

- Tighten all transmission bolts.

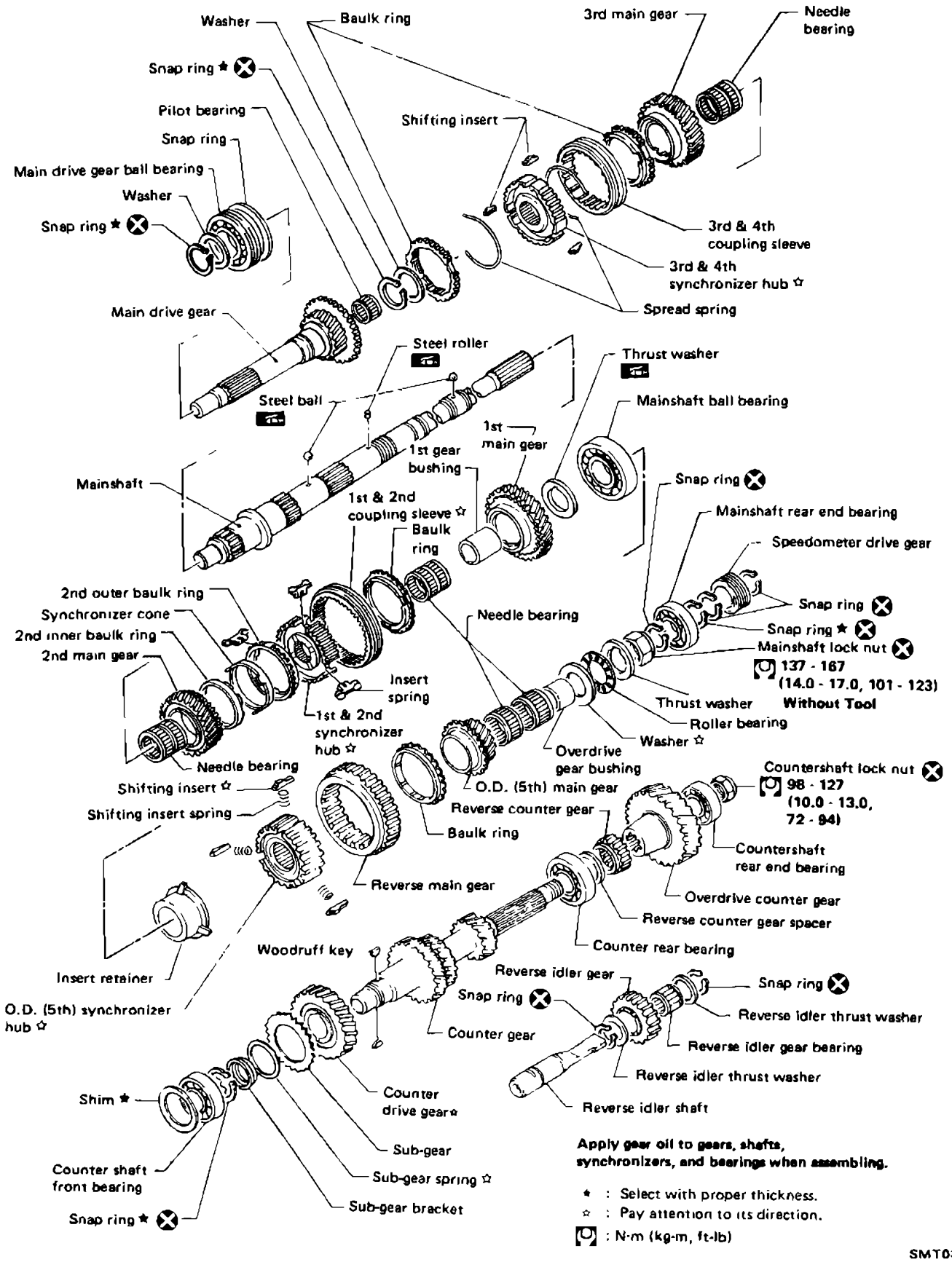
Bolt No.	Tightening torque N·m (kg-m, ft-lb)	ℓ mm (in)
1	39 - 49 (4.0 - 5.0, 29 - 36)	70 (2.76)
2	39 - 49 (4.0 - 5.0, 29 - 36)	60 (2.36)
3	29 - 39 (3.0 - 4.0, 22 - 29)	30 (1.18)
4	39 - 49 (4.0 - 5.0, 29 - 36)	25 (0.98)
Gusset to engine	29 - 39 (3.0 - 4.0, 22 - 29)	–

Case Components

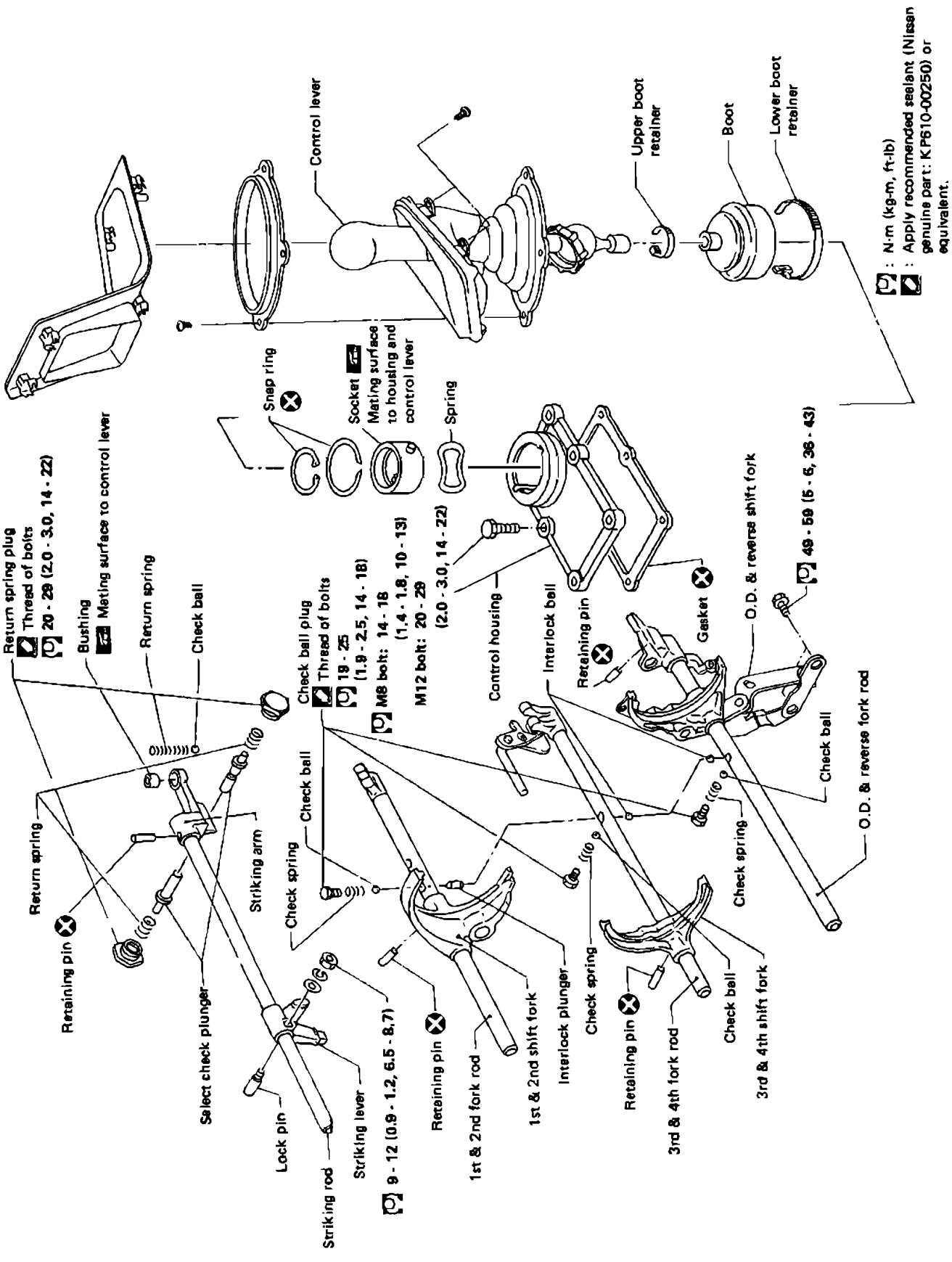


SMT385B

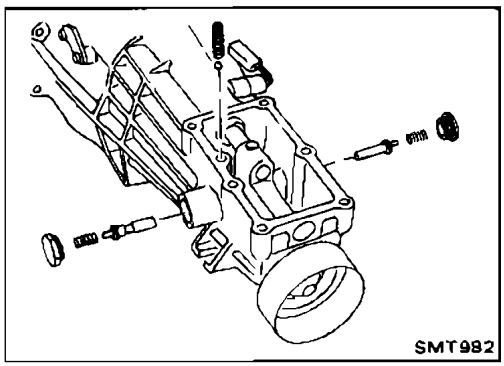
Gear Components



Shift Control Components



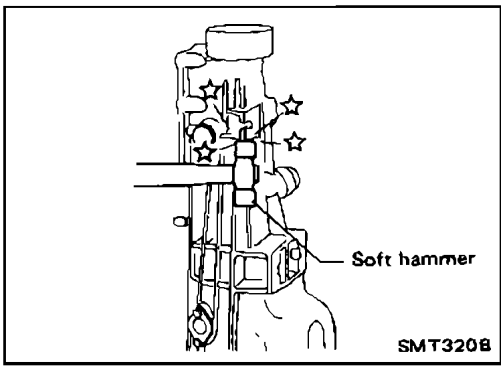
SMT382B



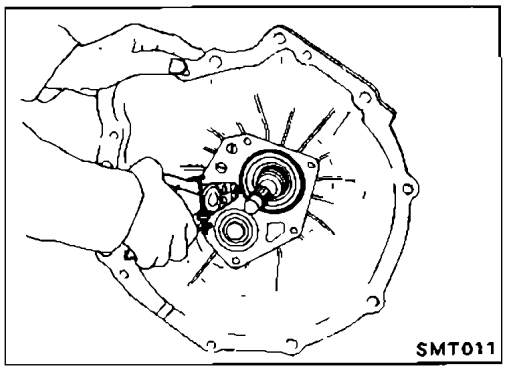
Case Components

1. Remove rear extension.

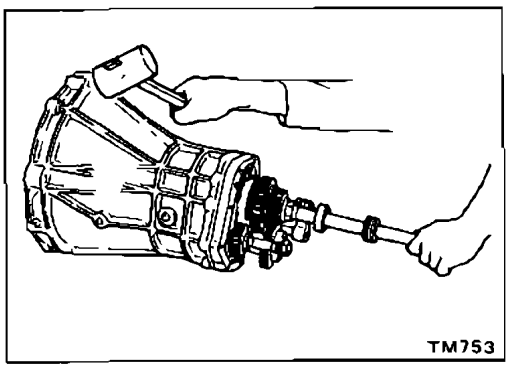
a. Remove control housing, check ball, return spring plug, select check plunger and return springs.



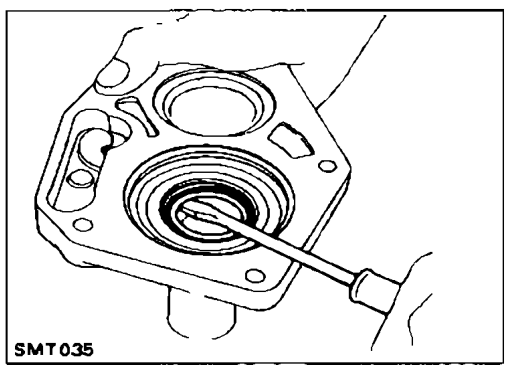
b. Remove rear extension by lightly tapping it.



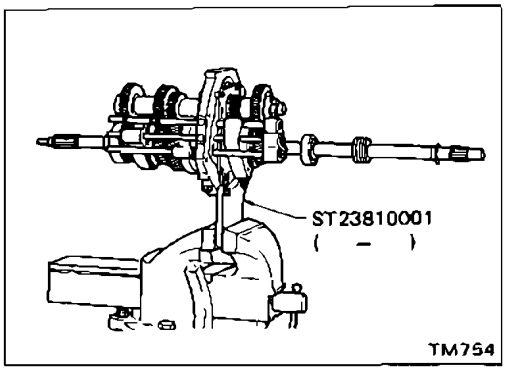
2. Remove front cover, gasket, shim of countershaft front bearing, and snap ring of main drive gear ball bearing.



3. Remove transmission case by tapping lightly.

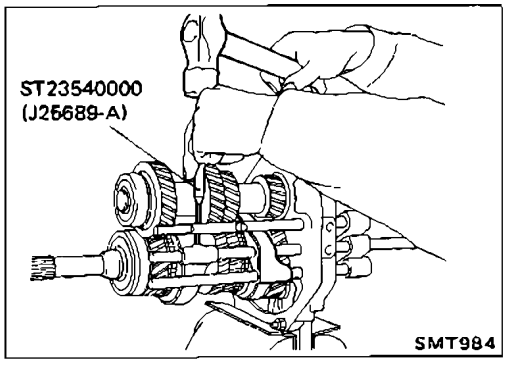


4. Remove front cover oil seal.

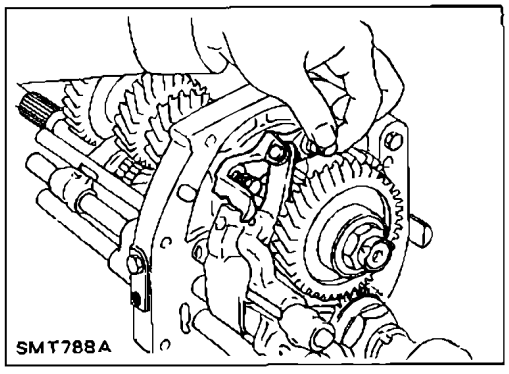


Shift Control Components

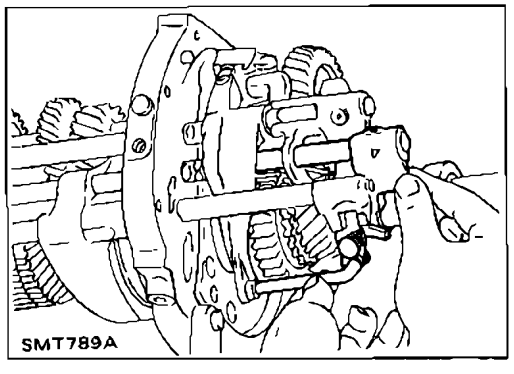
1. Set up Tool on adapter plate.
2. Remove check ball plugs, check springs, and check balls.



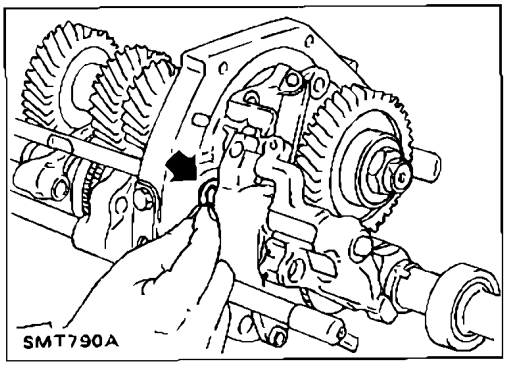
3. Drive out retaining pins. Then drive out fork rods and remove interlock balls.



4. Remove lever bracket securing bolt.

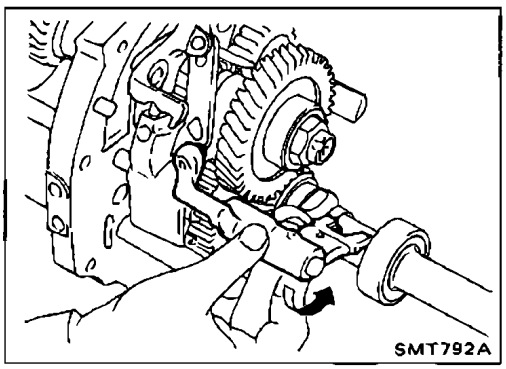


5. Draw out 3rd-4th fork rod.



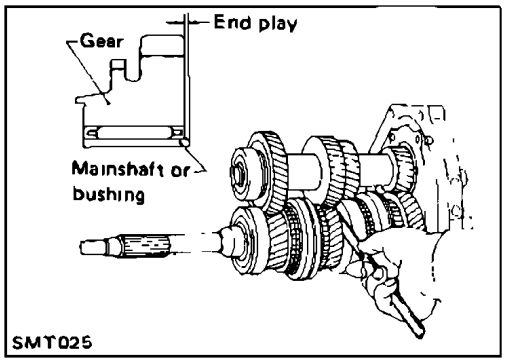
6. Remove E-ring from O.D. and reverse fork rod.

Shift Control Components (Cont'd)



7. Draw out O.D. and reverse fork shaft by rotating O.D. and reverse bracket counterclockwise.

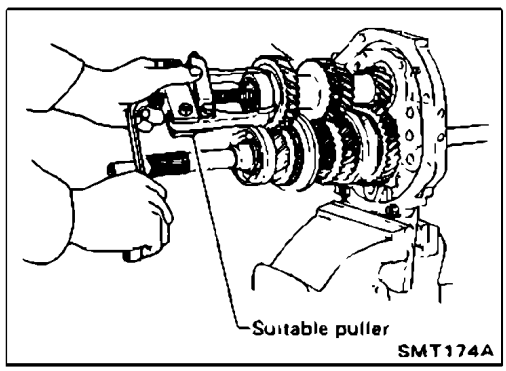
Gear Components



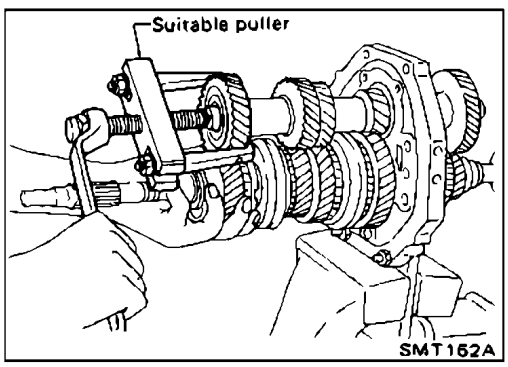
1. Before removing gears and shafts, measure each gear end play.

   Gear end play: Refer to S.D.S.

   If not within specification, disassemble and check contact surface of gear to hub, washer, bushing, needle bearing and shaft.

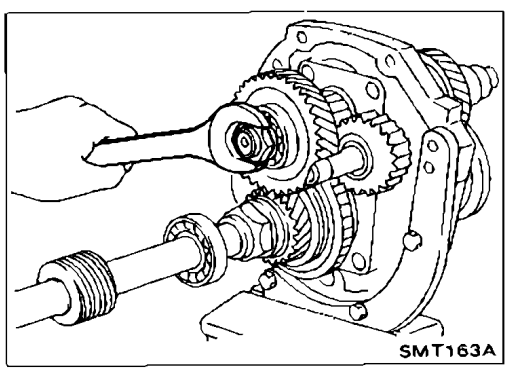


2. Mesh 2nd and reverse gear, then draw out counter front bearing with suitable puller.
3. Remove snap ring and then remove sub-gear bracket, sub-gear spring and sub-gear.



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.**

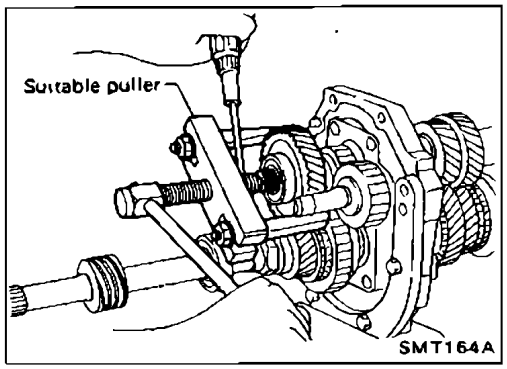


5. Remove rear side components on mainshaft and counter gear.

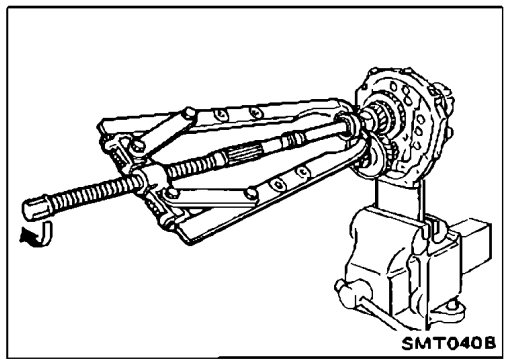
a. Release staking on countershaft nut and mainshaft nut and loosen these nuts.

   Mainshaft nut: Left-hand thread

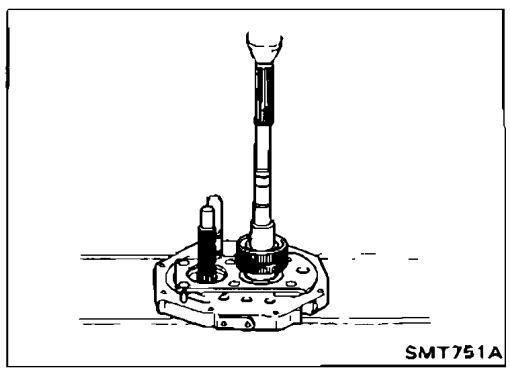
Gear Components (Cont'd)



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.
e. Remove speedometer drive gear and steel ball.

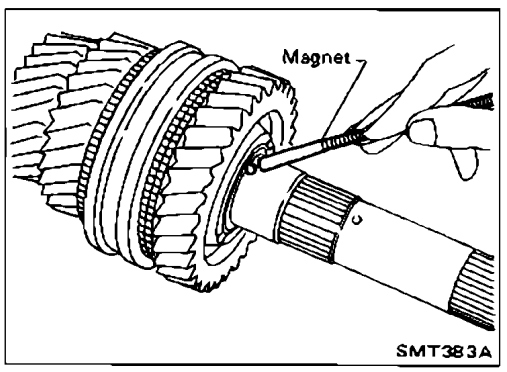


f. Remove snap ring and pull out overdrive mainshaft bearing, then remove snap ring.
g. Remove mainshaft nut.
h. Remove steel roller and washer.
i. Remove roller bearing and washer.
j. Remove O.D. main gear, needle bearing and baulk ring (O.D.).
k. Remove O.D. coupling sleeve, shifting inserts and shifting insert springs.

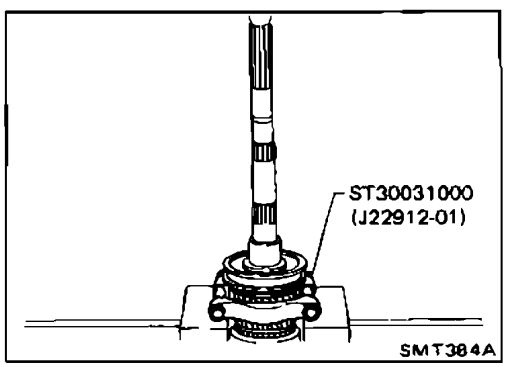


l. Press out mainshaft and counter gear alternately.

- **Make sure to alternate pressing of mainshaft and counter gear so as not to allow the front surface of one to contact the rear surface of the other.**

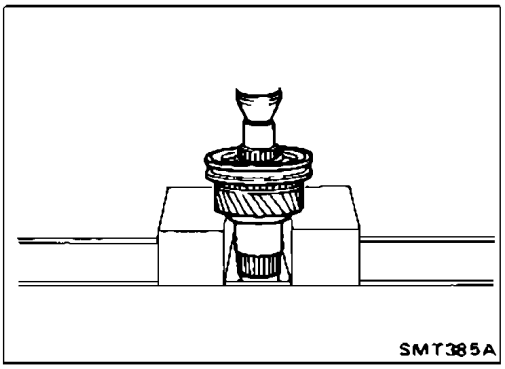


6. Remove front side components on mainshaft.
a. Remove 1st gear washer and steel ball.
b. Remove 1st main gear and 1st gear needle bearing.

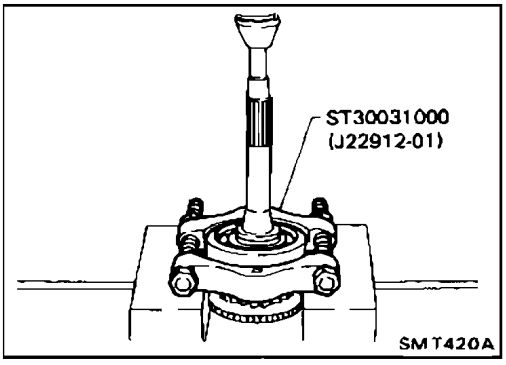


c. Press out 2nd main gear together with 1st gear bushing and 1st & 2nd synchronizer assembly.
d. Remove mainshaft front snap ring.

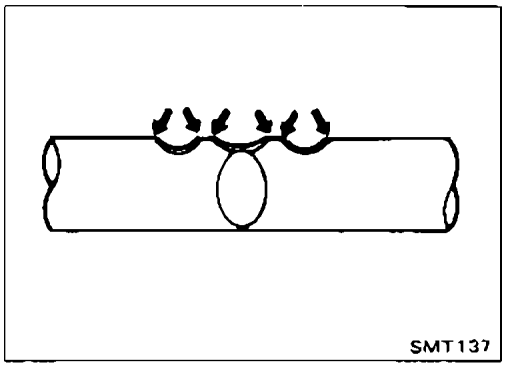
Gear Components (Cont'd)



e. Press out 3rd main gear together with 3rd & 4th synchronizer assembly and 3rd gear needle bearing.

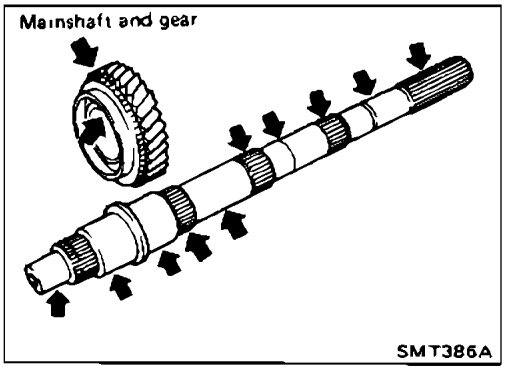


7. Remove main drive gear bearing.
a. Remove main drive gear snap ring and spacer.
b. Press out main drive gear bearing.


SMT137

Shift Control Components

- Check contact surface and sliding surface for wear, scratches, projections or other damage.

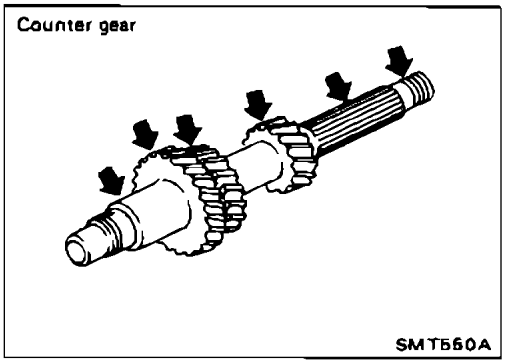


SMT386A

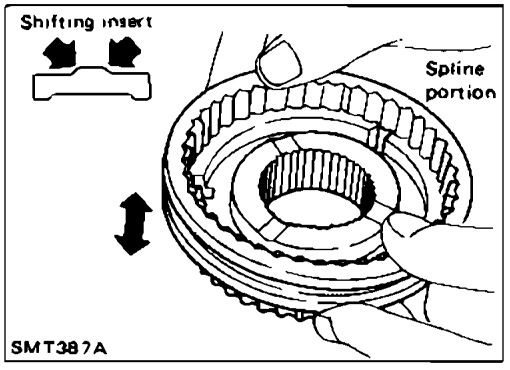
Gear Components

GEAR AND SHAFT

- Check shafts for cracks, wear or bending.
- Check gears for excessive wear, chips or cracks.



SMT550A

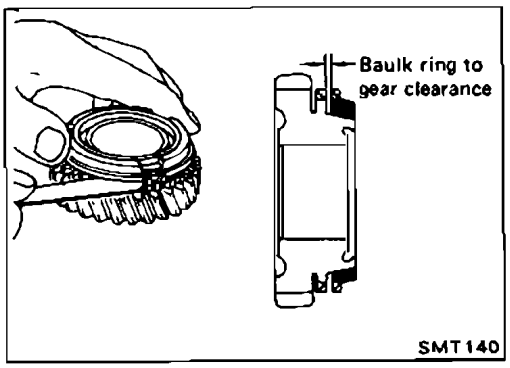


SMT387A

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.

Gear Components (Cont'd)



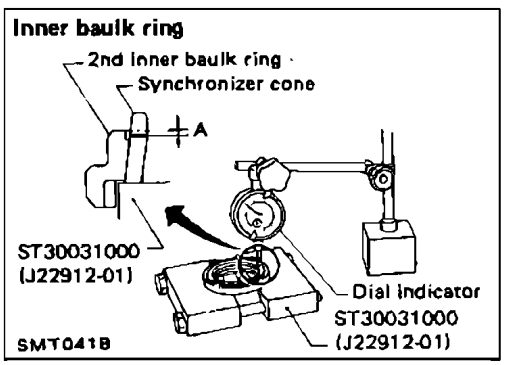
● Measure clearance between baulk ring and gear.

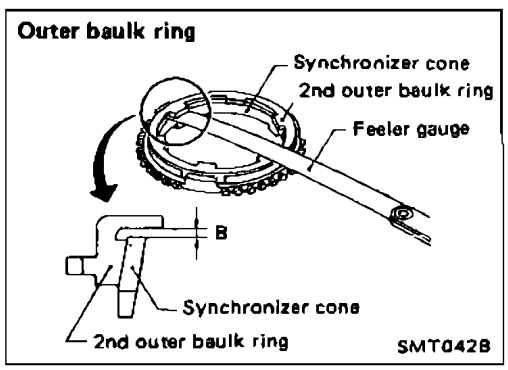
Clearance between baulk ring and gear (1st, 3rd, main drive and O.D. baulk ring):

Unit: mm (in)

Dimension	Standard	Wear limit
1st	1.2 - 1.6 (0.047 - 0.063)	0.8 (0.031)
3rd and main drive	1.2 - 1.6 (0.047 - 0.063)	
O.D.	1.2 - 1.4 (0.047 - 0.055)	

If the clearance is smaller than the wear limit, replace baulk ring.





● Measure wear of 2nd baulk ring.

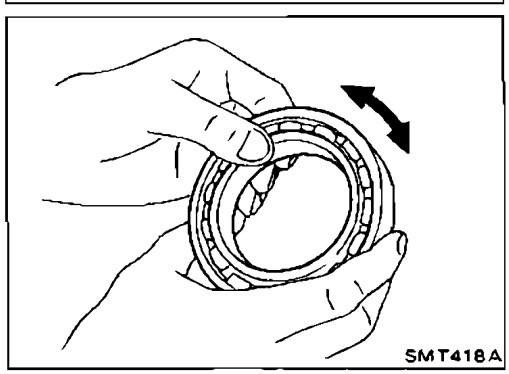
a. Place baulk rings in position on synchronizer cone.

b. While holding baulk rings against synchronizer cone as far as it will go, measure dimensions "A" and "B"

Unit: mm (in)

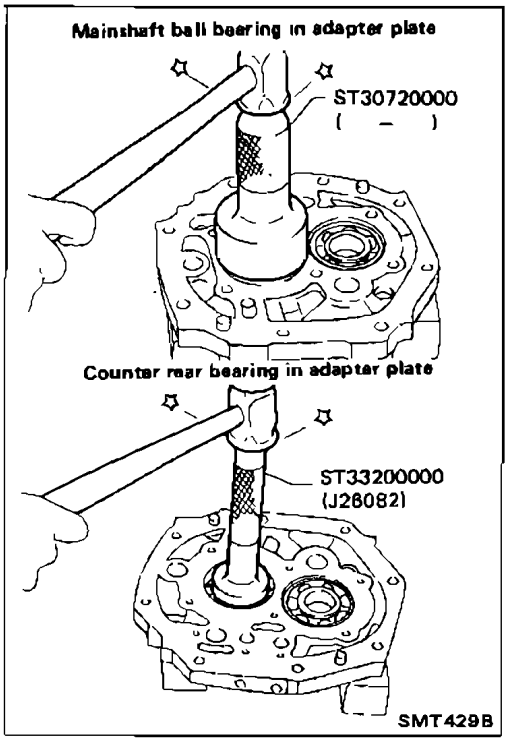
Dimension	Standard	Wear limit
A	0.6 - 1.1 (0.024 - 0.043)	0.2 (0.008)
B	0.7 - 0.9 (0.028 - 0.035)	

c. If dimension "A" or "B" is smaller than the wear limit, replace baulk ring.



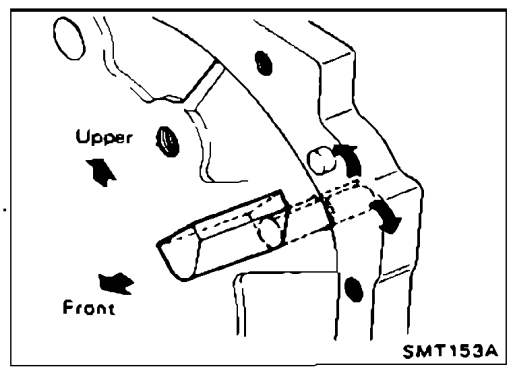
BEARINGS

● Make sure bearings roll freely and are free from noise, crack, pitting or wear.

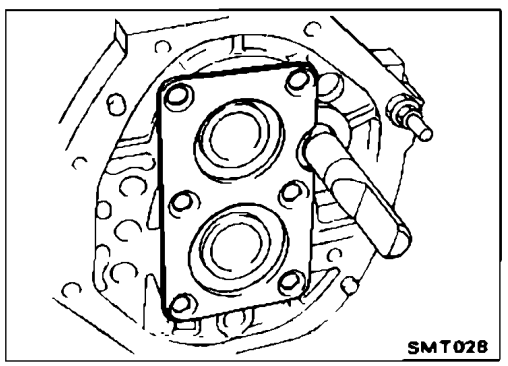


Gear Components

1. Install bearings into case components.



2. Assemble adapter plate parts.
- Install oil gutter on adapter plate and expand on rear side.

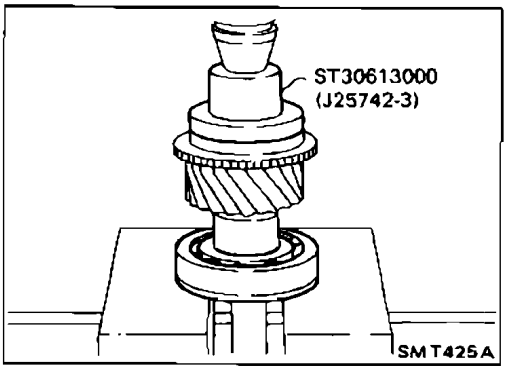


- Install bearing retainer.

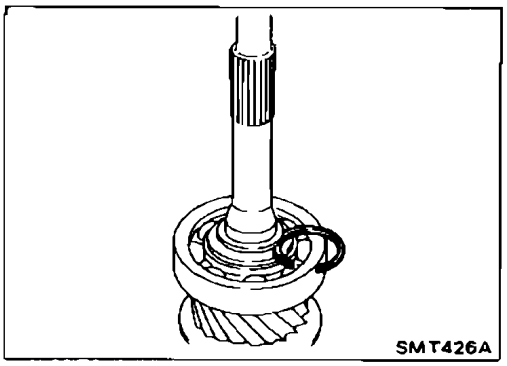
a. Insert reverse shaft, then install bearing retainer.

b. Tighten each screw, then stake each at two points.

Gear Components (Cont'd)

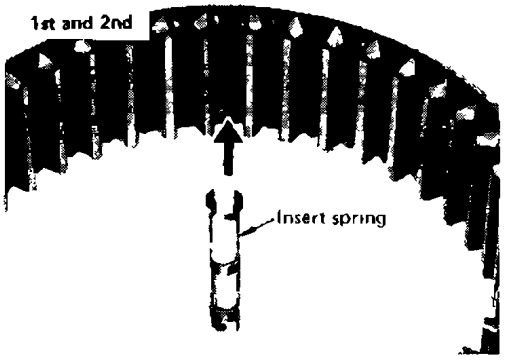


3. Install main drive gear bearing.
a. Press main drive gear bearing.
b. Install main drive gear spacer.

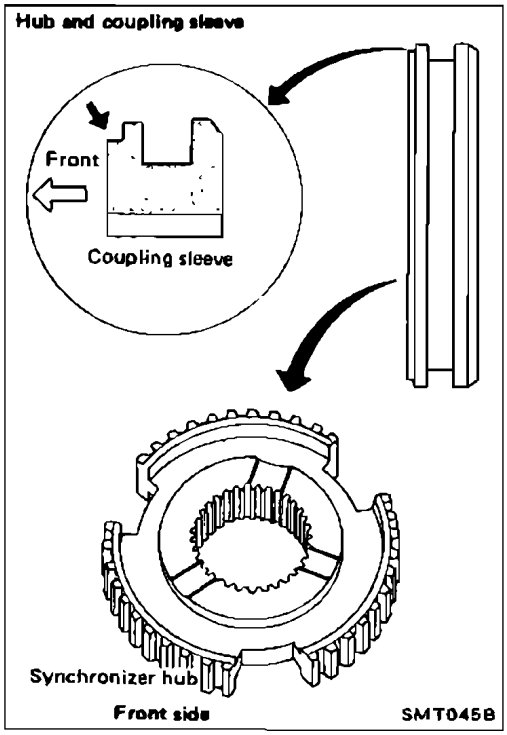


c. Select proper main drive gear snap ring to minimize clearance of groove and install it.

Allowable clearance of groove:
0 - 0.13 mm (0 - 0.0051 in)
Main drive gear snap ring:
Refer to S.D.S.

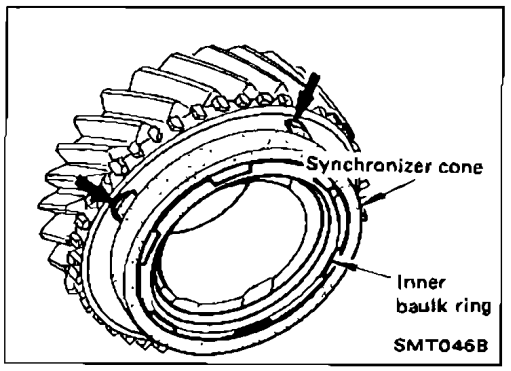


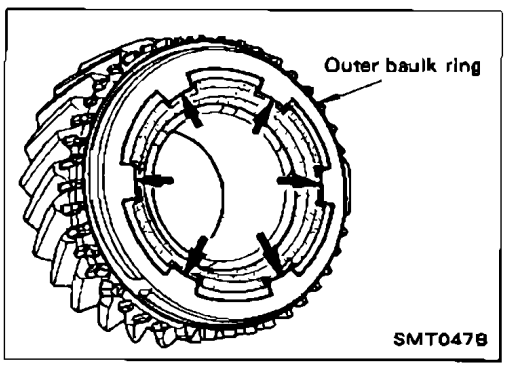
4. Assemble synchronizers.
- 1st & 2nd synchronizer

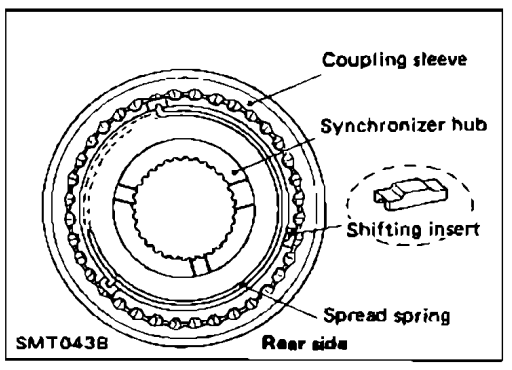


- Check coupling sleeve and synchronizer hub orientation.

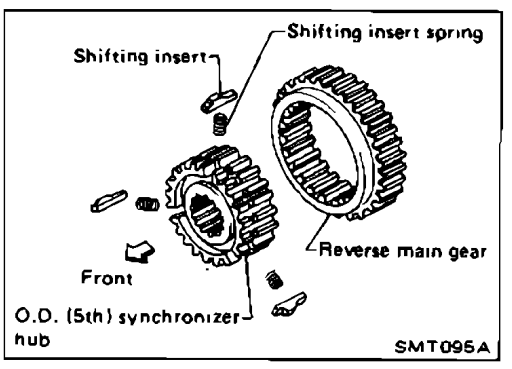
Gear Components (Cont'd)



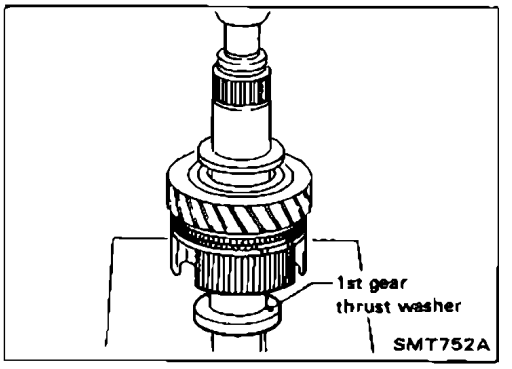




- 3rd & 4th synchronizer

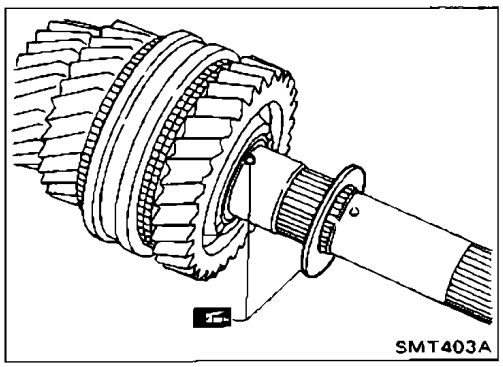


- O.D. synchronizer

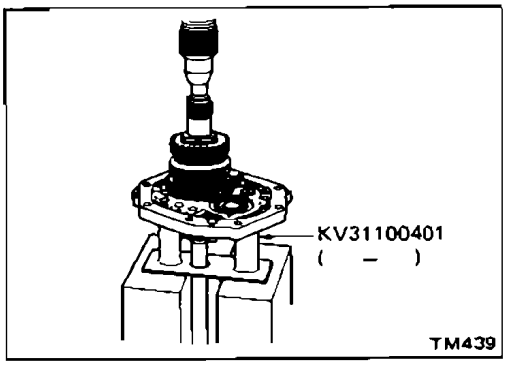


5. Install front side components on main shaft.
a. Assemble 2nd main gear, needle bearing and 1st & 2nd synchronizer assembly, then press 1st gear bushing on mainshaft.
b. Install 1st main gear.

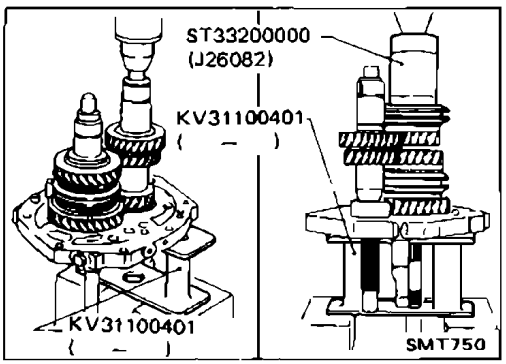
Gear Components (Cont'd)



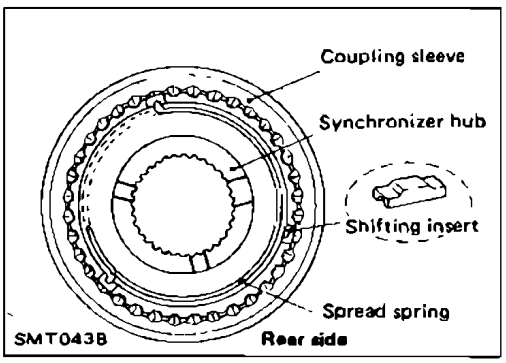
c. Install steel ball and 1st gear washer.
Apply multi-purpose grease to steel ball and 1st gear washer before installing.



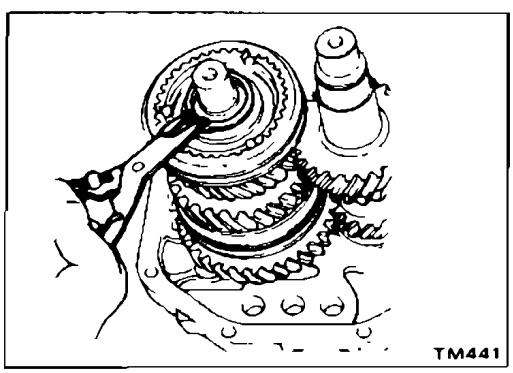
6. Install mainshaft and counter gear on adapter plate and main drive gear on mainshaft.
a. Press mainshaft assembly to adapter plate with Tool.



b. Press counter gear into adapter plate with Tool.
c. Install 3rd main gear and then press 3rd & 4th synchronizer assembly.



- **Pay attention to direction of 3rd & 4th synchronizer.**

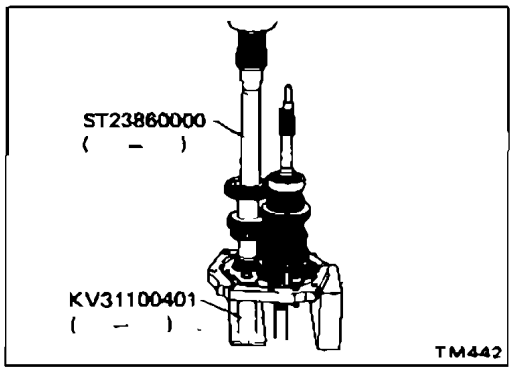


d. Install thrust washer on mainshaft and secure it with mainshaft front snap ring.
Select proper snap ring to minimize clearance of groove in mainshaft.

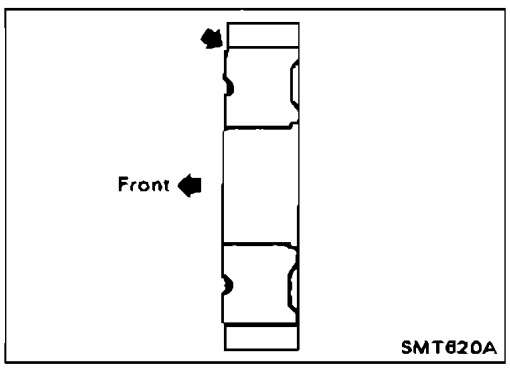
Allowable clearance of groove:
0 - 0.18 mm (0 - 0.0071 in)
Mainshaft front snap ring:
Refer to S.D.S.

e. Apply gear oil to mainshaft pilot bearing and install it on mainshaft.

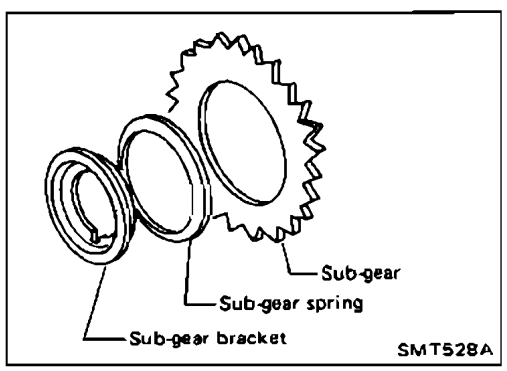
Gear Components (Cont'd)



f. Press counter drive gear with main drive gear with Tool.



- **Pay attention to direction of counter drive gear.**



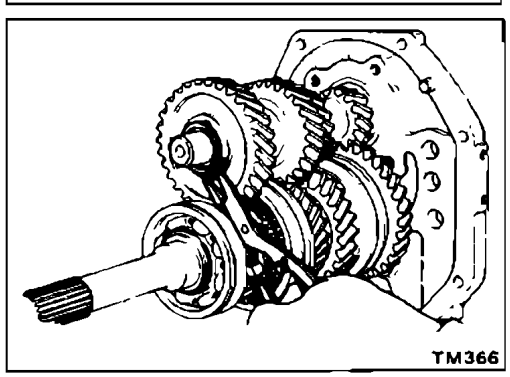
g. Install sub-gear components.

(1) Install sub-gear and sub-gear bracket on counter drive gear and then select proper snap ring to minimize clearance of groove in counter gear.

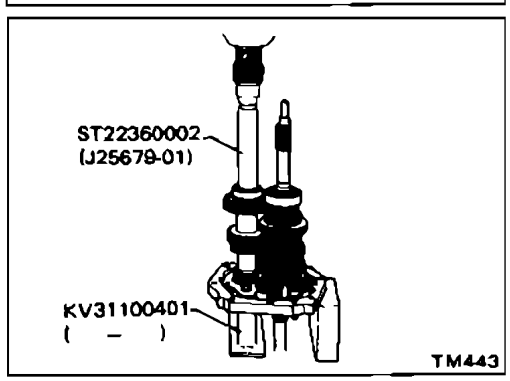
Allowable clearance of groove:
0 - 0.18 mm (0 - 0.0071 in)
Counter drive gear snap ring: Refer to S.D.S.

(2) Remove snap ring, sub-gear bracket and sub-gear from counter gear.

(3) Reinstall sub-gear, sub-gear spring and sub-gear bracket.

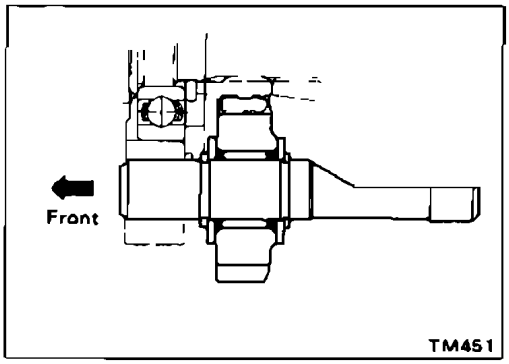


h. Install selected counter drive gear snap ring.

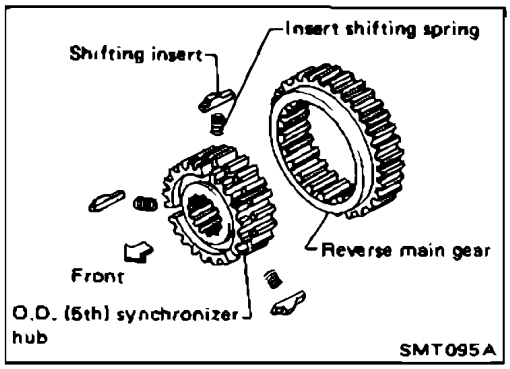


i. Press counter gear front bearing onto counter gear.

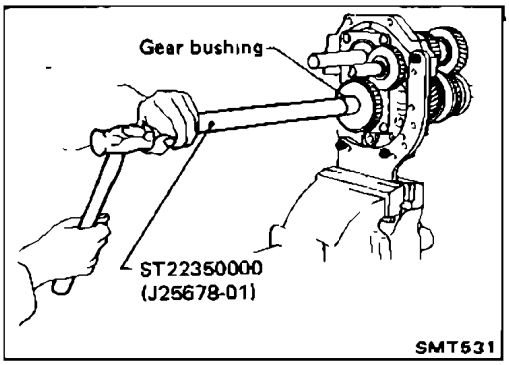
Gear Components (Cont'd)



7. Install rear side components on mainshaft and counter gear.
a. Install reverse idler gear to reverse idler shaft with spacers, snap rings and needle bearing.

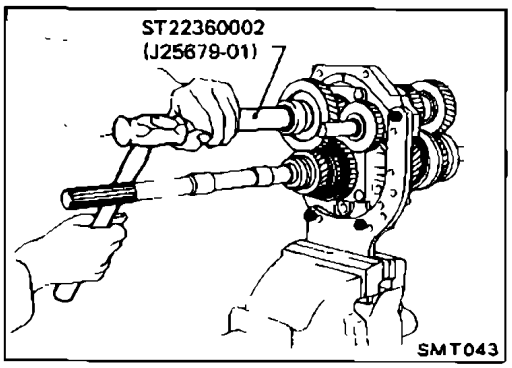


b. Install insert retainer and O.D. synchronizer to mainshaft.
- **Pay attention to direction of hub.**

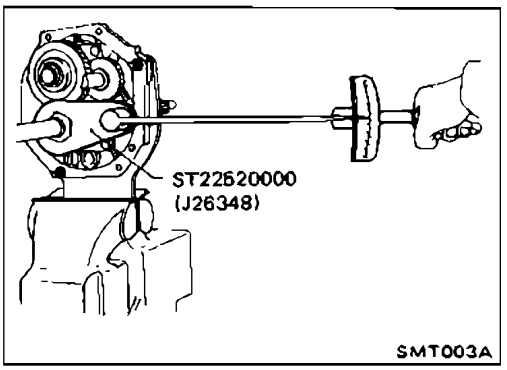


c. Install O.D. gear bushing with Tool.
d. Install O.D. main gear and needle bearing.
e. Install spacer, reverse counter gear and O.D. counter gear.
- **O.D. main gear and O.D. counter gear should be handled as a matched set.**

f. Install washer, roller bearing, steel roller and thrust washer.
g. Tighten mainshaft lock nut temporarily.
- **Always use new lock nut.**

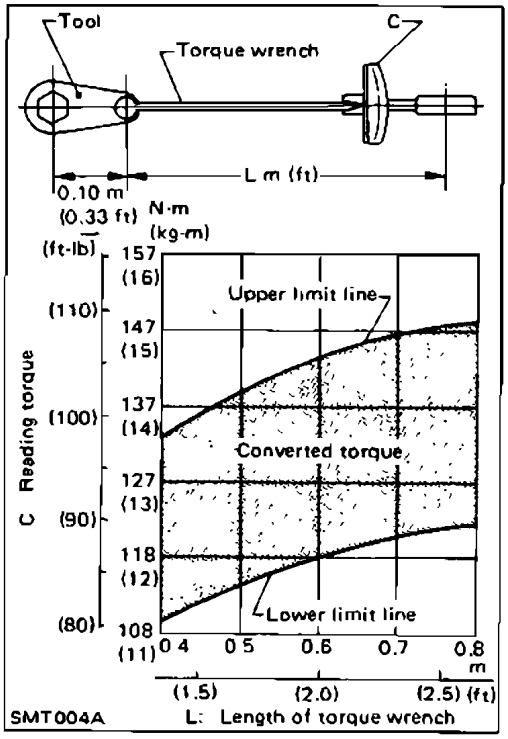


h. Install countershaft rear end bearing with Tool.



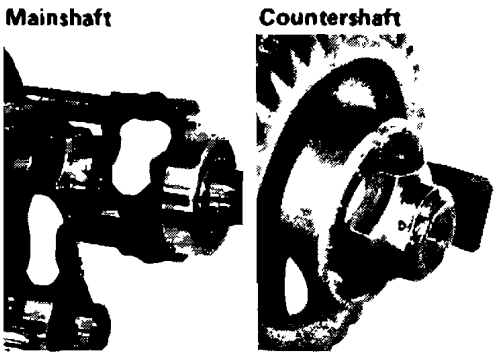
8. Mesh 2nd and reverse gears, then tighten mainshaft lock nut with Tool.

Gear Components (Cont'd)



- Use the left chart when deciding the reading torque. (Length of torque wrench vs. setting or reading torque)

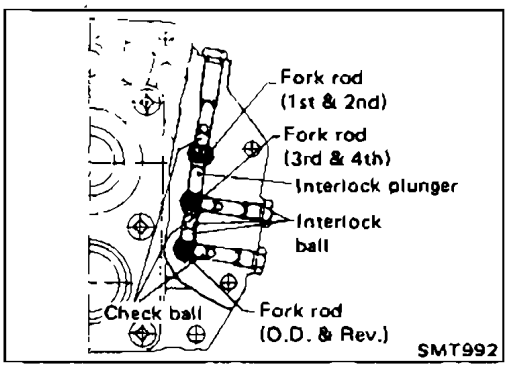
9. Tighten countershaft lock nut.
   - **Always use new lock nut.**

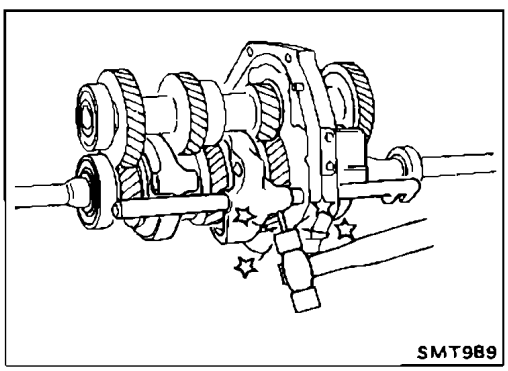


10. Stake mainshaft lock nut and countershaft lock nut with a punch.
11. Measure gear end play. For the description, refer to DISASSEMBLY for Gear Components.

Shift Control Components

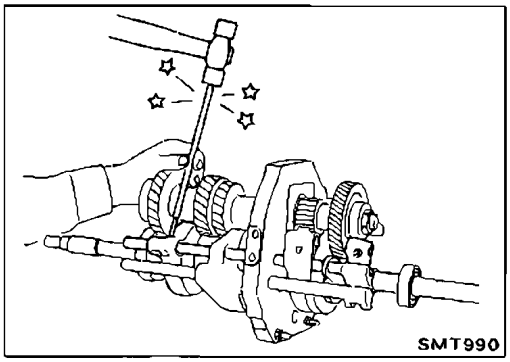
1. Install shift rods, interlock plunger, interlock balls and check balls.



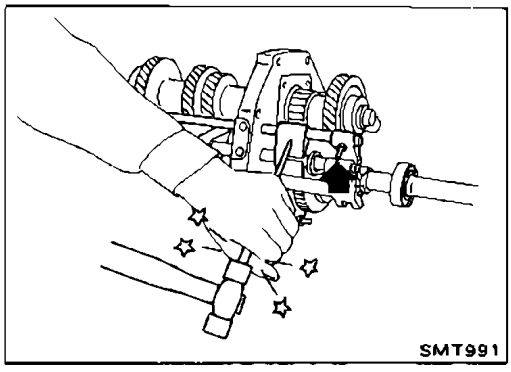


a. 1st-2nd shift fork

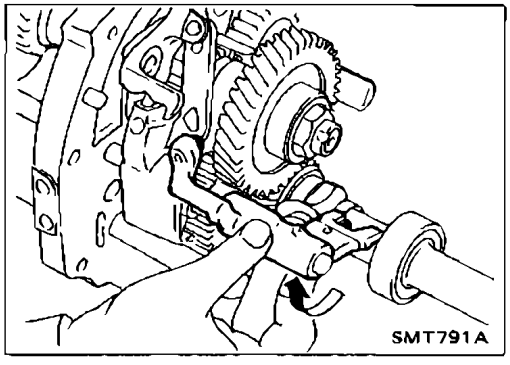
Shift Control Components (Cont'd)



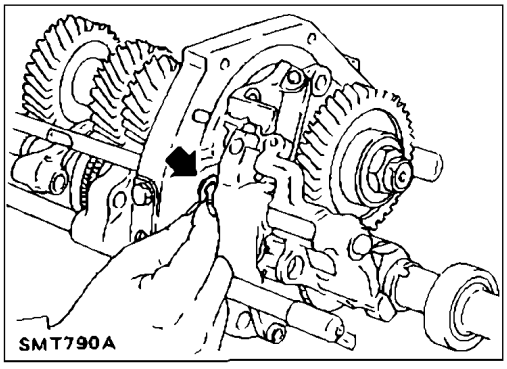
b. 3rd-4th shift fork



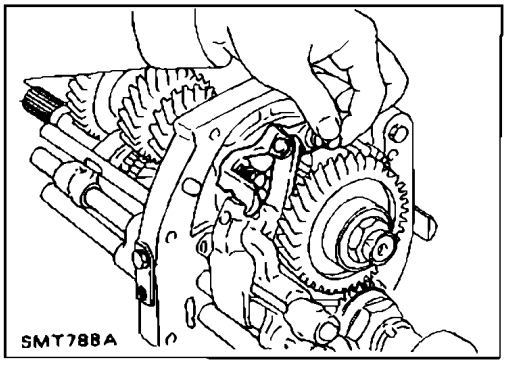
c. O.D.-reverse shift fork or reverse shift fork.



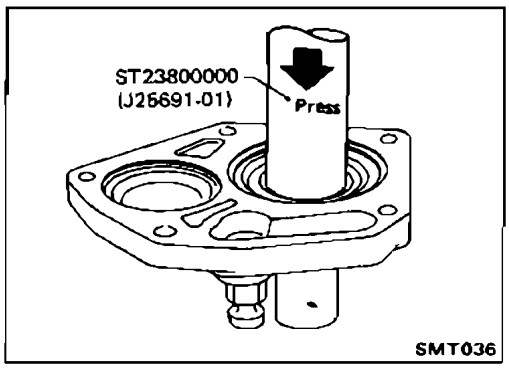
2. Install O.D. and reverse fork shaft by rotating O.D. and reverse bracket clockwise.



3. Install E-ring on O.D and reverse fork rod.

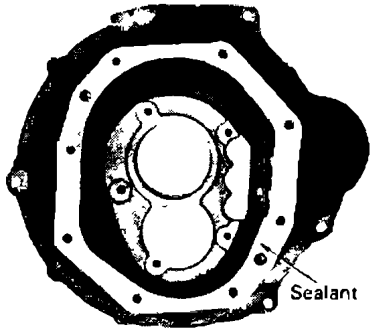


4. Install lever bracket securing bolt.

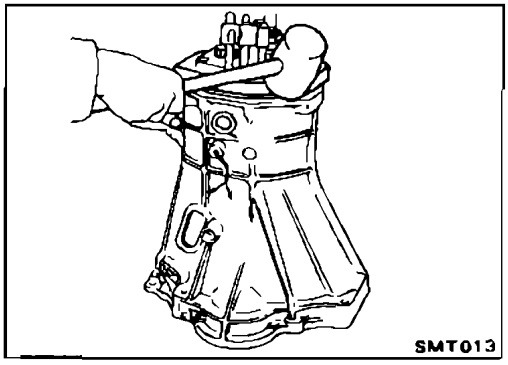


Case Components

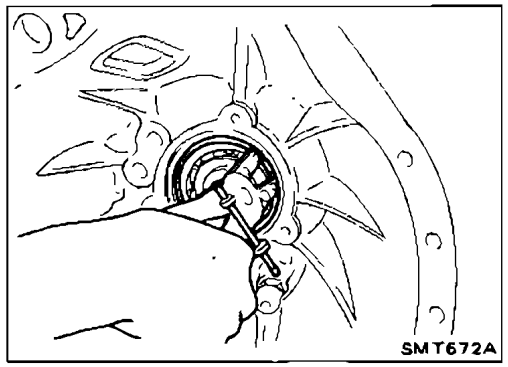
1. Install front cover oil seal.
- **Apply multi-purpose grease to seal lip of oil seal before installing.**



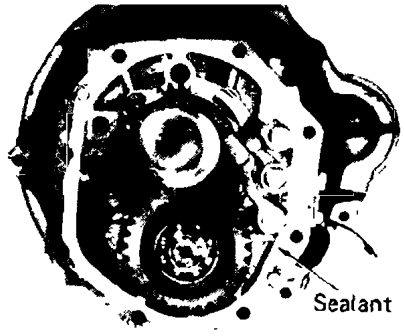
2. Apply sealant to mating surface of transmission case.



3. Install gear assembly onto transmission case.

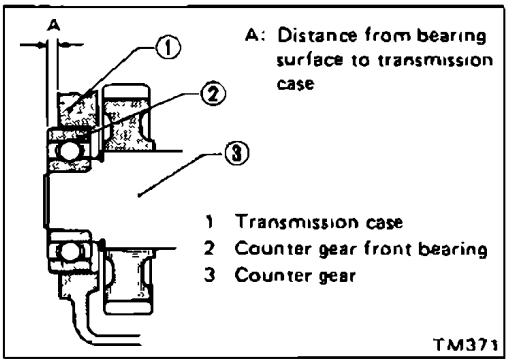


4. Install snap ring of main drive bearing.

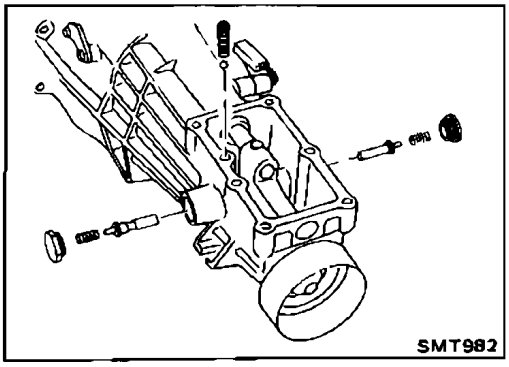


5. Apply sealant to mating surface of adapter plate.
6. Install rear extension.

Case Components (Cont'd)

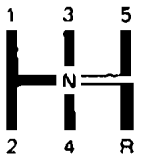


7. Select counter front bearing shim.
   Counter front bearing shim: Refer to S.D.S.
8. Install gasket and front cover.



9. Install return spring plugs, check ball, return springs and select check plunger.
10. Install control housing and gasket.

General Specifications

Transmission model		FS5W71C
Number of speeds		5
Shift patern		
Synchromesh type		Warner
Gear ratio	1st	3.321
	2nd	1.902
	3rd	1.308
	4th	1.000
	O.D.	0.759
	Reverse	3.382
Number of teeth		
Mainshaft	Drive	22
	1st	33
	2nd	27
	3rd	26
	O.D.	21
	Reverse	36
Countershaft	Drive	31
	1st	14
	2nd	20
	3rd	28
	O.D.	39
	Reverse	15
Reverse idler gear		21
Oil capacity	ℓ (US pt, Imp pt)	2.4 (5-1/8, 4-1/4)
Remarks	Sub-gear	○
	Mainshaft braking mechanism	○
	Double baulk ring type synchronizer	2nd synchronizer

Inspection and Adjustment

GEAR END PLAY

Gear	End play 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

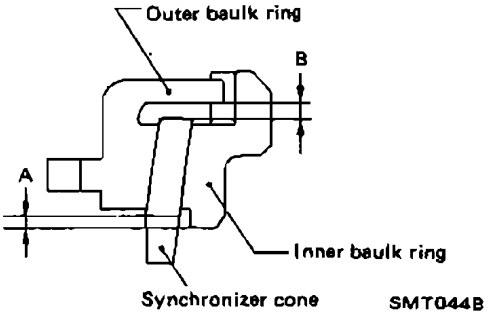
1st, 3rd, main drive and O.D. baulk ring

Unit: mm (in)

	Standard	Wear limit
1st	1.2 - 1.6 (0.047 - 0.063)	0.8 (0.031)
3rd and main drive	1.2 - 1.6 (0.047 - 0.063)	
O.D.	1.2 - 1.4 (0.047 - 0.055)	

2nd baulk ring

Unit: mm (in)



Dimension	Standard	Wear limit
A	0.6 - 1.1 (0.024 - 0.043)	0.2 (0.008)
B	0.7 - 0.9 (0.028 - 0.035)	

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

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

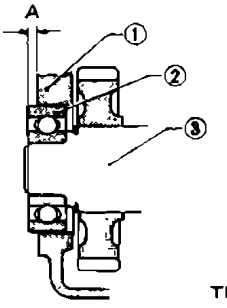
Counter drive gear

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)



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

AUTOMATIC TRANSMISSION

SECTION AT

CONTENTS

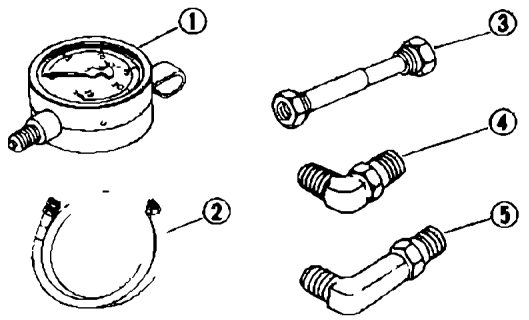
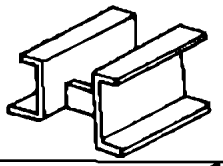
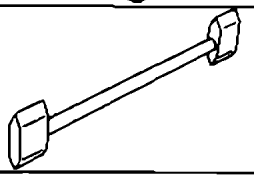
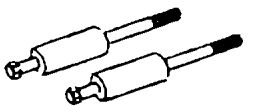
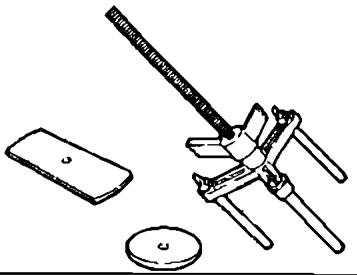
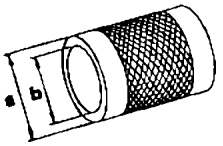
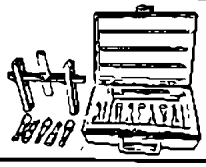
PREPARATION ..... AT- 2
PRECAUTIONS ..... AT- 3
A/T CONTROL DIAGRAM ..... AT- 4
ON-VEHICLE SERVICE ..... AT- 7
TROUBLE DIAGNOSES ..... AT- 11
REMOVAL AND INSTALLATION ..... AT- 85
MAJOR OVERHAUL ..... AT- 86
DISASSEMBLY ..... AT- 90
REPAIR FOR COMPONENT PARTS AT-101
ASSEMBLY AT-146
SERVICE DATA AND SPECIFICATIONS (S.D.S.) AT-165

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".

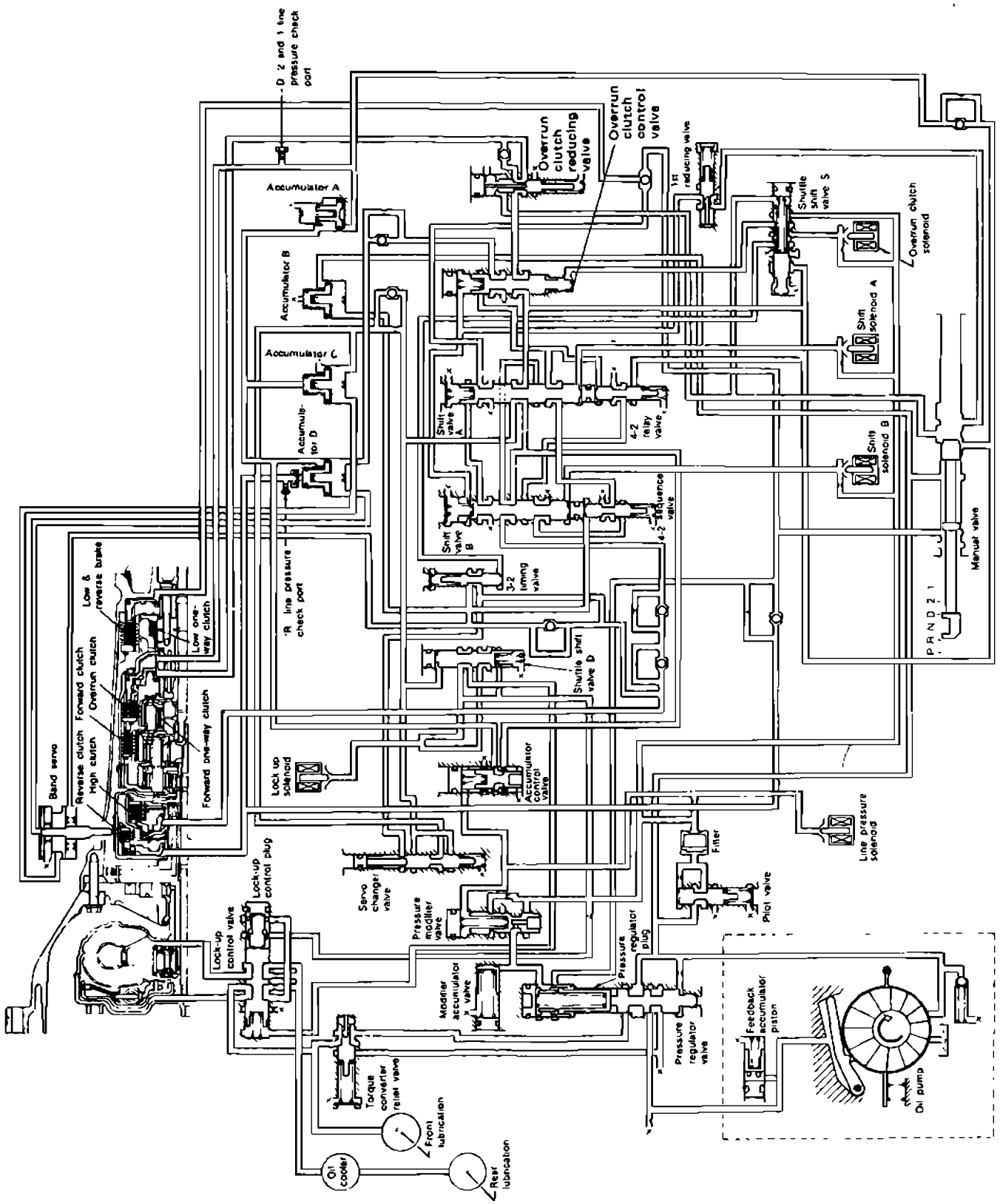
SPECIAL SERVICE TOOLS

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
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
(J34291) Shim setting gauge set		Selecting oil pump cover bearing race and oil pump thrust washer

Service Notice

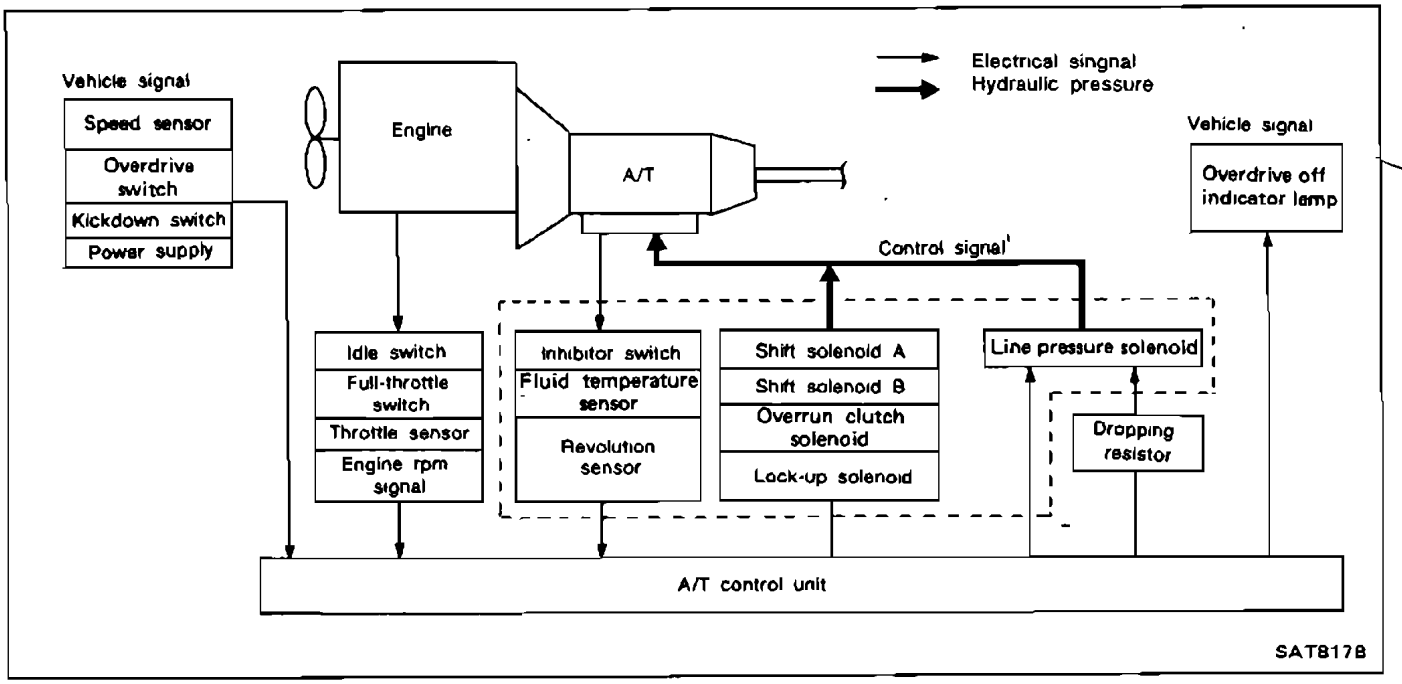
- Before proceeding with disassembly, thoroughly clean the outside of the transmission. It is important to prevent the internal parts from becoming contaminated by dirt or other foreign matter.
- Disassembly should be done in a clean work area.
- Use lint-free cloth or towels for wiping parts clean. 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



SAT123B

Electrical Control Chart

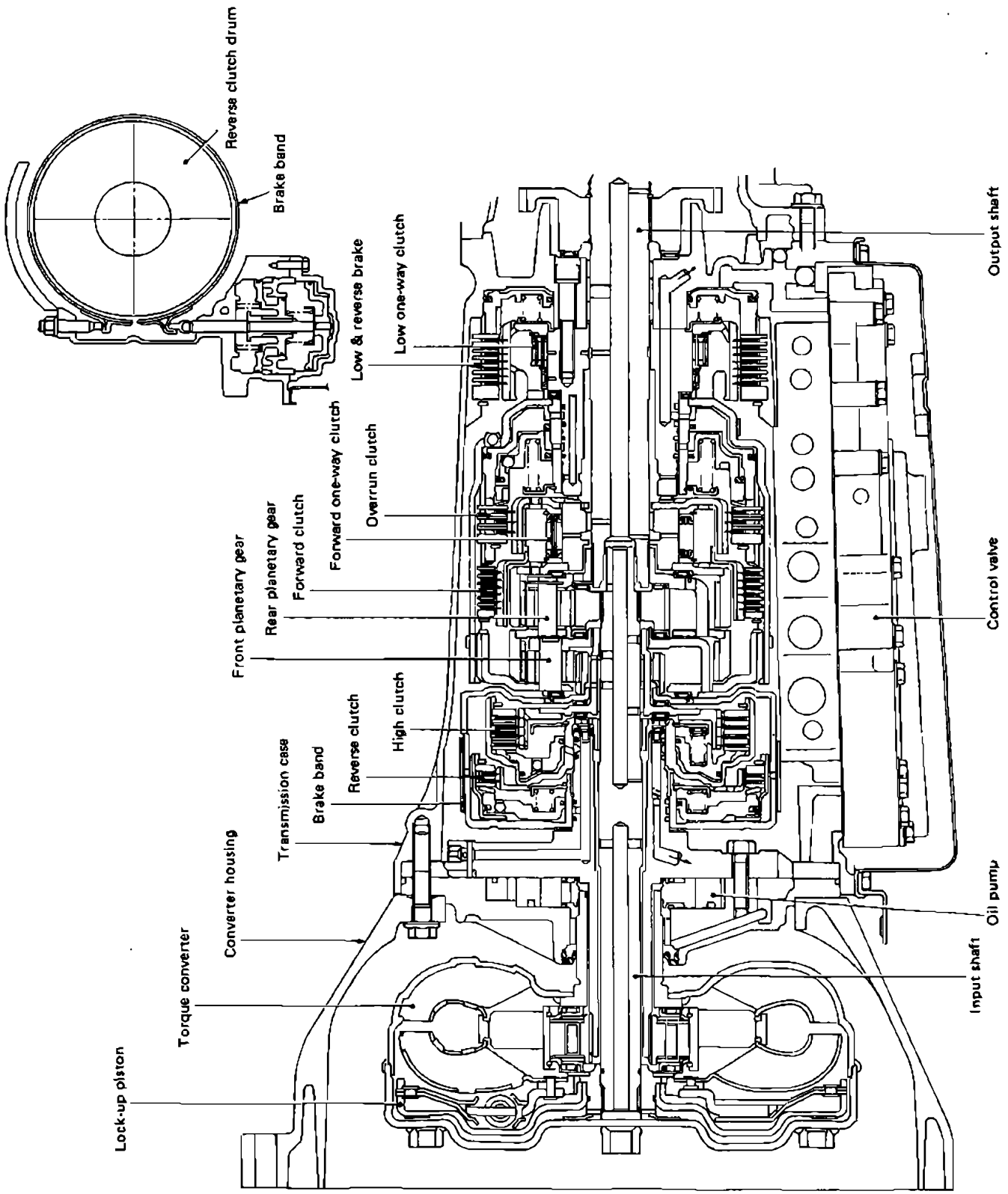


Mechnical Operation

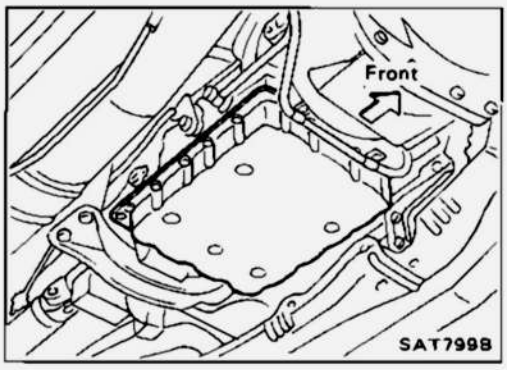
Shift position		Reverse clutch	High clutch	Forward clutch	Overrun clutch	Band servo			Forward one-way clutch	Low one-way clutch	Low & reverse brake	Lock-up	Remarks
						2nd apply	3rd release	4th apply					
P													PARK
R		○									○		REVERSE
N													NEUTRAL
D *4	1st			○	⊗				●	●			Automatic shift 1 ↔ 2 ↔ 3 ↔ 4
	2nd			○	*1 ○	○			●				
	3rd		○	○	○	*2 ⊗	⊗		●				
	4th		○	⊗		*3 ⊗	⊗	○				○	
2	1st			○	⊗				●	●			Automatic shift 1 ↔ 2
	2nd			○	○	○			●				
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.
○ : 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



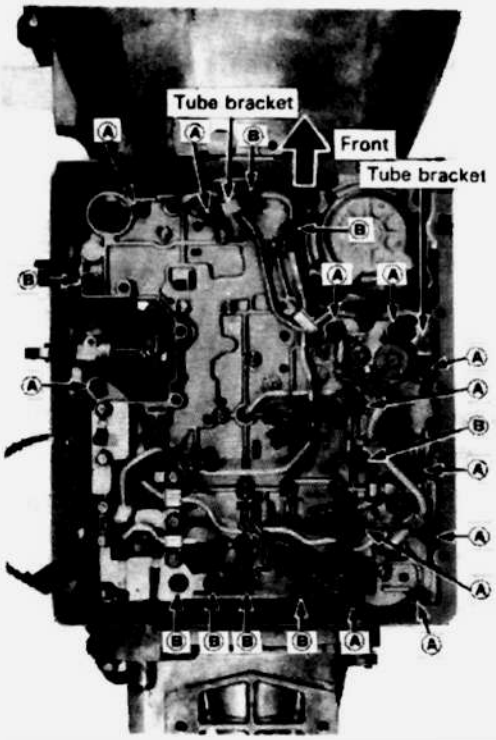
SAT1258



Control Valve Assembly and Accumulators Inspection

1. Remove oil pan and gasket and drain A.T.F.

2. Remove oil strainer.

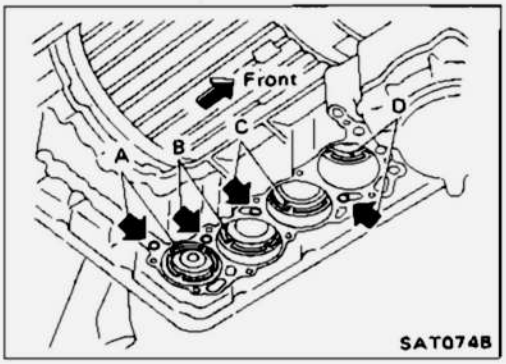


3. Remove control valve assembly by removing fixing bolts and disconnecting harness connector.

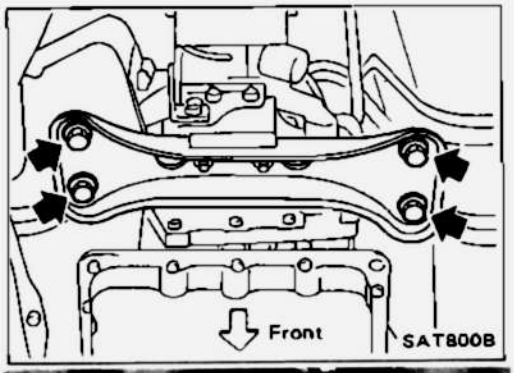
Bolt length and location

Bolt symbol	Length mm (in)
Ⓐ	37 (1.46)
Ⓑ	50 (1.97)

4. Remove solenoids and valves from valve body if necessary.
5. Remove terminal cord assembly if necessary.

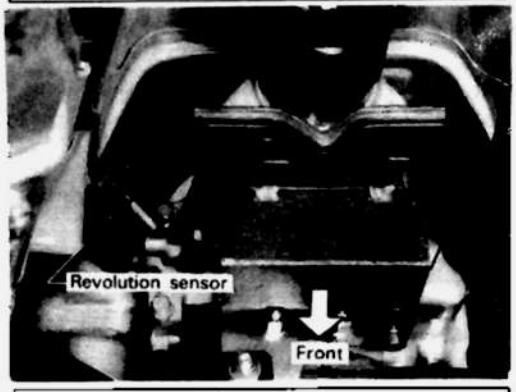


6. Remove accumulator A, B, C and D by applying compressed air if necessary.
- **Hold each piston with rag.**
7. Reinstall any part removed.
- **Always use new sealing parts.**



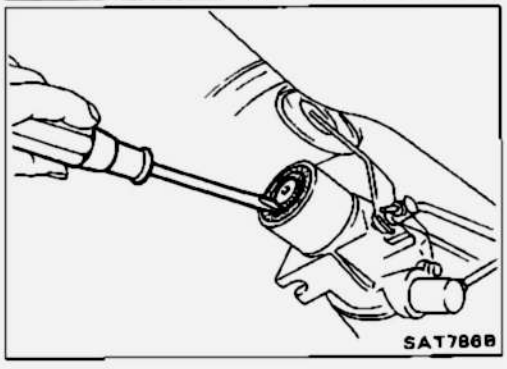
Revolution Sensor Replacement

1. Remove rear engine mounting member from body panel while supporting A/T with jack.
2. Lower A/T assembly as much as possible.



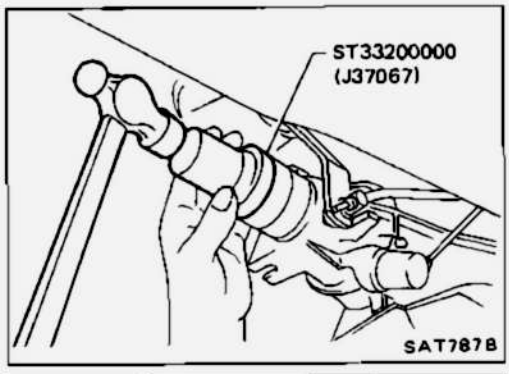
3. Remove revolution sensor from A/T assembly.
4. Reinstall any part removed.

● **Always use new sealing parts.**



Rear Oil Seal Replacement

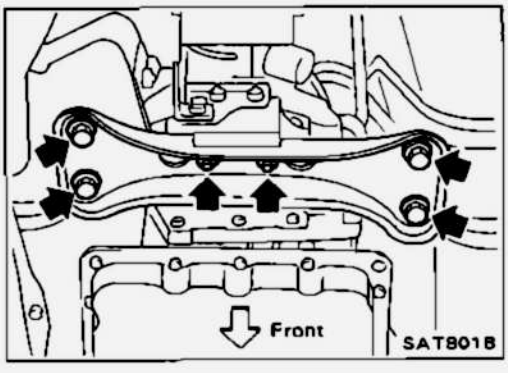
1. Remove propeller shaft from vehicle. — Refer to section PD.
2. Remove rear oil seal.



3. Install rear oil seal.

● **Apply A.T.F. before installing.**

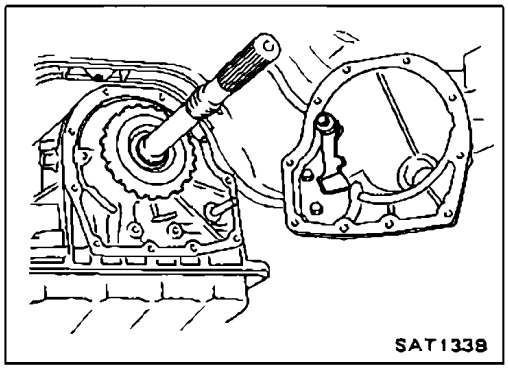
4. Reinstall any part removed.



Parking Components Inspection

1. Remove propeller shaft from vehicle. — Refer to section PD.
2. Remove rear engine mounting member from A/T assembly.

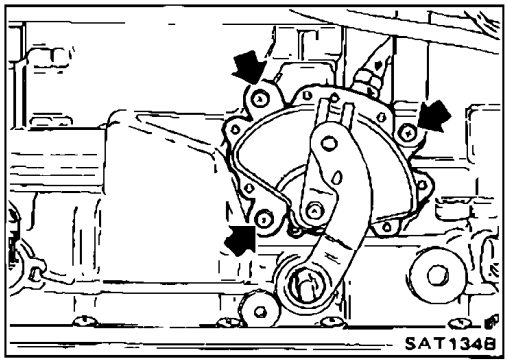
Parking Components Inspection (Cont'd)


SAT133B

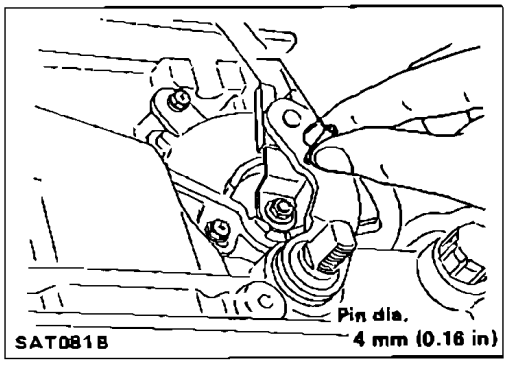
3. Remove rear extension from transmission case.
4. Replace parking components if necessary.
5. Reinstall any part removed.

● **Always use new sealing parts.**

Inhibitor Switch Adjustment


SAT134B

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.



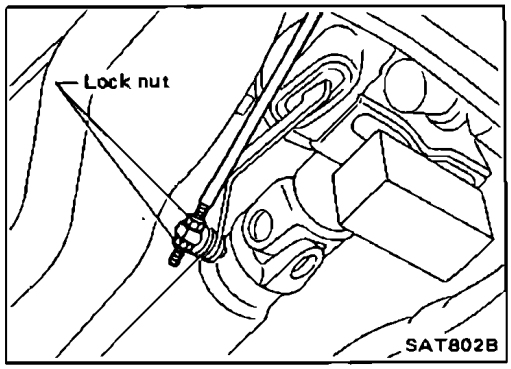
SAT081B

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 Components Inspection".

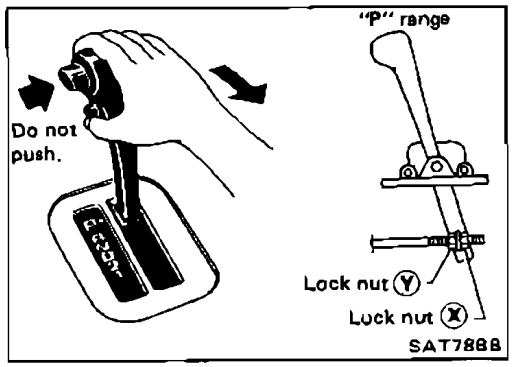
Manual Control Linkage Adjustment

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.



SAT802B



SAT788B

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:
   [O]: 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

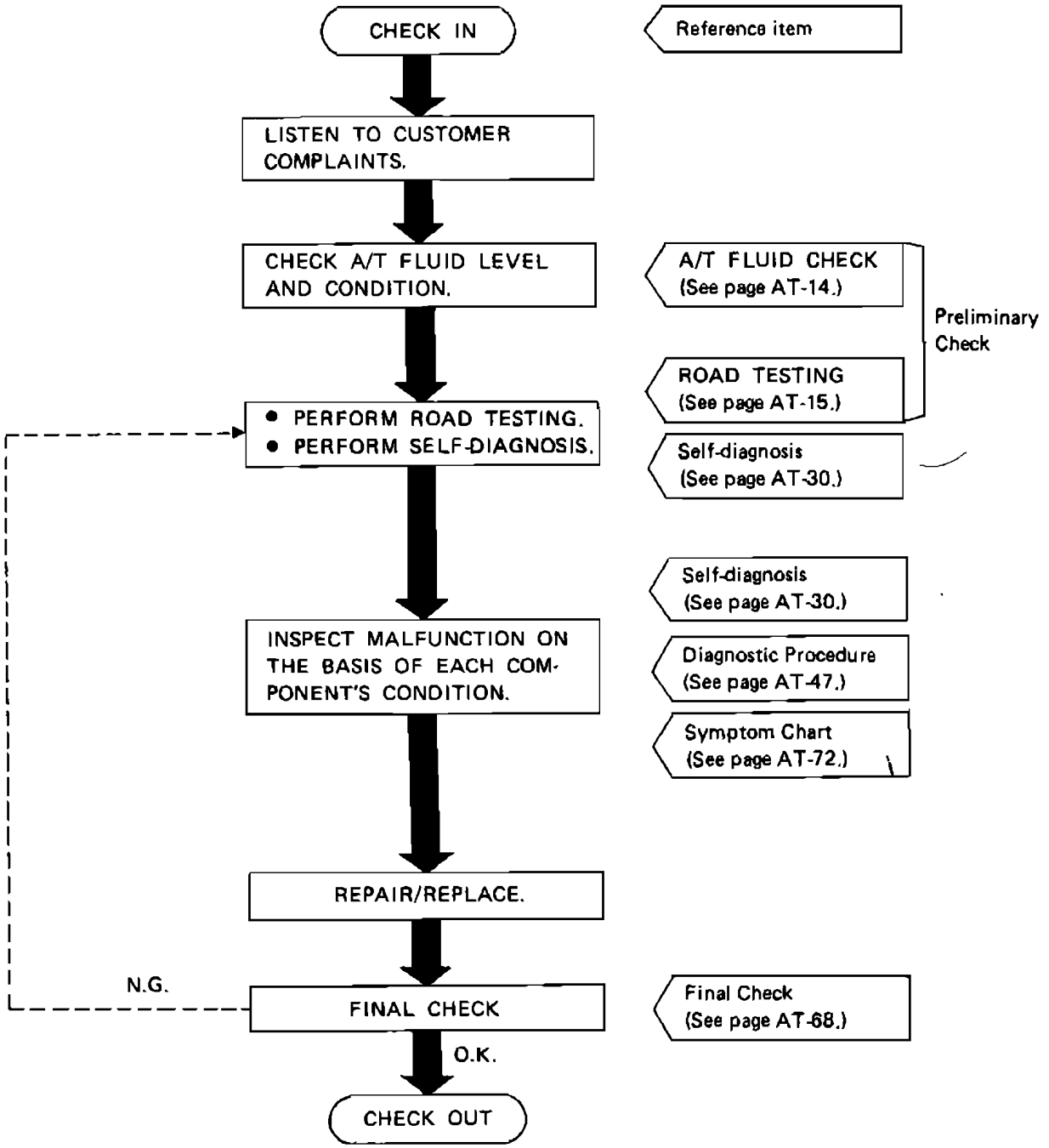
How to Perform Trouble Diagnoses for Quick and Accurate Repair AT-13
Preliminary Check AT-14
A/T Electrical Parts Location AT-25
Circuit Diagram for Quick Pin Point Check AT-27
Wiring Diagram AT-28
Self-diagnosis AT-30
SELF-DIAGNOSTIC PROCEDURE AT-30
JUDGEMENT OF SELF-DIAGNOSIS CODE AT-32
REVOLUTION SENSOR CIRCUIT CHECK AT-36
SPEED SENSOR CIRCUIT CHECK AT-36
THROTTLE SENSOR CIRCUIT CHECK AT-37
SHIFT SOLENOID A CIRCUIT CHECK AT-38
SHIFT SOLENOID B CIRCUIT CHECK AT-39
OVERRUN CLUTCH CIRCUIT CHECK AT-40
LOCK-UP SOLENOID CIRCUIT CHECK AT-41
FLUID TEMPERATURE SENSOR CIRCUIT AND A/T CONTROL UNIT POWER SOURCE CIRCUIT CHECKS AT-42
ENGINE REVOLUTION SIGNAL CIRCUIT CHECK AT-43
LINE PRESSURE SOLENOID CIRCUIT CHECK AT-44
INHIBITOR, OVERDRIVE, KICKDOWN AND IDLE SWITCH CIRCUIT CHECKS AT-45
Diagnostic Procedure 1
(SYMPTOM: O.D. OFF indicator lamp does not come on for about 2 seconds when turning ignition switch to "ON".) AT-47
Diagnostic Procedure 2
(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-48
Diagnostic Procedure 3
(SYMPTOM: Vehicle moves when it is pushed forward or backward with selector lever in "P" range.) AT-48
Diagnostic Procedure 4
(SYMPTOM: Vehicle moves forward when setting "N" range.) AT-49
Diagnostic Procedure 5
(SYMPTOM: There is large shock when changing from "N" to "R" range.) AT-50
Diagnostic Procedure 6
(SYMPTOM: vehicle does not creep backward when selecting "R" range.) AT-51
Diagnostic Procedure 7
(SYMPTOM: Vehicle does not creep forward when selecting "D" , "2" and "1" range.) AT-52
Diagnostic Procedure 8
(SYMPTOM: Vehicle cannot be started from D_1 on Cruise test—Part 1.) AT-53
Diagnostic Procedure 9
(SYMPTOM: A/T does not shift from D_1 to D_2 at specified speed.
A/T does not shift from D_4 to D_2 when depressing accelerator pedal fully at the specified speed.) AT-54
Diagnostic Procedure 10
(SYMPTOM: A/T does not shift from D_2 to D_3 at the specified speed.) AT-55
Diagnostic Procedure 11
(SYMPTOM: A/T does not shift from D_3 to D_4 at the specified speed.) AT-56
Diagnostic Procedure 12
(SYMPTOM: A/T does not perform lock-up at the specified speed.) AT-57
Diagnostic Procedure 13
(SYMPTOM: A/T does not hold lock-up condition for more than 30 seconds.) AT-58
Diagnostic Procedure 14
(SYMPTOM: Lock-up is not released when accelerator pedal is released.) AT-58

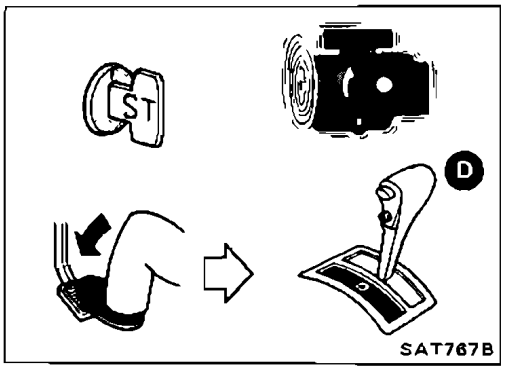
Contents (Cont'd)

Diagnostic Procedure 15
(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.) AT-59
Diagnostic Procedure 16
(SYMPTOM: Vehicle does not start from D_1 on Cruise test — Part 2.) AT-60
Diagnostic Procedure 17
(SYMPTOM: Vehicle does not shift from D_4 on D_3 when changing overdrive switch to "OFF" position.) AT-60
Diagnostic Procedure 18
(SYMPTOM: A/T does not shift from D_3 on D_2 when changing selector lever from "D" to "2" range.) AT-61
Diagnostic Procedure 19
(SYMPTOM: Vehicle does not shift from 2_2 on 1_1 when changing selector lever from "2" to "1" range.) AT-61
Diagnostic Procedure 20
(SYMPTOM: Vehicle does not decelerate by enigne brake when shifting from 2_2 (1_2) to 1_1.) AT-61
Electrical Components Inspection AT-62
Final Check AT-68
Symptom Chart AT-72
A/T Shift Lock System AT-75
SHIFT LOCK SYSTEM ELECTRICAL PARTS LOCATION AT-75
CIRCUIT DIAGRAM FOR QUICK PIN POINT CHECK AT-76
WIRING DIAGRAM AT-77
DIAGNOSTIC PROCEDURE 1
(SYMPTOM: Selector lever cannot be moved from "P" range when applying brake pedal or can be moved when releasing brake pedal.) AT-78
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".) AT-80
SHIFT LOCK CONTROL UNIT INSPECTION AT-82
SHIFT LOCK CONTROL UNIT INSPECTION TABLE AT-83
COMPONENT CHECK AT-84

How to Perform Trouble Diagnoses for Quick and Accurate Repair

WORK FLOW



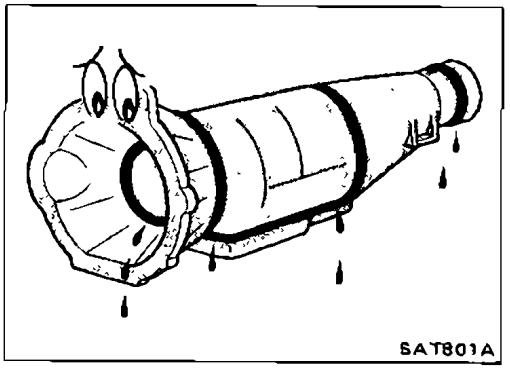


Preliminary Check

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

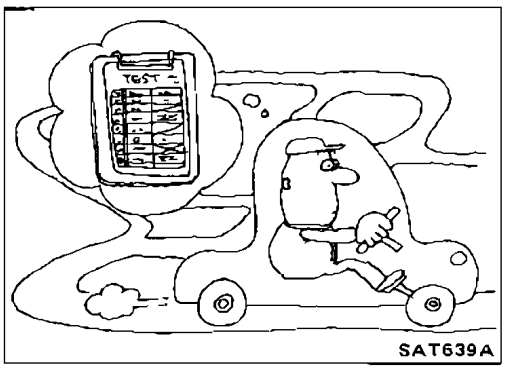
- The purpose of this road test is to determine overall performance of automatic transmission and analyze causes of problems.
- The road test consists of the following three parts:

1. Check before engine is started
2. Check at idle
3. Cruise test

ROAD TEST PROCEDURE

1. Check before engine is started.
2. Check at idle.
3. Cruise test.

SAT786A

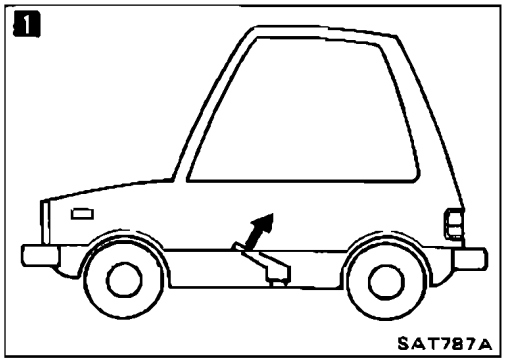


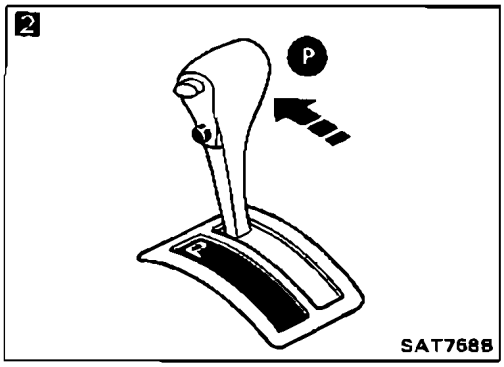
SAT639A

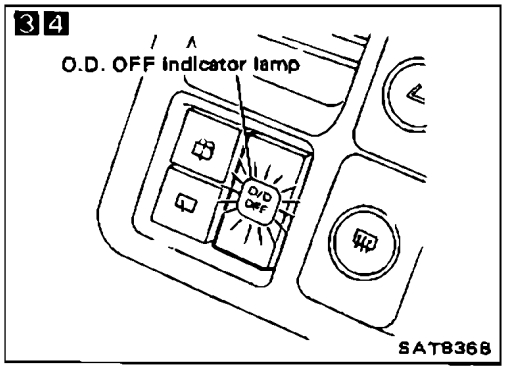
- Before road test, familiarize yourself with all test procedures and items to check.
- Conduct tests on all items. Troubleshoot items which check out No Good after road test. Refer to "Self-diagnosis" and "Diagnostic Procedure".

Preliminary Check (Cont'd)

1. Check before engine is started





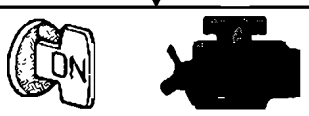


1

Park vehicle on flat surface.

2

Move selector lever to "P" range.



3

Does O.D. OFF indicator lamp come on for about 2 seconds?

No → Go to Diagnostic Procedure 1.

Yes

4

Does O.D. OFF indicator lamp flicker for about 8 seconds?

Yes → Perform self-diagnosis. — Refer to SELF-DIAGNOSIS PROCEDURE.

No

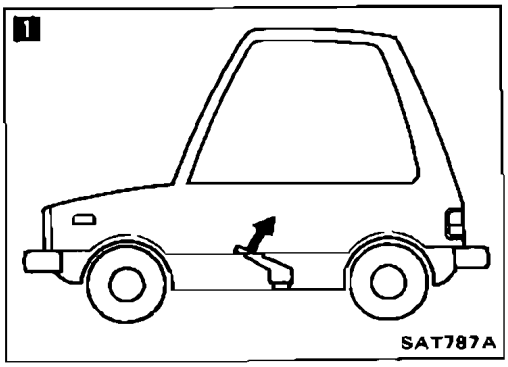
Perform self-diagnosis. — Refer to SELF-DIAGNOSIS PROCEDURE and note N.G. items.

Go to "ROAD TESTING — 2. Check at idle".

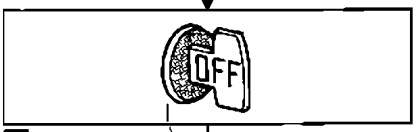
Preliminary Check (Cont'd)

2. Check at idle

1



Park vehicle on flat surface.

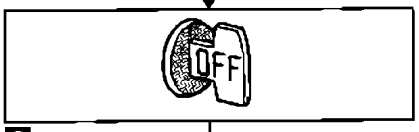


2

Move selector lever to "P" or "N" range.

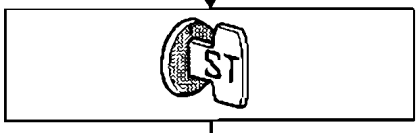
Is engine started? — No → Go to Diagnostic Procedure 2.

Yes



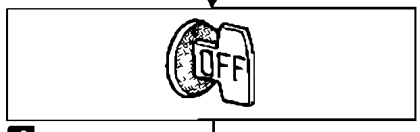
3

Move selector lever to "D", "1", "2" or "R" range.



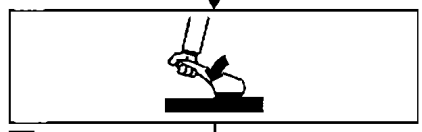
Is engine started? — Yes → Go to Diagnostic Procedure 2.

No



4

Move selector lever to "P" range.



5

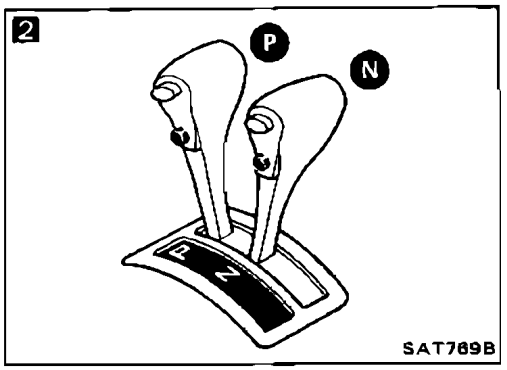
Push vehicle forward or backward.

Does vehicle move when it is pushed forward or backward? — Yes → Go to Diagnostic Procedure 3.

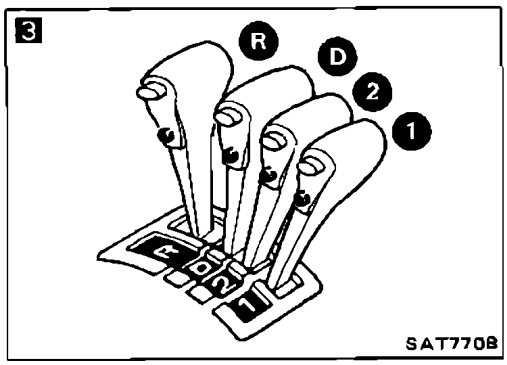
No

Ⓐ

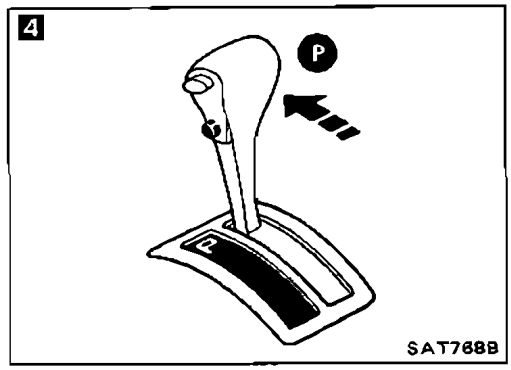
2



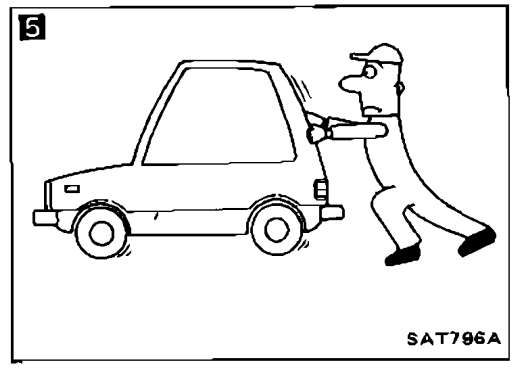
3



4

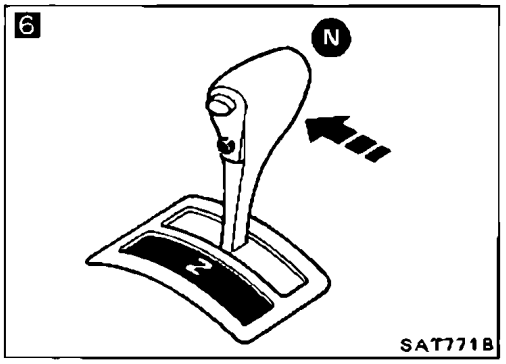


5

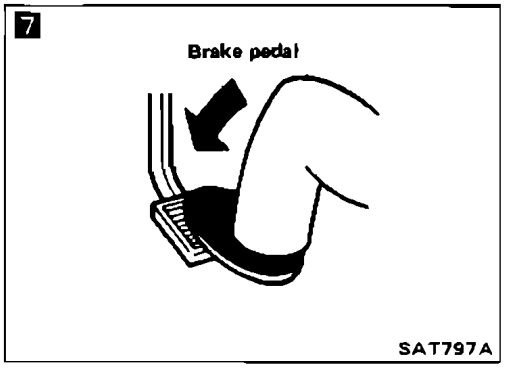


Preliminary Check (Cont'd)

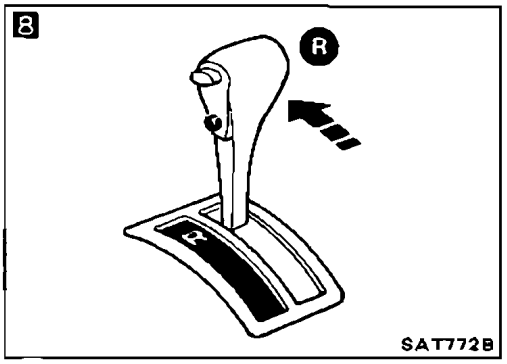
6



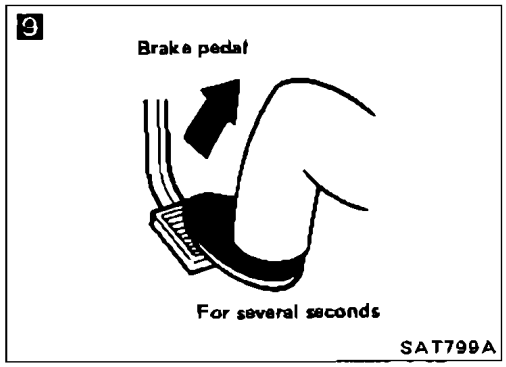
7



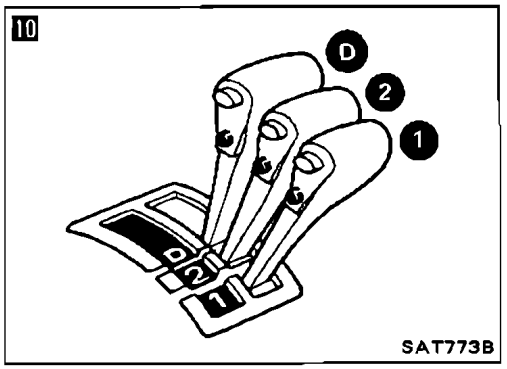
8

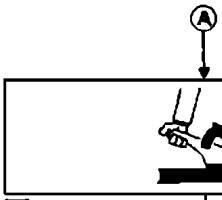


9

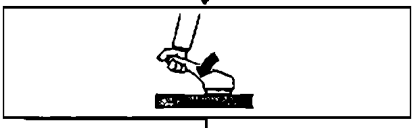


10





6 Move selector lever to "N" range.



Does vehicle move forward or backward?

Yes → Go to Diagnostic Procedure 4.

No

7 Apply foot brake.

8 Move selector lever to "R" range.

Is there large shock when changing from "N" to "R" range?

Yes → Go to Diagnostic Procedure 5.

No

9 Release foot brake for several seconds.

Does vehicle creep backward when foot brake is released?

No → Go to Diagnostic Procedure 6.

Yes

10 Move selector lever to "D", "1" and "2" range and check if vehicle creeps forward.

Does vehicle creep forward in all three ranges?

Yes → Go to Cruise test.

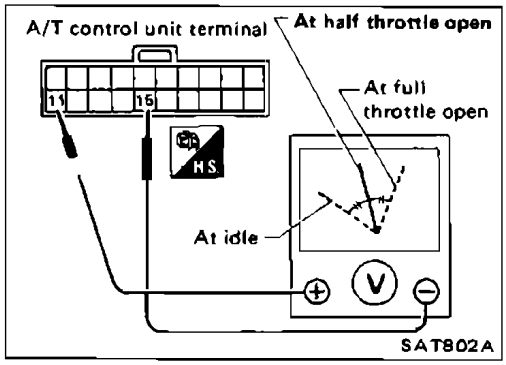
No

Go to Diagnostic Procedure 7.

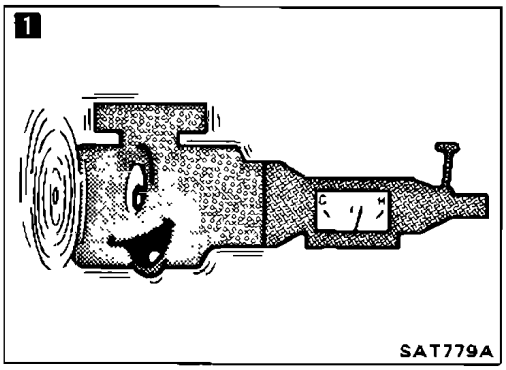
Preliminary Check (Cont'd)

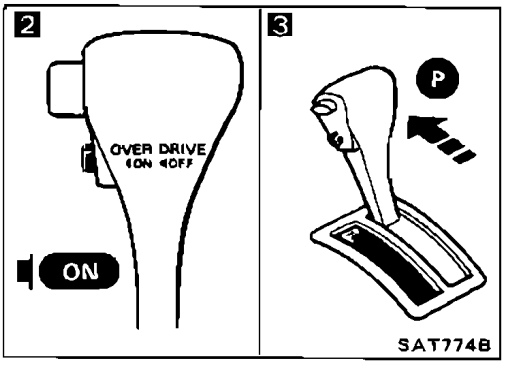
3. Cruise test

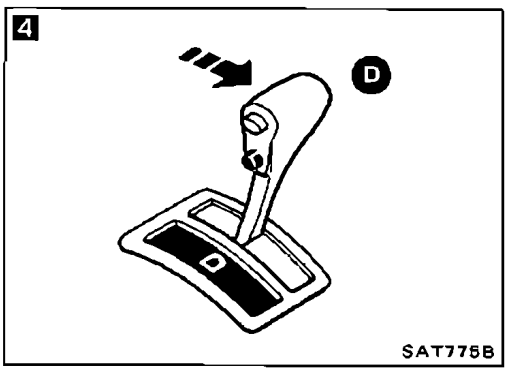
- Check all items listed in Parts 1 through 3.
- Throttle position can be controlled by voltage across terminals ⑪ and ⑮ of A/T control unit.

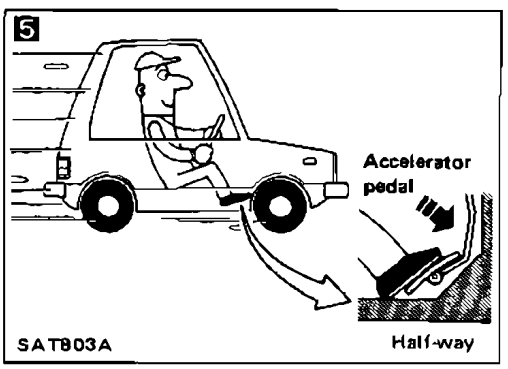


Cruise test — Part 1









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

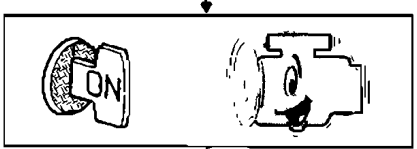
Set overdrive switch to "ON" position.

↓

3

Move selector lever to "P" range.

↓



↓

4

Move selector lever to "D" range.

↓

5

Accelerate vehicle by constantly depressing accelerator pedal halfway.

↓

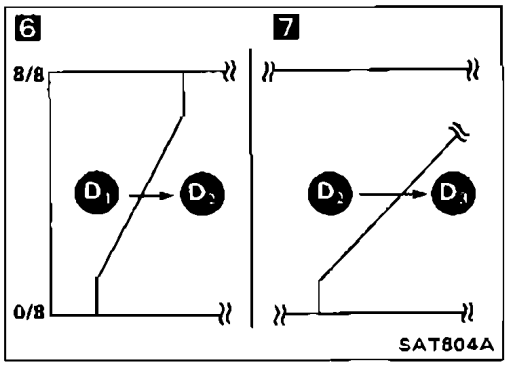
Does vehicle start from D_1? — No → Go to Diagnostic Procedure 8.

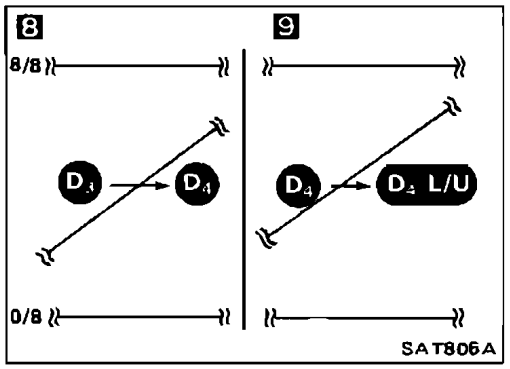
Yes

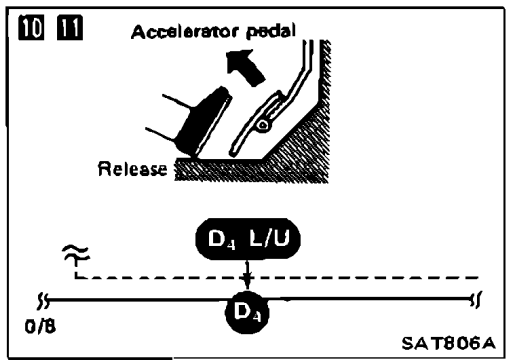
↓

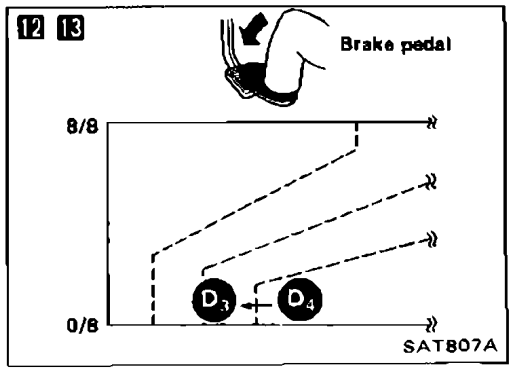
Ⓐ

Preliminary Check (Cont'd)









Ⓐ

6 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 9.
- Yes ↓

7 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 10.
- Yes ↓

8 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 11.
- Yes ↓

9 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 12.
- Yes ↓

Does A/T hold lock-up condition for more than 30 seconds?
- No → Go to Diagnostic Procedure 13.
- Yes ↓

10 Release accelerator pedal. ↓

11 Is lock-up released when accelerator pedal is released?
- No → Go to Diagnostic Procedure 14.
- Yes ↓

12 Decelerate vehicle by applying foot brake lightly. ↓

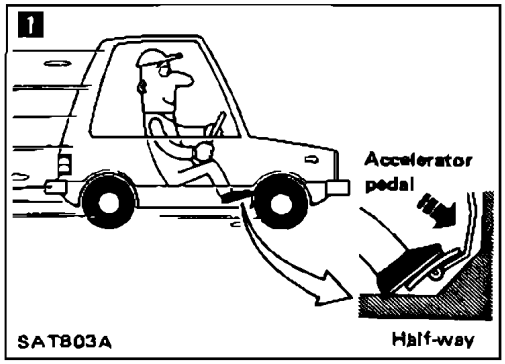
13 Does engine speed return to idle smoothly when A/T is shifted from D_4 to D_3?
- No → Go to Diagnostic Procedure 15.
- Yes ↓

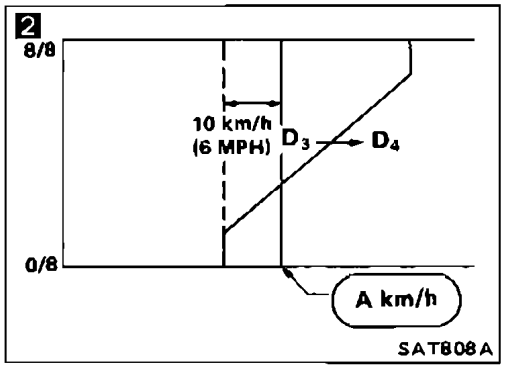
Stop vehicle. ↓

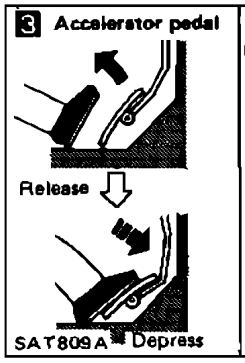
Go to "Cruise test – Part 2".

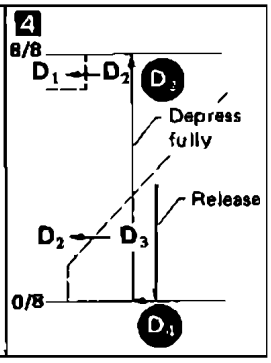
Preliminary Check (Cont'd)

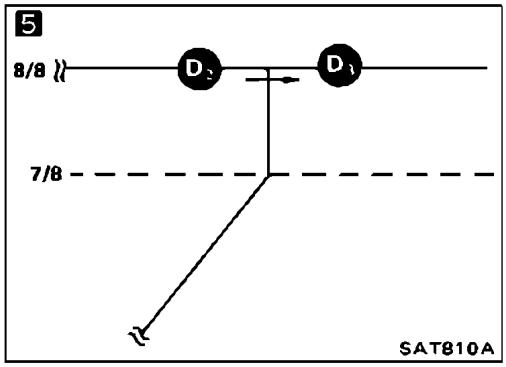
Cruise test — Part 2

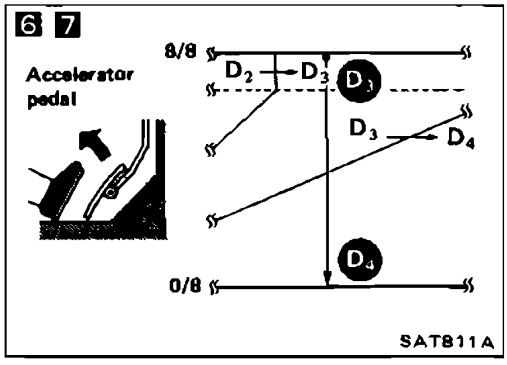












Confirm overdrive switch is in "ON" position.

↓

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 16.
- 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 9.
- 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 10.
- 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 11.
- Yes ↓

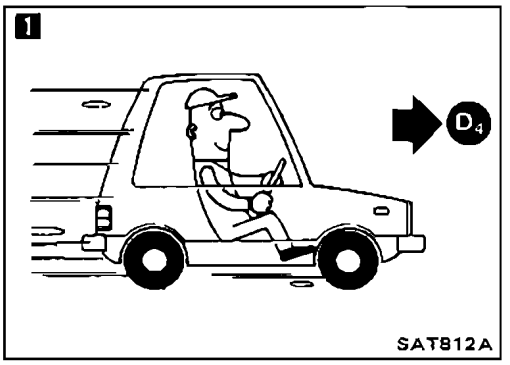
Stop vehicle.

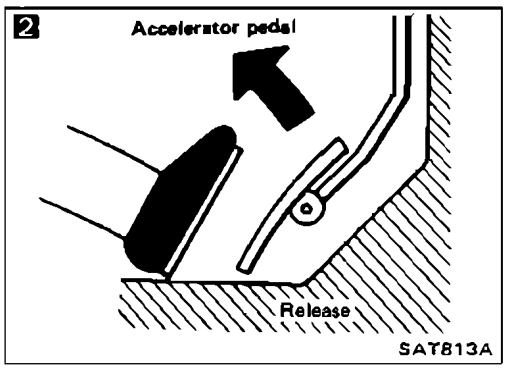
↓

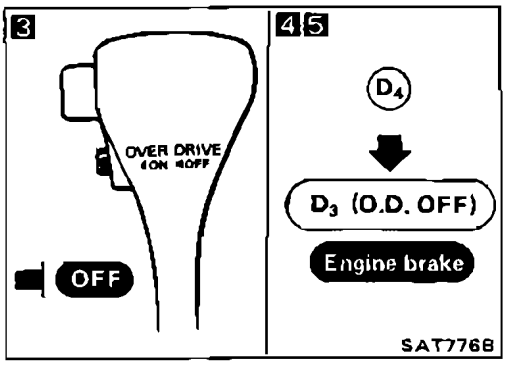
Go to "Cruise test — Part 3".

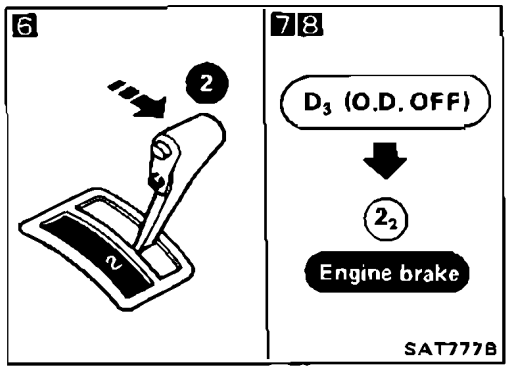
Preliminary Check (Cont'd)

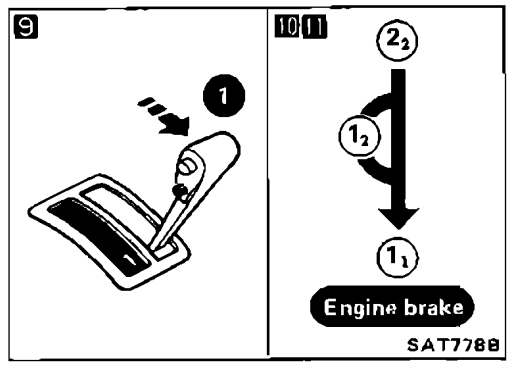
Cruise test — Part 3











Confirm 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 17.

↓ Yes

5 Does vehicle decelerate by engine brake? — No → Go to Diagnostic Procedure 15.

↓ 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 18.

↓ Yes

8 Does vehicle decelerate by engine brake? — No → Go to Diagnostic Procedure 15.

↓ Yes

9 Move selector lever from "2" to "1" range while driving in 2_1.

↓

10 Does A/T shift from 2_2 to 1_1 range? — No → Go to Diagnostic Procedure 19.

↓ Yes

11 Does vehicle decelerate by engine brake? — No → Go to Diagnostic Procedure 20.

↓ Yes

Stop vehicle.

↓

Perform self-diagnosis. — Refer to SELF-DIAGNOSIS PROCEDURE.

Preliminary Check (Cont'd)

Vehicle speed when shifting gears

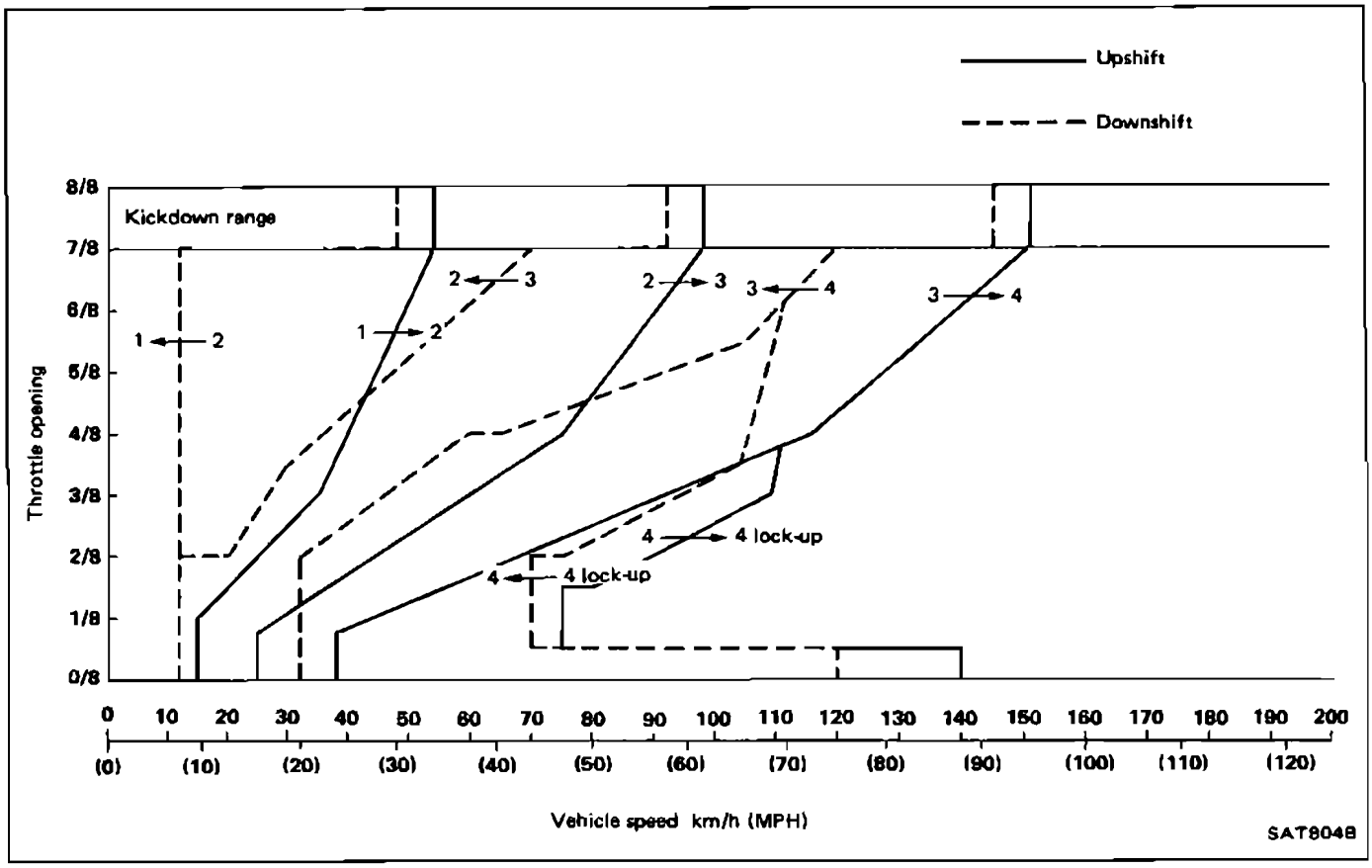
Throttle position	Vehicle speed km/h (MPH)						
	$D_1 \rightarrow D_2$	$D_2 \rightarrow D_3$	$D_3 \rightarrow D_4$	$D_4 \rightarrow D_3$	$D_3 \rightarrow D_2$	$D_2 \rightarrow D_1$	$1_2 \rightarrow 1_1$
Full throttle	52 - 56 (32 - 35)	95 - 101 (59 - 63)	146 - 156 (91 - 97)	140 - 150 (87 - 93)	89 - 95 (55 - 59)	40 - 44 (25 - 27)	53 - 57 (33 - 35)
Half throttle	38 - 42 (24 - 26)	72 - 78 (45 - 48)	111 - 121 (69 - 75)	56 - 65 (34 - 40)	33 - 39 (21 - 24)	10 - 14 (6 - 9)	53 - 57 (33 - 35)

Vehicle speed when performing and releasing lock-up

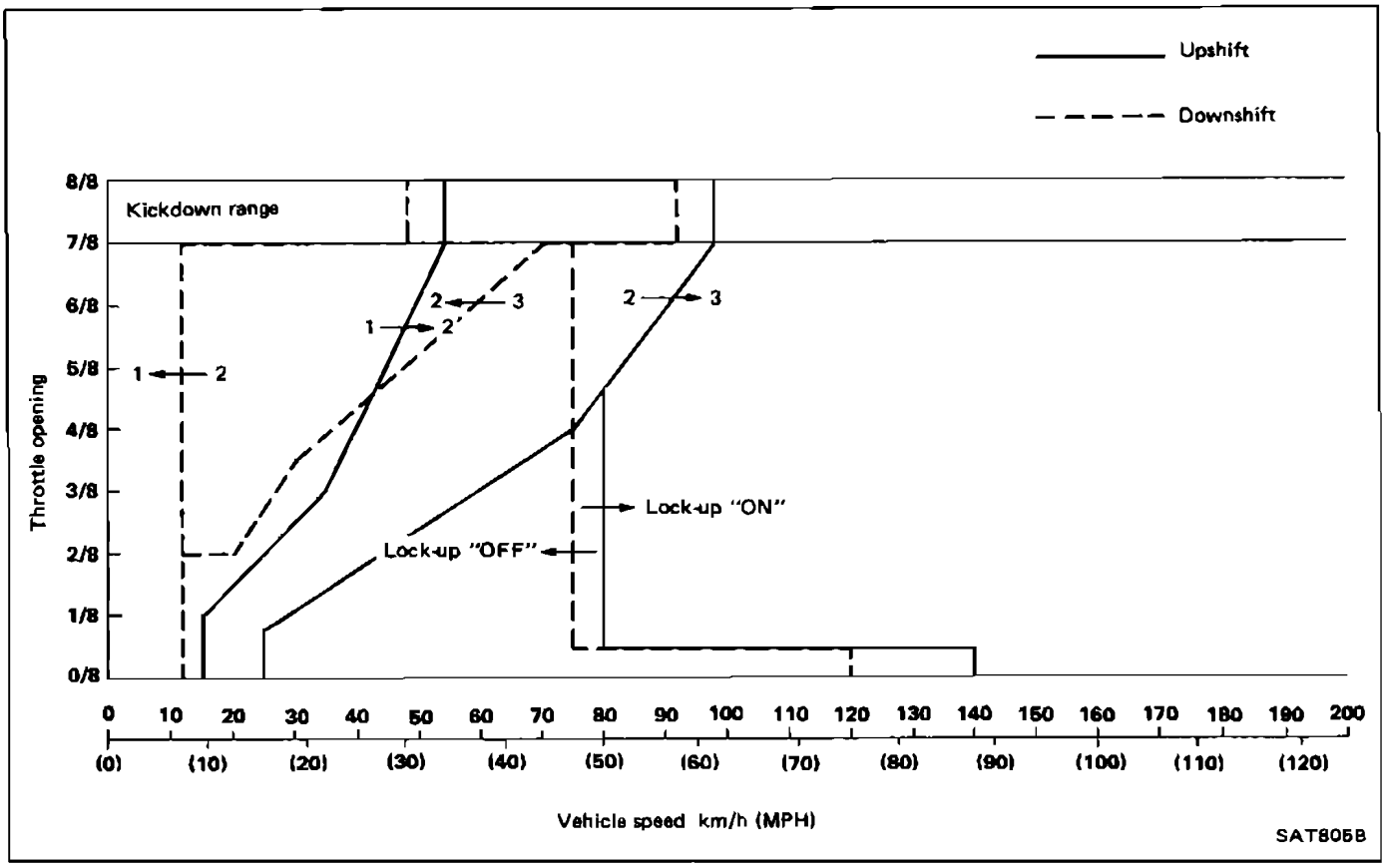
Throttle position	O.D. switch [Shift range]	Vehicle speed km/h (MPH)	
		Lock-up "ON"	Lock-up "OFF"
Full throttle	ON [D_4]	146 - 156 (91 - 97)	140 - 150 (87 - 93)
	OFF [D_3]	95 - 101 (59 - 63)	89 - 95 (55 - 59)
Half throttle	ON [D_4]	112 - 120 (70 - 75)	102 - 110 (63 - 68)
	OFF [D_3]	76 - 84 (47 - 52)	71 - 79 (44 - 49)

Preliminary Check (Cont'd)

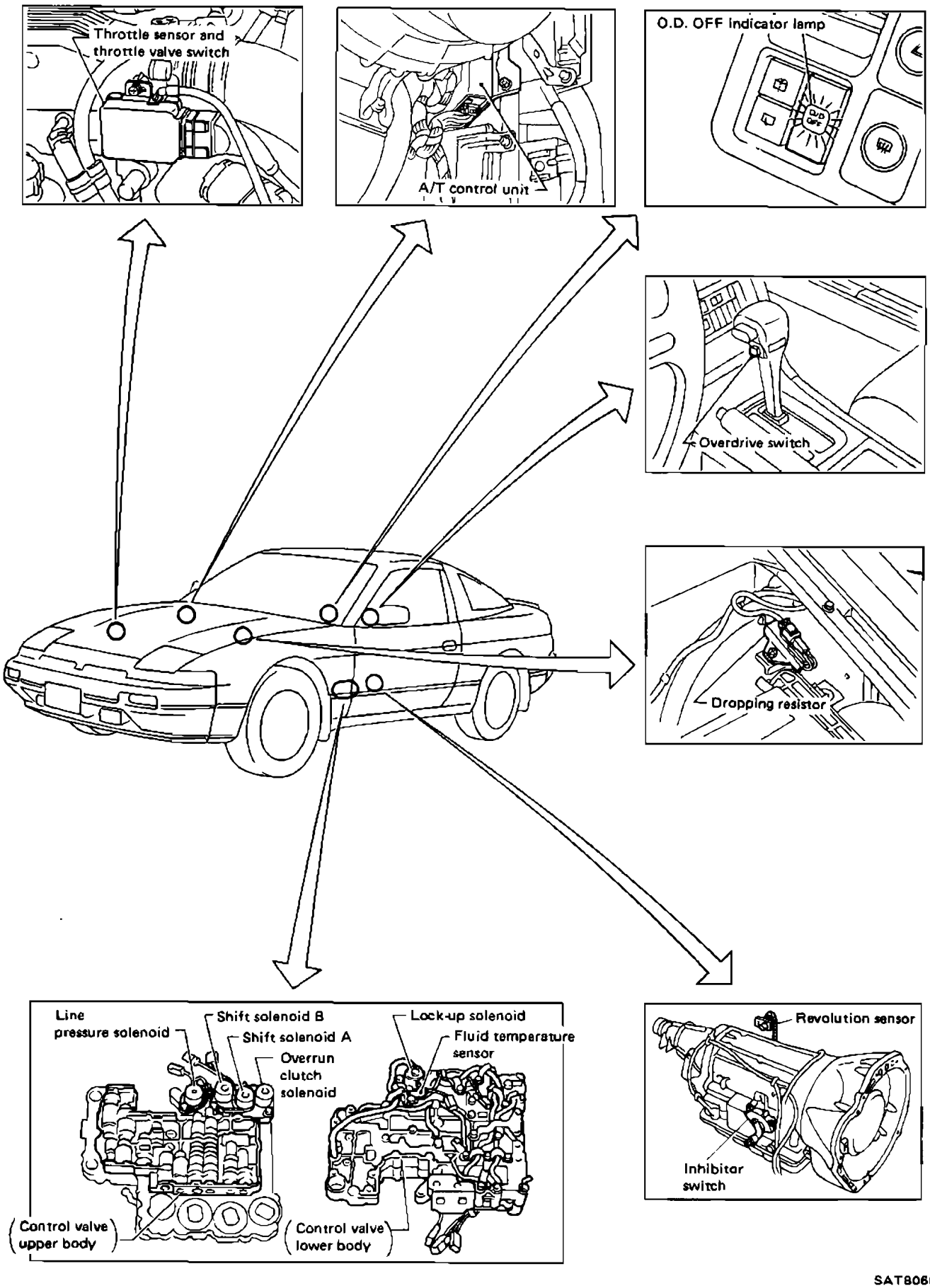
Shift schedule (Overdrive ON)



Shift schedule (Overdrive OFF)

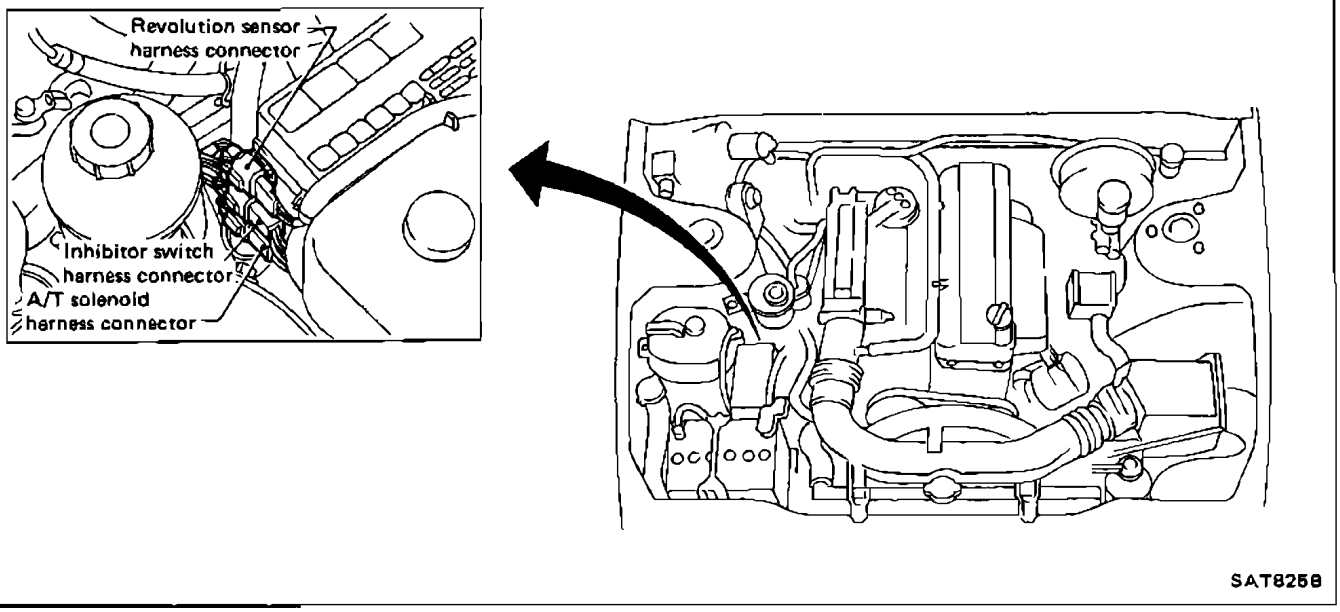


A/T Electrical Parts Location

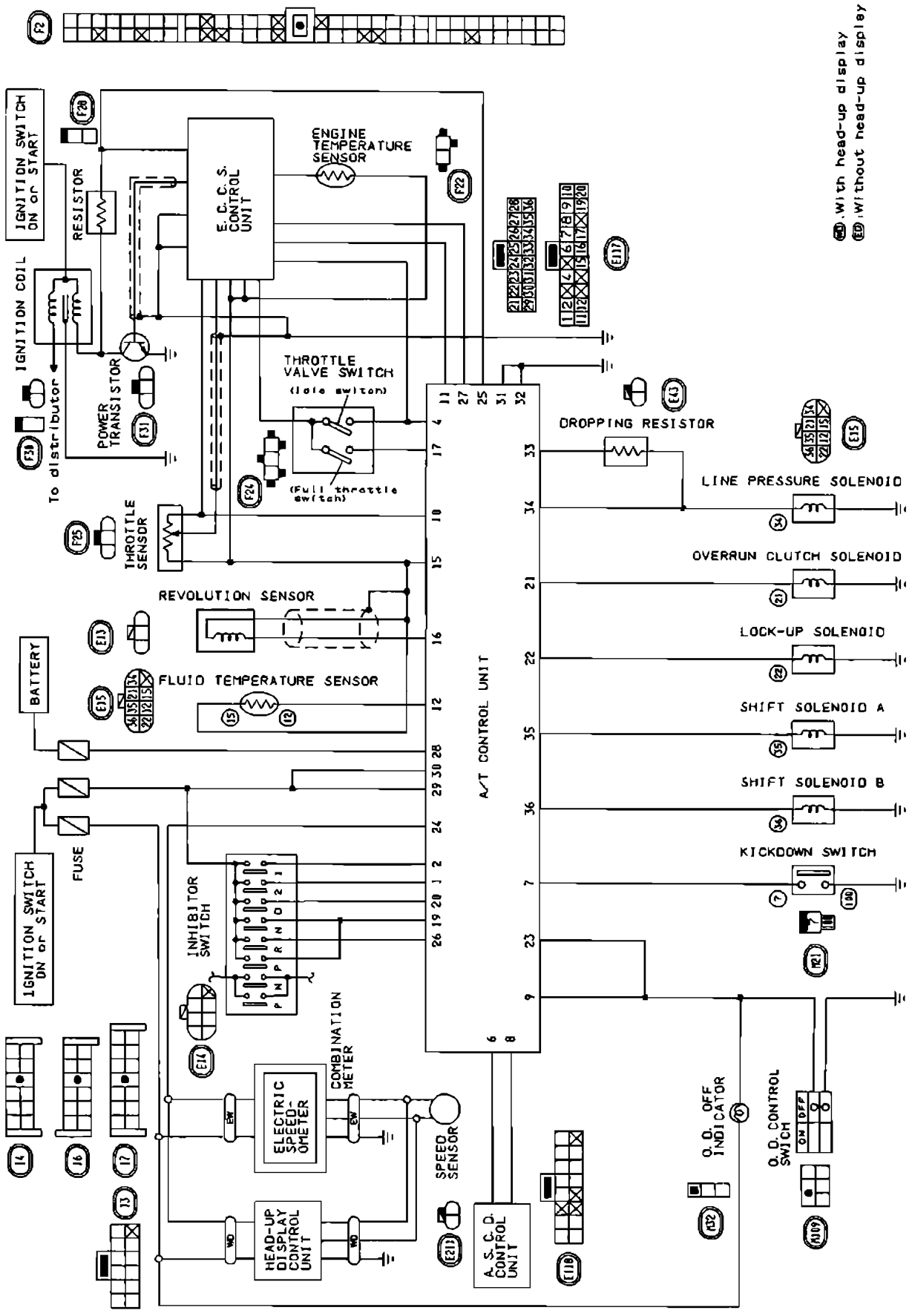


SAT806B

A/T Electrical Parts Location (Cont'd)

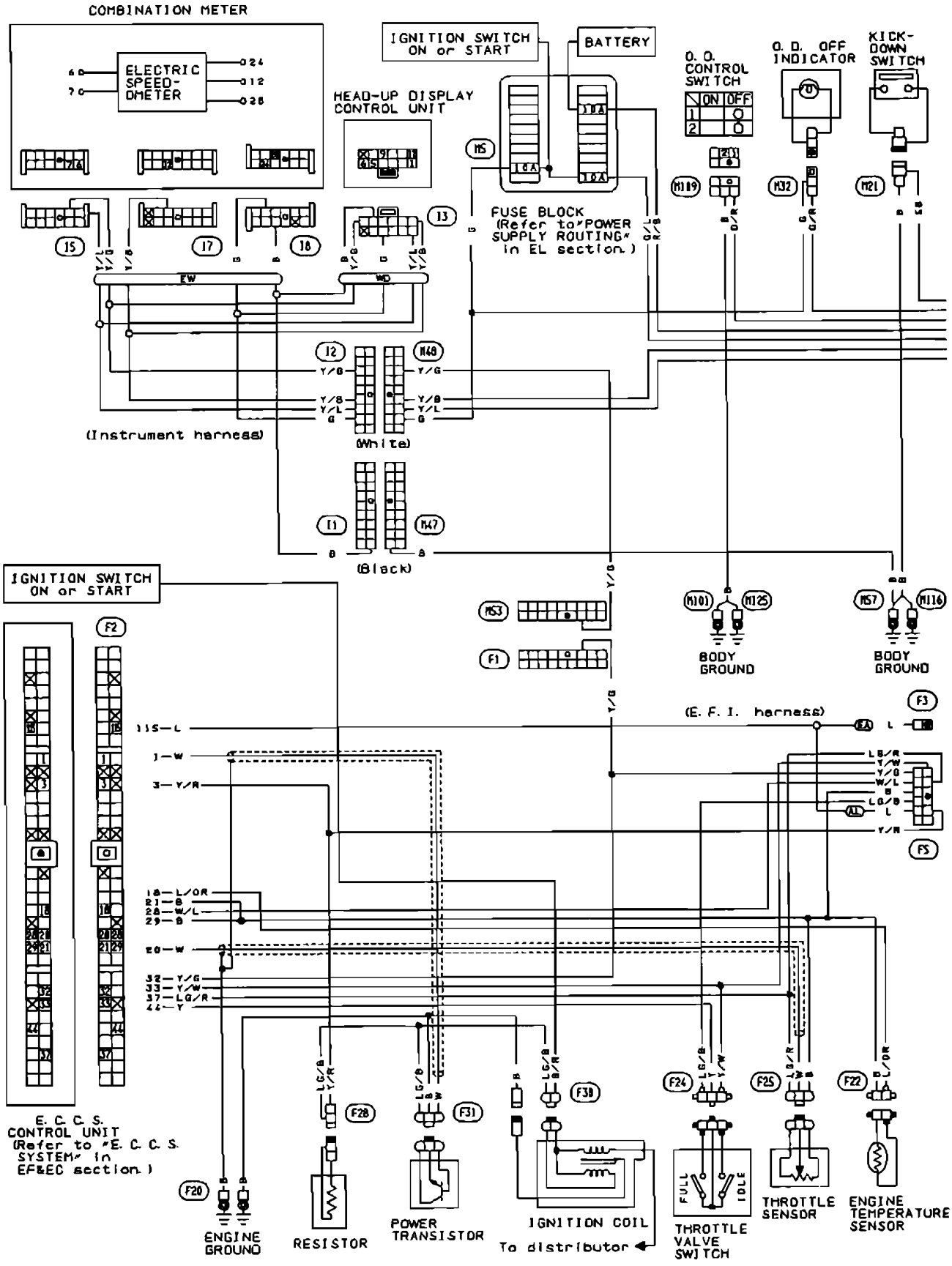


Circuit Diagram for Quick Pin Point Check

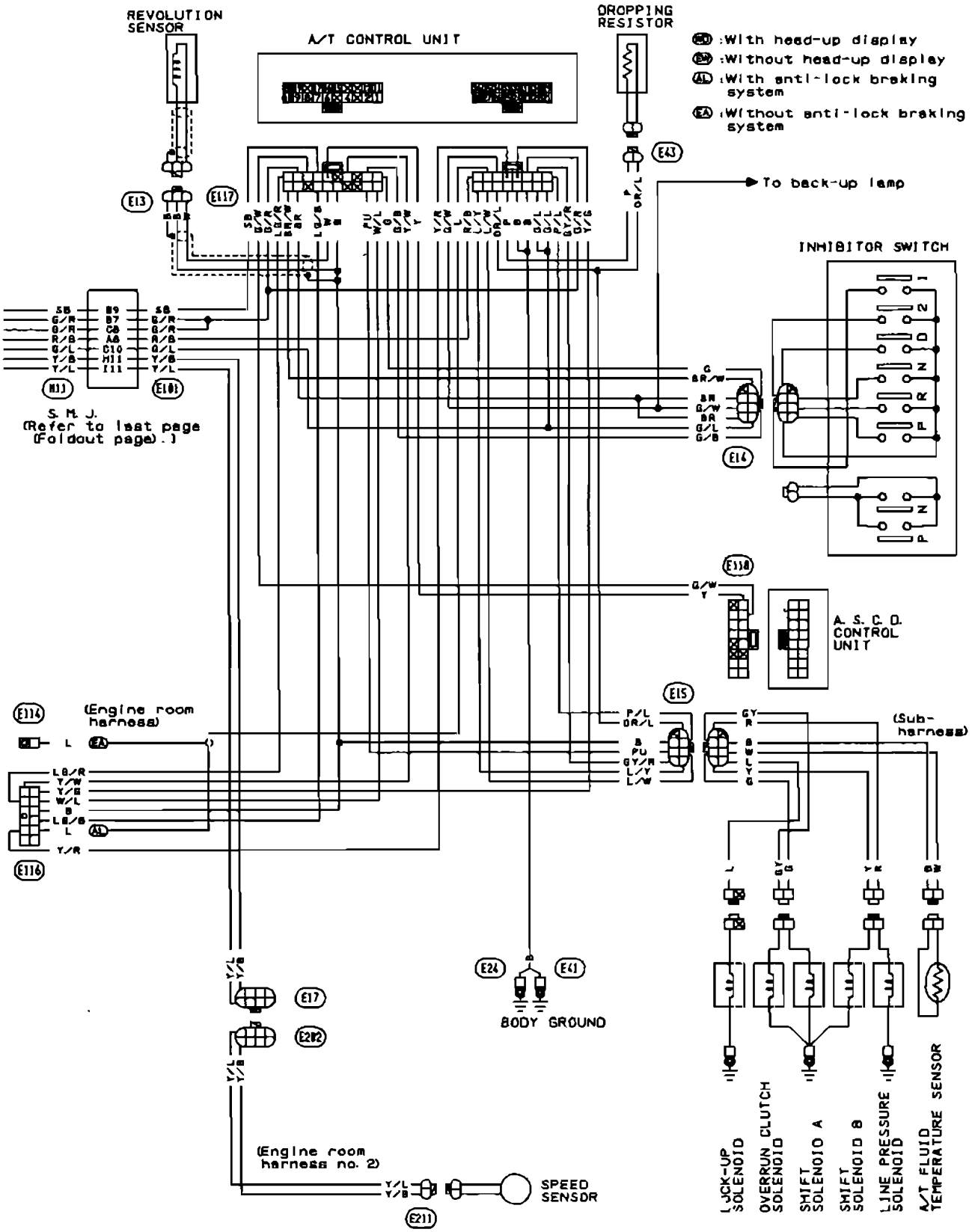


SAT813B

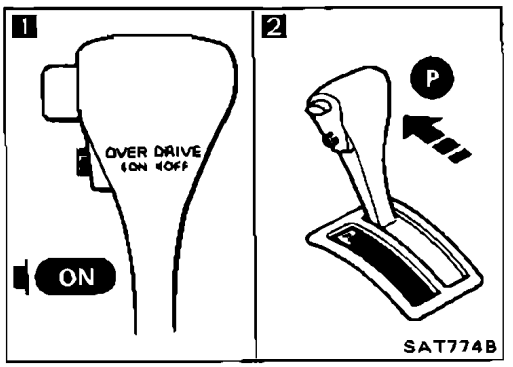
Wiring Diagram

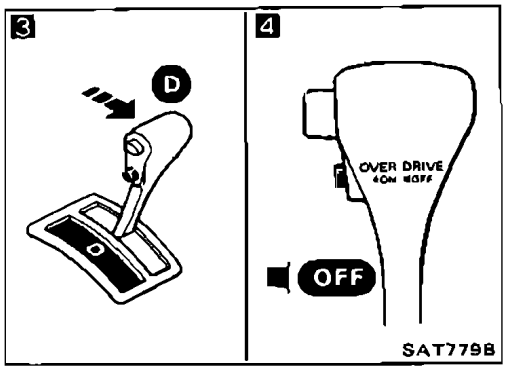


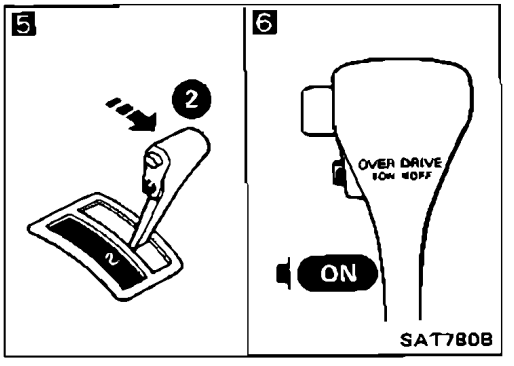
Wiring Diagram (Cont'd)

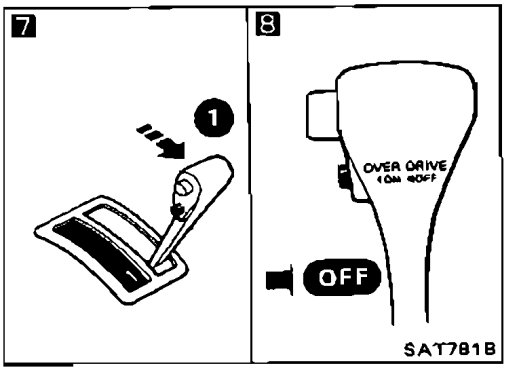


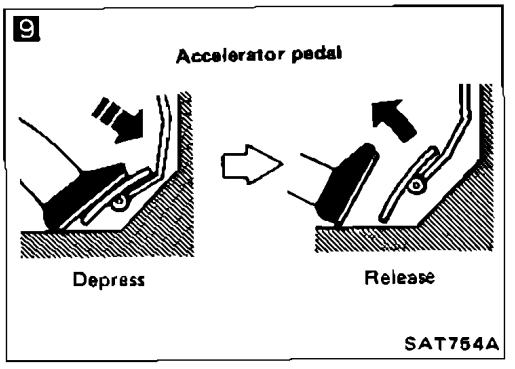
SAT101C











Self-diagnosis

SELF-DIAGNOSTIC PROCEDURE

DIAGNOSIS START

Start engine and warm it up to normal engine operating temperature.

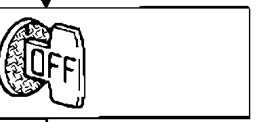
1 Set overdrive switch in "ON" position.

2 Move selector lever to "P" range.

Does O.D. OFF indicator lamp come on for about 2 seconds?

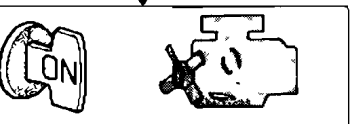
Yes

No → Go to Diagnostic Procedure 1.



3 Move selector lever to "D" range.

4 Set overdrive switch in "OFF" position.



Wait for more than 2 seconds after ignition switch "ON".

5 Move selector lever to "2" range.

6 Set overdrive switch in "ON" position.

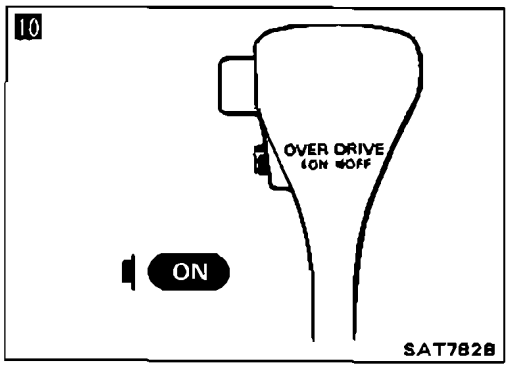
7 Move selector lever to "1" range.

8 Set overdrive switch in "OFF" position.

9 Depress accelerator pedal fully and release it.

Ⓐ

Self-diagnosis (Cont'd)



Ⓐ

10

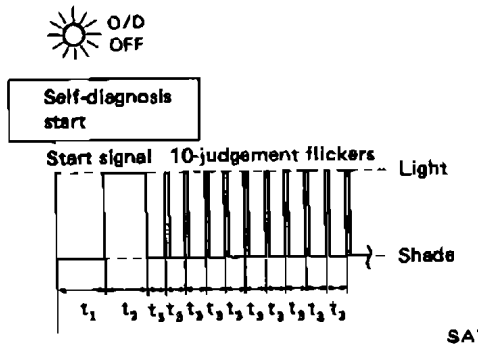
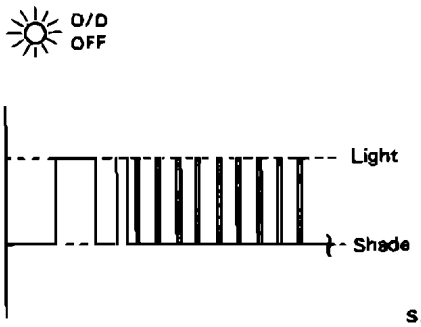
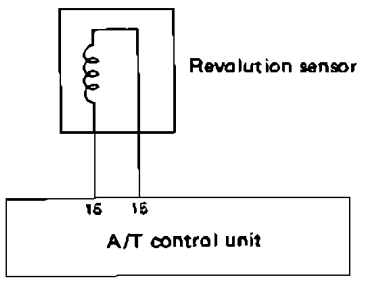
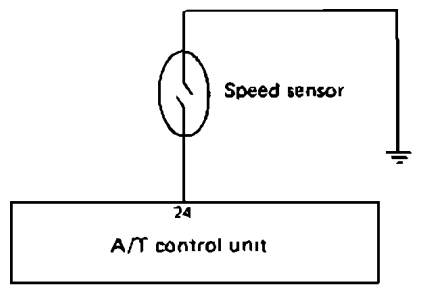
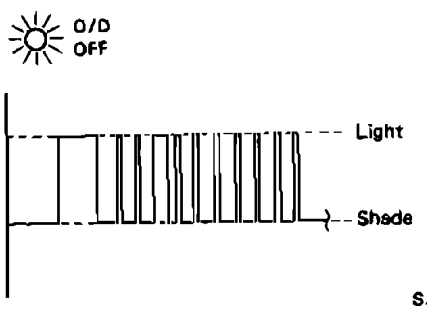
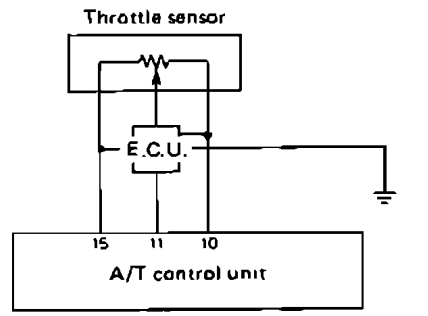
Set overdrive switch in "ON" position.

Check O.D. OFF indicator lamp.
Refer to JUDGEMENT OF SELF-DIAGNOSIS CODE on next page.

DIAGNOSIS END

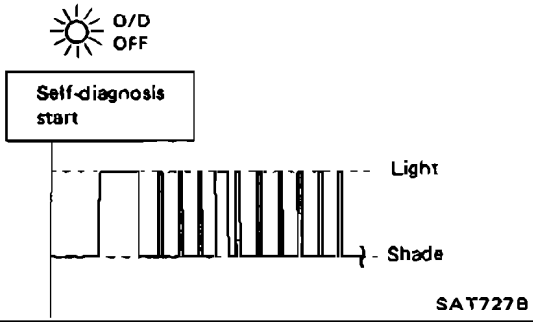
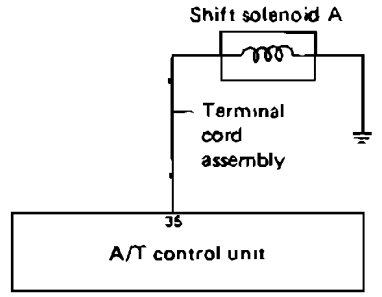
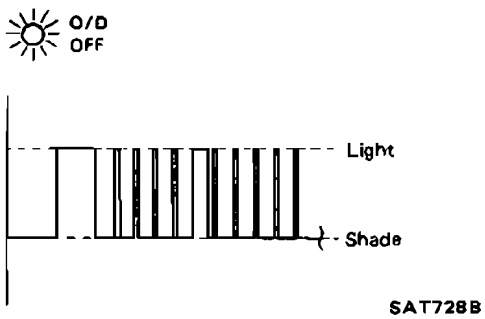
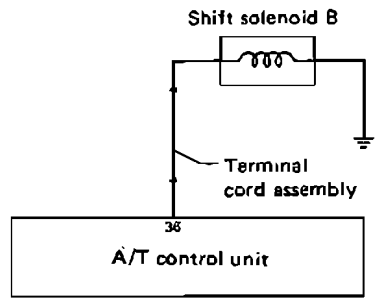
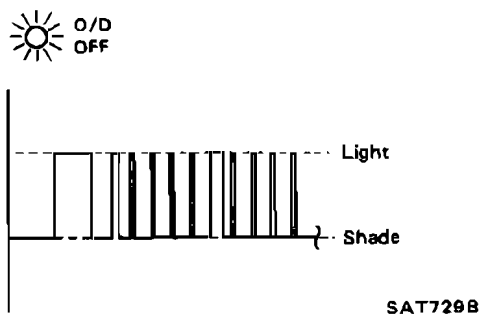
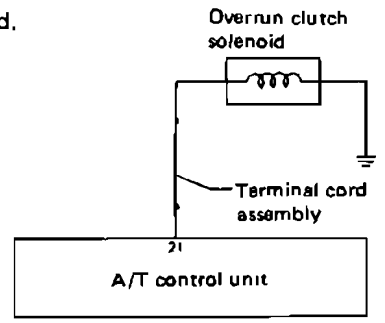
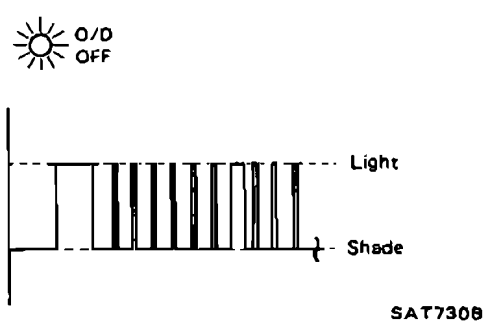
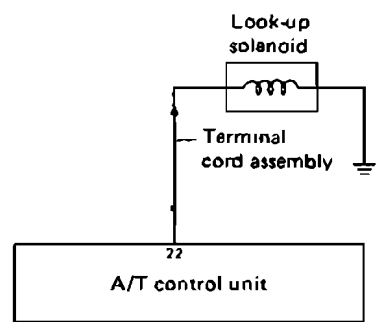
Self-diagnosis (Cont'd)

JUDGEMENT OF SELF-DIAGNOSIS CODE

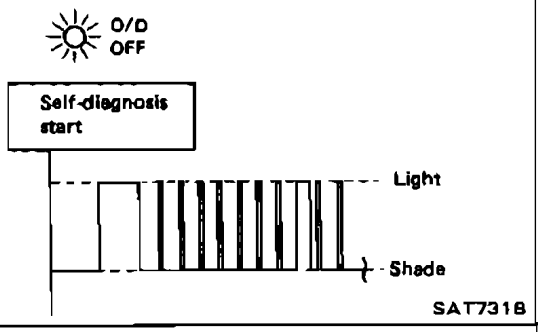
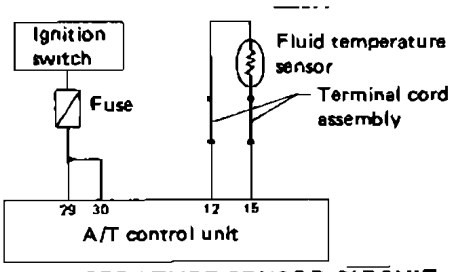
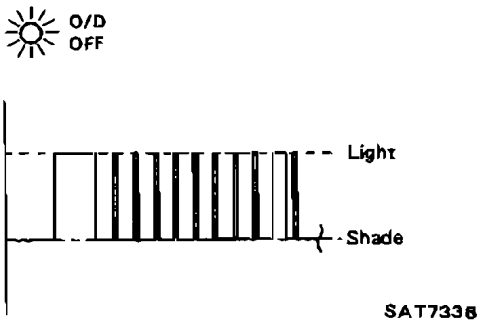
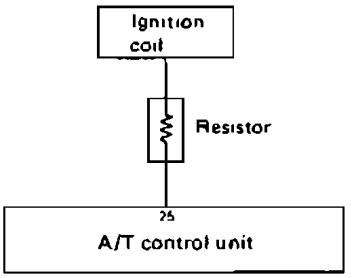
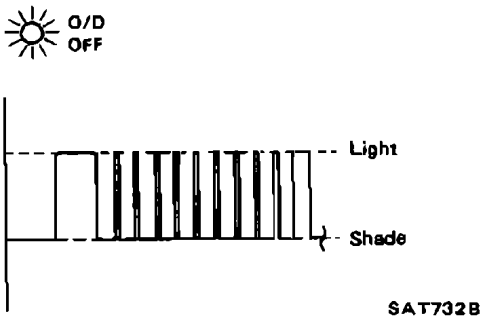
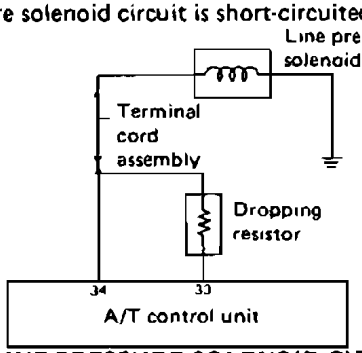
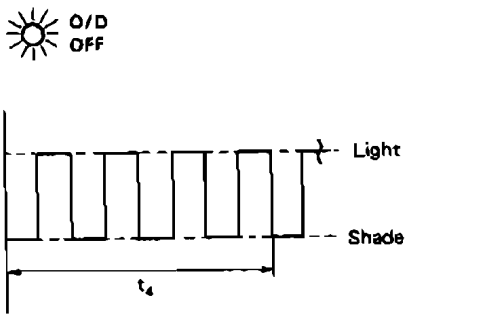
O.D. OFF indicator lamp:	Damaged circuit
All judgement flickers are same.  SAT723B	All circuits that can be confirmed by self-diagnosis are O.K.
1st judgement flicker is longer than others.  SAT724B	Revolution sensor circuit is short-circuited or disconnected.  ➡ Go to REVOLUTION SENSOR CIRCUIT CHECK. SAT140B
2nd judgement flicker is longer than others. SAT725B	Speed sensor circuit is short-circuited or disconnected.  ➡ Go to SPEED SENSOR CIRCUIT CHECK. SAT760A
3rd judgement flicker is longer than others.  SAT726B	Throttle sensor circuit is short-circuited or disconnected.  ➡ Go to THROTTLE SENSOR CIRCUIT CHECK. SAT761A

t_1 = 2.5 seconds t_2 = 2.0 seconds t_3 = 1.0 second

Self-diagnosis (Cont'd)

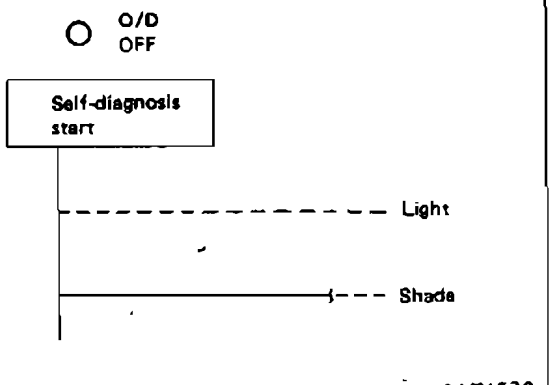
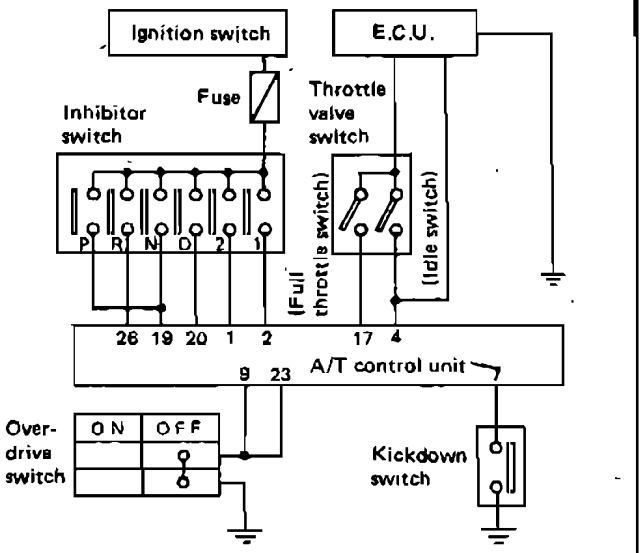
O.D. OFF indicator lamp:	Damaged circuit
4th judgement flicker is longer than others. 	Shift solenoid A circuit is short-circuited or disconnected.  ➡ Go to SHIFT SOLENOID A CIRCUIT CHECK. SAT766A
5th judgement flicker is longer than others. 	Shift solenoid B circuit is short-circuited or disconnected.  ➡ 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)

O.D. OFF 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. SAT624B
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.)

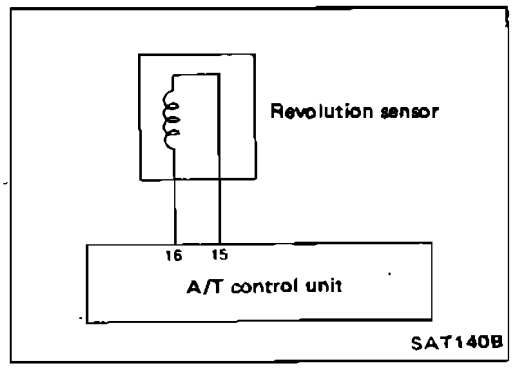
t_4 = 1.0 second

Self-diagnosis (Cont'd)

O.D. OFF indicator lamp:	Damaged circuit
Does not come on.  	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.** SAT736B

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.

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)

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.

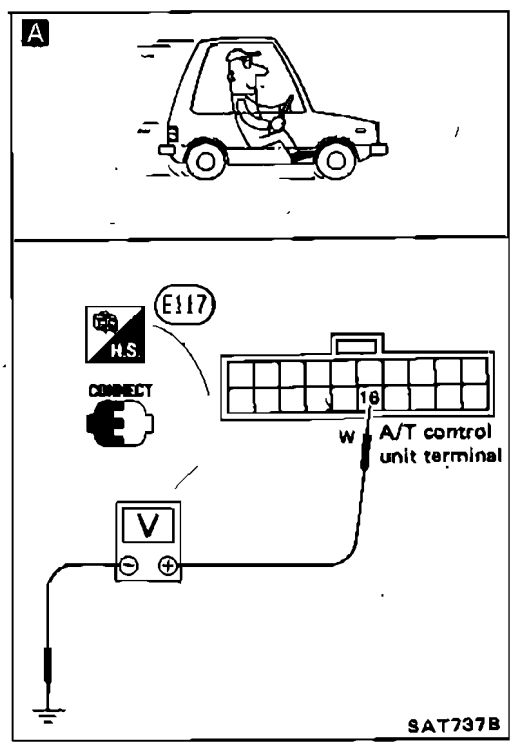
O.K. ↓

Perform self-diagnosis again after driving for a while.

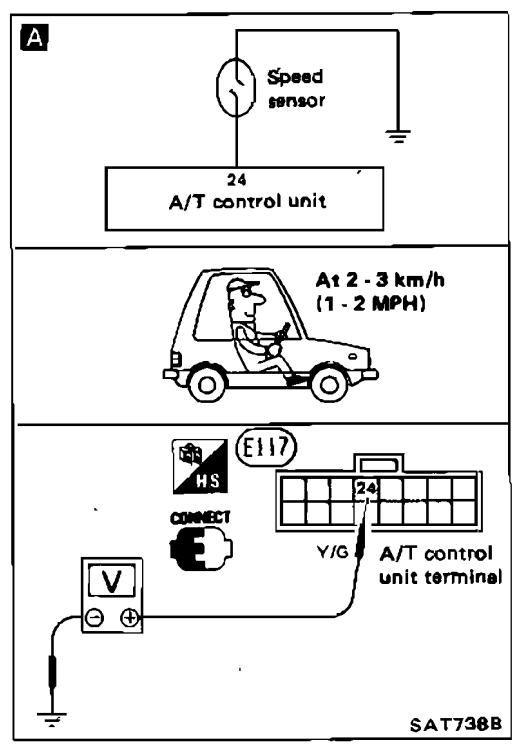
N.G. → 1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

O.K. ↓

INSPECTION END



SPEED SENSOR CIRCUIT CHECK



A

CHECK INPUT SIGNAL.

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

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)

O.K. ↓

Perform self-diagnosis again after driving for a while.

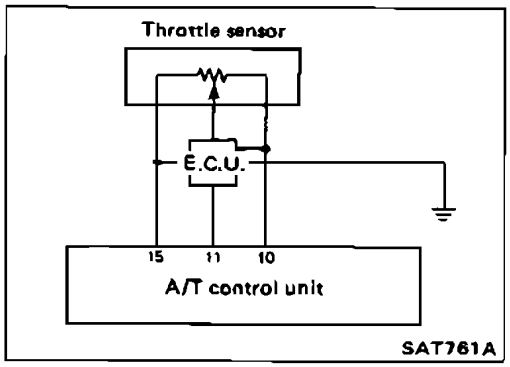
N.G. → 1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

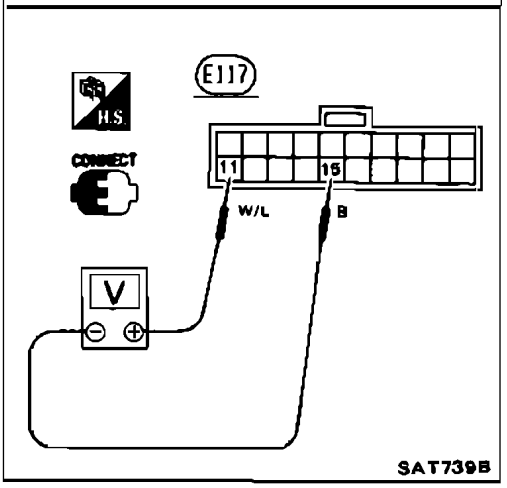
O.K. ↓

INSPECTION END

Self-diagnosis (Cont'd)

THROTTLE SENSOR CIRCUIT CHECK





Perform self-diagnosis (Mode III) for engine control. — N.G. → Check throttle sensor circuit for engine control. – Refer to section EF & EC.

O.K. ↓

A

CHECK INPUT SIGNAL. — N.G. → Check harness continuity between E.C.U. and A/T control unit regarding throttle sensor circuit. (Main harness)

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.)

O.K. ↓

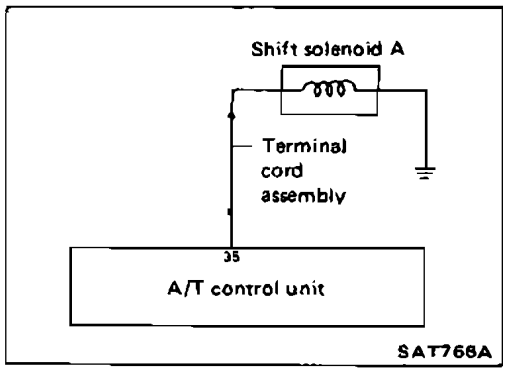
Perform self-diagnosis again after driving for a while. — N.G. → 1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

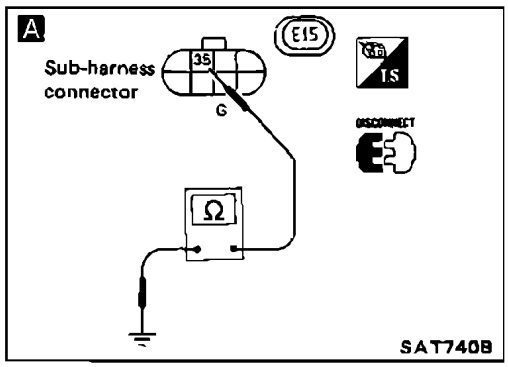
O.K. ↓

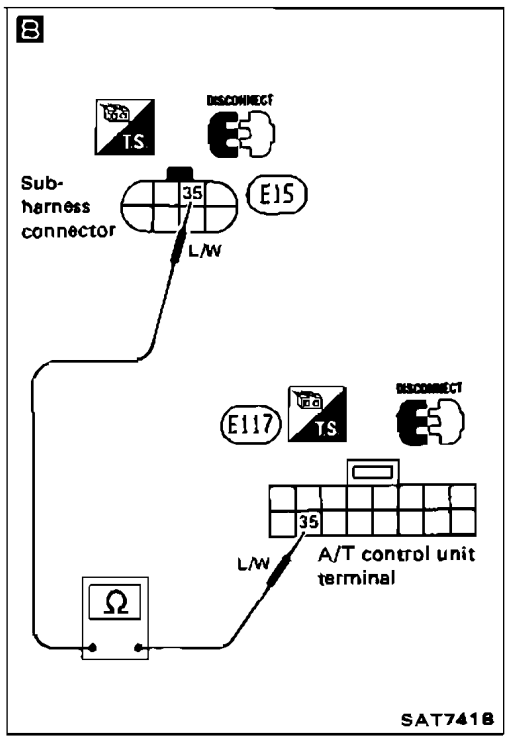
INSPECTION END

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.

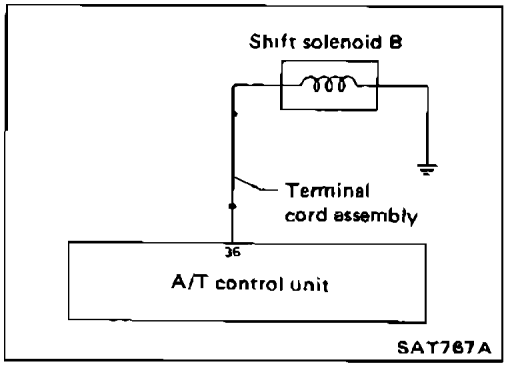
N.G. →
1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

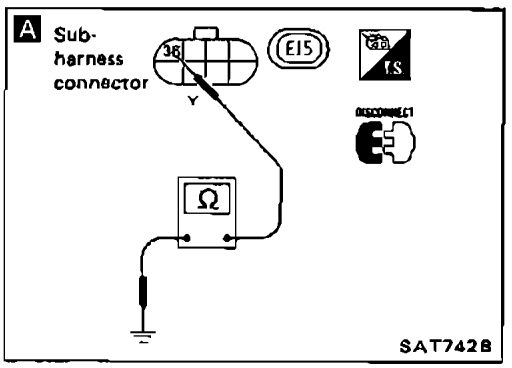
O.K. ↓

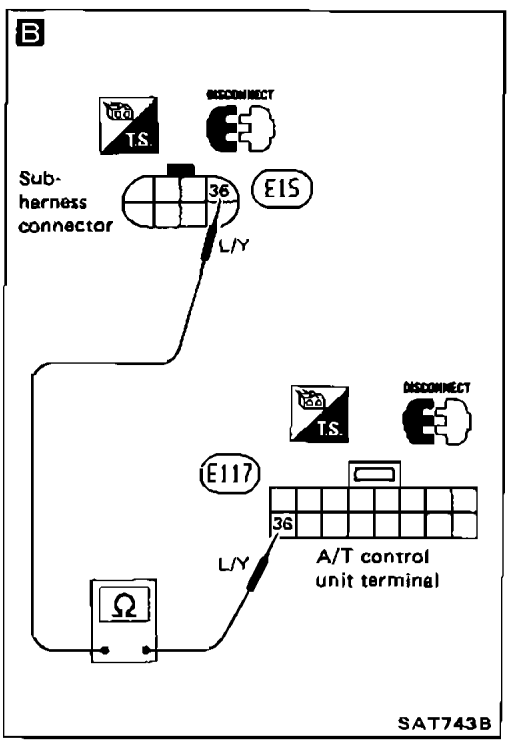
INSPECTION END

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.

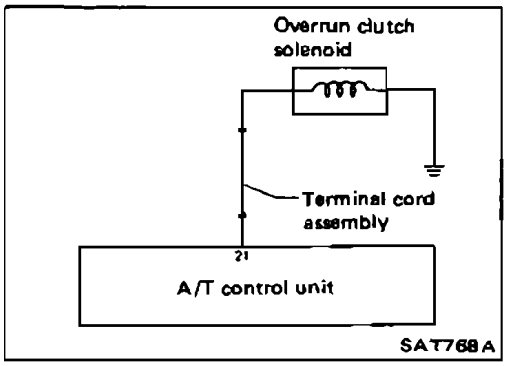
N.G. →
1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

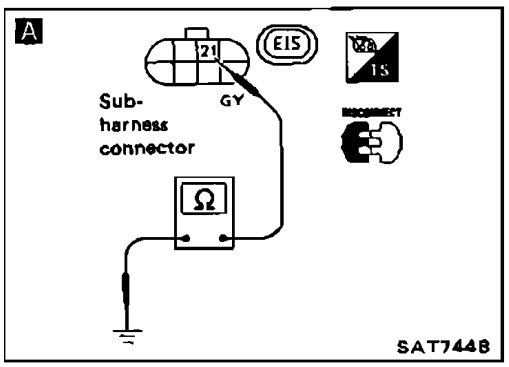
O.K. ↓

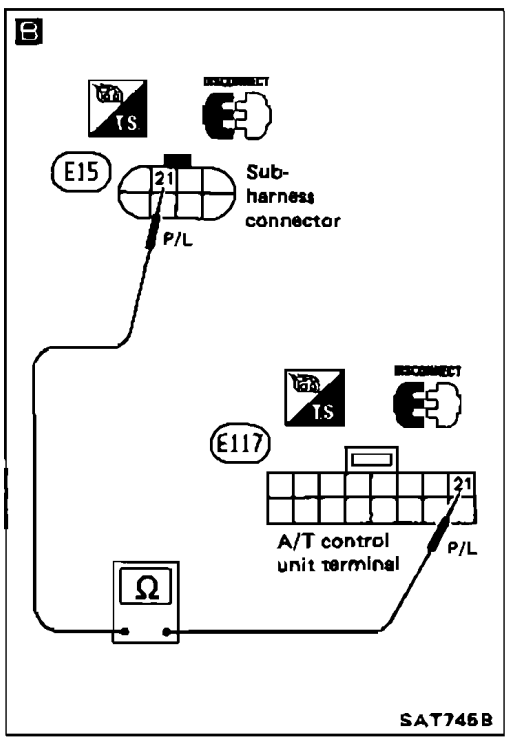
INSPECTION END

Self-diagnosis (Cont'd)

OVERRUN CLUTCH SOLENOID CIRCUIT CHECK







A

CHECK GROUND CIRCUIT.

1.

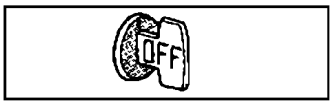
2. Disconnect terminal cord assembly connector in engine compartment.
3. Check resistance between terminal ㉑ and ground.
   Resistance: 20 - 30Ω

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.

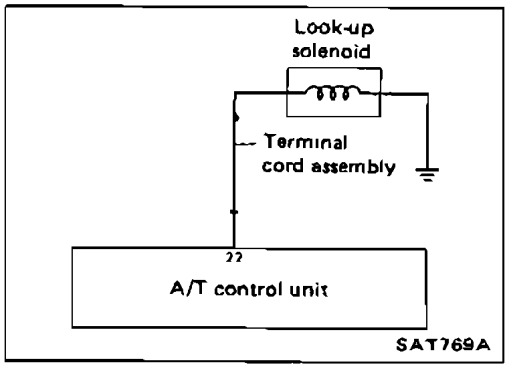
N.G. →
1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

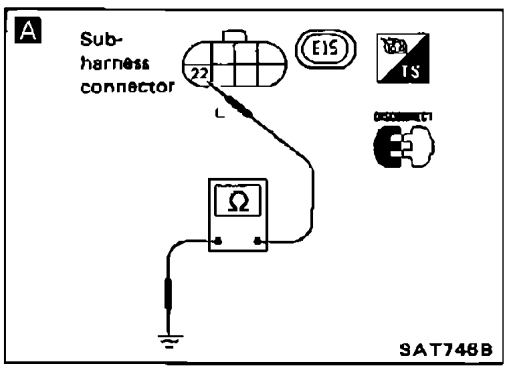
O.K. ↓

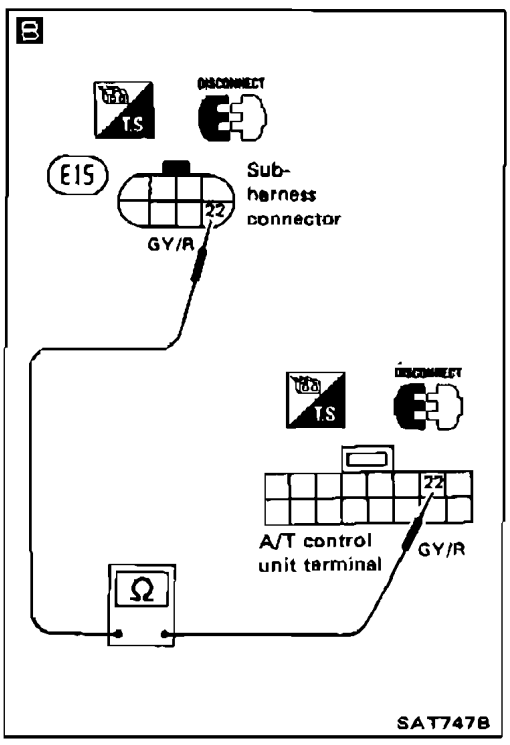
INSPECTION END

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.

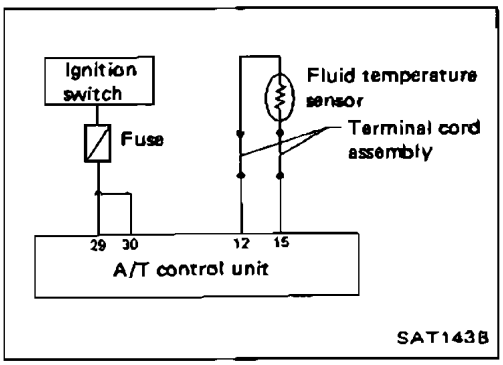
N.G. →
1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

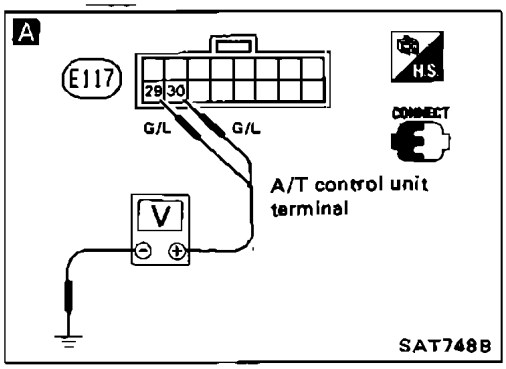
O.K. ↓

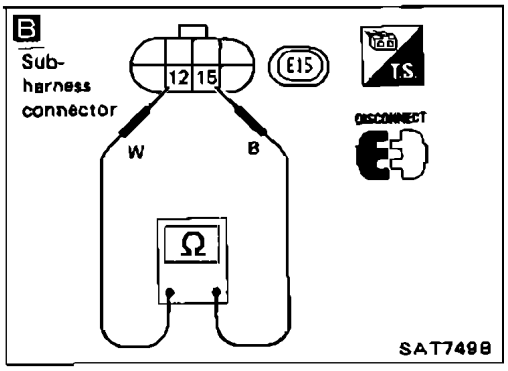
INSPECTION END

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.

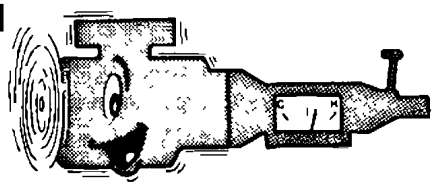
N.G. →
1. Remove oil pan.
2. Check the following items.
- Fluid temperature sensor
  — Refer to "Electrical Components Inspection".
- Harness continuity of terminal cord assembly

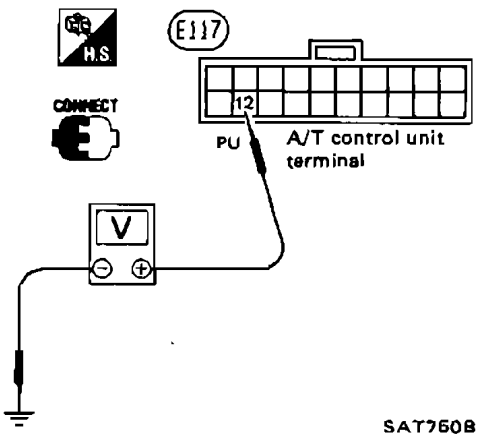
O.K. ↓

Ⓐ

Self-diagnosis (Cont'd)

C





(A)

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)

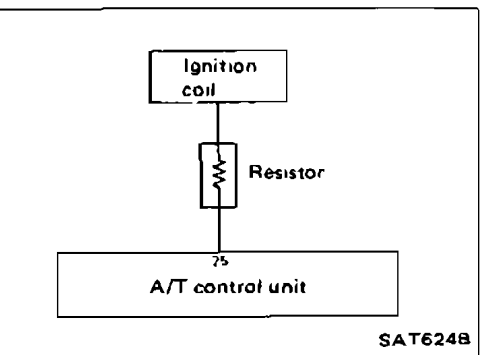
O.K. ↓

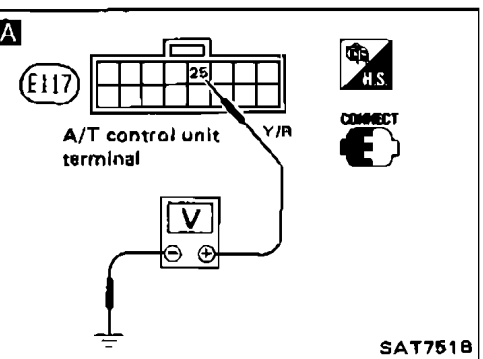
Perform self-diagnosis after driving for a while.

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 (Mode III) 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.

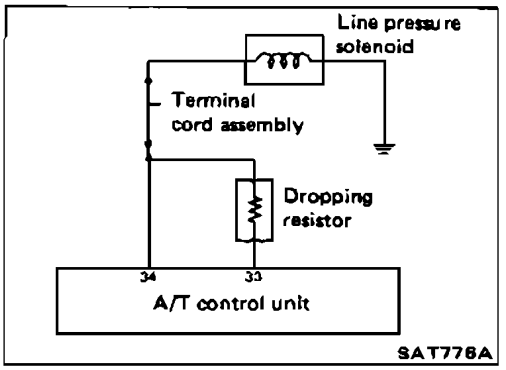
N.G. → 1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

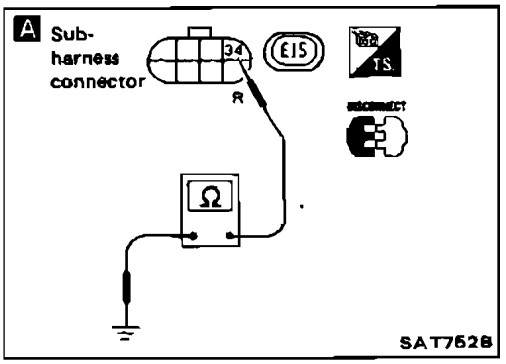
O.K. ↓

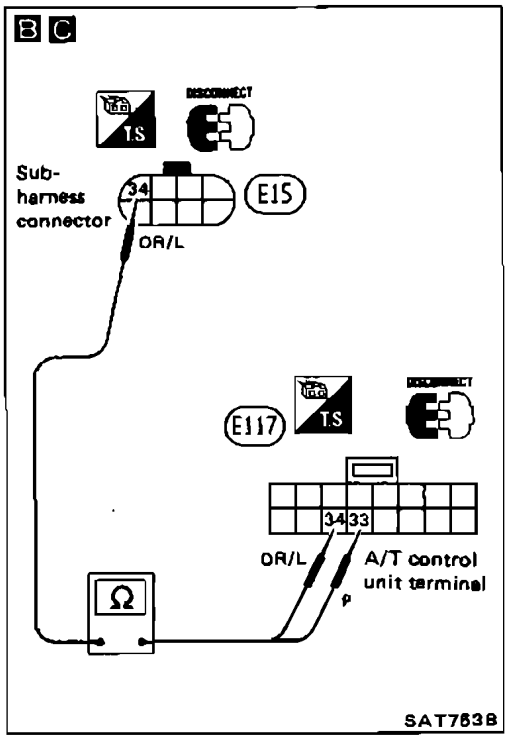
INSPECTION END

Self-diagnosis (Cont'd)

LINE PRESSURE SOLENOID CIRCUIT CHECK

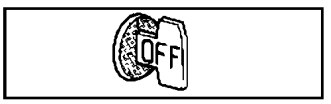






A

CHECK GROUND CIRCUIT.

1. 

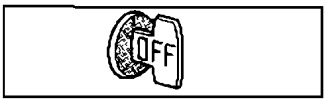
2. Disconnect terminal cord assembly connector in engine compartment.
3. Check resistance between terminal ㉞ and ground.
   Resistance: 2.5 - 5Ω

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.

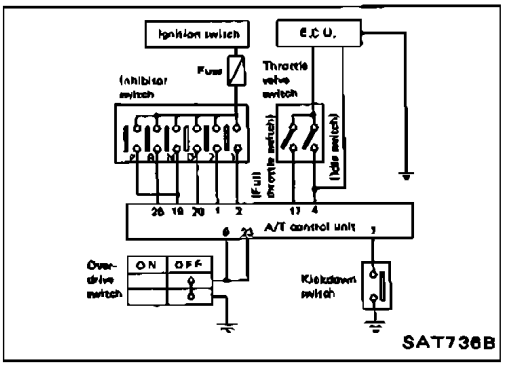
N.G. →
1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

O.K. ↓

INSPECTION END

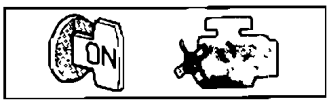
Self-diagnosis (Cont'd)

INHIBITOR, OVERDRIVE, KICKDOWN AND IDLE SWITCH CIRCUIT CHECKS



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.

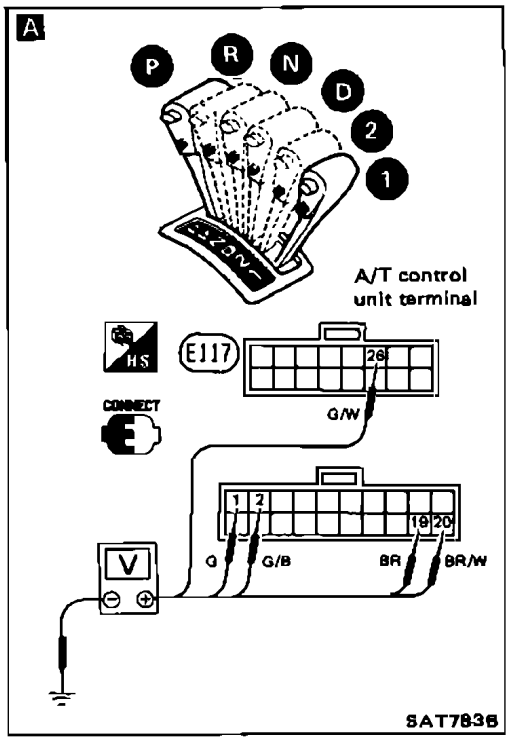
1.

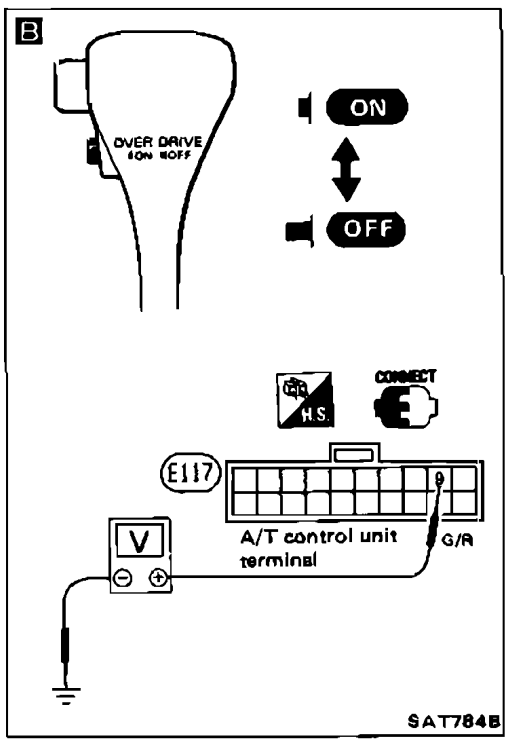
2. Check voltage between A/T control unit terminal ⑨ and ground when overdrive switch is in "ON" position and in "OFF" position.

Switch position	Voltage
ON	Battery voltage
OFF	1V or less

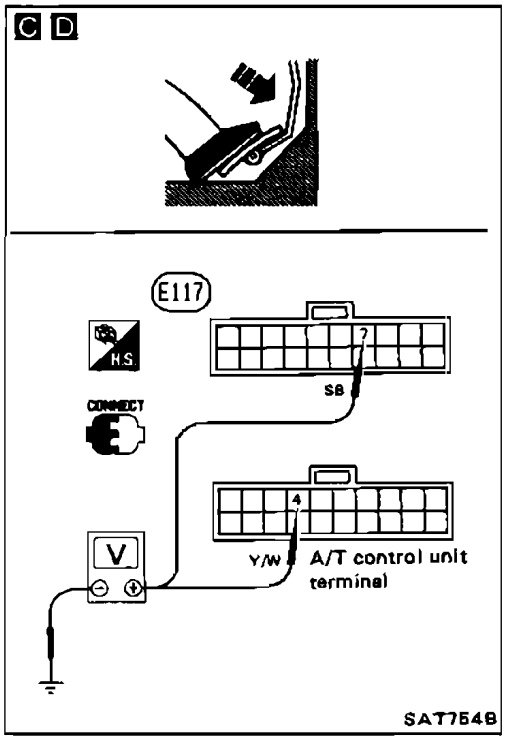
N.G. → Check the following items.
- Overdrive switch — Refer to "Electrical Components Inspection".
- Harness continuity between A/T control unit and overdrive switch (Main harness)
- Harness continuity of ground circuit for overdrive switch (Main harness)

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 (Mode [V]) 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.

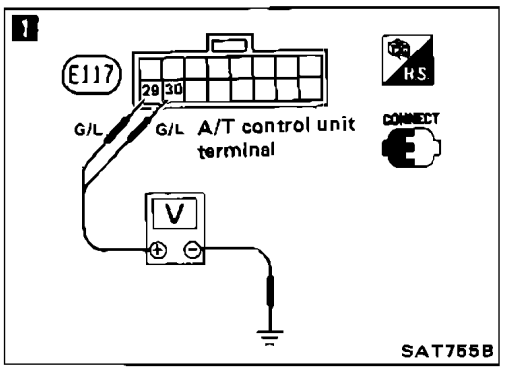
O.K. ↓

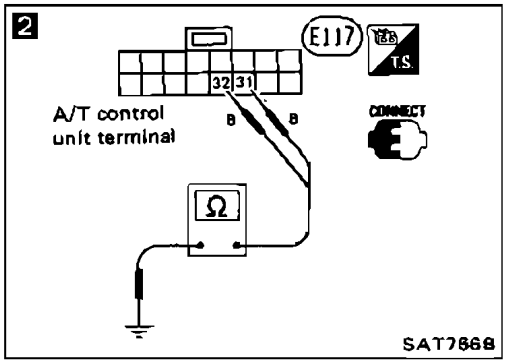
Perform self-diagnosis again after driving for a while.

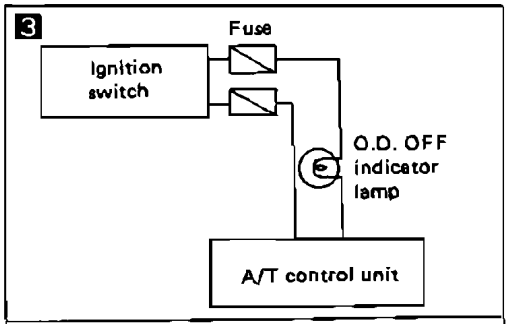
N.G. → 1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

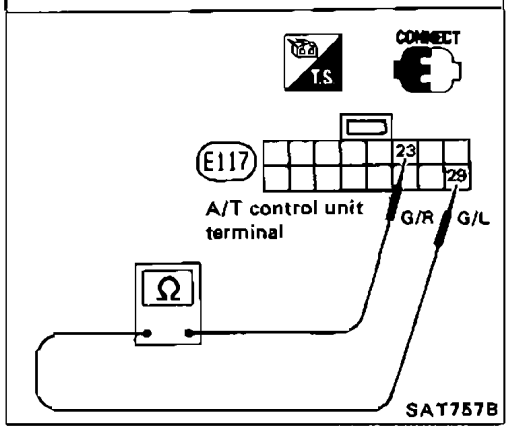
O.K. ↓

INSPECTION END









Diagnostic Procedure 1

SYMPTOM: O.D. OFF 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.

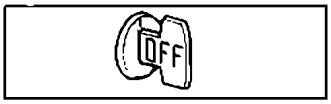
2. Disconnect A/T control unit 16-pin connector.
3. Check resistance between A/T control unit terminals ㉛, ㉜ and ground.
   Resistance:
   Approximately 0Ω

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.
- O.D. OFF indicator lamp
  — Refer to section EL.
- Harness continuity between ignition switch and O.D. OFF indicator lamp (Main harness)
- Harness continuity between O.D. OFF indicator lamp and A/T control unit

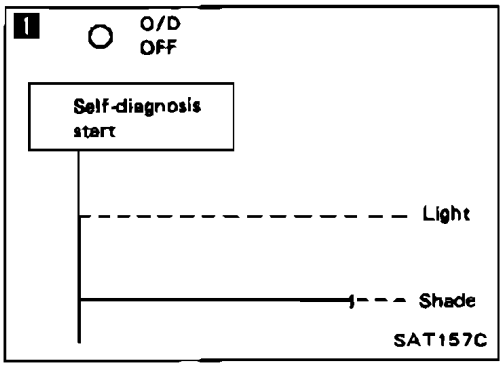
O.K. ↓

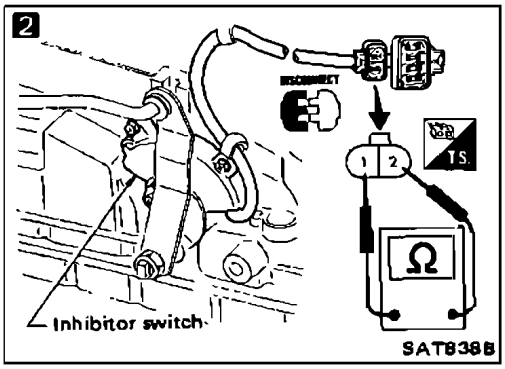
Check again.

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: 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

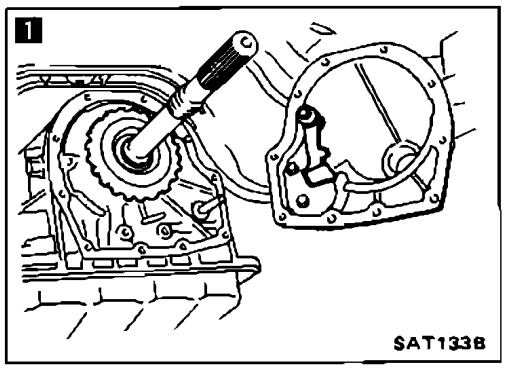
Check continuity of inhibitor switch 2-pin connector. — Refer to "Electrical Components Inspection". — N.G. → Repair or replace inhibitor switch.

O.K. ↓

Check starting system. — Refer to section EL. — N.G. → Repair or replace damaged parts.

O.K. ↓

INSPECTION END



Diagnostic Procedure 3

SYMPTOM: Vehicle moves when it is pushed forward or backward with selector lever in "P" range.

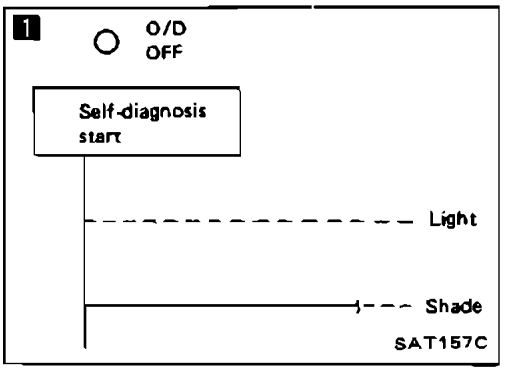
1

Check parking components. — Refer to "ON-VEHICLE SERVICE". — N.G. → Repair or replace damaged parts.

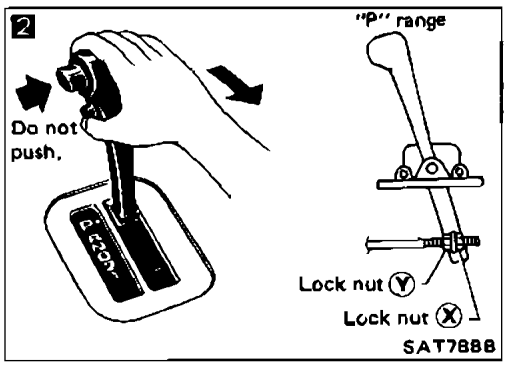
O.K. ↓

INSPECTION END

1

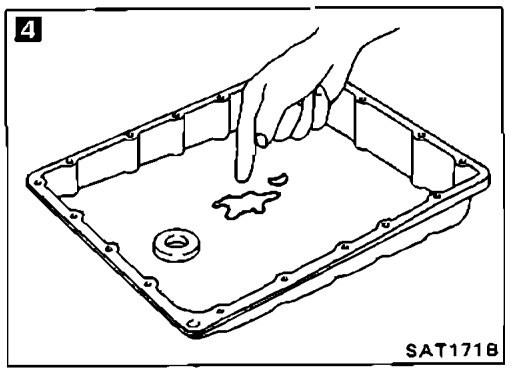


2



3

4



Diagnostic Procedure 4

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 linkage. – Refer to "ON-VEHICLE SERVICE".

N.G. → Adjust manual control linkage. – 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.

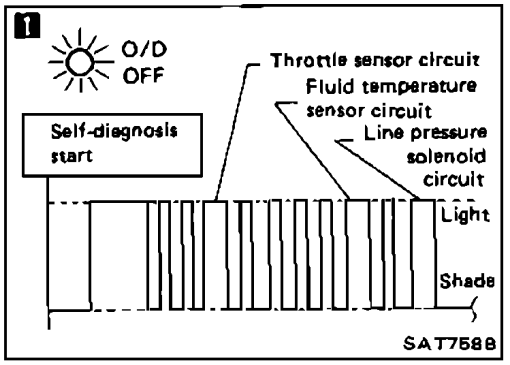
Check again.

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.

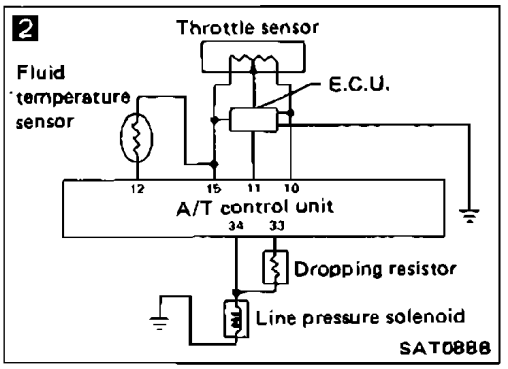
O.K.

INSPECTION END

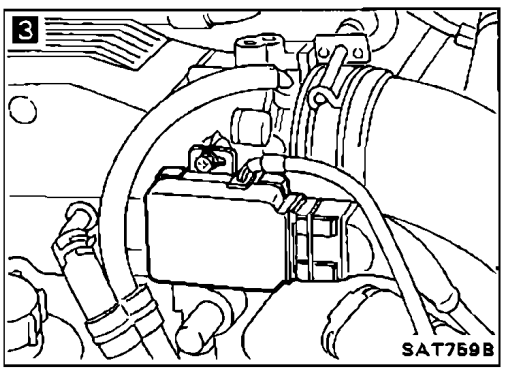
1



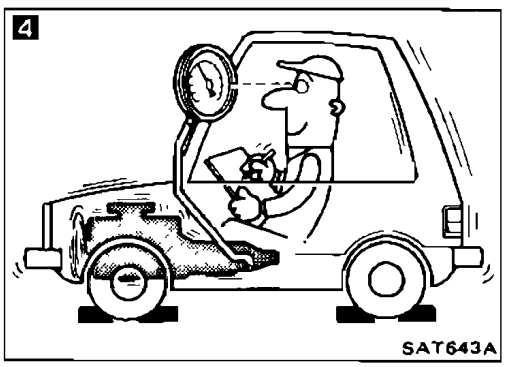
2



3



4



Diagnostic Procedure 5

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

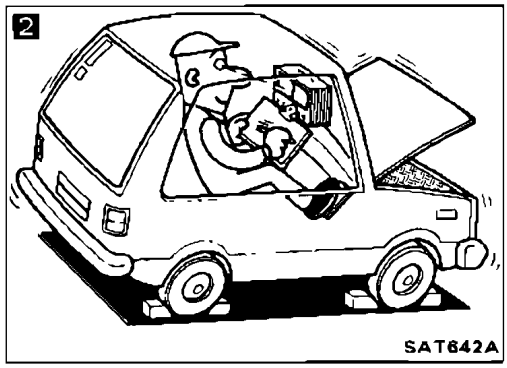
O.K. ↓

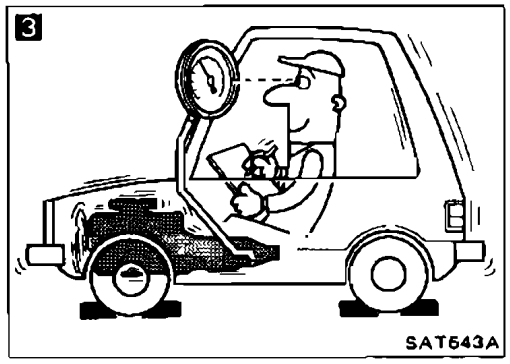
Check again.

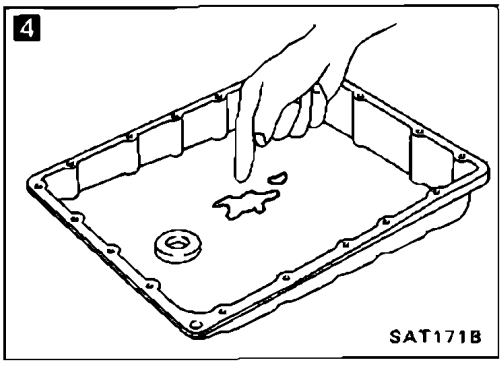
N.G. →
1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

O.K. ↓

INSPECTION END







Diagnostic Procedure 6

SYMPTOM: Vehicle does not creep backward when selecting "R" range.

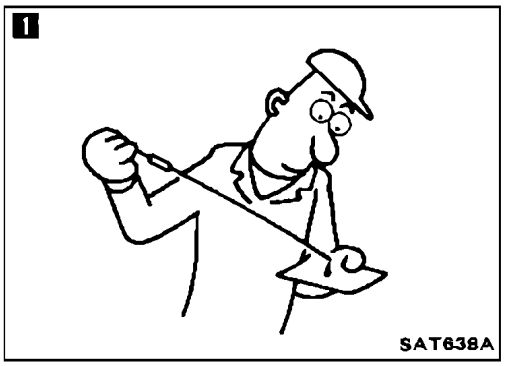
1 Check A/T fluid level again.
- N.G. → Refill A.T.F.
- O.K. → **2**

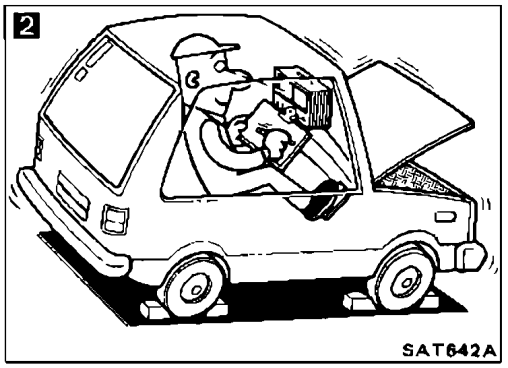
2 Check stall revolution with selector lever in "1" and "R" range.
- N.G. in both "1" and "R" range → 1. Remove control valve assembly. – Refer to "ON-VEHICLE SERVICE". 2. Check the following items. • Valves to control line pressure (Pressure regulator valve, pilot valve and pilot filter) • Line pressure 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. in "1" range, N.G. in "R" range → same as above
- O.K. → **3**

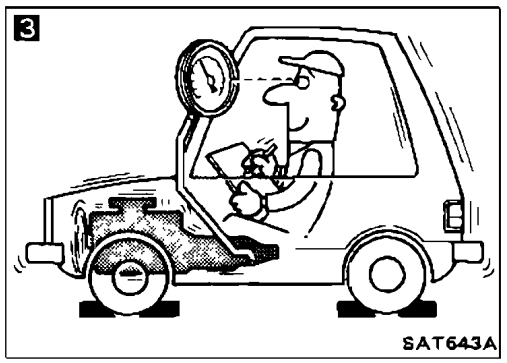
3 Check line pressure at idle with selector lever in "R" range. – Refer to "PRESSURE TESTING".
- N.G. → same as above
- O.K. → **4**

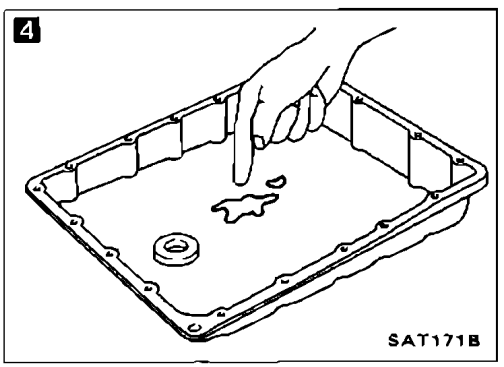
4
1. Remove oil pan.
2. Check fluid condition.

- N.G. → same as above
- 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 7

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. →
- O.K. →

3 Check line pressure at idle with selector lever in "D" range. — Refer to "PRESSURE TESTING".
- N.G. →
- O.K. →

4
1. Remove oil pan.
2. Check A/T fluid condition.

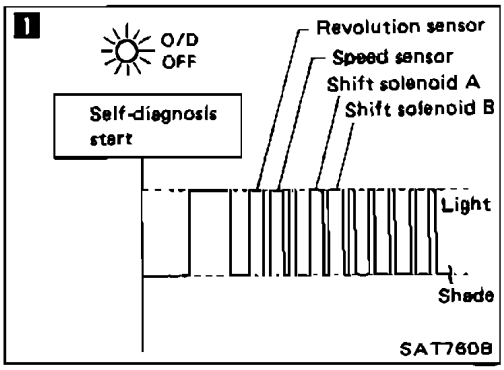
- N.G. →
- O.K. →

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

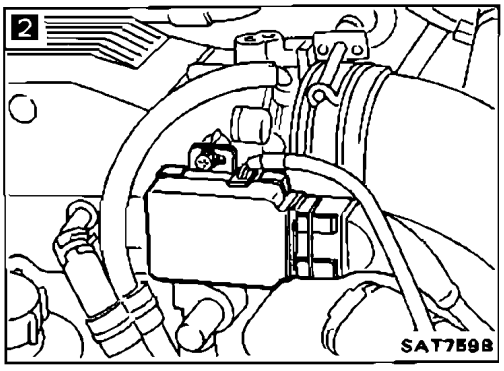
Check again.
- N.G. →
  1. Perform A/T control unit input/output signal inspection.
  2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.
- O.K. →

INSPECTION END

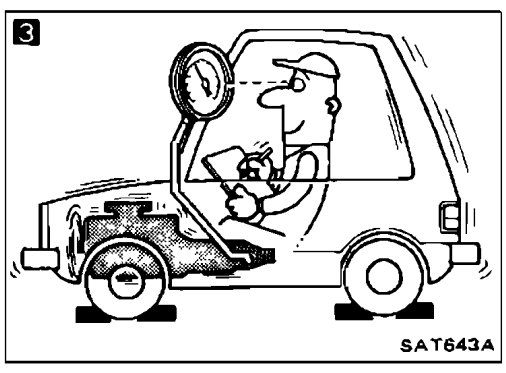
1



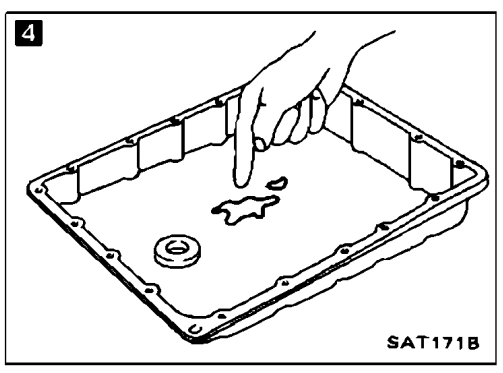
2



3



4



Diagnostic Procedure 8

SYMPTOM: Vehicle cannot be started from D₁ on Cruise test — Part 1.

Is Diagnostic Procedure 7 O.K.? — No → Go to Diagnostic Procedure 7.

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. → (1. 2. 3. 4. above)

N.G. → (1. 2. above)

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

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: 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 7 and 8 O.K.?
- No → Go to Diagnostic Procedure 7 or 8.
- 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

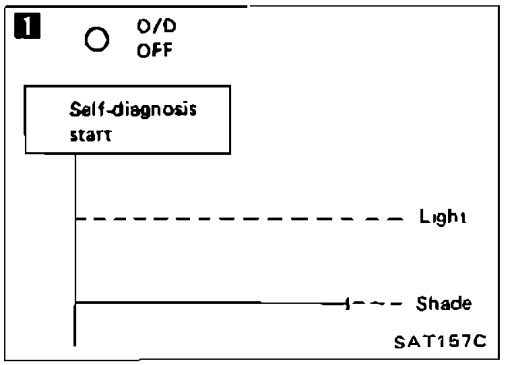
  O.K. ↑
3. Disassemble A/T.
4. Check the following items.
  - Servo piston assembly
  - Brake band
  - Oil pump assembly

  O.K. ↑
- O.K. ↓

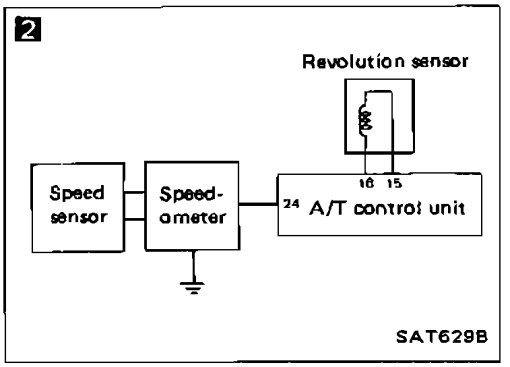
5 Check again.
- N.G. → 1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.
- O.K. ↓

INSPECTION END

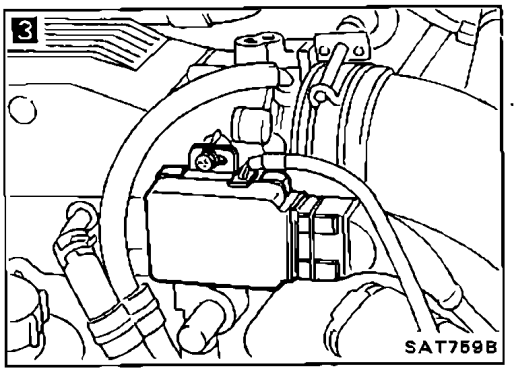
1



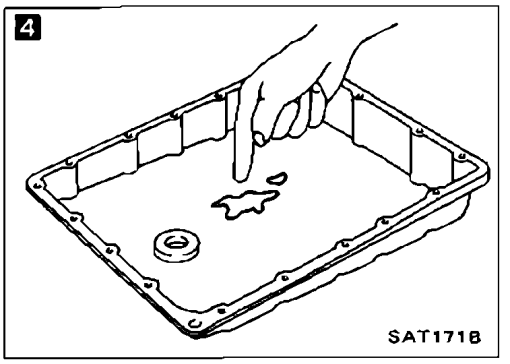
2



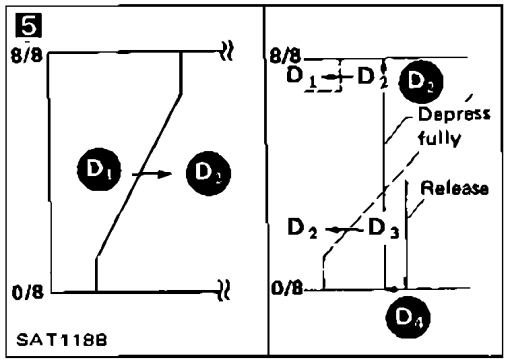
3

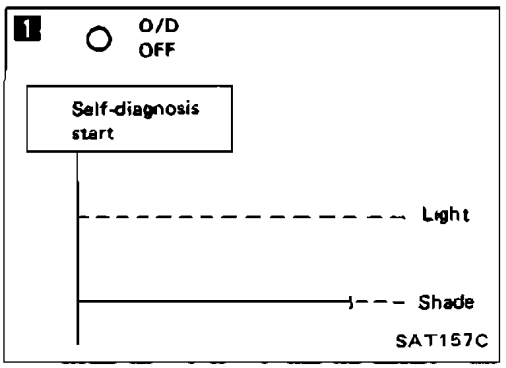


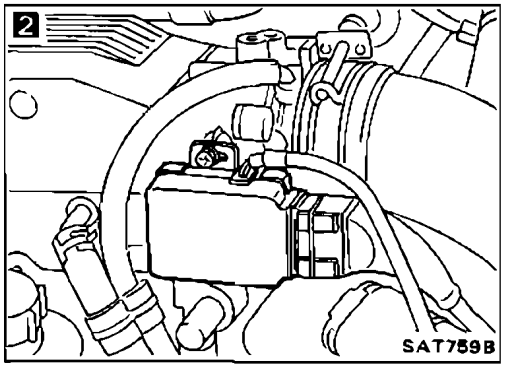
4

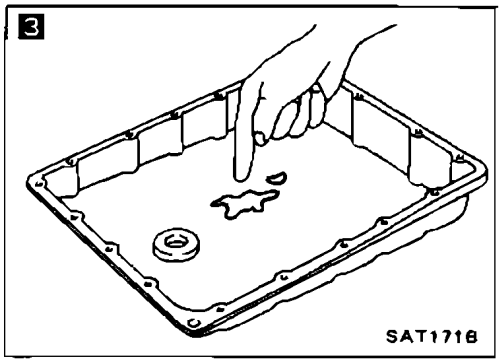


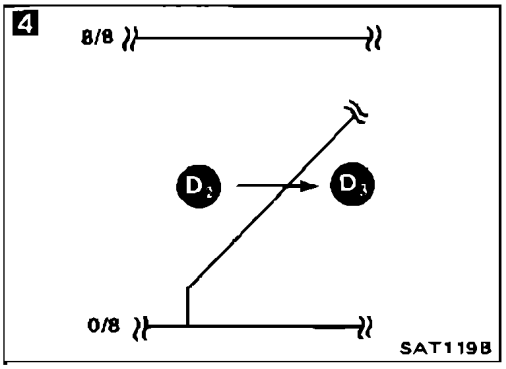
5











Diagnostic Procedure 10

SYMPTOM: A/T does not shift from D_2 to D_3 at the specified speed.

Are Diagnostic Procedures 7 and 8 O.K.? — No → Go to Diagnostic Procedure 7 or 8.

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. ↑ / O.K. ↑

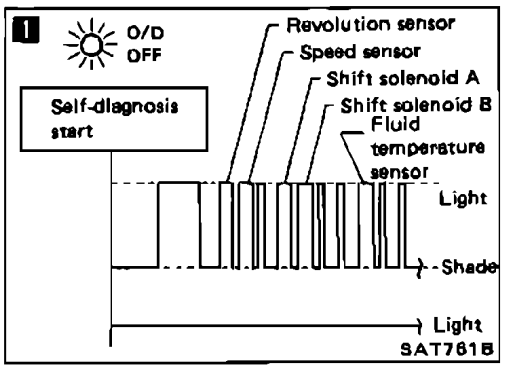
   3. Disassemble A/T.
   4. Check the following items.
      - Servo piston assembly
      - High clutch assembly
      - Oil pump assembly

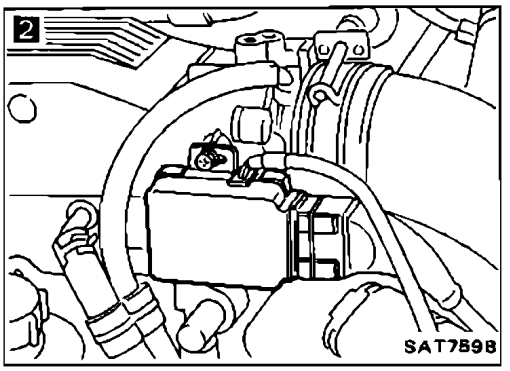
O.K. ↓

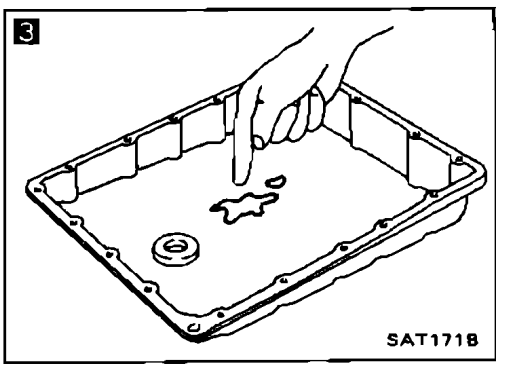
4 Check again. — N.G. →
1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

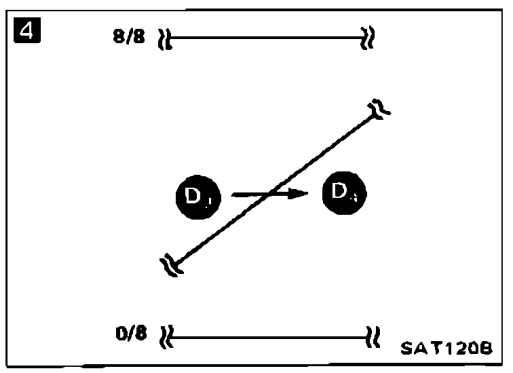
O.K. ↓

INSPECTION END









Diagnostic Procedure 11

SYMPTOM: A/T does not shift from D_3 to D_4 at the specified speed.

Are Diagnostic Procedures 7 and 8 O.K.? — No → Go to Diagnostic Procedure 7 or 8.

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. ↓

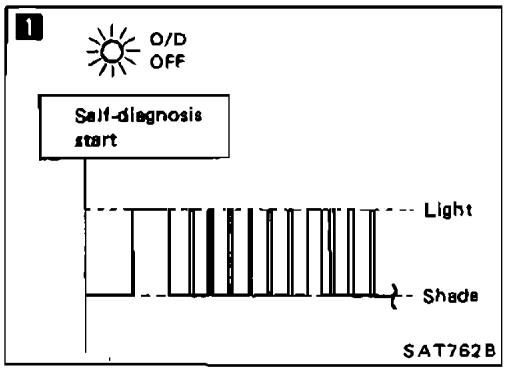
3 1. Remove oil pan.
2. Check A/T fluid condition. — N.G. →
   1. Remove control valve assembly. – Refer to "ON-VEHICLE SERVICE".
   2. Check the following items.
      - Shift valve B
      - Overrun clutch control valve
      - Shift solenoid B
      - Pilot valve
      - Pilot filter
   3. Disassemble A/T.
   4. Check the following items.
      - Servo piston assembly
      - Brake band
      - Torque converter
      - Oil pump assembly

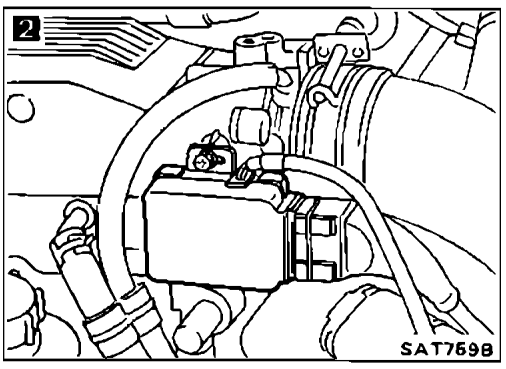
O.K. ↓

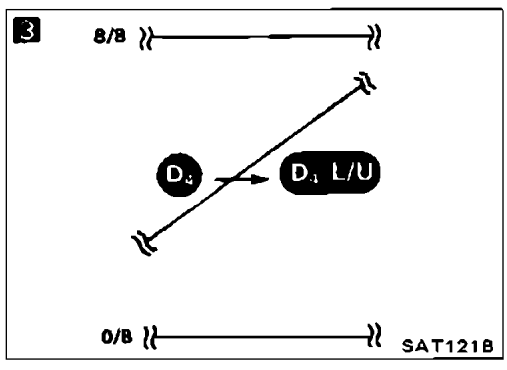
4 Check again. — N.G. → 1. Perform A/T control unit input/output signal inspection. 2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

O.K. ↓

INSPECTION END







Diagnostic Procedure 12

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. ↓

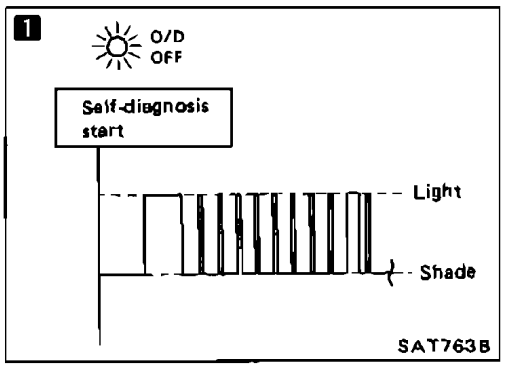
3

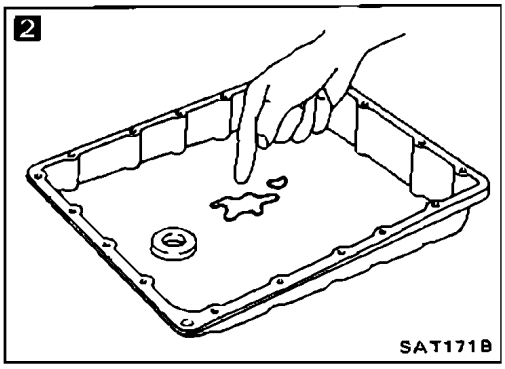
Check again.

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 13

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.

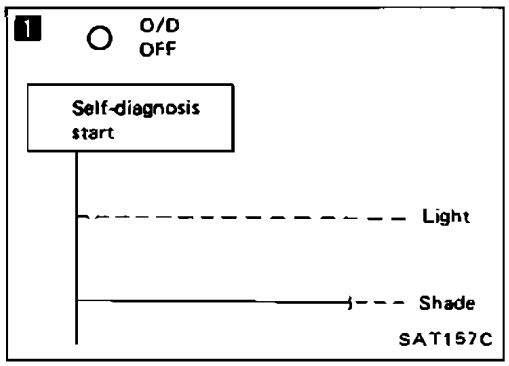
O.K.

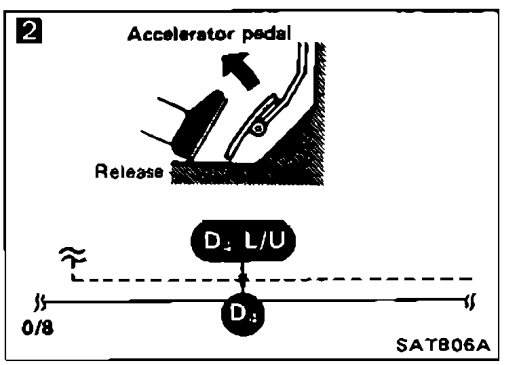
Check again.

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: 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

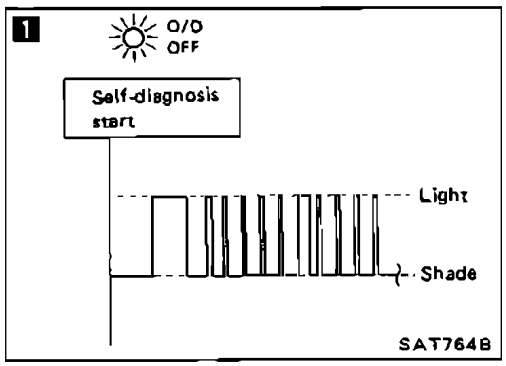
2

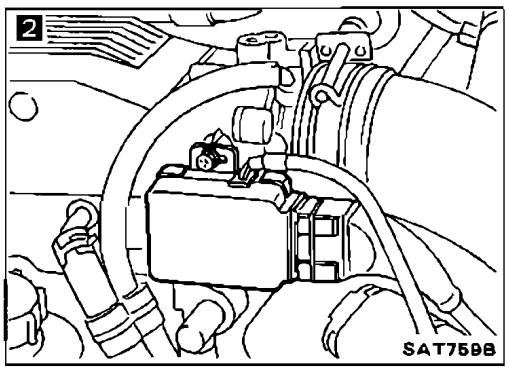
Check again.

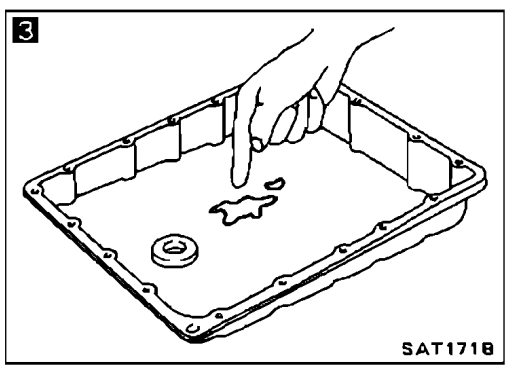
N.G. →
1. Perform A/T control unit input/output signal inspection.
2. If N.G., recheck A/T control unit pin terminals for damage or connection of A/T control unit harness connector.

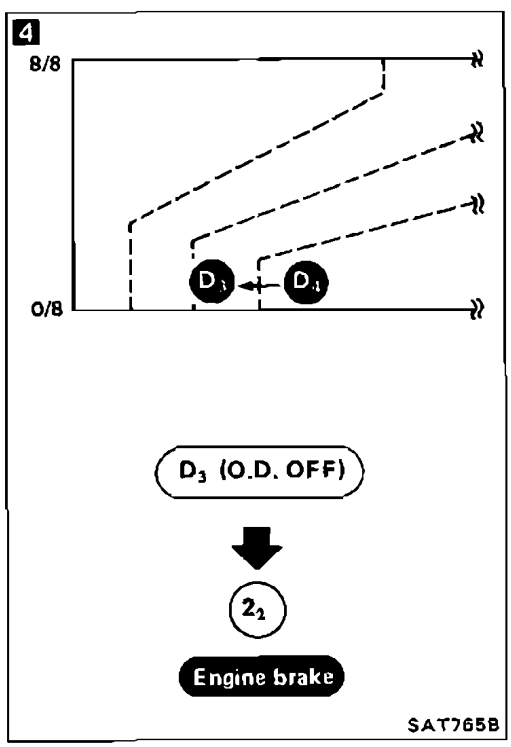
O.K.

INSPECTION END









Diagnostic Procedure 15

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.

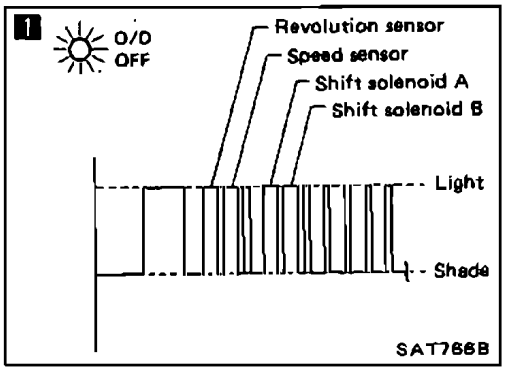
1 Does self-diagnosis show damage to overrun clutch solenoid circuit after cruise test?
- Yes → Check overrun clutch solenoid circuit. – Refer to "Self-diagnosis".
- No ↓

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. ↓ / O.K. →
3. Disassemble A/T.
4. Check the following items.
- Overrun clutch assembly
- 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 16

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".

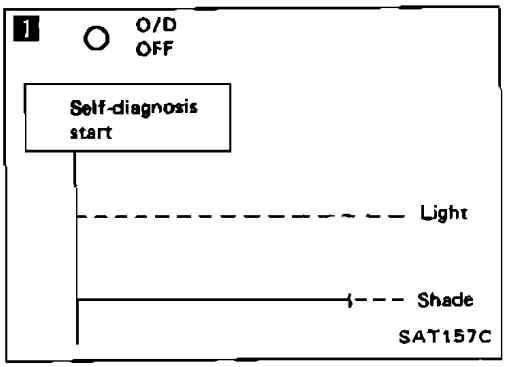
No

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 8.



Diagnostic Procedure 17

SYMPTOM: A/T does not shift from D_4 to D_3 when changing overdrive switch to "OFF" position.

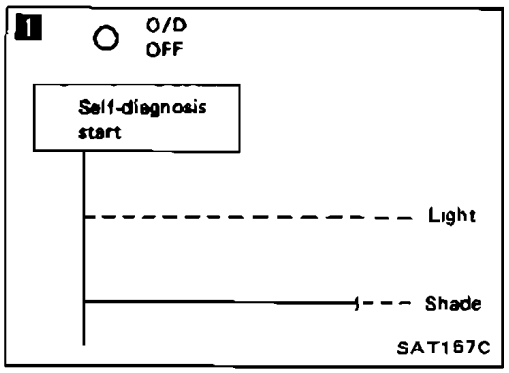
1

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 10.



Diagnostic Procedure 18

SYMPTOM: A/T does not shift from D_3 to 2_2 when changing selector lever from "D" to "2" range.

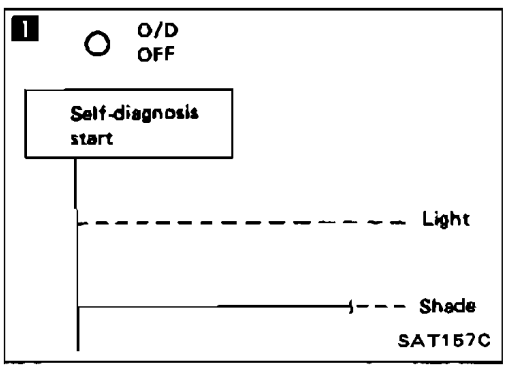
1

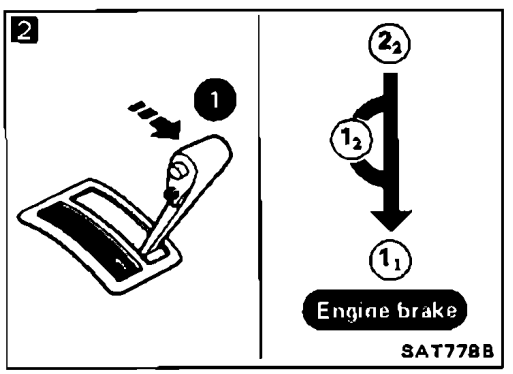
Does self-diagnosis show damage to inhibitor switch circuit after cruise test?

Yes → Check inhibitor switch circuit. — Refer to "Self-diagnosis".

No ↓

Go to Diagnostic Procedure 9.





Diagnostic Procedure 19

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 20

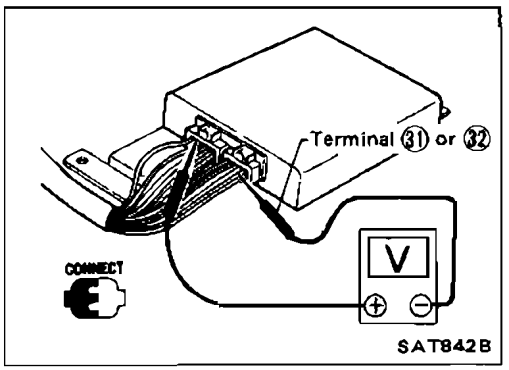
SYMPTOM: Vehicle does not decelerate by engine brake when shifting from 2_2 (1_2) to 1_1.

Is diagnostic procedure 6 O.K.?

No → Go to Diagnostic Procedure 6.

Yes ↓

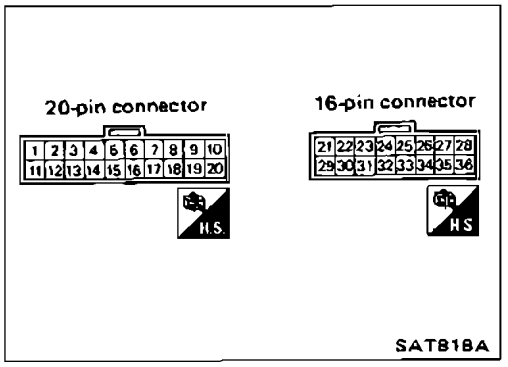
Go to Diagnostic Procedure 15.



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

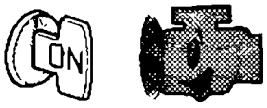
(Data are reference values.)

Terminal No.	Item	Condition		Judgement standard
1	Inhibitor "2" range switch		When setting selector lever to "D" range.	Battery voltage
			When setting selector lever to other ranges.	1V or less
2	Inhibitor "1" range switch		When setting selector lever to "1" range.	Battery voltage
			When setting selector lever to other ranges.	1V or less
3	–		–	–
4	Idle switch (in throttle valve switch)		When releasing accelerator pedal after warming up engine.	8 - 15V
			When depressing accelerator pedal after warming up engine.	1V or less
5	–		–	–
6	A.S.C.D. O.D. cut signal		When releasing "ACCEL" set switch on A.S.C.D. cruise.	5 - 8V
			When applying "ACCEL" set switch on A.S.C.D. cruise.	1V or less

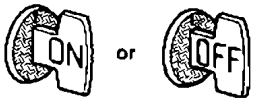
Electrical Components Inspection (Cont'd)

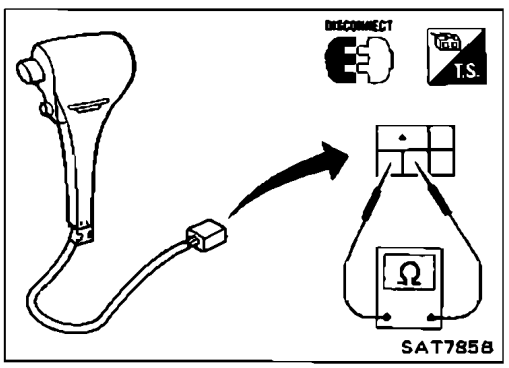
Terminal No.	Item	Condition		Judgement standard
7	Kickdown switch		When releasing accelerator pedal after warming up engine.	3 - 8V
			When depressing accelerator pedal fully after warming up engine.	1V or less
8	A.S.C.D. cruise signal		When performing A.S.C.D. cruise. ("CRUISE" light comes on.)	Battery voltage
			When not performing A.S.C.D. cruise. ("CRUISE" light does not come on.)	1V or less
9	Overdrive switch		When setting overdrive switch in "ON" position.	Battery voltage
			When setting overdrive switch in "OFF" position.	1V or less
10	Throttle sensor (Power source)		–	4.5 - 5.5V
11	Throttle sensor		When depressing accelerator pedal 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 cruises at 30 km/h (19 MPH).	1V or more Voltage rises gradually in response to vehicle speed.
			When vehicle parks.	0V

Electrical Components Inspection (Cont'd)

Terminal No.	Item	Condition		Judgement standard
17	Full throttle switch		When depressing accelerator pedal more than half-way after warming up engine.	8 - 15V
			When releasing accelerator pedal after warming up engine.	1V or less
18	–		–	–
19	Inhibitor "N" and "P" range switch		When setting selector lever to "N" or "P" range.	Battery voltage
			When setting selector lever to other ranges.	1V or less
20	Inhibitor "D" range switch		When setting selector lever to "2" range.	Battery voltage
			When setting selector lever to other ranges.	1V or less
21	Overrun clutch solenoid		When overrun clutch solenoid operates.	Battery voltage
			When overrun clutch solenoid does not operate.	1V or less
22	Lock-up solenoid		When A/T performs lock-up.	8 - 15V
			When A/T does not perform lock-up.	1V or less
23	O.D. OFF indicator lamp		When setting overdrive switch to "ON" position.	Battery voltage
			When setting overdrive switch to "OFF" position.	1V or less
24	Speed sensor		When moving vehicle 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 runs at idle speed.	9.5 - 12V
			When engine runs at 2,500 rpm.	Approximately 10V
26	Inhibitor "R" range switch		When setting selector lever to "R" range.	Battery voltage
			When setting selector lever to other ranges.	1V or less
27	–		–	–

Electrical Components Inspection (Cont'd)

Terminal No.	Item	Condition		Judgement standard
28	Power source (Back-up)		When turning ignition switch to "OFF".	Battery voltage
			When turning ignition switch to "ON".	Battery voltage
29 30	Power source		When turning ignition switch to "ON".	Battery voltage
			When turning ignition switch to "OFF".	1V or less
31 32	Ground		—	—
33	Line pressure solenoid (with dropping resistor)		When releasing accelerator pedal after warming up engine.	5 - 14V
			When depressing accelerator pedal fully after warming up engine.	0.5V or less
34	Line pressure solenoid		When releasing accelerator pedal after warming up engine.	1.5 - 2.5V
			When depressing accelerator pedal fully after warming up engine.	0.5V or less
35	Shift solenoid A		When shift solenoid A operates. (When driving in "D_1" or "D_4".)	Battery voltage
			When shift solenoid A does not operate. (When driving in "D_2" or "D_3".)	1V or less
36	Shift solenoid B		When shift solenoid B operates. (When driving in "D_1" or "D_2".)	Battery voltage
			When shift solenoid B does not operate. (When driving in "D_3" or "D_4".)	1V or less



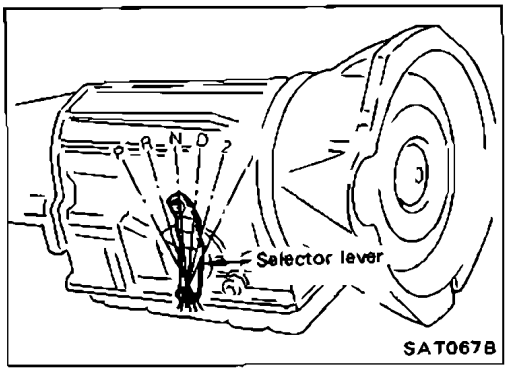
OVERDRIVE SWITCH

- Check continuity between two terminals.

O.D. switch position	Continuity
ON	No
OFF	Yes

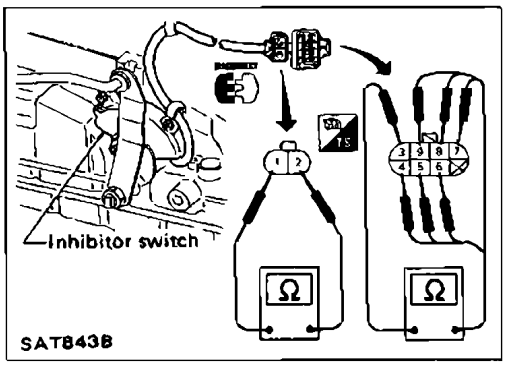
Electrical Components Inspection (Cont'd)

INHIBITOR SWITCH

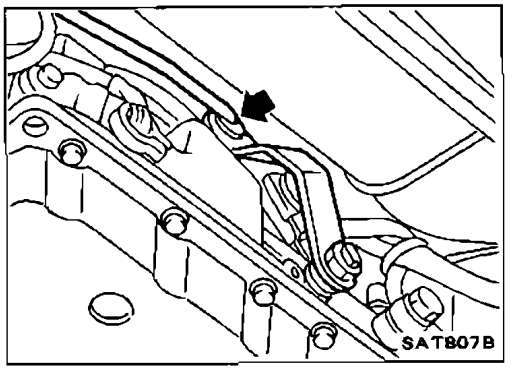


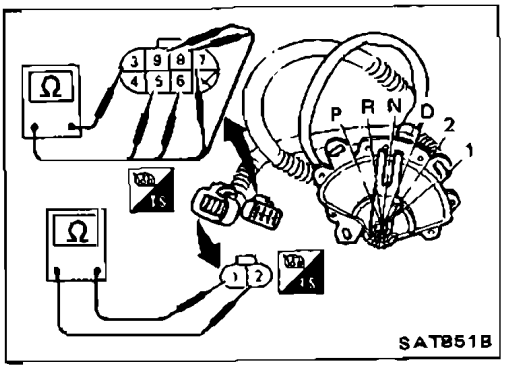
1. Check continuity between terminals ① and ② and between terminals ③ and ④, ⑤, ⑥, ⑦, ⑧, ⑨ while moving selector lever through each range.

Lever position \ Terminal No.	①	②	③	④	⑤	⑥	⑦	⑧	⑨
P	○	○	○	○					
R			○		○				
N	○	○	○			○			
D			○				○		
2			○					○	
1			○						○



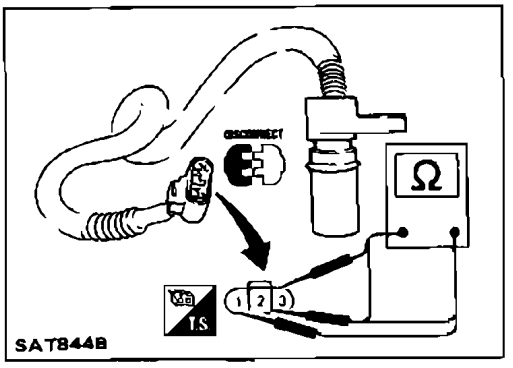
2. If N.G., check again with manual control linkage disconnected from manual shaft of A/T assembly. — Refer to step 1.
3. If O.K. on step 2, adjust manual control linkage. — Refer to "ON-VEHICLE SERVICE".





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

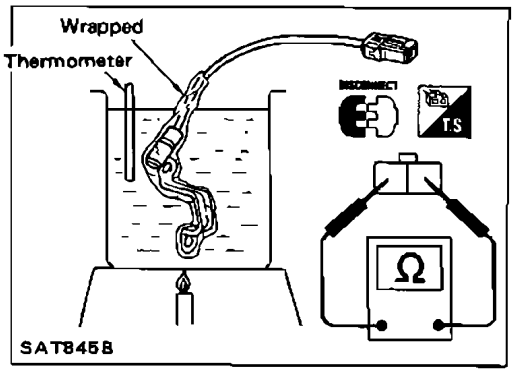


- For removal and installation, refer to "ON-VEHICLE SERVICE".
- Check resistance between terminals ①, ② and ③.

Terminal No.		Resistance
①	②	500 - 650Ω
②	③	No continuity
①	③	No continuity

Electrical Components Inspection (Cont'd)

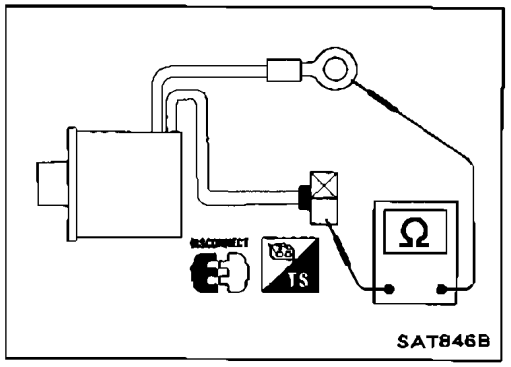
FLUID TEMPERATURE SENSOR



- 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.

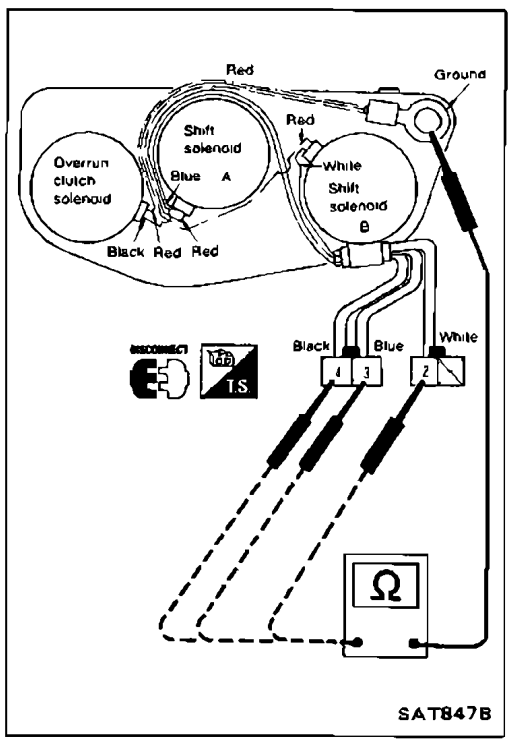
Resistance:

Lock-up solenoid 10 - 16Ω

Line pressure solenoid 2.5 - 5Ω

3-UNIT SOLENOID ASSEMBLY

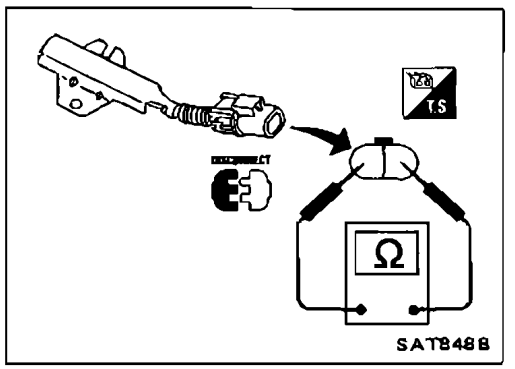
(Shift solenoid A, B and overrun clutch solenoid)



- For removal and installation, refer to "ON-VEHICLE SERVICE".
- Check resistance between terminals of each solenoid.

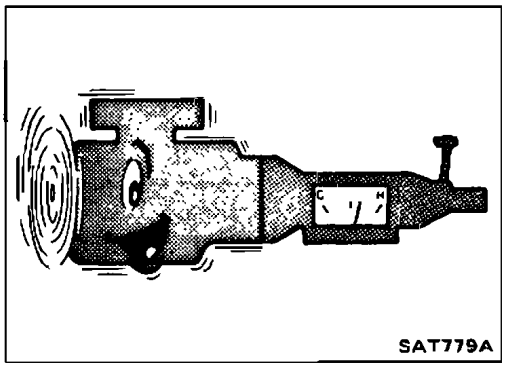
Solenoid	Terminal No.		Resistance
Shift solenoid A	③	Ground terminal	20 - 30Ω
Shift solenoid B	②		
Overrun clutch solenoid	④		

DROPPING RESISTOR



- Check resistance between two terminals.

Resistance: 11.2 - 12.8Ω


SAT779A

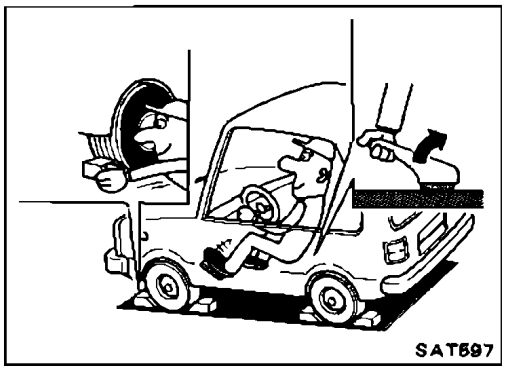
Final Check

STALL TESTING

Stall test procedure

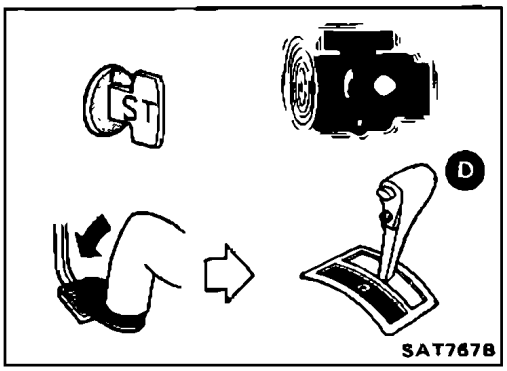
1. Check A/T and engine fluid levels. If necessary, add.
2. Warm up engine until engine oil and A.T.F. reach operating temperature after vehicle has been driven approx. 10 minutes.

   A.T.F. operating temperature:
   50 - 80°C (122 - 176°F)


SAT697

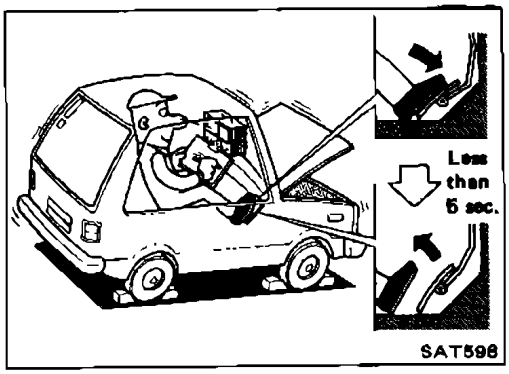
3. Set parking brake and block wheels.
4. Install a tachometer where it can be seen by driver during test.

- **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.

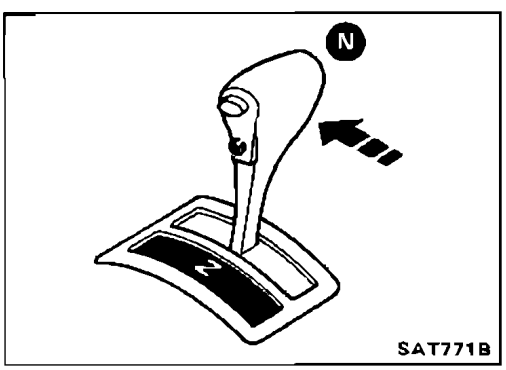


SAT598

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:
  2,050 - 2,250 rpm



SAT771B

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)

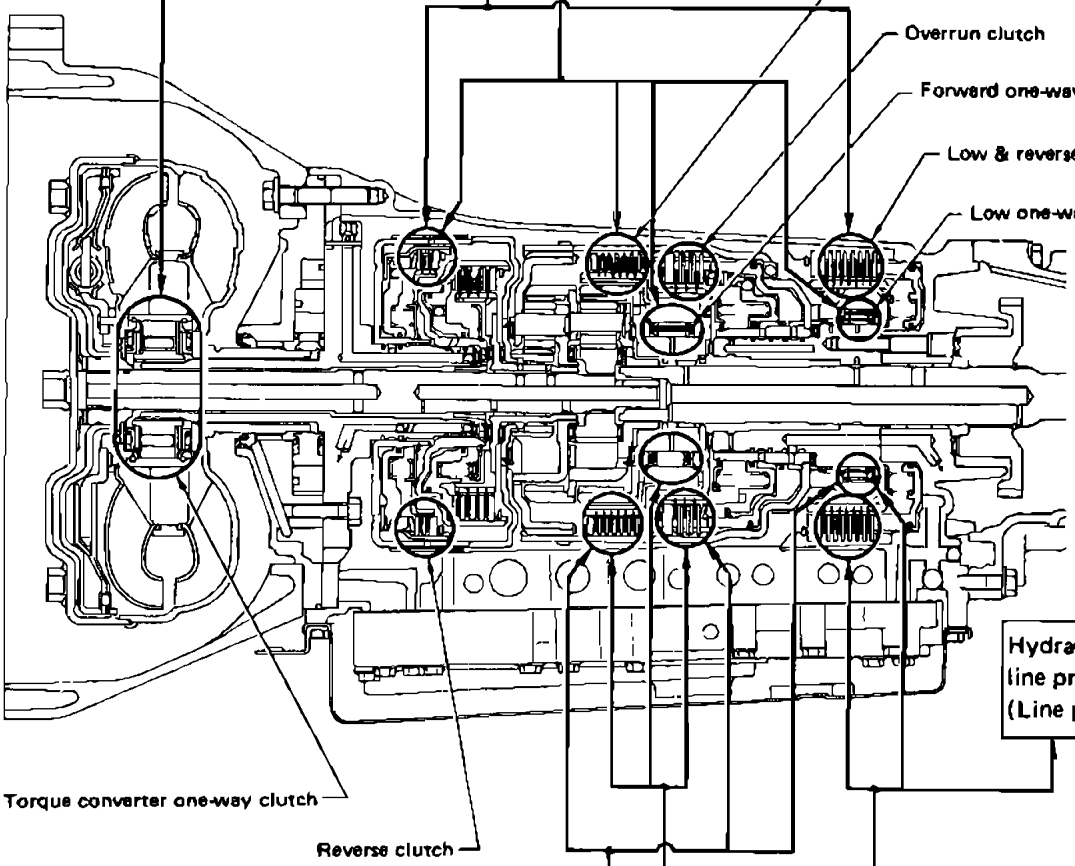
Judgement of stall test

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.)

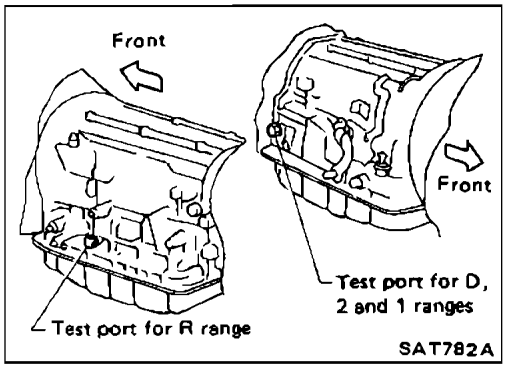
Clutches and brakes except high clutch and brake band are O.K. (Condition of high clutch and brake band cannot be confirmed by stall test.)

D	H	H	H	O
2	H	H	H	O
1	O	H	H	O
R	O	O	H	O
Selector lever position	Judgement			

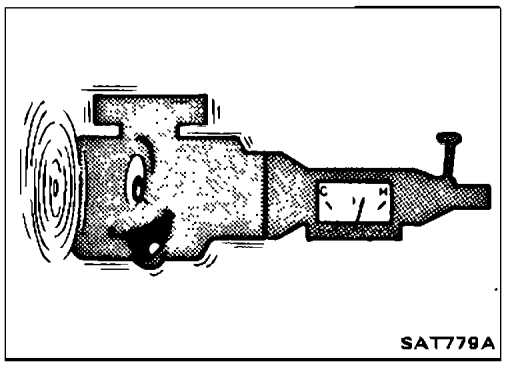
SAT107B

Final Check (Cont'd)

PRESSURE TESTING



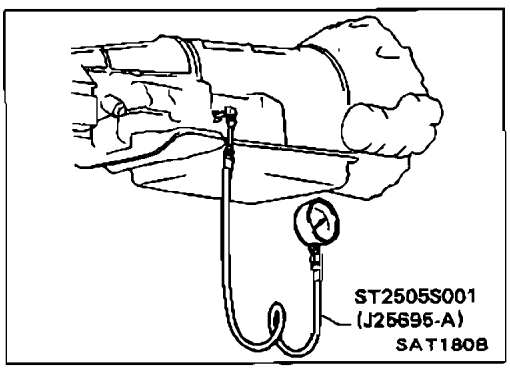
- Location of line pressure test port
- **Line pressure plugs are hexagon headed bolts.**
- **Always replace line pressure plugs as they are self-sealing bolts.**



Line pressure test procedure

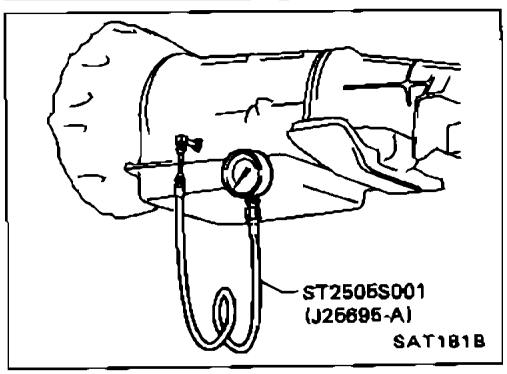
1. Check A/T and engine fluid levels. If necessary, add.
2. Warm up engine until engine oil and A.T.F. reach operating temperature after vehicle has been driven approx. 10 minutes.

   A.T.F. operating temperature:
   50 - 80°C (122 - 176°F)

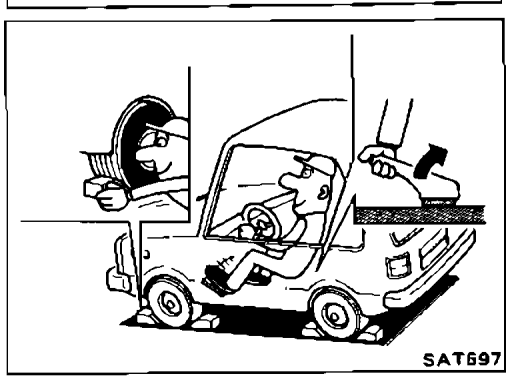


3. Install pressure gauge to line pressure port.

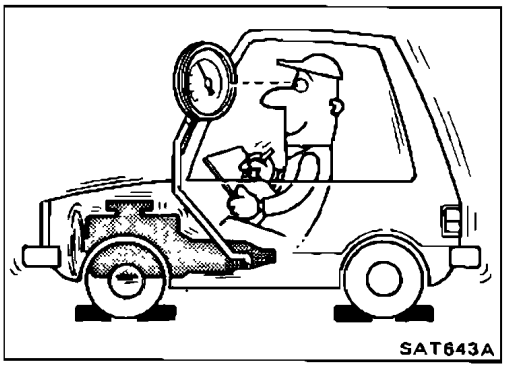
— D, 2 and 1 ranges —



— R range —



4. Set parking brake and block wheels.
- **Continue to depress brake pedal fully while line pressure test at stall speed is performed.**


SAT643A

Final Check (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/cm², psi)	
	D, 2 and 1 ranges	R range
Idle	471 - 510 (4.8 - 5.2, 68 - 74)	657 - 696 (6.7 - 7.1, 95 - 101)
Stall	1,020 - 1,098 (10.4 - 11.2, 148 - 159)	1,422 - 1,500 (14.5 - 15.3, 206 - 218)

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-)	9, 14	66	66	70	67, 106	67	67	7, 67	7	7	90, 101	120, 124	126, 137	126, 134	130	144
		Fluid level Control linkage	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
48	Engine does not start in "N", "P" ranges.	2	3								1						
48	Engine starts in range other than "N" and "P".	1	2														
–	Transmission noise in "P" and "N" ranges.	1	3	4 5	2							⑦⑥					
48	Vehicle moves when changing into "P" range or parking gear does not disengage when shifted out of "P" range.	1															②
49	Vehicle runs in "N" range.	1									4		⑧	②	⑤		
51	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		
52	Vehicle will not run in "D", "1", "2" ranges (but runs in "R" range). Clutch slips. Very poor acceleration.	1			2	4	3		5				⑥⑦	⑧⑨	⑩		
–	Clutches or brakes slip somewhat in starting.	1 2	3		4	6	5		7		8	⑬⑫	⑩	⑨		⑪	
–	Excessive creep.				1												
51, 52	No creep at all.	1			2	3						⑧⑤		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						⑧			⑦	
–	Failure to change gear from "D_3" to "D_4".	2	1	4		3			6							⑥	
54, 55, 56	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						⑧	
–	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_3" to "D_4".		1		2	4				3			⑤			⑥	

Symptom Chart (Cont'd)

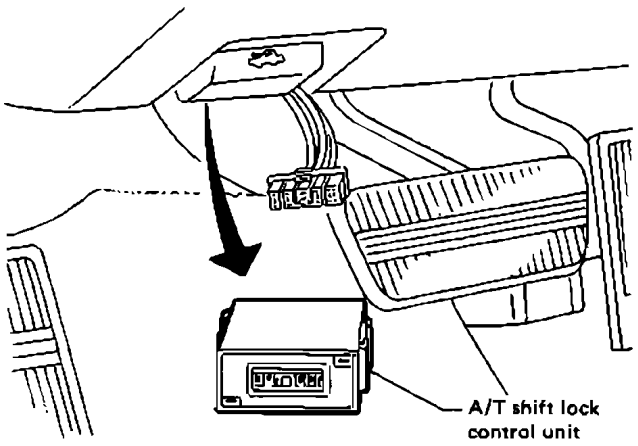
Reference page (AT-)		ON vehicle									OFF vehicle					
	Reference page (AT-)	9, 14	66	66	70	67, 105	67	67	7, 67	7	7	90, 101	120, 124	126, 137	128, 134	130	144
	Numbers are arranged in order of probability. Perform inspections starting with number one and working up. Circled numbers indicate that the transmission must be removed from the vehicle.	Fluid level Control linkage	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						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_3" to "D_2".	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											②④		⑤	③	
–	Vehicle braked by gear change from "D_3" to "D_2".	1														②	
–	Vehicle braked by gear change from "D_3" to "D_4".	1											④	⑤	②		
–	Maximum speed not attained. Acceleration poor.	1	2			5 3	4					⑪⑩	⑥⑦			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_1" 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							⑨ 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					

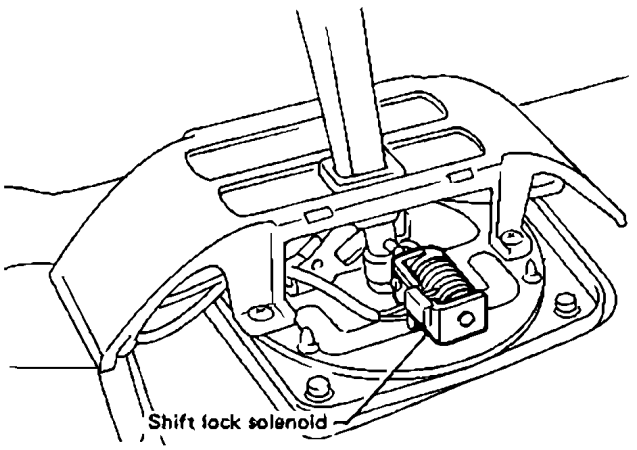
Symptom Chart (Cont'd)

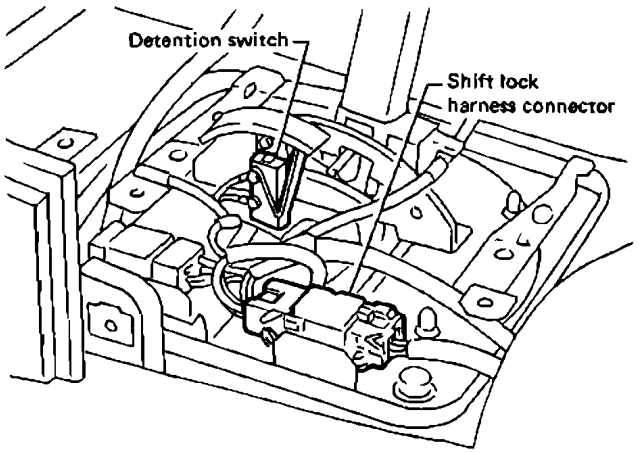
Reference page (AT-)	Numbers are arranged in order of probability. Perform inspections starting with number one and working up. Circled numbers indicate that the transmission must be removed from the vehicle.	ON vehicle									OFF vehicle					
	Reference page (AT-)	9, 14	66	66	70	67, 106	67	67	7, 67	7	7	90, 101	120, 124	126, 137	126, 134	130	144
		Fluid level Control linkage	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
61	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														
61	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					
57	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									

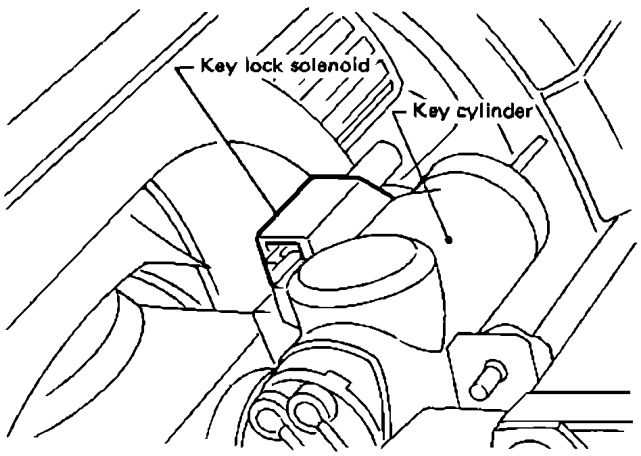
A/T Shift Lock System

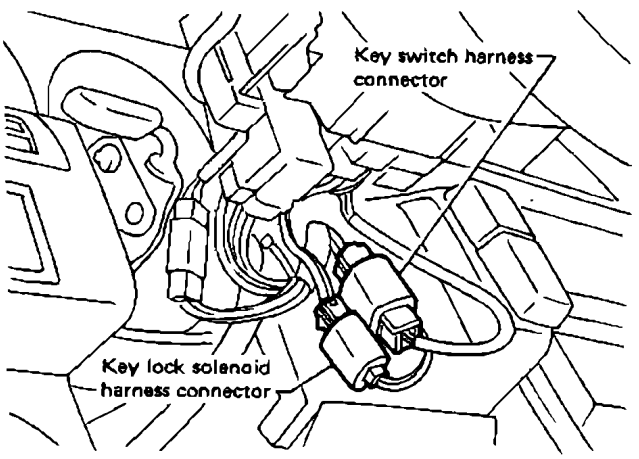
SHIFT LOCK SYSTEM ELECTRICAL PARTS LOCATION







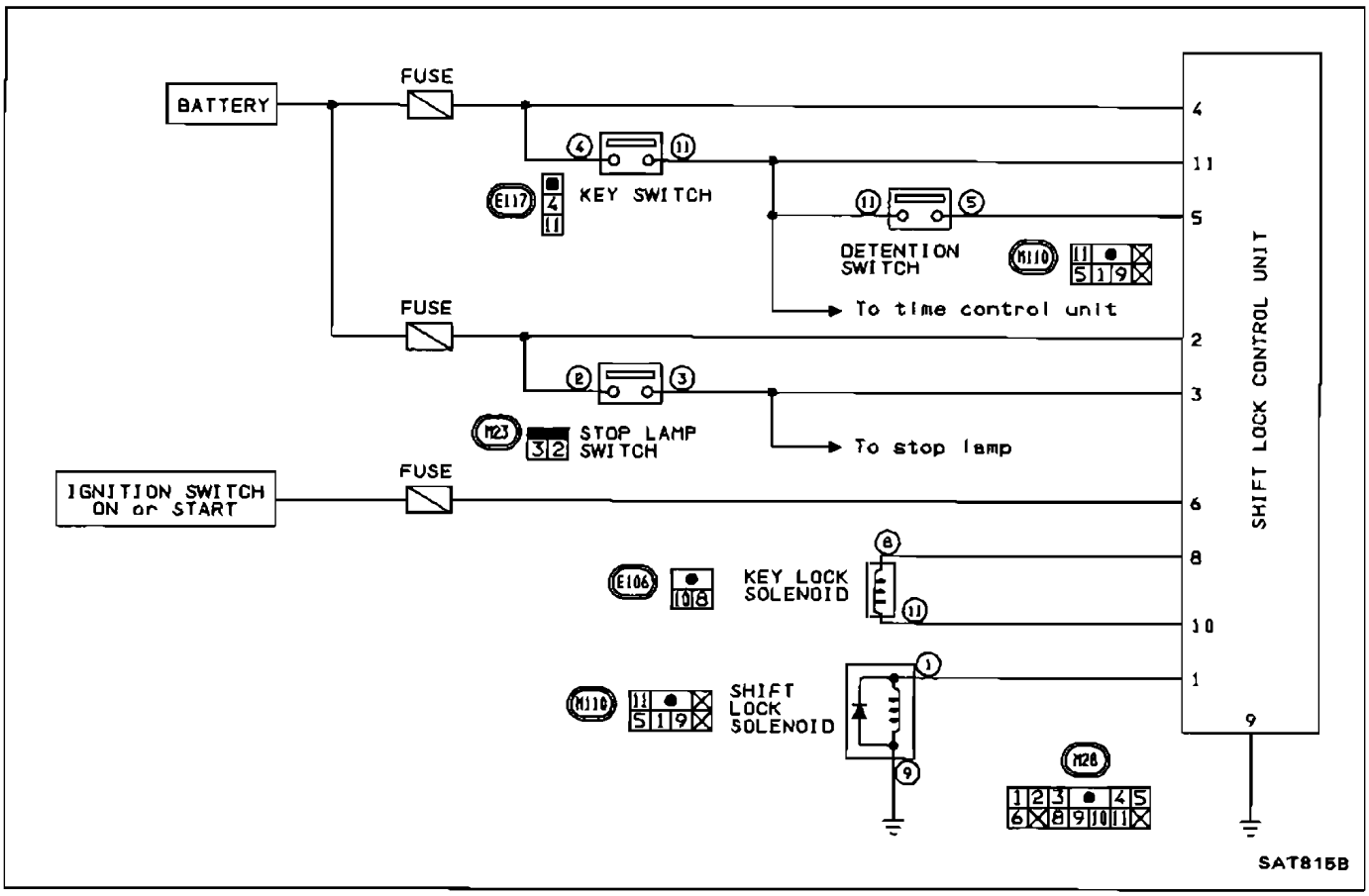




SAT835B

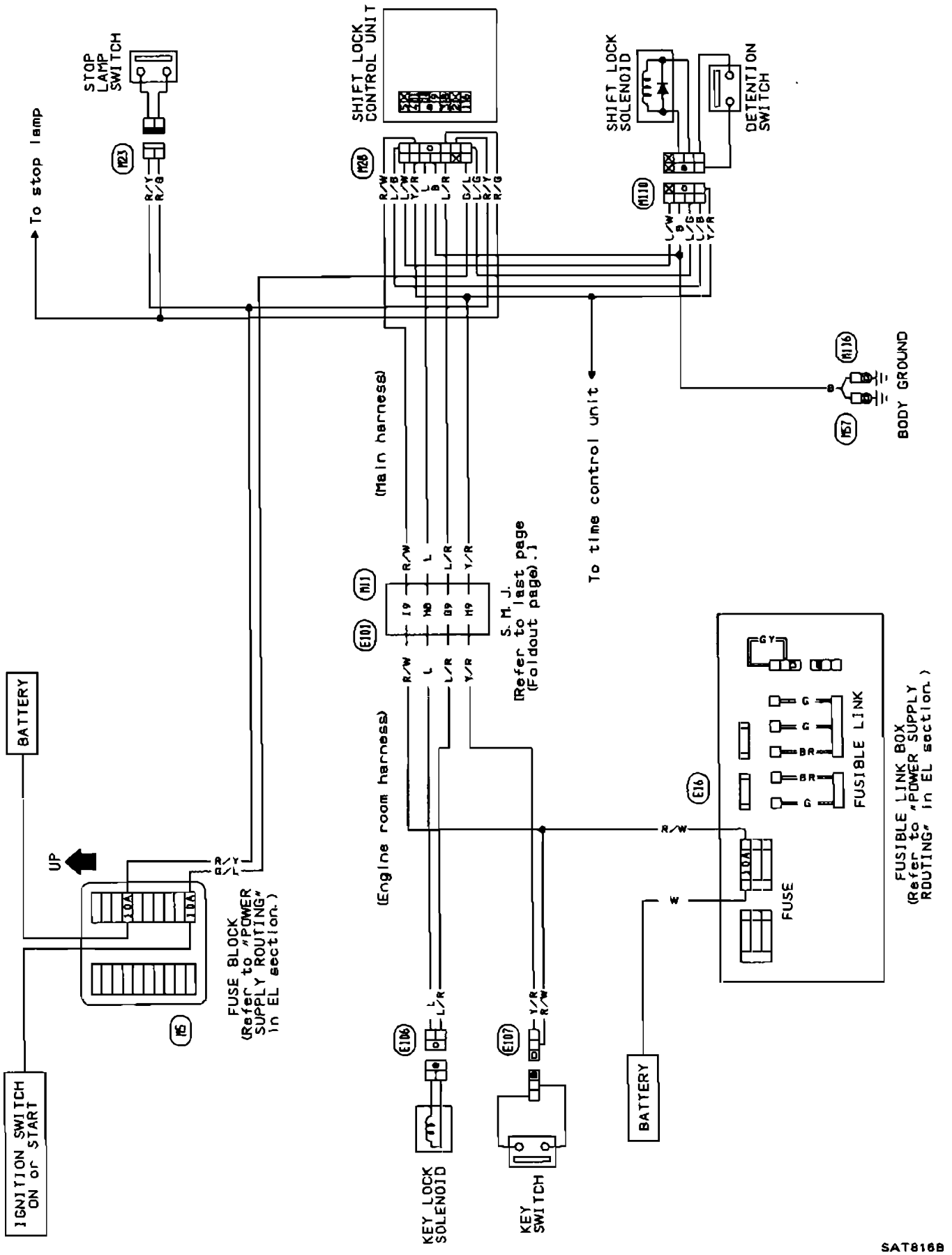
A/T Shift Lock System (Cont'd)

CIRCUIT DIAGRAM FOR QUICK PIN POINT CHECK



A/T Shift Lock System (Cont'd)

WIRING DIAGRAM

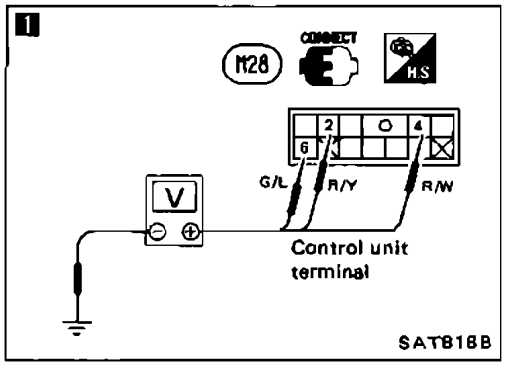


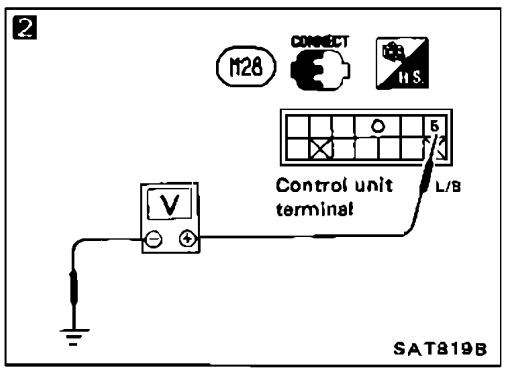
SAT816B

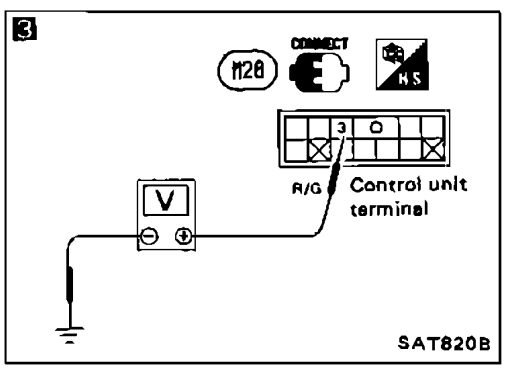
A/T Shift Lock System (Cont'd)

DIAGNOSTIC PROCEDURE 1

SYMPTOM: Selector lever cannot be moved from "P" range when applying brake pedal or can be moved when releasing brake pedal.







1

CHECK POWER SOURCE.

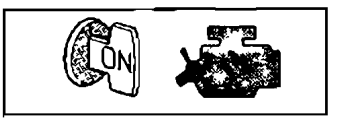
1.

2. Check voltage between control unit terminals ②, ④, ⑥ and ground.
Battery voltage should exist.

N.G. → Check the following items:
- Harness continuity between battery and control unit
- Fuse
- Ignition switch

2

CHECK INPUT SIGNAL (Detention switch).

1. 

2. Check voltage between control unit terminal ⑤ and ground while setting selector lever in "P" position.

Selector lever release button	Voltage
Not pressed	Battery voltage

N.G. → Check the following items:
- Detention switch – Refer to "COMPONENT CHECK".
- Key switch – Refer to "COMPONENT CHECK".
- Harness continuity between detention switch and control unit.

3

CHECK INPUT SIGNAL (STOP LAMP SWITCH).

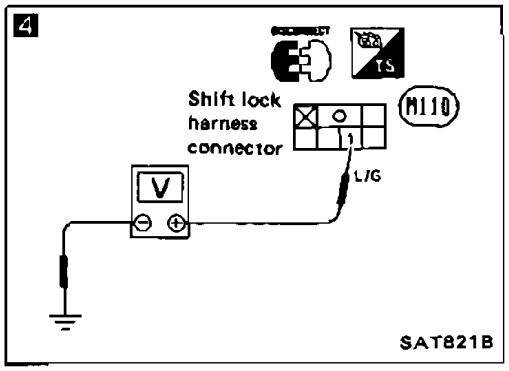
1.

2. Check voltage between control unit terminal ③ and ground while applying brake pedal.
Battery voltage should exist.

N.G. → Check the following items:
- Stop lamp switch
- Harness continuity between stop lamp switch and control unit

O.K. → Ⓐ

A/T Shift Lock System (Cont'd)



Ⓐ

4

CHECK OUTPUT SIGNAL.

1.

2. Check voltage between shift lock harness connector terminal ① and ground while setting selector lever in "P" position.

Brake pedal	Voltage
Release	Battery voltage
Depress	0V

N.G. → Check harness continuity between control unit and shift lock solenoid.

O.K. ↓

Check shift lock solenoid. (Refer to "COMPONENT CHECK".)

N.G. → Replace A/T shift lock control device assembly.

O.K. ↓

Recheck shift lock operation.

N.G. → 1. Perform control unit input/output signal inspection test.
2. If N.G., recheck harness connector connection.

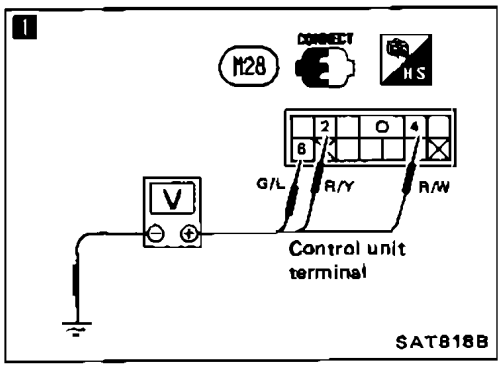
O.K. ↓

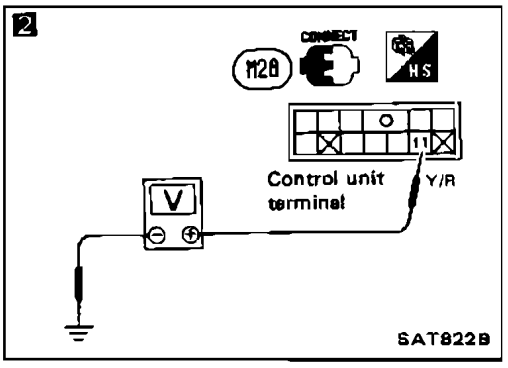
INSPECTION END

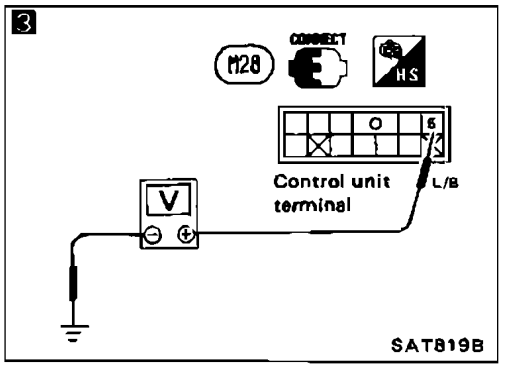
A/T Shift Lock System (Cont'd)

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".**

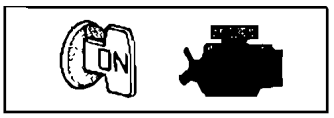






1

CHECK POWER SOURCE.

1. 

2. Check voltage between control unit terminals ②, ④, ⑥ and ground.
   Battery voltage should exist.

N.G. → Check the following items:
- Harness continuity between battery and control unit
- Fuse
- Ignition switch

O.K. ↓

2

CHECK INPUT SIGNAL (Key switch).

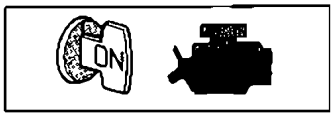
1. Insert ignition key into ignition switch.
2. Check voltage between control unit terminal ⑪ and ground.
   Battery voltage should exist.

N.G. → Check the following items:
- Key switch – Refer to "COMPONENT CHECK".
- Harness continuity between key switch and control unit.

O.K. ↓

3

CHECK INPUT SIGNAL (Detention switch).

1. 

2. Check voltage between control unit terminal ⑤ and ground while setting selector lever in "P" position.

Selector lever release button	Voltage
Release	Battery voltage

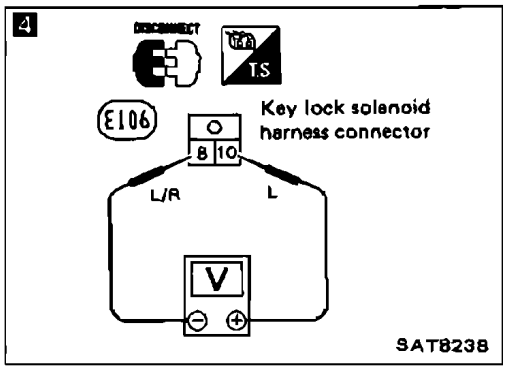
3. Check voltage between control unit terminal ⑤ and ground while setting selector lever in any position except "P".
   0V

N.G. → Check the following items:
- Detention switch – Refer to "COMPONENT CHECK".
- Harness continuity between detention switch and control unit.

O.K. ↓

Ⓐ

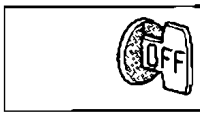
A/T Shift Lock System (Cont'd)



Ⓐ

4

CHECK OUTPUT SIGNAL.

1. 

2. Check voltage between terminals ⑧ and ⑩ of key lock solenoid harness connector when turning detention switch ON and OFF.
   Battery voltage is momentarily produced.
   (Refer to "SHIFT LOCK CONTROL UNIT INSPECTION TABLE".)

N.G. → Check harness continuity between control unit and key lock solenoid.

O.K. ↓

Check key lock solenoid. (Refer to "COMPONENT CHECK".)

N.G. → Replace key lock solenoid.

O.K. ↓

Recheck key lock operation.

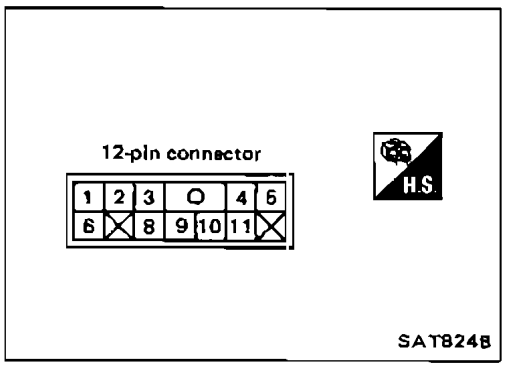
N.G. → 1. Perform control unit input/output signal inspection test.
2. If N.G., recheck harness connector connection.

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.)

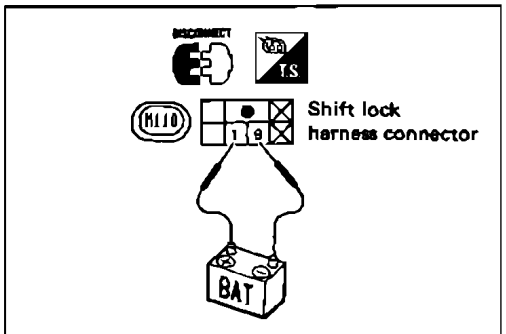
Terminal No. ⊕	Terminal No. ⊖	Item	Condition		Judgement standard
1	9	Shift lock signal		When setting selector lever in "P" position and releasing brake pedal	Battery voltage
			Except above		0V
2		Power source			Battery voltage
3		Stop lamp switch	When depressing brake pedal		Battery voltage
			When releasing brake pedal		0V
4		Power source			Battery voltage
5		Detention switch	When setting selector lever in "P" position and releasing selector lever release button		Battery voltage
			When setting selector lever in "P" position and pushing selector lever release button		0V
6		Ignition signal			Battery voltage
8	10	Key lock signal	When turning detention switch OFF with ignition switch set to LOCK, OFF or ACC		Battery voltage (Approximately 0.1 seconds)
			Except above		0V
9	–	Ground	–		–
10	8	Key unlock signal	When turning detention switch ON with ignition switch set to LOCK, OFF or ACC		Battery voltage (Approximately 0.1 seconds)
			Except above		0V
11	9	Key switch	When inserting key to key cylinder		Battery voltage
			When removing key from key cylinder		0V

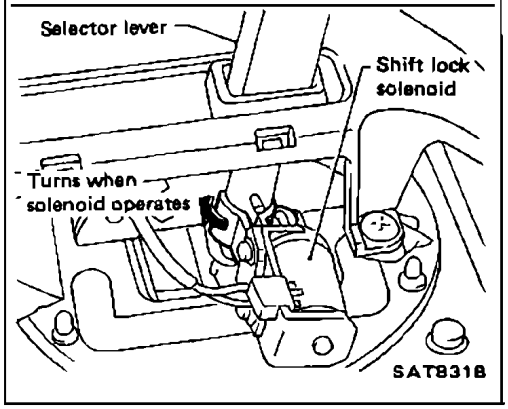
A/T Shift Lock System (Cont'd)

COMPONENT CHECK

Shift lock solenoid

- Check operation by applying battery voltage to shift lock harness connector.

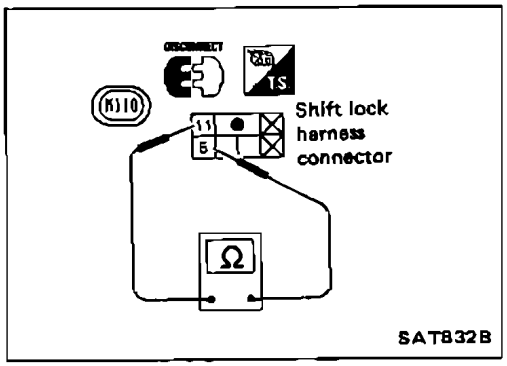




Detention switch

- Check continuity between terminals ⑤ and ⑪ of shift lock harness connector.

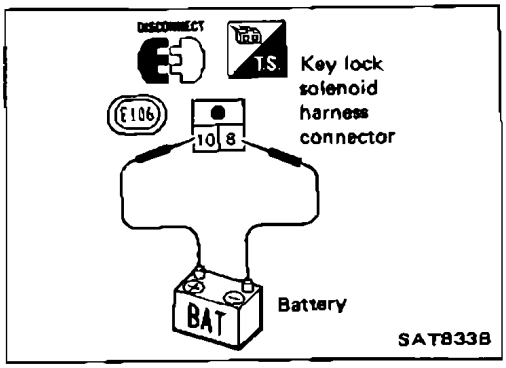
Condition	Continuity
When setting shift lever to "P" position with release button released.	Yes
Except the above	No



Key lock solenoid

- Check operation by applying battery voltage to key lock solenoid harness connector.

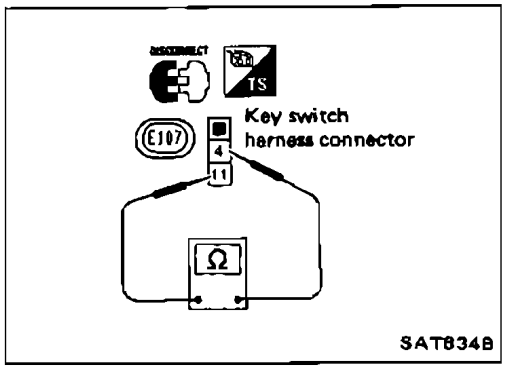
Operating sound must be emitted.

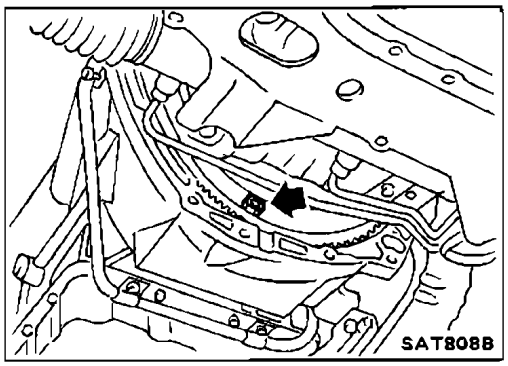


Key switch

- Check continuity between terminals ④ and ① of key switch harness connector.

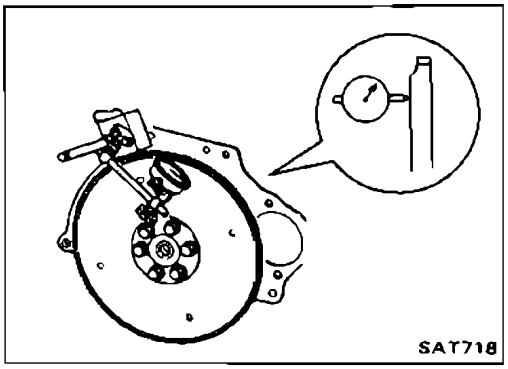
Condition	Continuity
When inserting key into key cylinder	Yes
When removing key from key cylinder	No





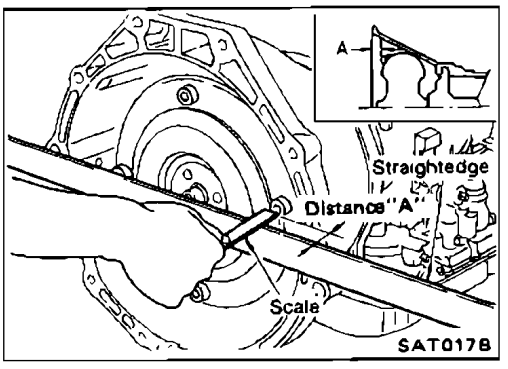
Removal

- Remove fluid charging pipe from A/T assembly.
- Remove bolts securing torque converter to drive plate.
- **Remove those bolts by turning crankshaft.**
- Plug up opening such as oil charging pipe hole, etc.

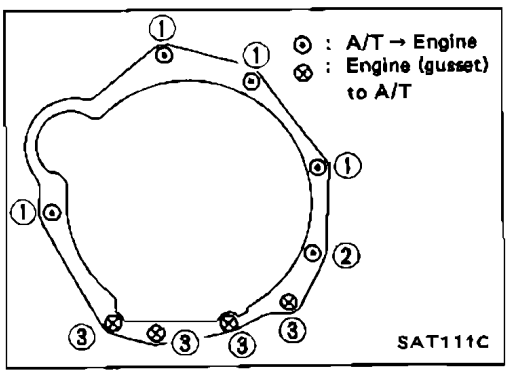


Installation

- Drive plate runout
  Maximum allowable runout:
  0.5 mm (0.020 in)
  If this runout is out of allowance, replace drive plate with ring gear.



- When connecting torque converter to transmission, measure distance "A" to be certain that they are correctly assembled.
  Distance "A":
  26 mm (1.02 in) or more
- Install converter to drive plate.
- Reinstall any part removed.
- **After converter is installed to drive plate, rotate crankshaft several turns and check to be sure that transmission rotates freely without binding.**



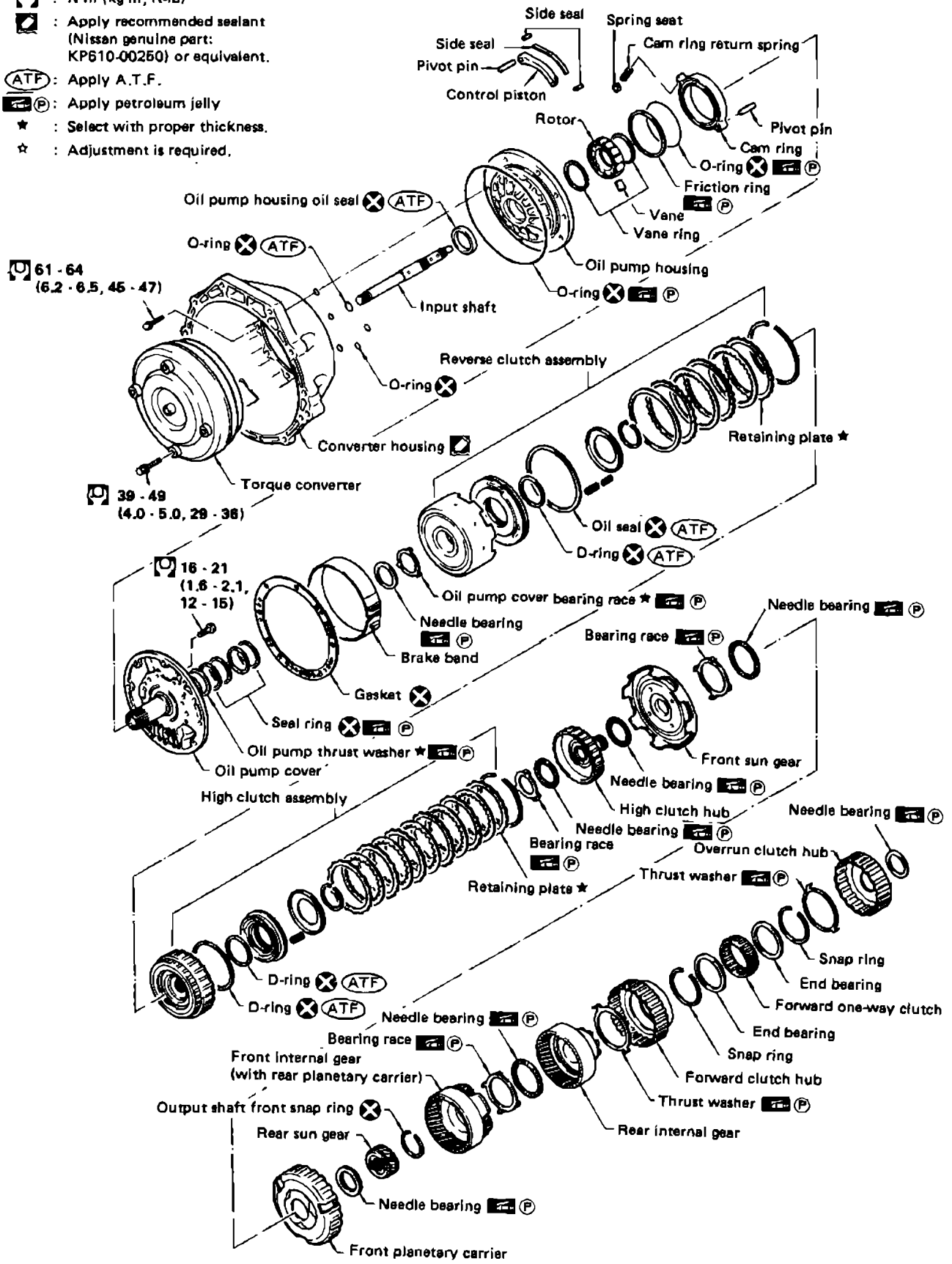
- Tighten bolts securing transmission.

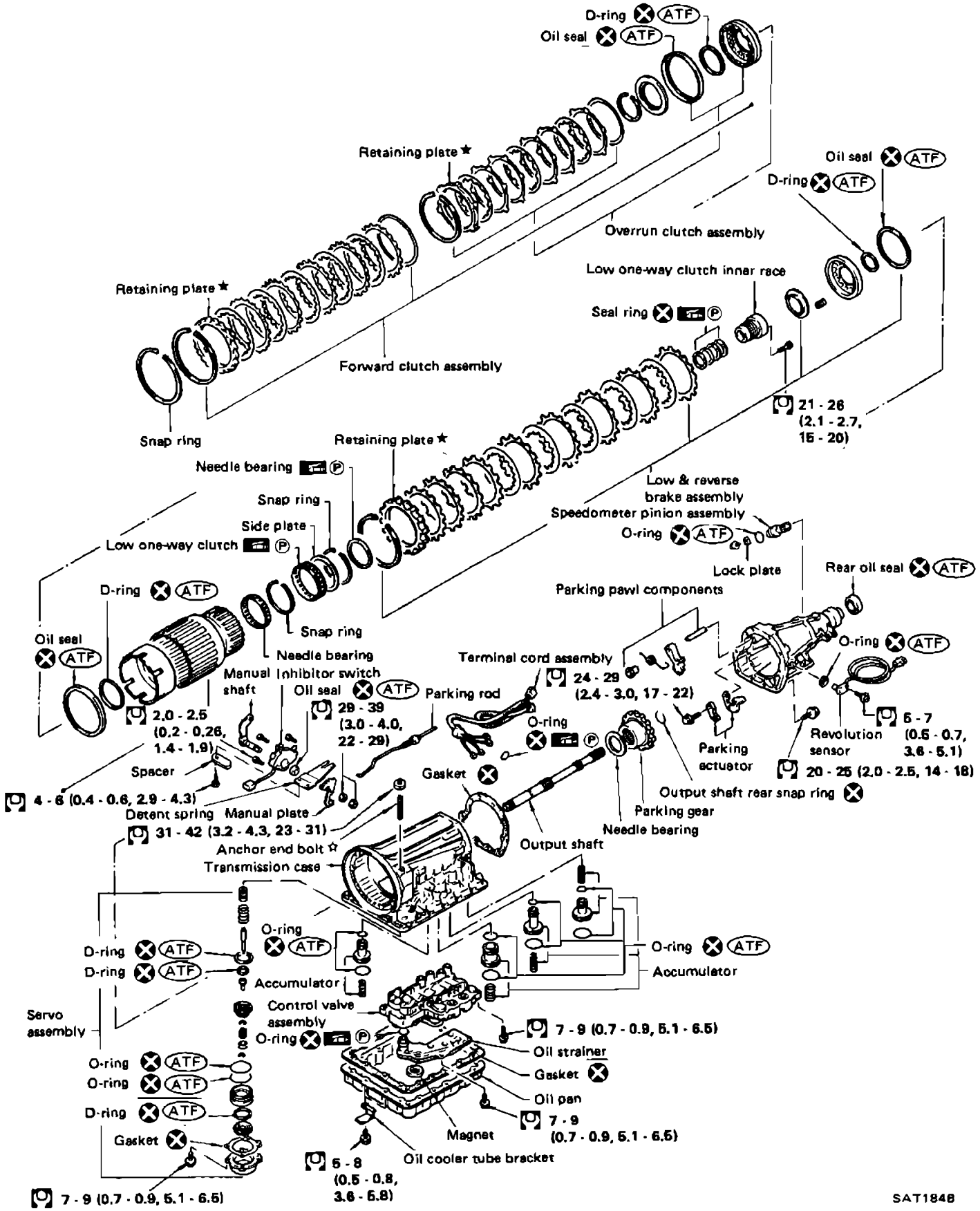
Bolt No.	Tightening torque N·m (kg-m, ft-lb)	Bolt length "L" mm (in)
1	39 - 49 (4.0 - 5.0, 29 - 36)	40 (1.57)
2	39 - 49 (4.0 - 5.0, 29 - 36)	50 (1.97)
3	29 - 39 (3.0 - 4.0, 22 - 29)	25 (0.98)
Gusset to engine	29 - 39 (3.0 - 4.0, 22 - 29)	20 (0.79)

- Reinstall any part removed.

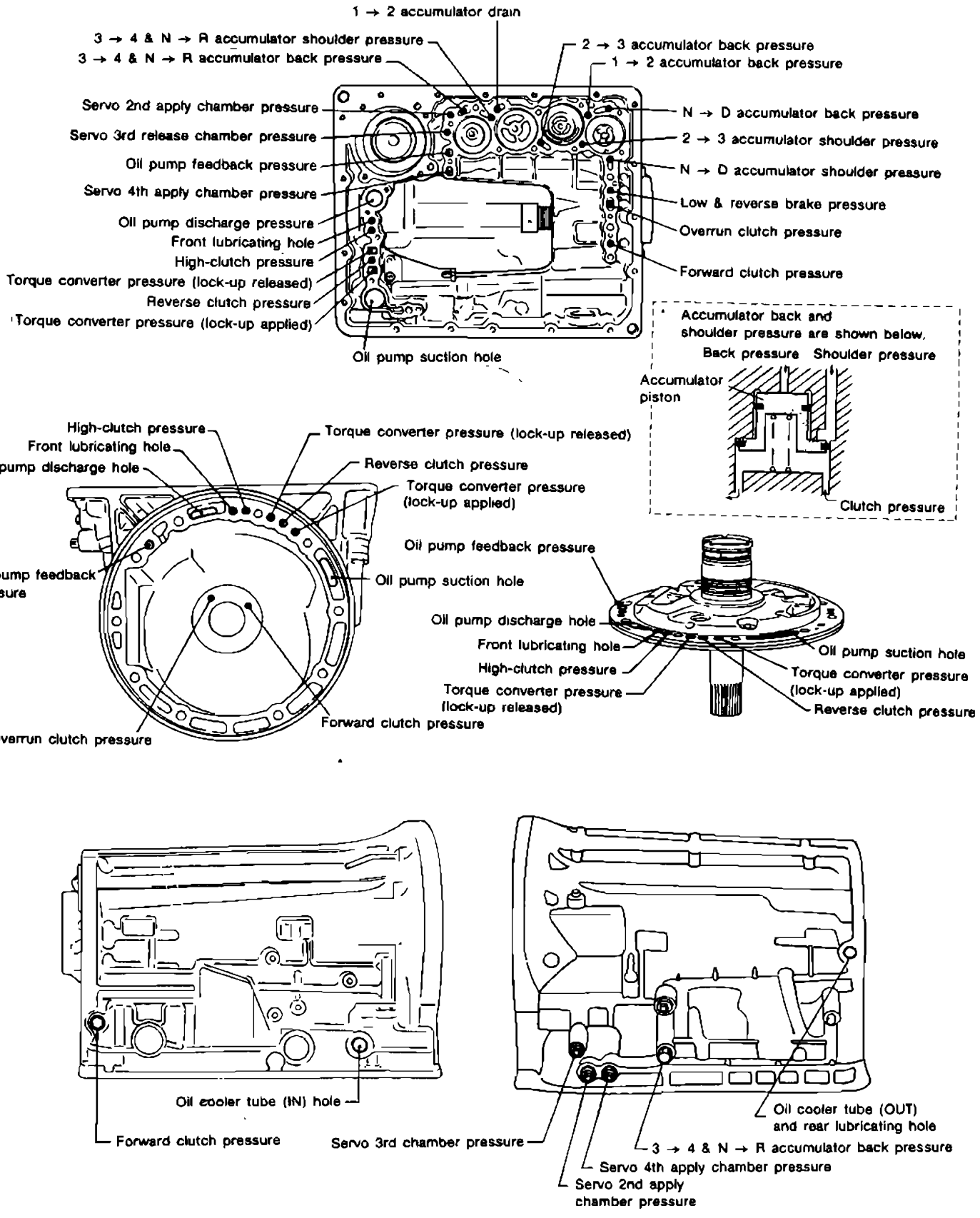
- Check fluid level in transmission.
- Move selector lever through all positions to be sure that transmission operates correctly.
  With parking brake applied, rotate engine at idling. Move selector lever through "N" to "D", to "2", to "1" and to "R". A slight shock should be felt by hand gripping selector each time transmission is shifted.
- Perform road test. — Refer to "ROAD TESTING".

: N·m (kg-m, ft-lb)
: Apply recommended sealant (Nissan genuine part: KP610-00250) or equivalent.
(ATF): Apply A.T.F.
Ⓟ: Apply petroleum jelly
★ : Select with proper thickness.
☆ : Adjustment is required.




D-ring ⊗ ATF
Oil seal ⊗ ATF
Retaining plate ★
Overrun clutch assembly
Oil seal ⊗ ATF
D-ring ⊗ ATF
Low one-way clutch inner race
Seal ring ⊗ Ⓟ
Retaining plate ★
Forward clutch assembly
21 - 26 (2.1 - 2.7, 15 - 20)
Snap ring
Retaining plate ★
Needle bearing Ⓟ
Snap ring
Side plate
Low one-way clutch Ⓟ
Low & reverse brake assembly
Speedometer pinion assembly
O-ring ⊗ ATF
Lock plate
Rear oil seal ⊗ ATF
Parking pawl components
D-ring ⊗ ATF
Oil seal ⊗ ATF
Snap ring
Needle bearing
Manual shaft
Inhibitor switch
Oil seal ⊗ ATF
2.0 - 2.5 (0.2 - 0.26, 1.4 - 1.9)
29 - 39 (3.0 - 4.0, 22 - 29)
Parking rod
Terminal cord assembly
24 - 29 (2.4 - 3.0, 17 - 22)
O-ring ⊗ ATF
O-ring ⊗ Ⓟ
Parking actuator
Revolution sensor
6 - 7 (0.5 - 0.7, 3.6 - 5.1)
20 - 25 (2.0 - 2.5, 14 - 18)
Spacer
4 - 6 (0.4 - 0.6, 2.9 - 4.3)
Gasket ⊗
Output shaft rear snap ring ⊗
Detent spring
Manual plate
31 - 42 (3.2 - 4.3, 23 - 31)
Parking gear
Needle bearing
Output shaft
Anchor end bolt ☆
Transmission case
O-ring ⊗ ATF
D-ring ⊗ ATF
D-ring ⊗ ATF
Accumulator
O-ring ⊗ ATF
Accumulator
Servo assembly
Control valve assembly
O-ring ⊗ Ⓟ
7 - 9 (0.7 - 0.9, 5.1 - 6.5)
Oil strainer
Gasket ⊗
Oil pan
7 - 9 (0.7 - 0.9, 5.1 - 6.5)
O-ring ⊗ ATF
O-ring ⊗ ATF
D-ring ⊗ ATF
Gasket ⊗
Magnet
Oil cooler tube bracket
5 - 8 (0.5 - 0.8, 3.6 - 5.8)
7 - 9 (0.7 - 0.9, 5.1 - 6.5)
SAT184B

Oil Channel



SAT186B

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

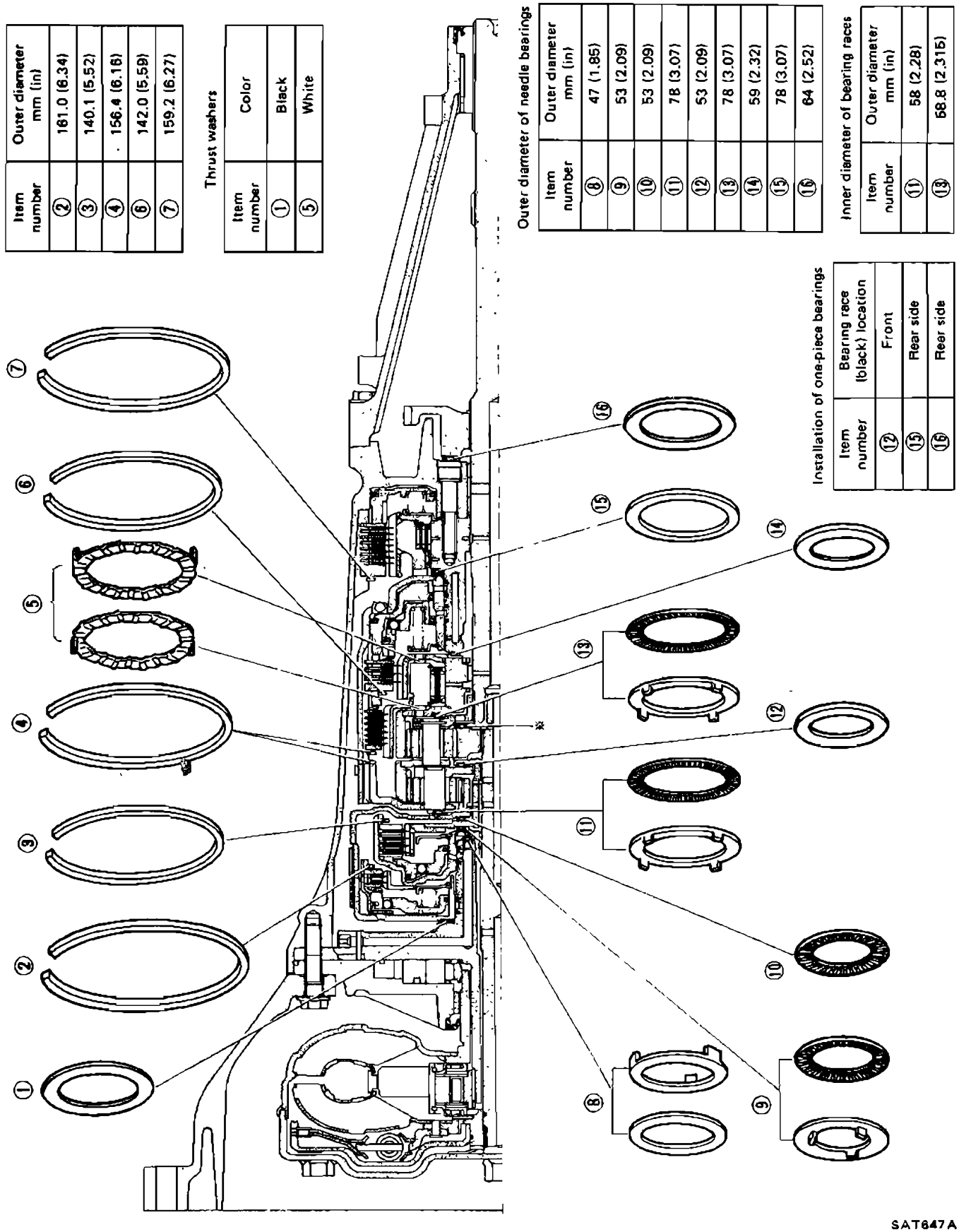
Item number	Outer diameter mm (in)
⑧	47 (1.85)
⑨	53 (2.09)
⑩	53 (2.09)
⑪	78 (3.07)
⑫	53 (2.09)
⑬	78 (3.07)
⑭	59 (2.32)
⑮	78 (3.07)
⑯	64 (2.52)

Inner diameter of bearing races

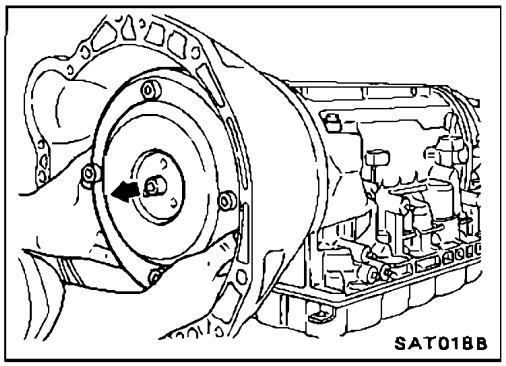
Item number	Outer diameter mm (in)
⑪	58 (2.28)
⑬	58.8 (2.315)

Installation of one-piece bearings

Item number	Bearing race (black) location
⑫	Front
⑬	Rear side
⑯	Rear side

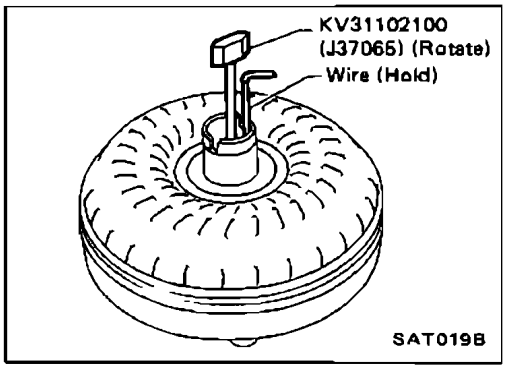


SAT647A

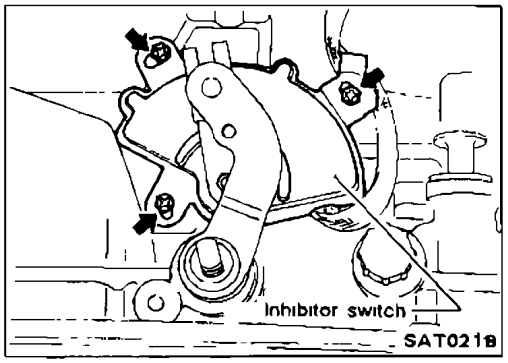


Disassembly

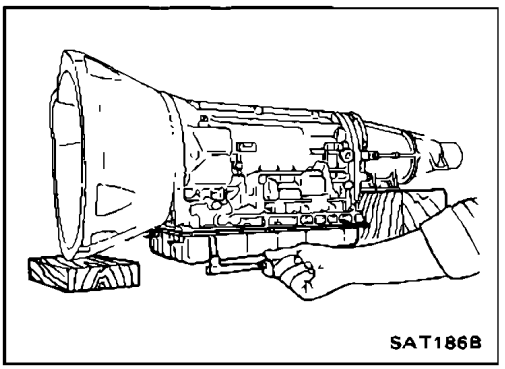
1. Remove torque converter by holding it firmly and turning while pulling straight out.



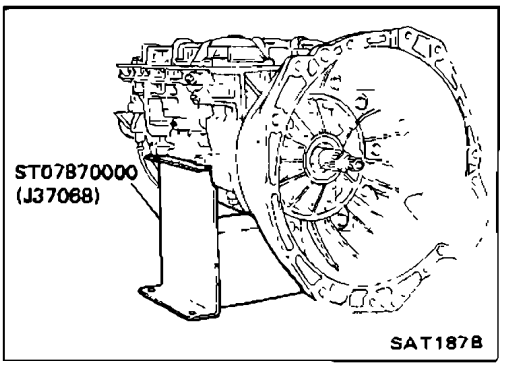
2. Check torque converter one-way clutch.
a. Insert Tool into spline of one-way clutch inner race.
b. Hook bearing support unitized with one-way clutch outer race with suitable wire.
c. Check that one-way clutch inner race rotates only clockwise with Tool while holding bearing support with wire.



3. Remove inhibitor switch from transmission case.

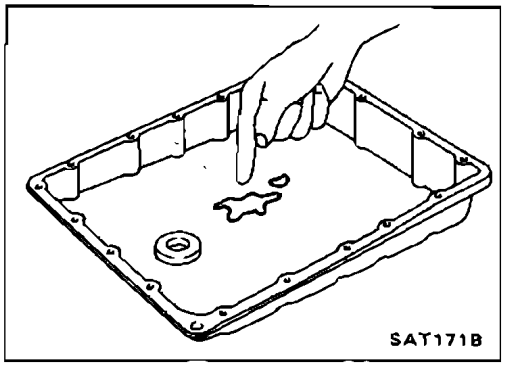


4. Remove oil pan.
a. Drain A.T.F. from rear extension.
b. Raise oil pan by placing wooden blocks under converter housing and rear extension.
c. Separate the oil pan and transmission case.
- **Always place oil pan straight down so that foreign particles inside will not move.**



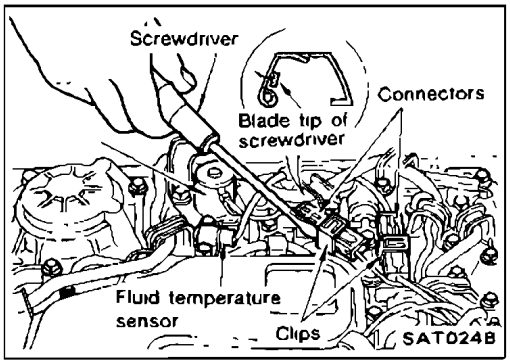
5. Place transmission into Tool with the control valve facing up.

Disassembly (Cont'd)

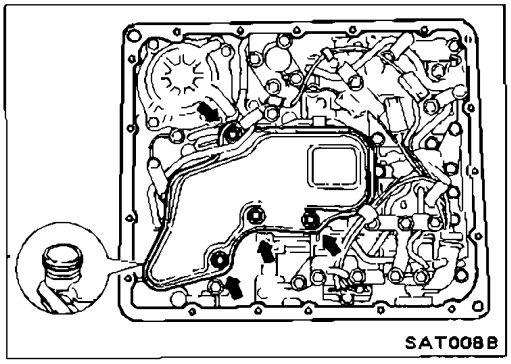


6. Check oil pan and oil strainer for accumulation of foreign particles.
- If materials of clutch facing are found, clutch plates may be worn.
- If metal filings are found, clutch plates, brake bands, etc. may be worn.
- If aluminum filings are found, bushings or aluminum cast parts may be worn.

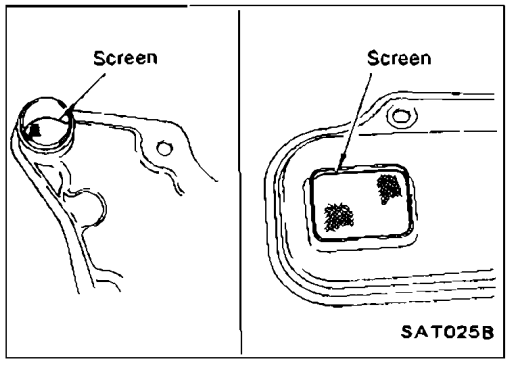
In above cases, replace torque converter and check unit for cause of particle accumulation.



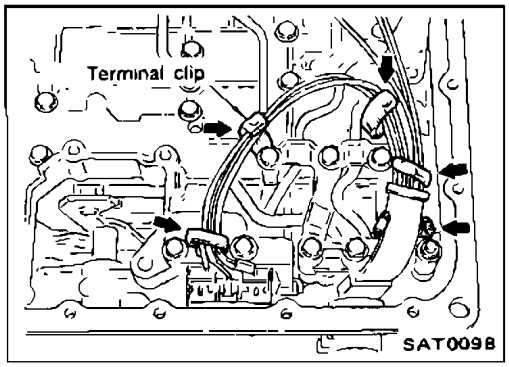
7. Remove lock-up solenoid and fluid temperature sensor connectors.
- **Be careful not to damage connector.**



8. Remove oil strainer.
a. Remove oil strainer from control valve assembly. Then remove O-ring from oil strainer.

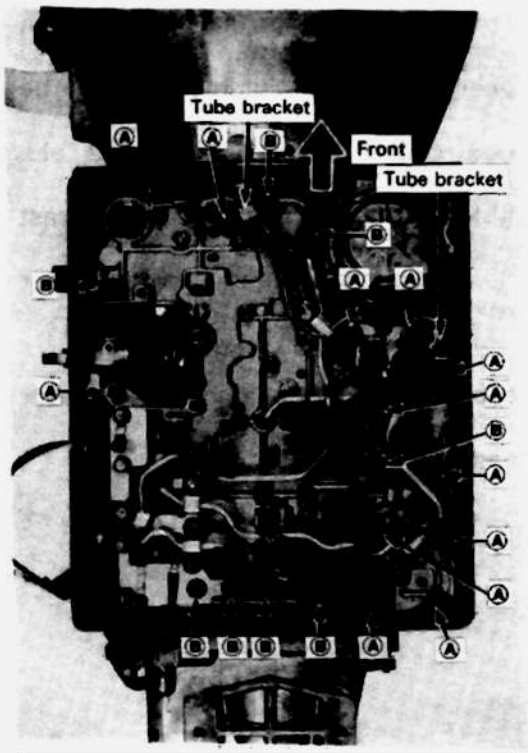


b. Check oil strainer screen for damage.



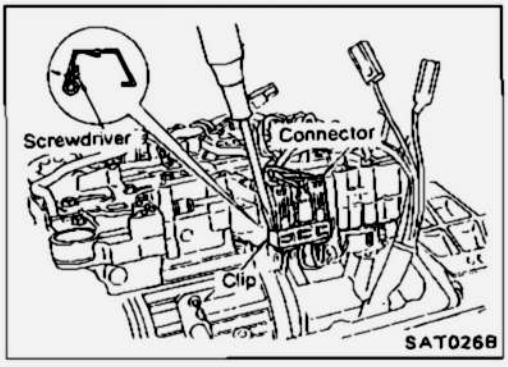
9. Remove control valve assembly.
a. Straighten terminal clips to free terminal cords then remove terminal clips.

Disassembly (Cont'd)

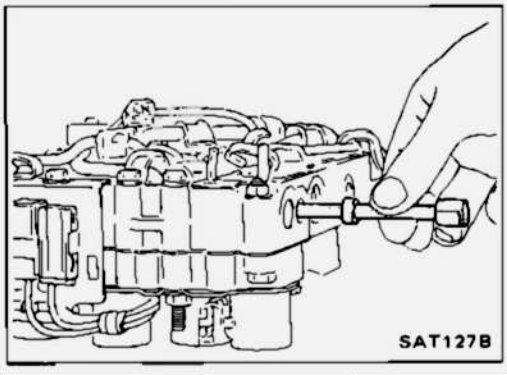


b. Remove bolts Ⓐ and Ⓑ, and remove control valve assembly from transmission.

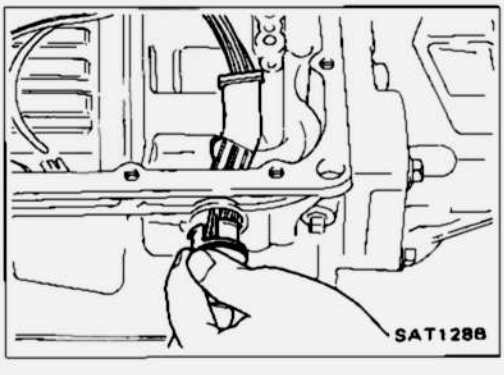
Bolt	Length
Ⓐ	37 mm (1.46 in)
Ⓑ	50 mm (1.97 in)



c. Remove solenoid connector.
- **Be careful not to damage connector.**

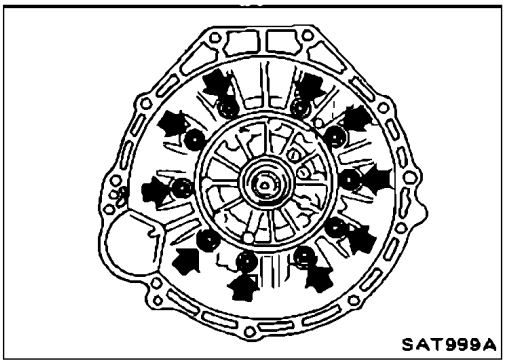


d. Remove manual valve from control valve assembly.

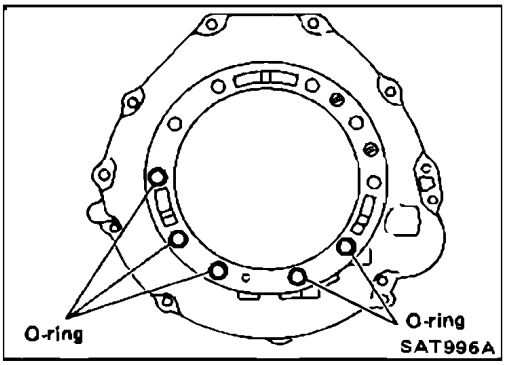


10. Remove terminal cord assembly from transmission case while pushing on stopper.
- **Be careful not to damage cord.**
- **Do not remove terminal cord assembly unless it is damaged.**

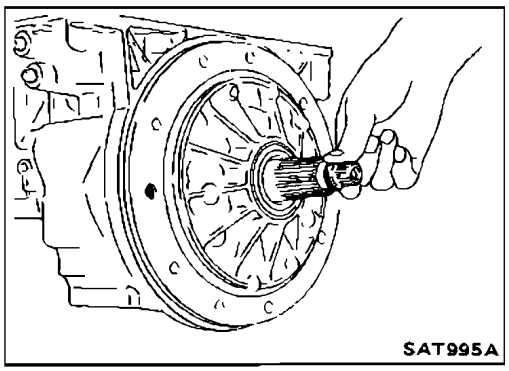
Disassembly (Cont'd)



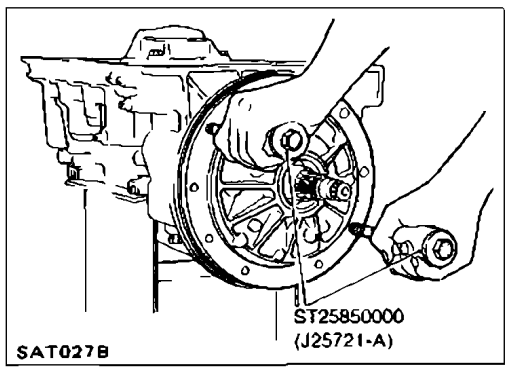
11. Remove converter housing.
a. Remove converter housing from transmission case.



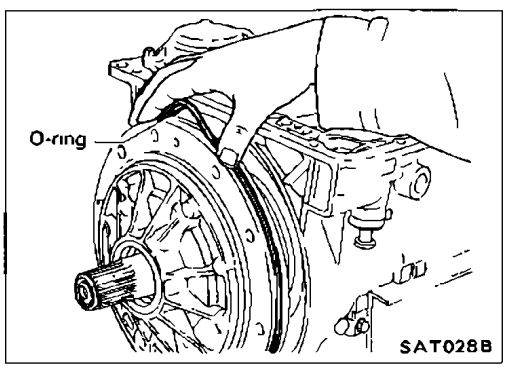
b. Remove O-rings from converter housing.
c. Remove traces of sealant.
- **Be careful not to scratch converter housing.**



12. Remove O-ring from input shaft.

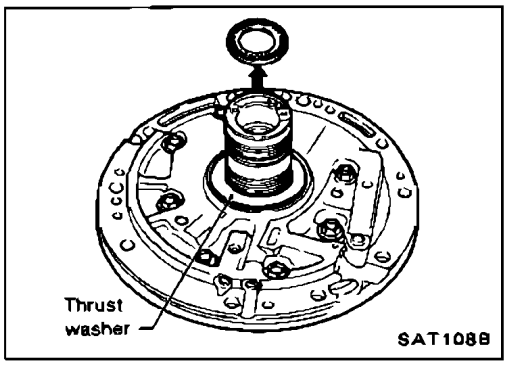


13. Remove oil pump assembly.
a. Attach Tool to oil pump assembly and extract it evenly from transmission case.

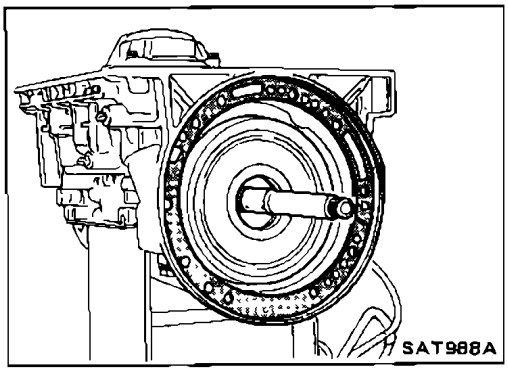


b. Remove O-ring from oil pump assembly.
c. Remove traces of sealant from oil pump housing.
- **Be careful not to scratch pump housing.**

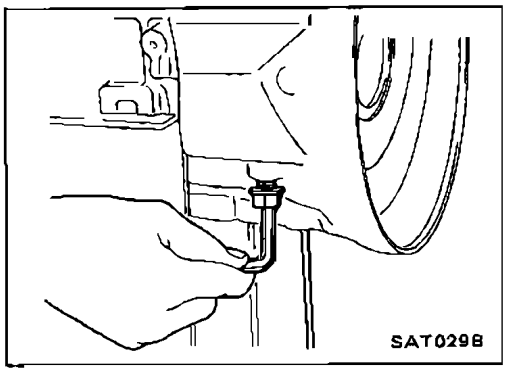
Disassembly (Cont'd)



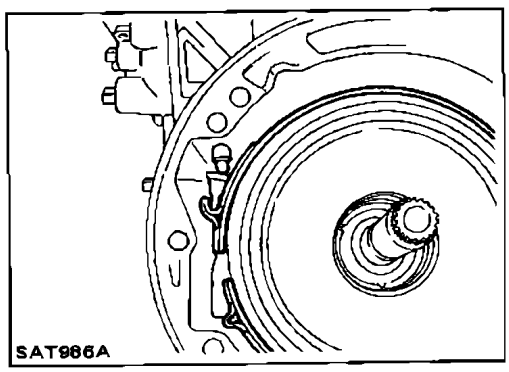
d. Remove needle bearing and thrust washer from oil pump assembly.



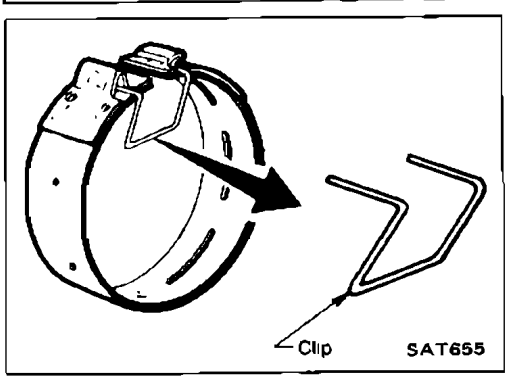
14. Remove input shaft and oil pump gasket.



15. Remove brake band and band strut.
a. Loosen lock nut and remove band servo anchor end pin from transmission case.

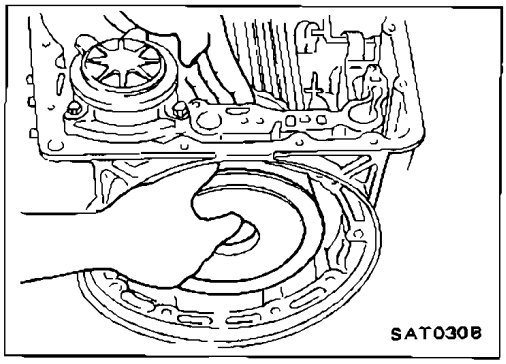


b. Remove brake band and band strut from transmission case.

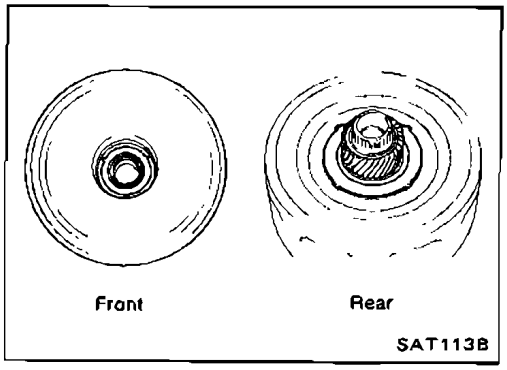


c. Hold brake band in a circular shape with clip.

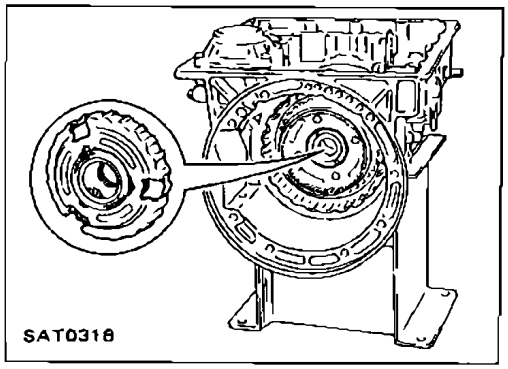
Disassembly (Cont'd)



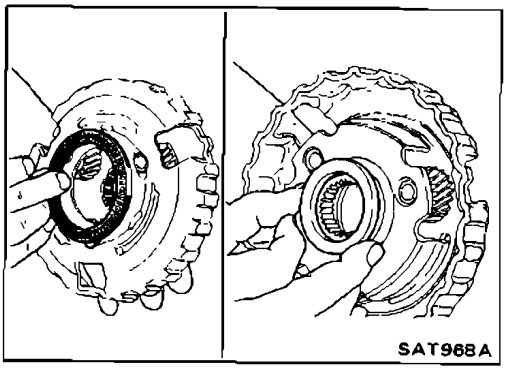
16. Remove front side clutch and gear components.
a. Remove clutch pack (reverse clutch, high clutch and front sun gear) from transmission case.



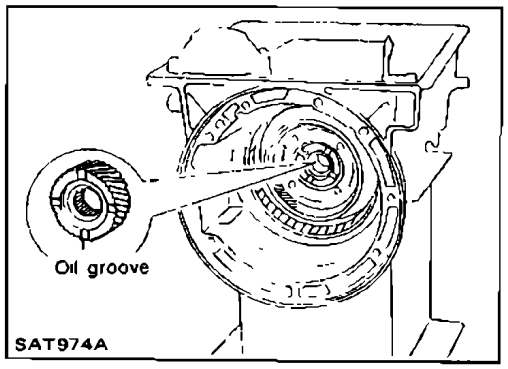
b. Remove front bearing race from clutch pack.
c. Remove rear bearing race from clutch pack.



d. Remove front planetary carrier from transmission case.

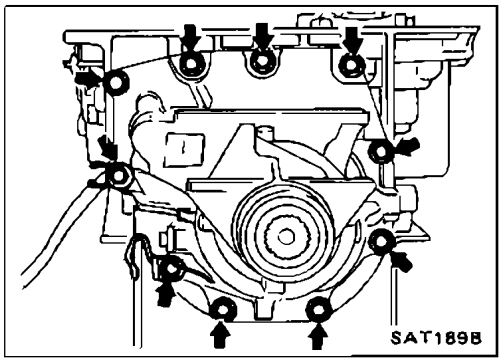


e. Remove front needle bearing from front planetary carrier.
f. Remove rear bearing from front planetary carrier.

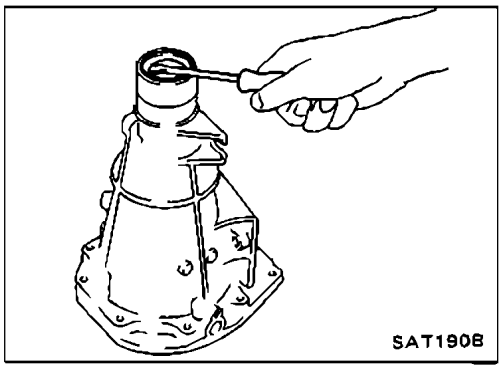


g. Remove rear sun gear from transmission case.

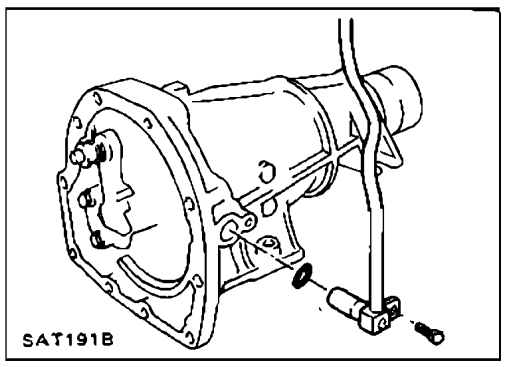
Disassembly (Cont'd)



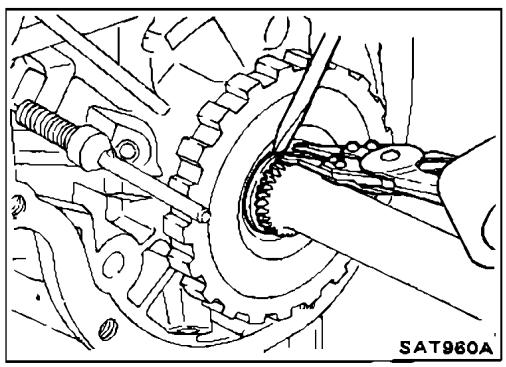
17. Remove rear extension.
a. Remove rear extension from transmission case.
b. Remove rear extension gasket from transmission case.



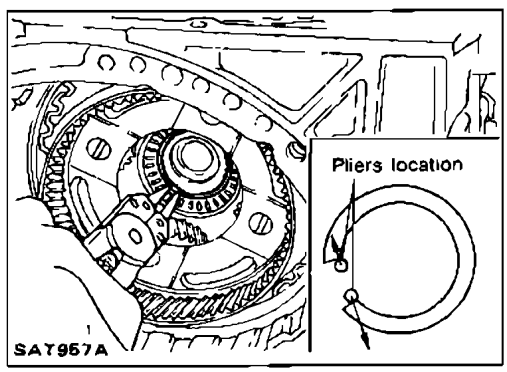
c. Remove oil seal from rear extension.
- **Do not remove oil seal unless it is to be replaced.**



d. Remove revolution sensor from rear extension.
e. Remove O-ring from revolution sensor.



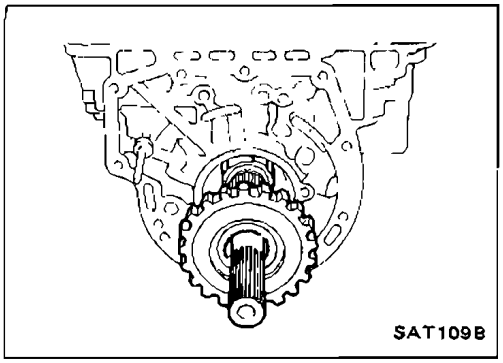
18. Remove output shaft and parking gear.
a. Remove rear snap ring from output shaft.



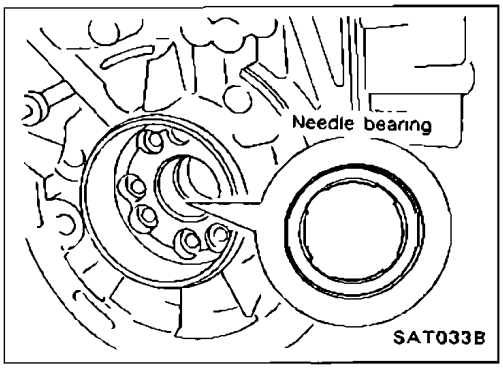
b. Slowly push output shaft all the way forward.
- **Do not use excessive force.**

c. Remove snap ring from output shaft.

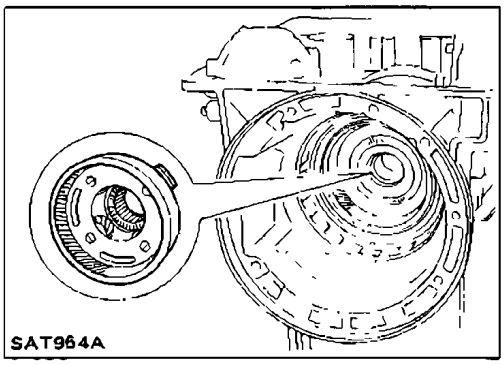
Disassembly (Cont'd)



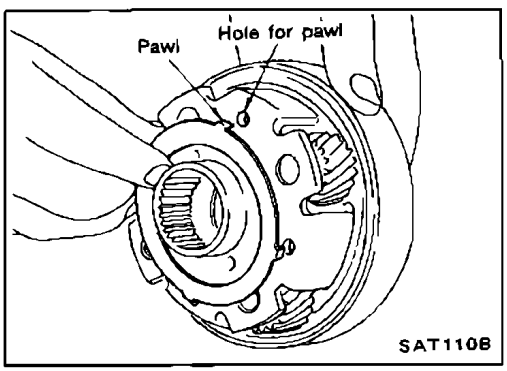
d. Remove output shaft and parking gear as a unit from transmission case.
e. Remove parking gear from output shaft.



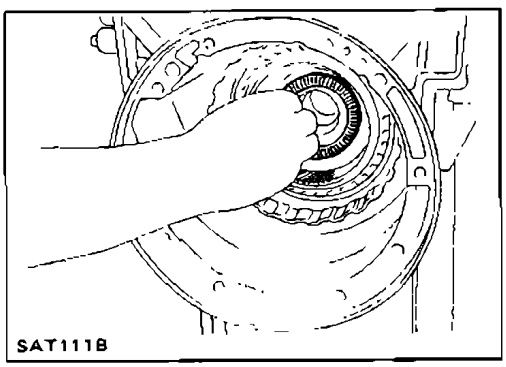
f. Remove needle bearing from transmission case.



19. Remove rear side clutch and gear components.
a. Remove front internal gear.

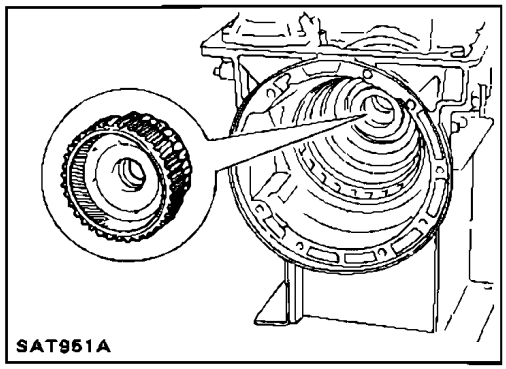


b. Remove bearing race from front internal gear.

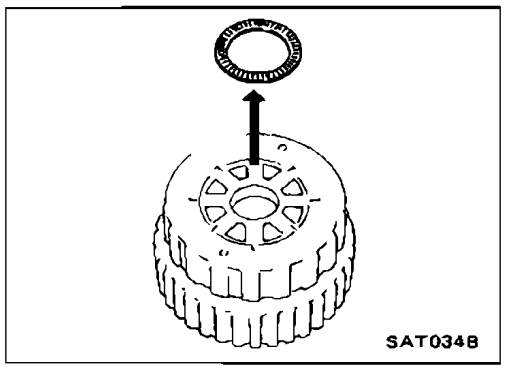


c. Remove needle bearing from rear internal gear.

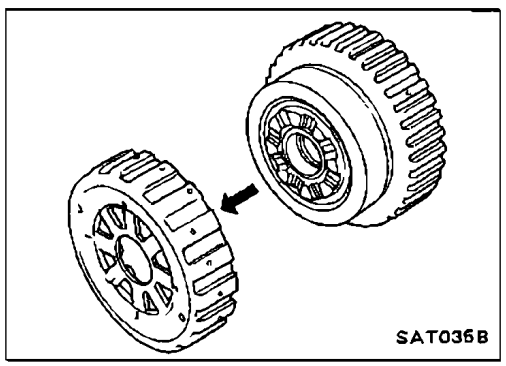
Disassembly (Cont'd)


SAT951A

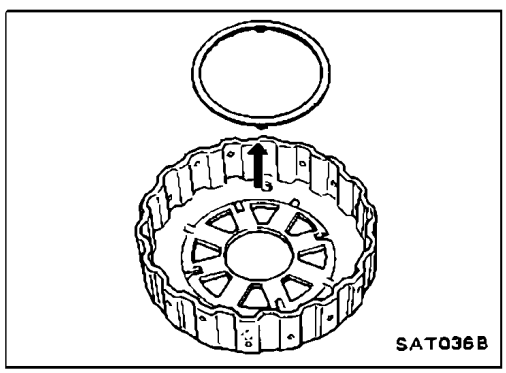
d. Remove rear internal gear, forward clutch hub and overrun clutch hub as a set from transmission case.


SAT034B

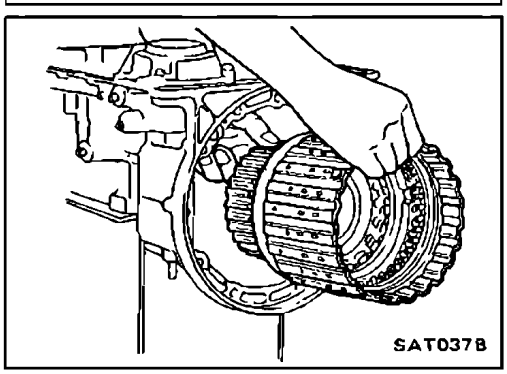
e. Remove needle bearing from overrun clutch hub.


SAT036B

f. Remove overrun clutch hub from rear internal gear and forward clutch hub.

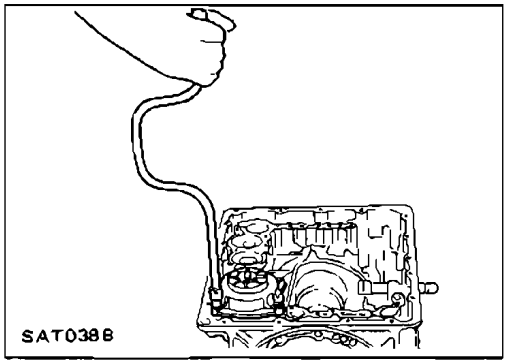

SAT036B

g. Remove thrust washer from overrun clutch hub.

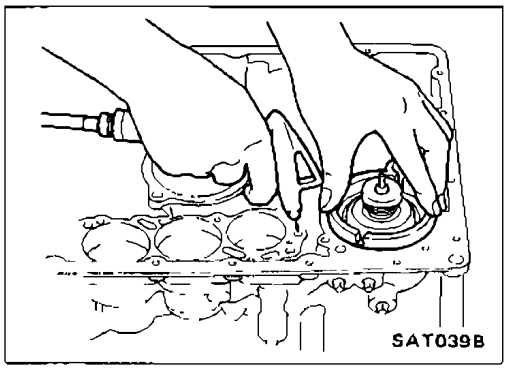

SAT037B

h. Remove forward clutch assembly from transmission case.

Disassembly (Cont'd)

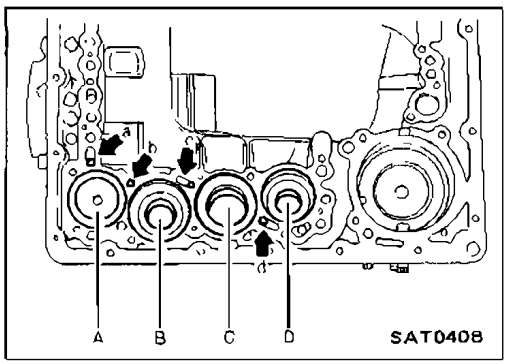


20. Remove band servo and accumulator components.
a. Remove band servo retainer from transmission case.



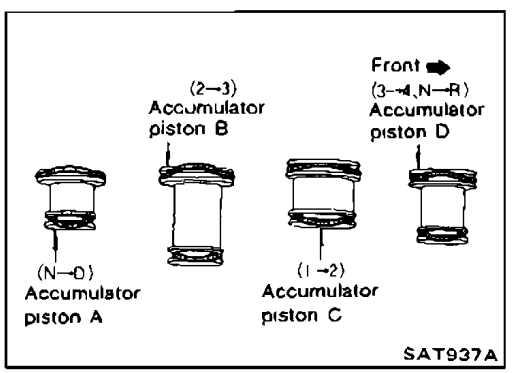
b. Apply compressed air to oil hole until band servo piston comes out of transmission case.
- **Hold piston with a rag and gradually direct air to oil hole.**

c. Remove return springs.

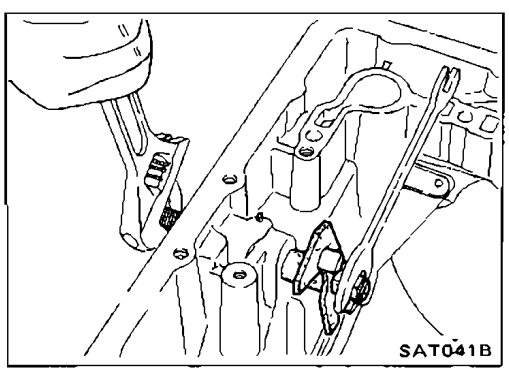


d. Remove springs from accumulator pistons B, C and D.
e. Apply compressed air to each oil hole until piston comes out.
- **Hold piston with a rag and gradually direct air to oil hole.**

Identification of accumulator pistons	A	B	C	D
Identification of oil holes	a	b	c	d

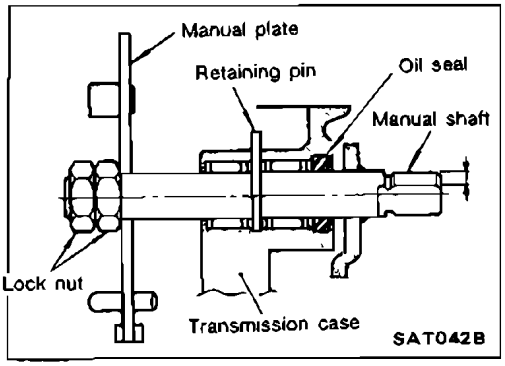


f. Remove O-ring from each piston.

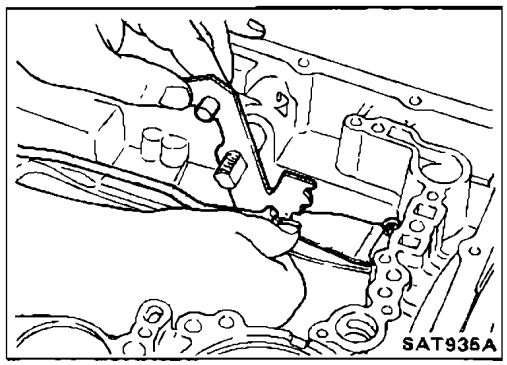


21. Remove manual shaft components, if necessary.
a. Hold width across flats of manual shaft (outside the transmission case) and remove lock nut from shaft.

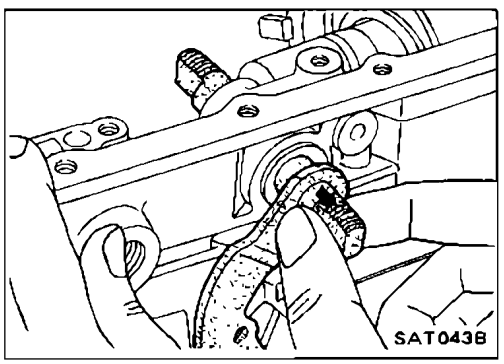
Disassembly (Cont'd)



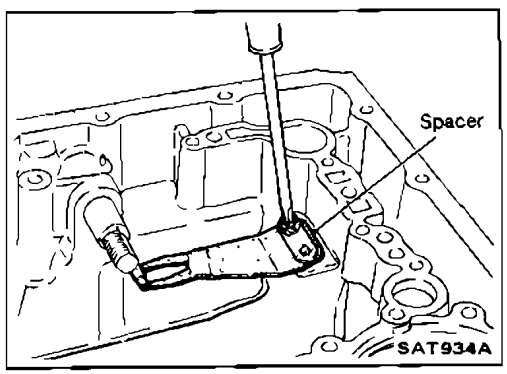
b. Remove retaining pin from transmission case.



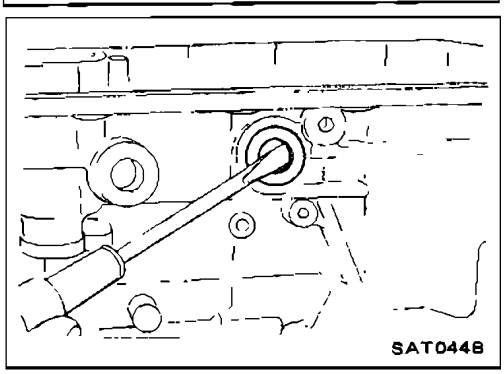
c. While pushing detent spring down, remove manual plate and parking rod from transmission case.



d. Remove manual shaft from transmission case.

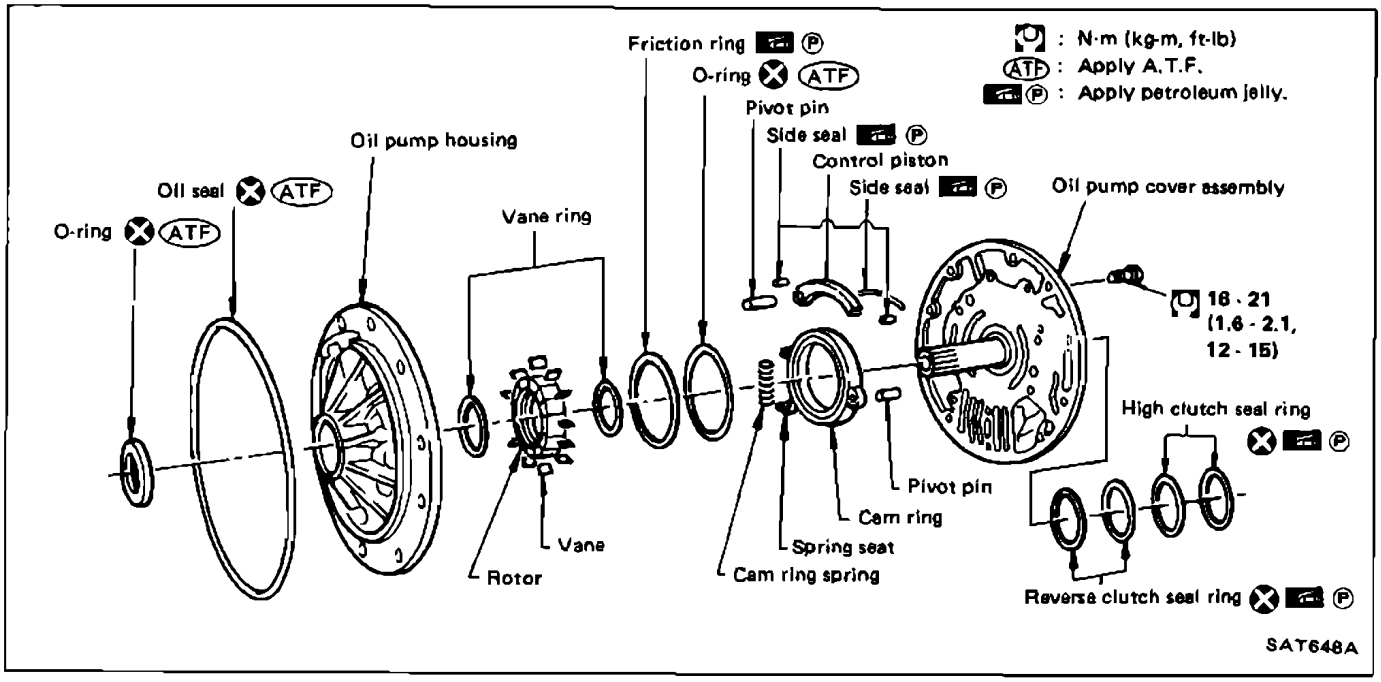


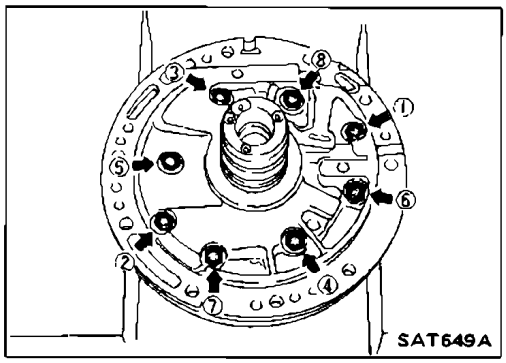
e. Remove spacer and detent spring from transmission case.



f. Remove oil seal from transmission case.

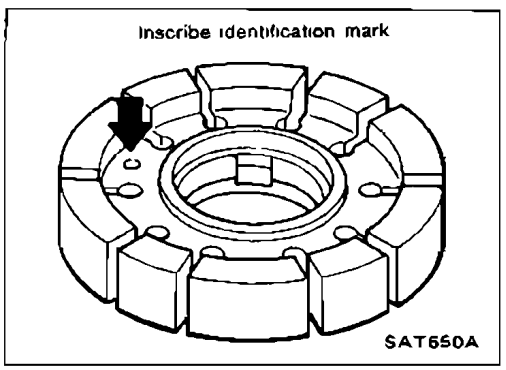
Oil Pump



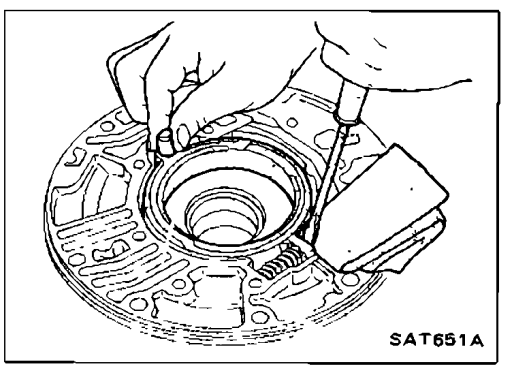


DISASSEMBLY

1. Loosen bolts in numerical order and remove oil pump cover.

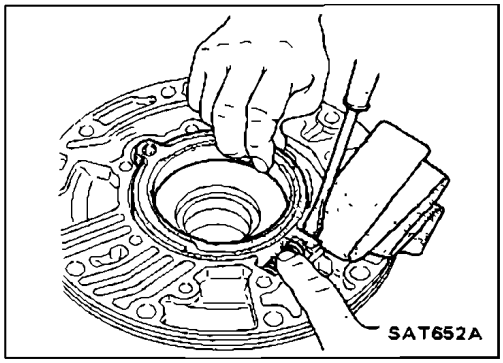


2. Remove rotor, vane rings and vanes.
   - **Inscribe a mark on back of rotor for identification of fore-aft direction when reassembling rotor. Then remove rotor.**

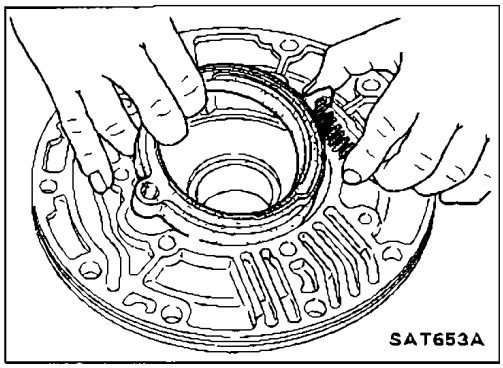


3. While pushing on cam ring remove pivot pin.
   - **Be careful not to scratch oil pump housing.**

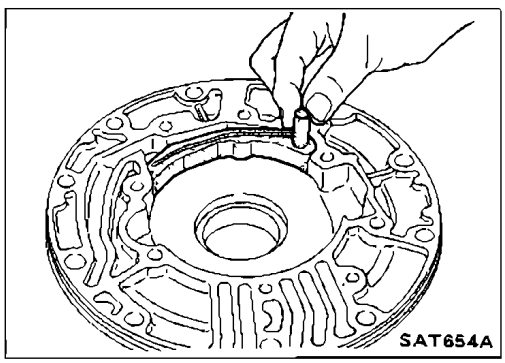
Oil Pump (Cont'd)



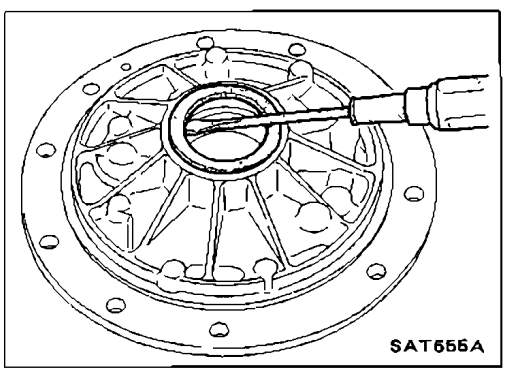
4. While holding cam ring and spring lift out cam ring spring.
   - **Be careful not to damage oil pump housing.**
   - **Hold cam ring spring to prevent it from jumping.**



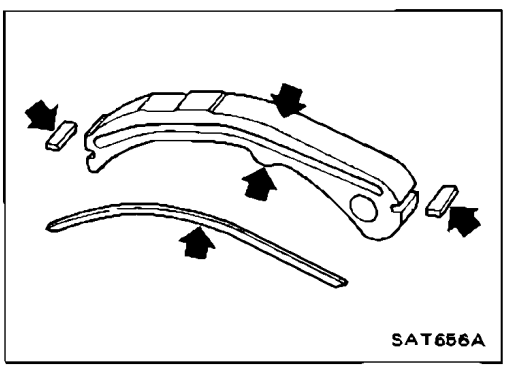
5. Remove cam ring and cam ring spring from oil pump housing.



6. Remove pivot pin from control piston and remove control piston assembly.



7. Remove oil seal from oil pump housing.
   - **Be careful not to scratch oil pump housing.**

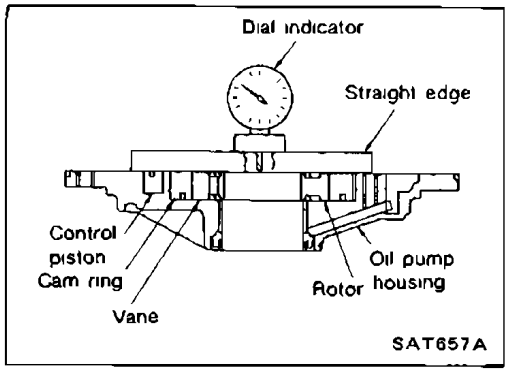


INSPECTION

Oil pump cover, rotor, vanes, control piston, side seals, cam ring and friction ring

- Check for wear or damage.

Oil Pump (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.**

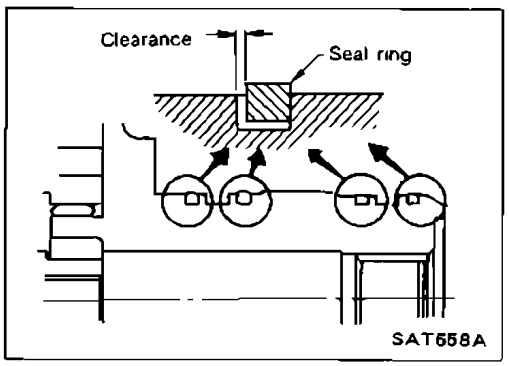
  Standard clearance:

  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

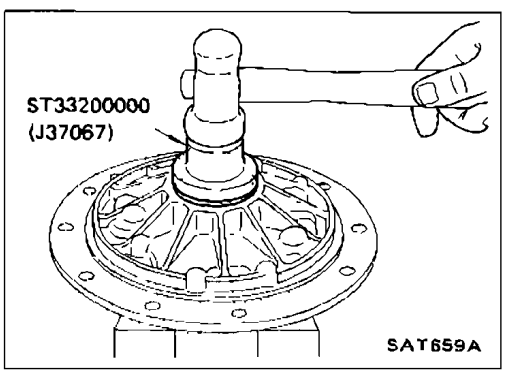
- Measure clearance between seal ring and ring groove.

  Standard clearance:

  0.10 - 0.25 mm (0.0039 - 0.0098 in)

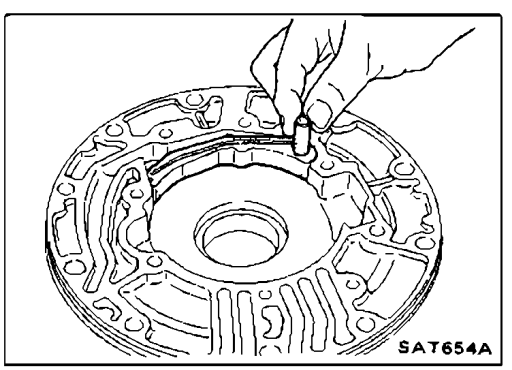
  Wear limit:

  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.**

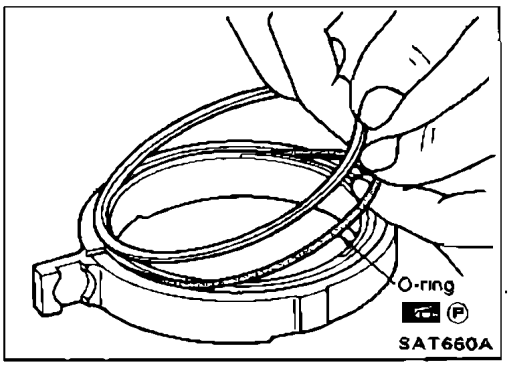


2. Install cam ring in oil pump housing by the following stops.

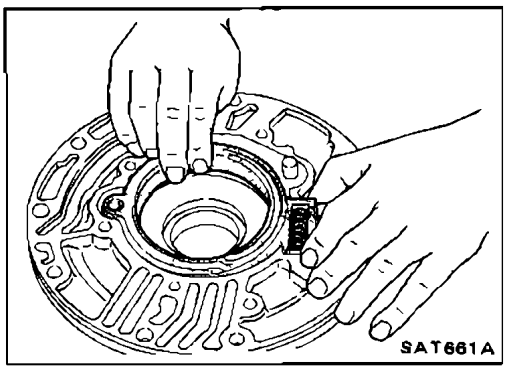
a. Install side seal on control piston.
- **Pay attention to its direction — Black surface goes toward control piston.**
- **Apply petroleum jelly to side seal.**

b. Install control piston on oil pump

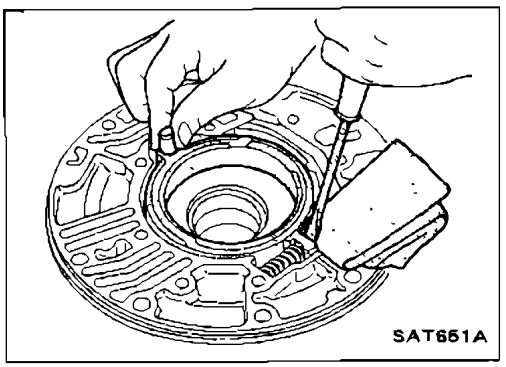
Oil Pump (Cont'd)



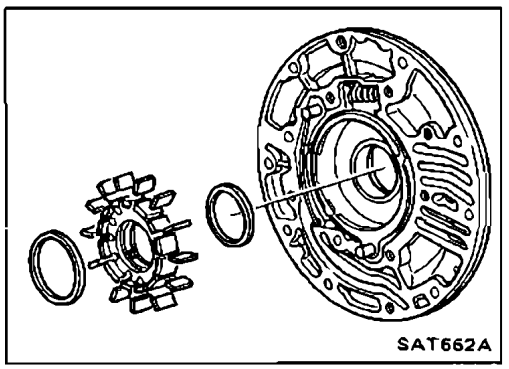
c. Install O-ring and friction ring on cam ring.
- **Apply petroleum jelly to O-ring.**



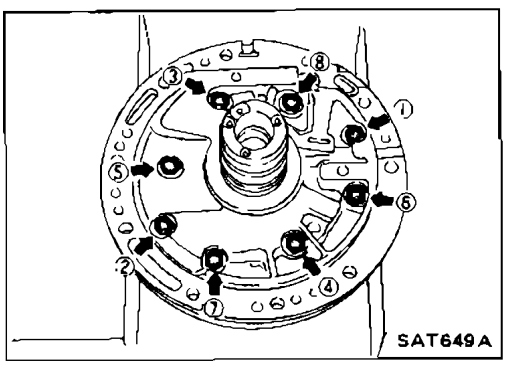
d. Assemble cam ring, cam ring spring and spring seat. Install spring by pushing it against pump housing.



e. While pushing on cam ring install pivot pin.

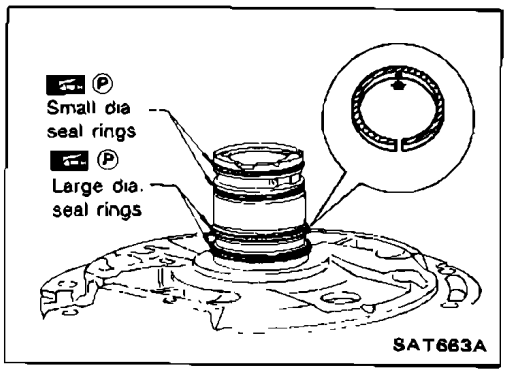


3. Install rotor, vanes and vane rings.
- **Pay attention to direction of rotor.**



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.

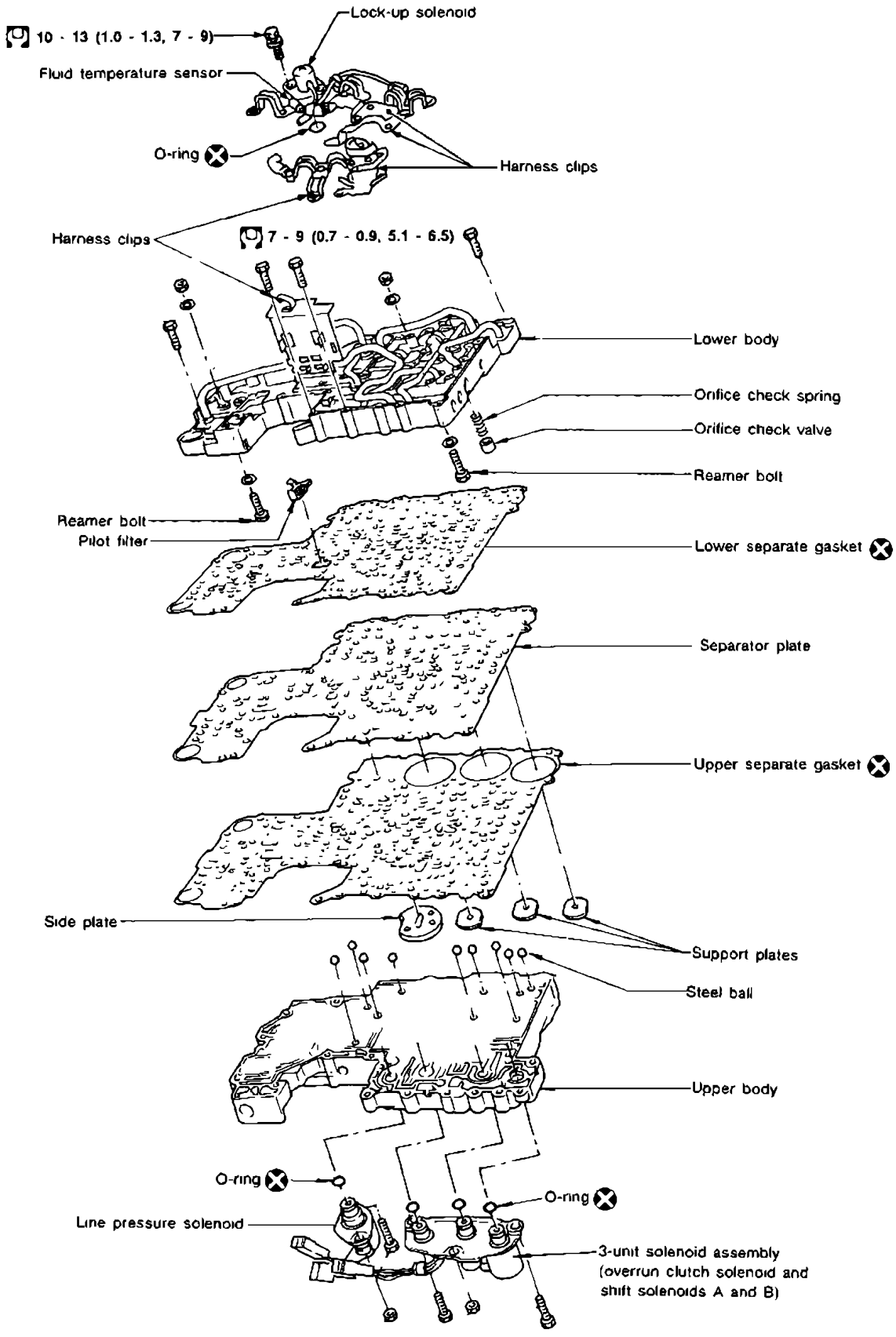
Oil Pump (Cont'd)



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

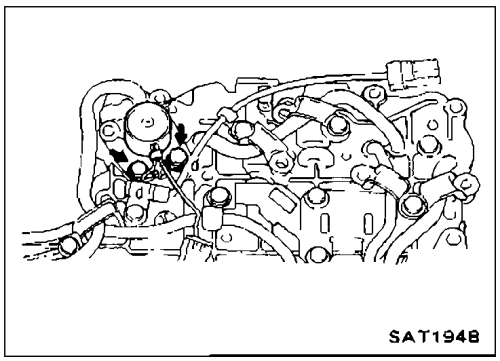


: N·m (kg-m, ft-lb)

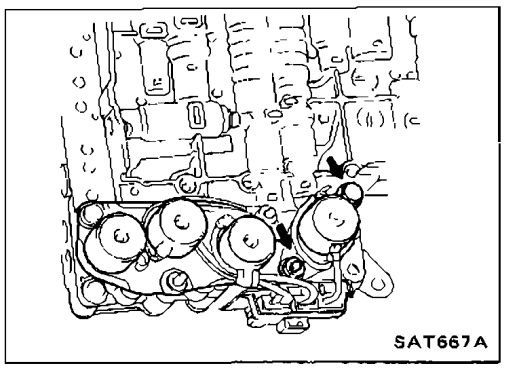
SAT193B

Control Valve Assembly (Cont'd)

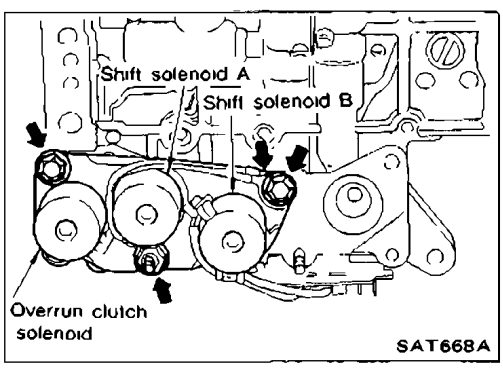
DISASSEMBLY


SAT194B

1. Remove solenoids.
a. Remove lock-up solenoid and side plate from lower body.
b. Remove O-ring from solenoid.

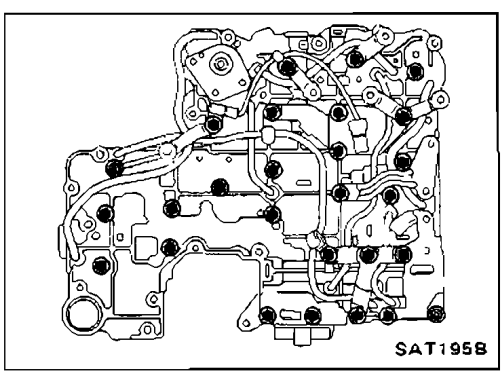

SAT667A

c. Remove line pressure solenoid from upper body.
d. Remove O-ring from solenoid.



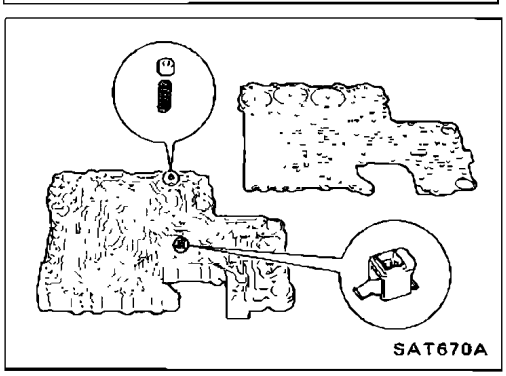
SAT668A

e. Remove 3-unit solenoid assembly from upper body.
f. Remove O-rings from solenoids.


SAT195B

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.

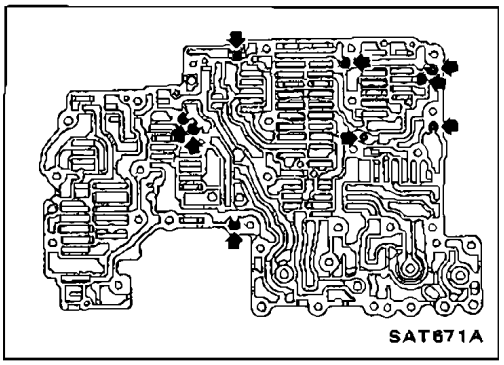
- **Be careful not to drop pilot filter, orifice check valve, spring and steel balls.**


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 (Cont'd)

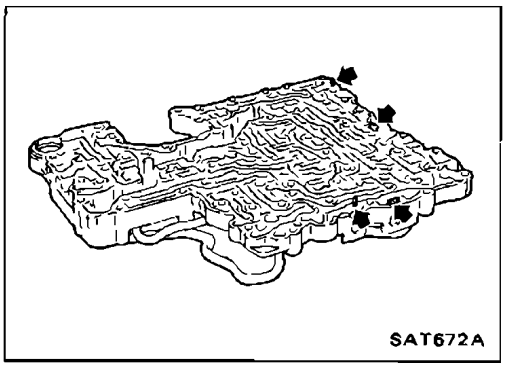
e. Check to see that steel balls are properly positioned in upper body and then remove them from upper body.


SAT671A

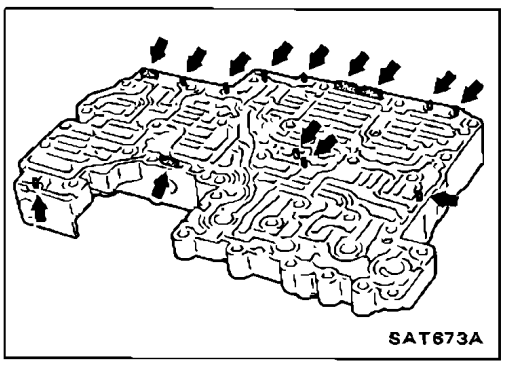
INSPECTION

Lower and upper bodies

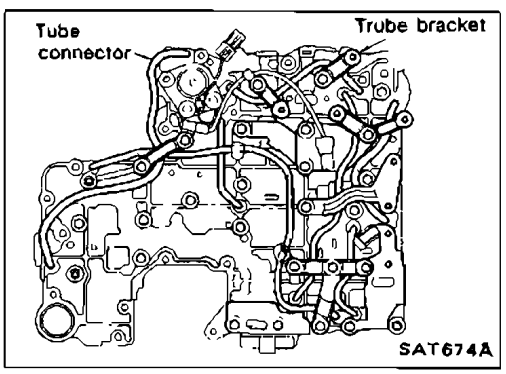
- Check to see that there are pins and retainer plates in lower body.


SAT672A

- Check to see that there are pins and retainer plates in upper body.
- **Be careful not to lose these parts.**


SAT673A

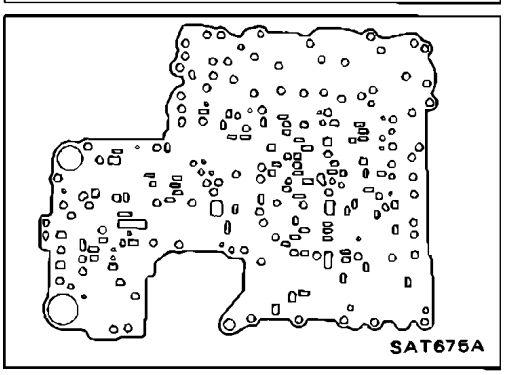
- Check to make sure that oil circuits are clean and free from damage.
- Check tube brackets and tube connectors for damage.



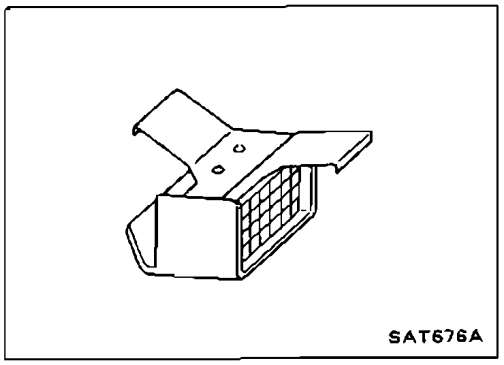
SAT674A

Separator plates

- Check to make sure that separator plate is free of damage and not deformed and oil holes are clean.

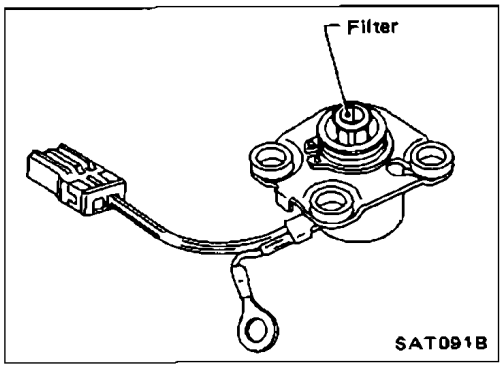

SAT675A

Control Valve Assembly (Cont'd)



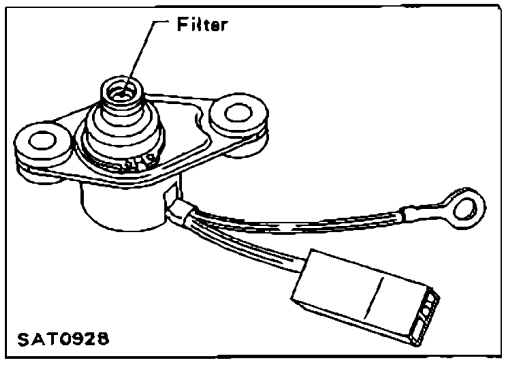
Pilot filter

- Check to make sure that filter is not clogged or damaged.



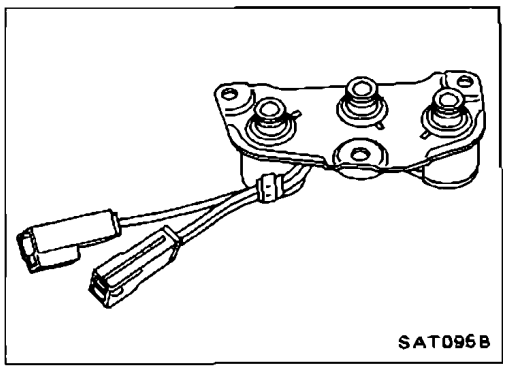
Lock-up solenoid

- Check that filter is not clogged or damaged.
- Measure resistance. — Refer to "Electrical Components Inspection".



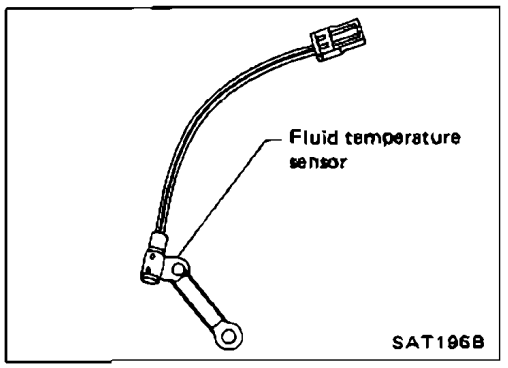
Line pressure solenoid

- Check that filter is not clogged or damaged.
- Measure resistance. — Refer to "Electrical Components Inspection".



3-unit solenoid assembly (Overrun clutch solenoid and shift solenoids A and B)

- Measure resistance of each solenoid. — Refer to "Electrical Components Inspection".

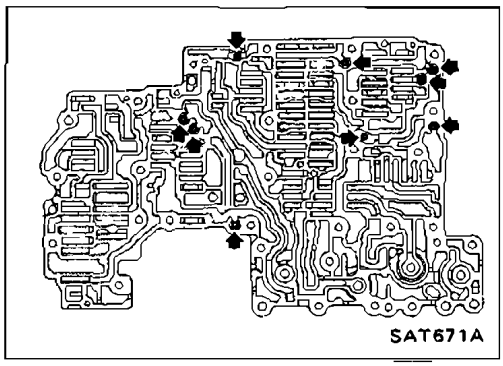


Fluid temperature sensor

- Measure resistance. — Refer to "Electrical Components Inspection".

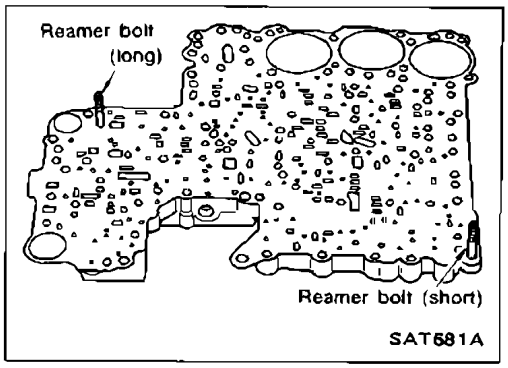
Control Valve Assembly (Cont'd)

ASSEMBLY


SAT671A

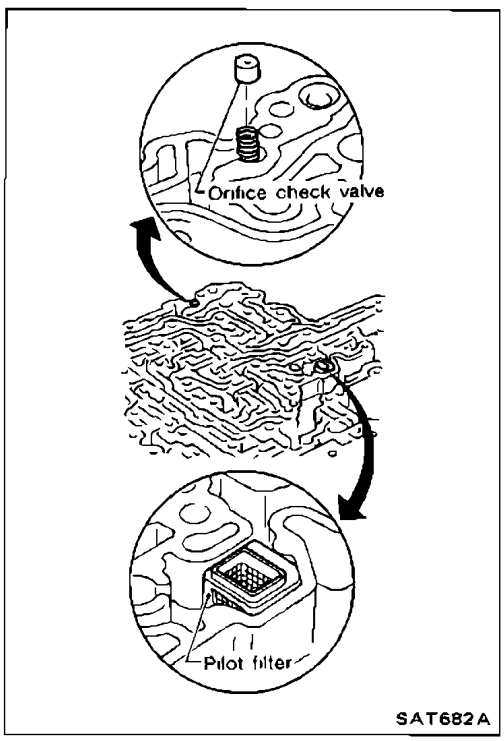
1. Install upper and lower bodies.

a. Place oil circuit of upper body face up. Install steel balls in their proper positions.



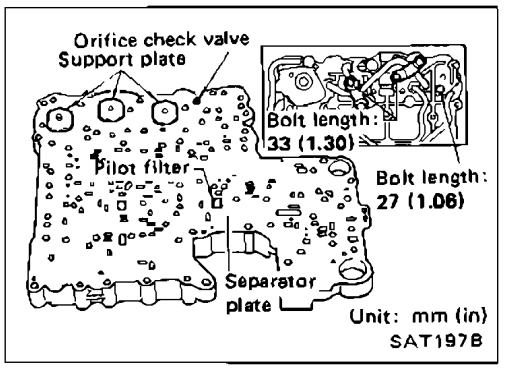
SAT681A

b. Install reamer bolts from bottom of upper body and install separate gaskets.



SAT682A

c. Place oil circuit of lower body face up. Install orifice check spring, orifice check valve and pilot filter.

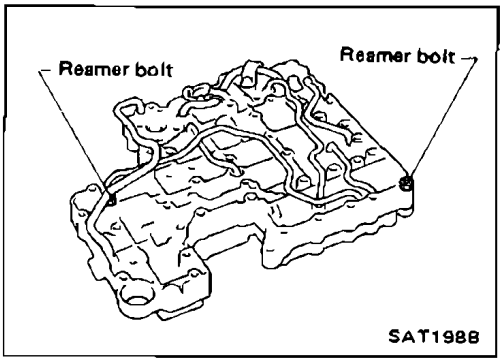


SAT197B

d. Install lower separate gaskets and separator plates on lower body.

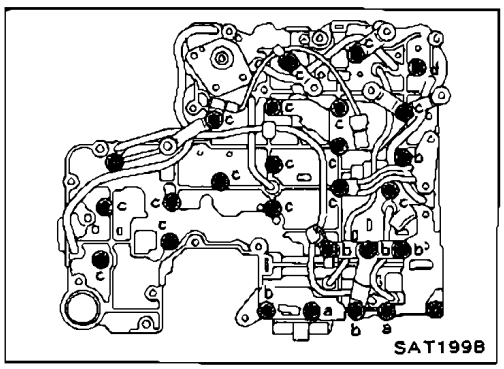
e. Install and temporarily tighten support plates, fluid temperature sensor and tube brackets.

Control Valve Assembly (Cont'd)



f. Temporarily assemble lower and upper bodies, using reamer bolt as a guide.

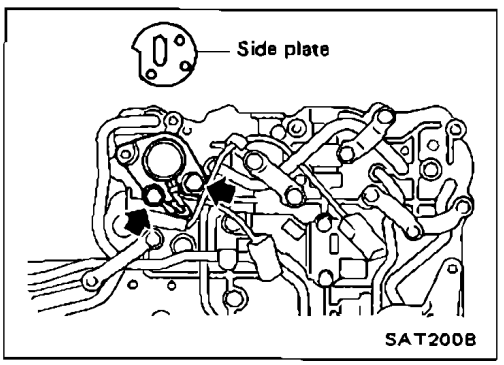
- **Be careful not to dislocate or drop steel balls, orifice check spring, orifice check valve and pilot filter.**



g. Install and temporarily tighten bolts and tube brackets in their proper locations.

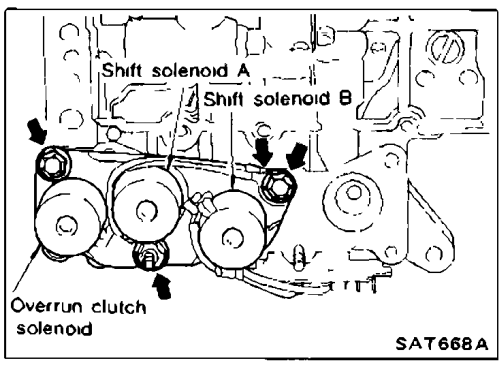
Bolt length and location:

Item \ Bolt symbol		a	b	c	d
Bolt length	mm (in)	70 (2.76)	50 (1.97)	33 (1.30)	27 (1.06)

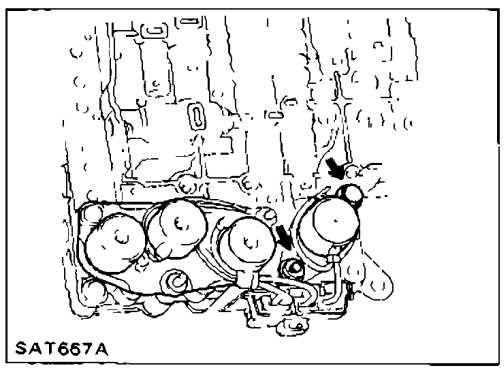


2. Install solenoids.

a. Attach O-ring and install lock-up solenoid and side plates onto lower body.



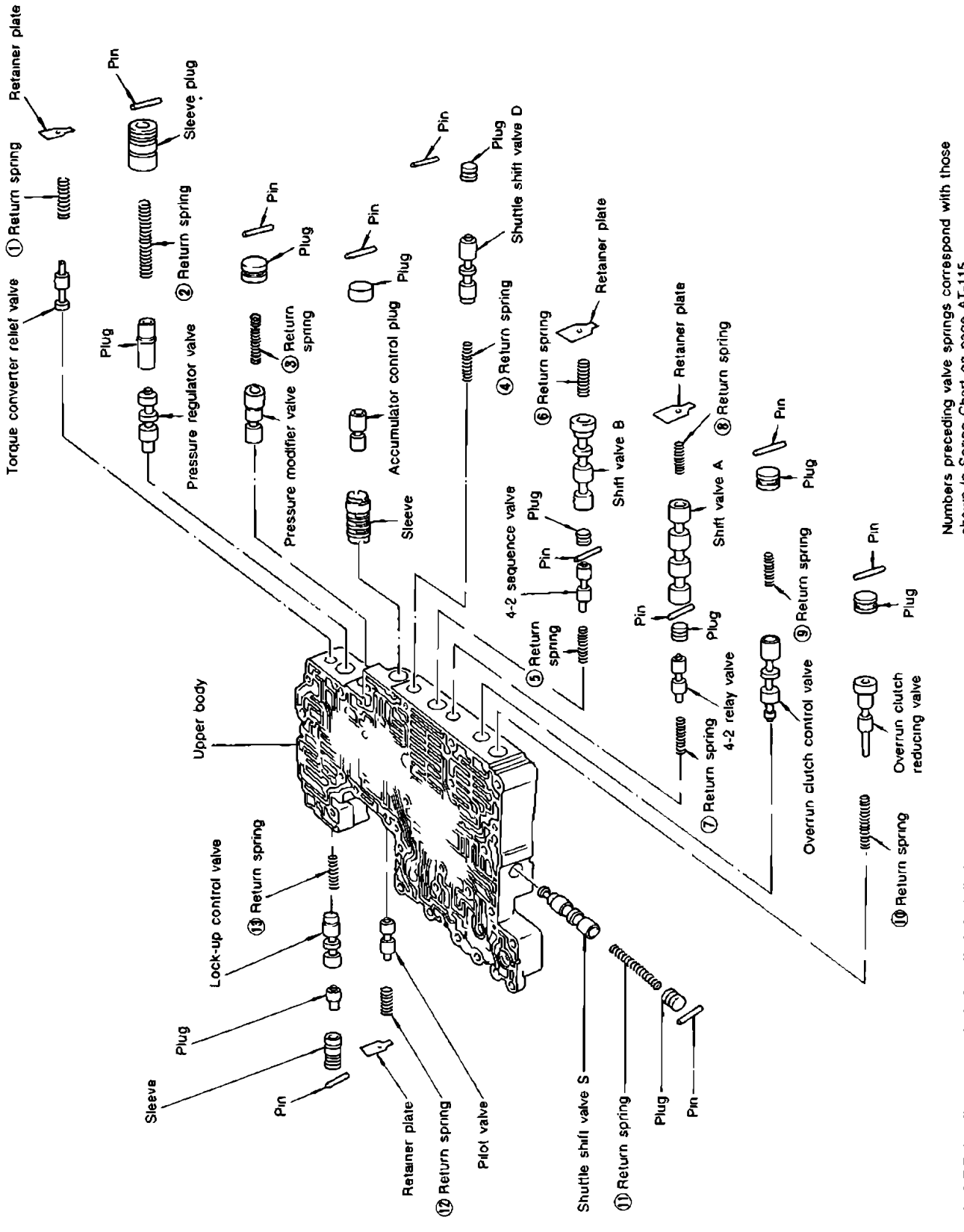
b. Attach O-rings and install 3-unit solenoids assembly onto upper body.



c. Attach O-ring and install line pressure solenoid onto upper body.

3. Tighten all bolts.

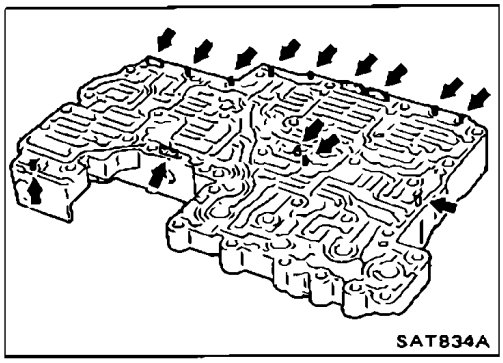
Control Valve Upper Body



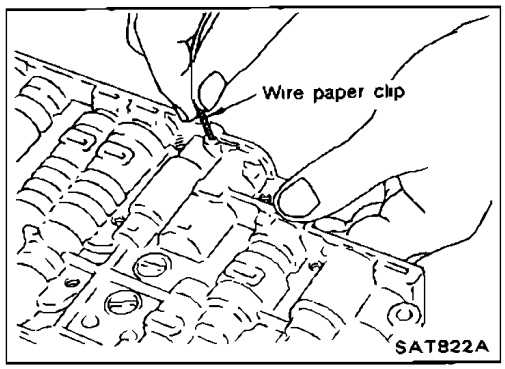
SAT837B

Control Valve Upper Body (Cont'd)

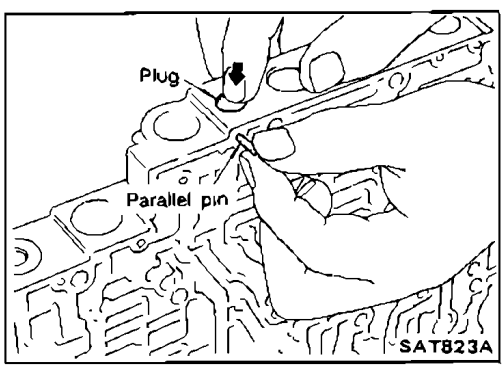
DISASSEMBLY



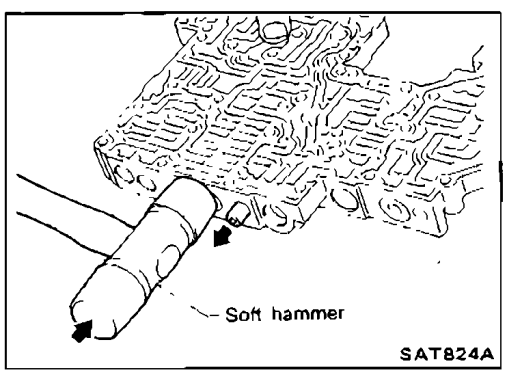
1. Remove valves at parallel pins.
- **Do not use a magnetic hand.**



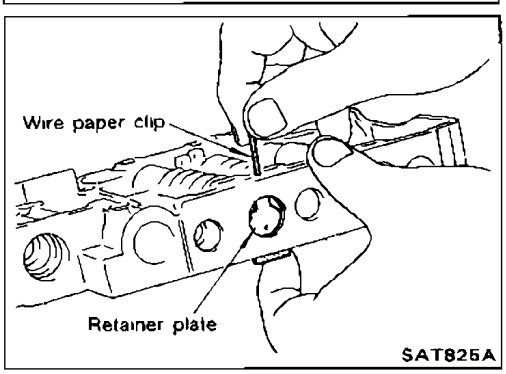
a. Use a wire paper clip to push out parallel pins.



b. Remove parallel pins while pressing their corresponding plugs and sleeves.
- **Remove plug slowly to prevent internal parts from jumping out.**



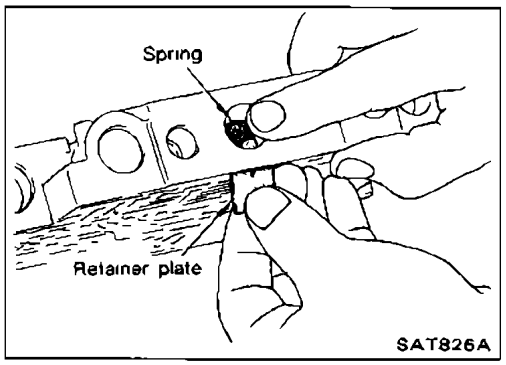
c. Place mating surface of valve facedown, and remove internal parts.
- **If a valve is hard to remove, place valve body facedown and lightly tap it with a soft hammer.**
- **Be careful not to drop or damage valves and sleeves.**



2. Remove valves at retainer plates.
a. Pry out retainer plate with wire paper clip.

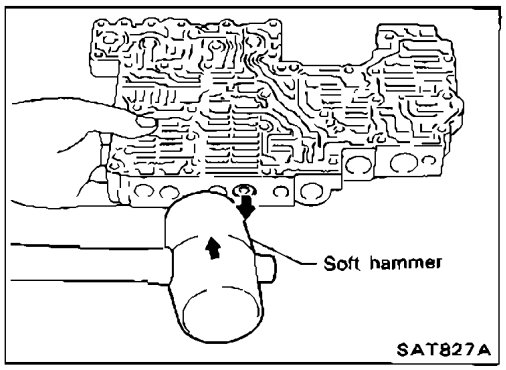
Control Valve Upper Body (Cont'd)

b. Remove retainer plates while holding spring.

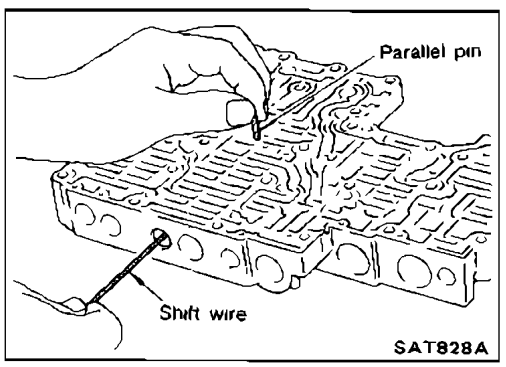


c. Place mating surface of valve facedown, and remove internal parts.

- **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.**

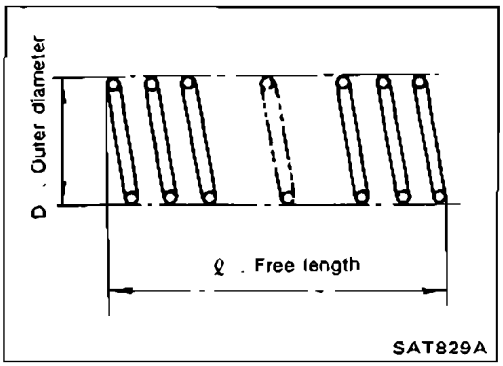


- 4-2 sequence valve and relay valve are located far back in upper body. If they are hard to remove, carefully push them out using stiff wire.
- **Be careful not to scratch sliding surface of valve with wire.**



Control Valve Upper Body (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-112.

Inspection standard

Unit: mm (in)

Parts / Item		Part No.	ℓ	D
①	Torque converter relief valve spring	31742-41X18	32.3 (1.272)	9.0 (0.354)
②	Pressure regulator valve spring	31742-41X16	61.5 (2.421)	8.9 (0.350)
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)

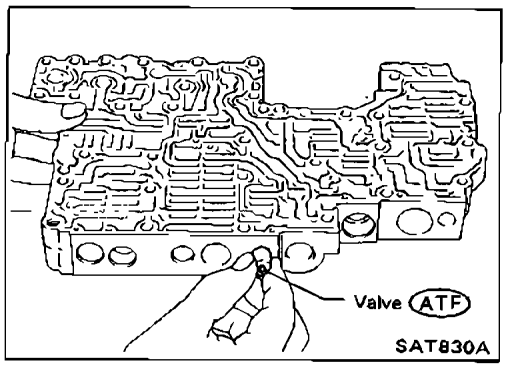
- Replace valve springs if deformed or fatigued.

Control valves

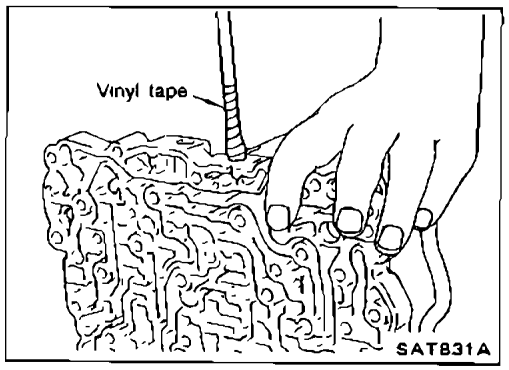
- Check sliding surfaces of valves, sleeves and plugs.

Control Valve Upper Body (Cont'd)

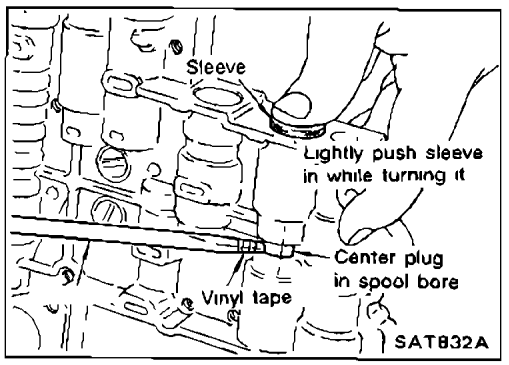
ASSEMBLY



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.**

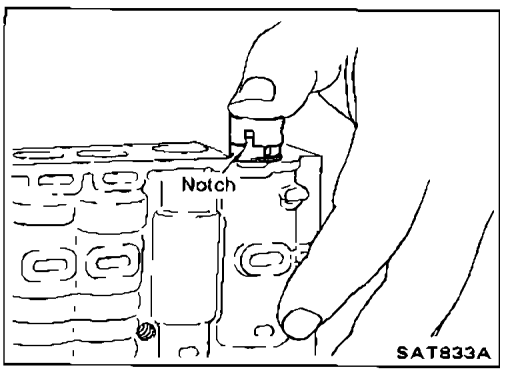


- Wrap a small screwdriver with vinyl tape and use it to insert the valves into proper position.



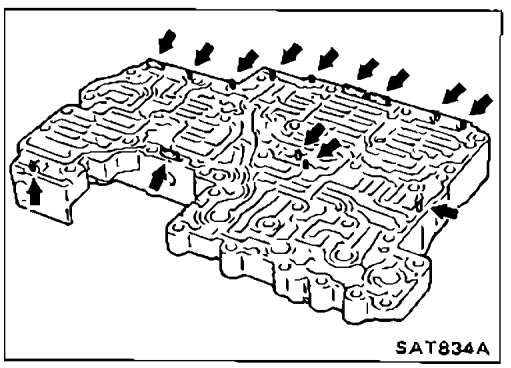
Pressure regulator valve

- 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.



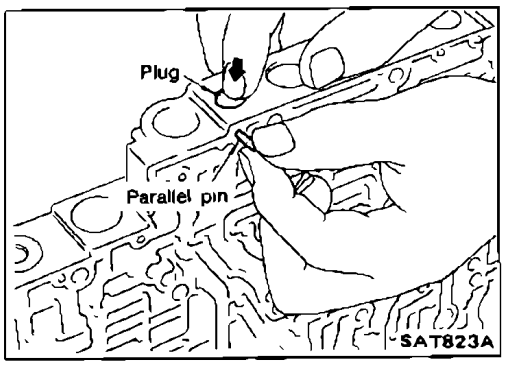
Accumulator control plug

- Align protrusion of accumulator control sleeve with notch in plug.
- Align parallel pin groove in plug with parallel pin, and install accumulator control valve.

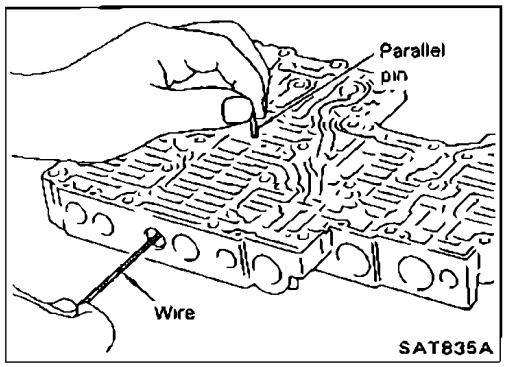


2. Install parallel pins and retainer plates.

Control Valve Upper Body (Cont'd)

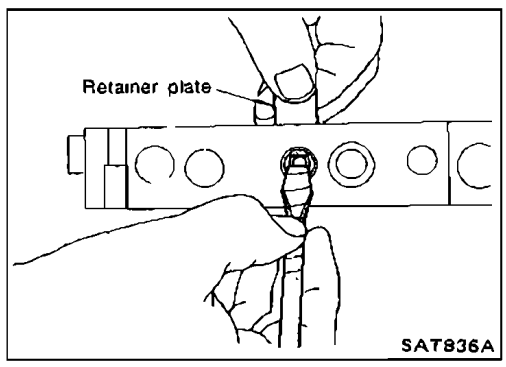


- **While pushing plug, install parallel pin.**



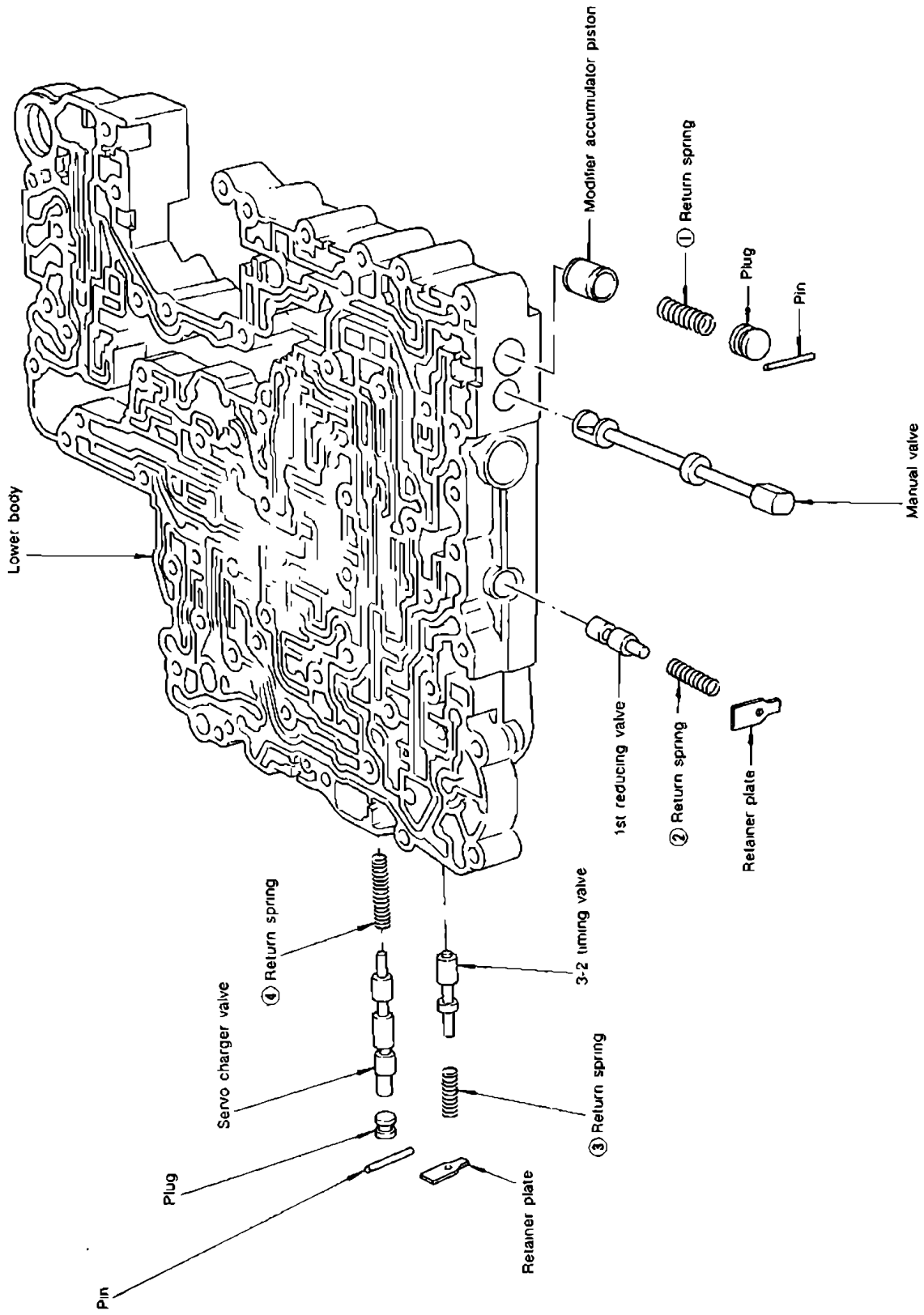
4-2 sequence valve and relay valve

- 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 Lower Body

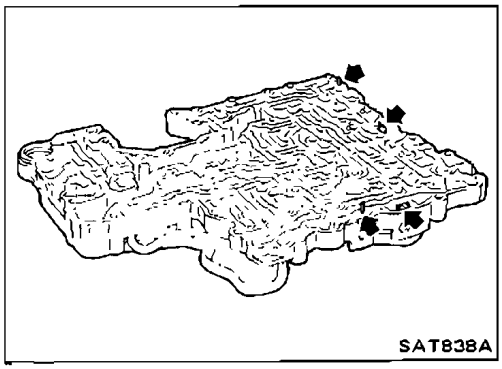


Numbers preceding valve springs correspond with those shown in Spring Chart on page AT-119

Apply A.T.F. to all components before their installation.

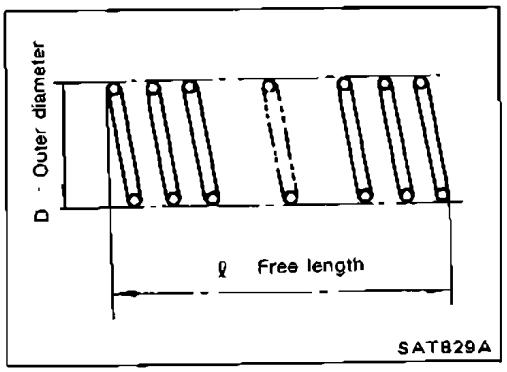
SAT837A

Control Valve Lower Body (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 on AT-118.

Inspection standard:

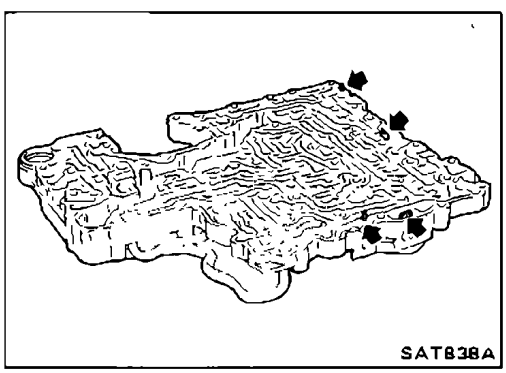
Unit: mm (in)

Parts / Item		Part No.	ℓ	D
①	Modifier accumulator piston 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

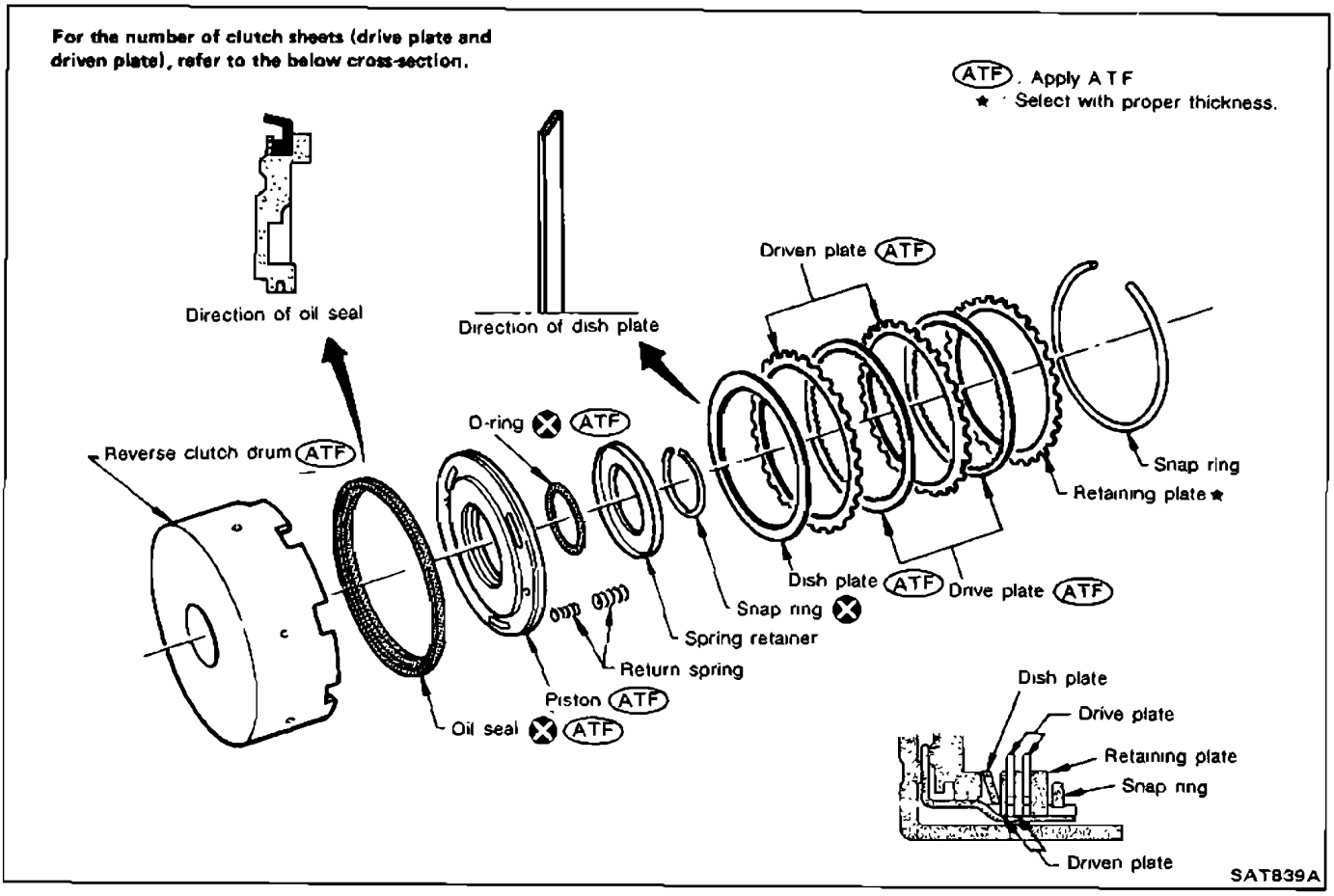
- Check sliding surfaces of control valves, sleeves and plugs for damage.

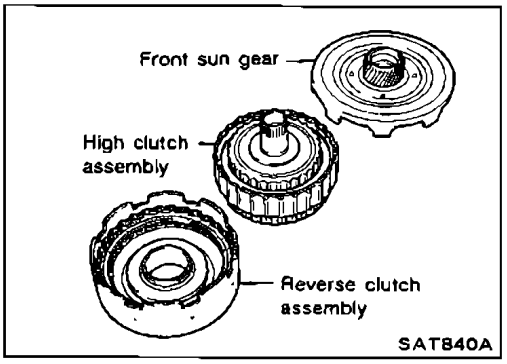


ASSEMBLY

- Install control valves.
  For installation procedures, refer to "ASSEMBLY" of Control Valve Upper Body.

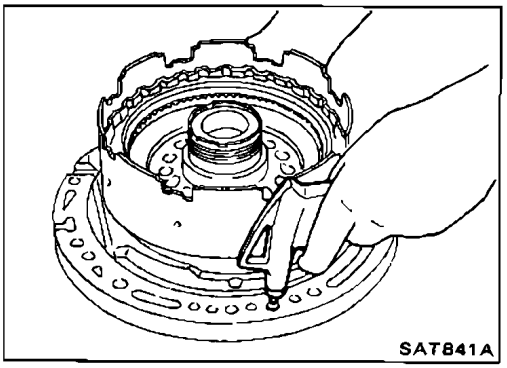
Reverse Clutch





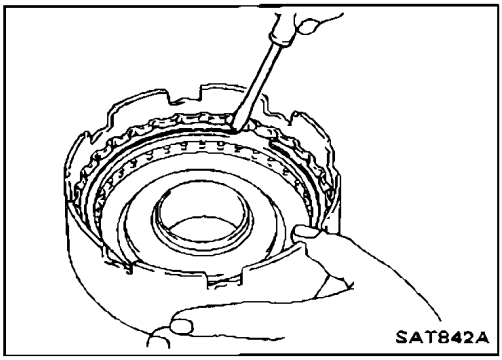
DISASSEMBLY

1. Remove reverse clutch assembly from clutch pack.

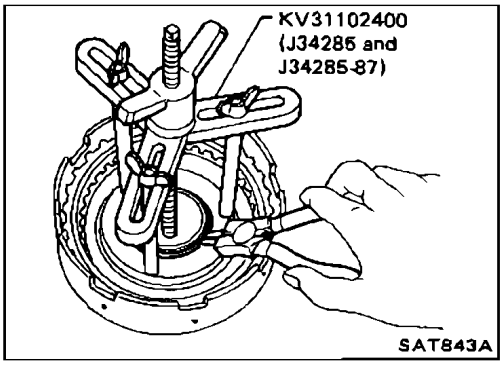


2. Check operation of reverse clutch.
a. Install seal ring onto oil pump cover and install reverse clutch. Apply compressed air to oil hole.
b. Check to see that retaining plate moves to snap ring.
c. If retaining plate does not move to snap ring, D-ring or oil seal may be damaged or fluid may be leaking at piston check ball.

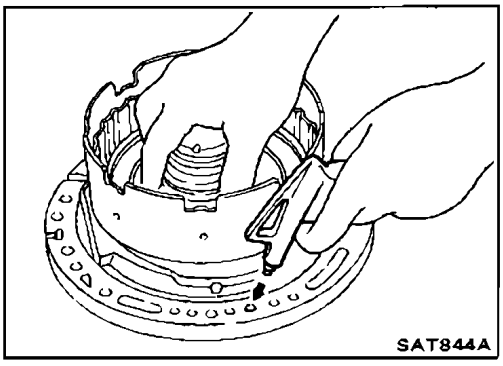
Reverse Clutch (Cont'd)



3. Remove drive plates, driven plates, retaining plate, dish plate and snap ring.



4. Remove snap ring from clutch drum while compressing clutch springs.
   - **Do not expand snap ring excessively.**
5. Remove spring retainer and return spring.

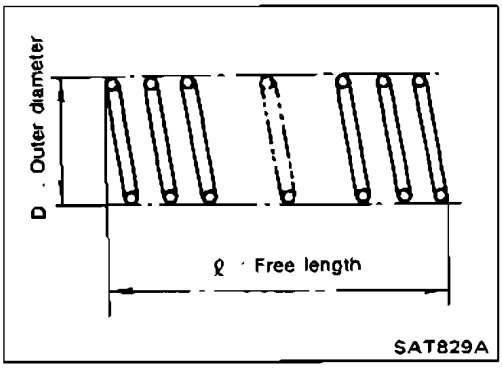


6. Install seal ring onto oil pump cover and install reverse clutch drum. While holding piston, gradually apply compressed air to oil hole until piston is removed.
   - **Do not apply compressed air abruptly.**
7. Remove D-ring and oil seal from piston.

INSPECTION

Reverse clutch snap ring and spring retainer

- Check for deformation, fatigue or damage.



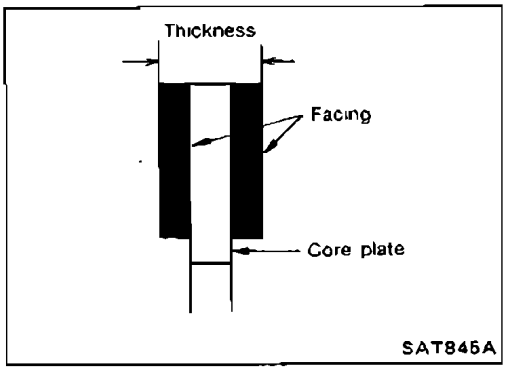
Reverse clutch return springs

- Check for deformation or damage. Also measure free length and outside diameter.

Inspection standard:

Unit: mm (in)

Parts	Part No.	ℓ	D
Spring	30505-41X02	19.69 (0.7752)	11.6 (0.457)



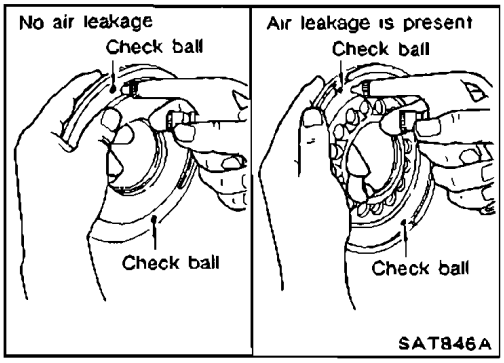
Reverse clutch drive plates

- Check facing for burns, cracks or damage.
- Measure thickness of facing.
  Thickness of drive plate:
  Standard value: 2.0 mm (0.079 in)
  Wear limit: 1.8 mm (0.071 in)
- If not within wear limit, replace.

Reverse clutch dish plate

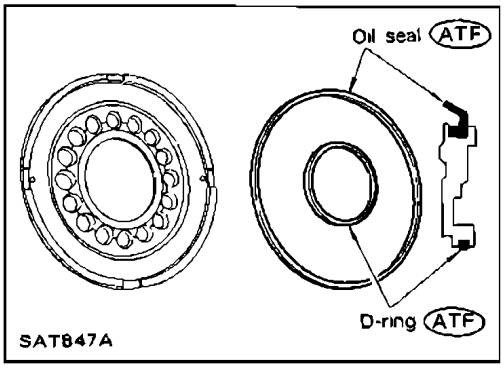
- Check for deformation or damage.

Reverse Clutch (Cont'd)



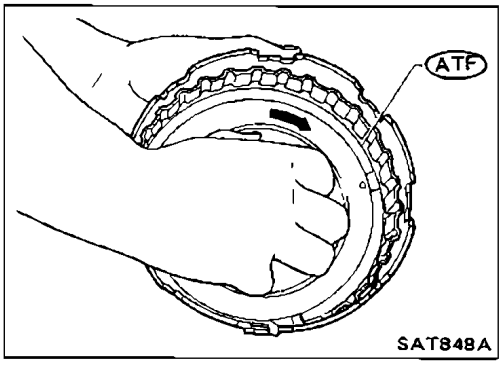
Reverse clutch piston

- 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.

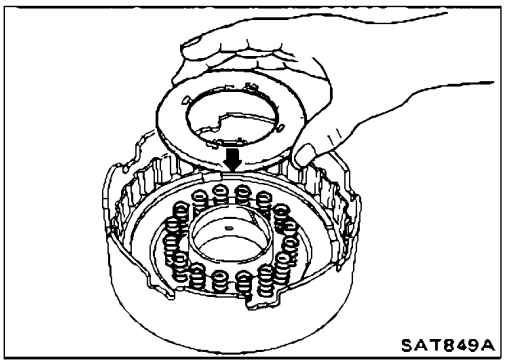


ASSEMBLY

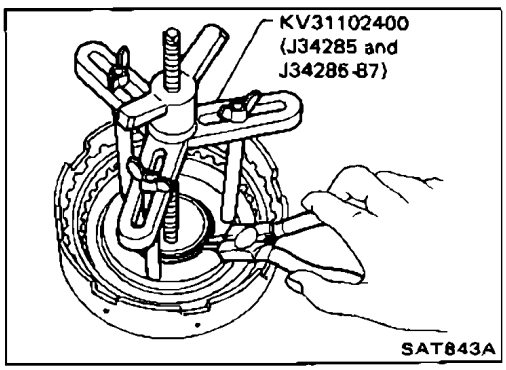
1. Install D-ring and oil seal on piston.
- **Apply A.T.F. to both parts.**



2. Install piston assembly by turning it slowly and evenly.
- **Apply A.T.F. to inner surface of drum.**

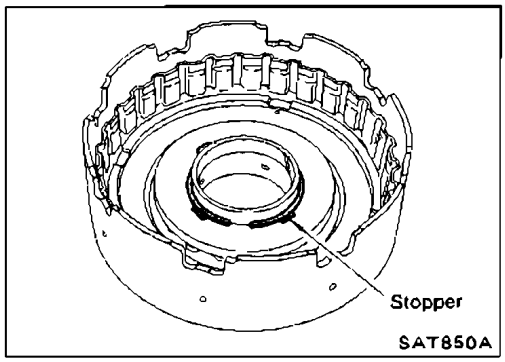


3. Install return springs and spring retainer.

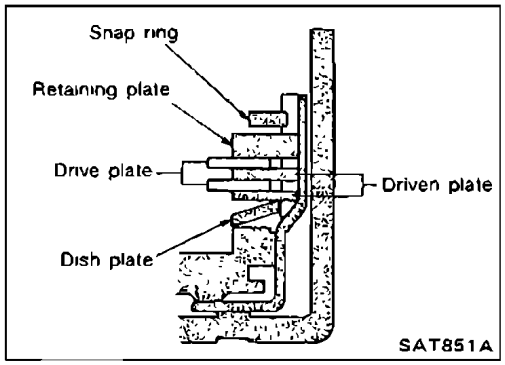


4. Install snap ring while compressing clutch springs.

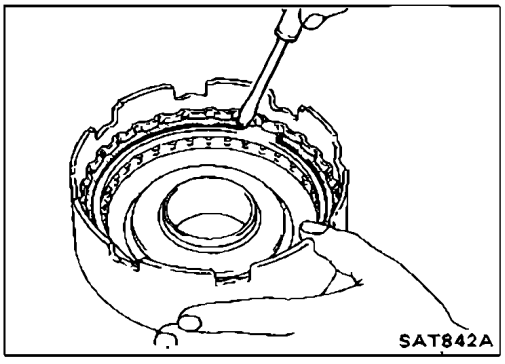
Reverse Clutch (Cont'd)



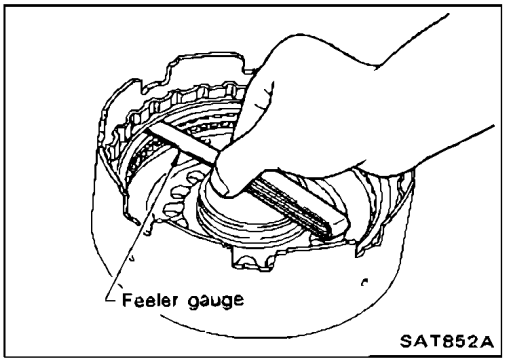
- **Do not align snap ring gap with spring retainer stopper.**



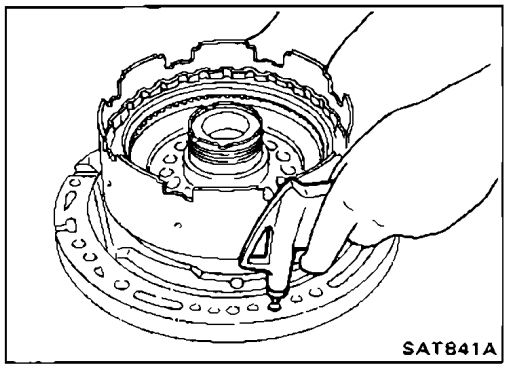
5. Install drive plates, driven plates, retaining plate and dish plate.



6. Install snap ring.



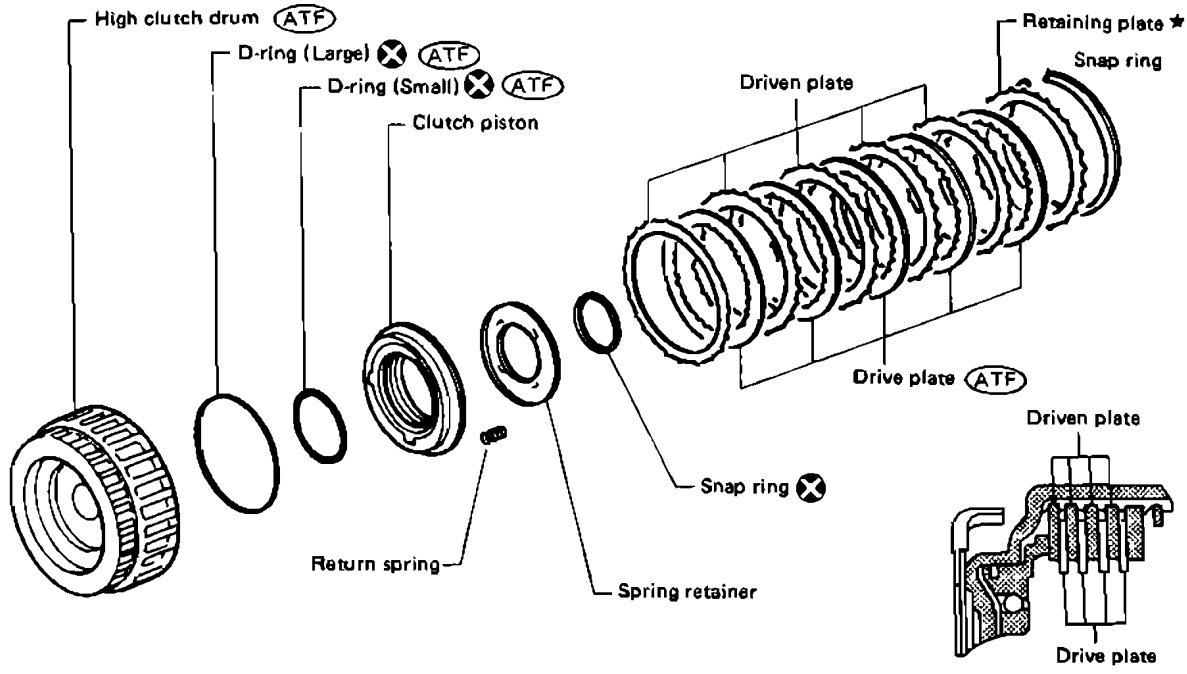
7. Measure clearance between retaining plate and snap ring. If not within allowable limit, select proper retaining plate.
   Specified clearance:
   Standard
   0.5 - 0.8 mm (0.020 - 0.031 in)
   Allowable limit
   1.2 mm (0.047 in)
   Retaining plate:
   Refer to S.D.S.



8. Check operation of reverse clutch.
   Refer to "DISASSEMBLY" of Reverse Clutch.

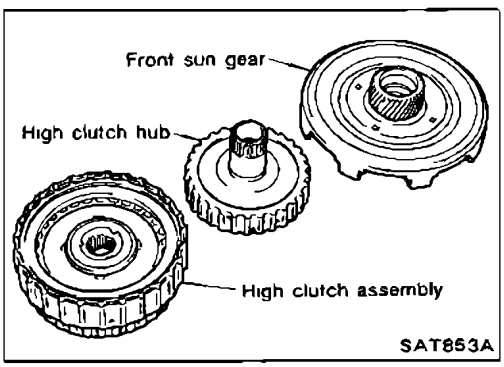
High Clutch

For the number of clutch sheets (drive plate and driven plate), refer to the below cross-section.



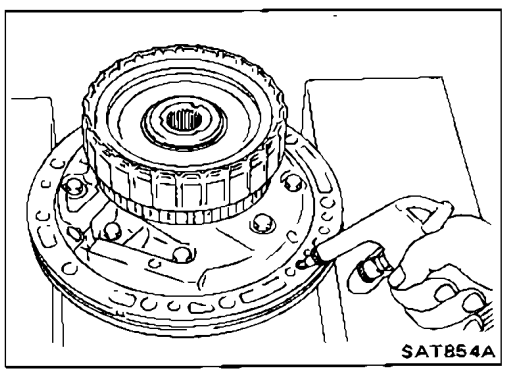
(ATF) : Apply A.T.F.
★ : Select with proper thickness.

SAT809B



SAT853A

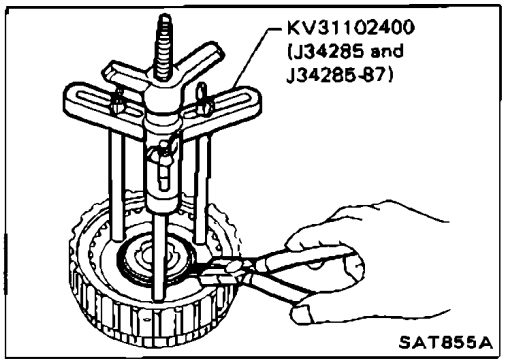
Service procedures for high clutch are essentially the same as those for reverse clutch, with the following exception:



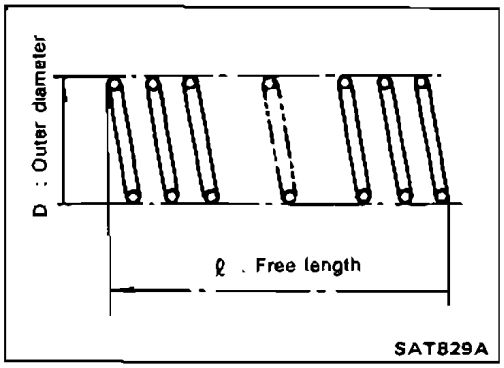
SAT854A

- Check of high clutch operation

High Clutch (Cont'd)



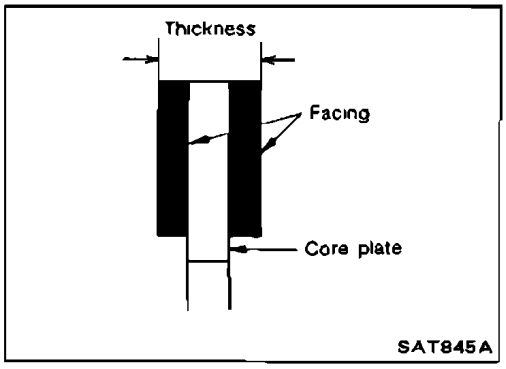
- Removal and installation of return spring



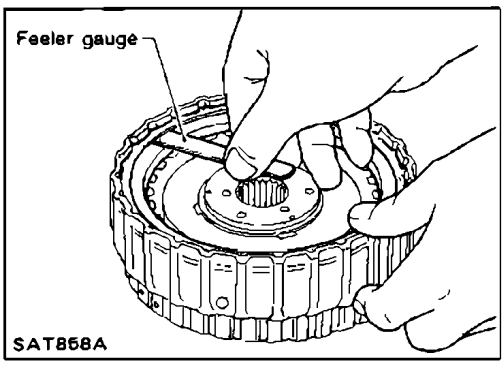
- Inspection of high clutch return springs

Inspection standard: Unit: mm (in)

Part No.	ℓ	D
31505-21X03	22.06 (0.8685)	11.6 (0.457)



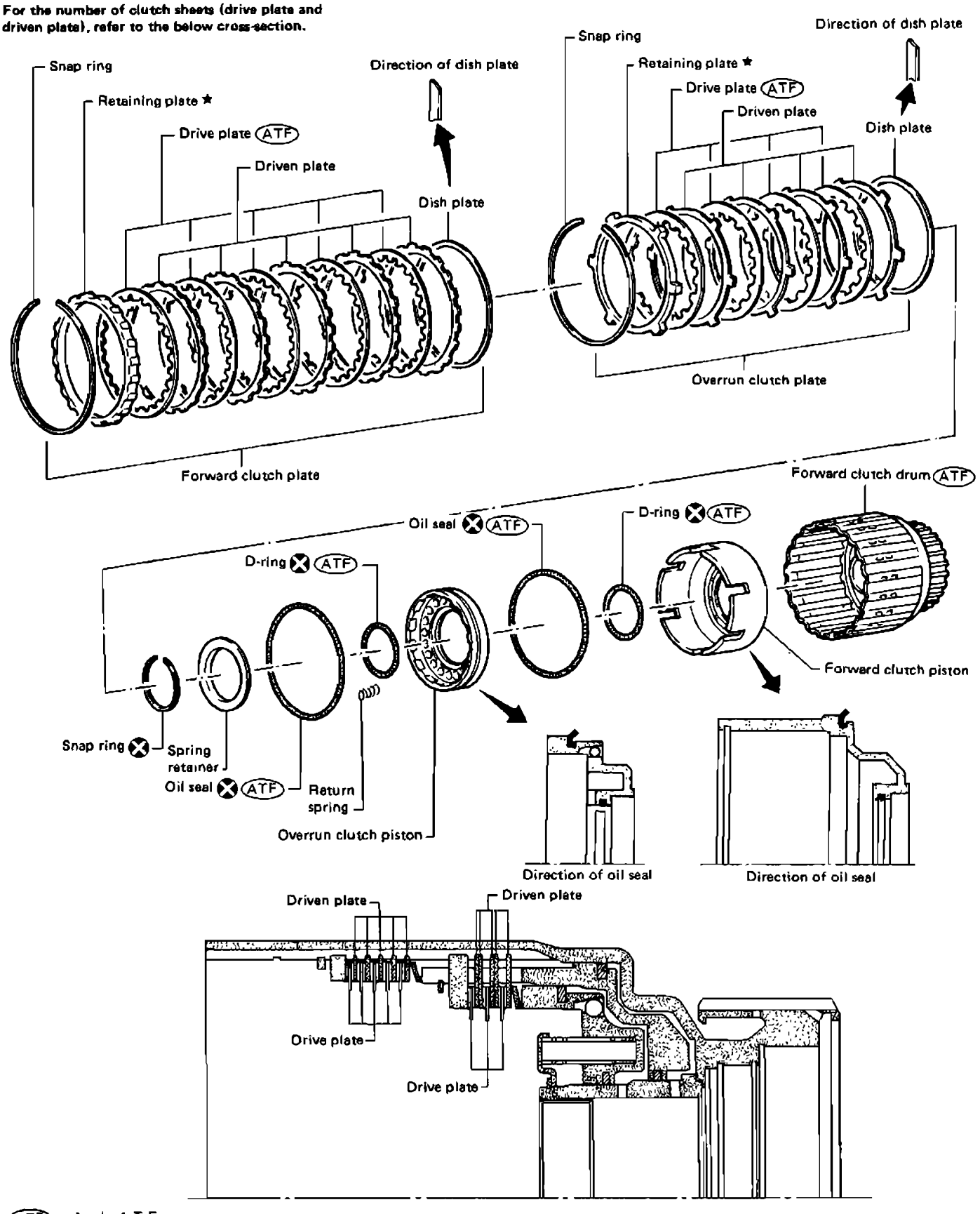
- Inspection of high clutch drive plate
  - **Thickness of drive plate:**
    - **Standard**
      - **1.6 mm (0.063 in)**
    - **Wear limit**
      - **1.4 mm (0.055 in)**



- Measurement of clearance between retaining plate and snap ring
  - **Specified clearance:**
    - **Standard**
      - **1.8 - 2.2 mm (0.071 - 0.087 in)**
    - **Allowable limit**
      - **3.0 mm (0.118 in)**
  - **Retaining plate:**
    - **Refer to S.D.S.**

Forward and Overrun Clutches

For the number of clutch sheets (drive plate and driven plate), refer to the below cross-section.

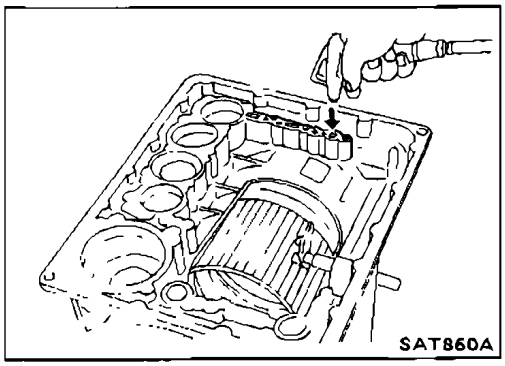


(ATF) : Apply A.T.F.

★ : Select with proper thickness.

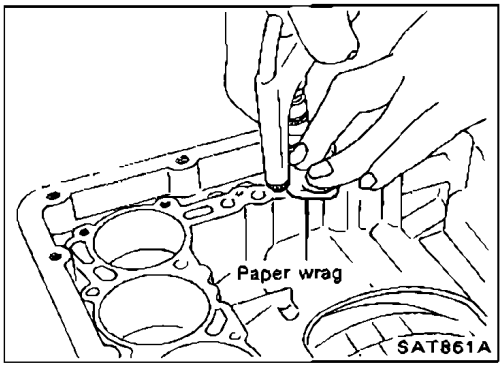
SAT810B

Forward and Overrun Clutches (Cont'd)


SAT860A

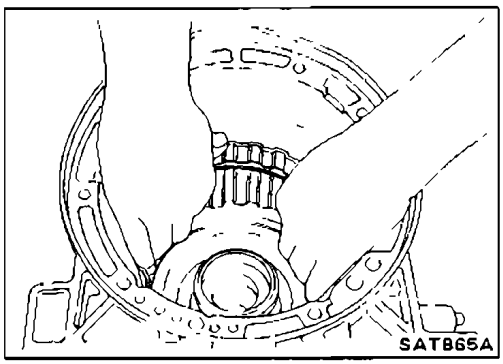
Service procedures for forward and overrun clutches are essentially the same as those for reverse clutch, with the following exception:

- Check of forward clutch operation.

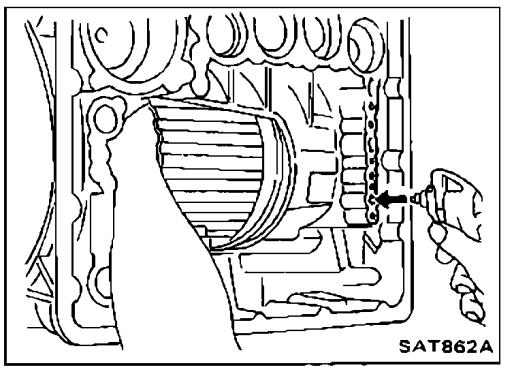


SAT861A

- Check of overrun clutch operation.

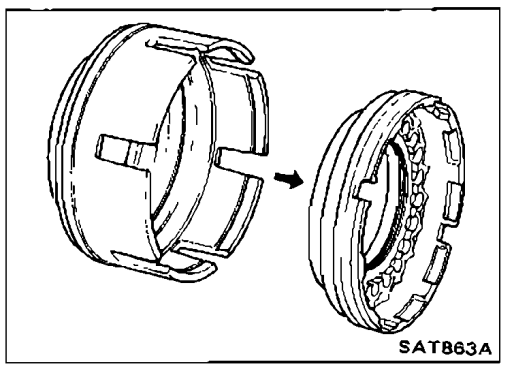

SAT865A

- Removal of forward clutch drum
  Remove forward clutch drum from transmission case by holding snap ring.


SAT862A

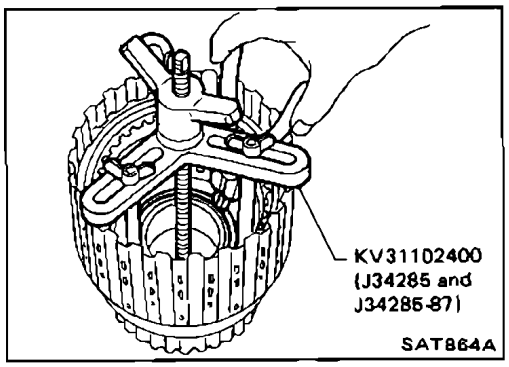
- Removal of forward clutch and overrun clutch pistons

1. While holding overrun clutch piston, gradually apply compressed air to oil hole.

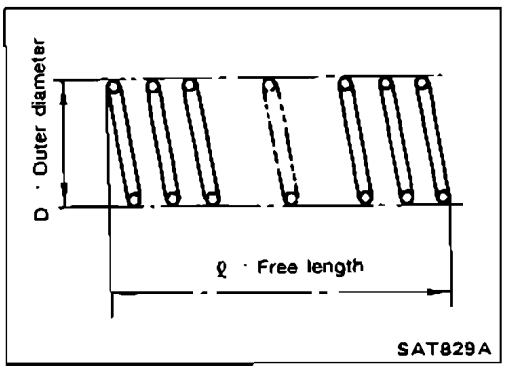

SAT863A

2. Remove overrun clutch from forward clutch.

Forward and Overrun Clutches (Cont'd)



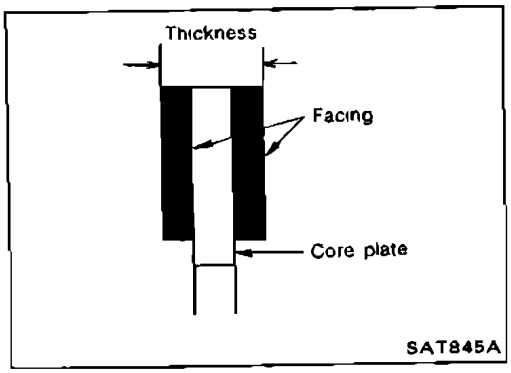
- Removal and installation of return springs



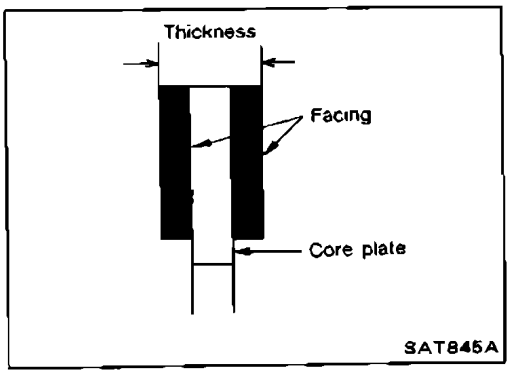
- Inspection of forward clutch and overrun clutch return springs

Inspection standard: Unit: mm (in)

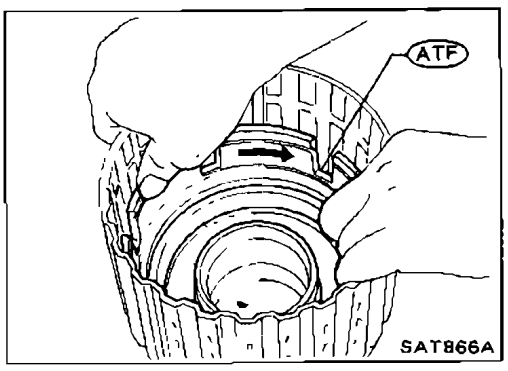
Part No.	ℓ	D
31505-41X01	35.77 (1.4083)	9.7 (0.382)



- Inspection of forward clutch drive plates
  - **Thickness of drive plate:**
    - **Standard**
      - **2.0 mm (0.079 in)**
    - **Wear limit**
      - **1.8 mm (0.071 in)**



- Inspection of overrun clutch drive plates
  - **Thickness of drive plate:**
    - **Standard**
      - **2.0 mm (0.079 in)**
    - **Wear limit**
      - **1.8 mm (0.071 in)**

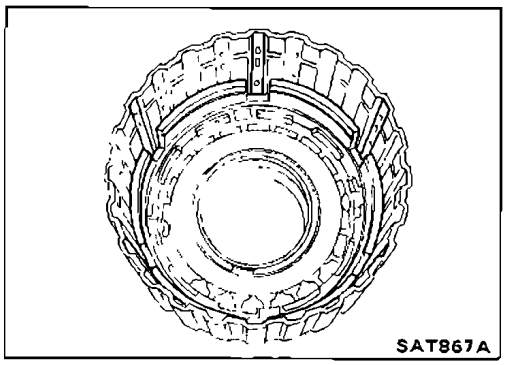


- Installation of forward clutch piston and overrun clutch piston

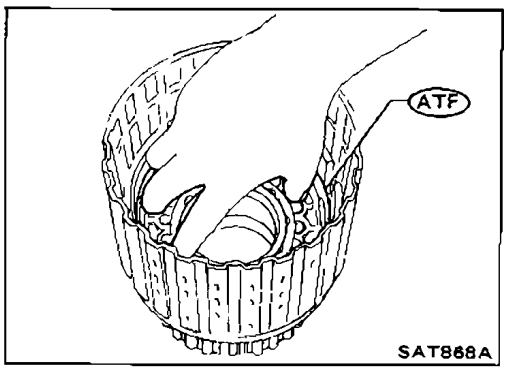
1. Install forward clutch piston by turning it slowly and evenly.

- **Apply A.T.F. to inner surface of clutch drum.**

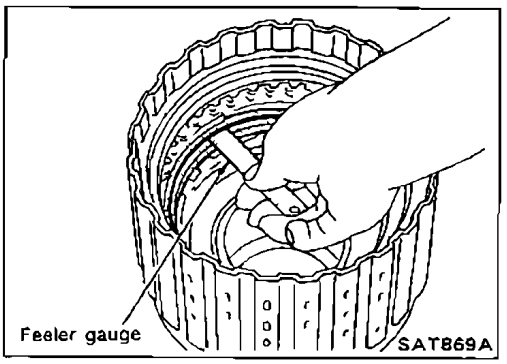
Forward and Overrun Clutches (Cont'd)



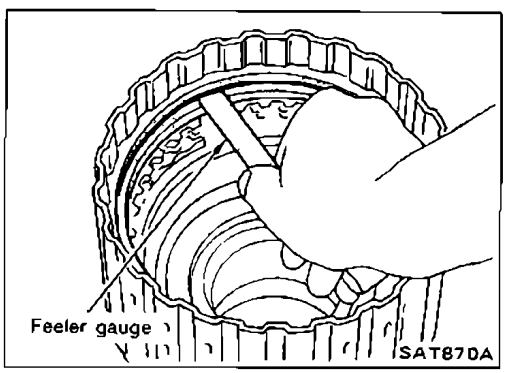
- **Align notch in forward clutch piston with groove in forward clutch drum.**



2. Install overrun clutch by turning it slowly and evenly.
- **Apply A.T.F. to inner surface of forward clutch piston.**

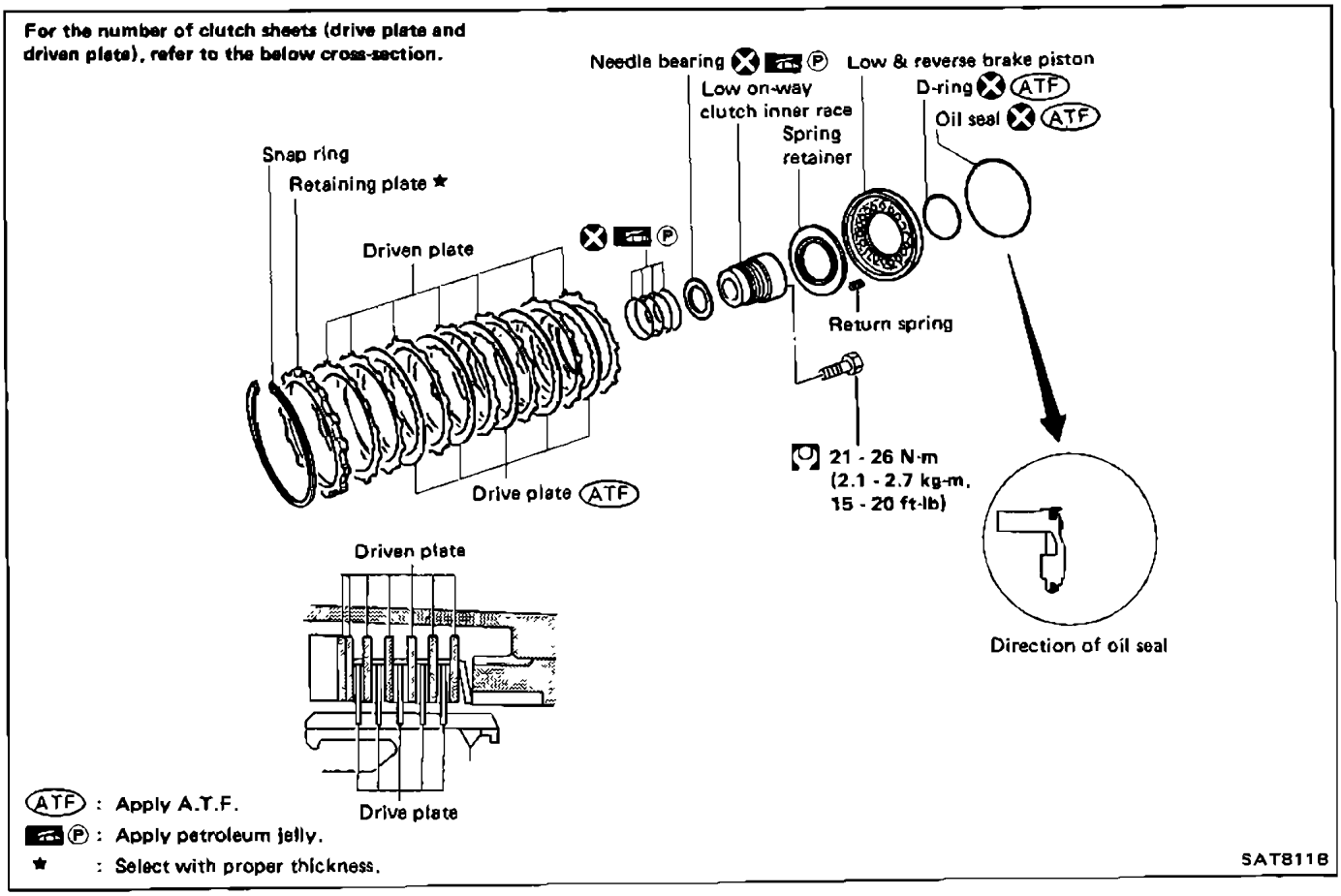


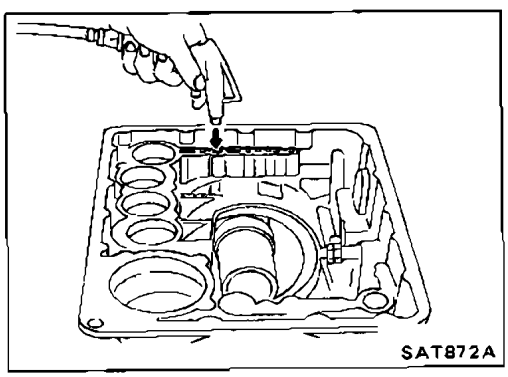
- Measurement of clearance between retaining plate and snap ring of overrun clutch
  Specified clearance:
  Standard
  1.0 - 1.4 mm (0.039 - 0.055 in)
  Allowable limit
  2.0 mm (0.079 in)
  Retaining plate:
  Refer to S.D.S.

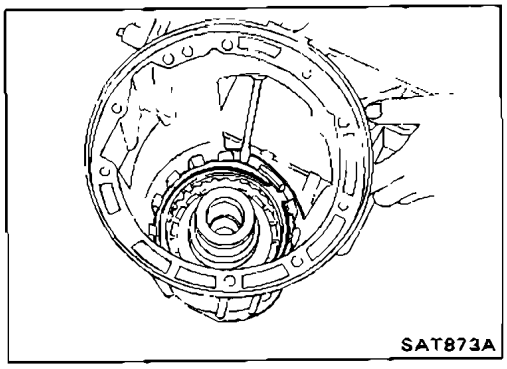


- Measurement of clearance between retaining plate and snap ring of forward clutch
  Specified clearance:
  Standard
  0.45 - 0.85 mm (0.0177 - 0.0335 in)
  Allowable limit
  1.85 mm (0.0728 in)
  Retaining plate:
  Refer to S.D.S.

Low & Reverse Brake





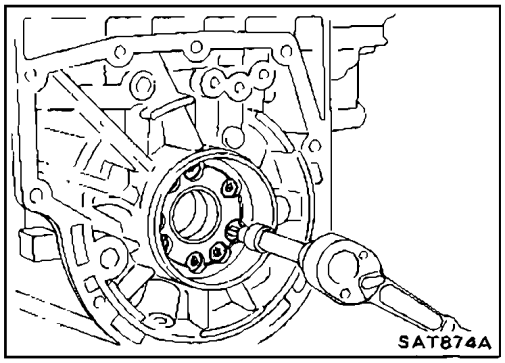


DISASSEMBLY

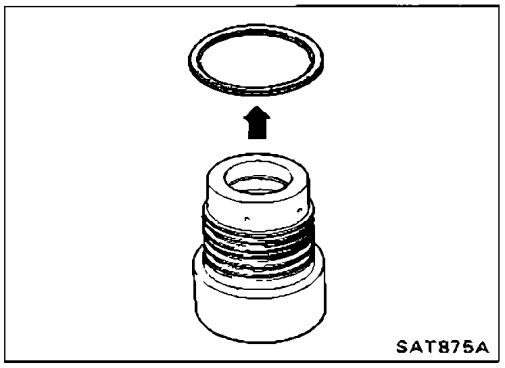
1. Check operation of low and reverse brake.
   a. Install seal ring onto oil pump cover and install reverse clutch. Apply compressed air to oil hole.
   b. Check to see that retaining plate moves to snap ring.
   c. If retaining plate does not move to snap ring, D-ring or oil seal may be damaged or fluid may be leaking at piston check ball.

2. Remove snap ring, low and reverse brake drive plates, driven plates and dish plate.

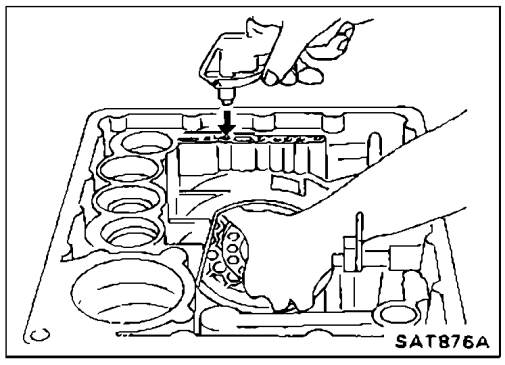
Low & Reverse Brake (Cont'd)



3. Remove low one-way clutch inner race, spring retainer and return spring from transmission case.



4. Remove seal rings from low one-way clutch inner race.
5. Remove needle bearing from low one-way clutch inner race.

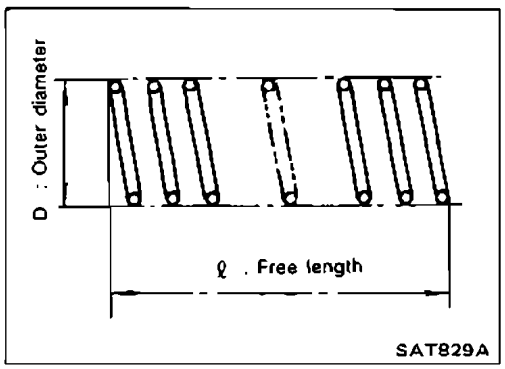


6. Remove low and reverse brake piston using compressed air.
7. Remove oil seal and D-ring from piston.

INSPECTION

Low and reverse brake snap ring and spring retainer

- Check for deformation, or damage.



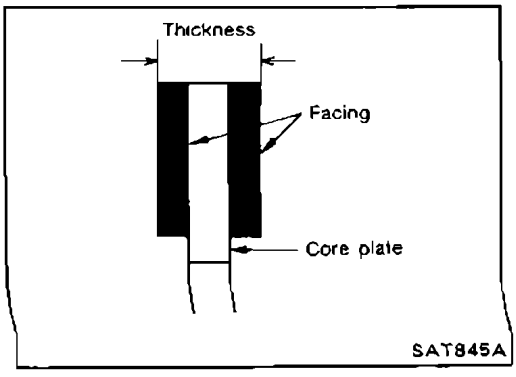
Low and reverse brake return springs

- 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)



Low and reverse brake drive plates

- Check facing for burns, cracks or damage.
- Measure thickness of facing.

  Thickness of drive plate:

  Standard value

  2.0 mm (0.079 in)

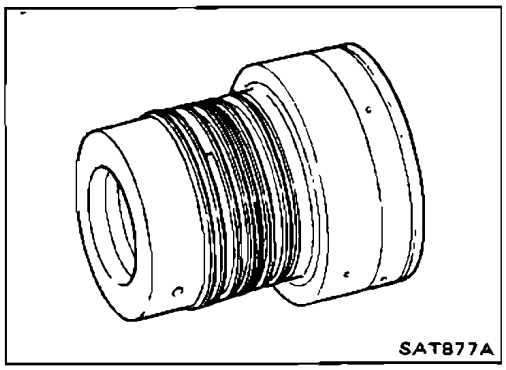
  Wear limit

  1.8 mm (0.071 in)

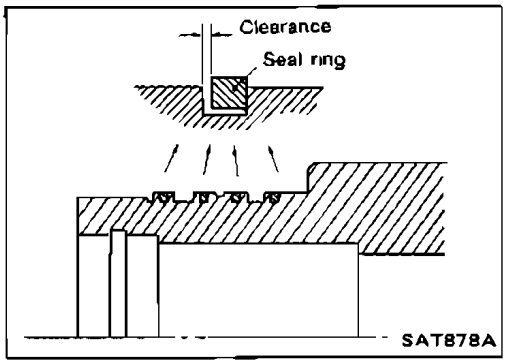
- If not within wear limit, replace.

Low & Reverse Brake (Cont'd)

Low one-way clutch inner race


SAT877A

- Check frictional surface of inner race for wear or damage.



SAT878A

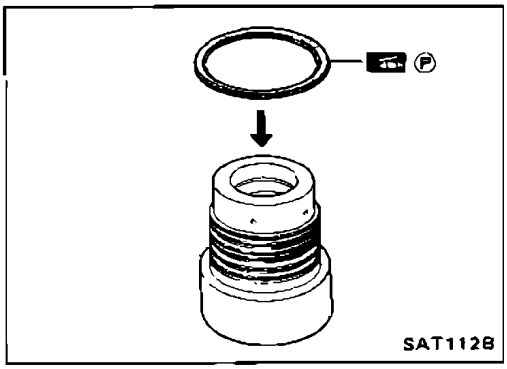
- Install a new seal rings onto low one-way clutch inner race.
- **Be careful not to expand seal ring gap excessively.**
- Measure seal ring-to-groove clearance.

  Inspection standard:

  Standard value: 0.10 - 0.25 mm (0.0039 - 0.0098 in)

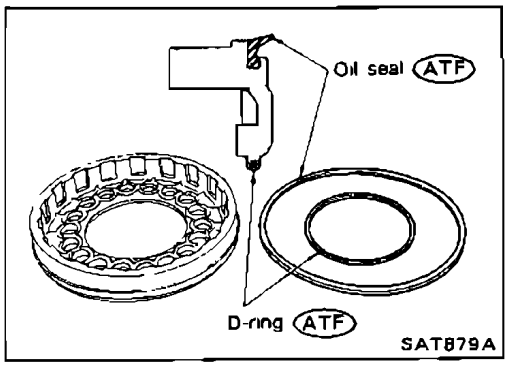
  Allowable limit: 0.25 mm (0.0098 in)
- If not within allowable limit, replace low one-way clutch inner race.

ASSEMBLY



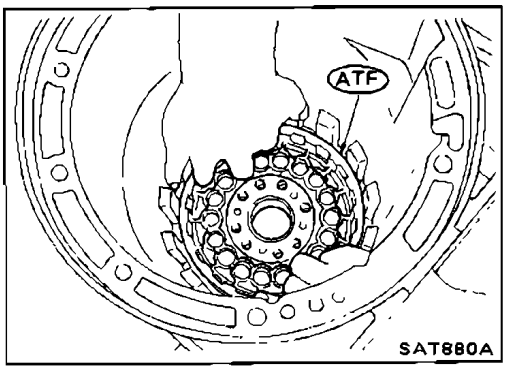
SAT1128

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

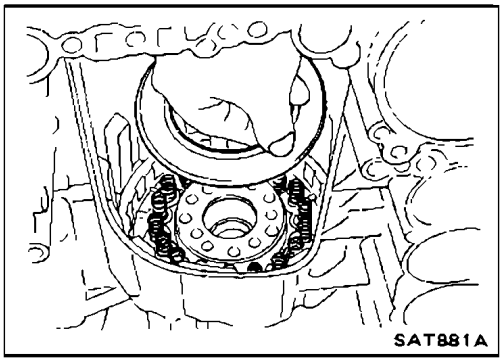
2. Install oil seal and D-ring onto piston.
- **Apply A.T.F. to oil seal and D-ring.**



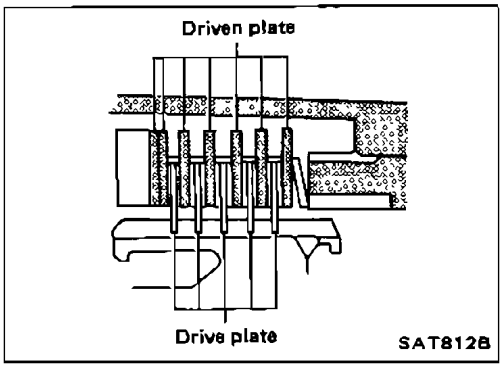
SAT880A

3. Install piston by rotating it slowly and evenly.
- **Apply A.T.F. to inner surface of transmission case.**

Low & Reverse Brake (Cont'd)

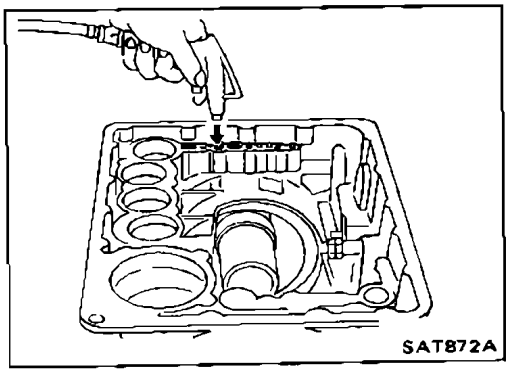

SAT881A

4. Install return springs, spring retainer and low one-way clutch inner race onto transmission case.

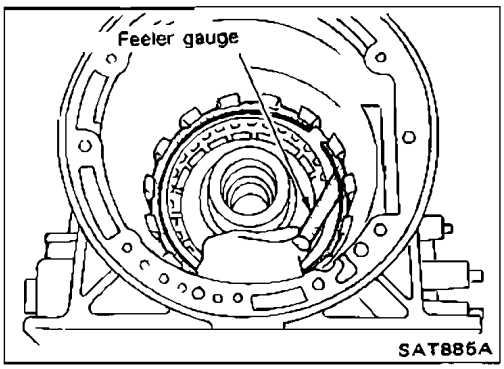


SAT812B

5. Install dish plate, low and reverse brake drive plates, driven plates and retaining plate.
6. Install snap ring on transmission case.


SAT872A

7. Check operation of low and 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

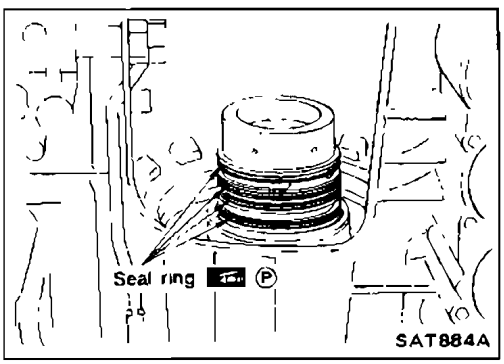
1.1 - 1.5 mm (0.043 - 0.059 in)

Allowable limit

2.5 mm (0.098 in)

Retaining plate:

Refer to S.D.S.

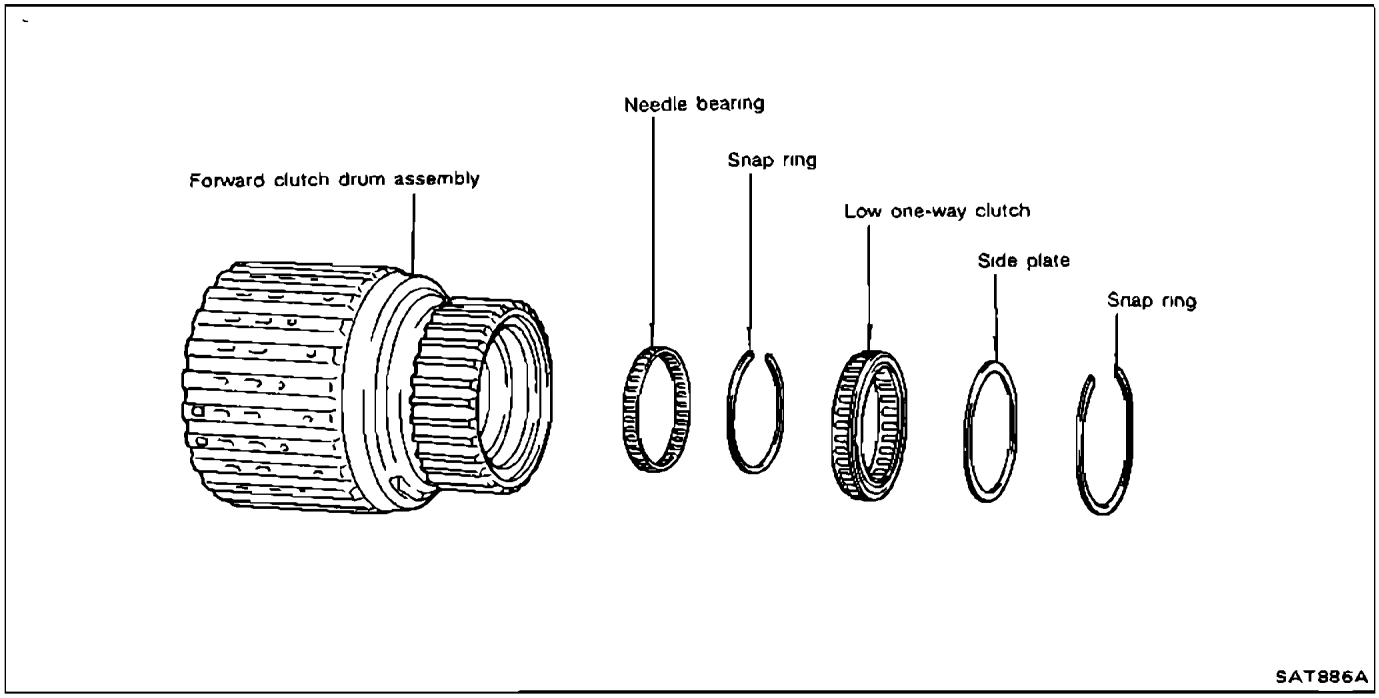


SAT884A

9. Install low one-way clutch inner race seal ring.

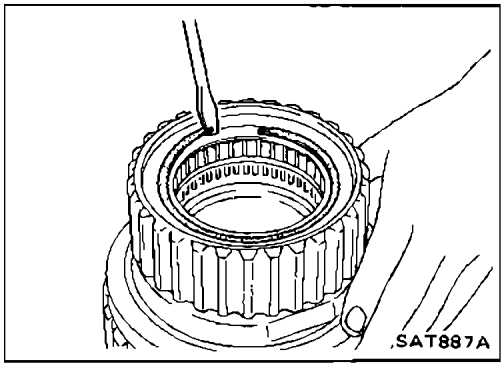
- **Apply petroleum jelly to seal ring.**
- **Make sure seal rings are pressed firmly into place and held by petroleum jelly.**

Forward Clutch Drum Assembly

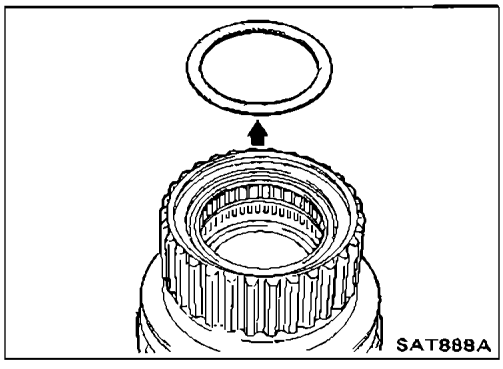


DISASSEMBLY

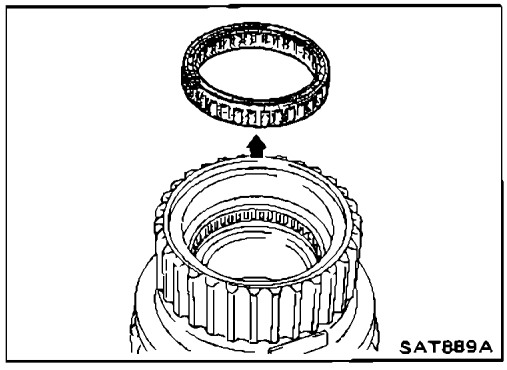
1. Remove snap ring from forward clutch drum.



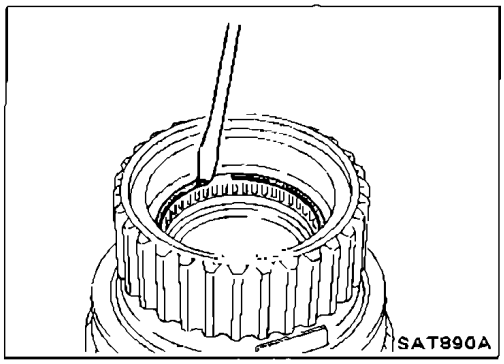
2. Remove side plate from forward clutch drum.



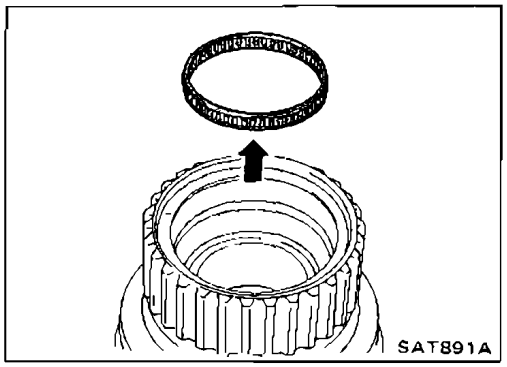
3. Remove low one-way clutch from forward clutch drum.



Forward Clutch Drum Assembly (Cont'd)



4. Remove snap ring from forward clutch drum.

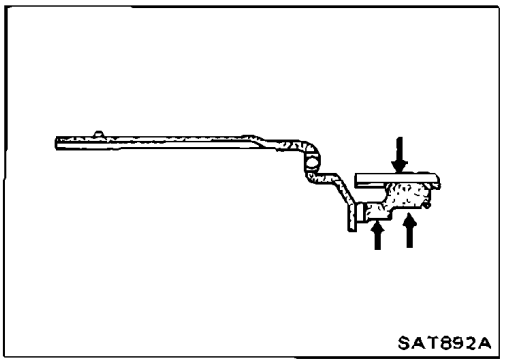


5. Remove needle bearing from forward clutch drum.

INSPECTION

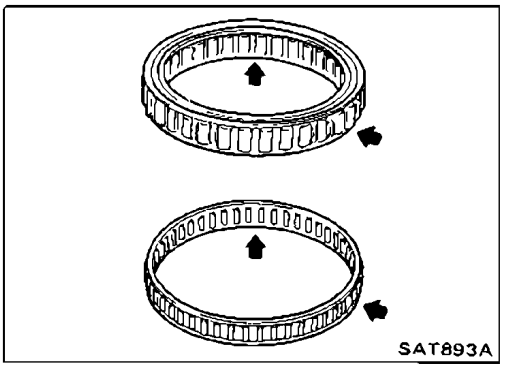
Forward clutch drum

- Check spline portion for wear or damage.
- Check frictional surfaces of low one-way clutch and needle bearing for wear or damage.



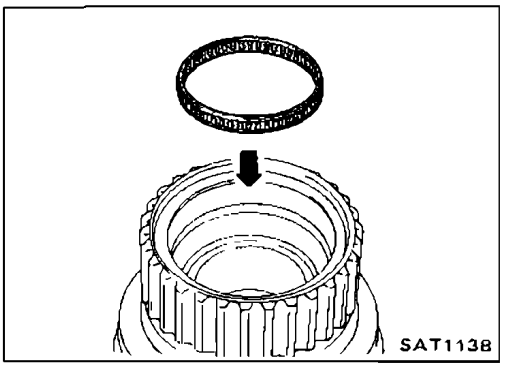
Needle bearing and low one-way clutch

- Check frictional surface for wear or damage.

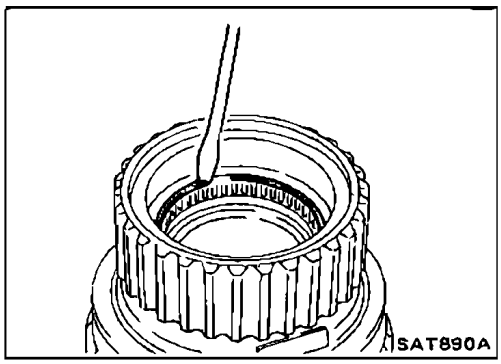


ASSEMBLY

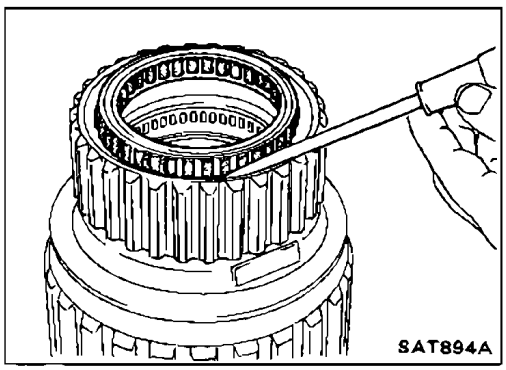
1. Install needle bearing in forward clutch drum.



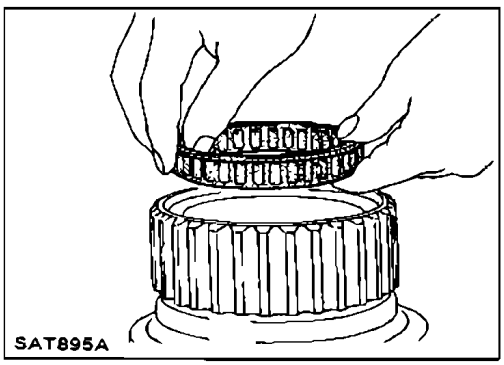
Forward Clutch Drum Assembly (Cont'd)



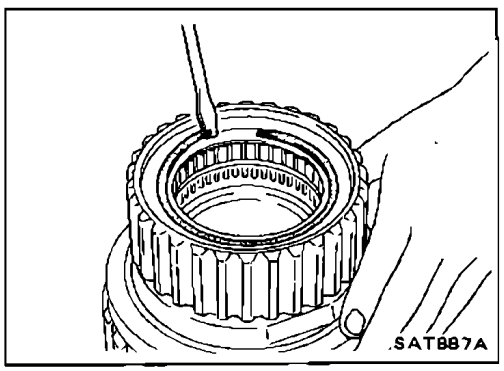
2. Install snap ring onto forward clutch drum.



3. Install low one-way clutch onto forward clutch drum by pushing the roller in evenly.

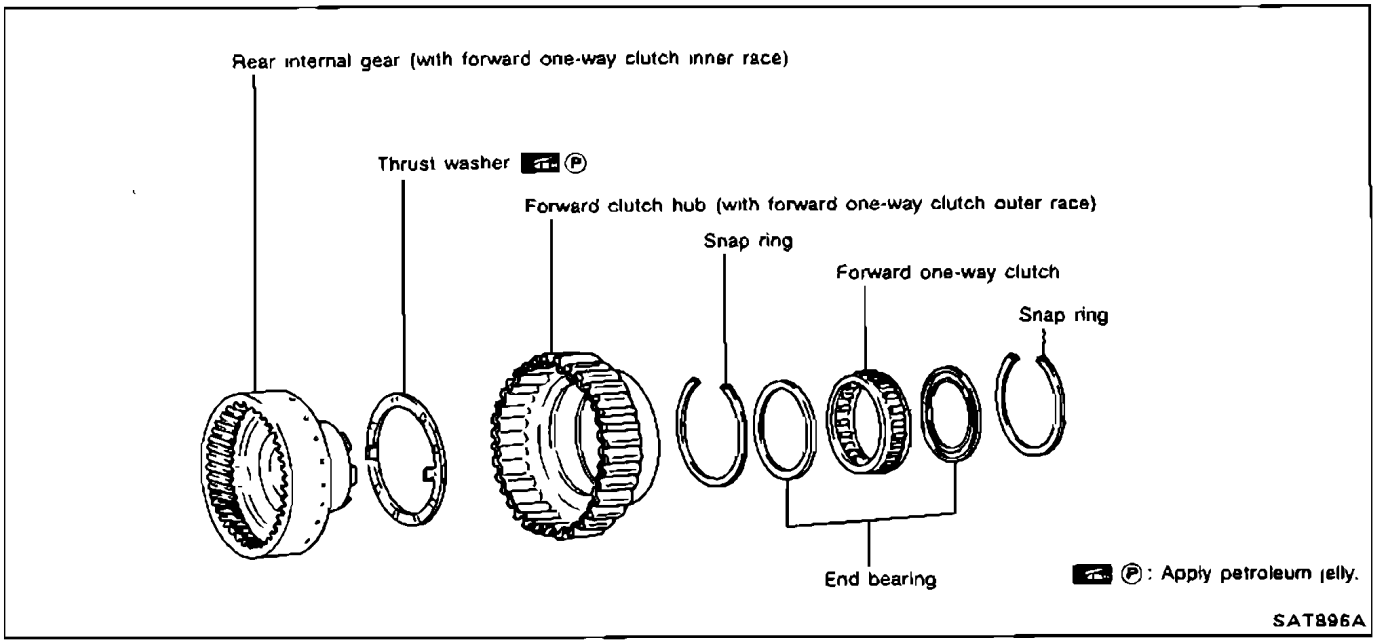


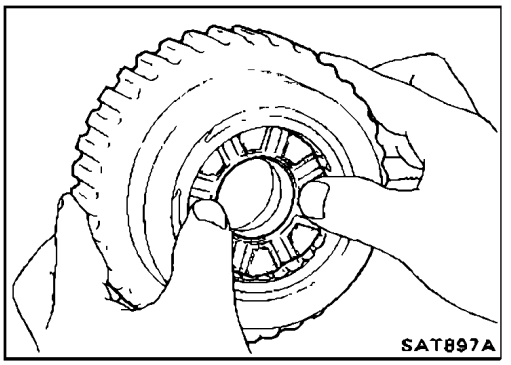
- **Install low one-way clutch with flange facing rearward.**



4. Install side plate onto forward clutch drum.
5. Install snap ring onto forward clutch drum.

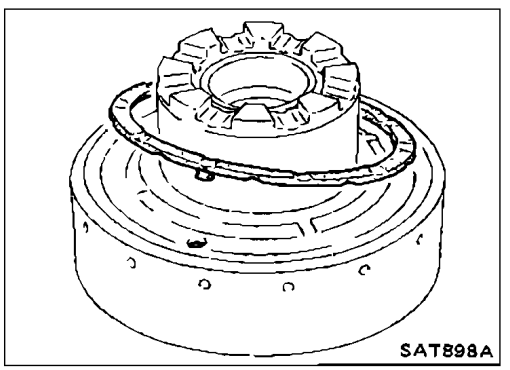
Rear Internal Gear and Forward Clutch Hub



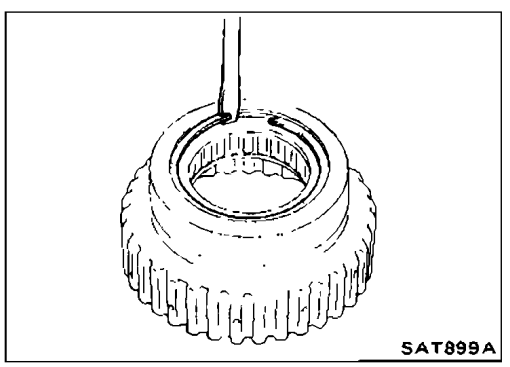


DISASSEMBLY

1. Remove rear internal gear by pushing forward clutch hub forward.

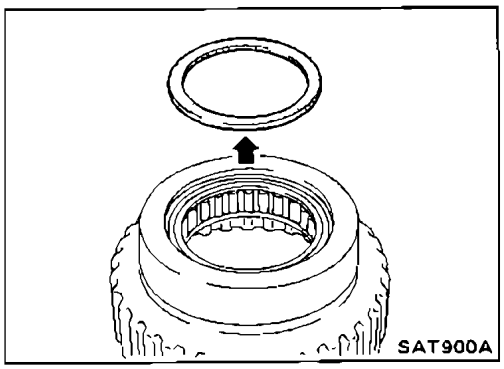


2. Remove thrust washer from rear internal gear.

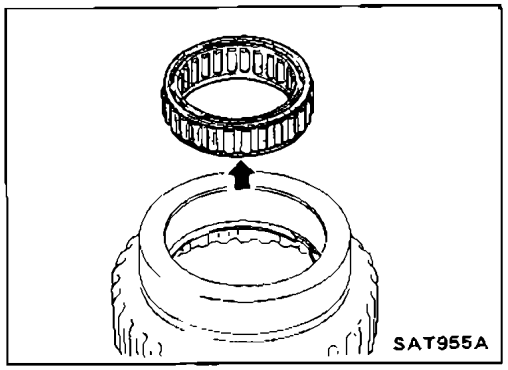


3. Remove snap ring from forward clutch hub.

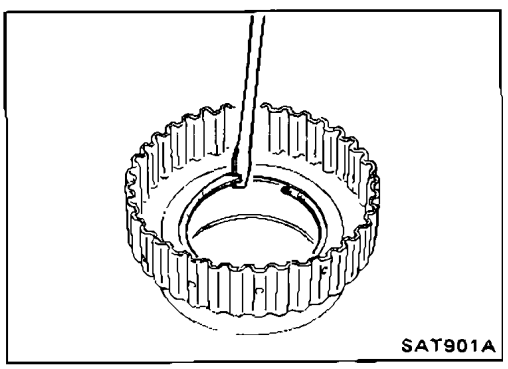
Rear Internal Gear and Forward Clutch Hub (Cont'd)



4. Remove end bearing.



5. Remove forward one-way clutch and end bearing as a unit from forward clutch hub.

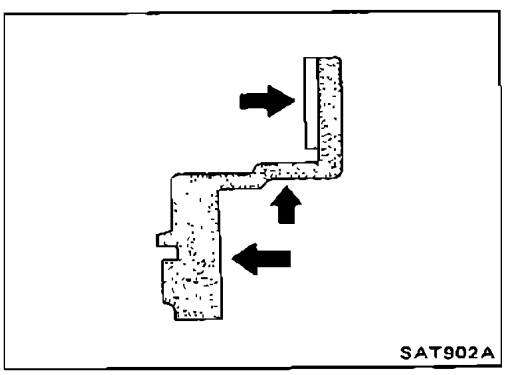


6. Remove snap ring from forward clutch hub.

INSPECTION

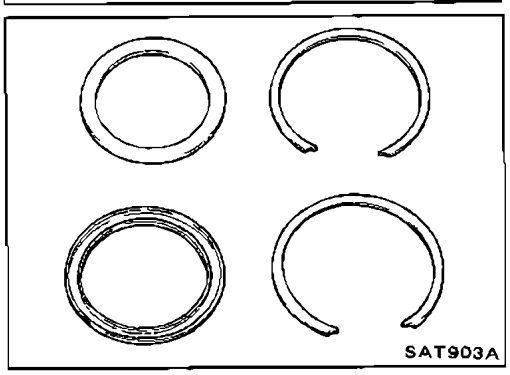
Rear internal gear and forward clutch hub

- 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.



Snap ring and end bearing

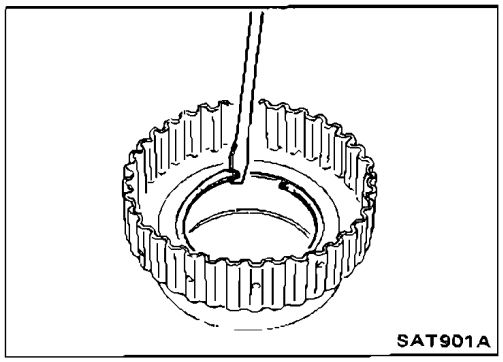
- Check for deformation or damage.



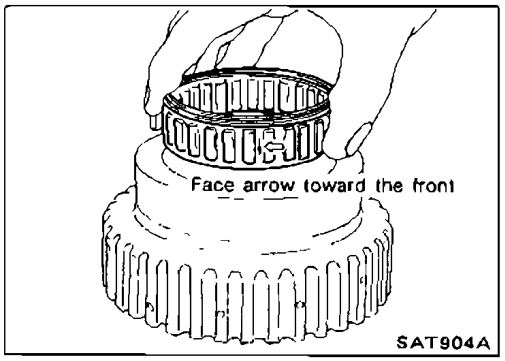
Rear Internal Gear and Forward Clutch Hub (Cont'd)

ASSEMBLY

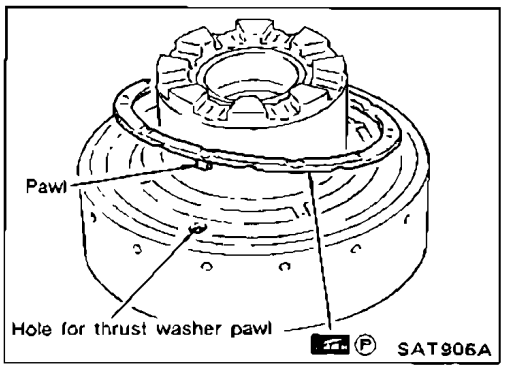
1. Install snap ring onto forward clutch hub.
2. Install end bearing.



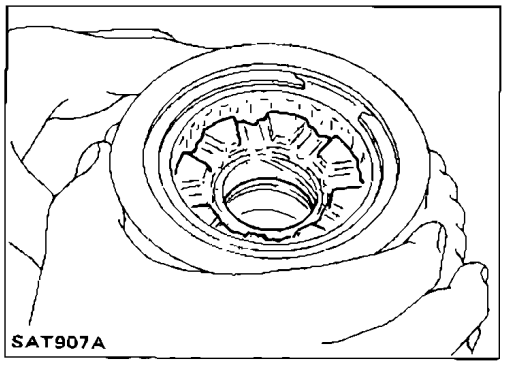
3. Install forward one-way clutch onto clutch hub.
- **Install forward one-way clutch with flange facing rearward.**
4. Install end bearing.
5. Install snap ring onto forward clutch hub.



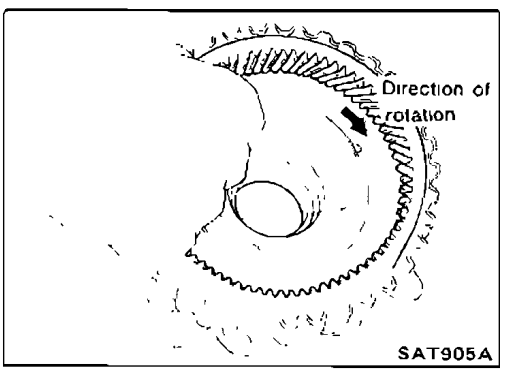
6. Install thrust washer onto rear internal gear.
- **Apply petroleum jelly to thrust washer.**
- **Securely insert pawls of thrust washer into holes in rear internal gear.**



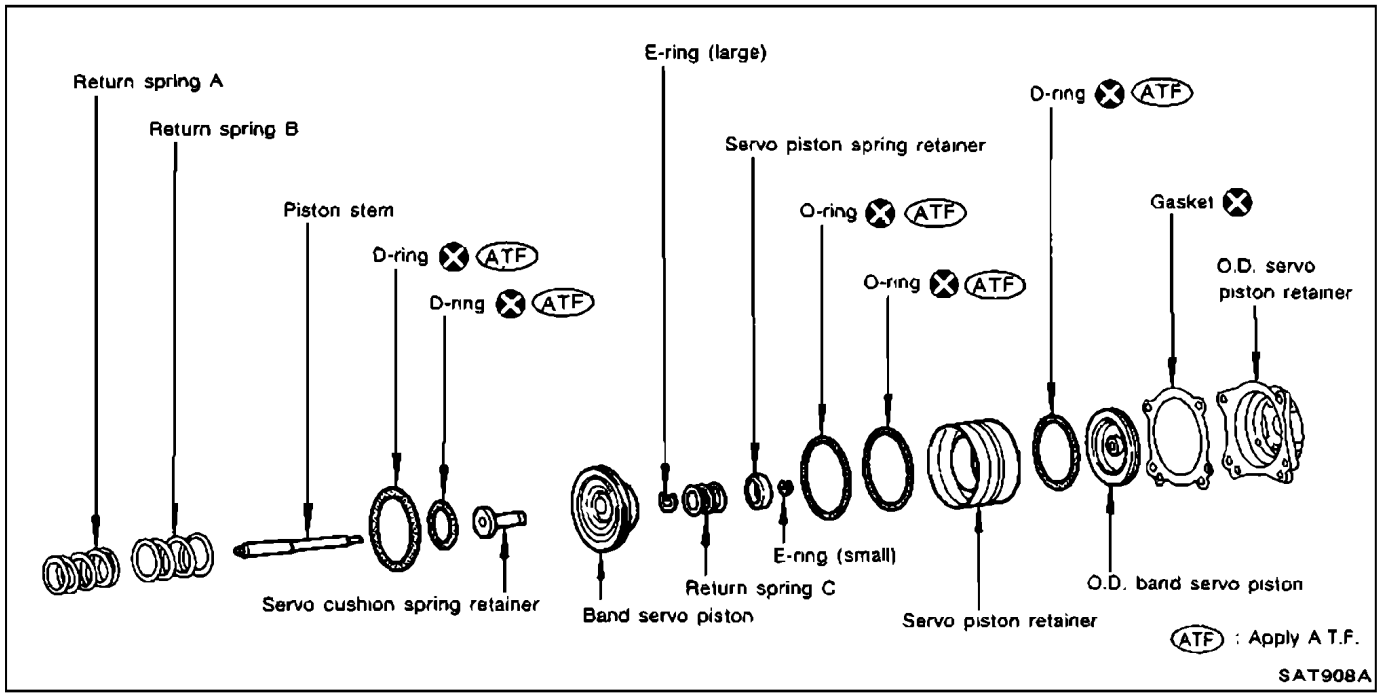
7. Position forward clutch hub in rear internal gear.

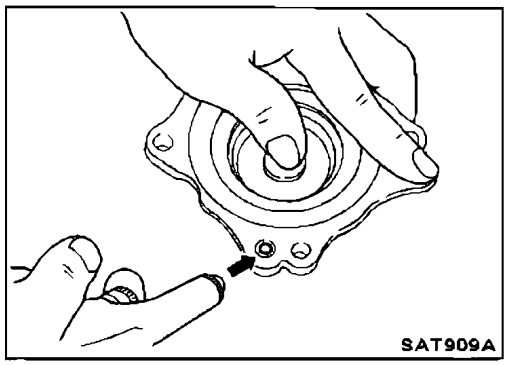


8. After installing, check to assure that forward clutch hub rotates clockwise.



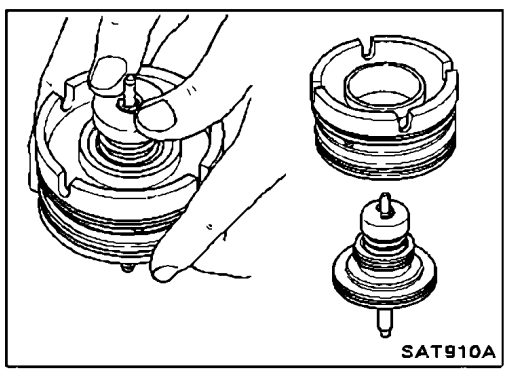
Band Servo Piston Assembly



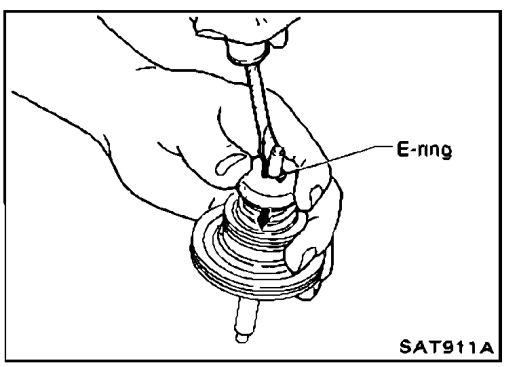


DISASSEMBLY

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.

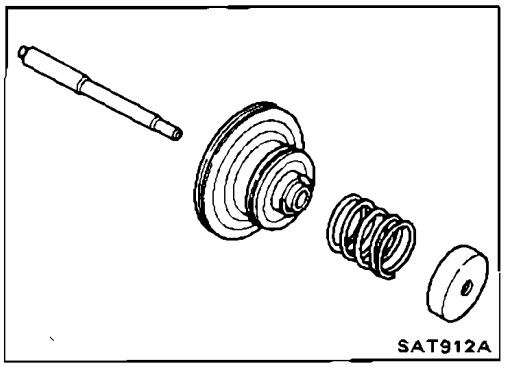


4. Remove band servo piston assembly from servo piston retainer by pushing it forward.

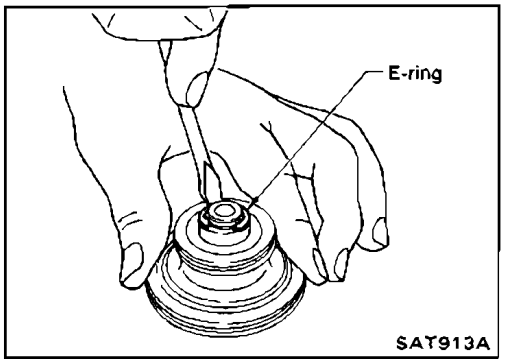


5. Place piston stem end on a wooden block. While pushing servo piston spring retainer down, remove E-ring.

Band Servo Piston Assembly (Cont'd)

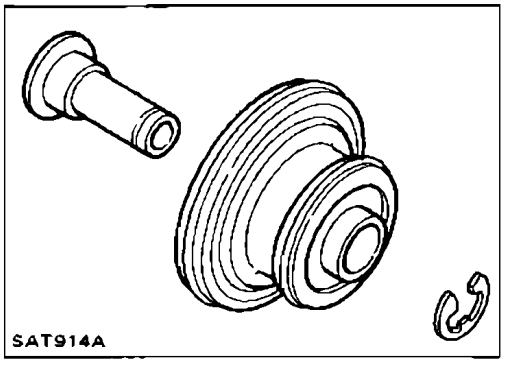

SAT912A

6. Remove servo piston spring retainer, return spring C and piston stem from band servo piston.

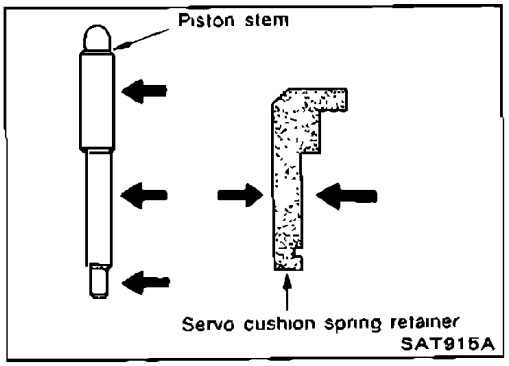


SAT913A

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.

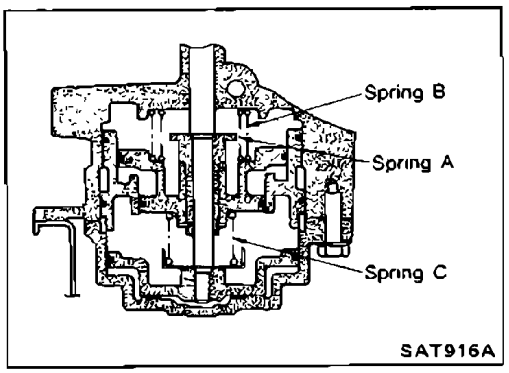


SAT915A

INSPECTION

Pistons, retainers and piston stem

- Check frictional surfaces for abnormal wear or damage.



SAT916A

Return springs

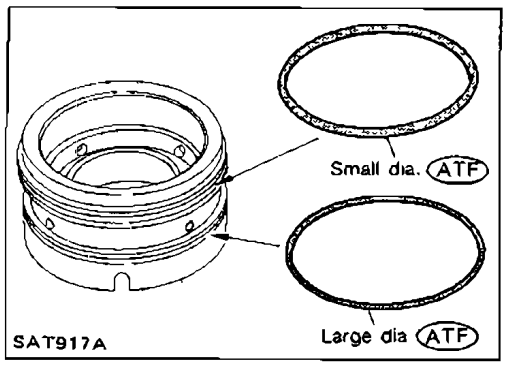
- Check for deformation or damage. Measure free length and outer diameter.

Inspection standard: Unit: mm (in)

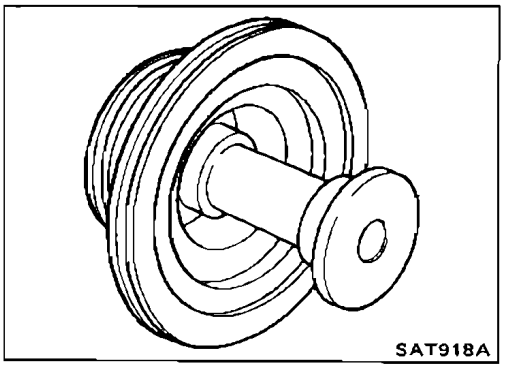
Parts	Free length	Outer diameter
Spring A	45.6 (1.795)	34.3 (1.350)
Spring B	53.8 (2.118)	40.3 (1.587)
Spring C	29.0 (1.142)	27.6 (1.087)

Band Servo Piston Assembly (Cont'd)

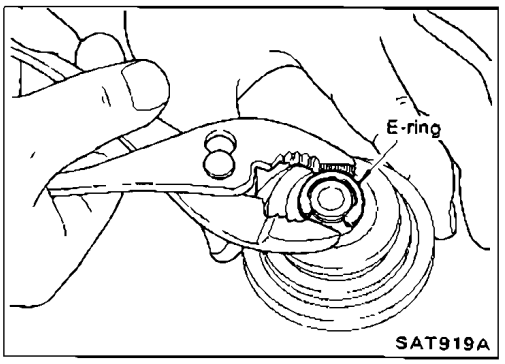
ASSEMBLY



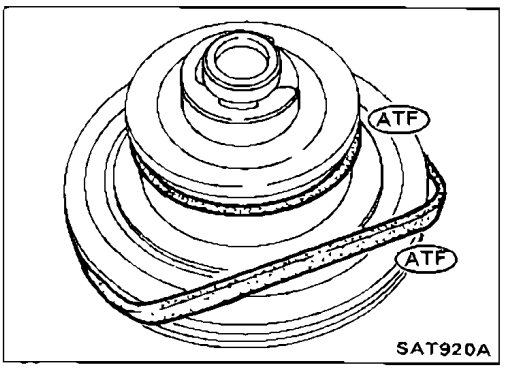
1. Install O-rings onto servo piston retainer.
   - **Apply A.T.F. to O-rings.**
   - **Pay attention to position of each O-ring.**



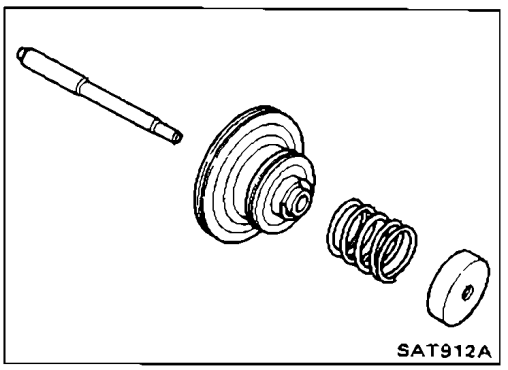
2. Install servo cushion spring retainer onto band servo piston.



3. Install E-ring onto servo cushion spring retainer.

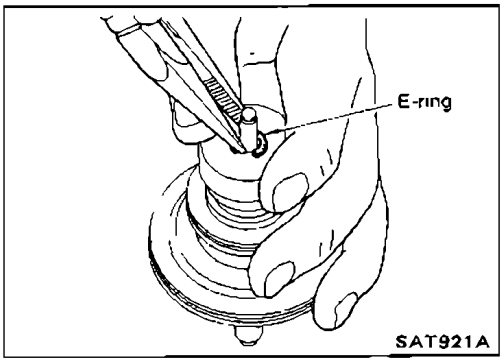


4. Install D-rings onto band servo piston.
   - **Apply A.T.F. to D-rings.**

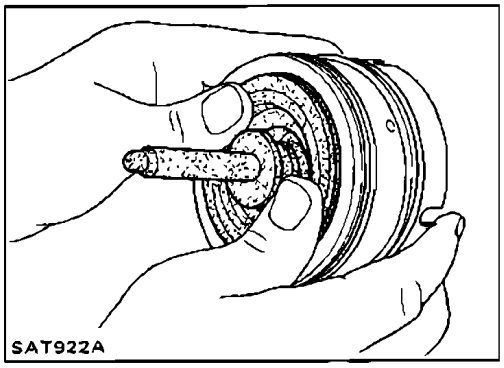


5. Install servo piston spring retainer, return spring C and piston stem onto band servo piston.

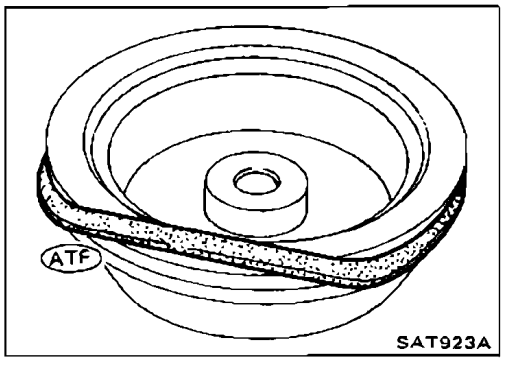
Band Servo Piston Assembly (Cont'd)



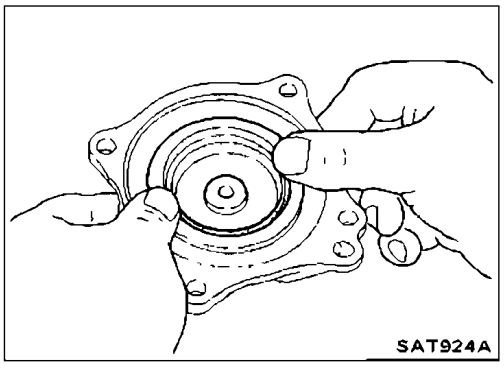
6. Place piston stem end on a wooden block. While pushing servo piston spring retainer down, install E-ring.



7. Install band servo piston assembly onto servo piston retainer by pushing it inward.

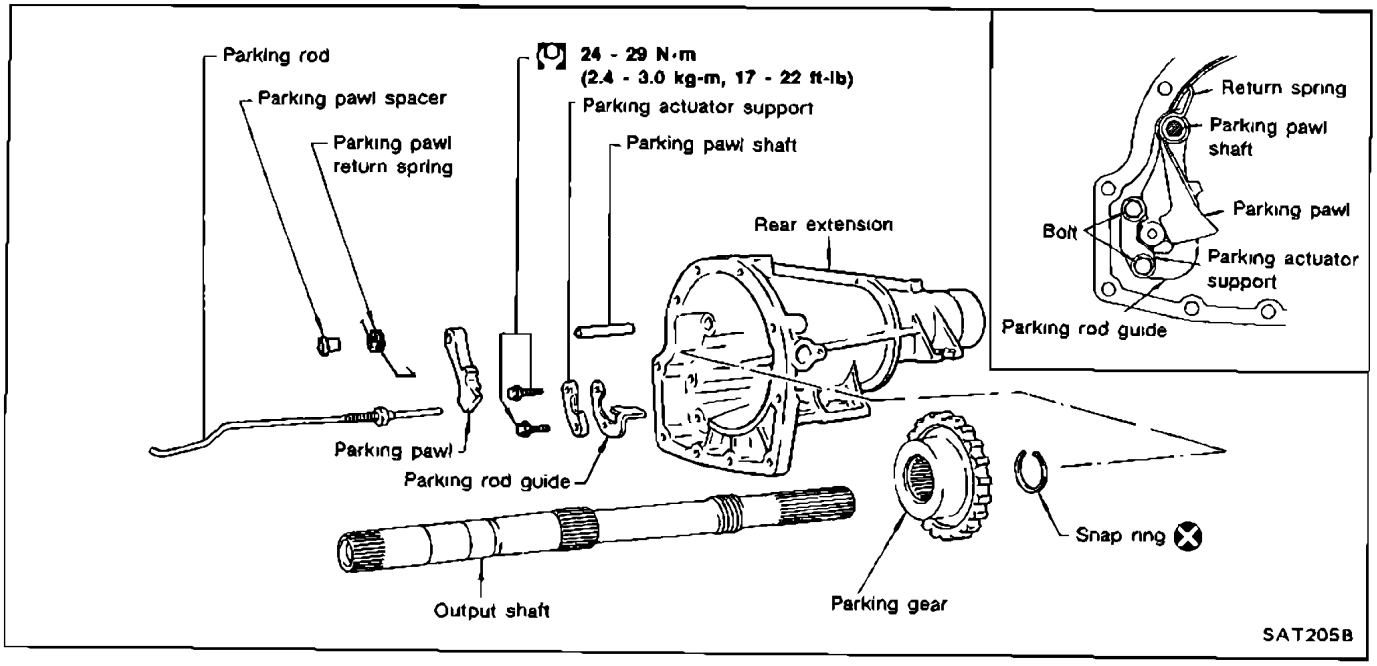


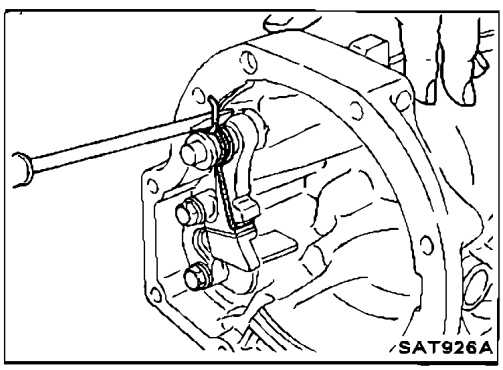
8. Install D-ring on O.D. band servo piston.
- **Apply A.T.F. to D-ring.**



9. Install O.D. band servo piston onto servo piston retainer by pushing it inward.

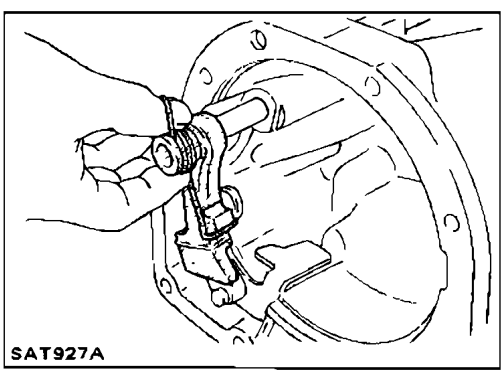
Parking Pawl Components



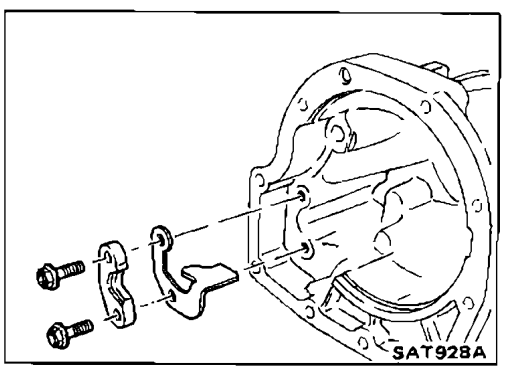


DISASSEMBLY

1. Slide return spring to the front of rear extension flange.



2. Remove return spring, pawl spacer and parking pawl from rear extension.
3. Remove parking pawl shaft from rear extension.



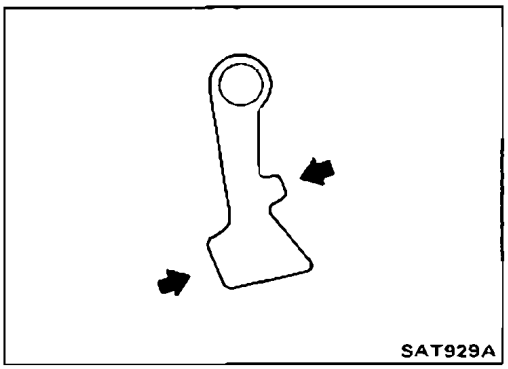
4. Remove parking actuator support and rod guide from rear extension.

Parking Pawl Components (Cont'd)

INSPECTION

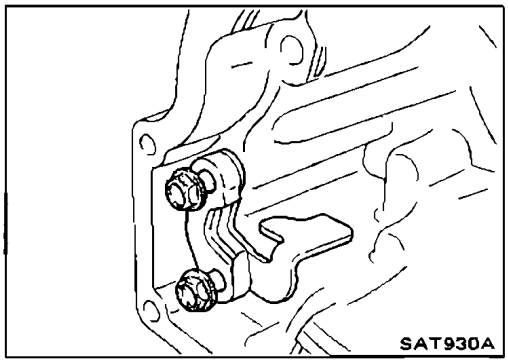
Parking pawl and parking actuator support

- Check contact surface of parking rod for wear.

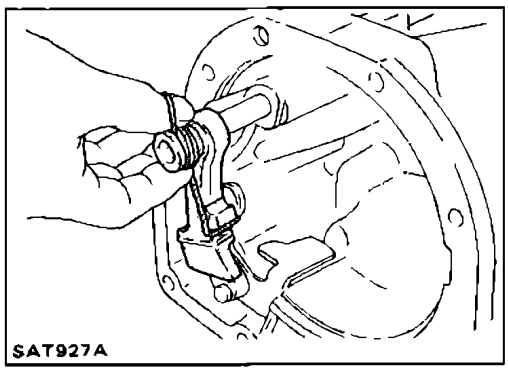

SAT929A

ASSEMBLY

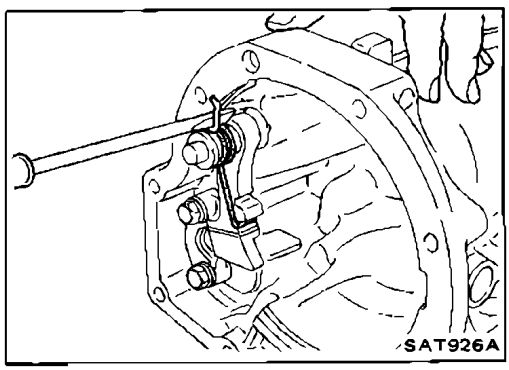
1. Install rod guide and parking actuator support onto rear extension.
2. Insert parking pawl shaft into rear extension.

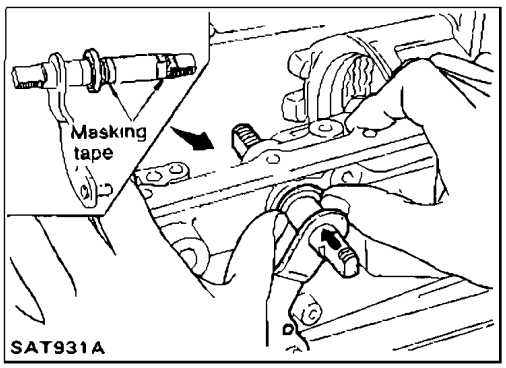

SAT930A

3. Install return spring, pawl spacer and parking pawl onto parking pawl shaft.


SAT927A

4. Bend return spring upward and install it onto rear extension.


SAT926A



Assembly

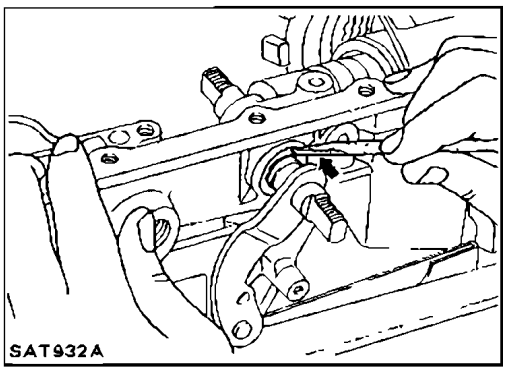
1. Install manual shaft components.

a. Install oil seal onto manual shaft.

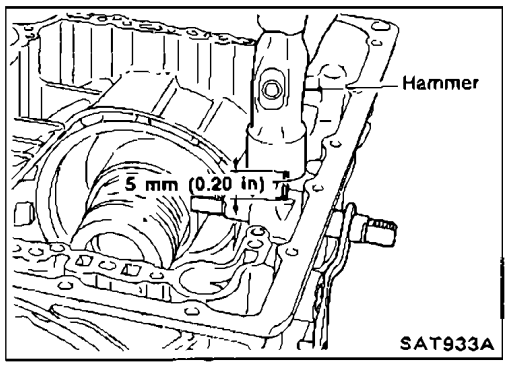
- **Apply A.T.F. to oil seal.**
- **Wrap threads of manual shaft with masking tape.**

b. Insert manual shaft and oil seal as a unit into transmission case.

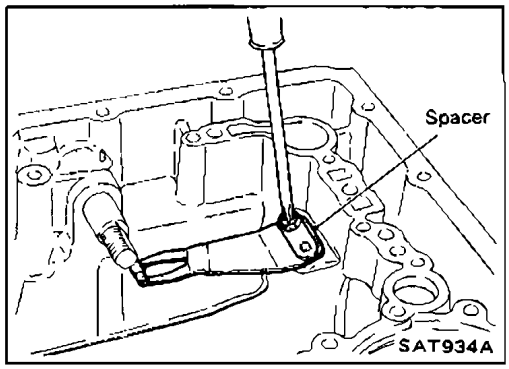
c. Remove masking tape.



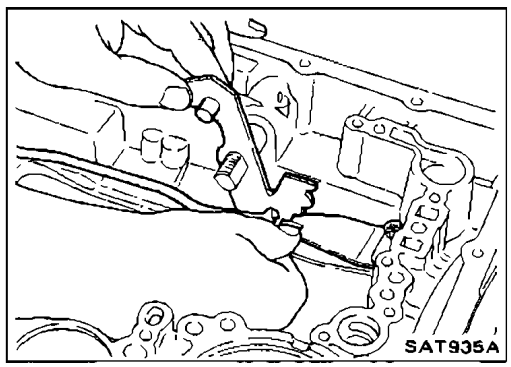
d. Push oil seal evenly and install it onto transmission case.



e. Align groove in shaft with drive pin hole, then drive pin into position as shown in figure at left.



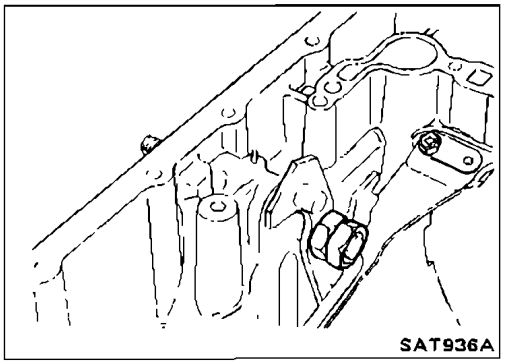
f. Install detent spring and spacer.



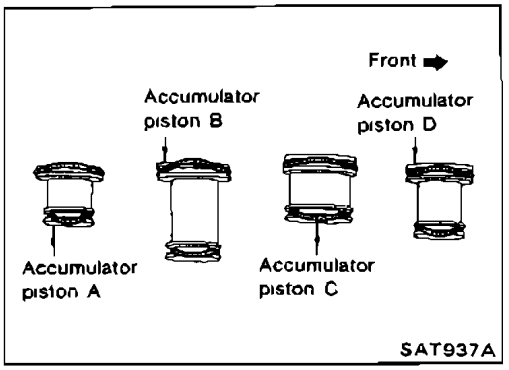
g. While pushing detent spring down, install manual plate onto manual shaft.

Assembly (Cont'd)

h. Install lock nuts onto manual shaft.



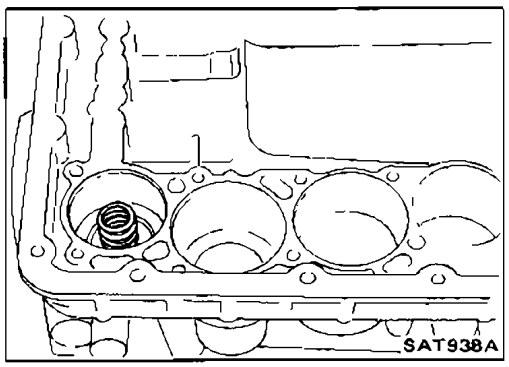
2. Install accumulator piston.
a. Install O-rings onto accumulator piston.
● **Apply A.T.F. to O-rings.**



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)

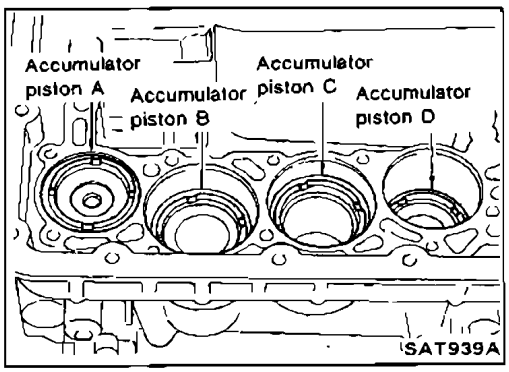
b. Install return spring for accumutator A onto transmission case.



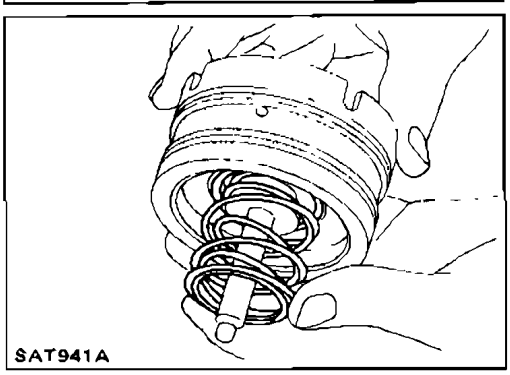
Free length of return spring: Unit: mm (in)

Accumulator	A
Free length	43 (1.69)

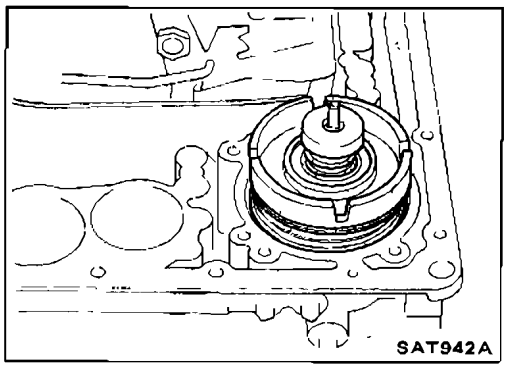
c. Install accumulator pistons A, B, C and D.
● **Apply A.T.F. to transmission case.**



3. Install band servo piston.
a. Install return springs onto servo piston.

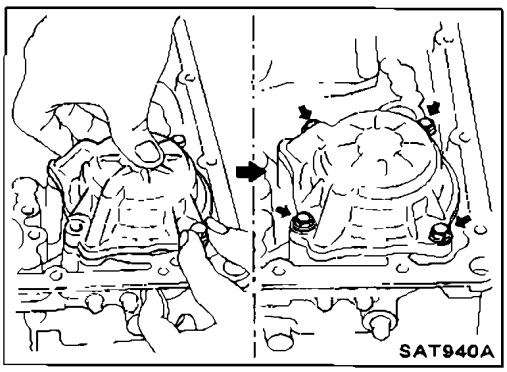


Assembly (Cont'd)

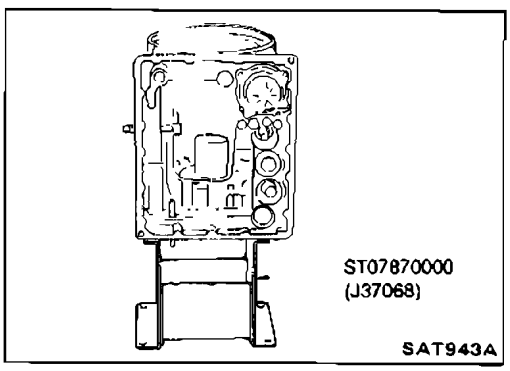


b. Install band servo piston onto transmission case.
- **Apply A.T.F. to O-ring of band servo piston and transmission case.**

c. Install gasket for band servo onto transmission case.

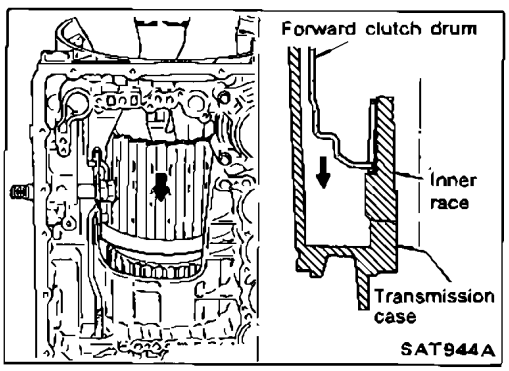


d. Install band servo retainer onto transmission case.

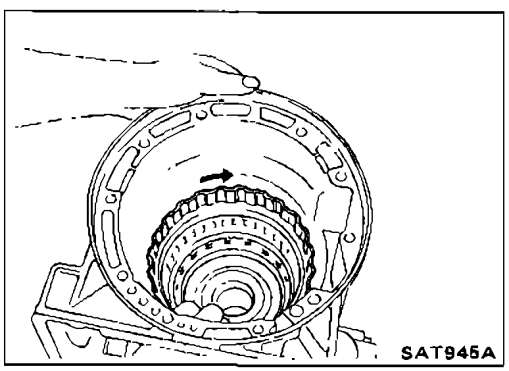


4. Install rear side clutch and gear components.

a. Place transmission case in vertical position.

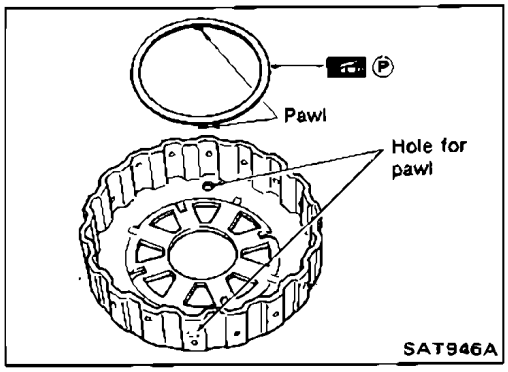


b. Slightly lift forward clutch drum assembly and slowly rotate it clockwise until its hub passes fully over the clutch inner race inside transmission case.

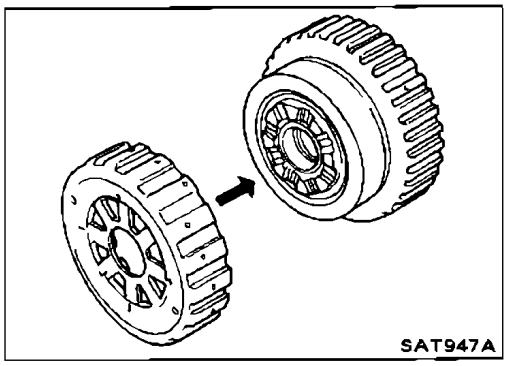


c. Check to be sure that rotation direction of forward clutch assembly is correct.

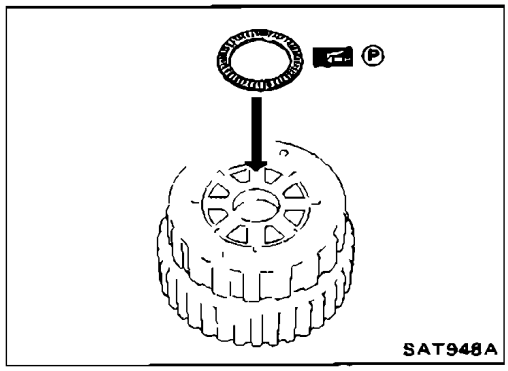
Assembly (Cont'd)



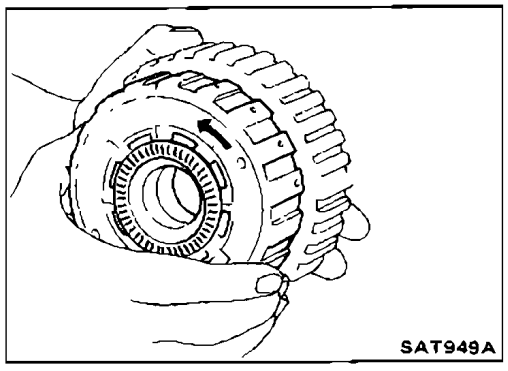
d. Install thrust washer onto front of overrun clutch hub.
- **Apply petroleum jelly to the thrust washer.**
- **Insert pawls of thrust washer securely into holes in overrun clutch hub.**



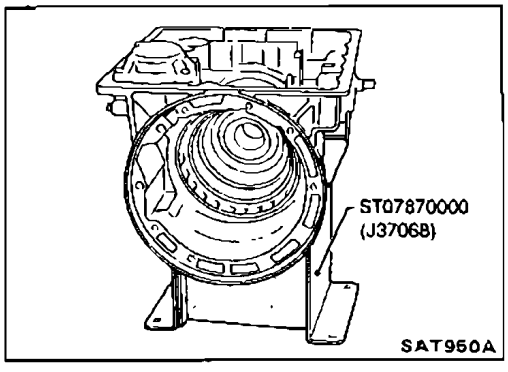
e. Install overrun clutch hub onto rear internal gear assembly.



f. Install needle bearing onto rear of overrun clutch hub.
- **Apply petroleum jelly to needle bearing.**

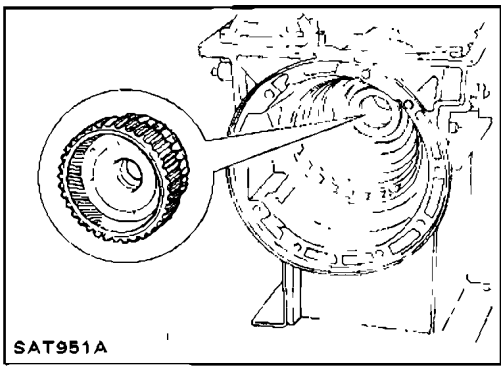


g. Check that overrun clutch hub rotates as shown while holding forward clutch hub.

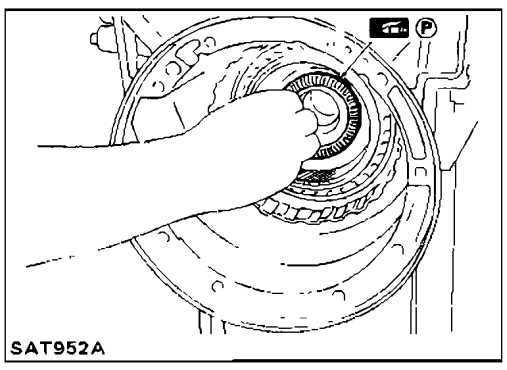


h. Place transmission case into horizontal position.

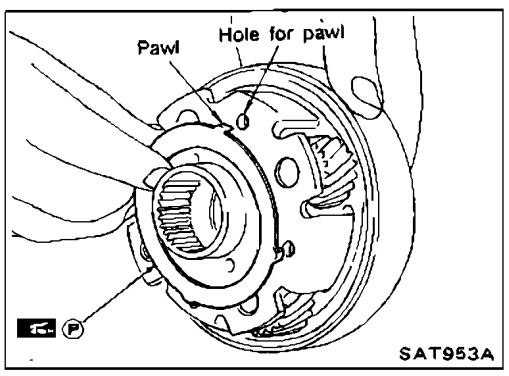
Assembly (Cont'd)


SAT951A

i. Install rear internal gear, forward clutch hub and overrun clutch hub as a unit onto transmission case.

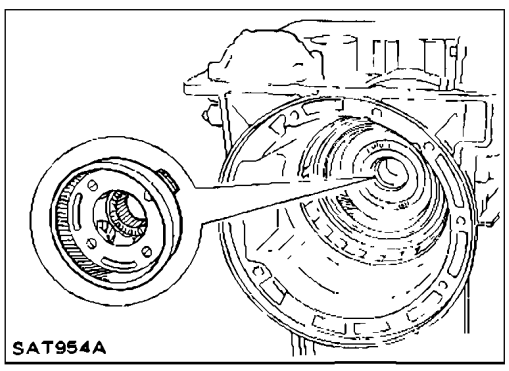

SAT952A

j. Install needle bearing onto rear internal gear.
- **Apply petroleum jelly to needle bearing.**



SAT953A

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.**

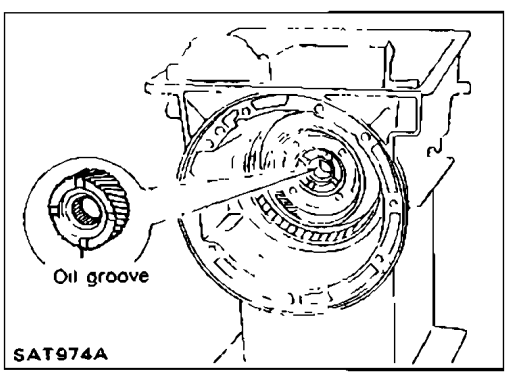

SAT954A

l. Install front internal gear on transmission case.

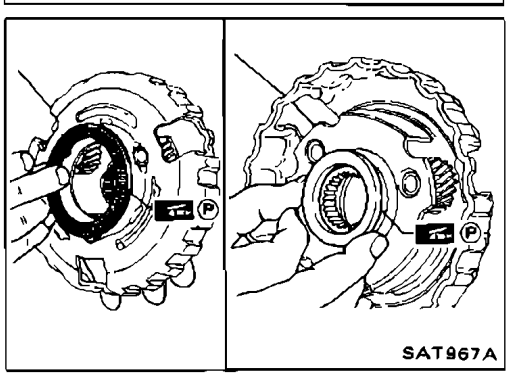
Adjustment

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	—	●



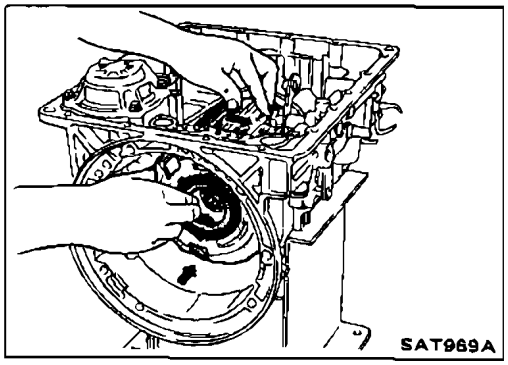
1. Install front side clutch and gear components.
a. Install rear sun gear on transmission case.
● **Pay attention to its direction.**

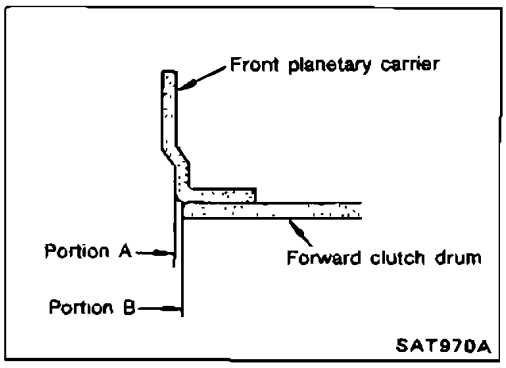


b. Install needle bearing on front of front planetary carrier.
● **Apply petroleum jelly to needle bearing.**
c. Install needle bearing on rear of front planetary carrier.
● **Apply petroleum jelly to bearing.**
● **Pay attention to its direction — Black side goes to front.**

Adjustment (Cont'd)

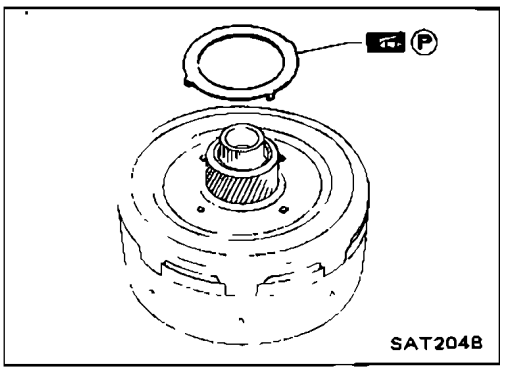
d. While rotating forward clutch drum clockwise, install front planetary carrier on forward clutch drum.



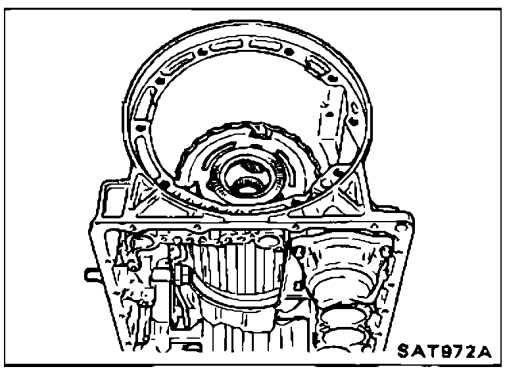


- **Check that portion A of front planetary carrier protrudes approximately 2 mm (0.08 in) beyond portion B of forward clutch assembly.**

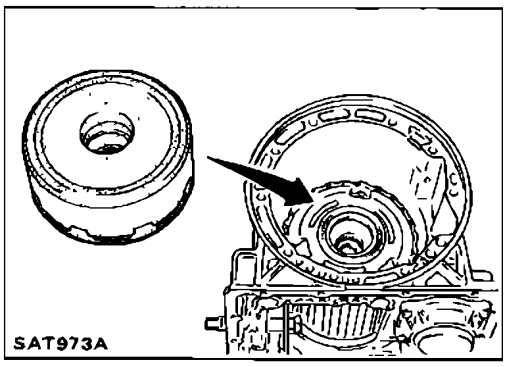
e. Install bearing races on rear of clutch pack.
- **Apply petroleum jelly to bearing races.**
- **Securely engage pawls of bearing race with hole in clutch pack.**



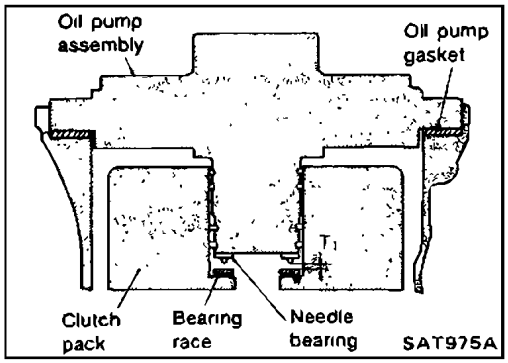
f. Place transmission case in vertical position.



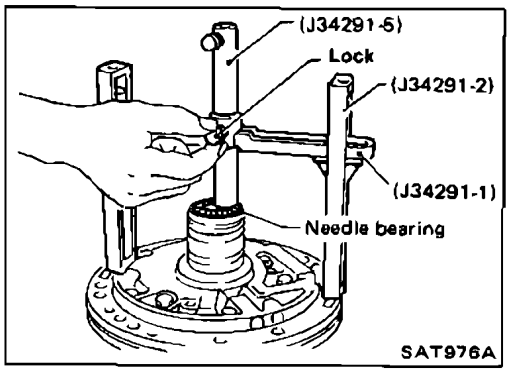
g. Install clutch pack into transmission case.



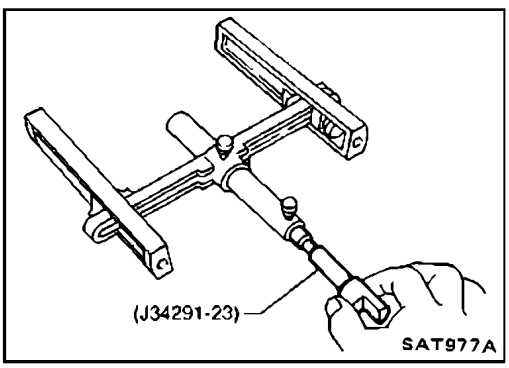
Adjustment (Cont'd)



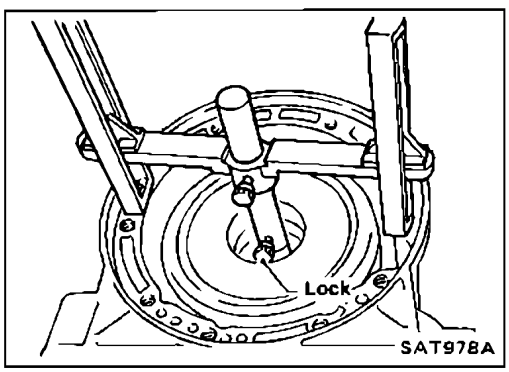
2. Adjust total end play.
   Total end play "T_1":
   0.25 - 0.55 mm (0.0098 - 0.0217 in)



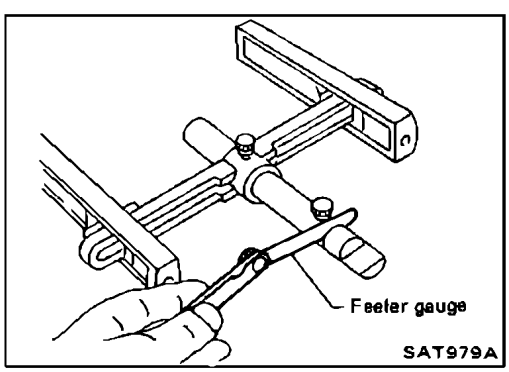
a. With needle bearing installed, place J34291-1 (bridge), J34291-2 (legs) and the J34291-5 (gauging cylinder) onto oil pump. The long ends of legs should be placed firmly on machined surface of oil pump assembly and gauging cylinder should rest on top of the needle bearing. Lock gauging cylinder in place with set screw.



b. Install J34291-23 (gauging plunger) into gauging cylinder.



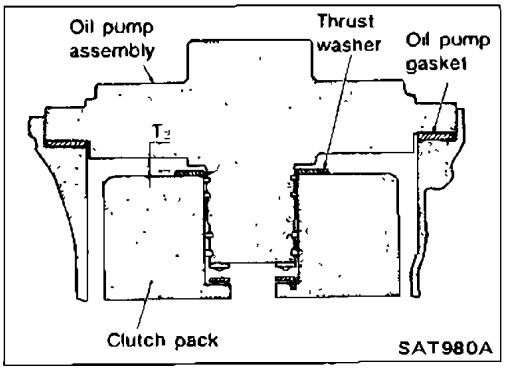
c. With original bearing race installed inside reverse clutch drum, place shim selecting gauge with its legs on machined surface of transmission case (no gasket) and allow gauging plunger to rest on bearing race. Lock gauging plunger in place with set screw.



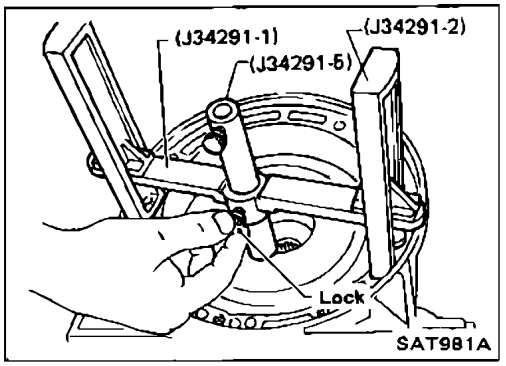
d. Remove Tool and use feeler gauge to measure gap between gauging cylinder and gauging plunger. This measurement should give exact total end play.
   Total end play "T_1":
   0.25 - 0.55 mm (0.0098 - 0.0217 in)

- 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.

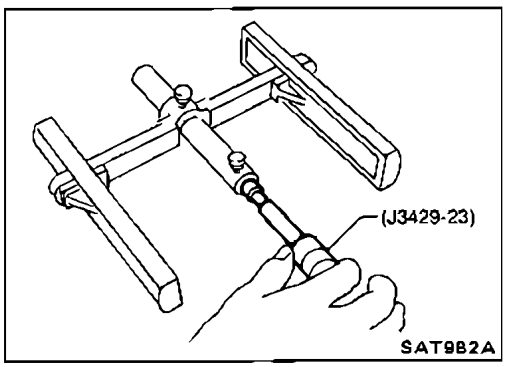
Adjustment (Cont'd)



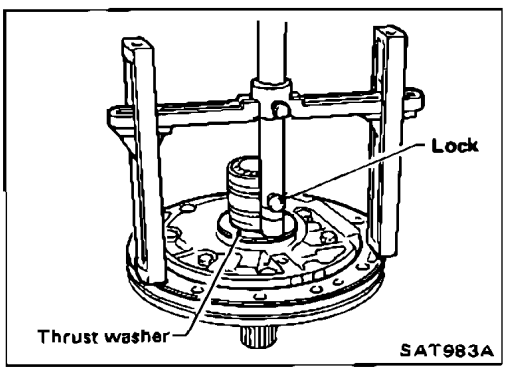
3. Adjust reverse clutch drum end play.
   Reverse clutch drum end play "T_2":
   0.55 - 0.90 mm (0.0217 - 0.0354 in)



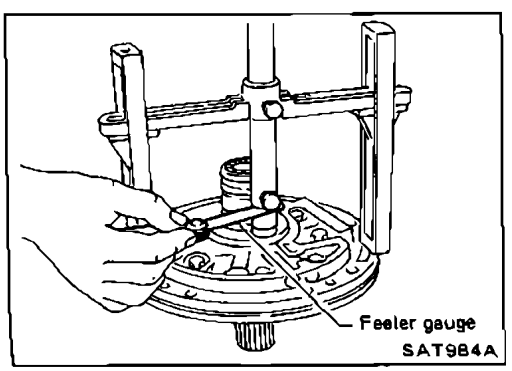
a. Place J34291-1 (bridge), J34291-2 (legs) and J34291-5 (gauging cylinder) on machined surface of transmission case (no gasket) and allow gauging cylinder to rest on front thrust surface of reverse clutch drum. Lock cylinder in place with set screw.



b. Install J34291-23 (gauging plunger) into gauging cylinder.

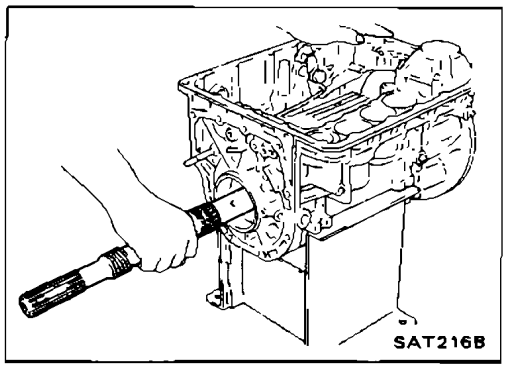


c. With original thrust washer installed on oil pump, place shim setting gauge legs onto machined surface of oil pump assembly and allow gauging plunger to rest on thrust washer. Lock plunger in place with set screw.



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.

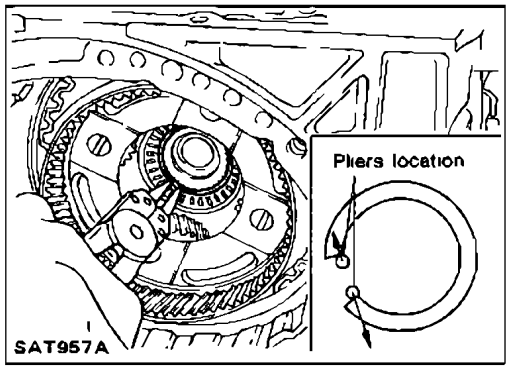


Assembly

1. Install output shaft and parking gear.

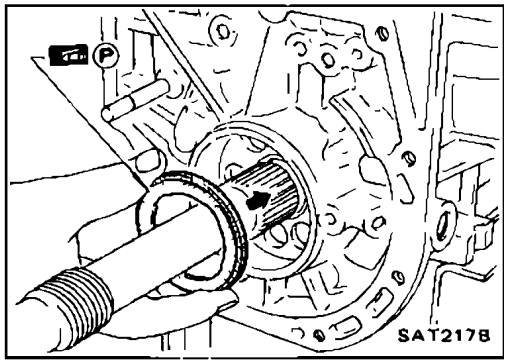
a. Insert output shaft from rear of transmission case while slightly lifting front internal gear.

- **Do not force output shaft against front of transmission case.**



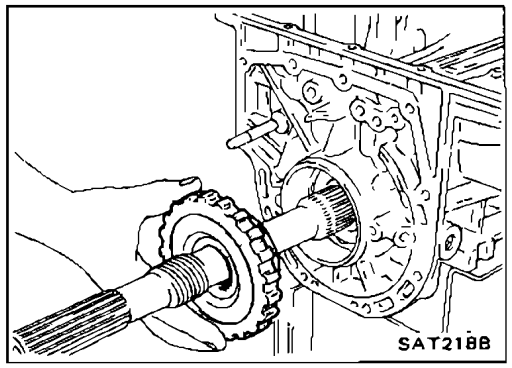
b. Carefully push output shaft against front of transmission case. Install snap ring on front of output shaft.

- **Check to be sure output shaft cannot be removed in rear direction.**

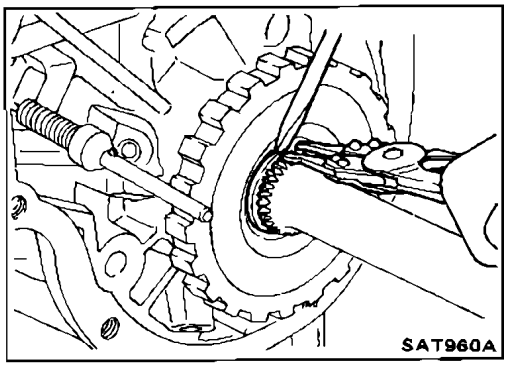


c. Install needle bearing on transmission case.

- **Pay attention to its direction — Black side goes to front.**
- **Apply petroleum jelly to needle bearing.**



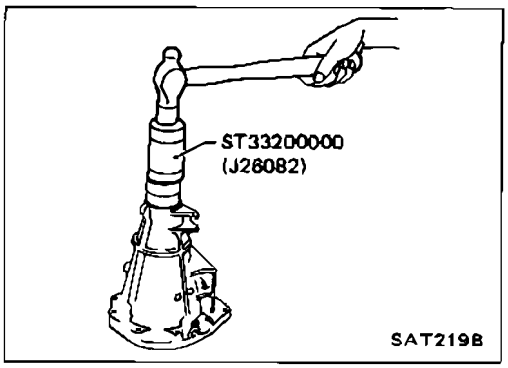
d. Install parking gear on transmission case.



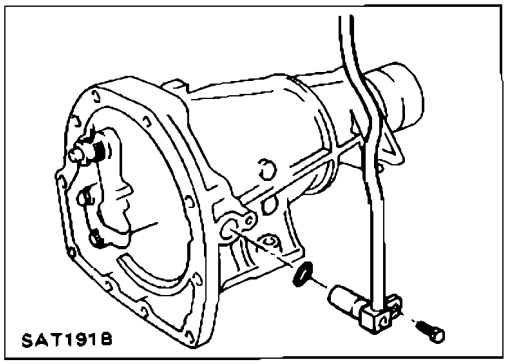
e. Install snap ring on rear of output shaft.

- **Check to be sure output shaft cannot be removed in forward direciton.**

Assembly (Cont'd)

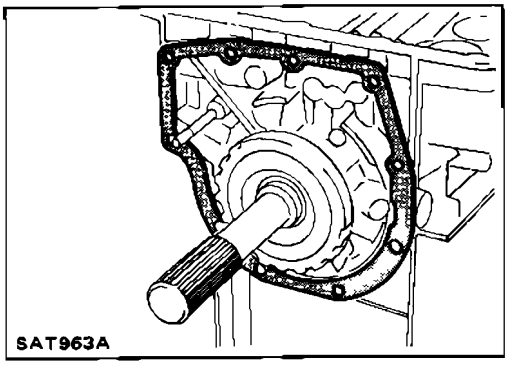


2. Install rear extension.
a. Install oil seal on rear extension.
- **Apply A.T.F. to oil seal.**

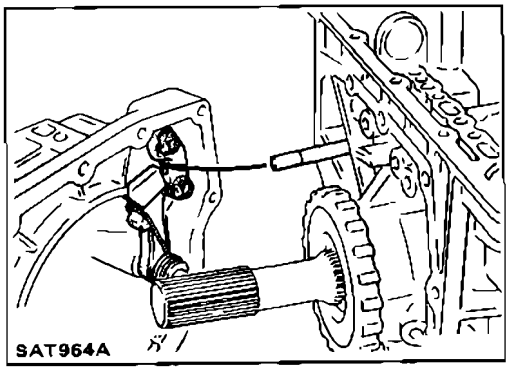


b. Install O-ring on revolution sensor.
- **Apply A.T.F. to O-ring.**

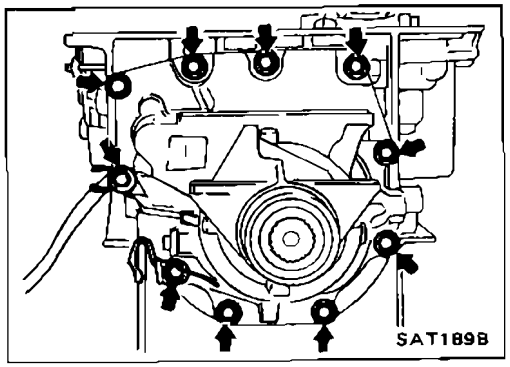
c. Install revolution sensor on rear extension.



d. Install rear extension gasket on transmission case.

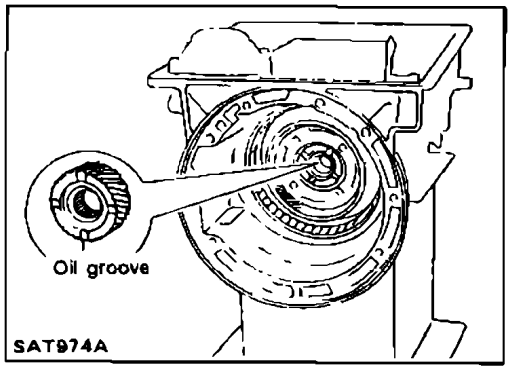


e. Install parking rod on transmission case.

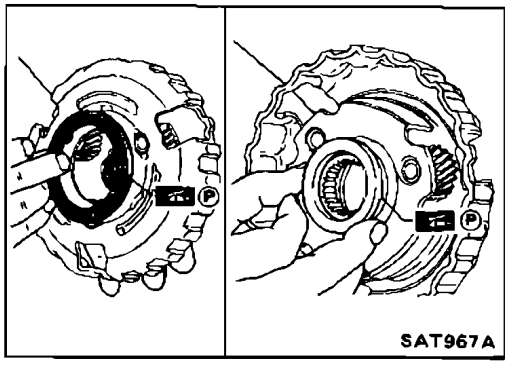


f. Install rear extension on transmission case.

Assembly (Cont'd)

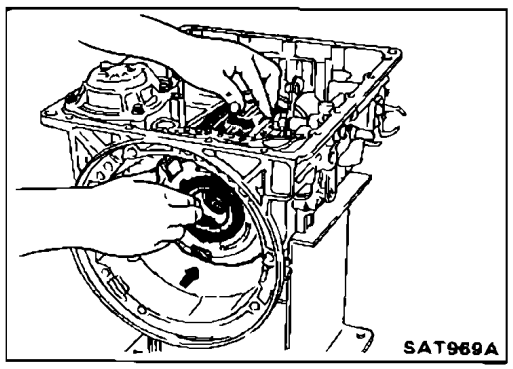


3. Install front side clutch and gear components.
a. Install rear sun gear on transmission case.
- **Pay attention to its direction.**

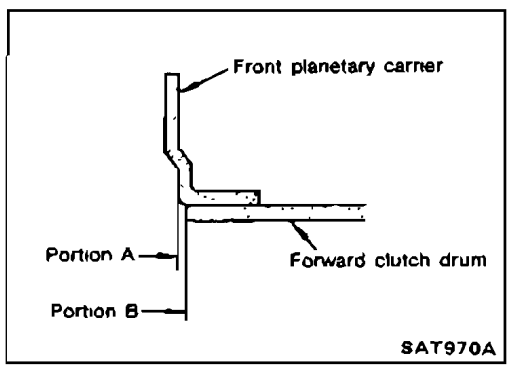


b. Make sure needle bearing is on front of front planetary carrier.
- **Apply petroleum jelly to needle bearing.**

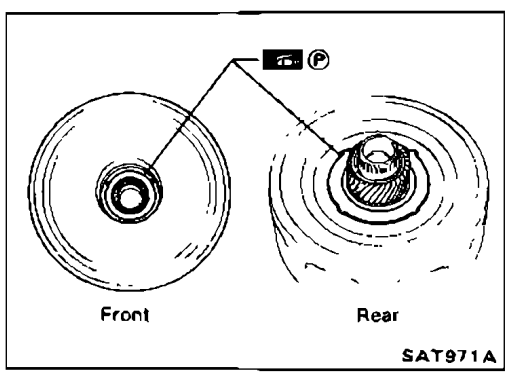
c. Make sure needle bearing is on rear of front planetary carrier.
- **Apply petroleum jelly to bearing.**
- **Pay attention to its direction — Black side goes to front.**



d. While rotating forward clutch drum clockwise, install front planetary carrier on forward clutch drum.



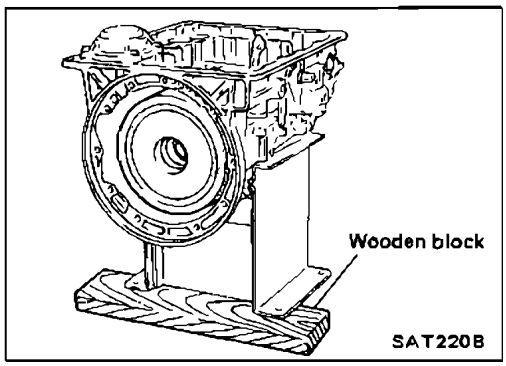
- **Check that portion A of front planetary carrier protrudes approximately 2 mm (0.08 in) beyond portion B of forward clutch assembly.**



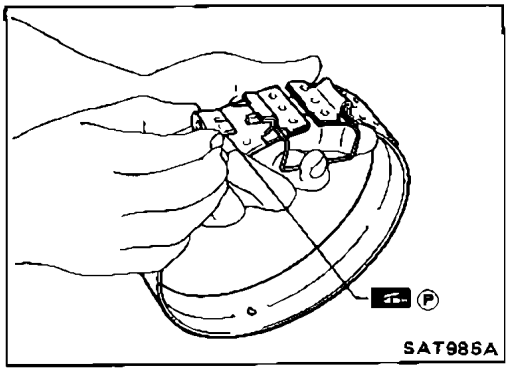
e. Make sure bearing races are on front and rear of clutch pack.
- **Apply petroleum jelly to bearing races.**
- **Securely engage pawls of bearing races with holes in clutch pack.**

Assembly (Cont'd)

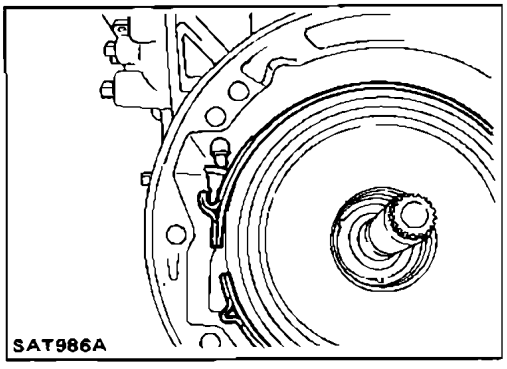
f. Install clutch pack into transmission case.



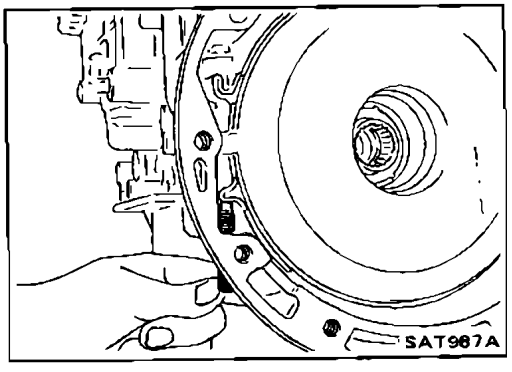
4. Install brake band and band strut.
a. Install band strut on brake band.
- **Apply petroleum jelly to band strut.**



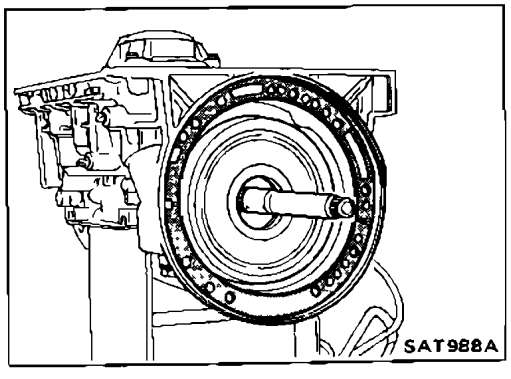
b. Place brake band on periphery of reverse clutch drum, and insert band strut into end of band servo piston stem.



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.



5. Install input shaft on transmission case.
- **Pay attention to its direction — O-ring groove side is front.**
6. Install gasket on transmission case.



Assembly (Cont'd)

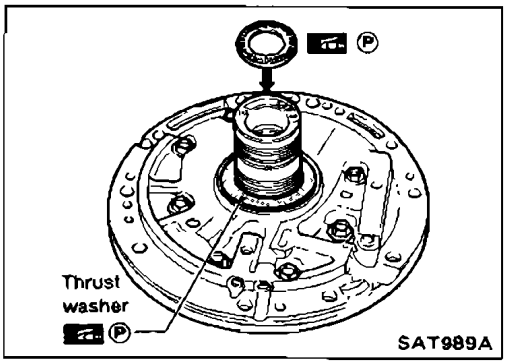
7. Install oil pump assembly.

a. Install needle bearing on oil pump assembly.

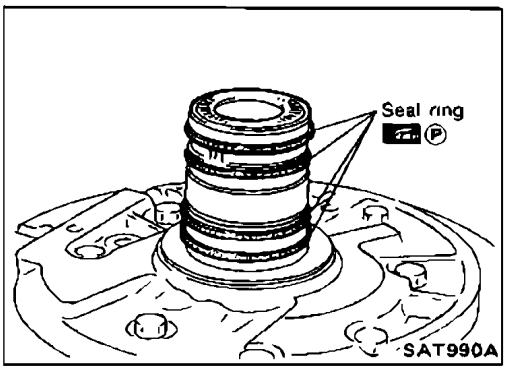
- **Apply petroleum jelly to the needle bearing.**

b. Install selected thrust washer on oil pump assembly.

- **Apply petroleum jelly to thrust washer.**

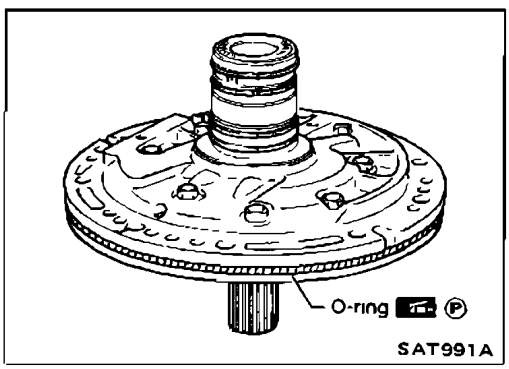


c. Carefully install seal rings into grooves and press them into the petroleum jelly so that they are a tight fit.

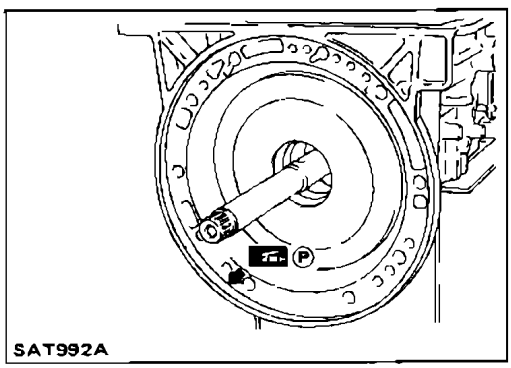


d. Install O-ring on oil pump assembly.

- **Apply petroleum jelly to O-ring.**

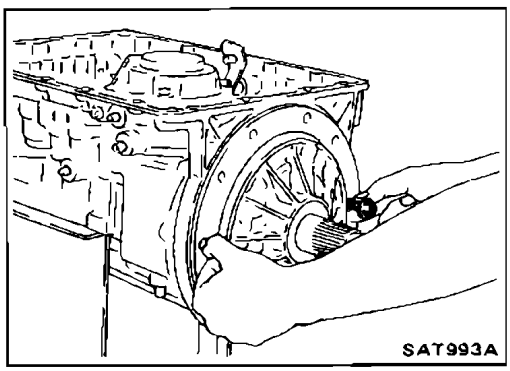


e. Apply petroleum jelly to mating surface of transmission case and oil pump assembly.

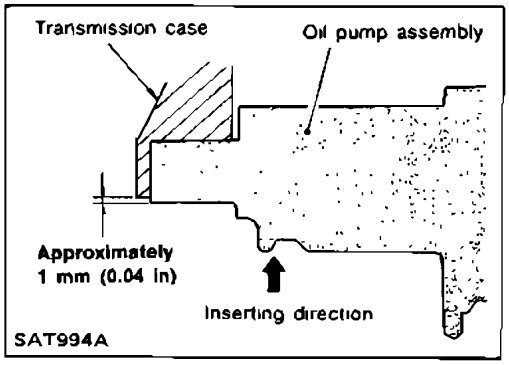


f. Install oil pump assembly.

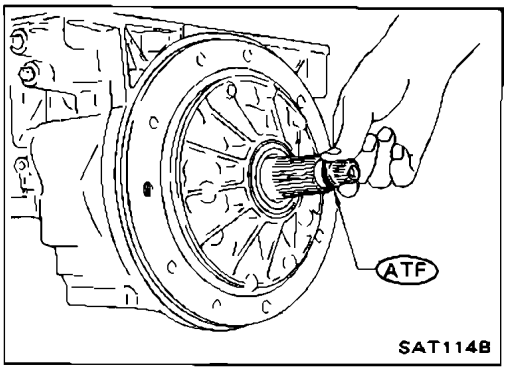
- **Install two converter housing securing bolts in bolt holes in oil pump assembly as guides.**



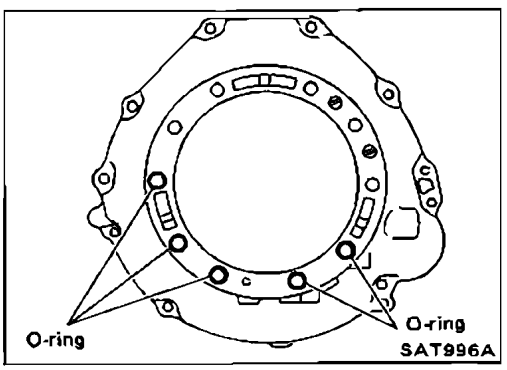
Assembly (Cont'd)



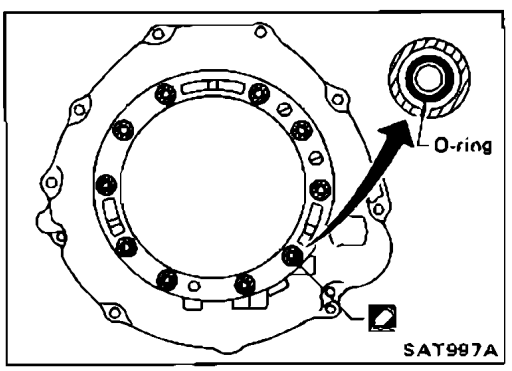
- **Insert oil pump assembly to the specified position in transmission, as shown at left.**



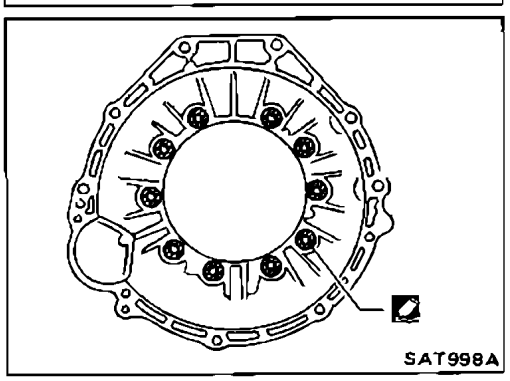
8. Install O-ring on input shaft.
- **Apply A.T.F. to O-rings.**



9. Install converter housing.
a. Install O-rings on converter housing.



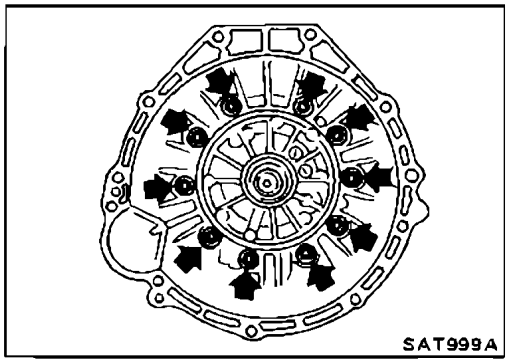
b. Apply recommended sealant (Nissan genuine part: KP610-00250 or equivalent) to outer periphery of bolt holes in converter housing.
- **Do not apply too much sealant.**



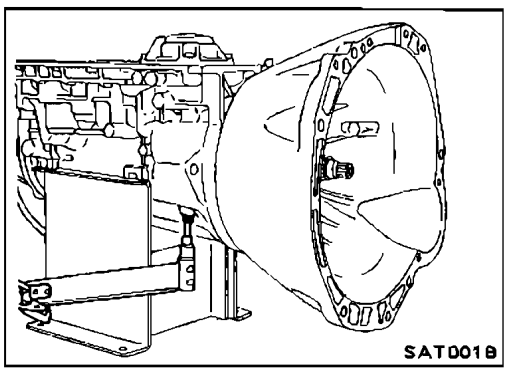
c. Apply recommended sealant (Nissan genuine part: KP610-00250 or equivalent) to seating surfaces of bolts that secure front of converter housing.

Assembly (Cont'd)

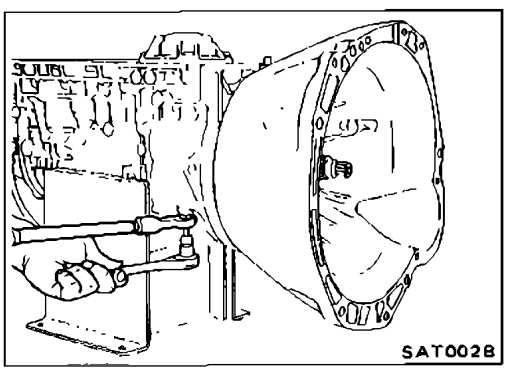
d. Install converter housing on transmission case.


SAT999A

10. 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.

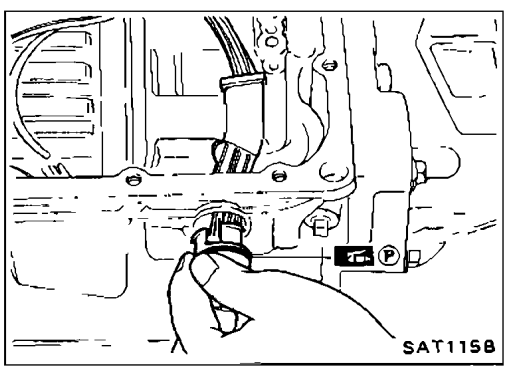

SAT001B

c. While holding anchor end pin, tighten lock nut.


SAT002B

11. Install terminal cord assembly.
a. Install O-ring on terminal cord assembly.
- **Apply petroleum jelly to O-ring.**

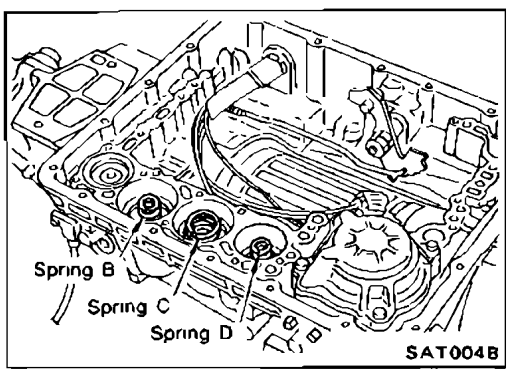
b. Compress terminal cord assembly stopper and install terminal cord assembly on transmission case.


SAT115B

12. Install control valve assembly.
a. Install accumulator piston return springs B, C and D.

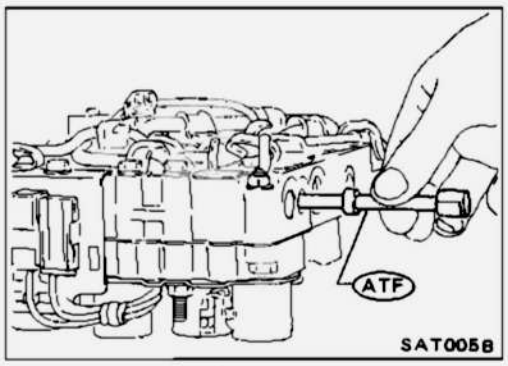
Free length of return springs: Unit: mm (in)

Item \ Accumulator	B	C	D
Free length	66 (2.60)	45 (1.77)	58.4 (2.299)

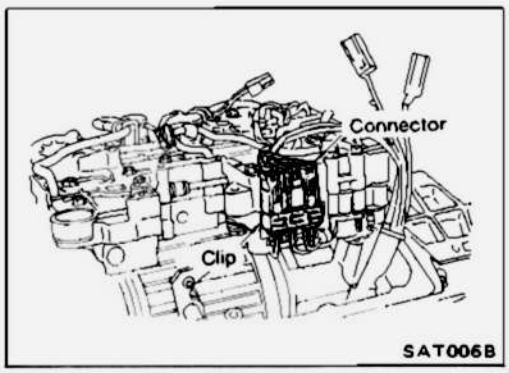


SAT004B

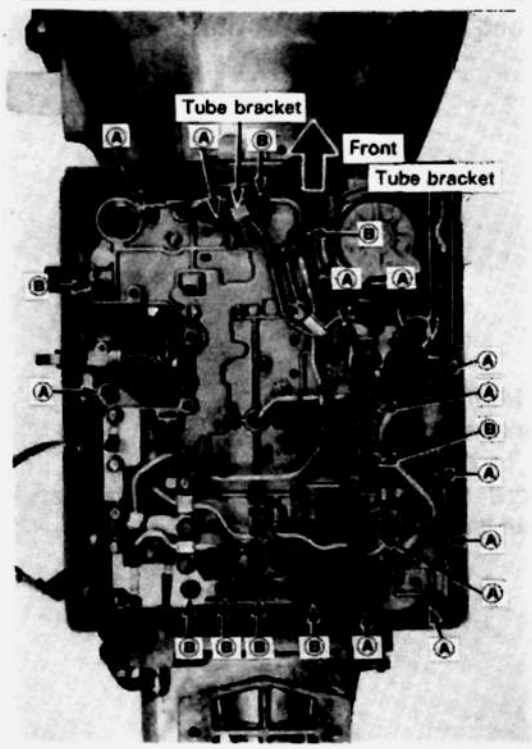
Assembly (Cont'd)



b. Install manual valve on control valve.
- **Apply A.T.F. to manual valve.**

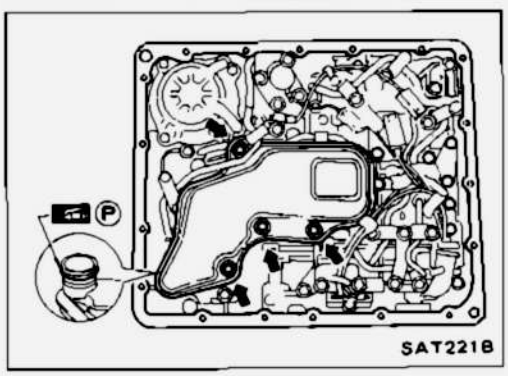


c. Place control valve assembly on transmission case. Connect solenoid connector for upper body.
d. Install connector clip.



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.**

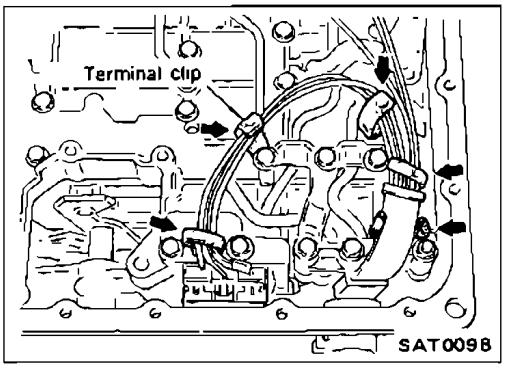
Bolt	Length
Ⓐ	37 mm (1.46 in)
Ⓑ	50 mm (1.97 in)



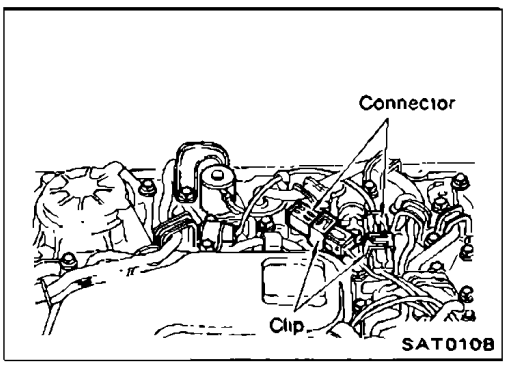
g. Install O-ring on oil strainer.
- **Apply petroleum jelly to O-ring.**

h. Install oil strainer on control valve.

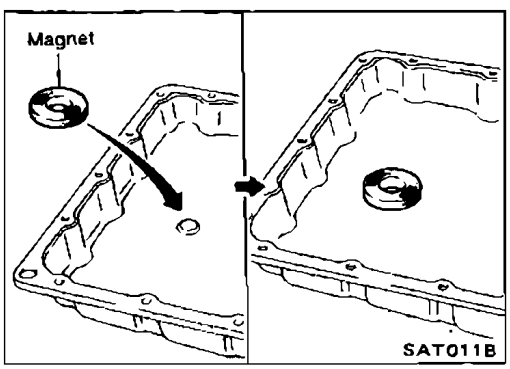
Assembly (Cont'd)



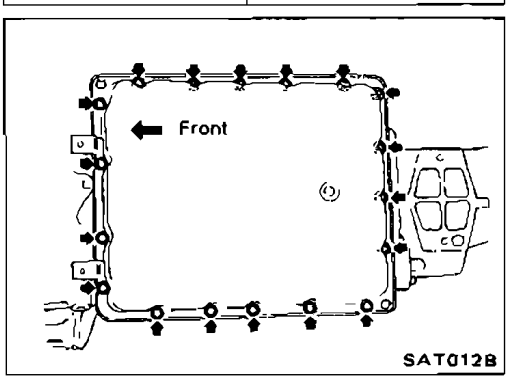
i. Securely fasten terminal harness with clips.



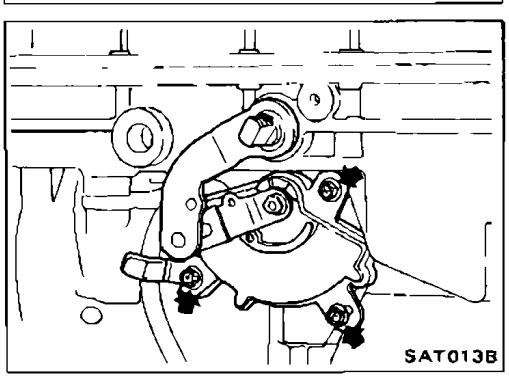
j. Install lock-up solenoid and fluid temperature sensor connectors.



13. Install oil pan.
a. Attach a magnet to oil pan.

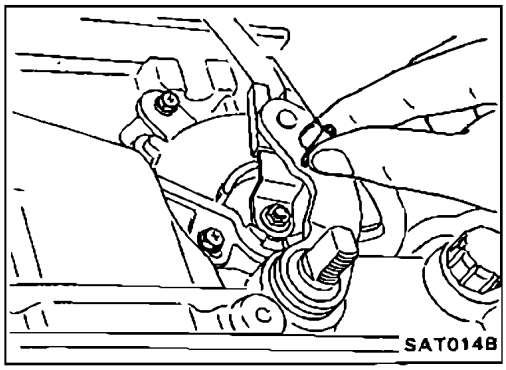


b. Install oil pan gasket on transmission case.
c. Install oil pan and bracket on transmission case.
- **Tighten four bolts in a criss-cross pattern to prevent dislocation of gasket.**

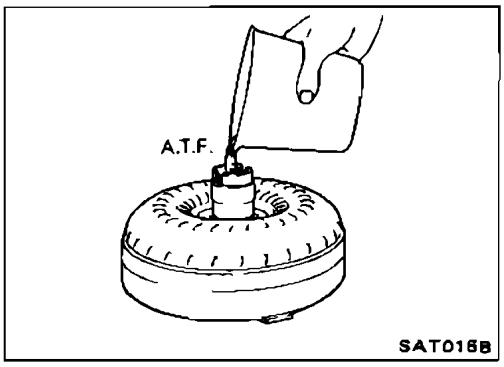


14. Install inhibitor switch.
a. Check that manual shaft is in "1" range.
b. Temporarily install inhibitor switch on manual shaft.
c. Move manual shaft to "N".

Assembly (Cont'd)



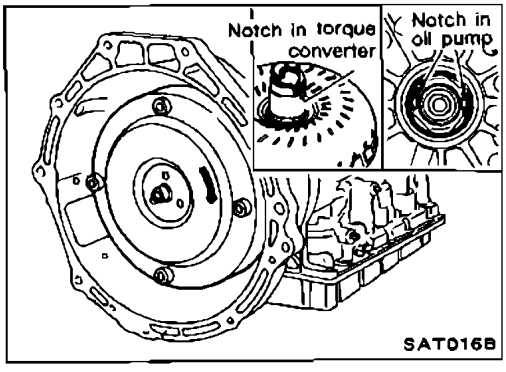
d. Tighten bolts while inserting 4.0 mm (0.157 in) dia. pin vertically into locating holes in inhibitor switch and manual shaft.



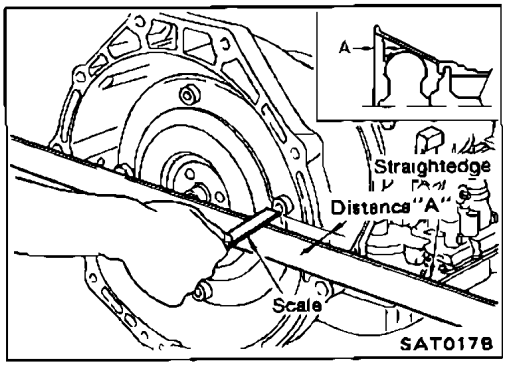
15. Install torque converter.

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.**



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 mm (1.02 in) or more

General Specifications

Engine	KA24E
Automatic transmission model	RE4R01A
Transmission model code number	45X06
Stall torque ratio	2.0 : 1
Transmission gear ratio	
1st	2.785
2nd	1.545
Top	1.000
O.D.	0.694
Reverse	2.272
Recommended oil	Automatic transmission fluid Type DEXRON™
Oil capacity ℓ (US qt, Imp qt)	8.3 (8-3/4, 7-1/4)

Specifications and Adjustment

VEHICLE SPEED WHEN SHIFTING GEARS

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	52 - 56 (32 - 35)	95 - 101 (59 - 63)	146 - 156 (91 - 97)	140 - 150 (87 - 93)	89 - 95 (55 - 59)	40 - 44 (25 - 27)	53 - 57 (33 - 35)
Half throttle	38 - 42 (24 - 26)	72 - 78 (45 - 48)	111 - 121 (69 - 75)	55 - 65 (34 - 40)	33 - 39 (21 - 24)	10 - 14 (6 - 9)	53 - 57 (33 - 35)

VEHICLE SPEED WHEN PERFORMING AND RELEASING LOCK-UP

Throttle position	O.D. switch [Shift range]	Vehicle speed km/h (MPH)	
		Lock-up "ON"	Lock-up "OFF"
Full throttle	ON [D_4]	146 - 156 (91 - 97)	140 - 150 (87 - 93)
	OFF [D_3]	95 - 101 (59 - 63)	89 - 95 (55 - 59)
Half throttle	ON [D_4]	112 - 120 (70 - 75)	102 - 110 (63 - 68)
	OFF [D_3]	76 - 84 (47 - 52)	71 - 79 (44 - 49)

STALL REVOLUTION

Stall revolution rpm
2,050 - 2,250

LINE PRESSURE

Engine speed rpm	Line pressure kPa (kg/cm², psi)	
	D, 2 and 1 ranges	R range
Idle	471 - 510 (4.8 - 5.2, 68 - 74)	657 - 696 (6.7 - 7.1, 95 - 101)
Stall	1,020 - 1,098 (10.4 - 11.2, 148 - 159)	1,422 - 1,500 (14.5 - 15.3, 206 - 218)

Specifications and Adjustment (Cont'd)

RETURN SPRINGS

Unit: mm (in)

Parts		Item	Part No.	Free length	Outer diameter
Control valve	Upper body	Torque converter relief valve spring	31742-41X18	32.3 (1.272)	9.0 (0.354)
		Pressure regulator valve spring	31742-41X16	61.5 (2.421)	8.9 (0.350)
		Pressure modifier valve spring	31742-41X19	31.95 (1.2579)	6.8 (0.268)
		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 piston 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	30505-41X02	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	36.77 (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	58.0 (2.283)	

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

Reverse clutch Number of drive plates	2	
Number of driven plates	2	
Thickness of drive plate mm (in) Standard Wear limit	2.0 (0.079) 1.8 (0.071)	
Clearance mm (in) Standard Allowable limit	0.5 - 0.8 (0.020 - 0.031) 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)	31567-41X13
	5.8 (0.228)	31567-41X14
High clutch Number of drive plates	4	
Number of driven plates	4	
Thickness of drive plate mm (in) Standard Wear limit	1.6 (0.063) 1.4 (0.055)	
Clearance mm (in) Standard Allowable limit	1.8 - 2.2 (0.071 - 0.087) 3.0 (0.118)	
Thickness of retaining plate	Thickness mm (in)	Part number
	3.6 (0.142)	31537-41X61
	3.8 (0.150)	31537-41X62
	4.0 (0.157)	31537-41X63
	4.2 (0.165)	31537-41X64
	4.4 (0.173)	31537-41X65
	4.6 (0.181)	31537-41X66
	4.8 (0.189)	31537-41X67
	5.0 (0.197)	31537-41X68

Forward clutch Number of drive plates	5	
Number of driven plates	5	
Thickness of drive plate mm (in) Standard Wear limit	2.0 (0.079) 1.8 (0.071)	
Clearance mm (in) Standard Allowable limit	0.45 - 0.85 (0.0177 - 0.0335) 1.85 (0.0728)	
Thickness of retaining plate	Thickness mm (in)	Part number
	8.0 (0.315)	31537-41X00
	8.2 (0.323)	31537-41X01
	8.4 (0.331)	31537-41X02
	8.6 (0.339)	31537-41X03
	8.8 (0.346)	31537-41X04
	9.0 (0.354)	31537-41X05
	9.2 (0.362)	31537-41X06
Overrun clutch Number of drive plates	3	
Number of driven plates	5	
Thickness of drive plate mm (in) Standard Wear limit	2.0 (0.079) 1.8 (0.071)	
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)

Low & reverse brake Number of drive plates	5	
Number of driven plates	7	
Thickness of drive plate mm (in) Standard Wear limit	2.0 (0.079) 1.8 (0.071)	
Clearance mm (in) Standard Allowable limit	1.1 - 1.5 (0.043 - 0.059) 2.5 (0.098)	
Thickness of retaining plate	Thickness mm (in)	Part number
	8.6 (0.339)	31667-41X03
	8.8 (0.346)	31667-41X04
	9.0 (0.354)	31667-41X05
	9.2 (0.362)	31667-41X06
	9.4 (0.370)	31667-41X09
	9.6 (0.378)	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) 0.26 (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

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

REMOVAL AND INSTALLATION

Manual control linkage Number of returning revolutions for lock nut	1
Lock nut tightening torque	11 - 15 N·m (1.1 - 1.5 kg-m, 8 - 11 ft-lb)
Distance between end of clutch housing and torque converter	26.0 mm (1.024 in) or more
Drive plate runout limit	0.5 mm (0.020 in)

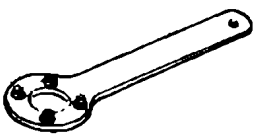
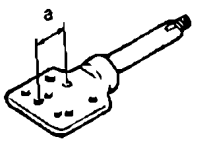
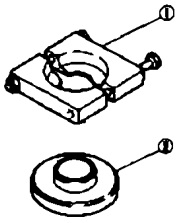
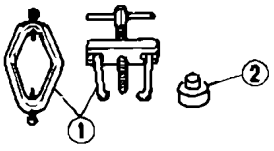
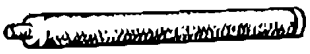
PROPELLER SHAFT & DIFFERENTIAL CARRIER

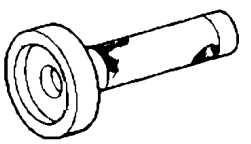
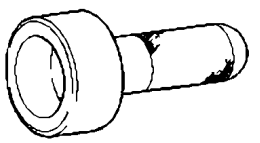
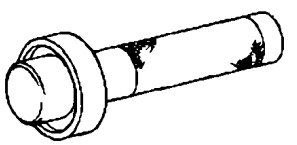
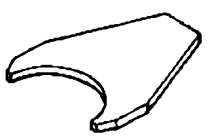
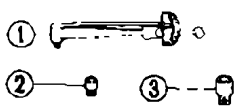
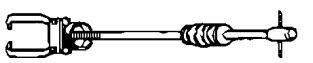
SECTION PD

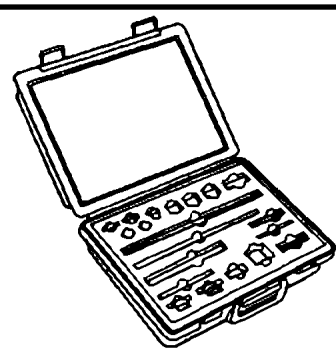
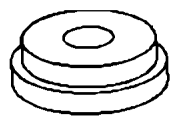
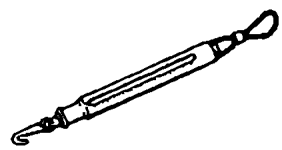
CONTENTS

PREPARATION ..... PD- 2
PROPELLER SHAFT ..... PD- 5
ON-VEHICLE SERVICE (Final drive) ..... PD- 9
REMOVAL AND INSTALLATION PD-11
FRONT FINAL DRIVE PD-12
DISASSEMBLY PD-13
INSPECTION PD-17
ADJUSTMENT PD-18
ASSEMBLY PD-25
SERVICE DATA AND SPECIFICATIONS (S.D.S.) PD-30

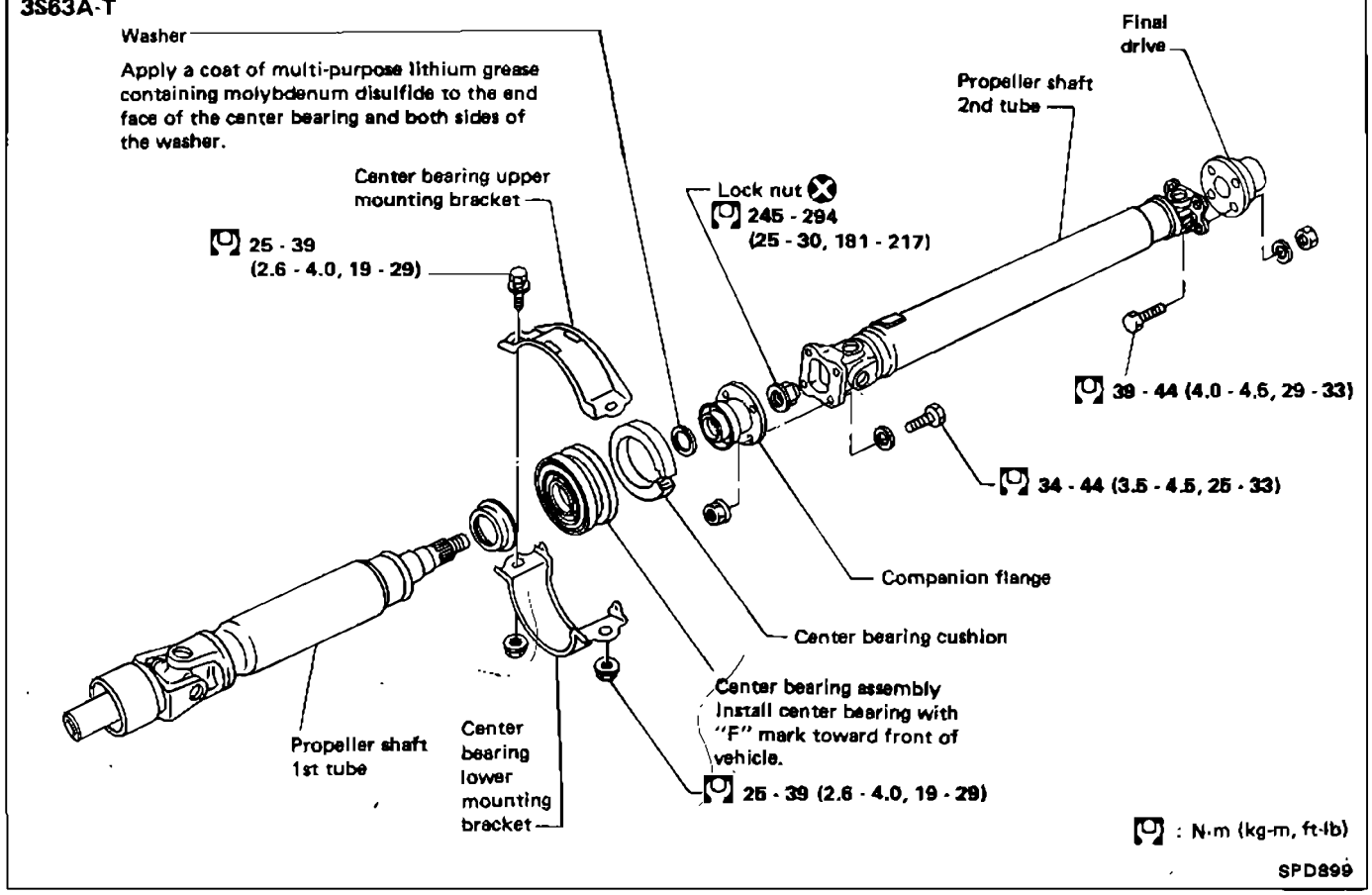
SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.) Tool name	Description	
ST38060002 (J34311) Drive pinion flange wrench		Removing and installing propeller shaft lock nut, and drive pinion lock nut.
KV38100800 (–) Equivalent tool (J25604-01) Differential attachment	 a: 152 mm (5.98 in)	Mounting final drive (To use, make a new hole.)
ST3090S000 (–) Drive pinion rear inner race puller set ① ST30031000 (J22912-01) Puller ② ST30901000 (–) Equivalent tool (J26010-01) Base		Removing and installing drive pinion rear cone
ST3306S001 (–) Differential side bearing puller set ① ST33051001 (–) Equivalent tool (J22888) Body ② ST33061000 (J8107-2) Equivalent tool (J26010-01) Adapter		Removing and installing differential side bearing inner cone
ST30611000 (J25742-1) Drift		Installing pinion rear bearing outer race

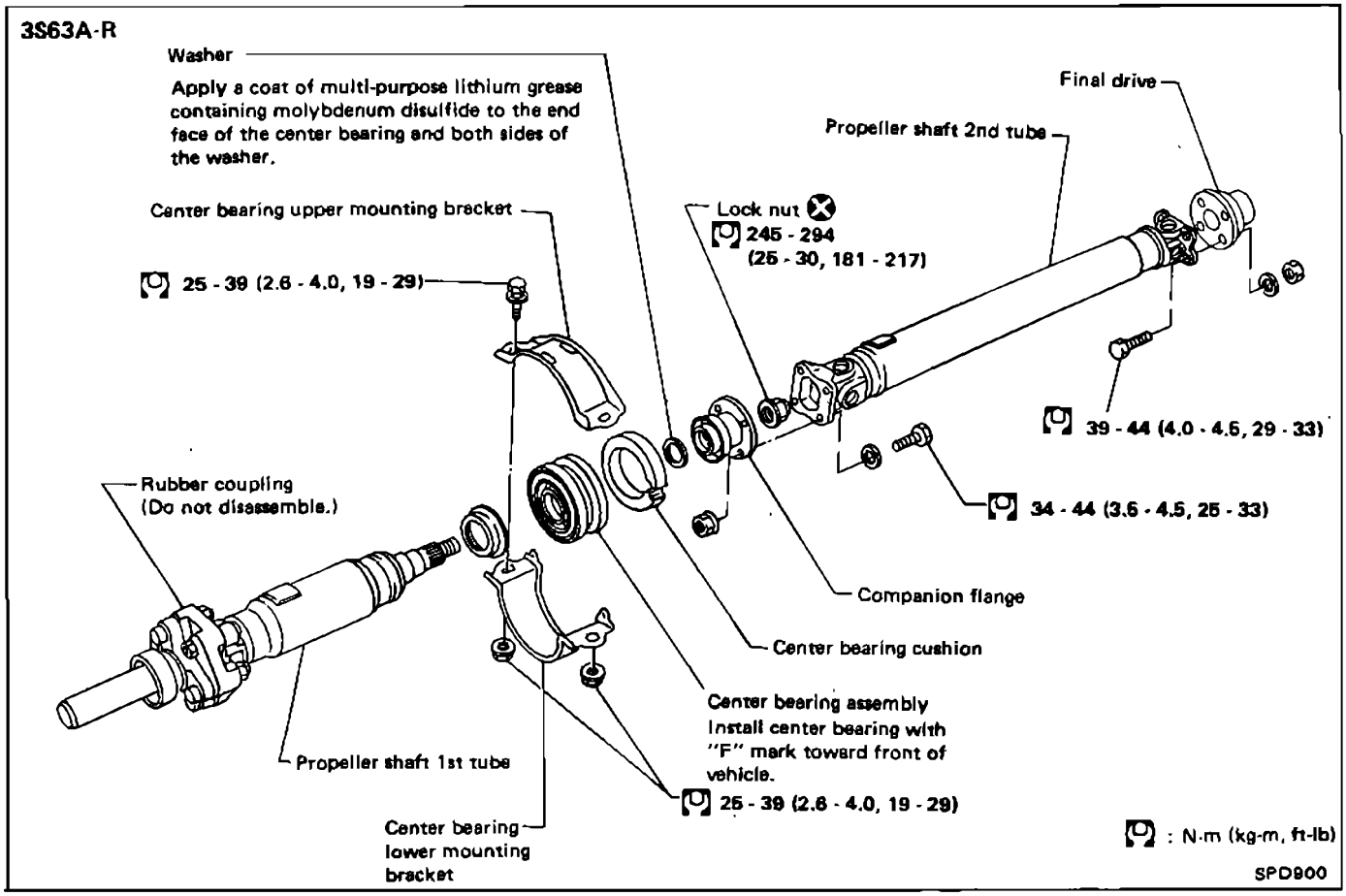
Tool number (Kent-Moore No.) Tool name	Description
ST30613000 (J25742-3) Drift	Installing pinion rear bearing outer race
ST30701000 (J25742-2) Drift	Installing pinion front bearing outer race
KV38100200 (J26233) Gear carrier side oil seal drift	Installing side oil seal 
KV38100500 (–) Gear carrier front oil seal drift	Installing front oil seal 
KV38100300 (J25523) Differential side bearing inner cone	Installing side bearing inner cone 
KV38100600 (J25267) Side bearing spacer drift	Installing side bearing spacer 
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 
HT72400000 (–) Slide hammer	Removing differential case assembly 

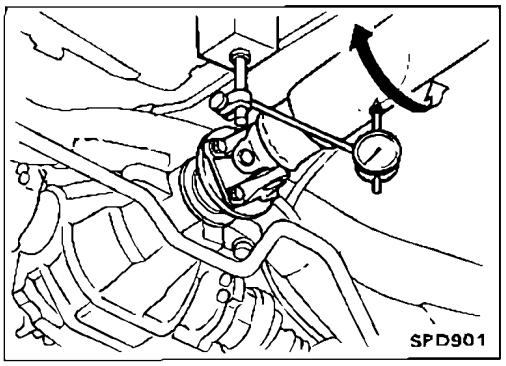
Tool number (Kent-Moore No.) Tool name	Description	
(J34309) Differential shim selector		Adjusting bearing preload and gear height
(J25269-4) Side bearing discs (2 Req'd)		Selecting pinion height adjusting washer
(J8129) Spring gauge		Measuring carrier turning torque

3S63A-T



3S63A-R



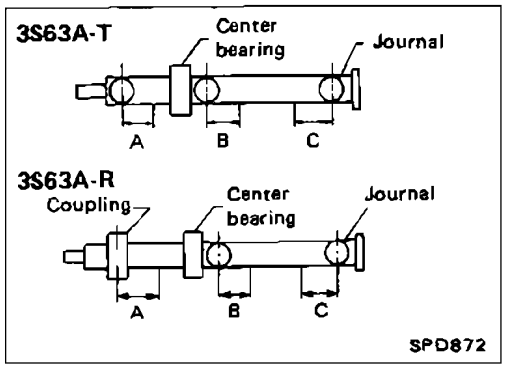


On-vehicle Service

PROPELLER SHAFT VIBRATION

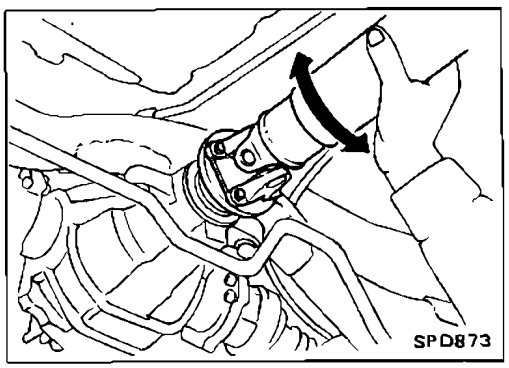
If vibration is present at high speed, inspect propeller shaft runout first.

1. Raise rear wheels.
2. Measure propeller shaft runout at indicated points by rotating final drive companion flange with hands.
   Runout limit: 0.6 mm (0.024 in)



Propeller shaft runout measuring points: Unit: mm (in)

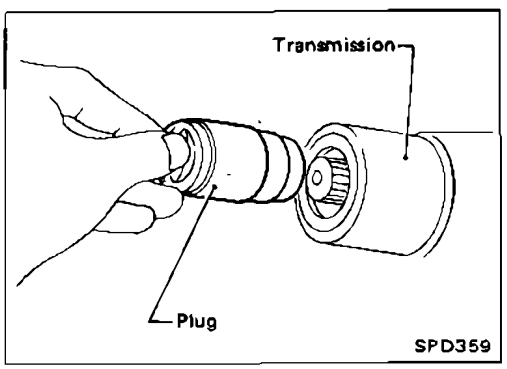
Model / Distance	3S63A-T	3S63A-R
A	175 (6.89)	155 (6.10)
B	165 (6.50)	165 (6.50)
C	185 (7.28)	185 (7.28)



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.

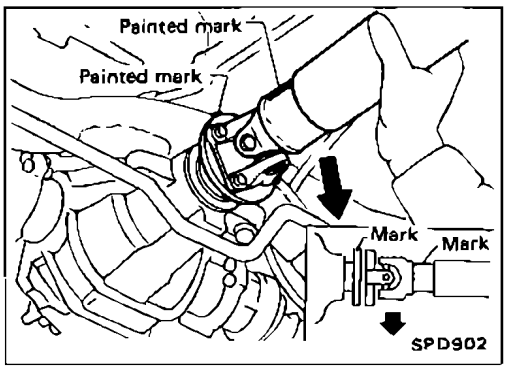
APPEARANCE CHECKING

- 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.



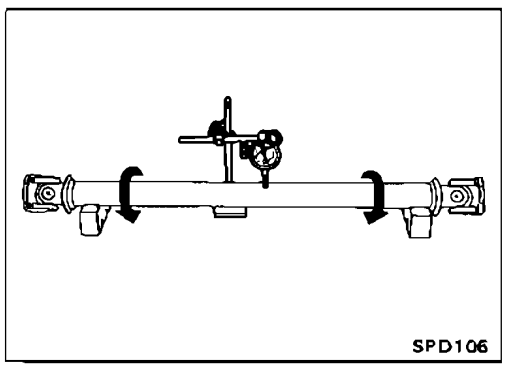
Removal

- Draw out propeller shaft from transmission and plug up rear end of transmission rear extension housing.



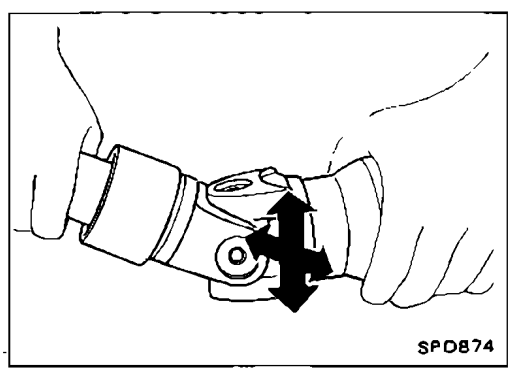
Installation

- Temporarily install differential companion flange and flange yoke so that their alignment marks are located as close to each other as possible.
- Turn propeller shaft until alignment marks face straight upward. Securely fasten propeller shaft so that lower side wall of concave flange yoke will touch lower side wall of convex companion flange.



Inspection

- Inspect propeller shaft runout. If runout exceeds specifications, replace propeller shaft assembly.
  Runout limit: 0.6 mm (0.024 in)

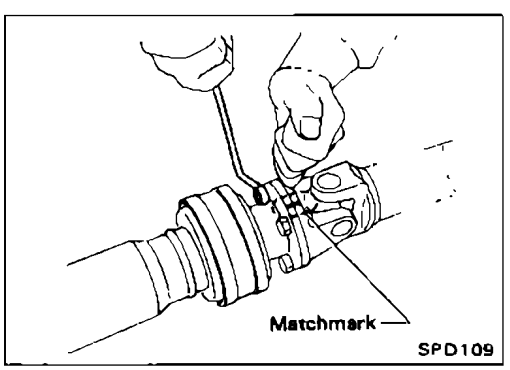


- Inspect journal axial play.
  If the play exceeds specifications, replace propeller shaft assembly.
  Journal axial play:
  0 mm (0 in)

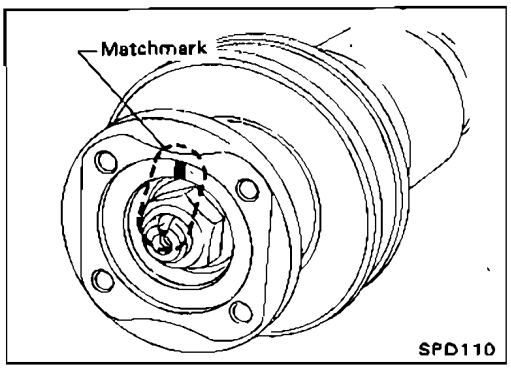
Disassembly

CENTER BEARING

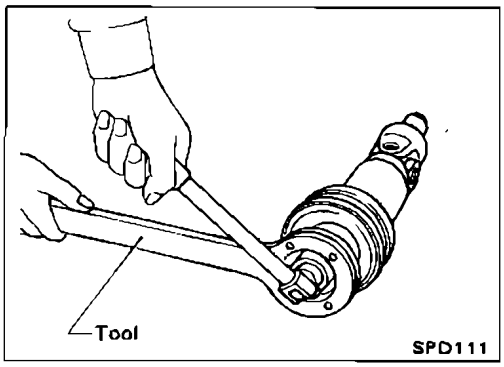
1. Put matchmarks on flanges, and separate 2nd tube from 1st tube.



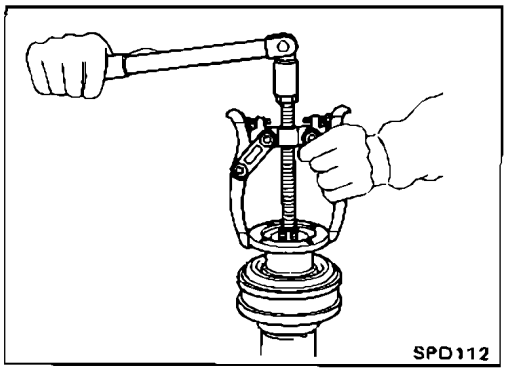
2. Put matchmarks on the flange and shaft.



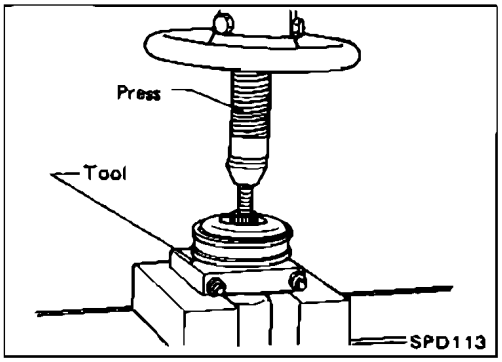
Disassembly (Cont'd)



3. Remove locking nut with Tool.
   Tool number:
   ST38060002 (J34311)



4. Remove companion flange with puller.

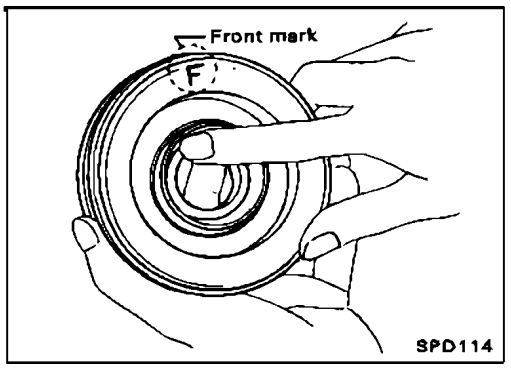


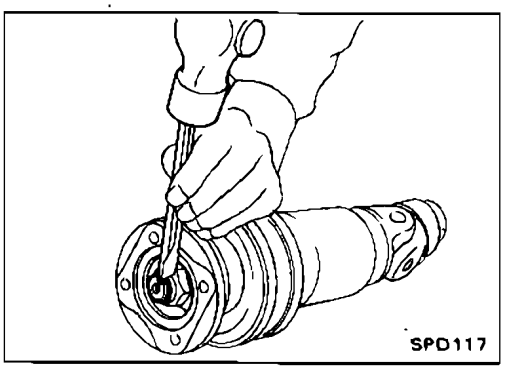
5. Remove center bearing with Tool and press.
   Tool number: ST30031000 (J22912-01)

Assembly

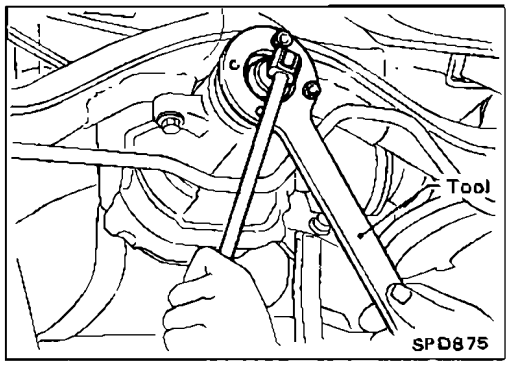
CENTER BEARING

- 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.**



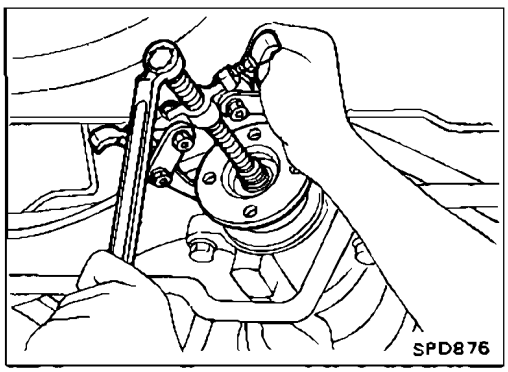


- Stake the nut. Always use new one.
- Align matchmarks when assembling tubes.

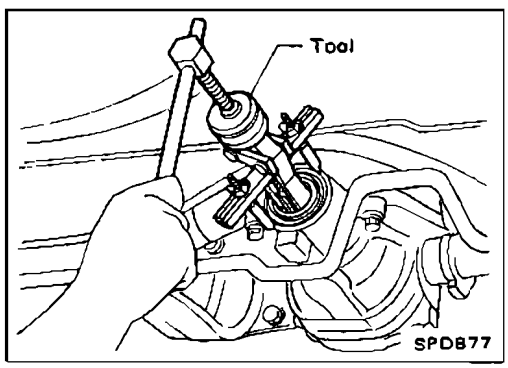


Front Oil Seal Replacement

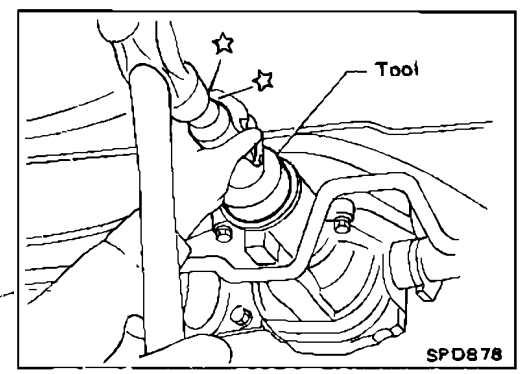
1. Remove propeller shaft.
2. Loosen drive pinion nut with Tool.
   Tool number: ST38060002 (J34311)



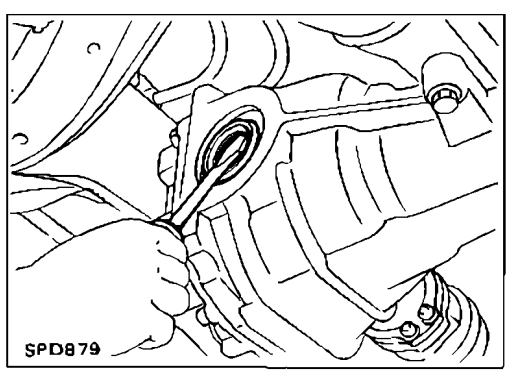
3. Remove companion flange.



4. Remove front oil seal.



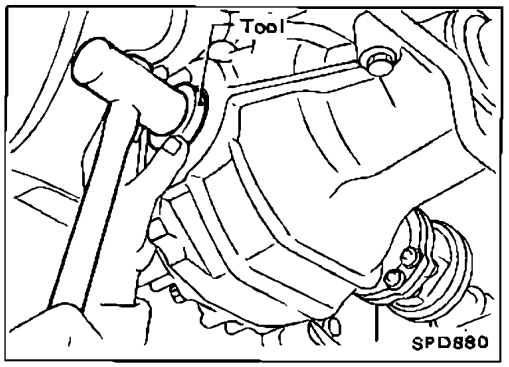
5. Apply multi-purpose grease to sealing lips of oil seal. Press front oil seal into carrier.
6. Install companion flange and drive pinion nut.
7. Install propeller shaft.



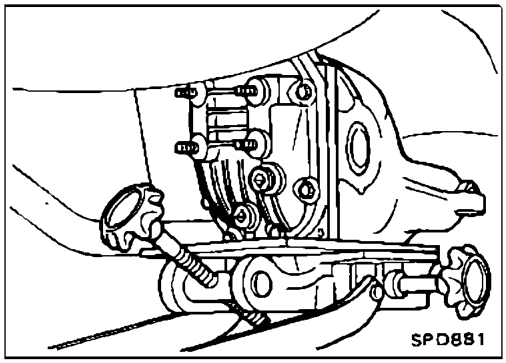
Side Oil Seal Replacement

1. Remove drive shafts.
   Refer to RA section.
2. Remove oil seal.

Side Oil Seal Replacement (Cont'd)



3. Apply multi-purpose grease to sealing lips of oil seal. Press-fit oil seal into carrier with Tool.
   Tool number: KV38100200 (J26233)
4. Install drive shafts.



Removal

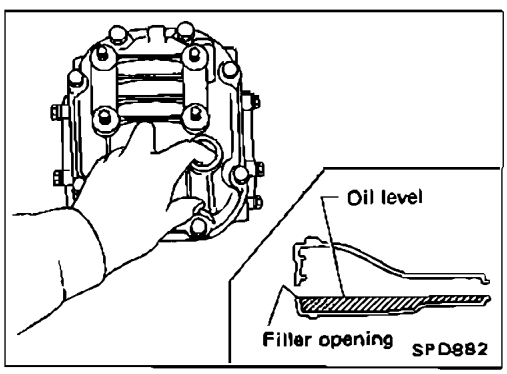
- Remove propeller shaft.

Insert plug into rear oil seal after removing propeller shaft.

- Remove drive shafts.
  Refer to RA section.
- Pull off final drive backward together with jack.

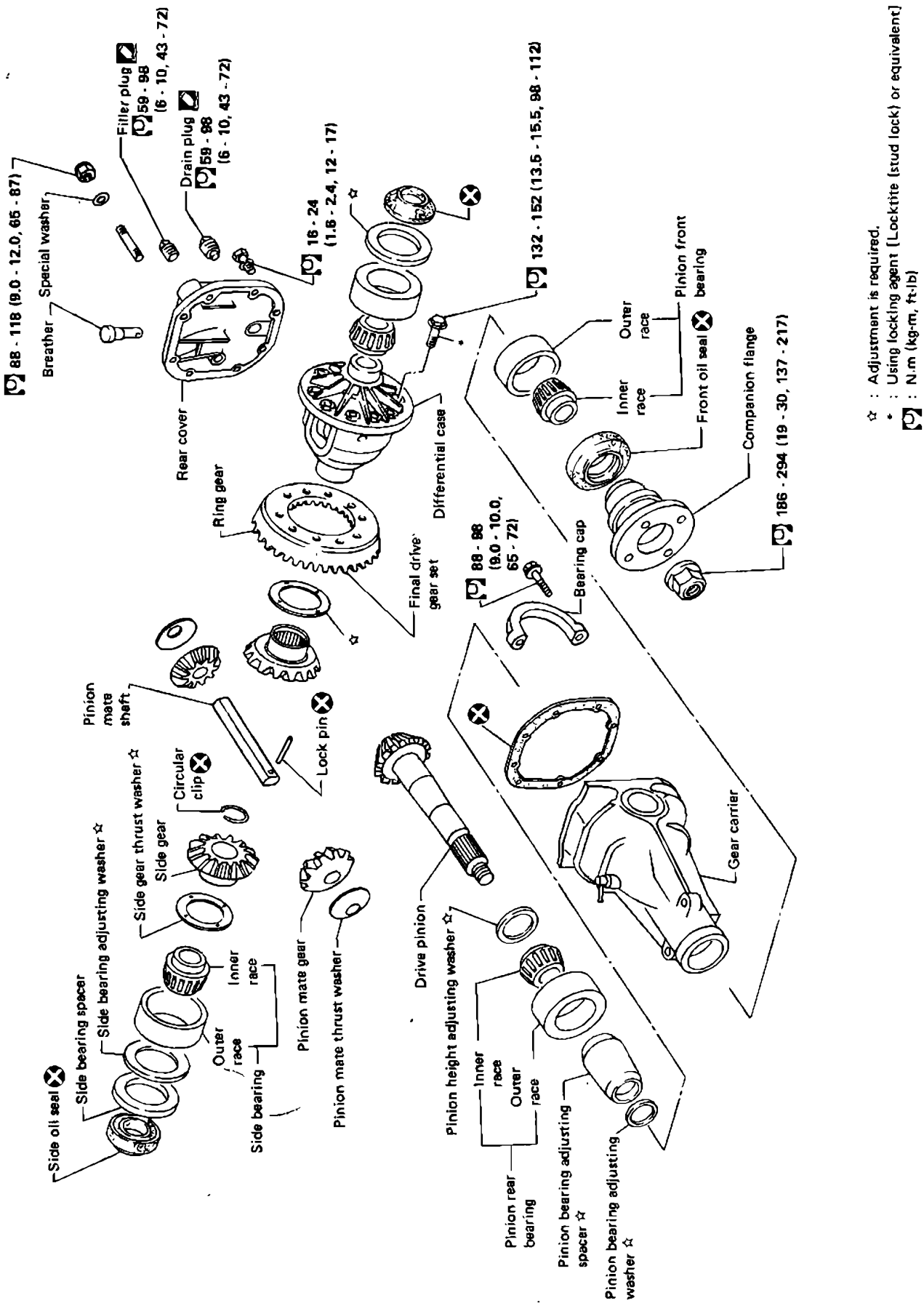
CAUTION:

- **Be careful not to damage spline, sleeve yoke and front oil seal, when removing propeller shaft.**
- **After final drive is removed, support suspension member on a stand to prevent its insulators from being twisted or damaged.**

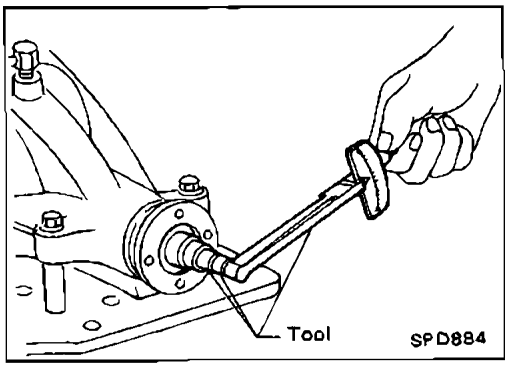


Installation

- Fill final drive with recommended gear oil.


88 - 118 (9.0 - 12.0, 65 - 87)
Special washer
Breather
Filler plug
59 - 98 (6 - 10, 43 - 72)
Drain plug
59 - 98 (6 - 10, 43 - 72)
16 - 24 (1.6 - 2.4, 12 - 17)
Rear cover
Ring gear
Differential case
132 - 152 (13.5 - 15.5, 98 - 112)
Outer race
Inner race
Pinion front bearing
Front oil seal
Companion flange
186 - 294 (19 - 30, 137 - 217)
Final drive gear set
88 - 98 (9.0 - 10.0, 65 - 72)
Bearing cap
Pinion mate shaft
Lock pin
Circular clip
Side gear thrust washer
Side gear
Side bearing adjusting washer
Side bearing spacer
Side oil seal
Outer race
Inner race
Side bearing
Pinion mate gear
Pinion mate thrust washer
Drive pinion
Pinion height adjusting washer
Inner race
Outer race
Pinion rear bearing
Pinion bearing adjusting spacer
Pinion bearing adjusting washer
Gear carrier
☆ : Adjustment is required.
• : Using locking agent (Locktite (stud lock) or equivalent)
: N.m (kg-m, ft-lb)

SPD883

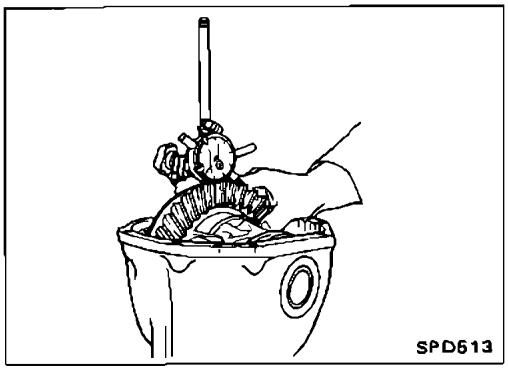


Pre-inspection

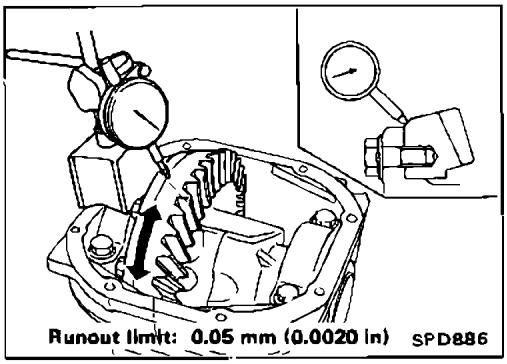
Before disassembling final drive, perform the following inspection.

- Total preload

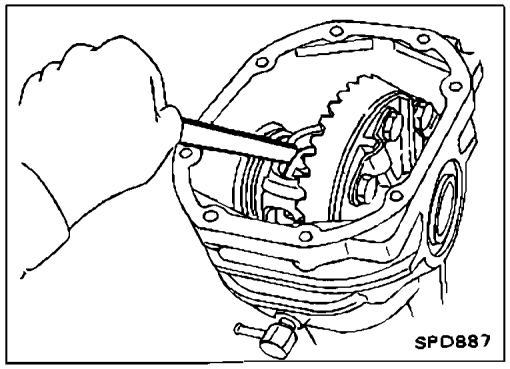
1) Turn drive pinion in both directions several times to set bearing rollers.
2) Check total preload with Tool.
   Tool number: ST3127S000 (See J25765-A.)
   Total preload:
   1.4 - 1.7 N·m
   (14 - 17 kg-cm, 12 - 15 in-lb)



- Ring gear to drive pinion backlash
  Check ring gear-to-drive pinion backlash with a dial indicator at several points.
  Ring gear-to-drive pinion backlash:
  0.10 - 0.15 mm (0.0039 - 0.0059 in)



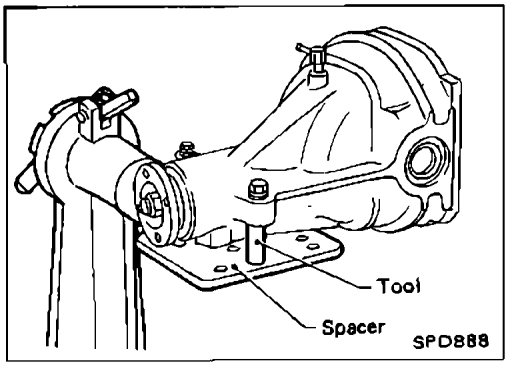
- Ring gear runout
  Check runout of ring gear with a dial indicator.
  Runout limit:
  0.05 mm (0.0020 in)
- Tooth contact
  Check tooth contact. (Refer to Adjustment.)



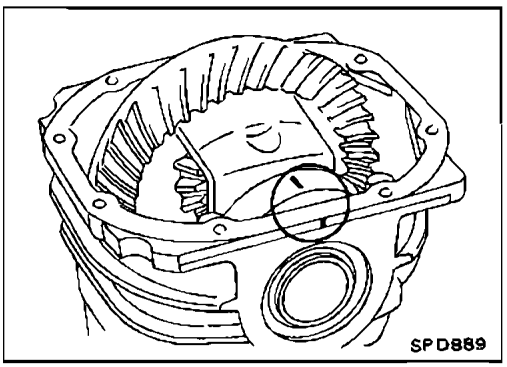
- Side gear to pinion mate gear backlash
  Measure clearance between side gear thrust washer and differential case with a feeler gauge.
  Clearance between side gear thrust washer and differential case:
  0.1 - 0.2 mm (0.004 - 0.008 in)

Differential Carrier

1. Using two 45 mm (1.77 in) spacers, mount carrier on Tool.
   Tool number: KV38100800 (—)

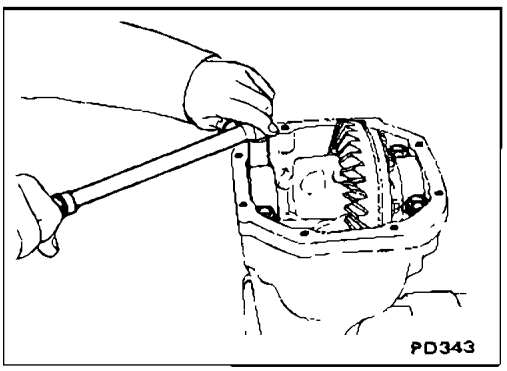


Differential Carrier (Cont'd)

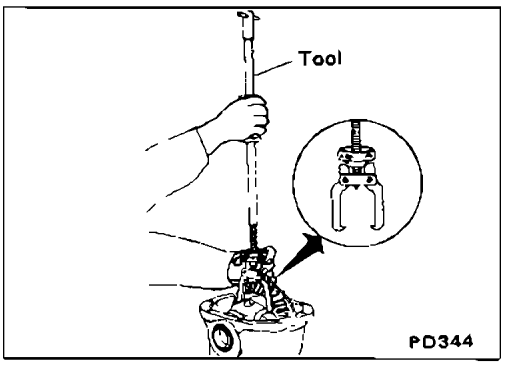


2. Paint or punch matchmarks on one side of the side bearing cap so it can be properly reinstalled.

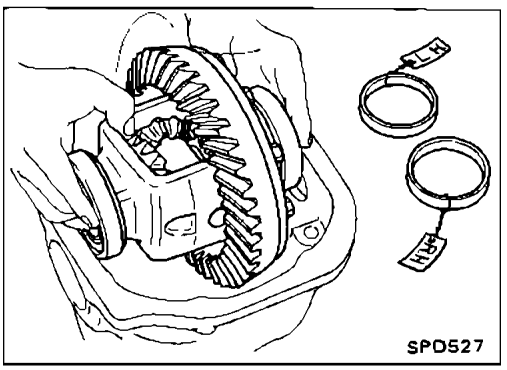
Bearing caps are line-board during manufacture. Replace them in their proper positions.



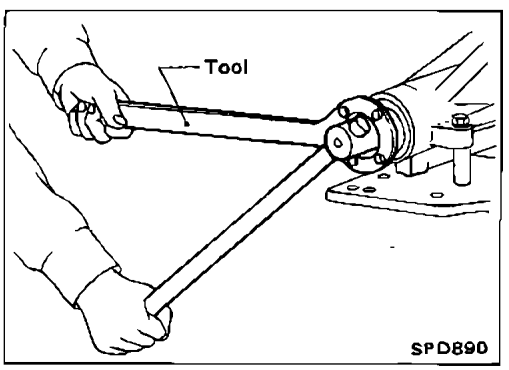
3. Remove side bearing caps.



4. Lift differential case assembly out with Tool.
   Tool number: HT72400000 (—)

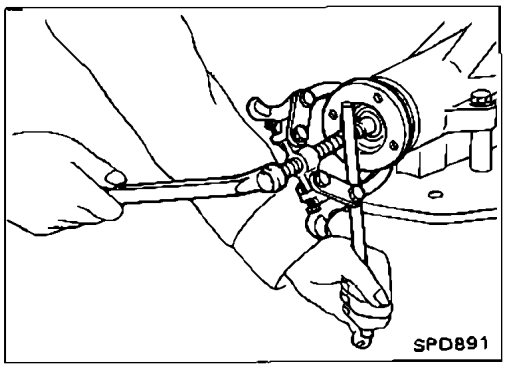


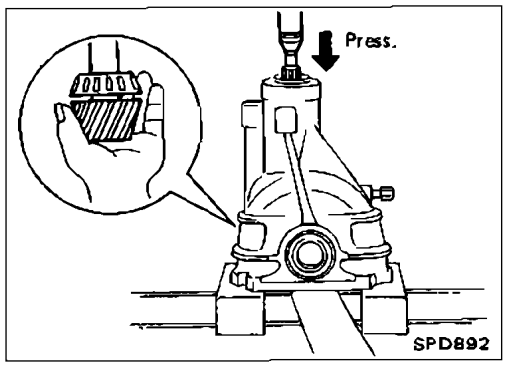
Keep the side bearing outer races together with inner cone — do not mix them up.



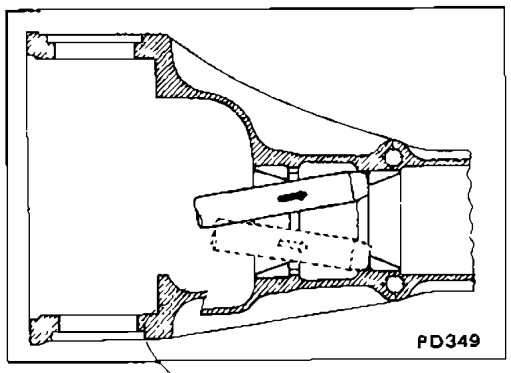
5. Loosen drive pinion nut and pull off companion flange.

Differential Carrier (Cont'd)

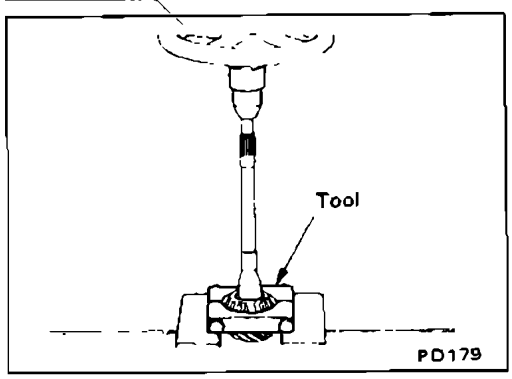




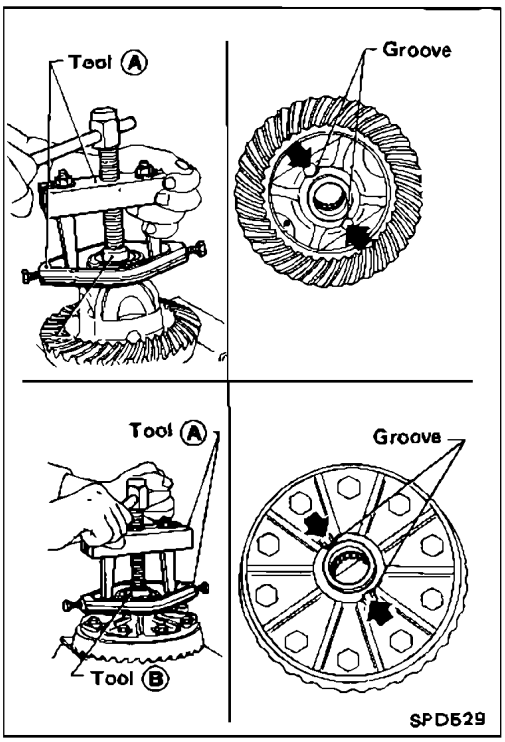
6. Take out drive pinion (together with rear bearing inner race, bearing spacer and adjusting washer).
7. Remove oil seal.
8. Remove front bearing inner race.
9. Remove side oil seal.



10. Remove pinion bearing outer races with a brass drift.



11. Remove pinion rear bearing inner race and drive pinion height adjusting washer with suitable tool.



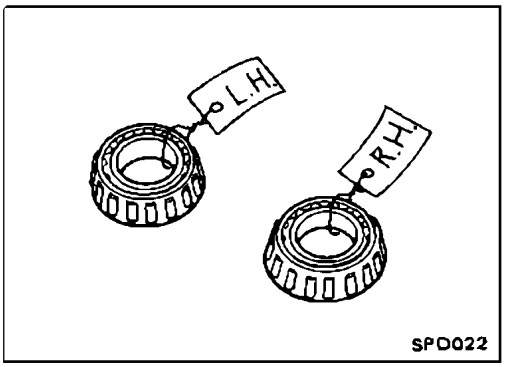
Differential Case

1. Remove side bearing inner cones.

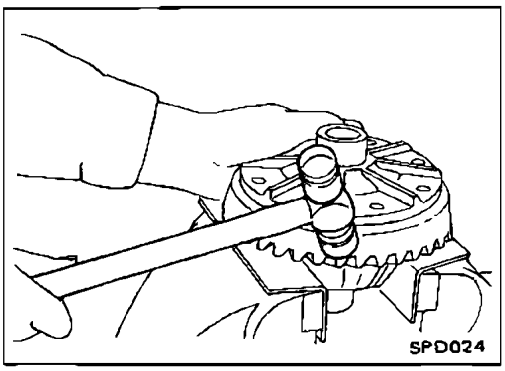
To prevent damage to bearing, engage puller jaws in groove.

Tool number:

Ⓐ ST33051001 (—)
Equivalent tool (J22888)
Ⓑ ST33061000 (J8107-2)

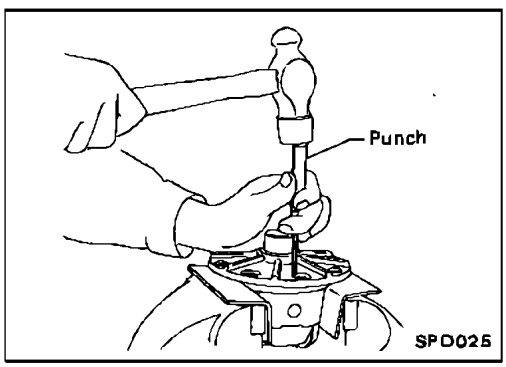


Be careful not to confuse left- and right-hand parts.



2. 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.

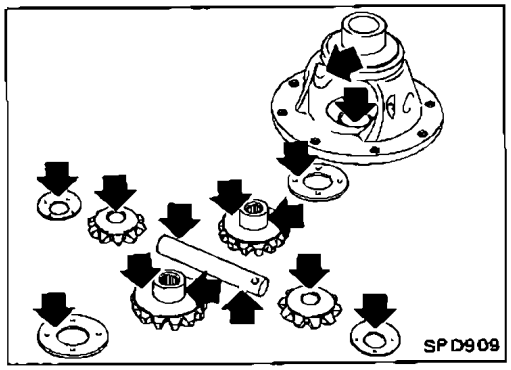


4. Drive out pinion mate shaft lock pin, with punch from ring gear side.

Lock pin is caked at pin hole mouth on differential case.

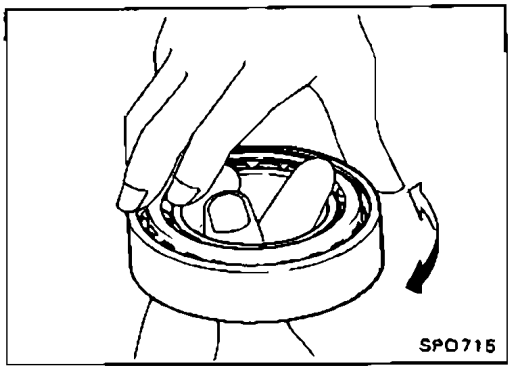
Ring Gear and Drive Pinion

Check gear teeth for scoring, cracking or chipping. If any part is damaged, 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

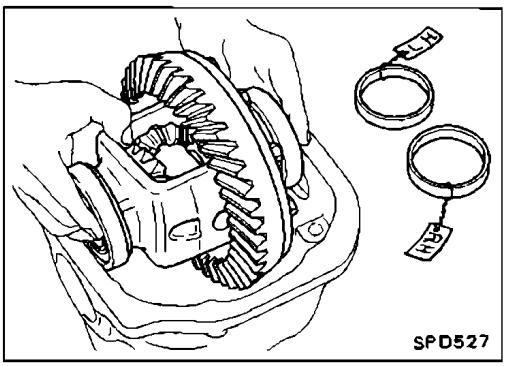
1. Thoroughly clean bearing.
2. Check bearings for wear, scratches, pitting or flaking.
   Check tapered roller bearing for smooth rotation. If damaged, replace outer race and inner cone as a set.

For quiet and reliable final drive operation, the following five adjustments must be made correctly.

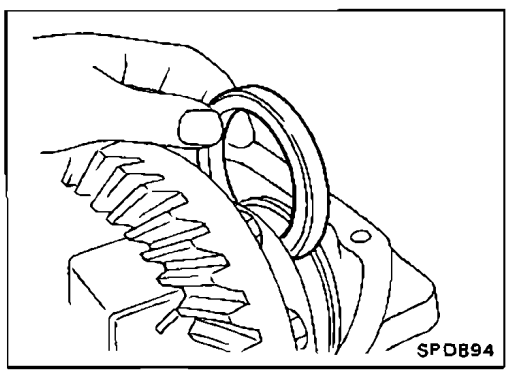
1. Side bearing preload
2. Pinion gear height
3. Pinion bearing preload
4. Ring gear-to-pinion backlash (Refer to ASSEMBLY.)
5. Ring and pinion gear tooth contact pattern

Side Bearing Preload

A selection of carrier side bearing preload shims is required for successful completion of this procedure.



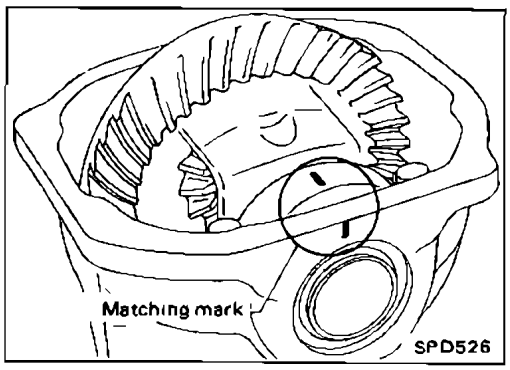
1. Make sure all parts are clean and that the bearings are well lubricated with light oil or Dexron™ type automatic transmission fluid.
2. Place the differential carrier, with side bearings and bearing races installed, into the final drive housing.



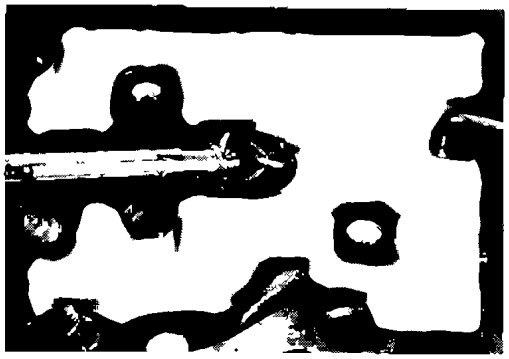
3. Put the side bearing spacer in place on the ring gear end of the carrier.

4. Using the J-25267 side bearing spacer drift, place both of the original carrier side bearing preload shims on the carrier end, opposite the ring gear.

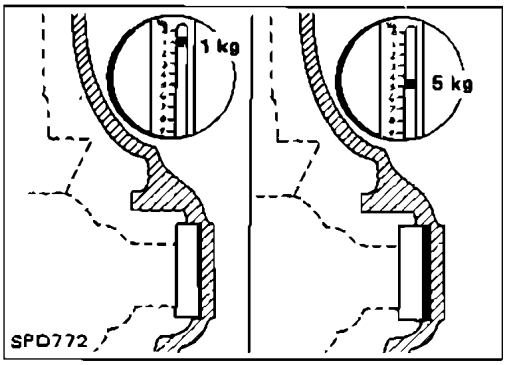
Side Bearing Preload (Cont'd)



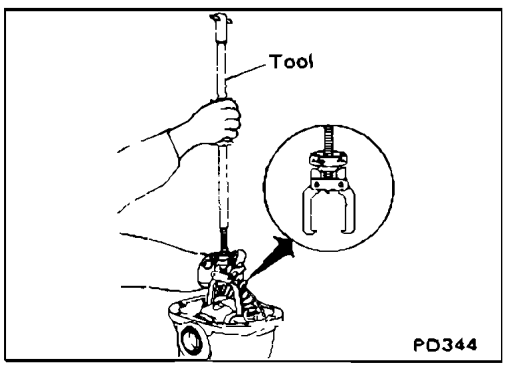
5. Install the side bearing caps in their correct locations and torque the bearing cap retaining bolts.
   Specification:
   88 - 98 N·m
   (9 - 10 kg-m, 65 - 72 ft-lb)
6. Turn the carrier several times to seat the bearings.



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.

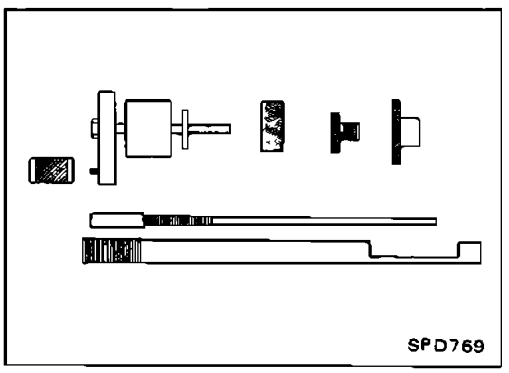


8. If the carrier turning torque is not within the specification range, increase or decrease the total thickness of the side bearing adjusting washers until the turning torque is correct. If the turning torque is less than the specified range, install washers of greater thickness; if the turning torque 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.



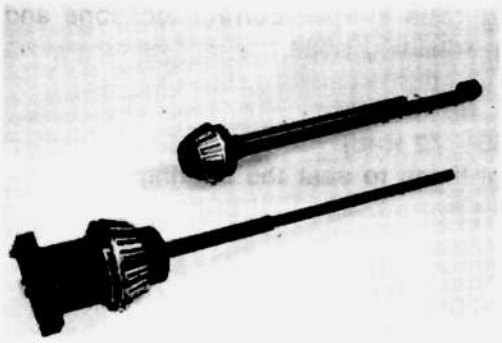
10. Remove the carrier from the final drive housing, saving the selected preload washers for later use during the assembly of the final drive unit.

Pinion Gear Height and Pinion Bearing Preload

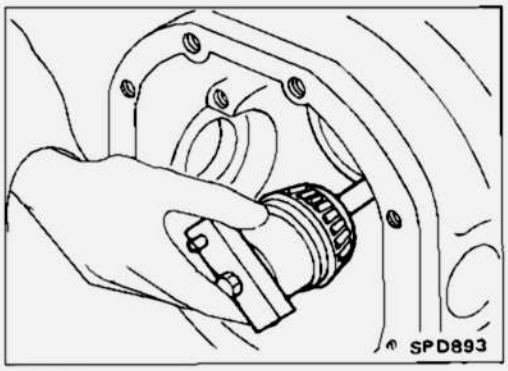


1. Make sure all parts are clean and that the bearings are well lubricated.
2. Assemble the pinion gear bearings into the pinion preload shim selector Tool, J-34309.

Pinion Gear Height and Pinion Bearing Preload (Cont'd)

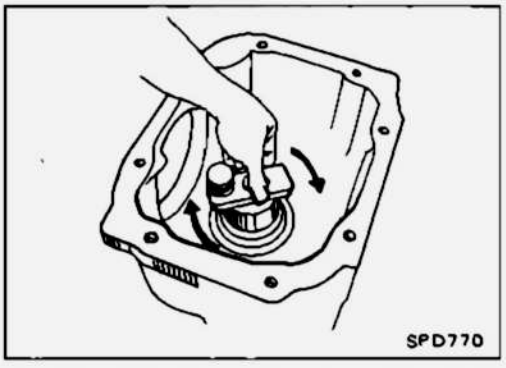


- **Front pinion bearing** — make sure the J-34309-3 front pinion bearing seat is secured tightly against the J-34309-2 gauge anvil. Then turn the front pinion bearing pilot, J-34309-5, to secure the bearing in its proper position.
- **Rear pinion bearing** — the rear pinion bearing pilot, J-34309-8, 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.



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 tig
hten the two sections together by hand.



5. Turn the assembly several times to seat the bearings.

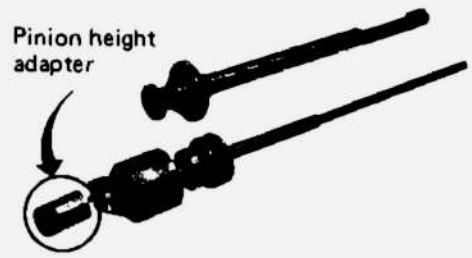
6. Measure the turning torque at the end of the J-34309-2 gauge anvil using torque wrench J-25765A.

   Turning torque specification:

   1.0 - 1.3 N·m

   (10 - 13 kg-cm, 8.7 - 11.3 in-lb)

Pinion Gear Height and Pinion Bearing Preload (Cont'd)

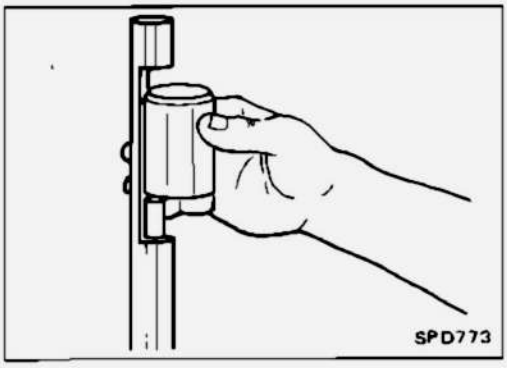


7. Place the J-34309-11 "R200A" pinion height adapter onto the gauge plate and tighten it by hand.

CAUTION:
Make sure all machined surfaces are clean.

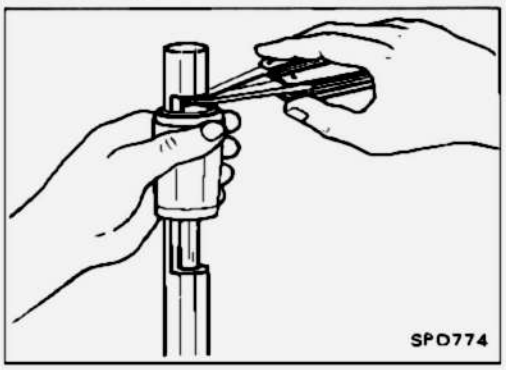
— PINION BEARING PRELOAD WASHER SELECTION —

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.



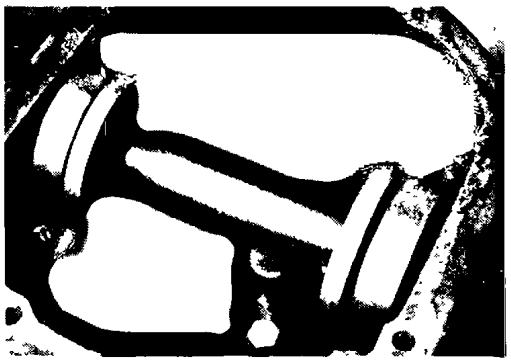
9. Select the correct thickness of pinion bearing preload adjusting washer using a standard gauge of 3.5 mm (0.138 in) and your J-34309-101 feeler gauge. *The exact measure you get with your gauges is the thickness of the adjusting washer required.* Select the correct washer from the following chart.

Drive pinion bearing preload adjusting washer:
Refer to S.D.S.



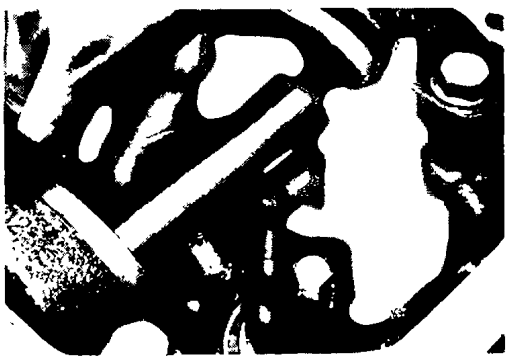
10. Set your selected, correct pinion bearing preload adjusting washer aside for use when assembling the pinion gear and bearings into the final drive.

Pinion Gear Height and Pinion Bearing Preload (Cont'd)

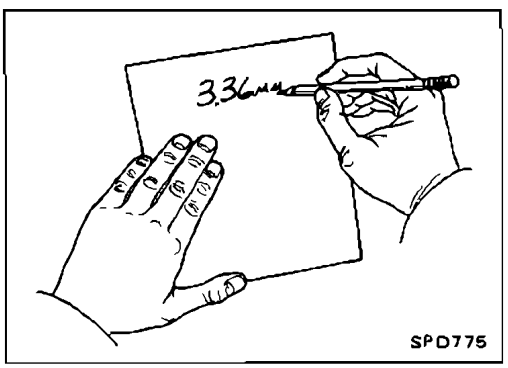


— PINION HEIGHT ADJUSTING WASHER SELECTION —

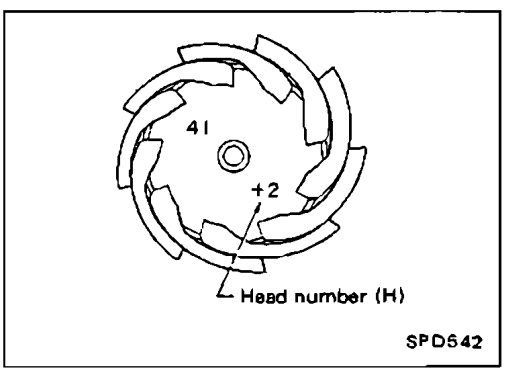
11. Now, position the side bearing discs, J-25269-4, and arbor firmly into the side bearing bores.
    Install the side bearing caps and tighten the cap bolts to proper torque.



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 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."

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.

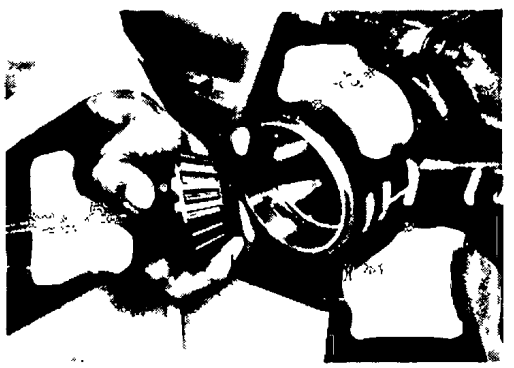
Pinion Gear Height and Pinion Bearing Preload (Cont'd)

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)

15. Select the correct pinion height washer from the following chart.

Drive pinion height adjusting washer (R200):

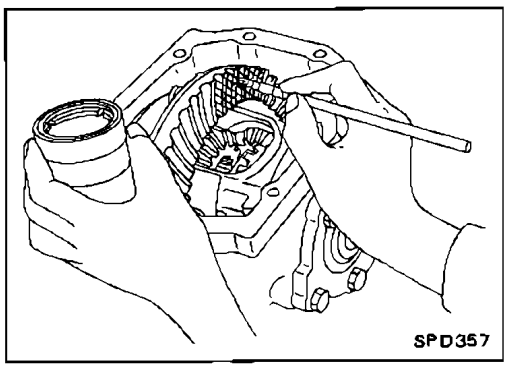
Thickness mm (in)	Part No.
3.09 (0.1217)	38154-P6017
3.12 (0.1228)	38154-P6018
3.15 (0.1240)	38154-P6019
3.18 (0.1252)	38154-P6020
3.21 (0.1264)	38154-P6021
3.24 (0.1276)	38154-P6022
3.27 (0.1287)	38154-P6023
3.30 (0.1299)	38154-P6024
3.33 (0.1311)	38154-P6025
3.36 (0.1323)	38154-P6026
3.39 (0.1335)	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



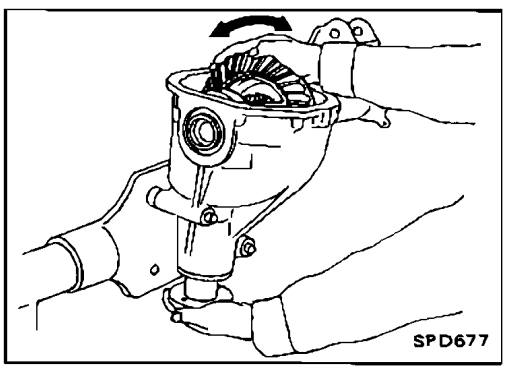
16. Remove the J-34309 pinion preload shim selector Tool from the final drive housing and disassemble to retrieve the pinion bearings.

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 may be noisy, or have short life, or both. Low noise and a long life can be assured with a pattern check.

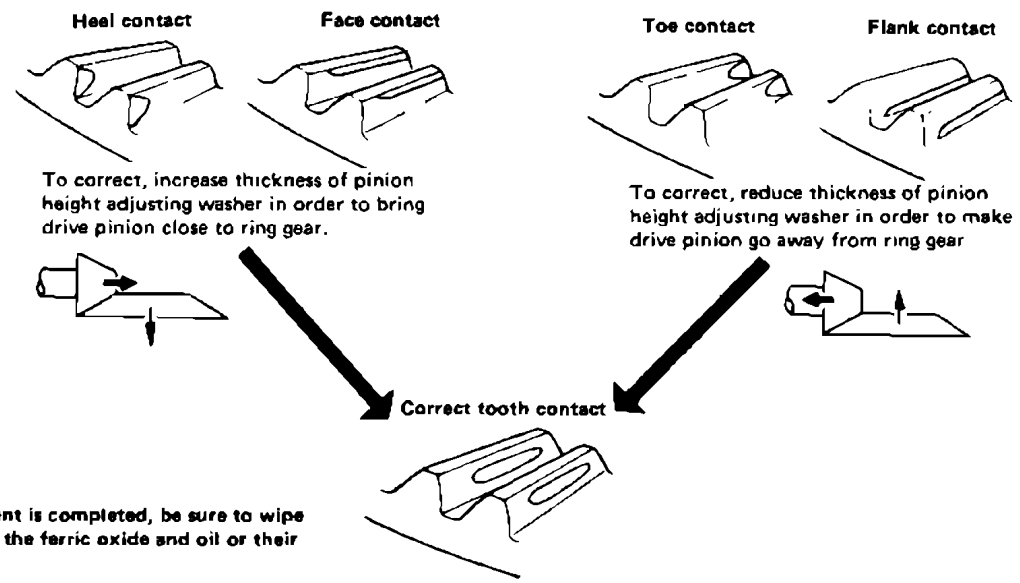

SPD357

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

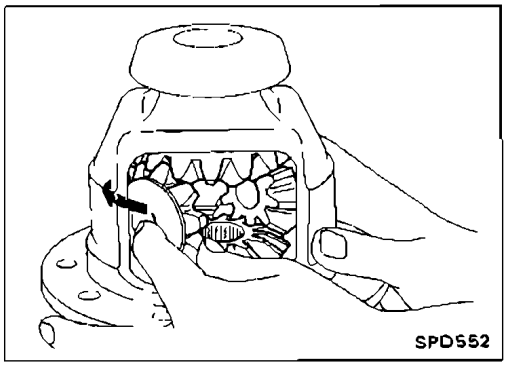
3. Hold companion flange steady and turn the ring gear in both directions.

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.



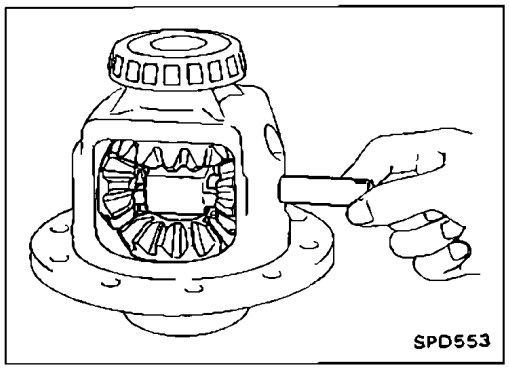
When adjustment is completed, be sure to wipe off completely the ferric oxide and oil or their equivalent.

SPD007

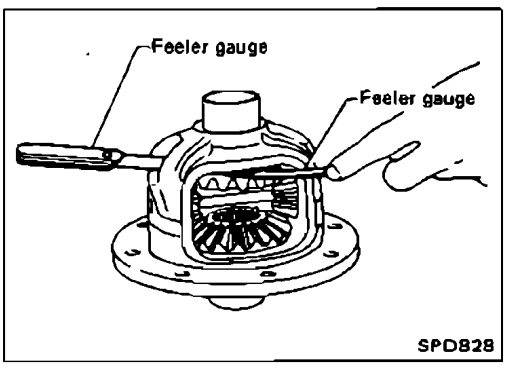


Differential Case

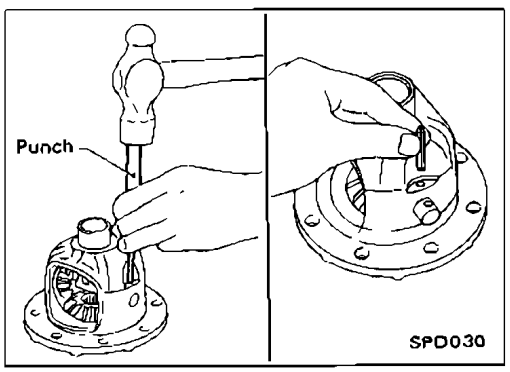
1. Install side gears, pinion mate gears, thrust washers and thrust block into differential case.



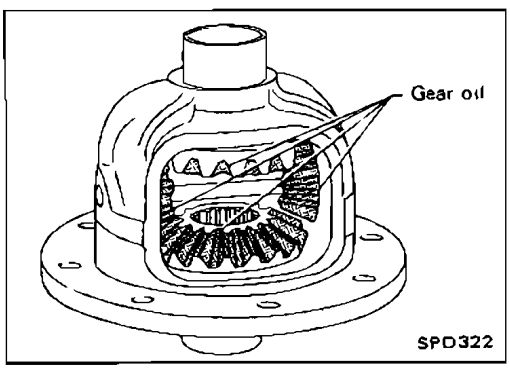
2. Fit pinion mate shaft to differential case so that it meets lock pin holes.



3. Adjust clearance between rear face of side gear and thrust washer by selecting side gear thrust washer. Refer to S.D.S.
   Clearance between side gear thrust washer and differential case:
   0.10 - 0.20 mm (0.0039 - 0.0079 in)

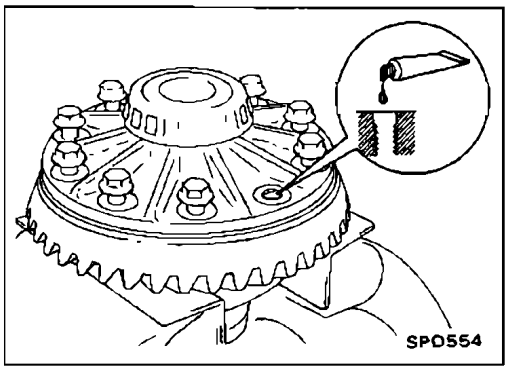


4. Install pinion mate shaft lock pin with a punch.
Make sure lock pin is flush with case.

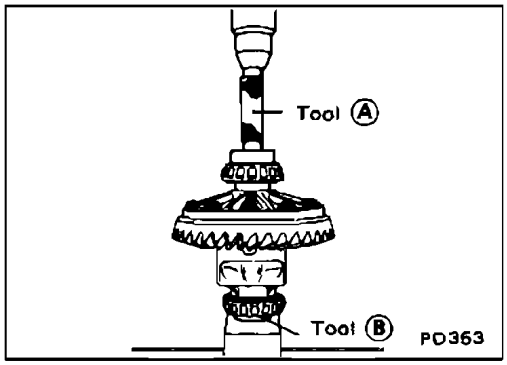


5. Apply oil to gear tooth surfaces and thrust surfaces and check that they turn properly.

Differential Case (Cont'd)

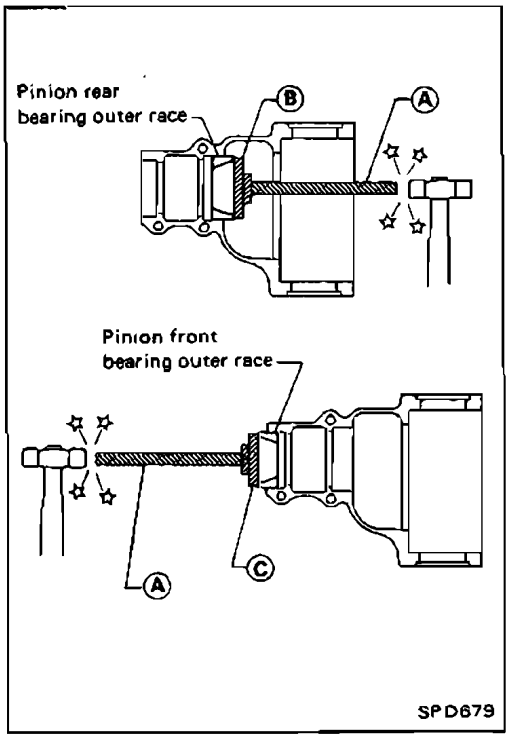


6. Apply locking sealant to ring gear bolts, and install them. **Tighten bolts in a criss-cross fashion, lightly tapping bolt head with a hammer.**

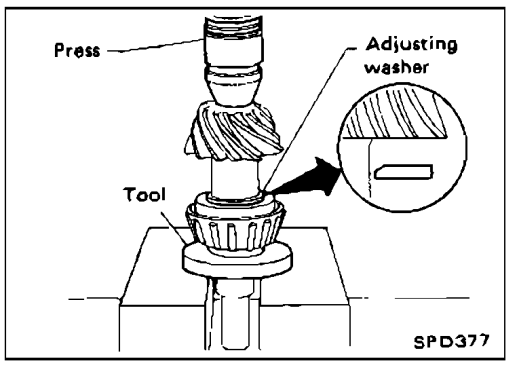


7. Press-fit side bearing inner cones on differential case with Tool.
   Tool number:
   - **Ⓐ KV38100300 (J25523)**
   - **Ⓑ ST33061000 (J8107-2)**

Differential Carrier

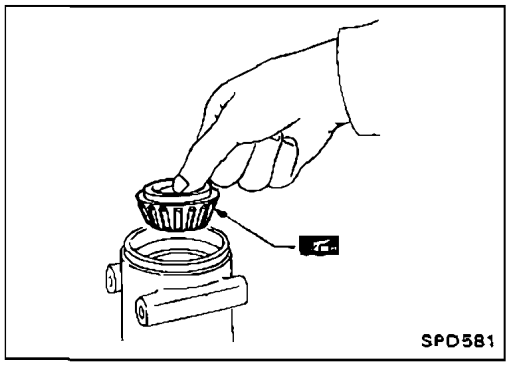


1. Press-fit front and rear bearing outer races with Tools.
   Tool number:
   - **Ⓐ ST30611000 (J25742-1)**
   - **Ⓑ ST30613000 (J25742-3)**
   - **Ⓒ ST30701000 (J25742-2)**
2. Select pinion bearing adjusting washer and drive pinion bearing spacer, referring to Adjustment.

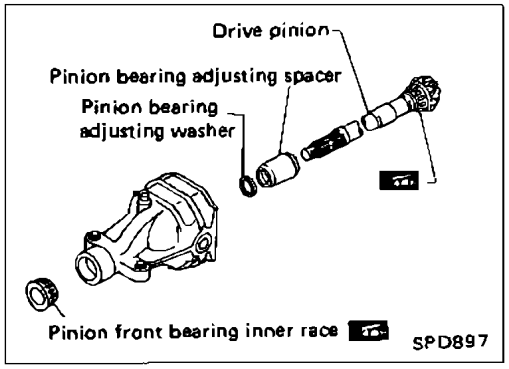


3. Install drive pinion height adjusting washer in drive pinion, and press-fit pinion rear bearing inner cone in it, using press and Tool.
   Tool number: ST30901000 (—)

Differential Carrier (Cont'd)



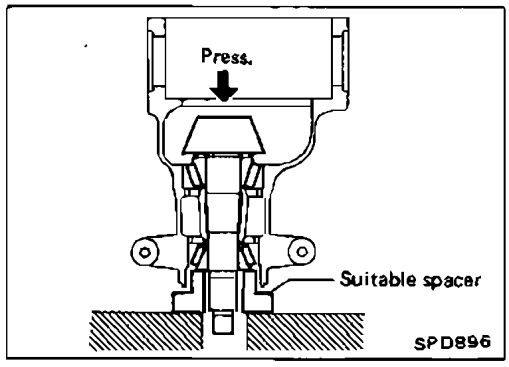
4. Place pinion front bearing inner cone in final drive housing.

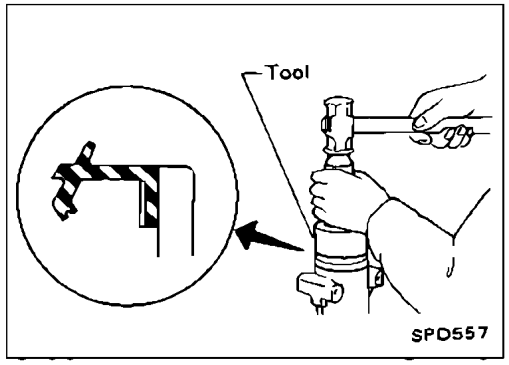


5. Set drive pinion assembly (as shown in figure at left) in differential carrier and install drive pinion, with press and suitable tool.

Stop when drive pinion touches bearing.

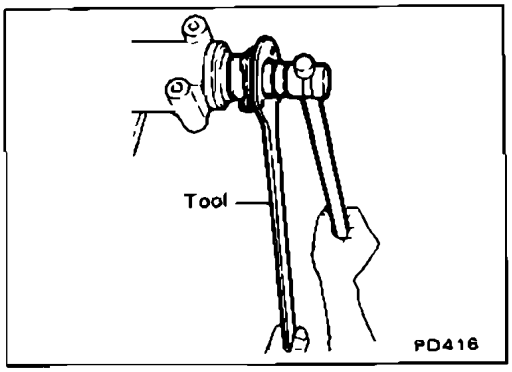
Apply multi-purpose grease to pinion rear bearing inner race, pinion front bearing inner race and front pilot bearing.





6. Apply multi-purpose grease to cavity at sealing lips of oil seal. Install front oil seal with Tool.

Tool number: KV38100500 (—)

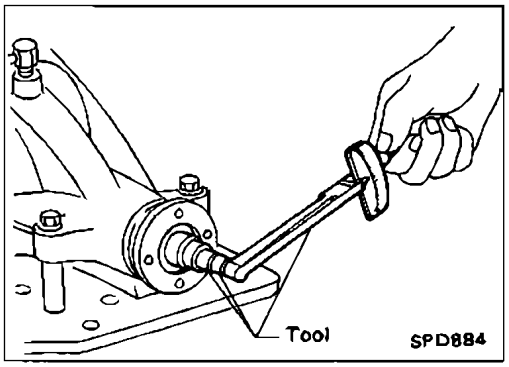


7. Install companion flange, and tighten pinion nut to specified torque with Tool.

Ascertain that threaded portion of drive pinion and pinion nut are free from oil or grease.

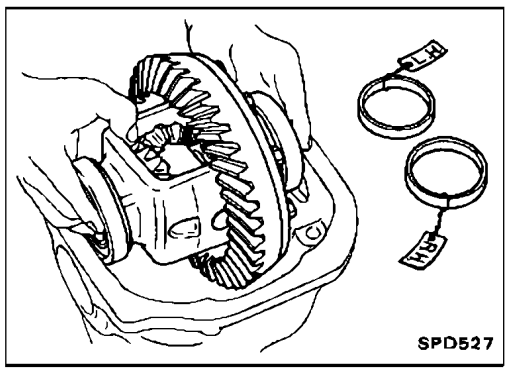
Tool number: ST38060002 (J34311)

Differential Carrier (Cont'd)

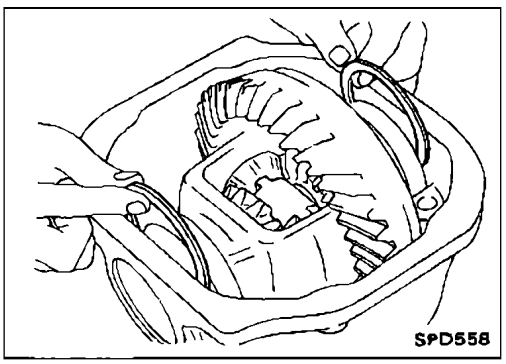


8. Turn drive pinion in both directions several times, and measure pinion bearing preload.
   Pinion bearing preload:
   1.1 - 1.4 N·m
   (11 - 14 kg-cm, 9.5 - 12.2 in-lb)

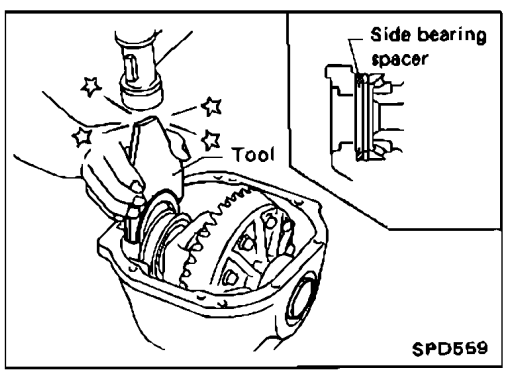
When pinion bearing preload is outside the specifications, replace pinion bearing adjusting washer and spacer with a different thickness.



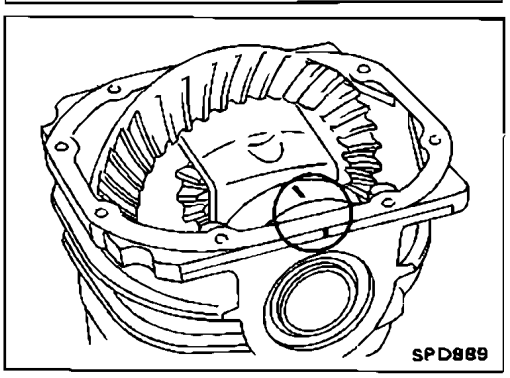
9. Select side bearing adjusting washer.
   Refer to Adjustment.
10. Install differential case assembly with side bearing outer races into gear carrier.



11. Insert left and right side bearing adjusting washers in place between side bearings and carrier.

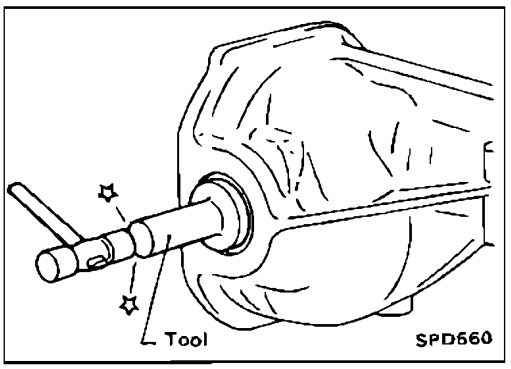


12. Drive in side bearing spacer with Tool.
    Tool number: KV38100600 (J25267)

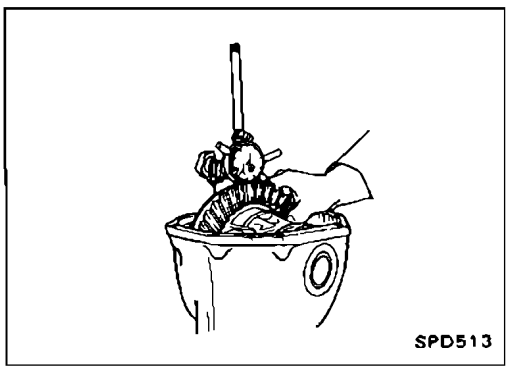


13. Align mark on bearing cap with that on gear carrier and install bearing cap on gear carrier.

Differential Carrier (Cont'd)



14. Apply multi-purpose grease to cavity at sealing lips of oil seal. Install side oil seal.
    Tool number: KV38100200 (J26233)

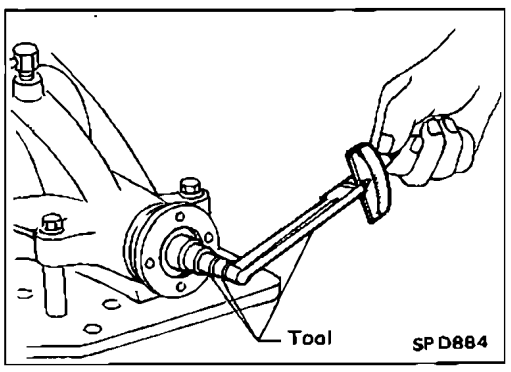


15. Measure ring gear-to-drive pinion backlash with a dial indicator.
    Ring gear-to-drive pinion backlash:
    0.10 - 0.15 mm
    (0.0039 - 0.0059 in)

- 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.



16. Check total preload with Tool.

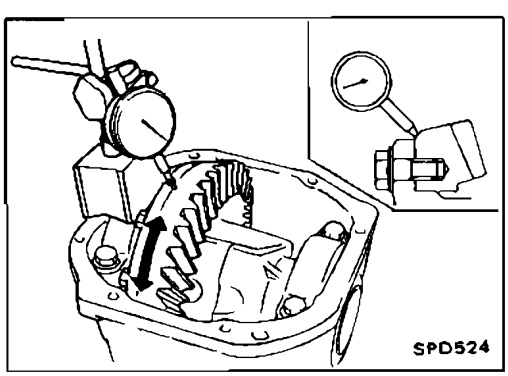
When checking preload, turn drive pinion in both directions several times to seat bearing rollers correctly.

Total preload:
Value more than 0.29 N·m (3.0 kg-cm, 2.6 in-lb) added on measured value of drive pinion preload

- If preload is too great, remove the same amount of shim to 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.

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, foreign matter may be caught between the ring gear and the differential case.
- If the backlash varies greatly when the ring gear runout is within a specified range, replace the hypoid gear set or differential case.

19. Check tooth contact.
    Refer to Adjustment.
20. Install rear cover and gasket.

Propeller Shaft

GENERAL SPECIFICATIONS

Unit: mm (in)

Applied model / Transmission type	M/T	A/T
Propeller shaft model	3S63A-R	3S63A-T
Number of joints	3	
Coupling method with transmission	Sleeve type	
Type of journal bearings	Shell type (Non-disassembly type)	
Distance between yokes	63.0 (2.480)	
Shaft length (Spider to spider) 1st	395.0 (15.55)	432.0 (17.01)
2nd	605.0 (23.82)	605.0 (23.82)
Shaft outer diameter 1st	75.0 (2.953)	
2nd	75.0 (2.953)	75.0 (2.953) ... Large side 63.5 (2.500) ... Small side

SPECIFICATIONS AND ADJUSTMENT

Unit: mm (in)

Propeller shaft model	3S63A-R	3S63A-T
Propeller shaft runout limit	0.6 (0.024)	
Journal axial play	0 (0)	

Final Drive

GENERAL SPECIFICATIONS

Final drive model	R200
Ring gear pitch diameter mm (in)	205 (8.07)
Gear ratio	4.083
Number of teeth (Ring gear/Drive pinion)	49/12
Oil capacity (approx.) ℓ (US pt, Imp pt)	1.8 (3-7/8, 3-1/8)

SPECIFICATIONS AND ADJUSTMENT (R200)

Drive pinion adjustment

Drive pinion bearing adjusting method	Pinion bearing adjusting washer
Drive pinion to ring gear backlash mm (in)	0.10 - 0.15 (0.0039 - 0.0059)

Available pinion height adjusting washer

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 - 1.4 (11 - 14, 9.5 - 12.2)

Available drive pinion bearing preload adjusting washer

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 preload adjusting spacer

Length mm (in)	Part number
55.10 (2.1693)	38165-84002
55.40 (2.1811)	38165-84003
55.70 (2.1929)	38165-84004
56.00 (2.2047)	38165-61001
56.25 (2.2146)	38166-61001

Final Drive (Cont'd)

Total preload adjustment

Total preload	Value more than 0.29 N-m (3.0 kg-cm, 2.6 in-lb) added on measured value of drive pinion preload

Available side bearing adjusting washer

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
2.65 (0.1043)	38453-N3113

Side bearing adjustment

Side bearing adjusting method	Adjusting shim
Side gear to pinion mate gear backlash (Clearance between side gear to differential case) mm (in)	0.03 - 0.09 (0.0012 - 0.0035)

Available side gear thrust washer

Thickness mm (in)	Part number
0.80 (0.0315)	38424-40F00
0.85 (0.0335)	38424-40F08
0.90 (0.0354)	38424-40F01
0.95 (0.0374)	38424-40F09
1.00 (0.0394)	38424-40F02
1.05 (0.0413)	38424-40F10
1.10 (0.0433)	38424-40F03
1.15 (0.0453)	38424-40F11
1.20 (0.0472)	38424-40F04
1.25 (0.0492)	38424-40F12
1.30 (0.0512)	38424-40F05
1.35 (0.0531)	38424-40F13
1.40 (0.0551)	38424-40F06
1.45 (0.0571)	38424-40F14
1.50 (0.0591)	38424-40F07

Ring gear runout

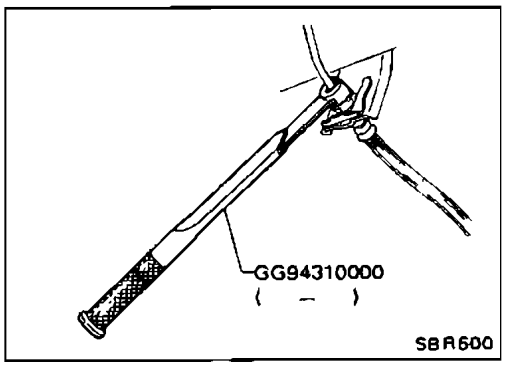
Ring gear runout limit	mm (in)	0.05 (0.0020)

FRONT AXLE & FRONT SUSPENSION

SECTION FA

CONTENTS

PRECAUTIONS AND PREPARATION ..... FA- 2
FRONT AXLE AND FRONT SUSPENSION ..... FA- 4
CHECK AND ADJUSTMENT — On-vehicle ..... FA- 5
FRONT AXLE ..... FA- 9
FRONT AXLE — Wheel Hub and Knuckle FA-10
FRONT AXLE — Baffle Plate FA-13
FRONT SUSPENSION FA-14
FRONT SUSPENSION — Coil Spring and Strut Assembly FA-15
FRONT SUSPENSION — Tension Rod and Stabilizer Bar FA-17
FRONT SUSPENSION — Transverse Link and Lower Ball Joint FA-18
SERVICE DATA AND SPECIFICATIONS (S.D.S.) FA-19

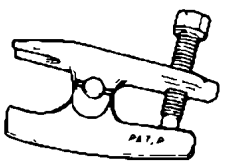
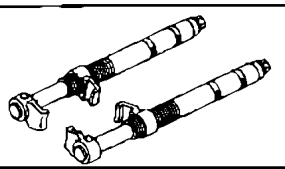
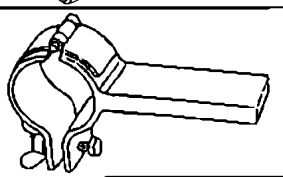
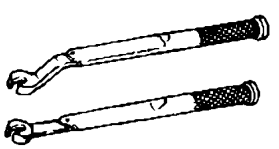


Precautions

- **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.**
- **When removing each suspension part, check wheel alignment and adjust if necessary.**
- **Use Tool when removing or installing brake tubes.**

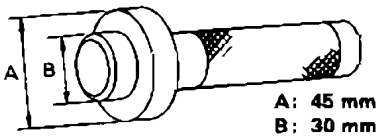
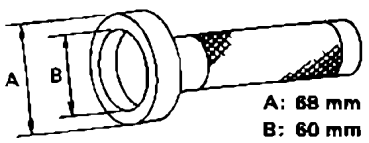
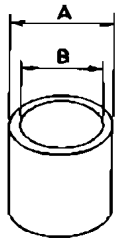
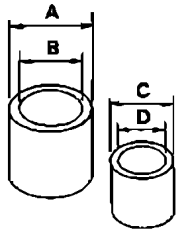
Preparation

SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.) Tool name	Description	
HT72520000 (J25730-A) Ball joint remover		Removing tie-rod outer end and lower ball joint
HT71780000 (–) Spring compressor		Removing and installing coil spring
ST35652000 (–) Strut attachment		Fixing strut assembly
GG94310000 (–) Flare nut torque wrench		Removing and installing brake piping

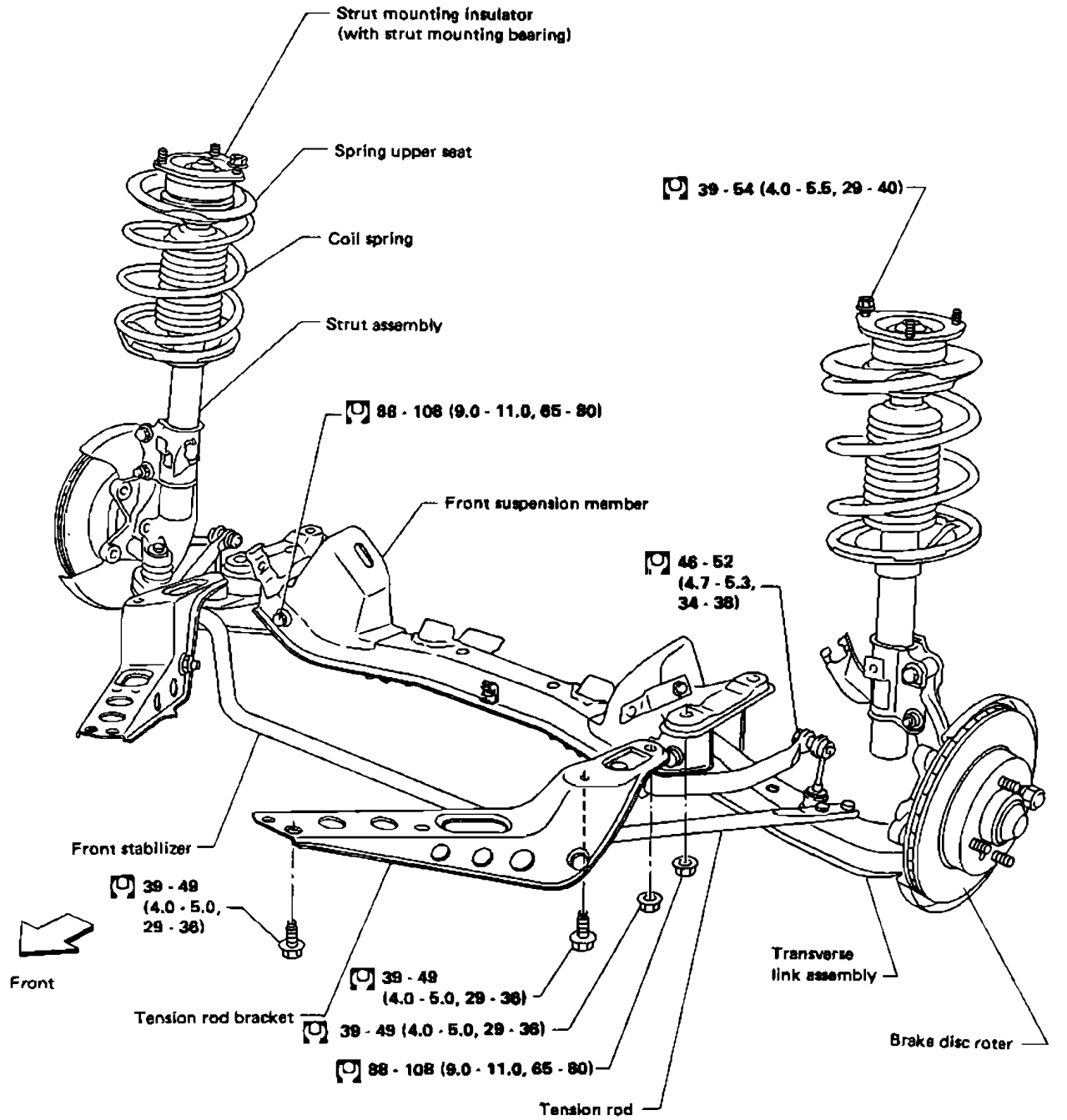
Preparation (Cont'd)

COMMERCIAL SERVICE TOOLS

Tool name	Description	
Wheel bearing drift	 A: 45 mm (1.77 in) dia. B: 30 mm (1.18 in) dia.	Removing wheel bearing
Wheel bearing drift	 A: 68 mm (2.68 in) dia. B: 60 mm (2.36 in) dia.	Installing wheel bearing
Baffle plate drift	 A: 88 mm (3.46 in) dia. B: 68 mm (2.68 in) dia.	Installing baffle plate
Tension rod bushing drift	 A: 75 mm (2.95 in) dia. B: 66 mm (2.60 in) dia. C: 62 mm (2.44 in) dia. D: 25 - 55 mm (0.98 - 2.17 in) dia.	Removing and installing tension rod bushing

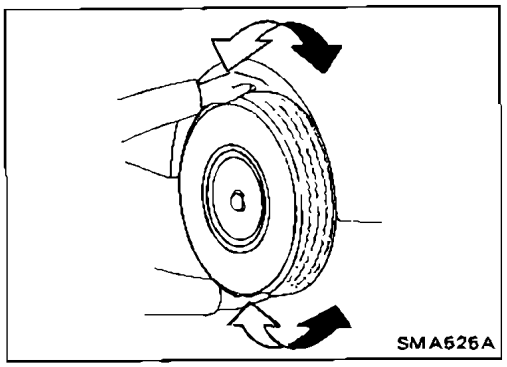
Final tightening for rubber parts requires to be carried out under unladen condition* with tires on ground.

* Fuel, radiator coolant and engine oil full.
Spare tire, jack, hand tools and mats in designated positions.



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

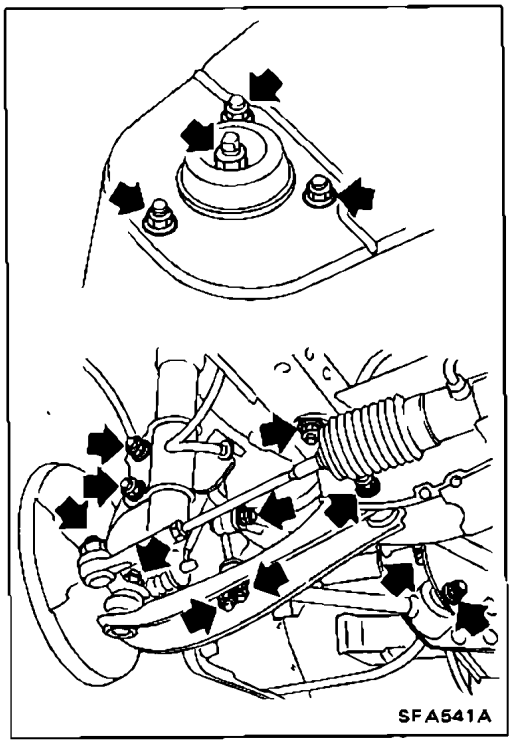
SFA640A


SMA626A

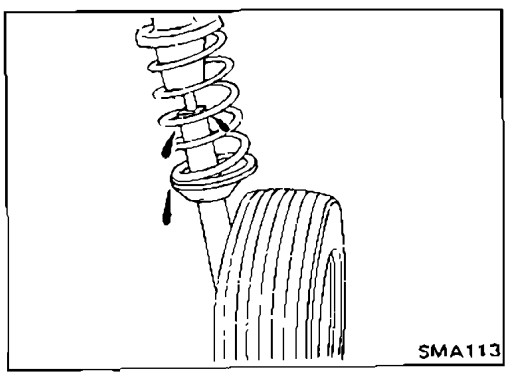
Front Axle and Front Suspension Parts

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

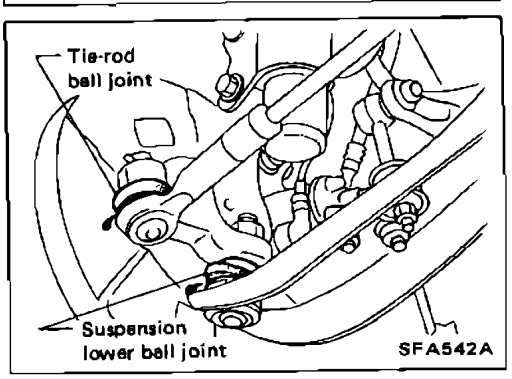
(1) Shake each front wheel.


SFA541A

(2) Retighten all nuts and bolts to the specified torque.
Tightening torque: Refer to S.D.S.
(3) Make sure that cotter pin is inserted.
(4) Check front axle and front suspension parts for wear, cracks or other damage.

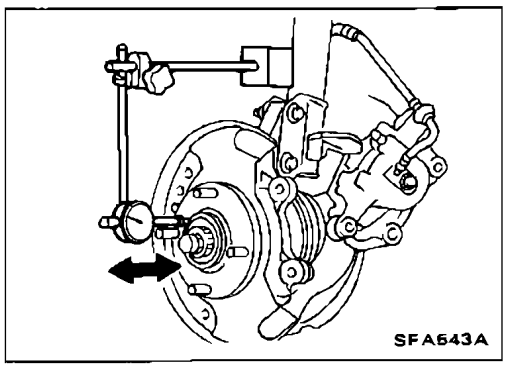

SMA113

- Check strut (shock absorber) for oil leakage or other damage.



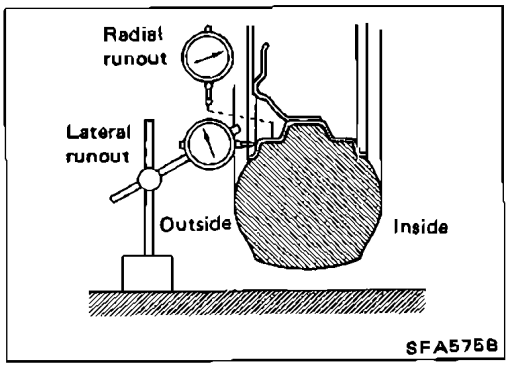
SFA542A

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


SFA543A

Front Wheel Bearing

- Check tightening torque of wheel bearing lock nut.
  (O): 147 - 216 N·m
  (15 - 22 kg-m, 108 - 159 ft-lb)
- Check that wheel bearings operate smoothly.
- Check axial end play.
  Axial end play: 0.03 mm (0.0012 in) or less
- If axial end play is not within specification or wheel bearing does not turn smoothly, replace wheel bearing assembly. Refer to FRONT AXLE — Wheel Hub and Knuckle.



SFA575B

Front Wheel Alignment

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

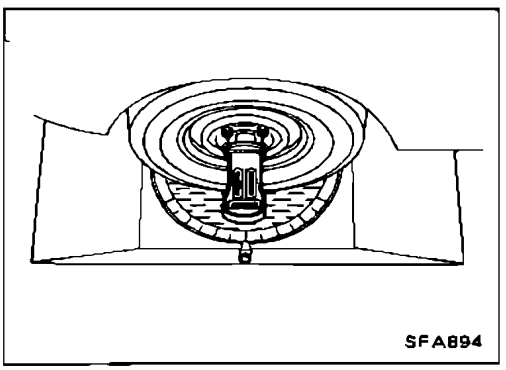
PRELIMINARY INSPECTION

Make following checks. Adjust, repair or replace if necessary.

- Check tires for wear and improper inflation.
- Check front wheel bearings for looseness.
- Check wheel runout.

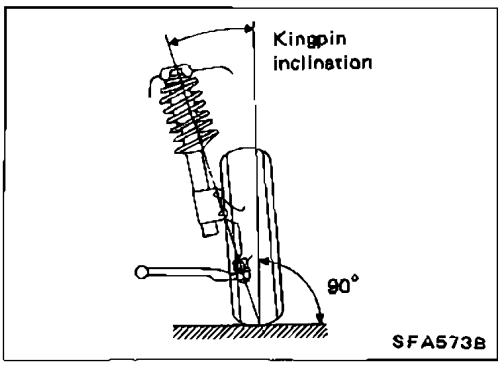
Refer to S.D.S.

- Check front suspension for looseness.
- Check steering linkage for looseness.
- Check that front shock absorbers work properly.
- Check vehicle posture (Unladen):
  "Unladen"
  Fuel, radiator coolant and engine oil full. Spare tire, jack, hand tools and mats in designated positions.


SFA894

CAMBER, CASTER AND KINGPIN INCLINATION

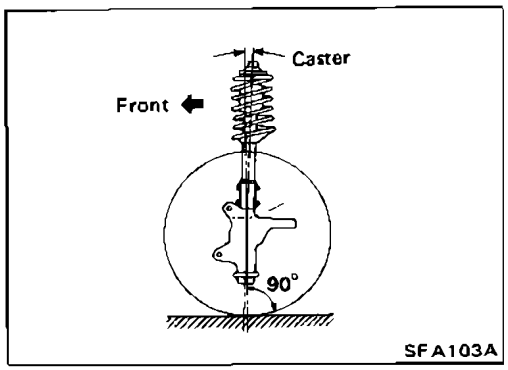
- **Caster and kingpin inclination are preset at factory and cannot be adjusted.**
- **Measure camber, caster and kingpin inclination of both right and left wheels with a suitable alignment gauge, and adjust in accordance with the following procedures.**



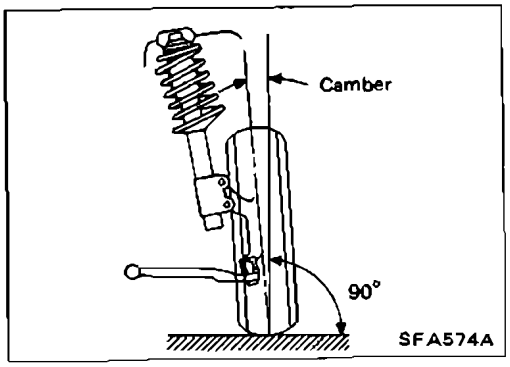
SFA573B

Kingpin inclination:
12°30′ - 14°00′

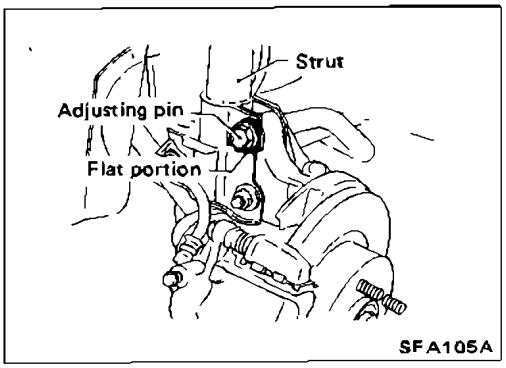
Front Wheel Alignment (Cont'd)



Caster:
6°00′ - 7°30′

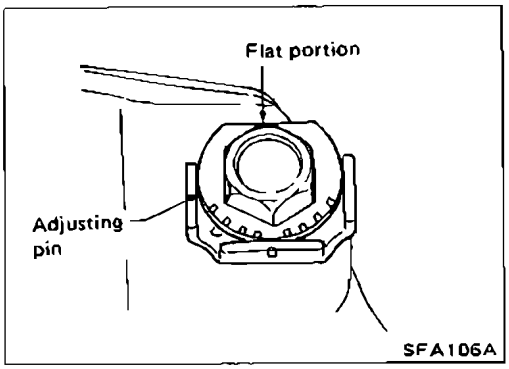


Camber:
−1°30′ to 0°

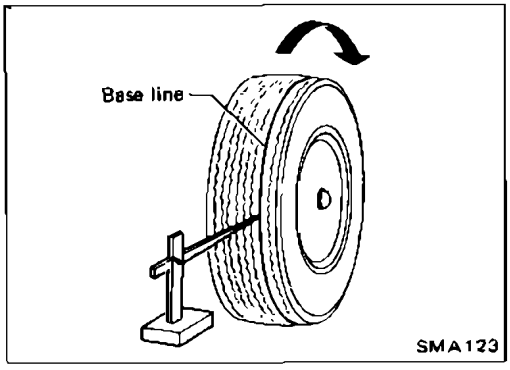


If camber is not within specification, adjust by turning adjusting pin as follows:

(1) Remove adjusting pin
Adjusting pin is installed with flat portion facing downward.



(2) Next replace adjusting pin with flat portion facing upward.
(3) Turn adjusting pin to adjust.
Camber changes about 5′ with each graduation of adjusting pin.
(4) Tighten adjusting pin to specified torque.
: 124 - 143 N·m (12.6 - 14.6 kg-m, 91 - 106 ft-lb)

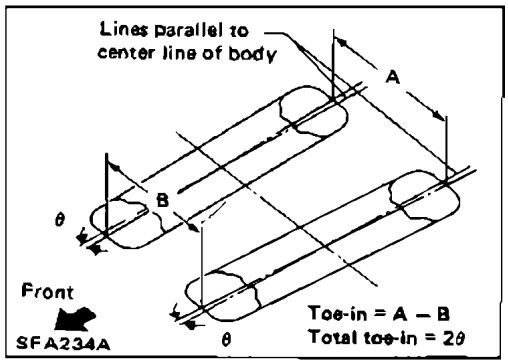


TOE-IN

1. Draw a base line on tread surface of tires.

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

Front Wheel Alignment (Cont'd)



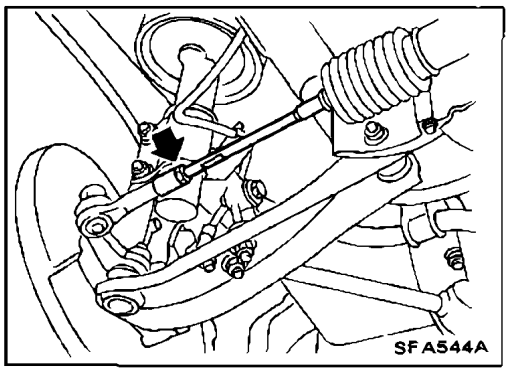
2. Measure toe-in.

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

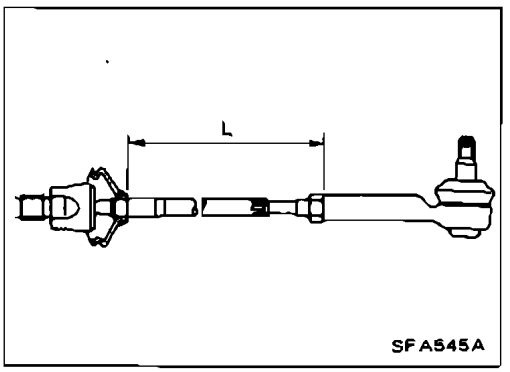
Toe-in:

A — B 0.3 - 2.3 mm (0.012 - 0.091 in)

2θ (Total toe-in) 1′ - 6.5′



3. Adjust toe-in by varying length of steering tie-rods.
(1) Loosen lock nuts.
(2) Adjust toe-in by turning forward and reverse tie-rod.



Make sure both tie-rods are the same length.

Standard length "L" — reference data:

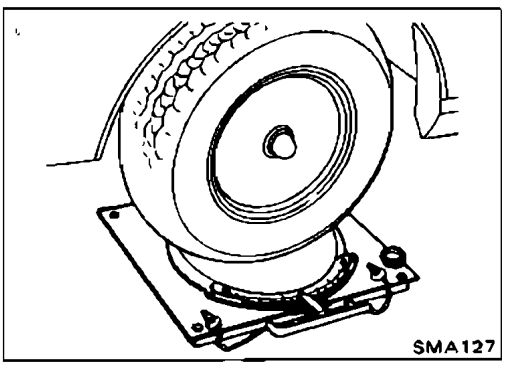
174.8 mm (6.88 in)

(3) Fix lock nuts, then tighten them designed torque.

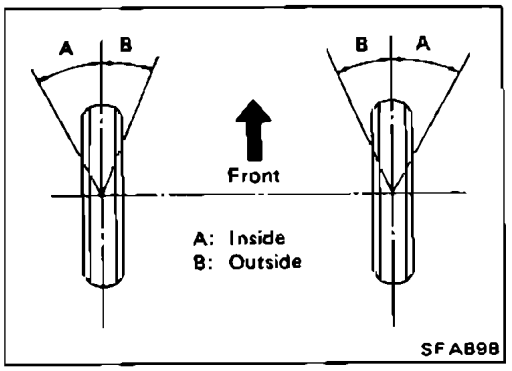
[O]: 37 - 46 N-m

(3.8 - 4.7 kg-m, 27 - 34 ft-lb)

FRONT WHEEL TURNING ANGLE



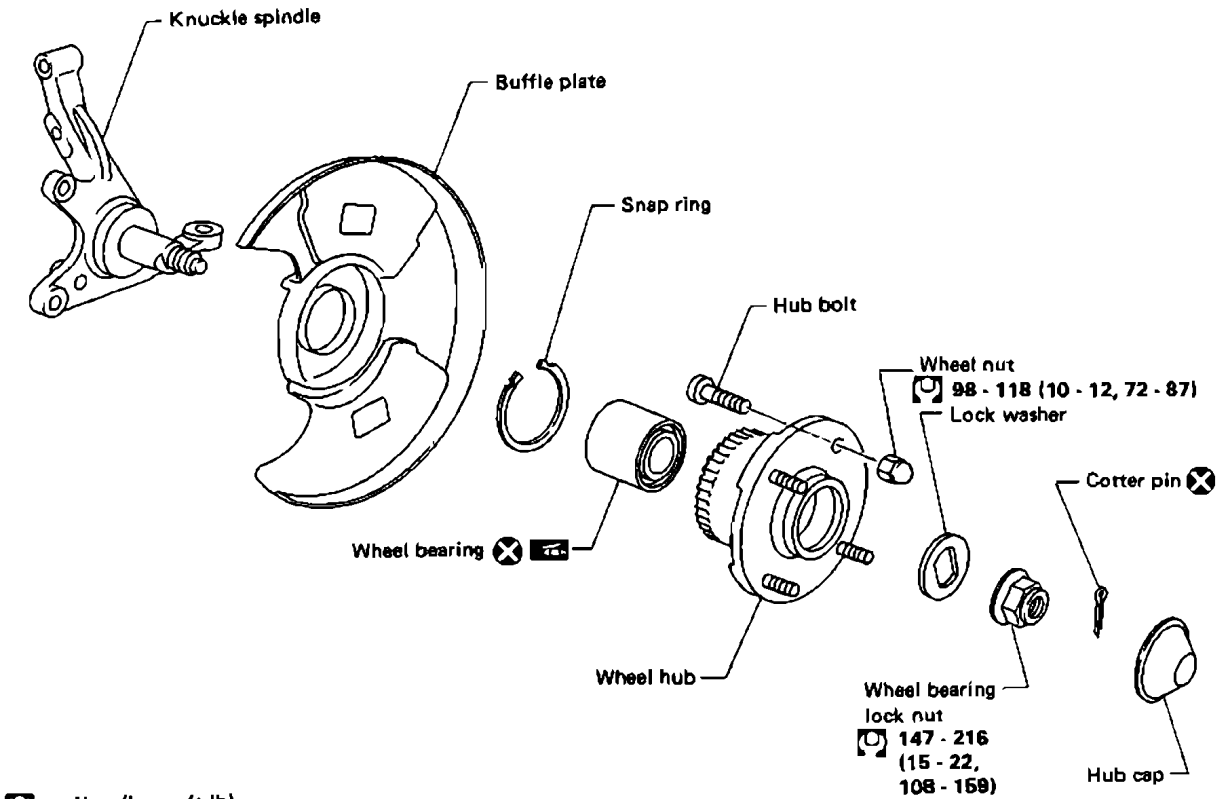
1. Set wheels in straight-ahead position and then move vehicle forward until front wheels rest on turning radius gauge properly.



2. Rotate fully steering wheel to the right or left; measure turning angle.

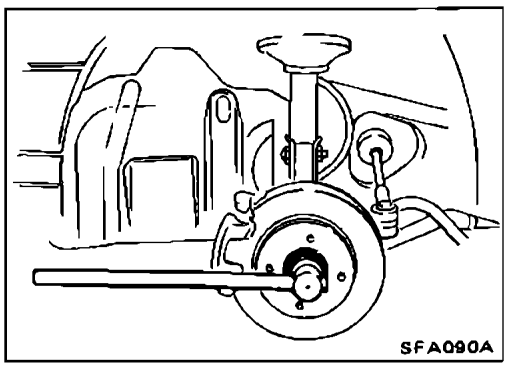
Wheel turning angle:

Full turns	Inside wheel: A	39° - 43°
	Outside wheel: B	33°

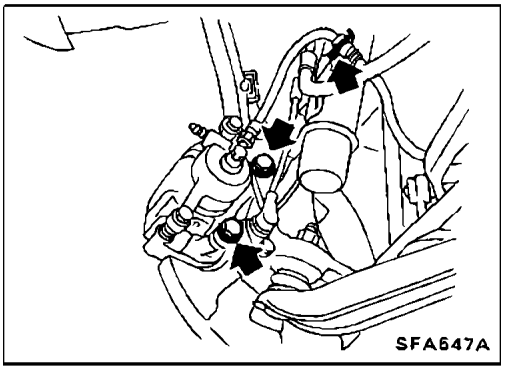

Knuckle spindle
Buffle plate
Snap ring
Hub bolt
Wheel nut
98 - 118 (10 - 12, 72 - 87)
Lock washer
Cotter pin
Wheel bearing
Wheel hub
Wheel bearing lock nut
147 - 216 (15 - 22, 108 - 159)
Hub cap
: N·m (kg-m, ft-lb)

SFA546A

Removal

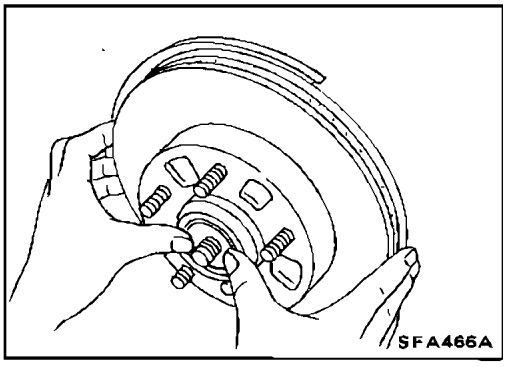


- Remove wheel bearing lock nut.

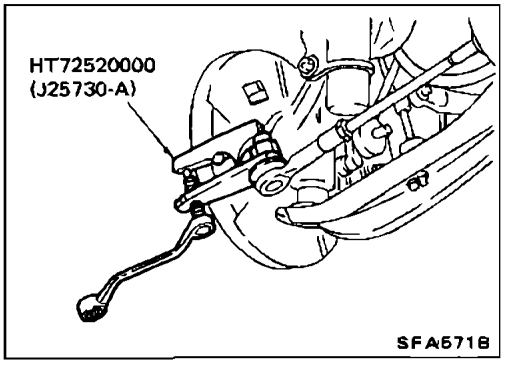


- Remove brake caliper assembly.

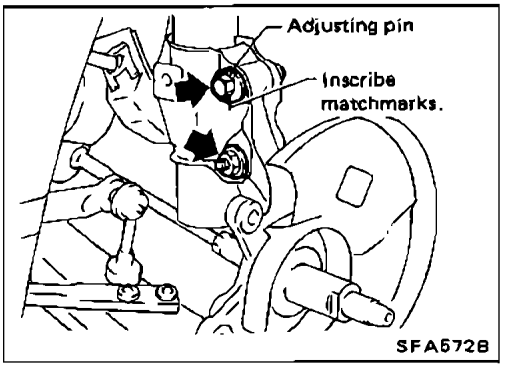
Brake hose need not be disconnected from brake caliper. Be careful not to depress brake pedal, or piston will pop out. Make sure brake hose is not twisted.



- Remove rotor and wheel hub from spindle.

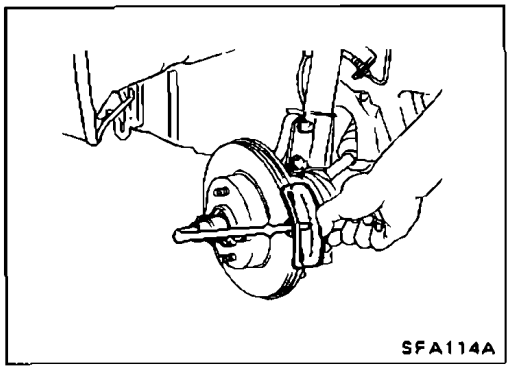


- Remove tie-rod ball joint and lower ball joint.



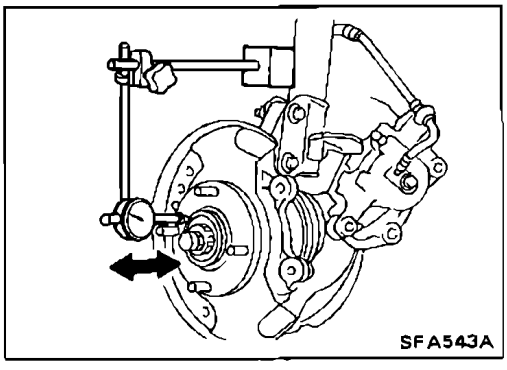
- Remove bolts and nuts as shown at left.

Make matchmarks before removing adjusting pin.

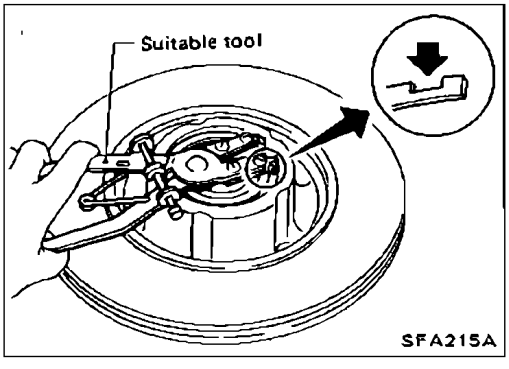

SFA114A

Installation

- Install wheel hub.
- Tighten wheel bearing lock nut.
  [O]: 147 - 216 N·m
  (15 - 22 kg-m, 108 - 159 ft-lb)


SFA543A

- Check wheel bearing axial end play.
  Axial end play: 0.03 mm (0.0012 in) or less

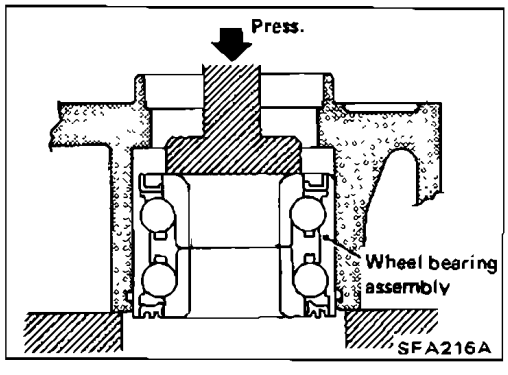


SFA215A

Disassembly

CAUTION:
When removing wheel bearing from wheel hub, replace wheel bearing assembly (outer race, inner races and grease seal) with a new one.

- Remove circular clip with suitable tool.



SFA216A

- Press out wheel bearing assembly from wheel hub.

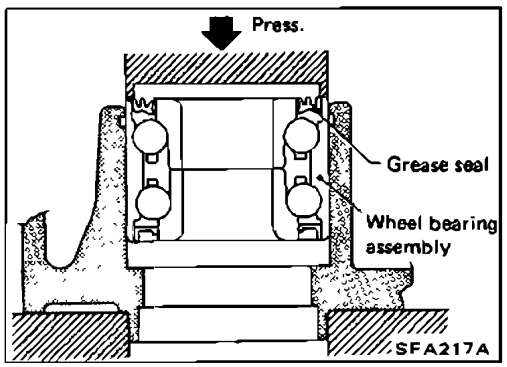
Inspection

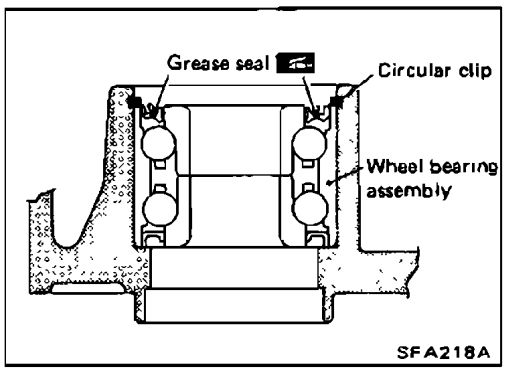
WHEEL HUB

- Check wheel hub for any cracks by using a magnetic exploration or dyeing test.

CIRCULAR CLIP

- Check circular clip for wear or cracks.
  Replace if necessary.





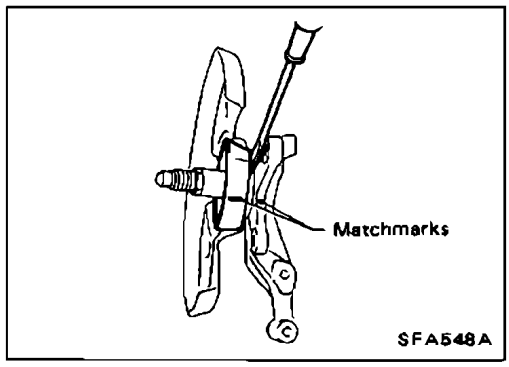
Assembly

1. Press new wheel bearing assembly into wheel hub from inside of rotor disc (with wheel hub).
   Maximum load P:
   29 kN (3 t, 3.3 US ton, 3.0 Imp ton)

CAUTION:

- **Do not press inner race of wheel bearing assembly.**
- **Do not apply oil or grease to mating surfaces of wheel bearing outer race and wheel hub.**
  Be careful not to damage grease seal.

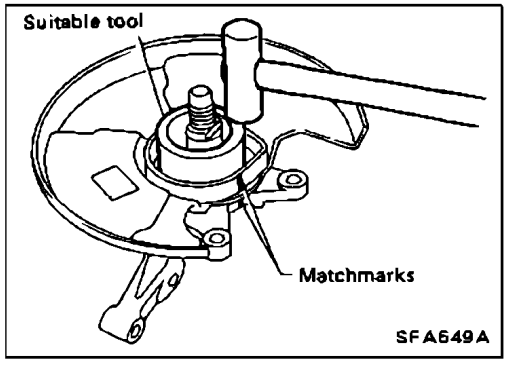
2. Install circular clip into groove of wheel hub.
3. Apply multi-purpose grease to sealing lip.



Removal

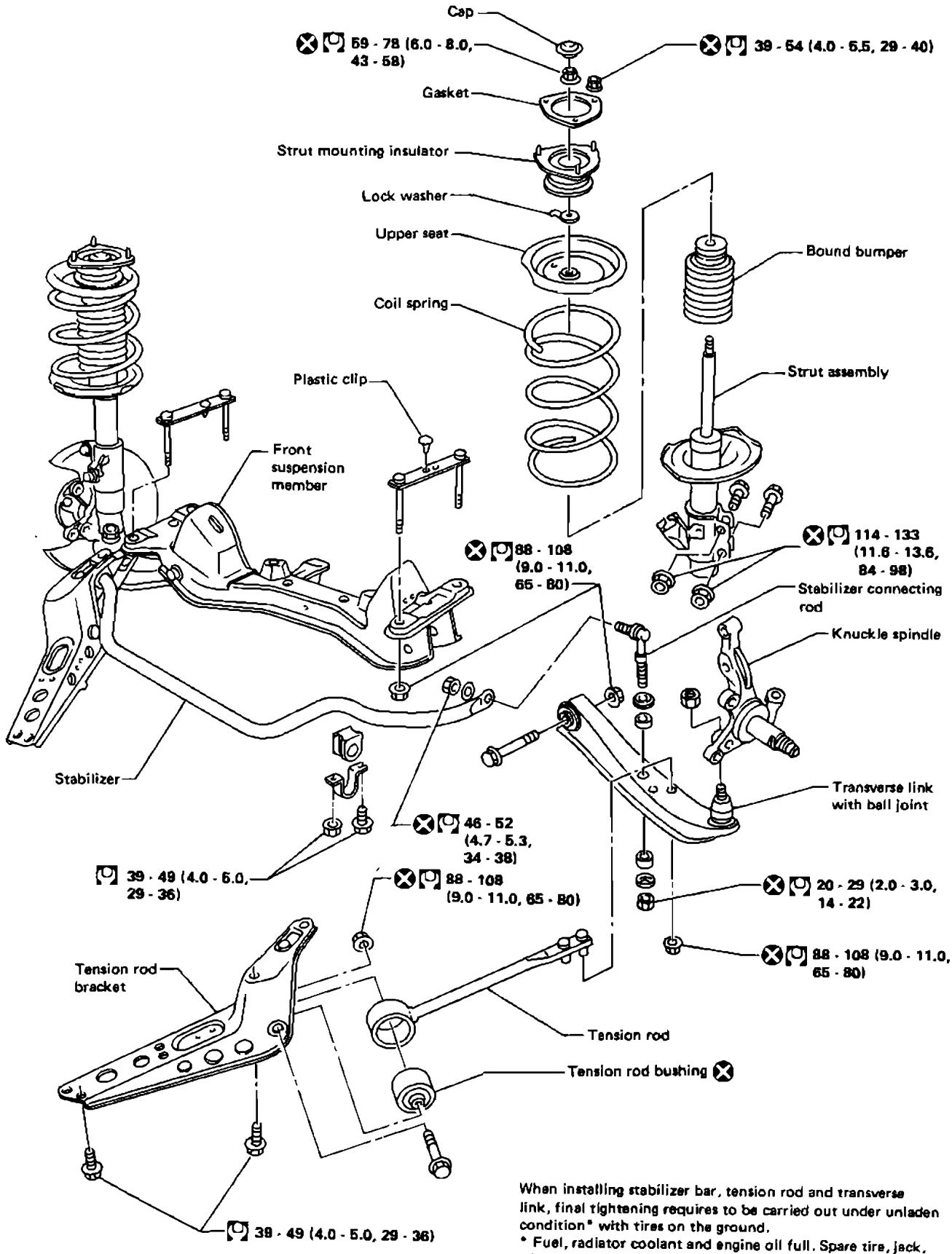
- Mark matchmarks on baffle plate before removing.
- If baffle plate raplacement requires removal of knuckle spindle, separate it equally using a screwdriver.

Be careful not to scratch knuckle spindle.



Installation

- Align matchmarks previously marked on baffle plate and install baffle plate by lightly tapping with a copper hammer and suitable tool.

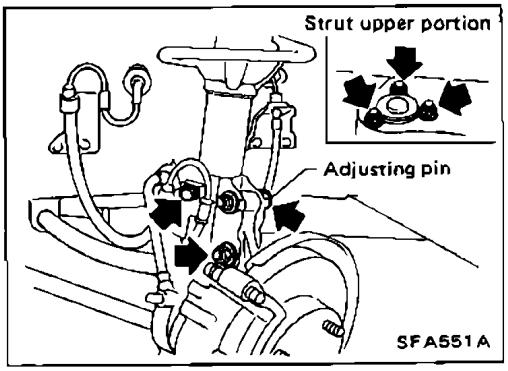


When installing stabilizer bar, tension rod and transverse link, final tightening requires to be carried out under unladen condition* with tires on the ground.

* Fuel, radiator coolant and engine oil full. Spare tire, jack, hand tools and mats in designated position.

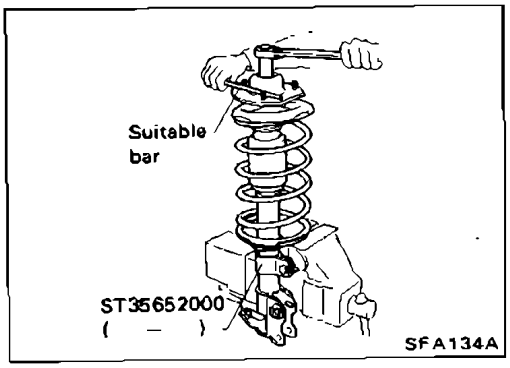
: N·m (kg-m, ft-lb)

SFA650A



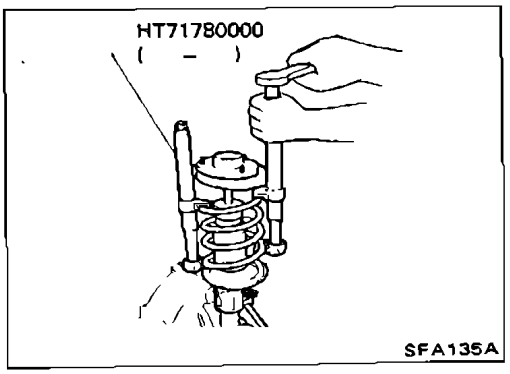
Removal

- Remove strut assembly fixing bolts and nuts (to hoodledge).
- Do not remove piston rod lock nut on vehicle.
- Put matchmarks on strut lower bracket and camber adjusting pin.

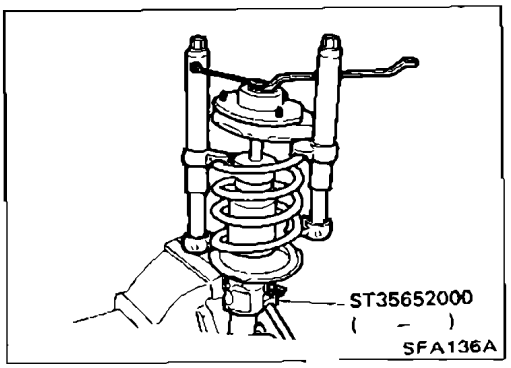


Disassembly

1. Set strut assembly on vise with Tool, then loosen piston rod lock nut.
- **Do not remove piston rod lock nut.**



2. Compress spring with a Tool so that strut mounting insulator can be turned by hand.



3. Remove piston rod lock nut.

Inspection

STRUT ASSEMBLY

- Check for smooth operation through a full stroke, both compression and extension.
- Check for oil leakage occuring on welded or gland packing portion.
- Check piston rod for cracks, deformation or other damage. Replace if necessary.

Inspection (Cont'd)

STRUT MOUNTING INSULATOR

- Check cemented rubber-to-metal portion for separation or cracks. Check rubber parts for deterioration.
- Check thrust bearing parts for abnormal noise or excessive rattle in axial direction.
  Replace if necessary.

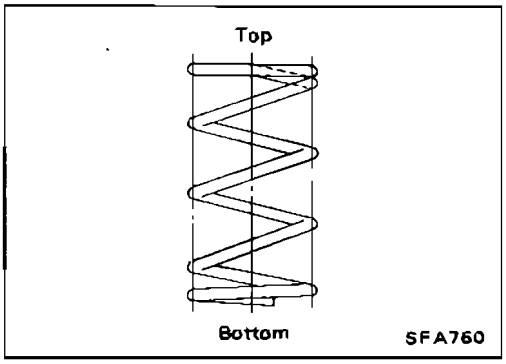
LOCK WASHER

- Check for cracks, deformation or other damage. Replace if necessary.

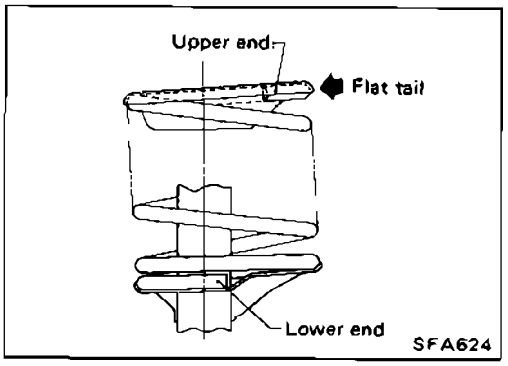
COIL SPRING

- Check for cracks, deformation or other damage. Replace if necessary.

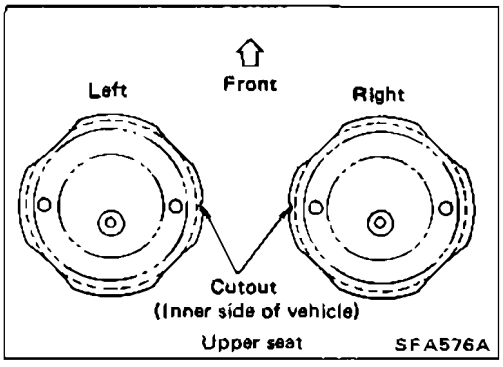
Assembly



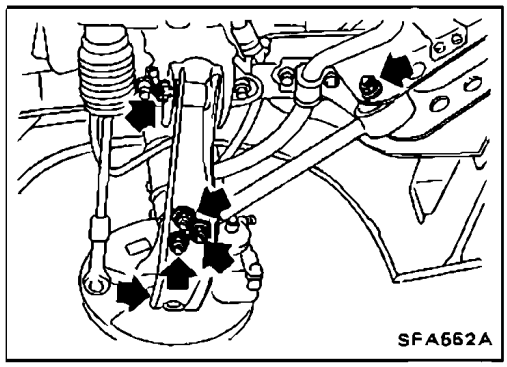
- When installing coil spring, be careful not to reverse top and bottom direction. (Top end is flat.)



- When installing coil spring on strut, it must be positioned as shown in figure at left.

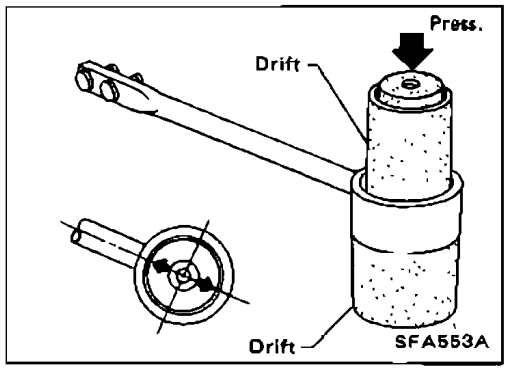


- Install upper spring seat with its cutout facing the inner side of vehicle.

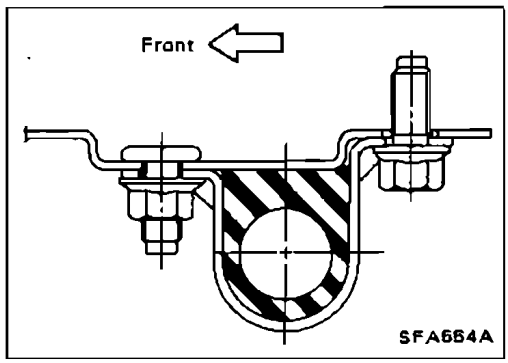


Removal and Installation

- Remove tension rod and stabilizer bar.

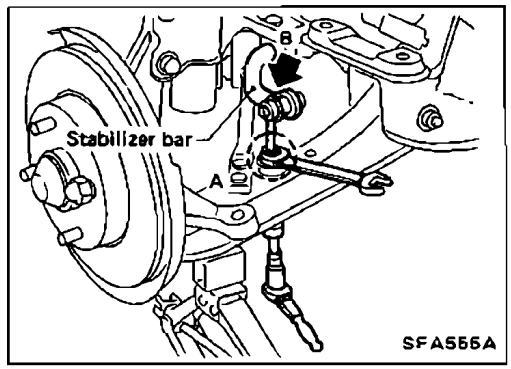


- When removing tension rod bushing, place one drift on lower side of bushing and the other on upper side, as shown at left, and press bushing out.
- Place arrow mark on bushing facing tension rod before installing bushing.

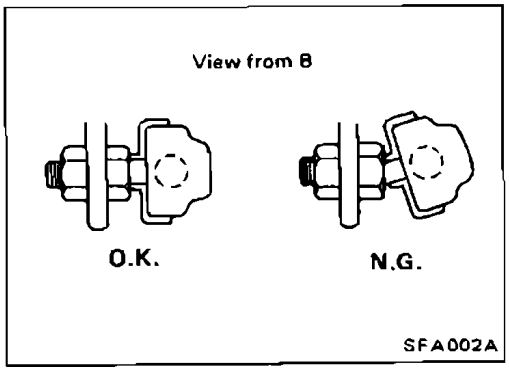


- Install stabilizer rear side bushings, then install front side bushings.

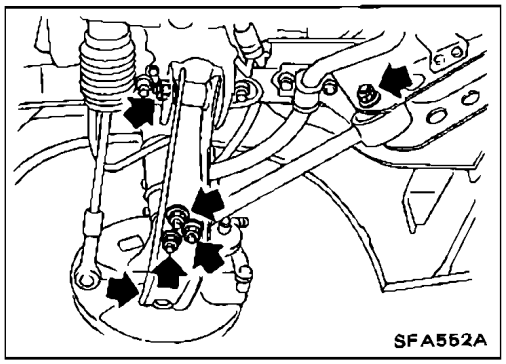
When installing stabilizer bar clamp, make sure direction is correct (as shown at left.)



- **When removing and installing stanbilizer bar, fix portion A.**



- **Install stabilizer bar with ball joint socket properly placed.**



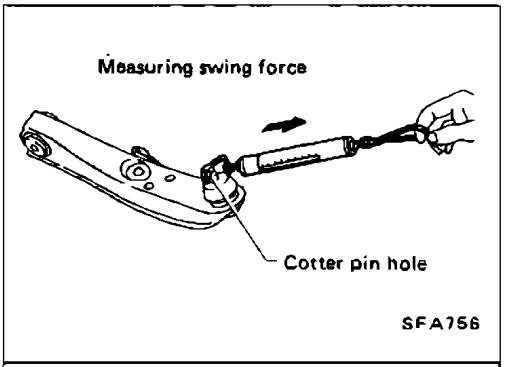
Removal and Installation

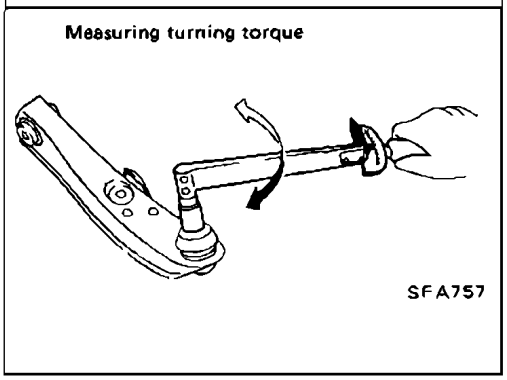
- Remove stabilizer, tension rod, ball joint and transverse link assembly.
- During installation, final tightening must be carried out at curb weight with tires on ground.
- After installation, check wheel alignment.
  Refer to "Front Wheel Alignment" of CHECK AND ADJUSTMENT — On-vehicle.

Inspection

TRANSVERSE LINK

- Check transverse link for damage, cracks or deformation. Replace it if necessary.
- Check rubber bushing for damage, cracks and deformation. Replace transverse link if necessary.





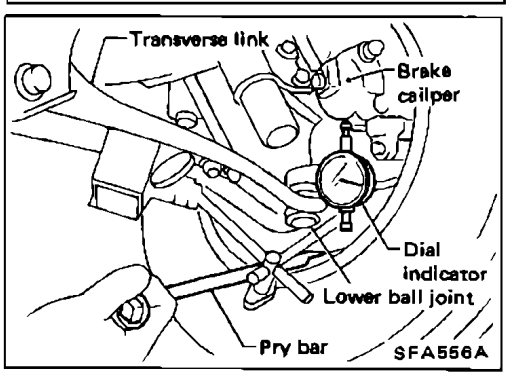
LOWER BALL JOINT

- Check ball joint for play. If ball stud is worn, play in axial direction is excessive or joint is hard to swing, replace transverse link assembly if necessary.

Swing force and turning torque

Before checking, turn ball joint at least 10 revolutions so that ball joint is properly broken in.

Swing force:
(measure point: cotter pin hole of ball stud)
7.8 - 55.9 N (0.8 - 5.7 kg, 1.8 - 12.6 lb)
Turning torque:
0.49 - 3.43 N·m (5.0 - 35 kg-cm, 4.3 - 30.4 in-lb)



Vertical end play (On-vehicle)

(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.
    Vertical end play: 0 mm (0 in)
(6) If not within above specification, replace transverse link.

General Specifications

COIL SPRING

Item \ Model	Except Sports package	Sports package
Wire diameter mm (in)	13.3 (0.524)	13.5 (0.531)
Coil diameter mm (in)	170 (6.69)	170 (6.69)
Free length mm (in)	326 (12.83)	311 (12.24)
Spring constant N/mm (kg/mm, lb/in)	19.6 (2.0, 112)	21.6 (2.2, 123)
Identification color	Orange x 1, Purple x 1	Pink x 1, Purple x 1

FRONT STABILIZER BAR

Item \ Model	Except Sports package	Sports package
Stabilizer diameter mm (in)	24 (0.94)	25 (0.98)
Identification color	White	Orange

STRUT

Item \ Model	Except Sports package	Sports package
Piston rod diameter mm (in)	20.0 (0.787)	
Stroke mm (in)	160 (6.30)	
Damping force [at 0.1 m (0.3 ft)/sec.] N (kg, lb)		
Expansion	412 - 608 (42 - 62, 93 - 137)	471 - 706 (48 - 72, 106 - 159)
Compression	206 - 304 (21 - 31, 46 - 68)	235 - 353 (24 - 36, 53 - 79)
Damping force [at 0.3 m (1.0 ft)/sec.] N (kg, lb)		
Expansion	912 - 1,245 (93 - 127, 205 - 280)	
Compression	392 - 588 (40 - 60, 88 - 132)	

Inspection and Adjustment

WHEEL ALIGNMENT (Unladen*1)

Camber	degree	−1°30′ to 0°
Caster	degree	6°00′ - 7°30′
Toe-in (Total)	mm (in)	0.3 - 2.3 (0.012 - 0.091)
	degree	1′ - 6.5′
Kingpin inclination	degree	12°30′ - 14°00′
Front wheel turning angle Full turn*2 inside/outside	degree	39° - 43°/33°

*1: Tankful of fuel, radiator coolant and engine oil full. Spare tire, jack, hand tools, mats in designated position.
*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

Wheel bearing axial end play mm (in)	0.03 (0.0012) or less
Wheel bearing lock nut Tightening tirque N·m (kg-m, ft-lb)	147 - 216 (15 - 22, 108 - 159)

LOWER BALL JOINT

Swing force (Measuring point: cotter pin hole of ball stud) N (kg, lb)	7.8 - 55.9 (0.8 - 5.7, 1.8 - 12.6)
Turning torque N·m (kg-cm, in-lb)	0.49 - 3.43 (5.0 - 35, 4.3 - 30.4)
Vertical end play mm (in)	0 (0)

WHEEL RUNOUT (Radial and lateral)

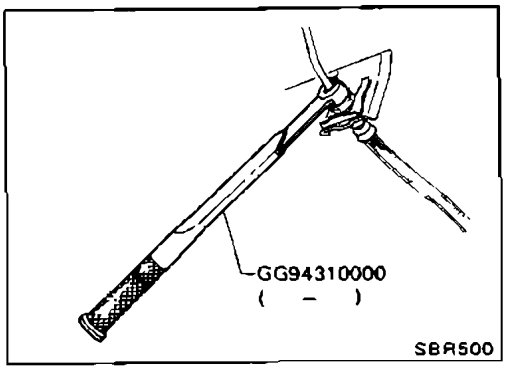
Wheel type	Radial runout	Lateral runout
Aluminum wheel mm (in)	0.3 (0.012) or less	
Steel wheel mm (in)	0.5 (0.020) or less	0.8 (0.031) or less

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- 5
REAR AXLE AND REAR SUSPENSION ASSEMBLY ..... RA- 8
REAR AXLE — Wheel Hub and Axle Housing ..... RA- 9
REAR AXLE — Drive Shaft RA-13
REAR SUSPENSION RA-19
REAR SUSPENSION — Coil Spring and Shock Absorber RA-20
REAR SUSPENSION — Stabilizer Bar RA-22
REAR SUSPENSION — Multi-link and Lower Ball Joint RA-23
SERVICE DATA AND SPECIFICATIONS (S.D.S.) RA-24

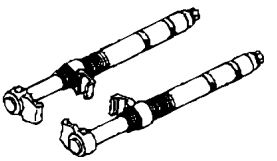
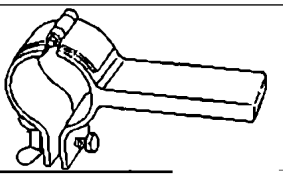
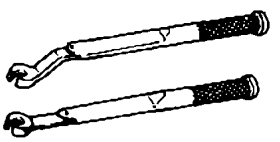
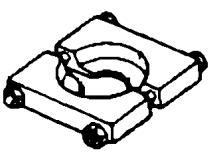
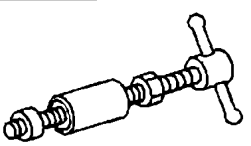


Precautions

- 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.
- Do not jack up at the lower arm.

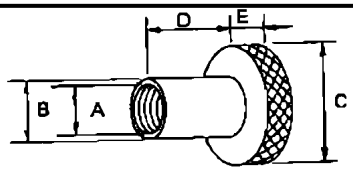
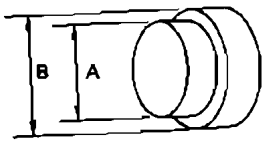
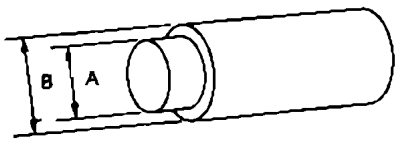
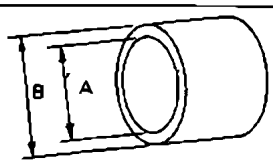
Preparation

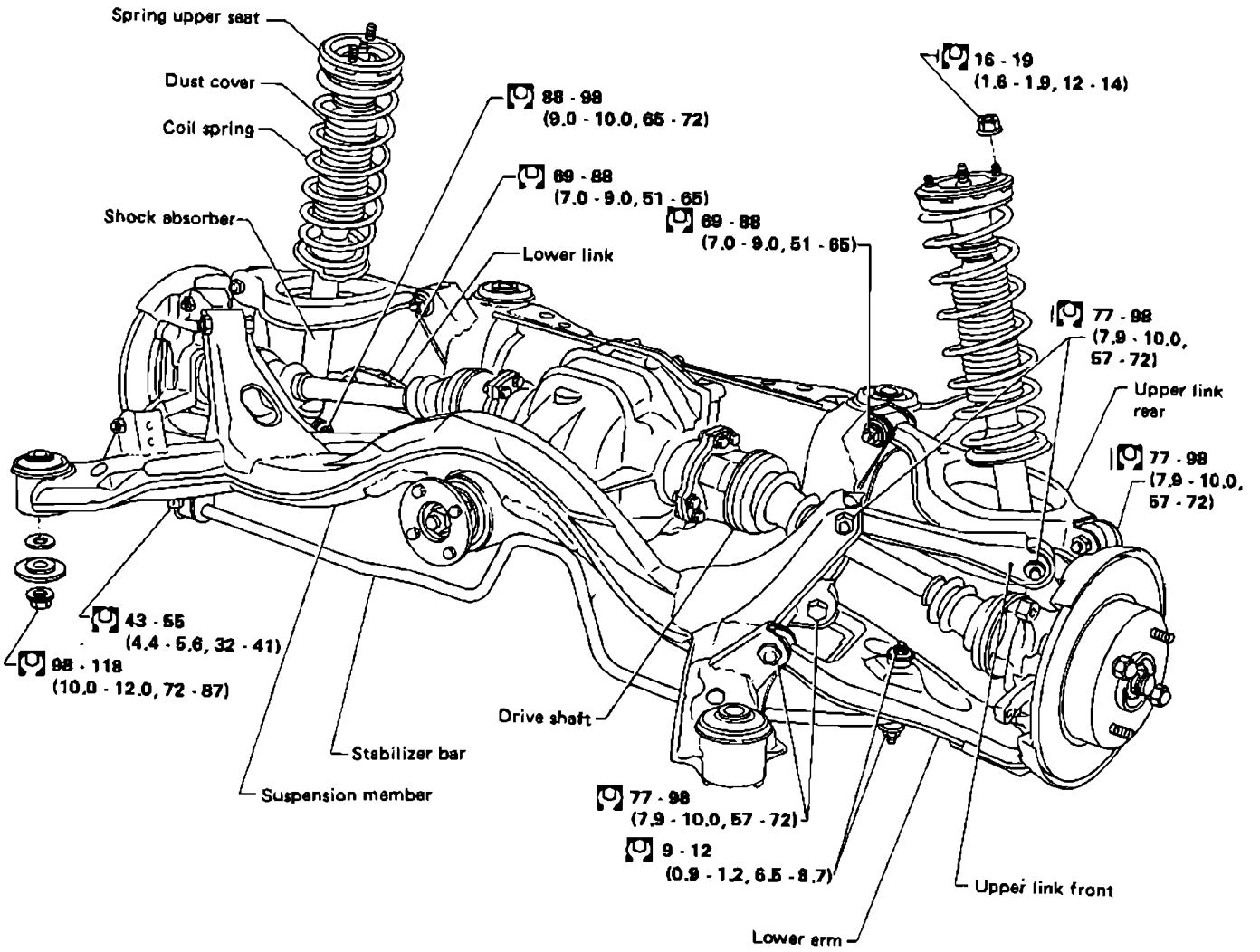
SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.) Tool name	Description	
HT71780000 (–) Spring compressor		Removing and installing coil spring
ST35652000 (– ·) Strut attachment		Fixing strut assembly
GG94310000 (–) Flare nut torque wrench		Removing and installing brake piping
ST30031000 (J22912-01) Bearing puller		Removing inner race of wheel bearing
ST38280000 (–) Arm bushing remover		Removing and installing bushing of rear axle housing

Precautions (Cont'd)

COMMERCIAL SERVICE TOOLS

Tool name	Description
Attachment Wheel alignment	 Measure rear wheel alignment A: Screw M24 x 1.5 B: 35 (1.38) dia. C: 65 (2.56) dia. D: 56 (2.20) E: 12 (0.47) Unit: mm (in)
Rear wheel hub drift	 Installing wheel bearing A: 41 mm (1.61 in) dia. B: 49 mm (1.93 in) dia.
Wheel bearing drift	 Removing rear wheel hub A: 26 mm (1.02 in) dia. B: 40 mm (1.57 in) dia.
Rear drive shaft plug seal drift	 Installing rear drive shaft plug seal A: 67 mm (2.64 in) dia. B: 85 mm (3.35 in) dia.

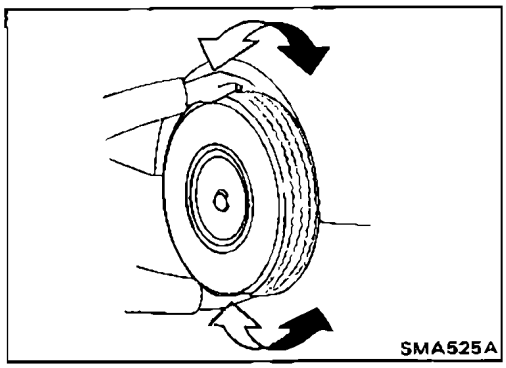


Final tightening for rubber parts requires to be carried out under unladen condition* with tires on ground.

* Fuel, radiator coolant and engine oil full.
Spare tire, jack, hand tools and mats in designated positions.

: N·m (kg-m, ft-lb)

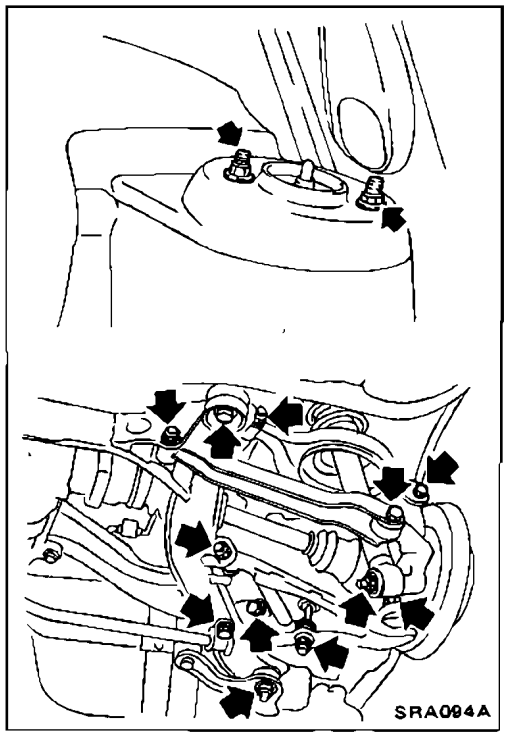
SRA093A



Rear Axle and Rear Suspension Parts

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

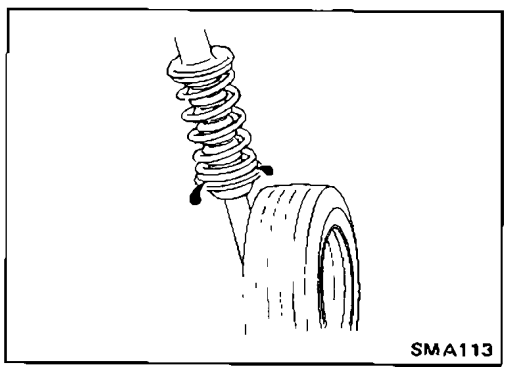
(1) Shake each rear wheel.



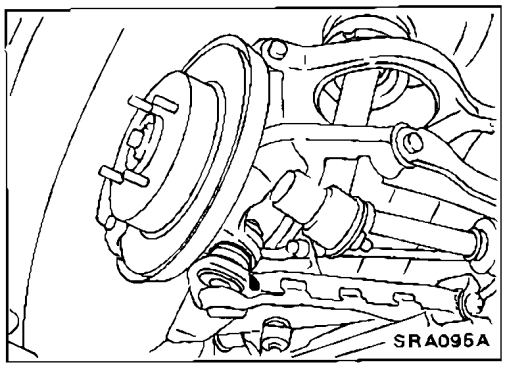
(2) Retighten all nuts and bolts to the specified torque.
Tightening torque:
Refer to S.D.S.

(3) Make sure that cotter pin is inserted.

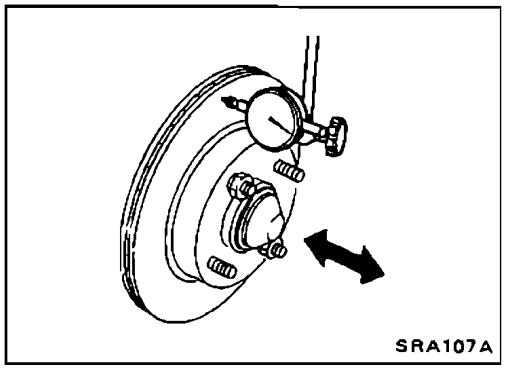
(4) Check rear axle and rear suspension parts for wear, cracks or other damage.



(5) Check shock absorber for oil leakage or other damage.



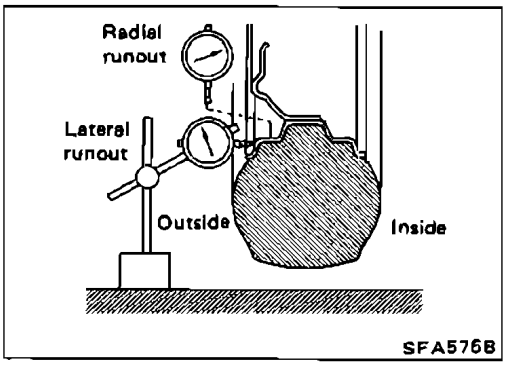
- Check suspension ball joint for grease leakage and ball joint dust cover for cracks or other damage.


SRA107A

Rear Wheel Bearing

- Check tightening torque of wheel bearing lock nut.
  (T): 235 - 314 N·m
  (24 - 32 kg-m, 174 - 231 ft-lb)
- Check that wheel bearings operates smoothly.
- Check axial end play.
  Axial end play:
  0.05 mm (0.0020 in) or less

If axial end play is not within specification or wheel bearing does not turn smoothly, replace wheel bearing assembly.
Refer to REAR AXLE — Wheel Hub and Axle Housing.



SFA576B

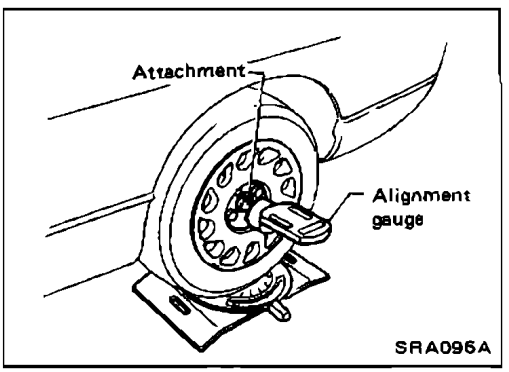
Rear Wheel Alignment

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

PRELIMINARY INSPECTION

Make following checks. Adjust, repair or replace if necessary.

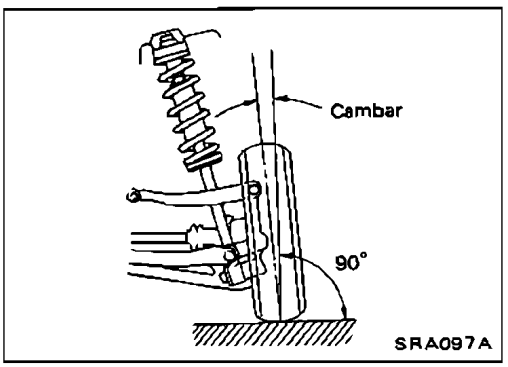
- Check tires for wear and for improper inflation.
- Check rear wheel bearings for looseness.
- Check wheel runout.
  Refer to S.D.S.
- Check that rear shock absorber works properly.
- Check rear axle and rear suspension parts for looseness.
- Check vehicle posture (Unladen).
  "Unladen":
  Fuel tank, radiator and engine oil full. Spare tire, jack, hand tools and mats in designated positions.



SRA096A

CAMBER

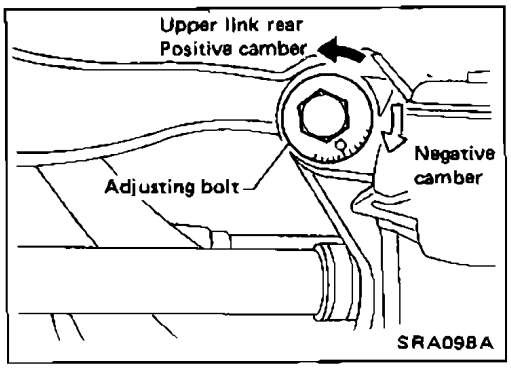
- **Measure camber of both right and left wheels with a suitable alignment gauge and adjust in accordance with the following procedures.**



SRA097A

Camber:
−1°36′ to −0°36′

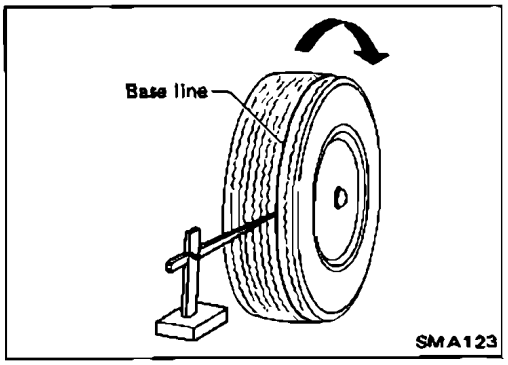
Rear Wheel Alignment (Cont'd)



If camber is not within specification, adjust by turning the adjusting pin.

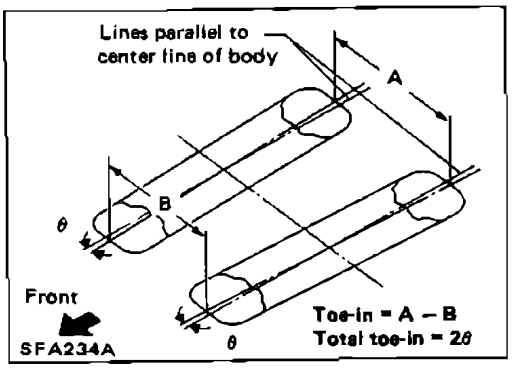
(1) Turn the adjusting pin to adjust.
Camber changes about 5′ with each graduation of the adjusting pin.

(2) Tighten to the specified torque.
: 69 - 88 N·m
(7.0 - 9.0 kg-m, 51 - 65 ft-lb)



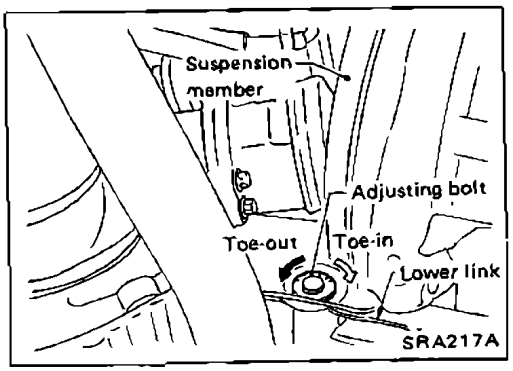
TOE-IN

1. Draw a base line across the tread.
After lowering rear of vehicle, move it up and down to eliminate friction.



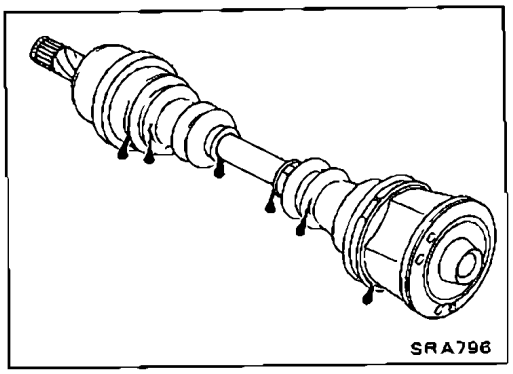
2. Measure toe-in.
Measure distance "A" and "B" at the same height as hub center.

Toe-in:
A – B
0.5 - 4.5 mm (0.020 - 0.177 in)
2θ (Total toe-in)
1.5′ - 12.5′



3. Adjust toe-in by turning adjusting pins.
Toe changes about 1.5 mm (0.059 in) [One side] with each graduation of the adjusting pin.

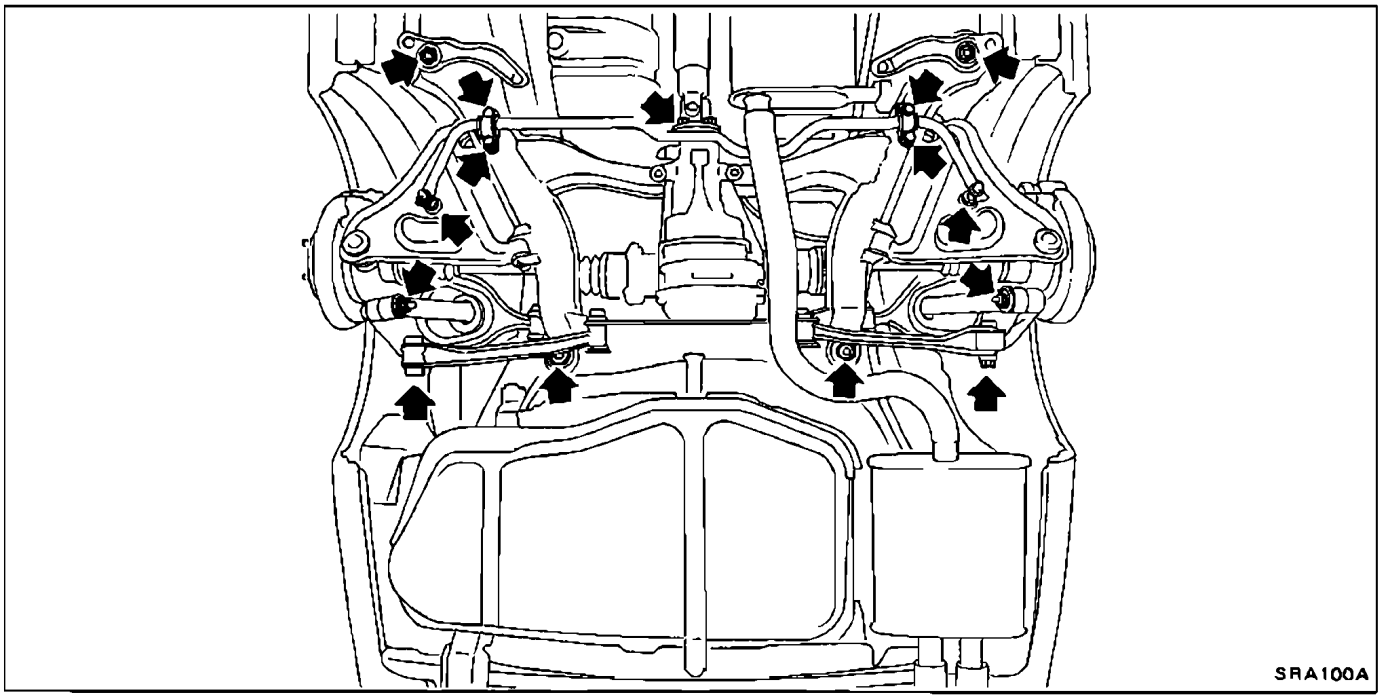
4. Tighten to the specified torque.
: 69 - 88 N·m
(7.0 - 9.0 kg-m, 51 - 65 ft-lb)



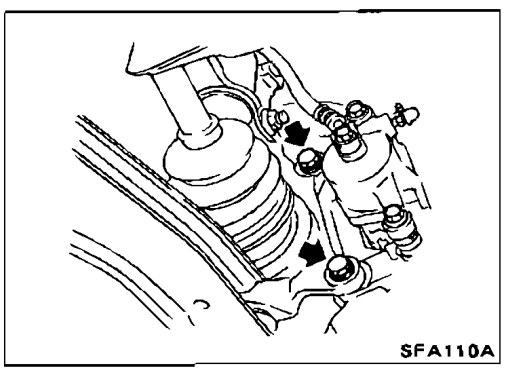
Drive Shaft

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

Removal and Installation

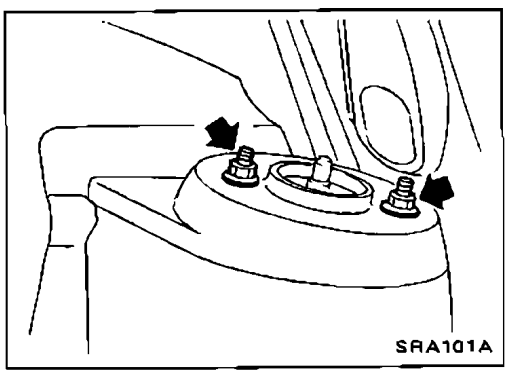


- Remove exhaust tube.
- Disconnect propeller shaft rear end.



- Remove brake caliper assembly.

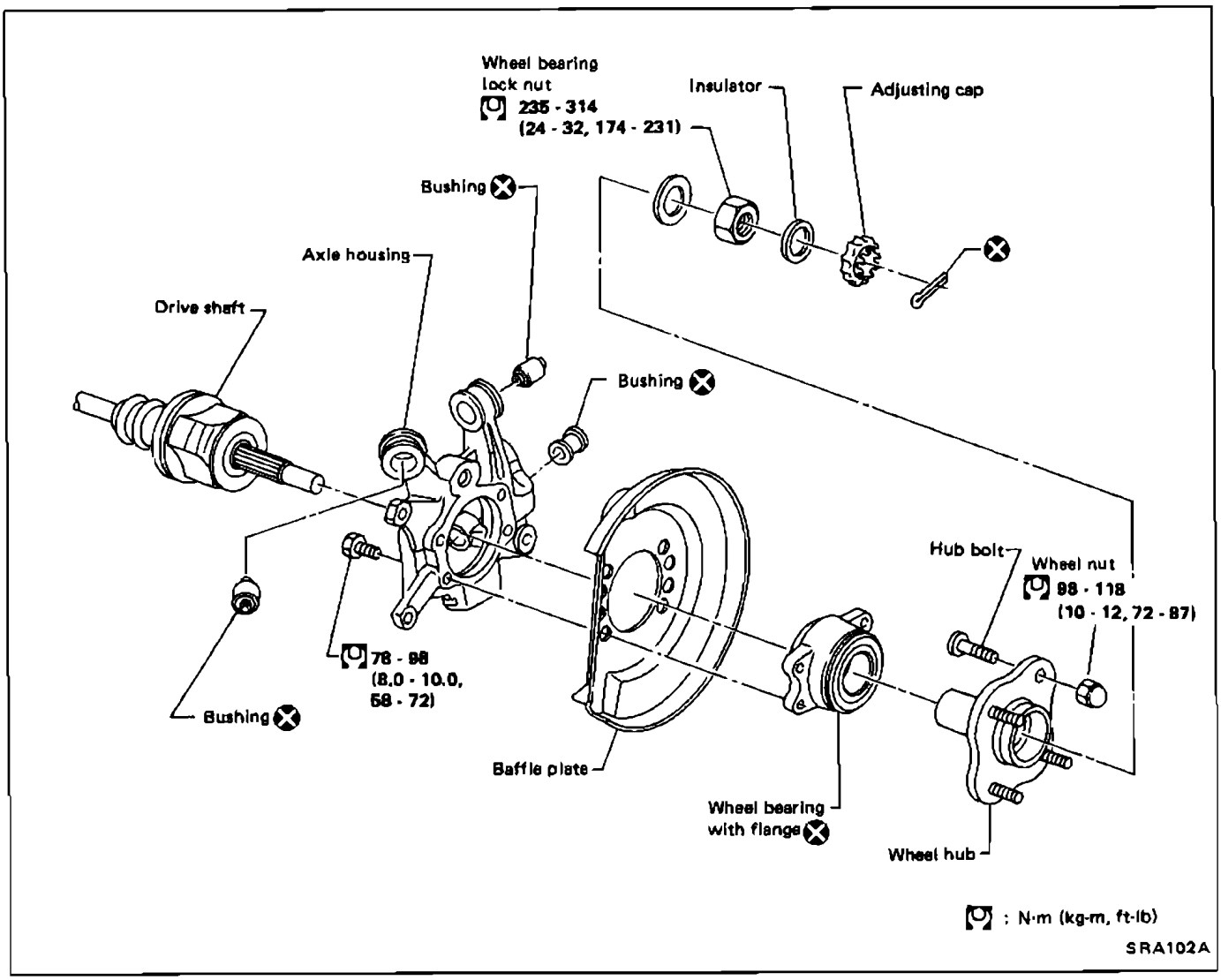
Brake hose need not be disconnected from brake caliper.
Be careful not to depress brake pedal, or piston will pop out.
Make sure brake hose is not twisted.



- Remove upper end nuts of shock absorber.

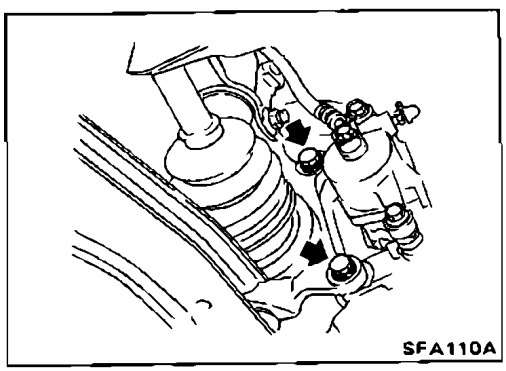
Do not remove piston rod lock nut.

- Remove suspension member fixing nuts. Then draw out rear axle and rear suspension assembly.



Removal

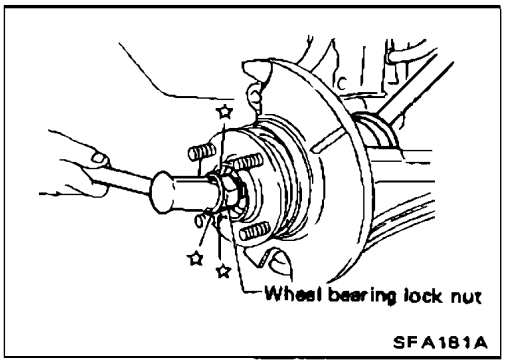
- Remove wheel bearing lock nut.



- Remove brake caliper assembly and rotor.

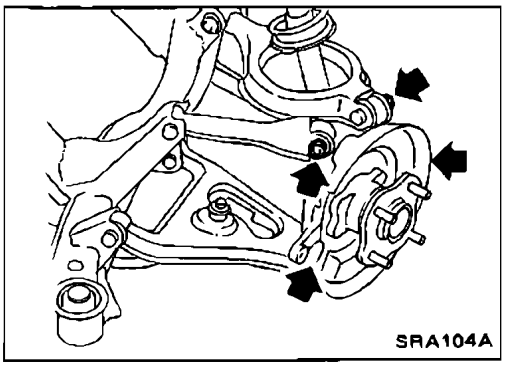
Brake hose need not be disconnected from brake caliper. Be careful not to depress brake pedal, or piston will pop out. Make sure brake hose is not twisted.

Removal (Cont'd)

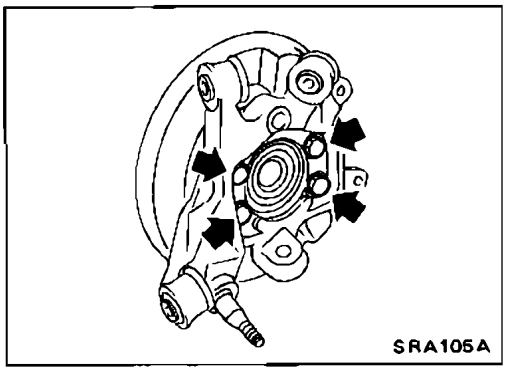


SFA181A

- Separate drive shaft from axle housing by slightly tapping it. **When removing drive shaft, cover boots with waste cloth to prevent them from being damaged.**

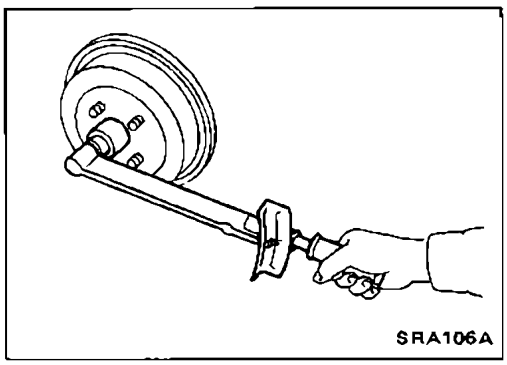

SRA104A

- Remove axle housing.

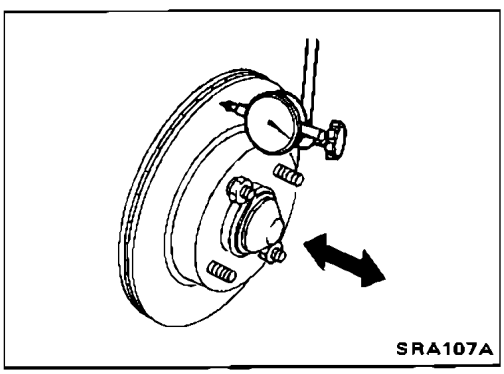

SRA105A

- Remove wheel bearing with flange, and wheel hub from axle housing.

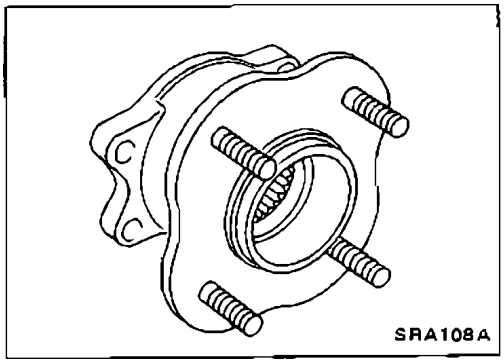
Installation


SRA106A

- Install axle housing with wheel hub.
- Tighten wheel bearing lock nut.
  : 235 - 314 N·m
  (24 - 32 kg-m, 174 - 231 ft-lb)


SRA107A

- Check wheel bearing axial end play.
  Axial end play: 0.05 mm (0.0020 in) or less



Disassembly

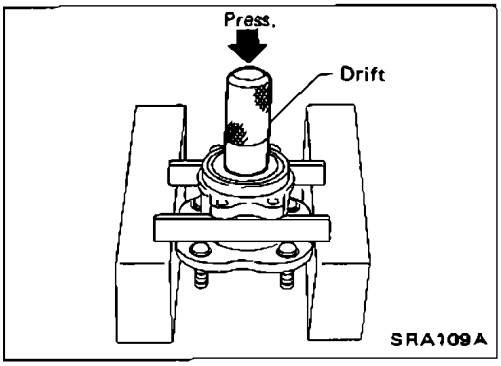
CAUTION:

Wheel bearing with flange usually does not require maintenance. If any of the following symptoms are noted, replace wheel bearing assembly (including flange, and inner and outer seals).

- **Growling noise is emitted from wheel bearing during operation.**
- **Wheel bearing drags or turns roughly when hub is turned with your hand after bearing lock nut is tightened to specified torque.**
- **After wheel bearing is removed from hub.**

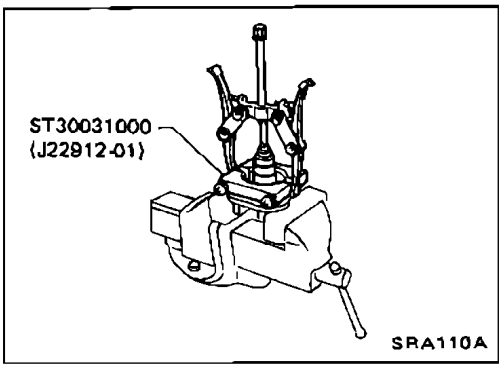
WHEEL HUB

- Remove wheel bearing (with flange) and wheel hub as one unit from axle housing before disassembling.



WHEEL BEARING

- Using a press and drift as shown in figure at left, press wheel bearing out.
- Discard old wheel bearing assembly. Replace with a new wheel assembly.



- Remove inner race from hub using a bearing replacer/puller.

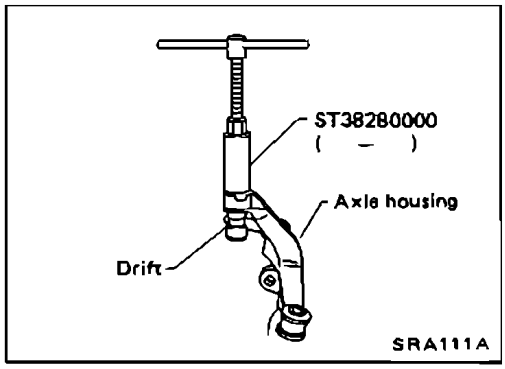
CAUTION:

a. Do not reuse old inner race although it is of the same brand as the bearing assembly.

b. Do not replace grease seals as single parts.

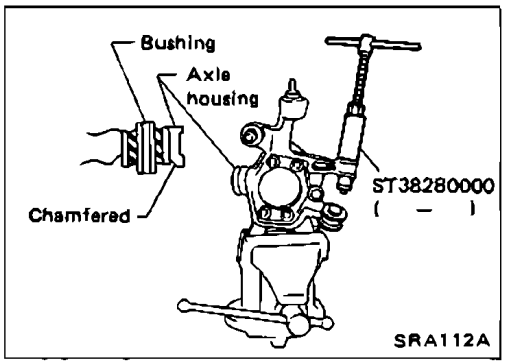
Disassembly (Cont'd)

AXLE HOUSING



- Attach a drift on outer shell of bushing as shown in figure at left, remove bushing using arm bushing remover.

When placing axle housing in a vise, use wooden blocks or copper plates as pads.



- Ensure axle housing bore is free from scratches or deformities before pressing bushing into it.
- Attach bushing to chamfered bore end of axle housing and press it until it is flush with end face of axle housing.

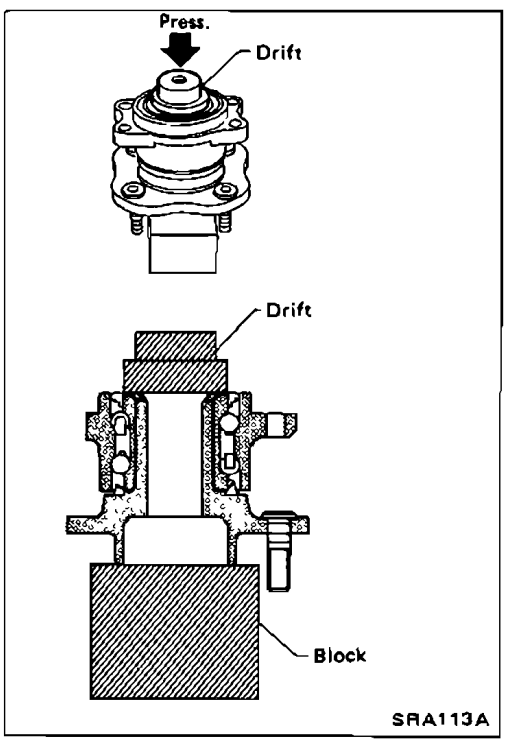
Inspection

WHEEL HUB AND AXLE HOUSING

- Check wheel hub and axle housing for cracks by using a magnetic exploration or dyeing test.
- Check wheel bearing for damage, seizure, rust or rough operation.
- Check rubber bushing for wear or other damage.

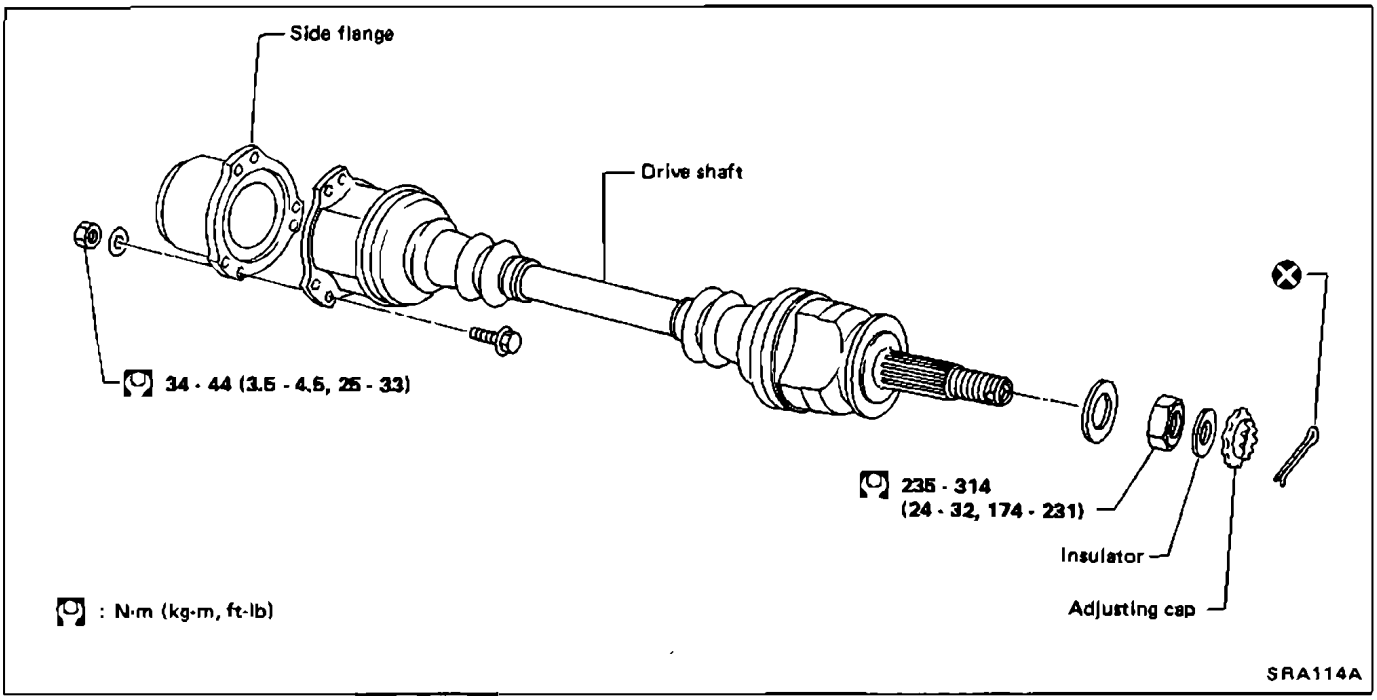
Replace if necessary.

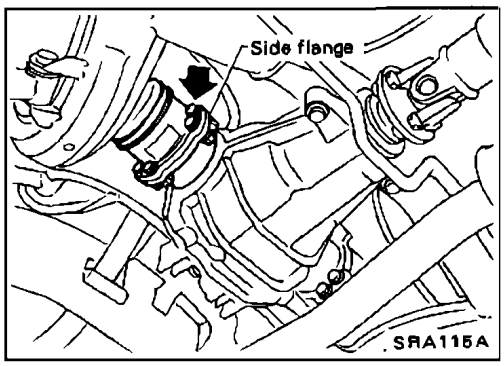
Assembly

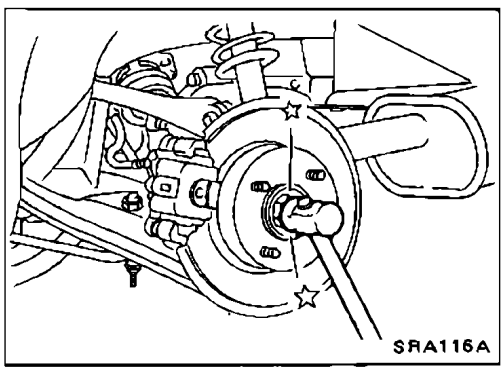


- Place hub on a block. Attach a drift to inner race of wheel bearing and press it into hub as shown in figure at left.

Be careful not to damage grease seal.







Removal

When removing drive shaft, cover boots with waste cloth to prevent damage to them.

FINAL DRIVE SIDE

- Remove side flange mounting bolt and separate shaft.

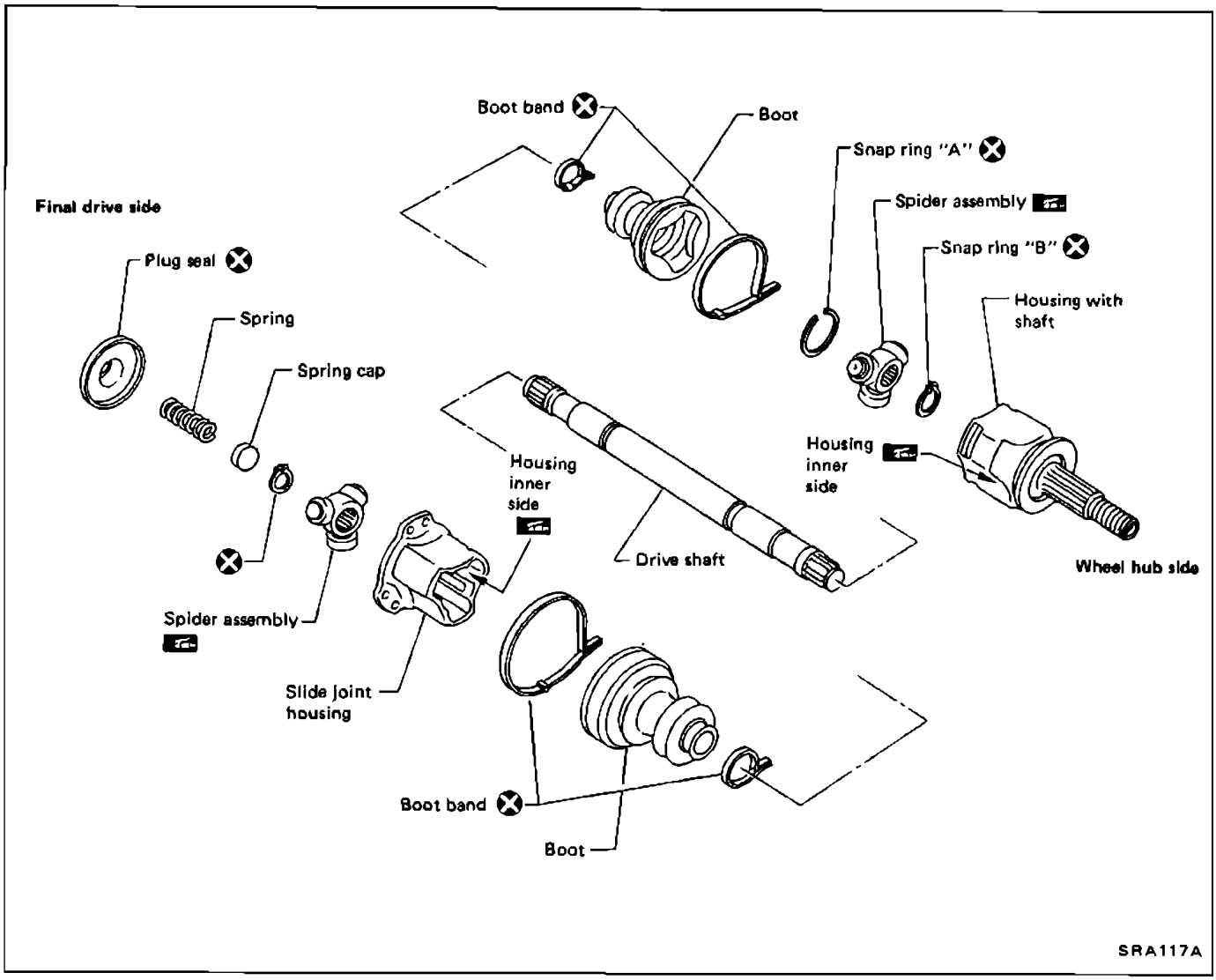
WHEEL SIDE

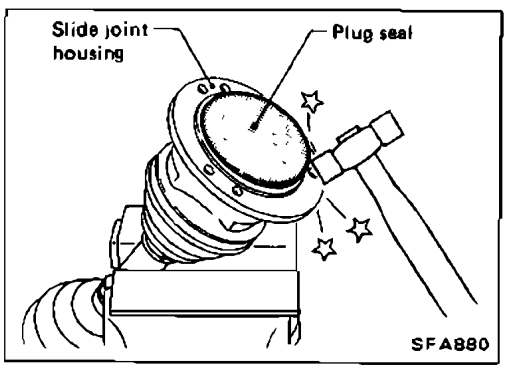
- Remove drive shaft by lightly tapping it with a copper hammer.

To avoid damaging threads of drive shaft, install a nut while removing drive shaft.

Installation

- Insert drive shaft from wheel hub and temporarily tighten wheel bearing lock nut.
- Tighten side flange mounting bolts to specified torque.
- Tighten wheel bearing lock nut to specified torque.

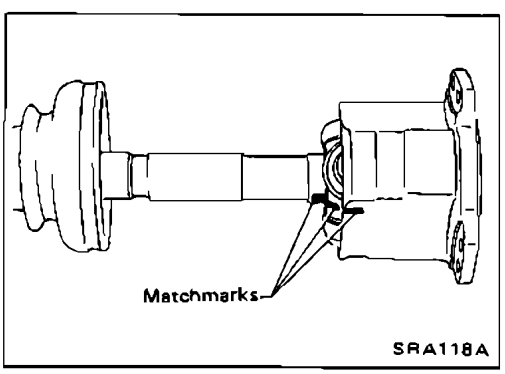




Disassembly

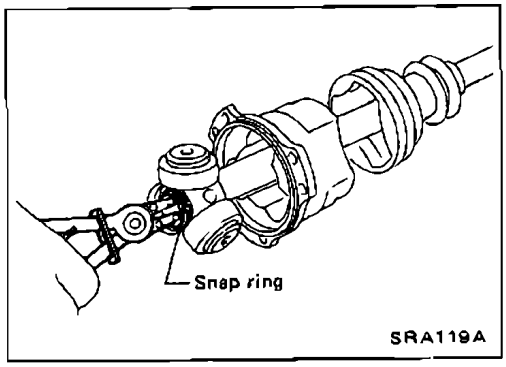
FINAL DRIVE SIDE

1. Remove plug seal from slide joint housing by lightly tapping around slide joint housing.



2. Remove boot bands.
3. Put matchmarks on slide joint housing and drive shaft before separating joint assembly.
4. Put matchmarks on spider assembly and drive shaft.

Disassembly (Cont'd)



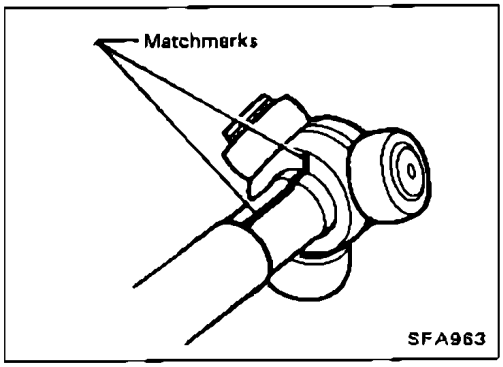
5. Pry off snap ring, then remove spider assembly.

CAUTION:

Do not disassemble spider assembly.

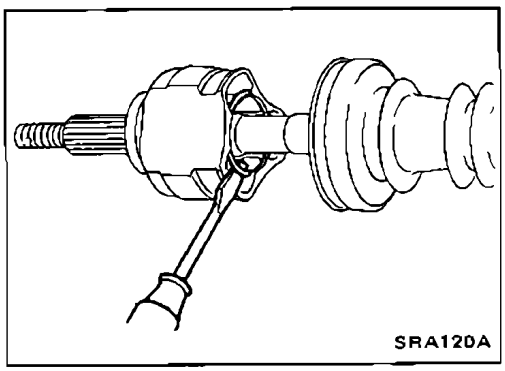
6. Draw out slide joint housing.
7. Draw out boot.

Cover drive shaft serration with tape to prevent damage to the boot.

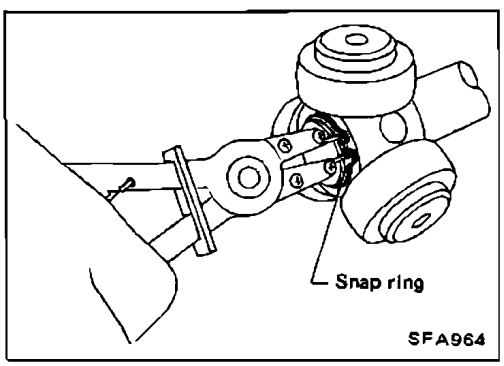


WHEEL SIDE

1. Remove boot bands.
2. Put matchmarks on housing together with shaft and drive shaft before separating joint assembly.
3. Put matchmarks on spider assembly and drive shaft.



4. Pry off snap ring "A" with a screwdriver, and pull out slide joint housing.



5. Pry off snap ring "B", then remove spider assembly.

CAUTION:

Do not disassemble spider assembly.

6. Draw out boot.

Cover drive shaft serration with tape to prevent damage to the boot.

Inspection

Thoroughly clean all parts in cleaning solvent, and dry with compressed air. Check parts for deformation or other damage.

DRIVE SHAFT

Replace drive shaft if it is twisted or cracked.

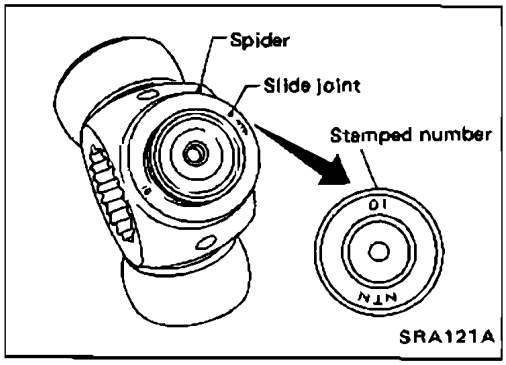
BOOT

Check boot for fatigue, cracks, or wear. Replace boot with new boot bands.

Inspection (Cont'd)

JOINT ASSEMBLY

- Check spider assembly for bearing, roller and washer damage. Replace spider assembly if necessary.
- Check housing for any damage. Replace housing set and spider assembly, if necessary.



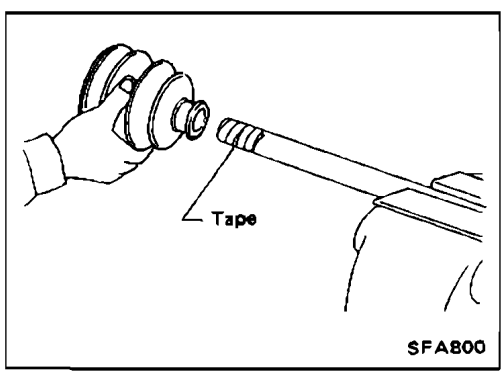
- When replacing only spider assembly, select a new spider assembly from among those listed in table below. Ensure the number stamped on sliding joint is the same as that stamped on new part.

Housing alone cannot be replaced. It must be replaced together with spider assembly.

Stamped number	Part No.
00	39720 10V10
01	39720 10V11
02	39720 10V12

Assembly

- **After drive shaft has been assembled, make sure it moves smoothly over its entire range without binding.**
- **Use Nissan Genuine Grease or equivalent after every overhaul.**

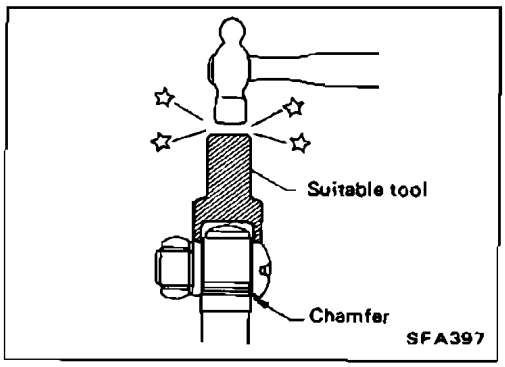


FINAL DRIVE SIDE

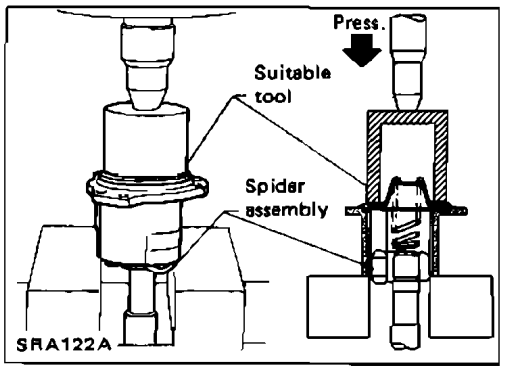
1. Install new small boot band, boot and slide joint housing to drive shaft.

Cover drive shaft serration with tape to prevent damage to boot during installation.

Assembly (Cont'd)



2. Install spider assembly securely, making sure marks are properly aligned.
- Press-fit with spider assembly serration chamfer facing shaft.
3. Install new snap ring.



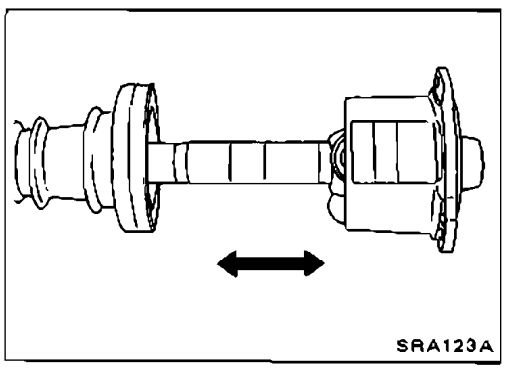
4. Install coil spring, spring cap and new plug seal to slide joint housing. Press plug seal.

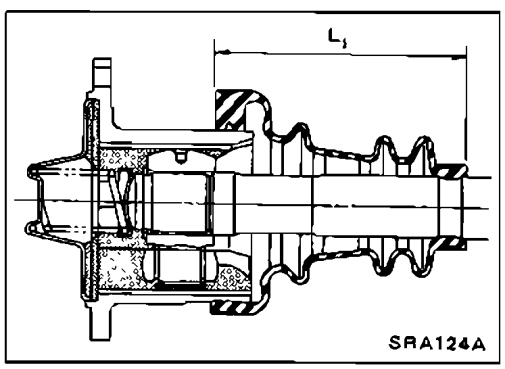
Apply sealant to mating surface of plug seal.

CAUTION:

a. When pressing plug seal into place, hold it horizontal so that spring inside it does not tilt or fall down.

b. Move shaft in axial direction to ensure that spring is installed properly. If shaft drags or if spring is not installed properly, remove plug seal and install a new one. Discard plug seal after removal.





5. Pack drive shaft with specified amount of grease.

Specified amount of grease:

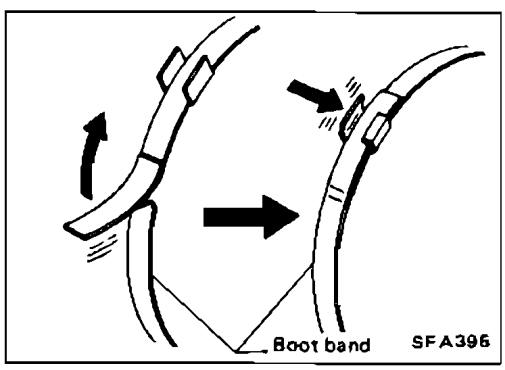
185 - 195 g (6.52 - 6.88 oz)

6. Set boot so that it does not swell and deform when its length is "L_1".

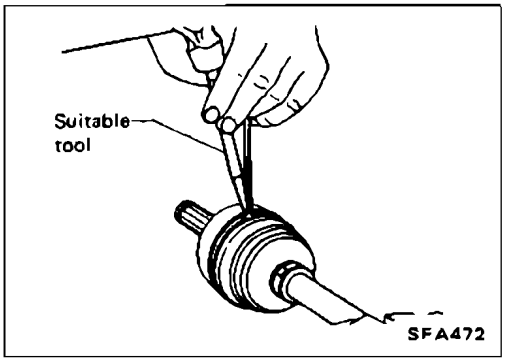
Length "L_1":

110.5 - 112.5 mm (4.35 - 4.43 in)

Make sure that boot is properly installed on the drive shaft groove.

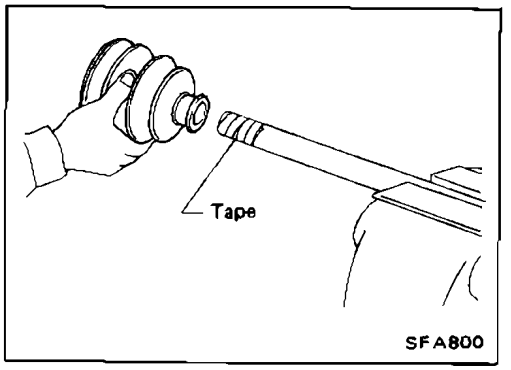


Assembly (Cont'd)



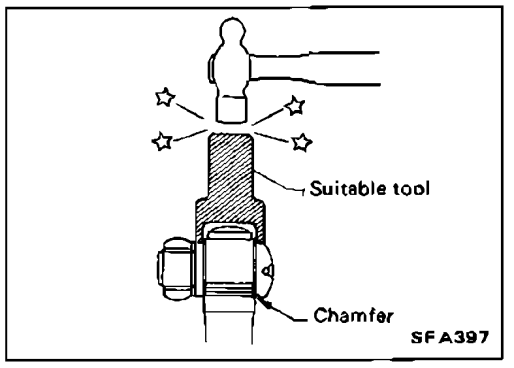
7. Lock new larger boot band securely with a suitable tool, then lock new smaller boot band.

WHEEL SIDE



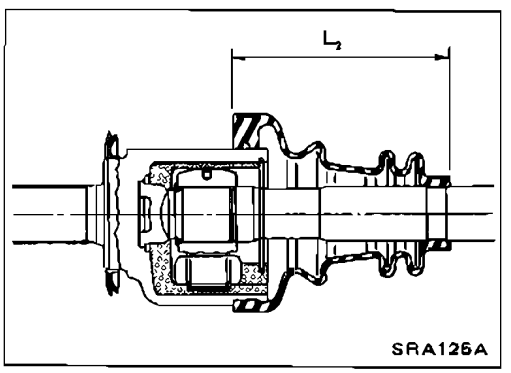
1. Install new small boot band and boot on drive shaft.

Cover drive shaft serration with tape to prevent damage to boot during installation.



2. Install spider assembly securely, making sure marks are properly aligned.
- Press-fit with spider assembly serration chamfer facing shaft.

3. Install new snap ring.



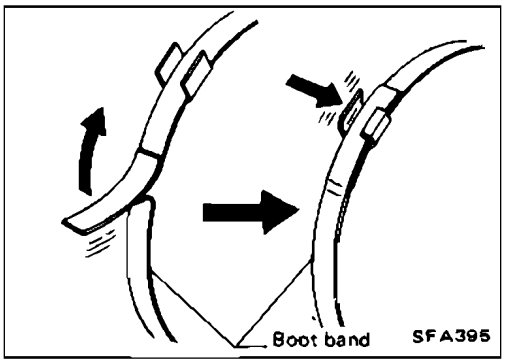
4. Pack drive shaft with specified amount of grease.

Specified amount of grease:
145 - 155 g (5.11 - 5.47 oz)

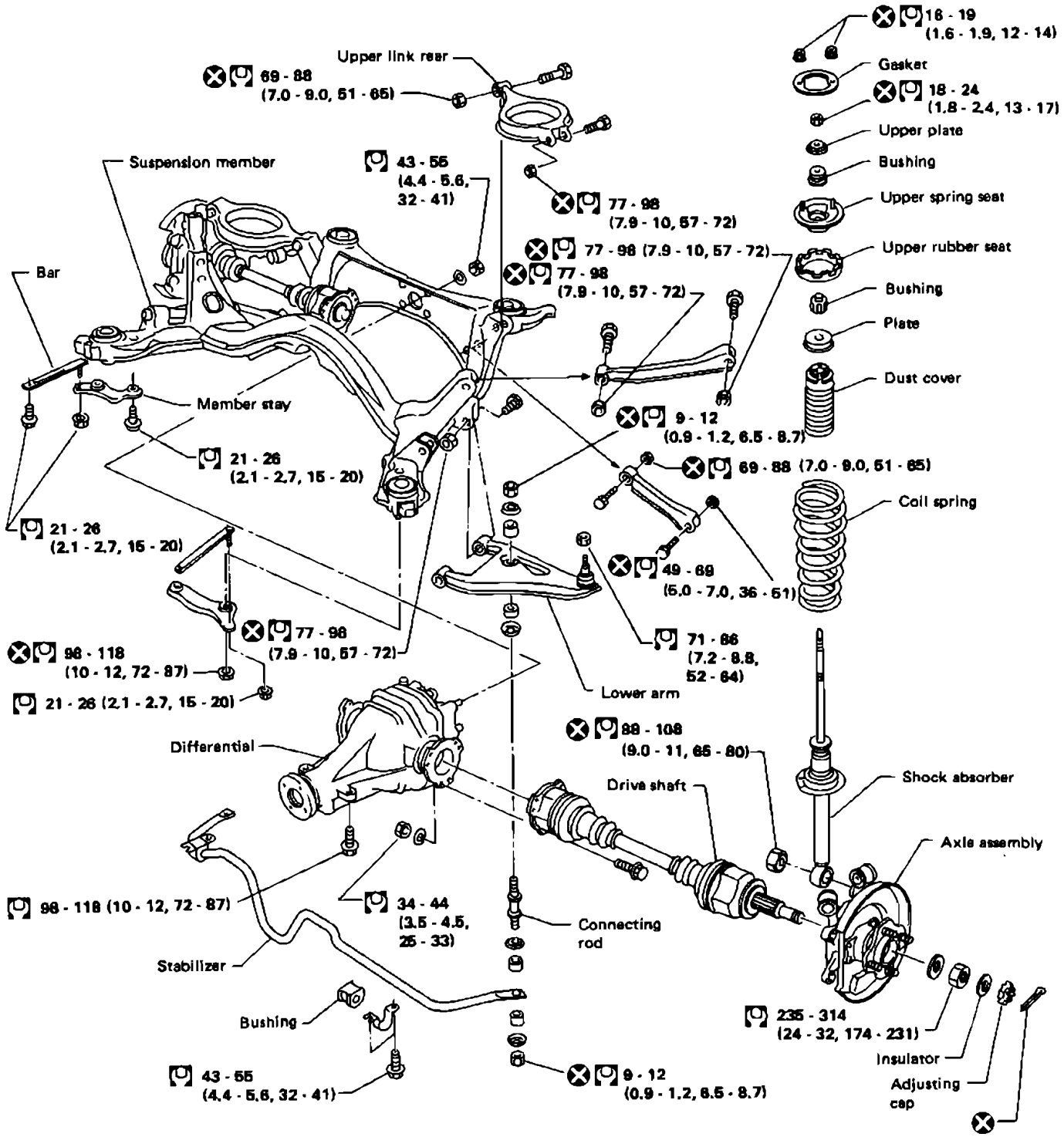
5. Install slide joint housing, then install new snap ring "A".
6. Set boot so that it does not swell and deform when its length is "L_2".

Length "L_2":
110.5 - 112.5 mm (4.35 - 4.43 in)

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.



CAUTION:
Do not jack up at lower arm.
When installing each rubber part, final tightening must be carried out under unladen condition* with tires on ground.

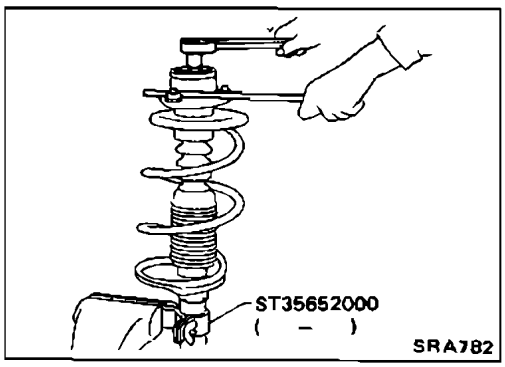
* Fuel, radiator coolant and engine oil full. Spare tire, jack, hand tools and mats in designated positions.

: N·m (kg-m, ft-lb)

SRA132A

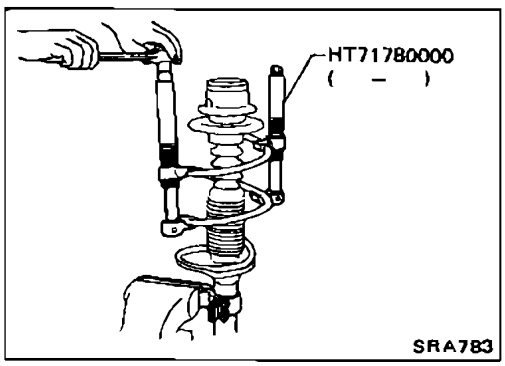
Removal

- Remove shock absorber upper and lower fixing nuts.
- **Do not remove piston rod lock nut on vehicle.**

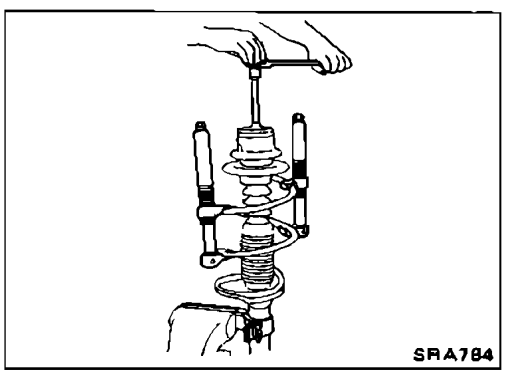


Disassembly

1. Set shock absorber on vise with attachment, then loosen piston rod lock nut.
- **Do not remove piston rod lock nut.**



2. Compress spring with Tool so that the strut upper spring seat can be turned by hand.



3. Remove piston rod lock nut.

Inspection

SHOCK ABSORBER ASSEMBLY

- Check for smooth operation through a full stroke, both compression and extension.
- Check for oil leakage occuring on welded or gland packing portion.
- Check piston rod for cracks, deformation or other damage. Replace if necessary.

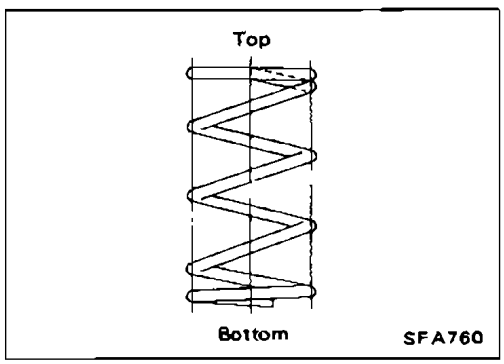
UPPER RUBBER SEAT AND BUSHING

- Check rubber parts for deterioration or cracks. Replace if necessary.

Inspection (Cont'd)

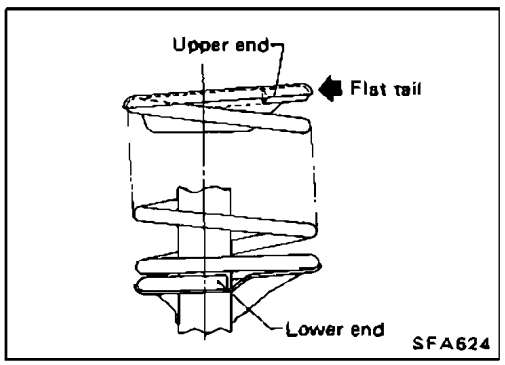
COIL SPRING

- Check for cracks, deformation or other damage. Replace if necessary.

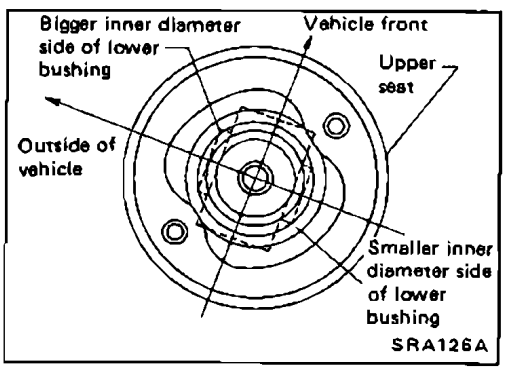


Assembly

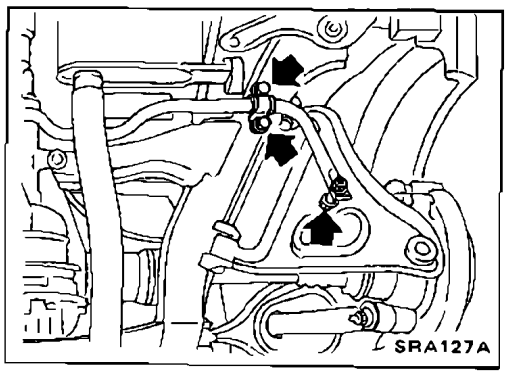
- When installing coil spring, be careful not to reverse top and bottom direction. (Top end is flat.)



- When installing coil spring on strut, it must be positioned as shown in figure at left.



- When installing upper spring seat, make sure that it is positioned as shown.

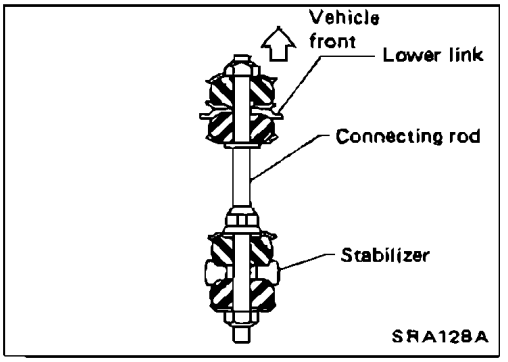


Removal

- Remove connecting rod and clamp.

Inspection

- Check stabilizer bar for deformation or cracks. Replace if necessary.
- Check rubber bushings for deterioration or cracks. Replace if necessary.

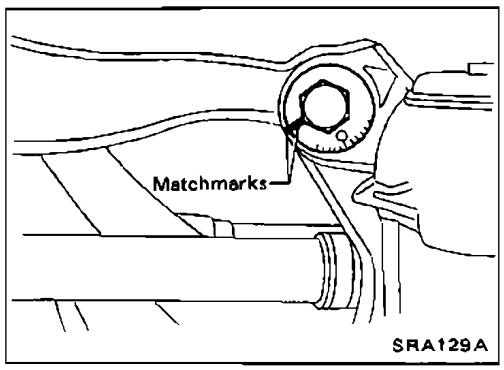


Installation

- When installing connecting rod, make sure direction is correct (as shown at left).

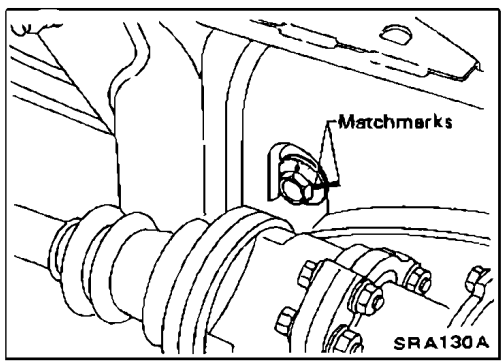
Removal and Installation

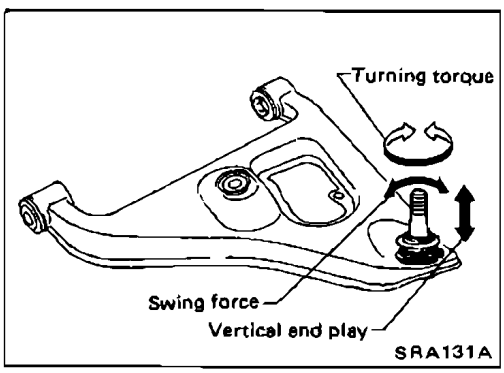
- Refer to "Removal and Installation" of REAR AXLE AND REAR SUSPENSION ASSEMBLY.



Before removing, put matchmarks on adjusting pin.

- When installing, final tightening must be carried out at curb weight with tires on ground.
- After installation, check wheel alignment.
  Refer to "Rear Wheel Alignment" of CHECK AND ADJUSTMENT — On vehicle.





Inspection

REAR SUSPENSION MEMBER

- Replace suspension member assembly if cracked or deformed or if any part (insulator, for example) is damaged.

UPPER AND LOWER LINKS

- Replace upper or lower link as required if cracked or deformed or if bushing is damaged.

SUSPENSION LOWER BALL JOINT

- Measure swing force, turning torque and vertical end play in axial direction. (Use same measurement procedures as that of FA section.)
- If ball stud is worn, play in axial direction is excessive, or joint is hard to swing, replace lower arm.

Ball joint specifications	Swing force	12.7 - 90.2 N (1.3 - 9.2 kg, 2.9 - 20.3 lb)
	Turning torque	0.5 - 3.4 N·m (5 - 35 kg-cm, 4.3 - 30.4 in-lb)
	Vertical end play	0 mm (0 in)

General Specifications

COIL SPRING

Item \ Model		Except Sports package	Sports package
Wire diameter	mm (in)	11.0 (0.433)	11.3 (0.445)
Coil diameter	mm (in)	90 - 100 (3.54 - 3.94)	
Free length	mm (in)	367.5 (14.47)	355 (13.98)
Spring constant	N/mm (kg/mm, lb/in)	19.6 (2.0, 112)	21.6 (2.2, 123)
Identification color		Pink x 2	Light green x 2

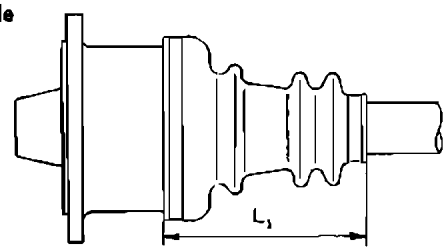
SHOCK ABSORBER

Item \ Model		Except Sports package	Sports package
Piston rod diameter	mm (in)	12.5 (0.492)	
Stroke	mm (in)	155 (6.10)	
Damping force [at 0.1 m (0.3 ft)/sec.]	N (kg, lb)		
Expansion		314 - 471 (32 - 48, 71 - 106)	392 - 588 (40 - 60, 88 - 132)
Compression		157 - 235 (16 - 24, 35 - 53)	196 - 294 (20 - 30, 44 - 66)
Damping force [at 0.3 m (1.0 ft)/sec.]	N (kg, lb)		
Expansion		647 - 902 (66 - 92, 146 - 203)	
Compression		363 - 539 (37 - 55, 82 - 121)	

DRIVE SHAFT

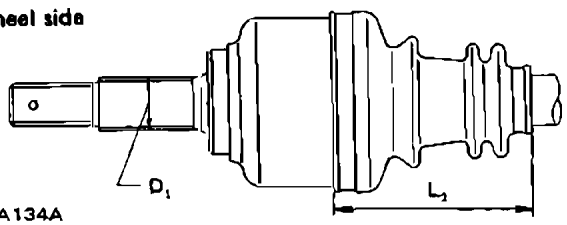
Joint type		
Final drive side		TS82F
Wheel side		TS82C
Diameter	mm (in)	
Wheel side D_1		30 (1.18)
Grease name		
Final drive side		Nissan genuine grease or equivalent
Wheel side		Nissan genuine grease or equivalent
Specified amount of grease	g (oz)	
Final drive side		185 - 195 (6.52 - 6.88)
Wheel side		145 - 155 (5.11 - 5.47)
Boot length	mm (in)	
Final drive side (L_1)		110.5 - 112.5 (4.35 - 4.43)
Wheel side (L_2)		

Final drive side



SRA133A

Wheel side



SRA134A

REAR STABILIZER BAR

Item \ Model		Except Sports package	Sports package
Stabilizer diameter	mm (in)	15 (0.59)	17 (0.67)
Identification color		Light green	Light blue

Inspection and Adjustment

WHEEL ALIGNMENT (Unladen*)

Camber	degree	−1°36' to −0°36'
Toe-out	mm (in)	0.5 - 4.5 (0.020 - 0.177)
	(Total) degree	1.5' - 12.5'

* Tankful of fuel, radiator coolant and engine oil full.
Spare tire, jack, hand tools, mats in designated position.

WHEEL BEARING

Wheel bearing axial end play mm (in)	0.05 (0.0020) or less
Wheel bearing lock nut Tightening torque N·m (kg-m, ft-lb)	235 - 314 (24 - 32, 174 - 231)

WHEEL RUNOUT (Radial and lateral)

Wheel type		Radial runout	Lateral runout
Aluminum wheel	mm (in)	0.3 (0.012) or less	
Steel wheel	mm (in)	0.5 (0.020) or less	0.8 (0.031) or less

LOWER BALL JOINT

Swing force (Measuring point: cotter pin hole of ball stud) N (kg, lb)	12.7 - 90.2 (1.3 - 9.2, 2.9 - 20.3)
Turning torque N·m (kg-cm, in-lb)	0.5 - 3.4 (5 - 35, 4.3 - 30.4)
Vertical end play mm (in)	0 (0)

BRAKE SYSTEM

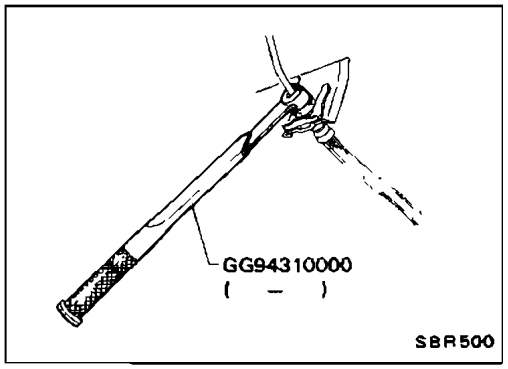
SECTION BR

CONTENTS

PRECAUTIONS AND PREPARATION ..... BR- 2
CHECK AND ADJUSTMENT ..... BR- 3
BRAKE HYDRAULIC LINE ..... BR- 4
BRAKE PEDAL AND BRACKET ..... BR- 6
BRAKE BOOSTER ..... BR- 8
VACUUM PIPING BR-10
MASTER CYLINDER BR-12
FRONT DISC BRAKE (CL22VB, CL25VA) — Caliper BR-13
FRONT DISC BRAKE (CL22VB, CL25VA) — Rotor BR-17
REAR DISC BRAKE (CL9H) — Caliper BR-18
REAR DISC BRAKE (CL9H) — Rotor BR-22
PARKING BRAKE CONTROL BR-23
ANTI-LOCK BRAKING SYSTEM BR-25
TROUBLE DIAGNOSES BR-29
SERVICE DATA AND SPECIFICATIONS (S.D.S.) BR-54

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 rubber parts of hydraulic system.**



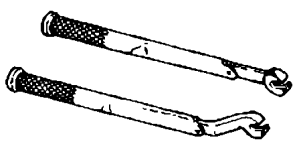
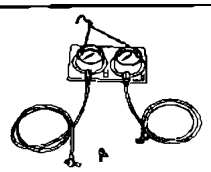
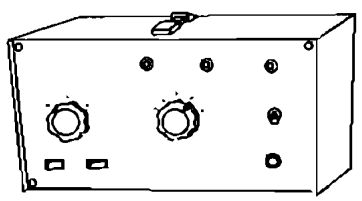
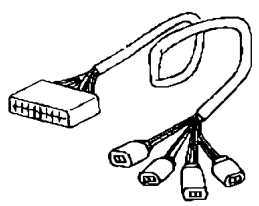
- **Use Tool when removing and installing brake tube.**

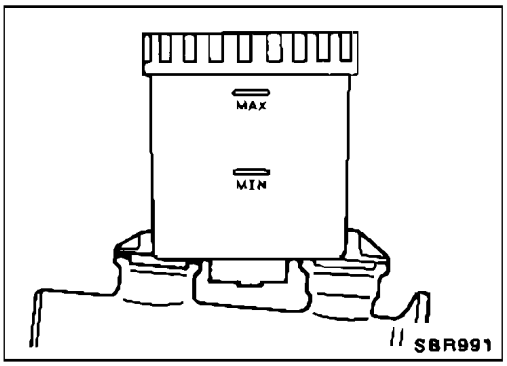
WARNING:

- **Clean brake pads and shoes with a waste cloth, then collect dust with a dust collector.**

Preparation

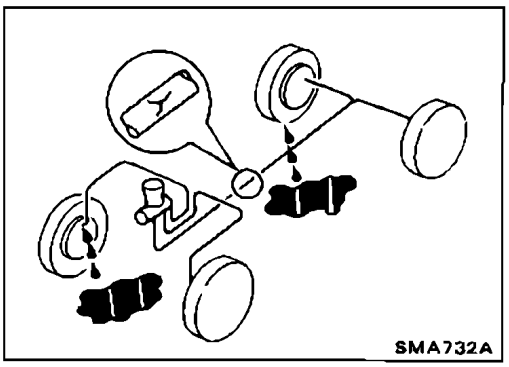
SPECIAL SERVICE TOOL

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
KV999P1000 (–) A.B.S. checker		Checking brake fluid pressure of A.B.S. actuator
KV999P1010 (–) A.B.S. checker adapter harness		Checking brake fluid pressure of A.B.S. actuator



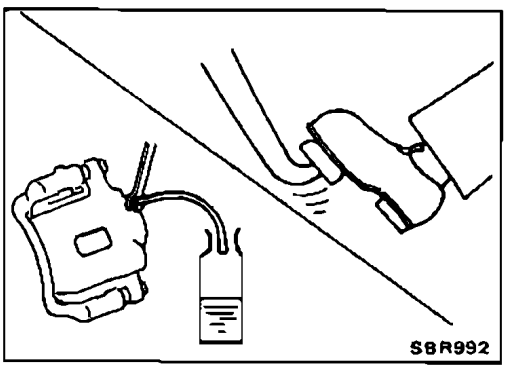
Checking Brake Fluid Level

- 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

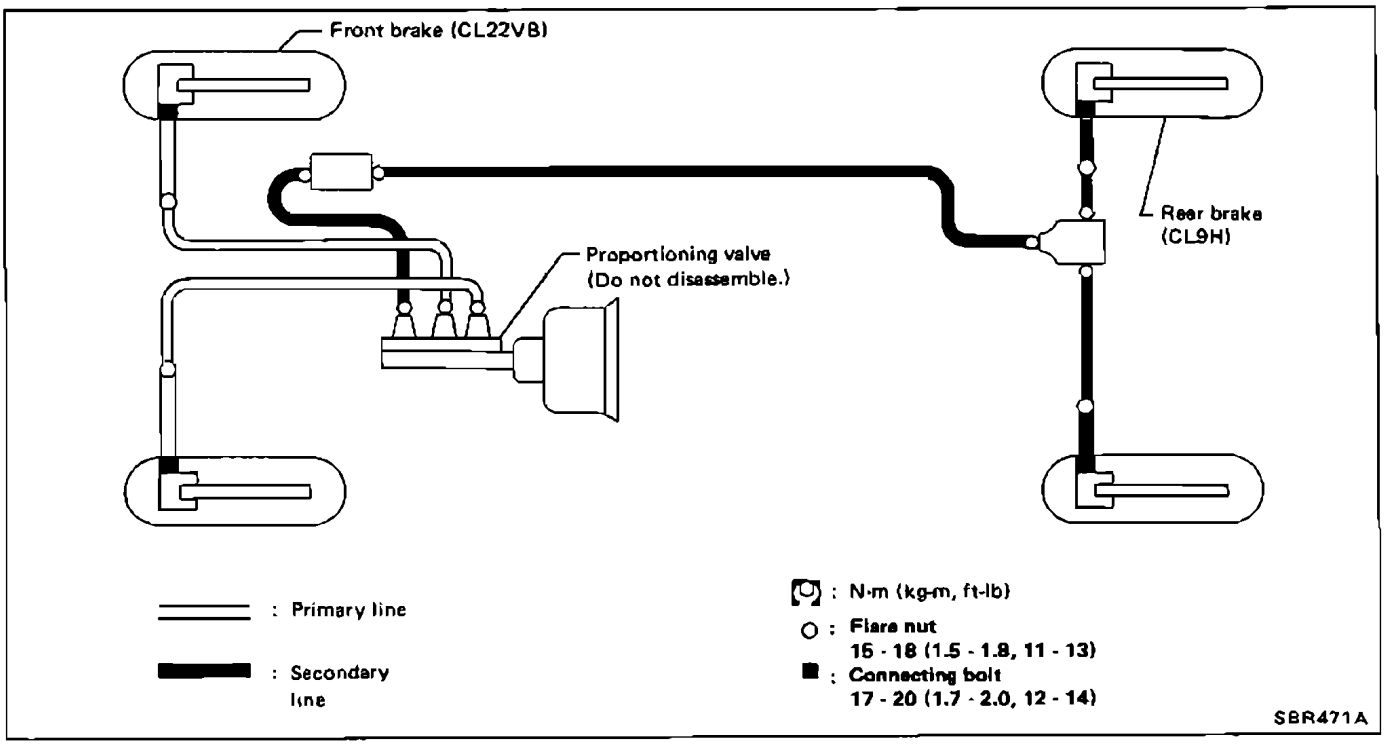
- Check brake lines (tubes and hoses) for cracks, deterioration or other damage. Replace any damaged parts.
  If leakage occurs around joints, retighten or, if necessary, replace damaged parts.
- Check for oil leakage by fully depressing brake pedal.

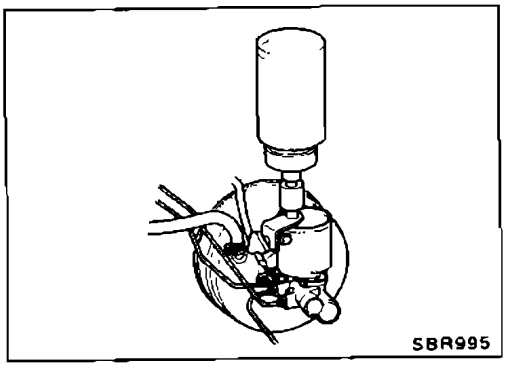


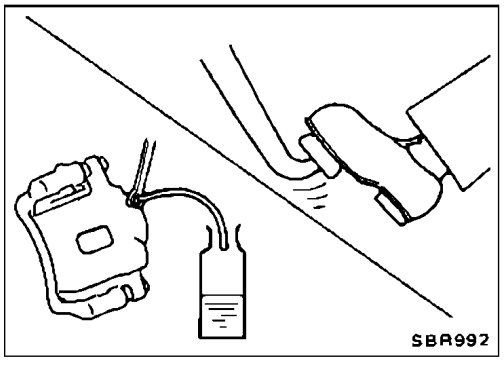
Changing Brake Fluid

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.

- **Refill with recommended brake fluid "DOT 3".**
- **Never reuse drained brake fluid.**
- **Be careful not to splash brake fluid on painted areas.**







Bleeding Procedure

CAUTION:

- **Carefully monitor brake fluid level at master cylinder during bleeding operation.**
- **Fill reservoir with recommended brake fluid. Make sure it is full at all times while bleeding air out of system.**
- **Place a container beneath master cylinder to avoid spillage of brake fluid.**

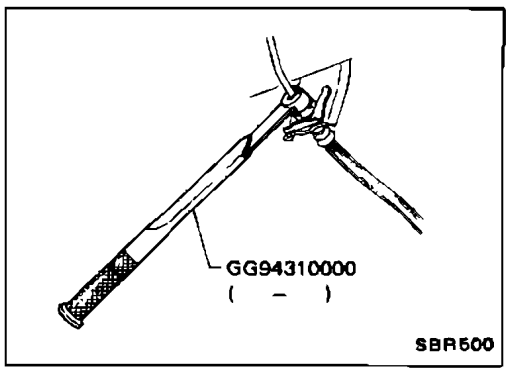
- Bleed air according to the following procedure.

Without Anti-lock Braking System:

Left rear caliper
↓
Right rear caliper
↓
Left front caliper
↓
Right front caliper

With Anti-lock Braking System:

Left rear caliper
↓
Right rear caliper
↓
Left front caliper
↓
Right front caliper
↓
Front side air bleeder on A.B.S. actuator
↓
Rear side air bleeder on A.B.S. actuator



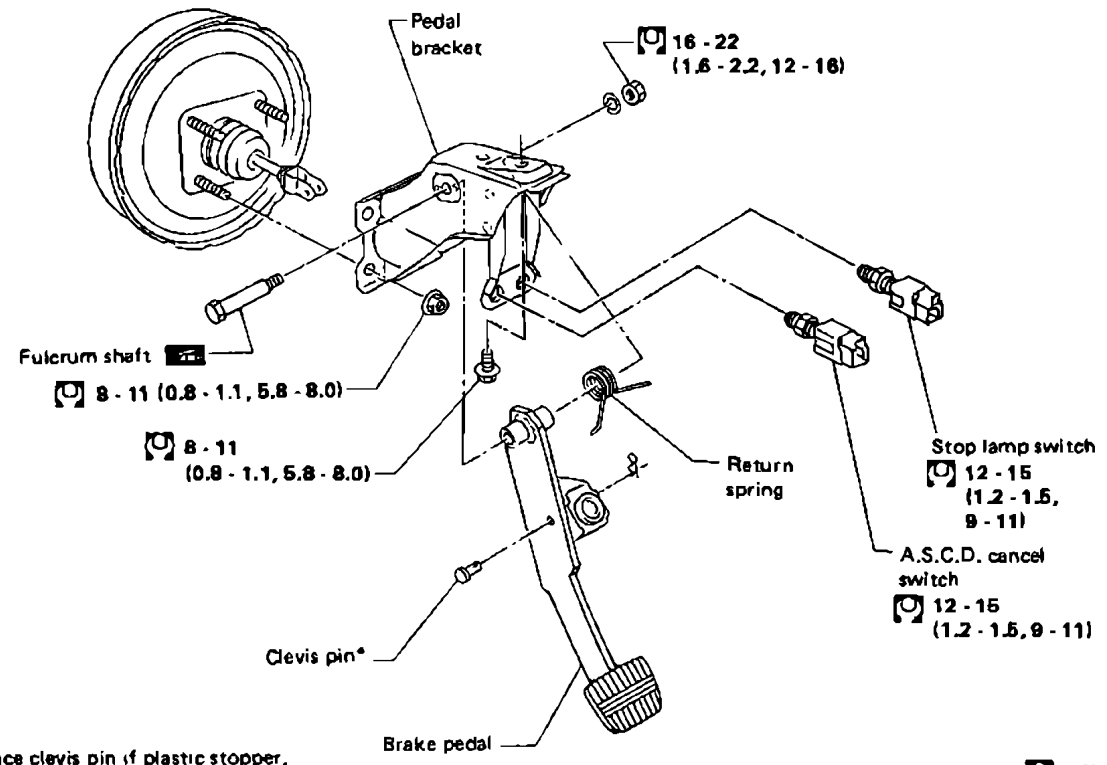
Removal and Installation

1. To remove brake hose, first remove flare nut securing brake tube to hose, then withdraw lock spring.
2. Cover openings to prevent entrance of dirt whenever disconnecting hydraulic line.
3. All hoses must be free from excessive bending, twisting and pulling.
4. After installing brake lines, check for oil leakage by fully depressing brake pedal.

Inspection

Check brake lines (tubes and hoses) for cracks, deterioration or other damage. Replace any damaged parts.
If leakage occurs around joints, retighten or, if necessary, replace damaged parts.

Removal and Installation



* Replace clevis pin if plastic stopper, which is located at the end of clevis pin, is deformed or damaged.

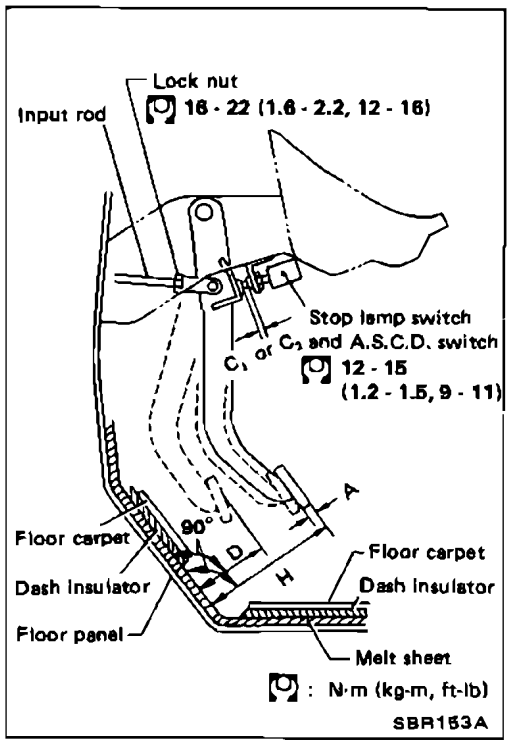
: N·m (kg-m, ft-lb)

SBR472A

Inspection

Check brake pedal for following items.

- Brake pedal bend
- Clevis pin deformation
- Crack of any welded portion



Adjustment

Check brake pedal free height from dash reinforcement panel. Adjust if necessary.

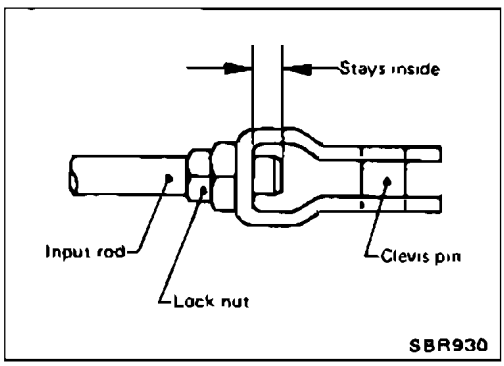
H: **Free height**
Refer to S.D.S.

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.

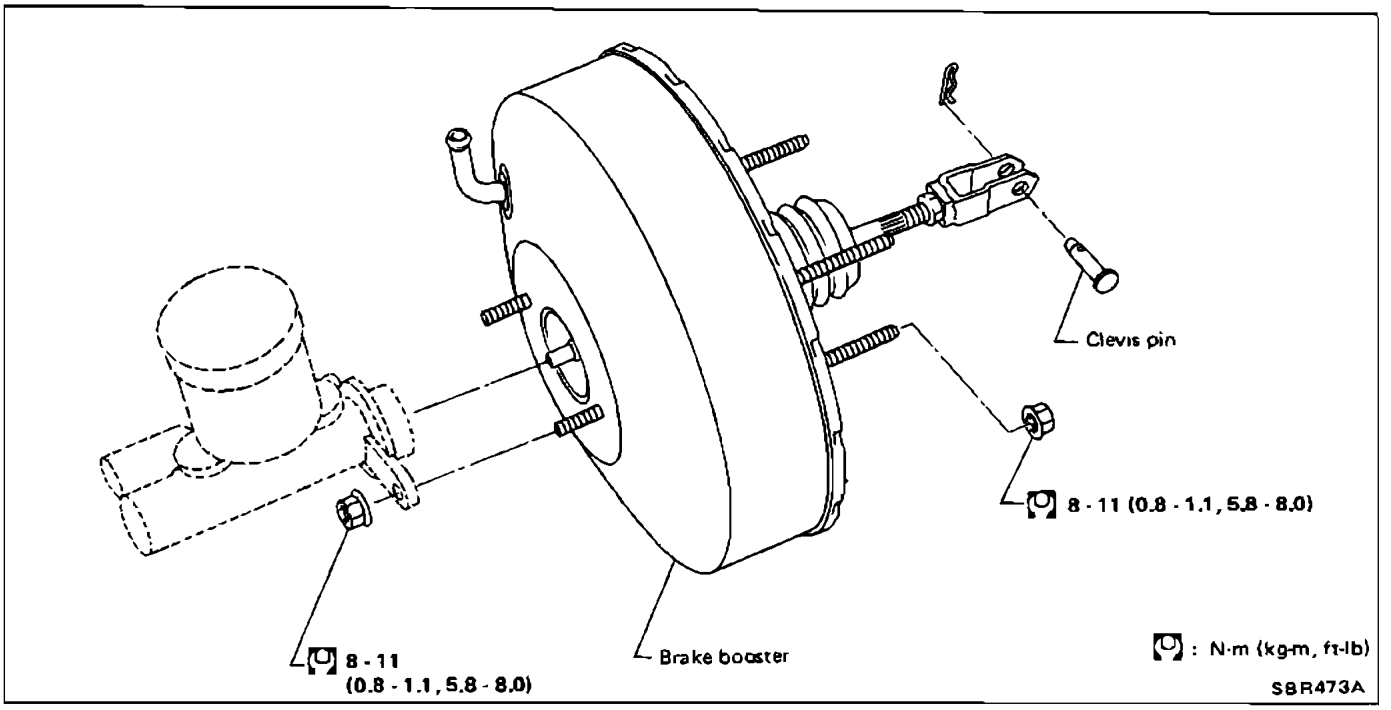
Make sure that tip of input rod stays inside.

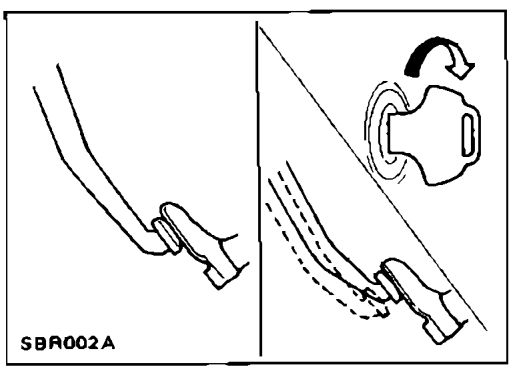
2. Adjust clearance "C_1" and "C_2" with stop lamp switch and A.S.C.D. switch respectively. Then tighten lock nuts.
3. Check pedal free play.

Make sure that stop lamp is off when pedal is released.

4. Check brake pedal's depressed height while engine is running.
   If depressed height is below specified value, check brake system for leaks, accumulation of air or any damage to components (master cylinder, wheel cylinder, etc.); then make necessary repairs.

Removal and Installation

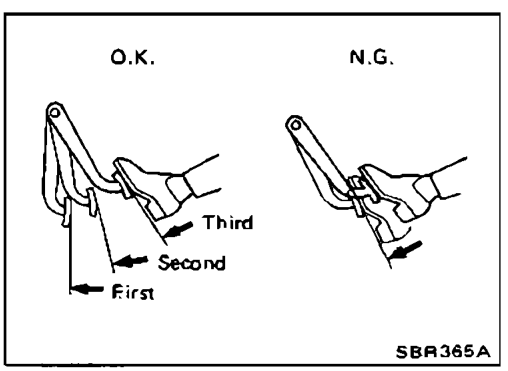




Inspection

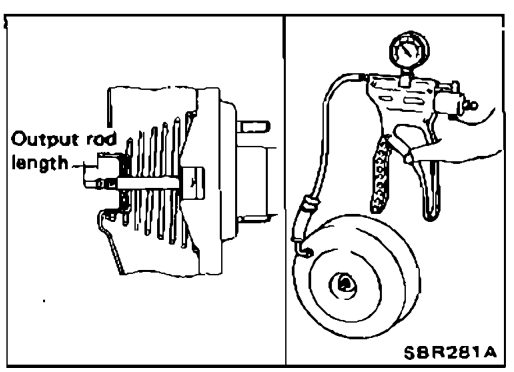
OPERATING CHECK

- Depress brake pedal several times with engine off, and 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

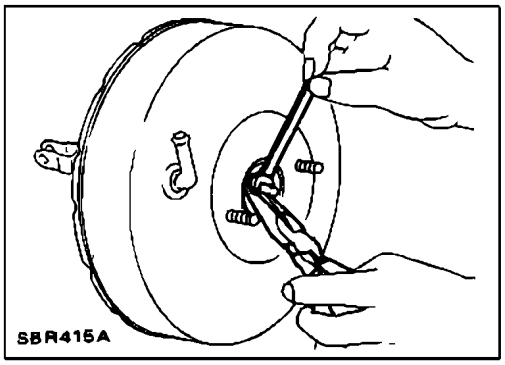
- Start engine, and stop it after one or two minutes. Depress brake pedal several times slowly. If pedal goes further down the first time and gradually rises after second or third time, booster is airtight.
- Depress brake pedal while engine is running, and stop engine with pedal depressed. If there is no change in pedal stroke after holding pedal down **30 seconds**, brake booster is airtight.



OUTPUT ROD LENGTH CHECK

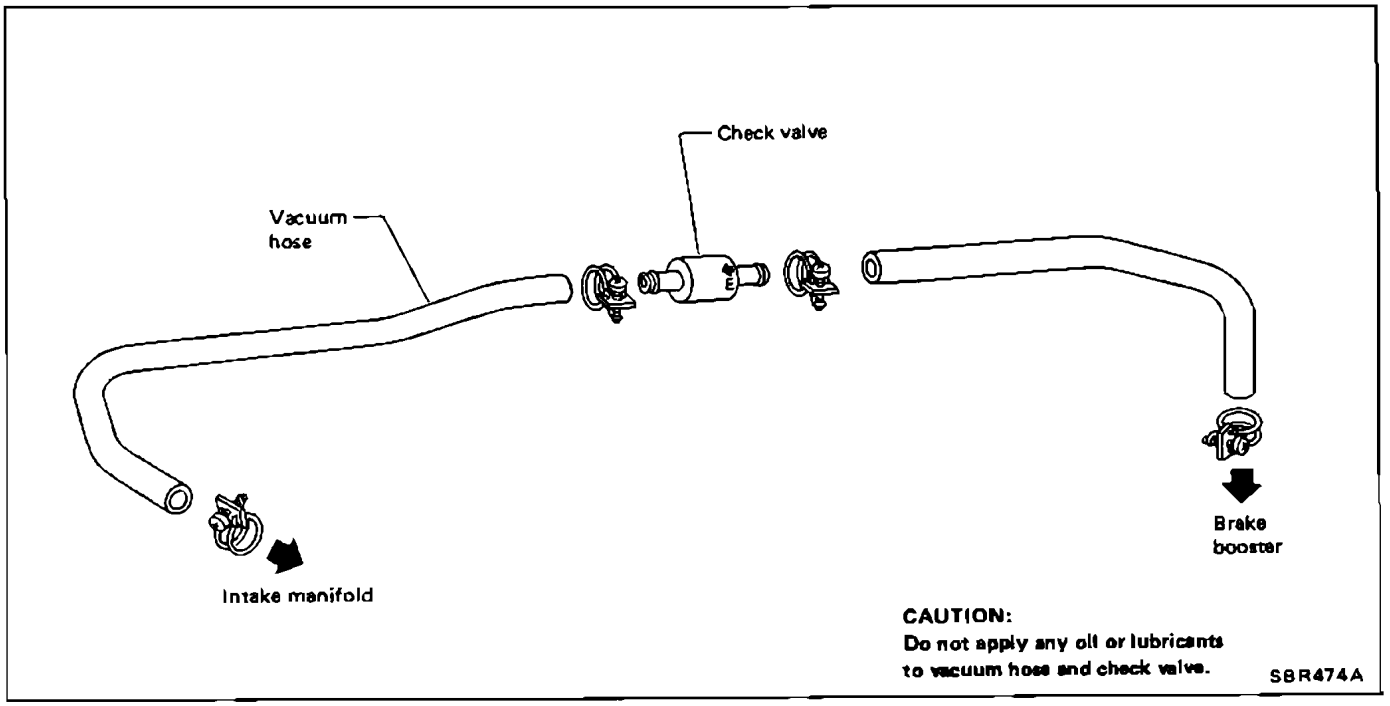
1. Supply brake booster with vacuum of –66.7 kPa (–500 mmHg, –19.69 inHg) using a handy vacuum pump.
2. Check output rod length.
   Specified length:
   10.275 - 10.525 mm (0.4045 - 0.4144 in)

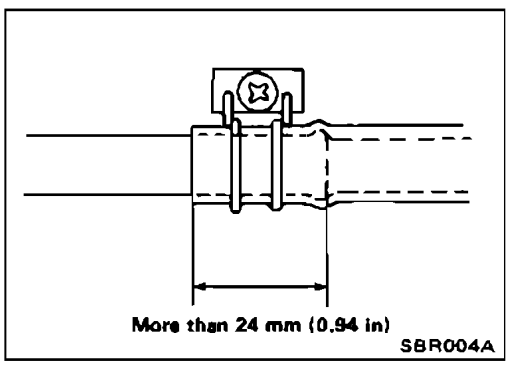
Inspection (Cont'd)



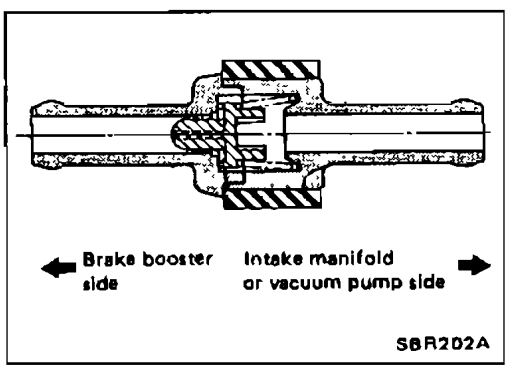
3. Adjust rod length if necessary.
4. If rod length is without specification, replace brake booster.

Removal and Installation

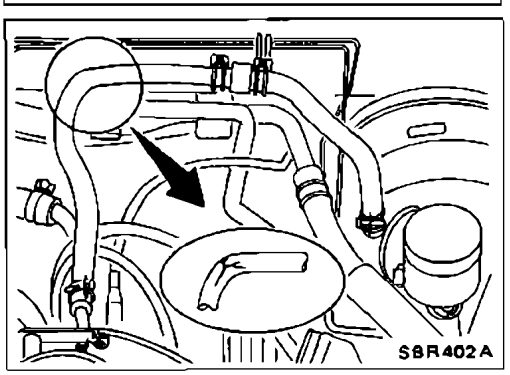




- Insert vacuum tube into vacuum hose more than 24 mm (0.94 in).



- Install check valve, paying attention to its direction.



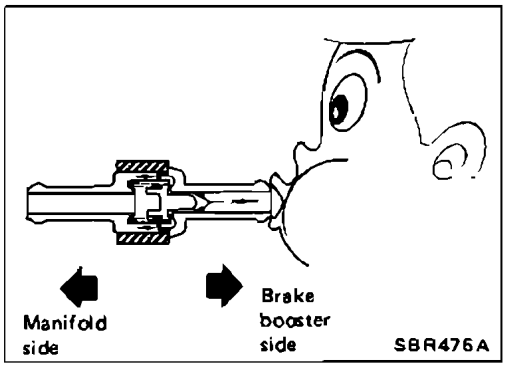
Inspection

HOSES AND CONNECTORS

- Check vacuum lines, connections and check valve for airtightness, improper attachment chafing and deterioration.

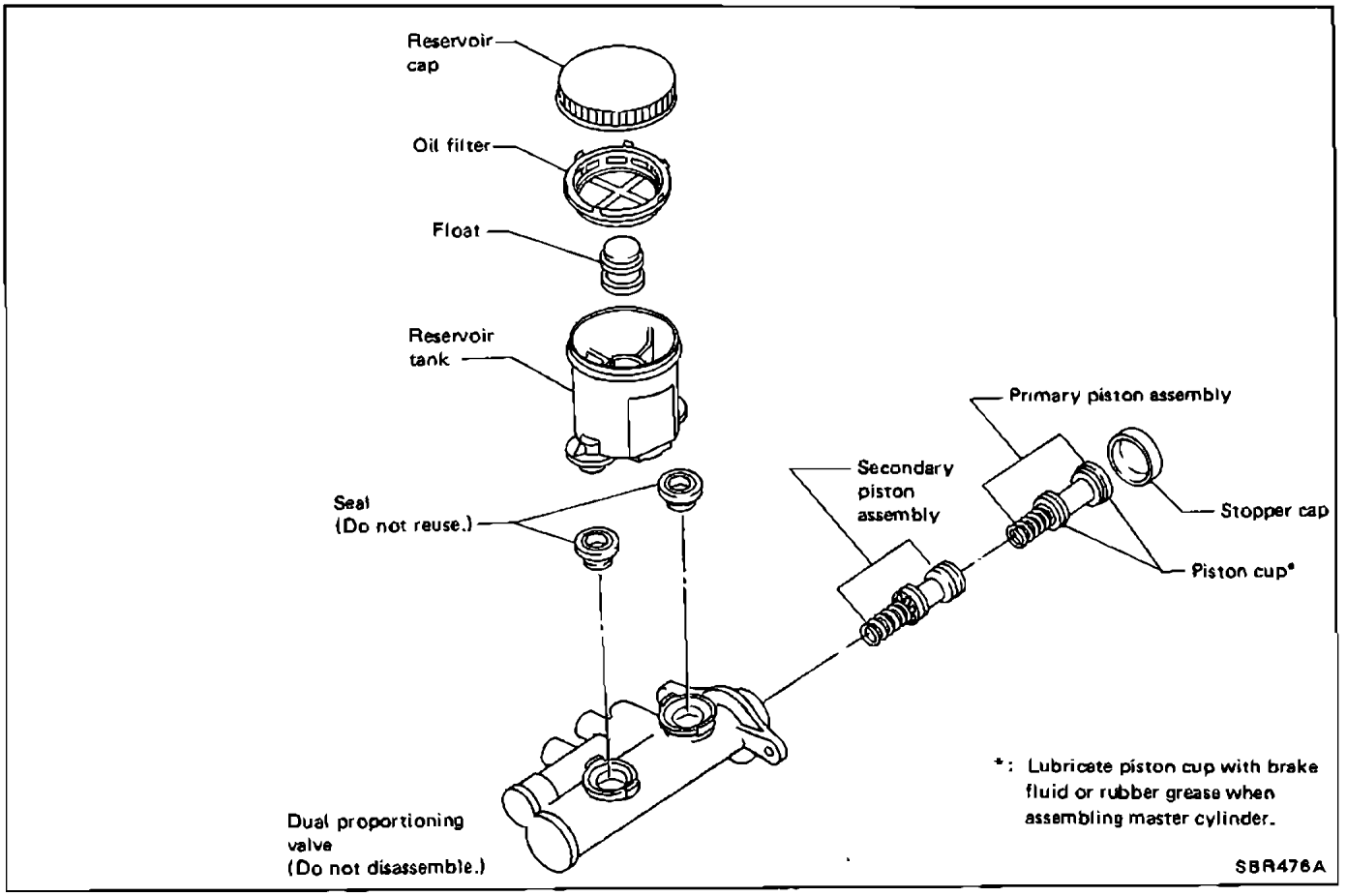
Inspection (Cont'd)

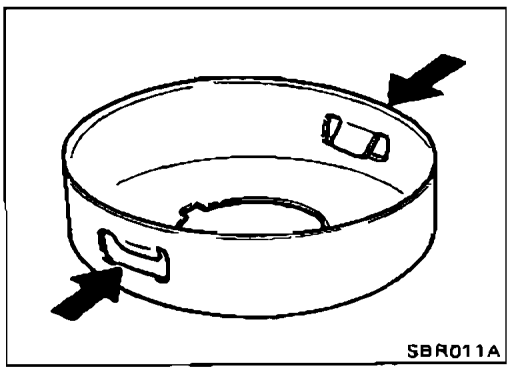
CHECK VALVE



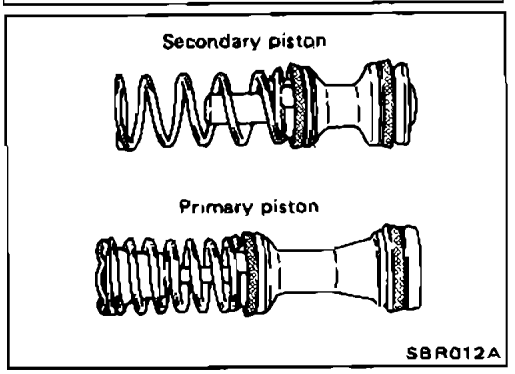
- When pressure is applied to brake booster side of check valve and valve does not open, replace check valve with a new one.

Removal and Installation

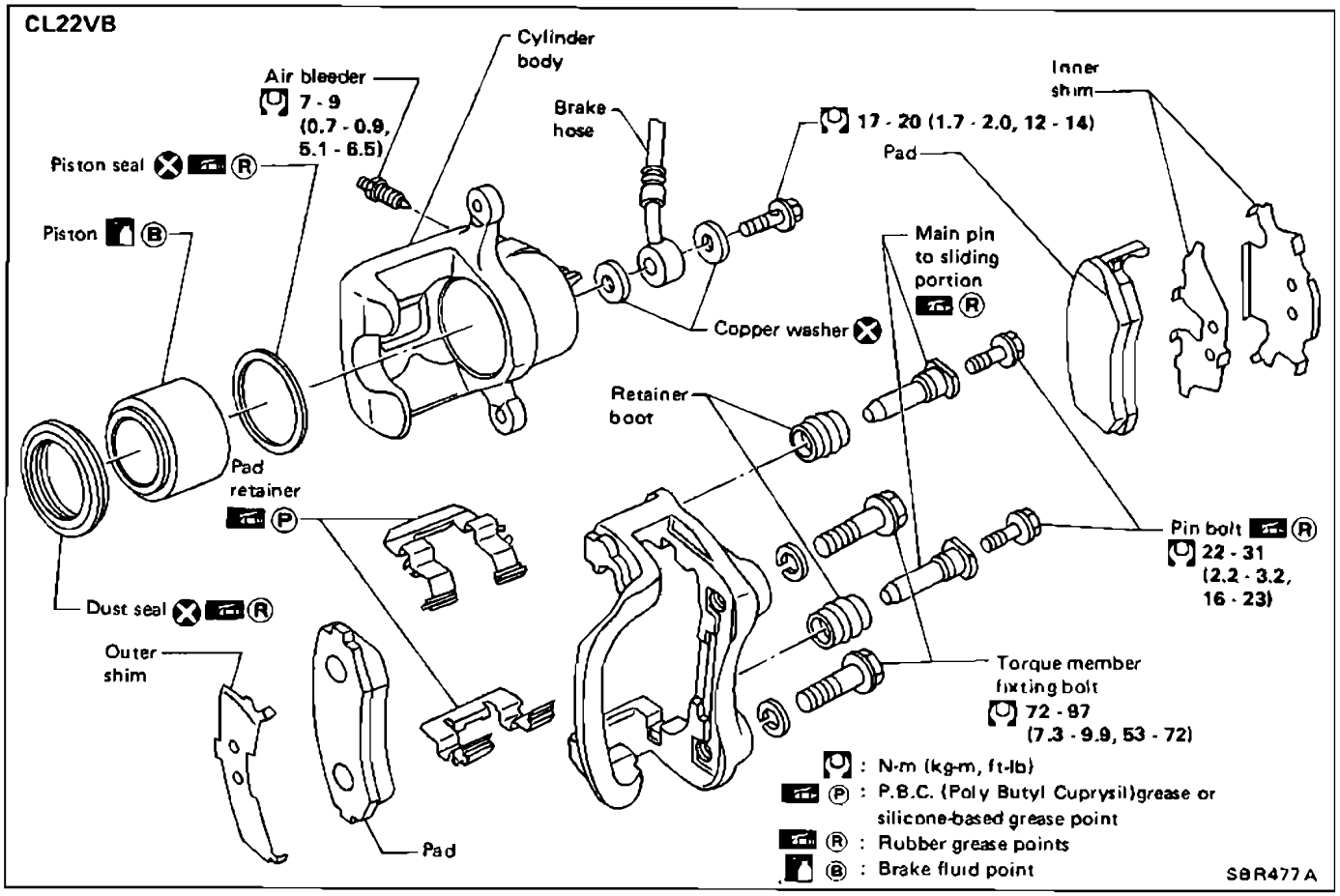


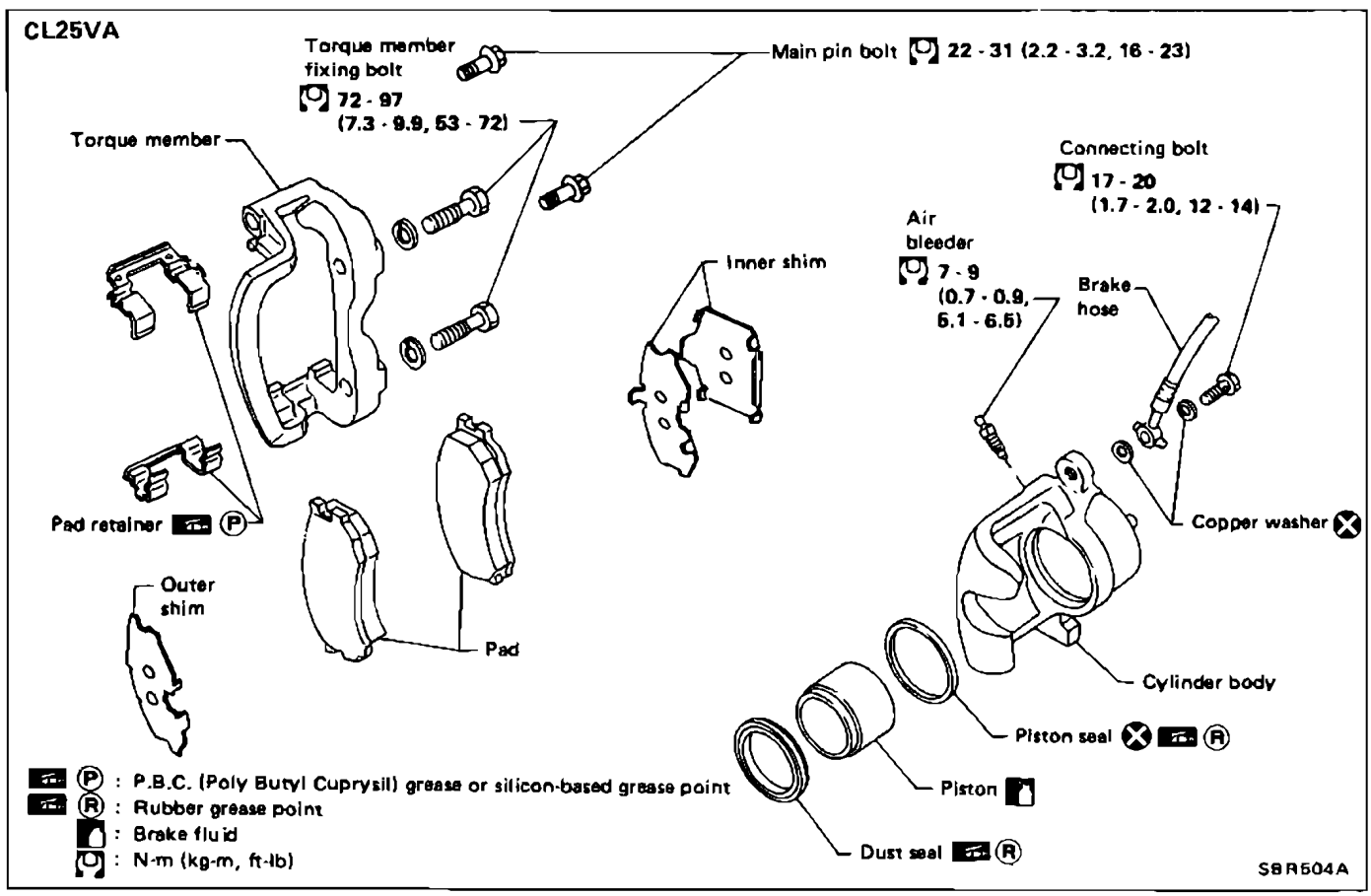


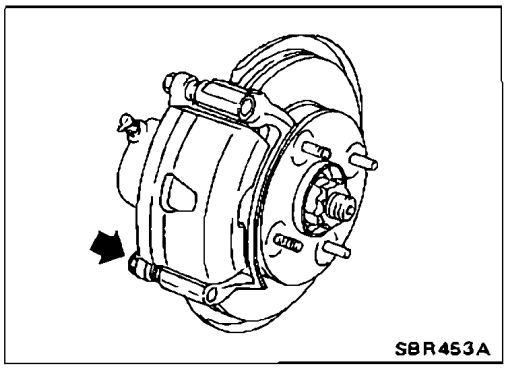
- Replace stopper cap if claw is damaged or deformed.
- Bend claws inward when installing stopper cap.



- Pay attention to direction of piston cups in figure at left.
- Check parts for wear or damage. Replace if necessary.

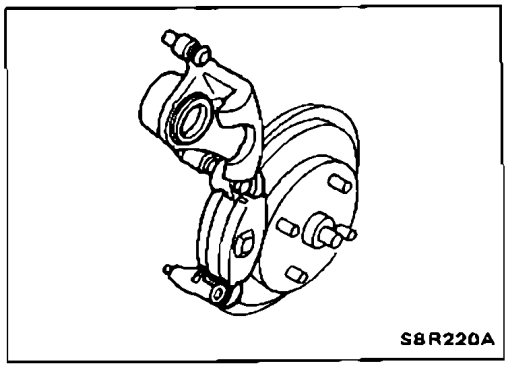

CL22VB
Cylinder body
Air bleeder
7 - 9 (0.7 - 0.9, 5.1 - 6.5)
Brake hose
17 - 20 (1.7 - 2.0, 12 - 14)
Inner shim
Pad
Piston seal
Piston
Main pin to sliding portion
Copper washer
Retainer boot
Pad retainer
Pin bolt
22 - 31 (2.2 - 3.2, 16 - 23)
Dust seal
Outer shim
Torque member fixing bolt
72 - 97 (7.3 - 9.9, 53 - 72)
Pad
: N-m (kg-m, ft-lb)
: P.B.C. (Poly Butyl Cuprysil)grease or silicone-based grease point
: Rubber grease points
: Brake fluid point
SBR477A


CL25VA
Torque member fixing bolt
72 - 97 (7.3 - 9.9, 53 - 72)
Main pin bolt
22 - 31 (2.2 - 3.2, 16 - 23)
Torque member
Connecting bolt
17 - 20 (1.7 - 2.0, 12 - 14)
Air bleeder
7 - 9 (0.7 - 0.9, 5.1 - 6.5)
Inner shim
Brake hose
Pad retainer
Copper washer
Outer shim
Pad
Cylinder body
Piston seal
Piston
Dust seal
: P.B.C. (Poly Butyl Cuprysil) grease or silicon-based grease point
: Rubber grease point
: Brake fluid
: N-m (kg-m, ft-lb)
SBR504A


SBR453A

Pad Replacement

1. Remove pin bolt.


SBR220A

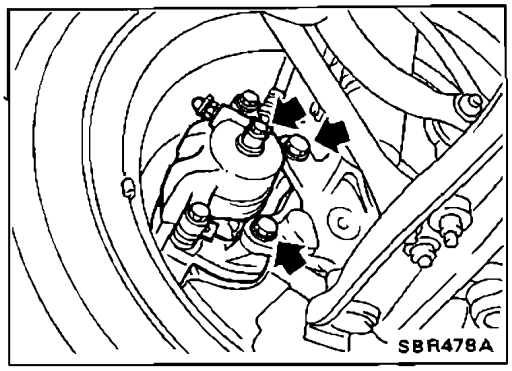
2. Swing cylinder body upward. Then remove pad retainer, and inner and outer shims.

CAUTION:

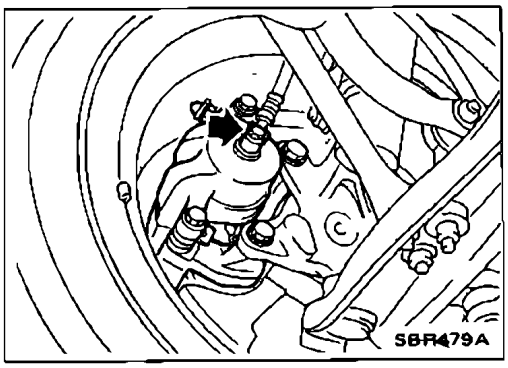
- **When cylinder body is swung up, do not depress brake pedal because piston will pop out.**
- **Be careful not to damage dust seal or get oil on rotor. Always replace shims when replacing pads.**

Removal and Installation

- Remove torque member fixing bolts and union bolt.

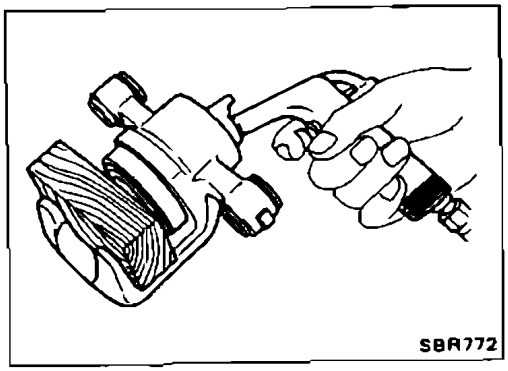

SBR478A

- Install brake hose to caliper at protrusions securely.


SBR479A

Disassembly

Push out piston with dust seal using compressed air.


SBR772

Inspection

CYLINDER BODY

- Check inside surface of cylinder for scoring, rust, wear, damage or foreign materials. Replace if any such condition exists.
- Eliminate minor damage from rust or foreign materials by polishing surface with fine emery paper.

CAUTION:

Use brake fluid to clean.

PISTON

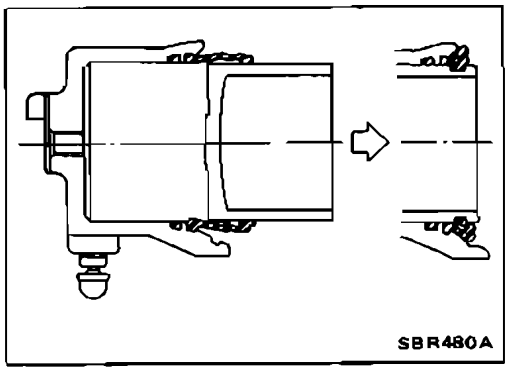
Check piston for scoring, rust, wear, damage or foreign materials. Replace if any condition exists.

CAUTION:

Piston sliding surface is plated. Do not polish with emery paper even if rust or foreign materials are stuck to sliding surface.

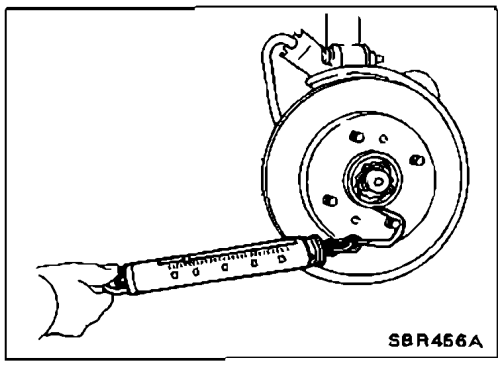
PIN, PIN BOLT AND PIN BOOT

Check for wear, cracks or other damage. Replace if any condition exists.


SBR480A

Assembly

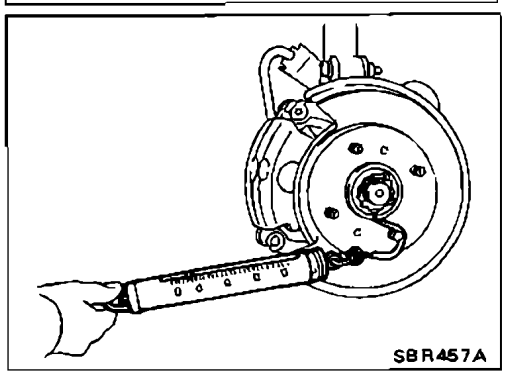
- Place piston boot over rear of piston. Fit piston boot's lip properly in corresponding groove on cylinder body.
- Insert piston into cylinder body and fit boot's lip properly in corresponding groove on piston.


SBR456A

Inspection (On-vehicle)

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).

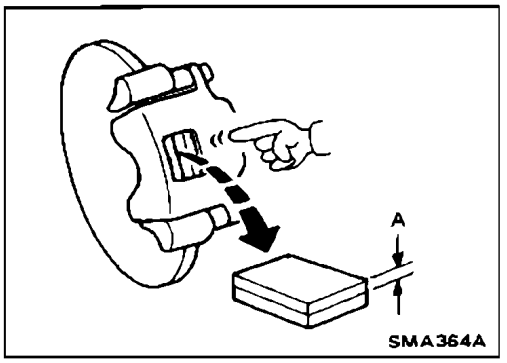

SBR457A

4. Install caliper with pads to original position.
5. Depress brake pedal for 5 seconds.
6. Release brake pedal and 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 ($F_2 - F_1$):

   59.8 N (6.1 kg, 13.5 lb)

   If it is not within specification, check main pins and retainer boots in caliper.



DISC PAD

Check disc pad for wear or damage.

Pad standard thickness (A):

10.0 mm (0.394 in)

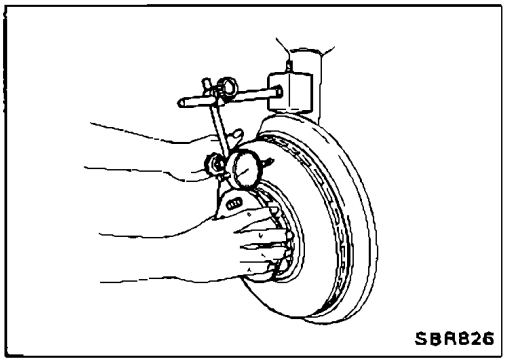
Pad wear limit (A):

2.0 mm (0.079 in)

Inspection

RUBBING SURFACE

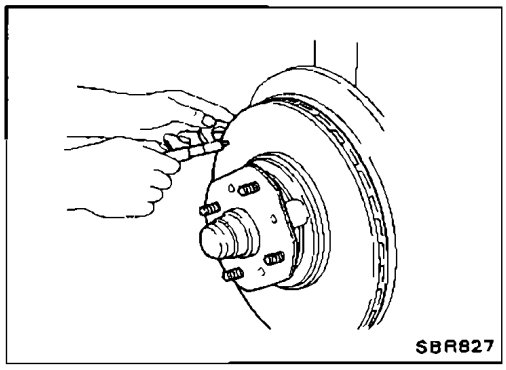
Check rotor for roughness, cracks or chips.


SBR826

RUNOUT

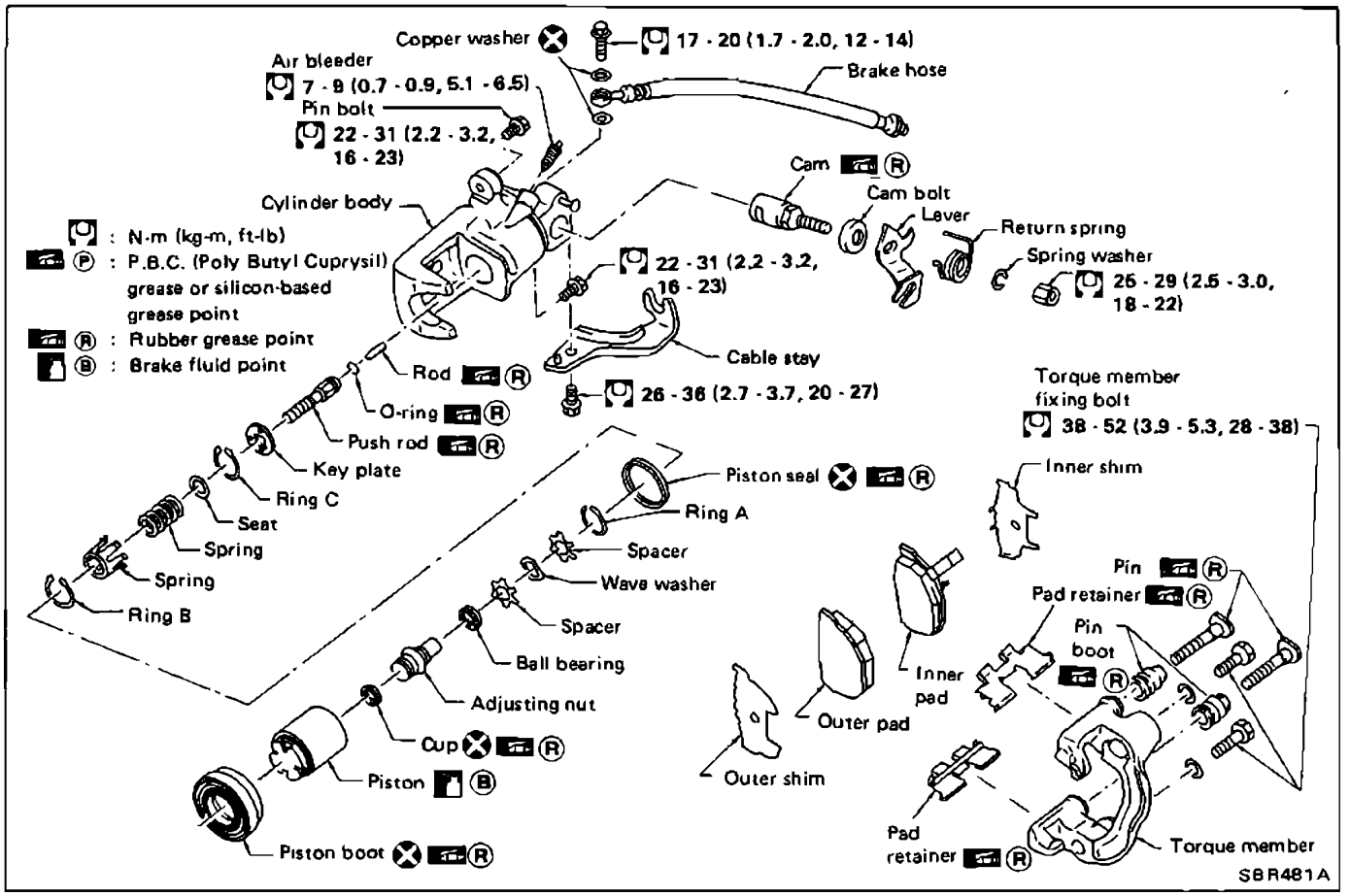
Adjust wheel bearing preload. Check runout using a dial indicator.

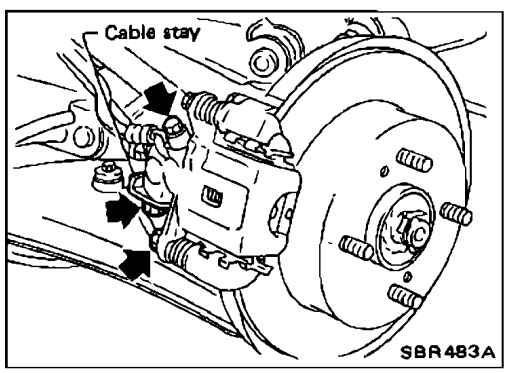
Rotor repair limit:
Maximum runout
(Total indicator reading at center of rotor pad contact surface)
0.07 mm (0.0028 in)

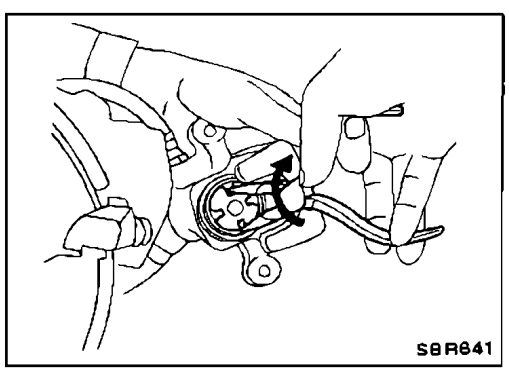

SBR827

THICKNESS

Standard thickness:
20.0 mm (0.787 in)
Minimum thickness:
18.0 mm (0.709 in)







Pad Replacement

CAUTION:

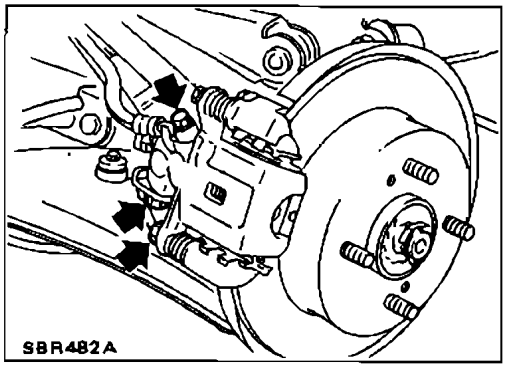
When cylinder body is swung up, do not depress brake pedal because piston will pop out.

- Remove parking cable stay fixing bolt, pin bolts and lock spring. Then remove pad retainers, pads and shims.

- When installing pads, retract piston into cylinder body by turning it clockwise.

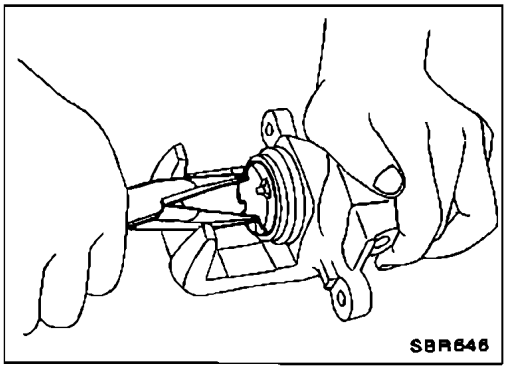
Be careful not to damage piston boot or get oil on rotor.

Always replace shims when replacing pads.



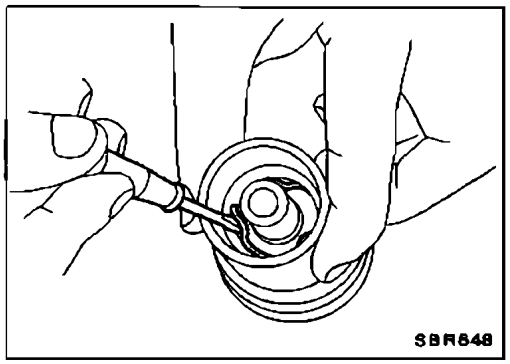
Removal and Installation

Disconnect parking brake cable and brake hose, then remove caliper assembly.

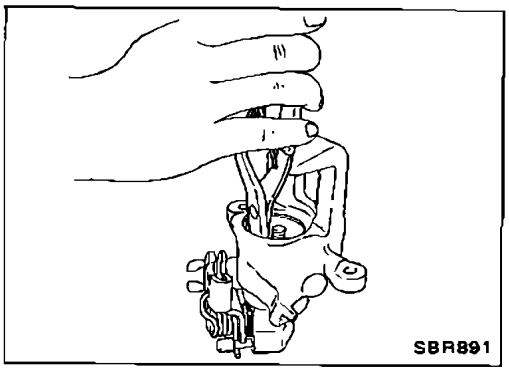


Disassembly

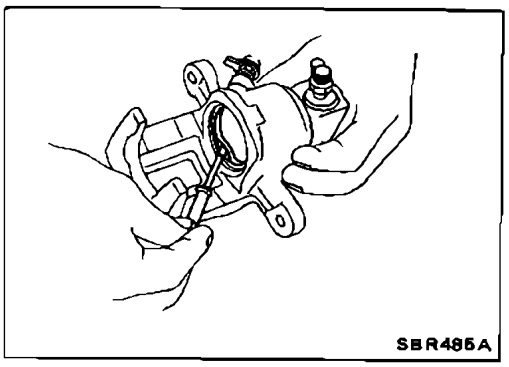
1. Remove piston by turning it counterclockwise with suitable longnose pliers.



2. Pry off ring A from piston with suitable pliers and remove adjusting nut.



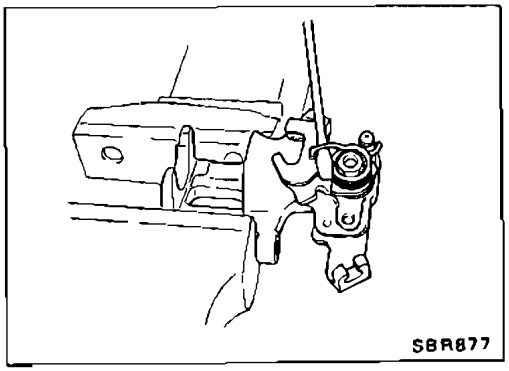
3. Disassemble cylinder body.
- Pry off rings B and C with pliers, then remove spring cover, spring and seat.



- Remove piston seal.

Be careful not to damage cylinder body.

Disassembly (Cont'd)



4. Remove return spring and lever.

Inspection

CYLINDER BODY

- Check inside surface of cylinder for score, rust, wear or other damage.
- Minor damage from rust of foreign materials may be eliminated by polishing surface with a fine emery paper. Replace if necessary.

CAUTION:
Use brake fluid to clean.

TORQUE MEMBER

Check for wear, cracks or other damage. Replace if necessary.

PISTON

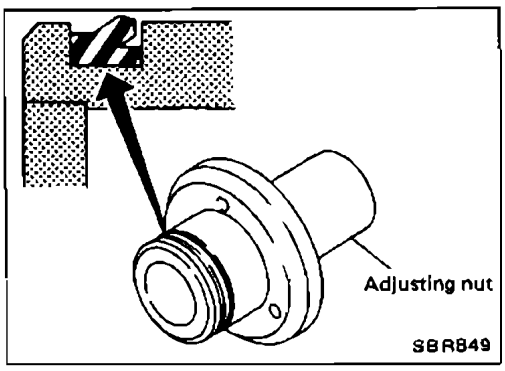
Check piston for score, rust, wear or other damage. Replace if necessary.

CAUTION:
Piston sliding surface is plated. Do not polish with emery paper even if rust or foreign matter is stuck to sliding surface.

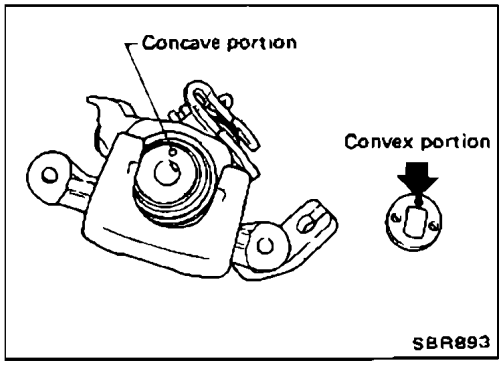
PIN AND PIN BOOT

Check for wear, cracks or other damage. Replace if necessary.

Assembly

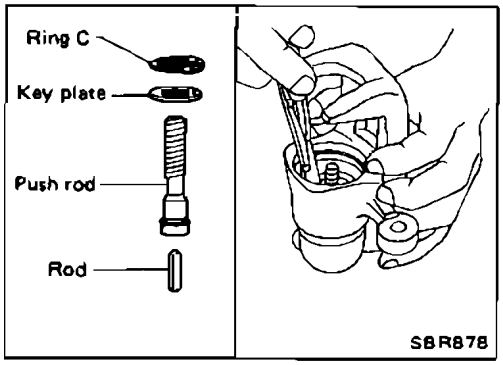


- Install cup securely in the specified direction.

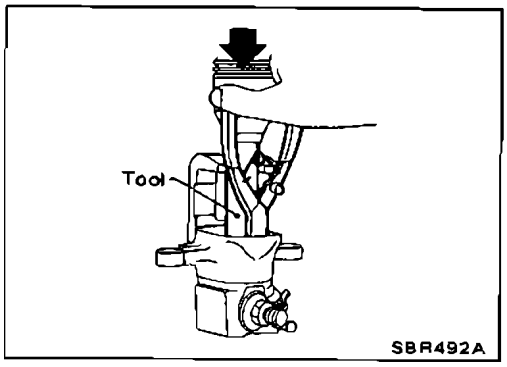


- Fit push rod into square hole in key plate. Also match convex portion of key plate with concave portion of cylinder.

Assembly (Cont'd)



- Install ring C with suitable tool.

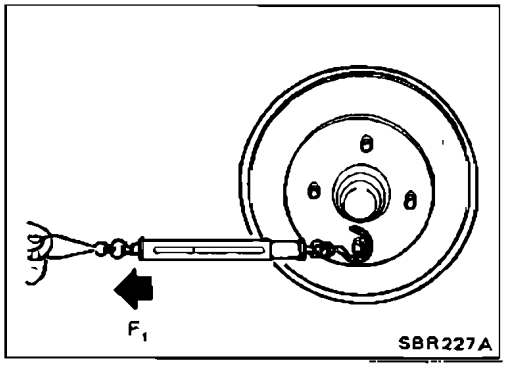


- Install seat, spring, spring cover and ring B with suitable press and drift.

Inspection (On-vehicle)

INSPECTION OF BRAKE DRAG FORCE

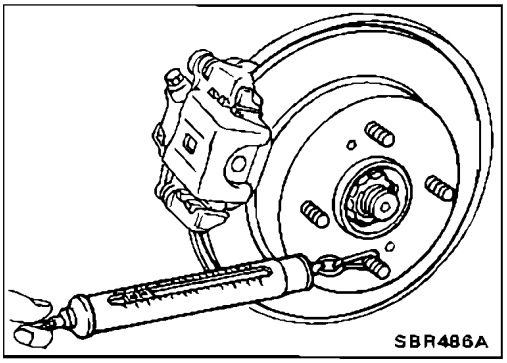
1. Swing cylinder body upward.
2. Make sure that wheel bearing is adjusted properly. Refer to section RA.
3. Measure rotating force (F_1).



4. Install caliper with pads to 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 ($F_2 - F_1$):
86.3 N (8.8 kg, 19.4 lb)

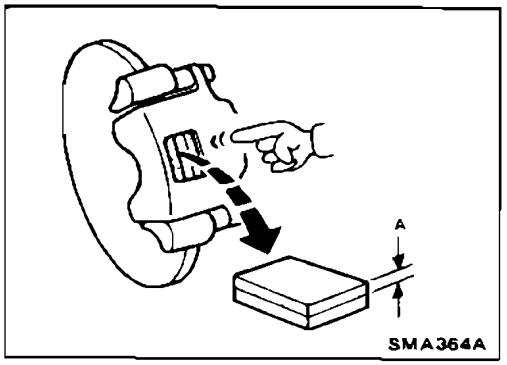
If it is not within specification, check pins and pin boots in caliper.



DISC PAD

Check disc pad for wear or damage.

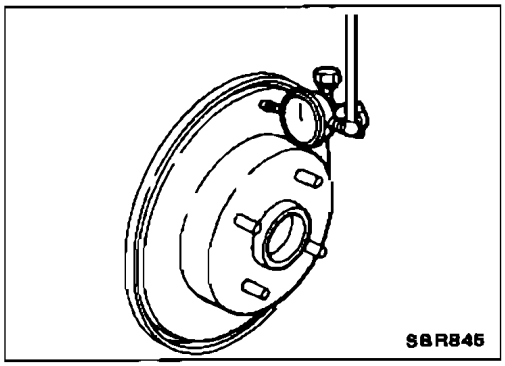
Standard thickness (A):
9.5 mm (0.374 in)
Pad wear limit (A):
2.0 mm (0.079 in)



Inspection

RUBBING SURFACE

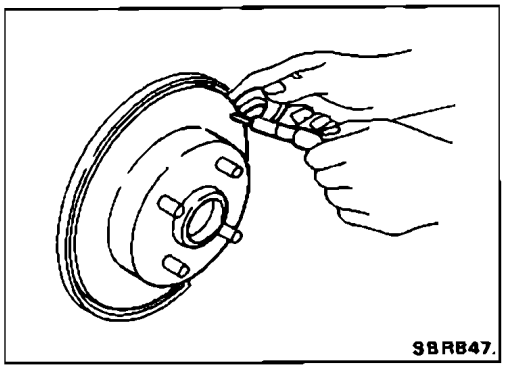
Check rotor for roughness, cracks or chips.



RUNOUT

- Check runout using a dial indicator.
- Make sure that axial end play is within the specifications before measuring. Refer to section RA.

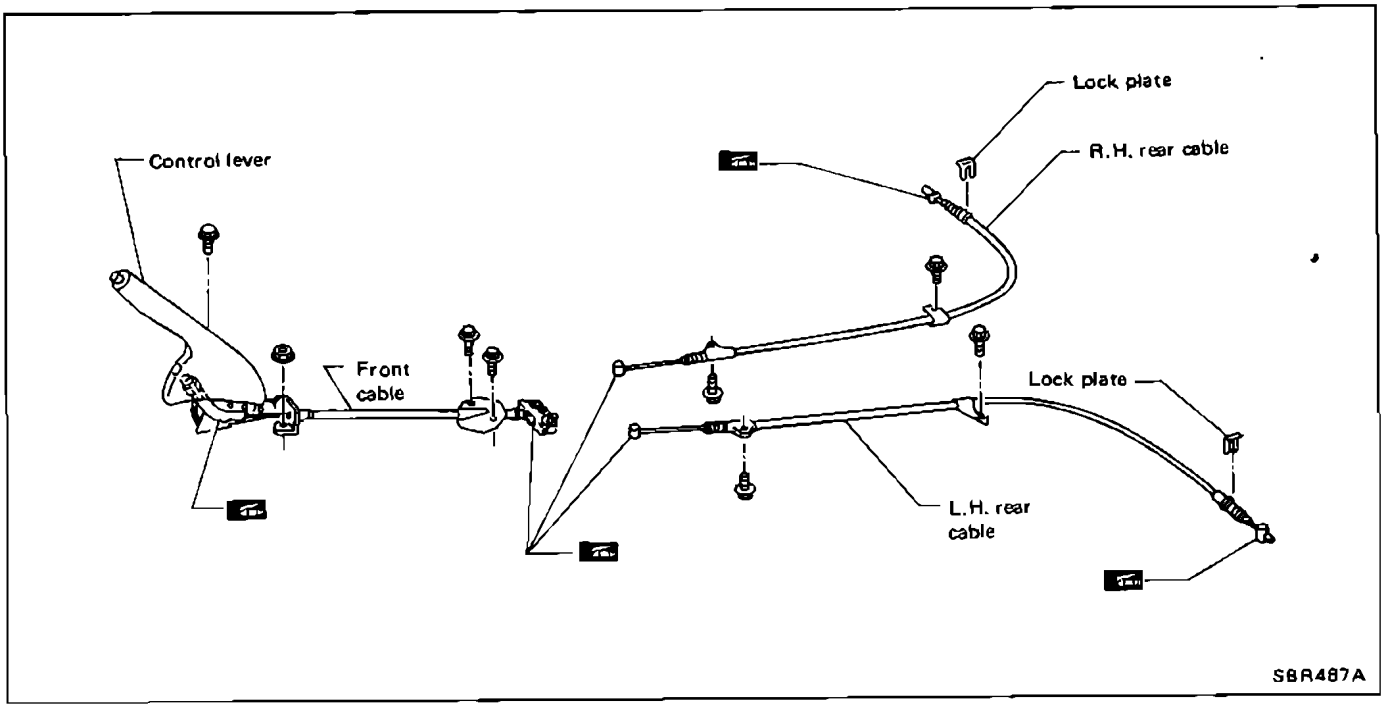
Rotor repair limit:
Maximum runout
(Total indicator reading at center of rotor pad contact surface)
0.07 mm (0.0028 in)

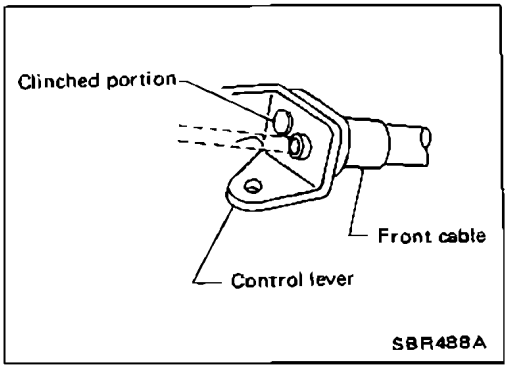


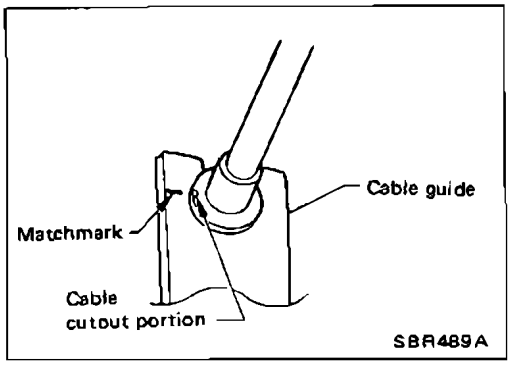
THICKNESS

Rotor repair limit:
Minimum thickness
8.0 mm (0.315 in)

Removal and Installation







REMOVAL

- Before removing parking brake control, remove console box.
- Loosen cable using control lever adjuster, and separate front and rear cables.
- Break clinched portion of control lever using a hammer and chisel as shown in figure at left, and replace cables with new parts.

Apply multi-purpose grease to areas between control lever drum and cables.

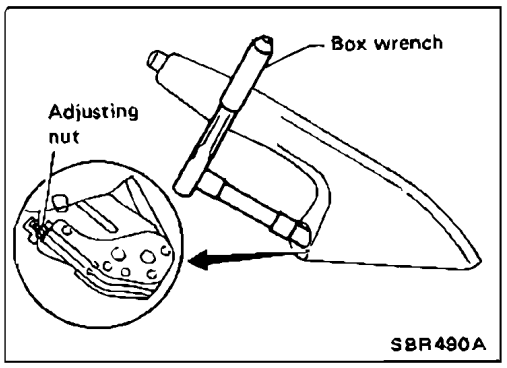
INSTALLATION

Be careful not to damage boot and inner cable.

- When installing parking brake cable at rear caliper, make sure to align matchmark on parking cable stay and cable.

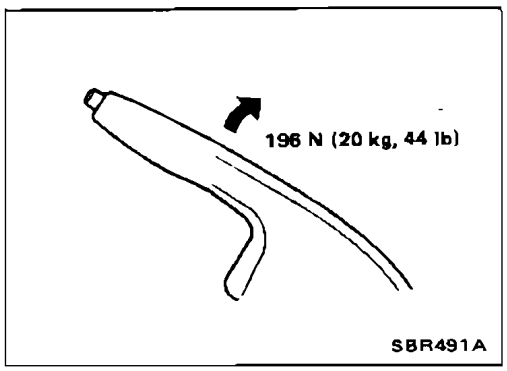
Inspection

1. Check control lever for wear or other damage. Replace if necessary.
2. Check parking brake cables, lamp and switch. Replace if necessary.
3. Check parts at each connecting portion for deformation or damage. If found, replace.

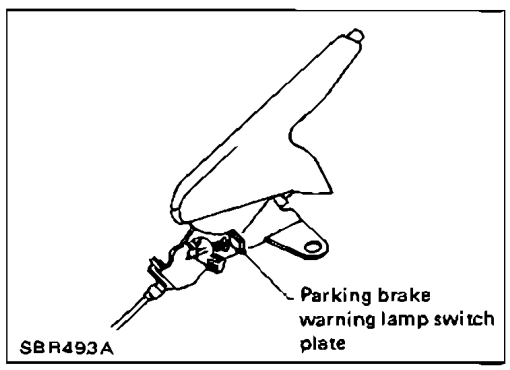


Adjustment

1. Ensure that parking brake releases when control lever is pulled down completely. If control lever does not release parking brake, proceed as follows:
- Pull control lever up by 4 or 5 notches.
- Insert a box wrench into opening in control lever and loosen self-lock adjusting nut to slacken cables. Completely push control lever down.
2. Forcefully depress brake pedal about five times (so that caliper is automatically set in position.).
3. Pull lever up by 4 or 5 notches.
4. Turn adjusting nut as shown in figure at left and adjust lever stroke to specified value.
5. Completely push control lever down and ensure that:
- Parking brake is released completely.
- Rear brakes are free from dragging.

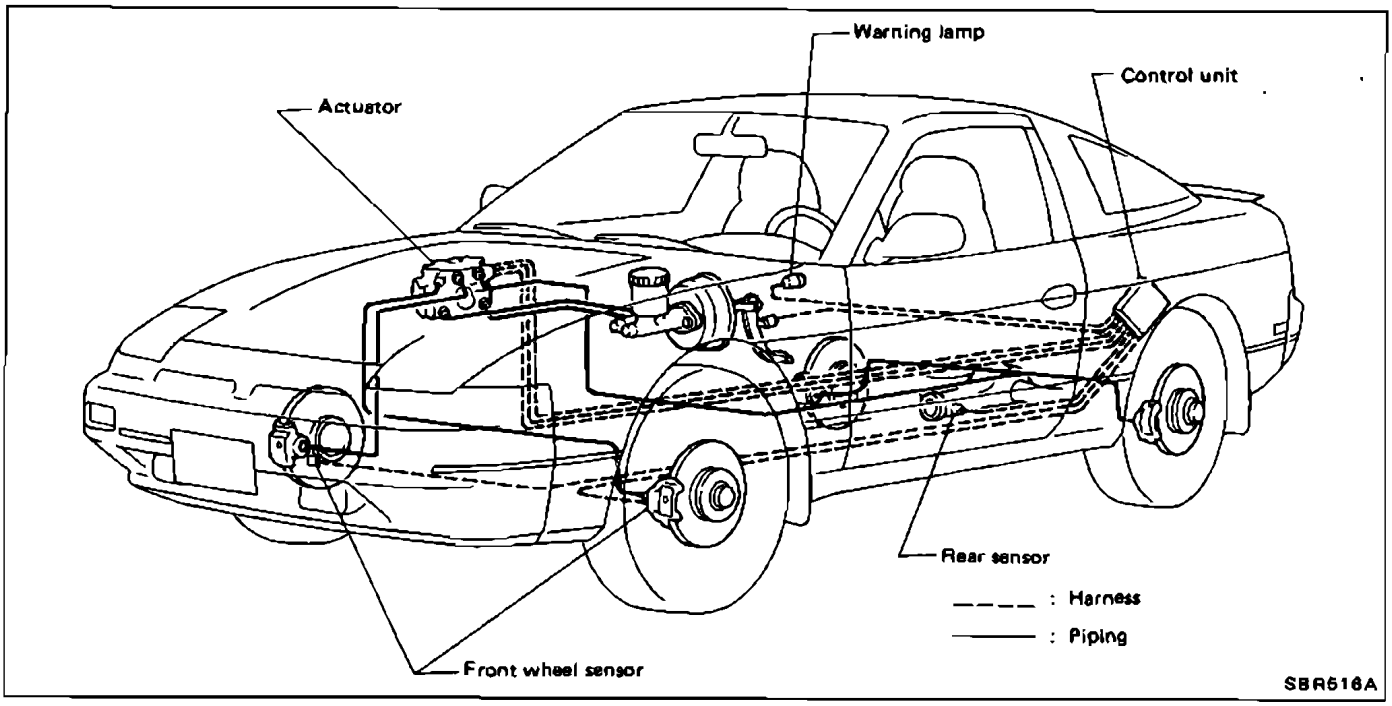


6. Pull control lever with specified amount of force. Check lever stroke and ensure smooth operation.
Number of notches:
Center lever type 6 - 8

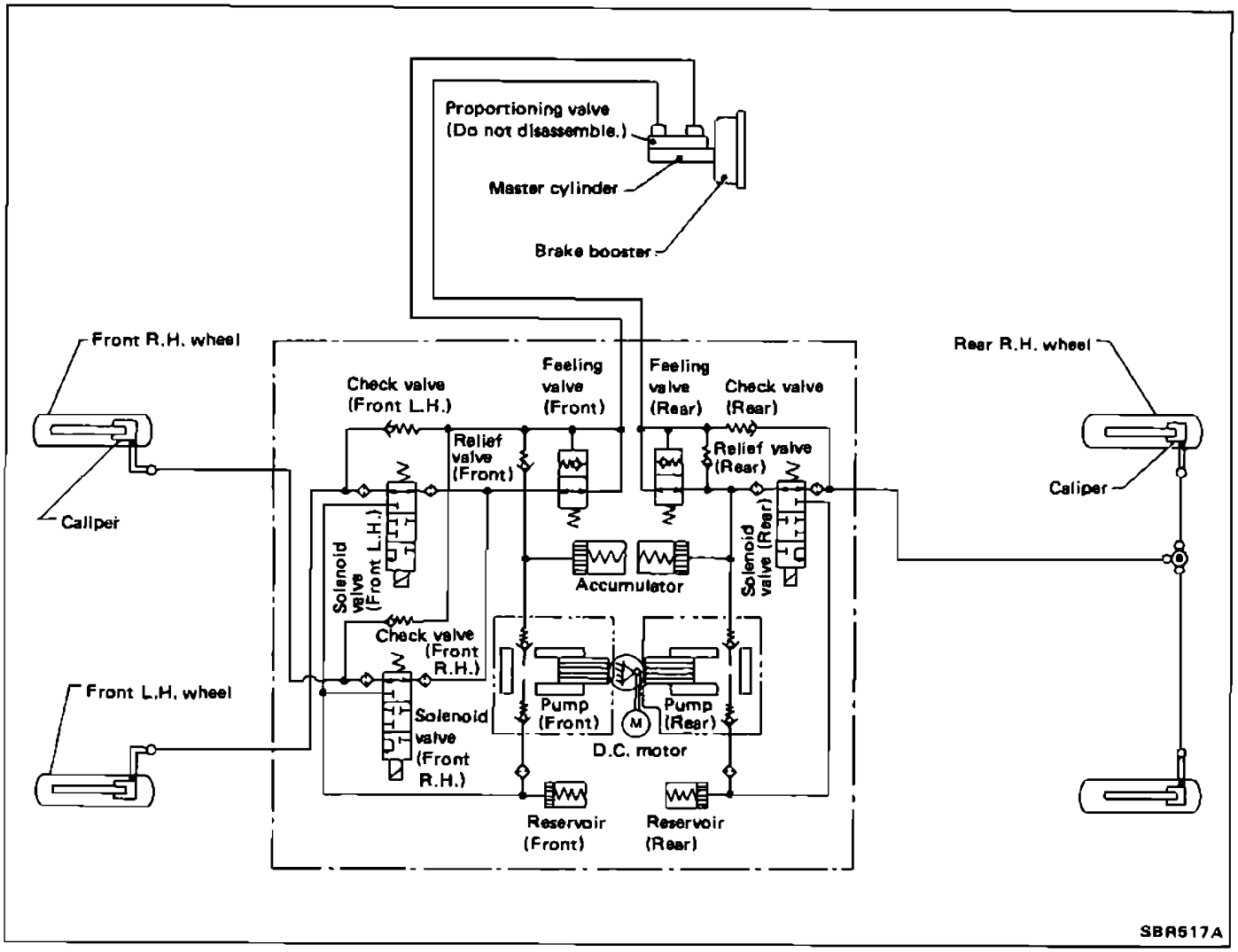


7. Bend parking brake warning lamp switch plate so that brake warning light comes on when ratchet at parking brake lever is pulled "A" notches and goes out when fully released.
Number of "A" notches: 1

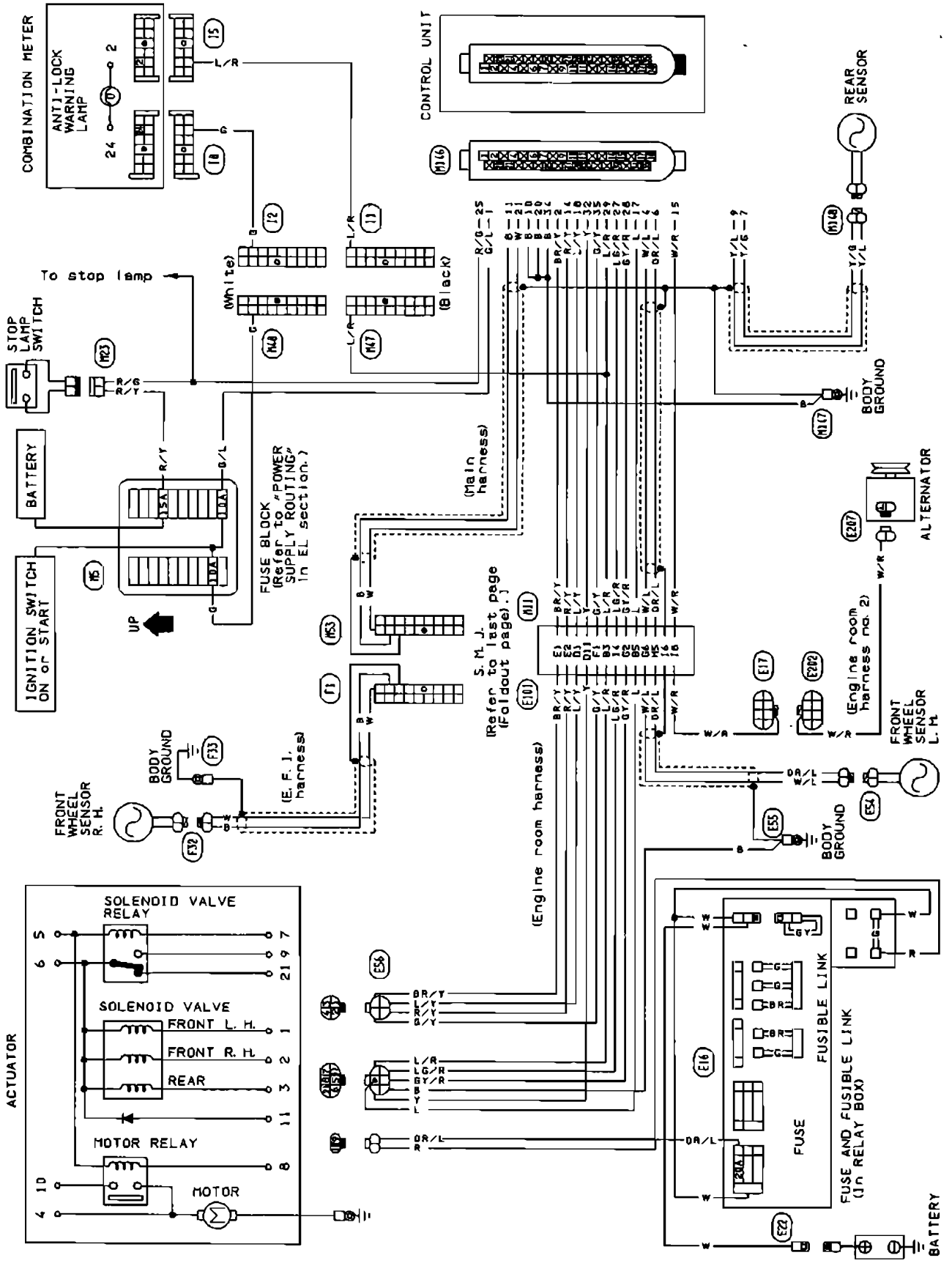
System Components



Hydraulic Circuit



Wiring Diagram

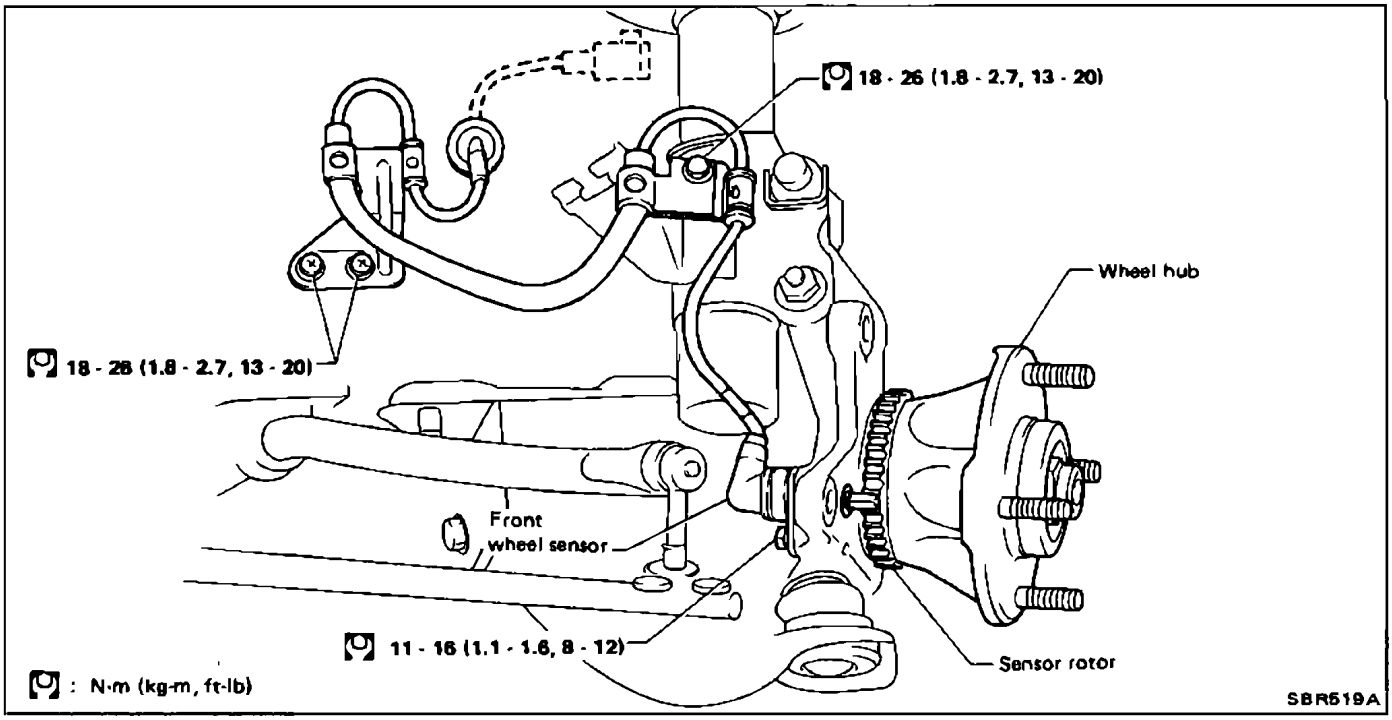


SBR685A

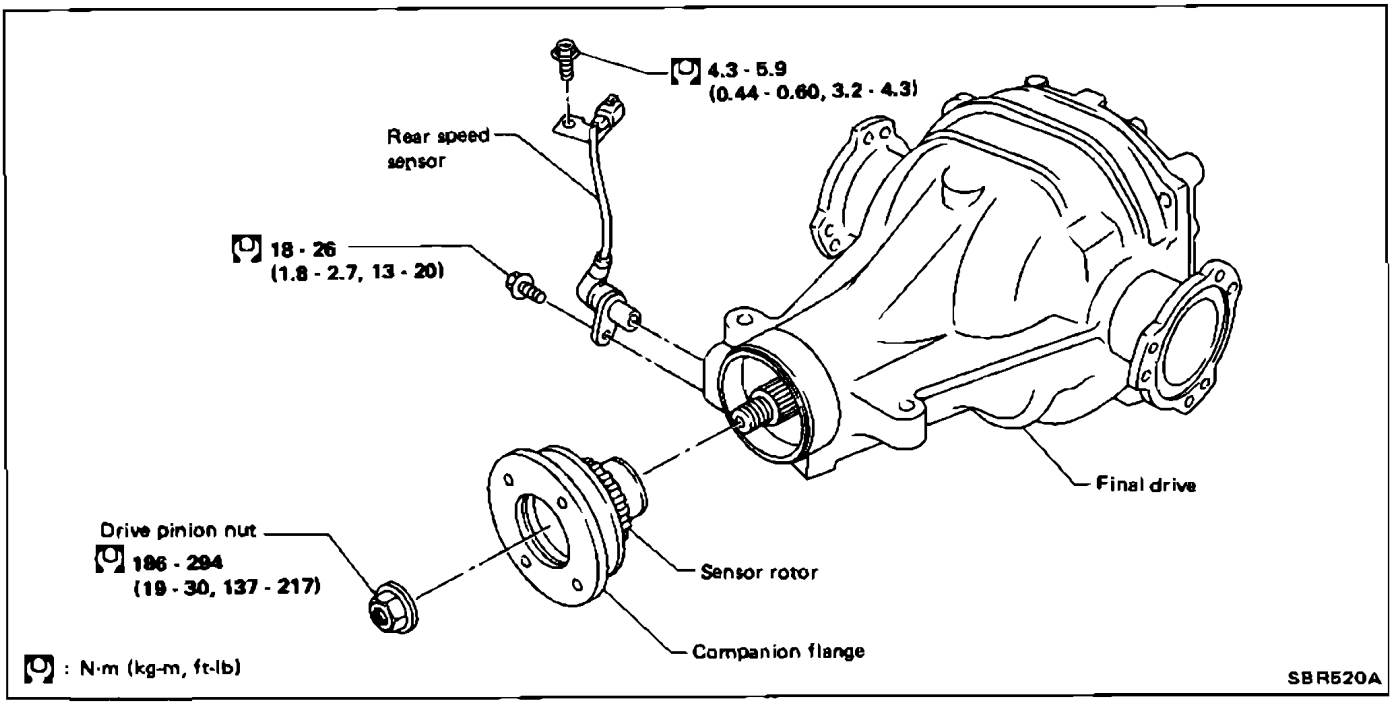
Removal and Installation

CAUTION:
Be careful not to damage sensor edge and sensor rotor teeth.

FRONT WHEEL SENSOR



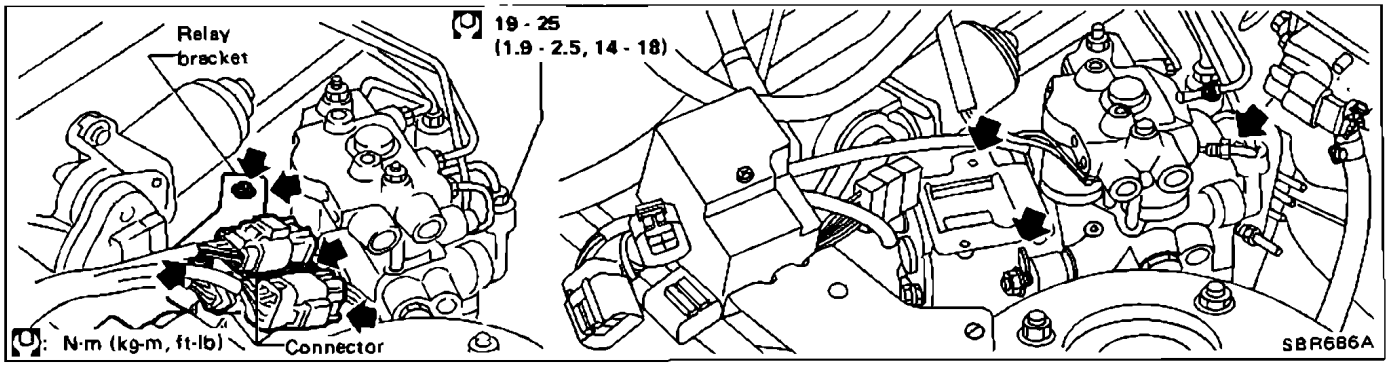
REAR SENSOR



- Remove rear sensor rotor with companion flange after propeller shaft removal.
  Refer to PD section.

Removal and Installation (Cont'd)

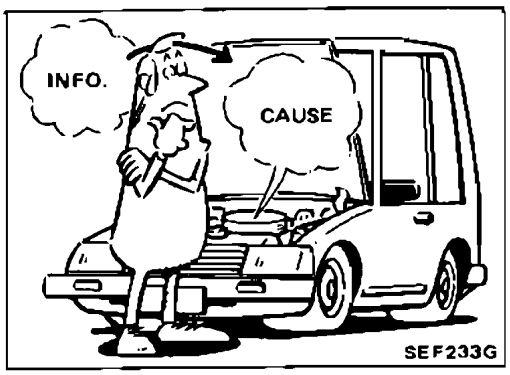
ACTUATOR

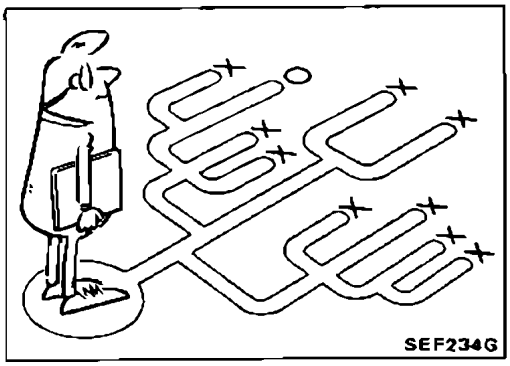


- Disconnect 3 connectors and brake tubes.
- Remove relay bracket.
- Remove actuator by removing 3 nuts fixing actuator to bracket.

Contents

How to Perform Trouble Diagnoses for Quick and Accurate Repair BR-30
Symptom Chart BR-33
Preliminary Check 1 ..... BR-34
Preliminary Check 2 ..... BR-35
Preliminary Check 3, 4 ..... BR-36
Self-diagnosis BR-37
Component Parts Location BR-38
Harness Connector Location BR-39
Ground Circuit Check BR-40
Circuit Diagram for Quick Pinpoint Check BR-41
Diagnostic Procedure 1 ..... BR-42
Diagnostic Procedure 2 ..... BR-43
Diagnostic Procedure 3 ..... BR-44
Diagnostic Procedure 4 ..... BR-44
Diagnostic Procedure 5 ..... BR-45
Diagnostic Procedure 6 ..... BR-45
Diagnostic Procedure 7 ..... BR-46
Diagnostic Procedure 8 ..... BR-47
Diagnostic Procedure 9 ..... BR-48
Diagnostic Procedure 10 ..... BR-49
Diagnostic Procedure 11 ..... BR-50
Diagnostic Procedure 12 ..... BR-51
Electrical Components Inspection BR-52





How to Perform Trouble Diagnoses for Quick and Accurate Repair

INTRODUCTION

The A.B.S. system has an electronic control unit to control major functions. 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 air leaks in the booster or lines, lack of brake fluid, or other problems with brake system.

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.

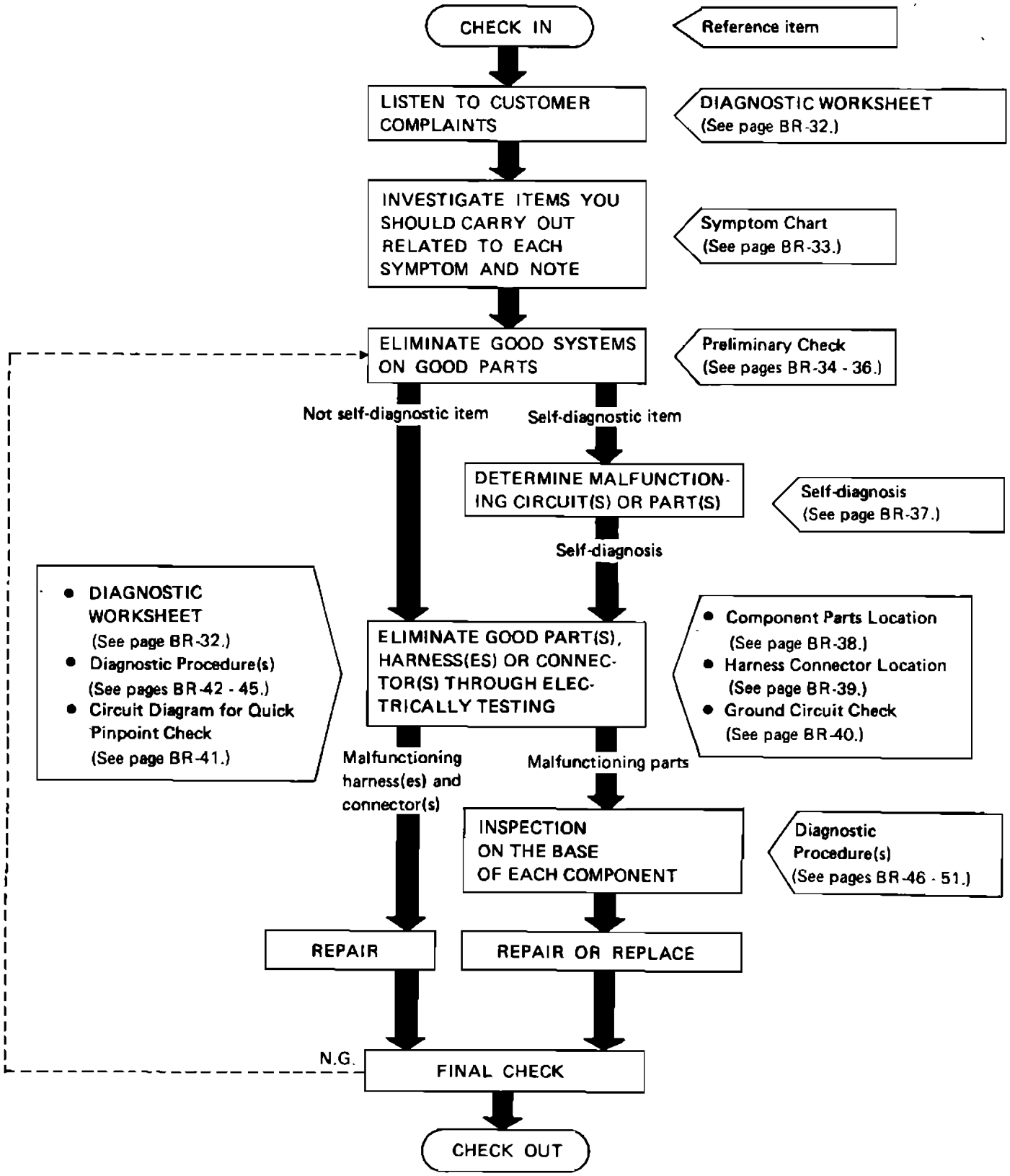
A visual check only may not find the cause of the problems, so a road test should be performed.

Before undertaking actual checks, take just a few minutes to talk with a customer who approaches with a A.B.S. complaint. The customer is a very good source 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 brake problems on an A.B.S. controlled vehicle.

How to Perform Trouble Diagnoses for Quick and Accurate Repair (Cont'd)

WORK FLOW



KEY POINTS

WHAT ..... Vehicle 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 customer complaints, even if the system is normal.
A good grasp of such conditions can make trouble-shooting faster and more accurate.
In general, feelings for a problem depend on each customer's information. It is therefore 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

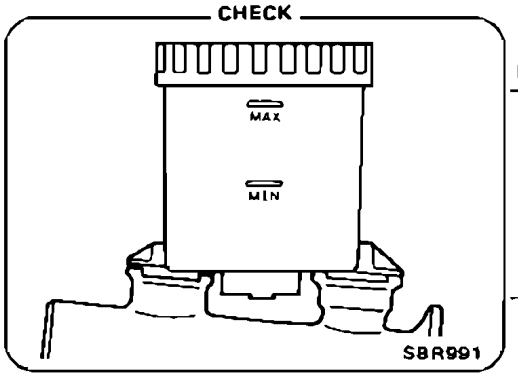
Customer name MR/MS		Model & Year			VIN		
Engine #		Trans.			Mileage		
Incident Date		Manuf. Date			In Service Date		
Symptoms	☐ Pedal vibration and noise	☐ Warning activates	☐ Long stopping distance	☐ Abnormal pedal action	☐ A.B.S. doesn't work	☐ A.B.S. works but warning activates	☐ A.B.S. works frequently
Engine conditions		☐ When starting ☐ After starting ☐ Engine speed: 5,000 rpm or more					
Road conditions		☐ Low friction road (☐ Snow ☐ Gravel ☐ Other) ☐ Protrusion					
Driving conditions		☐ High speed cornering ☐ Vehicle speed: Greater than 10 km/h (6 MPH) ☐ Vehicle speed: 10 km/h (6 MPH) or less ☐ Vehicle is stopped					
Applying brake conditions		☐ Suddenly ☐ Gradually					
Other conditions		☐ Operation of electrical equipment ☐ Large pedal stroke ☐ Operation of clutch					

Symptom Chart

PROCEDURE	Preliminary Check				Diagnostic Procedure								Diagnostic Procedure (Select inspection with L.E.D. flashing No.)								Ground Circuit Check		Electrical Com-ponents Inspec-tion
REFERENCE PAGE	BR-34	BR-35	BR-36	BR-36	BR-42	BR-43	BR-44	BR-44	BR-45	BR-45	BR-45	BR-46	BR-47	BR-48	BR-49	BR-50	BR-51	BR-40	BR-40	BR-52			
SYMPTOM	Preliminary Check 1	Preliminary Check 2	Preliminary Check 3	Preliminary Check 4	Diagnostic Procedure 1	Diagnostic Procedure 2	Diagnostic Procedure 3	Diagnostic Procedure 4	Diagnostic Procedure 5	Diagnostic Procedure 6	L.E.D. flashing 1 - 4	L.E.D. flashing 5 - 8	L.E.D. flashing 9	L.E.D. flashing 10	L.E.D. flashing 16	L.E.D. goes off	Sensor shield	Motor ground	Actuator inspection			
Pedal vibration & noise			○	○	○						○	○	○	○	○	○	○					
Warning activates		○	○	○							○	○	○	○	○	○						
Long stopping distance	○			○		○					○	○	○	○	○	○						
Abnormal pedal action	○			○			○				○	○	○	○	○	○						
A.B.S. doesn't work		○		○				○			○	○	○	○	○	○			○			
A.B.S. works but warning activates				○					○		○	○	○	○	○	○						
A.B.S. works frequently	○	○								○							○					

Preliminary Check 1

CHECK

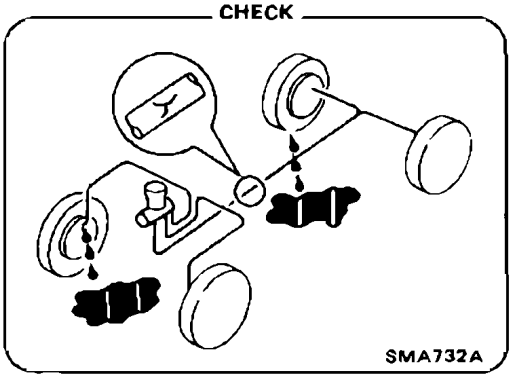


Check brake fluid level in reservoir tank.

N.G. → Fill up brake fluid.

O.K. →

CHECK

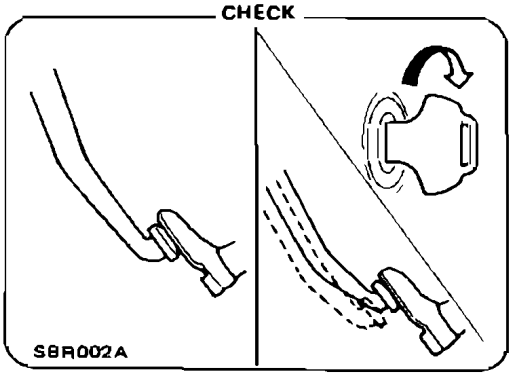


Check brake system.
Refer to CHECK AND ADJUSTMENT.

← N.G. Repair brake system.

O.K. ↓

CHECK

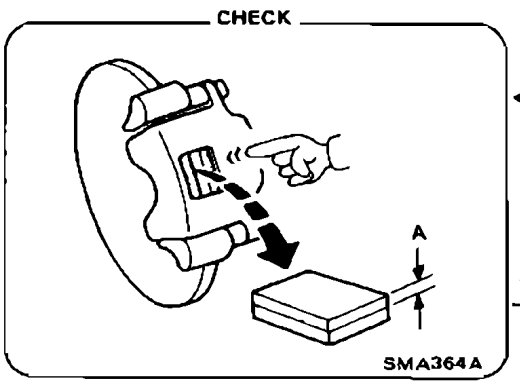


Check brake booster operation and airtightness.
Refer to "Inspection" of BRAKE BOOSTER.

← N.G. Repair or replace booster system.

O.K. ←

CHECK

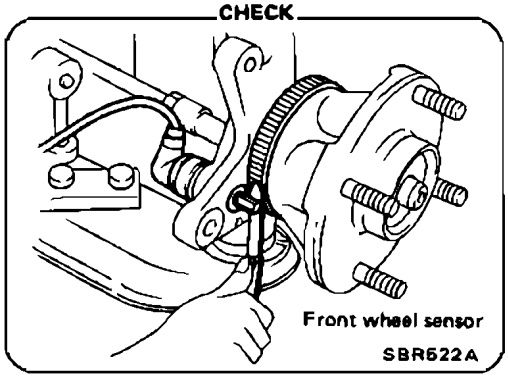


Check brake pads and rotor.
Refer to "Inspection" of FRONT and REAR DISC BRAKE.

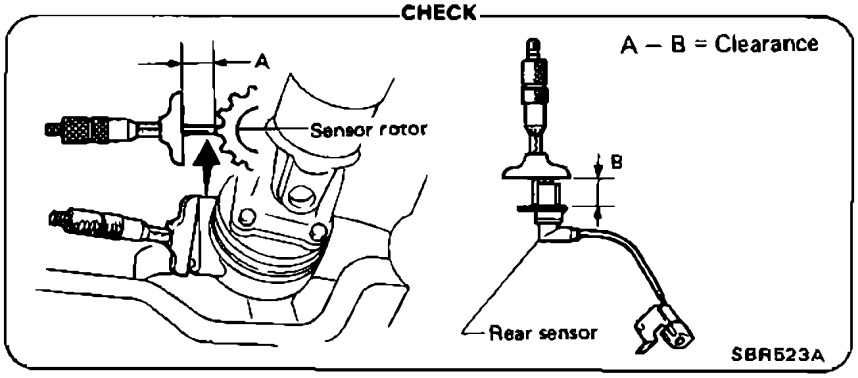
N.G. → Replace malfunctioning parts.

Preliminary Check 2

CHECK



CHECK

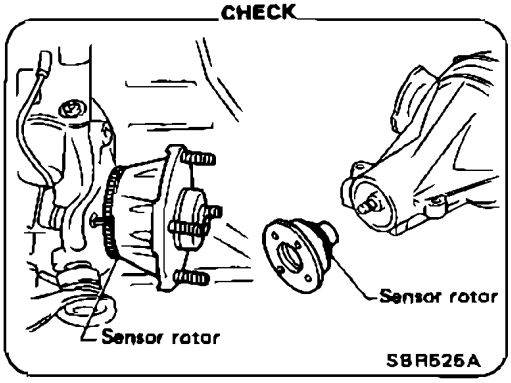


Check sensor clearance.

	Clearance mm (in)
Front wheel sensor	0.275 - 0.75 (0.0108 - 0.0295)
Rear sensor	0.35 - 0.625 (0.0138 - 0.0246)

N.G. → Check sensor for the following items:
- Dust, foreign materials, etc., at fastening portion
- Improper installation
- Breakage

O.K. → CHECK



N.G. → Replace sensor rotor with wheel hub or companion flange as a set.

Check sensor rotor for teeth damage.

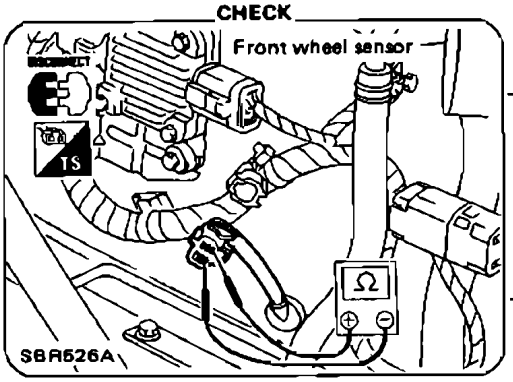
O.K. → (to CHECK)

N.G. → Repair or replace malfunctioning sensor.

Preliminary Check 3, 4

Preliminary Check 3

CHECK



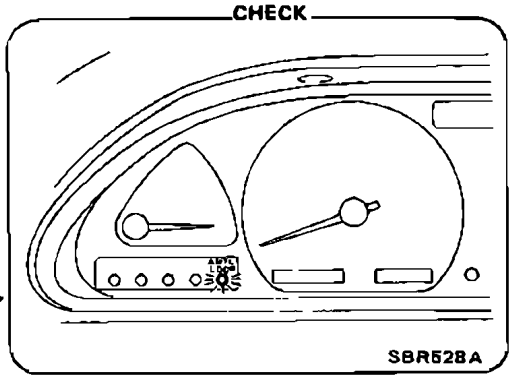
N.G. → Replace.

O.K.

Measure each sensor resistance.
0.8 - 1.2 kΩ

Preliminary Check 4

CHECK



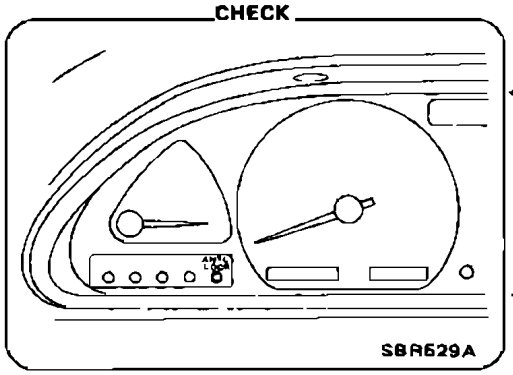
Check warning lamp activation.
When ignition switch is turned on, warning lamp turns on.

O.K. ↓

N.G. ↓

Check fuse.
Check bulb condition and remedy.

CHECK

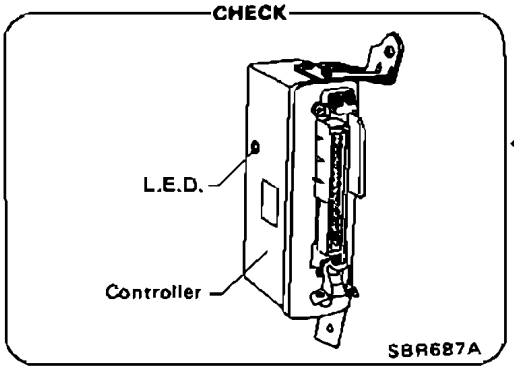


N.G. →

Check warning lamp for deactivation.
When engine starts, warning lamp deactivates.

O.K. ↓

CHECK

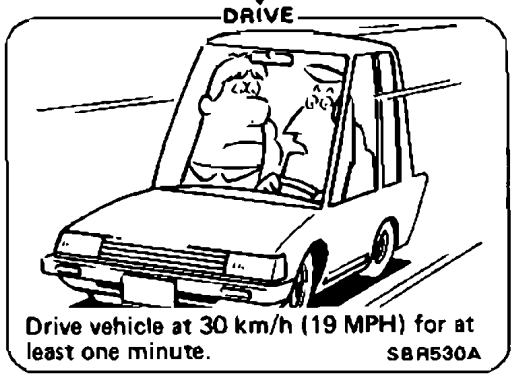


- Keep engine on and running.
- Remove rear side finisher.
- Count the number of L.E.D. flashes during 5 to 10 second "OFF" period.

↓

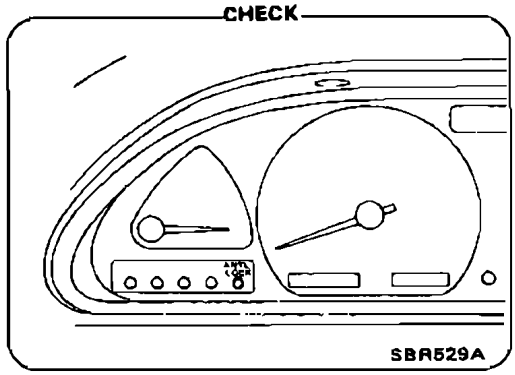
Go to Self-diagnosis.
(See page BR-37.)

DRIVE



↓

CHECK



N.G. →

O.K. → If Preliminary Check 2 is not performed and there is abnormal A.B.S. operation, perform Preliminary Check 2.

Ensure warning lamp remains off while driving.

Self-diagnosis

CHECKING THE NUMBER OF L.E.D. FLASHES

When a problem occurs in the A.B.S., the warning light on the instrument panel comes on. As shown in the Table, the control unit performs self-diagnosis.

To obtain satisfactory self-diagnosing results, the vehicle must be driven above 30 km/h (19 MPH) for at least one minute before the self-diagnosis is performed. After the vehicle is stopped, the number of L.E.D. flashes is counted while the engine is running.

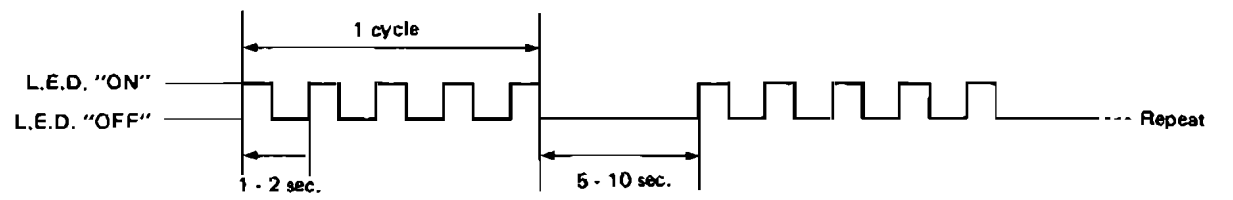
The L.E.D. is located on the control unit, identifying a malfunctioning part or unit by the number of flashes. Both the warning light and the L.E.D. persistently activate, even after a malfunctioning part or unit has been repaired, unless the ignition switch is turned "OFF". After repairs, turn the ignition switch "OFF". Then start the engine and drive the vehicle over 30 km/h (19 MPH) for at least one minute to ensure that the malfunctioning part or unit has been repaired properly.

If more than two circuits malfunction at the same time, the L.E.D. will flash to indicate one of the malfunctioning circuits. After the circuit has been repaired, the L.E.D. will then flash to indicate that the other circuit is malfunctioning.

No. of L.E.D. flashes	Malfunctioning part or unit
1	Left front actuator solenoid circuit
2	Right front actuator solenoid circuit
3 or 4	Rear actuator solenoid circuit
5	Left front rotor sensor circuit
6	Right front rotor sensor circuit
7 or 8	Rear rotor sensor circuit
9	Actuator motor, motor relay circuit
10	Actuator solenoid valve relay
16	Control unit
Warning activates and L.E.D. "OFF"	Power supply or ground circuit for control unit

Example

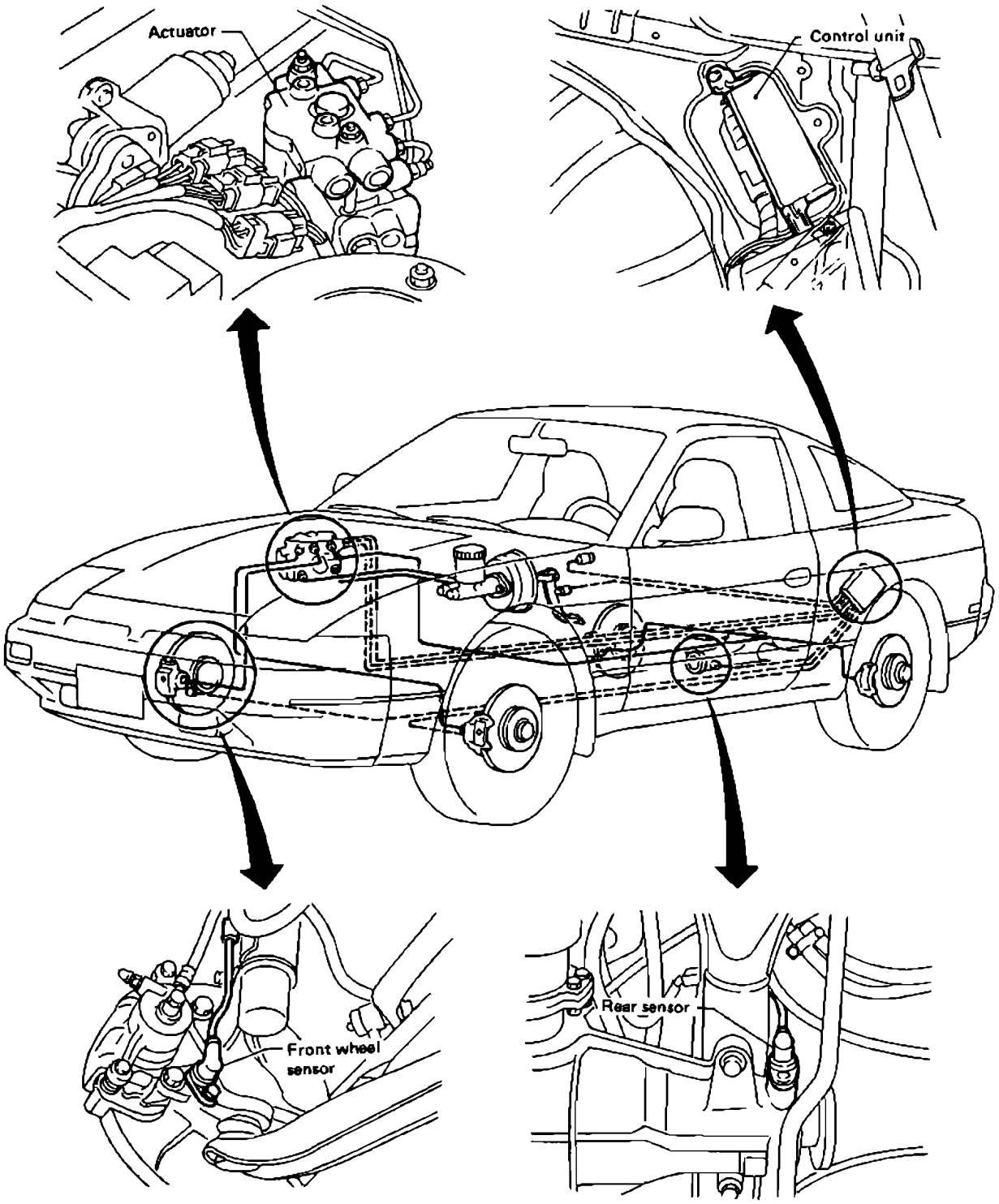
Improper operation of left front rotor sensor circuit



SBR531A

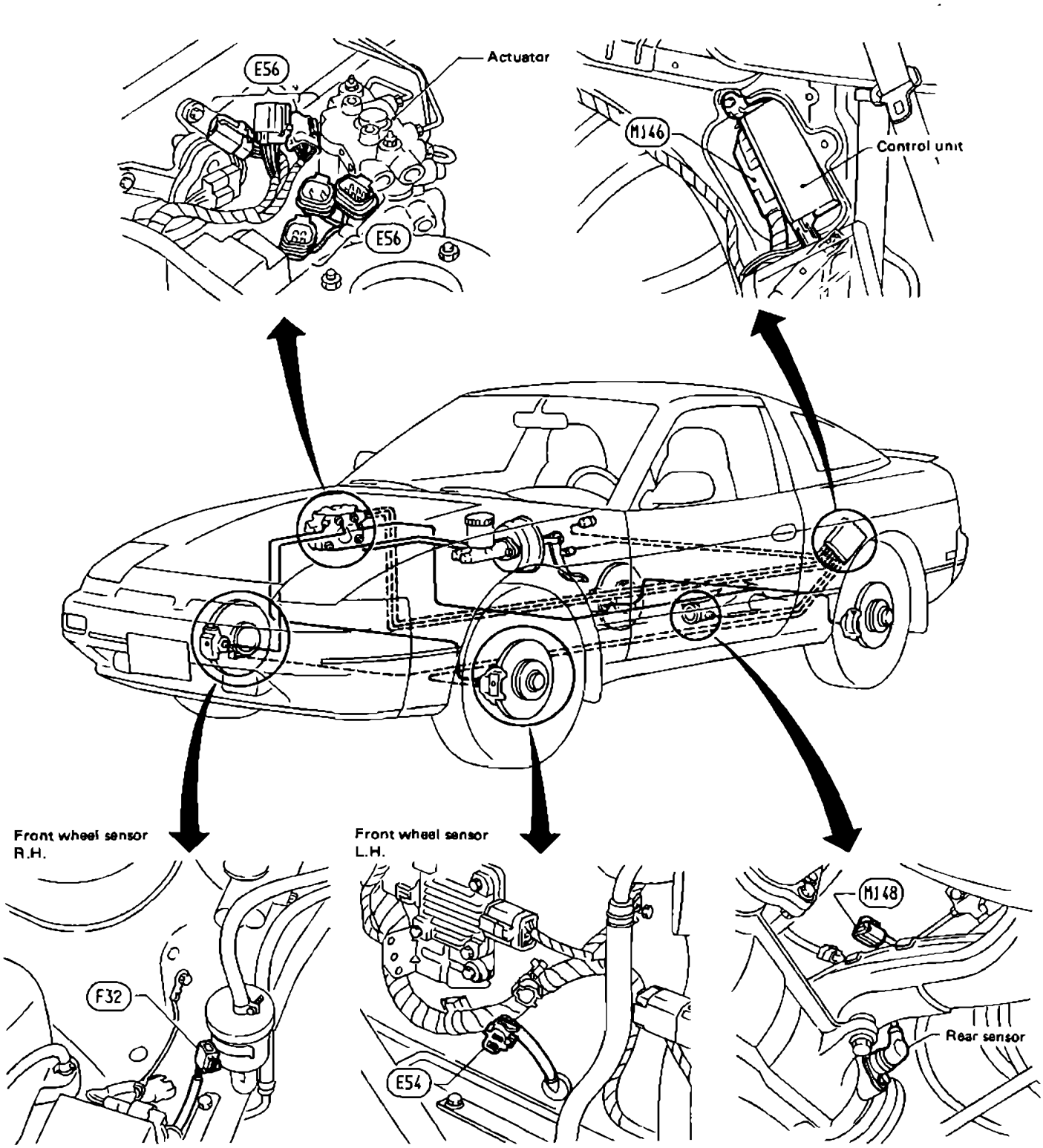
Go to Diagnostic Procedure from 7 to 10, where malfunction portion is concerned.

Component Parts Location

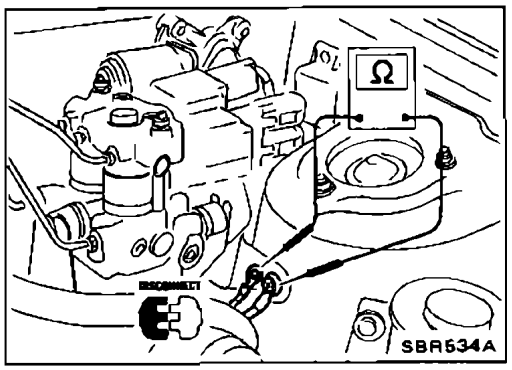


SBR532A

Harness Connector Location



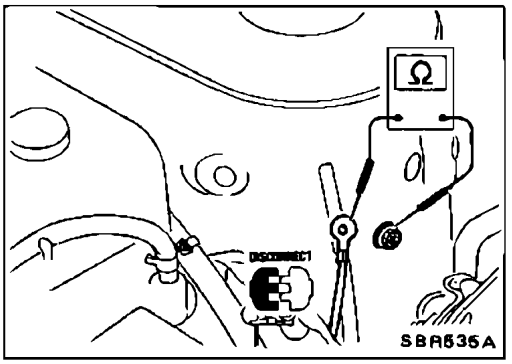
SBR533A



Ground Circuit Check

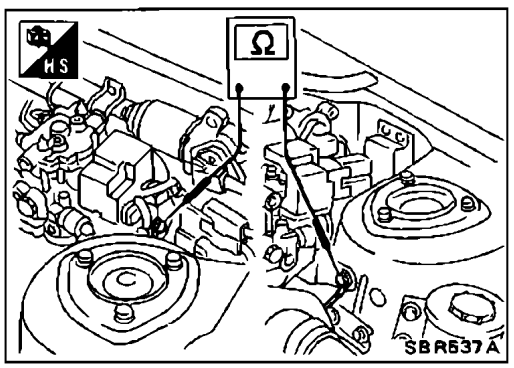
FRONT WHEEL SENSOR L.H. SHIELDED WIRE GROUND

- Check resistance between both terminals.
  Resistance: 0Ω



FRONT WHEEL SENSOR R.H. SHIELDED WIRE GROUND

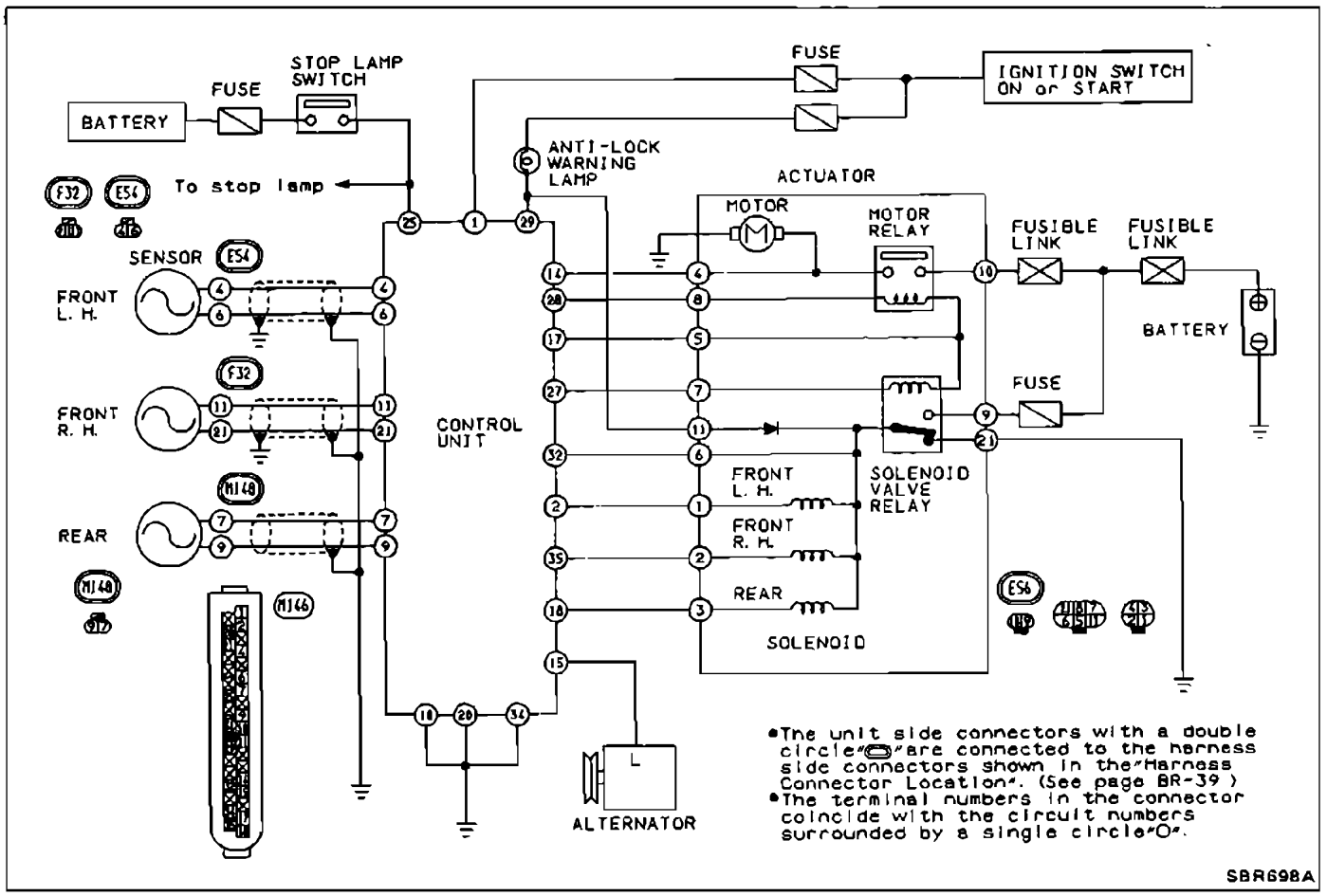
- Check resistance between both terminals.
  Resistance: 0Ω

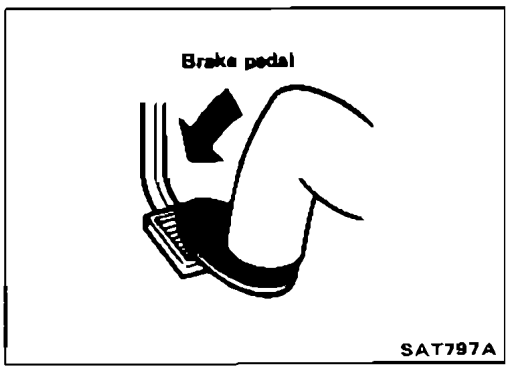


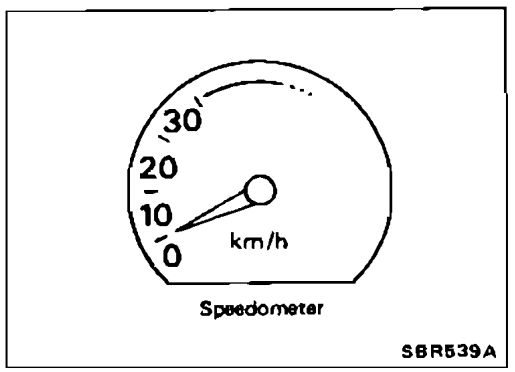
ACTUATOR MOTOR GROUND

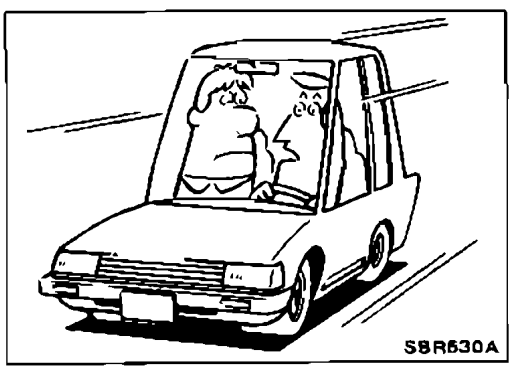
- Check resistance between both terminals.
  Resistance: 0Ω

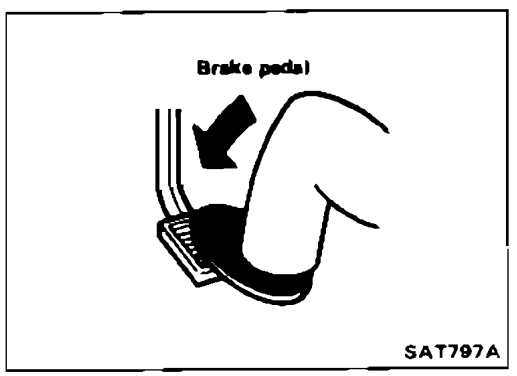
Circuit Diagram for Quick Pinpoint Check











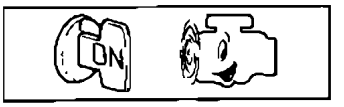
Diagnostic Procedure 1

SYMPTOM: Pedal vibration and noise

Refer to worksheet results.

Check whether brake is applied suddenly in normal driving conditions.
- Yes → When brake is normally applied, A.B.S. works and produces pedal vibration or noise.
- No ↓

Check whether the symptom appeared when engine is started.



- Yes → Refer to Preliminary Check 4 result.
- No ↓

Check whether the symptom appeared when the vehicle speed is within 10 km/h (6 MPH) after starting engine.
- Yes → Check whether the symptom disappeared within 5 seconds.
  - No → Ⓐ
  - Yes → A.B.S. may sometimes operate when load is high and voltage is low due to insufficient alternator output.
- No ↓

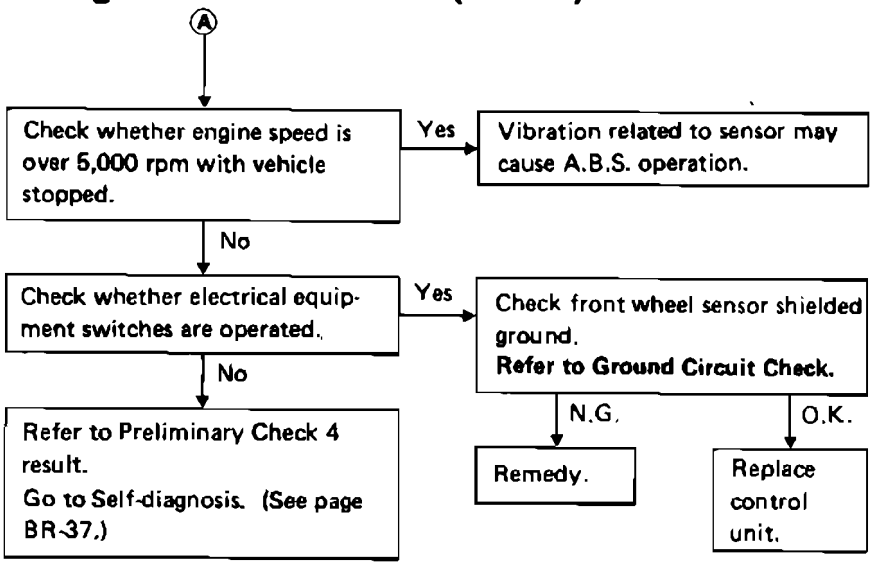
Check whether the symptom appeared while the vehicle was driven.
- No → Ⓐ
- Yes ↓

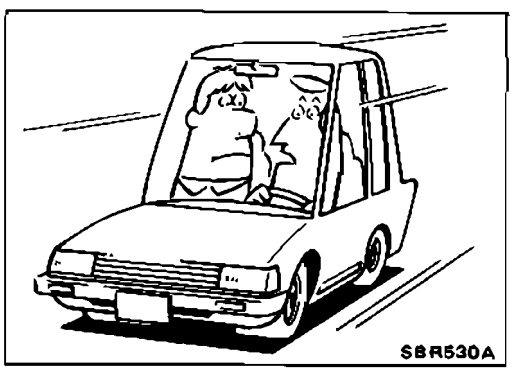
Check whether brake is applied gradually.
- No → Check if there were any conditions, among those listed below, when symptom appeared.
  - Shifting
  - Operating clutch
  - Passing protrusion
  - No → Ⓐ
  - Yes → For such condition, if there is considerable wheel speed variation and, A.B.S. will work normally.
- Yes ↓

Check if there were any conditions, among those listed below, when symptom appeared.
- Low friction road
- High speed cornering
- Passing protrusion

- Yes → For such conditions, if wheel speed is considerably different between front and rear or left and right, A.B.S. will work normally.
- No → Ⓐ

Diagnostic Procedure 1 (Cont'd)

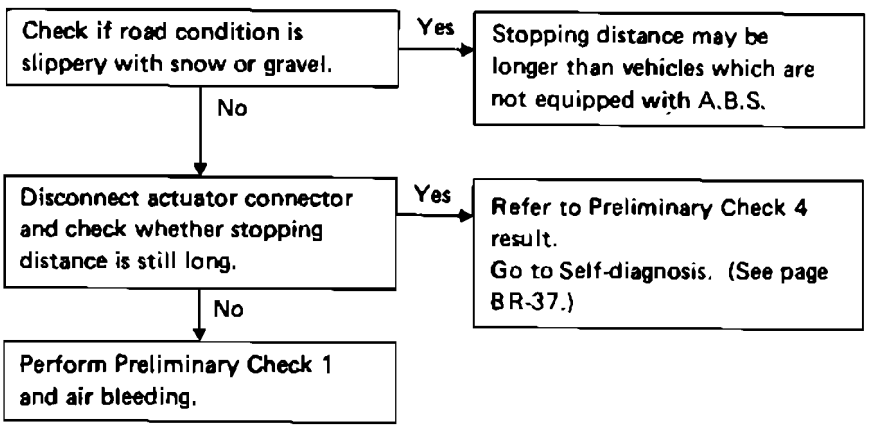


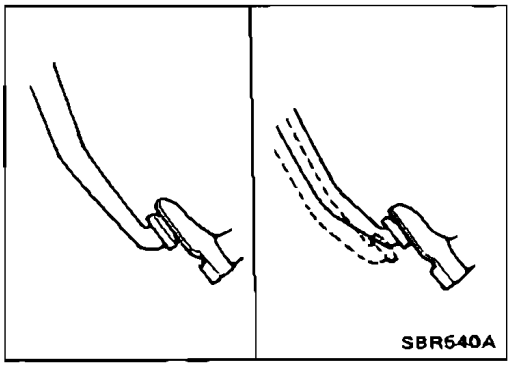


Diagnostic Procedure 2

SYMPTOM: Long stopping distance

Refer to worksheet results.

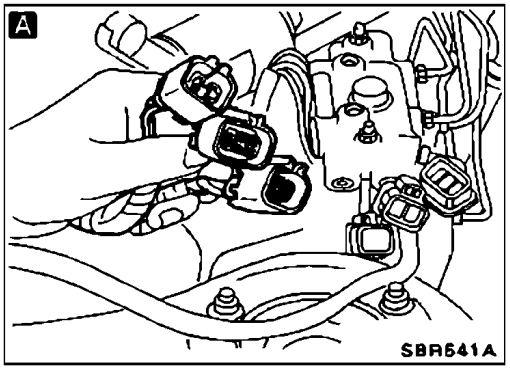



SBR540A

Diagnostic Procedure 3

SYMPTOM: Abnormal pedal action

Refer to worksheet results.


SBR541A

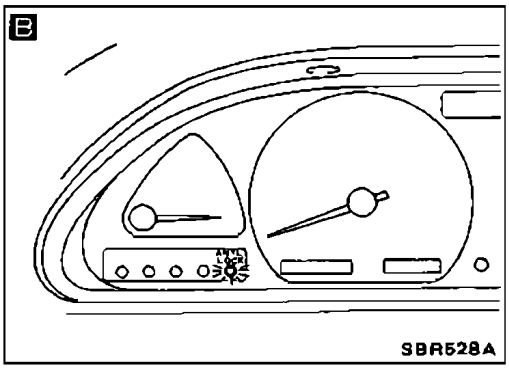
Check whether brake pedal stroke is abnormally large.
- Yes → Vehicle equipped with A.B.S. may have a tendency for large pedal strokes.
- No ↓

Check that brake pedal force is firm but brake is effective.
- Yes → Normal condition.
- No ↓

A

Disconnect actuator connector and check whether brake is effective.
- Yes → Refer to Preliminary Check 4 result. Go to Self-diagnosis. (See page BR-37.)
- No ↓

Perform Preliminary Check 1.


SBR528A

Diagnostic Procedure 4

SYMPTOM: A.B.S. doesn't work.

Refer to worksheet results.

B

Check whether warning activates.
- Yes → Refer to Preliminary Check 4 result. Go to Self-diagnosis. (See page BR-37.)
- No ↓

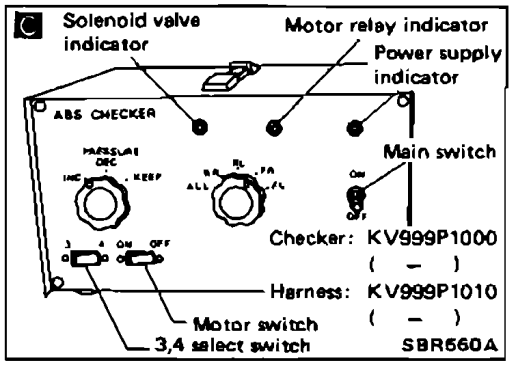
Check whether vehicle speed is under 10 km/h (6 MPH).
- Yes → A.B.S. doesn't work in this condition.
- No ↓

Refer to Preliminary Check 2 result.

O.K. but A.B.S. still doesn't work. ↓

C

Check actuator by referring to Electrical Components Inspection – ACTUATOR. (See page BR-52.)



SBR560A

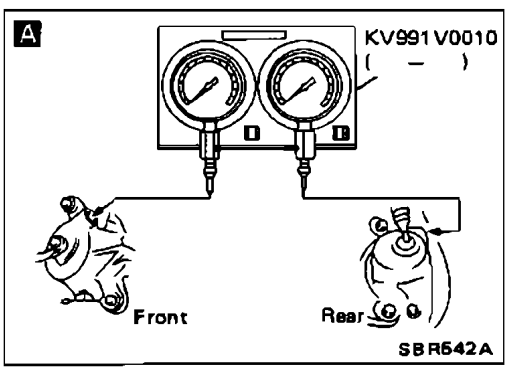
Diagnostic Procedure 5

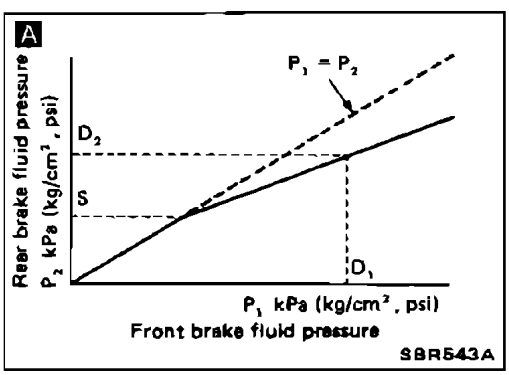
SYMPTOM: A.B.S. works but warning activates.

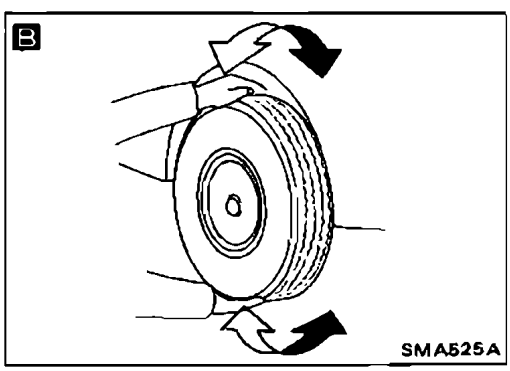
Check whether alternator produces proper output. Refer to EL section.
→ No → Remedy.
↓ Yes

Check whether battery has enough voltage. Refer to EL section.
→ No → Remedy.
↓ Yes

Refer to Preliminary Check 4 result.
Go to Self-diagnosis. (See page BR-37.)







Diagnostic Procedure 6

SYMPTOM: A.B.S. works frequently.

A

CHECK BRAKE FLUID PRESSURE.
Check whether brake fluid pressure distribution is normal.
D2/D1: 52 - 56/75
→ N.G. → Perform Preliminary Check 1.
↓ O.K.

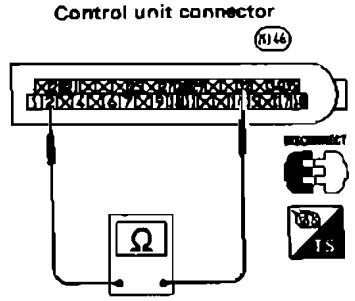
B

Check whether front axles have excessive looseness.
→ Yes → Remedy.
↓ No

Perform Preliminary Check 2 and Ground Circuit Check.

A

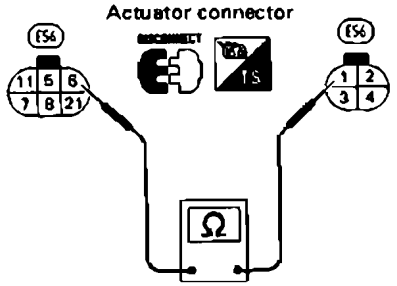
Control unit connector



SBR544A

B

Actuator connector



SBR545A

Diagnostic Procedure 7

ACTUATOR SOLENOID (L.E.D. flashing number 1 - 4)

INSPECTION START
Remove battery negative terminal connector.

A

CHECK SOLENOID VALVE RESISTANCE.
Disconnect control unit connector.
Check resistance between control unit connector (vehicle side) terminals.
Flashing number 1:
Terminals ㉜ and ②
Flashing number 2:
Terminals ㉜ and ㉟
Flashing number 3 or 4:
Terminals ㉜ and ⑱
Resistance: 0.7 - 1.6Ω

O.K. → Replace control unit.

N.G.

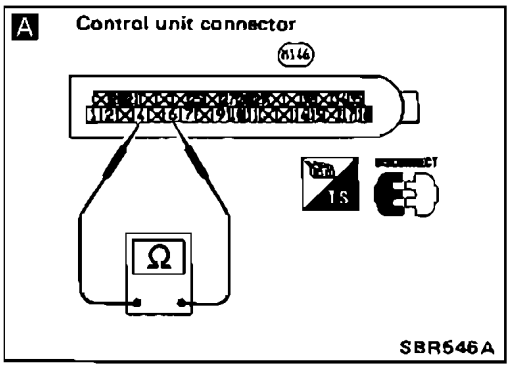
B

Disconnect actuator connector.
Check resistance between actuator connector (actuator side) terminals.
Flashing number 1:
Terminals ⑥ and ①
Flashing number 2:
Terminals ⑥ and ②
Flashing number 3 or 4:
Terminals ⑥ and ③
Resistance: 0.7 - 1.6Ω

O.K. → Repair harness between actuator connector and control unit connector.

N.G.

Replace actuator.



Diagnostic Procedure 8

WHEEL SPEED SENSOR (L.E.D. flashing number 5 - 8)

INSPECTION START
Remove battery negative terminal connector.

A

CHECK SPEED SENSOR RESISTANCE
Disconnect control unit connector.
Check resistance between control unit connector (vehicle side) terminals.
Flashing number 5:
Terminals ④ and ⑥
Flashing number 6:
Terminals ⑪ and ㉑
Flashing number 7 or 8:
Terminals ⑦ and ⑨
Resistance: 0.8 - 1.2 kΩ

O.K. → Replace control unit.

N.G.

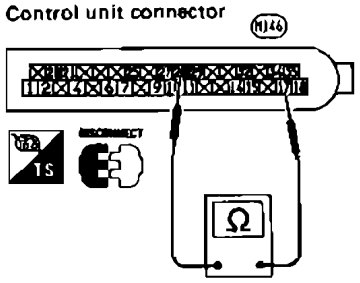
Refer to Preliminary Check 3 result.
Check whether sensor has 0.8 - 1.2 kΩ resistance.

N.G. → Replace sensor.

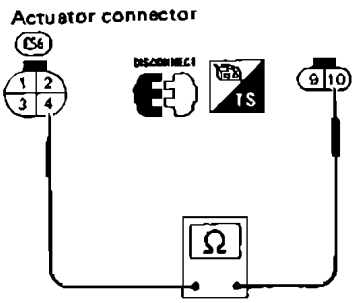
N.G.

Repair harness between sensor connector and control unit connector.

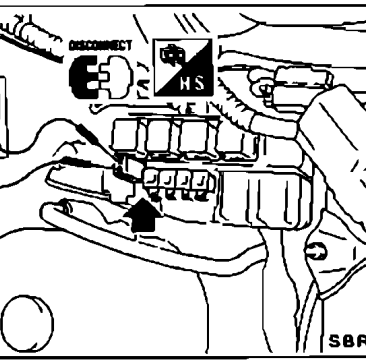
A



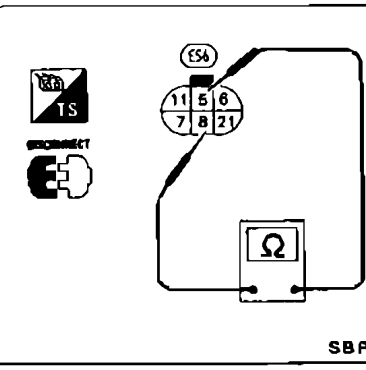
B



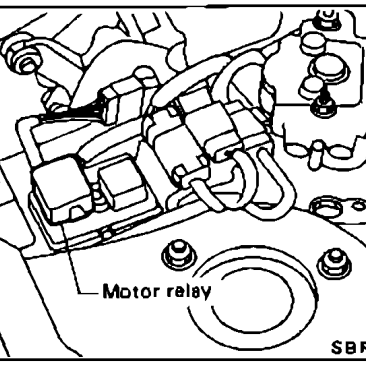
C



D



E



Diagnostic Procedure 9

ACTUATOR MOTOR RELAY (L.E.D. flashing number 9)

INSPECTION START
Remove battery negative terminal connector.

A
CHECK MOTOR RELAY SOLENOID RESISTANCE.
Disconnect control unit connector.
Check resistance between control unit connector (vehicle side) terminals ⑰ and ㉘.
Resistance: 38 - 45Ω

N.G. → **D**
Disconnect actuator connector.
Check resistance between actuator connector (actuator side) terminals ⑧ and ⑤.
Resistance: 38 - 45Ω

O.K. → Repair harness between actuator and control unit.

N.G. → **E** Replace motor relay.

B
CHECK MOTOR RELAY DEACTIVATION.
Disconnect actuator connector.
Check continuity between actuator connector (actuator side) terminals ④ and ⑩.

Yes → **E** Replace motor relay.

No → **C**
Check if motor's fusible link is blown.
Resistance:
Approximately 0Ω

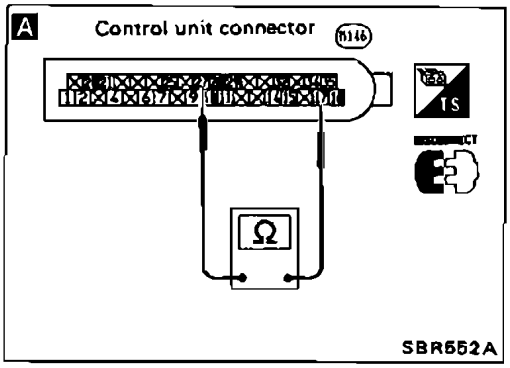
No → Perform Electrical Components Inspection – ACTUATOR. (See page BR-52.)

O.K. → Replace control unit.

N.G. → Replace actuator.

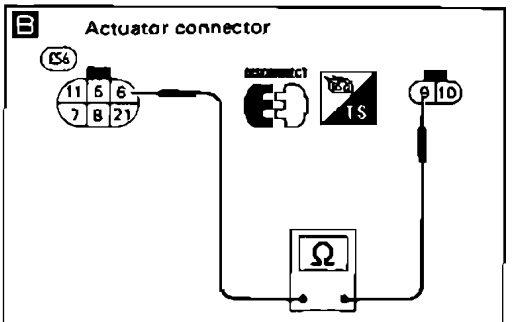
Yes → Replace fusible link.

A Control unit connector



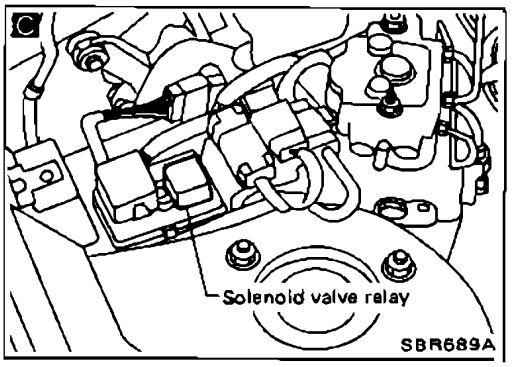
SBR552A

B Actuator connector



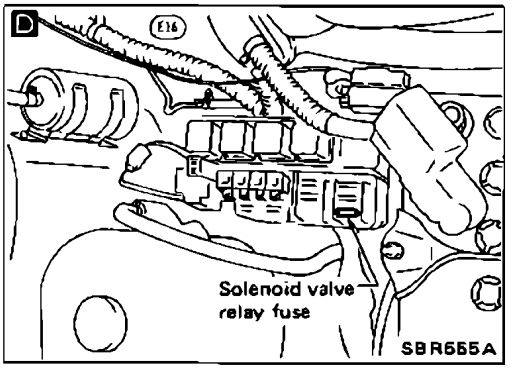
SBR553A

C



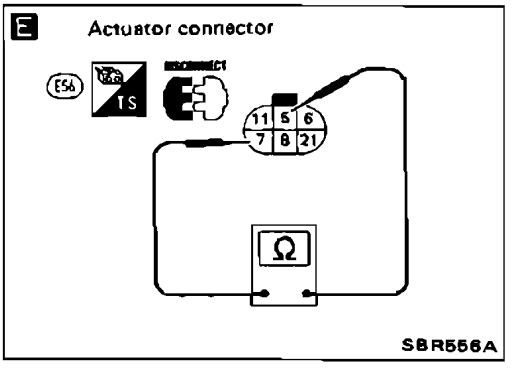
SBR689A

D



SBR555A

E Actuator connector



SBR556A

Diagnostic Procedure 10

ACTUATOR SOLENOID VALVE RELAY (L.E.D. flashing number 10)

INSPECTION START
Remove battery negative terminal connector.

A

CHECK SOLENOID VALVE RELAY RESISTANCE.
Disconnect control unit connector.
Check resistance between control unit connector (vehicle side) terminals ㉗ and ⑰.
Resistance: 80 - 90Ω

N.G. → **E**

Check resistance between actuator connector (actuator side) terminals ⑦ and ⑤.
Resistance: 80 - 90Ω

O.K. → Repair harness between actuator and control unit

N.G. → **C** Replace solenoid valve relay.

B

CHECK SOLENOID VALVE RELAY MOVEMENT.
Disconnect actuator connector.
Check continuity between actuator connector (actuator side) terminals ⑥ and ⑨.

Yes → **C** Replace solenoid valve relay.

No → **D**

Check if solenoid valve relay fuse is blown.

No → Perform Electrical Components Inspection – ACTUATOR. (See page BR-52.)

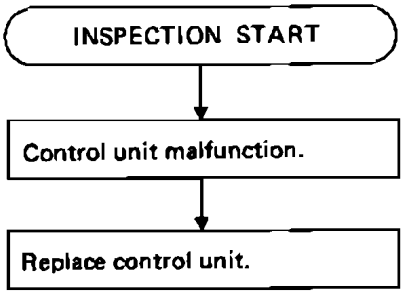
N.G. → Replace actuator.

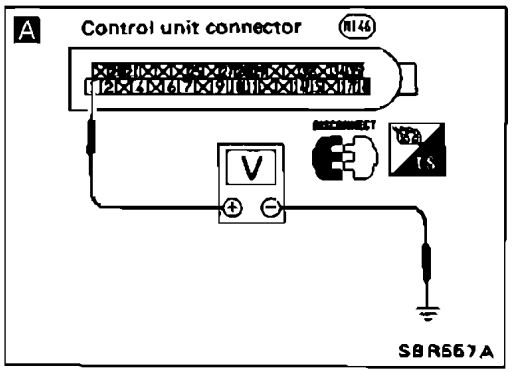
O.K. → Replace control unit.

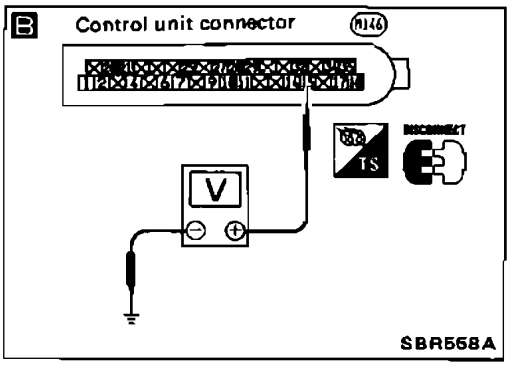
Yes → Replace fuse.

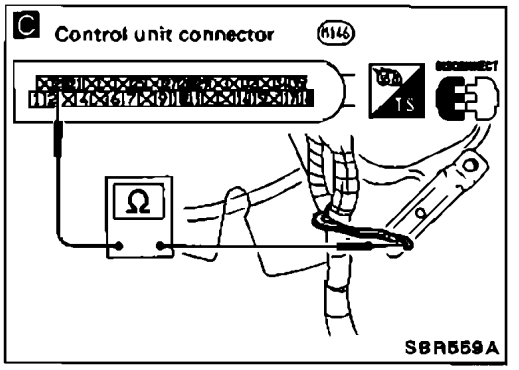
Diagnostic Procedure 11

CONTROL UNIT (L.E.D. flashing number 16)









Diagnostic Procedure 12

CONTROL UNIT OR POWER SUPPLY AND GROUND CIRCUIT (Warning activates but L.E.D. comes off.)

INSPECTION START

A

CHECK CONTROL UNIT POWER SUPPLY.
Disconnect control unit connector.
Check voltage between control unit connector (vehicle side) terminal ① and body ground with ignition switch turned on.

N.G. → Check if control unit "10A" fuse is blown.
- Yes → Replace fuse.
- No → Repair power supply harness.

O.K. ↓

B

CHECK ALTERNATOR L TERMINAL VOLTAGE.
Disconnect control unit connector.
Check voltage between control unit connector (vehicle side) terminal ⑮ and body ground after engine starting.
Voltage: 6V or more

N.G. → Check if other warnings activate.
- Yes → Repair harness between alternator and control unit.
- No → Malfunctioning alternator.

O.K. ↓

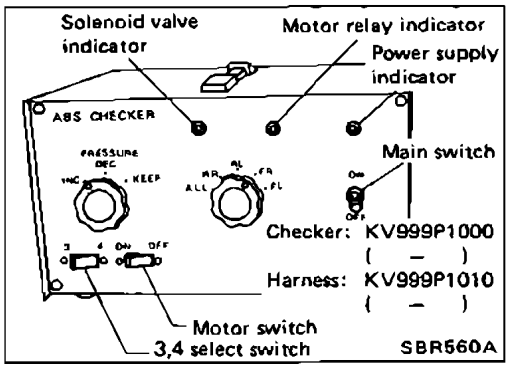
C

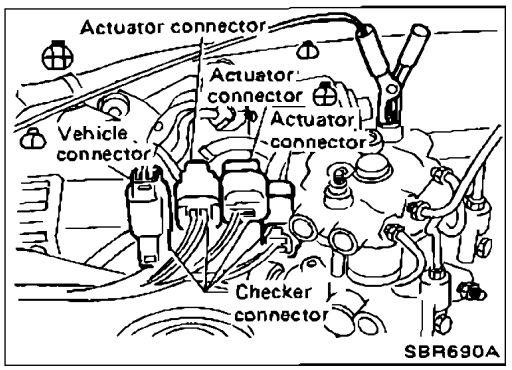
Check continuity between control unit connector (vehicle side) terminal ⑳ and body ground with ignition switch "OFF".

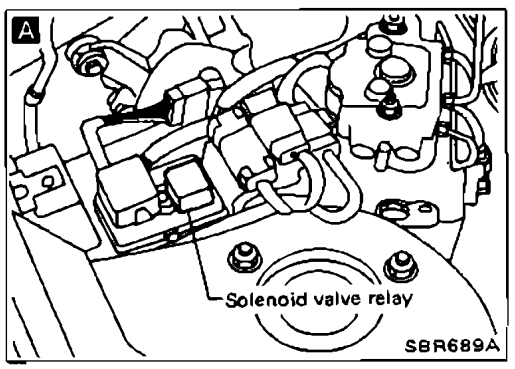
N.G. → Repair ground harness.

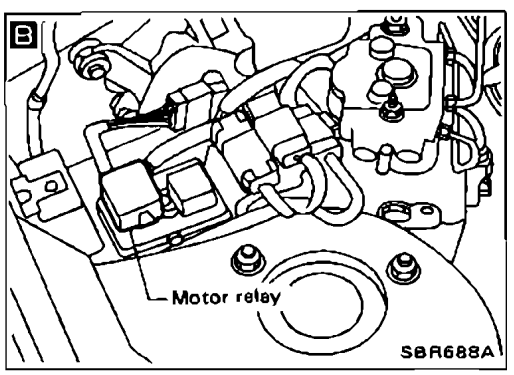
O.K. ↓

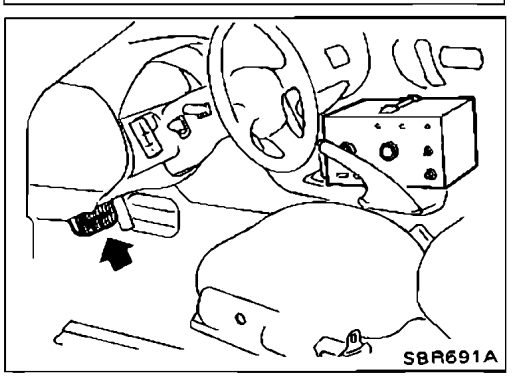
Replace control unit.











Electrical Components Inspection

ACTUATOR (Not self-diagnostic item)

INSPECTION START

Connect A.B.S. checker to actuator connector and vehicle harness with battery terminal connected and all checker switch turning off. Check that battery voltage is at least 12 volts.
Use harness for 3 channel.
Set select switch to 3 channel.

Turn checker power supply switch on.
Check power supply indicator for coming on.

No → Replace battery with fully charged new one, if checker connection is correct.

Yes

Check checker valve relay indicator for coming on.

No → A Replace solenoid valve relay, if checker connection is correct.

Yes

A Select one valve.
Select pressure decreasing position by switch then turn motor switch on.
Turn motor switch off.
Select pressure increasing position.

Repeat so that all valve will be performed.

CAUTION:
Do not hold switch at the pressure decreasing position for more than 5 seconds. Otherwise, solenoid valve may be overheated and damaged.

Check motor relay indicator for coming on while motor switch is turned on.

No → B Replace motor relay, if checker connection is correct.

Yes

Check motor for operational sound beside the actuator in a quiet place.

No → Replace actuator as assembly, if Diagnostic Procedures 7 - 12 are already performed and checker connection is correct.

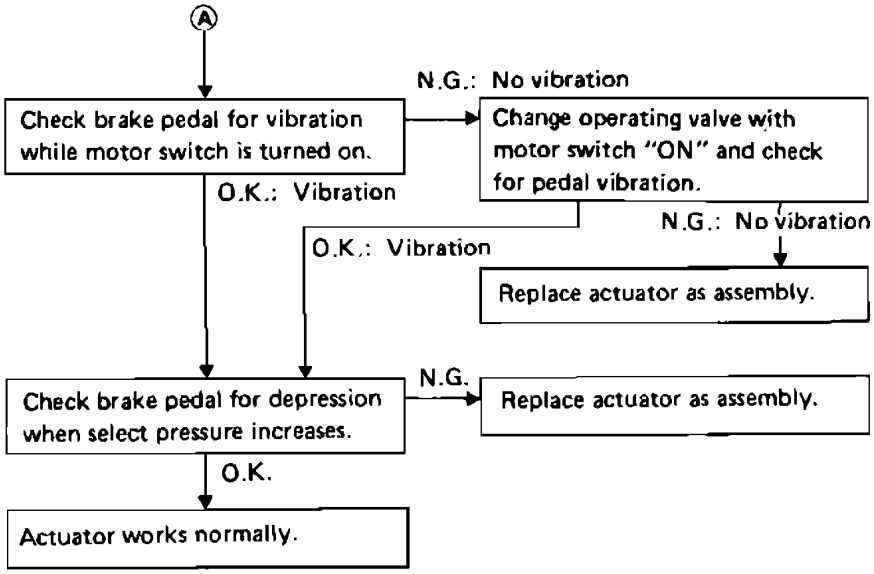
Yes

Bring checker in the vehicle and depress the brake pedal.
Repeat step A

Ⓐ

Valve select switch position RR is used for 4 channel checking. In the case of 3 channels, brake pedal vibration or depression will not occur in position RR. It will occur, however, in position RL.

Electrical Components Inspection (Cont'd)



General Specifications

Front brake Brake model		CL22VB	CL25VA
Cylinder bore diameter	mm (in)	54.0 (2.126)	57.2 (2.252)
Pad length x width x thickness	mm (in)	112.8 x 44.8 x 10.0 (4.44 x 1.764 x 0.394)	134.1 x 45.3 x 11.0 (5.28 x 1.783 x 0.433)
Rotor outer diameter x thickness	mm (in)	252 x 20 (9.92 x 0.79)	257 x 22 (10.12 x 0.87)
Rear brake Brake model		CL9H	
Cylinder bore diameter	mm (in)	33.96 (1.3370)	
Pad length x width x thickness	mm (in)	75.0 x 40.0 x 9.5 (2.953 x 1.575 x 0.374)	
Rotor outer diameter x thickness	mm (in)	258 x 9 (10.16 x 0.35)	
Master cylinder Cylinder bore diameter	mm (in)	22.22 (7/8)	23.81 (15/16)
Control valve Valve model		Proportioning valve (within master cylinder)	
Sprit point x reducing ratio	kPa (kg/cm^2, psi)	3,923 (40, 569) x 0.4	
Brake booster Booster model		M23	M195T
Diaphragm diameter	mm (in)	230 (9.06)	Primary 205 (8.07) Secondary 180 (7.09)
Brake fluid Recommended brake fluid		DOT 3	
Parking brake Control type		Center lever	

Inspection and Adjustment

FRONT DISC BRAKE

Item \ Brake model	CL22V8	CL25VA
Pad wear limit Minimum thickness mm (in)	2.0 (0.079)	
Rotor repair limit Minimum thickness mm (in)	18.0 (0.709)	20.0 (0.787)
Maximum runout mm (in)	0.07 (0.0028)	

REAR DISC BRAKE

Item \ Brake model	CL9H
Pad wear limit Minimum thickness mm (in)	2.0 (0.079)
Rotor repair limit Minimum thickness mm (in)	8.0 (0.315)
Maximum runout mm (in)	0.07 (0.0028)

BRAKE PEDAL

Free height mm (in) M/T	177.0 - 187.0 (6.97 - 7.36)
A/T	186.0 - 196.0 (7.32 - 7.72)
Depressed height [under force of 490 N (50 kg, 110 lb) with engine running] mm (in)	100 (3.94) or more
Clearance between pedal stopper and threaded end of stop lamp switch mm (in)	0.3 - 1.0 (0.012 - 0.039)
Clearance between pedal stopper and threaded end of A.S.C.D. switch mm (in)	0.3 - 1.0 (0.012 - 0.039)
Pedal free play at clevis mm (in)	1 - 3 (0.04 - 0.12)

PARKING BRAKE

Item \ Control type	Center lever
Number of notches [under force of 196 N (20 kg, 44 lb)]	6 - 8
Number of notches (when warning switch comes on)	1

STEERING SYSTEM

SECTION ST

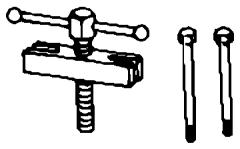
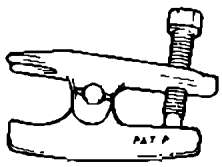
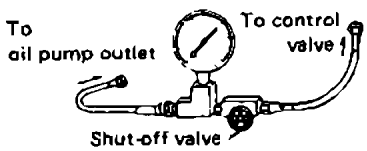
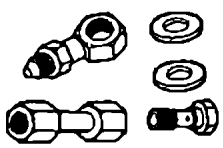
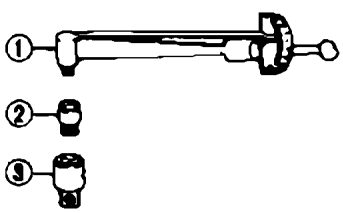
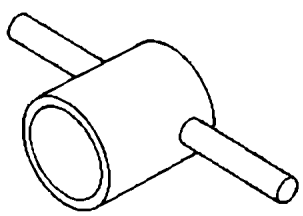
CONTENTS

PRECAUTIONS ..... ST- 2
PREPARATION ..... ST- 3
ON-VEHICLE INSPECTION ..... ST- 5
ON-VEHICLE INSPECTION (Power steering) ..... ST- 7
STEERING WHEEL AND STEERING COLUMN ST-10
POWER STEERING GEAR AND LINKAGE (Model PR24SC) ST-14
POWER STEERING OIL PUMP ST-27
SERVICE DATA AND SPECIFICATIONS (S.D.S.) ST-31

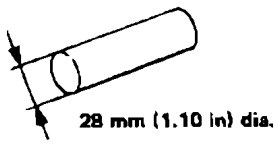
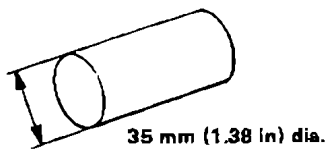
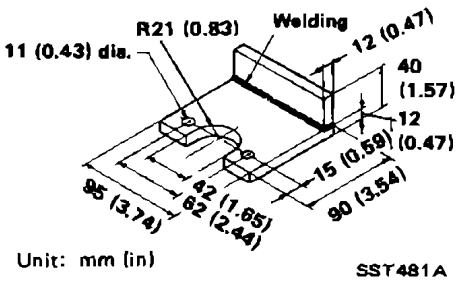
- Before disassembly, thoroughly clean the outside of the unit.
- Disassembly should be done in a clean work area. It is important to prevent the internal parts from becoming contaminated by dirt or other foreign matter.
- When disassembling parts, be sure to place them in order in a parts rack so they 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.

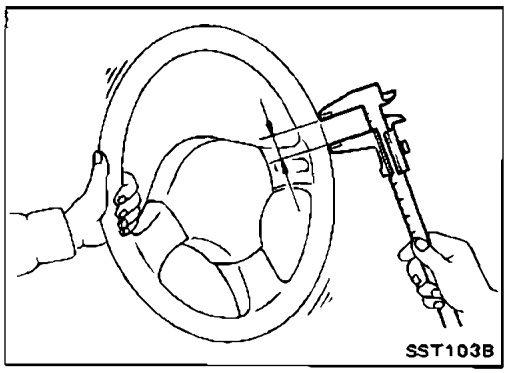
*: Automatic transmission fluid

SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.) Tool name	Description	
KV48100700 (J26364) Torque adapter		Measuring pinion rotating torque
ST27180001 (J25726-A) Steering wheel puller		Removing and installing steering wheel
HT72520000 (J25730-A) Ball joint remover		Removing ball joint
ST27091000 (J26357) Pressure gauge		Measuring oil pressure
KV48102500 (–) Pressure gauge adapter		Measuring oil pressure
ST3127S000 (See J25765-A) ① GG91030000 (J25765-A) Torque wrench ② HT62940000 (–) Socket adapter ③ HT62900000 (–) Socket adapter		Measuring turning torque
KV48104400 (–) Rack seal ring reformer		Reforming teflon ring

COMMERCIAL SERVICE TOOLS

Tool name	Description	
Rear oil seal drift		Installing rear oil seal
Pinion oil seal drift		Installing pinion oil seal
Oil pump attachment		Disassembling and assembling oil pump



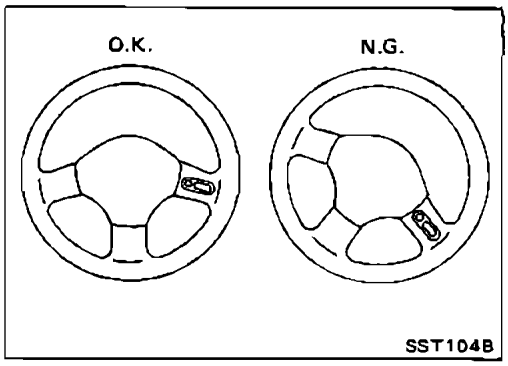
Checking Steering Wheel Play

- With wheels in a straight-ahead position, check steering wheel play.

  Steering wheel play:

  35 mm (1.38 in) or less

- If it is not within specification, check rack and pinion assembly.



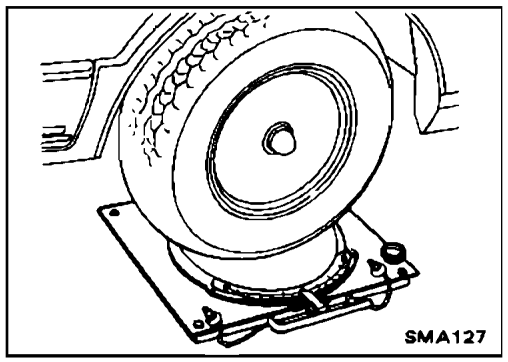
Checking Neutral Position on Steering Wheel

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.
- 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.

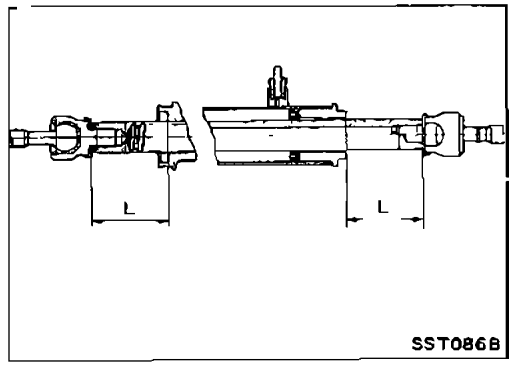


Front Wheel Turning Angle

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

  Turning angle of full turns:

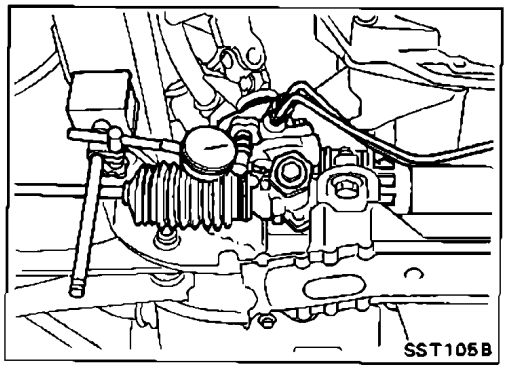
  Refer to section FA for S.D.S.



- If it is not within specification, check rack stroke.

  Measured length "L":

  Refer to S.D.S.



Checking Gear Housing Movement

- Check the movement of steering gear housing during stationary steering. The maximum allowable movement is as follows:

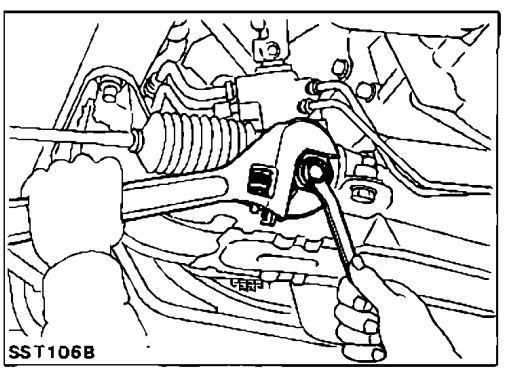
  Movement of gear housing:

  ±2 mm (±0.08 in) (on dry paved surface) or less

Apply a force of 49 N (5 kg, 11 lb) to steering wheel to check the gear housing movement.

On models equipped with power steering, turn off ignition key while checking.

- If movement exceeds the limit, replace mount insulator after confirming proper installation of gear housing clamps.



Adjusting Rack Retainer

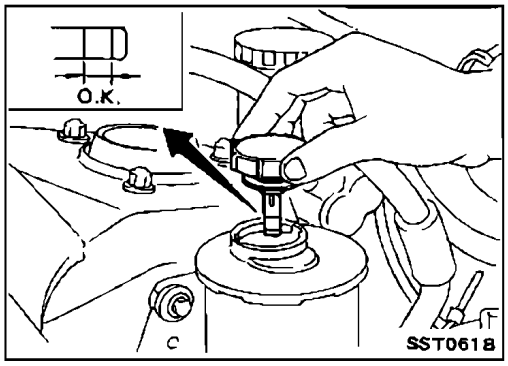
- Perform this driving test on a flat road.

1. Check whether vehicle moves in a straight line when steering wheel is released.
2. Check whether steering wheel returns to neutral position when steering wheel is released from a slightly turned (approx. 20°) position.

- If any abnormality is found, correct it by resetting adjusting screw.

Checking and Adjusting Drive Belts

Refer to section MA for Drive Belt Inspection.

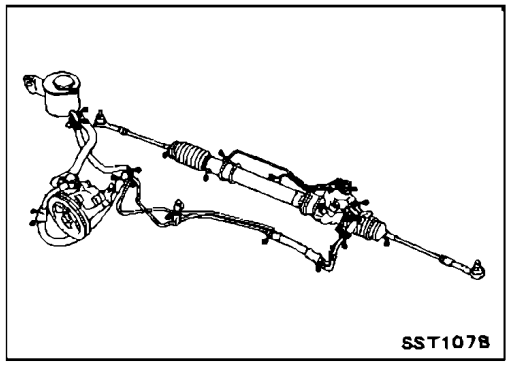


Checking Fluid Level

Check the level when the fluid is cold.

CAUTION:

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



Checking Fluid Leakage

Check the lines for improper attachment and for leaks, cracks, damage, loose connections, chafing or 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 the steering wheel in a locked position for more than 15 seconds.

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

1. Raise front end of vehicle until wheels clear ground.
2. Add fluid into oil tank to specified level. Meanwhile, quickly turn steering wheel fully to right and left and lightly touch steering stoppers.
   Repeat steering wheel operation until fluid level no longer decreases.
3. Start engine.
   Repeat step 2 above.

- Incomplete air bleeding will cause the following to occur. When this happens, bleed air again.

Bleeding Hydraulic System (Cont'd)

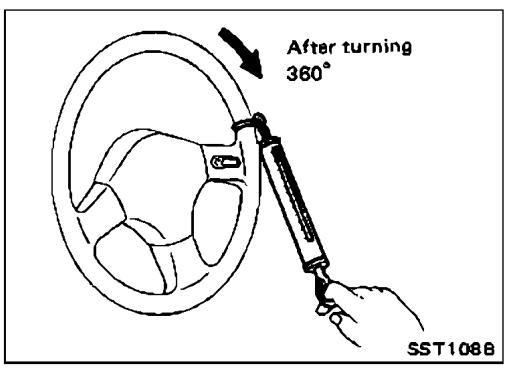
a. Generation of air bubbles in reservoir tank
b. Generation of clicking noise in oil pump
c. Excessive buzzing in oil pump

While the vehicle is stationary or while turning the steering wheel slowly, fluid noise may occur in the valve or oil pump. This noise is inherent in this steering system, and it will not affect performance or durability of the system.

Checking Steering Wheel Turning Force

1. Park vehicle on a level, dry surface and set parking brake.
2. Start engine.
3. Warm up power steering fluid to adequate operating temperature.
   Temperature of fluid:
   Approximately 60 - 80°C (140 - 176°F).

Tires need to be inflated to normal pressure.



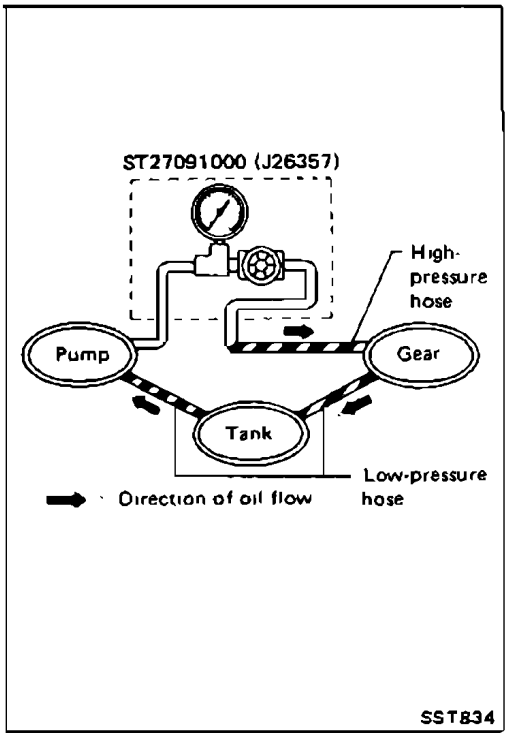
4. Check steering wheel turning force with engine idling when steering wheel has been turned 360° from neutral position.
   Steering wheel turning force:
   39 N (4 kg, 9 lb) or less

Checking Hydraulic System

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).

Checking Hydraulic System (Cont'd)



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 with engine idling at 1,000 rpm.

CAUTION:

Do not hold the steering wheel in a locked position for more than 15 seconds.

Oil pump maximum standard pressure:
6,865 kPa (70 kg/cm², 995 psi)
at idling

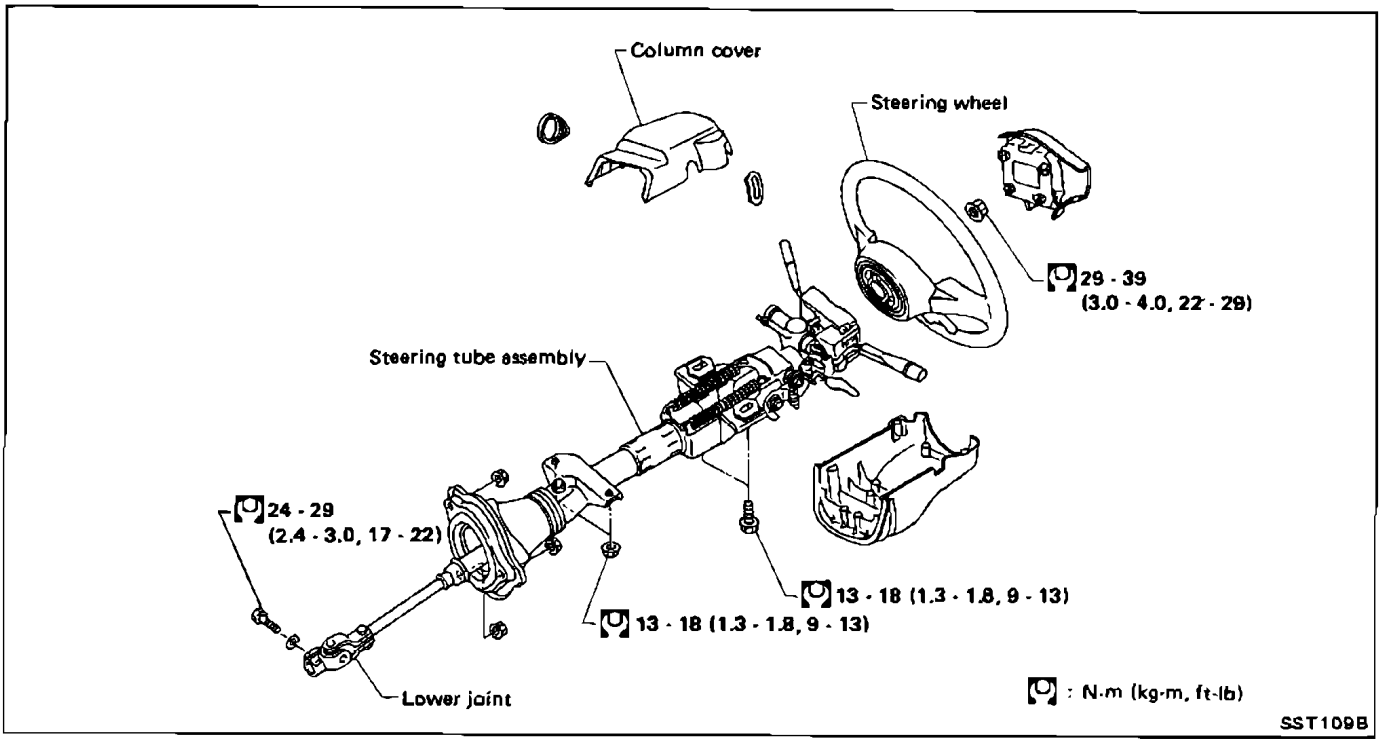
4. If oil pressure is below the standard pressure, slowly close shut-off valve and check pressure.

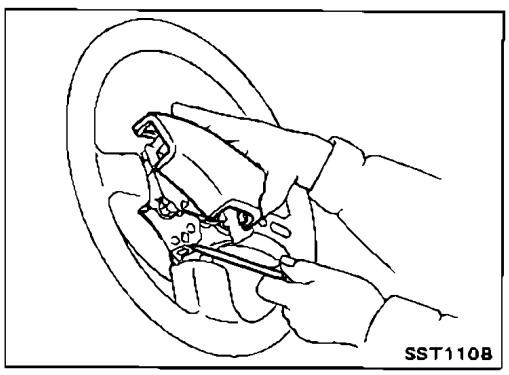
- When pressure reaches standard pressure, gear is damaged.
- When pressure remains below standard pressure, pump is damaged.

CAUTION:

Do not close shut-off valve for more than 15 seconds.

5. If oil pressure is higher than standard pressure, pump is damaged.
6. After checking hydraulic system, remove Tool and add fluid as necessary, then completely bleed air out of system.



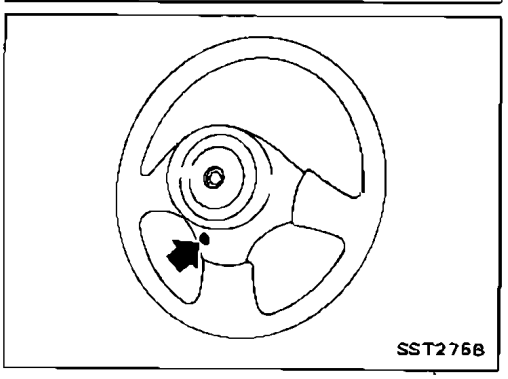


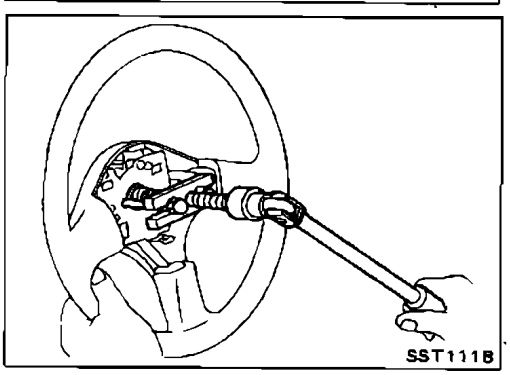
Removal

STEERING WHEEL

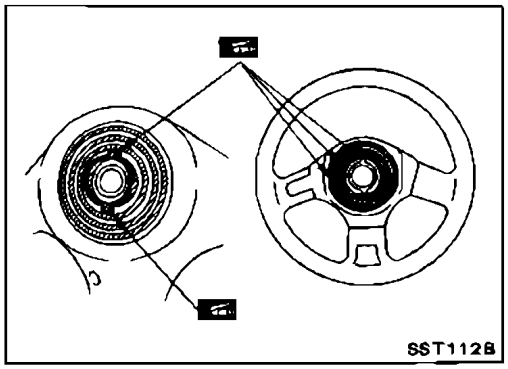
- Pull out horn pad.

If it is hard to pull out horn pad, temporarily loosen fixing screw of horn pad retaining spring.





- Remove steering wheel with Tool.



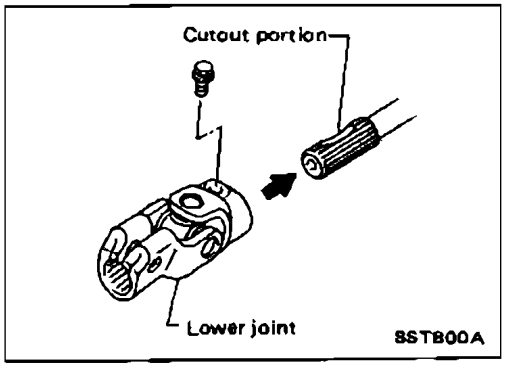
Installation

STEERING WHEEL

- 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.

STEERING COLUMN

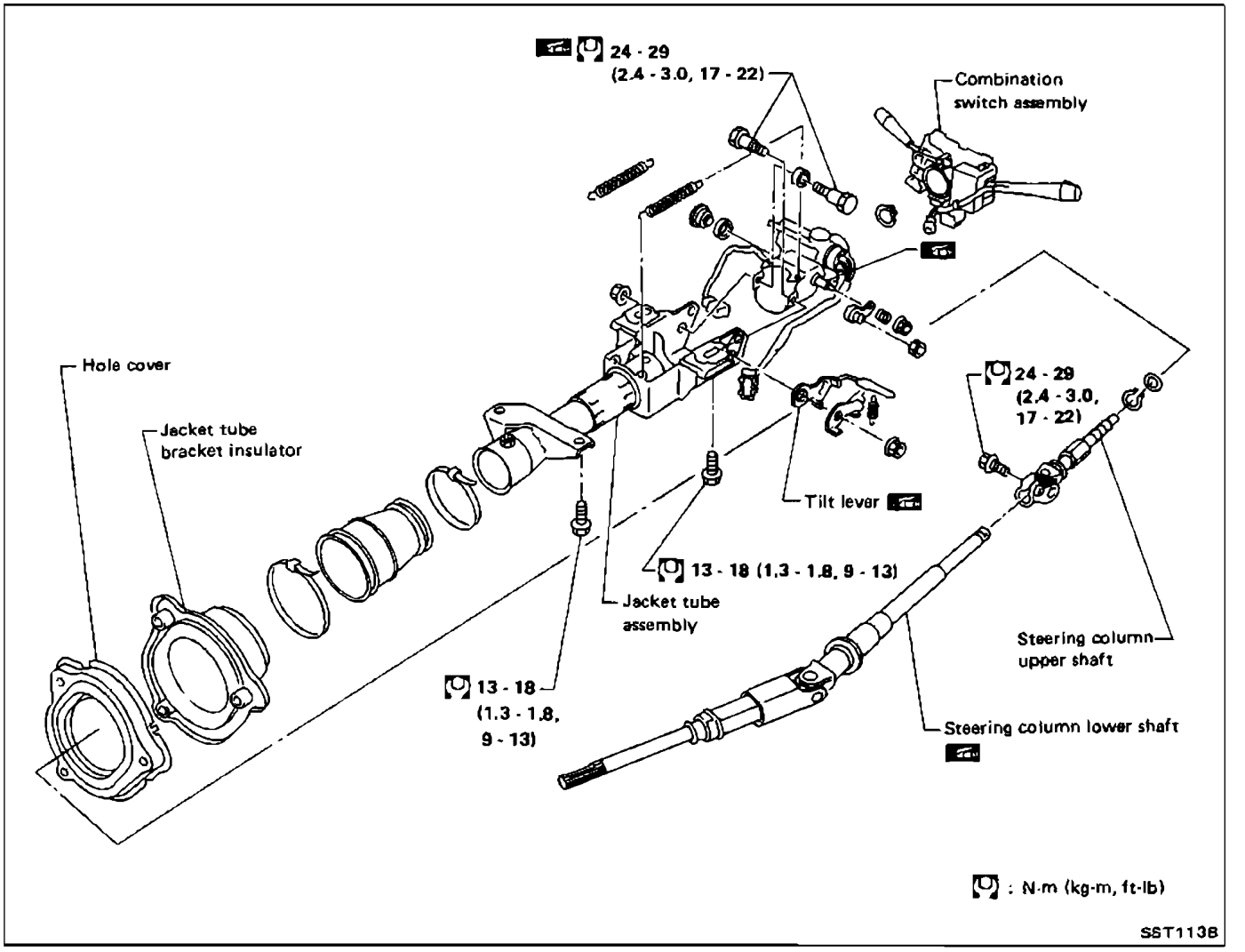
- When installing steering column, fingertighten all lower bracket and clamp retaining bolts; then tighten them securely. Do not apply undue stress to steering column.

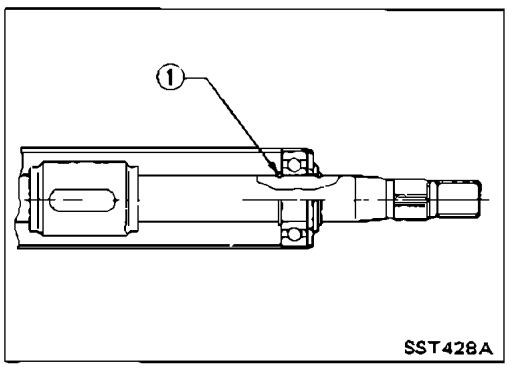


- When attaching coupling joint, be sure tightening bolt faces cutout portion.

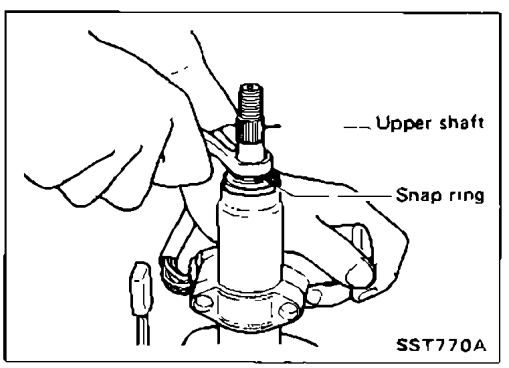
CAUTION:
After installing steering column, turn steering wheel to make sure it moves smoothly and that the number of turns from the straight forward position to left and right locks are equal.
Be sure that the steering wheel is in a neutral position when driving straight ahead.

Disassembly and Assembly



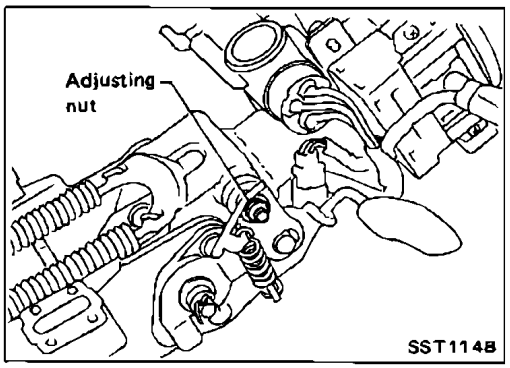


- When disassembling and assembling, unlock steering lock with key.
- Ensure that rounded surface of snap ring faces toward bearing when snap ring is installed.
- Install snap ring ① before inserting shaft into jacket tube.

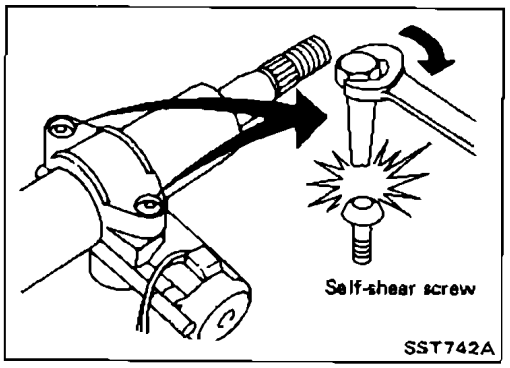


- Install snap ring on upper shaft with box wrench.

Disassembly and Assembly (Cont'd)



- **Tilt mechanism**
  Tighten adjusting nut to specification.
  [O]: 4 - 5 N·m
  (0.4 - 0.5 kg-m, 2.9 - 3.6 ft-lb)

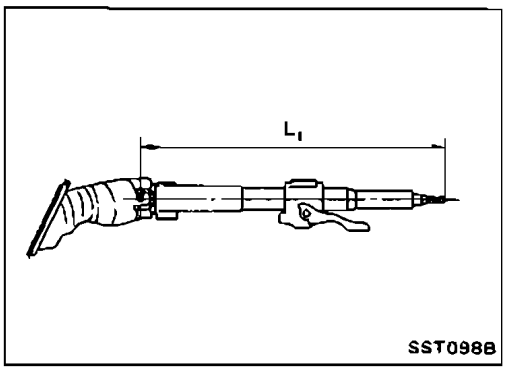


- Steering lock

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

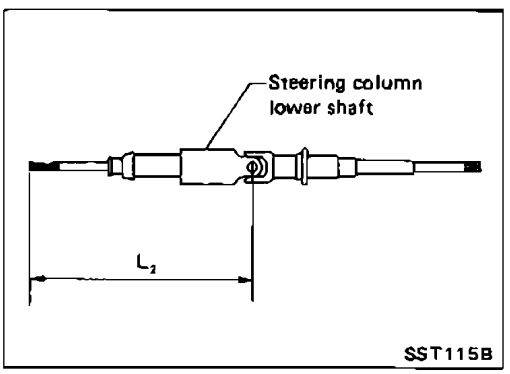


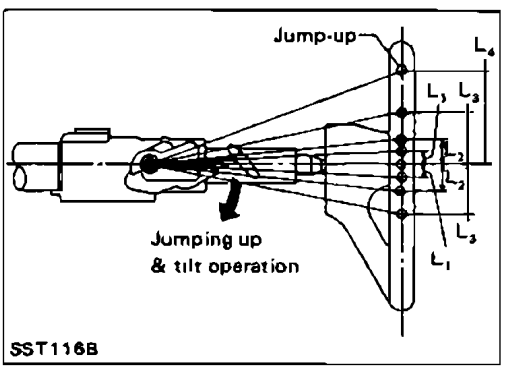
- When steering wheel can not be rotated smoothly, check the steering column for the following matters and replace damaged parts.

a. Check column bearings for damage or unevenness. Lubricate with recommended multi-purpose grease or replace steering column as an assembly, if necessary.

b. Check steering column lower shaft for deformation or breakage. Replace if necessary.

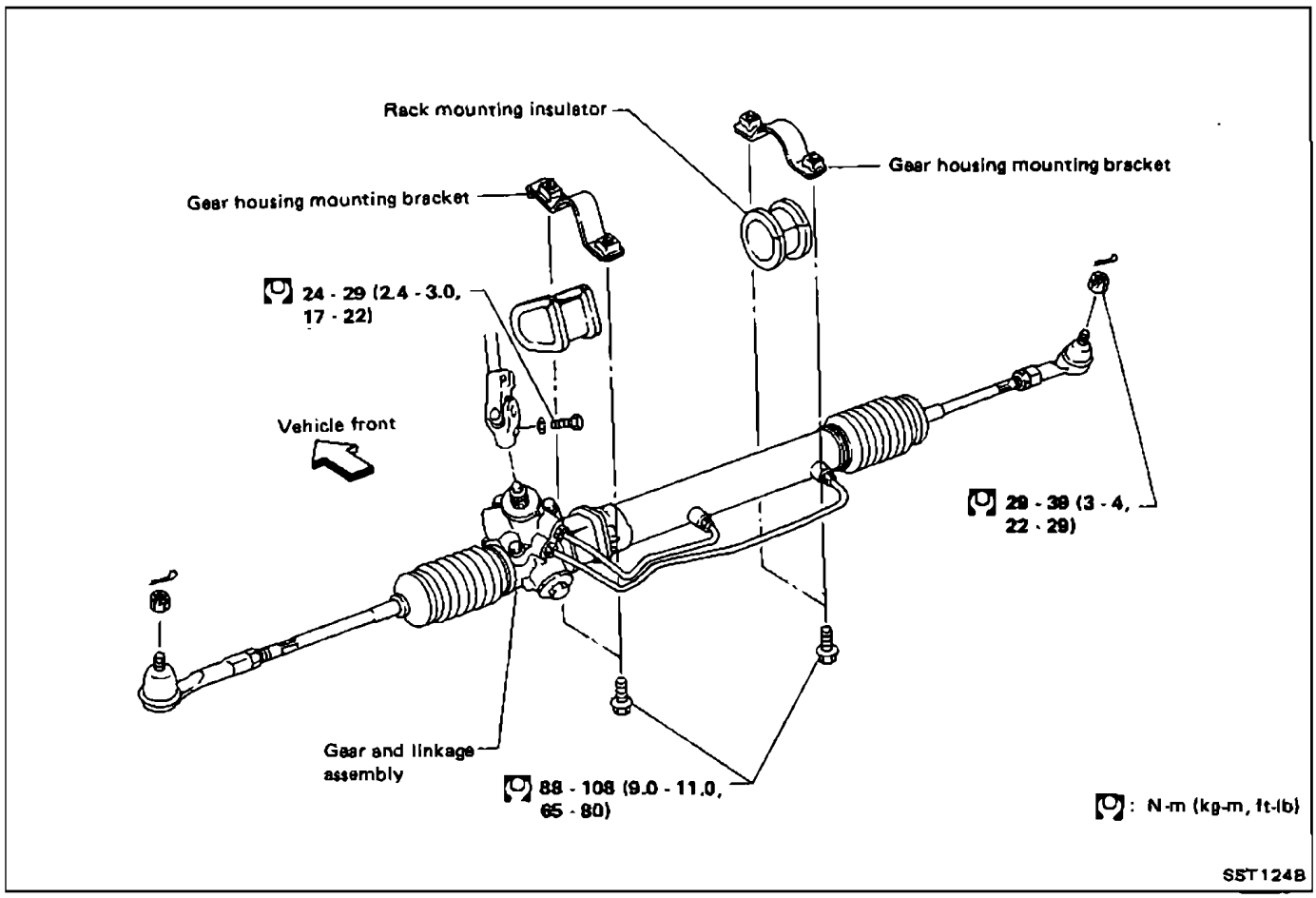
- When the vehicle is involved in a light collision, check steering column length "L_1" and steering column lower shaft length "L_2". If it is not within specifications, replace steering column as an assembly.
  Steering column length "L_1":
  653.1 - 654.5 mm (25.71 - 25.77 in)
  Steering column lower shaft length "L_2":
  323.7 - 325.3 mm (12.74 - 12.81 in)

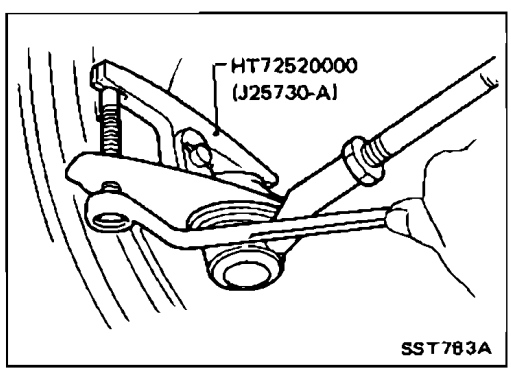




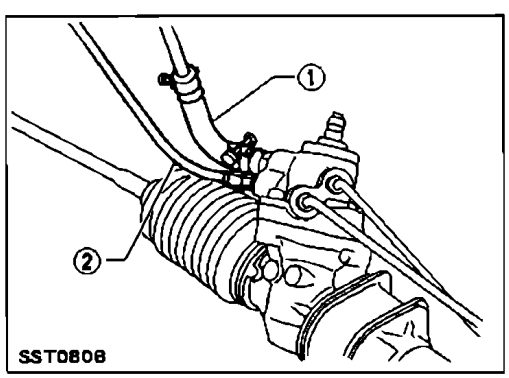
- After installing steering column, check tilt mechanism operation.
  L_1: 9.8 mm (0.386 in)
  L_2: 19.5 mm (0.768 in)
  L_3: 29.3 mm (1.154 in)
  L_4: 58.2 mm (2.291 in)

Removal and Installation





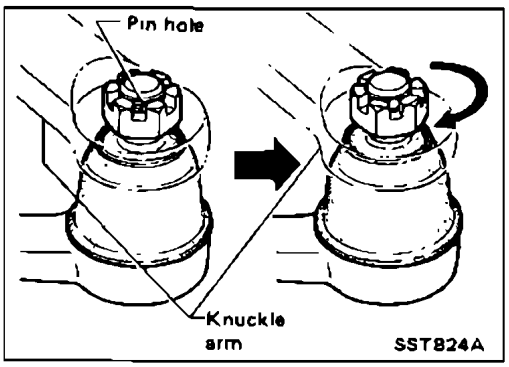
- Detach tie-rod outer sockets from knuckle arms with Tool.



- Install pipe connector.
  - ① Low-pressure side
    : 27 - 39 N·m (2.8 - 4.0 kg-m, 20 - 29 ft-lb)
  - ② High-pressure side
    : 15 - 25 N·m (1.5 - 2.5 kg-m, 11 - 18 ft-lb)

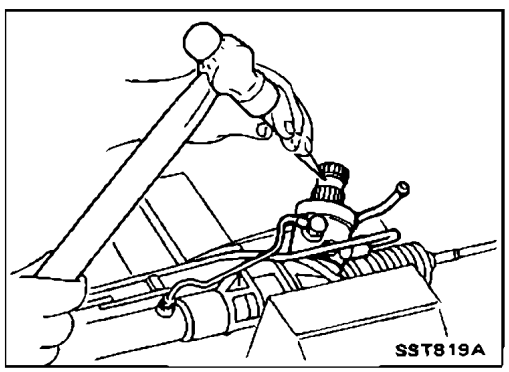
Removal and Installation (Cont'd)

- Observe specified tightening torque when tightening high-pressure and low-pressure pipe connectors. Excessive tightening can damage threads or damaged connector O-ring.
- The O-ring in low-pressure pipe connector is larger than that in high-pressure connector. Take care to install the proper O-ring.



- Initially, tighten nut on tie-rod outer socket and knuckle arm to 29 to 39 N·m (3 to 4 kg-m, 22 to 29 ft-lb). Then tighten further to align nut groove with first pin hole so that cotter pin can be installed.

CAUTION:
Tightening torque must not exceed 49 N·m (5 kg-m, 36 ft-lb).

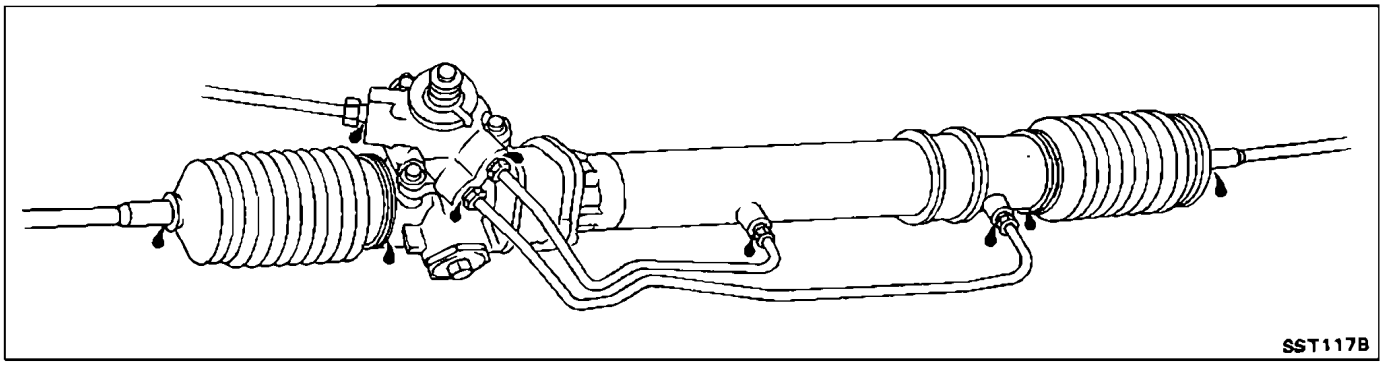


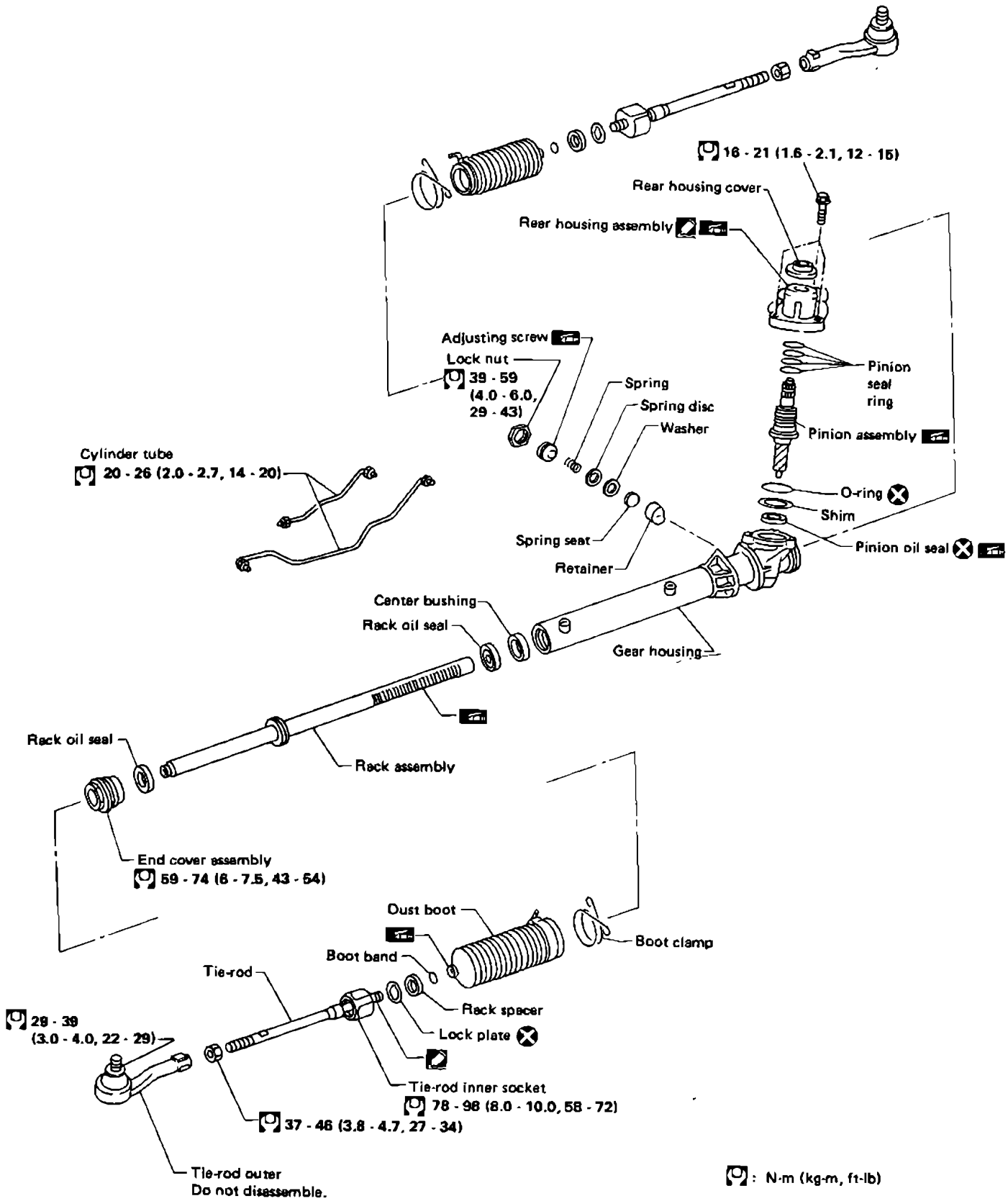
- Before removing lower joint from gear, set gear in neutral (wheels in straight-ahead position). After removing lower joint, put matching mark on pinion shaft and pinion housing to record neutral position of gear.
- To install, set left and right dust boots to equal deflection, and attach lower joint by aligning matching marks of pinion shaft and pinion housing.

Disassembly and Assembly

The table below lists four ways to repair oil leaks in the steering gear, depending on the location of the leak. **See the following figure for oil leak locations.**

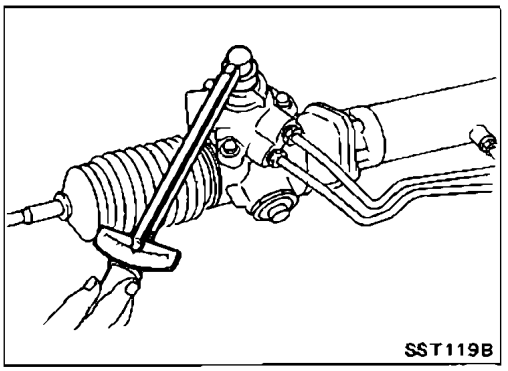
Position of oil leak / Item	① Rear housing cover and rear housing	② Boot	③ Boot	④ Cylinder tube
Operation	■ Replacement • Rear oil seal • Pinion oil seal • O-ring • Snap ring	■ Replacement • Rack oil seal • Boot clamp	■ Replacement • Rack oil seals • Rack oil seal • O-ring • Back-up collar • Boot clamp	■ Replacement • Cylinder tube • Copper washer
Procedure	Remove gear from vehicle. Measure rack starting force and pinion rotating torque. Replace parts described above. Replace rack oil seal. Replace parts described above. Replace cylinder tube. Measure pinion rotating torque. Adjust adjusting screw. Measure rack starting force and pinion rotating torque.			
Service parts to be prepared	• Pinion seal kit	• Gear housing seal kit	• Rack oil seal • Pinion seal kit	• Gear housing seal kit



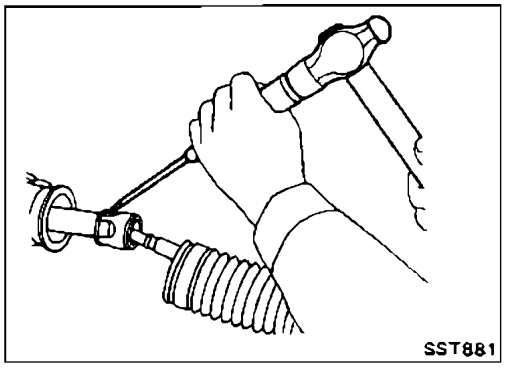

16 - 21 (1.6 - 2.1, 12 - 15)
Rear housing cover
Rear housing assembly
Adjusting screw
Lock nut
39 - 59 (4.0 - 6.0, 29 - 43)
Spring
Spring disc
Washer
Pinion seal ring
Pinion assembly
Cylinder tube
20 - 26 (2.0 - 2.7, 14 - 20)
O-ring
Shim
Spring seat
Retainer
Pinion oil seal
Center bushing
Rack oil seal
Gear housing
Rack oil seal
Rack assembly
End cover assembly
59 - 74 (6 - 7.5, 43 - 54)
Dust boot
Boot clamp
Boot band
Tie-rod
Rack spacer
29 - 39 (3.0 - 4.0, 22 - 29)
Lock plate
Tie-rod inner socket
78 - 98 (8.0 - 10.0, 58 - 72)
37 - 46 (3.8 - 4.7, 27 - 34)
Tie-rod outer
Do not disassemble.
: N·m (kg-m, ft-lb)

SST118B

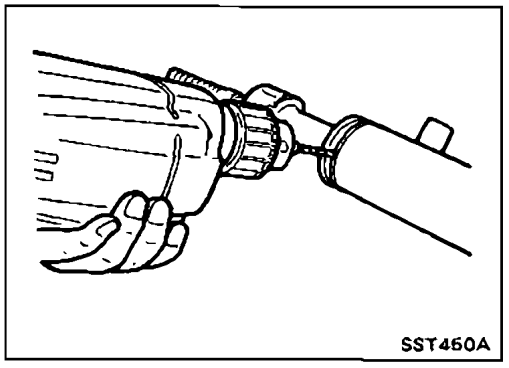
Disassembly


SST119B

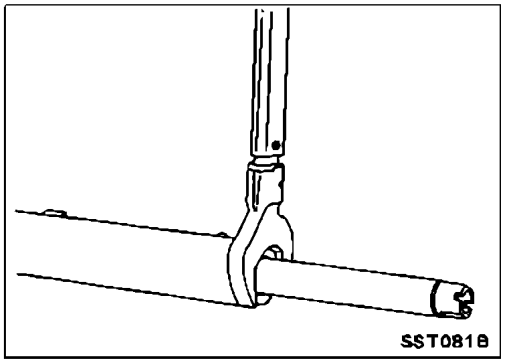
1. Prior to disassembling, measure pinion rotating torque. Record the pinion rotating torque as a reference.
- **Before measuring, disconnect cylinder tube and drain fluid.**
- **Use soft jaws when holding steering gear housing. Handle gear housing carefully, as it is made of aluminum. Do not grip cylinder in a vise.**
2. Remove pinion gear.
- **Be careful not to damage pinion gear when removing pinion seal ring.**


SST881

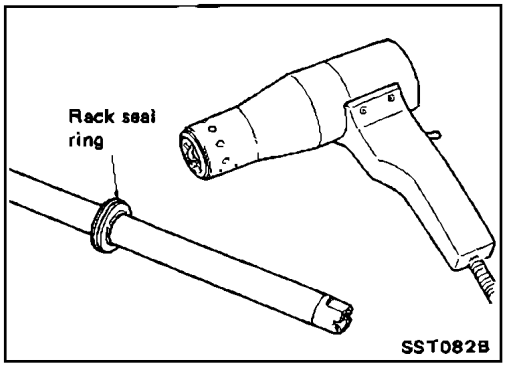
3. Remove tie-rod outer sockets and boots.
4. Loosen tie-rod inner socket by prying up staked portion, and remove socket.
5. Remove retainer.
6. Remove pinion assembly.


SST460A

7. Drill staked portion of cylinder end cover with drill of 2 to 2.5 mm (0.079 to 0.098 in) diameter, until the staking is eliminated.


SST081B

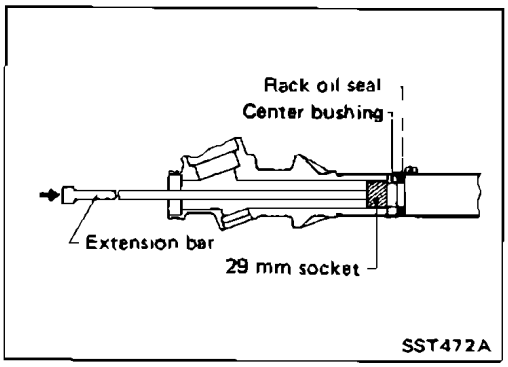
8. Remove gear housing end cover assembly with Tool.
9. Draw out rack assembly.



SST082B

10. Remove rack seal ring.
- Using a heat gun, heat rack seal to approximately 40°C (104°F).
- Remove rack seal ring. Be careful not to damage rack.
- Replace rack seal ring and O-ring with new ones.

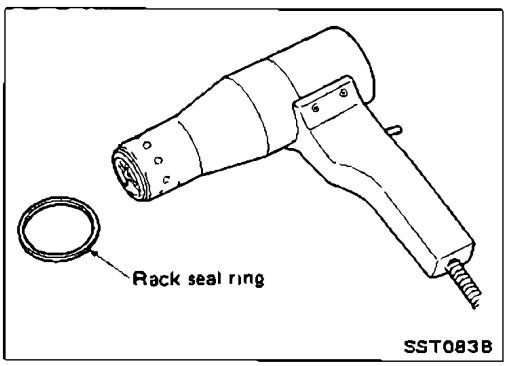
Disassembly (Cont'd)



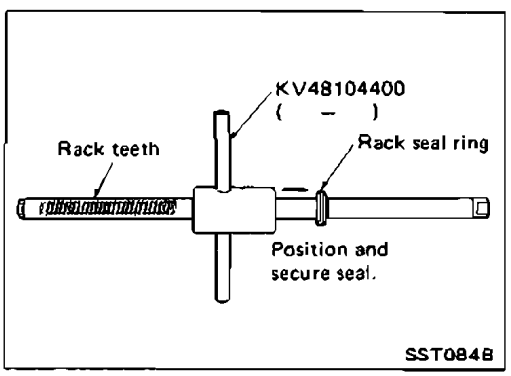
11. Remove center bushing and rack oil seal using tape wrapped socket and extension bar.

Do not scratch inner surfaces of pinion housing.

Assembly

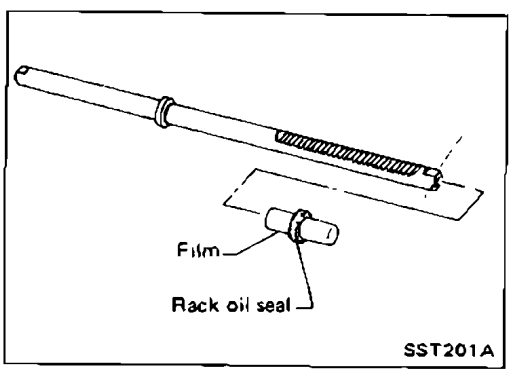


1. Using a heat gun, heat rack seal ring (made of Teflon) to approximately 40°C (104°F) and install it onto rack with your hand.

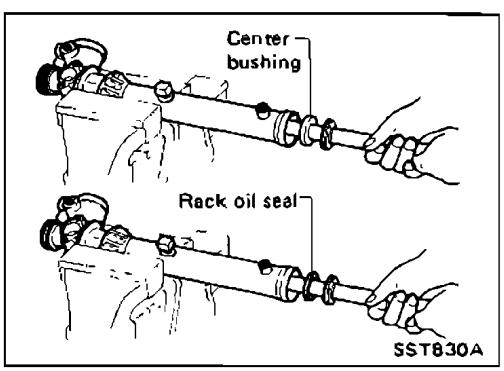


- Using Tool, compress periphery of rack seal ring (made of Teflon) to position and secure it on rack.

Always insert the tool from the rack gear side.

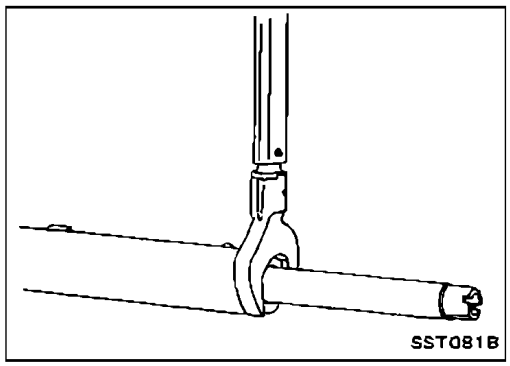


2. Insert rack oil seal.
- Place plastic film into rack oil seal to prevent damage by rack teeth.
- Always remove plastic film after rack oil seal is positioned properly.
- Make sure lips of rack oil seal face each other.

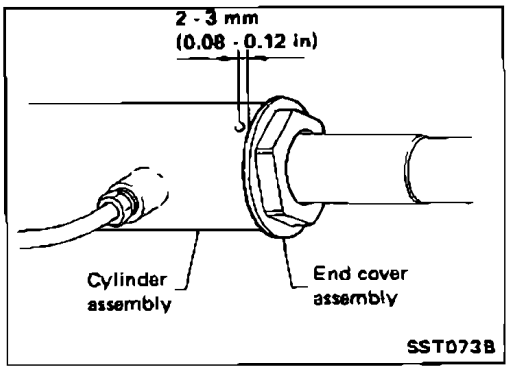


3. Install center bushing and rack oil seal with rack assembly.

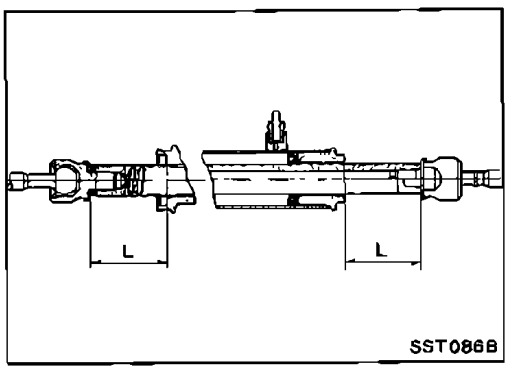
Assembly (Cont'd)



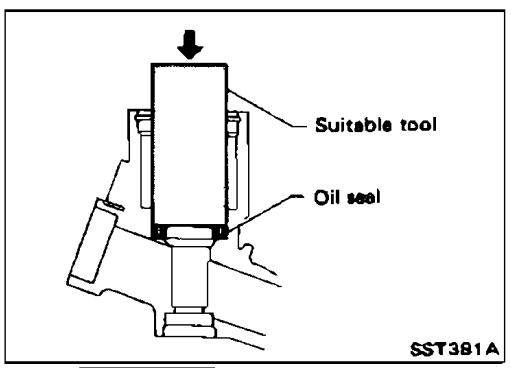
4. Tighten cylinder end cover assembly with Tool.



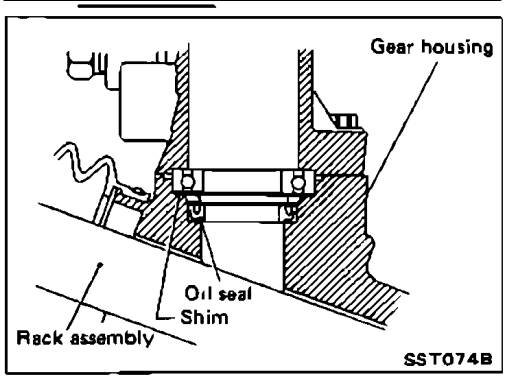
5. Fasten cylinder end cover assembly to gear housing by staking.



6. Set rack gear in neutral position.
   Measured length "L":
   Refer to S.D.S.

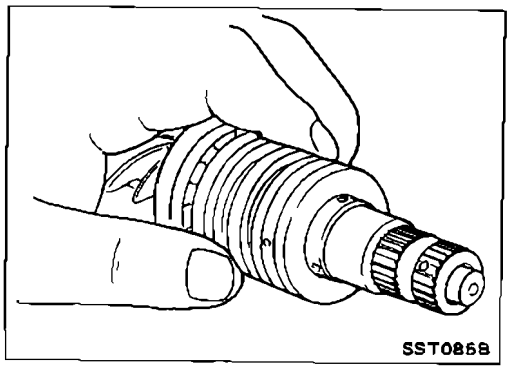


7. Coat seal lip of oil seal with multi-purpose grease and install new pinion oil seal to pinion housing with suitable tool.
   - Make sure lip of oil seal faces up when installed.

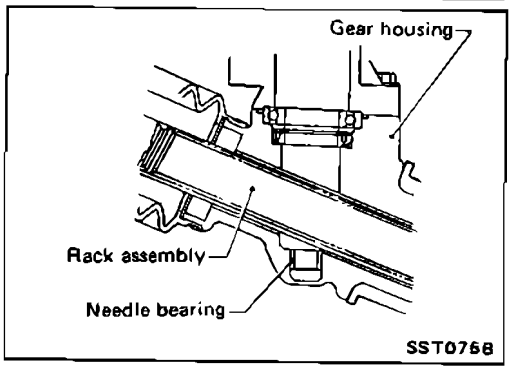


8. Install pinion bearing adjusting shim(s).
   - Whenever pinion assembly, gear housing and rear housing are disassembled, replace shim(s) with new ones. Always use the same number of shim(s) when replacing.

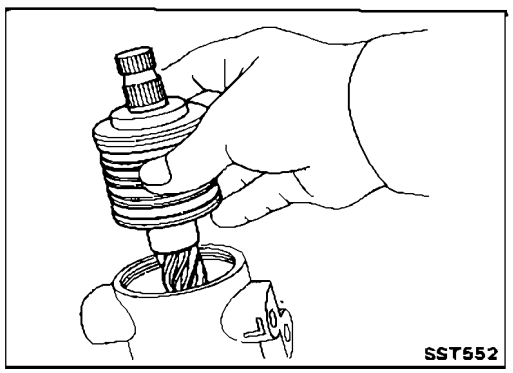
Assembly (Cont'd)



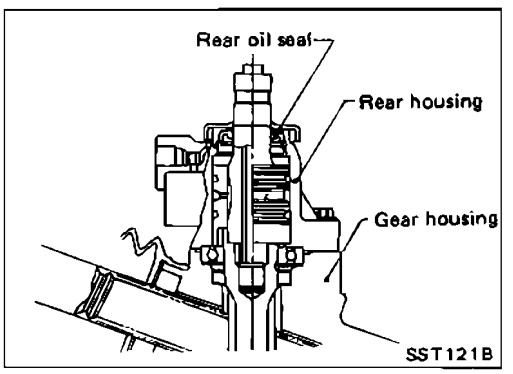
9. Install pinion seal ring on pinion gear assembly.
   - Using a heat gun, heat pinion seal ring to approximately 40°C (104°F) before installing it onto pinion gear assembly.
   - Make sure pinion seal ring is properly settled in valve groove.



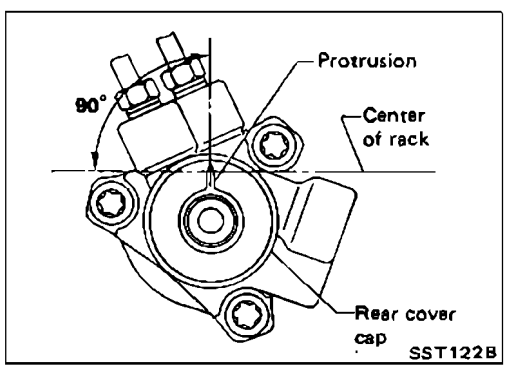
10. Apply a coat of multi-purpose grease to needle bearing roller and oil seal lip before installing pinion assembly in gear housing.



11. Install pinion assembly to pinion housing.
Be careful not to damage pinion oil seal.

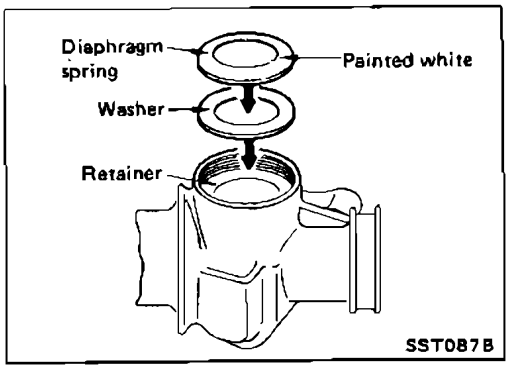


12. Apply a coat of multi-purpose grease to rear oil seal lip before installing rear housing.



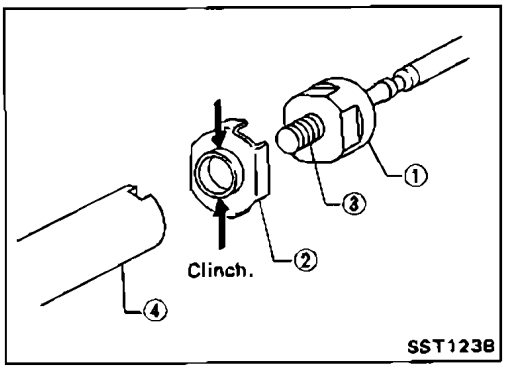
13. Install rear cover cap so that protrusion of rear housing cover is positioned as shown in figure at left.
Be careful not to damage worm ring and oil seal.

Assembly (Cont'd)



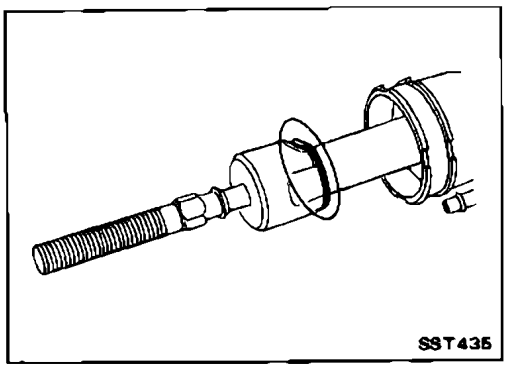
14. Install diaphragm spring at retainer.
- Always install retainer, spring washer and diaphragm spring in that order.
- Make sure convex end (painted white) of diaphragm spring faces outward when installing.

15. Install retainer spring and adjusting screw temporarily.



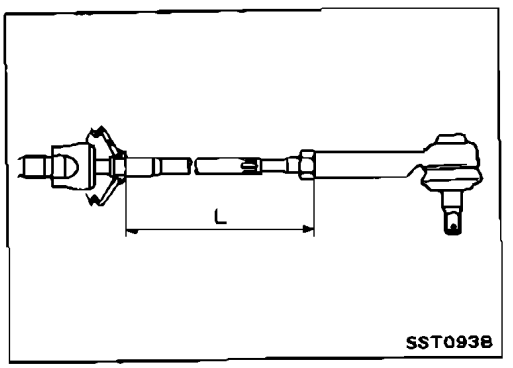
- Attach lock plate ② to side rod inner socket ①.
- Apply locking sealant to inner socket threads ③. Screw inner socket into rack ④ and tighten to specified torque.
- Clinch two places of lock plate at rack's groove.

CAUTION:
To prevent scratching the boot, remove burrs from lock plate.

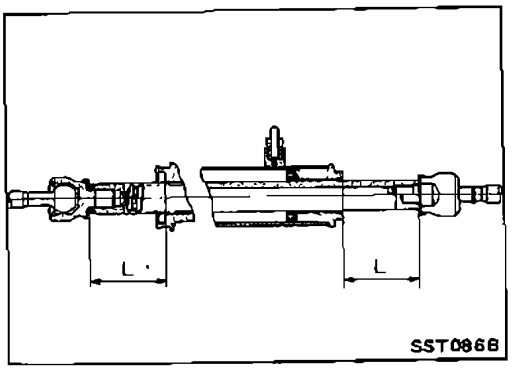


16. Tighten inner socket and securely bend lock plate at 2 cutout portions of inner socket.

To prevent damage to boot, remove burrs after bending lock plate.



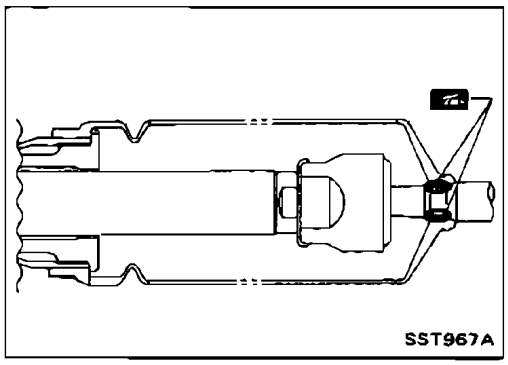
17. Tighten outer socket lock nut.
Tie-rod length "L":
Refer to S.D.S.



18. Measure rack stroke.
Measured length "L":
Refer to S.D.S.

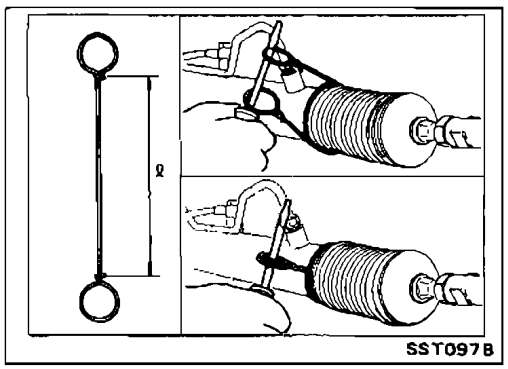
Assembly (Cont'd)

19. Before installing boot, coat the contact surfaces between boot and tie-rod with grease.

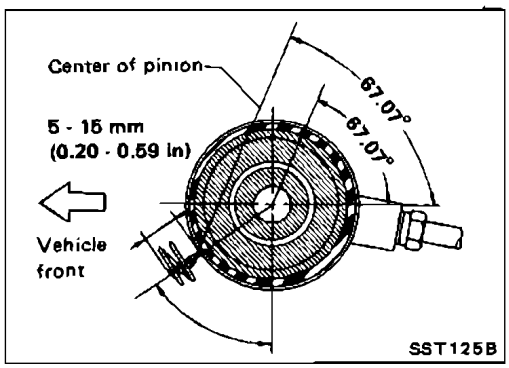


20. Install boot clamps.

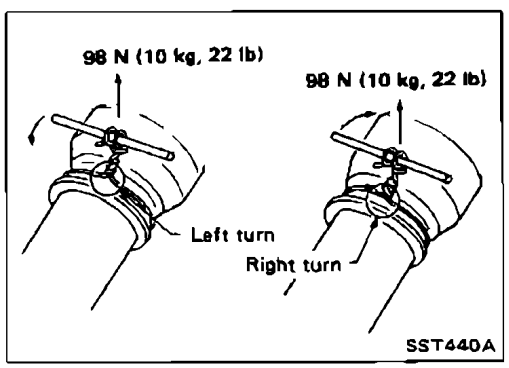
- To install, wrap boot clamp around boot groove twice. Tighten clamp by twisting rings at both ends 4 to 4-1/2 turns with screwdriver while pulling with a force of approx. 98 N (10 kg, 22 lb).



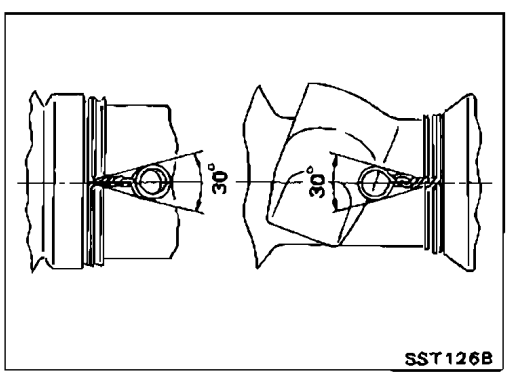
- Install boot clamp so that it is to the rear of the vehicle when gear housing is attached to the body. (This will prevent interference with other parts.)

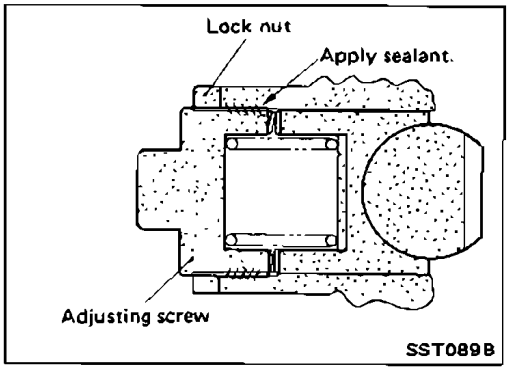


- Twist boot clamp in the direction shown in figure at left.



- After twisting boot clamp, bend twisted and diagonally so it does not contact boot.

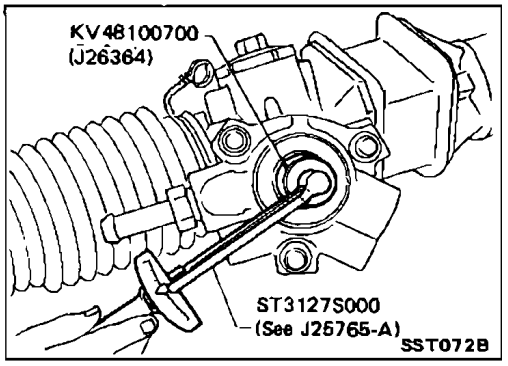




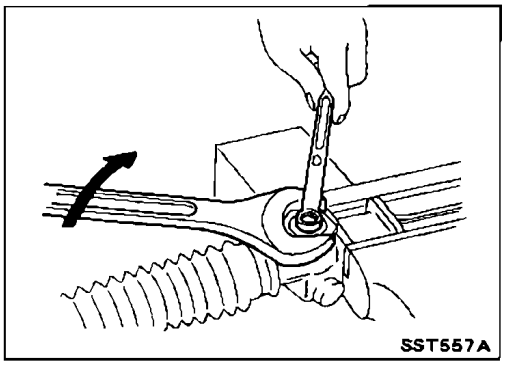
Adjustment

Adjust pinion rotating torque as follows:

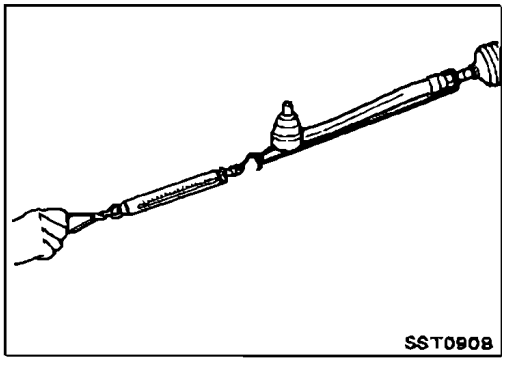
1. Set gears to Neutral without fluid in the gear.
2. Coat the adjusting screw with locking sealant and screw it in.
3. Lightly tighten lock nut.
4. Tighten adjusting screw to a torque of 4.9 to 5.9 N•m (50 to 60 kg-cm, 43 to 52 in-lb).
5. Loosen adjusting screw, then retighten it to 0.05 to 0.20 N•m (0.5 to 2 kg-cm, 0.43 to 1.74 in-lb).
6. Move rack over its entire stroke several times.



7. Measure pinion rotating torque within the range of 180° from neutral position.
   Stop the gear at the point of maximum torque.
8. Loosen adjusting screw, then retighten it to 4.9 to 5.9 N•m (50 to 60 kg-cm, 43 to 52 in-lb).
9. Loosen adjusting screw by 40° to 60°.

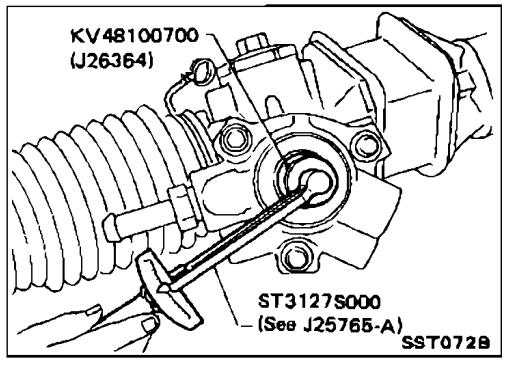


10. Prevent adjusting screw from turning, and tighten lock nut to specified torque.



11. Check steering gear for rack sliding frictional force.
    Around neutral point of rack stroke
    ±5.5 mm (±0.217 in):
    122.6 - 166.7 N (12.5 - 17 kg, 27.6 - 37.5 lb)
    Except for neutral point:
    122.6 - 186.3 N (12.5 - 19 kg, 27.6 - 41.9 lb)

If sliding frictional force is out of specification, repeat the adjustment procedure, starting from No. 4.
After the readjustment, if sliding force is still out of specification, steering gear is damaged.



12. Measure pinion rotating torque within the range of ±100° from the neutral point.
    Average rotating torque
    [(Max. measured value + Min. measured value) x 0.5]:
    0.8 - 1.3 N•m (8 - 13 kg-cm, 6.9 - 11.3 in-lb)
    Maximum torque increment:
    Less than 0.4 N•m (4 kg-cm, 3.5 in-lb)
    Except for above mentioned measuring range:
    Maximum rotating torque
    1.9 N•m (19 kg-cm, 16 in-lb)
    Maximum torque increment
    Less than 0.6 N•m (6 kg-cm, 5.2 in-lb)

Adjustment (Cont'd)

- If pinion rotating torque is not within specification, readjust it.
- After the readjustment, if pinion rotating torque is still out of specification, steering gear is damaged.

Inspection

Thoroughly clean all parts in cleaning solvent or automatic transmission fluid "DEXRON™ Type", and blow dry with compressed air, if available.

BOOT

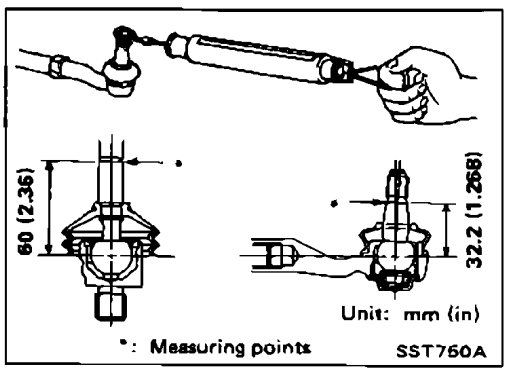
Check condition of boot. If cracked excessively, replace it.

RACK

Thoroughly examine rack gear. If damaged, cracked or worn, replace it.

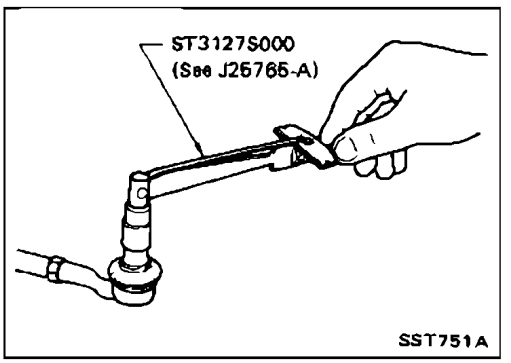
PINION ASSEMBLY

- Thoroughly examine pinion gear. If pinion gear is damaged, cracked or worn, replace it.
- Inspect bearings to see that they roll freely and are free from cracked, pitted, or worn balls, rollers and races. Replace if necessary.

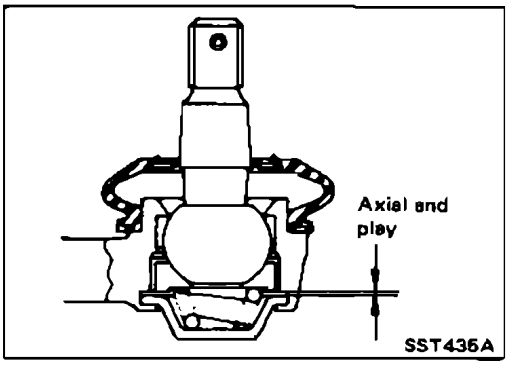


TIE-ROD OUTER AND INNER SOCKET

- Check ball joint for swinging force.
  Tie-rod outer ball joint:
  9.12 - 91.30 N
  (0.93 - 9.31 kg, 2.05 - 20.53 lb)
  Tie-rod inner ball joint:
  8.14 - 122.6 N
  (0.83 - 12.5 kg, 1.83 - 27.6 lb)



- Check ball joint for rotating torque.
  Tie-rod outer ball joint:
  0.29 - 2.94 N·m
  (3.0 - 30.0 kg-cm, 2.6 - 26.0 in-lb)
  Tie-rod inner ball joint:
  7.4 N·m (75 kg-cm, 65 in-lb) or less



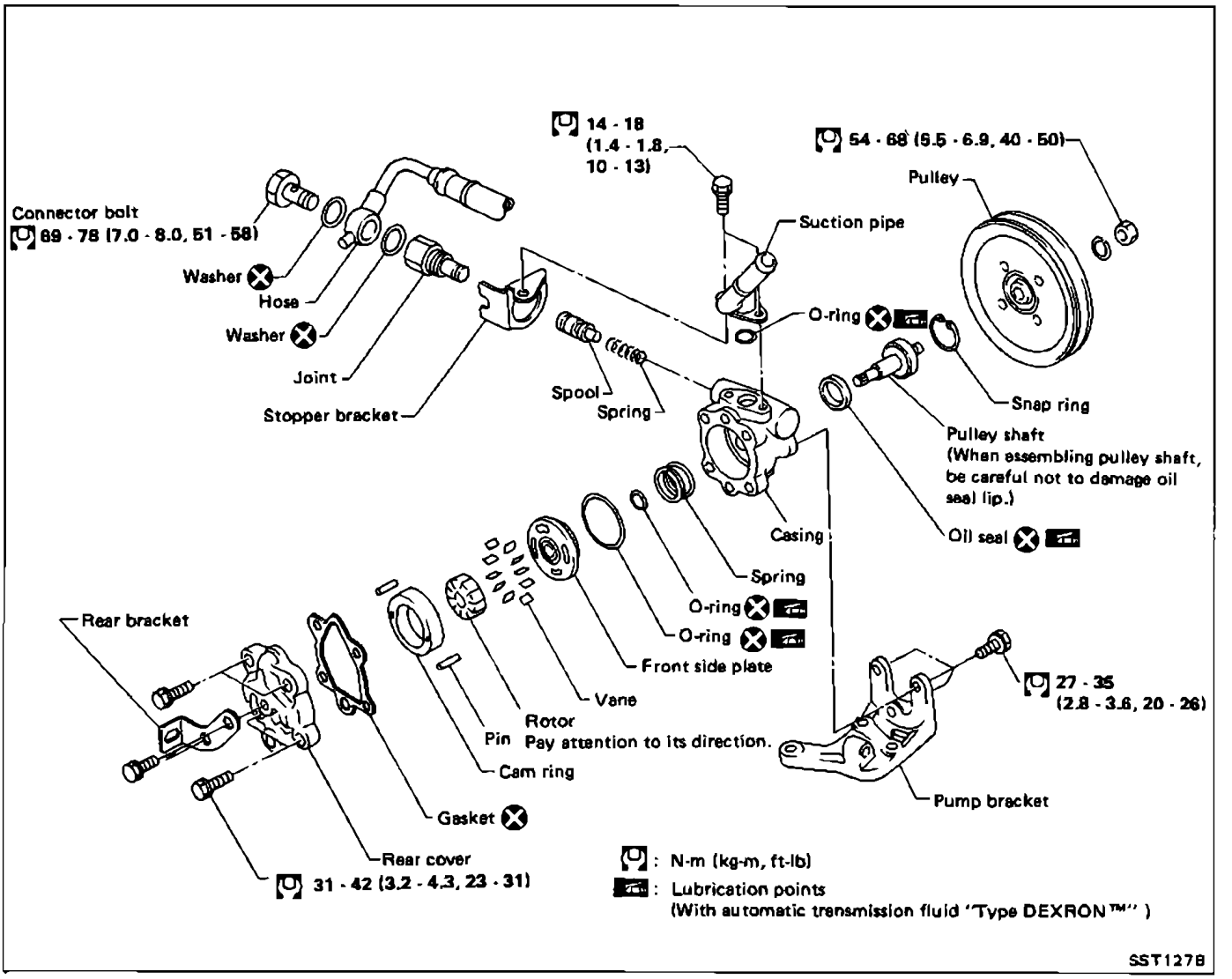
Inspection (Cont'd)

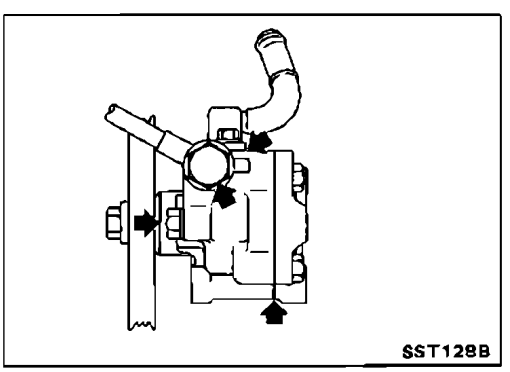
- Check ball joint for axial end play.
  Tie-rod outer ball joint:
  0.5 mm (0.020 in) or less
  Tie-rod inner ball joint:
  0 mm (0 in)
- Check condition of dust cover. If cracked excessively, replace it.

CYLINDER TUBES

Check cylinder tubes for scratches or other damage. Replace if necessary.

Disassembly and Assembly





Pre-disassembly Inspection

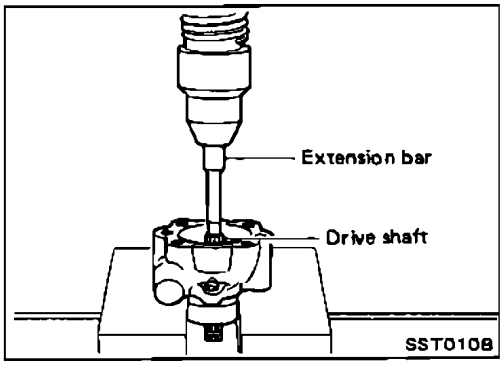
Disassemble the power steering oil pump only if the following items are found.

- Oil leak from any point shown in the figure.
- Deformed or damaged pulley.

Disassembly

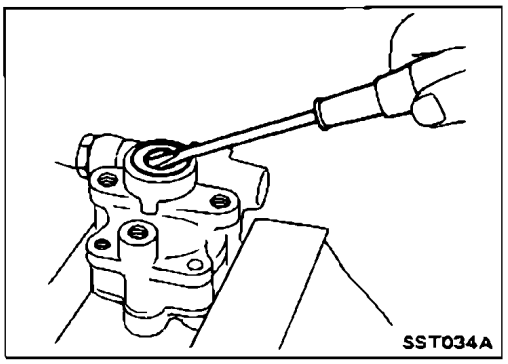
CAUTION:

- **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.**



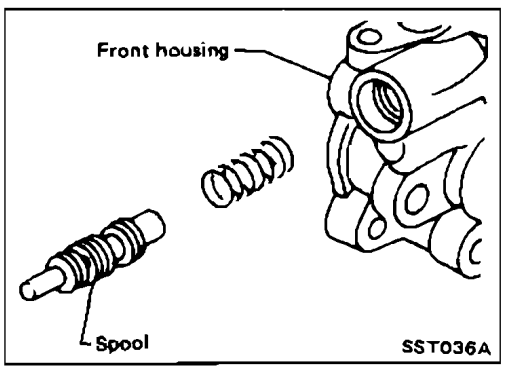
- Remove snap ring, then draw pulley shaft out.

Be careful not to drop pulley shaft.



- Remove oil seal.

Be careful not to damage front housing.



- Remove connector.

Be careful not to drop spool.

Inspection

PULLEY AND PULLEY SHAFT

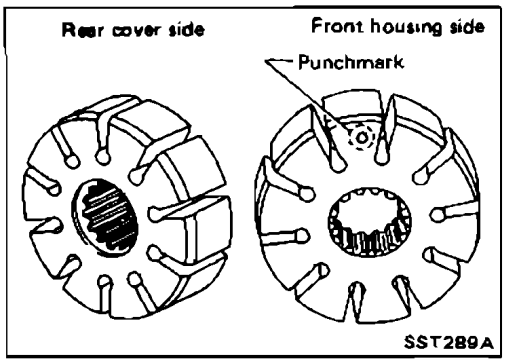
- If pulley is cracked or deformed, replace it.
- If an oil leak is found around pulley shaft oil seal, replace the seal.
- If serration of pulley or pulley shaft is deformed or worn, replace it.

Assembly

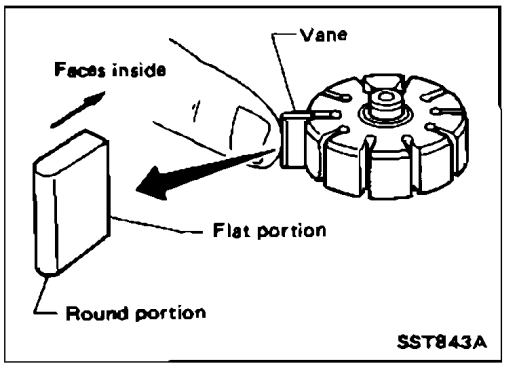
Assemble oil pump in the reverse order of disassembly, noting the following instructions.

- Before installation, coat the O-rings and oil seal with A.T.F.*
- Make sure O-rings and oil seal are properly installed.
- When assembling vanes to rotor, rounded surfaces of vanes must face cam case side.
- Always install new O-rings and oil seal.
- Be careful of oil seal direction.

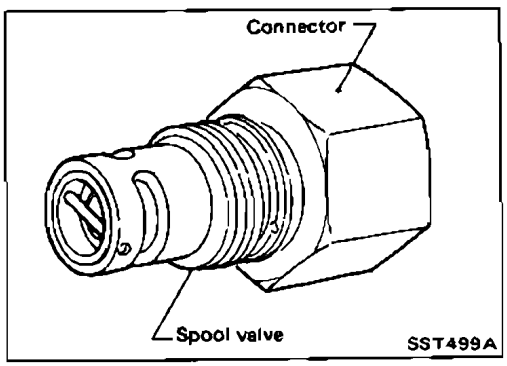
*: Automatic Transmission Fluid



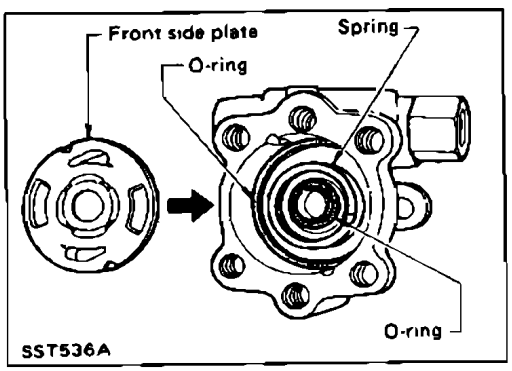
- Pay attention to the direction of rotor.



- Install vanes properly.



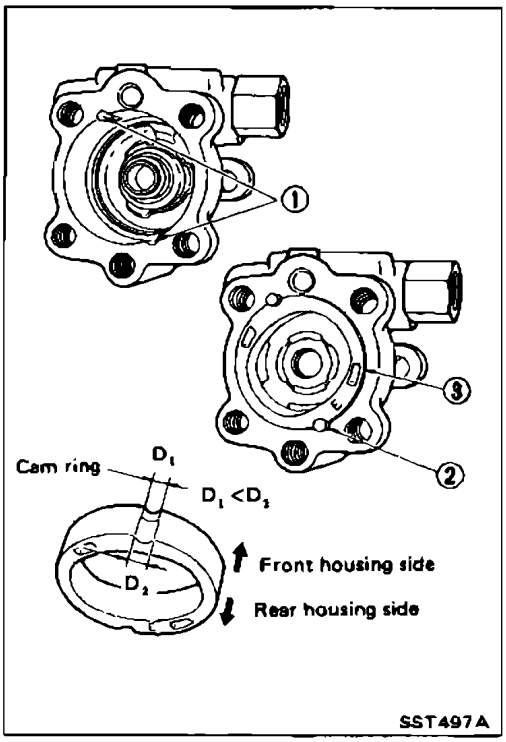
CAUTION:
Do not remove spool valve from connector.



- Apply A.T.F.* to O-ring.

*: Automatic Transmission Fluid

Assembly (Cont'd)



- Insert pin ② into pin groove ① of front housing and rotor. Then install cam ring ③ as shown at left.

General Specifications

Steering model	Power steering
Steering gear type	PR24SC
Steering overall gear ratio	16.8
Turn of steering wheel (Lock to lock)	3.1
Steering column type	Collapsible, tilt

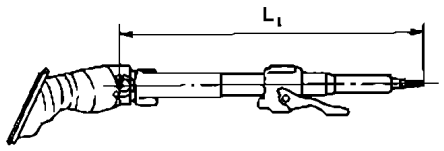
Inspection and Adjustment

GENERAL

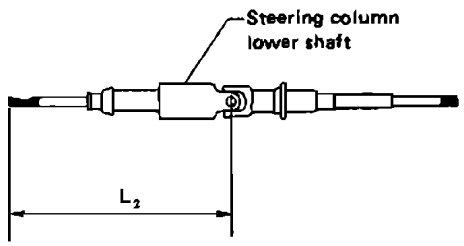
Steering wheel axial play mm (in)	0 (0)
Steering wheel play mm (in)	0 - 35 (0 - 1.38)

STEERING COLUMN

Steering column length "L_1" mm (in)	653.1 - 654.5 (25.71 - 25.77)
Steering column lower shaft length "L_2" mm (in)	323.7 - 325.3 (12.74 - 12.81)



SST098B

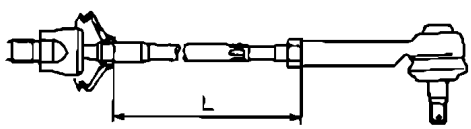


SST115B

STEERING GEAR AND LINKAGE

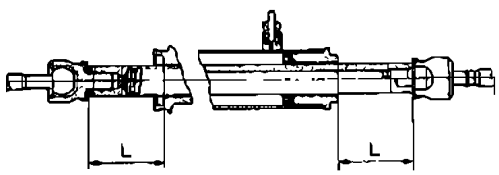
Item \ Steering gear type	PR24SC
Tie-rod outer ball joint N (kg, lb)	9.12 - 91.30 (0.93 - 9.31, 2.05 - 20.53)
Rotating torque N·m (kg-cm, in-lb)	0.29 - 2.94 (3.0 - 30.0, 2.6 - 26.0)
Axial end play mm (in)	0.5 (0.020)
Tie-rod inner ball joint Swinging force* N (kg, lb)	8.14 - 122.6 (0.83 - 12.5, 1.83 - 27.6)
Rotating torque N·m (kg-cm, in-lb)	7.4 (75, 65) or less
Axial end play mm (in)	0 (0)
Tie-rod standard length "L" mm (in)	176.8 (6.96)

*: Measuring point



SST093B

Pinion gear preload (Average) N·m (kg-cm, in-lb)	0.78 - 1.27 (8.0 - 13.0, 6.9 - 11.3)
Rack stroke "L" mm (in)	68.5 (2.697)



SST086B

Inspection and Adjustment (Cont'd)

POWER STEERING

Rack sliding force N (kg, lb)	166.7 - 255.6 (17.0 - 23.0, 37.5 - 50.7)
Steering wheel turning force (Mesured at one full turn from neutral) N (kg, lb)	39 (4, 9) or less
Normal operating temperature of power steering fluid °C (°F)	60 - 80 (140 - 176)
Fluid capacity (Approximate) ℓ (US qt, Imp qt)	0.9 (1, 3/4)
Oil pump maximum presure kPa (kg/cm^2, psi)	6,865 (70, 995)

SECTION BF

CONTENTS

GENERAL SERVICING
(Including all clips & fasteners) ..... BF- 2
BODY END ..... BF- 6
DOOR
(Including "Power Window" & "Power Door Lock") BF-12
INSTRUMENT PANEL BF-18
INTERIOR AND EXTERIOR
(In EXTERIOR, including "Weatherstrips") BF-20
SEAT BF-30
AUTOMATIC SEAT BELT SYSTEM BF-32
TROUBLE DIAGNOSES BF-39
SUN ROOF BF-66
WINDSHIELD AND WINDOWS BF-70
MIRROR – Door Mirror BF-77
REAR COMBINATION LAMP BF-78
FRONT AND REAR AIR SPOILER BF-79
BODY ALIGNMENT BF-80

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".

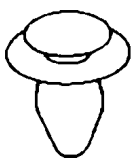
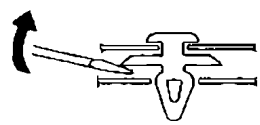
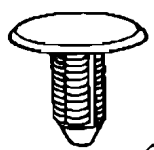
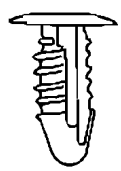
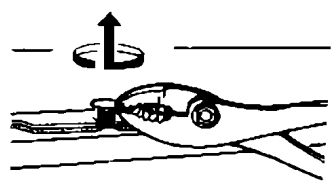
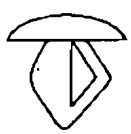
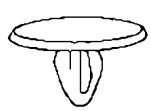
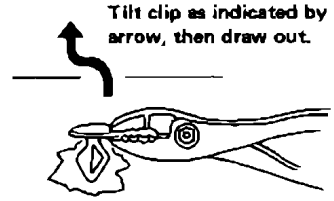
★ For conventional seat belt, refer to MA section.

Precautions

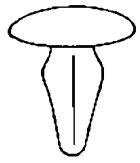
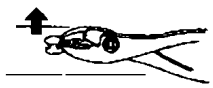
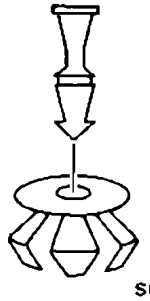
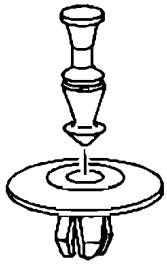
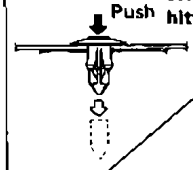
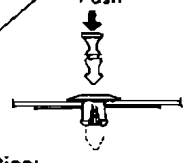
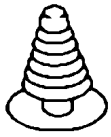
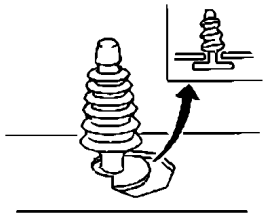
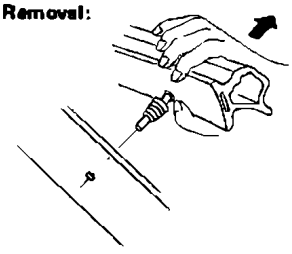
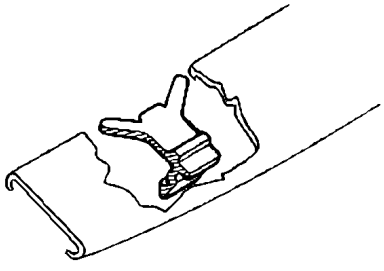
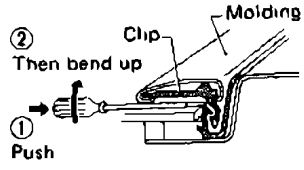
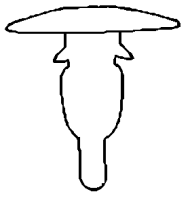
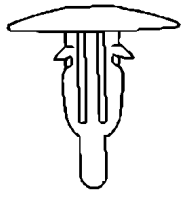
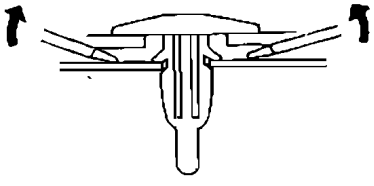
- When removing or installing various parts, place a cloth or padding onto the vehicle body to prevent scratches.
- Handle trim, molding, instruments, grille, etc. carefully during removing or installation. Be careful not to soil or damage them.
- Apply sealing compound where necessary when installing 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

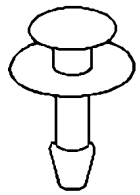
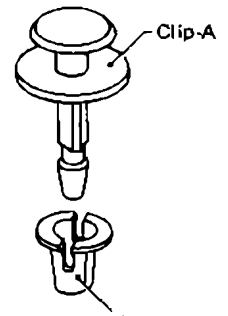
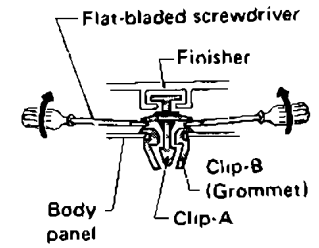
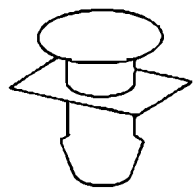
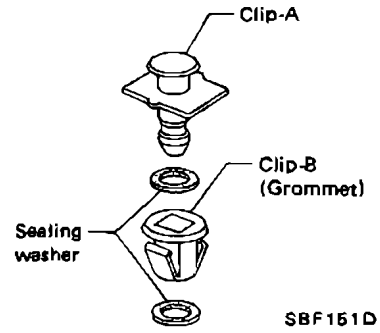
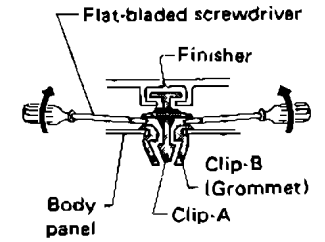
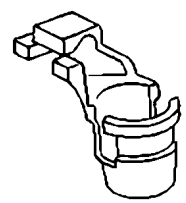
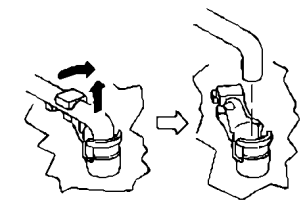
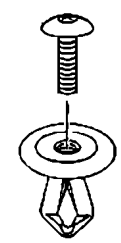
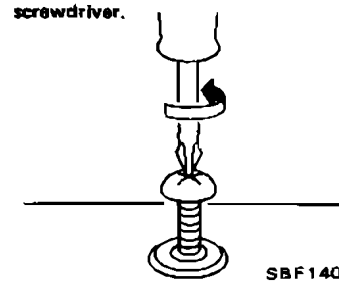
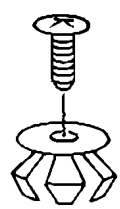
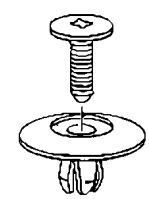
- Clips and fasteners in BF section correspond to the following numbers and symbols.
- Replace any clips and/or fasteners which are damaged during removal or installation.

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

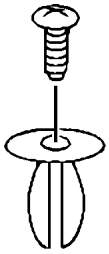
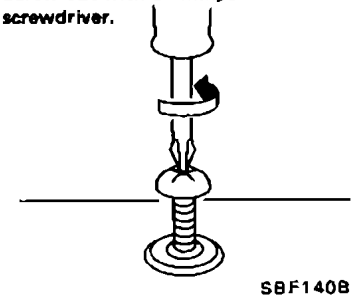
Clip and Fastener (Cont'd)

No.	Symbol	Shape	Removal & Installation
C106	 SBF089B	SBF090B	**Removal:** Remove with a flat-bladed screwdrivers or plier.  SBF091B
C203	 SBF318C	 SBF319C	**Push center pin to catching position. (Do not remove center pin by hitting it.)** Push  Push  **Installation:** SBF320C
CE103	 SBF103B	 SBF104B	**Removal:**  SBF147B
CE106	 SBF553B		**Removal:**  SBF654B
CE117	 SBF173D	 SBF174D	**Removal:** Remove with a flat-bladed screwdriver or pliers.  SBF175D

Clip and Fastener (Cont'd)

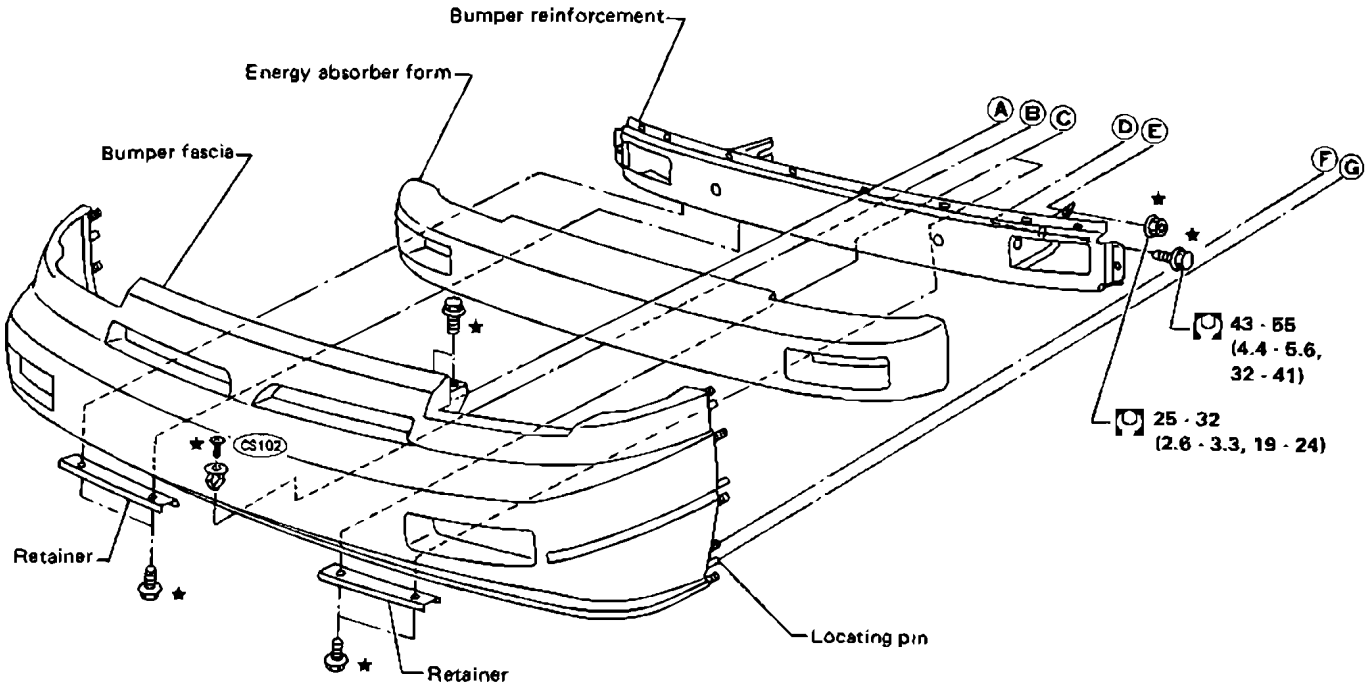
No.	Symbol	Shape	Removal & Installation
CF113	 SBF036C	 SBF036C	**Removal:**  SBF652B
CF118	 SBF150D	 SBF151D	**Removal:**  SBF652B
CR103	 SBF768B		**Removal:** **Holder portion of clip must be spread out to remove rod.**  SBF770B
CS102	SBF138B	 SBF139B	**Removal:** **Screw out with a Phillips screwdriver.**  SBF140B
CS103	 SBF363B	 SBF364B	

Clip and Fastener (Cont'd)

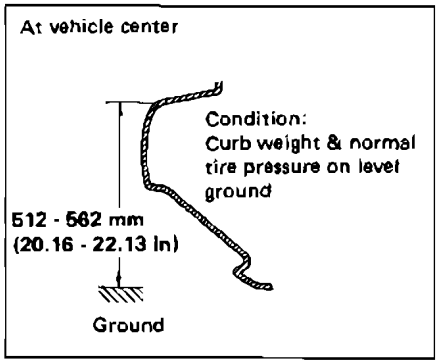
No.	Symbol	Shape	Removal & Installation
CS104	 SBF361B	SBF362B	**Removal:** **Screw out with a Phillips screwdriver.**  SBF140B

Body 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.



Bumber height

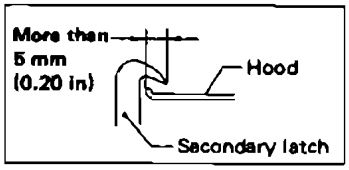


Body Front End (Cont'd)

Hood lock adjustment

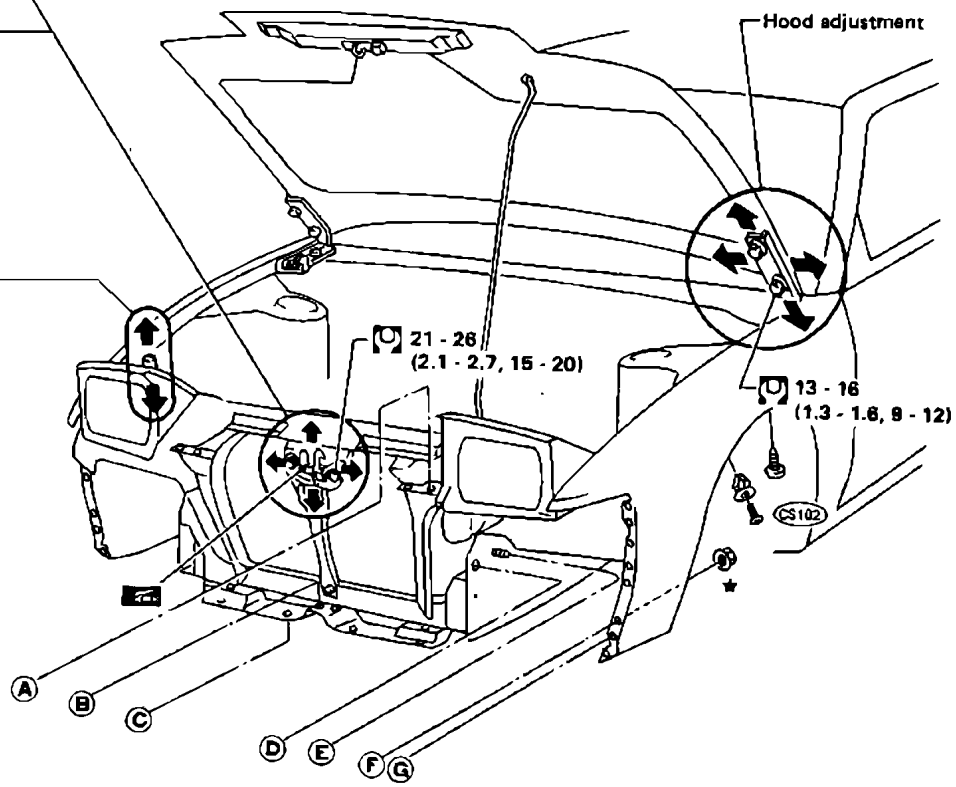
- Adjust lock so that hood primary lock meshes at a position where hood is 1 to 1.5 mm (0.039 to 0.059 in) lower than fender.
- After hood lock adjustment, adjust bumper rubber.
- When securing hood lock, ensure it does not tilt. Striker must be positioned at the center of hood primary lock.
- After adjustment, ensure that hood primary and secondary lock operate properly.

Hood lock secondary latch hooking length



Bumper rubber adjustment

- Adjust so that hood is aligned with fender. [Bumper rubber free height is approx. 20 mm (0.79 in).]



★ : Bumper assembly mounting bolts and nuts
: N·m (kg-m, ft-lb)

SBF174E

Body Rear End and Opener

- Back door adjustment: Adjust at hinge-body portion for proper back door fit.
- Back door lock system adjustment: Adjust lock & striker so that they are in the center. After adjustment, check back door lock operation.
- Trunk lid adjustment:Adjust at hinge-trunk lid portion for proper trunk lid fit.
- Trunk lid lock system adjustment: Adjust striker so that it is in the center of the lock. After adjustment, check trunk lid lock operation.

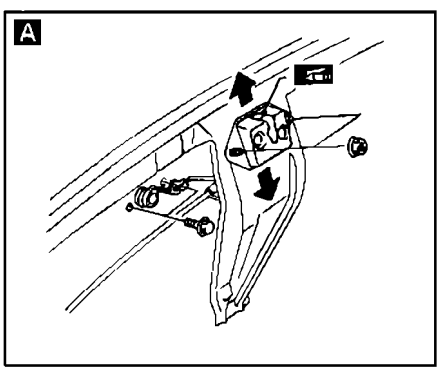
WARNING:

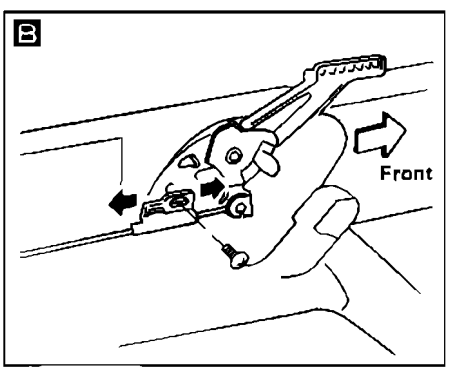
a. **Be careful not to scratch back door stay when installing back door. A scratched stay may cause gas leakage.**
b. **The contents of the back door stay are under pressure. Do not take apart, puncture, apply heat or allow fire near it.**

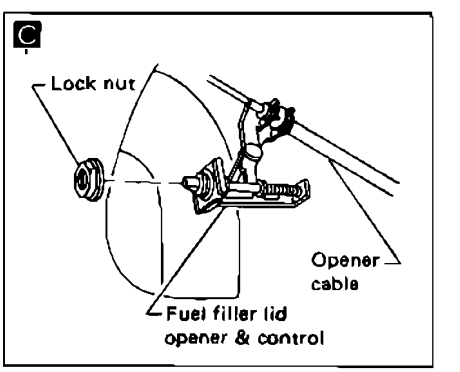
- Opener cable: do not attempt to bend cable using excessive force.
- After installation, make sure that trunk lid/back door and fuel filler lid open smoothly.

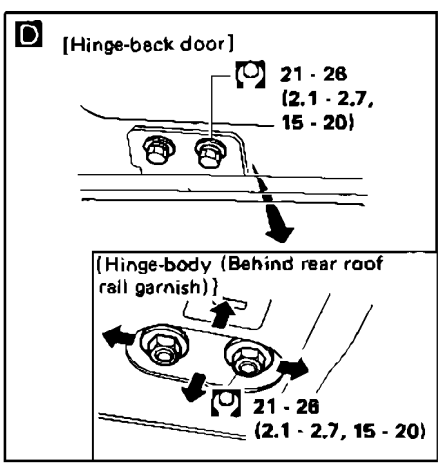
FASTBACK

- Before removing rear bumper, remove right drafter which is secured with two upper nuts and butyl seal.

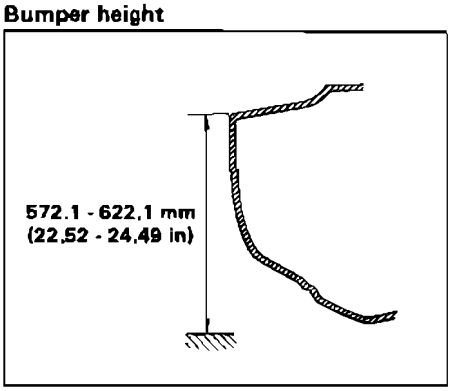




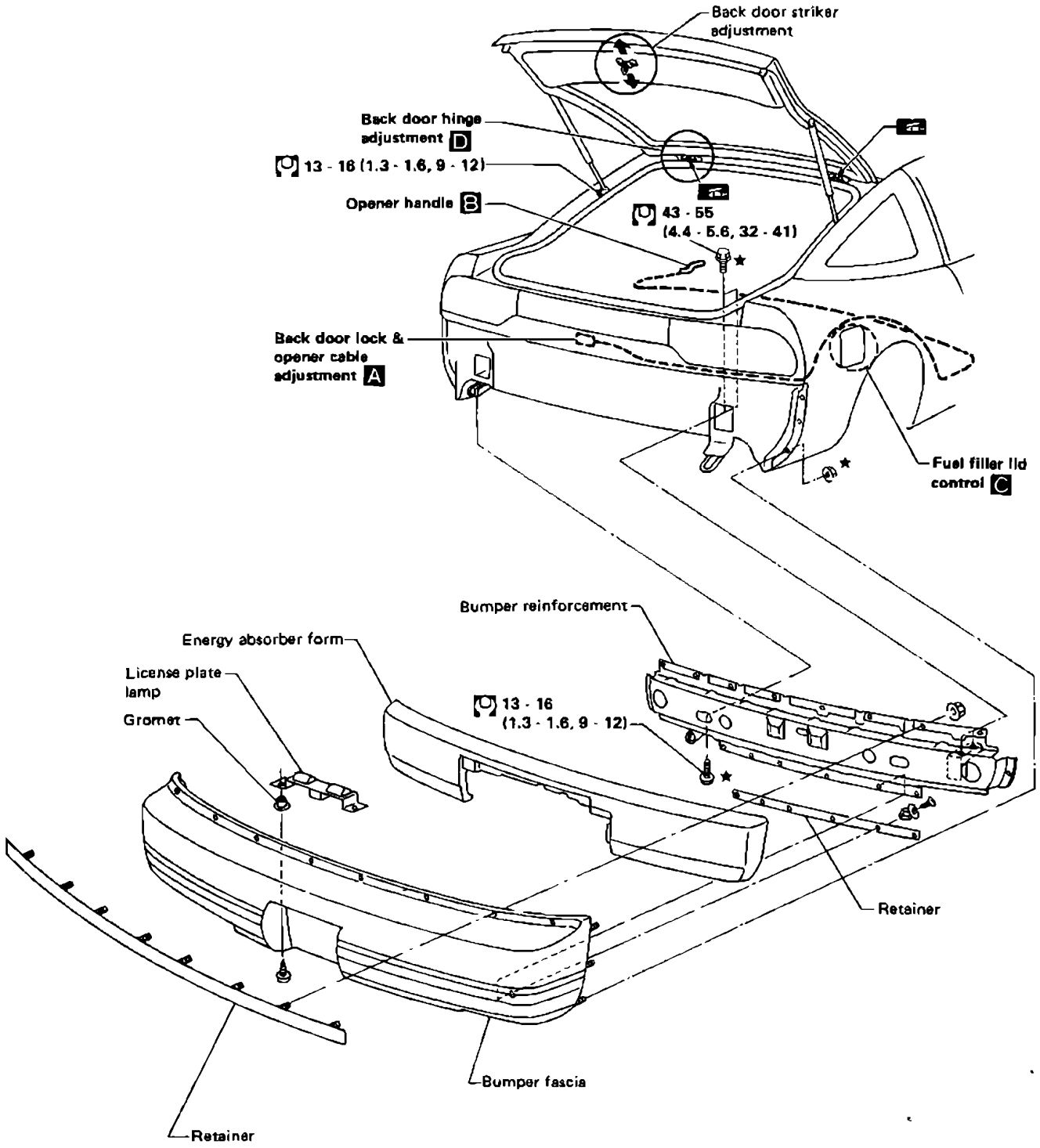




Bumper height



Body Rear End and Opener (Cont'd)



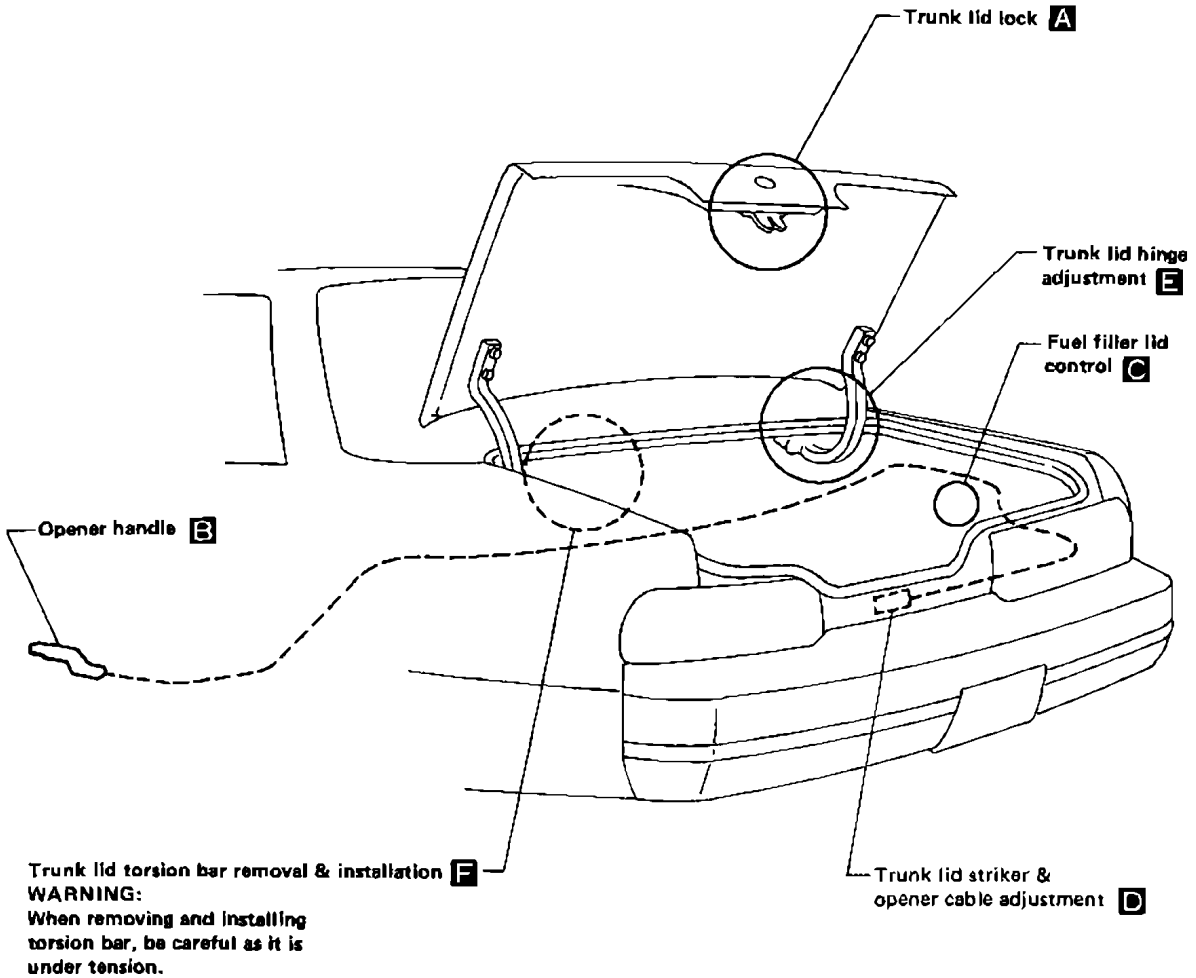
★ : Bumper assembly mounting bolts and nuts

[O] : N·m (kg-m, ft-lb)

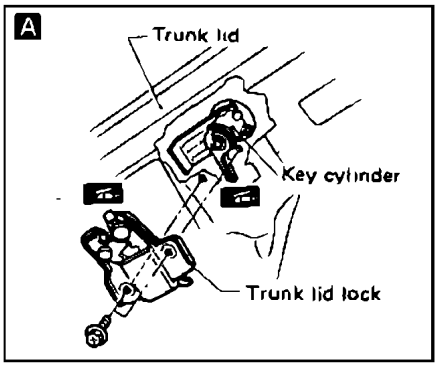
SBF175E

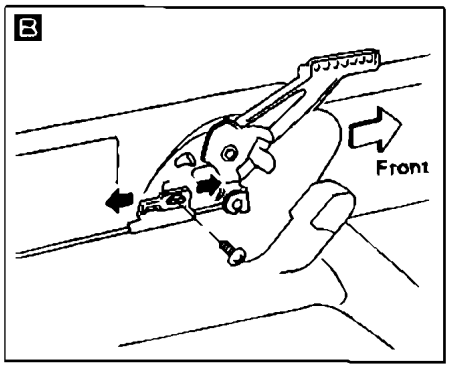
Body Rear End and Opener (Cont'd)

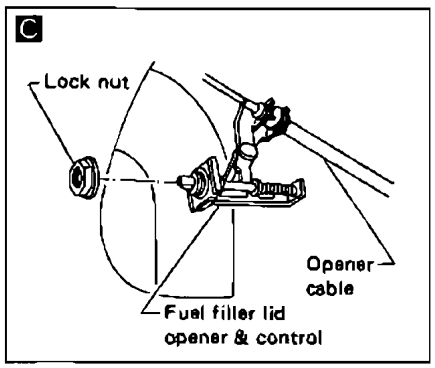
COUPE

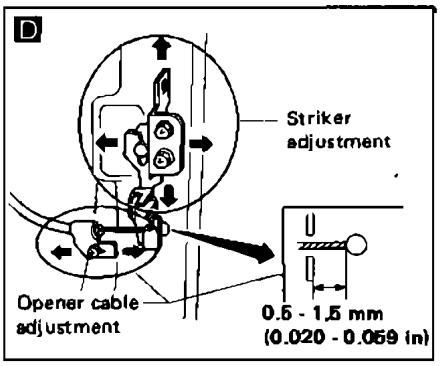


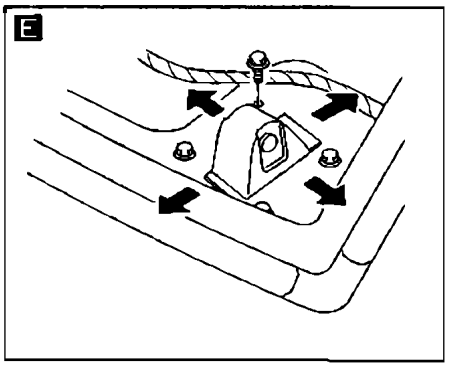
Body Rear End and Opener (Cont'd)

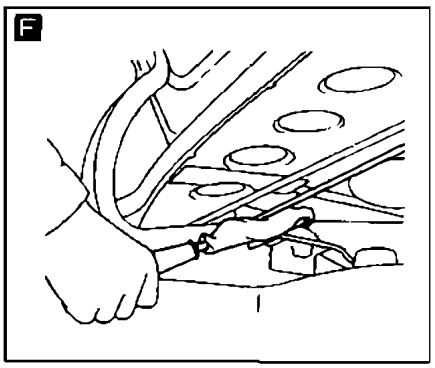




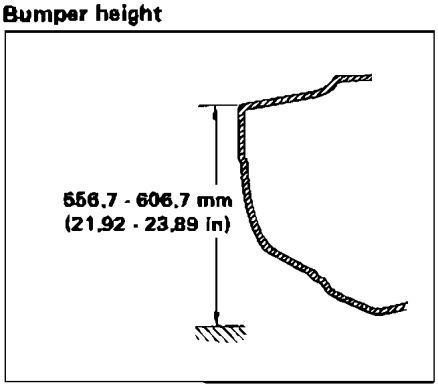






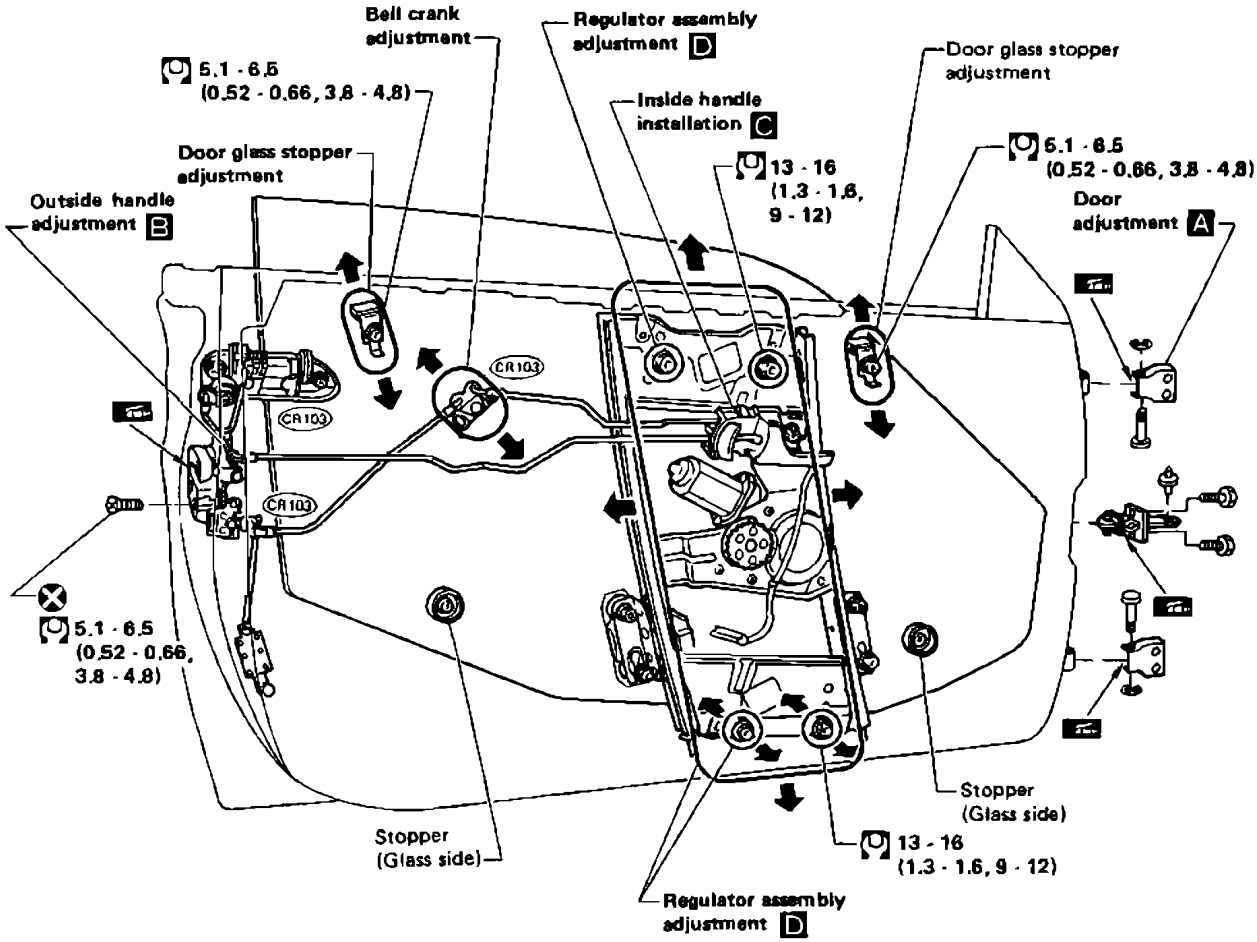


Bumper height



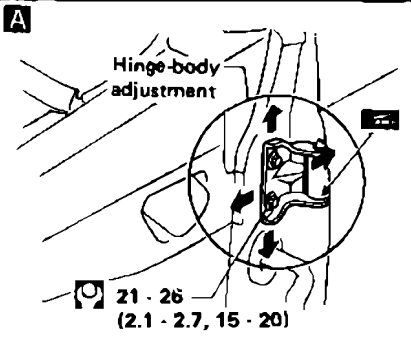
SBF176E

- After adjusting door or door lock, check door lock operation.

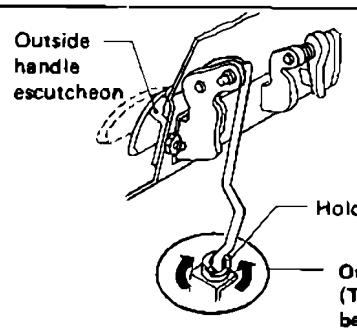


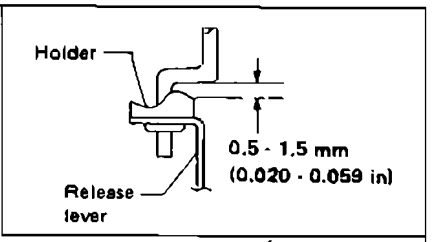
: N-m (kg-m, ft-lb)

A

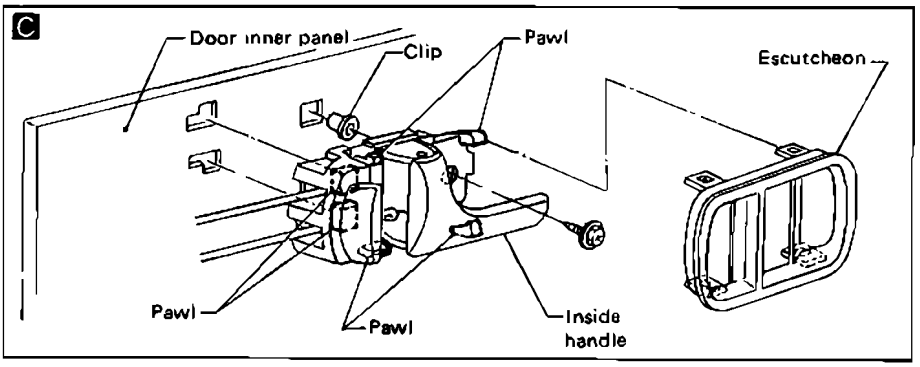


B

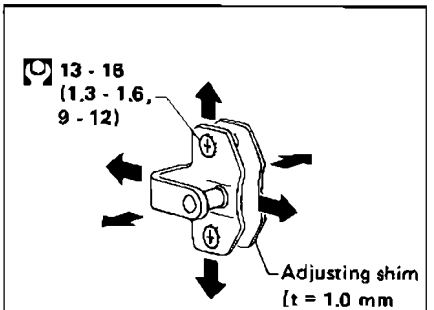




C



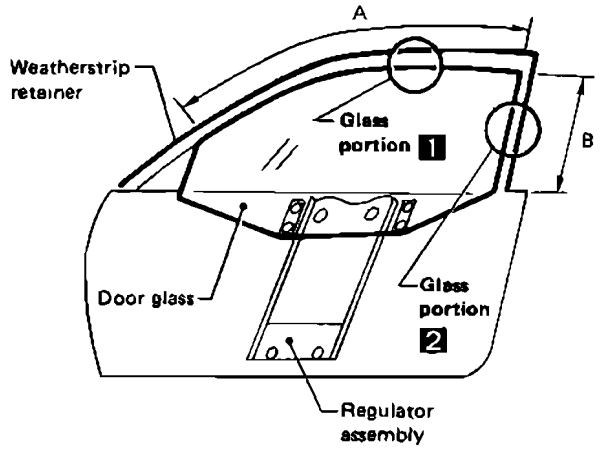
Striker adjustment



D

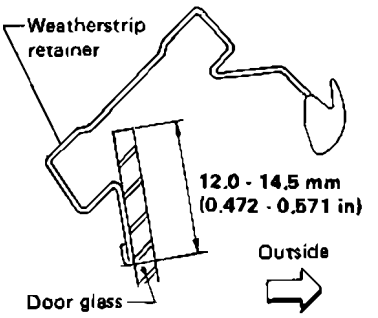
- **Remove weatherstrip from retainer.**

- **Door glass-to-retainer clearances A and B**
  Adjust so that clearances A and B are equal.
- **Ensure door glass is not tilted.**

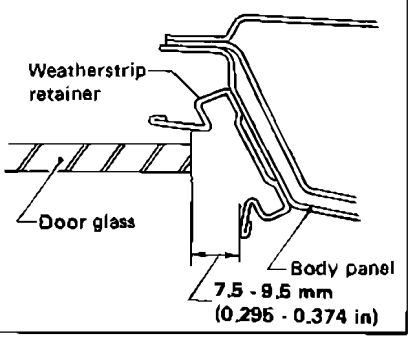


Glass portion 1

- **Adjust to provide proper light surface contact of glass and retainer.**



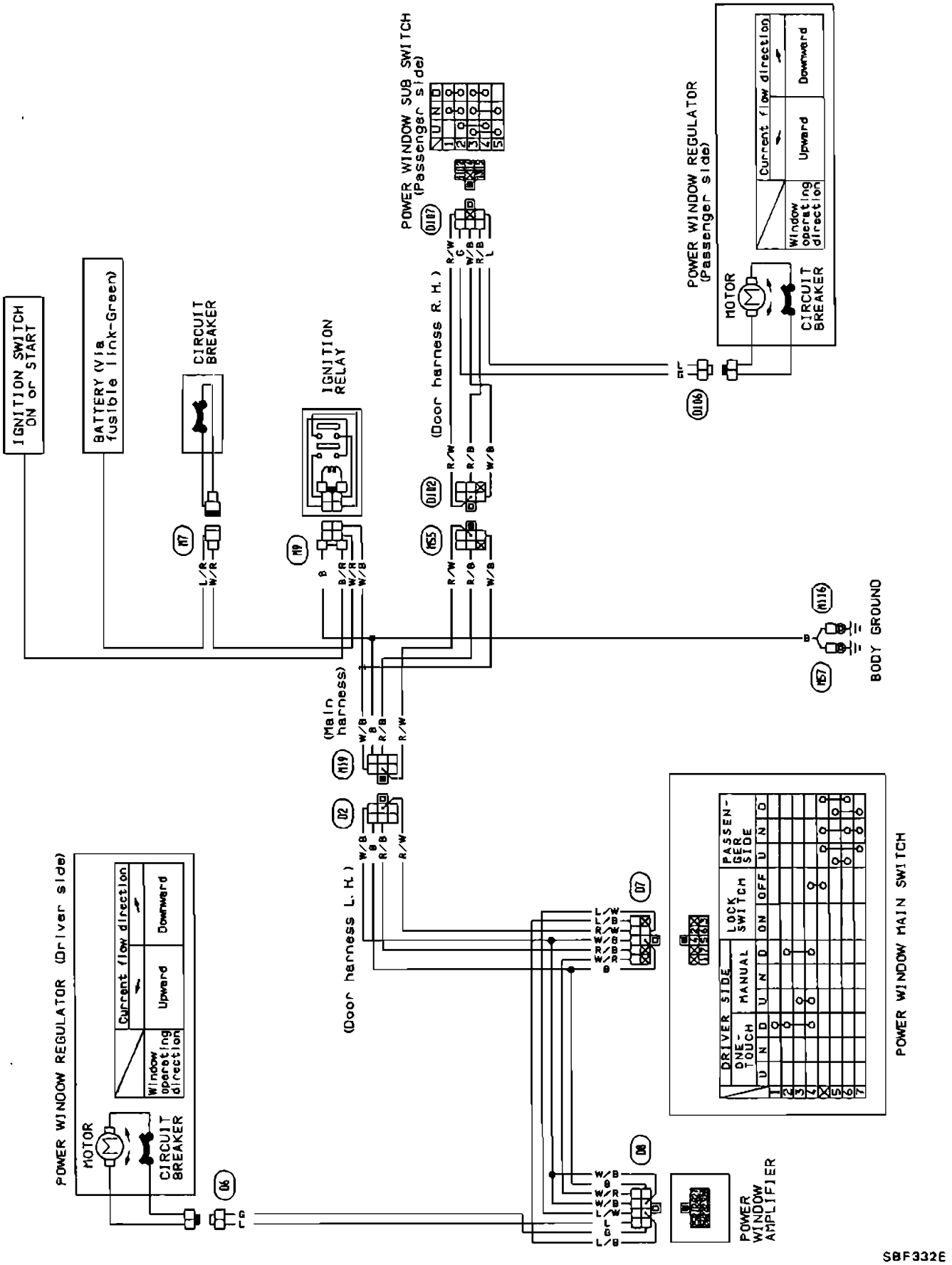
Glass portion 2



SBF177E

Power Window

WIRING DIAGRAM

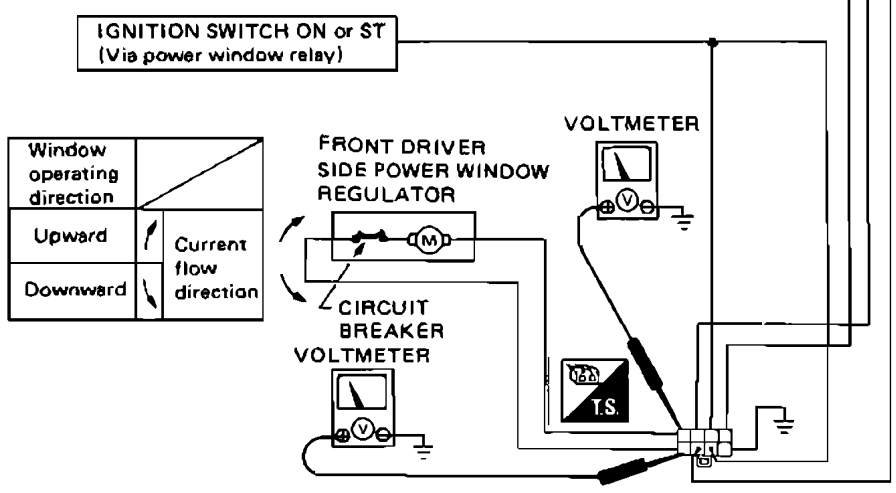


Power Window (Cont'd)

POWER WINDOW AMP. INSPECTION

FRONT DRIVER SIDE POWER WINDOW SWITCH

	FR Drive side						Connections
	One-touch (Auto)			Manual			
	U	N	D	U	N	D	
1			○				From power window AMP (54)
2			○			○	From power window AMP (56)
3				○		○	From power window AMP (55)
4			○	○		○	Ground



AMP. OPERATION

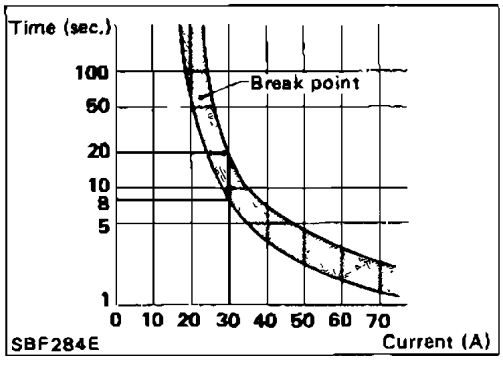
	Connections		Operations					
			Manual operation			One-touch (Auto) Operation		
51	Power source (IGN)		12V	12V	12V	12V	12V	12V
52	Ground		Ground	Ground	Ground	Ground	Ground	Ground
53	Input signal	From ignition SW (ON or ST)	ON or ST	ON or ST	ON or ST	ON or ST	ON or ST	ON or ST
54	Input signal	To FR driver 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	Approx. 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. —Front driver side door (Behind door trim)

SBF789C



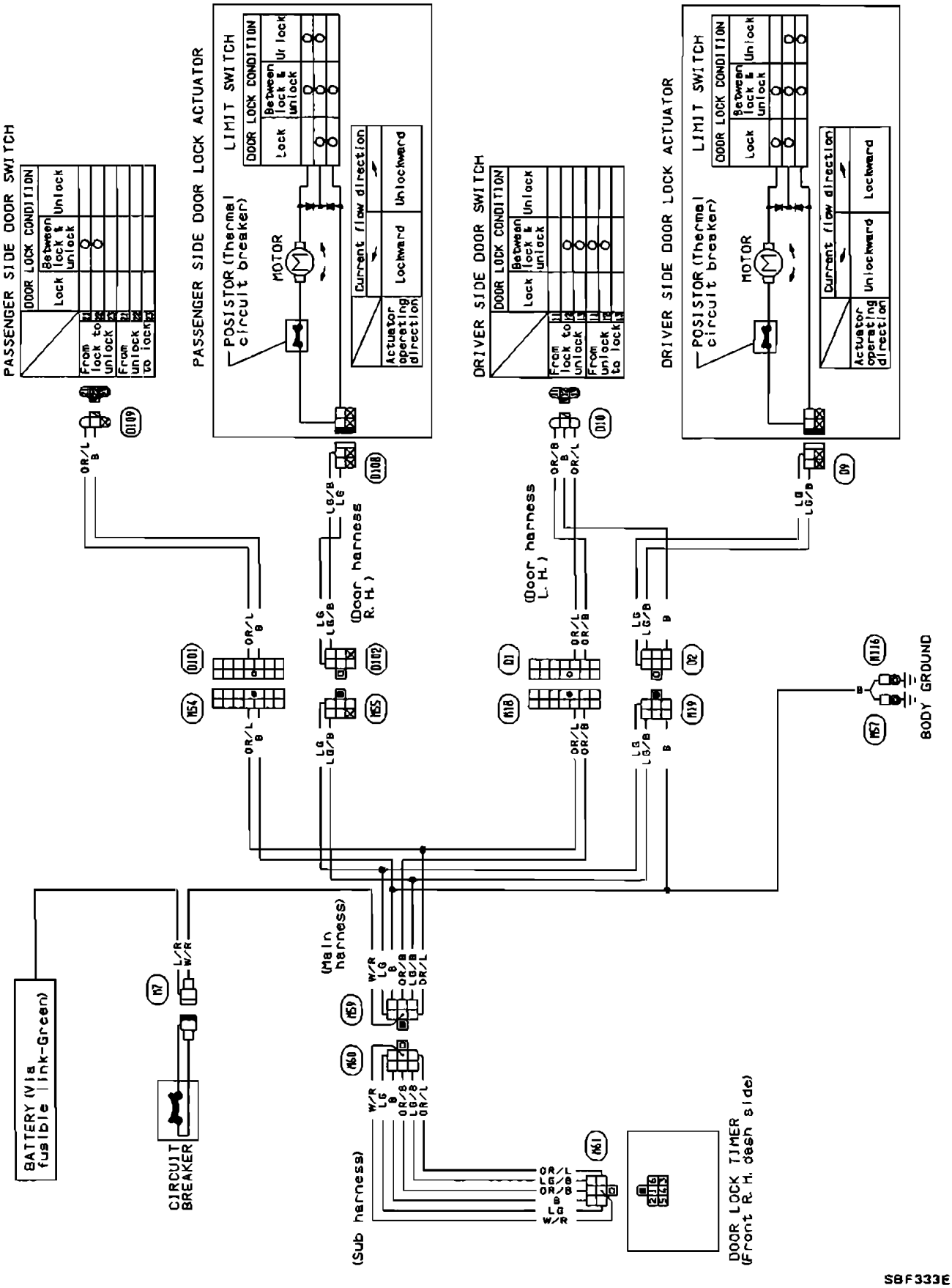
CIRCUIT BREAKER INSPECTION

For example, when current is 30A, the circuit is broken within 8 to 20 seconds.

This circuit breaker is also used in the power door lock system.

Power Door Lock

WIRING DIAGRAM



SBF333E

Power Door Lock (Cont'd)

DOOR LOCK TIMER INSPECTION

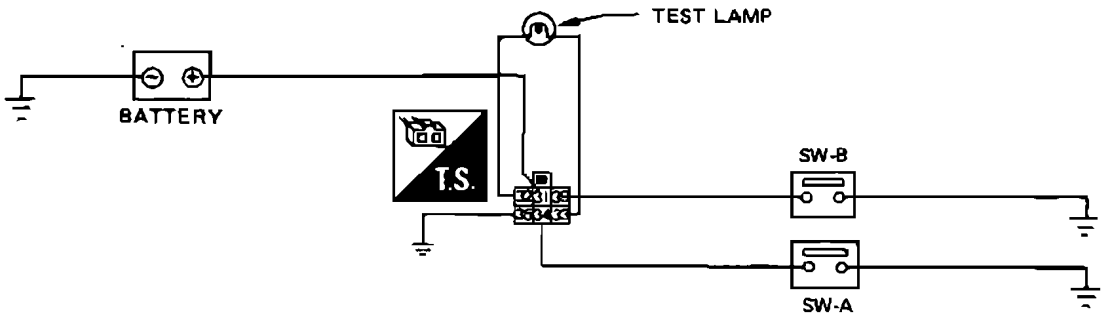
TESTING OPERATION

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

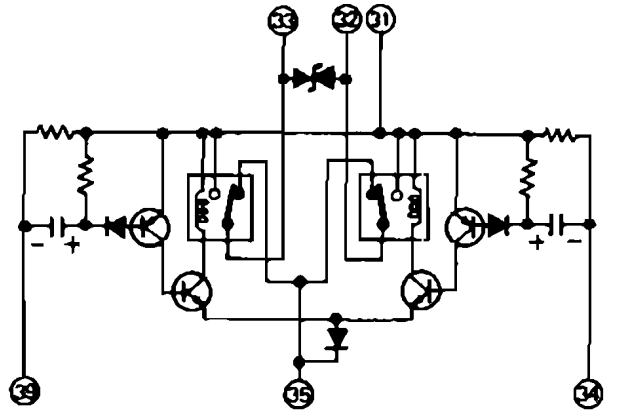
- Carry out the complete inspection in this chart from left to right.
- Do not carry out any switch operations that are not described in the above chart so as to avoid breaking the door lock timer.

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.

INSPECTION CIRCUIT (This test circuit must be wired by the technician.)



DOOR LOCK TIMER



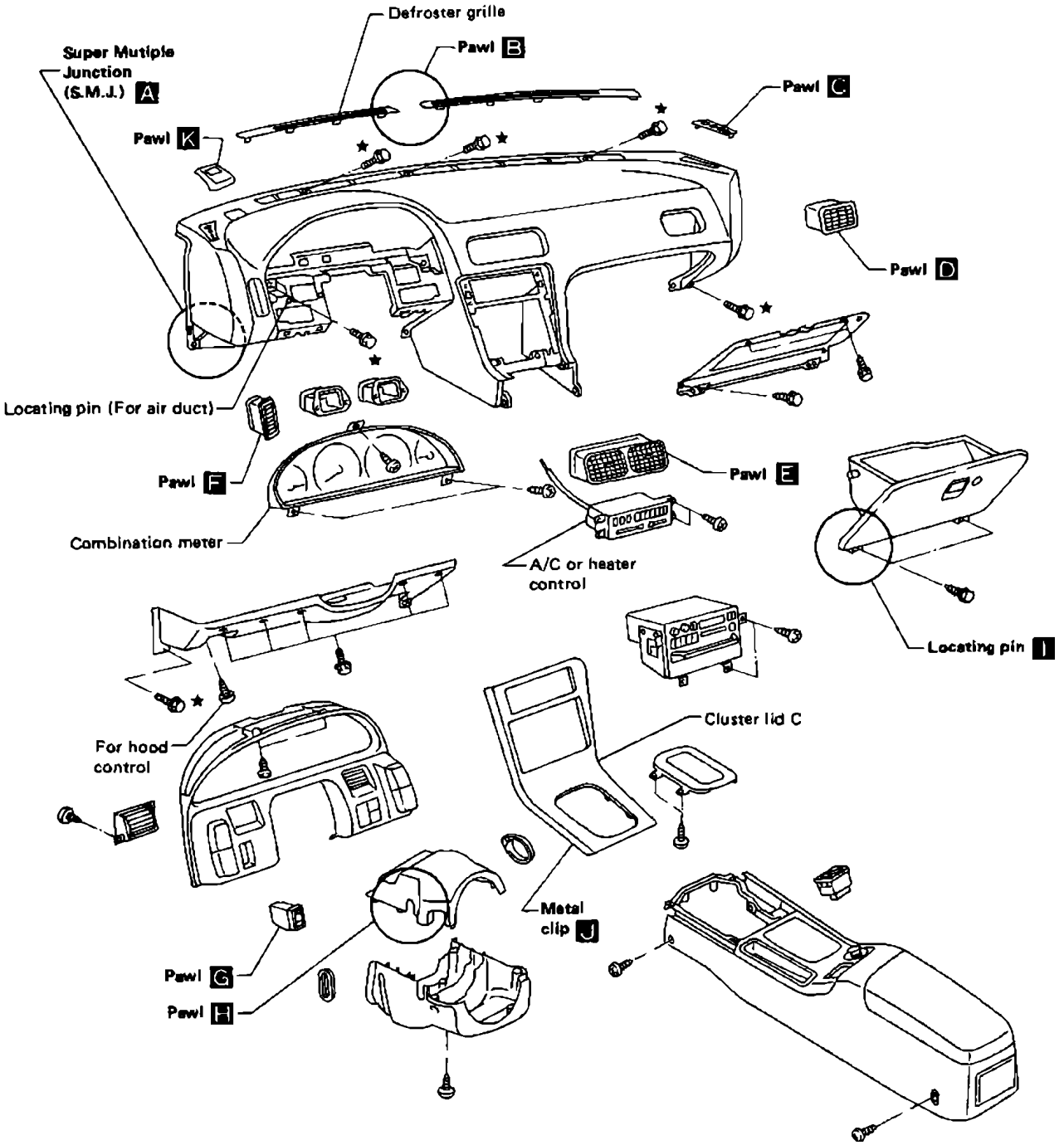
	CIRCUIT CONNECTIONS
31	Power source (BAT)
32	To/From actuators (Lock power source & Unlock ground)
33	To/From actuators (Unlock ground & Lock power source)
34	To lock-unlock switches (Input signal for lock)
35	Ground
39	To lock-unlock switches (Input signal for unlock)

SBF377E

- When removing instrument panel assembly, remove defroster grille, combination meter, A/C or heater control, cluster lid C and S.M.J. first.

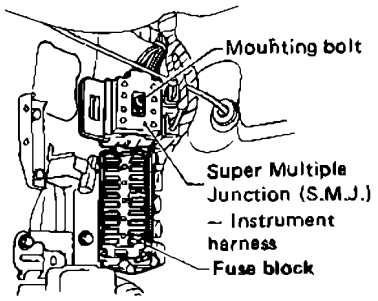
HEAD-UP DISPLAY (H.U.D.)

- When removing H.U.D. finisher, be extremely careful not to scratch H.U.D.'s reflective surface. To avoid scratching, cover H.U.D.'s reflective surface or finisher with a cloth or vinyl sheet. L

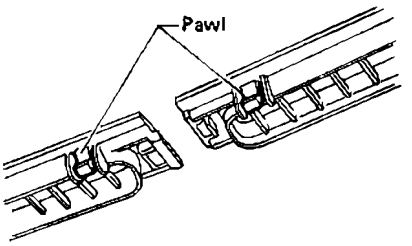


★ : Instrument panel assembly mounting bolts

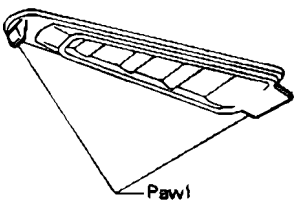
A



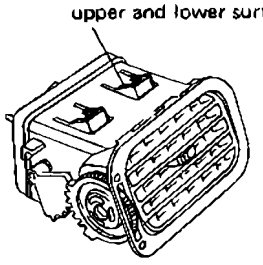
B



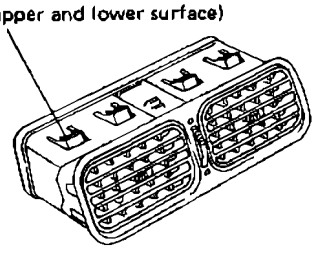
C



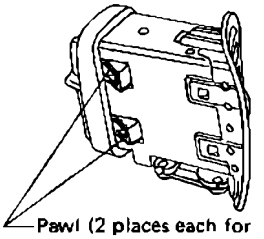
D



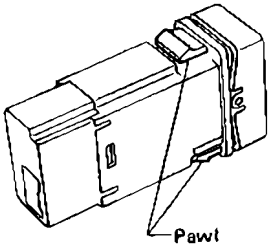
E



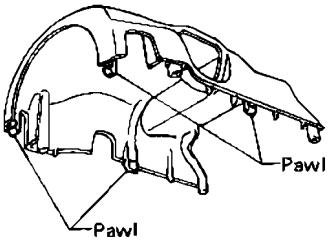
F



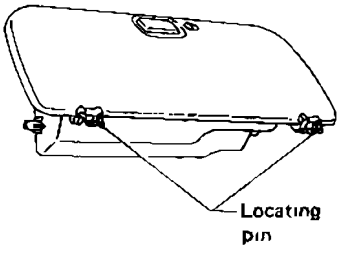
G



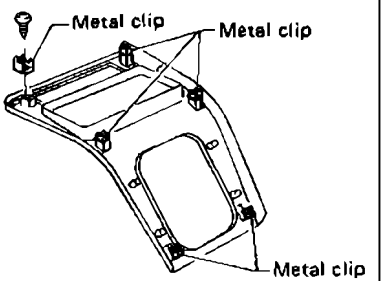
H



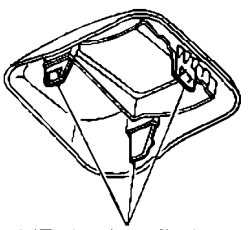
I



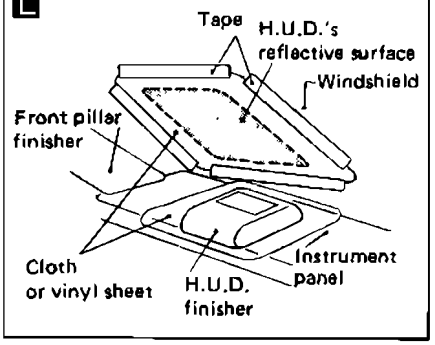
J



K



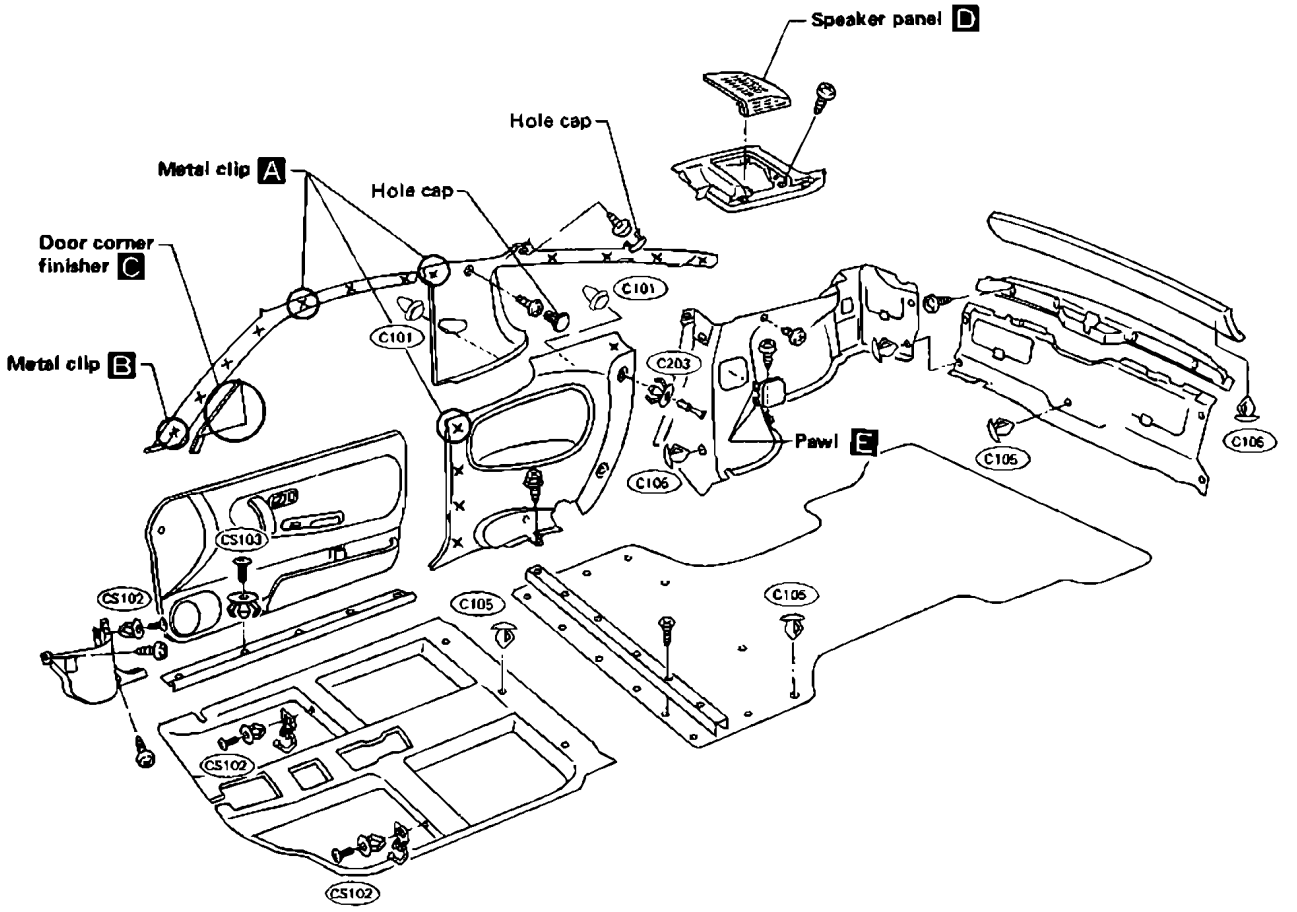
L

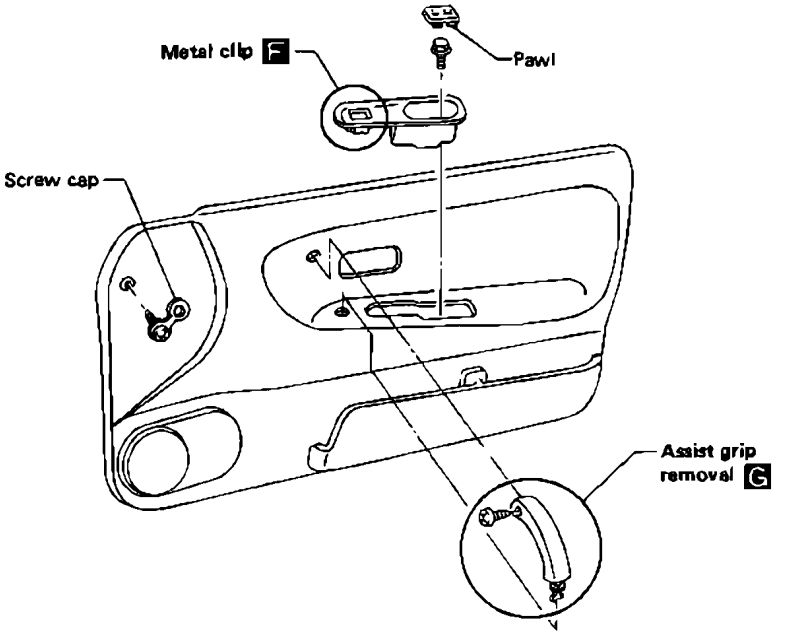


SBF178E

Interior

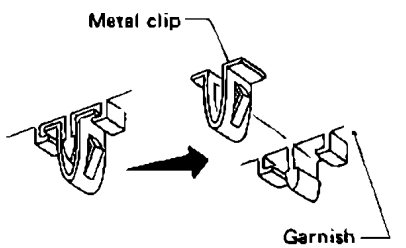
SIDE, LUGGAGE AND FLOOR TRIM – Fastback



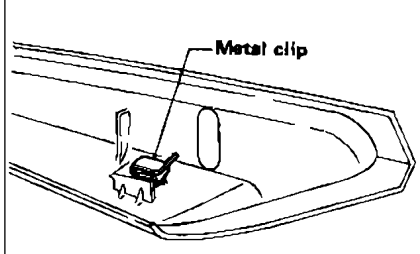


Interior (Cont'd)

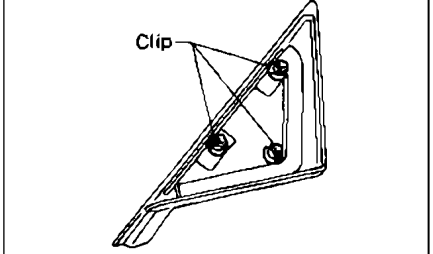
A



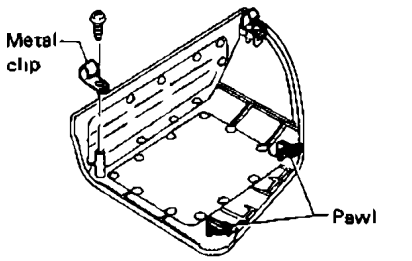
B



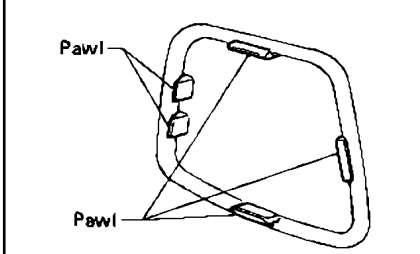
C



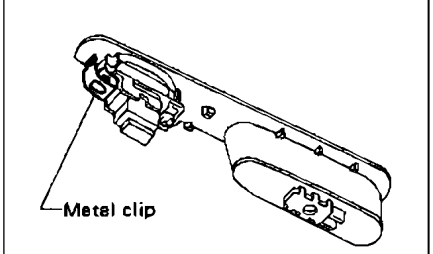
D



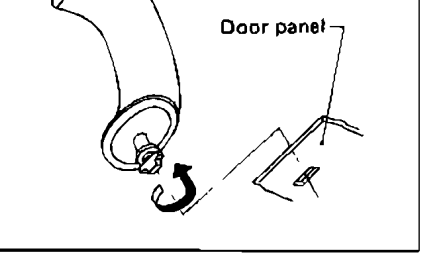
E



F



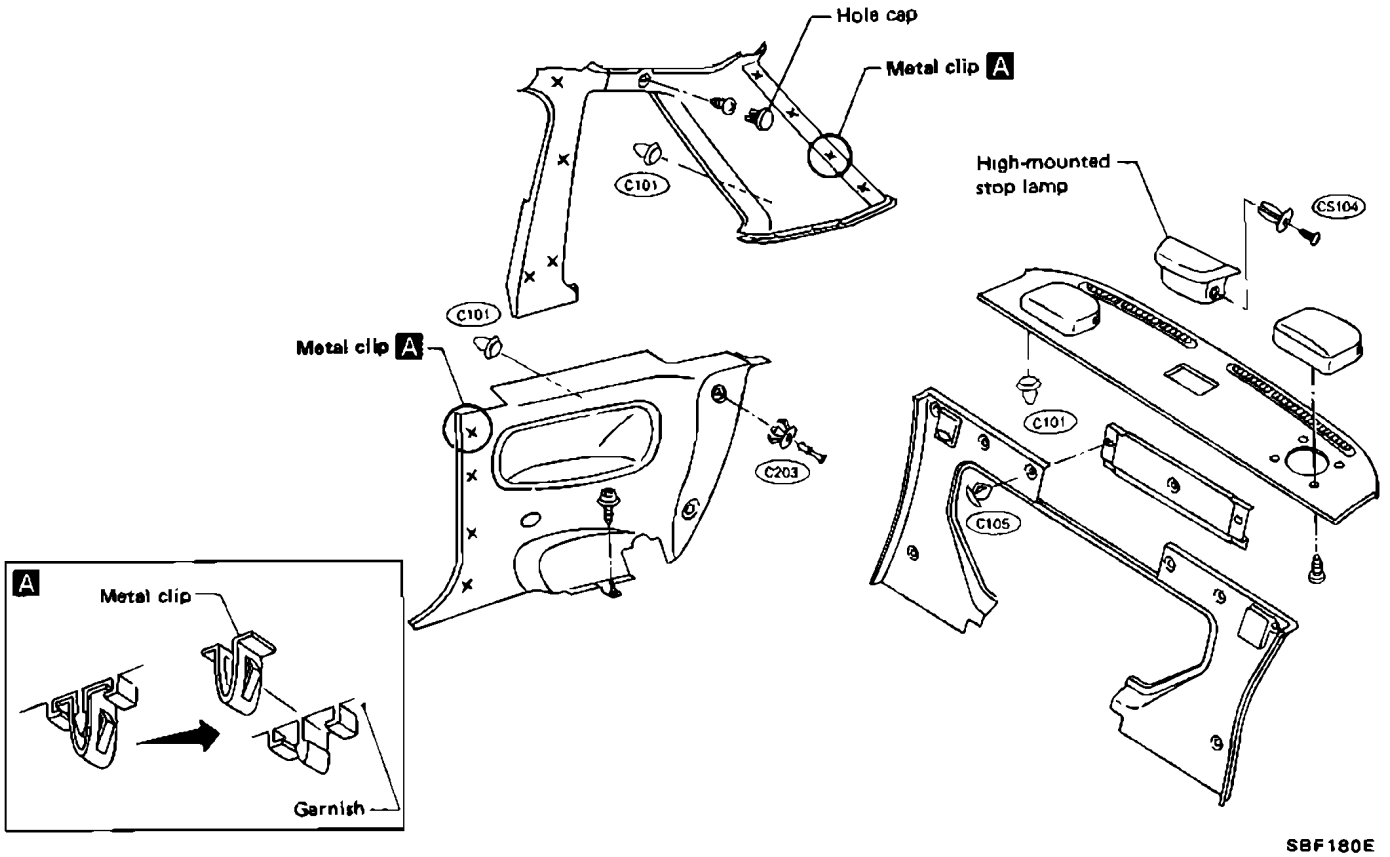
G



SBF179E

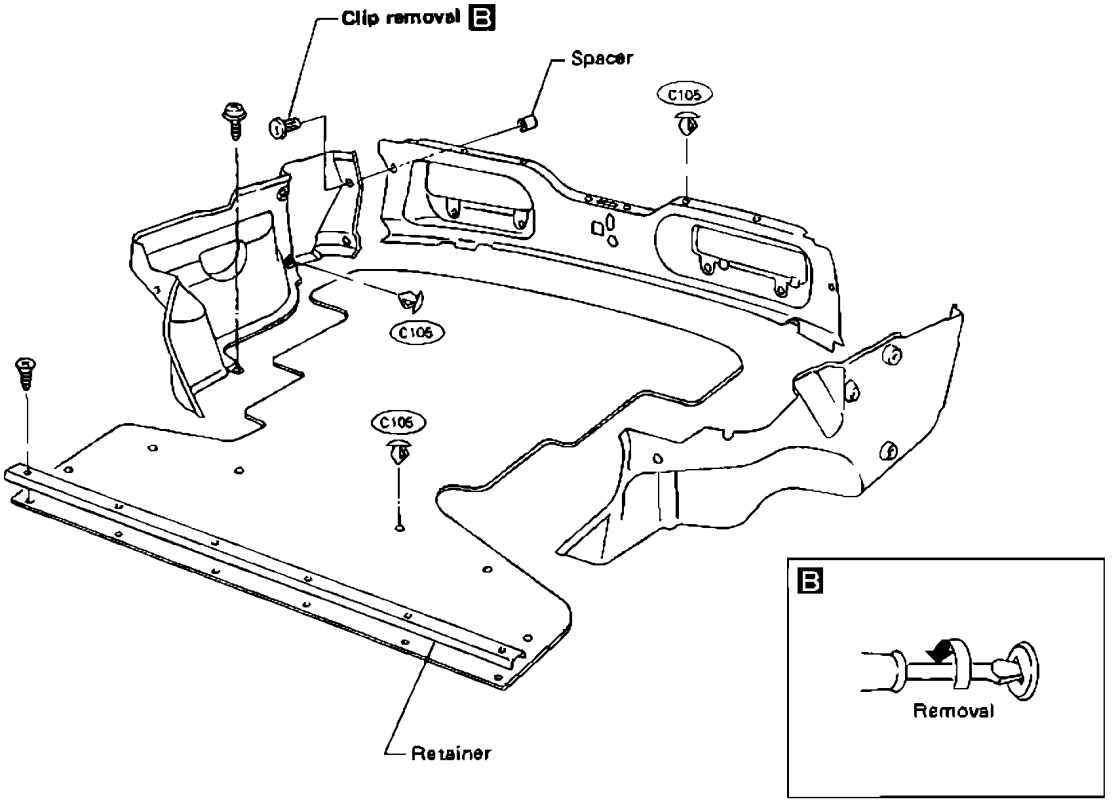
Interior (Cont'd)

SIDE TRIM – Coupe



SBF180E

LUGGAGE ROOM TRIM – Coupe

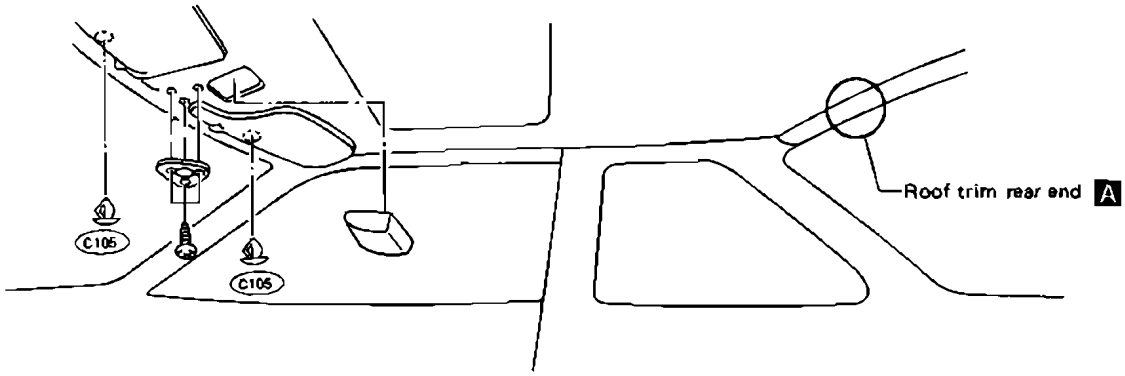


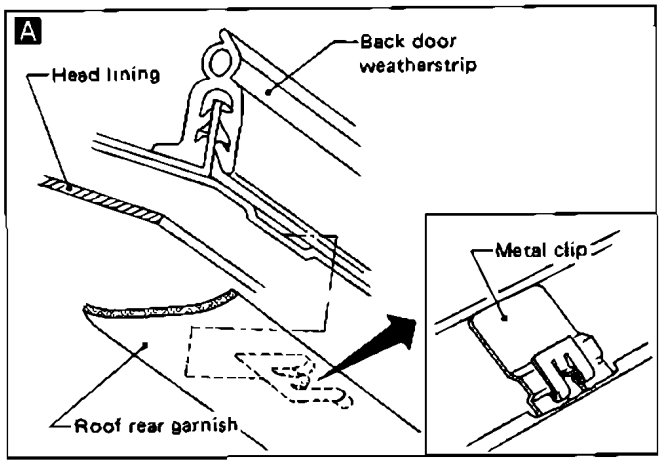
SBF181E

Interior (Cont'd)

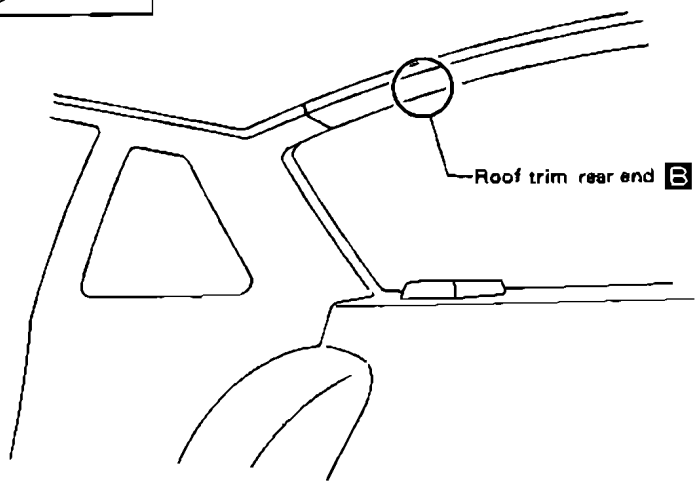
ROOF TRIM

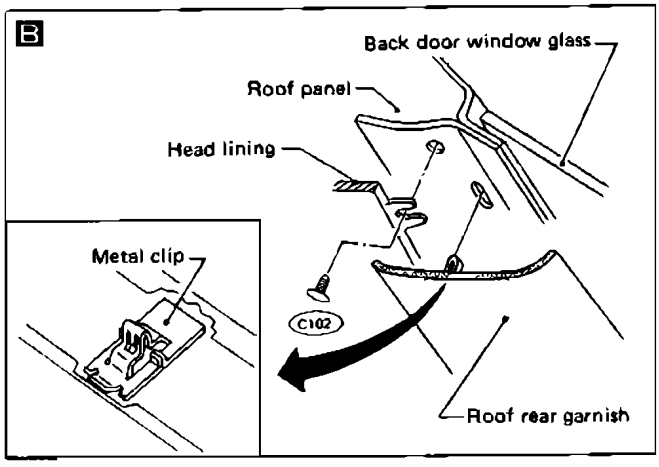
Fastback





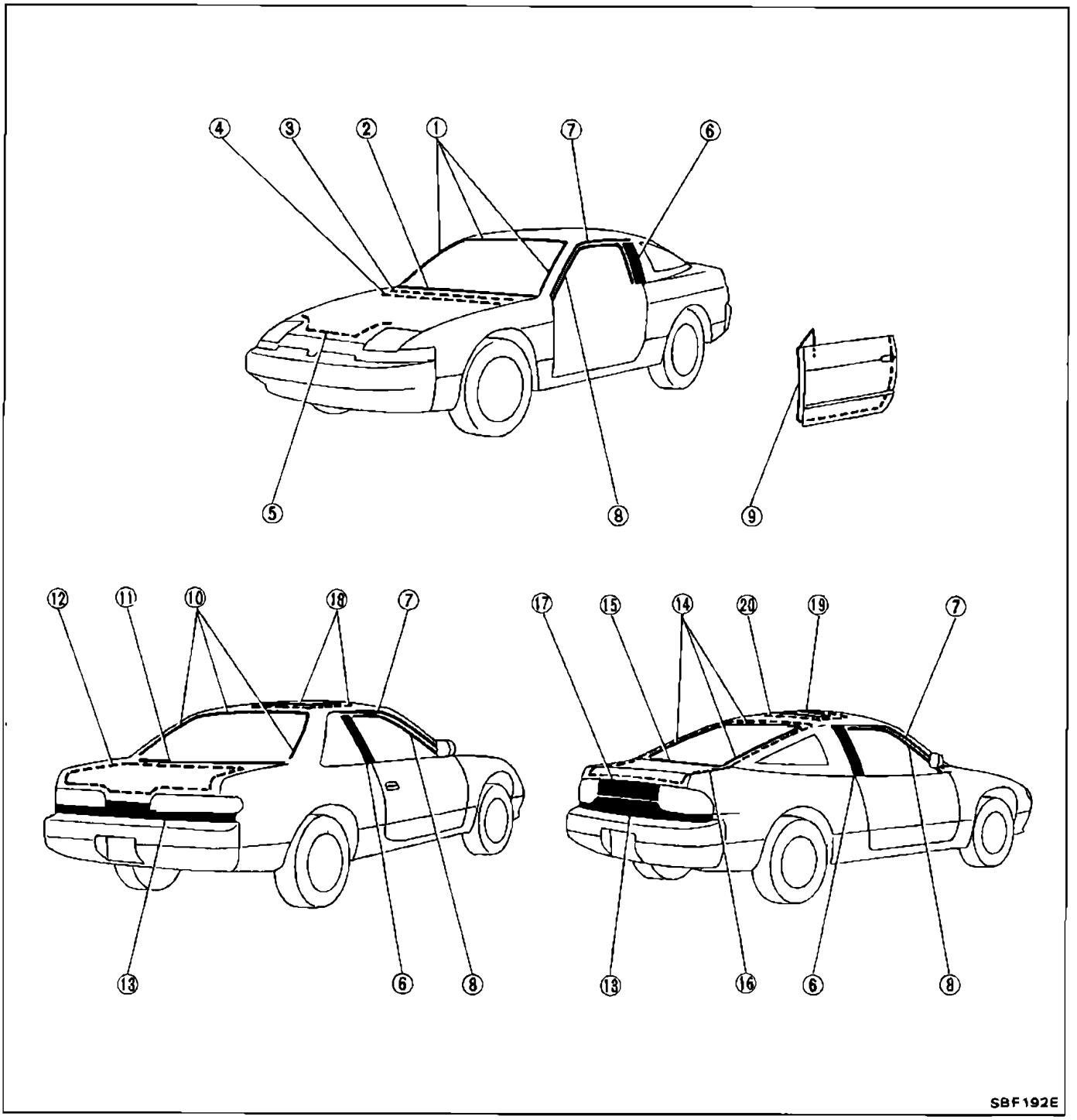
Coupe





SBF182E

Exterior

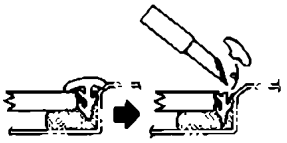


Exterior (Cont'd)

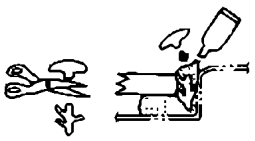
① Windshield upper and side molding

Method 1

Cut off top portion of molding and clean glass and panel surfaces.



Apply sealant to top portion of molding.

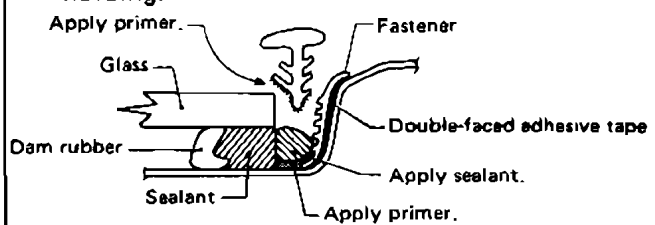


Cut off lower portion of new molding.

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.



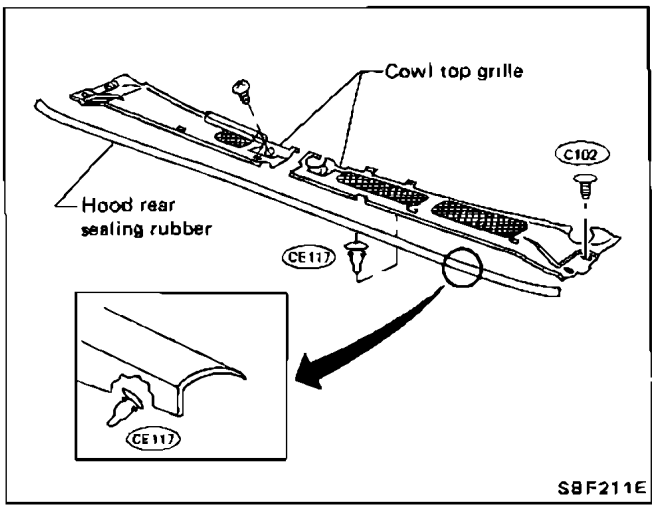
4. Install molding by aligning the molding mark located on center with vehicle center.
   Be sure to install tightly so that there is no gap around the corner.

SBF519B

② Windshield lower molding

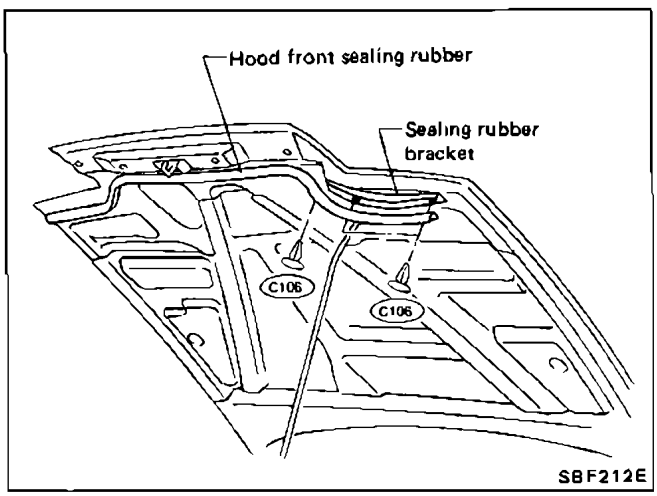
It is mounted with screws.

③, ④ Cowl top grille and hood rear sealing rubber



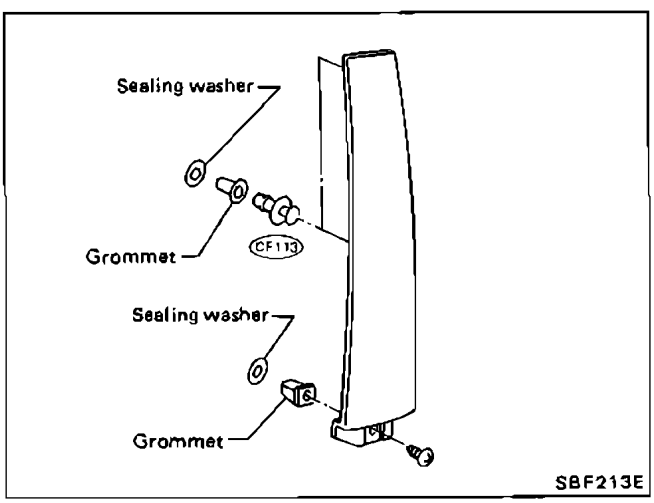
SBF211E

⑤ Hood front sealing rubber



SBF212E

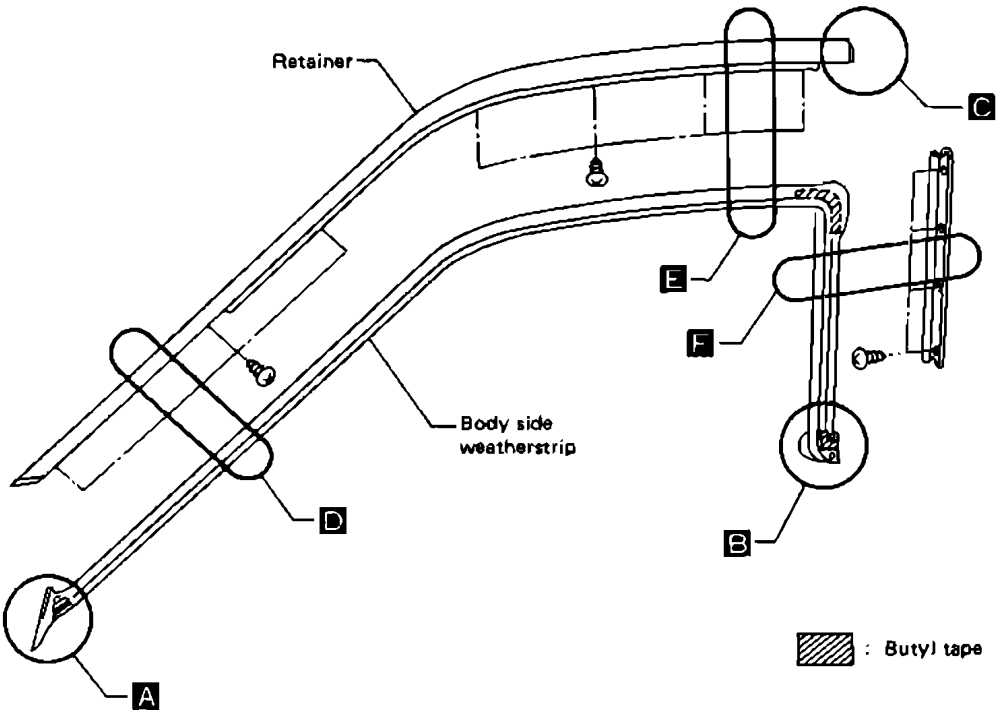
⑥ Center pillar finisher

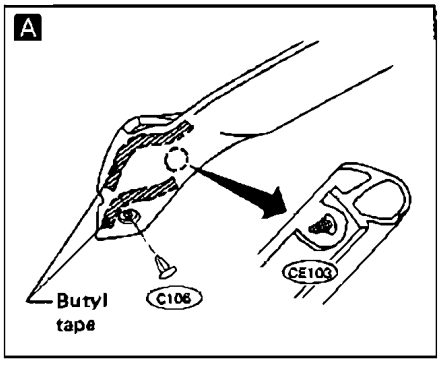


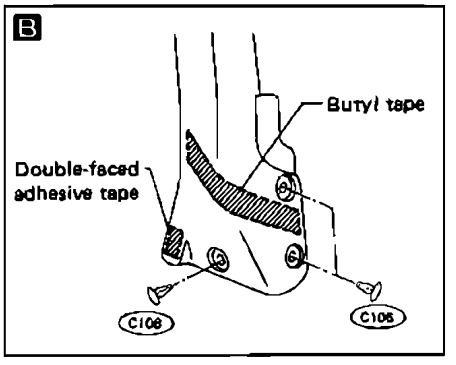
SBF213E

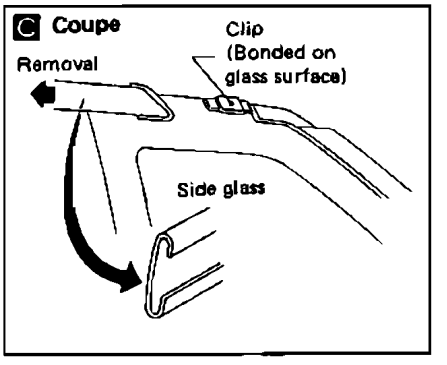
Exterior (Cont'd)

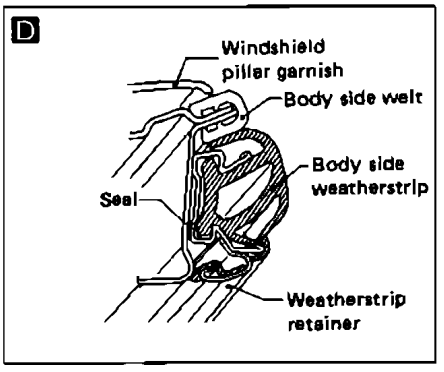
⑦, ⑧ Body side weatherstrip and weatherstrip retainer

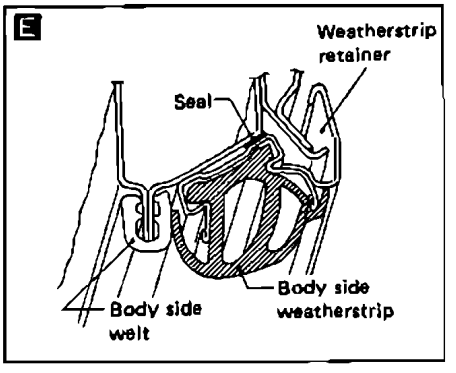


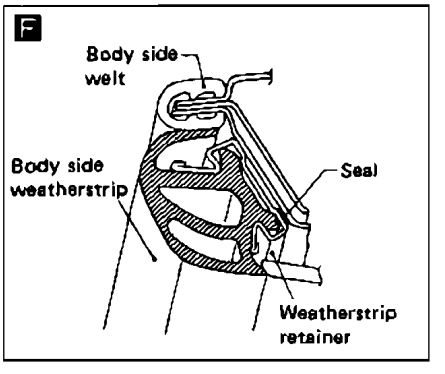








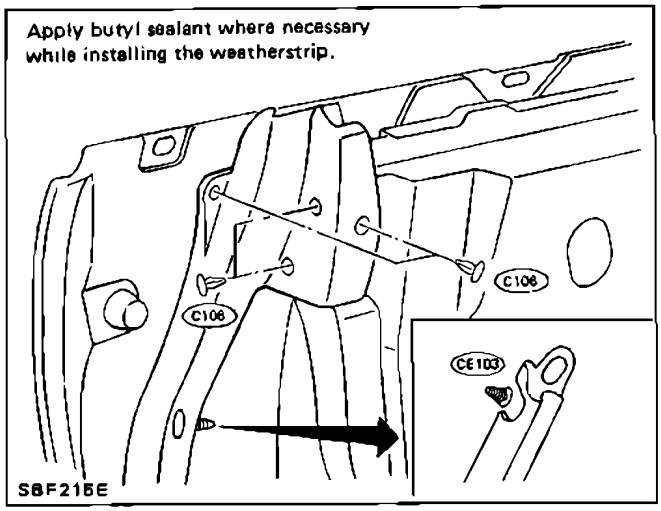




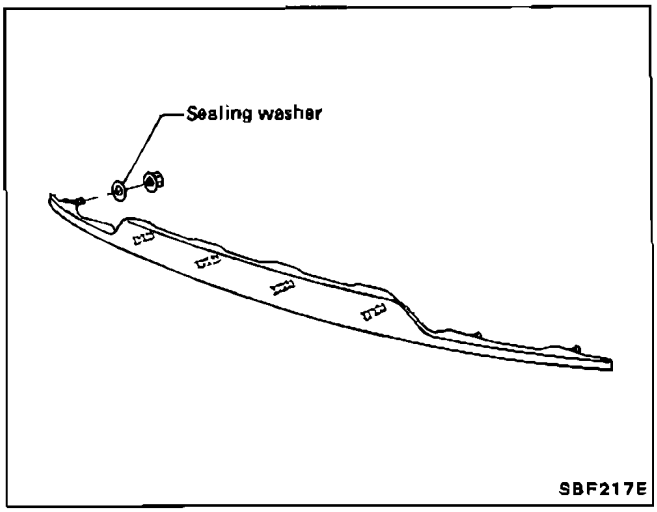
SBF214E

Exterior (Cont'd)

⑨ Door weatherstrip



⑬ Rear sight shield



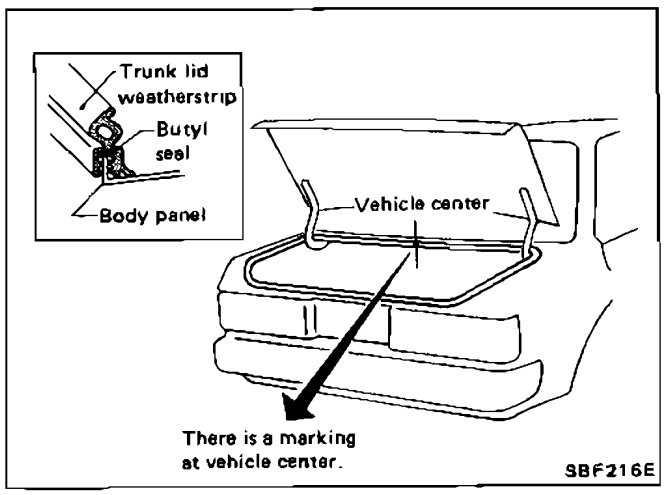
⑩ Back window upper and side molding (Coupe)

Basically the same as windshield upper and side molding.

⑪ Back window lower molding (Coupe)

It is mounted with screws.

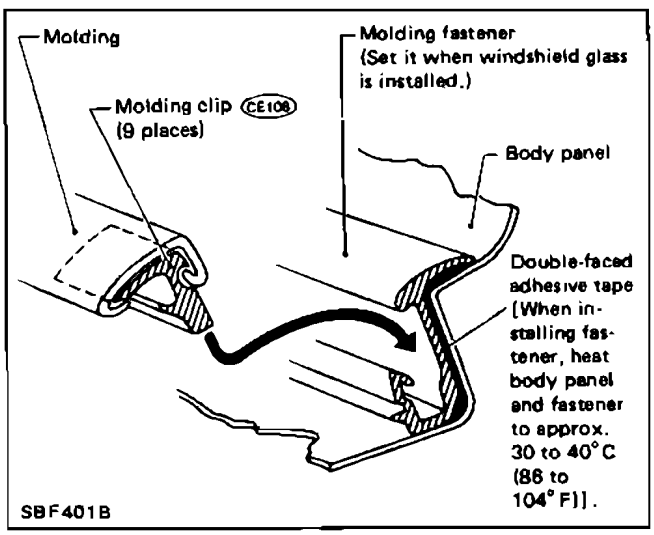
⑫ Trunk lid weatherstrip



⑭ Back door window upper and side molding (Fastback)

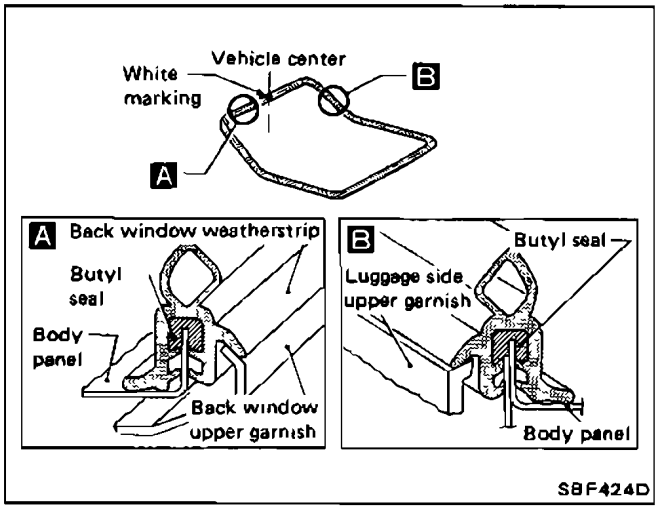
Bonded on back door glass side.

⑮ Back door window lower molding (Fastback)

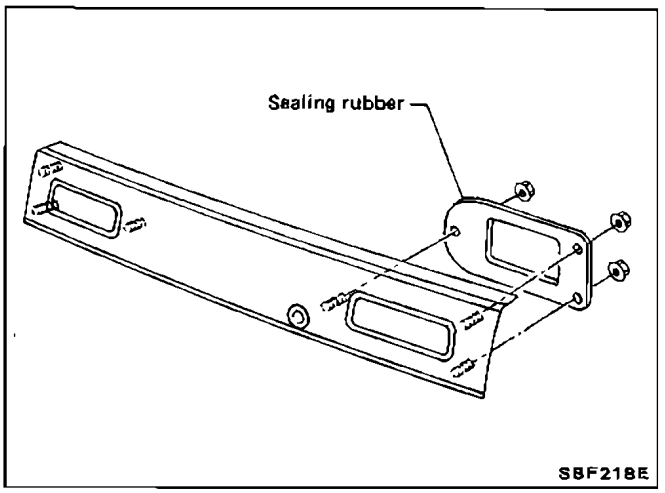


Exterior (Cont'd)

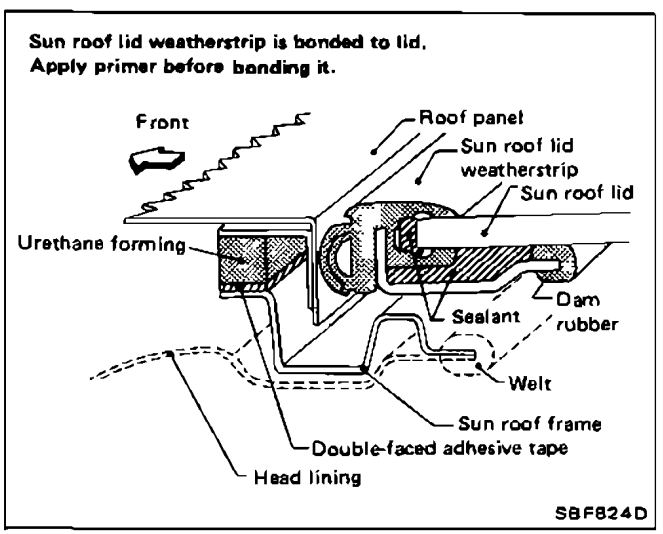
⑯ Back door weatherstrip



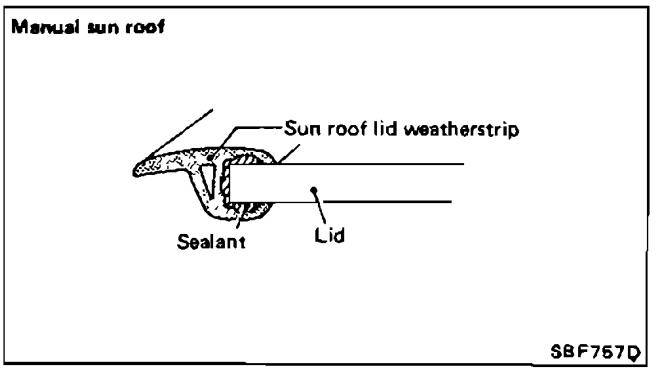
⑰ Rear panel finisher (Fastback)



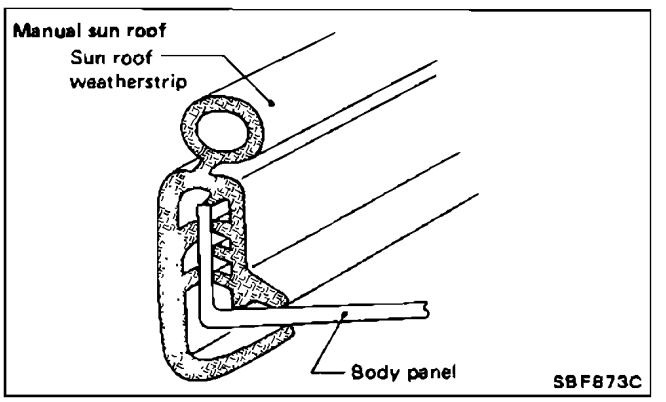
⑱ Sun roof lid weatherstrip and sun roof frame weatherstrip (Coupe)



⑲ Sun roof lid weatherstrip

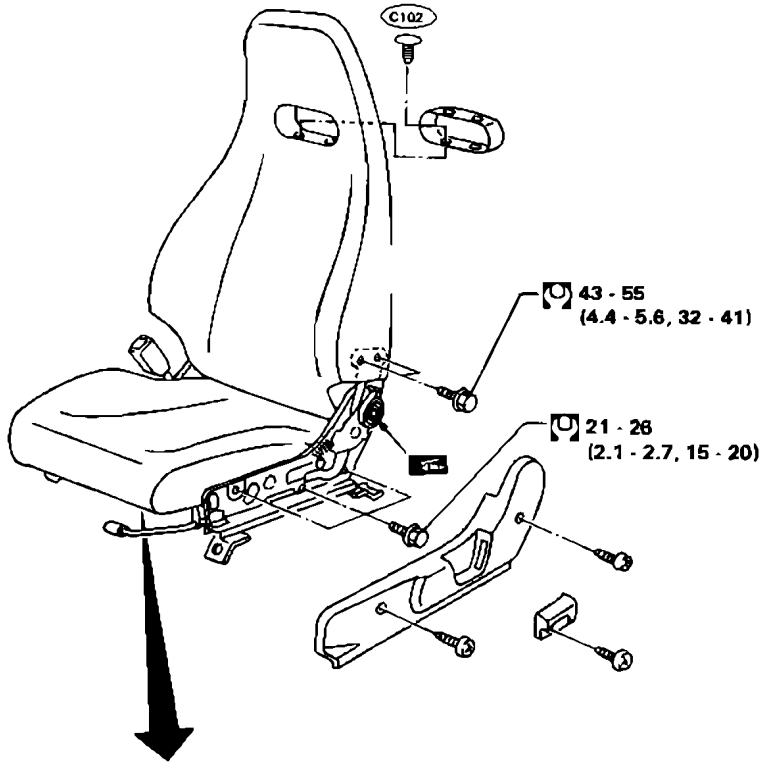


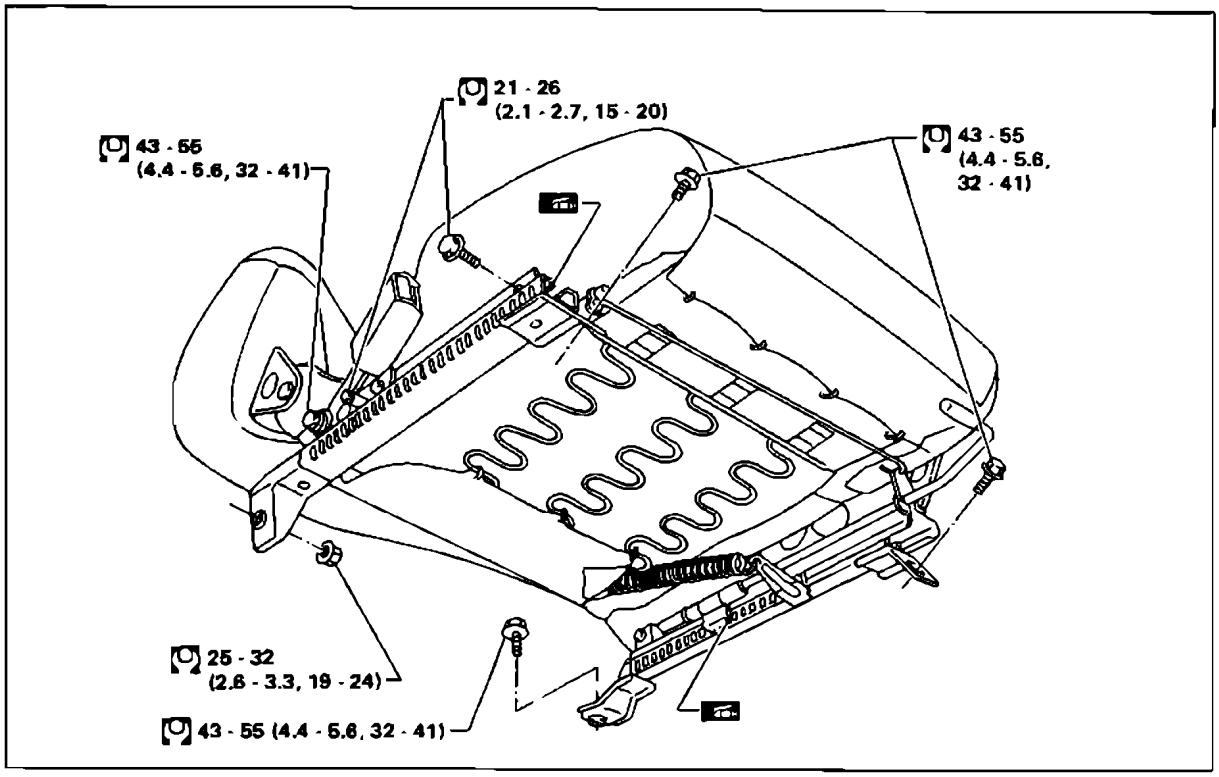
⑳ Sun roof weatherstrip



NOTE

Front Seat

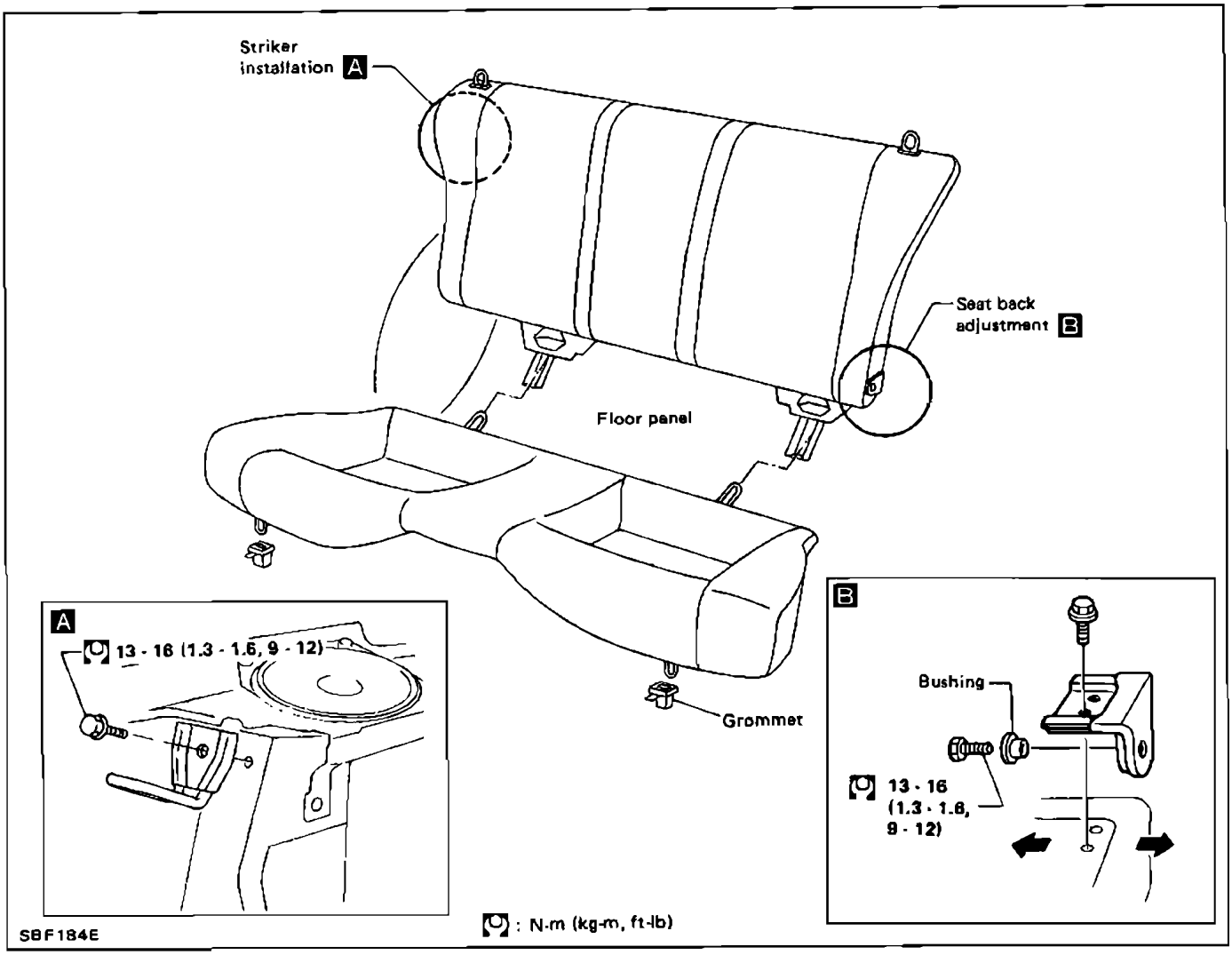




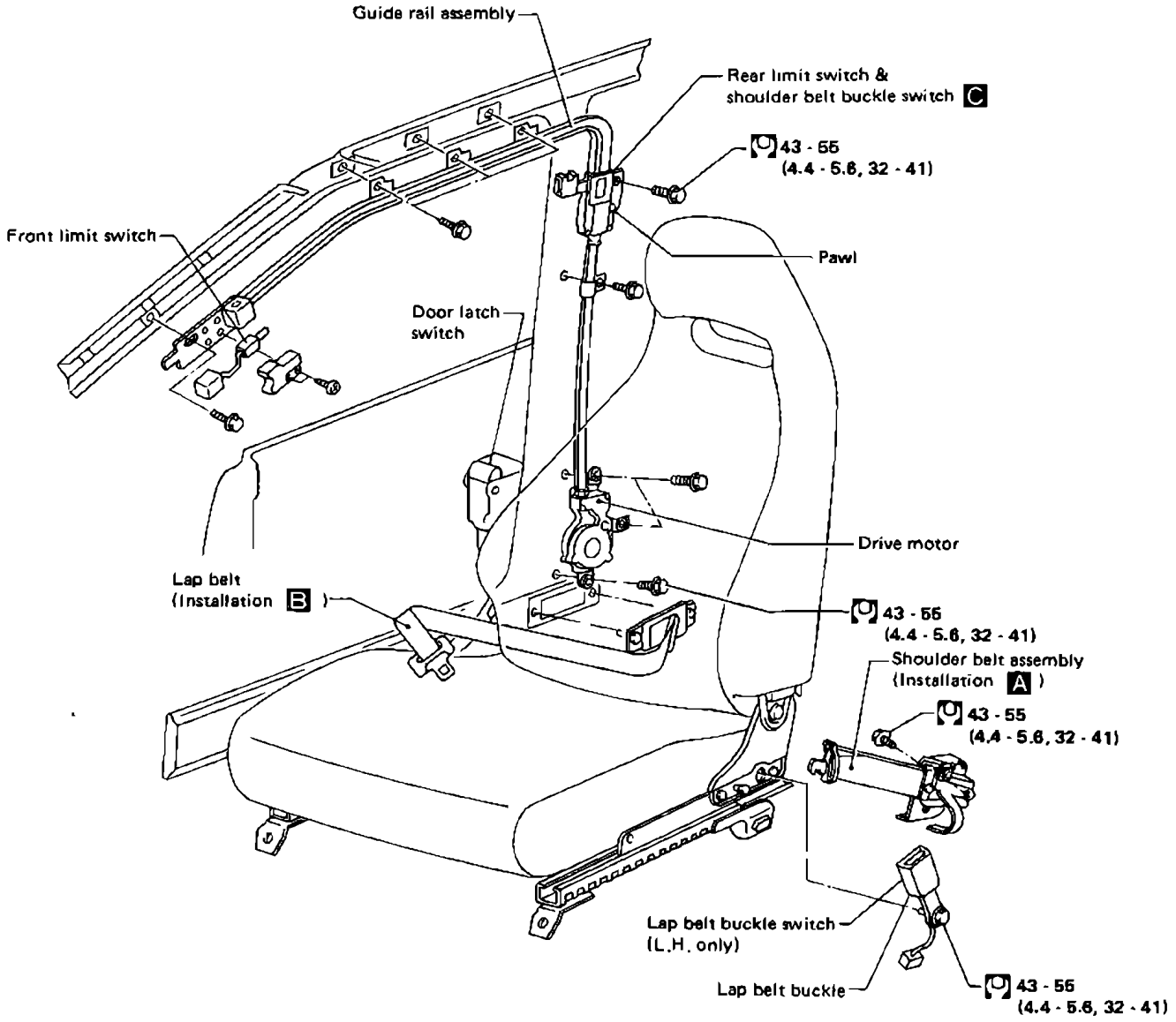
: N·m (kg-m, ft-lb)

SBF183E

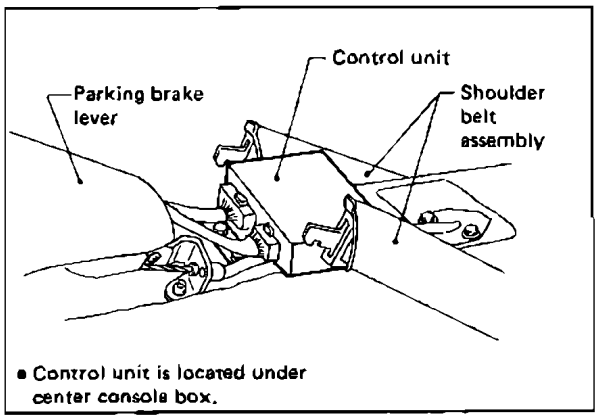
Rear Seat


Striker installation A
Seat back adjustment B
Floor panel
Grommet
A
13 - 16 (1.3 - 1.6, 9 - 12)
B
Bushing
13 - 16 (1.3 - 1.6, 9 - 12)
SBF184E
: N·m (kg-m, ft-lb)

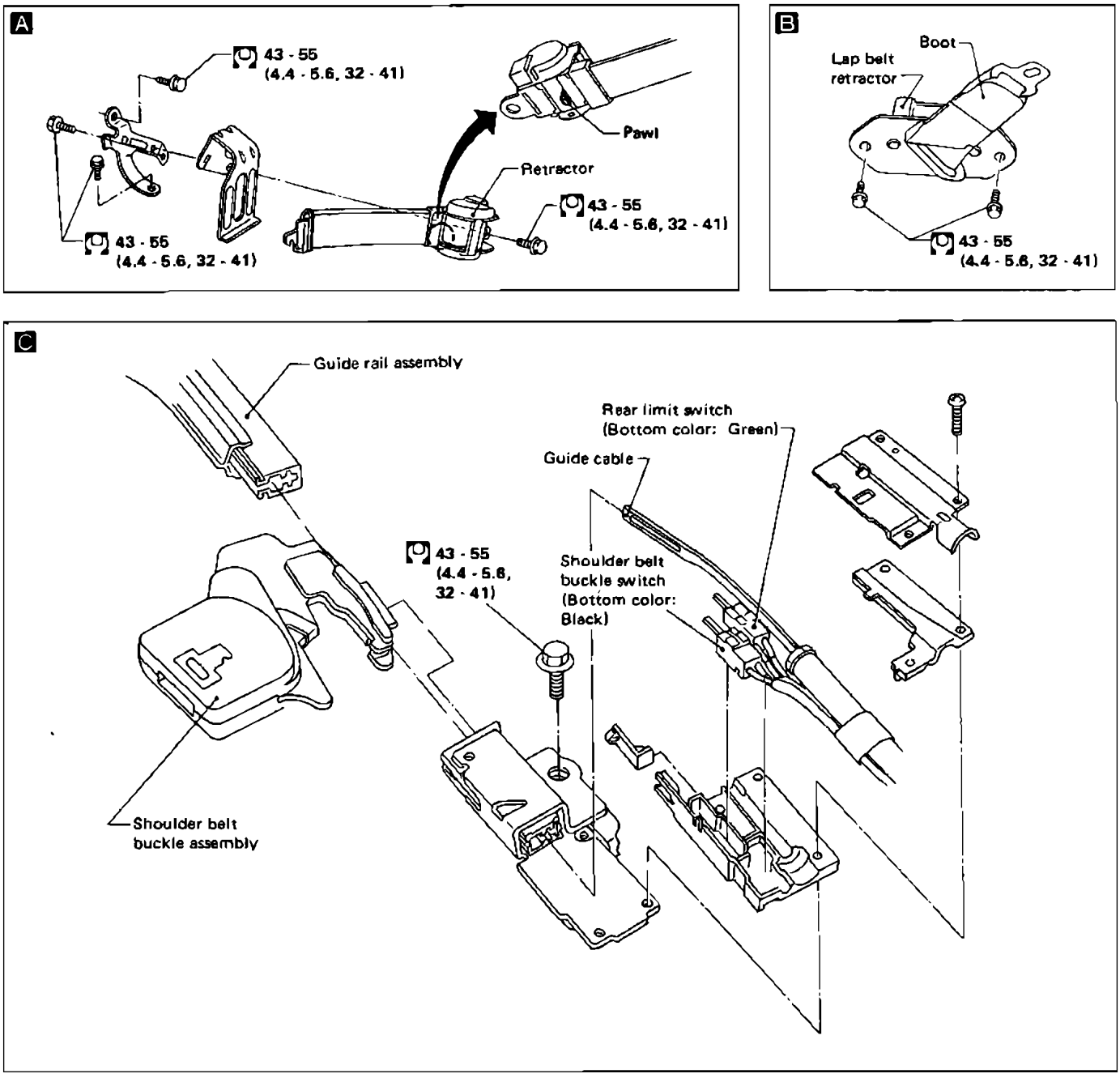
Unit Location



Control unit



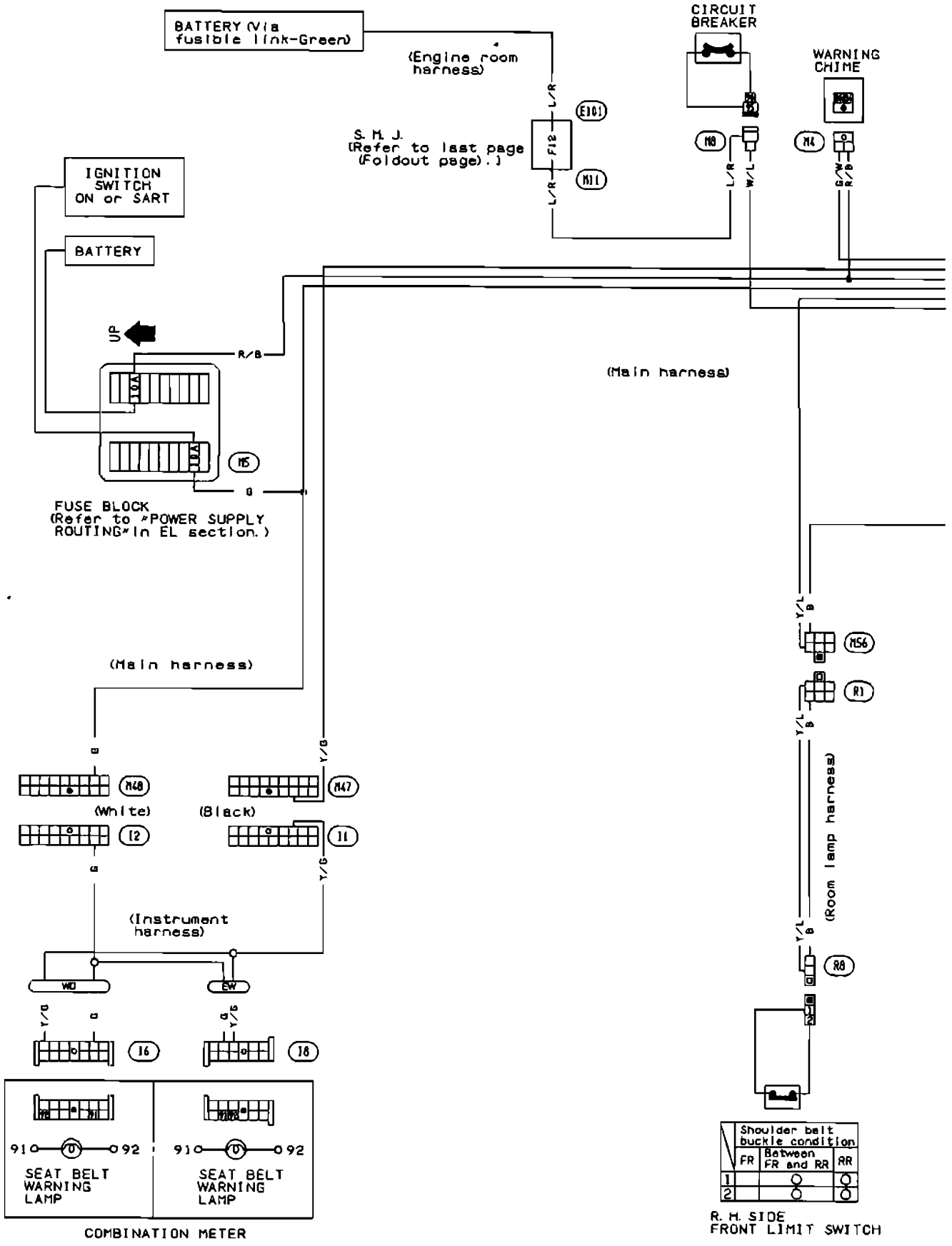
Unit Location (Cont'd)



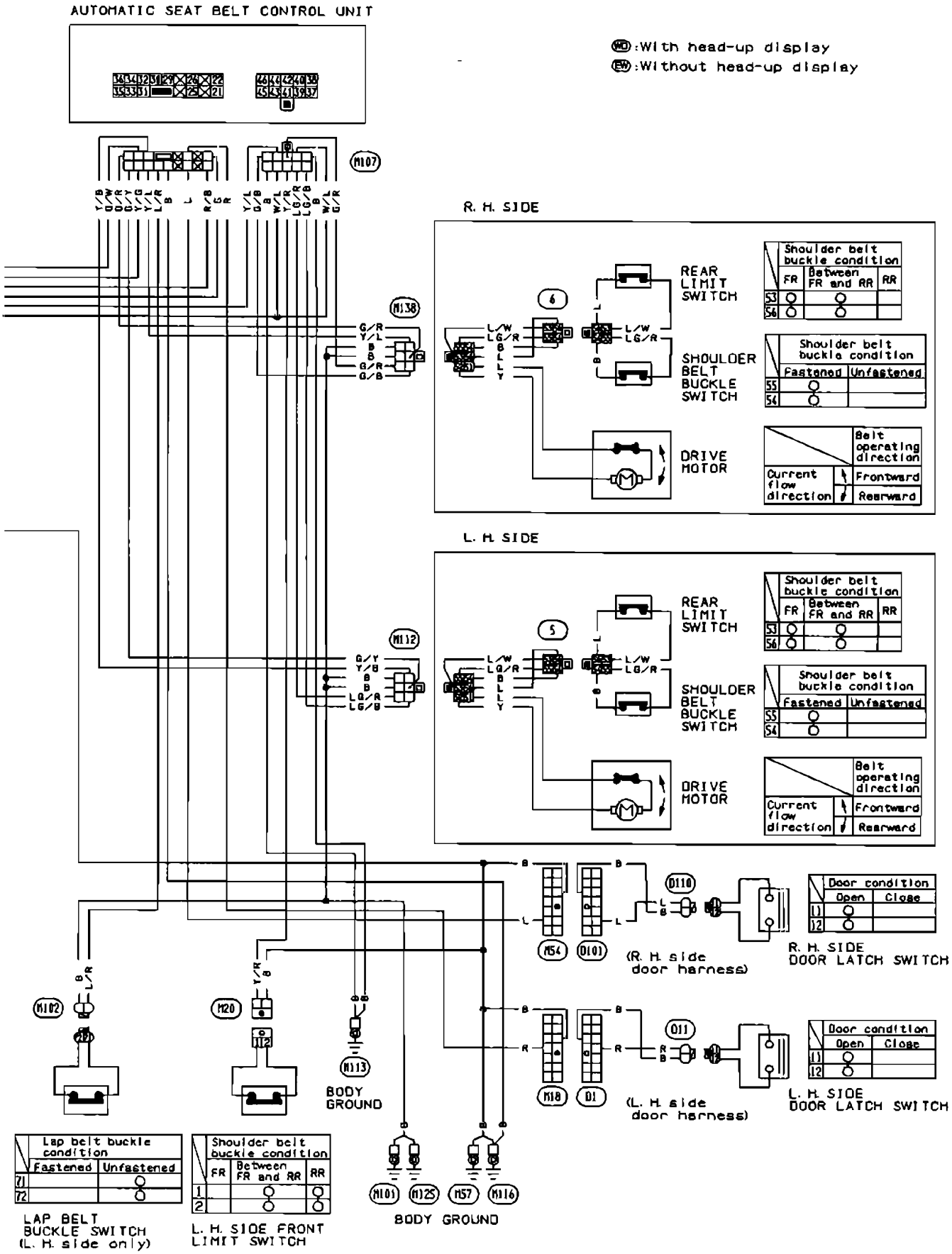
: N·m (kg-m, ft-lb)

SBF185E

Wiring Diagram



Wiring Diagram (Cont'd)



SBF784E

Description

FUNCTION

Shoulder belt buckle is mainly operated while ignition switch is "ON".

Condition (A): Ignition switch is "ON".

When door is opened, shoulder belt buckle is moved frontward and when door is closed, buckle is moved rearward.

Condition (B): Ignition switch is "OFF".

When door is opened, shoulder belt buckle is moved frontward. When the door is closed, buckle will remain in this position.

(Voltage of output signal is approximate value)

Input signal	Ignition switch	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF
	Door latch switch	OFF	ON	OFF	OFF	OFF	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	OFF
	Front limit switch	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	ON	ON	ON	ON	ON	OFF	OFF
	Rear limit switch	ON	ON	ON	ON	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	ON	ON	ON
Output signal	Drive motor power source for frontward operation	0V	0V	0V	0V	0V	12V	12V	0V	0V	0V	0V	0V	12V	12V	0V	0V
	Drive motor power source for rearward operation	0V	0V	12V	12V	0V	0V	0V	0V	12V	12V	0V	0V	0V	0V	0V	0V
Shoulder belt buckle	Function	Stop	Stop	Start to move	Moving	Stop	Start to move	Moving	Stop	Start to move	Moving	Stop	Stop	Start to move	Moving	Stop	Stop
	Position	Front	Front	Front	Between Front & Rear	Rear	Rear	Between Front & Rear	Front	Front	Between Front & Rear	Rear	Rear	Rear	Between Front & Rear	Front	Front

TIMER (Ignition switch either "ON" or "OFF")

If limit switch does not operate (when accomplishing frontward operation, front limit switch can not be turned "OFF" or when accomplishing rearward operation, rear limit switch can not be turned "OFF"), control unit will continue to supply power to drive motor for 15 seconds and control unit will stop supplying power.

QUICK WARNING (Ignition switch "ON")

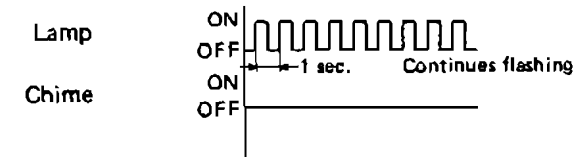
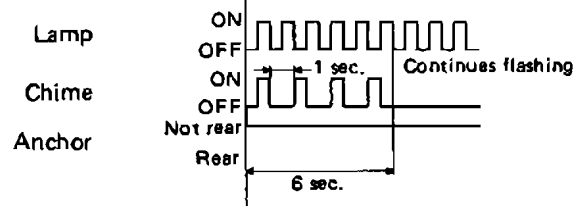
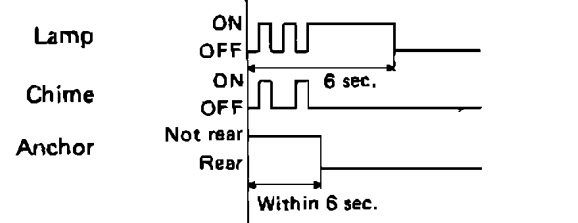
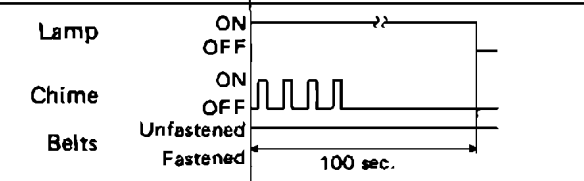
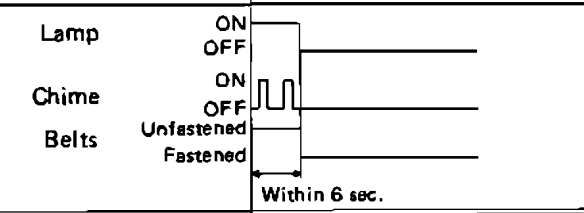
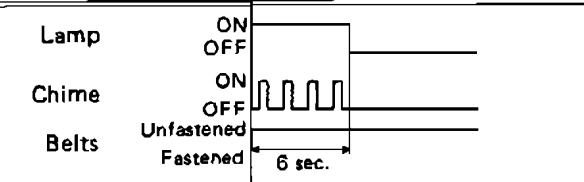
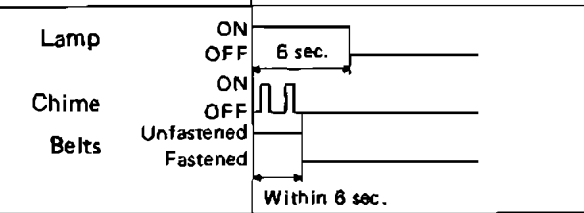
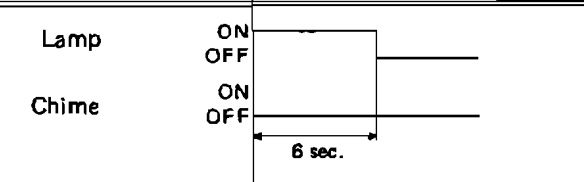
If front limit switch is not turned "OFF" after accomplishing frontward operation, control unit will stop supplying power 15 seconds later and warning lamp will flash and chime will operate rapidly for approximately 6 seconds.

REAR LOCK

If quick warning functions twice successively while ignition switch is "ON", shoulder belt buckle will move to rear position when the door is closed as normal but will remain in rear position even if door is opened. This function is canceled when ignition switch is "OFF".

Description (Cont'd)

WARNING

Priority	Warning item	Ignition switch	Indication of warning (Indicating time is approximate value.)
1	Shoulder anchors are not at rear lock position.	ON	
		OFF → ON	
			
2	Shoulder belts are not fastened.	ON	
			
3	Driver side lap belt is not fastened.	OFF → ON	
			
4	Normal (All belts are fastened and shoulder anchors are in rear lock position.)	OFF → ON	

NOTE

Contents

Symptom Chart BF-40
Preliminary Check BF-41
Main Power Supply and Ground Circuit Check BF-45
Harness Layout BF-46
Circuit Diagram for Quick Pin Point Check BF-48
Diagnostic Procedure 1
(Check motor circuit and stop signals.) BF-49
Diagnostic Procedure 2
(Check door switch circuit.) BF-52
Diagnostic Procedure 3
(Check front limit switch circuit.) BF-54
Diagnostic Procedure 4
(Check rear limit switch circuit.) BF-56
Diagnostic Procedure 5
(Check shoulder belt switch circuit.) BF-58
Diagnostic Procedure 6
(Check lap belt switch circuit.) BF-60
Diagnostic Procedure 7
(Check warning chime circuit.) BF-62
Diagnostic Procedure 8
(Check warning lamp circuit.) BF-63
Electrical Components Inspection BF-64

Since left and right component parts are basically the same, harness layout and methods for electronic components inspection are shown for one side only.

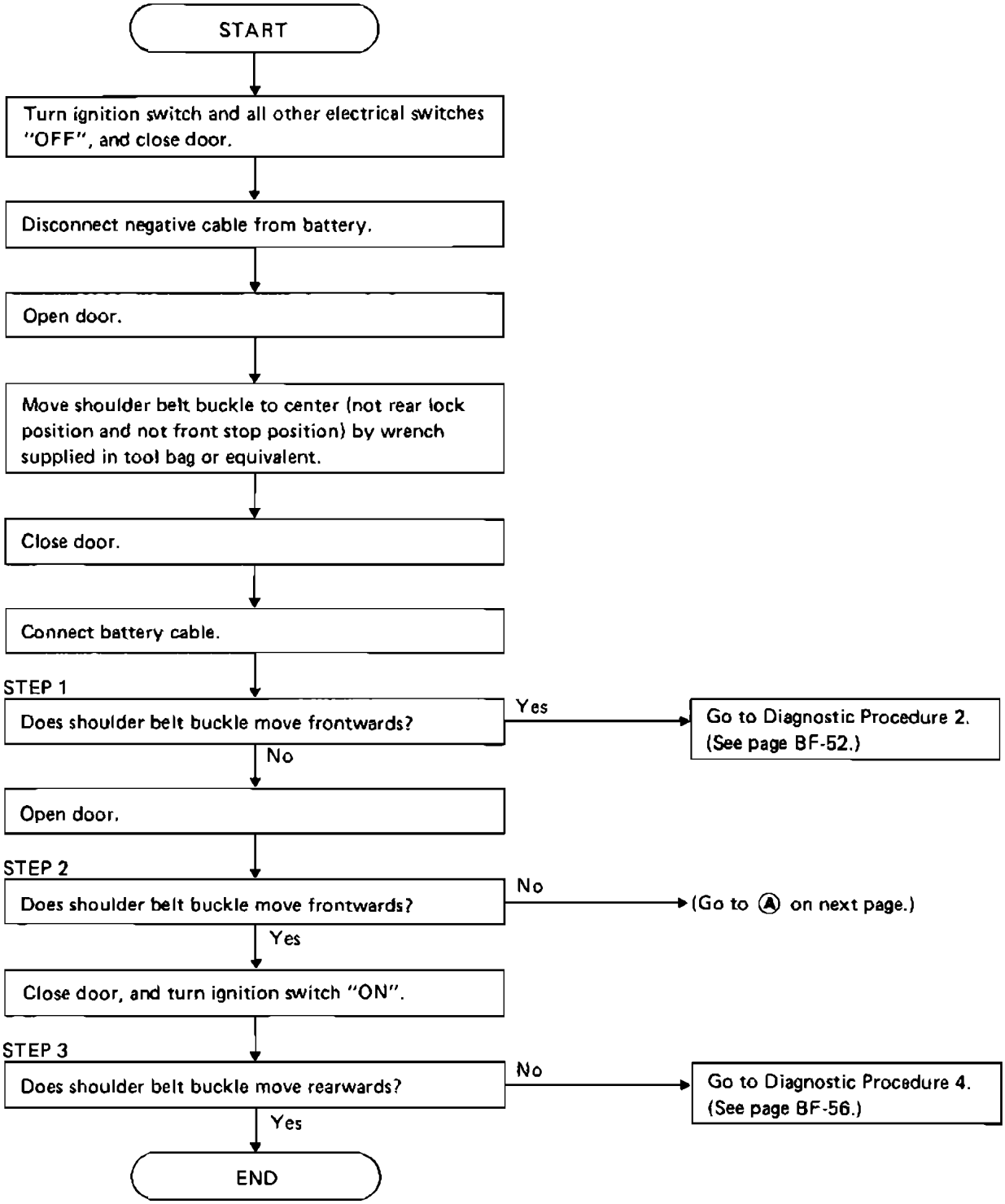
Although methods for checking component parts on both sides are described in the flow chart, making it easier to trouble-shoot, apply checking procedures to either side that have problems during trouble diagnoses. For those methods enclosed by double rectangulars, however, component parts on both sides must be checked as problems occurring on either side cannot be easily determined by a symptom.

Symptom Chart

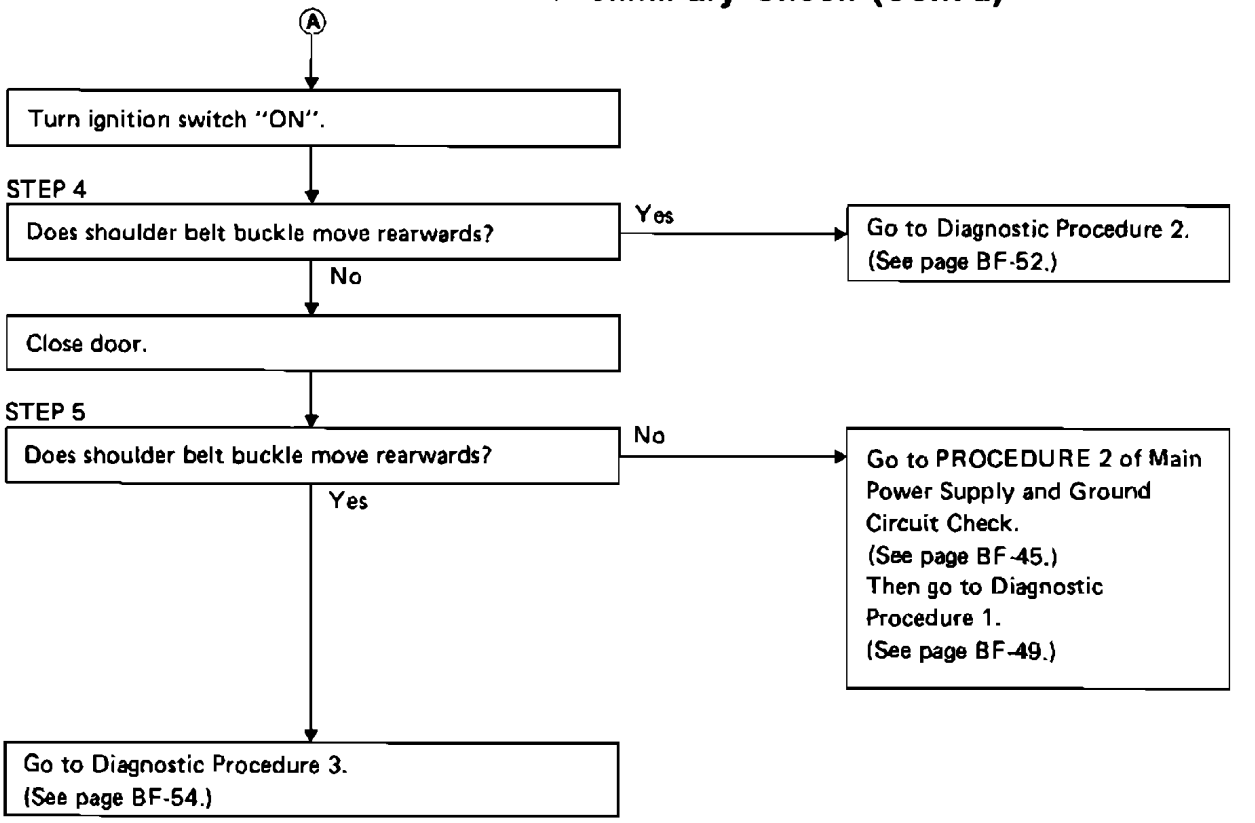
Procedure	Reference page		SYMPTOM	No operation has made. (No warning indicated and no buckles movement performed)	Shoulder belt buckle in L.H. or R.H. side does not move.	Shoulder belt buckle moves frontwards only. (not rearwards)	Shoulder belt buckle moves rearwards only. (not frontwards)	Warnings indicate incorrectly or do not function.	Quick warning operates.
Preliminary Check	BF-41		Procedure 1		○	○	○		
	BF-43		Procedure 2					○	
Main Power Supply and Ground Circuit Check	BF-45		Procedure 1	○					
	BF-45		Procedure 2		○				
Diagnostic Procedure	BF-49		Procedure 1	○	○				
	BF-52		Procedure 2			○	○		
	BF-54		Procedure 3	○	○		○		○
	BF-56		Procedure 4	○	○	○		○	
	BF-58		Procedure 5					○	
	BF-60		Procedure 6					○	
	BF-62		Procedure 7					○	
	BF-63		Procedure 8					○	
Electrical Components Inspection	–		Warning lamp	○				○	
	BF-65		Warning chime	○				○	
	BF-64	L.H. side	Front limit switch	○	○		○		○
	BF-64		Rear limit switch	○	○	○		○	
	BF-64		Door latch switch	○		○	○		
	BF-64		Shoulder belt buckle switch	○				○	
	BF-64		Motor	○	○				
	BF-65		Lap belt switch	○				○	
	BF-64	R.H. side	Front limit switch	○	○		○		○
	BF-64		Rear limit switch	○	○	○		○	
	BF-64		Door latch switch	○		○	○		
	BF-64		Shoulder belt buckle switch	○				○	
	BF-64		Motor	○	○				

Preliminary Check

PROCEDURE 1

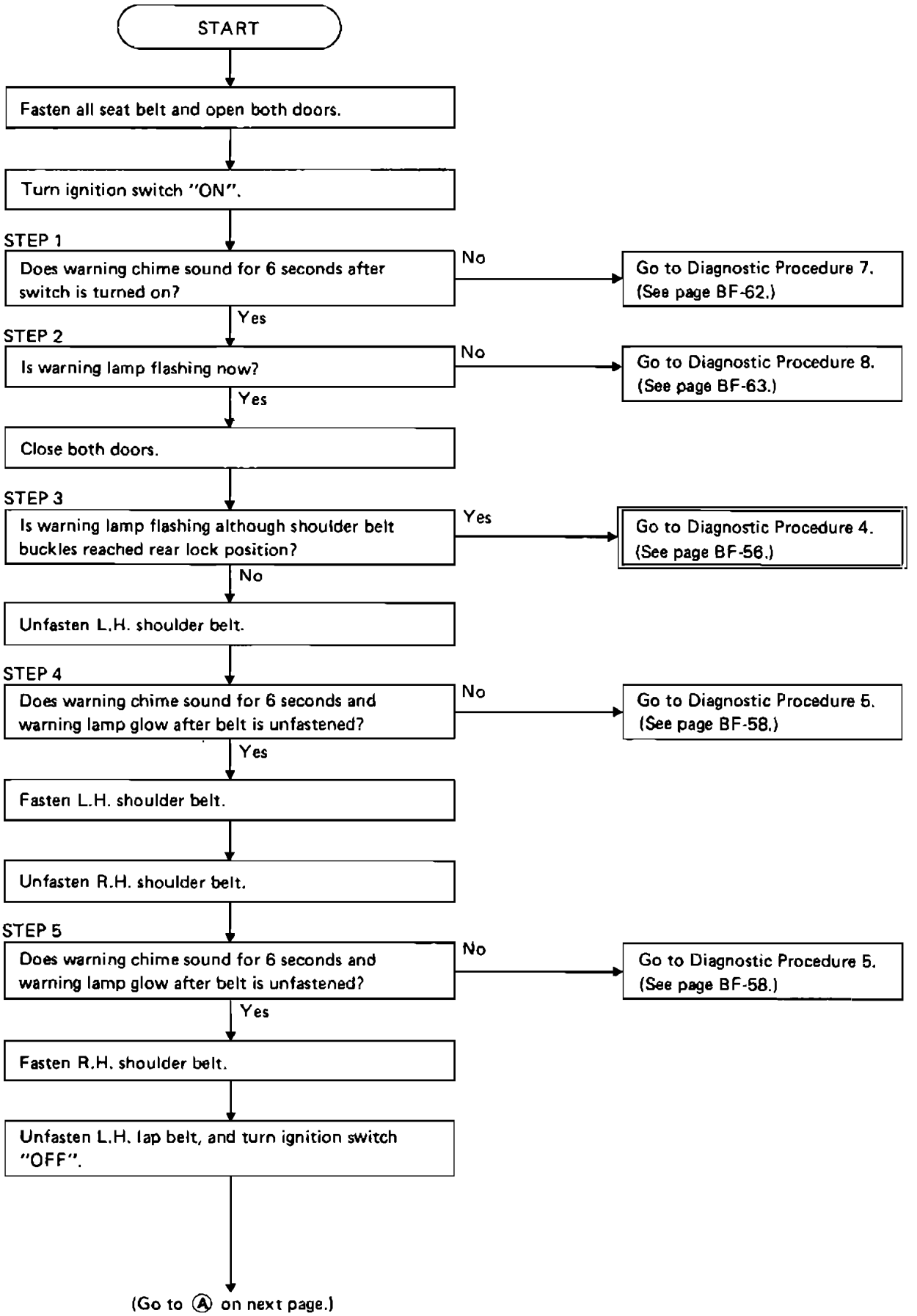


Preliminary Check (Cont'd)

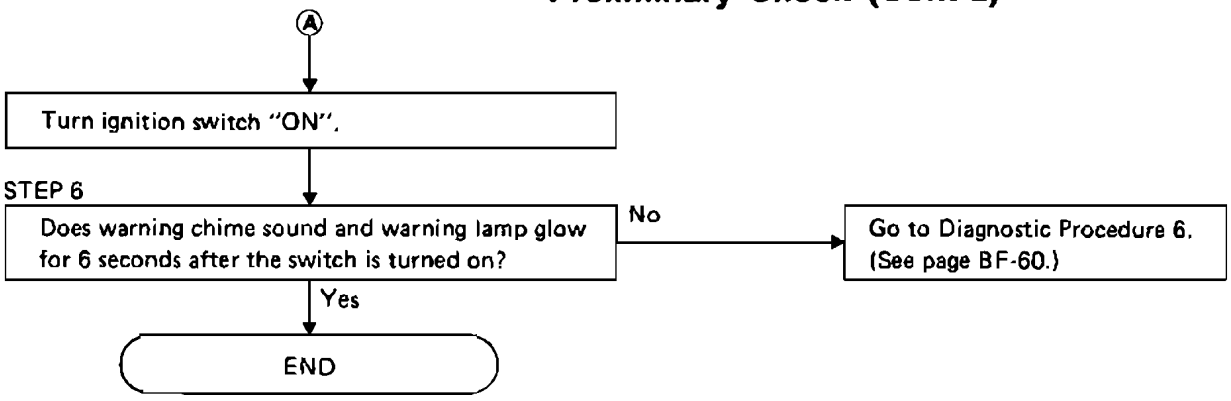


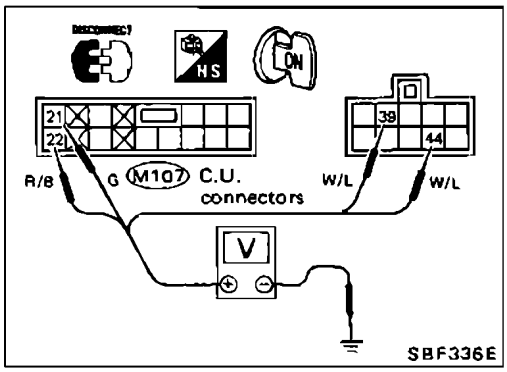
Preliminary Check (Cont'd)

PROCEDURE 2



Preliminary Check (Cont'd)



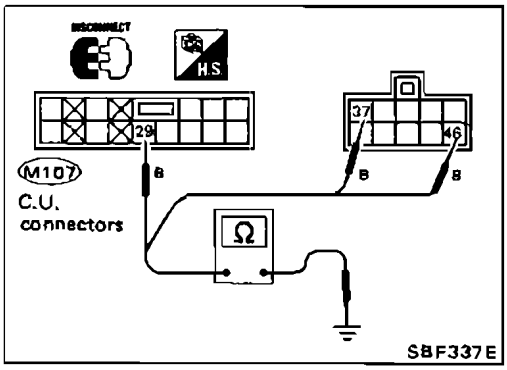


Main Power Supply and Ground Circuit Check

PROCEDURE 1

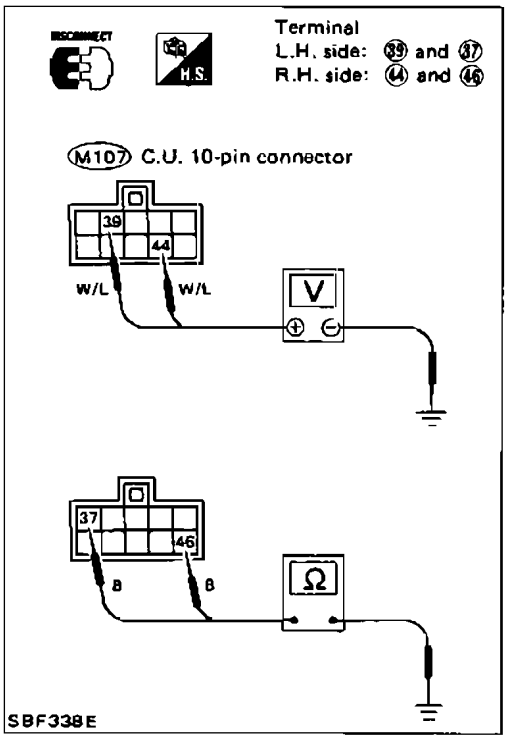
Main power supply

Terminals	Battery voltage existence condition	
	Ignition switch "ON"	Other than ignition switch "ON"
㉑ - Ground	Yes	No
㉒ - Ground	Yes	Yes
㊴ - Ground	Yes	Yes
㊹ - Ground	Yes	Yes



Ground circuit

Terminals	Continuity
㉙ - Ground	Yes
㊲ - Ground	Yes
㊻ - Ground	Yes



PROCEDURE 2

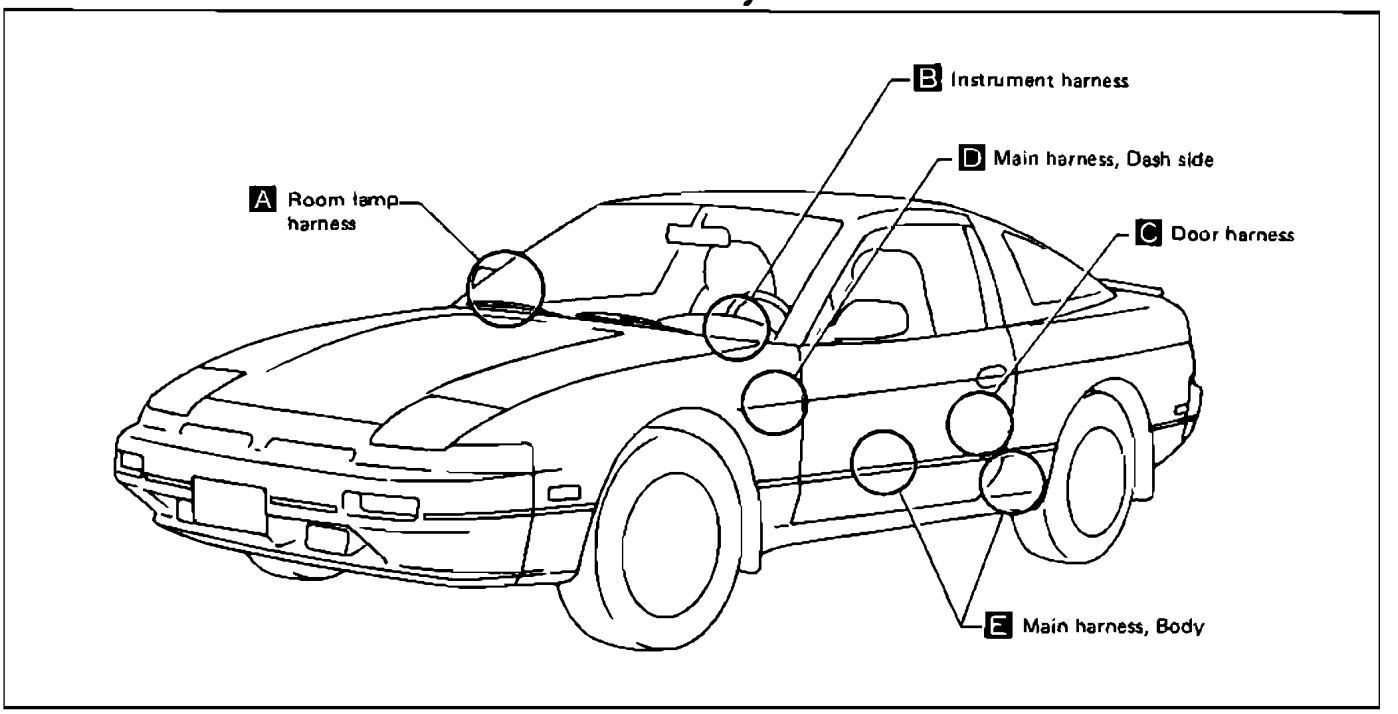
Power supply for motor drive

	Terminals	Battery voltage existence
L.H. side	㊴ - Ground	Yes
R.H. side	㊹ - Ground	Yes

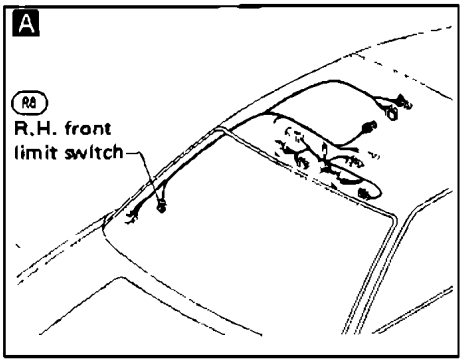
Ground circuit for motor drive

	Terminals	Continuity
L.H. side	㊲ - Ground	Yes
R.H. side	㊻ - Ground	Yes

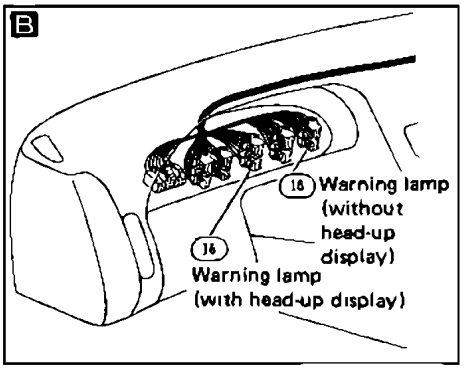
Harness Layout



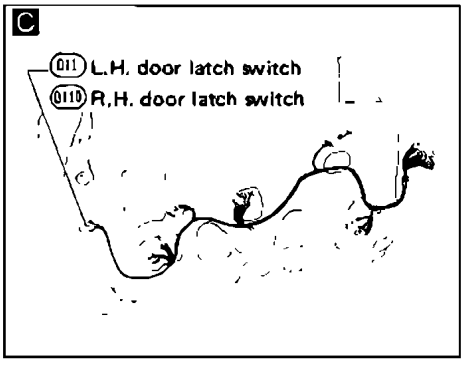
A



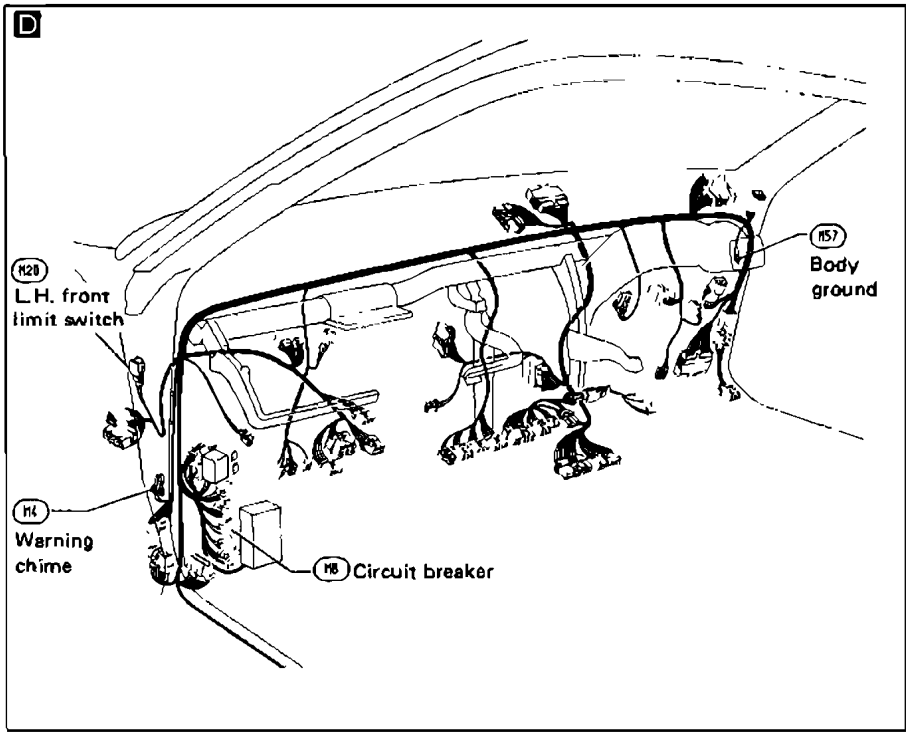
B



C

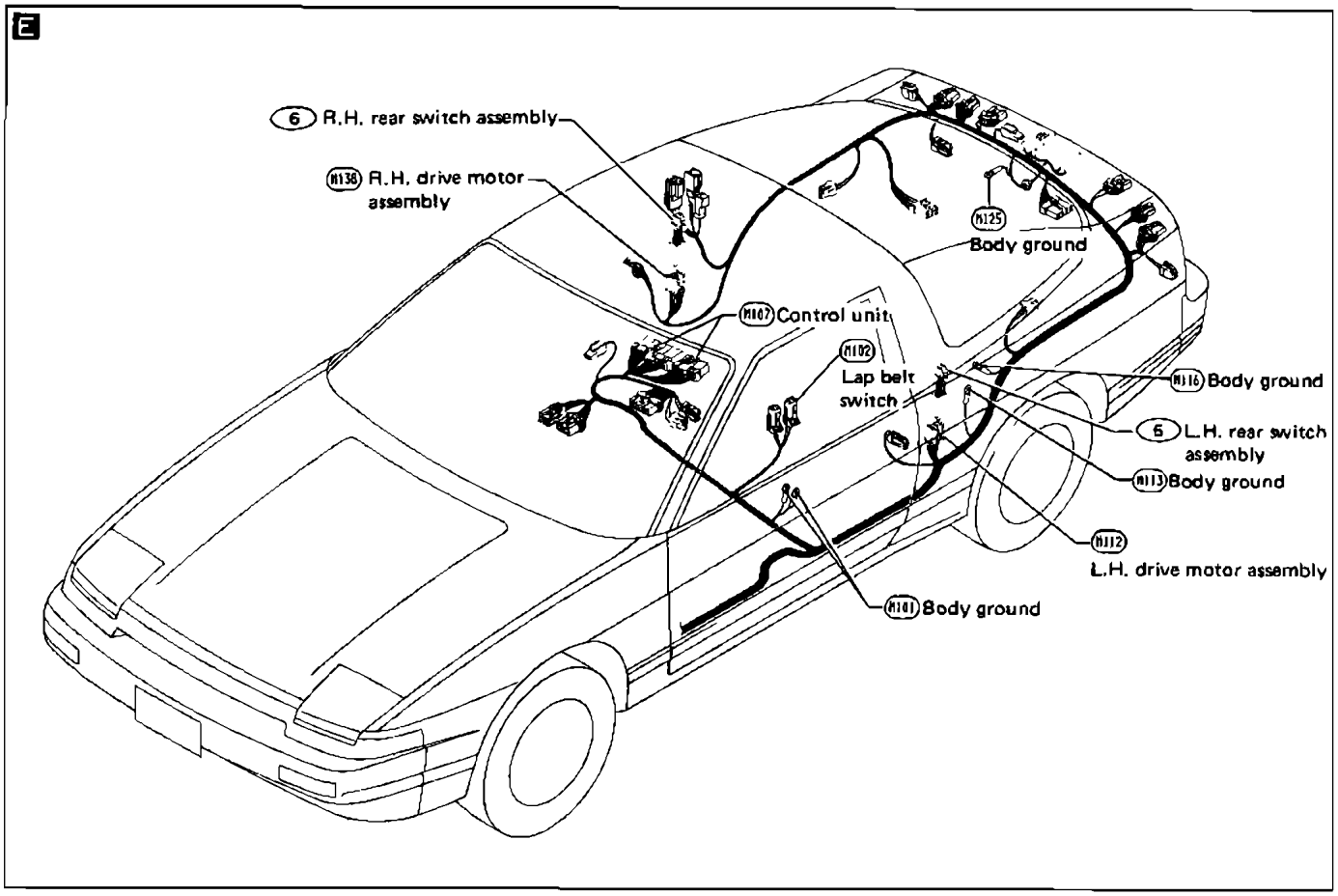


D



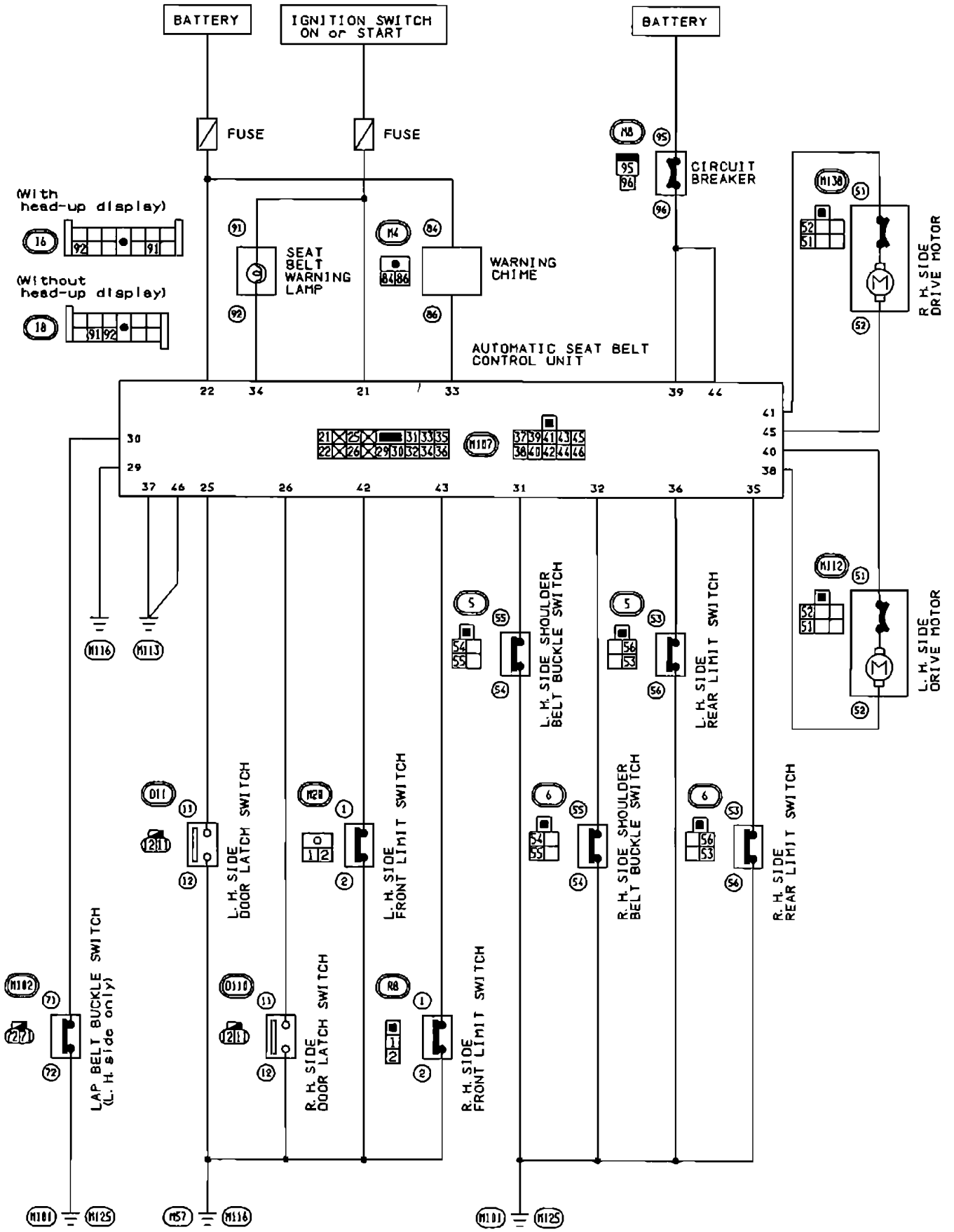
Harness Layout (Cont'd)

E

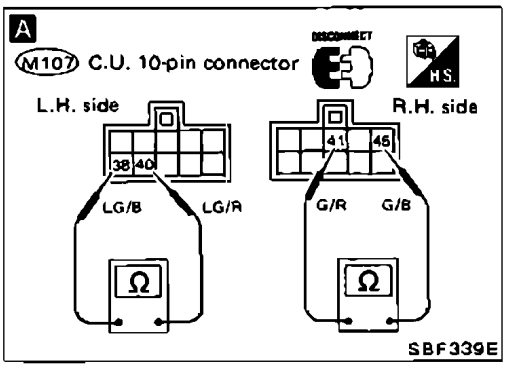


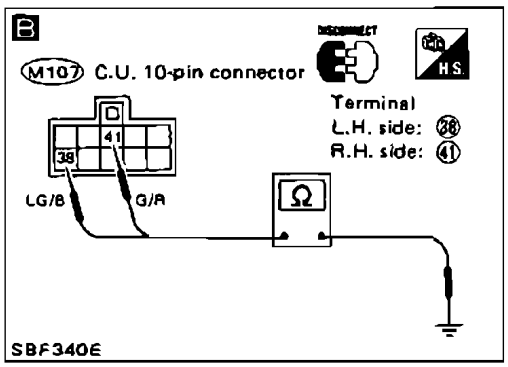
SBF368E

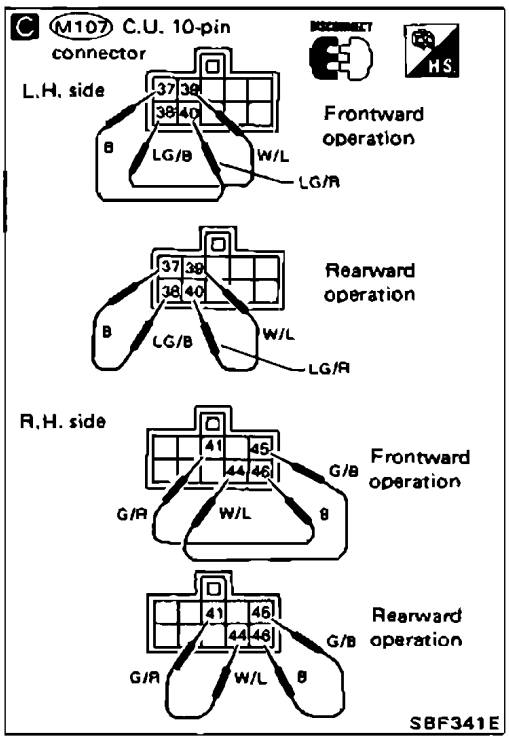
Circuit Diagram for Quick Pin Point Check



SBF785E







Diagnostic Procedure 1

START

A

CHECK MOTOR CIRCUIT.
1) Disconnect 10-pin connector from control unit.
2) Check continuity.

	Terminals
L.H. side	38 - 40
R.H. side	41 - 45

Continuity should exist.

N.G. → (Go to Ⓐ on next page.)

O.K.

B

Does continuity exist?

	Terminals
L.H. side	38 - Ground
R.H. side	41 - Ground

Yes → (Go to Ⓑ on next page.)

No

C

CHECK MOTOR OPERATION.
Check shoulder belt buckle movement.

O.K. → (Go to Ⓒ on page BF-51.)

N.G.

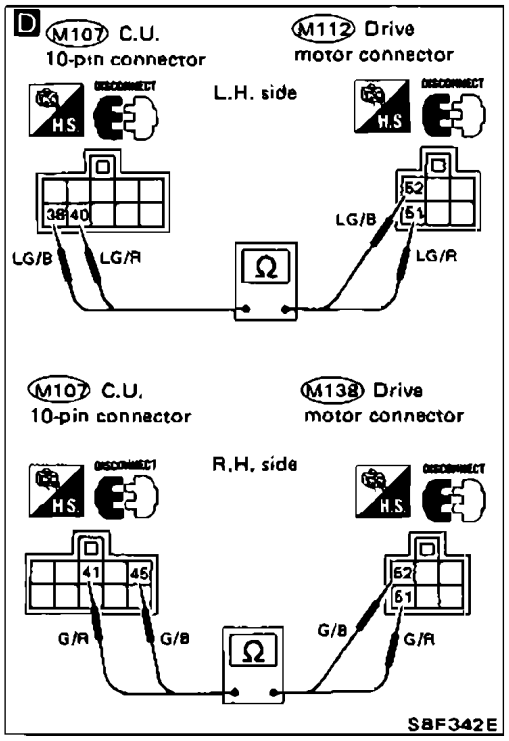
Go to DRIVE MOTOR ASSEMBLY of Electrical Components Inspection. (See page BF-64.)

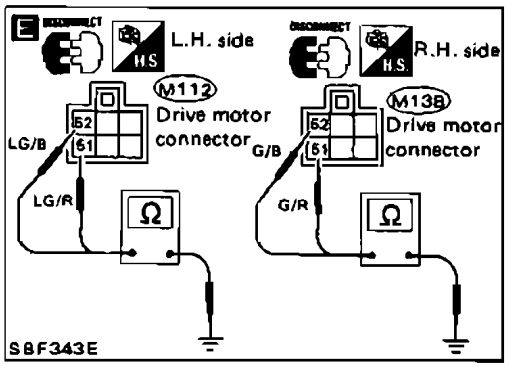
N.G. → Replace drive motor assembly.

O.K.

Replace guide rail assembly.

Diagnostic Procedure 1 (Cont'd)





Ⓐ

D

1) Disconnect connector from drive motor assembly.
2) Check continuity.

N.G. → Repair harness.

	Terminals
L.H. side	㊳ - ㊷
	㊵ - ㊶
R.H. side	㊶ - ㊶
	㊺ - ㊷

Continuity should exist.

O.K.

Check drive motor harness for open circuit.

N.G. → Repair drive motor harness.

O.K.

Replace drive motor.

Ⓑ

E

1) Disconnect connector from drive motor assembly.
2) Does continuity exist in at least one point?

Yes → Repair harness.
There will be incorrect grounding.

	Terminals
L.H. side	㊶ - Ground
	㊷ - Ground
R.H. side	㊶ - Ground
	㊷ - Ground

No

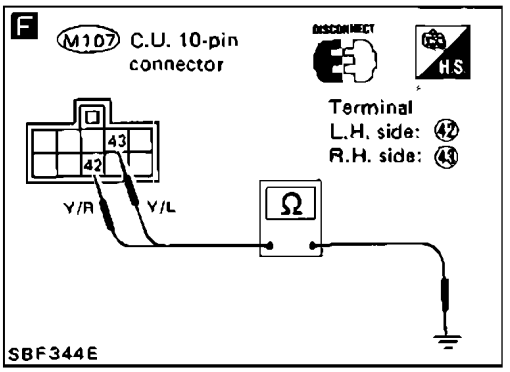
Check drive motor harness for incorrect grounding.

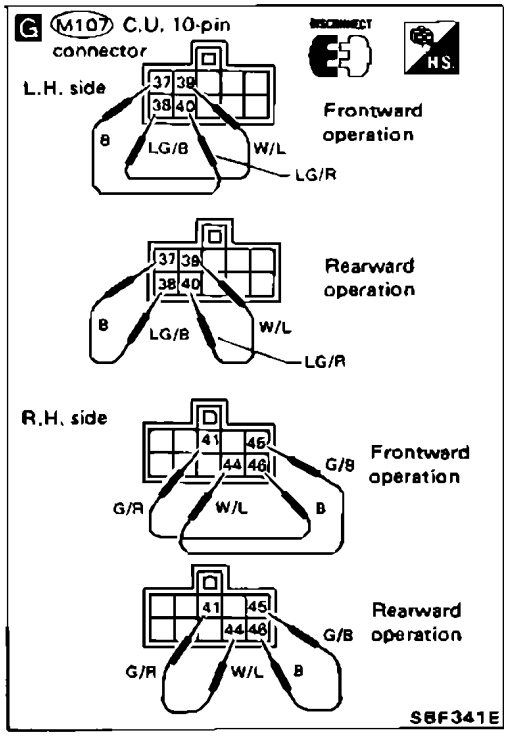
N.G. → Repair drive motor harness.

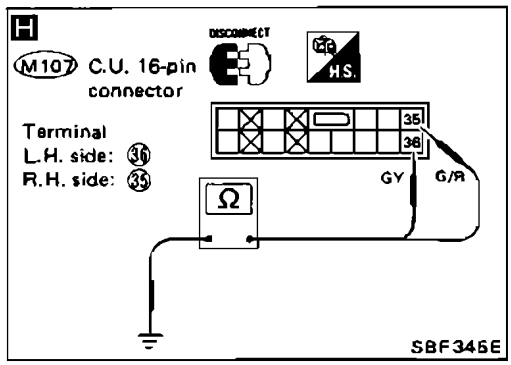
O.K.

Replace drive motor assembly.

Diagnostic Procedure 1 (Cont'd)







Ⓒ

F

CHECK STOP SIGNAL.
1) Move shoulder belt buckle to center (not rear lock position and not front).
2) Check continuity.

	Terminals
L.H. side	42 - Ground
R.H. side	43 - Ground

Continuity should exist.
G Refer to figure G to move shoulder belt buckle.

N.G. → Go to Diagnostic Procedure 3 (See page BF-54.) and return to next step.

O.K.

H

1) Disconnect 16-pin connector from control unit.
2) Check continuity.

	Terminals
L.H. side	36 - Ground
R.H. side	35 - Ground

Continuity should exist.

N.G. → Go to Diagnostic Procedure 4 (See page BF-56.) and return to next step.

O.K.

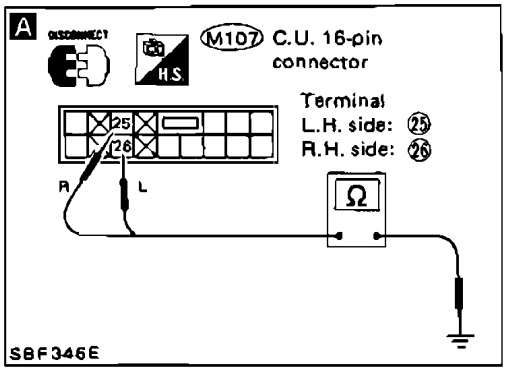
Is this the second time? Yes → Replace control unit.

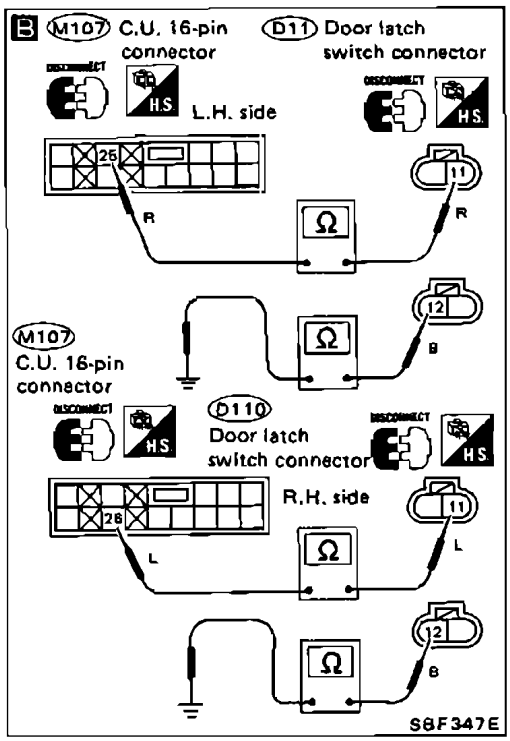
No

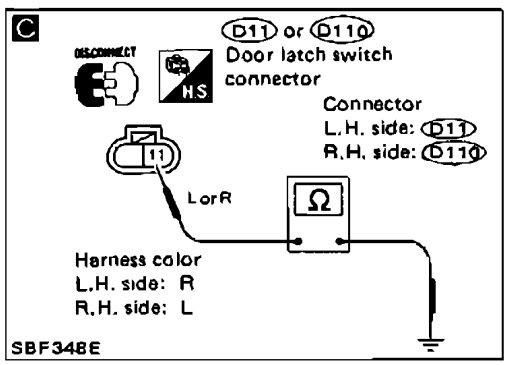
Reinstall any part removed.

Go to PROCEDURE 1 (START) of Preliminary Check. (See page BF-41.)

Diagnostic Procedure 2







START

A

CHECK DOOR SWITCH CIRCUIT.
1) Disconnect 16-pin connector from control unit.
2) Check continuity.

	Terminals	Door condition	Continuity
L.H. side	25 - Ground	Open	Yes
		Close	No
R.H. side	26 - Ground	Open	Yes
		Close	No

O.K. → (Go to Ⓐ on next page.)

N.G.

B

1) Disconnect door latch switch connector.
2) Check continuity.

	Terminals
L.H. side	25 - 11 12 - Ground (M57, M116)
R.H. side	26 - 11 12 - Ground (M57, M116)

Continuity should exist.

N.G. → Repair harness.

O.K.

C

Does continuity exist?

	Connector	Terminals
L.H. side	D11	11 - Ground
R.H. side	D110	11 - Ground

Yes → Repair harness.
There will be incorrect grounding between terminals 25 and 11 or 26 and 11.

No

Go to DOOR LATCH SWITCH of Electrical Components Inspection. (See page BF-64.)

O.K. → Reinstall any part removed.

→ Go to PROCEDURE 1 (START) of Preliminary Check. (See page BF-41.)

N.G.

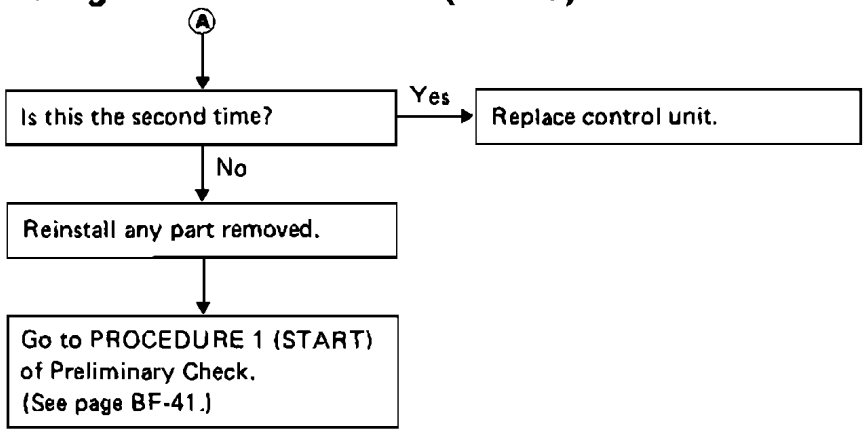
Check door latch switch harness for open and short circuit.

N.G. → Repair door latch switch harness.

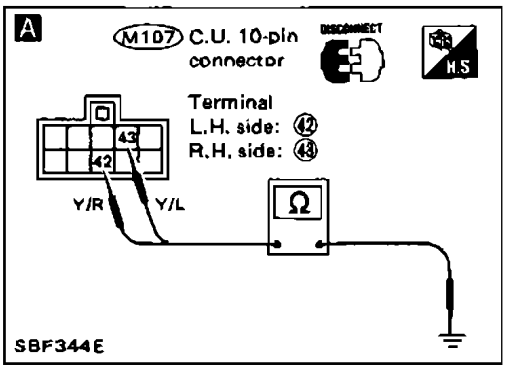
O.K.

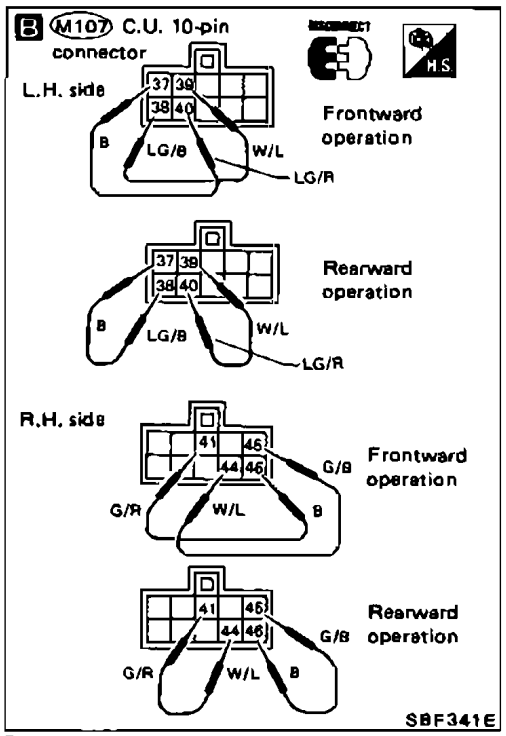
Replace door lock assembly.

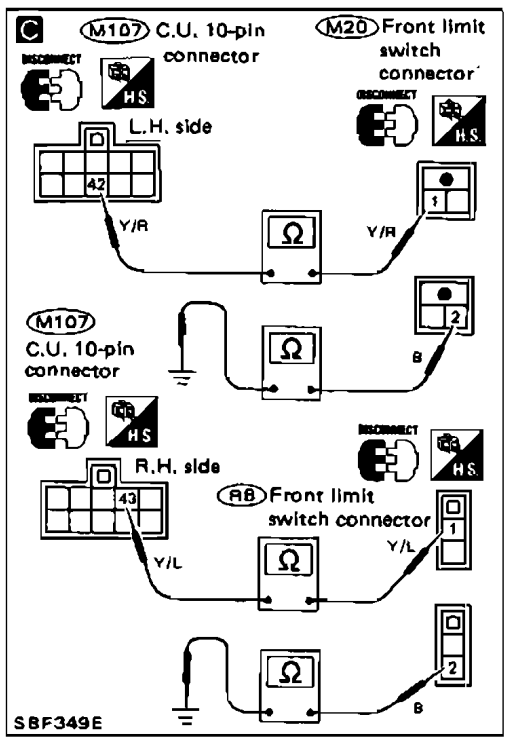
Diagnostic Procedure 2 (Cont'd)



Diagnostic Procedure 3







START

A

CHECK FRONT LIMIT SWITCH CIRCUIT.

1) Disconnect 10-pin connector from control unit.
2) Check continuity.

	Terminals	Shoulder belt buckle position	Continuity
L.H. side	42 - Ground	At front	No
		Not at front	Yes
R.H. side	43 - Ground	At front	No
		Not at front	Yes

B Refer to figure B to move shoulder belt buckle.

O.K. → (Go to Ⓑ on next page.)

N.G.

C

1) Disconnect connector from front limit switch.
2) Check continuity.

	Terminals
L.H. side	42 - ① ② - Ground (M57, M116)
R.H. side	43 - ① ② - Ground (M67, M116)

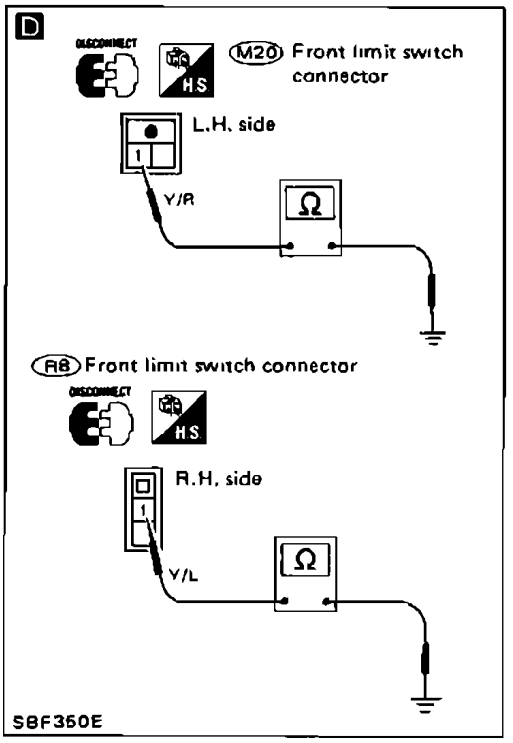
Continuity should exist.

N.G. → Repair harness.

O.K.

(Go to Ⓐ on next page.)

Diagnostic Procedure 3 (Cont'd)



(A)

D

Does continuity exist?

	Connector	Terminals
L.H. side	M20	① - Ground
R.H. side	R8	① - Ground

Yes → Repair harness.
There will be incorrect grounding between terminals ㊷ and ① or ㊸ and ①.

No ↓

Go to FRONT LIMIT SWITCH of Electrical Components Inspection. (See page BF-64.)

O.K. → Replace guide rail assembly.

N.G. ↓

Check front limit switch harness for open and short circuit.

N.G. → Repair front limit switch harness.

O.K. ↓

Replace front limit switch.

(B)

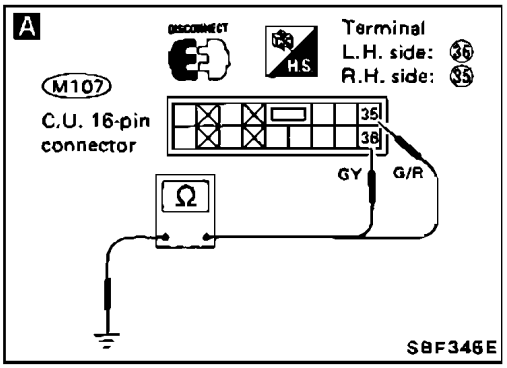
Is this the second time?

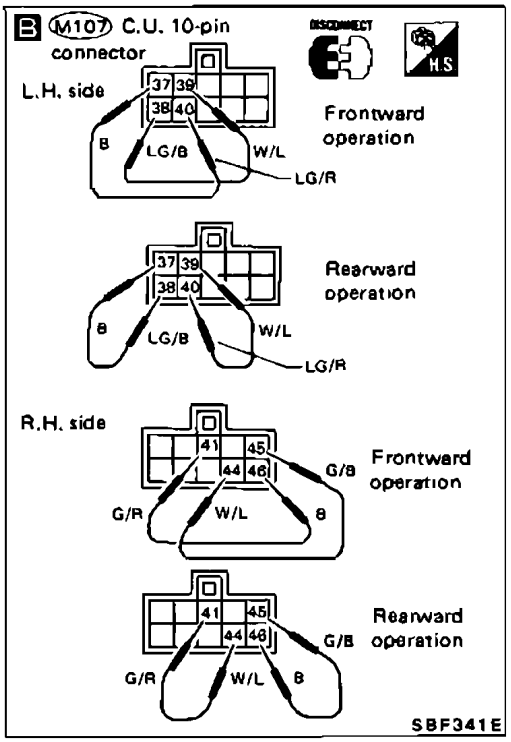
Yes → Replace control unit.

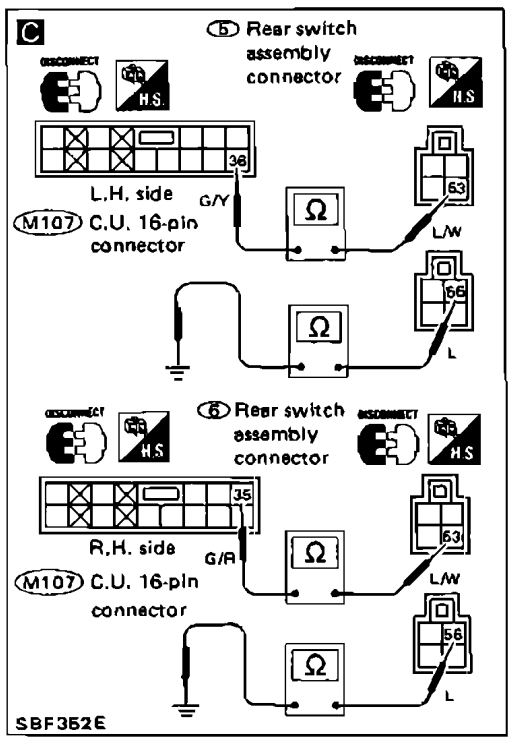
No ↓

Reinstall any part removed.

Go to PROCEDURE 1 (START) of Preliminary Check.
(See page BF-41.)







Diagnostic Procedure 4

START

A

CHECK REAR LIMIT SWITCH CIRCUIT.

1) Disconnect 16-pin connector from control unit.
2) Check continuity.

	Terminals	Shoulder belt buckle position	Continuity
L.H. side	36 - Ground	At rear	No
		Not at rear	Yes
R.H. side	35 - Ground	At rear	No
		Not at rear	Yes

B Refer to figure B to move shoulder belt buckle.

O.K. → (Go to Ⓑ on next page.)

N.G.

C

1) Disconnect connector from rear switch assembly.
2) Check continuity.

	Terminals
L.H. side	36 - 63 56 - Ground (M101, M126)
R.H. side	35 - 63 56 - Ground (M101, M126)

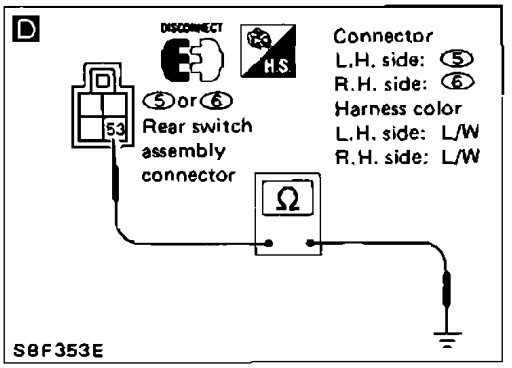
Continuity should exist.

N.G. → Repair harness.

O.K.

(Go to Ⓐ on next page.)

Diagnostic Procedure 4 (Cont'd)



Ⓐ

D

Does continuity exist?

	Connector	Terminals
L.H. side	⑤	㊸ - Ground
R.H. side	⑥	㊸ - Ground

Yes → Repair harness.
There will be incorrect grounding between terminals ㊱ and ㊸ or ㉟ and ㊸.

No ↓

Go to REAR LIMIT SWITCH of Electrical Components Inspection. (See page BF-64.)

O.K. → (Go to Ⓑ below.)

N.G. ↓

Check rear limit switch harness for open or short circuit.

N.G. → Repair rear limit switch harness.

O.K. ↓

Replace rear switch assembly.

Ⓑ

Is this the second time?

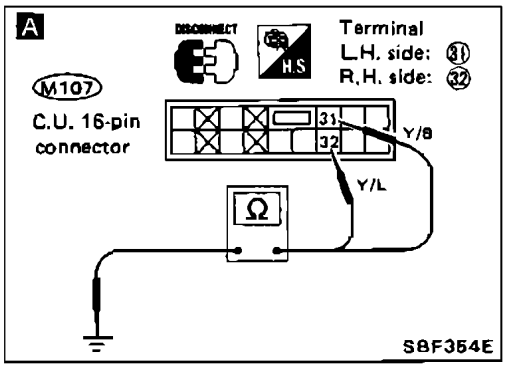
Yes → Replace control unit.

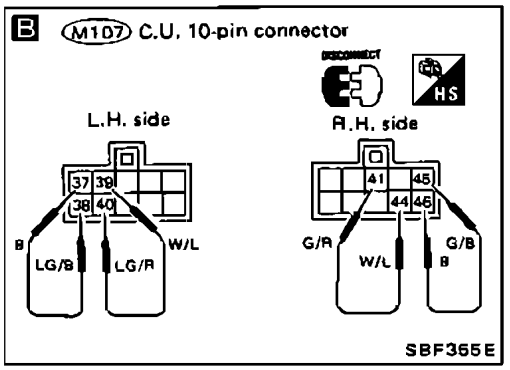
No ↓

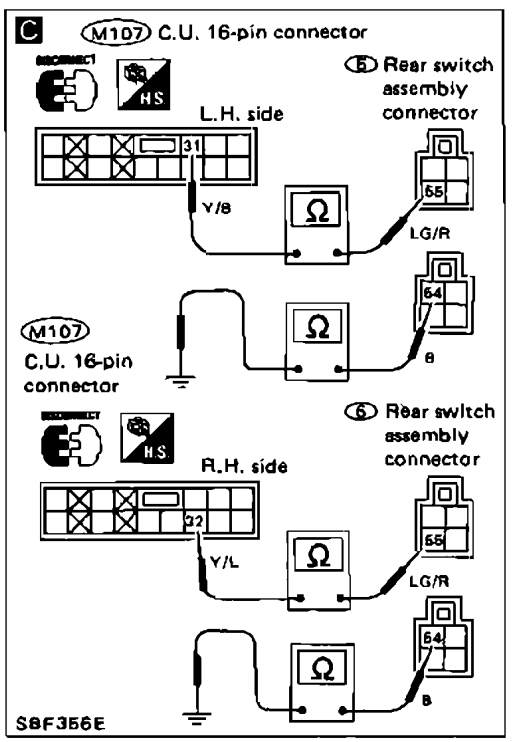
Reinstall any part removed.

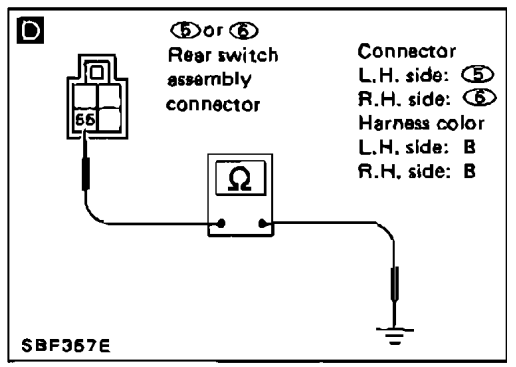
Go to PROCEDURE 1 (STEP 3) (See page BF-41.) or PROCEDURE 2 (STEP 3) (See page BF-43.) of Preliminary Check.

Diagnostic Procedure 5









START

A

CHECK SHOULDER BELT BUCKLE SWITCH CIRCUIT.

1) Disconnect 16-pin connector from control unit.
2) Check continuity when shoulder belt buckle is at rear lock position.

	Terminals	Shoulder belt	Continuity
L.H. side	31 - Ground	Fasten	Yes
		Unfasten	No
R.H. side	32 - Ground	Fasten	Yes
		Unfasten	No

B If shoulder belt buckle is not rear lock position, do as figure B to move it to rear.

O.K. → (Go to Ⓑ on next page.)

N.G. ↓

C

1) Disconnect connector from rear switch assembly.
2) Check continuity.

	Terminals
L.H. side	31 - 55 54 - Ground (M101, M125)
R.H. side	32 - 55 54 - Ground (M101, M125)

Continuity should exist.

N.G. → Repair harness.

O.K. ↓

D

Does continuity exist?

	Connector	Terminals
L.H. side	5	55 - Ground
R.H. side	6	55 - Ground

Yes → Repair harness. There will be incorrect grounding between terminals 31 and 55 or 32 and 55.

No ↓

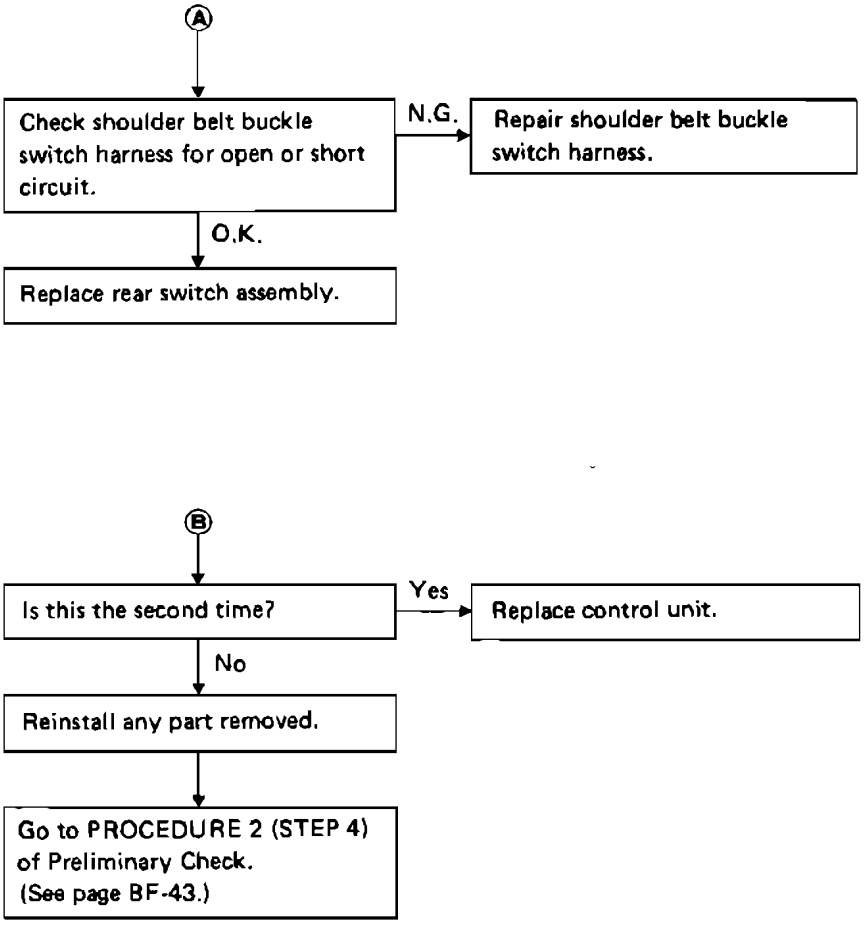
Go to SHOULDER BELT BUCKLE SWITCH of Electrical Components Inspection. (See page BF-64.)

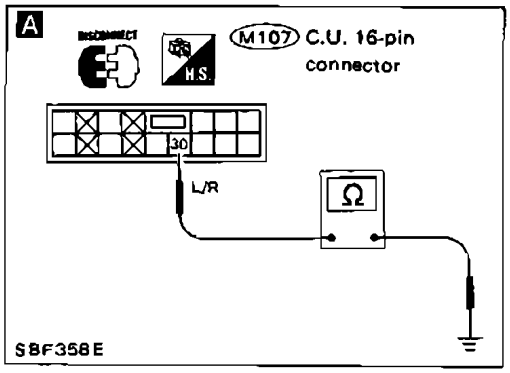
O.K. → (Go to Ⓑ on next page.)

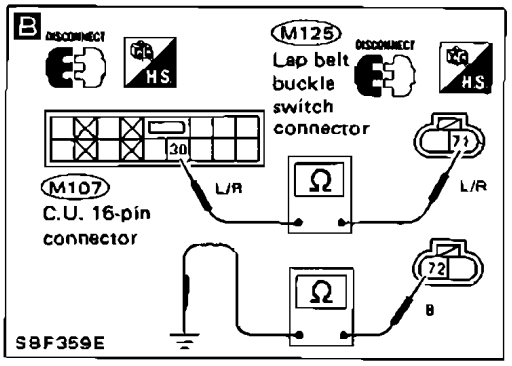
N.G. ↓

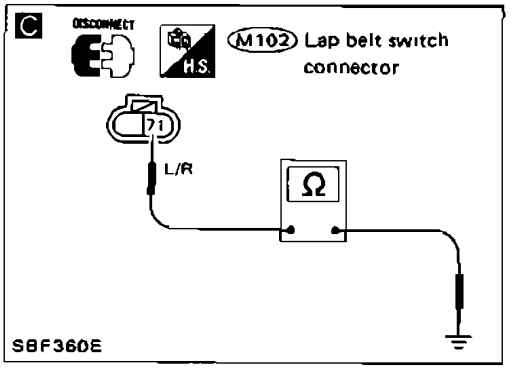
(Go to Ⓐ on next page.)

Diagnostic Procedure 5 (Cont'd)









Diagnostic Procedure 6

START

A

CHECK LAP BELT BUCKLE SWITCH CIRCUIT (L.H. only).
1) Disconnect 16-pin connector from control unit.
2) Check continuity.

Terminals	Lap belt	Continuity
30 - Ground	Fasten	No
	Unfasten	Yes

O.K. → (Go to Ⓐ on next page.)

N.G.

B

1) Disconnect lap belt switch connector.
2) Check continuity.

Terminals
30 - 71
72 - Ground (M101, M125)
Continuity should exist.

N.G. → Repair harness.

O.K.

C

Does continuity exist?

Terminals
71 - Ground

Yes → Repair harness. There will be incorrect grounding.

No

Go to LAP BELT BUCKLE SWITCH of Electrical Components Inspection. (See page BF-65.)

O.K. → (Go to Ⓐ on next page.)

N.G.

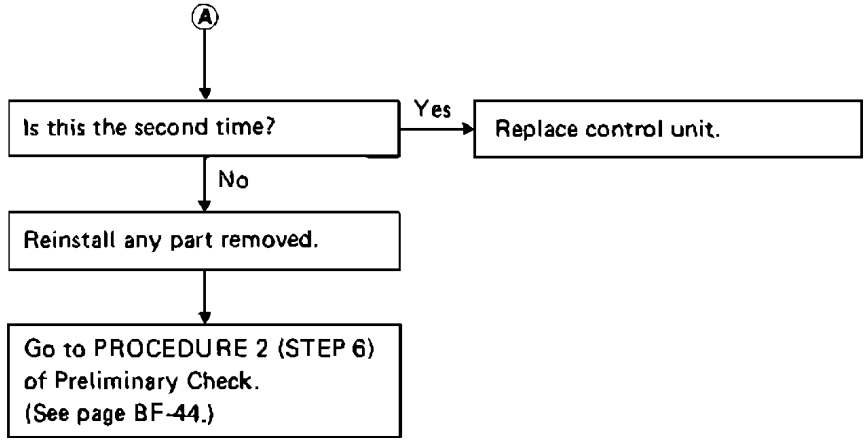
Check lap belt buckle switch harness for open and short circuit.

N.G. → Repair lap belt buckle switch harness.

O.K.

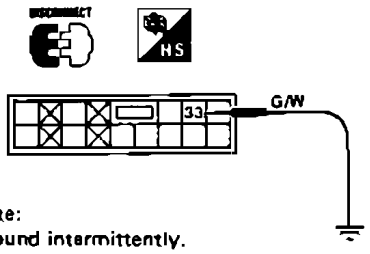
Replace shoulder belt buckle assembly.

Diagnostic Procedure 6 (Cont'd)



Diagnostic Procedure 7

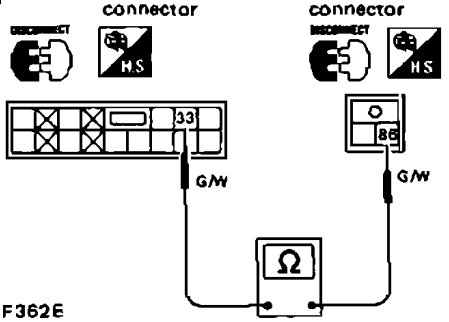
A (M107) C.U. 16-pin connector



Note:
Ground intermittently.

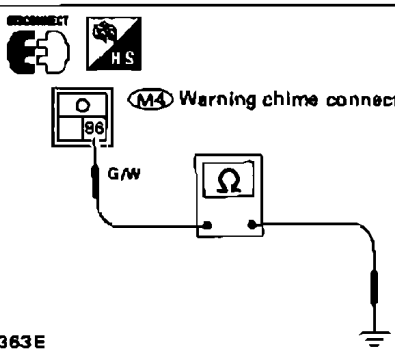
SBF361E

B (M107) C.U. 16-pin connector (M4) Warning chime connector



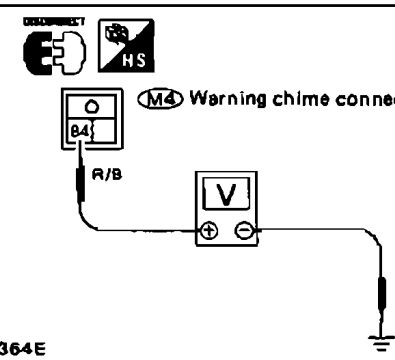
SBF362E

C (M4) Warning chime connector



SBF363E

D (M4) Warning chime connector



SBF364E

START

A CHECK WARNING CHIME CIRCUIT.
1) Disconnect 16-pin connector from control unit.
2) Check warning chime.

Terminals	Method	Result
33 - Ground	Ground intermittently.	Sound

O.K. → (Go to Ⓐ below.)

N.G.

B
1) Disconnect connector from warning chime.
2) Check continuity.

Terminals
33 - 86

Continuity should exist.

N.G. → Repair harness.

O.K.

C Does continuity exist?

Terminals
86 - Ground

Yes → Repair harness. There will be incorrect grounding.

No

D Check battery voltage existence.

Terminals
84 - Ground

Battery voltage should exist.

N.G. → Repair harness. For details, refer to POWER SUPPLY ROUTING in EL section.

O.K.

Go to WARNING CHIME of Electrical Components Inspection. (See page BF-65.)

N.G. → Replace warning chime.

O.K. ← Ⓐ

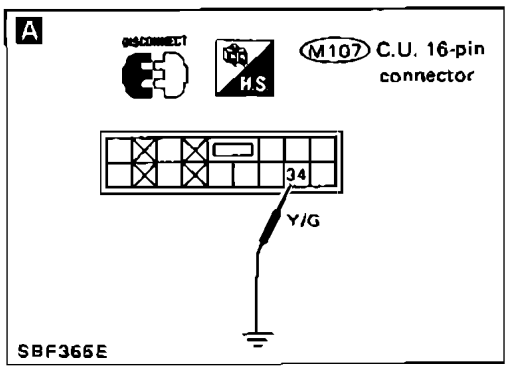
Is this the second time?

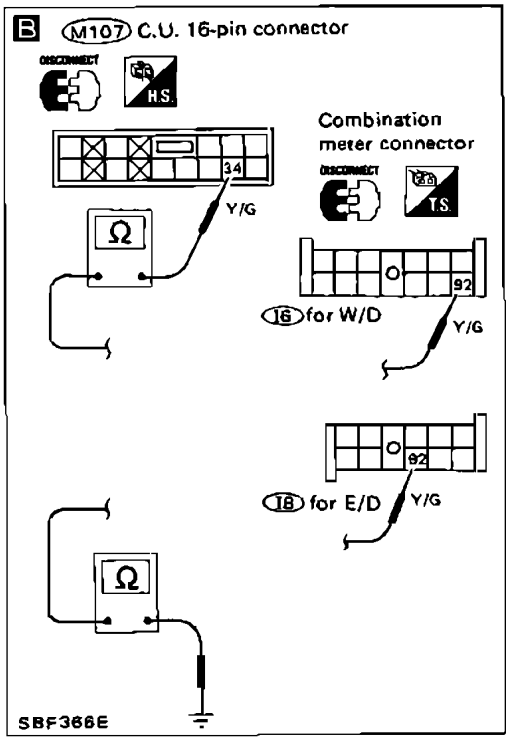
Yes → Replace control unit.

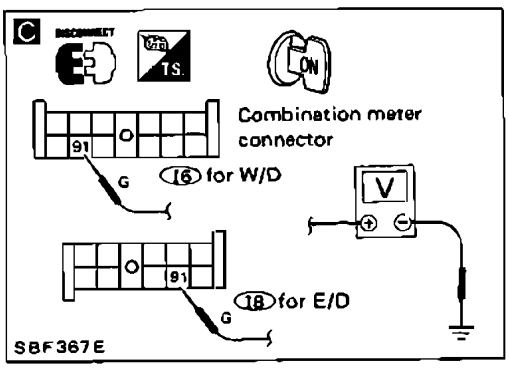
No

Reinstall any part removed.

Go to PROCEDURE 2 (START) of Preliminary Check. (See page BF-43.)







W/D: With Head-up Display
E/D: Without Head-up Display

Diagnostic Procedure 8

START

A

CHECK WARNING LAMP CIRCUIT.
1) Disconnect 16-pin connector from control unit.
2) Check warning lamp.

Terminals	Result
34 - Ground	Glow

O.K. → (Go to Ⓐ below.)

N.G.

B

1) Disconnect connector from combination meter.
2) Check continuity.

Terminals
34 - 92

Continuity should exist.

N.G. → Repair harness.

O.K.

B

Does continuity exist?

Terminals
92 - Ground

Yes → Repair harness.
There will be incorrect grounding.

No

C

Check battery voltage existence.

Terminals
91 - Ground

Battery voltage should exist.

N.G. → Repair harness.
For details, refer to POWER SUPPLY ROUTING in EL section.

O.K.

Is warning lamp bulb burn out? Yes → Replace bulb.

No

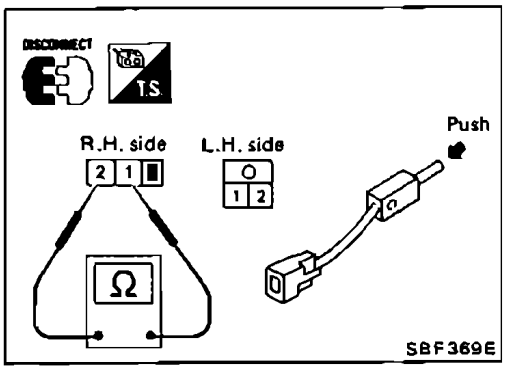
Ⓐ

Is this the second time? Yes → Replace control unit.

No

Reinstall any part removed.

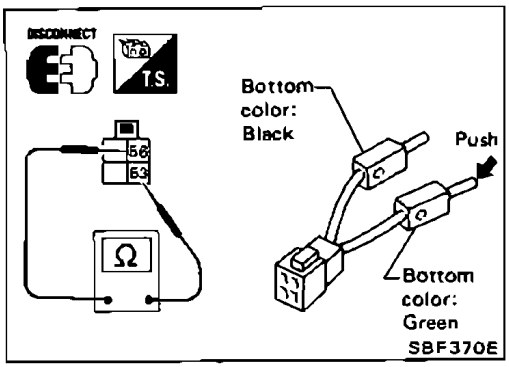
Go to PROCEDURE 2 (START) of Preliminary Check.
(See page BF-43.)



Electrical Components Inspection

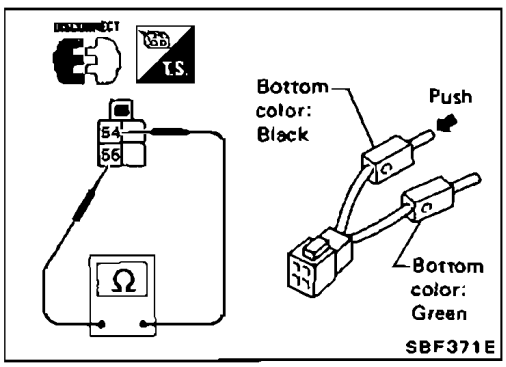
FRONT LIMIT SWITCH

Condition	Continuity
Pushed	No
Released	Yes



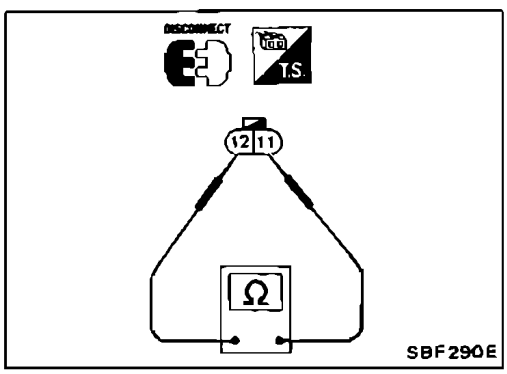
REAR LIMIT SWITCH

Condition	Continuity
Pushed	No
Released	Yes



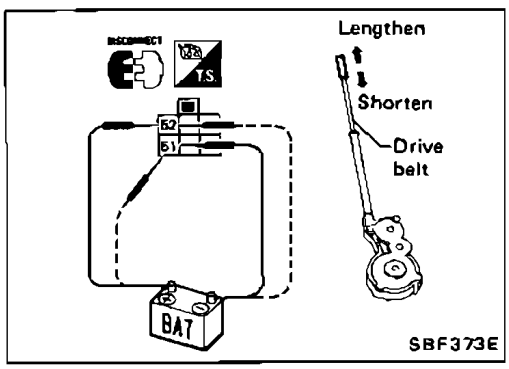
SHOULDER BELT BUCKLE SWITCH

Condition	Continuity
Pushed	Yes
Released	No



DOOR LATCH SWITCH
(Built-in door lock assembly)

Door condition	Continuity
Open	Yes
Closed	No

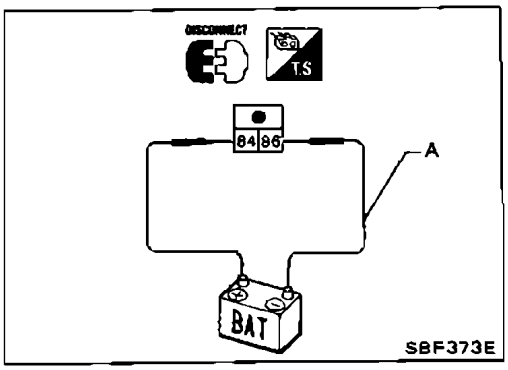


DRIVE MOTOR ASSEMBLY

Terminals		Drive belt operation
⊕	⊖	
52	51	Lengthen
51	52	Shorten

Electrical Components Inspection (Cont'd)

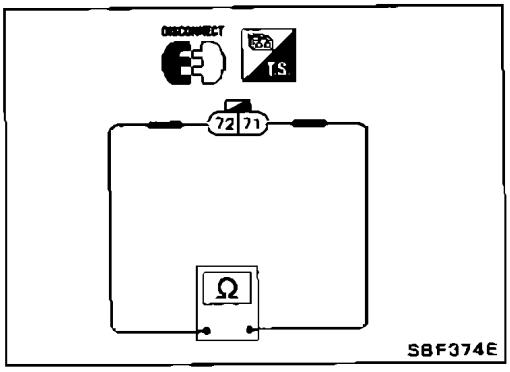
WARNING CHIME



Condition	Operation
Connect and disconnect harness A as shown at left	Sounds

LAP BELT BUCKLE SWITCH

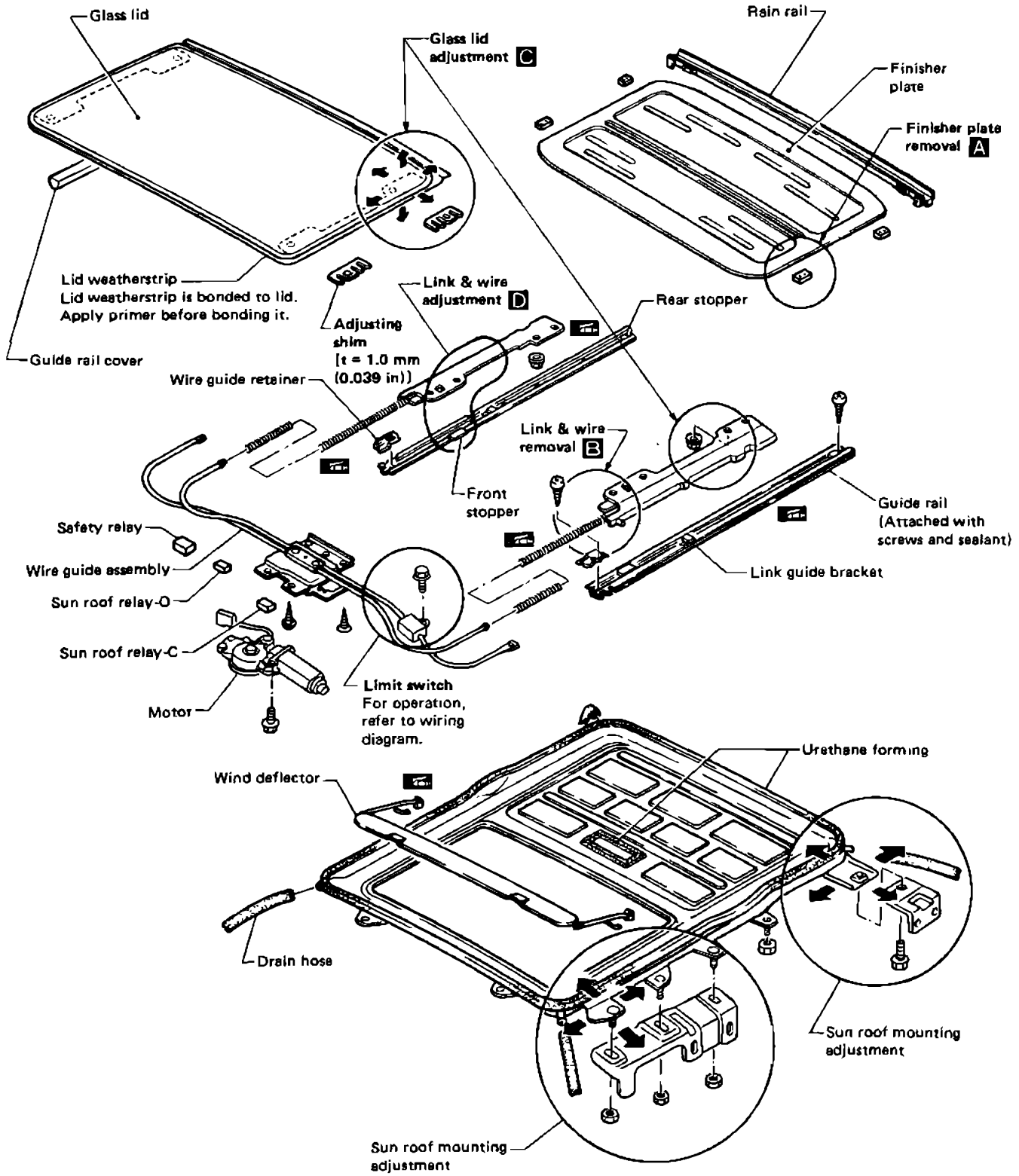
(Built-in lap belt buckle for L.H. side)



Condition	Continuity
Fastened	No
Unfastened	Yes

Electrical Sun Roof

- Do not move or remove limit switch unless it is necessary.
- After any adjustment, check sun roof operation and lid alignment.

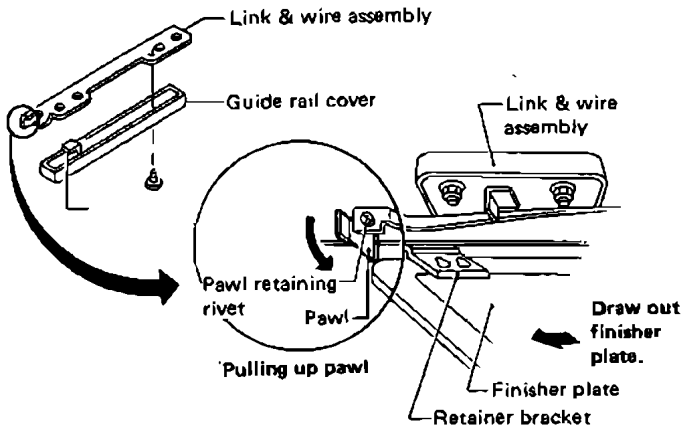


: Grease-up points

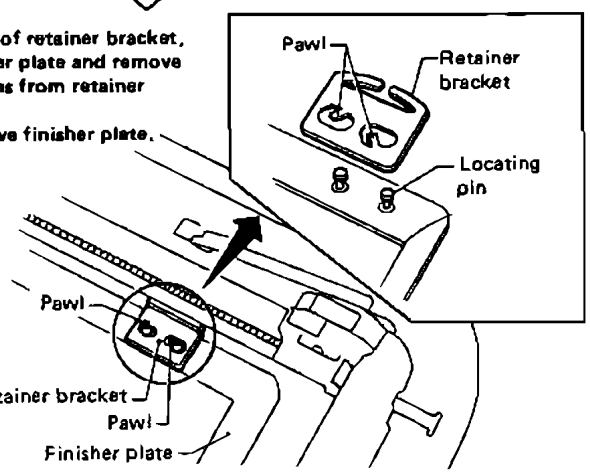
Electrical Sun Roof (Cont'd)

Finisher plate removal & installation

A Remove guide rail cover and pull up pawl, then draw out finisher plate with sun roof lid open.

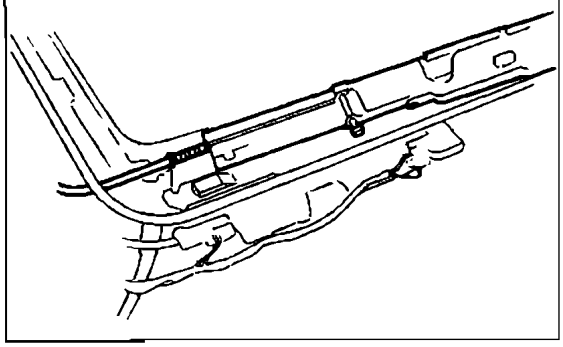


Removal:
Raise pawl of retainer bracket, shift finisher plate and remove locating pins from retainer bracket.
Then remove finisher plate.



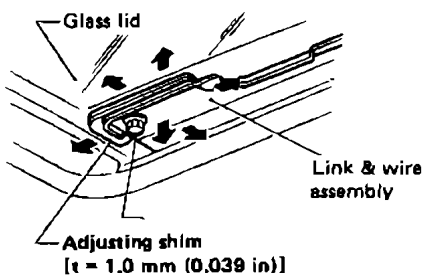
Link & wire removal & installation

B
- When replacing wire, remove rail first and then link & wire assembly.
- Be sure to lubricate.



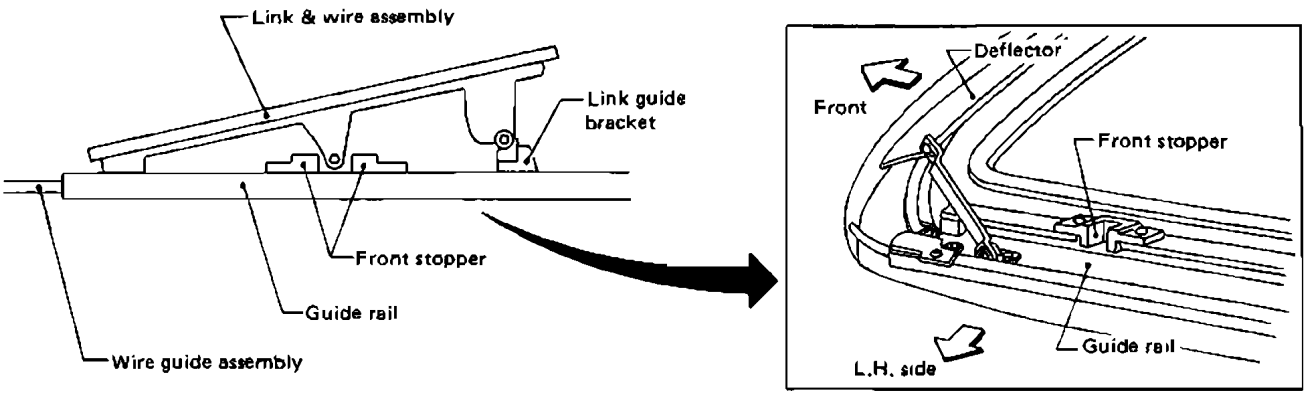
Glass lid adjustment

C



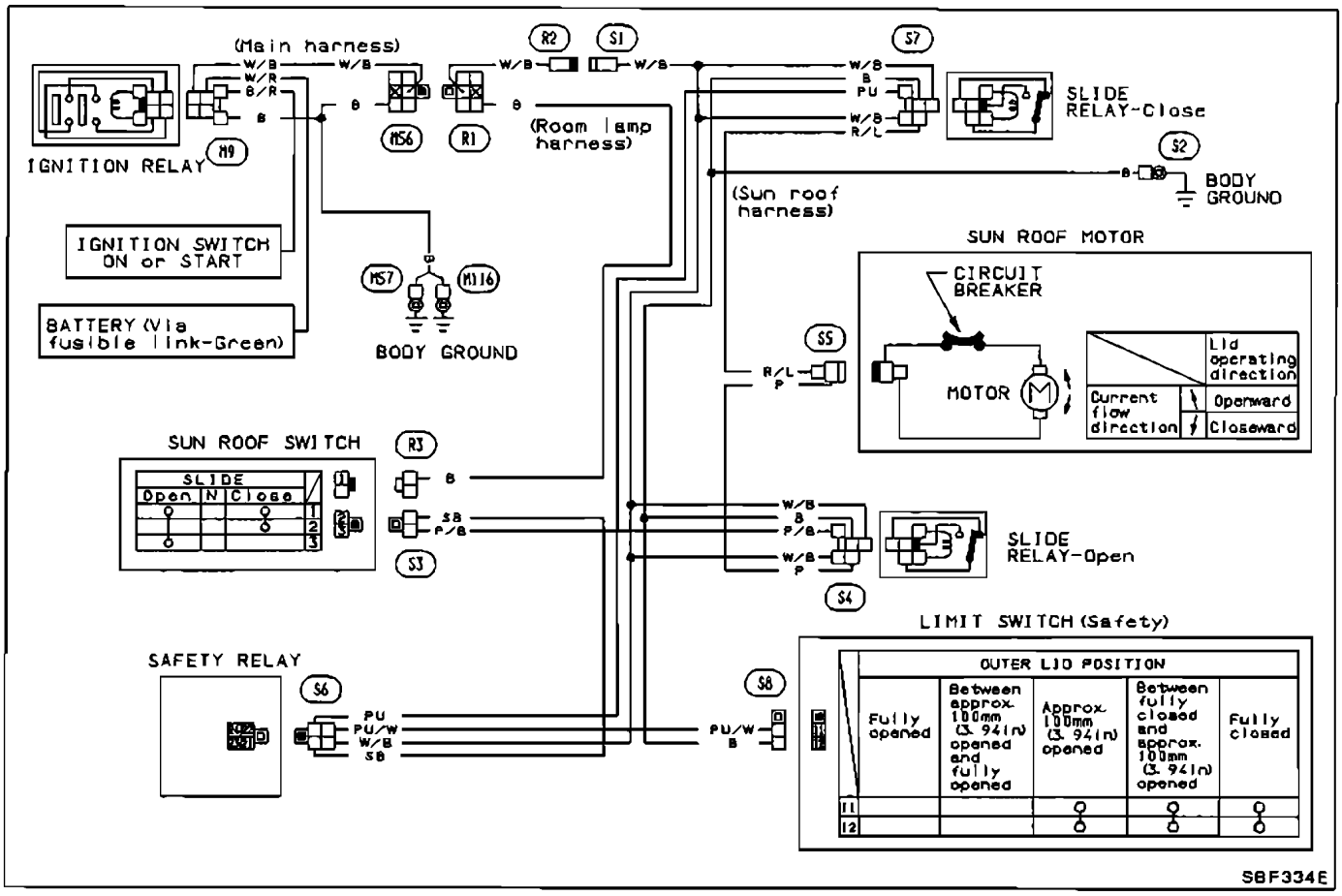
Link & wire adjustment

D Move link & wire assembly to closed lid position and after closing fully (as shown in figure below), install motor.

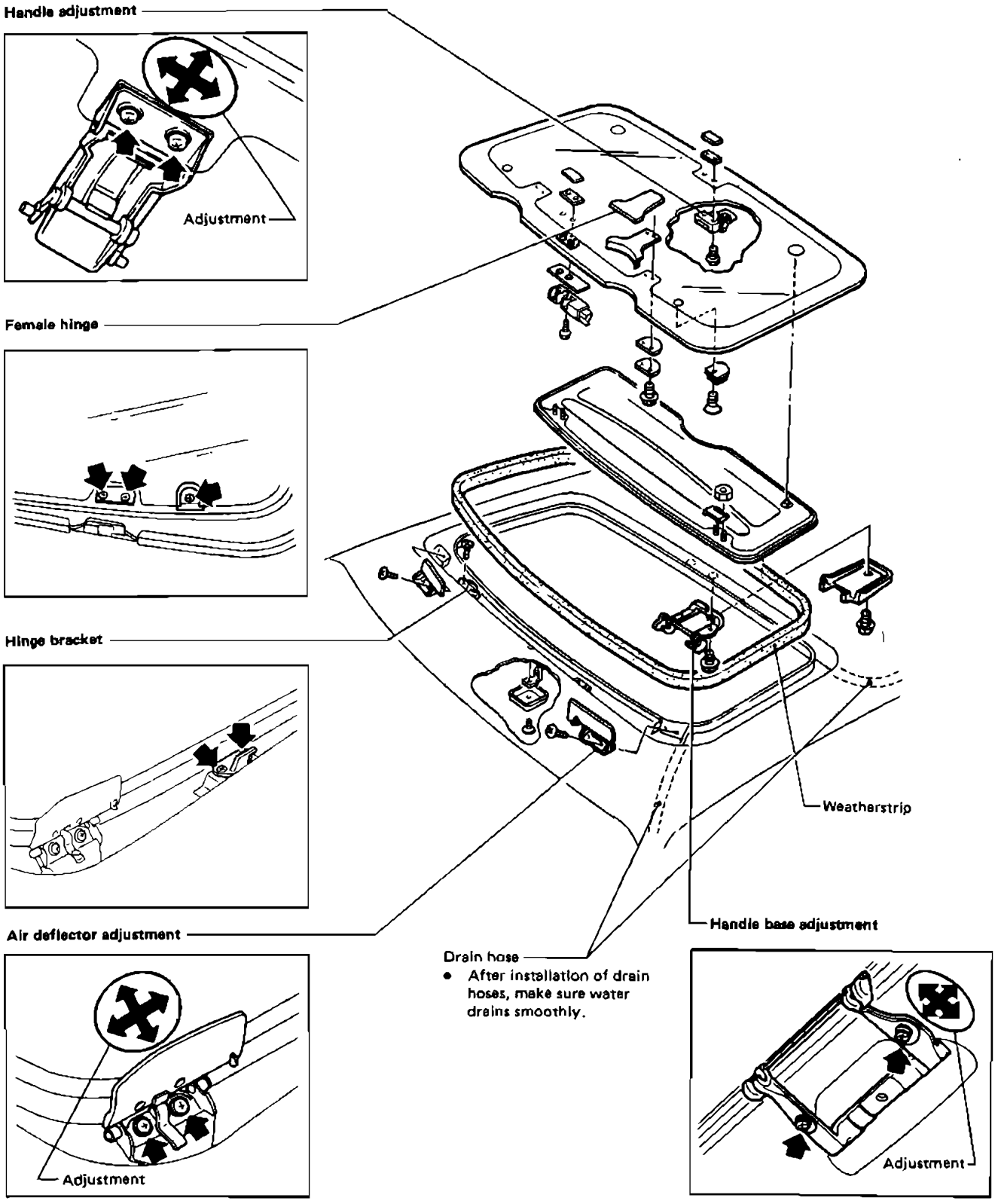


SBF187E

Wiring Diagram



Manual Sun Roof

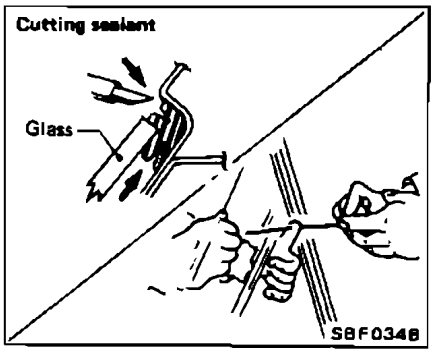


SBF186E

Windshield

REMOVAL

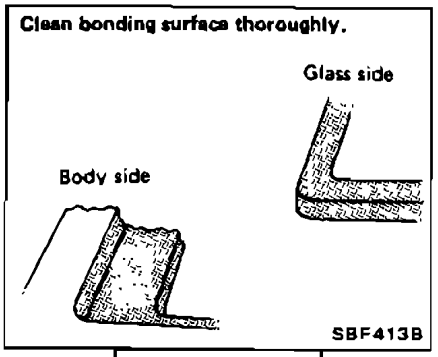
After removing moldings, remove glass.



CAUTION:
Be careful not to scratch glass when removing.

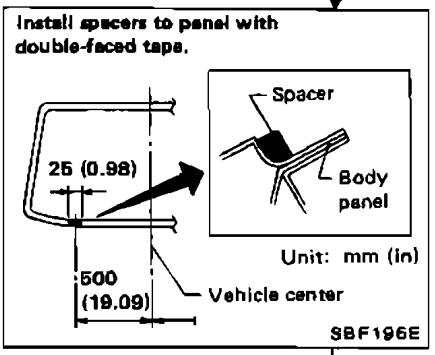
INSTALLATION

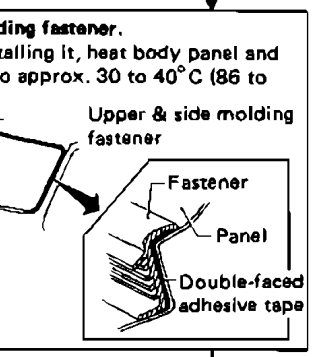
- Use genuine Nissan Sealant kit or equivalent. Follow instructions furnished with it.
- After installation, the vehicle should remain stationary for about 24 hours.
- Do not use sealant which is more than 12 months past its production date.
- Do not leave cartridge unattended with its cap open.
- Keep primers and sealant in a cool, dry place. Nissan recommends that they are stored in a refrigerator.
- Be sure to install moldings.



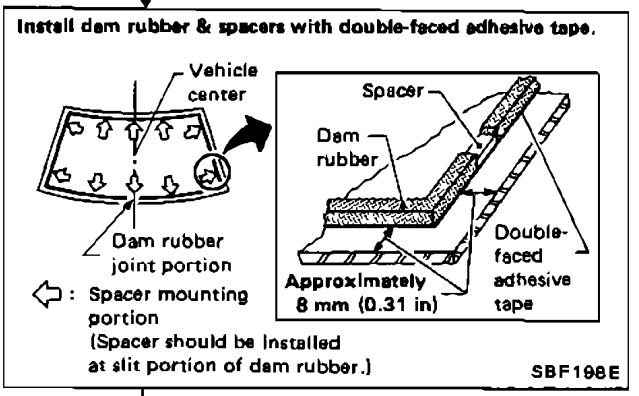
WARNING:
Keep heat or open flames away as primers are flammable.

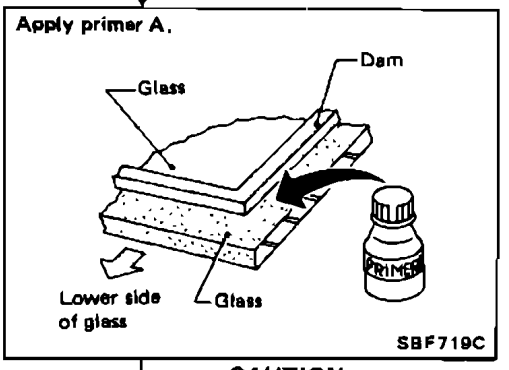
Body side





Glass side





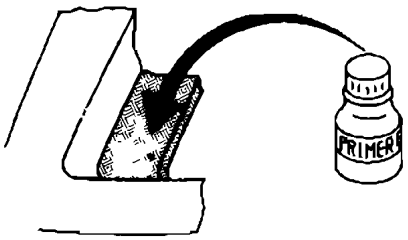
CAUTION:
Allow primers to dry for 10 to 15 minutes before proceeding to the next step.

Ⓐ Ⓑ

Windshield (Cont'd)

Ⓐ

Apply primer E.

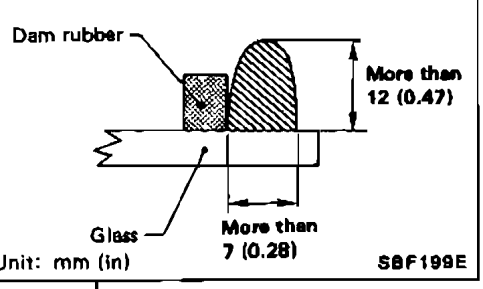


SBF038B

CAUTION:
Allow primers to dry for 10 to 15 minutes before proceeding to the next step.

Ⓑ

Apply sealant evenly.

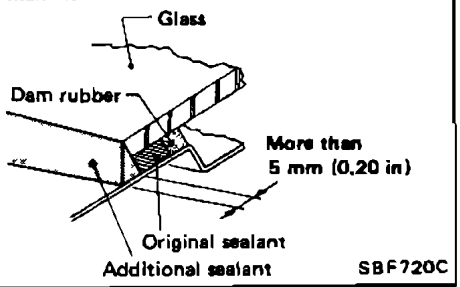


SBF199E

CAUTION:
Windshield glass should be installed within 15 minutes of applying sealant: sealant starts to harden 15 minutes after it is applied.

Set glass in position and press glass lightly and evenly.

Apply sealant additionally to lower portion of glass and make it uniform as shown below:



SBF720C

Check for water leakage.

CAUTION:
For sealant drying time, refer to "Drying Time for Sealant".

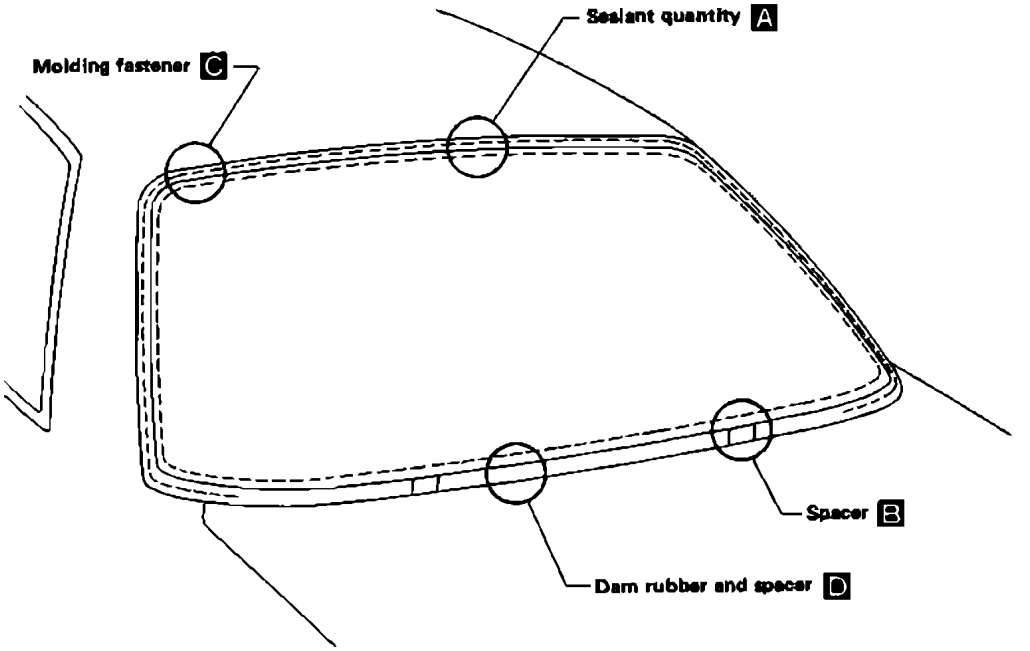
Apply sealant to upper & side molding fixing portion.

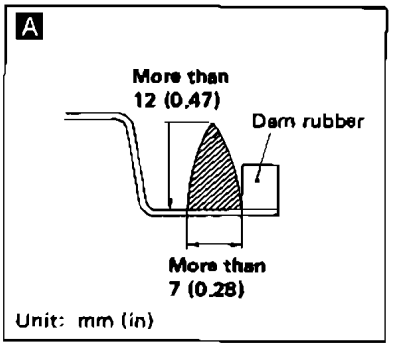
Install moldings.
(For details, refer to "Exterior".)

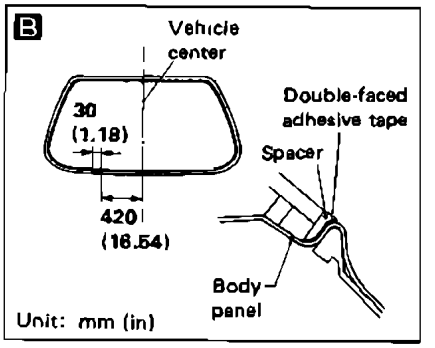
CAUTION:
Molding must be installed securely so that it is in position and leaves no gap.

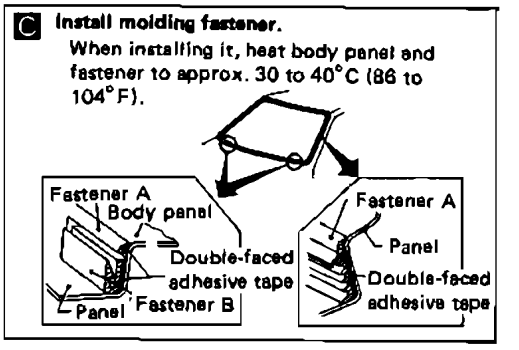
Back Window—Coupe

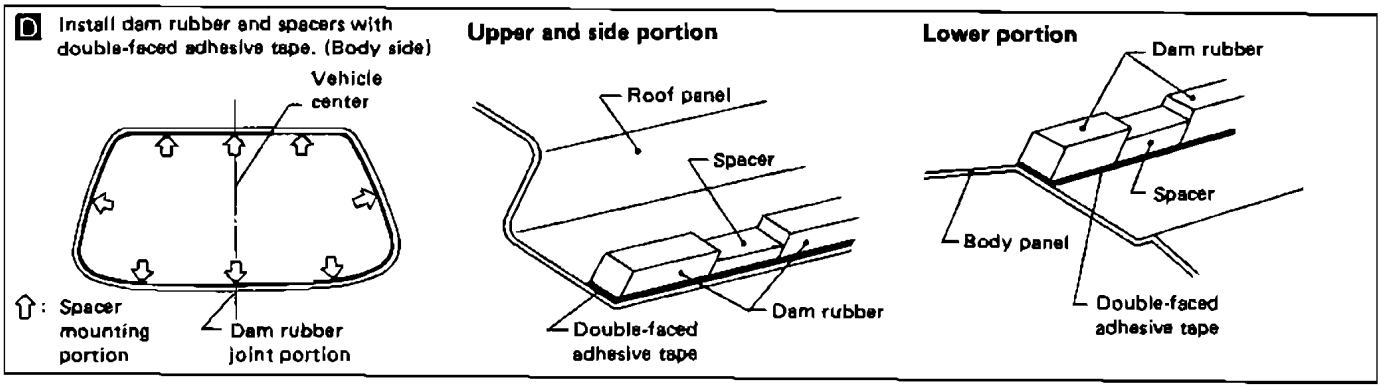
- Construction and removal/reinstallation methods of back window are basically the same as those of windshield.
  For details of service procedures, refer to "Windshield".
- The difference between windshield and back window is as follows:
- For sealant drying period, refer to "Drying Time for Sealant".
- For details of moldings, refer to "Exterior".







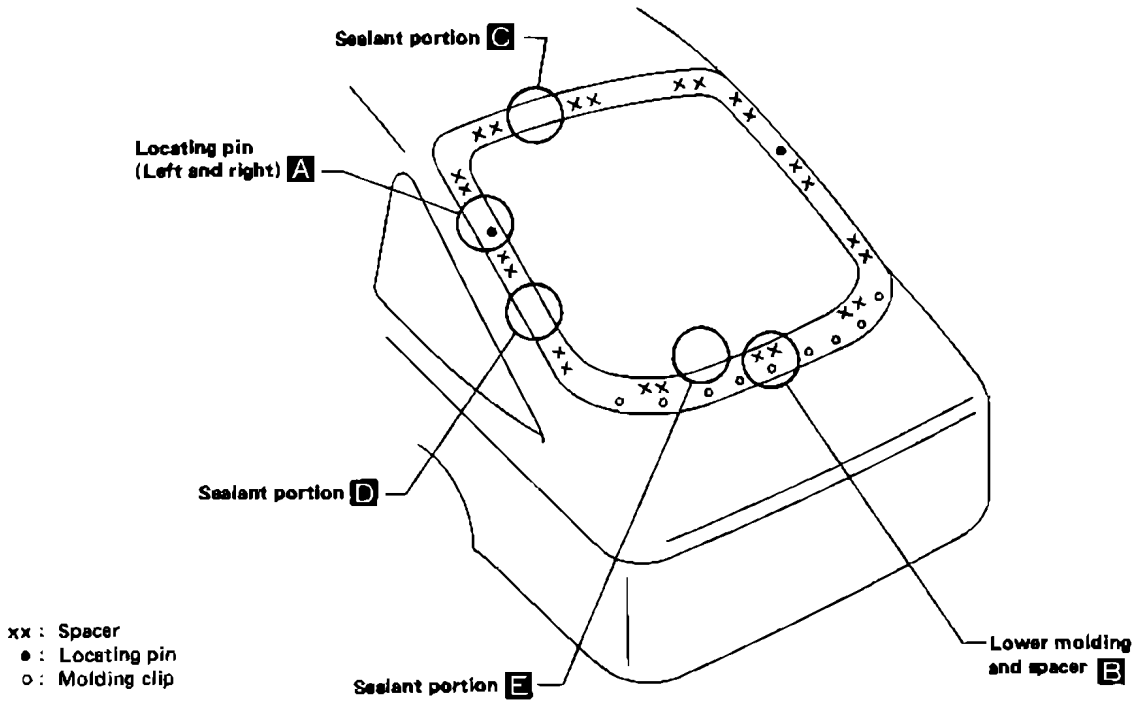


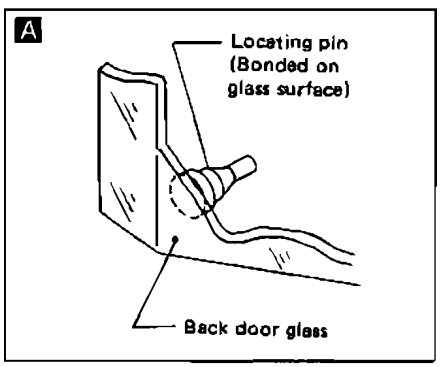


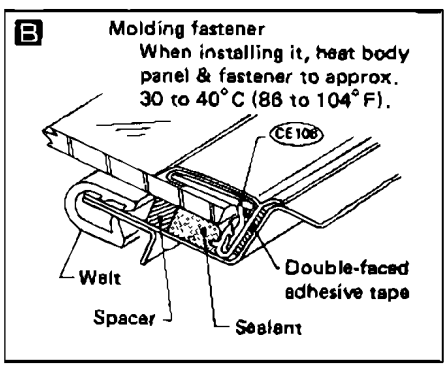
SBF200E

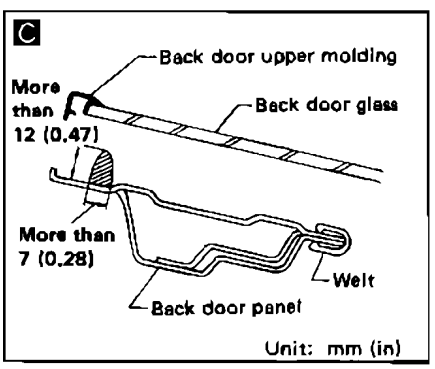
Back Door Window—Fastback

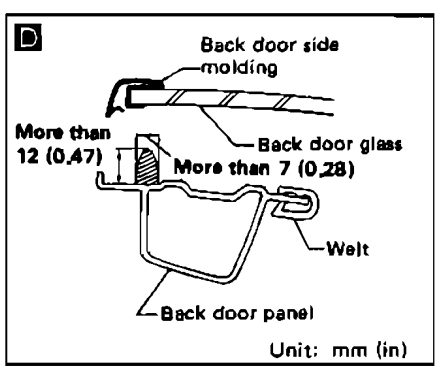
- Construction and removal/reinstallation method of back door window are basically the same as those of windshield.
- Major differences are that sealant & dam rubber are installed to back door panel instead of glass surface. Spacer position is also changed. Moreover, there are locating pins in lower portion of glass. For details, refer to following figure.
- For sealant drying period, refer to "Drying Time for Sealant".
- For details of moldings, refer to "Exterior".

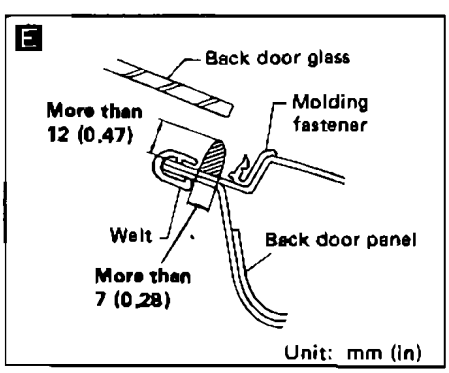




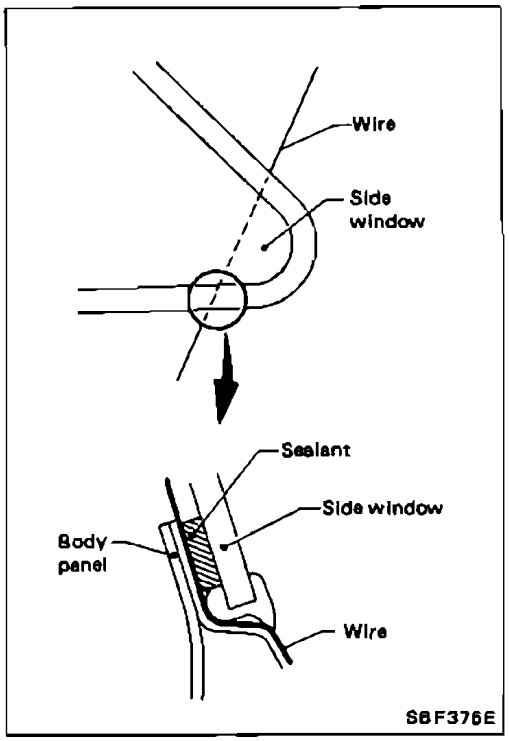








SBF201E

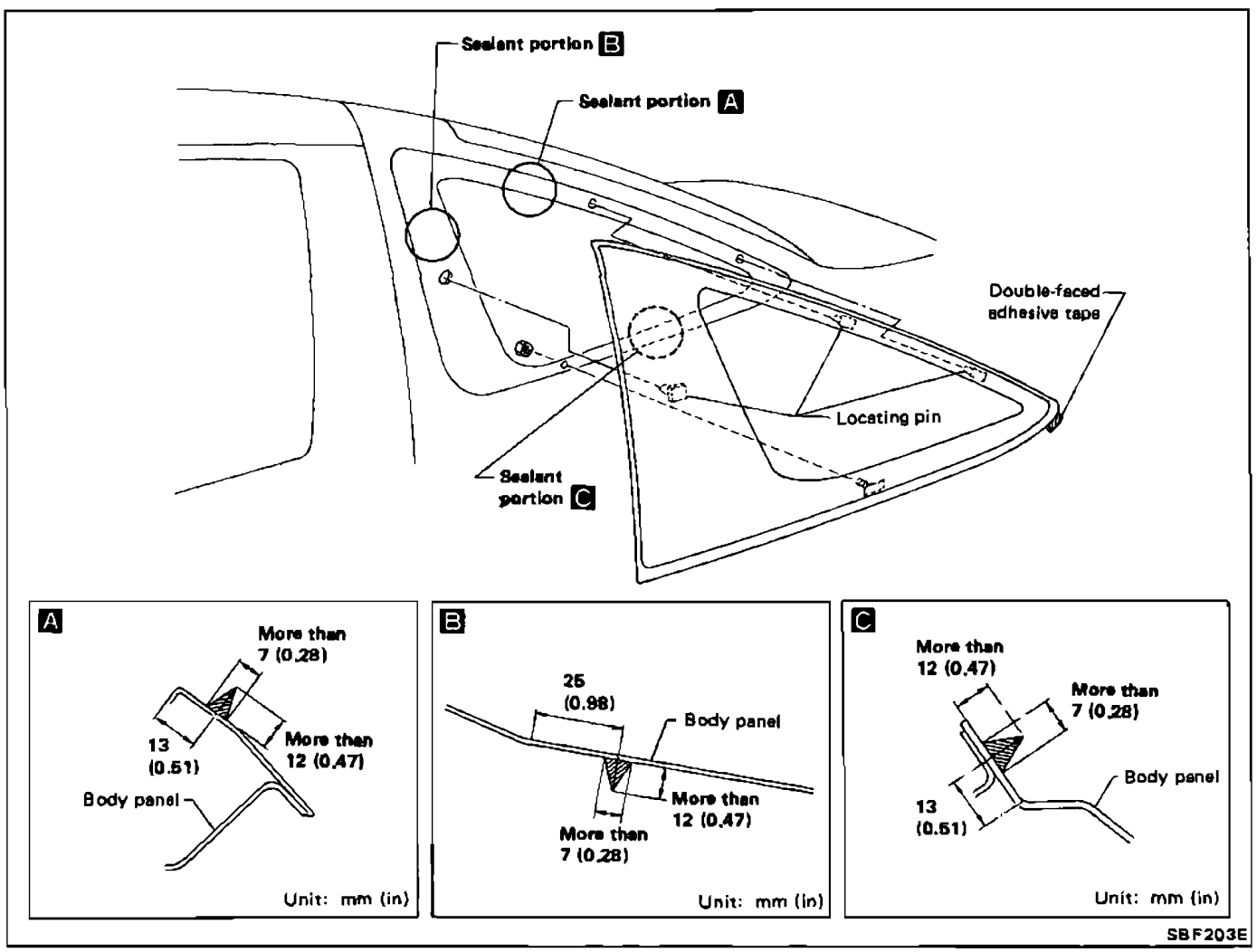


Side Window

Side window is a molded type. During removal or installation, observe the following instructions.

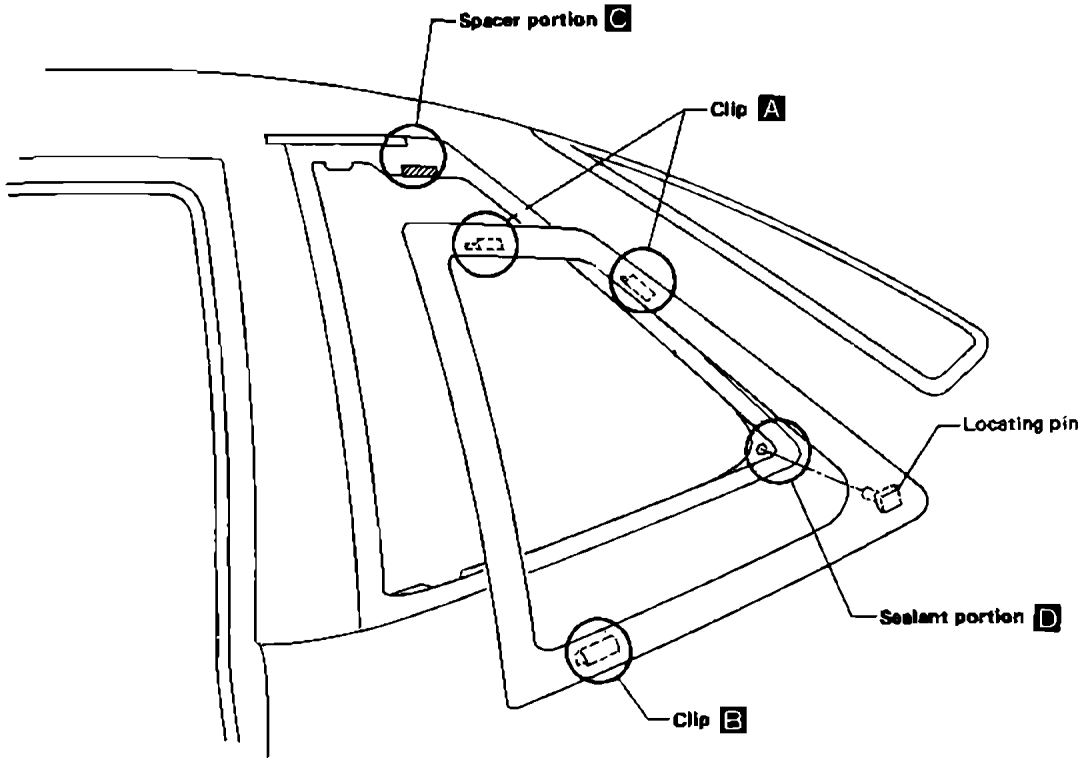
1. Cut sealant in the same manner as that outlined under "Windshield.".
2. Be careful not to scratch molding when cutting sealant. If molding is scratched, repair.
3. Remove clips and locating pins which have been exposed from vehicle body.

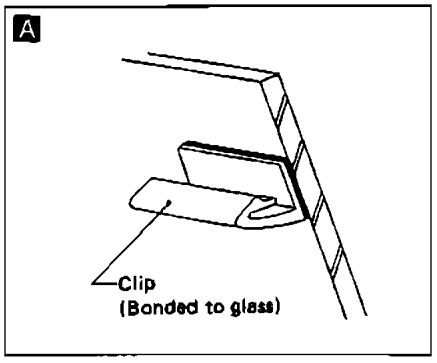
FASTBACK

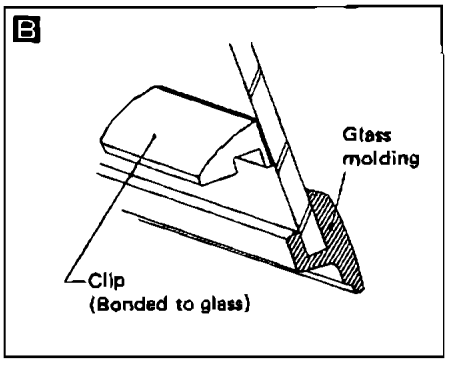


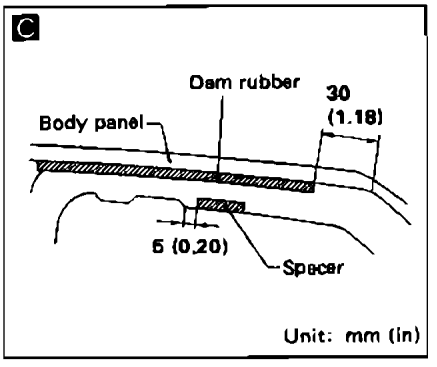
Side Window (Cont'd)

COUPE

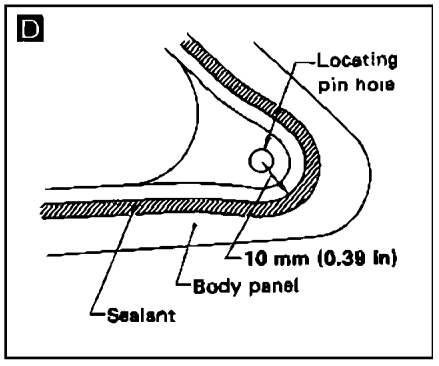


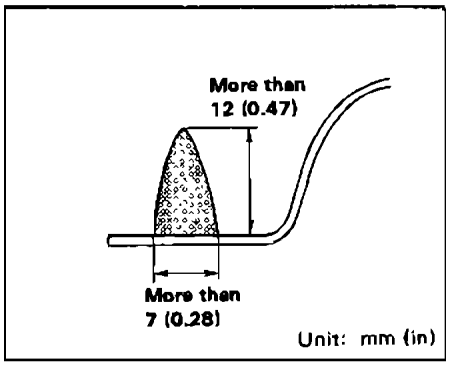






Sealant quantity





SBF202E

Drying Time for Sealant

Reference: Time required for sealant to dry to desired hardness.

Unit: days

Temperature °C (°F) \ Relative humidity %	90	50	25
40 (104)	1.5	2.5	5.0
25 (77)	2.5	4.0	7.5
5 (41)	5.0	13.0	20.5

CAUTION:

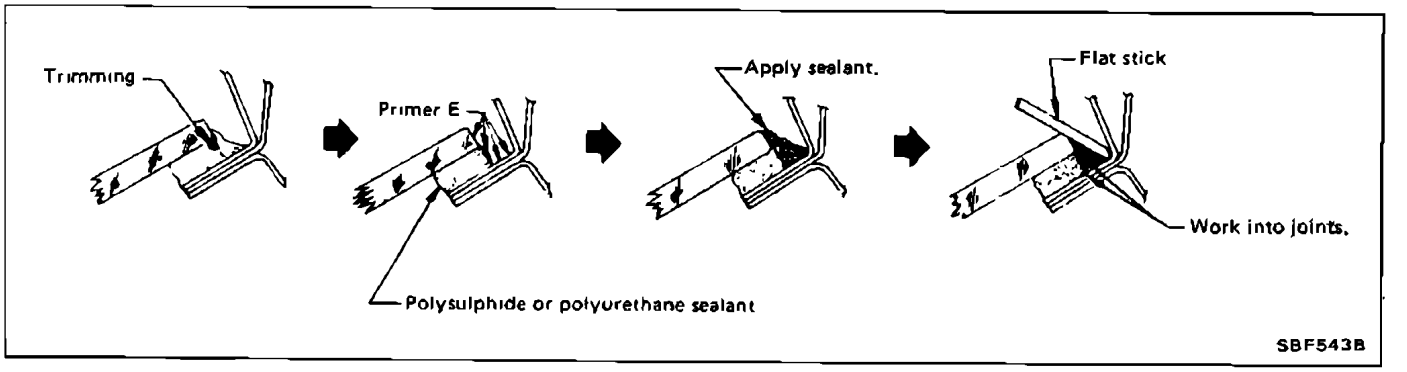
Advise the user of the fact that vehicle should not be driven on rough roads or surfaces until sealant has properly vulcanized.

Repairing Water Leaks for Windshield and Back Window (Coupe)/Back Door Window (Fastback)

Leaks can be repaired without removing and reinstalling glass.

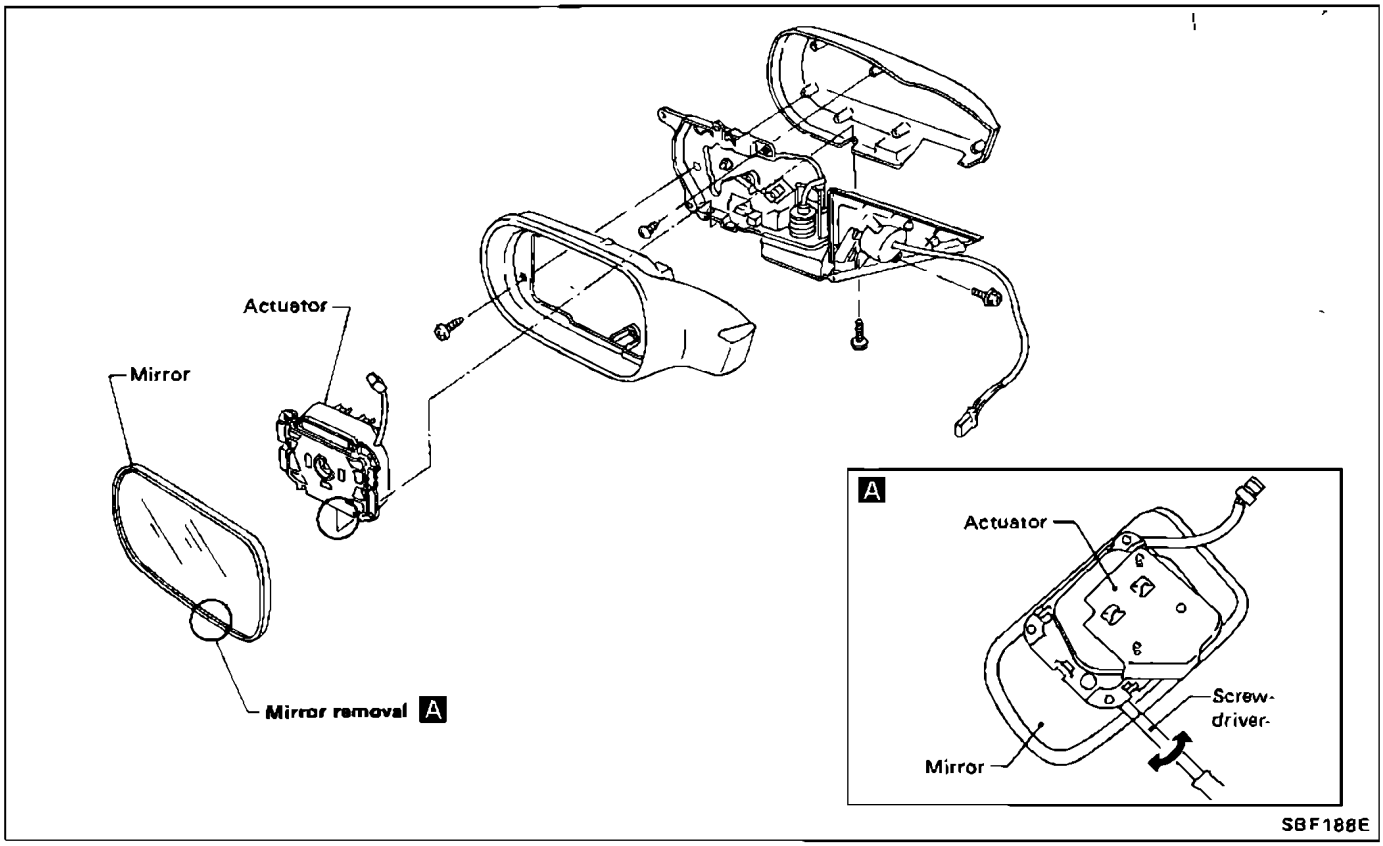
If water is leaking between caulking material and body or between glass and caulking material, determine the extent of the leak by applying water while pushing glass outward.

To stop the leak, apply primer and then sealant to the leak point.

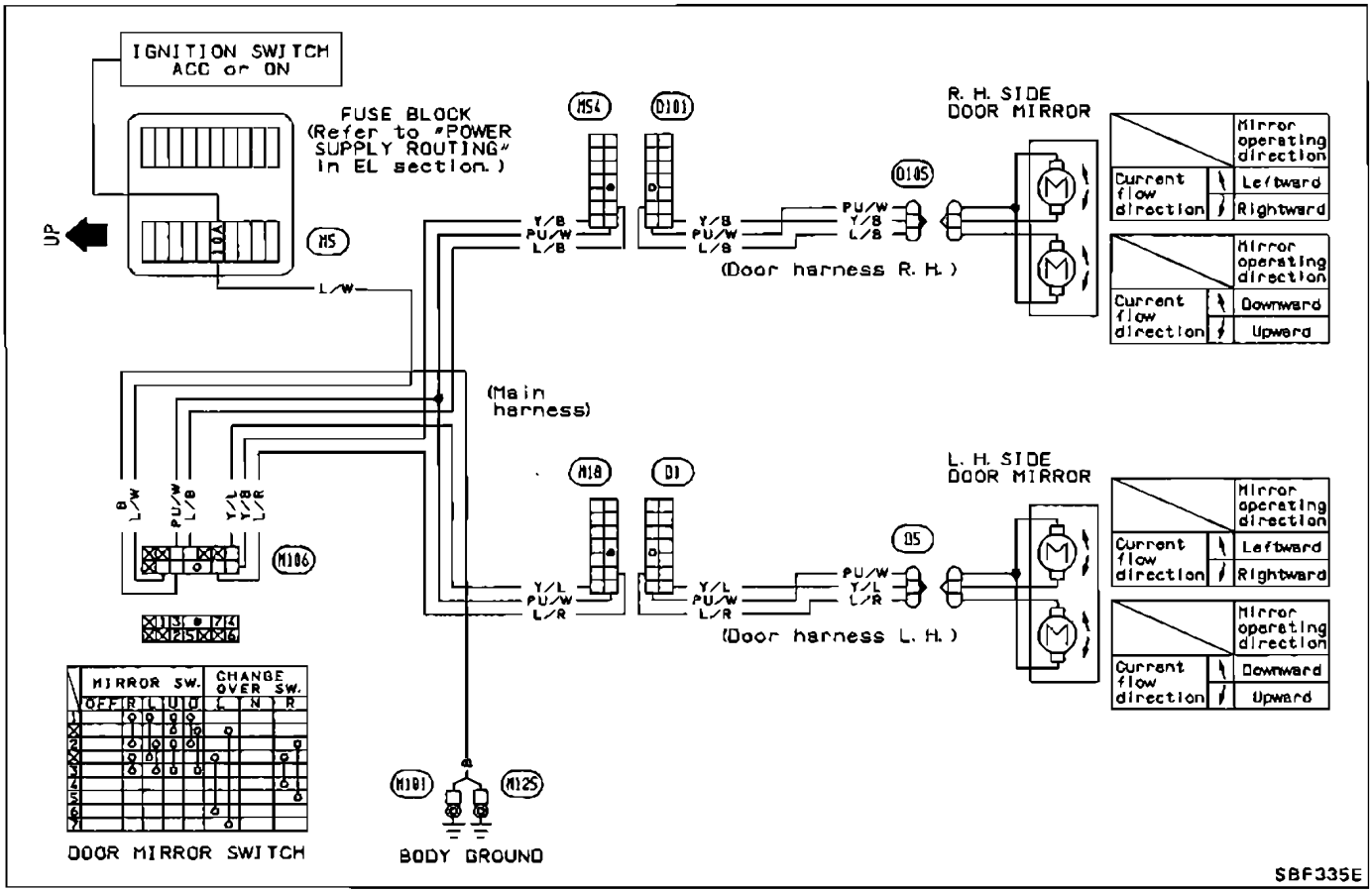


Afterwards, install molding securely.

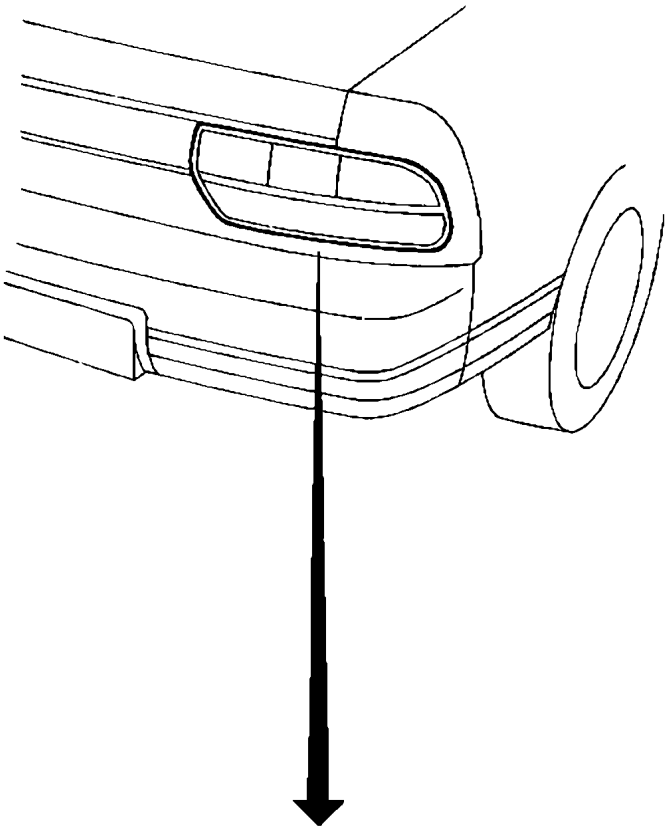
Door Mirror



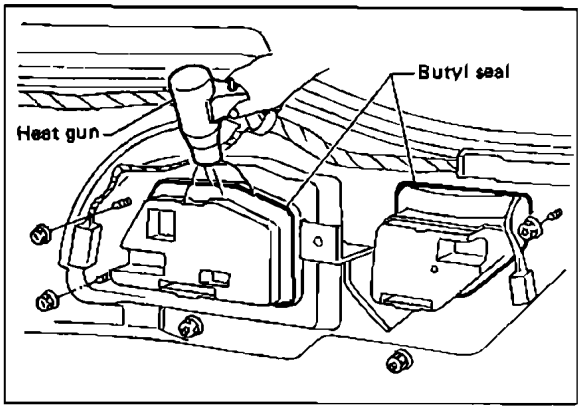
WIRING DIAGRAM



- Rear combination lamps are installed with nuts and butyl sealant.

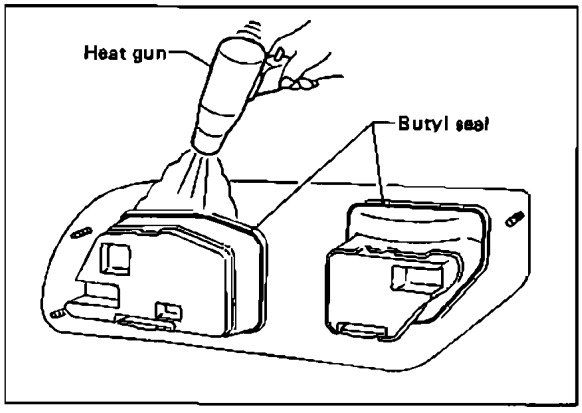


Removal



- Warm up lamp assembly area to a temperature of a little below 60°C (140°F).

Installation

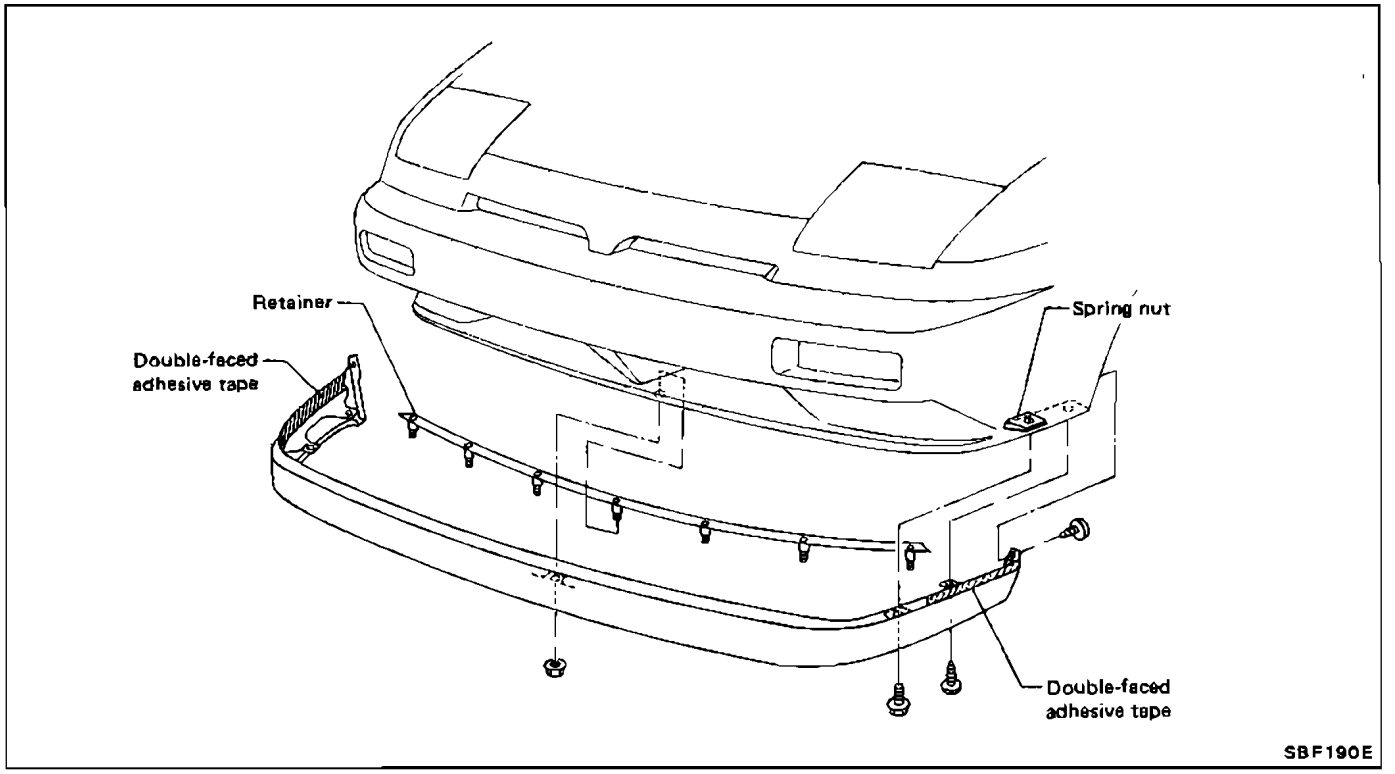


- Apply butyl seal evenly as it tends to become thin in the corners.
- Warm up lamp assembly area to a temperature of a little below 60°C (140°F).

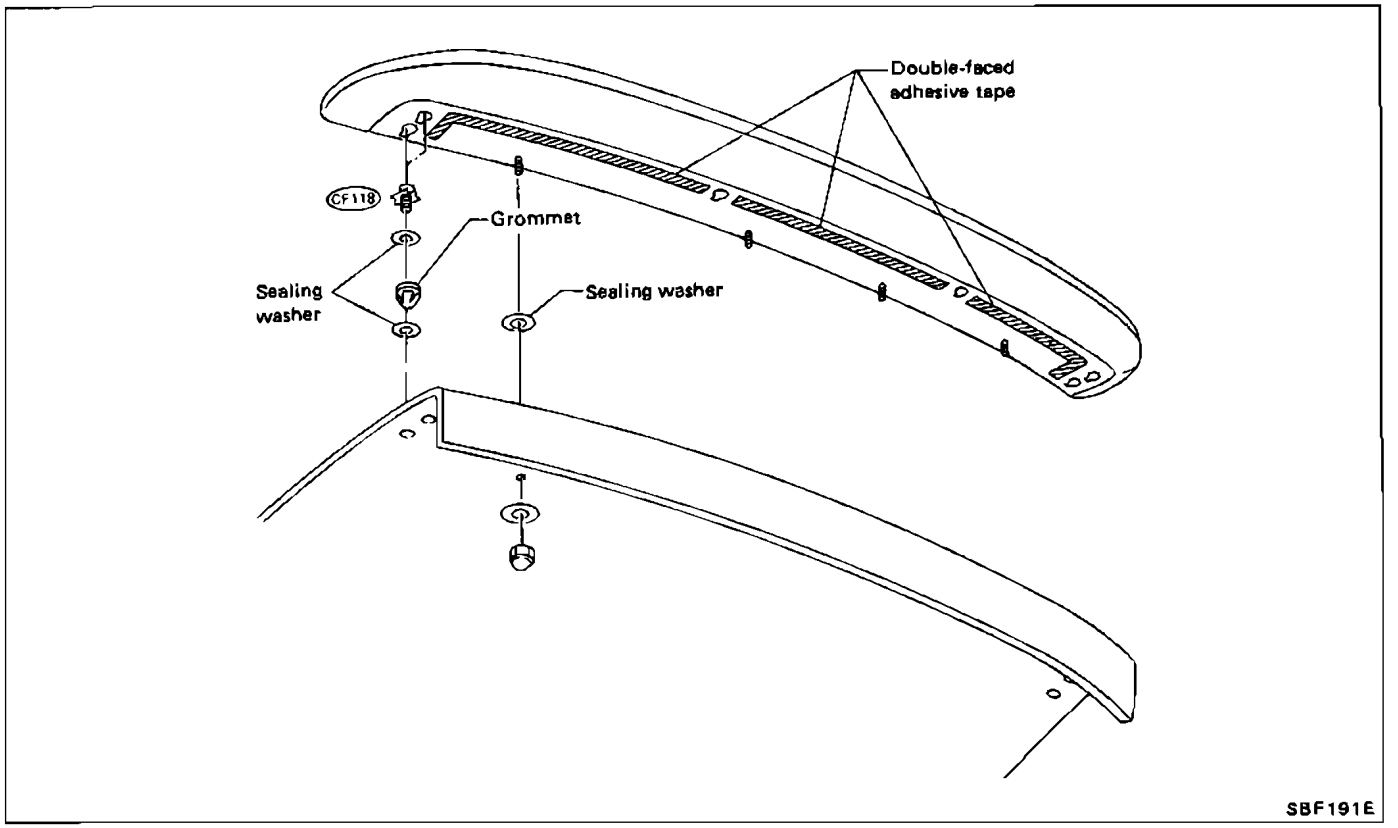
SBF189E

- When installing, make sure that there are not gaps or waves at ends of air spoiler.
- Before installing spoiler, clean and remove oil from surface where spoiler will be mounted.

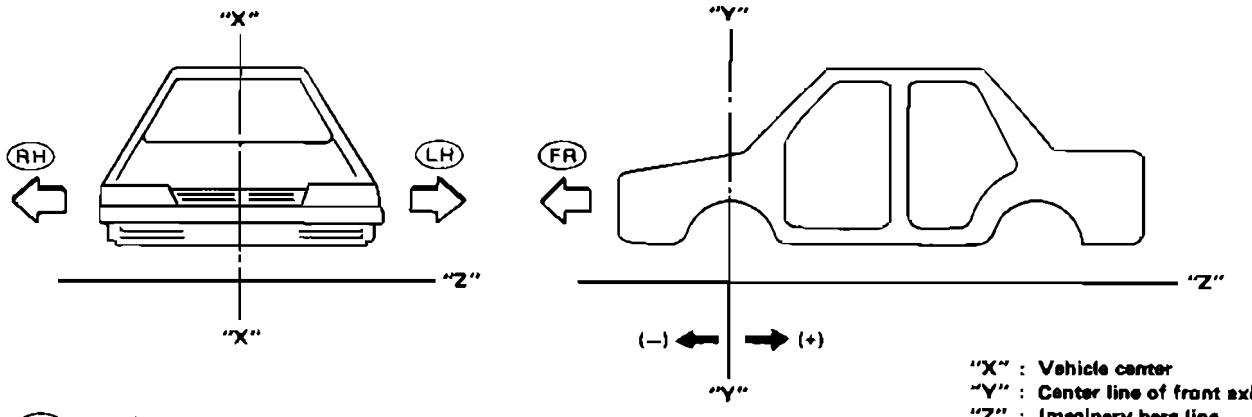
FRONT AIR SPOILER



REAR AIR SPOILER – Fastback



- 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.
- The coordinates of the measurement points are the distances measured from the standard line of "X", "Y" and "Z".

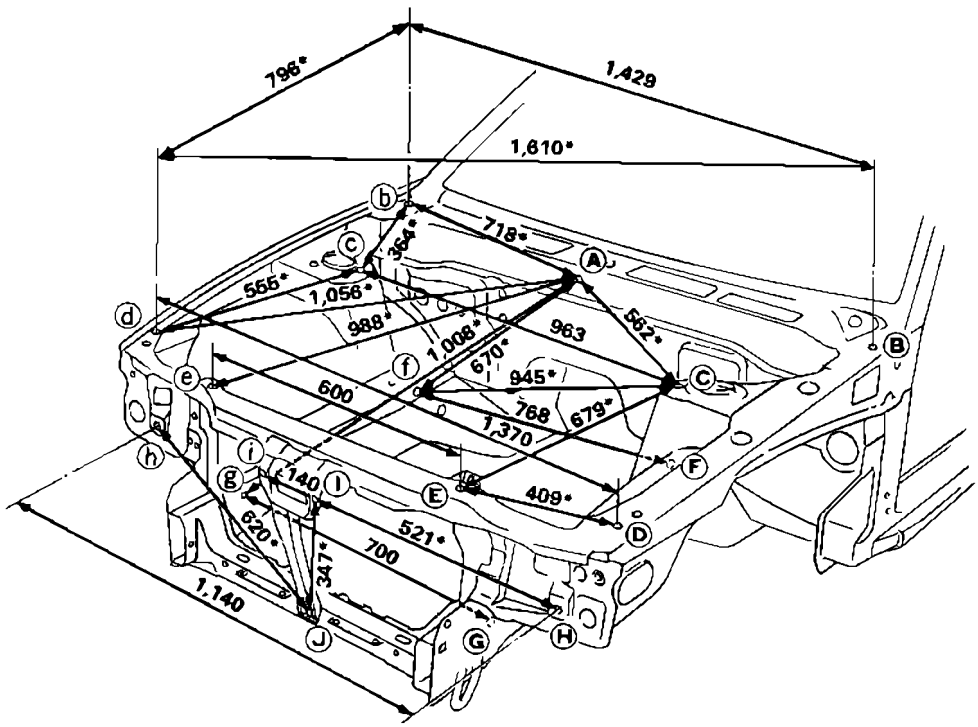


(LH) : L.H. side
(RH) : R.H. side

"X" : Vehicle center
"Y" : Center line of front axle
"Z" : Imaginary base line
[200 mm below datum line ("OZ" at design plan)]

Engine Compartment

MEASUREMENT



Unit: mm

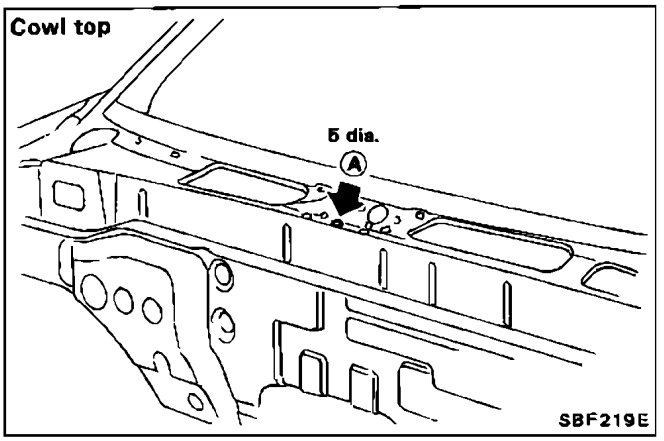
SBF193E

Engine Compartment (Cont'd)

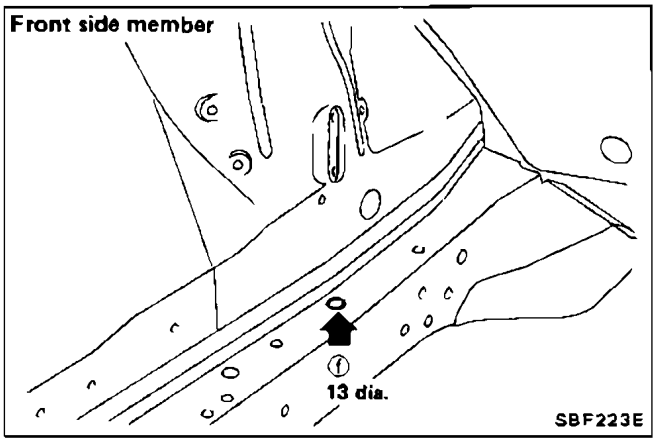
MEASUREMENT POINTS

Unit: mm

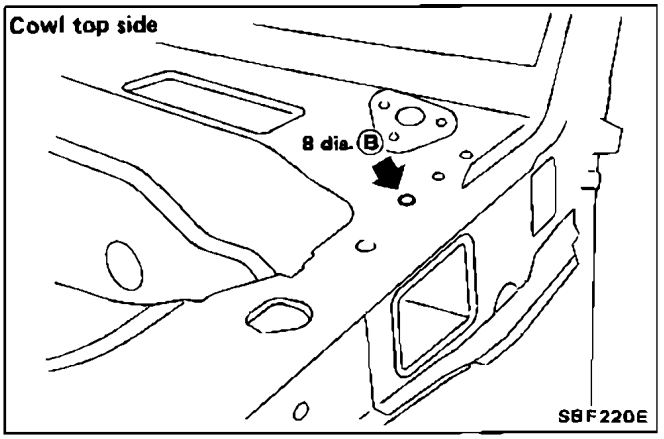
Cowl top



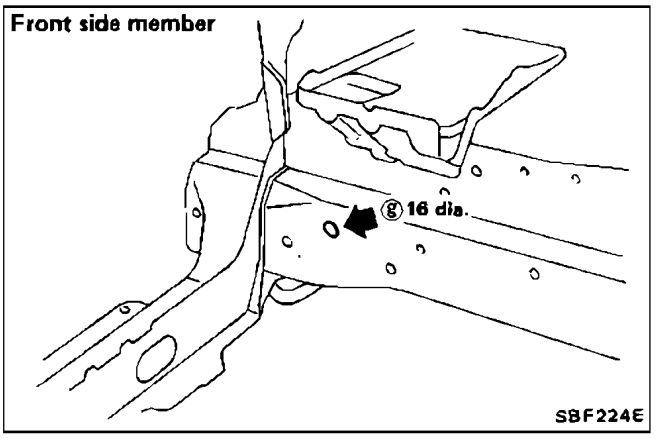
Front side member



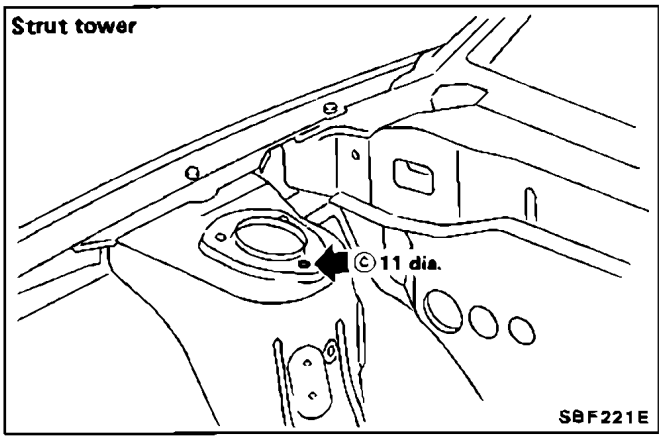
Cowl top side



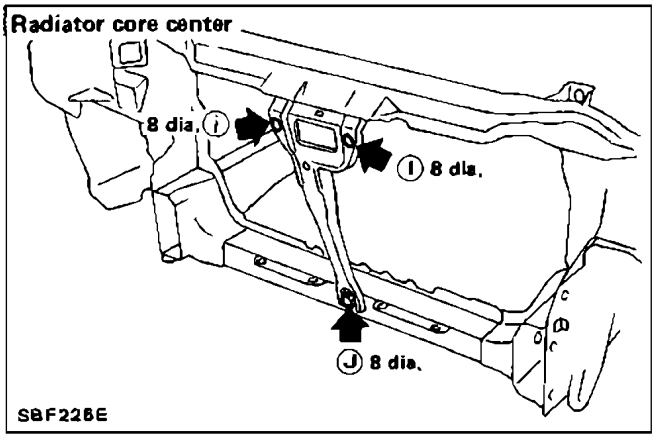
Front side member



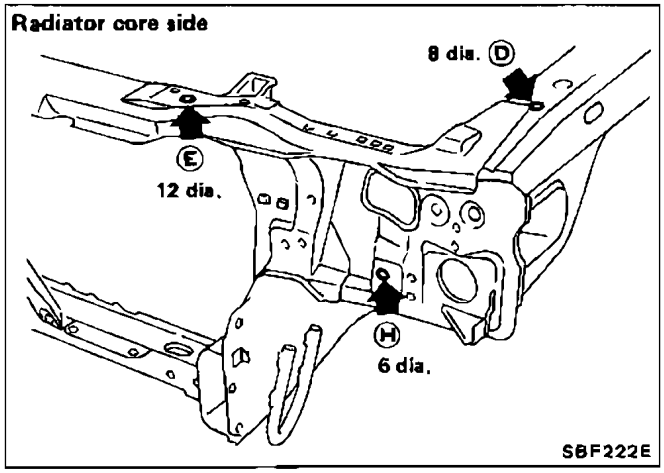
Strut tower



Radiator core center

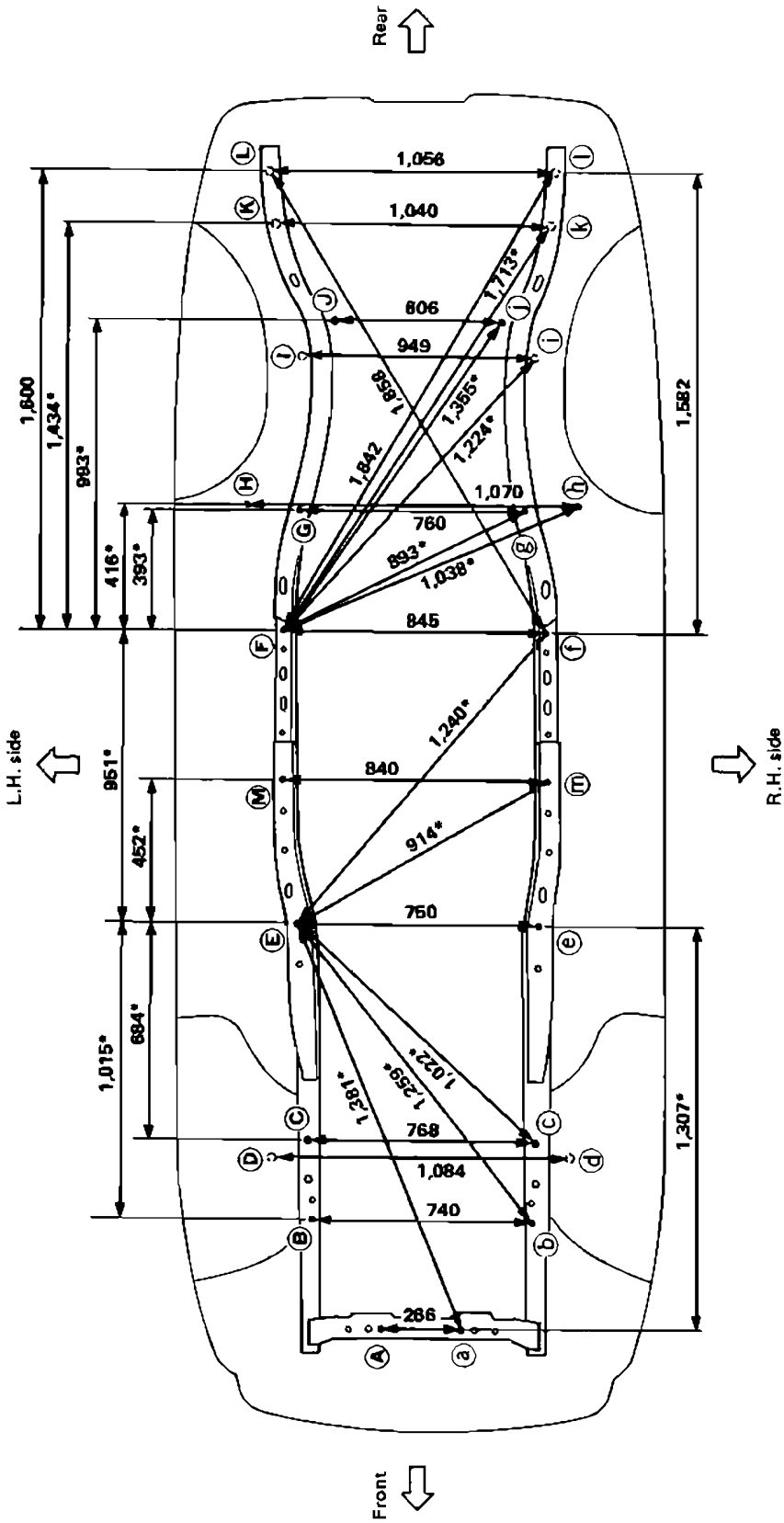


Radiator core side



Underbody

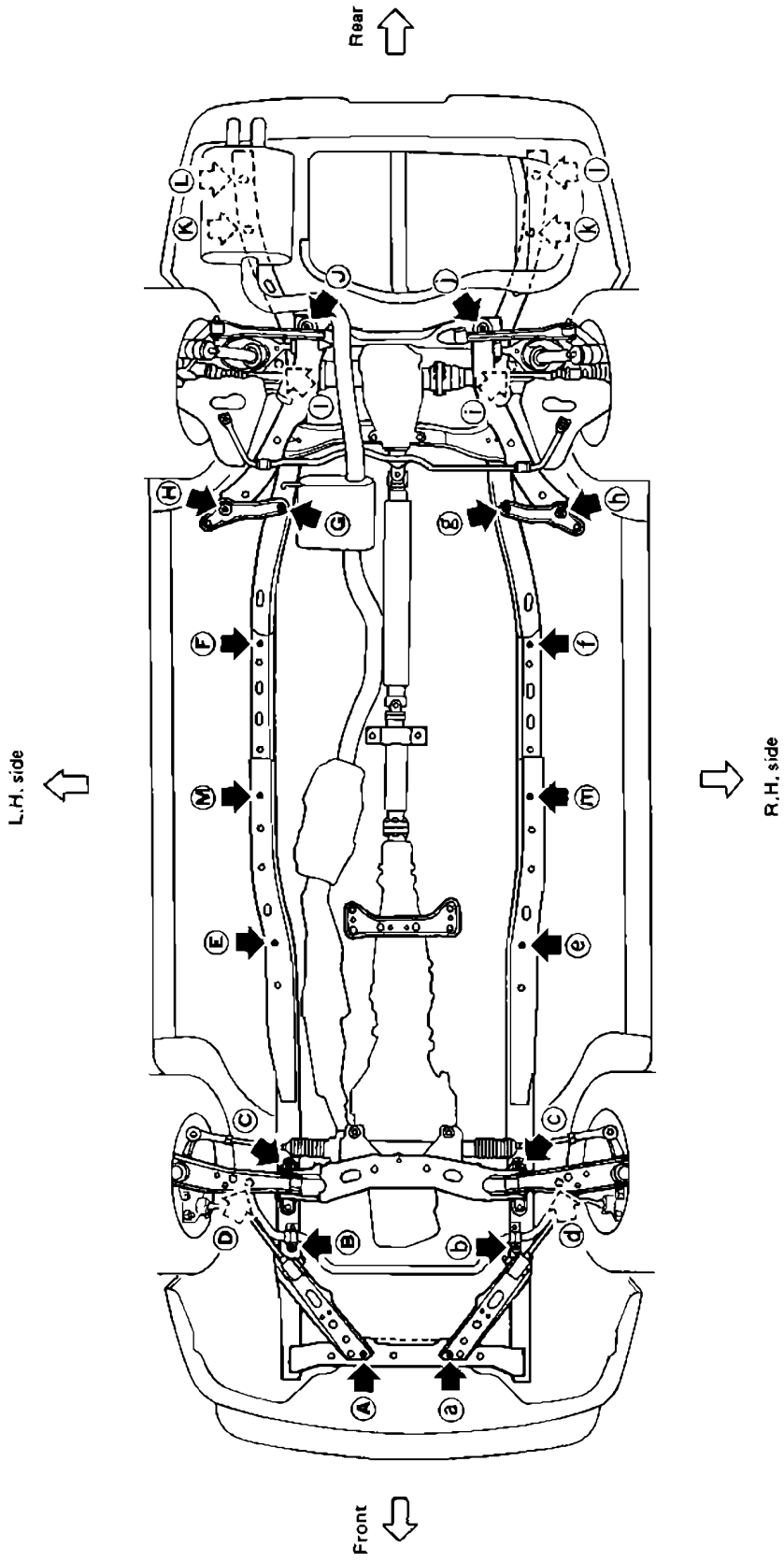
MEASUREMENT



SBF194E

Underbody (Cont'd)

MEASUREMENT POINTS



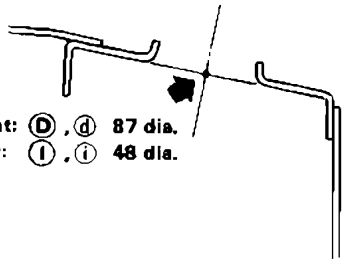
SBF196E

Underbody (Cont'd)

Unit: mm

Front and rear strut tower centers

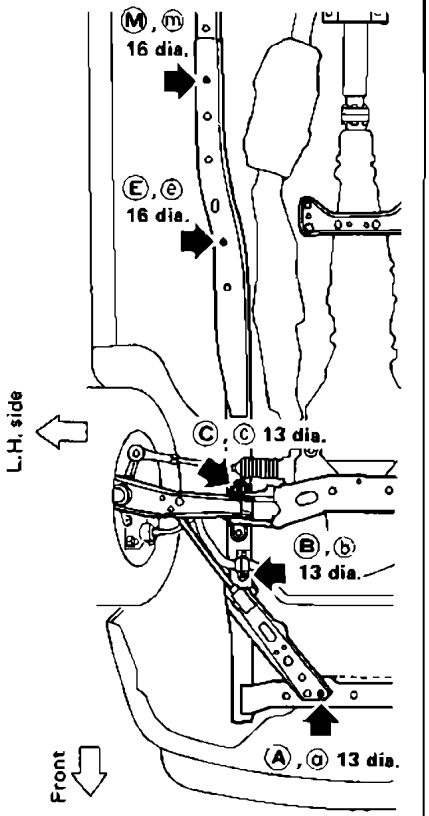
Coordinates:
Ⓓ, ⓓ
X: 542.2
Y: 63.5
Z: 725.7
Ⓘ, ⓘ
X: 474.5
Y: 2,500
Z: 658.9



SBF119C

Front side member and front extension

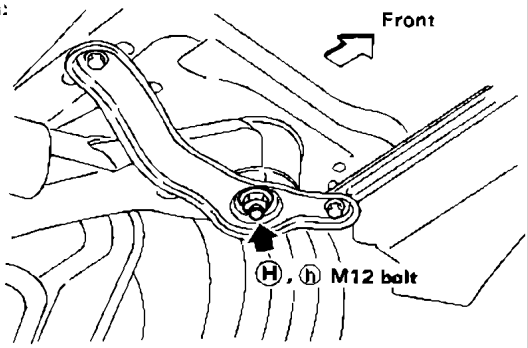
Coordinates:
Ⓐ, ⓐ
X: 132.9
Y: −582
Z: 189
Ⓑ, ⓑ
X: 370
Y: −304
Z: 255
Ⓒ, ⓒ
X: 384.2
Y: 32
Z: 255
Ⓔ, ⓔ
X: 375
Y: 700
Z: 106.2
Ⓜ, ⓜ
X: 420
Y: 1,150
Z: 106.2



SBF271E

Rear suspension member front mounting bolt threaded end

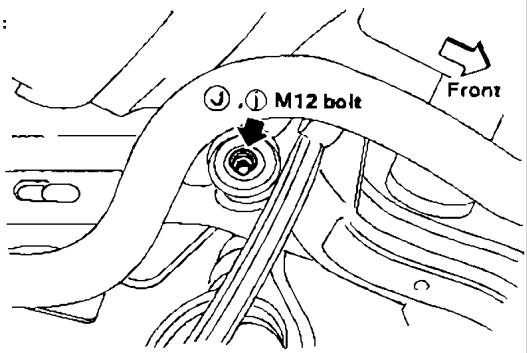
Coordinates:
Ⓗ, ⓗ
X: 635
Y: 2,050
Z: 116.3



SBF226E

Rear suspension member rear mounting bolt threaded end

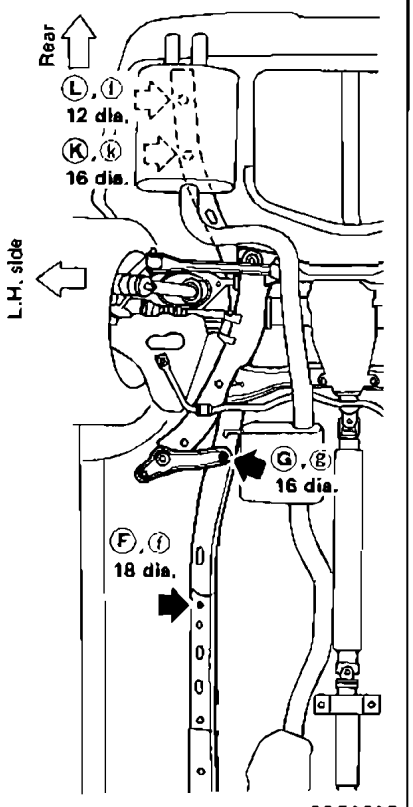
Coordinates:
Ⓙ, ⓙ
X: 303
Y: 2,635
Z: 65.8



SBF227E

Center side member, rear side member and rear extension

Coordinates:
Ⓕ, ⓕ
X: 422.5
Y: 1,650
Z: 104
Ⓖ, ⓖ
X: 380
Y: 2,030
Z: 195.8
Ⓚ, ⓚ
X: 520
Y: 3,050
Z: 398.8
Ⓛ
X: 528
Y: 3,221
Z: 386
Ⓘ
X: 528
Y: 3,200
Z: 400



SBF272E

HEATER & AIR CONDITIONER

SECTION HA

CONTENTS

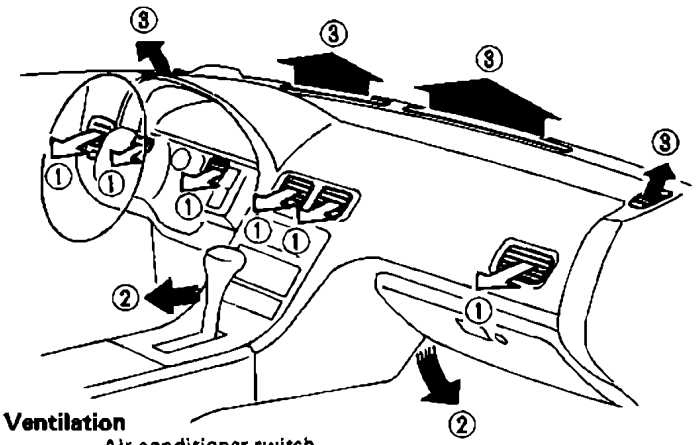
AIR FLOW AND COMPONENT LAYOUT ..... HA- 2
DOOR CONTROL ..... HA- 5
DESCRIPTION – Push Control ..... HA- 7
PUSH CONTROL UNIT ..... HA- 9
HEATER ELECTRICAL CIRCUIT HA-12
PRECAUTIONS HA-13
PRECAUTIONS FOR REFRIGERANT CONNECTION HA-14
PREPARATION HA-15
DISCHARGING, EVACUATING, CHARGING AND CHECKING HA-17
DESCRIPTION OF AIR CONDITIONER HA-24
SERVICE PROCEDURES HA-25
A/C PERFORMANCE TEST HA-28
COMPRESSOR OIL – For NVR 140S (ATSUGI make) HA-33
COMPRESSOR – Model NVR 140S (ATSUGI make) HA-35
A/C ELECTRICAL CIRCUIT HA-40
A/C COMPONENT LAYOUT HA-42
TROUBLE DIAGNOSES HA-44
SERVICE DATA AND SPECIFICATIONS (S.D.S.) HA-73

When you read wiring diagrams:

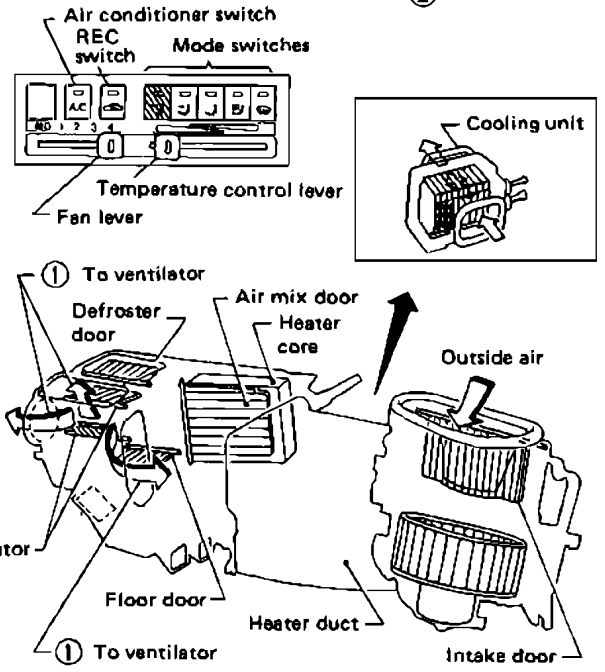
- **Read GI section, "HOW TO READ WIRING DIAGRAMS".**
- **See EL section, "POWER SUPPLY ROUTING" for power distribution circuit.**

When you perform trouble diagnoses, read GI section, "HOW TO FOLLOW FLOW CHART IN TROUBLE DIAGNOSES".

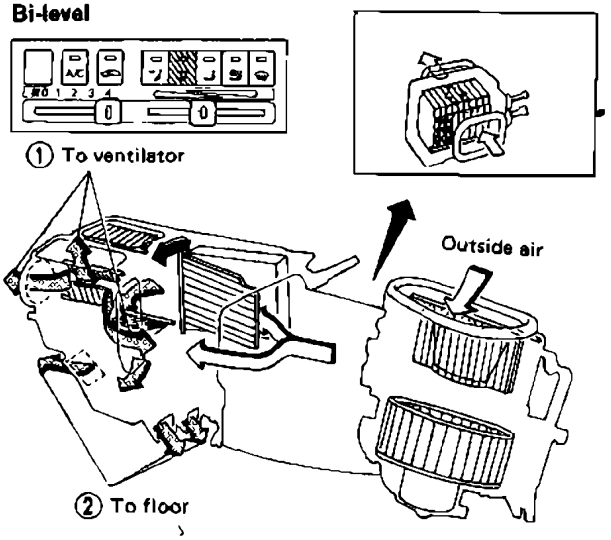
Air Flow



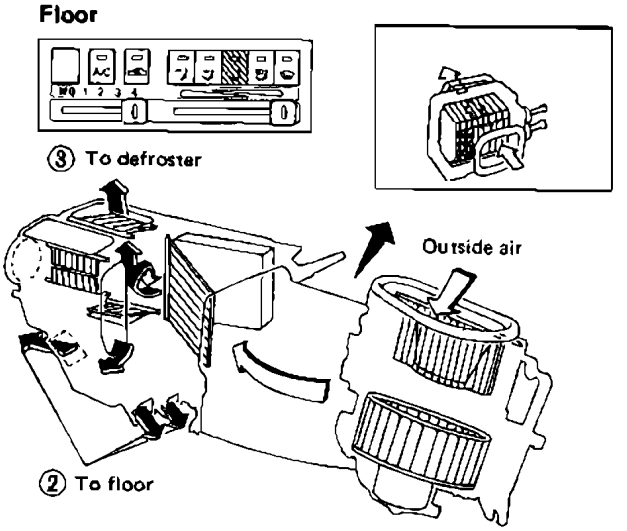
Ventilation



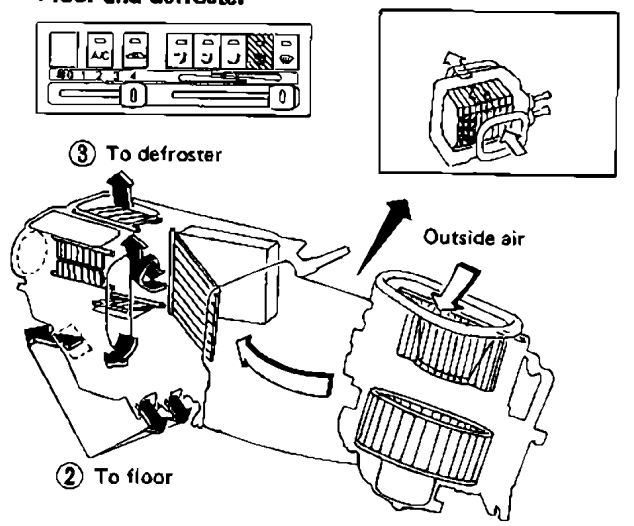
Bi-level



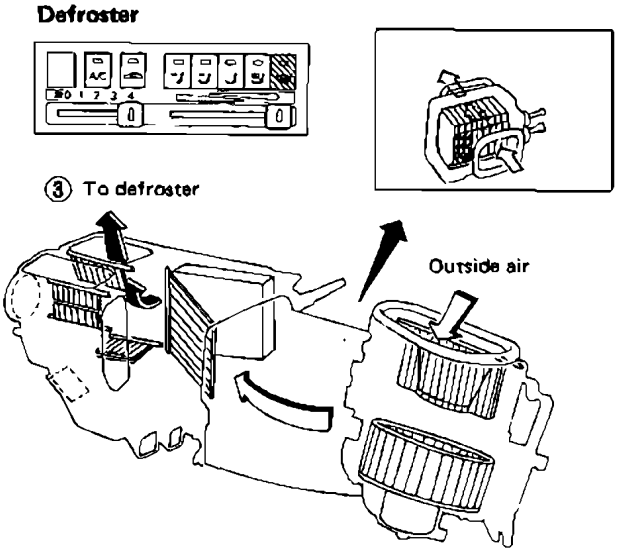
Floor



Floor and defroster



Defroster



: Air passed through heater core

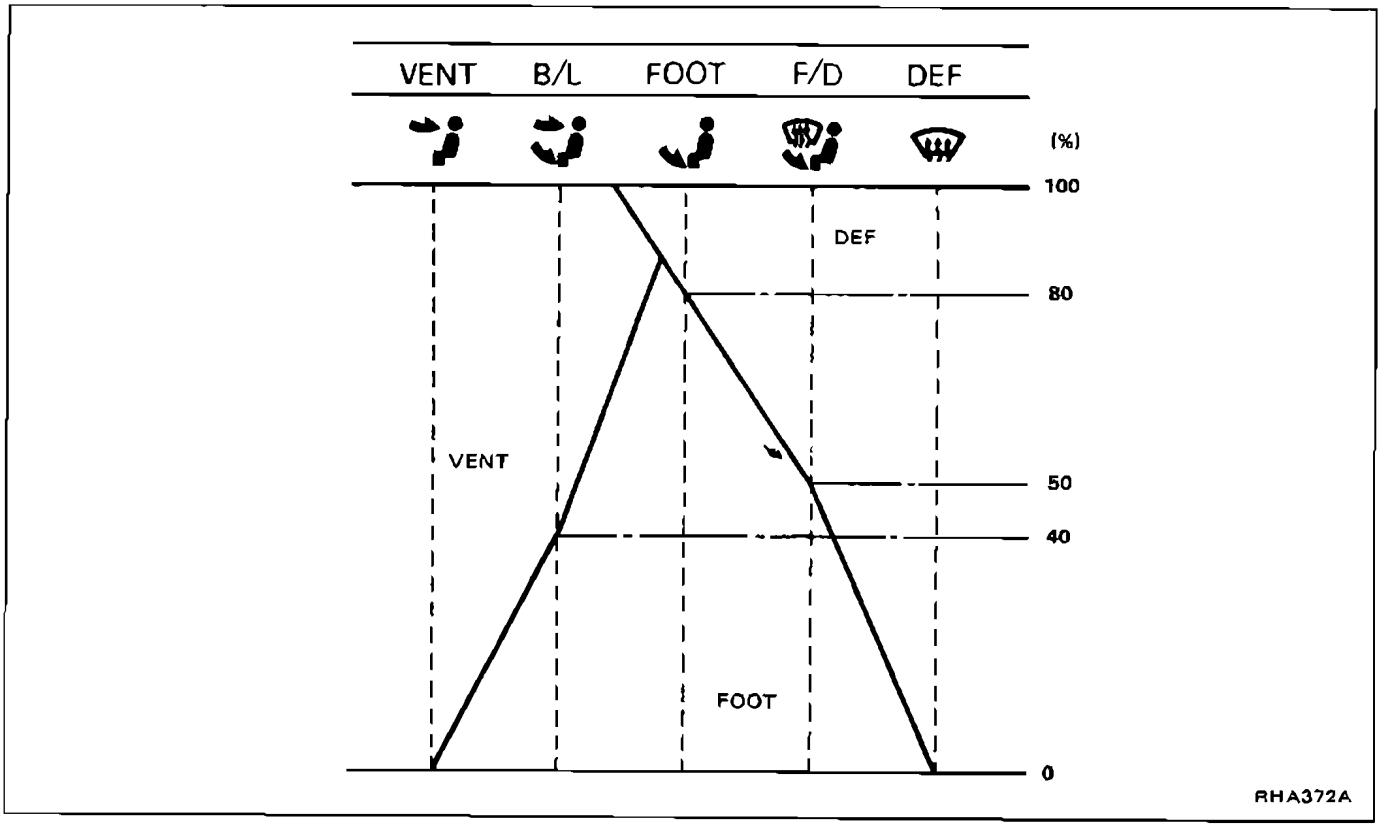
: Mixed air (+)

: Air not passed through heater core

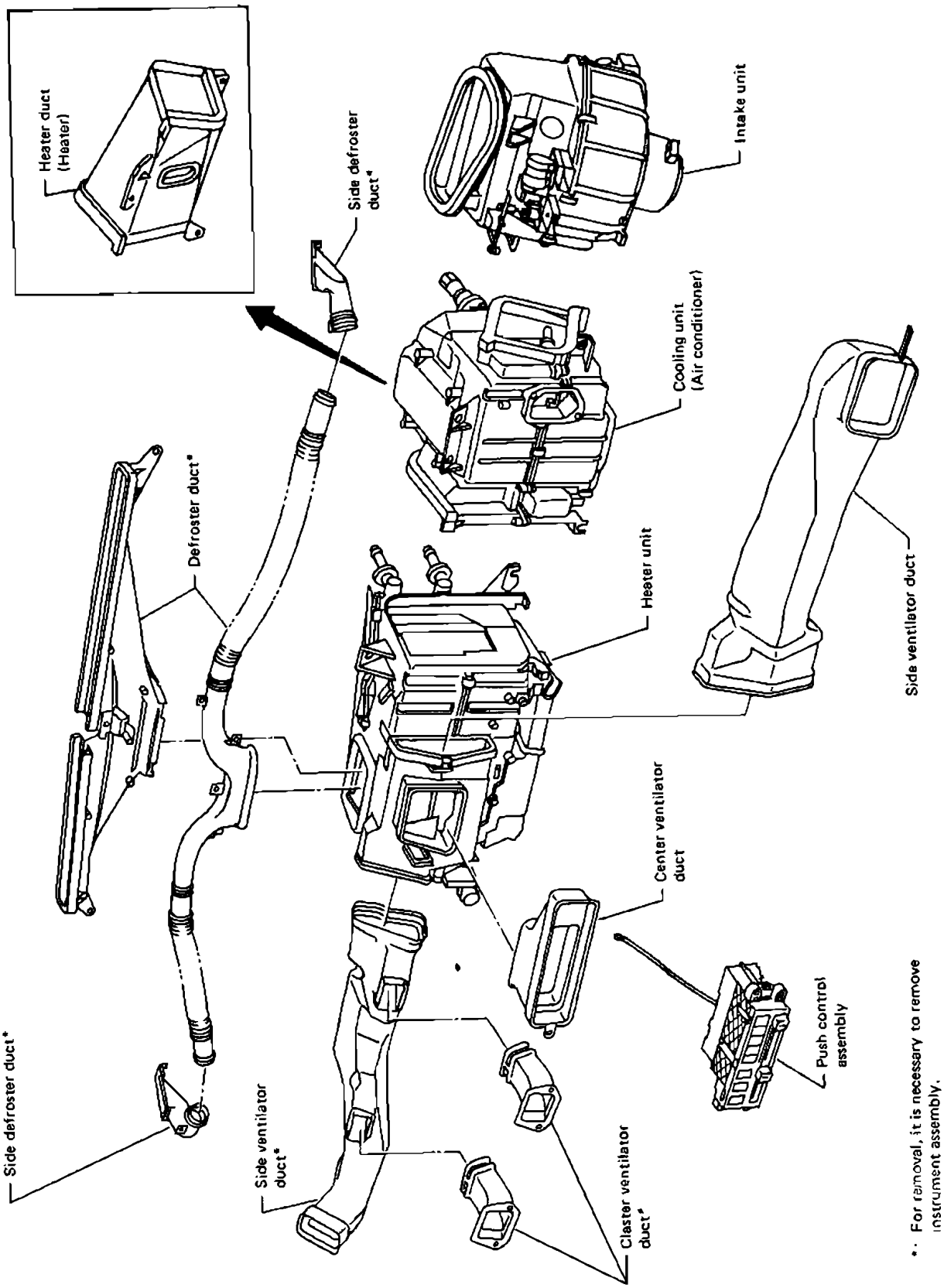
RHA371A

Air Flow (Cont'd)

AIR DISTRIBUTION RATIOS



Component Layout

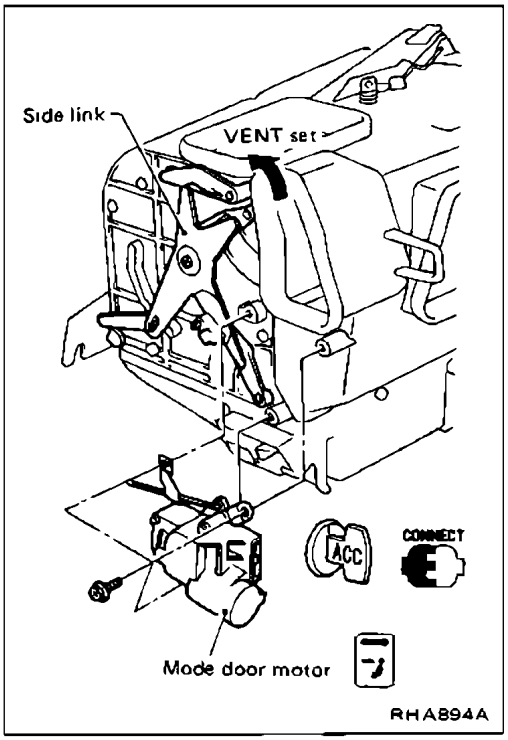


*: For removal, it is necessary to remove instrument assembly.

RHA373A

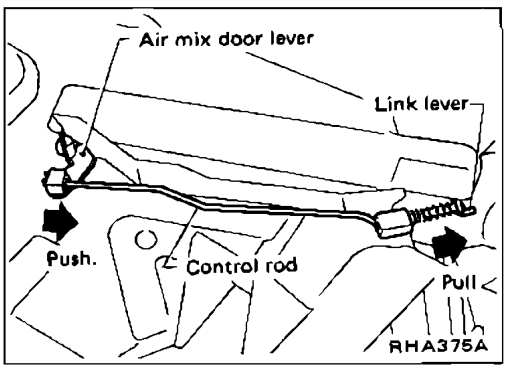
Control Cable Adjustment

- **When disconnecting control cable, remove E-ring and take off cable while pushing cable outer.**



MODE DOOR

1. Move side link with hand and hold mode door in VENT mode.
2. Install mode door motor on heater unit and connect it to body harness.
3. Turn ignition switch to ACC.
4. Turn VENT switch ON.
5. Attach mode door motor rod to side link rod holder.
6. 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.

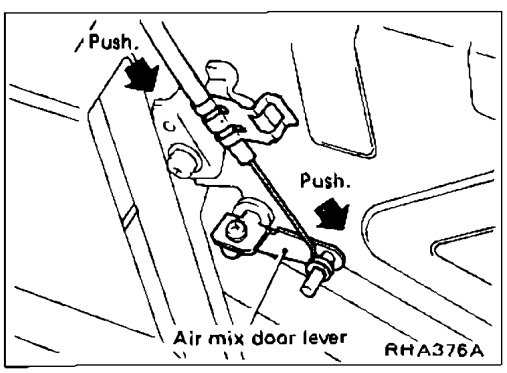


WATER COCK CONTROL ROD

- **When adjusting water cock control rod, first disconnect temperature control cable from air mix door lever. Reconnect and readjust temperature control cable.**

1. Push air mix door lever in direction of arrow.
2. Pull control rod of water cock in direction of arrow so as to give a clearance of about 2 mm (0.08 in) between ends of rod and link lever. Connect control rod to door lever.

After connecting control rod, check it operates properly.

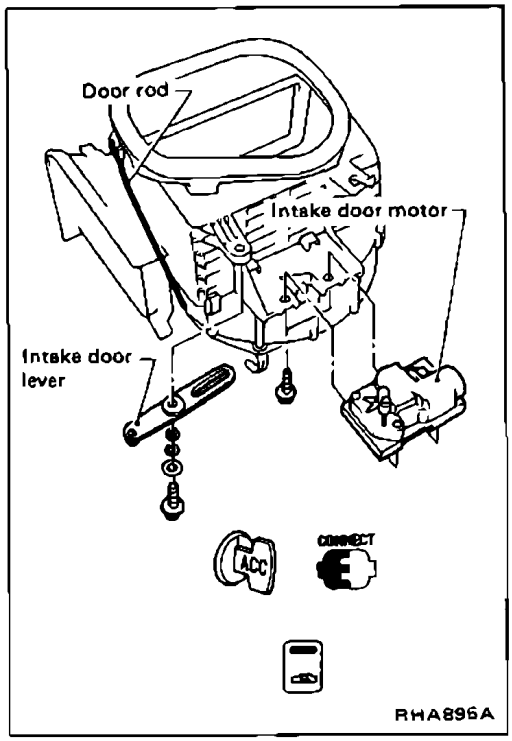


TEMPERATURE CONTROL CABLE

- Clamp cable while pushing cable outer and air mix door lever in direction of arrow.

After positioning control cable, check it operates properly.

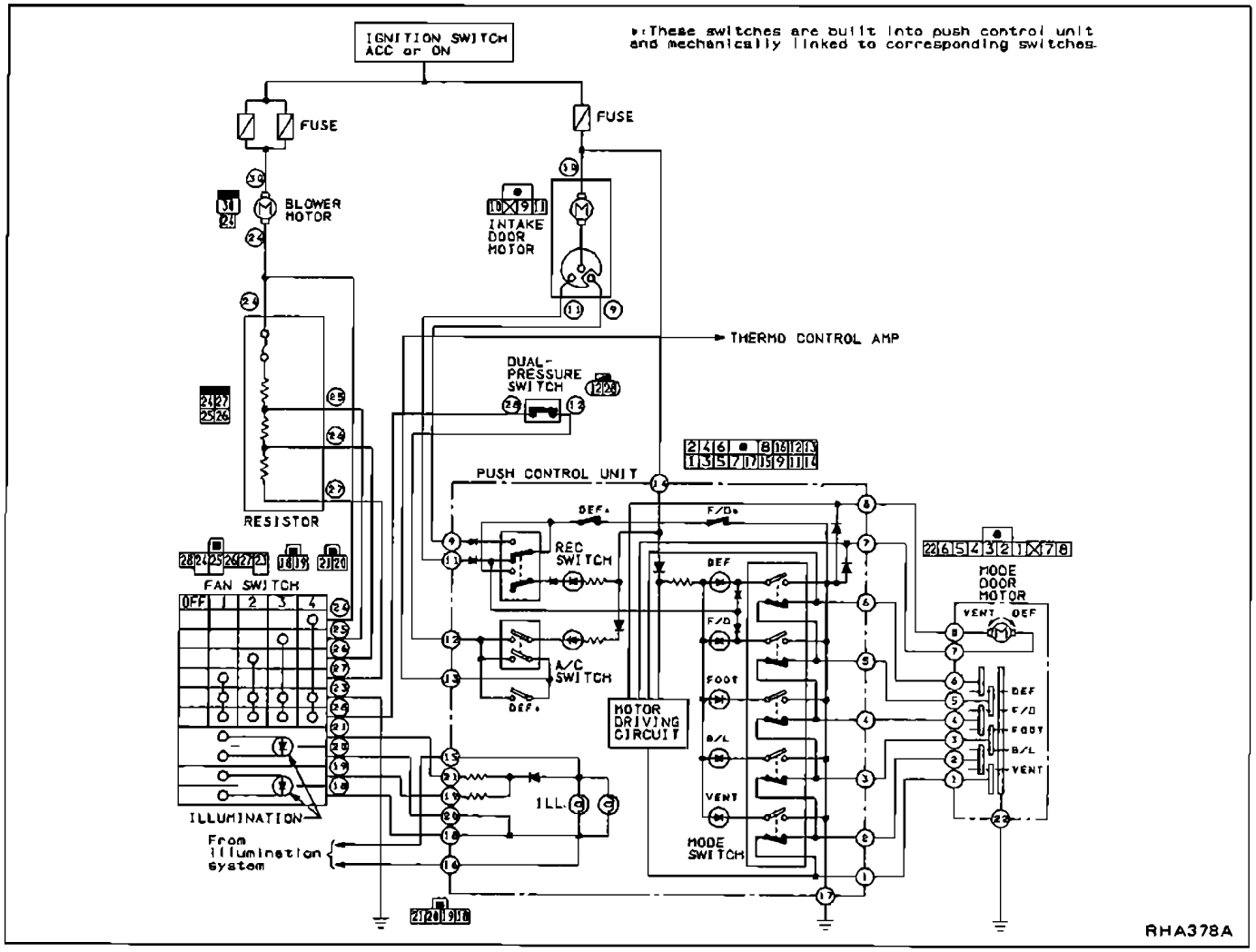
Control Cable Adjustment (Cont'd)



INTAKE DOOR

1. Connect intake door motor harness connector before installing on intake door motor.
2. Turn ignition switch to ACC.
3. Turn REC switch ON.
4. Install intake door lever.
5. Set intake door rod in REC and secure door rod to holder.
6. Check that intake door operates properly when REC switch is turned ON and OFF.

Push Control System

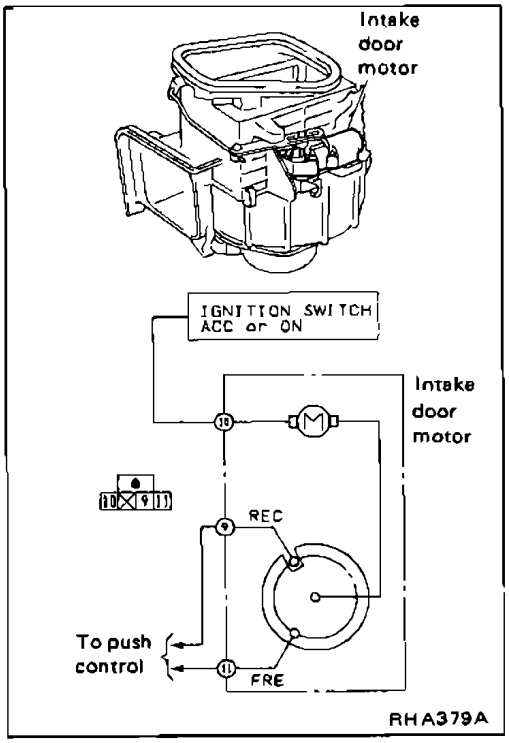


This push control system operates the intake and mode door motors to activate their corresponding doors.

SWITCHES AND THEIR CONTROL FUNCTIONS

Switch		Indicator illuminates							Air outlet	Intake air	Compressor
		A/C									
A/C		O									ON*1
Mode			O						VENT		
				O					B/L		
					O				FOOT		
						O			F/D	FRE	
							O		DEF	FRE	ON*1
								O*2		REC	

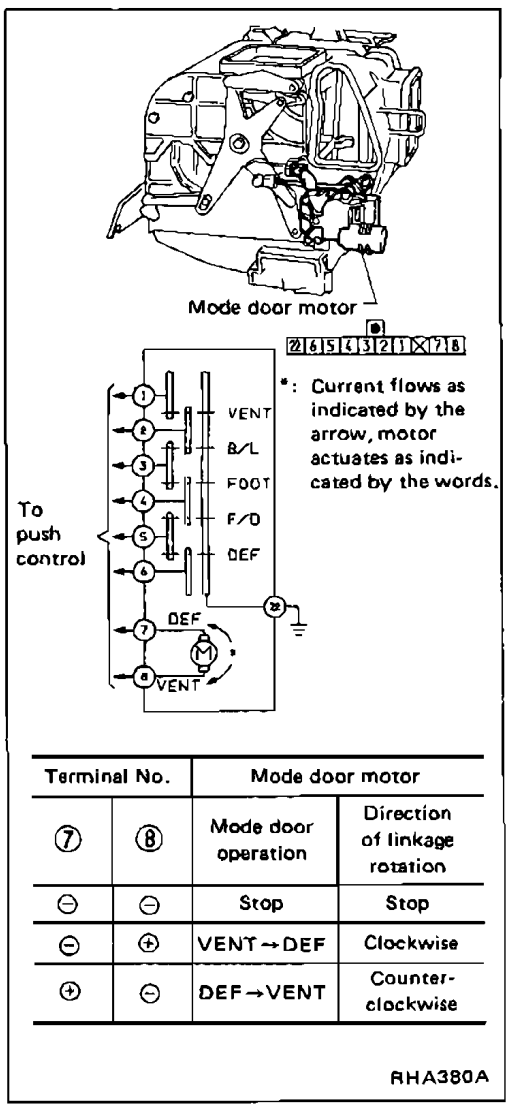
*1: Compressor is operated by thermo control amp.
*2: It depends on mode switch position.



Intake Door Motor

The intake door motor is installed on the front portion of the intake unit. Using a rod and link it opens and closes the intake door.

When the REC switch is ON (OFF), the ground line of the intake door motor is switched from terminal ⑪ to ⑨ (⑨ to ⑪). This causes the motor to start because the position switch contacts built into it are set to the current flow position. The contacts turn along with the motor. When they reach the non-current flow position, the motor will stop. The motor always turns in the same direction.



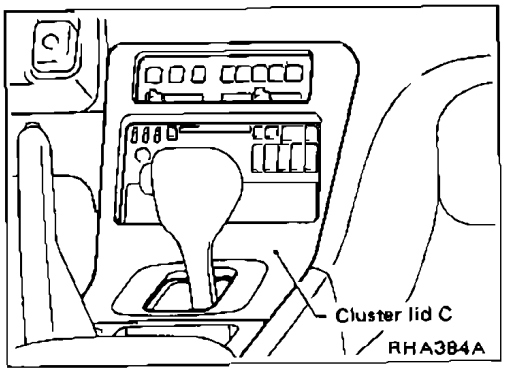
Terminal No.		Mode door motor	
⑦	⑧	Mode door operation	Direction of linkage rotation
⊖	⊖	Stop	Stop
⊖	⊕	VENT→DEF	Clockwise
⊕	⊖	DEF→VENT	Counter-clockwise

RHA380A

Mode Door Motor

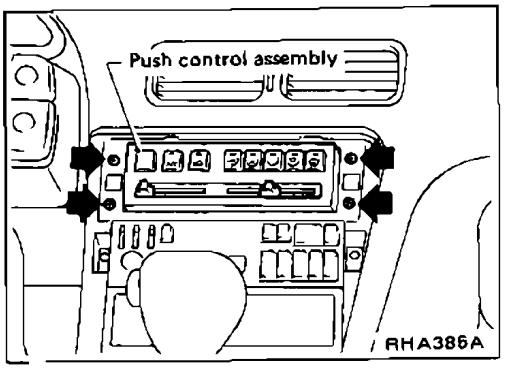
The mode door motor is located on the left side of the heater unit. Through the side link it opens and closes the vent, foot and defroster door.

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.



Removal and Installation

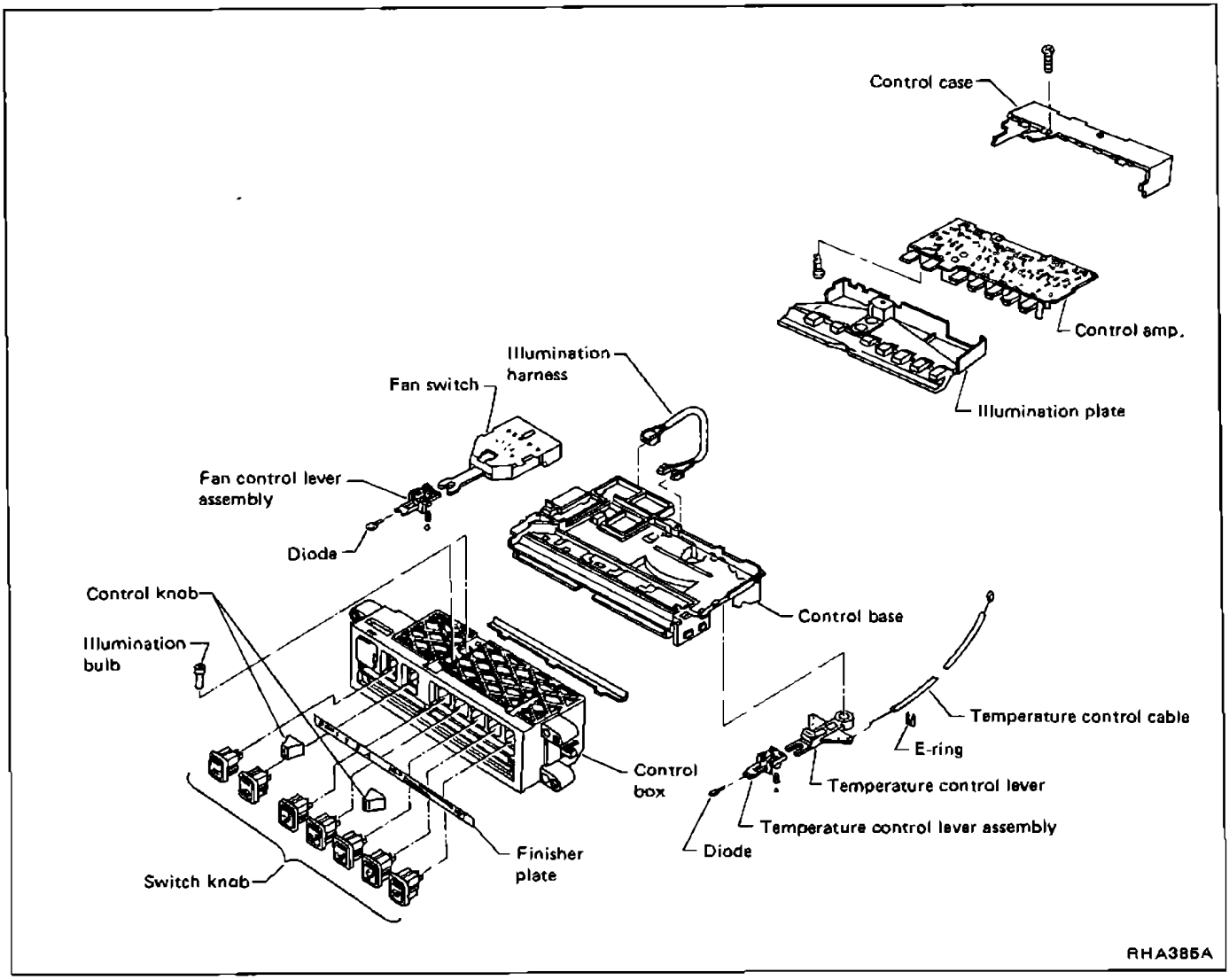
1. Remove cluster lid C.



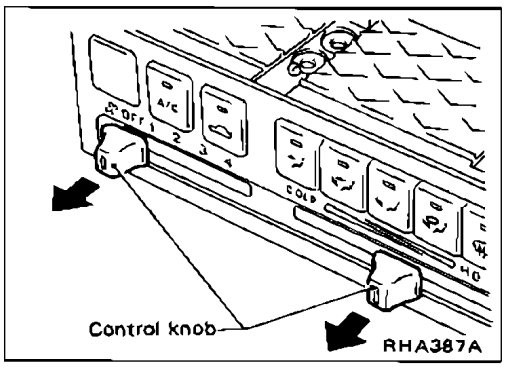
2. Remove audio (radio).
3. Remove four screws of push control unit.
4. Remove temperature control cable.
5. Disconnect push control unit harness connectors.
6. Remove push control unit.
7. Installation is in the reverse order of removal.

Refer to Control Cable Adjustment for temperature control cable.

Overhaul — Push control unit assembly

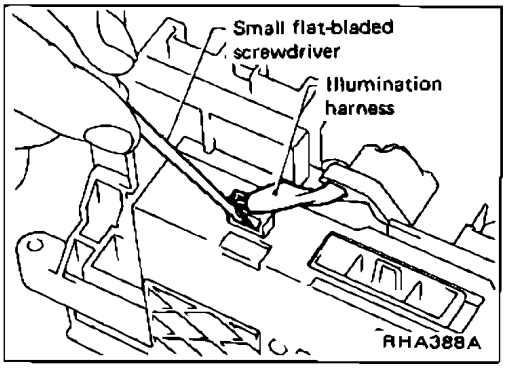


Overhaul — Push control unit assembly (Cont'd)

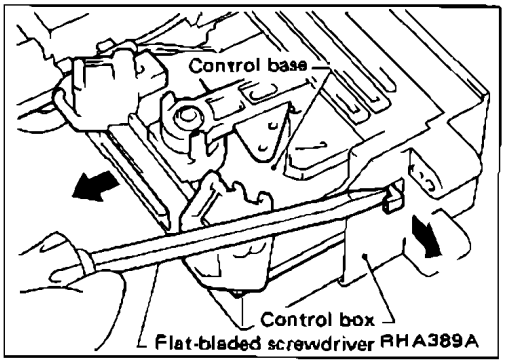


1. Remove control knobs.

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.

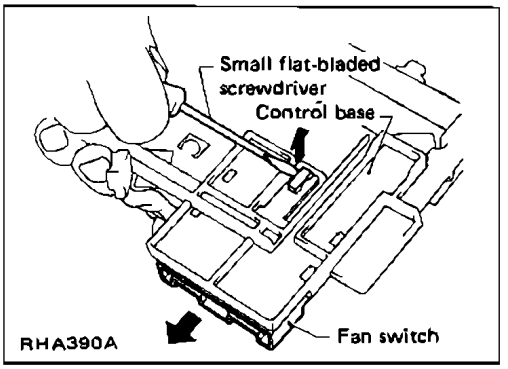


2. Disconnect illumination harness connectors.

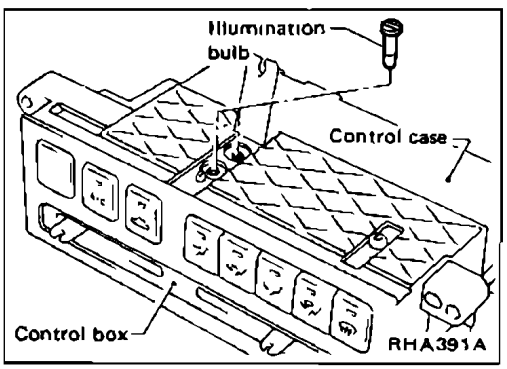


3. Remove control base.

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.

Overhaul — Push control unit assembly (Cont'd)

6. Remove control knobs.

Wrap finisher with a cloth and remove knobs using pliers or similar tool. Be careful not to scratch finisher's surface.

7. Remove control case.
8. Remove illumination plate.

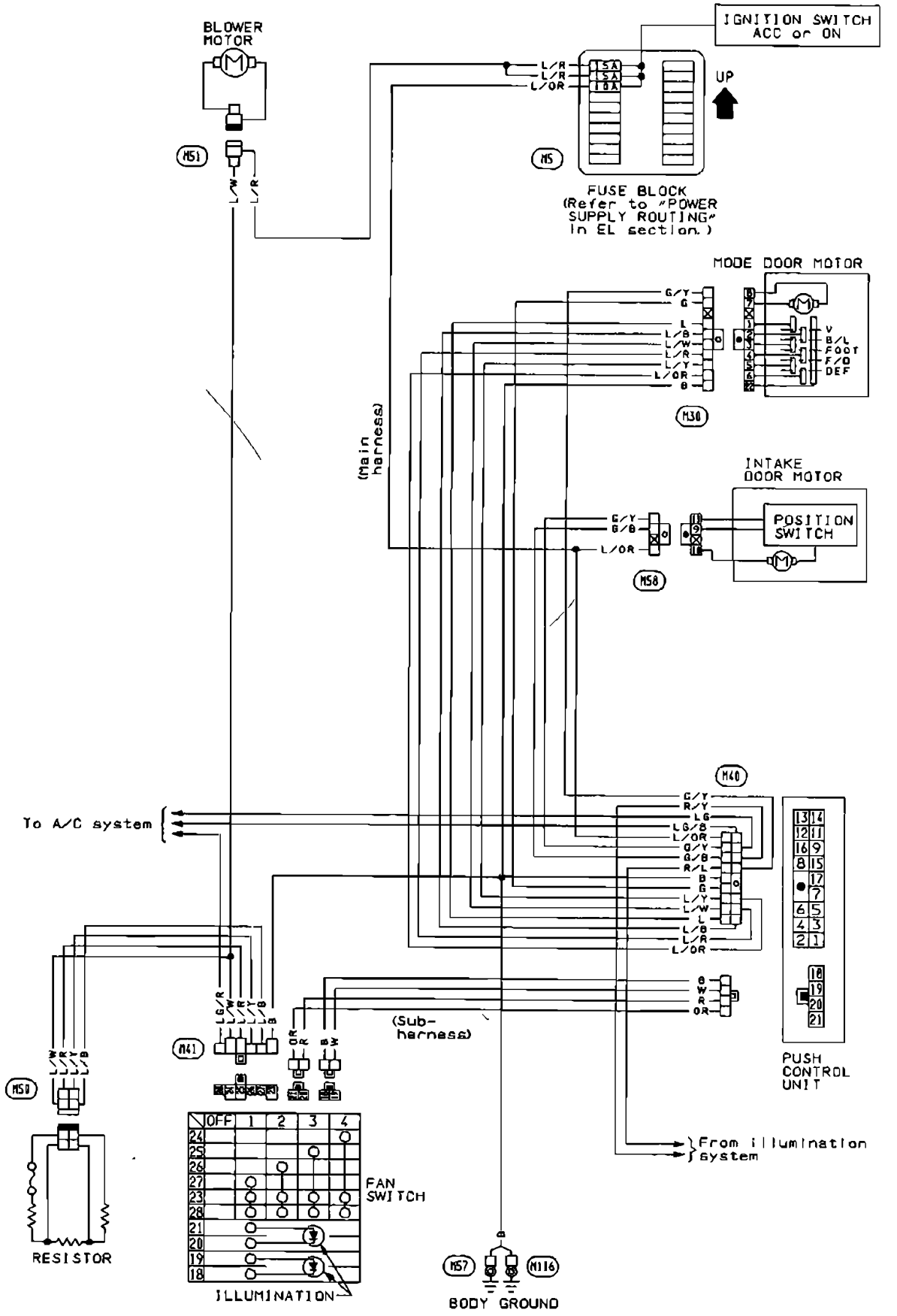
Be careful not to scratch control amp. when removing illumination plate.

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.

Wiring Diagram



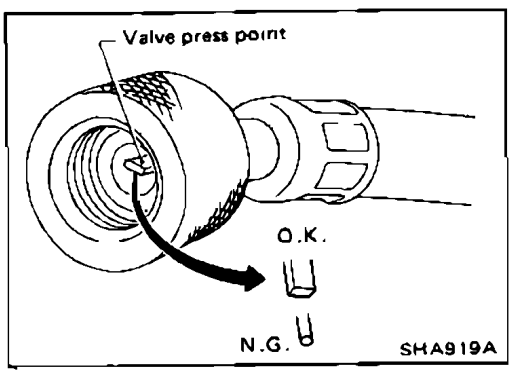
RHA392A

WARNING:

- 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 them from high places.
- Work in well-ventilated area because refrigerant gas evaporates quickly and breathing may become difficult due to 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 can with an open flame. There is a danger that can will explode.

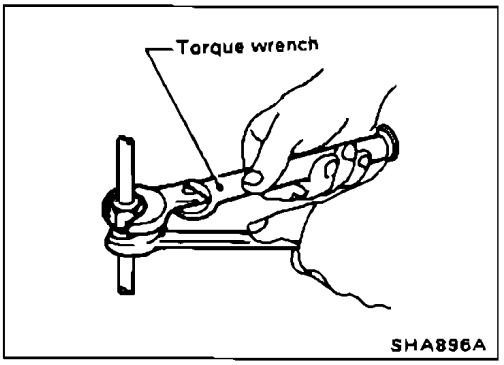
CAUTION:

- Do not use steam 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. Clean with refrigerant gas.



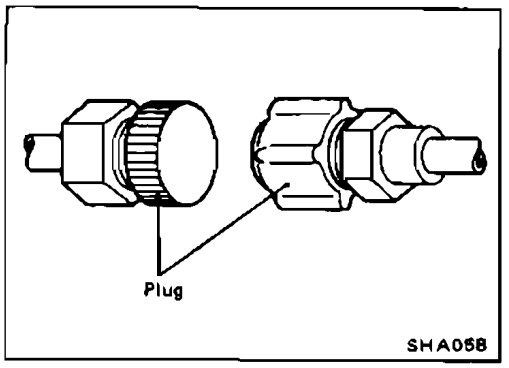
- Do not use manifold gauge whose press point shape is different from that shown. Otherwise, insufficient evacuation may occur.

- Do not over-tighten service valve cap.
- Do not allow refrigerant to rush out. Otherwise, compressor oil will be discharged along with refrigerant.

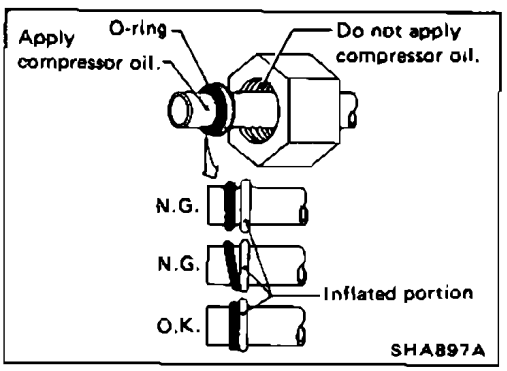


WARNING:
Gradually loosen discharge side hose fitting, and remove it after remaining pressure has been released.
CAUTION:
When replacing or cleaning refrigerant cycle components, observe the following.

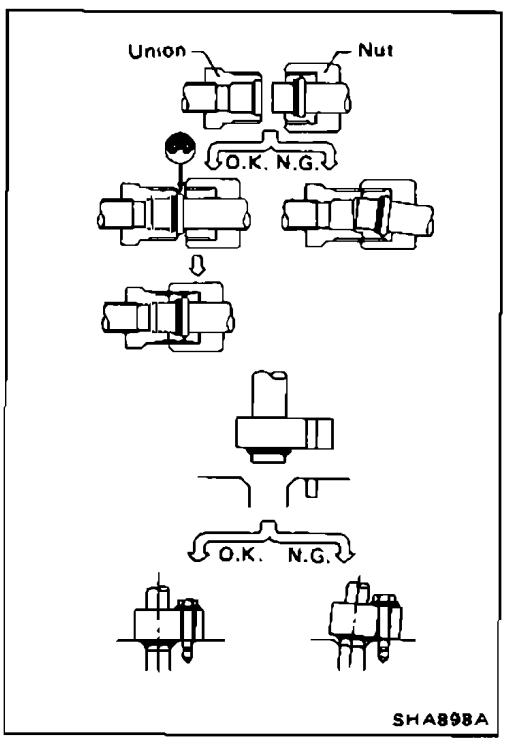
- **Do not leave compressor on its side or upside down for more than 10 minutes, as compressor oil will enter low pressure chamber.**
- **When connecting tubes, always use a torque wrench.**



- **After disconnecting tubes, plug all openings immediately to prevent entrance of dirt and moisture.**

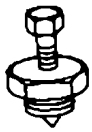


- **Always replace used O-rings.**
- **When connecting tube, apply compressor oil to portions shown in illustration. Be careful not to apply oil to threaded portion.**
- **O-ring must be closely attached to inflated portion of tube.**

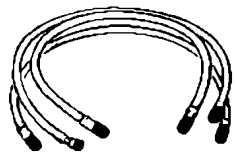
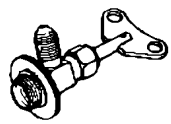
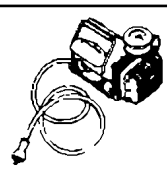


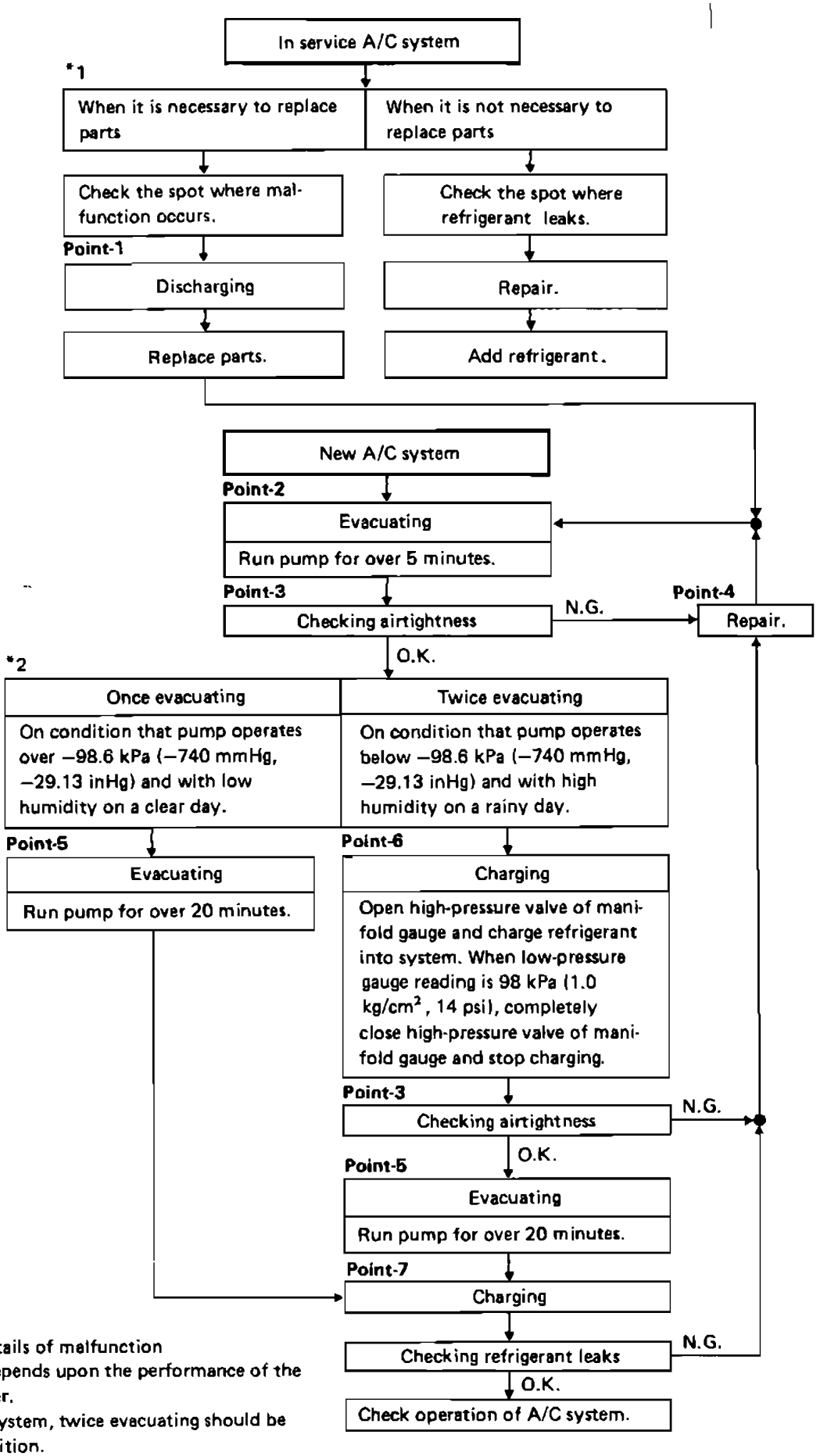
- **After inserting tube into union until O-ring is no longer visible, tighten nut to specified torque.**
- **After connecting line, conduct leak test and make sure that there is no leakage from connections. When the gas leaking point is found, disconnect that line and replace the O-ring. Then tighten connections of seal seat to the specified torque.**

SPECIAL SERVICE TOOLS

Tool number (Kent-Moore No.) Tool name	Description	
KV998VR001 (–) Clutch disc puller		Removing clutch disc
KV99231010 (–) Clutch disc wrench		Removing shaft nut and clutch disc
KV99235160 (J29751) Nut wrench		Removing lock nut

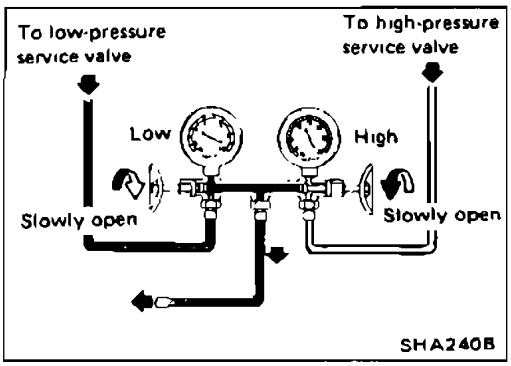
SERVICE TOOLS

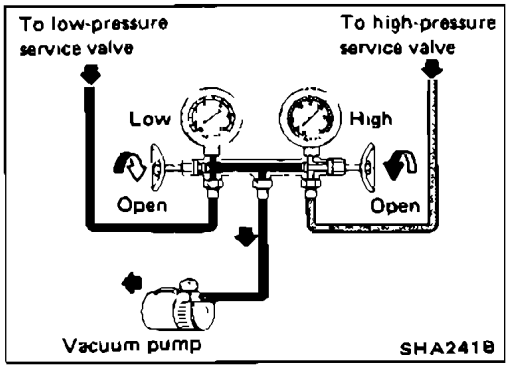
Tool name	Description	
Manifold gauge		Discharging and charging refrigerant
Charging hose		Discharging, evacuating and checking refrigerant
Charge valve		Discharging and charging refrigerant
Thermometer		Checking temperature
Vacuum pump		Evacuating refrigerant
Electric leak detector	**Nominal sensitivity:** **15 - 25 g (0.53 - 0.88 oz)/year** 	Checking refrigerant leaks



*1: Depending on the details of malfunction

*2: Working operation depends upon the performance of the pump and the weather.
When servicing A/C system, twice evacuating should be done under any condition.





Elevation m (ft)	Vacuum of system* kPa (mmHg, inHg)
0 (0)	101.3 (760, 29.92)
300 (1,000)	98.0 (735, 28.94)
600 (2,000)	94.6 (710, 27.95)
900 (3,000)	91.3 (686, 26.97)

*: Values show reading of the low-pressure gauge.

Point-1

Discharging

Slowly open the valves to discharge only refrigerant. If they are opened quickly, compressor oil will also be discharged.

Point-2

Evacuating the System

1. Start pump, then open both valves and run pump for over 5 minutes.
2. When low gauge has reached approx. 98.6 to 101.3 kPa (740 to 760 mmHg, 29.13 to 29.92 inHg), completely close both valves of gauge and stop vacuum pump.

a. The low-pressure gauge reads lower by 3.3 kPa (25 mmHg, 0.98 inHg) per 300 m (1,000 ft) elevation. Perform evacuation according to the following table.

b. The rate ascension of the low-pressure gauge should be less than 3.3 kPa (25 mmHg, 0.98 inHg) in 5 minutes.

Point-3

Checking Airtightness

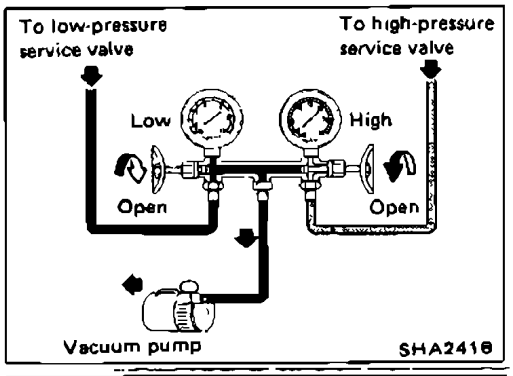
1. Close both low and high-pressure valves and leave them unattended for approx. 5 to 10 minutes.
2. Make sure the pointer of the low-pressure gauge does not deflect toward the "0" direction.
3. If the pointer deflects, gas leakage is present. Repair as outlined under Point-4.

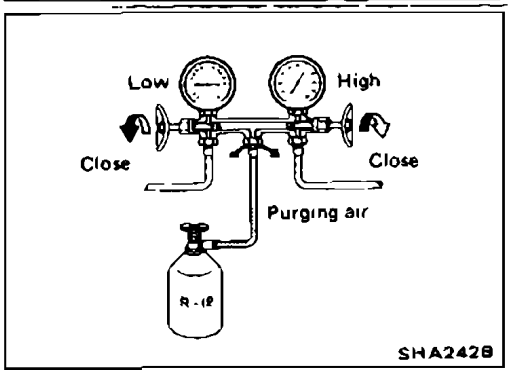
Point-4

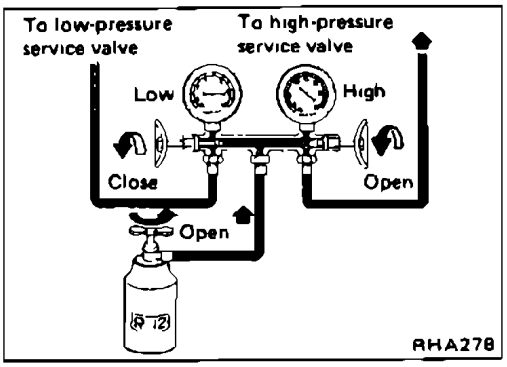
Repair

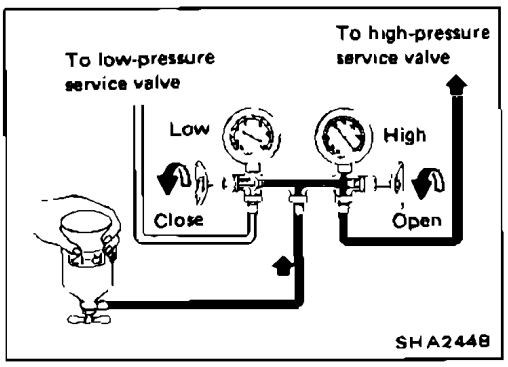
If a problem is noticed under Point-3 above, locate and repair the leaking point using the following table as a guide.

Leak at/around pipe connection	Leak at/around gauge manifold
• O-ring fouled, damaged or deformed • Oil not applied to pipe connections during installation • Pipe connections not properly tightened (too tight or too loose)	• Malfunctioning charging hose • Gauge improperly installed • Malfunctioning valve • Malfunctioning packing, etc.









Point-5

Evacuating the System

1. Close manifold gauge valve securely and disconnect charging hose from refrigerant can.
2. Connect center charging hose to vacuum pump.
3. Start pump, then open both valves and run pump for over 20 minutes.

Point-6

Charging

1. Close manifold gauge valves securely and disconnect charging hose from vacuum pump.
2. Purge air from center charging hose.
   1) Connect center charging hose to refrigerant can through charge valve.
   2) Break seal of refrigerant can and purge air.
3. Charge refrigerant into system.

WARNING:

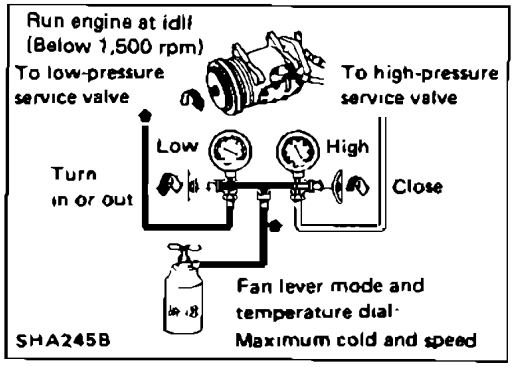
Ensure that engine is off.

1) Open high-pressure valve of manifold gauge and charge refrigerant into system.

CAUTION:

If charging liquefied refrigerant into the system with the can turned upside down to reduce charging time, charge it only through high-pressure (discharge) service valve. After charging, the compressor should always be turned several times manually.

2) When low-pressure gauge reading is 98 kPa (1.0 kg/cm^2, 14 psi), completely close high-pressure valve of manifold gauge and stop charging.



Point-7

Charging

1. Open manifold gauge low-pressure valve and charge refrigerant into system.

WARNING:

Ensure that engine is off.

2. When refrigerant charging speed slows down, start engine — air conditioning system ON, maximum cold temperature set, maximum blower speed set, can in upright position.
   Monitor sight glass. Charge is complete when sight glass is clear.

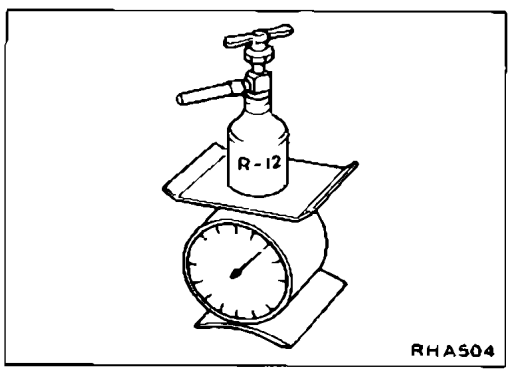
Cycling clutch systems will produce bubbles in sight glass when clutch engages. Therefore, allow 5 seconds after clutch engages to determine if bubbles continue, and, if so, add refrigerant to clear sight glass.

WARNING:

Never charge refrigerant through high-pressure side (discharge side) of system since this will force refrigerant back into refrigerant can and it may explode.

3. Charge refrigerant while controlling low-pressure gauge reading at 275 kPa (2.8 kg/cm^2, 40 psi) or less by turning in or out low-pressure valve of manifold gauge.

- **Be sure to purge air from charging hose when replacing can with a new one.**



4. Charge the specified amount of refrigerant into system by weighing charged refrigerant with scale. Overcharging will cause discharge pressure to rise.

   Refrigerant amount:

   0.9 - 1.0 kg (2.0 - 2.2 lb)

Point-7

Charging (Cont'd)

The state of the bubbles in the sight glass can only be used for checking whether the amount of charged refrigerant is small or not. The amount of charged refrigerant should be correctly judged by means of the discharge pressure.

5. After charging, be sure to install valve cap on service valve.
6. Confirm that there are no leaks in system by checking with a leak detector.

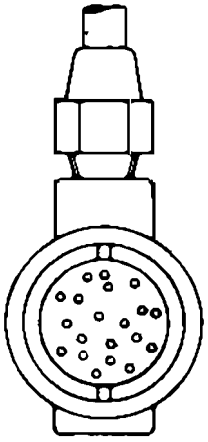
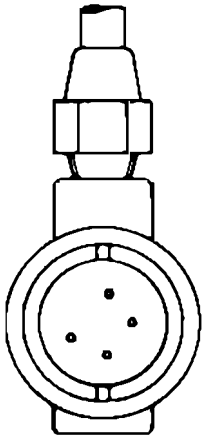
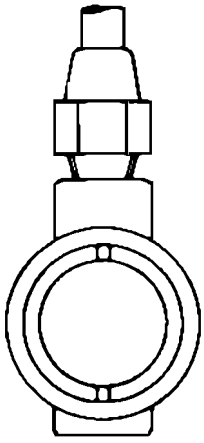
- When refrigerant charging is performed with a charging cylinder, charging station, or automatic charging equipment with engine off, charge only through high pressure side. After specified refrigerant amount has entered the system, close high-pressure valve on gauge set. Start engine, return to idle speed, operate A/C at maximum temperature setting, high blower. Observe sight glass to confirm complete charge.

Overcharging will result in increased high pressures, and reduced performance.

Checking Refrigerant Level

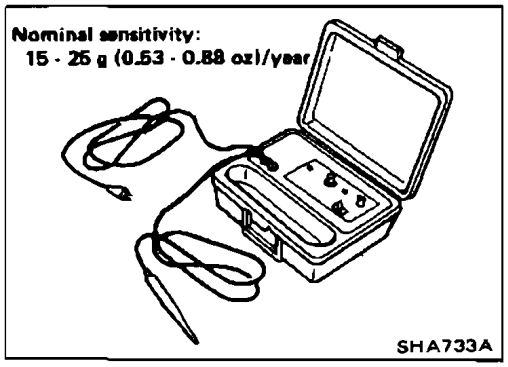
CONDITION

- Door window: Open
- A/C switch: ON
- TEMP. lever position: Max. COLD
- FAN lever position: 4
- Check sight glass after a lapse of about five minutes.

Amount of refrigerant / Check item	Almost no refrigerant	Insufficient	Suitable	Too much refrigerant
Temperature of high-pressure and low-pressure lines.	Almost no difference between high-pressure and low-pressure side temperature.	High-pressure side is warm and low-pressure side is fairly cold	High-pressure side is hot and low-pressure side is cold.	High-pressure side is abnormally hot.
State in sight glass.	Bubbles flow continuously. Bubbles will disappear and something like mist will flow when refrigerant is nearly gone.  AC256	The bubbles are seen at intervals of 1 - 2 seconds.  AC257	Almost transparent. Bubbles may appear when engine speed is raised and lowered. No clear difference exists between these two conditions.  AC258	No bubbles can be seen.
Pressure of system.	High-pressure side is abnormally low.	Both pressures on high and low-pressure sides are slightly low.	Both pressures on high and low-pressure sides are normal.	Both pressures on high and low-pressure sides are abnormally high.
Repair.	Stop compressor immediately and conduct an overall check.	Check for gas leakage, repair as required, replenish and charge system.		Discharge refrigerant from service valve of low-pressure side.

a. The bubbles seen through the sight glass are influenced by the ambient temperature. Since the bubbles are hard to show up in comparatively low temperatures below 20°C (68°F), it is possible that a slightly larger amount of refrigerant would be filled, if supplied according to the sight glass. Recheck the amount when it exceeds 20°C (68°F). In higher temperature the bubbles are easy to show up.

b. When the screen in the receiver drier is clogged, the bubbles will appear even if the amount or refrigerant is normal. In this case, the outlet side pipe of the receiver drier becomes considerably cold.

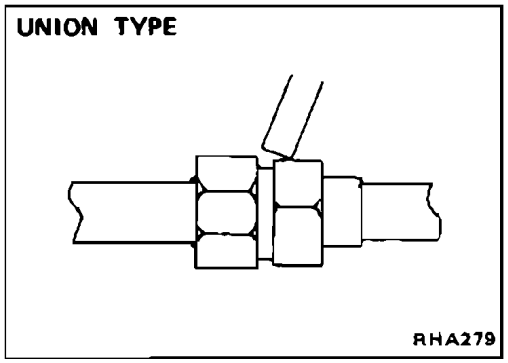


Checking Refrigerant Leaks

ELECTRIC LEAK DETECTOR

The leak detector is a delicate device that detects small amounts of halogen.

To use the device properly, read the manufacturer's manuals. Also perform the specified maintenance and inspections.

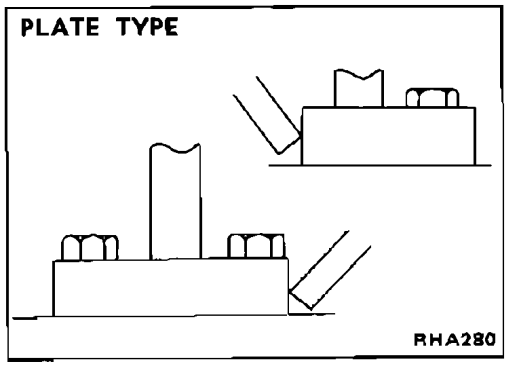


GENERAL PRECAUTIONS FOR HANDLING LEAK DETECTOR

Place the probe on connection fitting and wait for 5 seconds or more.

To check cooling unit, wait for 10 seconds or more.

If a leak is detected, keep the probe as still as possible for one more minute.

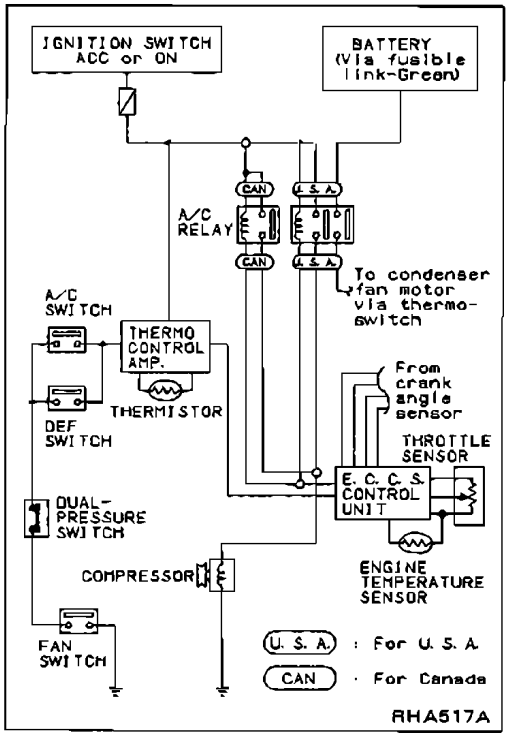


When testing single-bolt flange, place the probe on the opposite side of the fitting.

MEASUREMENT STANDARD

If any leak is noted with a detector having a nominal sensitivity of 15 to 25 g (0.53 to 0.88 oz)/year, that leak must be repaired.

- The nominal sensitivity of the detector is determined under the assumption that all the leaking gas is collected by the detector. Accordingly, the quantity of gas actually leaking can amount to five to ten times the indicated value. Generally speaking, leakage of 150 to 200 g (5.29 to 7.05 oz) of refrigerant can cause insufficient cooling.
- Oil deposited during assembling must be wiped off before inspection. Refrigerant easily dissolves in oil, and the presence of oil can cause an error in measurement.
  This precaution is important when checking a used car for refrigerant leakage.
- If oil is noted at or around connections, it indicates that refrigerant is leaking.



Acceleration Cut System

This system is controlled by the E.C.C.S. control unit.
When the engine is heavily over loaded (throttle sensor judges that throttle valve is at full throttle position), the compressor is turned off for approx. 4 seconds to reduce overloading.
Additionally when the temperature of engine coolant rises above approx. 113°C (235°F), the compressor is turned off.

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

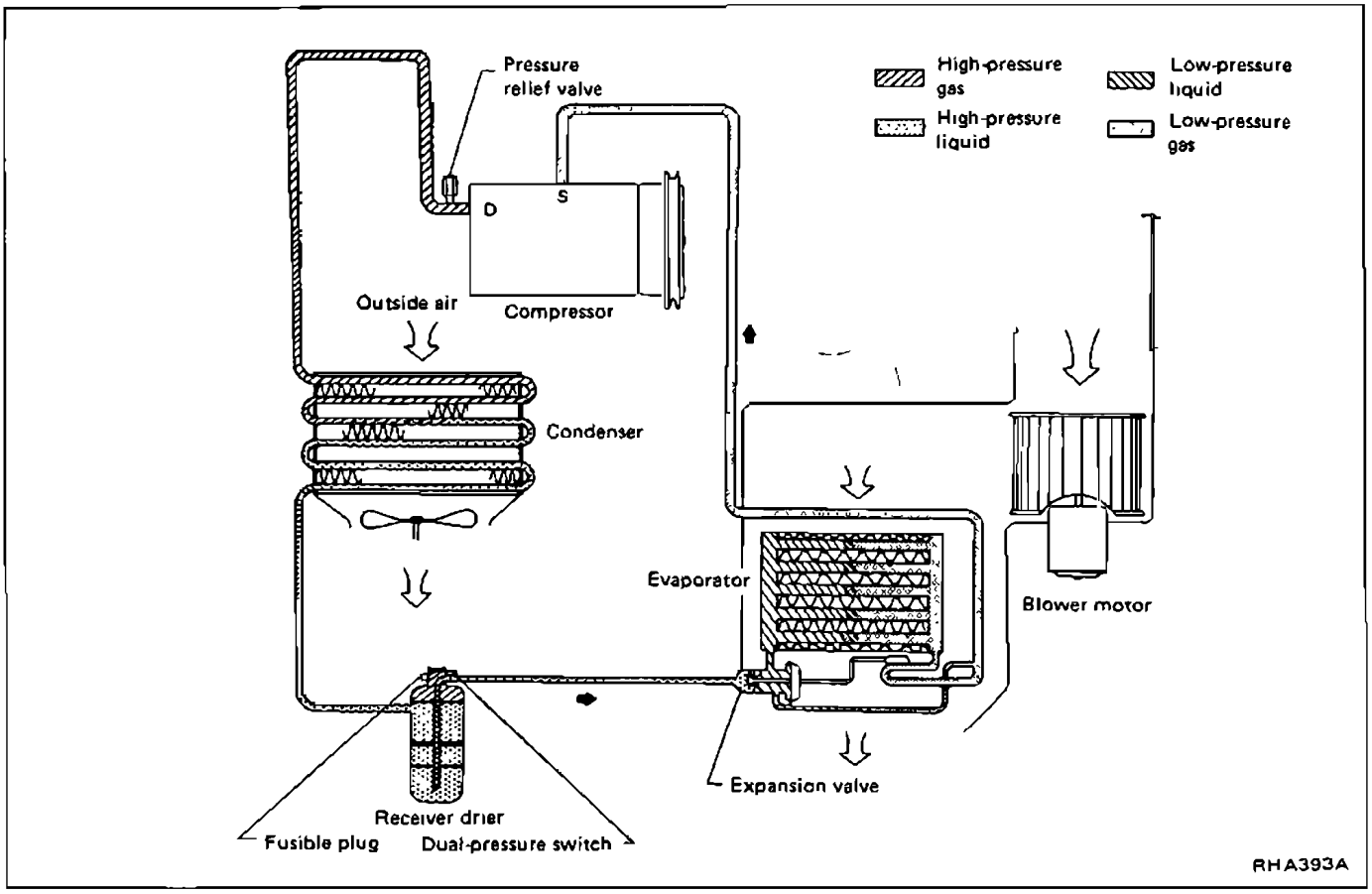
The refrigerant system is protected against excessively high or low pressures by the dual-pressure switch, located on the receiver drier. If the system pressure rises above, or falls below the specifications, the dual-pressure switch opens to interrupt the compressor operation.

Fusible plug

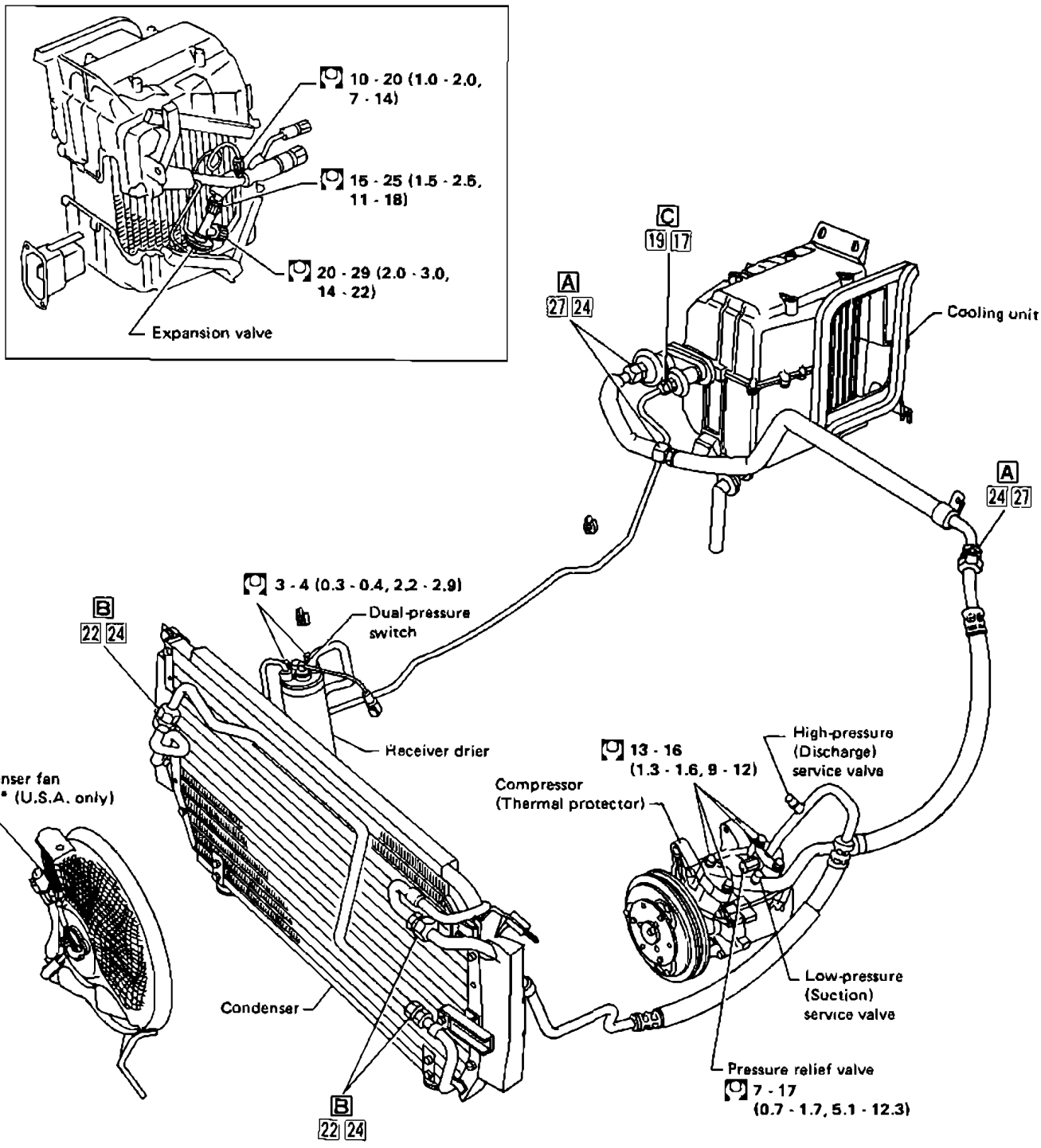
Open at temperature above 105°C (221°F), thereby discharging refrigerant to the atmosphere. If this plug is melted and opened, check the refrigerant line and replace receiver drier.

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



*: For removal, it is necessary to remove condenser.

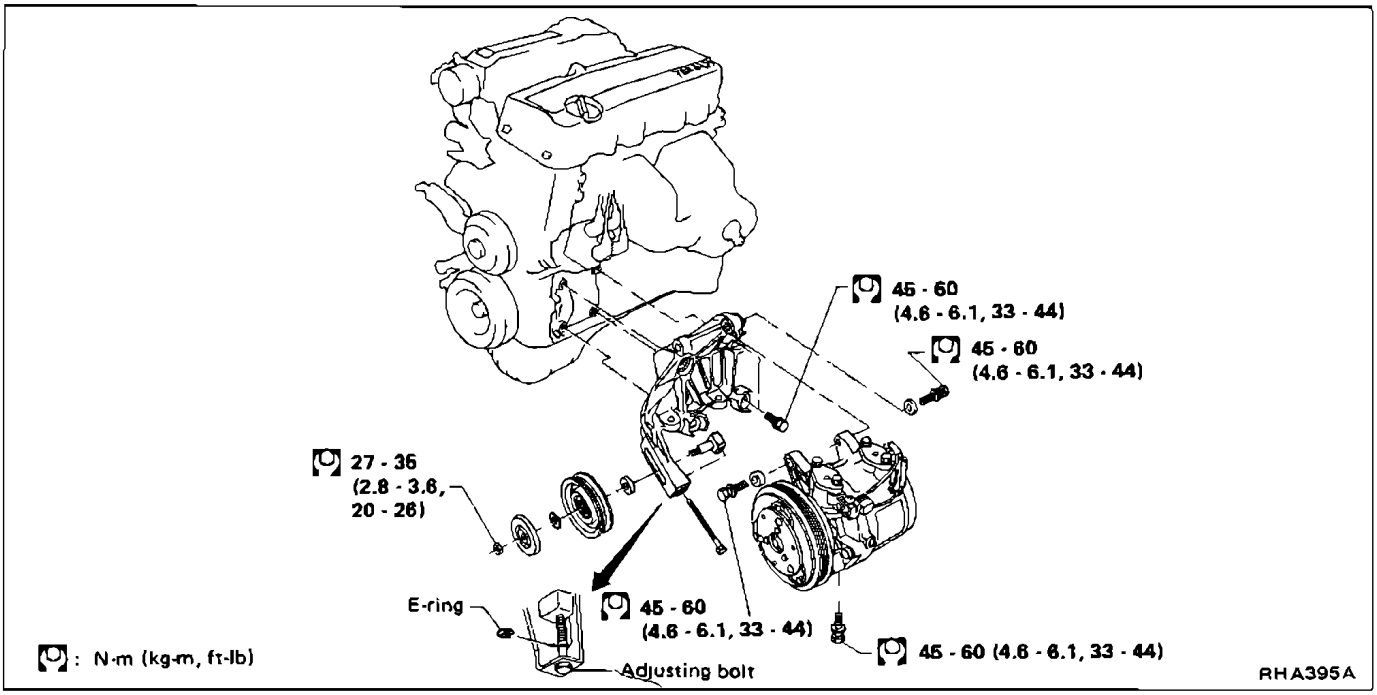
(Tightening torque)
(Wrench size)

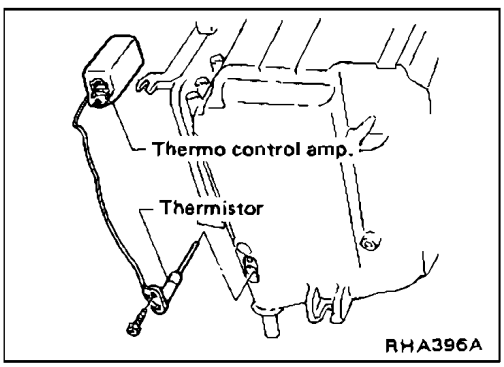
A 20 - 29 (2.0 - 3.0, 14 - 22)
B 15 - 25 (1.5 - 2.5, 11 - 18)
C 10 - 20 (1.0 - 2.0, 7 - 14)

: N·m (kg-m, ft-lb)

RHA394A

Compressor Mounting





Thermo Control Amp.

REPLACEMENT

Remove screws, which secure thermistor locating stay, from front of cooling unit. Replace thermo control amp. assembly with a new one. (Without removing cooling unit, thermo control amp. can be replace.)

Belt Tension

- **Refer to MA section.**

Fast Idle Control Device (F.I.C.D.)

- **Refer to EF & EC section.**

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
- MODE switch: (Ventilation) set
- REC switch: (Recirculation) set
- FAN lever position: Max. position
- Engine speed: 1,500 rpm
- Time required before starting testing after air conditioner starts operating: More than 10 minutes

For U.S.A. model, make sure that condenser fan motor does not operate during the following tests.

TEST READING

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)	1.6 - 2.7 (35 - 37)
	25 (77)	4.4 - 6.0 (40 - 43)
	30 (86)	9.2 - 11.3 (49 - 52)
	35 (95)	14.8 - 17.0 (59 - 63)
	40 (104)	18.1 - 20.3 (65 - 69)
60 - 70	20 (68)	2.7 - 4.3 (37 - 40)
	25 (77)	6.0 - 8.2 (43 - 47)
	30 (86)	11.3 - 13.8 (52 - 57)
	35 (95)	17.0 - 19.5 (63 - 67)
	40 (104)	20.3 - 22.8 (69 - 73)

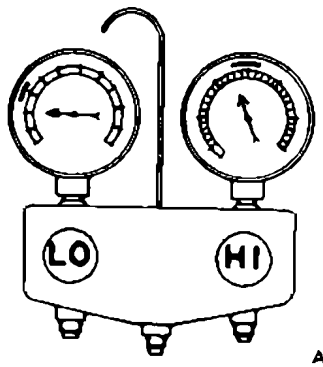
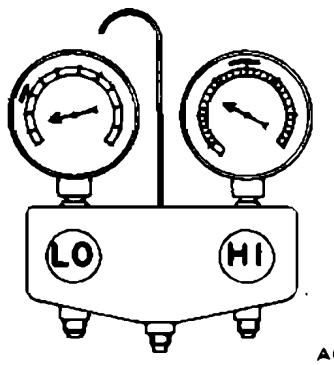
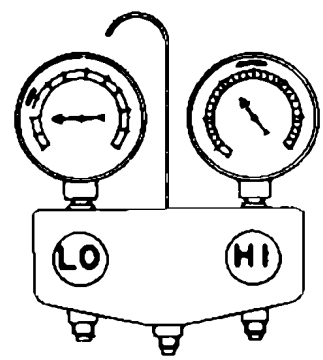
Ambient air temperature-to-compressor pressure table

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)	1,030 - 1,255 (10.5 - 12.8, 149 - 182)	98.1 - 142.2 (1.0 - 1.45, 14.2 - 20.6)
	25 (77)	1,196 - 1,471 (12.2 - 15.0, 173 - 213)	122.6 - 171.6 (1.25 - 1.75, 17.8 - 24.9)
	30 (86)	1,402 - 1,706 (14.3 - 17.4, 203 - 247)	161.8 - 210.9 (1.65 - 2.15, 23.5 - 30.6)
	35 (95)	1,608 - 1,971 (16.4 - 20.1, 233 - 286)	205.9 - 259.9 (2.1 - 2.65, 29.9 - 37.7)
	40 (104)	1,844 - 2,256 (18.8 - 23.0, 267 - 327)	259.9 - 318.7 (2.65 - 3.25, 37.7 - 46.2)

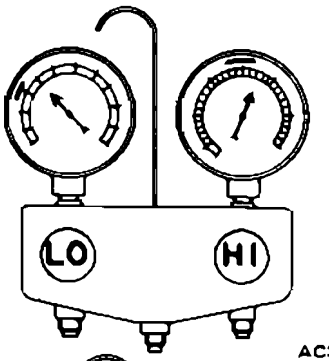
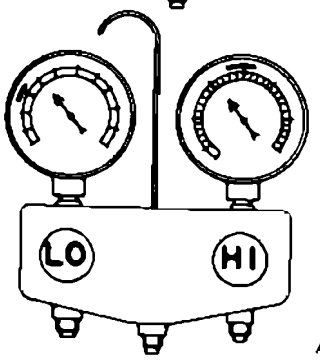
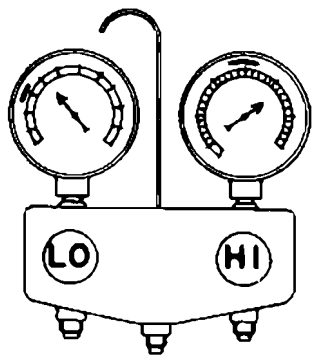
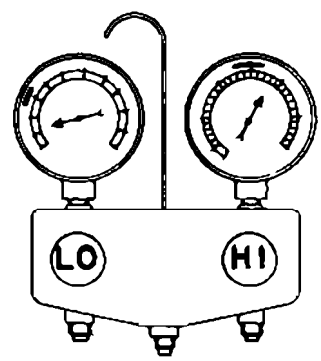
Performance Test Diagnoses

Characteristics revealed by the manifold gauge readings for the air conditioning system are shown in the following table.
For how to do the performance test, refer to the item "Performance Chart".

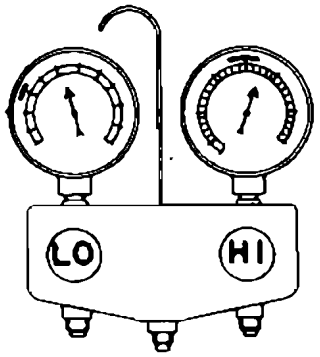
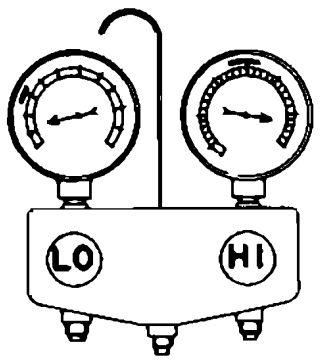
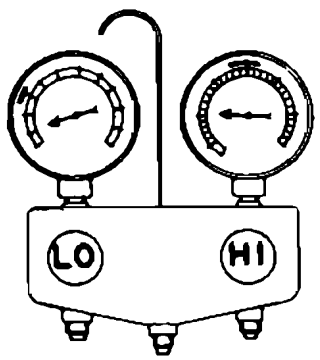
In the following table, the portion smeared with ink on each gauge scale indicates the range showing that the air conditioning system is in good order. This range is described in Performance Chart.

Condition	Probable cause	Corrective action
INSUFFICIENT REFRIGERANT CHARGE  AC352A Insufficient cooling. Bubbles appear in sight glass.	Refrigerant is low, or leaking slightly.	1. Leak test. 2. Repair leak. 3. Charge system. **Evacuate, as necessary, and recharge system.**
ALMOST NO REFRIGERANT  AC353A No cooling action. A lot of bubbles or something like mist appears in sight glass.	Serious refrigerant leak.	**Stop compressor immediately.** 1. Leak test. 2. Discharge system. 3. Repair leak(s). 4. Replace receiver drier if necessary. 5. Check oil level. 6. Evacuate and recharge system.
MALFUNCTIONING EXPANSION VALVE  AC354A Slight cooling. Sweat or frosting on expansion valve inlet.	Expansion valve restricts refrigerant flow. • Expansion valve is clogged. • Expansion valve is inoperative. Valve stuck closed. Thermal bulb has lost charge.	If valve inlet reveals sweat or frost: 1. Discharge system. 2. Remove valve and clean it. Replace it if necessary. 3. Evacuate system. 4. Charge system. If valve does not operate: 1. Discharge system. 2. Replace valve. 3. Evacuate and charge system.

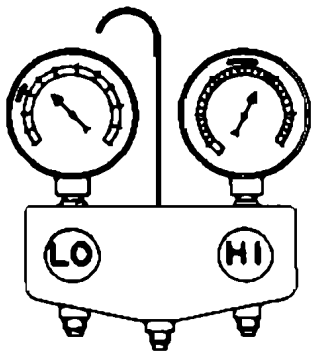
Performance Test Diagnoses (Cont'd)

Condition		Probable cause	Corrective action
 AC365A	Insufficient cooling. Sweat on suction line.	Expansion valve allows too much refrigerant through evaporator.	Check valve for operation. If suction side does not show a pressure decrease, replace valve.
 AC356A	No cooling. Sweat or frosting on suction line.	Malfunctioning expansion valve.	1. Discharge system. 2. Replace valve. 3. Evacuate and charge system.
AIR IN SYSTEM			
 AC359A	Insufficient cooling. Sight glass shows occasional bubbles.	Air mixed with refrigerant in system.	1. Discharge system. 2. Replace receiver drier. 3. Evacuate and charge system.
MOISTURE IN SYSTEM			
 AC360A	After short operation, suction side may show vacuum pressure reading. During this condition, discharge air will be warm. As a warning of this, reading vibrates around 39 kPa (0.4 kg/cm^2, 6 psi).	Drier is saturated with moisture. Moisture has frozen in expansion valve. Refrigerant flow is restricted.	1. Discharge system. 2. Replace receiver drier (twice if necessary). 3. Evacuate system completely. (Repeat 30-minutes evacuating three times.) 4. Recharge system.

Performance Test Diagnoses (Cont'd)

Condition	Probable cause	Corrective action
MALFUNCTIONING CONDENSER  AC361A No cooling action: engine may overheat. Bubbles appear in sight glass of drier. Suction line is very hot.	Usually a malfunctioning condenser.	• Check fan belt and fluid coupling • Check condenser fan motor. (U.S.A. model only) • Check condenser for dirt accumulation. • Check engine cooling system for overheating. • Check for refrigerant overcharging. **If pressure remains high in spite of all above actions taken, remove and inspect the condenser for possible oil clogging.**
HIGH PRESSURE LINE BLOCKED  AC362A Insufficient cooling. Frosted high-pressure liquid line.	Drier clogged, or restriction in high-pressure line.	1. Discharge system. 2. Remove receiver drier or strainer and replace it. 3. Evacuate and charge system.
MALFUNCTIONING COMPRESSOR  AC363A Insufficient cooling.	Internal problem in compressor, or damaged gasket and valve.	1. Discharge system. 2. Remove and check compressor. 3. Repair or replace compressor. 4. Check oil level. 5. Replace receiver drier. 6. Evacuate and charge system.

Performance Test Diagnoses (Cont'd)

Condition		Probable cause	Corrective action
TOO MUCH OIL IN SYSTEM (Excessive)  AC364A	Insufficient cooling.	Too much oil circulates with refrigerant, causing the cooling capacity of the system to be reduced.	Refer to COMPRESSOR OIL for correcting oil level.

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	Approx. 100 (3.4, 3.5)*
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 90 mℓ (3.0 US fl oz, 3.2 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 90 (3.0, 3.2)*	Oil level is right. Pour in same amount of oil as was drained out.
Below 90 (3.0, 3.2)	Oil level may be low. Pour in 90 mℓ (3.0 US fl oz, 3.2 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 90 (3.0, 3.2)*	200 (6.8, 7.0) − [Amount of oil drained + 20 (0.7, 0.7)]
Below 90 (3.0, 3.2)	90 (3.0, 3.2)

*: 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 compressor service parts.]

Example:

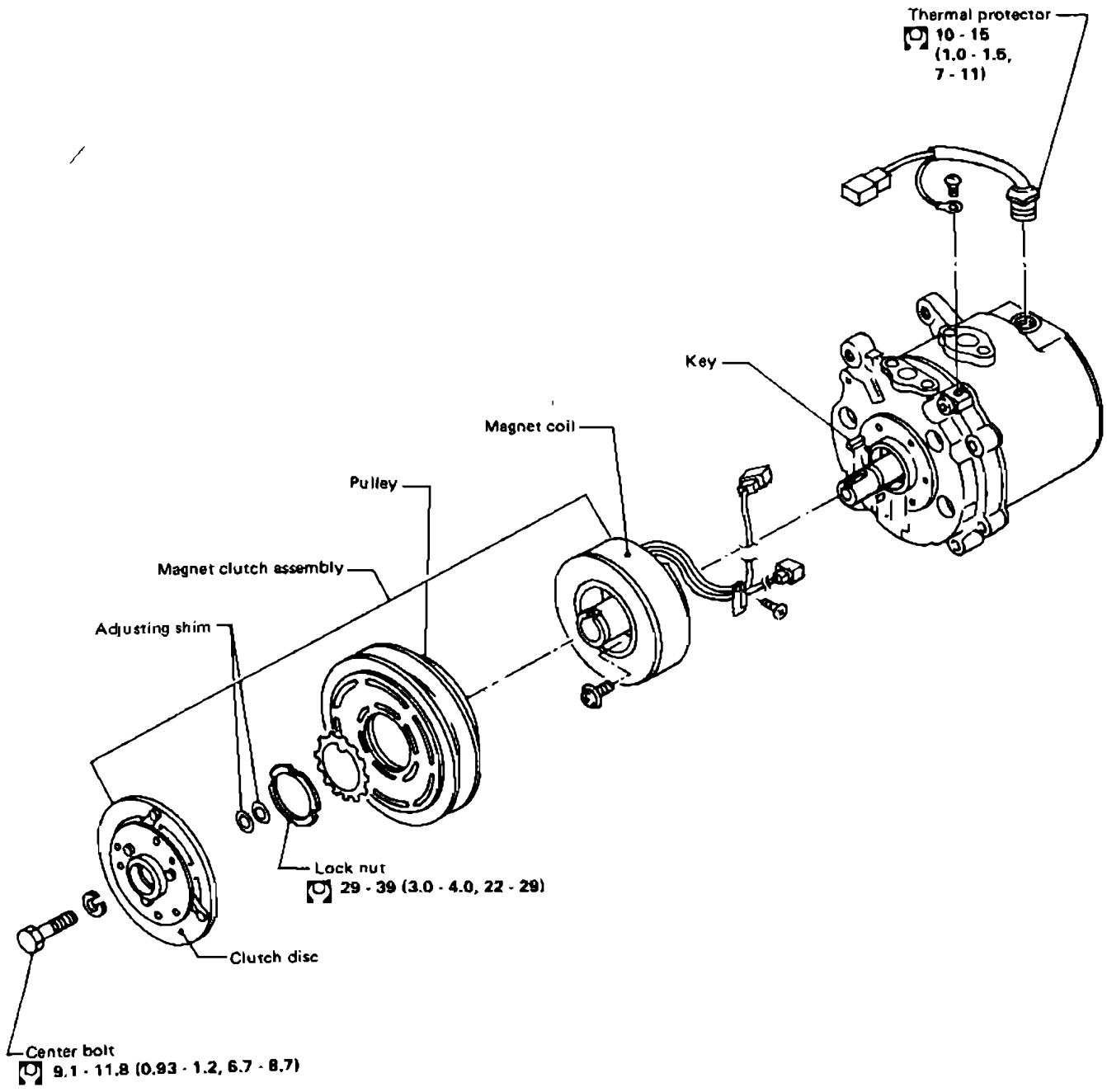
Unit: mℓ (US fl oz, Imp fl oz)

Amount of oil drained from used compressor	Draining amount of oil from new compressor
110 (3.7, 3.9)	70 (2.4, 2.5)
70 (2.4, 2.5)	90 (3.0, 3.2)

(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.]

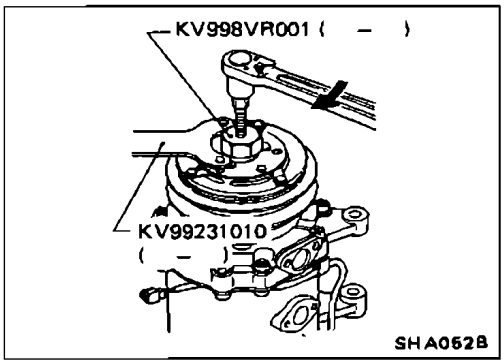
Precautions

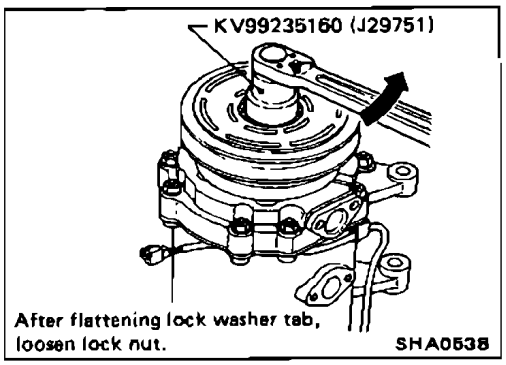
- Plug all openings to prevent moisture and foreign matter from entering.
- Do not leave compressor on its side or upside down for more than 10 minutes.
- When replacing or repairing compressor, check compressor oil level in system.
- When replacing with a new compressor, drain specified oil from new 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.

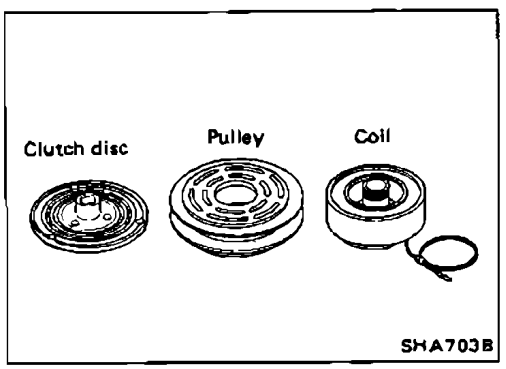


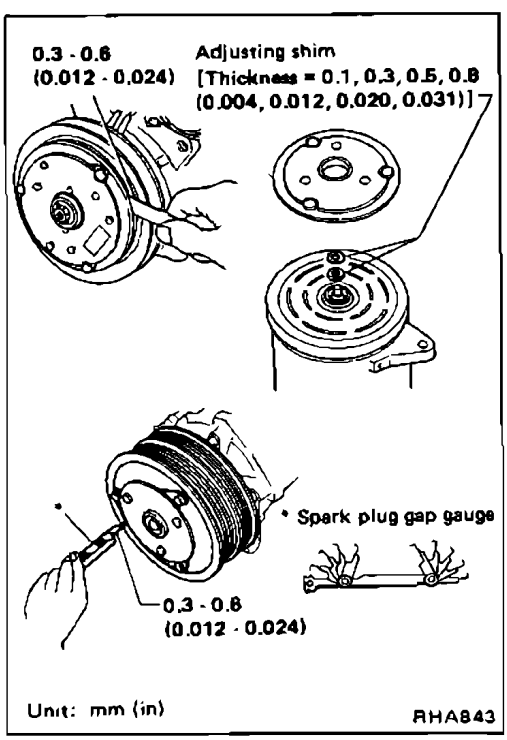
: N·m (kg-m, ft-lb)

RHA283









Compressor Clutch

REPLACEMENT

- When removing center bolt, hold clutch disc with clutch disc wrench.
- Using clutch disc puller, clutch disc can be removed.

- Bend down pawl of lock washer.
- When removing pulley, remove lock nut with nut wrench.

INSPECTION

Clutch disc

If the contact surface shows signs of damage due to excessive heat, the drive plate 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 drive plate should be replaced. The contact surfaces of the pulley assembly should be cleaned with a suitable solvent before reinstallation.

Coil

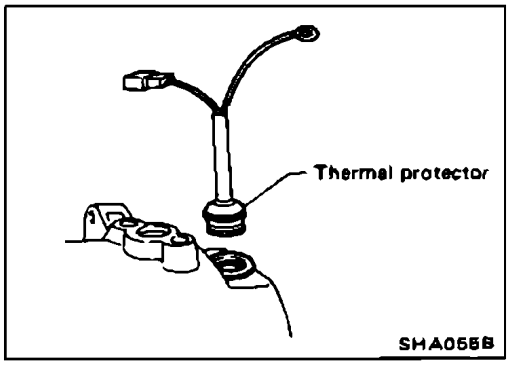
Check coil for loose connection or cracked insulation.

ADJUSTMENT

- When assembling clutch disc, adjust disc-to-pulley clearance with shims.

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.

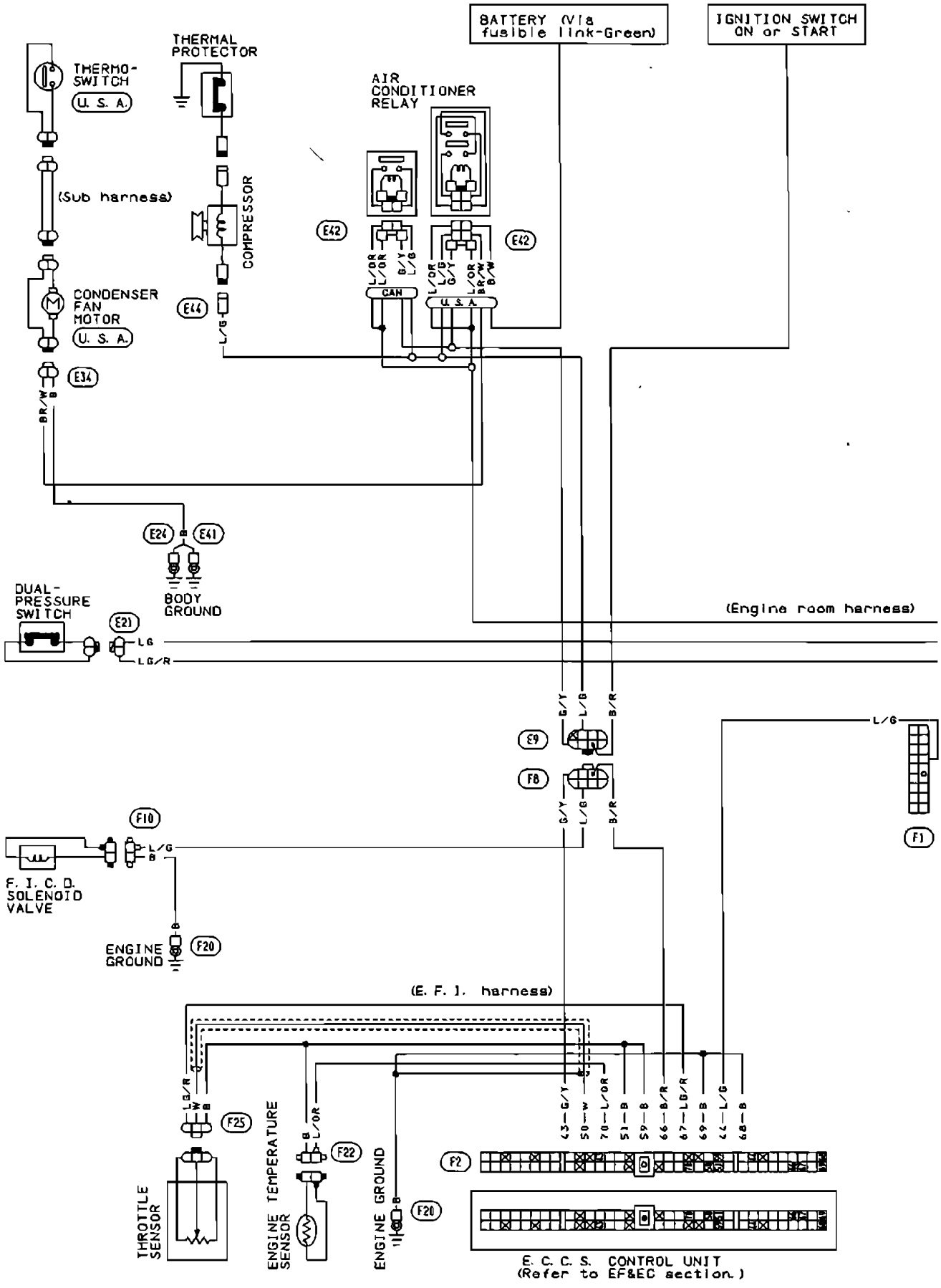


Thermal Protector

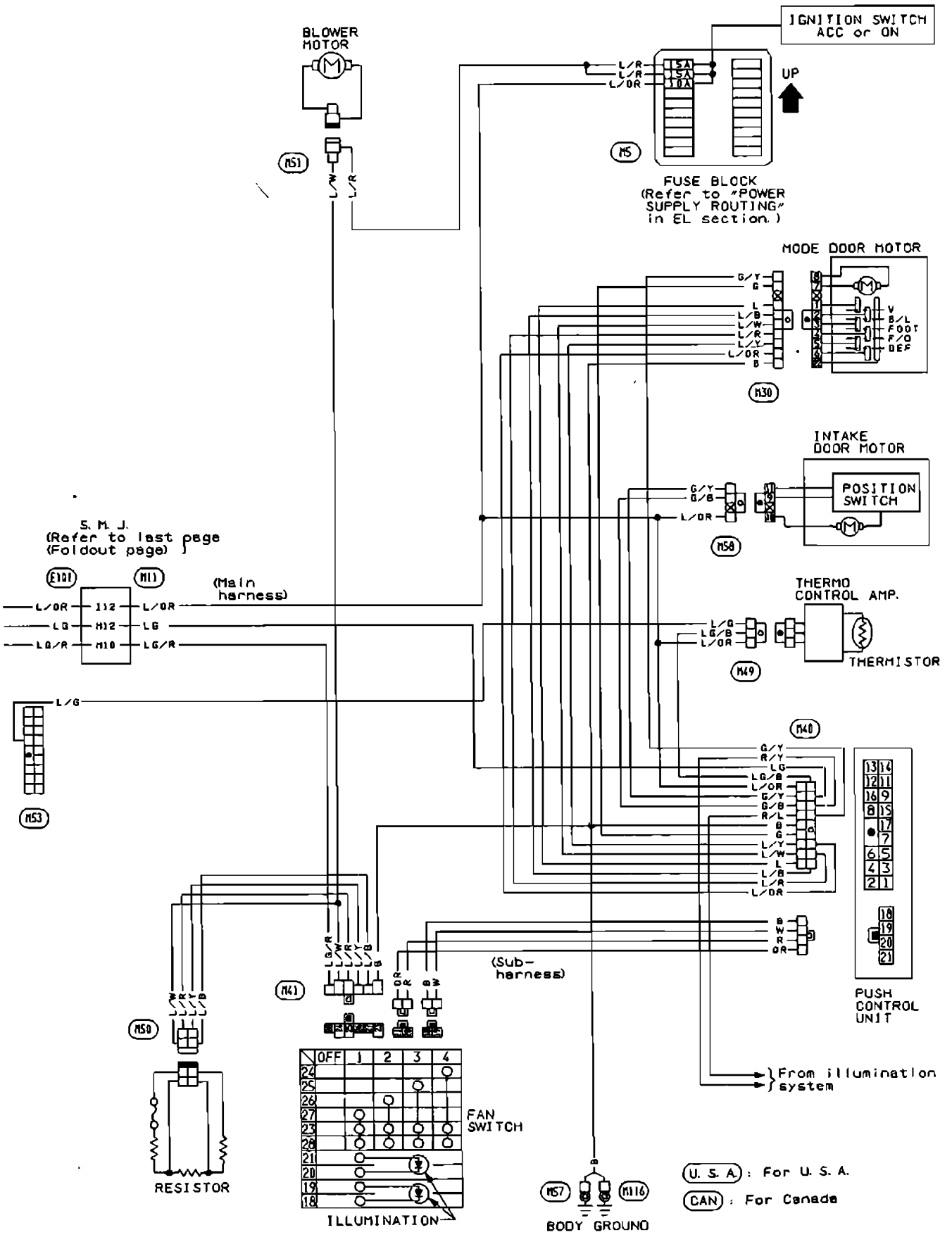
- When servicing, do not allow foreign matter to get into compressor.
- Check continuity between two terminals.

NOTE

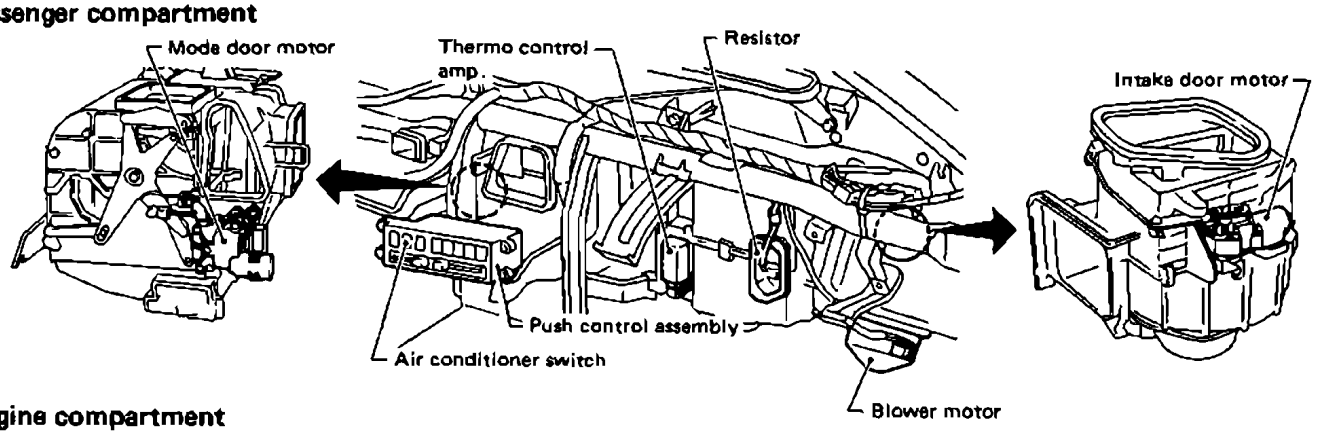
Wiring Diagram



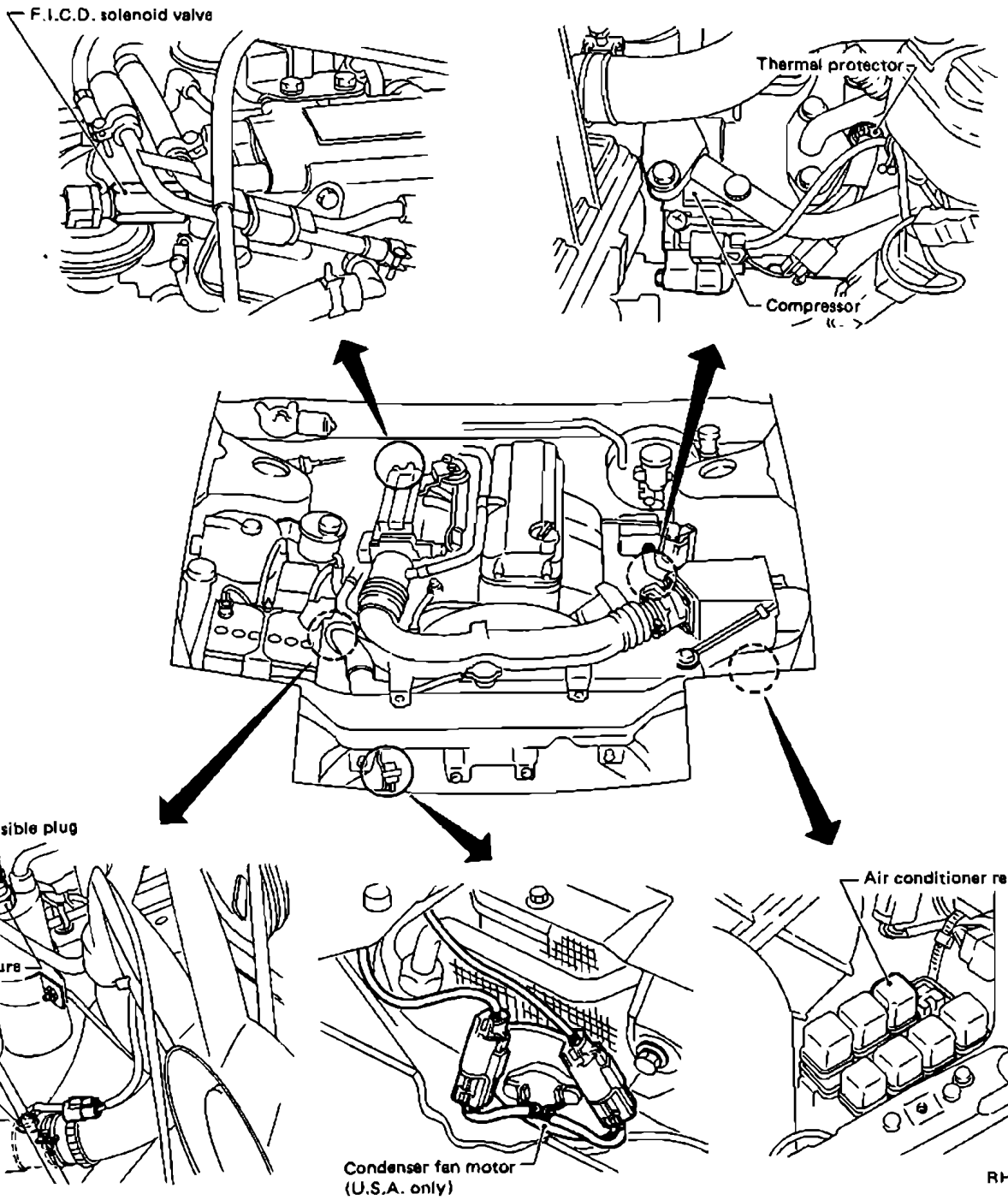
Wiring Diagram (Cont'd)



Passenger compartment



Engine compartment



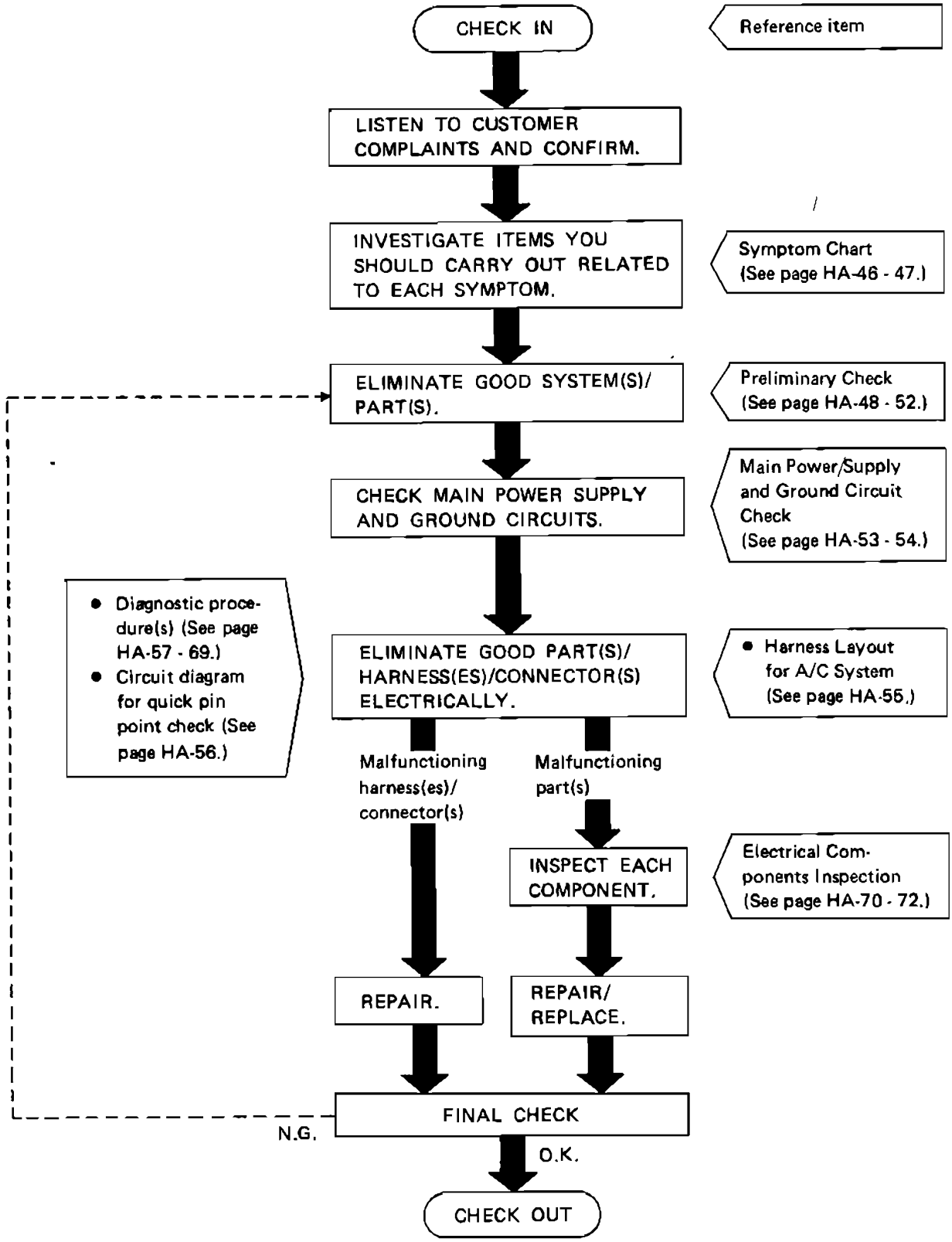
NOTE

Contents

How to Perform Trouble Diagnoses for Quick and Accurate Repair HA-45
Symptom Chart HA-46
Preliminary Check HA-48
PRELIMINARY CHECK 1
(Intake door is not set at "FRESH" in DEF or FOOT mode.) HA-48
PRELIMINARY CHECK 2
(A/C does not blow cold air.) HA-49
PRELIMINARY CHECK 3
(Magnet clutch does not engage in DEF mode.) HA-50
PRELIMINARY CHECK 4
(Air outlet does not change.) HA-51
PRELIMINARY CHECK 5
(Noise) HA-52
Main Power Supply and Ground Circuit Check HA-53
Harness Layout for A/C System HA-55
Circuit Diagram for Quick Pin Point Check HA-56
Diagnostic Procedure 1
(SYMPTOM: Blower motor does not rotate.) HA-57
Diagnostic Procedure 2
(SYMPTOM: Air outlet does not change.) HA-59
Diagnostic Procedure 3
(SYMPTOM: Intake door does not change in VENT, B/L or FOOT mode.) HA-61
Diagnostic Procedure 4
(SYMPTOM: Magnet clutch does not engage with A/C switch and fan switch are ON.) HA-62
Diagnostic Procedure 5
(SYMPTOM: Illumination or indicators of push control unit do not come on.) HA-66
Electrical Components Inspection HA-70

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-48	HA-49	HA-50	HA-51	HA-52	HA-57 - 58	HA-59 - 60	HA-61	HA-62 - 65	HA-66	HA-53	HA-53	HA-54	HA-53
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	15A Fuses	10A Fuse	Push control unit	Thermo control amp.
A/C does not blow cold air.		❶				○			○		○	○		○
Blower motor does not rotate.		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 FOOT mode.	❶							○				○	○	
Magnet clutch does not engage when A/C switch and fan switch are ON.		❶							❷			○		○
Magnet clutch does not engage in DEF mode.		❶	❷						○			○		○
Illumination or indicators of push control unit do not come on.										❶		○		
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)

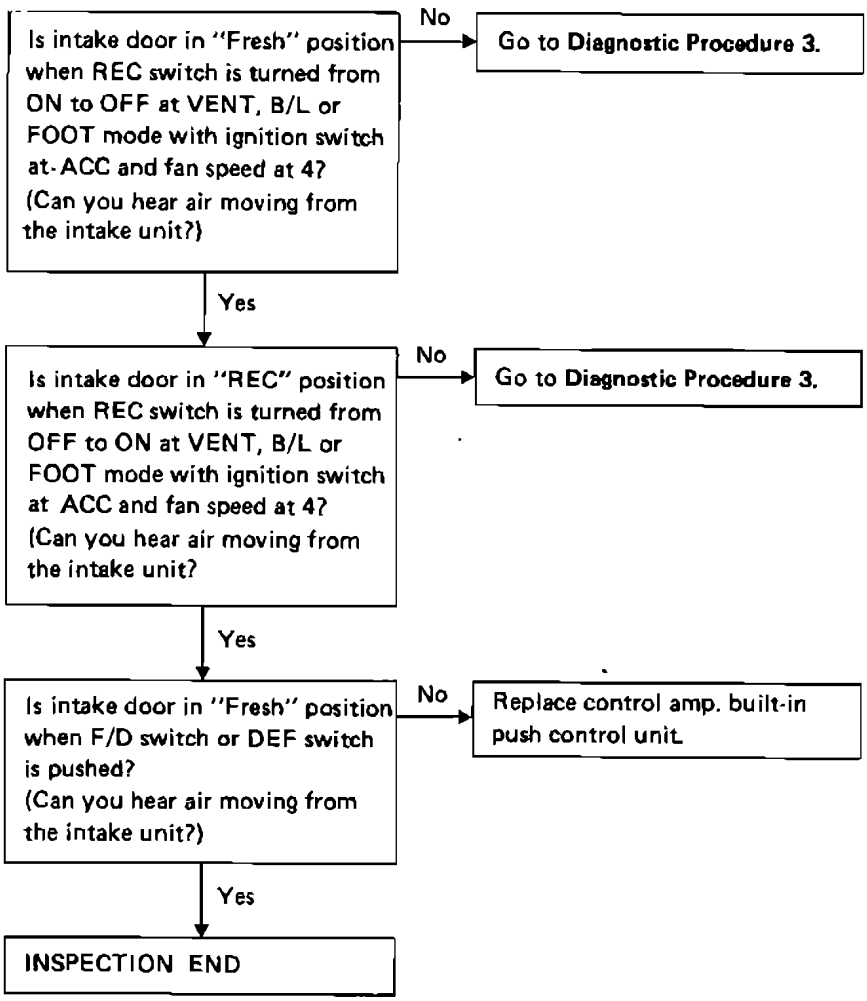
Electrical Components Inspection

| | | |

Preliminary Check

PRELIMINARY CHECK 1

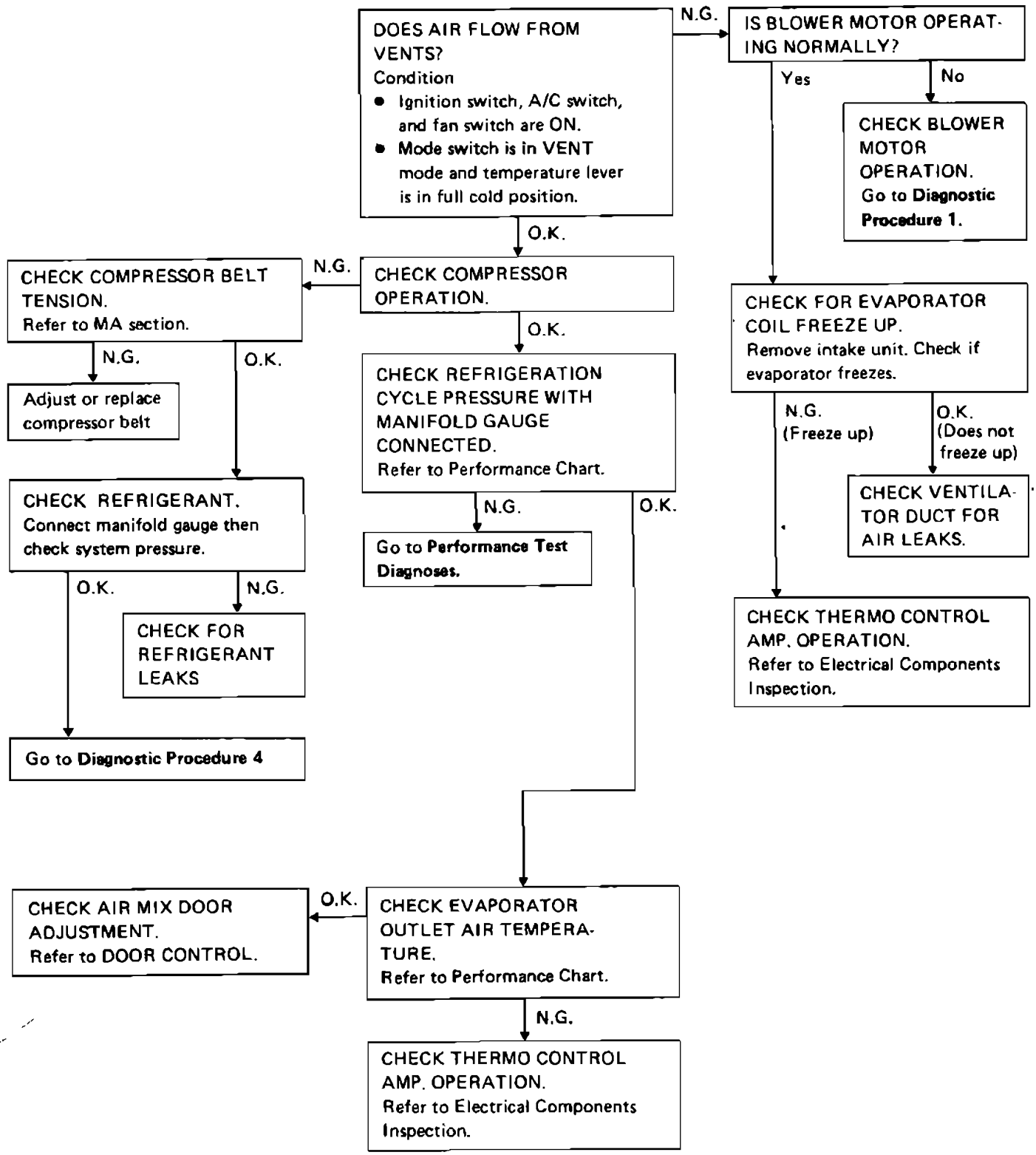
Intake door is set at "FRESH" in DEF or F/D mode.



Preliminary Check (Cont'd)

PRELIMINARY CHECK 2

A/C does not blow cold air.

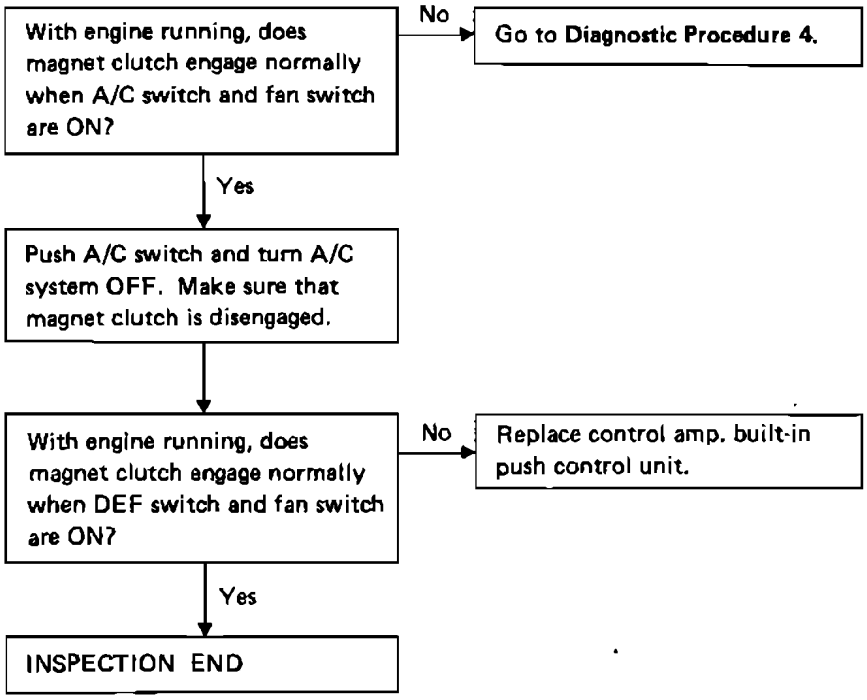


Preliminary Check (Cont'd)

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

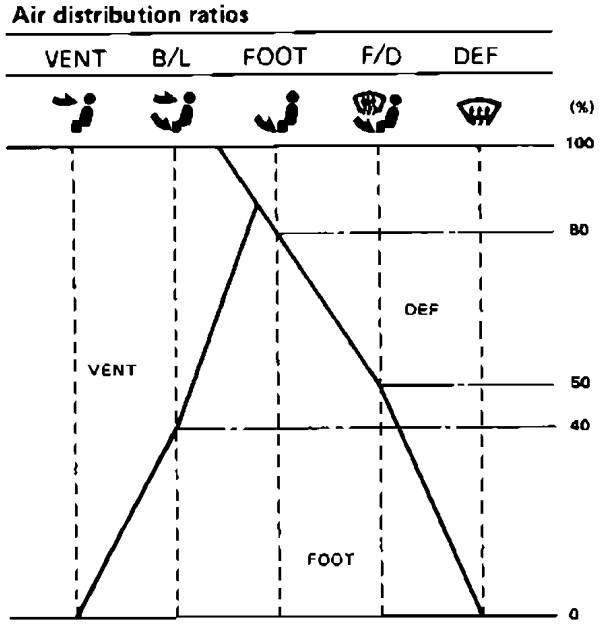
Air outlet does not change.

DOES AIR COME OUT FROM EACH DUCT NORMALLY WHEN EACH MODE SWITCH IS PUSHED WITH IGNITION SWITCH AT ACC?

No → Go to **Diagnostic Procedure 2.**

Switch	Indicator illuminates					Air outlet
Mode						
	○					VENT
		○				FOOT & VENT
			○			FOOT & DEF
				○		FOOT & DEF
					○	DEF

Air distribution ratios



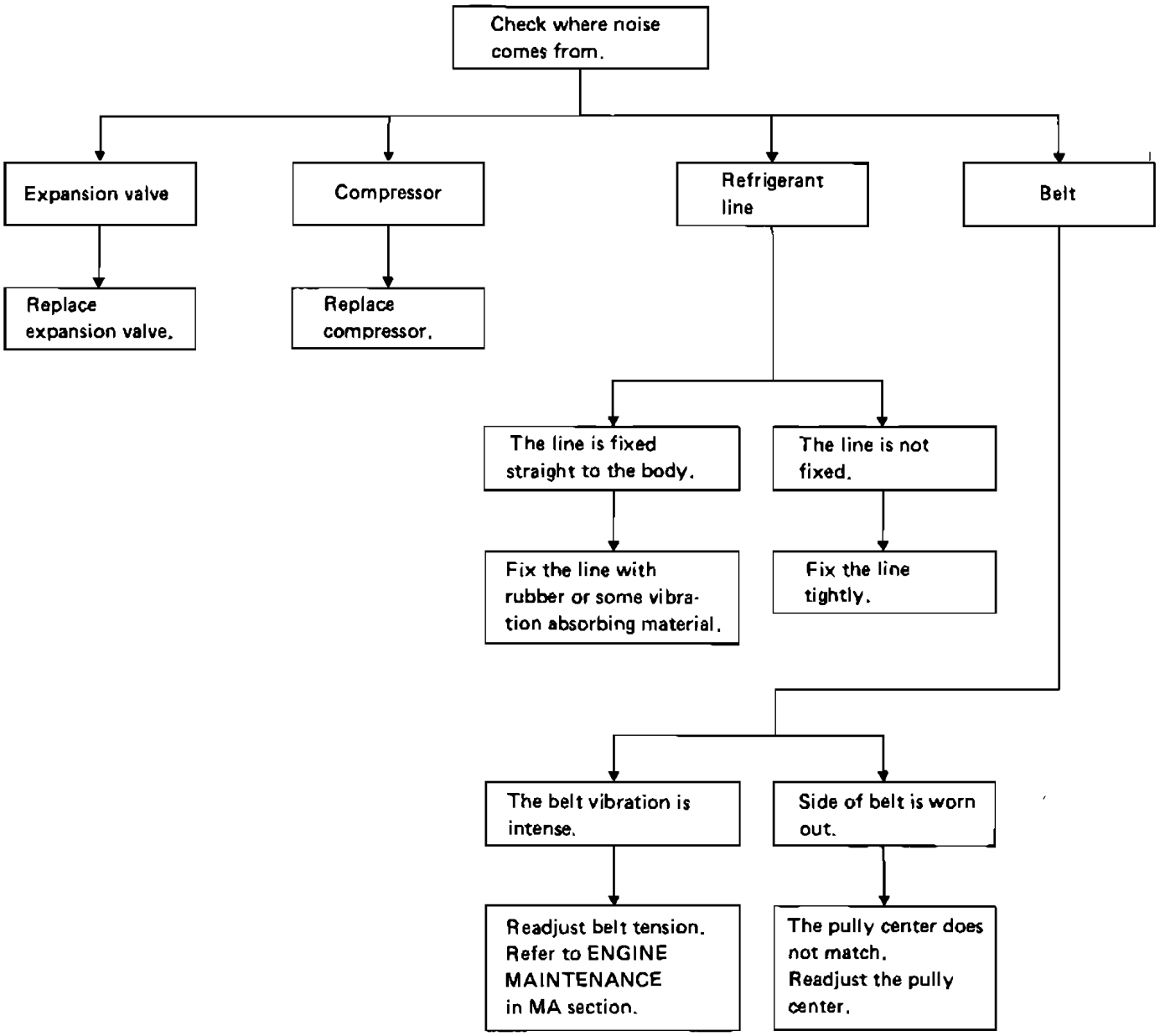
Yes

INSPECTION END

Preliminary Check (Cont'd)

PRELIMINARY CHECK 5

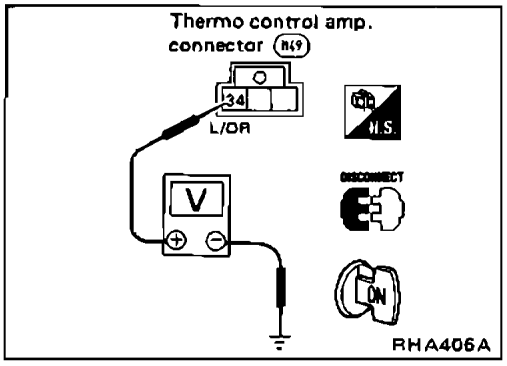
Noise



Main Power Supply and Ground Circuit Check

POWER SUPPLY CIRCUIT CHECK FOR A/C SYSTEM

Check power supply circuit for air conditioning system.
Refer to "POWER SUPPLY ROUTING" in EL section and A/C ELECTRICAL CIRCUIT.

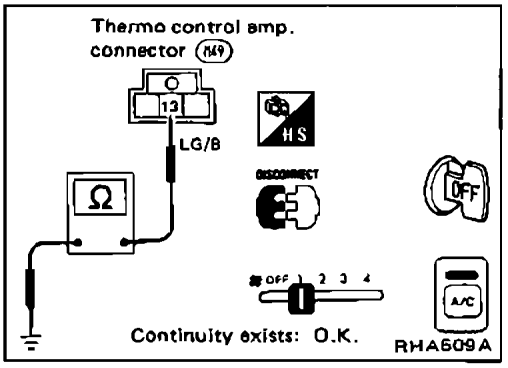


THERMO CONTROL AMP. CHECK

Check power supply circuit for thermo control amp. with ignition switch ON.

1. Disconnect thermo control amp. 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

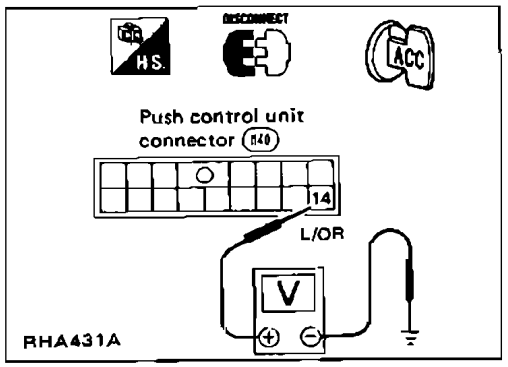


Check body ground circuit for thermo control amp. with ignition switch OFF, A/C switch ON and fan switch ON.

1. Disconnect thermo control amp. harness connector.
2. Connect ohmmeter from harness side.
3. Check for continuity between terminal No. ⑬ and body ground.

Ohmmeter terminal		Continuity
⊕	⊖	
⑬	Body ground	Yes

Main Power Supply and Ground Circuit Check (Cont'd)

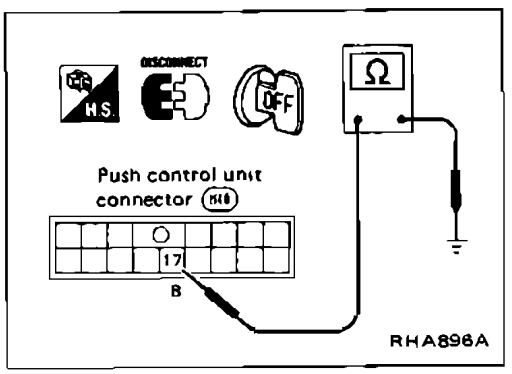


PUSH CONTROL UNIT CHECK

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. ⑭ and body ground.

Voltmeter terminal		Voltage
⊕	⊖	
⑭	Body ground	Approx. 12V

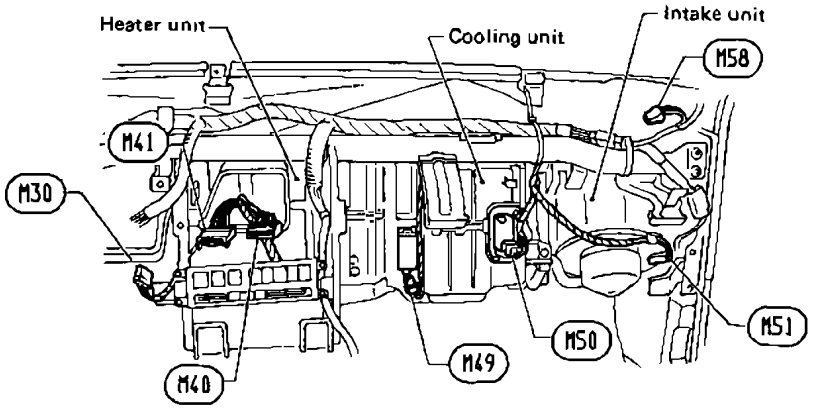


Check body ground circuit for push control unit with ignition switch OFF.

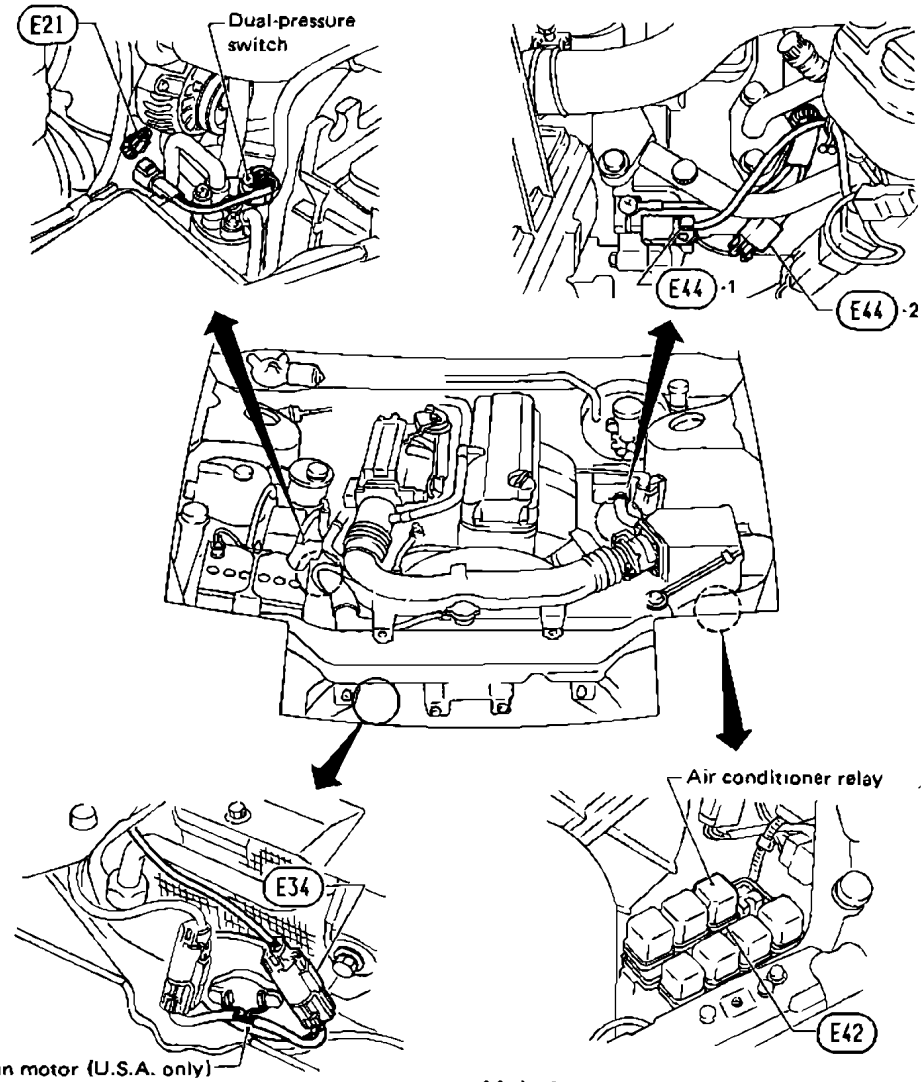
1. Disconnect push control unit harness connector.
2. Connect ohmmeter from harness side.
3. Check for continuity between terminal No. ⑰ and body ground.

Harness Layout for A/C System

Passenger compartment



Engine compartment



Engine room harness

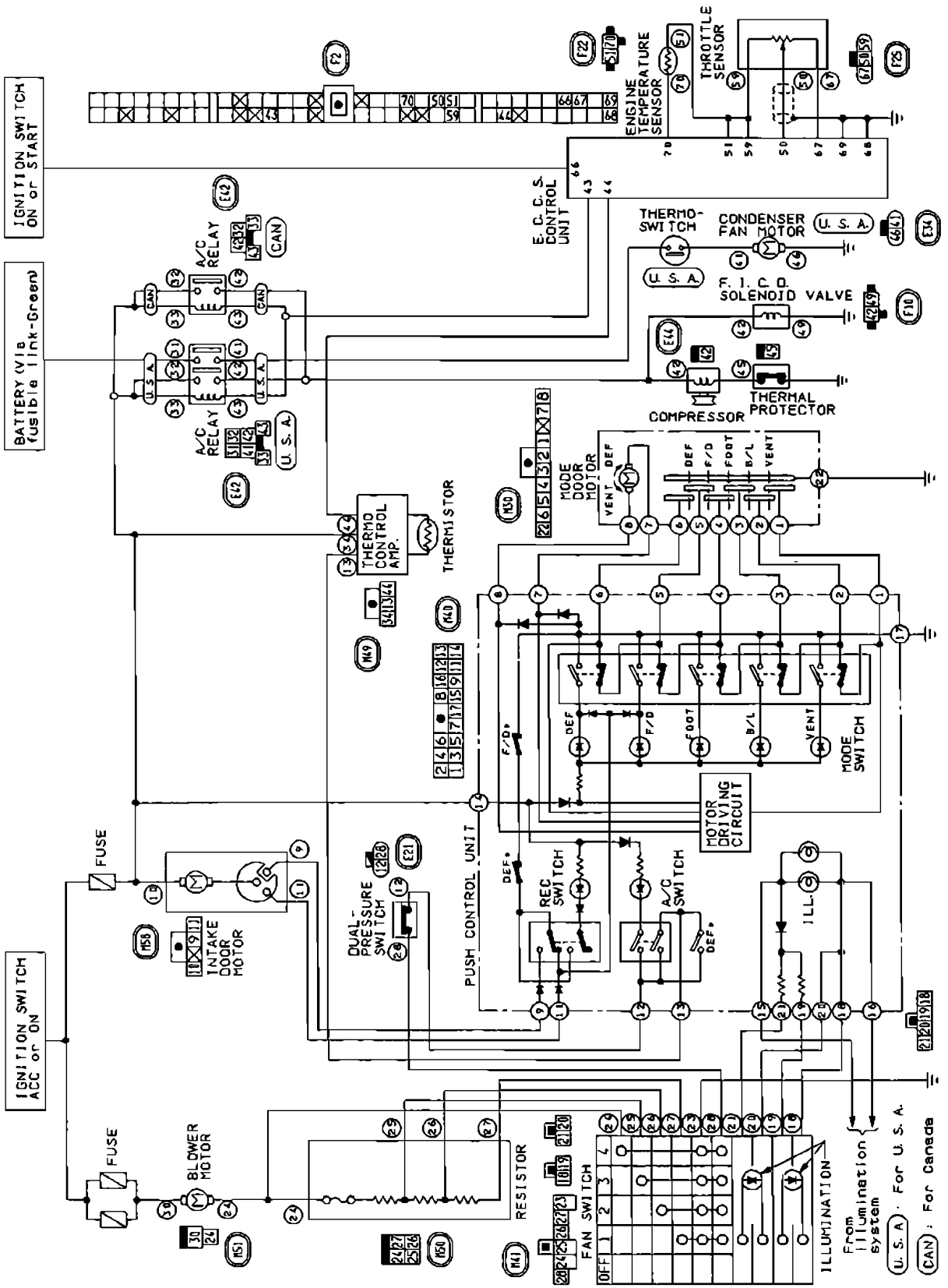
- E21 : Dual-pressure switch
- E34 : Condenser fan motor
- E42 : A/C relay
- E44-1 : Compressor (Magnet clutch)
- E44-2 : Compressor (Thermal protector)

Main harness

- M30 : Mode door motor
- M40 : Push control unit
- M41 : Fan switch
- M49 : Thermo control amp.
- M50 : Resistor
- M51 : Blower motor
- M58 : Intake door motor

RHA404A

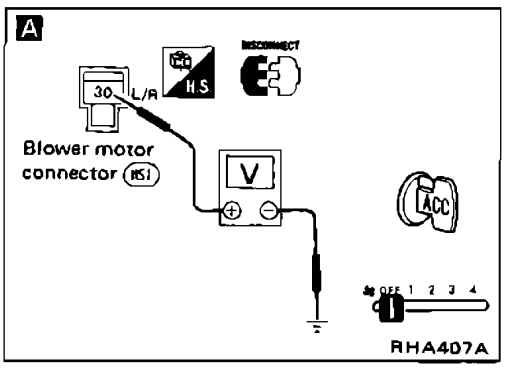
Circuit Diagram for Quick Pin Point Check

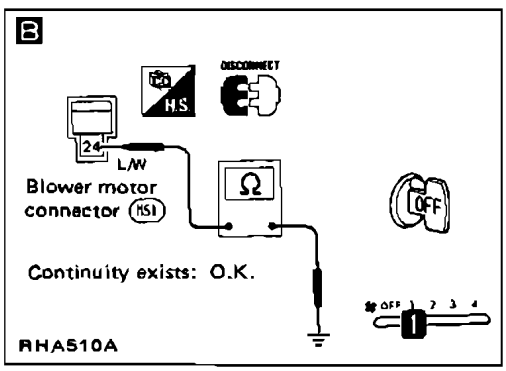


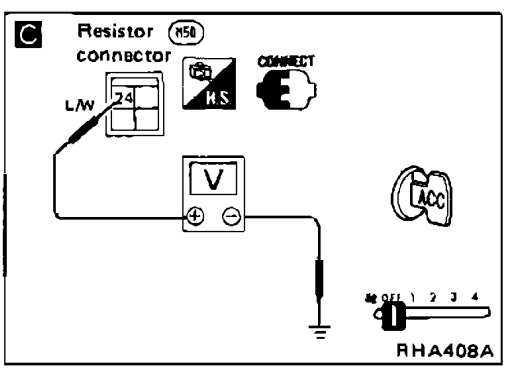
- All connectors shown in this illustration are unit side connectors.
- The unit side connectors with a double circle " ◎ " are connected to the harness side connectors shown in the "Harness Layout for A/C System". (See page HA-55.)
- The terminal numbers in the connector coincide with the circuit numbers surrounded by a single circle " ○ ".
- •: These switches are built in push control unit and mechanically linked to corresponding switches.

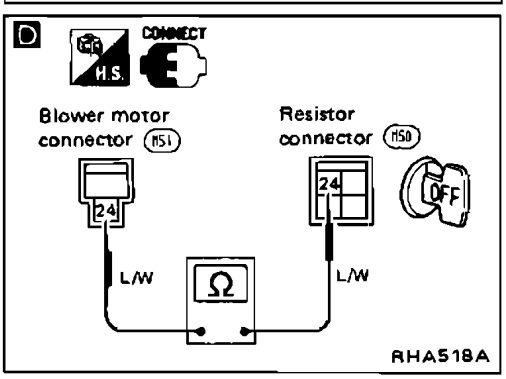
RHA405A

	INCIDENT	Flow chart No.
1	Fan fails to rotate.	1
2	Fan does not rotate at 1-speed.	2
3	Fan does not rotate at 2-speed.	3
4	Fan does not rotate at 3-speed.	4
5	Fan does not rotate at 4-speed.	5









Diagnostic Procedure 1

SYMPTOM: Blower motor does not rotate.

- **Perform PRELIMINARY CHECK 2 before referring to the following flow chart.**

Check if blower motor rotates properly at each fan speed.
Conduct check as per flow chart at left.

1 → A

A — CHECK POWER SUPPLY FOR BLOWER MOTOR.
Disconnect blower motor harness connector.
Do approx. 12 volts exist between blower motor harness terminal No. 30 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

B — Check circuit continuity between blower motor harness terminal No. 24 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. 24 and body ground?

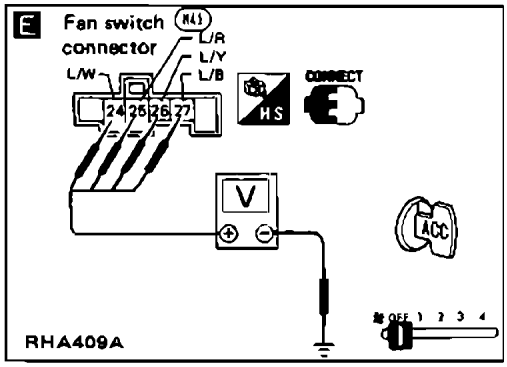
- N.G. → Disconnect blower motor and resistor harness connectors.
  - D — Check circuit continuity between blower motor harness terminal No. 24 and resistor harness terminal No. 24. (Note)
- O.K. → A (Go to next page.)

2 → B (Go to next page.)
3 → C (Go to next page.)
4 → D (Go to next page.)
5 → E (Go to next page.)

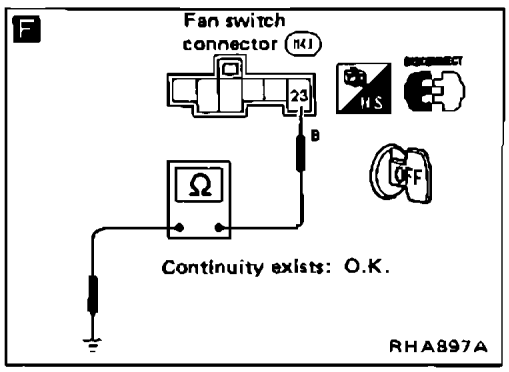
Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

Diagnostic Procedure 1 (Cont'd)

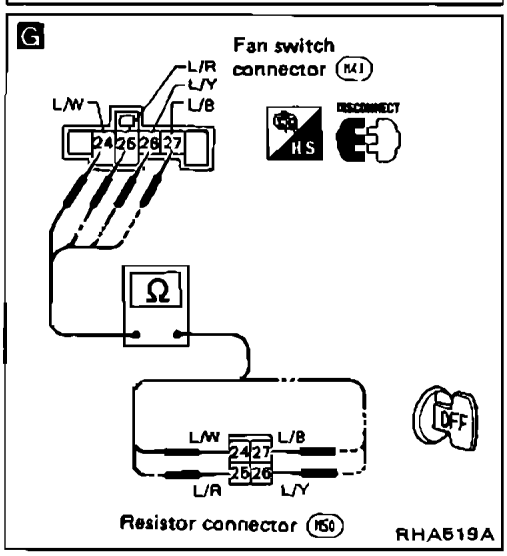
E



F



G



Ⓐ 1

CHECK RESISTOR AFTER DISCONNECTING IT.
(Refer to Electrical Components Inspection.)

Ⓑ 2 Ⓒ 3 Ⓓ 4 Ⓔ 5

O.K. — N.G.

N.G. → Replace resistor.

O.K. → Reconnect resistor harness connector.

1 2 3 4 5

E

CHECK FAN SWITCH CIRCUIT.
Do approx. 12 volts exist between each fan switch harness terminal and body ground?

Flow chart No.	Terminal No. ⊕	Terminal No. ⊖	Voltage
2	27	Body ground	Approx. 12V
3	26		
4	25		
5	24		

O.K. → 2 3 4 5

G N.G. → Check circuit continuity between fan switch and resistor. Note

CHECK FAN SWITCH AFTER DISCONNECTING IT.
(Refer to Electrical Components Inspection.)

N.G. → Replace fan switch.

O.K.

F

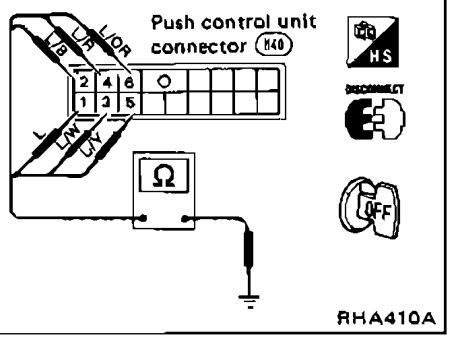
Check circuit continuity between fan switch harness terminal No. 23 and body ground. Note

O.K.

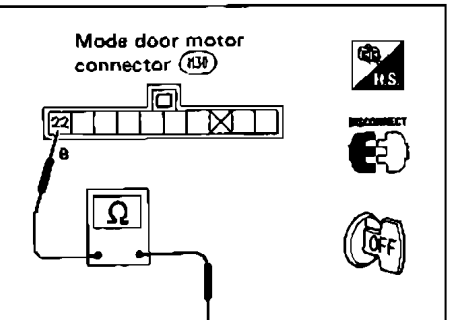
Replace blower motor.

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

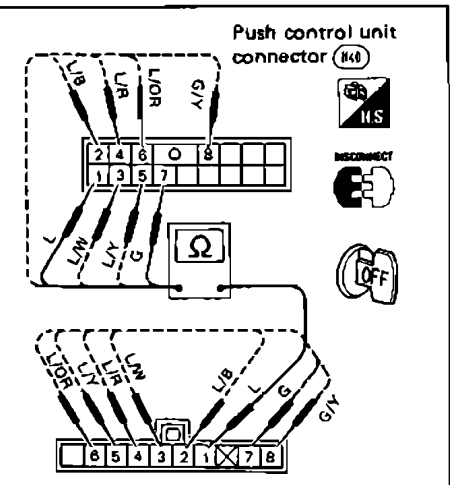
A



B



C



Diagnostic Procedure 2

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 ACC position.
2. Turn ignition switch OFF. Disconnect push control unit connector.
3. Check if continuity exists between terminal No. ① or ② of 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	① or ②	Body ground	Yes
B/L	② or ③		
FOOT	③ or ④		
F/D	④ or ⑤		
DEF	⑤ or ⑥		

O.K. ↓

CHECK SIDE LINK.
Refer to DOOR CONTROL.

N.G. →

Disconnect mode door motor harness connector.

B

Note

CHECK BODY GROUND CIRCUIT FOR MODE DOOR MOTOR.
Does continuity exist between mode door motor harness terminal No. ㉒ and body ground?

O.K. ↓

C

Note

Check circuit continuity between each terminal on push control unit and on mode door motor.

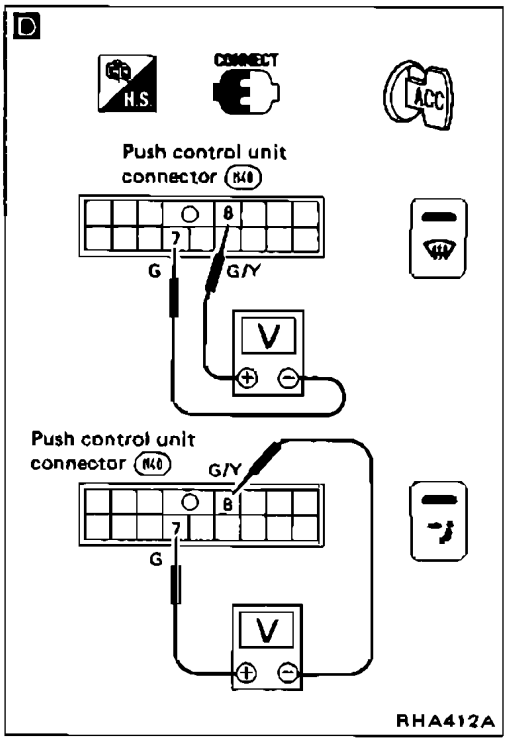
Terminal No. ⊕ Push control unit	Terminal No. ⊖ Mode door motor	Continuity
①	①	Yes
②	②	
③	③	
④	④	
⑤	⑤	
⑥	⑥	
⑦	⑦	
⑧	⑧	

Ⓐ

(Go to next page.)

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

Diagnostic Procedure 2 (Cont'd)



(A)

Reconnect push control unit and mode door motor harness connectors.

D

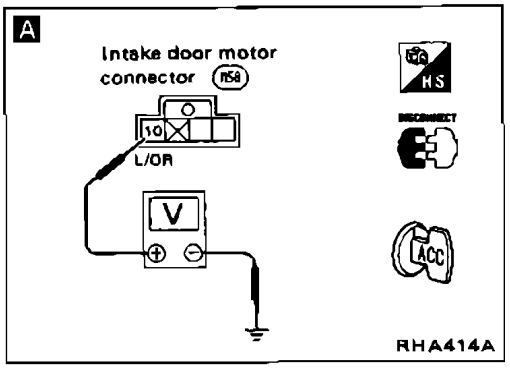
CHECK FOR OUTPUT OF PUSH CONTROL UNIT.
Do approx. 12 volts exist between push control unit harness terminal No. ⑦ and ⑧ when mode is switched from "VENT" to "DEF" or when mode is switched from "DEF" to "VENT"?

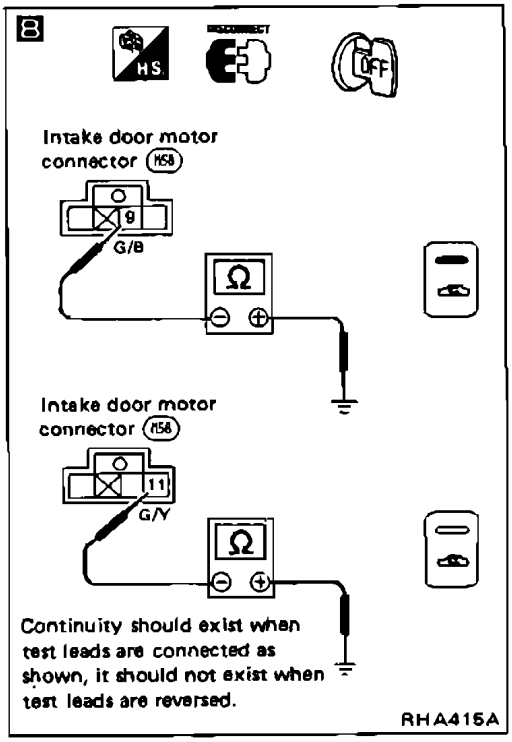
N.G. → Replace control amp. built-in push control unit.

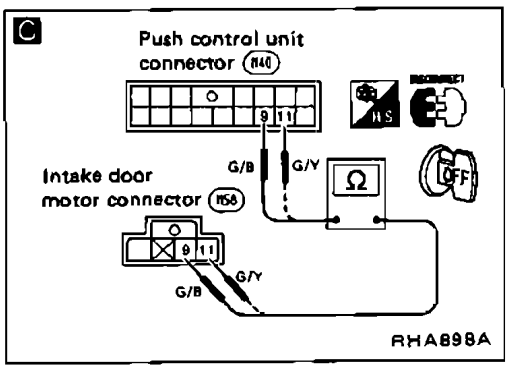
Terminal No.		Mode door motor	
⑦	⑧	Mode door operation	Direction of linkage rotation
⊖	⊖	Stop	Stop
⊖	⊕	VENT → DEF	Clockwise
⊕	⊖	DEF → VENT	Counterclockwise

O.K.

Replace mode door motor.







Diagnostic Procedure 3

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 approx. 12 volts exist between intake door motor harness terminal No. ⑩ 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. ⑨ and body ground when REC switch is ON?
Does continuity exist between intake door motor harness terminal No. ⑪ and body ground when REC switch is OFF?

N.G. → Disconnect push control unit harness connector.

C

Check circuit continuity between push control unit harness terminal No. ⑨ (⑪) and intake door motor harness terminal No. ⑨ (⑪).

Note

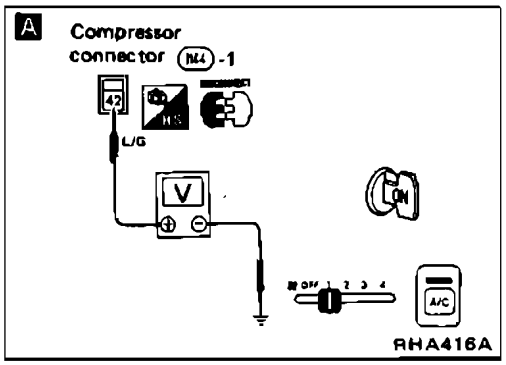
O.K. ↓

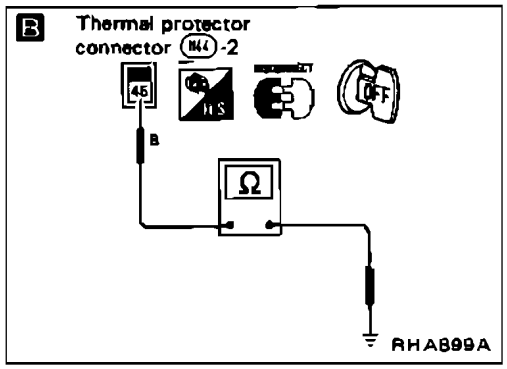
Replace control amp. built-in push control unit.

O.K. ↓

Replace intake door motor.

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.





Diagnostic Procedure 4

SYMPTOM: Magnet clutch does not operate when A/C switch and fan switch are 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. 42 and body ground?

N.G. → Ⓐ (Go to next page.)

O.K. ↓

B

CHECK THERMAL PROTECTOR.
Disconnect thermal protector harness connector.
Does continuity exist between thermal protector harness terminal No. 45 and body ground?

N.G. → Replace thermal protector.

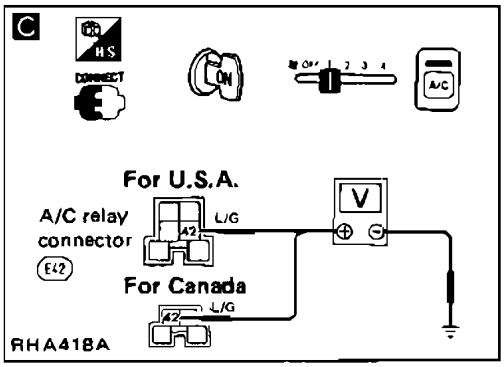
O.K. ↓

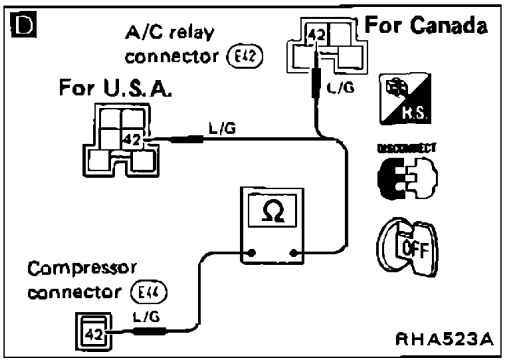
Check magnet clutch coil.

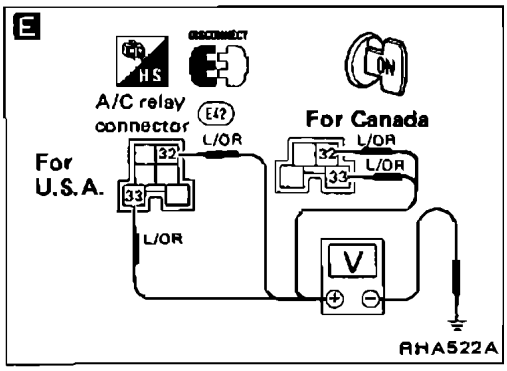
O.K. ↓

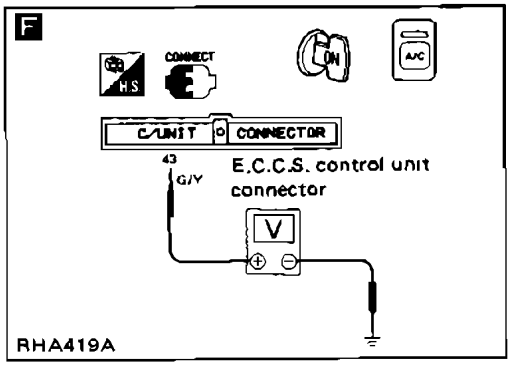
Replace magnet clutch.
Refer to COMPRESSOR – Model NVR 140S (ATSUGI make).

Diagnostic Procedure 4 (Cont'd)









Ⓐ

C CHECK A/C RELAY OPERATION.
Do approx. 12 volts exist between A/C relay harness terminal No. 42 and body ground?

N.G. → **E** CHECK POWER SUPPLY FOR A/C RELAY.
Disconnect A/C relay.
Do approx. 12 volts exist between A/C relay harness terminal No. 32, 33 and body ground?

O.K. → Disconnect A/C relay harness connector.

D Note: Check circuit continuity between A/C relay harness terminal No. 42 and compressor harness terminal No. 42.

O.K. → CHECK A/C RELAY AFTER DISCONNECTING IT. (Refer to Electrical Components Inspection.)

N.G. → Replace A/C relay.

O.K. → Reconnect A/C relay.

F CHECK COIL SIDE CIRCUIT OF A/C RELAY.
Do approx. 12 volts exist between E.C.C.S. control unit harness terminal No. 43 and body ground?

N.G. → Ⓒ

O.K. → Ⓑ

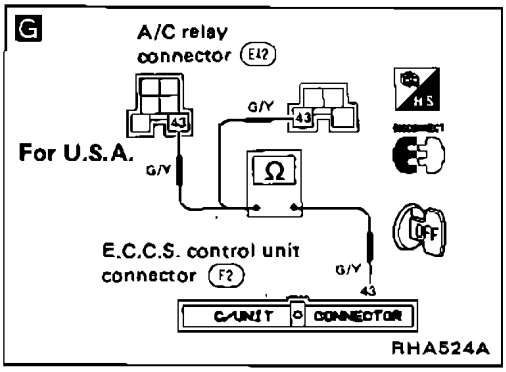
N.G. → CHECK POWER SUPPLY CIRCUIT AND 10A FUSE AT FUSE BLOCK.
Refer to "Power Supply ROUNTING" in EL section and A/C ELECTRICAL CIRCUIT.)

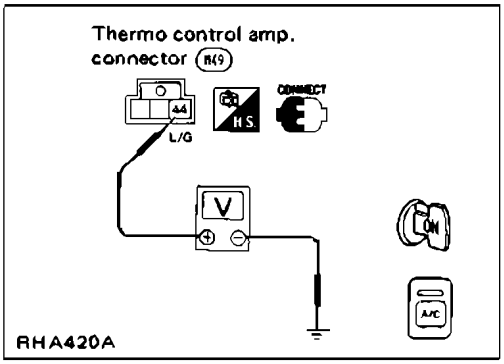
(Go to next page.)

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

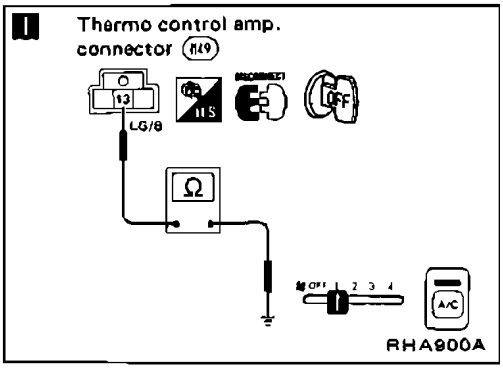
Diagnostic Procedure 4 (Cont'd)

G

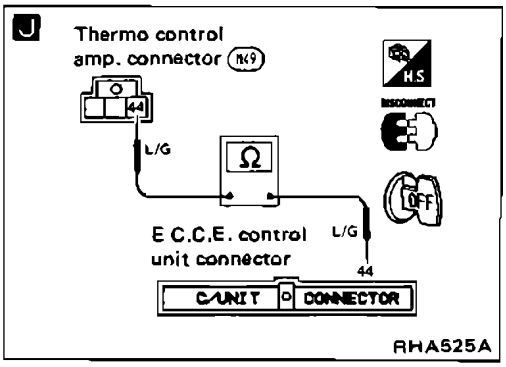




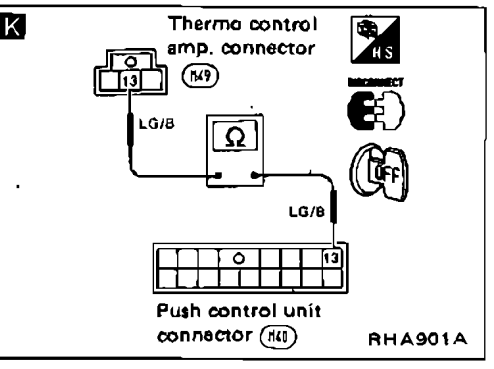
I



J



K



Ⓑ

H

CHECK VOLTAGE FOR THERMO CONTROL AMP.
Do approx. 8 to 9 volts exist between thermo control amp. harness terminal No. ㊹ and body ground?

N.G. → J

O.K.

CHECK POWER SUPPLY FOR THERMO CONTROL AMP.
Go to Main Power Supply and Ground Circuit Check.

I

CHECK BODY GROUND CIRCUIT FOR THERMO CONTROL AMP.
Disconnect thermo control amp. harness connector.
Does continuity exist between thermo control amp. harness terminal No. ⑬ and body ground?

N.G. → Disconnect push control unit harness connector. → K

O.K.

Replace thermo control amp.

Ⓒ

G

Check circuit continuity between A/C relay harness terminal No. ㊸ and E.C.C.S. control unit harness terminal No. ㊸.

J

Note

Check circuit continuity between E.C.C.S. control unit harness terminal No. ㊹ and thermo control amp. harness terminal No. ㊹.

O.K.

CHECK E.C.C.S. CONTROL UNIT.
Refer to EF & EC section.

K

Note

Check circuit continuity between thermo control amp. harness terminal No. ⑬ and push control unit harness terminal No. ⑬.

O.K.

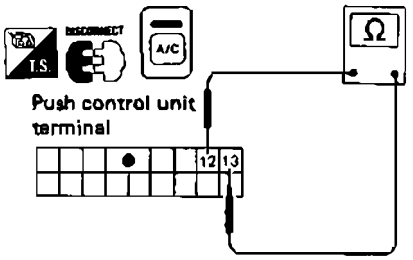
Ⓓ

(Go to next page.)

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

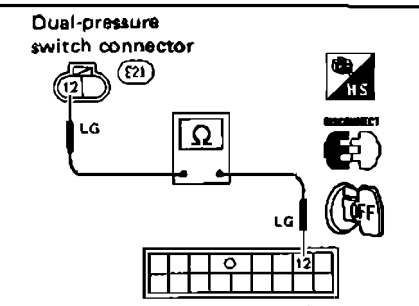
Diagnostic Procedure 4 (Cont'd)

L



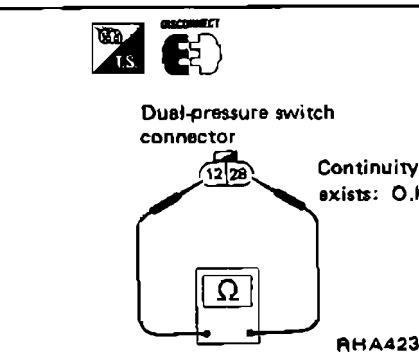
RHA422A

M



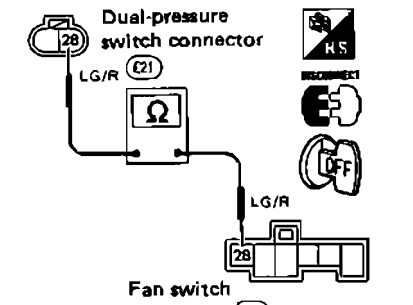
RHA902A

N



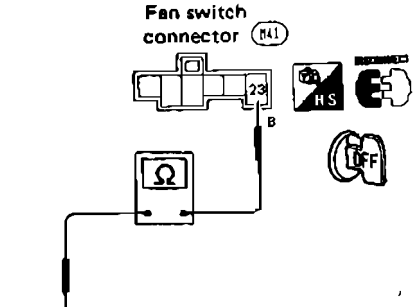
RHA423A

O



RHA903A

P



RHA904A

Ⓓ

L

CHECK PUSH CONTROL UNIT.
Does continuity exist between push control unit terminals No. ⑫ and ⑬?

N.G. → Replace control amp. built-in push control unit

O.K.

Disconnect dual-pressure switch.

M — Note

Check circuit continuity between dual-pressure switch harness terminal No. ⑫ and push control unit harness terminal No. ⑫.

O.K.

N

CHECK DUAL-PRESSURE SWITCH
Does continuity exist between dual-pressure switch terminals?

N.G. → Replace dual-pressure switch.

O.K.

Disconnect fan switch harness connector.

O — Note

Check circuit continuity between dual-pressure switch harness terminal No. ㉘ and fan switch harness terminal No. ㉘.

O.K.

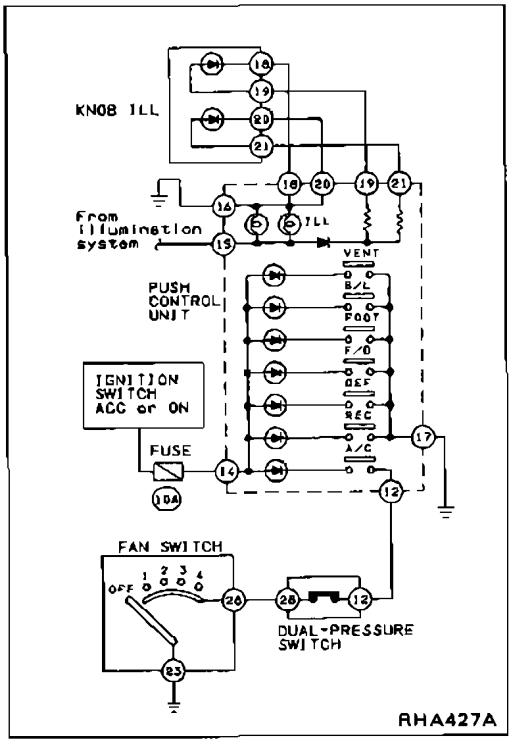
P — Note

CHECK BODY GROUND CIRCUIT FOR FAN SWITCH.
Does continuity exist between fan switch harness terminal No. ㉓ and body ground?

O.K. → CHECK FAN SWITCH (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.



Diagnostic Procedure 5

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								"How to repair"
ILL.	VENT	B/L	FOOT	F/D	DEF	REC	A/C	
X	O	O	O	O	O	O		Go to DIAGNOSTIC PROCEDURE 5-1.
	O	O	O	O	O	O	X	Go to DIAGNOSTIC PROCEDURE 5-2.
O	X	X	X	X	X	X		Go to DIAGNOSTIC PROCEDURE 5-3.
	Δ							Replace control amp. built-in push control unit.
O	X	X	X	X	X	X	O	Replace control amp. built-in push control nit.
	X	X	X	X	X	X	O	Go to DIAGNOSTIC PROCEDURE 5-4.

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 5-1

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. ↓

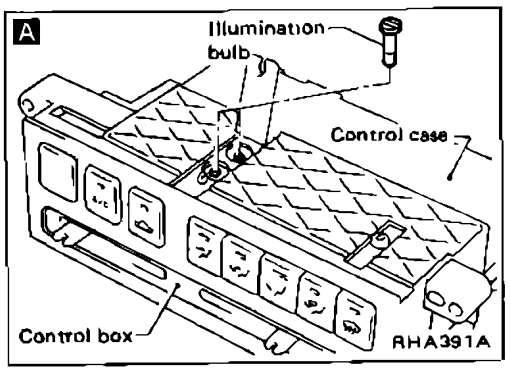
Turn ignition switch and lighting switch OFF.

Ⓐ

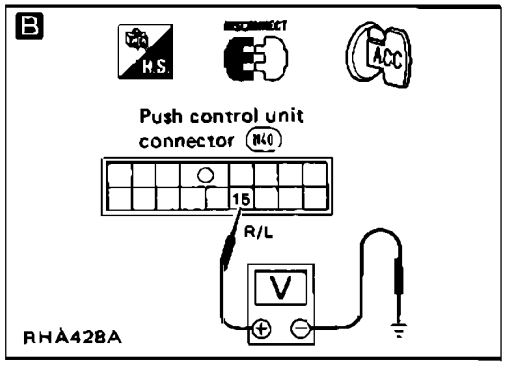
CHECK ILLUMINATION BULB.
Remove push control unit and disconnect harness connectors.
Remove illumination bulb(s) and check them.

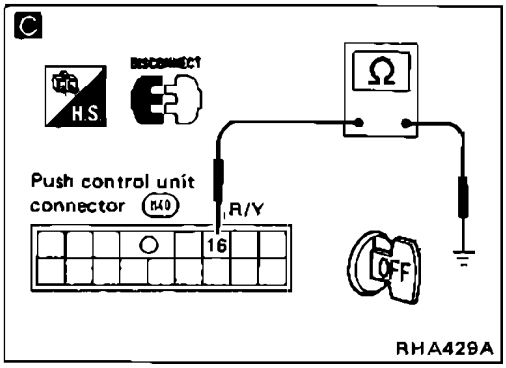
N.G. → Replace illumination bulb(s).

O.K. → Ⓐ (Go to next page.)



Diagnostic Procedure 5 (Cont'd)





Ⓐ

B

CHECK POWER SUPPLY FOR ILLUMINATION WITH LIGHTING SWITCH ON.
Do approx. 12 volts exist between push control unit harness terminal No. ⑮ and body ground?

N.G. → CHECK POWER SUPPLY FOR A/C ILLUMINATION SYSTEM.
Refer to Illumintion/Wiring Diagram in EL section.

O.K.

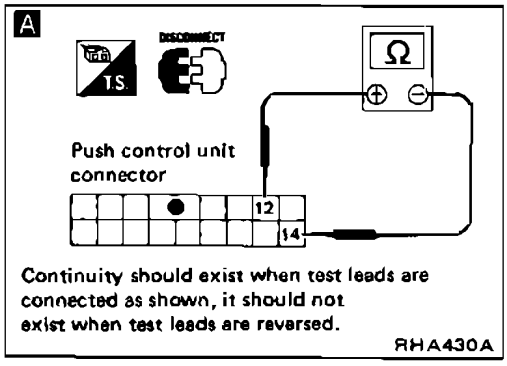
C

CHECK BODY GROUND CIRCUIT FOR ILLUMINATION.
Does contunity exist between push control unit harness terminal No. ⑯ and body ground?

Note

O.K.

Replace control amp. built-in push control unit.



DIAGNOSTIC PROCEDURE 5-2

CHECK MAGNET CLUTCH OPERATION.
Does magnet clutch operate normaly when engine ON, A/C switch, fan switch are ON?

N.G. → Go to Diagnostic Procedure 4.

O.K.

A

Check circuit continuity of L.E.D.

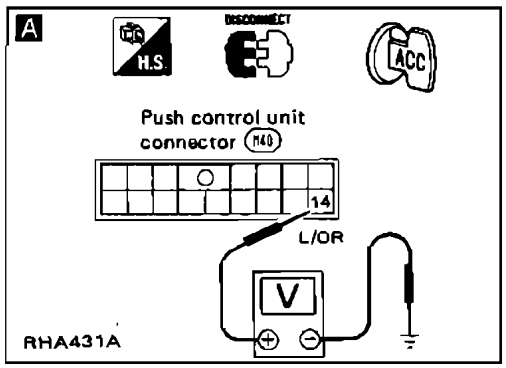
N.G.

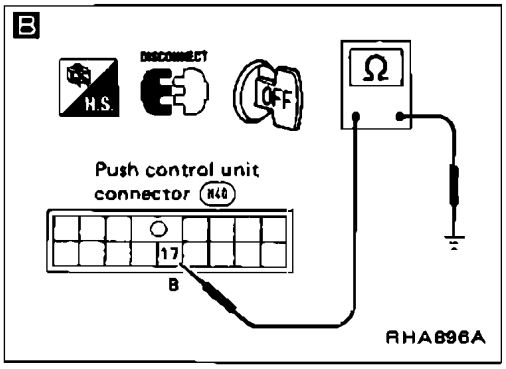
Replace control amp. built-in push control unit.

Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.

Diagnostic Procedure 5 (Cont'd)

DIAGNOSTIC PROCEDURE 5-3





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. ⑭ 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 Note

CHECK BODY GROUND CIRCUIT FOR PUSH CONTROL UNIT.
Does continuity exist between push control unit harness terminal No. ⑰ and body ground?

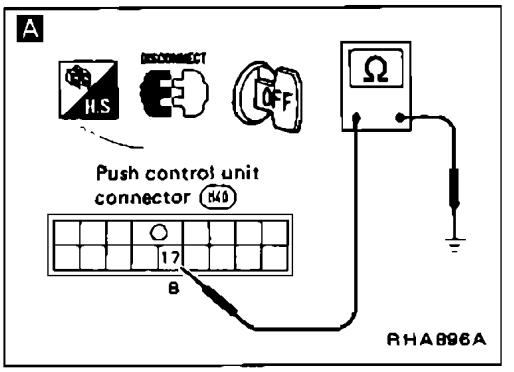
↓ O.K.

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 5 (Cont'd)

DIAGNOSTIC PROCEDURE 5-4



Turn ignition switch and lighting switch OFF.

↓

Disconnect push control unit harness connector.

↓

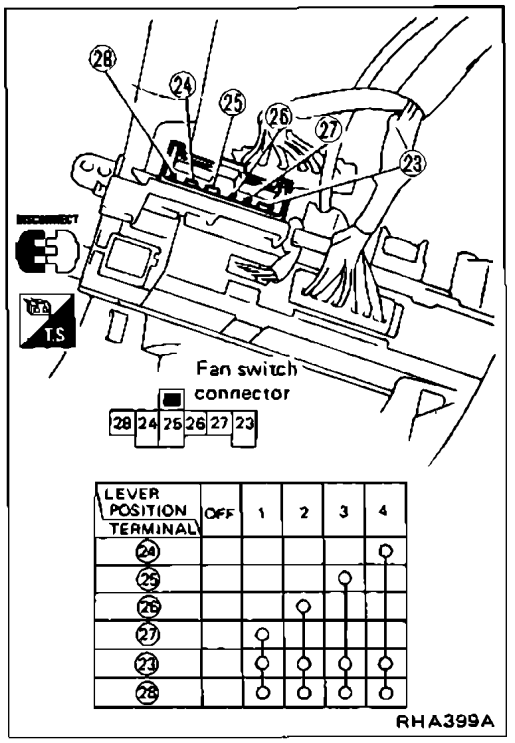
A Note

CHECK BODY GROUND CIRCUIT FOR PUSH CONTROL UNIT.
Does continuity exist between push control unit harness terminal No. ⑰ and body ground?

↓ O.K.

Replace control amp. built-in push control unit.

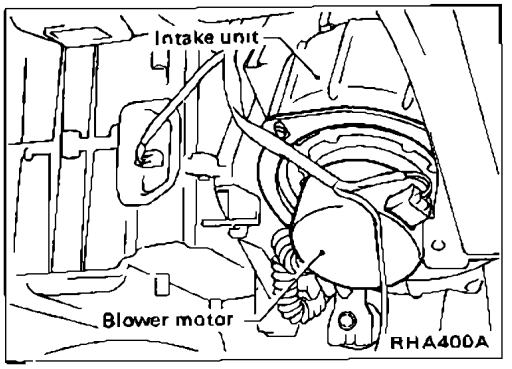
Note:
If the result is N.G. after checking circuit continuity, repair harness or connector.



Electrical Components Inspection

FAN SWITCH

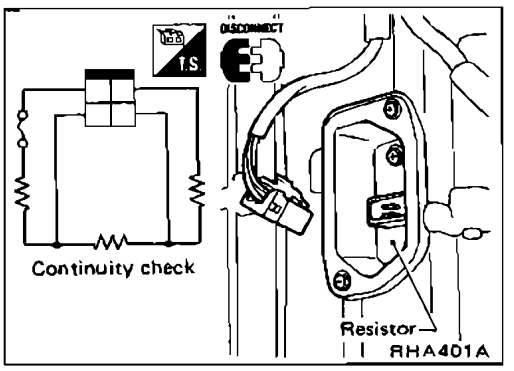
Check continuity between terminals at each switch position.



BLOWER MOTOR

Confirm smooth rotation of the blower motor.

- Ensure that there are no foreign particles inside the intake unit.



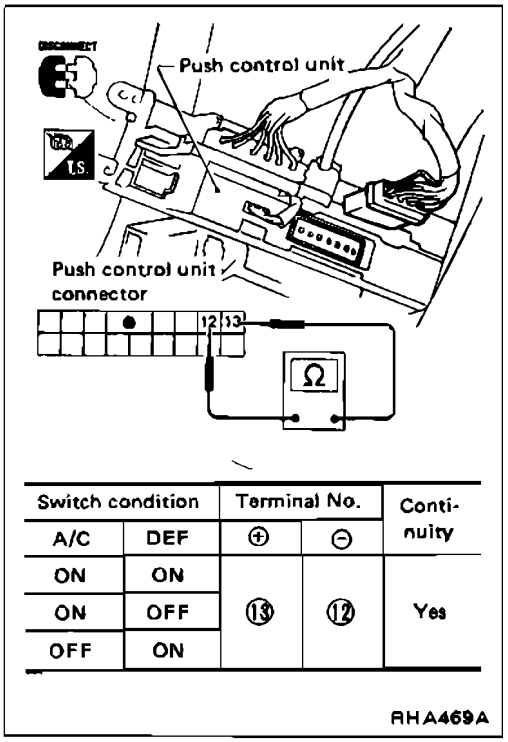
BLOWER RESISTOR

Check continuity between terminals.

Electrical Components Inspection (Cont'd)

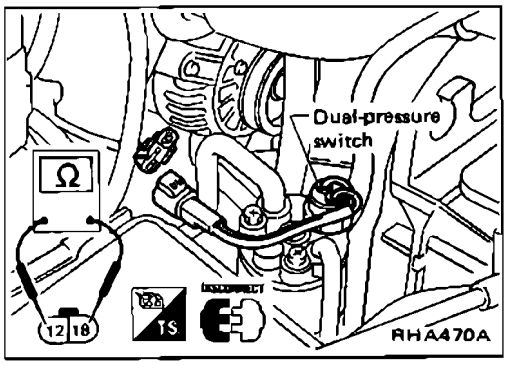
A/C SWITCH

Check continuity between terminals at each switch position.



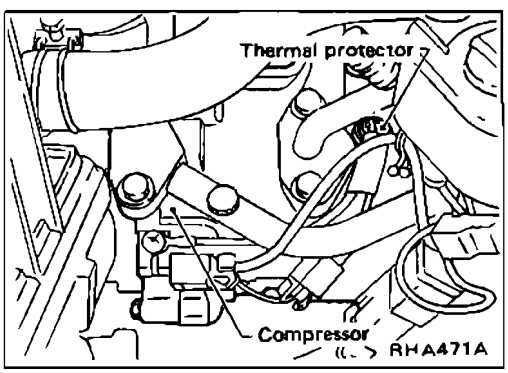
Switch condition		Terminal No.		Continuity
A/C	DEF	⊕	⊖	
ON	ON	13	12	Yes
ON	OFF			
OFF	ON			

DUAL-PRESSURE SWITCH



High-pressure side line pressure kPa (kg/cm², psi)	Operation	Continuity
Decreasing to 177 - 216 (1.8 - 2.2, 26 - 31) Increasing to 2,452 - 2,844 (25 - 29, 356 - 412)	Turn OFF	Does not exist
Increasing to 177 - 235 (1.8 - 2.4, 26 - 34) Decreasing to 1,863 - 2,256 (19 - 23, 270 - 327)	Turn ON	Exists

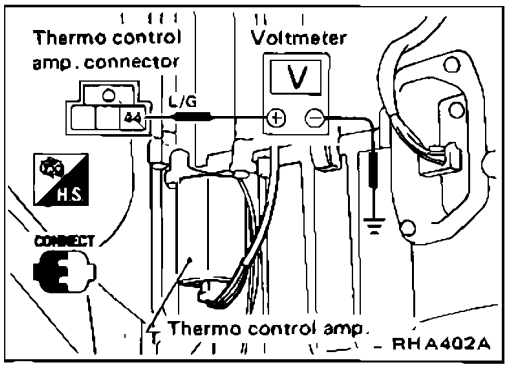
THERMAL PROTECTOR



Temperature of compressor °C (°F)	Operation
Increasing to approx. 135 - 145 (275 - 293)	Turn OFF
Decreasing to approx. 120 - 130 (248 - 266)	Turn ON

Electrical Components Inspection (Cont'd)

THERMO CONTROL AMP.

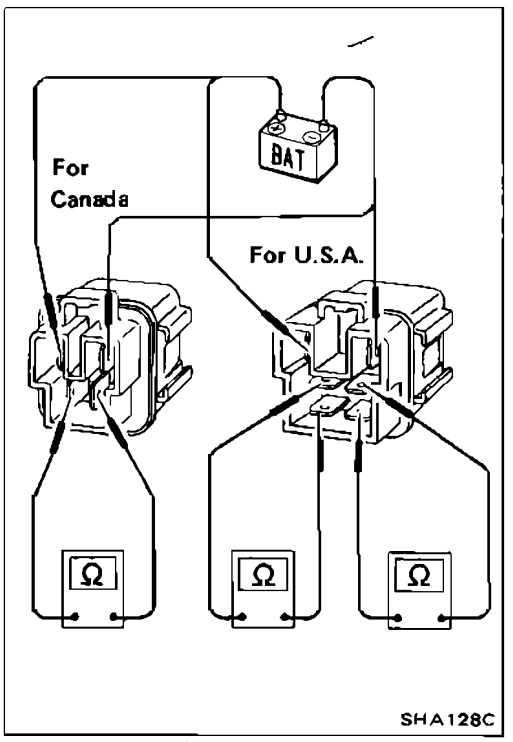


1. Run engine, and operate A/C system.
2. Connect the voltmeter from harness side.
3. Check thermo control amp. operation shown in the table.

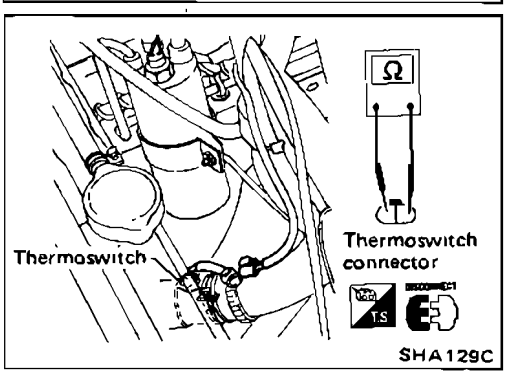
Evaporator outlet air temperature °C (°F)	Thermo amp. operation	Tester
Decreasing to 1.5 - 2.5 (35 - 37)	Turn OFF	Approx. 12V
Increasing to 3.0 - 4.0 (37 - 39)	Turn ON	Approx. 0V

A/C RELAY

Check circuit continuity between terminals by supplying 12 volts to coil side terminal of A/C relay.



THERMOSWITCH



Water temperature °C (°F)	Operation	Continuity
Decreasing to 85 - 91 (185 - 196)	Turn OFF	Does not exist
Increasing to 92 - 98 (198 - 208)	Turn ON	Exists

General Specifications

COMPRESSOR

Model	ATSUGI make NVR 140S
Type	Vane rotary
Displacement cm^3 (cu in)/Rev.	140 (8.54)
Direction of rotation	Clockwise (Viewed from drive end)
Drive belt	Poly V

LUBRICATION OIL

Model	ATSUGI make NVR 140S
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	Approx. 100 (3.4, 3.5)
Compressor (Service parts) charging amount	200 (6.8, 7.0)

REFRIGERANT

Type		R-12
Capacity	kg (lb)	0.9 - 1.0 (2.0 - 2.2)

Inspection and Adjustment

ENGINE IDLING SPEED (When A/C is ON.)

- **Refer to EF & EC section.**

BELT TENSION

- **Refer to Checking Drive Belts (MA section).**

COMPRESSOR

Model	NVR 140S
Clutch disc-pulley clearance mm (in)	0.3 - 0.6 (0.012 - 0.024)

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- 17
CHARGING SYSTEM ..... EL- 23
CHARGING SYSTEM — Alternator — ..... EL- 25
COMBINATION SWITCH ..... EL- 33
HEADLAMP ..... EL- 35
EXTERIOR LAMP ..... EL- 46
INTERIOR LAMP ..... EL- 52
METER AND GAUGES ..... EL- 54
WARNING LAMPS AND CHIME ..... EL- 61
TIME CONTROL SYSTEM ..... EL- 65
WIPER AND WASHER ..... EL- 75
HORN, CIGARETTE LIGHTER AND CLOCK ..... EL- 81
REAR WINDOW DEFOGGER ..... EL- 82
AUDIO AND ANTENNA ..... EL- 85
AUTOMATIC SPEED CONTROL DEVICE (A.S.C.D.) ..... EL- 88
LOCATION OF ELECTRICAL UNITS ..... EL- 97
HARNESS LAYOUT ..... EL- 99
SUPER MULTIPLE JUNCTION (S.M.J.) EL-117

EL

WIRING DIAGRAM REFERENCE CHART

E.C.C.S. ..... PULL-OUT FOLLOWING PAGE EL-118
LOCK-UP CONTROL ..... AT SECTION
O.D. CONTROL ..... AT SECTION
ELECTRIC DOOR MIRROR, SUN ROOF, DOOR LOCK, POWER WINDOW AND AUTOMATIC SEAT BELT .... BF SECTION
HEATER AND AIR CONDITIONER ..... HA SECTION

Description

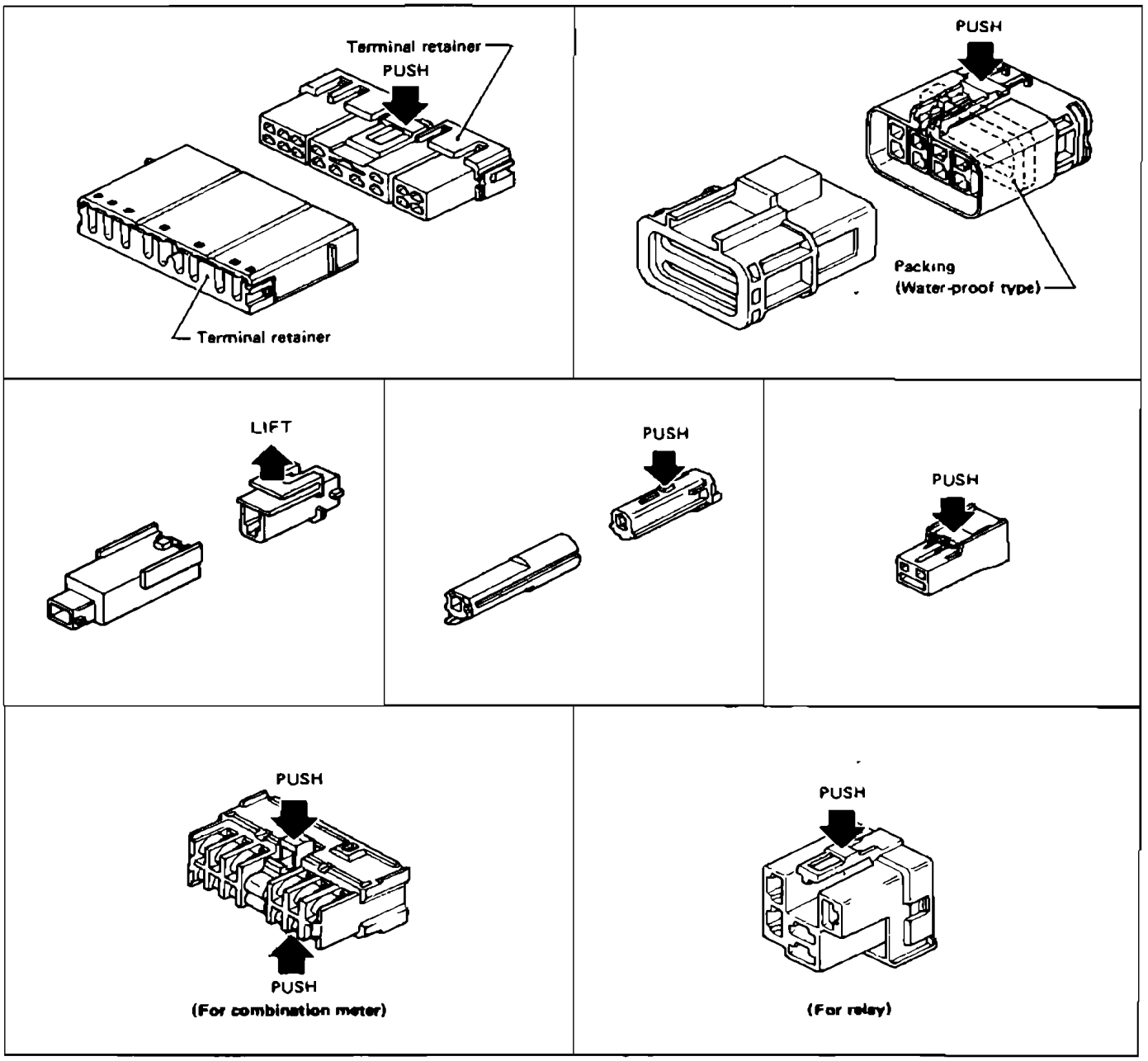
HARNESS CONNECTOR

- All harness connectors have been modified to 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]

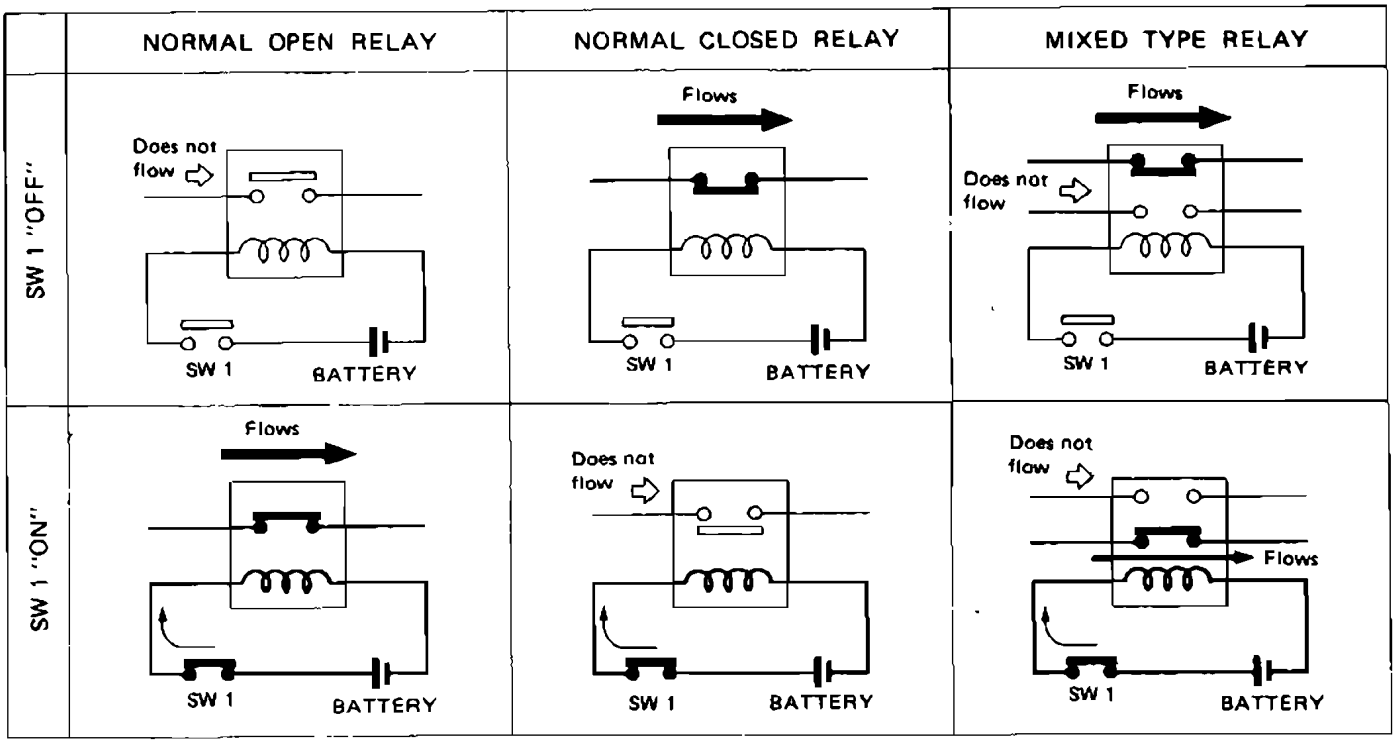


SEL769D

Description

NORMAL OPEN, NORMAL CLOSED AND MIXED TYPE RELAYS

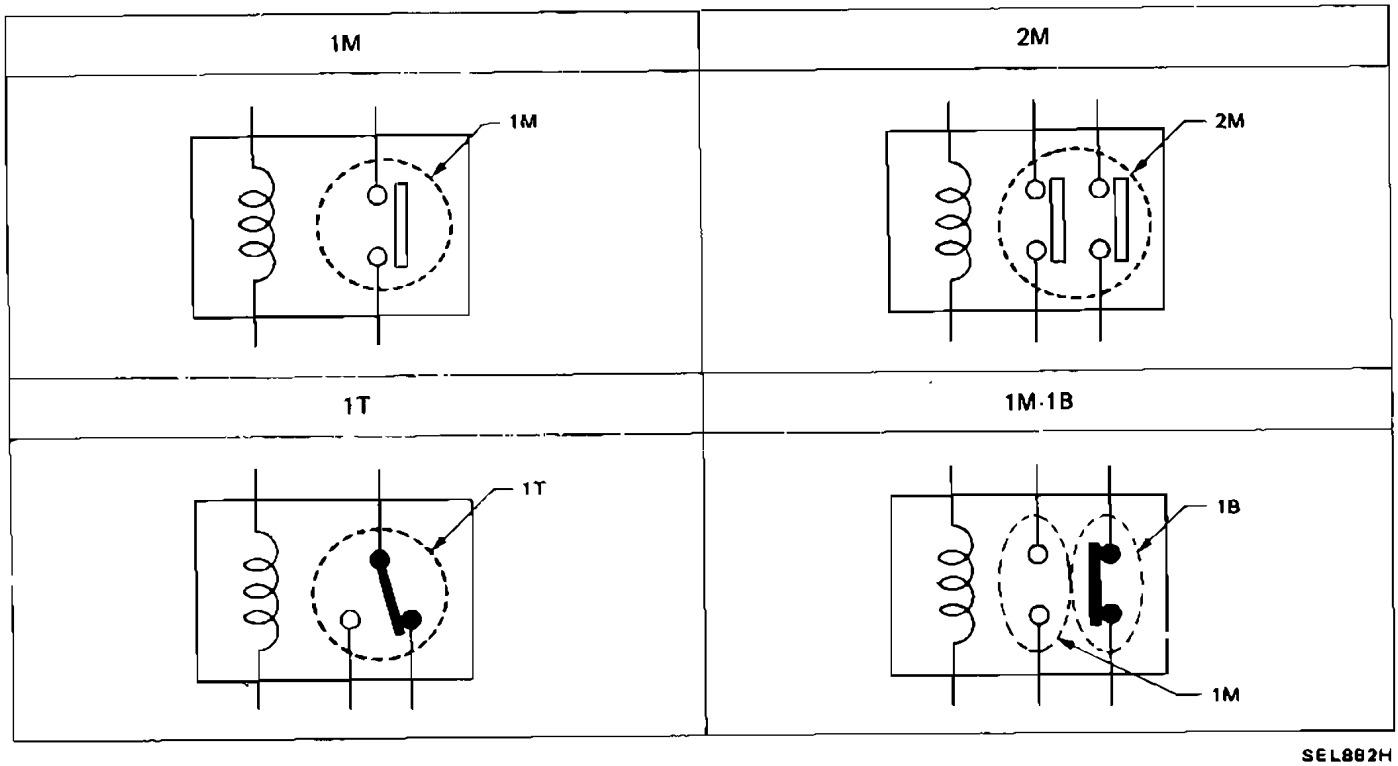
Relays can mainly be divided into three types: normal open, normal closed and mixed type relays.



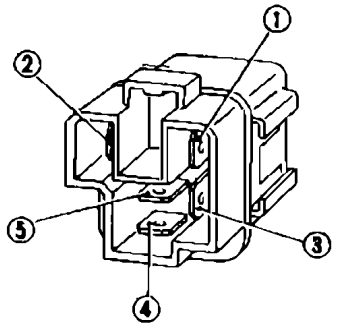
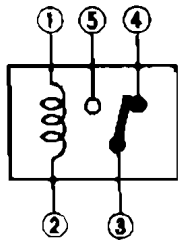
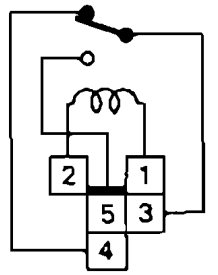
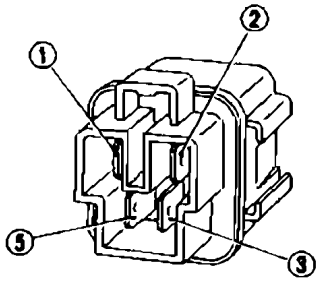
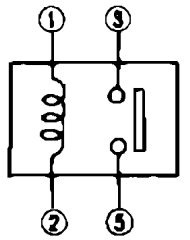
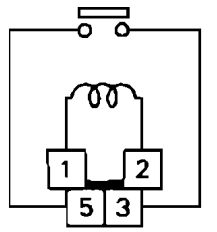
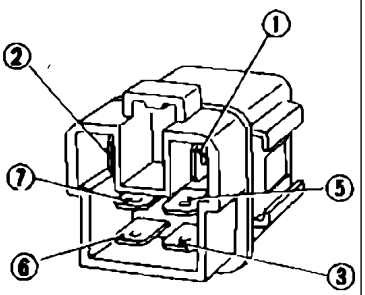
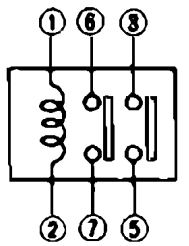
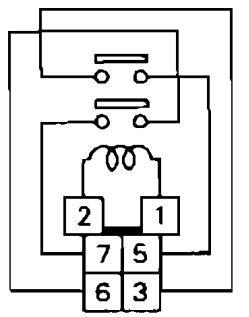
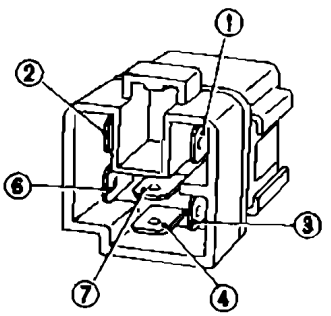
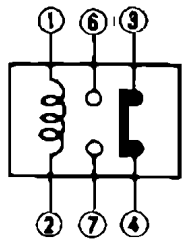
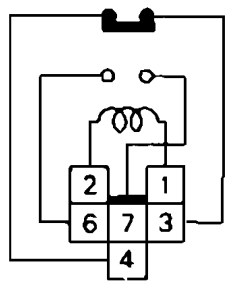
SEL881H

TYPE OF STANDARDIZED RELAYS

1M ..... 1 Make
1T ..... 1 Transfer
2M ..... 2 Make
1M·1B ..... 1 Make 1 Break

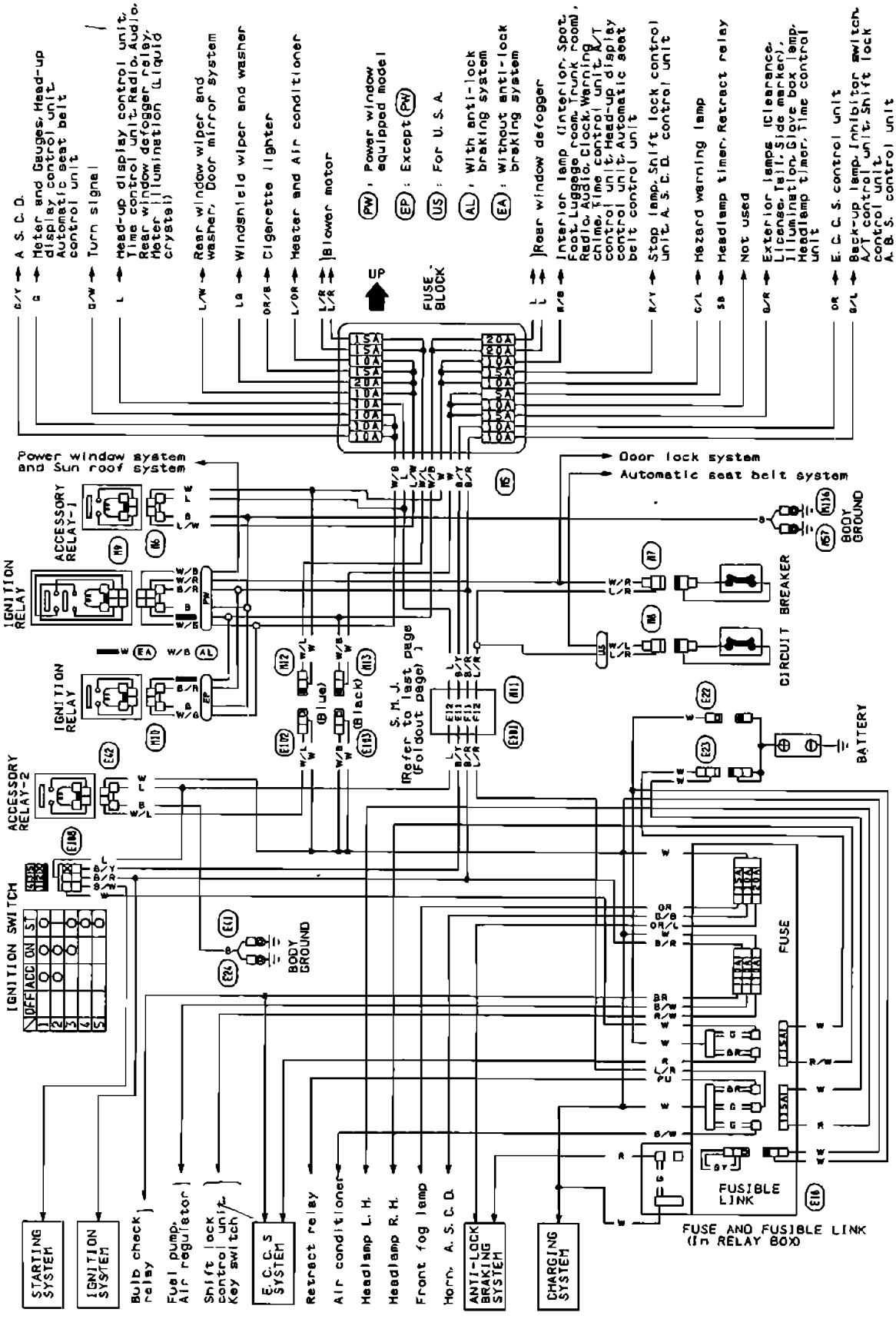


SEL882H

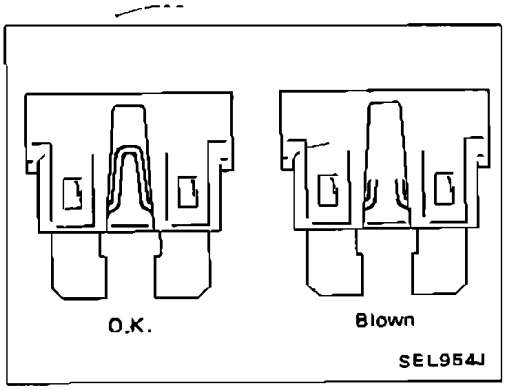
Type	Outer view	Circuit	Connector symbol and connection	Case color
1T				BLACK
1M				BLUE
2M				BROWN
1M·1B				GRAY

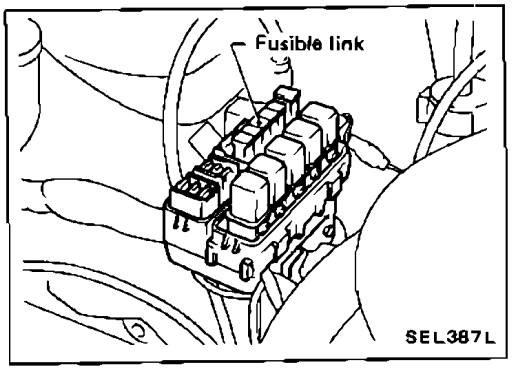
SEL883H

Wiring Diagram



SEL576M





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.**

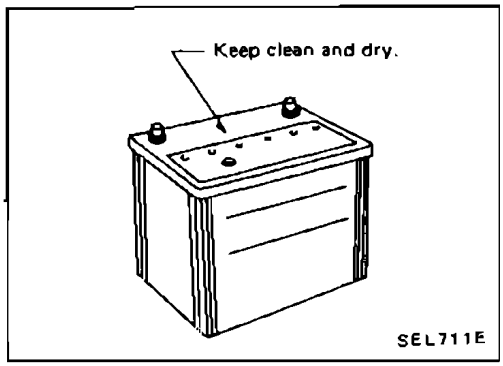
FUSIBLE LINK VARIATION

Color	Maximum amperage (A)
Brown	15
Green	20
Red	30
Black	35
Gray	40

*Temperature condition: Less than 80°C (176°F)

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.

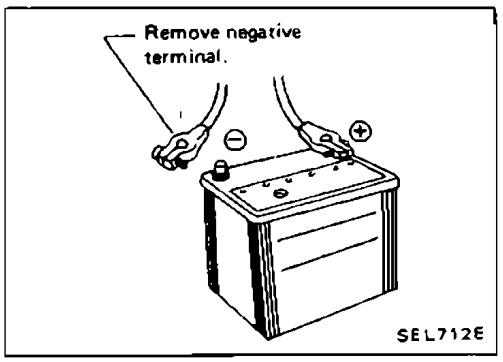


How to Handle Battery

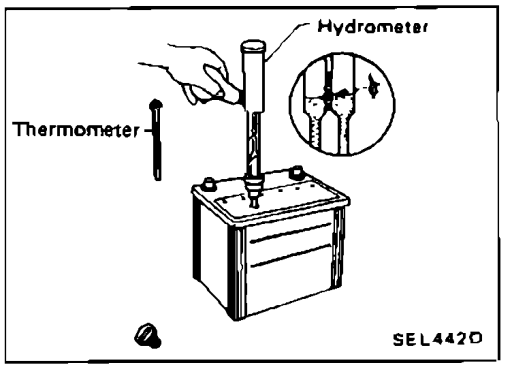
METHODS OF PREVENTING OVER-DISCHARGE

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.

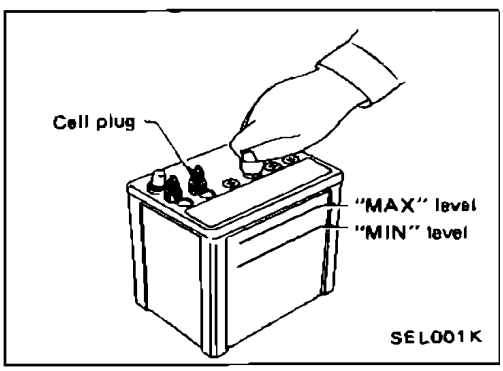
How to Handle Battery (Cont'd)

CHECKING ELECTROLYTE LEVEL

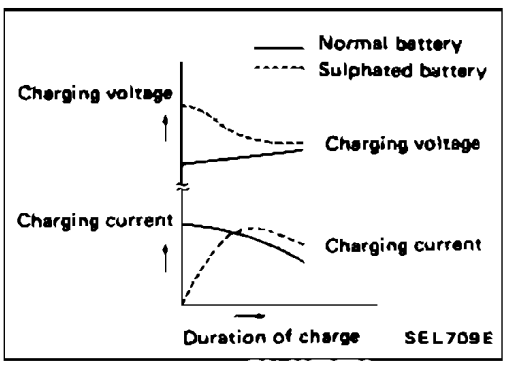
WARNING:

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.



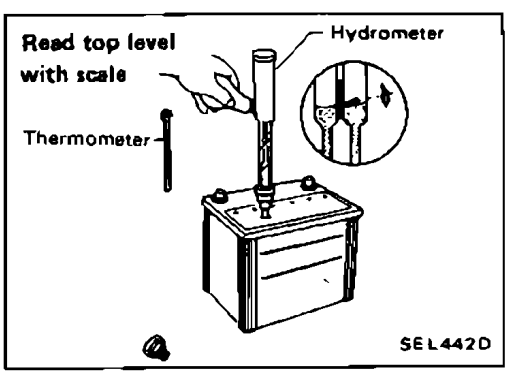
- Remove the cell plug using a suitable tool.
- Add distilled water up to the MAX level.



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.

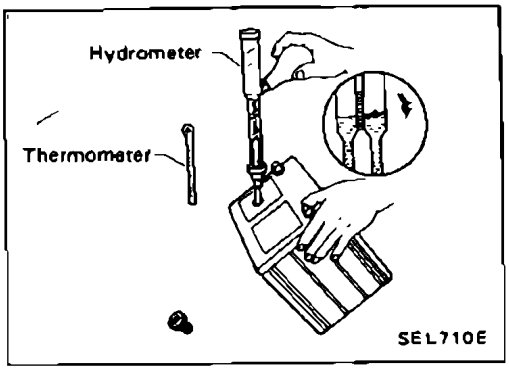
Compared with a battery discharged under normal conditions, the current flow in a "sulphated" battery is not as smooth although its voltage is high during the initial stage of charging, as shown in the figure at the left.



SPECIFIC GRAVITY CHECK

1. Read hydrometer and thermometer indications at eye level.

How to Handle Battery (Cont'd)

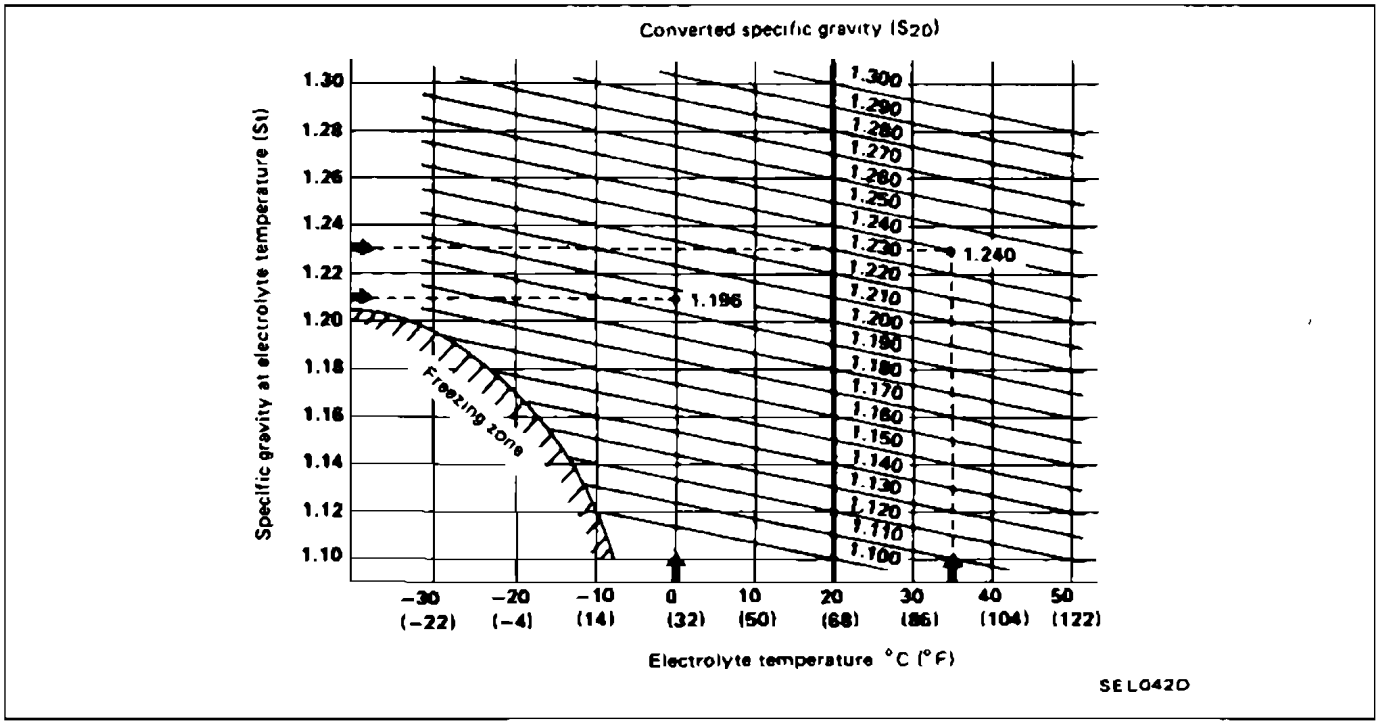


- When electrolyte level is too low, tilt battery case to raise it for easy measurement.

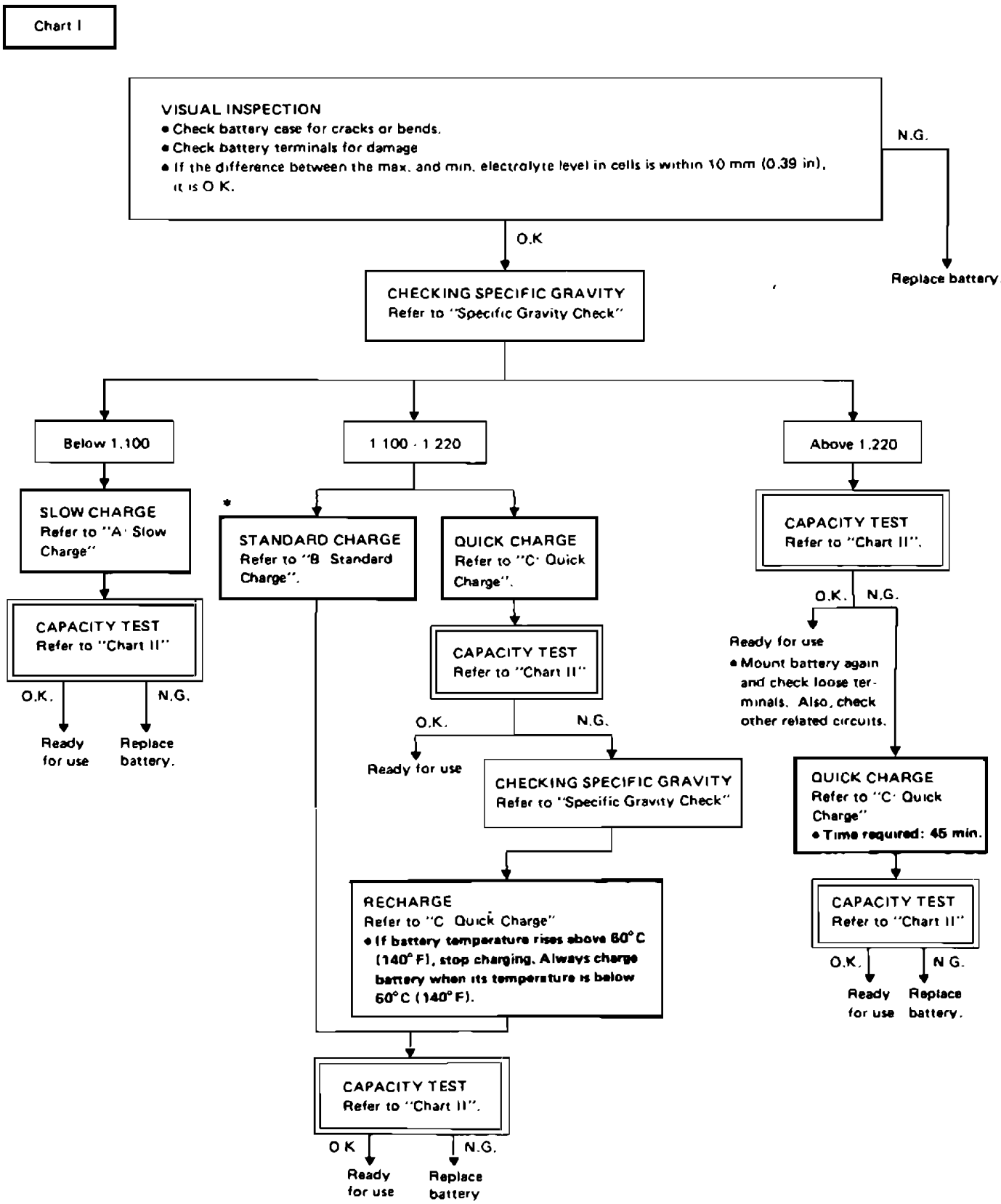
2. Convert into specific gravity at 20°C (68°F).

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.



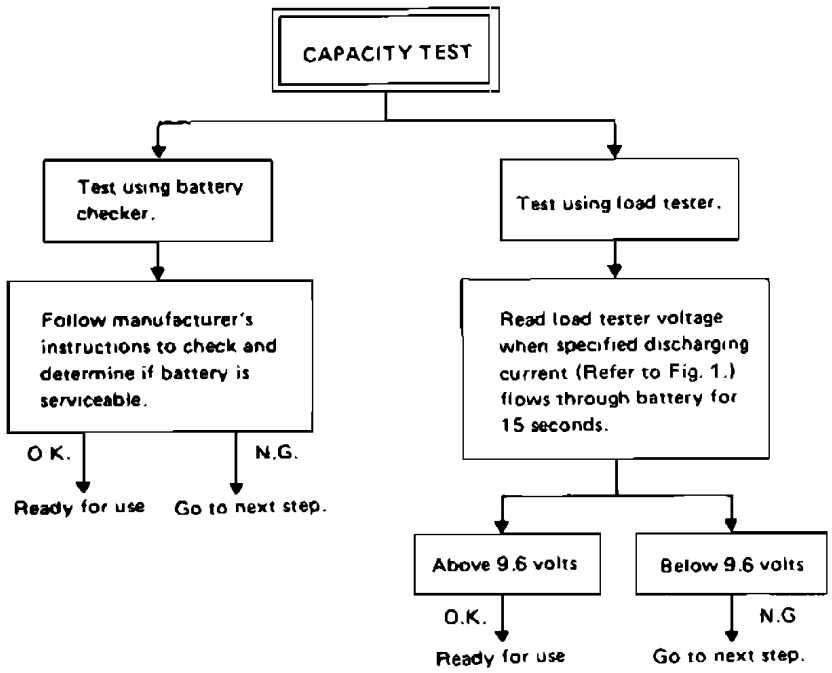
Battery Test and Charging Chart



* "STANDARD CHARGE" is recommended in case that the vehicle is in storage after charging.

Battery Test and Charging Chart (Cont'd)

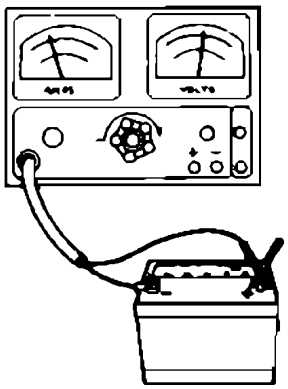
Chart II



- 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

Determine initial charging current from specific gravity referring to Fig. 2.

- Charge battery.
- Check charging voltage 30 minutes after starting the battery charge.

12 to 16 volts — O.K. → Continue to charge for 12 hours.

Below 12 volts or above 16 volts — N.G. → Replace battery.

CHECKING SPECIFIC GRAVITY
Refer to "Specific Gravity Check".

Conduct additional charge as per Fig 3, if necessary

Go to "CAPACITY TEST"

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)

Below 1.150	1.150 - 1.200	1.200 - 1.240	Above 1.240
Charge for 5 hours at initial charging current setting.	Charge for 4 hours at initial charging current setting.	Charge for 2 hours at initial charging current setting.	

Go to "CAPACITY TEST".

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

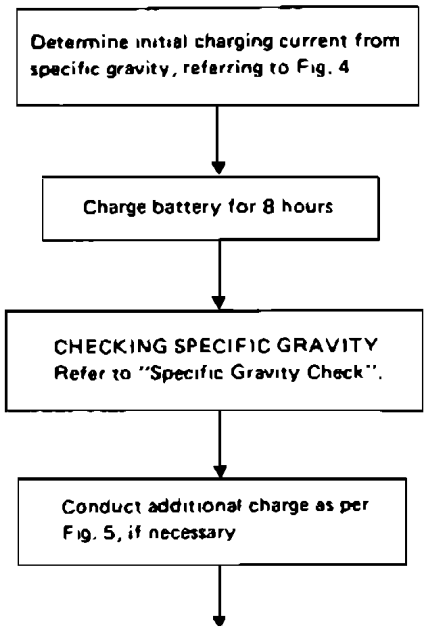
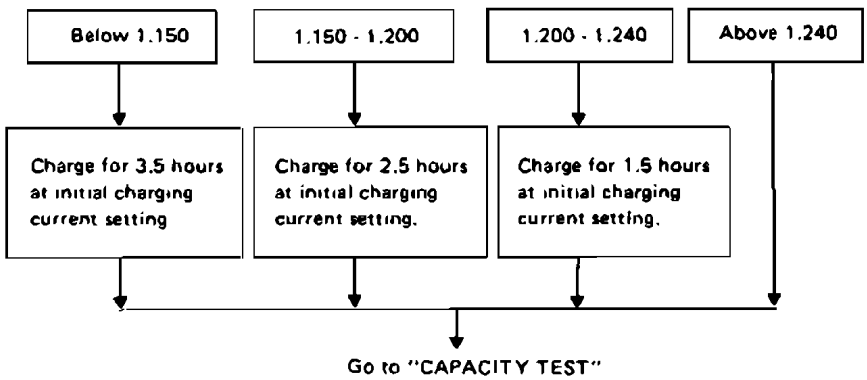


Fig. 4 INITIAL CHARGING CURRENT SETTING
(Standard charge)

BATTERY TYPE / CONVERTED SPECIFIC GRAVITY	28B19R(L) 34B19R(L)	46B24R(L) 55B24R(L)	50D23R(L) 65D23R(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

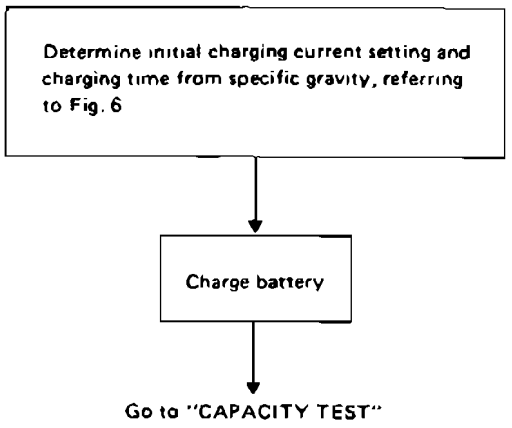


Fig. 6 INITIAL CHARGING CURRENT SETTING AND CHARGING TIME (Quick charge)

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:

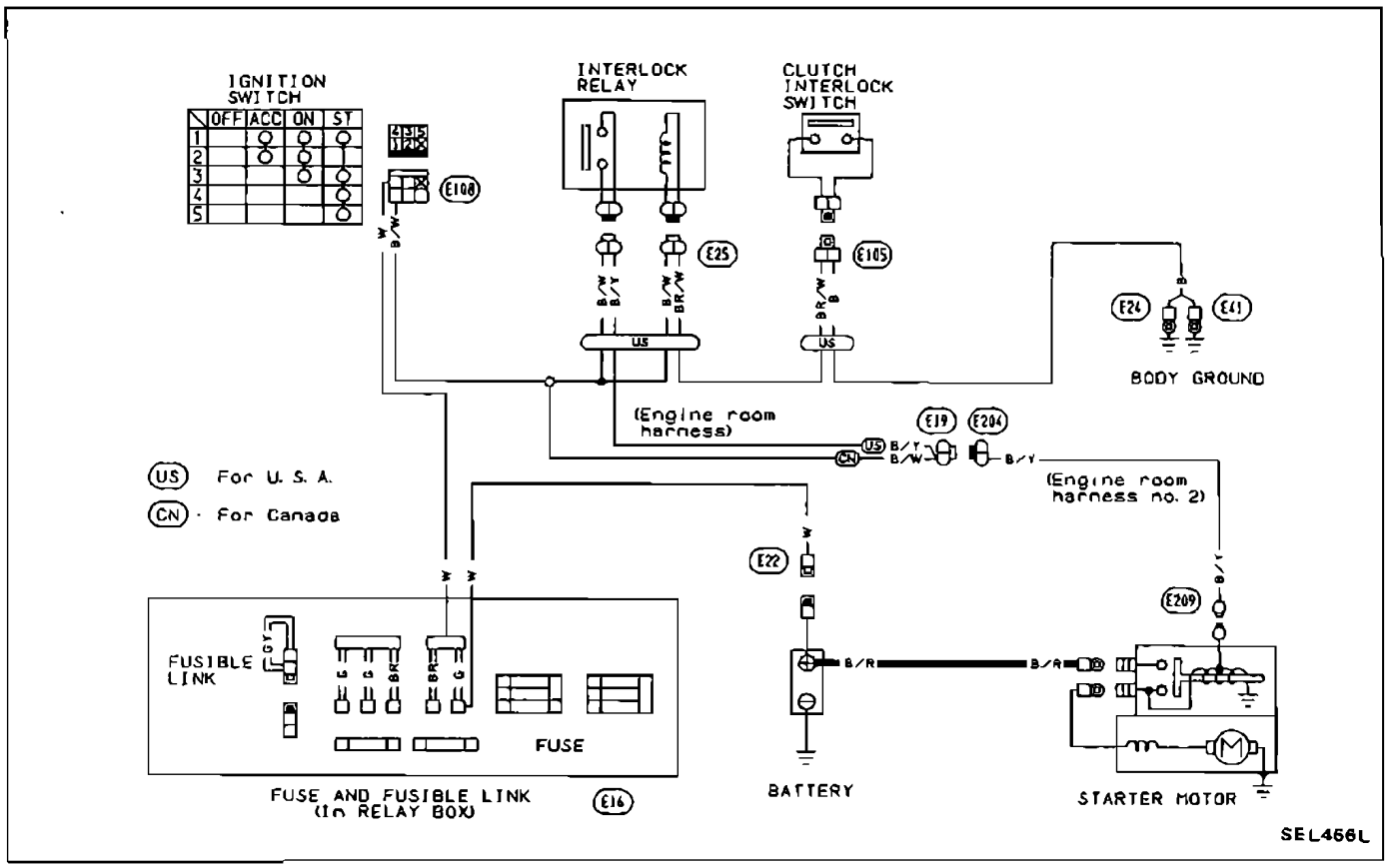
a. Do not use quick charge method on a battery whose specific gravity is less than 1.100.
b. Set initial charging current to value specified in Fig. 6. If charger is not capable of producing specified current value, set its charging current as close to that value as possible.
c. Keep battery away from 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.)

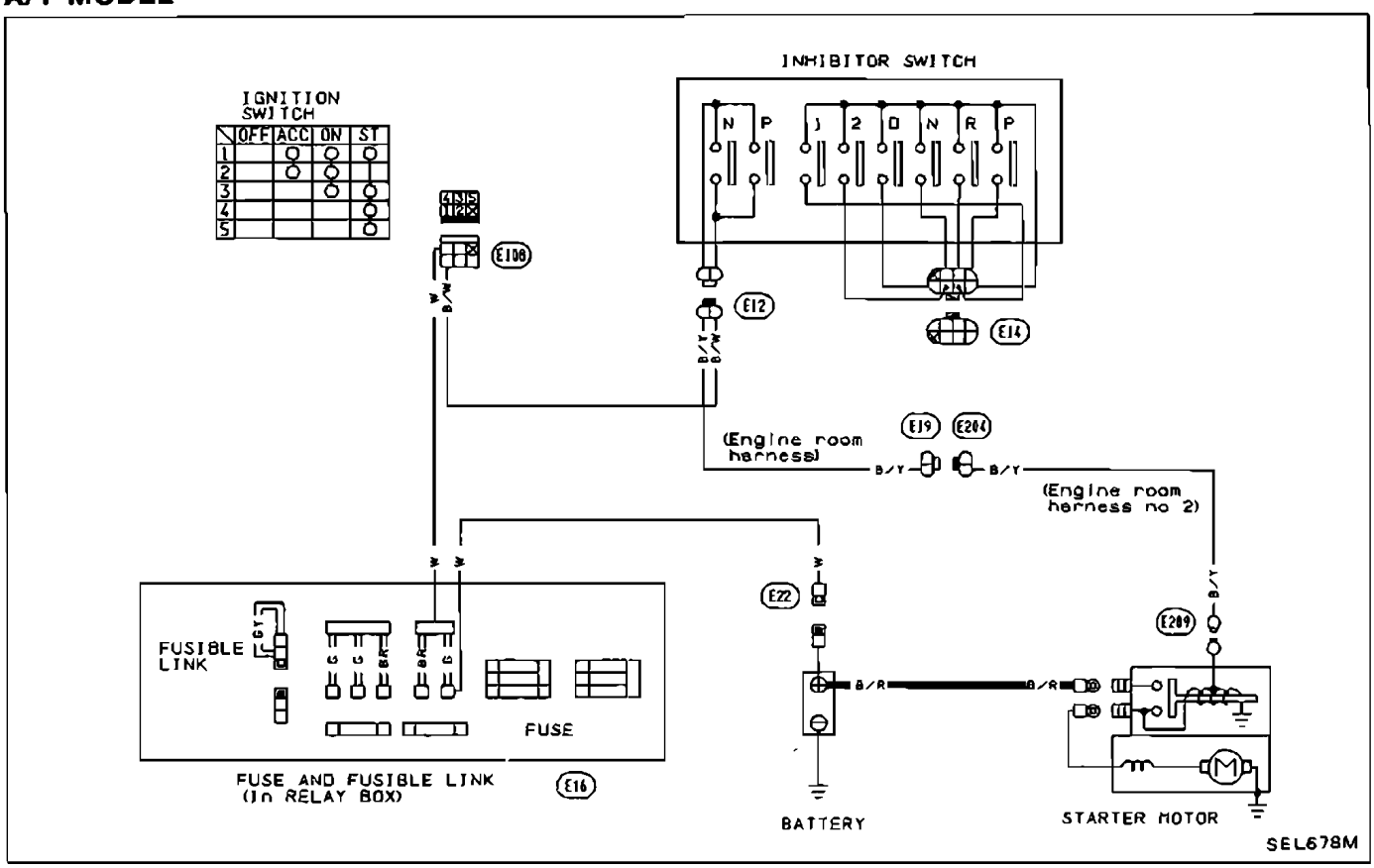
Applied area	U.S.A.	Canada
Type	55D23R	65D26R
Capacity V-AH	12-60	12-65

Wiring Diagram

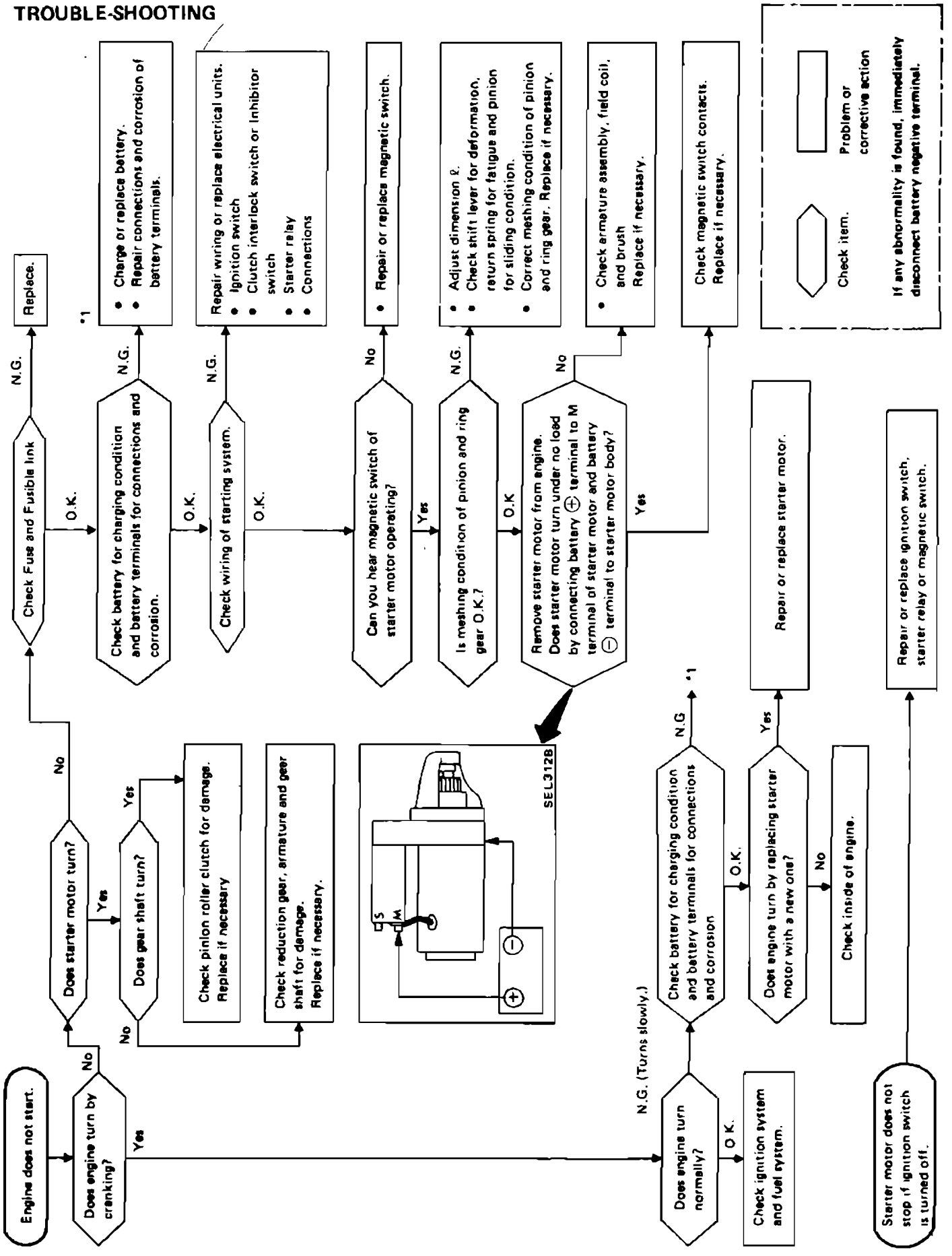
M/T MODEL



A/T MODEL

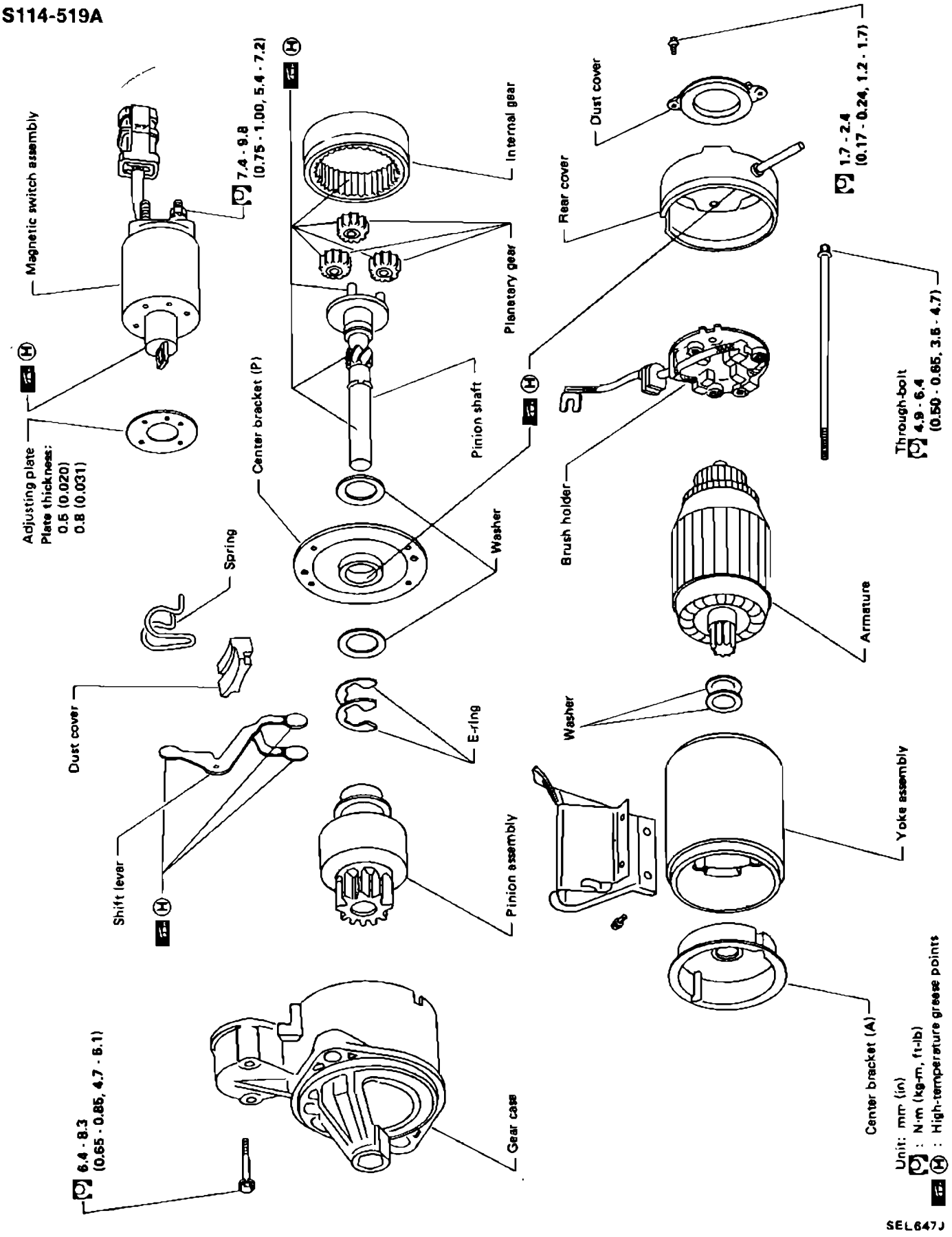


TROUBLE-SHOOTING



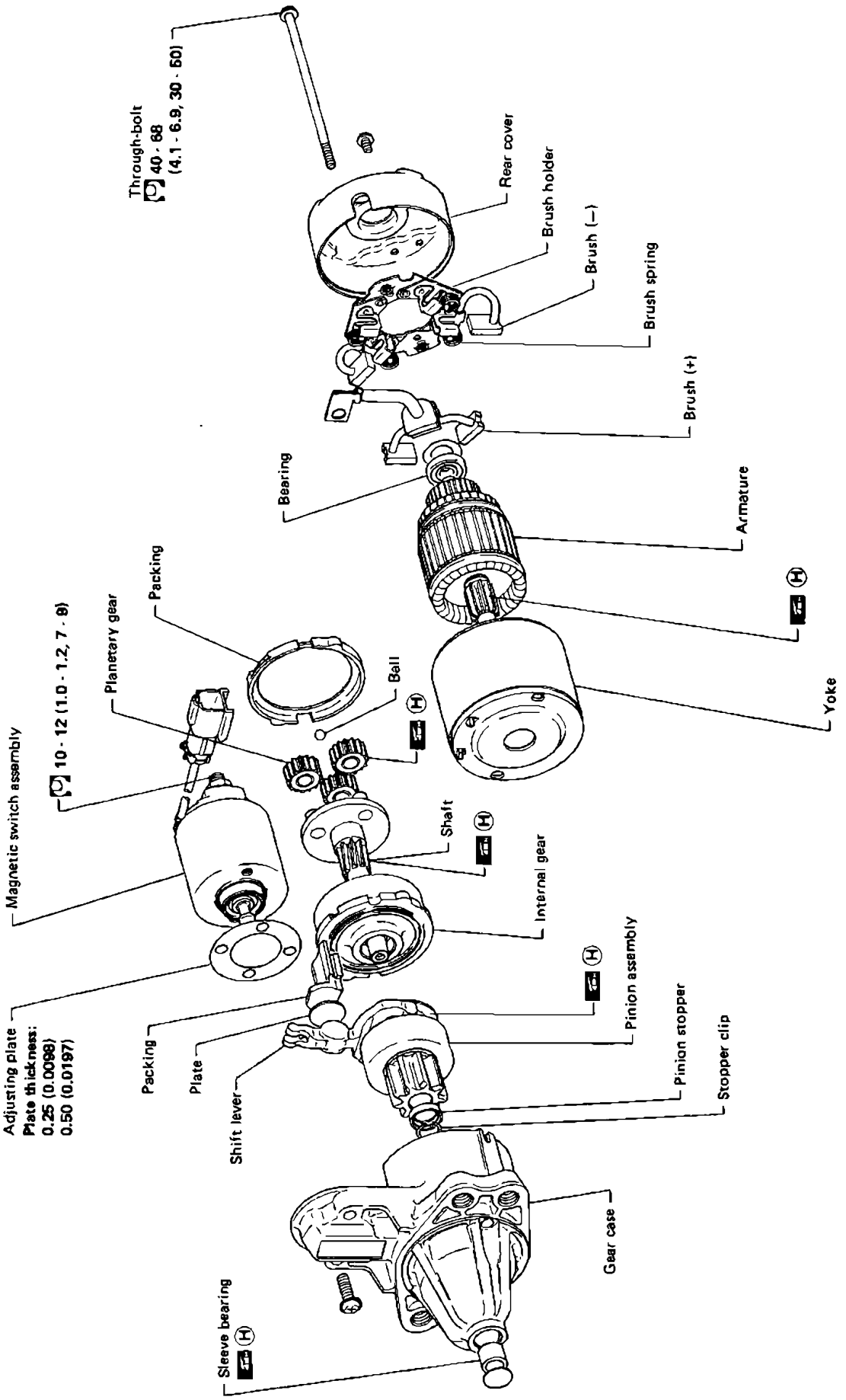
Construction

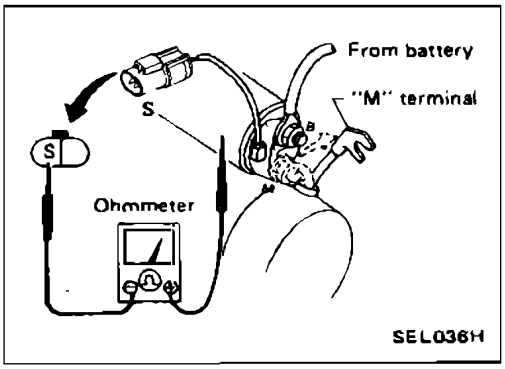
S114-519A



Construction (Cont'd)

M1T72781

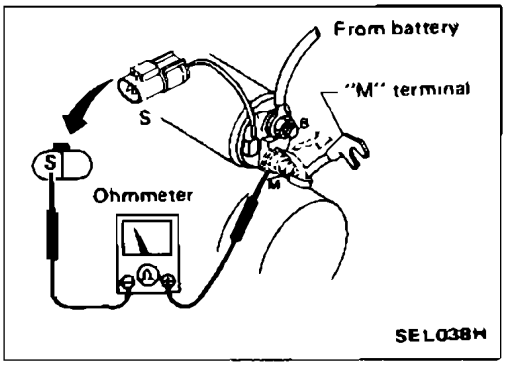




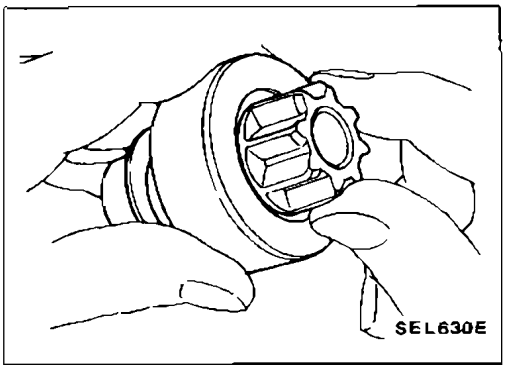
Magnetic Switch Check

- 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.



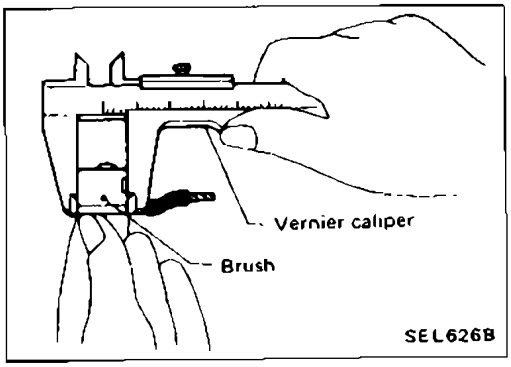
2. Continuity test (between "S" terminal and "M" terminal).
- No continuity ... Replace.



Pinion/Clutch Check

1. Inspect pinion teeth.
- Replace pinion if teeth are worn or damaged. (Also check condition of ring gear teeth.)

2. 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.



Brush Check

BRUSH

Check wear of brush.

Wear limit length:
Refer to S.D.S.

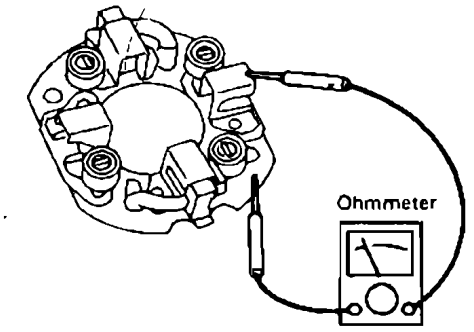
- Excessive wear ... Replace.

Brush Check (Cont'd)

BRUSH HOLDER

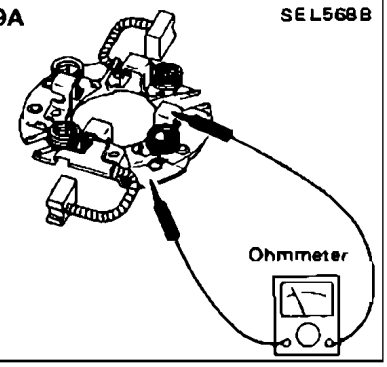
1. Perform insulation test between brush holder (positive side) and its base (negative side).
- Continuity exists. ... Replace.
2. Check brush to see if it moves smoothly.
- If brush holder is bent, replace it; if sliding surface is dirty, clean.

M1T72781



SEL568B

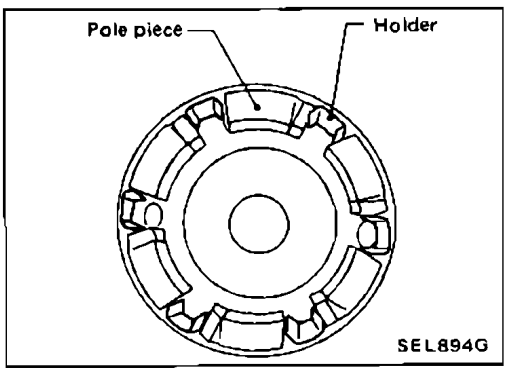
S114-519A



SEL558E

Pole Piece Check

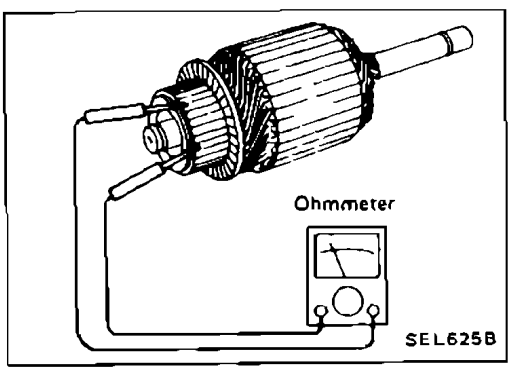
Pole piece is secured to yoke by bonding agent. Check pole piece to see that it is secured to yoke and for any cracks. Replace malfunctioning parts as an assembly.
Holder may move slightly as it is only inserted and not bonded.



SEL894G

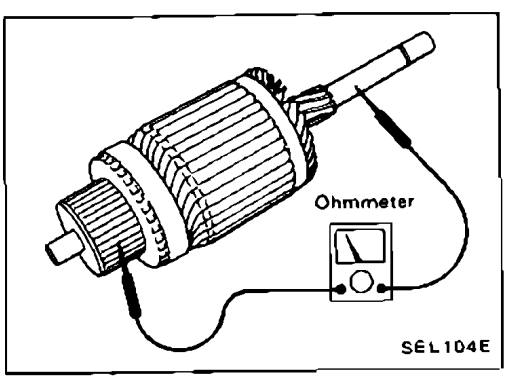
Armature Check

1. Continuity test (between two segments side by side).
- No continuity ... Replace.



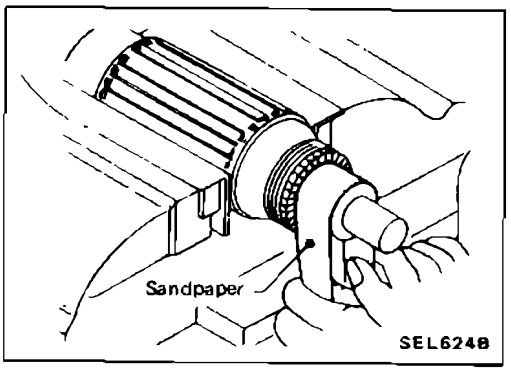
SEL625B

2. Insulation test (between each commutator bar and shaft).
- Continuity exists. ... Replace.

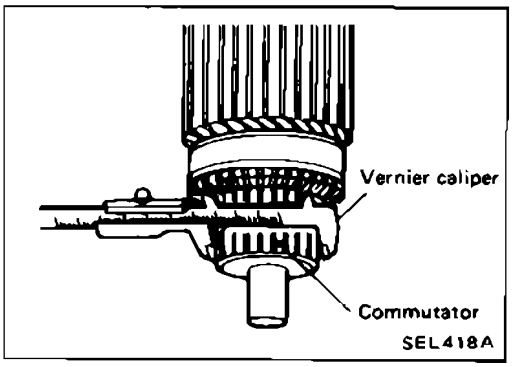


SEL104E

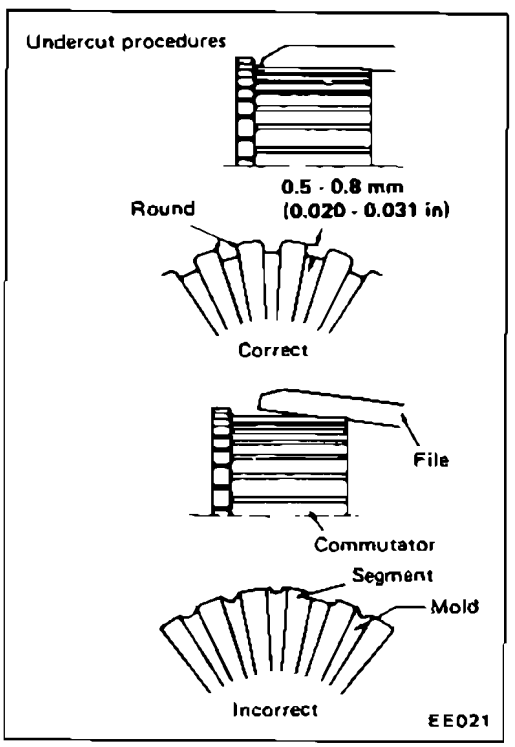
Armature Check (Cont'd)



3. Check commutator surface.
- Rough ... Sand lightly with No. 500 to 600 sandpaper.



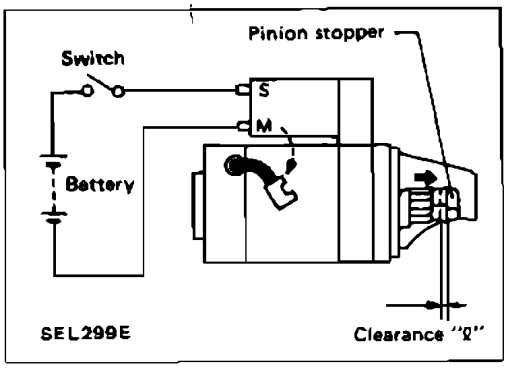
4. Check diameter of commutator.
Commutator minimum diameter:
Refer to S.D.S.
- Less than specified value ... Replace.

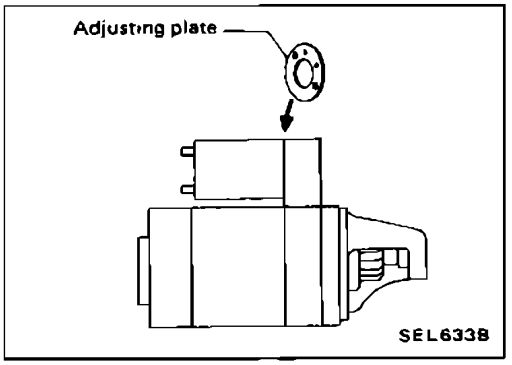


5. Check depth of insulating mold from commutator surface.
- Less than 0.2 mm (0.008 in) ... Undercut to 0.5 to 0.8 mm (0.020 to 0.031 in)

Assembly

Apply high-temperature grease to lubricate the bearing, gears and frictional surface when assembling the starter.
Carefully observe the following instructions.
- Gear case metal
- Moving portion of shift lever
- Plunger of magnetic switch
- Internal gear
- Planetary gear
- Shaft





Assembly (Cont'd)

PINION PROTRUSION LENGTH ADJUSTMENT

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 S.D.S.

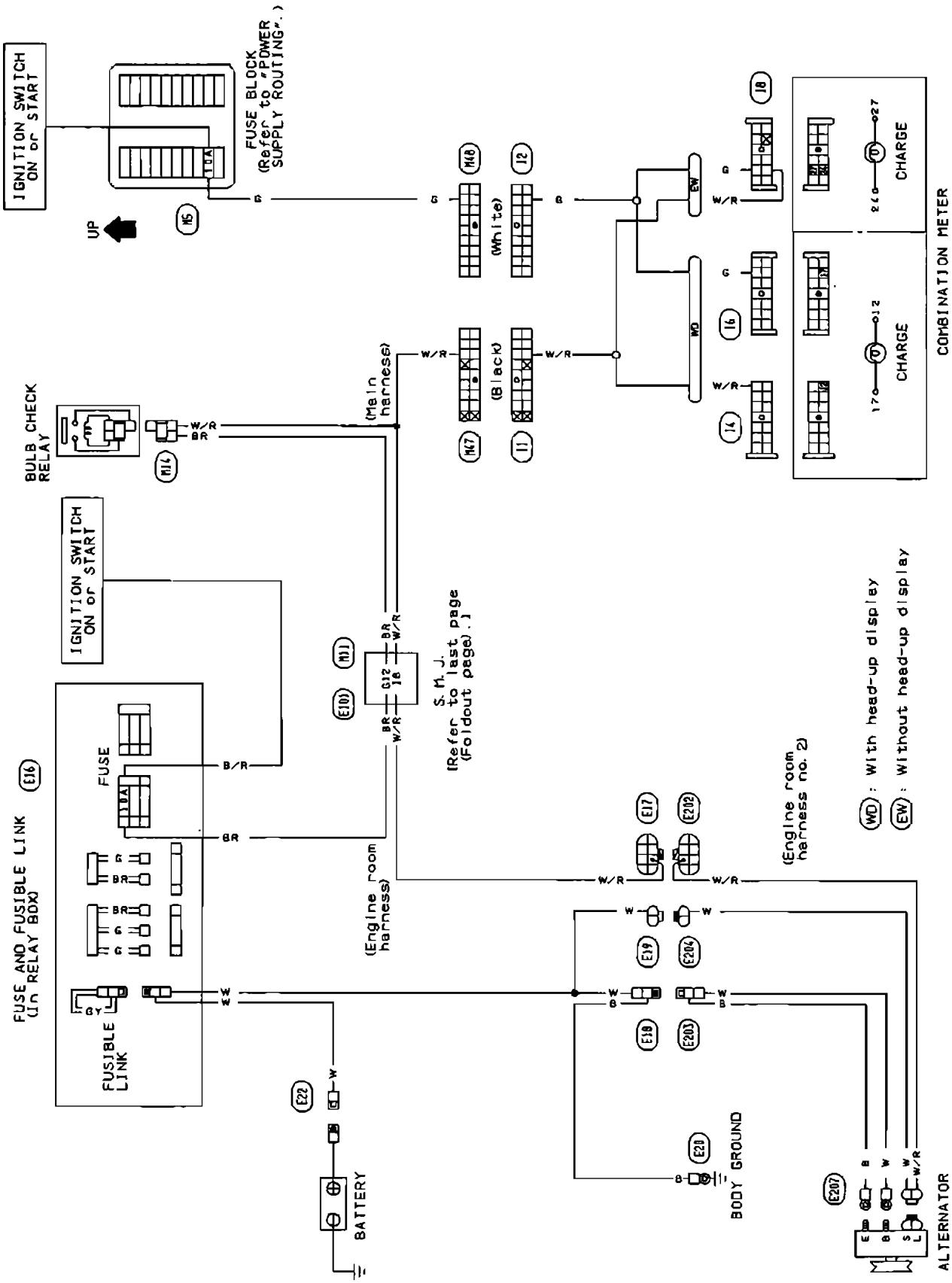
- Not in the specified value ... Adjust by adjusting plate.

Service Data and Specifications (S.D.S.)

STARTER

Type		S114-519A	M1T72781
		HITACHI make	MITSUBISHI make
		Reduction gear type	
Applied model		All	
System voltage	V	12	
No-load Terminal voltage	V	11.0	
Current	A	Less than 85	50 - 75
Revolution	rpm	More than 2,760	3,000 - 4,000
Minimum diameter of commutator	mm (in)	32.0 (1.260)	28.8 (1.134)
Minimum length of brush	mm (in)	11.0 (0.433)	12.0 (0.472)
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)
Clearance of bearing metal and armature shaft	mm (in)	0.2 (0.008)	–
Clearance "ℓ" between pinion front edge and pinion stopper	mm (in)	0.3 - 1.5 (0.012 - 0.059)	0.5 - 2.0 (0.020 - 0.079)

Wiring Diagram



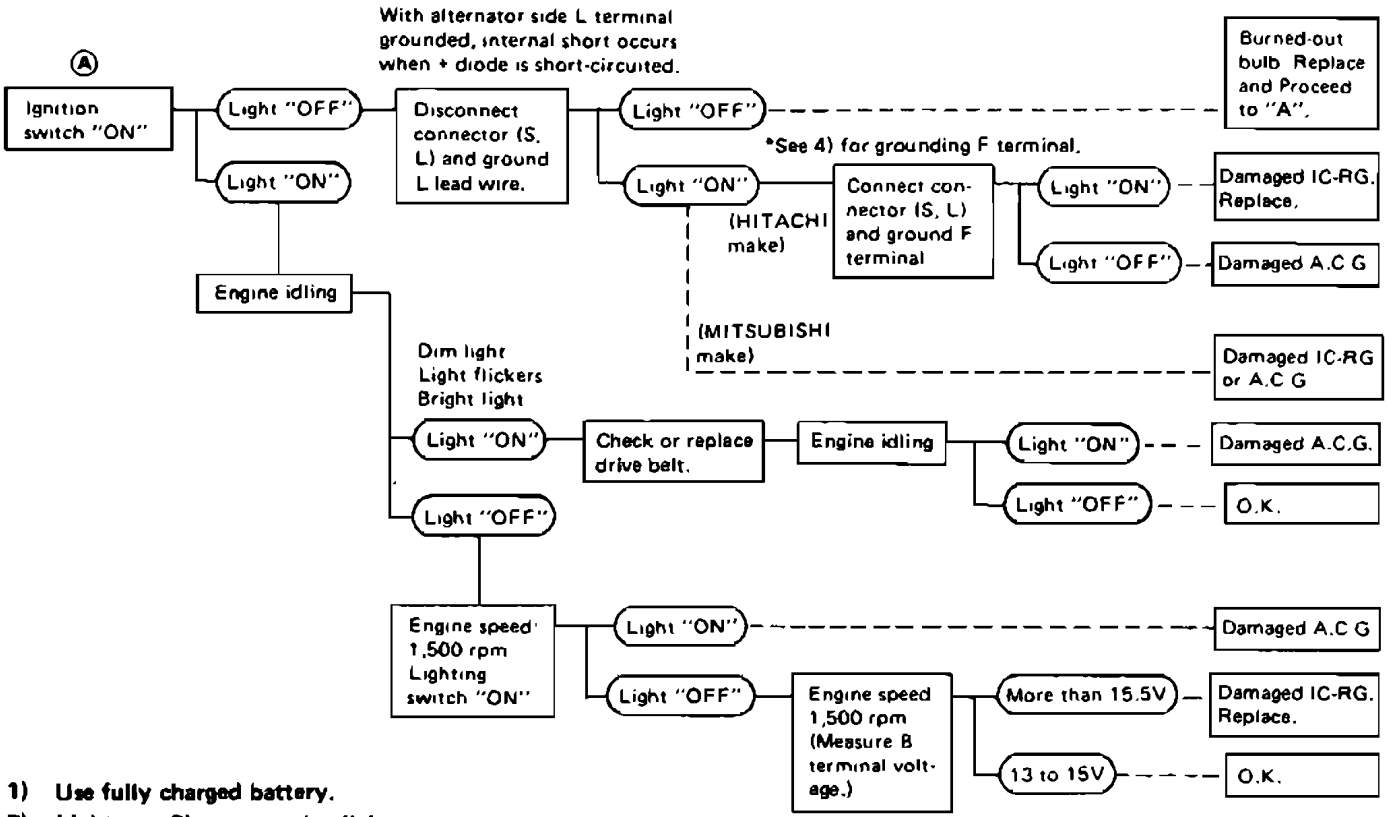
SEL584M

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.

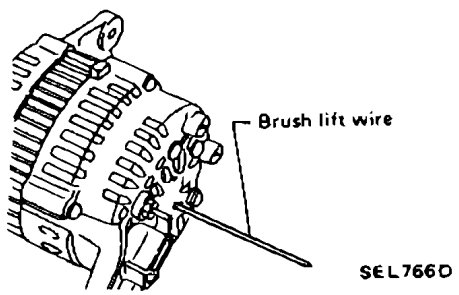
WITH IC REGULATOR



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 (HITACHI make only)**

Gasoline engine model

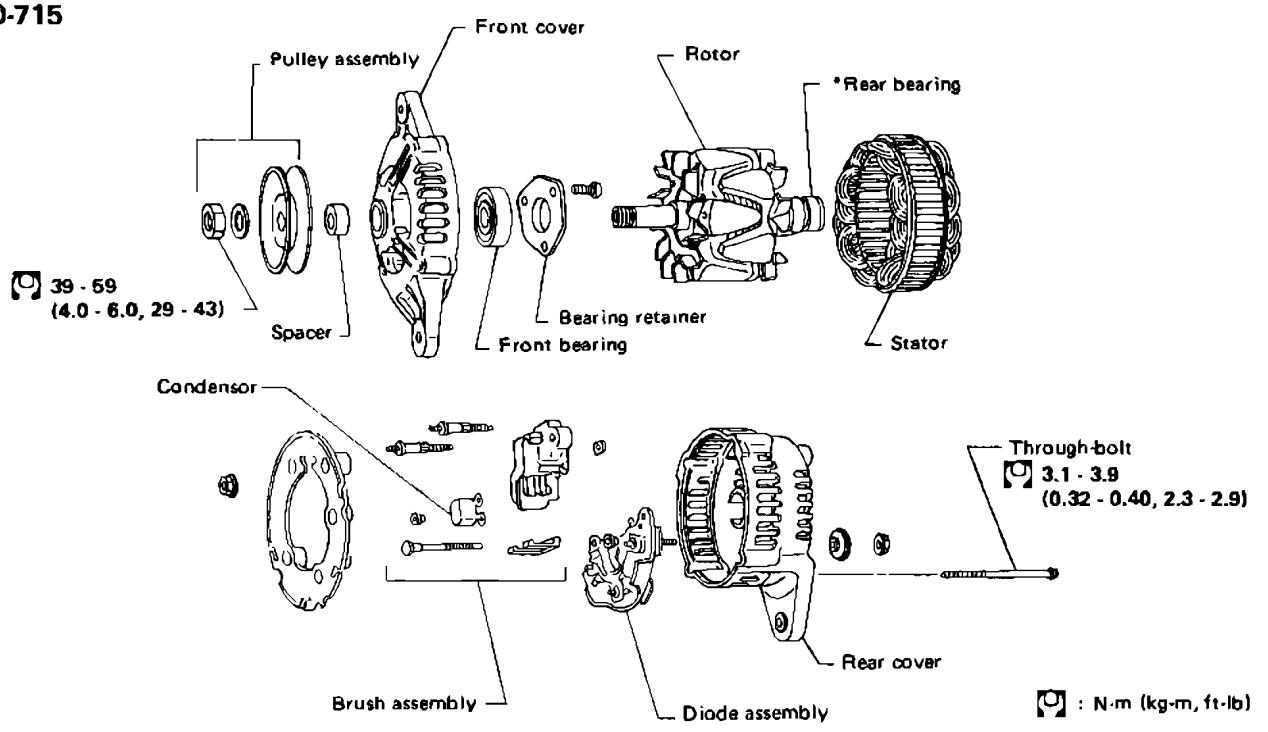
Contact tip of wire with brush and attach wire to alternator body.



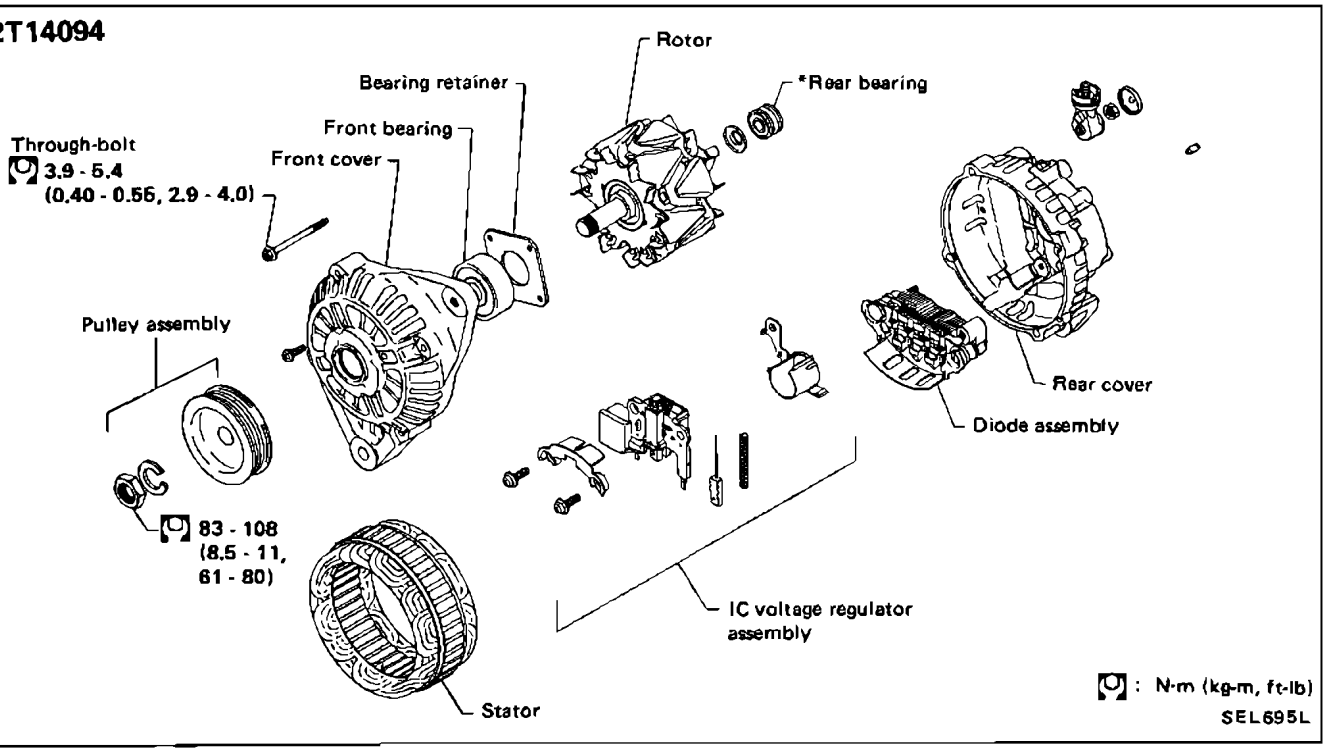
5) **Terminals "S", "L", "B" and "E" are marked on rear cover of alternator.**

Construction

LR180-715



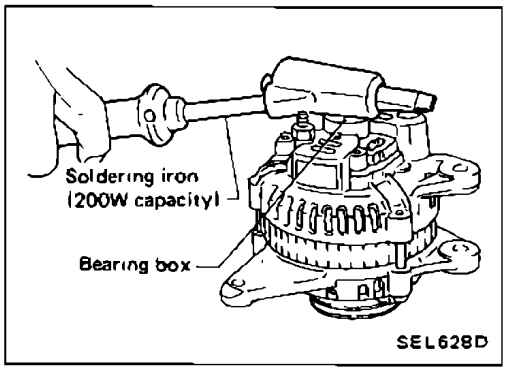
A2T14094



***Rear bearing**

CAUTION:

Rear cover may be hard to remove because a ring is used to lock outer race of rear bearing. Be careful not to lose this ring during removal.



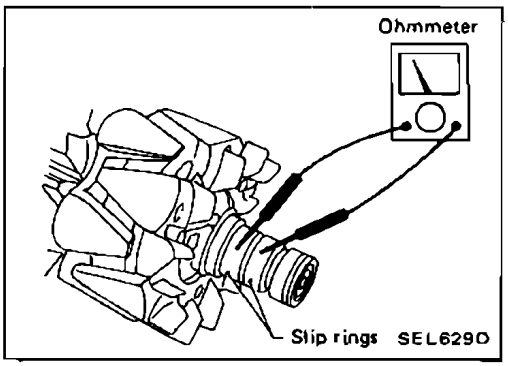
Disassembly

REAR COVER REMOVAL

CAUTION:

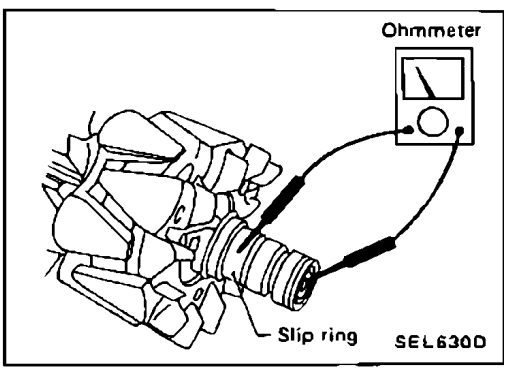
Rear cover may be hard to remove because a ring is used to lock outer race of rear bearing. To facilitate removal of rear cover, heat just bearing box section with a 200W soldering iron.

Do not use a heat gun, as it can damage diode assembly.



Rotor Slip Ring Check

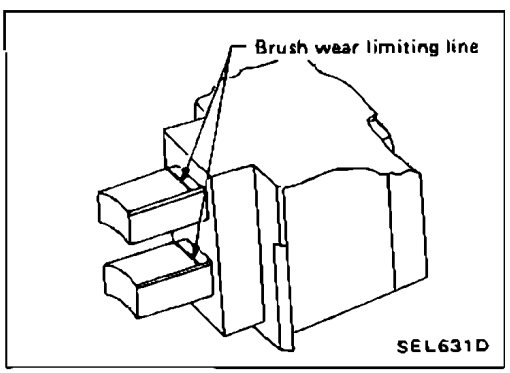
1. Continuity test
- No continuity ... Replace rotor.



2. Insulator test
- Continuity exists. ... Replace rotor.

3. Check slip ring for wear.

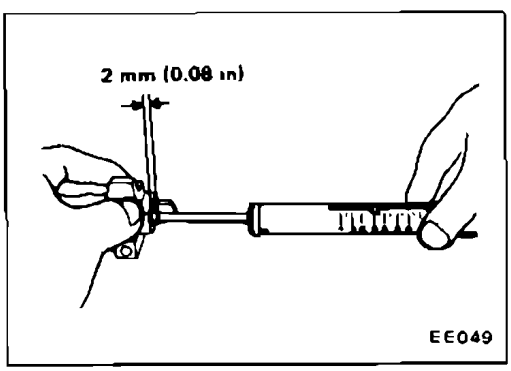
Slip ring minimum outer diameter:
Refer to S.D.S.



Brush Check

1. Check smooth movement of brush.
- Not smooth ... Check brush holder and clean.

2. Check brush for wear.
- Replace brush if it is worn down to the limit line.

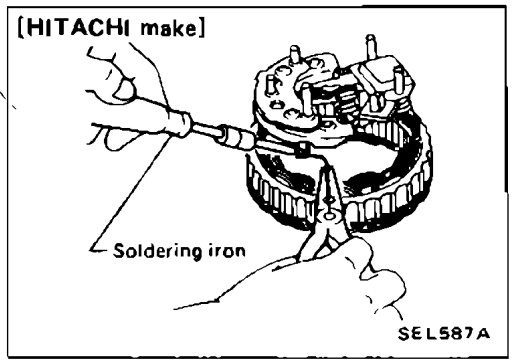


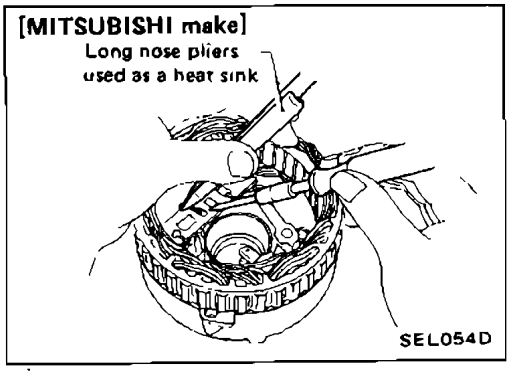
3. Check brush lead wire for damage.
- Damaged ... Replace.

4. Check brush spring pressure.
Measure brush spring pressure with brush projected approximately 2 mm (0.08 in) from brush holder.

Spring pressure:
Refer to S.D.S.

- Not within the specified values ... Replace.



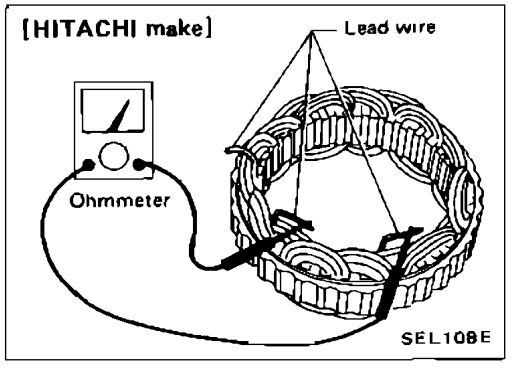


Stator Check

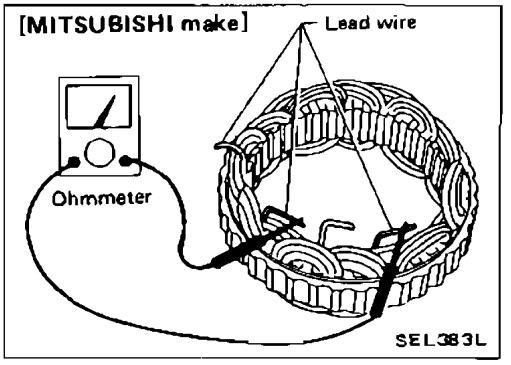
To test the stator or diode, separate them by unsoldering the connecting wires.

CAUTION:

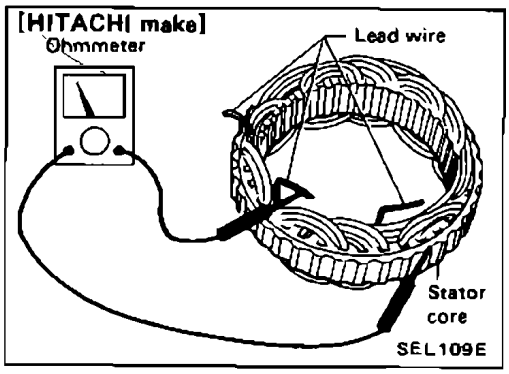
Use only as much heat as required to melt solder. Otherwise, diodes will be damaged by excessive heat.

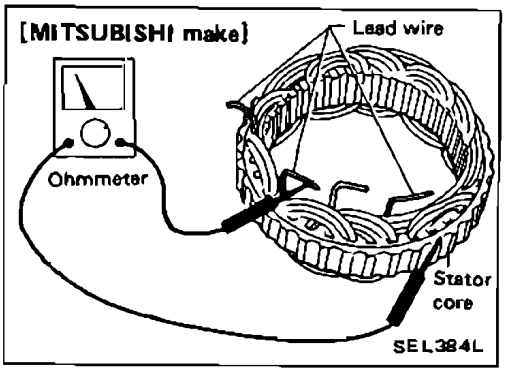


1. Continuity test
- No continuity ... Replace stator.



Stator Check (Cont'd)





2. Ground test
- Continuity exists. ... Replace stator.

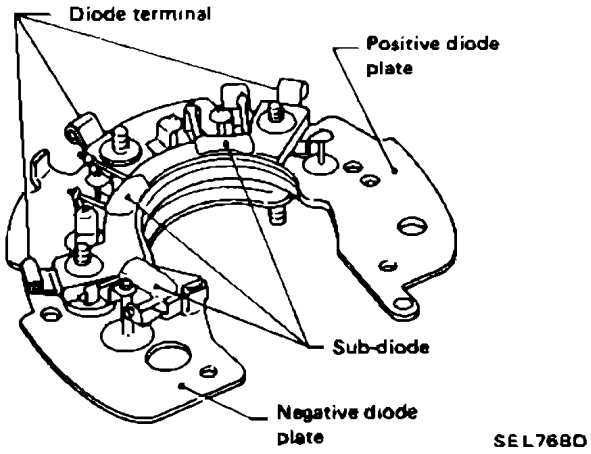
Diode Check

MAIN 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.

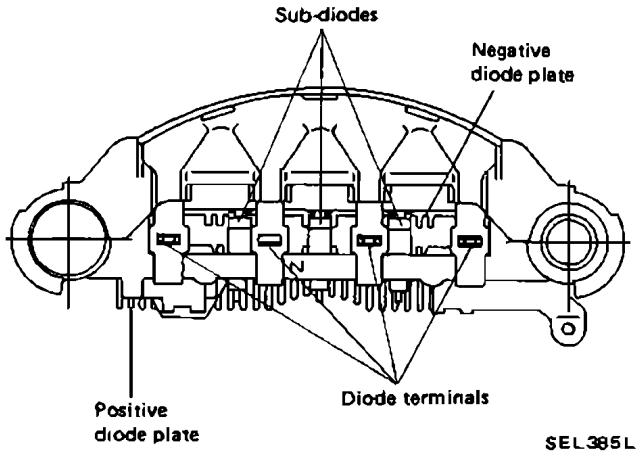
	Ohmmeter probes		Continuity
	Positive ⊕	Negative ⊖	
Diodes check (Positive side)	Positive diode plate	Diode terminals	Yes
	Diode terminals	Positive diode plate	No
Diodes check (Negative side)	Negative diode plate	Diode terminals	No
	Diode terminals	Negative diode plate	Yes

[HITACHI make]



SEL768D

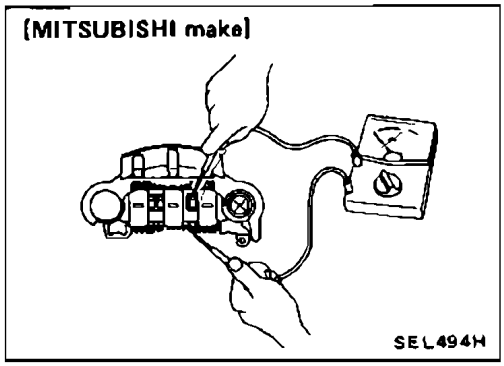
[MITSUBISHI make]



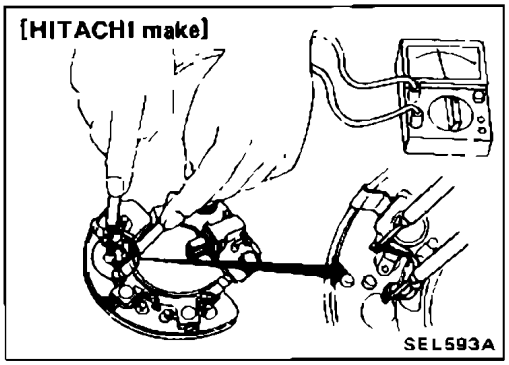
SEL385L

Diode Check (Cont'd)

[MITSUBISHI make]



[HITACHI make]



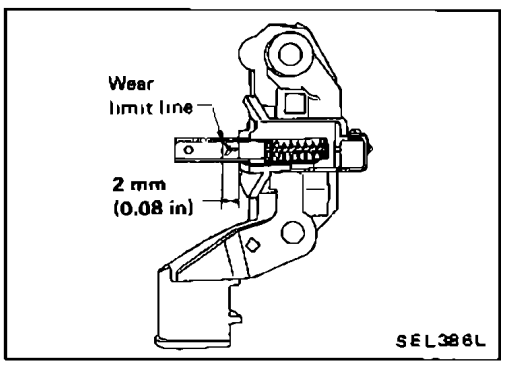
SUB-DIODES

- Attach ohmmeter's probe to each end of diode to check for continuity.
- Continuity is N.G. ... Replace diode assembly.

Assembly

Carefully observe the following instructions.

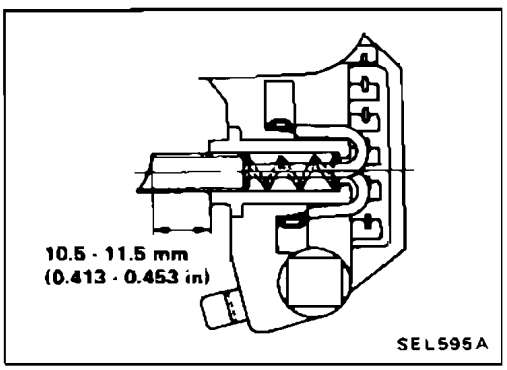
- When soldering each stator coil lead wire to diode assembly terminal, carry out the operation as fast as possible.



WHEN SOLDERING BRUSH LEAD WIRE

[MITSUBISHI make]

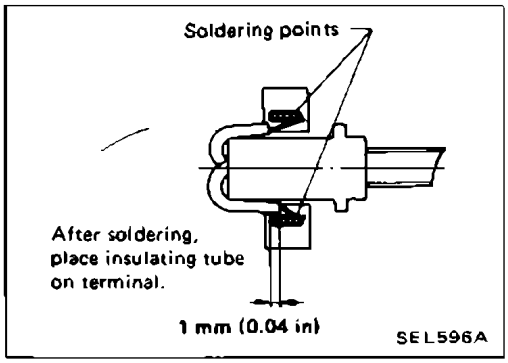
- Position brush so that its wear limit line protrudes 2 mm (0.08 in) beyond end face of brush holder.



[HITACHI make]

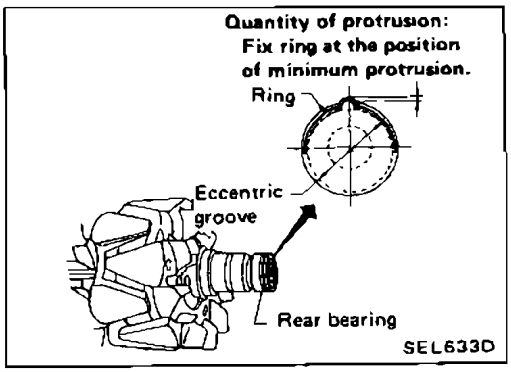
(1) Position brush so that it extends 10.5 to 11.5 mm (0.413 to 0.453 in) from brush holder.

Assembly (Cont'd)



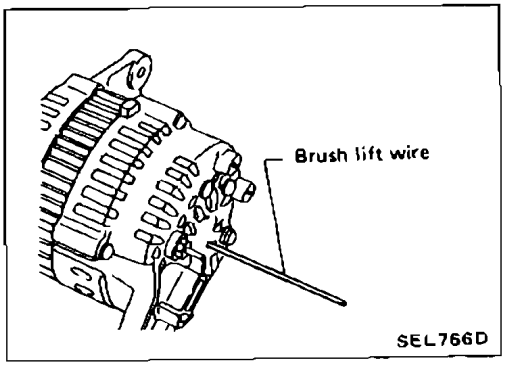
(2) Coil lead wire 1.5 times around terminal groove. Solder outside of terminal.

When soldering, be careful not to let solder adhere to insulating tube as it will weaken the tube and cause it to break.



RING FITTING IN REAR BEARING

- Fix ring into groove in rear bearing so that it is as close to the adjacent area as possible.

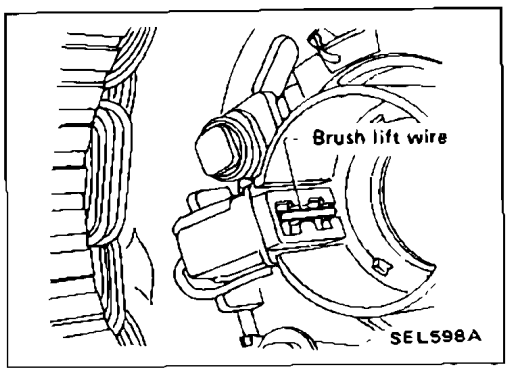


REAR COVER INSTALLATION

(1) Before installing front cover with pulley and rotor with rear cover, push brush up with fingers and retain brush by inserting brush lift wire into brush lift hole from outside.

(2) After installing front and rear sides of alternator, pull brush lift wire by pushing toward the center.

Do not pull brush lift wire by pushing toward outside of rear cover as it will damage slip ring sliding surface.

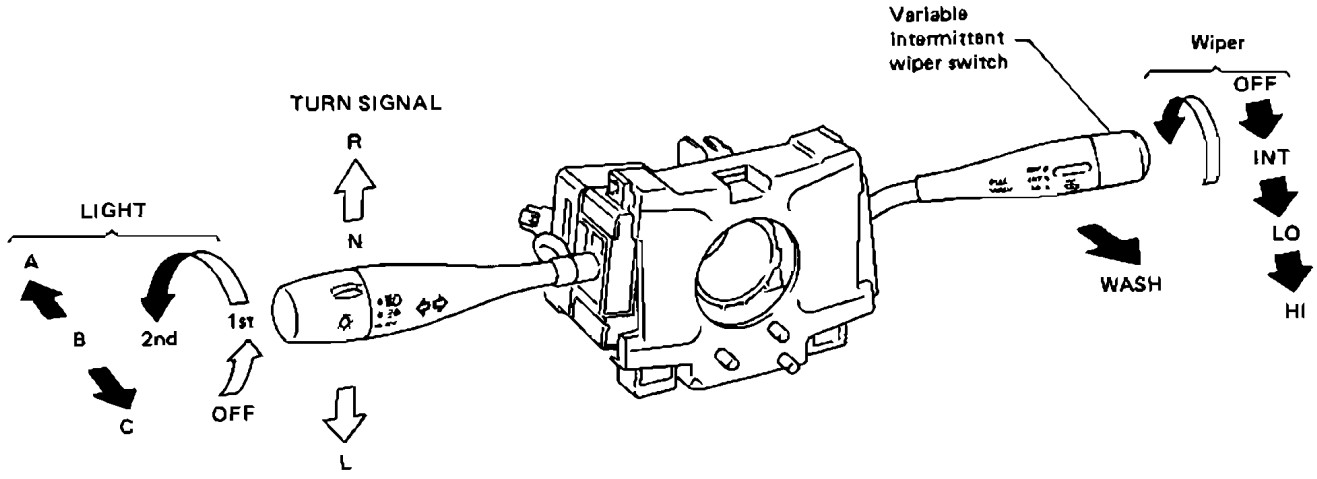


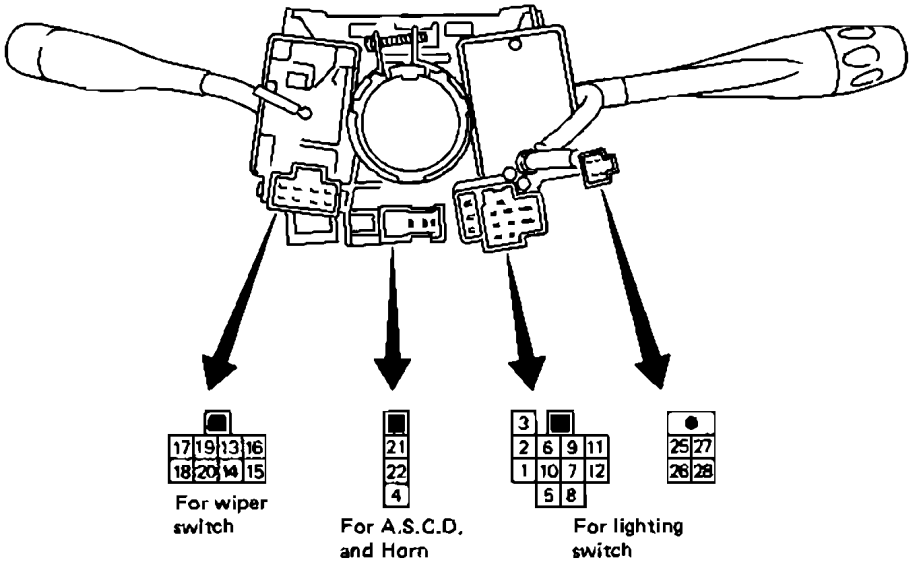
Service Data and Specifications (S.D.S.)

ALTERNATOR

Type	LR180-715	A2T14094
Applied model	All	
Nominal rating V-A	12-80	
Groung polarity	Negative	
Minimum revolution under no-load (When 13.5 volts is applied) rpm	Less than 950	Less than 1,100
Hot output current A/rpm	More than 22/1,300 More than 58/2,500 More than 77/5,000	More than 21/1,300 More than 60/2,500
Regulated output voltage V	14.1 - 14.7	
Minimum length of brush mm (in)	6.0 (0.236)	8.0 (0.315)
Brush spring pressure N (g, oz)	1.471 - 3.334 (150 - 340, 5.29 - 11.99)	3.040 - 4.217 (310 - 430, 10.93 - 15.17)
Slip ring minimum outer diameter mm (in)	26.8 (1.055)	22.1 (0.870)

Check





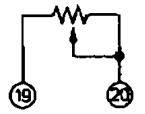
LIGHTING SWITCH

	OFF			1			2		
	A	B	C	A	B	C	A	B	C
5			○			○	○	○	○
6			○			○	○		○
7								○	
8			○			○	○	○	○
9			○			○	○	○	○
10								○	
11				○	○	○	○	○	○
12				○	○	○	○	○	○
25							○	○	○
26							○	○	○
27	○	○	○	○	○	○			
28	○	○	○	○	○	○			

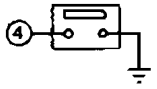
WIPER SWITCH

	OFF	INT	LO	HI	WASH
13	○	○			
14	○	○	○		
15		○			
16				○	
17		○	○	○	○
18					○

INTERMITTENT WIPER VOLUME



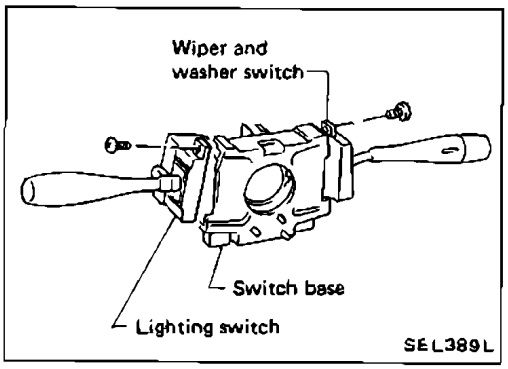
HORN SWITCH



	A	N	L
1	○		○
2	○		
3			○

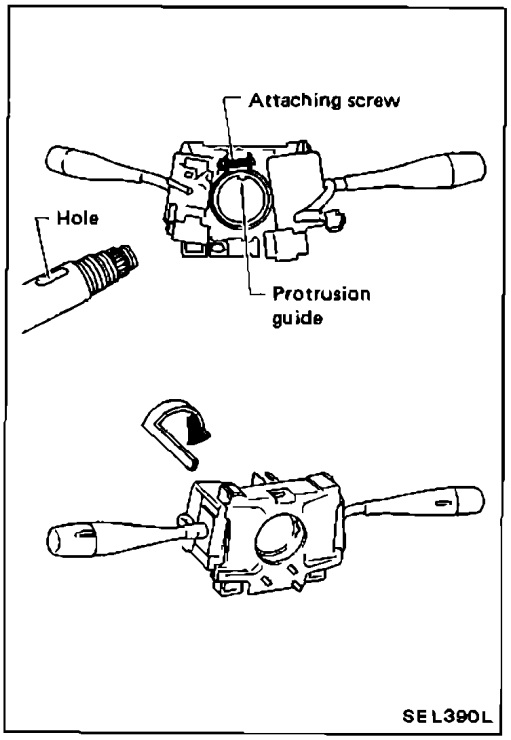
TURN SIGNAL SWITCH

SEL388L



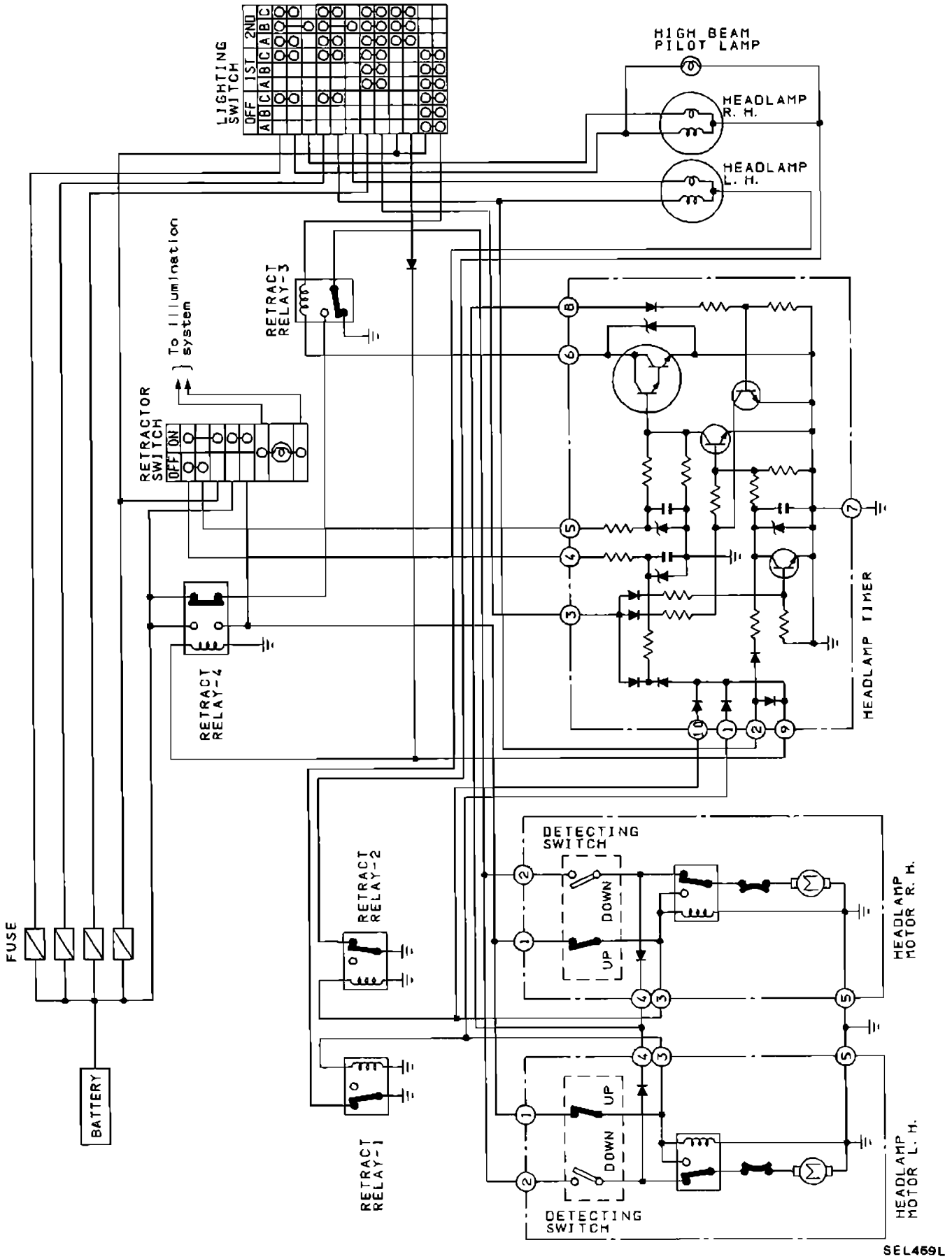
Replacement

- Each switch can be replaced without removing combination switch base.

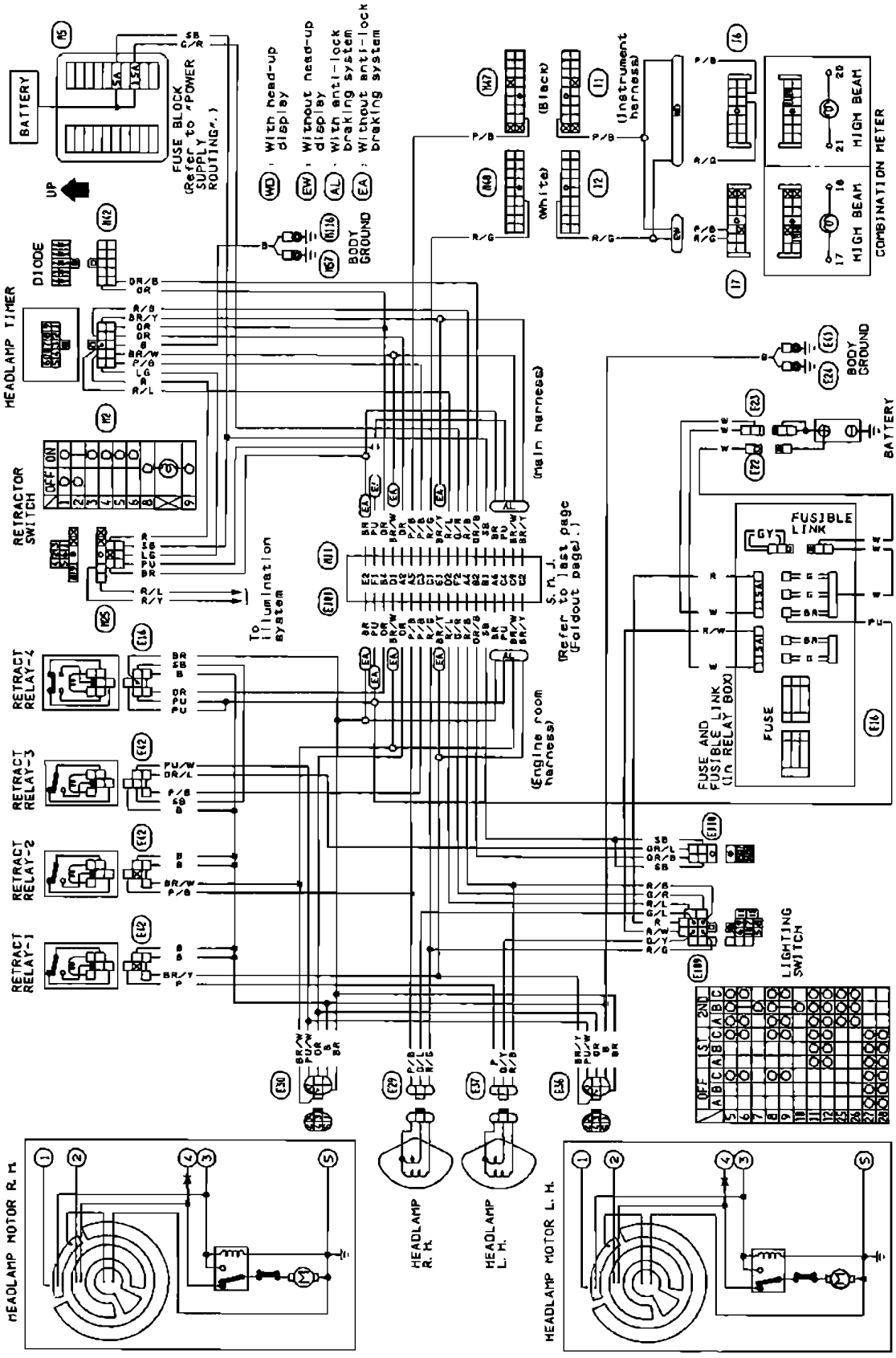


- To remove combination switch base, remove base attaching screw and turn after pushing on it.

Schematic


LIGHTING SWITCH
OFF 1ST 2ND
A B C A B C A B C
HIGH BEAM PILOT LAMP
HEADLAMP R. H.
HEADLAMP L. H.
RETRACT RELAY-3
To Illumination system
RETRACTOR SWITCH
OFF ON
RETRACT RELAY-4
HEADLAMP TIMER
DETECTING SWITCH
DOWN
UP
RETRACT RELAY-2
RETRACT RELAY-1
HEADLAMP MOTOR R. H.
HEADLAMP MOTOR L. H.
FUSE
BATTERY
SEL459L

Wiring Diagram



SEL586M

Description

BASIC OPERATION

Condition		Operation		
Lighting switch	Retractor switch	C/O*	Headlamp motor	Headlamps
OFF → 1ST	OFF		No operation	OFF
1ST → 2ND	OFF	[A]	Open	ON after headlamp motor reaches fully open position.
2ND → 1ST	OFF		Held to open position	OFF
1ST → OFF	OFF	[B]	Closed	OFF
Momentarily turned to PASSING	OFF	[C]	Opened and closed after headlamps go off.	Momentarily ON after headlamp motor reaches fully open position, and go off.
OFF	ON	[D]	Open	OFF

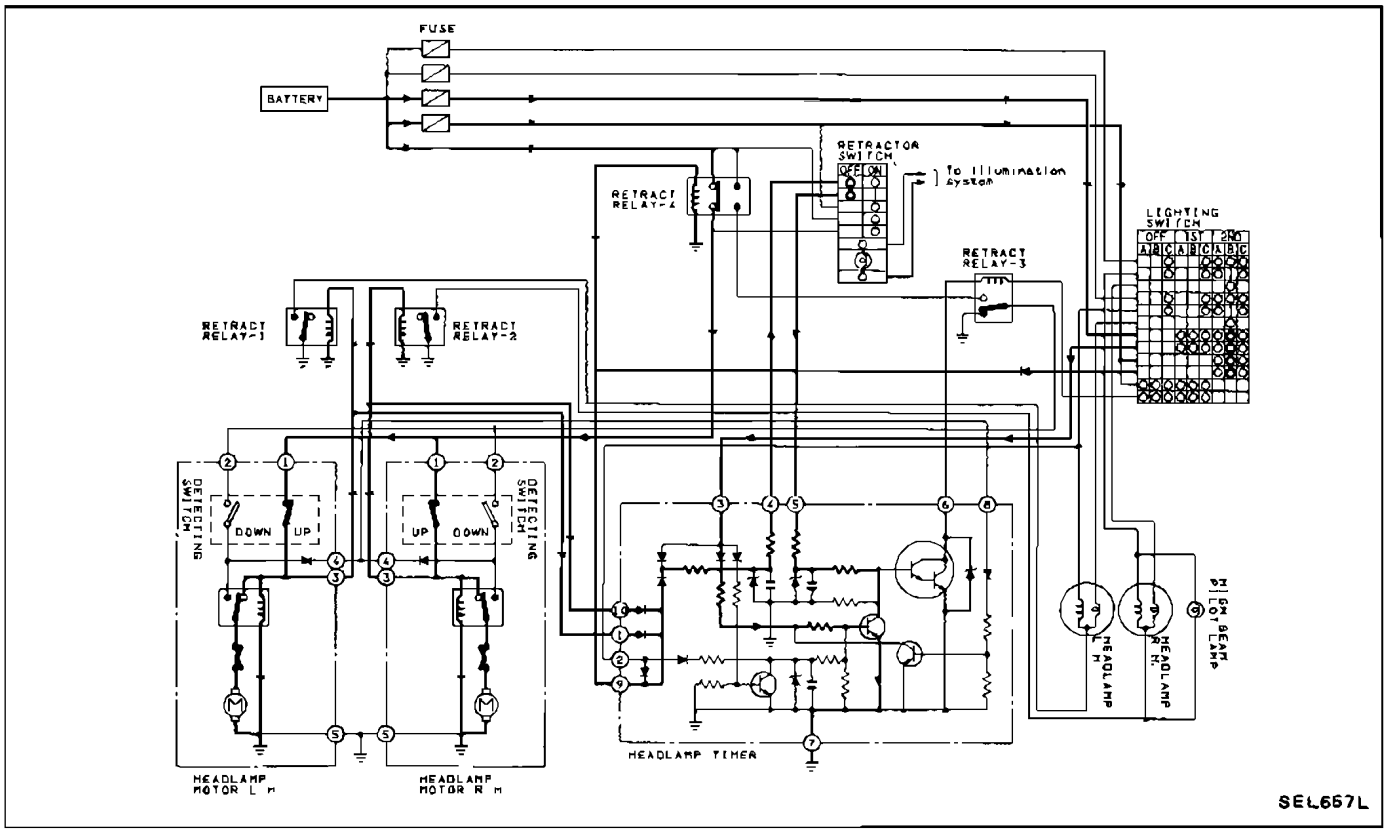
*: Refer to CIRCUIT OPERATION.

Description (Cont'd)

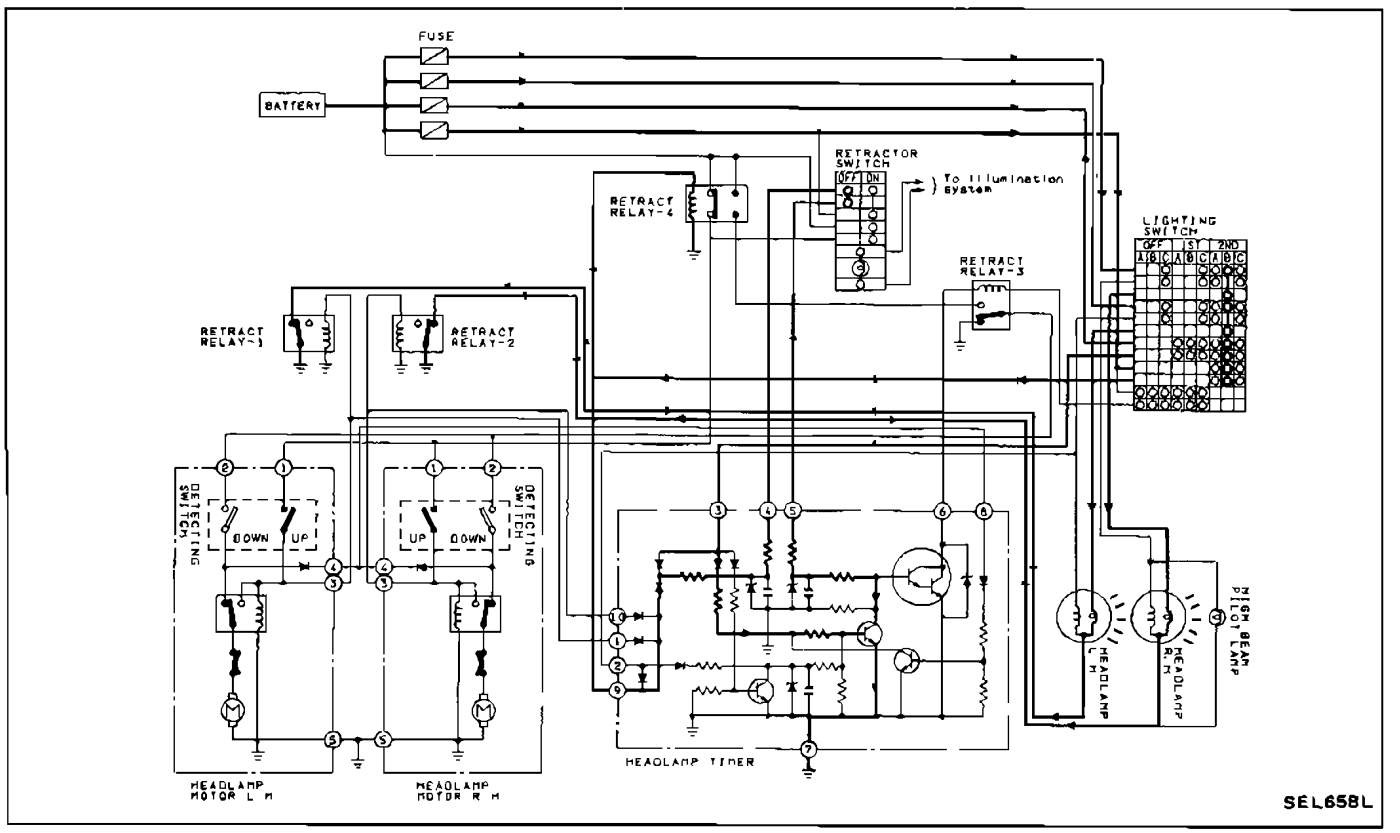
CIRCUIT OPERATION

[A] When lighting switch is switched from "1ST" → "2ND"

A-1: While operating the headlamp motor to open position

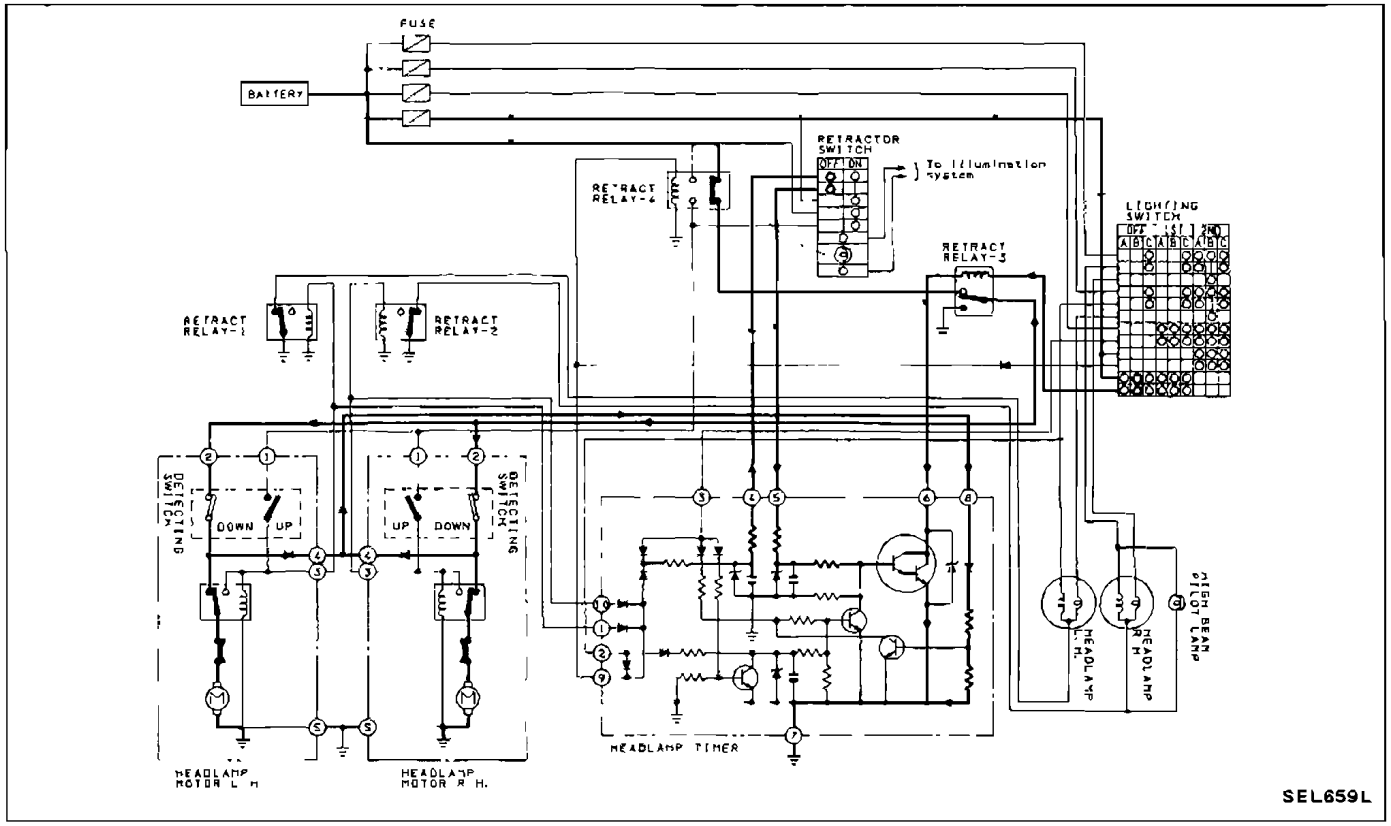


A-2: After the headlamp motor reaches fully open position

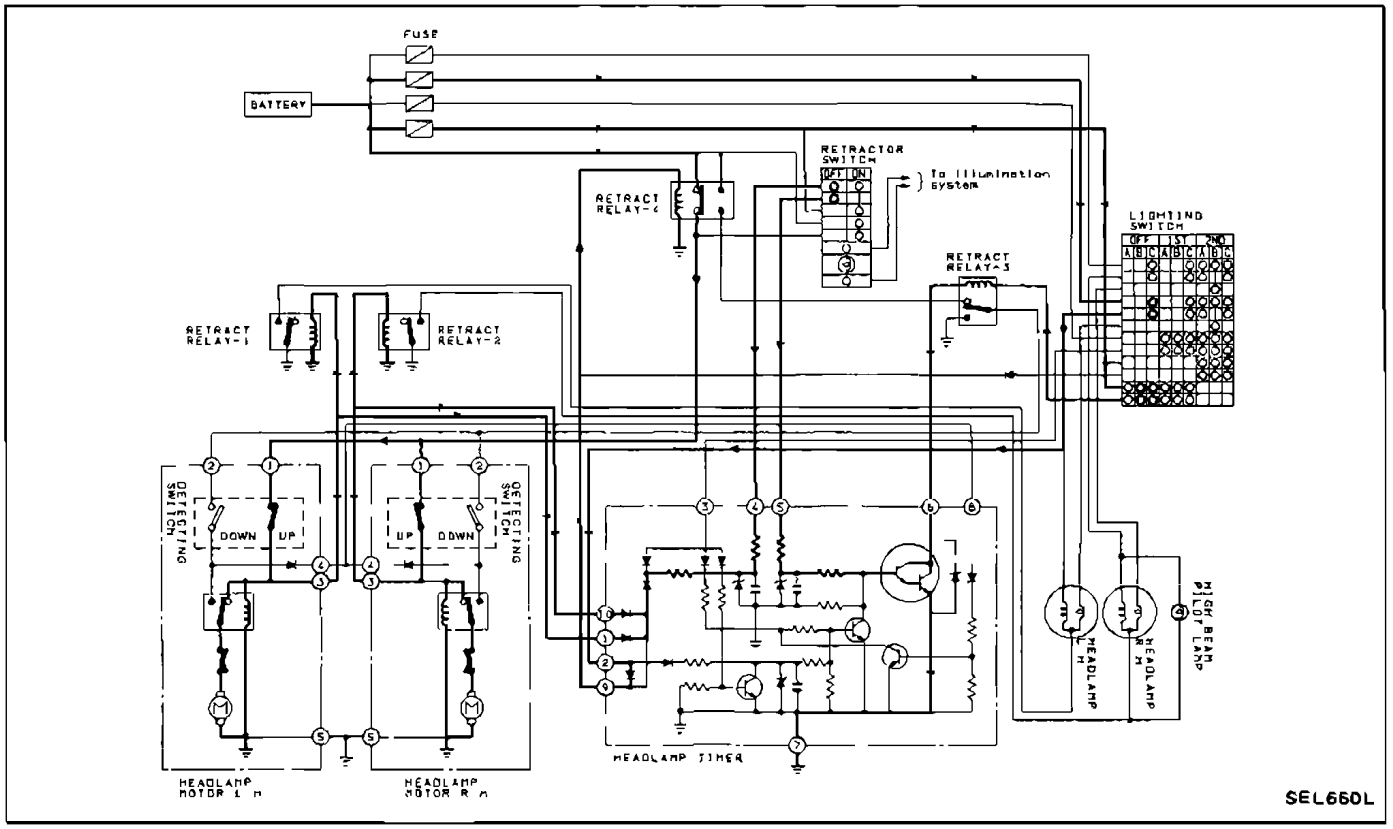


Description (Cont'd)

[B] When lighting switch is switched from "1ST" → "OFF"
(While operating the headlamp motor to closed position)

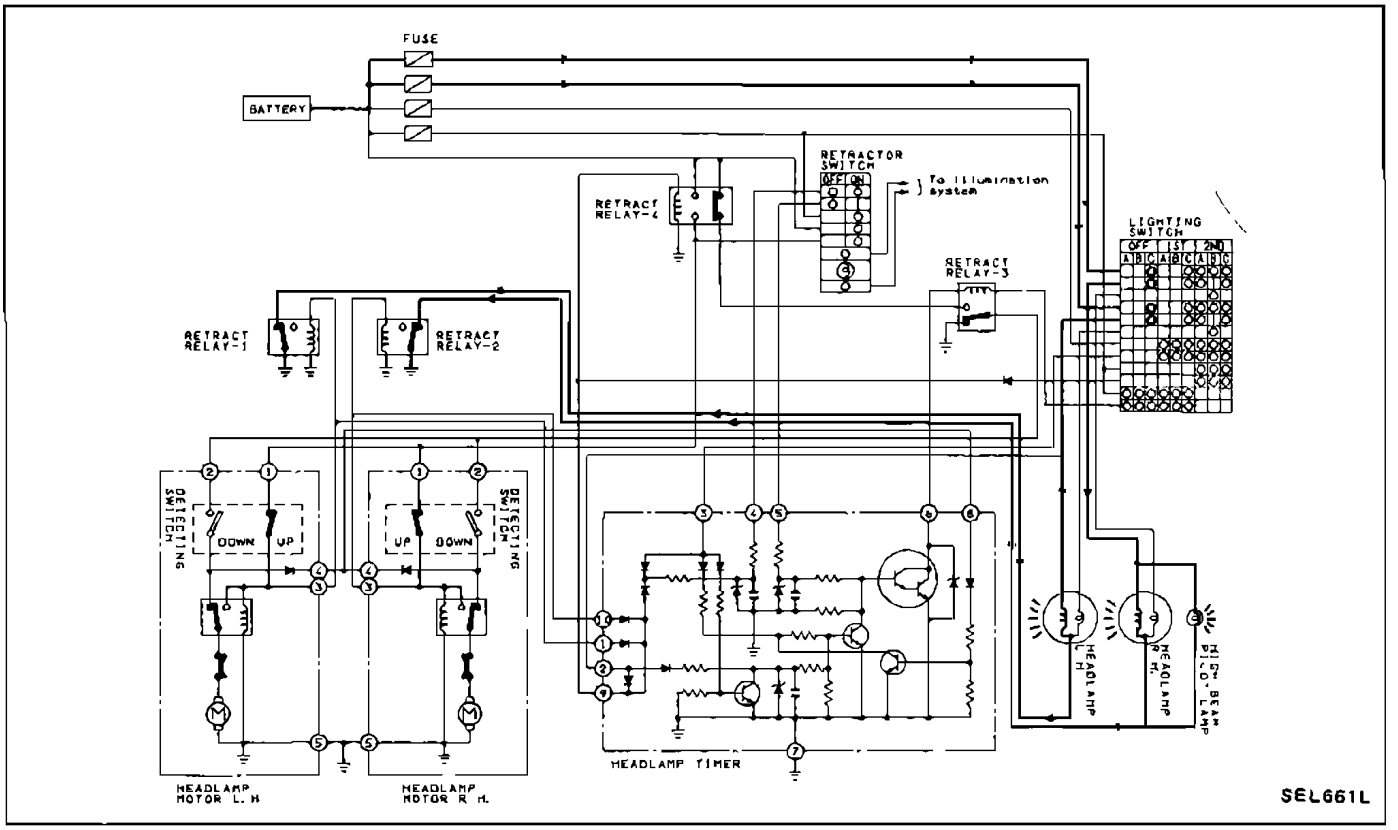


[C] When lighting switch is switched to "PASSING"
C-1: While operating the headlamp motor to open position

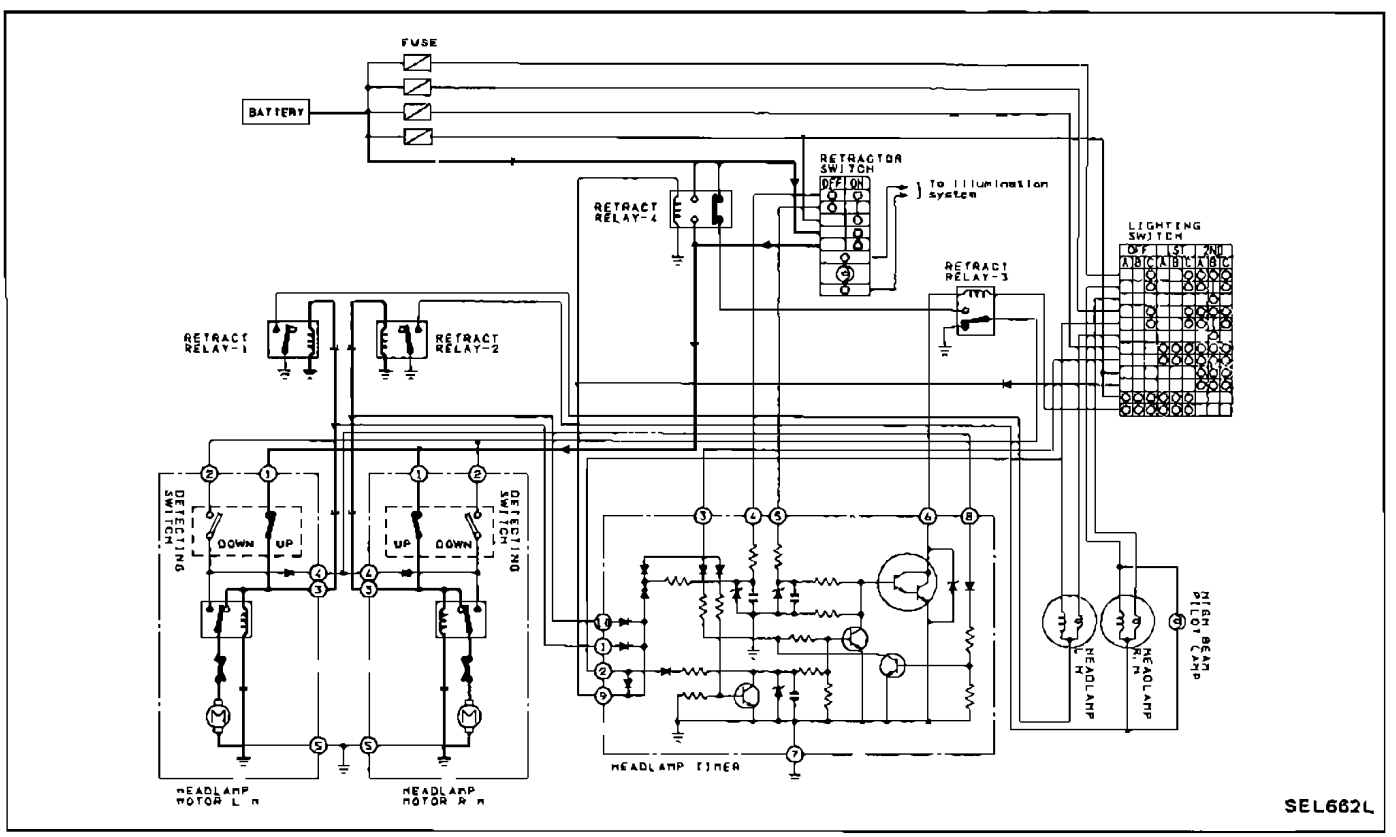


Description (Cont'd)

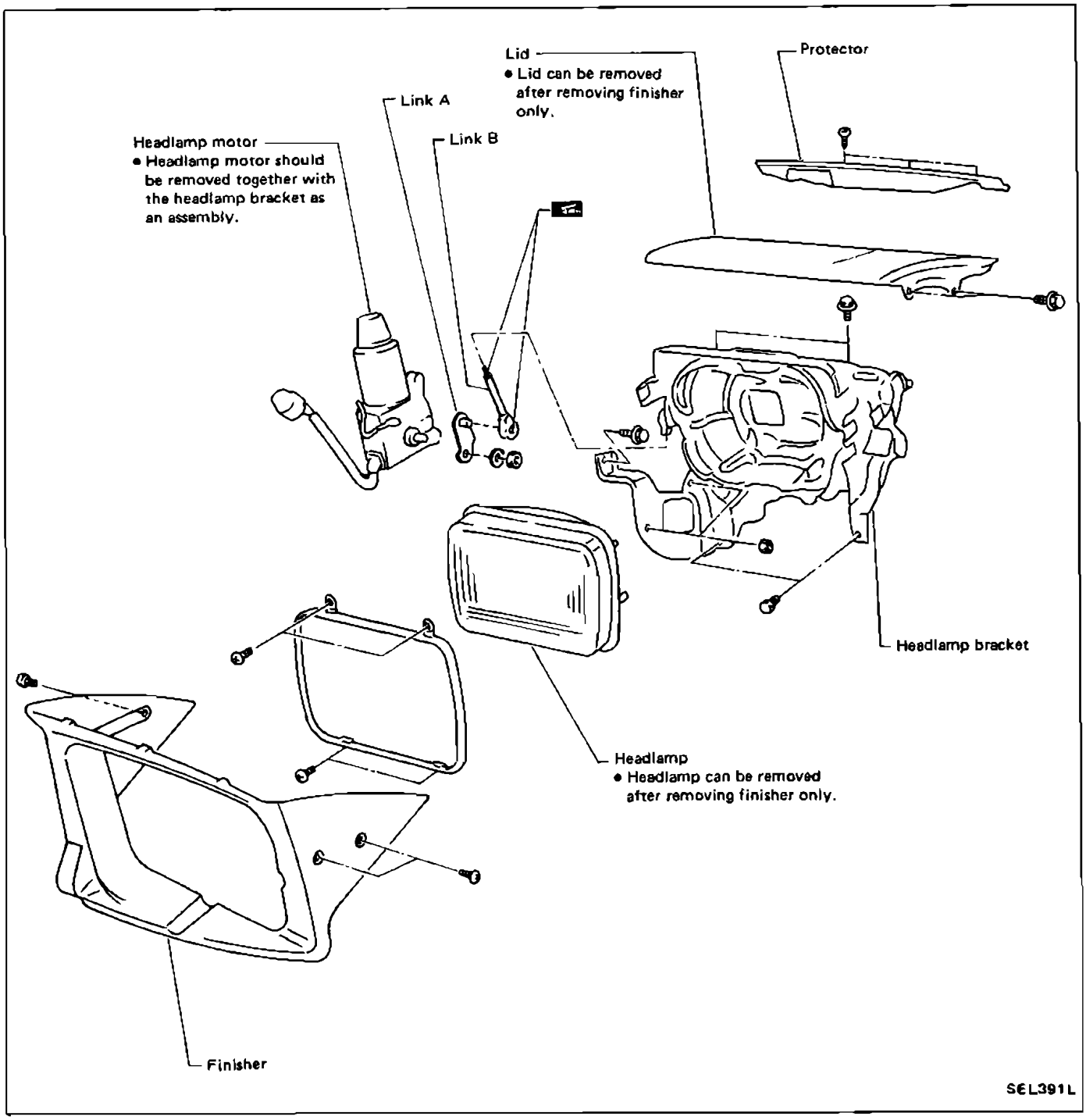
C-2: After the headlamp reaches fully open position

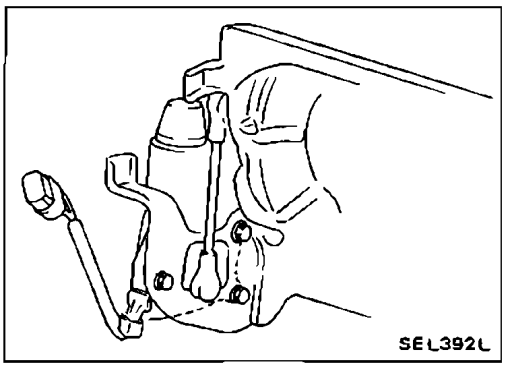


[D] When retractor switch is turned ON
(While operating the headlamp motor to open position)



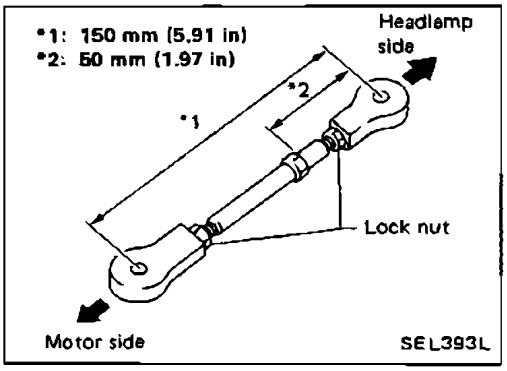
Constructions



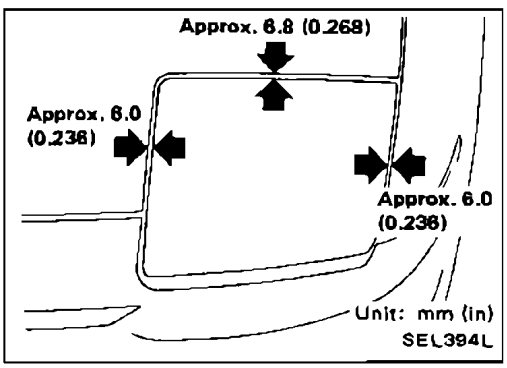

SEL392L

Assembly

1. Install headlamp motor, ball joint and link A (as one unit) on headlamp bracket.
2. While turning link B, install link A's ball joint on headlamp housing's ball joint.
3. Set distance between centers of upper and lower ball joints as shown in figure at left, and tighten lock nuts.
4. Assemble headlamp, finisher and lid.



SEL393L



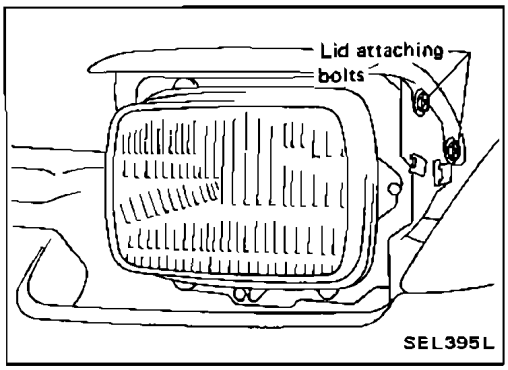
SEL394L

Installation and Adjustment

Before doing this, be sure to disconnect battery ground cable.

1. Install headlamp bracket to body temporarily.

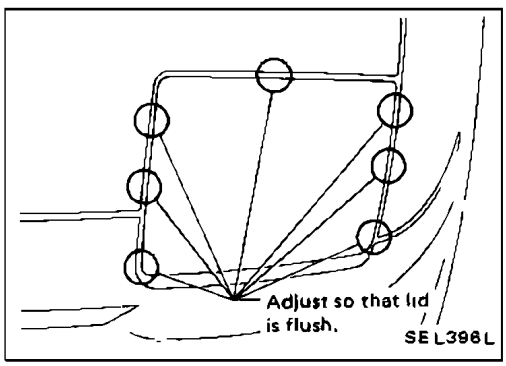
1) Determine headlamp bracket location on body so that alignment between lid, hood, and fender looks straight.
2) After adjusting alignment, tighten headlamp bracket to body.



SEL395L

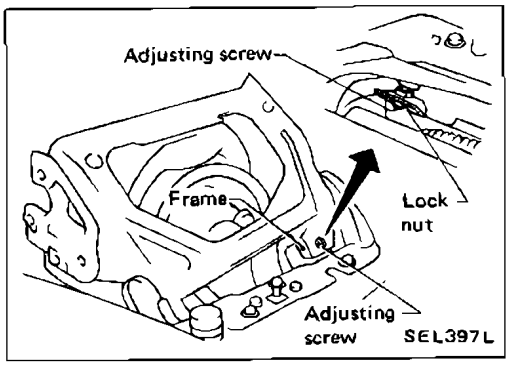
2. Adjust lid alignment.

- Adjust lid, hood and fender for alignment while opening and closing headlamp with motor manual knob.
  Use motor manual knob to open and close headlamp, and adjust alignment while checking that lid is not interfering with hood.



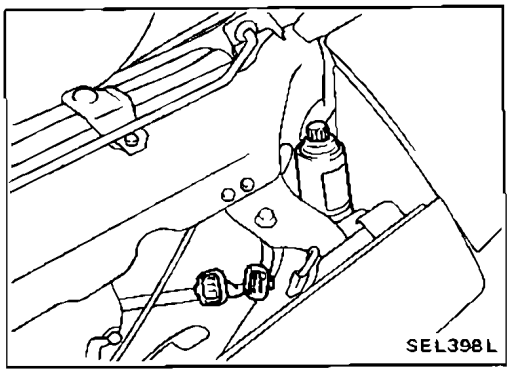
SEL396L

Installation and Adjustment (Cont'd)

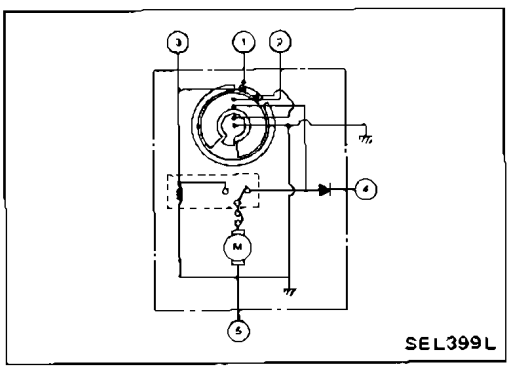


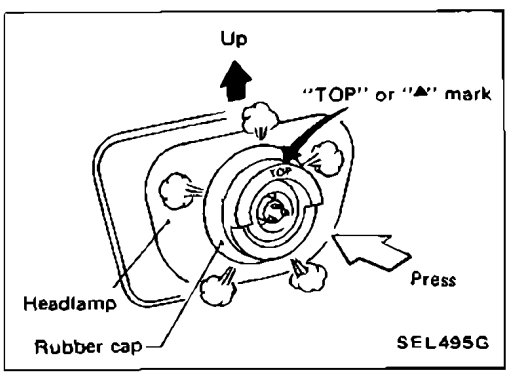
3. Adjust stopper.
1) Loosen lock nut on stopper.
2) Turn motor manual knob to open headlamp assembly completely.
3) Adjust stopper screw.

Headlamp Motor Check



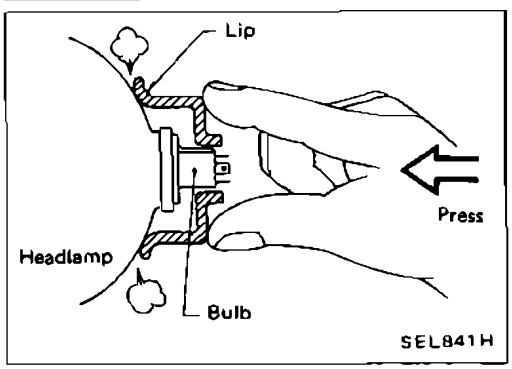
1. Disconnect battery ground cable.
2. Disconnect the headlamp motor connector.
3. Use an ohmmeter to check for continuity in headlamp motor circuit while rotating motor with manual knob.





INSTALLING HEADLAMP RUBBER CAP

When installing the rubber cap, set the "TOP" or "▲" mark so that it is facing up.



Press the rubber cap firmly so that the lip makes contact with the headlamp body.

Aiming Adjustment

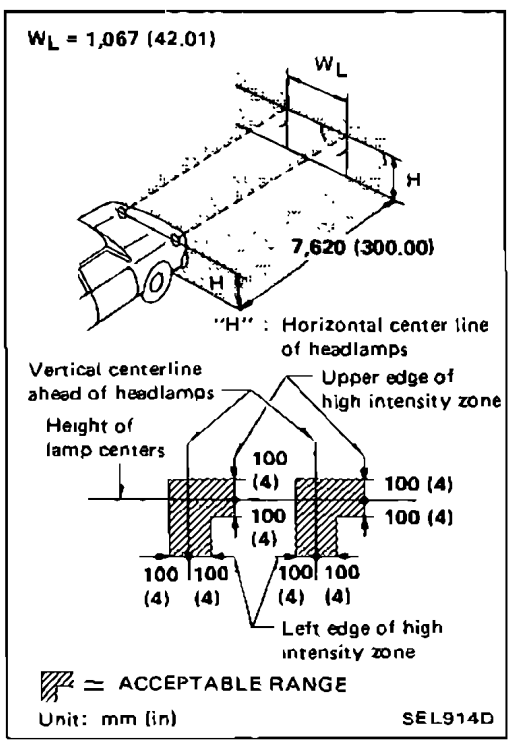
When performing headlamp aiming adjustment, use an aiming machine, aiming wall screen or headlamp tester. For operating instructions of any aimer, it should be in good repair, calibrated and used according to respective operation manuals supplied with the unit.

If any aimer is not available, aiming adjustment can be done as follows:

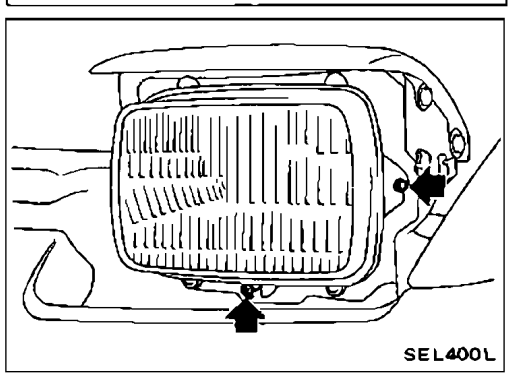
For details, refer to the regulations in your own country.

CAUTION:

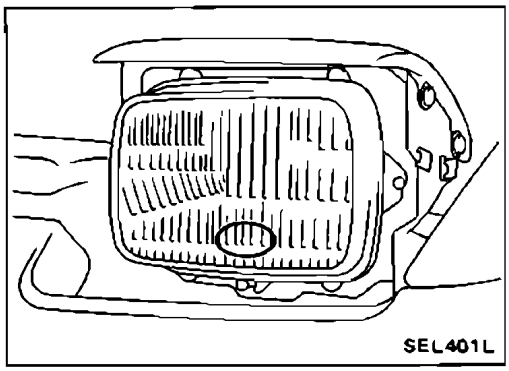
a. **Keep all tires inflated to correct pressures.**
b. **Place vehicle and tester on one and same flat surface.**
c. **See that there is no-load in vehicle (coolant, engine oil filled up to correct level and full fuel tank) other than the driver (or equivalent weight placed in driver's position).**



- **Adjust headlamps so that upper edge and left edge of high intensity zone are within the acceptable range as shown.**
- **Dotted lines in illustration show center of headlamp.**



ADJUSTING SCREWS

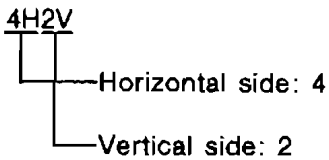


Aiming Adjustment (Cont'd)

AIMER ADJUSTMENT MARK

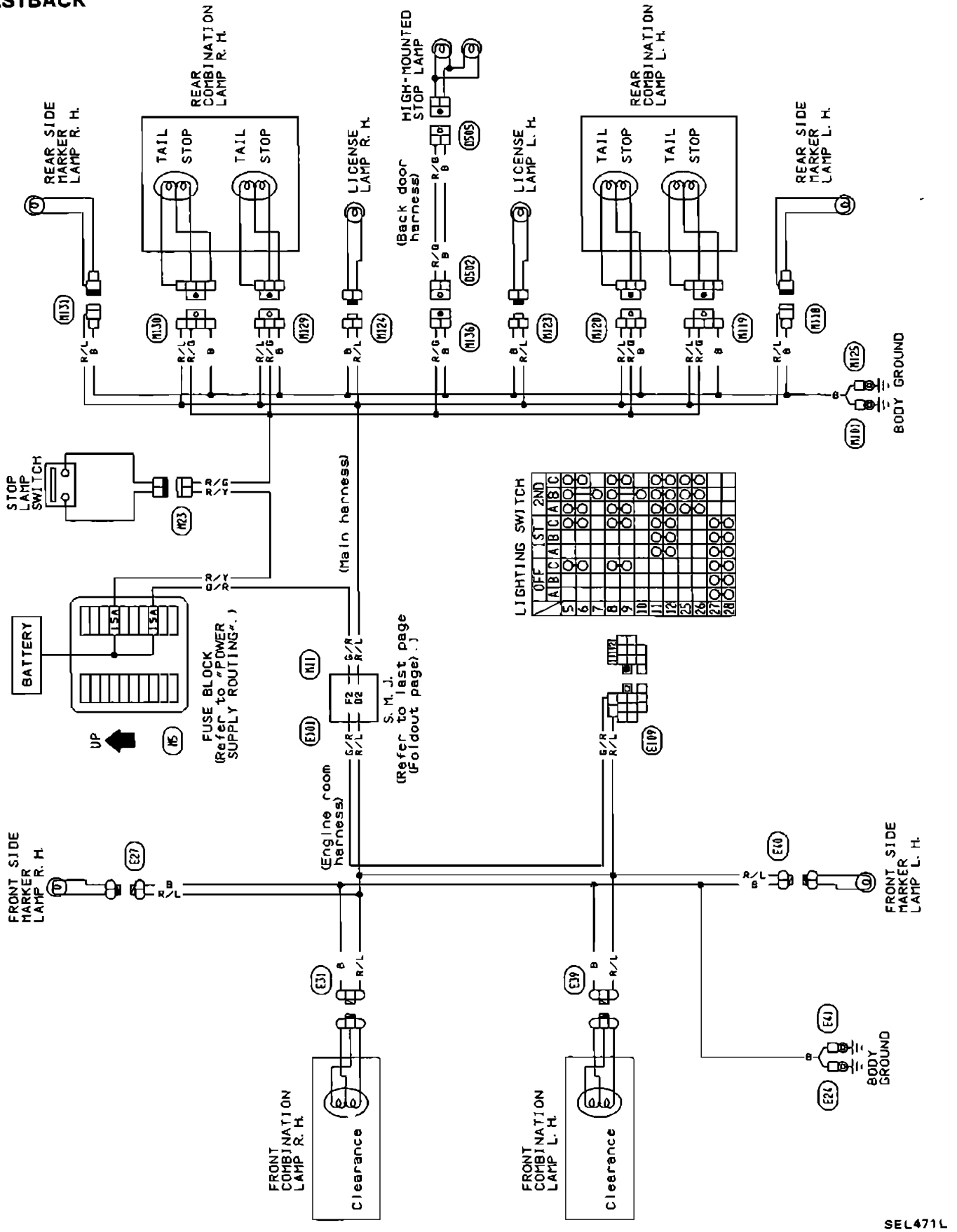
When using a mechanical aimer, adjust adapter legs to the data marked on the headlamps.

Example:



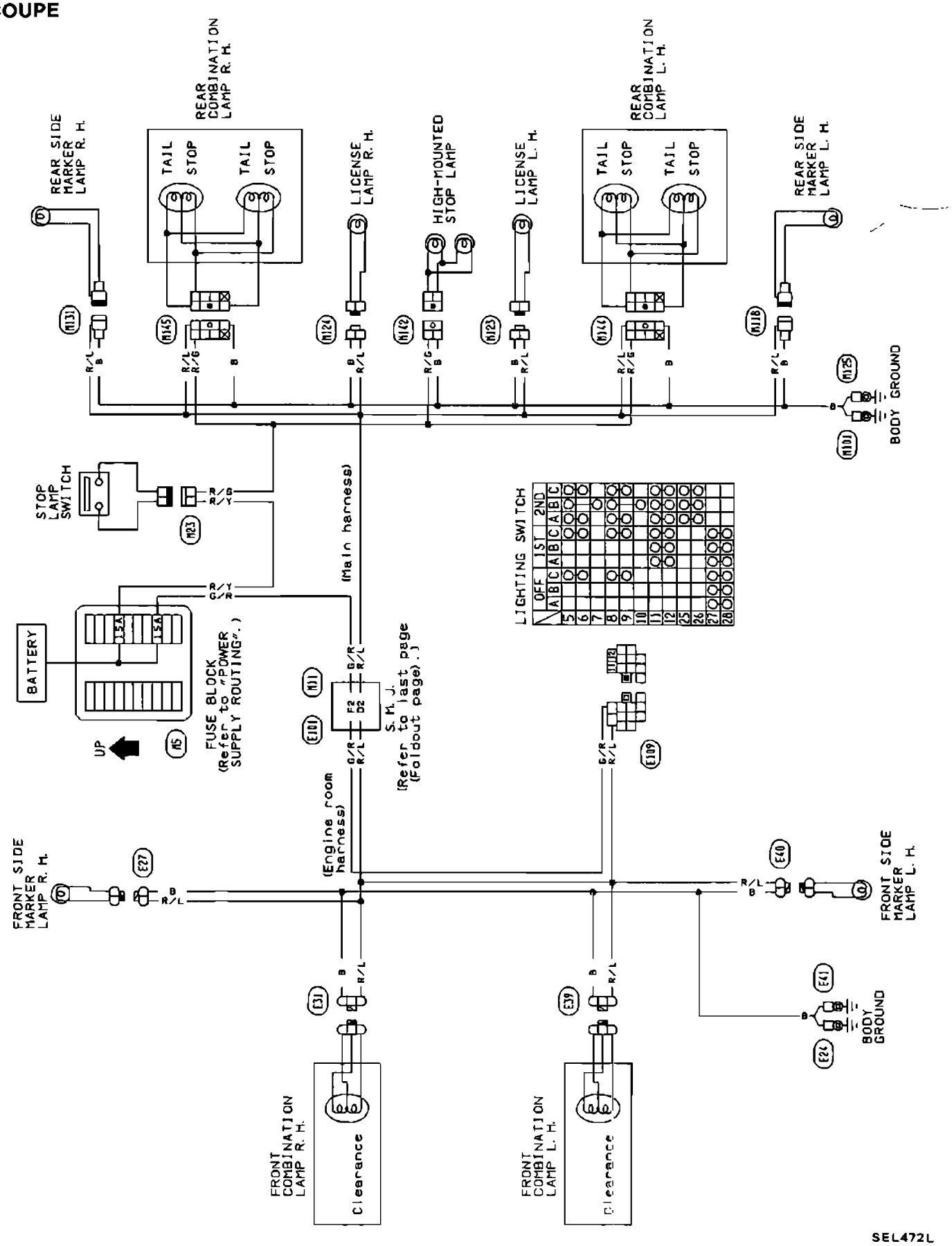
Clearance, License, Tail and Stop Lamps/Wiring Diagram

FASTBACK

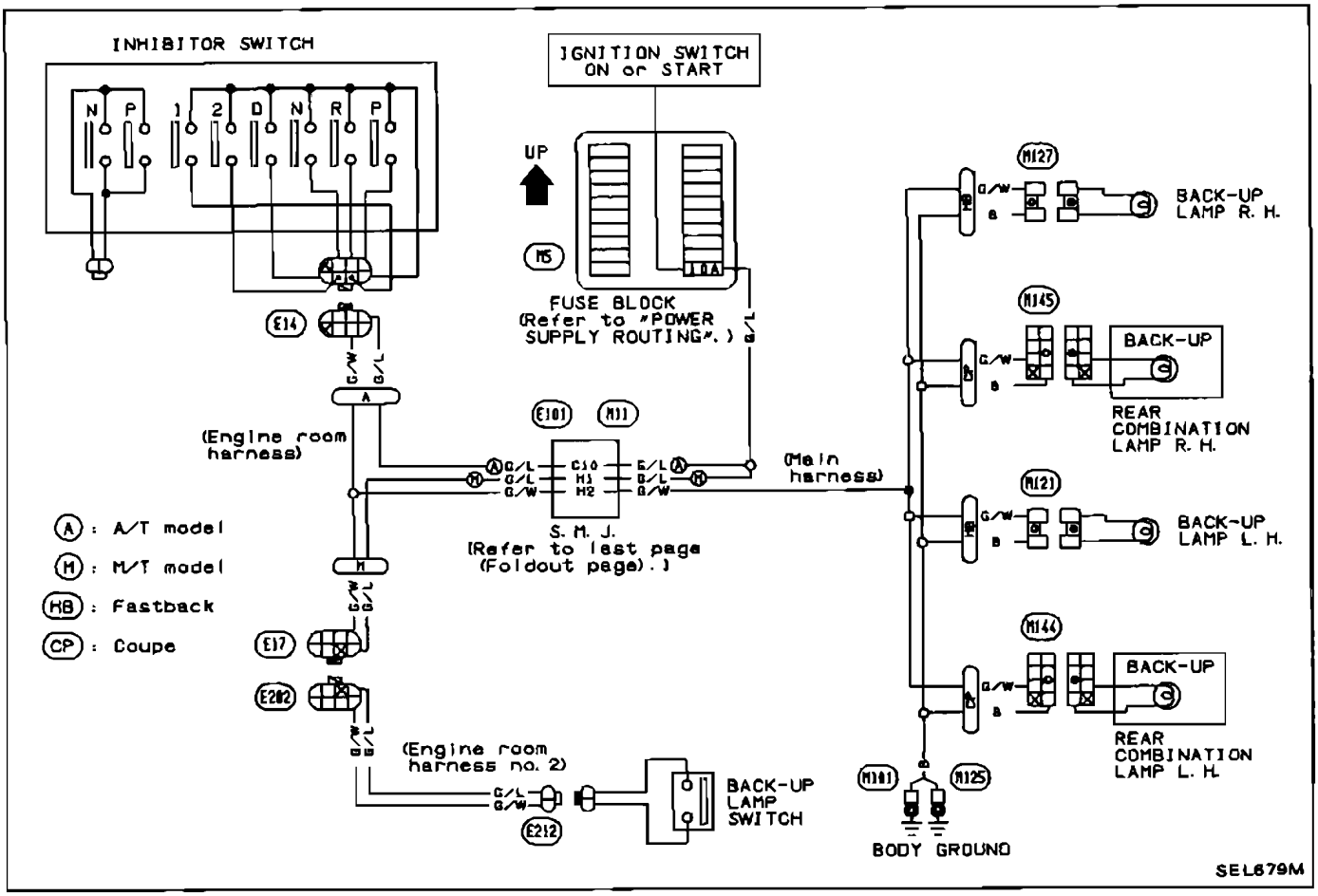


Clearance, License, Tail and Stop Lamps/Wiring Diagram (Cont'd)

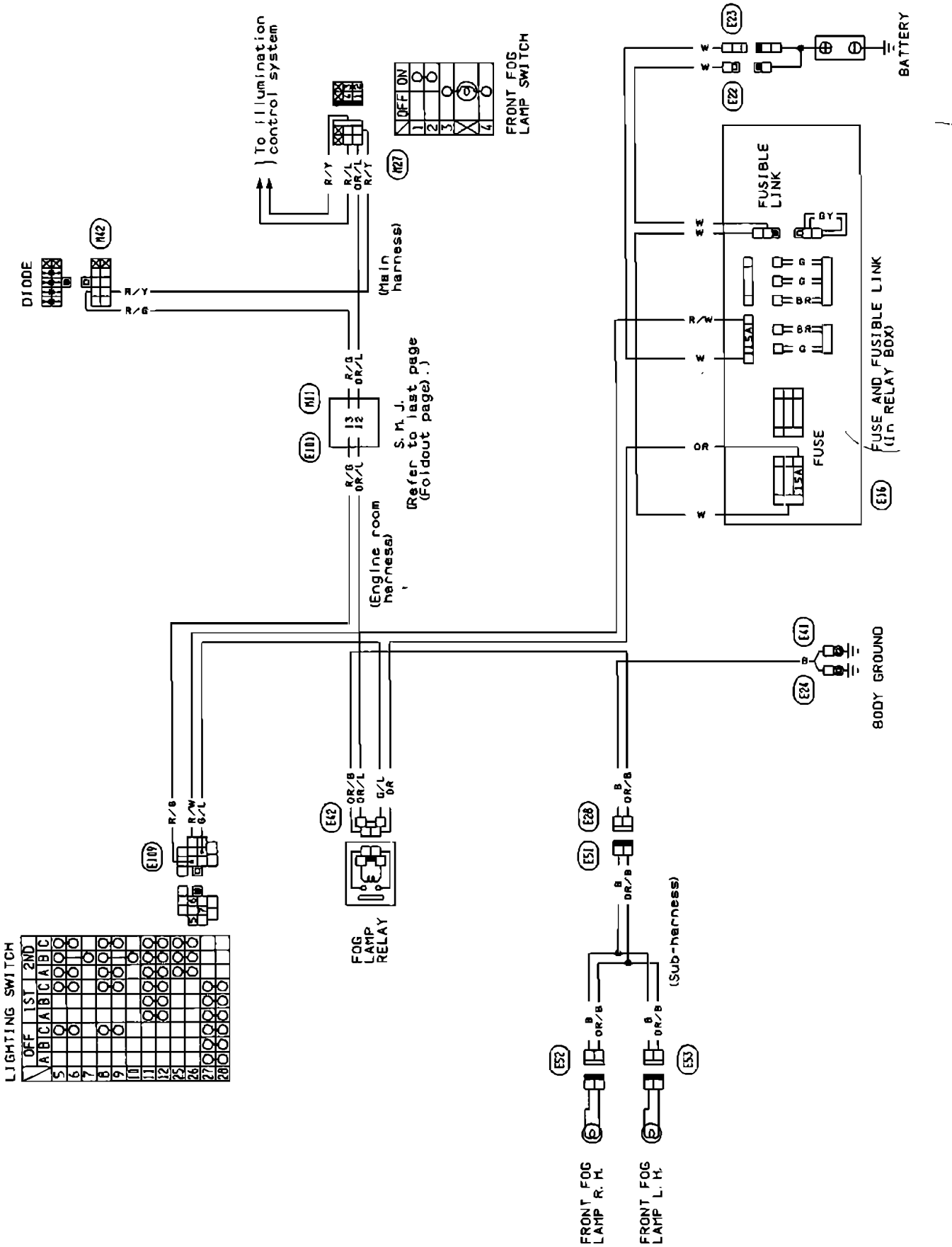
COUPE



Back-up Lamp/Wiring Diagram

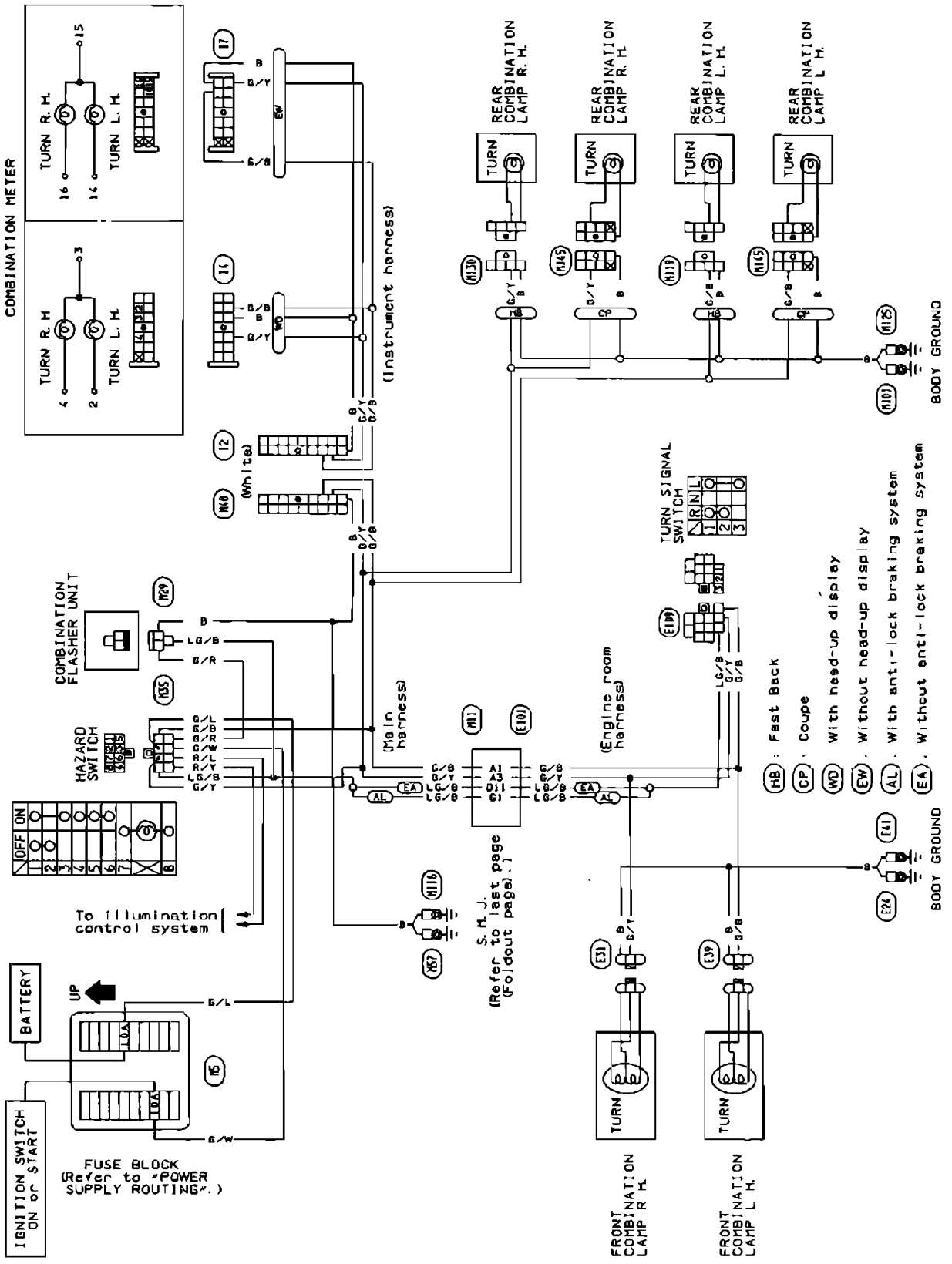


Front Fog Lamp/Wiring Diagram

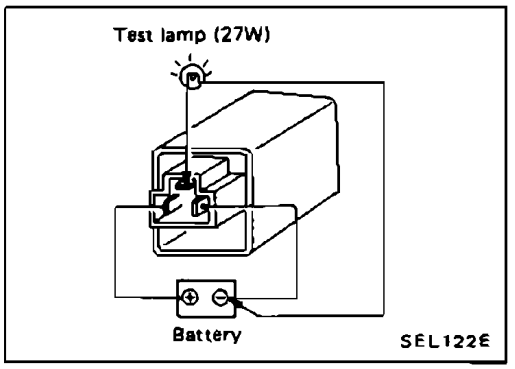


SEL474L

Turn Signal and Hazard Warning Lamps/Wiring Diagram



SEL586M



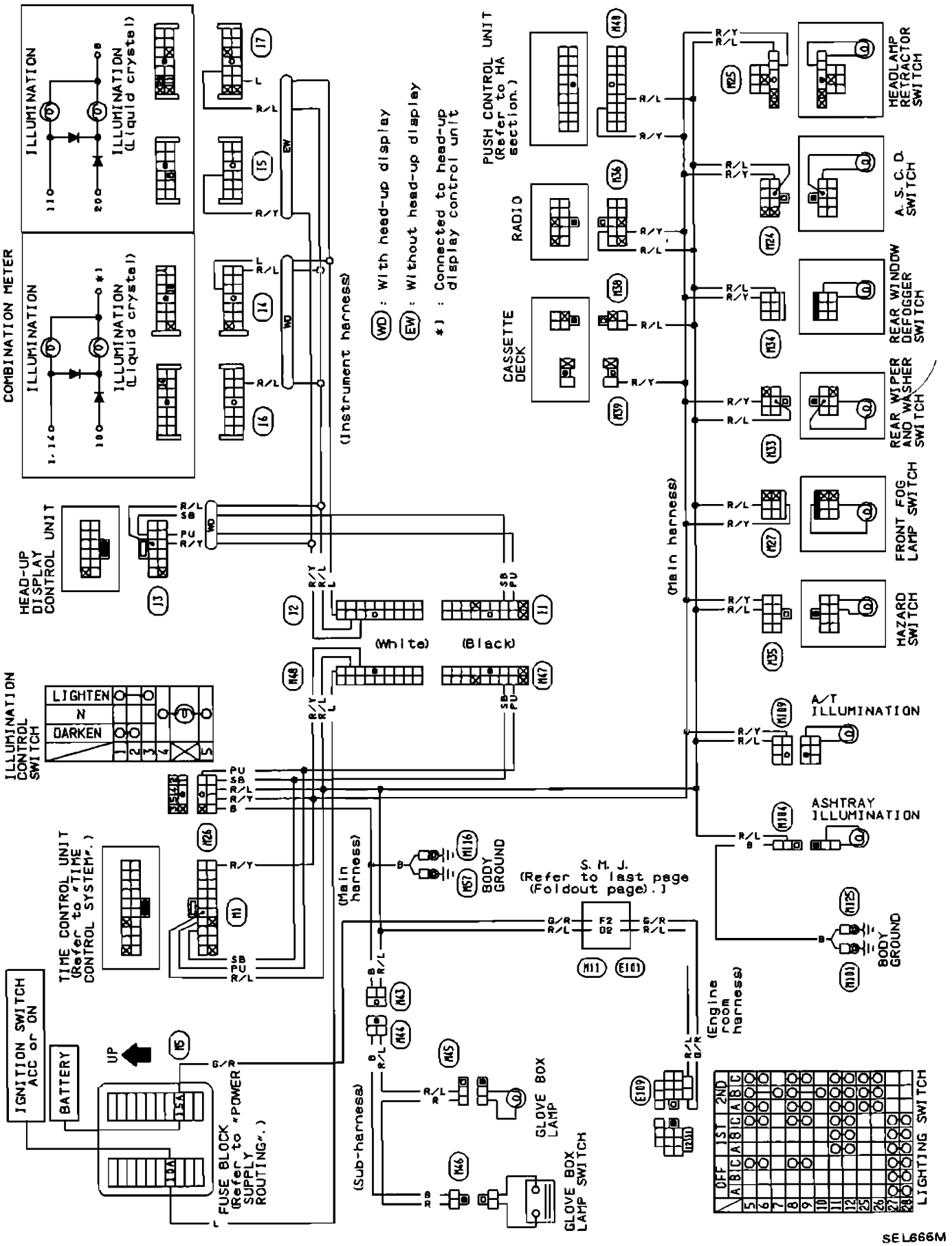
Combination Flasher Unit Check

- 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.

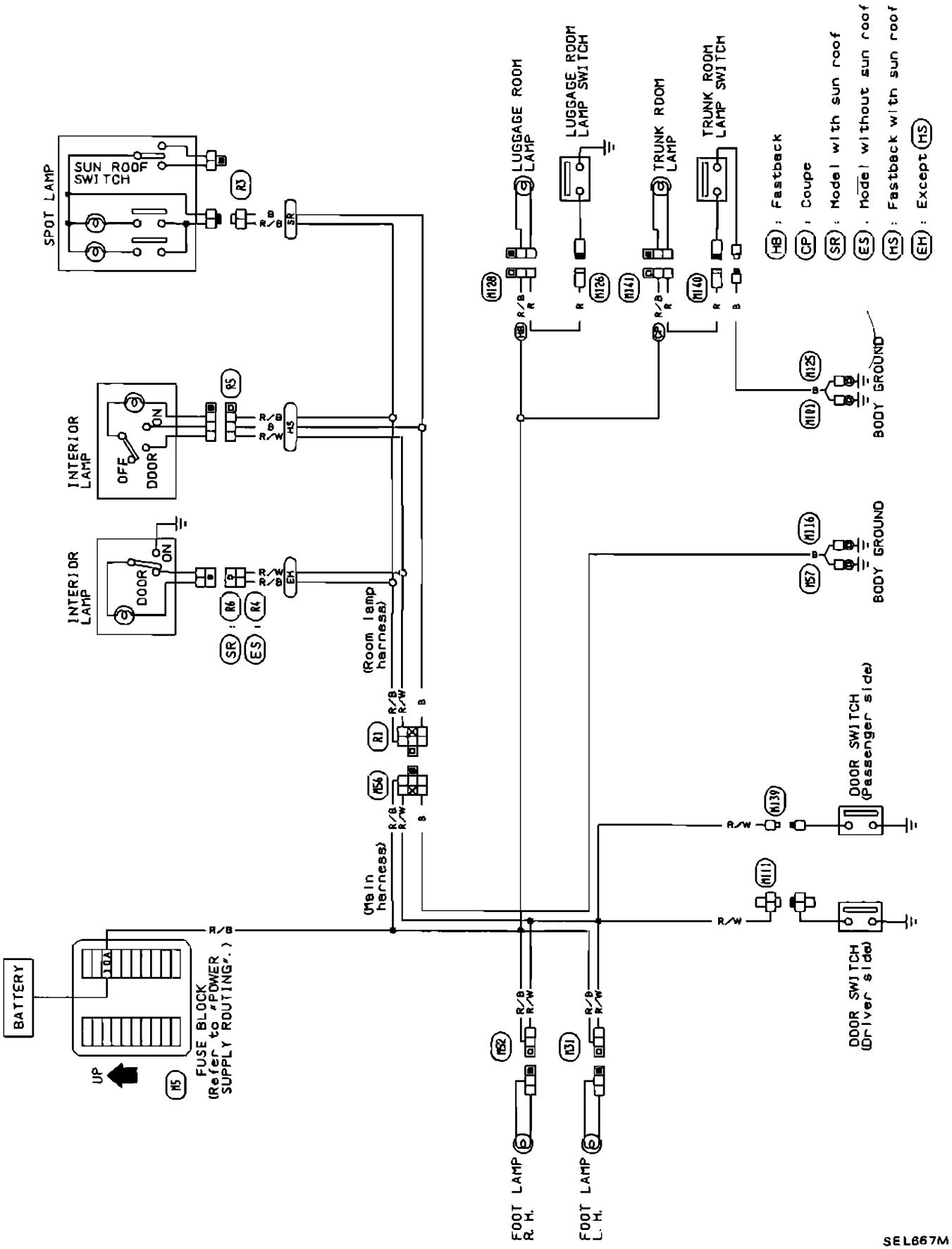
Bulb Specifications

Item	Wattage (W)
Headlamp (Sealed)	65/35
Front clearance lamp	8
Front turn signal lamp	27
Front side marker lamp	3.8
Rear side marker lamp	3.8
Turn signal lamp	27
Stop/Tail lamp	27/8
Back-up lamp	27
License plate lamp	7.5
Interior lamp	10
Spot lamp	8
Trunk room lamp	3.4
Foot well lamp	3
Luggage compartment lamp	5
High-mounted stop lamp	18

Illumination/Wiring Diagram

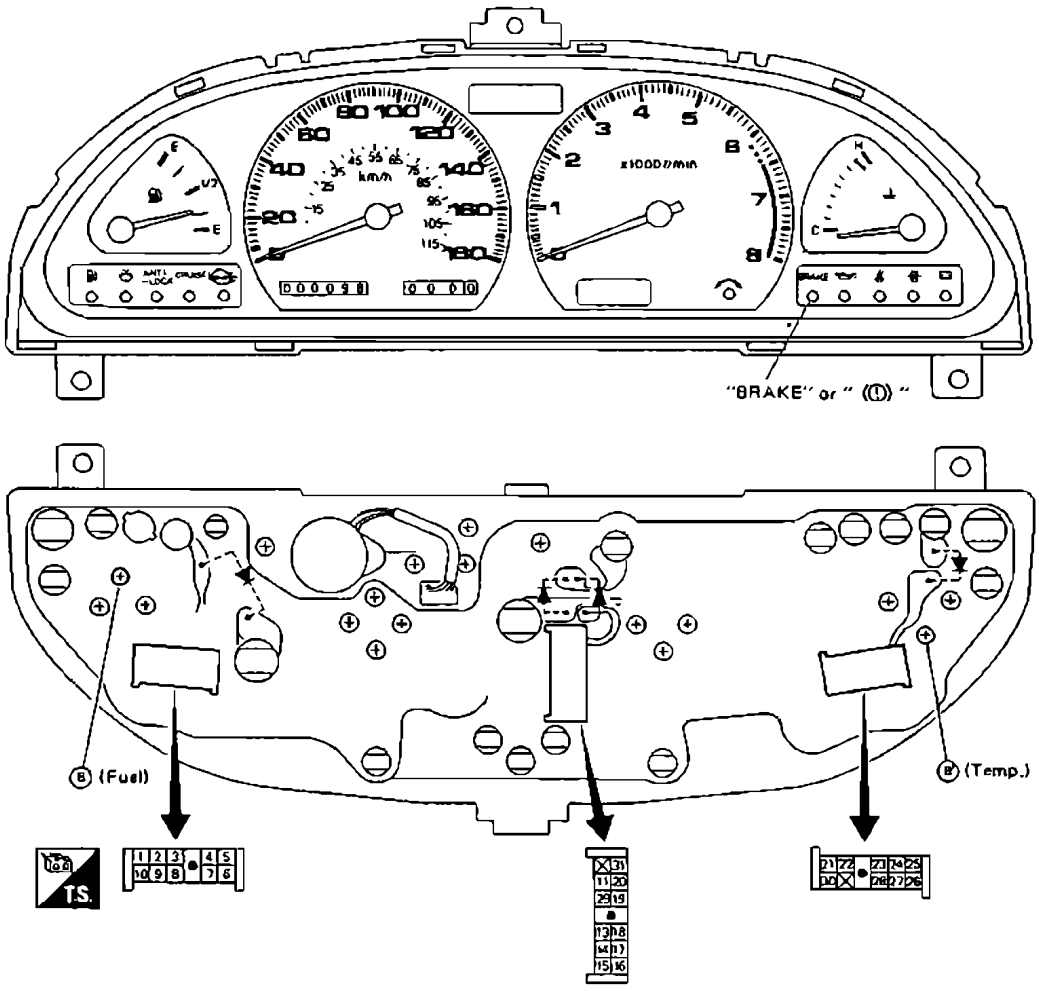


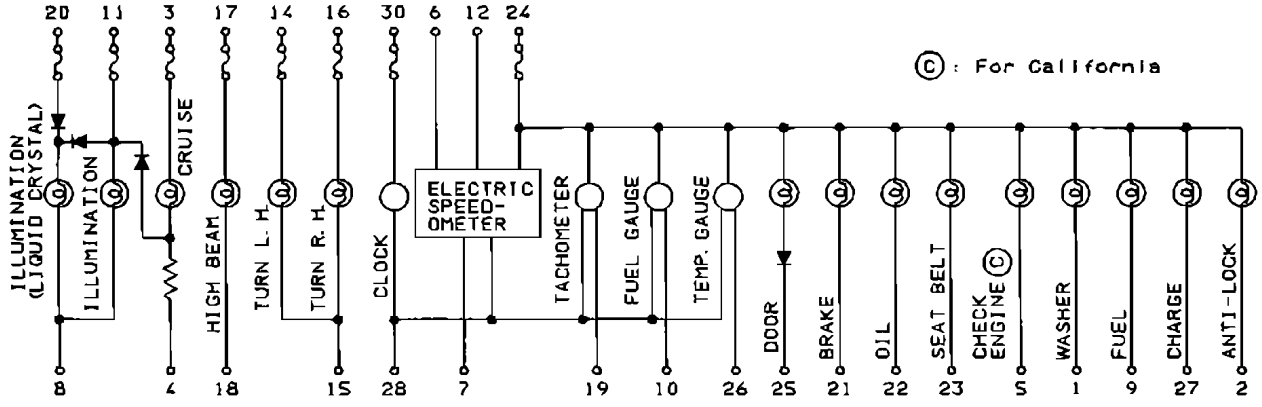
Interior Lamp/Wiring Diagram



Combination Meter

NEEDLE TYPE

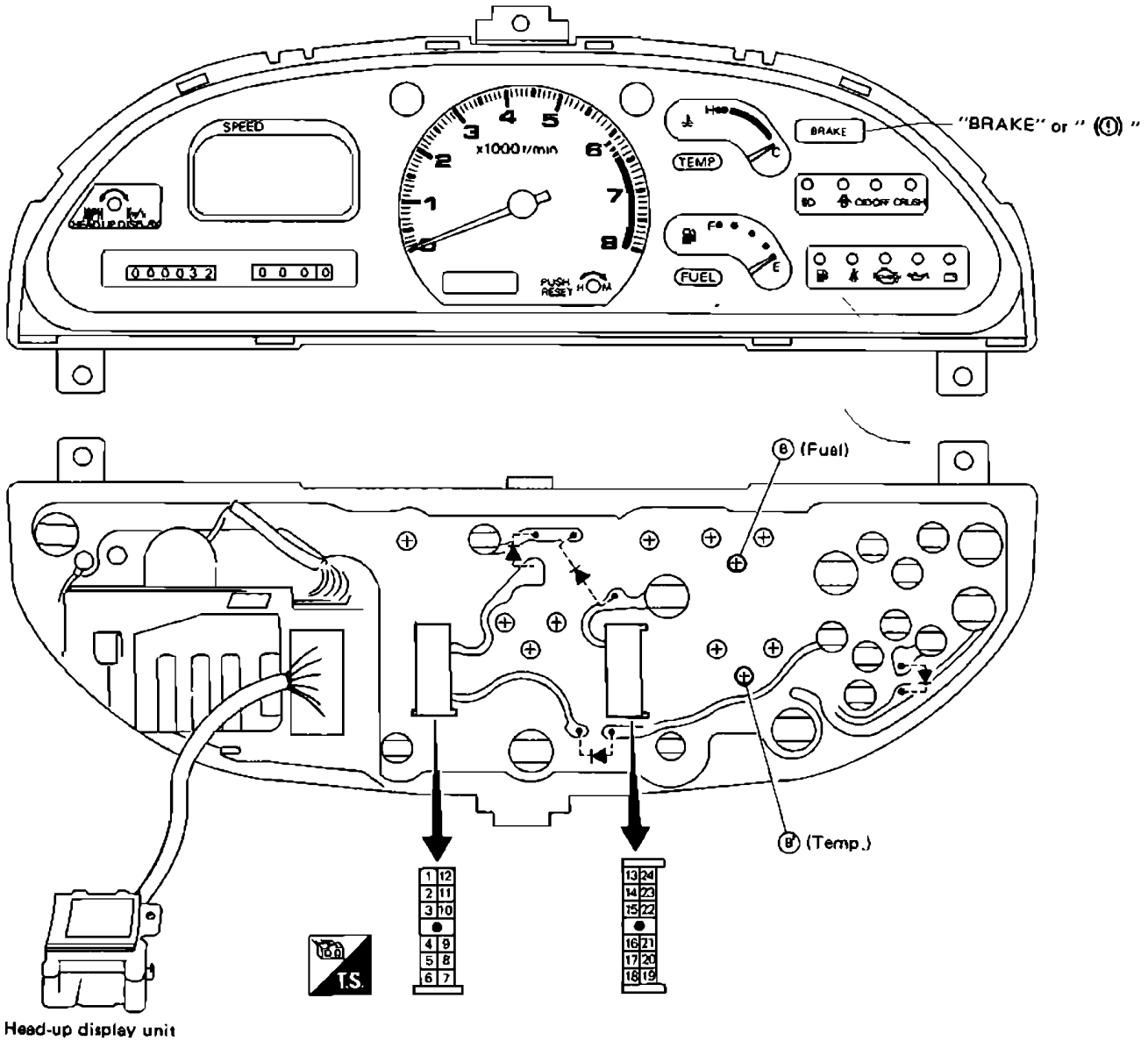


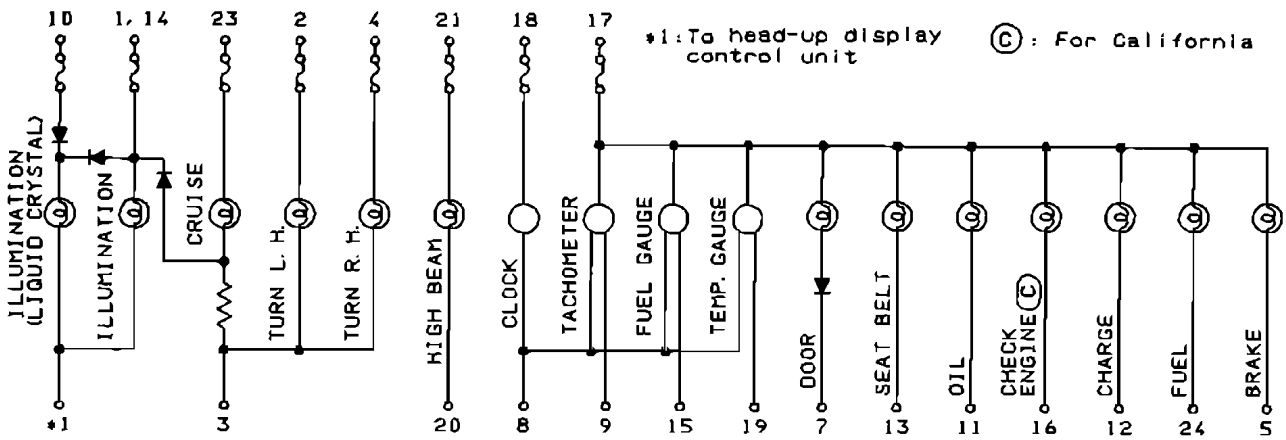


SEL577M

Combination Meter (Cont'd)

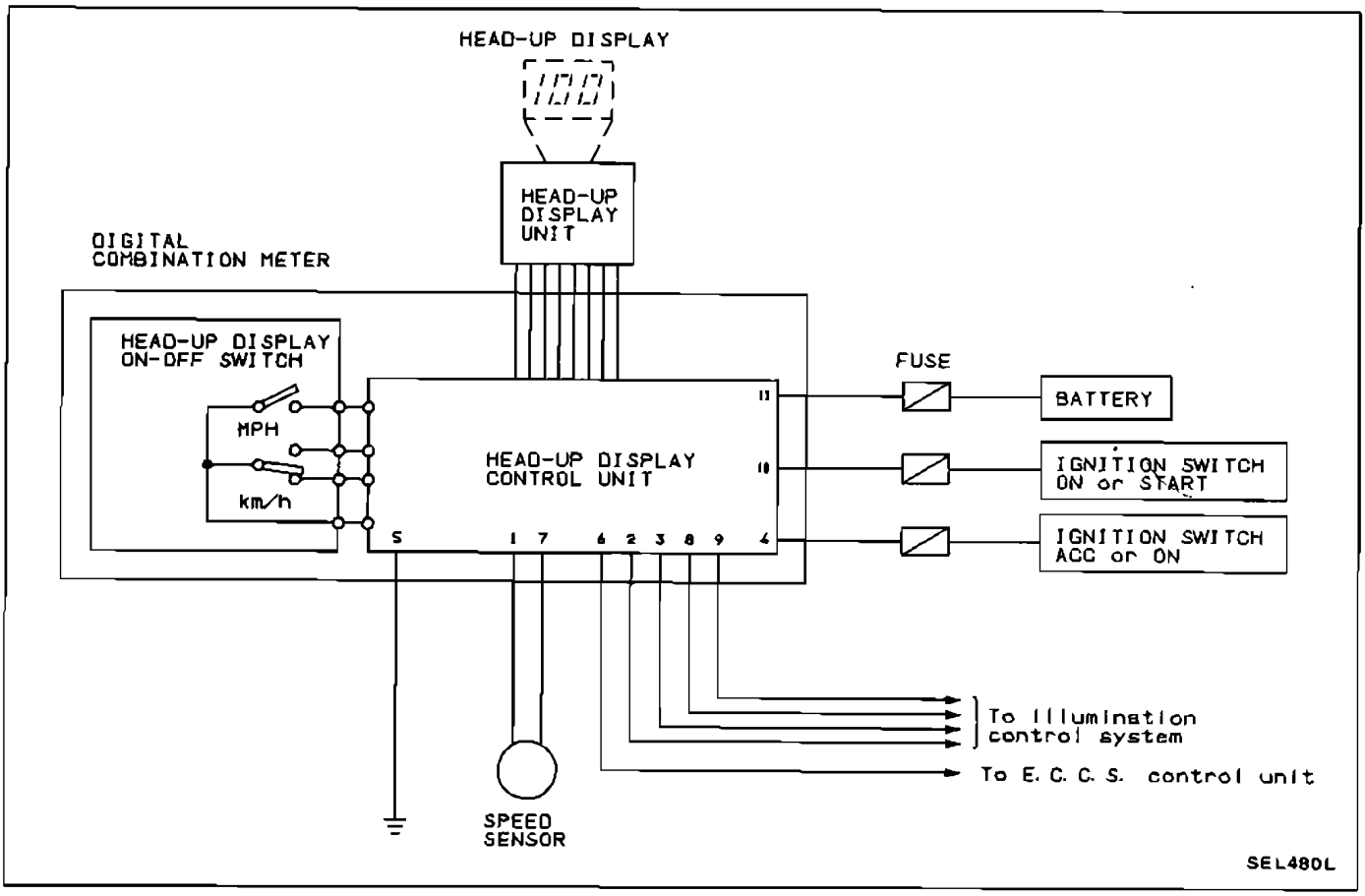
DIGITAL TYPE



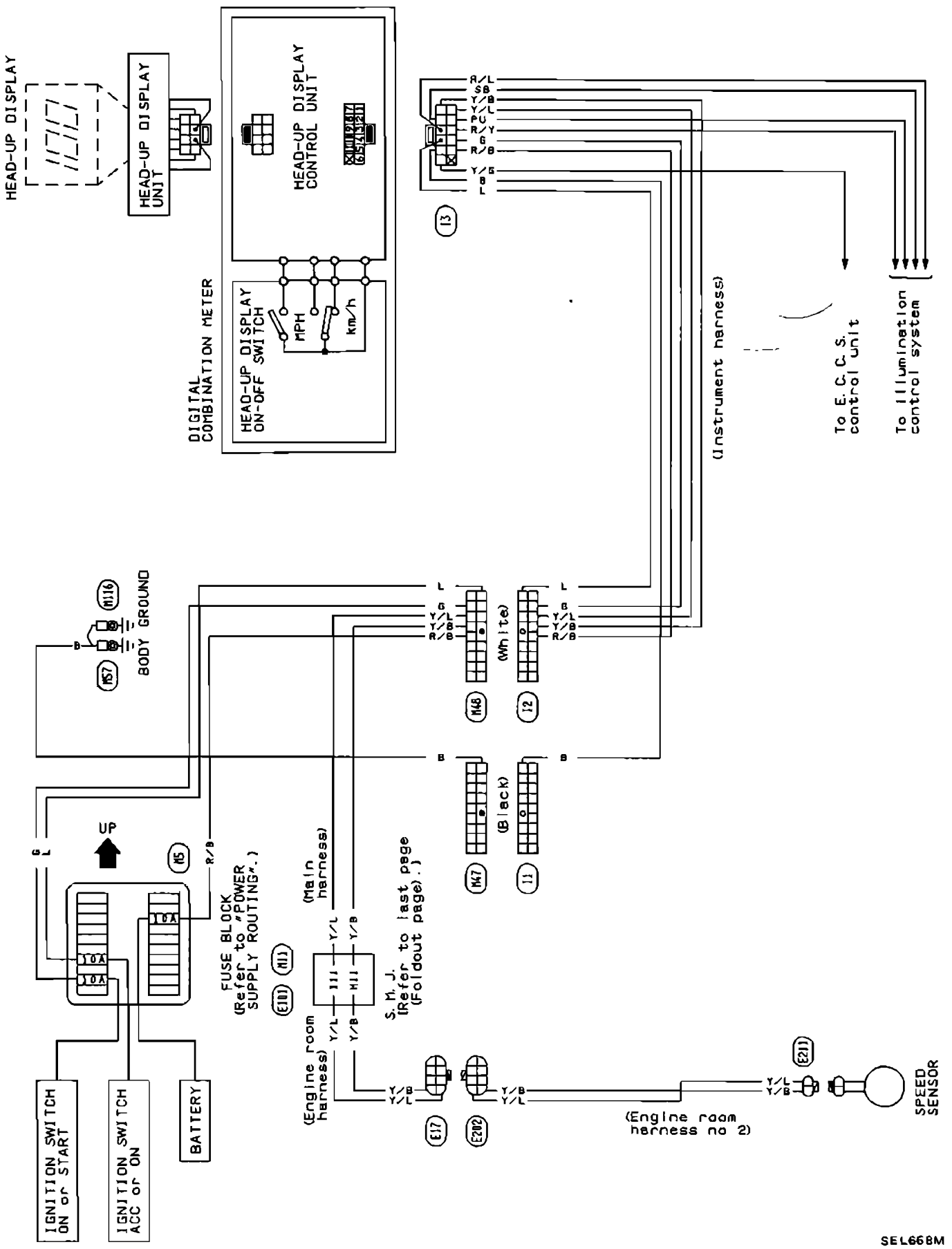


SEL403L

Combination Meter (Cont'd)

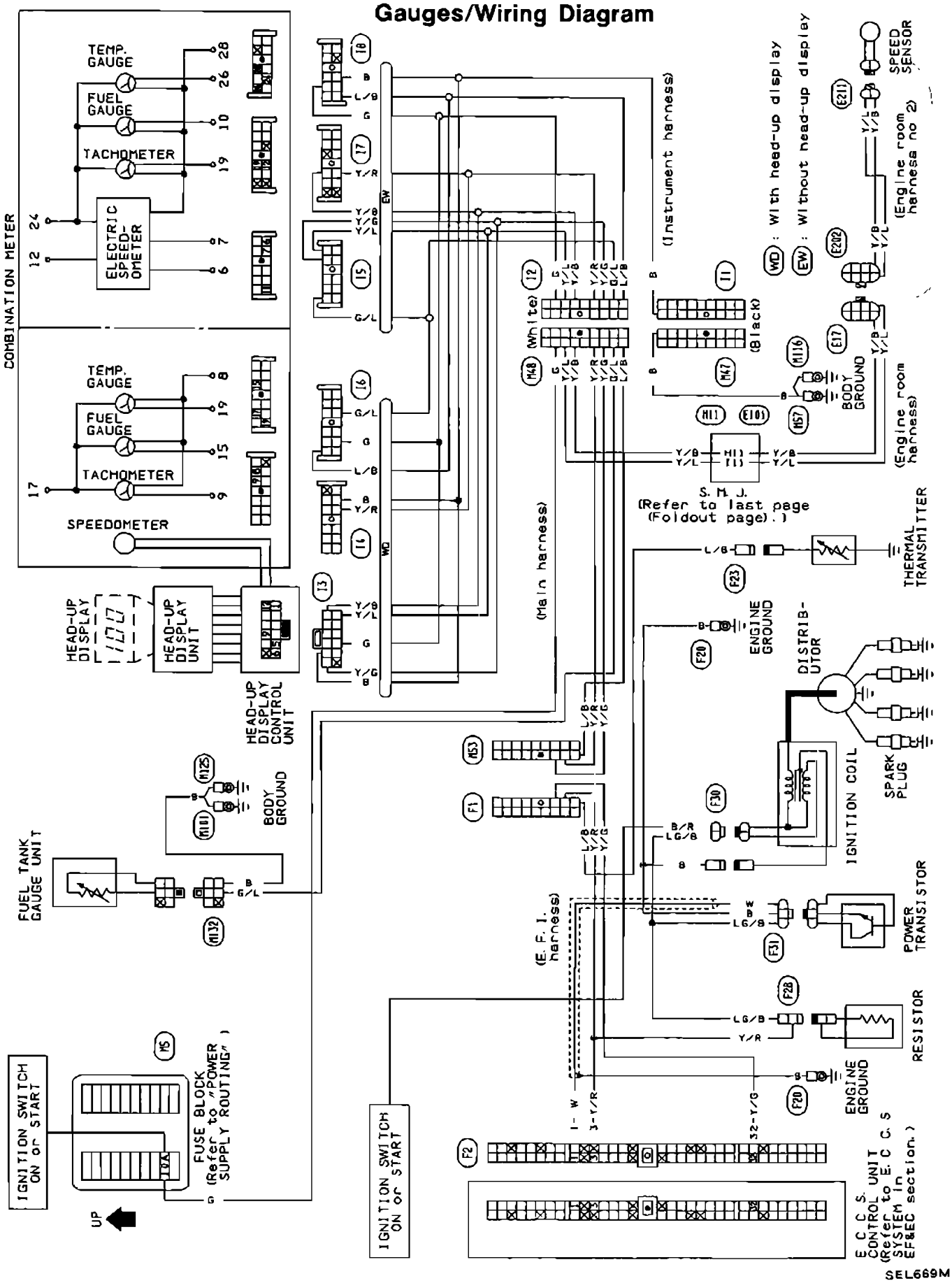


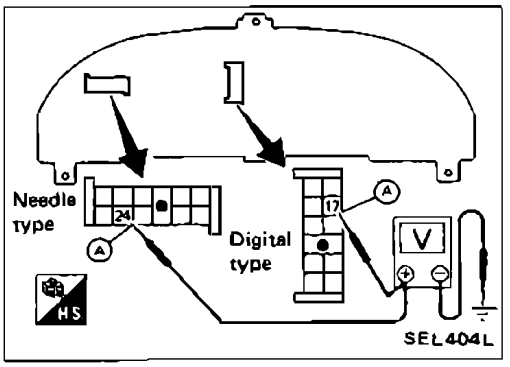
Combination Meter/Wiring Diagram



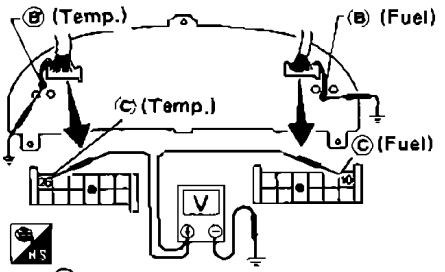
SEL668M

Speedometer, Tachometer, Temp. and Fuel Gauges/Wiring Diagram



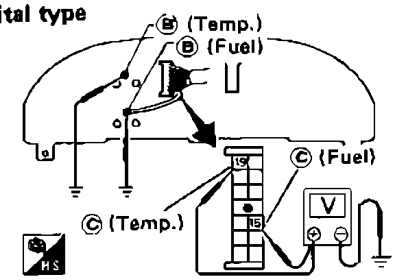


Needle type



• (B) and (C): Fuel gauge
(B) and (C): Water temperature gauge SEL405L

Digital type



• (B) and (C): Fuel gauge
(B) and (C): Water temperature gauge SEL406L

Inspection/Fuel Gauge and Water Temperature Gauge

INSPECTION START

O.K.

CHECK POWER SOURCE.
1) Turn ignition switch "ON".
2) Check voltage between terminal (A) 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 GAUGE OPERATION.
1) Turn ignition switch "ON".
2) Connect terminals (B) (Fuel), (B) (Temp.) 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 meters (C) (Fuel), (C) (Temp.).

N.G. → Repair or replace.

O.K.

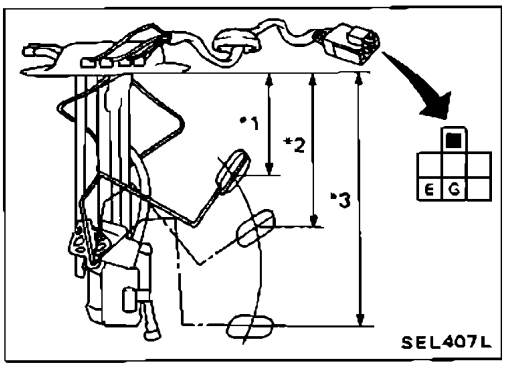
CHECK COMPONENT.
Check gauge units and harness.
Refer to "Fuel Tank Gauge Unit Check" or "Thermal Transmitter Check".

N.G. → Repair or replace.
Refer to FE section. (Fuel gauge)

O.K.

Reinstall any part removed.

INSPECTION END

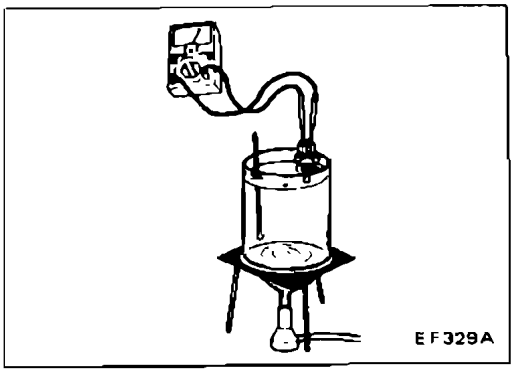


Fuel Tank Gauge Unit Check

● For removal, refer to FE section.

Check the resistance between terminals Ⓖ and Ⓔ.

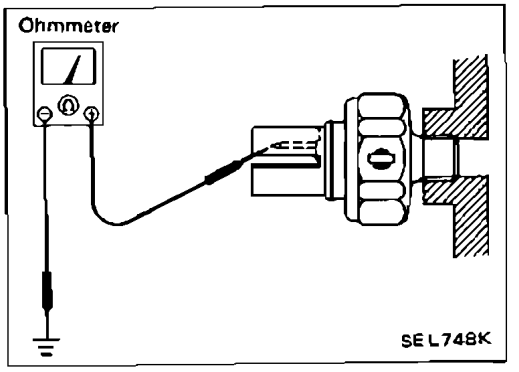
Ohmmeter (+)	Ohmmeter (−)	Float position mm (in)			Resistance Ω	Fuel value ℓ (US gal, Imp gal)
G	E	*1	Full	Approx. 64 (2.52)	4.3 - 6.3	57.6 (15-1/4, 12-5/8)
		*2	1/2	Approx. 137 (5.39)	27.7 - 34.3	32.9 (8-3/4, 7-1/4)
		*3	Empty	Approx. 210 (8.27)	73.3 - 84.8	7.2 (1-7/8, 1-5/8)



Thermal Transmitter Check

Check the resistance between the terminals of thermal transmitter and body ground.

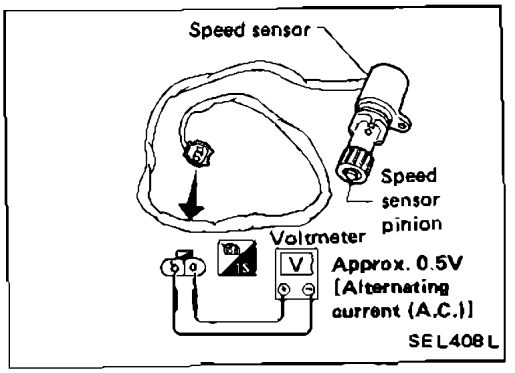
Water temperature	Resistance
60°C (140°F)	Approx. 70 - 90Ω
100°C (212°F)	Approx. 21 - 24Ω



Oil Pressure Switch Check

Check the continuity between the terminals of oil pressure switch and body ground.

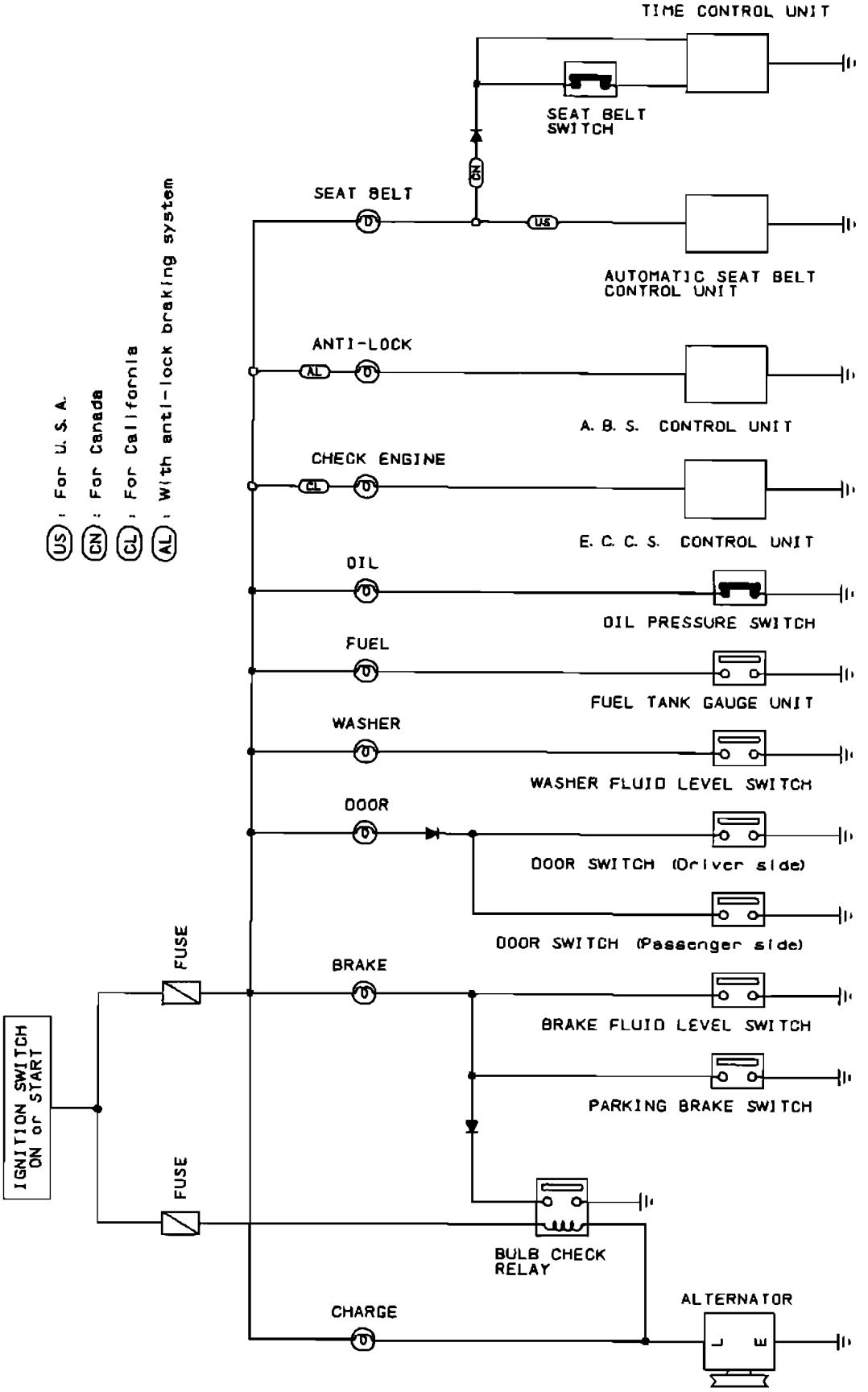
	Oil pressure kPa (kg/cm², psi)	Continuity
Engine start	More than 10 - 20 (0.1 - 0.2, 1.4 - 2.8)	NO
Engine stop	Less than 10 - 20 (0.1 - 0.2, 1.4 - 2.8)	YES



Speed Sensor Signal Check

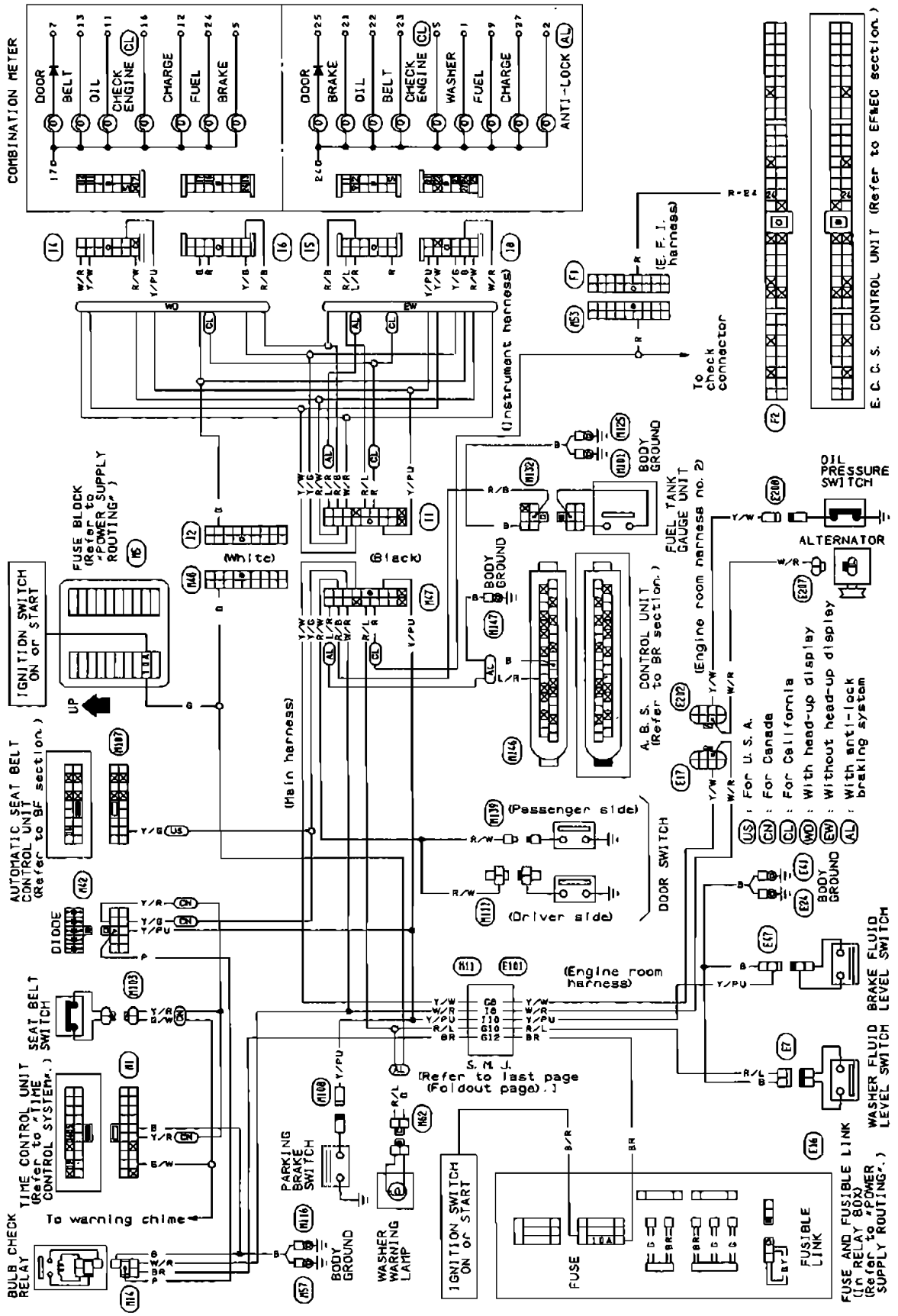
1. Remove speed sensor from transmission.
   Location: Refer to "Location of Electrical Units".
2. Turn speedometer pinion quickly and measure voltage across ⓐ and ⓑ.

Warning Lamps/Schematic



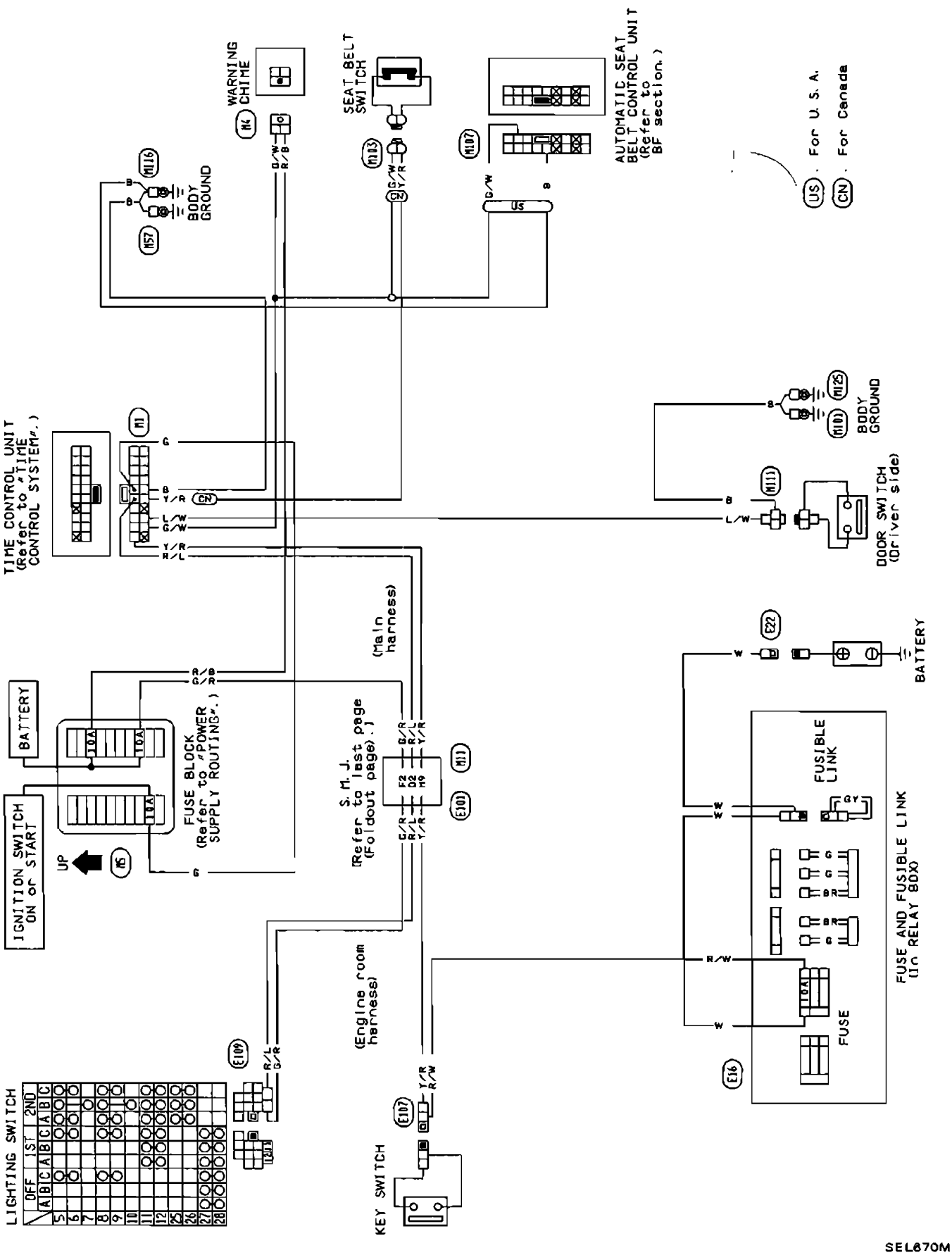
SEL678M

Warning Lamps/Wiring Diagram

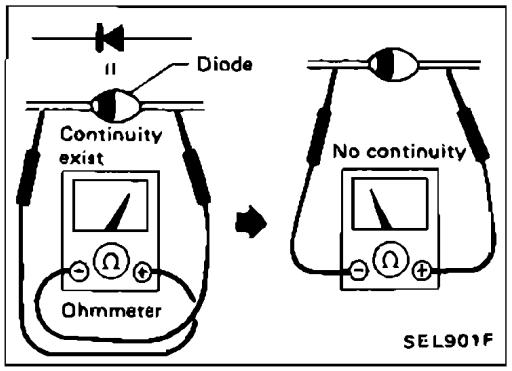


SEL579M

Warning Chime/Wiring Diagram

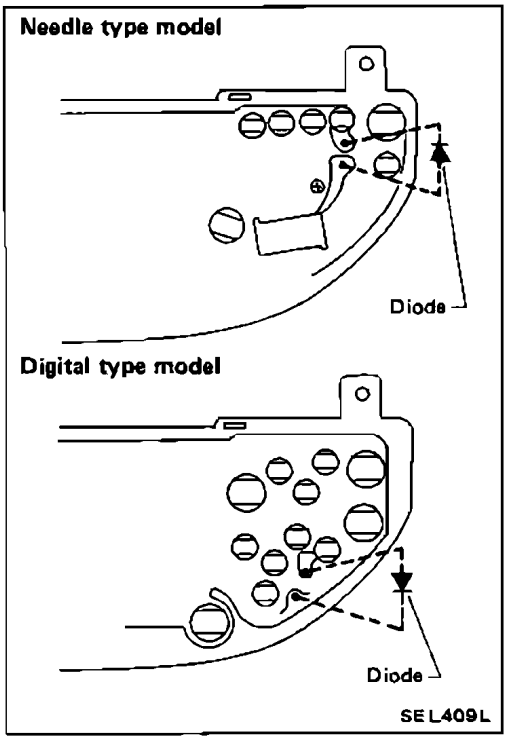


SEL670M

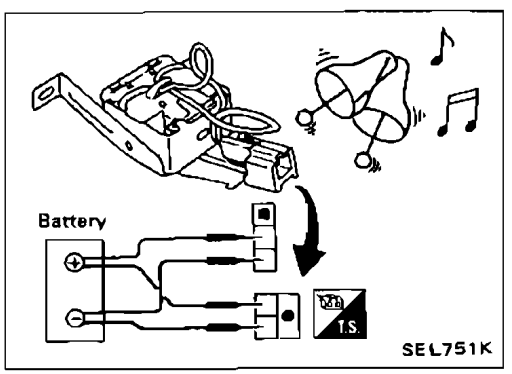


Diode Check

- Check continuity using an ohmmeter.
- Diode is functioning properly if test results are as shown in the figure at left.

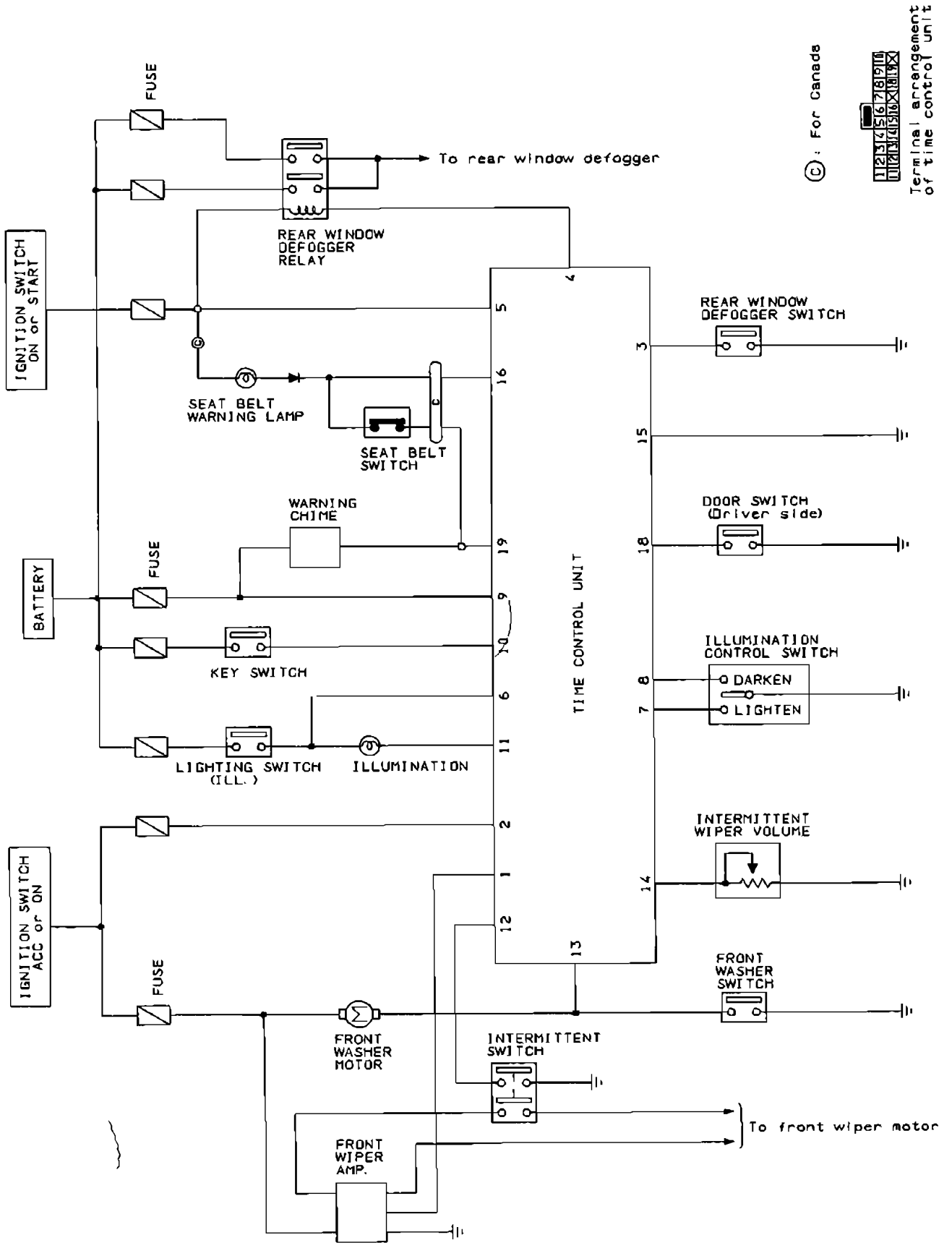


- Diodes for warning lamps are built into the combination meter printed circuit.



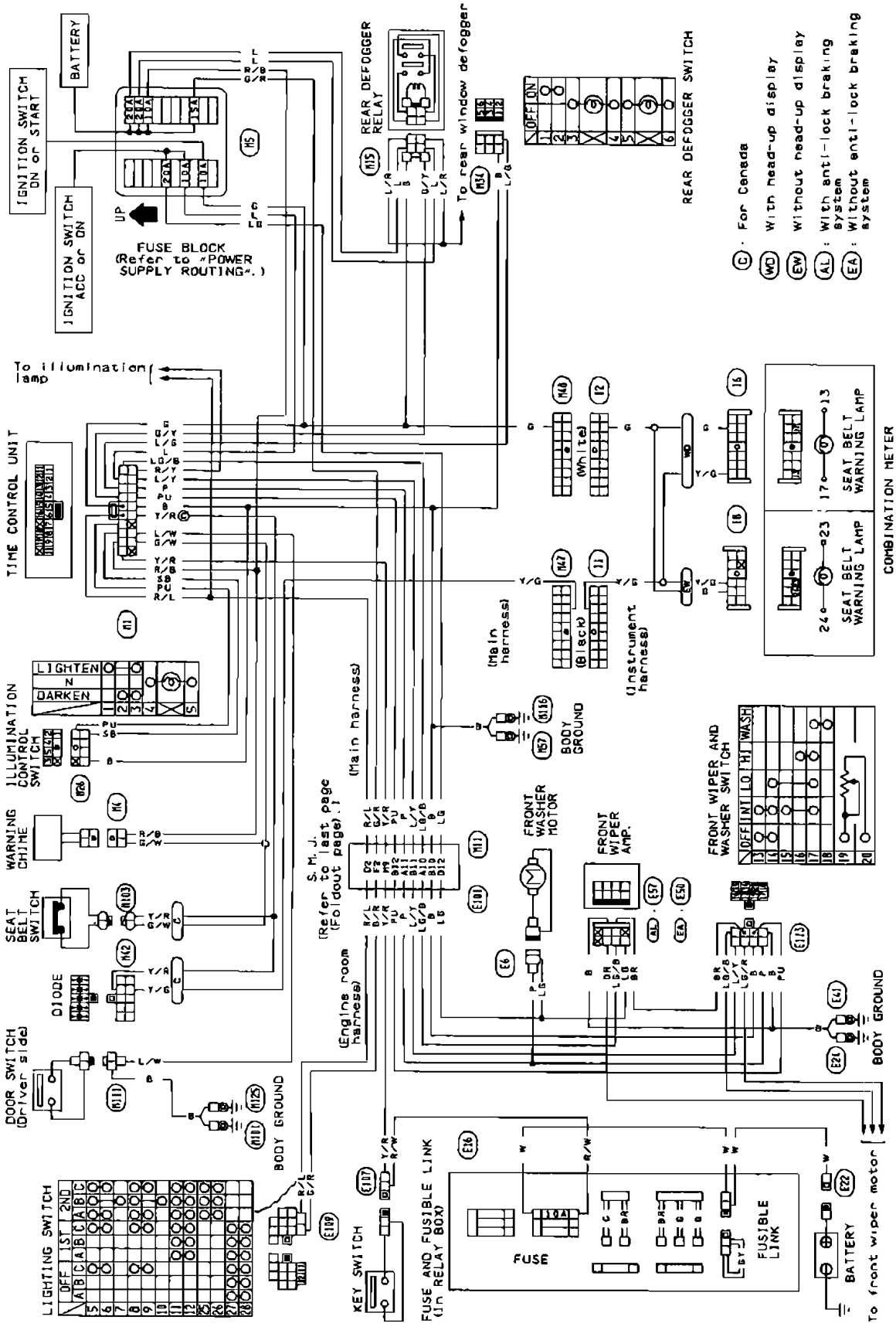
Warning Chime Check

Schematic



SEL486L

Wiring Diagram



SEL587M

Description

FUNCTION

- Time control unit has the following functions.

	Item	Details of control
1	Intermittent wiper control	Regulates intermittent time from approximately 3 to 12 seconds depending on the intermittent wiper volume setting.
2	Washer and wiper combination control	Wiper is operated in cojunction with washer switch.
3	Illumination control	Regulates brightness of illumination in 16 stages depending on the illumination control switch setting.
4	Light warning chime timer	When driver's door is opened with light switch ON and ignition switch OFF, warning chime sounds.
5	Seat belt warning lamp timer	Seat-belt warning lamp blinks for about 7 seconds when ignition switch is turned to "ON"
6	Seat belt warning chime timer	Sounds warning chime for about 7 seconds if ignition switch is turned "ON" when seat belt switch is "ON" (seat belt is unfastened).

OPERATING CONDITIONS

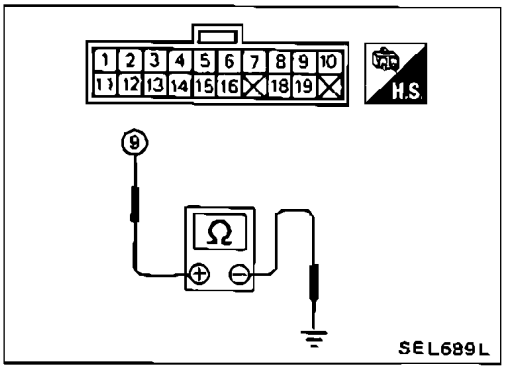
Input signal / Input terminal / Output terminal / Item		Power source from battery	Ignition switch	Light switch	Wiper switch "INT"	Washer switch	Driver's side door switch *1	Seat belt switch *2	Illumination control switch
		⑨	② or ⑤	⑥	⑫	⑬	⑱	⑯	⑦ or ⑧
Intermittent wiper control	①	ON	ACC or ON		ON				
Washer and wiper combination control	⑫	ON	ACC or ON			ON			
Illumination control	⑪	ON		ON					ON
Light warning chime timer	⑲	ON	OFF or ACC	ON			ON		
Seat belt warning lamp timer	⑯	ON	OFF or ACC →ON						
Seat belt warning chime timer	⑲	ON	OFF or ACC →ON					ON	

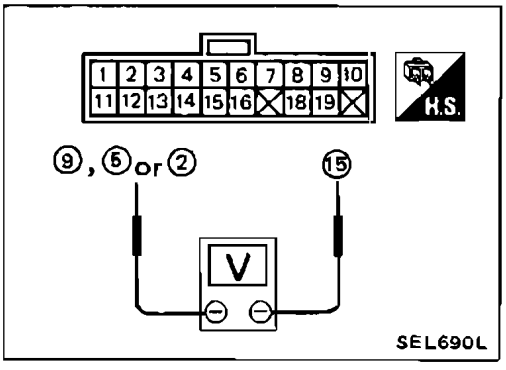
*1 Door switch is turned ON when door is opened.

*2 Seat belt switch is turned ON when driver's side seat belt is unfastened.

Trouble-shooting

Symptom		DIAGNOSTIC PROCEDURE
Wiper & washer	Intermittent wiper does not operate.	1
	Intermittent time of wiper cannot be adjusted.	2
	Wiper and washer activate individually but not in combination	3
Illumination	Illumination control system does not actuate.	4
Warning	Light warning chime does not activate.	5
	Seat belt warning chime does not activate.	6
	Seat belt warning lamp does not go off nor come on.	7
	Ignition key warning chime does not activate.	8
Rear defogger	Rear defogger does not activate, or does not go off.	9





PREPARATION FOR TROUBLE-SHOOTING

1. Remove driver's side dash side cover.
2. Remove time control unit with harness connected.

POWER SUPPLY CIRCUIT CHECK

1. Connect ohmmeter from harness side.
2. Check continuity between terminal ⑨ and body ground.

Ohmmeter terminals		Continuity
(+)	(−)	
⑨	Body ground	Yes

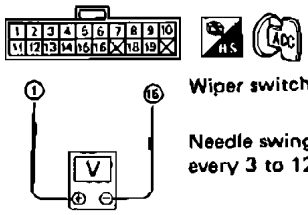
3. Connect voltmeter from harness side.
4. Measure voltage across terminal ⑮ and terminals ②, ⑤ or ⑨.

Voltmeter terminals		Ignition switch position		
(+)	(−)	OFF	ACC	ON
⑨	⑮	Approx. 12V	Approx. 12V	Approx. 12V
⑤	⑮	0V	0V	Approx. 12V
②	⑮	0V	Approx. 12V	Approx. 12V

Trouble-shooting (Cont'd)

A T.C.U. OUTPUT FOR WIPER RELAY CIRCUIT CHECK

Measure voltage across ① and ⑮.



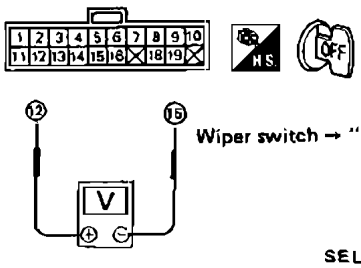
Wiper switch → "INT"

Needle swings from 0 to 12V every 3 to 12 seconds.

SEL652L

B WIPER SWITCH CIRCUIT CHECK

Check continuity between ⑫ and ⑮.

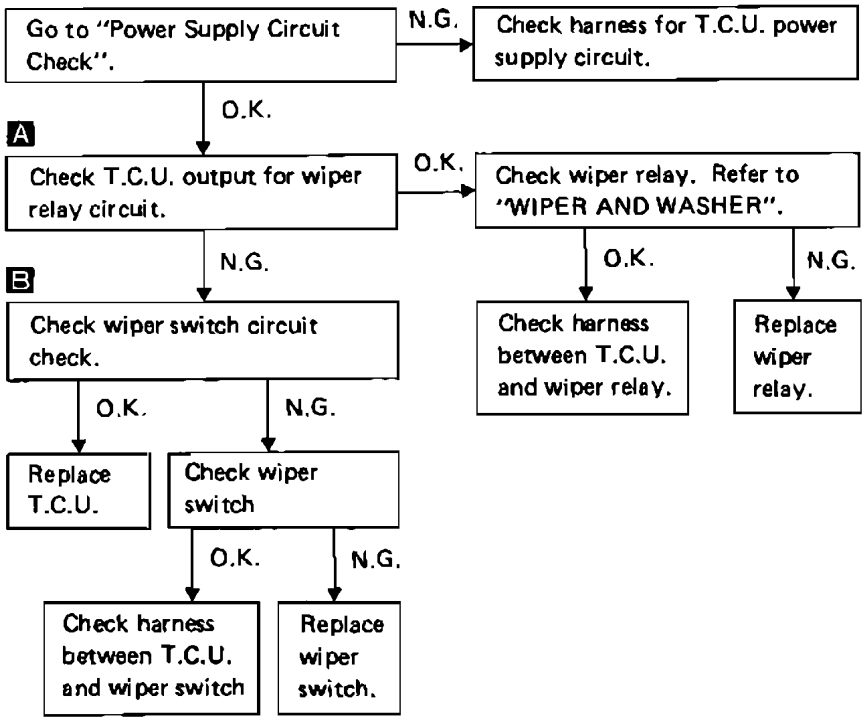


Wiper switch → "INT"

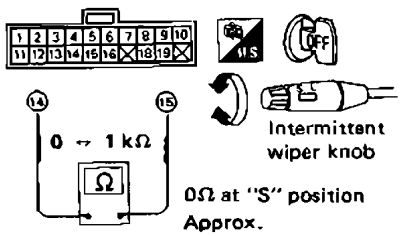
SEL653L

DIAGNOSTIC PROCEDURE-1

Intermittent wiper does not operate.



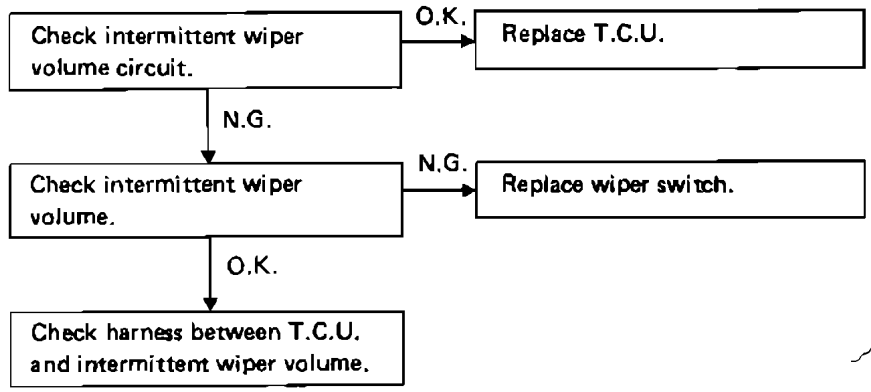
Measure resistance between ⑭ and ⑮ while turning intermittent wiper volume.



0Ω at "S" position
Approx.
1 kΩ at "L" position SEL664L

DIAGNOSTIC PROCEDURE-2

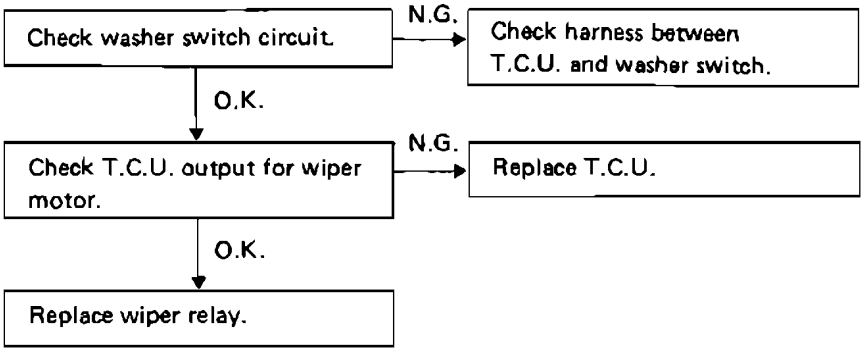
Intermittent time of wiper cannot be adjusted.



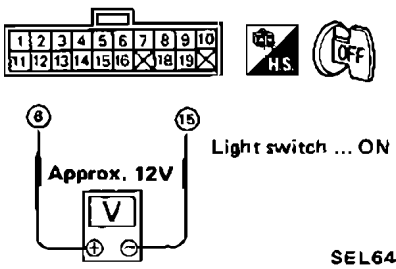
Trouble-shooting (Cont'd)

DIAGNOSTIC PROCEDURE-3

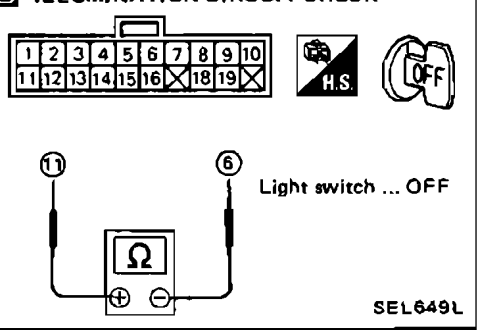
Wiper and washer activate individually but not in combination.



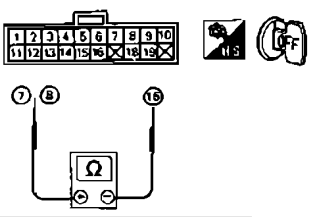
A T.C.U. OUTPUT FOR LIGHT SWITCH CIRCUIT CHECK



B ILLUMINATION CIRCUIT CHECK



C ILLUMINATION CONTROL CIRCUIT CHECK

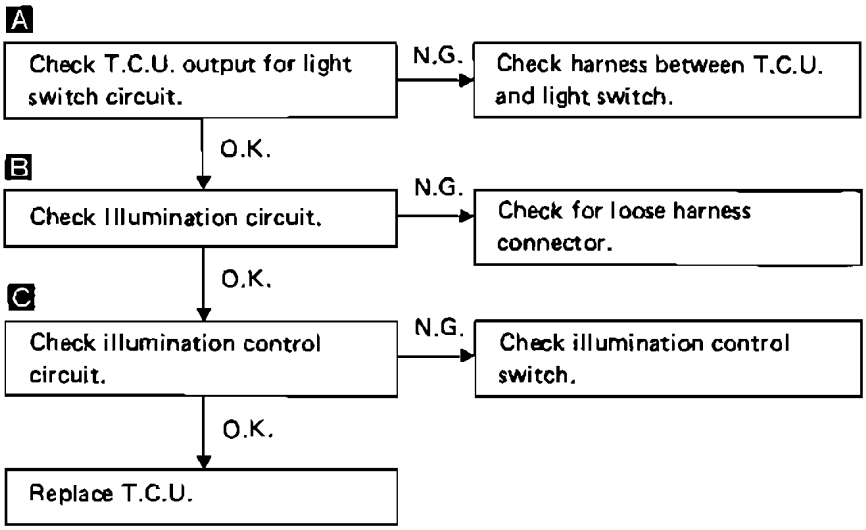


Ohmmeter (+)	Ohmmeter (−)	Illumination control switch: DARK	Illumination control switch: BRIGHT
8	15	0Ω	Except 0Ω
7	15	Except 0Ω	0Ω

SEL650L

DIAGNOSTIC PROCEDURE-4

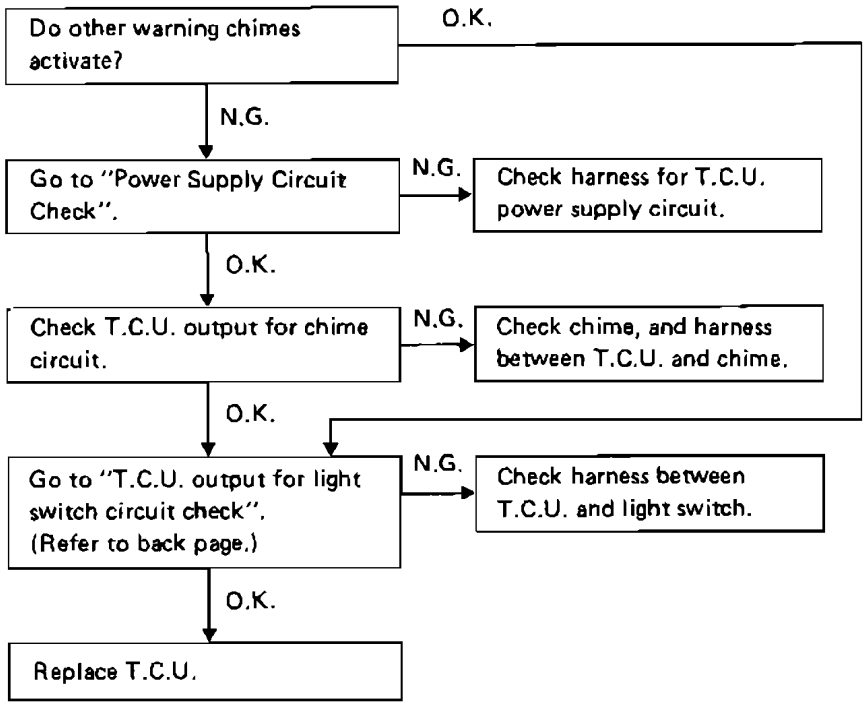
Illumination control system does not actuate.



Trouble-shooting (Cont'd)

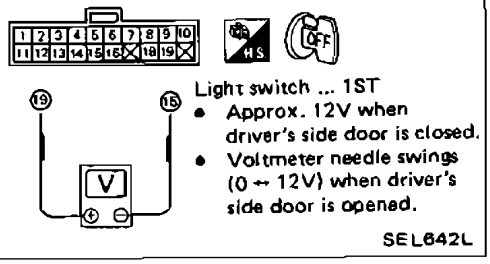
DIAGNOSTIC PROCEDURE-5

Light warning chime does not activate.



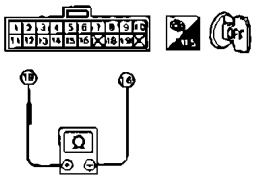
T.C.U. OUTPUT FOR CHIME CIRCUIT CHECK

Measure voltage across ⑲ and ⑮ when driver's door is opened and closed.



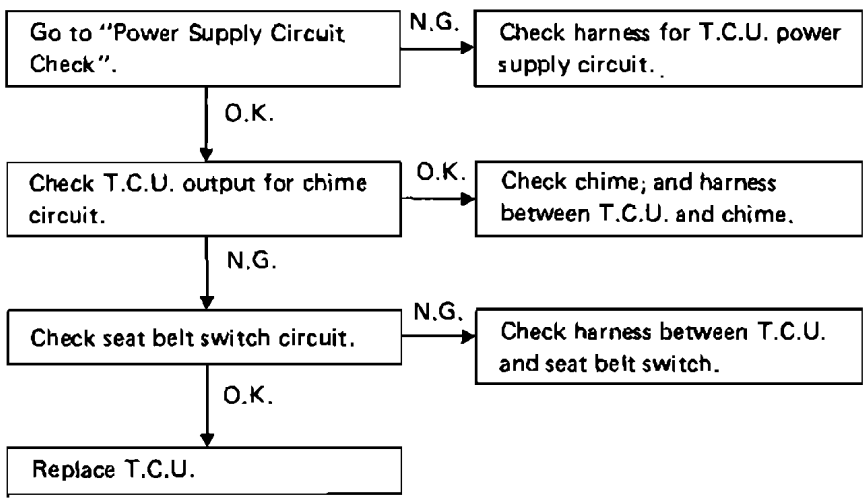
SEAT BELT SWITCH CIRCUIT CHECK

1. Unfasten driver's seat belt.
2. Check continuity between ⑲ and ⑯.
3. Fasten driver's seat belt.
4. Check to determine if continuity does not exist between ⑲ and ⑯.



DIAGNOSTIC PROCEDURE-6

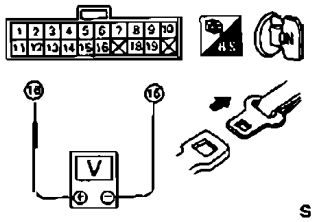
Seat belt warning chime does not activate.



Trouble-shooting (Cont'd)

T.C.U. OUTPUT FOR BELT WARNING LAMP CIRCUIT CHECK

Measure voltage across ⑯ and ⑮ when ignition switch is "ON".



SEL651L

DIAGNOSTIC PROCEDURE-7

Seat belt warning lamp does not go off nor comes on.

Go to "Power Supply Circuit Check". → N.G. → Check harness for T.C.U. power supply circuit.

↓ O.K.

Check T.C.U. output for belt warning lamp circuit. → N.G. → Replace T.C.U.

Voltmeter needle keeps swinging (approx. 0 ⟷ 12V) for about 7 seconds after ignition switch is turned ON.

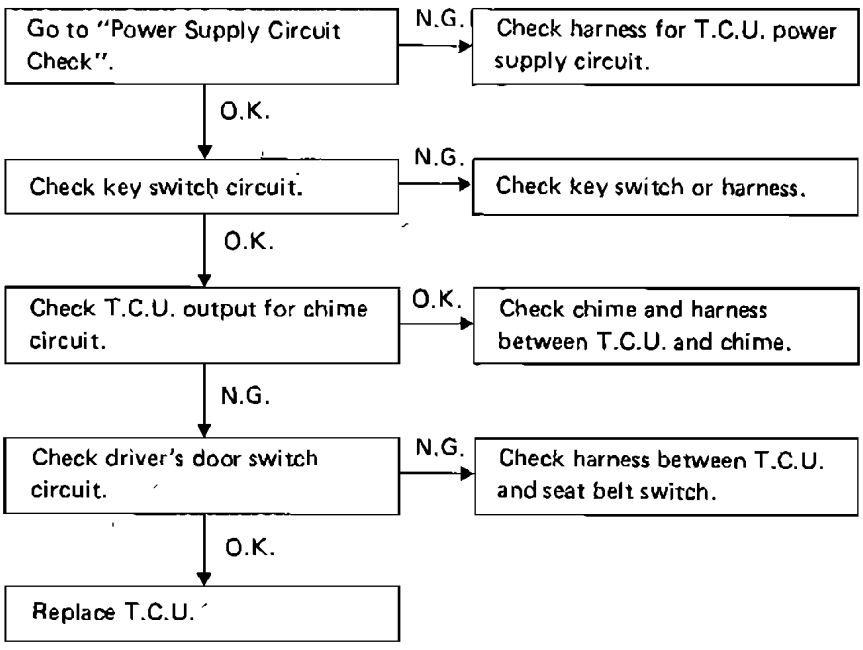
↓ O.K.

Check warning lamp, and harness between T.C.U. and warning lamp.

Trouble-shooting (Cont'd)

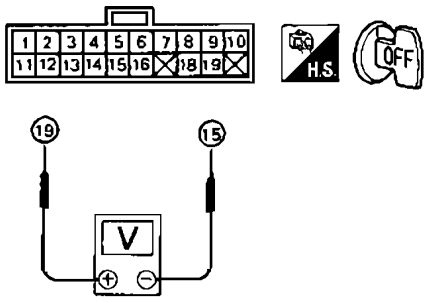
DIAGNOSTIC PROCEDURE-8

Ignition key warning chime does not activate.



T.C.U. OUTPUT FOR CHIME CIRCUIT CHECK

Measure voltage across ⑲ and ⑮ when driver's door is opened and closed.

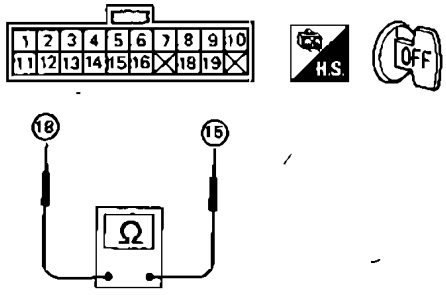


- Approx. 12V when driver's side door is opened.

SEL639L

DRIVER'S DOOR SWITCH CIRCUIT CHECK

Check continuity between ⑱ and ⑮.

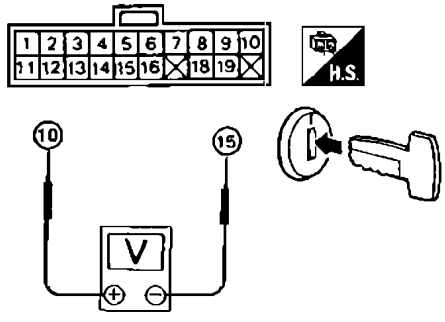


Driver's side door ... Open

SEL640L

KEY SWITCH CIRCUIT CHECK

Measure voltage across ⑩ and ⑮.

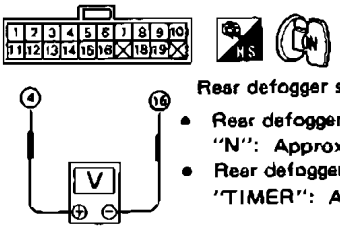


SEL641L

Trouble-shooting (Cont'd)

T.C.U. OUTPUT FOR REAR DEFOGGER CIRCUIT CHECK

Measure voltage across ④ and ⑮ while operating rear defogger switch.

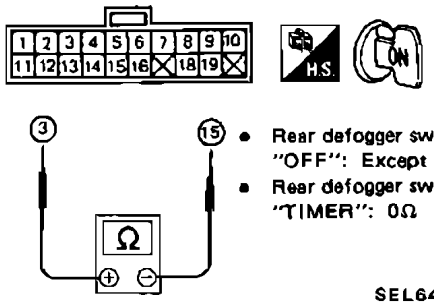


Rear defogger switch → ON

- Rear defogger switch "N": Approx. 12V
- Rear defogger switch "TIMER": Approx. 0V

SEL644L

DEFOGGER SWITCH CIRCUIT CHECK

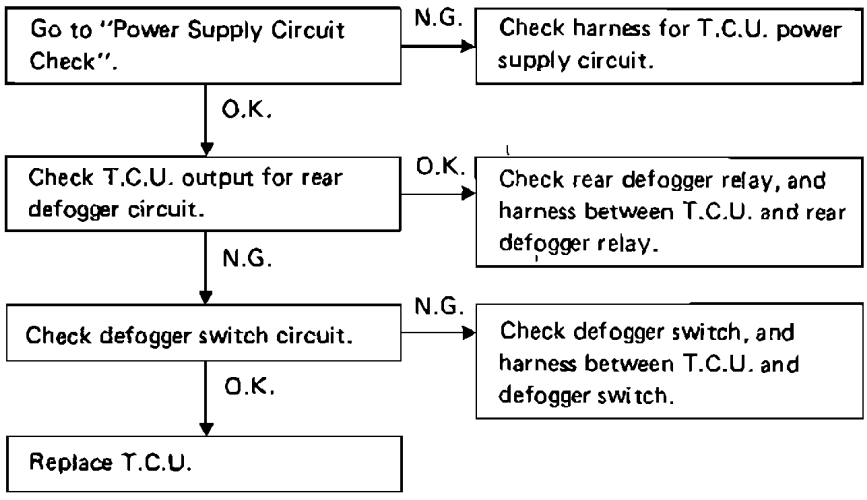


- Rear defogger switch "OFF": Except 0Ω
- Rear defogger switch "TIMER": 0Ω

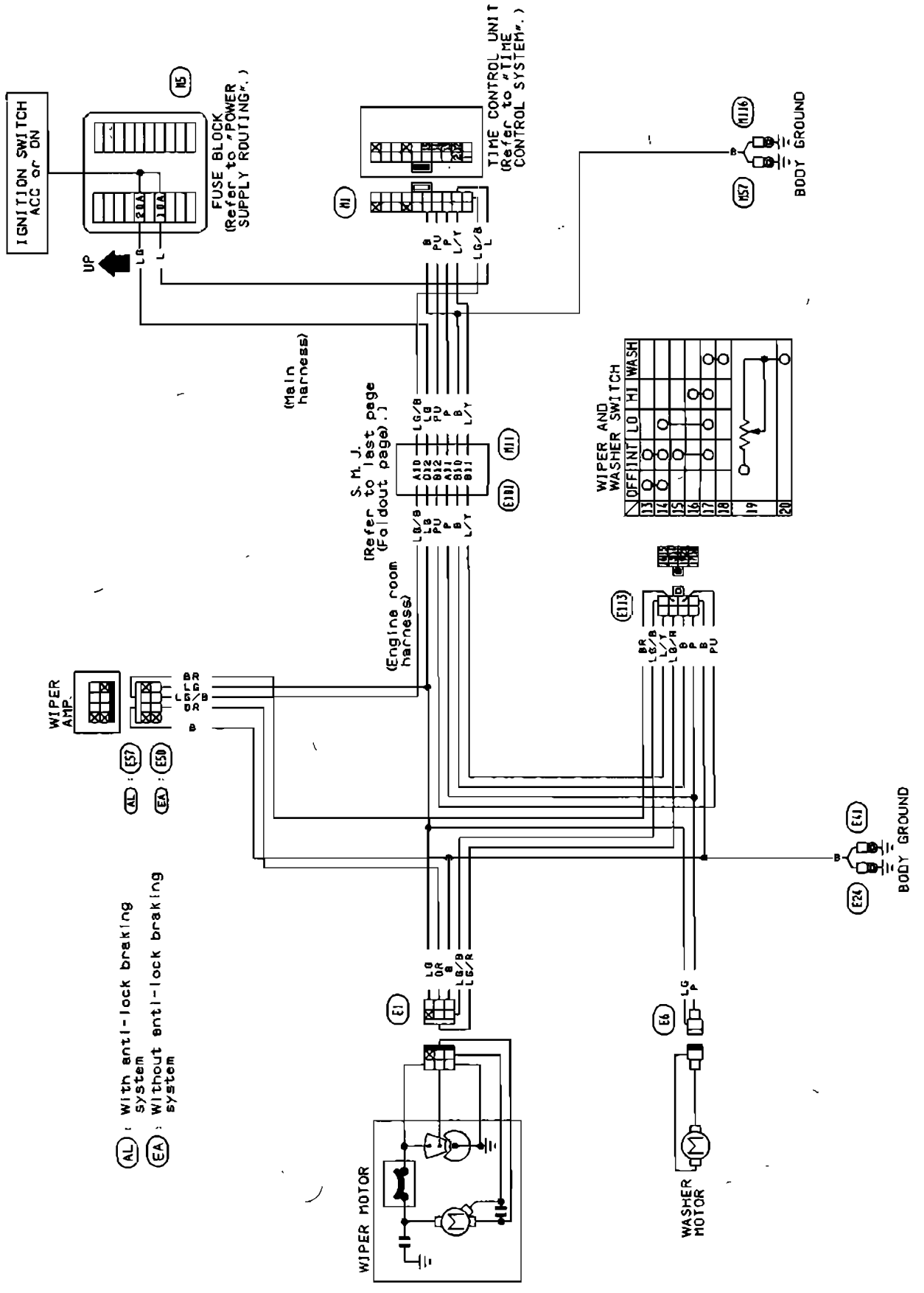
SEL645L

DIAGNOSTIC PROCEDURE-9

Rear defogger does not activate, or does not go off.

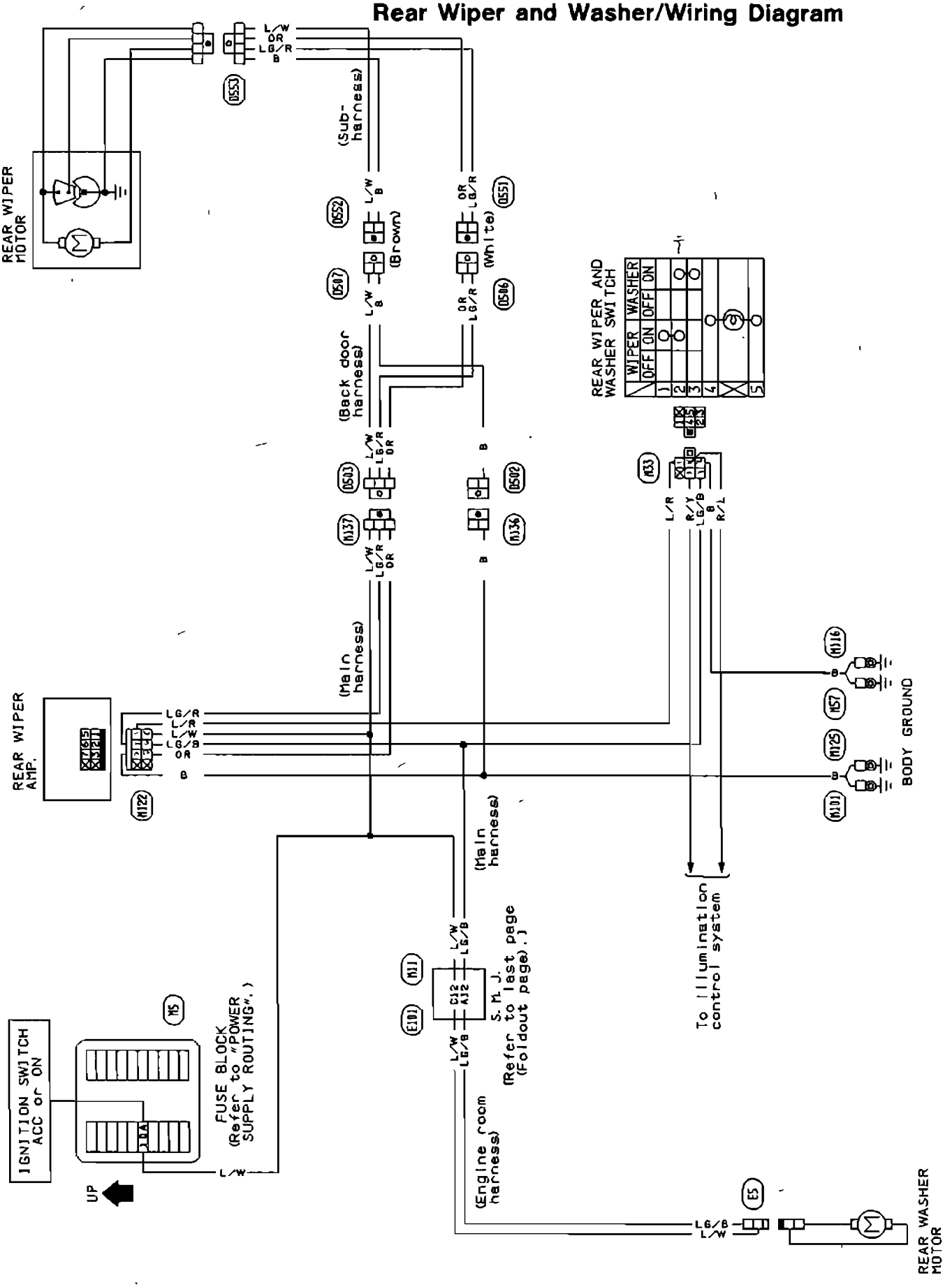


Front Wiper and Washer/Wiring Diagram



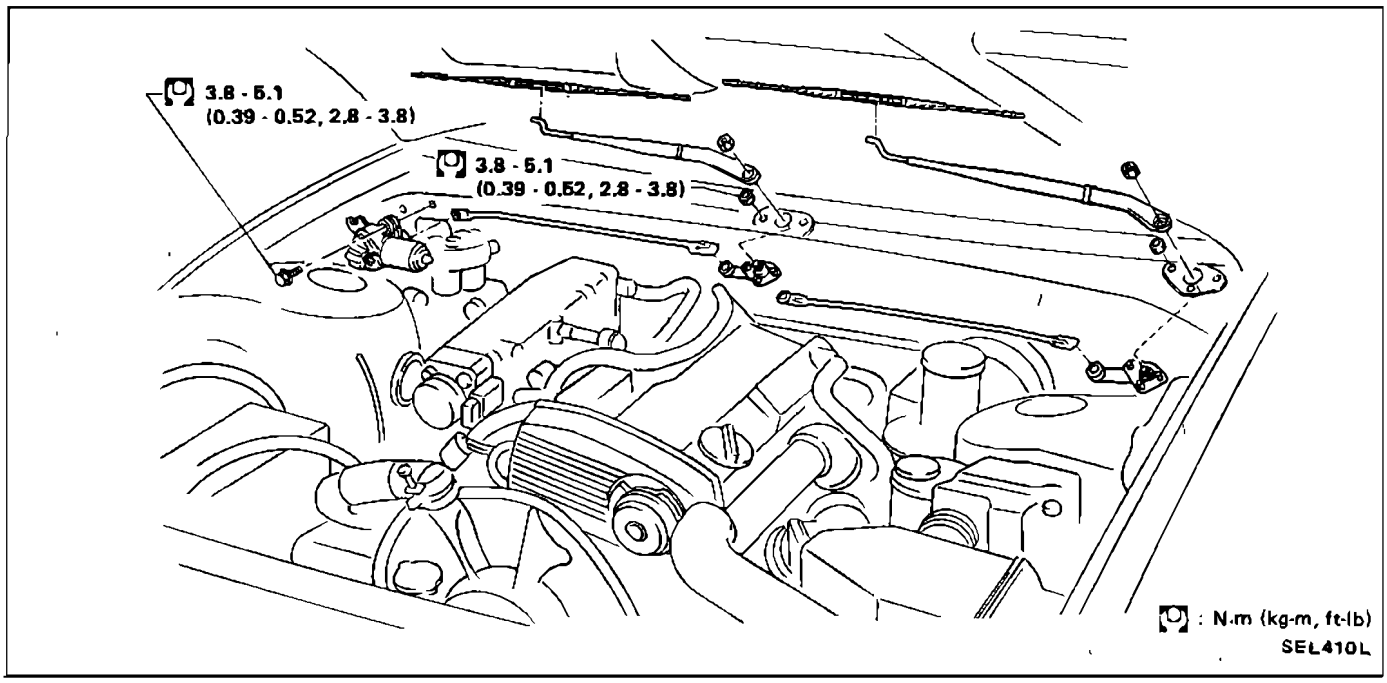
SEL588M

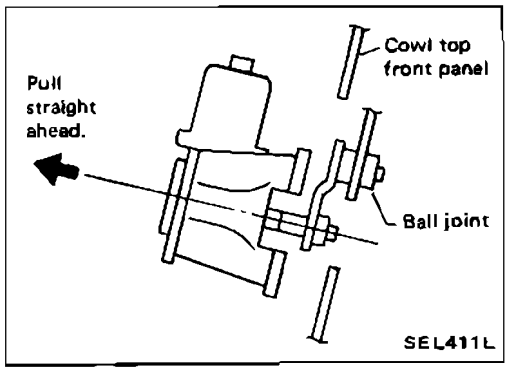
Rear Wiper and Washer/Wiring Diagram



SEL671M

Wiper Removal and Installation

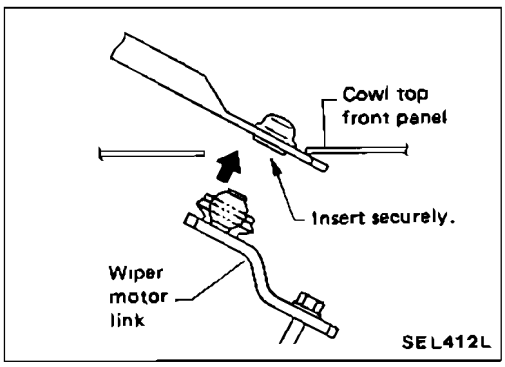




FRONT WIPER REMOVAL

Before removing front wiper motor link, turn wiper switch OFF and disconnect motor leads at connectors.

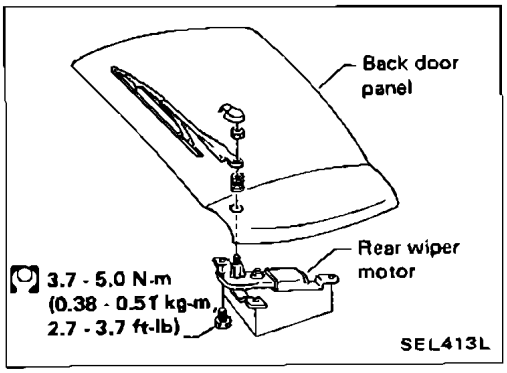
1. Remove wiper arm.
2. Remove cowl cover.
3. Remove bolts which secure wiper motor.
4. Extract wiper motor so that wiper motor link comes out of hole in front cowl top panel. Then, pull motor straight out to disconnect ball joint which connects motor link and wiper link. Wiper motor can then be removed.
5. Remove wiper link pivot blocks on driver and passenger sides.
6. Extract wiper link and pivot blocks (as one unit) from oblong hole on left side of cowl top.



FRONT WIPER INSTALLATION

1. Position wiper link and pivot blocks (as one unit) in cowl top through oblong hole.
2. Before installing pivot blocks on cowl top, hold end (motor link side) of wiper link at hole in front cowl top panel and insert motor link's ball pin into hole in wiper link.
3. Install front wiper in reverse order of above removal procedures.

- Apply a small amount of grease to ball joints before installation.

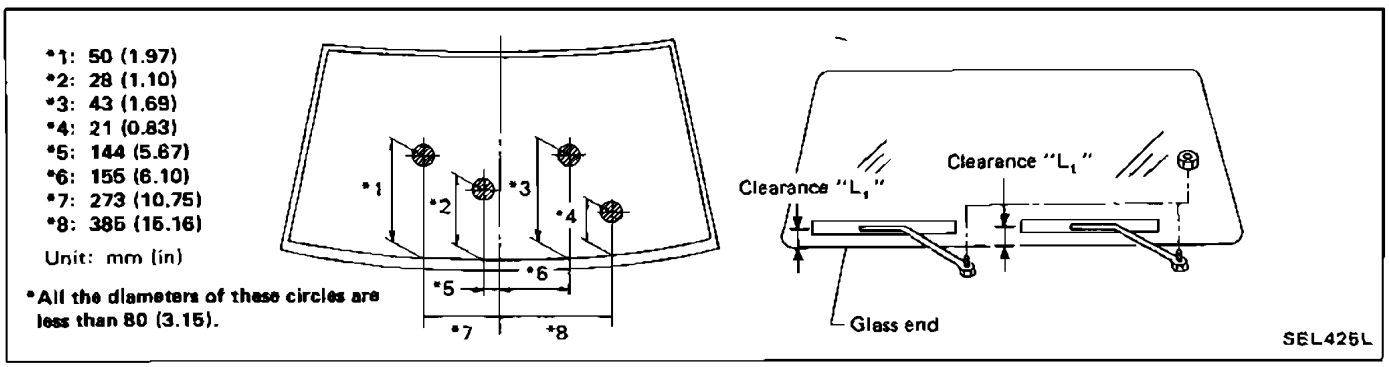


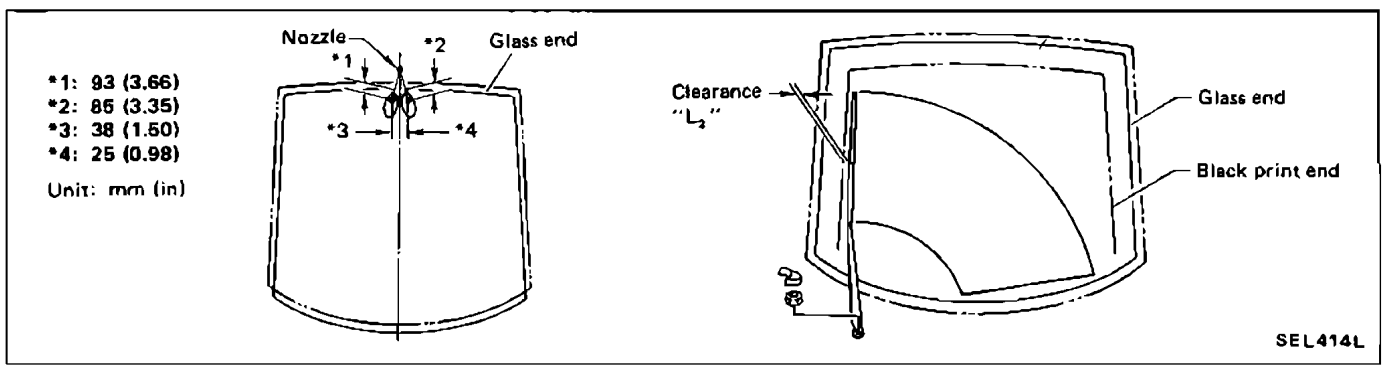
Wiper and Washer Adjustment

INSTALLATION

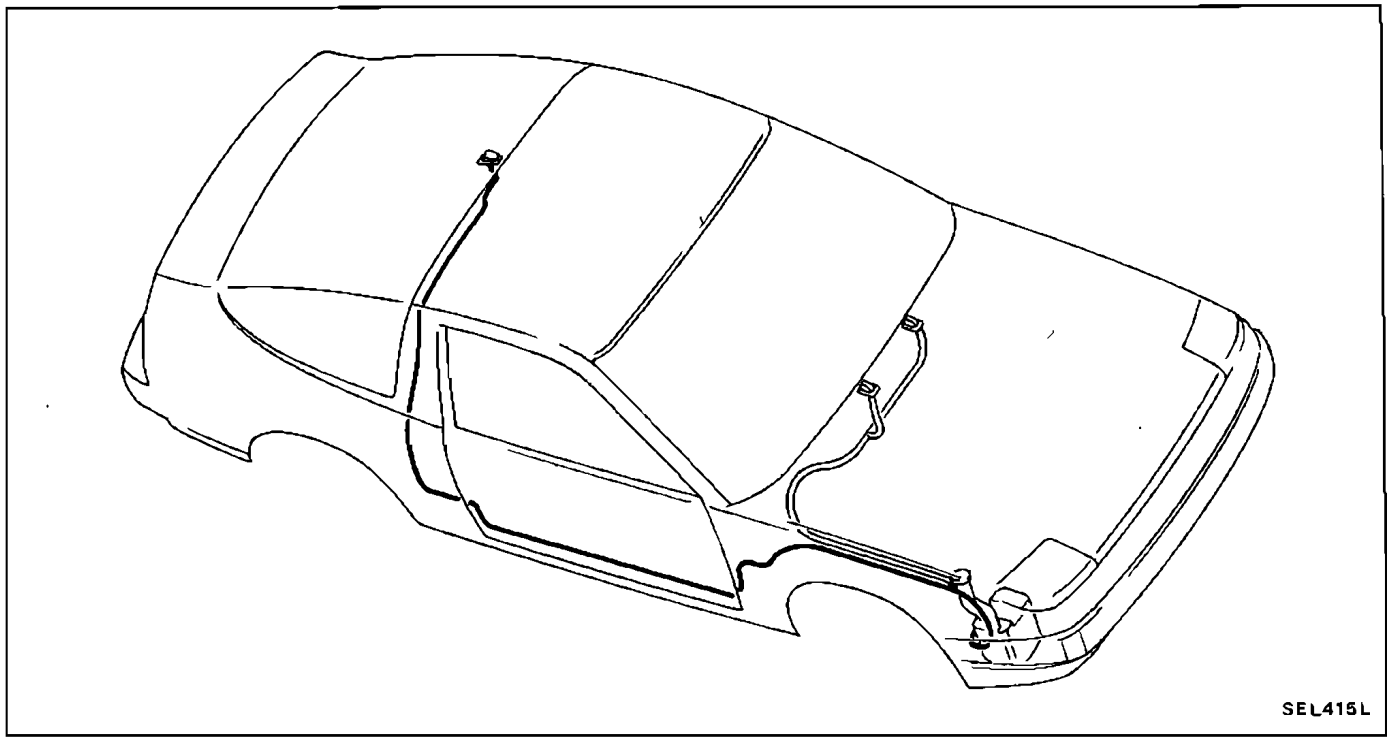
1. Prior to wiper arm installation, turn on wiper switch to operate wiper motor and then turn it "OFF" (Auto Stop).
2. Lift the blade up and then set it down onto glass surface to set the blade center to clearance "L_1" & "L_2" immediately before tightening nut.
3. Eject washer fluid. Turn on wiper switch to operate wiper motor and then turn it "OFF".
4. Ensure that wiper blades stop within clearance "L_1" & "L_2".
   Clearance "L_1": 17.5 - 32.5 mm (0.689 - 1.280 in)
   Clearance "L_2": 25 - 35 mm (0.98 - 1.38 in)

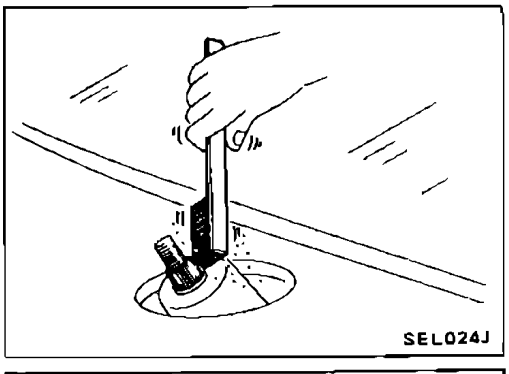
- Tighten wiper arm nuts to specified torque.
  Front wiper: 17 - 23 N·m (1.7 - 2.3 kg-m, 12 - 17 ft-lb)
  Rear wiper: 13 - 18 N·m (1.3 - 1.8 kg-m, 9 - 13 ft-lb)



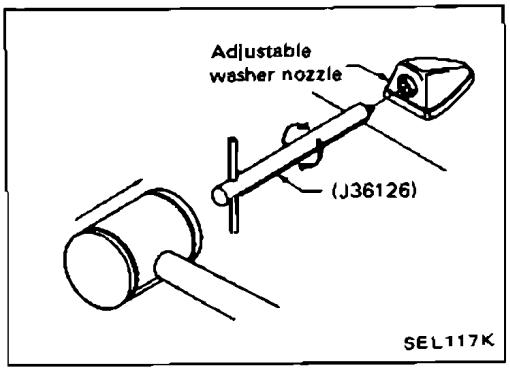


Wiper and Washer Adjustment (Cont'd)





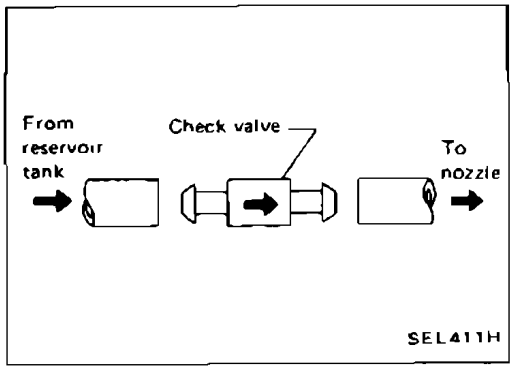
- **Before reinstalling wiper arm, clean up the pivot area as illustrated. This will reduce possibility of wiper arm looseness.**



Washer Nozzle Adjustment

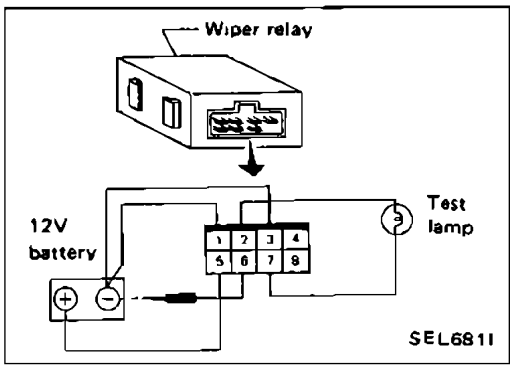
- Using Tool (J36126), adjust windshield washer nozzle to correct its spray pattern.

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.



Check Valve

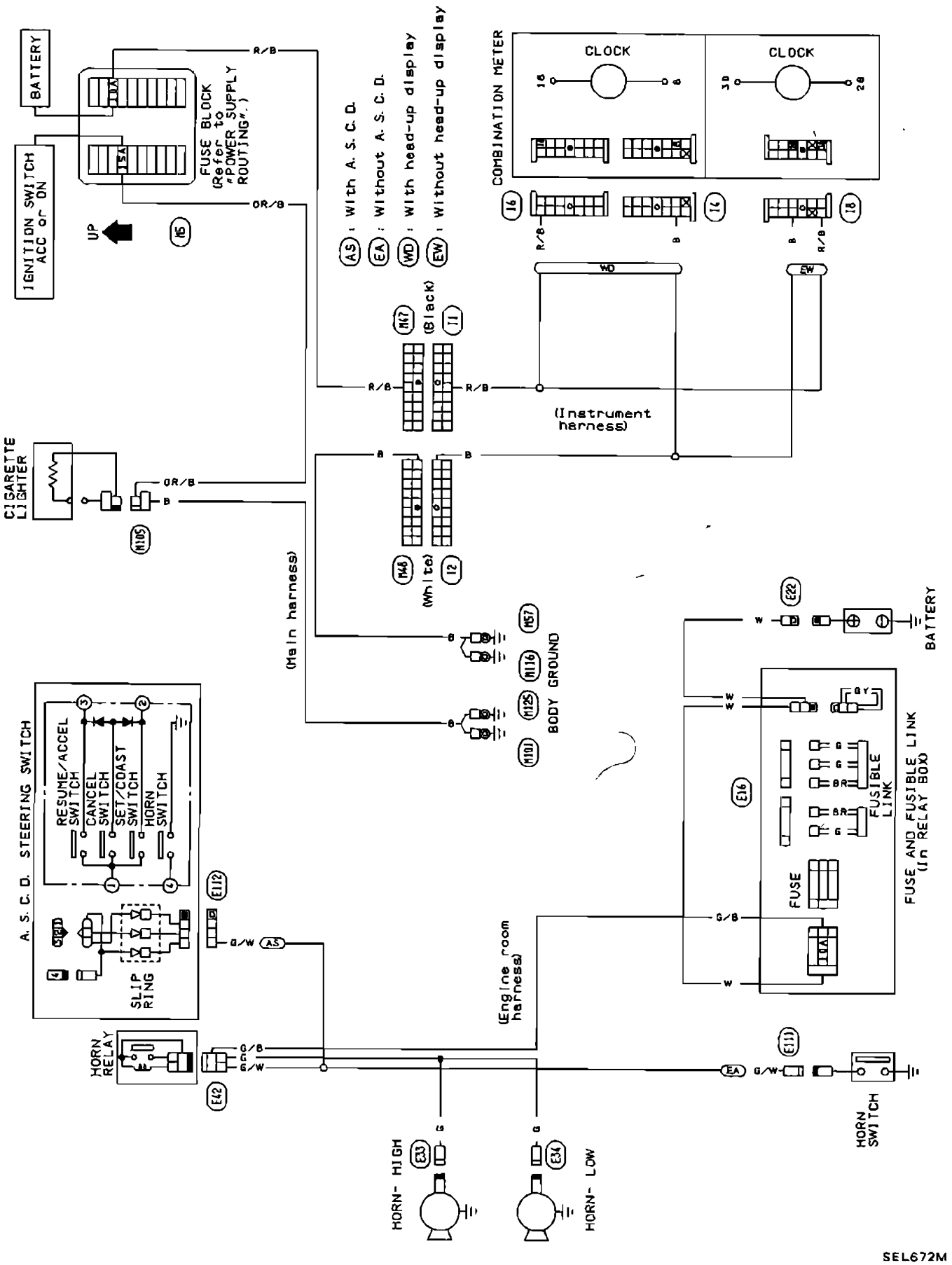
- A check valve is provided in the washer fluid line. Be careful not to connect check valve to washer tube in the wrong direction.



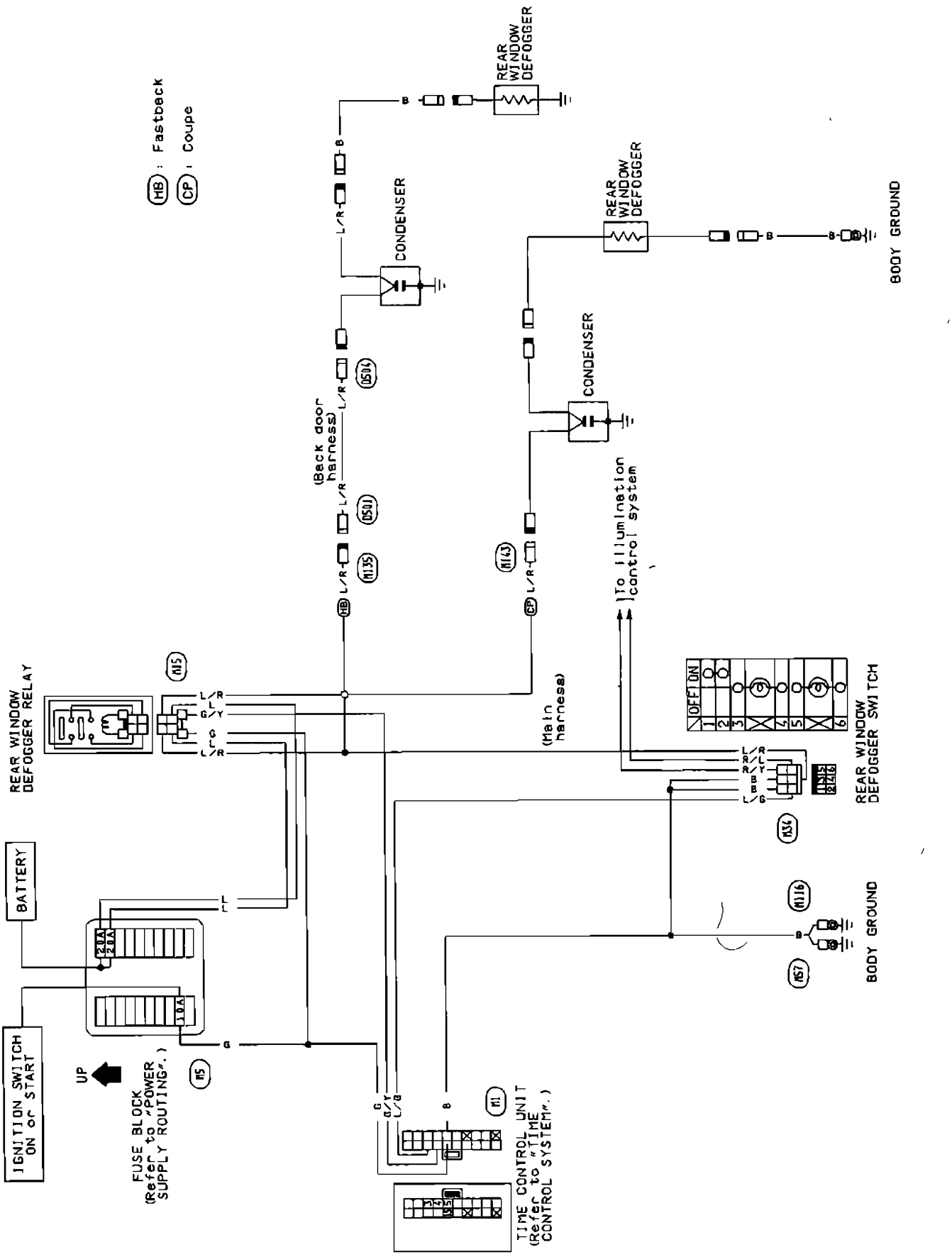
Wiper Amplifier Check

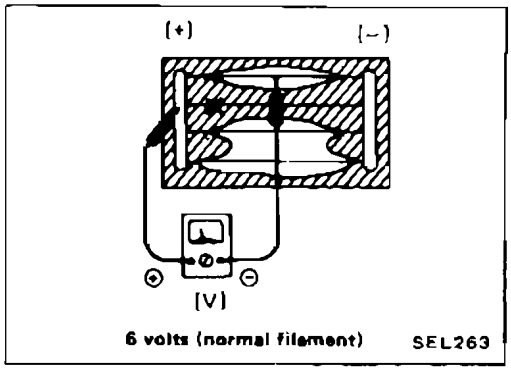
1. Connect as shown in the figure at left.
2. If test lamp comes on when connected to terminal ⑥ and battery ground, wiper relay is normal.

Wiring Diagram



SEL672M

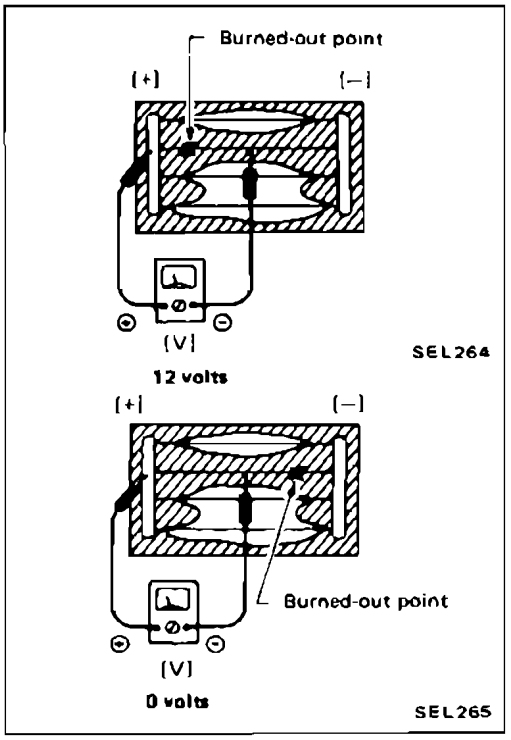

HB : Fastback
CP : Coupe
REAR WINDOW DEFOGGER
CONDENSER
REAR WINDOW DEFOGGER
CONDENSER
BODY GROUND
(Back door harness)
To illumination control system
REAR WINDOW DEFOGGER RELAY
(Main harness)
REAR WINDOW DEFOGGER SWITCH
OFF ON
BATTERY
IGNITION SWITCH ON or START
FUSE BLOCK (Refer to "POWER SUPPLY ROUTING".)
UP
TIME CONTROL UNIT (Refer to "TIME CONTROL SYSTEM".)
BODY GROUND
SEL673M



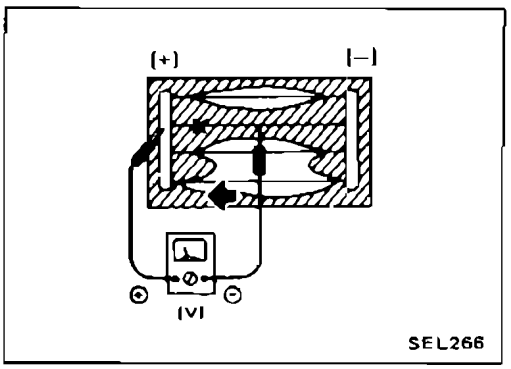
6 volts (normal filament) SEL263

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.

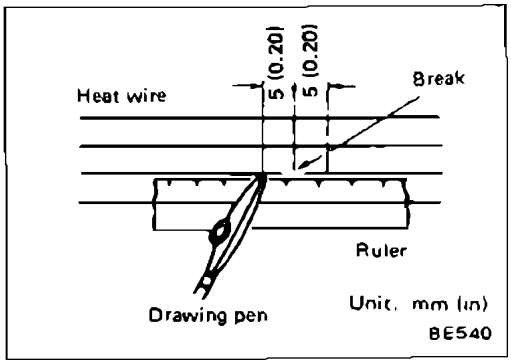


3. To locate burned out point, move probe to left and right along filament to determine point where tester needle swings abruptly.

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

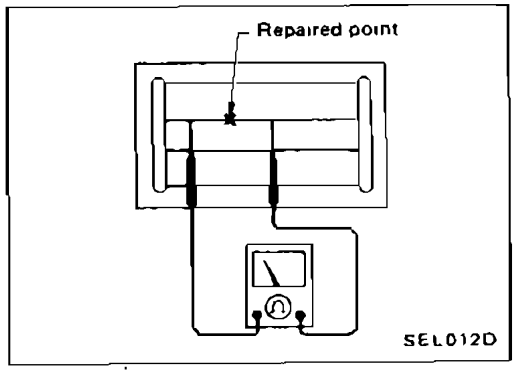


REPAIRING PROCEDURE

1. Wiper 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.

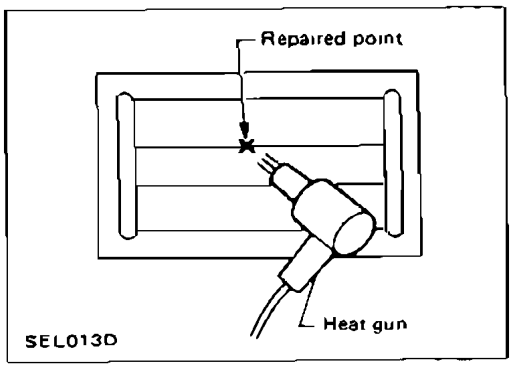
Shake silver composition container before use.

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.



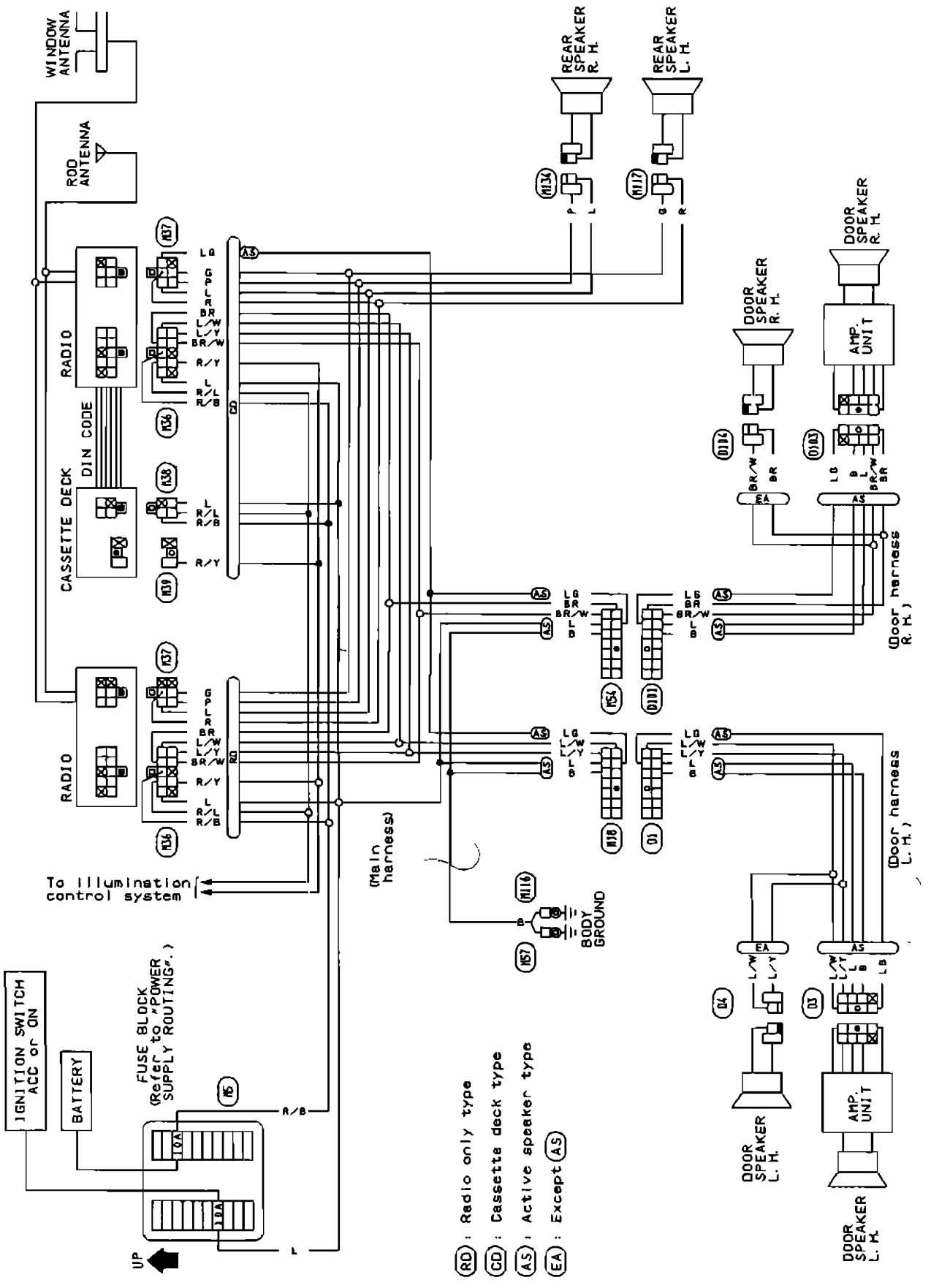
4. After repair has been completed, check repaired wire for continuity. This check should be conducted 10 minutes after silver composition is deposited.

Do not touch repaired area while test is being conducted.



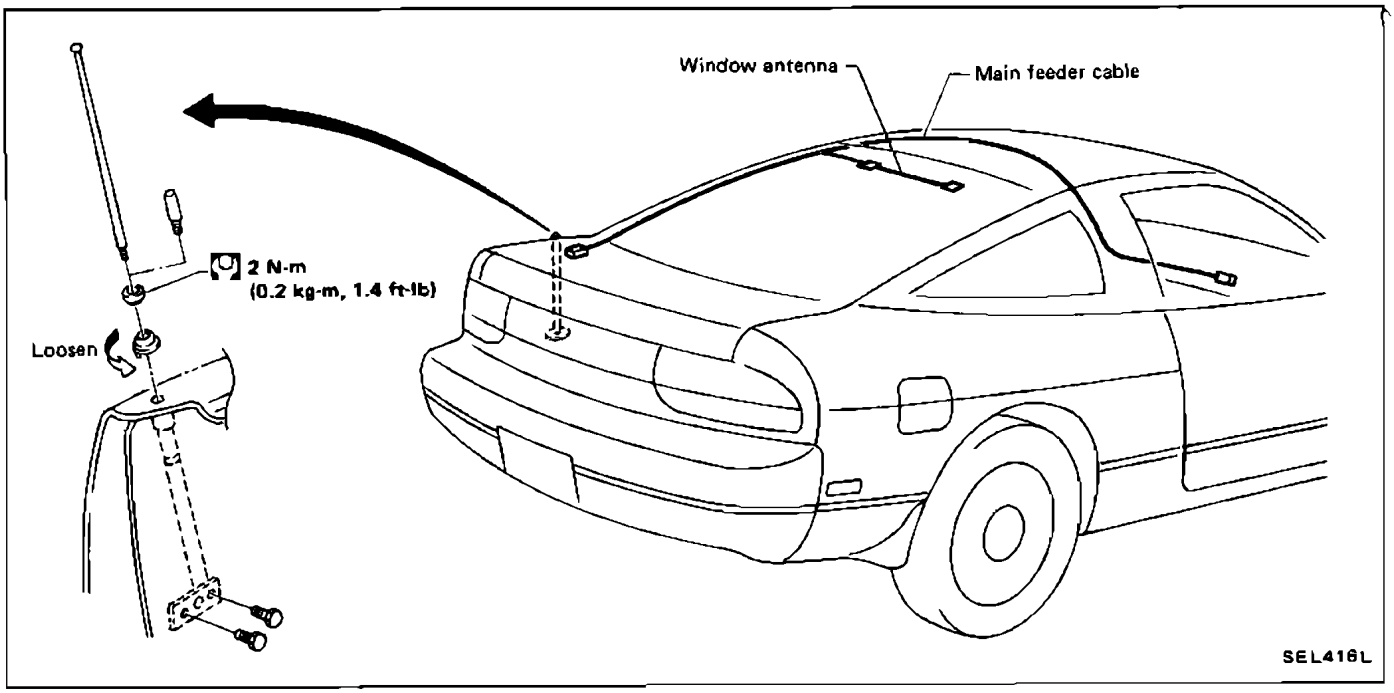
5. Apply a constant stream of hot air directly to the repaired area for approximately 20 minutes with a heat gun. A minimum distance of 3 cm (1.2 in) should be kept between repaired area and hot air outlet. If a heat gun is not available, let the repaired area dry for 24 hours.

Audio/Wiring Diagram

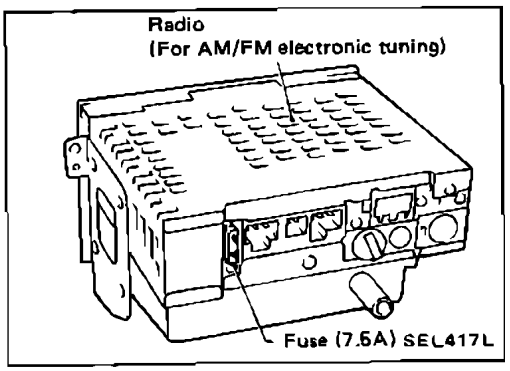


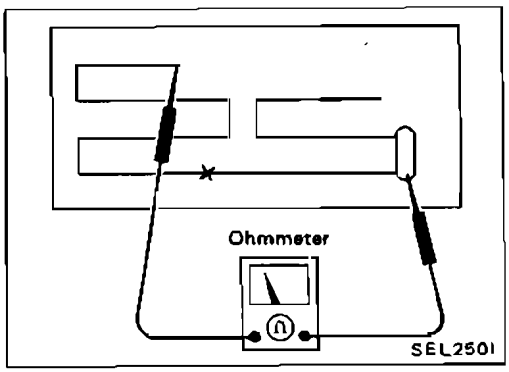
SEL674M

Location of Antenna



Radio Fuse Check

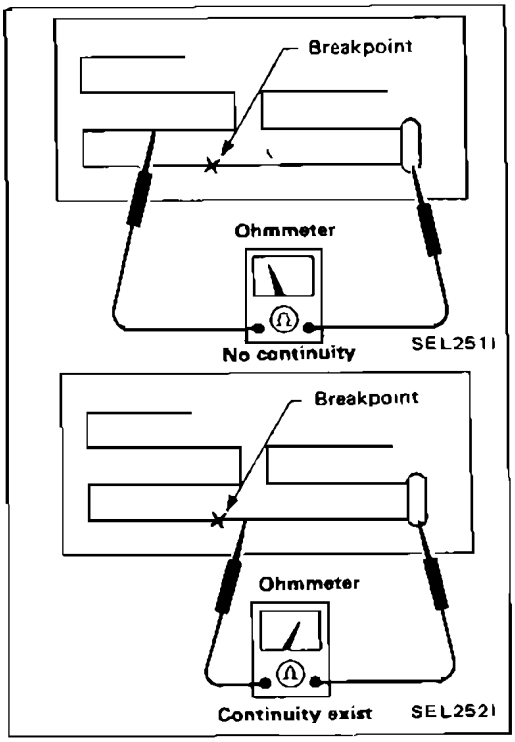




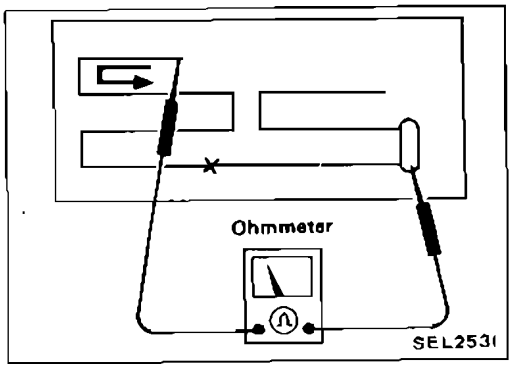
Window Antenna Repair

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.

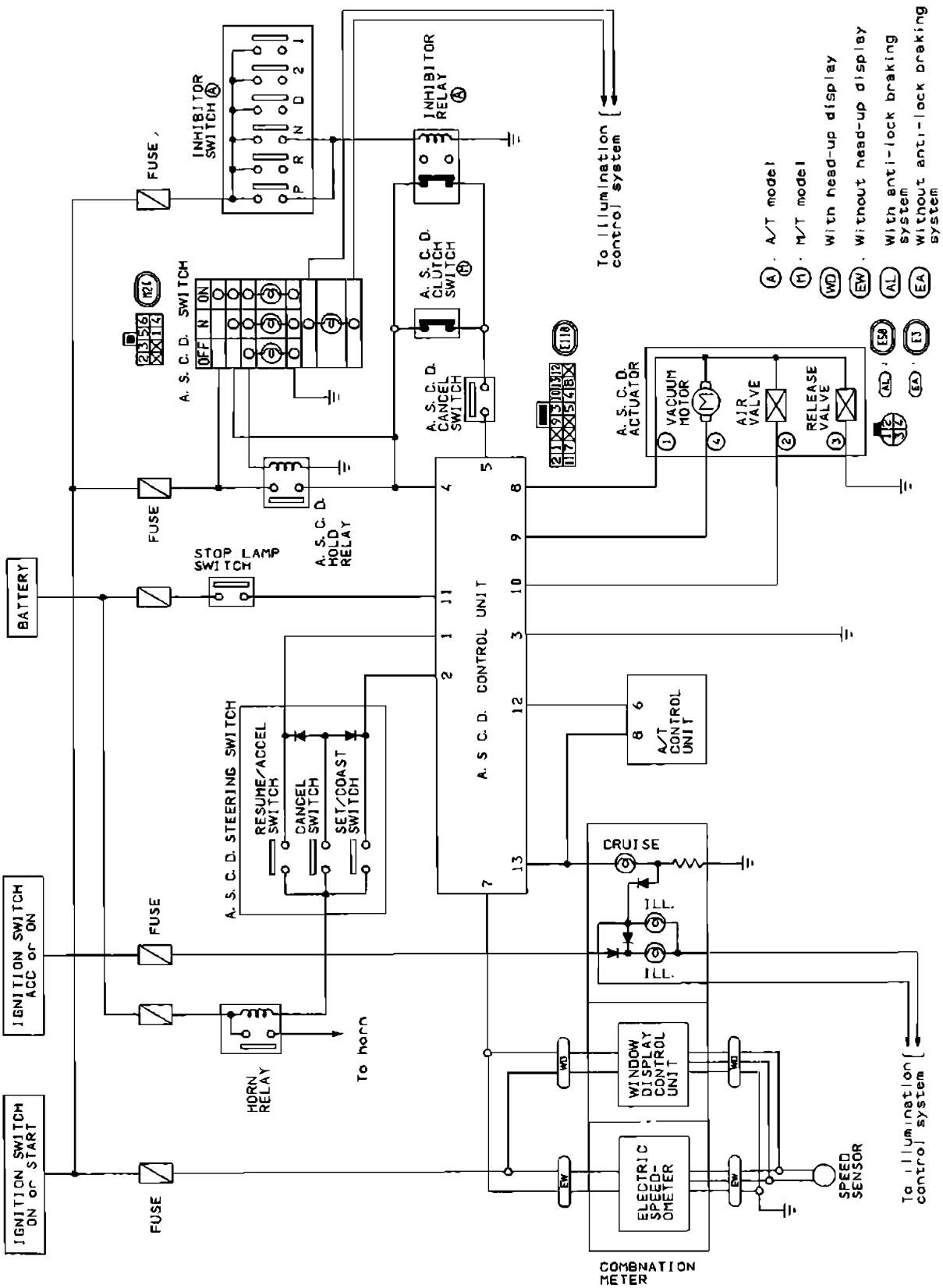


3. To locate broken point, move probe to left and right along element to determine point where tester needle swings abruptly.

ELEMENT REPAIR

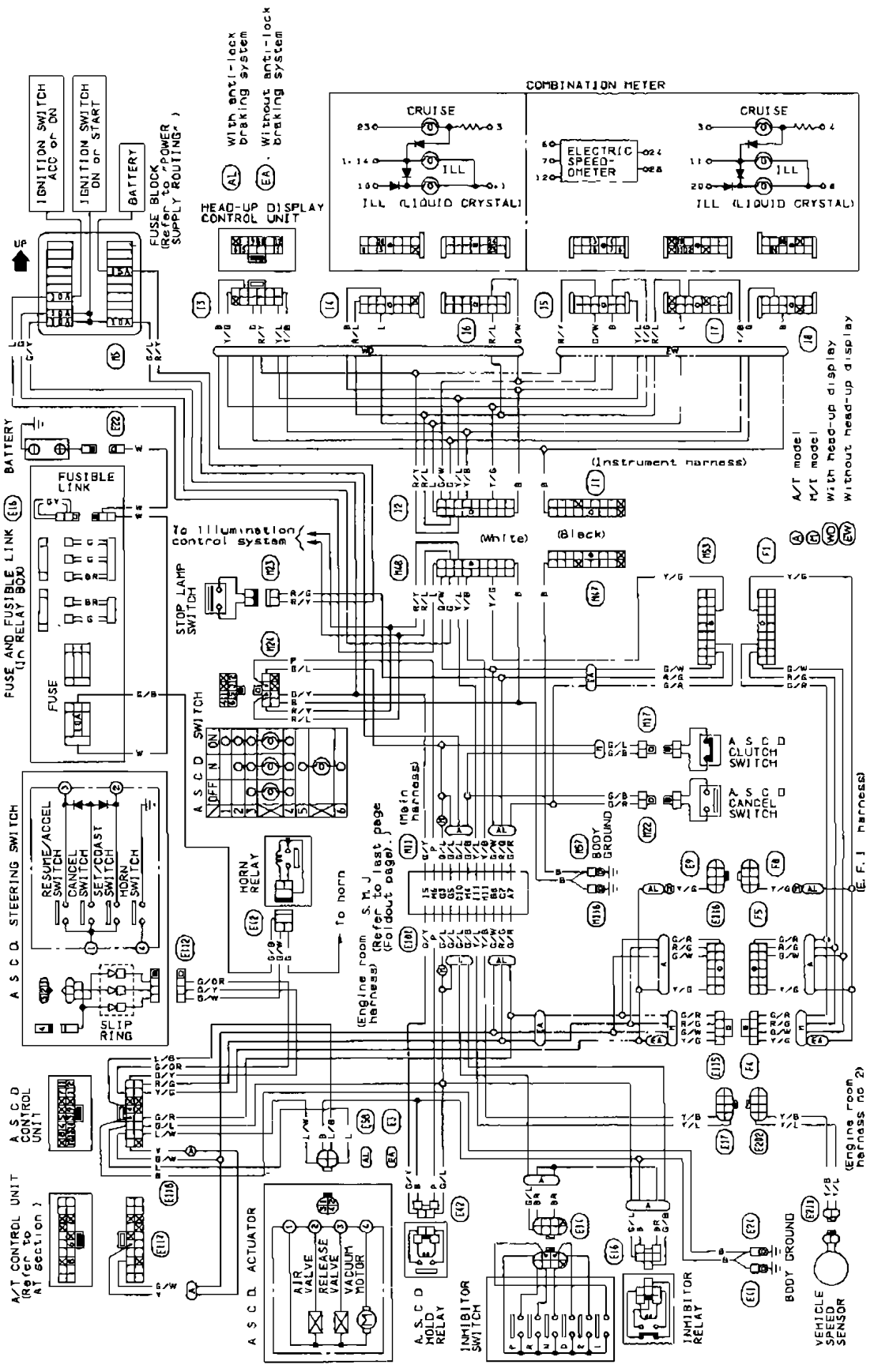
Refer to REAR WINDOW DEFOGGER "Filament Repair".

Schematic



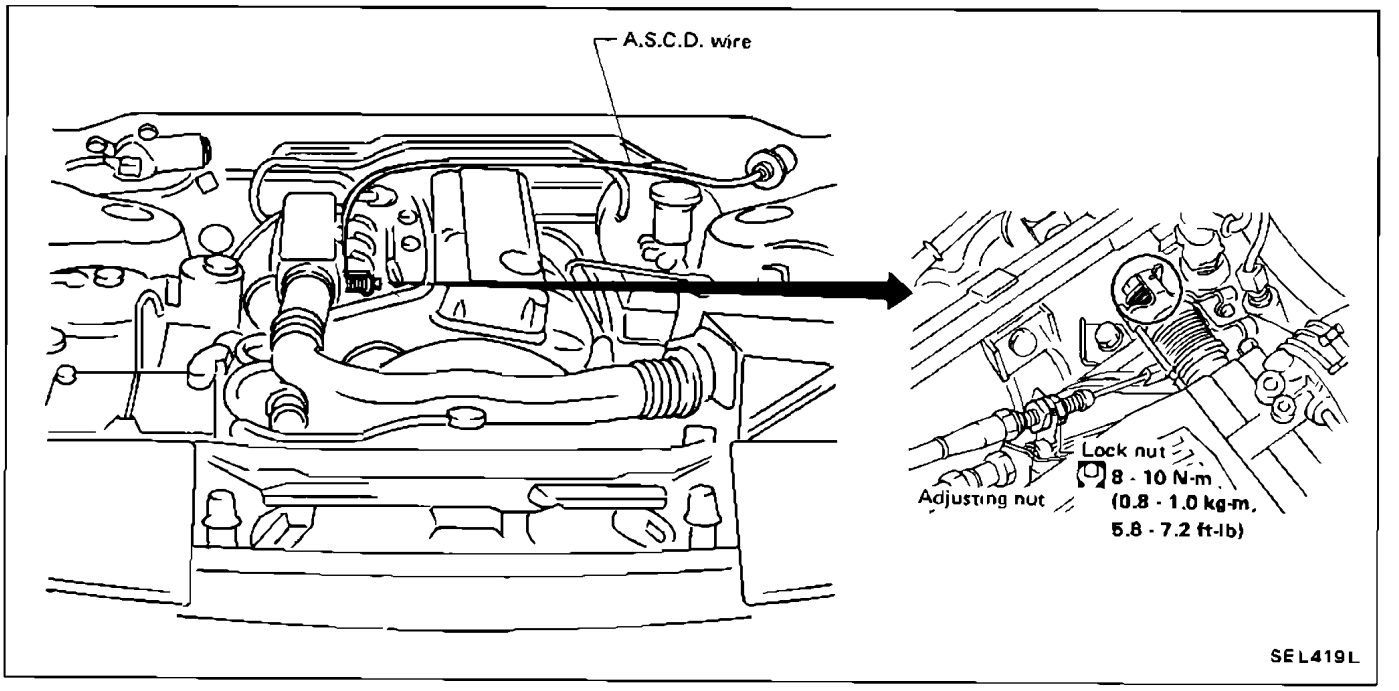
SEL589M

Wiring Diagram



SEL590M

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 accelerator 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.

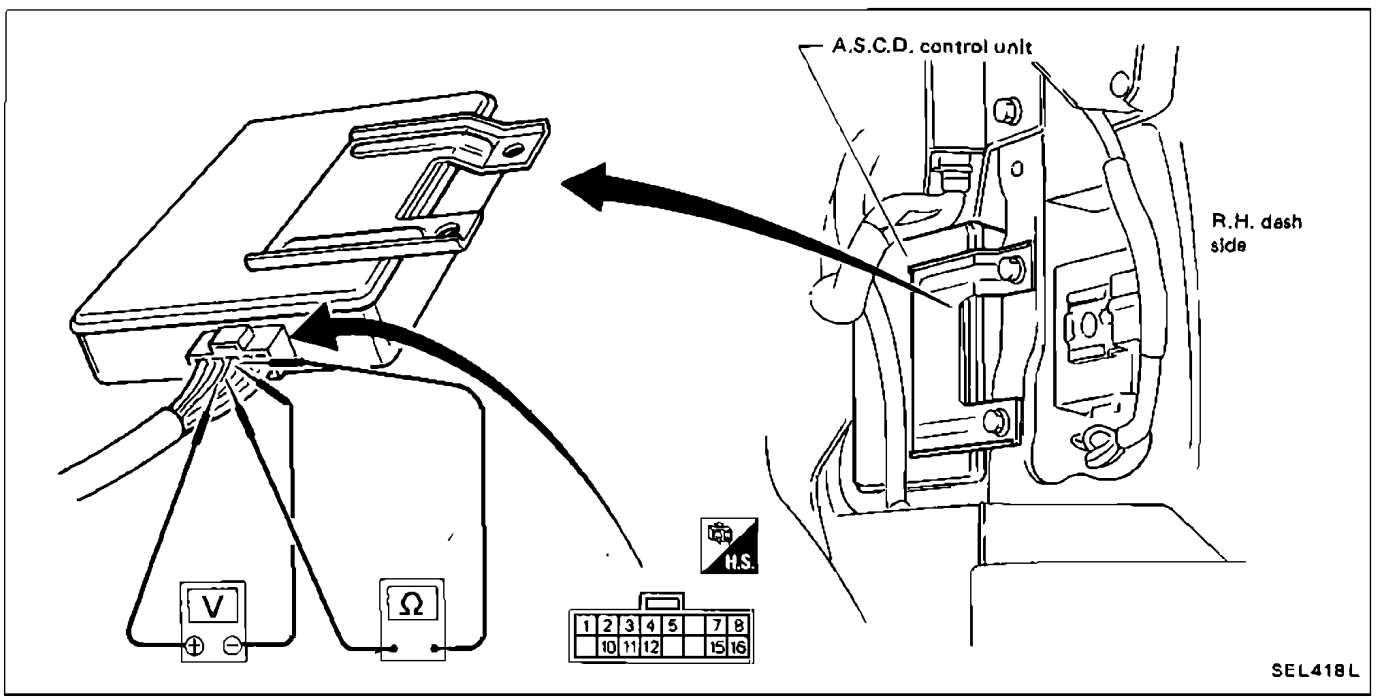
- For A.S.C.D. stop switch and clutch switch adjustment, refer to BR and CL sections.

Trouble Diagnoses

Symptom		DIAGNOSTIC PROCEDURE
A.S.C.D. control unit cannot be set properly.		1
Resume switch will not operate.		2
Cancel switch will not operate.		3
Engine hunts.		4
Large difference between set vehicle speed and actual speed.		5
Set speed cannot be cancelled.		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 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".	7

PREPARATION FOR TROUBLE-SHOOTING

1. Remove R.H. dash side cover.
2. Remove A.S.C.D. control unit with harness connected.
3. Perform check from harness side using circuit tester, with harness connector connected.



GROUND CIRCUIT CHECK

- Check continuity between ③ and body ground.

Trouble Diagnoses (Cont'd)

DIAGNOSTIC PROCEDURE-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.
- N.G. → Check indicator bulb, A.S.C.D. main switch and hold relay.
- O.K. ↓

Check power supply circuit for A.S.C.D. control unit.
- N.G. → Check A.S.C.D. power supply harness.
- O.K. ↓

Check cut-off circuit for A.S.C.D. control unit.
- N.G. → Check A.S.C.D. cancel switch, clutch switch (M/T model), inhibitor relay and inhibitor switch (A/T model).
- O.K. ↓

Check A.S.C.D. set switch circuit for A.S.C.D. control unit.
- N.G. → Check A.S.C.D. set switch and harness between control unit and set switch.
- O.K. ↓

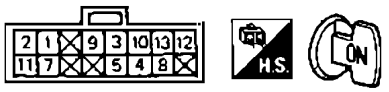
Check speed sensor circuit.
- N.G. → Check speed sensor and harness between A.S.C.D. control unit and speed sensor signal output terminal of combination meter.
- O.K. ↓

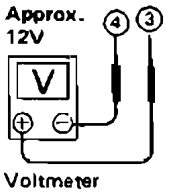
Check actuator. Refer to "Actuator Check".
- N.G. → Replace actuator.
- O.K. ↓

Replace A.S.C.D. control unit.

POWER SUPPLY CIRCUIT CHECK

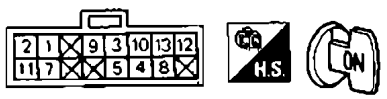
1. Turn A.S.C.D. main switch to "ON".
2. Check voltage between ④ and ③.

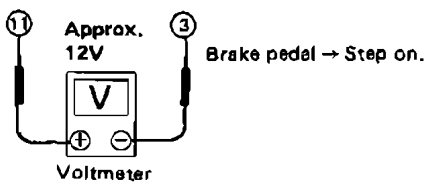




CUT-OFF CIRCUIT CHECK

1. Step on brake pedal.
2. Turn A.S.C.D. main switch to "ON".
3. Check voltage between ⑪ and ③.

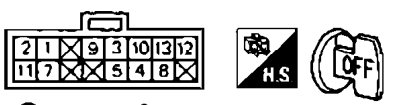


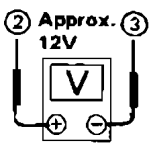


SEL629L

SET SWITCH CIRCUIT CHECK

1. Push A.S.C.D. set switch.
2. Check voltage between ② and ③.

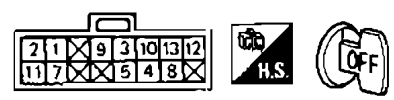


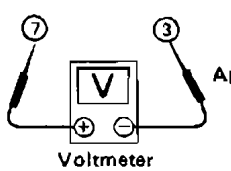


SPEED SENSOR CIRCUIT CHECK

1. Disconnect speed sensor from transmission.
2. Connect a voltmeter between ⑦ and ③.
3. Slowly turn speed sensor by hand to make sure voltmeter pointer deflects.

- **Voltmeter pointer deflects twice per rotation of pinion.**



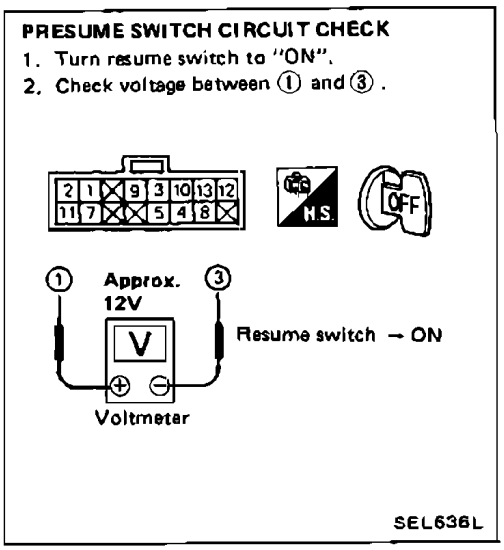


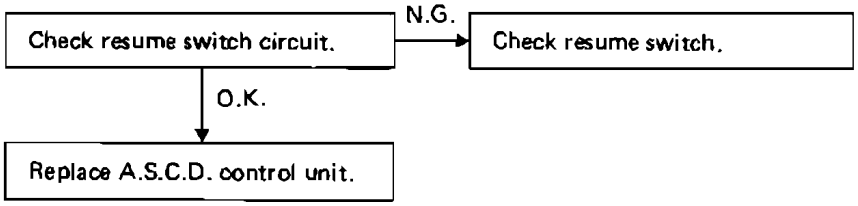
SEL630L

Trouble Diagnoses (Cont'd)

DIAGNOSTIC PROCEDURE-2

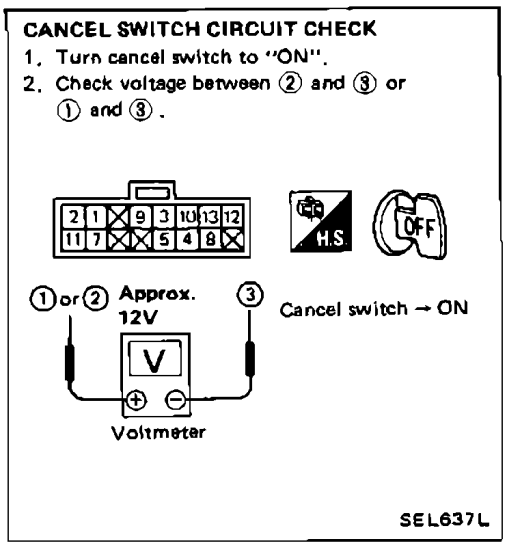
Resume switch will not operate.

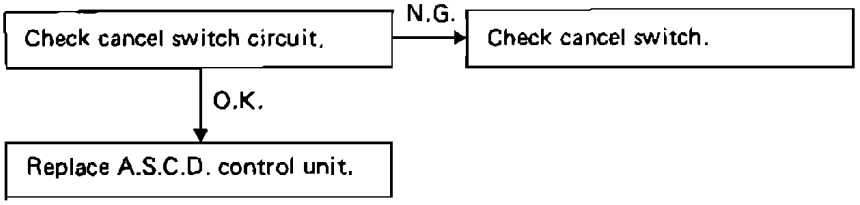




DIAGNOSTIC PROCEDURE-3

Cancel switch will not operate.

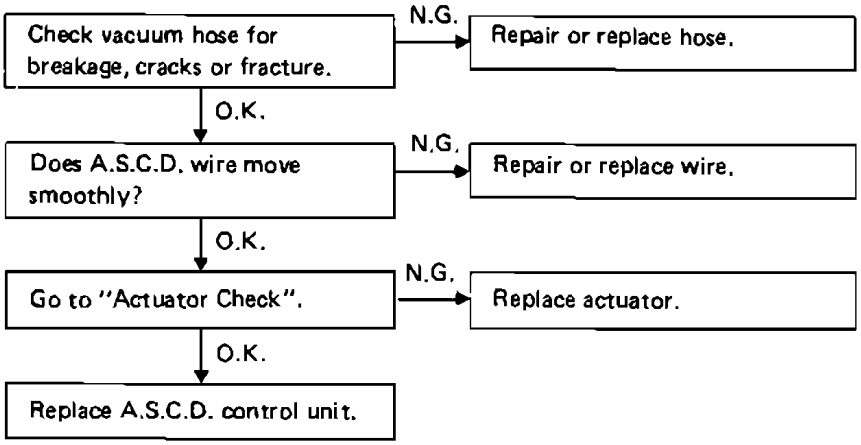




Trouble Diagnoses (Cont'd)

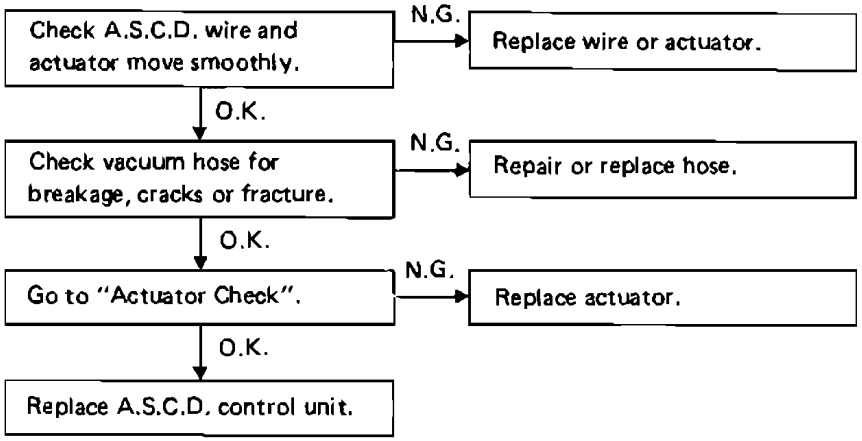
DIAGNOSTIC PROCEDURE-4

Engine hunts.



DIAGNOSTIC PROCEDURE-5

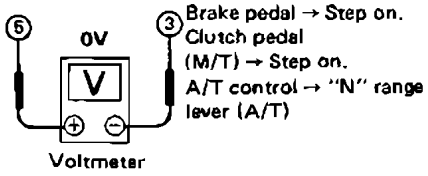
Large difference between set vehicle speed and actual speed.



Trouble Diagnoses (Cont'd)

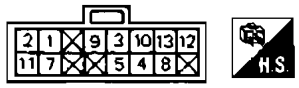
CUT-OFF CIRCUIT CHECK

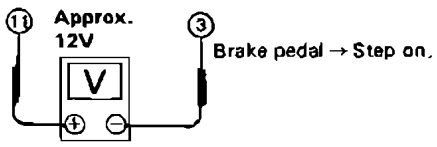
1. Turn A.S.C.D. main switch to "ON".
2. Turn A.S.C.D. main switch to "ON" again.
3. Step on brake pedal.
4. Step on clutch pedal (M/T) or shift in "N" range (A/T).
5. Check voltage between ⑤ and ③.



STOP LAMP CIRCUIT CHECK

1. Step on brake pedal.
2. Check voltage between ⑪ and ③.

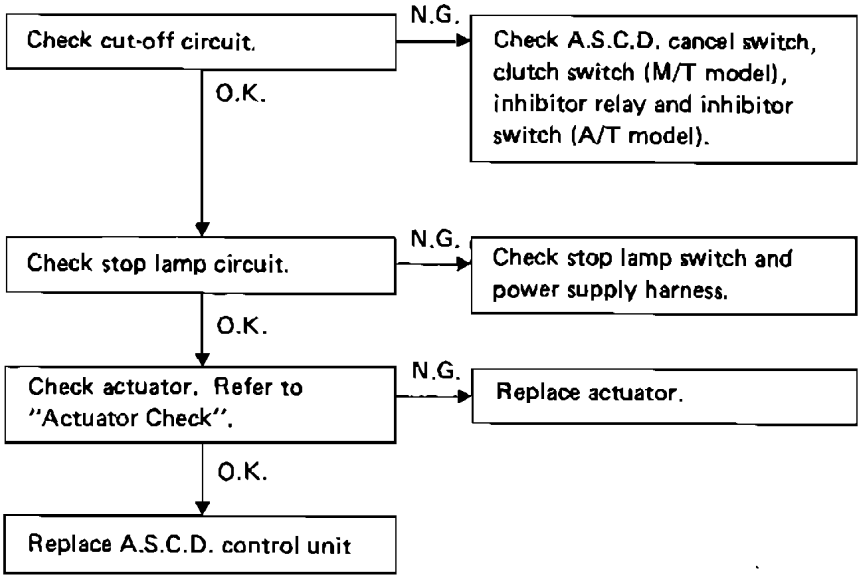




SEL631L

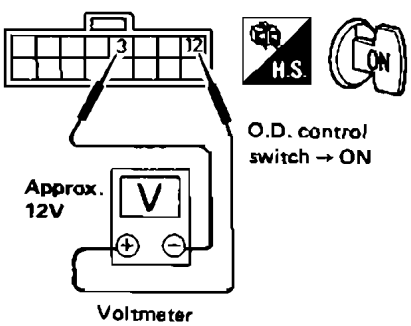
DIAGNOSTIC PROCEDURE-6

Set speed cannot be canceled.



O.D. CANCEL CIRCUIT CHECK FOR A.S.C.D. CONTROL UNIT

1. Turn O.D. control switch to "ON"
2. Measure voltage across ⑫ and ③.

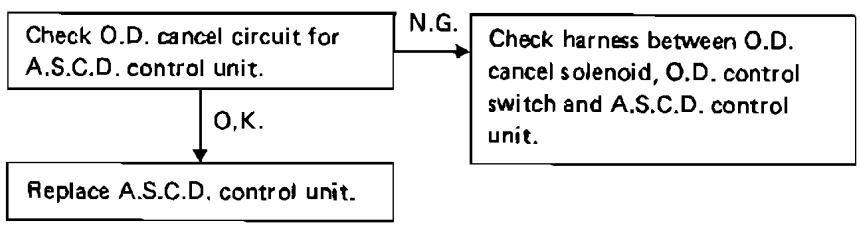


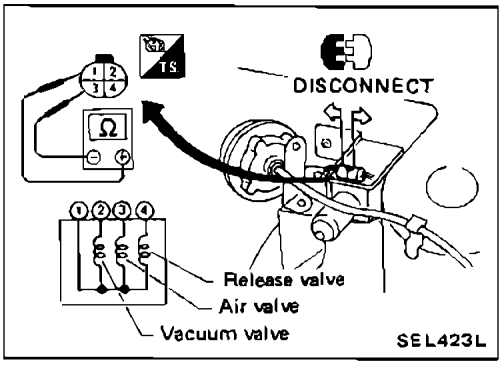
SEL640M

DIAGNOSTIC PROCEDURE-7

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".**





Actuator Check

1. Disconnect connector of actuator from main harness.
2. Check actuator operations as shown.

Check actuator.

O.K.

A

Check to see if motor starts when 12V D.C. is applied across ① and ④.

N.G. → Replace actuator.

O.K.

B

Check to see if A.S.C.D. wire is pulled when 12V D.C. is applied across ①, ②, ③ and ④.

N.G. → Replace actuator.

O.K. (Wire is pulled.)

C

Check to see if A.S.C.D. wire returns to original position 50 to 60 seconds after disconnecting lead from ④.

N.G. → Replace actuator.

O.K. (Wire does not return.)

D

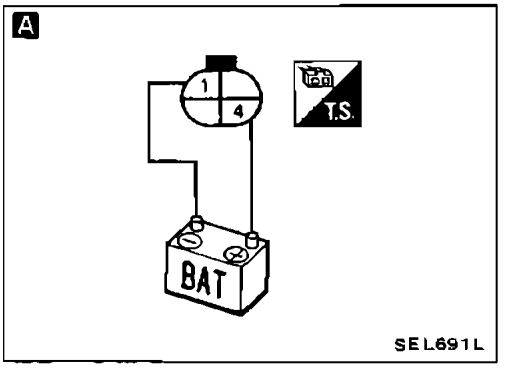
Disconnect lead from ① to see if A.S.C.D. wire returns immediately.

N.G. → Replace actuator.

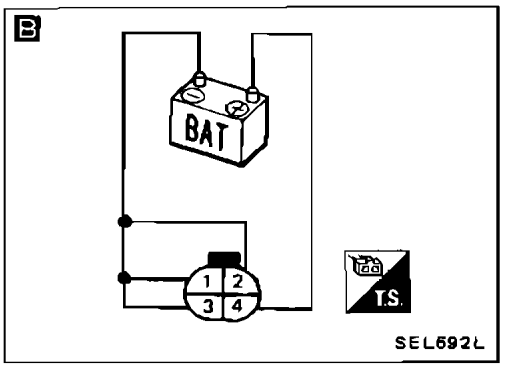
O.K. (Wire returns.)

Actuator is O.K.

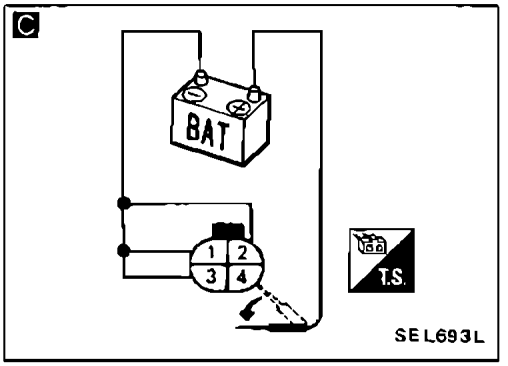
A



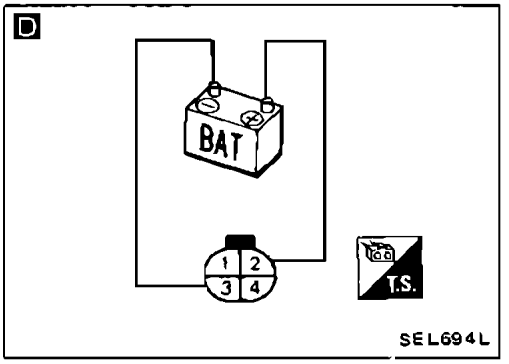
B



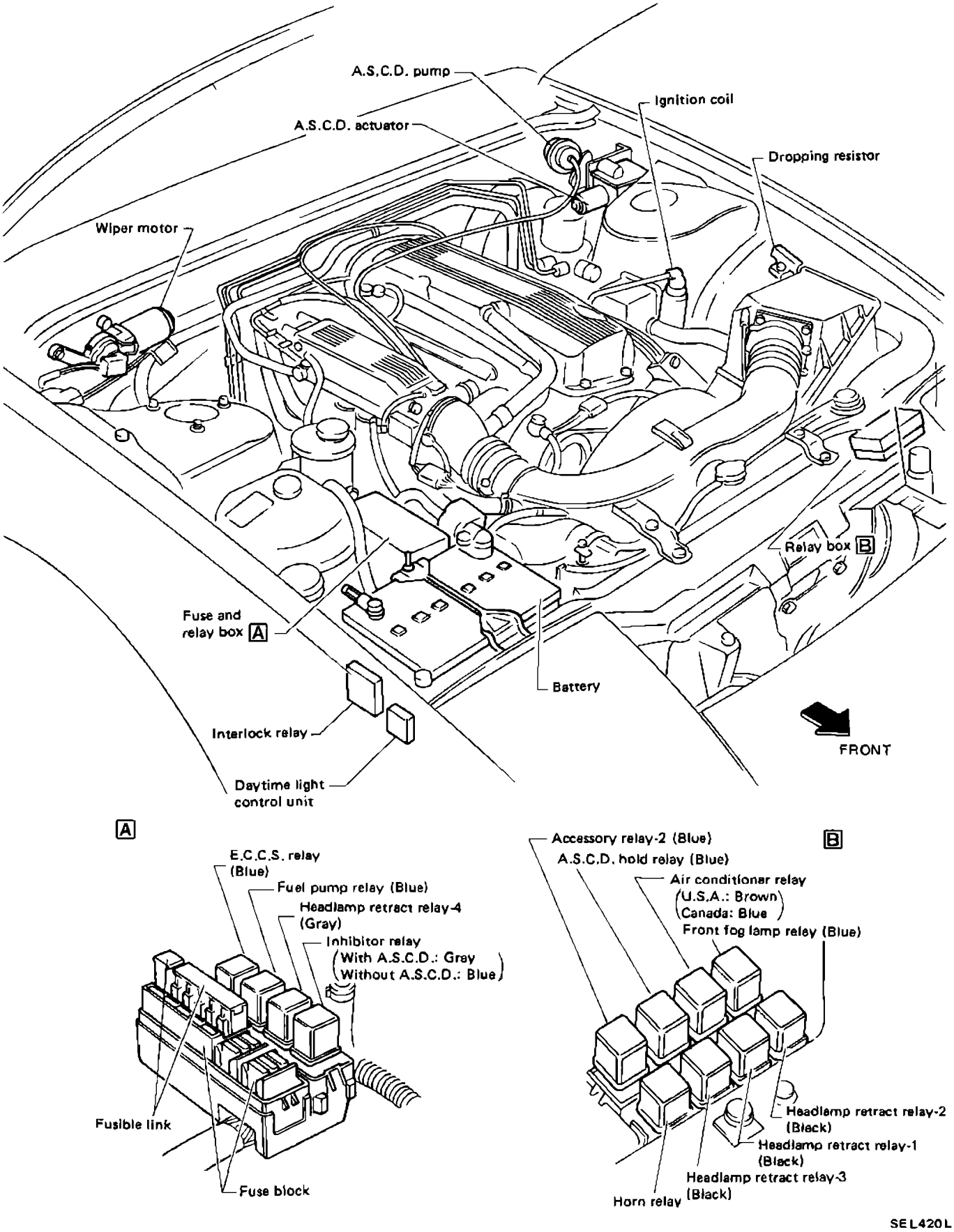
C



D

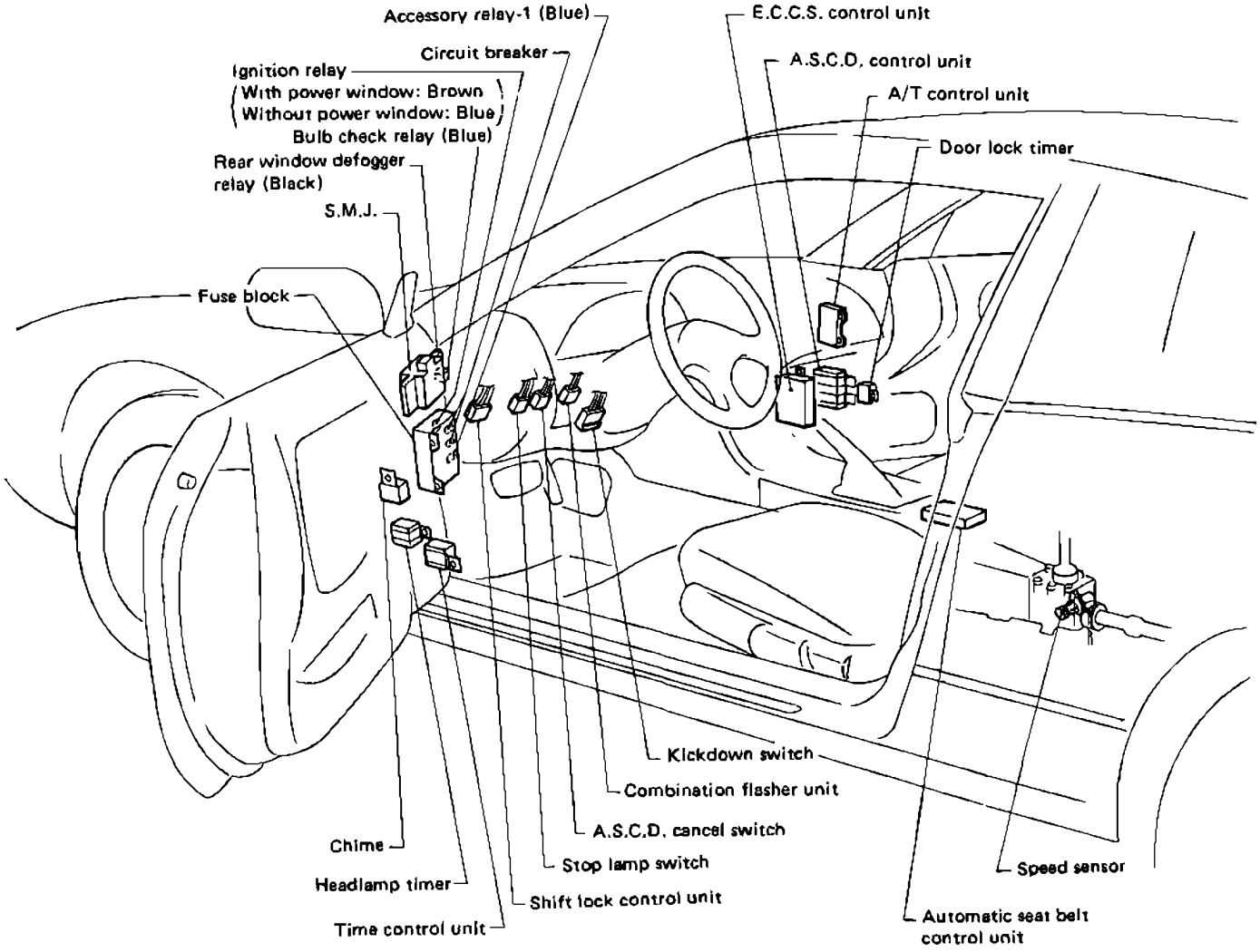


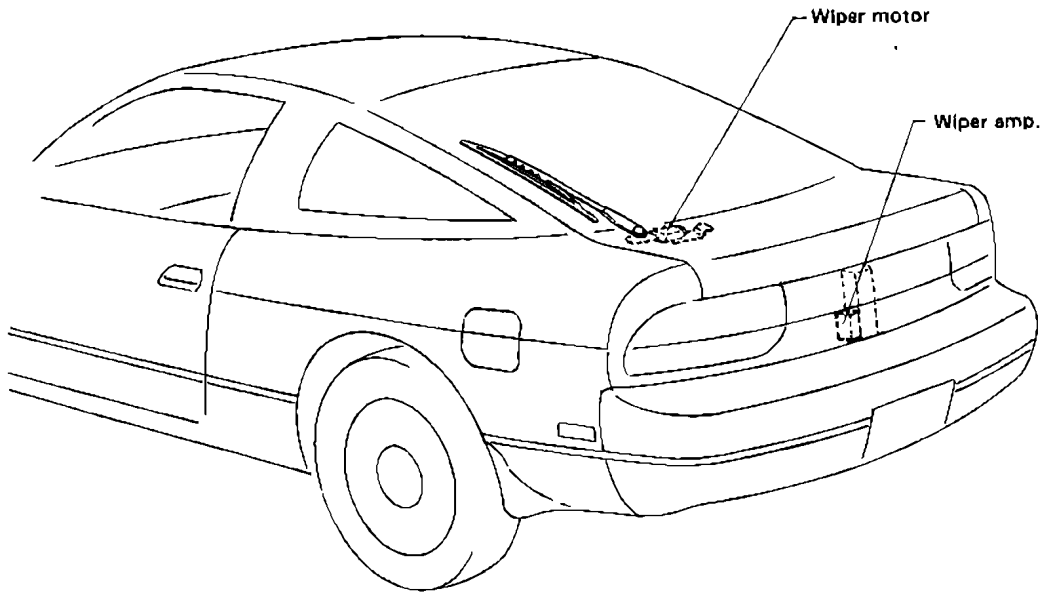
Engine Compartment



SEL420L

Passenger Compartment

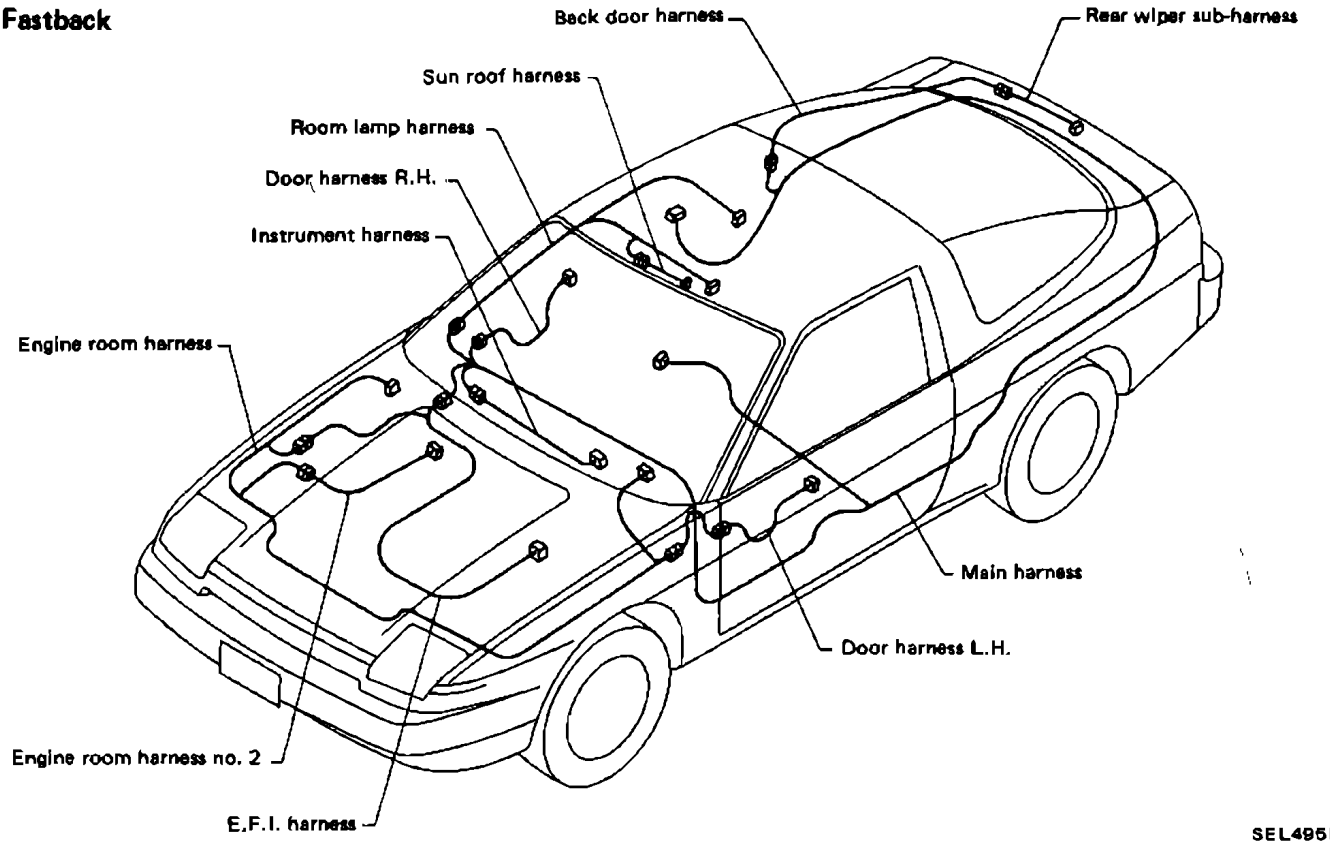




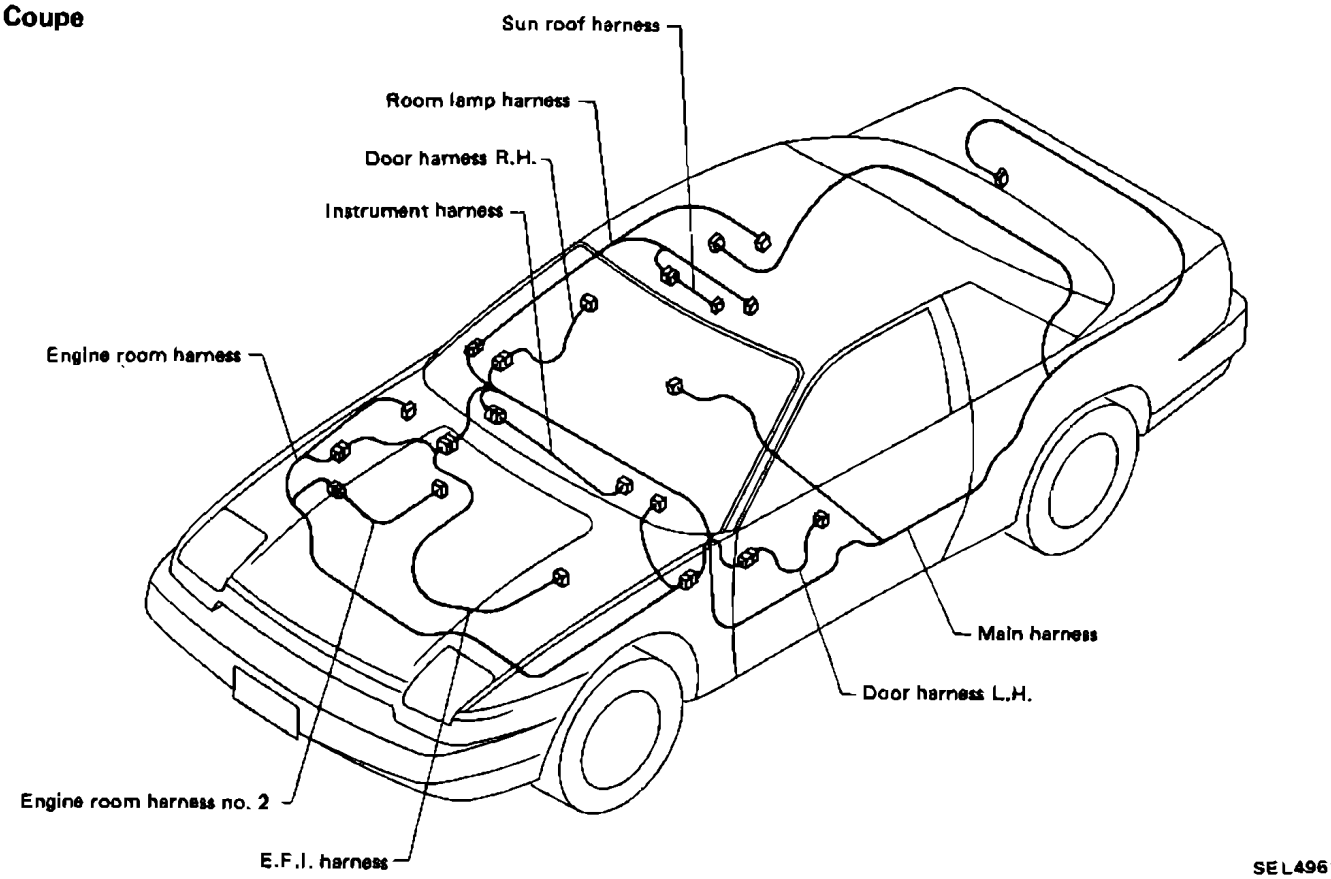
SEL421L

Outline

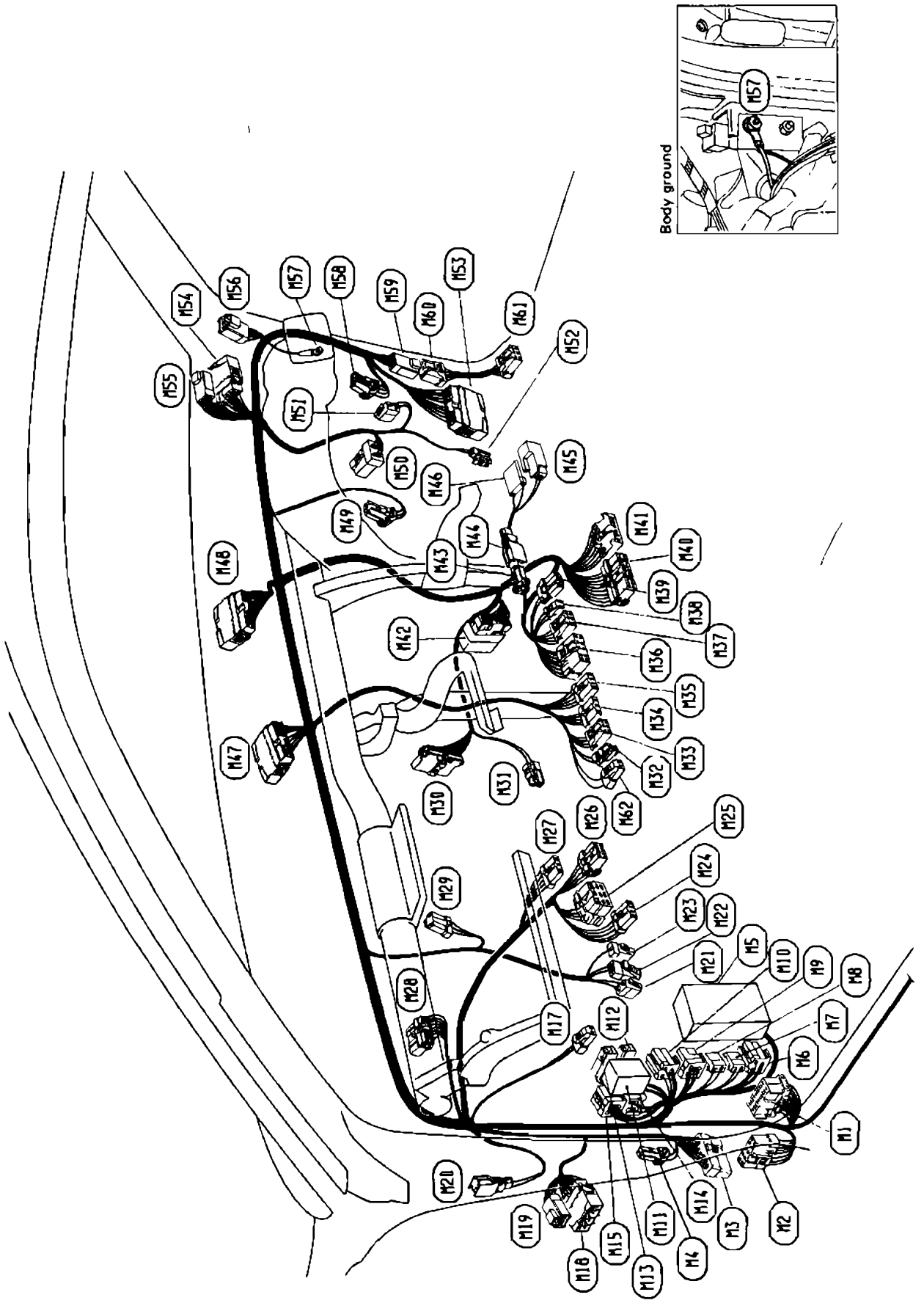
Fastback



Coupe

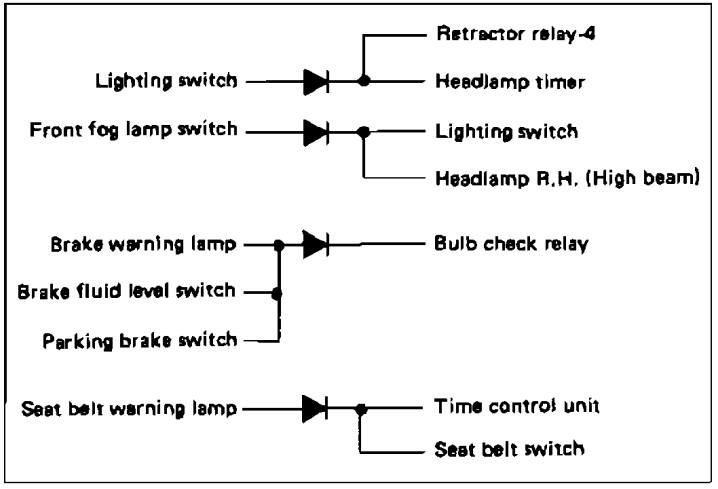


Main Harness



M1 : Time control unit
M2 : Headlamp timer
M3 : Check connector
M4 : Warning chime
M5 : Fuse block
M6 : Accessory relay-1
M7 : Circuit breaker (Model with power window system)
M8 : Circuit breaker (For U.S.A.)
M9 : Ignition relay (Model with power window system)
M10 : Ignition relay (Model without power window system)
M11 : To engine room harness (E101)
M12 : To engine room harness (E102) (Blue)
M13 : To engine room harness (E103) (Black)
M14 : Bulb check relay
M15 : Rear window defogger relay
M17 : A.S.C.D. clutch switch (M/T model with A.S.C.D.)
M18 : To door harness L.H. (D1)
M19 : To door harness L.H. (D2)
M20 : Driver side front limit switch (For U.S.A.)
M21 : Kickdown switch (A/T model)
M22 : A.S.C.D. cancel switch (Model with A.S.C.D.)
M23 : Stop lamp switch
M24 : A.S.C.D. main switch (Model with A.S.C.D.)
M25 : Headlamp retractor switch
M26 : Illumination control switch
M27 : Front fog lamp switch
M28 : Shift lock control unit (A/T model)
M29 : Combination flasher unit
M30 : Mode door motor
M31 : Foot lamp L.H.
M32 : O.D. off indicator lamp (A/T model)
M33 : Rear wiper and washer switch
M34 : Rear window defogger switch
M35 : Hazard switch
M36 : Radio
M37 : Radio
M38 : Cassette deck
M39 : Cassette deck
M40 : Push control unit
M41 : Fan switch
M42 : Diode
M43 : To sub-harness (M44)
M44 : To main harness (M43)
M45 : Glove box lamp
M46 : Glove box lamp switch
M47 : To instrument harness (I1) (Black)
M48 : To instrument harness (I2) (White)
M49 : Thermo control amplifier
M50 : Heater resistor
M51 : Blower motor
M52 : Foot lamp R.H.
M53 : To E.F.I. harness (F1)
M54 : To door harness R.H. (D101)
M55 : To door harness R.H. (D102)
M56 : To room lamp harness (R1)
M57 : Body ground
M58 : Intake door motor
M59 : To sub-harness (M60)
M60 : To main harness (M59)
M61 : Door lock timer
M62 : Washer warning lamp (Model with Anti-lock Braking System)

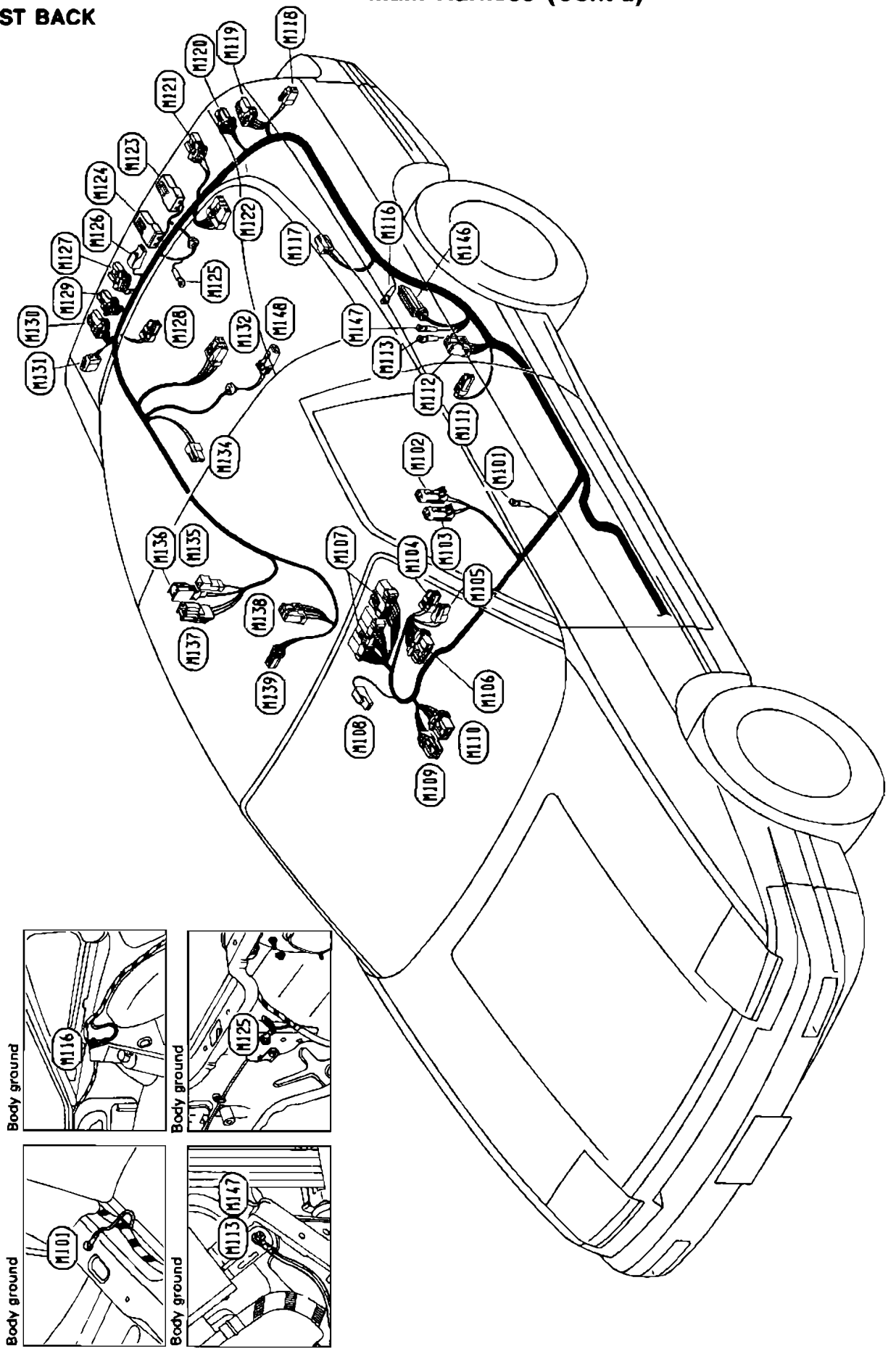
Diode (M42)



SEL591M

Main Harness (Cont'd)

FAST BACK



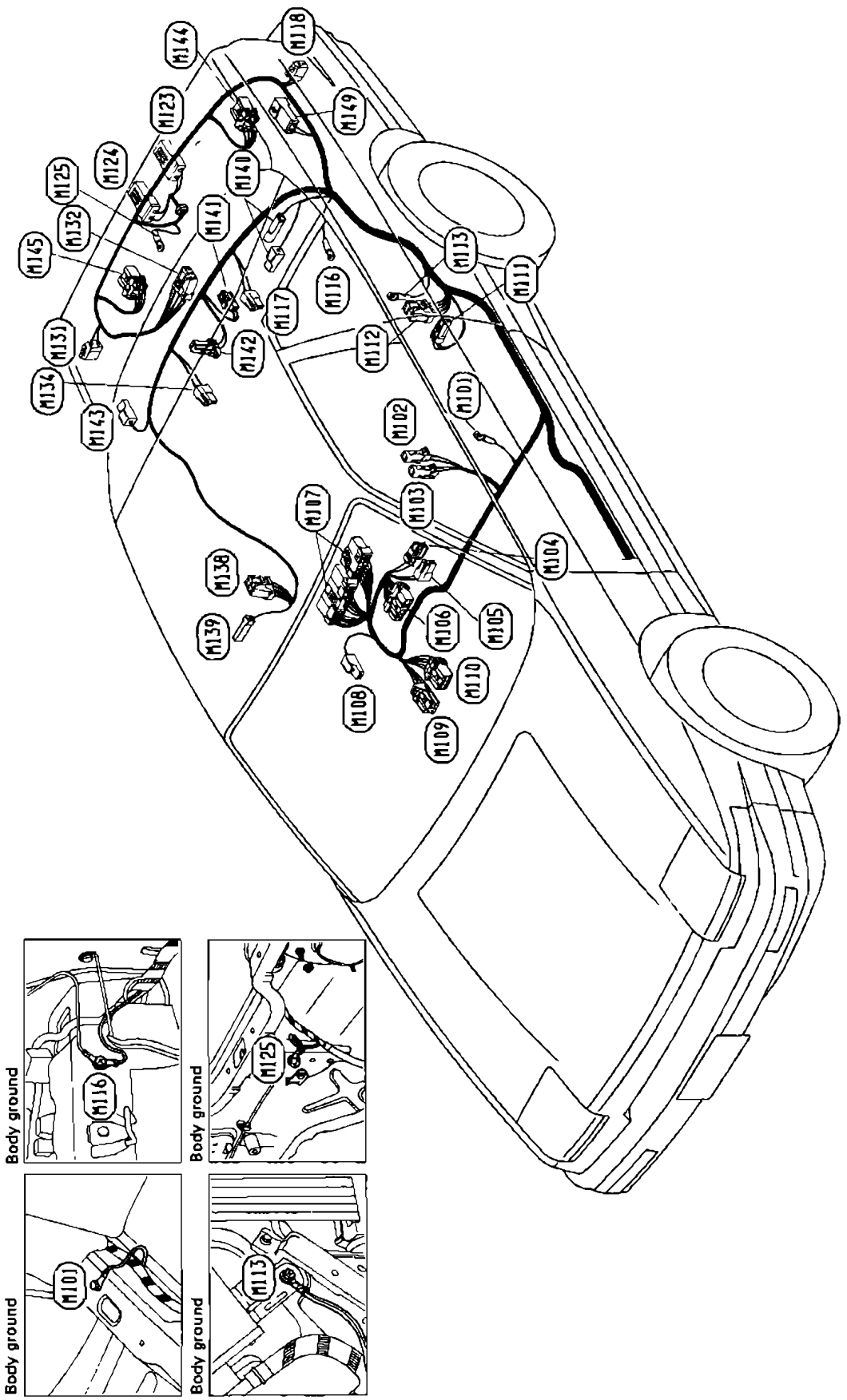
Main Harness (Cont'd)

(M101) : Body ground
(M102) : Lap belt buckle switch (For U.S.A.)
(M103) : Seat belt switch (For Canada)
(M104) : Ash tray illumination
(M105) : Cigarette lighter
(M106) : Door mirror control switch
(M107) : Automatic seat belt control unit (For U.S.A.)
(M108) : Parking brake switch
(M109) : A/T device (A/T illumination and O.D. control switch) (A/T model)
(M110) : Shift lock solenoid (A/T model)
(M111) : Door switch L.H.
(M112) : Automatic seat belt motor assembly L.H. (For U.S.A.)
(M113) : Body ground (For U.S.A.)
(M114) : Body ground
(M117) : Rear speaker L.H.
(M118) : Rear side marker lamp L.H.
(M119) : Rear combination lamp L.H.
(M120) : Rear combination lamp L.H.
(M121) : Back-up lamp L.H.
(M122) : Rear wiper amplifier
(M123) : License lamp L.H.
(M124) : License lamp R.H.
(M125) : Body ground
(M126) : Luggage room lamp switch
(M127) : Back-up lamp R.H.
(M128) : Luggage room lamp
(M129) : Rear combination lamp R.H.
(M130) : Rear combination lamp R.H.
(M131) : Rear side marker lamp R.H.
(M132) : Fuel tank gauge unit
(M134) : Rear speaker R.H.
(M135) : To back door harness (560)
(M136) : To back door harness (562)
(M137) : To back door harness (563)
(M138) : Automatic seat belt motor assembly R.H. (For U.S.A.)
(M139) : Door switch R.H.
(M144) : A.B.S. control unit (For Anti-lock Braking System)
(M147) : Body ground (For Anti-lock Braking System)
(M148) : Rear sensor (For Anti-lock Braking System)

SEL580M

Main Harness (Cont'd)

COUPE



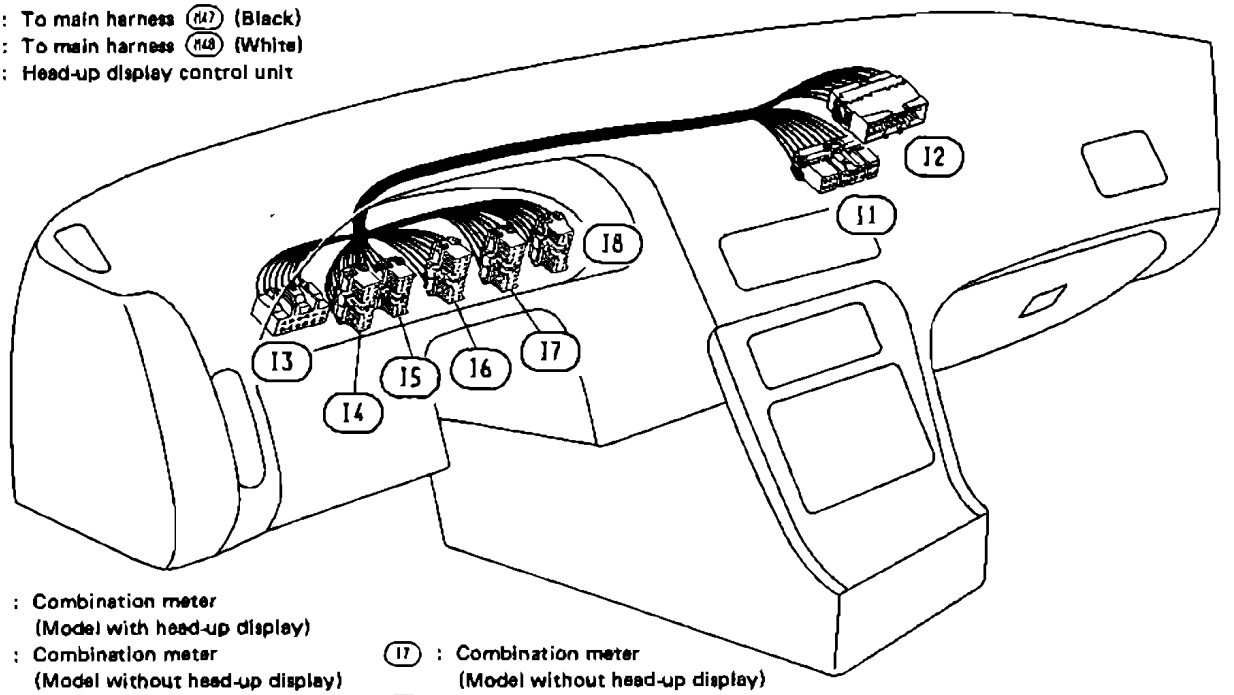
Main Harness (Cont'd)

(M101) : Body ground
(M102) : Lap belt buckle switch (For U.S.A.)
(M103) : Seat belt switch (For Canada)
(M104) : Ash tray illumination
(M105) : Cigarette lighter
(M106) : Door mirror control switch
(M107) : Automatic seat belt control unit (For U.S.A.)
(M108) : Parking brake switch
(M109) : A/T device (A/T illumination and O.D. control switch) (A/T model)
(M110) : Shift lock solenoid (A/T model)
(M111) : Door switch L.H.
(M112) : Automatic seat belt motor assembly L.H. (For U.S.A.)
(M113) : Body ground (For U.S.A.)
(M116) : Body ground
(M117) : Rear speaker L.H.
(M118) : Rear side marker lamp L.H.
(M123) : License lamp L.H.
(M124) : License lamp R.H.
(M125) : Body ground
(M131) : Rear side marker lamp R.H.
(M132) : Fuel tank gauge unit
(M134) : Rear speaker R.H.
(M136) : Automatic seat belt motor assembly R.H. (For U.S.A.)
(M139) : Door switch R.H.
(M140) : Trunk room lamp switch
(M141) : Trunk room lamp
(M142) : High-mounted stop lamp
(M143) : Rear window defogger
(M144) : Rear combination lamp L.H.
(M145) : Rear combination lamp R.H.
(M149) : Not used

SEL581M

Instrument Harness

(I1) : To main harness (M47) (Black)
(I2) : To main harness (M48) (White)
(I3) : Head-up display control unit



(I4) : Combination meter
(Model with head-up display)

(I5) : Combination meter
(Model without head-up display)

(I6) : Combination meter
(Model with head-up display)

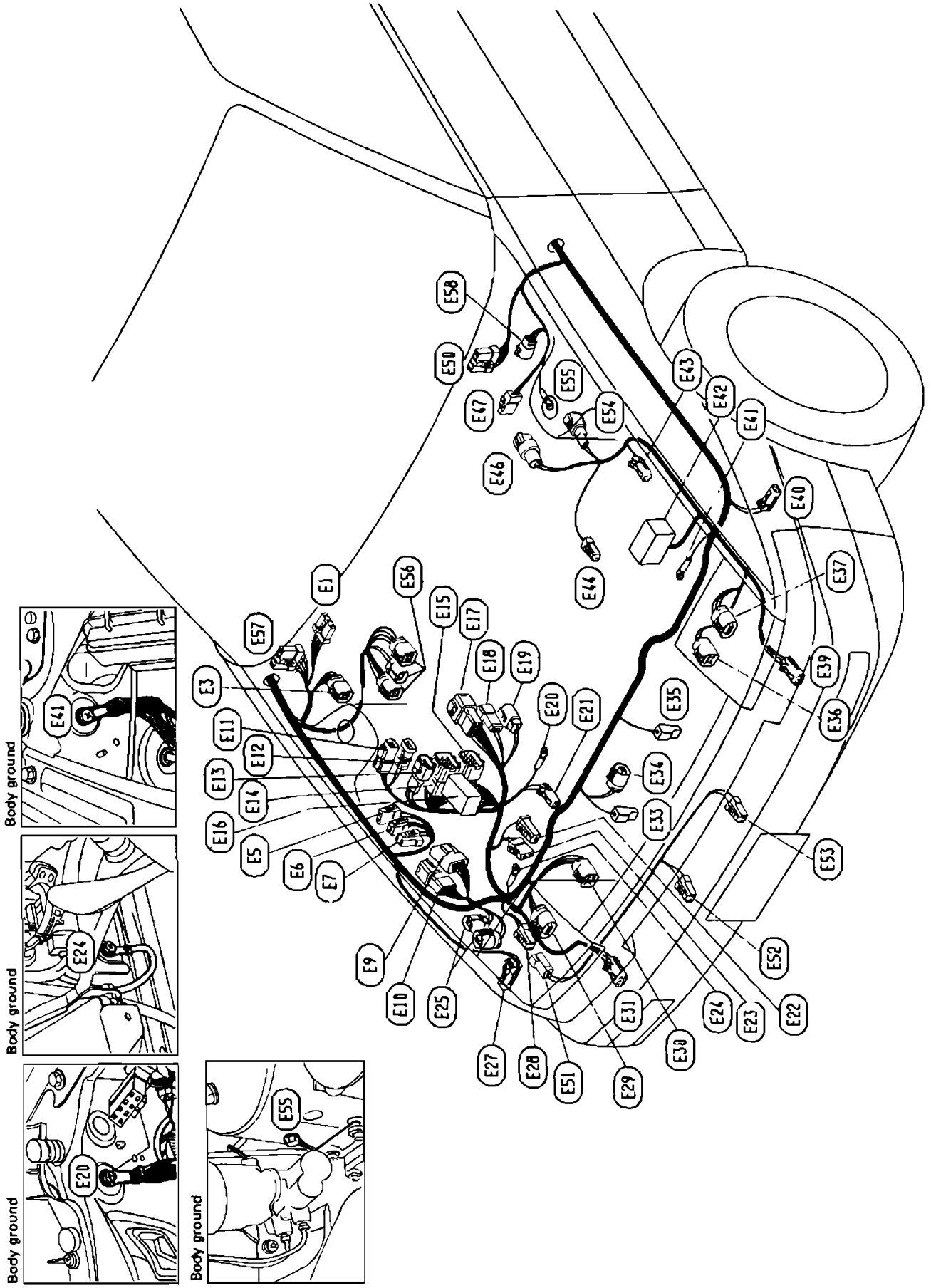
(I7) : Combination meter
(Model without head-up display)

(I8) : Combination meter
(Model without head-up display)

SEL501L

NOTE

Engine Room Harness

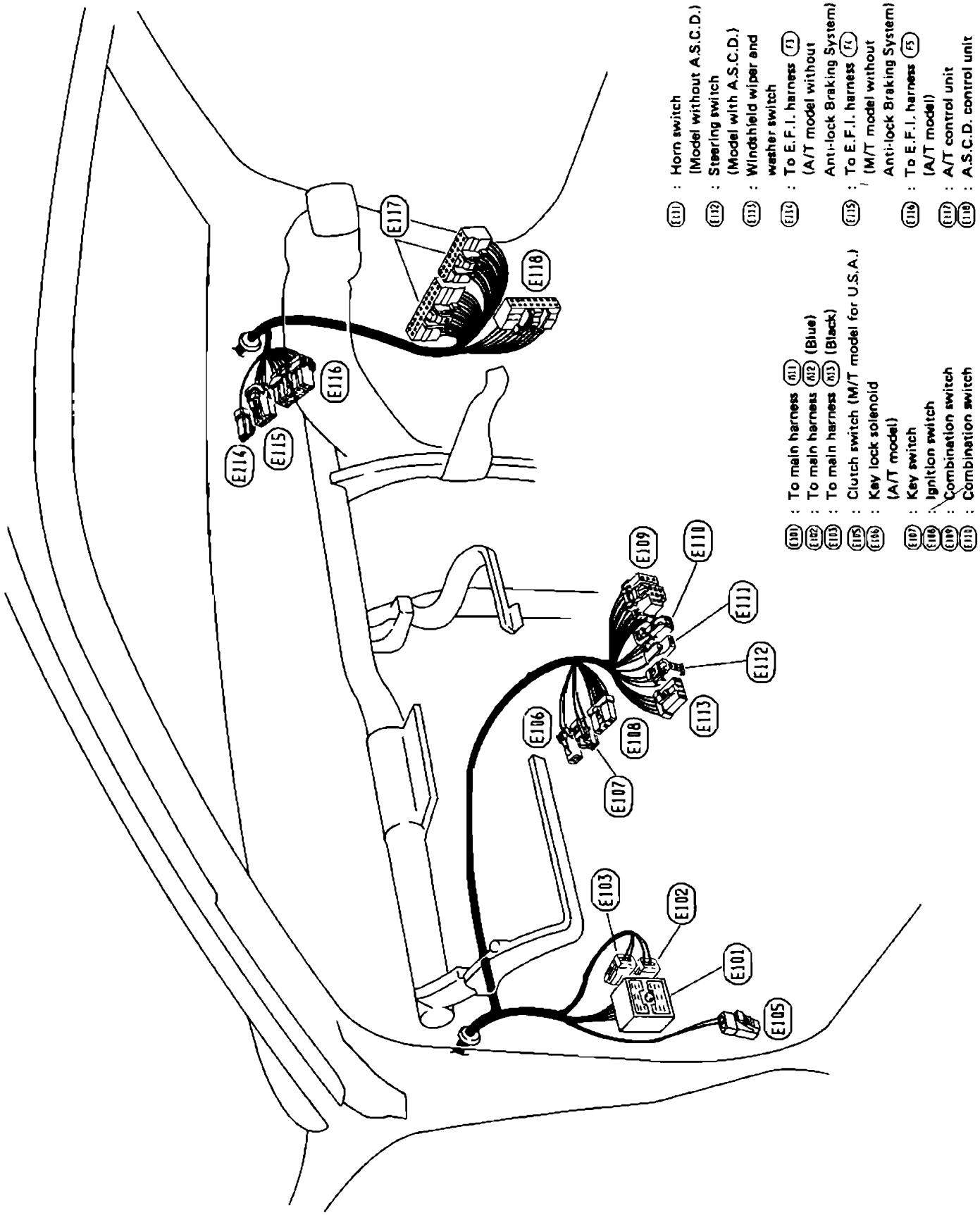


Engine Room Harness (Cont'd)

(E1) : Windshield wiper motor
(E3) : A.S.C.D. actuator (Model without Anti-lock Braking System)
(E5) : Rear washer motor
(E6) : Front washer motor
(E7) : Washer fluid level switch
(E9) : To E.F.I. harness (F8) (White)
(E10) : To E.F.I. harness (F9) (Brown)
(E11) : To engine room harness no. 2 (E201) (M/T model)
(E12) : Inhibitor switch (A/T model)
(E13) : Revolution sensor (A/T model)
(E14) : Inhibitor switch (A/T model) (Gray)
(E15) : To solenoid valve sub-harness (A/T model) (Brown)
(E16) : Relay box (Refer to page EL-97.)
(E17) : To engine room harness no. 2 (E202)
(E18) : To engine room harness no. 2 (E203)
(E19) : To engine room harness no. 2 (E204)
(E20) : Body ground
(E21) : Low-pressure switch
(E22) : Battery
(E23) : Battery
(E24) : Body ground
(E25) : Clutch interlock relay (M/T model for U.S.A.)
(E27) : Front side marker lamp R.H.
(E28) : To front fog lamp sub-harness (E51)
(E29) : Headlamp R.H.
(E30) : Headlamp motor R.H.
(E31) : Front combination lamp R.H.
(E33) : Horn-high
(E34) : Condenser fan motor
(E35) : Horn-low
(E36) : Headlamp motor L.H.
(E37) : Headlamp L.H.
(E39) : Front combination lamp L.H.
(E40) : Front side marker lamp L.H.
(E41) : Body ground
(E42) : Relay box (Refer to page EL-97.)
(E43) : Dropping resistor (A/T model.)
(E44) : Compressor
(E46) : A.I.V. control solenoid valve
(E47) : Brake fluid level switch
(E50) : Windshield wiper amplifier (Model without Anti-lock Braking System)
(E51) : To engine room harness (E28)
(E52) : Front fog lamp R.H.
(E53) : Front fog lamp L.H.
(E54) : Front wheel sensor L.H. (For Anti-lock Braking System)
(E55) : Body ground (For Anti-lock Braking System)
(E56) : Actuator (For Anti-lock Braking System)
(E57) : Windshield wiper amplifier (Model with Anti-lock Braking System)
(E58) : A.S.C.D. actuator (Model with Anti-lock Braking System)

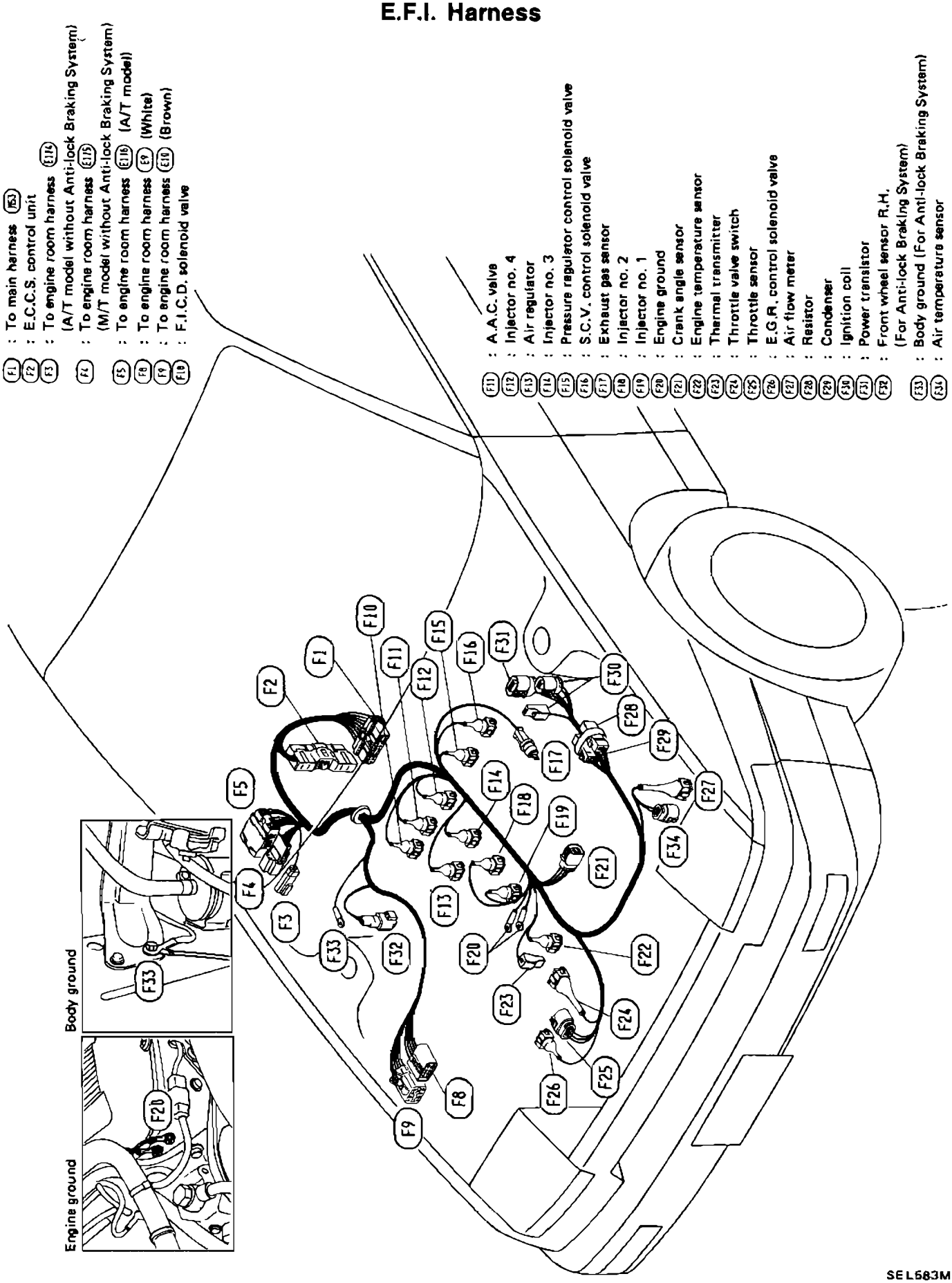
SEL582M

Engine Room Harness (Cont'd)

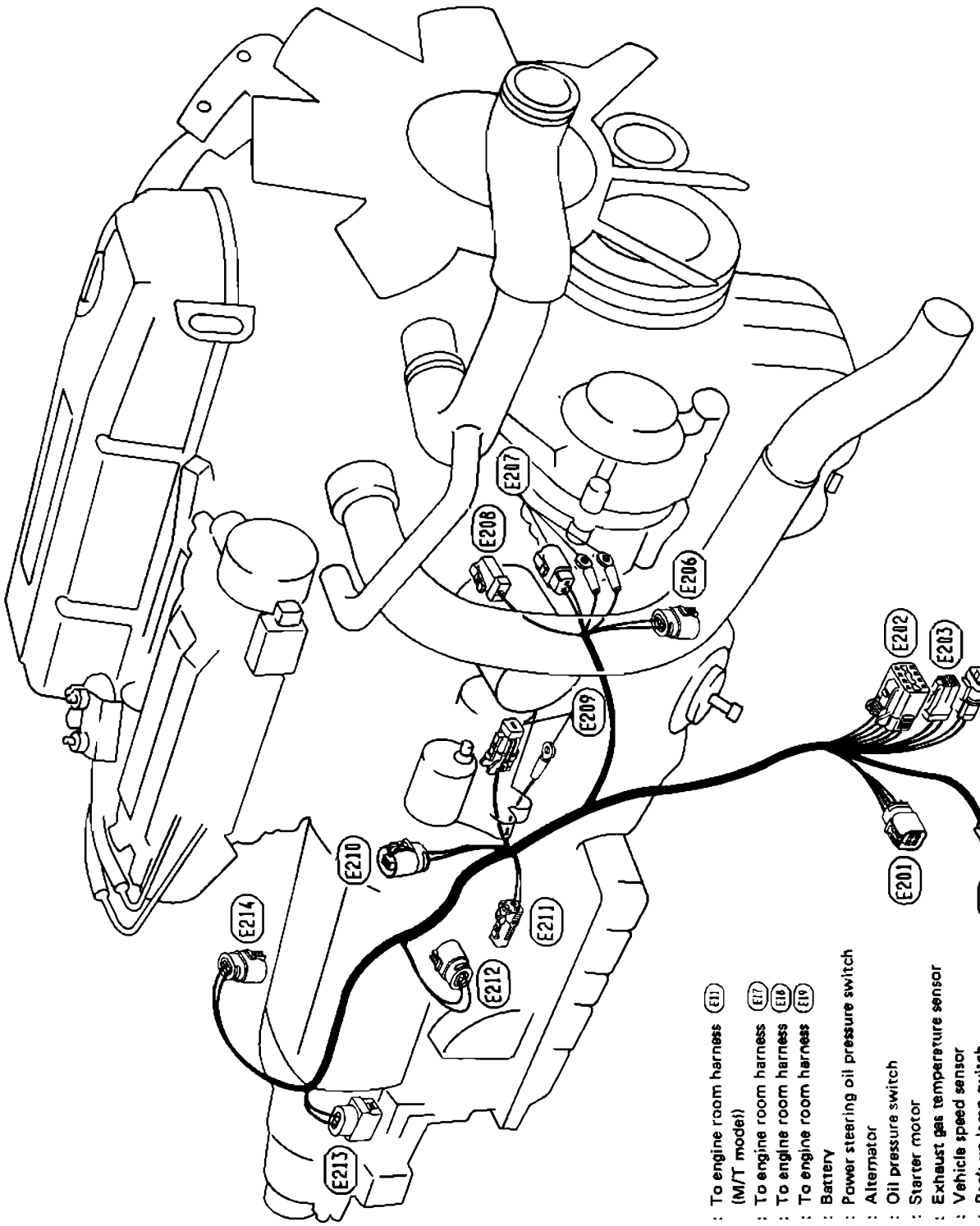


SEL592M

E.F.I. Harness

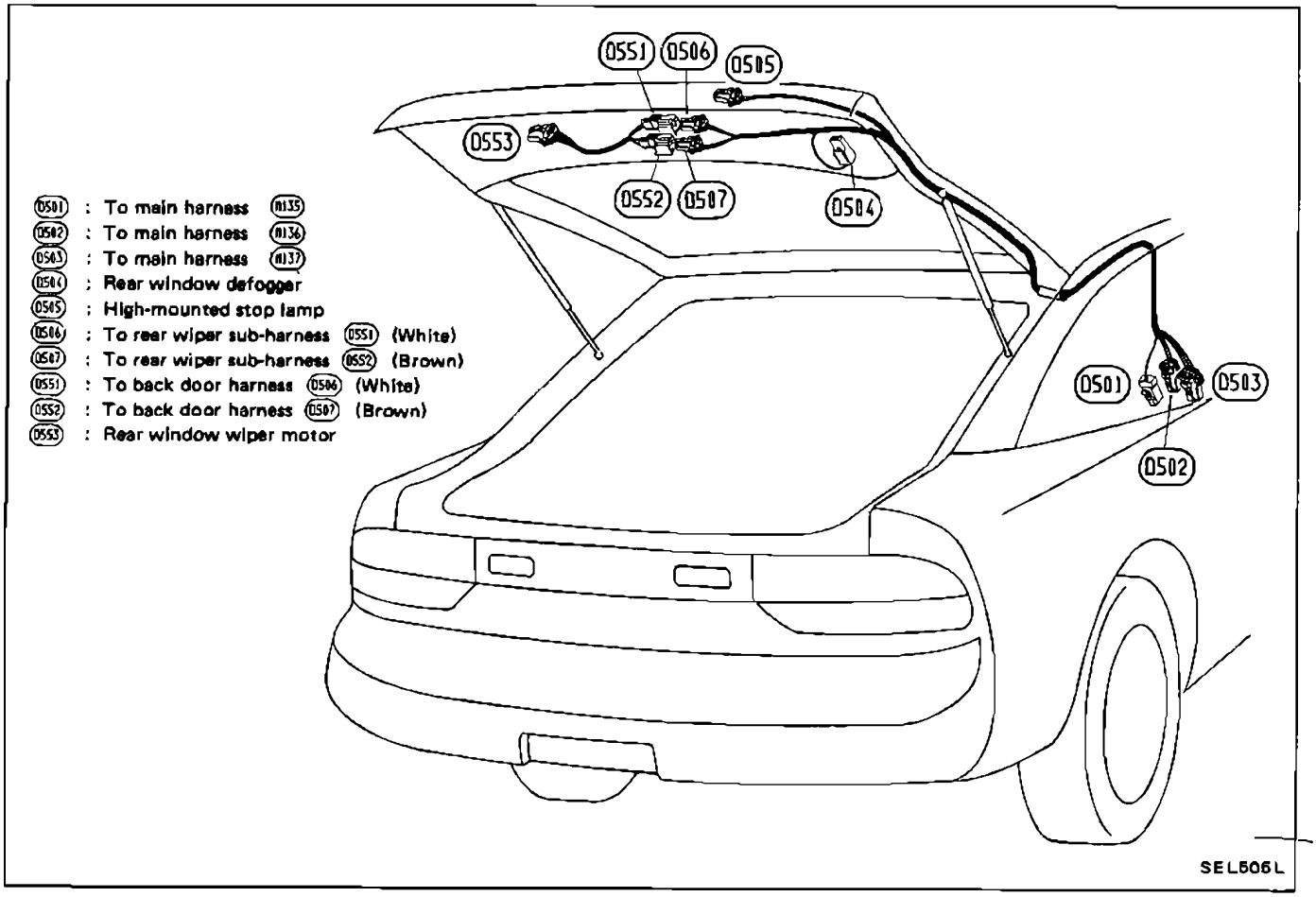

F1 : To main harness (M3)
F2 : E.C.C.S. control unit
F3 : To engine room harness (E114) (A/T model without Anti-lock Braking System)
F4 : To engine room harness (E115) (M/T model without Anti-lock Braking System)
F5 : To engine room harness (E116) (A/T model)
F8 : To engine room harness (E9) (White)
F9 : To engine room harness (E10) (Brown)
F10 : F.I.C.D. solenoid valve
F11 : A.A.C. valve
F12 : Injector no. 4
F13 : Air regulator
F14 : Injector no. 3
F15 : Pressure regulator control solenoid valve
F16 : S.C.V. control solenoid valve
F17 : Exhaust gas sensor
F18 : Injector no. 2
F19 : Injector no. 1
F20 : Engine ground
F21 : Crank angle sensor
F22 : Engine temperature sensor
F23 : Thermal transmitter
F24 : Throttle valve switch
F25 : Throttle sensor
F26 : E.G.R. control solenoid valve
F27 : Air flow meter
F28 : Resistor
F29 : Condenser
F30 : Ignition coil
F31 : Power transistor
F32 : Front wheel sensor R.H. (For Anti-lock Braking System)
F33 : Body ground (For Anti-lock Braking System)
F34 : Air temperature sensor
Body ground
Engine ground
SEL583M

Engine Room Harness no. 2



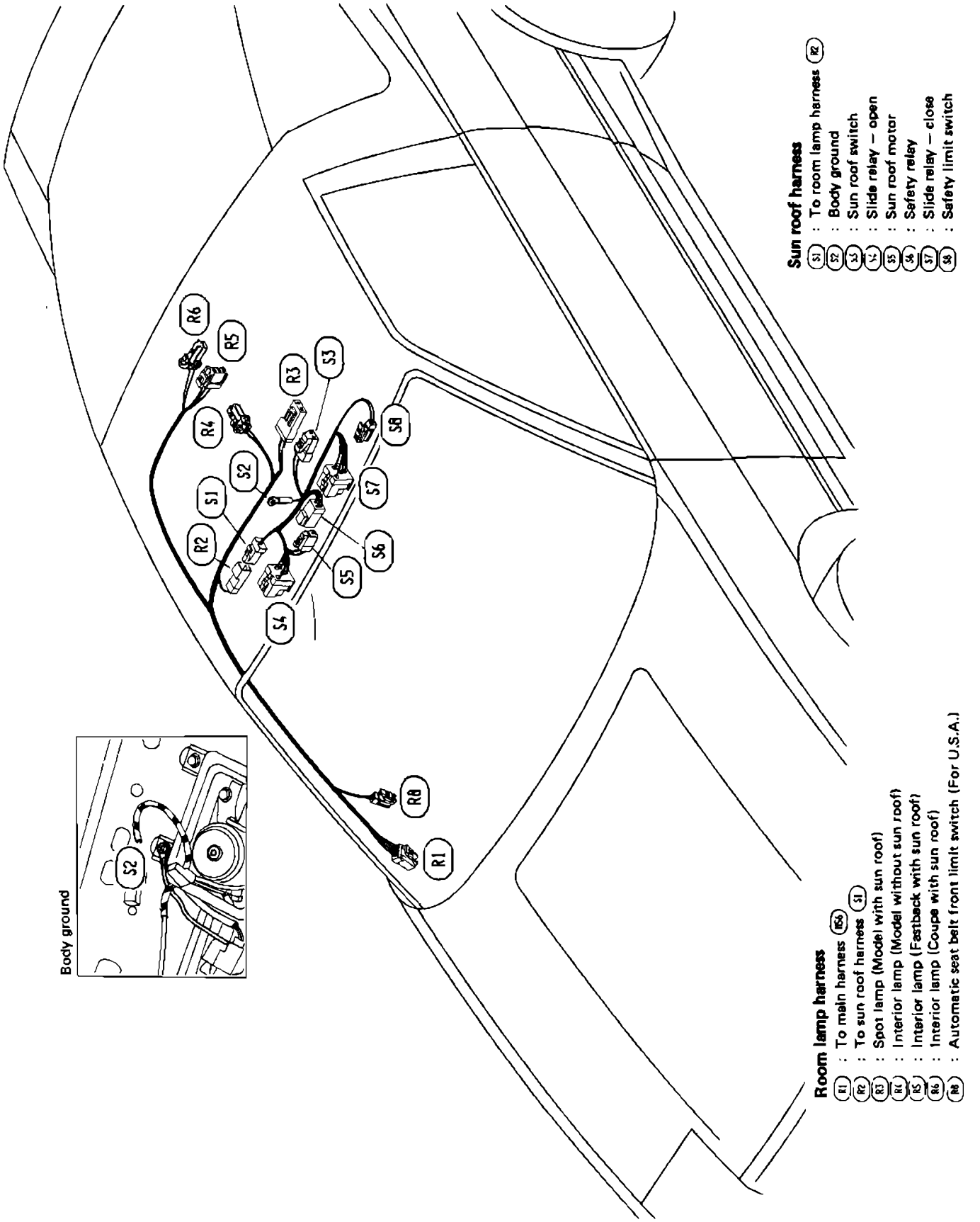
SEL507L

Back Door Harness



D501 : To main harness M135
D502 : To main harness M136
D503 : To main harness M137
D504 : Rear window defogger
D505 : High-mounted stop lamp
D506 : To rear wiper sub-harness D551 (White)
D507 : To rear wiper sub-harness D552 (Brown)
D551 : To back door harness D506 (White)
D552 : To back door harness D507 (Brown)
D553 : Rear window wiper motor

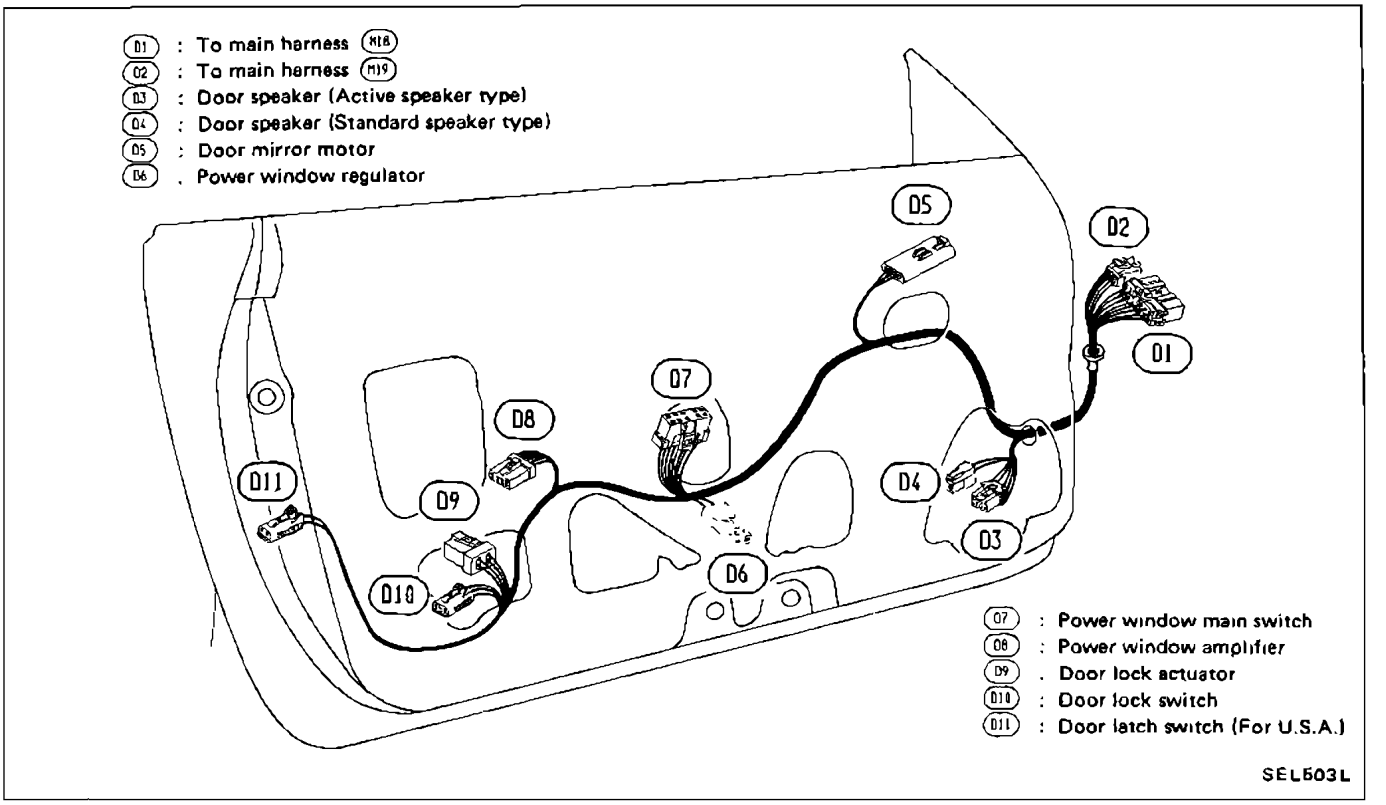
Room Lamp and Sun Roof Harness



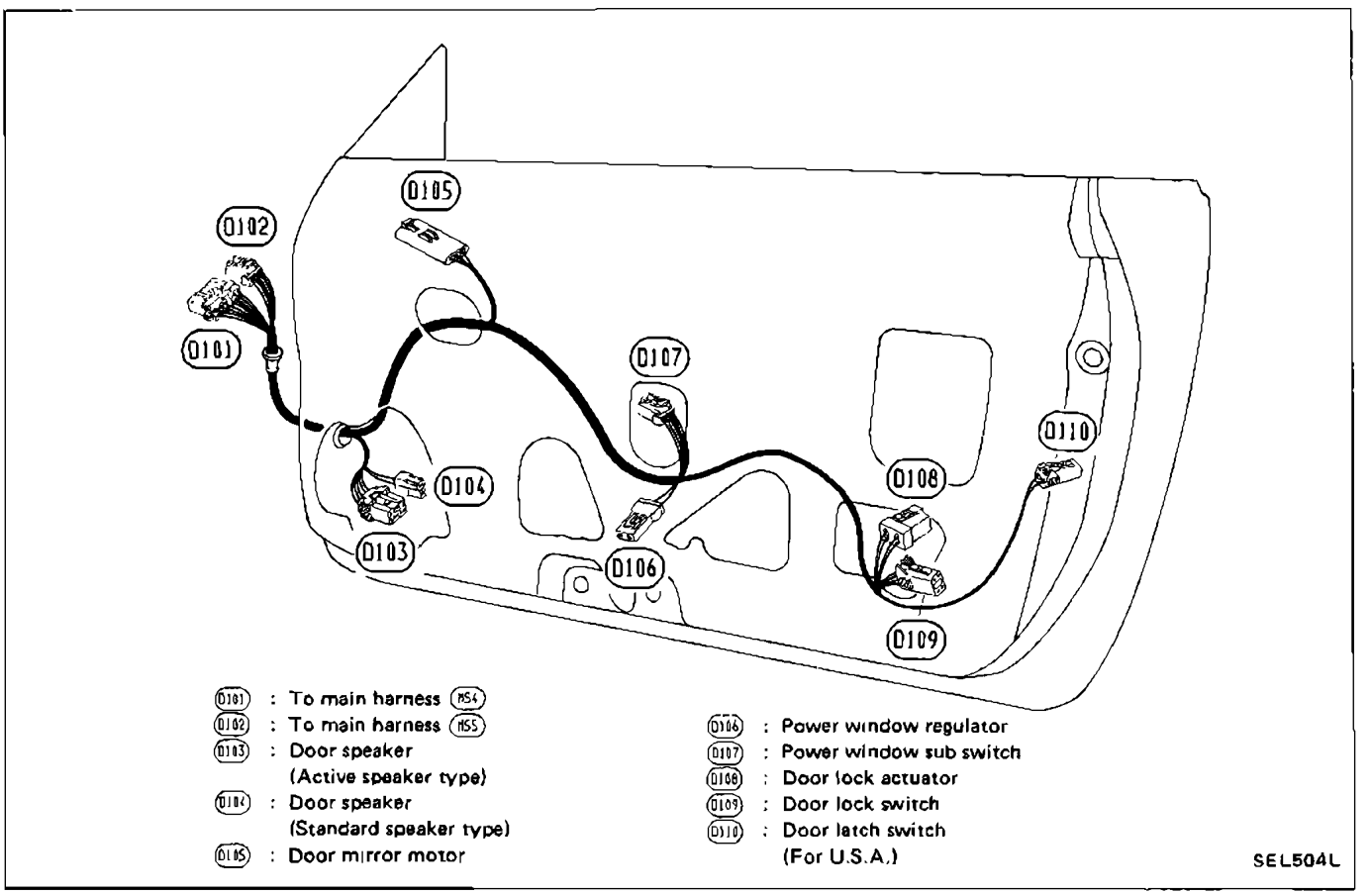
SEL502L

Door Harness

L.H.



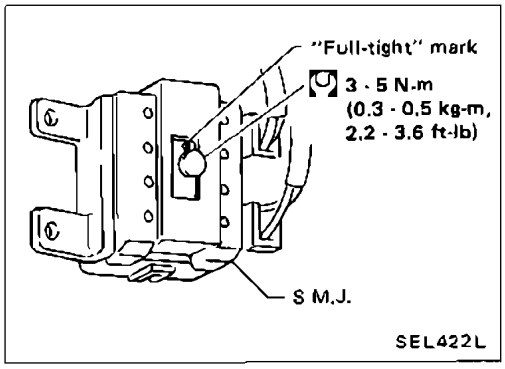
R.H.



NOTE

Disconnecting and Connecting

- S.M.J. is located on left side of dash.
- To disconnect S.M.J., loosen fixing bolt.

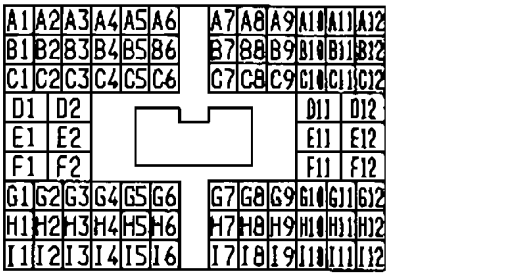


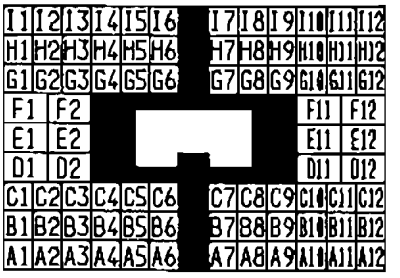
- To install S.M.J., tighten bolts until orange "full-tight" mark appears and then retighten to specified torque as required.
  : 3 - 5 N·m
  (0.3 - 0.5 kg-m, 2.2 - 3.6 ft-lb)

CAUTION:
Do not overtighten bolts, otherwise, they may be damaged.

Terminal Arrangement

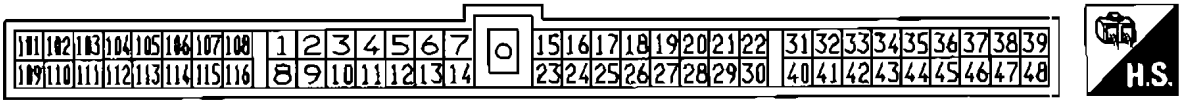
MAIN HARNESS





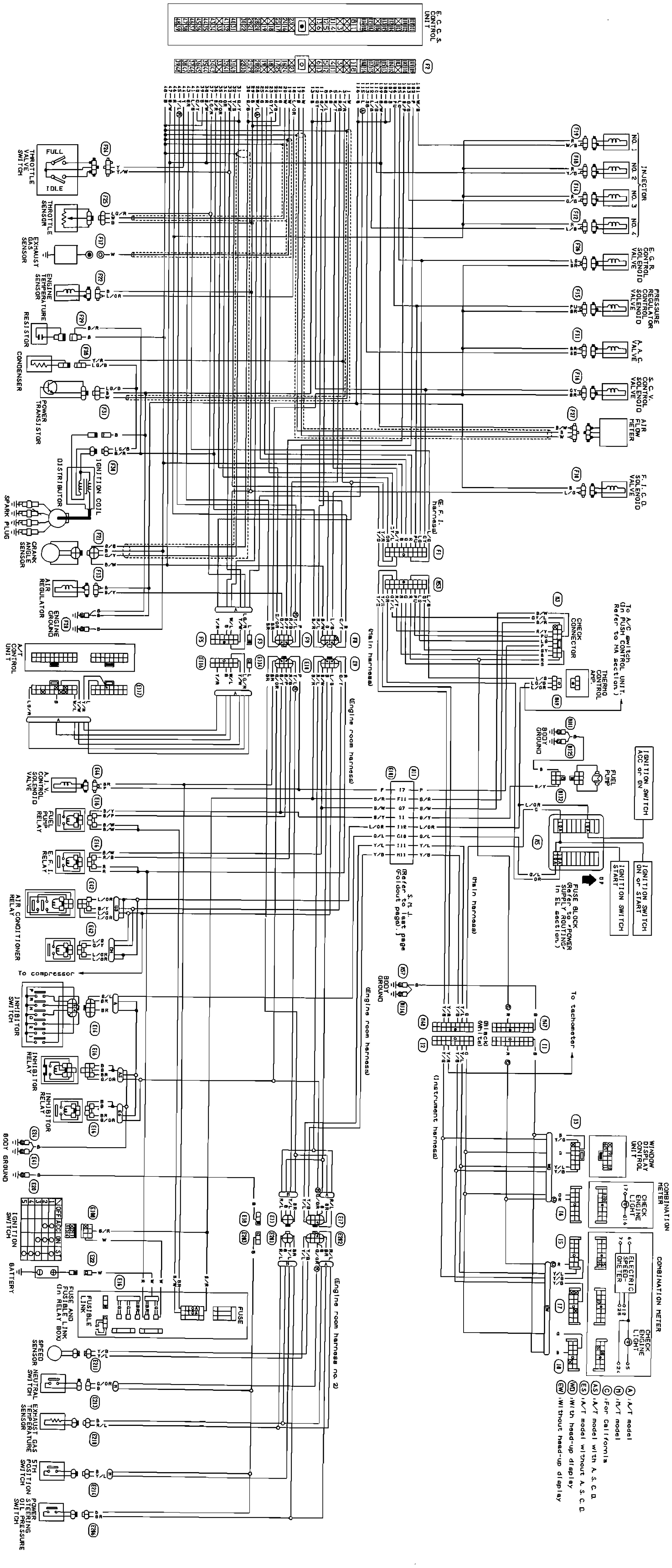
ENGINE ROOM HARNESS

E.C.C.S. CONTROL UNIT

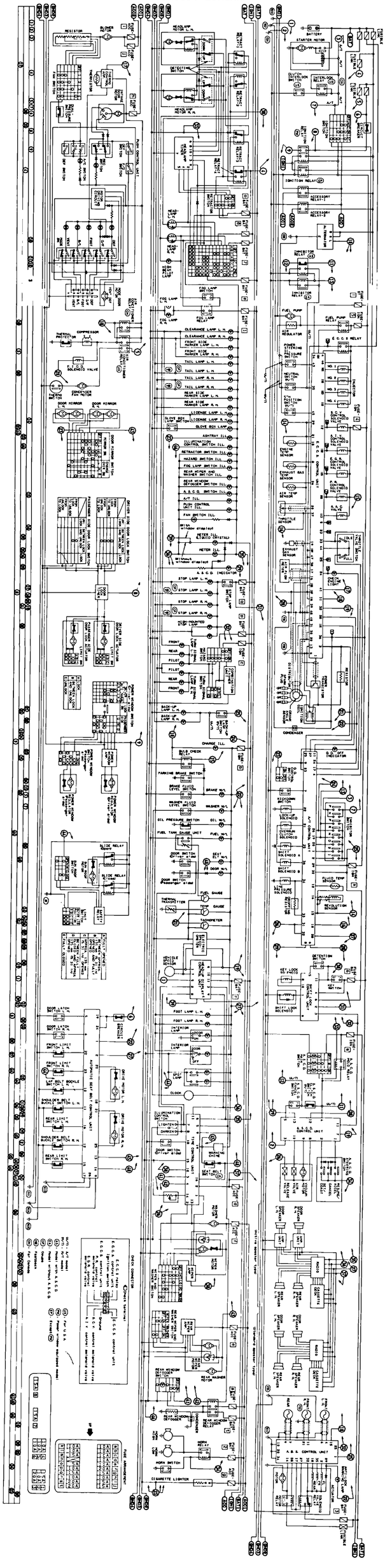


View from harness side

1989 NISSAN 240SX
E. C. C. S. WIRING DIAGRAM



1989 NISSAN 240SX
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 : 240SX [ ] 1989

ENGINE TUNE-UP DATA

Engine model		KA24E		
Firing order		1-3-4-2		
Idle speed	rpm			
M/T		750±50		
A/T (in "N" position)		750±50		
Ignition timing (degree B.T.D.C. at idle speed)		15±2		
Idle "CO" (% at idle speed)		Idle mixture screw is preset and sealed at factory.		
Valve clearance (Hot)	mm (in)	Non adjustable		
High tension cable resistance	kΩ	Less than 30		
Spark plug				
Type	Standard	ZFR5D-11		
	Hot	ZFR4D-11		
	Cold	ZFR6D-11		
Gap	mm (in)	1.0 - 1.1 (0.039 - 0.043)		
Drive belt deflection (Cold)	mm (in)	Used belt deflection		Set deflection of new belt
		Limit	Adjusted deflection	
Alternator		11 (0.43)	7 - 8 (0.28 - 0.31)	6 - 7 (0.24 - 0.28)
Air conditioner compressor		12 (0.47)	7 - 8 (0.28 - 0.31)	6 - 7 (0.24 - 0.28)
Power steering pump		13 (0.51)	8 - 9 (0.31 - 0.35)	7 - 8 (0.28 - 0.31)
Applied pressed force	N (kg, lb)	98 (10, 22)		
Tightening torque		N-m	kg-m	ft-lb
Spark plug		20 - 29	2.0 - 3.0	14 - 22
Oil pan drain plug		29 - 39	3.0 - 4.0	22 - 29

CLUTCH PEDAL

Unit: mm (in)

Pedal height	186 - 196 (7.32 - 7.72)
Pedal free play	1 - 3 (0.04 - 0.12)

FRONT WHEEL ALIGNMENT (Unladen*)

Camber	degree	−1°30′ to 0°
Caster	degree	8°00′ - 7°30′
Toe-in	mm (in)	0.3 - 2.3 (0.012 - 0.091)
	degree	1′ - 8.5′ (Total toe-in)
Full turns		
Inner wheel		39° - 43°
Outer wheel		33°

*: Tankful of fuel, radiator coolant and engine oil full.
Spare tire, jack, hand tools, and mats in designated positions.

FRONT WHEEL BEARING

Wheel bearing lock nut Tightening torque	N-m (kg-m, ft-lb)	147 - 216 (15 - 22, 108 - 159)
Wheel bearing end play	mm (in)	0.03 (0.0012) or less

REAR WHEEL ALIGNMENT (Unladen*)

Camber	degree	−1°36′ to −0°36′
Toe-in	mm (in)	0.5 - 4.5 (0.020 - 0.177)
	degree	1.5′ - 12.5′

*: Tankful of fuel, radiator coolant and engine oil full.
Spare tire, jack, hand tools, and mats in designated positions.

REAR WHEEL BEARING

Wheel bearing lock nut Tightening torque	N-m (kg-m, ft-lb)	235 - 314 (24 - 32, 174 - 231)
Wheel bearing end play	mm (in)	0.05 (0.0020) or less

BRAKE

Unit: mm (in)

Disc brake Pad repair limit		2.0 (0.079)
Rotor thickness repair limit	Front side	18.0 (0.709)
	Rear side	8.0 (0.315)
Pedal free height M/T model		177 - 187 (6.97 - 7.36)
A/T model		186 - 196 (7.32 - 7.72)
Pedal depressed height*1		100 (3.94) or more
Parking brake Number of notches*2		6 - 8

*1: Under force of 490 N (50 kg, 110 lb) with engine running
*2: At pulling force: 196 N (20 kg, 44 lb)

REFILL CAPACITIES

Unit		Liter	US measure
Engine model		KA24E	
Fuel tank		60	15-7/8 gal
Coolant	With reservoir tank	6.7	7-1/8 qt
Engine	With oil filter	3.5	3-3/4 qt
	Without oil filter	3.2	3-3/8 qt
Transmission	M/T	2.4	5 1/8 pt
	A/T	8.3	8-3/4 qt
Differential carrier	R200	1.3	2-3/4 pt
Power steering system		0.9	1 qt
Air conditioning system	Refrigerant	0.9 - 1.0 kg	2.0 - 2.2 lb

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

Edition: August 1988
Printing: February 1989 (02)
Publication No. SM9E-0S13U0

Printed in U.S.A.

NISSAN MOTOR CORPORATION IN U.S.A.
Post Office Box 191
Gardena, California 90247-7638
Telephone: (213) 532-3111

SERVICE BULLETIN

Classification:	Section:	Models:
EF&EC89-004	Engine Fuel & Emission Control	1989 240SX
Reference:		Date:
TECHNICAL BULLETIN TS89-072		May 18, 1989

KA24E ENGINE CHANGE

APPLIED MODEL: 1989 240SX (S13) from engine number KA24-012039*

SERVICE INFORMATION

To improve driveability the KA24E engine on the applied model has been changed as follows:

- Compression ratio has been changed (9.1 to 8.6).
- Air temperature sensor has been added.
- E.C.U. has been changed.
- Idle speed.
- Self-diagnosis for E.G.R.

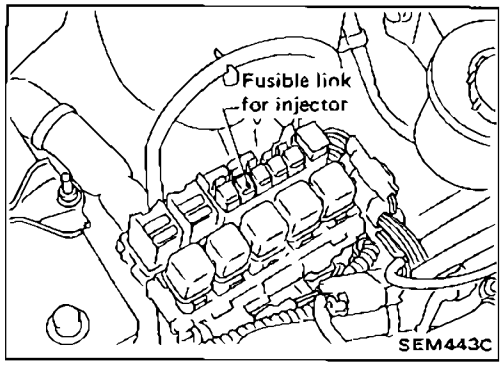
The following pages reflect these changes.

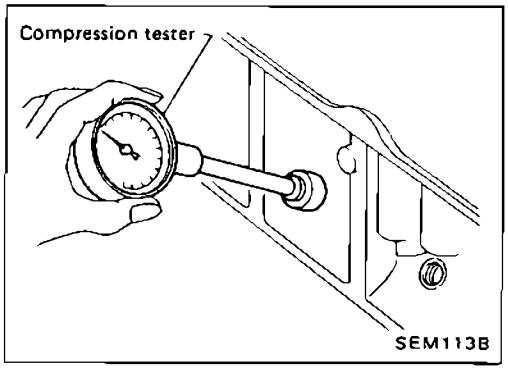
CONTENTS

Compression Pressure - Measurement 2
- General Specifications..... 3
Engine and Emission Control Overall System
E.C.C.S. Component Parts Location 4
System Diagram 5
System Chart 6
Circuit Diagram 7
Engine and Emission Control Parts Description
Air Temperature Sensor 8
Engine and Emission Control System Description
Ignition Timing Control 9
Swirl Control Valve (S.C.V.) Control 11
Fail-safe System 12
Idle Speed/Ignition Timing/Idle Mixture Ratio Inspection 13
Trouble Diagnoses
Self-diagnosis - Mode III (Self-diagnostic System) 15
Diagnostic Procedure 8 16
Diagnostic Procedure 24 19
Electrical Components Inspection 21
Service Data and Specifications 23

Please reference this Bulletin on the Contents pages of the EM and EF&EC Sections of the 1989 240SX Service Manual.

*Vehicles with an Air Temperature Sensor on the air cleaner box have the modified engine.





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/cm², psi)/rpm
Standard
1,206 (12.3, 175)/250
Minimum
1,010 (10.3, 146)/250
Difference limit between cylinders
98 (1.0, 14)/250

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.**

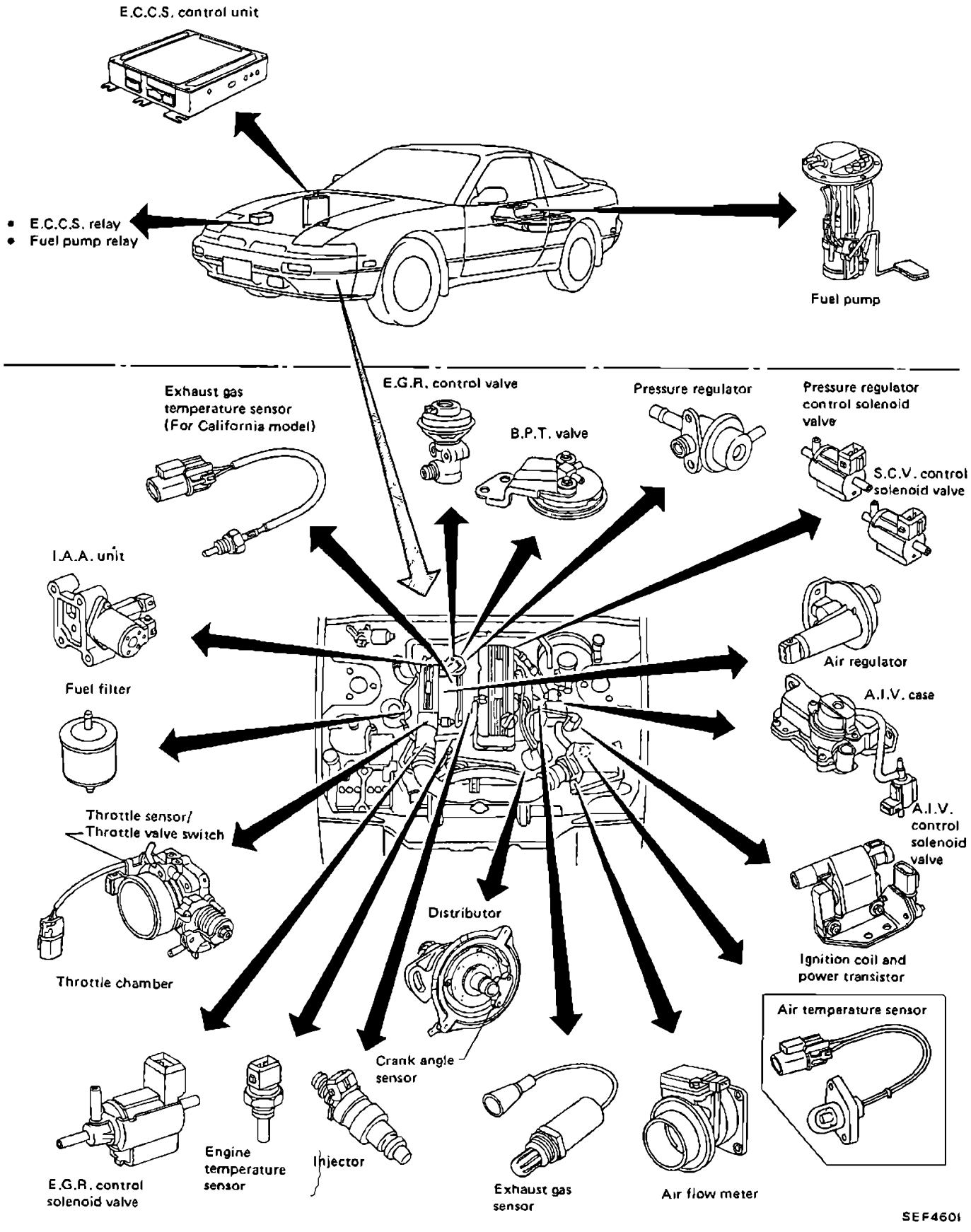
General Specifications

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

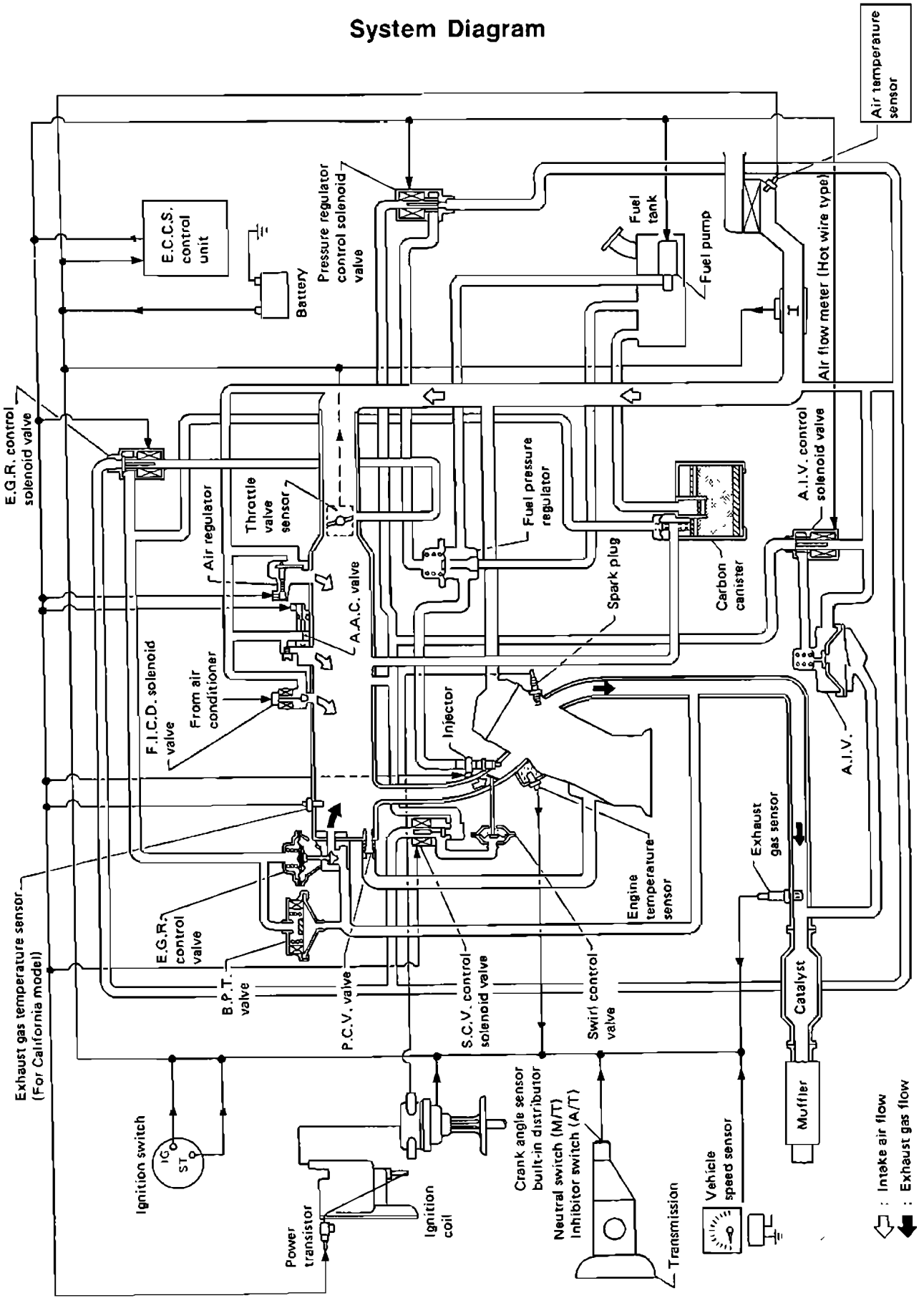
Unit: kPa (kg/cm^3, psi)/rpm

Compression pressure	
Standard	1,206 (12.3, 175)/250
Minimum	1,010 (10.3, 146)/250
Differential limit between cylinders	98 (1.0, 14)/250

E.C.C.S. Component Parts Location



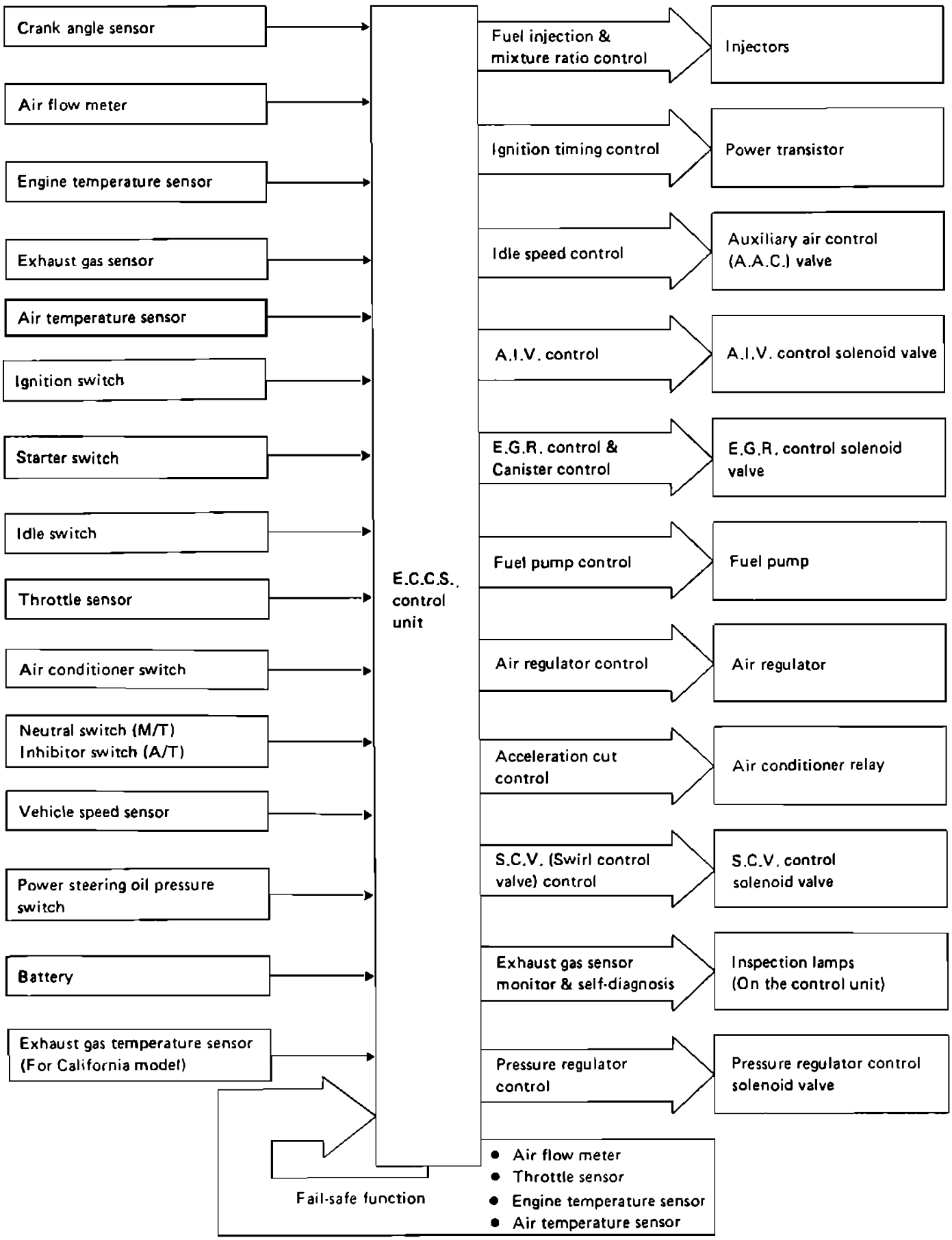
System Diagram



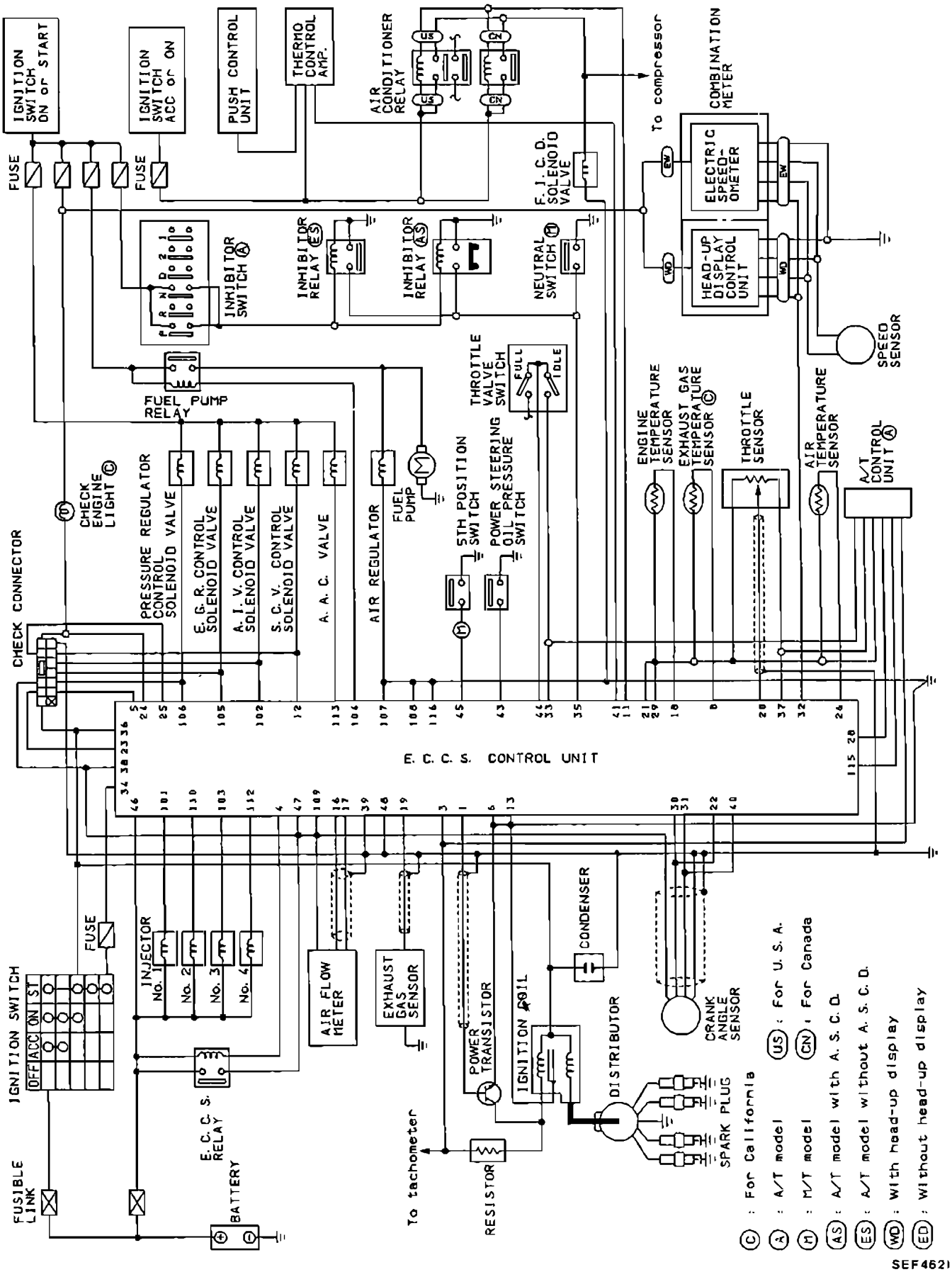
SEF461I

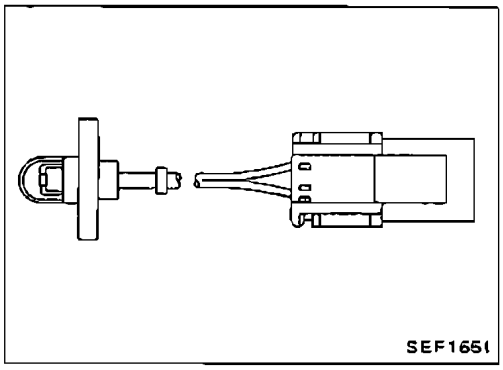
System Chart

E.C.C.S. CONTROL SYSTEM



Circuit Diagram



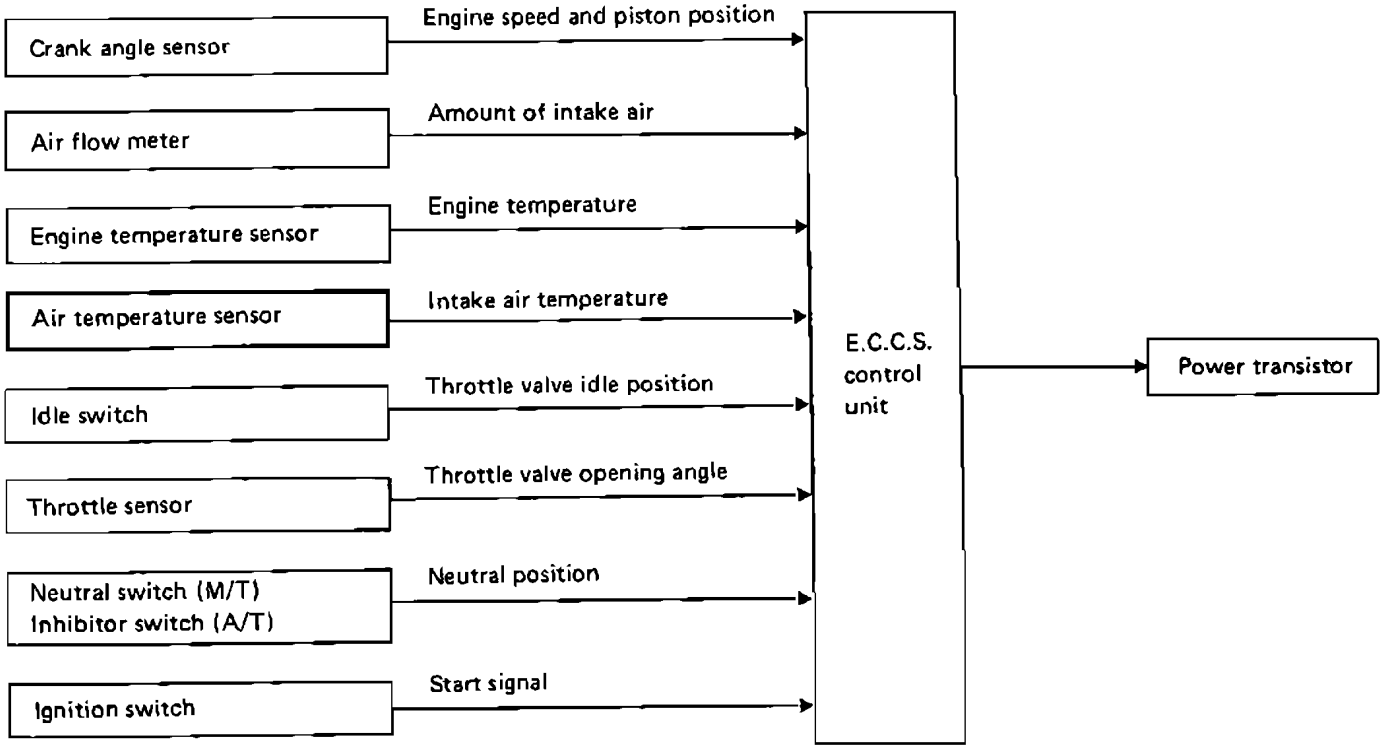


Air Temperature Sensor

The air temperature sensor is used to control ignition timing when the temperature of the intake air is extremely high, in order not to cause predetonation.

Ignition Timing Control

INPUT/OUTPUT SIGNAL LINE



Ignition Timing Control (Cont'd)

SYSTEM DESCRIPTION

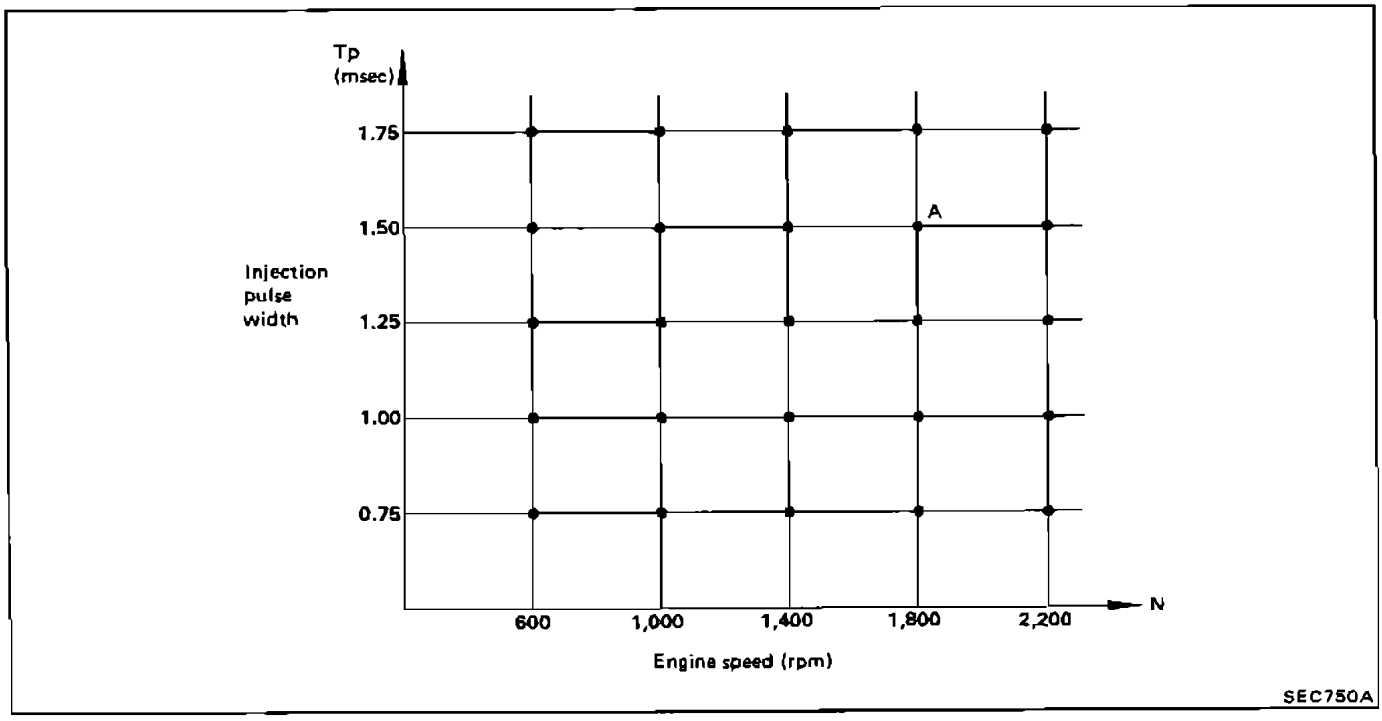
The ignition timing is controlled by the E.C.U. in order to maintain the best air-fuel ratio in response to every running condition of the engine.
The ignition timing data is stored in the ROM located in the E.C.U., in the form of the map shown below.
The E.C.U. detects information such as the injection 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,

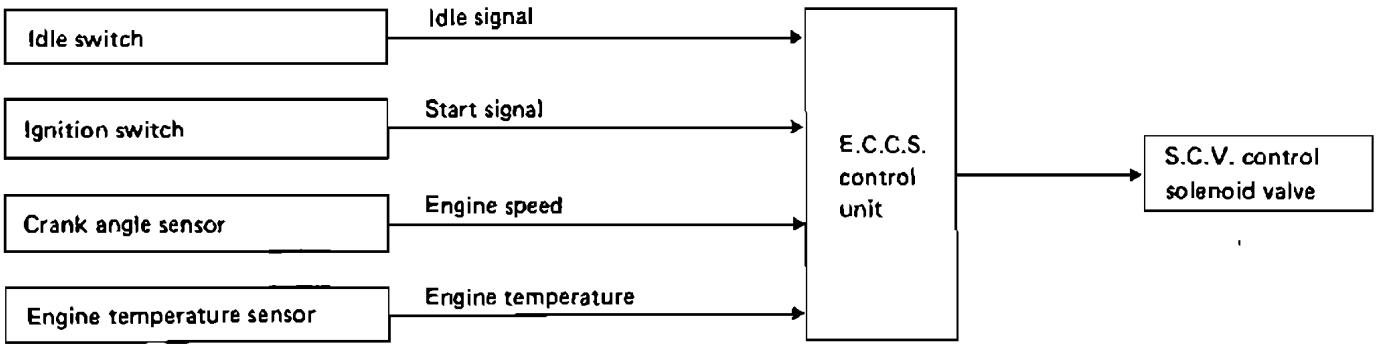
1 At starting
2 During warm-up
3 At idle
4 At low battery voltage
5 During swirl control valve operates
6 Hot engine operation
7 At acceleration
8 When intake air temperature is extremely high

the ignition timing is revised by the E.C.U. according to the other data stored in the ROM.



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.
The solenoid valve controls S.C.V.'s shut/open condition. This solenoid valve is operated by the E.C.U.

Idle switch	Water temperature	Engine rpm	Solenoid valve	S.C.V.
ON	Above 35°C (95°F)	Below 1,800	ON	Close
Except above			OFF	Open

- This table shows the control when starting engine temperature is above 10°C (50°F).

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.)

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

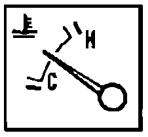
When throttle sensor output voltage is below or above the specified value, throttle sensor output is fixed at the preset value.

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)].

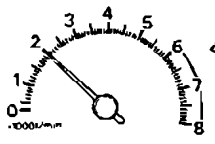
INSPECTION START

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 valve switch operation



SEF457C

Start engine and warm it up until water temperature indicator points to the middle of gauge.



SEF477B

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.

O.K. / N.G.

N.G. → Check, correct or replace malfunctioning parts.

Does engine run smoothly?

Yes / No

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.

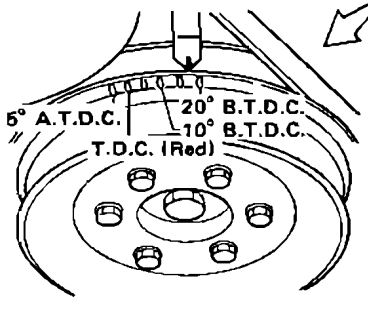
M/T: 700±50 rpm
A/T: 750±50 rpm (in "N" position)

O.K. / N.G.

Check ignition timing with a timing light.

15°±2° B.T.D.C.

O.K. / N.G.



SMA189A

N.G. → Disconnect throttle sensor harness connector.

Ensure that engine speed is below 800 rpm.

O.K. / N.G.

N.G. → Adjust idle speed to less than 800 rpm by turning idle speed adjusting screw.

Ⓐ Ⓑ Ⓒ

Ⓐ Ⓑ Ⓒ

Check ignition timing with a timing light.

15°±2° B.T.D.C.

O.K. / N.G.

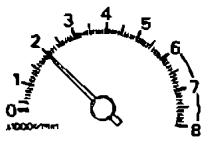
Adjust ignition timing by turning distributor after loosening bolt which secures distributor.

15°±2° B.T.D.C.

Adjust idle speed by turning idle speed adjusting screw.

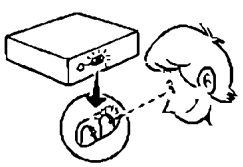
M/T: 650±50 rpm
A/T: 700±50 rpm (in "N" position)

Connect throttle sensor harness connector.



SEF477B

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.

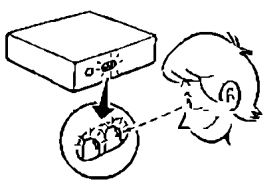
O.K.

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



SEF292H

Ⓓ Ⓔ Ⓒ

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.**

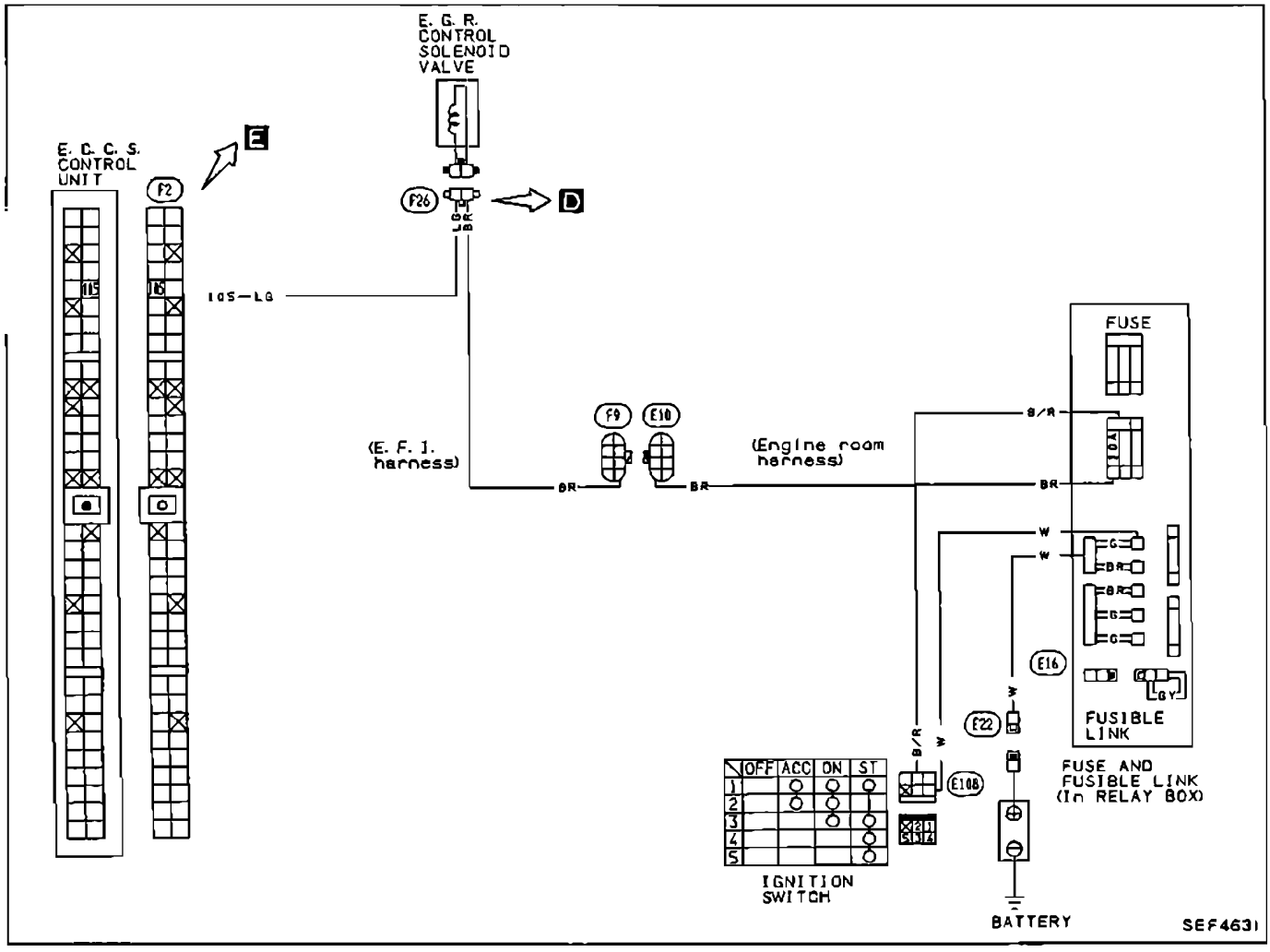
DISPLAY CODE TABLE

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 circuit	X	X

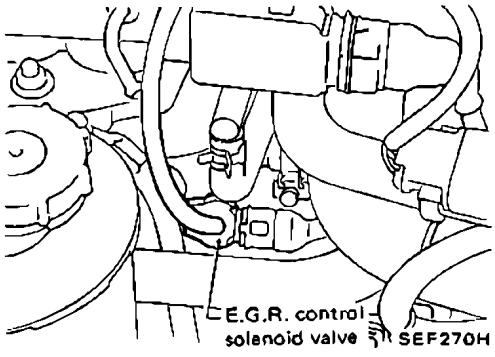
X: Available —: Not available

Diagnostic Procedure 8

E.G.R. FUNCTION (Code No. 32) [Not self-diagnostic item (For non-California models)]

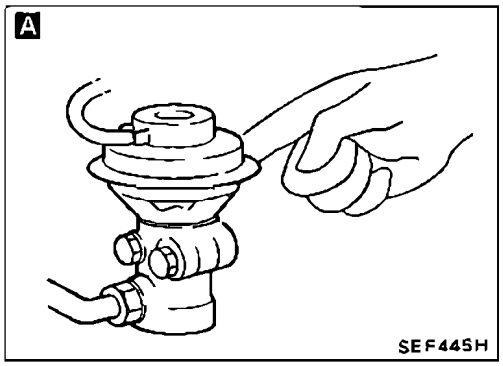


Component location



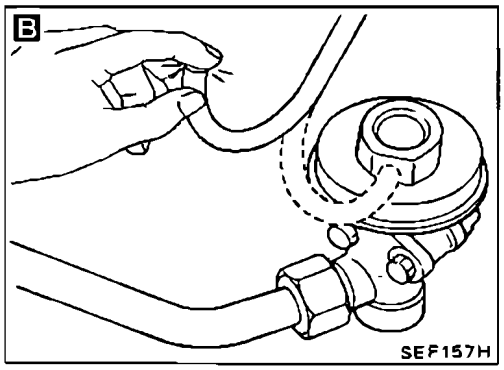
Diagnostic Procedure 8 (Cont'd)

A



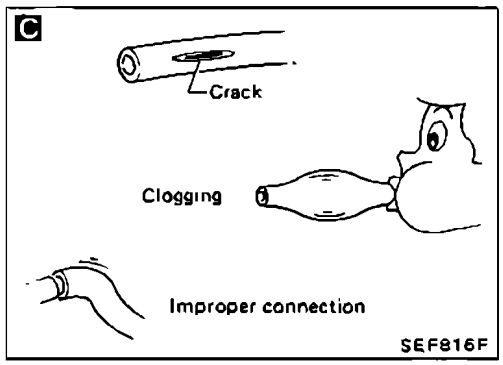
SEF445H

B



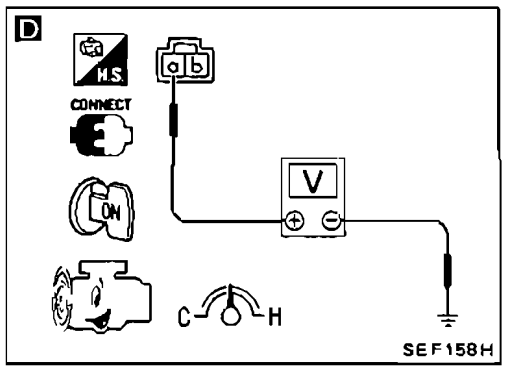
SEF157H

C



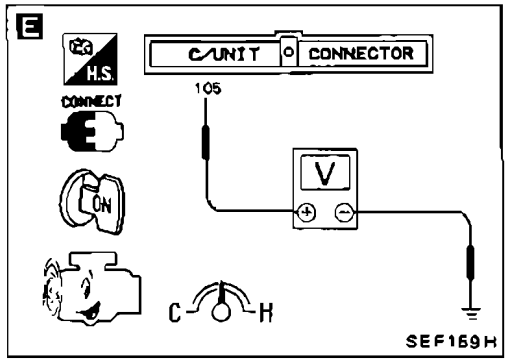
SEF816F

D



SEF158H

E



SEF159H

INSPECTION START

A CHECK E.G.R. CONTROL VALVE OPERATION.
1) Start engine and warm it up sufficiently.
2) Make sure E.G.R. control valve spring responds to your touch (use your fingers) and also when engine is raced.

Responds → INSPECTION END

Does not respond ↓

B CHECK VACUUM SOURCE TO E.G.R. CONTROL VALVE.
1) Stop engine.
2) Disconnect vacuum hose connected to E.G.R. control valve and B.P.T. valve.
3) Start engine.
4) Make sure vacuum exists when racing engine.

O.K. → CHECK COMPONENT.
Check E.G.R. control valve.
(See page EF & EC-148.)
N.G. → Replace E.G.R. control valve.

N.G. ↓

C CHECK VACUUM HOSE.
1) Stop engine.
2) Check vacuum hose for clogging, cracks, and proper connections.

N.G. → If necessary, replace vacuum hose or reconnect vacuum hose firmly.

O.K. ↓

D CHECK E.C.U. OUTPUT SIGNAL (Solenoid side).
1) Start engine and warm it up sufficiently.
2) Check voltage betwen E.G.R. control solenoid valve harness connector terminal ⓐ and ground.

Engine condition	Voltage
Idle	Battery voltage
Racing	Temporarily drops to 0 - 1V

N.G. → **E** CHECK E.C.U. OUTPUT SIGNAL (E.C.U. side).
Check voltage between E.C.U. harness connector terminal (105) and ground.

Engine condition	Voltage
Idle	Battery voltage
Racing	Temporarily drops to 0 - 1V

If N.G., check the E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K. ↓

Repair harness or connectors between terminals ⓐ and (105).

O.K. ↓

⊕

Diagnostic Procedure 8 (Cont'd)

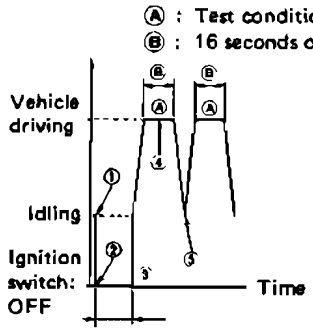
F

Test condition

Drive vehicle under the following conditions with a suitable shift position.

- Engine speed:
  3,200±400 rpm
- Intake manifold vacuum:
  −42.7±8.0 kPa
  (−320±60 mmHg, −12.60±2.36 inHg)

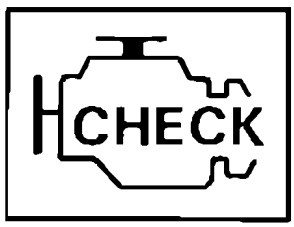
Driving mode



① Start engine and warm it up sufficiently.
② Turn off ignition switch and keep it off until green and red inspection lamps go off.
③ Start engine and make sure that air conditioner switch and rear defogger are turned "OFF" during driving test.
④ Shift to suitable gear position and drive in "Test condition" for at least 16 seconds.
⑤ Decrease engine revolution to less than 2,000 rpm.
⑥ Repeat steps ④ through ⑤ at least 1 time.

SEF037H

G



CHECK ENGINE LIGHT

SEF924F

CHECK COMPONENT.
1) Stop engine.
2) Check E.G.R. control solenoid valve. (See page EF & EC-149.)

N.G. → Replace E.G.R. control solenoid valve.

O.K.

CHECK COMPONENT.
Check E.G.R. control valve and B.P.T. valve.
(See page EF & EC-148.)

N.G. → Valve spring may be stuck. Clean if necessary. If this does not correct trouble, replace E.G.R. control valve.

O.K. For California

O.K. For non-California → INSPECTION END

Check resistance of exhaust gas temperature sensor.
(See page EF & EC-149.)

Reinstall any part removed.

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 check engine light does not come "ON" during driving test.

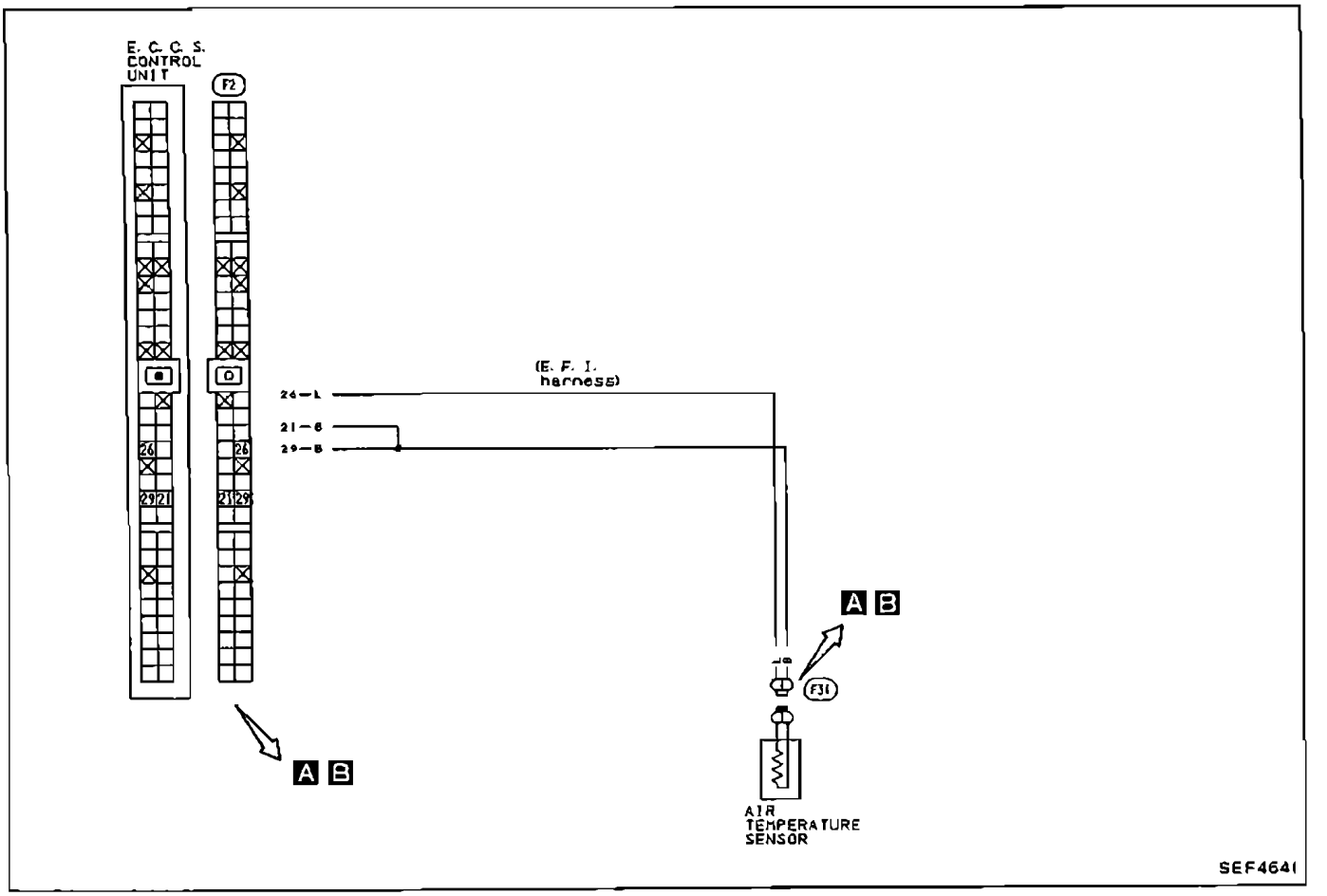
Comes "ON" → Perform self-diagnosis and find malfunction code. According to displayed code No., perform diagnosis.

Does not come "ON"

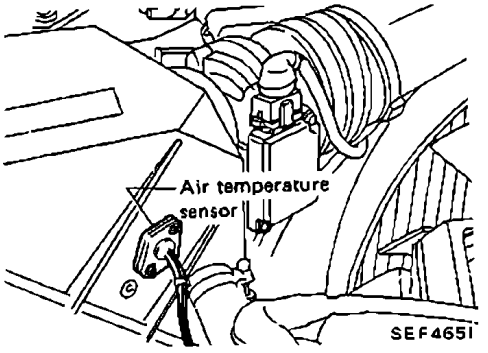
INSPECTION END

Diagnostic Procedure 24

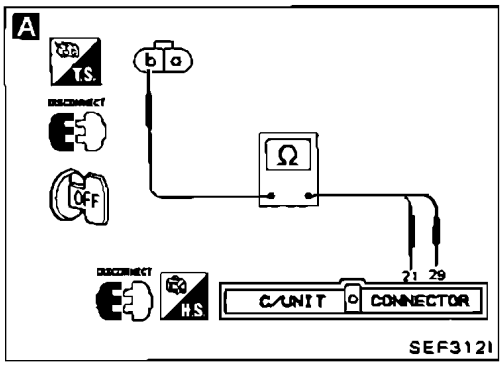
AIR TEMPERATURE SENSOR (Code No. 41)

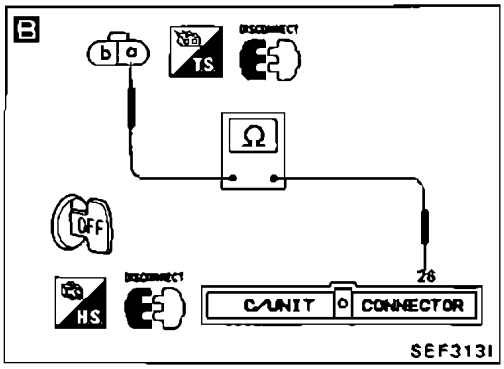


Component location



Diagnostic Procedure 24 (Cont'd)





INSPECTION START

CHECK COMPONENTS.
Check air temperature sensor.
(See page 20.)

N.G. → Replace air temperature sensor.

O.K.

A

CHECK GROUND CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check continuity between air temperature sensor terminal ⓑ and E.C.U. terminals ㉑, ㉙.
Continuity should exist.

N.G. →
1) Repair harness or connectors between terminals ⓑ and ㉑, ㉙.
2) Check engine ground.

O.K.

B

CHECK INPUT SIGNAL CIRCUIT.
Check continuity between terminals ⓐ and ㉖.
Continuity should exist.

N.G. → Repair or replace harness or connectors between terminals ⓐ and ㉖.

O.K.

Reinstall any part removed.

Erase the self-diagnosis memory.

Perform driving test and then perform self-diagnosis (Mode-III) again.

N.G. →
1) Perform E.C.U. input/output signal inspection test.
2) If N.G., recheck the E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K.

INSPECTION END

Electrical Components Inspection

E.C.U. INPUT/OUTPUT SIGNAL INSPECTION

E.C.U. inspection table

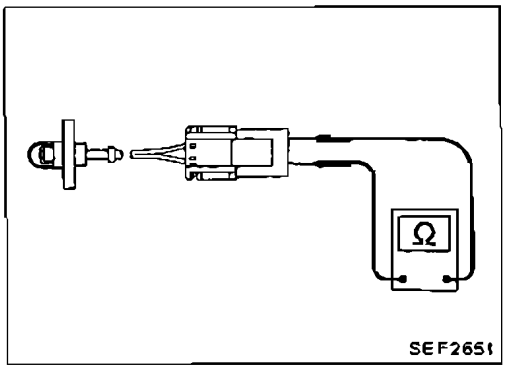
*Data are reference values.

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 - 5.0V 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
26	Air temperature sensor	Ignition switch "ON" └ Air temperature is 20°C (68°F).	1.0 - 1.5V
		Ignition switch "ON" └ Air temperature is 80°C (176°F).	Approximately 0.3V
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	Idle switch (⊖ side)	Ignition switch "ON" └ Throttle valve: idle position	Approximately 9 - 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)

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

General Specifications

IGNITION TIMING	°B.T.D.C.	15±2
IDLE SPEED	rpm	M/T 700±50 A/T 750±50 (In "N" position)

Inspection and Adjustment

ENGINE TEMPERATURE SENSOR		
Thermistor resistance	kΩ	20°C (68°F): 2.1 - 2.9 80°C (176°F): 0.30 - 0.33
AIR TEMPERATURE SENSOR		
Resistance	kΩ	20°C (68°F): 2.1 - 2.9 80°C (176°F): 0.27 - 0.38
IDLE SWITCH		
Engine speed when idle switch is changed from "OFF" to "ON"	rpm	M/T 1,000±150 A/T 1,000±150 (in "N" position)
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 76
EXHAUST GAS TEMPERATURE SENSOR		
Thermistor resistance	kΩ	100°C (212°F): 85.3±8.53

NISSAN MOTOR CORPORATION IN U.S.A.
Technical Publications Department