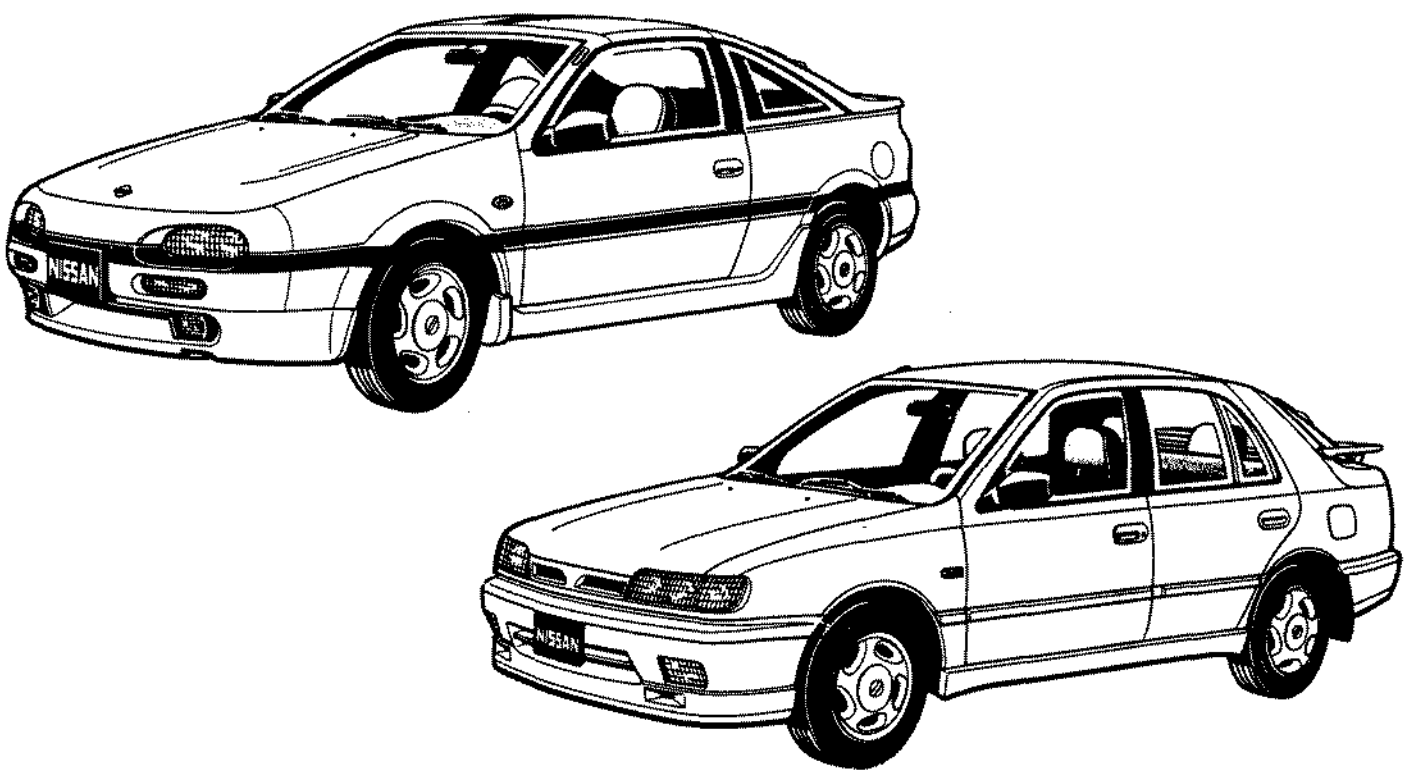
NISSAN

MODEL B13 AND N14 SERIES

Volume 1



SERVICE MANUAL

NISSAN

MODEL B13 AND N14 SERIES

Volume 1

QUICK REFERENCE INDEX

GI (General Information) section is contained in Volume 1 and Volume 2.

FOREWORD

This manual (Volume 1) contains maintenance and repair procedures for model B13 and N14 series engines.

For repair procedures for the following components, refer to Volume 2 (Pub. No. SM1E-2N4BG0).

1. Chassis
   - Clutch
   - Transaxle unit
   - Axle & suspension unit
   - Transfer unit
   - Propeller shaft & Differential carrier
   - Brake system
   - Steering system
2. Body
3. Heater & air conditioner unit
4. Electrical system

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

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

IMPORTANT SAFETY NOTICE

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

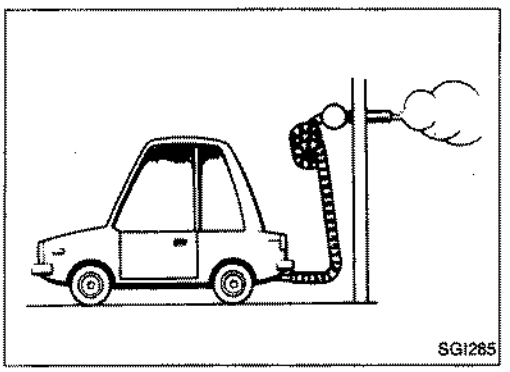
NISSAN MOTOR CO., LTD.
Overseas Service Department
Tokyo, Japan

GENERAL INFORMATION

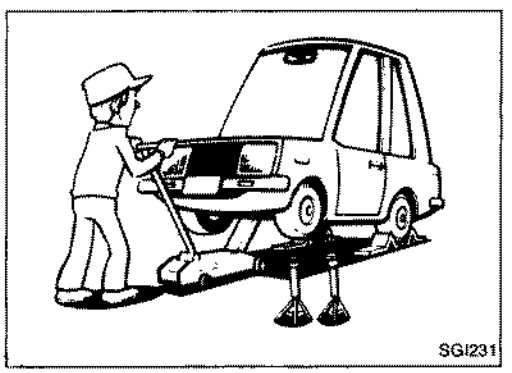
SECTION GI

CONTENTS

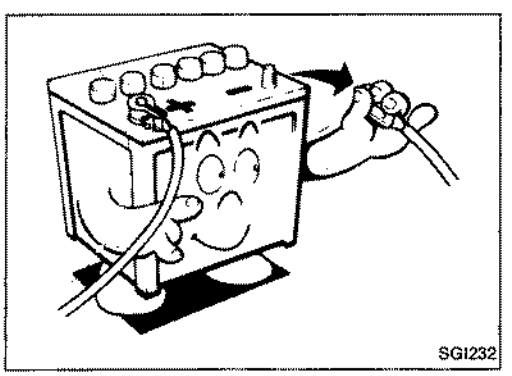
Observe the following precautions to ensure safe and proper servicing. These precautions are not described in each individual section.


SGI285

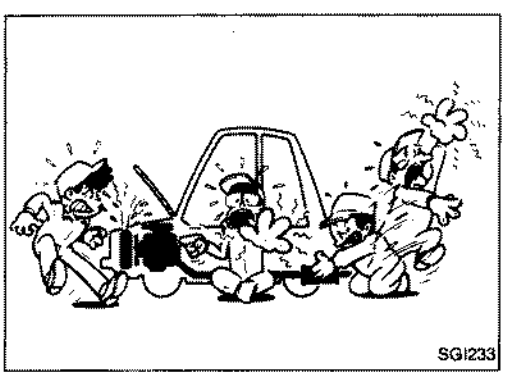
1. Do not operate the engine for an extended period of time without proper exhaust ventilation.
   Keep the work area well ventilated and free of any inflammable materials. Special care should be taken when handling any inflammable or poisonous materials, such as gasoline, refrigerant gas, etc. When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

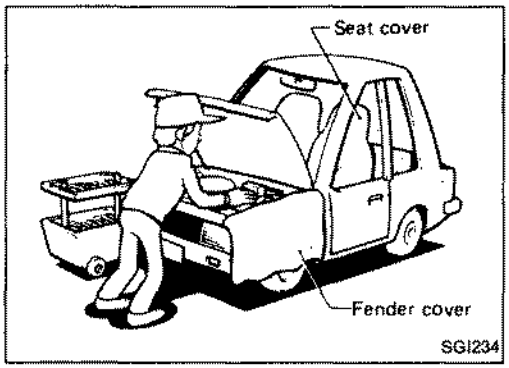
2. Before jacking up the vehicle, apply wheel chocks or other tire blocks to the wheels to prevent the vehicle from moving. After jacking up the vehicle, support the vehicle weight with safety stands at the points designated for proper lifting and towing before working on the vehicle.
   These operations 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.

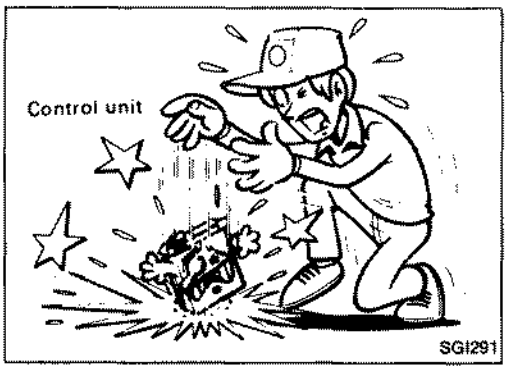

SGI233

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.



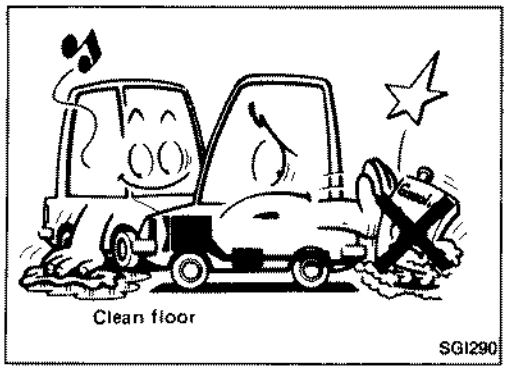
6. Before servicing the vehicle, protect fenders, upholstery and carpeting with appropriate covers.
   Take caution that keys, buckles or buttons on your person do not scratch the paint.

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

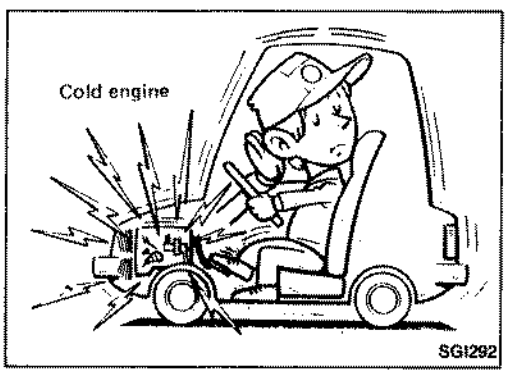
1. Before connecting or disconnecting E.F.I. or E.C.C.S. harness connector to or from any E.F.I. or E.C.C.S. control unit, be sure to turn the ignition switch to the "OFF" position and disconnect the negative battery terminal.
   Otherwise, there may be damage to control unit.
2. Before disconnecting 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 Turbocharger

The turbocharger turbine revolves at extremely high speeds and becomes very hot. Therefore, it is essential to maintain a clean supply of oil flowing through the turbocharger and to follow all required maintenance instructions and operating procedures.

For proper operation of the system, follow the procedure below.

1. Always use the recommended oil. Follow the instructions for proper time to change the oil and proper oil level.
2. Avoid accelerating engine to a high rpm immediately after starting.
3. If engine had been operating at high rpm for an extended period of time, let it idle for a few minutes prior to shutting it off.

Asbestos Safety Instructions (Based on United Kingdom and Republic of Ireland regulations)

This vehicle uses parts containing asbestos. Most are not hazardous but Brake and Clutch linings can be. Consult the manufacturer or his agent for further details. When working with these please observe the "Garage Workers' Asbestos Code" available through your Nissan Dealer, Local Authority or Health and Safety Executive. In particular, work in a well-ventilated place using, where possible, appropriate dust extraction equipment, and avoid creating dust. Dampen all asbestos/dust where possible prior to machining, cutting, cleaning, etc. Use only hand or low speed tools.

Dispose of all asbestos waste, wet rags, etc., in a closed container as directed by your local waste disposal authority.

Engine Oils

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

HEALTH PROTECTION PRECAUTIONS

1. Avoid prolonged and repeated contact with oils, particularly used engine oils.
2. Wear protective clothing, including impervious gloves where practicable.
3. Do not put oily rags in pockets.
4. Avoid contaminating clothes, particularly underpants, with oil.
5. Heavily soiled clothing and oil-impregnated footwear should not be worn. Overalls must be cleaned regularly.
6. First Aid treatment should be obtained immediately for open cuts and wounds.
7. Use barrier creams, applying them before each work period, to help the removal of oil from the skin.
8. Wash with soap and water to ensure all oil is removed (skin cleansers and nail brushes will help). Preparations containing lanolin replace the natural skin oils which have been removed.
9. Do not use petrol, kerosine, diesel fuel, gas oil, thinners or solvents for cleaning skin.
10. If skin disorders develop, obtain medical advice without delay.
11. Where practicable, degrease components prior to handling.
12. Where there is a risk of eye contact, eye protection should be worn, for example, chemical goggles or face shields; in addition an eye wash facility should be provided.

(For the United Kingdom, see also HSE Cautionary Notice SHW 397 "Effects of Mineral Oil on the Skin".)

ENVIRONMENTAL PROTECTION PRECAUTIONS

Burning used engine oil in small space heaters or boilers can be recommended only for units of approved design. The heating system must meet the requirements of HM Inspectorate of Pollution for small burners of less than 0.4 MW. If in doubt check with the appropriate local authority and/or manufacturer of the approved appliance.

Dispose of used oil and used oil filters through authorized waste disposal contractors to licensed waste disposal sites, or to the waste oil reclamation trade. If in doubt, contact the local authority for advice on disposal facilities.

It is illegal to pour used oil on to the ground, down sewers or drains, or into water courses.

The regulations concerning the pollution of the environment will vary from country to country.

Precautions for Fuel

GASOLINE ENGINE:

For Europe

Catalytic converter equipped engines:
GA14DS engine models except for Switzerland ...
Unleaded gasoline of at least 91 octane (RON)
GA14DS engine models for Switzerland ...
Unleaded gasoline of at least 95 octane (RON)
Except GA14DS engine models ...
Unleaded gasoline of at least 95 octane (RON)

CAUTION:
Do not use leaded gasoline. Using leaded gasoline will damage the catalytic converter.

Except catalytic converter equipped engines:
For the United Kingdom and France only
GA14DS engine models ...
Unleaded gasoline of at least 91 octane (RON)
Except GA14DS engine models ...
Unleaded gasoline of at least 95 octane (RON)
Except the United Kingdom and France
GA14DS engine models ...
Unleaded or leaded gasoline of at least 91 octane (RON)
Except GA14DS engine models ...
Unleaded or leaded gasoline of at least 95 octane (RON)

Except Europe

Leaded gasoline of at least 88 octane (RON)

GA16DS engine models for Middle East ...
Leaded gasoline of at least 95 octane (RON)

DIESEL ENGINE*:

CD17 engine models ... Diesel fuel of at least 45 cetane
CD20 engine models ... Diesel fuel of at least 50 cetane

* If two types of diesel fuel are available, use summer or winter fuel properly according to the following temperature conditions.

- Above –7°C (20°F) ... Summer type diesel fuel.
- Below –7°C (20°F) ... Winter type diesel fuel.

CAUTION:

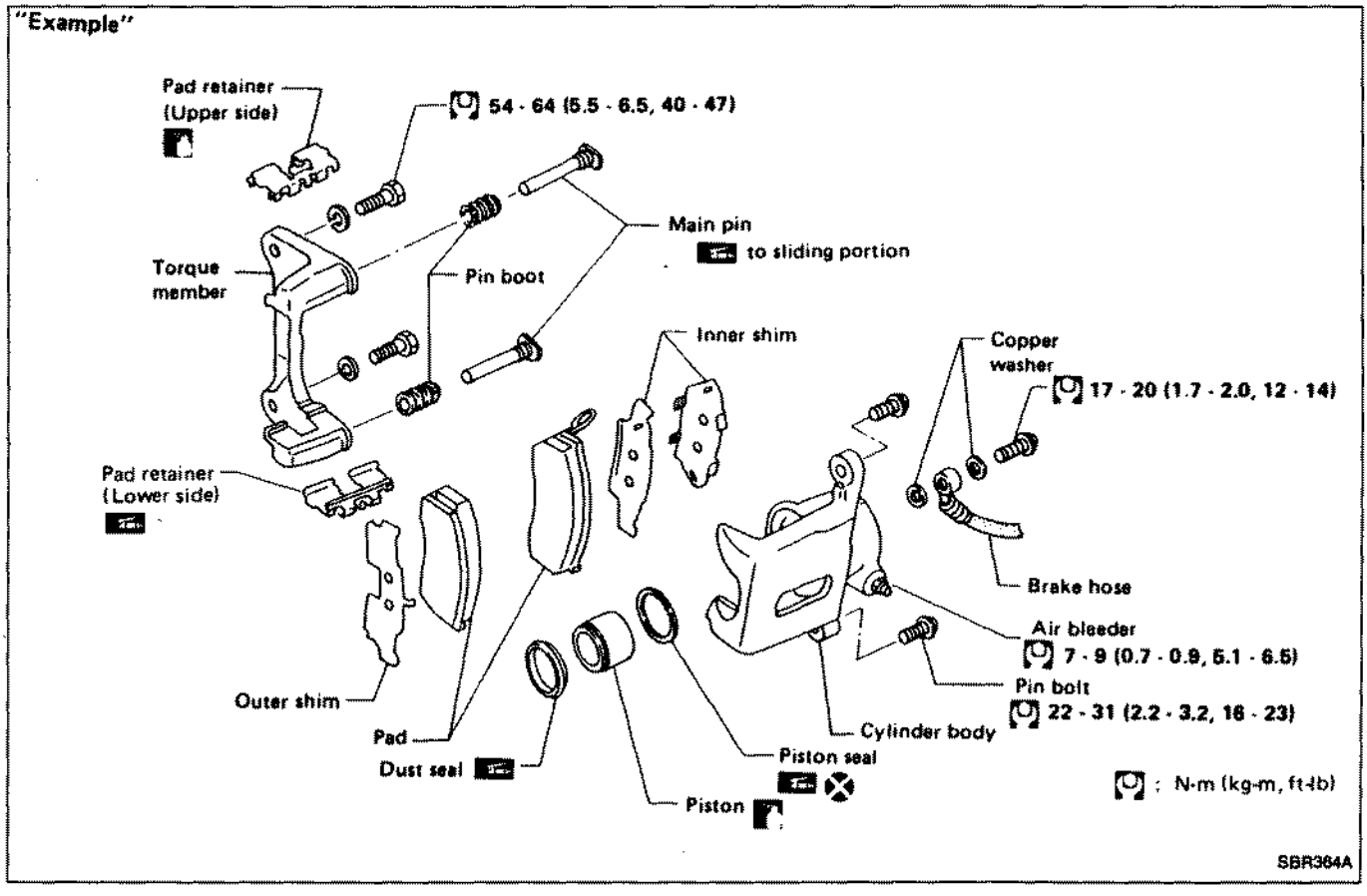
- **Do not use home heating oil, gasoline, or other alternate fuels in your diesel engine. The use of those can cause engine damage.**
- **Do not use summer fuel at temperature below –7°C (20°F). The cold temperatures will cause wax to form in the fuel. As a result, it may prevent the engine from running smoothly.**
- **Do not add gasoline or other alternate fuels to diesel fuel. Only under the following conditions may you use diesel fuel by mixing kerosene or regular gasoline (not premium gasoline) to prevent the fuel from thickening due to wax separation:**
  If the summer type diesel fuel is used at an ambient temperature below 0°C (32°F), add kerosene or regular gasoline but not more than 30% by volume. However, keep in mind that there may be less engine output performance due to the proportion of added fuel. The use of kerosene for motor vehicles is not permitted in some countries, e.g. U.K.

Precautions for Fuel (Cont'd)

Therefore, consult the relevant authorities before such mixtures are used.

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.**

"Example"



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 following **SYMBOLS AND ABBREVIATIONS** are used:

	:	Tightening torque
	:	Should be lubricated with grease. Unless otherwise indicated, use recommended multi-purpose grease.
	:	Should be lubricated with oil.
	:	Sealing point
	:	Checking point
	:	Always replace after every disassembly.
L.H., R.H.	:	Left-Hand, Right-Hand
FR, RR	:	Front, Rear

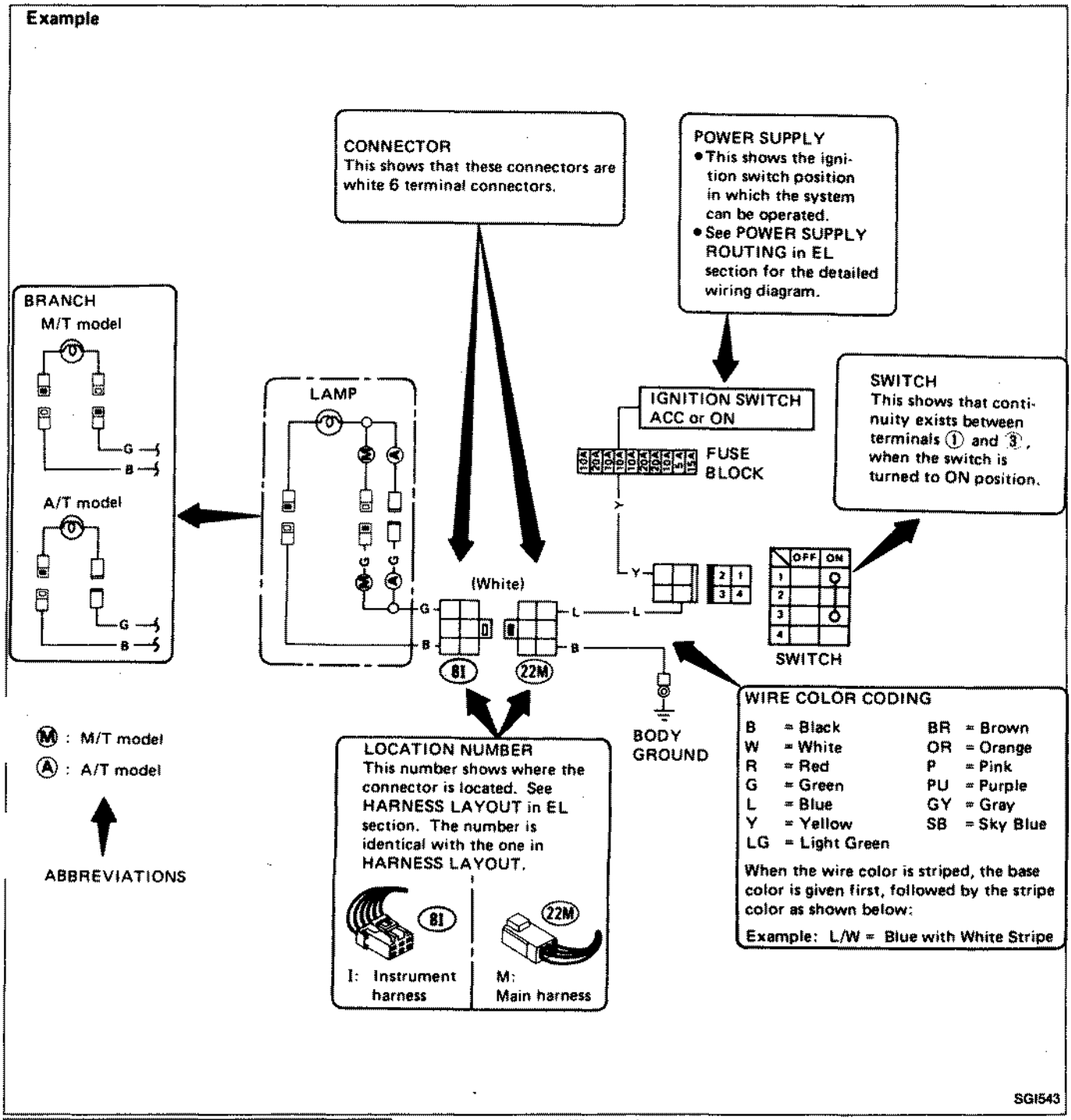
2WD	:	2-Wheel Drive
4WD	:	4-Wheel Drive
M/T	:	Manual Transaxle/Transmission
A/T	:	Automatic Transaxle/ Transmission
A/C	:	Air Conditioner
P/S	:	Power Steering
S.S.T.	:	Special Service Tools
S.D.S.	:	Service Data and Specifications
SAE	:	Society of Automotive Engineers, Inc.
G.C.C.	:	Gulf Cooperation Council
L.H.D.	:	Left-Hand Drive
R.H.D.	:	Right-Hand Drive

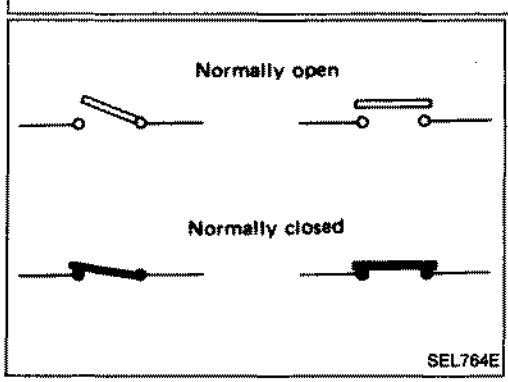
8. The **UNITS** given in this manual are primarily expressed as the SI UNIT (International System of Unit), and alternatively expressed in the metric system and in the yard/pound system.
   "Example"
   Tightening torque:
   59 - 78 N·m (6.0 - 8.0 kg-m, 43 - 58 ft-lb)
9. **TROUBLE DIAGNOSES** are included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



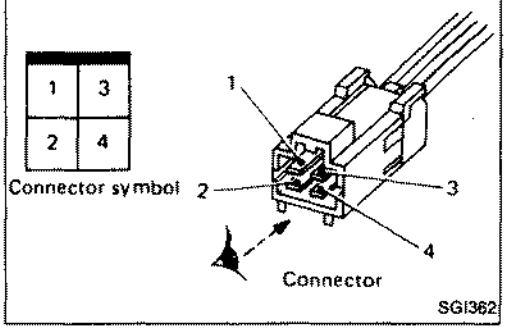


SWITCH POSITIONS

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.

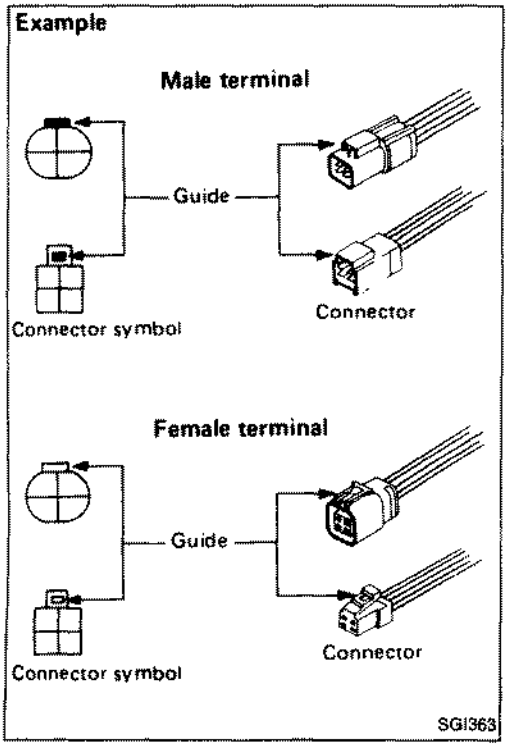
Example



CONNECTOR SYMBOLS

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

Example

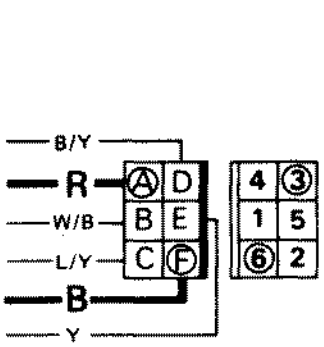


- Male and female terminals
  Connector guides for male terminals are shown in black and female terminals in white in wiring diagrams.

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

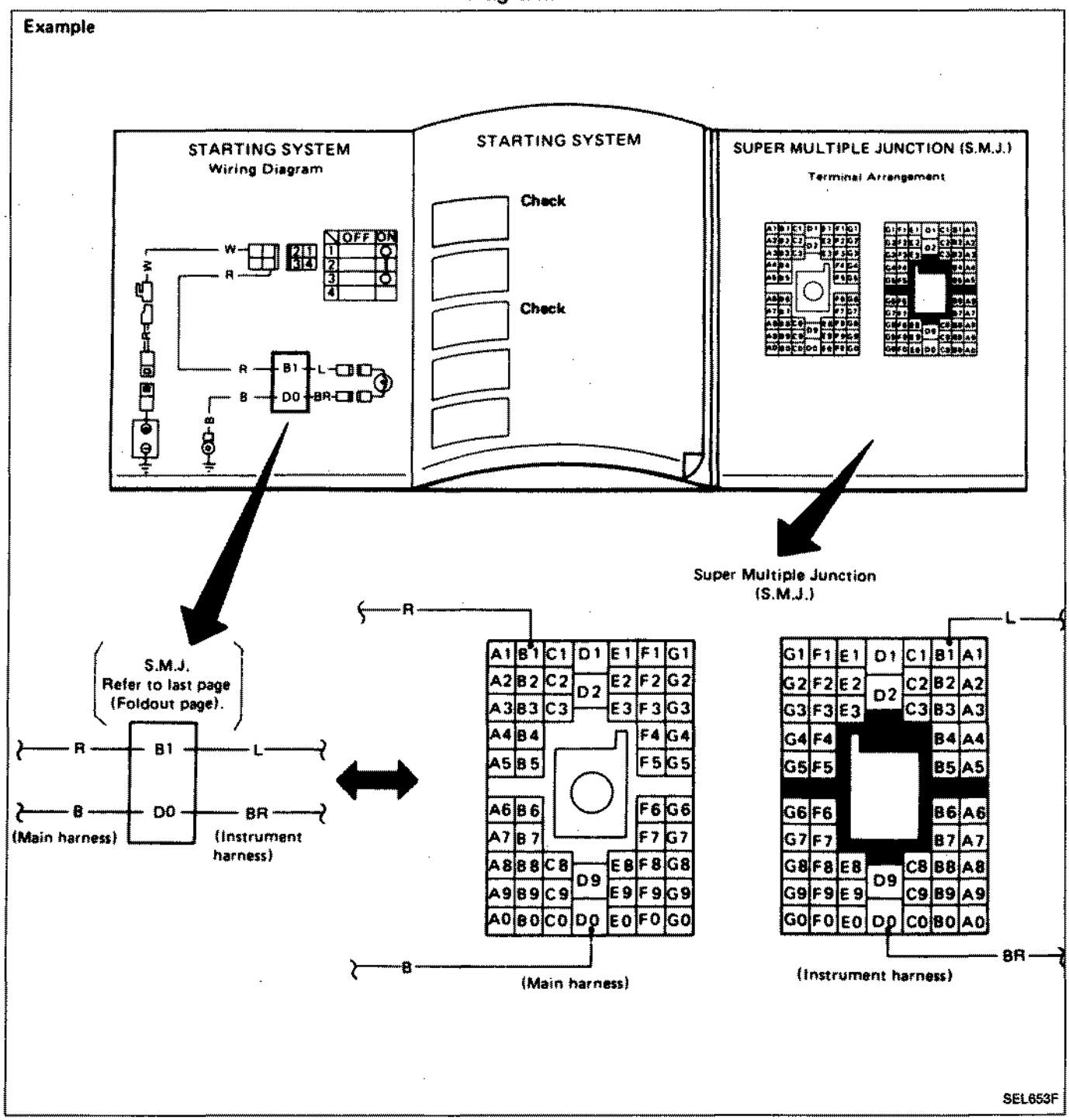
Example: Wiper switch in LO position
Continuity circuit: Red wire – Ⓐ terminal – ③ terminal – Wiper switch (● – ●: LO) – ⑥ terminal – Ⓕ terminal – Black wire

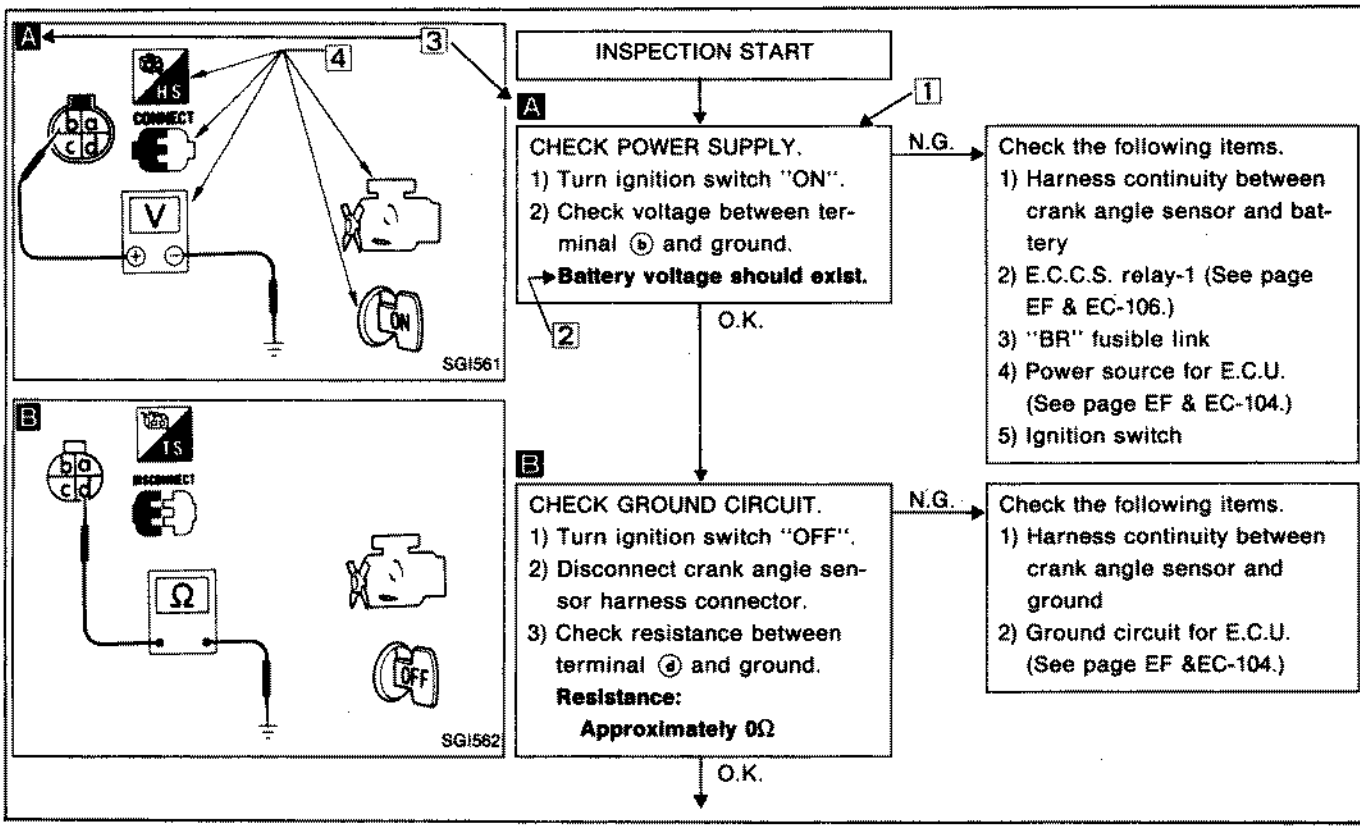
SGI365

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

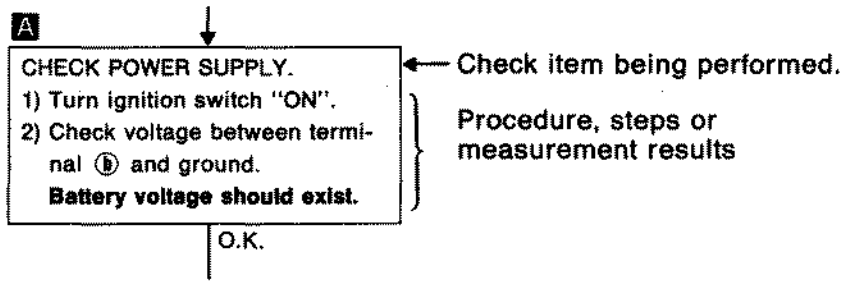
The flow chart indicates work procedures required to diagnose problems effectively. Observe the following instructions before diagnosing.

1) **Use the flow chart after locating probable causes of a problem following the "Preliminary Check" or the "Symptom Chart".**
2) **After repairs, recheck 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 Pinpoint 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 they were.**

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:

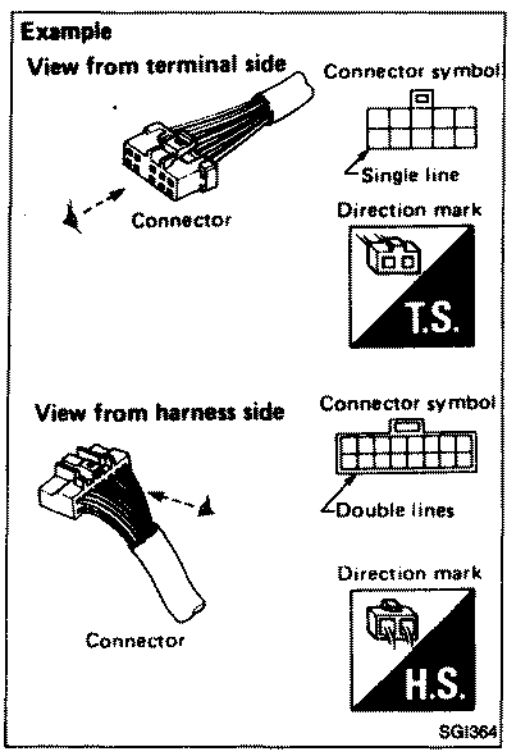
Battery voltage → 11 - 14V or approximately 12V
Voltage: Approximately 0V → Less than 1V

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.

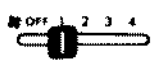
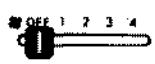
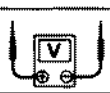
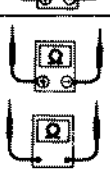
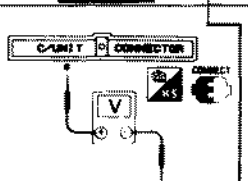
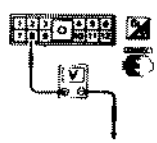
: **View from terminal side ... T.S.**

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

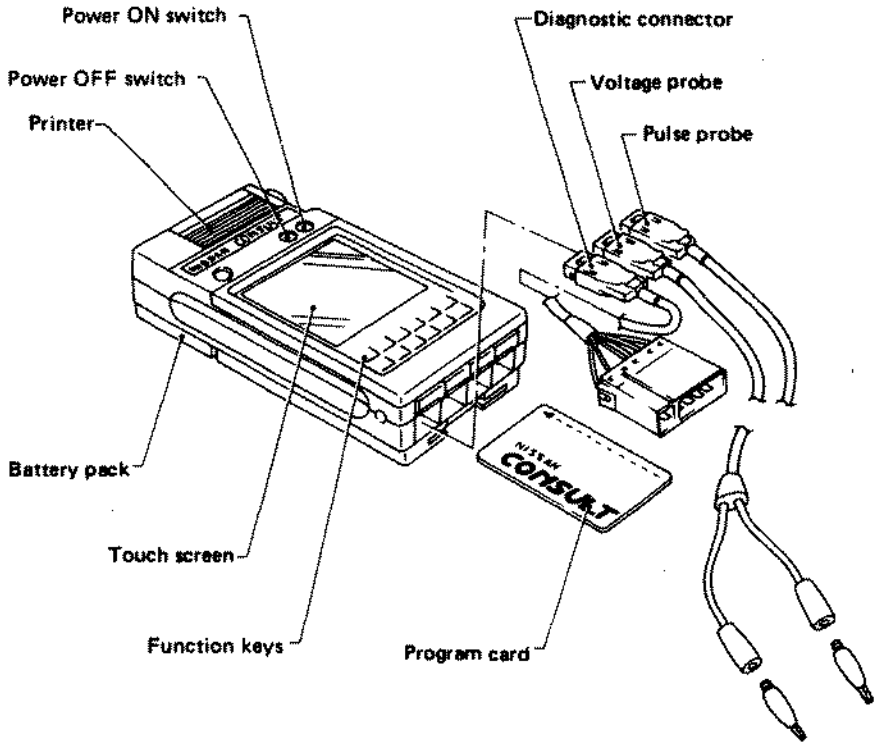
: **View from harness side ... H.S.**

- **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.		Procedure with Consult
	Check after connecting the connector to be measured.		Procedure with CONSULT
	Insert key into ignition switch.		A/C switch is "OFF".
	Remove key from ignition switch.		A/C switch is "ON".
	Turn ignition switch to "OFF" position.		REC switch is "ON".
	Turn ignition switch to "ON" position.		REC switch is "OFF".
	Turn ignition switch to "START" position.		DEF switch is "ON".
	Turn ignition switch from "OFF" to "ACC" position.		VENT switch is "ON".
	Turn ignition switch from "ACC" to "OFF" position.		Fan switch is "ON". (At any position except for "OFF" position)
	Turn ignition switch from "OFF" to "ON" position.		Fan switch is "OFF".
	Turn ignition switch from "ON" to "OFF" position.		Apply battery voltage directly to components.
	Do not start engine, or check with engine stopped.		Drive vehicle.
	Start engine, or check with engine running.		Disconnect battery negative cable.
	Apply parking brake.		Depress brake pedal.
	Release parking brake.		Release brake pedal.
	Check after engine is warmed up sufficiently.		Depress accelerator pedal.
	Voltage should be measured with a voltmeter.		Release accelerator pedal.
	Circuit resistance should be measured with an ohmmeter.		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.** 
	Current should be measured with an ammeter.		

Outside View



SGI619

System Application

Diagnostic mode \ System	E.C.C.S. (GA16DE and SR20DE engines)
Work support	X
Self-diagnostic results	X
Data monitor	X
Active test	X
E.C.U. part number	X

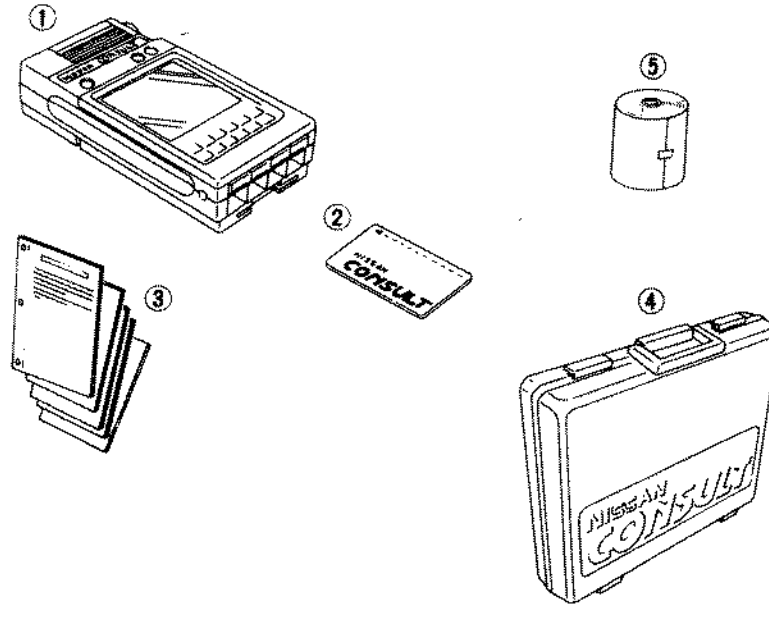
X: Applicable

Function

Diagnostic mode	Function
Work support	This mode enables a technician to adjust some devices faster and more accurately by following the indications on CONSULT.
Self-diagnostic results	Self-diagnostic results can be read and erased quickly.
Data monitor	Input/Output data in the control unit can be read.
Active test	Mode in which CONSULT drives some actuators apart from the control units and also shifts some parameters in a specified range.
E.C.U. part number	E.C.U. part number can be read.

Checking Equipment

When ordering this equipment, contact your NISSAN distributor.

Tool name	Description
NISSAN CONSULT kit ① CONSULT unit and accessories ② Program card ③ Operation manuals ④ Carrying case ⑤ Thermal paper (Rolls)	

Model Variation

MODEL B13 SERIES

Destination	Body	Grade	Transaxle / Engine	E10S	GA13DS	GA14DS		GA16DS		GA16DE		CD17
				RN4F30A	RS5F30A	RS5F30A	RL4F03A	RS5F31A	RL4F03A	RS5F31A	RL4F03A	RS5F30A
Except Europe and Middle East	R.H. drive	4-door Sedan	LE	—	BAJAR8F-SWA	BAVAR8F-SWA	BAVAR8A-SWA	BAYAR8F-SWA	—	—	—	BVAAR8F-NWA
			JX	BAJAR0T-SWA	BAJAR0F-SWA	BAVAR0F-SWA	BAVAR0A-SWA	—	—	—	—	—
			EX Saloon	BAJAR1T-SWA	BAJAR1F-SWA	BAVAR1F-SWA	BAVAR1A-SWA	BAYAR1F-SWA	BAYAR1A-SWA	—	—	—
			Super Saloon	—	BAJAR0F-SWA	BAVAR0F-SWA	BAVAR0A-SWA	BAYAR0F-SWA	BAYAR0A-SWA	BAYAR0F-EWA	BAYAR0A-EWA	—
	L.H. drive		LE	—	BAJAL8F-SWA	BAVAL8F-SWA	BAVAL8A-SWA	BAYAL8F-SWA	—	—	—	BVAAL8F-NWA
			JX	—	BAJAL0F-SWA	BAVAL0F-SWA	BAVAL0A-SWA	BAYAL0F-SWA	BAYAL0A-SWA	—	—	—
			Ex Saloon	—	BAJAL1F-SWA	BAVAL1F-SWA	BAVAL1A-SWA	BAYAL1F-SWA	BAYAL1A-SWA	—	—	—
			Super Saloon	—	—	—	—	BAYAL0F-SWA	BAYAL0A-SWA	BAYAL0F-EWA	BAYAL0A-EWA	—
	R.H. drive	Coupe	Type B	—	—	—	—	—	—	GAYAR1F-EWA	GAYAR1A-EWA	—
		T-bar roof		—	—	—	—	—	—	HAYAR1F-EWA	HAYAR1A-EWA	—
	L.H. drive	Coupe	Type B	—	—	—	—	—	—	GAYAL1F-EWA	GAYAL1A-EWA	—
		T-bar roof		—	—	—	—	—	—	HAYAL1F-EWA	HAYAL1A-EWA	—
Middle East	L.H. drive	4-door Sedan	LE	—	—	BAVAL8F-SKA	BAVAL8A-SKA	—	—	—	—	—
			JX	—	—	BAVAL0F-SKA	BAVAL0A-SKA	BAYAL0F-SKA	BAYAL0A-SKA	—	—	—
			EX Saloon	—	—	BAVAL1F-SKA	BAVAL1A-SKA	BAYAL1F-SKA	BAYAL1A-SKA	—	—	—
			Super Saloon	—	—	—	—	BAYAL0F-SKA	BAYAL0A-SKA	—	—	—
		Coupe	Type B	—	—	—	—	GAYAL1F-SKA	GAYAL1A-SKA	—	—	—
		T-bar roof	Type B	—	—	—	—	HAYAL1F-SKA	HAYAL1A-SKA	—	—	—

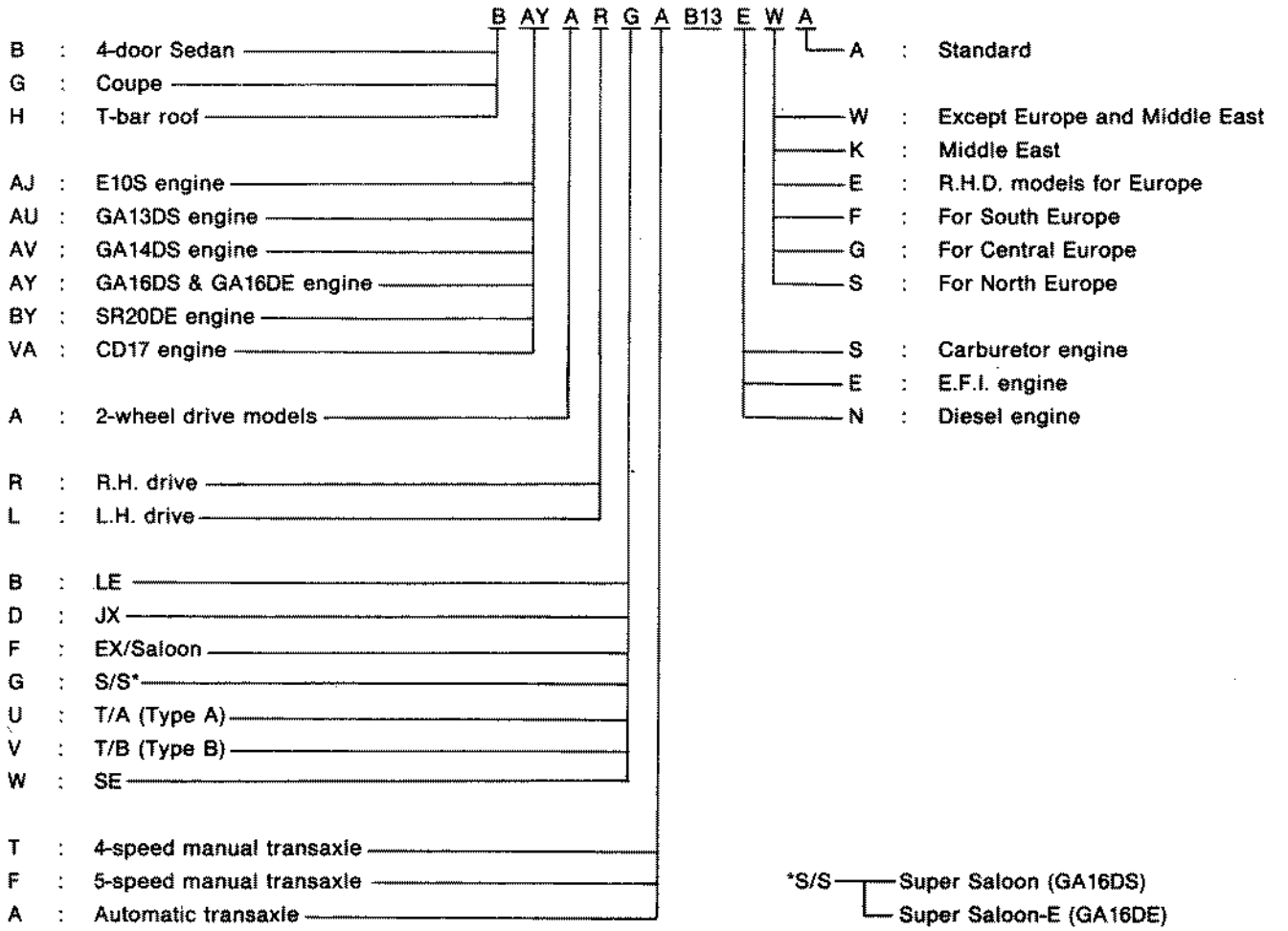
Model Variation (Cont'd)

MODEL B13 SERIES

Destination		Body	Grade	Engine: GA16DS / Transaxle: RS5F31A	Engine: GA16DS / Transaxle: RL4F03A	Engine: SR20DE / Transaxle: RS5F32A
Europe	R.H. drive models	Coupe	Type A	GAYARUF-SEA	GAYARUA-SEA	—
			SE	—	—	GBYARWF-EEA
		T-bar roof	Type A	HAYARUF-SEA	HAYARUA-SEA	—
			SE	—	—	HBYARWF-EEA
	For South Europe	Coupe	Type A	GAYALUF-SFA	GAYALUA-SFA	—
			SE	—	—	GBYALWF-EFA
		T-bar roof	Type A	HAYALUF-SFA	HAYALUA-SFA	—
			SE	—	—	HBYALWF-EFA
	For Central Europe	Coupe	Type A	GAYALUF-SGA	GAYALUA-SGA	—
			SE	—	—	GBYALWF-EGA
		T-bar roof	Type A	HAYALUF-SGA	HAYALUA-SGA	—
			SE	—	—	HBYALWF-EGA
	For North Europe	Coupe	Type A	GAYALUF-SSA	GAYALUA-SSA	—
			SE	—	—	GBYALWF-ESA
		T-bar roof	Type A	HAYALUF-SSA	HAYALUA-SSA	—
			SE	—	—	HBYALWF-ESA

Model Variation (Cont'd)

Prefix and suffix designations:



Model Variation (Cont'd)

MODEL N14 SERIES

Destination		Body	Grade	Engine	GA14DS		GA16DS		SR20DE	SR20DET	CD20
				Transaxle	5-speed M/T	4-speed A/T	5-speed M/T	4-speed A/T	5-speed M/T	5-speed M/T	5-speed M/T
					RS5F30A	RL4F03A	RS5F31A	RL4F03A	RS5F32A	RS5F50A	RS5F31A
Europe	R.H. drive models	Sedan	L		BAVARBF-SEA	BAVARBA-SEA	—	—	—	—	BVCARBF-NEA
			LX		BAVARDF-SEA	BAVARDA-SEA	BAYARDF-SEA	BAYARDA-SEA	—	—	BVCARDF-NEA
			SLX		—	—	BAYARFF-SEA	BAYARFA-SEA	—	—	—
		3-door Hatchback	L		EAVARBF-SEA	—	—	—	—	—	—
			LX		EAVARDF-SEA	—	—	—	—	—	—
			SLX		—	—	EAYARFF-SEA	EAYARFA-SEA	—	—	—
			GTI		—	—	—	—	EBYARUF-EEA	—	—
			GTI-R		—	—	—	—	—	EBYNRRF-TEA	—
		5-door Hatchback	L		FAVARBF-SEA	FAVARBA-SEA	—	—	—	—	FVCARBF-NEA
			LX		FAVARDF-SEA	—	FAYARDF-SEA	FAYARDA-SEA	—	—	FVCARDF-NEA
			SLX		—	—	FAYARFF-SEA	FAYARFA-SEA	—	—	—
			GTI		—	—	—	—	FBYARUF-EEA	—	—
	For South Europe	Sedan	LX		BAVALDF-SFA	BAVALDA-SFA	—	—	—	—	BVCALDF-NFA
			SLX		BAVALFF-SFA	BAVALFA-SFA	BAYALFF-SFA	BAYALFA-SFA	—	—	BVCALFF-NFA
			SLX 4WD		—	—	BAYNLFF-SFA	—	—	—	—
		3-door Hatchback	L		EAVALBF-SFA	—	—	—	—	—	—
			LX		EAVALDF-SFA	EAVALDA-SFA	—	—	—	—	EVCALDF-NFA
			SLX		EAVALFF-SFA	—	EAYALFF-SFA	EAYALFA-SFA	—	—	EVCALFF-NFA
			GTI		—	—	—	—	EBYALUF-EFA	—	—
			GTI-R		—	—	—	—	—	EBYNLRF-TFA	—
		5-door Hatchback	LX		FAVALDF-SFA	—	—	—	—	—	FVCALDF-NFA
			SLX		FAVALFF-SFA	FAVALFA-SFA	FAYALFF-SFA	FAYALFA-SFA	—	—	FVCALFF-NFA
			GTI		—	—	—	—	FBYALUF-EFA	—	—
	For Central Europe	Sedan	LX		BAVALDF-SGA	—	—	—	—	—	BVCALDF-NGA
			SLX		BAVALFF-SGA	—	BAYALFF-SGA	BAYALFA-SGA	—	—	BVCALFF-NGA
			SLX 4WD		—	—	BAYNLFF-SGA	—	—	—	—
		3-door Hatchback	L		EAVALBF-SGA	—	—	—	—	—	—
			LX		EAVALDF-SGA	EAVALDA-SGA	—	—	—	—	EVCALDF-NGA
			SLX		EAVALFF-SGA	—	EAYALFF-SGA	EAYALFA-SGA	—	—	EVCALFF-NGA
			GTI		—	—	—	—	EBYALUF-EGA	—	—
			GTI-R		—	—	—	—	—	EBYNLRF-TGA	—
		5-door Hatchback	LX		FAVALDF-SGA	—	FAYALDF-SGA	—	—	—	FVCALDF-NGA
			SLX		FAVALFF-SGA	—	FAYALFF-SGA	FAYALFA-SGA	—	—	FVCALFF-NGA
			GTI		—	—	—	—	FBYALUF-EGA	—	—
	For North Europe	Sedan	L		BAVALBF-SSA	—	—	—	—	—	—
			LX		BAVALDF-SSA	—	BAYALDF-SSA	—	—	—	BVCALDF-NSA
			SLX		—	—	BAYALFF-SSA	BAYALFA-SSA	—	—	—
			SLX 4WD		—	—	BAYNLFF-SSA	—	—	—	—
		3-door Hatchback	L		EAVALBF-SSA	—	—	—	—	—	—
			LX		EAVALDF-SSA	EAVALDA-SSA	EAYALDF-SSA	—	—	—	—
			SLX		—	—	EAYALFF-SSA	EAYALFA-SSA	—	—	—
			GTI		—	—	—	—	EBYALUF-ESA	—	—
			GTI-R		—	—	—	—	—	EBYNLRF-TSA	—
		5-door Hatchback	LX		FAVALDF-SSA	—	FAYALDF-SSA	—	—	—	—
			SLX		—	—	FAYALFF-SSA	—	—	—	—
			GTI		—	—	—	—	FBYALUF-ESA	—	—

Model Variation (Cont'd)

Destination		Body	Engine / Transaxle / Grade	GA14DS		GA16DE	
				5-speed M/T	4-speed A/T	5-speed M/T	4-speed A/T
				RS5F30A	RL4F03A	RS5F31A	RL4F03A
Except Europe	R.H. drive	5-door Hatchback	K1	FAVAREF-SHA	FAVAREA-SHA	—	—
			J1J	—	—	FAYARGF-EHA	FAYARGA-EHA

Prefix and suffix designations:

F A Y A R G A N14 E H A

- B : 4-door Sedan
- E : 3-door Hatchback
- F : 5-door Hatchback

- AV : GA14DS engine
- AY : GA16DS or GA16DE engine
- BY : SR20DE or SR20DET engine
- VC : CD20 engine

- A : 2-wheel drive models
- N : 4-wheel drive models

- R : R.H. drive
- L : L.H. drive

- B : L
- D : LX
- E : K1
- F : SLX
- G : J1J
- R : GTI-R
- U : GTI

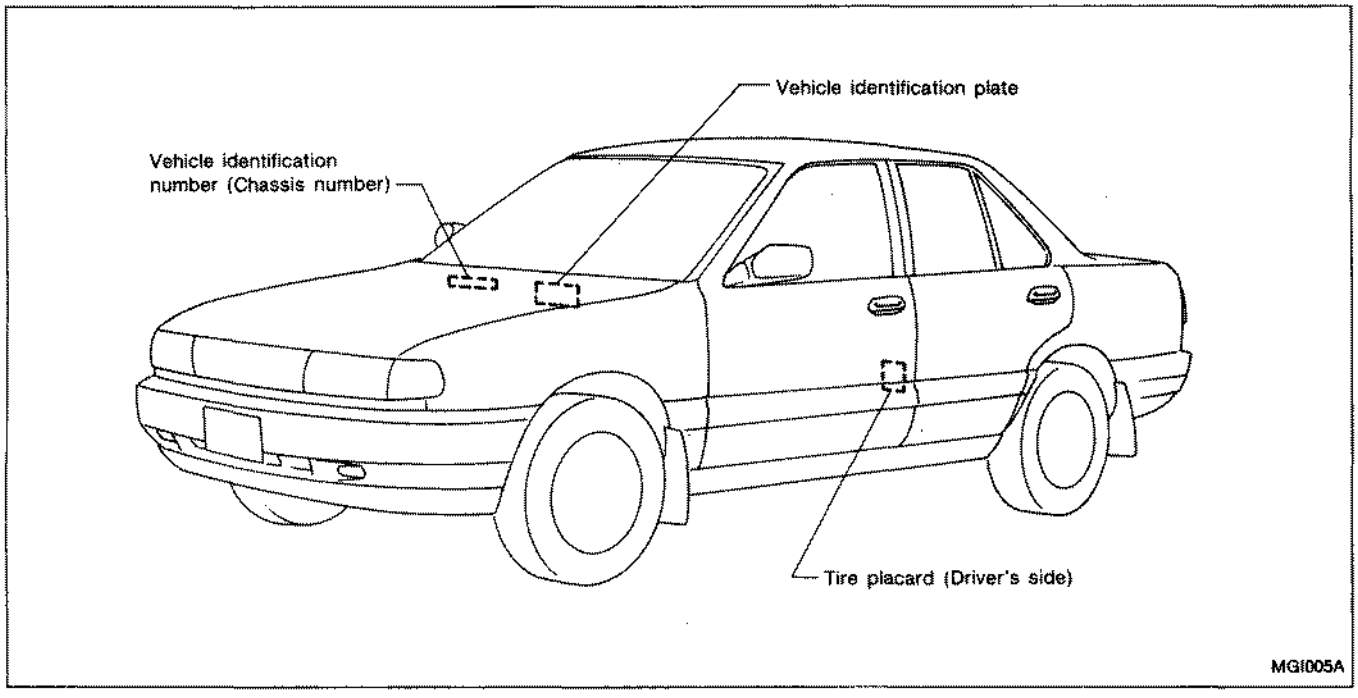
- F : 5-speed manual transaxle
- A : Automatic transaxle

- A : Standard

- H : Except for Europe
- E : R.H.D. models for Europe
- F : For South Europe
- G : For Central Europe
- S : For North Europe

- S : Carburetor engine
- E : E.F.I. engine
- N : Diesel engine
- T : Turbo engine

Identification Number



VEHICLE IDENTIFICATION NUMBER (Chassis number)

Prefix and suffix designations:

Model B13 series
(Except Europe)

B B A B13—XXXXXX

Body type
- B : Sedan
- G : Coupe
- H : T-bar roof

Engine type
- A : E10S engine
- B : GA13DS engine
- C : GA14DS engine
- E : GA16DS or GA16DE engine
- H : CD17 engine

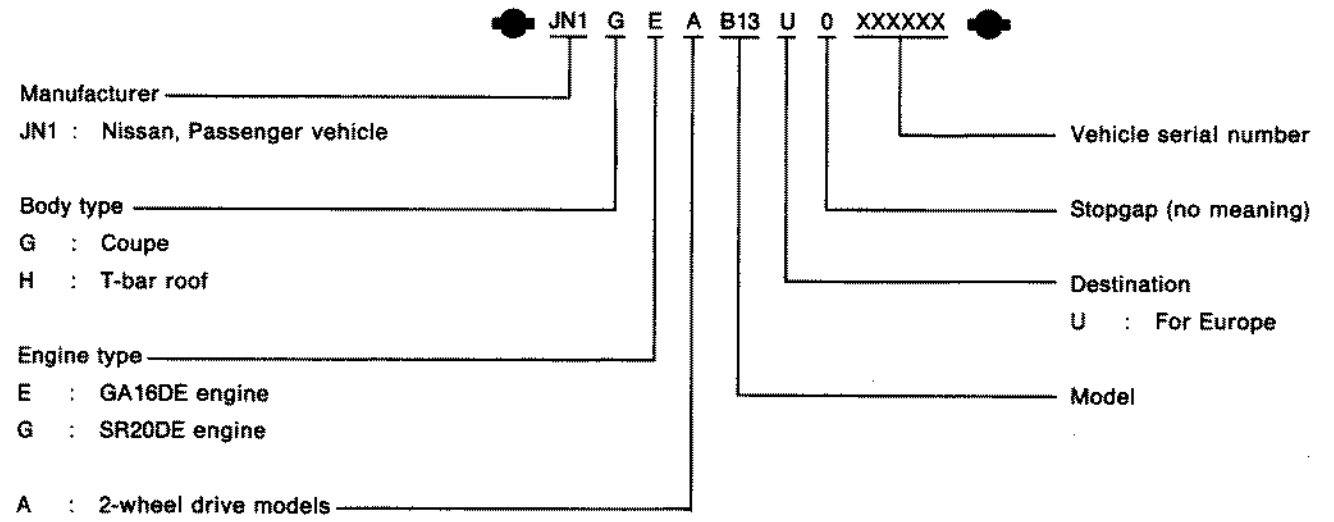
A : 2-wheel drive models

Model

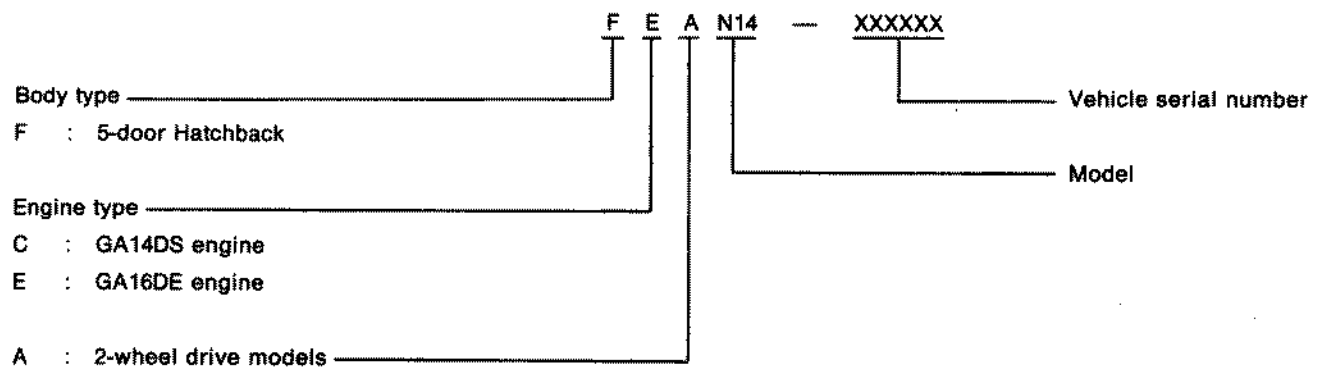
Vehicle serial number

Identification Number (Cont'd)

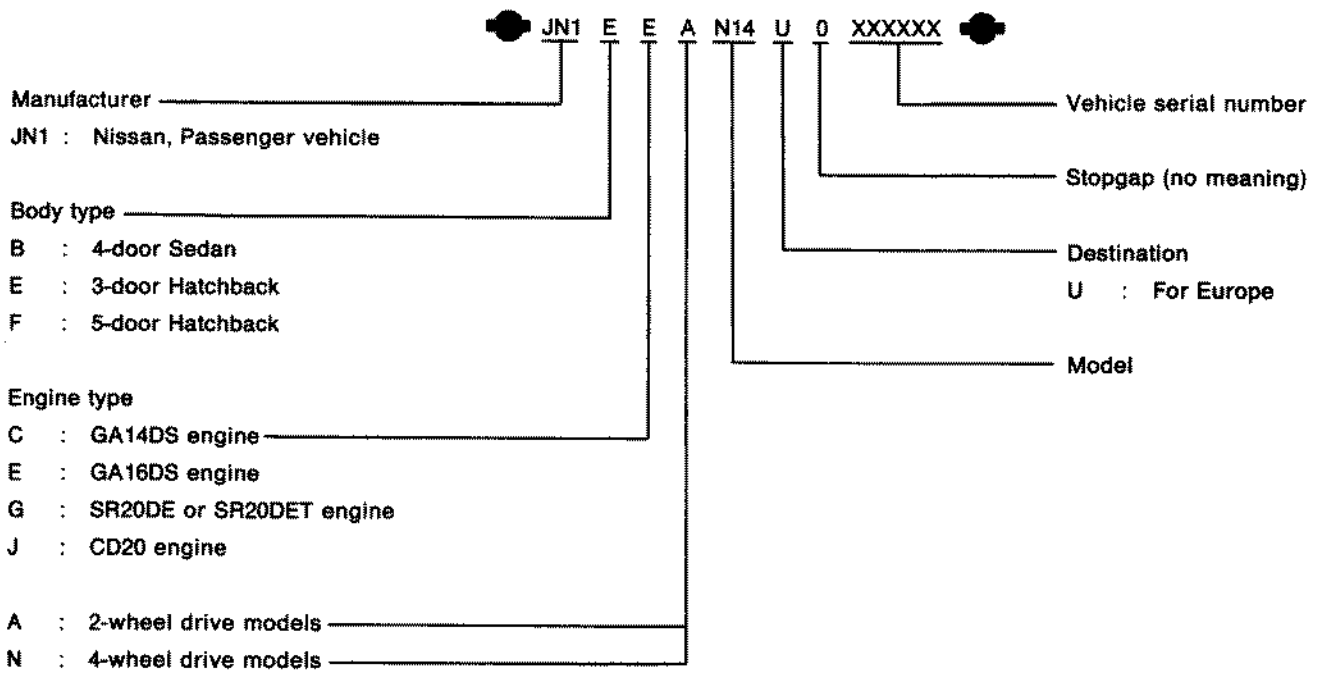
(For Europe)



Model N14 series
(Except Europe)



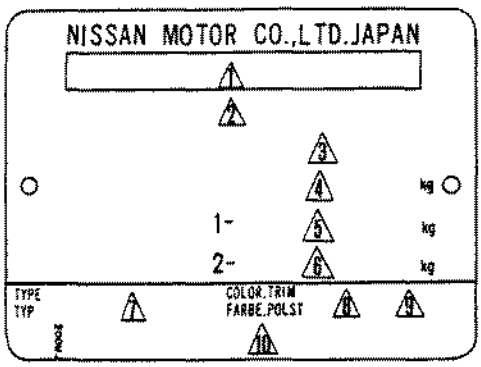
(For Europe)



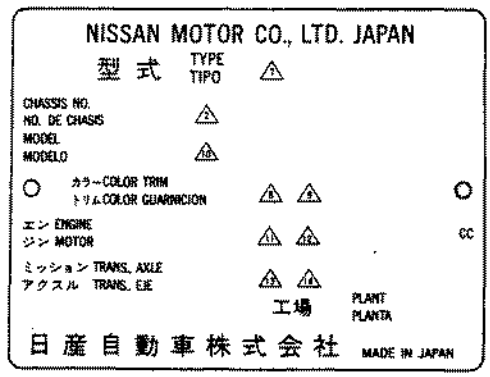
Identification Number (Cont'd)

IDENTIFICATION PLATE

Europe



Except Europe

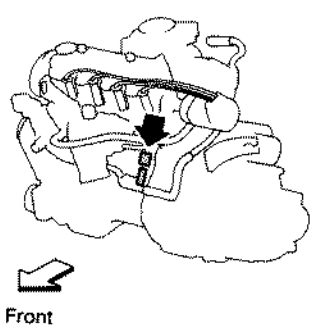


1 Type approval number
2 Vehicle identification number (Chassis number)
3 Gross vehicle weight
4 Gross combination weight
Gross vehicle weight
+ Gross trailing capacity (Weight)
5 Gross axle weight (Front)
6 Gross axle weight (Rear)
7 Type
8 Body color code
9 Trim color code
10 Model
11 Engine model
12 Engine displacement
13 Transaxle model
14 Axle model

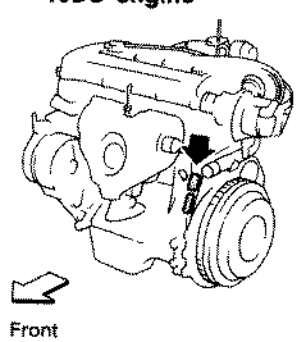
SGI704

ENGINE SERIAL NUMBER

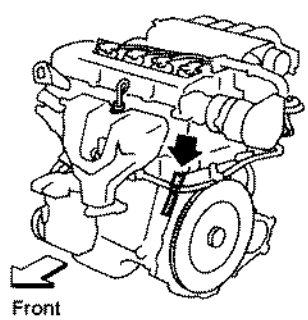
E10S engine



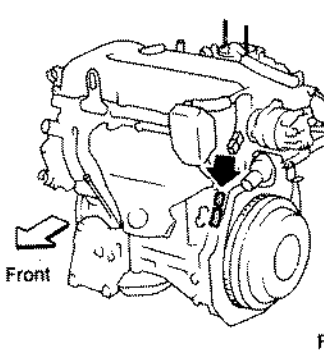
GA13DS, 14DS, 16DS engine



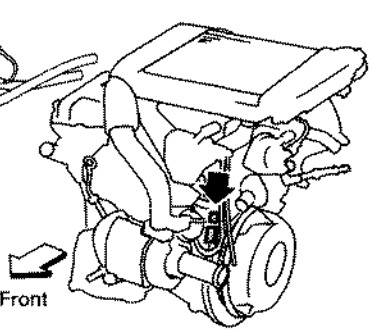
GA16DE engine



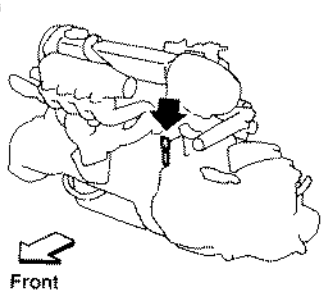
SR20DE engine



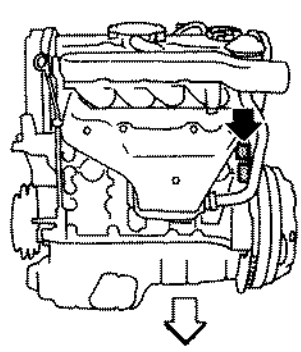
SR20DET engine



CD17 engine



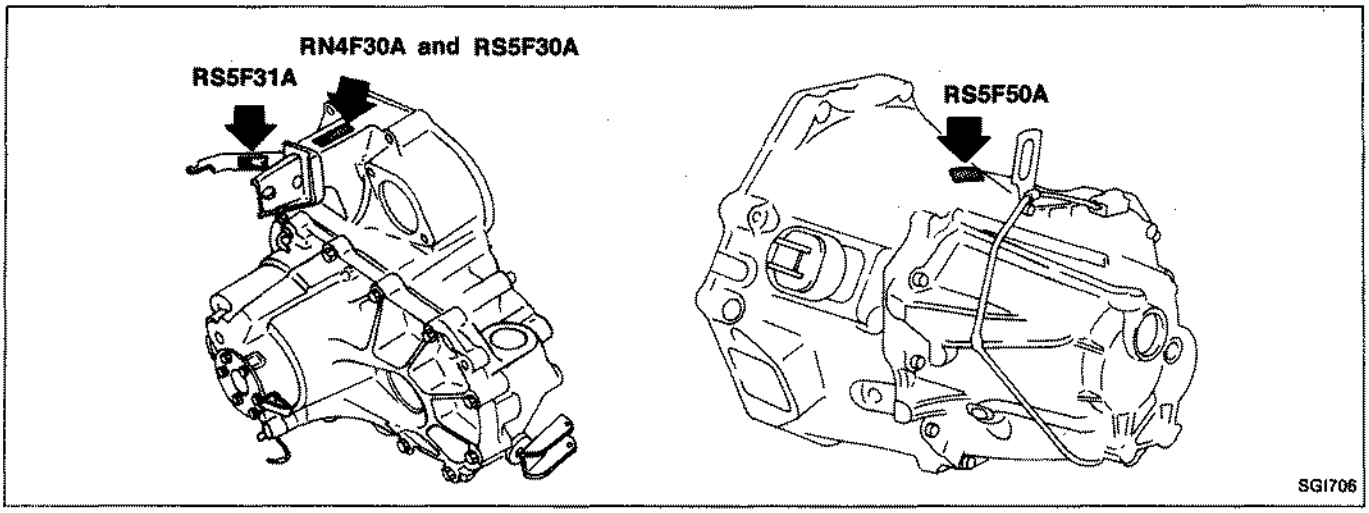
CD20 engine



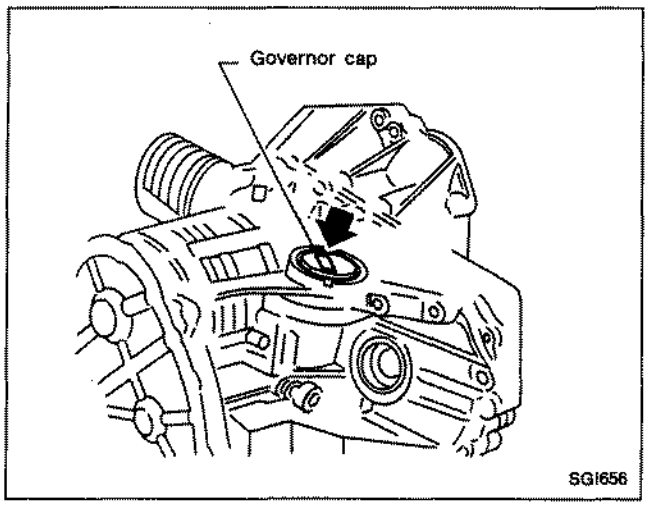
SGI705

Identification Number (Cont'd)

MANUAL TRANSAXLE NUMBER



AUTOMATIC TRANSAXLE NUMBER



Dimensions

MODEL B13 SERIES

Unit: mm (in)

	Sedan	Coupe
Overall length	4,210 (165.7)	4,140 (163.0) 4,135 (162.8)*4
Overall width	1,660 (65.4)*1 1,670 (65.7)	1,680 (66.1)
Overall height	1,375 (54.1)	1,310 (51.6) 1,315 (51.8)*2
Front tread	1,435 (56.5)*3 1,445 (56.9)	1,435 (56.5)*3 1,445 (56.9)
Rear tread	1,415 (55.7)*3 1,435 (56.5)	1,415 (55.7)*3 1,435 (56.5)
Wheelbase	2,430 (95.7)	2,430 (95.7)

*1: LE grade
*2: T-bar roof models
*3: 185/60R14 tire (Except Europe)/175/65R14 tire (For Europe)
*4: For Europe

MODEL N14 SERIES

Unit: mm (in)

	Sedan	3-door Hatchback	5-door Hatchback (For Europe)	5-door Hatchback (Except for Europe)
Overall length	4,230 (166.5)	3,975 (156.5)	4,145 (163.2)	4,145 (163.2)
Overall width	1,670 (65.7)	1,670 (65.7) 1,690 (66.5)*1	1,670 (65.7) 1,690 (66.5)*1	1,670 (65.7)
Overall height	1,395 (54.9) 1,410 (55.5)*2	1,395 (54.9) 1,410 (55.5)*2	1,395 (54.9)	1,385 (54.5)
Front tread	1,446 (56.9)*3 1,436 (56.5)*4	1,446 (56.9)*3 1,436 (56.5)*4	1,446 (56.9)*3 1,436 (56.5)*4	1,445 (56.9)
Rear tread	1,431 (56.3)*5 1,421 (55.9)*6	1,431 (56.3)*5 1,421 (55.9)*6	1,431 (56.3)*5 1,421 (55.9)*6	1,435 (56.5)
Wheelbase	2,430 (95.7)	2,430 (95.7)	2,430 (95.7)	2,430 (95.7)

*1: SR series engine models
*2: 4WD models
*3: Tire offset 40 mm (1.57 in)
*4: Tire offset 45 mm (1.77 in)
*5: 155SR13, 175/70R13 tire
*6: 175/65R14, 195/55R14 tire

Wheels and Tires

MODEL B13 SERIES

Except Europe

Wheels & tires \ Body			Coupe & T-bar roof model	Offset mm (in)	4-door sedan	Offset mm (in)
Wheel size	Steel	Standard	14 × 5-1/2JJ*8	45 (1.77)	13 × 5J	40 (1.57)
			13 × 5J*6	40 (1.57)		
		Option	—	—	14 x 5-1/2JJ*1	45 (1.77)
	Alu-minum	Option	13 × 5J*6	40 (1.57)	13 × 5J*7	40 (1.57)
			14 × 5-1/2JJ*8	45 (1.77)	14 × 5-1/2JJ*2	45 (1.77)
Tire size		Standard	185/60R14 82H*8 155/80R13 78S*6		155SR13*3 175/70R13 82S*4 6.15-13-4PR*5 155/80R13 78S*6	
		Option	175/70R13 82S*6		155SR13*5 175/70R13 82S*3,*6 185/60R14 82H*1 175/65R14 82H*1	

*1: GA16DS & GA16DE engine models
*2: Super saloon for GA16DS and GA16DE engine models
*3: Except E10S and GA16DE engine models
*4: GA16DE engine model
*5: E10S engine model
*6: For Middle East
*7: Except GA14DS engine for Middle East
*8: For General areas

For Europe

Wheels & tires \ Engine			GA16DS engine	Offset mm (in)	SR20DE engine	Offset mm (in)
Wheel size	Steel	Standard	14 × 5-1/2JJ	45 (1.77)	—	—
	Alu-minum	Standard	—	—	14 × 6JJ	40 (1.57)
		Option	14 × 5-1/2JJ	45 (1.77)	—	
	T-type	Standard	14 × 4T	40 (1.57)	15 × 4T	40 (1.57)
Tire size	Con-ven-tional	Standard	175/65R14 82H		195/55R14 82V	
	T-type	Standard	T115/70D14		T135/70D15	

Wheels and Tires (Cont'd)

MODEL N14 SERIES

Except Europe

Wheel & Tire \ Engine			GA14DS		GA16DE	
				Offset mm (in)		Offset mm (in)
Wheel size	Steel	Standard	13 x 5J	40 (1.57)	14 x 5-1/2JJ	45 (1.77)
	Aluminum	Option	—	—	14 x 5-1/2JJ	45 (1.77)
Tire size			175/70R13 82S		175/65R14 82H	

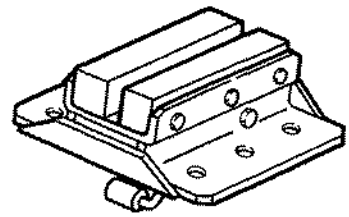
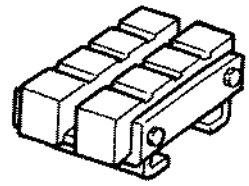
For Europe

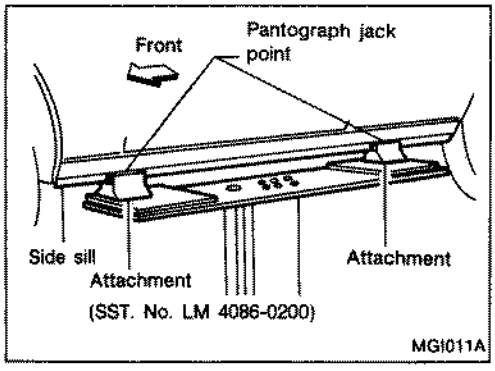
Wheel & Tire \ Engine			GA14DS		GA16DS		SR20DE		SR20DET		CD20	
				Offset mm (in)		Offset mm (in)		Offset mm (in)		Offset mm (in)		Offset mm (in)
Wheel size	Steel	Standard	13 × 5J	40 (1.57)	13 × 5J	40 (1.57)	—	—	—	—	13 × 5J	40 (1.57)
	Aluminum		—	—	—	—	14 × 6JJ	40 (1.57)	14 × 6JJ	40 (1.57)	—	—
	Steel	Option	—	—	14 × 5-1/2JJ *3	45 (1.77)	14 × 6JJ	40 (1.57)	14 × 6JJ	40 (1.57)	—	—
	Aluminum		13 × 5J *5	40 (1.57)	13 × 5J *5	40 (1.57)	—	—	—	—	13 × 5J *5	40 (1.57)
	T-type	Standard	—	—	—	—	—	—	15 × 4T	40 (1.57)	—	—
		Option	14 × 4T	40 (1.57)	14 × 4T*1 15 × 4T*2	40 (1.57) 40 (1.57)	15 × 4T	40 (1.57)	—	—	14 × 4T	40 (1.57)
Tire size	Conventional	Standard	155SR13		175/70R13 82H		195/55R14 82V		195/55R14 82V		175/70R13 82S	
		Option	175/70R13 82S*4		175/65R14 82H*3		—		—		—	
	T-type	Standard	—		—		—		T135/70D15		—	
		Option	T115/70D14		T115/70D14*1 T135/70D15*2		T135/70D15		—		T115/70D14	

*1: Except SLX 4WD
*2: SLX 4WD
*3: Except North Europe
*4: Except R.H.D. models for Europe
*5: Except Central Europe

Preparation

SPECIAL SERVICE TOOLS

Tool number Tool name	Description
LM4086-0200 Board-on lift attachment	
LM4519-0000 Safety stand attachment	



Board-on Lift

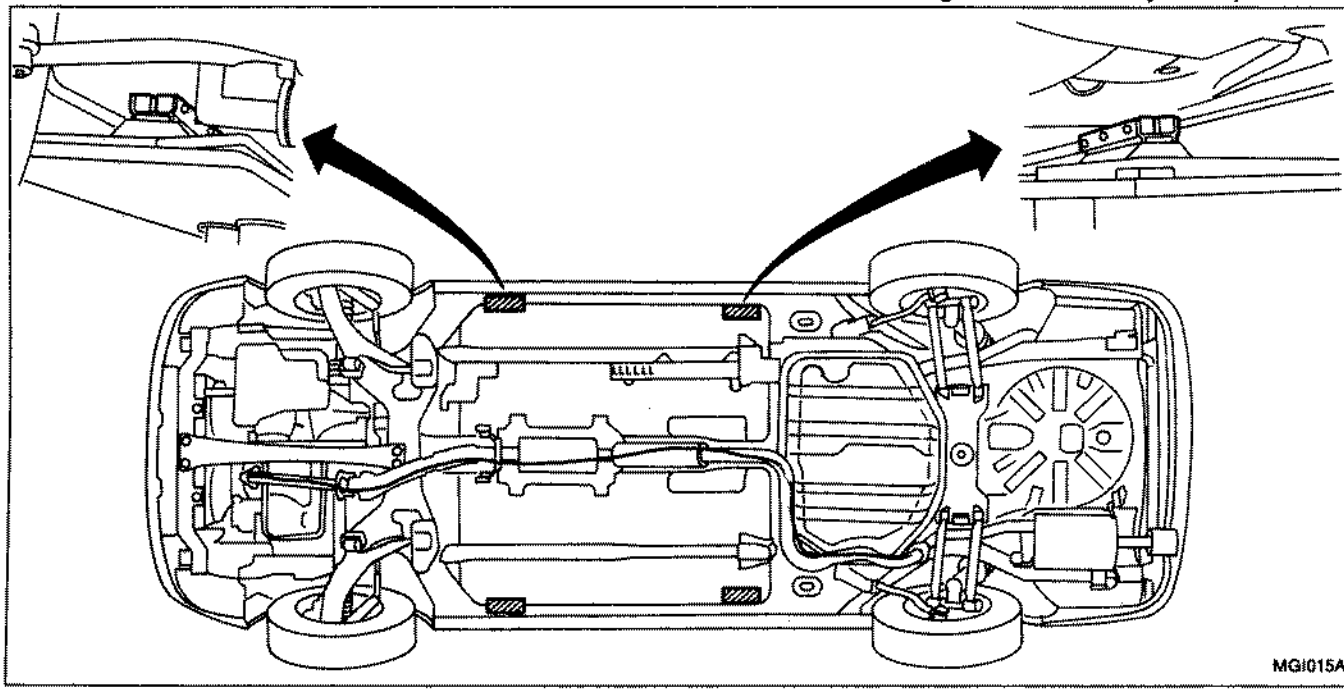
CAUTION:

Make sure vehicle is empty when lifting.

- **The board-on lift attachment (LM4086-0200) set at front end of vehicle should be set on the front of the sill under the front door opening.**
- **Position attachments at front and rear ends of board-on lift.**

Models with sill spoiler

Fix board-on lift attachments to inner side of sill when the side sill flange is covered by sill spoiler.

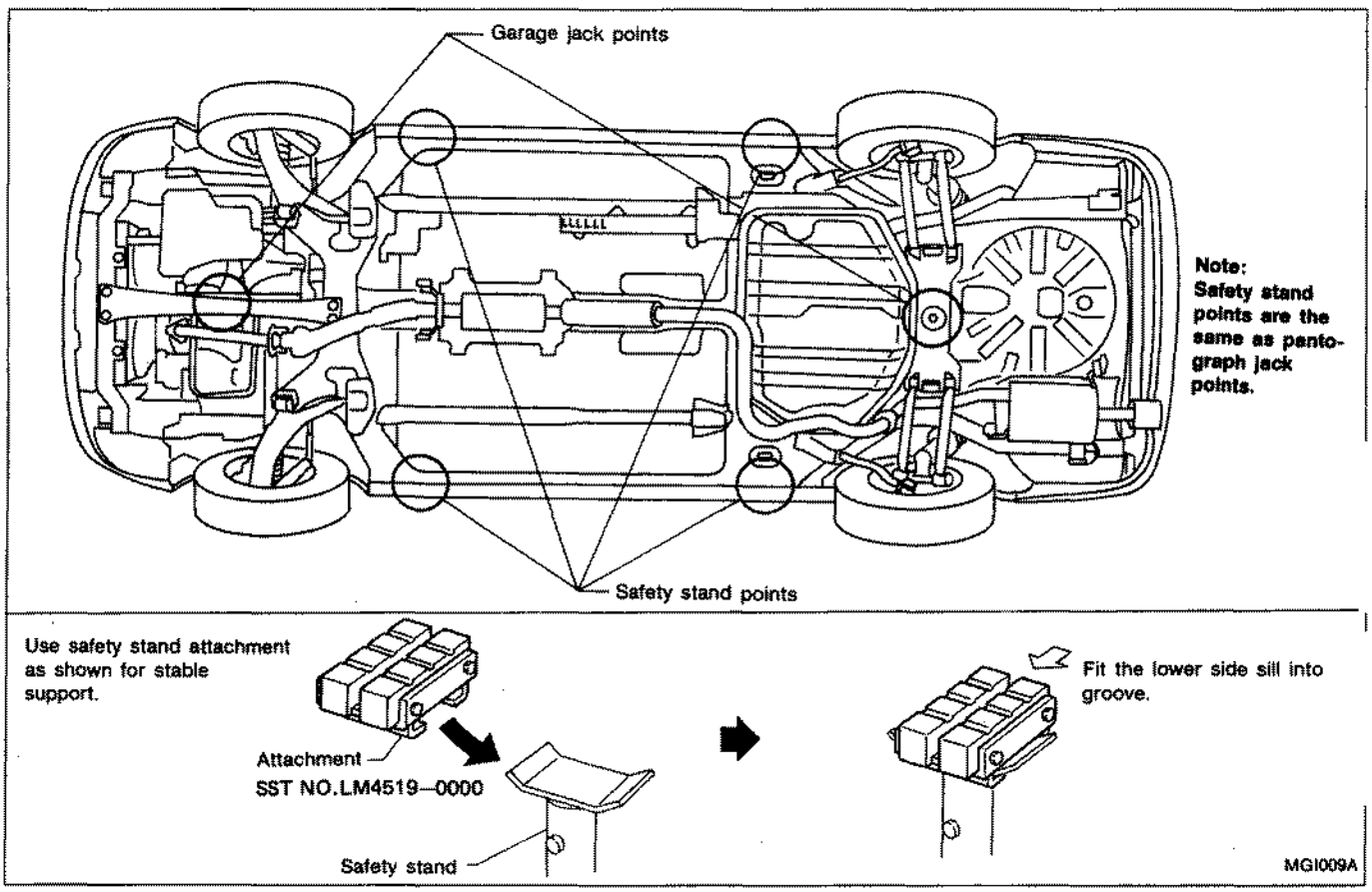


Garage Jack and Safety Stand

WARNING:

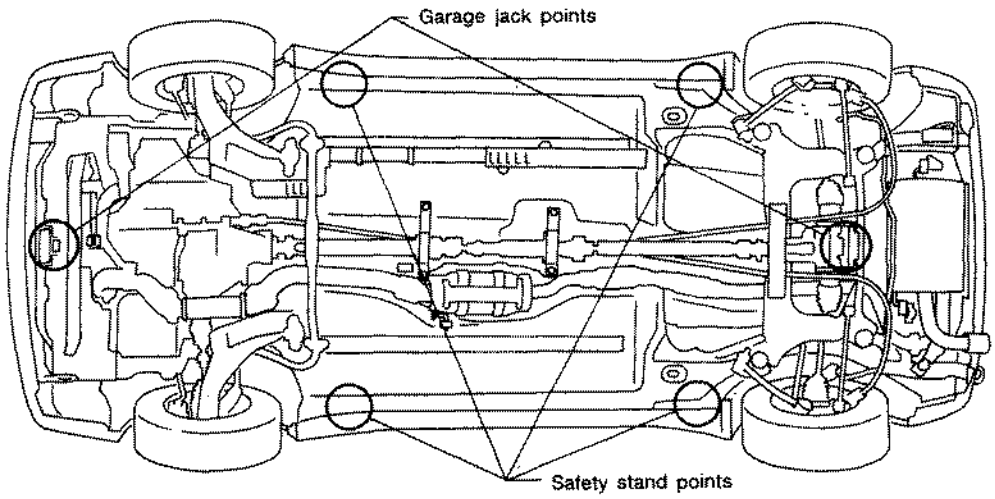
- **Never get under the vehicle while it is supported only by the jack. Always use safety stands when you have to get under the vehicle.**
- **Place wheel chocks at the front wheels when the rear wheels are raised and place wheel chocks at the rear wheels when the front wheels are raised.**

2-wheel drive models

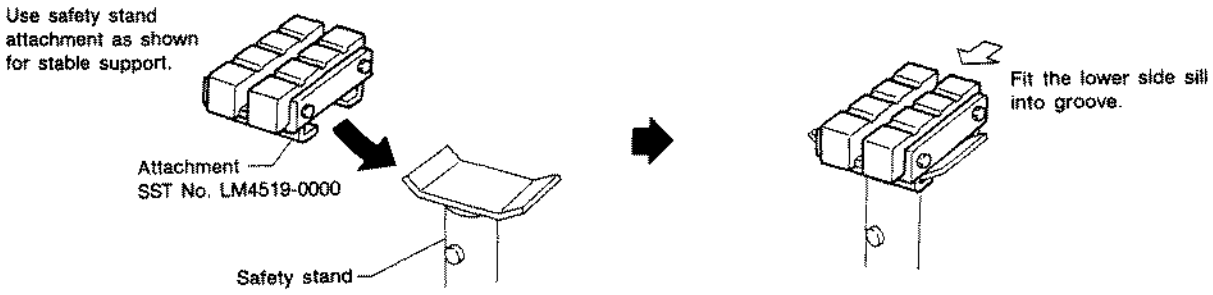


Garage Jack and Safety Stand (Cont'd)

4-wheel drive models



Note:
Safety stand points are the same as pantograph jack points.



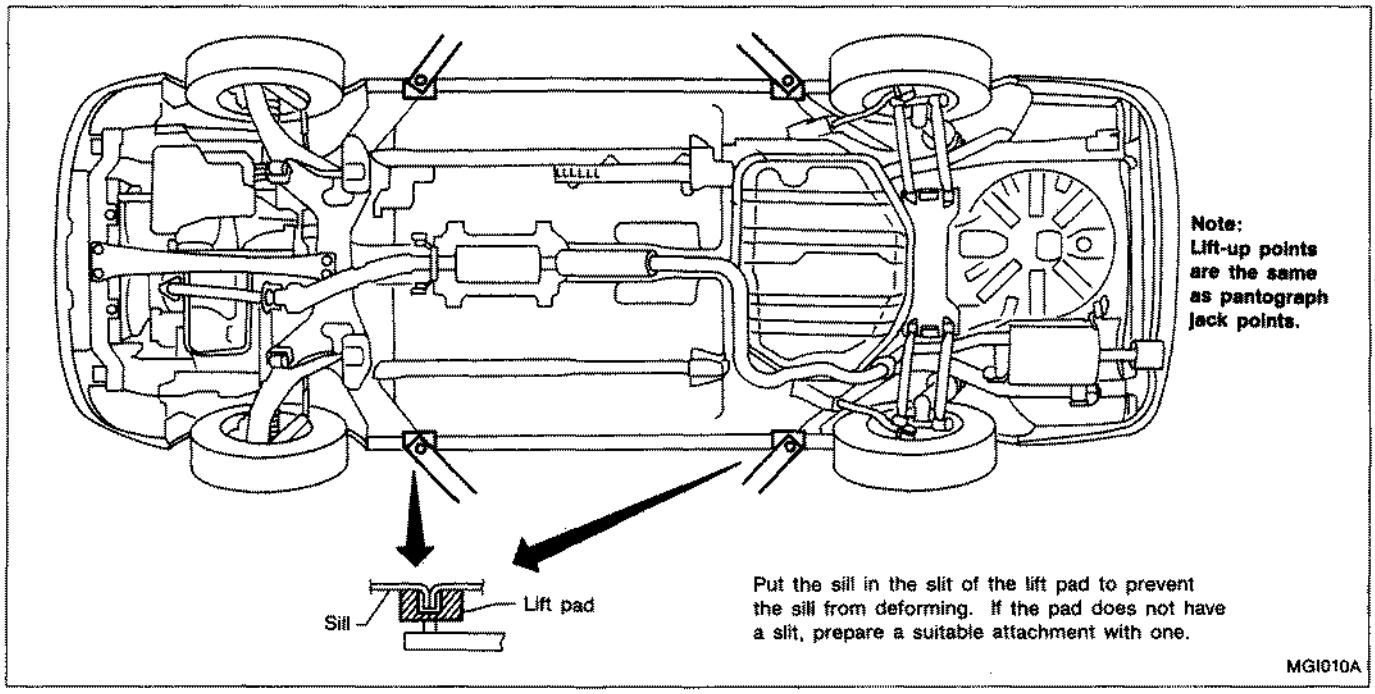
SGI707

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.

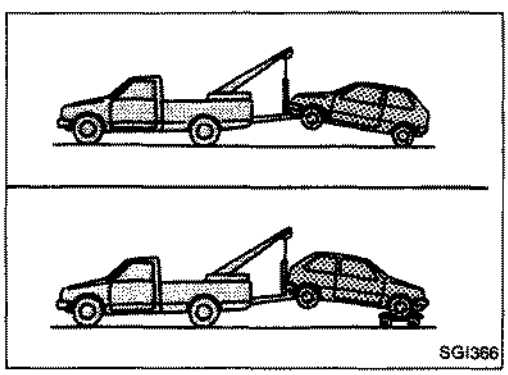
When setting the lift arm, do not allow the arm to contact the brake tubes and fuel lines.



Tow Truck Towing

CAUTION:

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



2-WHEEL DRIVE MODELS

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

Tow Truck Towing (Cont'd)

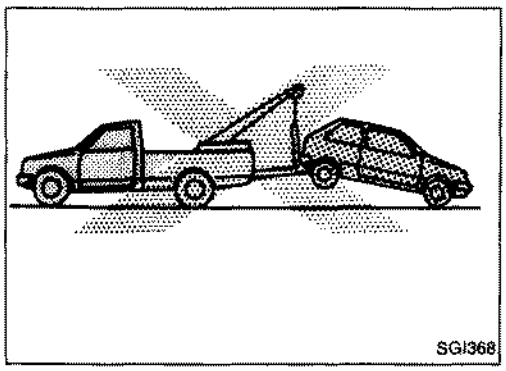
Towing an automatic transaxle model with four wheels on ground

Observe the following restricted towing speeds and distances.

Speed: Below 50 km/h (30 MPH)
Distance: Less than 65 km (40 miles)

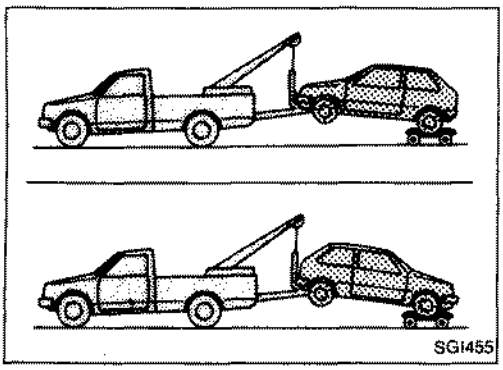
CAUTION:

Never tow an automatic transaxle model from the rear (i.e., backward) with four wheels on the ground as this may cause serious and expensive damage to the transaxle.


SGI368

Towing an automatic transaxle model with rear wheels raised (With front wheels on ground)

Never tow an automatic transaxle model with rear wheels raised (with front wheels on ground) as this may cause serious and expensive damage to the transaxle. If it is necessary to tow it with rear wheels raised, always use a towing dolly under the front wheels.


SGI455

4-WHEEL DRIVE MODELS

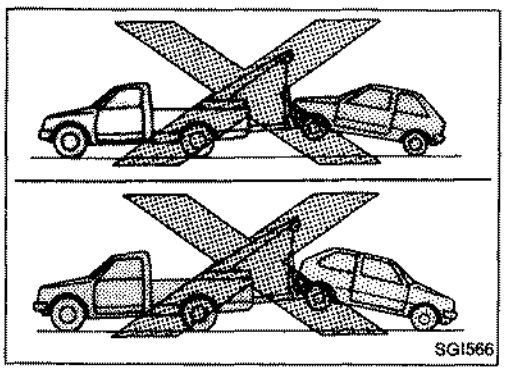
NISSAN recommends that the 4-wheel drive vehicle be towed with all wheels off the ground as follows:

1. Using a flat-bed truck.
2. Using a combination of a two truck and a dolly as illustrated.

Towing with four 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)

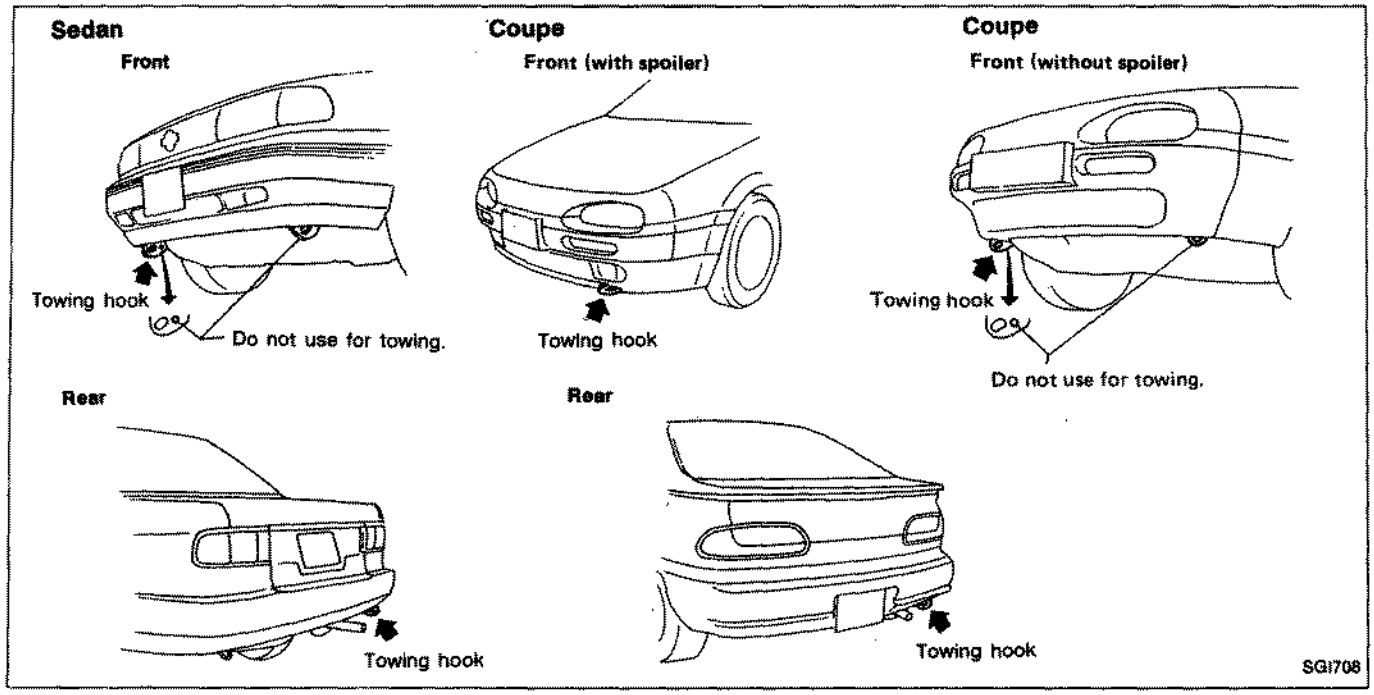

SGI566

Towing a 4-wheel drive model with front or rear wheels raised (With rear or front wheels on the ground)

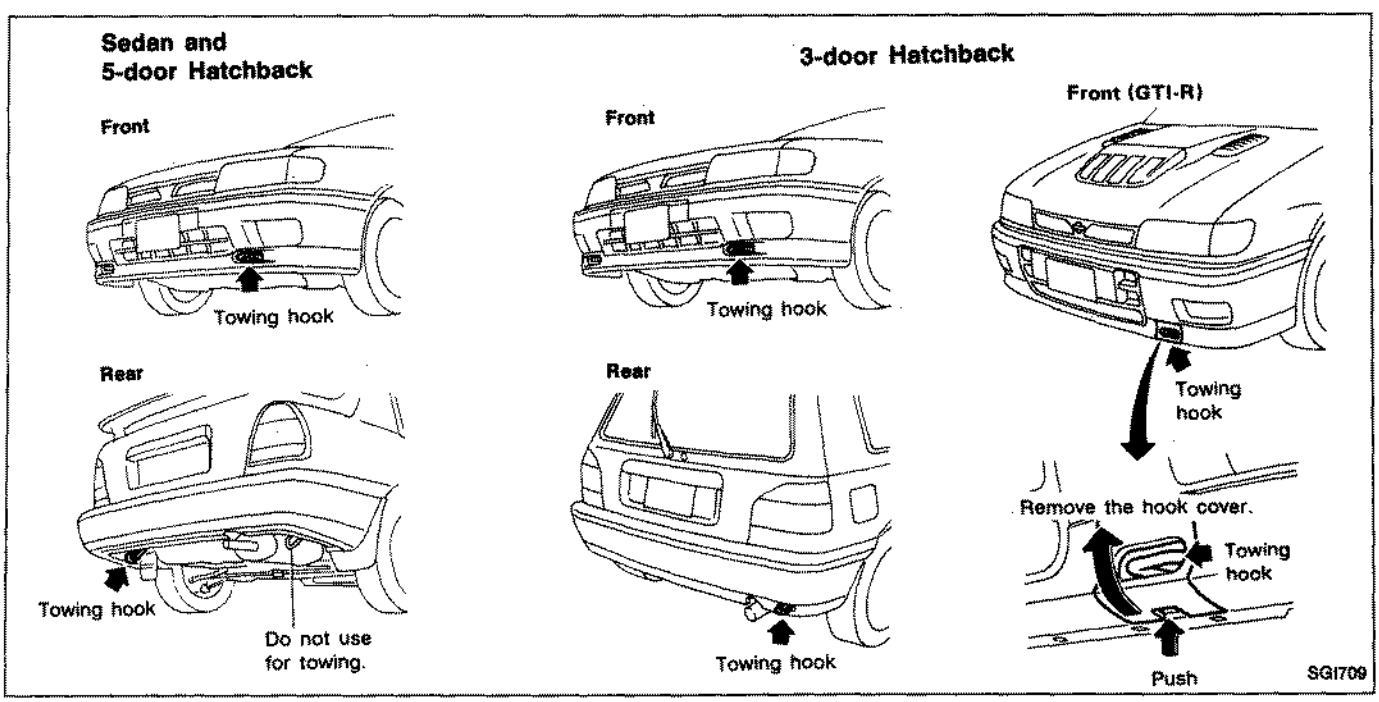
Never tow a 4-wheel drive model with front or rear wheels raised and rear or front wheels on the ground as this may cause serious and expensive damage to the transaxle. If it is necessary to tow the vehicle with the front or rear wheels raised, always use a towing dolly under the rear or front wheels.

Tow Truck Towing (Cont'd)

Model B13 series



Model N14 series



TOWING POINTS

Always pull the cable straight out from the vehicle. Never pull on the hook at a sideways angle.

CAUTION:

a. When doing on-the-car wheel balancing with a full-time 4WD vehicle, to prevent the wheels from rotating at different speeds or in different directions from each other (which could lead to damage to transaxle gear), always be sure to observe the following precautions:

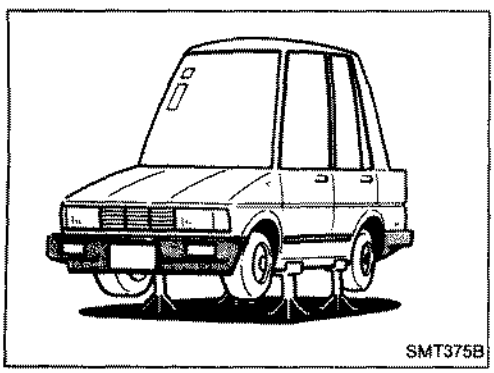
1) All four wheels should be jacked up, clearing the ground completely.

2) The wheels should be rotated with both the engine and the wheel balancer engaged.

3) The parking brake lever should be fully released.

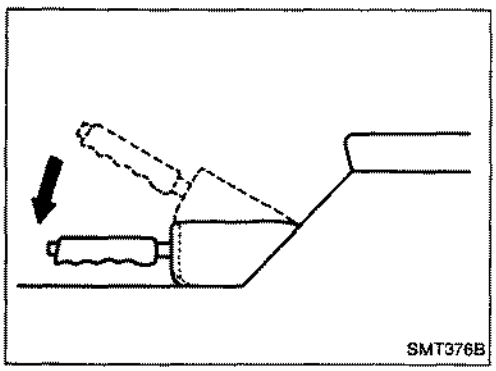
4) None of the brakes should be allowed to drag.

b. Avoid sudden acceleration, deceleration and braking.

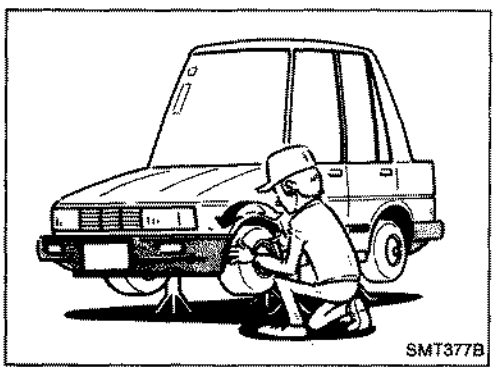

SMT375B

1. Jack up vehicle so that all four wheels can rotate.

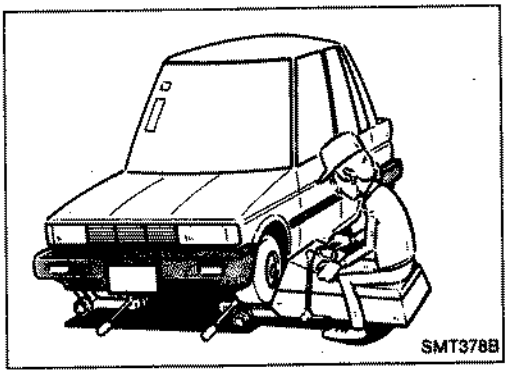
Make sure the vehicle is firmly supported on stands.


SMT376B

2. Release parking brake fully.


SMT377B

3. Make sure that brakes are not dragging on any of four wheels.


SMT378B

4. Place wheel to be balanced on wheel balancer.
   Follow the procedure specified by the wheel balancer manufacturer.

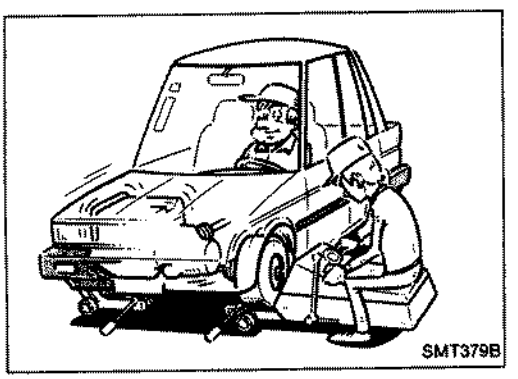
5. Start engine
6.

— M/T MODEL —

Put shift lever in 3rd or 4th gear and engage clutch slowly, then gradually increase speed to test speed.

— A/T MODEL —

Put shift lever into "D" position, then gradually increase speed to test speed.


SMT379B

7. Rotate wheels using both engine's driving force and wheel balancer driving force and check wheel balance.

Assure that the other wheels will rotate at the same time.

TIGHTENING TORQUE OF STANDARD BOLTS

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

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

Grade	Mark
4T	4
7T	7
9T	9

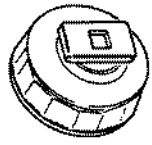
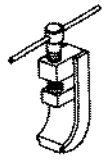
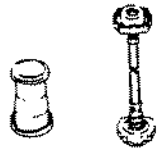
*: Nominal diameter

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

SECTION MA

CONTENTS

SPECIAL SERVICE TOOL

Tool number Tool name	Description	Engine application			
		GA	SR	E	CD
KV10115800 Oil filter cap wrench 65 mm (2.56 in) dia.	 SMA327C	—	X	—	—
KV10105900 Oil filter cap wrench		X	—	X	X
KV11102600 Lifter plate replacer		—	—	—	X
EG17650301 Radiator cap tester adapter		X	X	X	X

PRE-DELIVERY INSPECTION ITEMS

Shown below are Pre-delivery Inspection Items required for the new vehicle. It is recommended that necessary items other than those listed here be added, paying due regard to the conditions in each country.

Perform applicable items on each model. Consult text of this section for specifications.

UNDER HOOD — engine off

- ☐ Radiator coolant level and coolant hose connections for leaks
- ☐ Battery fluid level, specific gravity and conditions of battery terminals
- ☐ Drive belts tension
- ☐ Fuel filter for water or dusts, and fuel lines and connections for leaks
- ☐ Engine oil level and oil leaks
- ☐ Clutch and brake reservoir fluid level and fluid lines for leaks
- ☐ Windshield and rear window washer and headlamp cleaner reservoir fluid level
- ☐ Power steering reservoir fluid level and hose connections for leaks

ON INSIDE AND OUTSIDE

- ☐ Remove front spring/strut spacer (If applicable)
- ☐ Operation of all instruments, gauges, lights and accessories
- ☐ Operation of horn(s), wiper and washer
- ☐ Steering lock for operation
- ☐ Check air conditioner for gas leaks
- ☐ Front and rear seats, and seat belts for operation
- ☐ All moldings, trims and fittings for fit and alignment
- ☐ All windows for operation and alignment
- ☐ Hood, trunk lid, door panels for fit and alignment
- ☐ Latches, keys and locks for operation
- ☐ Weatherstrips for adhesion and fit
- ☐ Headlamp aiming
- ☐ Tighten wheel nuts (Inc. inner nuts if applicable)
- ☐ Tire pressure (Inc. spare tire)
- ☐ Check front wheels for toe-in
- ☐ Install clock/voltmeter/room lamp fuse (If applicable)
- ☒ Install deodorizing filter to air purifier (If applicable)
- ☒ Remove wiper blade protectors (If applicable)

UNDER BODY

- ☐ Manual transmission/transaxle, transfer and differential gear oil level
- ☐ Brake and fuel lines and oil/fluid reservoirs for leaks
- ☐ Tighten bolts and nuts of steering linkage and gear box, suspension, propeller shafts and drive shafts
- ☒ Tighten rear body bolts and nuts (Models with wooden bed only)

ROAD TEST

- ☐ Clutch operation
- ☐ Parking brake operation
- ☐ Service brake operation
- ☐ Automatic transmission/transaxle shift timing and kickdown
- ☐ Steering control and returnability
- ☐ Engine performance
- ☐ Squeaks and rattles

ENGINE OPERATING AND HOT

- ☐ Adjust idle mixture and speed (and ignition timing*1)
- ☐ Automatic transmission/transaxle fluid level
- ☒ Engine idling and stop knob operation (Diesel only)

FINAL INSPECTION

- ☐ Install necessary parts (outside mirror, wheel covers, seat belts, mat, carpet or mud flaps)
- ☐ Inspect for interior and exterior metal and paint damage
- ☐ Check for spare tire, jack, tools (wheel chock), and literature
- ☐ Wash, clean interior and exterior

*1: Not required on models with a direct ignition system

☒: Not applicable to this model.

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.

Item	Reference pages
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.	—
Windshield wiper blades Check for cracks or wear if they do not wipe properly.	—
Doors and engine hood Check that all doors , the engine hood, the trunk lid and back door operate properly. Also ensure that all latches lock securely. Lubricate hinges, latches, rollers and links if necessary. Make sure that the secondary latch keeps the hood from opening when the primary latch is released. When driving in areas using road salt or other corrosive materials, check for lubrication frequently.	MA-66
Tire rotation Tires should be rotated every 10,000 km (6,000 miles).	MA-64
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.	—
Steering wheel Check for change in the steering conditions, such as excessive free play, hard steering or strange noises. **Free play: Less than 35 mm (1.38 in)**	—
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-19, 30, 40, 53
Engine oil level Check the level after parking the vehicle on a level spot and turning off the engine.	MA-22, 33, 42, 55
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-58, 61
Battery Check the fluid level in each cell. It should be between the "MAX" and "MIN" lines.	—

PERIODIC MAINTENANCE (Except for Europe)

The following tables show the normal maintenance schedule. Depending upon weather and atmospheric conditions, varying road surfaces, individual driving habits and vehicle usage, additional or more frequent maintenance may be required.

Periodic maintenance beyond the last period shown on the tables requires similar maintenance.

MAINTENANCE OPERATION		MAINTENANCE INTERVAL [0016]									Reference page		
Perform either at number of kilometers (miles) or months, whichever comes first.	km x 1,000	1	10	20	30	40	50	60	70	80			
	(Miles x 1,000)	(0.6)	(6)	(12)	(18)	(24)	(30)	(36)	(42)	(48)			
	Months	—	6	12	18	24	30	36	42	48			
ENGINE AND EMISSION CONTROL MAINTENANCE	**Underhood and under vehicle**											GA	E	CD
Torque check manifolds & exhaust tube nuts & carburetor fixing nuts		X									MA	16	38	50
Adjust intake & exhaust valve clearance	GA series engines*1			X		X		X		X	EM	46	—	—
	Except above	X		X		X		X		X	MA	—	38	50
Check drive belts for cracks, fraying, wear & tension		X		X		X		X		X	MA	17	39	51
Change engine anti-freeze coolant (Ethylene glycol base)						X				X	MA	18	39	52
Change engine coolant (Soft water)			X	X	X	X	X	X	X	X	MA	18	39	52
Check cooling system				X		X		X		X	MA	19	41	53
Check fuel lines						X				X	MA	20	41	54
Clean & replace air cleaner filter (Dry paper type)	Clean★		X	X	X		X	X	X		MA	21	41	54
	Replace★					X				X	MA	21	41	54
Replace air cleaner filter (Viscous paper type)★						X				X	MA	21	41	54
GASOLINE ENGINE: Change engine oil (Use API SE, SF or SG oil.)★			X	X	X	X	X	X	X	X	MA	22	42	—
GASOLINE ENGINE: Change engine oil filter			X	X	X	X	X	X	X	X	MA	23	42	—
GASOLINE ENGINE: Check & adjust carburetor idle rpm & mixture ratio (Check mixture ratio only on models bound for areas affected by emission regulations.)		X	X	X	X	X	X	X	X	X	MA	*2	43	—
GASOLINE ENGINE: Replace fuel filter★						X				X	MA	20	47	—
GASOLINE ENGINE: Adjust ignition timing			X	X	X	X	X	X	X	X	MA	*2	43	—
GASOLINE ENGINE: Check & replace spark plugs	Check		X		X		X		X		MA	23	47	—
	Replace			X		X		X		X	MA	23	47	—
GASOLINE ENGINE: Check ignition wires						X				X	MA	24	48	—
GASOLINE ENGINE: Check positive crankcase ventilation (P.C.V.) system				X		X		X		X	MA	24	48	—
GASOLINE ENGINE: Replace P.C.V. filter★						X				X	MA	25	49	—
GASOLINE ENGINE: Check automatic temperature control air cleaner				X		X		X		X	MA	25	48	—
GASOLINE ENGINE: Check vacuum hoses & connections				X		X		X		X	MA	25	49	—
GASOLINE ENGINE: Check vapor lines (Hoses, connections, etc.) (Gulf standard models only)						X				X	MA	26	—	—
GASOLINE ENGINE: Replace timing belt (Except GA series engines)					Every 100,000 km (60,000 miles)						EM	—	161	—
DIESEL ENGINE: Check fuel filter, drain water & replace	Check & drain water		X	X	X		X	X	X		MA	—	—	54
	Replace★					X				X	MA	—	—	54
DIESEL ENGINE: Change engine oil (Use API CC or CD oil.)★					Every 5,000 km (3,000 miles) or 3 months						MA	—	—	55
DIESEL ENGINE: Change oil filter★			X	X	X	X	X	X	X	X	MA	—	—	55
DIESEL ENGINE: Check nozzles					See NOTE (1).						MA	—	—	56
DIESEL ENGINE: Check idling speed		X		X		X		X		X	MA	—	—	57
DIESEL ENGINE: Replace timing belts for camshaft and injection pump					Every 100,000 km (60,000 miles)						EM	—	—	203

NOTE: (1) If engine power decreases, black exhaust smoke is emitted or engine noise increases, check and, if necessary, adjust the fuel injection nozzle's starting pressure and the fuel spray pattern.

(2) Maintenance items with "★" should be performed more frequently according to "Maintenance under severe driving conditions".

Check: Check. Correct or replace if necessary.

*1: In models for Hong Kong and Singapore, periodic maintenance is not required. However, if valve noise increases, check valve clearance.

*2: Refer to page EF & EC-160.

MAINTENANCE OPERATION		MAINTENANCE INTERVAL									Reference page
Perform either at number of kilometers (miles) or months, whichever comes first.	km x 1,000	1	10	20	30	40	50	60	70	80	
	(Miles x 1,000)	(0.6)	(6)	(12)	(18)	(24)	(30)	(36)	(42)	(48)	
	Months	—	6	12	18	24	30	36	42	48	
CHASSIS AND BODY	**Underhood and under vehicle**										
Check brake & automatic transaxle fluid level & leaks★			X	X	X	X	X	X	X	X	MA-59, 61
Change brake fluid★						X				X	MA-62
Check brake booster vacuum hoses, connections & check valve						X				X	MA-62
Check power steering fluid & lines			X	X	X	X	X	X	X	X	MA-65
Check brake, clutch & exhaust systems for proper attachment, leaks, cracks, chafing, abrasion, deterioration, etc.			X	X	X	X	X	X	X	X	MA-58, 62
Check oil level in manual transaxle★			X	X	X	X	X	X	X	X	MA-40
Check steering gear & linkage, axle & suspension parts, drive shafts for damaged, loose & missing parts & lubrication★		X		X		X		X		X	MA-65, FA-6, 9, RA-4
	Outside and inside										
Check wheel alignment. If necessary, rotate & balance wheels				X		X		X		X	MA-64 FA-7
Check brake pads, discs & other brake components for wear, deterioration & leaks★			X	X	X	X	X	X	X	X	MA-62
Check brake linings, drums & other brake components for wear, deterioration & leaks★				X		X		X		X	MA-63
Lubricate locks, hinges & hood latch★			X	X	X	X	X	X	X	X	MA-66
Check seat belts, buckles, retractors, anchors & adjuster				X		X		X		X	MA-66
Check foot brake, parking brake & clutch for free play, stroke & operation			X	X	X	X	X	X	X	X	BR-13, 48, CL-5

NOTE: Maintenance items with "★" should be performed more frequently according to "Maintenance under severe driving conditions".

Check: Check. 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 must be performed on the following items as shown in the table.

Severe driving conditions

A — Driving under dusty conditions
B — Driving repeatedly short distances
C — Towing a trailer or caravan
D — Extensive idling
E — Driving in extremely adverse weather conditions or in areas where ambient temperatures are either extremely low or extremely high
F — Driving in high humidity areas or in mountainous areas
G — Driving in areas using salt or other corrosive materials
H — Driving on rough and/or muddy roads or in the desert
I — Driving with frequent use of braking or in mountainous areas

Driving condition	Maintenance item	Maintenance operation	Maintenance interval	Reference page			
					GA	E	CD
A	Air cleaner filter						
	Dry paper type	Clean	More frequently	MA	21	41	54
	All types	Replace		MA	21	41	54
	P.C.V. filter	Replace		MA	25	49	—
A B C D	Engine oil						
	Gasoline engine	Replace	Every 5,000 km (3,000 miles) or 3 months	MA	22	42	—
	Diesel engine	Replace	More frequently	MA	—	—	55
A B C D	Engine oil filter	Replace	Every 5,000 km (3,000 miles) or 3 months	MA	23	42	55
A E	Fuel filter	Replace	Every 20,000 km (12,000 miles) or 12 months	MA	20	47	54
F	Brake fluid	Replace		MA-62			
C H	Automatic & manual transaxle oil	Replace	Every 40,000 km (24,000 miles) or 24 months	MA-59, 60			
G H	Steering gear & linkage, axle & suspension parts & drive shafts	Check	Every 10,000 km (6,000 miles) or 6 months	MA-65 FA-6, 9 RA-4			
A C G H I	Brake pads, discs & other brake components	Check	Every 5,000 km (3,000 miles) or 3 months	MA-62			
A C G H I	Brake linings, drums & other brake components	Check	Every 10,000 km (6,000 miles) or 6 months	MA-63			
G	Lock, hinges & hood latch	Lubricate	Every 5,000 km (3,000 miles) or 3 months	MA-66			

Maintenance operation: Check = Check. Correct or replace if necessary.

The following tables show the normal maintenance schedule. Depending upon weather and atmospheric conditions, varying road surfaces, individual driving habits and vehicle usage, additional or more frequent maintenance may be required.

Periodic maintenance beyond the last period shown on the tables requires similar maintenance.

Engine Oil Service (Gasoline engine)

MAINTENANCE OPERATION		MAINTENANCE INTERVAL								Reference page	
Perform at the specified time, but at the specified mileage, when driving more than 10,000 km (6,000 miles) a year.	Months	12	24	36	48	60	72	84	96	SR series	GA series
	km x 1,000	10	20	30	40	50	60	70	80		
	(Miles x 1,000)	(6)	(12)	(18)	(24)	(30)	(36)	(42)	(48)		
Underhood and under vehicle											
Change engine oil (Use API SF or SG only for non-turbo engines/API SG only for turbo engines)★		X	X	X	X	X	X	X	X	MA-33	MA-22
Change engine oil filter★	See NOTE (1).	X	X	X	X	X	X	X	X	MA-33	MA-23

NOTE: (1) Use Nissan PREMIUM type or equivalent for GA series engines.
(2) Maintenance items with "★" should be performed more frequently according to "Maintenance Under Severe Driving Conditions".

Engine Oil Service (Diesel engine)

MAINTENANCE OPERATION		MAINTENANCE INTERVAL								Reference page
Perform at the specified time, but at the specified mileage, when driving more than 10,000 km (6,000 miles) in half a year.	Months	6	12	18	24	30	36	42	48	
	km x 1,000	10	20	30	40	50	60	70	80	
	(Miles x 1,000)	(6)	(12)	(18)	(24)	(30)	(36)	(42)	(48)	
Underhood and under vehicle										
Change engine oil (Use API CD only)★		X	X	X	X	X	X	X	X	MA-54
Change engine oil filter★	See NOTE (1).	X	X	X	X	X	X	X	X	MA-55
Check drive belts for tension		X	(At the first oil change only)							MA-51

NOTE: (1) Use dual element type (Part No. 15208-40L00) for engines with E.G.R. system.
(2) Maintenance items with "★" should be performed more frequently according to "Maintenance Under Severe Driving Conditions".

Check: Check. Correct or replace if necessary.

Standard Service

MAINTENANCE OPERATION			MAINTENANCE INTERVAL				Reference page		
Perform the standard service on a yearly basis, but on a mileage basis when driving more than 20,000 km (12,000 miles) a year.		Months	12	24	36	48	SR series	GA series	CD series
		km x 1,000	20	40	60	80			
		(Miles x 1,000)	(12)	(24)	(36)	(48)			
ENGINE		**Underhood and under vehicle**							
Check drive belts for cracks, fraying, wear & tension			X*1	X	X*1	X	MA-28	MA-17	MA-51
Change engine anti-freeze coolant (Ethylene glycol base)				X		X	MA-29	MA-18	MA-52
Check cooling system			X	X	X	X	MA-30	MA-19	MA-53
Check fuel lines				X		X	MA-31	MA-20	MA-54
Replace air cleaner filter (Viscous paper type)★				X		X	MA-32	MA-21	MA-54
Check & adjust (carburetor idle rpm *4) & (mixture ratio *2)			X	X	X	X	EF & EC-389	EF & EC-153	—
Replace fuel filter★				X		X	MA-31	MA-20	—
Replace spark plugs	Non-turbo engines	See NOTE (1).	X*2	X	X*2	X	MA-34	MA-23	—
	Turbo engines (Use PLATINUM-TIPPED type)		Every 100,000 km (60,000 miles)				MA-35	—	—
Check ignition wires		See NOTE (2).	X	X	X	X	MA-35	MA-24	—
Check positive crankcase ventilation (P.C.V.) system*2			X	X	X	X	MA-36	MA-24	—
Replace P.C.V. filter ★				X		X	—	MA-25	—
Check automatic temperature control air cleaner			X*2	X	X*2	X	—	MA-25	—
Check vacuum hoses & connections *2			X	X	X	X	MA-36	MA-25	—
Check exhaust gas sensor (Except for Sweden)*3				X		X	MA-37	MA-27	—
Check vapor lines*3		See NOTE (2).		X		X	MA-36	MA-26	—
Adjust intake & exhaust valve clearance	*4	See NOTE (3).					—	EM-46	—
	Turbo engines		X	X	X	X	EM-124	—	—
Replace fuel filter★					X		—	—	MA-54
Check nozzle		See NOTE (4).					—	—	MA-56
Check idling speed			X	X	X	X	—	—	MA-57
Replace timing belts for camshaft and injection pump			Every 100,000 km (60,000 miles)				—	—	EM-161
CHASSIS AND BODY		**Underhood and under vehicle**							
Check brake, clutch & automatic transaxle fluid level & leaks★			X	X	X	X	MA-58, 59, 61		
Change brake fluid★				X		X	MA-62		
Check brake booster vacuum hoses, connections & check valve				X		X	MA-62		
Check power steering fluid & lines			X	X	X	X	MA-55		
Check brake & clutch system for proper attachment, leaks, cracks, chafing, abrasion, deterioration, etc.			X	X	X	X	MA-58, 62		
Check oil level in manual transaxle★			X	X	X	X	MA-58		
Check oil level in transfer and differential gear (4WD)★				X		X	MA-60, 61		
Check steering gear & linkage, axle & suspension parts, (propeller shaft 4WD), drive shafts & exhaust system for damaged, loose & missing parts, lubrication & leaks★				X		X	MA-58, 65 FA-6, 9, RA-4		
		Outside and inside							
Check wheel alignment, if necessary, rotate & balance wheels			X	X	X	X	MA-64, FA-7		
Check brake pads, discs & other brake components for wear, deterioration & leaks★			X	X	X	X	MA-62		
Check brake linings, drums & other brake components for wear, deterioration & leaks★				X		X	MA-63		
Check seat belts, buckles, retractors, anchors & adjuster				X		X	MA-66		
Check foot brake, parking brake & clutch for free play, stroke & operation			X	X	X	X	BR-13, 48, CL-5		
Check body corrosion					Annually		MA-67		

GASOLINE ENGINE

DIESEL ENGINE

NOTE: (1) For models for Sweden perform at mileage interval only.
(2) For models for Sweden perform at the first 80,000 km (48,000 miles), and then every 40,000 km (24,000 miles) or 24 months, whichever comes first.
(3) Periodic maintenance is not required. However, if valve noise increases, check valve clearances.
(4) If engine power decreases, black exhaust smoke is emitted or engine noise increases, check and, if necessary, adjust the fuel injection nozzle's starting pressure and the fuel spray pattern.
(5) Maintenance items with "★" should be performed more frequently according to "Maintenance Under Severe Driving Conditions".

Check: Check. Correct or replace if necessary.
*1: Except flat belt type *2: Non-catalyzer models only *3: Catalyzer models only *4: GA series engines only

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 must be performed on the following items as shown in the table.

SEVERE DRIVING CONDITIONS

A — Driving under dusty conditions
B — Driving repeatedly short distances
C — Towing a trailer or caravan
D — Extensive idling
E — Driving in extremely adverse weather conditions or in areas where ambient temperatures are either extremely low or extremely high
F — Driving in high humidity areas or in mountainous areas
G — Driving in areas using salt or other corrosive materials
H — Driving on rough and/or muddy roads or in the desert
I — Driving with frequent use of braking or in mountainous areas

Driving condition	Maintenance item	Maintenance operation	Maintenance interval	Reference page SR series	GA series	CD series
Engine oil service						
A B C D	Engine oil & oil filter					
	Gasoline engine	Replace	Every 6 months or 5,000 km (3,000 miles)	MA-33	MA-22, 23	—
	Diesel engine	Replace	Every 3 months or 5,000 km (3,000 miles)	—	—	MA-54, 55
Standard service						
A	Air cleaner filter & P.C.V. filter	Replace		MA-32	MA-21, 25	MA-54
A . . . E	Fuel filter	Replace		MA-31	MA-20	MA-54
. . . . . F . . .	Brake fluid	Replace		MA-62		
. . . . . G H .	Steering gear & linkage, axle & suspension parts, (propeller shaft 4x4), drive shafts & exhaust system	Check	Every 12 months or 20,000 km (12,000 miles)	MA-65, FA-6, 9, RA-4		
A . C . . . G H I	Brake linings, drums & other brake components	Check		MA-63		
. . C . . . . H .	Automatic & manual transaxle oil (transfer & differential gear oil 4x4)	Replace	Every 24 months or 40,000 km (24,000 miles)	MA-59, 60, 61		
A . C . . . G H I	Brake pads, discs & other brake components	Check	Every 6 months or 10,000 km (6,000 miles)	MA-62		

Maintenance operation: Check = Check. Correct or replace if necessary.

Maintenance for off-road driving (4x4 only)

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

▲ Brake pads and discs
▲ Brake lining and drums
▲ Brake lines and hoses
▲ Differential, transaxle and transfer oil
▲ Steering linkage
▲ Propeller shafts and drive shafts
▲ Air cleaner filter
▲ Clutch housing (Check water entry. Refer to page MA-65.)

The following tables show the normal maintenance schedule. Depending upon weather and atmospheric conditions, varying road surfaces, individual driving habits and vehicle usage, additional or more frequent maintenance may be required.

Periodic maintenance beyond the last period shown on the tables requires similar maintenance.

Engine Oil Service (Non-turbo gasoline engine)

MAINTENANCE OPERATION		MAINTENANCE INTERVAL								Reference page	
Perform on a mileage basis, but on a semi-annual basis when driving less than 9,000 miles (15,000 km) in half a year.	Miles x 1,000	9	18	27	36	45	54	63	72	SR series	GA series
	(km x 1,000)	(15)	(30)	(45)	(60)	(75)	(90)	(105)	(120)		
	Months	6	12	18	24	30	36	42	48		
Under bonnet and under vehicle											
Change engine oil (Use API SF or SG only)★		X	X	X	X	X	X	X	X	MA-33	MA-22
Change engine oil filter★	See NOTE (1).	X	X	X	X	X	X	X	X	MA-33	MA-23

NOTE: (1) Use Nissan PREMIUM type or equivalent for GA series.
If Nissan oil filter other than PREMIUM type is used, oil filter and oil should be changed every 6,000 miles (10,000 km) or 6 months, whichever comes first.
(2) Maintenance items with "★" should be performed more frequently according to "Maintenance Under Severe Driving Conditions".

Engine Oil Service (Turbo gasoline engine)

MAINTENANCE OPERATION		MAINTENANCE INTERVAL								Reference page
Perform on a mileage basis but on a yearly basis when driving less than 6,000 miles (10,000 km) a year.	Miles x 1,000	6	12	18	24	30	36	42	48	
	(km x 1,000)	(10)	(20)	(30)	(40)	(50)	(60)	(70)	(80)	
	Months	12	24	36	48	60	72	84	96	
Under bonnet and under vehicle										
Change engine oil (Use API SG oil only)★		X	X	X	X	X	X	X	X	MA-33
Change engine oil filter★		X	X	X	X	X	X	X	X	MA-33

NOTE: (1) Maintenance items with "★" should be performed more frequently according to "Maintenance under severe driving conditions".

Engine Oil Service (Diesel engine)

MAINTENANCE OPERATION		MAINTENANCE INTERVAL								Reference page
Perform on a mileage basis but on a semi-annual basis when driving less than 6,000 miles (10,000 km) in half a year.	Miles x 1,000	6	12	18	24	30	36	42	48	
	(km x 1,000)	(10)	(20)	(30)	(40)	(50)	(60)	(70)	(80)	
	Months	6	12	18	24	30	36	42	48	
Under bonnet and under vehicle										
Change engine oil (Use API CD oil only)★		X	X	X	X	X	X	X	X	MA-54
Change engine oil filter★		X	X	X	X	X	X	X	X	MA-55
Check drive belts for tension		X	(At the first oil change only)							MA-51

NOTE: (1) Maintenance items with "★" should be performed more frequently according to "Maintenance Under Severe Driving Conditions".

Check: Check. Correct or replace if necessary.

Standard Service

MAINTENANCE OPERATION		MAINTENANCE INTERVAL								Reference page		
Perform on a mileage basis, but on a semi-annual basis when driving less than 9,000 miles (15,000 km) in half a year.	Miles x 1,000	9	18	27	36	45	54	63	72	SR series	GA series	CD series
	(km x 1,000)	(15)	(30)	(45)	(60)	(75)	(90)	(105)	(120)			
	Months	6	12	18	24	30	36	42	48			
ENGINE MAINTENANCE (Except engine oil service) Under bonnet and under vehicle												
Change engine anti-freeze coolant (Ethylene glycol base)					X				X	MA-29	MA-16	MA-32
Check cooling system			X		X		X		X	MA-30	MA-19	MA-53
Check fuel lines					X				X	MA-31	MA-20	MA-54
PETROL ENGINE: Adjust intake & exhaust valve clearance	*1	See NOTE (1).								—	EM-46	—
	Turbo engines		X		X		X		X	EM-124	—	—
PETROL ENGINE: Check drive belts for cracks, fraying, wear & tension			X		X		X		X	MA-28	MA-17	—
PETROL ENGINE: Replace air cleaner filter (Viscous paper type)★					X				X	MA-32	MA-21	—
PETROL ENGINE: Check & adjust (carburetor idle rpm*1) & (mixture ratio*2)		X	X	X	X	X	X	X	X	EF & EC-389	EF & EC-153	—
PETROL ENGINE: Replace fuel filter★			X		X		X		X	MA-31	MA-20	—
PETROL ENGINE: Replace spark plugs	Non-turbo engines	X*2	X	X*2	X	X*2	X	X*2	X	MA-34	MA-23	—
	Turbo engines (Use PLATINUM-TIPPED type)	Every 60,000 miles (100,000 km)								MA-35	—	—
PETROL ENGINE: Check ignition wires					X				X	MA-35	MA-24	—
PETROL ENGINE: Check positive crankcase ventilation (P.C.V.) system*2			X		X		X		X	MA-36	MA-24	—
PETROL ENGINE: Replace P.C.V. filter★					X				X	—	MA-25	—
PETROL ENGINE: Check automatic temperature control air cleaner			X		X		X		X	—	MA-25	—
PETROL ENGINE: Check vacuum hoses & connections*2			X		X		X		X	MA-36	MA-25	—
PETROL ENGINE: Check exhaust gas sensor*3			X		X		X		X	MA-37	MA-27	—
PETROL ENGINE: Check vapor lines*3			X		X		X		X	MA-36	MA-26	—
DIESEL ENGINE: Replace timing belts for camshaft & injection pump		Every 60,000 miles (100,000 km)								—	—	EM-161
DIESEL ENGINE: Check drive belts for cracks, fraying, wear & tension		X	X	X	X	X	X	X	X	—	—	MA-51
DIESEL ENGINE: Replace air cleaner filter (Viscous paper type)★			X		X		X		X	—	—	MA-54
DIESEL ENGINE: Replace fuel filter					X				X	—	—	MA-54
DIESEL ENGINE: Check nozzles		See NOTE (2).								—	—	MA-56
DIESEL ENGINE: Check idling speed			X		X		X		X	—	—	MA-57
CHASSIS AND BODY MAINTENANCE Under bonnet and under vehicle												
Check brake, clutch, & automatic transaxle fluid level & leaks★		X	X	X	X	X	X	X	X	MA-58, 59, 61		
Change brake fluid			X		X		X		X	MA-62		
Check brake booster vacuum hoses, connections & check valve					X				X	MA-62		
Check power steering fluid & lines		X	X	X	X	X	X	X	X	MA-65		
Check brake & clutch system for proper attachment, leaks, cracks, chafing, abrasion, deterioration, etc.		X	X	X	X	X	X	X	X	MA-58, 62		
Check oil level in manual transaxle★		X	X	X	X	X	X	X	X	MA-56		
Check oil level in transfer & differential gear (4WD) ★			X		X		X		X	MA-60, 61		
Check steering gear & linkage, axle & suspension parts (propeller shaft 4WD), drive shafts & exhaust system for damage, loose & missing parts, lubrication & leaks★			X		X		X		X	MA-58, 65 FA-6, 8, RA-4		
Outside and inside												
Check wheel alignment, if necessary, rotate & balance wheels			X		X		X		X	MA-64, FA-7		
Check brake pads, disc & other brake components for wear, deterioration & leaks★		X	X	X	X	X	X	X	X	MA-62		
Check brake linings, drums & other brake components for wear, deterioration & leaks★			X		X		X		X	MA-63		
Check seat belts, buckles, retractors, anchors & adjuster			X		X		X		X	MA-66		
Check foot brake, hand brake & clutch for free play, stroke & operation		X	X	X	X	X	X	X	X	BR-13, 48, CL-5		
Check body corrosion					Annually					MA-67		

NOTE: (1) Periodic maintenance is not required. However, if valve noise increases, check valve clearance.
(2) If engine power decreases, black exhaust smoke is emitted or engine noise increases, check and, if necessary, adjust the fuel injection nozzle's starting pressure and the fuel spray pattern.
(3) Maintenance items with "★" should be performed more frequently according to "Maintenance under severe driving conditions".

Check: Check, Correct or replace if necessary.
*1: GA series engines only *2: Non-catalyzer models only *3: Catalyzer models only

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 must be performed on the following items as shown in the table.

SEVERE DRIVING CONDITIONS

A — Driving under dusty conditions
B — Driving repeatedly short distances
C — Towing a trailer or caravan
D — Extensive idling
E — Driving in areas using salt or other corrosive materials
F — Driving on rough and/or muddy roads or in the desert
G — Driving with frequent use of braking or in mountainous areas

Driving condition	Maintenance item		Maintenance operation	Maintenance interval	Reference page		
					SR series	GA series	CD series
Engine oil service							
A B C D . . .	Engine oil & oil filter						
	Petrol engine	Non-turbo engines	Replace	Every 4,500 miles (7,500 km) or 3 months	MA-33	MA-22, 23	—
		Turbo engines	Replace	Every 3,000 miles (5,000 km) or 6 months	MA-33	—	—
	Diesel engine		Replace	Every 3,000 miles (5,000 km) or 3 months	—	—	MA-54, 55
Standard service							
A	Air cleaner filter & P.C.V. filter		Replace	More frequently	MA-32	MA-21	MA-54
. . C . . F .	Automatic & manual transaxle oil (transfer & differential gear oil 4x4)		Replace	Every 36,000 miles (60,000 km) or 12 months	MA-59, 60, 61		
. . . . E F .	Steering gear & linkage, axle & suspension parts, (propeller shaft 4x4), drive shafts & exhaust system		Check	Every 9,000 miles (15,000 km) or 6 months	MA-65 FA-6, 9 RA-4		
A . C . E F G	Brake pads, discs & other brake components		Check	Every 4,500 miles (7,500 km) or 3 months	MA-62		
A . C . E F G	Brake linings, drums & other brake components		Check	Every 9,000 miles (15,000 km) or 6 months	MA-63		

Maintenance operation: Check = Check. Correct or replace if necessary.

Maintenance for off-road driving (4x4 only)

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

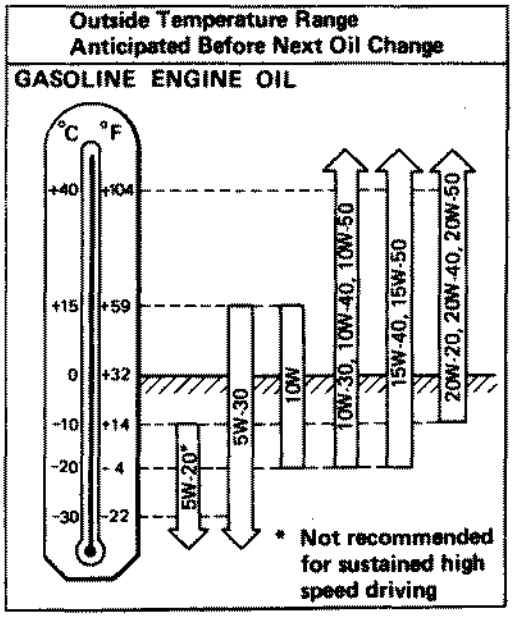
- ▲ Brake pads and discs
- ▲ Brake lining and drums
- ▲ Brake lines and hoses
- ▲ Differential, transaxle and transfer oil
- ▲ Steering linkage
- ▲ Propeller shafts and drive shafts
- ▲ Air cleaner filter
- ▲ Clutch housing (Check water entry. Refer to page MA-65.)

Lubricants and Fluids

		Capacity (Approximate)		Recommended lubricants and fluids
		Liter	Imp measure	
Engine oil (Refill)				
Gasoline				For Europe Non-turbo engines: API SF or SG*1 Turbo engines: API SG*1 Except for Europe API SE, SF or SG*1
With oil filter	GA & E series	3.2	2-7/8 qt	
	SR20DE	3.4	3 qt	
	SR20DET	3.7	3-1/4 qt	
Without oil filter	GA & E series	2.8	2-1/2 qt	
	SR20DE	3.2	2-7/8 qt	
	SR20DET	3.5	3-1/8 qt	
Diesel				
With oil filter	CD17	4.9	4-3/8 qt	CD17 engine: API CC or CD*1 CD20 engine: API CD*1
	CD20	5.4	4-3/4 qt	
Without oil filter	CD17	4.4	3-7/8 qt	
	CD20	4.9	4-3/8 qt	
Cooling system (With reservoir tank)				
Gasoline				
With heater	GA series	See MA-19.		
	E series	4.1	3-5/8 qt	
	SR series	6.6	5-7/8 qt	
Without heater	GA series	See MA-19.		Anti-freeze coolant (Ethylene glycol base) or soft water
	E series	3.8	3-3/8 qt	
Diesel				
With heater	CD17	6.5	5-3/4 qt	
	CD20	7.1	6-1/4 qt	
Without heater	CD17	6.2	5-1/2 qt	
	CD20	6.8	6 qt	
Manual transaxle gear oil				
RN4F30A		2.6	4-5/8 pt	
RS5F30A		2.8	4-7/8 pt	
RS5F31A		2.9	5-1/8 pt	API GL-4*1
RS5F32A		3.5 - 3.7	6-1/8 - 6-1/2 pt	
RS5F50A		4.2	7-3/8 pt	
Automatic transaxle fluid		7.0	6-1/8 qt	Type DEXRON™
Transfer gear oil 4WD	GA16DS engine models	1.1	1 qt	API GL-5*1
	SR20DET engine models	1.5	1-3/8 qt	
Differential gear oil 4WD		1.0	1-3/4 pt	API GL-5*1
Power steering fluid		—	—	Type DEXRON™
Brake & clutch fluid		—	—	DOT 3 (US FMVSS No. 116)
Multi-purpose grease		—	—	NLGI No. 2 (Lithium soap base)

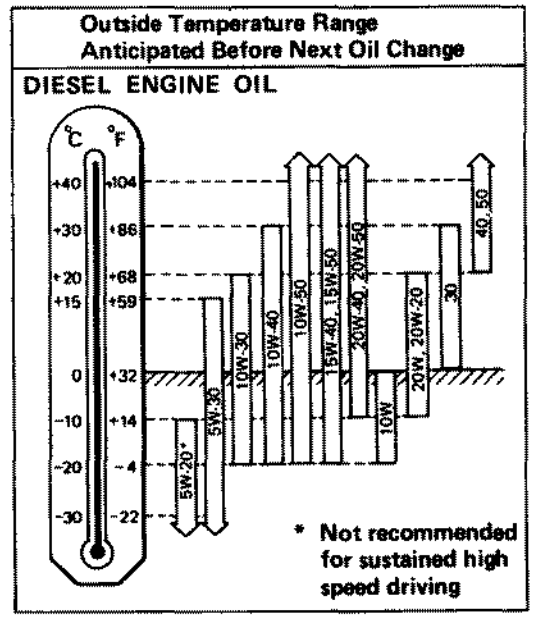
*1: For further details, see "Recommended SAE viscosity number".

SAE Viscosity Number



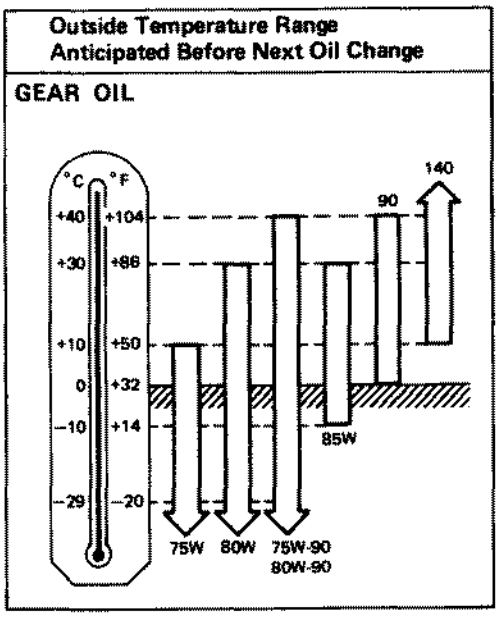
TI0005

- **For cold and warm areas:**
  10W-30 is preferable for ambient temperatures above –20°C (–4°F).
- **For hot areas:**
  20W-40 and 20W-50 are suitable.
- **On turbo engines, 5W-20 is not recommended. 5W-30 should be used only under extremely cold conditions.**



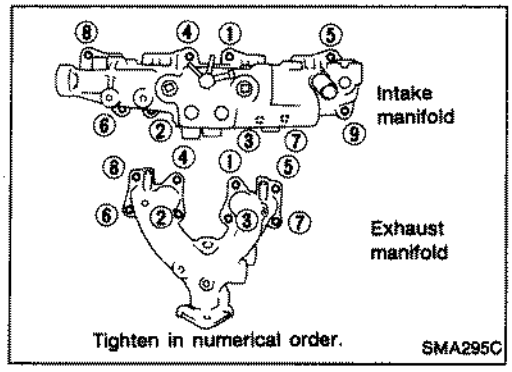
TI0006

- **For cold and warm areas:**
  10W-30 is preferable for ambient temperatures above –20°C (–4°F).
- **For hot areas:**
  20W-40 and 20W-50 are suitable.



TI0003

- **80W-90 is preferable for differential gear (for North Europe), transaxle and transfer for ambient temperatures below 40°C (104°F).**
- **90 is preferable for differential gear (except for North Europe).**



Checking Tightening Torque

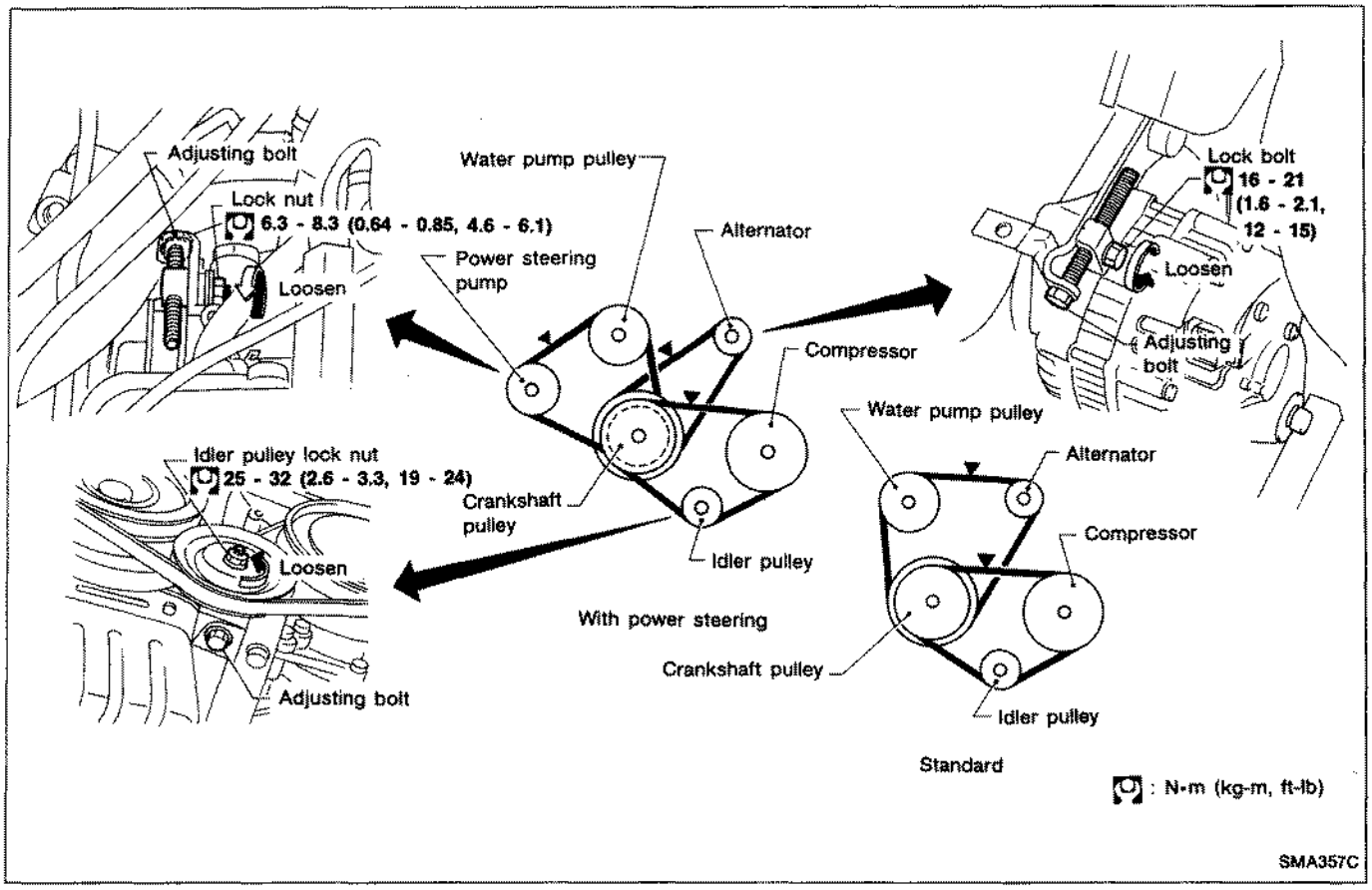
- Checking should be performed while engine is cold.

Manifold bolts and nuts:
: 16 - 21 N·m
(1.6 - 2.1 kg-m, 12 - 15 ft-lb)

Exhaust tube nuts:
: 28 - 33 N·m
(2.9 - 3.4 kg-m, 21 - 25 ft-lb)

Carburetor bolts:
: 16 - 21 N·m
(1.6 - 2.1 kg-m, 12 - 15 ft-lb)

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.

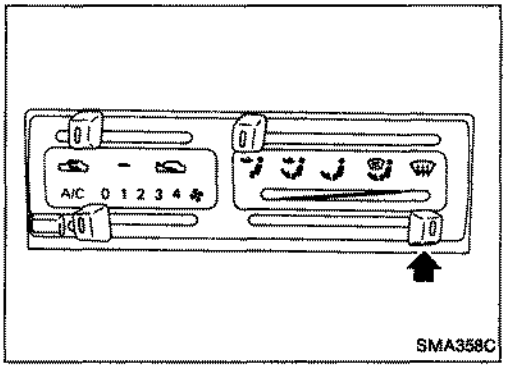
Adjust if belt deflections exceed the limit.

Belt deflection:

Unit: mm (in)

	Used belt deflection		Deflection of new belt
	Limit	Deflection after adjustment	
Alternator			
With power steering	11 (0.43)	7 - 9 (0.28 - 0.35)	6 - 8 (0.24 - 0.31)
Without power steering	10 (0.39)		
Air conditioner compressor	9.5 (0.374)	6 - 8 (0.24 - 0.31)	5 - 7 (0.20 - 0.28)
Power steering oil pump	7.5 (0.295)	4 - 6 (0.16 - 0.24)	3 - 5 (0.12 - 0.20)
Applied pushing force	98 N (10 kg, 22 lb)		

Inspect drive belt deflections when engine is cold.

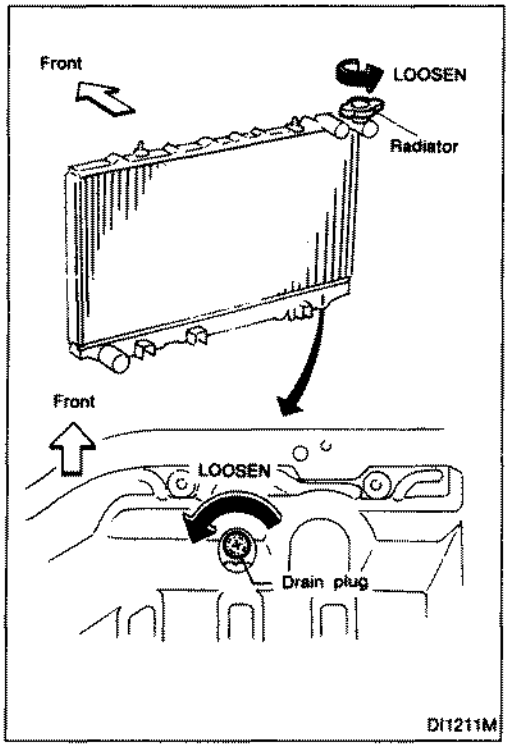


SMA358C

Changing Engine Coolant

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

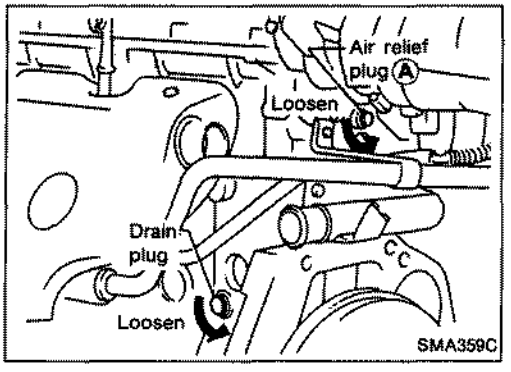
1. Move heater "TEMP" control lever all the way to "HOT".



DI1211M

2. Open radiator drain plug at the bottom of radiator and remove radiator cap.
3. Remove reservoir tank, drain coolant, then clean reservoir tank.
   Install it temporarily.

- **Be careful not to allow coolant to contact drive belts.**



SMA359C

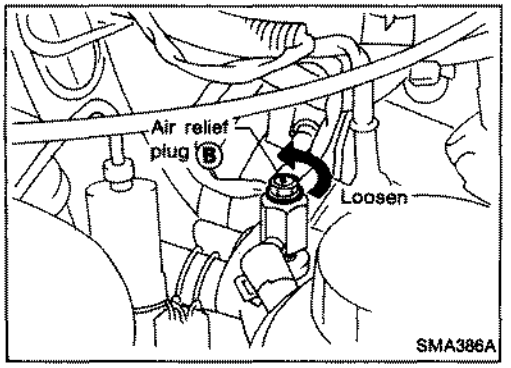
4. Remove cylinder block drain plug and air relief plugs Ⓐ and Ⓑ. (Air relief plug Ⓑ is only present on GA16DE.)
5. Close radiator drain plug.
6. Fill radiator with water until coolant spills from drain plug hole during refill, then reinstall drain plug securely.
7. Fill radiator with water again until coolant spills from the air relief hole during refill, then reinstall air relief plugs Ⓐ and Ⓑ. (Air relief plug Ⓑ is present on GA16DE.)
   Then fill radiator and reservoir tank with water.
   Air relief plug:
   (O): 7 - 8 N·m (0.7 - 0.8 kg-m, 5.1 - 5.8 ft-lb)
8. Reinstall radiator cap.
9. Warm up engine until radiator fan operates, then race engine 2 or 3 times under no-load.

- **Make sure that blower fan switch is "OFF".**

10. Stop engine and wait until it cools down.
11. Repeat step 2 through step 10 until clear water begins to drain from radiator.
12. Drain water.

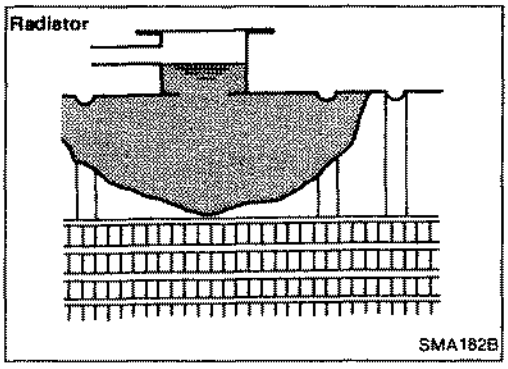
- **Apply sealant to the thread of drain plug.**
  (O): 34 - 44 N·m (3.5 - 4.5 kg-m, 25 - 33 ft-lb)

13. Reinstall reservoir tank.



SMA386A

Changing Engine Coolant (Cont'd)

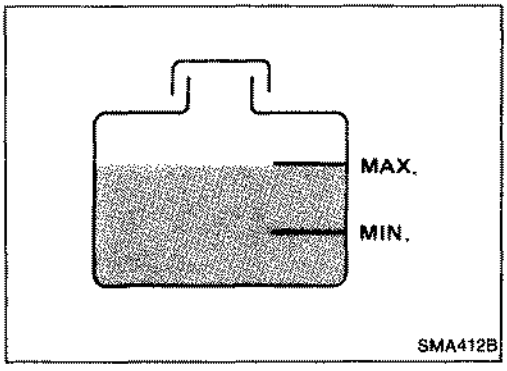


14. Fill radiator and reservoir tank with coolant up to specified level following step 6 through step 9.
    Follow instructions attached to anti-freeze container for mixing ratio of anti-freeze to water.

Coolant capacity (With reservoir tank):

Unit: ℓ (Imp qt)

	For 2WD model (except hot areas)	For 4WD model	For hot areas
M/T			
With heater	5.3 (4-5/8)	5.5 (4-7/8)	5.5 (4-7/8)
Without heater	5.0 (4-3/8)	5.2 (4-5/8)	5.2 (4-5/8)
A/T			
With heater	5.5 (4-7/8)	—	5.5 (4-7/8)
Without heater	5.2 (4-5/8)	—	5.2 (4-5/8)



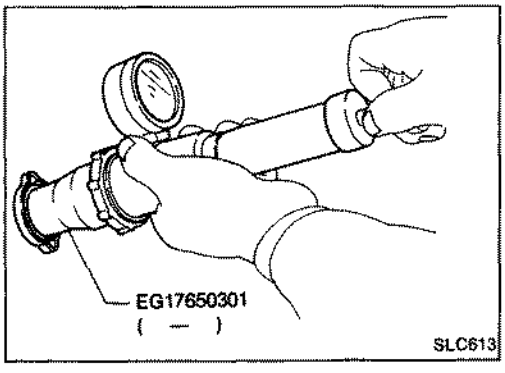
Reservoir tank capacity to "H" level is 0.7 ℓ (5/8 Imp qt).
Pour coolant through coolant filler neck slowly to allow air in system to escape.

15. If necessary, add coolant.

Checking Cooling System

CHECKING HOSES

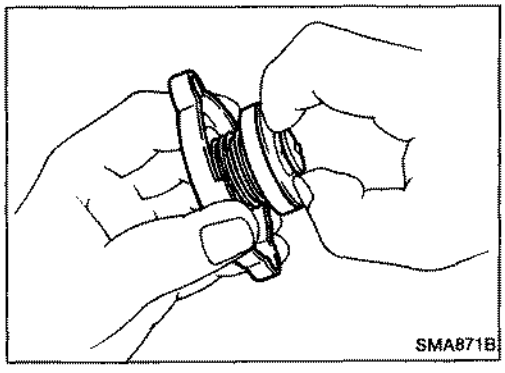
Check hoses for improper attachment and for leaks, cracks, damage, loose connections, chafing and deterioration.



CHECKING RADIATOR CAP

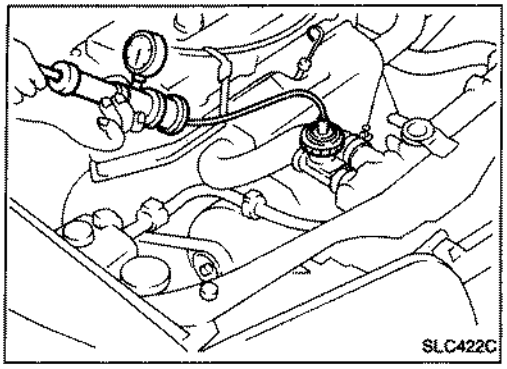
Apply pressure to radiator cap with cap tester to see if it is satisfactory.

Radiator cap relief pressure:
78 - 98 kPa
(0.78 - 0.98 bar, 0.8 - 1.0 kg/cm^2, 11 - 14 psi)



Pull the negative-pressure valve to open it. Check that it closes completely when released.

Checking Cooling System (Cont'd)



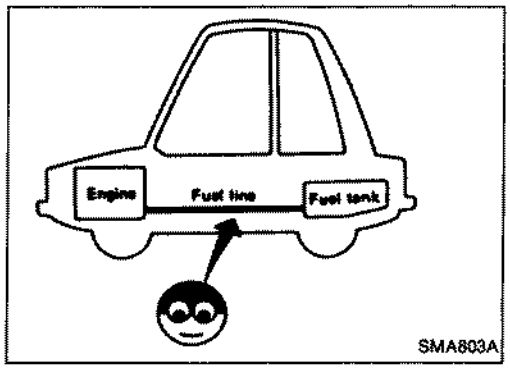
CHECKING COOLING SYSTEM FOR LEAKS

Apply pressure to the cooling system with cap tester to check for leakage.

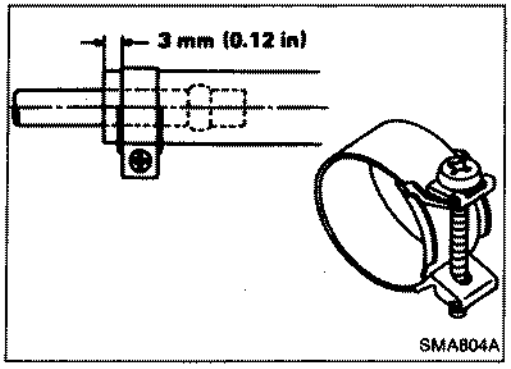
Testing pressure:
157 kPa (1.57 bar, 1.6 kg/cm^2, 23 psi)

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

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.

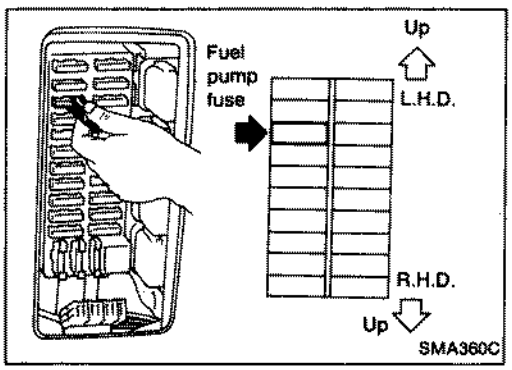


CAUTION:
Tighten high-pressure rubber hose clamp so that clamp end is 3 mm (0.12 in) from hose end.
Tightening torque specifications are the same for all rubber hose clamps.
Ensure that screw does not contact adjacent parts.

Changing Fuel Filter

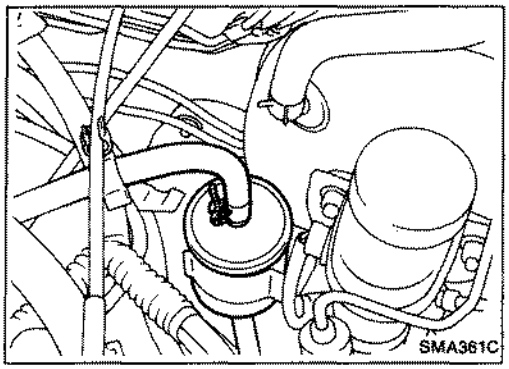
GA16DE MODELS

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



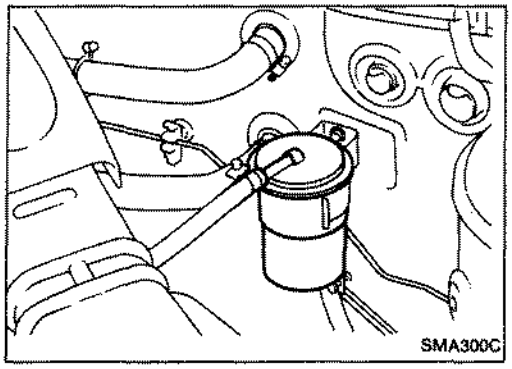
1. Remove fuse for fuel pump.
2. Start engine.
3. After engine stalls, crank engine two or three times to make sure that fuel pressure is released.
4. Turn ignition switch off and install fuse for fuel pump.

Changing Fuel Filter (Cont'd)



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.**



EXCEPT GA16DE MODELS

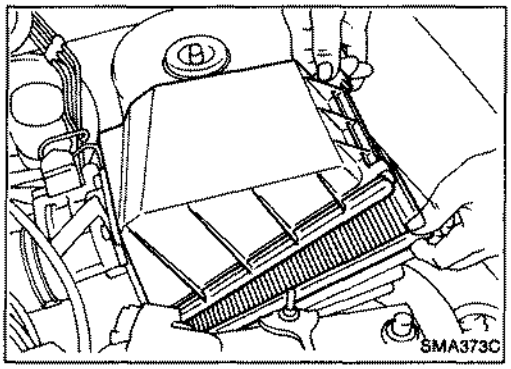
- **Be careful not to spill fuel over engine compartment. Place a shop towel to absorb fuel.**

Cleaning and Changing Air Cleaner Filter

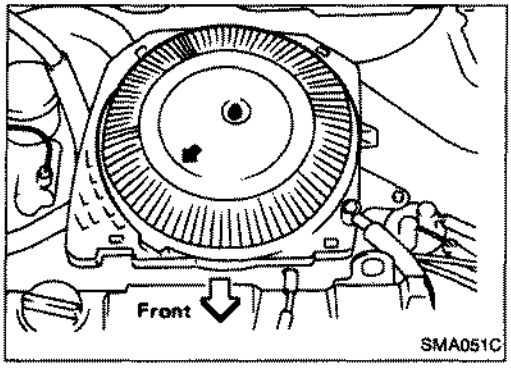
VISCOUS PAPER TYPE

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

GA16DE models



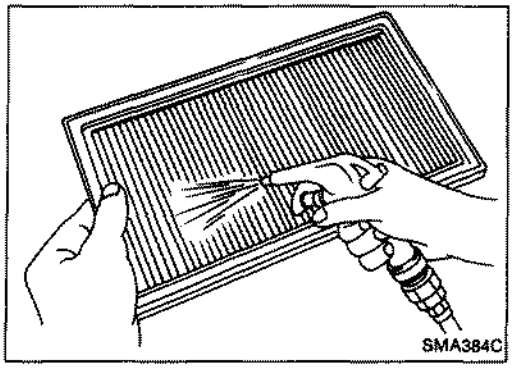
Except GA16DE models



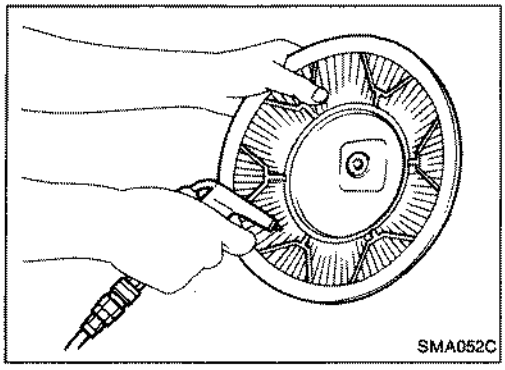
DRY PAPER TYPE

Clean or replace element more often under dusty driving conditions.

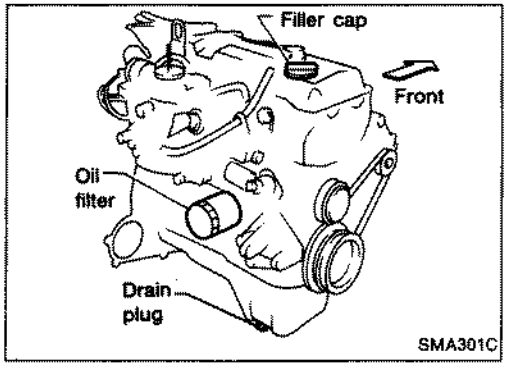
GA16DE models



Cleaning and Changing Air Cleaner Filter (Cont'd)


SMA052C

Except GA16DE models



SMA301C

Changing Engine Oil

WARNING:

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

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

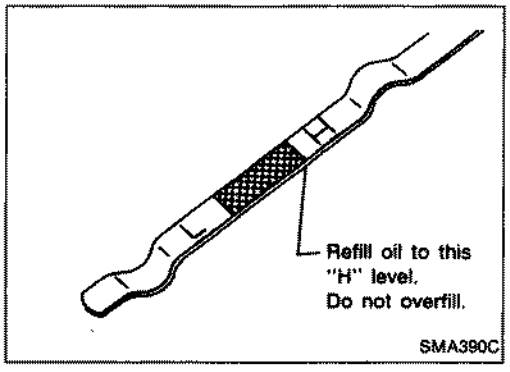
Refill oil capacity (Approximate):

Unit: ℓ (Imp qt)

With oil filter change	3.2 (2-7/8)
Without oil filter change	2.8 (2-1/2)

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 "API SE (Except Europe), SF or SG" with suitable viscosity.**
- **Refill oil capacity changes depending on the oil temperature and drain time. Use these values as a reference and be certain to check with the dipstick when changing the oil.**



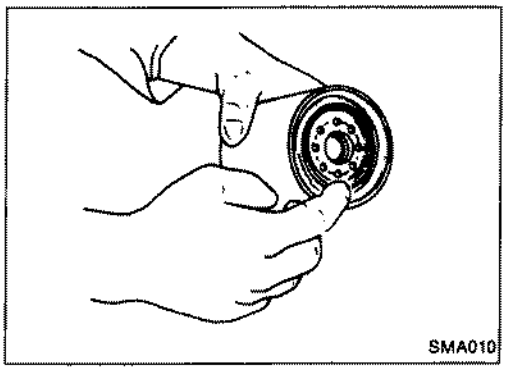
SMA390C

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

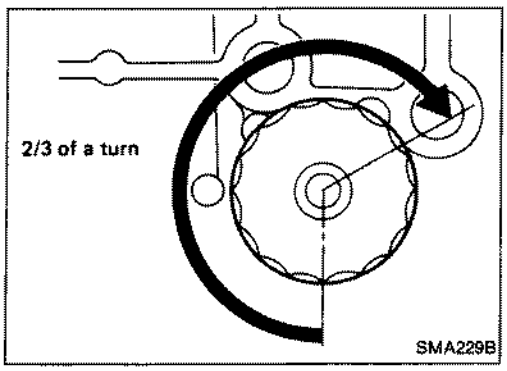
Changing Oil Filter

1. Remove oil filter with Tool.

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

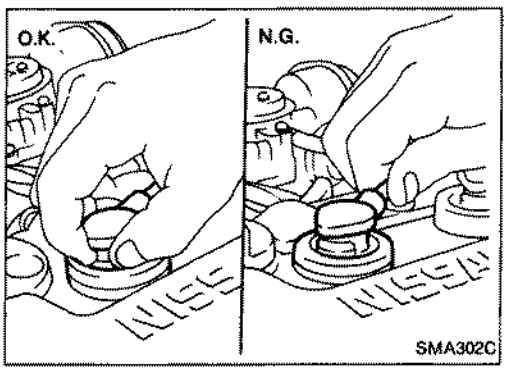


2. Before installing new oil filter, clean the oil filter mounting surface on cylinder block, and coat the rubber seal of oil filter with a little engine oil.



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

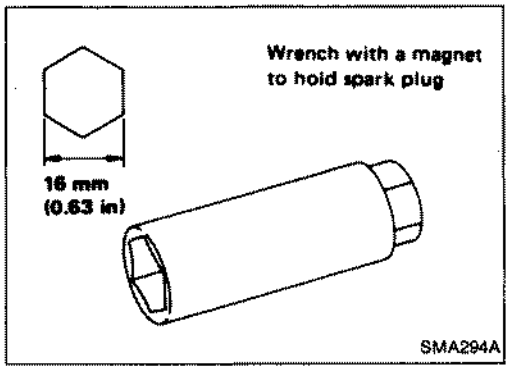
Refer to Changing Engine Oil.



Checking and Changing Spark Plugs

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

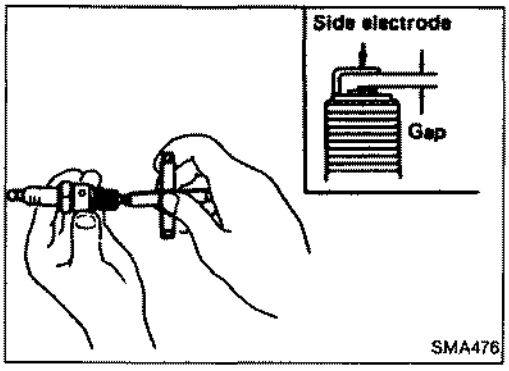
Checking and Changing Spark Plugs (Cont'd)



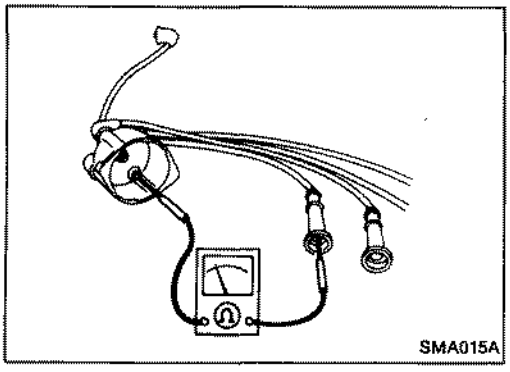
2. Remove spark plugs with spark plug wrench.
3. Clean plugs in sand blast cleaner.
4. Check insulator for cracks or chips, gasket for damage or deterioration and electrode for wear and burning. If they are excessively worn away, replace with new spark plugs.

Spark plug:

	GA16DS	GA13DS, GA14DS & GA16DE
Standard type	BKR6E	BKR5E
Hot type	BKR5E	—
Cold type	BKR7E	BKR6E, BKR7E



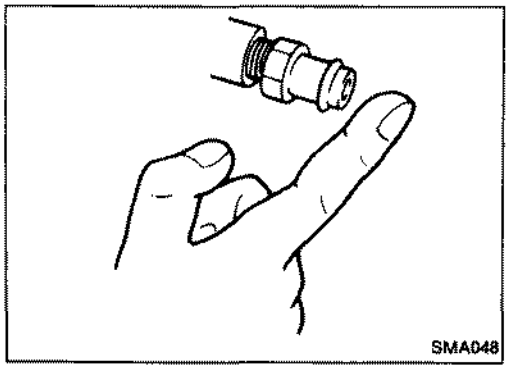
5. Check spark plug gap.
   Gap: 0.8 - 0.9 mm (0.031 - 0.035 in)
6. Install spark plugs. Reconnect ignition wires according to nos. indicated on them.
   Spark plug:
   [☐]: 20 - 29 N·m
   (2.0 - 3.0 kg-m, 14 - 22 ft-lb)



Checking 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.
   Resistance:
   9.6 - 22.4 kΩ/m (2.93 - 6.83 kΩ/ft)

If it exceeds the limit, replace the ignition wire with a new one.

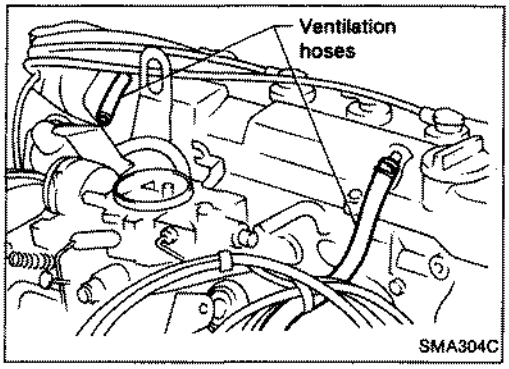


Checking Positive Crankcase Ventilation (P.C.V.) System

CHECKING P.C.V. VALVE

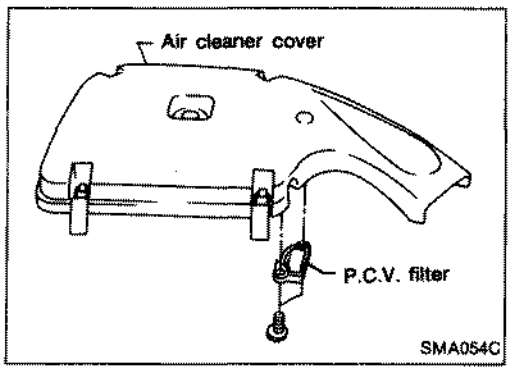
With engine running at idle, remove ventilation hose from P.C.V. valve; if valve is working properly, a hissing noise will be heard as air passes through it and a strong vacuum should be felt immediately when a finger is placed over valve inlet.

Checking Positive Crankcase Ventilation (P.C.V.) System (Cont'd)



CHECKING VENTILATION HOSES

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.

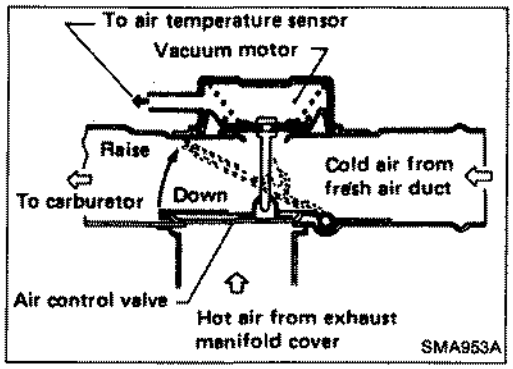


Changing Positive Crankcase Ventilation (P.C.V.) Filter

Remove air cleaner cover and replace P.C.V. filter.

Checking Vacuum Hoses and Connections

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



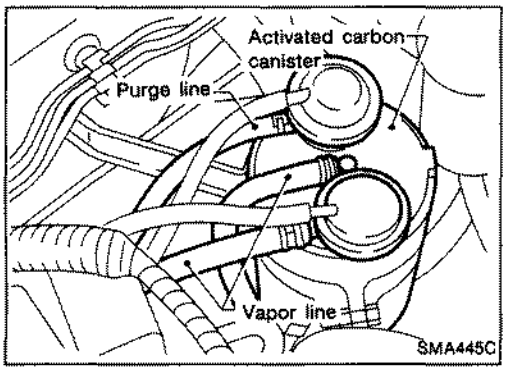
Checking Automatic Temperature Control (A.T.C.) Air Cleaner

1. Inspect vacuum hoses (Intake manifold to temperature sensor and vacuum motor) for secure connections.
2. Check each hose for cracks or distortion.
3. Check A.T.C. system for proper function.

- Make sure that air control valve moves when engine is raced under no-load.
- Make sure that air control valve partially rises as engine warms up.

Refer to AUTOMATIC TEMPERATURE CONTROL (A.T.C.) AIR CLEANER SYSTEM INSPECTION in EF & EC section.

Engine	Temperature	Air control valve position	Intake air temperature
Stopped	Any	Closed	—
At idle	Low	Open	Hot
	High	Closed	Cool

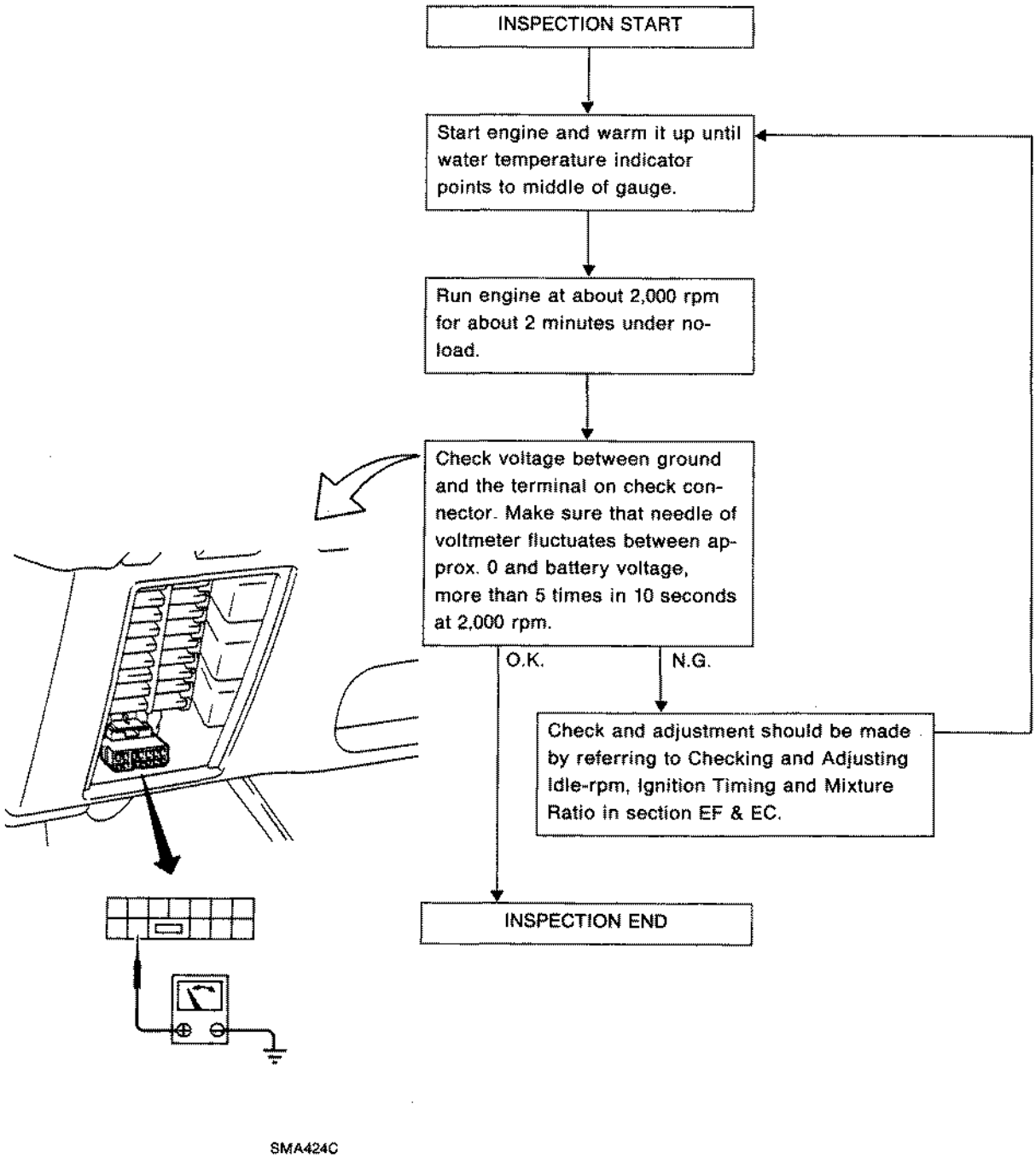


Checking Vapor Lines

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.

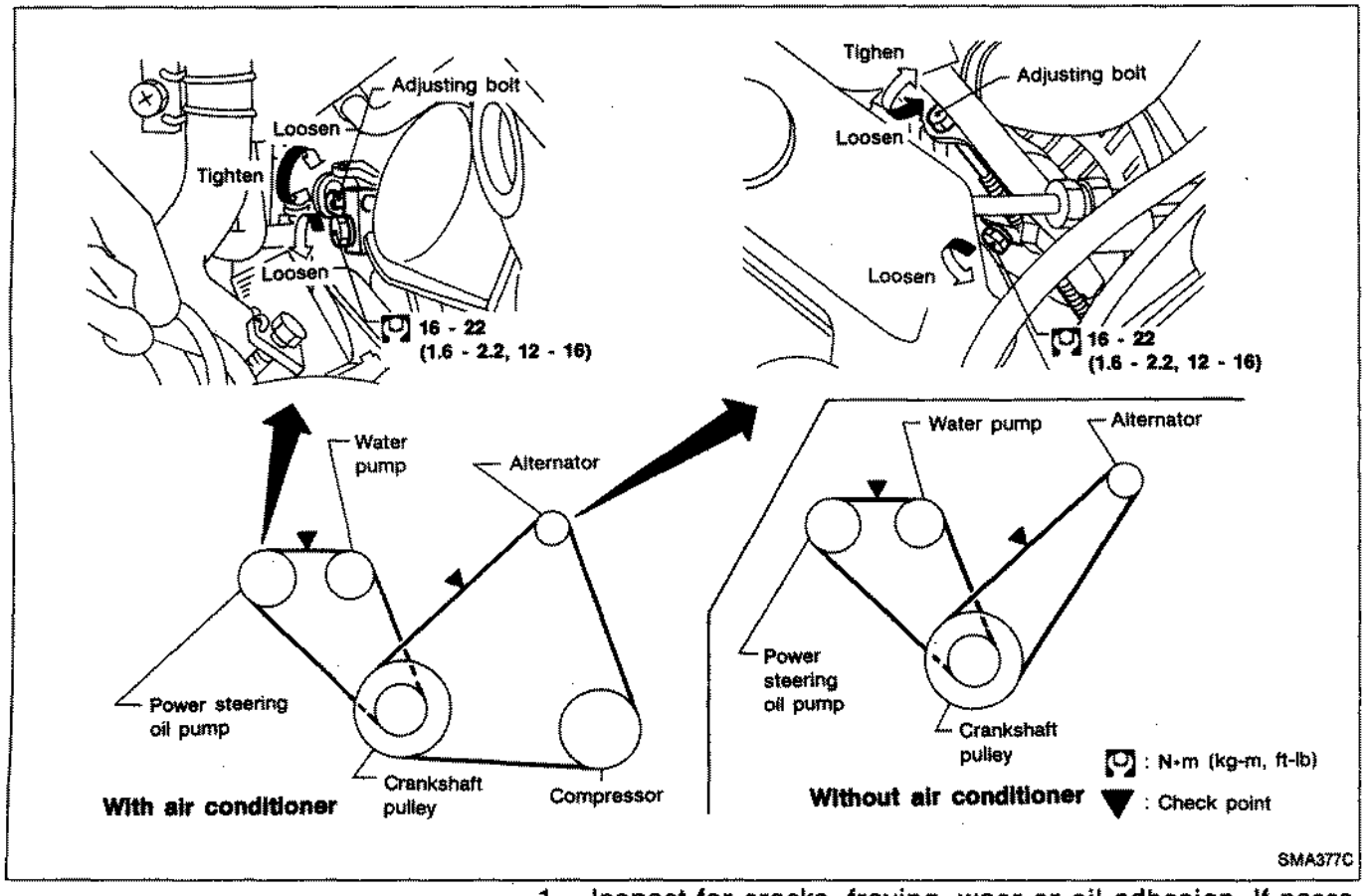
Refer to EVAPORATIVE EMISSION CONTROL SYSTEM INSPECTION in EF & EC section.

Checking Exhaust Gas Sensor



SMA424C

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.

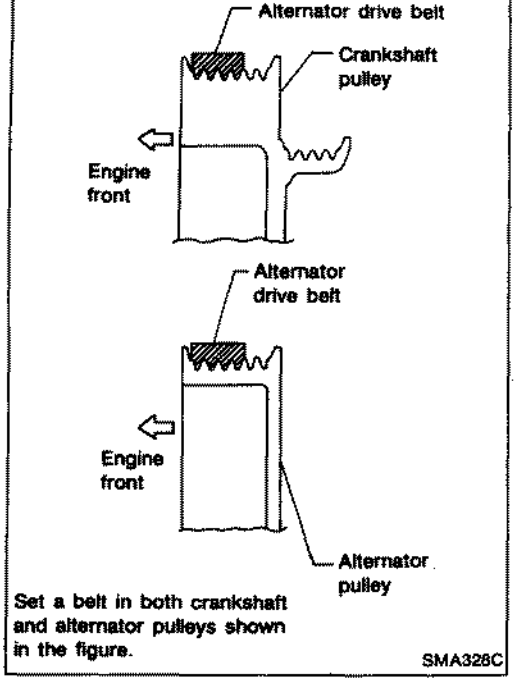
Belt deflection:

Unit: mm (in)

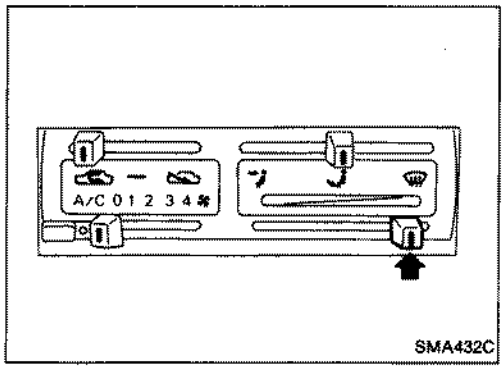
	Used belt deflection		Deflection of new belt
	Limit	Deflection after adjustment	
Alternator			
With air conditioner compressor	11.5 - 12.5 (0.453 - 0.492)	7 - 8 (0.28 - 0.31)	6.5 - 7.5 (0.256 - 0.295)
Without air conditioner compressor	12 - 13 (0.47 - 0.51)	8 - 9 (0.31 - 0.35)	7 - 8 (0.28 - 0.31)
Power steering oil pump	6 - 7 (0.24 - 0.28)	4 - 5 (0.16 - 0.20)	3.5 - 4.5 (0.138 - 0.177)
Applied pushing force	98 N (10 kg, 22 lb)		

Inspect drive belt deflections when engine is cold.

Alternator drive belt fitting place (Models without air conditioner)



Set a belt in both crankshaft and alternator pulleys shown in the figure.



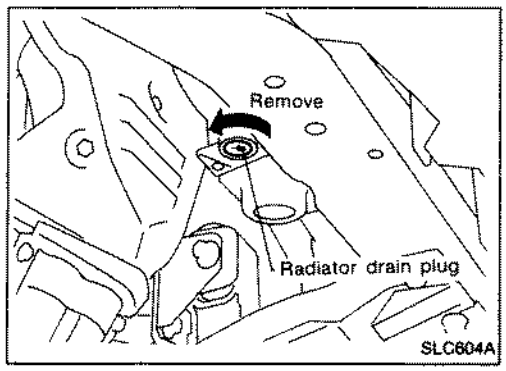
SMA432C

Changing Engine Coolant

WARNING:

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

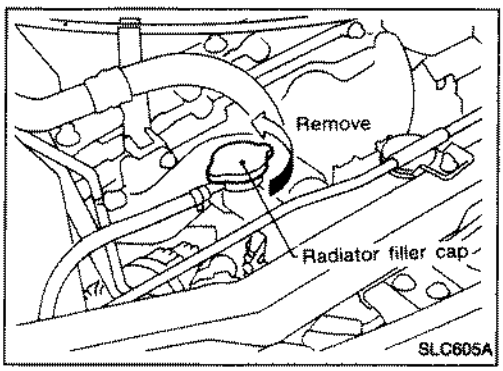
1. Move heater "TEMP" control lever all the way to "HOT".



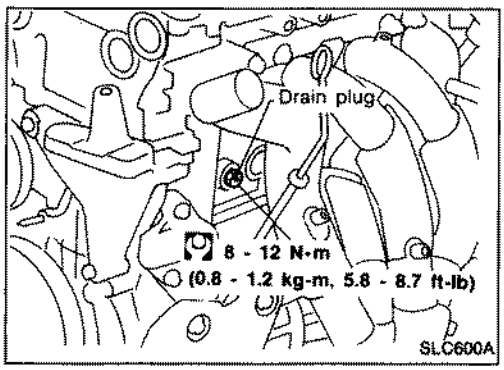
SLC604A

2. Remove radiator drain plug and radiator filler cap.
3. Remove reservoir tank, drain coolant, then clean reservoir tank.
   Install it temporarily.

- **Be careful not to allow coolant to contact drive belts.**



SLC605A



SLC600A

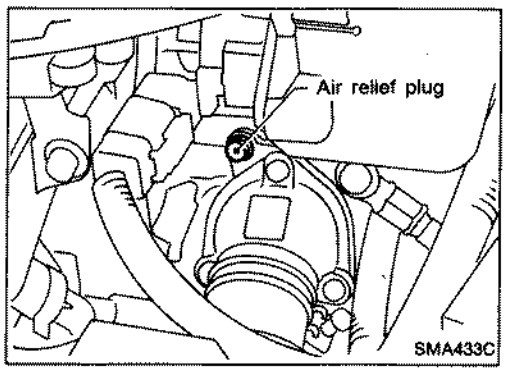
4. Remove cylinder block drain plug, air relief plug and air bleeder cap.
5. Install radiator drain plug and tighten cylinder block drain plug securely.
6. Fill radiator and reservoir tank with water.
   Air relief plug is reinstalled once coolant spills from the air relief hole during refill.
   Then fill radiator and reservoir tank with water.
   Air relief plug:
   : 10 N·m (1.0 kg-m, 7 ft-lb)
7. Reinstall radiator cap and air bleeder cap.
8. Warm up engine until radiator fan operates, then race engine 2 or 3 times under no-load.

- **Make sure that air conditioner switch is "OFF".**

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.

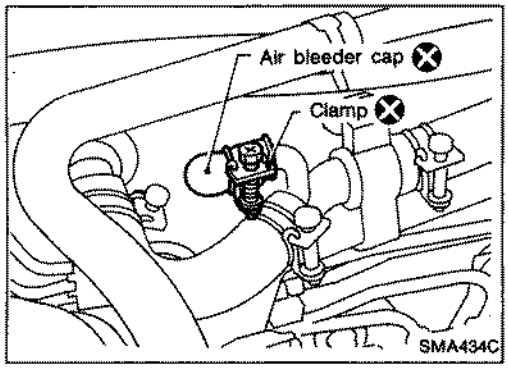
- **Apply sealant to the thread of drain plug.**
  : 8 - 12 N·m (0.8 - 1.2 kg-m, 5.8 - 8.7 ft-lb)

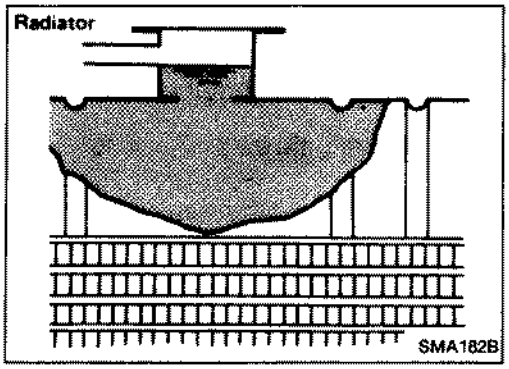
12. Reinstall reservoir tank.



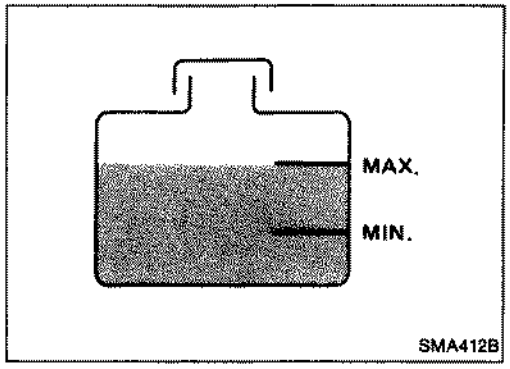
SMA433C

Changing Engine Coolant (Cont'd)





13. Fill radiator and reservoir tank with coolant up to specified level following step 6 through step 9.
    Follow instructions attached to anti-freeze container for mixing ratio of anti-freeze to water.
    Coolant capacity (With reservoir tank):
    6.6 ℓ (5-7/8 Imp qt)



[Reservoir tank capacity for "H" level is 0.7 ℓ (5/8 Imp qt).]

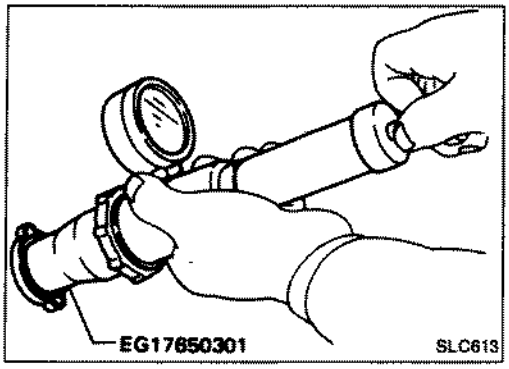
Pour coolant through coolant filler neck slowly to allow air in system to escape.

14. If necessary, add coolant.
15. Start and warm up engine, then increase engine speed to 4,000 rpm. Check that radiator coolant level is not lowered, and that no water noise is heard in heater core. If water noise is heard, bleed air by referring to "Refilling Engine Coolant" in section LC.

Checking Cooling System

CHECKING HOSES

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

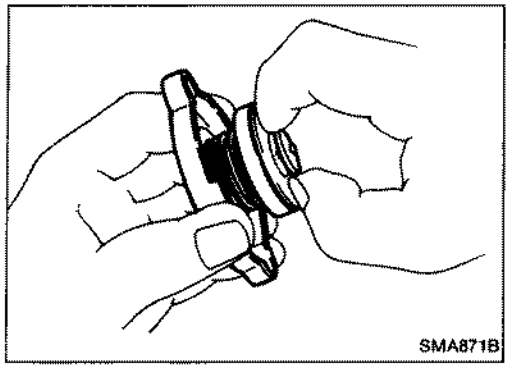


CHECKING RADIATOR CAP

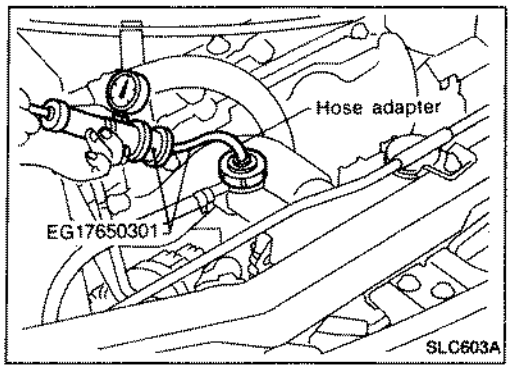
Apply pressure to radiator cap with cap tester to see if it is satisfactory.

Radiator cap relief pressure:
78 - 98 kPa
(0.78 - 0.98 bar, 0.8 - 1.0 kg/cm^2, 11 - 14 psi)

Checking Cooling System (Cont'd)



Pull the negative-pressure valve to open it. Check that it closes completely when released.

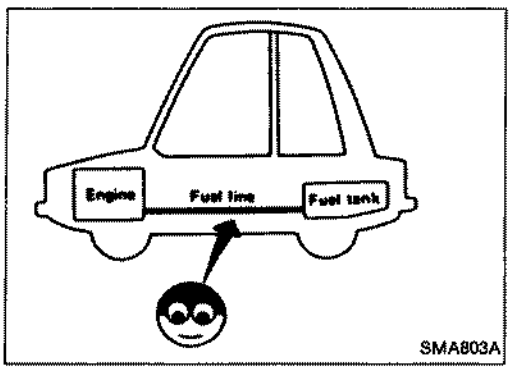


CHECKING COOLING SYSTEM FOR LEAKS

Apply pressure to the cooling system with cap tester to check for leakage.

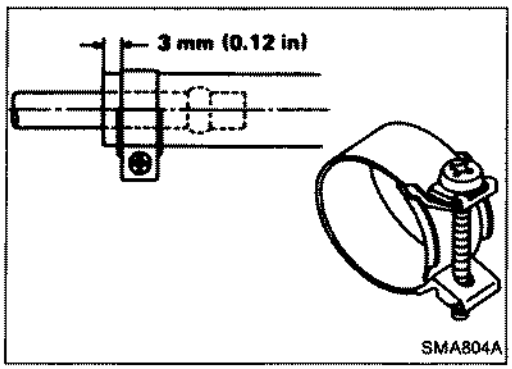
Testing pressure:
157 kPa (1.57 bar, 1.6 kg/cm², 23 psi)

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

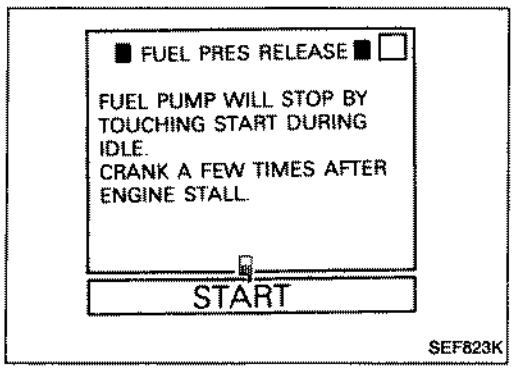


Checking Fuel Lines

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.



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

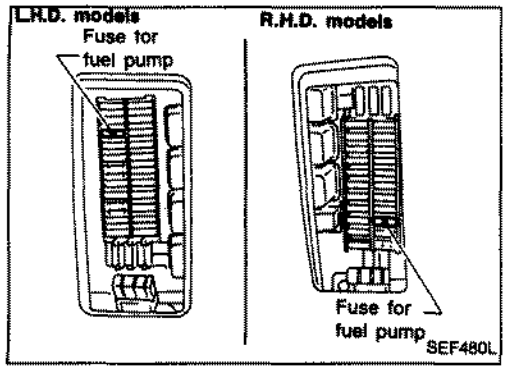


Changing Fuel Filter

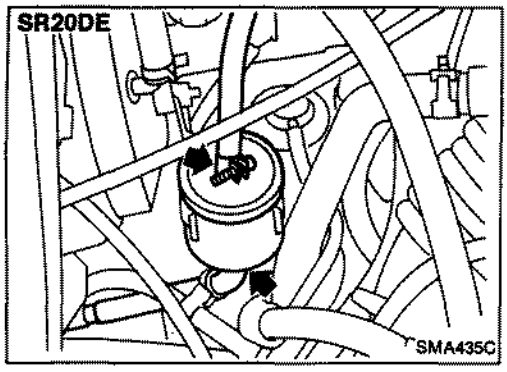
WARNING:
Before removing fuel filter, release fuel pressure from fuel line to eliminate danger.

1. Perform "FUEL PRESSURE RELEASE" in "WORK SUPPORT" mode and release fuel pressure to zero.
2. Turn ignition switch off.

Changing Fuel Filter (Cont'd)

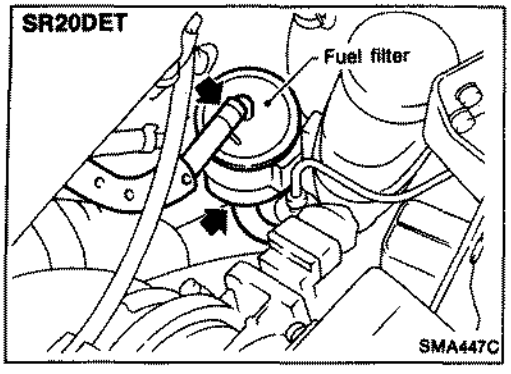


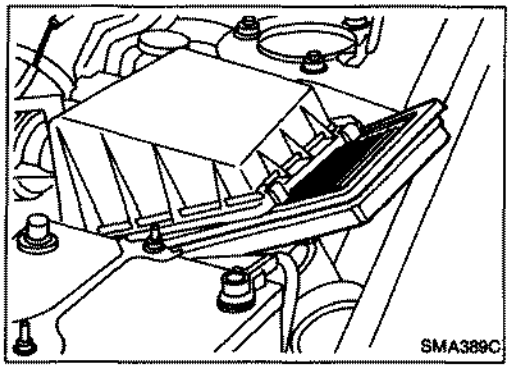
1. Remove fuse for fuel pump.
2. Start engine.
3. After engine stalls, crank engine two or three times to make sure that fuel pressure is released.
4. Turn ignition switch off and install fuse for fuel pump.



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".**

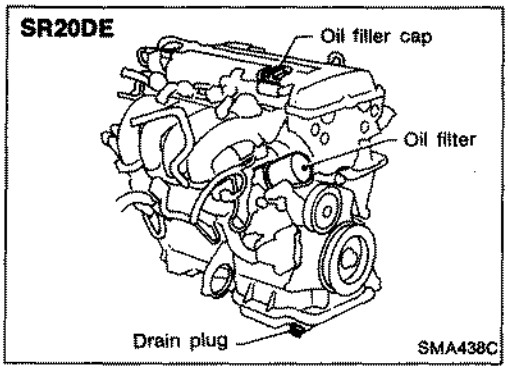


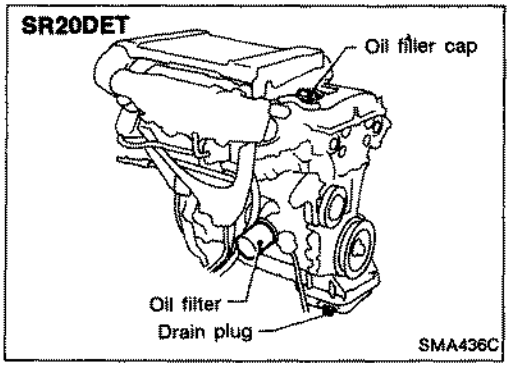


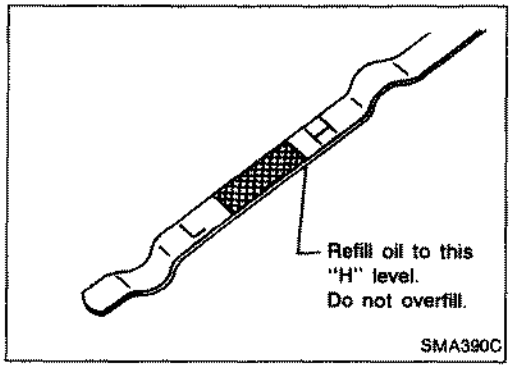
Changing Air Cleaner Filter

Viscous paper type

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







Changing Engine Oil

WARNING:

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

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

Refill oil capacity (Approximate):

Unit: ℓ (Imp qt)

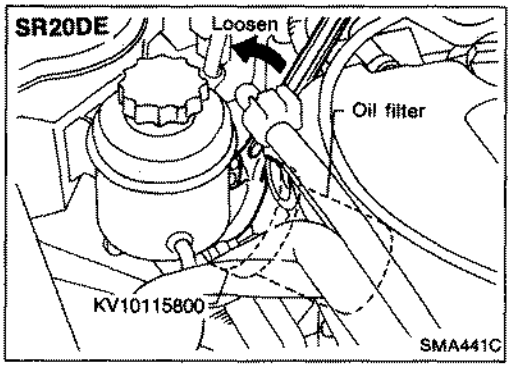
	SR20DE	SR20DET
With oil filter change	3.4 (3)	3.7 (3-1/4)
Without oil filter change	3.2 (2-7/8)	3.5 (3-1/8)

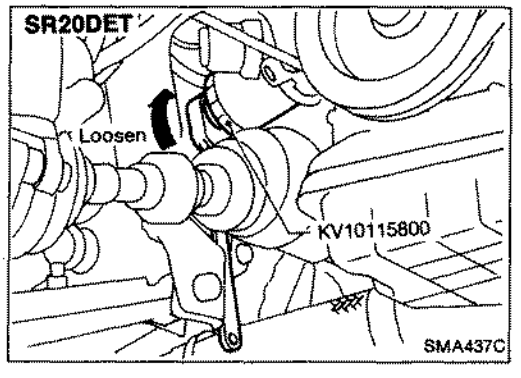
CAUTION:

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

The refill capacity changes depending on the oil temperature and drain time, use these valves as a reference and be certain to check with the dipstick when changing the oil.

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





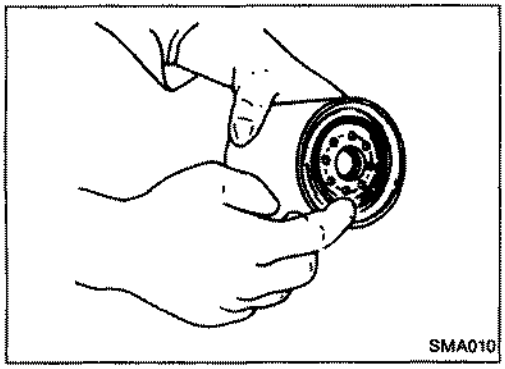
Changing Oil Filter

1. Remove oil filter with Tool.

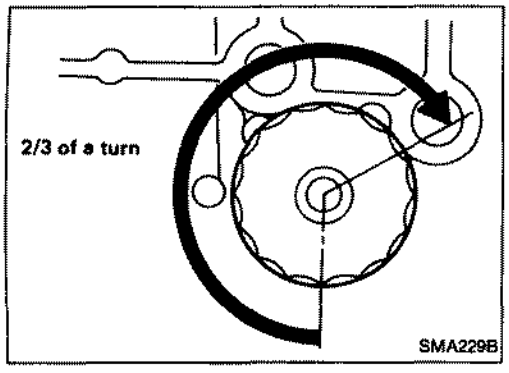
WARNING:

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

Changing Oil Filter (Cont'd)



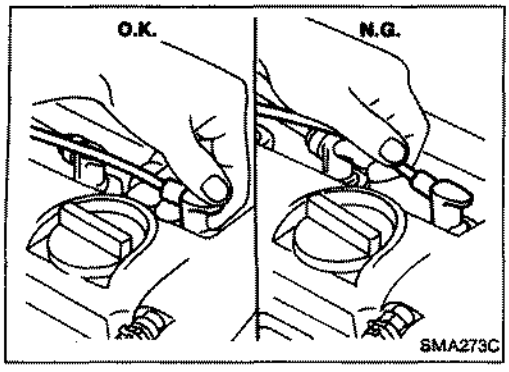
2. Before installing new oil filter, clean the oil filter mounting surface on cylinder block, and coat the rubber seal of oil filter with a little engine oil.



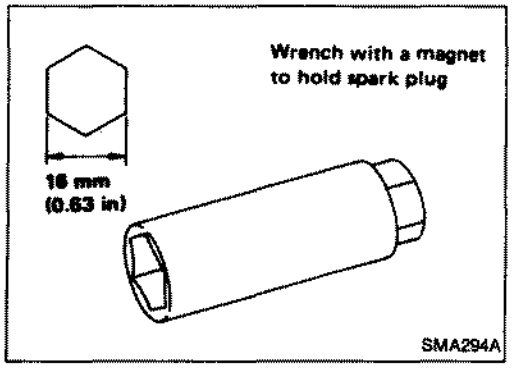
3. Screw in the oil filter until a slight resistance is felt, then tighten an additional 2/3 turn.
4. Add engine oil.

Refer to Changing Engine Oil.

Checking and Changing Spark Plugs (Conventional type for SR20DE engine)



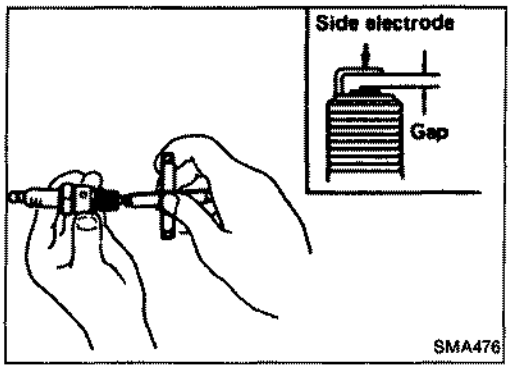
1. Disconnect ignition wires from spark plugs at boot. Do not pull on the wire.



2. Remove spark plugs with spark plug wrench.

Spark plug:

Standard type	**BKR6EY**
Hot type	**BKR5EY**
Cold type	**BKR7EY**



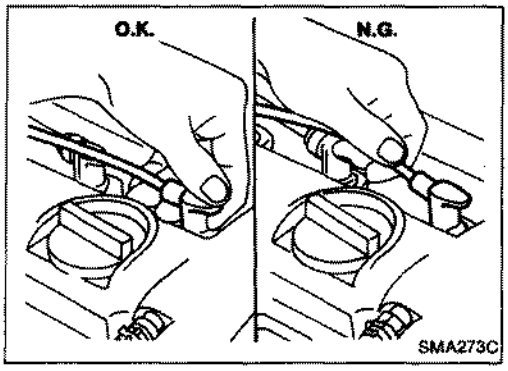
3. Check gap of each new spark plug.

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

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

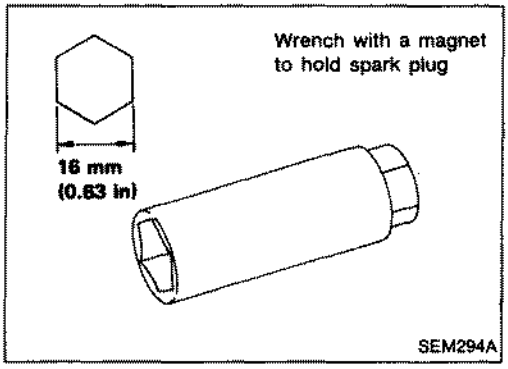
Spark plug:

[O]: 20 - 29 N·m (2 - 3 kg-m, 14 - 22 ft-lb)



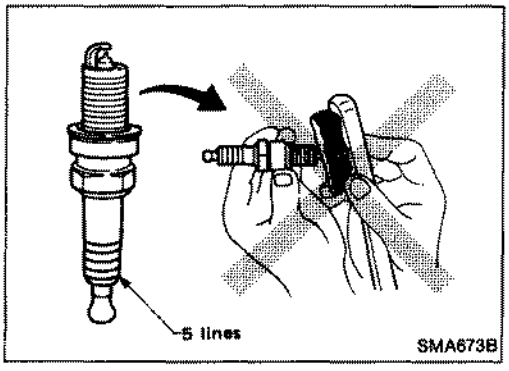
Changing Spark Plugs (Platinum-tipped type for SR20DET engine)

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



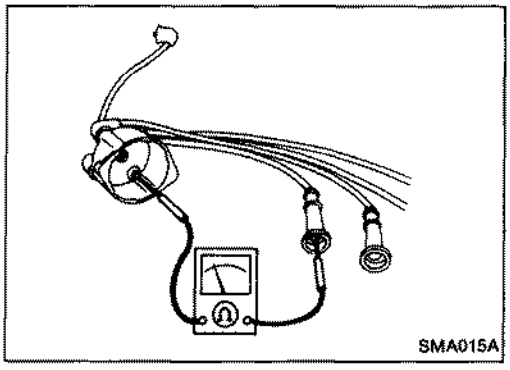
2. Remove spark plugs with spark plug wrench.
   Spark plug:

Standard type	**PFR7B-9**
Hot type	**PFR6B-9**
Cold type	**PFR8B-9**



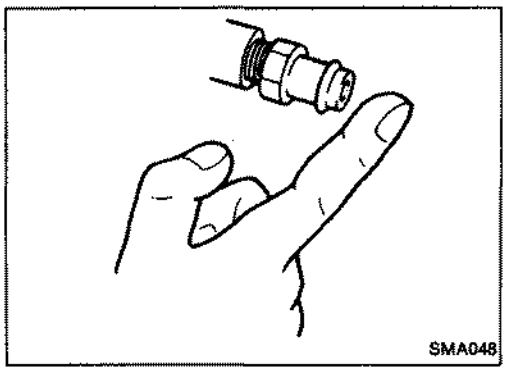
- **Checking and adjusting plug gap are not required between renewals.**
- **Do not use a wire brush for cleaning.**
- **If plug tip is covered with carbon, spark plug cleaner may be used.**
  Cleaner air pressure:
  Less than 588 kPa (5.9 bar, 6 kg/cm^2, 85 psi)
  Cleaning time:
  Less than 20 seconds

3. Install spark plugs. Reconnect ignition wires according to nos. indicated on them.
   Spark plug:
   : 20 - 29 N·m (2.0 - 3.0 kg-m, 14 - 22 ft-lb)



Checking Ignition Wires

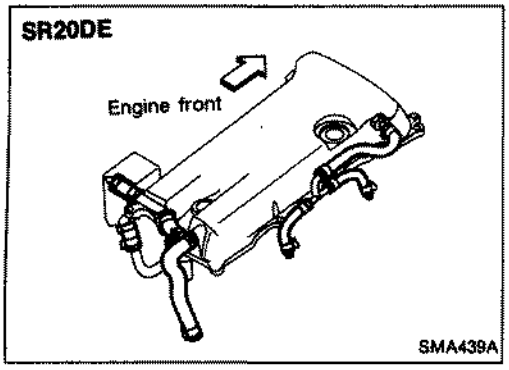
1. Inspect wires for cracks, damage, burned terminals and for improper fit.
2. Measure the resistance of wires and check for intermittent breaks.
   Resistance:
   13.6 - 18.4 kΩ/m (4.15 - 5.61 kΩ/ft)
   If the resistance exceeds the above specification, replace the ignition wire with a new one.



Checking Positive Crankcase Ventilation (P.C.V.) System

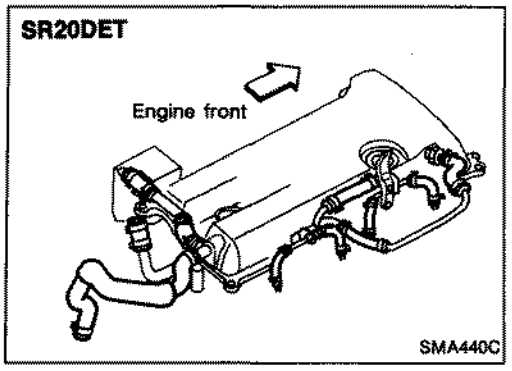
CHECKING P.C.V. VALVE

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.



CHECKING VENTILATION HOSES

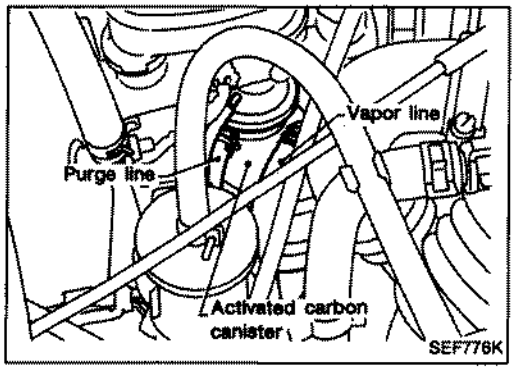
1. Check hoses and hose connections for leaks.
2. Disconnect all hoses and clean with compressed air. If any hose cannot be freed of obstructions, replace.



Checking Vacuum Hoses and Connections

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

Refer to Vacuum Hose Drawing in ENGINE AND EMISSION CONTROL OVERALL SYSTEM in EF & EC section.



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.

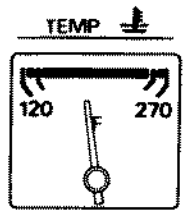
Refer to EVAPORATIVE EMISSION CONTROL SYSTEM INSPECTION in EF & EC section.

Checking Exhaust Gas Sensor

Checking procedure

INSPECTION START

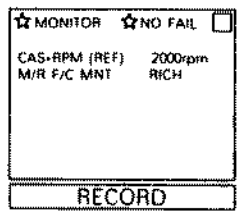
Start engine and warm it up until water temperature indicator points to the middle of gauge.



SEF246F

1. See "M/R F/C MNT" in "Data monitor" mode.
2. Run engine at about 2,000 rpm for about 2 minutes under no-load.
3. Maintaining engine at 2,000 rpm under no-load (engine is warmed up sufficiently.), check that the monitor fluctuates between "LEAN" and "RICH" more than 5 times during 10 seconds.

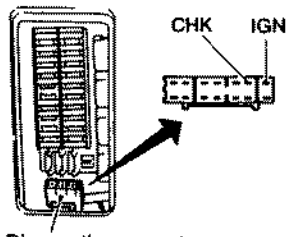
RICH → LEAN → RICH → LEAN → RICH .....
(1 time = RICH → LEAN → RICH; 2 times = LEAN → RICH)



SEF818K

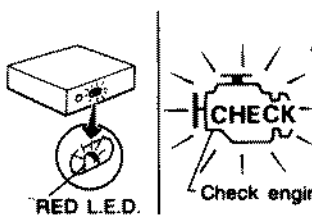
OR

1. Set "Exhaust gas sensor monitor" in the self-diagnostic Mode II. (Refer to section EF & EC.)
2. Run engine at about 2,000 rpm for about 2 minutes under no-load.
3. Maintaining engine at 2,000 rpm under no-load, check to make sure that the RED L.E.D. on the E.C.U. or the check engine light on the instrument panel goes ON and OFF more than 5 times during 10 seconds.



Diagnostic connector for CONSULT
(Connect CHK and IGN terminals with a suitable harness.)

SEF265L



SEF621K

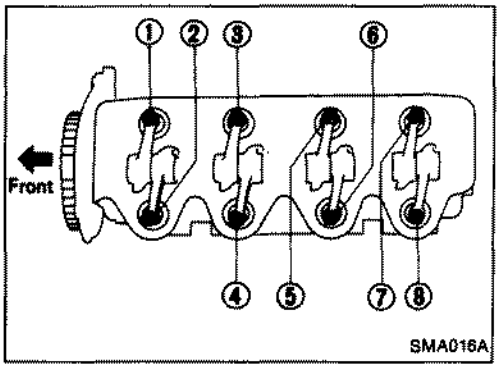
O.K. → INSPECTION END

N.G. → Check and adjustment should be made by referring to IDLE SPEED/ IGNITION TIMING/IDLE MIXTURE RATIO INSPECTION in section EF & EC.

RETIGHTENING MANIFOLD, CARBURETOR AND EXHAUST TUBE BOLTS AND NUTS

Retighten to prevent air and/or exhaust gas leakage.

Intake & exhaust manifold nut:
: 16 - 21 N·m
(1.6 - 2.1 kg-m, 12 - 15 ft-lb)
Carburetor bolt:
: 6 - 7 N·m
(0.6 - 0.7 kg-m, 4.3 - 5.1 ft-lb)
Exhaust tube nut:
: 28 - 33 N·m
(2.9 - 3.4 kg-m, 21 - 25 ft-lb)



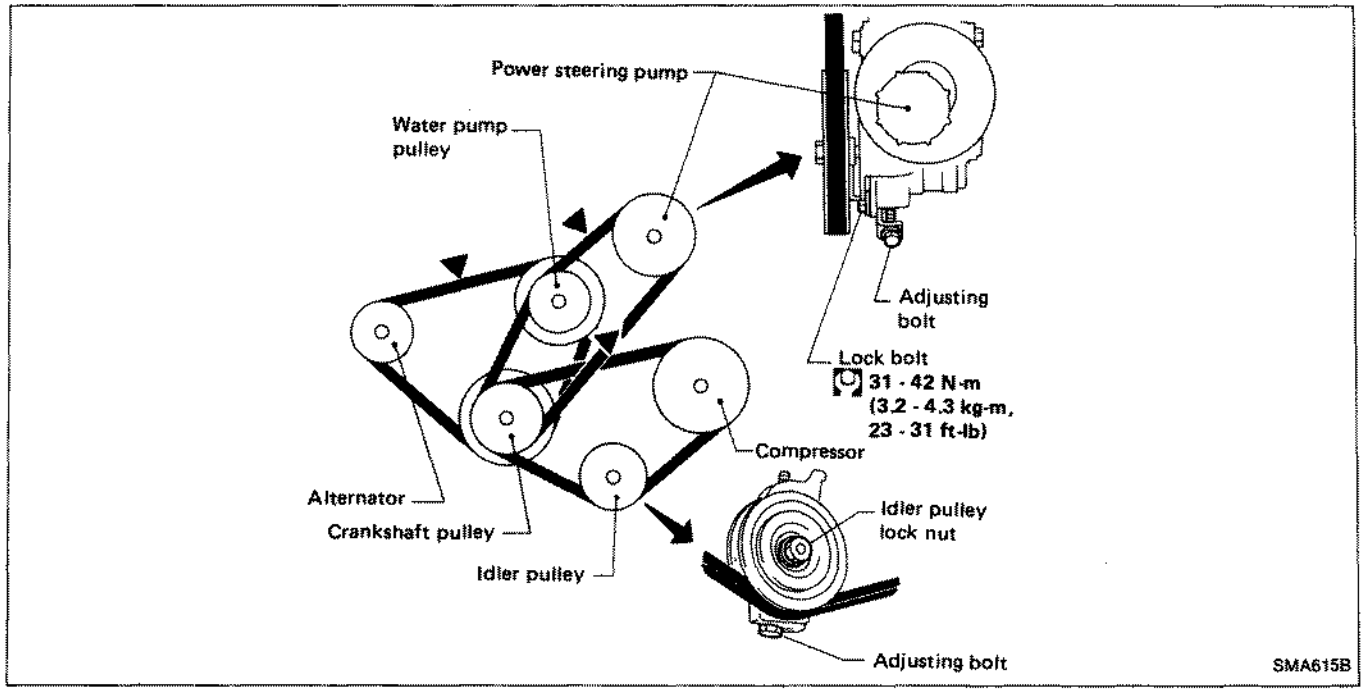
Adjusting Intake and Exhaust Valve Clearance

Adjustment must be made after engine has been warmed up sufficiently.

1. Set No. 1 cylinder at top dead center on its compression stroke, and adjust valve clearance ①, ②, ③ and ⑥.
2. Set No. 4 cylinder at top dead center on its compression stroke, and adjust valve clearance ④, ⑤, ⑦ and ⑧.

Valve clearance:
Intake and exhaust
0.28 mm (0.011 in)
Adjusting screw lock nut:
: 16 - 21 N·m
(1.6 - 2.1 kg-m, 12 - 15 ft-lb)

Drive Belt Inspection



1. Inspect for cracks, fraying, wear or oil adhesion. If necessary, replace with new one.

The belts should not touch the bottom of the pulley groove.

2. Inspect drive belt deflections by pushing on the belt midway between pulleys.

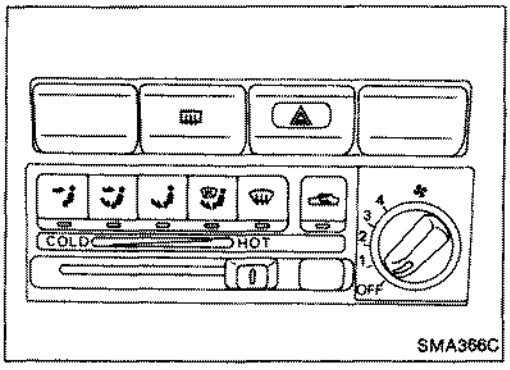
Adjust if belt deflections exceed the limit.

Belt deflection:

Unit: mm (in)

	Used belt deflection		Deflection of new belt
	Limit	Deflection after adjustment	
Alternator	13.5 (0.531)	8.5 - 9.5 (0.335 - 0.374)	7.5 - 8.5 (0.295 - 0.335)
Air conditioner compressor	12.5 (0.492)	9 - 10 (0.35 - 0.39)	6 - 8 (0.24 - 0.31)
Power steering oil pump	10.5 (0.413)	7 - 9 (0.28 - 0.35)	6.5 - 8.5 (0.256 - 0.335)
Applied pushing force	98 N (10 kg, 22 lb)		

Inspect drive belt deflections when engine is cold. If engine is hot, wait 30 minutes or more and check deflections.



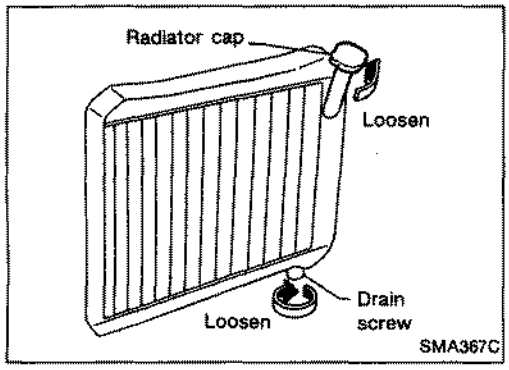
Changing Engine Coolant

WARNING:

To avoid the danger of being scalded, never attempt to change the coolant when the engine is hot.

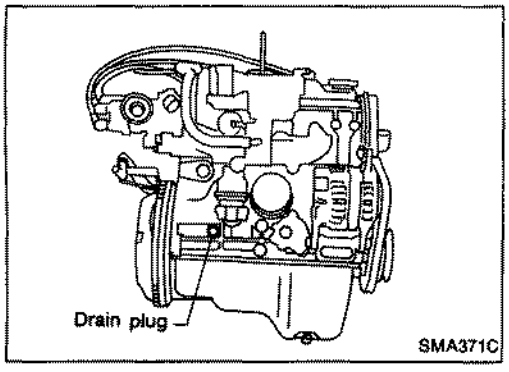
1. Move heater "TEMP" control lever all the way to "HOT" position.

Changing Engine Coolant (Cont'd)

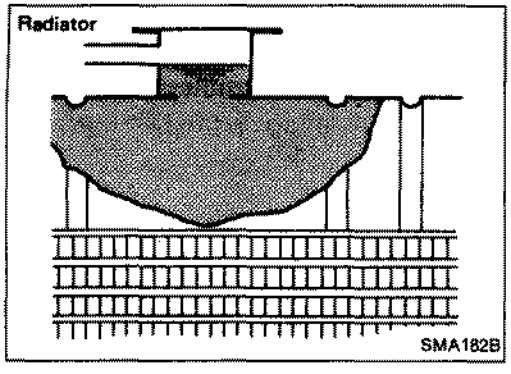


2. Drain engine coolant.
(1) Open drain screw at the bottom of radiator, and remove radiator cap.

Be careful not to allow coolant to contact drive belts.



(2) Remove drain plug on cylinder block.
3. Flush the cooling system.
(1) Close drain screw and drain plug.
(2) Fill radiator with water, then warm up engine.
(3) Stop engine and wait until it cools down.
(4) Drain water.
(5) Repeat step (1) through step (4) two or three times.



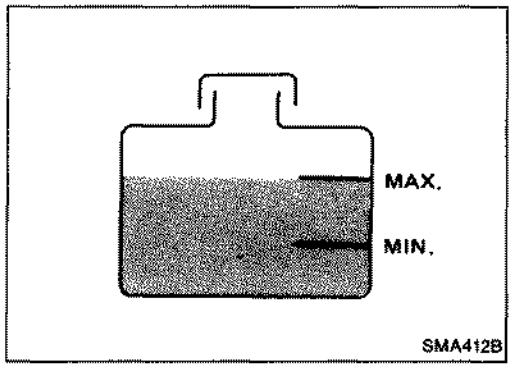
4. Fill radiator with coolant up to filler opening.
Follow instructions attached to anti-freeze container for mixing ratio of anti-freeze to water.

Coolant capacity (Without reservoir tank):

Coolant capacity ℓ (Imp qt)	
With heater	Without heater
4.1 (3-5/8)	3.8 (3-3/8)

Reservoir tank: 0.7ℓ (5/8 Imp qt)

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

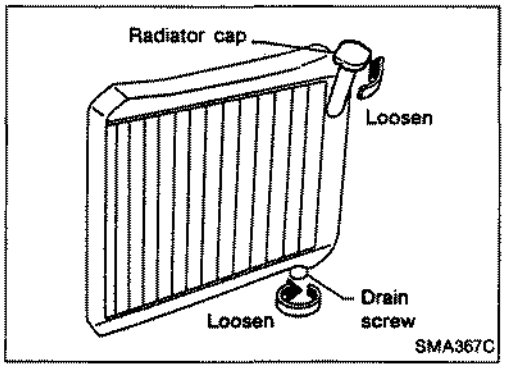


5. Fill reservoir tank with coolant up to "MAX" level.
6. Run engine at approximately 2,000 rpm for about one minute.
7. Stop engine and cool it down, then refill radiator and reservoir tank.

Checking Cooling System

CHECKING HOSES

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



CHECKING COOLING SYSTEM FOR LEAKS

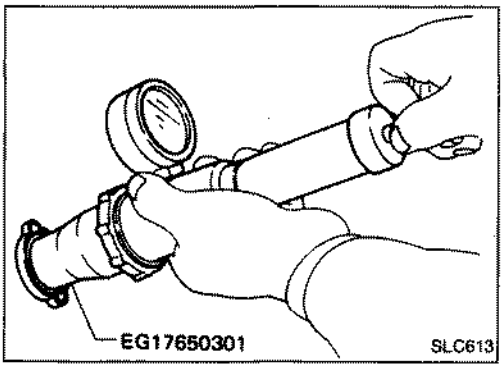
Apply pressure to the cooling system by means of a tester to check for leakage.

Testing pressure:

98 kPa (0.98 bar, 1.0 kg/cm^2, 14 psi)

CAUTION:

Higher than the specified pressure may cause radiator damage.



CHECKING RADIATOR CAP

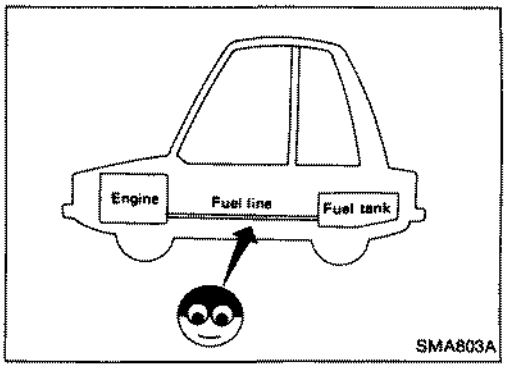
Apply pressure to radiator cap by means of a cap tester to see if it is satisfactory.

Radiator cap relief pressure:

78 - 98 kPa (0.78 - 0.98 bar, 0.8 - 1.0 kg/cm^2, 11 - 14 psi)

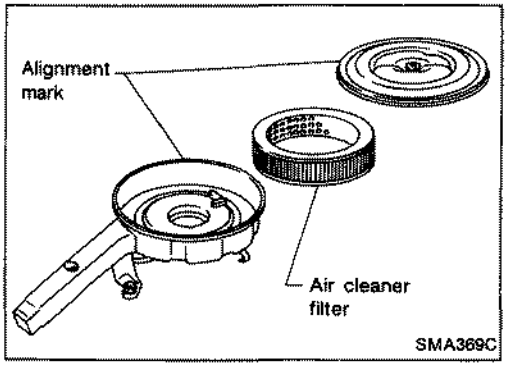
Checking Fuel Lines

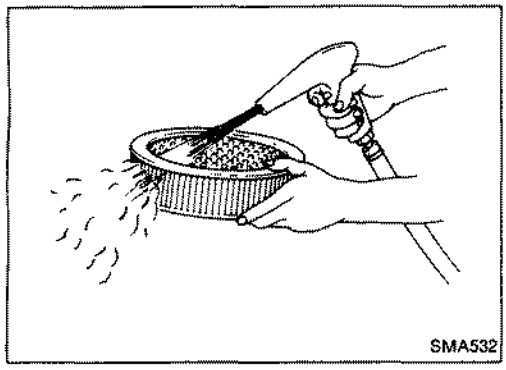
Check fuel lines and tank for proper attachment, leaks, cracks, damage, loose connections, chafing and deterioration.



Replacing Air Cleaner Filter (Viscous paper type)

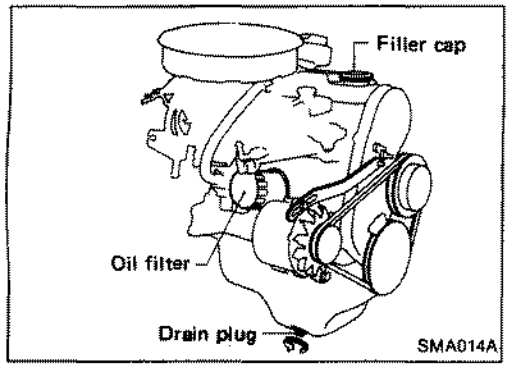
The viscous paper type air cleaner filter does not require any cleaning operation between renewals.




SMA532

Cleaning and Replacing Air Cleaner Filter (Dry paper type)

Clean or replace element more often under dusty driving conditions.



Changing Engine Oil

WARNING:

Be careful not to burn yourself, as the engine oil may be hot.

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

Oil capacity (Approximately):

With oil filter change 3.2ℓ (2-7/8 Imp qt)

Without oil filter change 2.8ℓ (2-1/2 Imp qt)

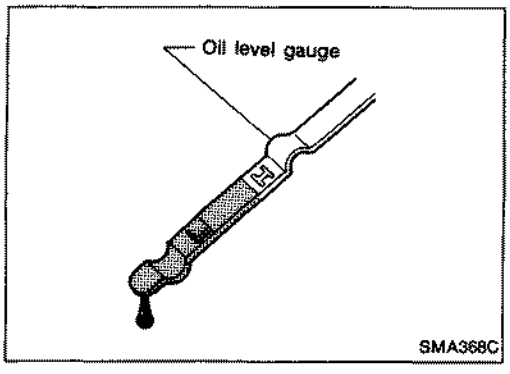
CAUTION:

- **Be sure to clean drain plug and install with new washer.**

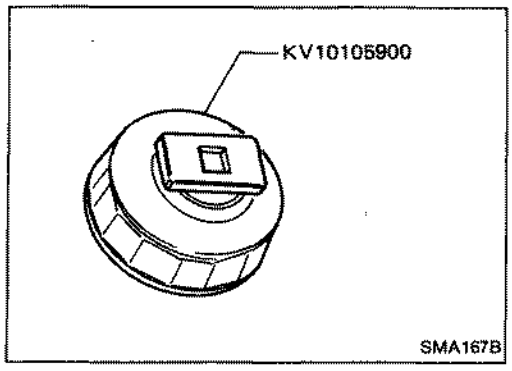
  Drain plug:

  : 29 - 39 N·m

  (3.0 - 4.0 kg-m, 22 - 29 ft-lb)
- **Use recommended engine oil "API SE, SF or SG" with suitable viscosity.**
- **The refill capacity changes depending on the oil temperature and drain time, use these values as a reference and be certain to check with the dipstick when changing the oil.**



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



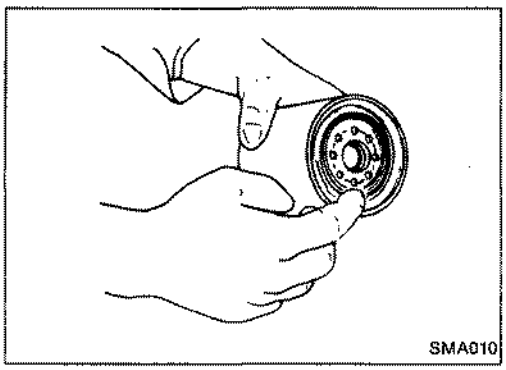
Changing Engine Oil Filter

1. Remove oil filter with Tool.

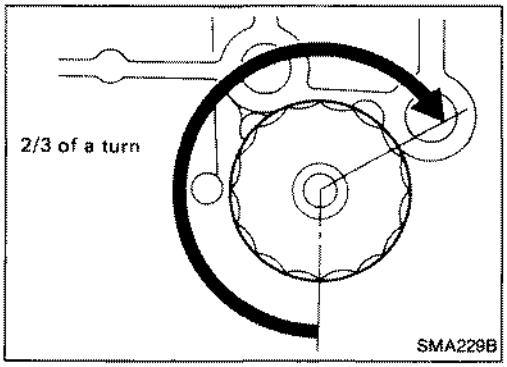
WARNING:

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

Changing Engine Oil Filter (Cont'd)



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



3. Screw oil filter on until a slight resistance is felt, then tighten by at least an additional 2/3 turn further.
4. Add engine oil.

Refer to Changing Engine Oil.

Checking and Adjusting Idle-rpm, Ignition Timing and Mixture Ratio

CAUTION:

Do not attempt to screw the idle adjusting screw down completely. Doing so could cause damage to tip, which in turn will tend to cause malfunctions.

Preparation

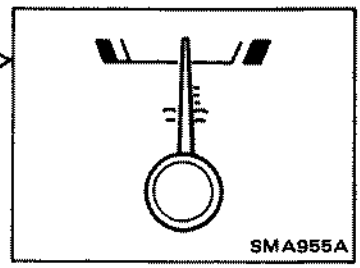
1. Set shift lever in "Neutral" position. Keep front wheels in a straight-ahead position on power steering equipped models. Engage parking brake and lock both front and rear wheels with wheel chocks.
2. Turn off air conditioner and headlamps.
3. Use "CO"-meter after it is fully warmed up, and insert "CO"-meter probe into tail pipe more than 0.4 m (1.3 ft).
4. Measure "CO"% with air cleaner installed.
5. During checking and adjusting, make sure that engine is at normal operating temperature.

Checking and Adjusting Idle-rpm, Ignition Timing and Mixture Ratio (Cont'd)

CHECKING AND ADJUSTING IDLE-RPM, IGNITION TIMING AND MIXTURE RATIO

START

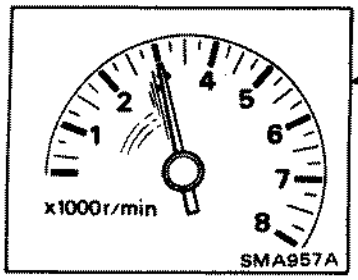
Start engine and warm it up until water temperature indicator reaches normal operating temperature.


SMA955A

Open engine hood.

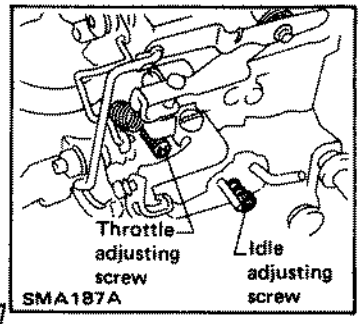
Run engine at idle speed for 2 minutes.

Disconnect distributor vacuum hose on intake manifold connector side and install blind cap to connector.



SMA957A

Race engine (2,000 - 3,000 rpm) 2 or 3 times under no-load, and then run engine at idle speed.



SMA187A

Check idle speed.

Idle speed:
Below 1,000 rpm

O.K.

N.G.

Adjust idle speed by turning throttle adjusting screw.

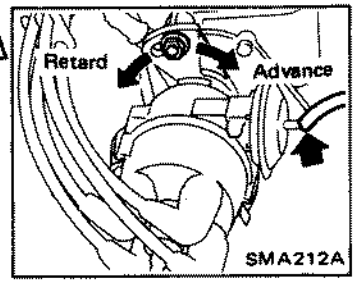
Check ignition timing at idle speed.

Ignition timing: B.T.D.C. degree
2±2

O.K.

N.G.

Adjust ignition timing by turning distributor.



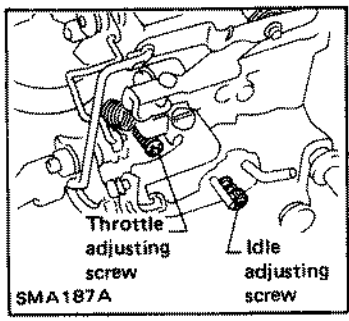
SMA212A

Connect distributor vacuum hose to intake manifold connector.

Ⓐ

Ⓑ

Checking and Adjusting Idle-rpm, Ignition Timing and Mixture Ratio (Cont'd)



Race engine (2,000 - 3,000 rpm) 2 or 3 times under no-load, and then run engine at idle speed.

Adjust idle speed by turning throttle adjusting screw.

Idle speed: rpm
900 ± 50

Confirm ignition timing at idle speed.

Ignition timing: B.T.D.C. degree
15 ± 5

O.K.

N.G.

Clean or replace vacuum hoses.

Check distributor and vacuum hoses.

Repair or replace distributor or vacuum controller.

Without "CO"-meter → Ⓒ

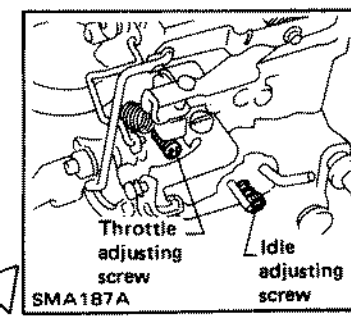
With "CO"-meter

Check "CO"% at idle speed.

Idle "CO": %
1.5 ± 0.5

O.K.

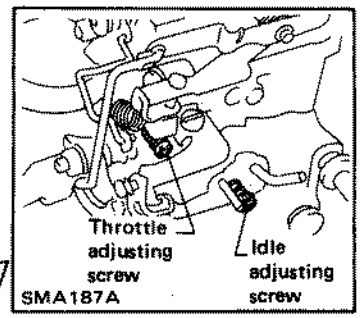
N.G.



Adjust idle "CO"% to 1.5 ± 0.5% by turning idle adjusting screw.

END

Checking and Adjusting Idle-rpm, Ignition Timing and Mixture Ratio (Cont'd)



CAUTION:
Do not attempt to screw the idle adjusting screw down completely. Doing so could cause damage to tip, which in turn will tend to cause malfunctions.

Turn out idle adjusting screw approximately three turns, starting from fully closed position.

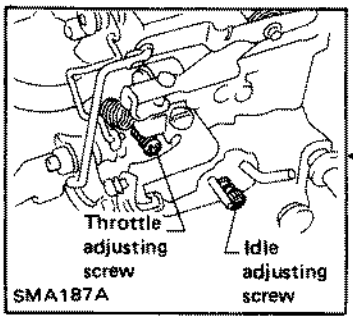
Adjust engine speed by turning throttle adjusting screw.

Engine speed: rpm
950 ± 50

Turn idle adjusting screw until engine runs smoothly at highest speed.

Engine speed does not rise.

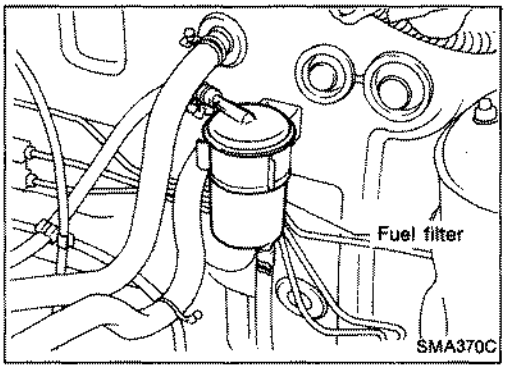
Engine speed rises.



Adjust engine speed by turning in idle adjusting screw.

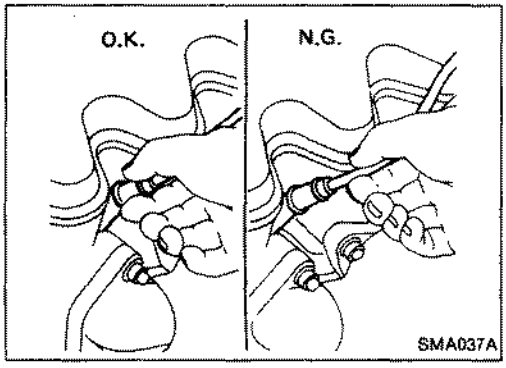
Idle speed: rpm
900 ± 50

END



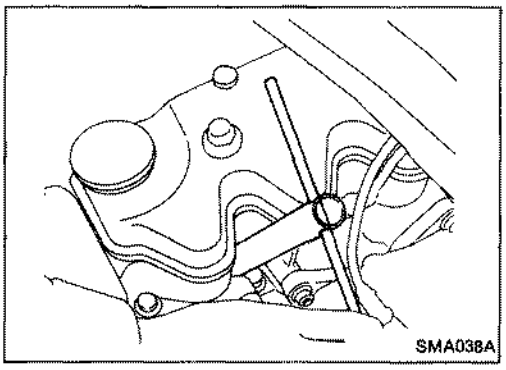
Replacing Fuel Filter

Be careful not to spill fuel over engine compartment. Place a rag to absorb fuel.



Checking and Replacing Spark Plugs

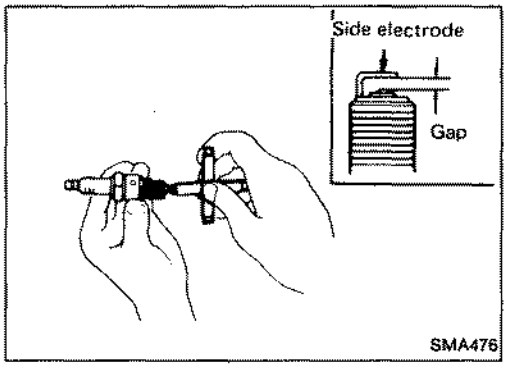
1. Remove air cleaner.
2. Disconnect ignition wires from spark plugs by pulling on boots. Do not pull on wires.



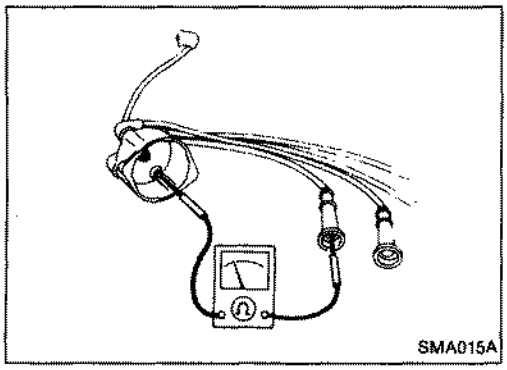
3. Remove spark plugs with spark plug wrench.

Spark plug:

Type	
Standard	BP5ES
Hot	BP4ES
Cold	BP6ES

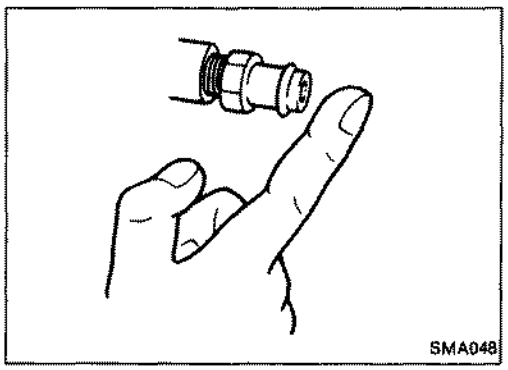


4. Check new spark plug gap.
   Gap: 0.8 - 0.9 mm (0.031 - 0.035 in)
5. Install spark plugs. Reconnect ignition wires according to Nos. indicated on them.
   Spark plug:
   : 20 - 29 N·m
   (2.0 - 3.0 kg-m, 14 - 22 ft-lb)


SMA015A

Checking Ignition Wire (High Tension Wire)

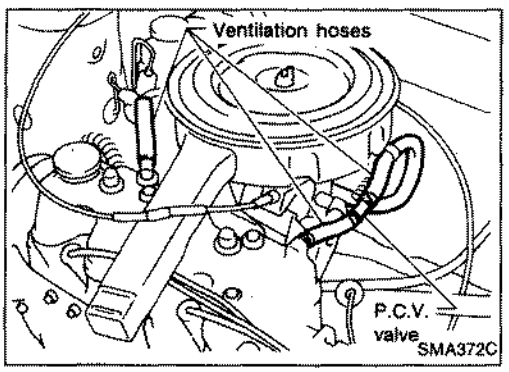
1. Inspect ignition wires for cracks, damage, burned terminals and proper fit.
2. Measure the resistance of ignition wires by shaking them and checking for intermittent breaks.
   Resistance: Less than 30 kΩ
   If N.G., replace with new ones.


SMA048

Checking Positive Crankcase Ventilation (P.C.V.) System

CHECKING P.C.V. VALVE

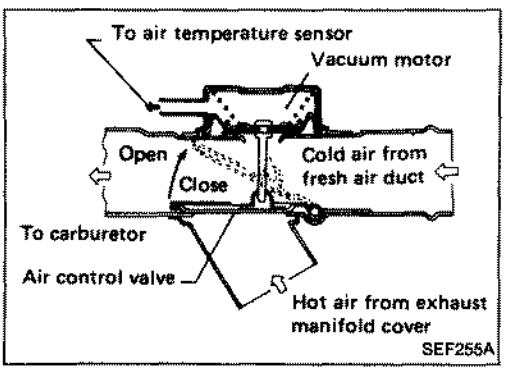
With engine running at idle, remove ventilation hose from P.C.V. valve; if valve is working properly, a hissing noise will be heard as air passes through it and a strong vacuum should be felt immediately when a finger is placed over valve inlet.



SMA372C

CHECKING VENTILATION HOSES

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.



SEF255A

Checking Automatic Temperature Control (A.T.C.) Air Cleaner

1. Check that vacuum hoses (Intake manifold to temperature sensor and vacuum motor) are securely connected.
2. Inspect each hose for cracks or distortion.
3. Inspect A.T.C. system for proper function.

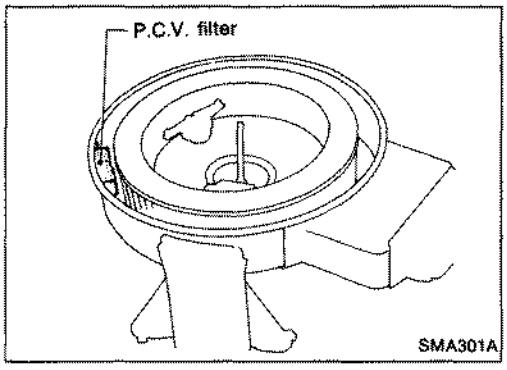
Engine	Temperature	Air control valve position	Intake air temperature
Stopped	Any	Closed	—
At idle	Low	Open	Hot
	High	Closed	Cool

4. Make sure that air control valve moves when engine is raced under no-load.
5. Make sure that air control valve gradually closes when engine warm-up advances.

Refer to section EF & EC.

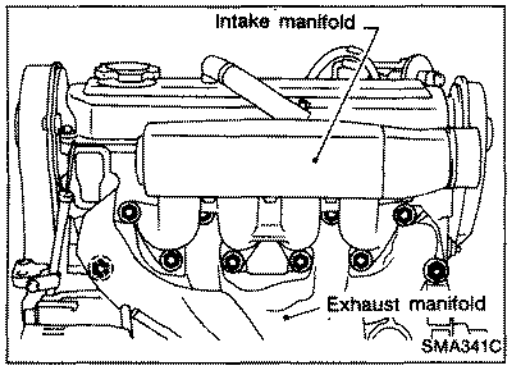
Checking Vacuum Fitting Hoses and Connections

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



Replacing P.C.V. filter

Remove air cleaner cover, and replace filter.

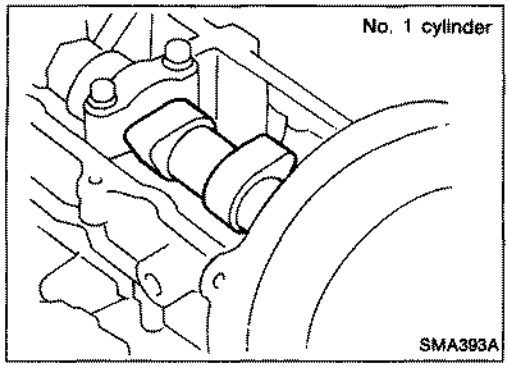


Manifold Nut Check

1. Remove exhaust manifold cover.
2. Tighten manifold bolts and nuts to the specified torque.
3. Install exhaust manifold cover.

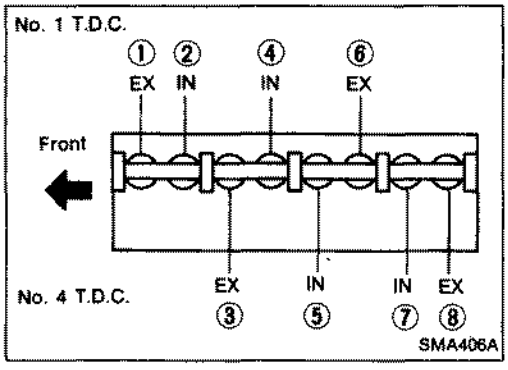
Valve Clearance Adjustment

Warm up engine to the normal operating temperature.



VALVE CLEARANCE CHECK

1. Set No. 1 cylinder to T.D.C. on its compression stroke.
2. Check valve clearances of cylinders No. ①, ②, ④ and ⑥.

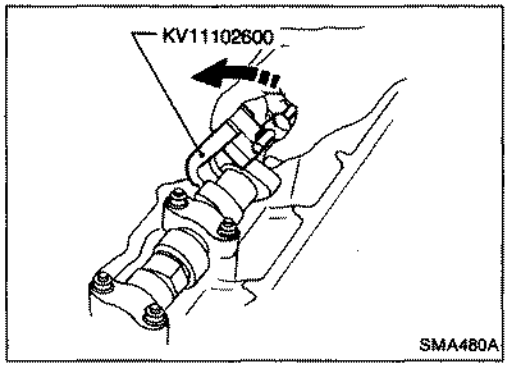


3. Set No. 4 cylinder to T.D.C. on its compression stroke.
4. Check valve clearances of cylinders No. ③, ⑤, ⑦ and ⑧.

Valve clearance (Hot):

Unit: mm (in)

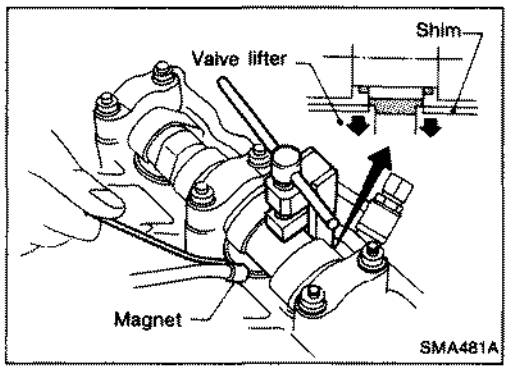
Intake	0.20 - 0.30 (0.008 - 0.012)
Exhaust	0.40 - 0.50 (0.016 - 0.020)



VALVE CLEARANCE ADJUSTMENT

1. Set the cylinder, whose valve clearance needs to be adjusted, to T.D.C.
2. Turn crankshaft an additional 90 degrees clockwise from T.D.C.
3. Set Tool or equivalent between cams on camshaft.

Valve Clearance Adjustment (Cont'd)

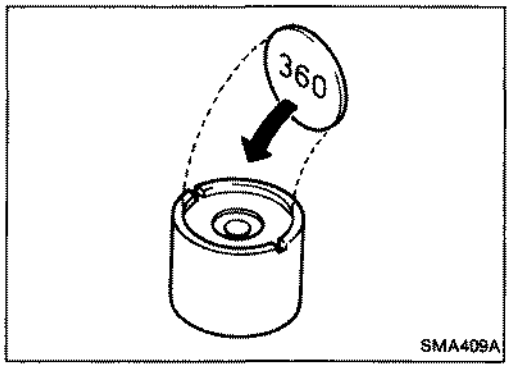


4. Install selected shim to valve lifter.

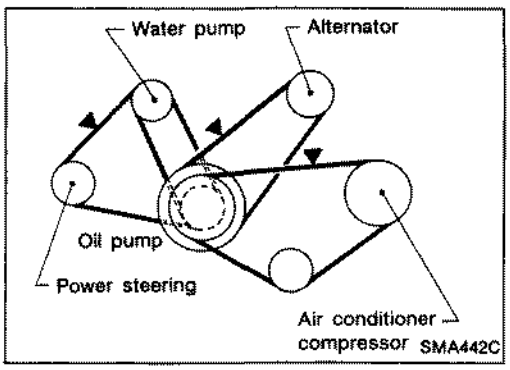
Example:

Unit: mm (in)

	Intake	Exhaust
Specified clearance	0.20 - 0.30 (0.008 - 0.012)	0.40 - 0.50 (0.016 - 0.020)
Measured clearance	0.32 (0.013)	0.36 (0.014)
Difference	0.02 - 0.12 (0.001 - 0.005) large	0.04 - 0.14 (0.002 - 0.006) small
Thickness of plate that was used	3.60 (0.142)	3.55 (0.140)
Thickness of plate to be used	3.65 or 3.70 (0.144 or 0.146)	3.45 or 3.50 (0.136 or 0.138)



Set shim with numbered side down.
Refer to S.D.S. for service shims.



Drive Belt Check

WARNING:

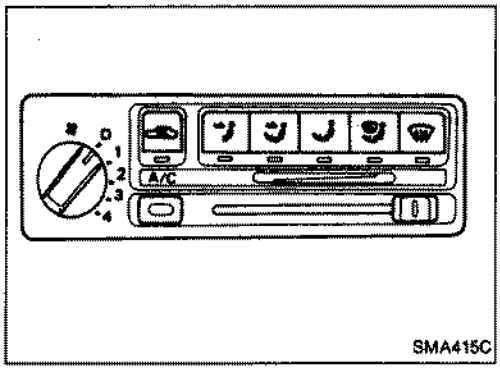
Inspect drive belt deflections when engine is cold. When engine is hot, check deflections at least 30 minutes after engine has been switched off.

1. Inspect belts for cracks, fraying, wear or oil adhesion. If necessary, replace with new ones.
2. Inspect drive belt deflections by pushing on the belt midway between pulleys.
3. Adjust belt deflection if it exceeds the limit.

Belt deflection:

Unit: mm (in)/98 N (10 kg, 22 lb)

	Alternator	A/C compressor	P/S oil pump		Water pump
			CD17	CD20	CD20 without P/S
New belt	8.5 - 10.5 (0.335 - 0.413)	9.5 - 11.5 (0.374 - 0.453)	8.5 - 10.5 (0.335 - 0.413)	4 - 6 (0.16 - 0.24)	6 (0.24)
Used belt	10.5 - 12.5 (0.413 - 0.492)	11.5 - 13.5 (0.453 - 0.531)	10.5 - 12.5 (0.413 - 0.492)	5 - 7 (0.20 - 0.28)	8 (0.31)
Limit	17 (0.67)	17 (0.67)	14 (0.55)	8 (0.31)	—

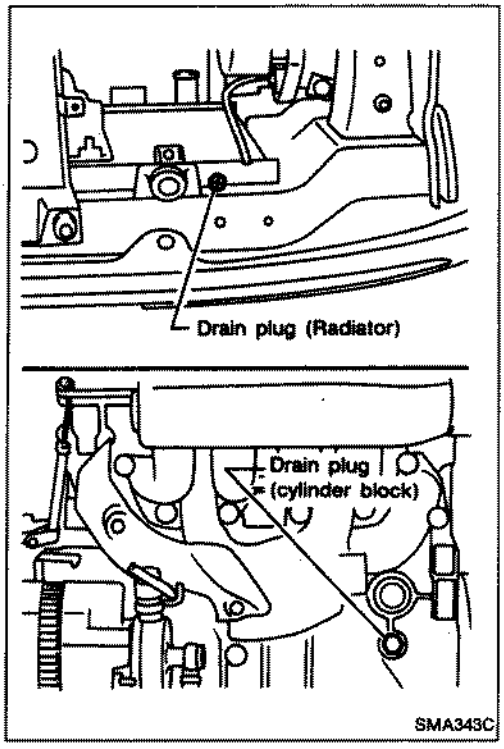


Engine Coolant Change

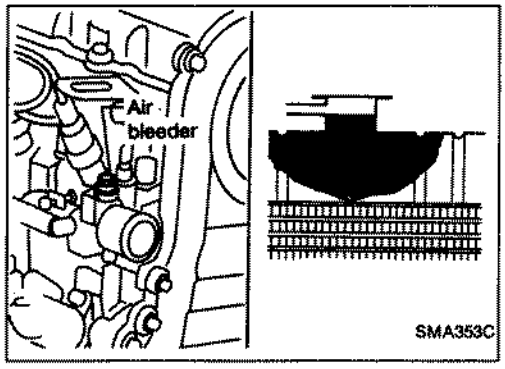
WARNING:

To avoid the danger of being scalded, never attempt to change the coolant when the engine is hot.

1. Set heater "TEMP" control lever to the max. "HOT" position.



2. Open drain plugs on the bottom right of radiator and on the left side of cylinder block.
3. Remove radiator cap and drain coolant.
4. Close drain plugs and fill radiator with water up to filler neck.
5. Warm up engine and repeat steps 2, 3 and 4 one or two times to drain old coolant.



6. Open air bleeder on intake manifold.
7. Fill radiator with coolant up to filler neck.
   Follow instructions attached to anti-freeze container for anti-freeze to water mixing ratio.

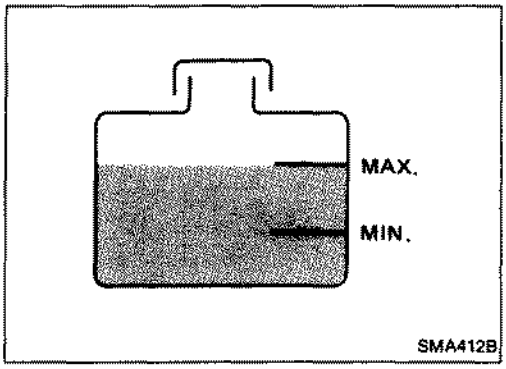
Pour coolant slowly to allow air in system to escape.

Coolant capacity:

Unit: ℓ (Imp qt)

	CD17	CD20
With heater	6.5 (5-3/4)	7.1 (6-1/4)
Without heater	6.2 (5-1/2)	6.8 (6)
Reservoir tank	0.7 (5/8)	

Engine Coolant Change (Cont'd)



8. Securely close air bleeder.
9. Fill reservoir tank with coolant up to "MAX" level.
10. Warm up engine at about 2,000 rpm to normal operating temperature.
11. Stop engine and allow it to cool.
12. Check coolant level and refill reservoir tank if necessary.

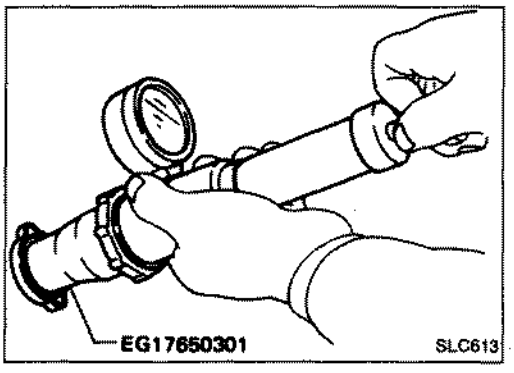
INFORMATION

For more detailed procedure of filling up radiator with coolant, refer to LC section.

Cooling System Check

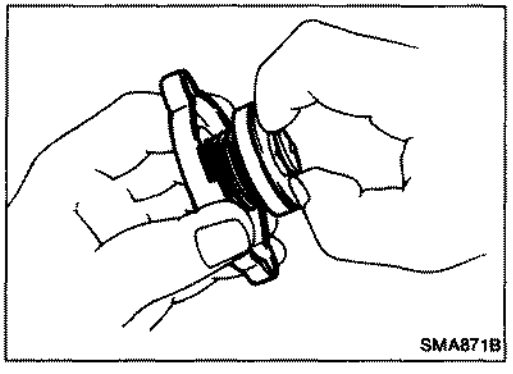
HOSE AND CLAMP CHECK

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

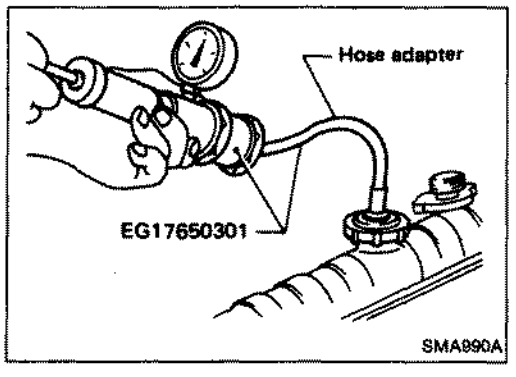


RADIATOR CAP CHECK

1. Check relief pressure with cap tester.
   Radiator cap relief pressure:
   CD17
   59 - 98 kPa (0.59 - 0.98 bar, 0.6 - 1.0 kg/cm^2, 9 - 14 psi)
   CD20
   88 - 127 kPa (0.88 - 1.27 bar, 0.9 - 1.3 kg/cm^2, 13 - 18 psi)
   Replace radiator cap if pressure is not within the specified values.



2. Pull the negative-pressure valve to open it, and check that it closes completely when released.

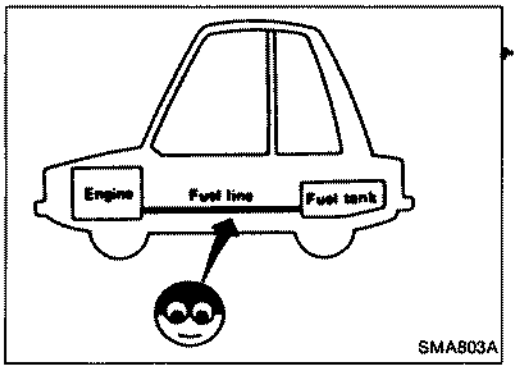


COOLING SYSTEM LEAK CHECK

Apply pressure to the cooling system with cap tester to check for leakage.

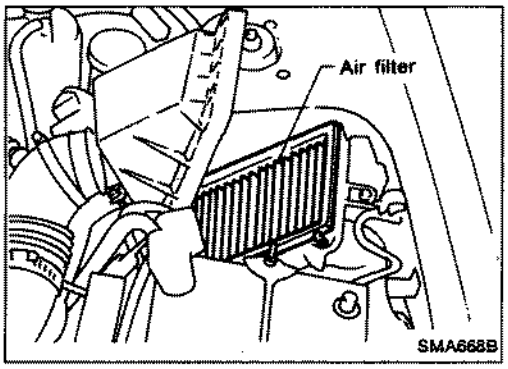
Testing pressure:
157 kPa (1.57 bar, 1.6 kg/cm^2, 23 psi)

CAUTION:
Use of higher pressure than that specified value may cause damage to radiator.



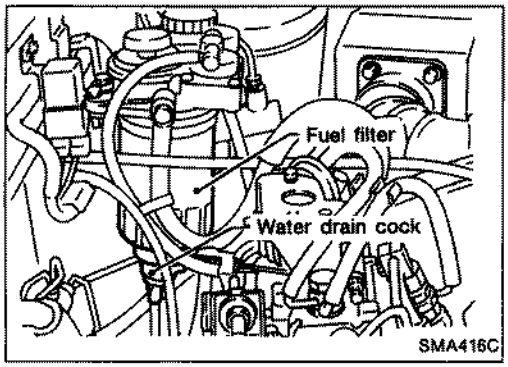
Fuel Line Check

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



Air Cleaner Filter Replacement

The viscous paper type air cleaner filter does not require any cleaning operation between renewals.



Water Draining, Fuel Filter Check and Replacement

WATER DRAINING

Open drain cock at the bottom of fuel filter.

FUEL FILTER CHECK

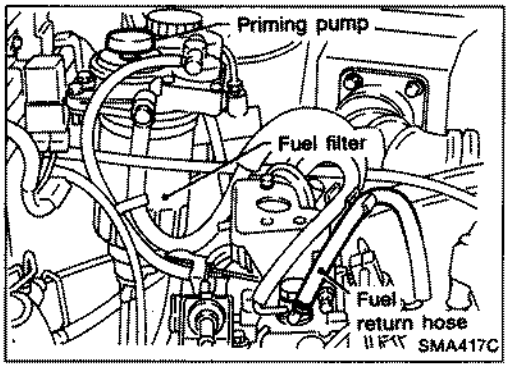
Check fuel filter for fuel leakage, damage and other abnormal signs.

FUEL FILTER REPLACEMENT

1. Disconnect water sensor connector and replace fuel filter with a new one.

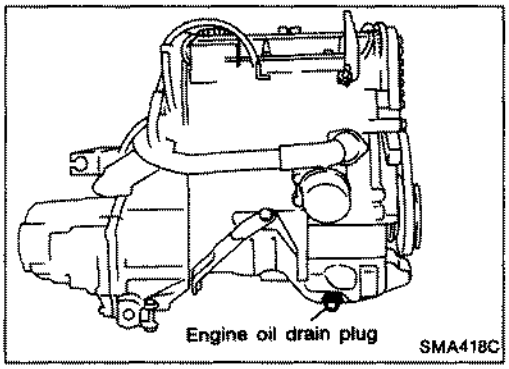
Hand-tighten fuel filter by about 2/3 turn after O-ring touches mounting surface. Follow the instructions on fuel filter.

2. Connect water sensor connector and bleed fuel system.



FUEL SYSTEM AIR BLEEDING

1. Disconnect fuel return hose at fuel injection pump.
2. Bleed air from fuel system with the priming pump until no bubbles come out of fuel return pipe of injection pump.
3. Securely connect fuel return hose.

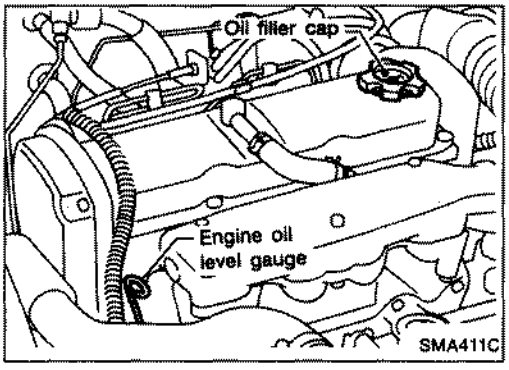


Engine Oil Change

WARNING:

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

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



3. Tighten oil drain plug.
4. Fill with engine oil.

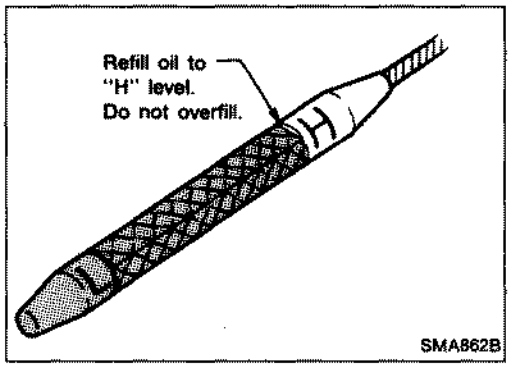
Oil refill capacity:

Unit: ℓ (Imp qt)

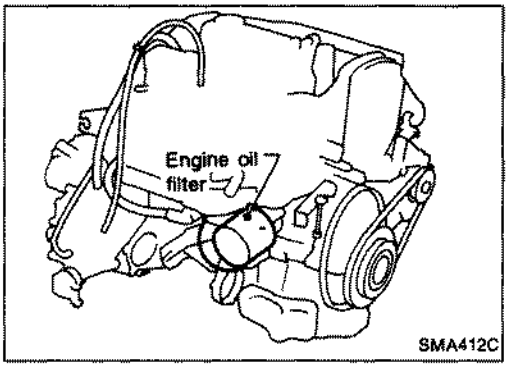
	CD17	CD20
Without oil filter	4.4 (3-7/8)	4.9 (4-3/8)
With oil filter	4.9 (4-3/8)	5.4 (4-3/4)

- **Use recommended engine oil "API CD" with suitable viscosity.**

5. Confirm oil level and warm up engine.



6. Recheck oil level and adjust it to "H" level if necessary.



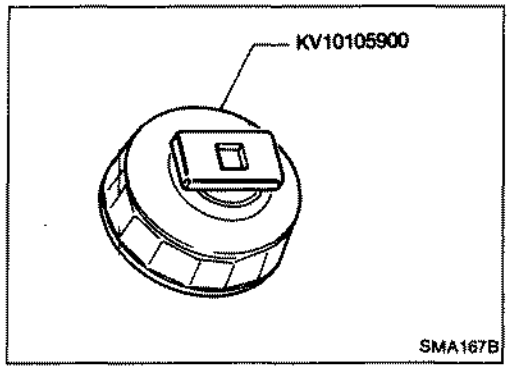
Engine Oil Filter Change

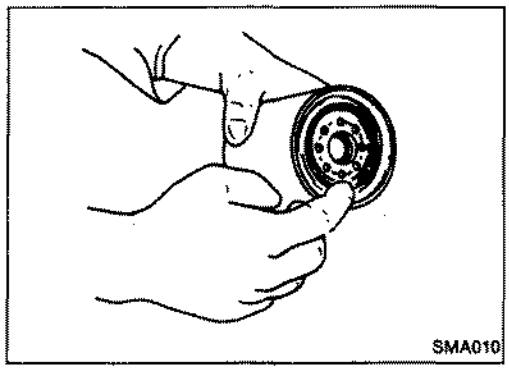
1. Remove oil filter with Tool.

WARNING:

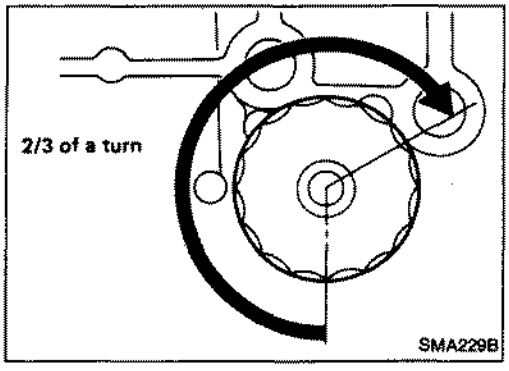
Be careful not to burn yourself, as engine and engine oil are hot.

Engine Oil Filter Change (Cont'd)



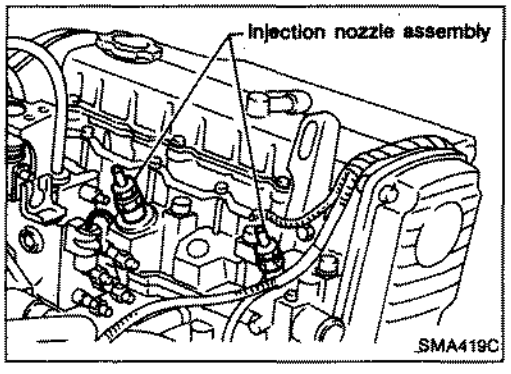


2. Before installing new oil filter, wipe clean oil filter mounting surface on cylinder block, and apply a little engine oil to rubber seal of oil filter.

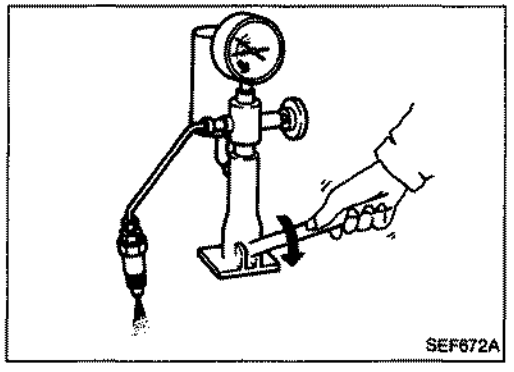


3. Screw oil filter on until a slight resistance is felt, then tighten an additional 2/3 turn or more (1/2 turn for CD20 models with E.G.R. system).
4. Warm up engine and check oil level.
5. Adjust oil level if necessary.

Injection Nozzle Check



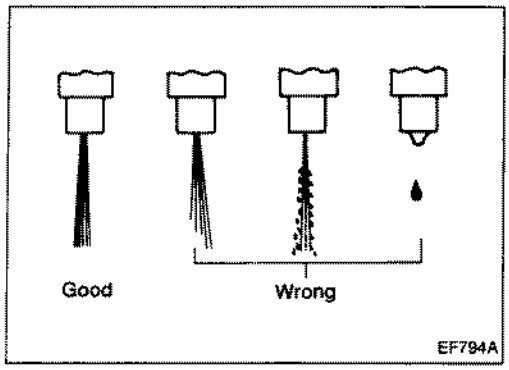
1. Remove injection delivery tubes and fuel spill tube.
2. Remove nozzle with a suitable tool [span 27 mm (1.06 in)].



3. Install injector to pressure tester.
4. Check initial injection pressure by pumping tester handle slowly (one time per second).

Injection pressure:
12,749 kPa (127.5 bar, 130 kg/cm^2, 1,849 psi)

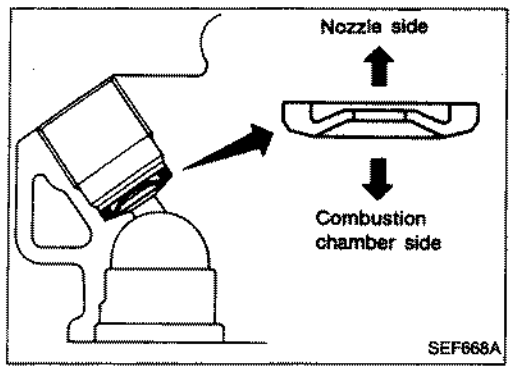
Injection Nozzle Check (Cont'd)



5. Check fuel spray pattern by pumping tester handle quickly (4 or 6 times per second).
6. If injection nozzle is not in normal condition, replace or correct.

Refer to EF & EC section for injection pressure adjustment.

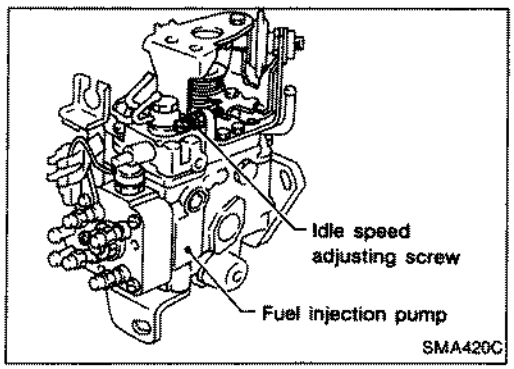
7. Install all injection nozzles and securely connect fuel spill tube and delivery tubes.
8. Bleed air from fuel system and check for fuel leakage with engine running.



Idle Speed Check

Inspection should be carried out with gears in "Neutral" and with air conditioner and other electrical loads off.

1. Warm up engine to normal operating temperature.
2. Attach a diesel tacho tester.
3. Race engine two or three times and check idle speed.



Idle Speed:

Unit: rpm

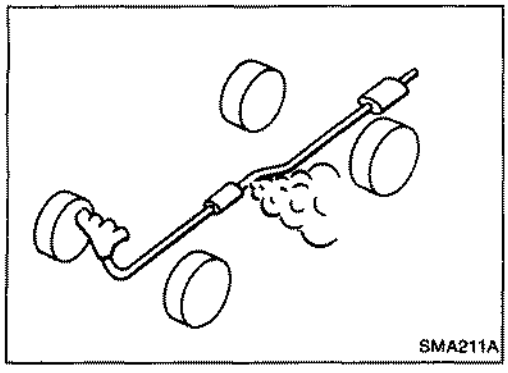
M/T
700^{+50}_{-0}

4. If it is out of specification, adjust idle speed with idle speed adjusting screw.

Securely lock the adjusting screw with lock nut.

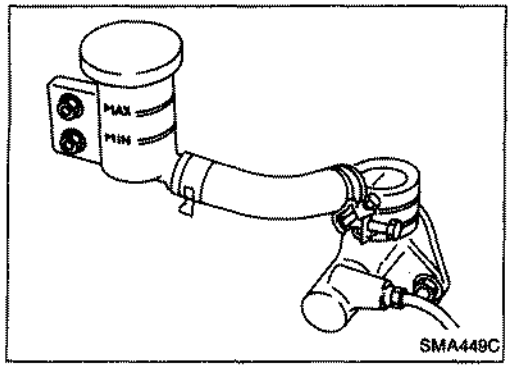
Timing Belt Replacement

Refer to EM section.


SMA211A

Checking Exhaust System

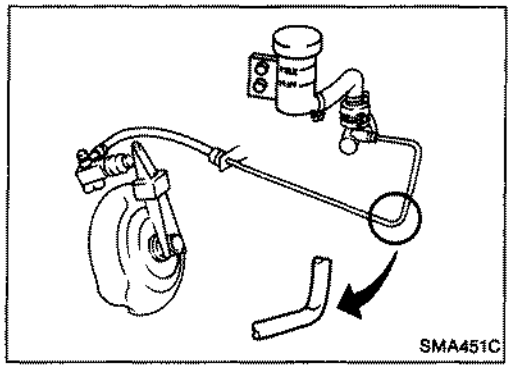
Check exhaust pipes, muffler and mounting for improper attachment and for leaks, cracks, damage, loose connections, chafing and deterioration.



SMA449C

Checking Clutch Fluid Level and Leaks

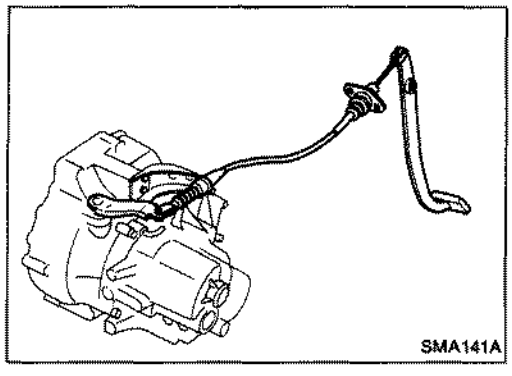
If fluid level is extremely low, check clutch system for leaks.


SMA451C

Checking Clutch System

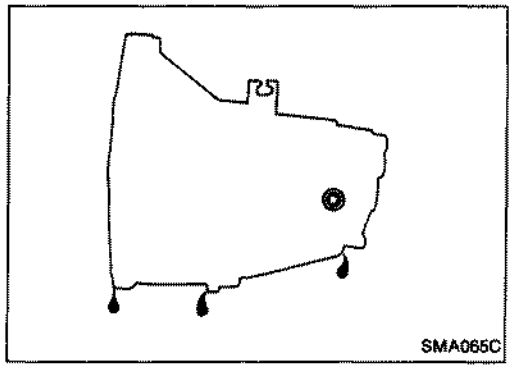
HYDRAULIC TYPE

Check fluid lines and operating cylinder for improper attachment, cracks, damage, loose connections, chafing and deterioration.


SMA141A

MECHANICAL TYPE

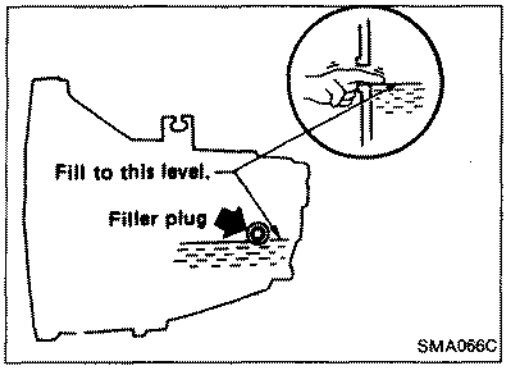
Check cable and links for improper attachment, chafing, wear and deterioration.


SMA065C

Checking M/T Oil

1. Check for oil leaks.

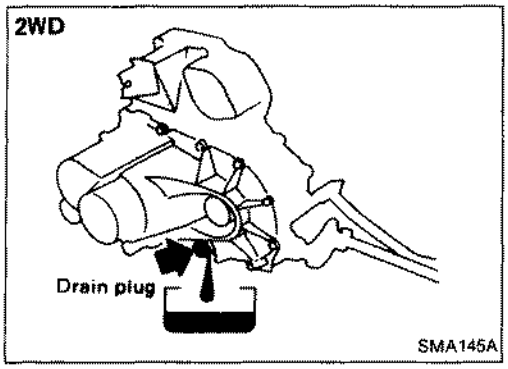
Checking M/T Oil (Cont'd)

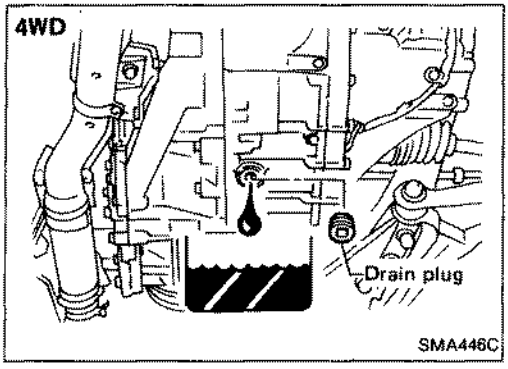


2. Check oil level.

Never start engine while checking oil level.

Changing M/T Oil



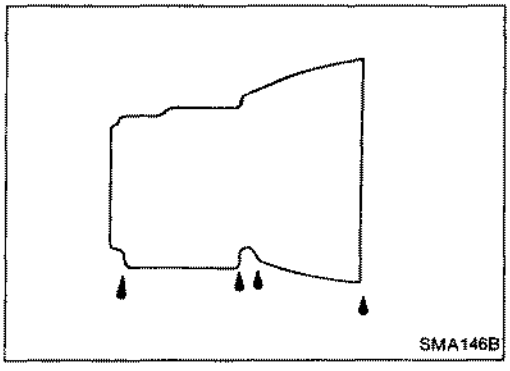


Oil capacity:

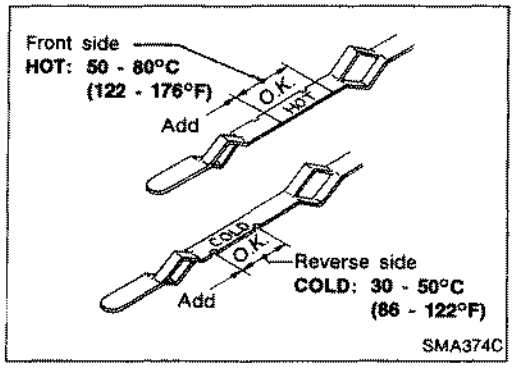
RN4F30A
2.6 liters (4-5/8 Imp pt)
RS5F30A
2.8 liters (4-7/8 Imp pt)
RS5F31A
2.9 liters (5-1/8 Imp pt)
RS5F32A
3.5 - 3.7 liters (6-1/8 - 6-1/2 Imp pt)
RS5F50A
4.2 liters (7-3/8 Imp pt)

- **Use recommended gear oil "API GL-4" with suitable viscosity.**

Checking A/T Fluid Level



1. Check for fluid leakage.

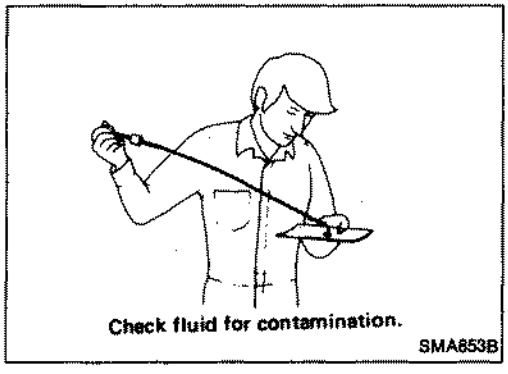


2. Check fluid level.
   Fluid level should be checked using "HOT" range on dipstick at fluid temperatures of 50 to 80°C (122 to 176°F) after vehicle has been driven approximately 5 minutes in urban areas after engine is warmed up. But it can be checked at fluid temperatures of 30 to 50°C (86 to 122°F) using "COLD" range on dipstick for reference after engine is warmed up and before driving. However, fluid level must be rechecked using "HOT" range.

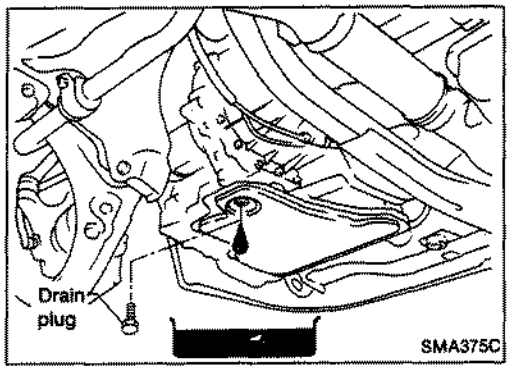
Checking A/T Fluid Level (Cont'd)

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) Re-insert dipstick into charging pipe as far as it will go.
6) Remove dipstick and note reading. If level is at low side of either range, add fluid to the charging pipe.

Do not overfill.



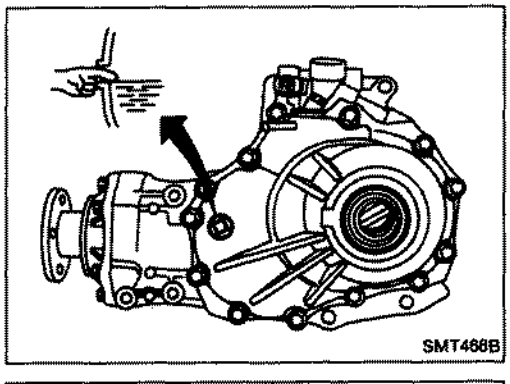
3. Check fluid condition.
   Check fluid for contamination. If fluid is very dark or smells burned, or contains frictional material (clutches, band, etc.), check operation of A/T.
   Refer to section AT for checking operation of A/T.



Changing A/T Fluid

Oil capacity (With torque converter):
7.0 liters (6-1/8 Imp qt)
Drain plug:
: 29 - 39 N·m (3.0 - 4.0 kg-m, 22 - 29 ft-lb)

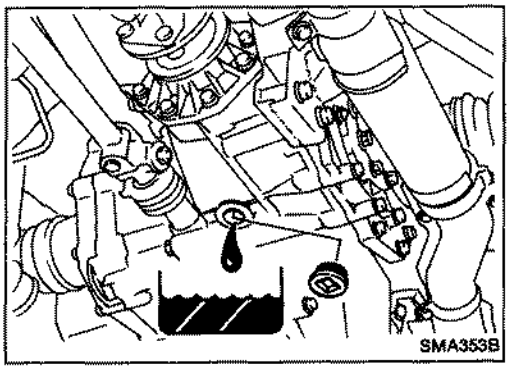
- **Use recommended A/T fluid "DEXRON™".**



Checking Transfer Oil Level

Never start engine while checking oil level.

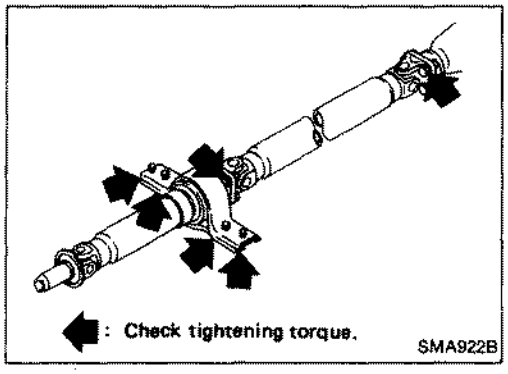
1. Check for oil leaks.
2. Check oil level.



Changing Transfer Oil

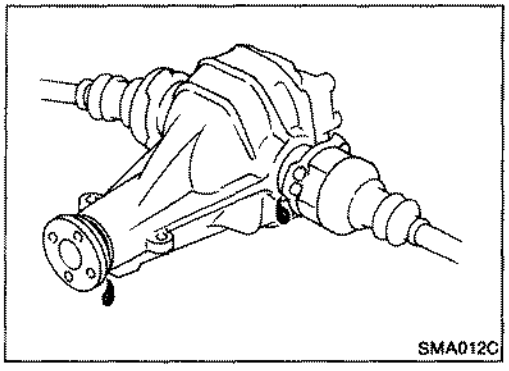
Oil capacity:
GA16DS engine models
1.1 liters (1 Imp qt)
SR20DET engine models
1.5 liters (1-3/8 Imp qt)

- **Use recommended gear oil "API GL-5" with suitable cosity.**



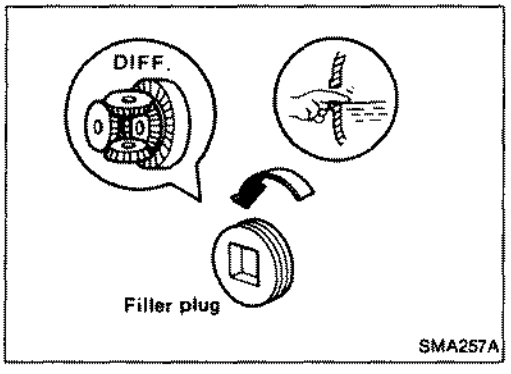
Checking Propeller Shaft

Check propeller shaft and center bearing for damage, looseness or grease leakage.
If greasing points are provided, supply grease as necessary.
Refer to section PD.

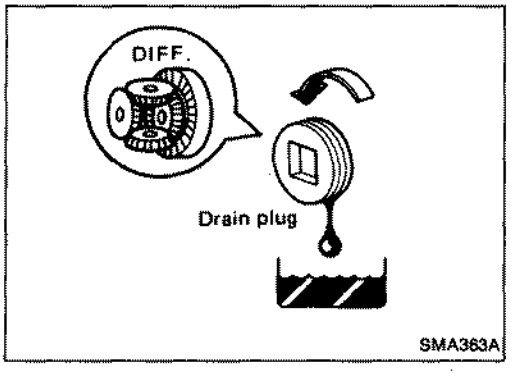


Checking Differential Gear Oil

1. Check differential carrier for oil leakage.



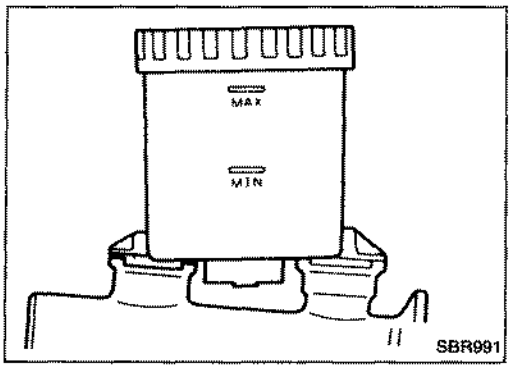
2. Check oil level.



Changing Differential Gear Oil

1. Drain oil and refill with new gear oil.
2. Check oil level.
   Oil capacity:
   1.0 liters (1-3/4 Imp pt)

- **Use recommended gear oil "API GL-5" with suitable viscosity.**

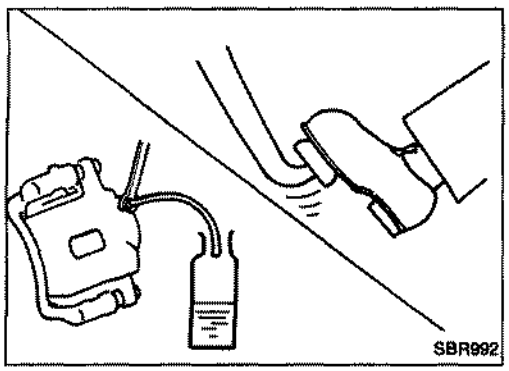


Checking Brake Fluid Level and Leaks

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

Checking Brake System

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



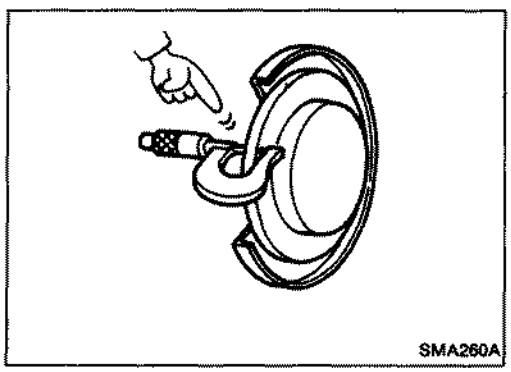
Changing Brake Fluid

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

- **Refill with recommended brake fluid "DOT 3".**
- **Never reuse drained brake fluid.**
- **Be careful not to splash brake fluid on painted areas.**

Checking Brake Booster, Vacuum Hoses, Connections and Check Valve

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



Checking Disc Brake

Check condition of disc brake components.

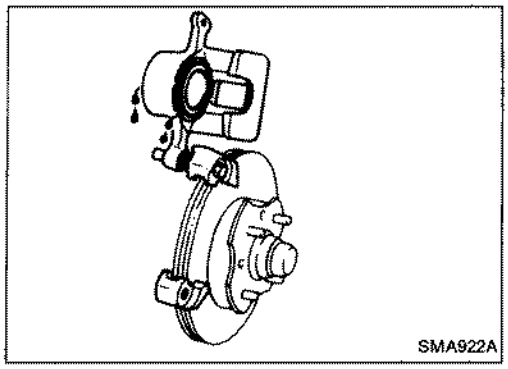
ROTOR

Check condition and thickness.

Unit: mm (in)

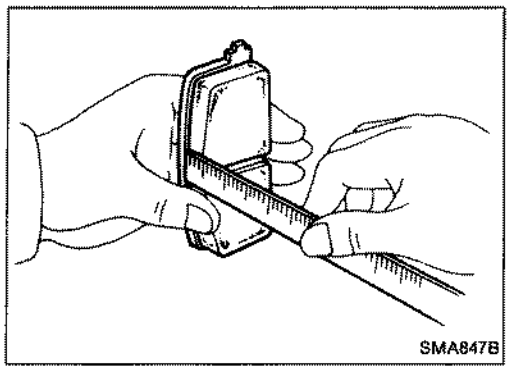
Brake model	CL18C	CL18VD	AD22VF	AD7HA	CL9HA
Standard thickness	12.0 (0.472)	18.0 (0.709)	26.0 (1.024)	7.0 (0.276)	9.0 (0.354)
Minimum thickness	10.0 (0.394)	16.0 (0.630)	24.0 (0.945)	6.0 (0.236)	8.0 (0.315)

Checking Disc Brake (Cont'd)


SMA922A

CALIPER

Check operation and for leakage.


SMA847B

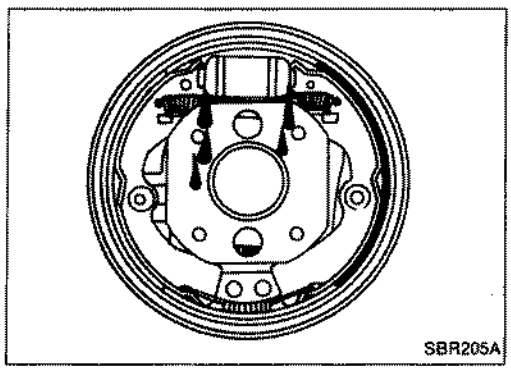
PAD

Check for wear or damage.

Standard thickness:
10.0 mm (0.394 in)
Minimum thickness:
2.0 mm (0.079 in)

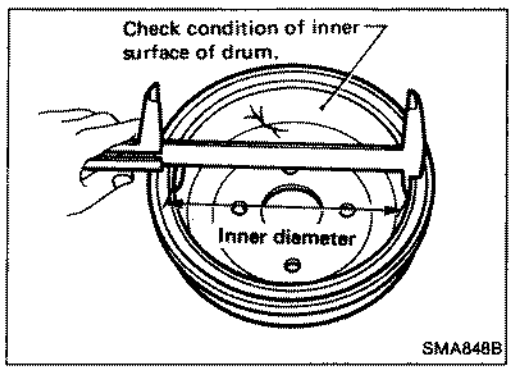
Checking Drum Brake

Check condition of drum brake components.


SBR205A

WHEEL CYLINDER

Check operation and for leakage.



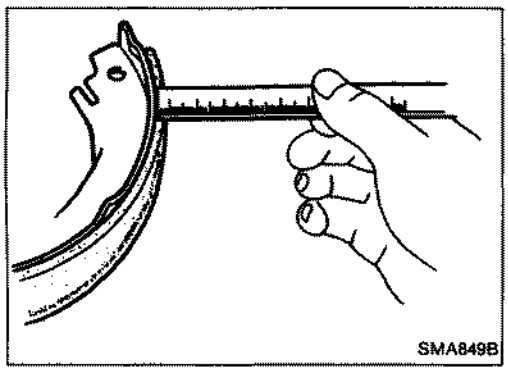
SMA848B

DRUM

Check condition of inner surface.

LT18C:
Standard diameter
180.0 mm (7.09 in)
Drum repair limit (inner diameter)
181.0 mm (7.13 in)
LT23B:
Standard diameter
228.6 mm (9 in)
Maximum diameter
230.0 mm (9.06 in)

Checking Drum Brake (Cont'd)



LINING

Check for wear or damage.

Standard thickness:

LT18C

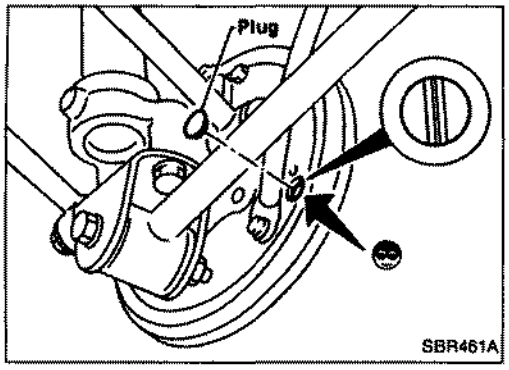
4.0 mm (0.157 in)

LT23B

4.5 mm (0.177 in)

Lining wear limit (Minimum thickness):

1.5 mm (0.059 in)



TEMPORARY METHOD FOR CHECKING LINING WEAR

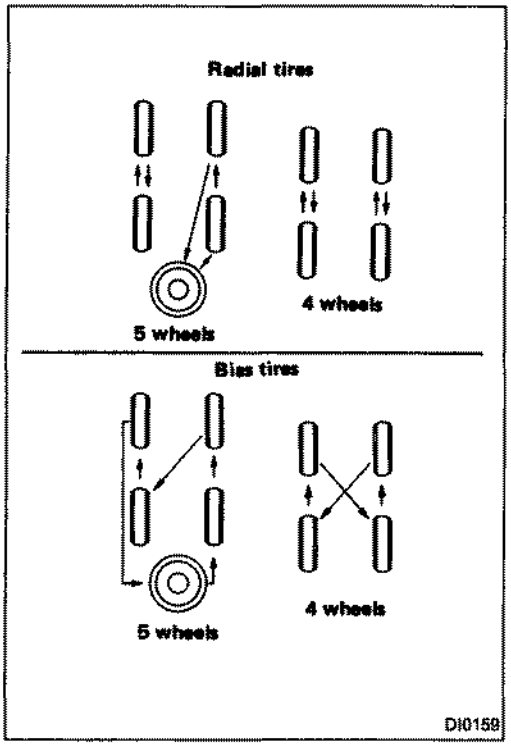
Remove inspection hole plug and check for lining wear.

Balancing Wheels

- Adjust wheel balance using road wheel center.

Wheel balance (Maximum allowable unbalance):

Refer to S.D.S.



Tire Rotation

Wheel nuts:

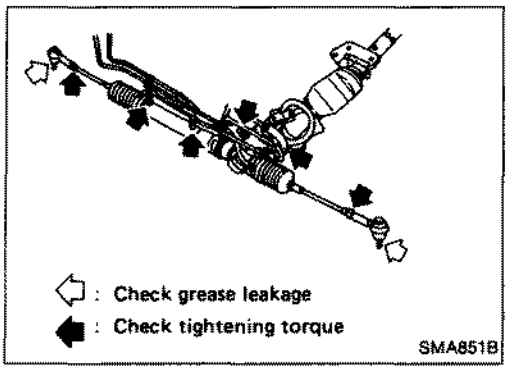
[O]: 98 - 118 N·m (10.0 - 12.0 kg-m, 72 - 87 ft-lb)

T-TYPE SPARE TIRE

- **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)



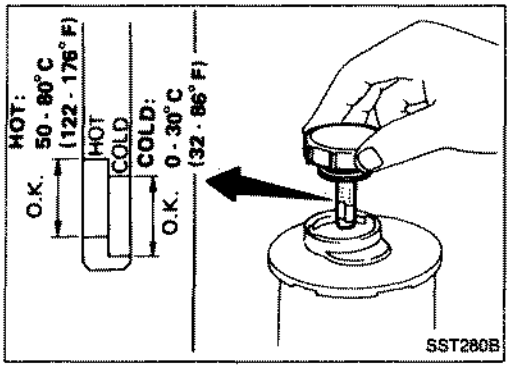
Checking Steering Gear and Linkage

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.

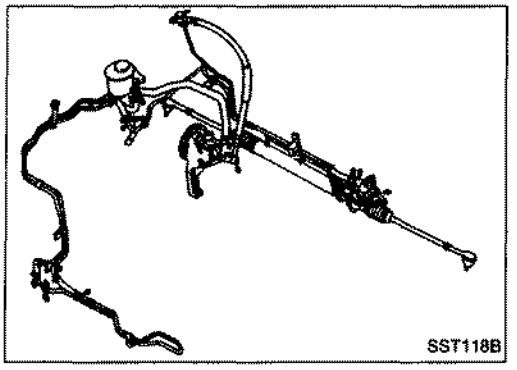


Checking Power Steering Fluid and Lines

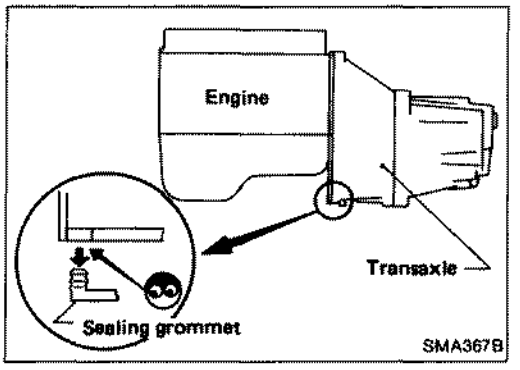
1. Check fluid level.
   Fluid level should be checked using "HOT" range on dipstick at fluid temperatures of 50 to 80°C (122 to 176°F) or using "COLD" range on dipstick at fluid temperatures of 0 to 30°C (32 to 86°F).

CAUTION:

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



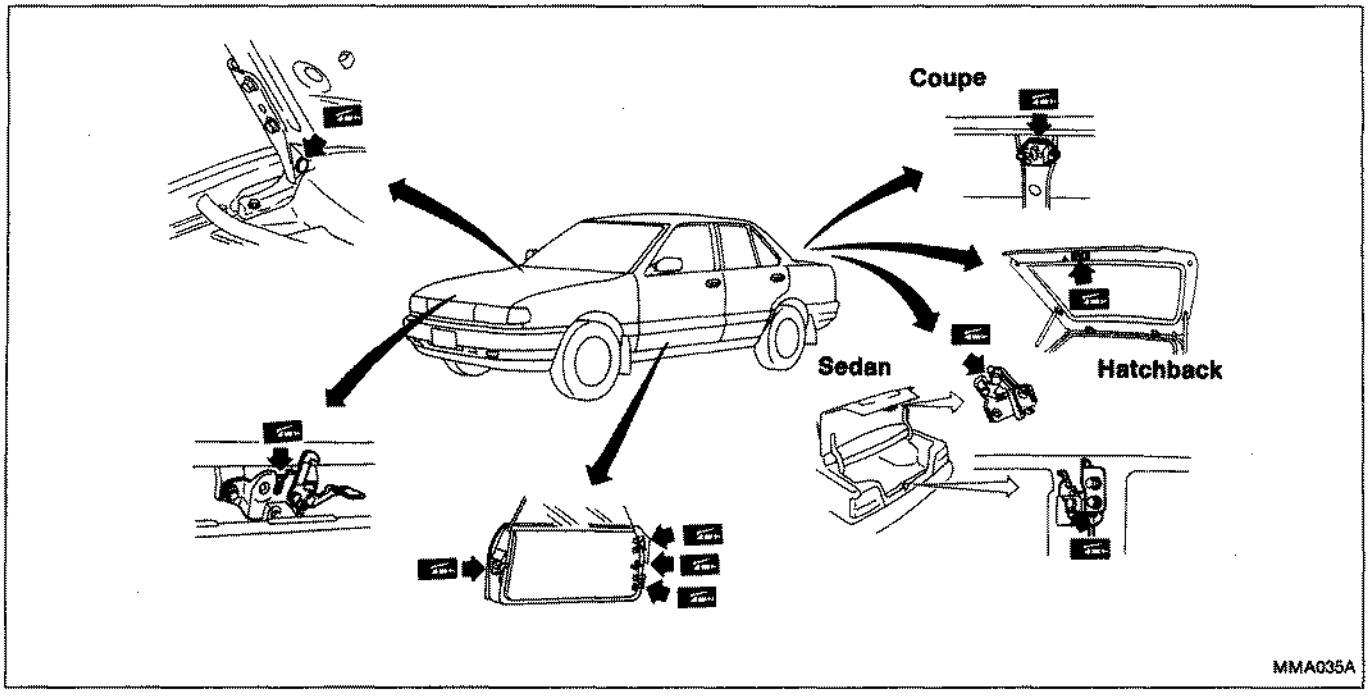
2. Check lines for improper attachment, leaks, cracks, damage, loose connections, chafing and deterioration.



Checking Water Entry

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

Lubricating Locks, Hinges and Hood Latches

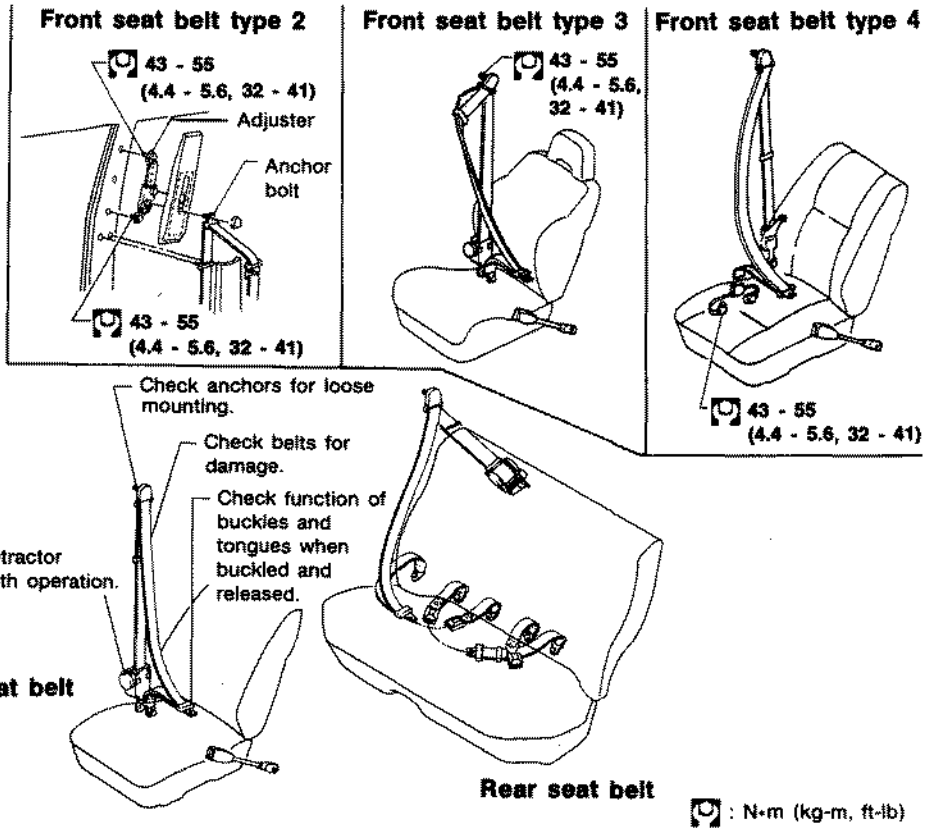


Checking Seat Belts, Buckles, Retractors, Anchors and Adjusters

CAUTION:

1. **If the vehicle is collided or overturned, replace the entire belt assembly, regardless of nature of accident.**
2. **If the condition of any component of a seat belt is questionable, do not 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
43 - 55 (4.4 - 5.6, 32 - 41)



Checking Body Corrosion

Visually check the body sheet metal panel for corrosion, paint damage (scratches, chipping, rubbing, etc.) or damage to the anti-corrosion materials. In particular, check the following locations.

Hemmed portion

Hood front end, door lower end, trunk lid rear end, etc.

Panel joint

Side sill of rear fender and center pillar, rear wheel housing of rear fender, around strut tower in engine compartment, etc.

Panel edge

Trunk lid opening, sunroof opening, fender wheelarch flange, fuel filler lid flange, around holes in panel, etc.

Parts contact

Waist molding, windshield molding, bumper, etc.

Protectors

Damage or condition of mudguard, fender protector, chipping protector, etc.

Anti-corrosion materials

Damage or separation of anti-corrosion materials under the body.

Drain holes

Condition of drain holes at door and side sill.

When repairing corroded areas, refer to the Corrosion Repair Manual.

Engine Maintenance

INSPECTION AND ADJUSTMENT

Drive belt deflection

Unit: mm (in)

	Used belt deflection		Deflection of new belt
	Limit	Deflection after adjustment	
Alternator			
With power steering	11 (0.43)	7 - 9 (0.28 - 0.35)	6 - 8 (0.24 - 0.31)
Without power steering	10 (0.39)		
Air conditioner compressor	9.5 (0.374)	6 - 8 (0.24 - 0.31)	5 - 7 (0.20 - 0.28)
Power steering oil pump	7.5 (0.295)	4 - 6 (0.16 - 0.24)	3 - 5 (0.12 - 0.20)
Applied pushing force	98 N (10 kg, 22 lb)		

Oil capacity (Refill capacity)

Unit: ℓ (Imp qt)

With oil filter change	3.2 (2-7/8)
Without oil filter change	2.8 (2-1/2)

Coolant capacity (Refill capacity)

With reservoir tank

Unit: ℓ (Imp qt)

	With heater	Without heater
M/T	5.5 (4-7/8)	5.2 (4-5/8)
A/T	5.9 (5-1/4)	5.6 (4-7/8)
Reservoir tank	0.7 (5/8)	

Spark plug

	GA16DS	GA13DS, GA14DS & GA16DE -
Type		
Standard	BKR6E	BKR5E
Hot	BKR5E	—
Cold	BKR7E	BKR6E, BKR7E
Plug gap mm (in)	0.8 - 0.9 (0.031 - 0.035)	0.8 - 0.9 (0.031 - 0.035)

Engine Maintenance (Cont'd)

INSPECTION AND ADJUSTMENT

Drive belt deflection

Unit: mm (in)

	Used belt deflection		Deflection of new belt
	Limit	Deflection after adjustment	
Alternator			
With air conditioner compressor	11.5 - 12.5 (0.453 - 0.492)	7 - 8 (0.28 - 0.31)	6.5 - 7.5 (0.256 - 0.295)
Without air conditioner compressor	12 - 13 (0.47 - 0.51)	8 - 9 (0.31 - 0.35)	7 - 8 (0.28 - 0.31)
Power steering oil pump	6 - 7 (0.24 - 0.28)	4 - 5 (0.16 - 0.20)	3.5 - 4.5 (0.138 - 0.177)
Applied pushing force	98 N (10 kg, 22 lb)		

Oil capacity (Refill capacity)

Unit: ℓ (Imp qt)

	SR20DE	SR20DET
With oil filter change	3.4 (3)	3.7 (3-1/4)
Without oil filter change	3.2 (2-7/8)	3.5 (3-1/8)

Coolant capacity (Refill capacity)

Unit: ℓ (Imp qt)

With reservoir tank	6.6 (5-7/8)
Reservoir tank	0.7 (5/8)

Spark plug

	SR20DE (Conventional type)	SR20DET (Platinum-tipped type)
Type		
Standard	BKR6EY	PFR7B-9
Hot	BKR5EY	PFR6B-9
Cold	BKR7EY	PFR8B-9
Plug gap mm (in)	0.8 - 0.9 (0.031 - 0.035)	0.8 - 0.9 (0.031 - 0.035)

Ignition wire

Resistance	kΩ/m (kΩ/ft)	13.6 - 18.4 (4.15 - 5.61)

Engine Maintenance (Cont'd)

Valve clearance

Unit: mm (in)

	Hot
Intake	0.28 (0.011)
Exhaust	0.28 (0.011)

Drive belt deflection

	Used belt		Deflection of new belt
	Limit	Deflection after adjustment	
Alternator mm (in)	13.5 (0.531)	8.5 - 9.5 (0.335 - 0.374)	7.5 - 8.5 (0.295 - 0.335)
Air conditioner mm (in)	12.5 (0.492)	9 - 10 (0.35 - 0.39)	6 - 8 (0.24 - 0.31)
Power steering mm (in)	10.5 (0.413)	7 - 9 (0.28 - 0.35)	6.5 - 8.5 (0.256 - 0.335)
Pushing force N (kg, lb)	98 (10, 22)		

Cooling system check

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

Cooling system leakage testing pressure	98 (0.98, 1.0, 14)
Radiator cap testing pressure	78 - 98 (0.78 - 0.98, 0.8 - 1.0, 11 - 14)

Spark plug

Type	
Standard	BP5ES
Hot	BP4ES
Cold	BP6ES
Plug gap mm (in)	0.8 - 0.9 (0.031 - 0.035)

Ignition timing & Idle speed

Ignition timing*1	2° ± 2° B.T.D.C.
Idle speed	
M/T	900 ± 50
A/T (in "N" position)	—

*1: Distributor vacuum hose disconnected and plugged

Mixture ratio

Idle CO%	1.5 ± 0.5

Engine Maintenance (Cont'd)

INSPECTION AND ADJUSTMENT

Valve clearance (Hot)

Unit: mm (in)

Intake	0.20 - 0.30 (0.008 - 0.012)
Exhaust	0.40 - 0.50 (0.016 - 0.020)

Service shims

Part number	Thickness mm (in)	Identification
13232-16A00	3.00 (0.1181)	300
13232-16A01	3.05 (0.1201)	305
13232-16A02	3.10 (0.1220)	310
13232-16A03	3.15 (0.1240)	315
13232-16A04	3.20 (0.1260)	320
13232-16A05	3.25 (0.1280)	325
13232-16A06	3.30 (0.1299)	330
13232-16A07	3.35 (0.1319)	335
13232-16A08	3.40 (0.1339)	340
13232-16A09	3.45 (0.1358)	345
13232-16A10	3.50 (0.1378)	350
13232-16A11	3.55 (0.1398)	355
13232-16A12	3.60 (0.1417)	360
13232-16A13	3.65 (0.1437)	365
13232-16A14	3.70 (0.1457)	370
13232-16A15	3.75 (0.1476)	375
13232-16A16	3.80 (0.1496)	380
13232-16A17	3.85 (0.1516)	385
13232-16A18	3.90 (0.1535)	390
13232-16A19	3.95 (0.1555)	395
13232-16A20	4.00 (0.1575)	400
13232-16A21	4.05 (0.1594)	405
13232-16A22	4.10 (0.1614)	410
13232-16A23	4.15 (0.1634)	415
13232-16A24	4.20 (0.1654)	420

Drive belt deflection [Applied pushing force:98 N (10 kg, 22 lb)]

Unit: mm (in)

	Alternator	A/C compressor	P/S oil pump		Water pump
			CD17	CD20	CD20 without P/S
New belt	8.5 - 10.5 (0.335 - 0.413)	9.5 - 11.5 (0.374 - 0.453)	8.5 - 10.5 (0.335 - 0.413)	4 - 6 (0.16 - 0.24)	6 (0.24)
Used belt	10.5 - 12.5 (0.413 - 0.492)	11.5 - 13.5 (0.453 - 0.531)	10.5 - 12.5 (0.413 - 0.492)	5 - 7 (0.20 - 0.28)	8 (0.31)
Limit	17 (0.67)	17 (0.67)	14 (0.55)	8 (0.31)	—

Coolant capacity (Refill capacity)

Unit: ℓ (Imp qt)

	CD17	CD20
With heater	6.5 (5-3/4)	7.1 (6-1/4)
Without heater	6.2 (5-1/2)	6.8 (6)
Reservoir tank	0.7 (5/8)	

Cooling system check

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

	CD17	CD20
Radiator cap relief pressure	88 (0.88, 0.9, 13)	118 (1.18, 1.2, 17)
Radiator testing pressure	157 (1.57, 1.6, 23)	

Engine oil capacity (Refill capacity)

Unit: ℓ (Imp qt)

	CD17	CD20
Without oil filter	4.4 (3-7/8)	4.9 (4-3/8)
With oil filter	4.9 (4-3/8)	5.4 (4-3/4)

Injection nozzle

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

Injection pressure	12,749 (127.5, 130, 1,849)

Idle speed

Unit: rpm

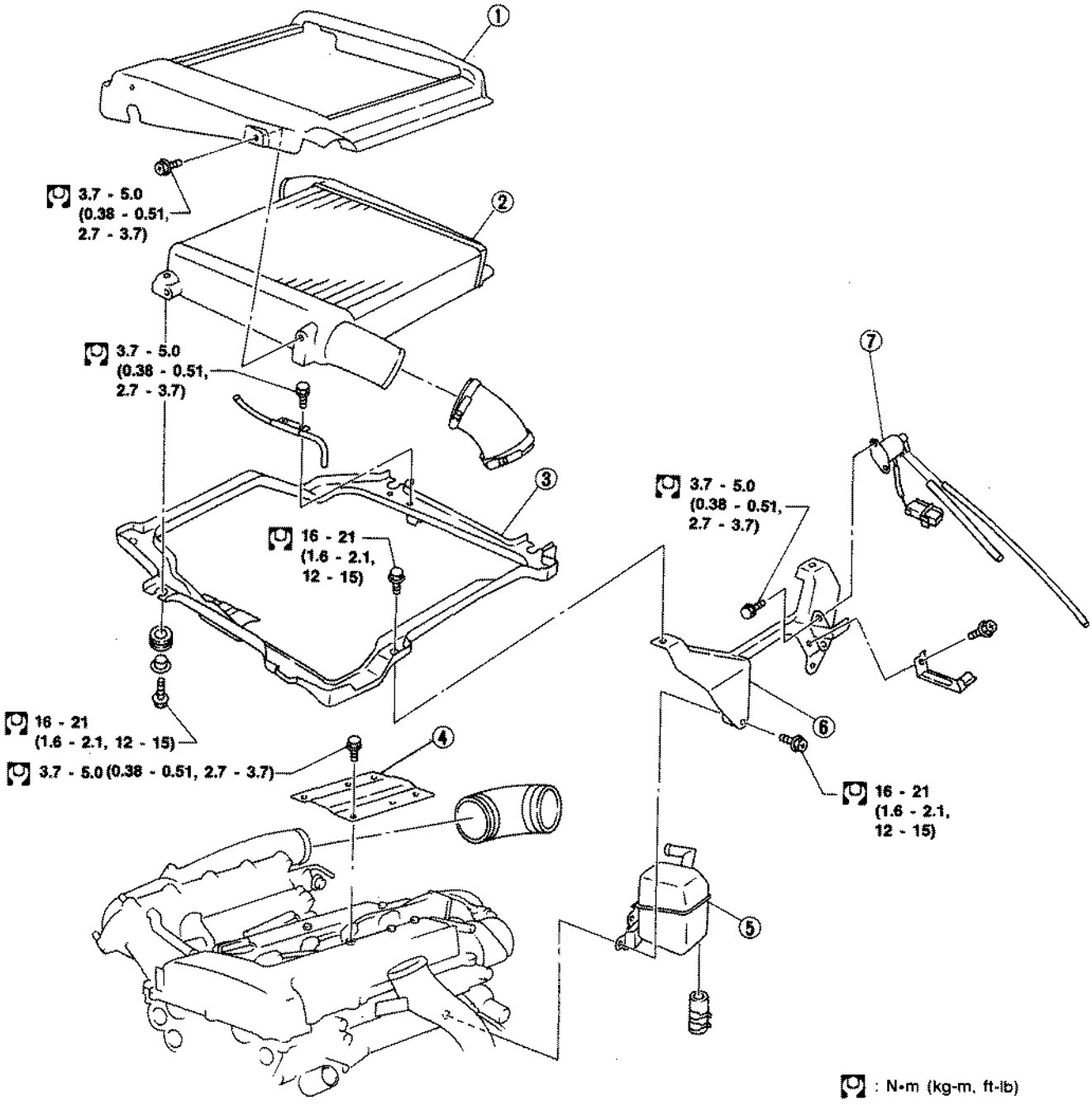
	Standard	—
M/T	700^{+50}_{-0}	800*

*: Air conditioner "ON"

TIGHTENING TORQUE

Unit	N·m	kg-m	ft-lb
Manifold nuts & bolts	18 - 22	1.8 - 2.2	13 - 16
Rocker cover screw	1 - 3	0.1 - 0.3	0.7 - 2.2
Alternator, power steering mounting bolt	37 - 51	3.8 - 5.2	27 - 38
Alternator, power steering adjuster lock bolt	21 - 26	2.1 - 2.7	15 - 20
Cylinder block drain plug	54 - 74	5.5 - 7.5	40 - 54
Engine oil pan drain plug	29 - 39	3.0 - 4.0	22 - 29
Injector (To head)	59 - 69	6.0 - 7.0	43 - 51
Spill tube	39 - 49	4.0 - 5.0	29 - 36
Delivery tube	22 - 25	2.2 - 2.5	16 - 18

SR20DET



① Intercooler cover
② Intercooler
③ Intercooler support
④ Rocker cover ornament
⑤ Oil separator
⑥ Intercooler support bracket
⑦ Recirculation valve control solenoid valve

Chassis and Body Maintenance (Cont'd)

Model N14

Applied model	2WD			4WD	
	13-inch wheel		14-inch wheel	13-inch wheel	14-inch wheel
	Except CD engine	CD engine			
Camber degree	−1°00′ to 0°30′			−0°40′ to 0°50′	
Caster degree	0°40′ to 2°10′			0°30′ to 2°00′	
Kingpin inclination degree	13°15′ to 14°45′			12°15′ to 13°45′	
Total toe-in mm (in)	1 - 3 (0.04 - 0.12)				
degree	6′ - 18′				
Front wheel turning angle					
Full turn* degree					
Inside	39° - 43°	36° - 40°	33° - 37°	37° - 41°	34° - 38°
Outside	34°	32°	30°	31°	29°

*: On power steering models, wheel turning force (at circumference of steering wheel) is 98 to 147 N (10 to 15 kg, 22 to 33 lb) with engine at idle.

Rear axle and rear suspension (Unladen)*

Model B13

Applied model	Coupe	Sedan
Camber degree	−1°55′ to −0°25′	
Toe-in mm (in)	−1 to 3 (−0.04 to 0.12)	
Total toe-in degree	−6′ to 18′	

Model N14

Applied model	2WD	4WD
Camber degree	−1°40′ to −0°10′	−0°55′ to 0°35′
Toe-in mm (in)	−1 to 3 (−0.04 to 0.12)	
Total toe-in degree	−6′ to 18′	

*: Fuel, radiator coolant and engine oil full.
Spare tire, jack, hand tools and mats in designated positions.

Brake

Disc brake mm (in)	
Pad	
Standard thickness	10.0 (0.394)
Minimum thickness	2.0 (0.079)
Rotor	
Standard thickness	
CL18C	12.0 (0.472)
CL18VD	18.0 (0.709)
AD22VF	26.0 (1.024)
AD7HA	7.0 (0.276)
CL9HA	9.0 (0.354)
Minimum thickness	
CL18C	10.0 (0.394)
CL18VD	16.0 (0.630)
AD22VF	24.0 (0.945)
AD7HA	6.0 (0.236)
CL9HA	8.0 (0.315)
Drum brake	
Lining	
Standard thickness	
LT18C	4.0 (0.157)
LT23B	4.5 (0.177)
Wear limit	1.5 (0.059)
Drum	
Standard diameter	
LT18C	180.0 (7.09)
LT23B	228.6 (9)
Maximum diameter	
LT18C	181.0 (7.13)
LT23B	230.0 (9.06)

Wheel balance

Maximum allowable unbalance	Dynamic (At rim flange) g (oz)	10 (0.35) (one side)
	Static g (oz)	20 (0.71)

Wheel bearing

	Front	Rear
Wheel bearing axle end play mm (in)	0.05 (0.0020) or less	
Wheel bearing lock nut		
Tightening torque N·m (kg-m, ft-lb)	196 - 275 (20 - 28, 145 - 203)	2WD: 186 - 255 (19 - 26, 137 - 188) 4WD: 196 - 275 (20 - 28, 145 - 203)

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 transaxle			
Drain and filler plugs	25 - 34	2.5 - 3.5	18 - 25
Automatic transaxle			
Drain plug	29 - 39	3.0 - 4.0	22 - 29
Front axle and front suspension			
Tie-rod lock nut	37 - 46	3.8 - 4.7	27 - 34
Rear axle and rear suspension			
Toe adjusting pin	98 - 118	10 - 12	72 - 87
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 - 12	72 - 87

ENGINE MECHANICAL

SECTION EM

EM

CONTENTS

Contents (Cont'd)

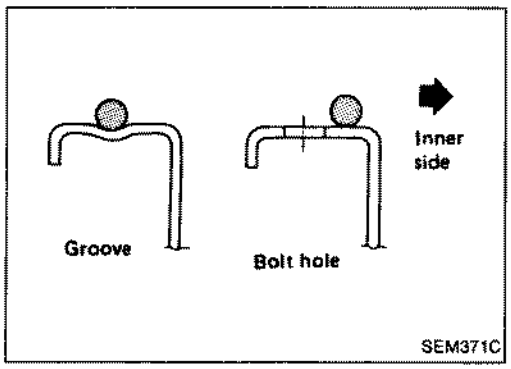
E

CD

GA, SR, E and CD

Parts Requiring Angular Tightening

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



Liquid Gasket Application Procedure

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

b. Apply a continuous bead of liquid gasket to mating surfaces. (Use Genuine Liquid Gasket or equivalent.)
- **Be sure liquid gasket is specified width (for oil pan).**
  SR: 4.0 to 5.0 mm (0.157 to 0.197 in)
  GA, E, CD: 3.5 to 4.5 mm (0.138 to 0.177 in)
- **Be sure liquid gasket is 2.0 to 3.0 mm (0.079 to 0.118 in) wide (in areas except oil pan).**

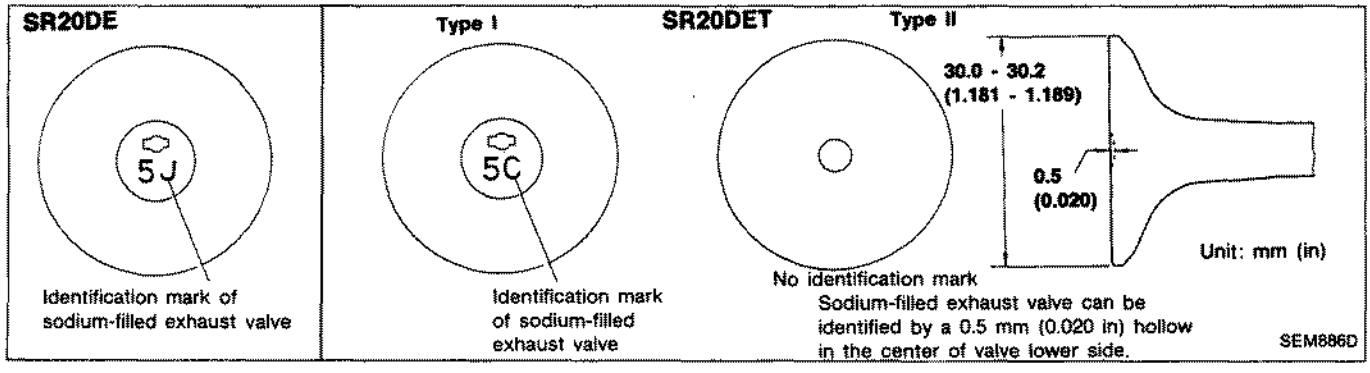
c. Apply liquid gasket to inner surface around hole perimeter area.
(Assembly should be done within 5 minutes after coating.)

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

Special Cautions to Ensure the Safe Disposal of Sodium-filled Exhaust Valves (SR20DE & SR20DET engines)

The handling and disposal of sodium-filled exhaust valves requires special care and consideration. Under conditions such as breakage with subsequent exposure to water, the sodium metal which lines the inner portion of the exhaust valve will react violently, forming sodium hydroxide and releasing hydrogen gas which may result in an explosion or fire.

A sodium-filled exhaust valve is identified on the top of its stem as shown in illustration.

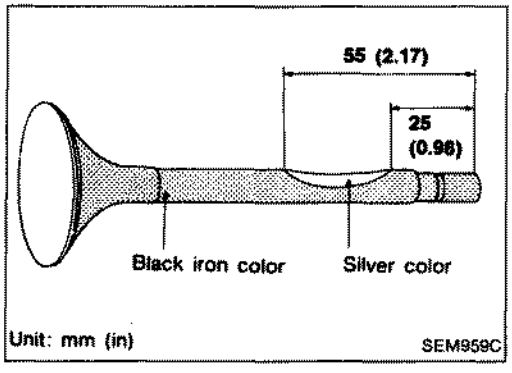


DEALER DISPOSAL INSTRUCTIONS

CAUTION:

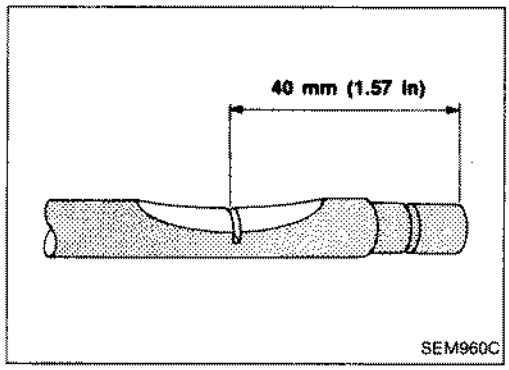
- **Use approved shatter-resistant eye protection when performing this procedure.**
- **Perform this and all subsequent disposal work procedures in an open room, away from flammable liquids. Keep a fire extinguisher, rated at least 10 ABC, in close proximity to the work area.**
- **Be sure to wear rubber gloves when performing the following operations.**

1. Clamp valve stem in a vice.

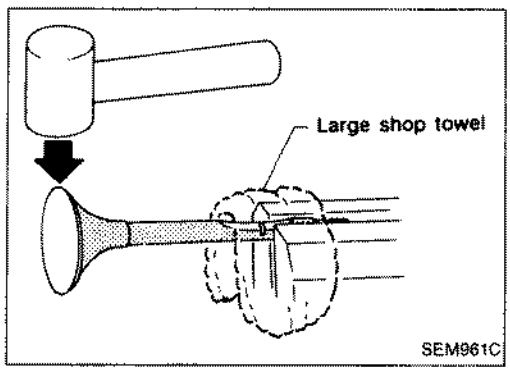


2. The valve has a specially-hardened surface. To cut through it, first remove a half-round section, approximately 30 mm (1.18 in) long. Use an air-powered grinder until the black iron color is removed and the silver-colored metal appears.

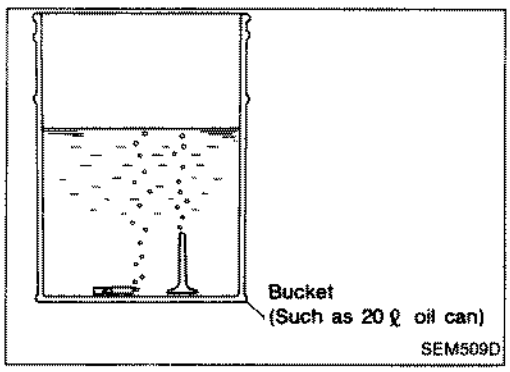
Special Cautions to Ensure the Safe Disposal of Sodium-filled Exhaust Valves (SR20DE & SR20DET engines) (Cont'd)



3. Use a hacksaw to cut through approximately half the diameter of the valve stem. Make the serration at a point 40 mm (1.57 in) from the end of the stem.



4. Cover the serrated end of the valve with a large shop towel. Strike the valve face end with a hammer, separating it into two pieces.



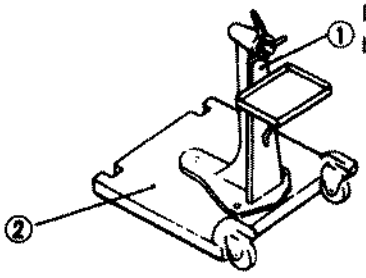
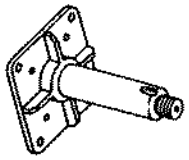
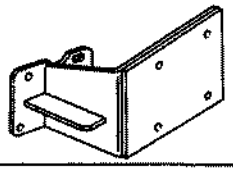
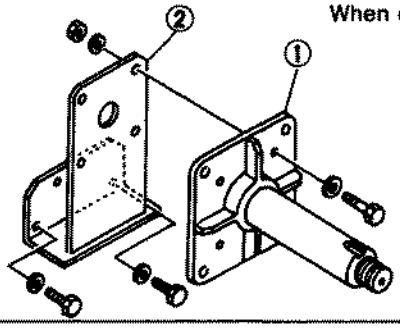
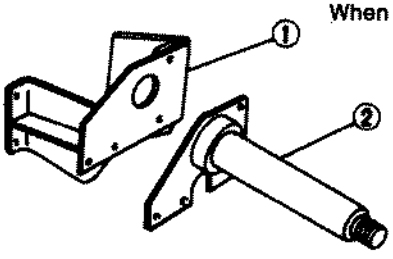
5. Fill a bucket (such as a 20 ℓ oil can) with at least 10 ℓ (2-1/4 Imp gal) of water. Carefully place the already-cut (serrated) valves into the water one-at-a-time using a set of large tweezers and quickly move away at least 2.7 m (9 ft). The valves should be placed in a standing position as shown in the illustration to allow complete reaction of the sodium with the water. The major portion of the resultant chemical reaction lasts 1 to 2 minutes. After the bubbling action has subsided, additional valves can be placed into the bucket allowing each subsequent chemical reaction to subside. However, no more than 8 valves should be placed in the same 10 ℓ (2-1/4 Imp gal) amount of water. The complete chemical reaction may take as long as 4 to 5 hours. Remove the valves using a set of large tweezers after the chemical reaction has stopped. Afterwards, the valves can be mixed with ordinary scrap metal.

CAUTION:

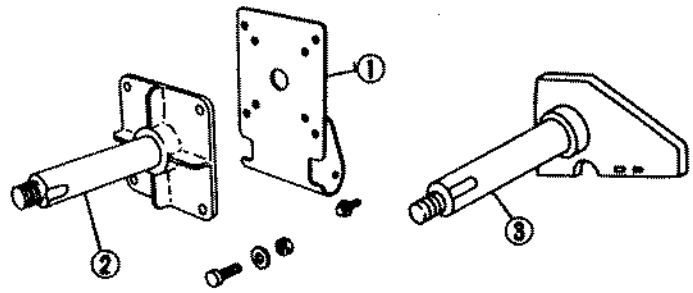
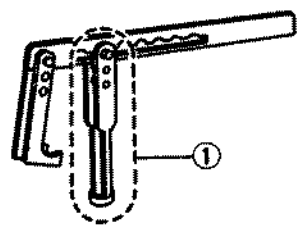
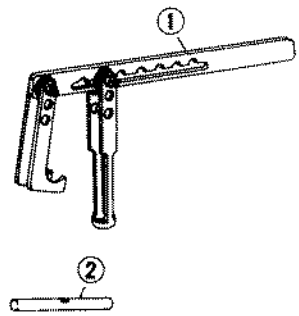
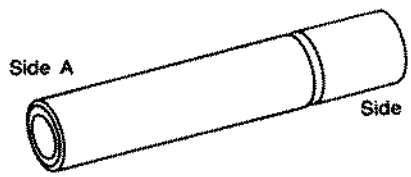
- **Make sure the resultant (high alkalinity) waste water does not contact your skin. If the waste water does contact you, wash the contacted area immediately with large quantities of water.**
- **Dealers should check their respective country and local regulations concerning any chemical treatment or waste water discharge permits which may be required to dispose of the resultant (high alkalinity) waste water.**

SPECIAL SERVICE TOOLS

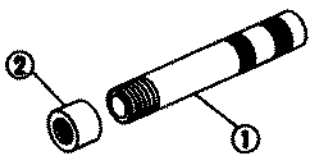
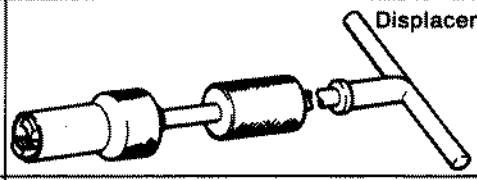
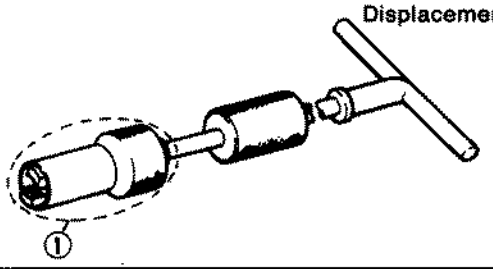
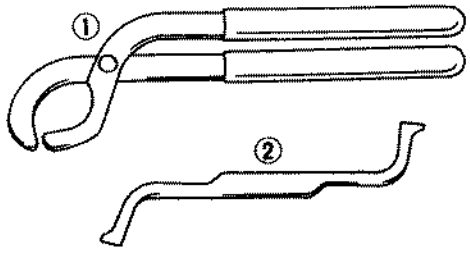
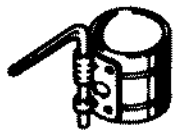
*: Special tool or commercial equivalent

Tool number Tool name	Description	Engine application			
		GA	SR	E	CD
ST0501S000 Engine stand assembly ① ST05011000 Engine stand ② ST05012000 Base	 Disassembling and assembling	X	X	X	X
KV10106500 Engine stand shaft		—	X	—	—
KV10115300 Engine sub-attachment		—	X	—	—
Engine attachment assembly ① KV10106500 Engine attachment ② KV10113300 Sub-attachment	 When overhauling engine	X	—	—	—
Engine attachment assembly* ① KV10107110 Engine attachment ② KV10102500 Sub-attachment	 When overhauling engine	—	—	X	—

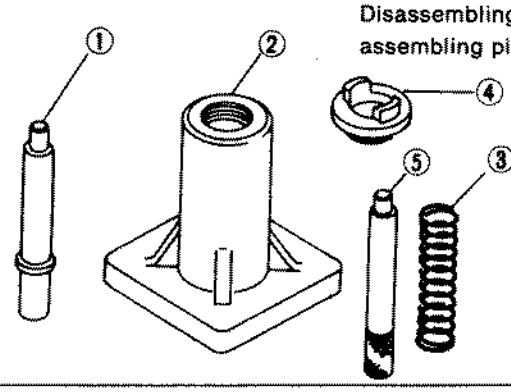
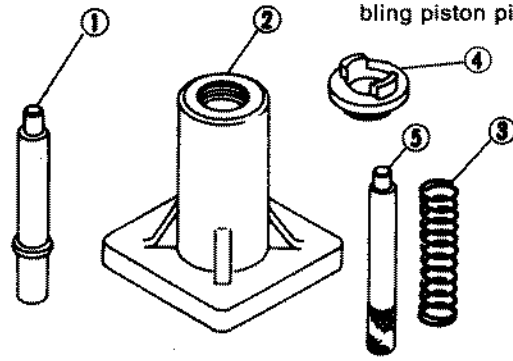
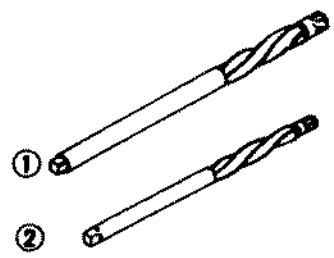
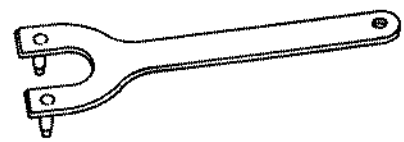
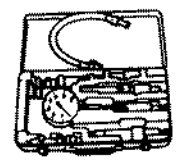
*: Special tool or commercial equivalent

Tool number Tool name	Description	Engine application			
		GA	SR	E	CD
① KV10108101* Engine attachment ② KV10106500* Engine stand shaft or ③ KV10102500* Engine stand shaft		—	—	—	X
ST10120000 Cylinder head bolt wrench	 Loosening and tightening cylinder head bolt	X	X	—	—
KV10116200 Valve spring compressor ① KV10115900 Attachment	 Disassembling valve mechanism	X	X	—	—
KV101092S0 Valve spring compressor ① KV10109210 Compressor ② KV10109220 Adapter	 Disassembling valve mechanism	—	X	X	X
KV10115600 Valve oil seal drift	Installing valve oil seal  Side A Side B Intake: Side A, Exhaust: Side B (SR) Intake: Side A, Exhaust: Side A (GA)	X	X	—	—

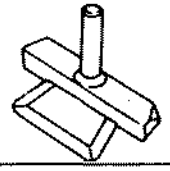
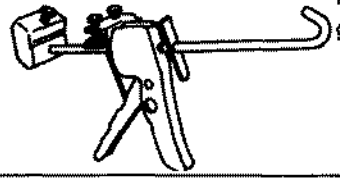
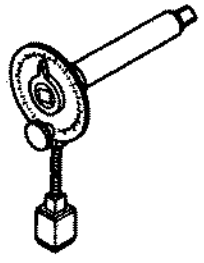
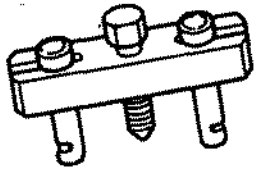
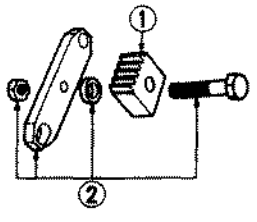
*: Special tool or commercial equivalent

Tool number Tool name	Description	Engine application			
		GA	SR	E	CD
① KV10107501 Valve lip seal drift* ② KV10109100 Valve oil seal drift attachment*	Installing valve lip seal 	—	—	X	—
KV10107900 Valve lip seal puller	Displacement valve lip seal 	—	X	X	X
KV10107902 Valve oil seal puller ① KV10116100 Holder (Holder design differs between KV10107900 and KV10107902.)	Displacement valve lip seal 	X	X	X	X
KV10115700 Dial gauge stand	Adjusting shims 	—	X	—	—
KV101151S0 Lifter stopper set ① KV10115110 Camshaft pliers ② KV10115120 Lifter stopper	Changing shims 	X	—	—	—
EM03470000 Piston ring compressor	Installing piston assembly into cylinder bore 	X	X	X	X

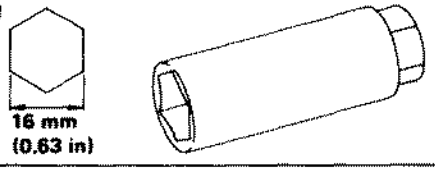
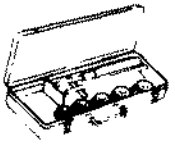
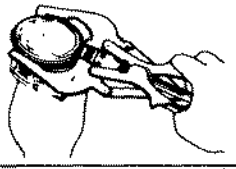
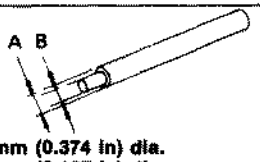
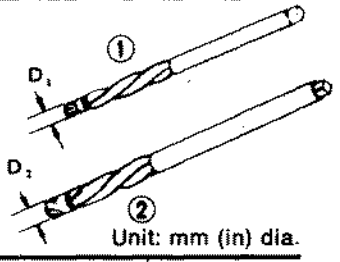
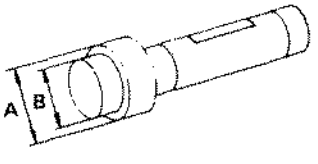
*: Special tool or commercial equivalent

Tool number Tool name	Description	Engine application			
		GA	SR	E	CD
KV10107400 Piston pin press stand ① KV10107310 Center shaft ② ST13040020 Stand ③ ST13040030 Spring ④ KV10107320 Cap ⑤ ST13040050 Drift	 Disassembling and assembling piston pin	X	X	—	—
KV101082S0 Piston pin press stand* ① KV10108210 Center shaft ② ST13040020 Stand ③ ST13040030 Spring ④ KV10108220 Cap ⑤ ST13040050 Drift	 Disassembling and assembling piston pin	—	—	X	—
① ST11081000 Reamer* ② KV10107700 Reamer*	 Reaming valve guide and hole [12.2 mm (0.480 in) dia.] [7 mm (0.28 in) dia.]	—	—	X	—
KV10109300* Pulley holder		—	—	—	X
ED19600000* Compression gauge set		—	—	—	X

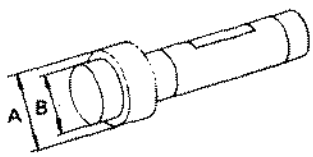
*: Special tool or commercial equivalent

Tool number Tool name	Description	Engine application			
		GA	SR	E	CD
KV11100300* Nozzle holder socket		—	—	—	X
KV10111100 Seal cutter	 Removing oil pan	X	X	X	X
WS39930000 Tube presser	 Pressing the tube of liquid gasket	X	X	X	X
KV10112100 Angle wrench	 Tightening bolts for bearing cap, cylinder head, etc.	X	X	X	X
KV11102900* Pulley puller		—	—	—	X
KV101056S0* Ring gear stopper ① KV10105630 Adapter ② KV10105610 Plate assembly		—	—	—	X

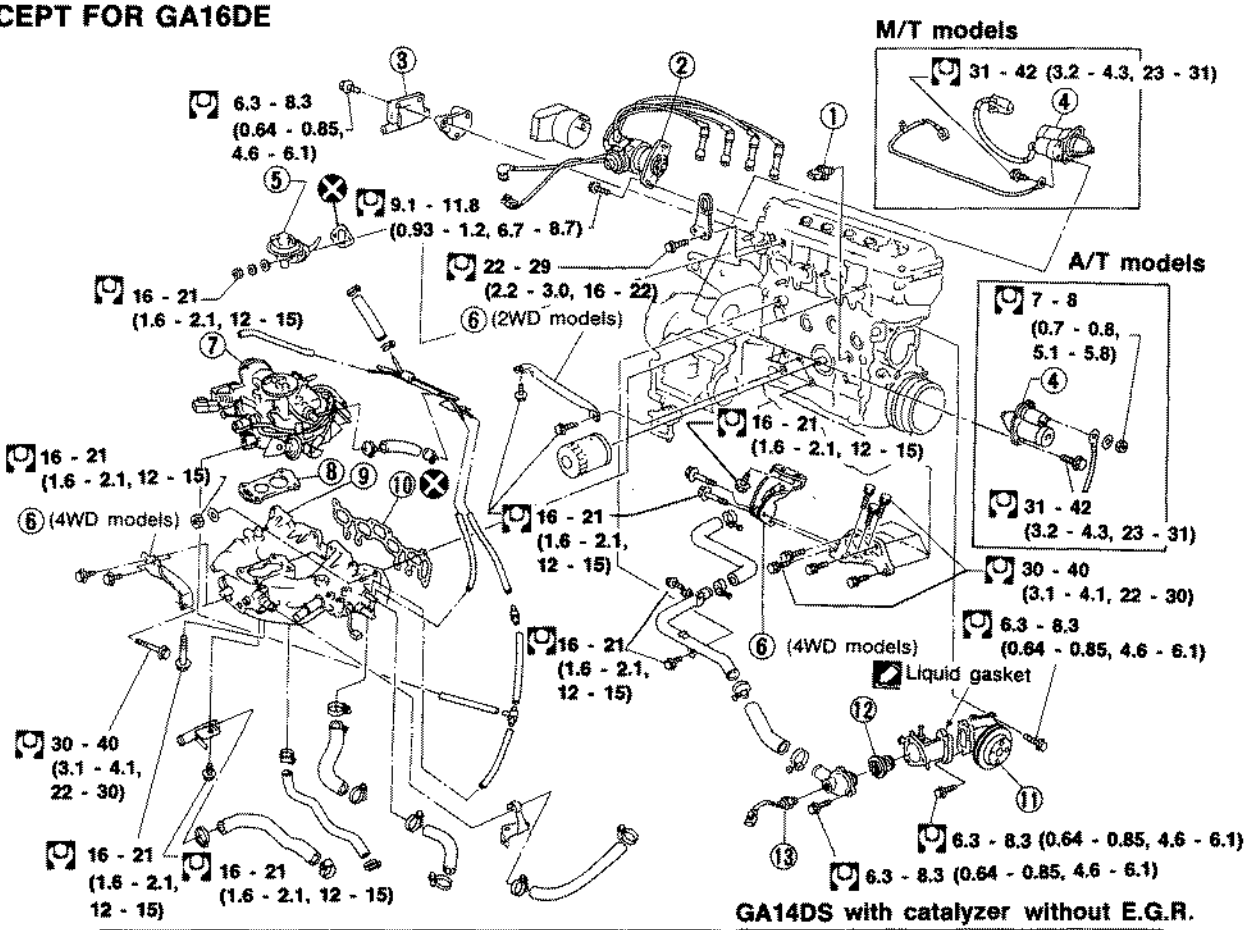
COMMERCIAL SERVICE TOOLS

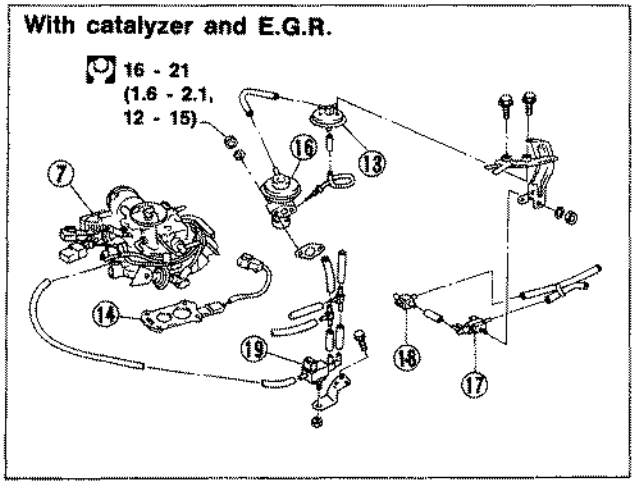
Tool name	Description	Engine application			
		GA	SR	E	CD
Spark plug wrench	Removing and installing spark plug 	X	X	—	—
Valve seat cutter set	Finishing valve seat dimensions 	X	X	X	X
Piston ring expander	Removing and installing piston ring 	X	X	X	X
Valve guide drift	Removing and installing valve guide  **SR Intake** A = 9.5 mm (0.374 in) dia. B = 5.0 mm (0.197 in) dia. **Exhaust** A = 10.5 mm (0.413 in) dia. B = 6.0 mm (0.236 in) dia. **GA Intake & Exhaust** A = 9.5 mm (0.374 in) dia. B = 5.5 mm (0.217 in) dia.	X	X	—	—
Valve guide reamer	Reaming valve guide ① or hole for oversize valve guide ②  Unit: mm (in) dia.	X	X	—	—
Front oil seal drift	Installing front oil seal  A = 75 mm (2.95 in) dia. B = 45 mm (1.77 in) dia.	X	X	—	—

		D_1	D_2
SR	Intake	6.0 (0.236)	10.175 (0.4006)
	Exhaust	7.0 (0.276)	11.175 (0.4400)
GA	Intake & Exhaust	5.5 (0.217)	9.685 (0.3813)

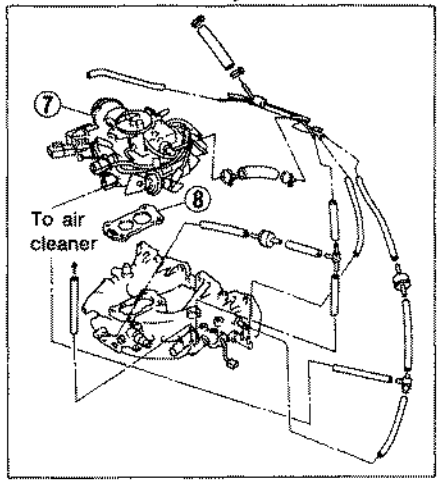
Tool name	Description	Engine application			
		GA	SR	E	CD
Rear oil seal drift	Installing rear oil seal  **A = 110 mm (4.33 in) dia.** **B = 80 mm (3.15 in) dia.**	X	X	—	—

EXCEPT FOR GA16DE





GA14DS with catalyzer without E.G.R.

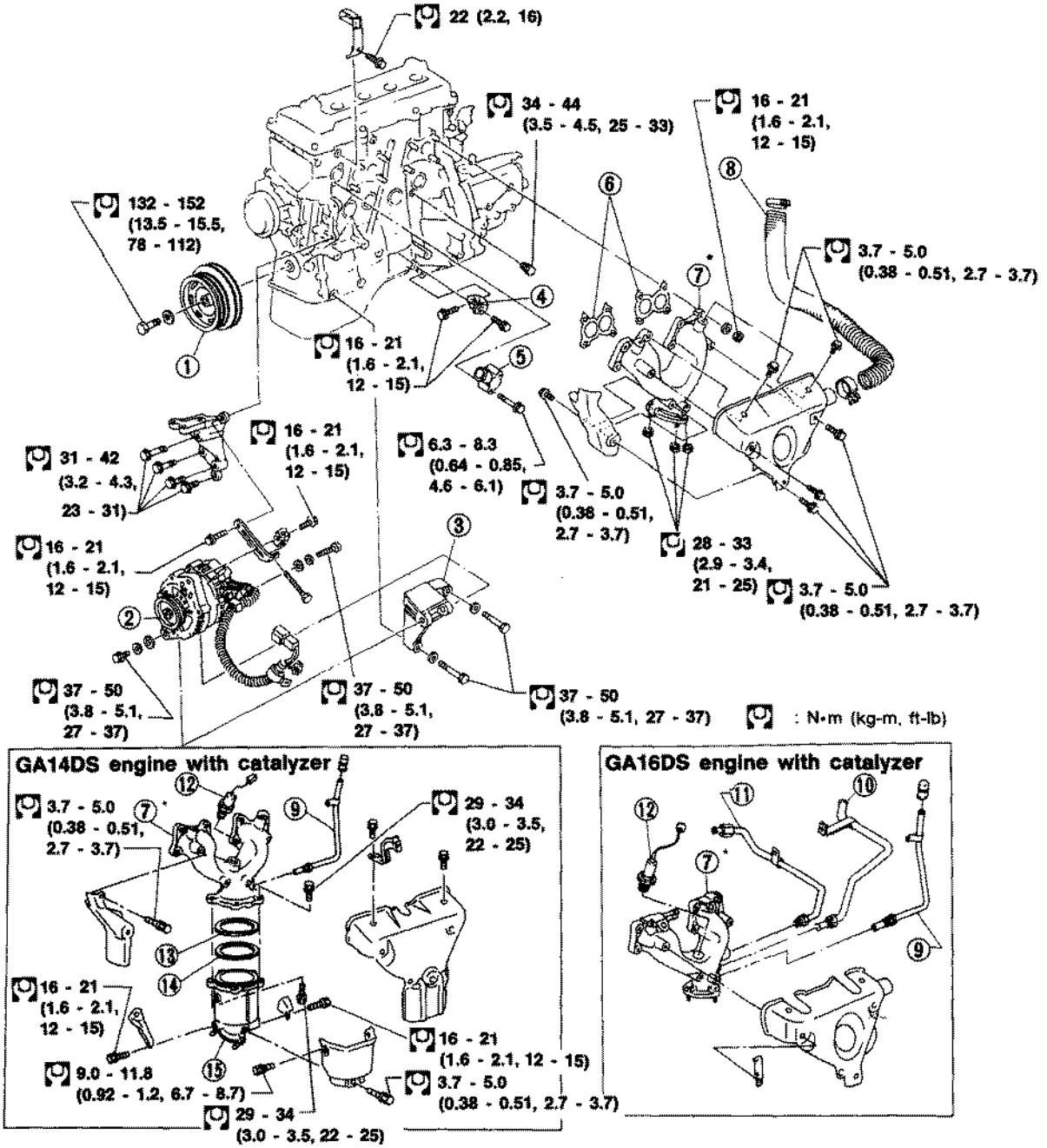


: N•m (kg-m, ft-lb)

SEM873D

① Oil pressure switch
② Distributor
③ Ignition coil
④ Starter motor
⑤ Fuel pump
⑥ Intake manifold support
⑦ Carburetor
⑧ Insulator
⑨ Intake manifold
⑩ Intake manifold gasket
⑪ Water pump
⑫ Thermostat
⑬ Thermoswitch
⑭ Mixture heater
⑮ B.P.T. valve
⑯ E.G.R. control valve
⑰ A.I.V. control solenoid valve
⑱ 3-way connector
⑲ E.G.R. & canister control solenoid valve

EXCEPT FOR GA16DE

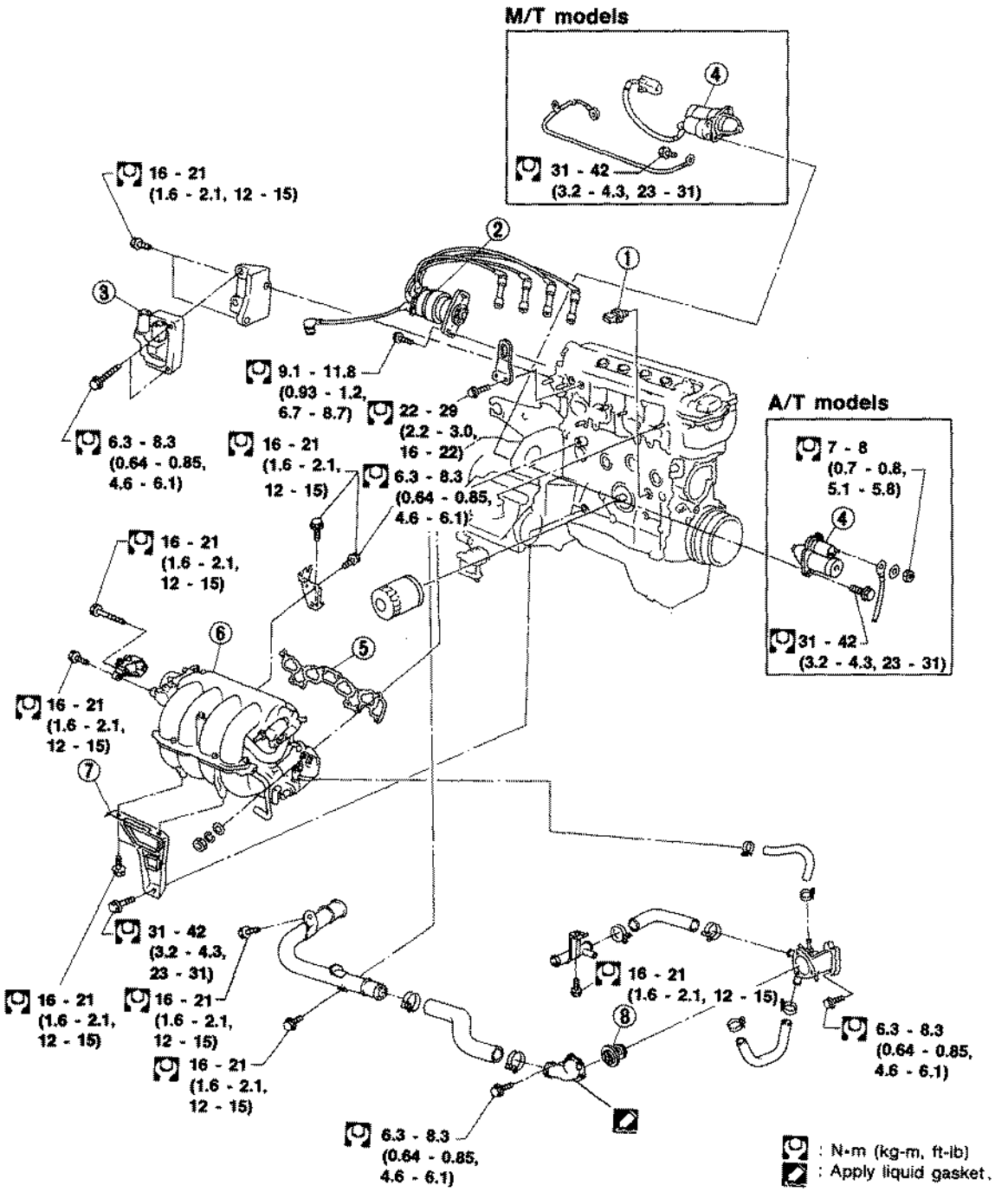


*: Refer to "Tightening order".

SEM874D

① Crankshaft pulley
② Alternator
③ Alternator bracket
④ Gusset
⑤ Water outlet
⑥ Exhaust manifold gasket
⑦ Exhaust manifold
⑧ Hot air duct
⑨ Test take-off
⑩ E.A.I. pipe
⑪ E.G.R. tube
⑫ Exhaust gas sensor
⑬ Gasket
⑭ O-ring
⑮ Catalyzer

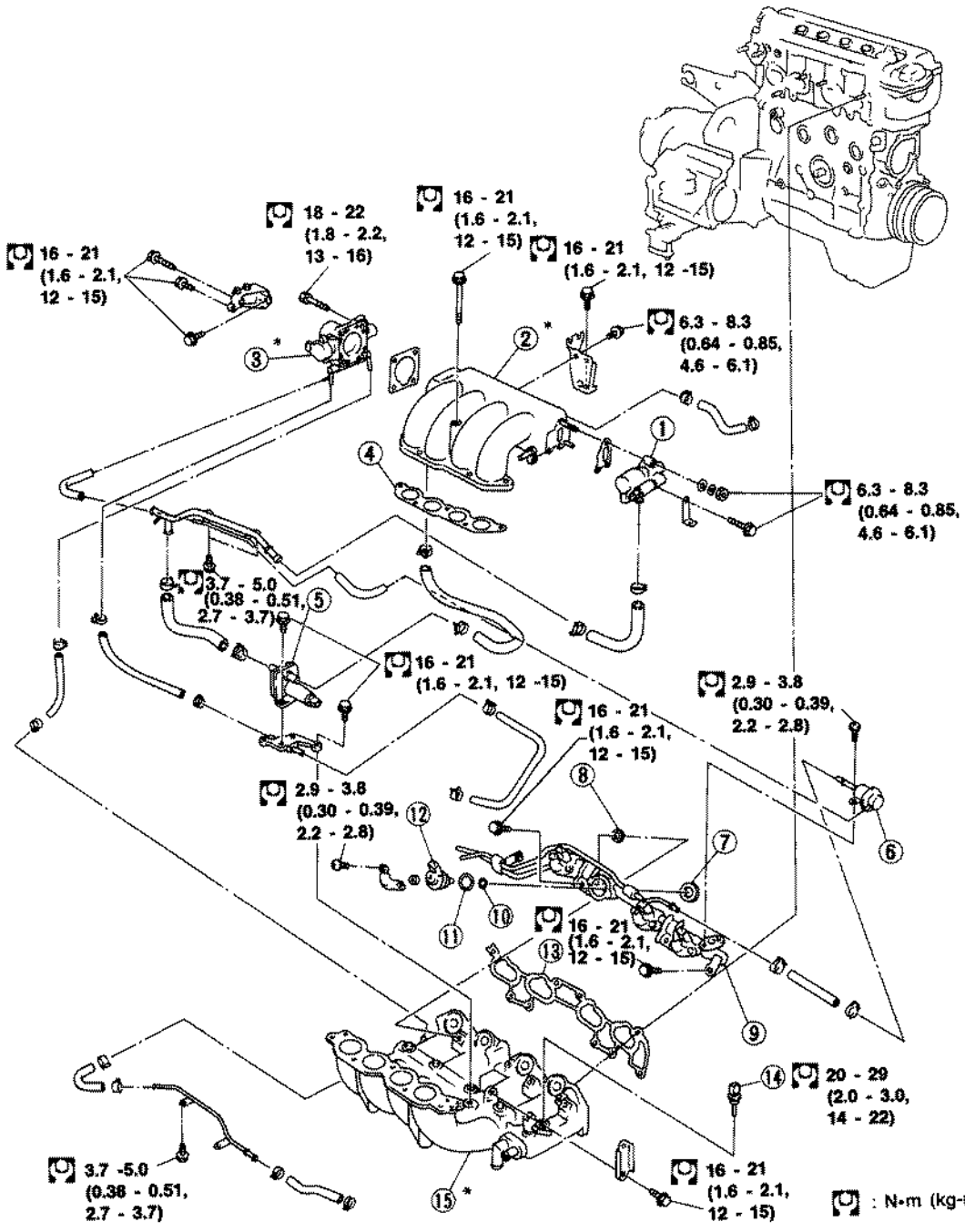
GA16DE



SEM872D

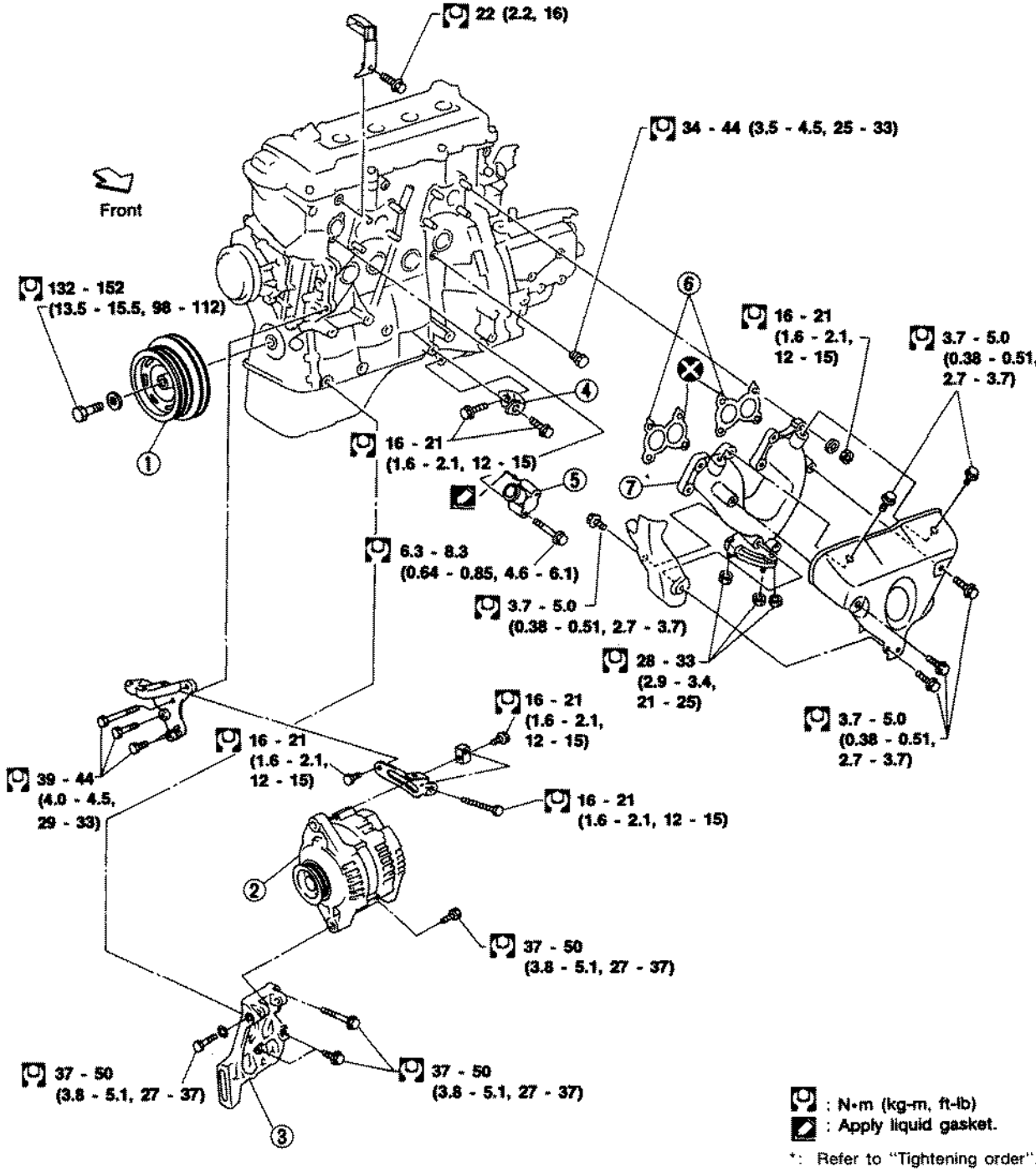
① Oil pressure switch
② Crank angle sensor built into distributor
③ Ignition coil
④ Starter motor
⑤ Intake manifold gasket
⑥ Intake manifold assembly
⑦ Intake manifold support
⑧ Thermostat

GA16DE



① Idle air adjusting unit
② Intake manifold collector
③ Throttle chamber
④ Collector gasket
⑤ Air regulator
⑥ Fuel pressure regulator
⑦ Insulator
⑧ Insulator
⑨ Fuel gallery assembly
⑩ O-ring
⑪ O-ring
⑫ Fuel injector
⑬ Intake manifold gasket
⑭ Engine temperature sensor
⑮ Intake manifold

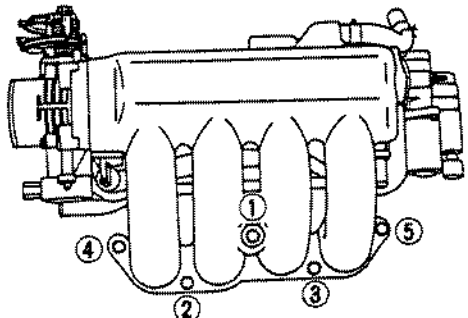
GA16DE



① Crankshaft pulley
② Alternator
③ Compressor bracket
④ Gusset
⑤ Water outlet
⑥ Exhaust manifold gasket
⑦ Exhaust manifold

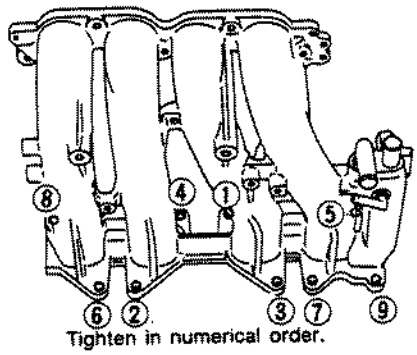
Tightening Order

***Intake manifold collector bolts tightening order**



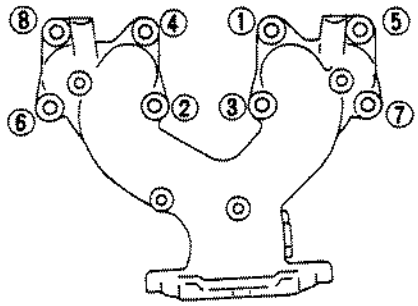
Tighten in numerical order.

***Intake manifold bolts and nuts tightening order**



Tighten in numerical order.

***Exhaust manifold nuts tightening order**

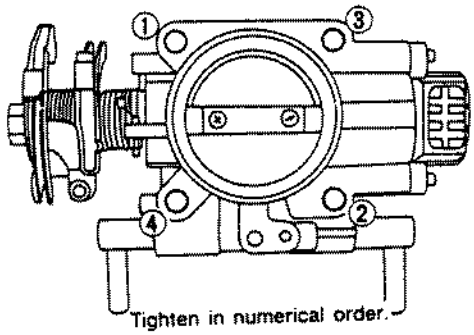


Tighten in numerical order.

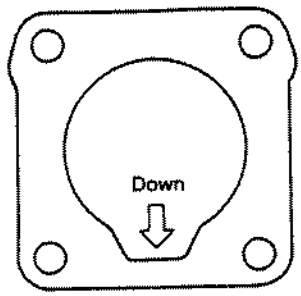
***Throttle chamber bolts tightening procedure**

1) **Tighten all bolts to 9 to 11 N·m (0.9 to 1.1 kg-m, 6.5 to 8.0 ft-lb)**
2) **Tighten all bolts to 18 to 22 N·m (1.8 to 2.2 kg-m, 13 to 16 ft-lb)**

● Make sure the direction of the gasket is as shown in figure.



Tighten in numerical order.



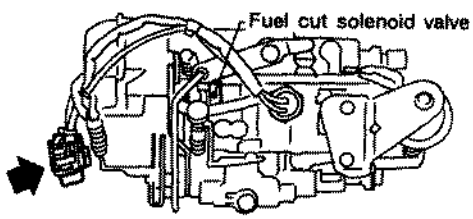
Gasket

SEM661D

Measurement of Compression Pressure

1. Warm up engine.
2. Turn ignition switch off.

Except for GA16DE



SEM394D

3.

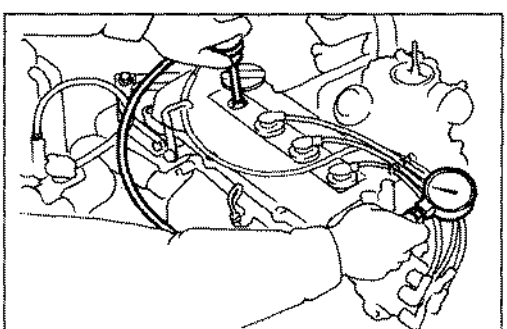
- **Except for GA16DE models**

Disconnect fuel cut solenoid valve connector.

- **GA16DE models**

Release fuel pressure.
Refer to "Releasing Fuel Pressure" in section EF & EC.

4. Remove all spark plugs.
5. Disconnect distributor center cable.



SEM149D

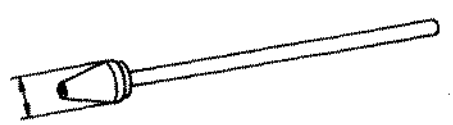
6. Attach a compression tester to No. 1 cylinder.
7. Depress accelerator pedal fully to keep throttle valve wide open.
8. Crank engine and record highest gauge indication.
9. Repeat the measurement on each cylinder as shown above.

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

Compression pressure:
kPa (bar, kg/cm^2, psi)/rpm
Standard
1,324 (13.24, 13.5, 192)/350
Minimum
1,128 (11.28, 11.5, 164)/350
Difference limit between cylinders
98 (0.98, 1.0, 14)/350

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

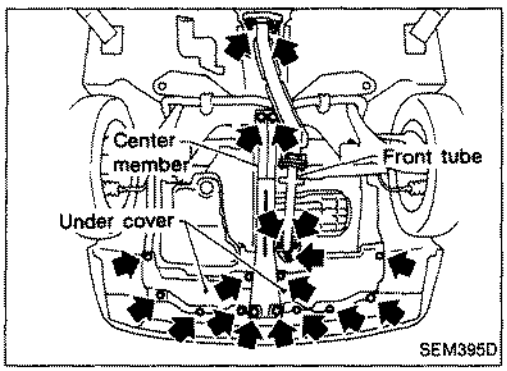
- **If adding oil helps compression, piston rings may be worn or damaged. If so, replace piston rings after checking piston.**
- **If pressure stays low, a valve may be sticking or seating improperly. Inspect and repair valve and valve seat. (Refer to S.D.S.) If valve or valve seat is damaged excessively,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



20 mm (0.79 in) dia.

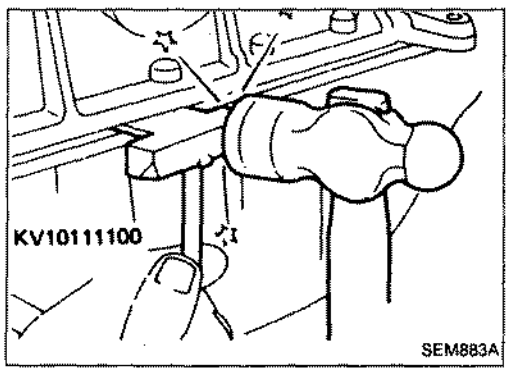
Use compressor tester whose end (rubber portion) is less than 20 mm (0.79 in) dia. Otherwise, it may be caught by cylinder head during removal.

SEM387C



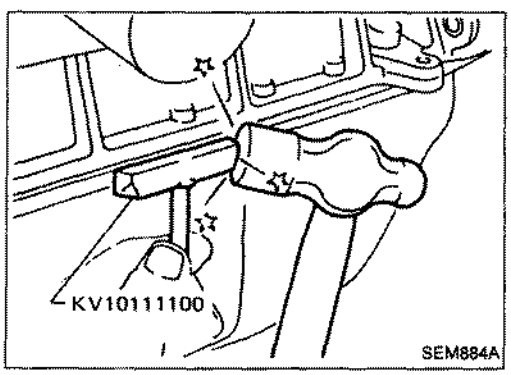
Removal

1. Remove undercovers.
2. Drain engine oil.
3. Remove center member.
4. Remove front exhaust tube.

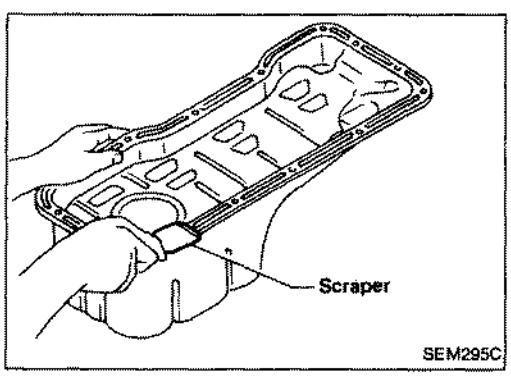


5. Remove oil pan.
(1) Insert Tool between cylinder block and oil pan.

- **Be careful not to damage aluminum mating face.**
- **Do not insert screwdriver, or oil pan flange will be deformed.**



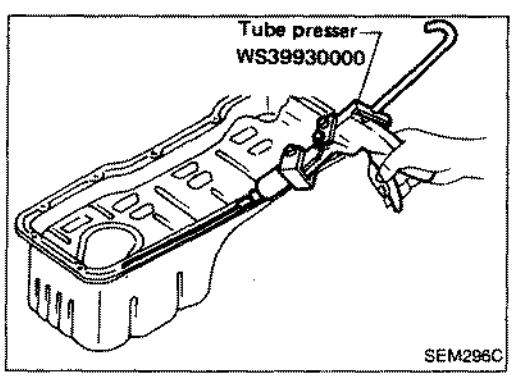
(2) Slide Tool by tapping its side with a hammer, and remove oil pan.



Installation

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

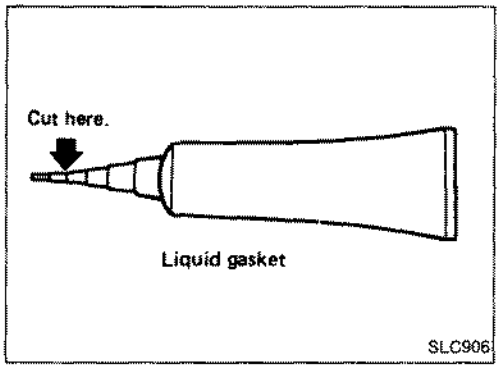
- Also remove traces of liquid gasket from mating surface of cylinder block.



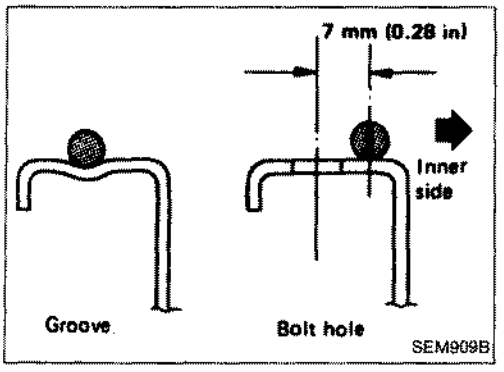
2. Apply a continuous bead of liquid gasket to mating surface of oil pan.

- **Use Genuine Liquid Gasket or equivalent.**

Installation (Cont'd)

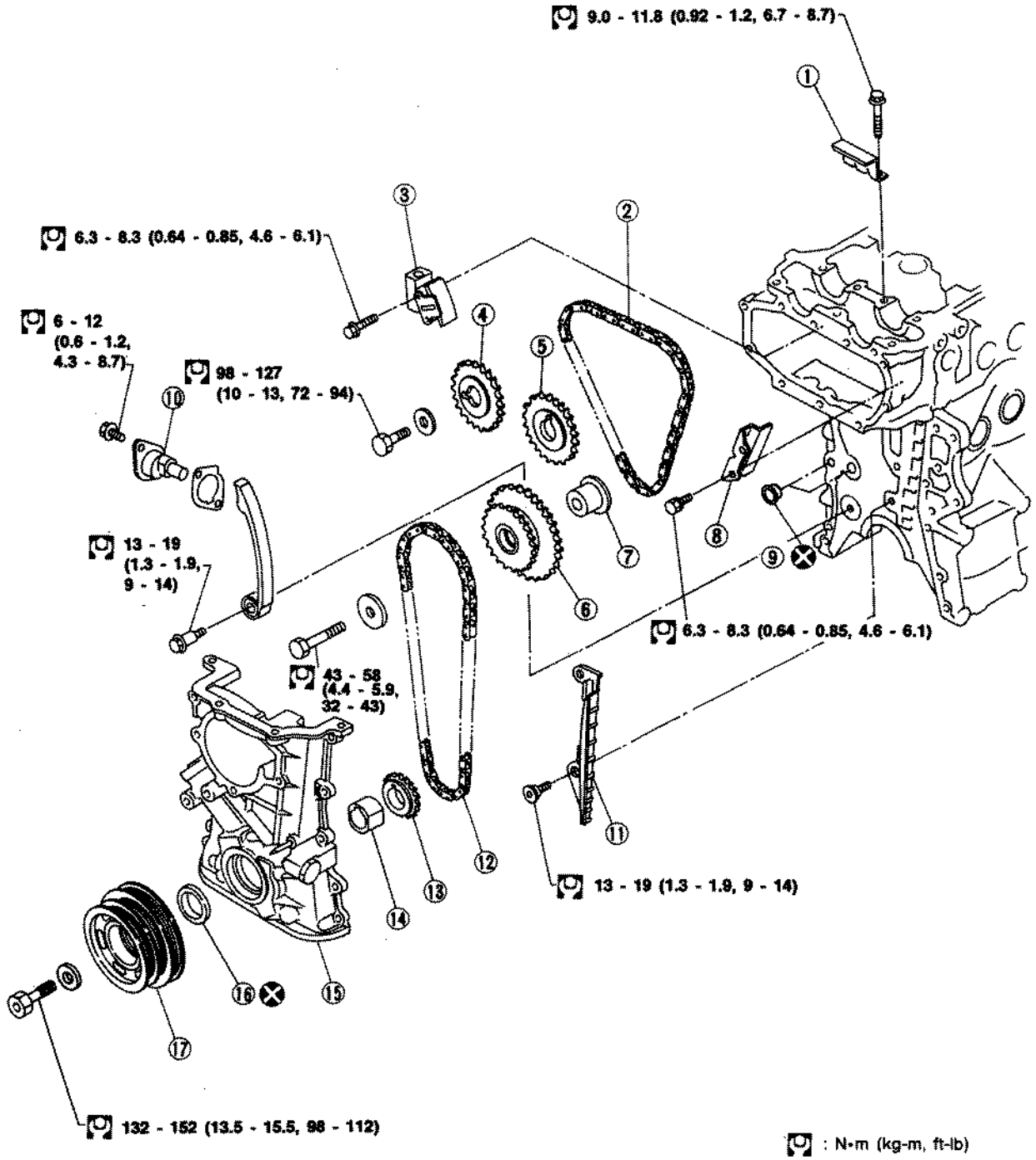


- Be sure liquid gasket is 3.5 to 4.5 mm (0.138 to 0.177 in) wide.



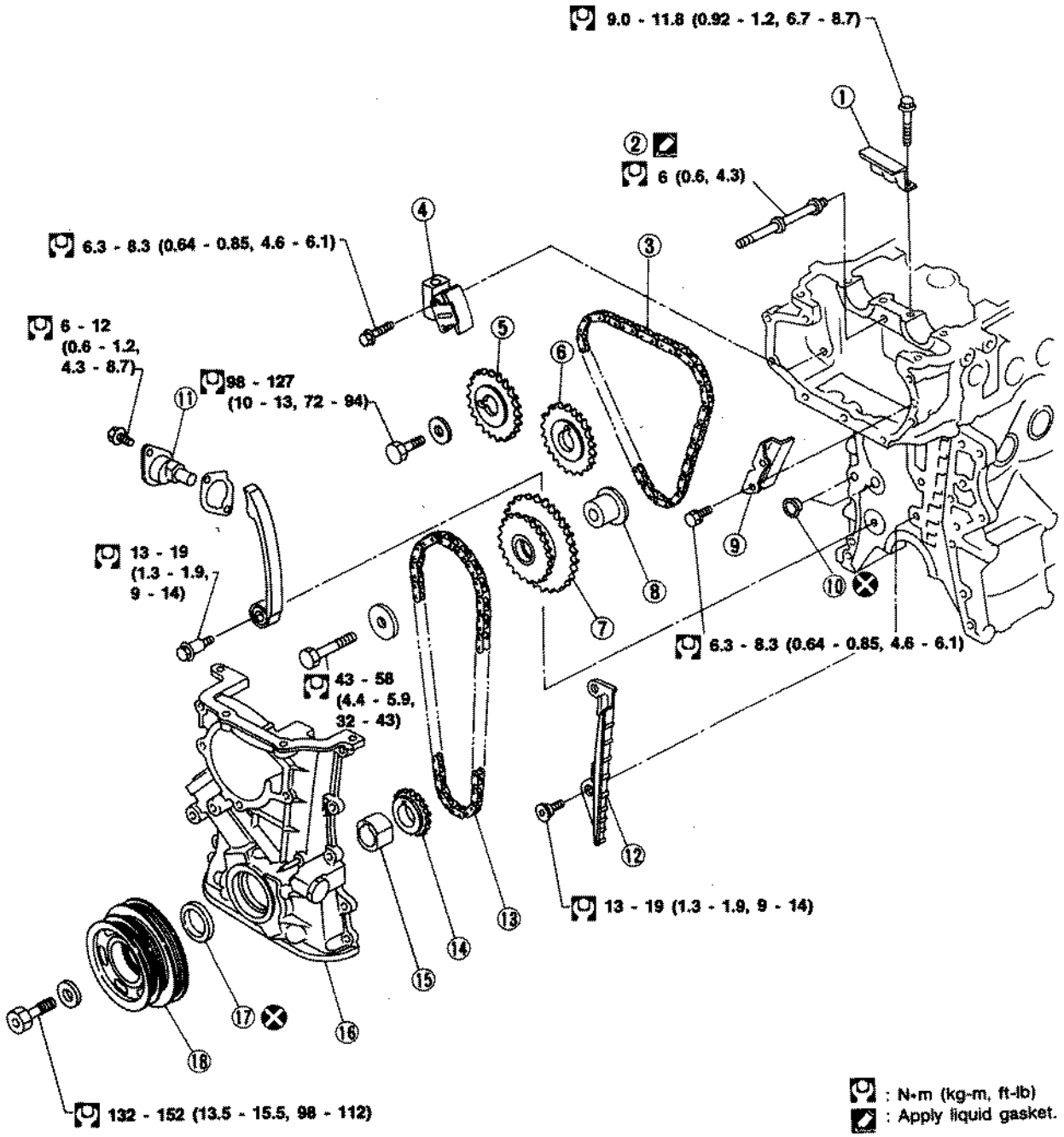
3. Apply liquid gasket to inner sealing surface as shown in figure.
- Attaching should be done within 5 minutes after coating.
4. Install oil pan.
- Wait at least 30 minutes before refilling engine oil.

EXCEPT FOR GA16DE



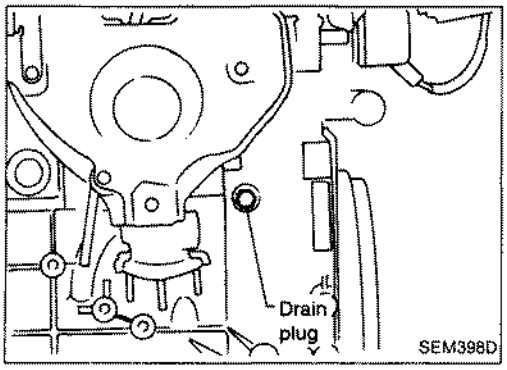
① Chain guide
② Upper timing chain
③ Chain tensioner
④ Camshaft sprocket (Intake)
⑤ Camshaft sprocket (Exhaust)
⑥ Idler sprocket
⑦ Idler shaft
⑧ Chain guide
⑨ O-ring
⑩ Chain tensioner
⑪ Chain guide
⑫ Lower timing chain
⑬ Crankshaft sprocket
⑭ Oil pump drive spacer
⑮ Front cover
⑯ Oil seal
⑰ Crankshaft pulley

GA16DE



SEM397D

① Chain guide
② Cylinder head front cover gusset
③ Upper timing chain
④ Chain tensioner
⑤ Camshaft sprocket (Intake)
⑥ Camshaft sprocket (Exhaust)
⑦ Idler sprocket
⑧ Idler shaft
⑨ Chain guide
⑩ O-ring
⑪ Chain tensioner
⑫ Chain guide
⑬ Lower timing chain
⑭ Crankshaft sprocket
⑮ Oil pump drive spacer
⑯ Front cover
⑰ Oil seal
⑱ Crankshaft pulley

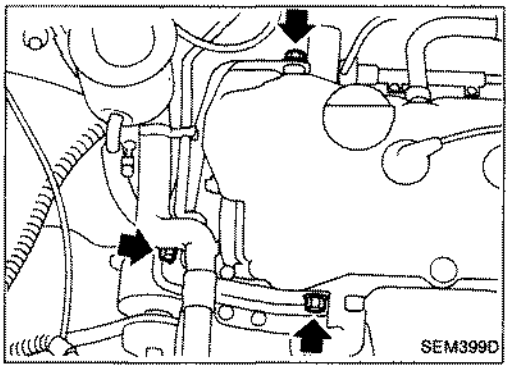


CAUTION:

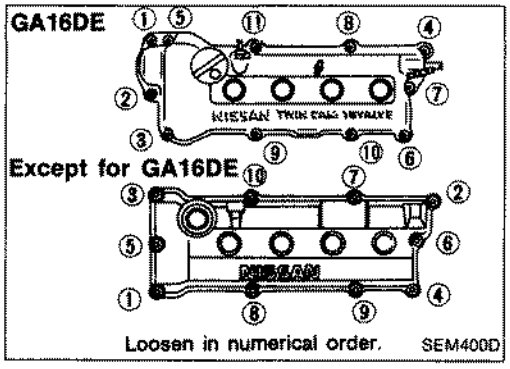
- **After removing timing chain, do not turn crankshaft and camshaft separately, or valves will strike piston heads.**

Removal

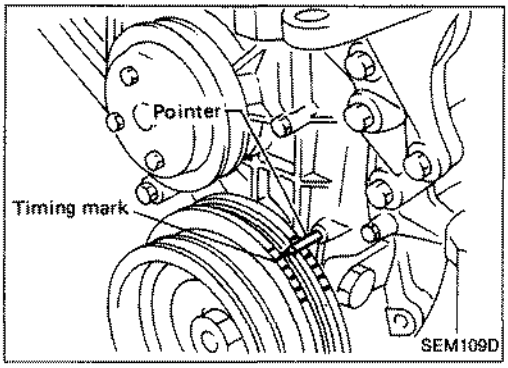
1. Drain engine coolant from radiator and cylinder block. Be careful not to spill coolant on drive belts.
2. Release fuel pressure (GA16DE). Refer to "Releasing Fuel Pressure" in section EF & EC.
3. Remove the following belts.
   - Power steering pump drive belt
   - Alternator drive belt
   - Air conditioner drive belt
4. Remove power steering pump bracket.
5. Remove air cleaner. (Except for GA16DE) Remove air duct to intake manifold collector. (GA16DE)
6. Remove front right-side wheel.
7. Remove front right-side splash cover.
8. Remove front undercovers.
9. Remove front exhaust tube.



10. Remove engine front mounting bracket.

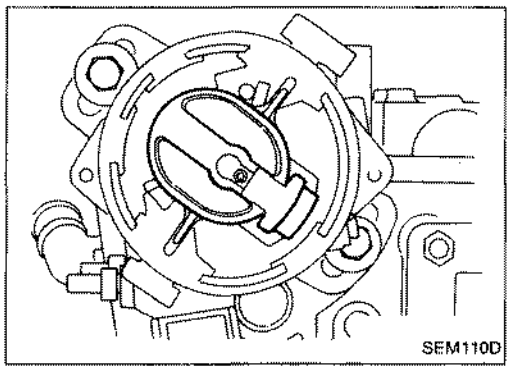


11. Remove rocker cover.
12. Remove distributor cap.
13. Remove all spark plugs.
14. Remove intake manifold support.



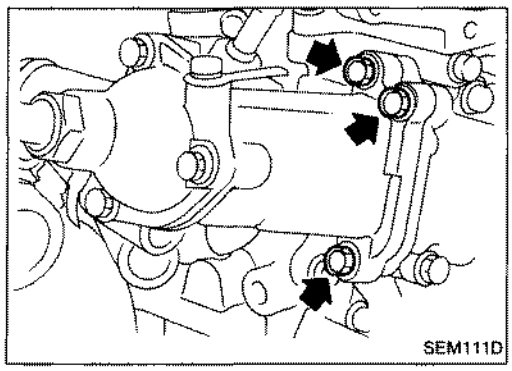
15. Set No. 1 piston at T.D.C. on its compression stroke.

Removal (Cont'd)

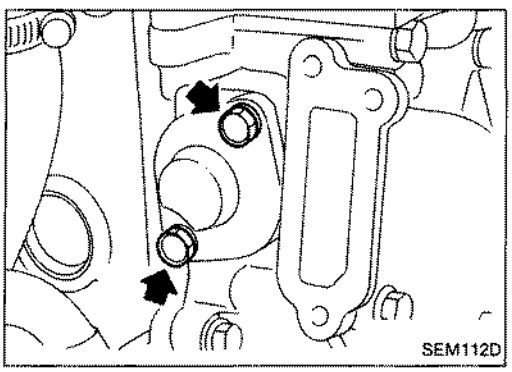


- Make sure No. 1 cylinder is at T.D.C. by looking at distributor rotor position.

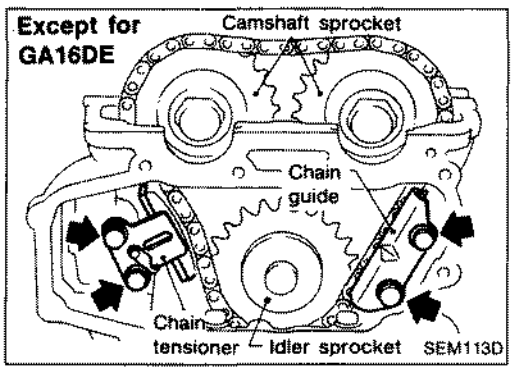
16. Remove distributor.
17. Remove cam sprocket cover and gusset.
18. Remove water pump pulley.



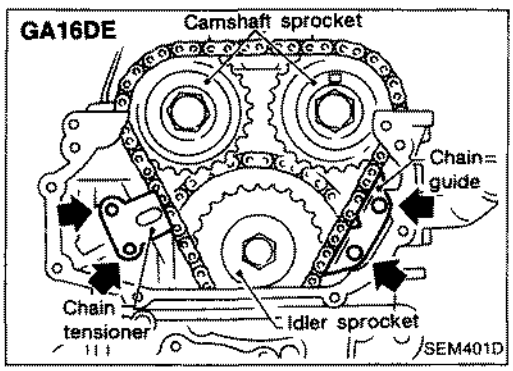
19. Remove thermostat housing.



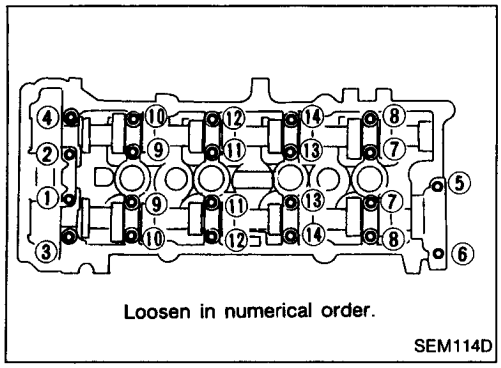
20. Remove chain tensioner.



21. Remove chain tensioner and chain guide.
22. Loosen idler sprocket bolt.
23. Remove camshaft sprocket bolts.
24. Remove camshaft sprockets.

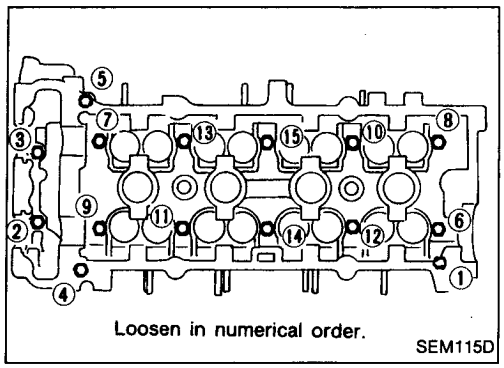


Removal (Cont'd)



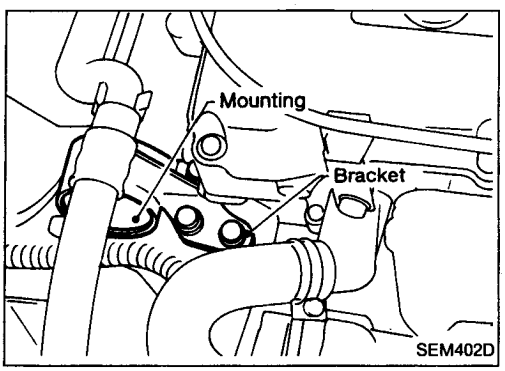
25. Remove camshaft brackets and camshafts.
- **These parts should be reassembled in their original positions.**
- **Bolts should be loosened in two or three steps.**

26. Remove idler sprocket bolt.

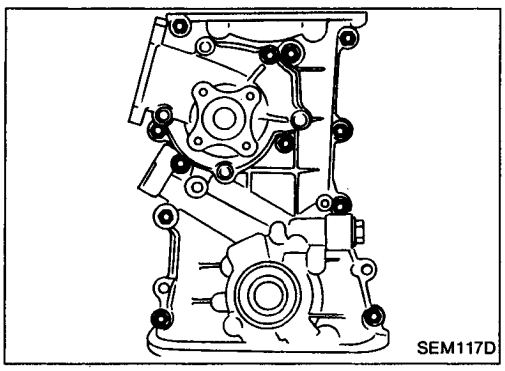


27. Remove cylinder head with manifolds.
- **Head warpage or cracking could result from removing in incorrect order.**
- **Cylinder head bolts should be loosened in two or three steps.**

28. Remove idler sprocket shaft from rear side.
29. Remove upper timing chain.
30. Remove center member.
31. Remove oil pan. Refer to "Removal" in "OIL PAN".
32. Remove oil strainer.
33. Remove crankshaft pulley.



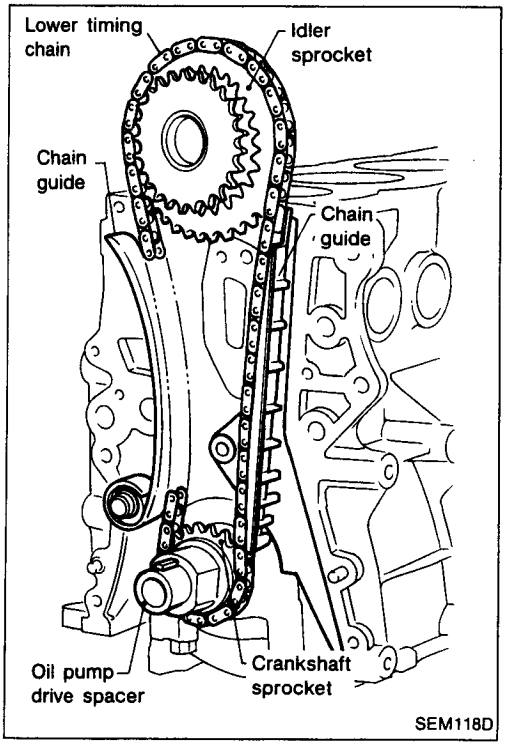
34. Support engine with a suitable jack.
35. Remove engine front mounting bracket.



36. Remove front cover bolts and front cover as shown.

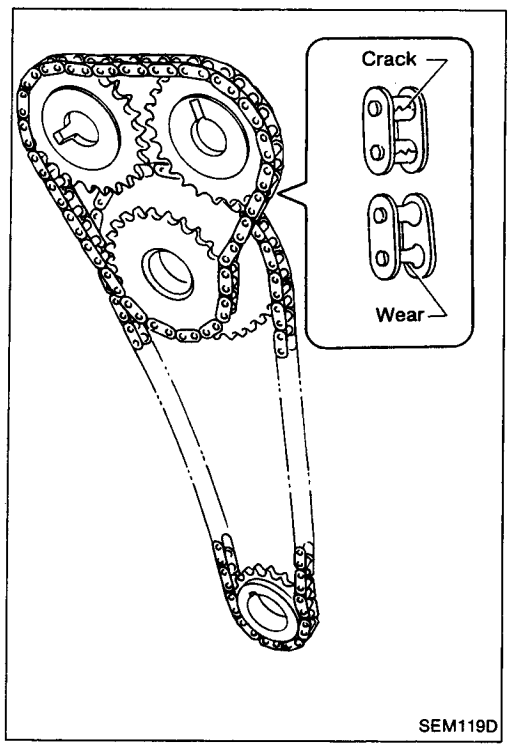
CAUTION:
One bolt is located on water pump.

Removal (Cont'd)



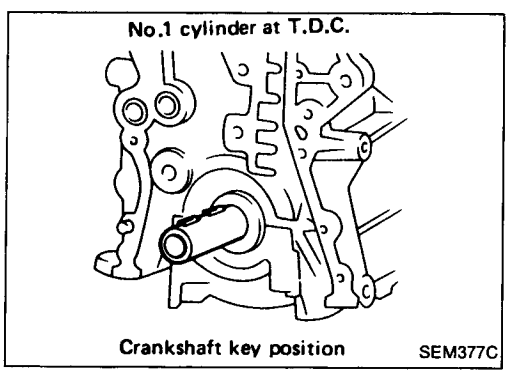
37. Remove idler sprocket.
38. Remove lower timing chain.
39. Remove oil pump drive spacer.
40. Remove chain guide.
41. Remove crankshaft sprocket.

Inspection



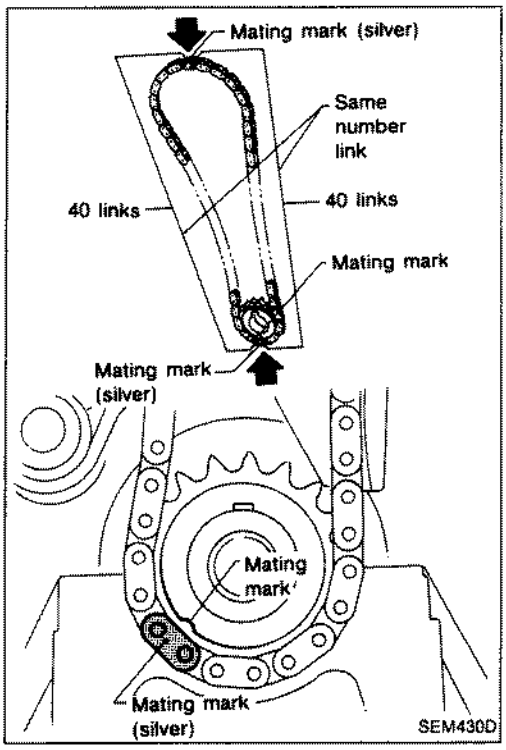
Check for cracks and excessive wear at roller links. Replace if necessary.

Installation



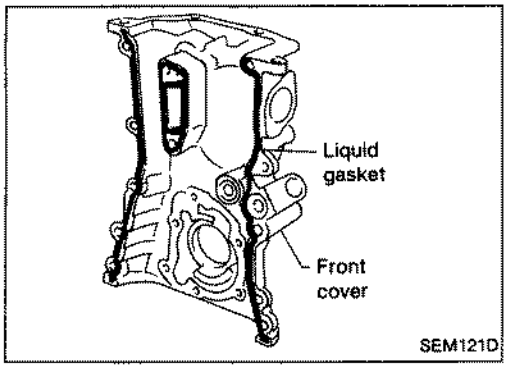
1. Confirm that No. 1 piston is set at T.D.C. on its compression stroke.

Installation (Cont'd)



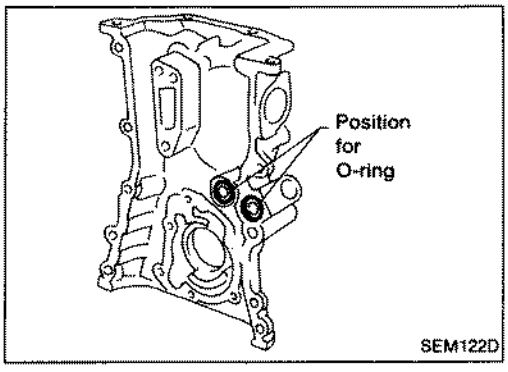
2. Install chain guide.
3. Install crankshaft sprocket and lower timing chain.

- **Set timing chain by aligning its mating mark with the one on crankshaft sprocket.**
- **Make sure sprocket's mating mark faces engine front.**
- **The number of links between the alignment marks (gold) are the same for the left and right sides, so either side can be used during alignment with the sprocket.**



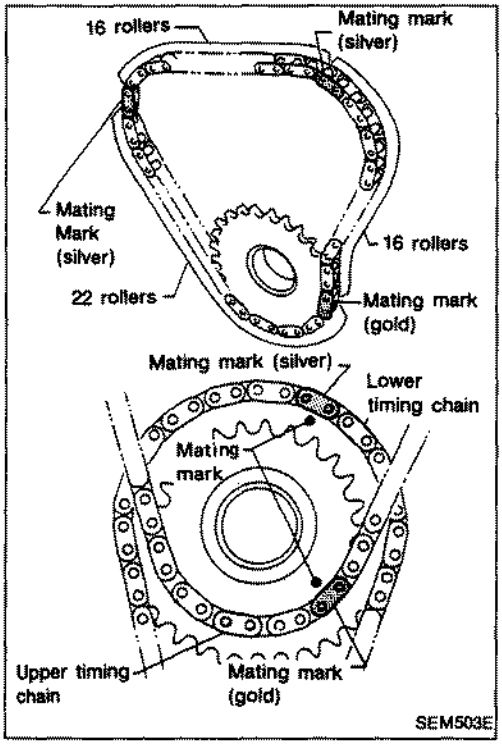
4. Apply liquid gasket to front cover.
5. Install front cover.

- **Check alignment of mating marks on chain and crankshaft sprocket.**
- **Align oil drive spacer with oil pump.**
- **Put chain to the side of chain guide so that chain does not make contact with water seal area of front cover.**
- **Make sure two O-rings are present.**
- **Be careful not to damage oil seal when installing front cover.**



6. Install engine front mounting.
7. Install oil strainer.
8. Install oil pan. Refer to "Installation" in "OIL PAN".
9. Install crankshaft pulley.
10. Install center member.

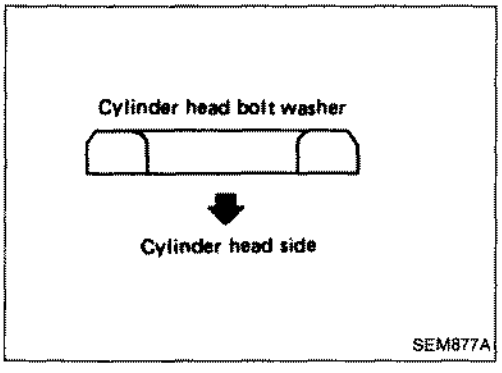
Installation (Cont'd)



11. Set idler sprocket by aligning the mating mark on the larger sprocket with the silver mating mark on the lower timing chain.
12. Install upper timing chain and set it by aligning the mating mark on the smaller sprocket with the silver mating marks on the upper timing chain.

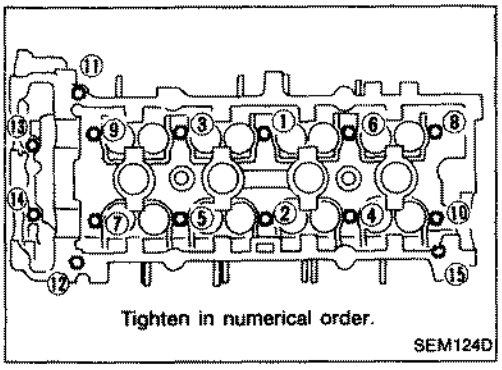
- **Make sure sprocket's mating mark faces engine front.**

13. Install idler sprocket shaft from the rear side.



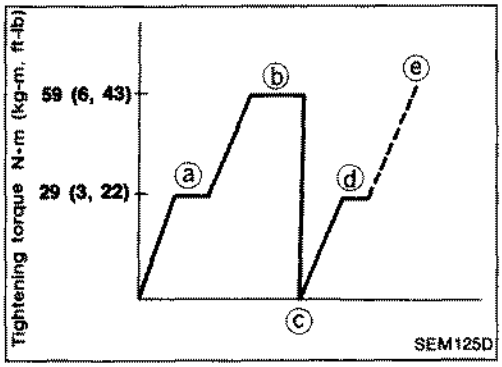
14. Install cylinder head with new gasket.

- **Be sure to install washers between bolts and cylinder head.**
- **Do not rotate crankshaft and camshaft separately, or valves will strike piston heads.**



- **Tightening procedure**

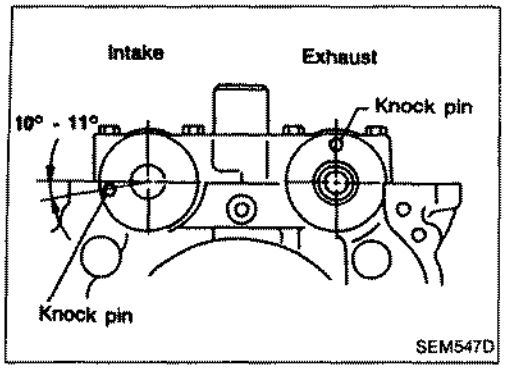
ⓐ **Tighten bolts to 29 N·m (3 kg-m, 22 ft-lb).**
ⓑ **Tighten bolts to 59 N·m (6 kg-m, 43 ft-lb).**
ⓒ **Loosen bolts completely.**
ⓓ **Tighten bolts to 29 N·m (3 kg-m, 22 ft-lb).**
ⓔ **Turn bolts 50 to 55 degrees clockwise or if angle wrench is not available, tighten bolts to 59 ± 5 N·m (6 ± 0.5 kg-m, 43.4 ± 3.6 ft-lb).**
ⓕ **Tighten bolts (⑪ - ⑮) to 6.3 to 8.3 N·m (0.64 to 0.85 kg-m, 4.6 to 6.1 ft-lb).**



	Tightening torque N·m (kg-m, ft-lb)				
	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ, ⓕ
Bolts (① - ⑩)	29 (3, 22)	59 (6, 43)	0 (0, 0)	29 (3, 22)	50 - 55 degrees or 59 ± 5 (6 ± 0.5, 43.4 ± 3.6)
Bolts (⑪ - ⑮)	—	—	—	—	6.3 - 8.3 (0.64 - 0.85, 4.6 - 6.1)

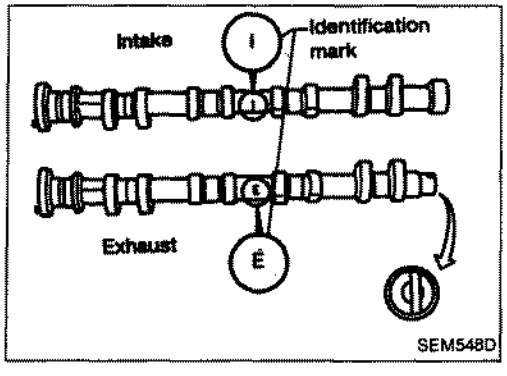
Installation (Cont'd)

15. Install idler sprocket bolt.

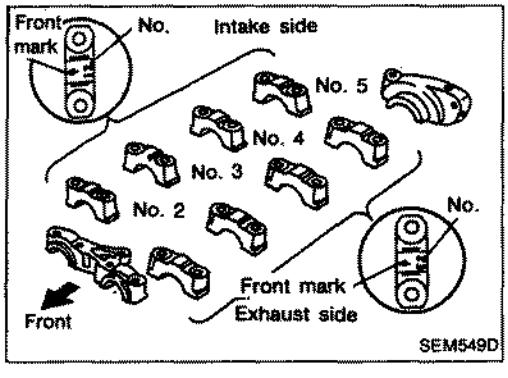


16. Install camshaft.

- **Make sure camshafts are aligned as shown in figure.**

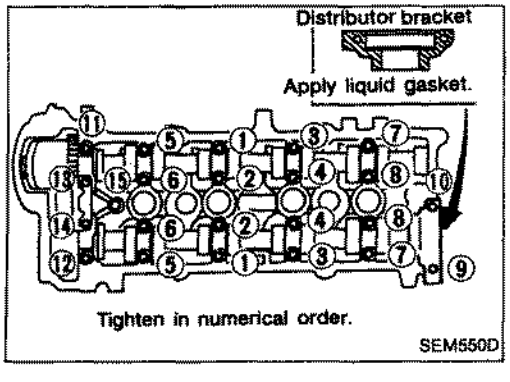


- **Identification marks are present on camshafts.**

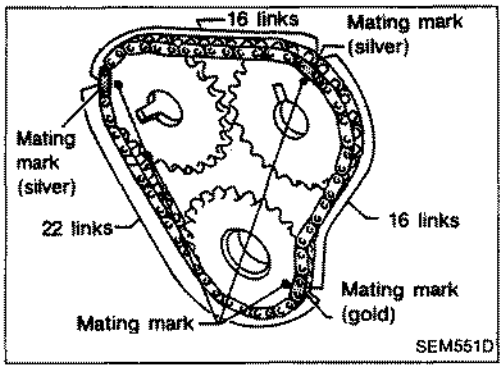


17. Install camshaft brackets and distributor bracket.

- **Make sure camshaft brackets are aligned as shown in figure.**
- **Apply liquid gasket to distributor bracket.**
- **Tighten camshaft bracket bolts gradually in two or three stages.**
- **If any part of valve assembly or camshaft is replaced, check valve clearance according to reference data.**
  After completing assembly check valve clearance. Refer to "Checking" and "Adjusting" in "VALVE CLEARANCE".
  Reference data valve clearance (Cold):
  Intake
  0.30 mm (0.012 in)
  Exhaust
  0.35 mm (0.014 in)

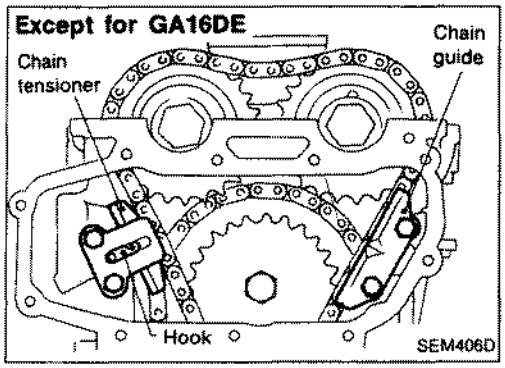


Installation (Cont'd)

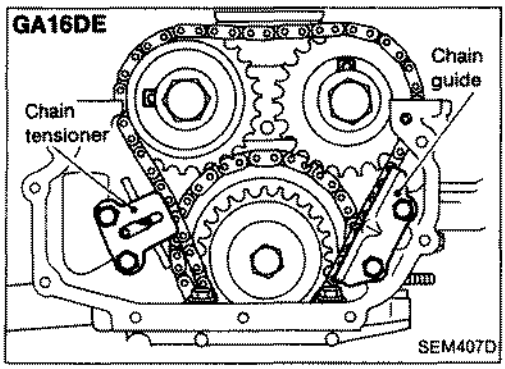


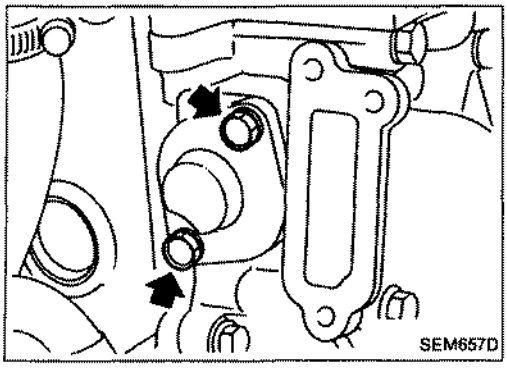
18. Assemble camshaft sprocket with chain.
- **Set timing chain by aligning mating marks with those of camshaft sprockets.**
- **Make sure sprocket's mating marks face engine front.**

19. Install camshaft sprocket bolts.



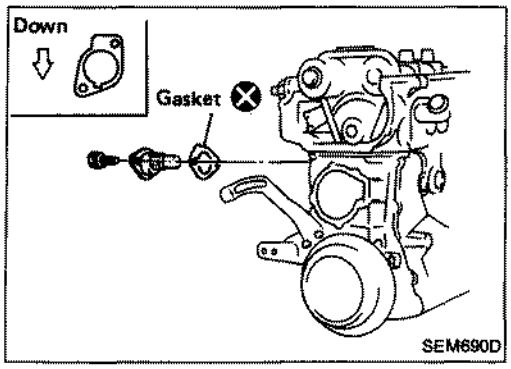
20. Install chain tensioner and chain guide.
- **Make sure that hook used to retain chain tensioner is released.**





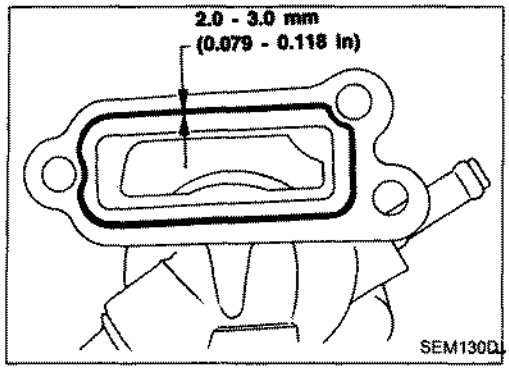
21. Install lower chain tensioner.

CAUTION:
- **Check no problems occur when engine is rotated.**
- **Make sure that No. 1 piston is set at T.D.C. on its compression stroke.**

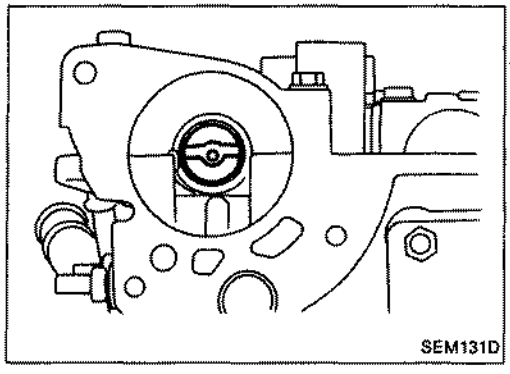


- **Make sure of the direction of the gasket before installing lower chain tensioner.**

Installation (Cont'd)



22. Apply liquid gasket to thermostat housing.
23. Install thermostat housing.
24. Install water pump pulley.

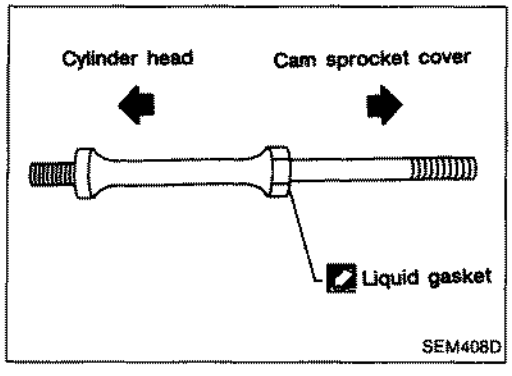


25. Install distributor.

- **Make sure that position of camshaft is as shown in figure.**

Except for GA16DE

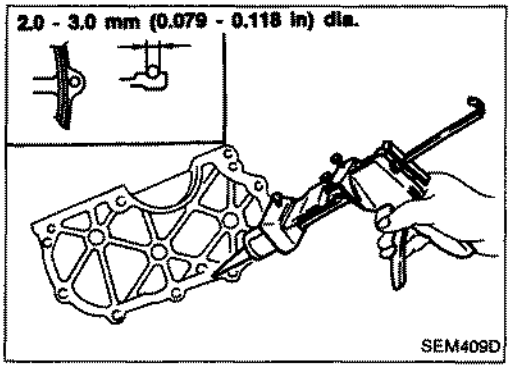
26. Install cam sprocket cover.



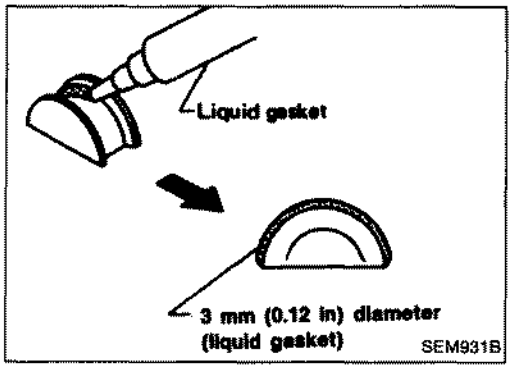
GA16DE

26. Install cam sprocket cover gusset and cam sprocket cover.

- Apply liquid gasket to cam sprocket cover gusset.



- Apply liquid gasket to cam sprocket cover.

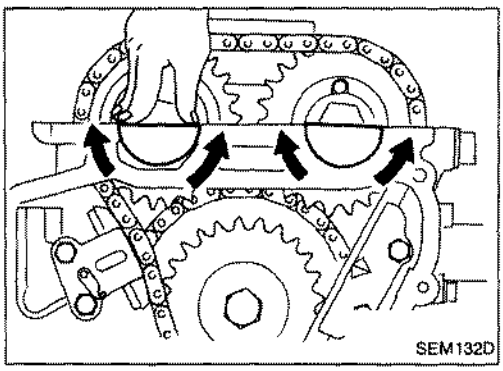


Except for GA16DE

27. Install rubber plugs as follows:
(1) Apply liquid gasket to rubber plugs.

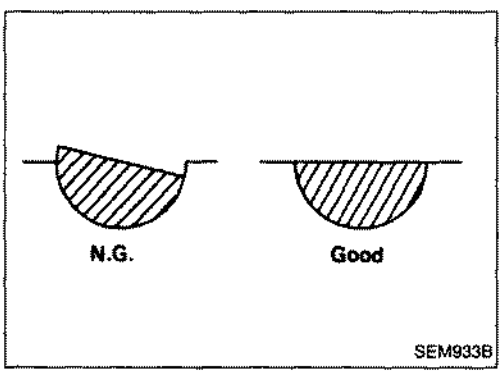
Rubber plugs should be installed within 5 minutes of applying liquid gasket.

Installation (Cont'd)



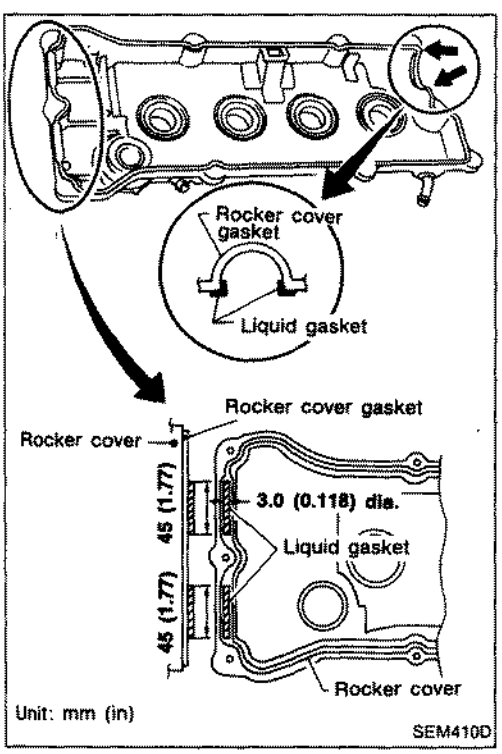
(2) Install rubber plugs, then move them with your fingers to uniformly spread the gasket on cylinder head surface.

- **Rubber plugs should be installed flush with the surface.**
- **Do not start engine for 30 minutes after installing rocker cover.**



Except for GA16DE

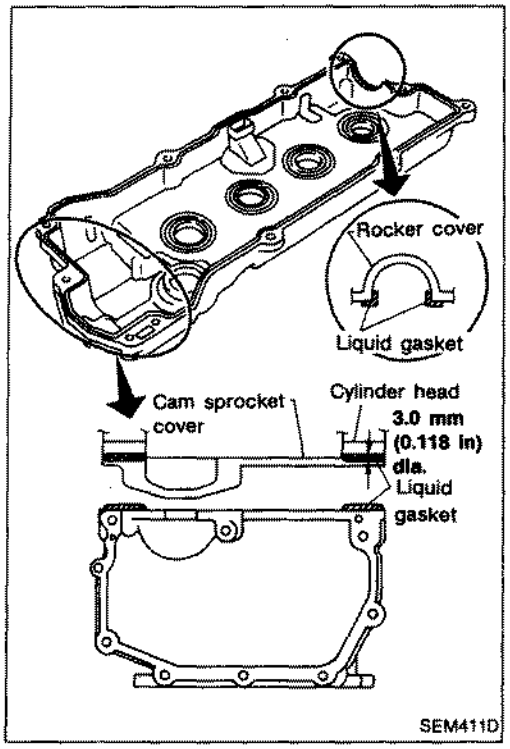
28. Apply liquid gasket to rocker cover.

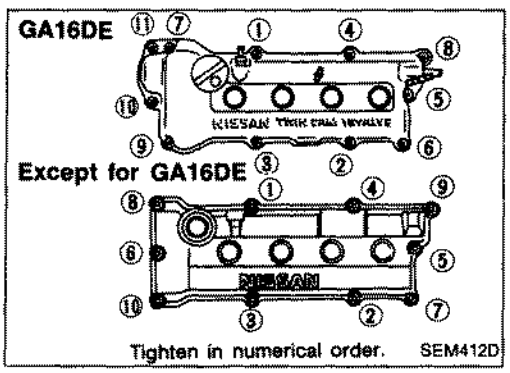


Installation (Cont'd)

GA16DE

28. Apply liquid gasket to rocker cover and cylinder head.



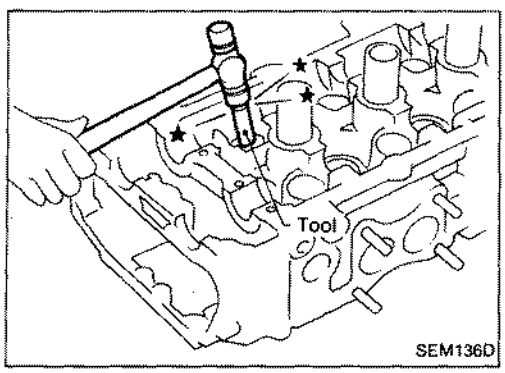


29. Install rocker cover.
30. Install all spark plugs.
31. Install engine front mounting bracket.
32. Install front exhaust tube.
33. Install front undercover.
34. Install front right splash cover.
35. Install front right wheel.
36. Install air cleaner.
37. Install power steering pump bracket.
38. Install the following belts.
- Alternator drive belt
- Power steering pump drive belt
- Air conditioner compressor drive belt

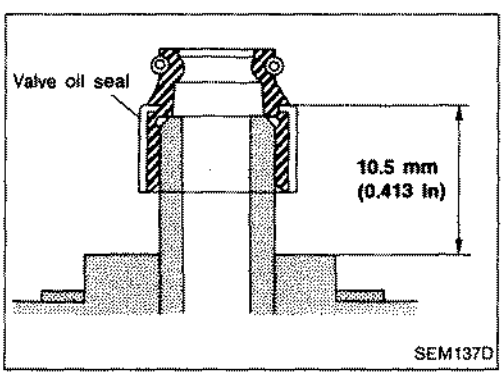
VALVE OIL SEAL

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

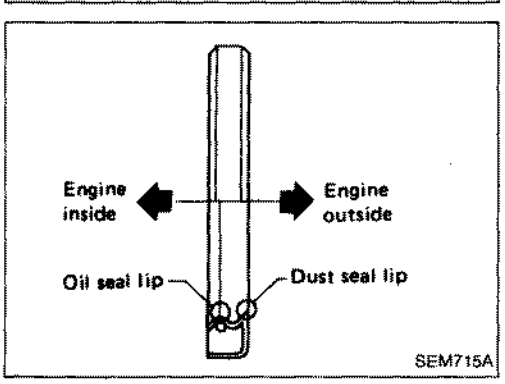
Piston concerned should be set at T.D.C. to prevent valve from falling.



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



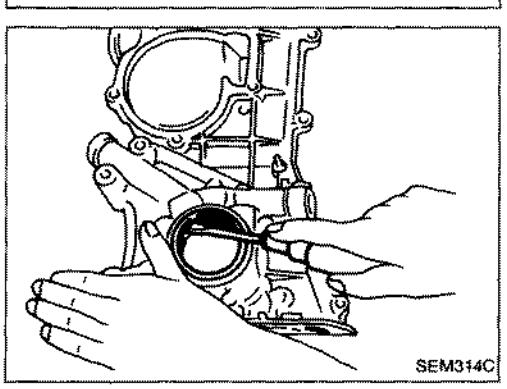
OIL SEAL INSTALLING DIRECTION

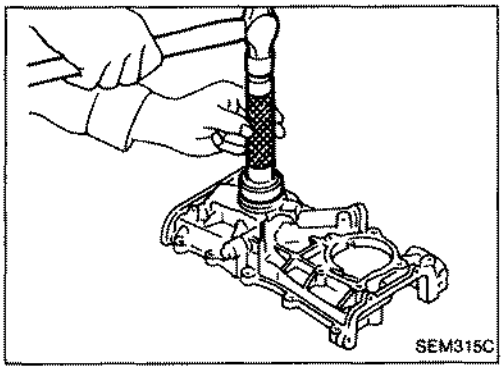


FRONT OIL SEAL

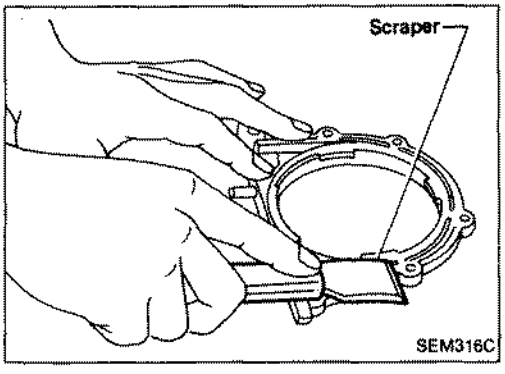
1. Remove front cover. Refer to "Removal" in "TIMING CHAIN".
2. Remove front oil seal from front cover.

Be careful not to damage oil seal retainer.




SEM315C

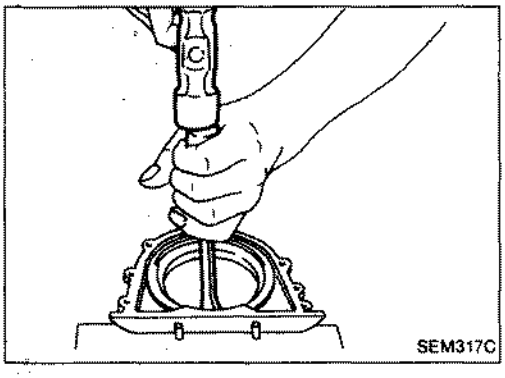
3. Apply engine oil to new oil seal and install it using a suitable tool.



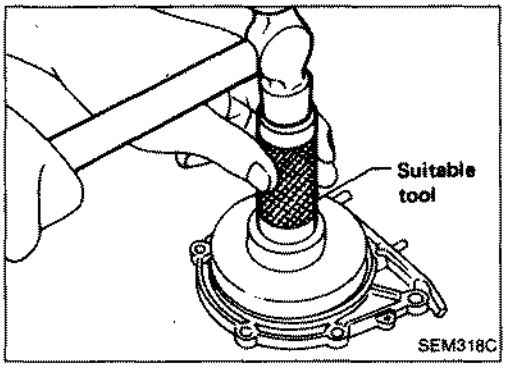
SEM316C

REAR OIL SEAL

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

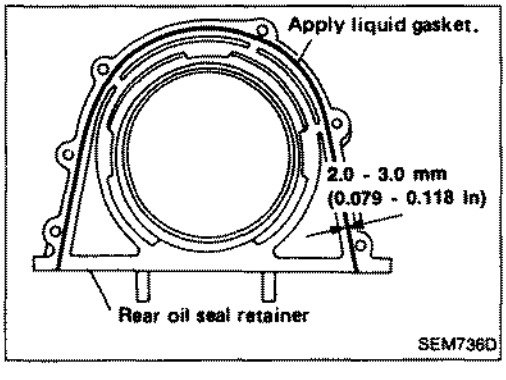

SEM317C

4. Remove seal from rear oil seal retainer.



SEM318C

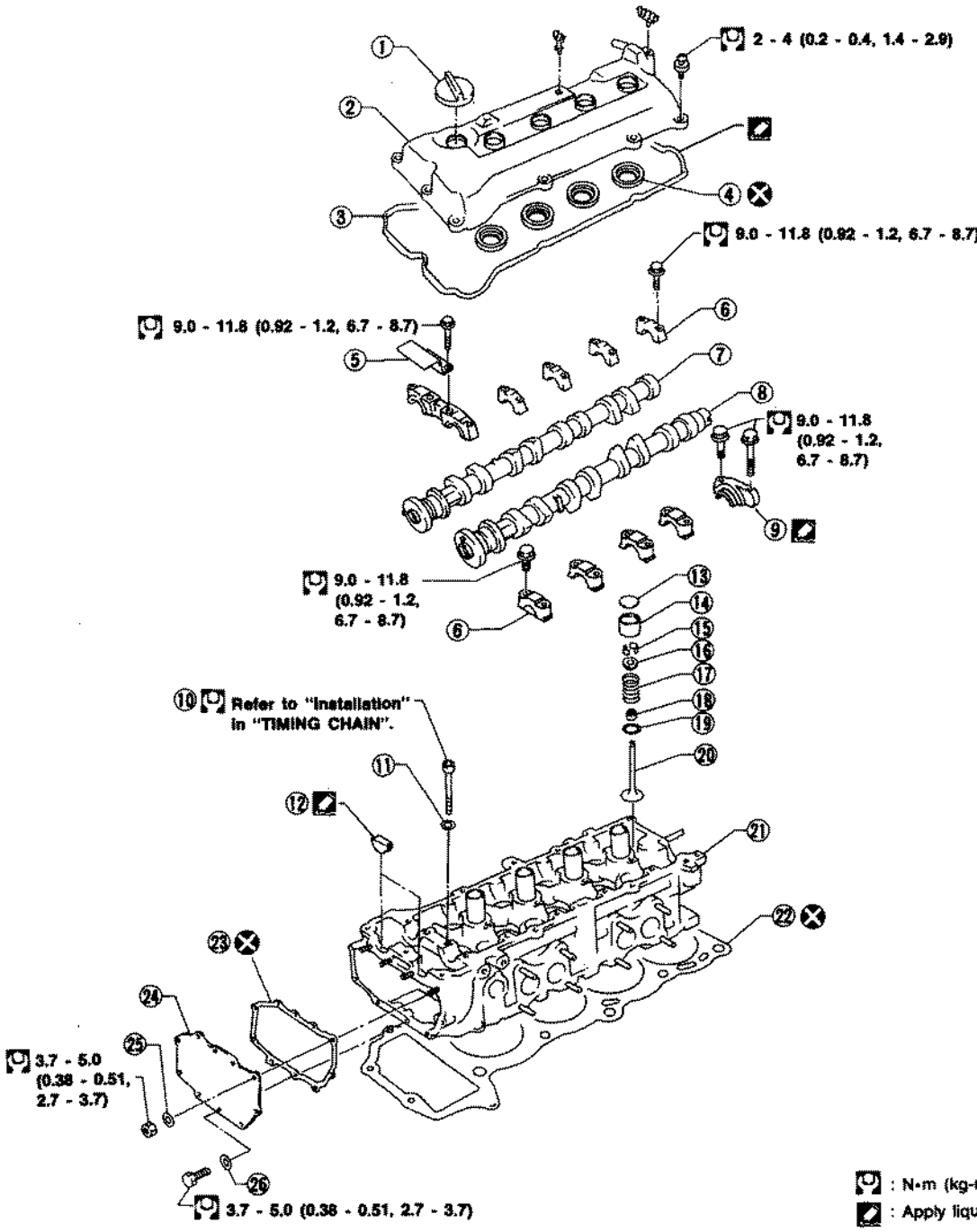
5. Apply engine oil to new oil seal and install it using a suitable tool.



SEM736D

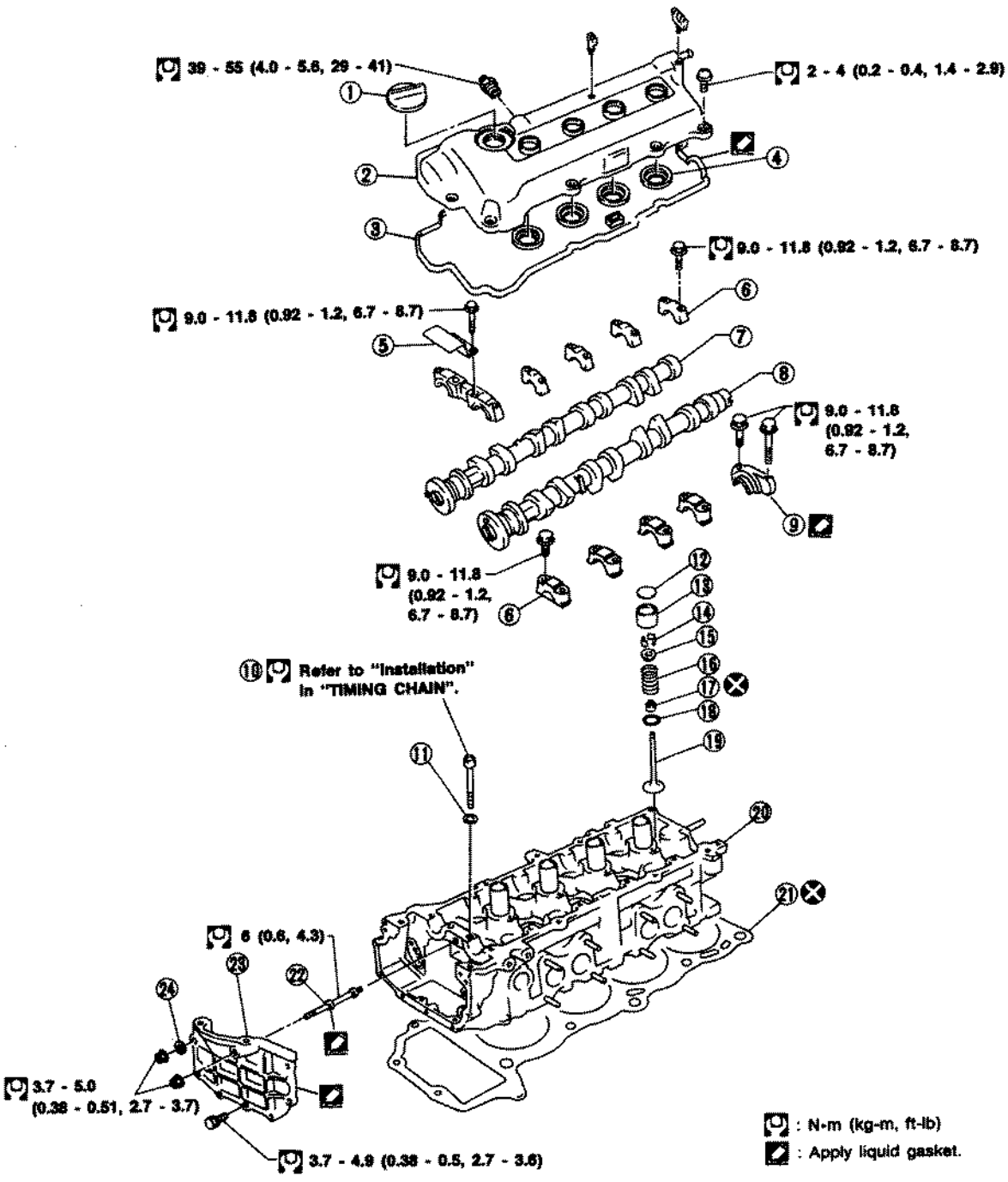
6. Apply liquid gasket to rear oil seal retainer.

Except for GA16DE



① Oil filler cap
② Rocker cover
③ Rocker cover gasket
④ Oil seal
⑤ Chain guide
⑥ Camshaft bracket
⑦ Intake camshaft
⑧ Exhaust camshaft
⑨ Distributor bracket
⑩ Cylinder head bolt
⑪ Washer
⑫ Rubber plug
⑬ Shim
⑭ Valve lifter
⑮ Valve cotter
⑯ Valve spring retainer
⑰ Valve spring
⑱ Valve oil seal
⑲ Spring seat
⑳ Valve
㉑ Cylinder head
㉒ Cylinder head gasket
㉓ Front cover gasket
㉔ Cam sprocket cover
㉕ Washer
㉖ Washer

GA16DE



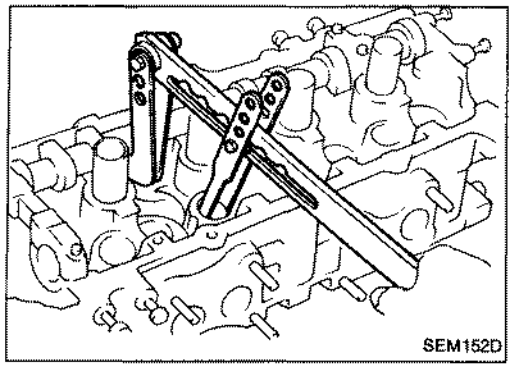
① Oil filler cap
② Rocker cover
③ Rocker cover gasket
④ Oil seal
⑤ Chain guide
⑥ Camshaft bracket
⑦ Intake camshaft
⑧ Exhaust camshaft
⑨ Distributor bracket
⑩ Cylinder head bolt
⑪ Washer
⑫ Shim
⑬ Valve lifter
⑭ Valve cotter
⑮ Valve spring retainer
⑯ Valve spring
⑰ Valve oil seal
⑱ Spring seat
⑲ Valve
⑳ Cylinder head
㉑ Cylinder head gasket
㉒ Cam sprocket cover gusset
㉓ Cam sprocket cover
㉔ Washer

CAUTION:

- **When installing sliding parts such as camshaft and oil seal, be sure to apply new engine oil on their sliding surfaces.**
- **When tightening cylinder head bolts, camshaft sprocket bolts and camshaft bracket bolts, apply new engine oil to thread portions and seat surfaces of bolts.**
- **Attach tags to valve lifters so as not to mix them up.**

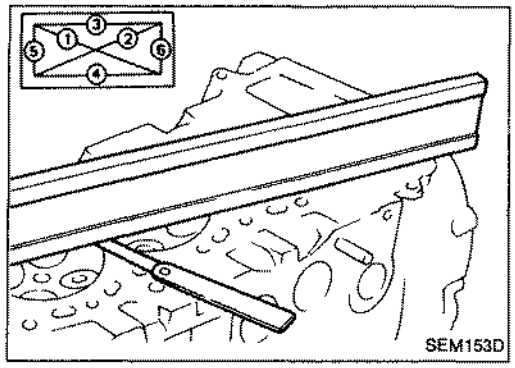
Removal

- This removal is the same procedure as those for timing chain. Refer to "Removal" in "TIMING CHAIN".


SEM152D

Disassembly

1. Remove valve components with Tool.
2. Remove valve oil seal with a suitable tool.



SEM153D

Inspection

CYLINDER HEAD DISTORTION

Head surface flatness:

Standard:

Less than 0.03 mm (0.0012 in)

Limit:

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.

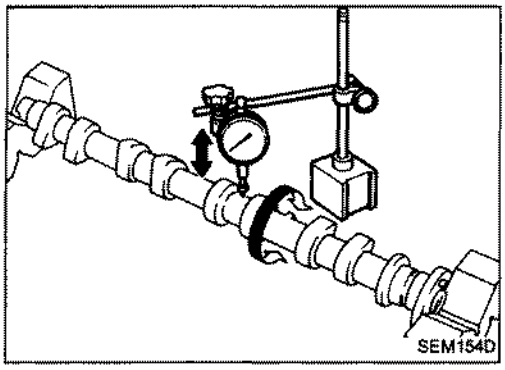
Nominal cylinder head height:

117.8 - 118.0 mm (4.638 - 4.646 in)

Inspection (Cont'd)

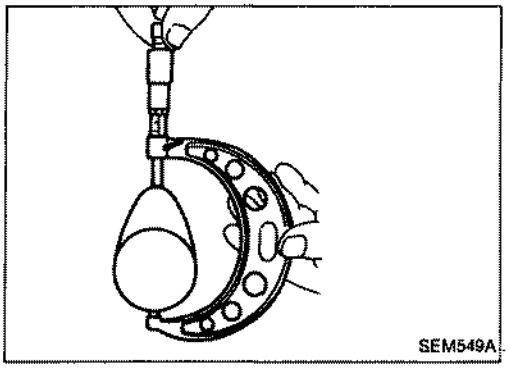
CAMSHAFT VISUAL CHECK

Check camshaft for scratches, seizure and wear.



CAMSHAFT RUNOUT

1. Measure camshaft runout at the center journal.
   Runout (Total indicator reading):
   Standard:
   Less than 0.02 mm (0.0008 in)
   Limit:
   0.1 mm (0.004 in)
2. If it exceeds the limit, replace camshaft.



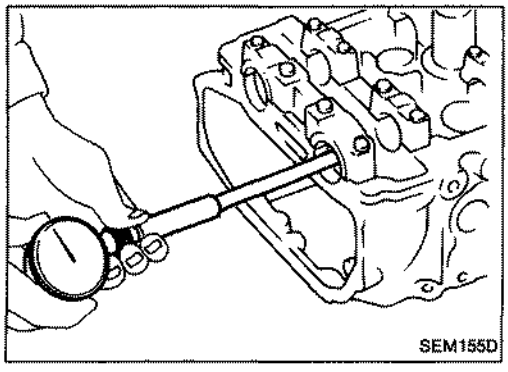
CAMSHAFT CAM HEIGHT

1. Measure camshaft cam height.

Unit: mm (in)

		GA14DS with catalyzer without E.G.R., except for GA16DE	GA14DS with catalyzer and E.G.R.	GA16DE
Standard cam height	Intake	39.880 - 40.070 (1.5701 - 1.5776)	39.380 - 39.570 (1.5504 - 1.5579)	40.600 - 40.790 (1.5984 - 1.6059)
	Exhaust	39.880 - 40.070 (1.5701 - 1.5776)	39.380 - 39.570 (1.5504 - 1.5579)	39.880 - 40.070 (1.5701 - 1.5776)
Cam wear limit		0.2 (0.008)		

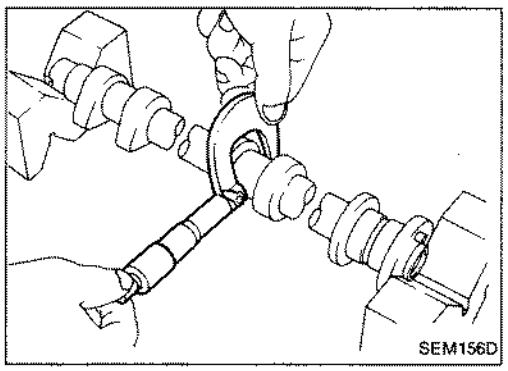
2. If wear is beyond the limit, replace camshaft.



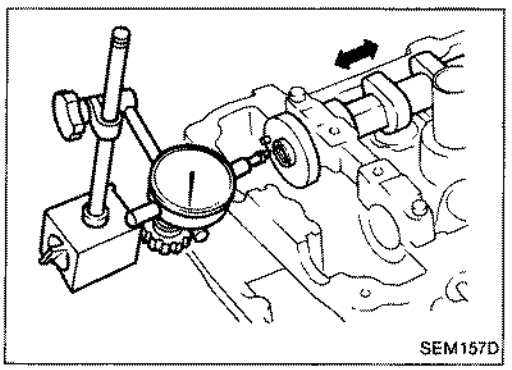
CAMSHAFT JOURNAL CLEARANCE

1. Install camshaft bracket and tighten bolts to the specified torque.
2. Measure inner diameter of camshaft bearing.
   Standard inner diameter:
   No. 1 bearing
   28.000 - 28.021 mm (1.1024 - 1.1032 in)
   No. 2 to No. 5 bearings
   24.000 - 24.021 mm (0.9449 - 0.9457 in)

Inspection (Cont'd)

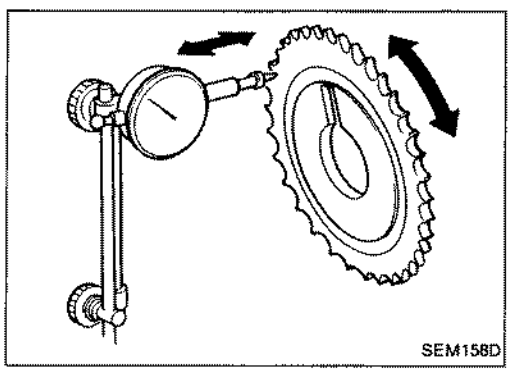

SEM156D

3. Measure outer diameter of camshaft journal.
   Standard outer diameter:
   No. 1 journal
   27.935 - 27.955 mm (1.0998 - 1.1006 in)
   No. 2 to No. 5 journals
   23.935 - 23.955 mm (0.9423 - 0.9431 in)
4. If clearance exceeds the limit, replace camshaft and/or cylinder head.
   Camshaft journal clearance:
   Standard
   0.045 - 0.086 mm (0.0018 - 0.0034 in)
   Limit
   0.15 mm (0.0059 in)


SEM157D

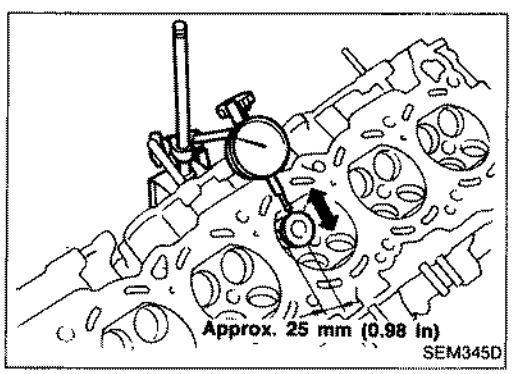
CAMSHAFT END PLAY

1. Install camshaft in cylinder head.
2. Measure camshaft end play.
   Camshaft end play:
   Standard
   0.070 - 0.143 mm (0.0028 - 0.0056 in)
   Limit
   0.20 mm (0.0079 in)


SEM158D

CAMSHAFT SPROCKET RUNOUT

1. Install sprocket on camshaft.
2. Measure camshaft sprocket runout.
   Runout (Total indicator reading):
   Limit 0.15 mm (0.0059 in)
3. If it exceeds the limit, replace camshaft sprocket.

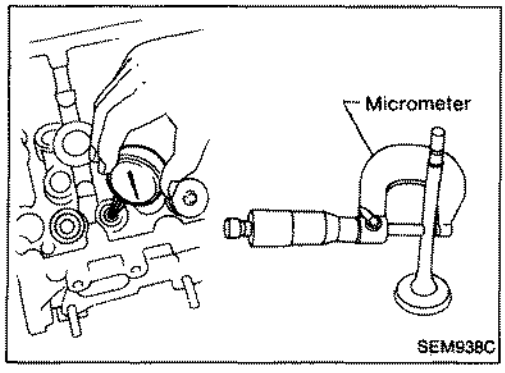


SEM345D

VALVE GUIDE CLEARANCE

1. Measure valve deflection in a parallel direction with rocker arm. (Valve and valve guide mostly wear in this direction.)
   Valve deflection limit (Dial gauge reading):
   Intake & Exhaust
   0.2 mm (0.008 in)

Inspection (Cont'd)



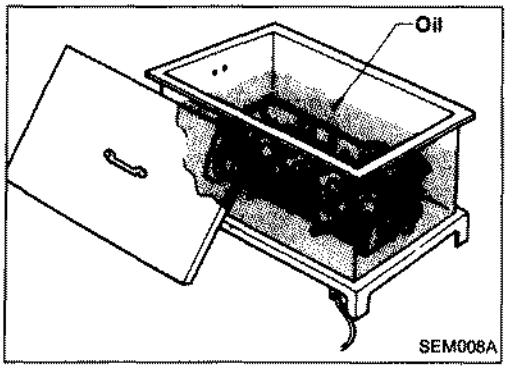
2. If it exceeds the limit, check valve to valve guide clearance.
a. Measure valve stem diameter and valve guide inner diameter.
b. Check that clearance is within specification.

Valve to valve guide clearance:

Unit: mm (in)

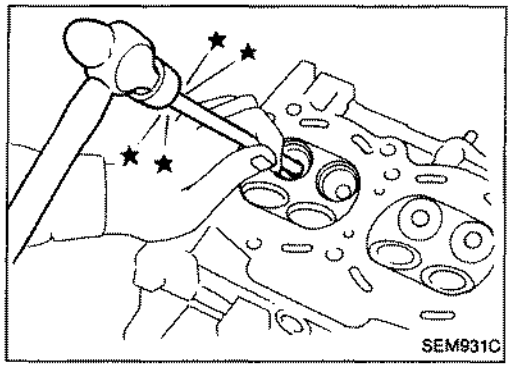
	Standard	Limit
Intake	0.020 - 0.050 (0.0008 - 0.0020)	0.1 (0.004)
Exhaust	0.040 - 0.070 (0.0016 - 0.0028)	0.1 (0.004)

c. If it exceeds the limit, replace valve or valve guide.

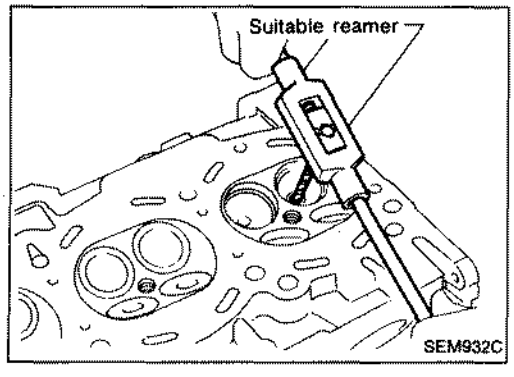


VALVE GUIDE REPLACEMENT

1. To remove valve guide, heat cylinder head to 110 to 120°C (230 to 248°F).

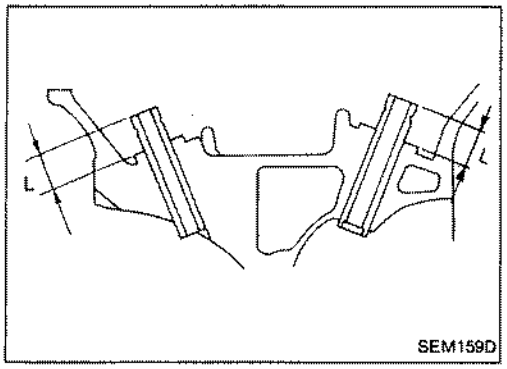


2. Drive out valve guide with a press [under a 20 kN (2 t, 2.2 US ton, 2.0 Imp ton) pressure] or hammer and suitable tool.

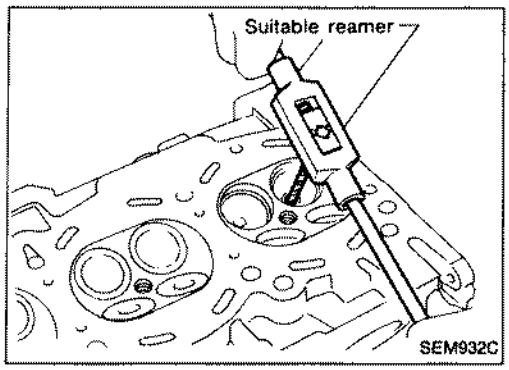


3. Ream cylinder head valve guide hole.
Valve guide hole diameter (for service parts):
Intake & Exhaust
9.685 - 9.696 mm (0.3813 - 0.3817 in)

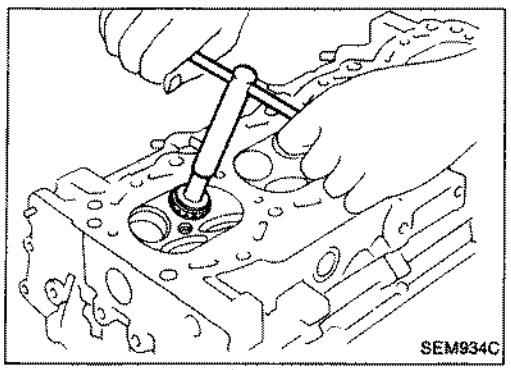
Inspection (Cont'd)



4. Heat cylinder head to 110 to 120°C (230 to 248°F) and press service valve guide into cylinder head.
   Projection "L":
   11.5 - 11.7 mm (0.453 - 0.461 in)



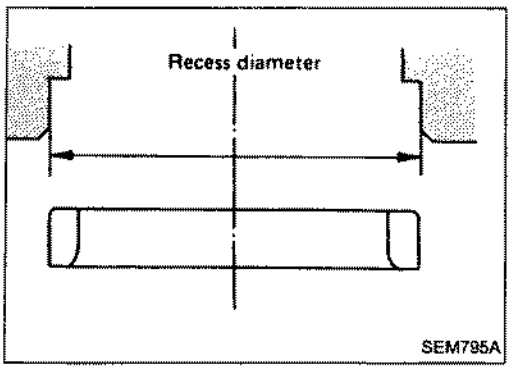
5. Ream valve guide.
   Finished size:
   Intake & Exhaust
   5.500 - 5.515 mm (0.2165 - 0.2171 in)



VALVE SEATS

Check valve seats for any evidence of pitting at valve contact surface, and reset 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

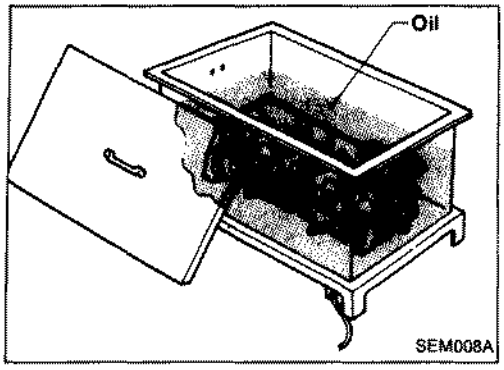
1. Bore out old seat until it collapses. The machine depth stop should be set so that boring cannot continue beyond the bottom face of the seat recess in cylinder head.
2. Ream cylinder head recess.
   Reaming bore for service valve seat
   Oversize [0.5 mm (0.020 in)]:

Unit: mm (in)

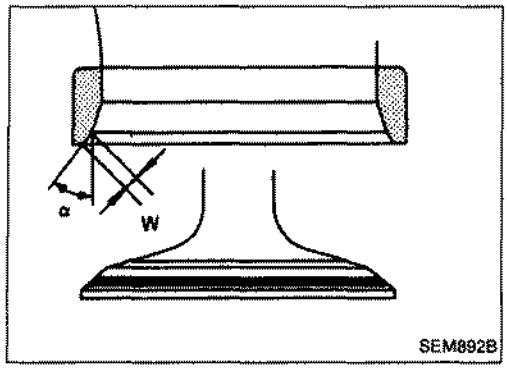
	GA13DS	GA14DS	GA16DS & GA16DE
Intake	28.000 - 28.016 (1.1024 - 1.1030)	30.500 - 30.516 (1.2008 - 1.2014)	31.500 - 31.516 (1.2402 - 1.2408)
Exhaust	23.000 - 23.016 (0.9055 - 0.9061)	25.500 - 25.516 (1.0039 - 1.0046)	25.500 - 25.516 (1.0039 - 1.0046)

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

Inspection (Cont'd)

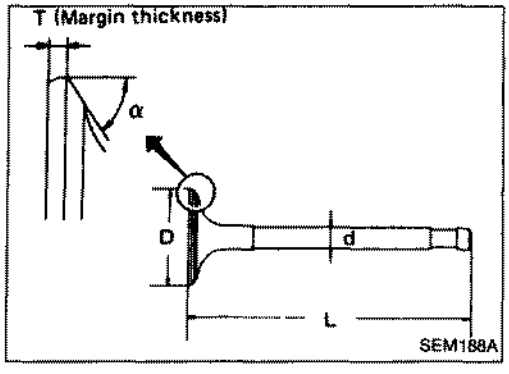


3. Heat cylinder head to 110 to 120°C (230 to 248°F).
4. Press fit valve seat until it seats on the bottom.



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

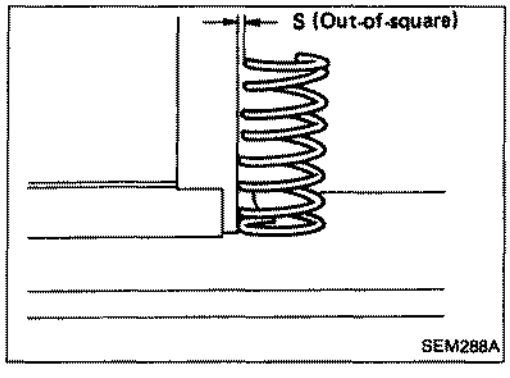
Seat face angle "α":
45°15' - 45°45' deg.
Contacting width "W":
Intake
1.34 - 1.63 mm (0.0528 - 0.0642 in)
Exhaust
1.70 - 2.12 mm (0.0669 - 0.0835 in)



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.



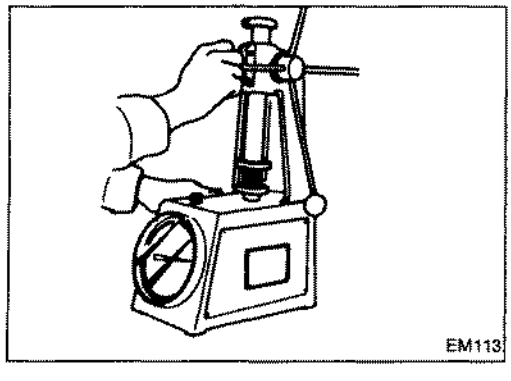
VALVE SPRING

Squareness

1. Measure "S" dimension.

Out-of-square:
Less than 1.80 mm (0.0709 in)

2. If it exceeds the limit, replace spring.



Pressure

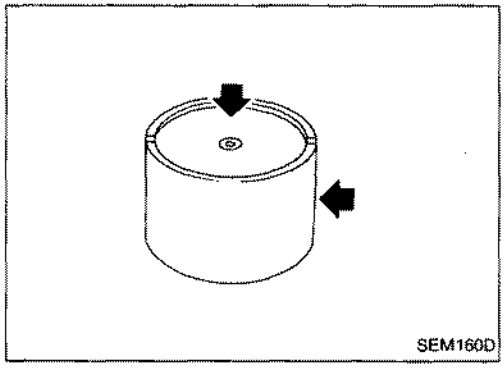
Check valve spring pressure.

Pressure: N (kg, lb) at height mm (in)
Standard
344.42 (35.12, 77.44) at 25.26 (0.9945)
Limit
More than 323.73 (33.01, 72.79) at 25.26 (0.9945)

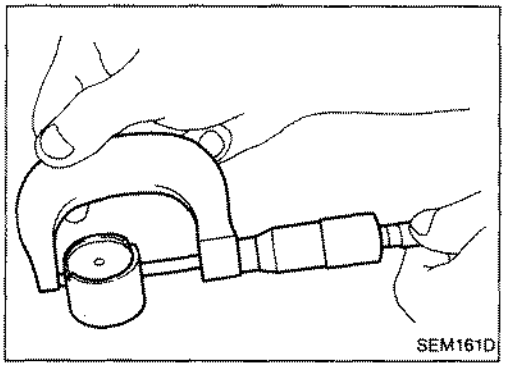
If it exceeds the limit, replace spring.

Inspection (Cont'd)

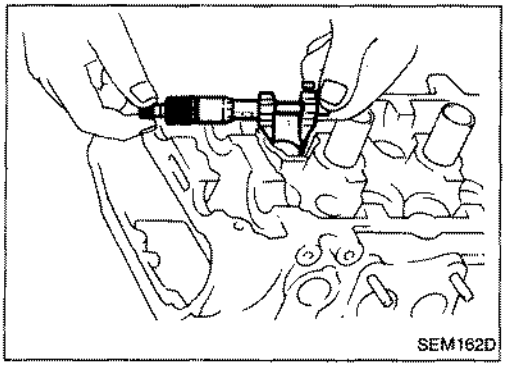
VALVE LIFTER


SEM160D

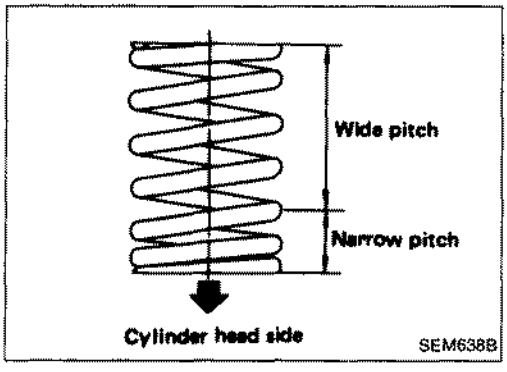
1. Check contact and sliding surfaces for wear or scratches.


SEM161D

2. Check diameter of valve lifter and valve lifter guide bore.
   Valve lifter diameter:
   29.960 - 29.975 mm (1.1795 - 1.1801 in)


SEM162D

Lifter guide bore diameter:
30.000 - 30.021 mm (1.1811 - 1.1819 in)



SEM638B

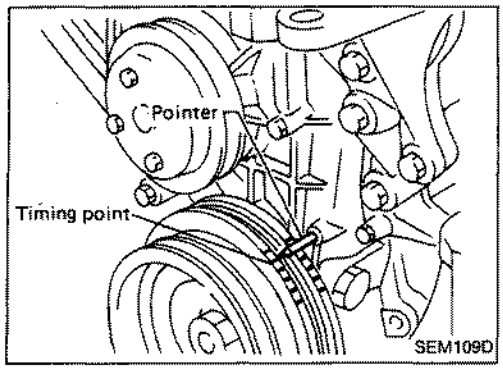
Assembly

1. Install valve component parts.

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

Installation

- This installation is the same procedure as those for timing chain. Refer to "Installation" in "TIMING CHAIN".

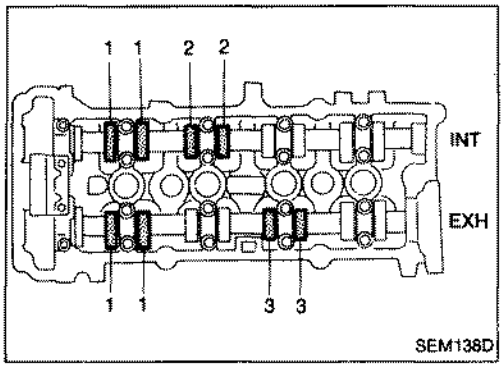


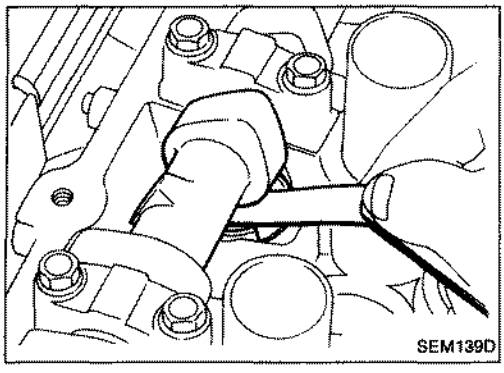
Checking

Check valve clearance while engine is warm and not running.

1. Remove rocker cover.
2. Remove all spark plugs.
3. Set No. 1 cylinder at T.D.C. on its compression stroke.
- Align pointer with T.D.C. mark on crankshaft pulley.
- Check that valve lifters on No. 1 cylinder are loose and valve lifters on No. 4 are tight.

  If not, turn crankshaft one revolution (360°) and align as above.
4. Check only those valves shown in the figure.





- Using a feeler gauge, measure clearance between valve lifter and camshaft.
- Record any valve clearance measurements which are out of specification. They will be used later to determine the required replacement adjusting shim.

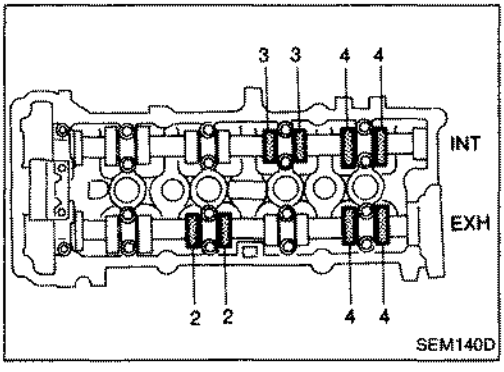
Valve clearance for checking (Hot):

Intake

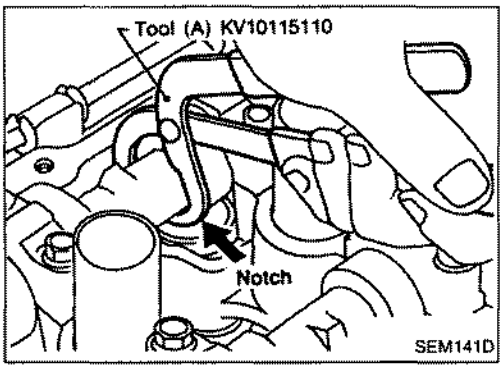
0.21 - 0.49 mm (0.008 - 0.019 in)

Exhaust

0.30 - 0.58 mm (0.012 - 0.023 in)



5. Turn crankshaft one revolution (360°) and align mark on crankshaft pulley with pointer.
6. Check those valves shown in the figure.
- Use the same procedure as mentioned in step 4.
7. If all valve clearances are within specification, install the following parts.
- Rocker cover
- All spark plugs



Adjusting

Adjust valve clearance while engine is cold.

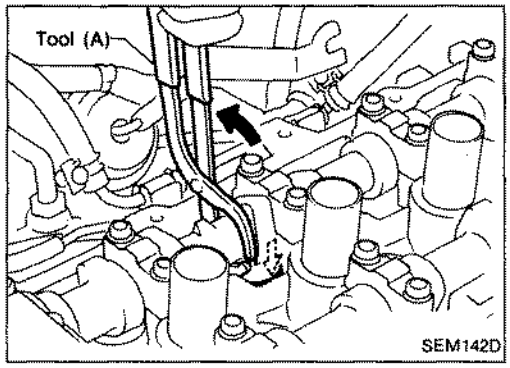
1. Turn crankshaft, to position cam lobe on camshaft of valve that must be adjusted upward.
2. Place Tool (A) around camshaft as shown in figure.

Before placing Tool (A), rotate notch toward center of cylinder head (See figure.), to simplify shim removal later.

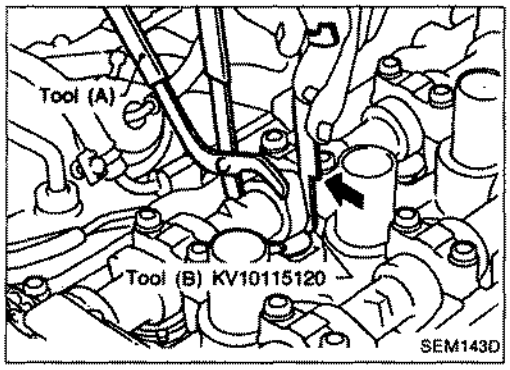
CAUTION:

Be careful not to damage cam surface with Tool (A).

Adjusting (Cont'd)



3. Rotate Tool (A) (See figure.) so that valve lifter is pushed down.

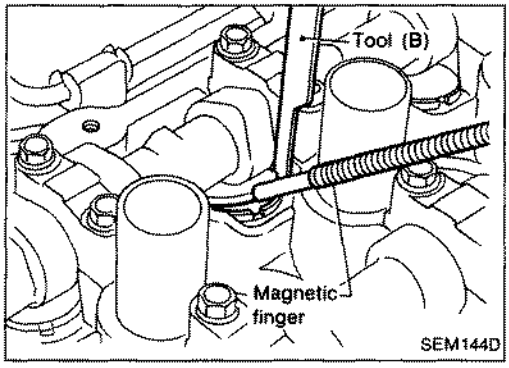


4. Place Tool (B) between camshaft and valve lifter to retain valve lifter.

CAUTION:

- **Tool (B) must be placed as close to camshaft bracket as possible.**
- **Be careful not to damage cam surface with Tool (B).**

5. Remove Tool (A).



6. Remove adjusting shim using a small screwdriver and a magnetic finger.
7. Determine replacement adjusting shim size following formula.

- Using a micrometer determine thickness of removed shim.
- Calculate thickness of new adjusting shim so valve clearance comes within specified values.

R = Thickness of removed shim
N = Thickness of new shim
M = Measured valve clearance

Intake:

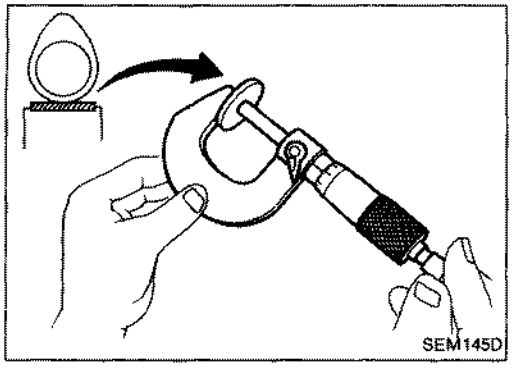
N = R + [M – 0.37 mm (0.0146 in)]

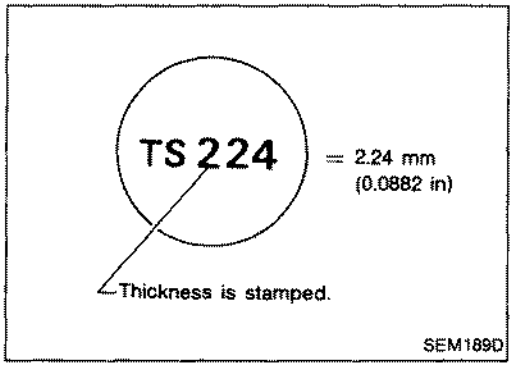
Exhaust:

N = R + [M – 0.40 mm (0.0157 in)]

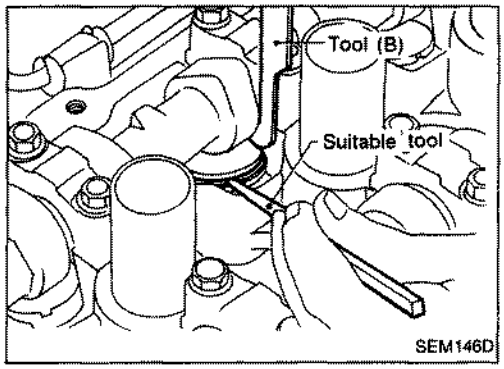
Shims are available in 50 sizes from 2.00 mm (0.0787 in) to 2.98 mm (0.1173 in), in steps of 0.02 mm (0.0008 in).

- Select new shim with thickness as close as possible to calculated value.

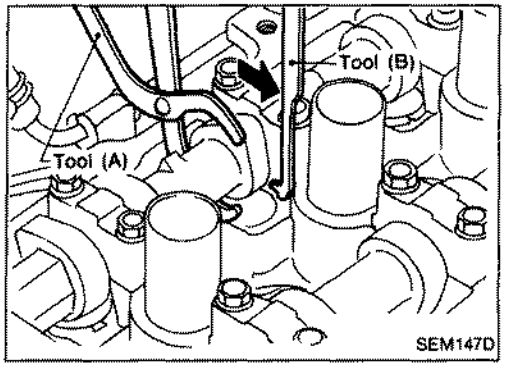




Adjusting (Cont'd)



8. Install new shim using a suitable tool.
- **Install with the surface on which the thickness is stamped facing down.**



9. Place Tool (A) as mentioned in steps 2 and 3.
10. Remove Tool (B).
11. Remove Tool (A).
12. Recheck valve clearance.

Valve clearance:

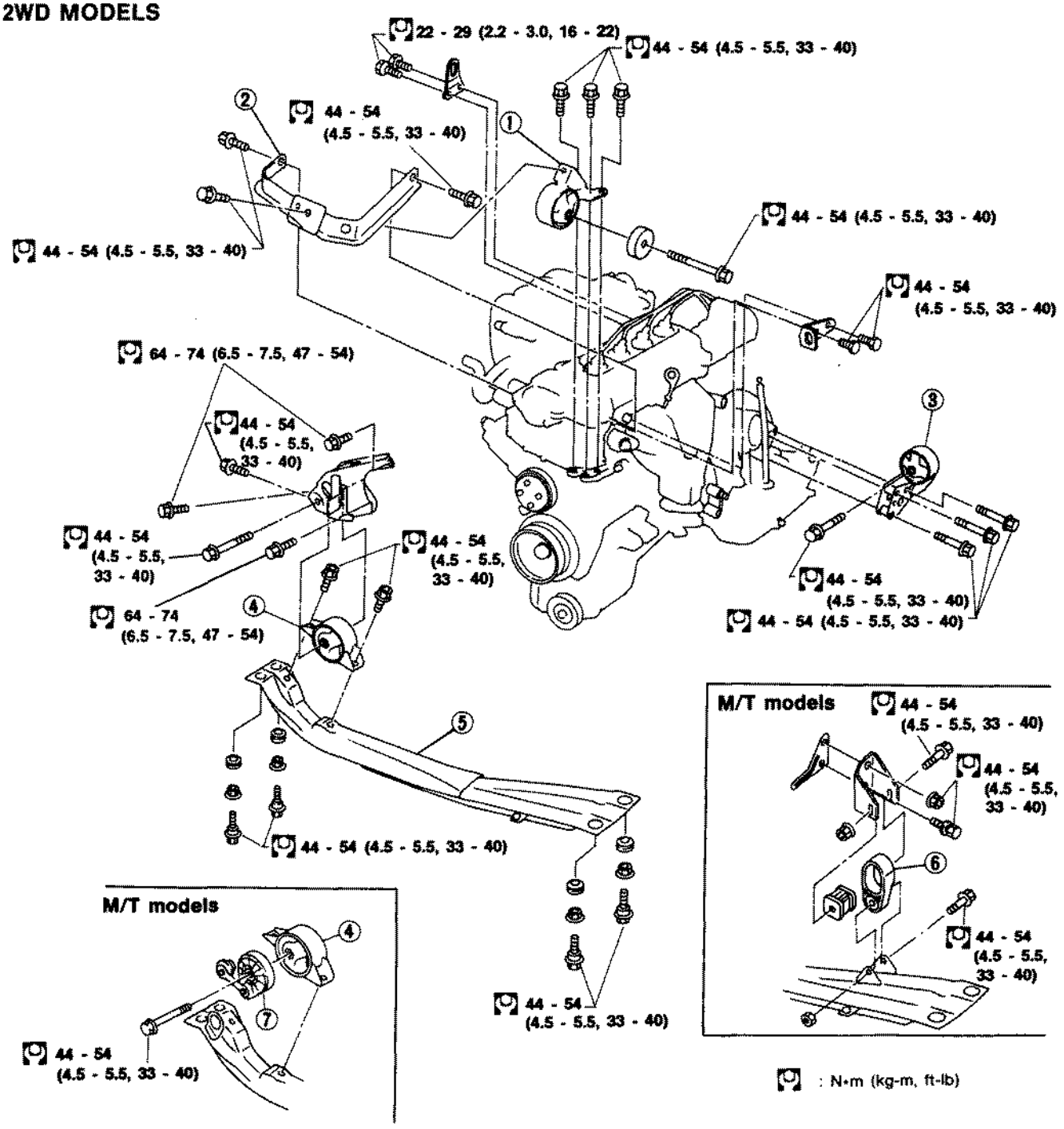
Unit: mm (in)

	For adjusting		For checking
	Hot	Cold*	Hot
Intake	0.32 - 0.40 (0.013 - 0.016)	0.25 - 0.33 (0.010 - 0.013)	0.21 - 0.49 (0.008 - 0.019)
Exhaust	0.37 - 0.45 (0.015 - 0.018)	0.32 - 0.40 (0.013 - 0.016)	0.30 - 0.58 (0.012 - 0.023)

*: At a temperature of approximately 20°C (68°F)

Whenever valve clearance are adjusted to cold specifications, check that the clearances satisfy hot specifications and adjust again if necessary.

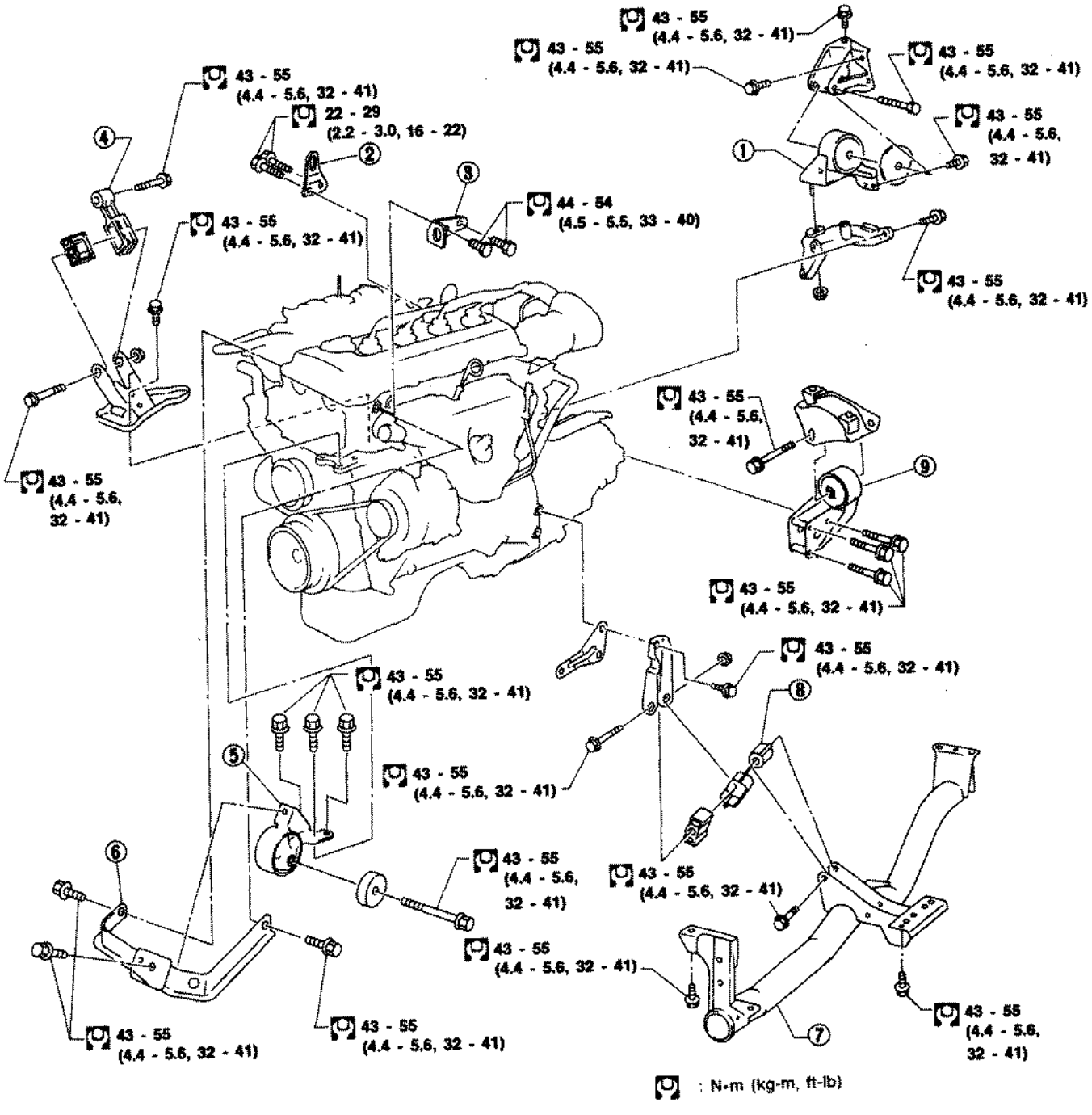
2WD MODELS



SEM422D

① Engine front mounting
② Engine front mounting bracket
③ Engine rear mounting bracket
④ Rear mounting
⑤ Center member
⑥ Buffer
⑦ Roll damper

4WD MODELS



① Rear mounting
② Rear engine slinger
③ Front engine slinger
④ Rear buffer
⑤ Front engine mounting
⑥ Front engine mounting bracket
⑦ Front member
⑧ Front buffer
⑨ Rear engine mounting

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. (GA16DE)
Refer to "Releasing Fuel Pressure" in section EF & EC.
f. Be sure to hoist engine and transaxle in a safe manner.
g. For engines not equipped with engine slingers, attach proper slingers and bolts described in PARTS CATALOG.

CAUTION:

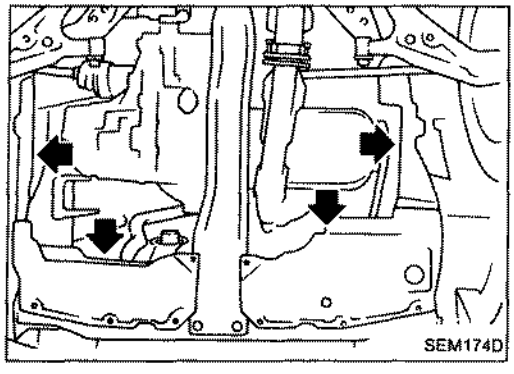
- **When lifting engine, be careful not to strike adjacent parts, especially accelerator wire casing, brake lines, and brake master cylinder.**
- **In hoisting the engine, always use engine slingers in a safe manner.**
- **In removing drive shaft, be careful not to damage grease seal of transaxle.**

Engine cannot be removed separately from transaxle. Remove engine with transaxle.

Removal

1. Drain water.
2. Remove hood.
3. Remove battery.
4. Remove reservoir tank and bracket.
5. Remove drive belts.
6. Remove alternator, compressor and power steering oil pump from engine.
7. Remove the following parts:

- Right and left front tires



- Under covers
- Splash covers
- Brake caliper assembly

: 72 - 97 N·m
(7.3 - 9.9 kg-m, 53 - 72 ft-lb)

Brake hose does not need to be disconnected from brake caliper assembly.
Never depress brake pedal.

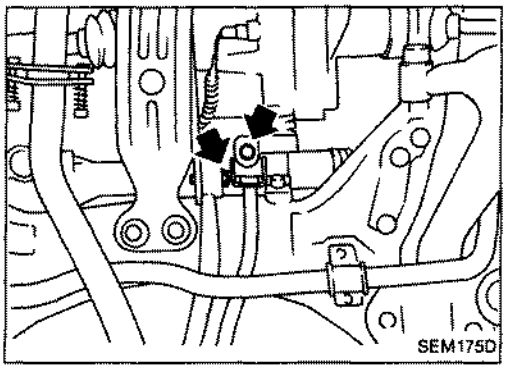
- Disconnect tie-rod ball joint (R.H. & L.H.).

: 29 - 39 N·m
(3.0 - 4.0 kg-m, 22 - 29 ft-lb)

Removal (Cont'd)

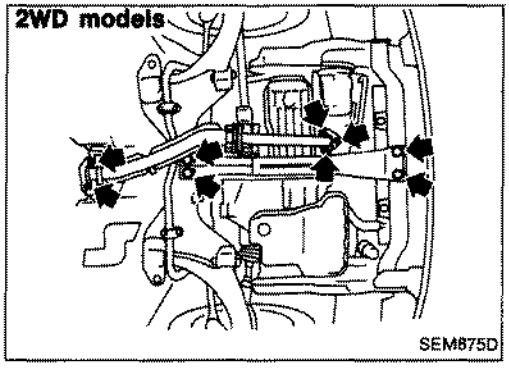
- R.H. & L.H. drive shaft

When removing drive shaft, be careful not to damage transaxle side grease seal.

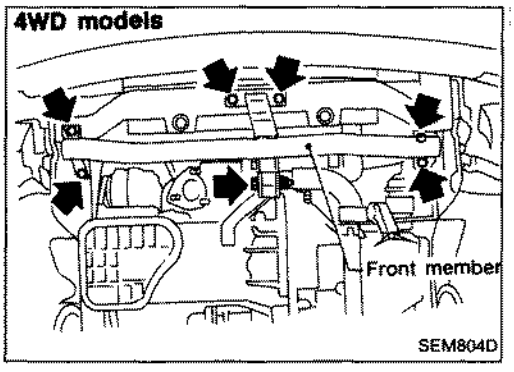


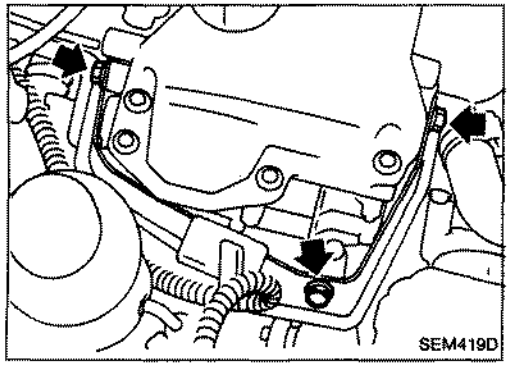
- Disconnect control rod and support rod from transaxle. (M/T models)

  Control rod:
  : 14 - 18 N·m (1.4 - 1.8 kg-m, 10 - 13 ft-lb)
  Support rod:
  : 36 - 49 N·m (3.7 - 5.0 kg-m, 27 - 36 ft-lb)
- Disconnect control cable from transaxle. (A/T models)



- Center member (2WD models)
- Front member (4WD models)
- Front exhaust tube
- Stabilizer
- Radiator fan
- Radiator
- Propeller shaft (4WD models)





- Front mounting bracket
- Power steering pump from engine

Power steering pump does not need to be disconnected from power steering tubes.

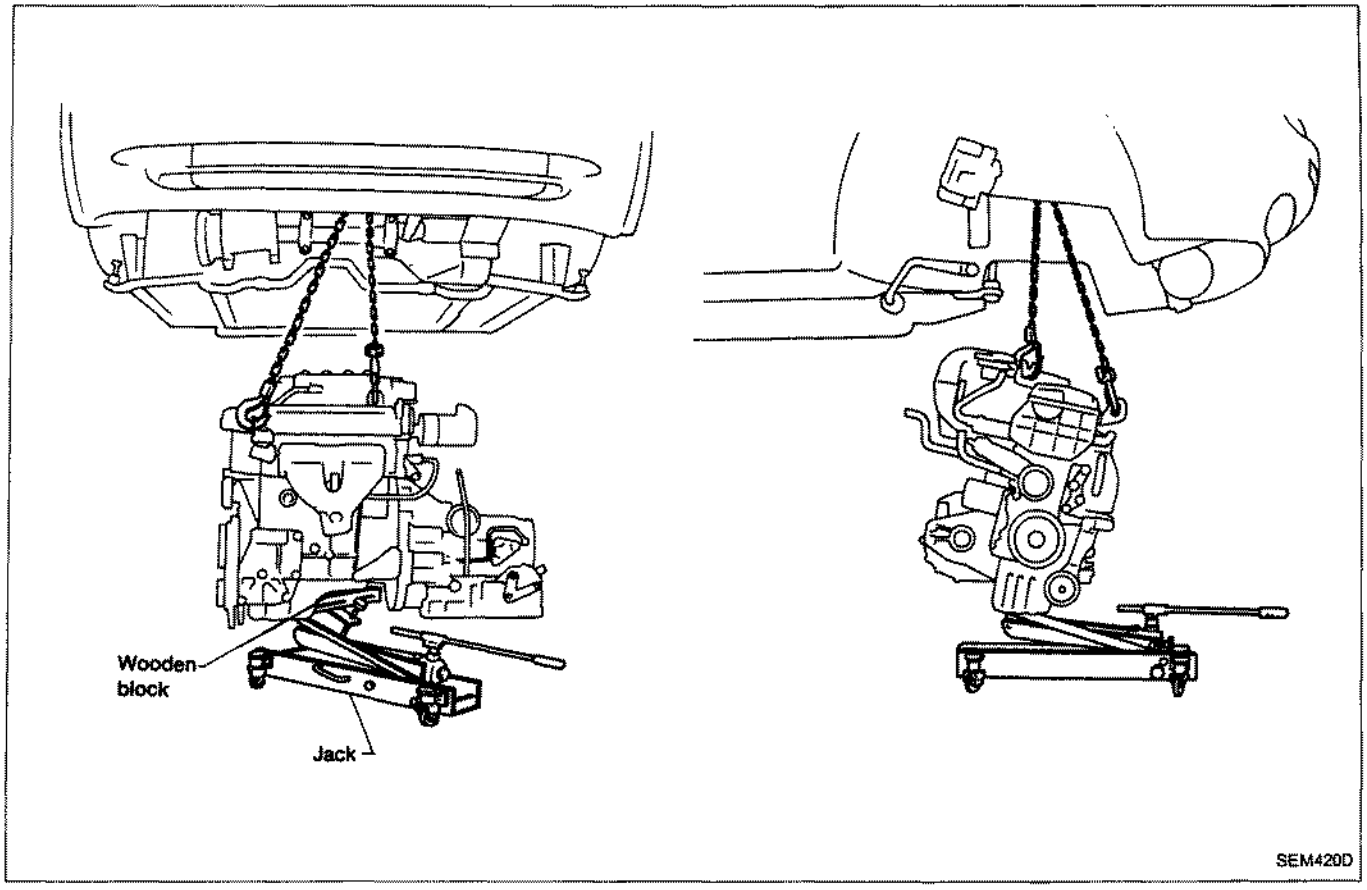
- Remove air duct and disconnect wires, harness, pipes, hoses and so on.

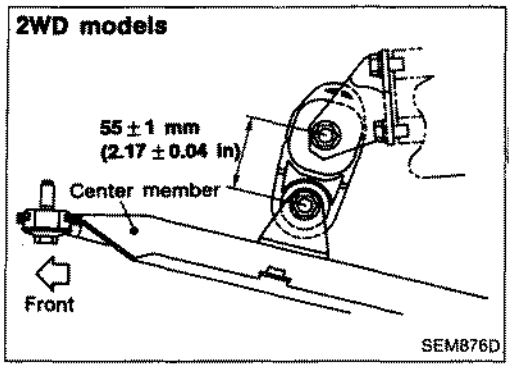
8. Lift up engine slightly and disconnect or remove all engine mountings.

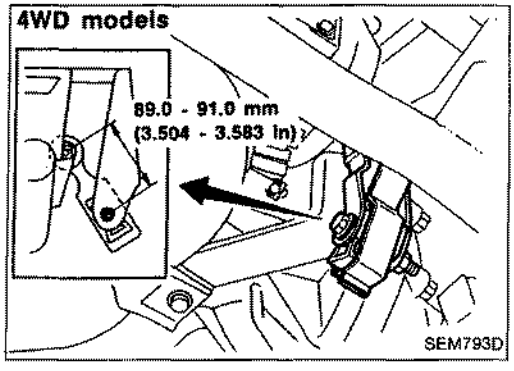
When lifting engine, be careful not to hit it against adjacent parts, especially against brake tubes and brake master cylinder.

Removal (Cont'd)

9. Remove engine with transaxle as shown. (2WD models)
   Remove engine with transaxle and transfer. (4WD models)



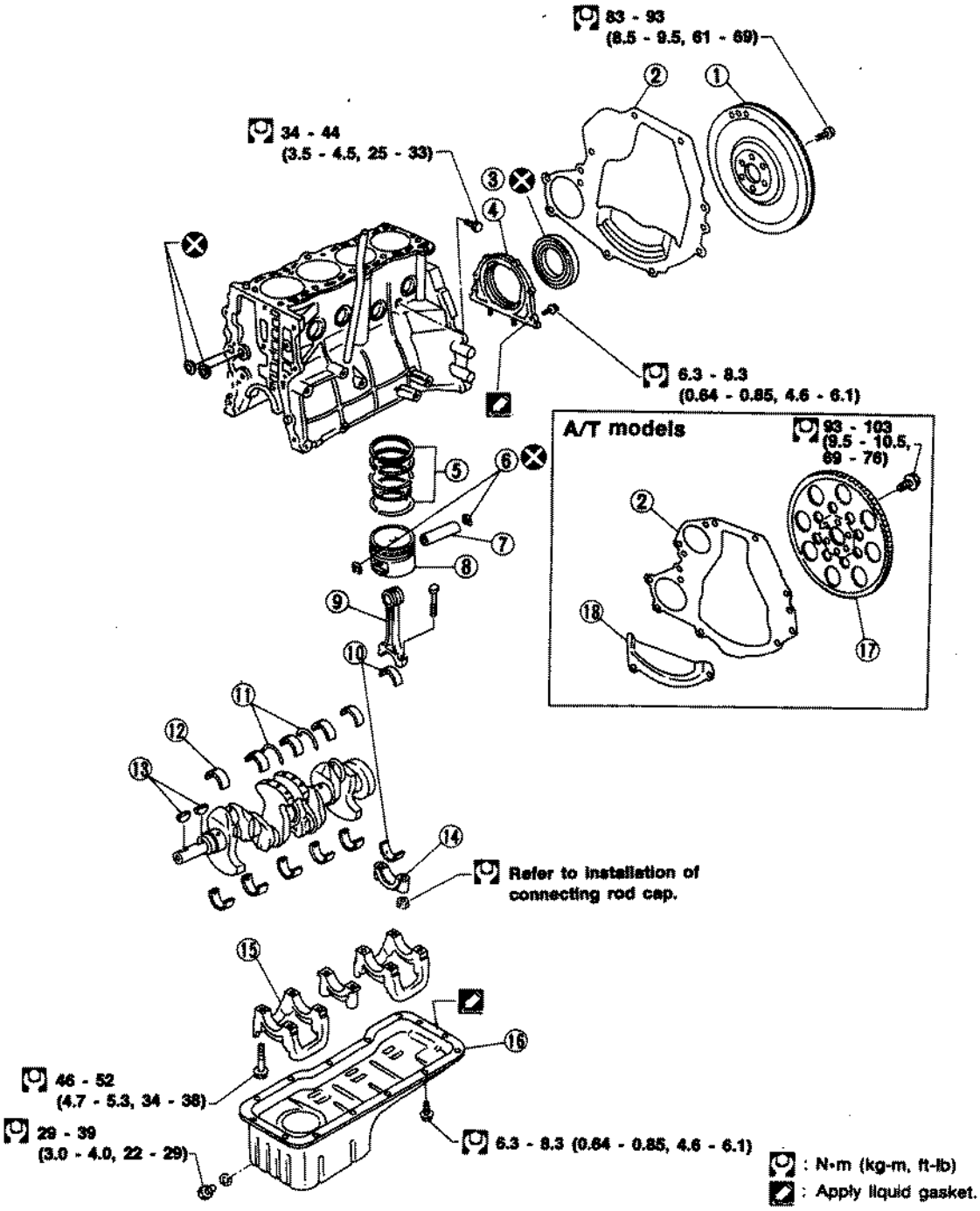




Installation

When installing the engine, adjust the height of buffer rod as shown. (For M/T)

- Installation is the reverse order of removal.

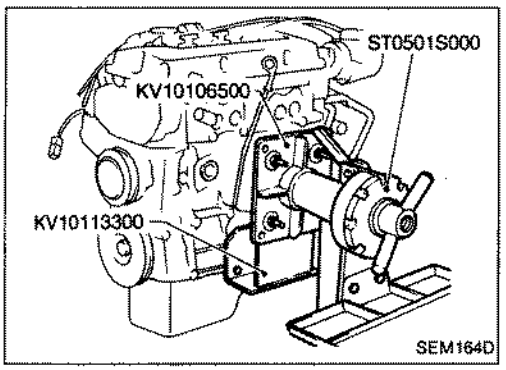


SEM415D

① Flywheel
② Rear plate
③ Rear oil seal
④ Rear oil seal retainer
⑤ Piston ring
⑥ Snap ring
⑦ Piston pin
⑧ Piston
⑨ Connecting rod
⑩ Connecting bearing
⑪ Thrust bearing
⑫ Main bearing
⑬ Key
⑭ Connecting rod cap
⑮ Bearing beam cap
⑯ Oil pan
⑰ Drive plate
⑱ Dust cover

CAUTION:

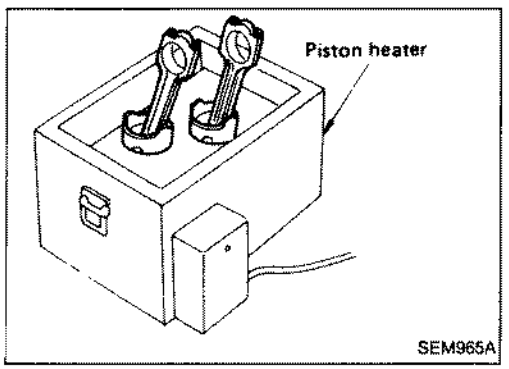
- **When installing sliding parts such as bearings and pistons, be sure to apply engine oil on the sliding surfaces.**
- **Place removed parts such as bearings and bearing caps in their proper order and direction.**
- **When tightening connecting rod bolts and main bearing cap bolts, apply engine oil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



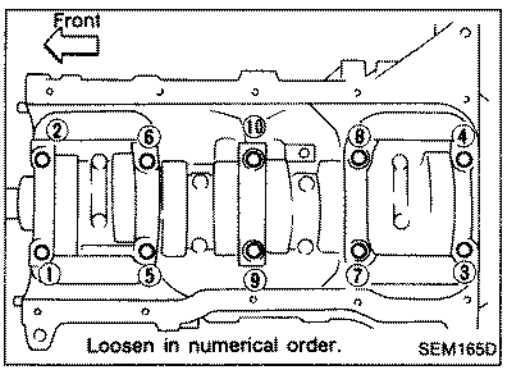
Disassembly

PISTON AND CRANKSHAFT

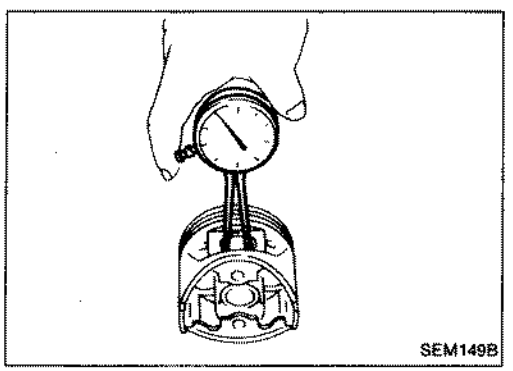
1. Place engine on a work stand.
2. Drain coolant and oil.
3. Remove timing chain.
   Refer to "Removal" in "TIMING CHAIN".



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



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

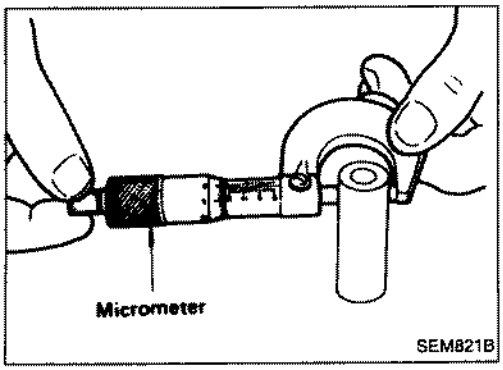


Inspection

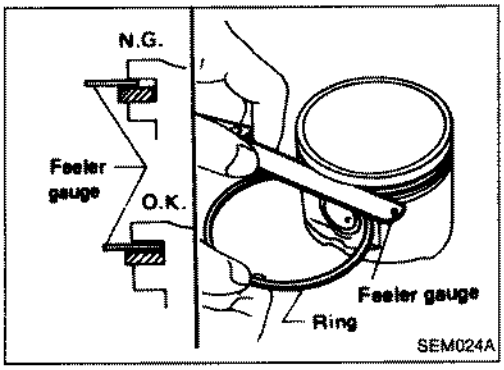
PISTON AND PISTON PIN CLEARANCE

1. Measure inner diameter of piston pin hole "dp".
   Standard diameter "dp":
   18.987 - 18.999 mm (0.7475 - 0.7480 in)

Inspection (Cont'd)



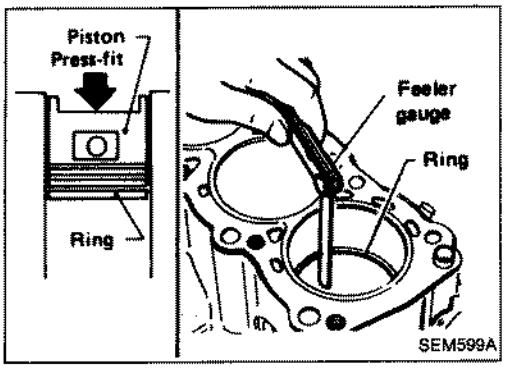
2. Measure outer diameter of piston pin "Dp".
   Standard diameter "Dp":
   18.989 - 19.001 mm (0.7476 - 0.7481 in)
3. Calculate piston pin clearance.
   dp – Dp = –0.004 to 0 mm (–0.0002 to 0 in)
   If it exceeds the above value, replace piston assembly with pin.



PISTON RING SIDE CLEARANCE

Side clearance:
Top ring
0.040 - 0.080 mm (0.0016 - 0.0031 in)
2nd ring
0.030 - 0.070 mm (0.0012 - 0.0028 in)
Max. limit of side clearance:
0.2 mm (0.008 in)

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

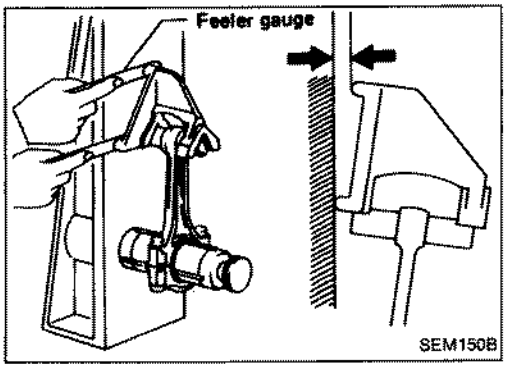


PISTON RING END GAP

End gap:
Top ring
0.20 - 0.35 mm (0.0079 - 0.0138 in)
2nd ring
0.37 - 0.52 mm (0.0146 - 0.0205 in)
Oil ring
0.20 - 0.60 mm (0.0079 - 0.0236 in)
Max. limit of ring gap:
1.0 mm (0.039 in)

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

Refer to S.D.S.

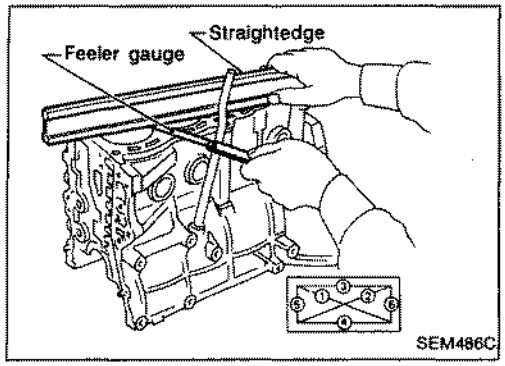


CONNECTING ROD BEND AND TORSION

Bend limit:
0.15 mm (0.0059 in)
per 100 mm (3.94 in) length
Torsion limit:
0.3 mm (0.012 in)
per 100 mm (3.94 in) length

If it exceeds the limit, replace connecting rod assembly.

Inspection (Cont'd)

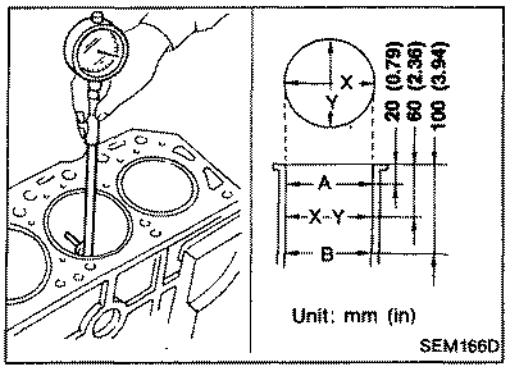


CYLINDER BLOCK DISTORTION AND WEAR

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

Amount of cylinder head resurfacing is "A".
Amount of cylinder block resurfacing is "B".
The maximum limit is as follows:
A + B = 0.2 mm (0.008 in)
Nominal cylinder block height from crankshaft center:
213.95 - 214.05 mm (8.4232 - 8.4271 in)

3. If necessary, replace cylinder block.



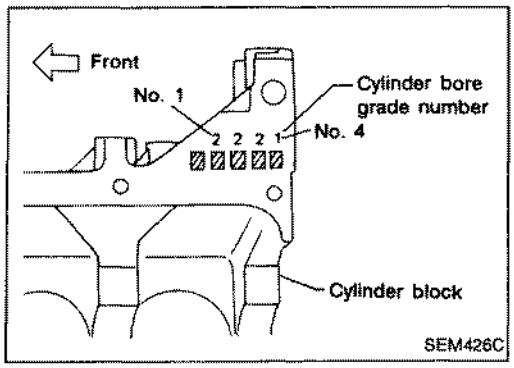
PISTON-TO-BORE CLEARANCE

1. Using a bore gauge, measure cylinder bore for wear, out-of-round and taper.
   Standard inner diameter:

Unit: mm (in)

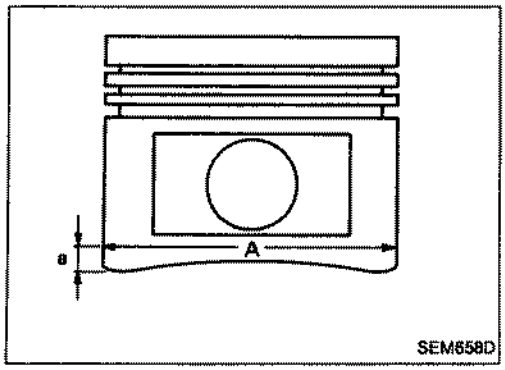
GA13DS	GA14DS	GA16DS & GA16DE
71.000 - 71.030 (2.7953 - 2.7965)	73.600 - 73.630 (2.8976 - 2.8988)	76.000 - 76.030 (2.9921 - 2.9933)

   Wear limit:
   0.2 mm (0.008 in)
   If it exceeds the limit, rebore all cylinders. Replace cylinder block if necessary.
   Out-of-round (X – Y) standard:
   0.015 mm (0.0006 in)
   Taper (A – B) standard:
   0.01 mm (0.0004 in)
2. Check for scratches and seizure. If seizure is found, hone it.



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

Inspection (Cont'd)



3. Measure piston skirt diameter.
   Piston diameter "A":
   Refer to S.D.S.
   Measuring point "a" (Distance from the bottom):
   9.5 mm (0.374 in)
4. Check that piston-to-bore clearance is within specification.
   Piston-to-bore clearance "B":
   0.015 - 0.035 mm (0.0006 - 0.0014 in)
5. Determine piston oversize according to amount of cylinder wear.

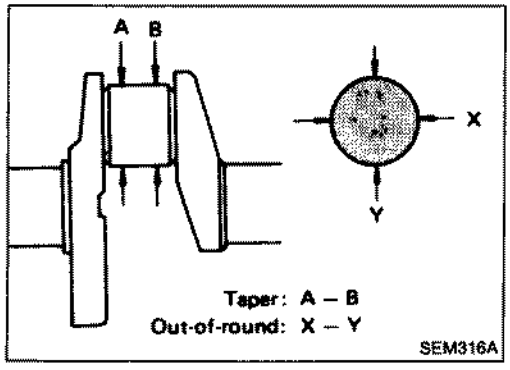
Oversize pistons are available for service. Refer to S.D.S.

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

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

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

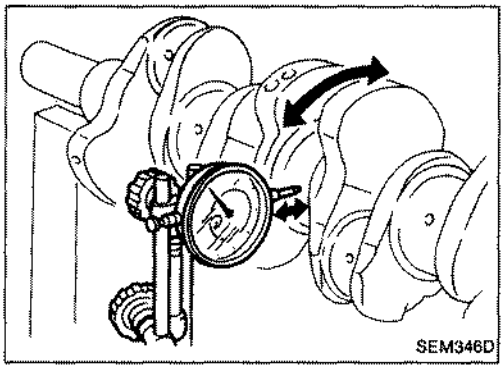
- **Measurement should be done after cylinder bore cools down.**



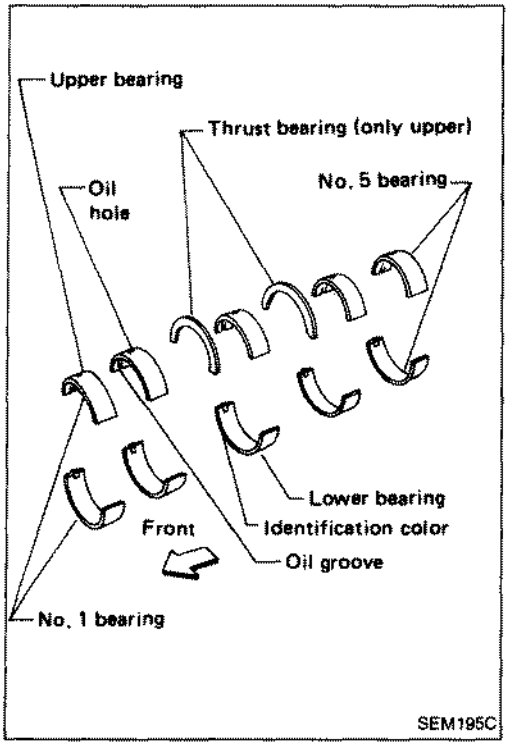
CRANKSHAFT

1. Check crankshaft main and pin journals for score, wear or cracks.
2. With a micrometer, measure journals for taper and out-of-round.
   Out-of-round (X – Y):
   Less than 0.005 mm (0.0002 in)
   Taper (A – B):
   Less than 0.002 mm (0.0001 in)

Inspection (Cont'd)



3. Measure crankshaft runout.
   Runout (Total indicator reading):
   Less than 0.05 mm (0.0020 in)



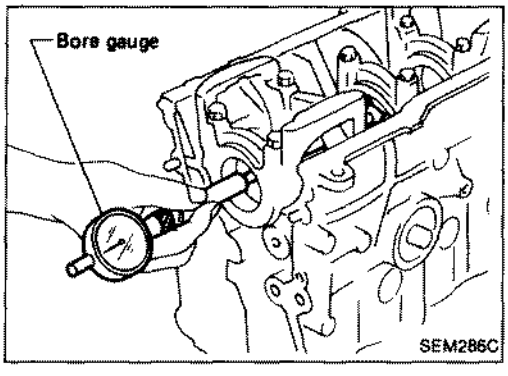
BEARING CLEARANCE

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

Method A (Using bore gauge & micrometer)

Main bearing

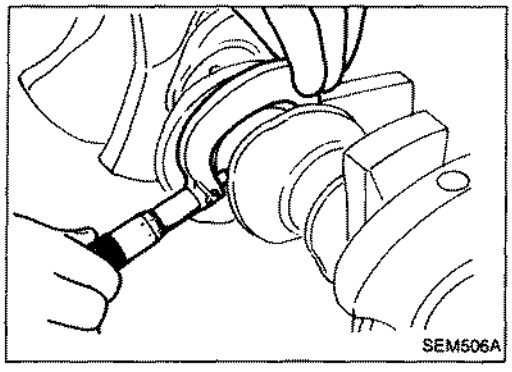
1. Set main bearings in their proper positions on cylinder block and main bearing cap.



2. Install main bearing cap to cylinder block.

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

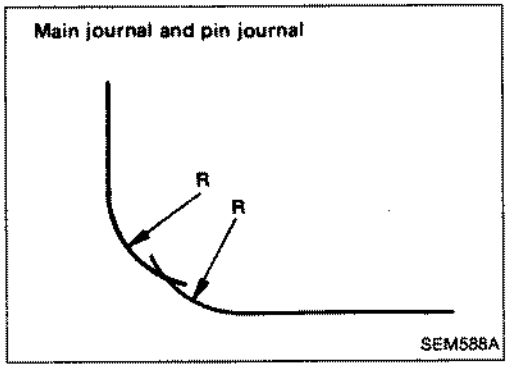
3. Measure inner diameter "A" of each main bearing.



4. Measure outer diameter "Dm" of each main journal in crankshaft.
5. Calculate main bearing clearance.
   Main bearing clearance = A – Dm
   Standard:
   0.018 - 0.042 mm (0.0007 - 0.0017 in)
   Limit: 0.1 mm (0.004 in)
6. If it exceeds the limit, replace bearing.

Inspection (Cont'd)

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



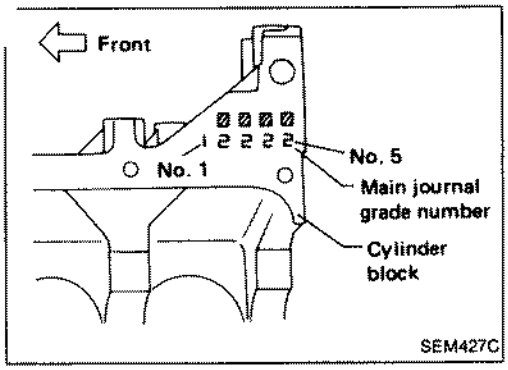
When grinding crank pin and crank journal:

a. Grind until clearance is within specified standard bearing clearance.

b. Fillets should be finished as shown in the figure.
R: 2.3 - 2.5 mm (0.091 - 0.098 in)

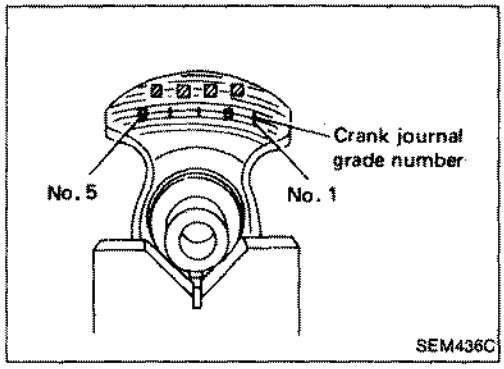
Refer to S.D.S. for standard bearing clearance and available spare parts.

8. If crankshaft, cylinder block or main bearing is reused again, measure main bearing clearance. If crankshaft, cylinder block and main bearings are replaced with new ones, 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. These numbers are punched in either Arabic or Roman numerals.

Inspection (Cont'd)

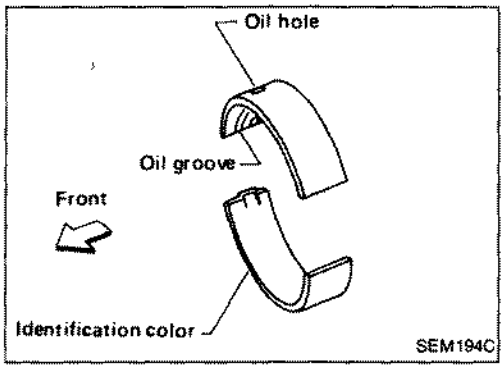


b. Grade number of each crankshaft main journal is punched on the respective crankshaft. These numbers are punched in either Arabic or Roman numerals.

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

Main bearing grade color:

Crankshaft journal grade number \ Main journal grade number	0	1	2
0	Black	Brown	Green
1	Brown	Green	Yellow
2	Green	Yellow	Blue



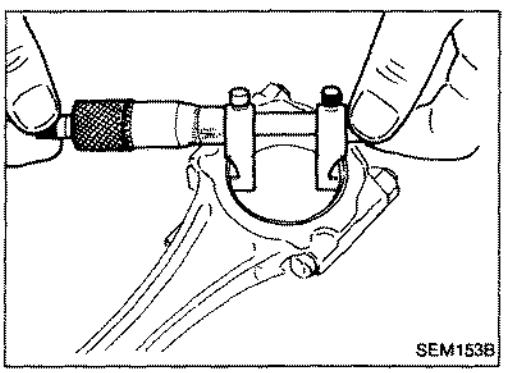
For example:
Main journal grade number: 1
Crankshaft journal grade number: 2
Main bearing grade number = 1 + 2 = Yellow

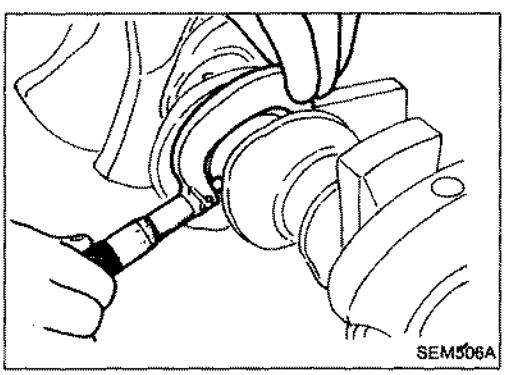
Connecting rod bearing (Big end)

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

Tighten bolts to the specified torque.

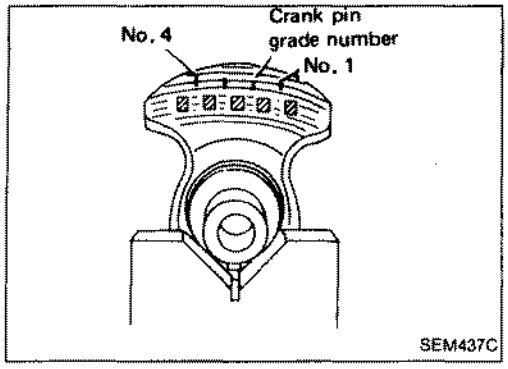
3. Measure inner diameter "C" of each bearing.





4. Measure outer diameter "Dp" of each crankshaft pin journal.
5. Calculate connecting rod bearing clearance.
   Connecting rod bearing clearance = C – Dp
   Standard:
   0.010 - 0.035 mm (0.0004 - 0.0014 in)
   Limit: 0.1 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. Refer to step 7 of "BEARING CLEARANCE — Main bearing".

Inspection (Cont'd)

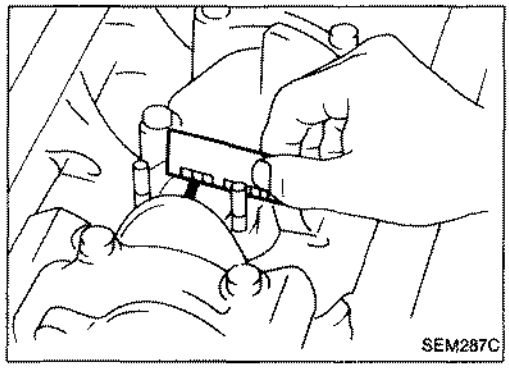


8. If bearing, crankshaft or connecting rod is replaced with a new one, select connecting rod bearing according to the following table.

Connecting rod bearing grade number:

Grade numbers are punched in either Arabic or Roman numerals.

Crank pin grade color	Connecting rod bearing grade color
0	—
1	Brown
2	Green



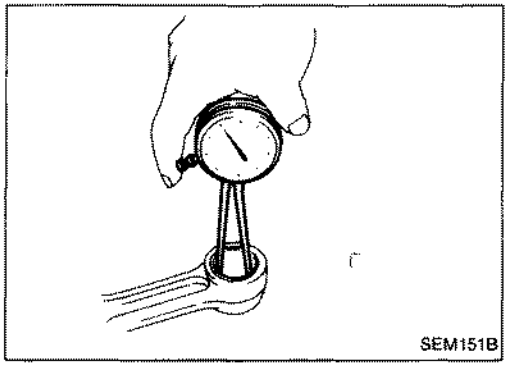
Method B (Using plastigage)

CAUTION:

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

CONNECTING ROD BUSHING CLEARANCE (Small end)

1. Measure inner diameter "C" of bushing.



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

Connecting rod bushing clearance = C – Dp

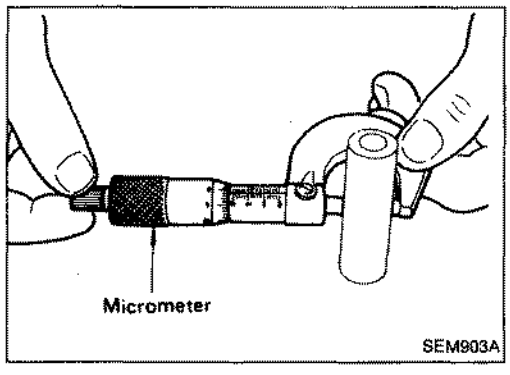
Standard:

0.005 - 0.017 mm (0.0002 - 0.0007 in)

Limit:

0.023 mm (0.0009 in)

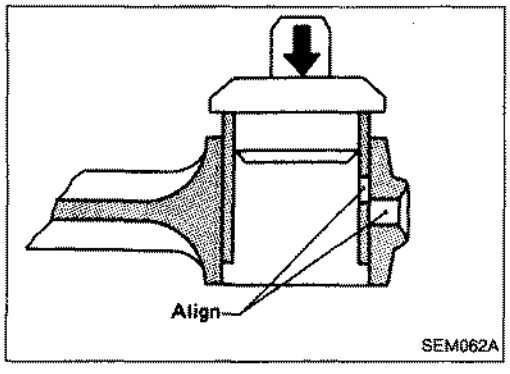
If it exceeds the limit, replace connecting rod assembly or connecting rod bushing and/or piston pin.



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.

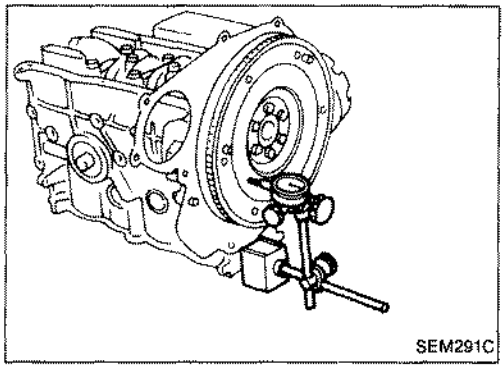


2. After driving in small end bushing, ream the bushing so that clearance between connecting rod busing and piston pin achieves specified value.

Clearance between connecting rod bushing and piston pin:

0.005 - 0.017 mm (0.0002 - 0.0007 in)

Inspection (Cont'd)


SEM291C

FLYWHEEL RUNOUT

Runout (Total indicator reading):

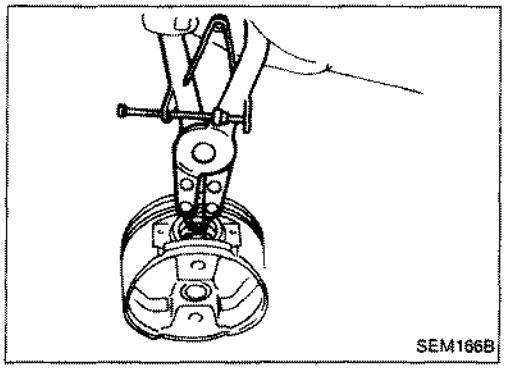
Flywheel

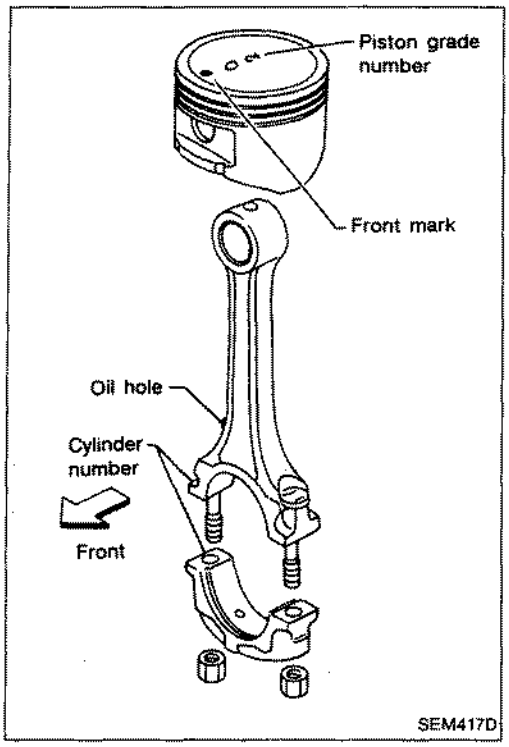
Less than 0.15 mm (0.0059 in)

Assembly

PISTON

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

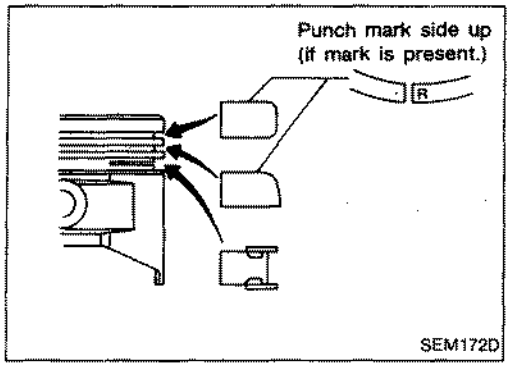

SEM166B



SEM417D

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.**



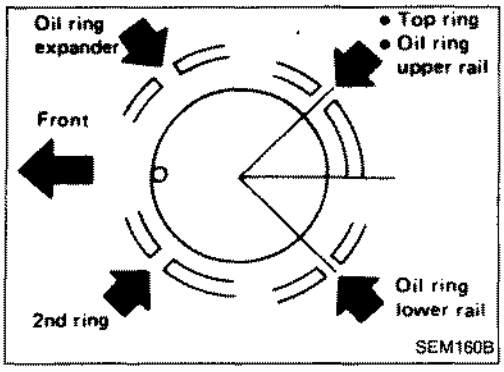
SEM172D

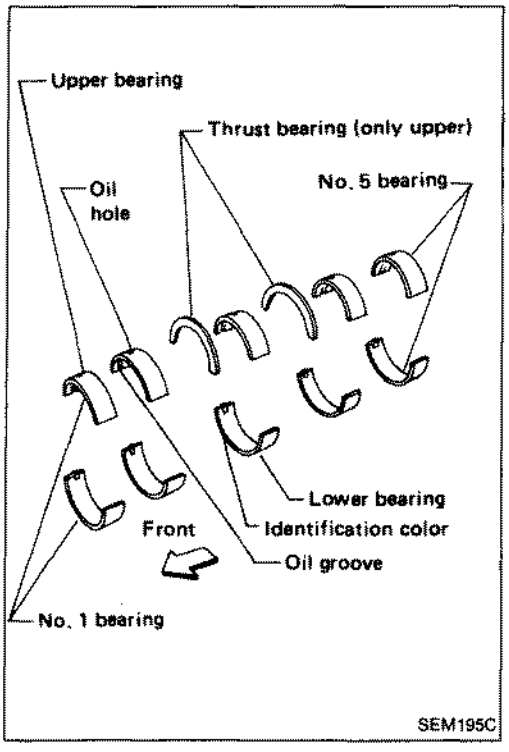
3. Set piston rings as shown.

CAUTION:

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

Assembly (Cont'd)

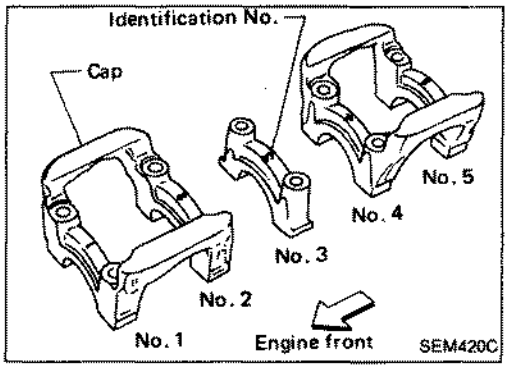


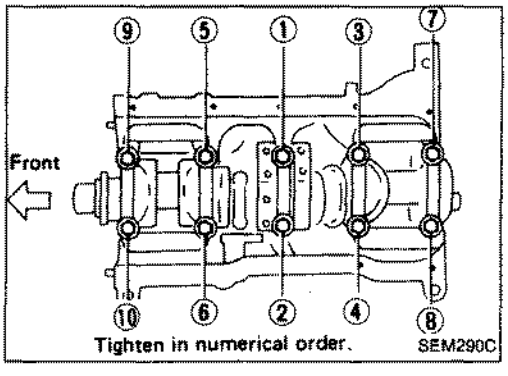


CRANKSHAFT

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

- **Confirm that correct main bearings are used. Refer to "Inspection".**

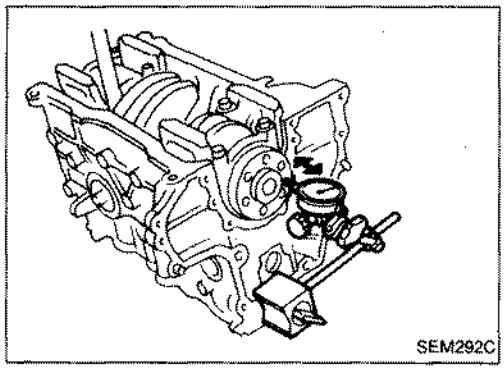




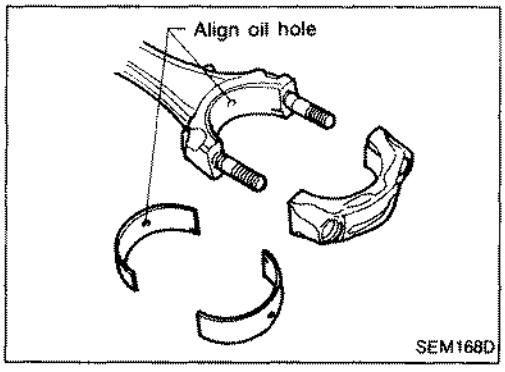
2. Install crankshaft and main bearing caps and tighten bolts to the specified torque.

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

Assembly (Cont'd)

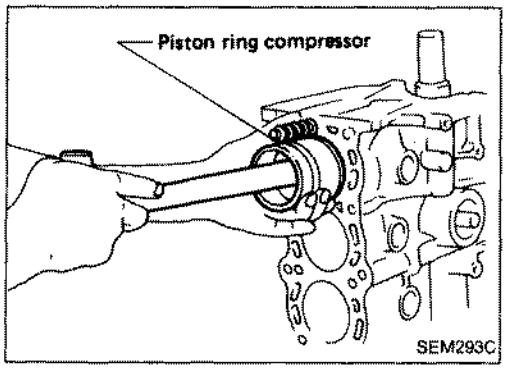

SEM292C

3. Measure crankshaft end play.
   Crankshaft end play:
   Standard
   0.060 - 0.180 mm (0.0024 - 0.0071 in)
   Limit
   0.3 mm (0.012 in)
   If beyond the limit, replace thrust bearing with a new one.



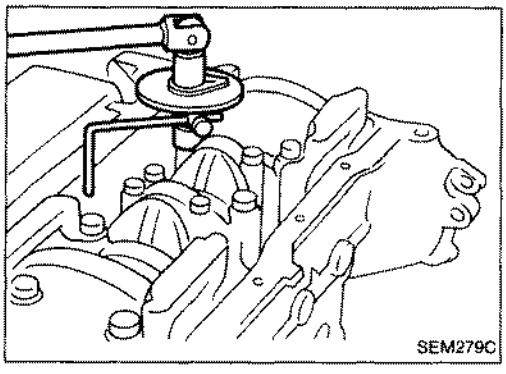
SEM168D

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.

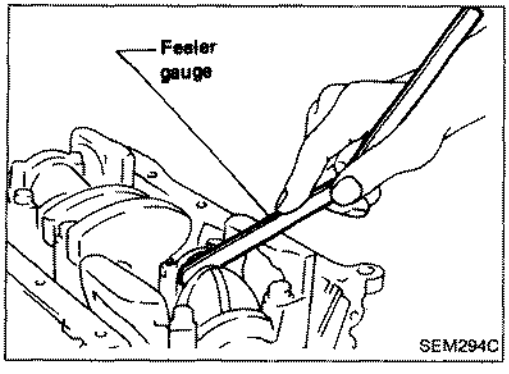


SEM293C

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.**


SEM279C

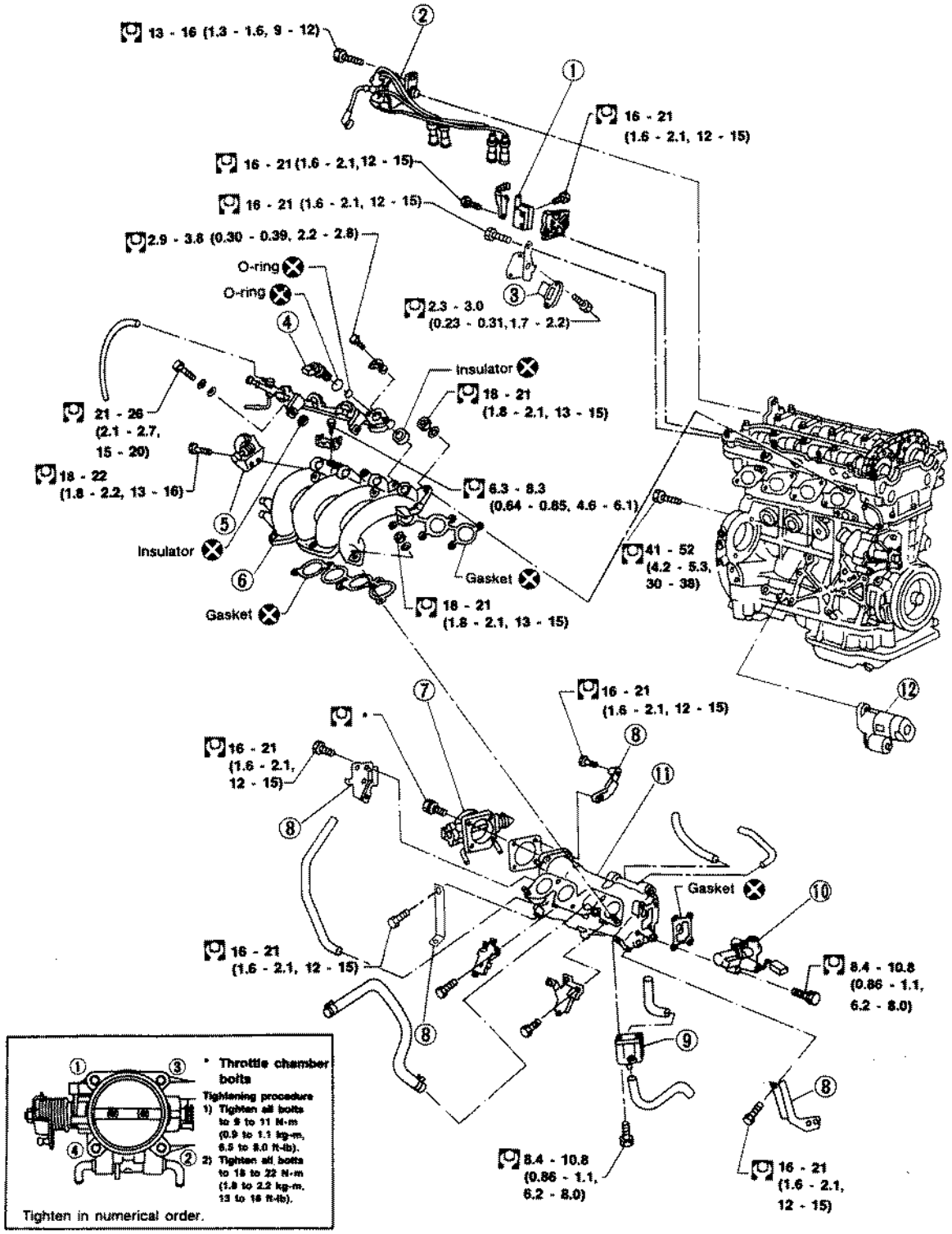
b. Install connecting rod caps.
Tighten connecting rod cap nuts to the specified torque.
: Connecting rod cap nuts
(1) Tighten to 14 to 16 N·m (1.4 to 1.6 kg-m, 10 to 12 ft-lb).
(2) Turn nuts to 35° to 40° degrees clockwise with an angle wrench. If an angle wrench is not available tighten nuts to 23 to 28 N·m (2.3 to 2.9 kg-m, 17 to 21 ft-lb).



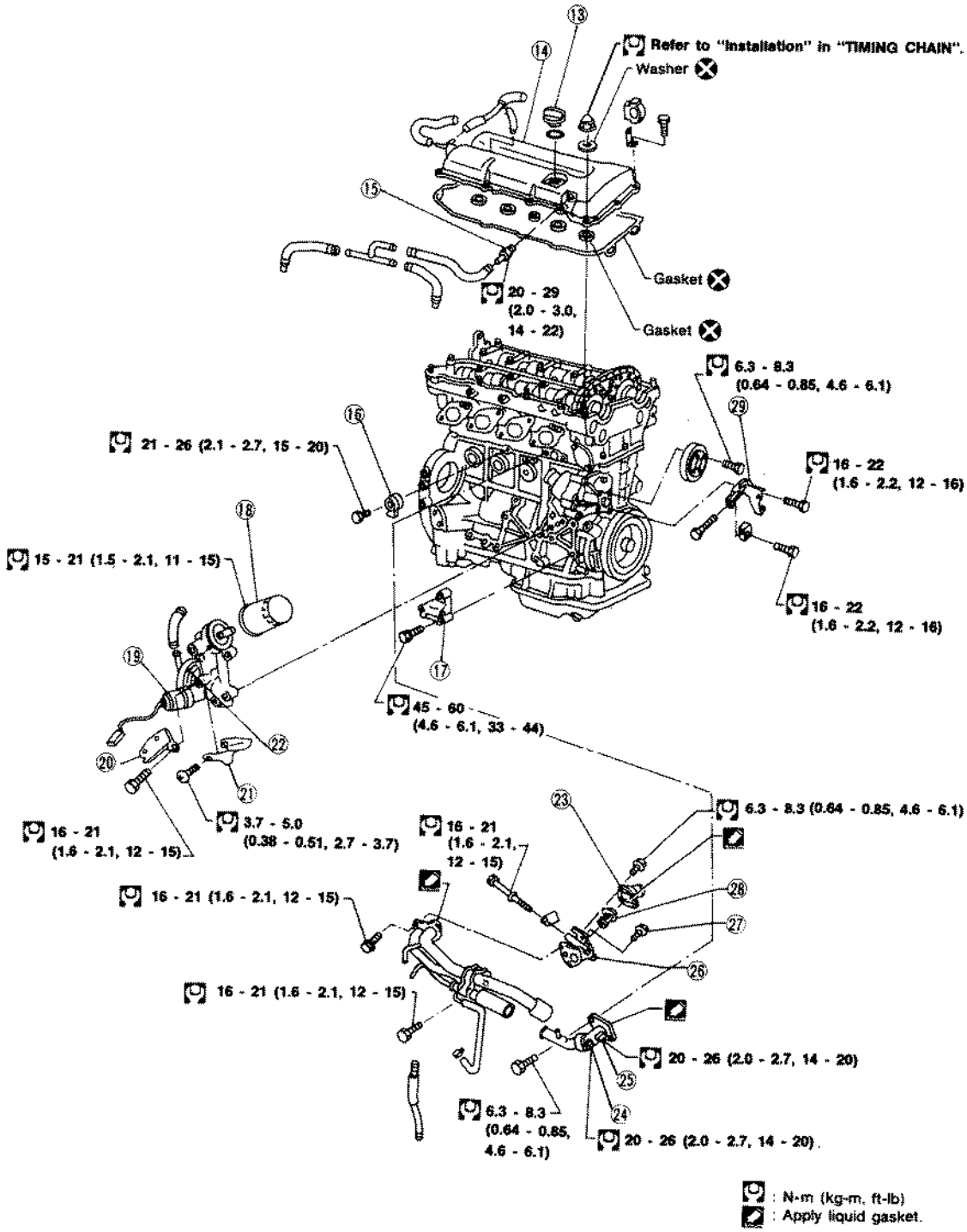
SEM294C

6. Measure connecting rod side clearance.
   Connecting rod side clearance:
   Standard
   0.200 - 0.470 mm (0.0079 - 0.0185 in)
   Limit
   0.52 mm (0.0205 in)
   If beyond the limit, replace connecting rod and/or crankshaft.

SR20DE



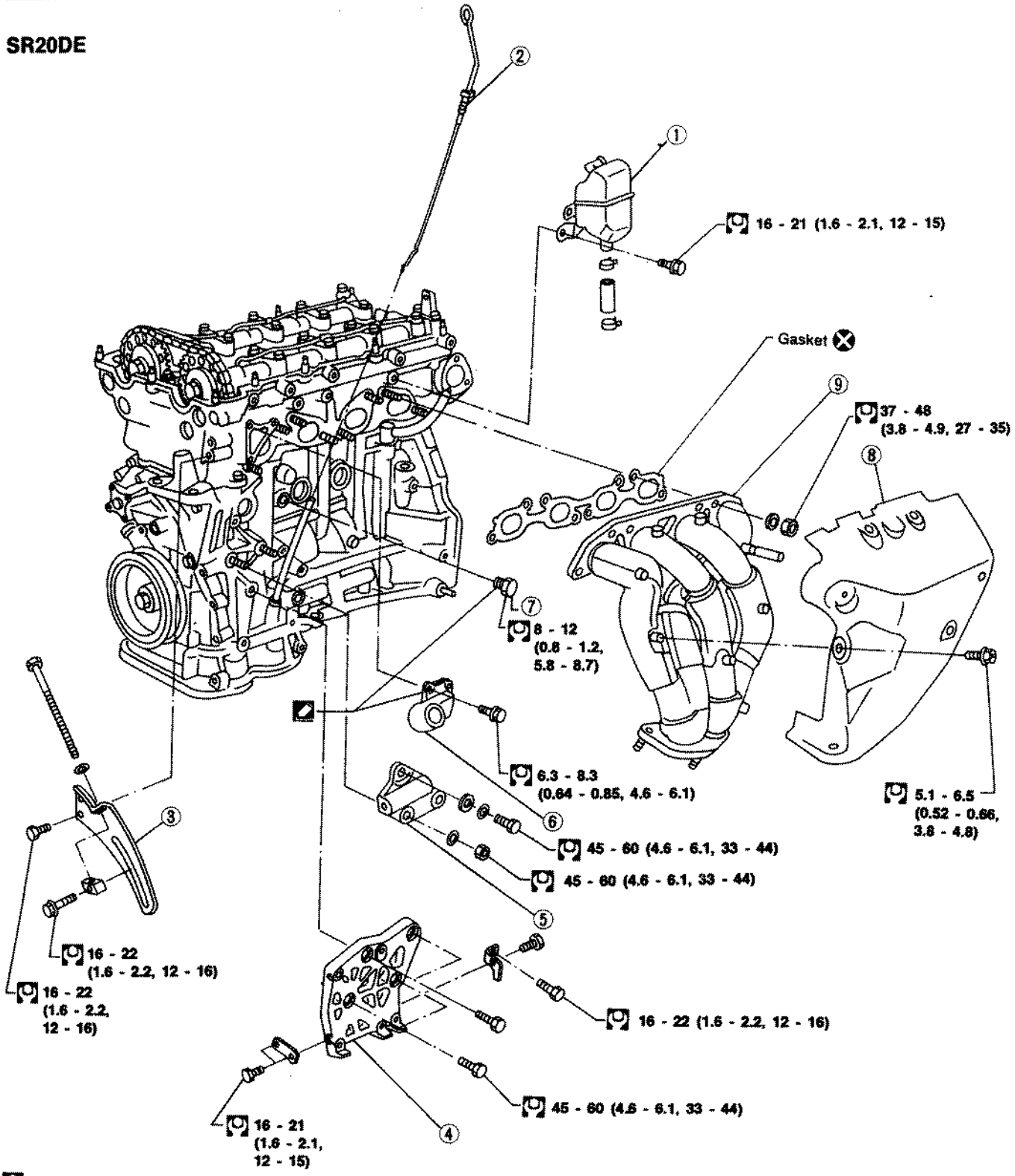
① Ignition coil
② Distributor
③ Power transistor
④ Injector
⑤ Accel-drum unit
⑥ Intake manifold
⑦ Throttle chamber
⑧ Intake manifold supports
⑨ Air regulator
⑩ A.A.C. valve
⑪ Intake manifold collector
⑫ Starter motor



SEM650D

⑬ Oil filter cap
⑭ Rocker cover
⑮ P.C.V. valve
⑯ Detonation sensor
⑰ Power steering oil pump bracket
⑱ Oil filter
⑲ Oil pressure switch
⑳ Intake manifold support
㉑ Oil catcher
㉒ Oil cooler
㉓ Water inlet
㉔ Thermal transmitter
㉕ Engine temperature sensor
㉖ Thermostat housing
㉗ Air relief plug
㉘ Thermostat
㉙ Power steering oil pump adjusting bar

SR20DE

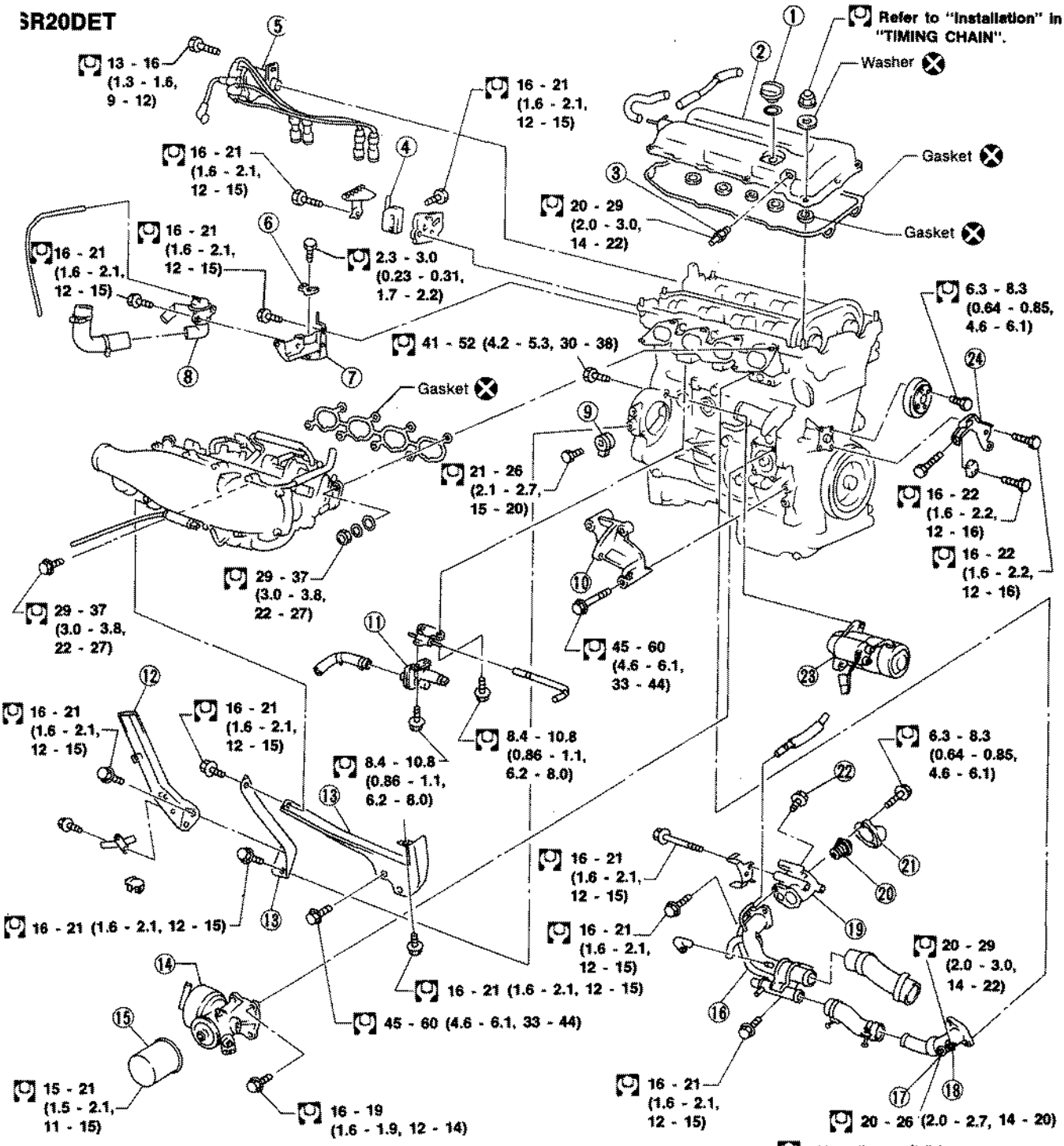


: N•m (kg-m, ft-lb)

: Apply liquid gasket.

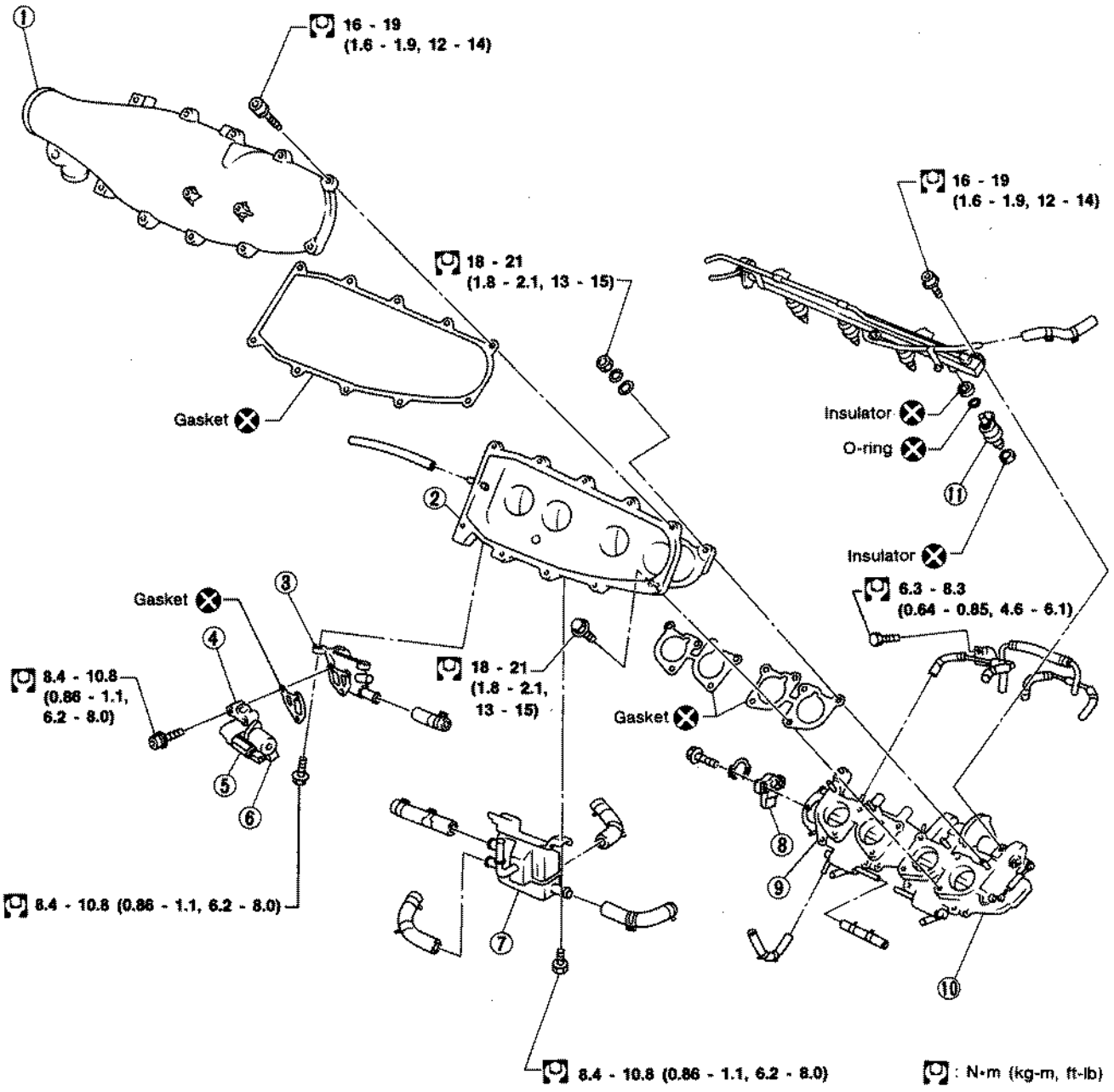
SEM851D

① Oil separator
② Oil level gauge
③ Alternator adjusting bar
④ Compressor bracket
⑤ Alternator bracket
⑥ Water outlet
⑦ Drain plug
⑧ Exhaust manifold cover
⑨ Exhaust manifold



① Oil filler cap
② Rocker cover
③ P.C.V. valve
④ Ignition coil
⑤ Distributor
⑥ Power transistor
⑦ Recirculation valve bracket
⑧ Recirculation valve
⑨ Detonation sensor
⑩ Power steering oil pump bracket
⑪ Air regulator
⑫ Intercooler support bracket
⑬ Intake manifold supports
⑭ Oil cooler
⑮ Oil filter
⑯ Water pipe
⑰ Thermal transmitter
⑱ Engine temperature sensor
⑲ Thermostat housing
⑳ Thermostat
㉑ Water inlet
㉒ Air relief plug
㉓ Starter motor
㉔ Power steering oil pump adjusting bar

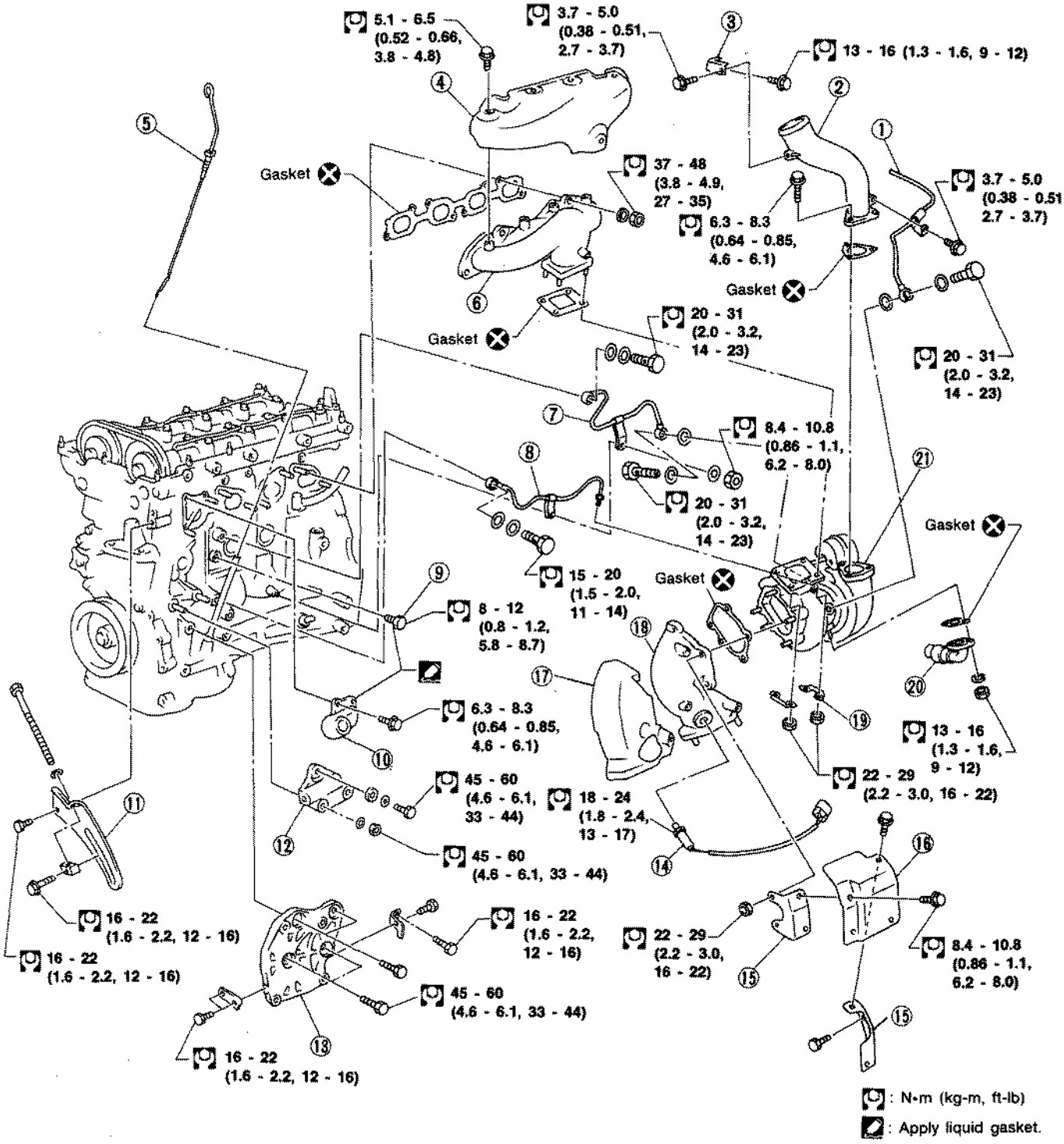
SR20DET



SEM760D

① Intake manifold collector
② Intake manifold
③ I.A.A. unit bracket
④ I.A.A. unit
⑤ F.I.C.D. solenoid valve
⑥ A.A.C. valve
⑦ Air chamber
⑧ Throttle sensor
⑨ Rear throttle chamber
⑩ Front throttle chamber
⑪ Injector

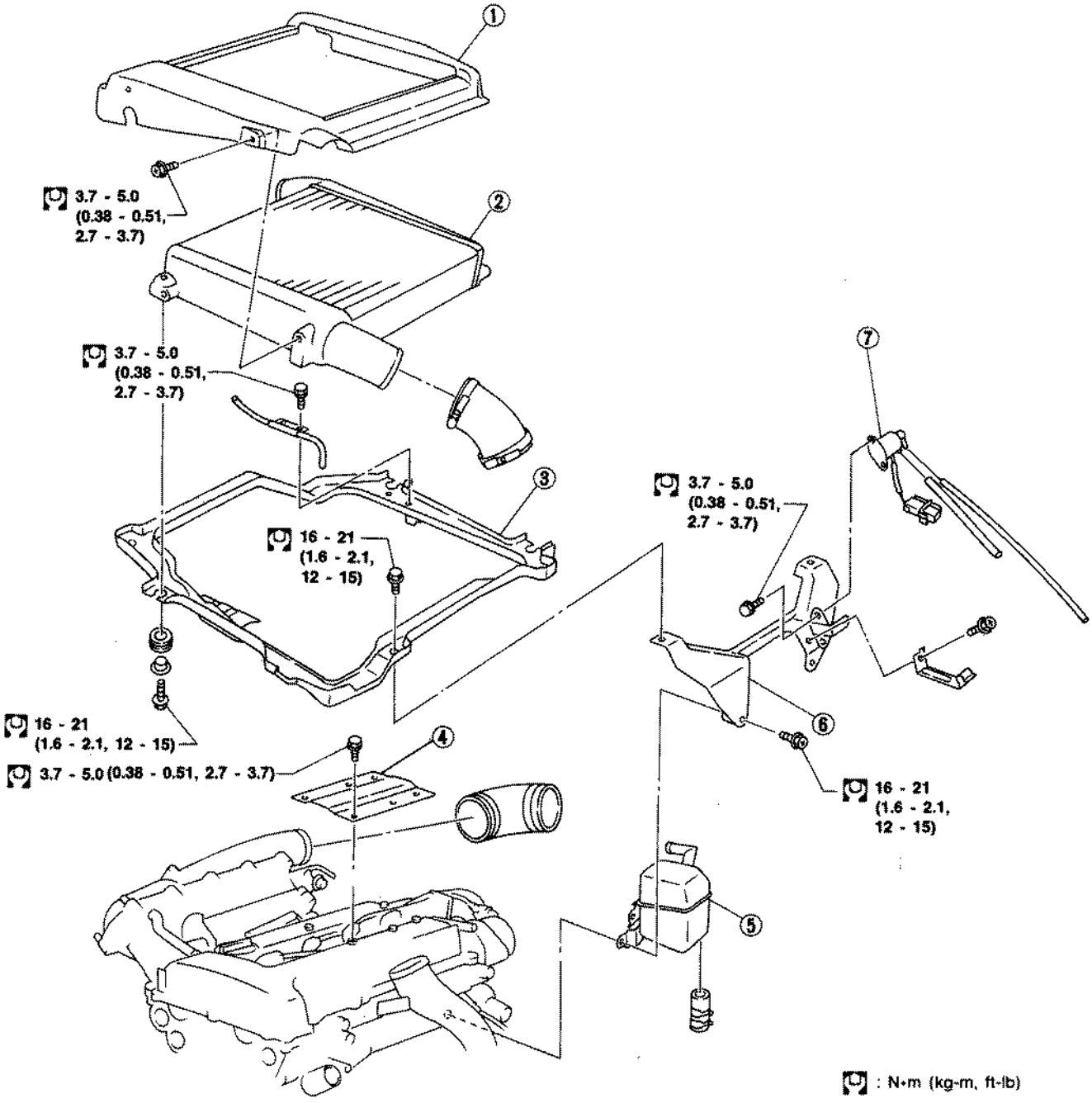
SR20DET



SEM761D

① Water return tube
② Air inlet tube
③ Air inlet tube bracket
④ Exhaust manifold cover
⑤ Oil level gauge
⑥ Exhaust manifold
⑦ Water inlet tube
⑧ Oil inlet tube
⑨ Drain plug
⑩ Water outlet
⑪ Alternator adjusting bar
⑫ Alternator bracket
⑬ Compressor bracket
⑭ Exhaust gas sensor
⑮ Heat insulator brackets
⑯ Heat insulator
⑰ Exhaust outlet cover
⑱ Exhaust outlet
⑲ Lock plate
⑳ Oil return tube
㉑ Turbocharger

SR20DET

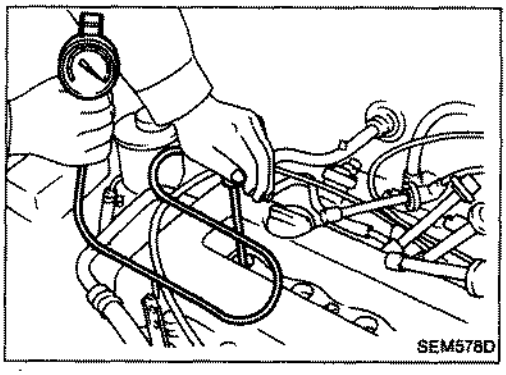


SEM762D

① Intercooler cover
② Intercooler
③ Intercooler support
④ Rocker cover ornament
⑤ Oil separator
⑥ Intercooler support bracket
⑦ Recirculation valve control solenoid valve

Measurement of Compression Pressure

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


SEM578D

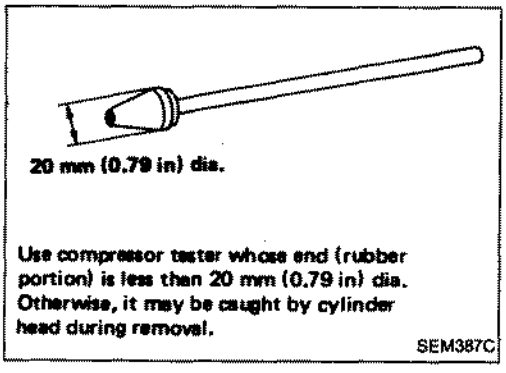
6. Attach a compression tester to No. 1 cylinder.
7. Depress accelerator pedal fully to keep throttle valve wide open.
8. Crank engine and record highest gauge indication.
9. Repeat the measurement on each cylinder as shown above.

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

Compression pressure:

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

	SR20DE	SR20DET
Standard	1,275 (12.75, 13.0, 185)	1,128 (11.28, 11.5, 164)
Minimum	1,079 (10.79, 11.0, 156)	932 (9.32, 9.5, 135)
Difference limit between cylinders	98 (0.98, 1.0, 14)	



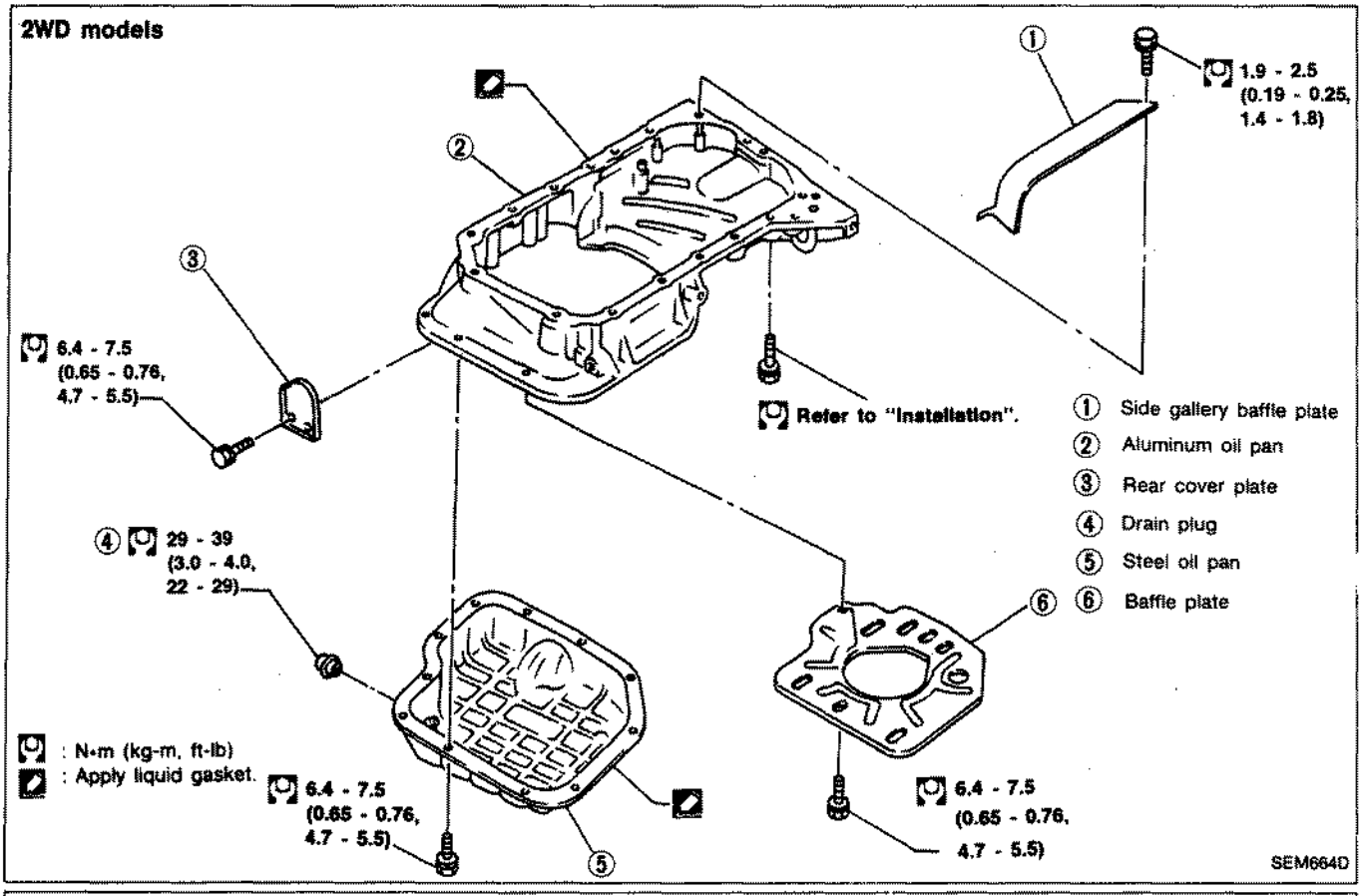
Use compressor tester whose end (rubber portion) is less than 20 mm (0.79 in) dia. Otherwise, it may be caught by cylinder head during removal.

SEM387C

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.

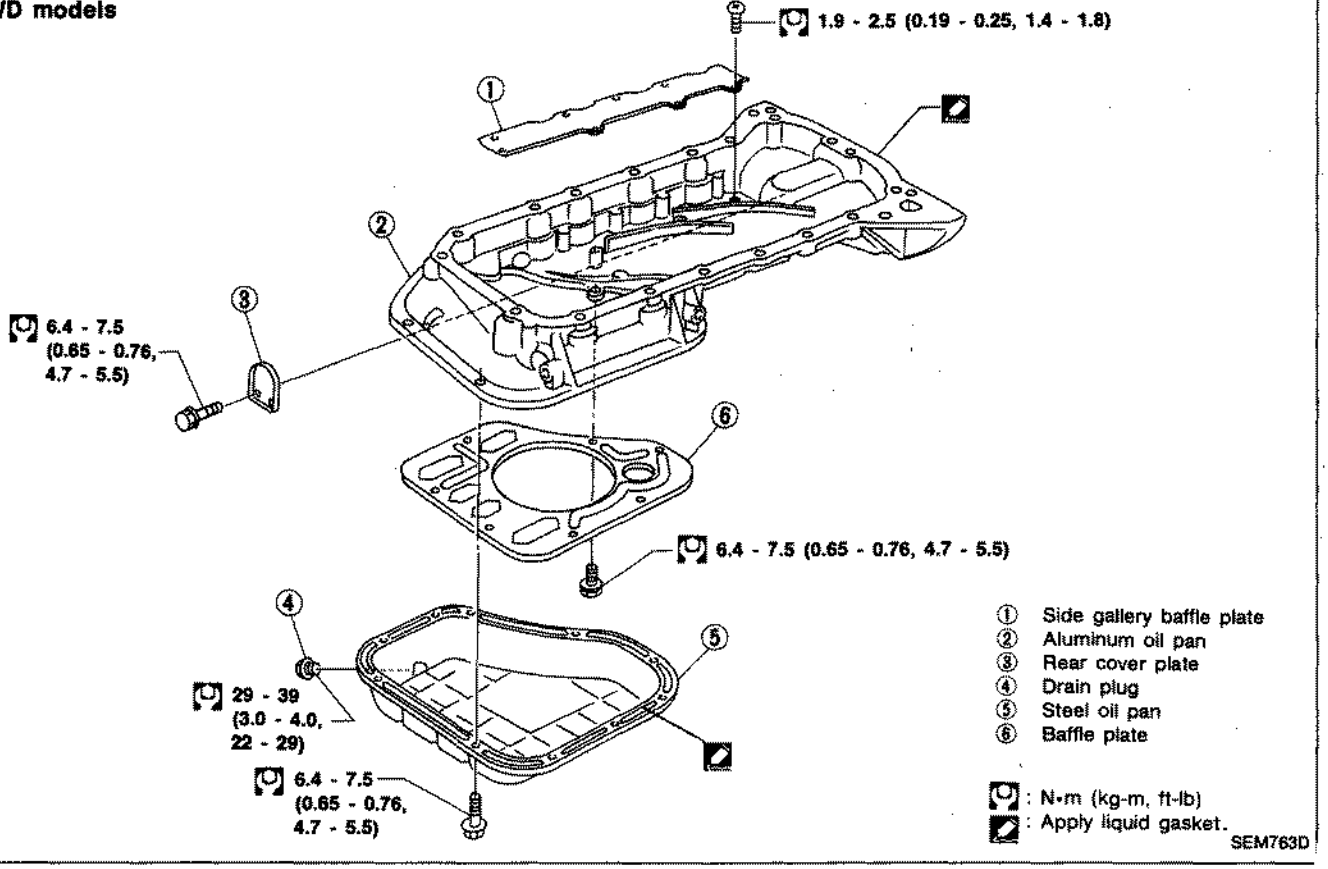
- **If adding oil helps compression, piston rings may be worn or damaged. If so, replace piston rings after checking piston.**
- **If pressure stays low, a valve may be sticking or seating improperly. Inspect and repair valve and valve seat. (Refer to S.D.S.) If valve or valve seat is damaged excessively,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

2WD models



SEM664D

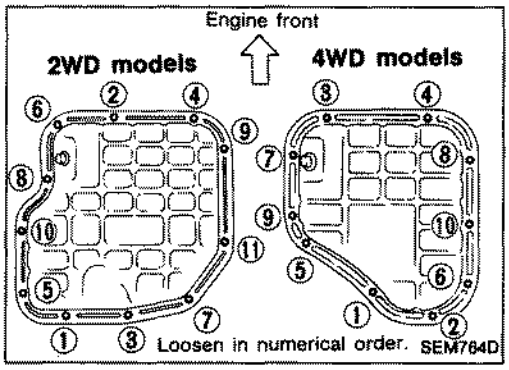
4WD models



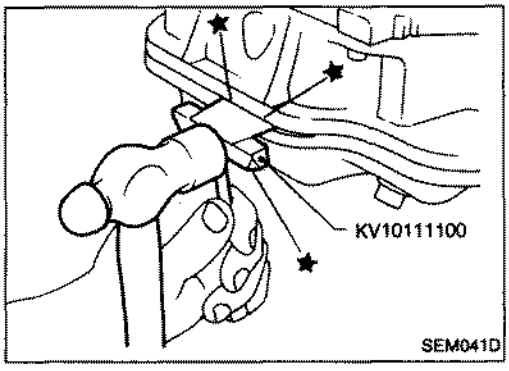
SEM763D

Removal

1. Remove engine under cover.
2. Drain engine oil.

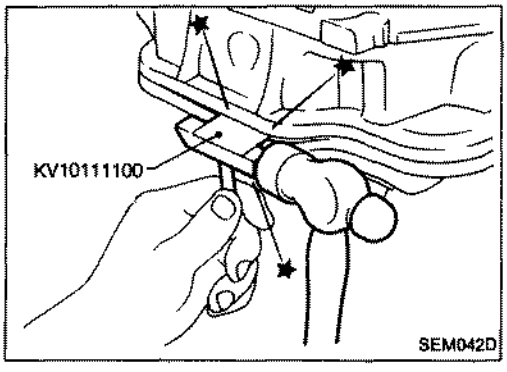


3. Remove steel oil pan bolts.

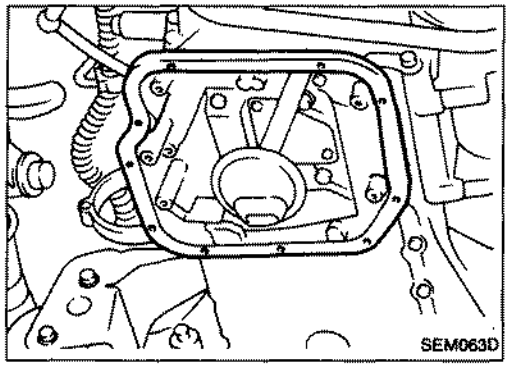


4. Remove steel oil pan.
(1) Insert Tool between aluminum oil pan and steel oil pan.

- **Be careful not to damage aluminum mating surface.**
- **Do not insert screwdriver, or oil pan flange will be deformed.**

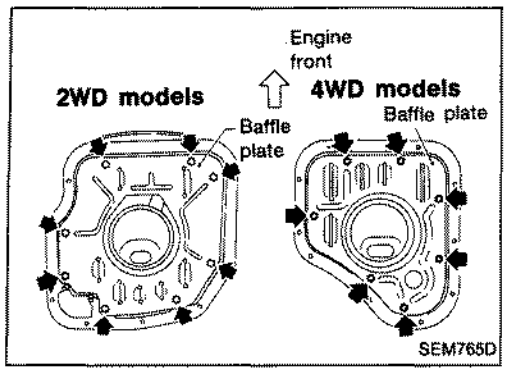


(2) Slide Tool by tapping on the side of the Tool with a hammer.

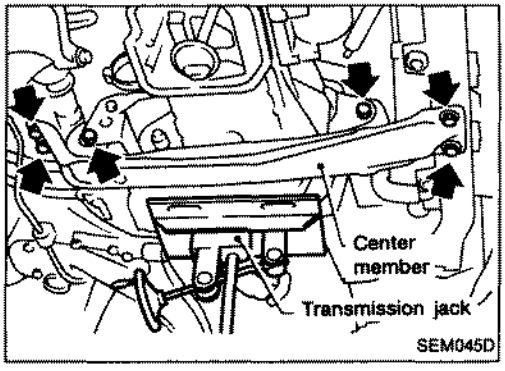


(3) Remove steel oil pan.

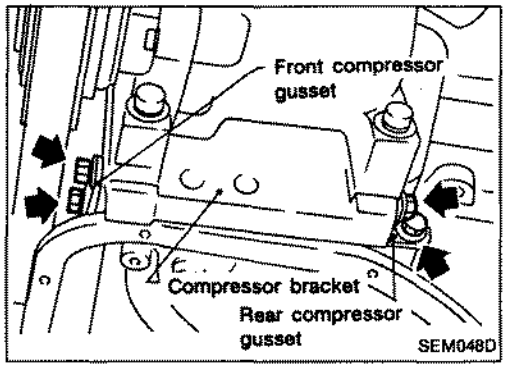
Removal (Cont'd)



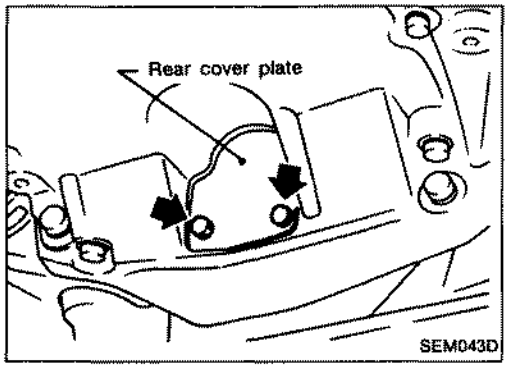
5. Remove baffle plate.



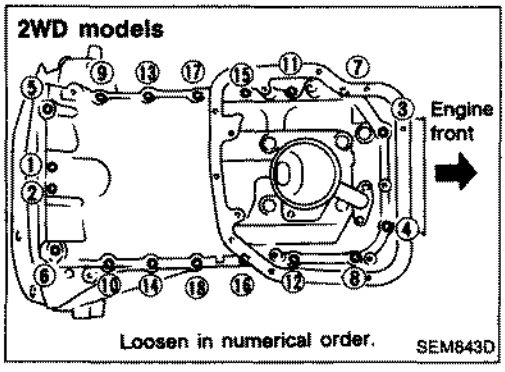
6. Remove front tube.
7. Set a suitable transmission jack under transaxle and hoist engine with engine slinger. (2WD only)
8. Remove center member. (2WD only)
9. Remove A/T shift control cable. (A/T only)



10. Remove compressor gussets.

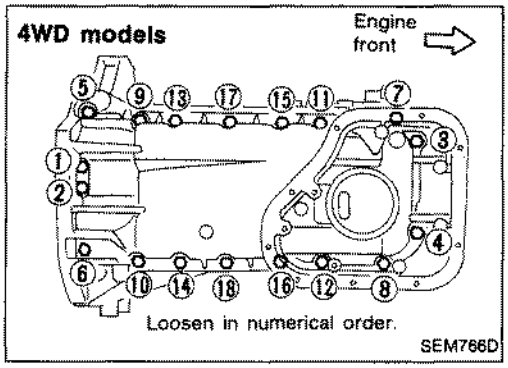


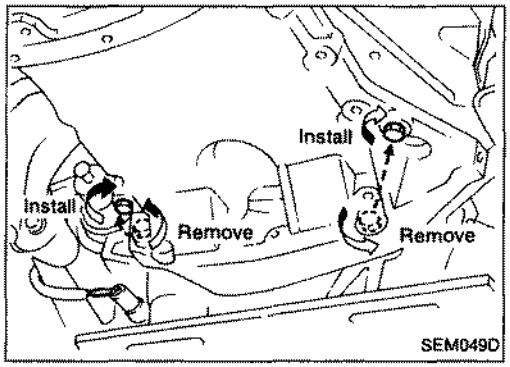
11. Remove rear cover plate.



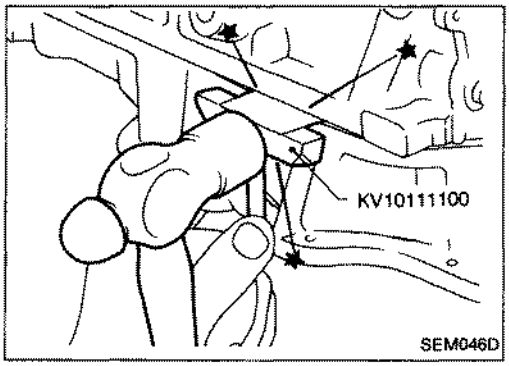
12. Remove aluminum oil pan bolts.

Removal (Cont'd)

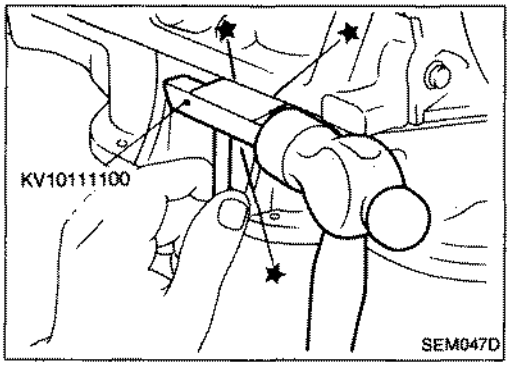




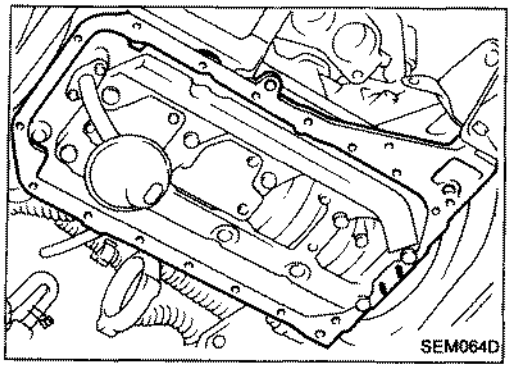
13. Remove the two engine to transaxle bolts and refit them into vacant holes as indicated. Tighten bolts to release aluminum oil pan from cylinder block.



14. Remove aluminum oil pan.
(1) Insert Tool between cylinder block and aluminum oil pan.
- **Be careful not to damage aluminum mating surface.**
- **Do not insert screwdriver, or oil pan flange will be deformed.**

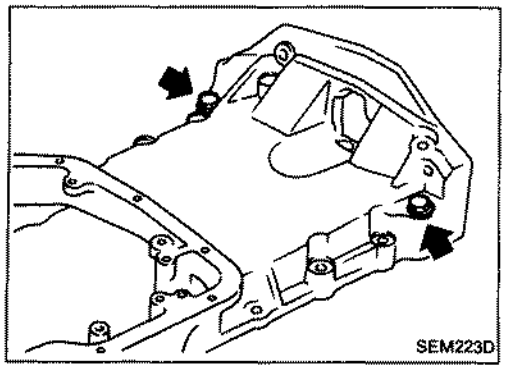


(2) Slide Tool by tapping on the side of the Tool with a hammer.



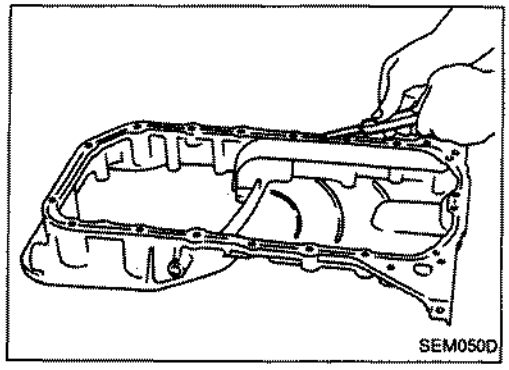
(3) Remove aluminum oil pan.

Removal (Cont'd)

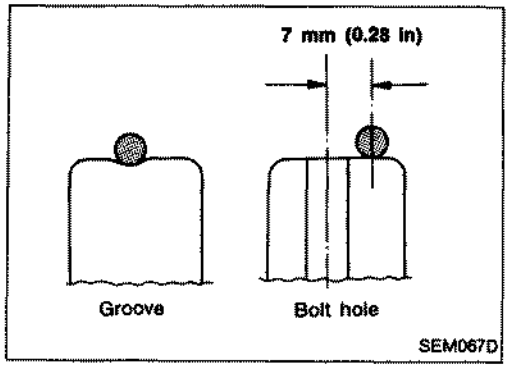


15. Remove the two engine to transaxle bolts previously installed in aluminum oil pan.

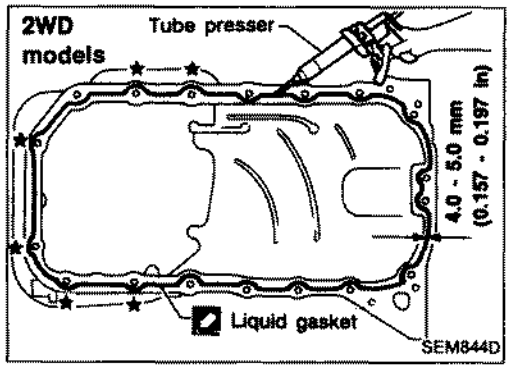
Installation



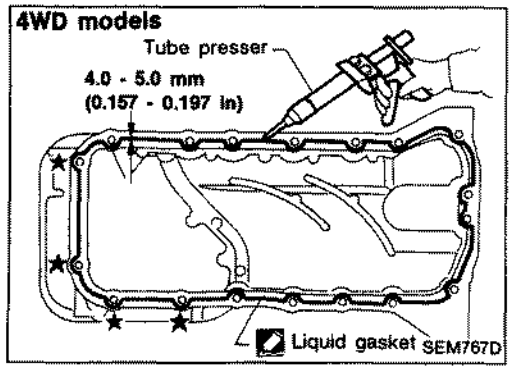
1. Install aluminum oil pan.
(1) Before installing aluminum oil pan, remove all traces of liquid gasket from mating surfaces using a scraper.
- Also remove traces of liquid gasket from mating surface of cylinder block and front cover.



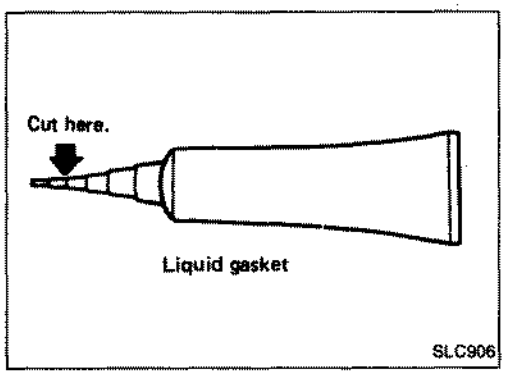
(2) Apply a continuous bead of liquid gasket to mating surface of aluminum oil pan.
- **Use Genuine Liquid Gasket or equivalent.**



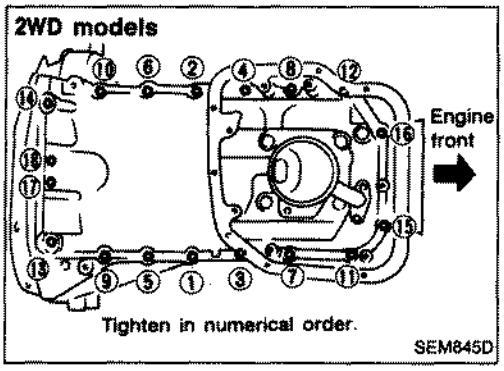
- **For areas marked with "★", apply liquid gasket to the outer side of the bolt hole.**



Installation (Cont'd)

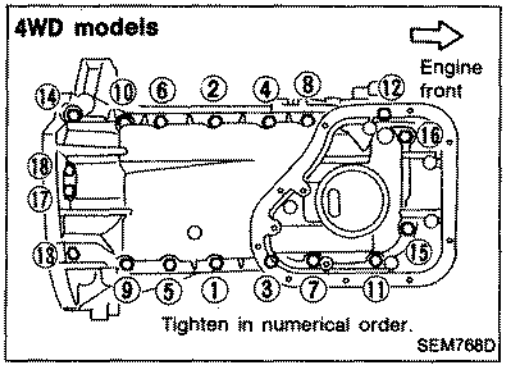


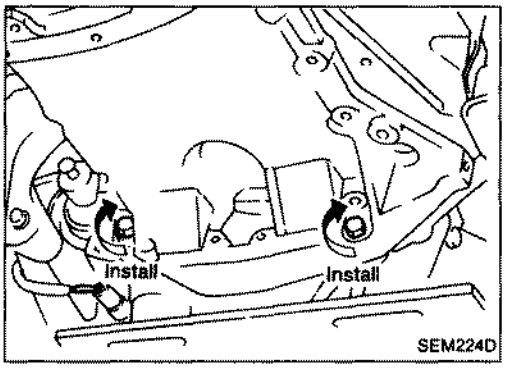
- **Be sure liquid gasket is 4.0 to 5.0 mm (0.157 to 0.197 in) wide.**
- **Attaching should be done within 5 minutes after coating.**



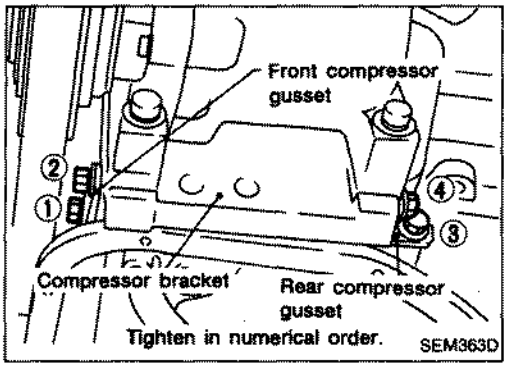
(3) Install aluminum oil pan.

- Install bolts in the reverse order of removal.
  - ① - ⑯ **bolts:**
    : 16 - 19 N·m (1.6 - 1.9 kg-m, 12 - 14 ft-lb)
  - ⑰, ⑱ **bolts:**
    : 6.4 - 7.5 N·m (0.65 - 0.76 kg-m, 4.7 - 5.5 ft-lb)



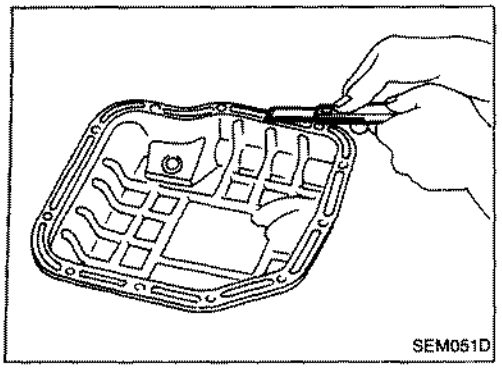


2. Install the two engine to transaxle bolts.
3. Install rear cover plate.

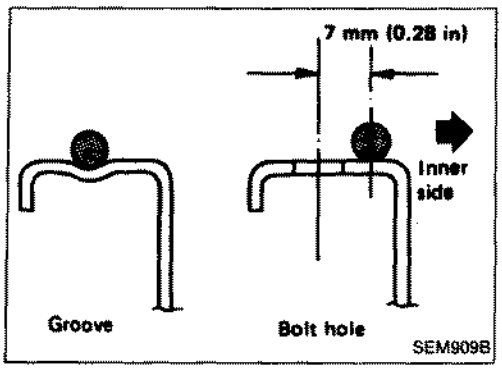


4. Install compressor gussets.
5. Install A/T shift control cable. (A/T only)
6. Install center member. (2WD only)
7. Install front tube.
8. Install baffle plate.

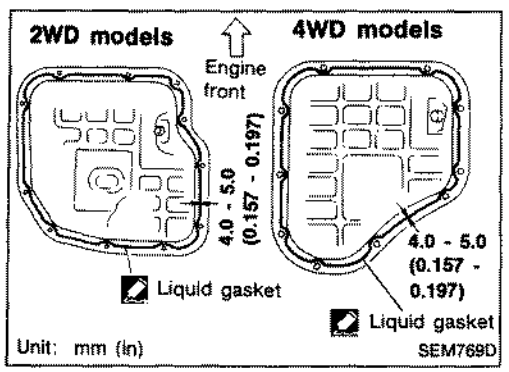
Installation (Cont'd)



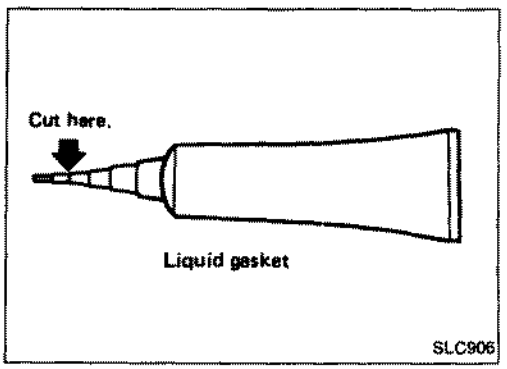
9. Install steel oil pan.
(1) Before installing steel oil pan, remove all traces of liquid gasket from mating surfaces using a scraper.
- Also remove traces of liquid gasket from mating surface of aluminum oil pan.

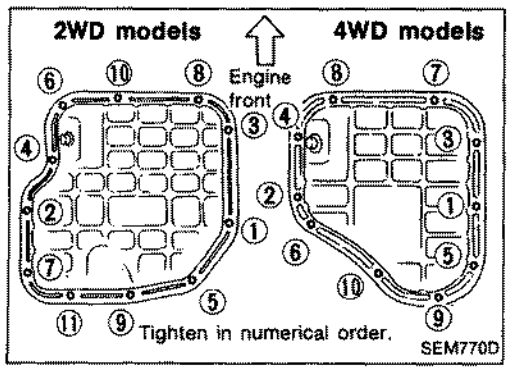


(2) Apply a continuous bead of liquid gasket to mating surface of steel oil pan.
- **Use Genuine Liquid Gasket or equivalent.**

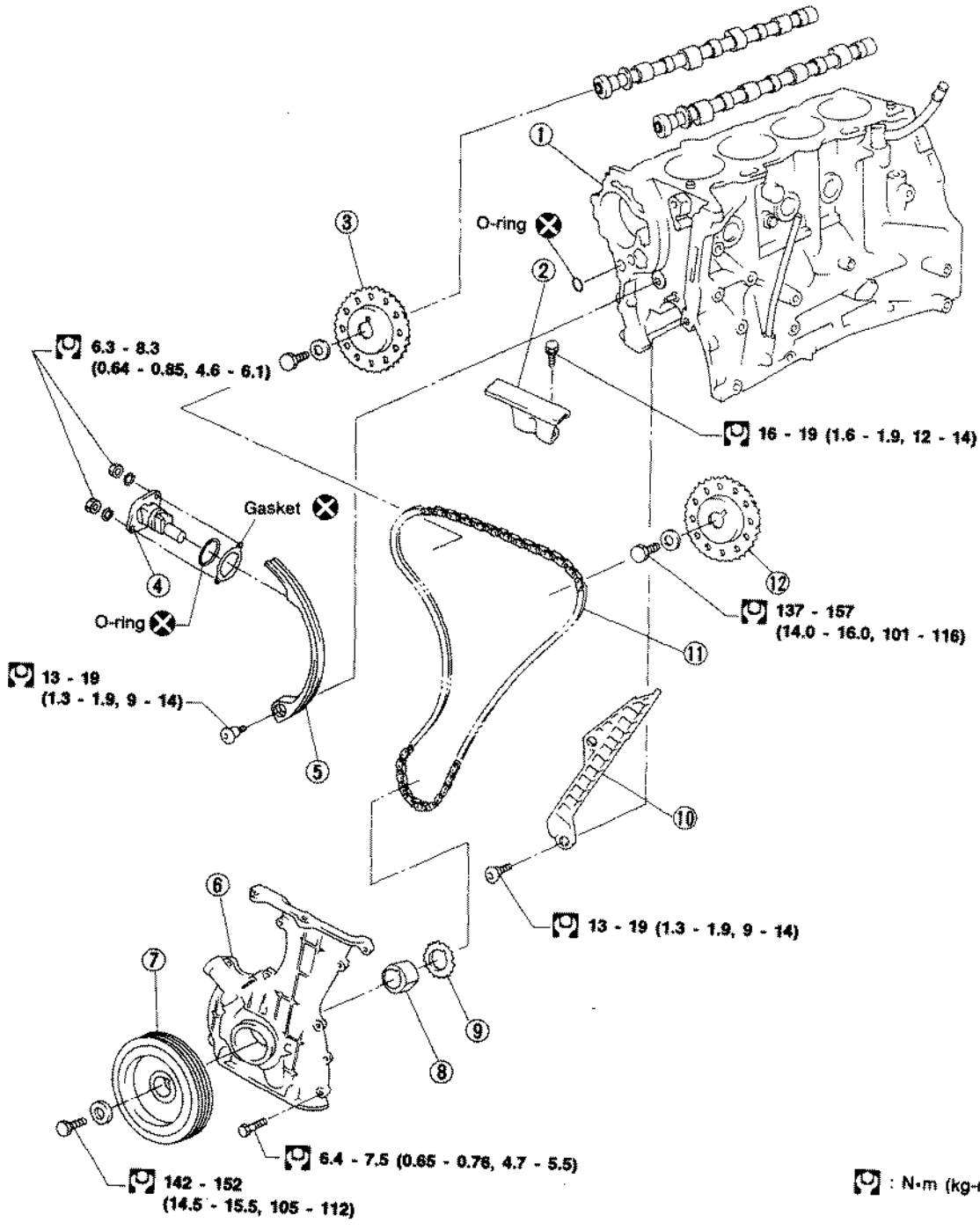


- **Be sure liquid gasket is 4.0 to 5.0 mm (0.157 to 0.197 in) wide.**
- **Attaching should be done within 5 minutes after coating.**





(3) Install steel oil pan.
- Install bolts in the reverse order of removal together with exhaust gas sensor harness bracket.
- Wait at least 30 minutes before refilling engine oil.



SEM699E

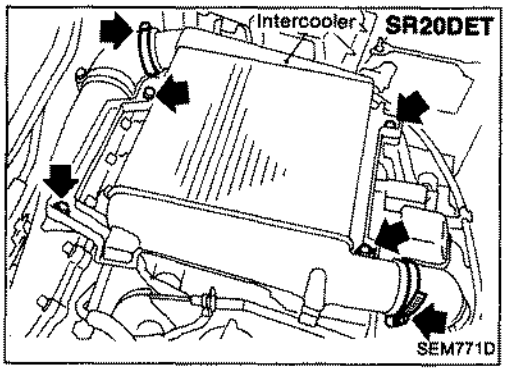
① Cylinder block
② Chain guide
③ R.H. camshaft sprocket
④ Chain tensioner
⑤ Chain guide
⑥ Front cover
⑦ Crank pulley
⑧ Oil pump spacer
⑨ Crankshaft sprocket
⑩ Chain guide
⑪ Timing chain
⑫ L.H. camshaft sprocket

CAUTION:

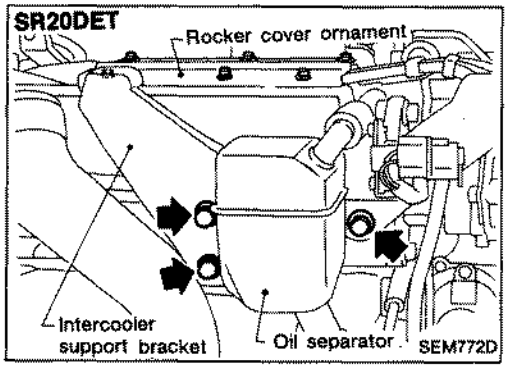
- **After removing timing chain, do not turn crankshaft and camshaft separately, or valves will strike piston heads.**
- **When installing sliding parts such as rocker arms, camshafts, chain tensioner and oil seal, be sure to apply new engine oil on their sliding surfaces.**
- **When tightening cylinder head bolts, camshaft sprocket bolts, crankshaft pulley bolt and camshaft bracket bolts, apply new engine oil to thread portions and seat surfaces of bolts.**

Removal

1. Release fuel pressure.
   Refer to "Releasing Fuel Pressure" in section EF & EC.
2. Remove engine under covers.
3. Remove front R.H. wheel and engine side cover.
4. Drain coolant by removing cylinder block drain plug and radiator drain cock.
5. Remove radiator.
6. Remove air duct to intake manifold.

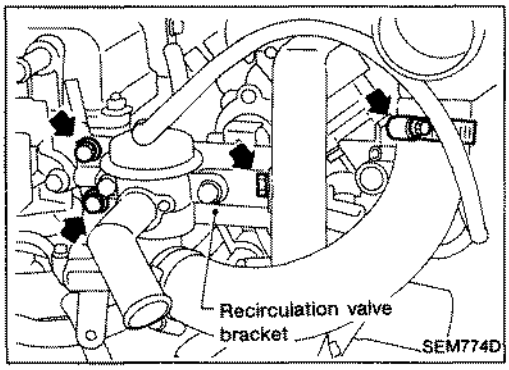


7. Remove intercooler cover and intercooler. (SR20DET only)

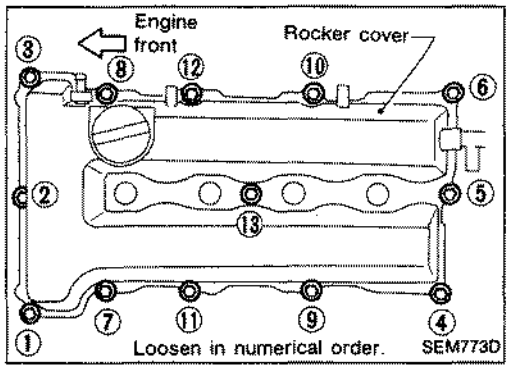


8. - SR20DE: Remove oil separator.
   - SR20DET: Remove oil separator, intercooler support bracket and rocker cover ornament.
9. Remove P.C.V. hoses from rocker cover.
10. Remove drive belts and water pump pulley.
11. Remove alternator.
12. Remove power steering oil pump.
13. Remove vacuum hoses, fuel hoses, wires, harness, connectors and so on.
14. Remove all spark plugs.

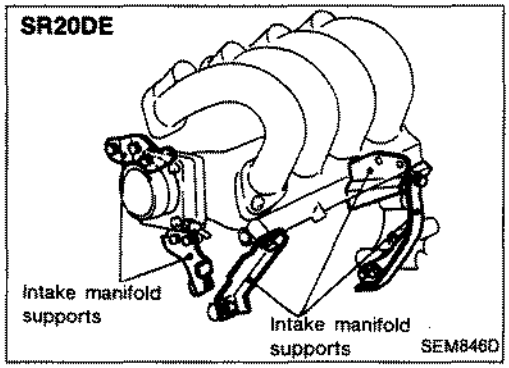
Removal (Cont'd)



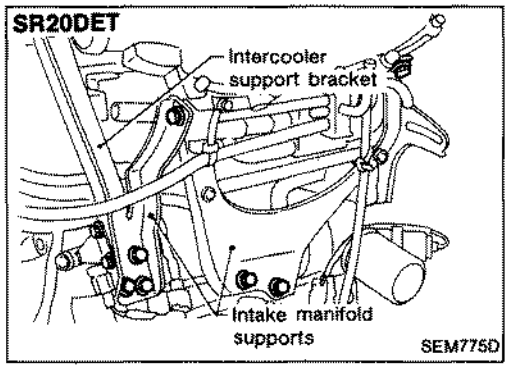
15. Remove recirculation valve bracket. (SR20DET only)

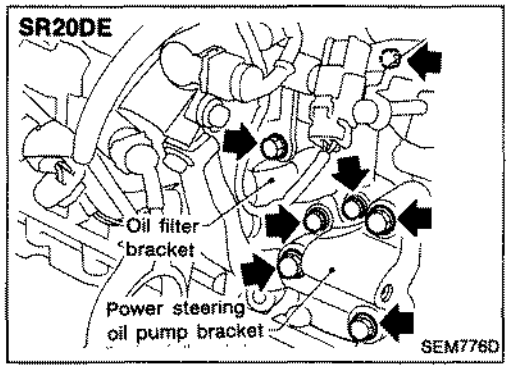


16. Remove rocker cover.



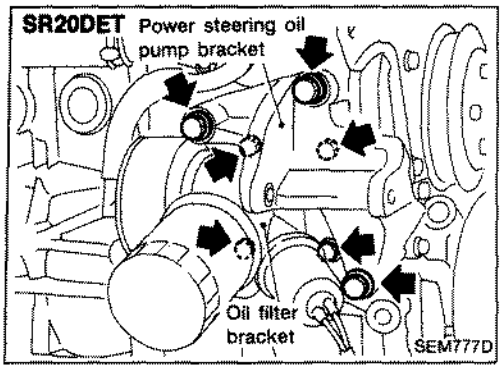
17. • SR20DE: Remove intake manifold supports.
    • SR20DET: Remove intake manifold supports and intercooler support bracket.

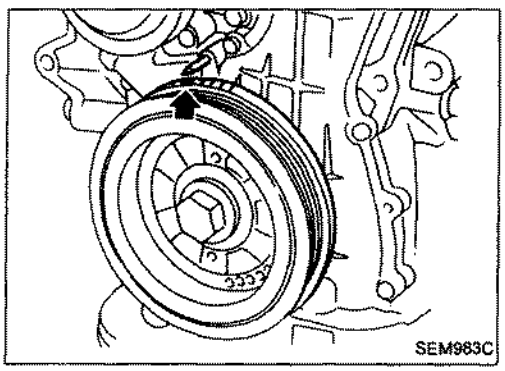




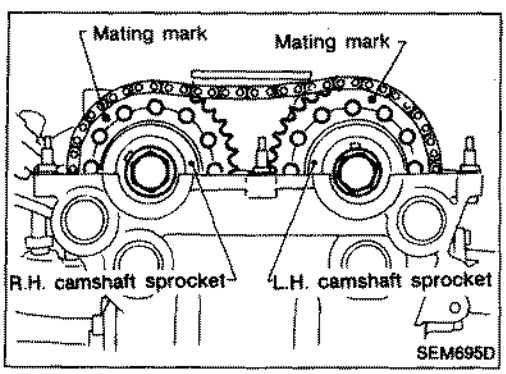
18. Remove oil filter bracket and power steering oil pump bracket.

Removal (Cont'd)

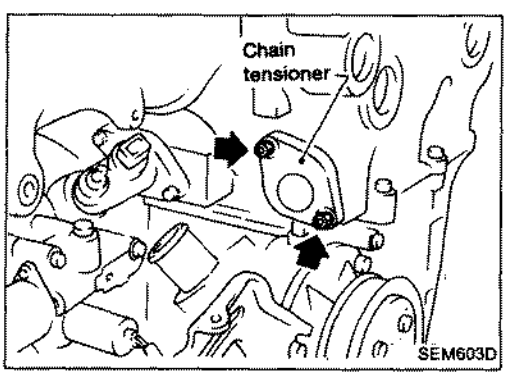




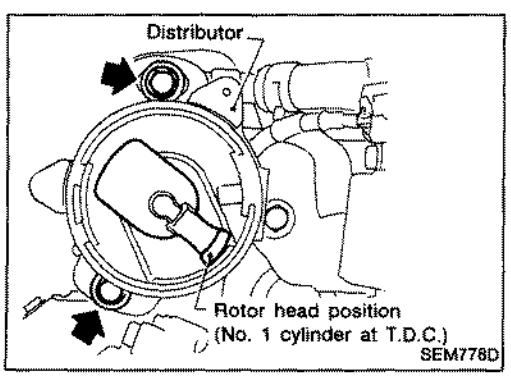
19. Set No. 1 piston at T.D.C. on the compression stroke by rotating crankshaft.



- **Rotate crankshaft until mating mark on camshaft sprocket is set at position indicated in figure at left.**



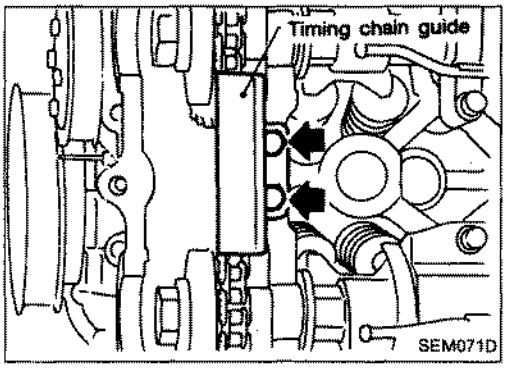
20. Remove chain tensioner.



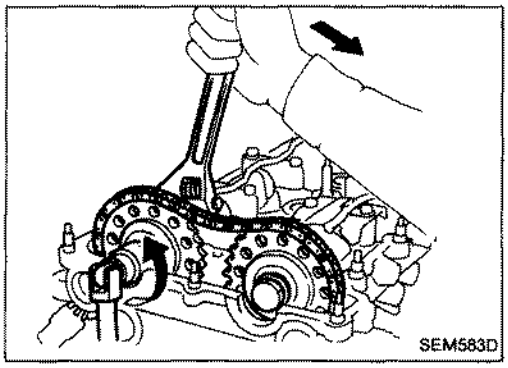
21. Remove distributor.

Do not turn rotor with distributor removed.

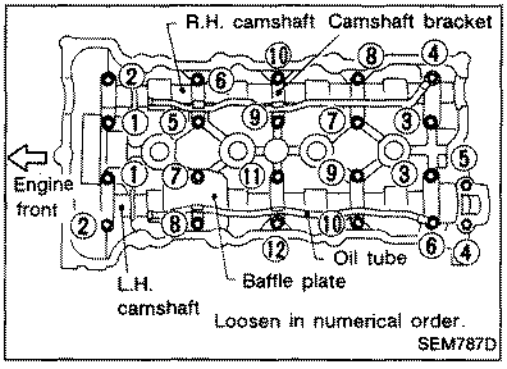
Removal (Cont'd)



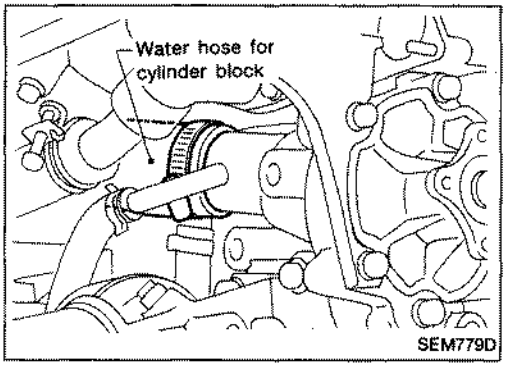
22. Remove timing chain guide.



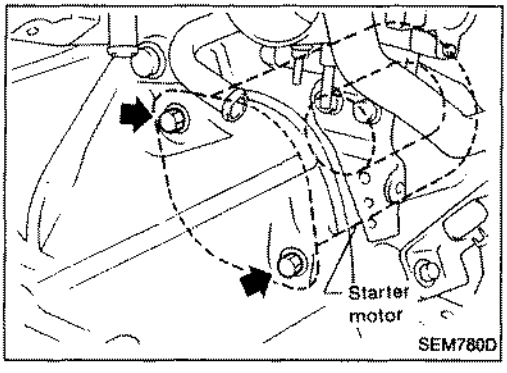
23. Remove camshaft sprockets.



24. Remove camshafts, camshaft brackets, oil tubes and baffle plate.

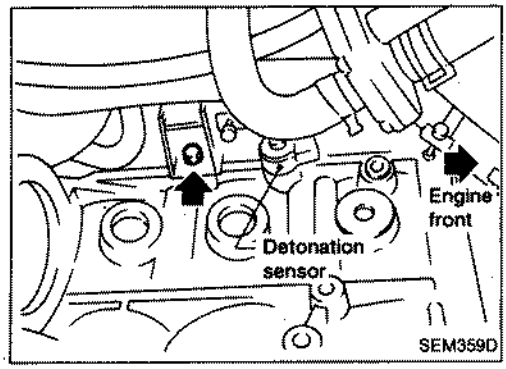


25. Remove the following water hoses.
- Water hose for cylinder block.
- Water hoses from heater.

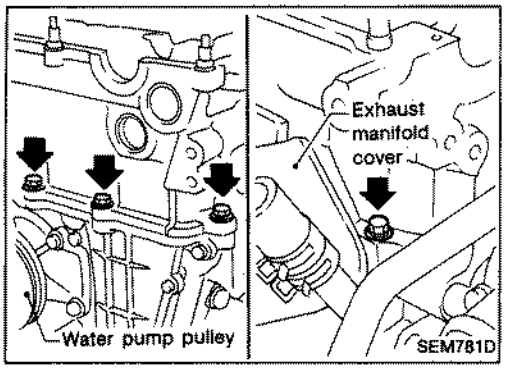


26. Remove starter motor.

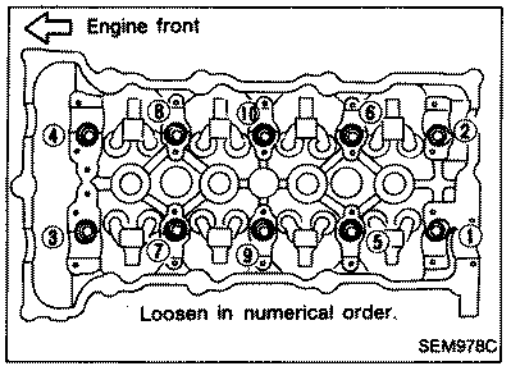
Removal (Cont'd)



27. Remove water pipe bolt.
28. Remove exhaust manifold with turbocharger. Refer to "Removal" in "TURBOCHARGER". (SR20DET only)



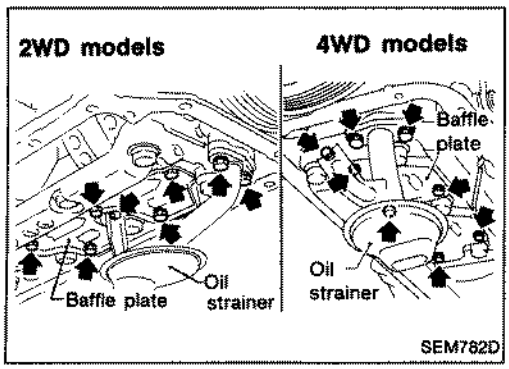
29. Remove cylinder head outside bolts.



30. Remove cylinder head bolts.
- **Bolts should be loosened in two or three steps.**

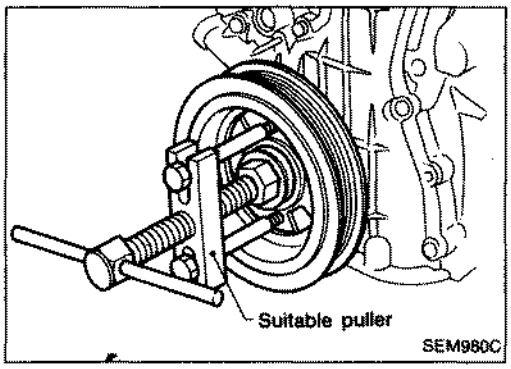
31. • SR20DE: Remove cylinder head with intake and exhaust manifolds.
    • SR20DET: Remove cylinder head with intake manifold.

32. Remove oil pans.
    Refer to "Removal" in "OIL PAN".

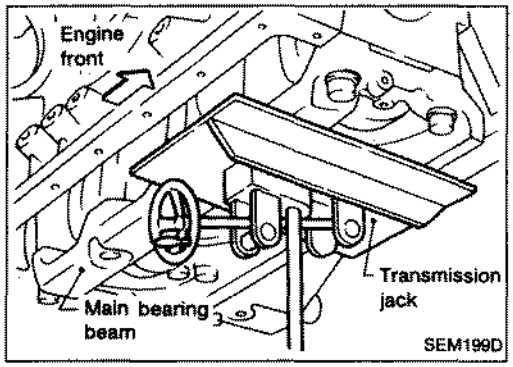


33. Remove oil strainer and baffle plate.

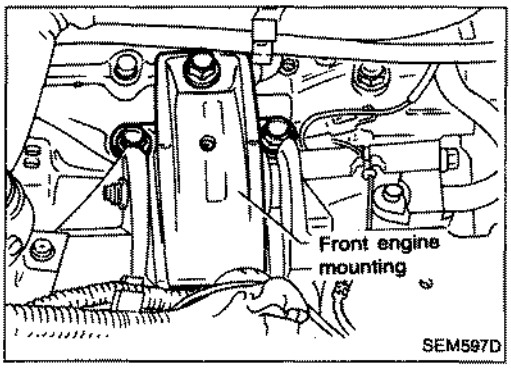
Removal (Cont'd)



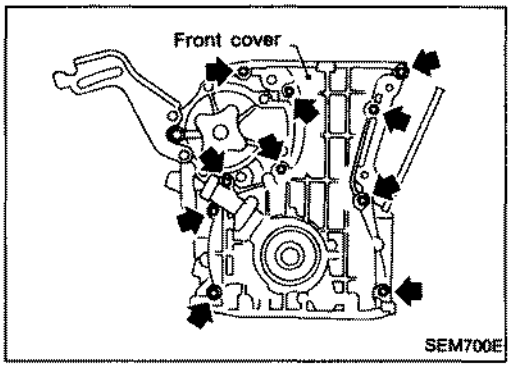
34. Remove crankshaft pulley.



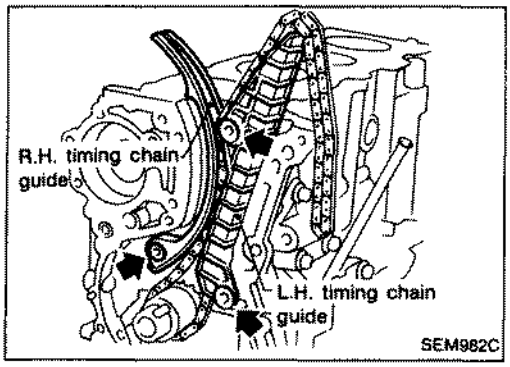
35. Set a suitable transmission jack under main bearing beam.



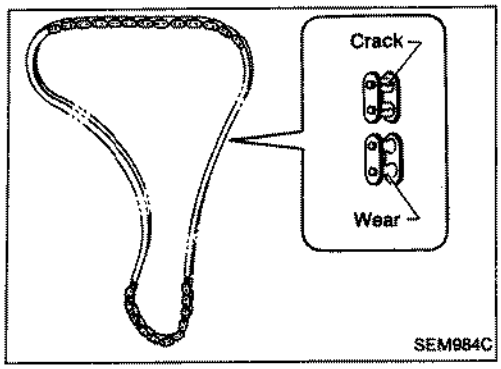
36. Remove front engine mounting.



37. Remove front cover.

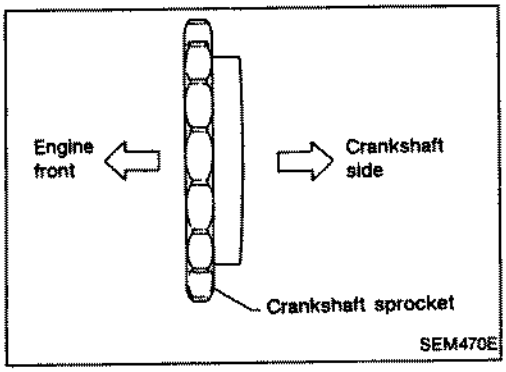


38. Remove timing chain guides and timing chain.



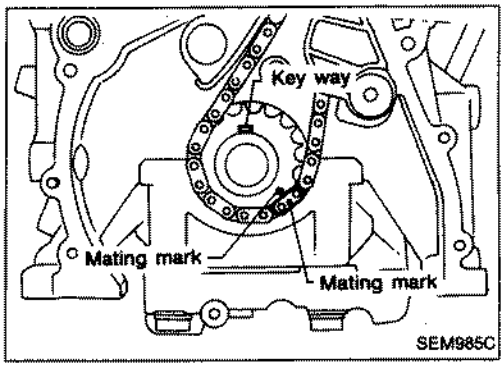
Inspection

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

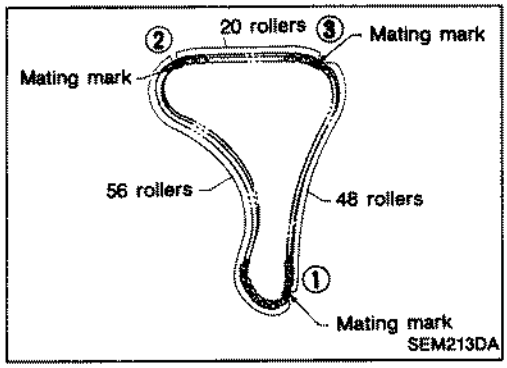


Installation

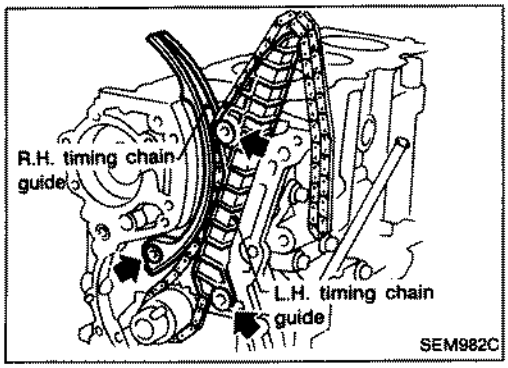
1. Install crankshaft sprocket on crankshaft.



2. Position crankshaft so that No. 1 piston is set at T.D.C. (Keyway at 12 o'clock-mating mark at 4 o'clock approx.) fit timing chain to crankshaft sprocket so that mating mark is in line with mating mark on crankshaft sprocket.

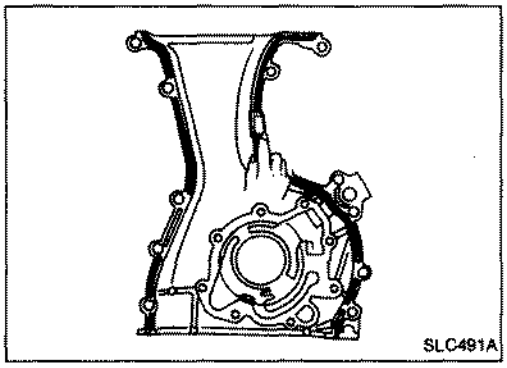


- Mating mark color on timing chain.
  ① : **Gold**
  ②, ③ : **Silver**

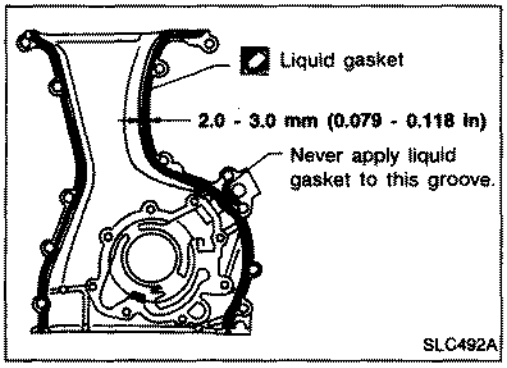


3. Install timing chain and timing chain guides.

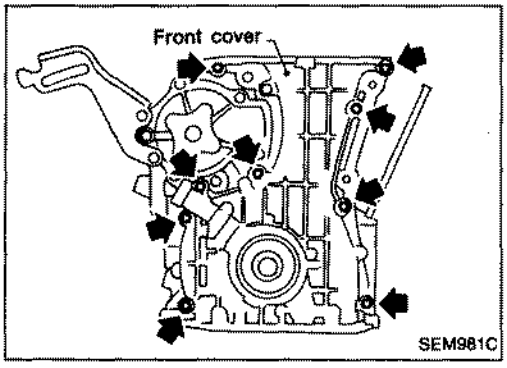
Installation (Cont'd)



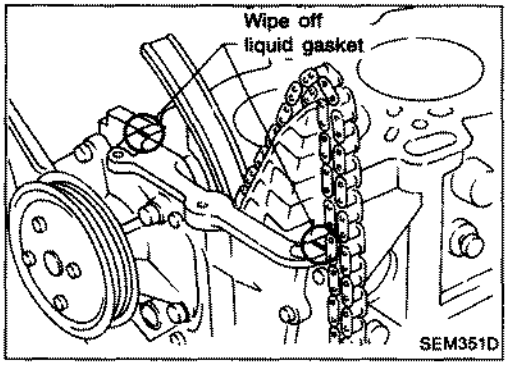
4. Before installing front cover, remove all traces of liquid gasket from mating surface using a scraper.
- Also remove traces of liquid gasket from mating surface of cylinder block.



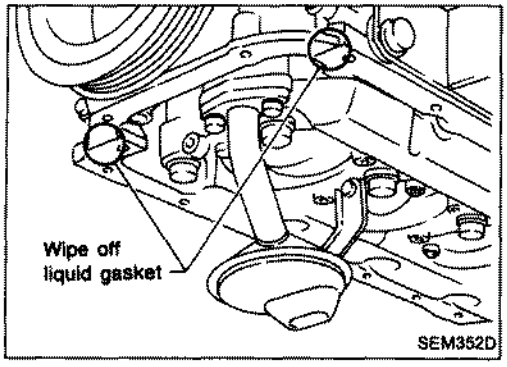
5. Apply a continuous bead of liquid gasket to mating surface of front cover.
- Use Genuine Liquid Gasket or equivalent.



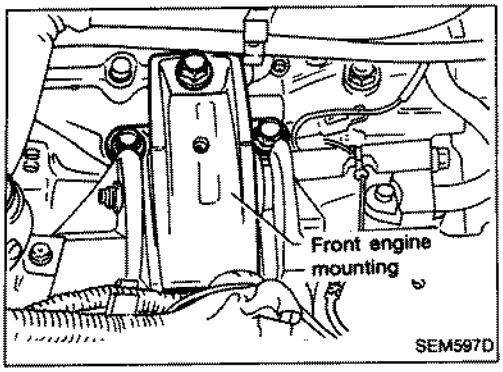
6. Install oil pump drive spacer and front cover.



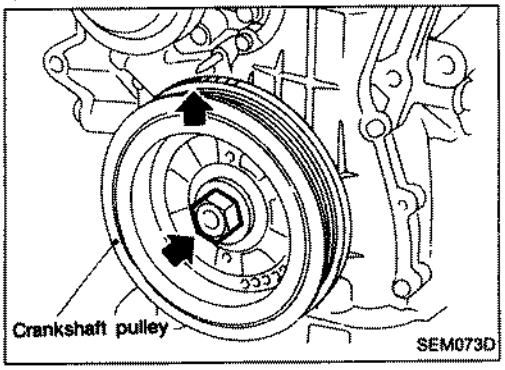
- Wipe off excessive liquid gasket.



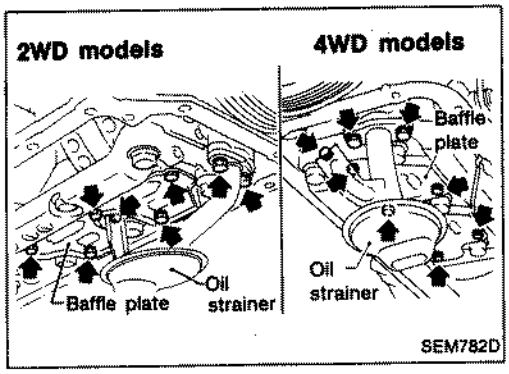
Installation (Cont'd)



7. Install front engine mounting.

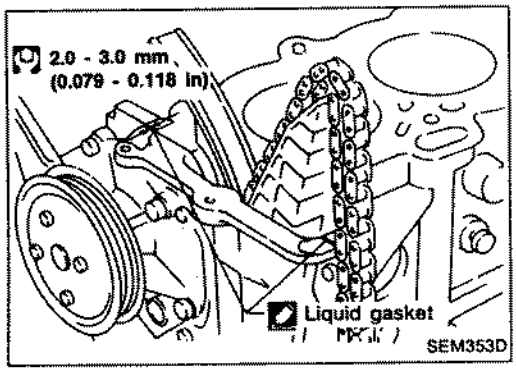


8. Install crankshaft pulley.
9. Set No. 1 piston at T.D.C. on its compression stroke.



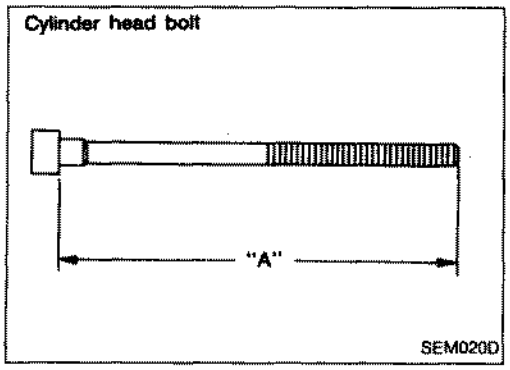
10. Install oil strainer and baffle plate.

11. Install oil pan.
    Refer to "Installation" in "OIL PAN".



12. Before installing cylinder head gasket, apply a continuous bead of liquid gasket to mating surface of cylinder block.

Installation (Cont'd)

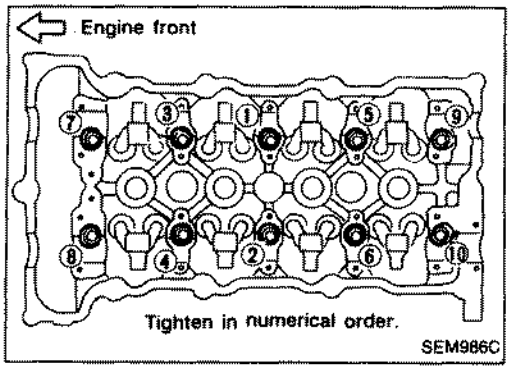


13. • SR20DE: Install cylinder head with intake and exhaust manifolds.
    • SR20DET: Install cylinder head with intake manifold.

CAUTION:

The cylinder head bolts of SR20DE can be reused providing dimension "A" is not exceeded.

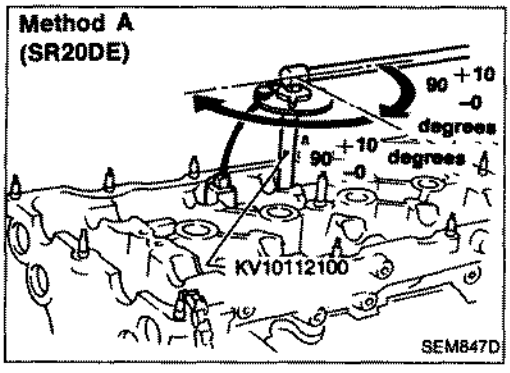
Dimension "A":
158.2 mm (6.23 in)



- **Tightening procedure:**

(SR20DE)

ⓐ **Tighten all bolts to 39 N·m (4.0 kg-m, 29 ft-lb).**
ⓑ **Tighten all bolts to 78 N·m (8.0 kg-m, 58 ft-lb).**
ⓒ **Loosen all bolts completely.**
ⓓ **Tighten all bolts to 34 to 44 N·m (3.5 to 4.5 kg-m, 25 to 33 ft-lb).**

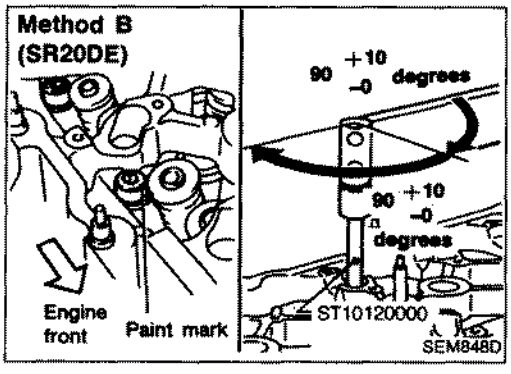


ⓔ **Method A: Turn all bolts 90 to 100 degrees clockwise with Tool or suitable angle wrench.**

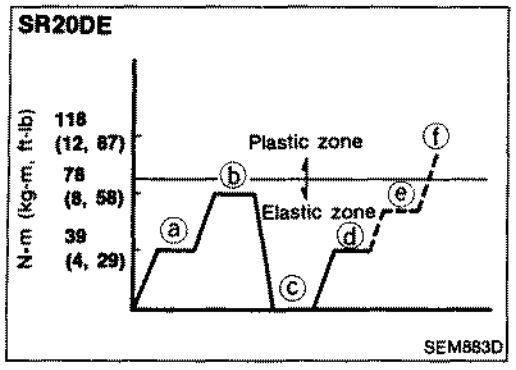
Method B: If angle wrench is not available, mark the side of each cylinder head bolt with a paint mark facing the front of the engine, then turn all bolts 90 to 100 degrees clockwise.

ⓕ **Turn all bolts 90 to 100 degrees clockwise.**
ⓖ **Ensure that paint mark on each bolt faces the rear of the engine. (Method B only)**

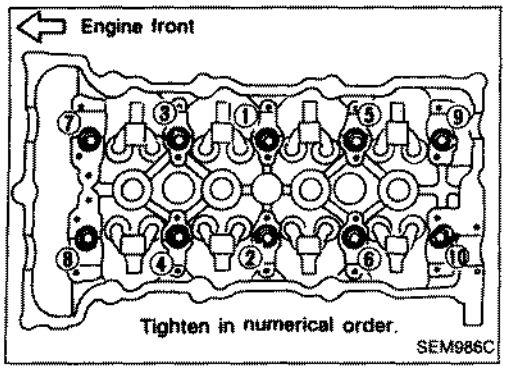
Do not turn any bolt 180 to 200 degrees clockwise all at once.



	Tightening torque N·m (kg-m, ft-lb)
ⓐ	39 (4.0, 29)
ⓑ	78 (8.0, 58)
ⓒ	0 (0, 0)
ⓓ	39 ± 5 (4.0 ± 0.5, 28.9 ± 3.6)
ⓔ	90 $^{+10}_{-0}$ degrees
ⓕ	90 $^{+10}_{-0}$ degrees

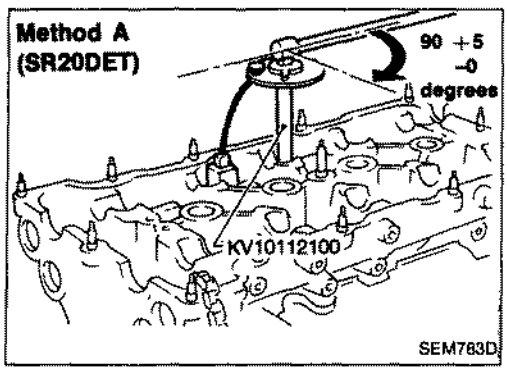


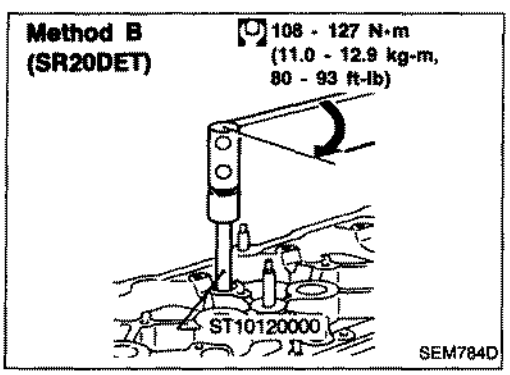
Installation (Cont'd)



(SR20DET)

- ⓐ **Tighten all bolts to 59 N·m (6.0 kg-m, 43 ft-lb).**
- ⓑ **Tighten all bolts to 108 to 118 N·m (11.0 to 12.0 kg-m, 80 to 87 ft-lb).**
- ⓒ **Loosen all bolts completely.**
- ⓓ **Tighten all bolts to 36 to 42 N·m (3.7 to 4.3 kg-m, 27 to 31 ft-lb).**

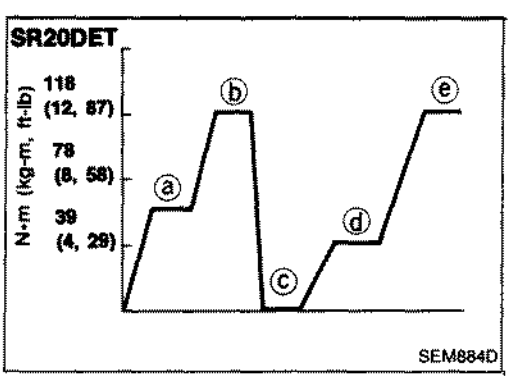


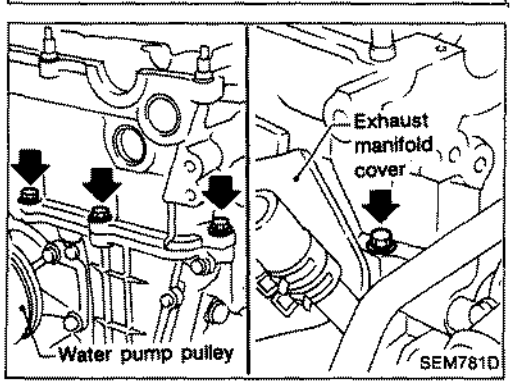


- ⓔ **Method A: Turn all bolts 90 to 95 degrees clockwise with Tool or suitable angle wrench.**

  Method B: If angle wrench is not available, tighten all bolts to 108 to 127 N·m (11.0 to 12.9 kg-m, 80 to 93 ft-lb).

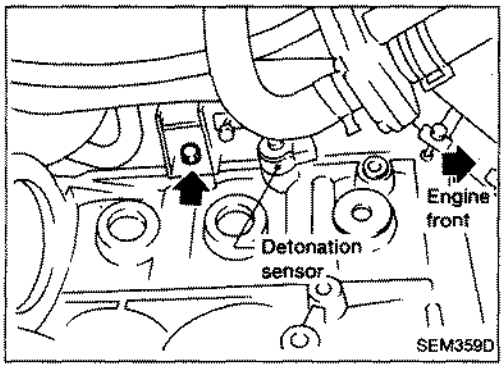
	Tightening torque N·m (kg-m, ft-lb)
ⓐ	59 (6.0, 43)
ⓑ	113 ± 5 (11.5 ± 0.5, 83.2 ± 3.6)
ⓒ	0 (0, 0)
ⓓ	39 ± 3 (4.0 ± 0.3, 28.9 ± 2.2)
ⓔ	90 $^{+5}_{-0}$ degrees or 117.2 ± 9.3 (11.95 ± 0.95, 86.4 ± 6.9)



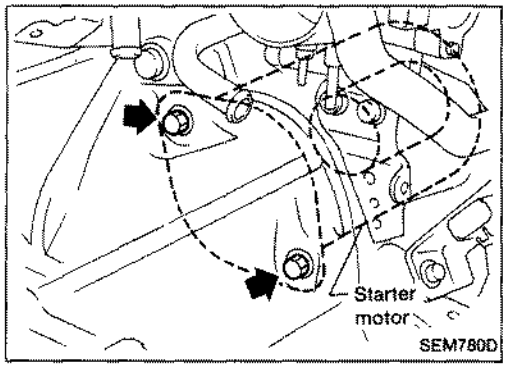


14. Install cylinder head outside bolts.
15. Install exhaust manifold with turbocharger. Refer to "Installation" in "TURBOCHARGER". (SR20DET only)

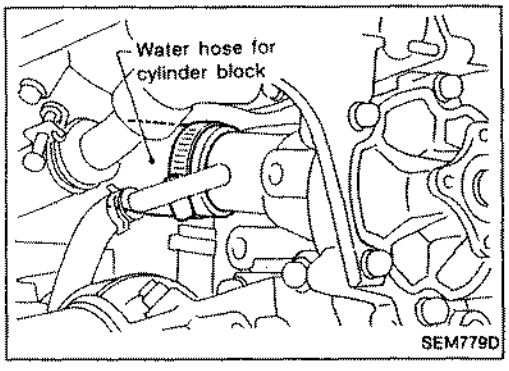
Installation (Cont'd)



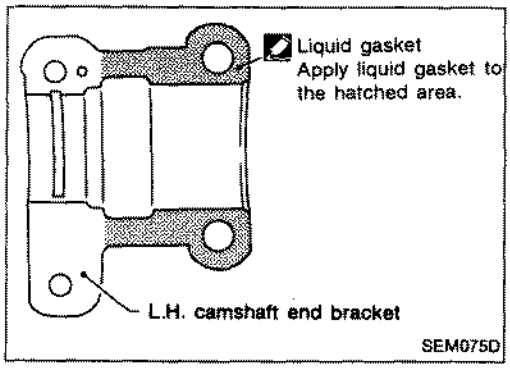
16. Install water pipe bolt.



17. Install starter motor.

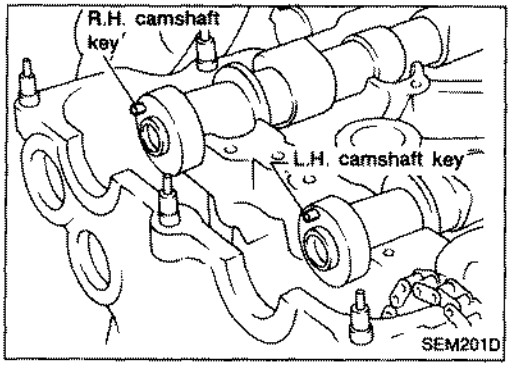


18. Install the following water hoses.
- Water hose for cylinder block.
- Water hoses for heater.



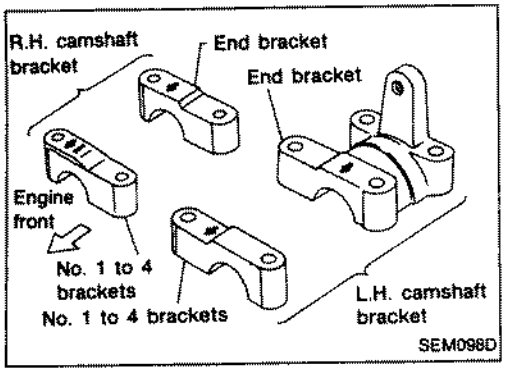
19. Before installing L.H. camshaft end bracket, remove all traces of liquid gasket from mating surface.
- Also remove traces of liquid gasket from mating surface of cylinder head.

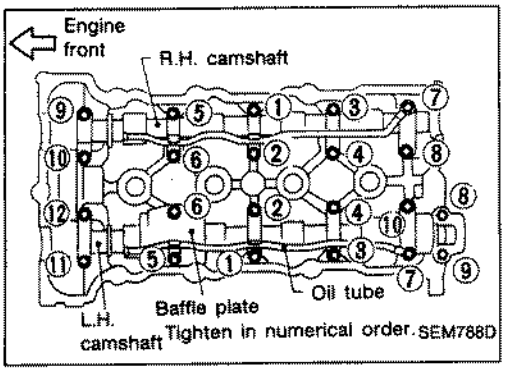
20. Apply a continuous bead of liquid gasket to mating surface of L.H. camshaft end bracket.
- Use Genuine Liquid Gasket or equivalent.



21. Install camshafts, camshaft brackets, oil tubes and baffle plate.
- Position camshaft.
  - L.H. camshaft key at about 12 o'clock
  - R.H. camshaft key at about 10 o'clock

Installation (Cont'd)





- **Tightening procedure**

STEP 1:

R.H. camshaft

Tighten bolts ⑨ - ⑩ in that order then tighten bolts ① - ⑧ in that order.

: 2 N·m (0.2 kg-m, 1.4 ft-lb)

L.H. camshaft

Tighten bolts ⑪ - ⑫ in that order then tighten bolts ① - ⑩ in that order.

: 2 N·m (0.2 kg-m, 1.4 ft-lb)

STEP 2:

Tighten bolts in the specified order.

: 6 N·m (0.6 kg-m, 4.3 ft-lb)

STEP 3:

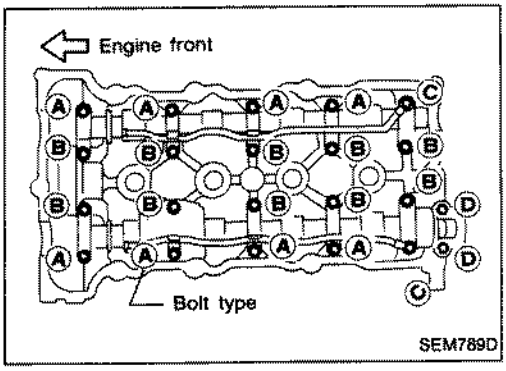
Tighten bolts in the specified order.

: 9.0 - 11.8 N·m (0.92 - 1.2 kg-m, 6.7 - 8.7 ft-lb)

... Bolt type Ⓐ Ⓑ Ⓒ

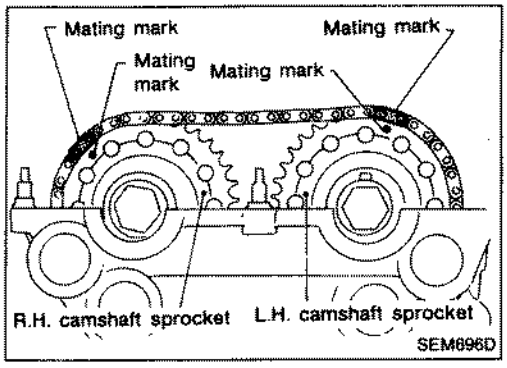
: 18 - 25 N·m (1.8 - 2.6 kg-m, 13 - 19 ft-lb)

... Bolt type Ⓓ



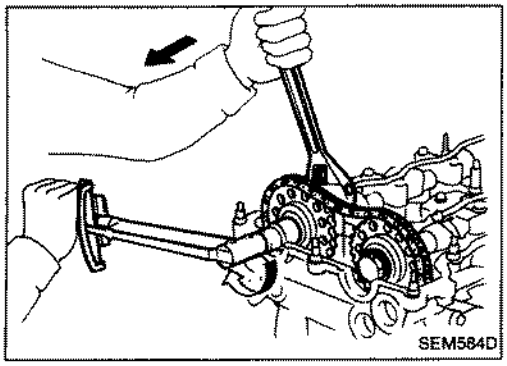
22. Install camshaft sprockets.

Line up mating marks on timing chain with mating marks on camshaft sprockets.

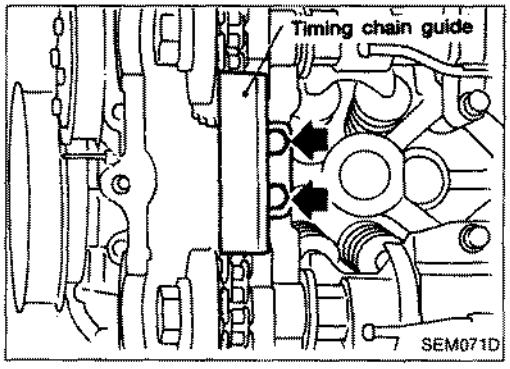


- Lock camshafts as shown in figure and tighten to specified torque.

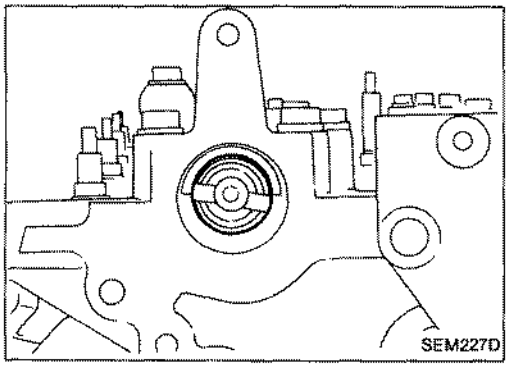
: 137 - 157 N·m (14.0 - 16.0 kg-m, 101 - 116 ft-lb)



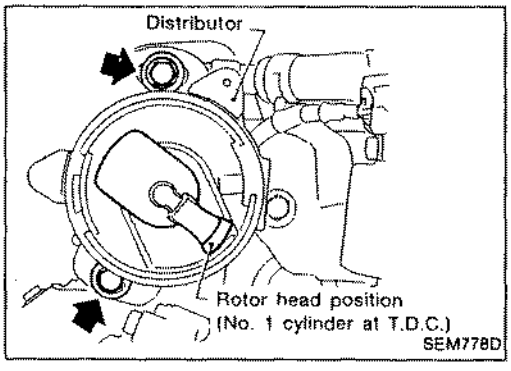
Installation (Cont'd)



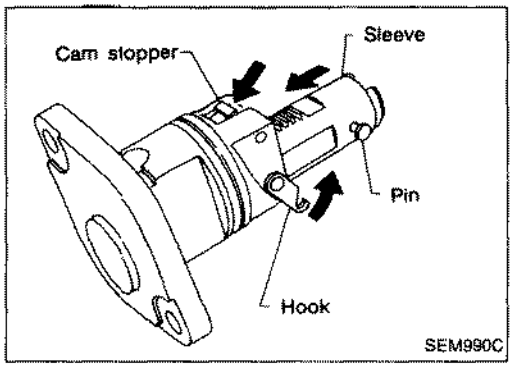
23. Install timing chain guide.



24. Install distributor.
- **Make sure that position of camshaft is as shown in figure.**

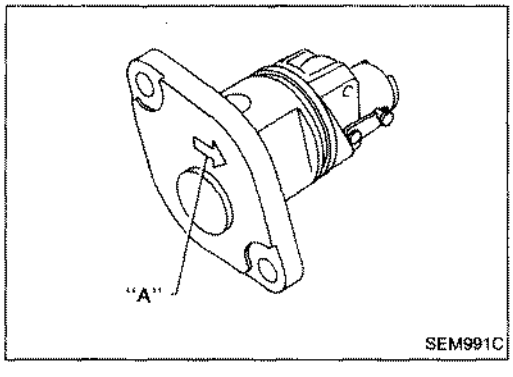


- **After installing, confirm that distributor rotor head is set as shown in figure.**

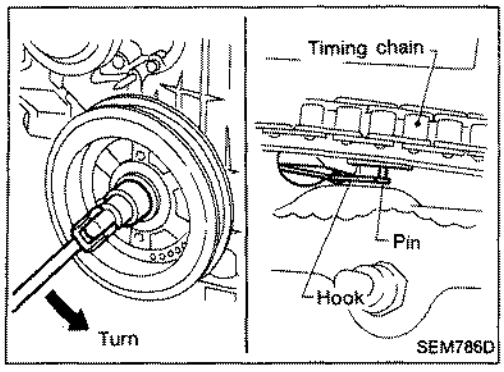


25. Install chain tensioner.

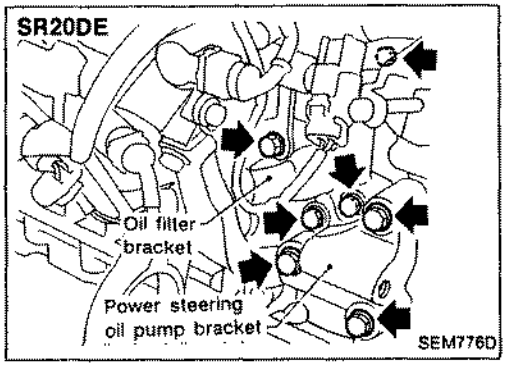
Press cam stopper down and "press-in" sleeve until hook can be engaged on pin. When tensioner is bolted in position the hook will release automatically. Ensure arrow "A" faces the front of the engine.



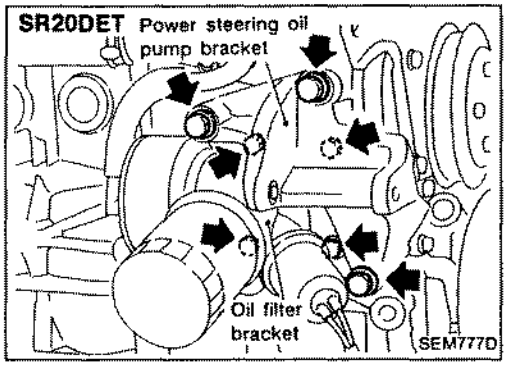
Installation (Cont'd)

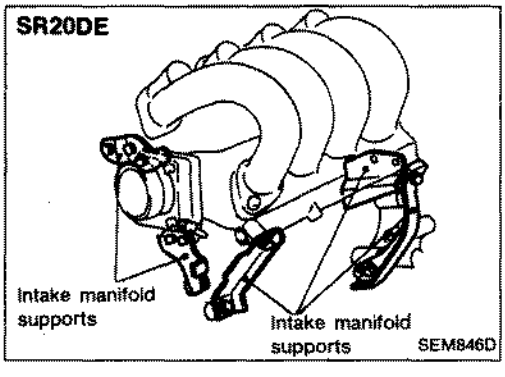


- **If hook does not release automatically, turn crankshaft counterclockwise until it does release.**

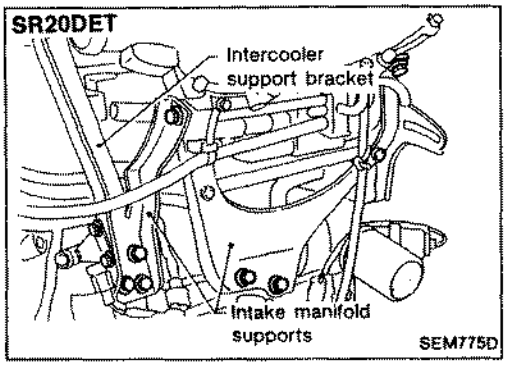


26. Install oil filter bracket and power steering oil pump bracket.

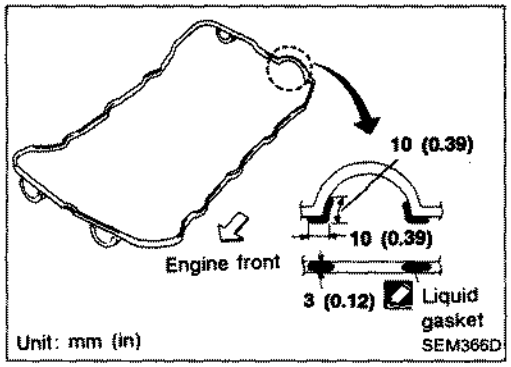




27. • SR20DE: Install intake manifold supports.
    • SR20DET: Install intake manifold supports and intercooler support bracket.

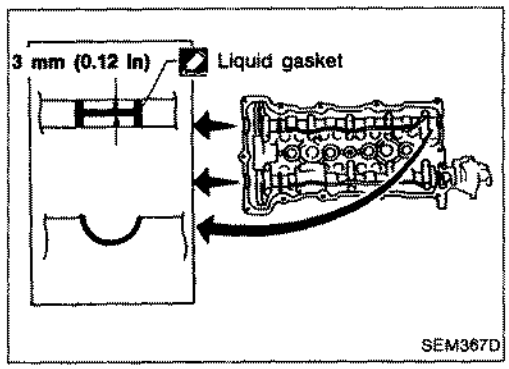


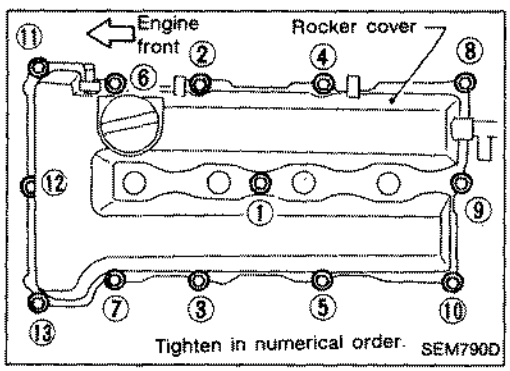
Installation (Cont'd)



28. Before installing rocker cover, remove all traces of liquid gasket from mating surface of rocker cover gasket to cylinder head.
29. Apply a continuous bead of liquid gasket to mating surface of rocker cover gasket and cylinder head.

- **Use Genuine Liquid Gasket or equivalent.**





30. Install rocker cover.

Rocker cover tightening procedure:

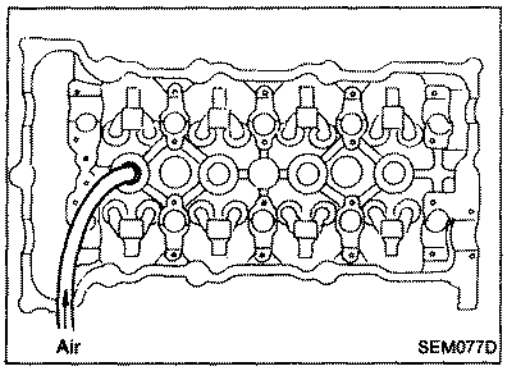
(1) Tighten nuts ① - ⑩ - ⑪ - ⑬ - ⑧ in that order to 4 N·m (0.4 kg-m, 2.9 ft-lb).

(2) Tighten nuts ① to ⑬ as indicated in figure to 8 to 10 N·m (0.8 to 1.0 kg-m, 5.8 to 7.2 ft-lb).

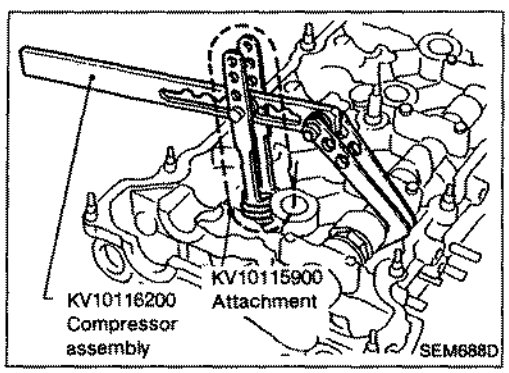
31. Install recirculation valve bracket. (SR20DET only)
32. Refit spark plugs and leads.
33. Install vacuum hoses, fuel hoses, wires, harness, connectors and so on.
34. Install power steering oil pump.
35. Install alternator.
36. Install water pump pulley and drive belts.
37. Install P.C.V. hoses to rocker cover.
38. • Install oil separator. (SR20DE)
    • Install oil separator, intercooler support bracket and rocker cover ornament. (SR20DET)
39. Install intercooler cover and intercooler. (SR20DET only)
40. Refit air duct to intake manifold.
41. Install radiator.
42. Refit hoses and refill with coolant.
    Refer to MA section.
43. Install engine side cover and front R.H. wheel.
44. Install engine under covers.

VALVE OIL SEAL

1. Remove accelerator cable.
2. Remove rocker cover and oil separator.
3. Remove camshafts and sprockets.
   Refer to "Removal" in "TIMING CHAIN".
4. Remove spark plugs.

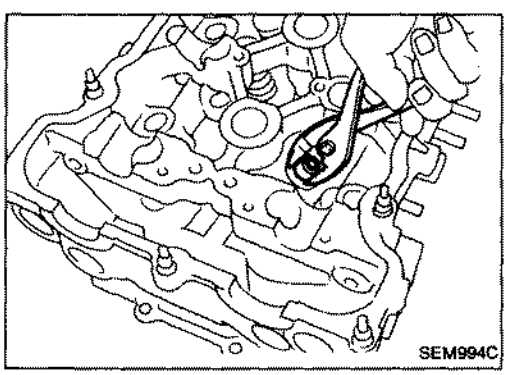


5. Install air hose adapter into spark plug hole and apply air pressure to hold valves in place. Apply a pressure of 490 kPa (4.9 bar, 5 kg/cm^2, 71 psi).
6. Remove rocker arm, rocker arm guide and shim.

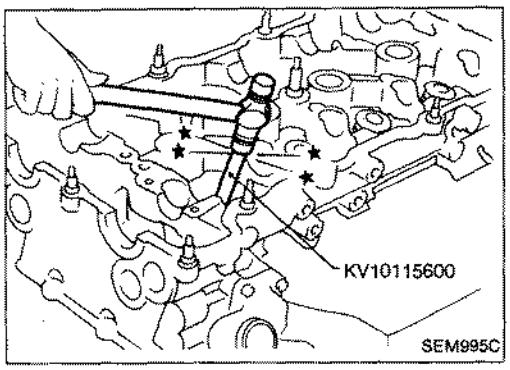


7. Remove valve spring with Tool.

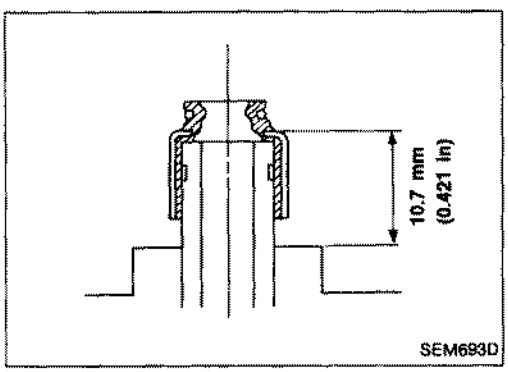
Piston concerned should be set at T.D.C. to prevent valve from falling.



8. Remove valve oil seal.

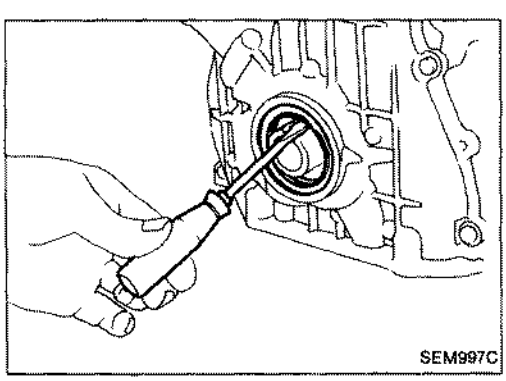


9. Apply engine oil to new valve oil seal and install it with Tool.



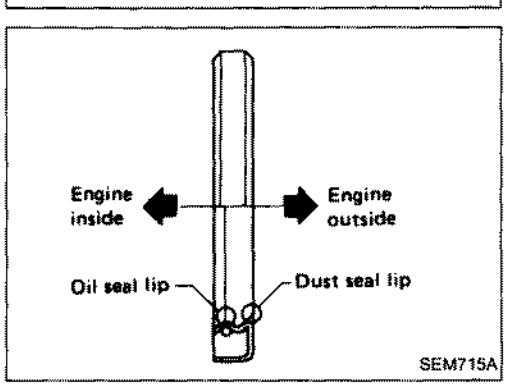
FRONT OIL SEAL

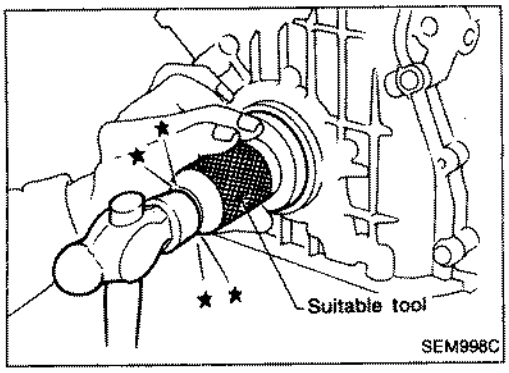
1. Remove the following parts:
- Engine under cover
- Front R.H. wheel and engine side cover
- Drive belts
- Crankshaft pulley



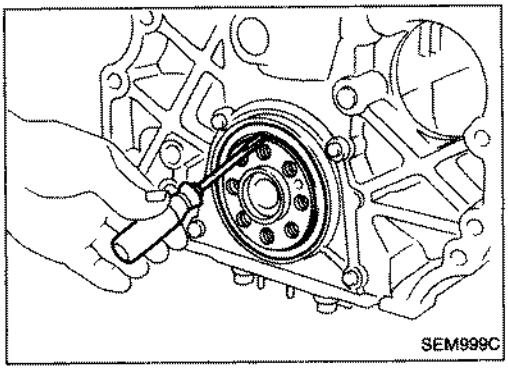
2. Remove front oil seal.

Be careful not to scratch front cover.





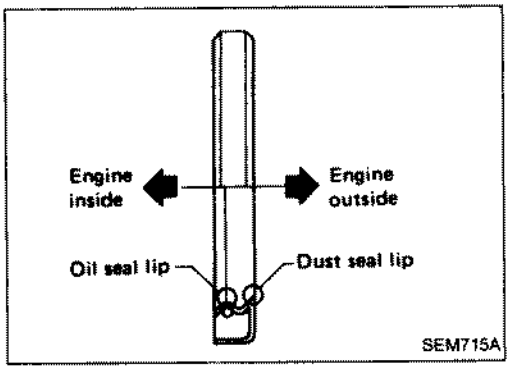
3. Apply engine oil to new oil seal and install it using a suitable tool.

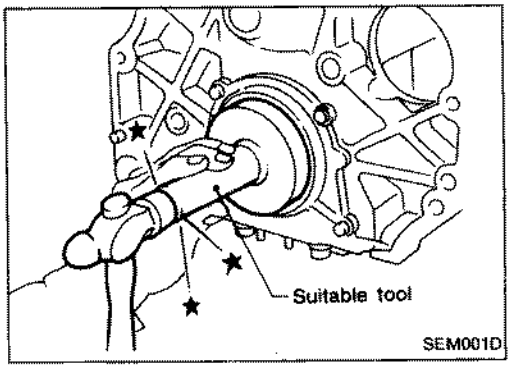


REAR OIL SEAL

1. Remove transaxle. (Refer to MT section.)
2. Remove flywheel.
3. Remove rear oil seal.

Be careful not to scratch rear oil seal retainer.

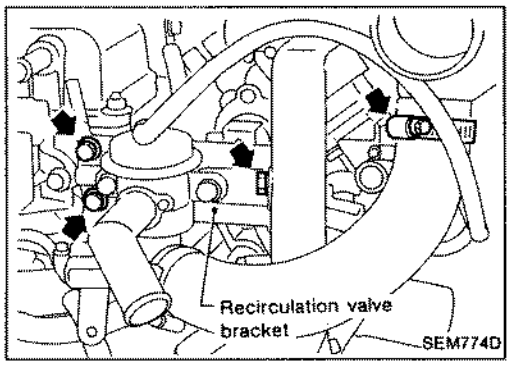




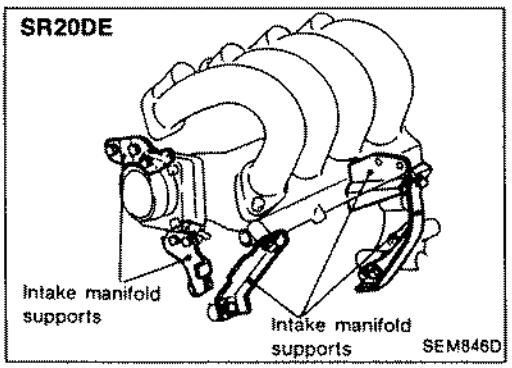
4. Apply engine oil to new oil seal and install it using a suitable tool.

Removal

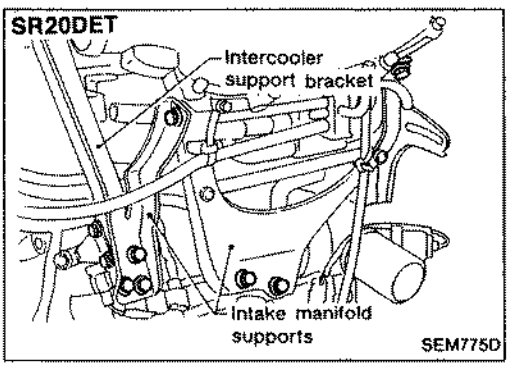
1. Release fuel pressure.
   Refer to "Releasing Fuel Pressure" in section EF & EC.
2. Drain coolant by removing cylinder block drain plug.
3. Remove air duct from intake manifold.
4. Remove intercooler cover and intercooler. (SR20DET only)
5. Remove P.C.V. hoses from rocker cover.
6. Remove vacuum hoses, fuel hoses, wires, harnesses, connectors, etc.

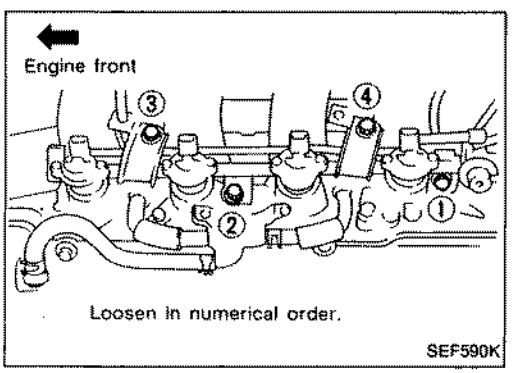


7. Remove recirculation valve bracket. (SR20DET only)



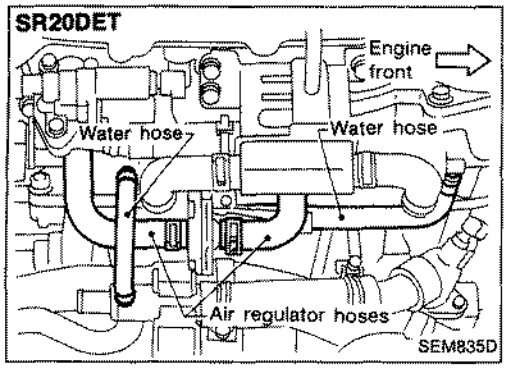
8. • SR20DE: Remove intake manifold supports.
   • SR20DET: Remove intake manifold supports and intercooler support bracket.



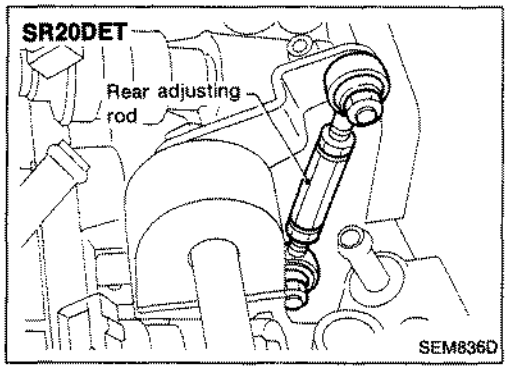


9. Remove fuel tube assembly. (SR20DE only)

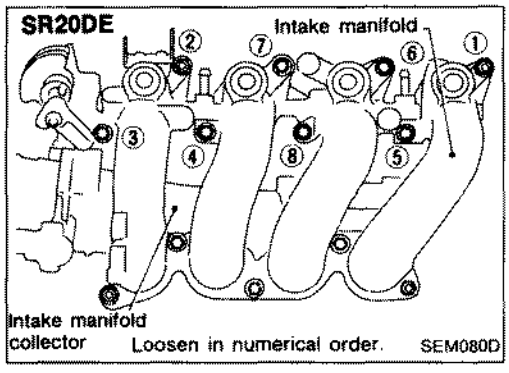
Removal (Cont'd)



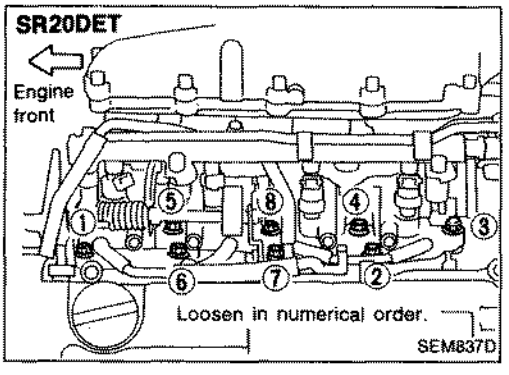
10. Remove the following hoses. (SR20DET only)
    - Air regulator hoses
    - Water hoses

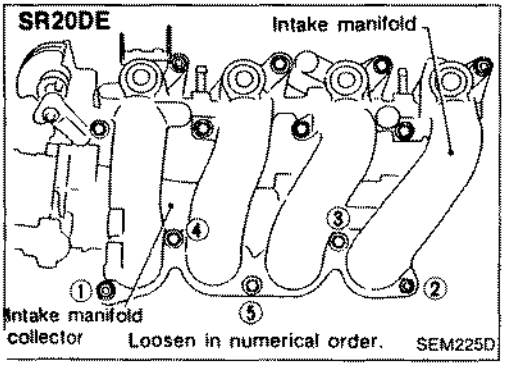


11. Remove rear adjusting rod. (SR20DET only)



12. Remove intake manifold.



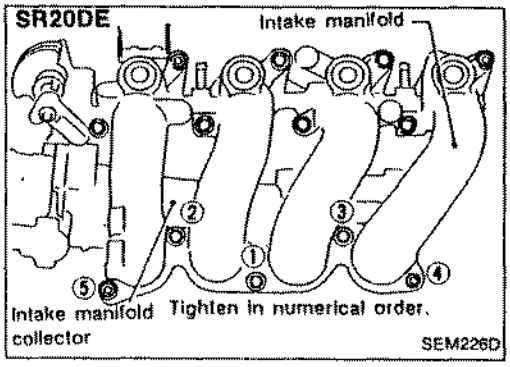


Disassembly and Assembly

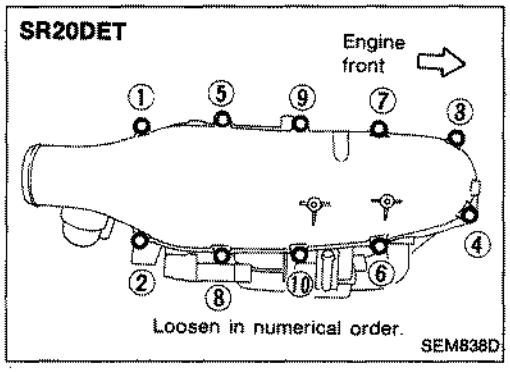
SR20DE

1. Remove intake manifold collector.

Disassembly and Assembly (Cont'd)

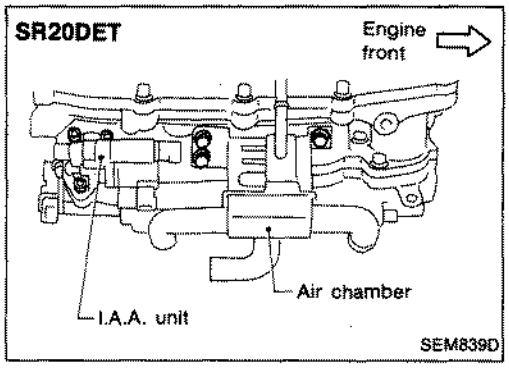


2. Install intake manifold collector.

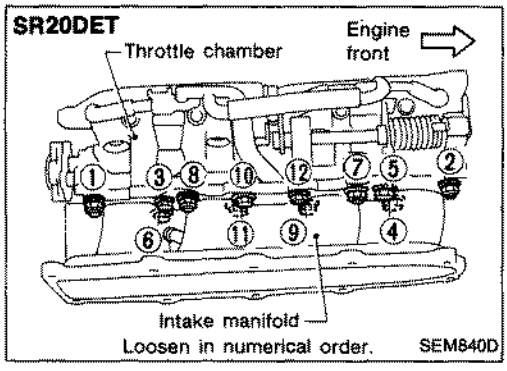


SR20DET

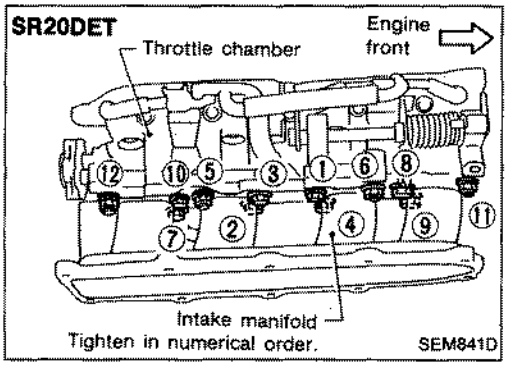
1. Remove intake manifold collector.



2. Remove air chamber and I.A.A. unit.
3. Remove injector tube assembly.
   Refer to "Injector Removal and Installation" in EF & EC section.

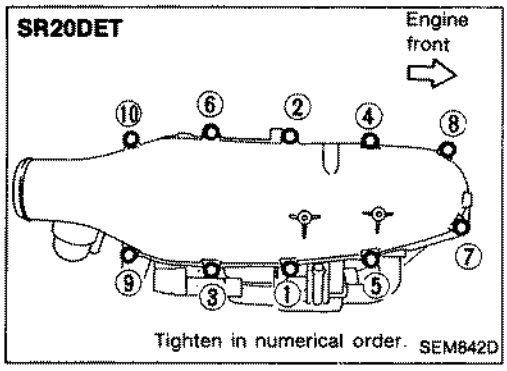


4. Remove intake manifold.

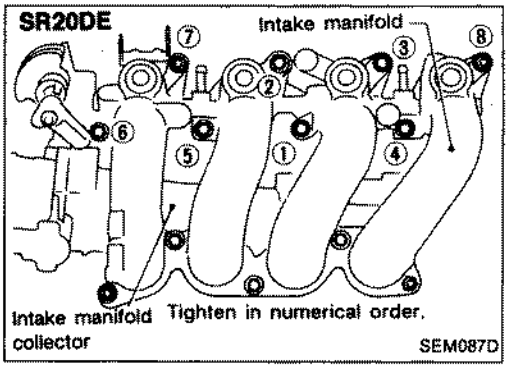


5. Install intake manifold.
6. Install injector tube assembly.
   Refer to "Injector Removal and Installation" in EF & EC section.
7. Install air chamber and I.A.A. unit.

Disassembly and Assembly (Cont'd)

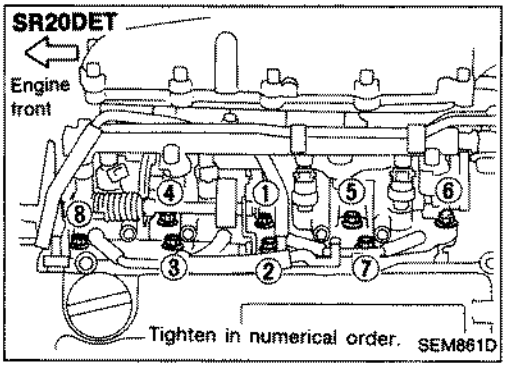


8. Install intake manifold collector.

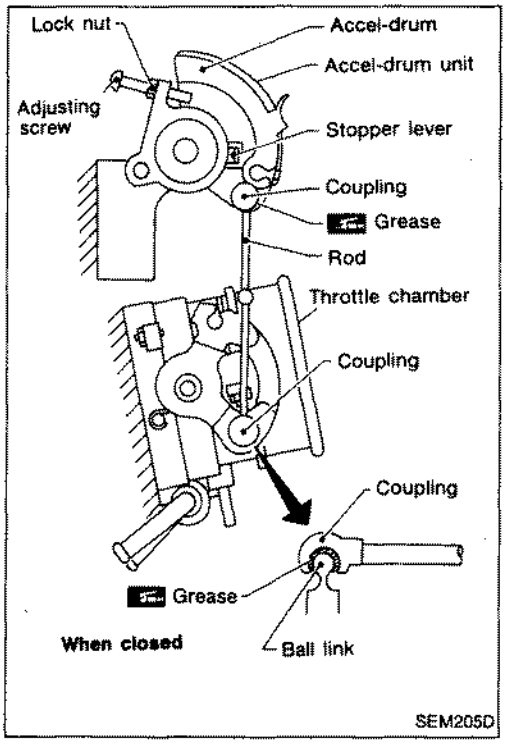


Installation

1. Install intake manifold.



2. Reinstall any parts removed in reverse order of removal.



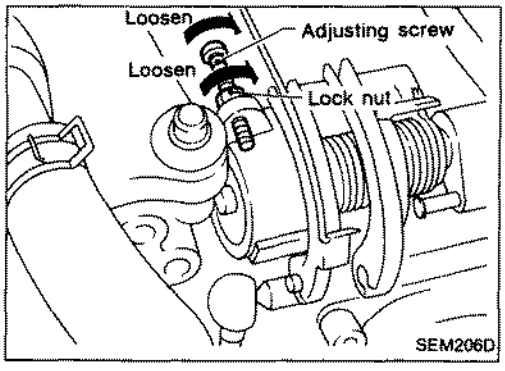
Adjust accel-drum unit whenever any of the following parts (new or old) are installed:

- **Accel-drum unit**
- **Throttle chamber**
- **Rod (Always replace with a new one after removal.)**

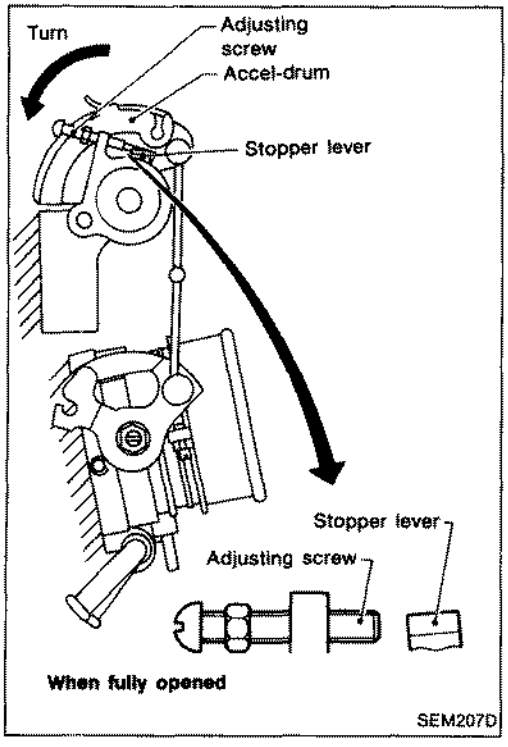
1. Install accel-drum unit and throttle chamber.
2. Apply grease all over the inside of the rod couplings.

Use genuine Nissan grease or equivalent.

3. Insert each one coupling to ball links of throttle chamber and accel-drum unit.

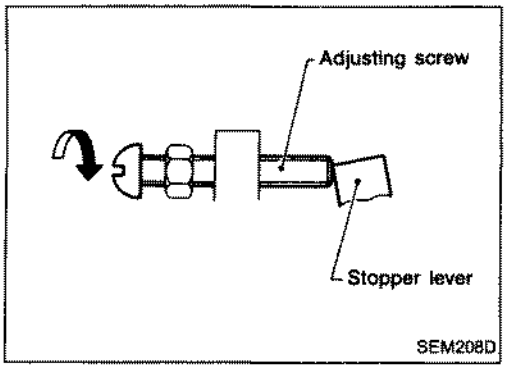


4. Loosen lock nut.
5. Loosen adjusting screw enough.

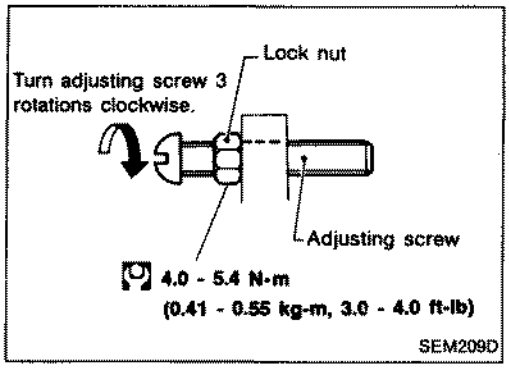


6. Manually turn accel-drum until throttle valve is fully open.

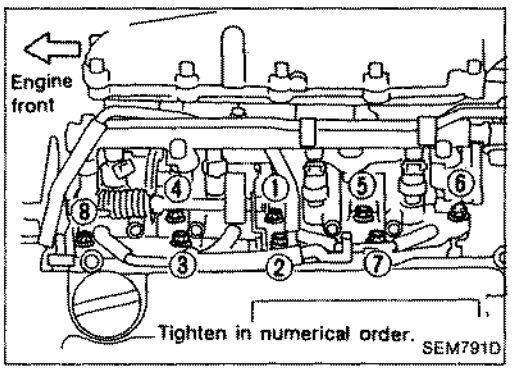
- Check that stopper lever is not touching adjusting screw. If it is, loosen adjusting screw to maintain clearance between the two.



7. Turn adjusting screw until it touches stopper lever.
8. Back off accel-drum.



9. Turn adjusting screw 3 rotations clockwise.
10. Tighten lock nut.



Installation

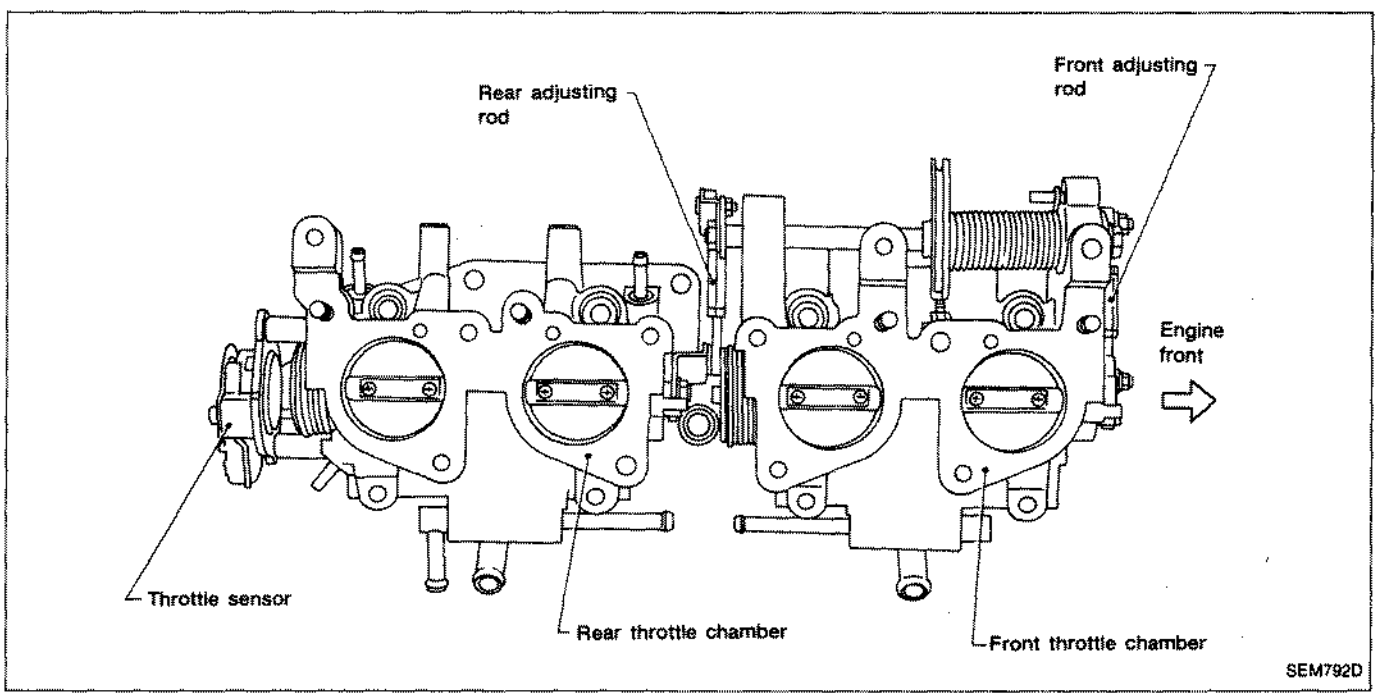
1. Install throttle chamber assembly.

Adjustment

Adjust throttle chambers whenever any of the following parts (new or old) are installed.

- **Throttle chambers.**
- **Adjusting rods.**

The above adjustment is made to equalize the four throttle valve positions.

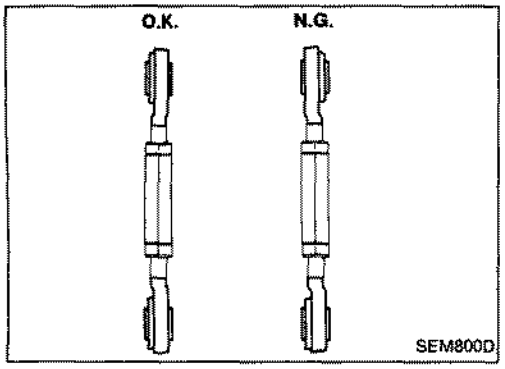


Throttle chamber adjustments

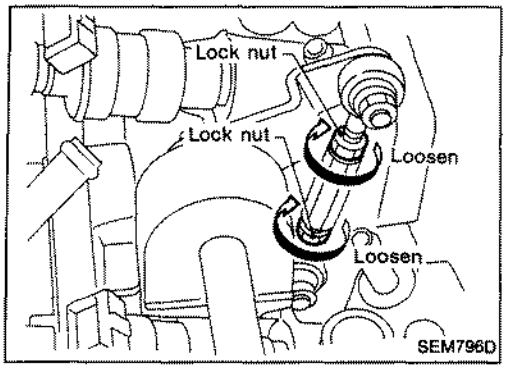
	Parts to be adjusted
When old throttle chamber assembly is reused.	Rear adjusting rod*
When throttle chamber assembly is replaced with a new one.	
When rear throttle chamber or rear adjusting rod is replace with a new one.	
When front adjusting rod is replaced with a new one.	Front adjusting rod
When front throttle chamber is replaced with a new one.	Front and rear adjusting rods

*: Front adjusting rod is adjusted at the factory and normally requires no adjustment in the field.

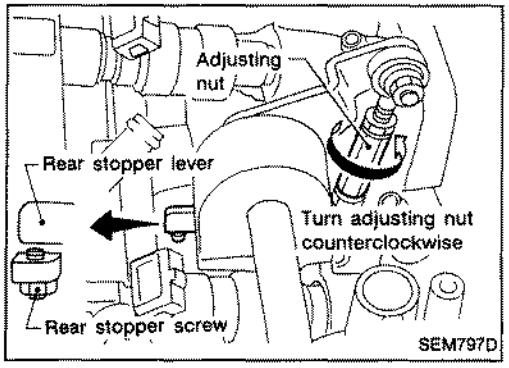
Adjustment (Cont'd)



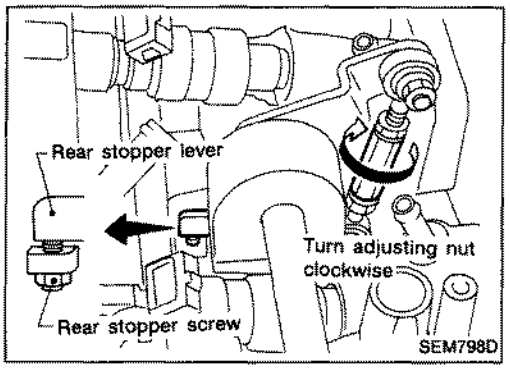
When installing rear adjusting rod, make sure it faces the correct direction, as shown in figure at left.



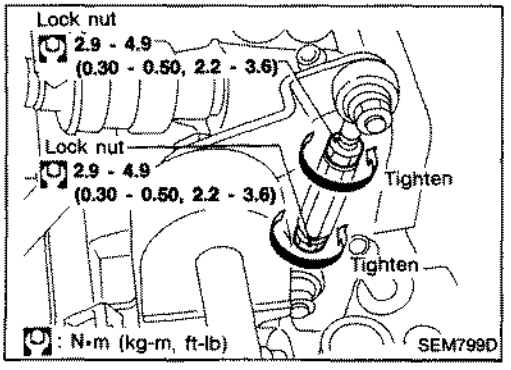
1. Loosen lock nuts.



2. Turn adjusting nut counterclockwise until rear stopper lever is slightly away from rear stopper screw.

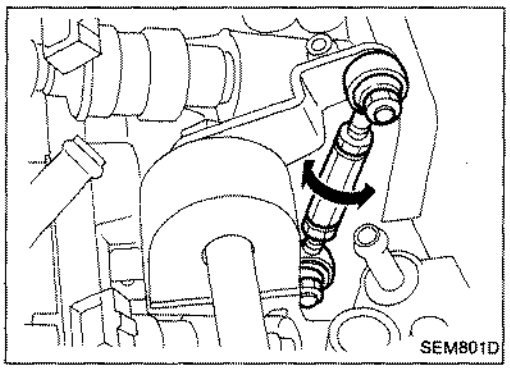


3. Turn adjusting nut clockwise until rear stopper lever contacts rear stopper screw or immediately before resistance is felt.



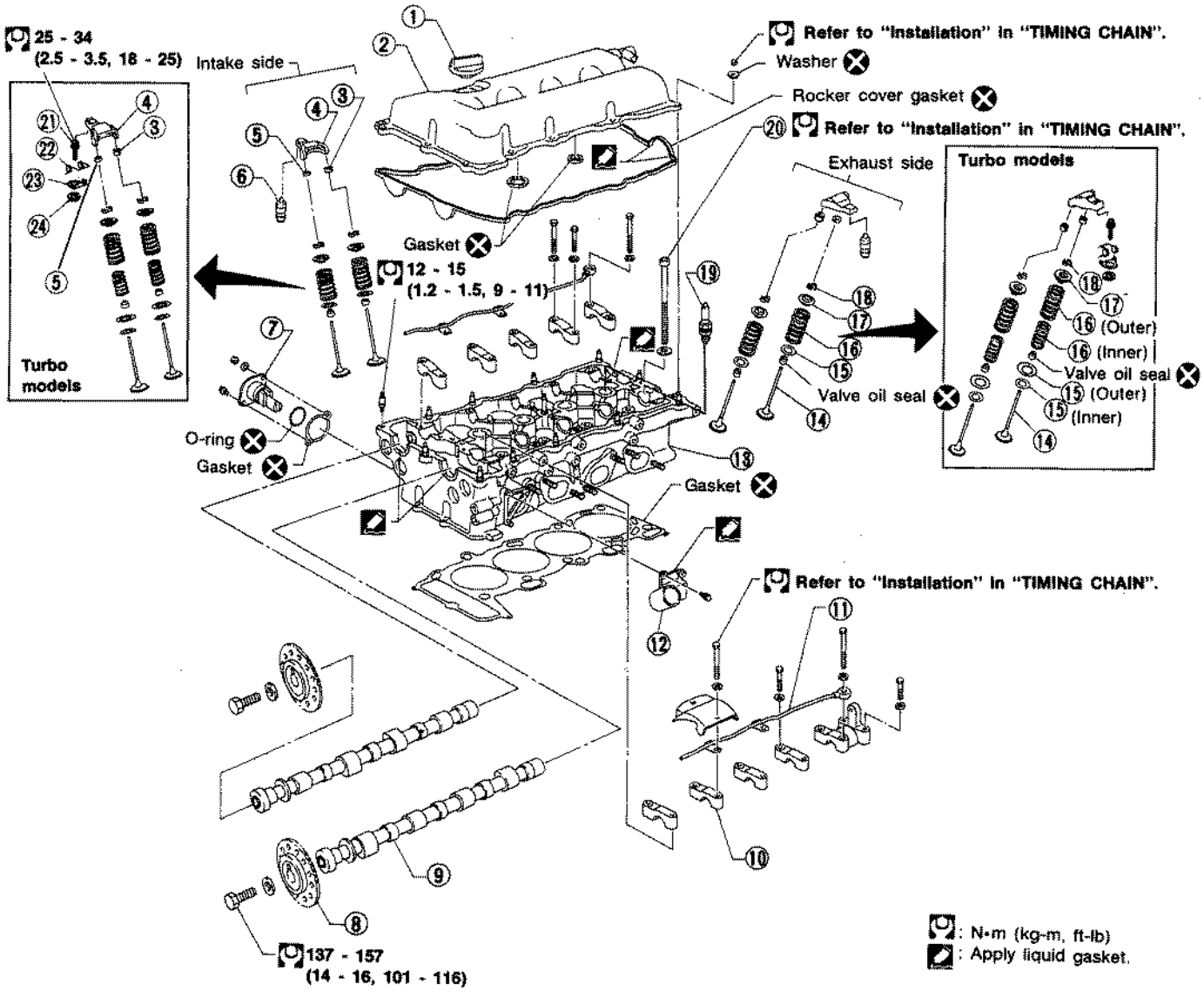
4. Prevent adjusting nut from turning and tighten lock nuts.

Adjustment (Cont'd)



5. Check front and rear adjusting rods for smooth and equal rotation. If not, readjust.

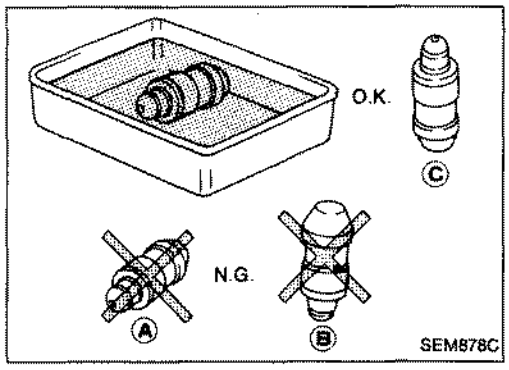
If front adjusting rod is to be adjusted, use the same adjustment procedure as that used for the rear adjusting rod.



SEM794D

① Oil filler cap
② Rocker cover
③ Rocker arm guide
④ Rocker arm
⑤ Shim
⑥ Hydraulic lash adjuster
⑦ Chain tensioner
⑧ Camshaft sprocket
⑨ Camshaft
⑩ Camshaft bracket
⑪ Oil tube
⑫ Water outlet
⑬ Cylinder head
⑭ Valve
⑮ Valve spring seat
⑯ Valve spring
⑰ Valve spring retainer
⑱ Valve collet
⑲ Spark plug
⑳ Cylinder head bolt
㉑ Rocker pivot
㉒ Rocker arm spring
㉓ Rocker arm spring retainer
㉔ Washer

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, camshaft sprocket bolts and camshaft bracket bolts, apply new engine oil to thread portions and seat surfaces of bolts.**

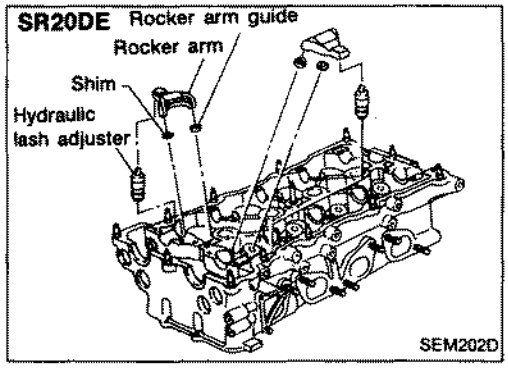


- **If a hydraulic lash adjuster is kept on its side, there is a risk of air entering it. After removal, always set hydraulic lash adjuster straight up, or when laying it on its side, have it soak in new engine oil.**
- **Do not disassemble hydraulic lash adjusters.**
- **Attach tags to lash adjusters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

Removal

1. • SR20DE: Remove cylinder head with intake and exhaust manifolds.
   • SR20DET: Remove cylinder head with intake manifold.

This removal is the same procedure as that for timing chain. Refer to "Removal" in "TIMING CHAIN".

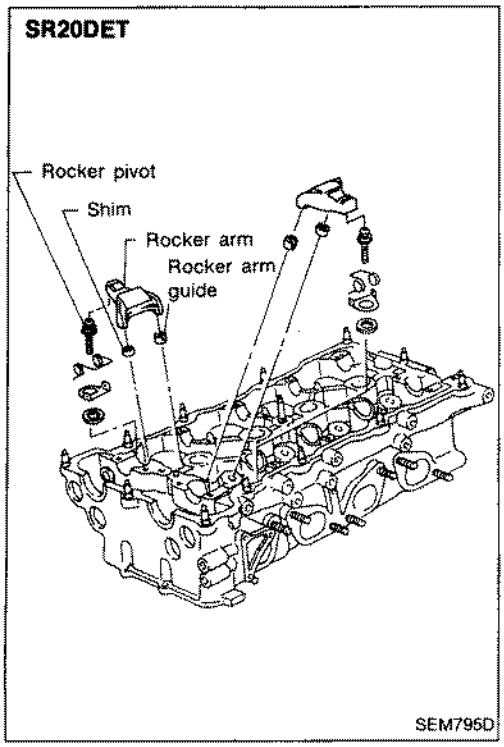


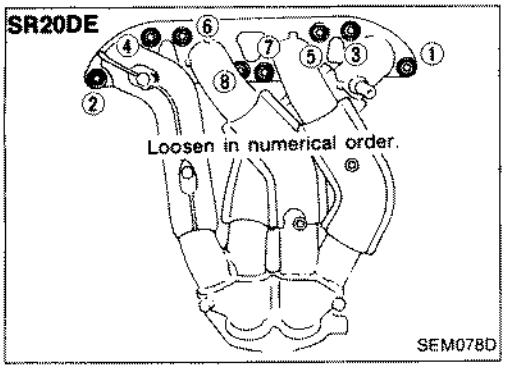
Disassembly

1. • SR20DE: Remove rocker arms, shims, rocker arm guides and hydraulic lash adjusters from cylinder head.
   • SR20DET: Remove rocker arms, shims, rocker arm guides and rocker pivots from cylinder head.

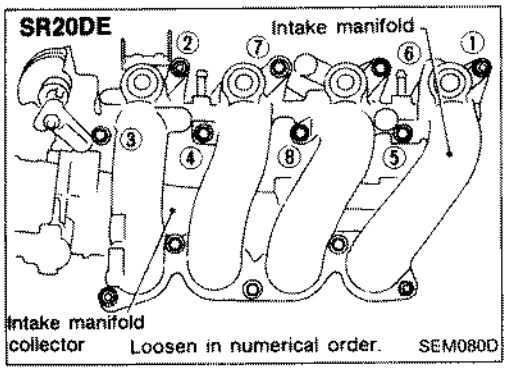
CAUTION:
Keep parts in order so that they can be installed in their original positions during assembly. (Install parts in their original positions.)

Disassembly (Cont'd)

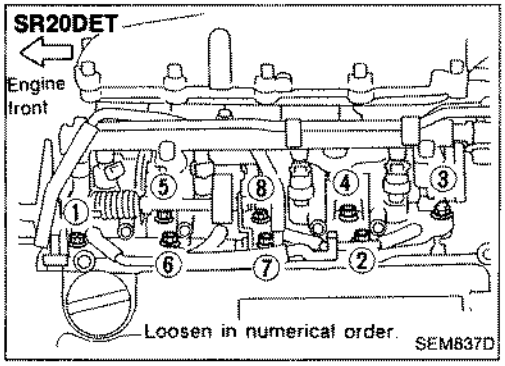




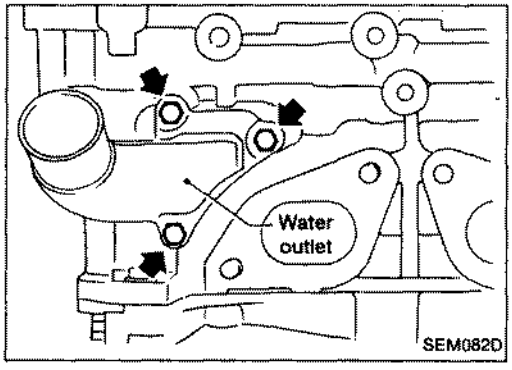
2. Remove exhaust manifold cover. (SR20DE only)
3. Remove exhaust manifold. (SR20DE only)



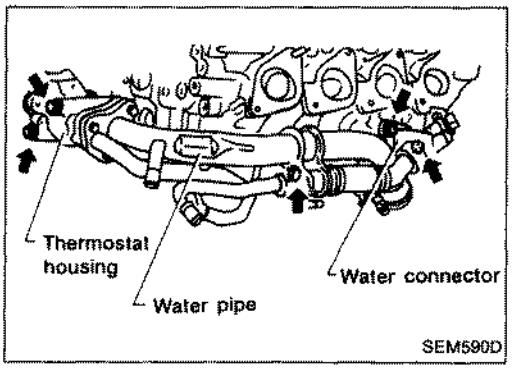
4. Remove intake manifold.



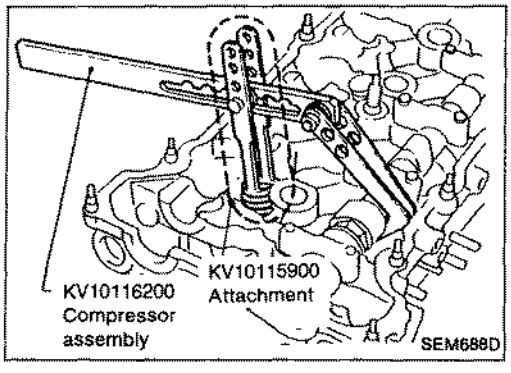
Disassembly (Cont'd)



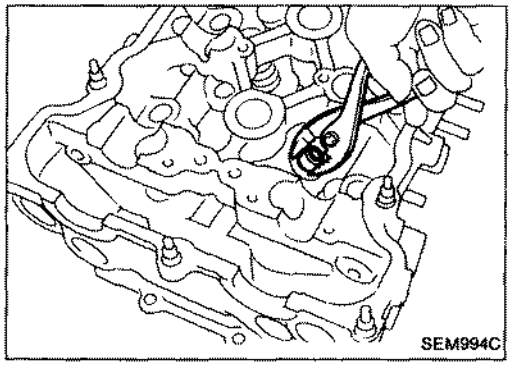
5. Remove water outlet.



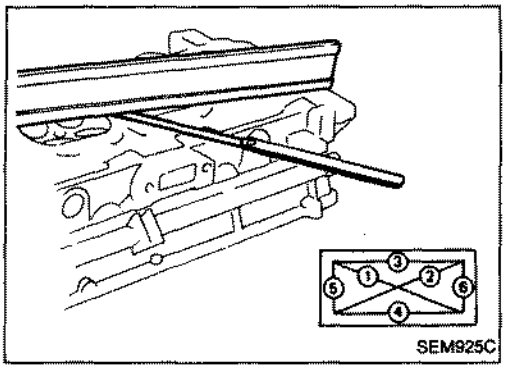
6. Remove water connector.
7. Remove thermostat housing with water pipe.



8. Remove valve components with Tool.



9. Remove valve oil seal with a suitable tool.



Inspection

CYLINDER HEAD DISTORTION

Head surface flatness:

Standard

Less than 0.03 mm (0.0012 in)

Limit

0.1 mm (0.004 in)

If beyond the specified limit, replace or resurface.

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)

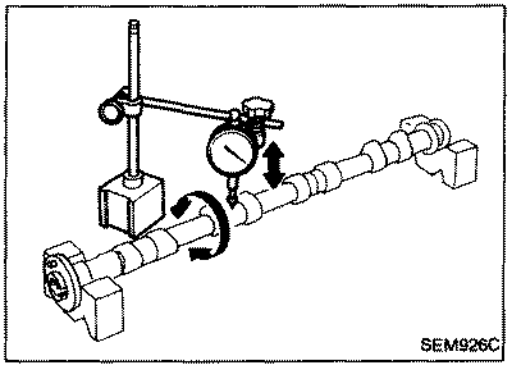
After resurfacing cylinder head, check that camshaft rotates freely by hand. If resistance is felt, cylinder head must be replaced.

Nominal cylinder head height:

136.9 - 137.1 mm (5.390 - 5.398 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):

Standard

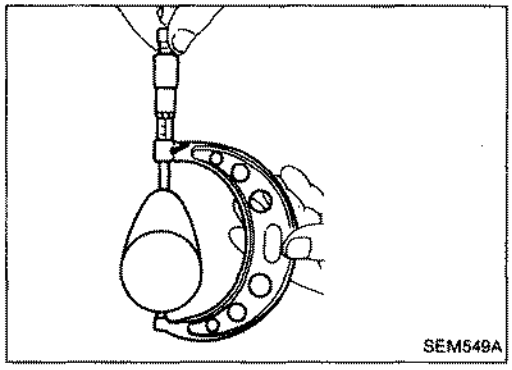
Less than 0.02 mm (0.0008 in)

Limit

0.1 mm (0.004 in)

2. If it exceeds the limit, replace camshaft.

Inspection (Cont'd)


SEM549A

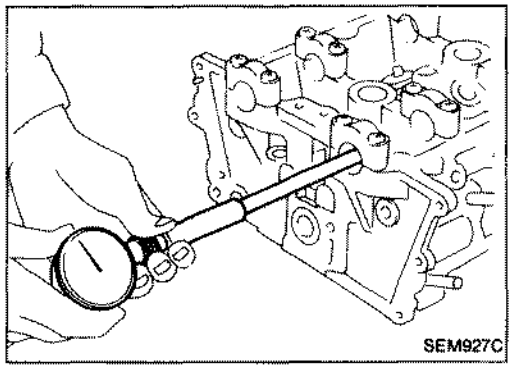
CAMSHAFT CAM HEIGHT

1. Measure camshaft cam height.

Unit: mm (in)

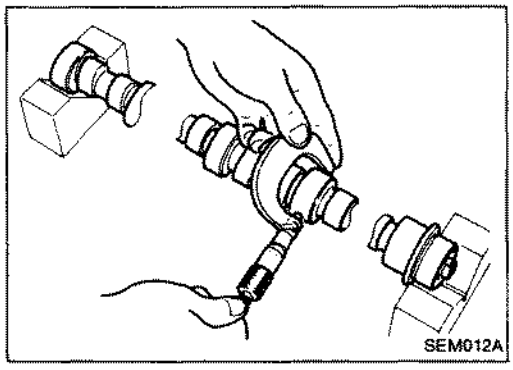
Engine	SR20DE	SR20DET
Standard cam height		
Intake	38.408 - 38.598 (1.5121 - 1.5196)	38.648 - 38.838 (1.5216 - 1.5291)
Exhaust	37.920 - 38.110 (1.4929 - 1.5004)	38.648 - 38.838 (1.5216 - 1.5291)
Cam wear limit		
Intake & Exhaust	0.20 (0.0079)	0.20 (0.0079)

2. If wear is beyond the limit, replace camshaft.

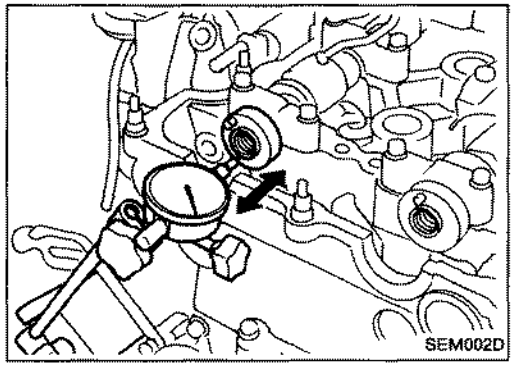

SEM927C

CAMSHAFT JOURNAL CLEARANCE

1. Install camshaft bracket and tighten bolts to the specified torque.
2. Measure inner diameter of camshaft bearing.
   Standard inner diameter:
   28.000 - 28.021 mm (1.1024 - 1.1032 in)


SEM012A

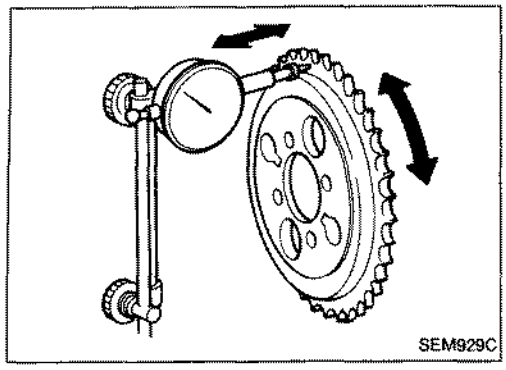
3. Measure outer diameter of camshaft journal.
   Standard outer diameter:
   27.935 - 27.955 mm (1.0998 - 1.1006 in)
4. If clearance exceeds the limit, replace camshaft and/or cylinder head.
   Camshaft journal clearance:
   Standard
   0.045 - 0.086 mm (0.0018 - 0.0034 in)
   Limit
   0.12 mm (0.0047 in)


SEM002D

CAMSHAFT END PLAY

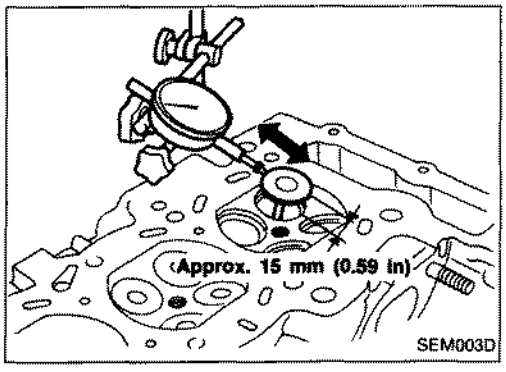
1. Install camshaft in cylinder head.
2. Measure camshaft end play.
   Camshaft end play:
   Standard
   0.055 - 0.139 mm (0.0022 - 0.0055 in)
   Limit
   0.20 mm (0.0079 in)

Inspection (Cont'd)



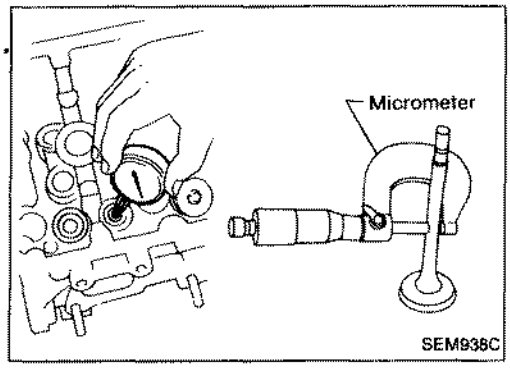
CAMSHAFT SPROCKET RUNOUT

1. Install sprocket on camshaft.
2. Measure camshaft sprocket runout.
   Runout (Total indicator reading):
   Limit 0.25 mm (0.0098 in)
3. If it exceeds the limit, replace camshaft sprocket.



VALVE GUIDE CLEARANCE

1. Measure valve deflection in a parallel direction with rocker arm. (Valve and valve guide mostly wear in this direction.)
   Valve deflection limit (Dial gauge reading):
   Intake & Exhaust
   0.2 mm (0.008 in)



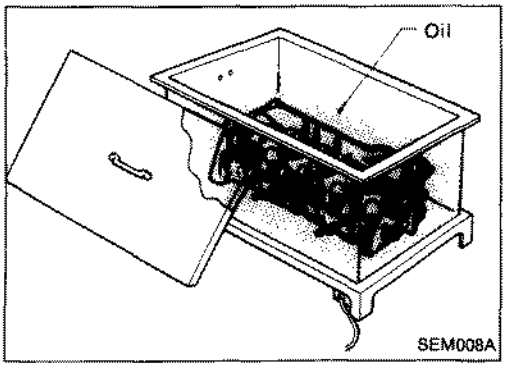
2. If it exceeds the limit, check valve to valve guide clearance.
a. Measure valve stem diameter and valve guide inner diameter.
b. Check that clearance is within specification.

Valve to valve guide clearance:

Unit: mm (in)

	Standard	Limit
Intake	0.020 - 0.053 (0.0008 - 0.0021)	0.1 (0.004)
Exhaust	0.040 - 0.073 (0.0016 - 0.0029)	0.1 (0.004)

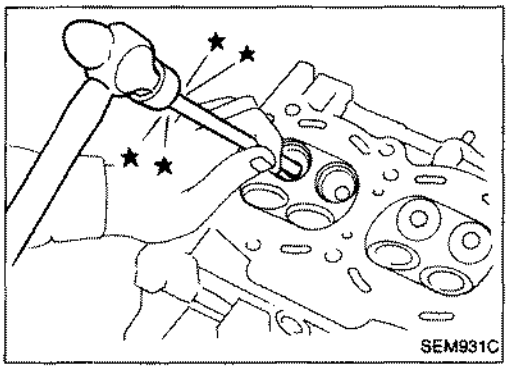
c. If it exceeds the limit, replace valve or valve guide.



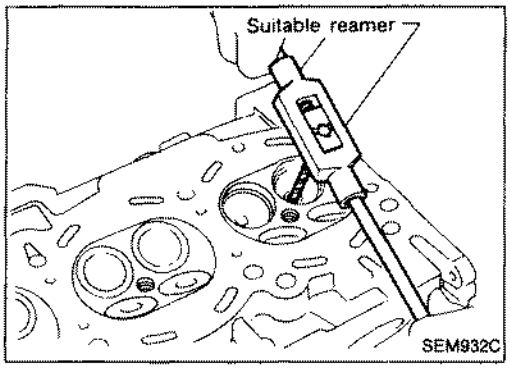
VALVE GUIDE REPLACEMENT

1. To remove valve guide, heat cylinder head to 110 to 130°C (230 to 266°F).

Inspection (Cont'd)

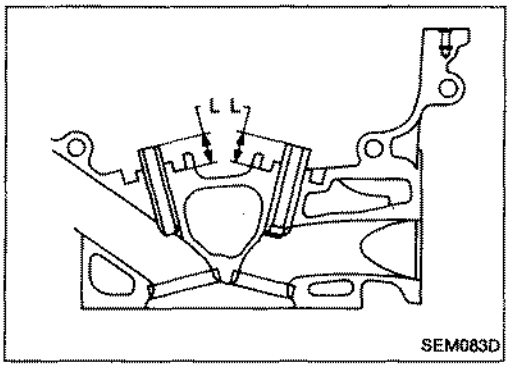

SEM931C

2. Press out valve guide or use a hammer and suitable tool.



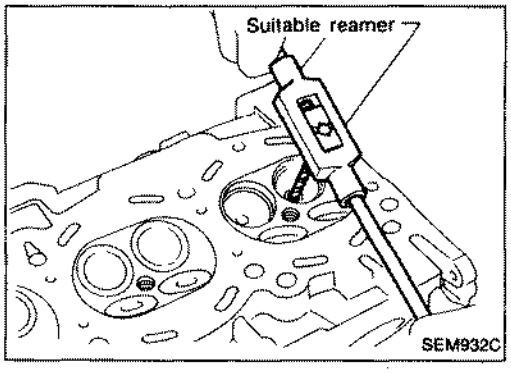
SEM932C

3. Ream cylinder head valve guide hole.
   Valve guide hole diameter
   (for service parts):
   Intake
   10.175 - 10.196 mm (0.4006 - 0.4014 in)
   Exhaust
   11.175 - 11.196 mm (0.4400 - 0.4408 in)



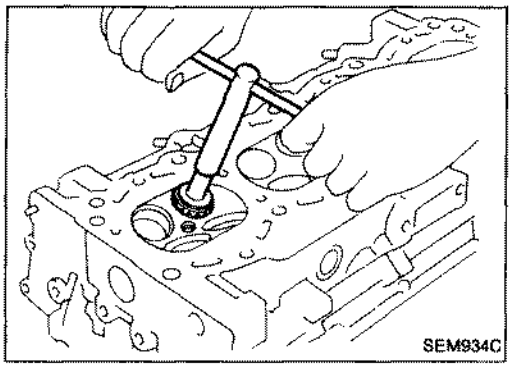
SEM083D

4. Heat cylinder head to 110 to 130°C (230 to 266°F) and press service valve guide onto cylinder head.
   Projection "L":
   14.0 - 14.2 mm (0.551 - 0.559 in)



SEM932C

5. Ream valve guide.
   Valve guide inner diameter:
   Intake
   6.000 - 6.018 mm (0.2362 - 0.2369 in)
   Exhaust
   7.000 - 7.018 mm (0.2756 - 0.2763 in)

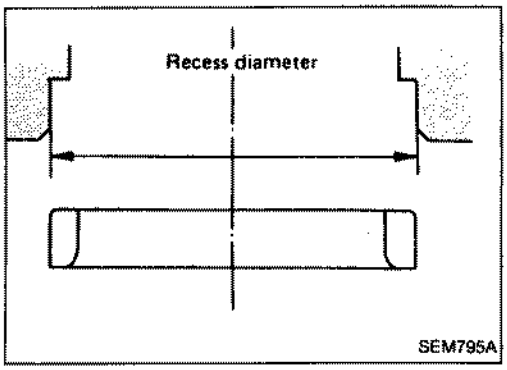

SEM934C

VALVE SEATS

Check valve seats for any evidence of pitting at valve contact surface, and reset 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.**

Inspection (Cont'd)

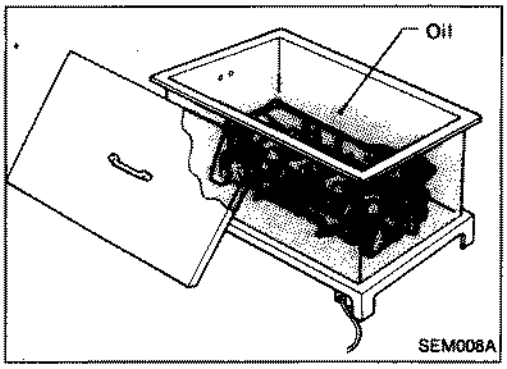


REPLACING VALVE SEAT FOR SERVICE PARTS

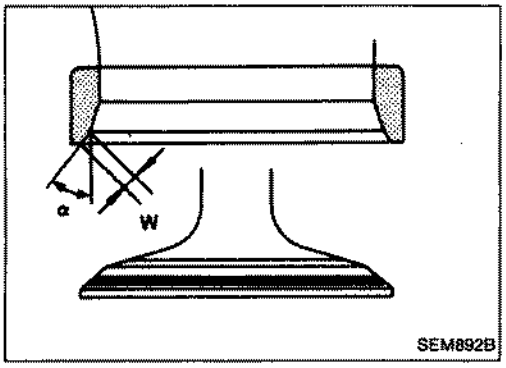
1. Bore out old seat until it collapses. The machine depth stop should be set so that boring cannot continue beyond the bottom face of the seat recess in cylinder head.
2. Ream cylinder head recess.

Reaming bore for service valve seat
Oversize [0.5 mm (0.020 in)]:
Intake
35.500 - 35.516 mm (1.3976 - 1.3983 in)
Exhaust
31.500 - 31.516 mm (1.2402 - 1.2408 in)

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

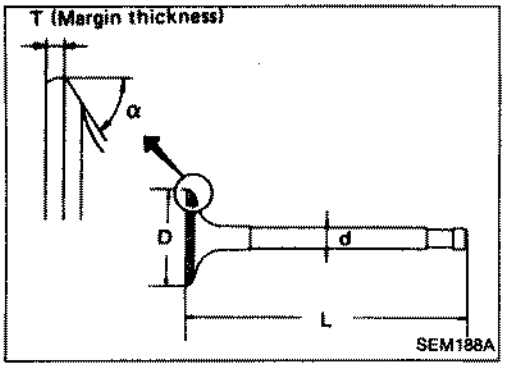


3. Heat cylinder head to 110 to 130°C (230 to 266°F).
4. Press fit valve seat until it seats on the bottom.



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

Seat face angle "α":
44°53' - 45°07' deg.
Contacting width "W":
Intake
1.4 - 1.7 mm (0.055 - 0.067 in)
Exhaust
1.7 - 2.0 mm (0.067 - 0.079 in)

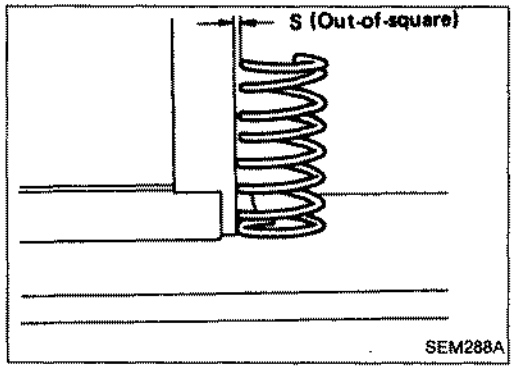


VALVE DIMENSIONS

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.

Inspection (Cont'd)



VALVE SPRING

Squareness

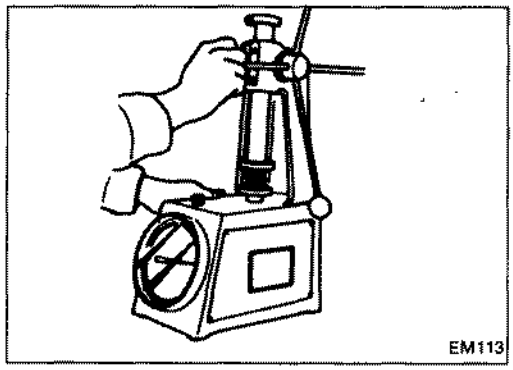
1. Measure "S" dimension.

Out-of-square:

Unit: mm (in)

SR20DE	SR20DET	
	Inner	Outer
Less than 2.2 (0.087)	Less than 1.8 (0.071)	Less than 2.1 (0.083)

2. If it exceeds the limit, replace spring.



Pressure

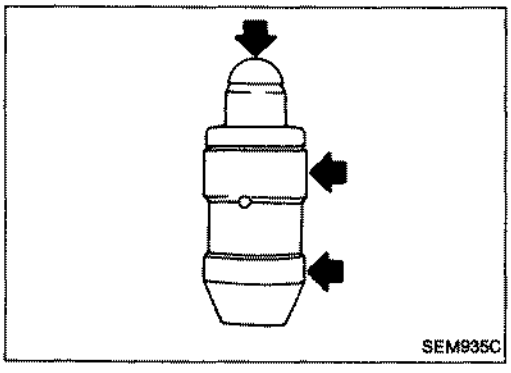
Check valve spring pressure.

Pressure:

N (kg, lb) at height mm (in)

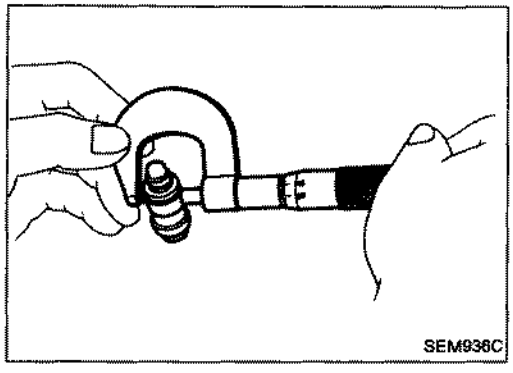
	SR20DE	SR20DET	
		Inner	Outer
Standard	569.00 - 641.57 (58.02 - 65.42, 127.93 - 144.25) at 30.0 (1.181)	154.95 - 174.76 (15.8 - 17.82, 34.84 - 39.29) at 20.6 (0.811)	451.51 - 504.18 (46.04 - 51.41, 101.52 - 113.36) at 27.9 (1.098)
Limit	More than 549.2 (56.0, 123.5) at 30.0 (1.181)	More than 147.1 (15.0, 33.1) at 20.6 (0.811)	More than 428.6 (43.7, 96.4) at 27.9 (1.098)

If it exceeds the limit, replace spring.



HYDRAULIC LASH ADJUSTER (SR20DE)

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

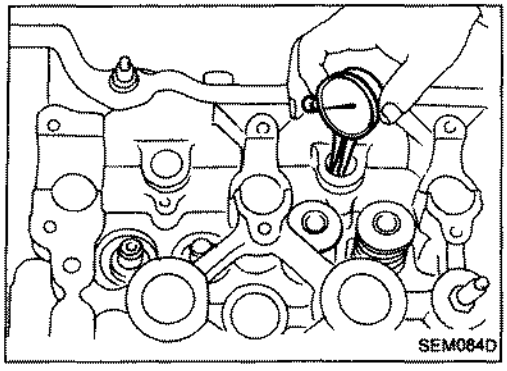


2. Check diameter of lash adjuster.

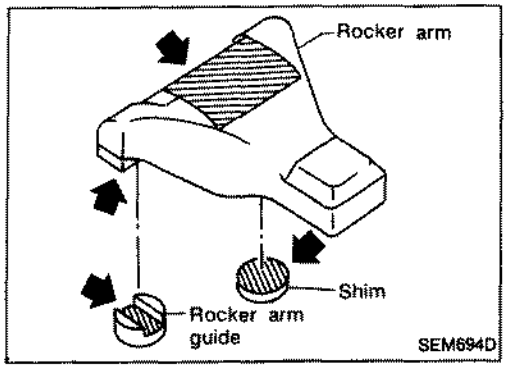
Outer diameter:

16.980 - 16.993 mm (0.6685 - 0.6690 in)

Inspection (Cont'd)


SEM084D

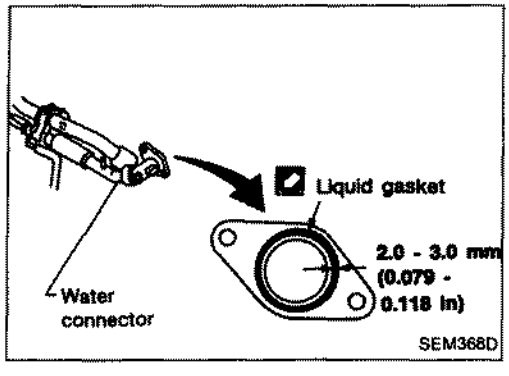
3. Check lash adjuster guide inner diameter.
   Inner diameter:
   17.000 - 17.020 mm (0.6693 - 0.6701 in)
   Standard clearance between lash adjuster and adjuster guide:
   0.007 - 0.040 mm (0.0003 - 0.0016 in)



SEM694D

ROCKER ARM, SHIM AND ROCKER ARM GUIDE

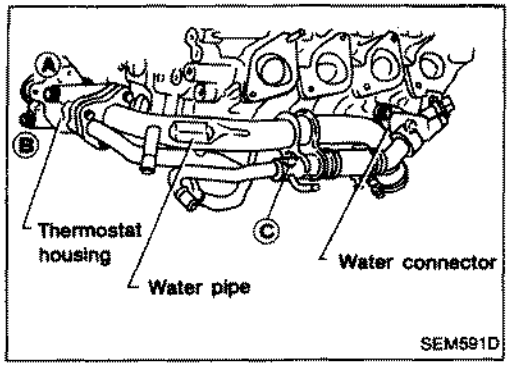
Check contact and sliding surfaces of rocker arms, shims and rocker arm guides for wear or scratches.



SEM368D

Assembly

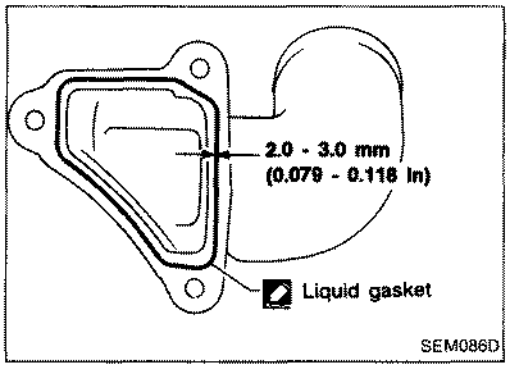
1. Install water connector.
(1) Before installing water connector, remove all traces of liquid gasket from mating surface using a scraper.
- Also remove traces of liquid gasket from mating surface of cylinder head.
(2) Apply a continuous bead of liquid gasket to mating surface of water connector.
- **Use Genuine Liquid Gasket or equivalent.**



SEM591D

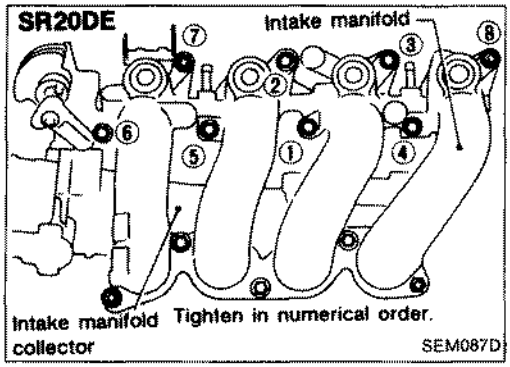
2. Install thermostat housing with water pipe.
- Tightening procedure:
(1) Tighten thermostat housing bolt Ⓐ to 2 - 5 N·m (0.2 - 0.5 kg-m, 1.4 - 3.6 ft-lb).
(2) Tighten water pipe bolt Ⓒ to 16 - 21 N·m (1.6 - 2.1 kg-m, 12 - 15 ft-lb).
(3) Tighten thermostat housing bolt Ⓐ to 16 - 21 N·m (1.6 - 2.1 kg-m, 12 - 15 ft-lb).
(4) Tighten thermostat housing bolt Ⓑ to 16 - 21 N·m (1.6 - 2.1 kg-m, 12 - 15 ft-lb).
- **Perform steps (2) through (4) after installing cylinder head on cylinder block.**

Assembly (Cont'd)

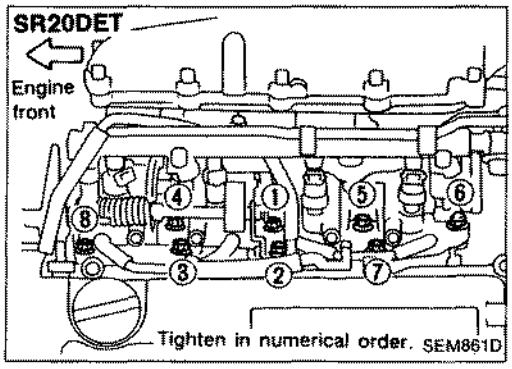


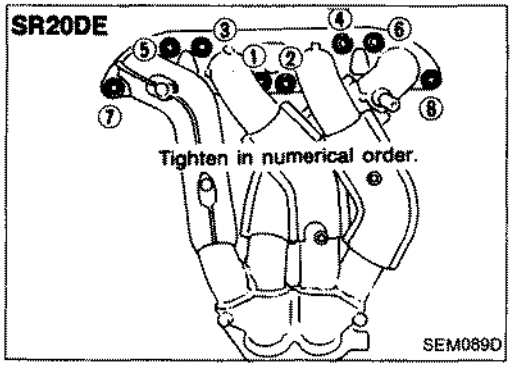
3. Install water outlet.
(1) Before installing water outlet, remove all traces of liquid gasket from mating surface using a scraper.
- Also remove traces of liquid gasket from mating surface of cylinder head.

(2) Apply a continuous bead of liquid gasket to mating surface of water outlet.
- **Use Genuine Liquid Gasket or equivalent.**

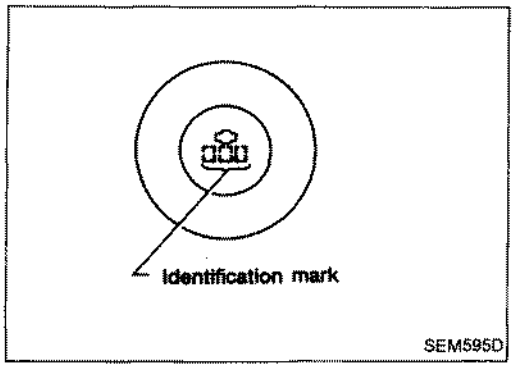


4. Install intake manifold.
Refer to "Installation" in "INTAKE MANIFOLD".





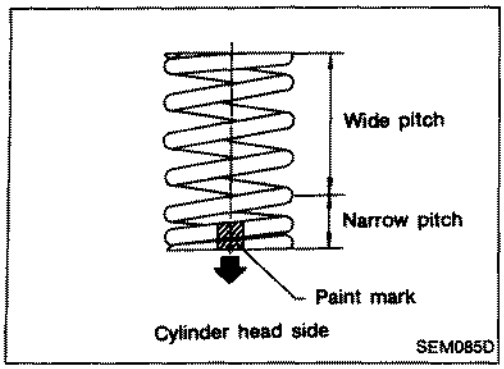
5. Install exhaust manifold. (SR20DE only)
6. Install exhaust manifold cover. (SR20DE only)



7. Install valve component parts.
- **Install valves, noting their identification marks as indicated in the table below.**

	Identification mark	
	SR20DE	SR20DET
Intake valve	53J	54C
Exhaust valve	5J	5C or no mark

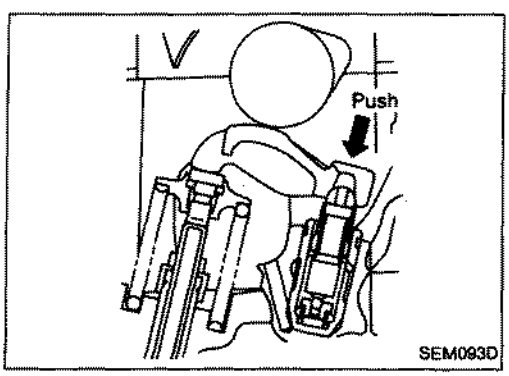
Assembly (Cont'd)



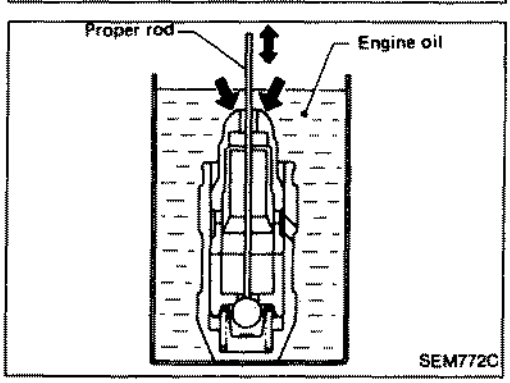
- **Always use new valve oil seal.**
  Refer to OIL SEAL REPLACEMENT.
- **Before installing valve oil seal, install valve spring seat.**
- **Install valve spring (uneven pitch type) with its narrow pitched side toward cylinder head side (paint mark).**

	SR20DE	SR20DET	
		Inner	Outer
Paint mark	Green	No color	Pink

- **After installing valve component parts, use plastic hammer to lightly tap valve stem tip to assure a proper fit.**

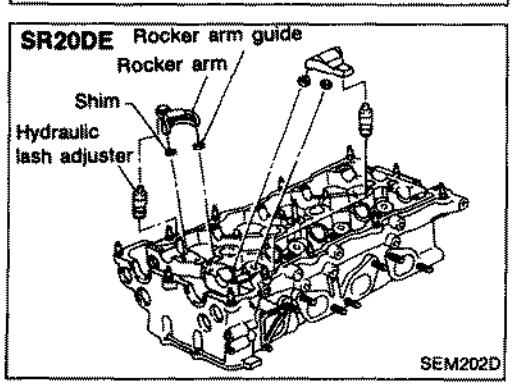


8. Check hydraulic lash adjusters. (SR20DE only)
(1) When rocker arm can be moved at least 1 mm (0.04 in) by pushing at hydraulic lash adjuster location, it indicates that there is air in the high pressure chamber.
Noise will be emitted from hydraulic lash adjuster if engine is started without bleeding air.



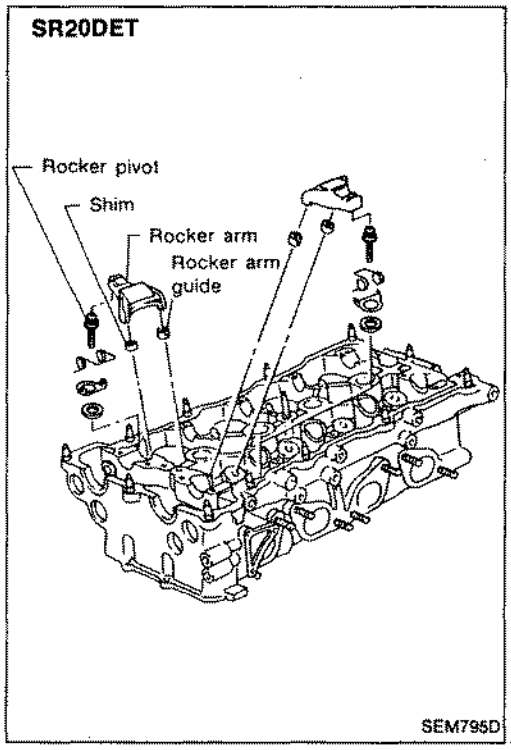
(2) Remove hydraulic lash adjuster and dip in a container filled with engine oil. While pushing plunger as shown in figure, lightly push check ball using a thin rod. Air is completely bled when plunger no longer moves.

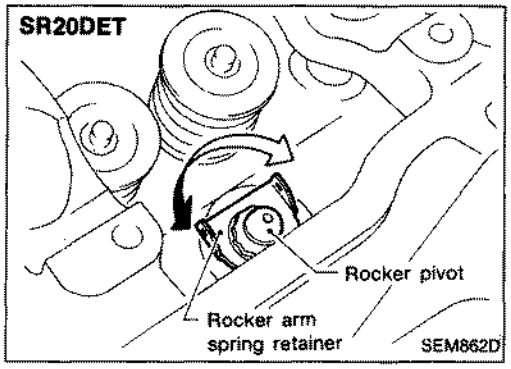
Air cannot be bled from this type of lash adjuster by running the engine.



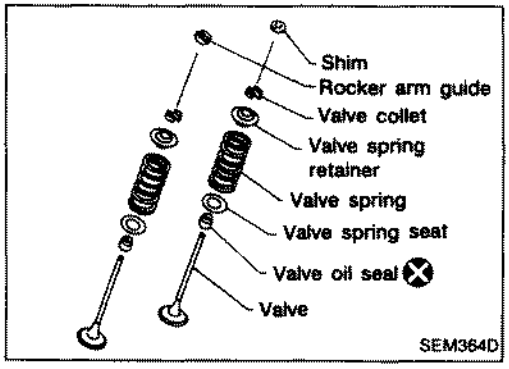
9. ● SR20DE: Install rocker arms, shims, rocker arm guides and hydraulic lash adjusters.
● SR20DET: Install rocker arms, rocker arm guides and rocker pivots.

CAUTION:
Install all parts in their original positions.





- **After installing rocker arm spring retainer, check that it moves smoothly right and left. (SR20DET only)**

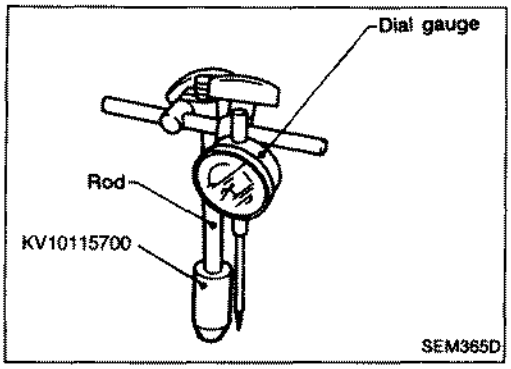


Valve Clearance Adjustment

SR20DE

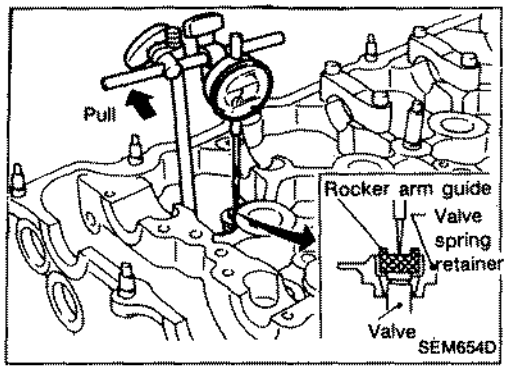
Select a suitable shim when replacing valve, cylinder head, shim, rocker arm guide and/or valve seat with new one(s), as follows:

1. Install valve component parts to cylinder head (Except shim).
- Always replace rocker arm guide with a new one.



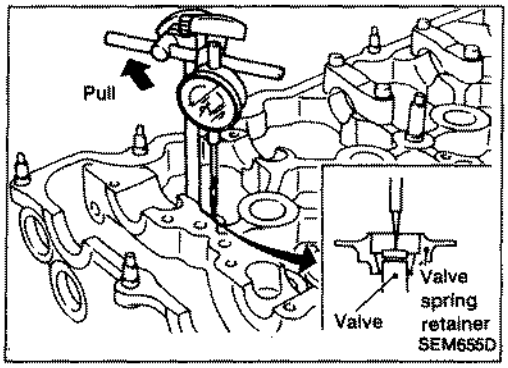
2. Remove hydraulic lash adjuster.
3. Install Tool* into hydraulic lash adjuster fixing hole.
   * Tool (KV10115700) is screwed into magnetic stand rod used with dial gauge.

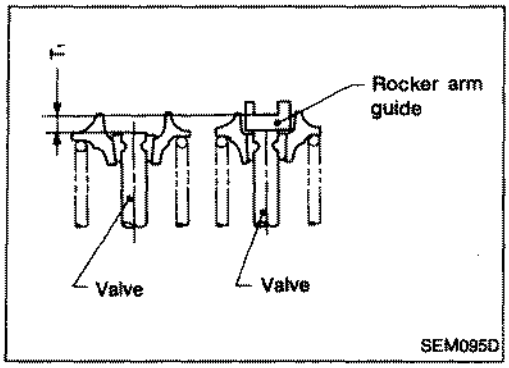
Valve Clearance Adjustment (Cont'd)

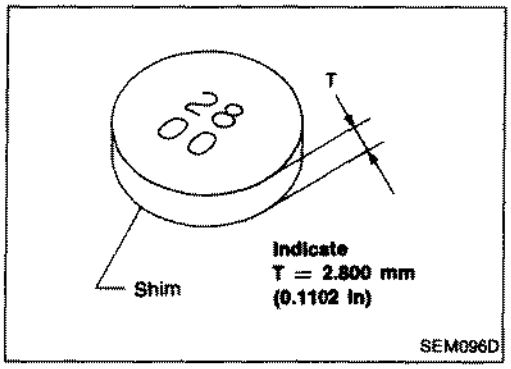


4. Measure difference in level (T_1) between sliding surface of rocker arm guide against rocker arm and valve stem end on shim side with valve, valve spring, collet, retainer and rocker arm guide installed to the head (Except shim),

When measuring, lightly pull dial indicator rod toward you to eliminate play in Tool (KV10115700).







5. Select a shim having a thickness (T) that makes –0.025 mm (–0.0010 in) ≦ [(T) – (T_1)] ≦ 0.025 mm (0.0010 in).

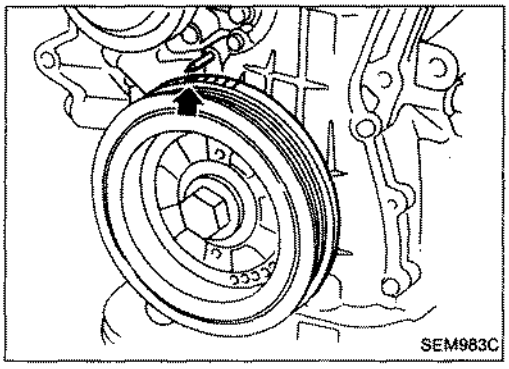
- Shims are available in 17 different thicknesses ranging from 2.800 mm (0.1102 in) to 3.200 mm (0.1260 in) in increments of 0.025 mm (0.0010 in).

SR20DET

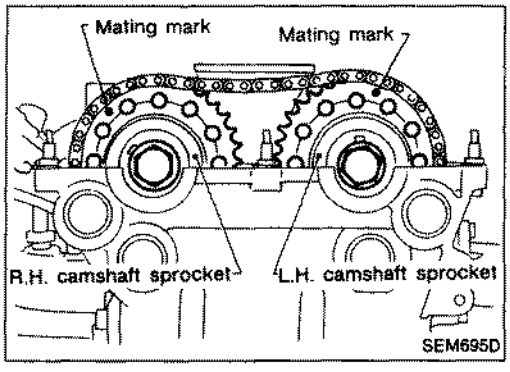
Check camshaft clearance while engine is warmed up sufficiently and not running.

1. Remove rocker cover.
2. Remove all spark plugs.

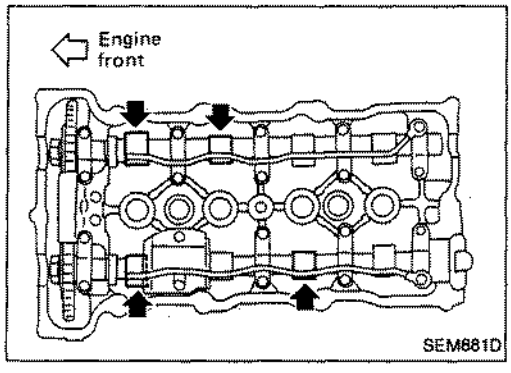
Valve Clearance Adjustment (Cont'd)



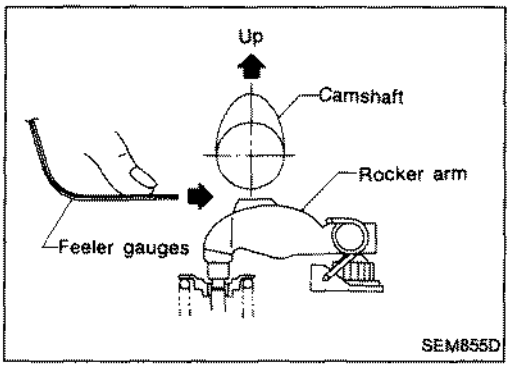
3. Set No. 1 piston at T.D.C. on the compression stroke by rotating crankshaft.



- **Rotate crankshaft until mating mark on camshaft sprocket is set at position indicated in figure at left.**

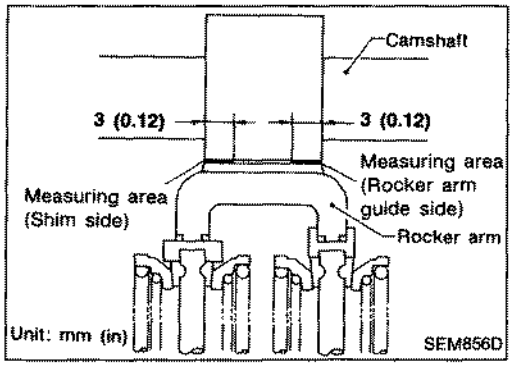


4. Check only those camshaft clearances shown in the figure.



1) Using *two feeler gauges (with one placed on the other), measure the camshaft-to-rocker arm clearance at two places (one on the shim side and one on the rocker arm guide side). Be sure to insert the gauges horizontally.

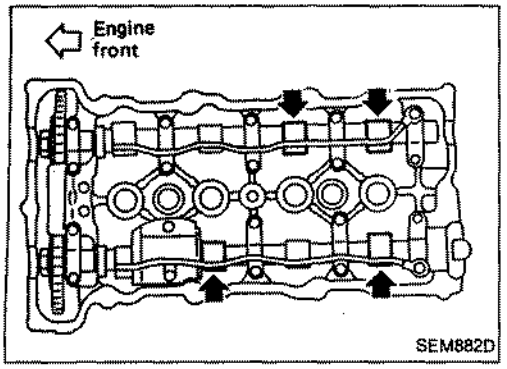
*: To minimize the measuring error.
- One feeler gauge increases the measurement error because the gauge is too stiff to bend.
- More than two gauges increases the gauge error twice as much, resulting in a considerable measurement error.



2) Record any valve clearance measurements which are out of specification.
They will be used later to determine the required replacement adjusting shim.

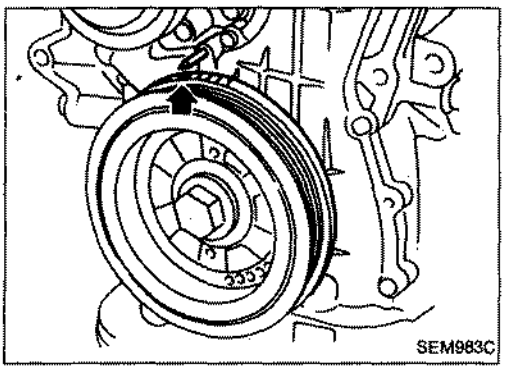
Camshaft clearance (Hot):
Intake & Exhaust
0.20 - 0.23 mm (0.0079 - 0.0091 in)

Valve Clearance Adjustment (Cont'd)

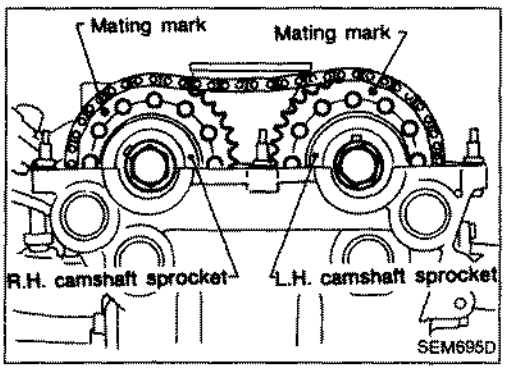


5. Turn crankshaft one revolution (360°) and align mark on crankshaft pulley with pointer.
6. Check those camshaft clearances shown in the figure.
   - Use the same procedure as mentioned in step 4.
7. If camshaft clearances are within specification, install any parts removed in reverse order of removal.

Select a suitable shim and a suitable rocker arm guide when camshaft clearances are out of specification or when replacing valve, cylinder head, shim, rocker arm guide and/or valve seat with new one(s), as follows:
Adjust valve clearance and camshaft clearance while engine is hot.

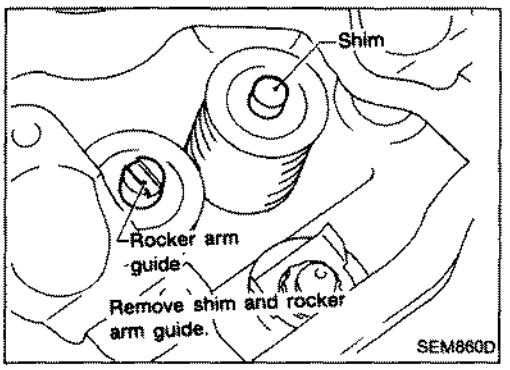


8. Set No. 1 piston at T.D.C. on the compression stroke by rotating crankshaft.



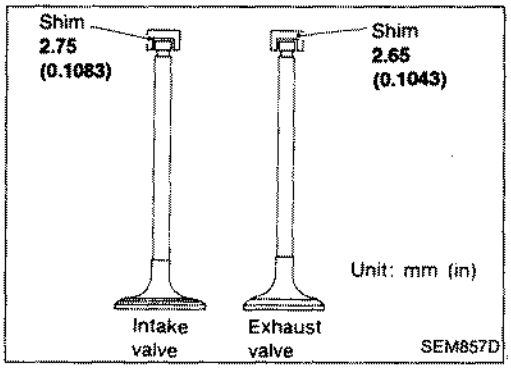
Rotate crankshaft until mating mark on camshaft sprocket is set at position indicated in figure at right.

9. Remove chain tensioner.
10. Remove distributor.
11. Remove camshaft sprockets.
12. Remove camshafts, oil tubes and rocker arms.



13. Remove the shim and rocker arm guide to adjust the corresponding camshaft.

Valve Clearance Adjustment (Cont'd)



14. Place new shims of the proper thickness (indicated below) in place of the shim and rocker arm guide that were removed in step 6 above.

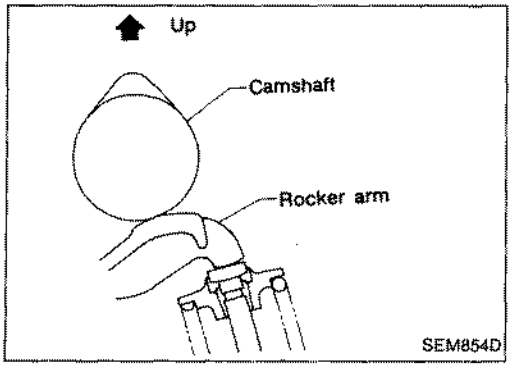
Shim thickness:

Intake 2.75 mm (0.1083 in)

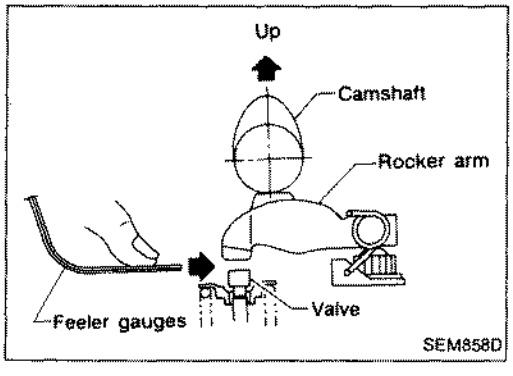
Exhaust 2.65 mm (0.1043 in)

Make sure the valve head and shims are clean and free from foreign matter.

15. Install rocker arms, oil tubes and camshafts.
16. Install camshaft sprockets.
17. Install distributor.
18. Install chain tensioner.



19. Rotate the crankshaft until the surface is set for the cylinder to be adjusted, as shown in figure.



20. Using two feeler gauges (one placed on the other), insert horizontally between the shim-to-rocker arm guide to measure the valve clearance.

Valve clearance:

Unit: mm (in)

	Hot	Cold* (reference data)
Intake & Exhaust	0.30 - 0.35 (0.012 - 0.014)	0.21 - 0.26 (0.008 - 0.010)

*: At a temperature of approximately 20°C (68°F)

- **Whenever valve clearances are adjusted to cold specifications, check that the clearances satisfy hot specifications and adjust again if necessary.**

Valve Clearance Adjustment (Cont'd)

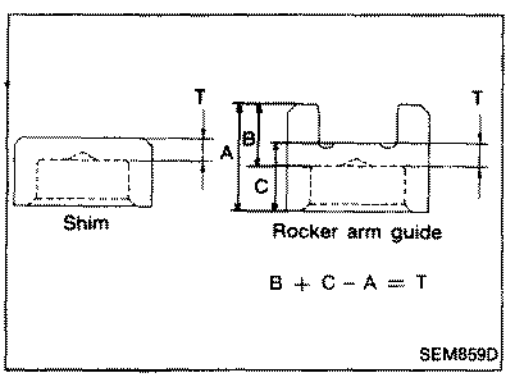
21. If valve clearance is not within specifications, select suitable shim(s) and rocker arm guide.

- **How to select a suitable shim and a suitable rocker arm guide**

  Example: When intake valve clearance (on the shim side) is 0.4 mm (0.016 in), determine the required shim thickness using the following equations:

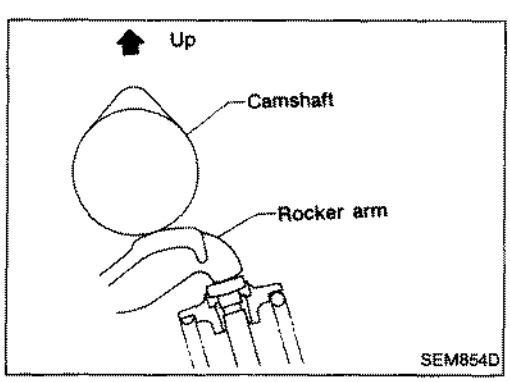
  0.40 mm (0.0157 in) − 0.30 mm (0.0118 in)
  └Minimum standard value
  = 0.10 mm (0.0039 in)
  2.55 mm (0.1043 in) + 0.10 mm (0.0039 in)
  └Actual shim thickness
  = 2.75 mm (0.1083 in)

  Select a total of 2.75 mm (0.1083 in) thick shim(s).



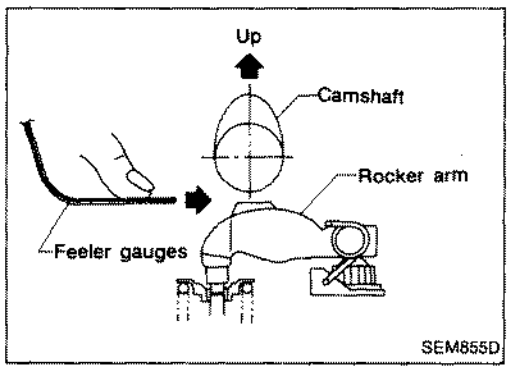
- **Using a dial gauge, measure thickness (T) of the selected shim(s) and the rocker arm guide on a flat surface to make sure it is within specifications.**
- Shims and rocker arm guides are available in 81 different thicknesses ranging from 1.50 mm (0.0591 in) to 3.50 mm (0.1378 in) in increments of 0.025 mm (0.0010 in).

22. Remove camshafts, oil tubes and rocker arms in the order of steps 1 through 5 above.
23. Remove the existing shim(s) and install the selected shim(s) and the rocker arm guide.



24. After installing the required parts as outlined in steps 8 through 11 above, rotate the crankshaft until the camshaft surface is positioned in relation to the cylinder to be checked, as shown in figure.

Valve Clearance Adjustment (Cont'd)



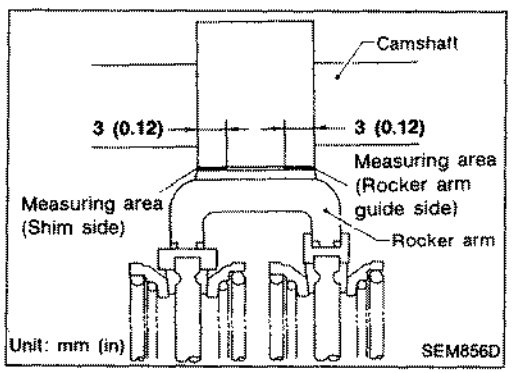
25. Using two feeler gauges (one placed on the other), insert horizontally between the camshaft and rocker arm to measure the clearance at two points (the front and rear of the rocker arm).

Camshaft clearance:

Unit: mm (in)

	Hot	Cold* (reference data)
Intake & Exhaust	0.20 - 0.23 (0.008 - 0.009)	0.14 - 0.17 (0.006 - 0.007)

*: At a temperature of approximately 20°C (68°F)



- **Whenever camshaft clearances are adjusted to cold specifications, check that the clearances satisfy hot specifications and adjust again if necessary.**

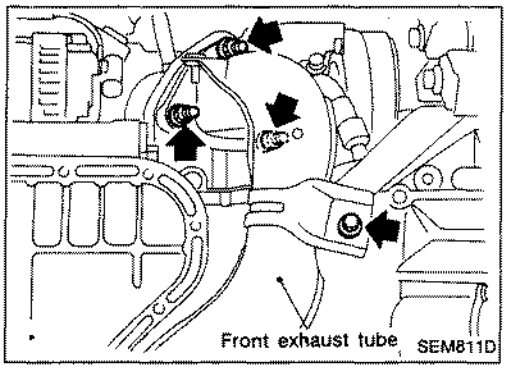
26. If the camshaft clearance is not within specifications, repeat steps 1 through 18 until correct clearance is obtained.

Installation

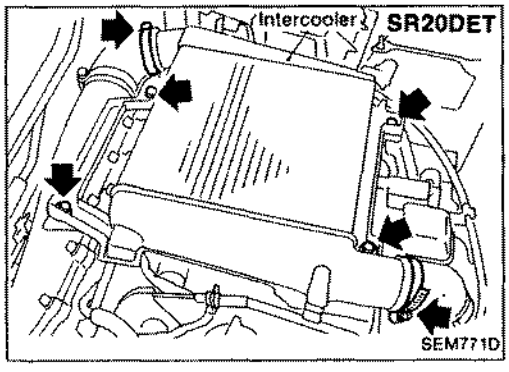
- This installation is the same procedure as that for timing chain. Refer to "Installation" in "TIMING CHAIN".

Removal

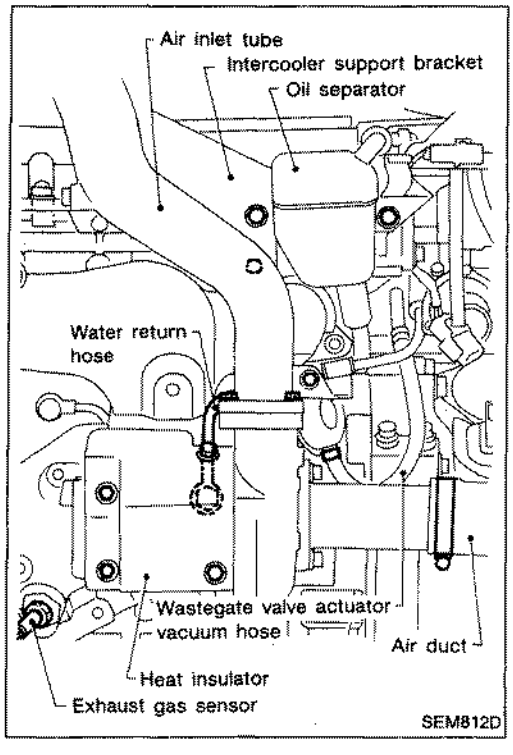
1. Drain coolant from radiator and cylinder block.
2. Remove engine under cover.



3. Remove front exhaust tube.

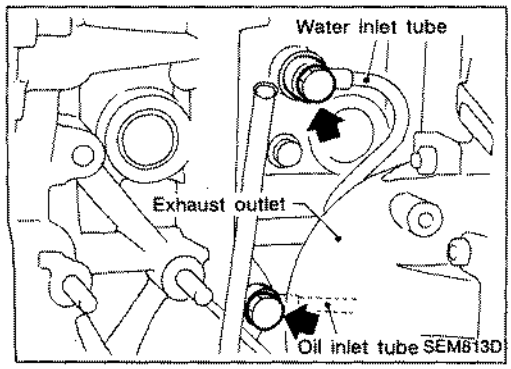


4. Remove intercooler cover and intercooler.
5. Remove radiator with fans.

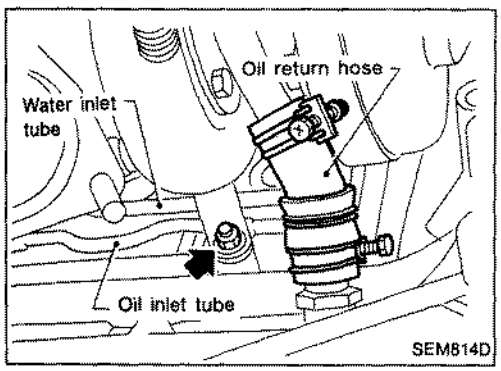


6. Remove heat insulator.
7. Remove water return tube.
8. Remove air inlet tube.
9. Remove oil separator and intercooler support bracket.
10. Remove wastegate valve actuator vacuum hose.
11. Remove air duct for turbocharger unit.
12. Remove exhaust gas sensor.

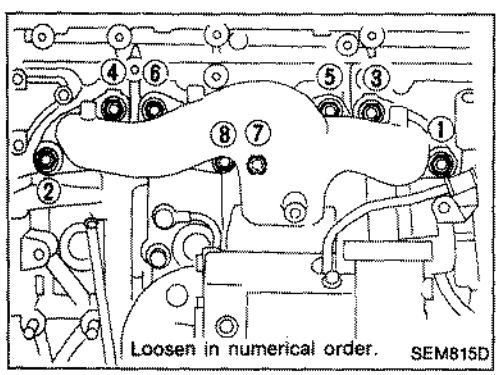
Removal (Cont'd)



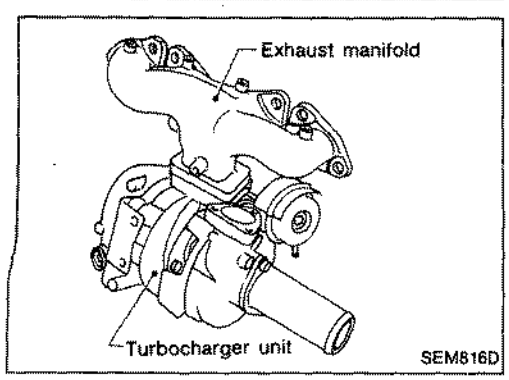
13. Remove exhaust outlet cover.
14. Remove water inlet tube and oil inlet tube.



15. Remove oil return hose.
16. Remove nut fixing both water inlet tube and oil inlet tube.

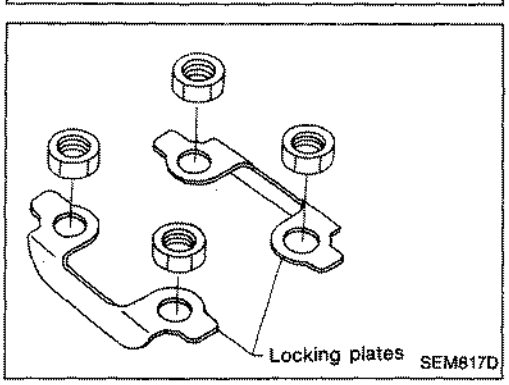


17. Remove exhaust manifold cover.
18. Remove exhaust manifold fixing nuts.



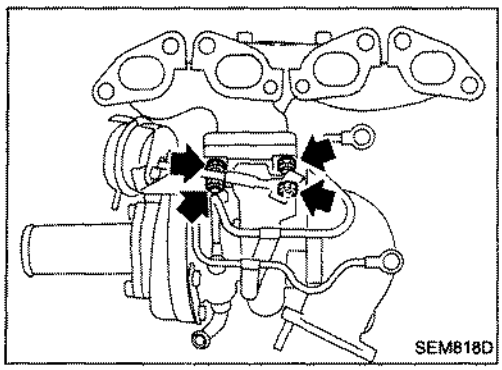
19. Remove exhaust manifold with turbocharger unit.

Disassembly

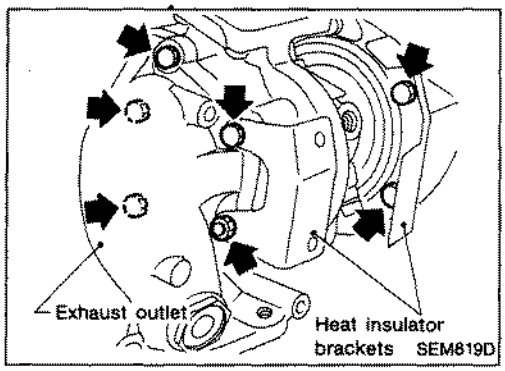


1. Unbend locking plates for turbocharger unit fastening nuts.

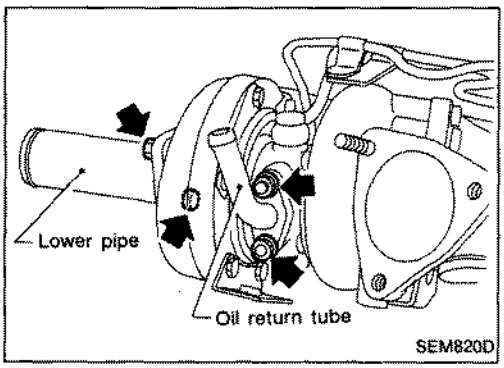
Disassembly (Cont'd)



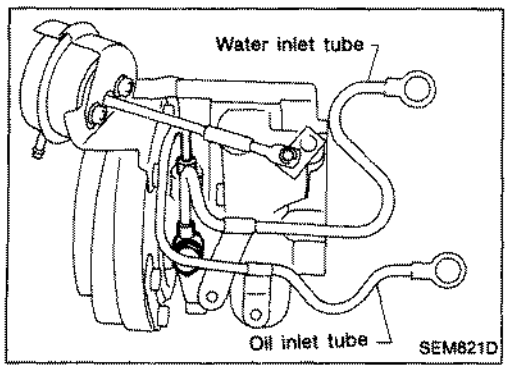
2. Remove exhaust manifold.



3.. Remove exhaust outlet and heat insulator brackets.



4. Remove oil return tube.
5. Remove lower pipe.

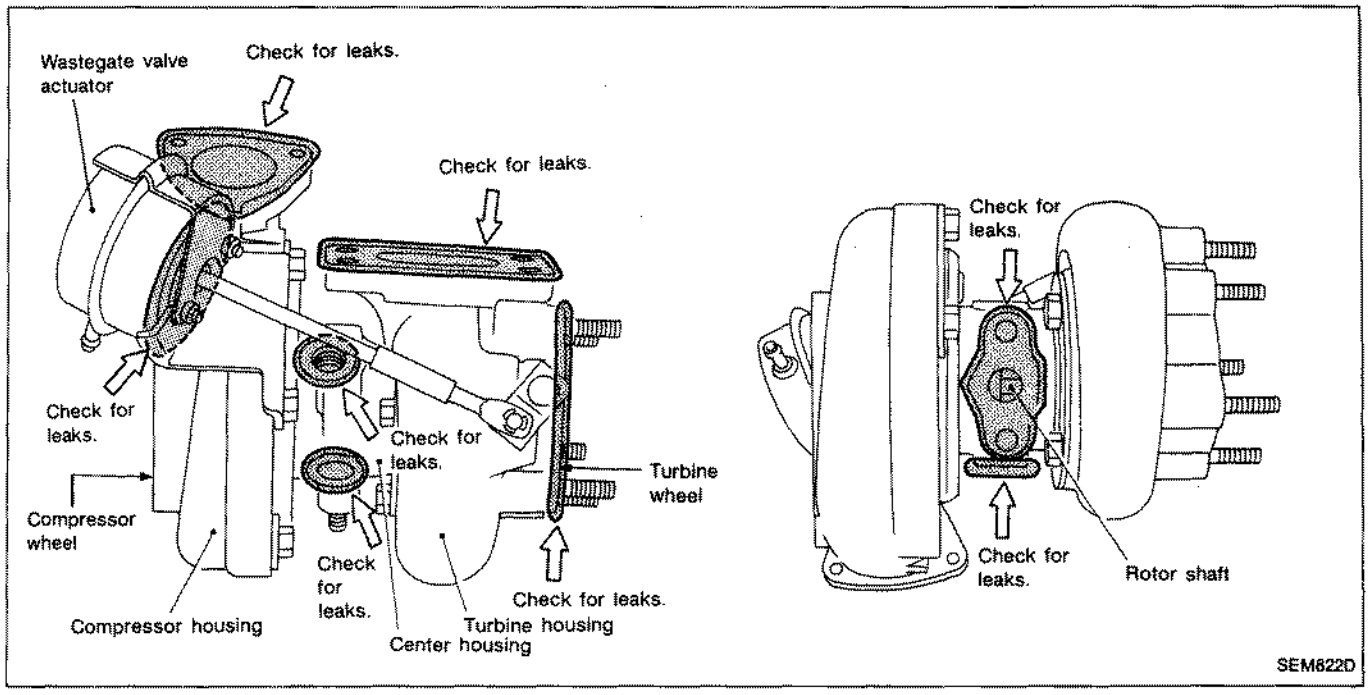


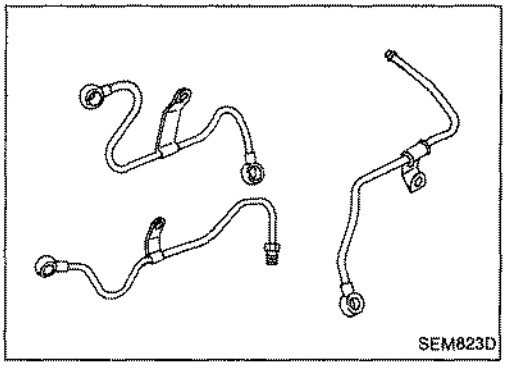
6. Remove oil inlet tube and water inlet tube.

Inspection

Perform the following checks. If N.G., replace turbocharger unit.

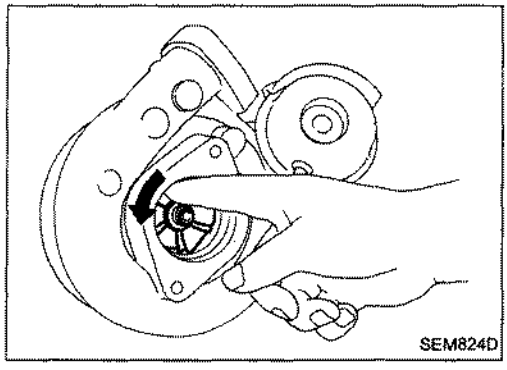
Inspection (Cont'd)





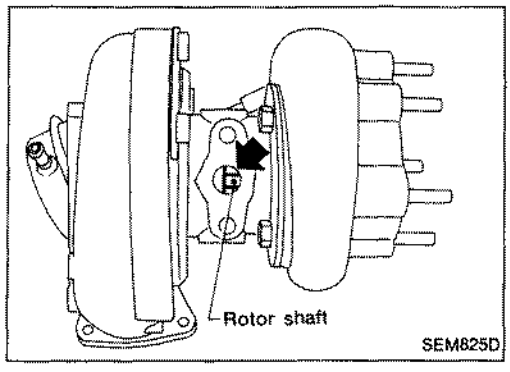
OIL AND WATER TUBES

Check tubes for clogging.



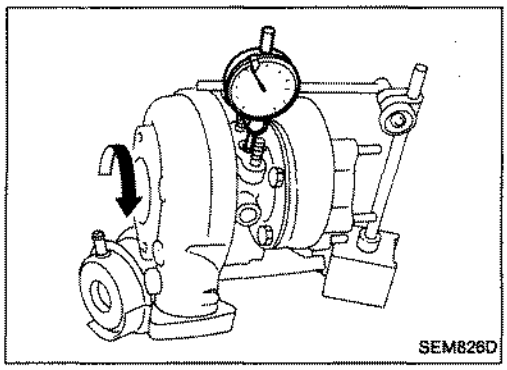
ROTOR SHAFT

1. Check rotor shaft for smooth rotation.

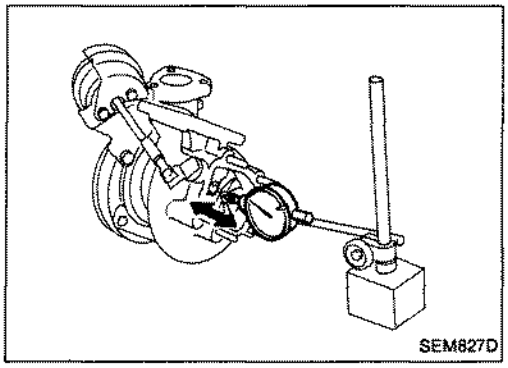


2. Check rotor shaft for carbon deposits.

Inspection (Cont'd)

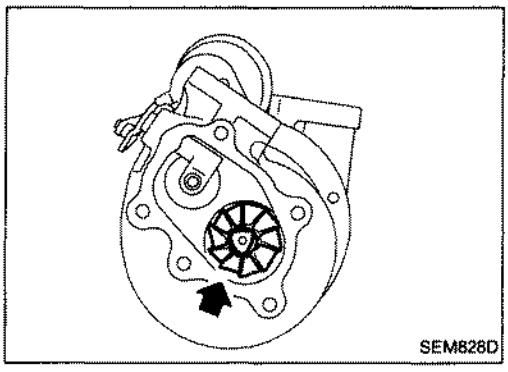

SEM826D

3. Measure rotor shaft runout.
   Runout (Total indicator reading):
   0.056 - 0.127 mm (0.0022 - 0.0050 in)


SEM827D

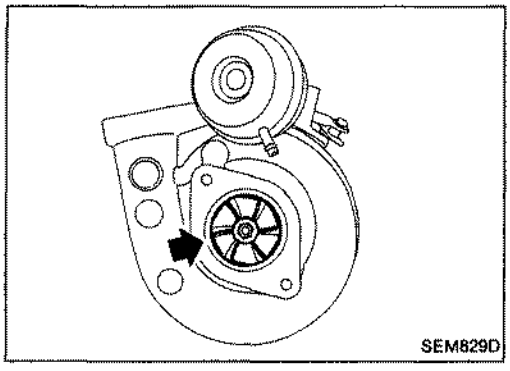
4. Measure rotor shaft end play.
   End play:
   0.013 - 0.097 mm (0.0005 - 0.0038 in)

- **Do not allow wheels to turn when axial play is being measured.**


SEM826D

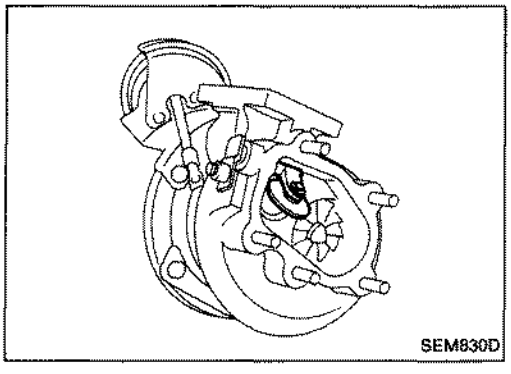
TURBINE WHEEL

Check turbine wheel for the following.
- Oil
- Carbon deposits
- Deformed fins
- Contact with turbine housing


SEM829D

COMPRESSOR WHEEL

Check compressor wheel for the following.
- Oil
- Deformed fins
- Contact with compressor housing

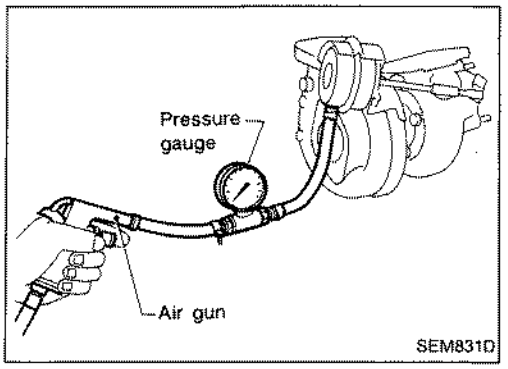

SEM830D

WASTEGATE VALVE

Remove rod pin and check wastegate valve for cracks, deformation and smooth movement. Check valve seat surface for smoothness.

Inspection (Cont'd)

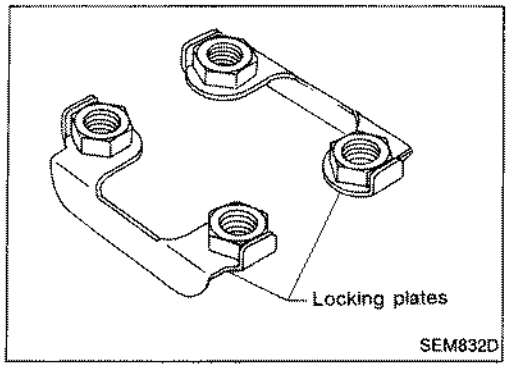
WASTEGATE VALVE ACTUATOR



Apply compressed air to wastegate valve actuator and check it for smooth movement.

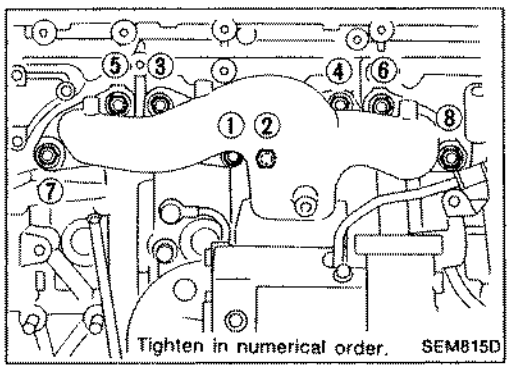
- **Do not applying compressed air to the actuator continuously.**
- **The air pressure should be in the range of 59 to 69 kPa (0.59 to 0.69 bar, 0.6 to 0.7 kg/cm^2, 9 to 10 psi).**

Assembly

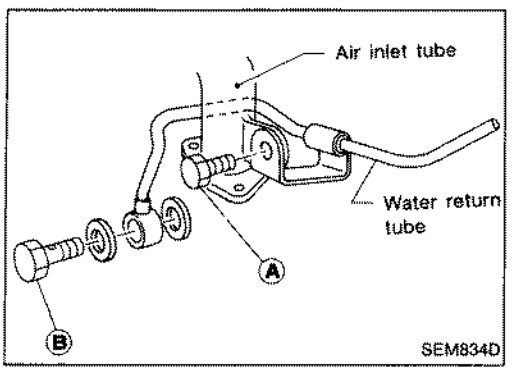


Assembly is the reverse order of disassembly. Bend locking plates along the side of turbocharger fastening nuts.

Installation



1. Install exhaust manifold fixing nuts.

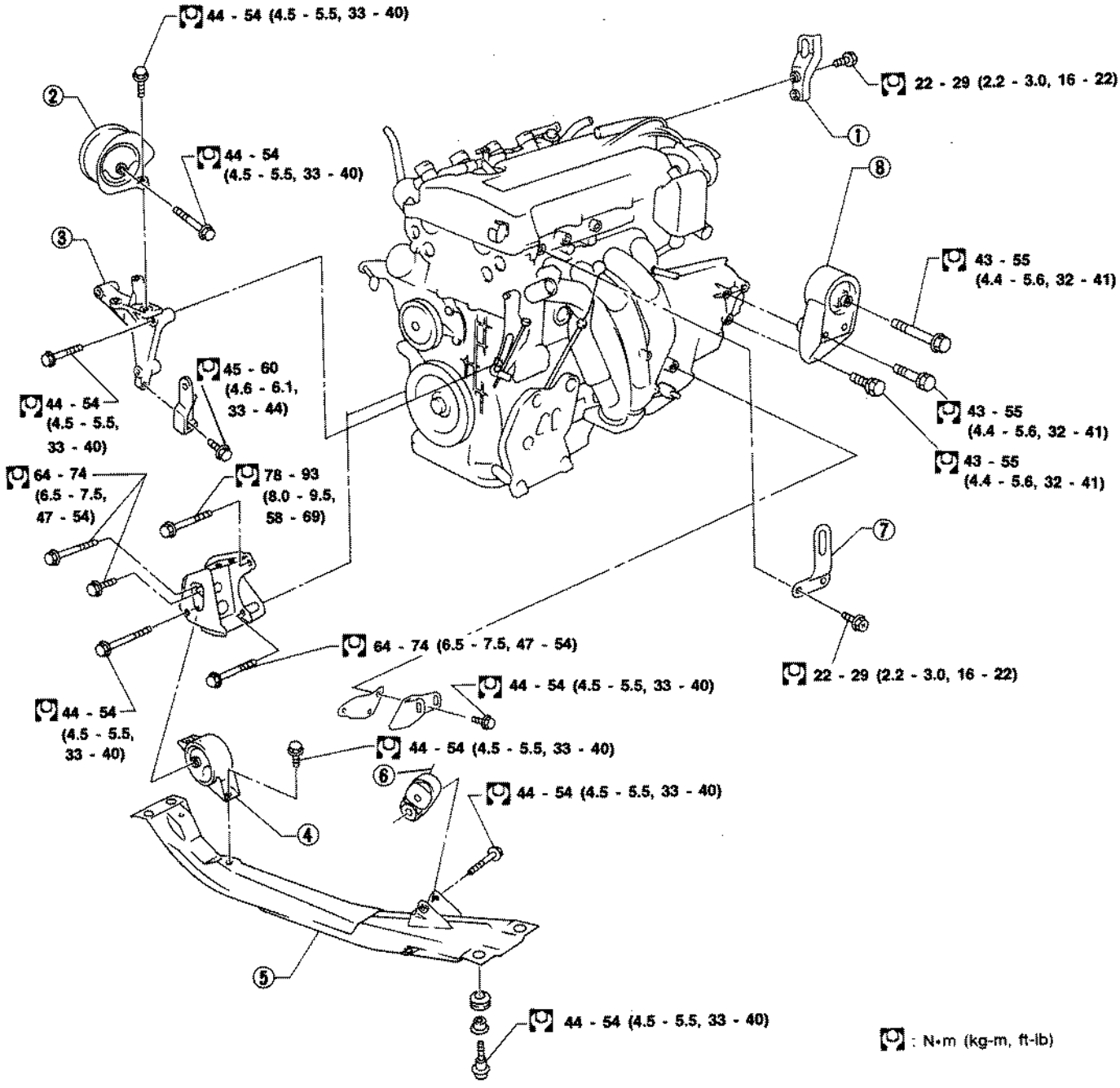


2. Installation is the reverse order of removal. When installing the water return tube, tighten in the following way.

Tightening procedure:

(1) Tighten bolt Ⓐ temporarily.
(2) Tighten bolt Ⓑ to 20 to 31 N·m (2.0 to 3.2 kg-m, 14 to 23 ft-lb).
(3) Tighten bolt Ⓐ to 3.7 to 5.0 N·m (0.38 to 0.51 kg-m, 2.7 to 3.7 ft-lb).

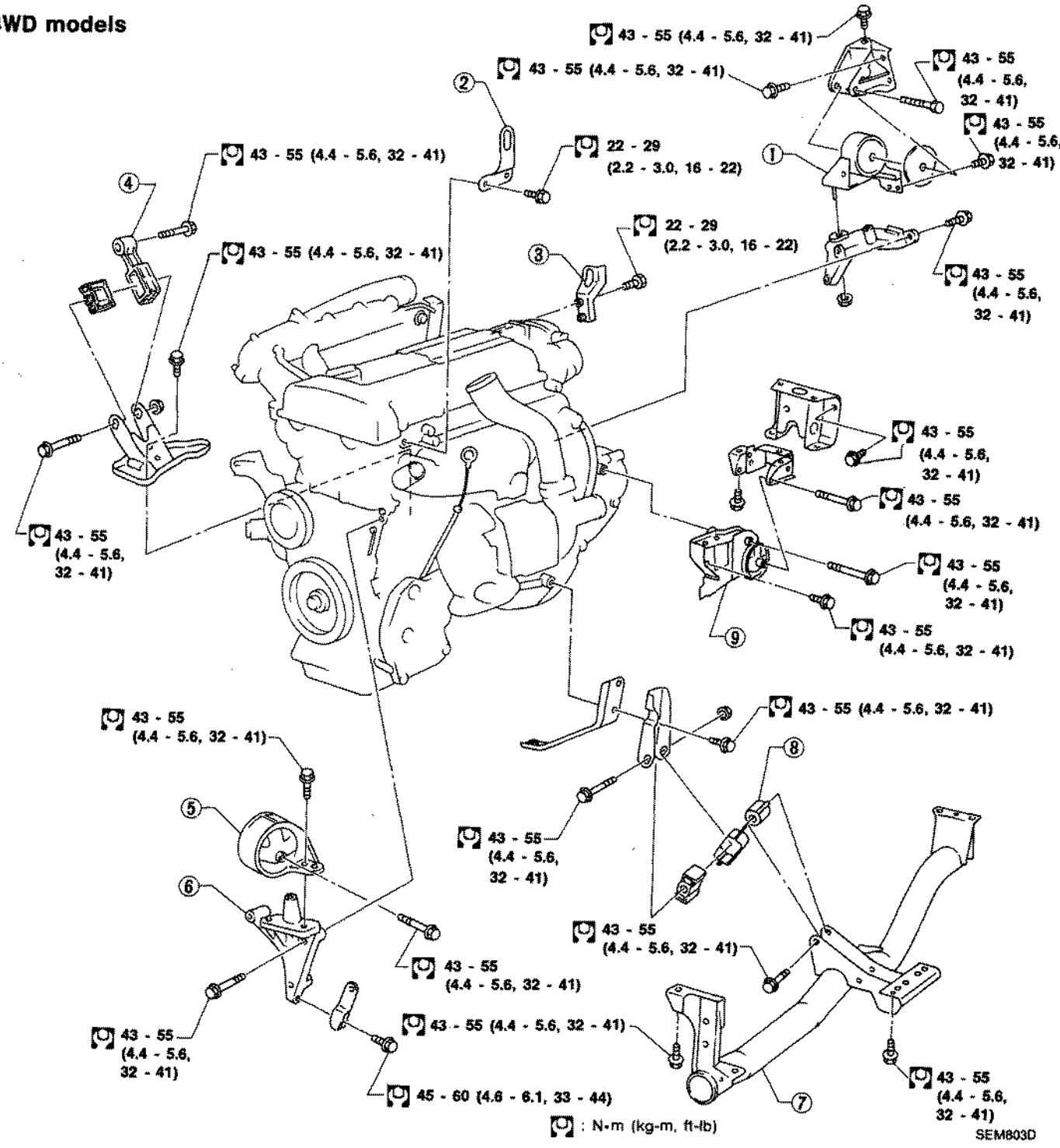
2WD models



SEM802D

① Rear engine slinger
② Front engine mounting (Fluid type)
③ Mounting bracket
④ Rear insulator
⑤ Center member
⑥ Buffer
⑦ Front engine slinger
⑧ Rear engine mounting

4WD models



① R.H. rear engine mounting
② Front engine slinger
③ Rear engine slinger
④ R.H. buffer
⑤ Front engine mounting (Fluid type)
⑥ Mounting bracket
⑦ Front member
⑧ L.H. buffer
⑨ L.H. rear engine mounting

WARNING:

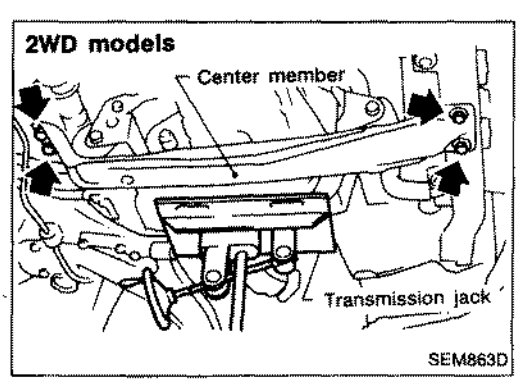
a. Situate vehicle on a flat and solid surface.
b. Place chocks at front and back of rear wheels.
c. Do not remove engine until exhaust system has completely cooled off.
Otherwise, you may burn yourself and/or fire may break out in fuel line.
d. For safety during subsequent steps, the tension of wires 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 transaxle 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.**

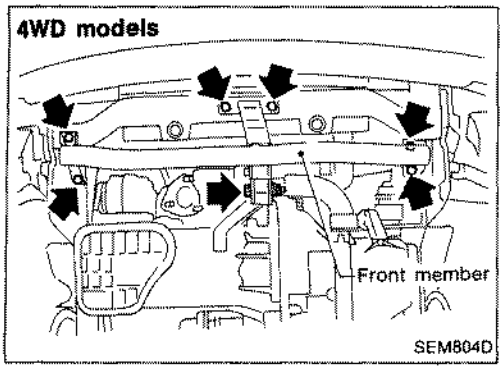
Removal

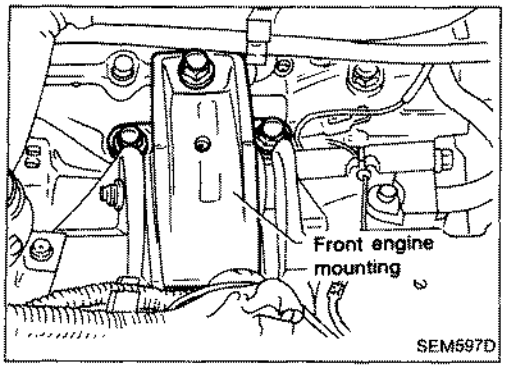
1. Remove engine under cover and hood.
2. Drain coolant from both cylinder block, and radiator.
3. Remove intercooler. (SR20DET only)
4. Remove vacuum hoses, fuel hoses, wires, harness and connectors and so on.
5. Remove exhaust tubes, ball joints and drive shafts.
6. Remove propeller shaft. (4WD models only)
7. Remove clutch operating cylinder. (4WD models only)
8. Remove radiator and fans.
9. Remove drive belts.
10. Remove alternator, compressor and power steering oil pump from engine.



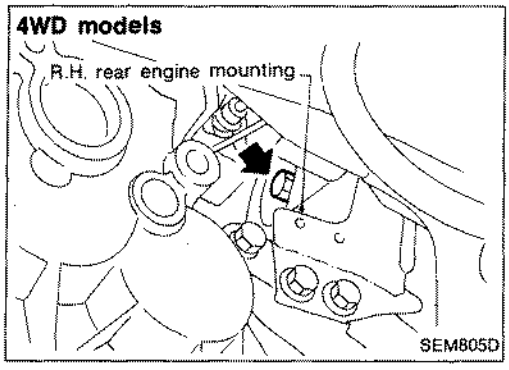
11. Set a suitable transmission jack under transaxle. Hoist engine with engine slinger.
12. • 2WD models: Remove center member.
    • 4WD models: Remove front member.
13. Remove R.H. buffer. (4WD models only)

Removal (Cont'd)

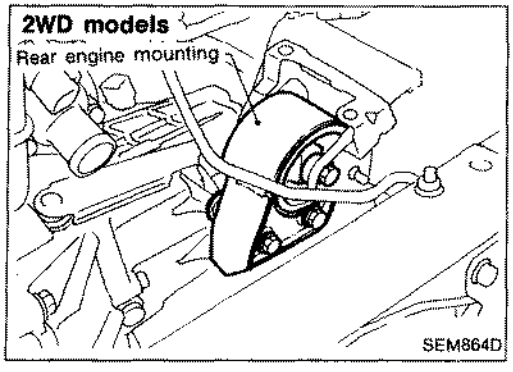




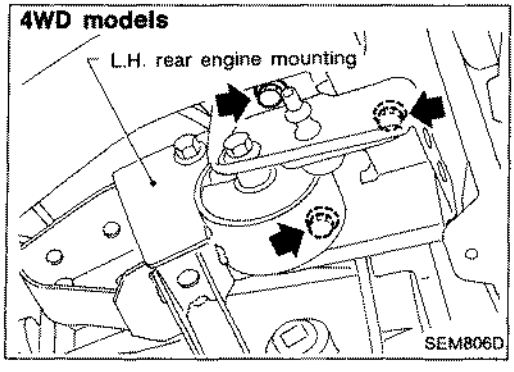
14. Remove front engine mounting.



15. Remove R.H. rear engine mounting. (4WD models only)

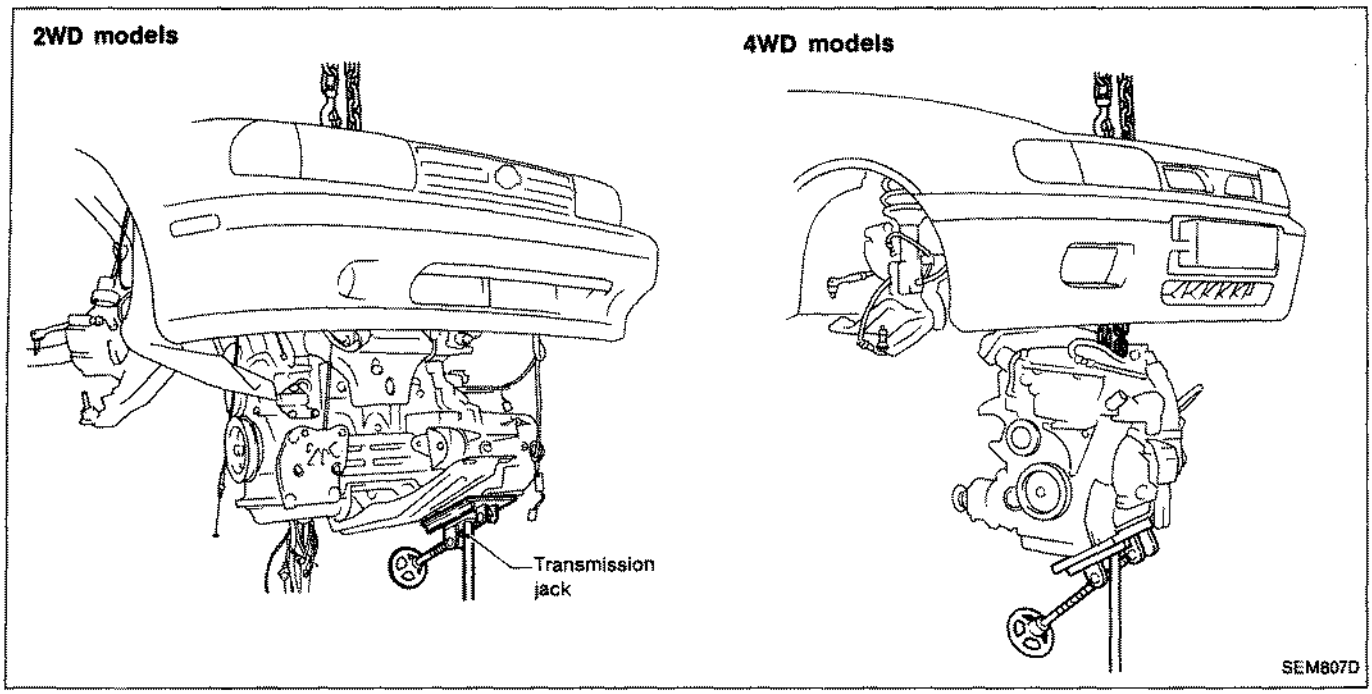


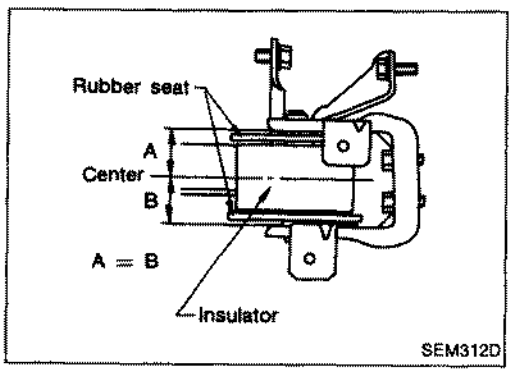
16. Remove rear engine mounting (engine left side) and then slowly lower transmission jack.



Removal (Cont'd)

17. • Remove engine with transaxle as shown. (2WD models)
    • Remove engine with transaxle and transfer as shown. (4WD models)



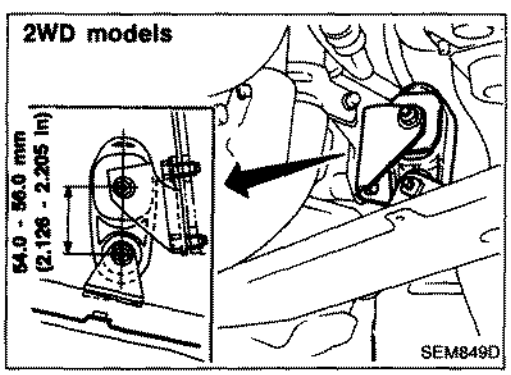


Installation

1. Install engine mounting bracket and fixing bolts.

Be sure that insulators are correctly positioned on the brackets.

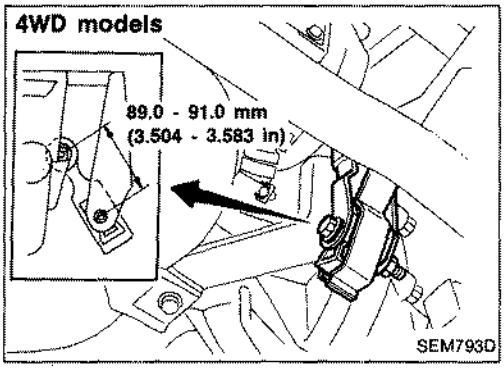
2. Carefully lower the engine onto engine mounting insulators.



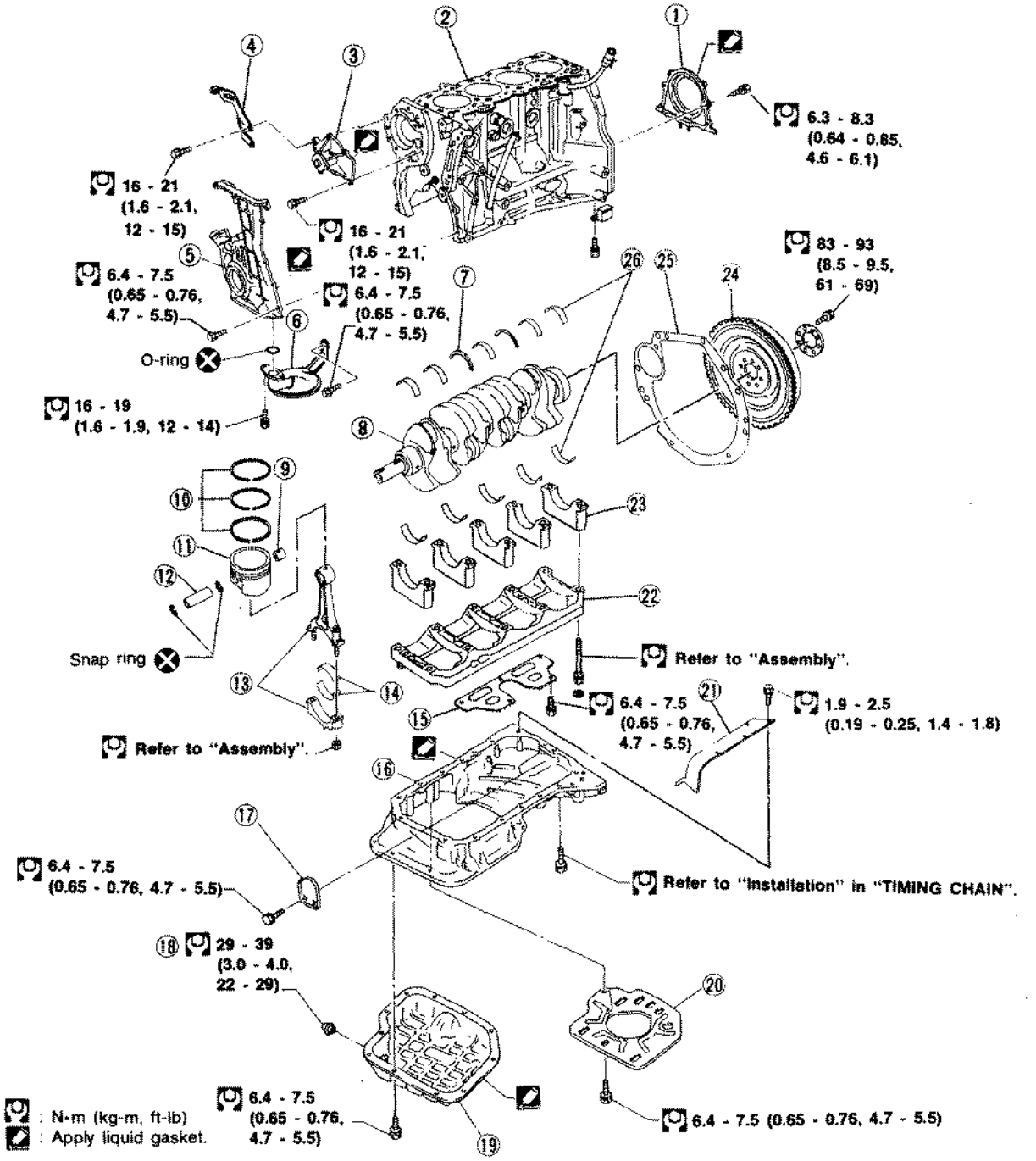
When installing the engine, adjust the height of the engine mounting as shown.

3. Installation is in the reverse order of removal.

Installation (Cont'd)



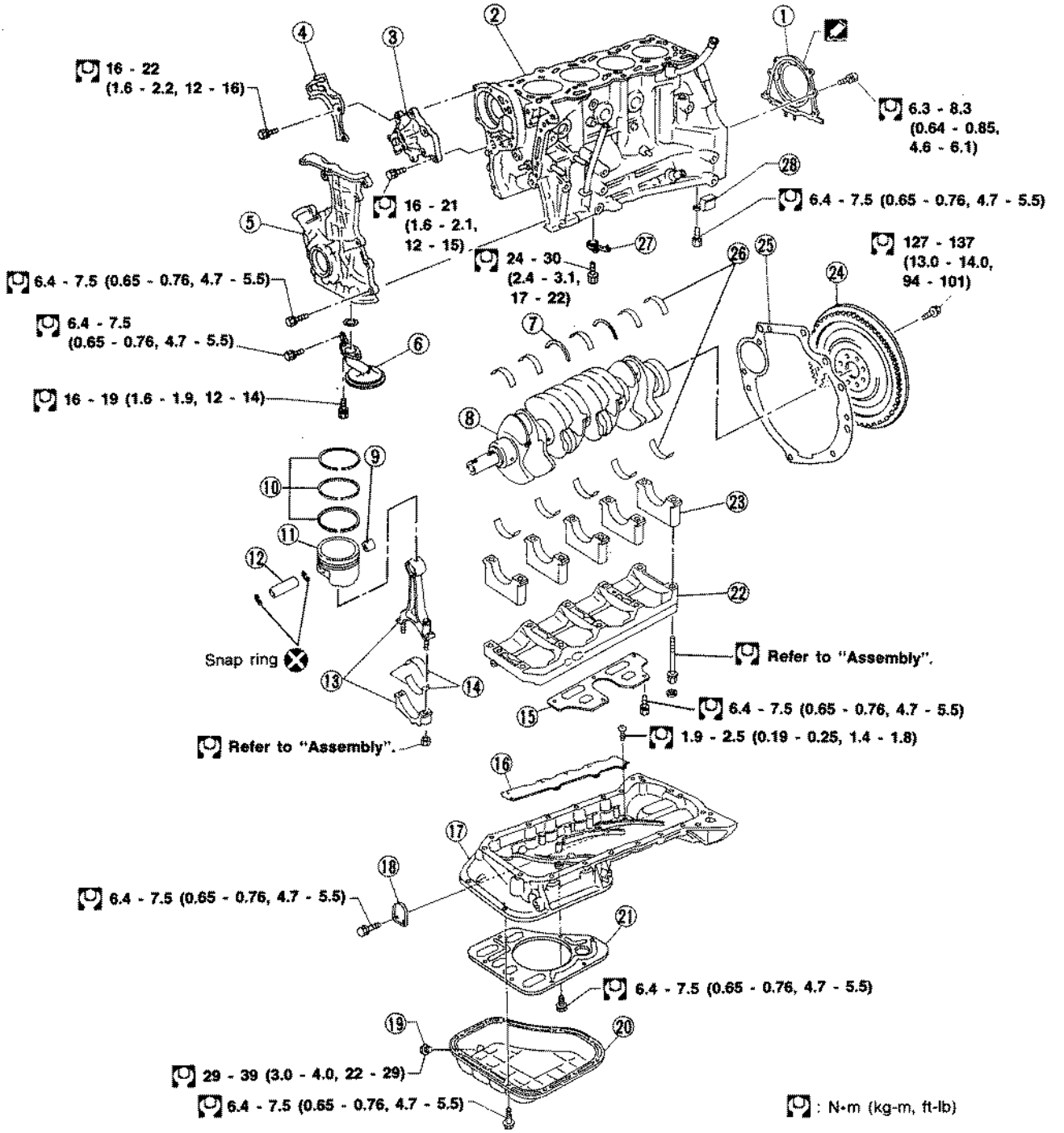
SR20DE



SEM602D

① Rear oil seal retainer
② Cylinder block
③ Water pump
④ Power steering oil pump adjusting bar
⑤ Front cover with oil pump
⑥ Oil strainer
⑦ Thrust bearing
⑧ Crankshaft
⑨ Connecting rod bushing
⑩ Piston rings
⑪ Piston
⑫ Piston pin
⑬ Connecting rod
⑭ Connecting rod bearing
⑮ Baffle plate
⑯ Aluminum oil pan
⑰ Rear cover plate
⑱ Drain plug
⑲ Steel oil pan
⑳ Baffle plate
㉑ Side gallery baffle plate
㉒ Main bearing beam
㉓ Main bearing cap
㉔ Flywheel or drive plate
㉕ Rear plate
㉖ Main bearing

SR20DET

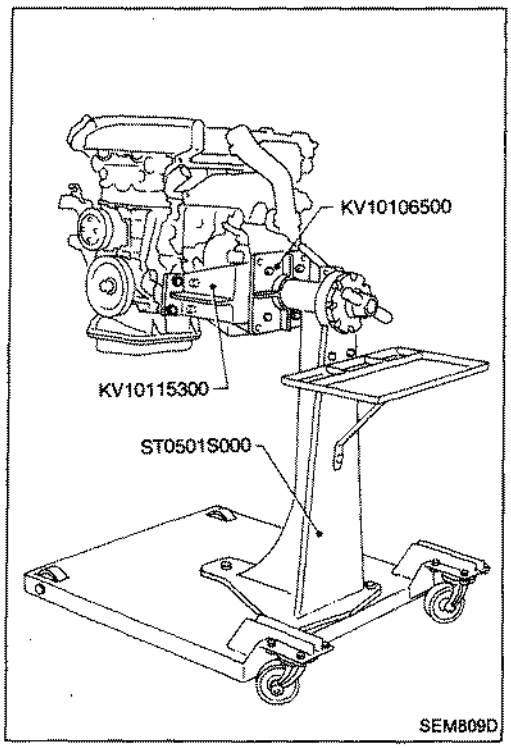


SEM808D

① Rear oil seal retainer
② Cylinder block
③ Water pump
④ Power steering oil pump adjusting bar
⑤ Front cover with oil pump
⑥ Oil strainer
⑦ Thrust bearing
⑧ Crank shaft
⑨ Connecting rod bushing
⑩ Piston rings
⑪ Piston
⑫ Piston pin
⑬ Connecting rod
⑭ Connecting rod bearing
⑮ Baffle plate
⑯ Side gallery baffle plate
⑰ Aluminum oil pan
⑱ Rear cover plate
⑲ Drain plug
⑳ Steel oil pan
㉑ Baffle plate
㉒ Main bearing beam
㉓ Main bearing cap
㉔ Flywheel
㉕ Rear plate
㉖ Main bearing
㉗ Oil jet
㉘ Baffle plate

CAUTION:

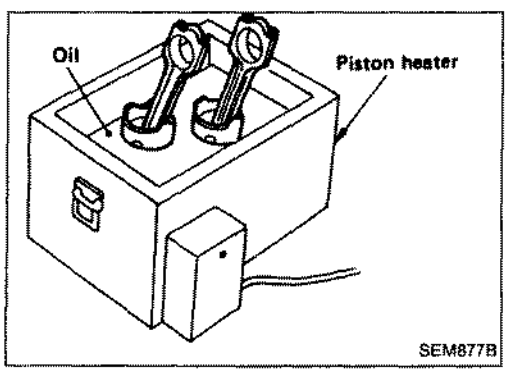
- **When installing sliding parts such as bearings and pistons, be sure to apply new engine oil on the sliding surfaces.**
- **Place removed parts such as bearings and bearing caps in their proper order and direction.**
- **When tightening connecting rod bolts and main bearing cap bolts, apply engine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



Disassembly

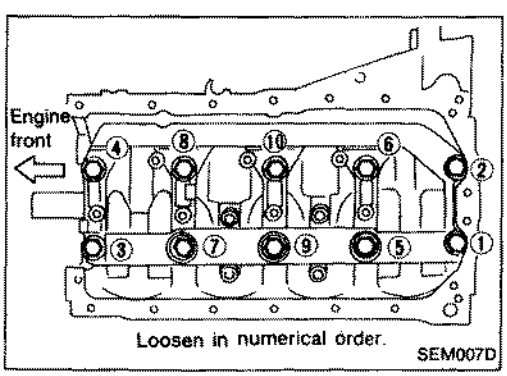
PISTON AND CRANKSHAFT

1. Remove engine.
   Refer to "ENGINE REMOVAL".
2. Remove compressor bracket then install engine on Tool.
3. Remove cylinder head.
   Refer to "Removal" in "TIMING CHAIN".
4. Remove oil pan.
   Refer to "Removal" in "OIL PAN".
5. Remove timing chain.
   Refer to "Removal" in "TIMING CHAIN".



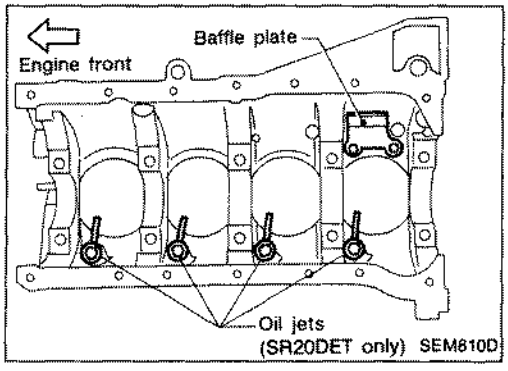
6. Remove pistons with connecting rod.
- When disassembling piston and connecting rod, remove snap ring first, then heat piston to 60 to 70°C (140 to 158°F) or use piston pin press stand at room temperature.

7. Remove rear oil seal retainer.



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

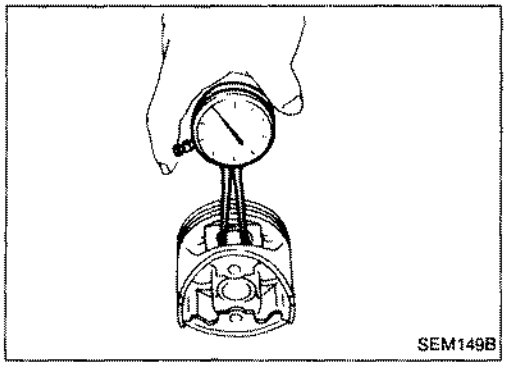
Disassembly (Cont'd)



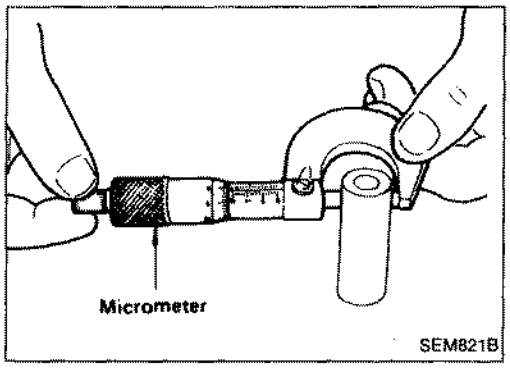
9. Remove baffle plate.
10. Remove oil jets. (SR20DET only)

Inspection

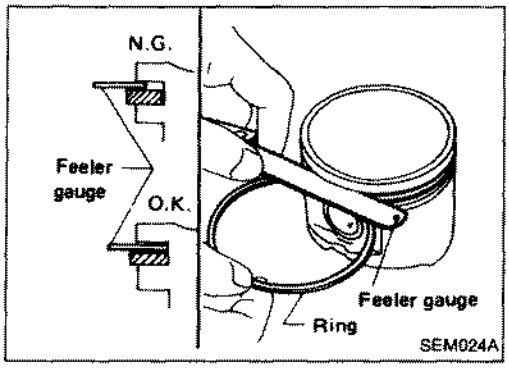
PISTON AND PISTON PIN CLEARANCE



1. Measure inner diameter of piston pin hole "dp".
   Standard diameter "dp":
   21.987 - 21.999 mm (0.8656 - 0.8661 in)



2. Measure outer diameter of piston pin "Dp".
   Standard diameter "Dp":
   21.989 - 22.001 mm (0.8657 - 0.8662 in)
3. Calculate piston pin clearance.
   dp – Dp = –0.004 to 0 mm (–0.0002 to 0 in)
   If it exceeds the above value, replace piston assembly with pin.

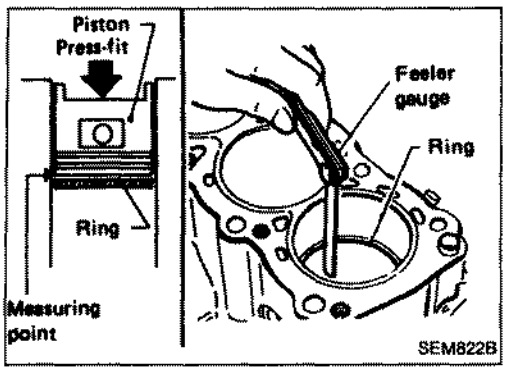


PISTON RING SIDE CLEARANCE

Side clearance:
Top ring
0.045 - 0.080 mm (0.0018 - 0.0031 in)
2nd ring
0.030 - 0.065 mm (0.0012 - 0.0026 in)
Max. limit of side clearance:
0.2 mm (0.008 in)

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

Inspection (Cont'd)



PISTON RING END GAP

End gap:

Top ring

0.20 - 0.30 mm (0.0079 - 0.0118 in)

2nd ring

0.35 - 0.50 mm (0.0138 - 0.0197 in)

Oil ring

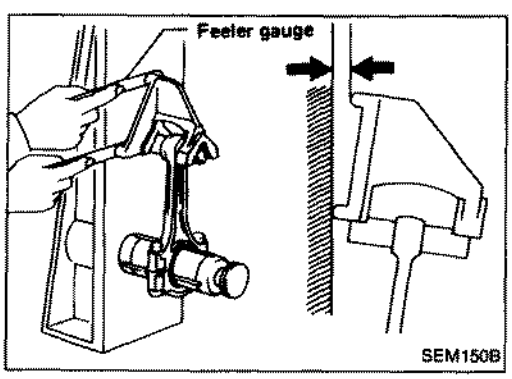
0.20 - 0.60 mm (0.0079 - 0.0236 in)

Max. limit of ring gap:

1.0 mm (0.039 in)

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

Refer to S.D.S.



CONNECTING ROD BEND AND TORSION

Bend:

Limit 0.15 mm (0.0059 in)

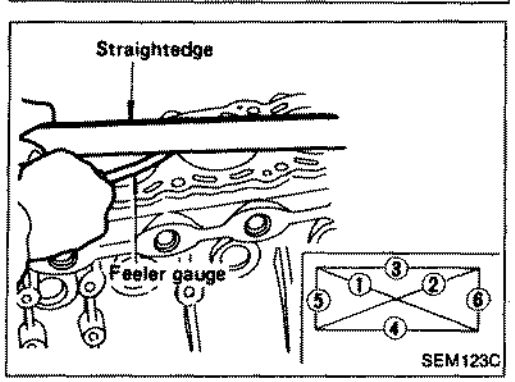
per 100 mm (3.94 in) length

Torsion:

Limit 0.30 mm (0.0118 in)

per 100 mm (3.94 in) length

If it exceeds the limit, replace connecting rod assembly.



CYLINDER BLOCK DISTORTION AND WEAR

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

   Standard:

   Less than 0.03 mm (0.0012 in)

   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".

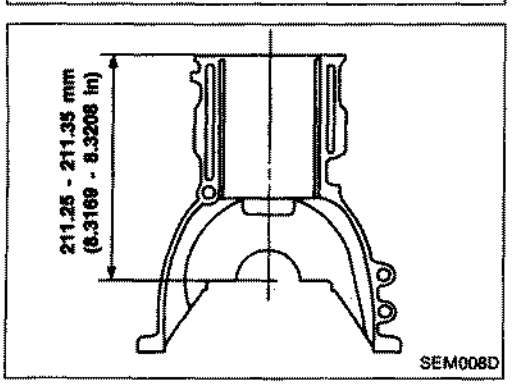
The maximum limit is as follows:

A + B = 0.2 mm (0.008 in)

Nominal cylinder block height from crankshaft center:

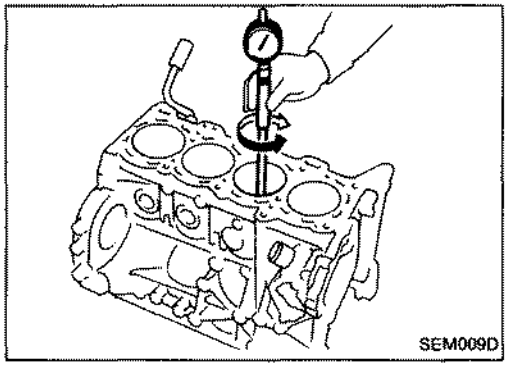
211.25 - 211.35 mm (8.3169 - 8.3208 in)

3. If necessary, replace cylinder block.

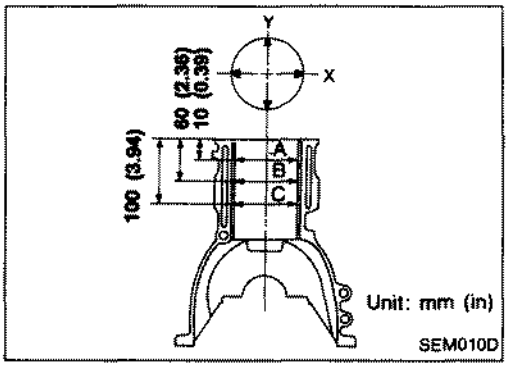


Inspection (Cont'd)

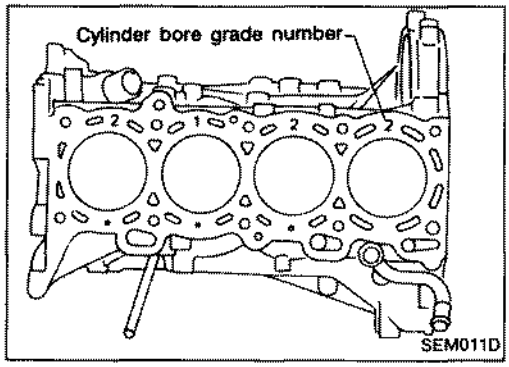
PISTON-TO-BORE CLEARANCE


SEM009D

1. Using a bore gauge, measure cylinder bore for wear, out-of-round and taper.
   Standard inner diameter:
   86.000 - 86.030 mm (3.3858 - 3.3870 in)
   Wear limit:
   0.20 mm (0.0079 in)
   Out-of-round limit:
   0.015 mm (0.0006 in)
   Taper limit:
   0.010 mm (0.0004 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.

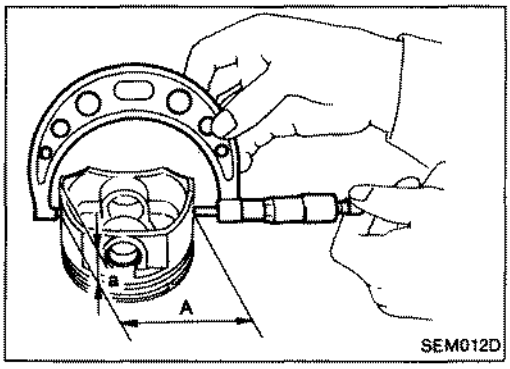


SEM010D



SEM011D

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



SEM012D

3. Measure piston skirt diameter.
   Piston diameter "A":
   Refer to S.D.S.
   Measuring point "a" (Distance from the bottom):
   14.0 mm (0.551 in)
4. Check that piston-to-bore clearance is within specification.
   Piston-to-bore clearance "B":
   0.010 - 0.030 mm (0.0004 - 0.0012 in)
5. Determine piston oversize according to amount of cylinder wear.

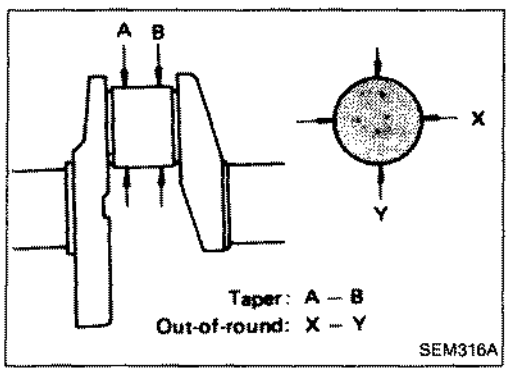
Oversize pistons are available for service. Refer to S.D.S.

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.

Inspection (Cont'd)

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.**

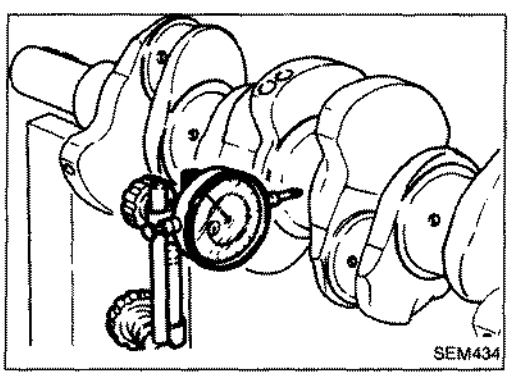


CRANKSHAFT

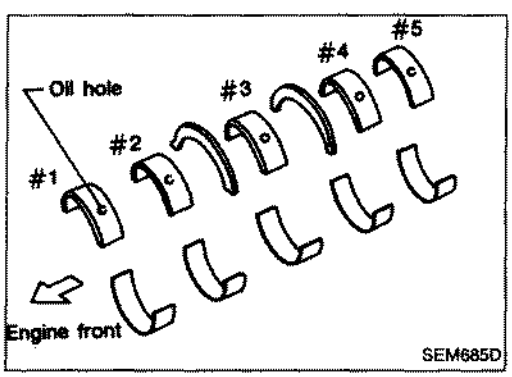
1. Check crankshaft main and pin journals for score, wear or cracks.
2. With a micrometer, measure journals for taper and out-of-round.

Unit: mm (in)

		SR20DE	SR20DET
Out-of-round (X—Y) and Taper (A—B)	Main journal	Less than 0.005 (0.0002)	
	Pin journal	Less than 0.005 (0.0002)	Less than 0.0025 (0.0001)



3. Measure crankshaft runout.
Runout (Total indicator reading):
Less than 0.05 mm (0.0020 in)



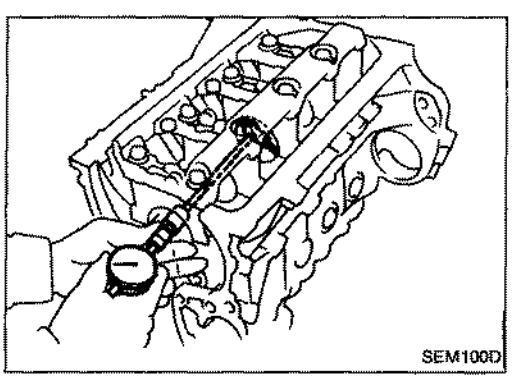
BEARING CLEARANCE

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

Method A (Using bore gauge & micrometer)

Main bearing

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

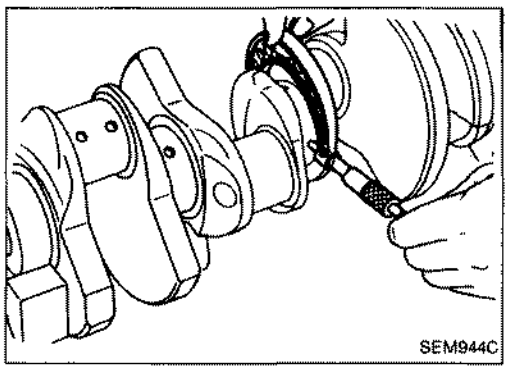


2. Install main bearing cap and main bearing beam to cylinder block.

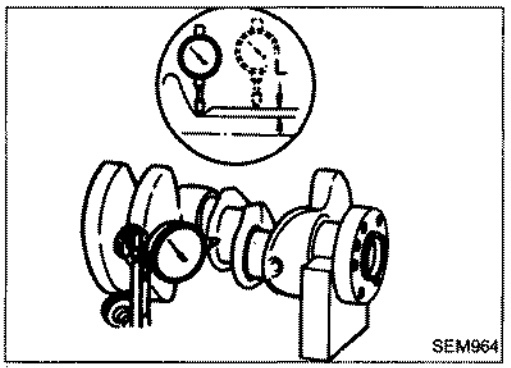
Tighten all bolts in correct order in two or three stages.

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

Inspection (Cont'd)

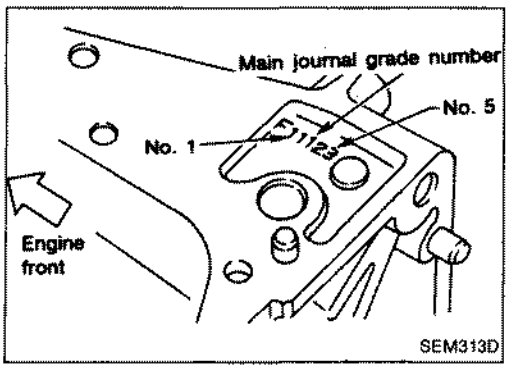

SEM944C

4. Measure outer diameter "Dm" of each crankshaft main journal.
5. Calculate main bearing clearance.
   Main bearing clearance = A – Dm
   Standard: 0.004 - 0.022 mm (0.0002 - 0.0009 in)
   Limit: 0.050 mm (0.0020 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.



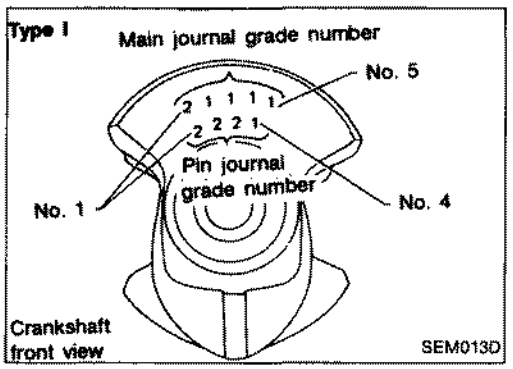
SEM964

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.



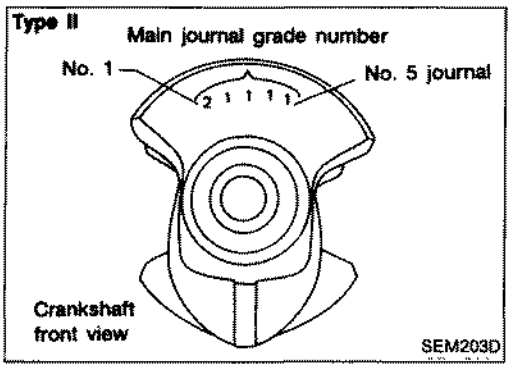
SEM313D

8. If crankshaft is reused, measure main bearing clearances and select thickness of main bearings.
   If crankshaft is replaced with a new one, it is necessary to select thickness of main bearings as follows:
a. Grade number of each cylinder block main journal is punched on the respective cylinder block. These numbers are punched in either Arabic or Roman numerals.



SEM013D

b. Grade number of each crankshaft main journal is punched on the respective crankshaft. These numbers are punched in either Arabic or Roman numerals.



SEM203D

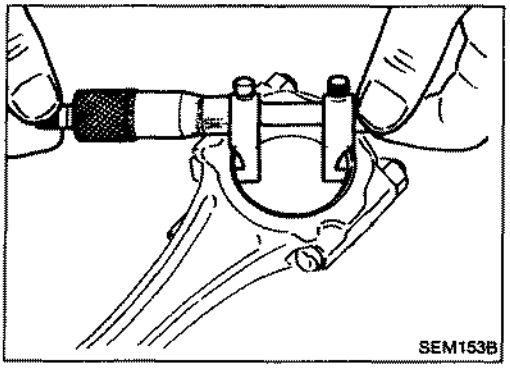
Inspection (Cont'd)

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

How to select main bearings (Identification mark and color)

Crankshaft journal grade number \ Main journal grade number	0	1	2	3
0	0 (A, Black)	1 (B, Brown)	2 (C, Green)	3 (D, Yellow)
1	1 (B, Brown)	2 (C, Green)	3 (D, Yellow)	4 (E, Blue)
2	2 (C, Green)	3 (D, Yellow)	4 (E, Blue)	5 (F, Pink)
3	3 (D, Yellow)	4 (E, Blue)	5 (F, Pink)	6 (G, No color)

For example:
Main journal grade number: 1
Crankshaft journal grade number: 2
Main bearing grade number = 1 + 2
= 3 (D, Yellow)

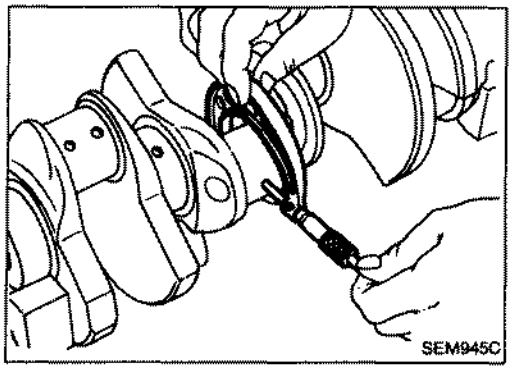

SEM153B

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.


SEM945C

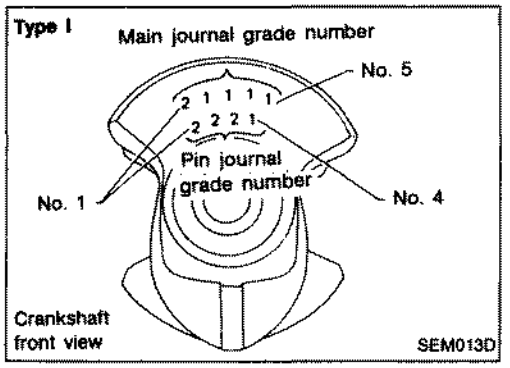
4. Measure outer diameter "Dp" of each crankshaft pin journal.
5. Calculate connecting rod bearing clearance.
   Connecting rod bearing clearance = C – Dp

Unit: mm (in)

	SR20DE	SR20DET
Standard	0.020 - 0.045 (0.0008 - 0.0018)	0.030 - 0.055 (0.0012 - 0.0022)
Limit	0.090 (0.0035)	

Inspection (Cont'd)

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

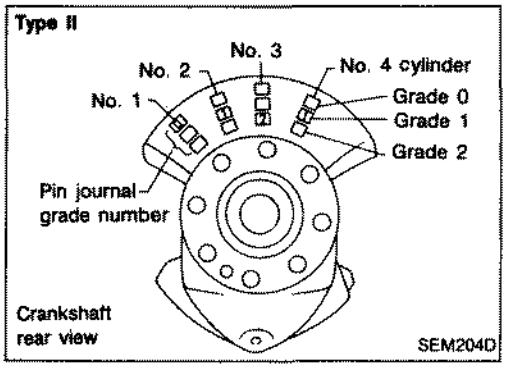


8. If crankshaft is replaced with a new one, select connecting rod bearing according to the following table.

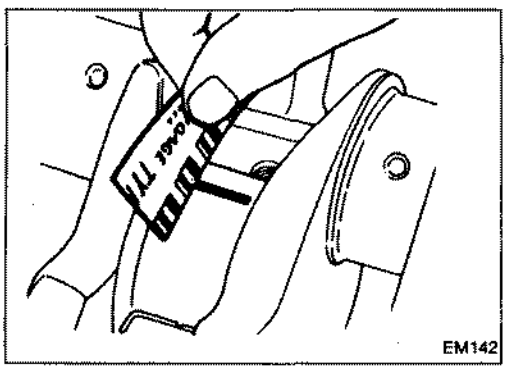
Connecting rod bearing grade number:

Grade numbers are punched in either Arabic or Roman numerals.

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



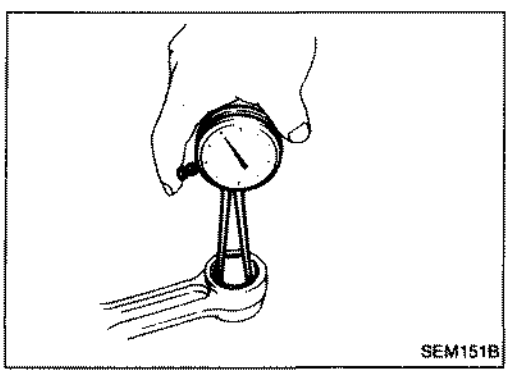
Identification color:
Grade 0; No color
Grade 1; Black
Grade 2; Brown



Method B (Using plastigage)

CAUTION:

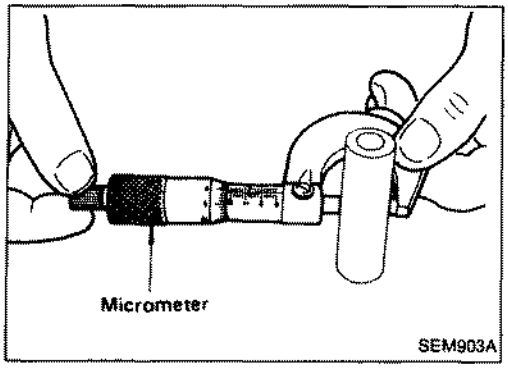
- **Do not turn crankshaft or connecting rod while plastigage is being inserted.**
- **When bearing clearance exceeds the specified limit, ensure that the proper bearing has been installed. Then if excessive bearing clearance exists, use a thicker main bearing or undersized bearing so that the specified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



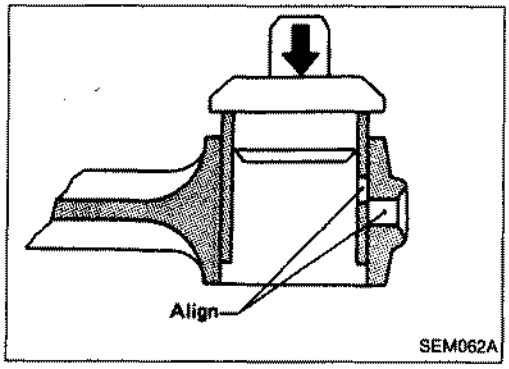
CONNECTING ROD BUSHING CLEARANCE (Small end)

1. Measure inner diameter "C" of bushing.

Inspection (Cont'd)



2. Measure outer diameter "Dp" of piston pin.
3. Calculate connecting rod bushing clearance.
   Connecting rod bushing clearance = C – Dp
   Standard:
   0.005 - 0.017 mm (0.0002 - 0.0007 in)
   Limit:
   0.023 mm (0.0009 in)
   If it exceeds the limit, replace connecting rod assembly or connecting rod bushing and/or piston set with pin.

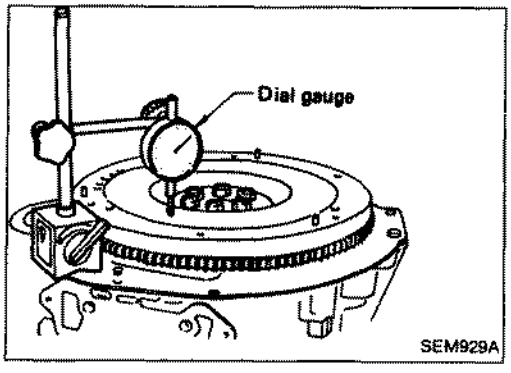


REPLACEMENT OF CONNECTING ROD BUSHING (Small end)

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

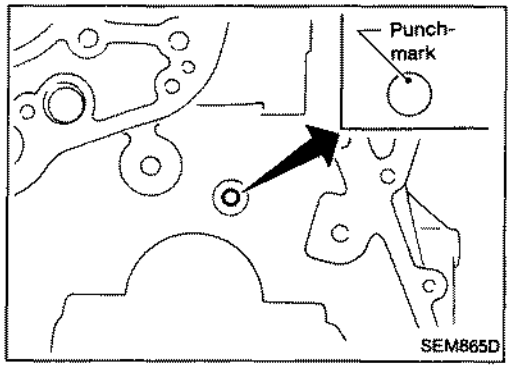
Be sure to align the oil holes.

2. After driving in small end bushing, ream the bushing so that clearance between connecting rod bushing and piston pin is the specified value.
   Clearance between connecting rod bushing and piston pin:
   0.005 - 0.017 mm (0.0002 - 0.0007 in)



FLYWHEEL RUNOUT

Runout (Total indicator reading):
Less than 0.10 mm (0.0039 in)

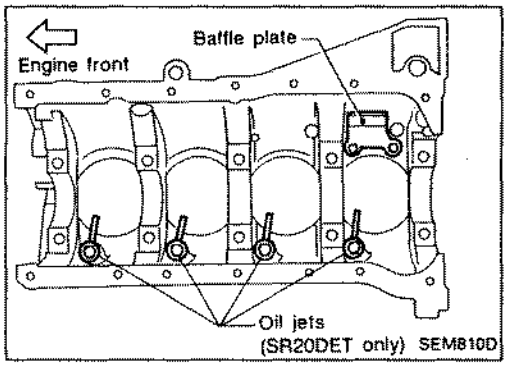


Assembly

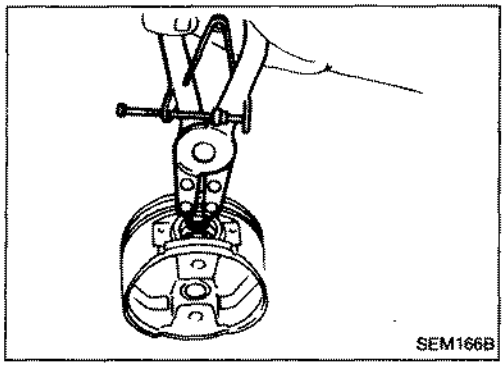
1. Install timing chain oil jet.

Drive oil jet into cylinder block with punchmark facing up.

Assembly (Cont'd)

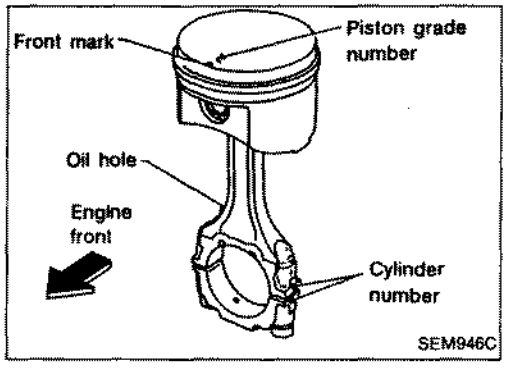


2. Install piston oil jets. (SR20DET only).
3. Install baffle plate.



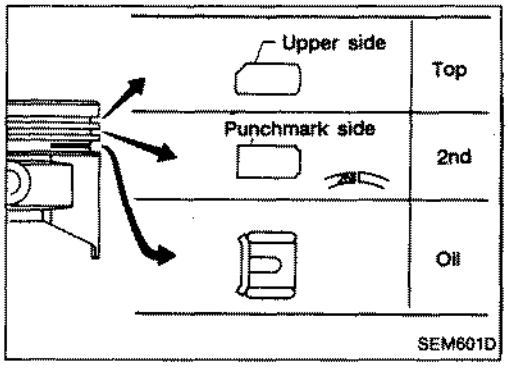
PISTON

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.

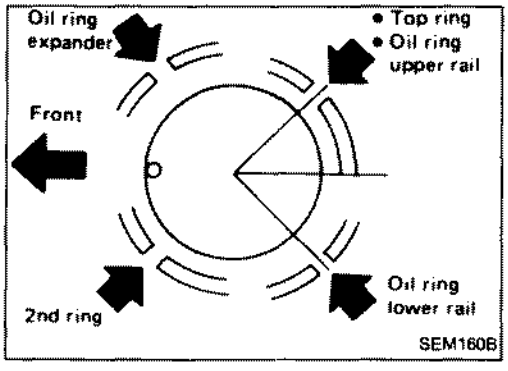
- **Align the direction of piston and connecting rod.**
- **Numbers stamped on connecting rod and cap correspond to each cylinder.**
- **After assembly, make sure connecting rod swings smoothly.**



3. Set piston rings as shown.

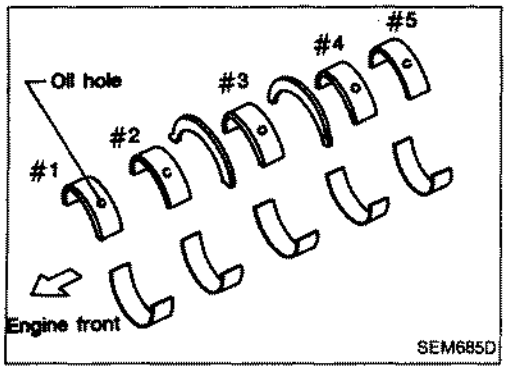
CAUTION:

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



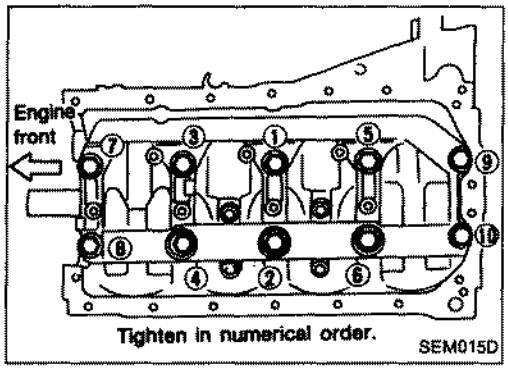
Assembly (Cont'd)

CRANKSHAFT



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

- **Confirm that correct main bearings are used. Refer to "Inspection" of this section.**



2. Install crankshaft, main bearing caps and 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.**
- **Tightening procedure**

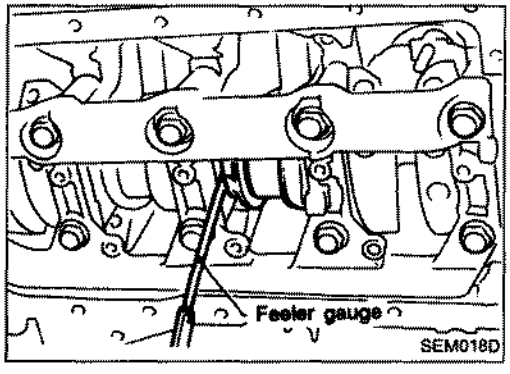
(SR20DE)

1) **Tighten bolts to 32 to 38 N·m (3.3 to 3.9 kg-m, 24 to 28 ft-lb).**
2) **Turn bolts 45 to 50 degrees clockwise or if angle wrench is not available, tighten bolts to 73 to 82 N·m (7.4 to 8.4 kg-m, 54 to 61 ft-lb).**

(SR20DET)

1) **Tighten bolts to 38 to 44 N·m (3.9 to 4.5 kg-m, 28 to 33 ft-lb).**
2) **Turn bolts 60 to 65 degrees clockwise or if angle wrench is not available, tighten bolts to 84 to 114 N·m (8.6 to 11.6 kg-m, 62 to 84 ft-lb).**

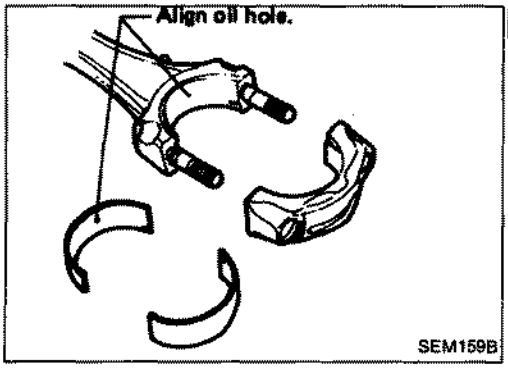
- **After securing bearing cap bolts, make sure crankshaft turns smoothly by hand.**



3. Measure crankshaft end play.

Crankshaft end play:
Standard
0.10 - 0.26 mm (0.0039 - 0.0102 in)
Limit
0.30 mm (0.0118 in)

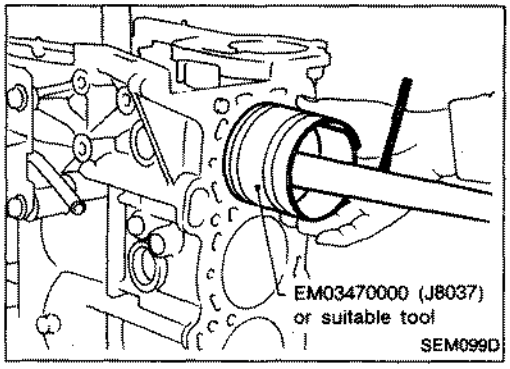
If beyond the limit, replace thrust bearings with new ones.



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

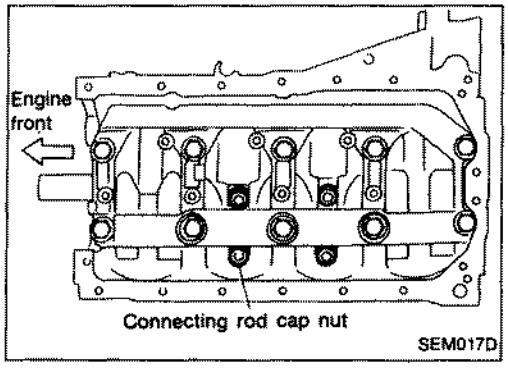
- **Confirm that correct bearings are used. Refer to "Inspection".**
- **Install bearings so that oil hole in connecting rod aligns with oil hole of bearing.**

Assembly (Cont'd)



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.**
- **Be careful not to hit oil jet with connecting rod. (SR20DET only)**



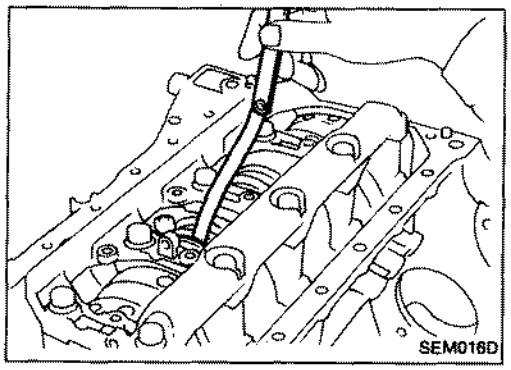
b. Install connecting rod caps.
Tighten connecting rod cap nuts to the specified torque.

Tightening procedure:
(SR20DE)

1) **Tighten nuts to 14 to 16 N·m (1.4 to 1.6 kg-m, 10 to 12 ft-lb).**
2) **Turn nuts 60 to 65 degrees clockwise or if angle wrench is not available, tighten nuts to 38 to 44 N·m (3.9 to 4.5 kg-m, 28 to 33 ft-lb).**

(SR20DET)

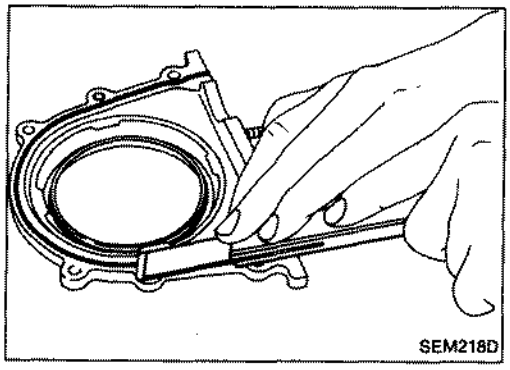
1) **Tighten nuts to 19 to 21 N·m (1.9 to 2.1 kg-m, 14 to 15 ft-lb).**
2) **Turn nuts 60 to 65 degrees clockwise or if angle wrench is not available, tighten nuts to 46 to 52 N·m (4.7 to 5.3 kg-m, 34 to 38 ft-lb).**



6. Measure connecting rod side clearance.

Connecting rod side clearance:
Standard
0.20 - 0.35 mm (0.0079 - 0.0138 in)
Limit
0.50 mm (0.0197 in)

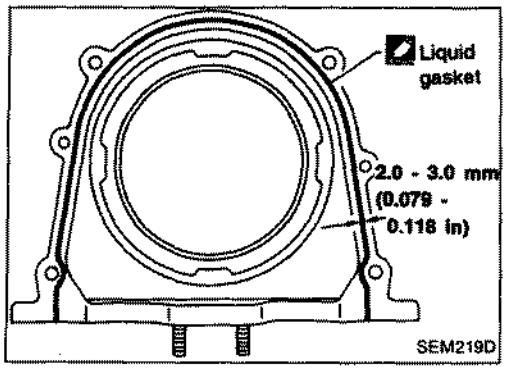
If beyond the limit, replace connecting rod and/or crankshaft.



7. Install rear oil seal retainer.
(1) Before installing rear oil seal retainer, remove all traces of liquid gasket from mating surface using a scraper.

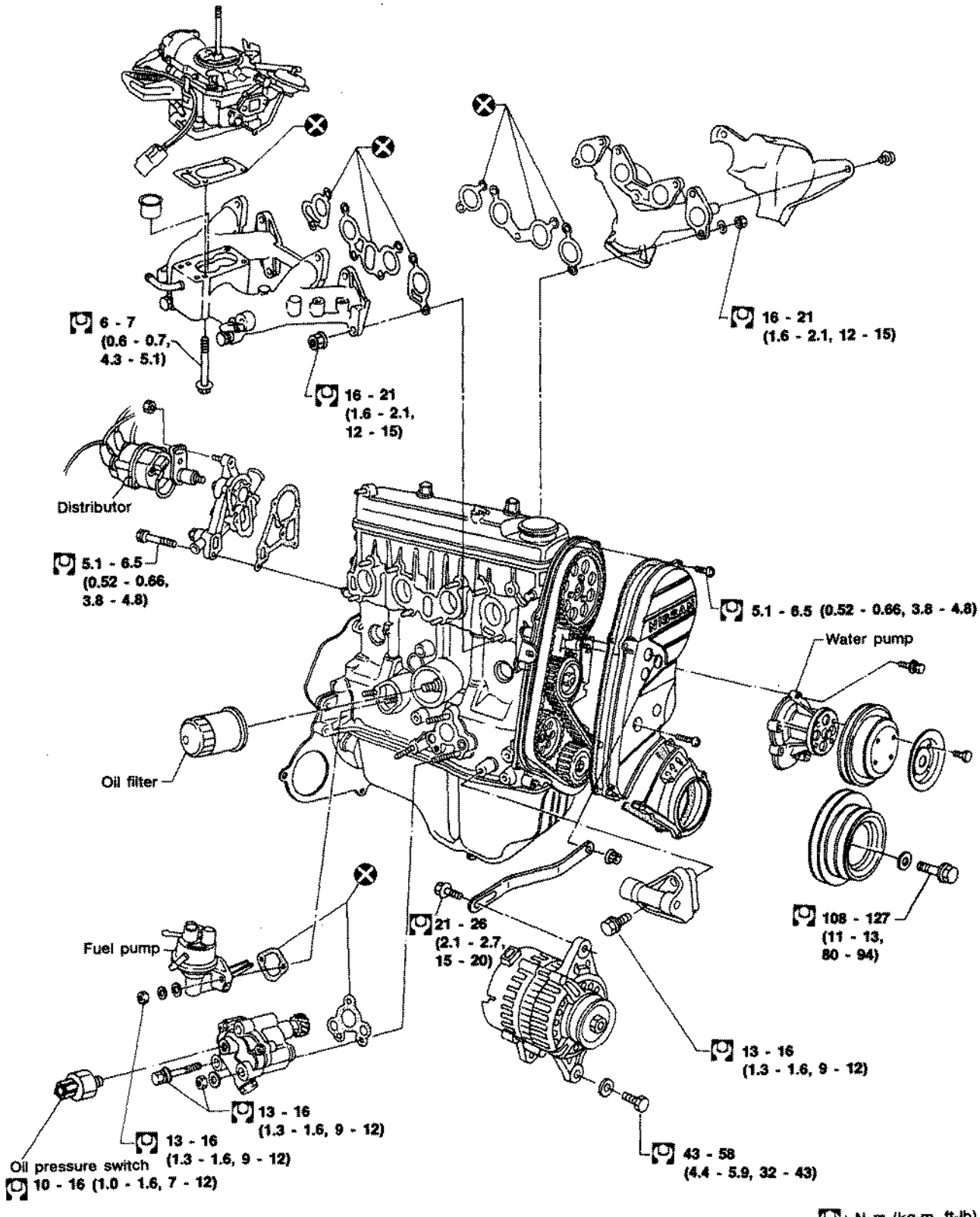
- Also remove traces of liquid gasket from mating surface of cylinder block.

Assembly (Cont'd)

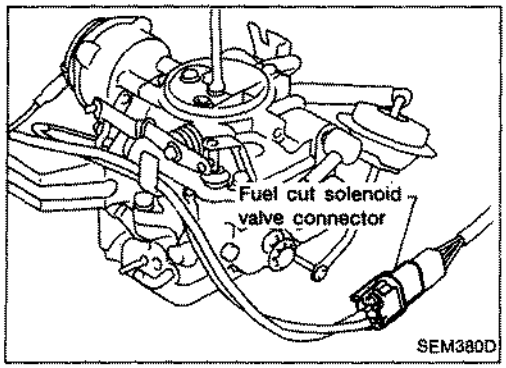


(2) Apply a continuous bead of liquid gasket to mating surface of rear oil seal retainer.

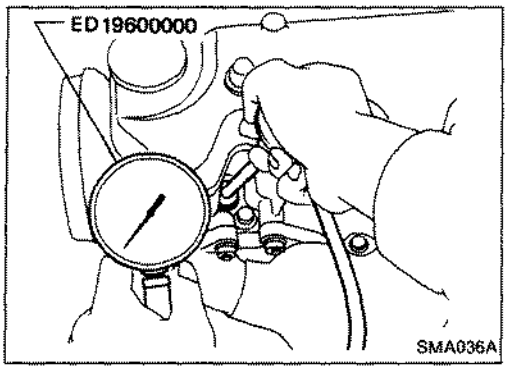
- Use Genuine Liquid Gasket or equivalent.


6 - 7 (0.6 - 0.7, 4.3 - 5.1)
16 - 21 (1.6 - 2.1, 12 - 15)
16 - 21 (1.6 - 2.1, 12 - 15)
Distributor
5.1 - 6.5 (0.52 - 0.66, 3.8 - 4.8)
5.1 - 6.5 (0.52 - 0.66, 3.8 - 4.8)
Water pump
Oil filter
108 - 127 (11 - 13, 80 - 94)
21 - 26 (2.1 - 2.7, 15 - 20)
Fuel pump
13 - 16 (1.3 - 1.6, 9 - 12)
13 - 16 (1.3 - 1.6, 9 - 12)
13 - 16 (1.3 - 1.6, 9 - 12)
Oil pressure switch
10 - 16 (1.0 - 1.6, 7 - 12)
43 - 58 (4.4 - 5.9, 32 - 43)
: N•m (kg-m, ft-lb)

SEM379D



1. Warm up engine.
2. Turn ignition switch off.
3. Disconnect fuel cut solenoid valve connector.
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 the 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 (bar, kg/cm^2, psi)/350 rpm

Standard

1,245 (12.45, 12.7, 181)

Minimum

981 (9.81, 10.0, 142)

Difference limit between cylinders:

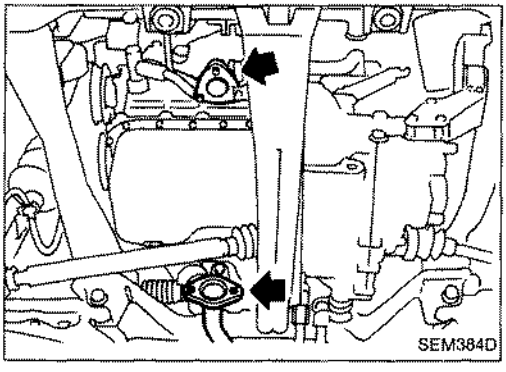
98 (0.98, 1.0, 14)

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

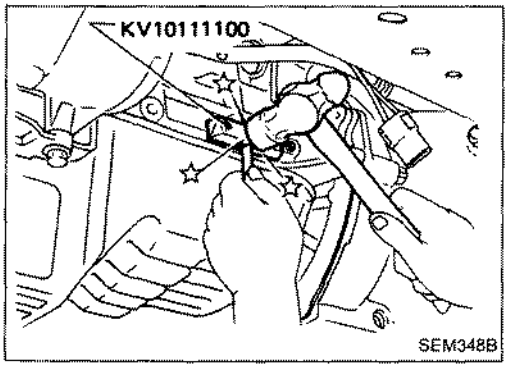
- **If adding oil helps compression, piston rings may be worn or damaged. If so, replace piston rings after checking piston.**
- **If pressure stays low, a valve may be sticking or seating improperly. Inspect and repair valve and valve seat. (Refer to S.D.S.) If valve or valve seat is damaged excessively,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

Removal

1. Drain engine oil.



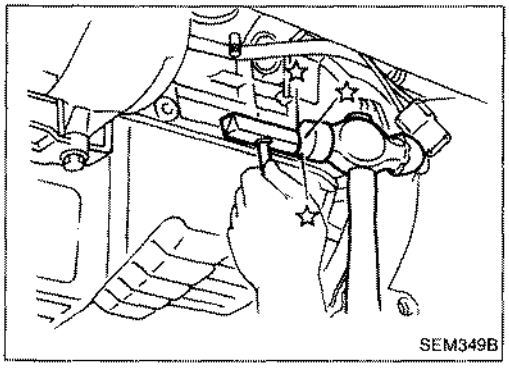
2. Remove front exhaust tube.
3. Remove engine gussets.



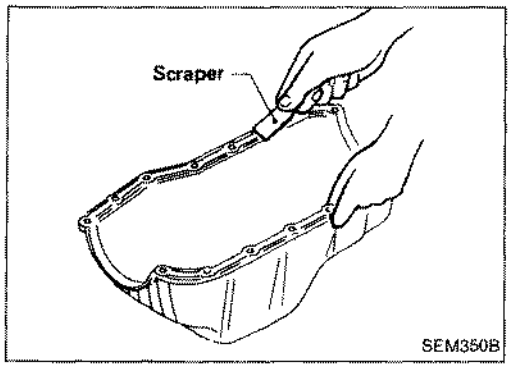
4. Remove oil pan.

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

- Do not insert Tool 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.



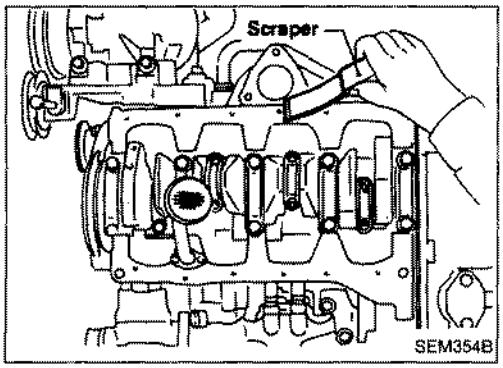
(2) Slide seal cutter by tapping it with a hammer, and remove oil pan.



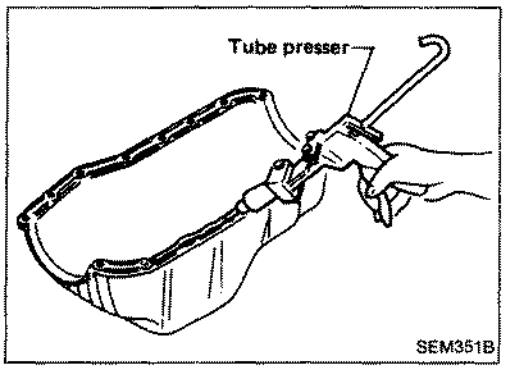
Installation

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

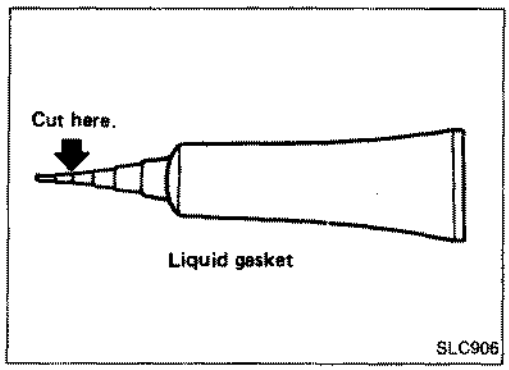
Installation (Cont'd)



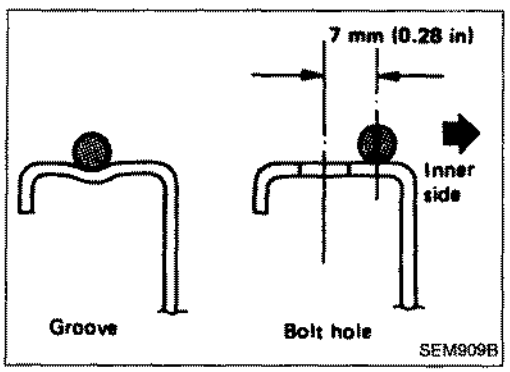
- Also remove traces of liquid gasket from mating surface of cylinder block.



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



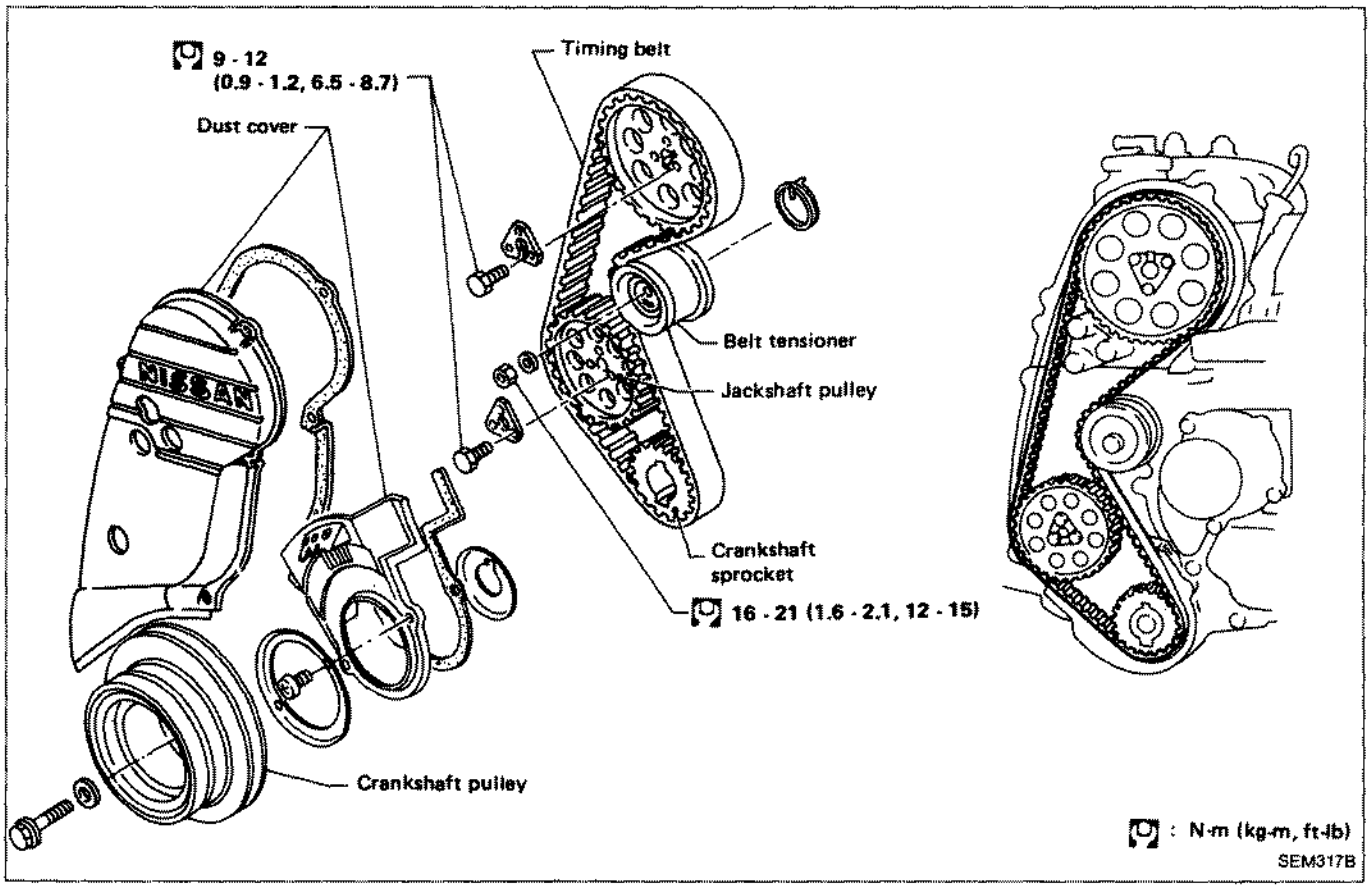
- **Be sure liquid gasket is 3.5 to 4.5 mm (0.138 to 0.177 in) wide.**

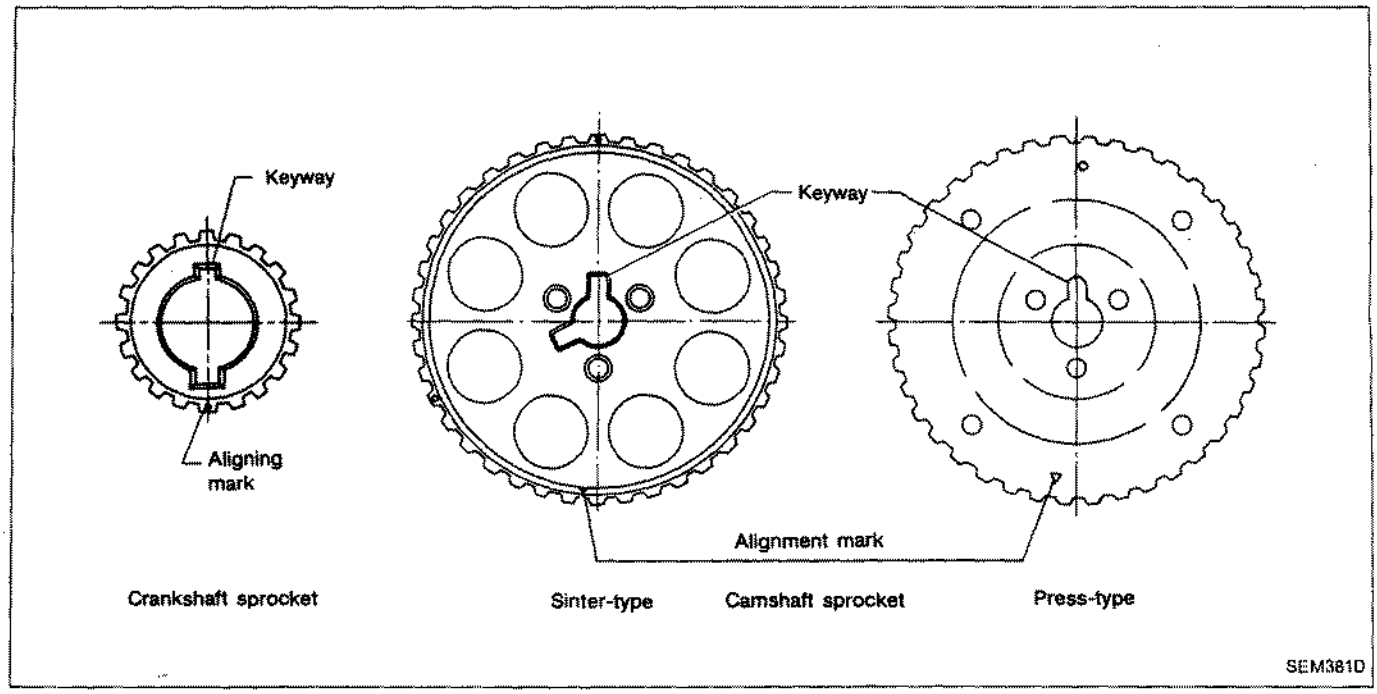


3. Apply liquid gasket to inner sealing surface instead of surface where there is no groove at bolt hole.
- **Attach oil pan to cylinder block within five minutes after coating.**
- **Wait at least 30 minutes before refilling engine oil and engine coolant.**

CAUTION:

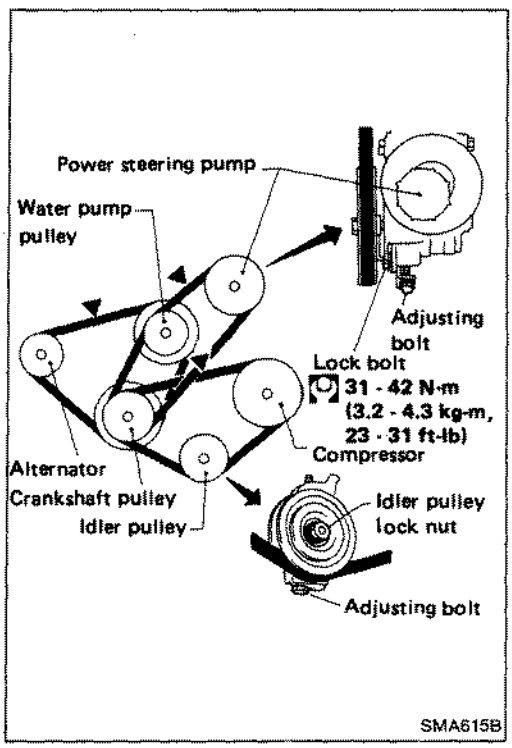
a. **Do not bend or twist timing belt.**
b. **After removing timing belt, do not rotate crankshaft and camshaft separately because valves will strike piston heads.**
c. **Make sure that timing belt, camshaft sprocket, crankshaft sprocket and belt tensioner are clean and free from oil and water.**
d. **Before installing timing belt, confirm that No. 1 cylinder is set at top dead center (T.D.C.) on compression stroke.**
e. **Align arrow in direction of timing belt rotation.**
f. **Adjust timing belt tension with all spark plugs removed.**





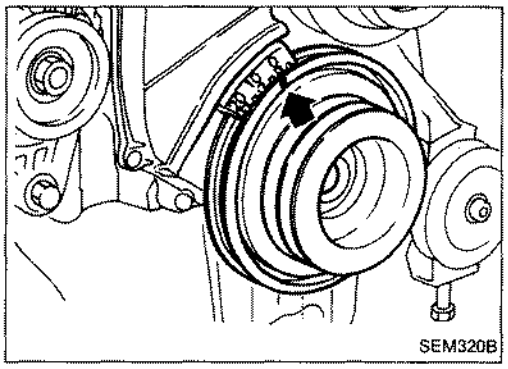
Removal

1. Remove front right side splash cover.

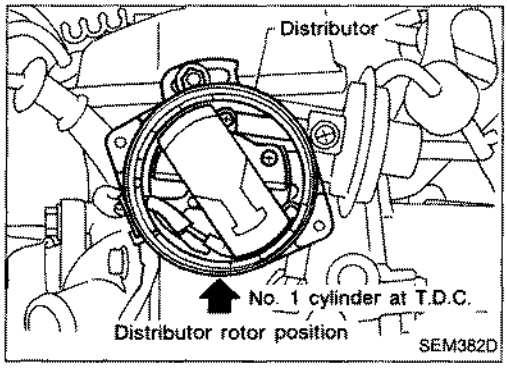


2. Remove the following belts.
- Power steering oil pump drive belt.
- Compressor drive belt
- Alternator drive belt

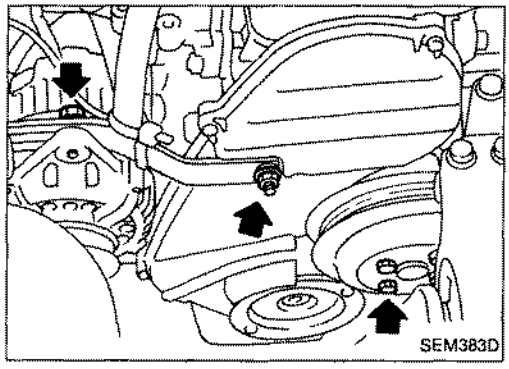
Removal (Cont'd)


SEM320B

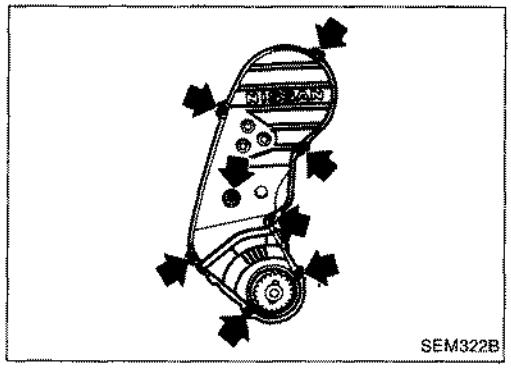
3. Set No. 1 cylinder at top dead center (T.D.C.) on its compression stroke.



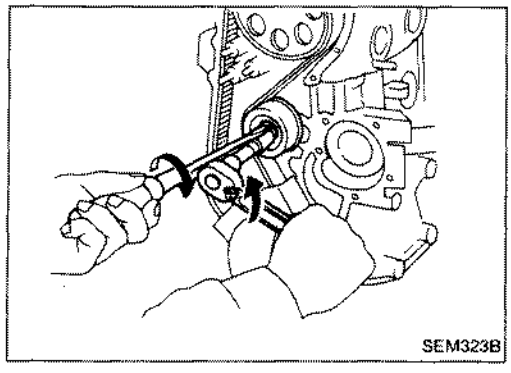
SEM382D


SEM383D

4. Remove the following parts.
- Alternator adjusting bar
- Water pump pulley
- Crankshaft pulley


SEM322B

5. Remove upper and lower dust covers. Use a torx wrench.


SEM323B

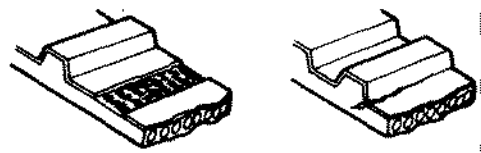
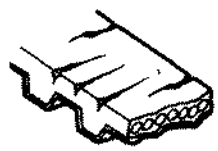
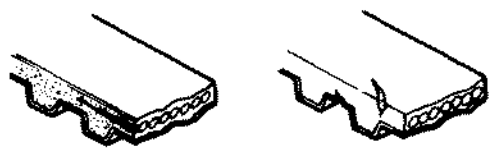
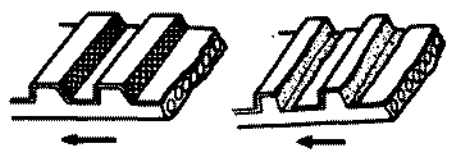
6. Loosen timing belt tension lock nut and rotate tension clockwise. Then tighten tensioner lock nut.

Mark rotating direction mark on timing belt.

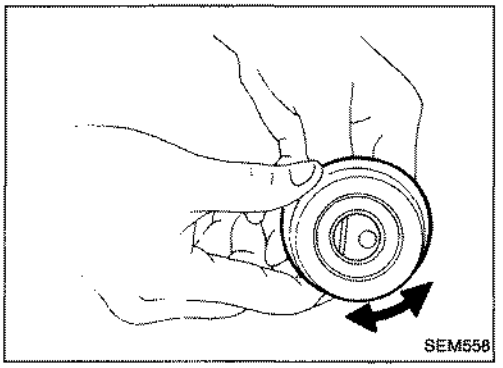
7. Remove timing belt.
8. Remove belt tensioner and return spring.

Inspection

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

Item to check	Problem	Cause
Tooth is broken/tooth root is cracked.	 SEM394A	• Camshaft jamming • Distributor jamming • Damaged camshaft/crankshaft oil seal
Back surface is cracked/worn.	 SEM395A	• Tensioner jamming • Overheated engine • Interference with belt cover
Side surface is worn.	 • Side surface of belt is worn to such an extent that there is no trace of cutoff performed during manufacturing process. • Belt corners are worn and round. • Wicks are frayed and coming out. SEM396A	• Improper installation of belt • Malfunctioning crank pulley plate/timing belt plate
Teeth are worn.	 Rotating direction • Canvas on tooth face is worn down. • Canvas on tooth is fluffy, rubber layer is worn down and faded white, or weft is worn down and invisible. SEM397A	• Poor belt cover sealing • Coolant leakage at water pump • Camshaft not functioning properly • Distributor not functioning properly • Excessive belt tension
Oil/Coolant or water is stuck to belt.		• Poor oil sealing of each oil seal • Coolant leakage at water pump • Poor belt cover sealing

Inspection (Cont'd)


SEM558

BELT TENSIONER AND RETURN SPRING

1. Visually check belt tensioner for stickiness, rust and any evidence of breaks.
2. Confirm that tensioner pulley can be rotated smoothly.
3. Visually check return spring for corrosion, distortion and any abnormal signs.

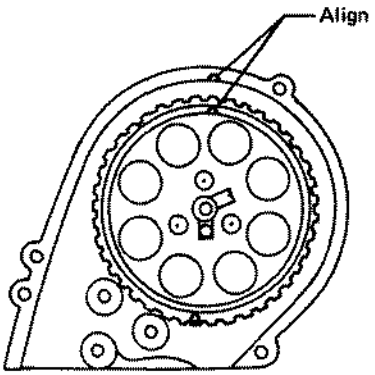
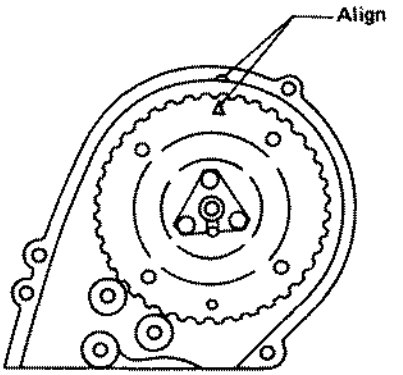
Installation

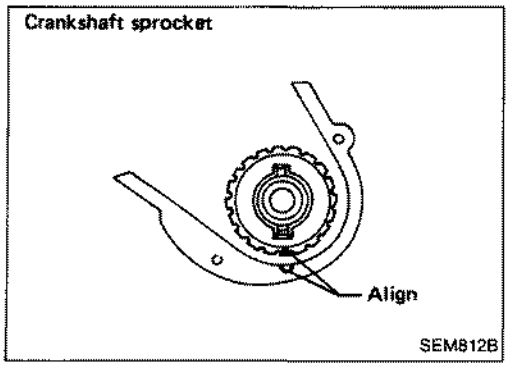
1. Confirm that No. 1 cylinder is set at T.D.C. on its compression stroke.

Ensure that marks on camshaft sprocket and upper front cover and marks on crankshaft sprocket and lower front cover are properly aligned.

2. Temporarily install tensioner and return spring.

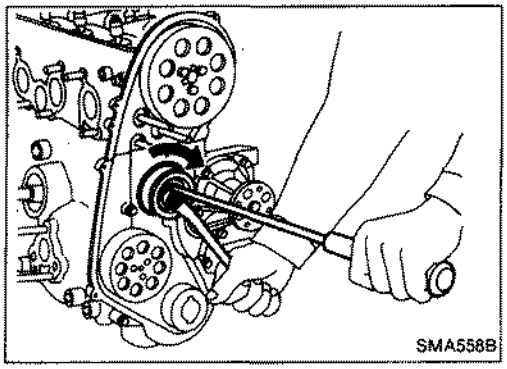
Camshaft sprocket adjusting mark

Sinter-type	Press-type
 SEM809B	 SEM810B



SEM812B

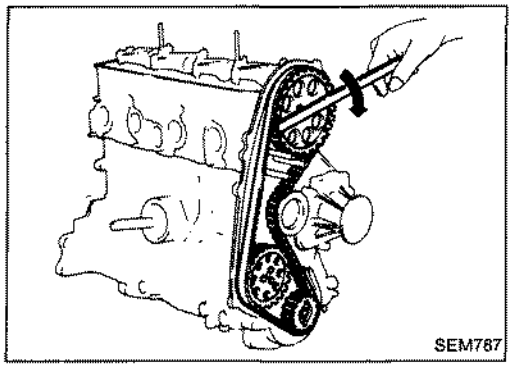
Installation (Cont'd)


SMA558B

3. Rotate tensioner clockwise about 70° to 80° and temporarily tighten lock nut.

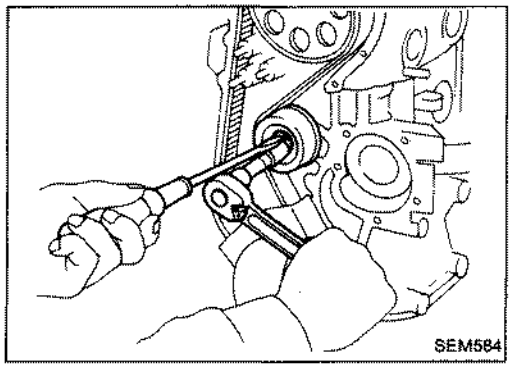
4. Set timing belt.
a. Ensure that timing belt and sprockets are clean and free of oil or water. Do not bend timing belt tightly.
b. Install timing belt with rotating direction mark facing engine rotating direction.
c. Ensure that timing belt is not loose around jackshaft and camshaft sprockets.

5. Loosen tensioner lock nut so that tensioner pushes on timing belt.

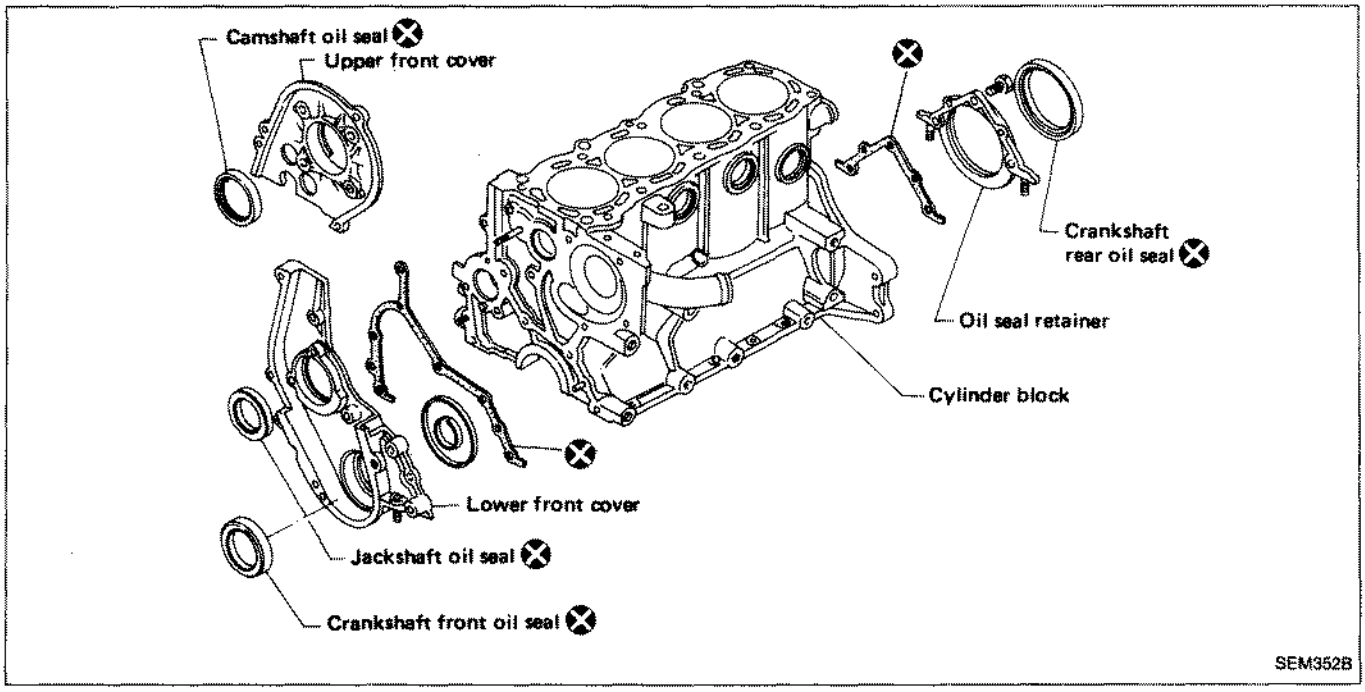

SEM787

6. Turn camshaft sprocket about 20° (2 cogs) clockwise.

Ensure that all spark plugs are removed.

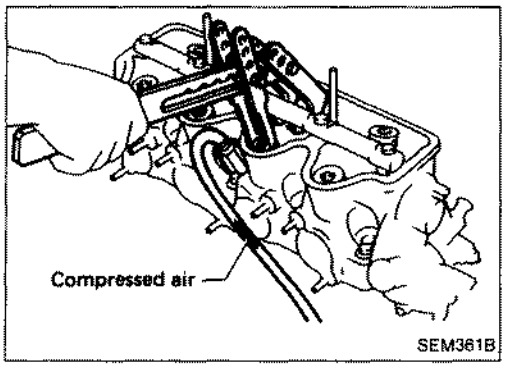

SEM584

7. Tighten nut while preventing tensioner from turning in "free" direction.
8. Install crank sprocket plate and upper and lower dust covers.



VALVE OIL SEAL

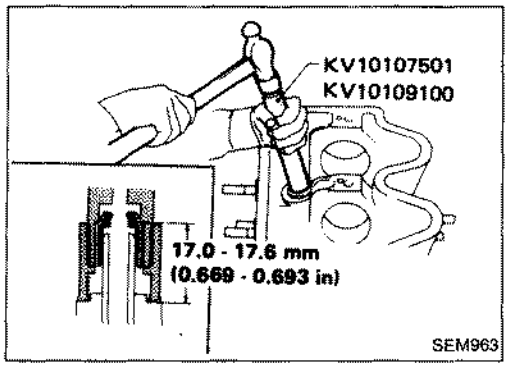
1. Remove rocker cover.
2. Remove rocker shaft assembly with rocker arm.
3. Remove all spark plugs.



4. Install air hose adapter into spark plug hole and apply air pressure to hold valves in place [Apply pressure of 490 kPa (4.9 bar, 5 kg/cm^2, 71 psi)].

When performing this operation, piston should be set at T.D.C.

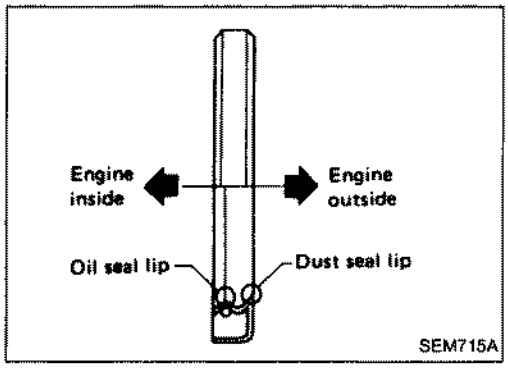
5. Remove valve spring with Tool, then remove valve oil seal.



6. Apply engine oil to valve oil seal lip and install it in place with Tool.

Before installing valve oil seal, be sure to install valve spring seat.

7. Install parts in the reverse order of removal.



OIL SEAL INSTALLING DIRECTION

CAMSHAFT OIL SEAL, CRANKSHAFT FRONT OIL SEAL AND JACKSHAFT OIL SEAL

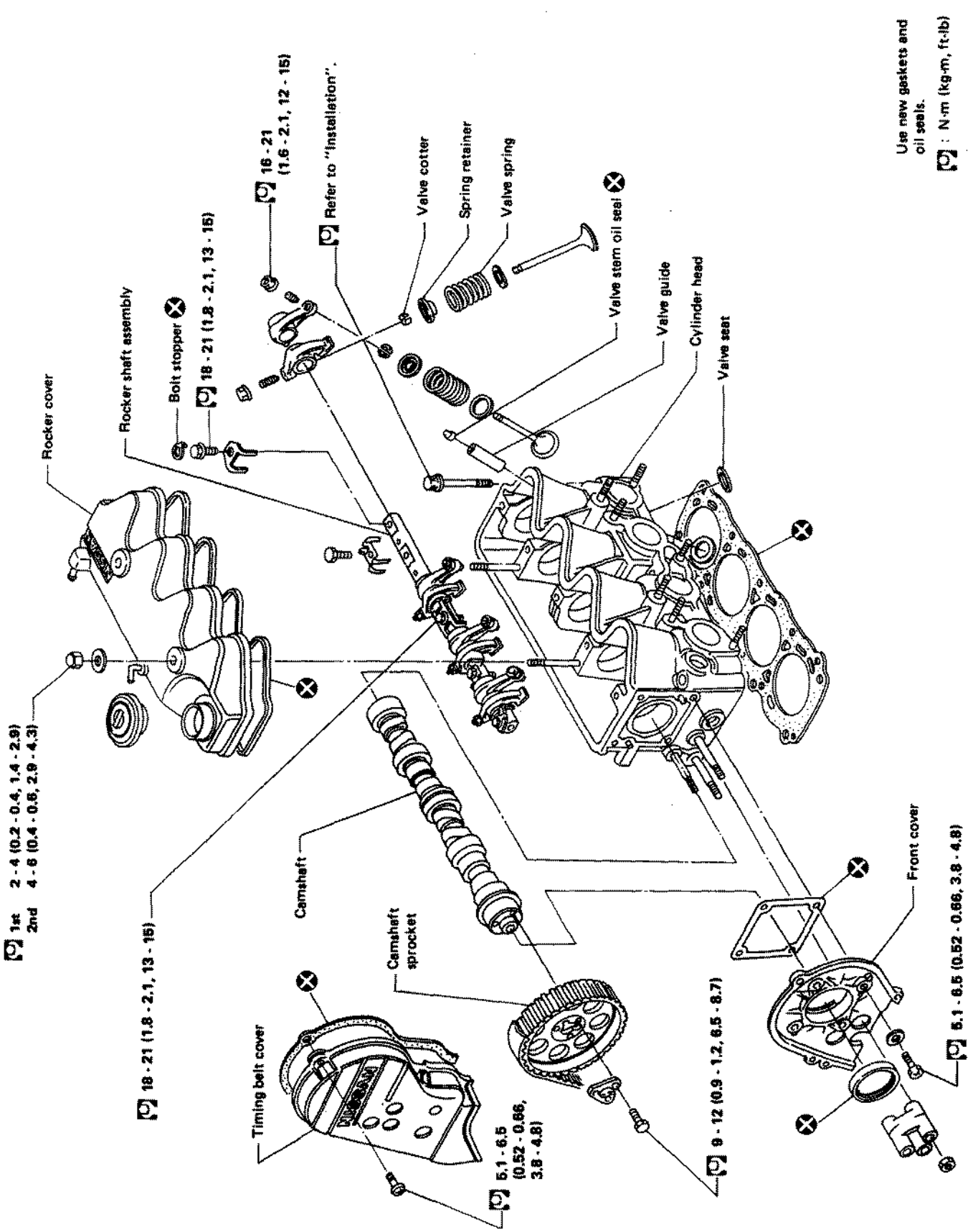
1. Remove timing belt and sprockets.
2. Remove oil seal.

Be careful not to damage surfaces of shafts.

3. Apply engine oil to oil seal lip and install seal in place.

CRANKSHAFT REAR OIL SEAL

1. Remove transaxle. (Refer to MT section.)
2. Remove flywheel. Remove oil seal using a suitable tool. Be careful not to damage sealing surface of crankshaft.
3. Apply engine oil to oil seal lip and install it in place using suitable drift.
4. Install flywheel and transaxle. (Refer to MT section.)

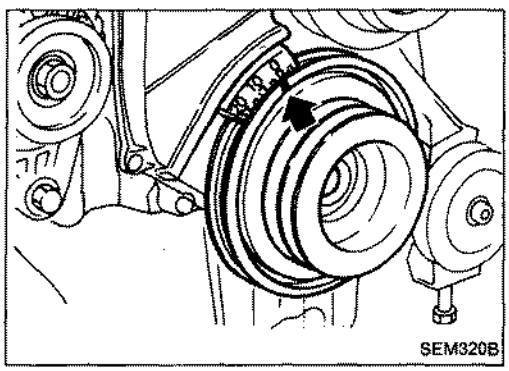

Use new gaskets and oil seals.
: N·m (kg-m, ft-lb)
Rocker cover
Rocker shaft assembly
Bolt stopper
18 - 21 (1.8 - 2.1, 13 - 15)
16 - 21 (1.6 - 2.1, 12 - 15)
Refer to "installation".
Valve cotter
Spring retainer
Valve spring
Valve stem oil seal
Valve guide
Cylinder head
Valve seat
1st 2 - 4 (0.2 - 0.4, 1.4 - 2.9)
2nd 4 - 8 (0.4 - 0.8, 2.9 - 4.3)
18 - 21 (1.8 - 2.1, 13 - 15)
Camshaft
Camshaft sprocket
Timing belt cover
5.1 - 6.5 (0.52 - 0.66, 3.8 - 4.8)
9 - 12 (0.9 - 1.2, 6.5 - 8.7)
Front cover
5.1 - 6.5 (0.52 - 0.66, 3.8 - 4.8)

SEM358B

CAUTION:

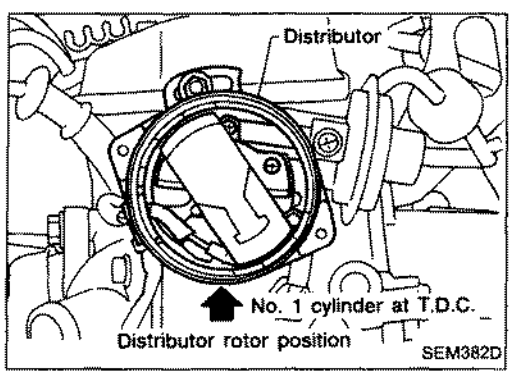
- **When installing sliding parts such as rocker arms, camshaft and oil seal, be sure to apply new engine oil on their sliding surfaces.**
- **When tightening cylinder head bolts and rocker shaft bolts, apply new engine oil to thread portions and seat surfaces of bolts.**

Removal


SEM320B

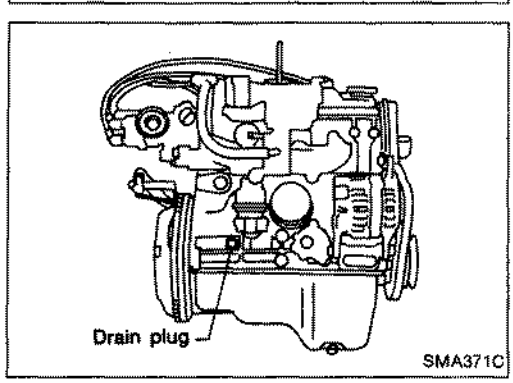
1. Set No. 1 cylinder at T.D.C. on its compression stroke and remove timing belt.

After removing timing belt, do not rotate crankshaft and camshaft separately, because valves will hit piston heads.



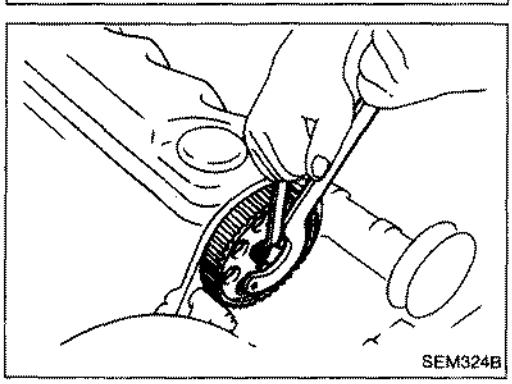
SEM382D

2. Drain engine coolant from radiator and cylinder block.

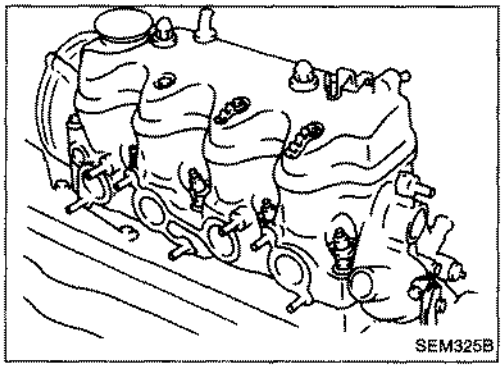


SMA371C

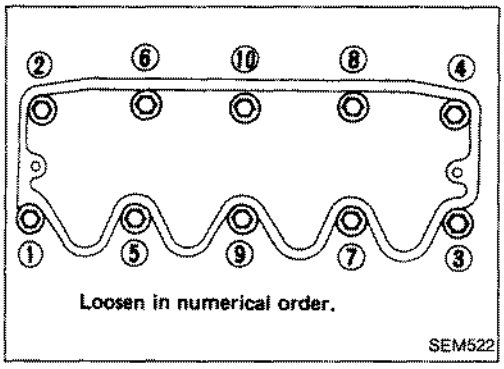
3. Remove camshaft sprocket and front cover.


SEM324B

Removal (Cont'd)


SEM325B

4. Remove the following parts.
- Exhaust manifold
- Air cleaner
- Intake manifold
- Rocker cover
- Distributor

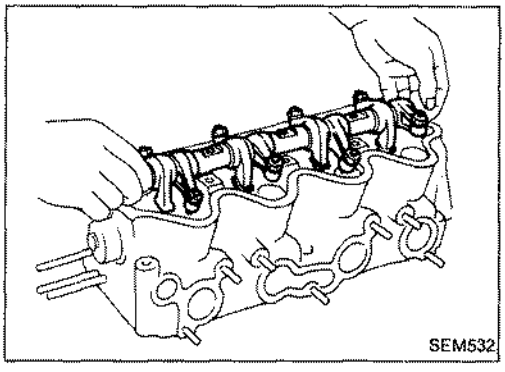


Loosen in numerical order.
SEM522

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

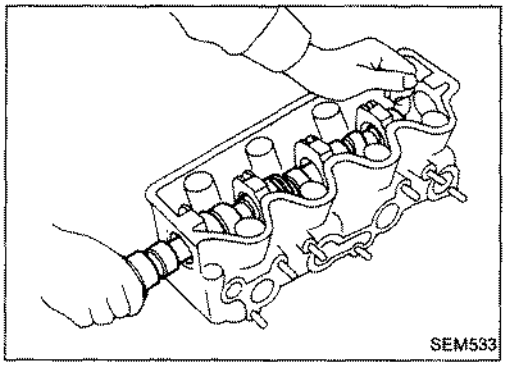
6. Remove intake manifold from cylinder head.

Disassembly

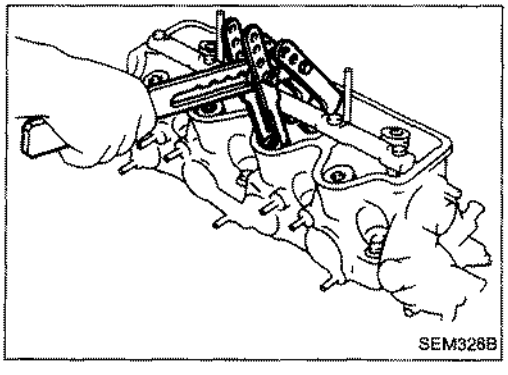

SEM532

1. Remove rocker shaft with rocker arms.

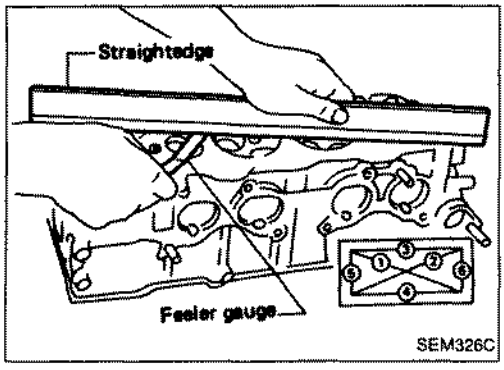
The bolts should be loosened in two or three stages.
Keep rocker shaft components in correct order.


SEM533

2. Remove camshaft from front side.


SEM328B

3. Remove valve component parts with Tool.



Inspection

CYLINDER HEAD DISTORTION

Cylinder head distortion:

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".

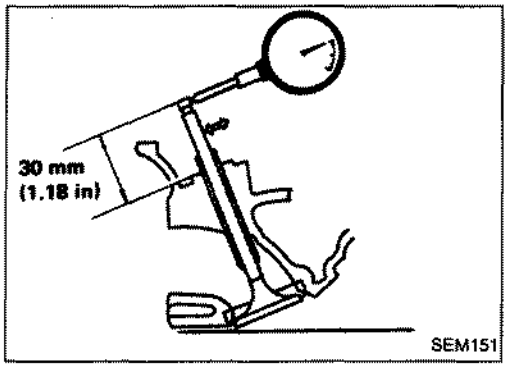
The maximum limit is as follows:

A + B = 0.2 mm (0.008 in)

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

Cylinder head height (Nominal):

120 ± 0.1 mm (4.724 ± 0.004 in)



VALVE GUIDE CLEARANCE

- **Valve guide clearance should be measured parallel with rocker arm. (Generally, a large amount of wear occurs in this direction.)**

Stem to guide clearance:

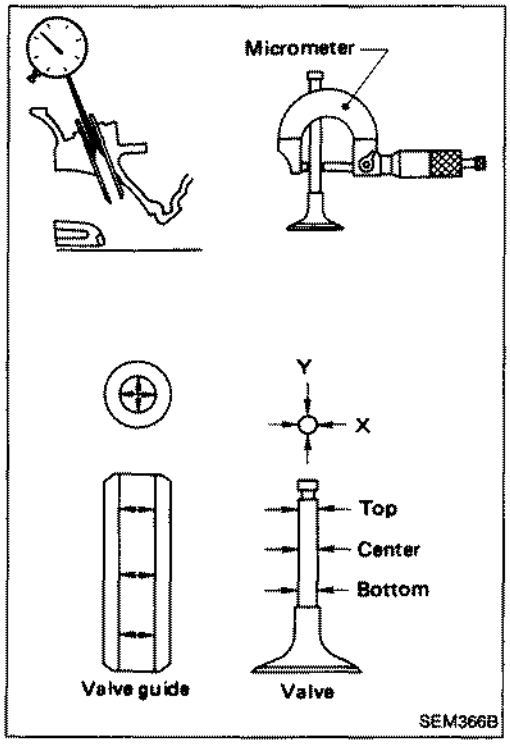
Maximum limit

0.10 mm (0.0039 in)

Maximum allowable deflection

(Dial indicator reading)

0.2 mm (0.008 in)

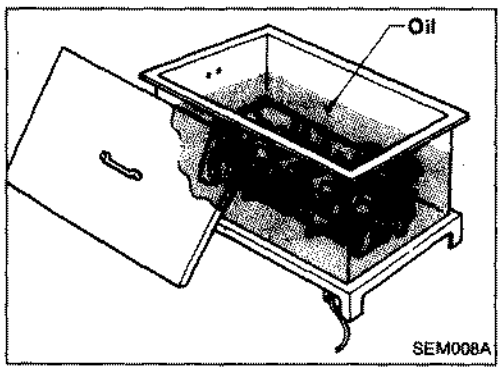


- **To determine the correct replacement part, measure valve stem diameter and valve guide bore.**

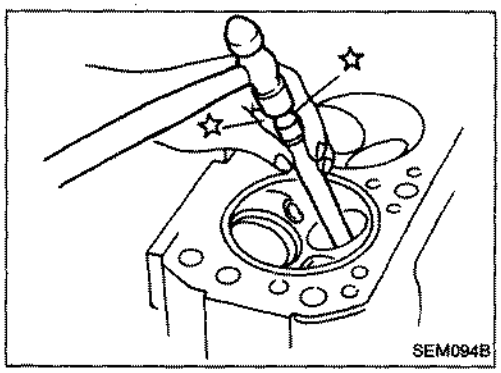
For dimensions, refer to S.D.S.

Inspection (Cont'd)

VALVE GUIDE REPLACEMENT

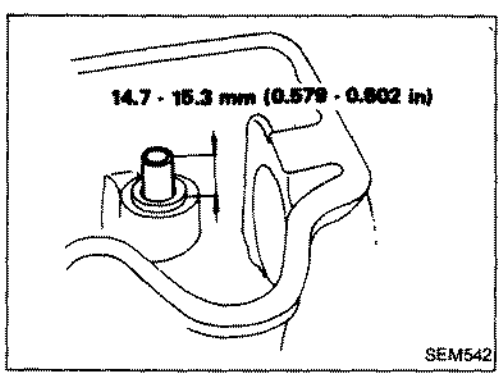


1. To remove valve guide, heat cylinder head to 150 to 160°C (302 to 320°F).

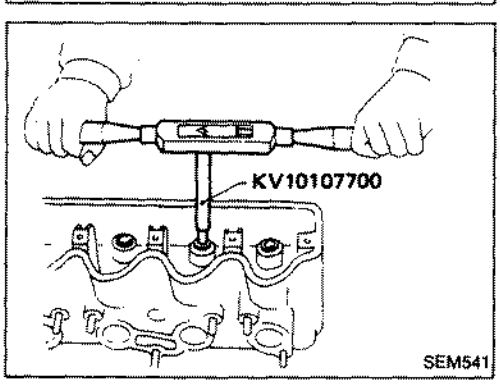


2. Drive out valve guide with hammer and suitable tool.

3. Ream cylinder head valve guide hole. (at room temperature)
   Valve guide hole inner diameter
   (For service parts):
   12.200 - 12.211 mm (0.4803 - 0.4807 in)

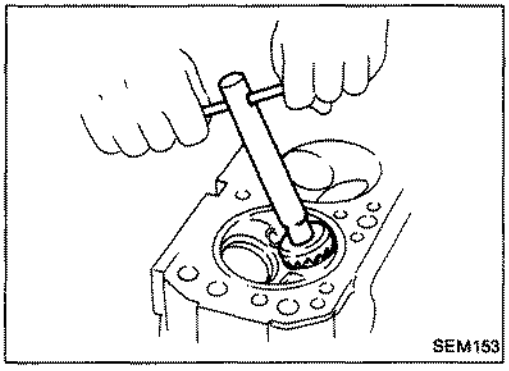


4. Heat cylinder head to 150 to 160°C (302 to 320°F) and press service valve guide onto cylinder head.



5. Ream valve guide. (at room temperature)
   Finished size (Inner diameter):
   7.005 - 7.020 mm (0.2758 - 0.2764 in)

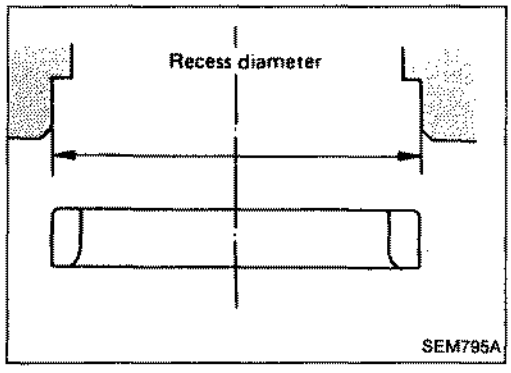
Inspection (Cont'd)


SEM153

VALVE SEATS

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

- **When repairing valve seats, check valve and valve guide for wear beforehand. If worn, replace them. Then correct valve seat.**
- **The cutting should be done with both hands for uniform cutting.**



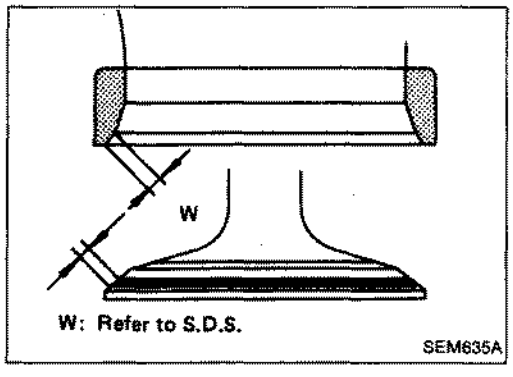
SEM795A

REPLACING VALVE SEAT FOR SERVICE PARTS

1. Bore out old seat until it collapses. The machine depth stop should be set so that boring cannot continue beyond the bottom face of the seat recess in cylinder head.
2. Ream cylinder head recess.
   Reaming bore for service valve seat
   [Oversize 0.5 mm (0.020 in)]:
   Intake
   37.500 - 37.516 mm (1.4764 - 1.4770 in)
   Exhaust
   31.500 - 31.511 mm (1.2402 - 1.2406 in)

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

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



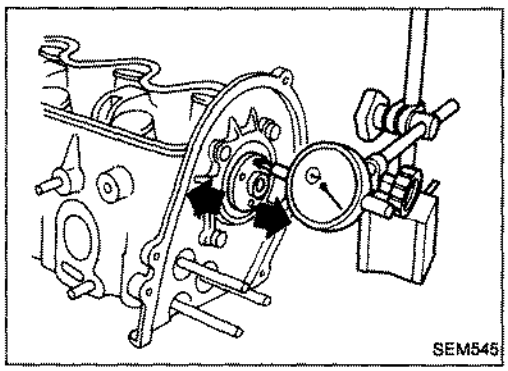
W: Refer to S.D.S.
SEM635A

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

CAMSHAFT VISUAL CHECK

Check camshaft for scratches, seizure and wear.

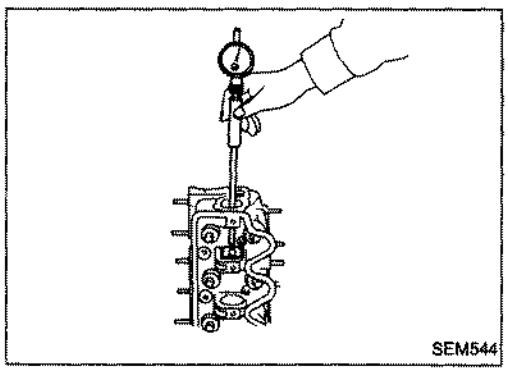
Inspection (Cont'd)


SEM545

CAMSHAFT END PLAY

1. Install camshaft and front cover in cylinder head.
2. Measure camshaft end play.

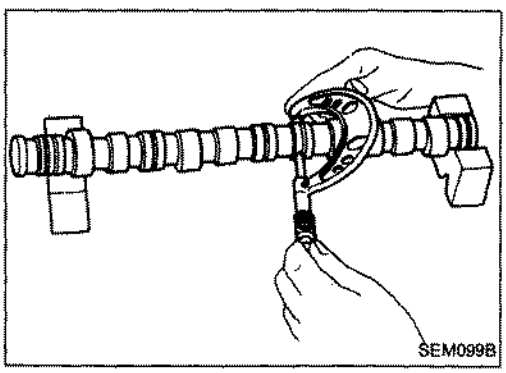
Camshaft end play:
Limit 0.4 mm (0.016 in)


SEM544

CAMSHAFT JOURNAL CLEARANCE

1. Measure the inside diameter of camshaft bearing.

Standard inner diameter:
42.000 - 42.025 mm (1.6535 - 1.6545 in)

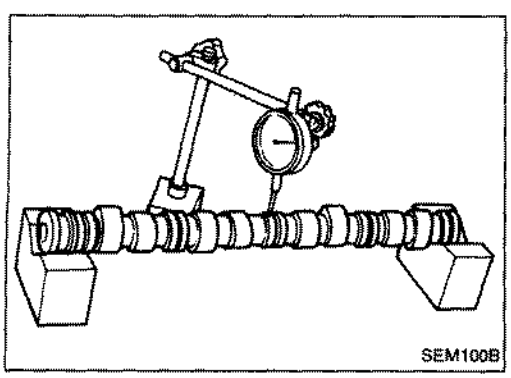

SEM099B

2. Measure the outside diameter of camshaft journal.

Standard outer diameter:
No. 1, 3, 5
41.949 - 41.965 mm (1.6515 - 1.6522 in)
No. 2, 4
41.906 - 41.922 mm (1.6498 - 1.6505 in)

If the clearance is greater than the maximum, replace camshaft and/or cylinder head.

Maximum clearance:
No. 1, 3, 5
0.15 mm (0.0059 in)
No. 4, 6
0.20 mm (0.0079 in)

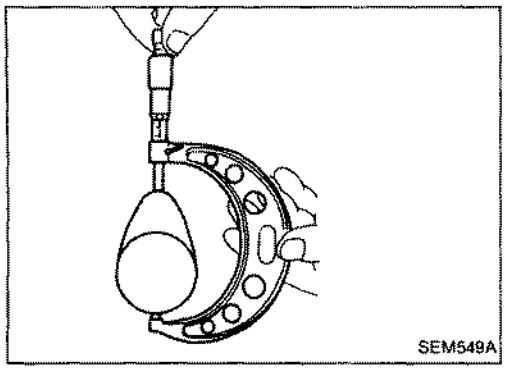

SEM100B

CAMSHAFT RUNOUT

Runout [T.I.R. (Total Indicator Reading)]
Limit 0.1 mm (0.004 in)
at the center journal

If beyond the limit, replace.

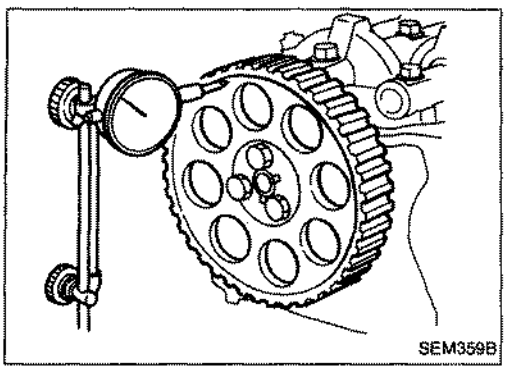
Inspection (Cont'd)


SEM549A

CAMSHAFT CAM HEIGHT

Standard cam height:
Intake
35.71 - 35.96 mm (1.4059 - 1.4157 in)
Exhaust
35.43 - 35.68 mm (1.3949 - 1.4047 in)
Cam wear:
Limit 0.20 mm (0.0079 in)

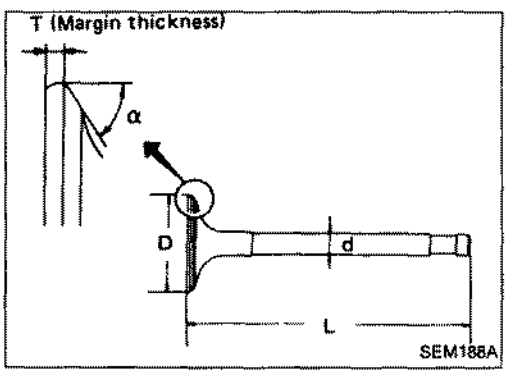
If wear is beyond the limit, replace.


SEM359B

CAMSHAFT SPROCKET RUNOUT

Install sprocket on camshaft and check for runout.

If runout exceeds the specified limit, replace camshaft sprocket.
Runout (Total indicator reading):
Limit 0.1 mm (0.004 in)



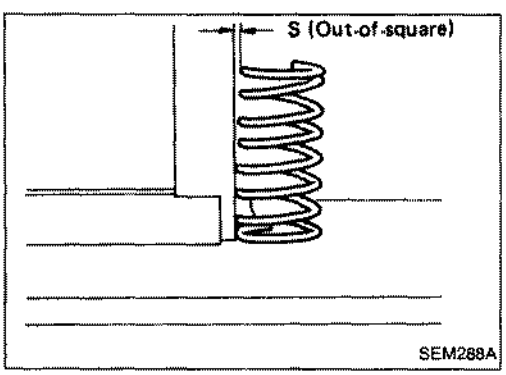
SEM188A

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.

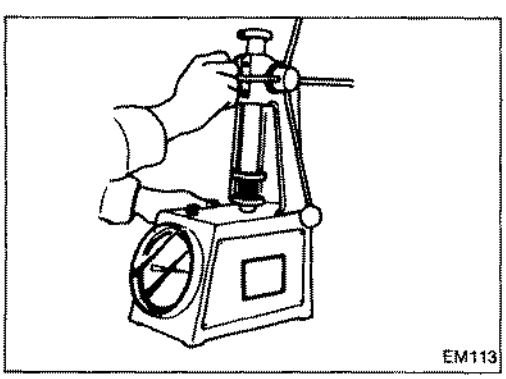
Grinding allowance for valve stem tip is 0.2 mm (0.008 in) or less.



SEM288A

VALVE SPRING SQUARENESS

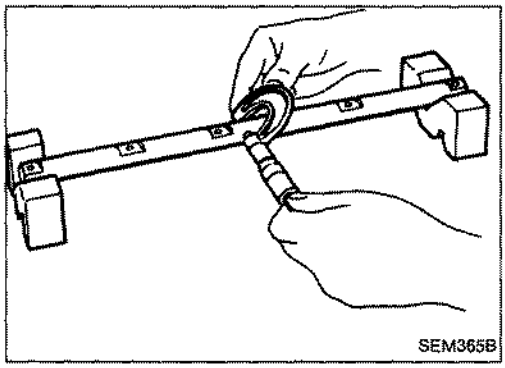
Out-of-square:
Less than 2.0 mm (0.079 in)


EM113

VALVE SPRING PRESSURE LOAD

Refer to S.D.S.

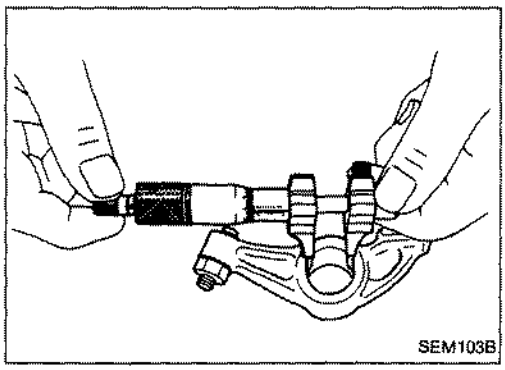
Inspection (Cont'd)


SEM365B

ROCKER SHAFT AND ROCKER ARM

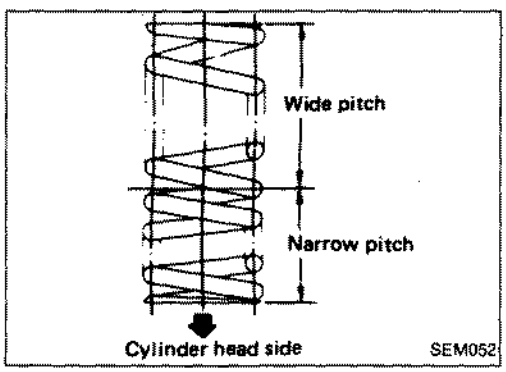
1. Check rocker shaft and rocker arms for scratches, seizure and wear.
2. Check outer diameter of rocker shaft.

Diameter:
19.979 - 20.000 mm (0.7866 - 0.7874 in)


SEM103B

3. Check inner diameter of rocker arm.

Diameter:
20.007 - 20.028 mm (0.7877 - 0.7885 in)
Rocker arm to shaft clearance:
0.007 - 0.049 mm (0.0003 - 0.0019 in)



SEM052

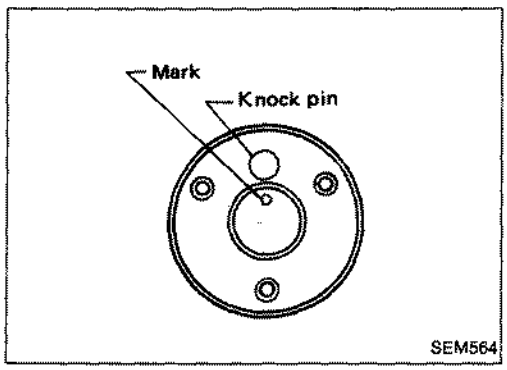
Assembly

1. Install valve component parts.

- **Always use new valve oil seal. (Refer to OIL SEAL REPLACEMENT.)**
- **Before installing valve oil seal, install valve spring seat.**
- **Install uneven pitch type spring 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. Install camshaft and upper front cover in cylinder head with new camshaft oil seal.

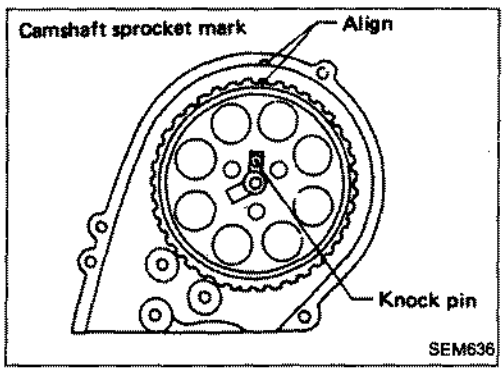
- **Refer to OIL SEAL REPLACEMENT.**



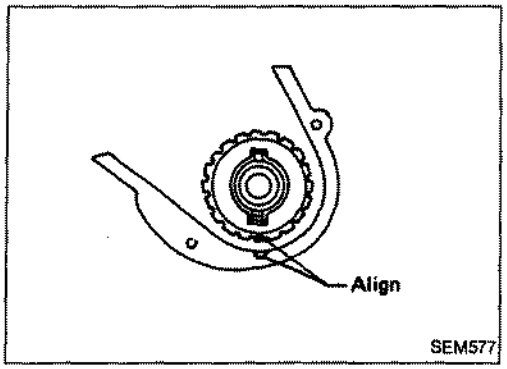
SEM564

- **After installing camshaft, set knock pin upper side.**

Assembly (Cont'd)



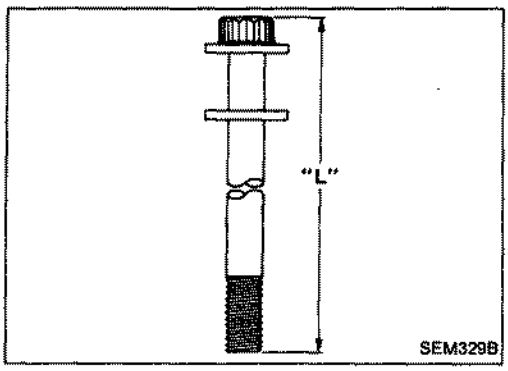
3. Install camshaft sprocket.
- **Align camshaft sprocket mark with upper front cover mark.**



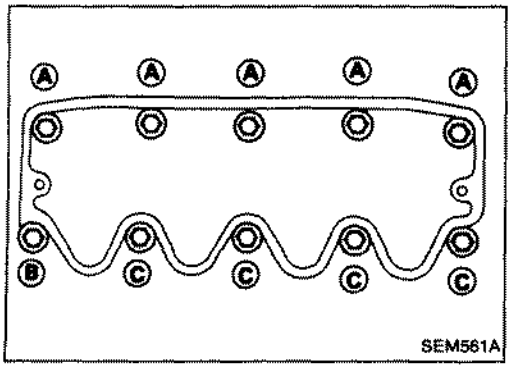
4. Align crankshaft sprocket mark with lower front cover mark.
5. Install intake manifold to cylinder head.

Installation

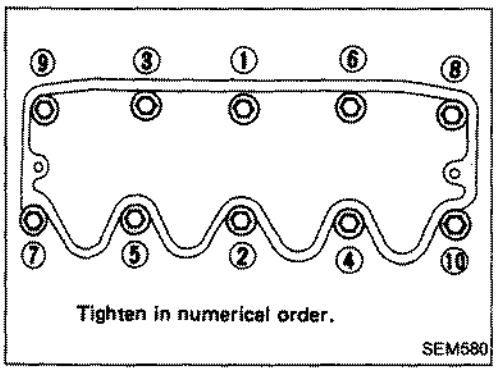
1. Install cylinder head with new gasket.
- **Be sure to install washers between cylinder head and bolts.**



- **There are three kinds of cylinder head bolts with different lengths.**
  Bolt length "L":
  Ⓐ: 95 mm (3.74 in)
  Ⓑ: 110 mm (4.33 in)
  Ⓒ: 80 mm (3.15 in)



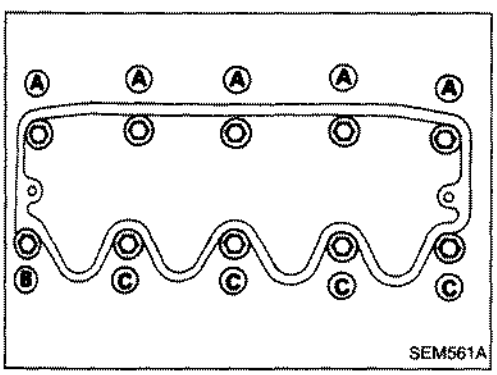
Installation (Cont'd)



2. Apply oil to the thread portion and seat surface of cylinder head bolts and tighten cylinder head bolts with washers.

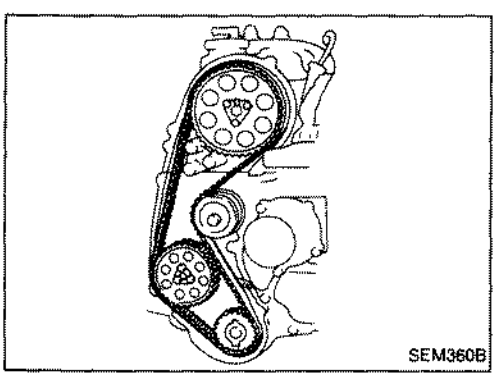
- **Tightening procedure**

1st	**Tighten all bolts to 29 N·m (3.0 kg-m, 22 ft-lb)**
2nd	**Tighten all bolts to 69 N·m (7.0 kg-m, 51 ft-lb)**
3rd	**Loosen all bolts completely**
4th	**Tighten all bolts to 29 N·m (3.0 kg-m, 22 ft-lb)**
5th	**Turn each bolt clockwise the specified number of degrees. If an angle wrench is not available, tighten all bolts to 69 to 74 N·m (7.0 to 7.5 kg-m, 51 to 54 ft-lb).**

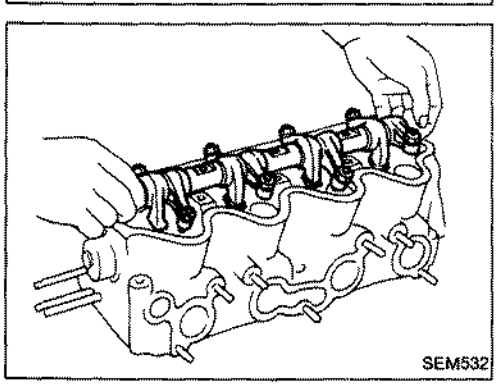


Specified number of degrees.

Ⓐ	**45 - 50**
Ⓑ	**55 - 60**
Ⓒ	**40 - 45**

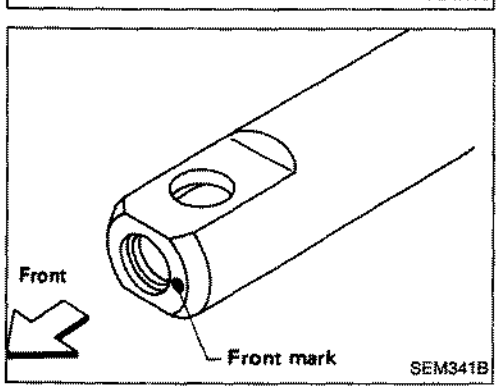


3. Install timing belt and adjust belt tension.
Refer to "TIMING BELT".



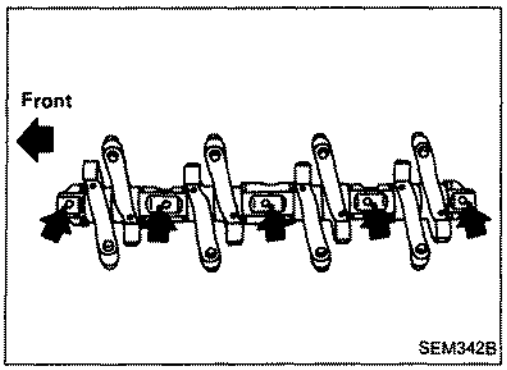
4. Install rocker shaft with rocker arms.

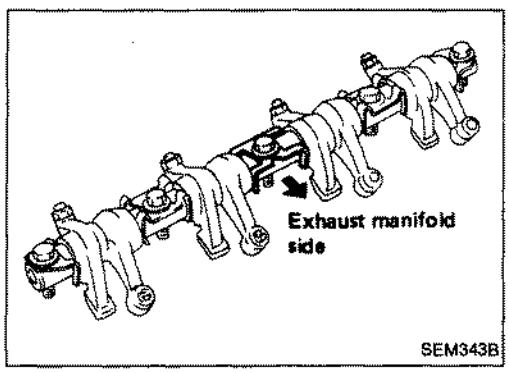
- **Apply engine oil to rocker shaft and interior of rocker arm.**



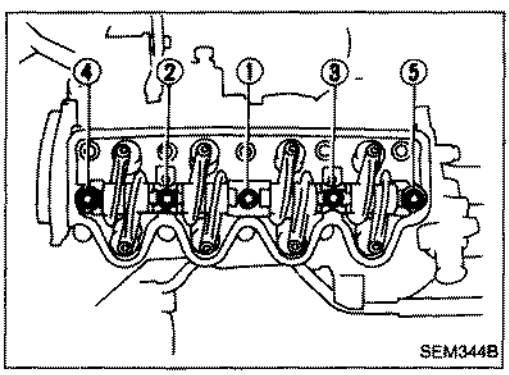
- **Ensure that punched mark on rocker shaft faces toward front side and oil holes in rocker shaft face downward.**

Installation (Cont'd)

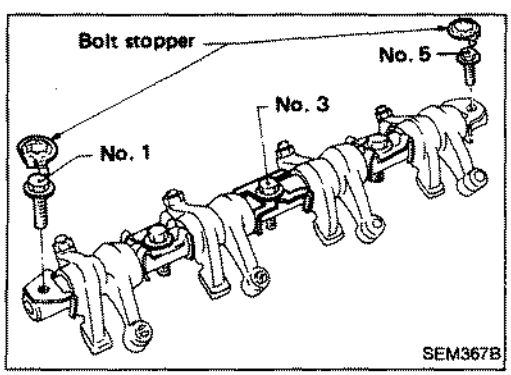




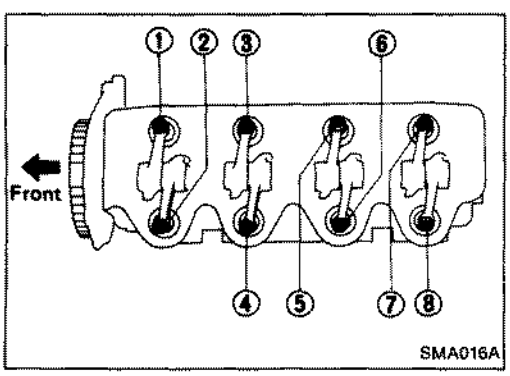
- **Ensure that cutout in center retainer of rocker shaft faces toward exhaust manifold side.**



5. Tighten rocker shaft bolts.
- **Make sure that valve clearance adjusting screws are fully loosened.**
- **Tighten bolts gradually, in two or three stages, outward from center position.**

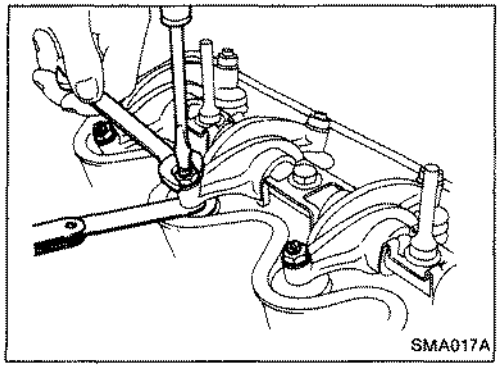


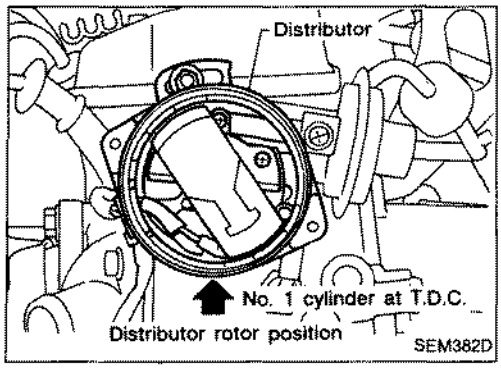
6. Install new bolt stopper on No. 1 and 5 bolts.



7. Adjust valve clearance.
(1) Set No. 1 cylinder in top dead center on its compression stroke, and adjust valve clearance ①, ②, ③ and ⑥.
(2) Set No. 4 cylinder in top dead center on its compression stroke, and adjust valve clearance ④, ⑤, ⑦ and ⑧.

Installation (Cont'd)


SMA017A



SEM382D

Valve clearance:

Unit: mm (in)

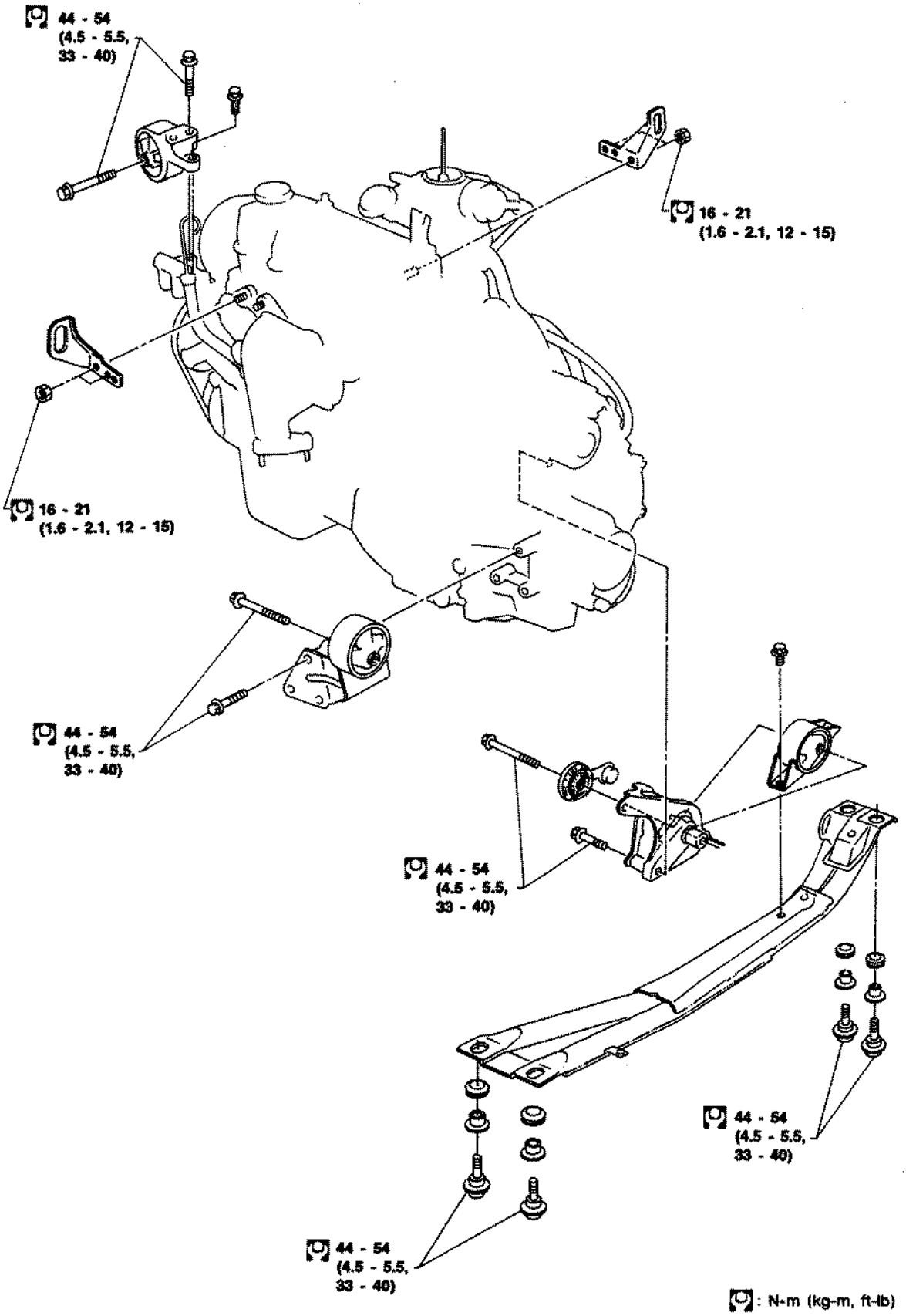
	COLD*	HOT
Intake & Exhaust	0.22 (0.009)	0.28 (0.011)

*: At temperature 20°C (68°F)

Whenever valve clearances are adjusted to cold specifications, check that the clearances satisfy hot specifications and adjust again if necessary.

8. Install exhaust manifold.
9. Install distributor.
   Confirm the rotor position with the No. 1 cylinder at the T.D.C. compression stroke, and then set the distributor.
10. Install the following parts.

- Rocker cover and dust covers
- Water pump pulley
- Crankshaft pulley and drive belts


44 - 54
(4.5 - 5.5,
33 - 40)
16 - 21
(1.6 - 2.1, 12 - 15)
16 - 21
(1.6 - 2.1, 12 - 15)
44 - 54
(4.5 - 5.5,
33 - 40)
44 - 54
(4.5 - 5.5,
33 - 40)
44 - 54
(4.5 - 5.5,
33 - 40)
44 - 54
(4.5 - 5.5,
33 - 40)
: N•m (kg-m, ft-lb)

SEM385D

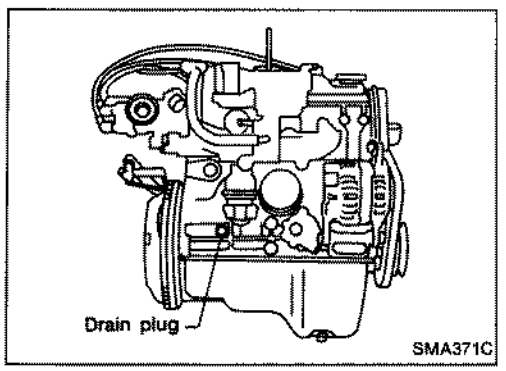
WARNING:

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 removing front axle from transaxle, place safety stands under designated front supporting points. Refer to GI section for lifting points and towing.**
f. **Be sure to hoist engine and transaxle in a safe manner.**
g. **For engines not equipped with engine slingers, attach proper slingers and bolts described in PARTS CATALOG.**

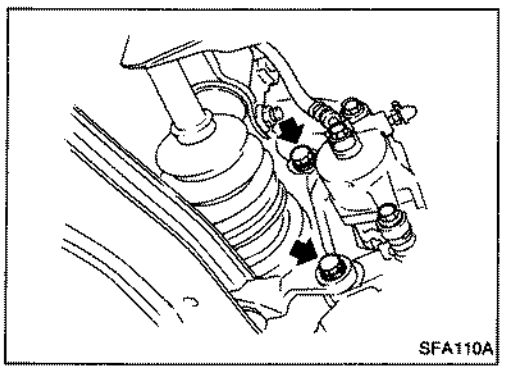
CAUTION:

- **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.**
- **In removing drive shaft, be careful not to damage grease seal of transaxle.**

1. Remove engine under cover and hood.

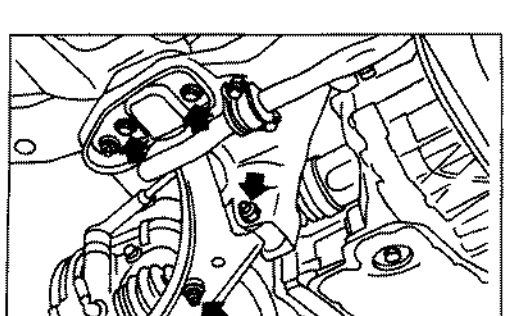


2. Drain engine coolant from radiator and cylinder block.
3. Remove drive belts for cooling fan, air compressor and power steering pump.
4. Disconnect adjacent wires, harness, pipes and hoses.
5. Remove front tires and splash covers.

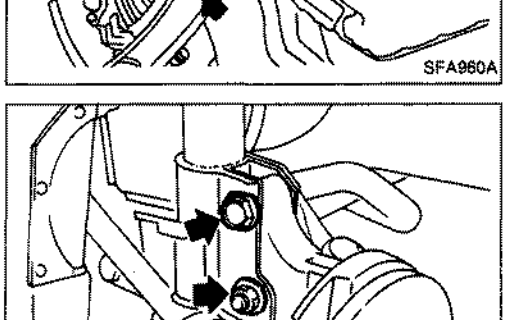


6. Remove brake caliper assembly and rotor.

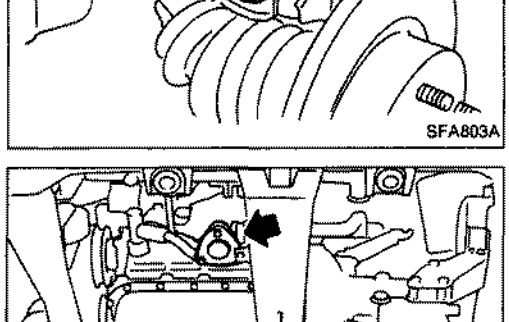
- **Brake hose does not need to be disconnected from brake caliper assembly.**
- **Never depress brake pedal.**



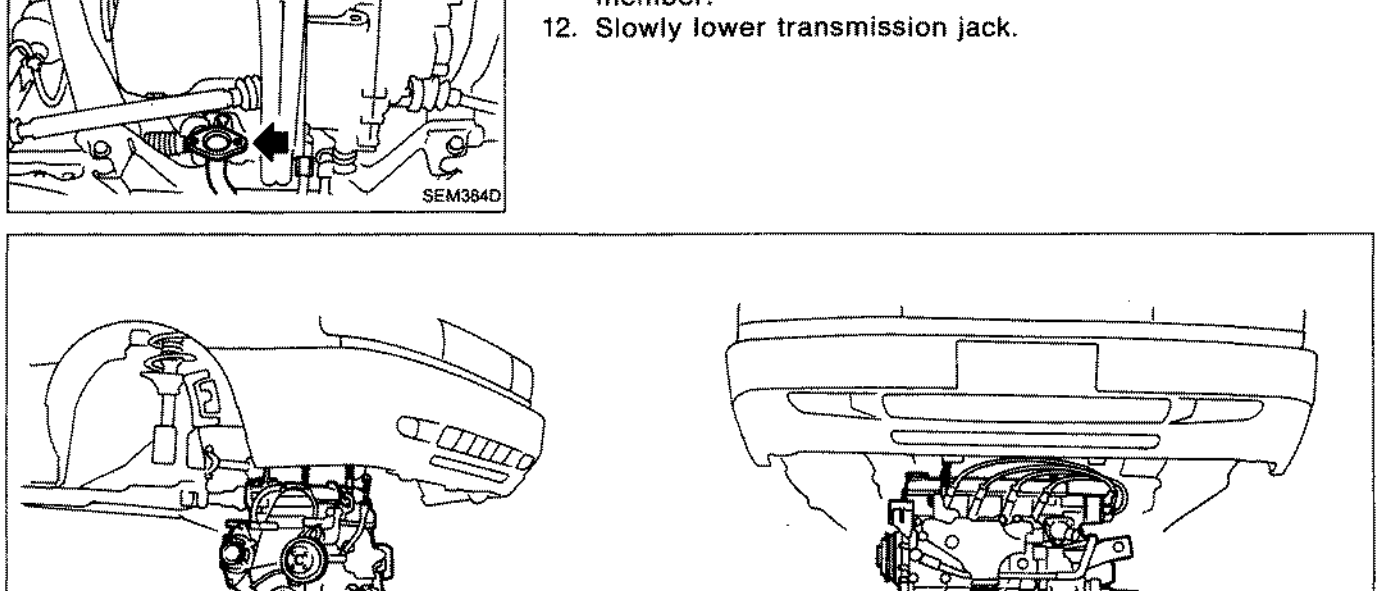
7. Disconnect transverse link (RH & LH) and tie-rod ball joint (RH & LH).



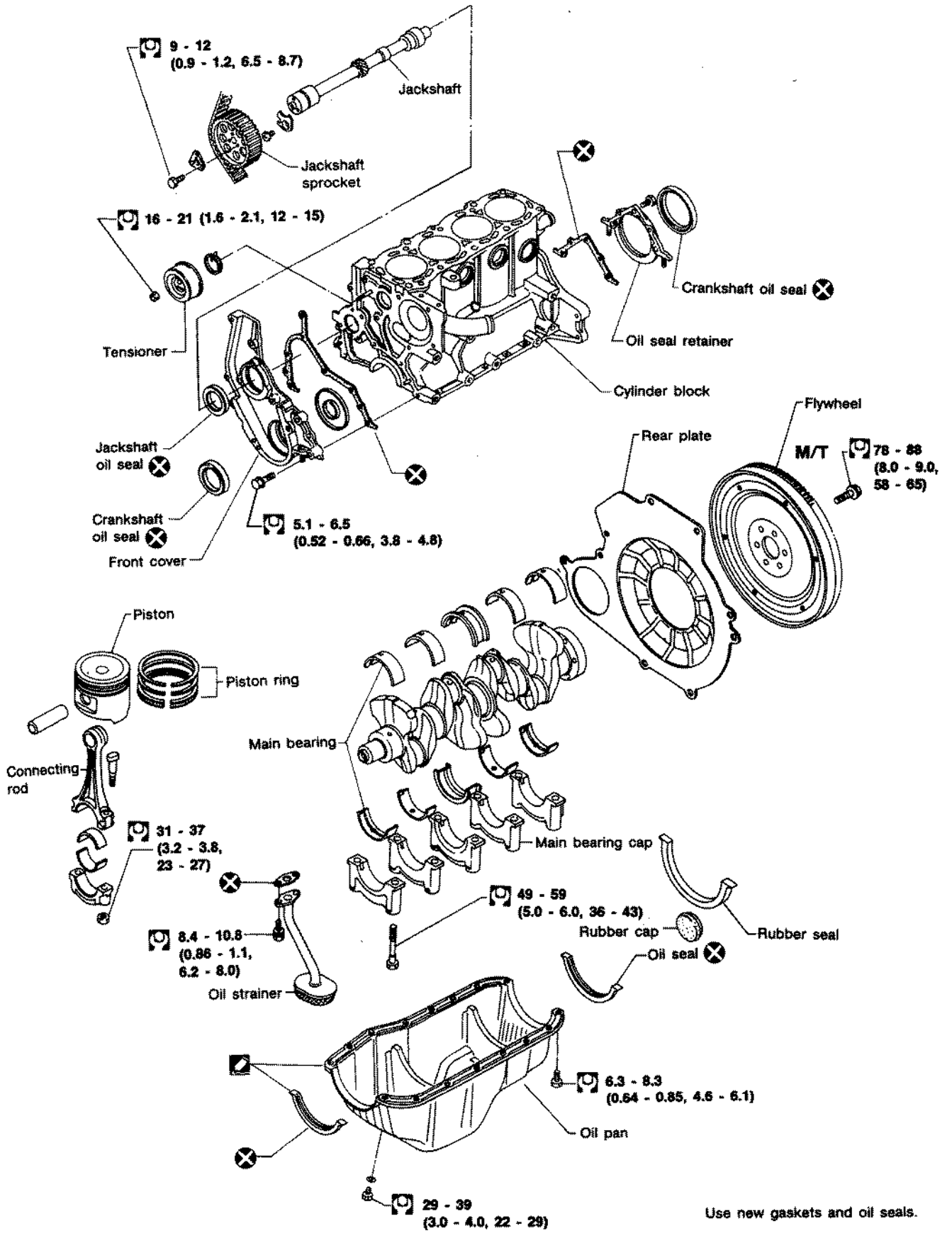
8. Remove knuckle to strut bolts (RH & LH).



9. Remove front exhaust tube.
10. Set a suitable transmission jack under transaxle and engine. Hoist engine with engine slinger.
11. Remove front and right engine mounting bolts and center member.
12. Slowly lower transmission jack.



13. Remove engine with transaxle as shown.



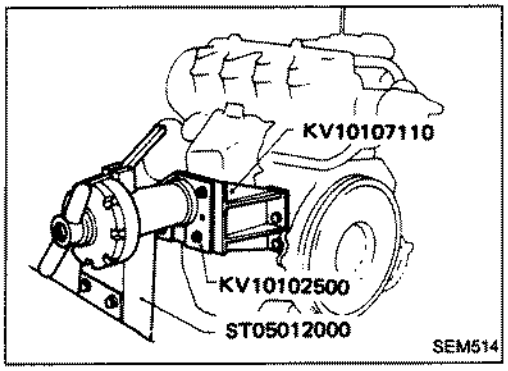
Use new gaskets and oil seals.

: N·m (kg-m, ft-lb)

SEM387D

CAUTION:

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

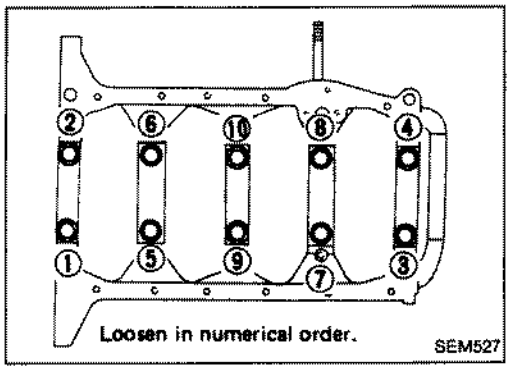


Disassembly

PISTON AND CRANKSHAFT

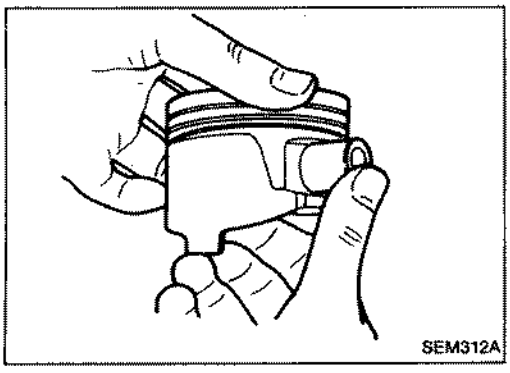
1. Place engine on work stand with Tool.

2. Remove cylinder head and timing belt.
3. Drain engine oil.
4. Remove water pump.
5. Remove oil pan and oil strainer.
6. Remove pistons.



7. Remove bearing caps and crankshaft.

Place the bearings and caps in their proper order.



Inspection

PISTON AND PISTON PIN CLEARANCE

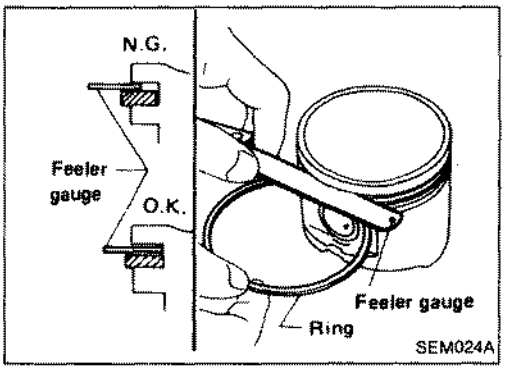
- Confirm the fitting of piston pin into piston pin hole to such an extent that it can be pressed smoothly by finger at room temperature.

  Piston pin to piston clearance:

  0.006 - 0.010 mm (0.0002 - 0.0004 in)

Apply engine oil to piston pin.

Inspection (Cont'd)



PISTON RING SIDE CLEARANCE

Side clearance:

Top ring

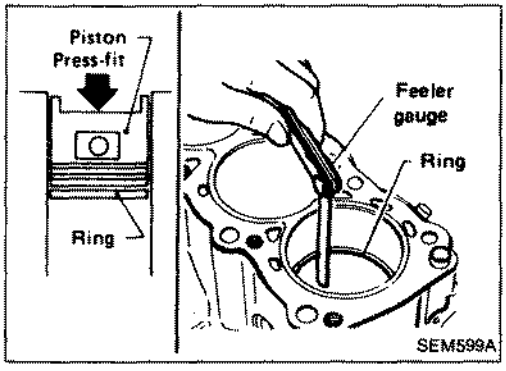
0.040 - 0.073 mm (0.0016 - 0.0029 in)

2nd ring

0.030 - 0.063 mm (0.0012 - 0.0025 in)

Max. limit of side clearance (Top and 2nd rings)

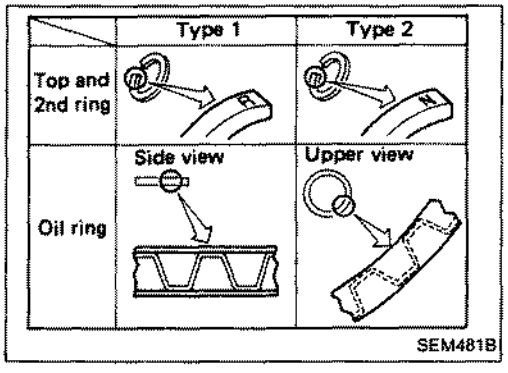
0.2 mm (0.008 in)



PISTON RING GAP

Unit: mm (in)

Ring	Type 1	Type 2	Max. limit
Top	0.14 - 0.26 (0.0055 - 0.0102)	0.20 - 0.30 (0.0079 - 0.0118)	1.0 (0.039)
2nd	0.28 - 0.37 (0.0110 - 0.0146)	0.15 - 0.25 (0.0059 - 0.0098)	
Oil	0.20 - 0.60 (0.0079 - 0.0236)		



BEARING CLEARANCE

Main bearing clearance:

No. 1, No. 3 and No. 5 bearings

0.031 - 0.056 mm (0.0012 - 0.0022 in)

No. 2 and No. 4 bearings

0.031 - 0.092 mm (0.0012 - 0.0036 in)

Limit 0.10 mm (0.0039 in)

Connecting rod bearing clearance:

0.010 - 0.044 mm (0.0004 - 0.0017 in)

Limit 0.10 mm (0.0039 in)

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

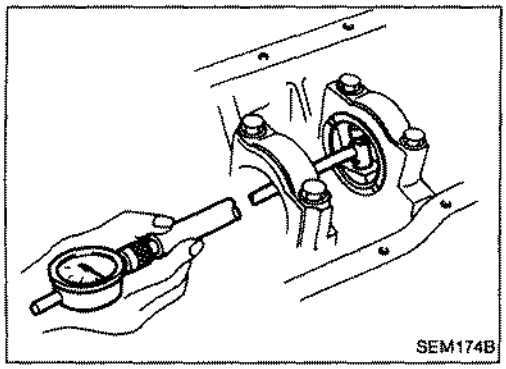
Method A (Using bore gauge & micrometer)

Main bearing

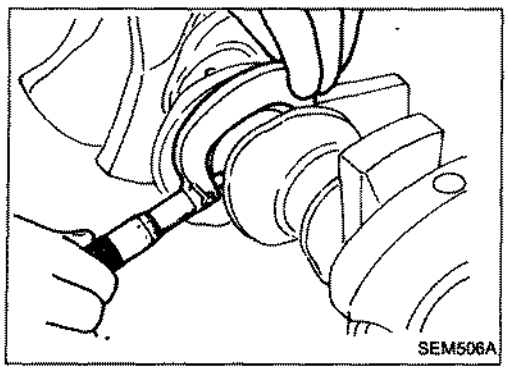
1. Install main bearings to cylinder block and main bearing caps.
2. Install main bearing caps to cylinder block.

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

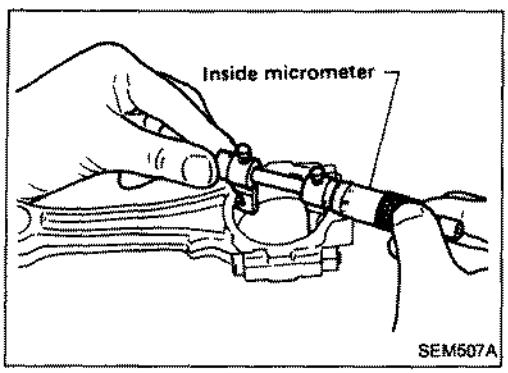
Inspection (Cont'd)



3. Measure inside diameter "A" of main bearing.



4. Measure outside diameter "Dm" of main journal in crankshaft.
5. Calculate main bearing clearance.
   Main bearing clearance = A – Dm

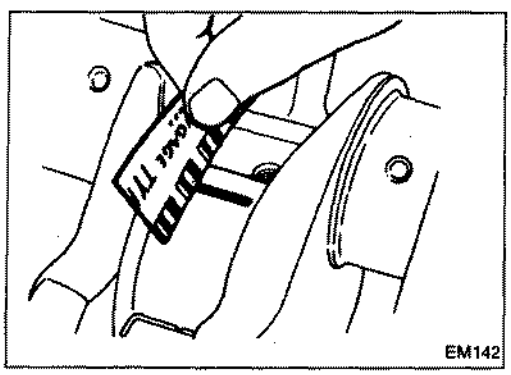


Connecting rod bearing

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

Apply oil to the thread portion of bolts and seating surface of nuts.

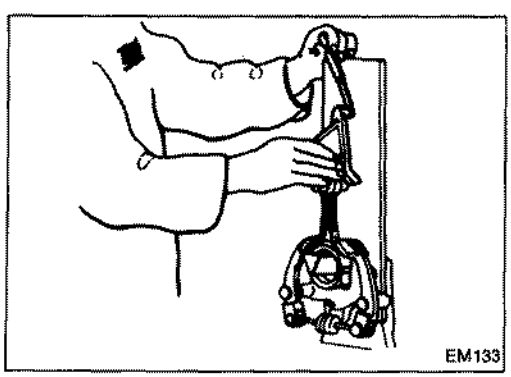
3. Measure inside diameter "C" of bearing.
4. Measure outside diameter "Dp" of pin journal in crankshaft.
5. Calculate connecting rod bearing clearance.
   Connecting rod bearing clearance = C – Dp



Method B (Using plastigage)

CAUTION:

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

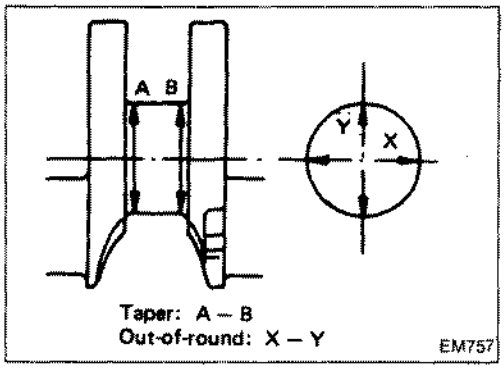


CONNECTING ROD BEND AND TORSION

Bend and torsion:
Limit 0.05 mm (0.0020 in)
per 100 mm (3.94 in) length

Inspection (Cont'd)

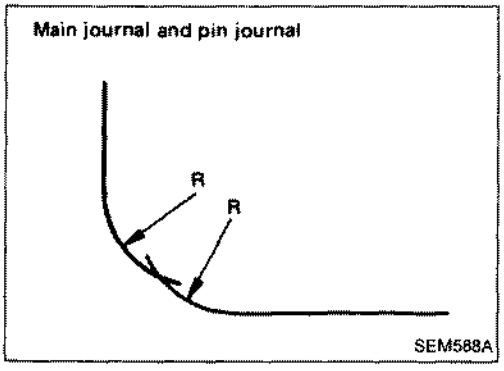
CRANKSHAFT



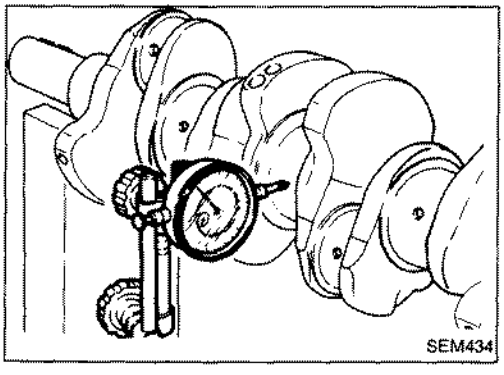
Taper: A – B
Out-of-round: X – Y
EM757

1. Check crankshaft journals for score, bias, wear or cracks. If faults are minor, correct with fine crocus cloth.
2. Check journals with a micrometer for taper and out-of-round.

Out-of-round (X – Y):
Less than 0.01 mm (0.0004 in)
Taper (A – B):
Less than 0.01 mm (0.0004 in)
Limit: 0.03 mm (0.0012 in)



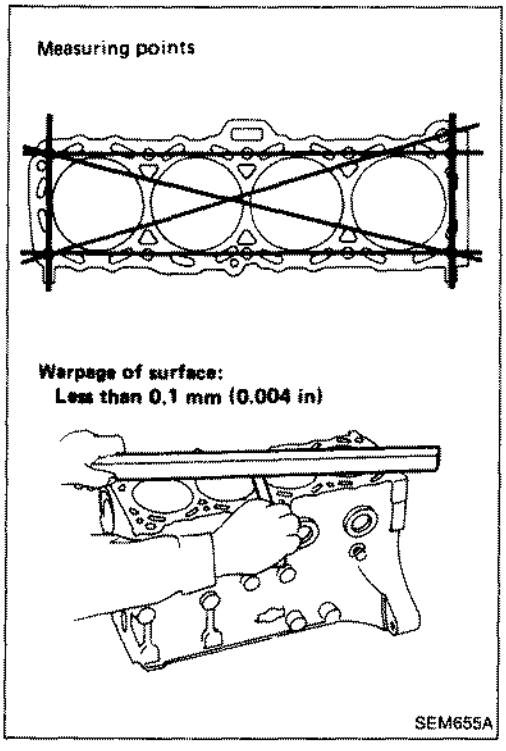
When regrinding crank pin and crank journal, fillets should be finished as shown.
R: 2.3 - 2.7 mm (0.091 - 0.106 in)



3. Check crankshaft runout.

Runout [T.I.R. (Total Indicator Reading)]:
Less than 0.04 mm (0.0016 in)
Limit 0.08 mm (0.0031 in)

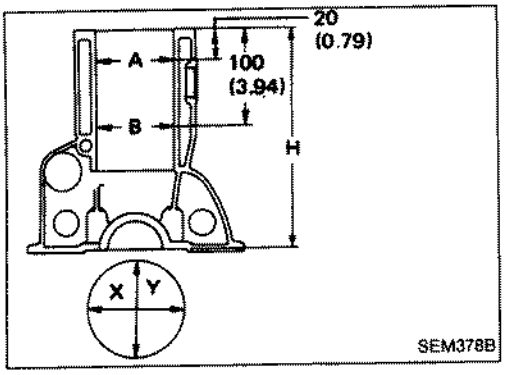
CYLINDER BLOCK DISTORTION AND WEAR



1. If beyond the specified limit, resurface it.

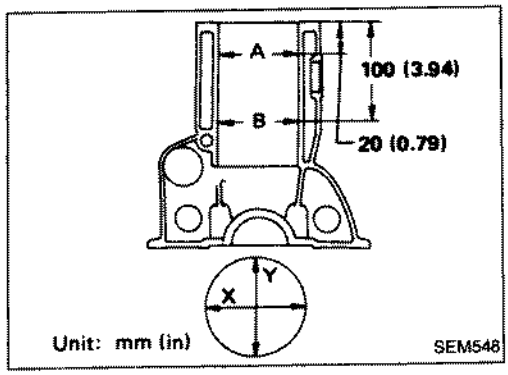
Resurfacing limit:
The resurfacing limit of cylinder block is determined by the cylinder head resurfacing in an engine.
Amount of cylinder head resurfacing is "A".
Amount of cylinder block resurfacing is "B".
The maximum limit is as follows:
A + B = 0.2 mm (0.008 in)

Inspection (Cont'd)



Nominal cylinder block height from crankshaft center "H":

189.00 ± 0.05 mm (7.4409 ± 0.0020 in)



2. Using a bore gauge, measure cylinder bore for wear, out-of-round or taper.

   Standard inner diameter:

   73.00 - 73.05 mm (2.8740 - 2.8760 in)

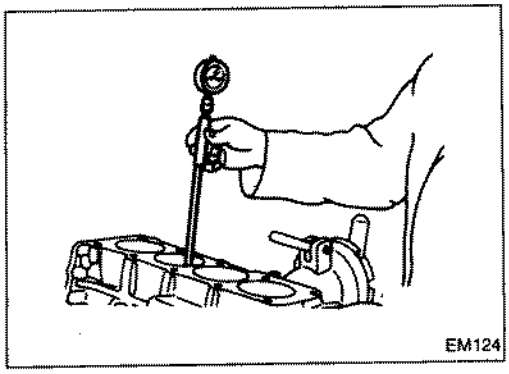
   Out-of-round (X – Y):

   Limit 0.02 mm (0.0008 in)

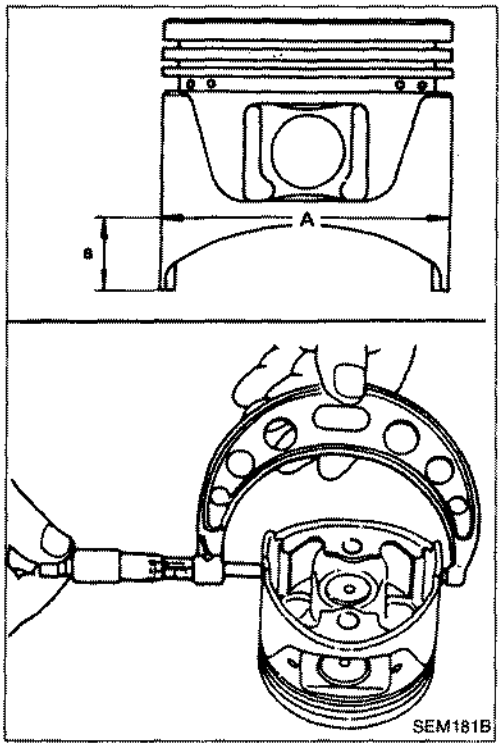
   Taper (A – B):

   Limit 0.015 mm (0.0006 in)

3. Check for scratches or seizure. If seizure is found, hone it.



Inspection (Cont'd)



CYLINDER BORING

When any cylinder needs boring, all other cylinders must also be bored.

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

Oversize pistons are available for service.

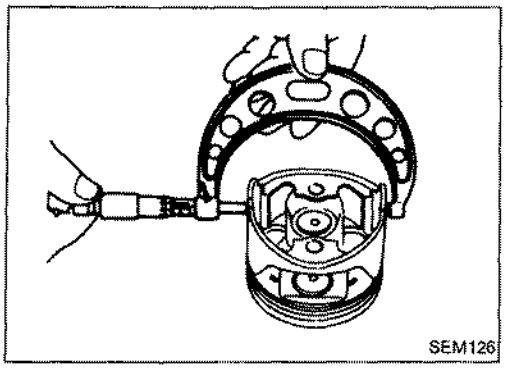
Refer to S.D.S.

2. The size to which cylinders must be honed is determined by adding piston-to-cylinder clearance to the piston skirt diameter "A".
   Dimension "a":
   10.6 mm (0.417 in)
   Rebored size calculation:
   D = A + B – C = A + [0.003 to 0.023 mm (0.0001 to 0.0009 in)]
   where,
   D: Bored diameter
   A: Skirt diameter as measured
   B: Piston-to-wall clearance
   C: Honing allowance 0.02 mm (0.0008 in)
3. Install main bearing caps in place, and tighten to the specified torque to prevent distortion of the cylinder bores in final assembly.
4. Cut cylinder bores.

- **Do not cut too much out of the cylinder bore at a time. Cut only 0.05 mm (0.0020 in) or so in diameter at a time.**

5. Hone the cylinders to the required size referring to S.D.S.
6. Measure the finished cylinder bore for out-of-round and taper.

- **Do not cut too much out of the cylinder bore at a time. Cut only 0.05 mm (0.0020 in) or so in diameter at a time.**
- **Bore the cylinders in the order of 2-4-1-3 to prevent heat strain due to cutting.**

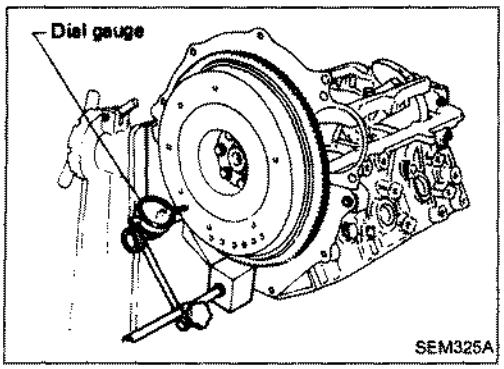


PISTON TO CYLINDER WALL CLEARANCE

Using micrometer

1. Measure piston skirt diameter "A" and cylinder bore diameter.
   Piston diameter "A":
   Refer to S.D.S.
2. Check that piston clearance is within the specification.
   Piston clearance:
   0.023 - 0.043 mm (0.0009 - 0.0017 in)

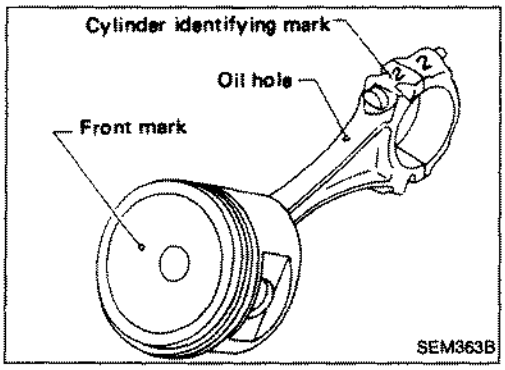
Inspection (Cont'd)



FLYWHEEL RUNOUT

Runout (Total indicator reading):
Less than 0.15 mm (0.0059 in)

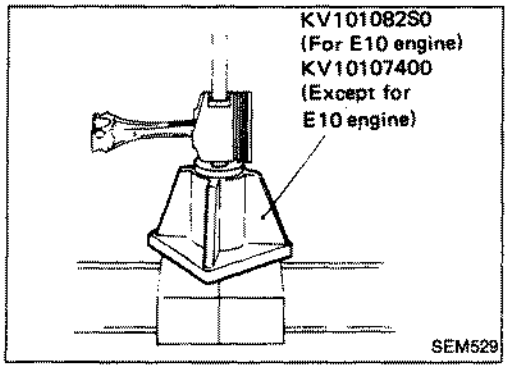
Assembly



PISTON

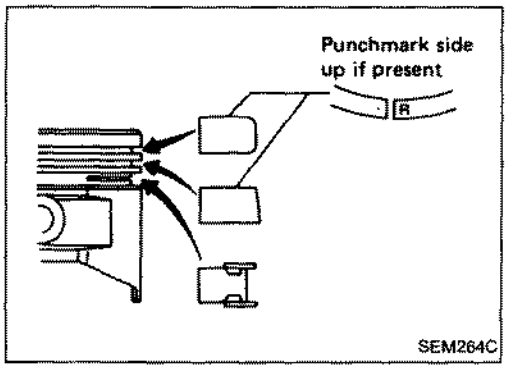
a. **Numbers are stamped on the connecting rod and cap corresponding to each cylinder. Care should be taken to avoid a wrong combination including bearing.**

b. **Arrange so that the front mark on piston head faces to the front of engine.**



c. **When pressing piston pin in connecting rod, apply engine oil to pin and small end of connecting rod.**

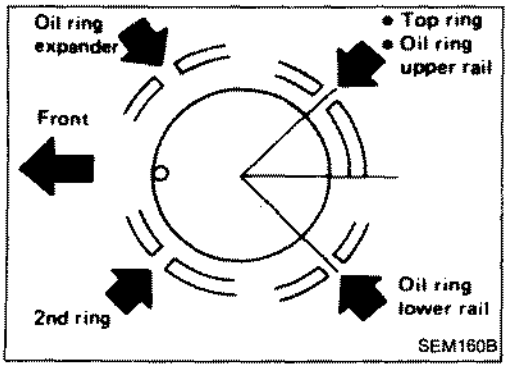
d. **After assembling, ascertain that piston swings smoothly.**



e. **Set piston rings as shown.**

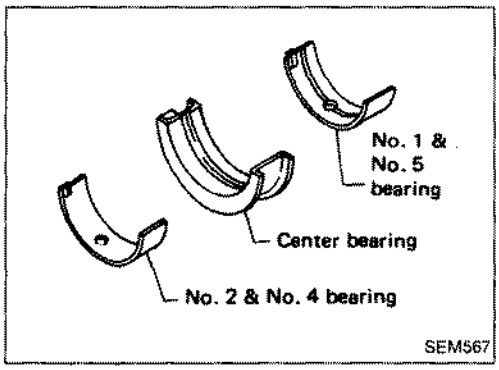
CAUTION:

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



Assembly (Cont'd)

CRANKSHAFT



1. Set main bearings in the proper position on cylinder block.

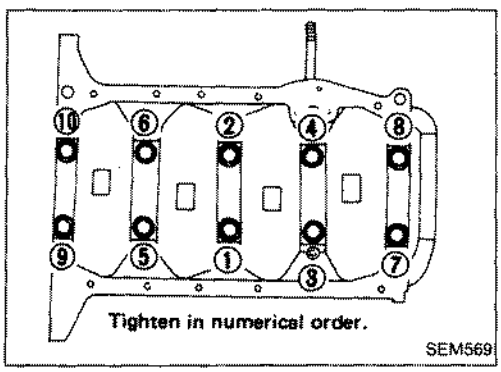
If either crankshaft, cylinder block or main bearing is reused again, it is necessary to measure main bearing clearance.

a. Only center bearing (No. 3) is a flanged type.

b. All inter-bearings (No. 2 and No. 4) are the same type.

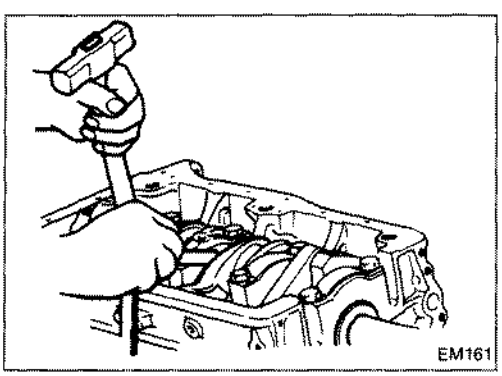
c. Front bearing (No. 1) is also the same type as rear bearing (No. 5).

d. Upper and lower bearings are not interchangeable. Upper ones have oil groove.



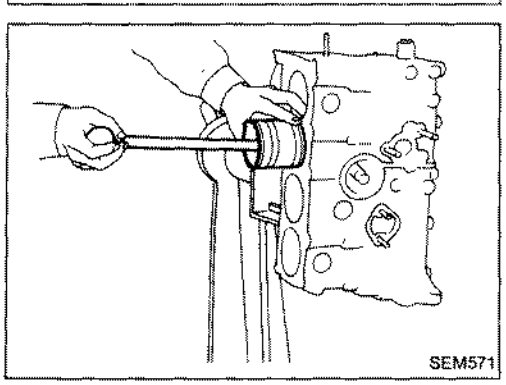
2. Apply engine oil to main bearing surfaces on both sides of cylinder block and cap.
3. Install crankshaft and main bearing caps and tighten bolts to the specified torque.

- **Tighten in two or three stages.**
- **After securing bearing cap bolts, ascertain that crankshaft turns smoothly by hand.**



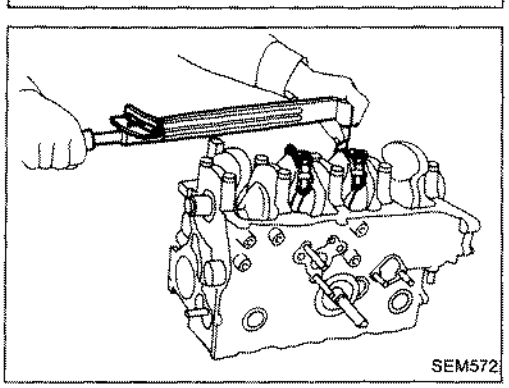
4. Make sure that there exists proper end play of crankshaft at center bearing.

Crankshaft free end play:
Standard
0.05 - 0.165 mm (0.0020 - 0.0065 in)
Limit
0.30 mm (0.0118 in)



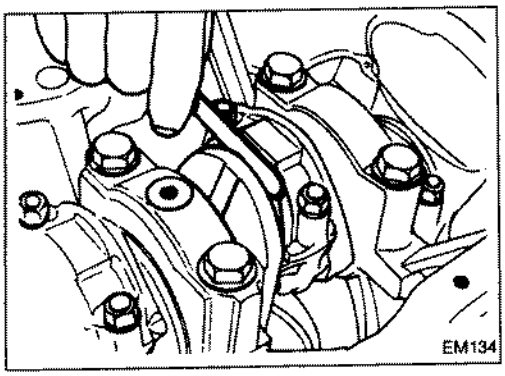
5. Install pistons with connecting rods.
(1) Install them into corresponding cylinder using Tool.

- **Be careful not to scratch cylinder wall with connecting rod.**
- **Apply engine oil to cylinder wall, piston and bearing.**
- **Arrange so that the front mark on piston head faces to the front of engine.**



(2) Install connecting rod bearing caps.

Assembly (Cont'd)



6. Measure connecting rod side clearance.

Connecting rod side clearance:

Standard

0.1 - 0.37 mm (0.0039 - 0.0146 in)

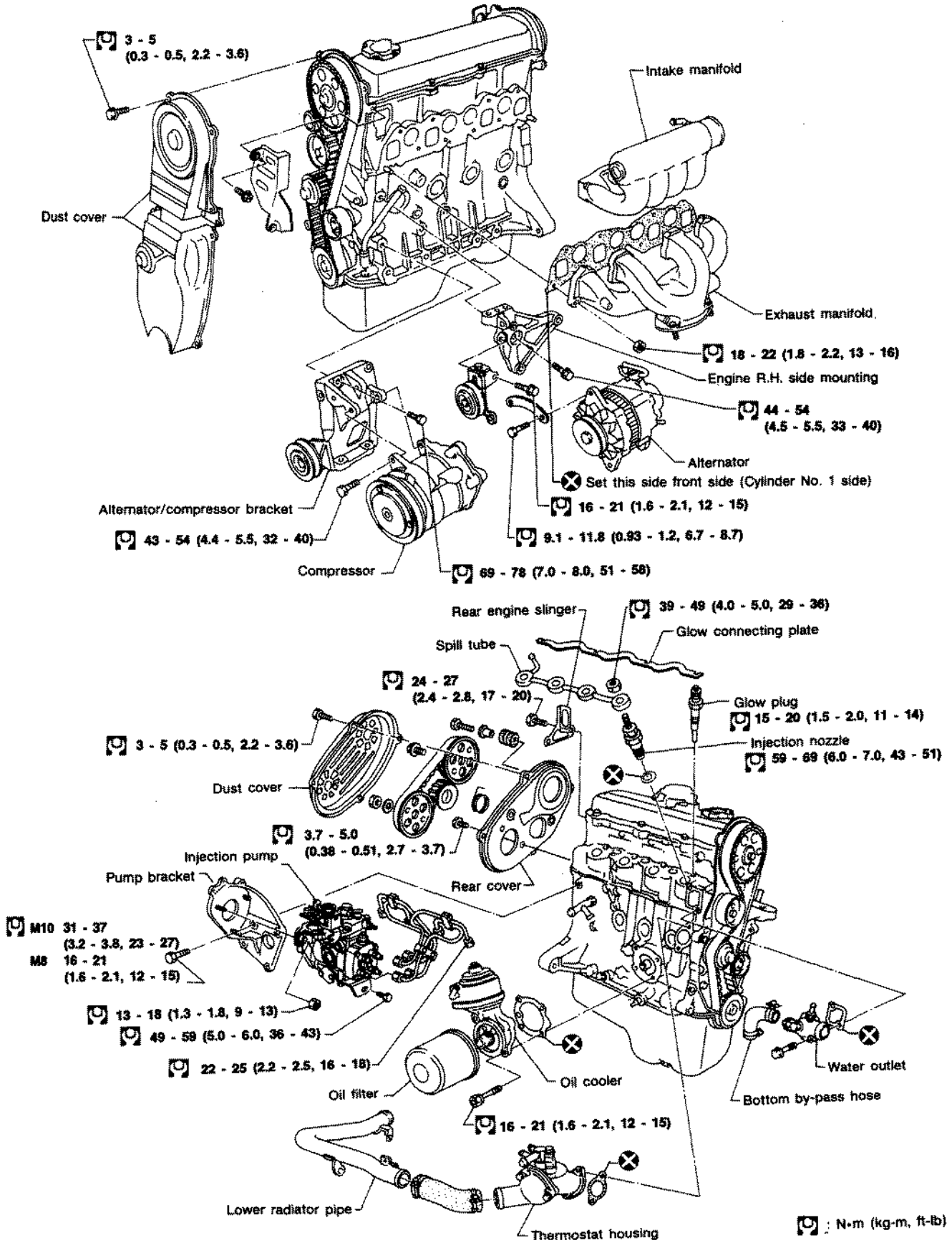
Limit

0.50 mm (0.0197 in)

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

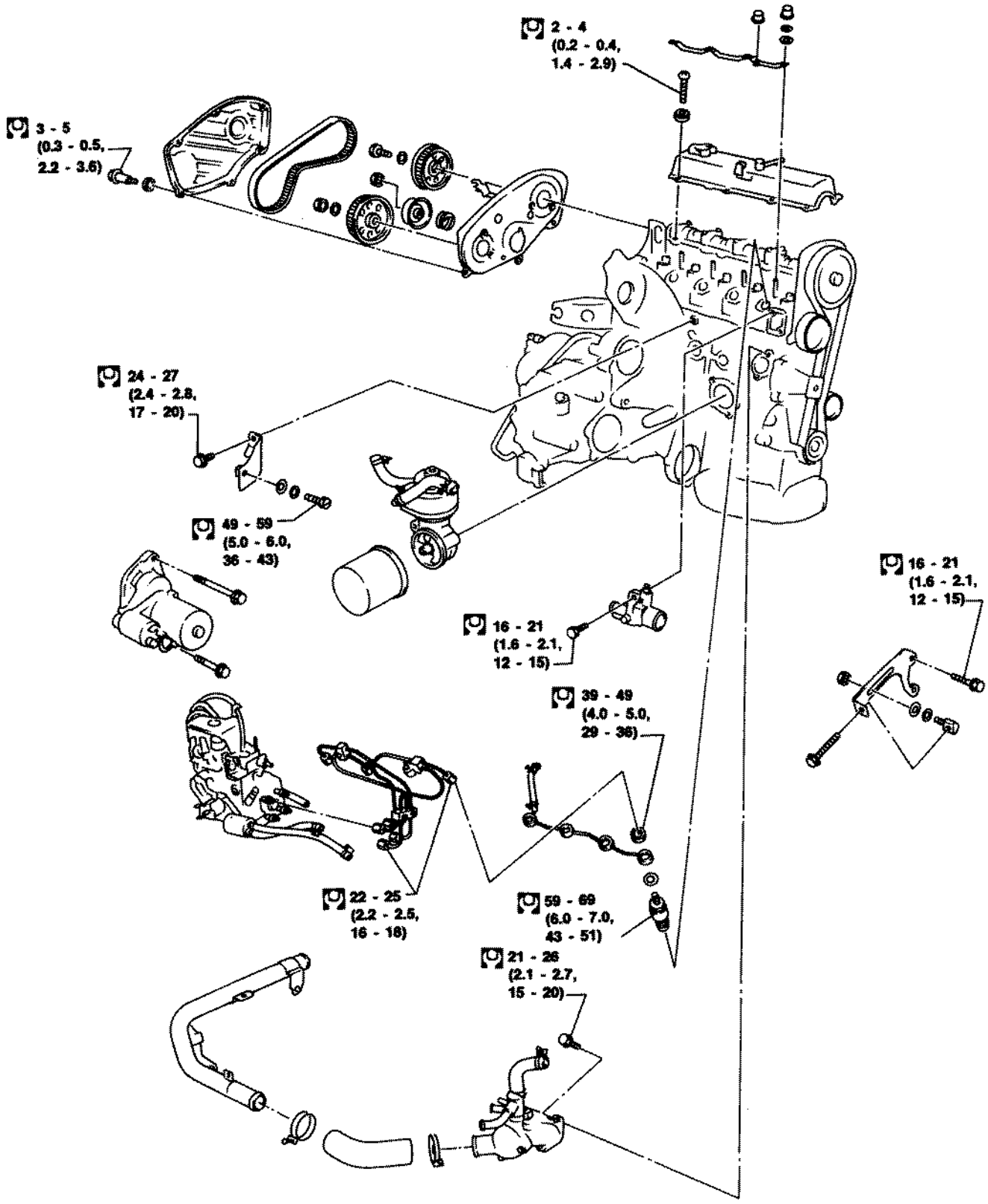
7. Install oil pan.

CD17



SEM708A

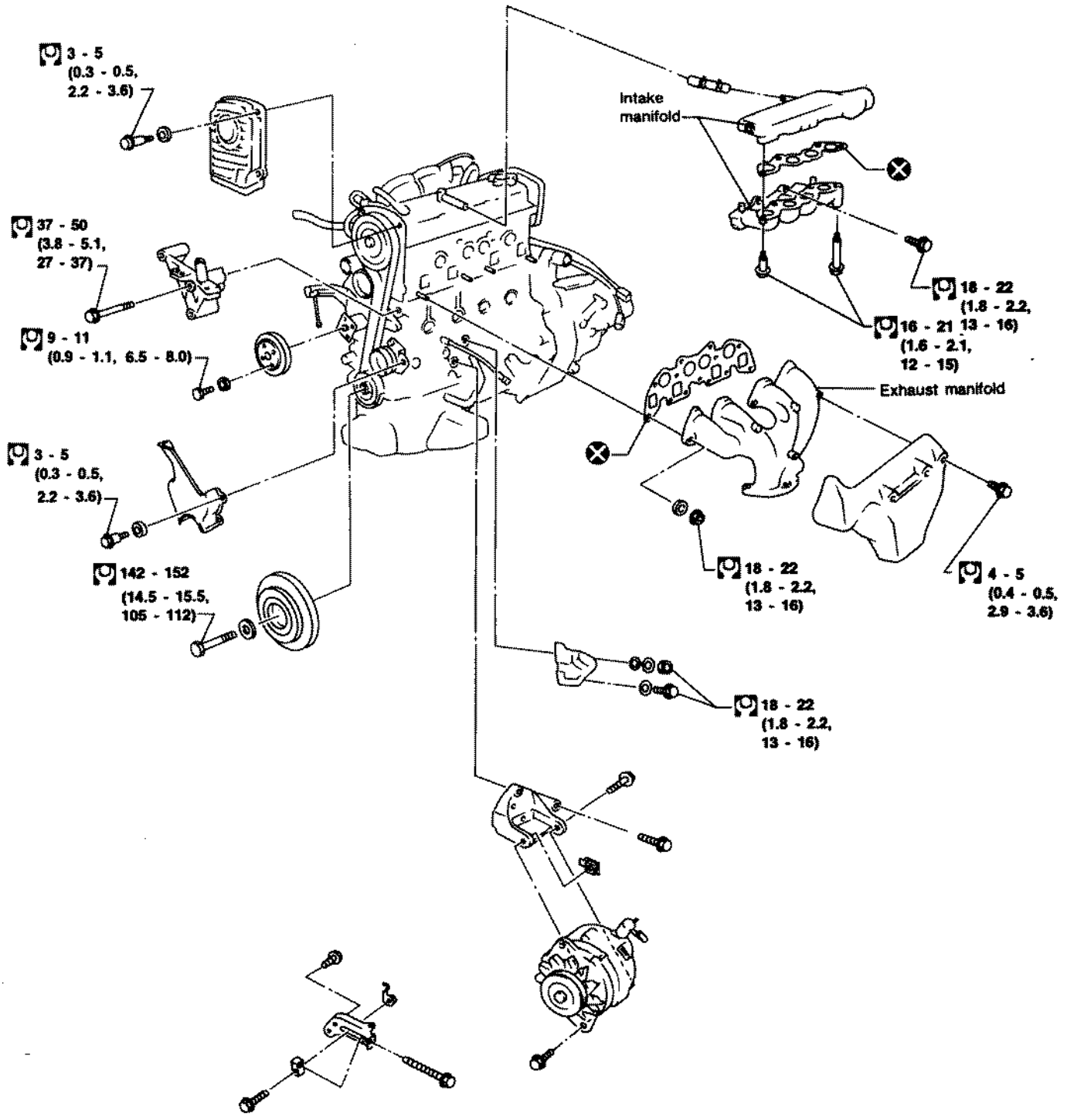
CD20 — Right side



: N·m (kg-m, ft-lb)

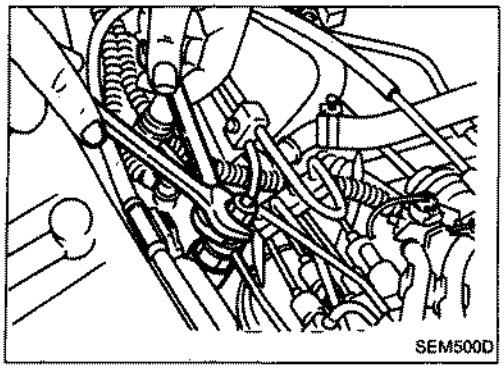
SEM571D

CD20 — Left side



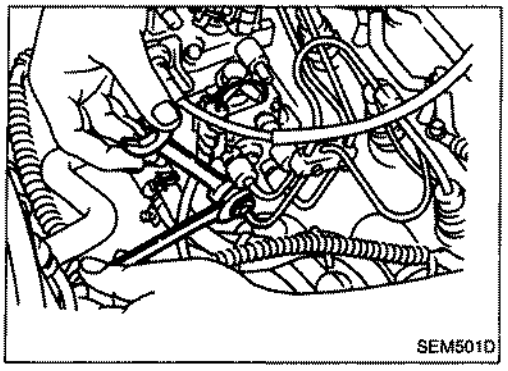
: N·m (kg-m, ft-lb)

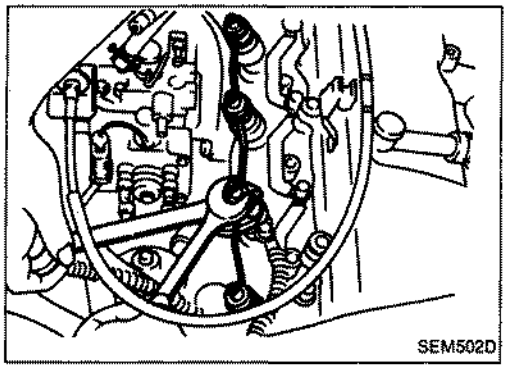
SEM572D


SEM500D

1. Warm up engine sufficiently.
2. Disconnect injection tubes on nozzle side and loosen injection tubes on pump side. Release clamps on injection tubes.

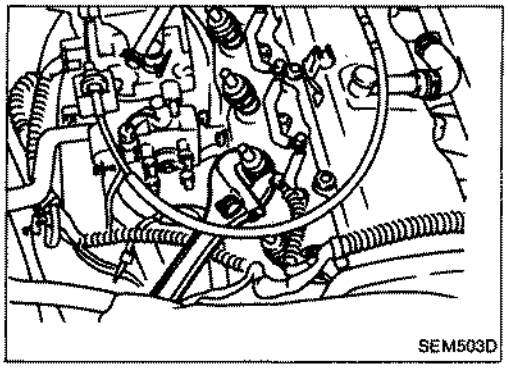
- **Use two wrenches to prevent delivery holder on pump side from loosening.**


SEM501D

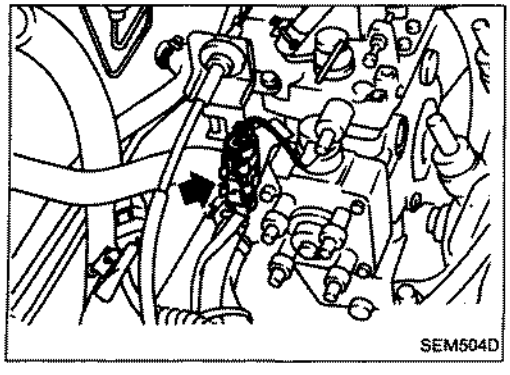

SEM502D

3. Remove spill-tube assembly.

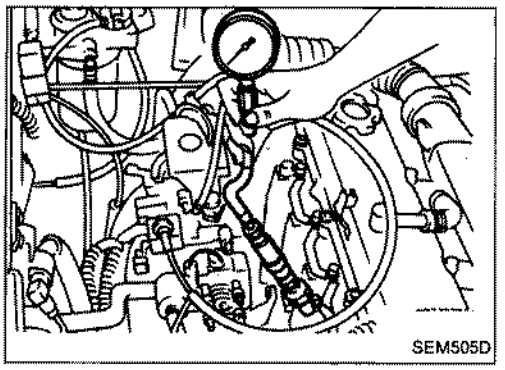
- **To prevent spill tube from breaking, remove it by gripping nozzle holder.**


SEM503D

4. Remove all injection nozzles using a suitable tool.

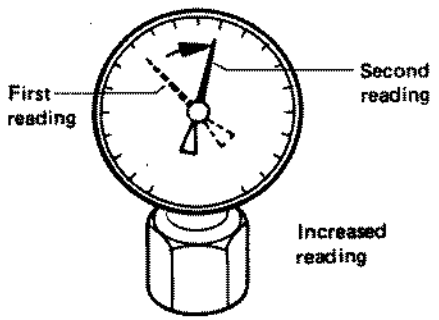
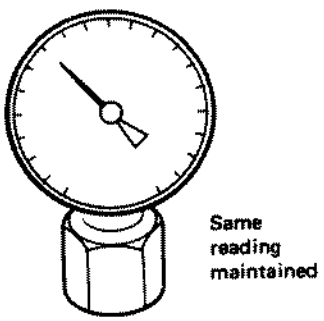

SEM504D

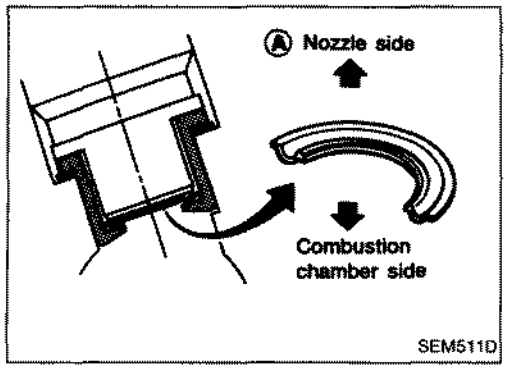
5. Disconnect fuel-cut solenoid valve connector.


SEM505D

6. Fit compression gauge to cylinder head.

7. Crank engine and read compression gauge indication.
   Cranking speed: 200 rpm
   Compression pressure: kPa (bar, kg/cm^2, psi)
   Standard
   2,942 - 3,236 (29.4 - 32.4, 30 - 33, 427 - 469)
   Limit
   2,452 (24.52, 25.0, 356)
   Limit of difference between cylinders
   490 (4.90, 5.0, 71)
8. If the pressure appears low, pour about 3 mℓ (0.11 Imp fl oz) of engine oil through nozzle holes and repeat test.
   For indications of test, refer to the following table.

Gauge indication during tests	Trouble diagnosis
	• Piston rings are worn or damaged.
	• If two adjacent cylinders are low, gasket is damaged. • Valve is sticking. • Valve seat or valve contact surface is incorrect.



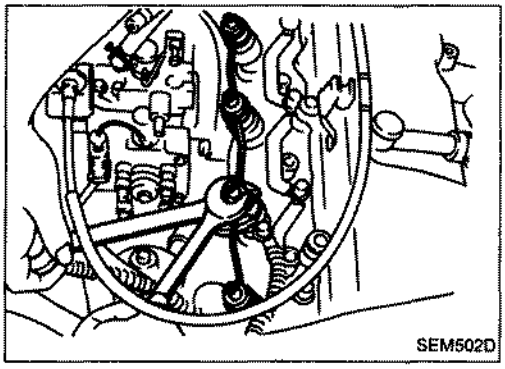
9. Replace nozzle gaskets and re-install injection nozzles.

New nozzle gaskets must be installed in the direction shown.

Nozzle to cylinder head:

[O]: 59 - 69 N·m

(6 - 7 kg-m, 43 - 51 ft-lb)

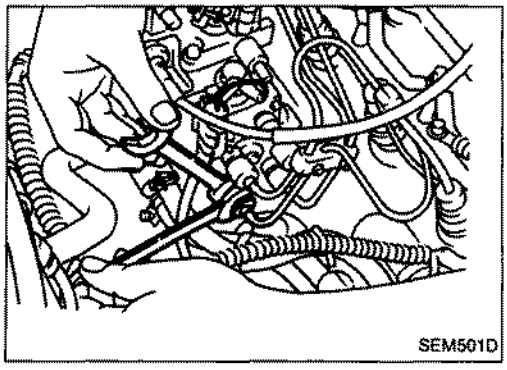


10. Install spill tube by holding nozzle holder.

Spill tube nut:

[O]: 39 - 49 N·m

(4 - 5 kg-m, 29 - 36 ft-lb)

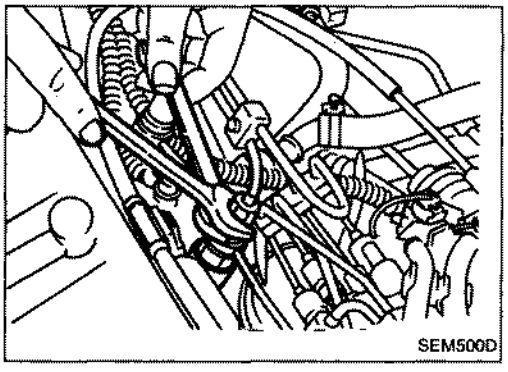


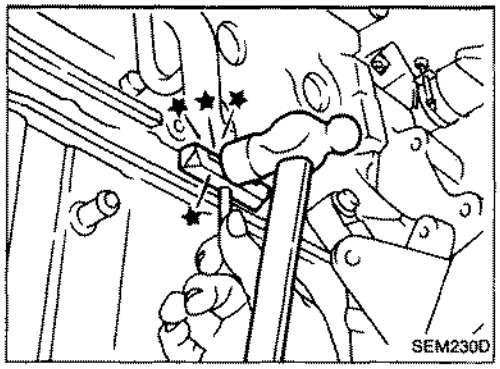
11. Install injection tubes using two wrenches as shown.

Injection tubes:

[O]: 22 - 25 N·m

(2.2 - 2.5 kg-m, 16 - 18 ft-lb)



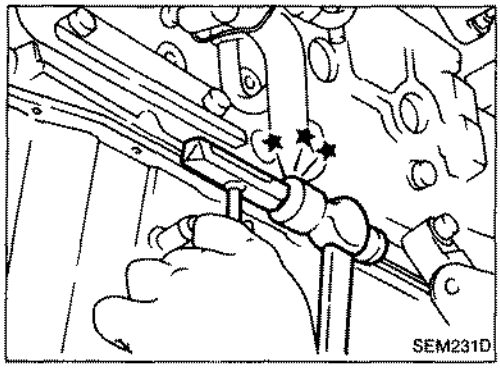


Removal

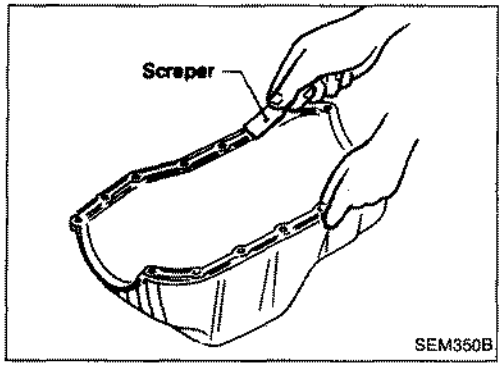
1. Drain oil.
2. Remove oil pan using tool as illustrated.

1) Insert Tool between oil pan and cylinder block.

- **Do not drive seal cutter into oil pump or rear oil seal retainer portion, or aluminum mating surfaces will be damaged.**
- **Do not insert screwdriver, or oil pan flange will be deformed.**



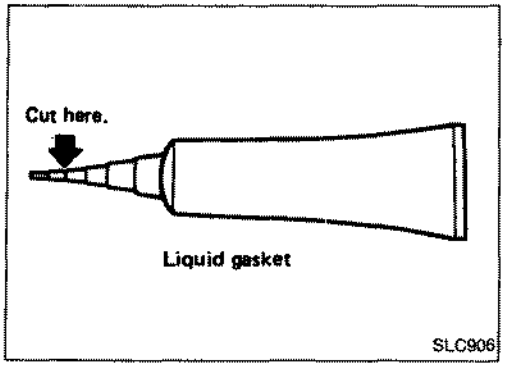
2) Slide Tool by tapping it with a hammer, and remove oil pan.



Installation

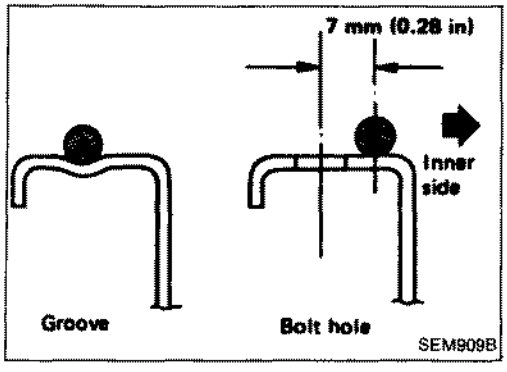
1. Before installing oil pan, remove all traces of liquid gasket from mating surface using a scraper.

- Also remove traces of liquid gasket from mating surface of cylinder block.



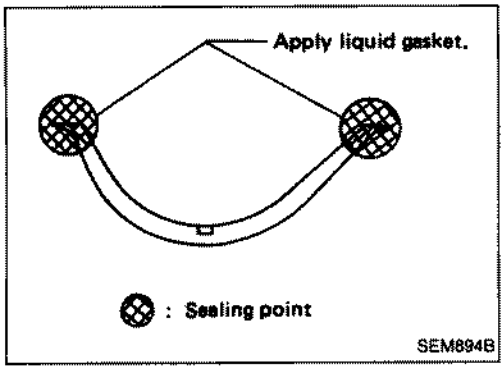
- Be sure liquid gasket is 3.5 to 4.5 mm (0.138 to 0.177 in) wide.

Use Genuine Liquid Gasket or equivalent.

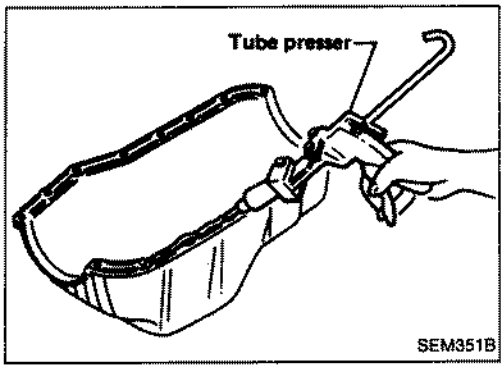


2. Apply liquid gasket to inner sealing surface as shown at left.

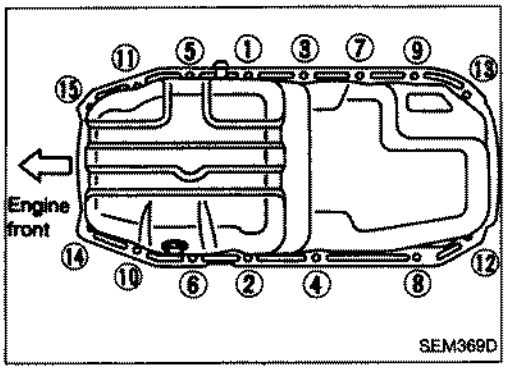
Installation (Cont'd)



3. Apply liquid gasket to oil pan front oil seal and rear oil seal.



4. Apply a continuous bead of liquid gasket to mating surface of oil pan.
- Attaching should be done within 5 minutes after coating.



5. Install oil pan and tighten bolts in the order shown in the figure.

Wait at least 30 minutes before refilling engine oil.

Oil pan bolts:

: CD17 5 - 7 N·m (0.5 - 0.7 kg-m, 3.6 - 5.1 ft-lb)
CD20 7 - 8 N·m (0.7 - 0.8 kg-m, 5.1 - 5.8 ft-lb)

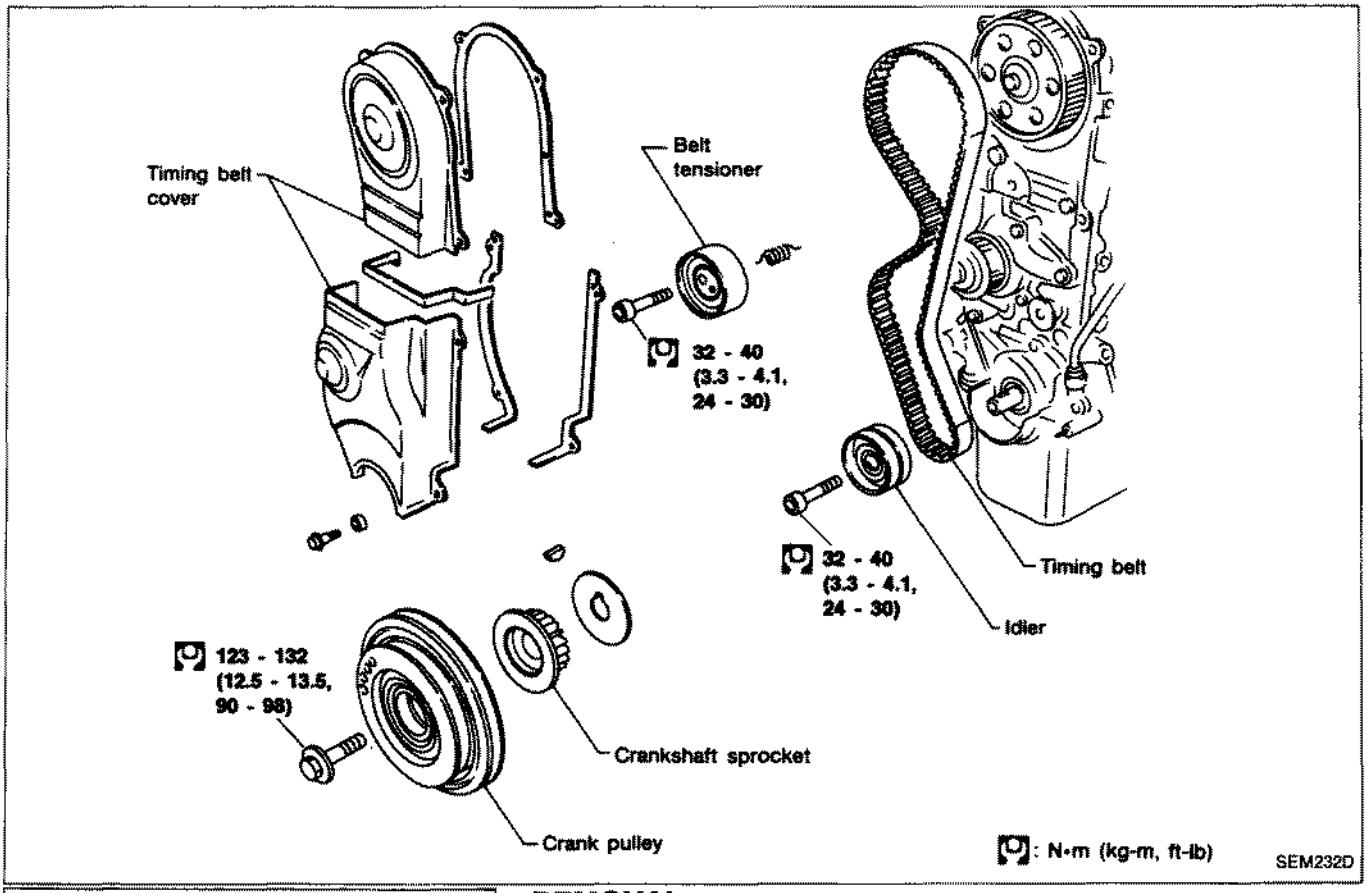
Camshaft Timing Belt — CD17

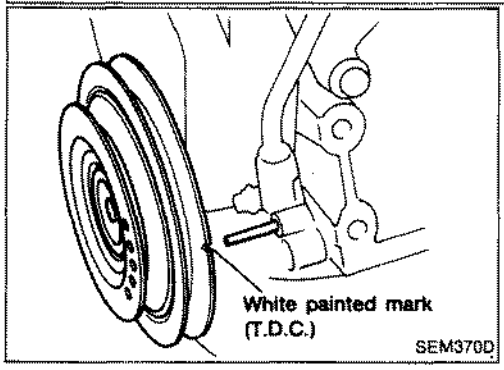
CAUTION:

a. Do not bend or twist timing belt.

b. After removing timing belt, do not turn crankshaft and camshaft separately because valves will strike piston heads.

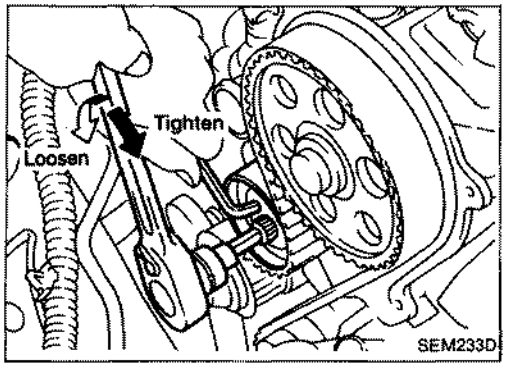
c. Ensure that timing belt, camshaft sprocket, crankshaft sprocket and belt tensioner are clean and free from oil and water.





REMOVAL

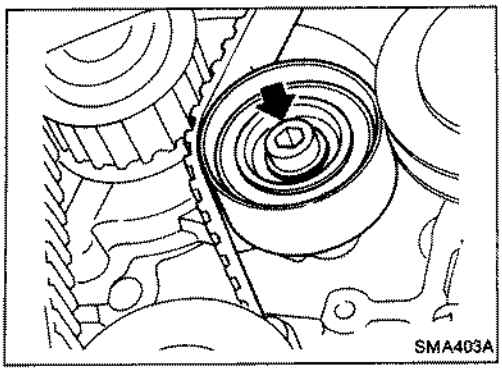
1. Set No. 1 cylinder at T.D.C. on its compression stroke.



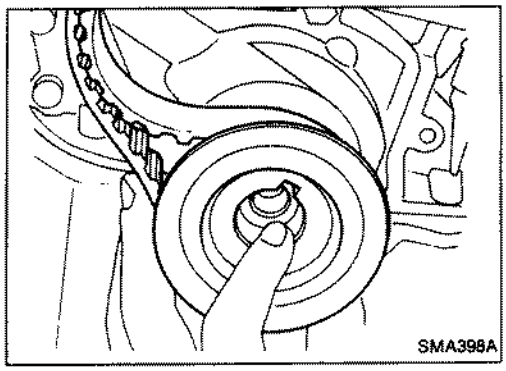
2. Remove timing belt.

(1) Loosen tensioner pulley bolt, turn tensioner pulley counter-clockwise then tighten bolt.

Camshaft Timing Belt — CD17 (Cont'd)



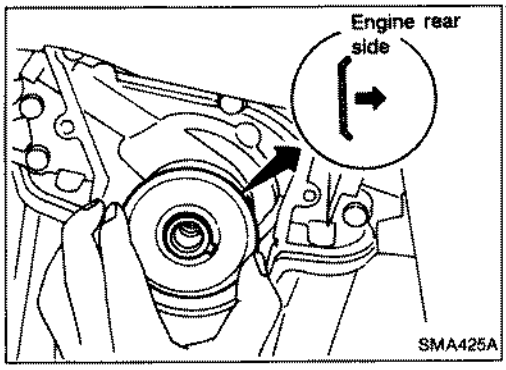
(2) Remove idler pulley.



(3) Remove timing belt with crankshaft sprocket.

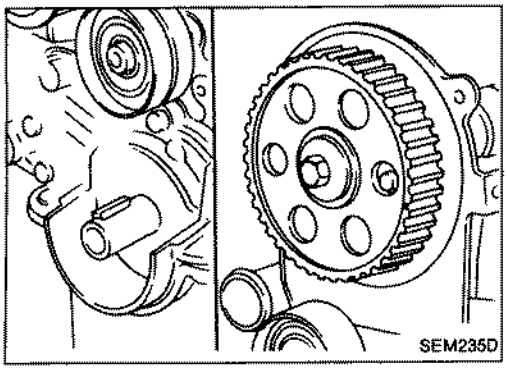
INSPECTION

Refer to page EM-208. (CD20 engine)



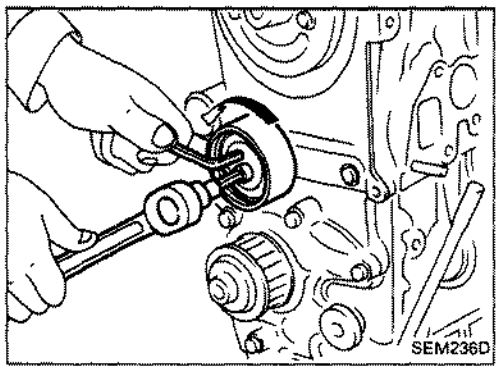
INSTALLATION

1. Install sprocket plate in correct direction.



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

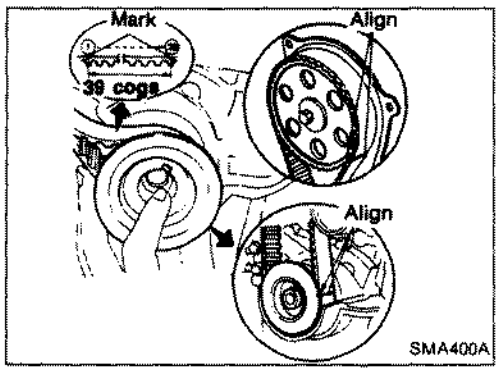
Camshaft Timing Belt — CD17 (Cont'd)



3. Install tensioner and return spring.

Temporarily tighten bolts so that tensioner is set at the fully outside position.

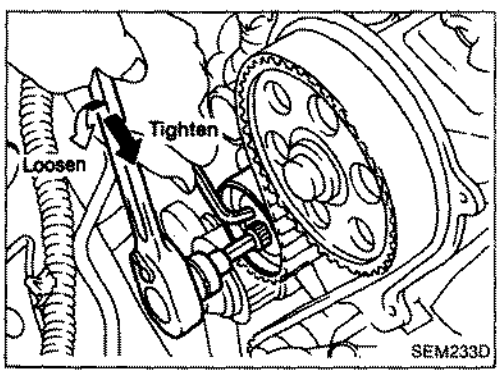
4. Install idler and tighten bolt to the specified torque.
5. Check tensioner and idler for smooth turning.



6. Install timing belt with crankshaft sprocket.

a. Align white lines on timing belt with punchmarks on camshaft sprocket and crankshaft sprocket.

b. Point arrow on timing belt toward belt cover.



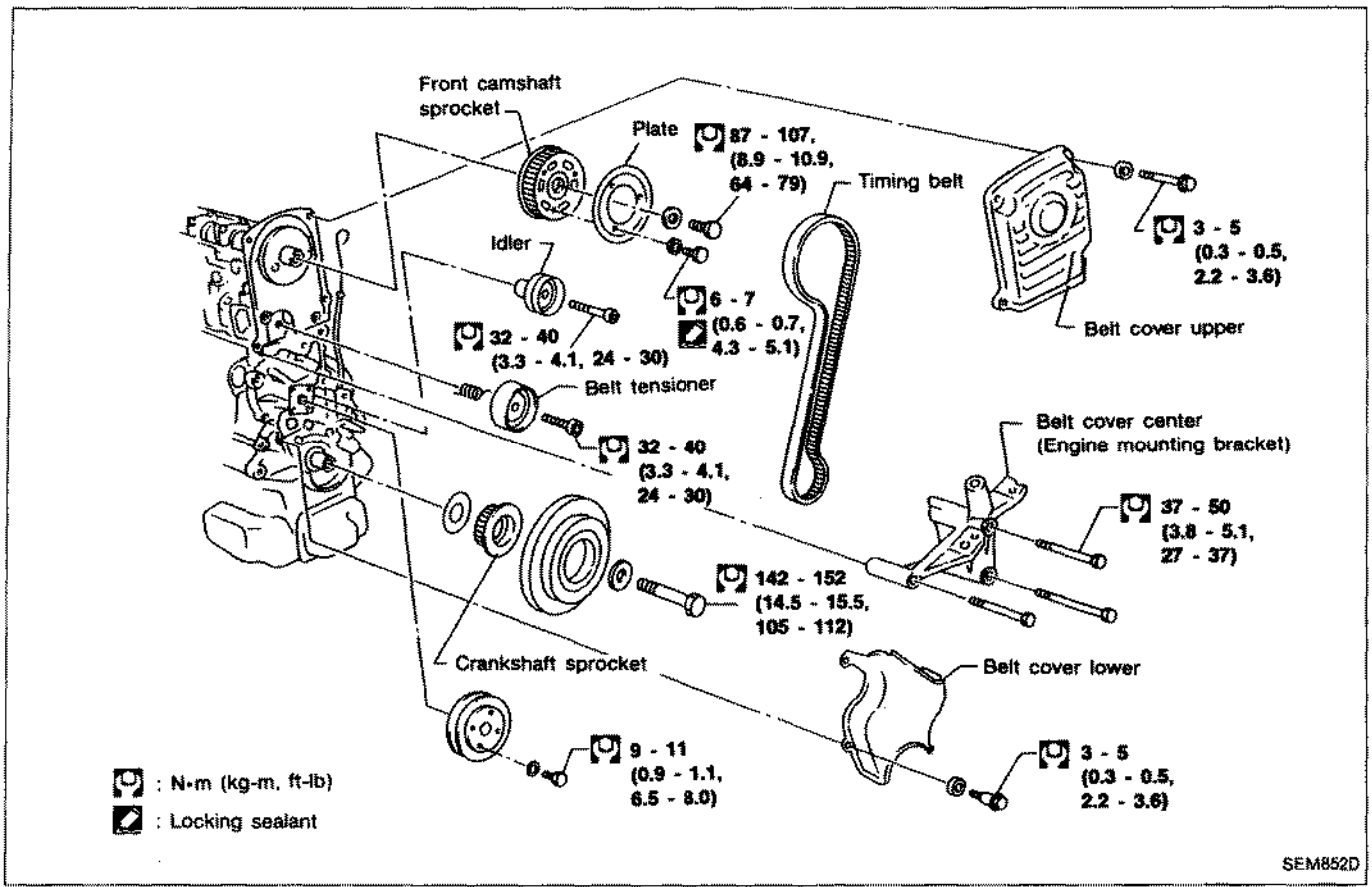
7. Adjust timing belt tension.

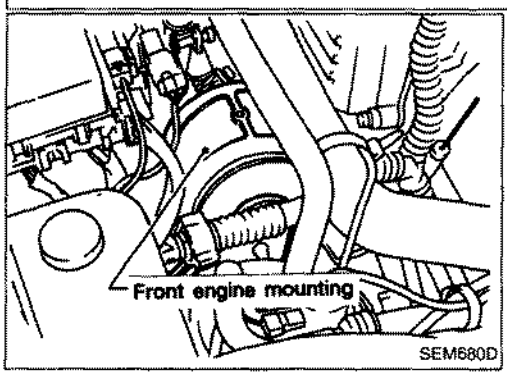
1) Loosen tensioner lock bolt to apply tension to timing belt.
2) Rotate crankshaft clockwise two turns to apply the specified tension to timing belt.
3) Tighten tensioner lock bolt while holding tensioner pulley with hexagon wrench.

Camshaft Timing Belt — CD20

CAUTION:

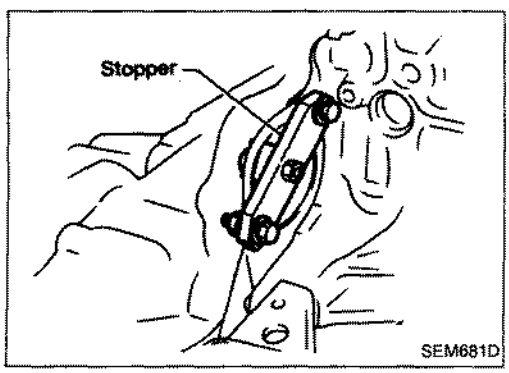
a. **Do not bend or twist timing belt.**
b. **After removing timing belt, do not turn crankshaft and camshaft separately because valves will strike piston heads.**
c. **Ensure that timing belt, camshaft sprocket, crankshaft sprocket and belt tensioner are clean and free from oil and water.**





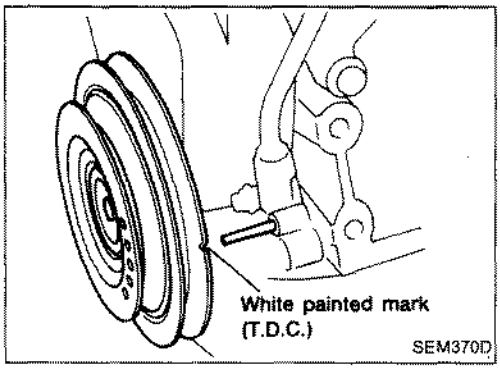
REMOVAL

- Remove engine front mounting bracket.
  When removing, support front portion of engine with transmission jack or hoist.

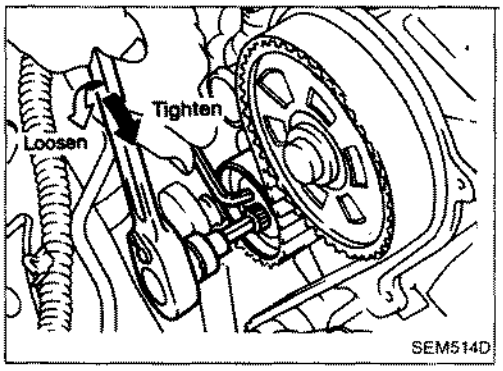


- Remove starter motor, and install ring gear stopper using mounting bolt holes.
- Remove crank pulley bolt.
- Remove crank pulley using puller.
  Be sure to securely attach puller jaws. Attach jaws only to the rear side of pulley.

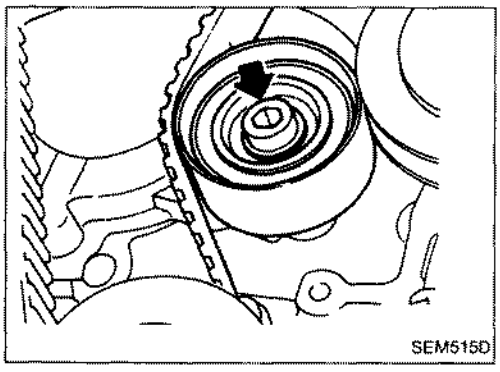
Camshaft Timing Belt — CD20 (Cont'd)



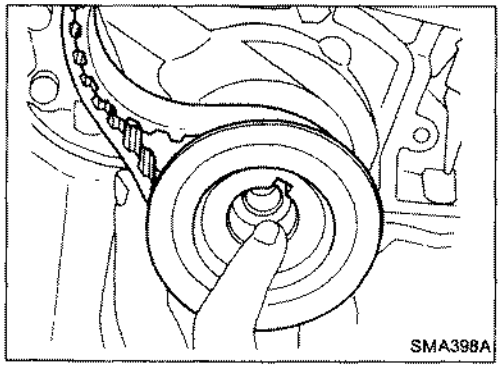
1. Set No. 1 cylinder at T.D.C. on its compression stroke.



2. Remove timing belt.
(1) Loosen tensioner pulley bolt, turn tensioner pulley counterclockwise then tighten bolt.
(2) Remove camshaft sprocket plate.



(3) Remove idler pulley.



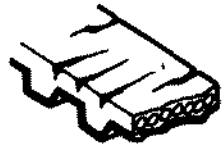
(4) Remove timing belt with crankshaft sprocket.

Camshaft Timing Belt — CD20 (Cont'd)

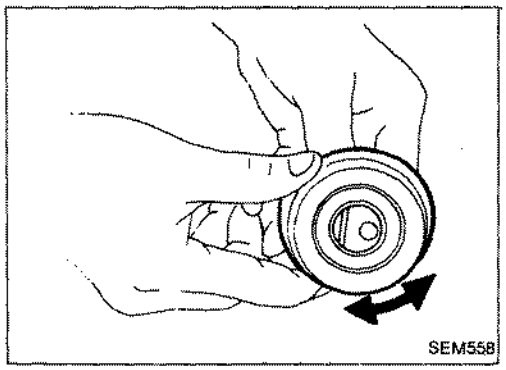
INSPECTION

Timing belt

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

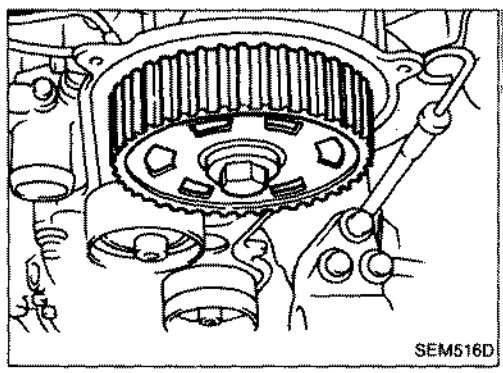
Item to check	Problem	Cause
Tooth is broken/tooth root is cracked.	 SEM394A	• Camshaft jamming • Distributor jamming • Damaged camshaft/crankshaft oil seal
Back surface is cracked/worn.	 SEM395A	• Tensioner jamming • Overheated engine • Interference with belt cover
Side surface is worn.	 • Belt corners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

Camshaft Timing Belt — CD20 (Cont'd)


SEM558

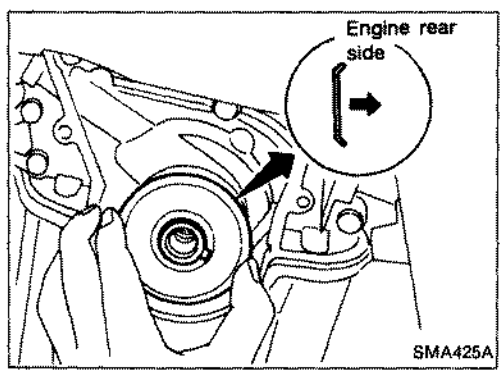
Belt tensioner, tensioner spring and idler

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


SEM516D

Crankshaft sprocket and front camshaft sprocket

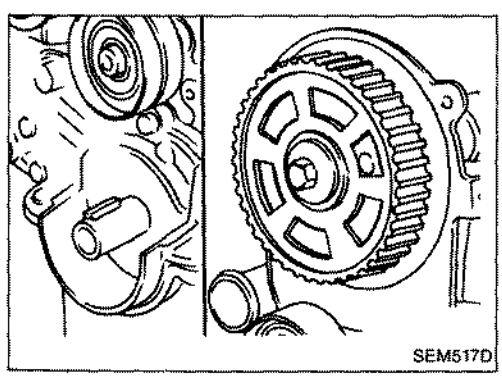
Check teeth for abnormal signs.



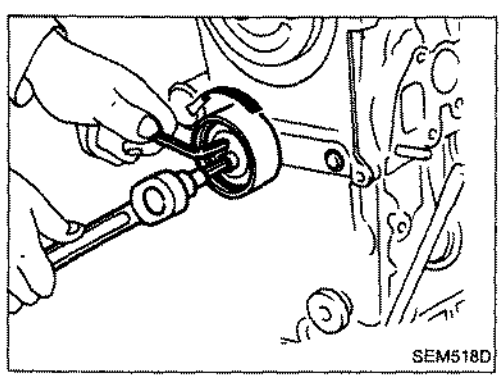
SMA425A

INSTALLATION

1. Install crankshaft sprocket plate in correct direction.


SEM517D

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

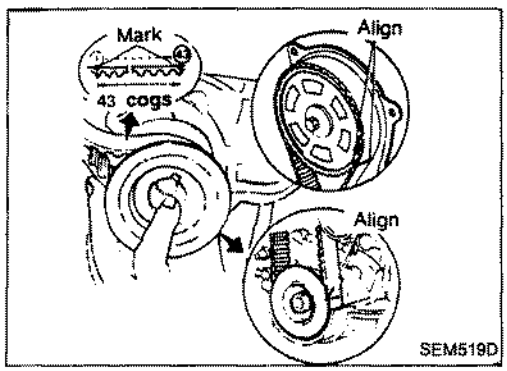

SEM518D

3. Install tensioner and return spring.

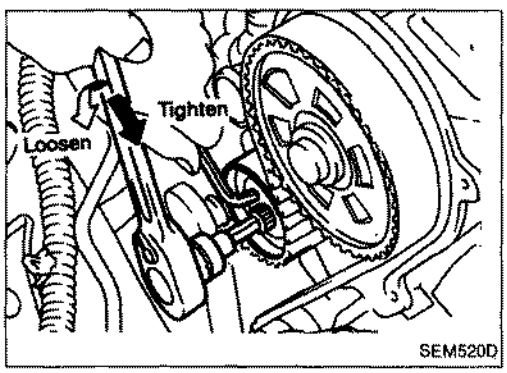
Temporarily tighten bolts so that tensioner is set at the fully outside position.

4. Install idler and tighten bolt to the specified torque.

Camshaft Timing Belt — CD20 (Cont'd)



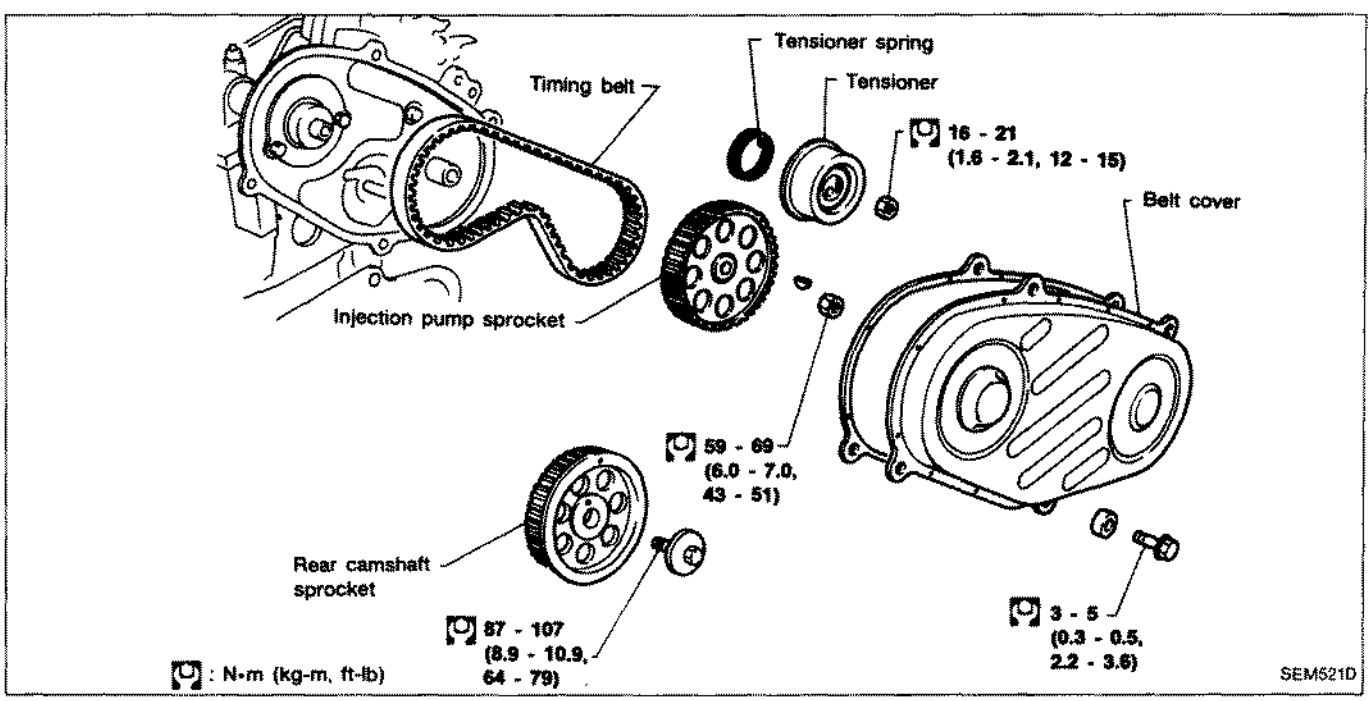
5. Install timing belt with crankshaft sprocket.
   a. Align white lines on timing belt with punchmarks on camshaft sprocket and crankshaft sprocket.
   b. Point arrow on timing belt toward belt cover.
6. Install camshaft sprocket plate and secure screws with locktite.

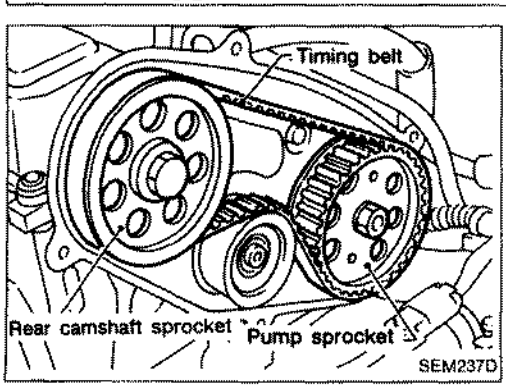


7. Adjust timing belt tension.
   1) Loosen tensioner lock bolt to apply tension to timing belt.
   2) Rotate crankshaft clockwise two turns to apply the specified tension to timing belt.
   3) Tighten tensioner lock bolt while holding tensioner pulley with hexagon wrench.

   Belt tension:
   147.1 ± 24.5 N (15 ± 2.5 kg, 33.1 ± 5.5 lb)

Injection Pump Timing Belt

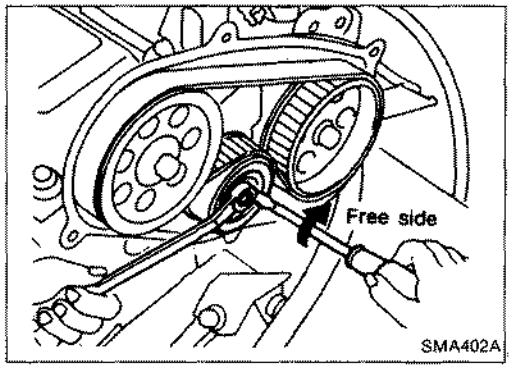




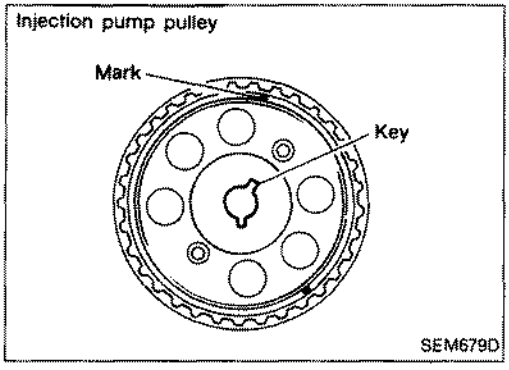
REMOVAL

1. Set No. 1 cylinder at T.D.C. (white paint mark) on its compression stroke.
2. Remove air duct with resonator and timing belt cover.

Injection Pump Timing Belt (Cont'd)



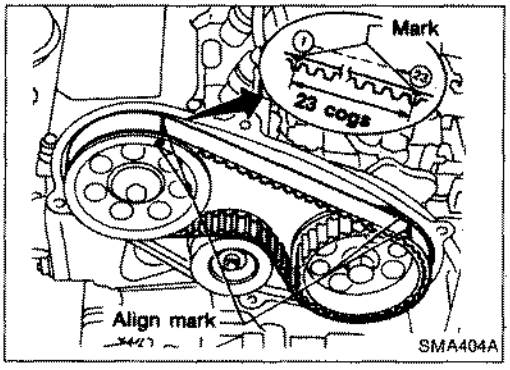
3. Remove timing belt.
1) Loosen tensioner lock nut and turn tensioner clockwise to free belt from tension. Then temporarily tighten tensioner nut.
2) Remove timing belt.



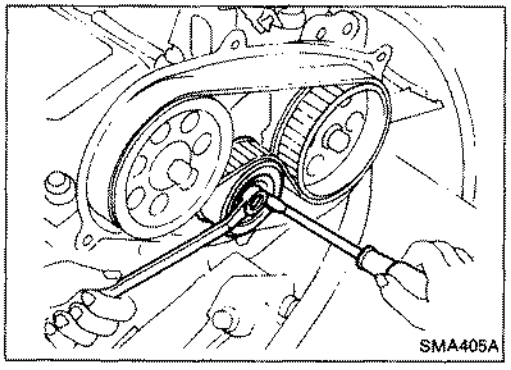
INSTALLATION

1. Confirm that No. 1 piston is set at T.D.C. on its compression stroke.
- If injection pump pulley was removed, confirm that it is re-installed as illustrated.

Identification of alignment:
CD17 No mark
CD20 Use mark "A"



2. Set timing belt.
a. Align white lines on timing belt with punchmarks on camshaft sprocket and injection pump sprocket.
b. Point arrow on timing belt toward belt cover.



3. Adjust belt tension.
1) Loosen tensioner lock nut to apply tension to timing belt.
2) Rotate crankshaft clockwise two turns.

Do not turn crankshaft by camshaft sprockets.

3) Tighten tensioner lock nut while holding tensioner with a screwdriver.

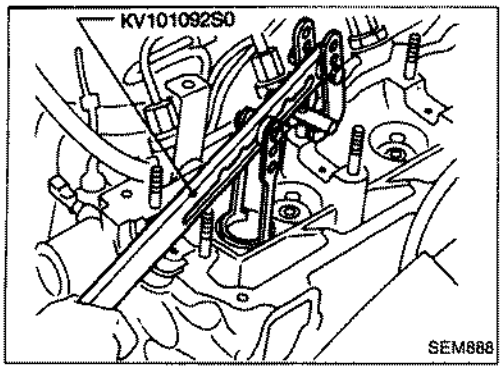
Belt tension:
CD17 255 ± 49 N (26 ± 5 kg, 57 ± 11 lb)
CD20 147 ± 49 N (15 ± 5 kg, 33 ± 11 lb)

INSPECTION

Refer to page EM-208.

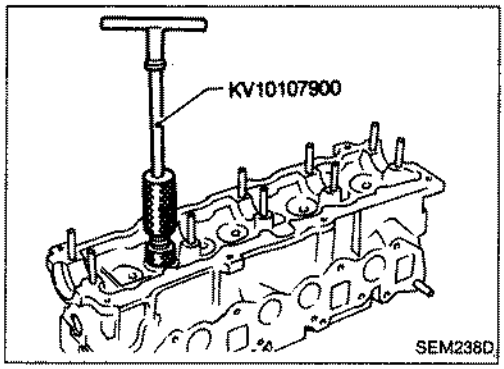
INJECTION TIMING ADJUSTMENT

Refer to EF & EC section.



VALVE OIL SEAL

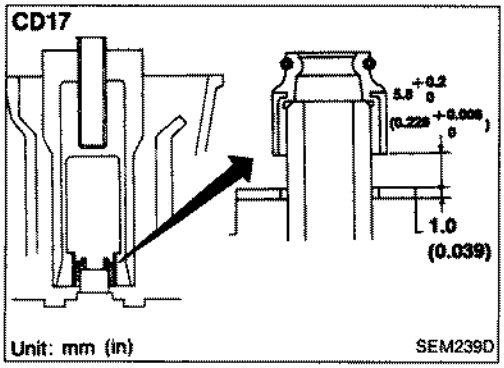
1. Remove both timing belts.
2. Remove camshaft sprockets and back covers.
3. Remove camshaft brackets by loosening bracket nuts from center to outside in two or three stages.
4. Remove camshaft oil seals and camshaft.

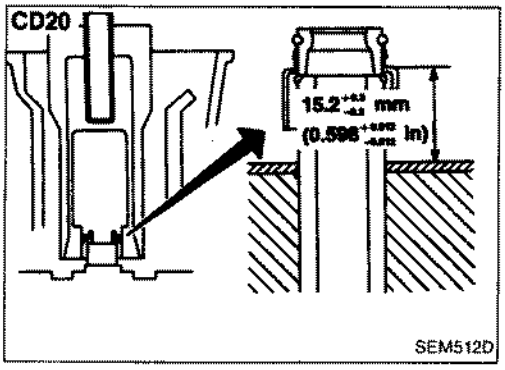


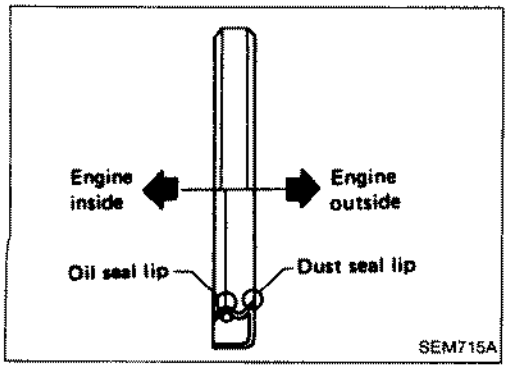
5. Remove valve lifters and mark order No. on each lifter.
6. Replace valve oil seal according to the following procedure.

When replacing valve oil seal, set the corresponding piston at T.D.C. Failure to do so causes the valve to drop into the cylinder.

1) Set No. 1 cylinder at T.D.C.
2) Remove valve springs and valve oil seals for No. 1 and No. 4 cylinders. Valve spring seats should not be removed.
3) Install new valve oil seals for No. 1 and No. 4 cylinders as illustrated. Reinstall valve springs. (narrow pitch side toward cylinder head)
4) Install valve spring retainers on intake valves and valve rotators on exhaust valves, and remount valve assembly.
5) Set No. 2 cylinder at T.D.C.
6) Replace valve oil seals for No. 2 and No. 3 cylinders according to steps 2) and 3).
7) Install valve lifters in original positions.

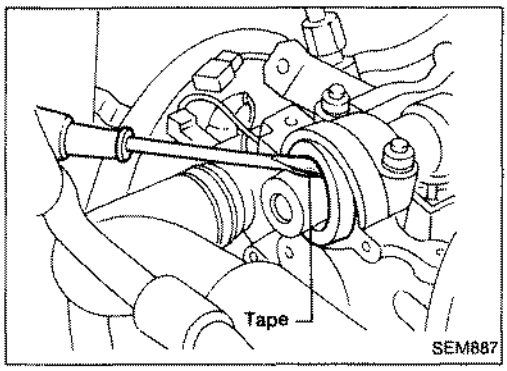






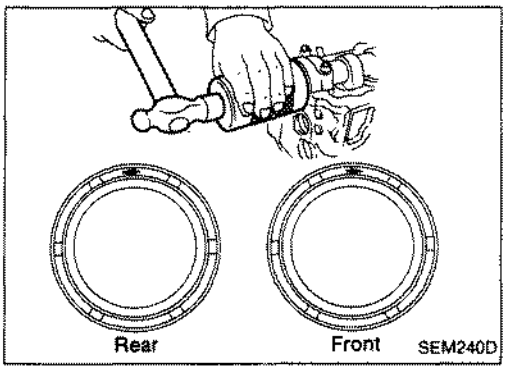
CAMSHAFT AND CRANKSHAFT OIL SEAL INSTALLING DIRECTION AND MANNER

- **When installing camshaft and crankshaft oil seals, be careful to install them correctly, as shown in the figure.**
- **Apply engine oil to oil seal lip, outer face, camshaft and bracket.**
- **Wipe off excess oil after installing oil seal.**



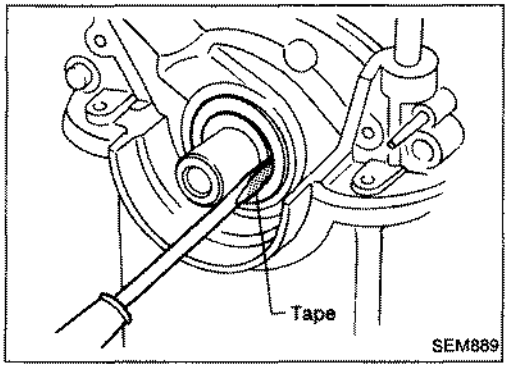
CAMSHAFT OIL SEALS

1. Remove timing belts, sprockets and back covers.
2. Pull out oil seal with a suitable tool.



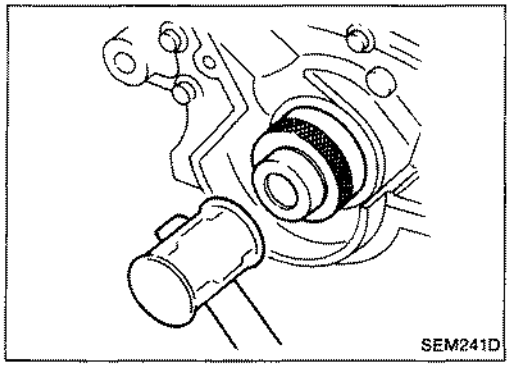
3. Install new oil seals with a suitable tool.

Confirm turning direction of both oil seals and camshaft.

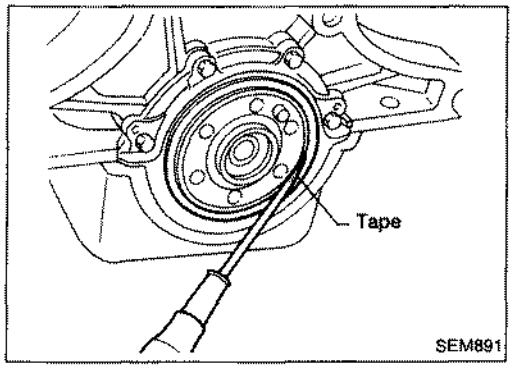


CRANKSHAFT FRONT OIL SEAL

1. Remove valve timing belt and crankshaft sprocket.
2. Remove oil seal with a suitable tool.

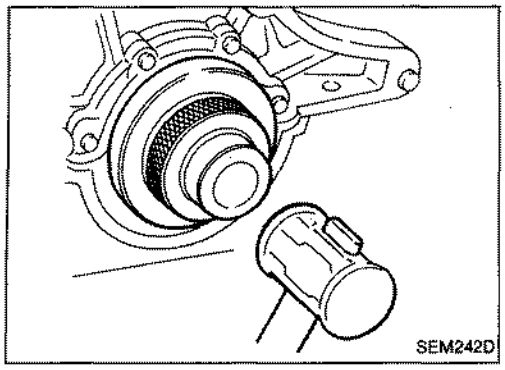


3. Apply engine oil to new oil seal and install oil seal using a suitable tool.



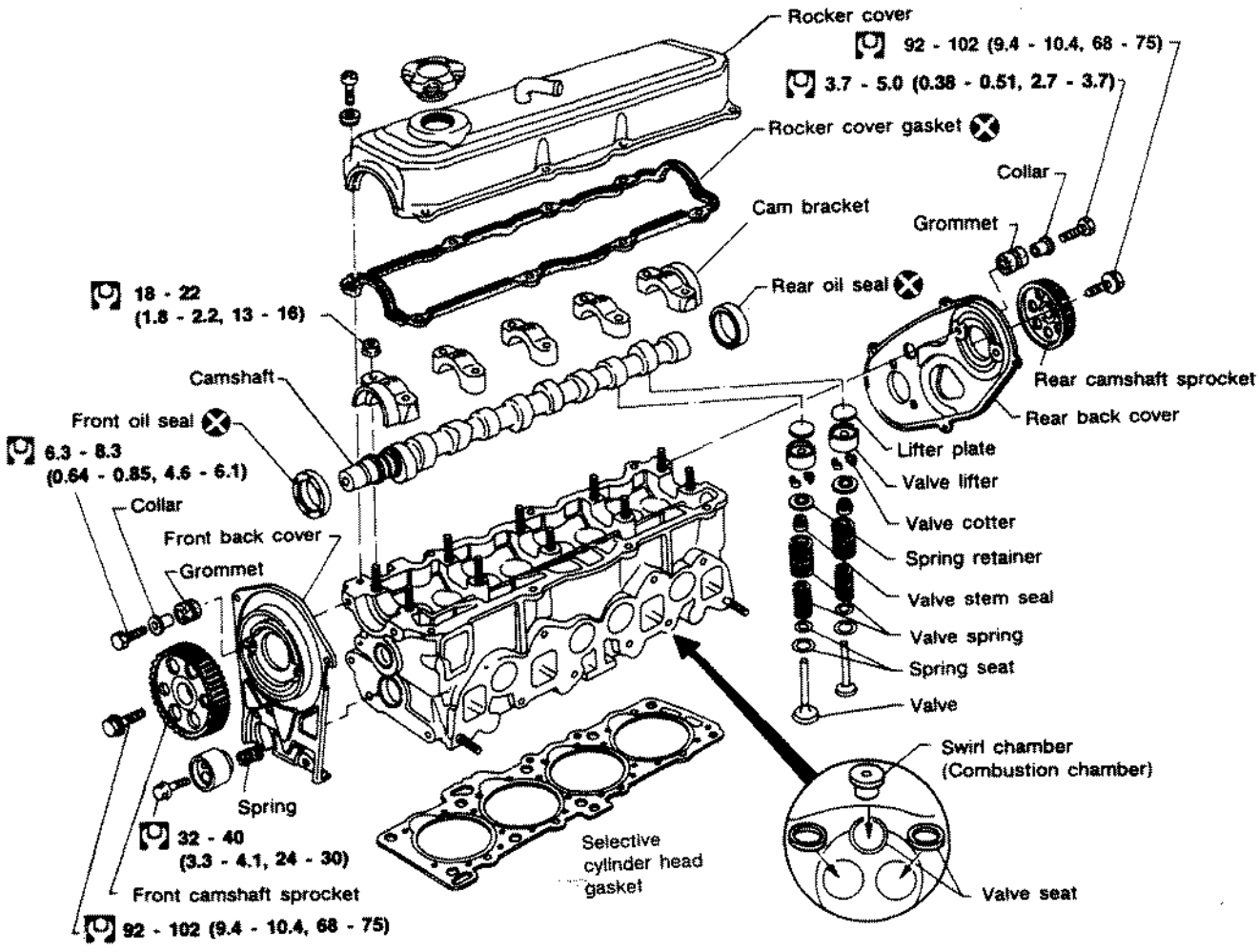
CRANKSHAFT REAR OIL SEAL

1. Remove transaxle assembly. (Refer to MT/AT section.)
2. Remove flywheel (drive plate).
3. Remove rear oil seal with a suitable tool.



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

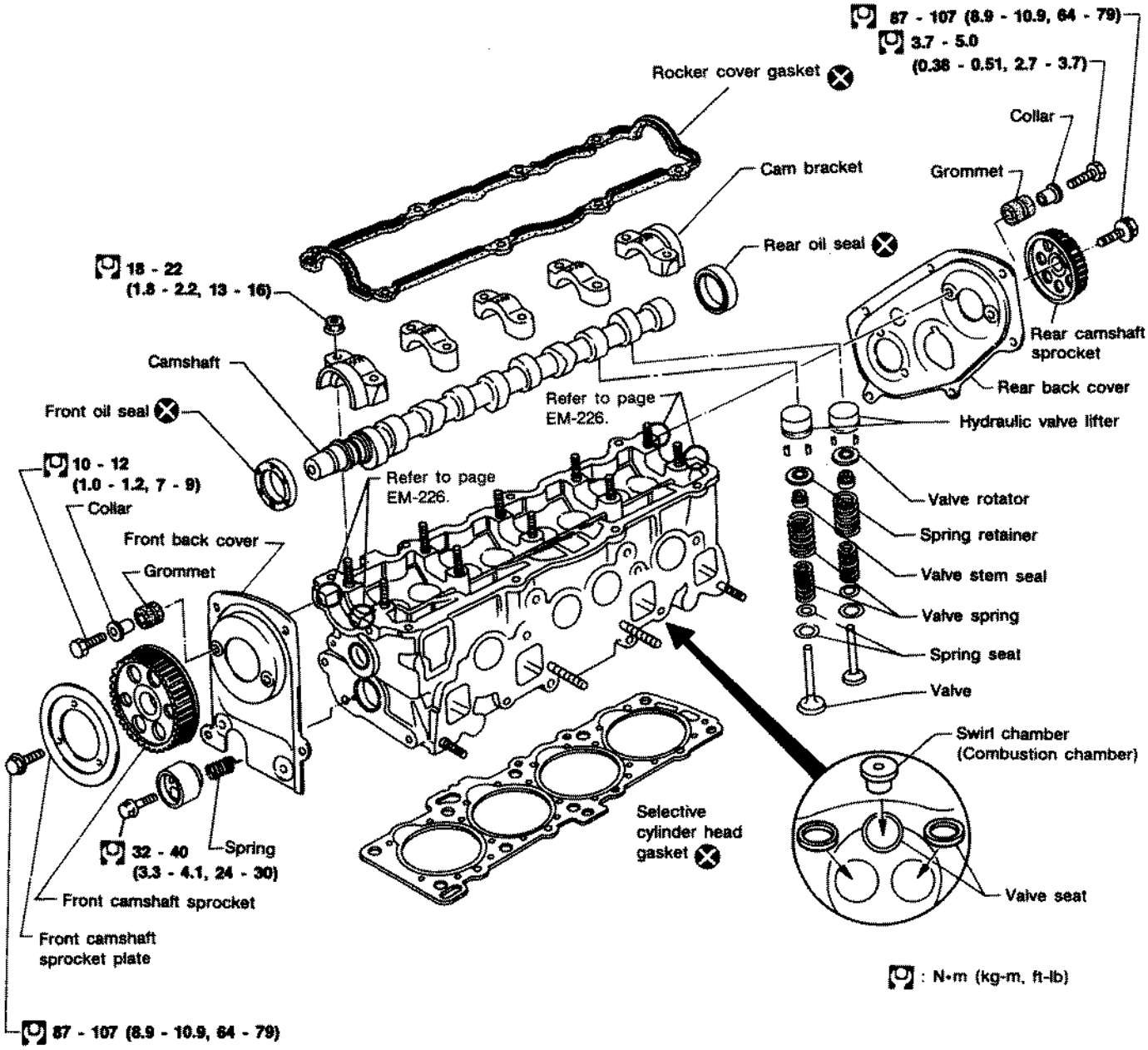
CD17



: N·m (kg-m, ft-lb)

SEM709A

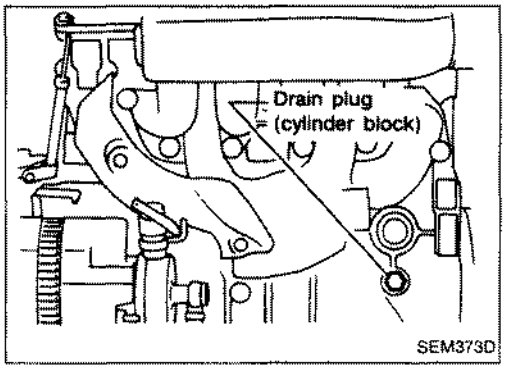
CD20



SEM524D

For hydraulic valve lifter

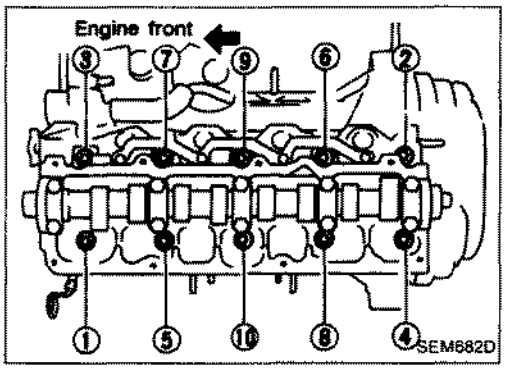
- Before starting engine, make sure that valve does not hit piston when rotating crankshaft by hand.
- When bleeding air out from hydraulic valve lifter, run engine at more than 2,400 rpm for 20 minutes or more.



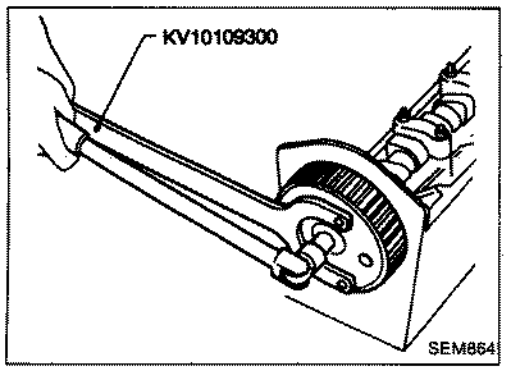
1. Drain coolant and disconnect front exhaust pipe from manifold.
2. Remove water hoses, air duct and intake manifold.
3. Remove heat shield and exhaust manifold.
4. Remove rocker cover and injection tubes.

5. Remove both timing belts.
   Set No. 1 cylinder at T.D.C. on its compression stroke. Refer to "Replacing Timing Belt".

After timing belts have been removed, do not rotate crankshaft and/or camshaft separately as valves will hit piston heads.



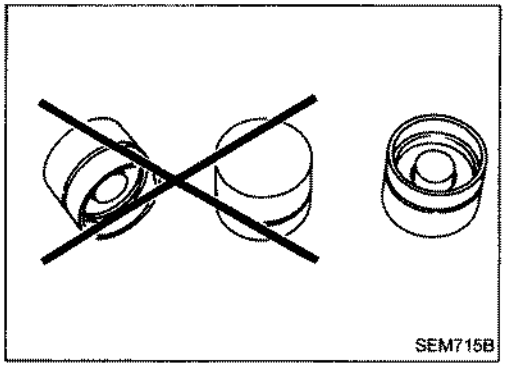
6. Remove cylinder head.



1. Remove front camshaft sprocket plate, front and rear sprockets using suitable tools and front back cover.

2. Remove camshaft brackets in order from outside to inside.
- Loosen camshaft bracket nuts in two or three stages.

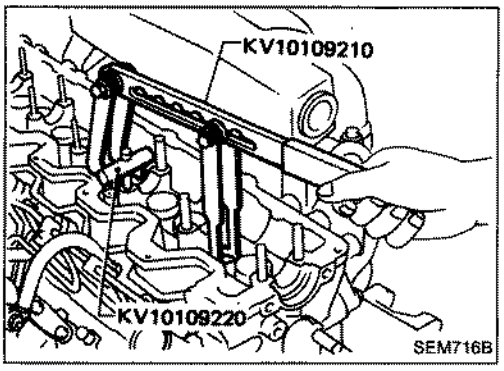
3. Remove camshaft and oil seals.



4. Remove valve lifters.

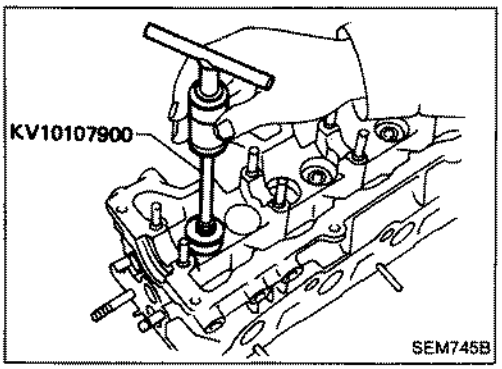
For hydraulic valve lifter — CD20

- **Do not set hydraulic valve lifters as illustrated as air will enter valve lifter causing malfunction.**
- **Do not disassemble hydraulic valve lifters.**
- **Attach tags to valve lifters to prevent mixing them up.**
- **Valve lifters must be put in engine oil after removal.**

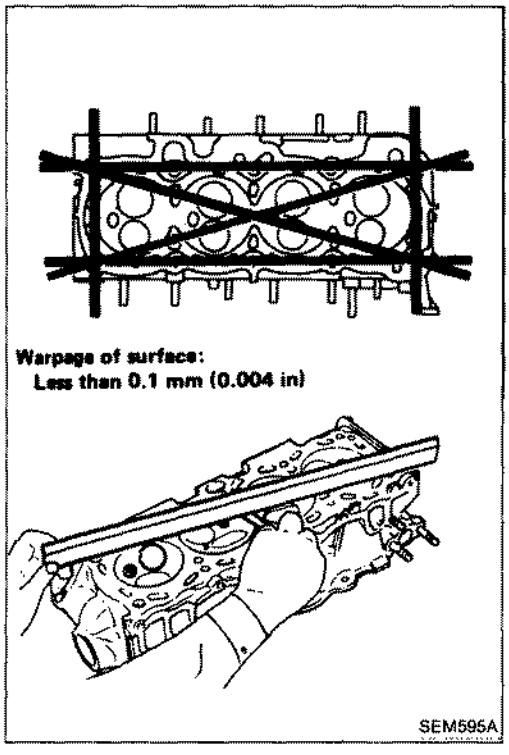


5. Remove valve component parts using special service tool or a suitable tool.

- **Keep each valve and its components together and mark them so they can be reassembled in their original positions.**



6. Remove valve oil seals using special tool.



CYLINDER HEAD DISTORTION

1. Visually check for cracks and deformation.
2. Check cylinder head for distortion.

Head surface flatness:
Less than 0.1 mm (0.004 in)

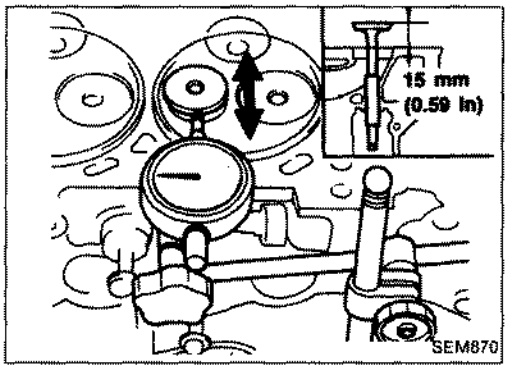
If beyond the specified limit, replace or resurface cylinder head.

Resurfacing limit:
The resurfacing limit of the cylinder head is related to the amount of resurfacing of the cylinder block.
When:
"A" is the amount of resurfacing needed for the cylinder head and "B" is the amount of resurfacing needed for the cylinder block, the maximum limit is determined by

A + B = 0.1 mm (0.004 in)

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

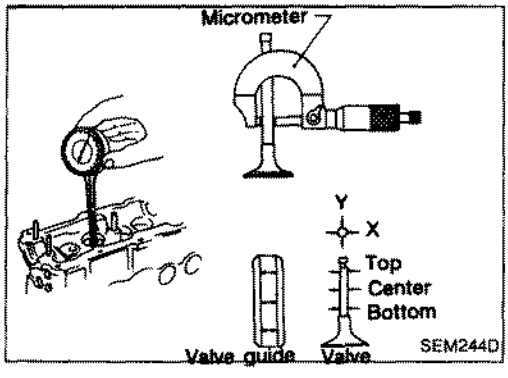
Nominal height of cylinder head:
CD17 116.6 - 117.0 mm (4.591 - 4.606 in)



VALVE GUIDE CLEARANCE

1. Measure deflection across the cylinder head as illustrated.

Valve deflection limit (dial gauge reading):
0.1 mm (0.004 in)

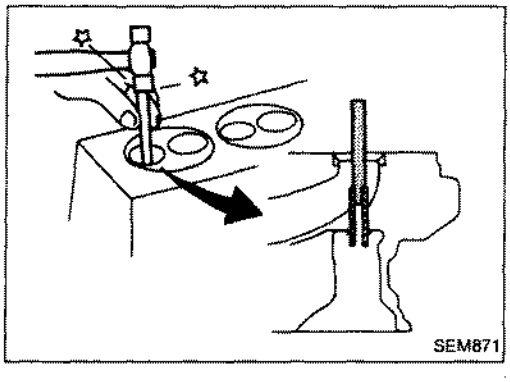


2. If exceeding the limit, check valve-to-guide clearance.

a) Measure valve stem diameter and valve guide inner diameter as illustrated.
b) Check that clearance is within the specification.

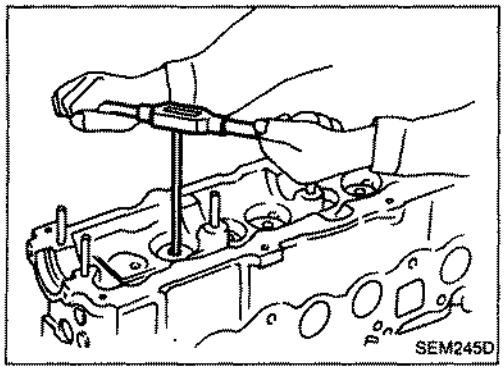
Valve stem to valve guide clearance limit:
0.1 mm (0.004 in)

c) If exceeding the limit, replace valve or valve guide.

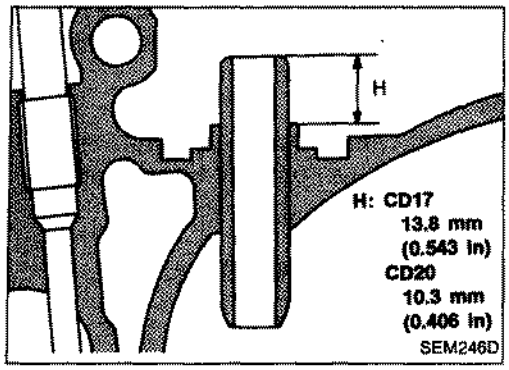


VALVE GUIDE REPLACEMENT

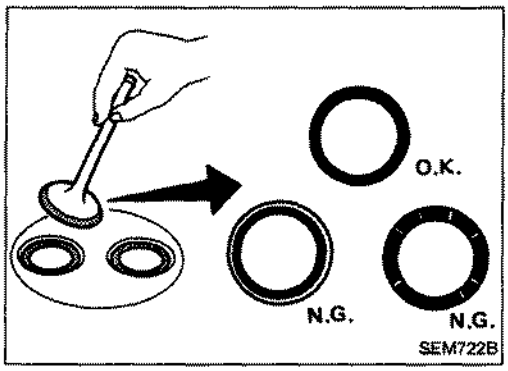
1. Heat cylinder head in oil to 150 to 160°C (300 to 320°F).
2. Drive out valve guide using a press or hammer and a suitable tool.



3. Ream cylinder head valve guide bore.
   Reaming bore (service part):
   11.185 - 11.196 mm (0.4404 - 0.4408 in)



4. Heat cylinder head to 150 to 160°C (302 to 320°F) and press service valve guide onto cylinder head.
5. Ream valve guide.
   Final size:
   7.000 - 7.015 mm (0.2756 - 0.2762 in)

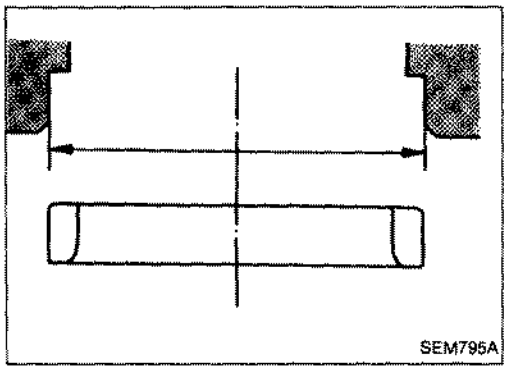


VALVE SEATS

1. Check valve and valve seat for contact.
   Coat the valve face with prussian red lead. If contact is wrong, correct valve seat. If the valve red lead appears 360° around face, the valve stem and face are concentric. If not, repair or replace valve.

2. Check valve seats for any evidence of pitting on valve contact surface, and reseat or replace if worn out excessively.
   Correct valve seat surface.

When repairing valve seat, check valve and valve guide for wear beforehand. If worn, replace them. Then correct valve seat.


SEM795A

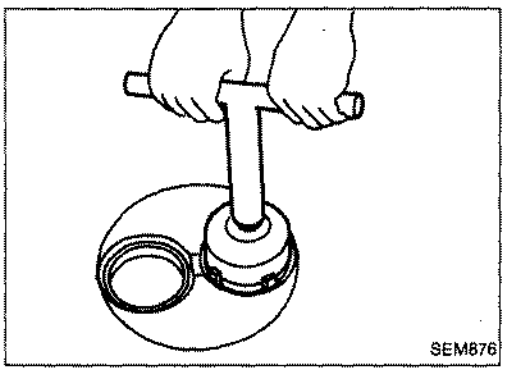
VALVE SEAT REPLACEMENT

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 the cylinder head recess.
   Reaming bore for service valve seat
   [Oversize 0.5 mm (0.020 in)]:
   CD17
   Intake 38.44 ± 0.01 mm (1.5134 ± 0.0004 in)
   Exhaust 34.46 ± 0.01 mm (1.3567 ± 0.0004 in)
   CD20
   Intake 40.943 ± 0.011 mm (1.6119 ± 0.0004 in)
   Exhaust 34.943 ± 0.011 mm (1.3757 ± 0.0004 in)

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

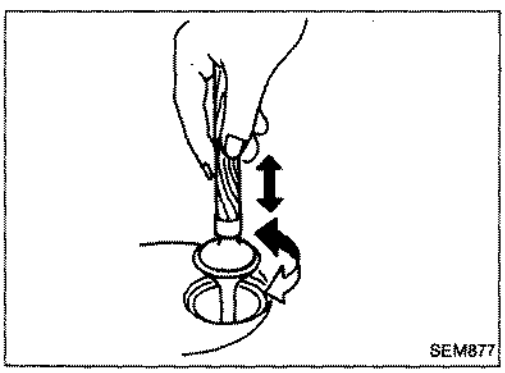
3. Heat cylinder head to a temperature of 150 to 160°C (302 to 320°F) and press fit seat until it seats on the bottom.
4. Install valve seats.

When replacing valve seat, valve should be replaced as well.

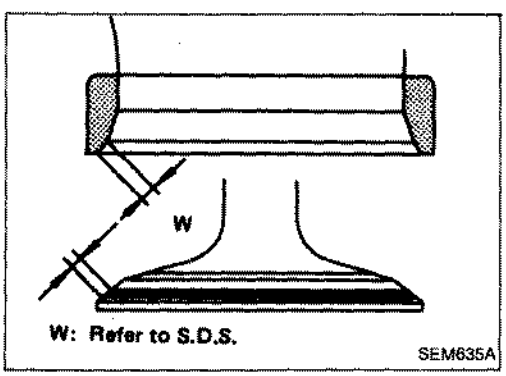

SEM876

5. Cut or grind valve seat using a suitable tool at the specified dimensions as shown in S.D.S.

The cutting should be done with both hands to obtain a uniform and concentric finish.

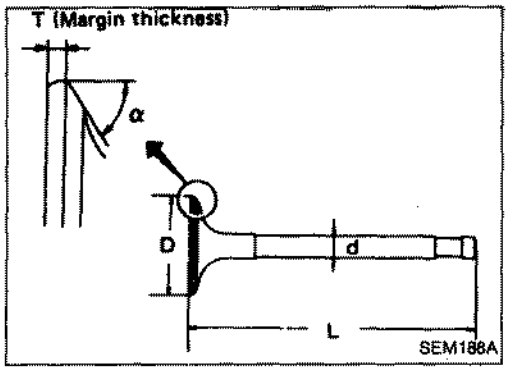

SEM877

6. Apply a small amount of fine grinding compound to the valve's contacting face and put the valve into its guide.
   Lap valve against its seat until proper valve seating is obtained.



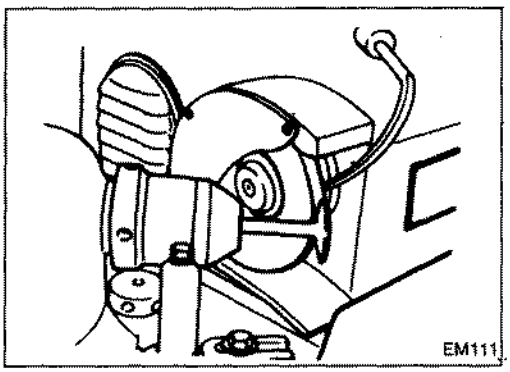
W: Refer to S.D.S.
SEM635A

7. Check valve seating condition.



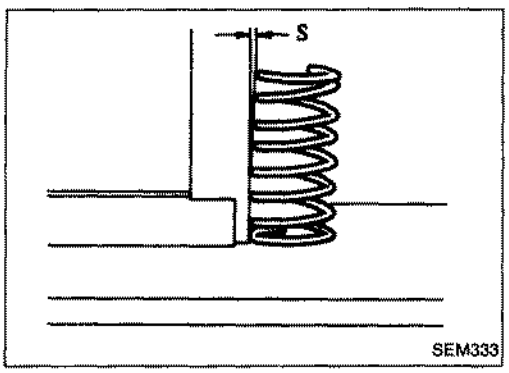
VALVE DIMENSIONS

1. Check dimensions of each valve. For dimensions, refer to S.D.S.
2. Correct or replace any valve that is faulty.



3. Valve face or valve stem end surface should be refaced by using a valve grinder.

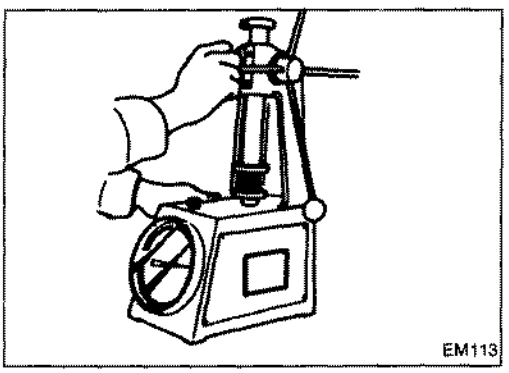
When valve head has been worn down to 0.5 mm (0.020 in) in margin thickness, replace the valve.
Grinding allowance for valve stem tip is 0.5 mm (0.020 in) or less.



VALVE SPRING SQUARENESS

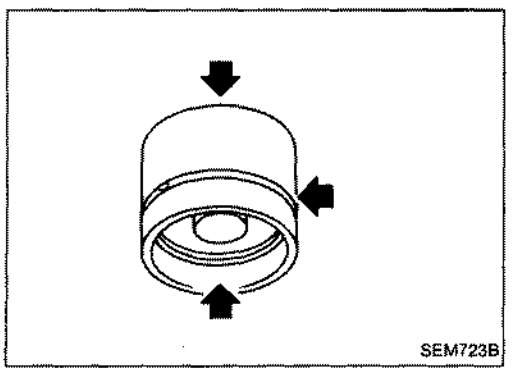
Check valve spring for squareness using a steel square and flat surface plate.
If spring is out of square "S" more than specified limit, replace with new one.

Out-of-square:
Outer
Less than 2.1 mm (0.083 in)
Inner
Less than 1.9 mm (0.075 in)



VALVE SPRING PRESSURE LOAD

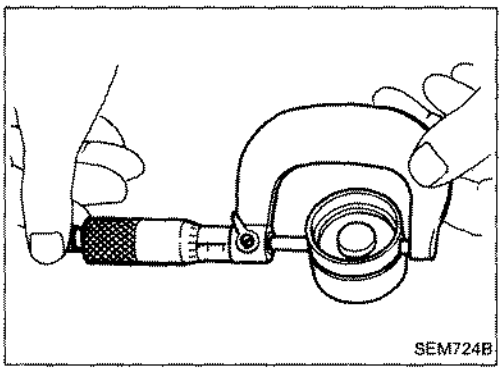
Measure the free length and the tension of each spring. If the measured value exceeds the specified limit, replace spring. Refer to S.D.S.



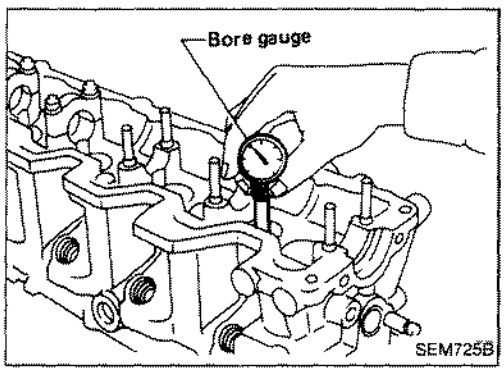
VALVE LIFTER

CD17: Valve lifter
CD20: Hydraulic valve lifter

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

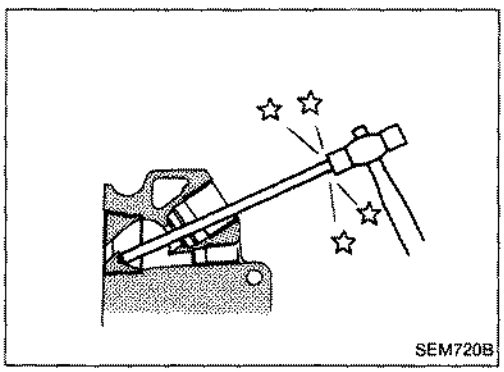

SEM724B

2. Check diameter of valve lifters.
   Outer diameter:
   34.959 - 34.975 mm (1.3763 - 1.3770 in)



SEM725B

3. Check valve lifter guide bore.
   CD17
   Bore diameter
   34.988 - 35.013 mm (1.3775 - 1.3785 in)
   Standard clearance
   0.013 - 0.054 mm (0.0005 - 0.0021 in)
   CD20
   Bore diameter
   34.998 - 35.018 mm (1.3779 - 1.3787 in)
   Standard clearance
   0.023 - 0.059 mm (0.0009 - 0.0023 in)


SEM720B

COMBUSTION CHAMBER REPLACEMENT

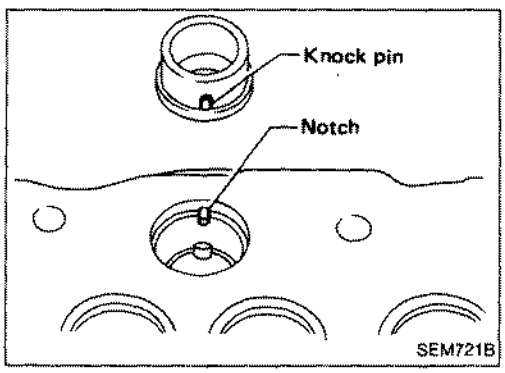
Usually combustion chambers should not be removed. However, if they show cracks or extensive damage, they should be replaced.

1. Remove glow plug connecting plate, glow plugs and injection nozzle.
2. Heat cylinder head in oil to between 150 and 160°C (302 and 320°F).
3. Remove combustion chamber so that cylinder head will not be damaged.

Be careful not to scratch inside of nozzle hole.

4. Install combustion chamber.

a. Heat cylinder head 150 to 160°C (302 to 320°F) in oil.
b. Align combustion chamber knock pin with cylinder head notch, and install it into cylinder head using a plastic-tip hammer.



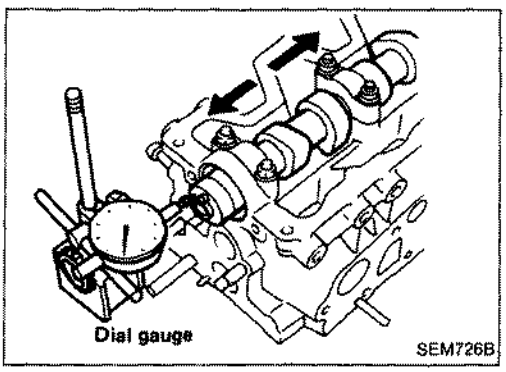
SEM721B

CAMSHAFT VISUAL CHECK

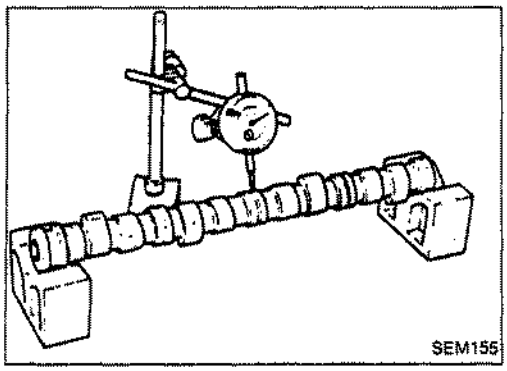
Check camshaft for scratches, seizure and wear.

CAMSHAFT END PLAY

1. Install camshaft in cylinder head.
2. Tighten bracket bolts to the specified torque.
3. Measure camshaft end play.
   Camshaft end play: Standard
   CD17 0.06 - 0.17 mm (0.0024 - 0.0067 in)
   CD20 0.115 - 0.188 mm (0.0045 - 0.0074 in)

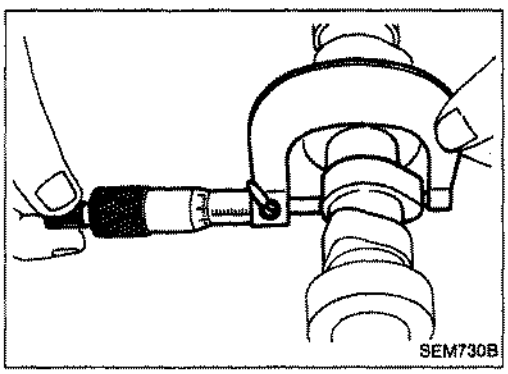


SEM726B


SEM155

CAMSHAFT RUNOUT

1. Measure camshaft runout at the center journal.
   Runout (Total indicator reading):
   Limit 0.05 mm (0.0020 in)
2. If it exceeds the limit, replace camshaft.


SEM730B

CAMSHAFT CAM HEIGHT

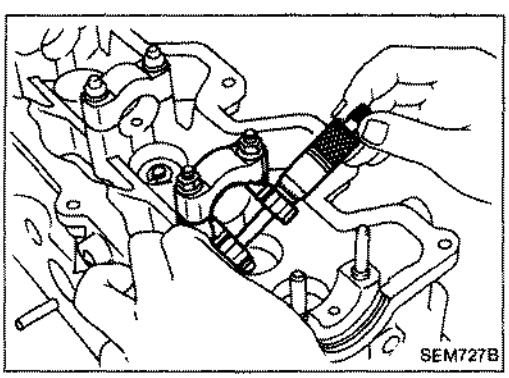
1. Measure camshaft cam height.

Cam height: Standard

Unit: mm (in)

	CD17	CD20
Intake	44.45 - 44.50 (1.7500 - 1.7520)	49.20 - 49.30 (1.9370 - 1.9409)
Exhaust	45.45 - 45.50 (1.7894 - 1.7913)	49.15 - 49.25 (1.9350 - 1.9390)

2. If wear is beyond the limit, replace camshaft.

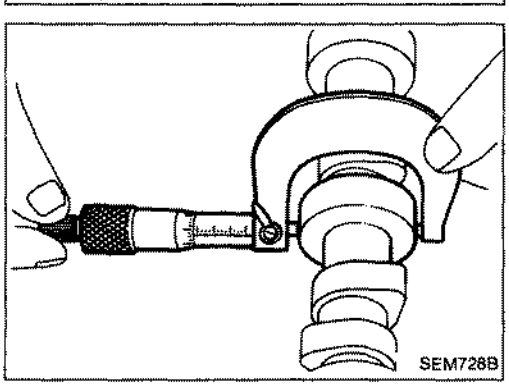

SEM727B

CAMSHAFT JOURNAL CLEARANCE

Using micrometer

1. Measure the inner diameter of camshaft bearings.
   Standard inner diameter:
   30.000 - 30.021 mm (1.1811 - 1.1819 in)

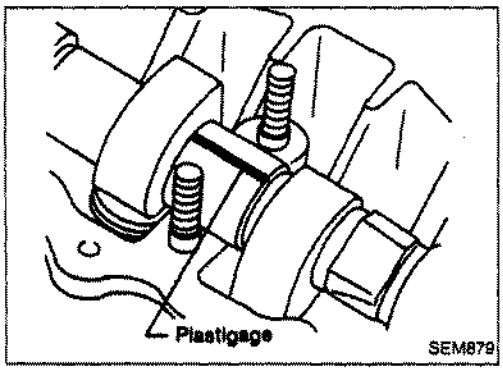
Tighten bracket bolts to the specified torque.


SEM728B

2. Measure the outer diameter of camshaft journals.
   Standard outer diameter:
   29.935 - 29.955 mm (1.1785 - 1.1793 in)

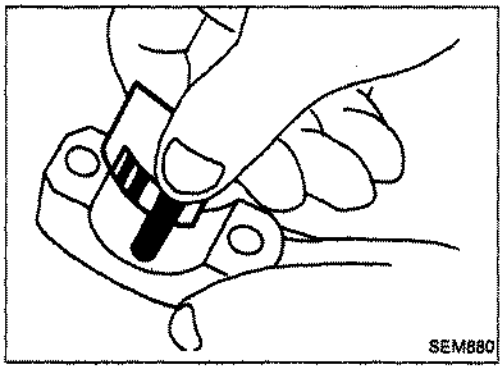
If clearance exceeds the limit, replace camshaft and/or cylinder head.

Standard clearance:
0.045 - 0.086 mm (0.0018 - 0.0034 in)
Limit: 0.1 mm (0.004 in)



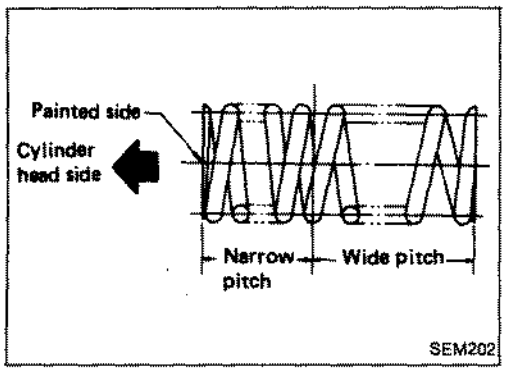
Using plastigage

1. Wipe off oil from camshaft journal bracket caps and brackets.
2. Install camshaft in journal bracket caps and put plastigage on each camshaft journal.
3. Install cam bracket caps and tighten cam bracket cap nuts in the correct order to the specified torque.
   [O]: 18 - 22 N·m (1.8 - 2.2 kg-m, 13 - 16 ft-lb)



4. Remove cam bracket caps and measure maximum width of plastigage.
   Camshaft bearing clearance:
   Limit
   0.1 mm (0.004 in)
5. If clearance appears to exceed the limit, replace camshaft or cylinder head.

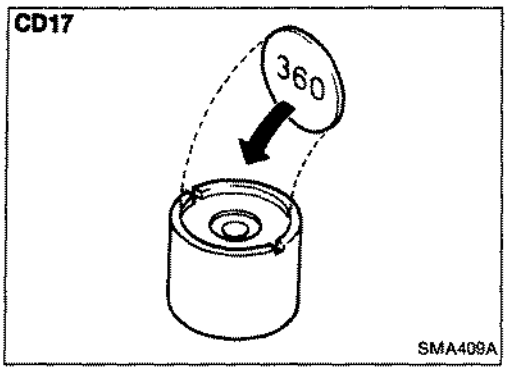
- Which parts to be replaced should be decided upon after measuring the diameters of the parts concerned.



1. Install valve component parts.

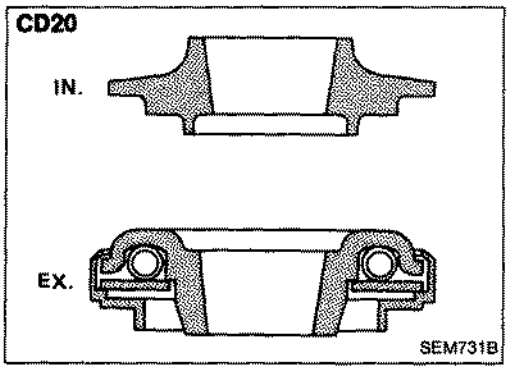
Install valve spring with its narrow pitch side toward cylinder head side.

- **Always install new valve oil seals.**
  Refer to oil seal replacement.
- **Before installing oil seal, install valve-spring seat.**
- **When installing valve, apply engine oil on the valve stem and lip of valve oil seal.**
- **Check whether the valve face is free from foreign matter.**



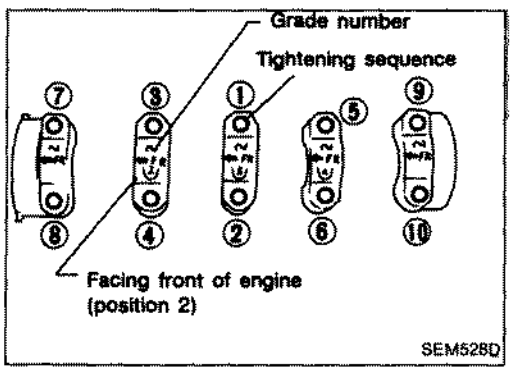
For CD17

- **Install valve lifter plate.**
- **Adjust valve clearance.**



For CD20

- **Install valve spring retainers on the intake side and valve rotators on the exhaust side.**
- **Valve rotators cannot be disassembled.**

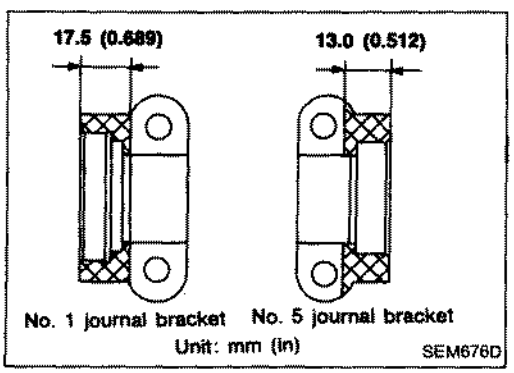


2. Install camshaft and brackets and tighten bracket nuts to the specified torque in two or three stages.

Camshaft-bracket nuts:

: 18 - 22 N·m (1.8 - 2.2 kg-m, 13 - 16 ft-lb)

- **Tighten bracket from center to outside.**
- **Apply sealant to brackets No. 1 and No. 5.**
- **When installing brackets, set camshaft so that the pin of camshaft front head is uppermost.**
- **Install new camshaft oil seals.**
  Refer to oil seal replacement.

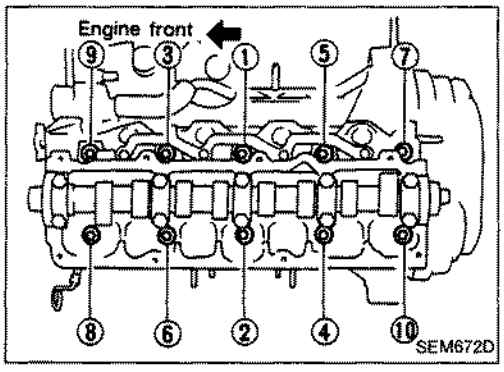


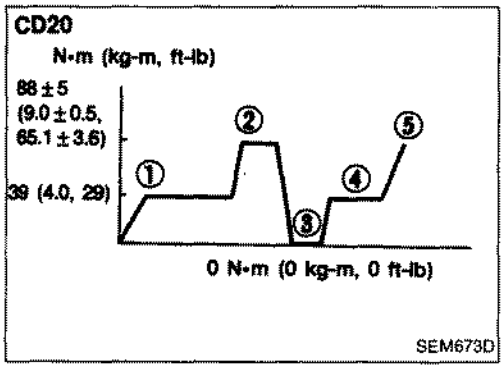
1. Install cylinder head gasket.

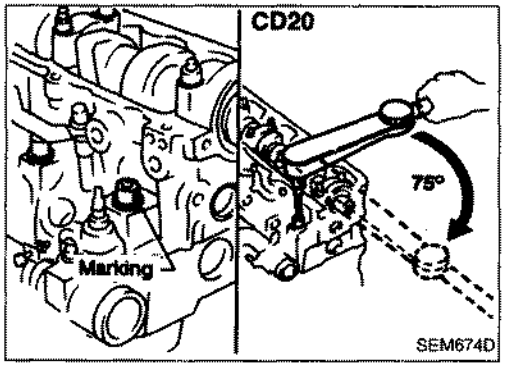
a. When replacing only cylinder head gasket, install same grade gasket as the one formerly used.

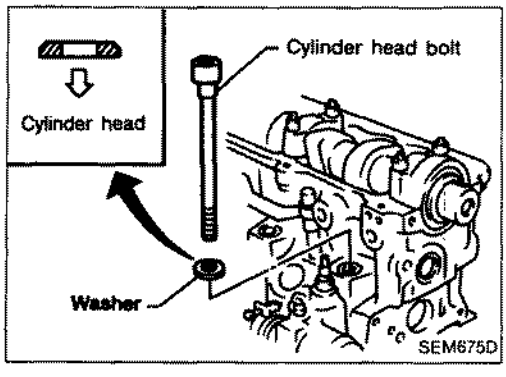
b. When replacing or repairing cylinder block, piston, connecting rod and crankshaft, select gasket referring to "Selecting cylinder head gasket".

2. Install cylinder head and tighten cylinder head bolts according to the following sequence.









Tightening procedure

1. Apply engine oil to threads and underhead seating face of each bolt.

For CD20

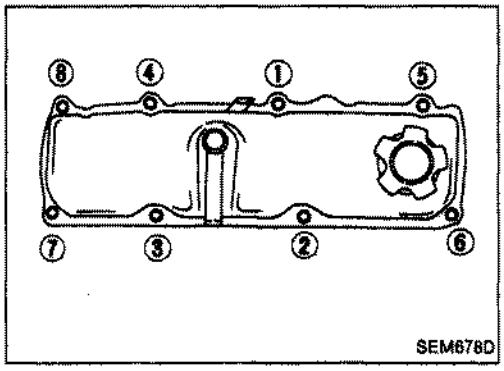
2. Tighten bolts progressively in the following steps.
   - ① 39 N·m (4.0 kg-m, 29 ft-lb)
   - ② 88 ± 5 N·m (9.0 ± 0.5 kg-m, 65.1 ± 3.6 ft-lb)
   - ③ Return to 0 N·m (0 kg-m, 0 ft-lb)
   - ④ 39 N·m (4.0 kg-m, 29 ft-lb)
   - ⑤ Tighten to 75 $^{+5^\circ}_{-0^\circ}$

   If it is difficult to check tightening angle of bolt, tighten to 83 to 93 N·m (8.5 to 9.5 kg-m, 61 to 69 ft-lb).

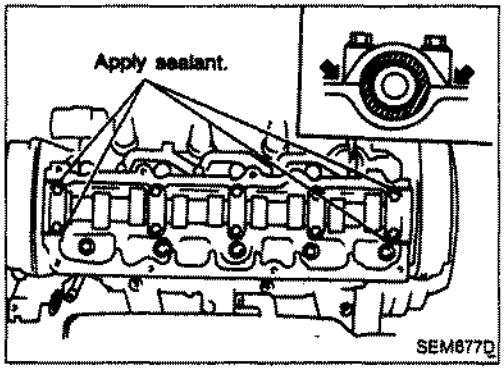
For CD17

2. Tighten bolts progressively in the following steps.
   - ① 39 N·m (4.0 kg-m, 29 ft-lb)
   - ② 103 ± 5 N·m (10.5 ± 0.5 kg-m, 76 ± 3.6 ft-lb)
   - ③ Return to 0 N·m (0 kg-m, 0 ft-lb)
   - ④ 39 N·m (4.0 kg-m, 29 ft-lb)
   - ⑤ Tighten to 82 $^{+5^\circ}_{-0^\circ}$

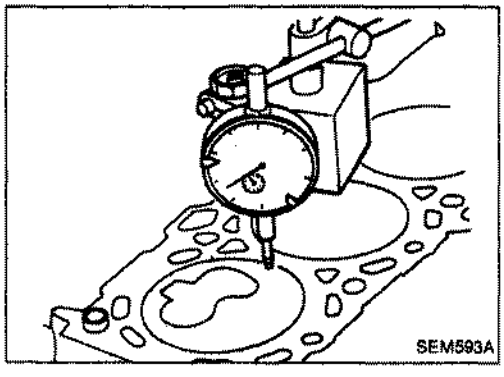
   If it is difficult to check tightening angle of bolt, tighten to 98 to 108 N·m (10.0 to 11.0 kg-m, 72 to 80 ft-lb).



3. Install rocker cover.
- Install rocker cover in the sequence shown at left.

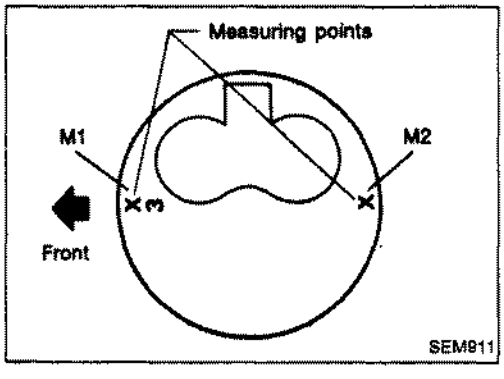


- Apply sealing compound (THREE-BOND No. 10 or equivalent) to both ends of brackets No. 1 and No. 5.

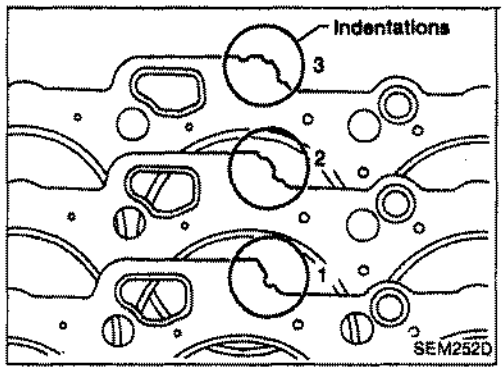


Selecting cylinder head gasket — CD17

1. Set dial gauge and needle on cylinder block surface.
2. Adjust scale to zero.
3. Move dial gauge assembly until needle is set on the measuring point of piston.
4. Read scale.
5. Reset dial gauge on cylinder block and confirm that scale indicates zero again.



- Be sure to measure the projection at two points for each cylinder as shown.
- Set each piston at its T.D.C.



6. Determine gasket grade.
(1) Calculate average value of projections for all pistons.
(2) Determine gasket thickness, referring to the chart.

Unit: mm (in)

Grade	Average values for piston projections	Gasket thickness	Number of indentations
A	Less than 0.52 (0.0205)	1.15 (0.0453)	1
B	0.52 - 0.57 (0.0205 - 0.0224)	1.20 (0.0472)	2
C	More than 0.57 (0.0224)	1.25 (0.0492)	3

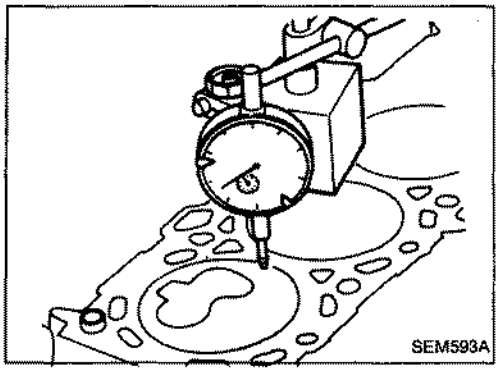
(3) If any one of the average values of each piston exceeds the average value (Max.) for piston projections by more than 0.05 mm (0.0020 in), select a one grade thicker gasket than that determined in step (2).

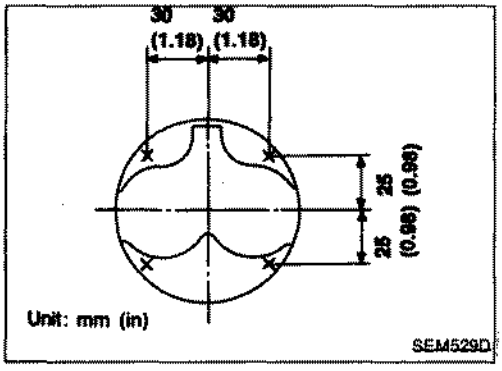
Example

Unit: mm (in)

Step	Item \ Cylinder No.	1		2		3		4		Remarks
1.	Measured value	M1	M2	M1	M2	M1	M2	M1	M2	
		0.53 (0.0209)	0.56 (0.0220)	0.59 (0.0232)	0.55 (0.0217)	0.53 (0.0209)	0.58 (0.0228)	0.58 (0.0228)	0.51 (0.0201)	
2.	Average value of each piston	0.545 (0.0215)		0.57 (0.0224)		0.555 (0.0219)		0.545 (0.0215)		
3.	Average value of all pistons	0.55375 (0.02180)								
4.	Rounded value	0.55 (0.0217)								
5.	Determined gasket thickness (Temporary)	1.20 (0.0472) (Grade B)								
6.	X: Maximum piston projection of selected gasket ... 0.57 (0.0224) + 0.05 (0.0020) = 0.62 (0.0244) Y: Maximum of the average value of each piston = 0.57 (0.0224) Result: Y < X									*1
7.	Determined gasket thickness (Final)	1.20 (0.0472) (Grade B)								

*1: If Y > X [for example Y = 0.63 mm (0.0248 in)], use thicker gasket grade C.


SEM593A



SEM529D

Selecting cylinder head gasket — CD20

When replacing only cylinder head gasket, install the same grade gasket as the one formerly used.

Step 1

Measure projection of piston to cylinder head surface.

a) Set dial gauge and needle on cylinder block and adjust dial gauge to zero.
b) Set dial gauge needle at measuring point on piston, taking care not to disturb its zero setting.
c) Rotate crankshaft around the top dead center position.
d) Read and write down the maximum value.
e) Reset dial gauge on cylinder block and confirm that zero setting has not been disturbed during measurement.
f) Repeat steps b through d for all measuring points as illustrated and for each cylinder.

- Be sure that piston whose projection is being measured is at its TDC.

Step 2

Calculate the average value of measurements taken for each piston.

Step 3

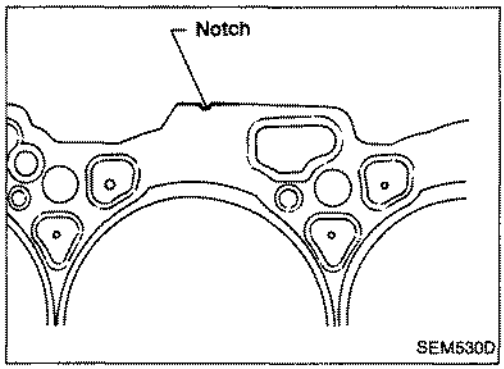
Calculate the average value of measurements for all pistons from the values obtained from step 2.

Step 4

Round of the value obtained.

Step 5

Determine required thickness of gasket, referring to chart A.



Relation between piston average projection and cylinder head gasket (Chart A)

Grade	Average value of piston projections mm (in)	Gasket thickness mm (in)	Number of notches
A	Less than 0.505 (0.0199)	$1.15^{+0.05}_{-0.05}$ ($0.0453^{+0.0020}_{-0.0020}$)	1
B	0.505 - 0.555 (0.0199 - 0.0219)	$1.20^{+0.05}_{-0.05}$ ($0.0472^{+0.0020}_{-0.0020}$)	2
C	Over 0.555 (0.0219)	$1.25^{+0.05}_{-0.05}$ ($0.0492^{+0.0020}_{-0.0020}$)	3

Step 6
Check if the average value of each projection obtained from step 2 is larger than the max. value of the standard projection (of selected gasket) incremented by 0.05 mm (0.0020 in).
If so, use gasket that is 1 grade thicker. If not so, use gasket as selected in step 4.

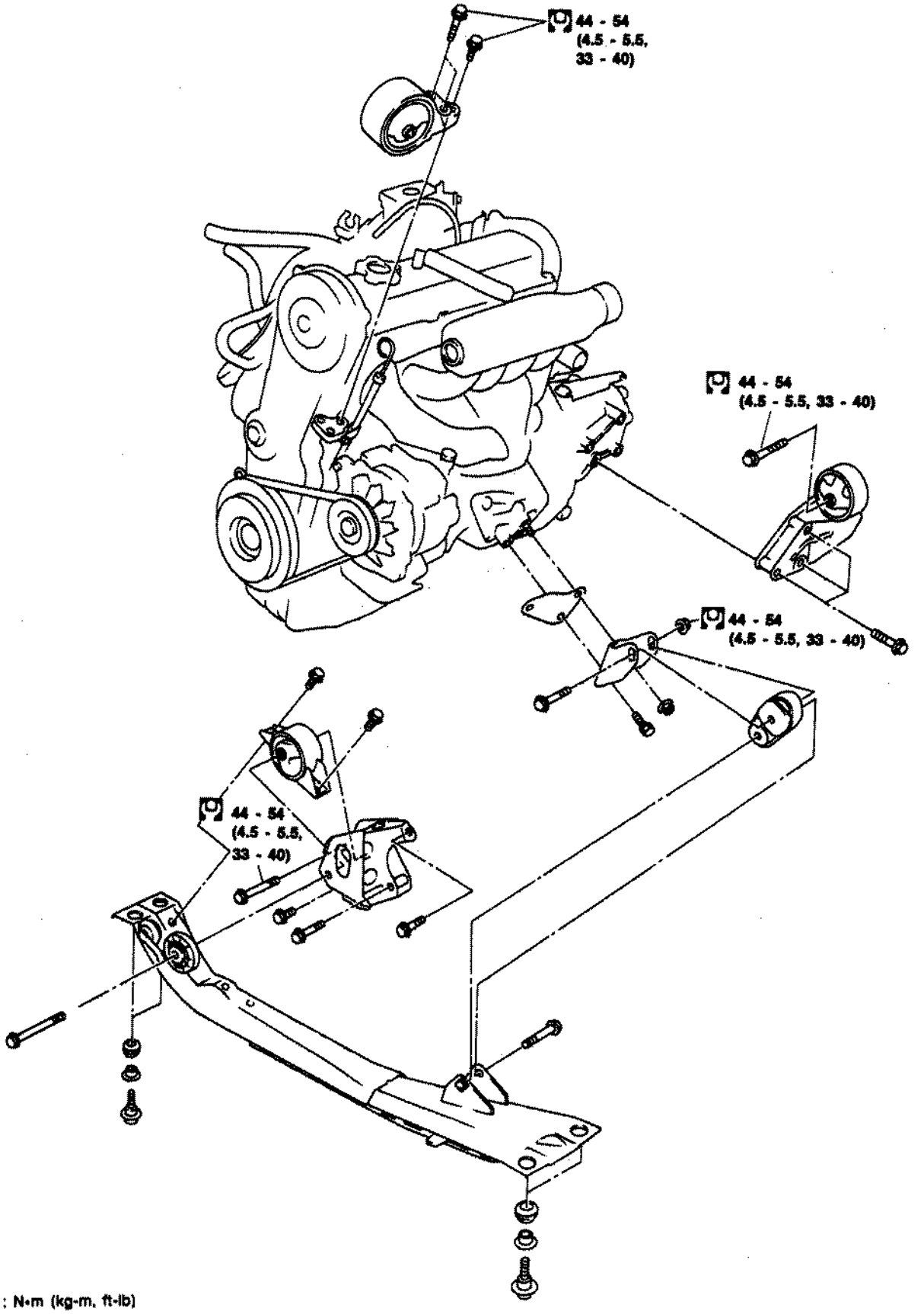
Example

Unit: mm (in)

Step	Cylinder No. / Item	1				2				3				4			
1.	Measured value	M1	M2	M3	M4	M1	M2	M3	M4	M1	M2	M3	M4	M1	M2	M3	M4
		0.53 (0.0209)	0.56 (0.0220)	0.53 (0.0209)	0.56 (0.0220)	0.59 (0.0232)	0.55 (0.0217)	0.59 (0.0232)	0.55 (0.0217)	0.53 (0.0209)	0.58 (0.0228)	0.57 (0.0224)	0.54 (0.0213)	0.58 (0.0228)	0.51 (0.0201)	0.52 (0.0205)	0.57 (0.0224)
2.	Average value of each piston	0.545 (0.0215)				0.57 (0.0224)				0.555 (0.0219)				0.545 (0.0215)			
3.	Average value of all pistons	0.55375 (0.02180)															
4.	Round off value	0.554 (0.0218)*1															
5.	Determined gasket thickness (Temporarily)	1.20 (0.0472) (Grade B)															
6.	X: Maximum value of standard projection of selected gasket ... 0.555 (0.0219) (in chart A) + 0.05 (0.0020) = 0.605 (0.0238) Y: Maximum value in step 2 = 0.57 (0.0224) The relationship between X and Y is "X > Y".*2																
7.	Determined gasket thickness (Finally)	1.20 (0.0472) (Grade B)*2															

***1: If the average value of projections for all pistons is, for example, 0.553 (7) 5, as shown in the table above, it should be rounded off as follows: If the digit in the forth decimal place (which is enclosed by a circle in this case) is smaller than 5, the average value should be regarded as 0.553 mm (0.0218 in); if it is larger than 5, the average value should be regarded as 0.554 mm (0.0218 in).**

***2: If X < Y, then the thicker grade C gasket must be used.**



: N•m (kg-m, ft-lb)

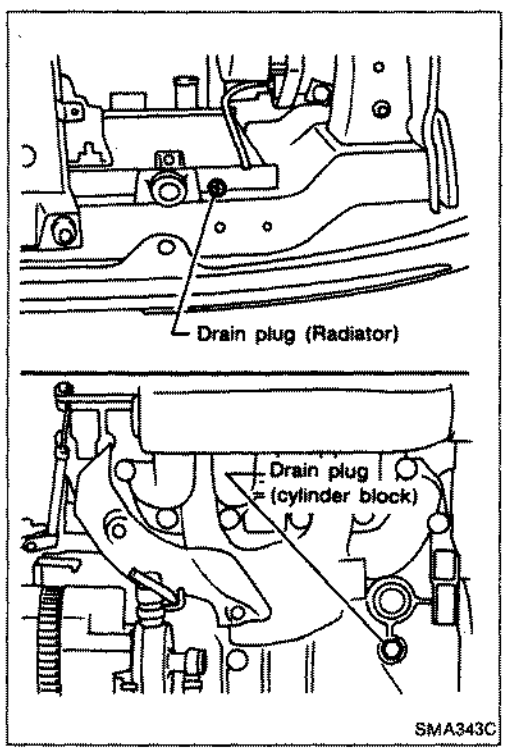
SEM248D

WARNING:

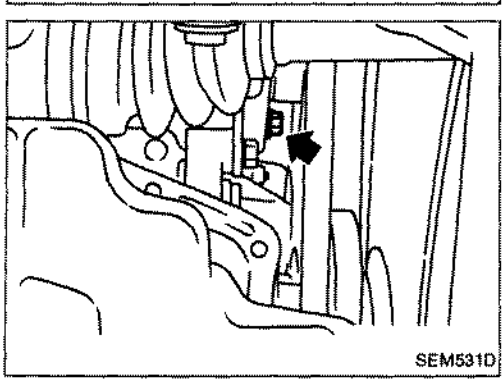
- **Situate vehicle on a flat and solid surface.**
- **Place chocks at front and back of rear wheels.**
- **Do not remove engine until exhaust system has completely cooled off. Otherwise, you may burn yourself and/or fire may break out in the fuel line.**
- **For safety during subsequent steps, the tension of wires should be slackened against the engine.**
- **Before removing front axle from transaxle, place safety stands under designated front supporting points. Refer to GI section for lifting points and towing.**
- **Be sure to hoist engine and transaxle in a safe manner.**
- **For engines not equipped with engine slingers, attach proper slingers and bolts described in PARTS CATALOG.**

CAUTION:

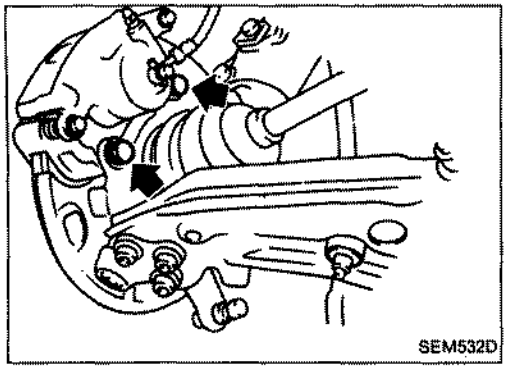
- **When lifting engine, be careful not to strike adjacent parts, especially accelerator wire casing, brake lines, and brake master cylinder.**
- **In hoisting the engine, always use engine slingers in a safe manner.**
- **In removing drive shaft, be careful not to damage transaxle oil seal.**



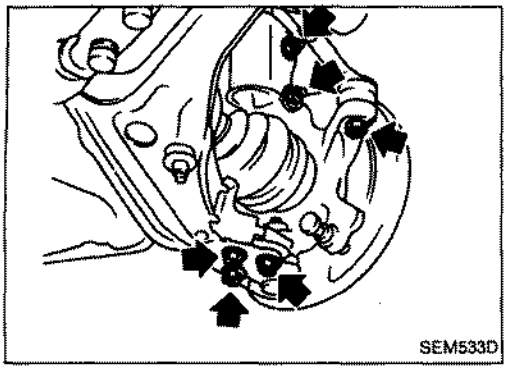
SMA343C


SEM531D

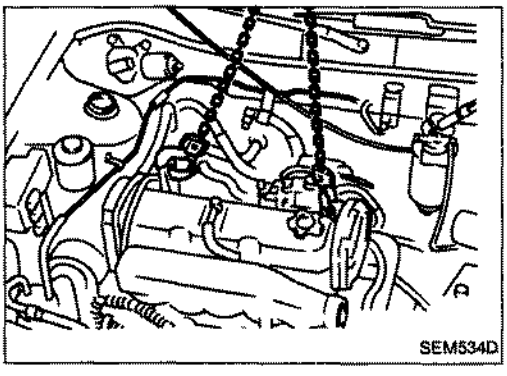
1. Remove engine undercovers and splash covers.
2. Remove front exhaust tube.
3. Drain coolant and disconnect lower water hose from radiator.
4. Drain transaxle oil.
5. Disconnect electrical wiring from radiator.
6. Remove power steering mounting bolt.
7. Drain coolant from cylinder head.
8. Disconnect water hoses and electrical wiring from radiator and remove radiator.
9. Disconnect fuel tubes and vacuum tubes.
10. Release power steering belt adjusting nut and remove power steering pump from engine.
    Bind pump properly to the vehicle.
11. Disconnect or remove electrical wiring where necessary.
12. Release clutch lever cable and accelerator cable.
13. Release tachometer cable from transaxle housing.
14. Remove front wheels.


SEM532D

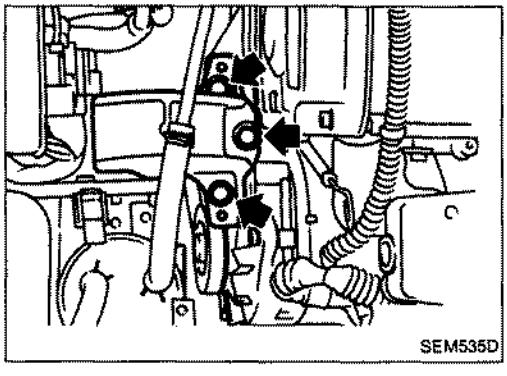
15. Remove brake caliper mounting bolts and bind caliper properly to vehicle (coil spring) L.H. & R.H.


SEM533D

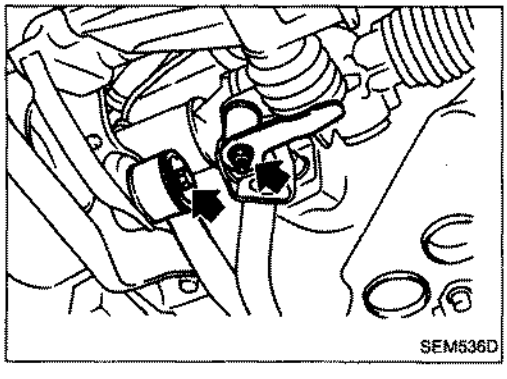
16. Remove lower ball joint nuts and release the upper hub mounting bolts.
17. Release steering arm ball joint using a suitable tool. Remove drive shafts from transaxle.
1) RH: Split drive shaft center thrust bearing.
2) RH & LH: Remove hub mounting bolts and remove drive shaft carefully from transaxle.


SEM534D

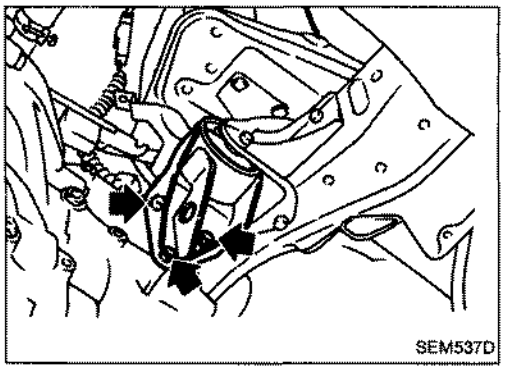
18. Mount suitable slingers to cylinder head. Fit hoist with studge and hoist engine to release force on engine mountings.


SEM535D

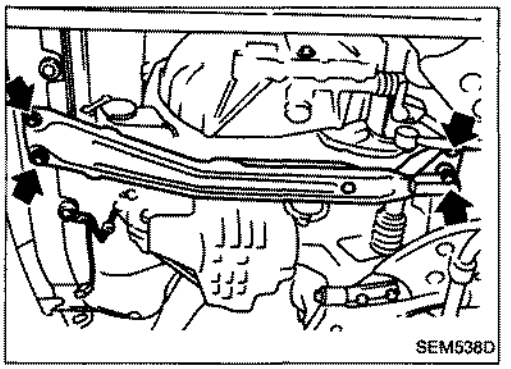
19. Remove upper mounting (Right side).


SEM536D

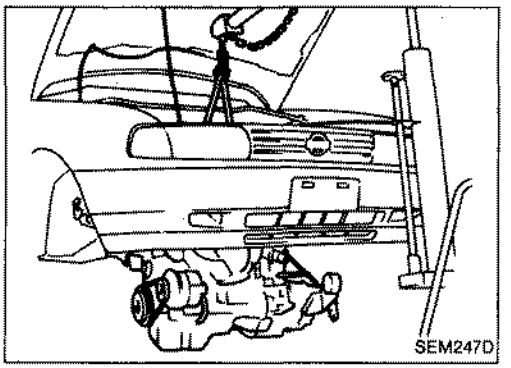
20. Release transaxle shift linkages.



21. Release lower left engine mounting.

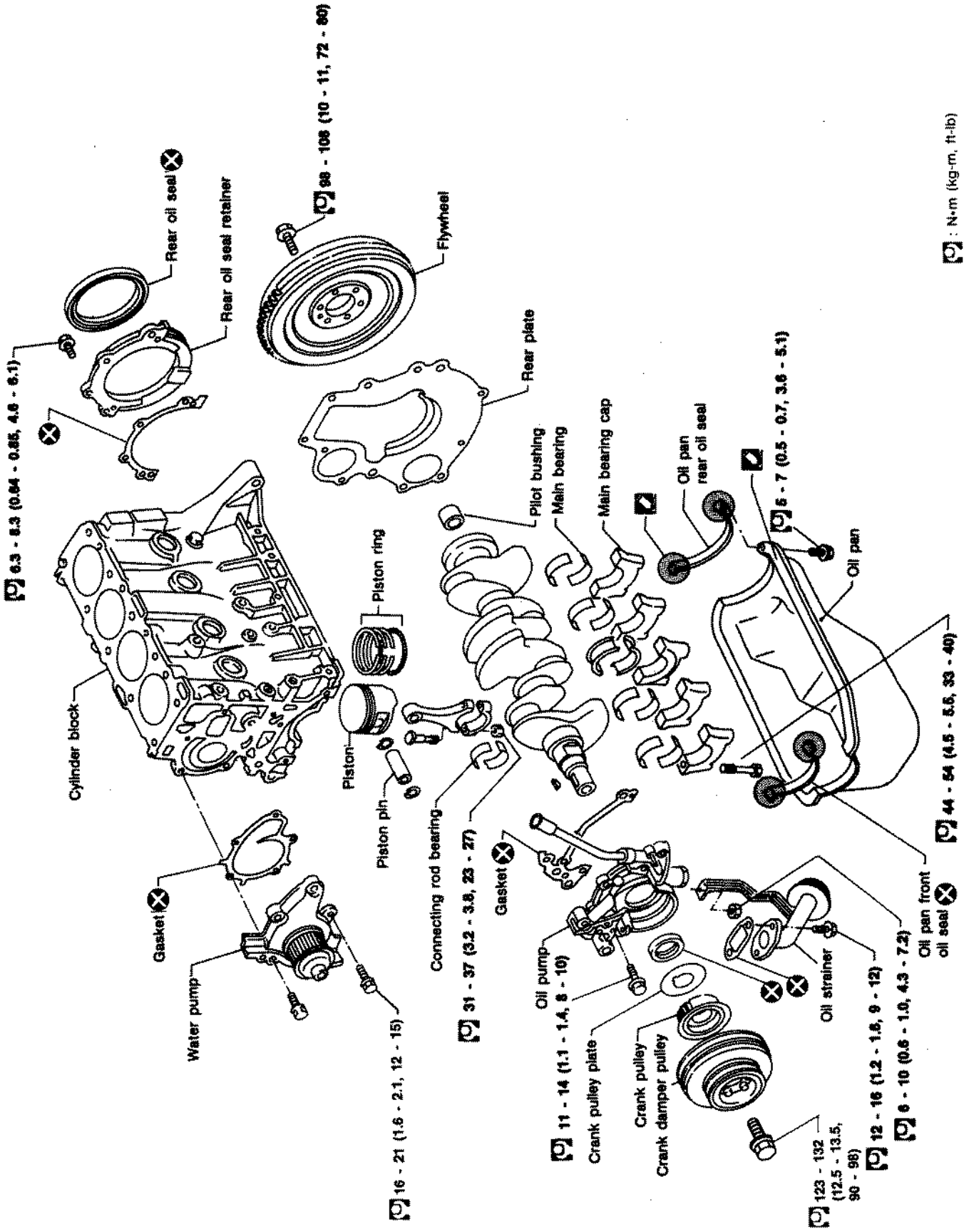


22. Remove center member from chassis.



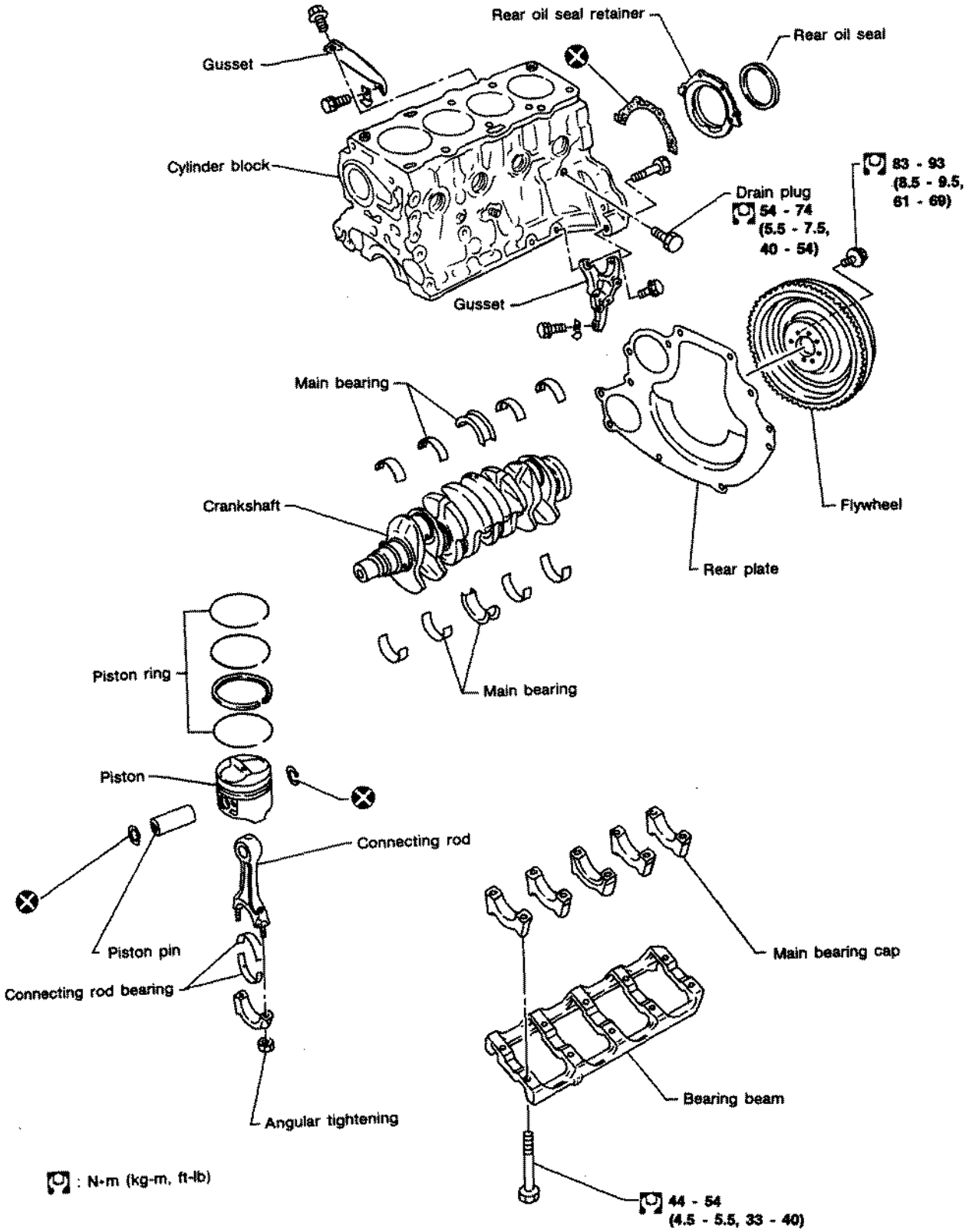
23. Remove engine with transaxle as shown.

CD17

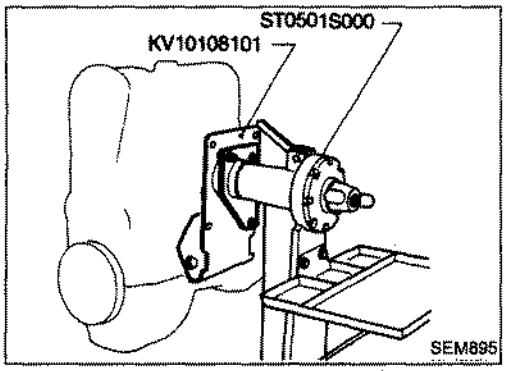


SEM853D

CD20



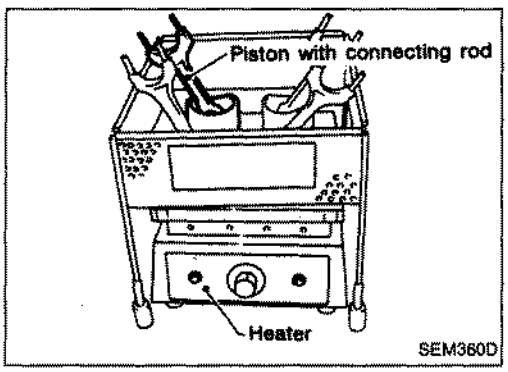
SEM708D



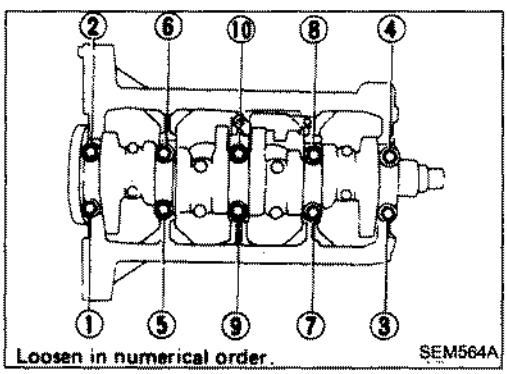
Disassembly

PISTON AND CRANKSHAFT

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

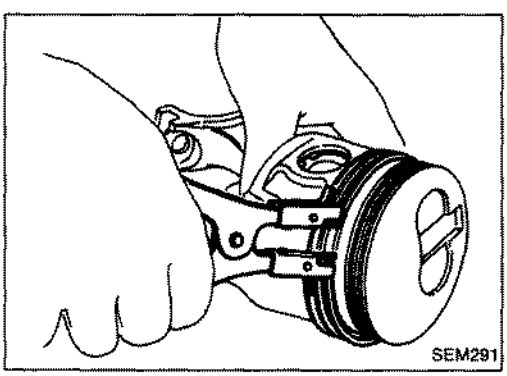


When disassembling piston and connecting rod, heat piston to 60 to 70°C (140 to 158°F) or use piston pin press stand at room temperature.



8. Remove bearing cap and crankshaft.

Place the bearings and caps in their proper order.
Upper bearings (cylinder block side) have oil groove.



9. Remove piston rings with a tool.

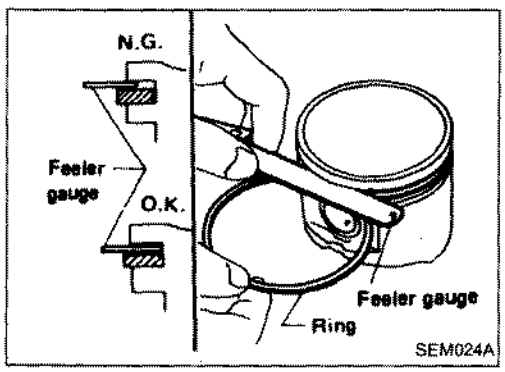
Inspection

PISTON AND PISTON PIN CLEARANCE

1. Measure outer diameter of piston pin and inner diameter of piston pin hole.
2. Calculate piston to piston pin clearance.

Pin diameter:
CD17 23.994 - 24.000 mm (0.9446 - 0.9449 in)
CD20 24.994 - 25.000 mm (0.9840 - 0.9843 in)
Pin hole diameter:
CD17 23.991 - 23.999 mm (0.9445 - 0.9448 in)
CD20 24.991 - 24.999 mm (0.9839 - 0.9842 in)
Clearance:
−0.004 to 0 mm (−0.0002 to 0 in)
(Interference fit)

Service parts are available as a set of piston and piston pin.



PISTON RING SIDE CLEARANCE

Side clearance:

CD17

Unit: mm (in)

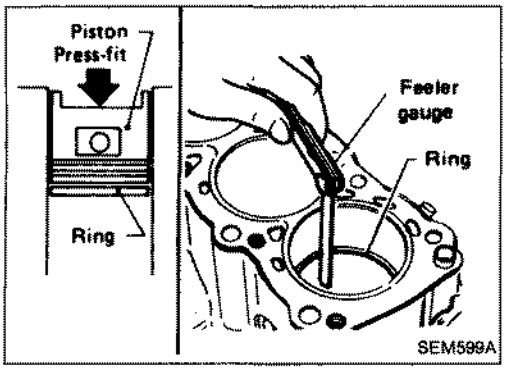
	Standard	Limit
Top ring	0.020 - 0.060 (0.0008 - 0.0024)	0.20 (0.0079)
2nd ring	0.040 - 0.080 (0.0016 - 0.0031)	0.15 (0.0059)
Oil ring	0.030 - 0.070 (0.0012 - 0.0028)	0.10 (0.0039)

CD20

Unit: mm (in)

	Standard	Limit
Top ring	0.060 - 0.095 (0.0024 - 0.0037)	0.10 (0.0039)
2nd ring	0.040 - 0.075 (0.0016 - 0.0030)	0.10 (0.0039)
Oil ring	0.030 - 0.070 (0.0012 - 0.0028)	0.10 (0.0039)

Inspection (Cont'd)



PISTON RING GAP

Ring gap:

CD17

Unit: mm (in)

	Standard	Limit
Top ring	0.20 - 0.35 (0.0079 - 0.0138)	1.0 (0.039)
2nd ring	0.20 - 0.35 (0.0079 - 0.0138)	0.7 (0.028)
Oil ring	0.30 - 0.45 (0.0118 - 0.0177)	0.6 (0.024)

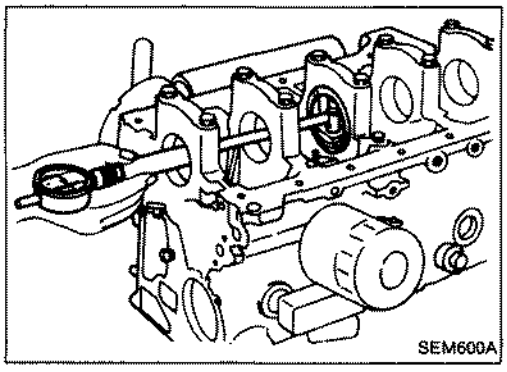
CD20

Unit: mm (in)

	Standard	Limit
Top ring	0.12 - 0.30 (0.0047 - 0.0118)	1.0 (0.039)
2nd ring	0.38 - 0.53 (0.0150 - 0.0209)	0.7 (0.028)
Oil ring	0.30 - 0.55 (0.0118 - 0.0217)	0.6 (0.024)

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

Refer to S.D.S.



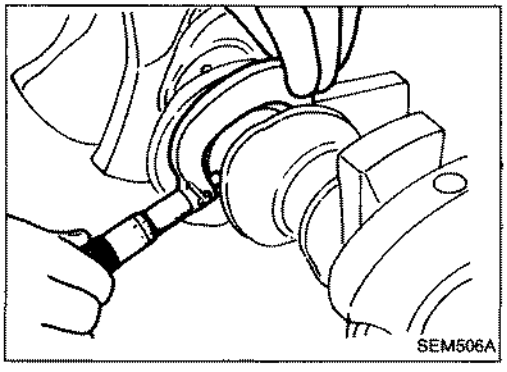
MAIN BEARING CLEARANCE

1. Install main bearings to cylinder block and main bearing cap.
2. Install main bearing cap with bearing to cylinder block.

Tighten all bolts in two or three stages.

: 44 - 54 N·m (4.5 - 5.5 kg-m, 33 - 40 ft-lb)

3. Measure inside diameter "A" of main journal.



4. Measure outside diameter "Dm" of main journal of crankshaft.

Journal diameter:

Refer to S.D.S.

5. Calculate main bearing clearance.

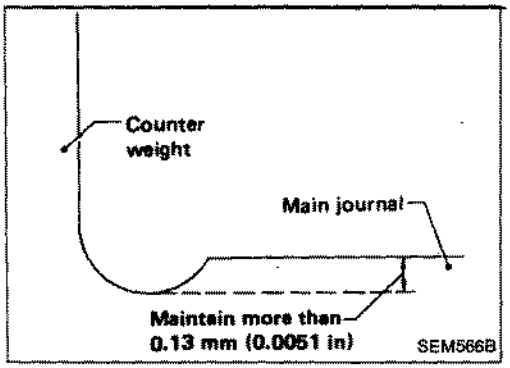
Main bearing clearance = A – Dm

Standard:

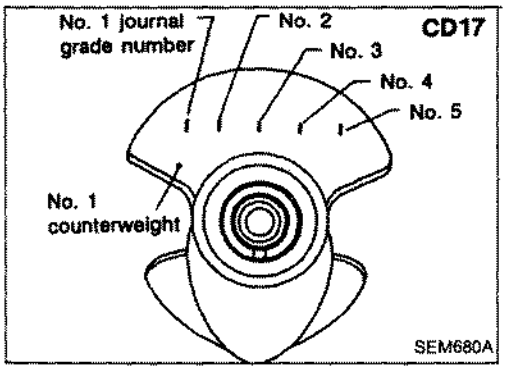
0.039 - 0.065 mm (0.0015 - 0.0026 in)

- If it exceeds the limit, replace the bearing.

Inspection (Cont'd)

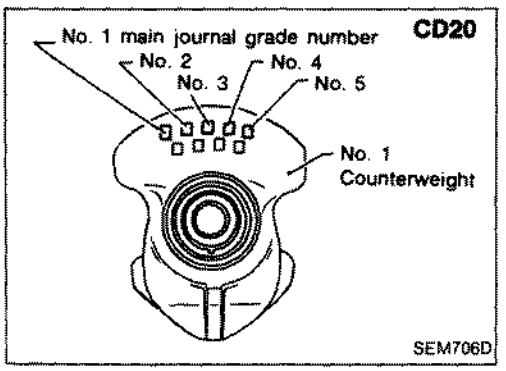


- If crankshaft main journal is worn or shows any abnormality, regrind crank journal and use undersized bearings to maintain the specified oil clearance.
- **Refer to S.D.S. for regrinding crankshaft journal diameter and available service parts.**
- **When regrinding crankshaft journal, do not grind fillet-roll.**



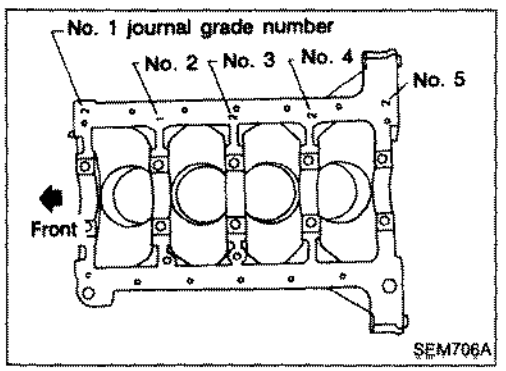
- If either bearing, crankshaft or cylinder block is replaced with a new one, select main bearing according to the following table. These numbers are punched in either Arabic or Roman numerals.

Crankshaft main journal grade number	Main bearing housing grade number: 0	1	2
	Main bearing grade number		
0	0	1	2
1	1	2	3
2	2	3	4



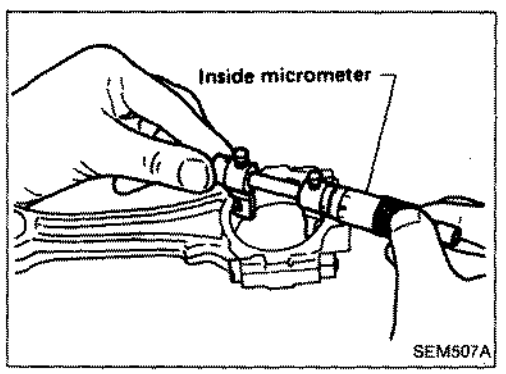
Identification color:

	CD17	CD20
Grade 0	Black	Yellow
Grade 1	Brown	Green
Grade 2	Green	Brown
Grade 3	Yellow	Black
Grade 4	Blue	Blue



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

Main bearing thickness:
Refer to S.D.S.



CONNECTING ROD BEARING CLEARANCE (Big end)

CD17: Non-selective connecting rod bearing
CD20: Selective connecting rod bearing

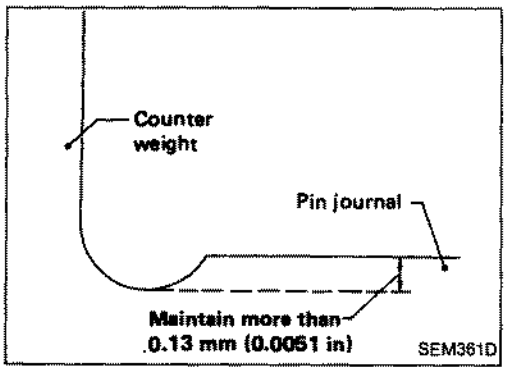
1. Install connecting rod bearing to connecting rod and cap.
2. Install connecting rod cap with bearing to connecting rod.

Apply oil to the thread portion of bolts and seating surface of nuts.

: CD17 31 - 37 N·m (3.2 - 3.8 kg-m, 23 - 27 ft-lb)
CD20 37 - 45 N·m (3.8 - 4.6 kg-m, 27 - 33 ft-lb)

3. Measure inside diameter "C" of bearing.

Inspection (Cont'd)



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

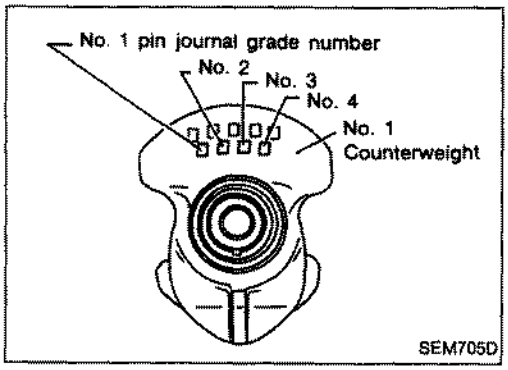
Connecting rod bearing clearance = C – Dp

Standard:

CD17 0.024 - 0.066 mm (0.0009 - 0.0026 in)

CD20 0.031 - 0.061 mm (0.0012 - 0.0024 in)

- If it exceeds the limit, replace the bearing.
- If crankshaft pin journal is worn or shows any abnormality, regrind crank pin and use undersized bearings to maintain the specified oil clearance.
- **Refer to S.D.S. for regrinding diameter of crankshaft pin and available service parts.**
- **When regrinding crankshaft pin, do not grind fillet-roll.**



For CD20 (Selective connecting rod bearing)

- If either bearings or crankshaft are being replaced with new ones, select connecting rod bearings according to the following table. Grade numbers are punched in either Arabic or Roman numerals.

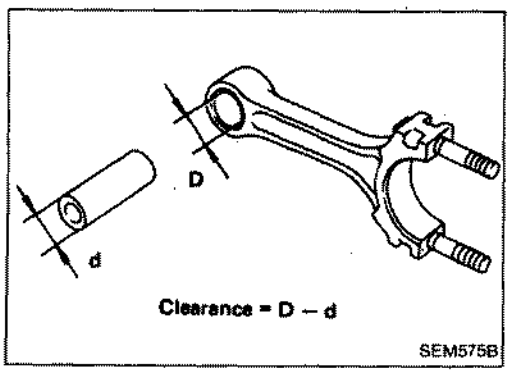
	Crankshaft pin journal grade number		
	0	1	2
Connecting rod baring grade number	0	1	2

Identification color

Grade 0: Black

Grade1: Yellow

Grade2: Blue



CONNECTING ROD AND PISTON PIN CLEARANCE (Small end)

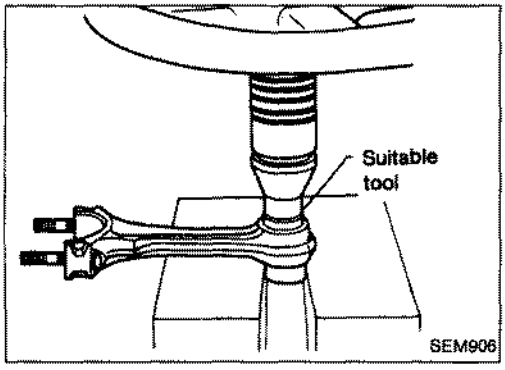
Clearance (D – d):

0.025 - 0.044 mm (0.0010 - 0.0017 in)

- If clearance exceeds the specifications, replace the bearing.

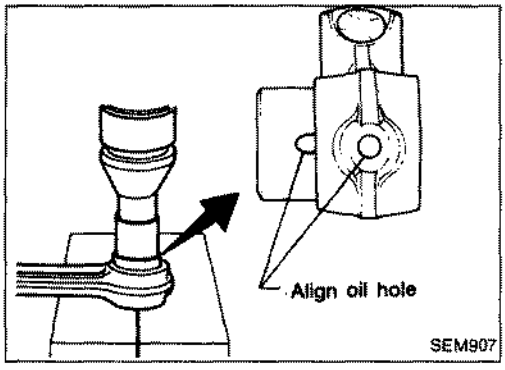
Inspection (Cont'd)

Bearing replacement



1. Remove bearing with a suitable tool.

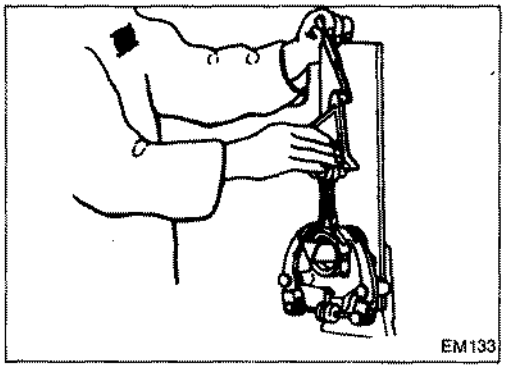
Do not scratch inner surface of connecting rod.



2. Install new bearing with oil holes aligned correctly.
3. Ream bore using a suitable tool.

Ream bore:

CD17 24.025 - 24.038 mm (0.9459 - 0.9464 in)
CD20 25.025 - 25.038 mm (0.9852 - 0.9857 in)



CONNECTING ROD BEND AND TORSION

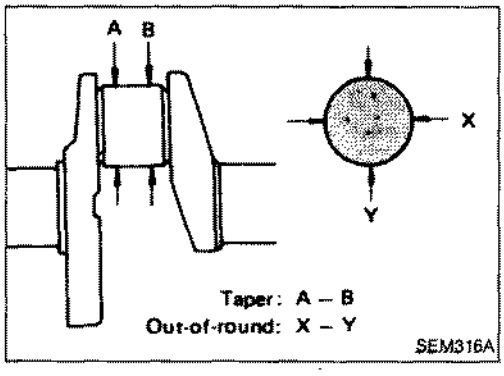
Bend and torsion [per 100 mm (3.94 in) length]:

CD17

Bend Less than 0.15 mm (0.0059 in)
Torsion Less than 0.30 mm (0.0118 in)

CD20

Bend Less than 0.025 mm (0.0010 in)
Torsion Less than 0.025 mm (0.0010 in)



CRANKSHAFT

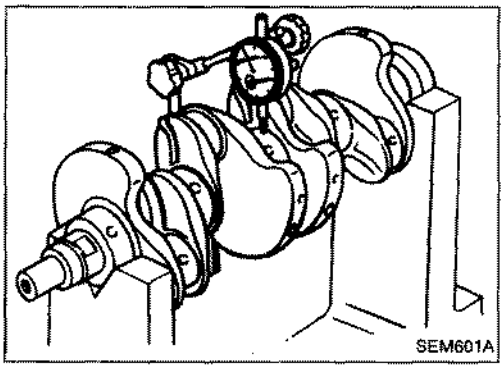
1. Check crankshaft journals and pins for score, bias, wear or cracks. If faults are minor, correct with fine crocus cloth.
2. Check journals and pins with a micrometer for taper and out-of-round.

Out-of-round (X – Y):

Less than 0.005 mm (0.0002 in)

Taper (A – B):

Less than 0.005 mm (0.0002 in)

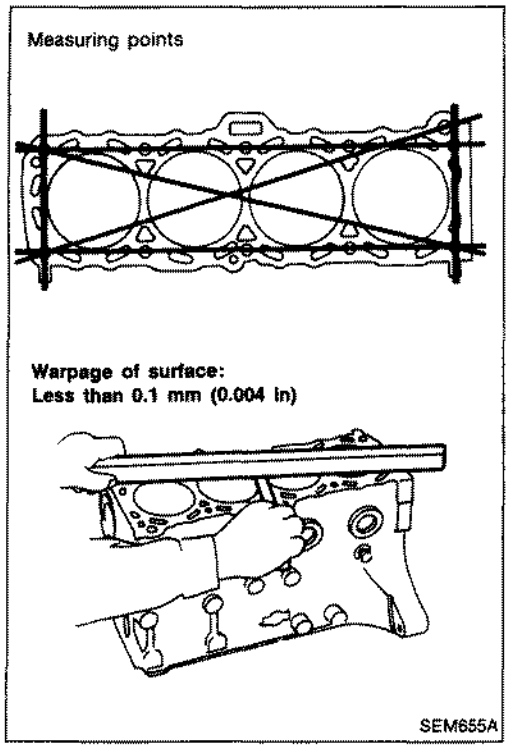


3. Check crankshaft runout.

Runout (Total indicator reading):

Less than 0.05 mm (0.0020 in)

Inspection (Cont'd)



CYLINDER BLOCK DISTORTION

Clean upper face of cylinder block and measure the distortion.

Limit:

0.10 mm (0.0039 in)

If out of specification, resurface it.

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

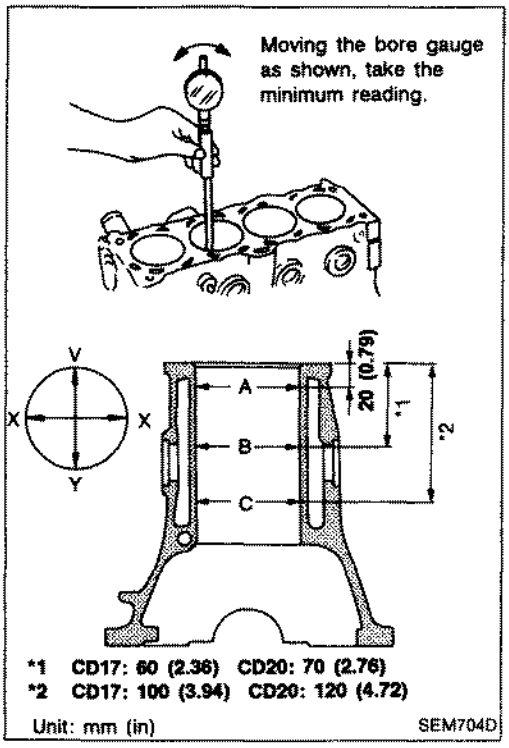
Amount of cylinder head resurfacing is "A".

Amount of cylinder block resurfacing is "B".

The maximum limit is as follows:

A + B = 0.1 mm (0.004 in)

If necessary, replace cylinder block.



CYLINDER BORE

1. Check for scratches or seizure. If seizure is found, hone bore.
2. Using a bore gauge, measure cylinder bore for wear, out-of-round or taper.

Standard bore diameter:

CD17 80.000 - 80.050 mm (3.1496 - 3.1516 in)

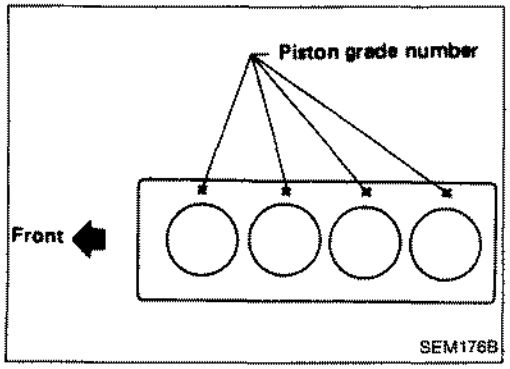
CD20 84.500 - 84.550 mm (3.3268 - 3.3287 in)

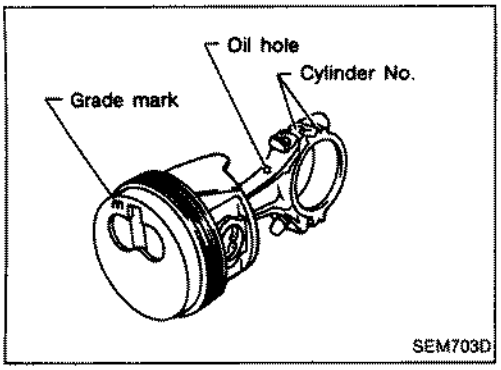
Unit: mm (in)

	CD17	CD20
Bore wear limit	0.1 (0.004)	0.2 (0.008)
Out-of-round standard	0.04 (0.0016)	0.015 (0.0006)
Taper (A – B) standard	0.04 (0.0016)	0.010 (0.0004)

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

If either cylinder block or piston is replaced with a new one, select the same piston as piston grade number punched on cylinder block upper surfaces.

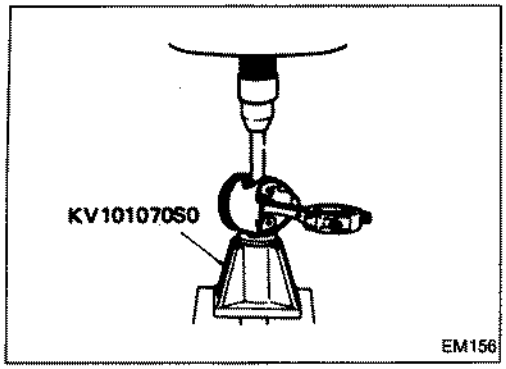




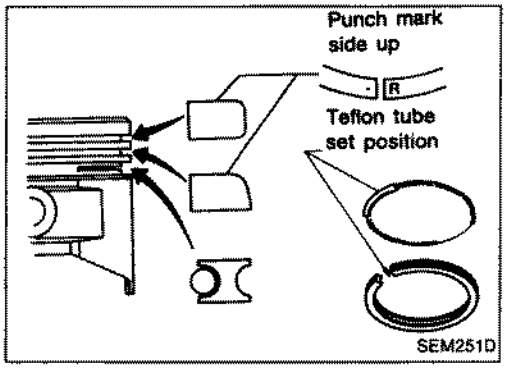
Assembly

PISTON

- **Numbers stamped on connecting rod and cap correspond to each cylinder. Care should be taken to avoid a wrong combination including bearing and connecting rod direction.**



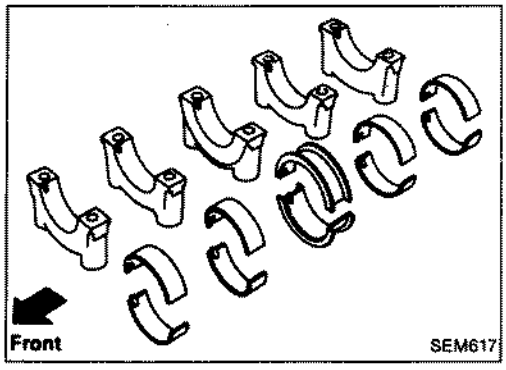
- **Install new snap ring on one side of piston pin hole.**
- **When assembling piston and connecting rod with piston pin, heat piston to between 60 and 80°C (140 and 176°F) and install piston pin with a suitable tool.**
- **Install new snap ring.**
- **After assembling, ascertain that piston swings smoothly.**



- Install piston rings with a suitable tool.

CD20 selective top ring; When installing new top ring or replacing cylinder block, select top ring to adjust ring gap.

	Cylinder bore grade	
	1, 2, 3	4, 5
Top ring grade No.	No mark	S

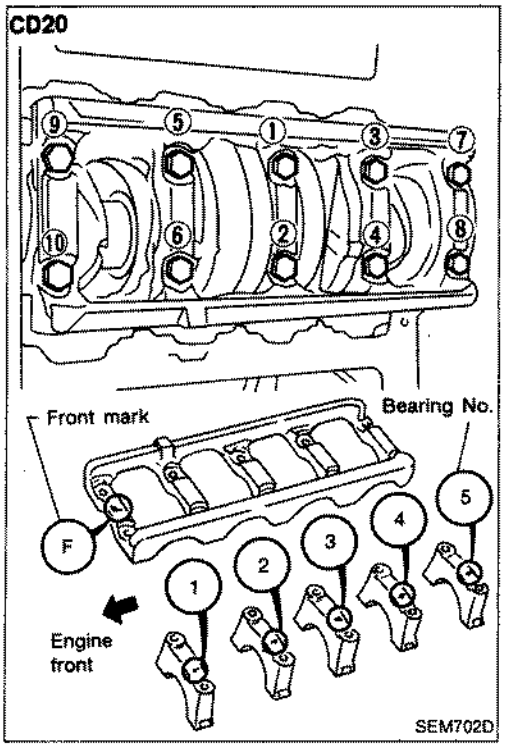


CRANKSHAFT

1. Set main bearings in the proper position on cylinder block and main bearing caps.

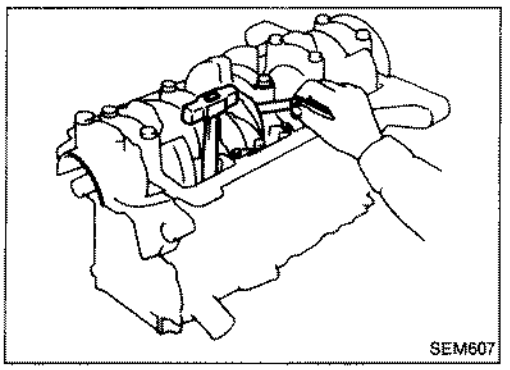
- **If either crankshaft, cylinder block or main bearing is reused again, it is necessary to measure main bearing clearance.**
- **Upper bearings (cylinder block side) have oil groove.**

Assembly (Cont'd)

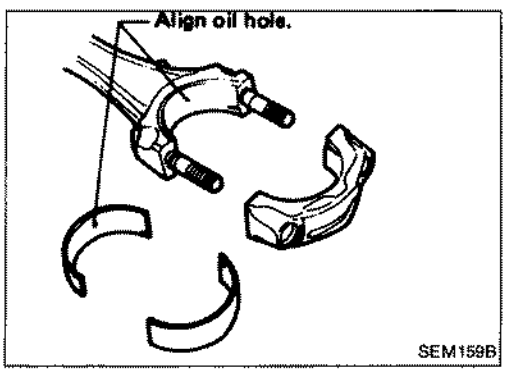


2. Apply engine oil to main bearing surfaces on crankshaft journal side.
3. Install crankshaft and main bearing caps and main bearing beam (CD20).
   Main bearing cap bolt:
   : 44 - 54 N·m (4.5 - 5.5 kg-m, 33 - 40 ft-lb)
4. Tighten main bearing cap bolts.

- **Arrange the parts so that the indicated numbers on bearing caps are in a row from the front of engine.**
- **Tighten bearing cap bolts gradually in two or three stages and outwardly from center bearing in sequence.**
- **After securing bearing cap bolts, ascertain that crankshaft turns smoothly.**



5. Measure crankshaft free end play at center bearing.
   Crankshaft free end play:
   Standard
   0.05 - 0.18 mm (0.0020 - 0.0071 in)
   Limit
   0.30 mm (0.0118 in)



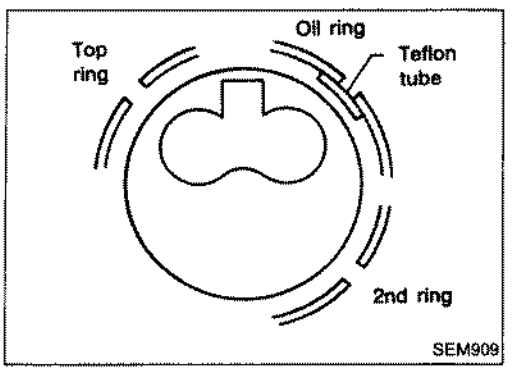
PISTON WITH CONNECTING ROD

1. Install connecting rod bearings in the connecting rods and connecting rod caps.

- Confirm that correct size of bearings is used.

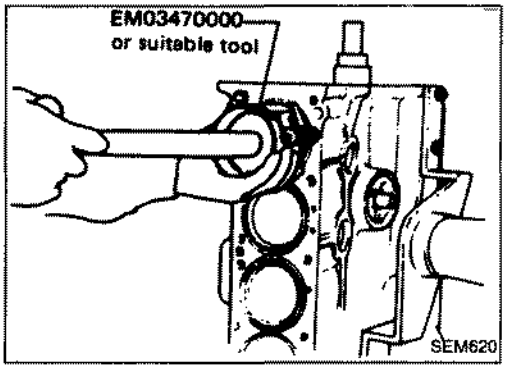
Refer to "Inspection".

- Install the bearings so that the oil hole in the connecting rod aligns with the oil hole of the bearing.
- Apply engine oil to connecting rod bearing surfaces on the crankshaft journal side.

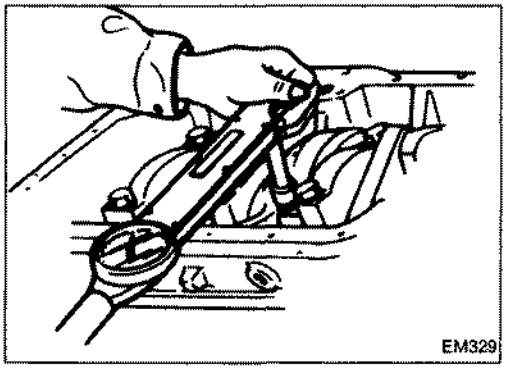


- Set piston rings as shown.

Assembly (Cont'd)



2. Install pistons with connecting rods.
- Install them into corresponding cylinder using Tool.
- **Be careful not to scratch cylinder wall with connecting rod.**
- **Apply engine oil to cylinder wall, piston and bearing.**
- **Arrange so that the front mark on piston head faces to the front of engine.**



3. Install connecting rod bearing caps.
- Apply a little engine oil to the thread of connecting rod bearing nut.

For CD17

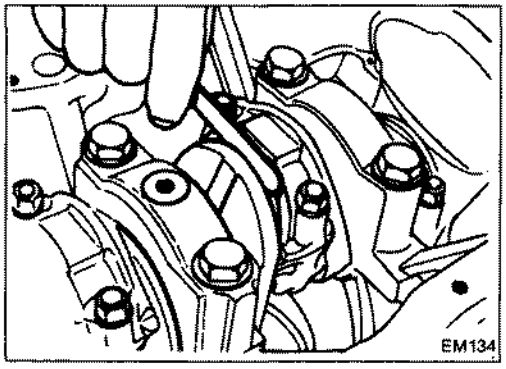
: 31 - 37 N·m (3.2 - 3.8 kg-m, 23 - 27 ft-lb)

For CD20

(1) Tighten connecting rod bearing nut to 15 ± 1 N·m (1.5 ± 0.1 kg-m, 10.8 ± 0.7 ft-lb).

(2) Then tighten an additional 60 $^{+5^\circ}_{-0^\circ}$ turns with an angular tightening wrench.

: 15 ± 1 N·m (1.5 ± 0.1 kg-m, 10.8 ± 0.7 ft-lb) plus 60 $^{+5^\circ}_{-0^\circ}$ or 27 - 45 N·m (3.8 - 4.6 kg-m, 27 - 33 ft-lb)

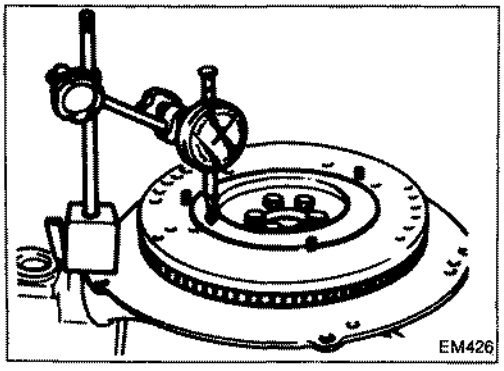


4. Measure connecting rod side clearance.

Connecting rod side clearance (Big end play):

Limit

0.3 mm (0.012 in)



FLYWHEEL RUNOUT

Runout (Total indicator reading):

Less than 0.15 mm (0.0059 in)

Assembly (Cont'd)

CYLINDER HEAD GASKET

- Refer to "Selecting cylinder head gasket".
- When replacing or repairing cylinder block, piston, connecting rod and crankshaft, select gasket.

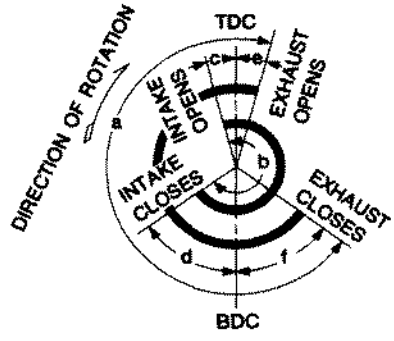
General Specifications

GENERAL SPECIFICATIONS

Engine	GA13DS	GA14DS	GA16DS & GA16DE
Classification	Gasoline		
Cylinder arrangement	4, in-line		
Displacement cm^3 (cu in)	1,295 (79.02)	1,392 (84.94)	1,597 (97.45)
Bore × stroke mm (in)	71.0 x 81.8 (2.795 x 3.220)	73.6 x 81.8 (2.898 x 3.220)	76.0 × 88.0 (2.992 × 3.465)
Valve arrangement	D.O.H.C.		
Firing order	1-3-4-2		
Number of piston rings			
Compression	2		
Oil	1		
Number of main bearings	5		
Compression ratio	9.5	9.5	9.5, 9.8*

Valve timing

* For Europe and Gulf standard



EM120

Unit: degree

	a	b	c	d	e	f
GA13DS, GA16DS, and GA14DS without E.G.R.	222°	222°	0°	42°	0°	42°
GA14DS with E.G.R.	214°	214°	2°	32°	−12°	46°
GA16DE	222°	236°	−2°	58°	0°	42°

Inspection and Adjustment

ENGINE COMPRESSION PRESSURE

Unit: kPa (bar, kg/cm^2, psi)/350 rpm

Standard	1,324 (13.24, 13.5, 192)
Minimum	1,128 (11.28, 11.5, 164)
Difference limit between cylinders	98 (0.98, 1.0, 14)

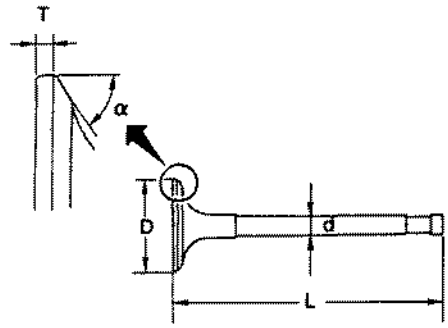
CYLINDER HEAD

Unit: mm (in)

	Standard	Limit
Head surface flatness	Less than 0.03 (0.0012)	0.1 (0.004)
Height	117.8 - 118.0 (4.638 - 4.646)	—

VALVE

Unit: mm (in)



SEM188

		GA13DS	GA14DS	GA16DS GA16DE
Valve head diameter "D"	Intake	26.4 - 26.6 (1.039 - 1.047)	28.9 - 29.1 (1.138 - 1.146)	29.9 - 30.1 (1.177 - 1.185)
	Exhaust	21.4 - 21.6 (0.843 - 0.850)	23.9 - 24.1 (0.941 - 0.949)	23.9 - 24.1 (0.941 - 0.949)
Valve length "L"	Intake	92.00 - 92.5 (3.6220 - 3.6417)		
	Exhaust	92.37 - 92.87 (3.6366 - 3.6563)		
Valve stem diameter "d"	Intake	5.465 - 5.480 (0.2152 - 0.2157)		
	Exhaust	5.445 - 5.460 (0.2144 - 0.2150)		
Valve face angle "α"		45°15' - 45°45'		
Valve margin "T" limit		0.9 - 1.1 (0.035 - 0.043)		
Valve stem end surface grinding limit		Less than 0.2 (0.008)		

Valve clearance

Unit: mm (in)

	For adjusting		For checking
	Hot	Cold*	Hot
Intake	0.32 - 0.40 (0.013 - 0.016)	0.25 - 0.33 (0.010 - 0.013)	0.21 - 0.49 (0.008 - 0.019)
Exhaust	0.37 - 0.45 (0.015 - 0.018)	0.32 - 0.40 (0.013 - 0.016)	0.30 - 0.58 (0.012 - 0.023)

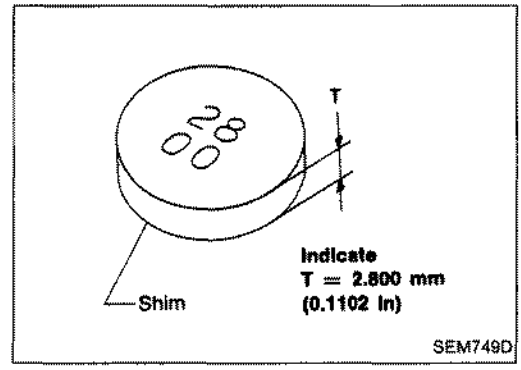
*: At a temperature of approximately 20°C (68°F)

Whenever valve clearances are adjusted to cold specifications, check that the clearances satisfy hot specifications and adjust again if necessary.

Inspection and Adjustment (Cont'd)

Available shims

Thickness mm (in)	Identification mark
2.00 (0.0787)	200
2.02 (0.0795)	202
2.04 (0.0803)	204
2.06 (0.0811)	206
2.08 (0.0819)	208
2.10 (0.0827)	210
2.12 (0.0835)	212
2.14 (0.0843)	214
2.16 (0.0850)	216
2.18 (0.0858)	218
2.20 (0.0866)	220
2.22 (0.0874)	222
2.24 (0.0882)	224
2.26 (0.0890)	226
2.28 (0.0898)	228
2.30 (0.0906)	230
2.32 (0.0913)	2.32
2.34 (0.0921)	234
2.36 (0.0929)	236
2.38 (0.0937)	238
2.40 (0.0945)	240
2.42 (0.0953)	242
2.44 (0.0961)	244
2.46 (0.0969)	246
2.48 (0.0976)	248
2.50 (0.0984)	250
2.52 (0.0992)	252
2.54 (0.1000)	254
2.56 (0.1008)	256
2.58 (0.1016)	258
2.60 (0.1024)	260
2.62 (0.1031)	262
2.64 (0.1039)	264
2.66 (0.1047)	266
2.68 (0.1055)	268
2.70 (0.1063)	270
2.72 (0.1071)	272
2.74 (0.1079)	274
2.76 (0.1087)	276
2.78 (0.1094)	278
2.80 (0.1102)	280
2.82 (0.1110)	282
2.84 (0.1118)	284
2.86 (0.1126)	286
2.88 (0.1134)	288
2.90 (0.1142)	290
2.92 (0.1150)	292
2.94 (0.1157)	294
2.96 (0.1165)	296
2.98 (0.1173)	298



Inspection and Adjustment (Cont'd)

Valve guide

Unit: mm (in)

	Intake		Exhaust	
	Standard	Service	Standard	Service
Valve guide Outer diameter	9.523 - 9.534 (0.3749 - 0.3754)	9.723 - 9.734 (0.3828 - 0.3832)	9.523 - 9.534 (0.3749 - 0.3754)	9.723 - 9.734 (0.3828 - 0.3832)
Valve guide Inner diameter [Finished size]	5.500 - 5.515 (0.2165 - 0.2171)		5.500 - 5.515 (0.2165 - 0.2171)	
Cylinder head valve guide hole diameter	9.475 - 9.496 (0.3730 - 0.3739)	9.685 - 9.696 (0.3813 - 0.3817)	9.475 - 9.496 (0.3730 - 0.3739)	9.685 - 9.696 (0.3813 - 0.3817)
Interference fit of valve guide	0.027 - 0.059 (0.0011 - 0.0023)	0.027 - 0.049 (0.0011 - 0.0019)	0.027 - 0.059 (0.0011 - 0.0023)	0.027 - 0.049 (0.0011 - 0.0019)
Stem to guide clearance	0.020 - 0.050 (0.0008 - 0.0020)		0.040 - 0.070 (0.0016 - 0.0028)	
Valve deflection limit (Dial gauge reading)	0.2 (0.008)		0.2 (0.008)	

Valve spring

Free height	mm (in)	41.19 (1.6217)
Pressure N (kg, lb) at height mm (in)	Standard	344.42 (35.12, 77.44) at 25.26 (0.9945)
	Limit	323.73 (33.01, 72.79) at 25.26 (0.9945)
Out-of-square	mm (in)	Less than 1.80 (0.0709)

Valve lifter

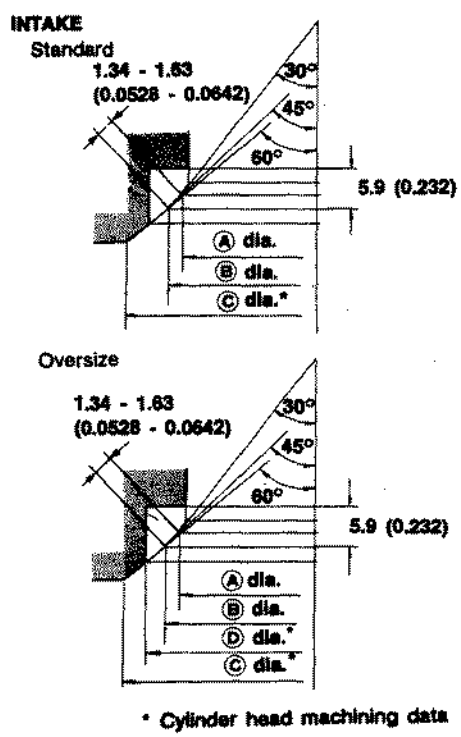
Unit: mm (in)

Valve lifter outside diameter	29.960 - 29.975 (1.1795 - 1.1801)
Lifter guide inside diameter	30.000 - 30.021 (1.1811 - 1.1819)
Clearance between lifter and lifter guide	0.025 - 0.061 (0.0010 - 0.0024)

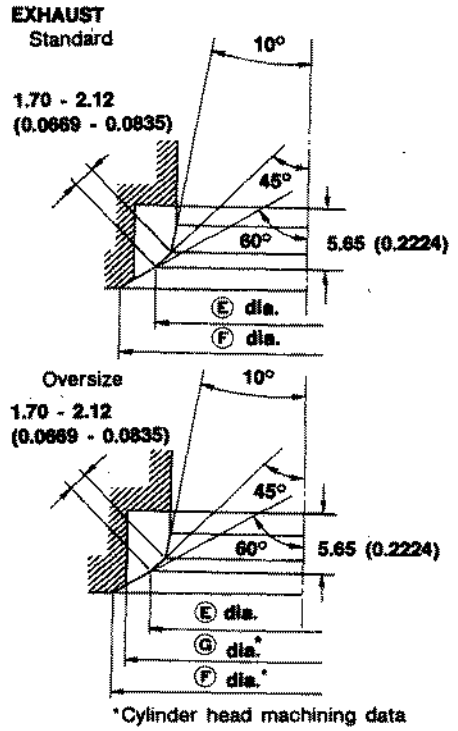
Inspection and Adjustment (Cont'd)

Valve seat

Unit: mm (in)



SEM573D



SEM574D

Dia.	GA13DS	GA14DS	GA16DS & GA16DE
Ⓐ	23.9 - 24.1 (0.941 - 0.949)	26.4 - 26.6 (1.039 - 1.047)	27.4 - 27.6 (1.079 - 1.087)
Ⓑ	26.0 - 26.2 (1.024 - 1.031)	28.5 - 28.7 (1.122 - 1.130)	29.5 - 29.7 (1.161 - 1.169)
Ⓒ	27.7 - 27.9 (1.091 - 1.098)	30.2 - 30.4 (1.189 - 1.197)	31.9 - 32.1 (1.256 - 1.264)
Ⓓ	28.000 - 28.016 (1.1024 - 1.1030)	30.500 - 30.516 (1.2008 - 1.2014)	31.500 - 31.516 (1.2402 - 1.2408)
Ⓔ	21.0 - 21.2 (0.827 - 0.835)	23.5 - 23.7 (0.925 - 0.933)	23.5 - 23.7 (0.925 - 0.933)
Ⓕ	22.7 - 22.9 (0.894 - 0.902)	25.2 - 25.4 (0.992 - 1.000)	25.2 - 25.4 (0.992 - 1.000)
Ⓖ	23.000 - 23.016 (0.9055 - 0.9061)	25.500 - 25.516 (1.0039 - 1.0046)	25.500 - 25.516 (1.0039 - 1.0046)

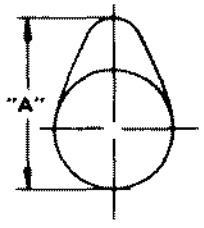
Inspection and Adjustment (Cont'd)

CAMSHAFT AND CAMSHAFT BEARING

Camshaft

Unit: mm (in)

Engine model		GA13DS, GA16DS, and GA14DS with E.G.R.	GA16DE	GA14DS with E.G.R.
Cam height "A"	Intake	39.880 - 40.070 (1.5701 - 1.5776)	40.600 - 40.790 (1.5984 - 1.6059)	39.380 - 39.570 (1.5504 - 1.5579)
	Exhaust	39.880 - 40.070 (1.5701 - 1.5776)	39.880 - 40.070 (1.5701 - 1.5776)	39.380 - 39.570 (1.5504 - 1.5579)
Cam wear limit		0.20 (0.0079)		



EM671

Camshaft bearing

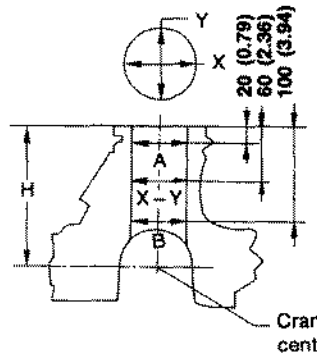
Unit: mm (in)

		Standard	Limit
Camshaft journal to bearing clearance		0.045 - 0.086 (0.0018 - 0.0034)	0.15 (0.0059)
Inner diameter of camshaft bearing	No. 1	28.000 - 28.021 (1.1024 - 1.1032)	—
	No. 2 to No. 5	24.000 - 24.021 (0.9449 - 0.9457)	
Outer diameter of camshaft journal	No. 1	27.935 - 27.955 (1.0998 - 1.1006)	—
	No. 2 to No. 5	23.935 - 23.955 (0.9423 - 0.9431)	
Camshaft runout [T.I.R.*]		Less than 0.02 (0.0008)	0.1 (0.004)
Camshaft end play		0.070 - 0.143 (0.0028 - 0.0056)	0.20 (0.0079)

*: Total indicator reading

CYLINDER BLOCK

Unit: mm (in)



SEM171D

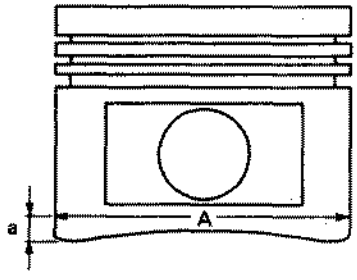
	GA13DS	GA14DS	GA16DS GA16DE	Limit
	Standard			
Surface flatness	Less than 0.03 (0.0012)			0.1 (0.004)
Height "H" (nominal)	213.95 - 214.05 (8.4232 - 8.4271)			—
Standard Inner diameter Grade No. 1	71.000 - 71.010 (2.7953 - 2.7957)	73.600 - 73.610 (2.7986 - 2.8980)	76.000 - 76.010 (2.9921 - 2.9925)	0.2 (0.008)
Grade No. 2	71.010 - 71.020 (2.7957 - 2.7961)	73.610 - 73.620 (2.8980 - 2.8984)	76.010 - 76.020 (2.9925 - 2.9929)	
Grade No. 3	71.020 - 71.030 (2.7961 - 2.7965)	73.620 - 73.630 (2.8984 - 2.8988)	76.020 - 76.030 (2.9929 - 2.9933)	
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	0.05 (0.0020)			0.2 (0.008)

Inspection and Adjustment (Cont'd)

PISTON, PISTON RING AND PISTON PIN

Piston

Unit: mm (in)



SEM658D

	GA13DS	GA14DS	GA16DS GA16DE
Piston skirt diameter "A"			
Standard			
Grade No. 1	70.975 - 70.985 (2.7943 - 2.7947)	73.575 - 73.585 (2.8966 - 2.8970)	75.975 - 75.985 (2.9911 - 2.9915)
Grade No. 2	70.985 - 70.995 (2.7947 - 2.7951)	73.585 - 73.595 (2.8970 - 2.8974)	75.985 - 75.995 (2.9915 - 2.9919)
Grade No. 3	70.995 - 71.005 (2.7951 - 2.7955)	73.595 - 73.605 (2.8974 - 2.8978)	75.995 - 76.005 (2.9919 - 2.9923)
0.5 (0.020) oversize (service)	71.475 - 71.505 (2.8140 - 2.8152)	74.075 - 74.105 (2.9163 - 2.9175)	76.475 - 76.505 (3.0108 - 3.0120)
1.0 (0.039) oversize (service)	71.975 - 72.005 (2.8337 - 2.8348)	74.575 - 74.605 (2.9360 - 2.9372)	76.975 - 77.005 (3.0305 - 3.0317)
"a" dimension	9.5 (0.374)		
Piston pin hole inner diameter	18.987 - 18.999 (0.7475 - 0.7480)		
Piston pin outer diameter	18.989 - 19.001 (0.7476 - 0.7481)		
Piston to bore clearance	0.015 - 0.035 (0.0006 - 0.0014)		

Piston ring

Unit: mm (in)

		Standard	Limit
Side clearance	Top	0.040 - 0.080 (0.0016 - 0.0031)	0.2 (0.008)
	2nd	0.030 - 0.070 (0.0012 - 0.0028)	
End gap	Top	0.20 - 0.35 (0.0079 - 0.0138)	1.0 (0.039)
	2nd	0.37 - 0.52 (0.0146 - 0.0205)	
	Oil	0.20 - 0.60 (0.0079 - 0.0236)	

Piston pin

Unit: mm (in)

Piston pin outer diameter	18.989 - 19.001 (0.7476 - 0.7481)
Piston pin to piston clearance	–0.004 to 0 (–0.0002 to 0)
Piston pin to connecting rod, bushing clearance	0.005 - 0.017 (0.0002 - 0.0007)

CONNECTING ROD

Unit: mm (in)

Center distance	140.45 - 140.55 (5.5295 - 5.5335)
Bend limit [per 100 (3.94)]	0.15 (0.0059)
Torsion limit [per 100 (3.94)]	0.3 (0.012)
Connecting rod bushing inner diameter* (small end)	19.000 - 19.012 (0.7480 - 0.7485)
Connecting rod big end inner diameter	43.000 - 43.013 (1.6929 - 1.6934)
Side clearance	
Standard	0.20 - 0.47 (0.0079 - 0.0185)
Limit	0.52 (0.0205)

*: After installing in connecting rod

Inspection and Adjustment (Cont'd)

CRANKSHAFT

Unit: mm (in)

	GA13DS	GA14DS	GA16DS GA16DE
Main journal dia. "Dm"			
Grade No. 0	49.956 - 49.964 (1.9668 - 1.9671)		
Grade No. 1	49.948 - 49.956 (1.9665 - 1.9668)		
Grade No. 2	49.940 - 49.948 (1.9661 - 1.9665)		
Pin journal dia. "Dp"			
Grade No. 0	39.968 - 39.974 (1.5735 - 1.5738)		
Grade No. 1	39.962 - 39.968 (1.5733 - 1.5735)		
Grade No. 2	39.956 - 39.962 (1.5731 - 1.5733)		
Center distance "r"	40.85 - 40.95 (1.6083 - 1.6122)	40.85 - 40.95 (1.6083 - 1.6122)	43.95 - 44.05 (1.7303 - 1.7342)
Out-of-round (X — Y)			
Standard	Less than 0.005 (0.0002)		
Taper (A — B)			
Standard	Less than 0.002 (0.0001)		
Runout [T.I.R.*]			
Standard	Less than 0.05 (0.0020)		
Free end play			
Standard	0.060 - 0.180 (0.0024 - 0.0071)		
Limit	0.3 (0.012)		

*: Total indicator reading

MAIN BEARING

Standard

Grade No.	Thickness "T" mm (in)	Identification color
0	1.826 - 1.830 (0.0719 - 0.0720)	Black
1	1.830 - 1.834 (0.0720 - 0.0722)	Brown
2	1.834 - 1.838 (0.0722 - 0.0724)	Green
3	1.838 - 1.842 (0.0724 - 0.0725)	Yellow
4	1.842 - 1.846 (0.0725 - 0.0727)	Blue

Undersize

Unit: mm (in)

	Thickness "T"
0.25 (0.0098)	1.957 - 1.965 (0.0770 - 0.0774)
0.50 (0.0197)	2.082 - 2.090 (0.0820 - 0.0823)

AVAILABLE CONNECTING ROD BEARING

Connecting rod bearing

Unit: mm (in)

	Grade No.	Thickness	Identification color or number
Standard	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	0.08 (0.0031)	1.542 - 1.546 (0.0607 - 0.0609)	8
	0.12 (0.0047)	1.562 - 1.566 (0.0615 - 0.0617)	12
	0.25 (0.0098)	1.627 - 1.631 (0.0641 - 0.0642)	25

Bearing clearance

Unit: mm (in)

Main bearing clearance	
Standard	0.018 - 0.042 (0.0007 - 0.0017)
Limit	0.1 (0.004)
Connecting rod bearing clearance	
Standard	0.010 - 0.035 (0.0004 - 0.0014)
Limit All	0.1 (0.004)

MISCELLANEOUS COMPONENTS

Unit: mm (in)

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

*: Total indicator reading

General Specifications

Cylinder arrangement		In-line 4
Displacement	cm^3 (cu in)	1,998 (121.92)
Bore and stroke	mm (in)	86 x 86 (3.39 x 3.39)
Valve arrangement		D.O.H.C.
Firing order		1-3-4-2
Number of piston rings		
Compression		2
Oil		1
Number of main bearings		5
Compression ratio		
SR20DE		10.0
SR20DET		8.3

COMPRESSION PRESSURE

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

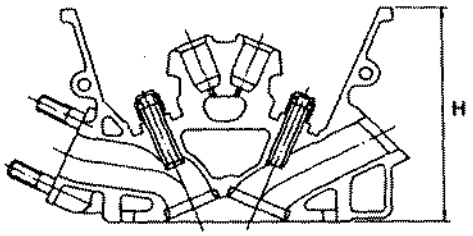
	SR20DE	SR20DET
Standard	1,275 (12.75, 13.0, 185)	1,128 (11.28, 11.5, 164)
Minimum	1,079 (10.79, 11.0, 156)	932 (9.32, 9.5, 135)
Differential limit between cylinders	98 (0.98, 1.0, 14)	

Inspection and Adjustment

CYLINDER HEAD

Unit: mm (in)

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

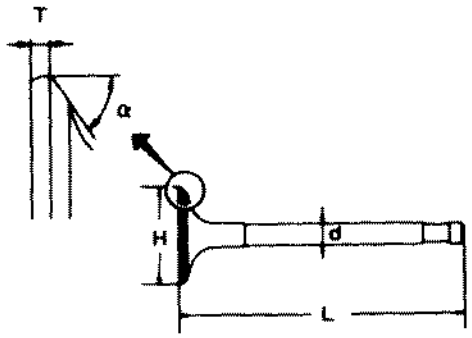


Nominal cylinder head height:
H = 136.9 - 137.1 (5.390 - 5.398)

SEM956C

VALVE

Unit: mm (in)



SEM188

Valve head diameter "D"	
Intake	34.0 - 34.2 (1.339 - 1.346)
Exhaust	30.0 - 30.2 (1.181 - 1.189)
Valve length "L"	
Intake	
SR20DE	101.19 - 101.61 (3.9839 - 4.0004)
SR20DET	101.845 - 102.355 (4.0096 - 4.0297)
Exhaust	
SR20DE	102.11 - 102.53 (4.0201 - 4.0366)
SR20DET	102.765 - 103.275 (4.0459 - 4.0659)
Valve stem diameter "d"	
Intake	5.965 - 5.980 (0.2348 - 0.2354)
Exhaust	6.945 - 6.960 (0.2734 - 0.2740)
Valve seat angle "α"	
Intake	45°15' - 45°45'
Exhaust	
Valve margin "T"	
Intake	
SR20DE	1.1 (0.043)
SR20DET	1.3 (0.051)
Exhaust	
SR20DE	1.3 (0.051)
SR20DET	1.5 (0.059)
Valve margin "T" limit	More than 0.5 (0.020)
Valve stem end surface grinding limit	Less than 0.2 (0.008)

Inspection and Adjustment (Cont'd)

Valve spring

	SR20DE	SR20DET	
		Inner	Outer
Free height mm (in)	49.36 (1.9433)	40.49 (1.5941)	47.74 (1.8795)
Pressure N (kg, lb) at height mm (in)			
Standard	569.00 - 641.57 (58.02- 65.42, 127.93 - 144.25) at 30.0 (1.181)	154.95 - 174.76 (15.8 - 17.82, 34.84 - 39.29) at 20.6 (0.811)	451.51 - 504.18 (46.04 - 51.41, 101.52 - 113.36) at 27.9 (1.098)
Limit	549.2 (56.0, 123.5) at 30.0 (1.181)	147.1 (15.0, 33.1) at 20.6 (0.811)	428.6 (43.7, 96.4) at 27.9 (1.098)
Out-of-square mm (in)	Less than 2.2 (0.087)	Less than 1.8 (0.071)	Less than 2.1 (0.083)

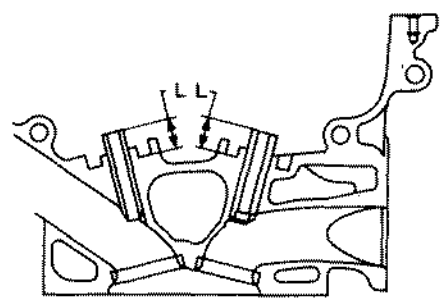
Hydraulic lash adjuster (H.L.A.)

Unit: mm (in)

H.L.A. outer diameter	16.980 - 16.993 (0.6685 - 0.6690)
H.L.A. guide inner diameter	17.000 - 17.020 (0.6693 - 0.6701)
Clearance between H.L.A. and H.L.A. guide	0.007 - 0.040 (0.0003 - 0.0016)

Valve guide

Unit: mm (in)



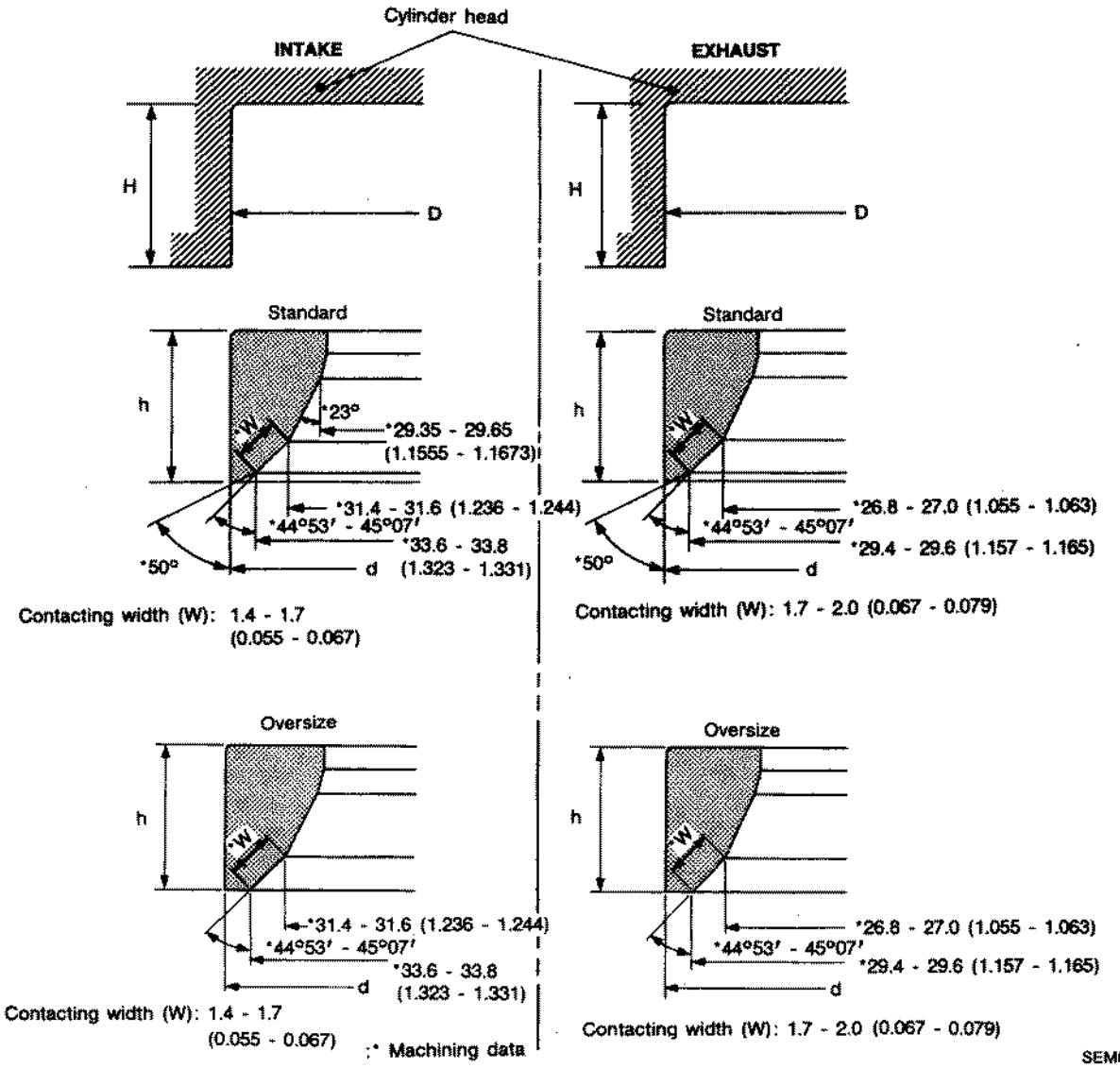
SEM083D

		Standard	Service
Valve guide Outer diameter	Intake	10.023 - 10.034 (0.3946 - 0.3950)	10.223 - 10.234 (0.4025 - 0.4029)
	Exhaust	11.023 - 11.034 (0.4340 - 0.4344)	11.223 - 11.234 (0.4418 - 0.4423)
Valve guide inner diameter (Finished size)	Intake	6.000 - 6.018 (0.2362 - 0.2369)	
	Exhaust	7.000 - 7.018 (0.2756 - 0.2763)	
Cylinder head valve guide hole diameter	Intake	9.975 - 9.996 (0.3927 - 0.3935)	10.175 - 10.196 (0.4006 - 0.4014)
	Exhaust	10.975 - 10.996 (0.4321 - 0.4329)	11.175 - 11.196 (0.4400 - 0.4408)
Interference fit of valve guide		0.027 - 0.059 (0.0011 - 0.0023)	
		Standard	Limit
Stem to guide clearance	Intake	0.020 - 0.053 (0.0008 - 0.0021)	0.1 (0.004)
	Exhaust	0.040 - 0.073 (0.0016 - 0.0029)	0.1 (0.004)
Valve deflection limit		0.2 (0.008)	
Projection length "L"		14.0 - 14.2 (0.551 - 0.559)	

Inspection and Adjustment (Cont'd)

Valve seat

Unit: mm (in)



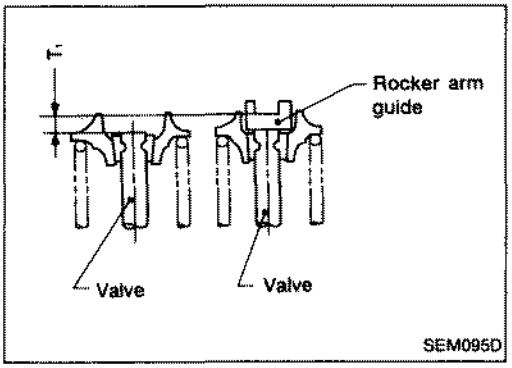
		Standard	Service
Cylinder head seat recess diameter (D)	In.	35.000 - 35.016 (1.3780 - 1.3786)	35.500 - 35.516 (1.3976 - 1.3983)
	Ex.	31.000 - 31.016 (1.2205 - 1.2211)	31.500 - 31.516 (1.2402 - 1.2408)
Valve seat interference fit	In.	0.064 - 0.096 (0.0025 - 0.0038)	
	Ex.	0.064 - 0.096 (0.0025 - 0.0038)	
Valve seat outer diameter (d)	In.	35.080 - 35.096 (1.3811 - 1.3817)	35.580 - 35.596 (1.4008 - 1.4014)
	Ex.	31.080 - 31.096 (1.2236 - 1.2242)	31.580 - 31.596 (1.2433 - 1.2439)
Depth (H)	In.	6.25 (0.2461)	
	Ex.	6.25 (0.2461)	
Height (h)		6.2 - 6.3 (0.244 - 0.248)	5.4 - 5.5 (0.213 - 0.217)

Inspection and Adjustment (Cont'd)

Valve clearance adjustment (For SR20DE)

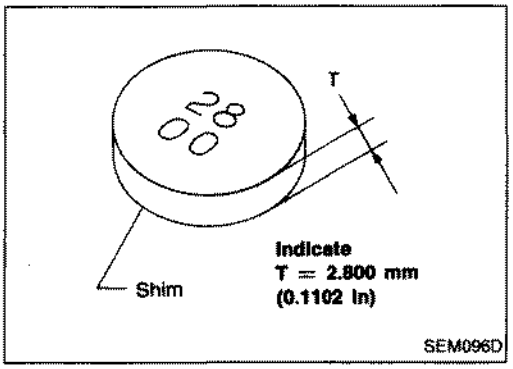
Unit: mm (in)

Valve clearance	
Intake	0 (0)
Exhaust	0 (0)
Valve clearance	
Adjustment valve limit $(T) - (T_1) =$	$-0.025\ (-0.0010) \leqq$ $[(T) - (T_1)] \leqq 0.025\ (0.0010)$



Available shims (For SR20DE)

Thickness mm (in)	Identification mark
2.800 (0.1102)	28 00
2.825 (0.1112)	28 25
2.850 (0.1122)	28 50
2.875 (0.1132)	28 75
2.900 (0.1142)	29 00
2.925 (0.1152)	29 25
2.950 (0.1161)	29 50
2.975 (0.1171)	29 75
3.000 (0.1181)	30 00
3.025 (0.1191)	30 25
3.050 (0.1201)	30 50
3.075 (0.1211)	30 75
3.100 (0.1220)	31 00
3.125 (0.1230)	31 25
3.150 (0.1240)	31 50
3.175 (0.1250)	31 75
3.200 (0.1260)	32 00



Inspection and Adjustment (Cont'd)

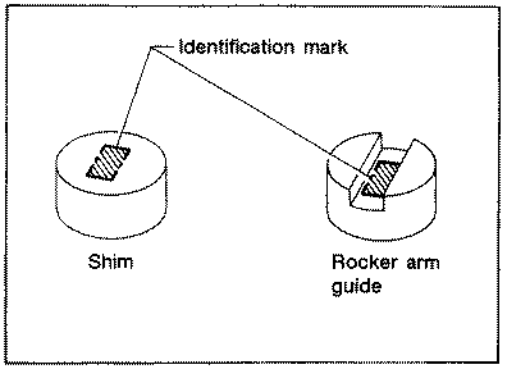
Valve clearance adjustment (For SR20DET)

Unit: mm (in)

	Hot	Cold*
Valve clearance		
Intake & Exhaust	0.30 - 0.35 (0.012 - 0.014)	0.21 - 0.26 (0.008 - 0.010)
Camshaft clearance		
Intake & Exhaust	0.20 - 0.23 (0.008 - 0.009)	0.14 - 0.17 (0.006 - 0.007)

*: At a temperature of approximately 20°C (68°F)

Whenever valve clearances are adjusted to cold specifications, check that the clearances satisfy hot specifications and adjust again if necessary.



Available shims and rocker arm guides (For SR20DET)

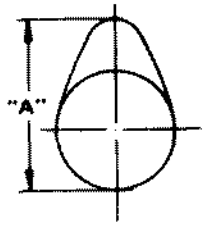
Thickness mm (in)	Identification mark	Thickness mm (in)	Identification mark	Thickness mm (in)	Identification mark
1.50 (0.0591)	1	2.175 (0.0856)	28	2.85 (0.1122)	55
1.525 (0.0600)	2	2.20 (0.0866)	29	2.875 (0.1132)	56
1.55 (0.0610)	3	2.225 (0.0876)	30	2.90 (0.1142)	57
1.575 (0.0620)	4	2.25 (0.0886)	31	2.925 (0.1152)	58
1.60 (0.0630)	5	2.275 (0.0896)	32	2.95 (0.1161)	59
1.625 (0.0640)	6	2.30 (0.0906)	33	2.975 (0.1171)	60
1.65 (0.0650)	7	2.325 (0.0915)	34	3.00 (0.1181)	61
1.675 (0.0659)	8	2.35 (0.0925)	35	3.025 (0.1191)	62
1.70 (0.0669)	9	2.375 (0.0935)	36	3.05 (0.1201)	63
1.725 (0.0679)	10	2.40 (0.0945)	37	3.075 (0.1211)	64
1.75 (0.0689)	11	2.425 (0.0955)	38	3.10 (0.1220)	65
1.775 (0.0699)	12	2.45 (0.0965)	39	3.125 (0.1230)	66
1.80 (0.0709)	13	2.475 (0.0974)	40	3.150 (0.1240)	67
1.825 (0.0719)	14	2.50 (0.0984)	41	3.175 (0.1250)	68
1.85 (0.0728)	15	2.525 (0.0994)	42	3.20 (0.1260)	69
1.875 (0.0738)	16	2.55 (0.1004)	43	3.225 (0.1270)	70
1.90 (0.0748)	17	2.575 (0.1014)	44	3.25 (0.1280)	71
1.925 (0.0758)	18	2.60 (0.1024)	45	3.275 (0.1289)	72
1.95 (0.0768)	19	2.625 (0.1033)	46	3.30 (0.1299)	73
1.975 (0.0778)	20	2.65 (0.1043)	47	3.325 (0.1309)	74
2.00 (0.0787)	21	2.675 (0.1053)	48	3.35 (0.1319)	75
2.025 (0.0797)	22	2.70 (0.1063)	49	3.375 (0.1329)	76
2.05 (0.0807)	23	2.725 (0.1073)	50	3.40 (0.1339)	77
2.075 (0.0817)	24	2.75 (0.1083)	51	3.425 (0.1348)	78
2.10 (0.0827)	25	2.775 (0.1093)	52	3.45 (0.1358)	79
2.125 (0.0837)	26	2.80 (0.1102)	53	3.475 (0.1368)	80
2.15 (0.0846)	27	2.825 (0.1112)	54	3.50 (0.1378)	81

Inspection and Adjustment (Cont'd)

CAMSHAFT AND CAMSHAFT BEARING

Unit: mm (in)

	Standard	Limit
Camshaft journal to bearing clearance	0.045 - 0.086 (0.0018 - 0.0034)	0.12 (0.0047)
Inner diameter of camshaft bearing	28.000 - 28.021 (1.1024 - 1.1032)	—
Outer diameter of camshaft journal	27.935 - 27.955 (1.0998 - 1.1006)	—
Camshaft runout [T.I.R.*]	Less than 0.02 (0.0008)	0.1 (0.004)
Camshaft sprocket runout [T.I.R.*]	Less than 0.25 (0.0098)	—
Camshaft end play	0.055 - 0.139 (0.0022 - 0.0055)	0.20 (0.0079)

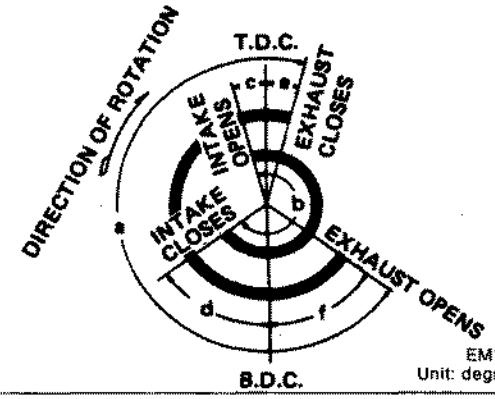


EM671

Cam height "A"	
Intake	
SR20DE	38.408 - 38.598 (1.5121 - 1.5196)
SR20DET	38.648 - 38.838 (1.5216 - 1.5291)
Exhaust	
SR20DE	37.920 - 38.110 (1.4929 - 1.5004)
SR20DET	38.648 - 38.838 (1.5216 - 1.5291)
Wear limit of cam height	0.2 (0.008)
Valve lift	
Intake	
SR20DE & SR20DET	10.0 (0.394)
Exhaust	
SR20DE	9.2 (0.362)
SR20DET	10.0 (0.394)

*Total indicator reading

Valve timing



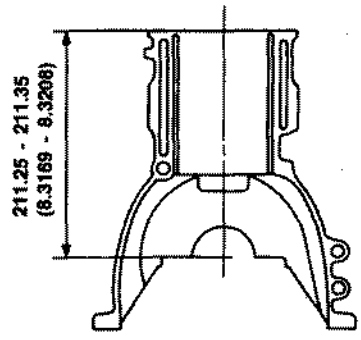
EM120
Unit: degree

	a	b	c	d	e	f
SR20DE	240°	248°	9°	59°	9°	51°
SR20DET	248°	248°	14°	54°	8°	60°

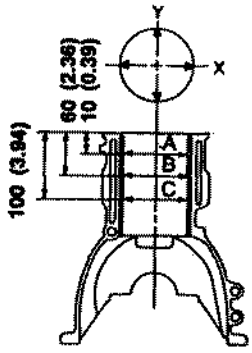
Inspection and Adjustment (Cont'd)

CYLINDER BLOCK

Unit: mm (in)



SEM008D



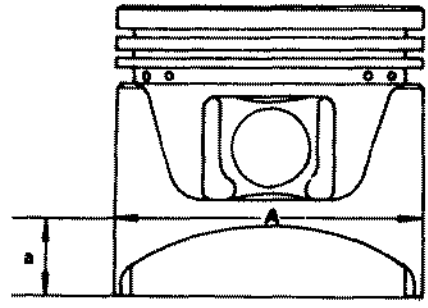
SEM686D

Surface flatness	
Standard	Less than 0.03 (0.0012)
Limit	0.10 (0.0039)
Cylinder bore	
Inner diameter	
Standard	
Grade No. 1	86.000 - 86.010 (3.3858 - 3.3862)
Grade No. 2	86.010 - 86.020 (3.3862 - 3.3866)
Grade No. 3	86.020 - 86.030 (3.3866 - 3.3870)
Wear limit	0.20 (0.0079)
Out-of-round (X – Y)	Less than 0.015 (0.0006)
Taper (A – B – C)	Less than 0.010 (0.0004)
Difference in inner diameter between cylinders	
Limit	Less than 0.05 (0.0020)
Main journal inner diameter	
Grade No. 0	58.944 - 58.950 (2.3206 - 2.3209)
Grade No. 1	58.950 - 58.956 (2.3209 - 2.3211)
Grade No. 2	58.956 - 58.962 (2.3211 - 2.3213)
Grade No. 3	58.962 - 58.968 (2.3213 - 2.3216)

PISTON, PISTON RING AND PISTON PIN

Available piston

Unit: mm (in)



SEM750C

Piston skirt diameter "A"	
Standard	
Grade No. 1	85.980 - 85.990 (3.3850 - 3.3854)
Grade No. 2	85.990 - 86.000 (3.3854 - 3.3858)
Grade No. 3	86.000 - 86.010 (3.3858 - 3.3862)
0.20 (0.0079) oversize (Service)	86.180 - 86.210 (3.3929 - 3.3941)
"a" dimension	14.0 (0.551)
Piston clearance to cylinder block	0.010 - 0.030 (0.0004 - 0.0012)
Piston pin hole diameter	21.987 - 21.999 (0.8656 - 0.8661)

Inspection and Adjustment (Cont'd)

Piston ring

Unit: mm (in)

Side clearance	
Top	
Standard	0.045 - 0.080 (0.0018 - 0.0031)
Limit	0.2 (0.008)
2nd	
Standard	0.030 - 0.065 (0.0012 - 0.0026)
Limit	0.2 (0.008)
Ring gap	
Top	
Standard	0.20 - 0.30 (0.0079 - 0.0118)
Limit	1.0 (0.039)
2nd	
Standard	0.35 - 0.50 (0.0138 - 0.0197)
Limit	1.0 (0.039)
Oil	
Standard	0.20 - 0.60 (0.0079 - 0.0236)
Limit	1.0 (0.039)

Piston pin

Unit: mm (in)

Piston pin outer diameter	21.989 - 22.001 (0.8657 - 0.8662)
Interference fit of piston pin to piston	0 - 0.004 (0 - 0.0002)
Piston pin to connecting rod bushing clearance	
Standard	0.005 - 0.017 (0.0002 - 0.0007)
Limit	0.023 (0.0009)

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

CONNECTING ROD

Unit: mm (in)

Center distance	136.30 (5.3661)
Bend, torsion [per 100 (3.94)]	
Limit	0.15 (0.0059)
Torsion [per 100 (3.94)]	
Limit	0.3 (0.0012)
Connecting rod small end inner diameter	24.980 - 25.000 (0.9835 - 0.9843)
Piston pin bushing inner diameter*	22.000 - 22.012 (0.8661 - 0.8666)
Connecting rod big end inner diameter	51.000 - 51.013 (2.0079 - 2.0084)
Side clearance	
Standard	0.20 - 0.35 (0.0079 - 0.0138)
Limit	0.5 (0.020)

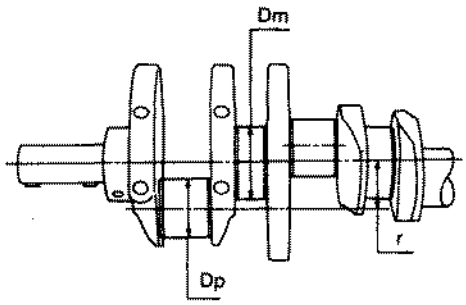
*After installing in connecting rod

Inspection and Adjustment (Cont'd)

CRANKSHAFT

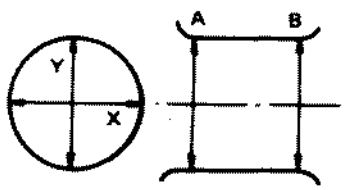
Unit: mm (in)

Main journal dia. "Dm"	
Grade No. 0	54.974 - 54.980 (2.1643 - 2.1646)
Grade No. 1	54.968 - 54.974 (2.1641 - 2.1643)
Grade No. 2	54.962 - 54.968 (2.1639 - 2.1641)
Grade No. 3	54.956 - 54.962 (2.1636 - 2.1639)
Pin journal dia. "Dp"	
Grade No. 0	47.968 - 47.974 (1.8885 - 1.8887)
Grade No. 1	47.962 - 47.968 (1.8883 - 1.8885)
Grade No. 2	47.956 - 47.962 (1.8880 - 1.8883)
Center distance "r"	42.96 - 43.04 (1.6913 - 1.6945)
Out-of-round (X – Y)	
Standard	
SR20DE (Main & pin journal)	Less than 0.005 (0.0002)
SR20DET (Main journal)	Less than 0.005 (0.0002)
SR20DET (Pin journal)	Less than 0.0025 (0.0001)
Taper (A – B)	
Standard	
SR20DE (Main & pin journal)	Less than 0.005 (0.0002)
SR20DET (Main journal)	Less than 0.005 (0.0002)
SR20DET (Pin journal)	Less than 0.0025 (0.0001)
Runout [T.I.R.]	
Standard	Less than 0.025 (0.0010)
Limit	Less than 0.05 (0.0020)
Free end play	
Standard	0.10 - 0.26 (0.0039 - 0.0102)
Limit	0.30 (0.0118)



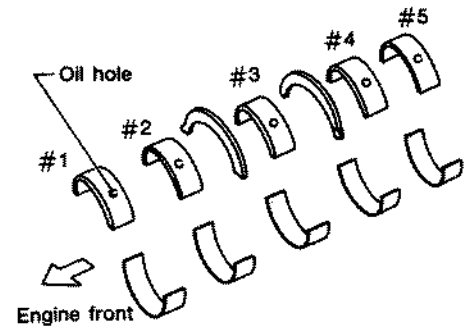
SEM954C

Out-of-round X — Y
Taper A — B



EM715

AVAILABLE MAIN BEARING



SEM685D

Main bearing (Standard)

Unit: mm (in)

Grade number	Thickness "T"	Width "W"	Identification color (mark)
0	1.977 - 1.980 (0.0778 - 0.0780)	18.9 - 19.1 (0.744 - 0.752)	Black (A)
1	1.980 - 1.983 (0.0780 - 0.0781)		Brown (B)
2	1.983 - 1.986 (0.0781 - 0.0782)		Green (C)
3	1.986 - 1.989 (0.0782 - 0.0783)		Yellow (D)
4	1.989 - 1.992 (0.0783 - 0.0784)		Blue (E)
5	1.992 - 1.995 (0.0784 - 0.0785)		Pink (F)
6	1.995 - 1.998 (0.0785 - 0.0787)		No color (G)

Main bearing (Undersize)

Unit: mm (in)

Undersize	Thickness "T"	Main journal diameter "Dm"
0.25 (0.0098)	2.109 - 2.117 (0.0830 - 0.0833)	Grind so that bearing clearance is the specified value.

Inspection and Adjustment (Cont'd)

AVAILABLE CONNECTING ROD BEARING

Connecting rod bearing

Standard size

Unit: mm (in)

Grade number	Thickness "T"		Width "W"	Identification color (mark)
	SR20DE	SR20DET		
0	1.500 - 1.503 (0.0591 - 0.0592)	1.495 - 1.498 (0.0589 - 0.0590)	16.9 - 17.1 (0.665 - 0.673)	No color (A)
1	1.503 - 1.506 (0.0592 - 0.0593)	1.498 - 1.501 (0.0590 - 0.0591)		Black (B)
2	1.506 - 1.509 (0.0593 - 0.0594)	1.501 - 1.504 (0.0591 - 0.0592)		Brown (C)

Undersize

Unit: mm (in)

Undersize	Thickness "T"		Crank pin journal diameter "Dp"
	SR20DE	SR20DET	
0.08 (0.0031)	1.541 - 1.549 (0.0607 - 0.0610)	1.536 - 1.544 (0.0605 - 0.0608)	Grind so that bearing clearance is the specified value.
0.12 (0.0047)	1.561 - 1.569 (0.0615 - 0.0618)	1.556 - 1.564 (0.0613 - 0.0616)	
0.25 (0.0098)	1.626 - 1.634 (0.0640 - 0.0643)	1.621 - 1.629 (0.0638 - 0.0641)	

Bearing clearance

Unit: mm (in)

Main bearing clearance	
Standard	0.004 - 0.022 (0.0002 - 0.0009)
Limit	0.05 (0.0020)
Connecting rod bearing clearance	
Standard	
SR20DE	0.020 - 0.045 (0.0008 - 0.0018)
SR20DET	0.030 - 0.055 (0.0012 - 0.0022)
Limit	0.09 (0.0035)

MISCELLANEOUS COMPONENTS

Unit: mm (in)

Camshaft sprocket runout limit [T.I.R.]	0.25 (0.0098)
Flywheel runout limit [T.I.R.]	0.1 (0.004)

General Specifications

Cylinder arrangement		4, in-line
Displacement	cm^3 (cu in)	988 (60.29)
Bore and stroke	mm (in)	73 x 59 (2.87 x 2.32)
Valve arrangement		S.O.H.C.
Firing order		1-3-4-2
Number of piston rings	Compression	2
	Oil	1
Number of main bearings		5
Compression ratio		9.0

Inspection and Adjustment

ENGINE COMPRESSION PRESSURE

Unit: kPa (bar, kg/cm^2, psi)/350 rpm

Standard	1,245 (12.45, 12.7, 181)
Minimum	981 (9.81, 10.0, 142)
Difference limit between cylinders	98 (0.98, 1.0, 14)

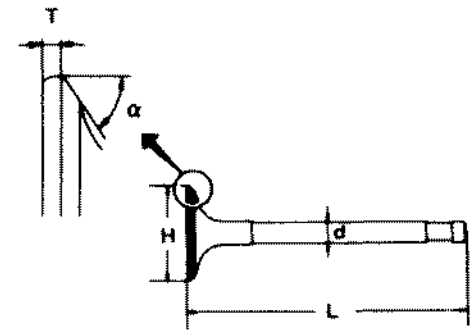
CYLINDER HEAD

Unit: mm (in)

	Standard	Limit
Head surface flatness	Less than 0.03 (0.0012)	0.1 (0.004)
Height	119.9 - 120.1 (4.720 - 4.728)	—

VALVE

Unit: mm (in)



SEM188

Valve head diameter "D"	Intake	35 (1.38)
	Exhaust	29 (1.14)
Valve length "L"	Intake	118.98 - 119.28 (4.6842 - 4.6961)
	Exhaust	118.28 - 118.88 (4.6567 - 4.6803)
Valve stem diameter "d"	Intake	6.970 - 6.985 (0.2744 - 0.2750)
	Exhaust	6.945 - 6.960 (0.2734 - 0.2740)
Valve seat angle "α"	Intake	45°15' - 45°45'
	Exhaust	
Valve margin "T" Limit		0.5 (0.020)
Valve stem end surface grinding limit		0.2 (0.008)
Valve clearance (Hot) [*1Cold]	Intake	0.28 (0.011) [*0.22 (0.009)]
	Exhaust	0.28 (0.011) [*0.22 (0.009)]

*: Used as approximate values during engine assembly, clearances should ultimately be adjusted to the above hot values.

Inspection and Adjustment (Cont'd)

Valve spring

Free height	mm (in)	46.70 (1.8386)
Pressure N (kg, lb) at height mm (in)		
Standard		568.8 (58.0, 127.9) at 30.2 (1.189)
Limit		521.7 (53.2, 117.3) at 30.2 (1.189)
Out-of-square "S"	mm (in)	2.0 (0.079)

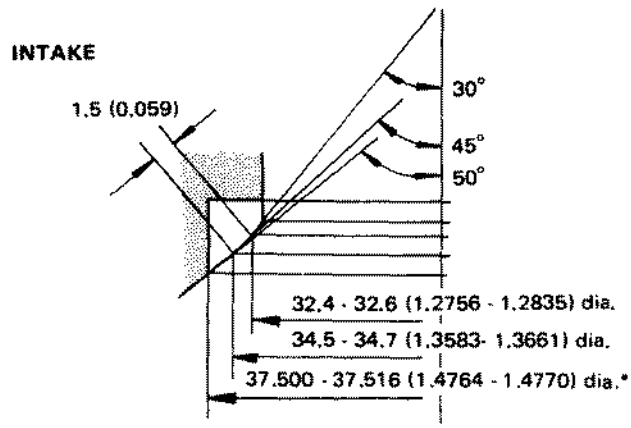
Valve guide

Unit: mm (in)

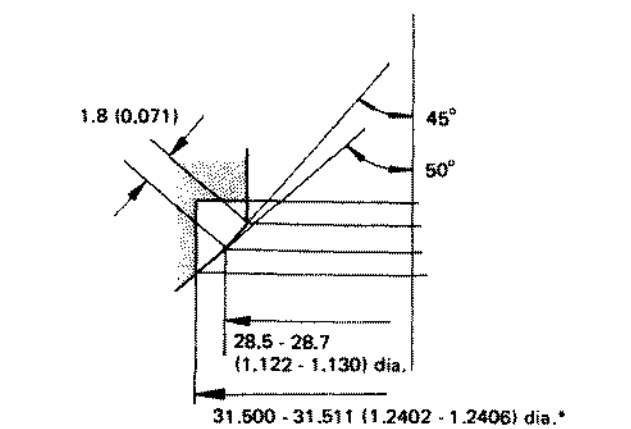
		Standard	Service
Valve guide Outer diameter		12.033 - 12.044 (0.4737 - 0.4742)	12.256 - 12.274 (0.4825 - 0.4832)
Inner diameter [Finished size]		7.005 - 7.020 (0.2758 - 0.2764)	
Cylinder head valve guide hole diameter		11.970 - 11.988 (0.4713 - 0.4720)	12.200 - 12.211 (0.4803 - 0.4807)
Interference fit of valve guide		0.045 - 0.074 (0.0018 - 0.0029)	
		Standard	Max. tolerance
Stem to guide clearance	Intake	0.02 - 0.05 (0.0008 - 0.0020)	0.10 (0.0039)
	Exhaust	0.045 - 0.075 (0.0018 - 0.0030)	
Valve deflection limit (Dial indicator reading)		0.2 (0.008)	

Valve seat

Unit: mm (in)



SEM737



SEM738

* Cylinder head machining data for 0.5 (0.020) oversize

Rocker shaft and rocker arm

Unit: mm (in)

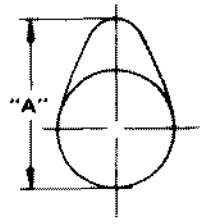
Rocker shaft	
Outer diameter	19.979 - 20.000 (0.7866 - 0.7874)
Rocker arm	
Inner diameter	20.007 - 20.028 (0.7877 - 0.7885)
Clearance between rocker arm and rocker shaft	0.007 - 0.049 (0.0003 - 0.0019)

Inspection and Adjustment (Cont'd)

CAMSHAFT AND CAMSHAFT BEARING

Unit: mm (in)

		Standard	Max. tolerance
Camshaft journal to bearing clearance	No. 1, 3, 5	0.035 - 0.076 (0.0014 - 0.0030)	0.15 (0.0059)
	No. 2, 4	0.078 - 0.119 (0.0031 - 0.0047)	0.20 (0.0079)
Inner diameter of camshaft bearing		42.000 - 42.025 (1.6535 - 1.6545)	—
Outer diameter of camshaft journal	No. 1, 3, 5	41.949 - 41.965 (1.6515 - 1.6522)	—
	No. 2, 4	41.906 - 41.922 (1.6498 - 1.6505)	
Camshaft bend [T.I.R.*]		Less than 0.02 (0.0008)	0.1 (0.004)
Camshaft end play		0.15 - 0.29 (0.0059 - 0.0114)	0.4 (0.016)

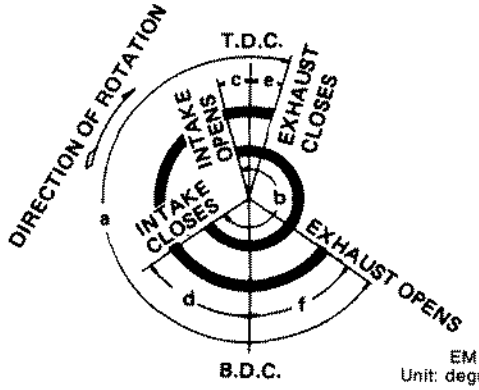


EM671

Cam height "A"	Intake	35.71 - 35.96 (1.4059 - 1.4157)
	Exhaust	35.43 - 35.68 (1.3949 - 1.4047)
Wear limit of cam height		0.2 (0.008)

*Total indicator reading

Valve timing



EM120
Unit: degree

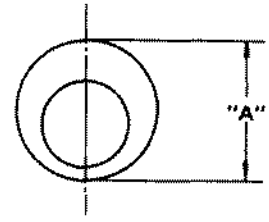
a	b	c	d	e	f
237°	236°	17°	39°	0°	57°

JACKSHAFT AND JACKSHAFT BUSHING

Unit: mm (in)

		Standard	Max. tolerance
Jackshaft journal to bushing clearance	FR	0.020 - 0.098 (0.0008 - 0.0039)	0.20 (0.0079)
	RR	0.020 - 0.098 (0.0008 - 0.0039)	
Inner diameter of jackshaft bushing	FR	32.020 - 32.085 (1.2606 - 1.2632)	
	RR	28.620 - 28.685 (1.1268 - 1.1293)	
Outer diameter of jackshaft journal	FR	31.987 - 32.000 (1.2593 - 1.2598)	
	RR	28.587 - 28.600 (1.1255 - 1.1260)	
Jackshaft end play		0.045 - 0.105 (0.0018 - 0.0041)	—

Fuel pump cam

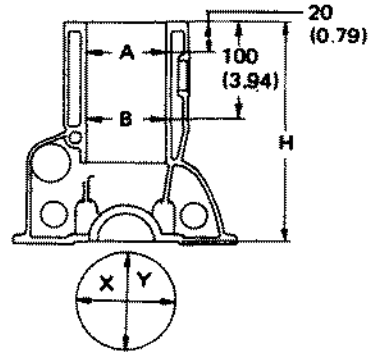


SEM734

Cam height "A"	27.7 - 27.8 (1.091 - 1.094)	—

CYLINDER BLOCK

Unit: mm (in)



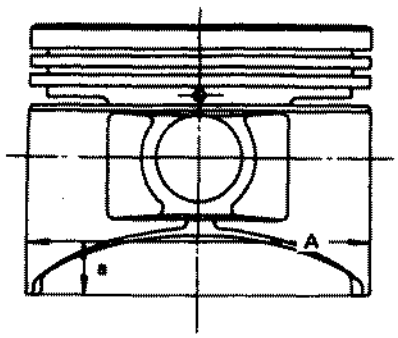
SEM378B

Surface flatness	Standard	Less than 0.05 (0.0020)
	Limit	0.10 (0.0039)
Height "H"		188.95 - 189.05 (7.4390 - 7.4429)
Cylinder bore	Inner diameter	73.00 - 73.05 (2.8740 - 2.8760)
	Out-of-round (X – Y)	Less than 0.02 (0.0008)
	Taper (A – B)	Less than 0.015 (0.0006)
Difference in inner diameter between cylinders		Less than 0.05 (0.0020)

PISTON RING AND PISTON PIN

Piston

Unit: mm (in)



SEM646

Piston skirt diameter "A"	Standard		72.967 - 73.017 (2.8727 - 2.8747)
	Oversize for service	0.25 (0.0098)	73.217 - 73.287 (2.8826 - 2.8853)
		0.5 (0.020)	73.467 - 73.517 (2.8924 - 2.8944)
"a" dimension			10.6 (0.417)
Piston pin hole diameter			17.452 - 17.459 (0.6871 - 0.6874)
Piston clearance to cylinder block			0.023 - 0.043 (0.0009 - 0.0017)

Piston ring

Unit: mm (in)

		Standard	Limit
Side clearance	Top	0.040 - 0.073 (0.0016 - 0.0029)	0.2 (0.008)
	2nd	0.030 - 0.063 (0.0012 - 0.0025)	
Ring gap	Top	Type 1: 0.14 - 0.26 (0.0055 - 0.0102) Type 2: 0.20 - 0.30 (0.0079 - 0.0118)	1.0 (0.039)
	2nd	Type 1: 0.28 - 0.37 (0.0110 - 0.0146) Type 2: 0.15 - 0.25 (0.0059 - 0.0098)	
	Oil (rail ring)	0.20 - 0.60 (0.0079 - 0.0236)	

Type 1, Type 2: Refer to page EM-90.

Piston pin

Unit: mm (in)

Piston pin outer diameter	17.445 - 17.450 (0.6868 - 0.6870)
Piston pin to piston clearance	0.006 - 0.010 (0.0002 - 0.0004)
Interference fit of piston pin to connecting rod	0.017 - 0.038 (0.0007 - 0.0015)

CONNECTING ROD

Unit: mm (in)

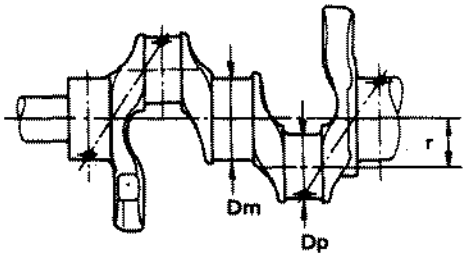
Center distance		131.5 (5.1772)
Bend, torsion [per 100 (3.94)]	Limit	0.05 (0.0020)
Piston pin bore dia.		17.412 - 17.428 (0.6855 - 0.6861)
Big end play	Standard	0.1 - 0.37 (0.0039 - 0.0146)
	Limit	0.5 (0.020)

Inspection and Adjustment (Cont'd)

CRANKSHAFT

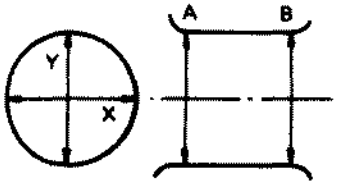
Unit: mm (in)

Main journal dia. "Dm"		49.940 - 49.964 (1.9661 - 1.9671)
Pin journal dia. "Dp"		39.961 - 39.974 (1.5733 - 1.5738)
Center distance "r"		29.5 (1.1614)
Out-of-round (X – Y) and taper (A – B)	Standard	Less than 0.01 (0.0004)
	Limit	0.03 (0.0012)
Bend [T.I.R.*]	Standard	Less than 0.04 (0.0016)
	Limit	0.08 (0.0031)
Free end play	Standard	0.05 - 0.165 (0.0020 - 0.0065)
	Limit	0.30 (0.0118)



SEM645

Out-of-round X – Y
Taper A – B



EM715

*: Total indicator reading

BEARING

Bearing clearance

Unit: mm (in)

	Standard	Limit
Main bearing clearance		
No. 1, 3, 5	0.031 - 0.056 (0.0012 - 0.0022)	0.10 (0.0039)
No. 2, 4	0.031 - 0.092 (0.0012 - 0.0036)	
Connecting rod bearing clearance	0.018 - 0.052 (0.0007 - 0.0020)	0.12 (0.0047)

Main bearing size

Unit: mm (in)

		Thickness
Standard		1.820 - 1.840 (0.0717 - 0.0724)
Undersize	0.25 (0.0098)	1.943 - 1.949 (0.0765 - 0.0767)

Connecting rod bearing size

Unit: mm (in)

		Thickness
Standard		1.499 - 1.508 (0.0590 - 0.0594)
Undersize	0.25 (0.0098)	1.615 - 1.623 (0.0636 - 0.0639)

MISCELLANEOUS COMPONENTS

Unit: mm (in)

Camshaft pulley Runout [T.I.R.*]	Less than 0.1 (0.004)
Flywheel Runout [T.I.R.*]	Less than 0.15 (0.0059)

*: Total indicator reading

Inspection and Adjustment — CD17

COMPRESSION PRESSURE

Unit: kPa (bar, kg/cm², psi) at 200 rpm

Standard	3,138 (31.4, 32, 455)
Limit	2,452 (24.5, 25, 356)
Difference limit between cylinders	490 (4.9, 5, 71)

CYLINDER HEAD

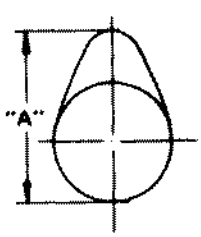
Unit: mm (in)

Head surface flatness	
Standard	Less than 0.05 (0.0020)
Limit	0.1 (0.004)
Nominal cylinder head height	116.6 - 117.0 (4.591 - 4.606)

CAMSHAFT AND CAMSHAFT BEARING

Unit: mm (in)

	Standard	Max. tolerance
Camshaft journal clearance	0.045 - 0.086 (0.0018 - 0.0034)	0.1 (0.004)
Inner diameter of camshaft bearing	30.000 - 30.021 (1.1811 - 1.1819)	—
Outer diameter of camshaft journal	29.935 - 29.955 (1.1785 - 1.1793)	—
Camshaft runout	Less than 0.02 (0.0008)	0.05 (0.0020)
Camshaft end play	0.06 - 0.17 (0.0024 - 0.0067)	0.17 (0.0067)

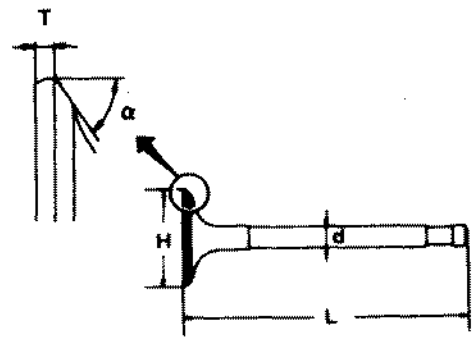


EM671

Cam height "A"	
Intake	44.45 - 44.50 (1.7500 - 1.7520)
Exhaust	45.45 - 45.50 (1.7894 - 1.7913)
Wear limit of cam height	
Intake	44.300 (1.7441)
Exhaust	45.300 (1.7835)

VALVE

Unit: mm (in)



SEM188

Valve head diameter "D"	
Intake	36.00 (1.4173)
Exhaust	31.00 (1.2205)
Valve length "L"	
Intake & Exhaust	100.55 - 100.85 (3.9587 - 3.9705)
Valve stem diameter "d"	
Intake	6.965 - 6.980 (0.2742 - 0.2748)
Exhaust	6.945 - 6.960 (0.2734 - 0.2740)
Valve seat angle "α"	45°30'
Valve margin "T" limit	0.5 (0.020)
Valve stem end surface grinding limit	0.5 (0.020)
Valve seat contact width	
Intake	1.7 (0.067)
Exhaust	1.8 (0.071)

Valve spring

Free height mm (in)		
Outer	46.40 (1.8268)	
Inner	43.20 (1.7008)	
	Standard	Limit
Assembled height mm/N (mm/kg, in/lb)		
Outer	39.5/150.0 (39.5/15.3, 1.555/33.7)	39.5/125.5 (39.5/12.8, 1.555/28.2)
Inner	36.0/85.3 (36.0/8.7, 1.417/19.2)	36.0/71.6 (36.0/7.3, 1.417/16.1)
Out-of-square "S" mm (in)		
Outer	2.1 (0.083)	
Inner	1.9 (0.075)	

Valve guide

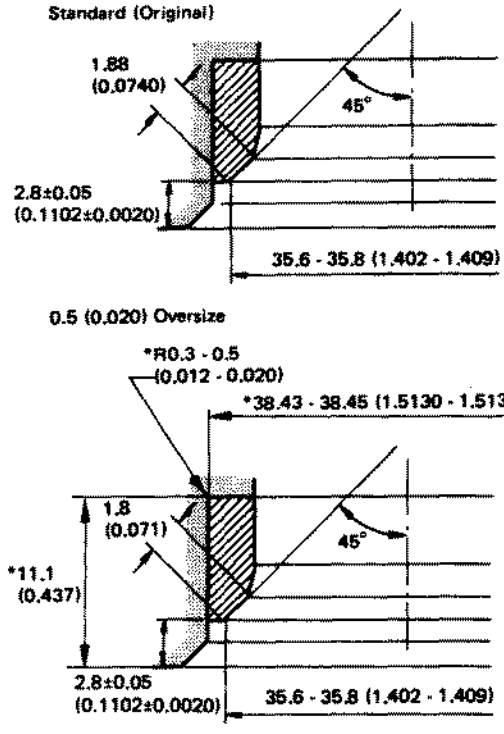
Unit: mm (in)

	Standard	Service
Valve guide		
Outer diameter	11.023 - 11.034 (0.4340 - 0.4344)	11.223 - 11.234 (0.4418 - 0.4423)
Valve guide		
Inner diameter (Finished size)	7.000 - 7.015 (0.2756 - 0.2762)	
Cylinder head valve guide hole diameter	10.975 - 10.996 (0.4321 - 0.4329)	11.185 - 11.196 (0.4404 - 0.4408)
Interference fit of valve guide	0.027 - 0.059 (0.0011 - 0.0023)	
	Standard	Max. tolerance
Stem to guide clearance		
Intake	0.020 - 0.050 (0.0008 - 0.0020)	0.10 (0.0039)
Exhaust	0.040 - 0.070 (0.0016 - 0.0028)	0.10 (0.0039)
Valve deflection limit		0.1 (0.004)

Valve seat resurfacing

Unit: mm (in)

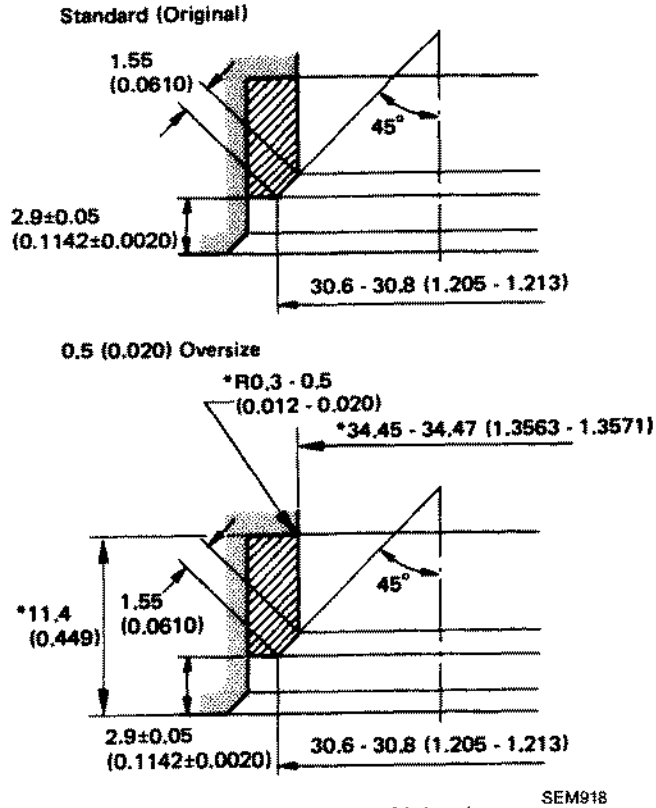
Intake



*: Cylinder head machining data

SEM917

Exhaust



*: Cylinder head machining data

SEM918

Inspection and Adjustment — CD17 (Cont'd)

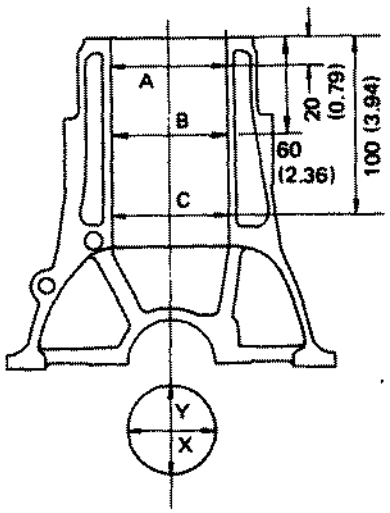
VALVE LIFTER

Unit: mm (in)

Valve lifter outer diameter	
Standard	34.959 - 34.975 (1.3763 - 1.3770)
Cylinder head valve lifter hole diameter	34.988 - 35.013 (1.3775 - 1.3785)
Clearance	
Standard	0.013 - 0.054 (0.0005 - 0.0021)
Limit	0.1 (0.004)

CYLINDER BLOCK

Unit: mm (in)



SEM902

		Standard	Limit
Surface flatness		Less than 0.05 (0.0020)	0.10 (0.0039)
Cylinder bore	Inner diameter	Grade No. 1 80.000 - 80.010 (3.1496 - 3.1500) Grade No. 2 80.010 - 80.020 (3.1500 - 3.1504) Grade No. 3 80.020 - 80.030 (3.1504 - 3.1508) Grade No. 4 80.030 - 80.040 (3.1508 - 3.1512) Grade No. 5 80.040 - 80.050 (3.1512 - 3.1516)	—
	Out-of-round (X – Y)	Less than 0.02 (0.0008)	0.04 (0.0016)
	Taper (A – B)	Less than 0.02 (0.0008)	0.04 (0.0016)
Difference in inner diameter between cylinders		Less than 0.05 (0.0020)	0.2 (0.008)
Piston to cylinder clearance		0.05 - 0.07 (0.0020 - 0.0028)	—
Feeler gauge extracting force [with gauge thickness 0.06 mm (0.0024 in)] N (kg, lb)		7.8 - 14.7 (0.8 - 1.5, 1.8 - 3.3)	—
Main journal inner diameter		Grade No. 0 56.654 - 56.663 (2.2305 - 2.2308) Grade No. 1 56.663 - 56.672 (2.2308 - 2.2312) Grade No. 2 56.672 - 56.680 (2.2312 - 2.2315)	—

PISTON, PISTON RING AND PISTON PIN

Piston

Unit: mm (in)

Piston skirt diameter	Standard	Grade No. 1	79.94 - 79.95 (3.1472 - 3.1476)
		Grade No. 2	79.95 - 79.96 (3.1476 - 3.1480)
		Grade No. 3	79.96 - 79.97 (3.1480 - 3.1484)
		Grade No. 4	79.97 - 79.98 (3.1484 - 3.1488)
		Grade No. 5	79.98 - 79.99 (3.1488 - 3.1492)
	Oversize	Standard	79.96 - 80.01 (3.1480 - 3.1500)
		0.5 (0.020)	80.44 - 80.49 (3.1669 - 3.1689)
		1.0 (0.039)	80.94 - 80.99 (3.1866 - 3.1886)
Measure position (From Top)			60 (2.36)
Piston pin hole diameter			23.991 - 23.999 (0.9445 - 0.9448)

Piston ring

Unit: mm (in)

Side clearance	
Top	
Standard	0.020 - 0.060 (0.0008 - 0.0024)
Limit	0.20 (0.0079)
2nd	
Standard	0.040 - 0.080 (0.0016 - 0.0031)
Limit	0.15 (0.0059)
Oil	
Standard	0.030 - 0.070 (0.0012 - 0.0028)
Limit	0.10 (0.0039)
Ring gap	
Top	
Standard	0.20 - 0.35 (0.0079 - 0.0138)
Limit	1.0 (0.039)
2nd	
Standard	0.20 - 0.35 (0.0079 - 0.0138)
Limit	0.7 (0.028)
Oil	
Standard	0.30 - 0.45 (0.0118 - 0.0177)
Limit	0.6 (0.024)

Piston pin

Unit: mm (in)

Piston pin outer diameter	23.994 - 24.000 (0.9446 - 0.9449)
Interference fit of piston pin to piston	0 - 0.004 (0 - 0.0002)
Piston pin to connecting rod clearance	0.025 - 0.044 (0.0010 - 0.0017)

CONNECTING ROD

Unit: mm (in)

Bend [per 100 mm (3.94 in)]	
Standard	Less than 0.15 (0.0059)
Torsion	
Standard	Less than 0.30 (0.0118)
Piston pin bore dia.	24.025 - 24.038 (0.9459 - 0.9464)
Big end play	
Limit	0.3 (0.012)

CRANKSHAFT

Unit: mm (in)

Main journal dia.	Grade No. 0 52.967 - 52.975 (2.0853 - 2.0856) Grade No. 1 52.959 - 52.967 (2.0850 - 2.0853) Grade No. 2 52.951 - 52.959 (2.0847 - 2.0850)
Pin journal dia.	44.961 - 44.974 (1.7701 - 1.7706)
Out-of-round (X – Y) and taper (A – B)	
Standard	Less than 0.005 (0.0002)
Limit	0.03 (0.0012)
Runout	
Standard	Less than 0.05 (0.0020)
Limit	0.03 (0.0012)
Free end play	
Standard	0.05 - 0.18 (0.0020 - 0.0071)
Limit	0.3 (0.012)

AVAILABLE MAIN BEARINGS

No. 1, No. 2, No. 4 and No. 5 main bearings

Grade number	Thickness "T" mm (in)	Width "W" mm (in)	Identification color
0	1.816 - 1.820 (0.0715 - 0.0717)		Black
1	1.820 - 1.824 (0.0717 - 0.0718)		Brown
2	1.824 - 1.828 (0.0718 - 0.0720)	22 (0.87)	Green
3	1.828 - 1.832 (0.0720 - 0.0721)		Yellow
4	1.832 - 1.836 (0.0721 - 0.0723)		Blue

No. 3 main bearings

Grade number	Thickness "T" mm (in)	Width "W" mm (in)	Identification color
0	1.816 - 1.820 (0.0715 - 0.0717)		Black
1	1.820 - 1.824 (0.0717 - 0.0718)		Brown
2	1.824 - 1.828 (0.0718 - 0.0720)	24 (0.94)	Green
3	1.828 - 1.832 (0.0720 - 0.0721)		Yellow
4	1.832 - 1.836 (0.0721 - 0.0723)		Blue

Main bearing undersize

Unit: mm (in)

	Crank journal diameter
STD	52.951 - 52.975 (2.0847 - 2.0856)
0.25 (0.0098) undersize	52.701 - 52.725 (2.0748 - 2.0758)

Connecting rod bearing undersize

Unit: mm (in)

	Crank pin diameter
STD	44.961 - 44.974 (1.7701 - 1.7706)
0.08 (0.0031) undersize	44.881 - 44.894 (1.7670 - 1.7675)
0.12 (0.0047) undersize	44.841 - 44.854 (1.7654 - 1.7659)
0.25 (0.0098) undersize	44.711 - 44.724 (1.7603 - 1.7608)

Bearing clearance

Unit: mm (in)

Main bearing clearance	
Standard	0.039 - 0.065 (0.0015 - 0.0026)
Limit	0.12 (0.0047)
Connecting rod bearing clearance	
Standard	0.024 - 0.066 (0.0009 - 0.0026)
Limit	0.12 (0.0047)

MISCELLANEOUS COMPONENTS

Unit: mm (in)

Camshaft sprocket	
Runout [T.I.R.*]	Less than 0.1 (0.004)
Flywheel	
Runout [T.I.R.*]	Less than 0.15 (0.0059)

*: Total indicator reading

Inspection and Adjustment — CD20

COMPRESSION PRESSURE

Unit: kPa (bar, kg/cm², psi) at 200 rpm

Standard	3,138 (31.4, 32, 455)
Limit	2,452 (24.5, 25, 356)
Difference limit between cylinders	490 (4.9, 5, 71)

CYLINDER HEAD

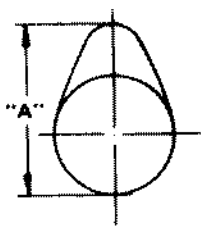
Unit: mm (in)

Head surface flatness	
Standard	Less than 0.05 (0.0020)
Limit	0.1 (0.004)
Nominal cylinder head height	137.9 - 138.1 (5.429 - 5.437)

CAMSHAFT AND CAMSHAFT BEARING

Unit: mm (in)

	Standard	Max. tolerance
Camshaft journal clearance	0.045 - 0.086 (0.0018 - 0.0034)	0.1 (0.004)
Inner diameter of camshaft bearing	30.000 - 30.021 (1.1811 - 1.1819)	—
Outer diameter of camshaft journal	29.935 - 29.955 (1.1785 - 1.1793)	—
Camshaft runout	Less than 0.02 (0.0008)	0.05 (0.0020)
Camshaft end play	0.115 - 0.188 (0.0045 - 0.0074)	—

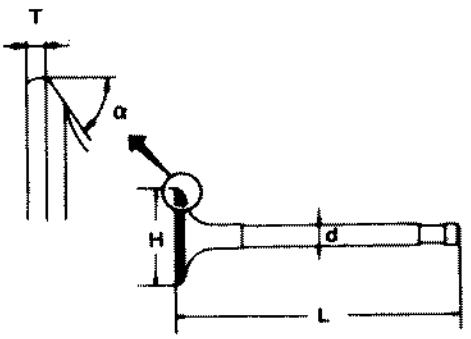


EM671

Cam height "A"	
Intake	49.20 - 49.30 (1.9370 - 1.9409)
Exhaust	49.15 - 49.25 (1.9350 - 1.9390)

VALVE

Unit: mm (in)



SEM188

Valve head diameter "D"	
Intake	39.0 - 39.2 (1.535 - 1.543)
Exhaust	32.0 - 32.2 (1.260 - 1.268)
Valve length "L"	
Intake	100.53 - 100.97 (3.9579 - 3.9752)
Exhaust	100.38 - 100.82 (3.9520 - 3.9693)
Valve stem diameter "d"	
Intake	6.965 - 6.980 (0.2742 - 0.2748)
Exhaust	6.945 - 6.960 (0.2734 - 0.2740)
Valve seat angle "α"	45°30'
Valve margin "T" limit	0.5 (0.020)
Valve stem end surface grinding limit	0.5 (0.020)

Inspection and Adjustment — CD20 (Cont'd)

Valve spring

Free height mm (in)	
Outer	43.2 (1.701)
Inner	38.2 (1.504)
	Standard
Assembled height mm/N (mm/kg, in/lb)	
Outer	36.1/164.8 (36.1/16.8, 1.421/37.0)
Inner	32.6/78.5 (32.6/8.0, 1.283/17.6)
Out-of-square "S" mm (in)	
Outer	2.1 (0.083)
Inner	1.9 (0.075)

Valve guide

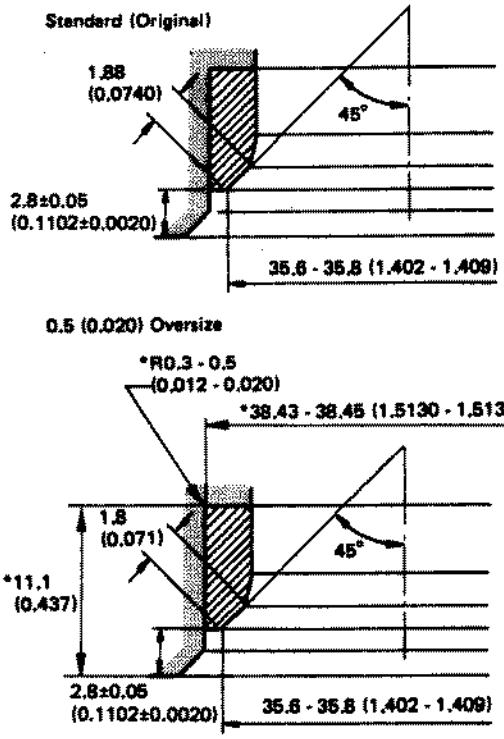
Unit: mm (in)

	Standard	Service
Valve guide		
Outer diameter	11.023 - 11.034 (0.4340 - 0.4344)	11.223 - 11.234 (0.4418 - 0.4423)
Valve guide		
Inner diameter (Finished size)	7.000 - 7.015 (0.2756 - 0.2762)	
Cylinder head valve guide hole diameter	10.975 - 10.996 (0.4321 - 0.4329)	11.185 - 11.196 (0.4404 - 0.4408)
Interference fit of valve guide	0.027 - 0.059 (0.0011 - 0.0023)	
	Standard	Max. tolerance
Stem to guide clearance		
Intake	0.020 - 0.050 (0.0008 - 0.0020)	0.10 (0.0039)
Exhaust	0.040 - 0.070 (0.0016 - 0.0028)	0.10 (0.0039)
Valve deflection limit		0.1 (0.004)

Valve seat resurfacing

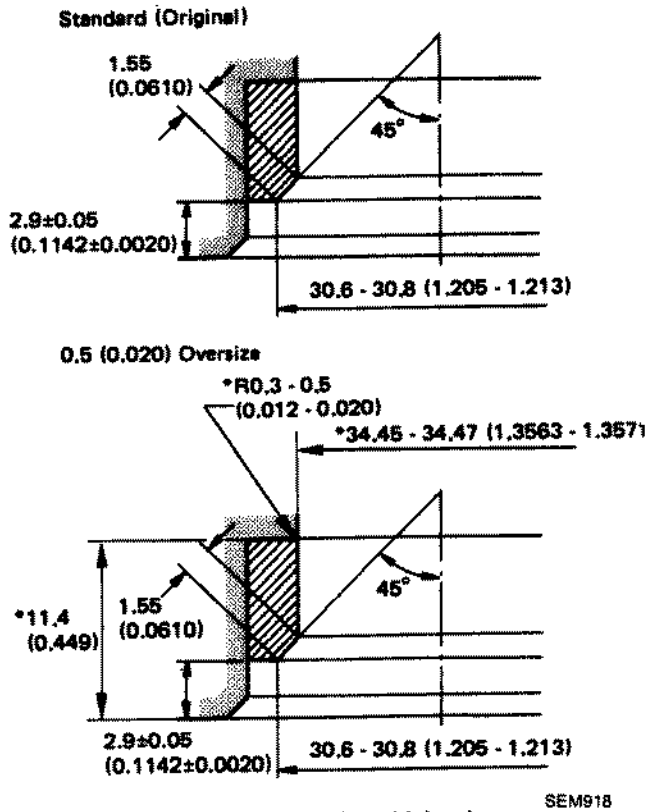
Unit: mm (in)

Intake



SEM917

Exhaust



SEM918

Inspection and Adjustment — CD20 (Cont'd)

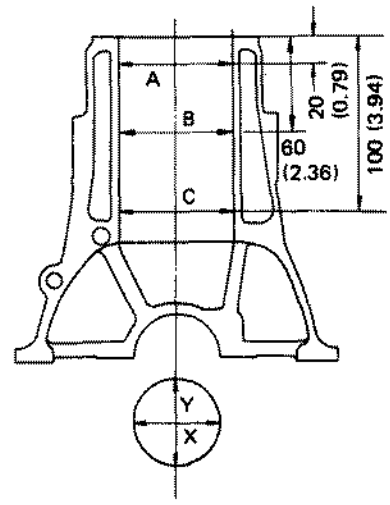
VALVE LIFTER

Unit: mm (in)

Valve lifter outer diameter	
Standard	34.959 - 34.975 (1.3763 - 1.3770)
Cylinder head valve lifter hole diameter	34.988 - 35.018 (1.3775 - 1.3787)
Clearance	
Standard	0.023 - 0.059 (0.0009 - 0.0023)
Limit	0.1 (0.004)

CYLINDER BLOCK

Unit: mm (in)



SEM902

		Standard	Limit
Surface flatness		Less than 0.05 (0.0020)	0.10 (0.0039)
Cylinder bore	Inner diameter	Grade No. 1 84.500 - 84.510 (3.3268 - 3.3272) Grade No. 2 84.510 - 84.520 (3.3276 - 3.3279) Grade No. 3 84.520 - 84.530 (3.3276 - 3.3279) Grade No. 4 84.530 - 84.540 (3.3279 - 3.3283) Grade No. 5 84.540 - 84.550 (3.3283 - 3.3287)	—
	Out-of-round (X – Y)	Less than 0.015 (0.0006)	0.04 (0.0016)
	Taper (A – B)	Less than 0.010 (0.0004)	0.04 (0.0016)
Piston to cylinder clearance		0.025 - 0.045 (0.0010 - 0.0018)	—
Feeler gauge extracting force [with gauge thickness 0.06 mm (0.0024 in)] N (kg, lb)		7.8 - 14.7 (0.8 - 1.5, 1.8 - 3.3)	—
Main journal inner diameter		Grade No. 0 56.654 - 56.663 (2.2305 - 2.2308) Grade No. 1 56.663 - 56.672 (2.2308 - 2.2312) Grade No. 2 56.672 - 56.680 (2.2312 - 2.2315)	—

AVAILABLE MAIN BEARINGS

No. 1, No. 2, No. 4 and No. 5 main bearings

Grade number	Thickness "T" mm (in)	Width "W" mm (in)	Identification color
0	1.816 - 1.820 (0.0715 - 0.0717)		Yellow
1	1.820 - 1.824 (0.0717 - 0.0718)		Green
2	1.824 - 1.828 (0.0718 - 0.0720)	20.0 (0.787) 17.8 (0.701)*	Brown
3	1.828 - 1.832 (0.0720 - 0.0721)		Black
4	1.832 - 1.836 (0.0721 - 0.0723)		Blue

*: Contacting width

No. 3 main bearings

Grade number	Thickness "T" mm (in)	Width "W" mm (in)	Identification color
0	1.816 - 1.820 (0.0715 - 0.0717)		Yellow
1	1.820 - 1.824 (0.0717 - 0.0718)		Green
2	1.824 - 1.828 (0.0718 - 0.0720)	27.95 (1.1004) 20.8 (0.819)*	Brown
3	1.828 - 1.832 (0.0720 - 0.0721)		Black
4	1.832 - 1.836 (0.0721 - 0.0723)		Blue

*: Contacting width

Main bearing undersize

Unit: mm (in)

	Crank journal diameter
STD	52.951 - 52.975 (2.0847 - 2.0856)
0.25 (0.0098) undersize	52.701 - 52.725 (2.0748 - 2.0758)

Bearing clearance

Unit: mm (in)

Main bearing clearance	
Standard	0.039 - 0.065 (0.0015 - 0.0026)
Connecting rod bearing clearance	
Standard	0.031 - 0.061 (0.0012 - 0.0024)

Connecting rod bearing undersize

Unit: mm (in)

			Crank pin diameter
STD	Grade 0	Black	49.968 - 49.974 (1.9672 - 1.9675)
	Grade 1	Yellow	49.961 - 49.968 (1.9670 - 1.9672)
	Grade 2	Blue	49.954 - 49.961 (1.9667 - 1.9670)
0.08 (0.0031) undersize			49.874 - 49.894* (1.9635 - 1.9643)
0.12 (0.0047) undersize			49.834 - 49.854* (1.9620 - 1.9628)
0.25 (0.0098) undersize			49.704 - 49.724* (1.9568 - 1.9576)

*: Reference value

MISCELLANEOUS COMPONENTS

Unit: mm (in)

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

*: Total indicator reading

PISTON, PISTON RING AND PISTON PIN

Piston

Unit: mm (in)

Piston skirt diameter	Standard	Grade No. 1	84.465 - 84.475 (3.3254 - 3.3258)
		Grade No. 2	84.475 - 84.485 (3.3258 - 3.3262)
		Grade No. 3	84.485 - 84.495 (3.3262 - 3.3266)
		Grade No. 4	84.495 - 84.505 (3.3266 - 3.3270)
		Grade No. 5	84.505 - 84.515 (3.3270 - 3.3274)
	Oversize	0.25 (0.0098)	84.715 - 84.765 (3.3352 - 3.3372)
		0.5 (0.020)	84.965 - 85.015 (3.3451 - 3.3470)
Measure position (From Top)			62 (2.44)
Piston pin hole diameter			24.991 - 24.999 (0.9839 - 0.9842)

Piston ring

Unit: mm (in)

Side clearance		
Top		
Standard		0.060 - 0.095 (0.0024 - 0.0037)
Limit		0.10 (0.0039)
2nd		
Standard		0.040 - 0.075 (0.0016 - 0.0030)
Limit		0.10 (0.0039)
Oil		
Standard		0.030 - 0.070 (0.0012 - 0.0028)
Ring gap		
Top		
Standard		
Bore grade 1, 2, 3		0.20 - 0.30 (0.0079 - 0.0118)
Bore grade 4, 5		0.12 - 0.22 (0.0047 - 0.0087)
2nd		
Standard		0.38 - 0.53 (0.0150 - 0.0209)
Oil		
Standard		0.30 - 0.55 (0.0118 - 0.0217)

Piston pin

Unit: mm (in)

Piston pin outer diameter	24.994 - 25.000 (0.9840 - 0.9843)
Interference fit of piston pin to piston	0 - 0.004 (0 - 0.0002)
Piston pin to connecting rod clearance	0.025 - 0.044 (0.0010 - 0.0017)

CONNECTING ROD

Unit: mm (in)

Bend [per 100 mm (3.94 in)]	
Standard	Less than 0.025 (0.0010)
Torsion	
Standard	Less than 0.025 (0.0010)
Piston pin bore dia.	25.025 - 25.038 (0.9852 - 0.9857)
Big end play	
Limit	0.3 (0.012)

CRANKSHAFT

Unit: mm (in)

Main journal dia.	Grade No. 0 52.967 - 52.975 (2.0853 - 2.0856) Grade No. 1 52.959 - 52.967 (2.0850 - 2.0853) Grade No. 2 52.951 - 52.959 (2.0847 - 2.0850)
Pin journal dia.	Grade No. 0 49.968 - 49.974 (1.9672 - 1.9675) Grade No.1 49.961 - 49.968 (1.9670 - 1.9672) Grade No. 2 49.954 - 49.961 (1.9667 - 1.9670)
Out-of-round (X – Y) and taper (A – B)	
Standard	Less than 0.005 (0.0002)
Runout	
Standard	Less than 0.05 (0.0020)
Free end play	
Standard	0.05 - 0.18 (0.0020 - 0.0071)
Limit	0.3 (0.012)

Tightening Torque

ENGINE OUTER PARTS

Unit		N·m	kg-m	ft-lb
Adjusting bar to engine mounting	CD17	16 - 21	1.6 - 2.1	12 - 15
	CD20	21 - 26	2.1 - 2.7	15 - 20
Alternator to bracket		37 - 51	3.8 - 5.2	27 - 38
Front dust cover		3 - 5	0.3 - 0.5	2.2 - 3.6
Idler pulley nut (For air conditioner)		19 - 25	1.9 - 2.6	14 - 19
Injection pump rear bracket (to cylinder block)		24 - 27	2.4 - 2.8	17 - 20
Injection pump rear bracket		49 - 59	5.0 - 6.0	36 - 43
Injection pump to rear bracket		24 - 27	2.4 - 2.8	17 - 20
Injection pump sprocket nut		59 - 69	6.0 - 7.0	43 - 51

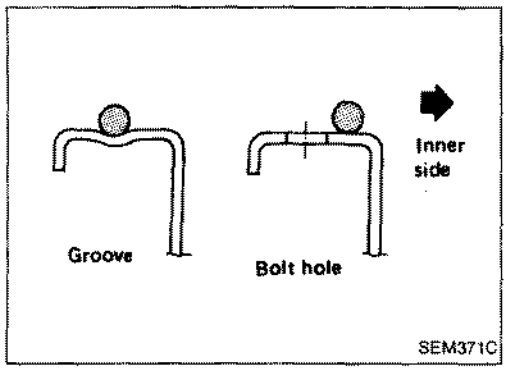
ENGINE BODY PARTS

Unit		N·m	kg-m	ft-lb
Oil pan drain plug		29 - 39	3.0 - 4.0	22 - 29
Rocker cover	CD17	1 - 3	0.1 - 0.3	0.7 - 2.2
	CD20	2 - 4	0.2 - 0.4	1.4 - 2.9
Water pump to cylinder block		16 - 21	1.6 - 2.1	12 - 15
Water drain plug		54 - 74	5.5 - 7.5	40 - 54

ENGINE LUBRICATION & COOLING SYSTEMS

SECTION LC

CONTENTS

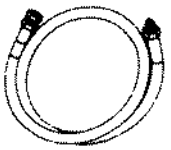
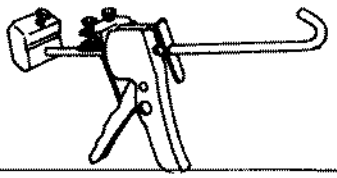
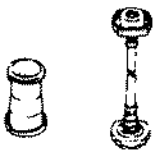


LIQUID GASKET APPLICATION PROCEDURE

a. Before applying liquid gasket, use a scraper to remove all traces of old liquid gasket from mating surface.
b. Apply a continuous bead of liquid gasket to mating surfaces. (Use Genuine Liquid Gasket or equivalent.)
   - Be sure liquid gasket is specified width (for oil pan).
     SR: 4.0 to 5.0 mm (0.157 to 0.197 in)
     GA, E, CD: 3.5 to 4.5 mm (0.138 to 0.177 in)
   - Be sure liquid gasket is 2.0 to 3.0 mm (0.079 to 0.118 in) wide (in areas except oil pan).
c. Apply liquid gasket to inner sealing surface around hole perimeter area.
   (Assembly should be done within 5 minutes after coating.)
d. Wait at least 30 minutes before refilling engine oil and engine coolant.

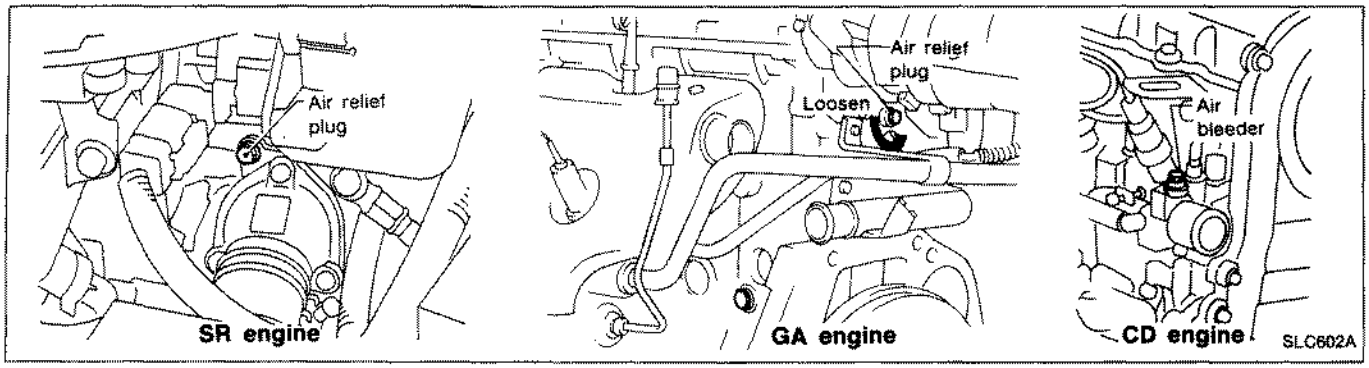
SPECIAL SERVICE TOOLS

*: Special tool or commercial equivalent

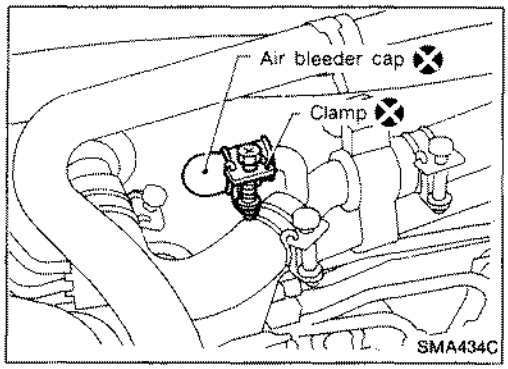
Tool number Tool name	Description		Engine application			
			GA	SR	E	CD
ST25051001* Oil pressure gauge			X	X	X	X
ST25052000* Hose		Adapting oil pressure gauge to cylinder block	X	X	X	X
WS39930000 Tube presser		Pressing the tube of liquid gasket	X	X	X	X
EG17650301 Radiator cap tester adapter		Adapting radiator cap tester to radiator filler neck	X	X	X	X
KV99103510 Radiator plate pliers A		Installing radiator upper and lower tanks	X	X	X	X
KV99103520 Radiator plate pliers B		Removing radiator upper and lower tanks	X	X	X	X

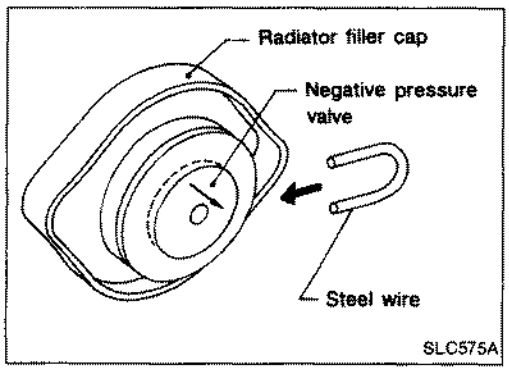
Refilling Engine Coolant

1. Set heater temperature control lever to Maximum Hot position.
2. Remove radiator filler cap, air relief plug and air bleeder cap.



3. Fill radiator with coolant and fill reservoir tank to Max line with coolant.
- Air relief plug is reinstalled once coolant spills from the air relief hole during refill.
  Then fill radiator and reservoir tank with coolant.
4. Reinstall air bleeder cap.



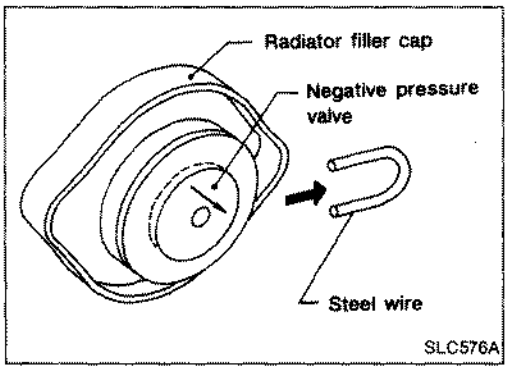


5. Install a temporary radiator filler cap which allows air and coolant in cooling system to be directed into reservoir tank regardless of pressure.
- Install a suitable steel wire between negative pressure valve and its seat as shown in the picture.
6. Warm up engine to normal operating temperature.
7. Run engine at 2,500 rpm for 10 seconds and return to idle speed.
- Repeat 2 or 3 times

Watch coolant temperature gauge so as not to overheat the engine.

8. Stop engine and cool it down.
- Cool down using a fan to reduce the time.
9. Remove the temporary radiator filler cap and check coolant level.
- If necessary, refill radiator up to filler neck with coolant.
10. Refill reservoir tank to Max line with coolant.
11. Repeat step 7 through step 10 two or more times.

Refilling Engine Coolant (Cont'd)

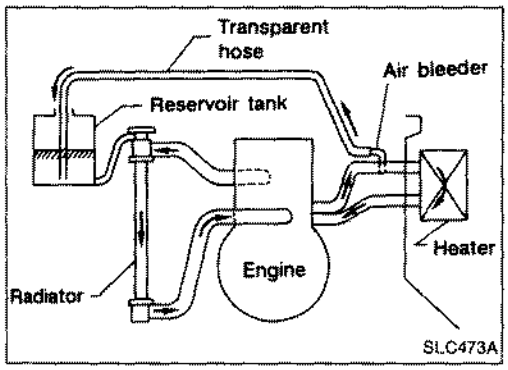


12. Install a proper radiator filler cap. (Original radiator filler cap)
13. Warm up engine, and check for sound of coolant flow while running engine from idle up to 4,000 rpm with heater temperature control lever set at several positions between COOL and HOT.

- Sound may be noticeable at heater water cock.

14. GA and CD engines:
    If sound is heard, bleed air from cooling system by repeating steps 5 through 10 until coolant level no longer drops.
    SR engine:
    If sound is heard, bleed air from cooling system according to the following steps.

1) Cool engine down and remove air bleeder cap on heater inlet hose.



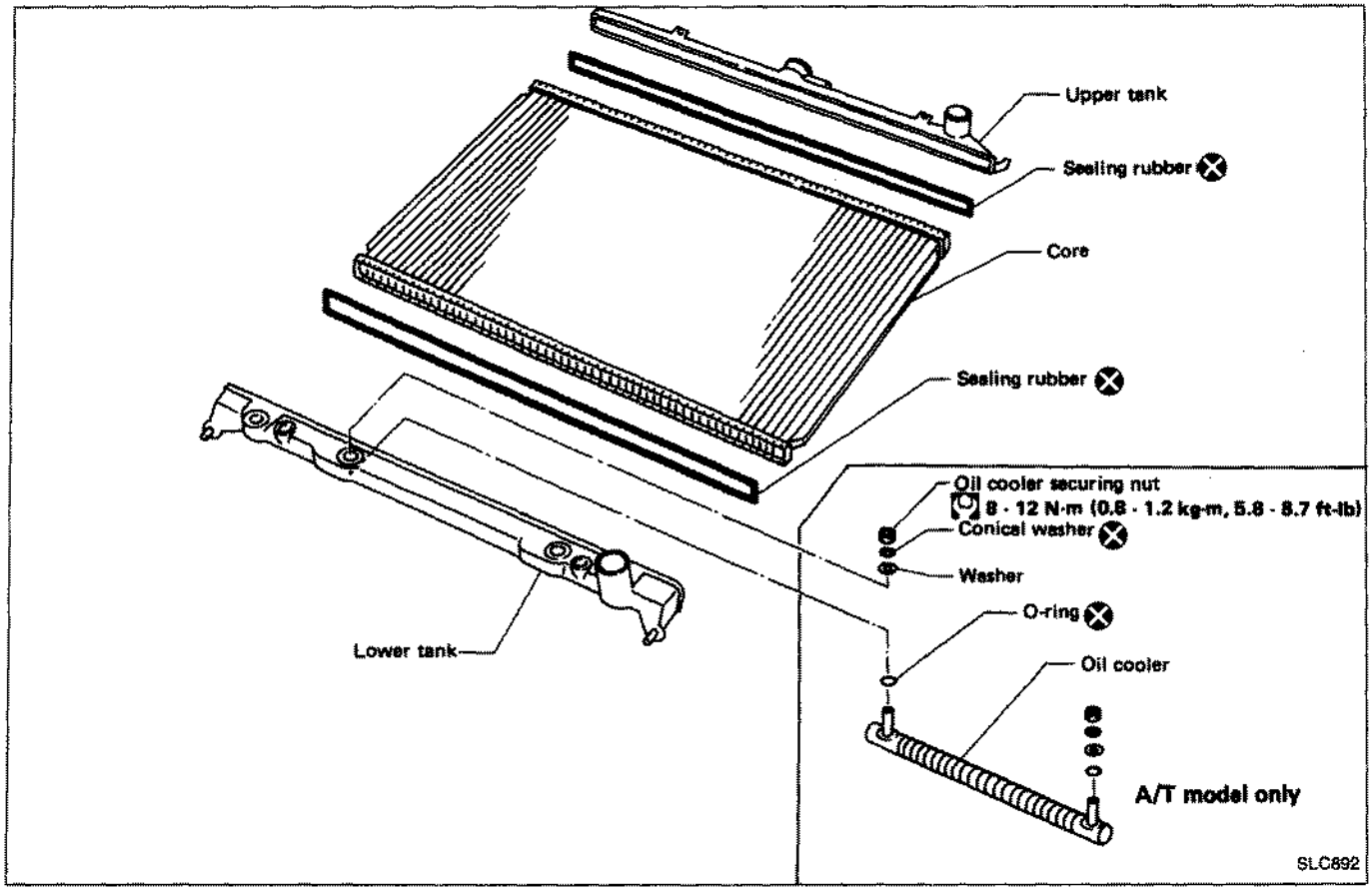
2) Attach a suitable transparent hose at air bleeder pipe and put the opposite end of the hose into coolant of reservoir tank.
3) Install the temporary radiator cap and check for proper connection of all coolant related hoses.
4) Start engine and check for bubbles in reservoir tank.
5) Set heater temperature control lever to max "COOL" position in order to bypass coolant through the transparent hose.
6) Run engine up to 2,300 rpm until bubbles disappear in the transparent hose.

Do not run engine over 2,300 rpm because engine may be damaged due to reduced coolant flow.

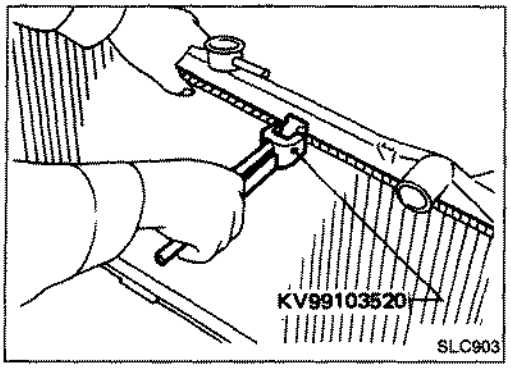
7) After removing bubbles, set heater temperature control lever to max "HOT" position and check for sound of coolant flow.
8) If sound is heard, repeat step 5) through step 7).

15. Stop engine and cool it down.
16. Install a proper radiator cap. (Original radiator cap)
17. Remove the transparent hose and install air bleeder cap.
18. Check any removed parts for secure reinstallation.

Radiator (Aluminum type)

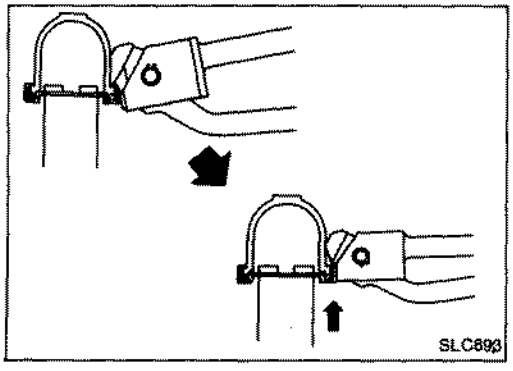


Aluminum radiator can be disassembled by using special procedures and special service tools.



DISASSEMBLY

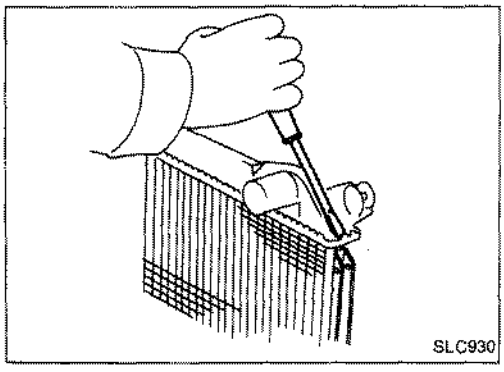
1. Remove tank with Tool.



- Grip the crimped edge and bend it upwards so that Tool slips off.

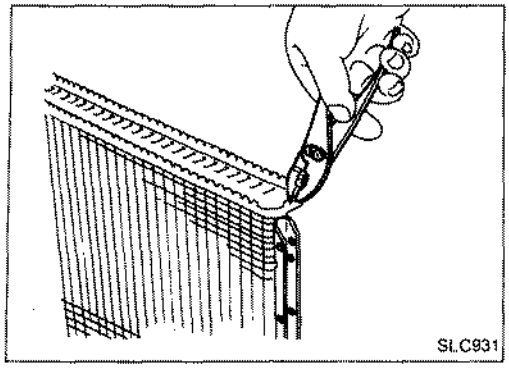
Do not bend excessively.

Radiator (Aluminum type) (Cont'd)

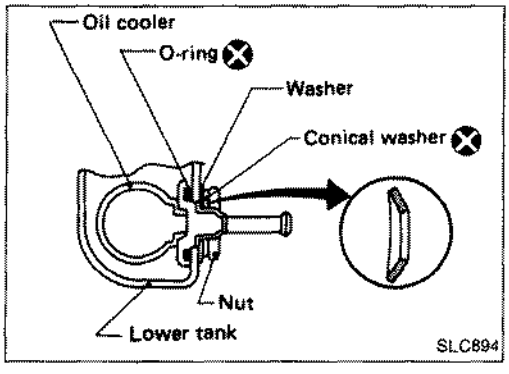


- In areas where Tool cannot be used, use a screwdriver to bend the edge up.

Be careful not to damage tank.



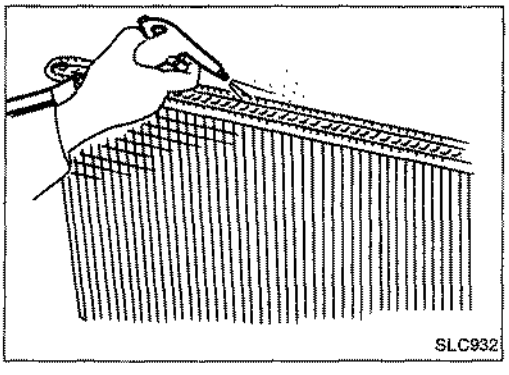
2. Make sure the edge stands straight up.
3. Remove oil cooler from tank. (A/T models only)



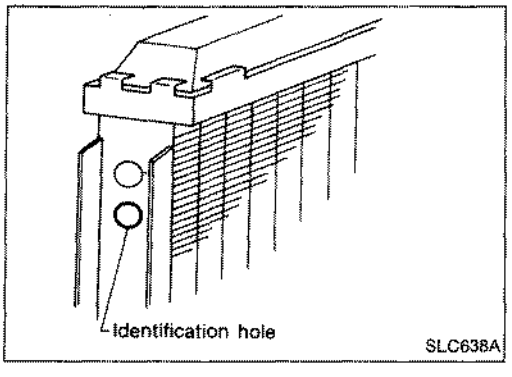
ASSEMBLY

1. Install oil cooler. (A/T models only)

Pay attention to direction of conical washer.



2. Clean contact portion of tank.

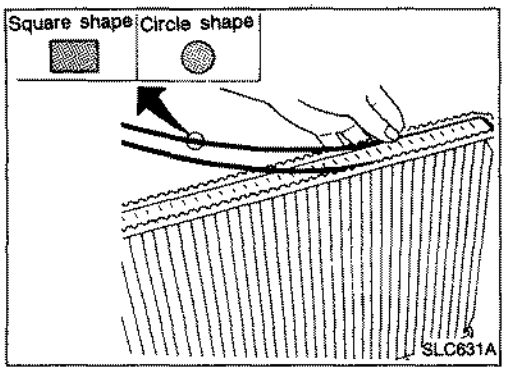


3. Install sealing rubber.

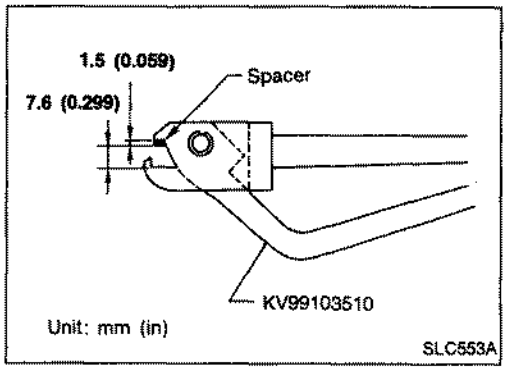
When installing sealing rubber, select the correct one according to the table below.

Identification hole	Applicable sealing rubber
Yes (on the side of radiator core)	Square shaped sealing rubber
No	Circle shaped sealing rubber

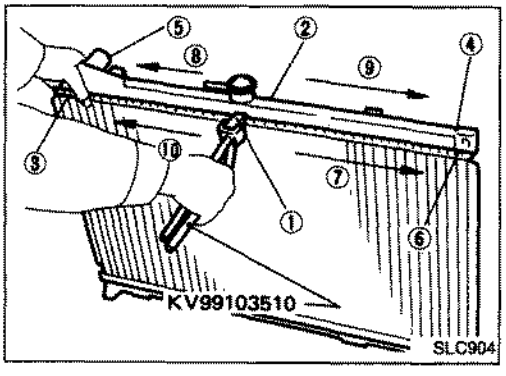
Radiator (Aluminum type) (Cont'd)



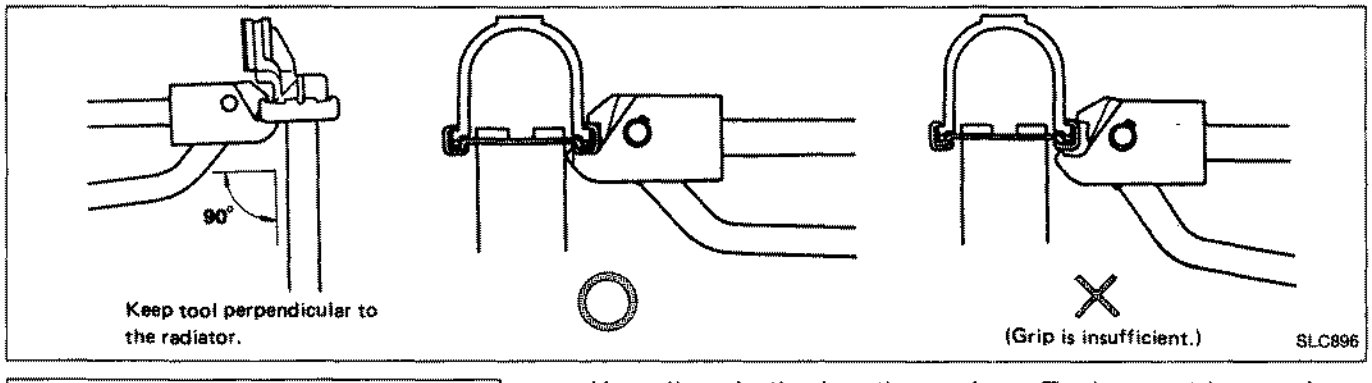
Push it in with fingers.
Be careful not to twist sealing rubber.

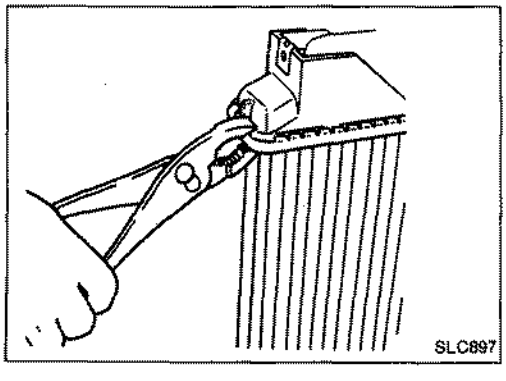


4. Attach a 1.5 mm (0.059 in) thick spacer to the tip of Tool. (Square shaped sealing rubber only)



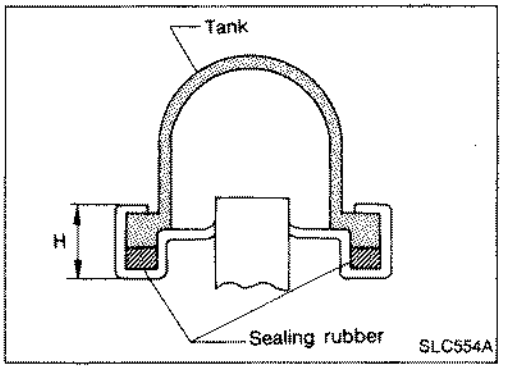
5. Caulk tank in specified sequence with Tool.





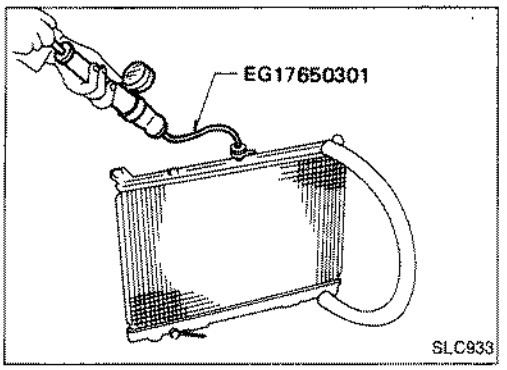
- Use pliers in the locations where Tool cannot be used.

Radiator (Aluminum type) (Cont'd)



6. Make sure that the rim is completely crimped down.
   Standard height "H":
   Square shaped sealing rubber
   8.0 - 8.4 mm (0.315 - 0.331 in)
   Circle shaped sealing rubber
   9.5 - 9.9 mm (0.374 - 0.390 in)
7. Confirm that there is no leakage.

Refer to Inspection.



INSPECTION

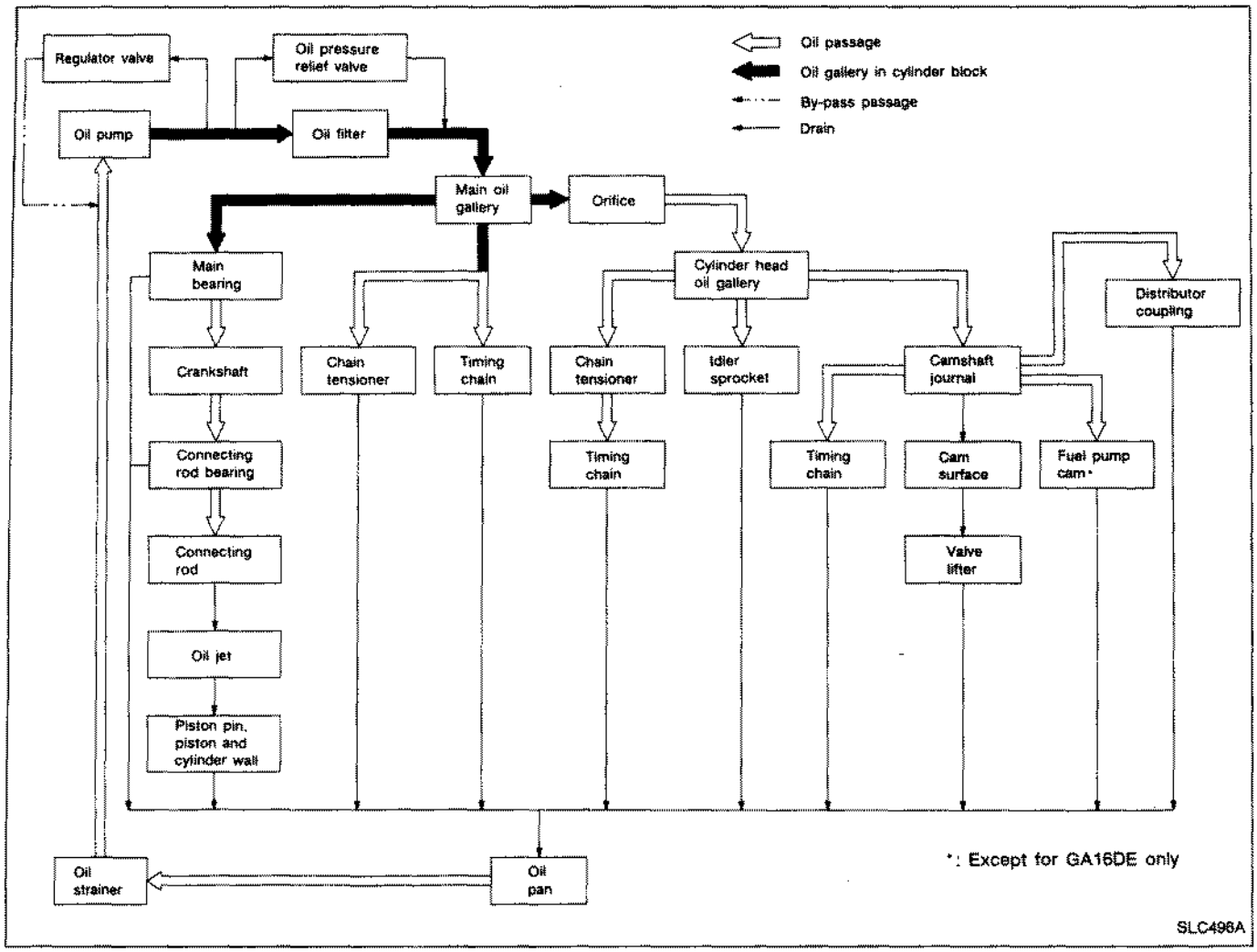
Apply pressure with Tool.

Specified pressure value:
157 kPa (1.57 bar, 1.6 kg/cm^2, 23 psi)

WARNING:

To prevent the risk of the hose coming undone while under pressure, securely fasten it down with a hose clamp.
Attach a hose to the oil cooler as well. (A/T models only)

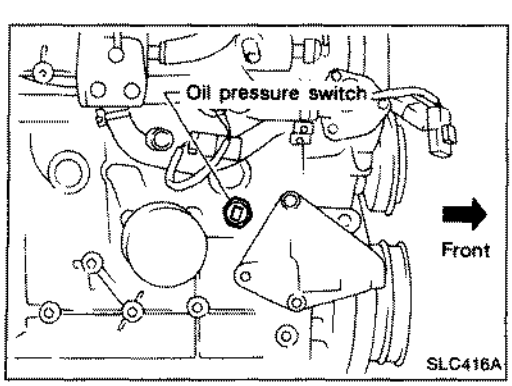
Lubrication Circuit



Oil Pressure Check

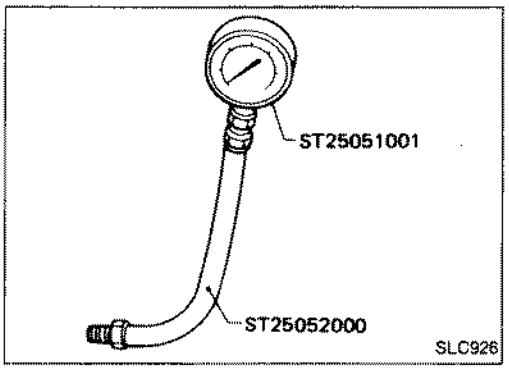
WARNING:

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



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

Oil Pressure Check (Cont'd)



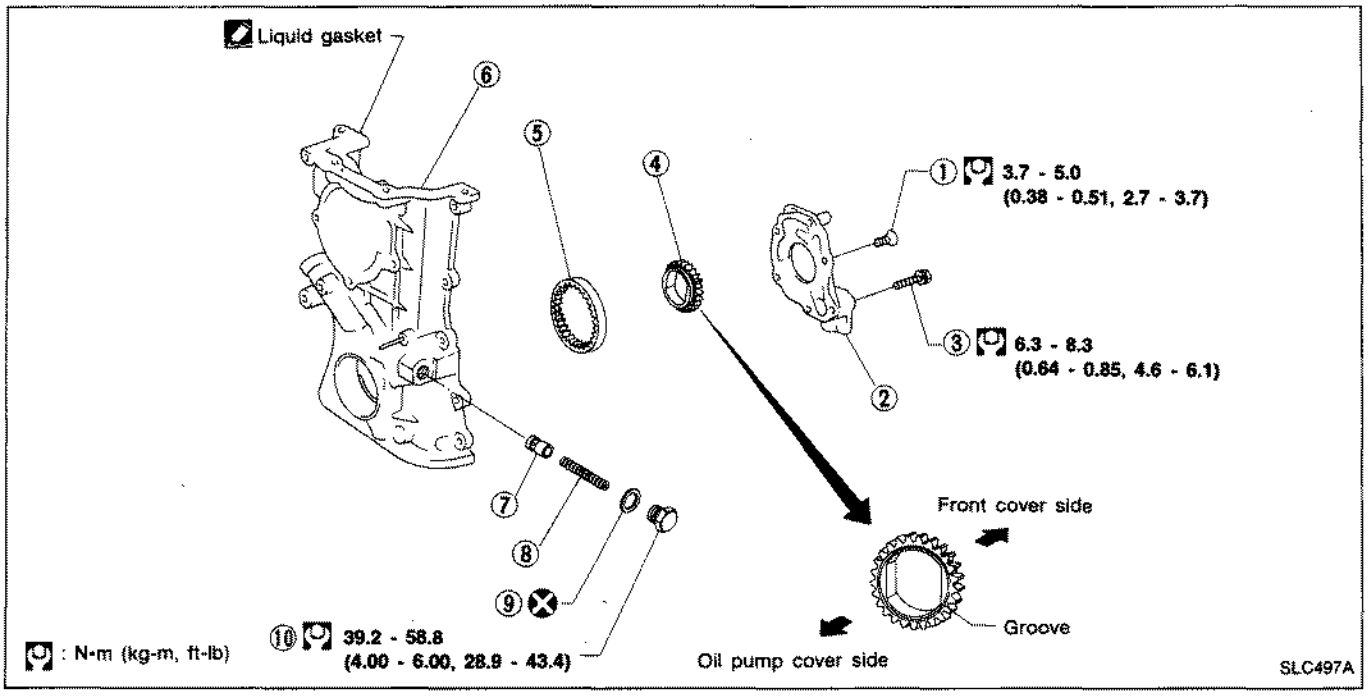
Engine speed rpm	Approximate discharge pressure kPa (bar, kg/cm^2, psi)
Idle speed	49 - 186 (0.49 - 1.86, 0.5 - 1.9, 7 - 27)
3,000	343 - 441 (3.43 - 4.41, 3.5 - 4.5, 50 - 64)

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.

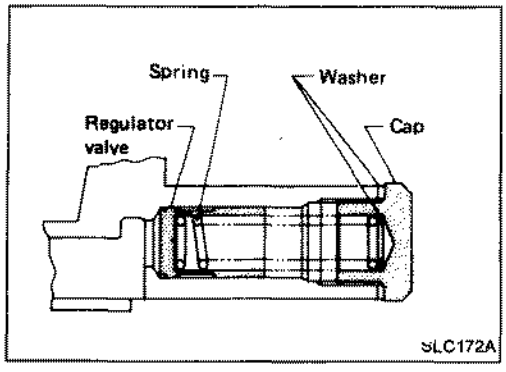
If difference is extreme, check oil passage and oil pump for oil leaks.

6. Install oil pressure switch with sealant.

Oil Pump



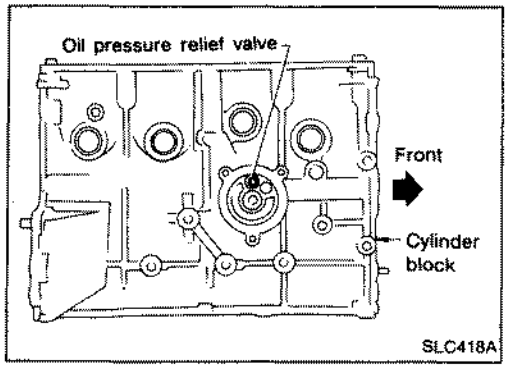
① Screw
② Oil pump cover
③ Bolt
④ Inner gear
⑤ Outer gear
⑥ Front cover
⑦ Regulator valve
⑧ Spring
⑨ Washer
⑩ Plug



REGULATOR VALVE INSPECTION

1. Visually inspect components for wear and damage.
2. Check oil pressure regulator valve sliding surface and valve spring.
3. Apply 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.



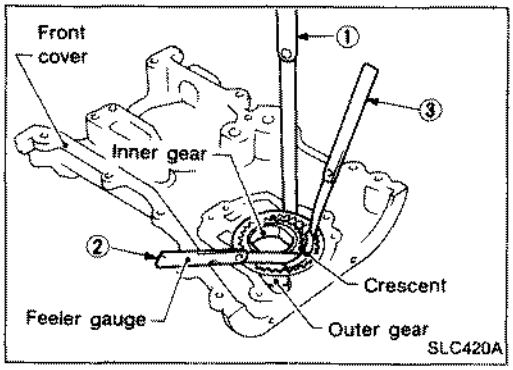
OIL PRESSURE RELIEF VALVE INSPECTION

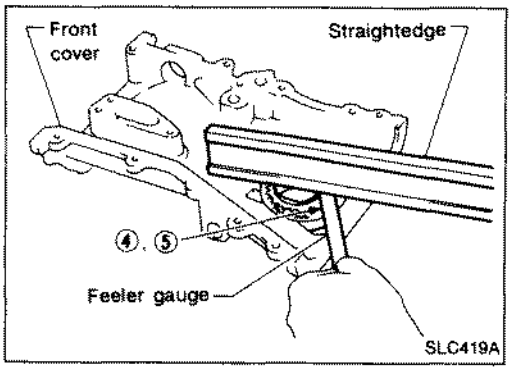
Inspect oil pressure relief valve for movement, cracks and breaks by pushing the ball. If replacement is necessary, remove valve by prying it out with suitable tool.
Install a new valve in place by tapping it.

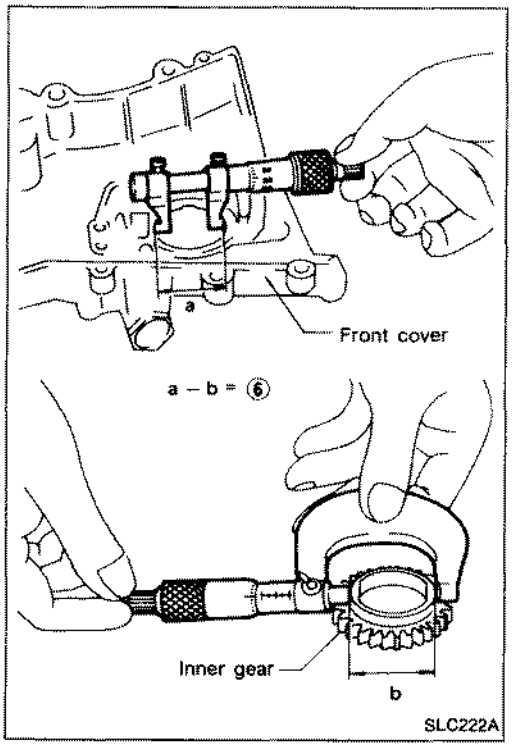
Oil Pump (Cont'd)

DISASSEMBLY AND ASSEMBLY

- **Always replace oil seal with a new one.**
- **When installing oil pump, apply engine oil to gears.**
- **Make sure that O-ring is fitted properly.**







OIL PUMP INSPECTION

Using a feeler gauge, check the following clearance.

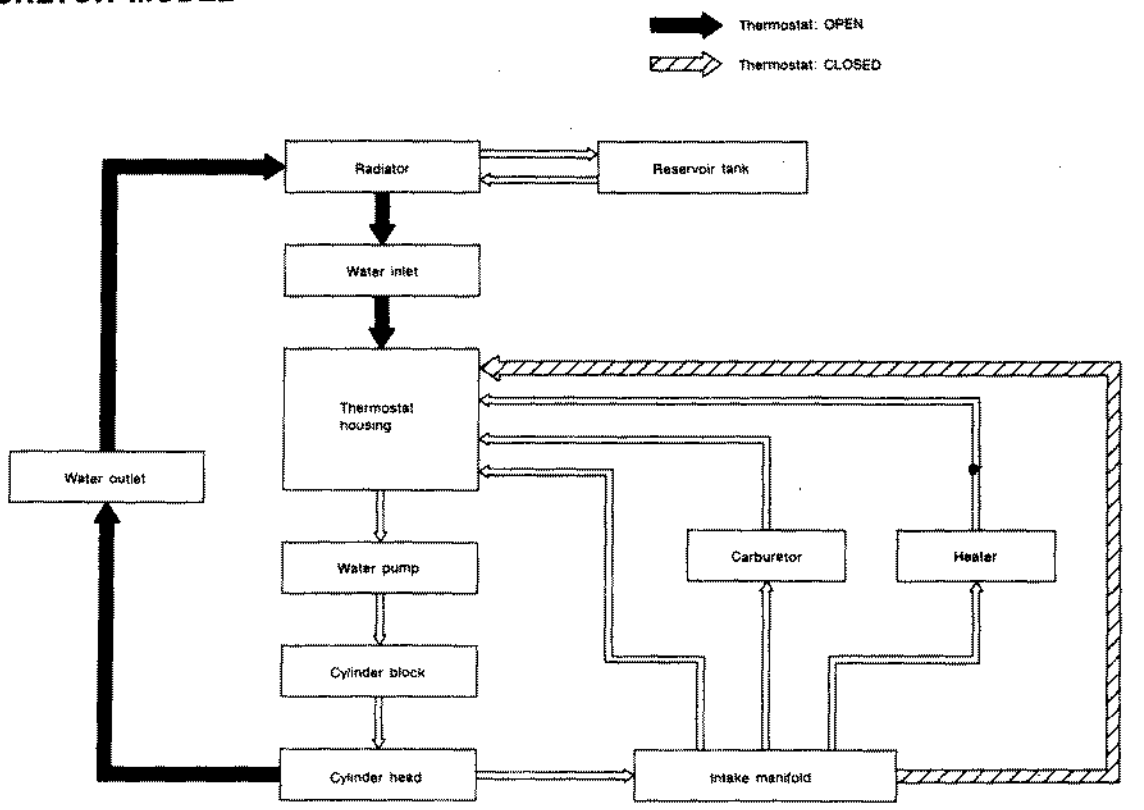
Unit: mm (in)

Body to outer gear clearance ①	0.110 - 0.200 (0.0043 - 0.0079)
Inner gear to crescent clearance ②	0.217 - 0.327 (0.0085 - 0.0129)
Outer gear to crescent clearance ③	0.21 - 0.32 (0.0083 - 0.0126)
Body to inner gear clearance ④	0.05 - 0.09 (0.0020 - 0.0035)
Body to outer gear clearance ⑤	0.05 - 0.11 (0.0020 - 0.0043)
Inner gear to brazed portion of housing clearance ⑥	0.045 - 0.091 (0.0018 - 0.0036)

- **If the tip clearance (②) exceeds the limit, replace gear set.**
- **If body to gear clearances (①, ③, ④, ⑤, ⑥) exceed the limit, replace front cover assembly.**

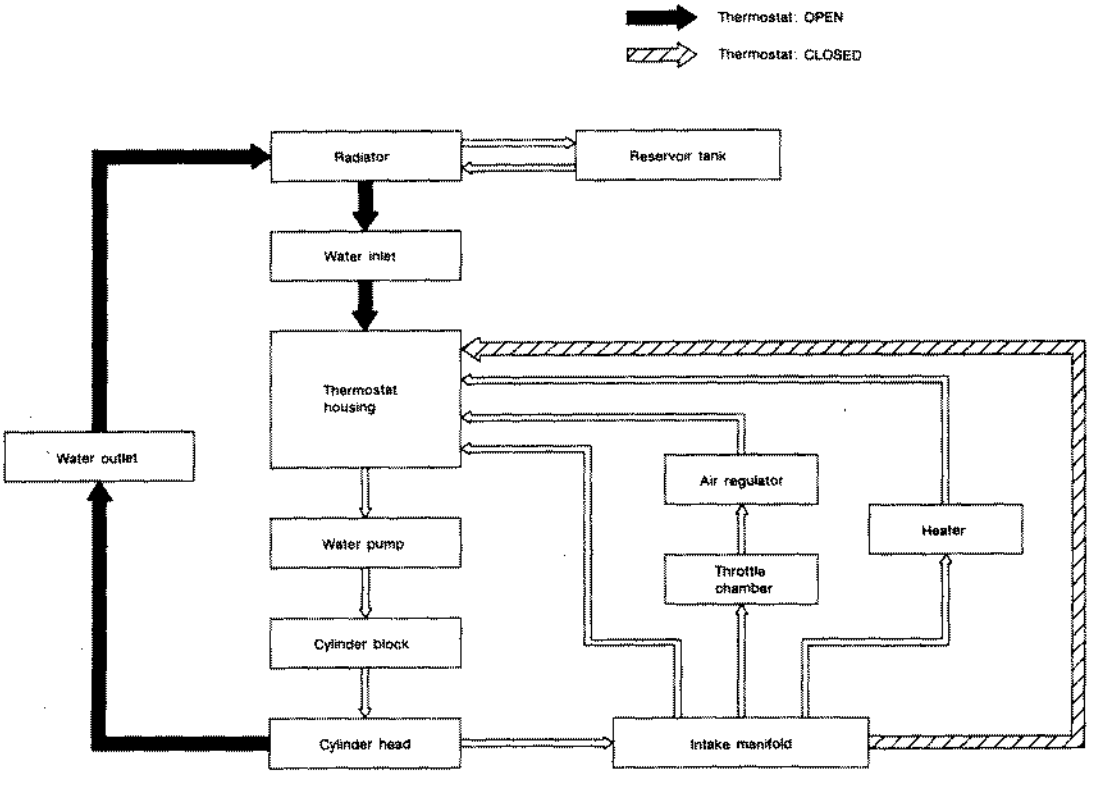
Cooling Circuit

CARBURETOR MODEL



SLC421A

EXCEPT CARBURETOR MODEL



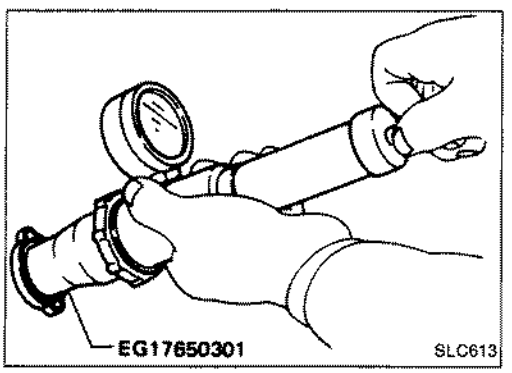
SLC498C

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

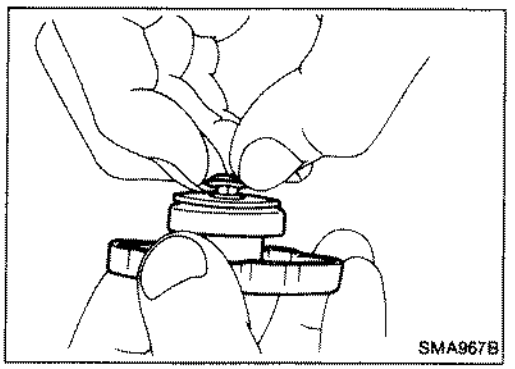
Check hoses for improper attachment, leaks, cracks, damage, loose connections, chafing and deterioration.



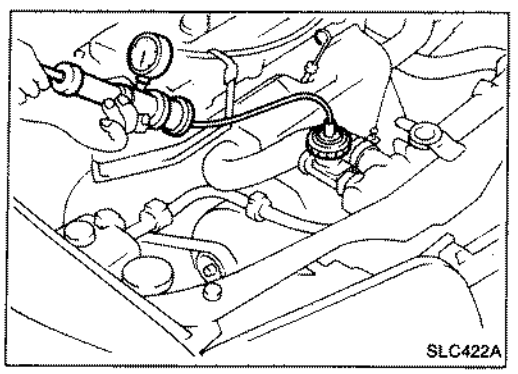
CHECKING RADIATOR CAP

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

Radiator cap relief pressure:
78 - 98 kPa
(0.78 - 0.98 bar, 0.8 - 1.0 kg/cm^2, 11 - 14 psi)



Pull the negative pressure valve to open it. Check that it closes completely when released.



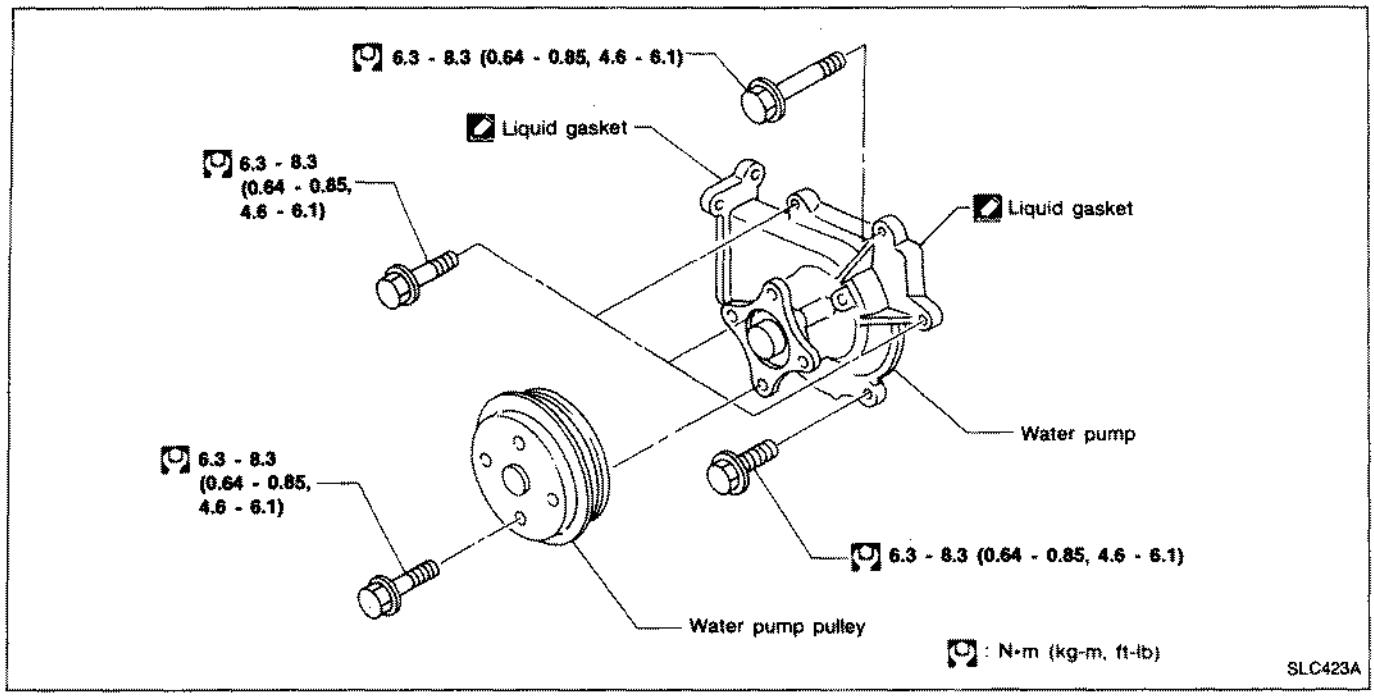
CHECKING COOLING SYSTEM FOR LEAKS

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

Testing pressure:
157 kPa (1.57 bar, 1.6 kg/cm^2, 23 psi)

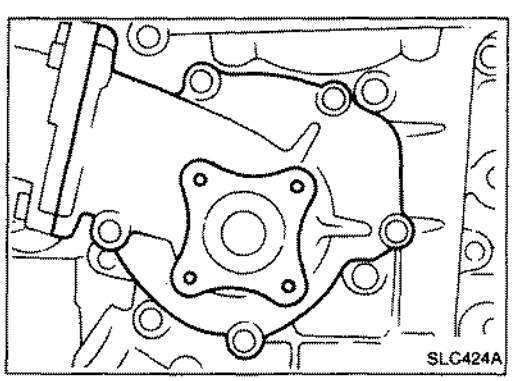
CAUTION:
Higher than the specified pressure may cause radiator damage.

Water Pump



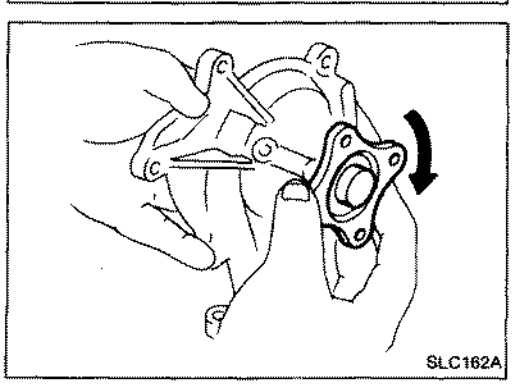
CAUTION:

- **When removing water pump assembly, be careful not to get coolant on timing chain.**
- **Water pump cannot be disassembled and should be replaced as a unit.**
- **After installing water pump, connect hose and clamp securely, then check for leaks using radiator cap tester.**



REMOVAL

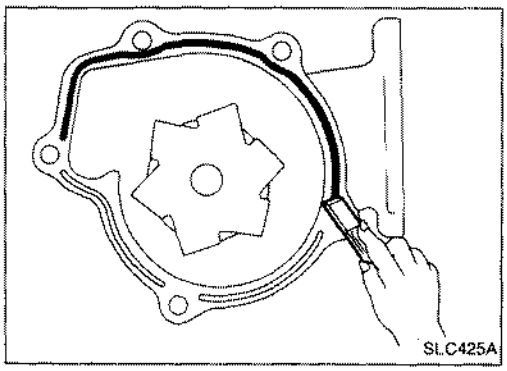
1. Drain coolant from radiator and cylinder block.
2. Remove drive belts for compressor, power steering pump and alternator.
3. Remove water pump pulley.
4. Remove water pump.



INSPECTION

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

Water Pump (Cont'd)

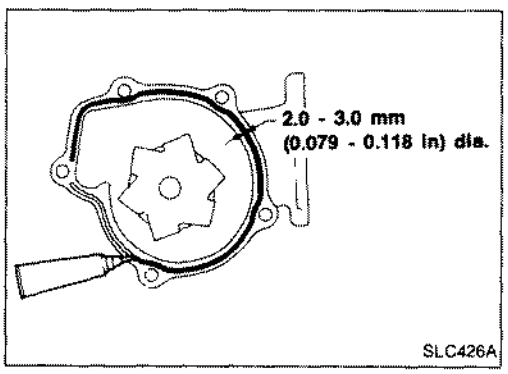


INSTALLATION

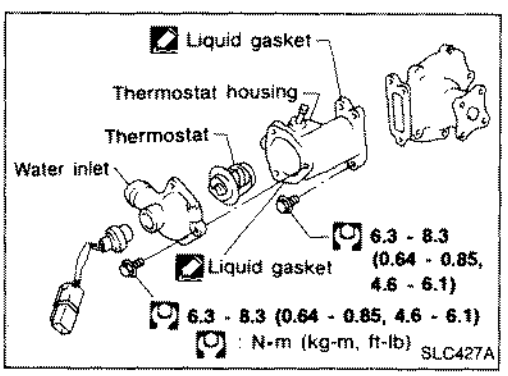
- Before installing water pump, remove liquid gasket from mating surface of water pump using a scraper.

Be sure liquid gasket in grooves is also removed.

- Remove liquid gasket from mating surface of front cover.
- Remove all traces of liquid gasket using white gasoline.



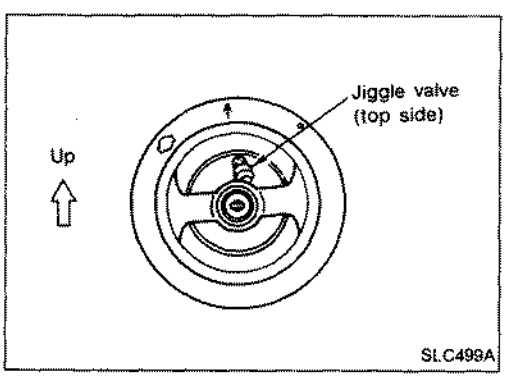
- Apply liquid gasket to mating surface of pump housing as shown.

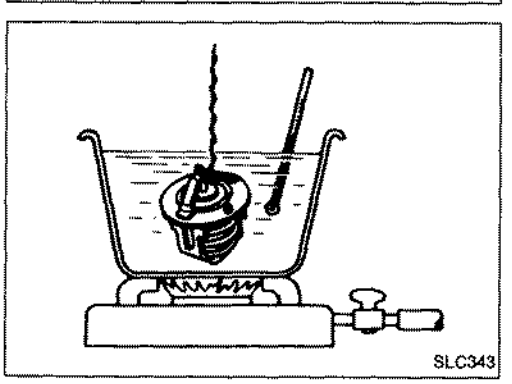


Thermostat

INSPECTION

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





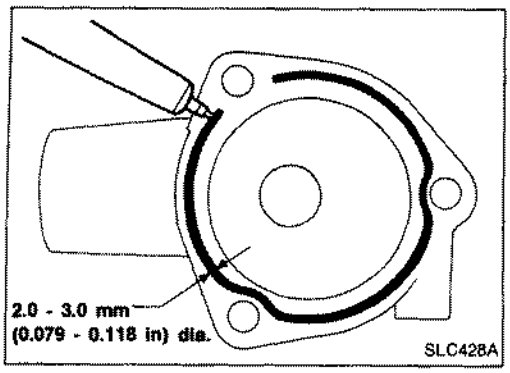
2. Check valve opening temperature and maximum valve lift.

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

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

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

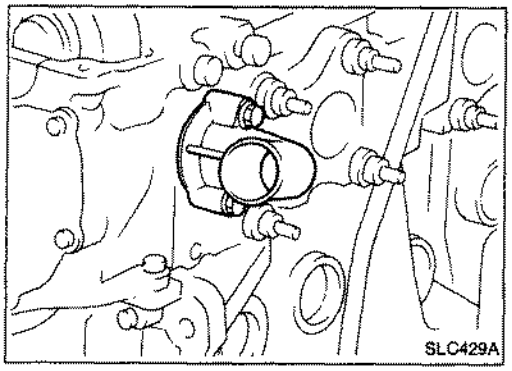
Thermostat (Cont'd)



INSTALLATION

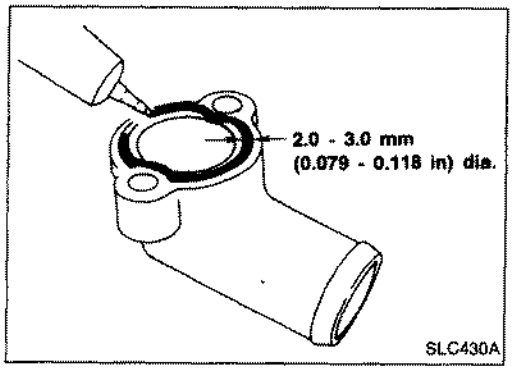
When installing water inlet apply liquid gasket as shown.

Water Outlet



INSPECTION

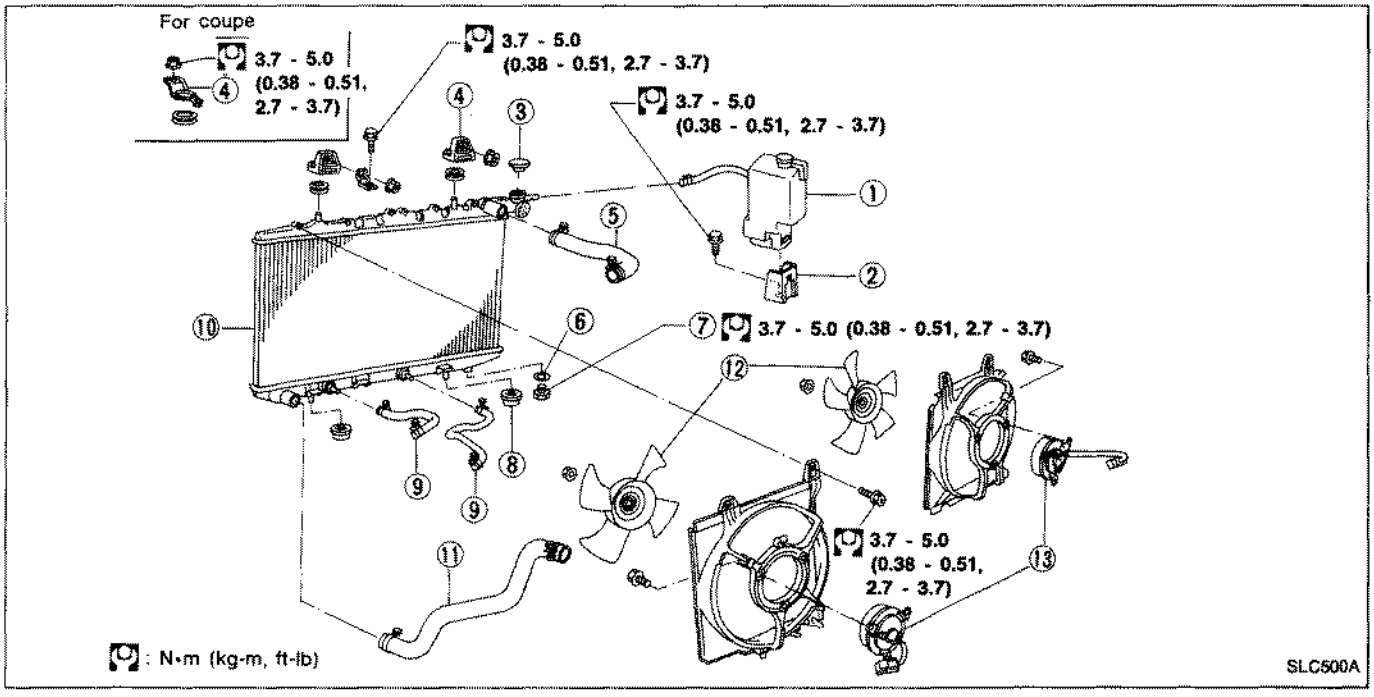
Visually inspect for water leaks. If there is leakage, apply liquid gasket.



INSTALLATION

When installing water outlet, apply liquid gasket as shown.

Radiator

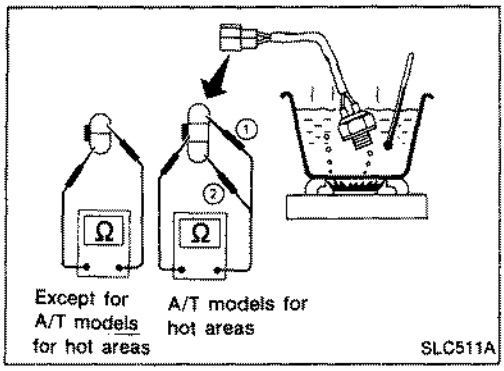


① Reservoir tank
② Reservoir tank bracket
③ Radiator cap
④ Mounting bracket
⑤ Upper hose
⑥ Washer
⑦ Drain plug
⑧ Mounting rubber
⑨ Oil cooler hose (A/T models)
⑩ Radiator
⑪ Lower hose
⑫ Fan
⑬ Fan motor

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

Electrical Cooling Fan

For schematic and wiring diagram of electrical cooling fan, refer to pages LC-21, 22 and 23.



Thermoswitch (GA13DS, GA14DS & GA16DS)

INSPECTION

1. Drain about one liter of coolant.
2. Remove thermoswitch.
3. Check thermoswitch for proper operation.

Operating temperature:

Except for A/T models for hot areas

OFF → ON 82 - 88°C (180 - 190°F)

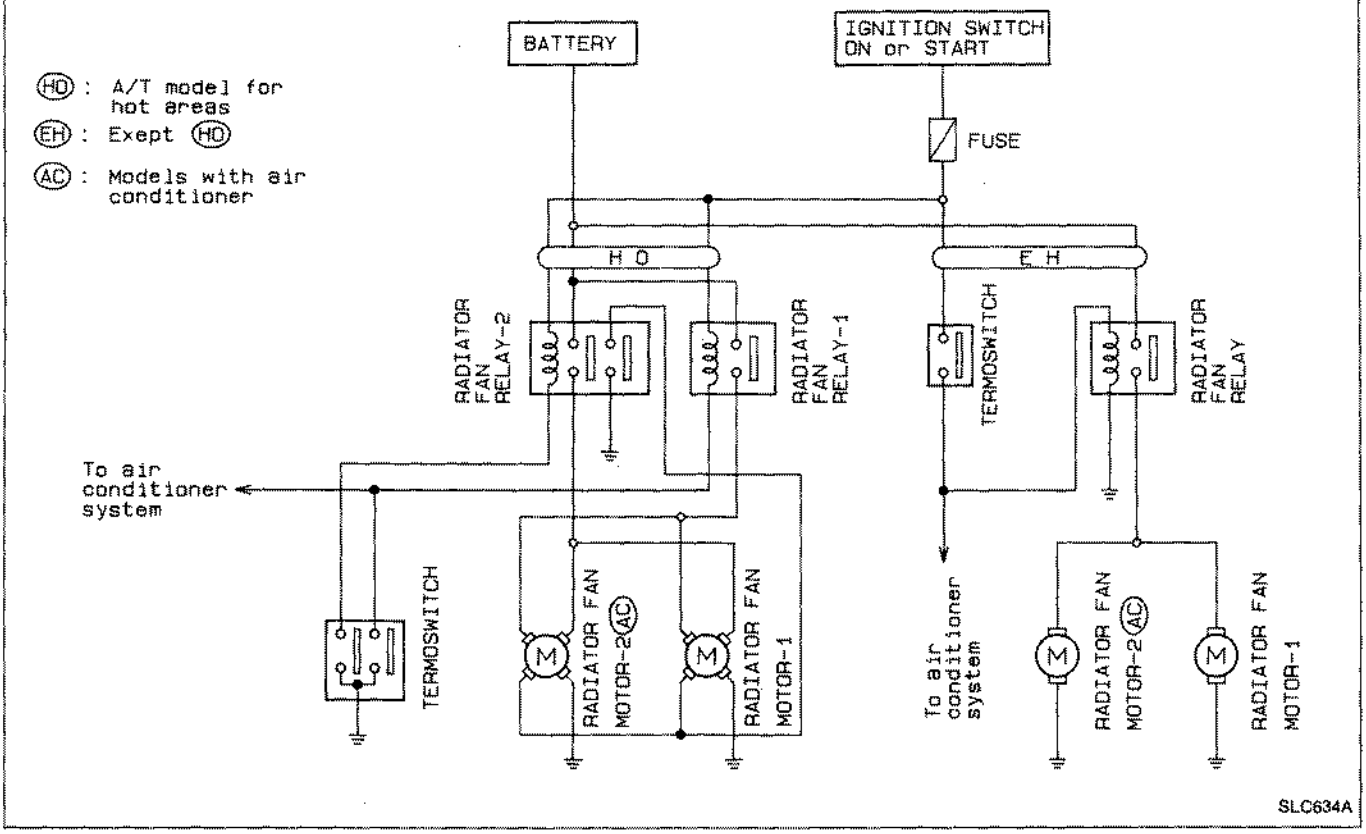
A/T models for hot areas

OFF → ON ① 82 - 88°C (180 - 190°F)

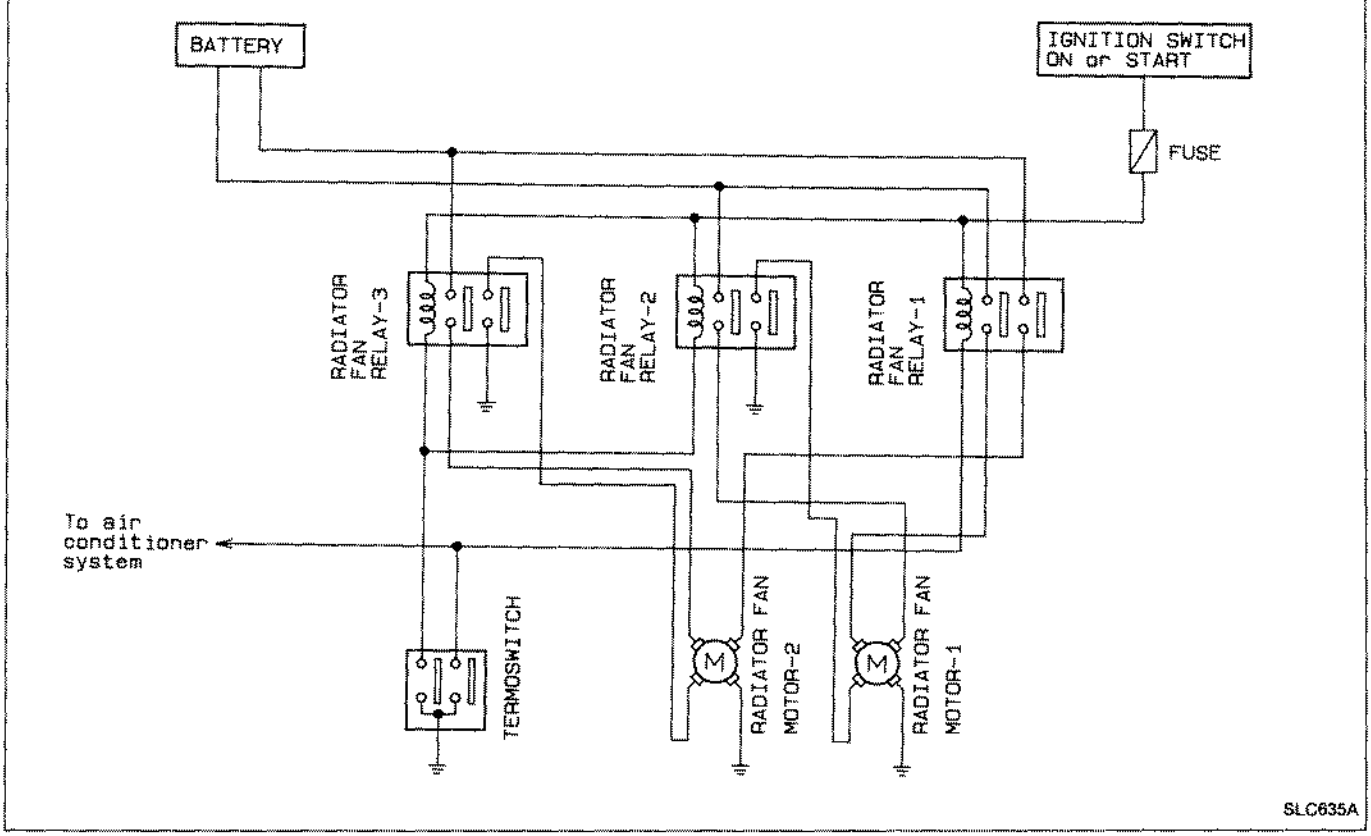
② 102 - 108°C (216 - 226°F)

Schematic

Except A/T model for Middle East

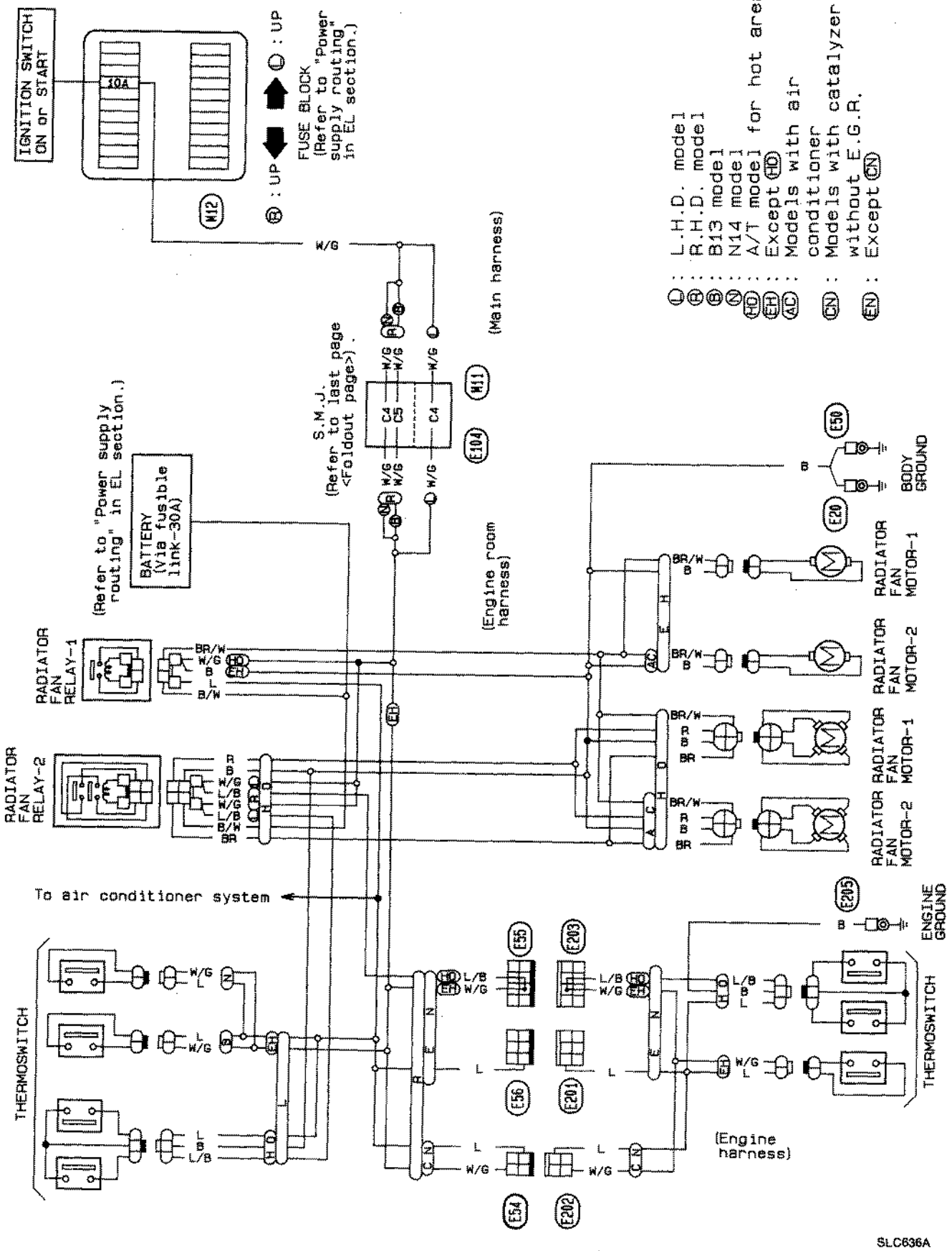


A/T model for Middle East



Wiring Diagram

Except A/T model for Middle East



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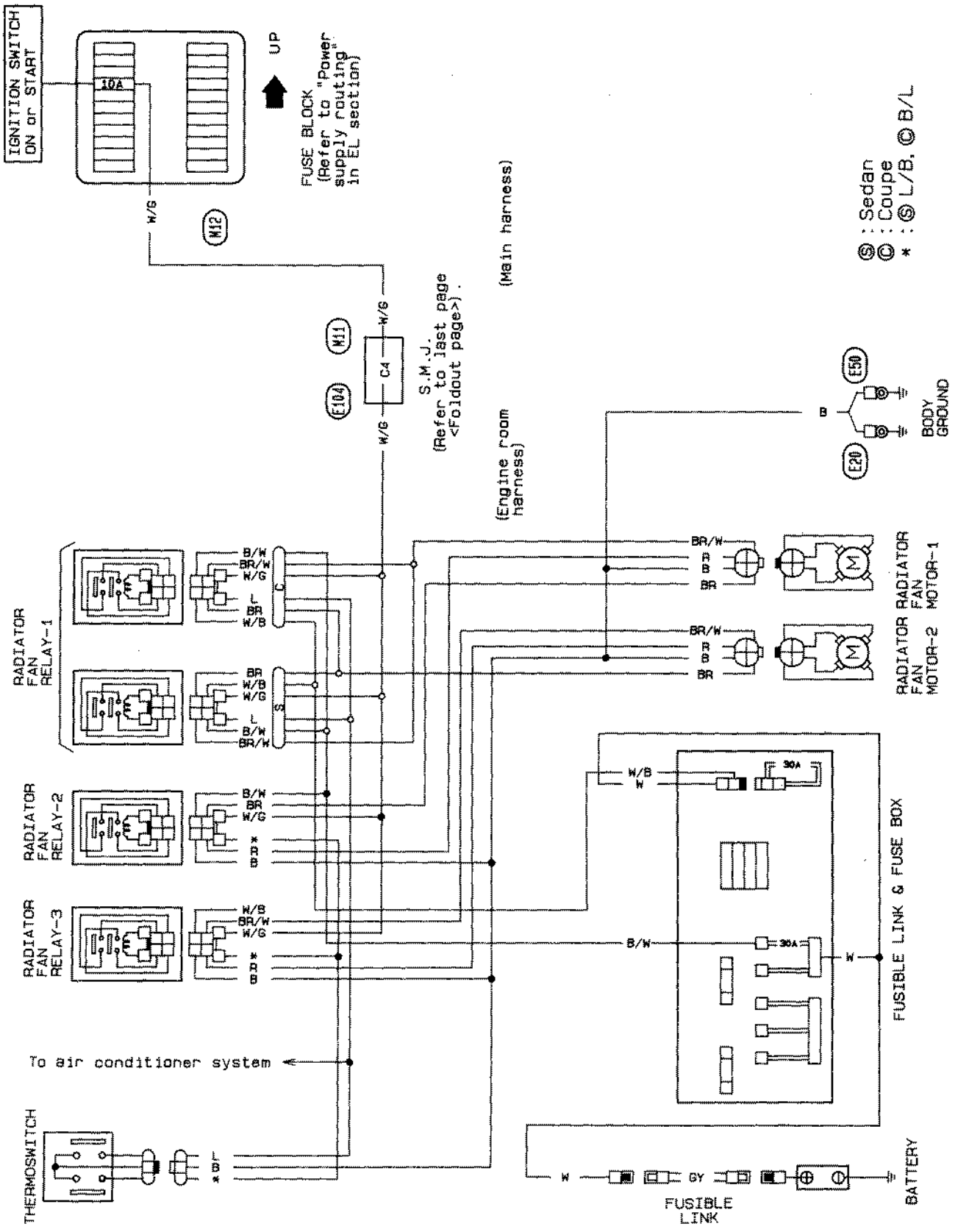
Wiring Diagram (Cont'd)

A/T model for Middle East



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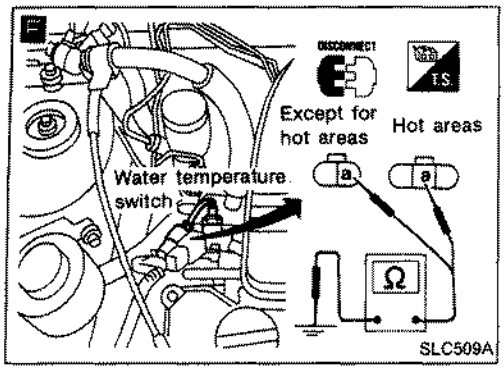
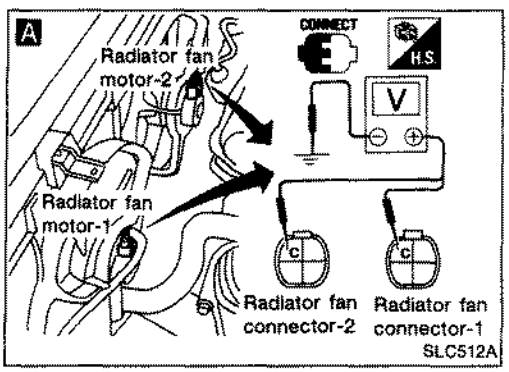
Trouble Diagnoses — Radiator Fan Motor (Cont'd)

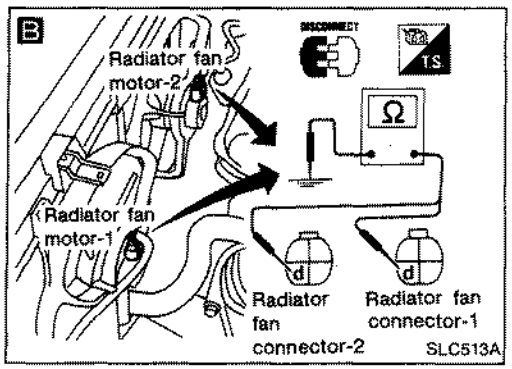


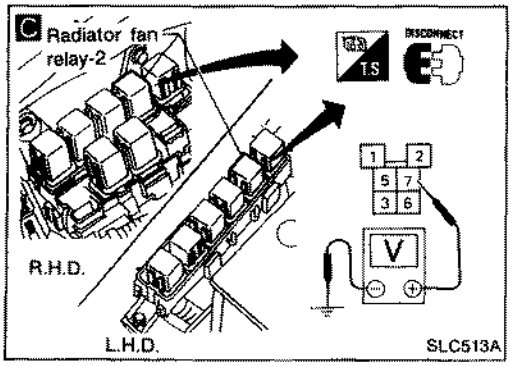
F

1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⑧ and ground.
Continuity should exist.
If N.G., repair harness.

Replace water temperature switch with a new one.







SYMPTOM:
Even though the engine is extremely hot [engine temperature is above 105°C (221°F)], the radiator fan motor does not rotate at a higher speed. (Only for A/T models for hot areas)

This check should be performed after the engine is warmed up sufficiently.

A

CHECK POWER SUPPLY.
1) Turn ignition switch "ON".
2) Check voltage between ⓒ and ground.
Battery voltage should exist.

N.G. →
1) Turn ignition switch "OFF".
2) Disconnect radiator fan relay.
C 3) Check voltage between terminal ⑦ and ground.
Battery voltage should exist.
If N.G., check harness continuity between battery ⊕ terminal and terminal ⑦.

O.K. ↓

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect radiator fan motor harness connector.
3) Check harness continuity between ⓓ and ground.
Continuity should exist.
If N.G., repair harness.

O.K. ↓

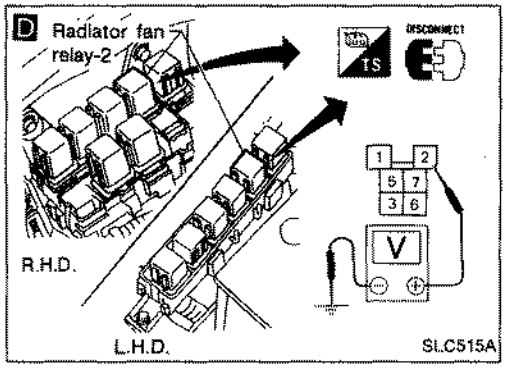
Replace radiator fan motor with a new one.

O.K. ↓

1) Check radiator fan relay. If N.G., replace with a new one.
2) Check harness continuity between radiator fan relay terminal ⑥ and radiator fan motor harness connector terminal ⓒ.
If N.G., repair harness.

O.K. ↓ Ⓐ

Trouble Diagnoses — Radiator Fan Motor (Cont'd)

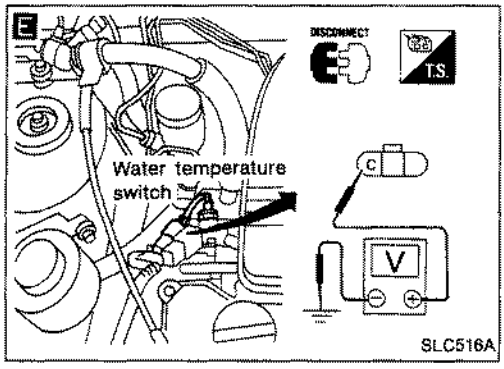


D

(A)

1) Turn ignition switch "ON".
2) Check voltage between terminal ② and ground.
Battery voltage should exist.
If N.G., check the following parts:
- Harness continuity between terminal ② and fuse
- Fuse

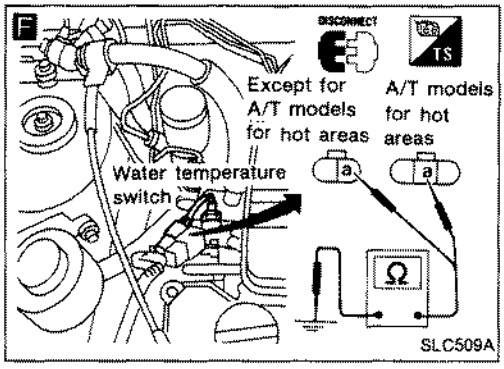
O.K.



1) Connect radiator fan relay.
2) Disconnect water temperature switch harness connector.

E 3) Check voltage between terminal ⓒ and ground.
Battery voltage should exist.
If N.G., check harness between terminal ⓒ and radiator fan relay terminal ①.

O.K.

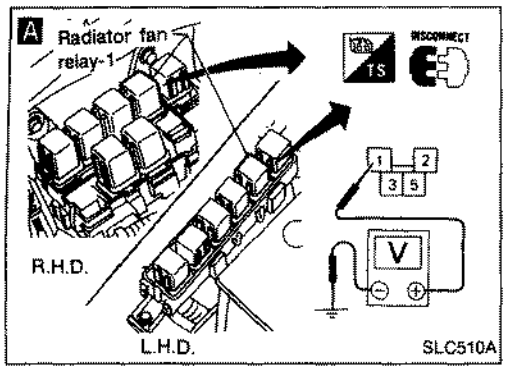


F

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

Replace water temperature switch with a new one.

Trouble Diagnoses — Radiator Fan Motor (Cont'd)



SYMPTOM:
Even though the engine is cold, the radiator fan motor is rotating.

1) Turn ignition switch "ON".
2) Disconnect water temperature switch.
Radiator fan motor should stop.

N.G. →

1) Disconnect radiator relay.
Radiator fan motor should stop.

N.G. → Ⓑ

O.K. ↓

Replace water temperature switch with a new one.

O.K. ↓

Replace radiator fan relay with a new one.

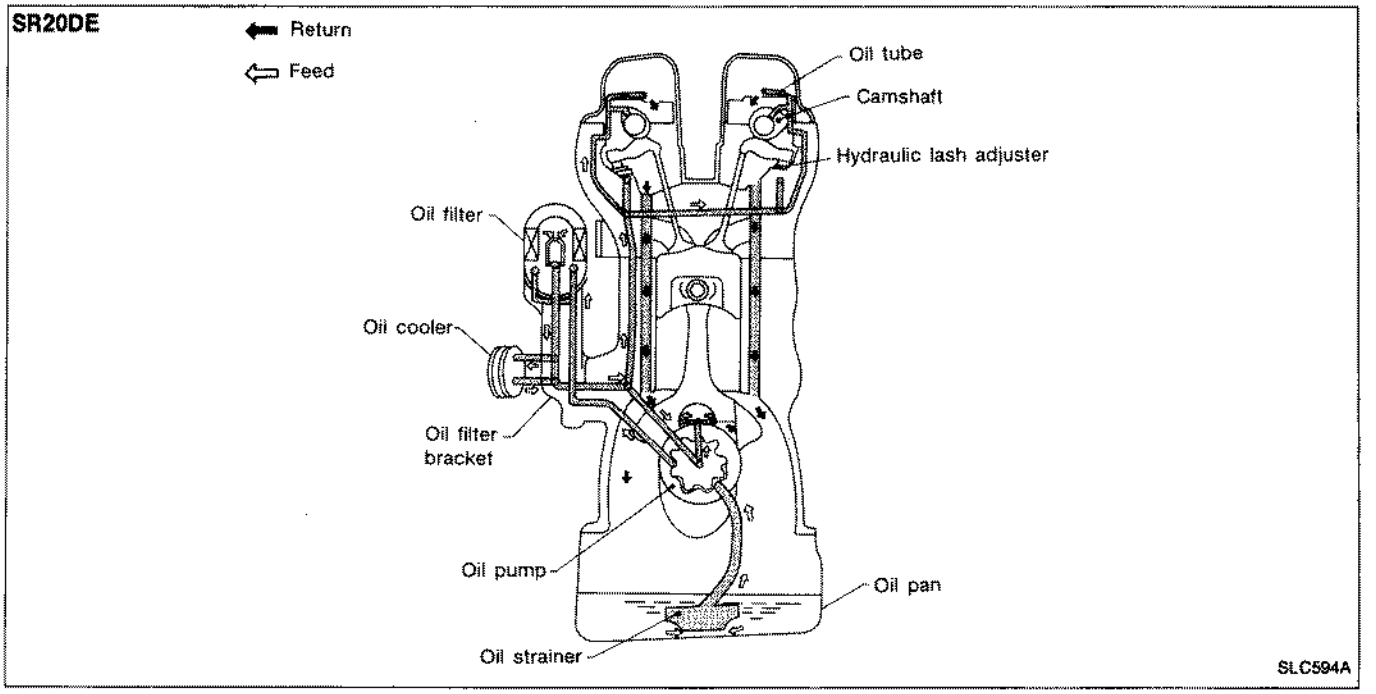
Ⓑ →

A

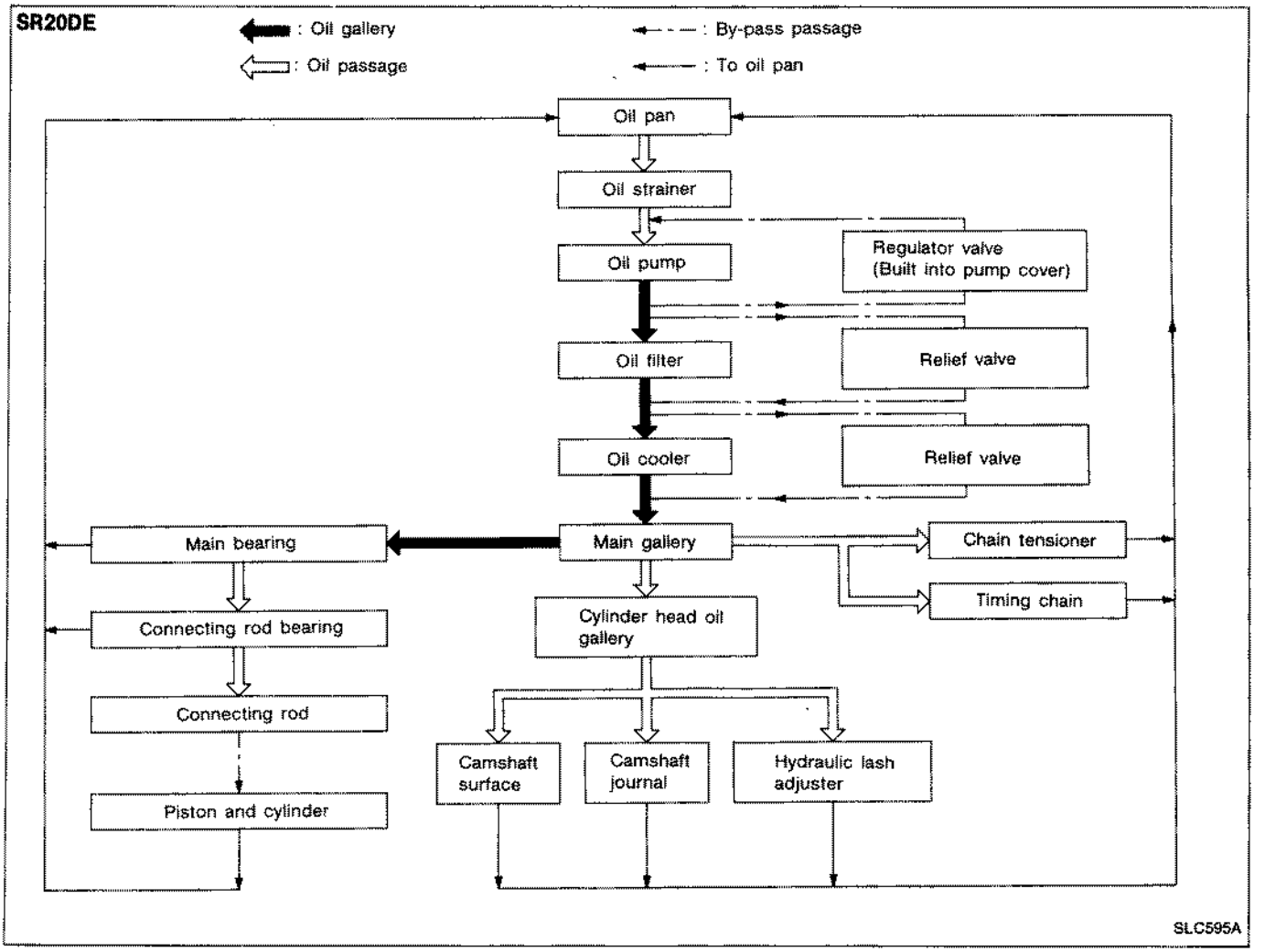
1) Check voltage between terminal ⑤ and ground.
No voltage should exist.
If N.G., check harness between terminal ⑤ and radiator fan motor harness connector terminal ⓑ for shorting.

Lubrication Circuit

SR20DE

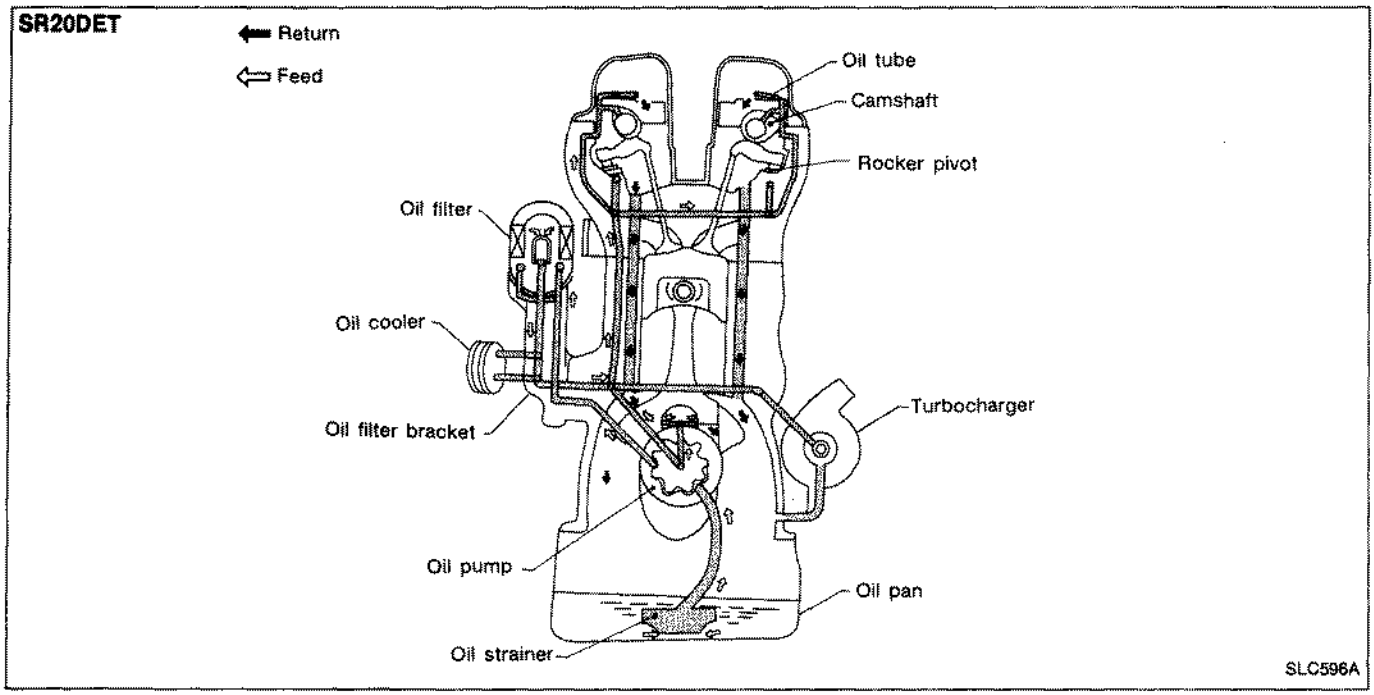


SR20DE

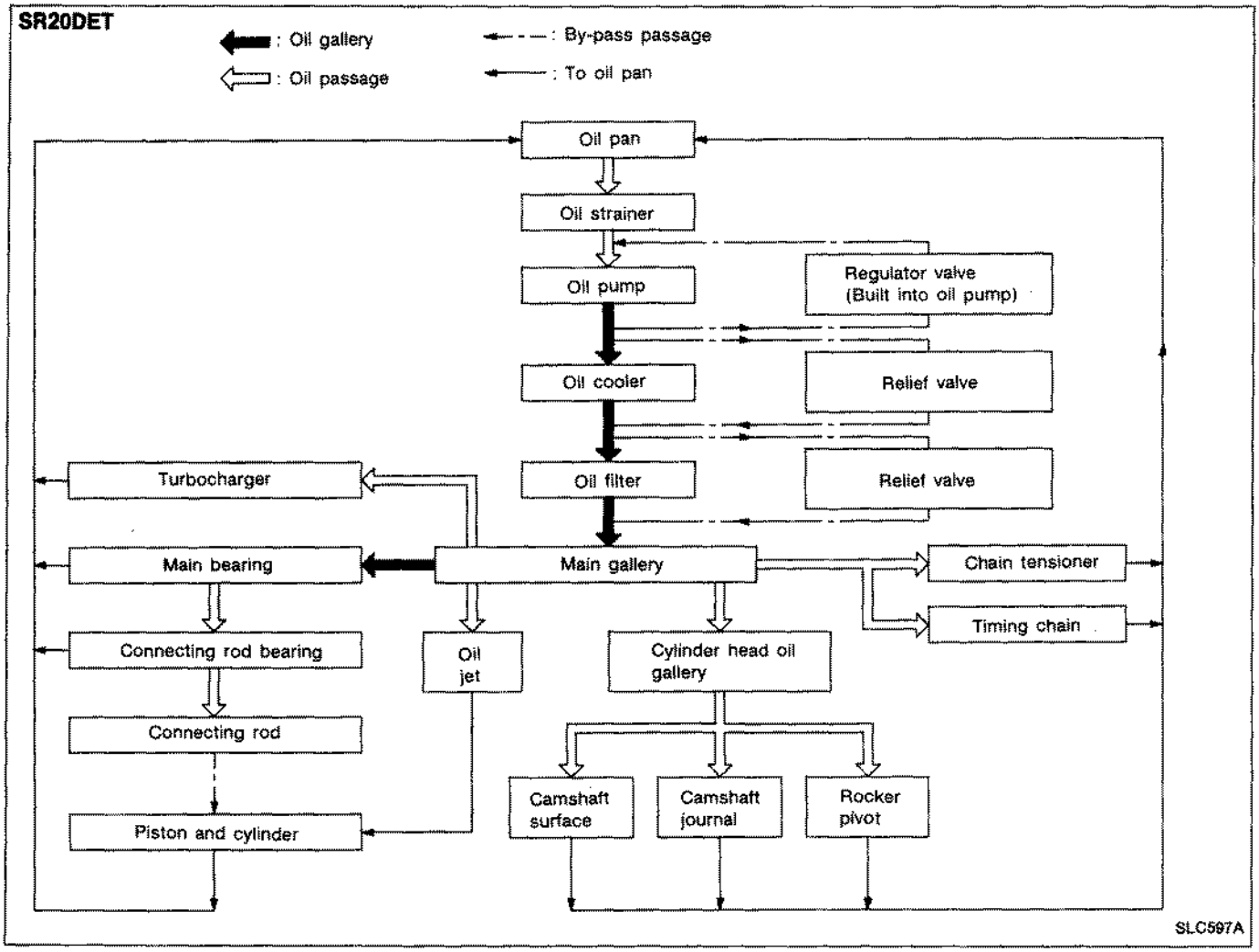


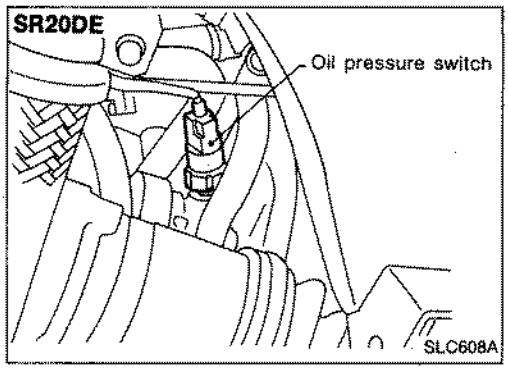
Lubrication Circuit (Cont'd)

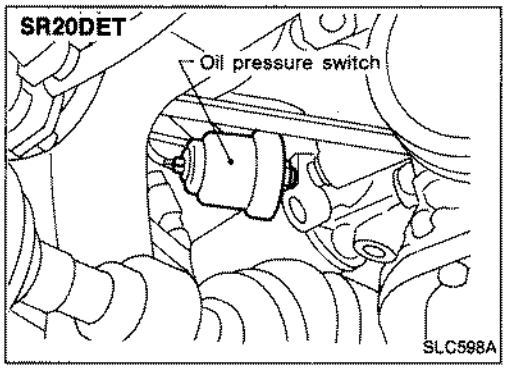
SR20DET

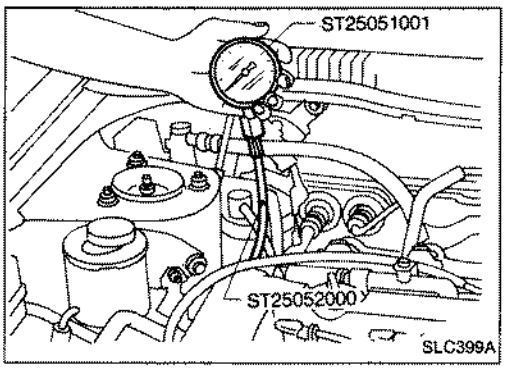


SR20DET









Oil Pressure Check

WARNING:

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

1. Check oil level.
2. Remove oil pressure switch.
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 (bar, kg/cm^2, psi)
Idle speed	SR20DE: More than 98 (0.98, 1.0, 14) SR20DET: More than 98 (0.98, 1.0, 14)
3,200	SR20DE: 324 - 422 (3.24 - 4.22, 3.3 - 4.3, 47 - 61) SR20DET: 343 - 441 (3.43 - 4.41, 3.5 - 4.5, 50 - 64)

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

6. Install oil pressure switch with sealant.

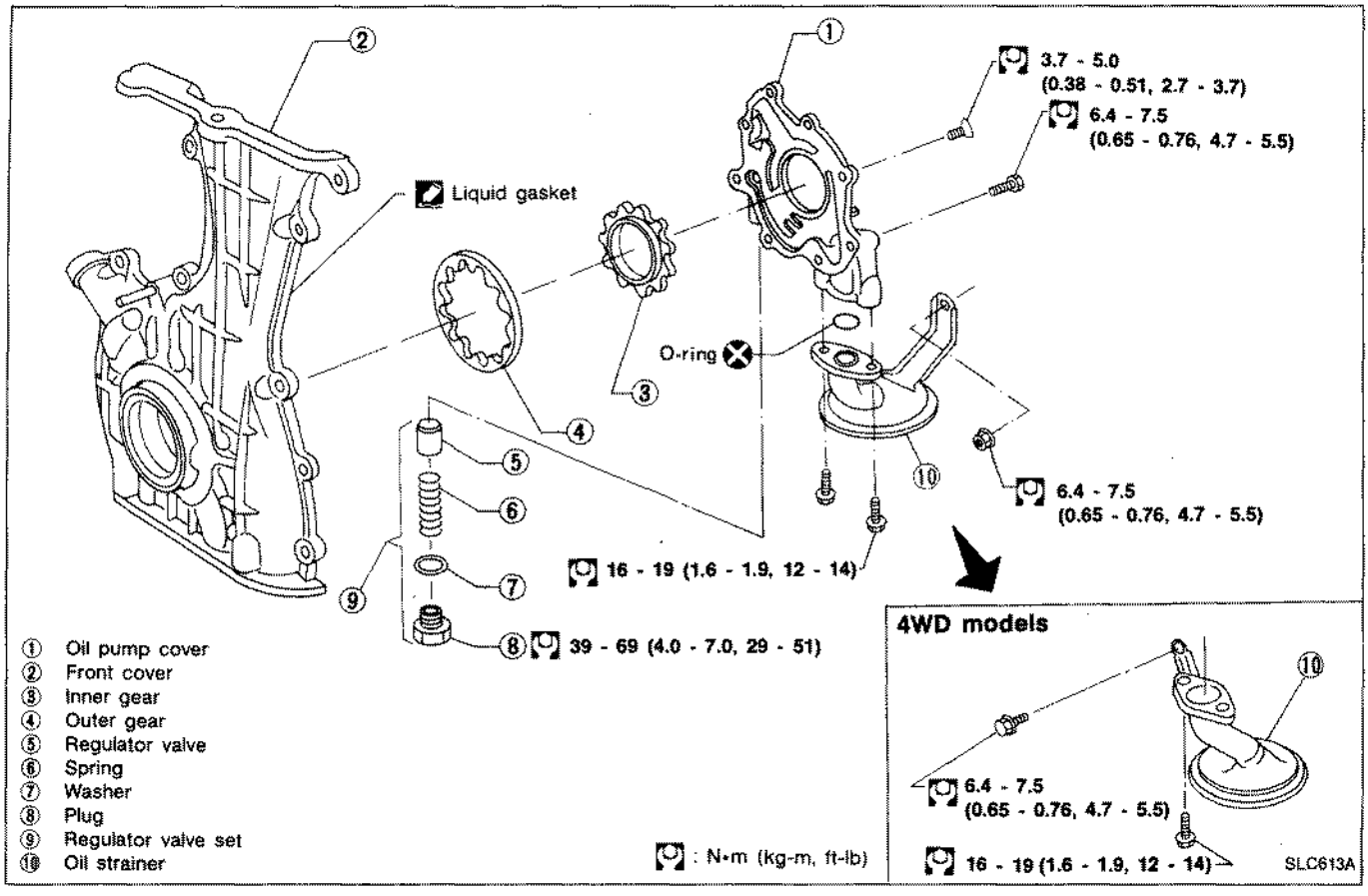
Oil Pump

REMOVAL

1. Remove drive belts.
2. Remove cylinder head. (Refer to EM section.)
3. Remove oil pans. (Refer to EM section.)
4. Remove oil strainer and baffle plate.
5. Remove front cover assembly.

Oil Pump (Cont'd)

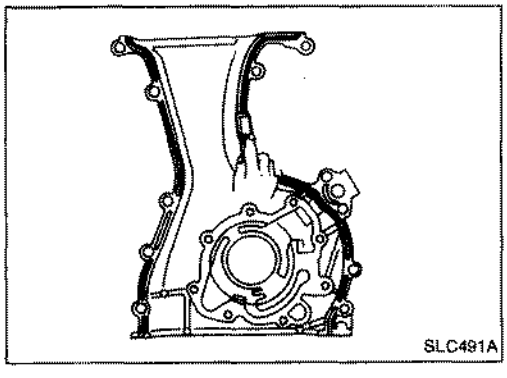
DISASSEMBLY AND ASSEMBLY



① Oil pump cover
② Front cover
③ Inner gear
④ Outer gear
⑤ Regulator valve
⑥ Spring
⑦ Washer
⑧ Plug
⑨ Regulator valve set
⑩ Oil strainer

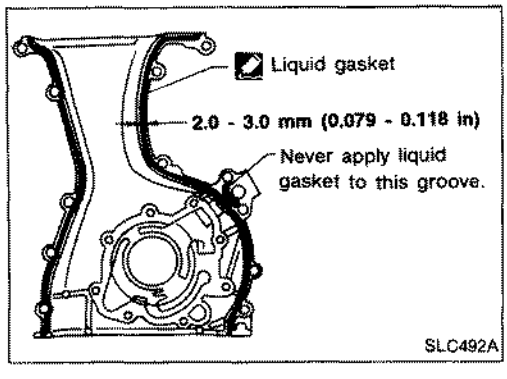
: N·m (kg-m, ft-lb)

- **Always replace oil seal and O-ring with new ones.**
- **When installing oil pump, apply engine oil to inner and outer gear.**
- **Be sure that O-rings are properly fitted.**



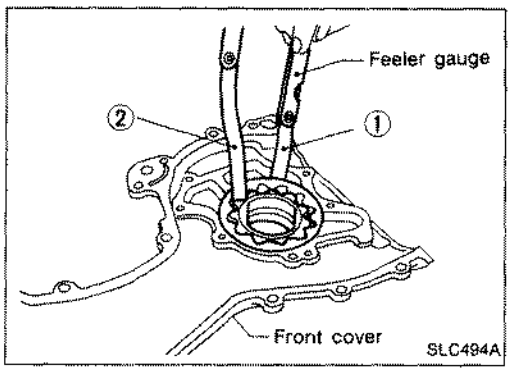
INSTALLATION

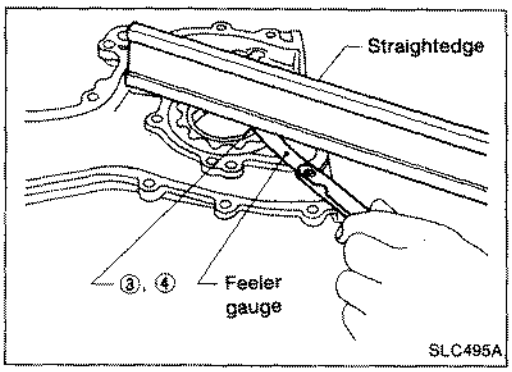
- Before installing front cover assembly, remove all traces of liquid gasket from mating surface using a scraper.
- Also remove traces of liquid gasket from mating surface of cylinder block.

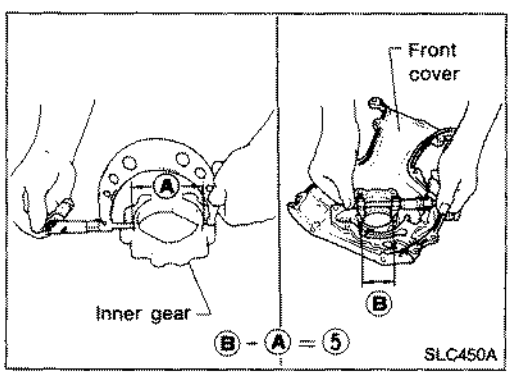


1. Apply a continuous bead of liquid gasket to mating surface of front cover assembly.
   - Use Genuine Liquid Gasket or equivalent.
2. Installation is in reverse order of removal.

Oil Pump (Cont'd)







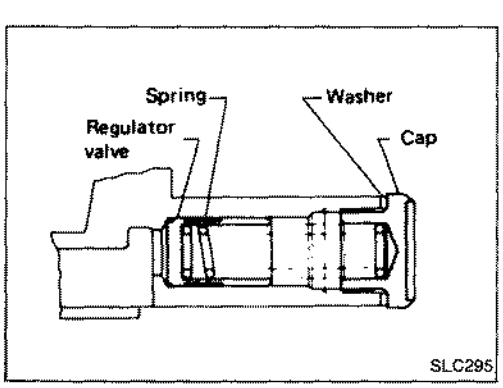
INSPECTION

Using a feeler gauge, check the following clearances:

Unit: mm (in)

Body to outer gear clearance ①	0.114 - 0.200 (0.0045 - 0.0079)
Inner gear to outer gear tip clearance ②	Below 0.18 (0.0071)
Body to inner gear clearance ③	0.05 - 0.09 (0.0020 - 0.0035)
Body to outer gear clearance ④	0.05 - 0.11 (0.0020 - 0.0043)
Inner gear to brazed portion of housing clearance ⑤	0.045 - 0.091 (0.0018 - 0.0036)

- **If the tip clearance (②) exceeds the limit, replace gear set.**
- **If body to gear clearances (①, ③, ④, ⑤) exceed the limit, replace front cover assembly.**

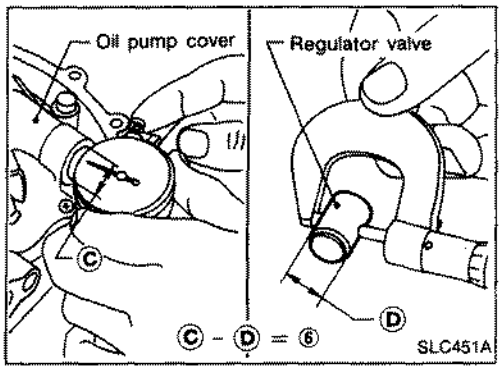


REGULATOR VALVE INSPECTION

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 front cover assembly.

Oil Pump (Cont'd)

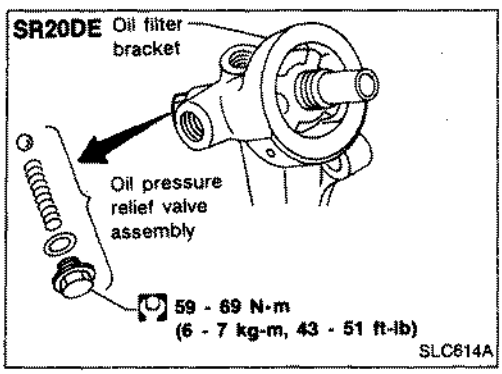


4. Check regulator valve to oil pump cover clearance.

Clearance:

⑥ : 0.040 - 0.097 mm (0.0016 - 0.0038 in)

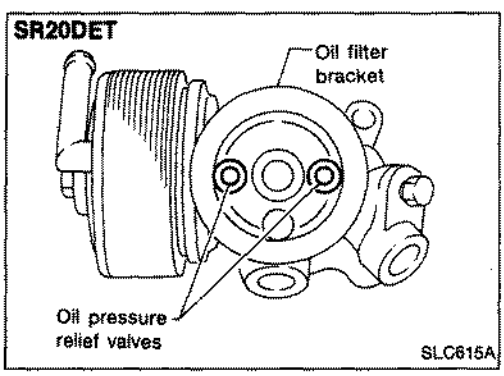
If it exceeds the limit, replace oil pump cover.



OIL PRESSURE RELIEF VALVE INSPECTION

(SR20DE)

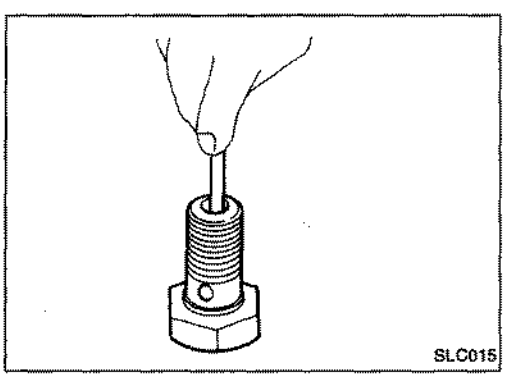
Inspect oil pressure relief valve for movement, cracks and breaks. If damaged, replace oil filter bracket assembly.



(SR20DET)

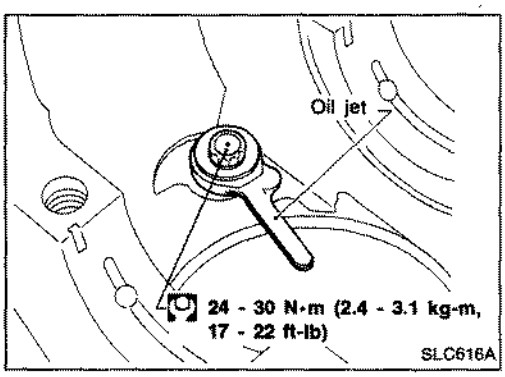
Inspect oil pressure relief valves for movement, cracks and breaks by pushing the ball, If replacement is necessary, remove valve by prying it out with a suitable tool. Install a new valve in place by tapping it.

Oil Jet (For piston)



INSPECTION

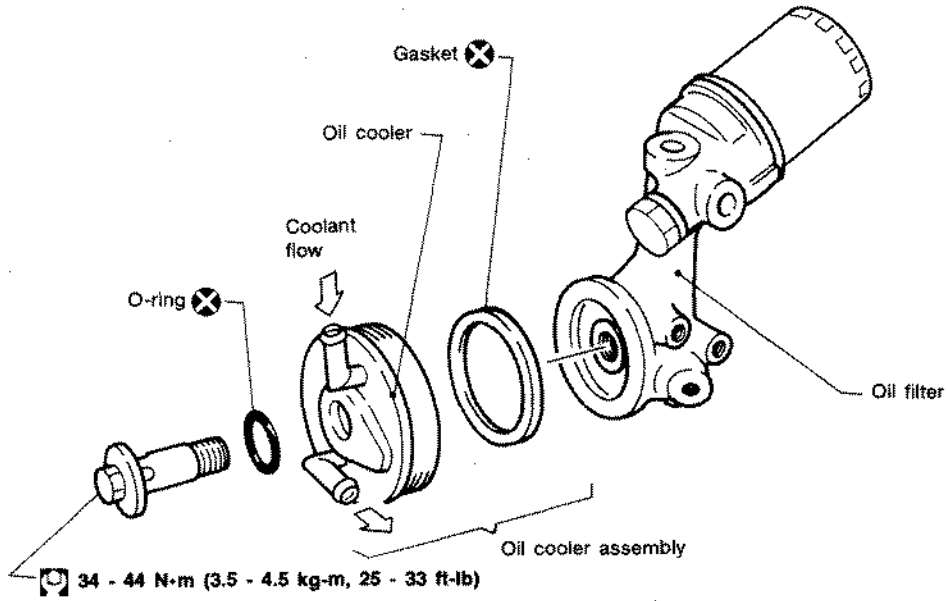
1. Blow through outlet of oil jet and make sure that air comes out of inlet.
2. Push cut-off valve of oil jet bolt with a clean resin or brass rod and make sure that cut-off valve moves smoothly with proper repulsion.



When installing oil jet, align oil jet's boss with hole on cylinder block.

Oil Cooler

SR20DE



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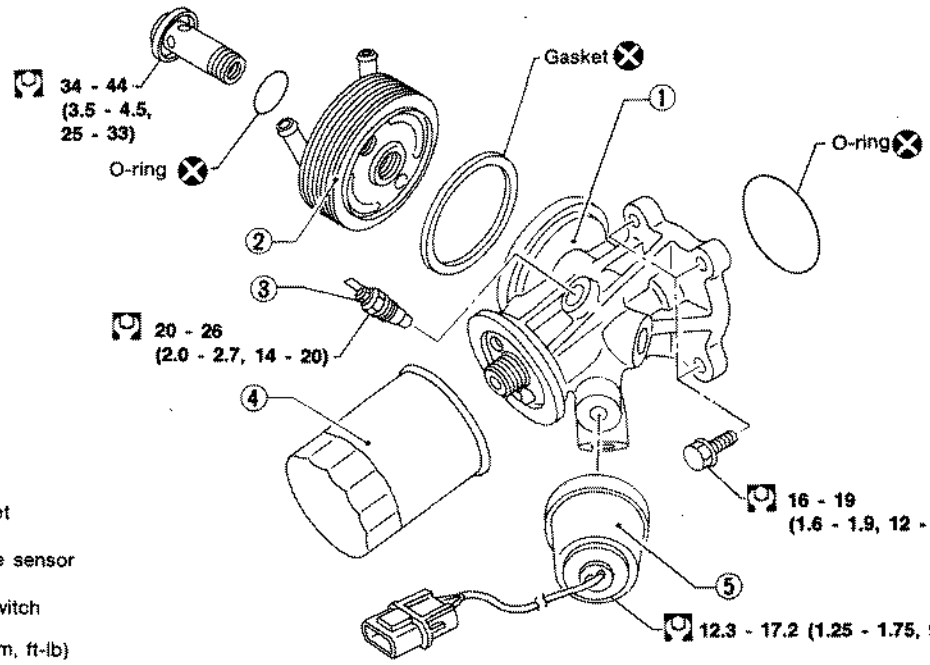
SR20DET



SLC612A

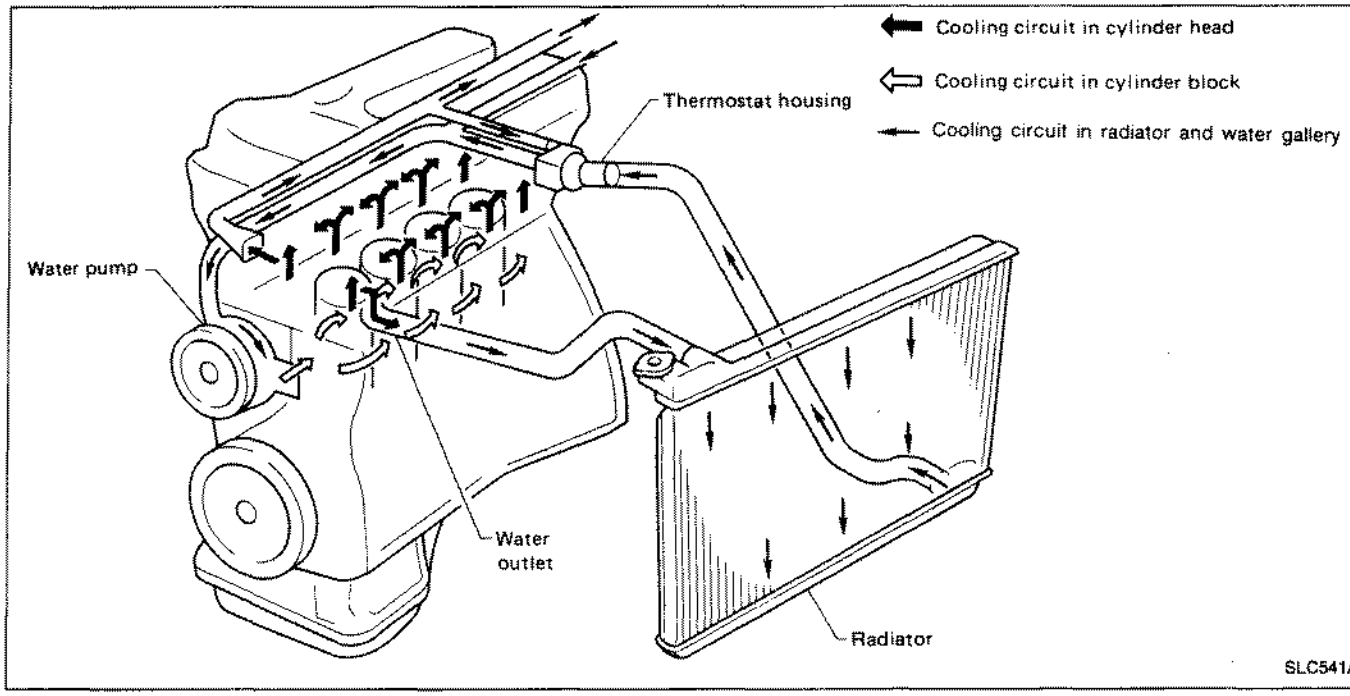
REMOVAL AND INSTALLATION

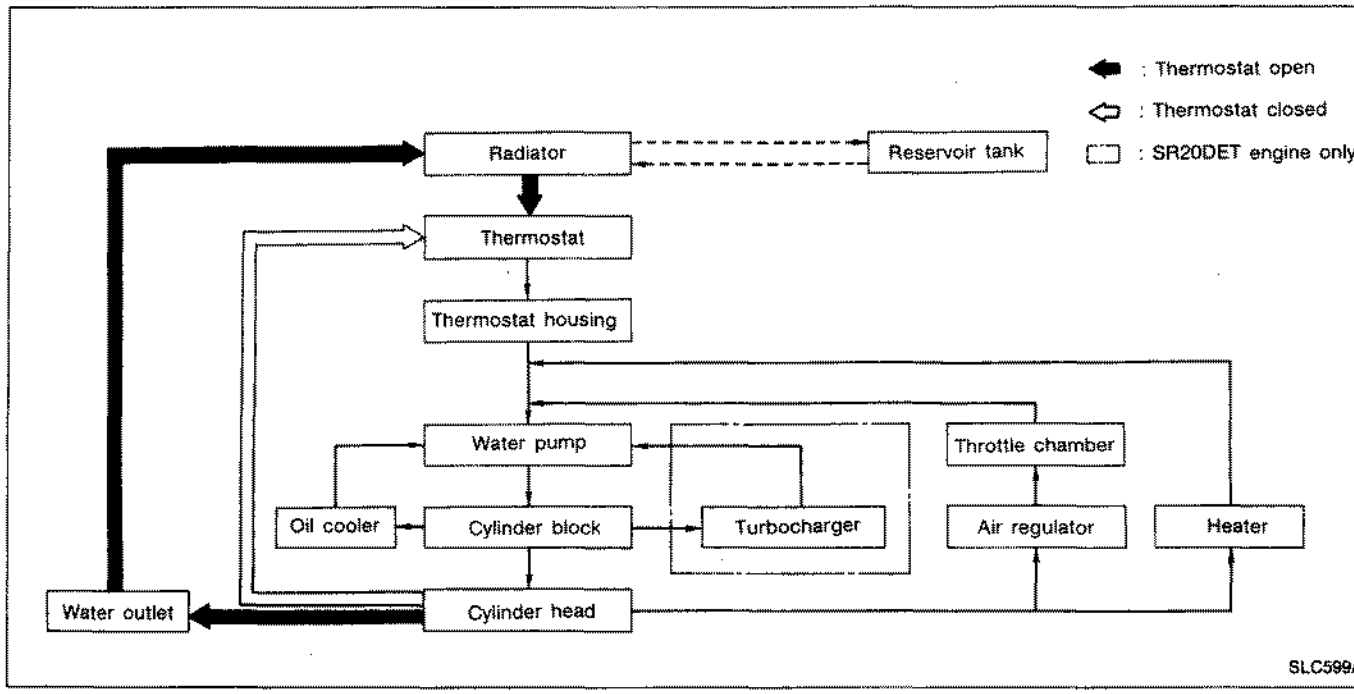
1. Drain engine oil and coolant.
2. Remove oil cooler.
3. Installation is in reverse order of removal.

INSPECTION

1. Check oil cooler for cracks.
2. Check oil cooler for clogging by blowing through coolant inlet.
   If necessary, replace oil cooler assembly.

Cooling Circuit





System Check

WARNING:

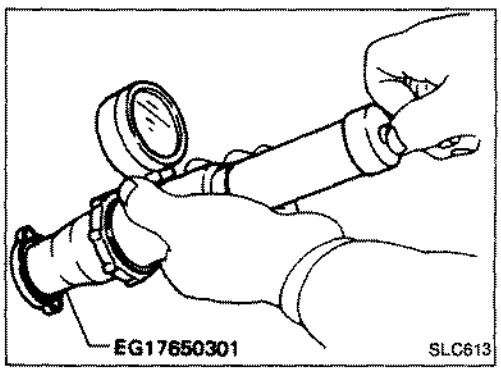
Never remove the radiator cap when the engine is hot; serious burns could be caused by high pressure fluid escaping from the radiator.

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

Cooling System Inspection

CHECKING HOSES

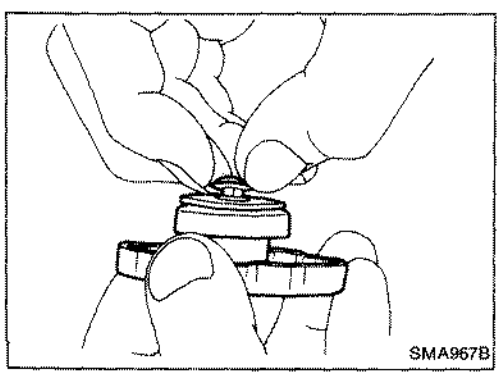
Check water hoses for proper attachment, leaks, cracks, damage, loose connections, chafing and deterioration.



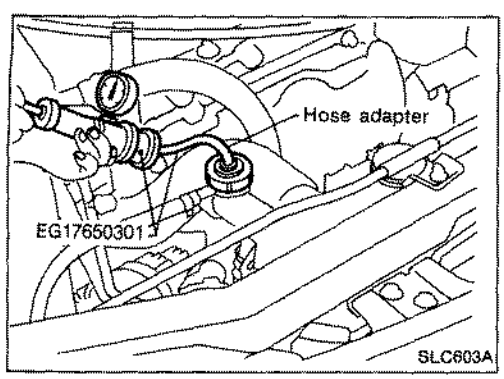
CHECKING RADIATOR CAP

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

Radiator cap relief pressure:
78 - 98 kPa
(0.78 - 0.98 bar, 0.8 - 1.0 kg/cm^2, 11 - 14 psi)



Pull the negative pressure valve to open it.
Check that it closes completely when released.

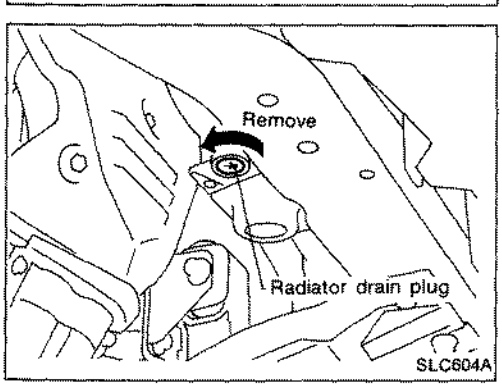


CHECKING COOLING SYSTEM FOR LEAKS

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

Testing pressure:
157 kPa (1.57 bar, 1.6 kg/cm^2, 23 psi)

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

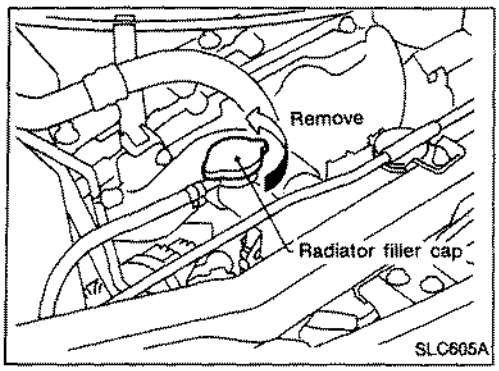


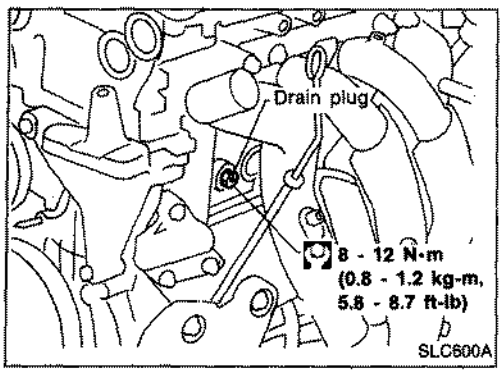
Water Pump

REMOVAL

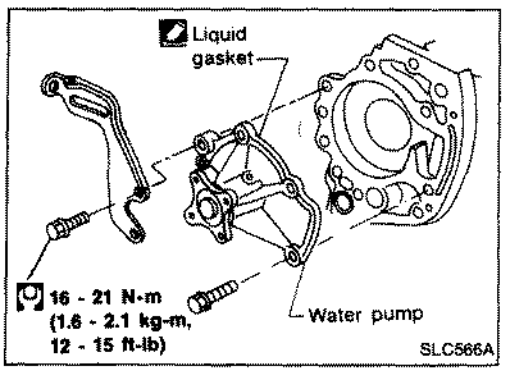
1. Drain coolant from radiator.

Water Pump (Cont'd)





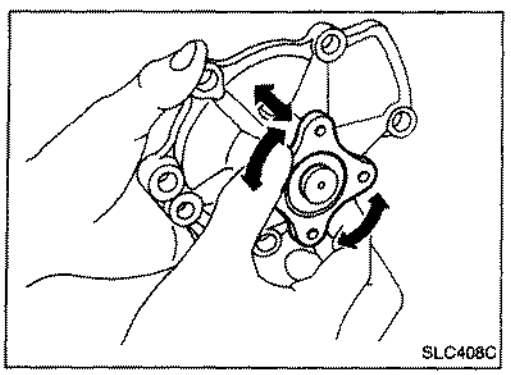
2. Remove cylinder block drain plug located at left front of cylinder block and drain coolant.



3. Remove drive belts.
4. Remove water pump pulley.
5. Remove water pump.

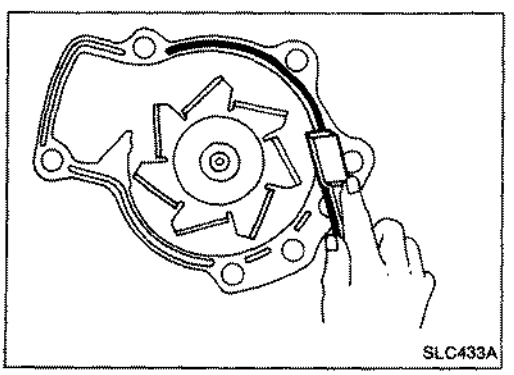
CAUTION:

- **When removing water pump assembly, be careful not to get coolant on drive belt.**
- **Water pump cannot be disassembled and should be replaced as a unit.**
- **After installing water pump, connect hose and clamp securely, then check for leaks using radiator cap tester.**



INSPECTION

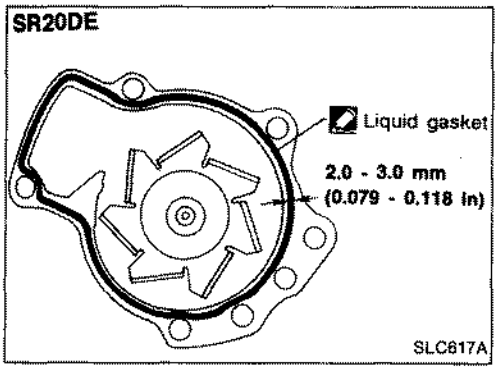
1. Check for badly rusted or corroded body assembly.
2. Check for rough operation due to excessive end play.

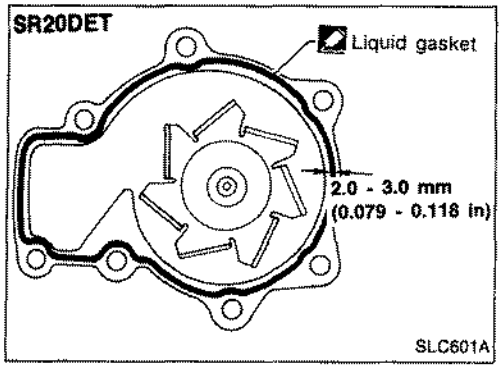


INSTALLATION

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

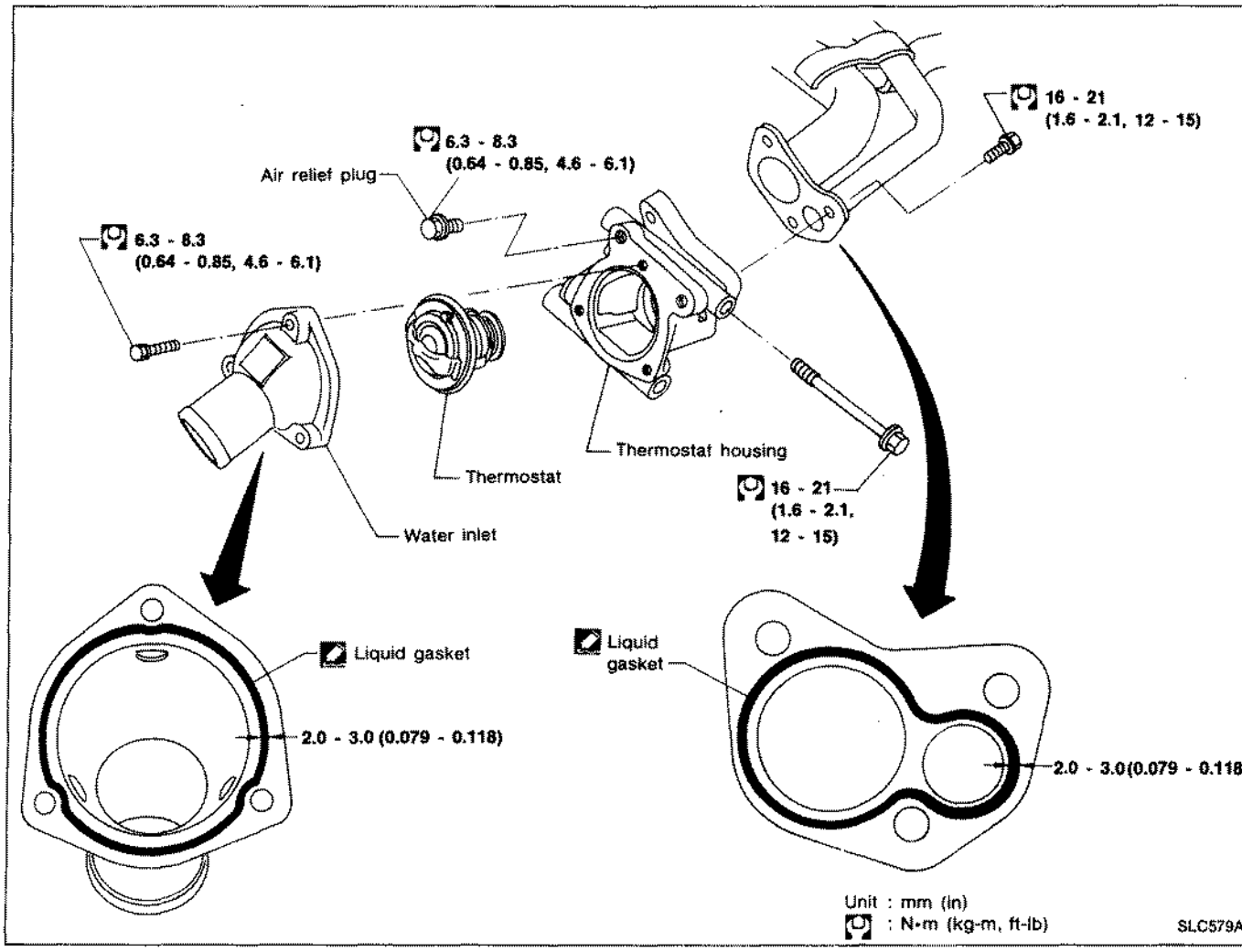
Water Pump (Cont'd)





2. Apply a continuous bead of liquid gasket to mating surface of water pump.
- Use Genuine Liquid Gasket or equivalent.

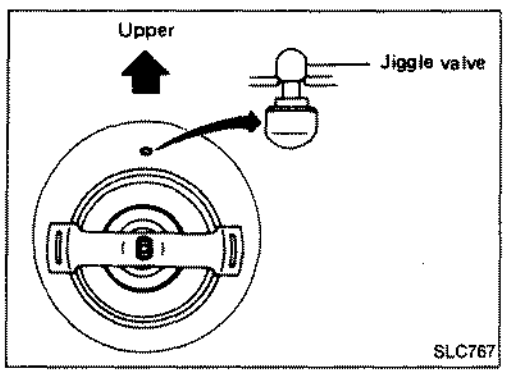
Thermostat



Thermostat (Cont'd)

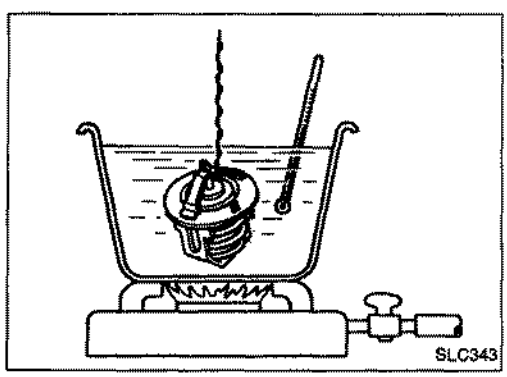
REMOVAL AND INSTALLATION

1. Drain engine coolant.
2. Remove lower radiator hose.
3. Remove water inlet, then take out thermostat.



4. Install thermostat with jiggle valve or air bleeder facing upward.

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

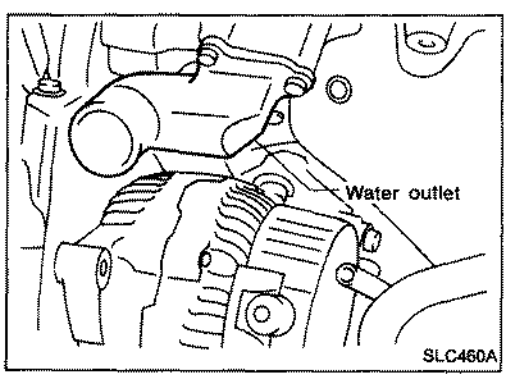


INSPECTION

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)

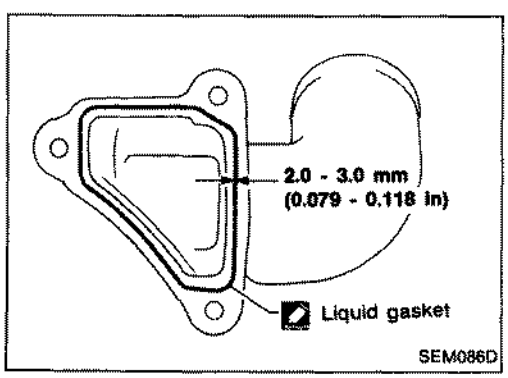
3. Then check if valve closes at 5°C (9°F) below valve opening temperature.



Water outlet

INSPECTION

Visually inspect for water leaks. If there is leakage, apply liquid gasket.

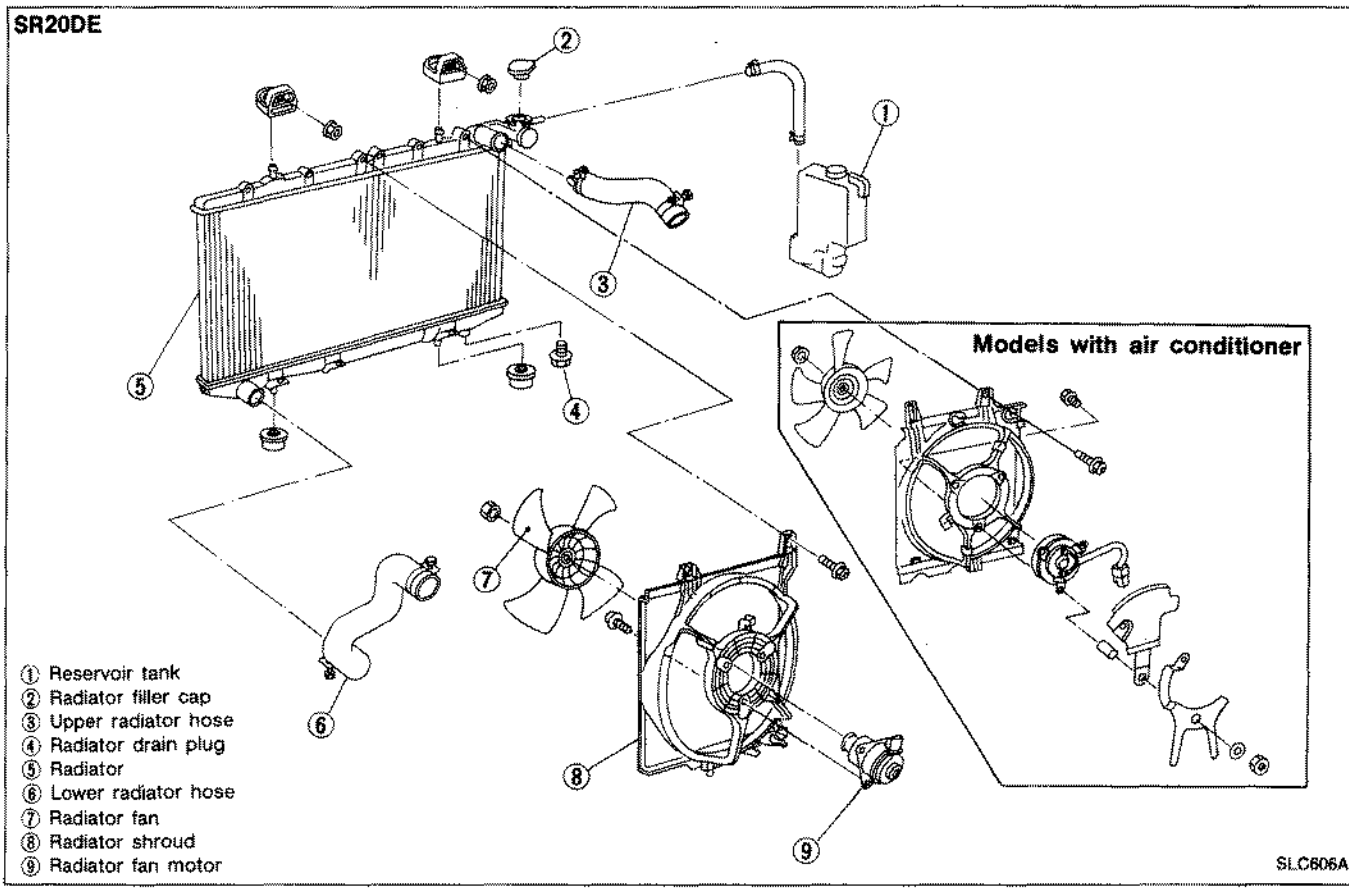


INSTALLATION

1. Before installing water outlet, remove all traces of liquid gasket from mating surface of water outlet using a scraper.
- Also remove traces of liquid gasket from mating surface of cylinder head.
2. Apply a continuous bead of liquid gasket to mating surface of water outlet.
- Use Genuine Liquid Gasket or equivalent.

Radiator (Aluminum type)

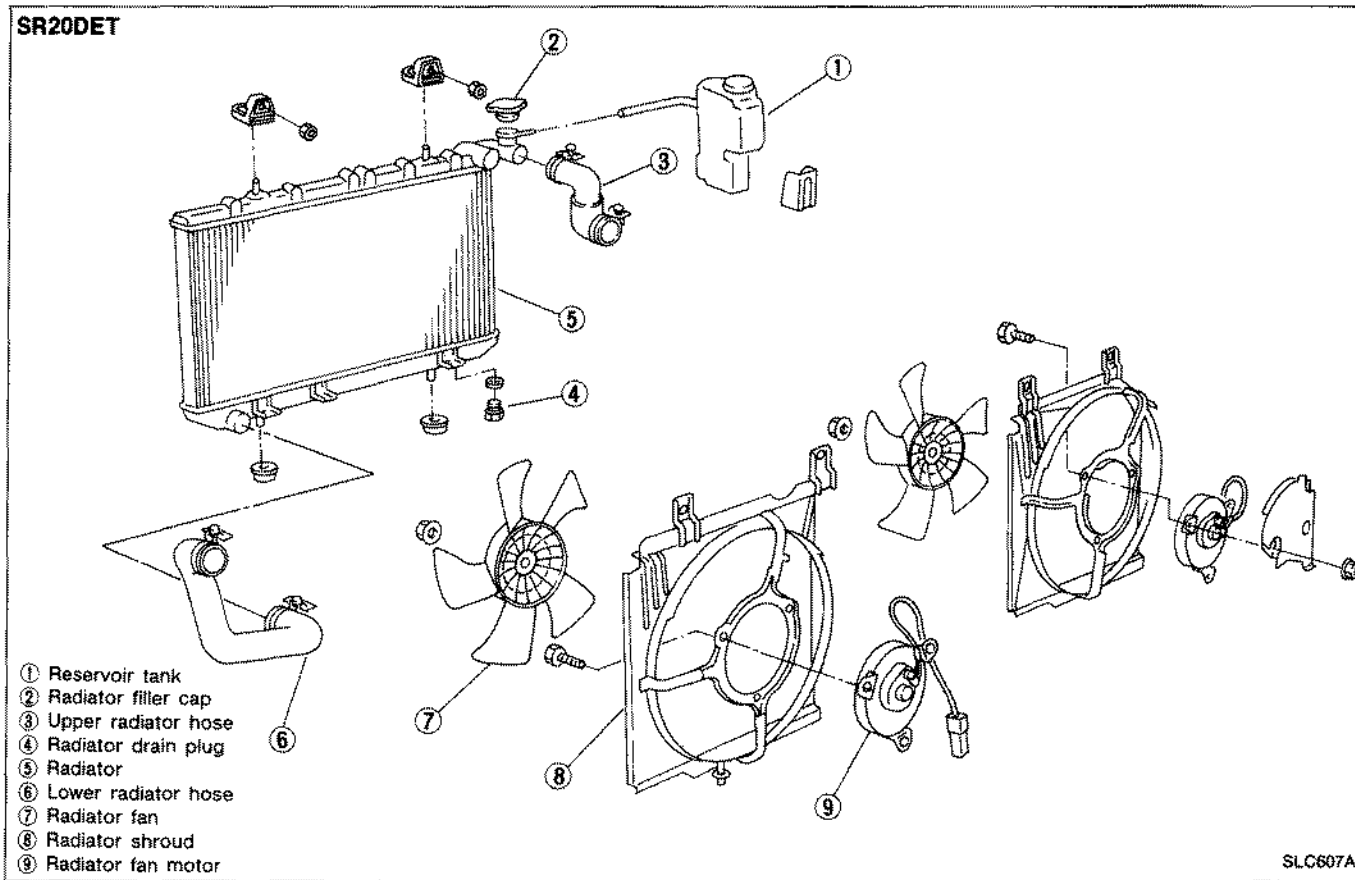
SR20DE



① Reservoir tank
② Radiator filler cap
③ Upper radiator hose
④ Radiator drain plug
⑤ Radiator
⑥ Lower radiator hose
⑦ Radiator fan
⑧ Radiator shroud
⑨ Radiator fan motor

SLC606A

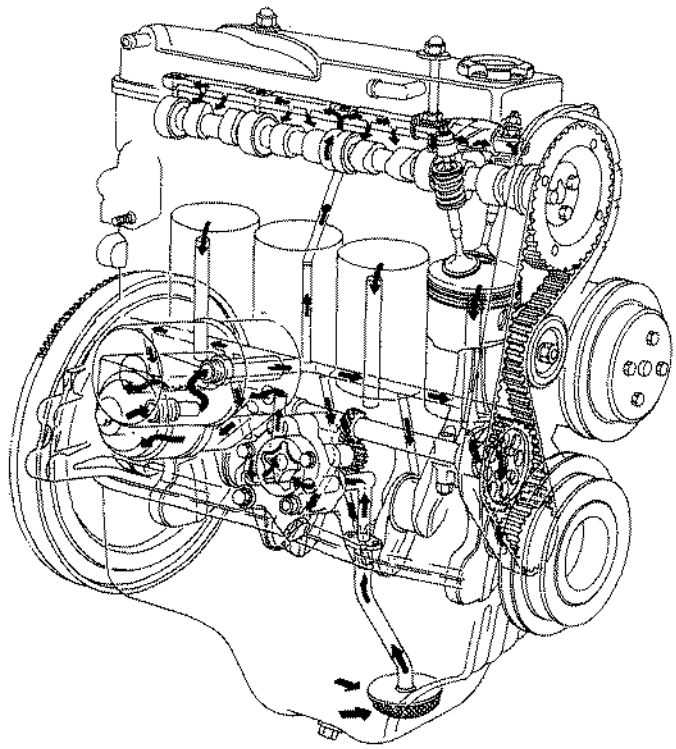
SR20DET

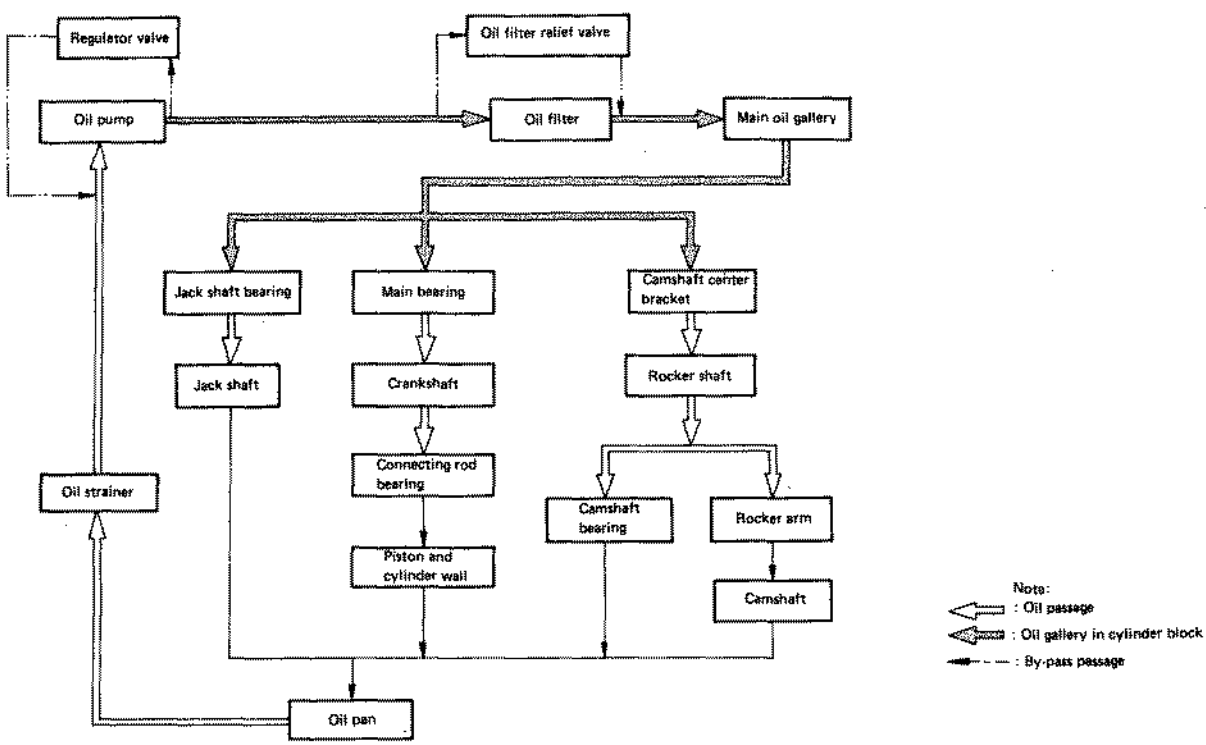


① Reservoir tank
② Radiator filler cap
③ Upper radiator hose
④ Radiator drain plug
⑤ Radiator
⑥ Lower radiator hose
⑦ Radiator fan
⑧ Radiator shroud
⑨ Radiator fan motor

SLC607A

Lubrication Circuit



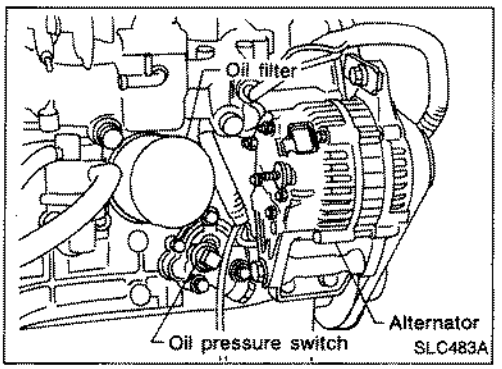


SLC486A

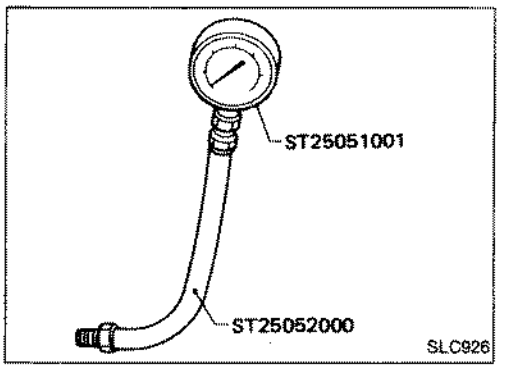
Oil Pressure Check

WARNING:

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



1. Warm up engine.
2. Stop engine and remove oil pressure switch.

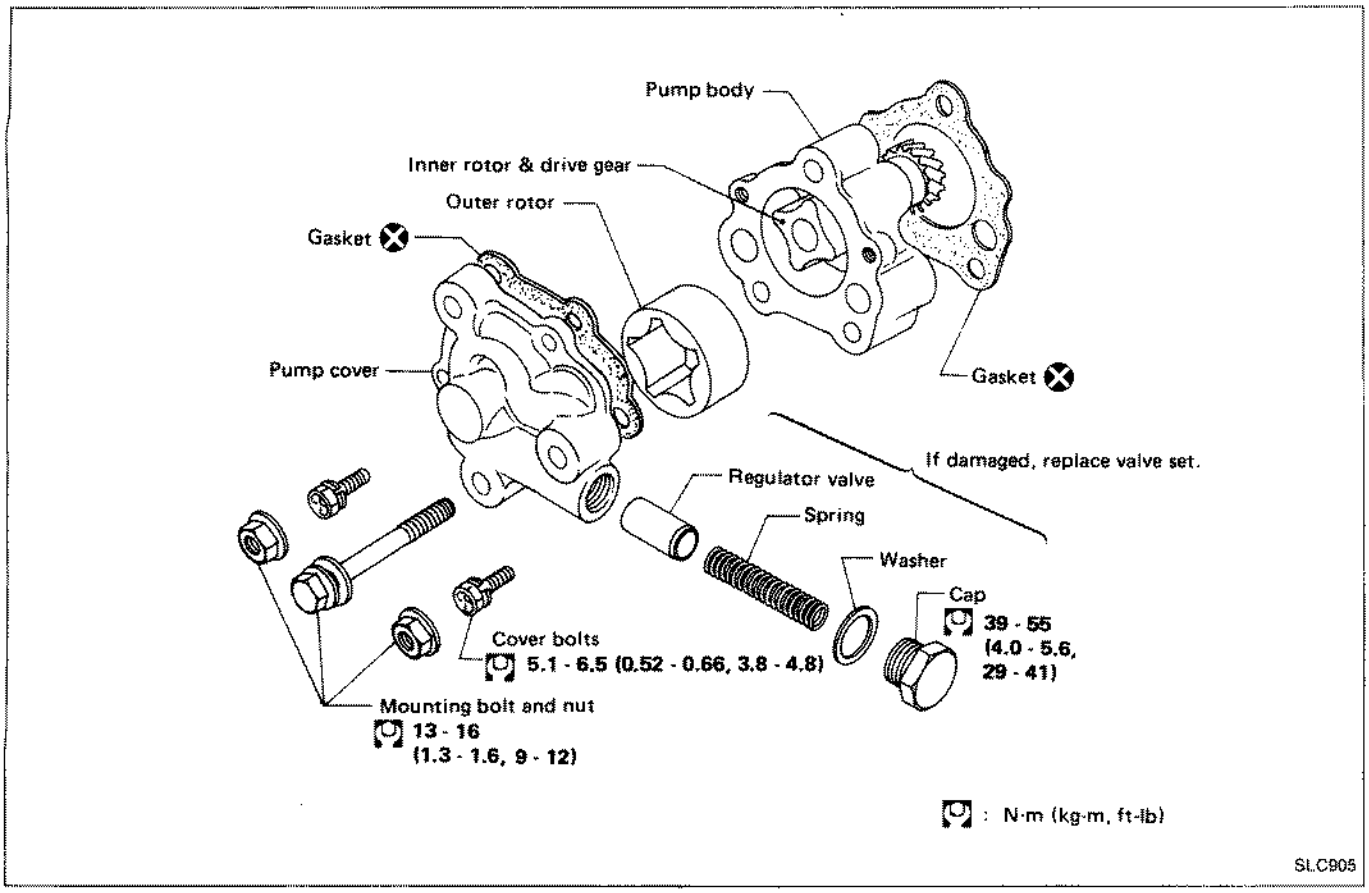


3. Install pressure gauge.
4. Start engine and warm it up to normal operating temperature.
5. Check oil pressure with engine running under no-load.

Engine rpm	Approximate discharge pressure kPa (bar, kg/cm^2, psi)
Idle speed	More than 59 (0.59, 0.6, 9)
3,000	363 - 520 (3.63 - 5.20, 3.7 - 5.3, 53 - 75)

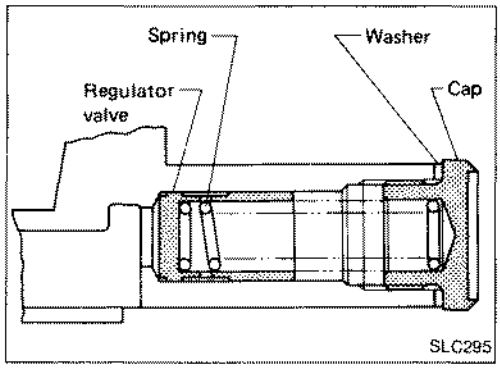
6. Install oil pressure switch.
   Oil pressure switch:
   : 10 - 16 N·m
   (1.0 - 1.6 kg-m, 7 - 12 ft-lb)

Oil Pump



- **Do not disassemble inner rotor and drive gear.**
- **Always replace gaskets with new ones.**
- **When installing oil pump, apply engine oil to inner and outer rotors.**
- **After installation, run engine for a few minutes, and check for leaks.**

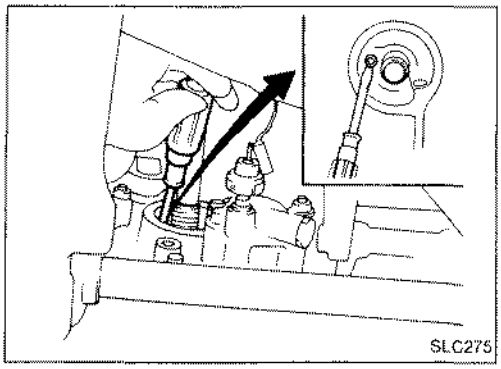
Oil Pump (Cont'd)



REGULATOR VALVE INSPECTION

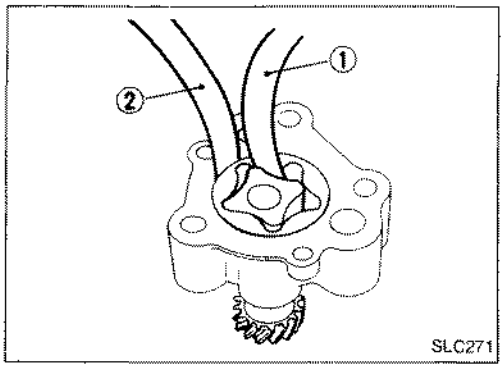
1. Visually inspect components for wear and damage.
2. Check oil pressure regulator valve sliding surface and valve spring.
3. Coat regulator valve with engine oil and check that it falls smoothly into the valve hole by its own weight.

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



OIL PRESSURE RELIEF VALVE INSPECTION

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



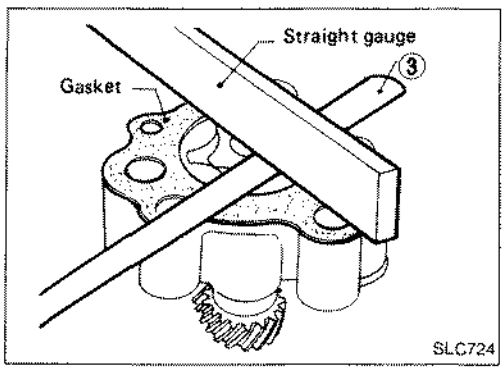
OIL PUMP INSPECTION

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	0.05 - 0.12 (0.0020 - 0.0047)

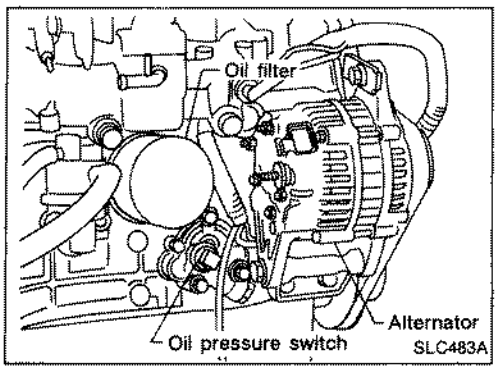
If it exceeds the limit, replace gear set or entire oil pump assembly.



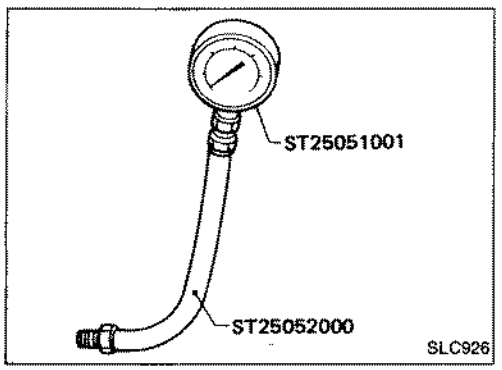
Oil Pressure Check

WARNING:

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



1. Warm up engine.
2. Stop engine and remove oil pressure switch.

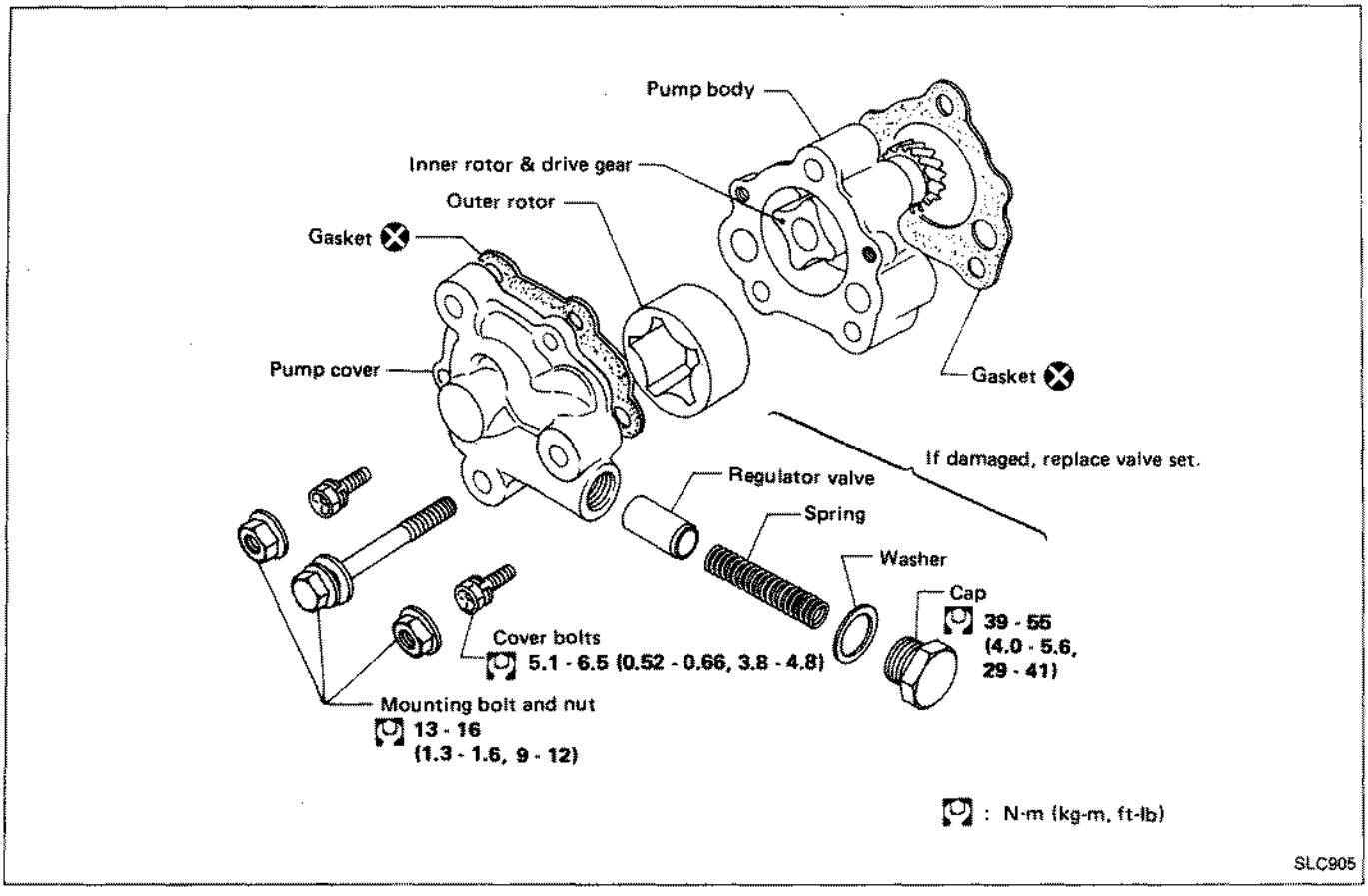


3. Install pressure gauge.
4. Start engine and warm it up to normal operating temperature.
5. Check oil pressure with engine running under no-load.

Engine rpm	Approximate discharge pressure kPa (bar, kg/cm^2, psi)
Idle speed	More than 59 (0.59, 0.6, 9)
3,000	363 - 520 (3.63 - 5.20, 3.7 - 5.3, 53 - 75)

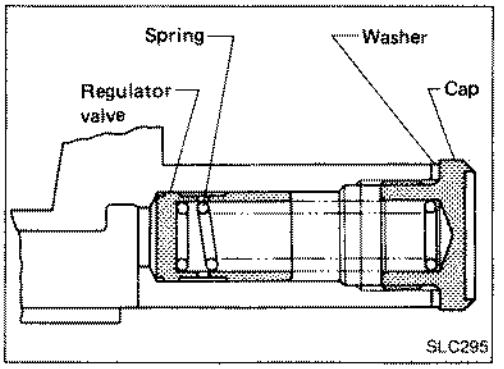
6. Install oil pressure switch.
   Oil pressure switch:
   : 10 - 16 N·m
   (1.0 - 1.6 kg-m, 7 - 12 ft-lb)

Oil Pump



- **Do not disassemble inner rotor and drive gear.**
- **Always replace gaskets with new ones.**
- **When installing oil pump, apply engine oil to inner and outer rotors.**
- **After installation, run engine for a few minutes, and check for leaks.**

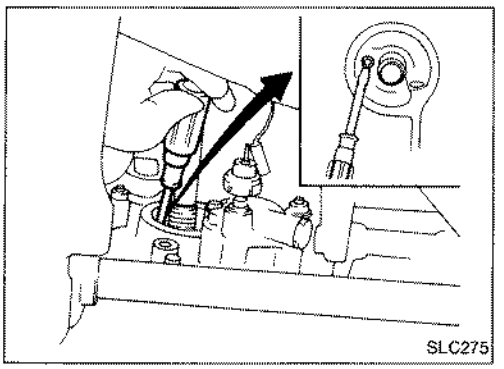
Oil Pump (Cont'd)



REGULATOR VALVE INSPECTION

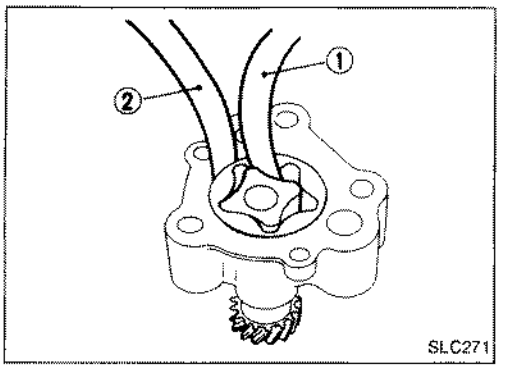
1. Visually inspect components for wear and damage.
2. Check oil pressure regulator valve sliding surface and valve spring.
3. Coat regulator valve with engine oil and check that it falls smoothly into the valve hole by its own weight.

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



OIL PRESSURE RELIEF VALVE INSPECTION

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



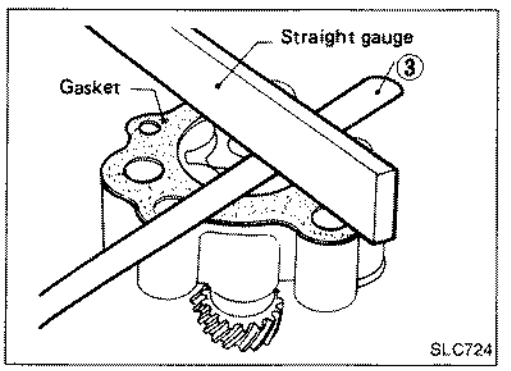
OIL PUMP INSPECTION

Using a feeler gauge, check the following clearance.

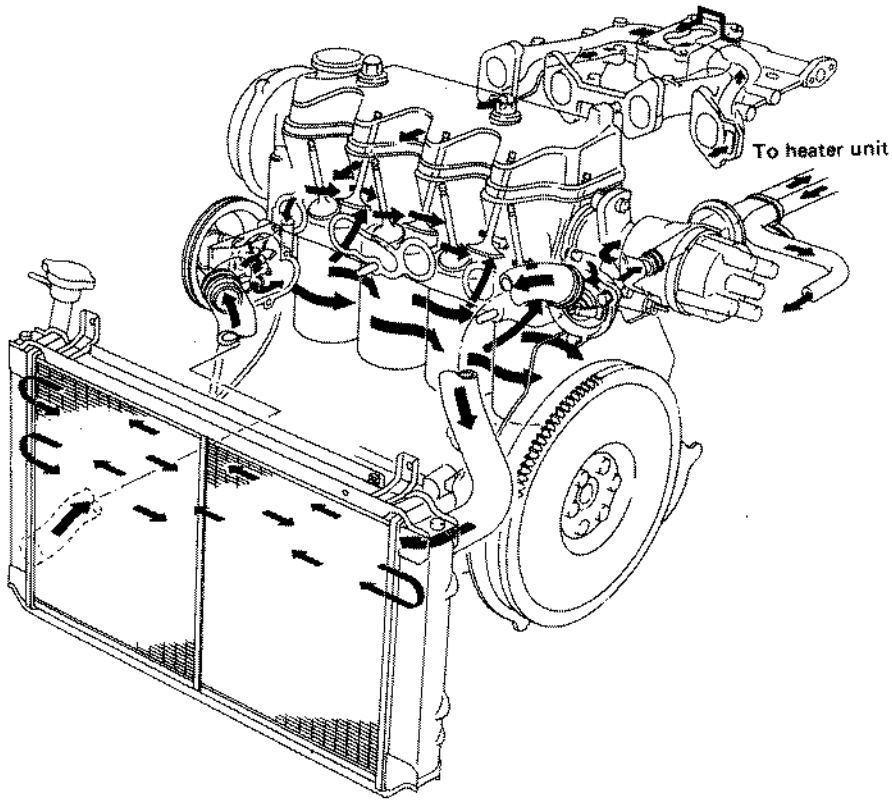
Unit: mm (in)

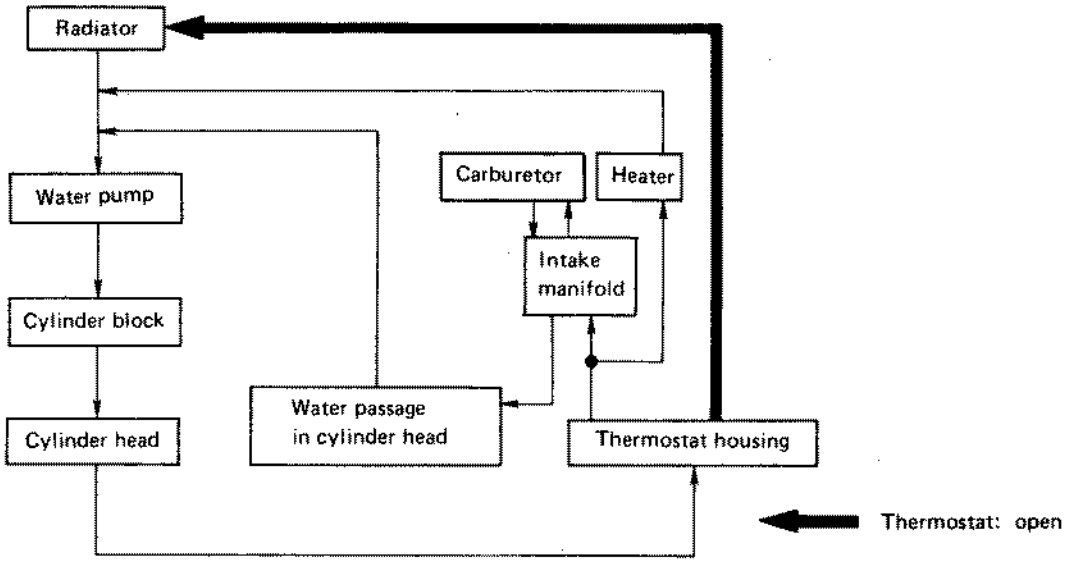
Rotor tip clearance ①	Less than 0.12 (0.0047)
Outer rotor to body clearance ②	0.15 - 0.21 (0.0059 - 0.0083)
Side clearance (with gasket) ③	0.05 - 0.12 (0.0020 - 0.0047)

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



Cooling Circuit



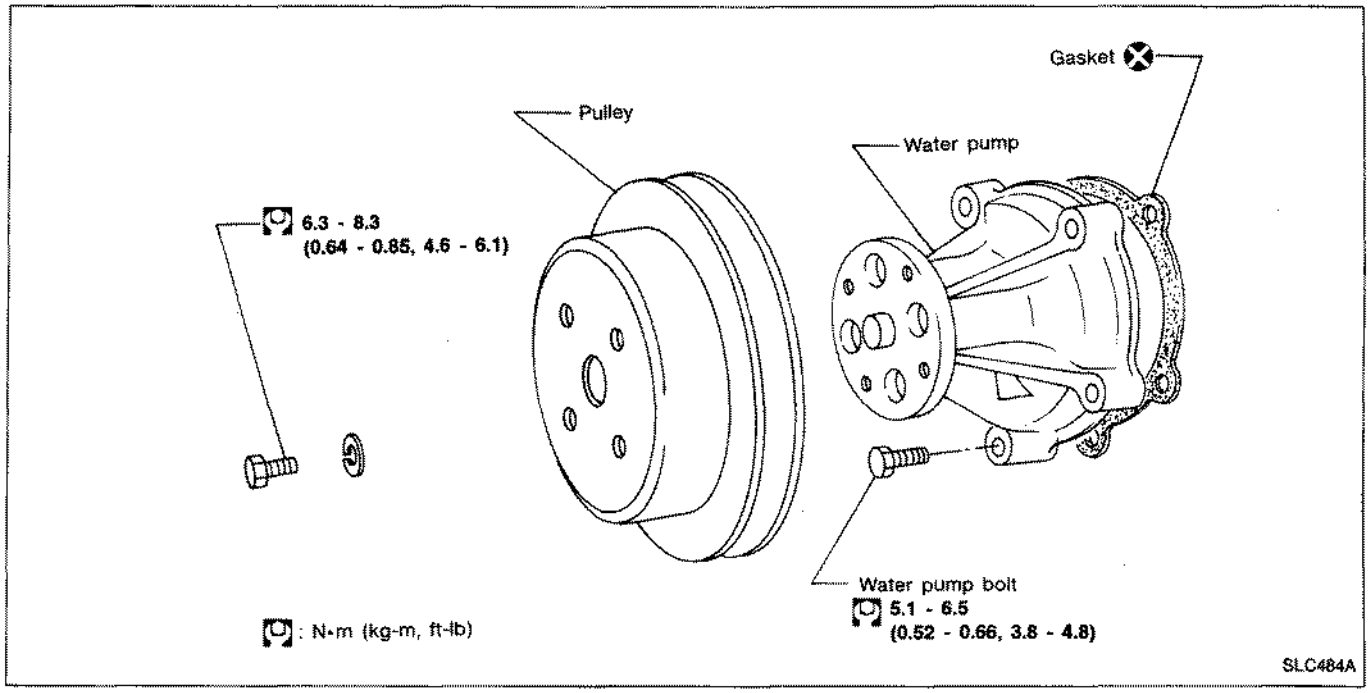


WARNING:
To avoid serious personal injury, never remove radiator cap quickly when engine is hot. Sudden release of cooling system pressure is very dangerous.
If it is necessary to remove radiator cap when radiator is hot, wrap cap with a cloth and turn cap slowly counterclockwise to the first stop. After all pressure in the cooling system is released, turn cap passing the stop and remove it.

Cooling System Inspection

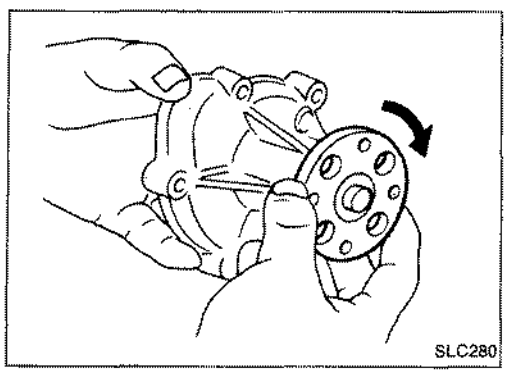
Refer to MA section.

Water Pump



CAUTION:

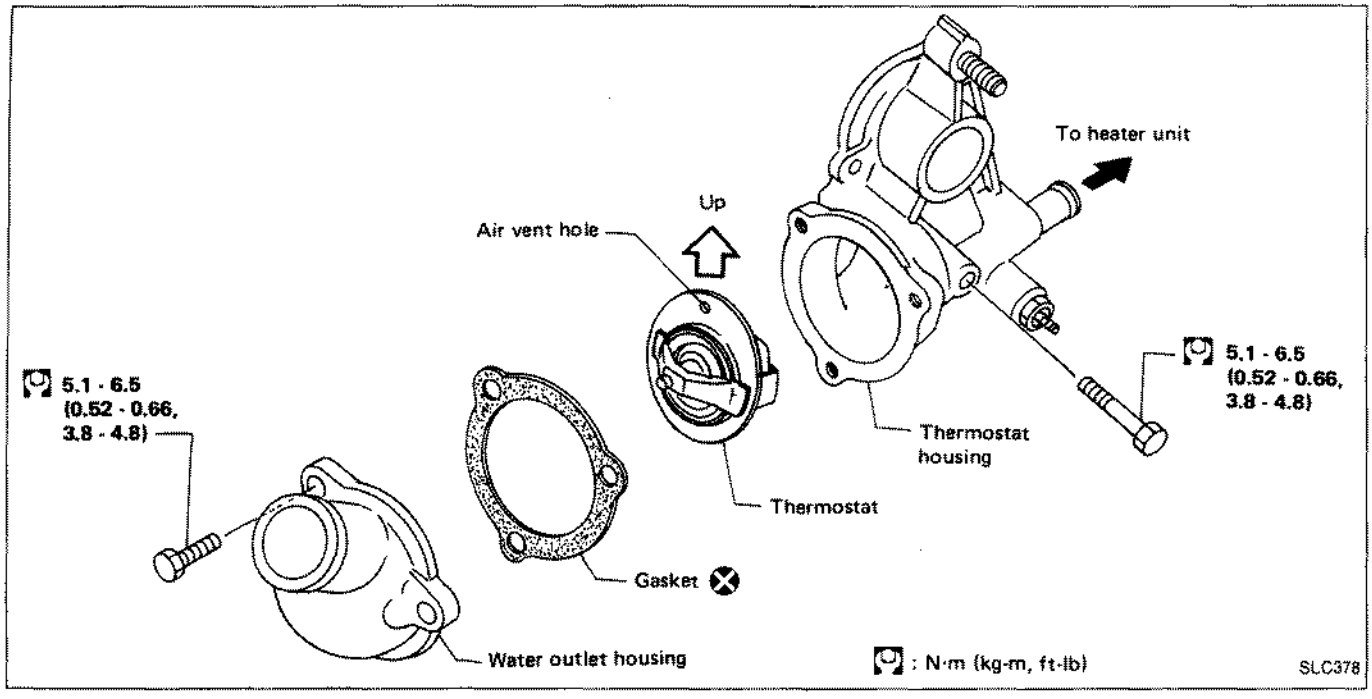
- **When removing water pump assembly, be careful not to get coolant on timing belt.**
- **Water pump cannot be disassembled and should be replaced as a unit.**
- **To avoid deforming timing cover, make sure there is adequate clearance between cover and hose clamp.**
- **After installing water pump,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



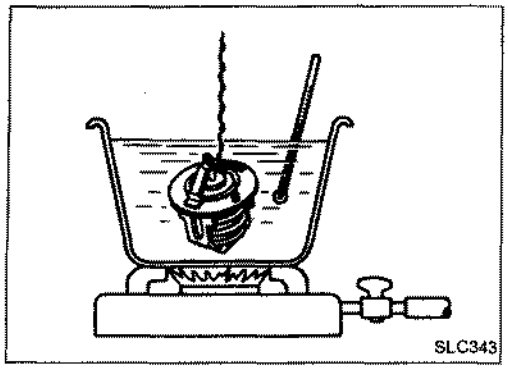
INSPECTION

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

Thermostat



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



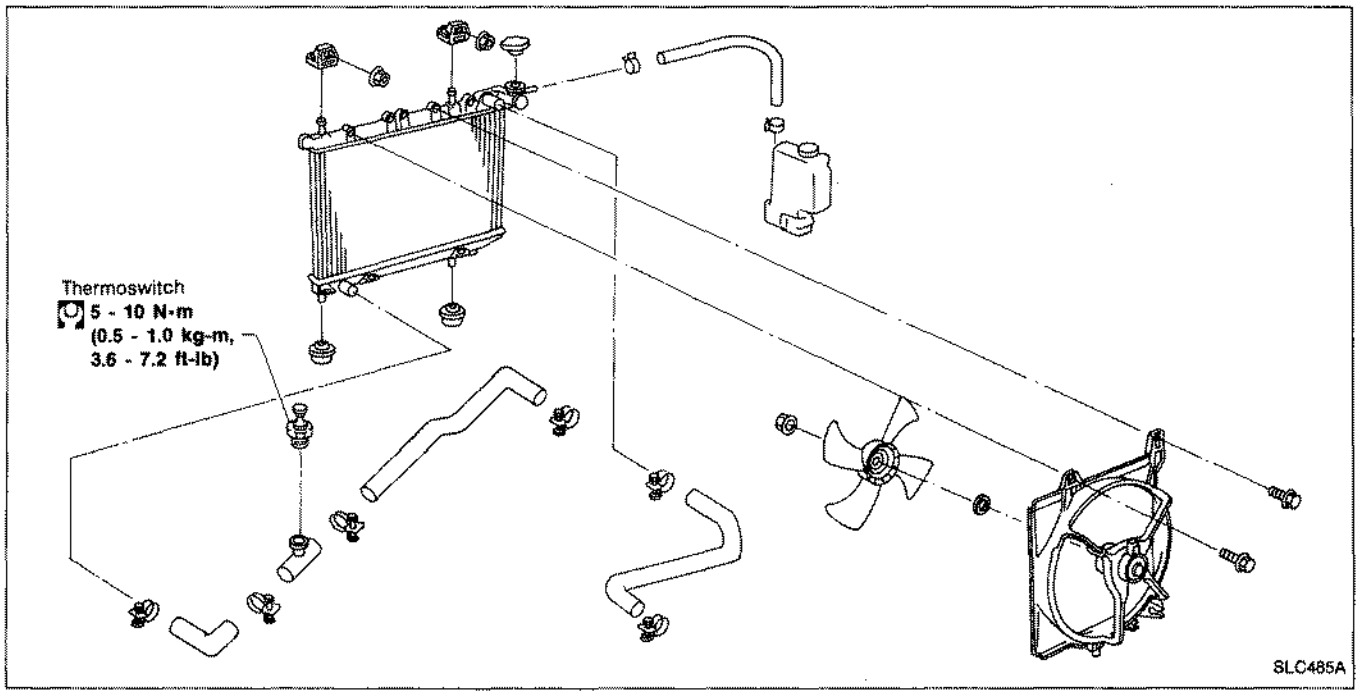
INSPECTION

1. Check valve seating condition at ordinary temperatures. It should seat tightly.
2. Check valve opening temperature and maximum valve lift.

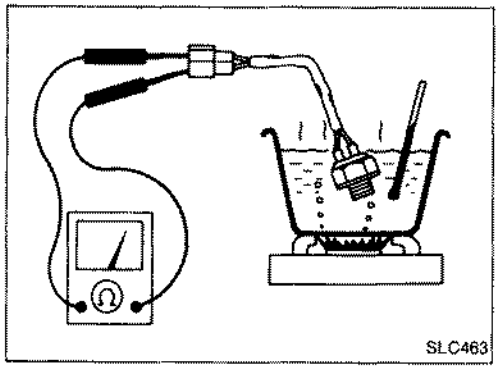
	Frigid type	Standard type	Tropical type
Valve opening temperature °C (°F)	88 (190)	82 (180)	76.5 (170)
Max. valve lift mm/°C (in/°F)	8/100 (0.31/212)	8/95 (0.31/203)	8/90 (0.31/194)

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

Radiator



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

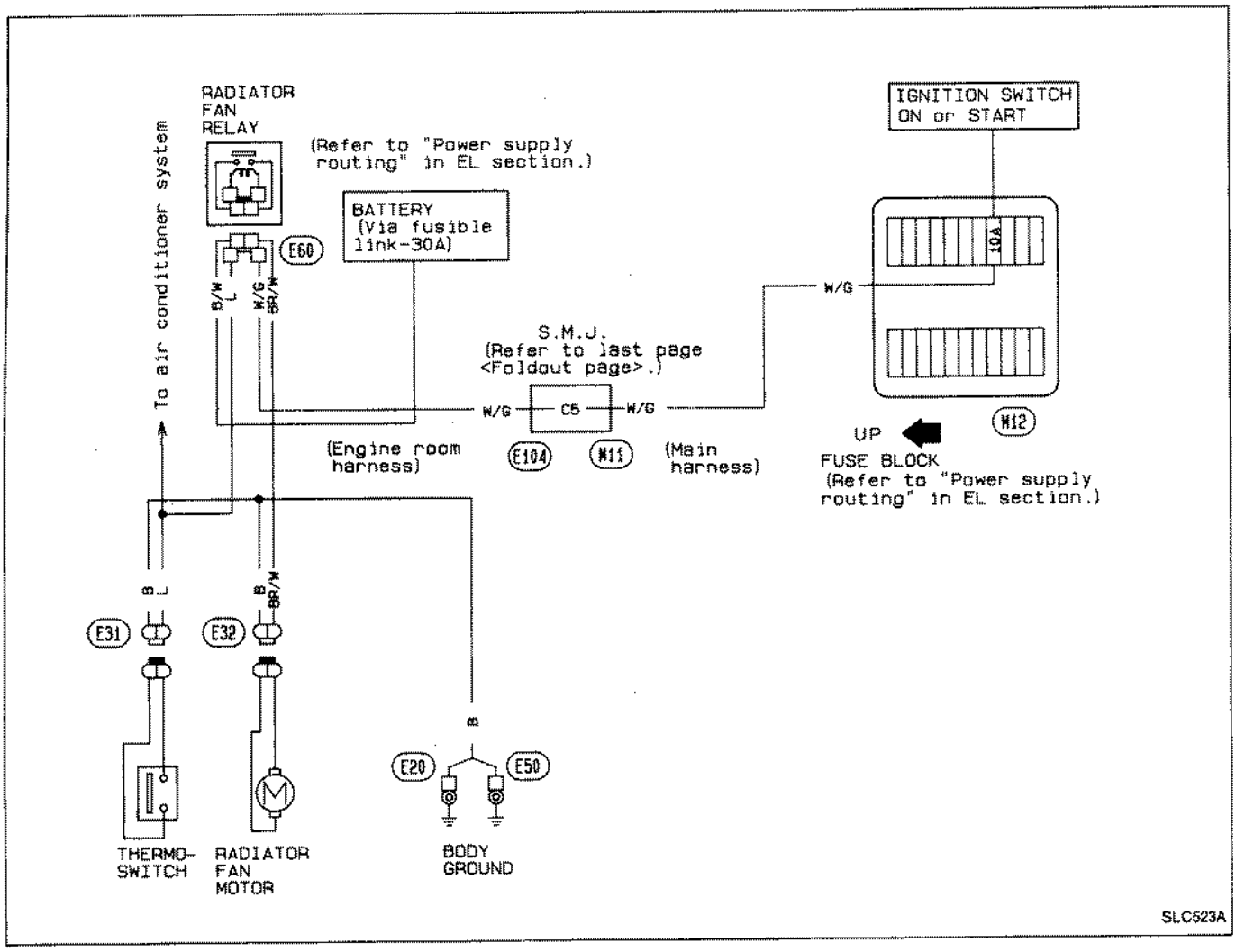


Thermoswitch

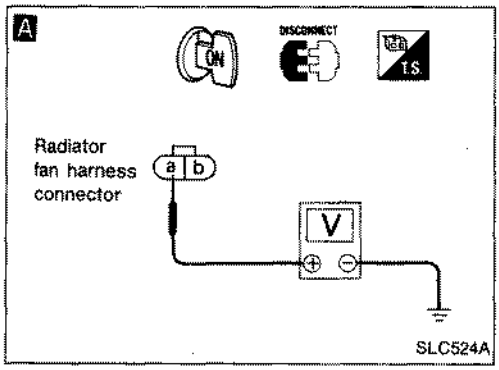
INSPECTION

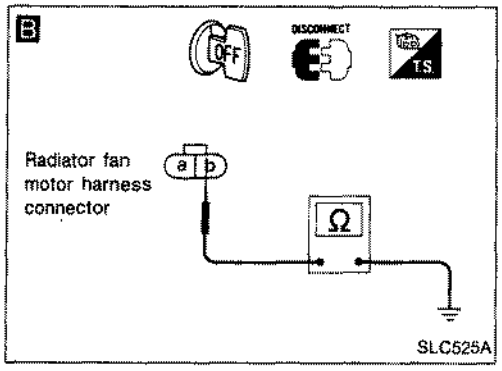
1. Drain about one liter of coolant.
2. Remove thermoswitch.
3. Check thermoswitch for proper operation.
   Operating temperature:
   OFF → ON 87 - 93°C (189 - 199°F)

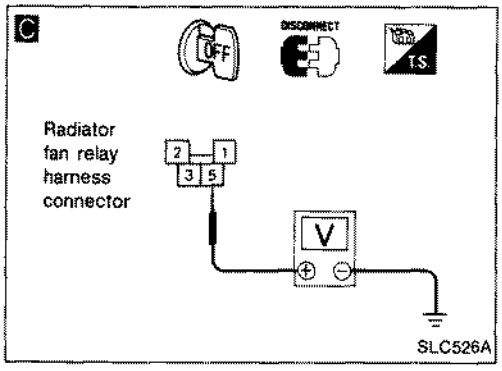
Trouble Diagnoses — Radiator Fan Motor

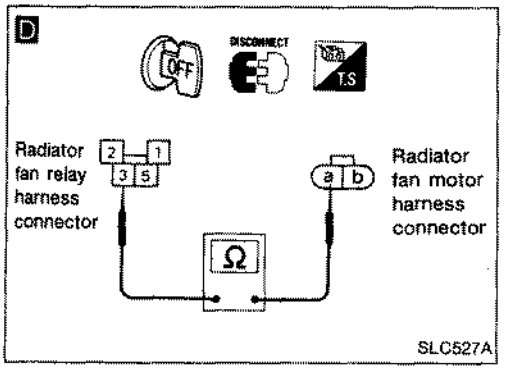


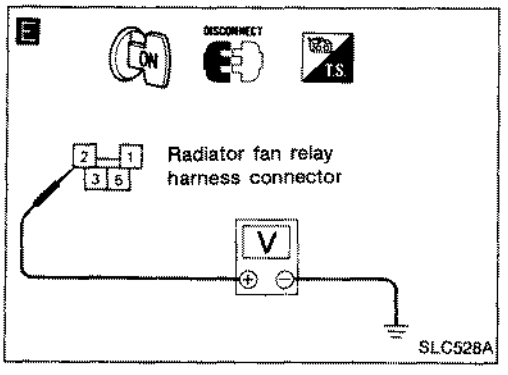
Trouble Diagnoses — Radiator Fan Motor (Cont'd)











SYMPTOM:
Even though the engine coolant is hot, the radiator fan motor does not rotate.

This check should be performed after engine is warmed up sufficiently.

A

CHECK POWER SUPPLY.
1) Turn ignition switch "ON".
2) Disconnect radiator fan harness connector.
3) Check voltage between ⓐ and ground.
Battery voltage should exist.

N.G. →
1) Turn ignition switch "OFF".
2) Disconnect radiator fan relay.
C 3) Check voltage between terminal ⑤ and ground.
Battery voltage should exist.
If N.G., check harness continuity between battery ⊕ pole and terminal ⑤.
D 4) Check harness continuity between radiator fan relay terminal ③ and radiator fan motor harness connector terminal ⓐ.
Continuity should exist.
If N.G., repair harness.

O.K. ↓

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect radiator fan motor harness connector.
3) Check harness continuity between ⓑ and ground.
Continuity should exist.
If N.G., repair harness.

O.K. ↓

Replace radiator fan motor with a new one.

E

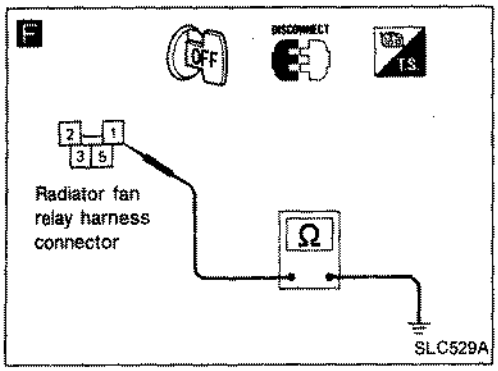
O.K. ↓

1) Turn ignition switch "ON".
2) Check voltage between terminal ② and ground.
Battery voltage should exist.
If N.G., check following parts:
- Harness continuity between fuse and terminal ②
- Fuse

O.K. ↓

Ⓐ

Trouble Diagnoses — Radiator Fan Motor (Cont'd)



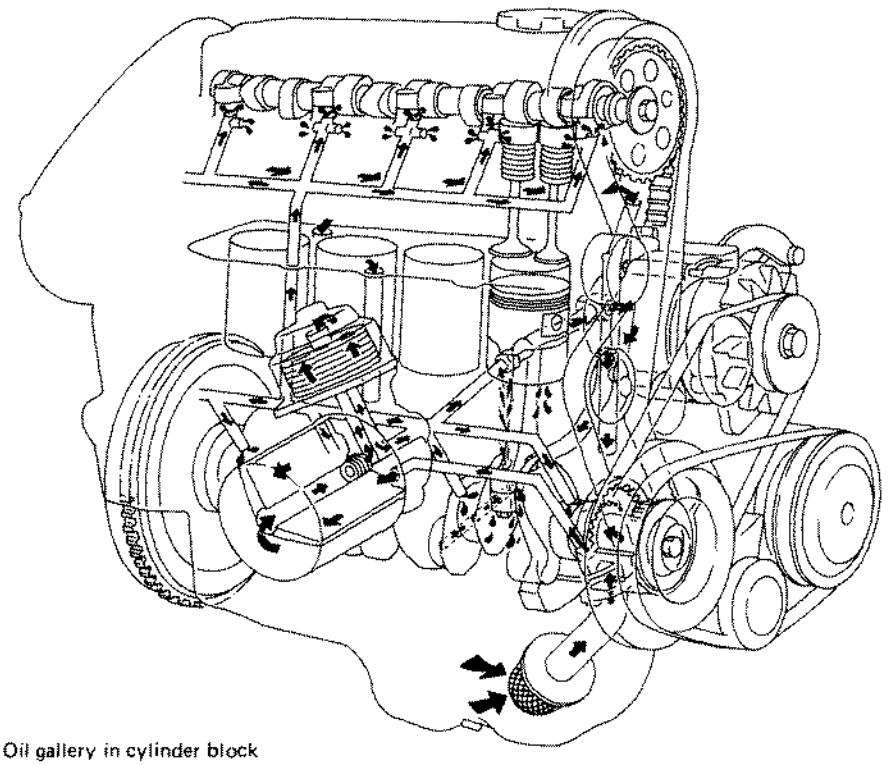
F (A)

1) Turn ignition switch "OFF".
2) Check continuity between terminal ① and ground.
Continuity should exist.
If N.G., check the following parts:
- Thermoswitch
- Harness continuity between ① and thermoswitch terminal
- Harness continuity between thermoswitch terminal and body ground

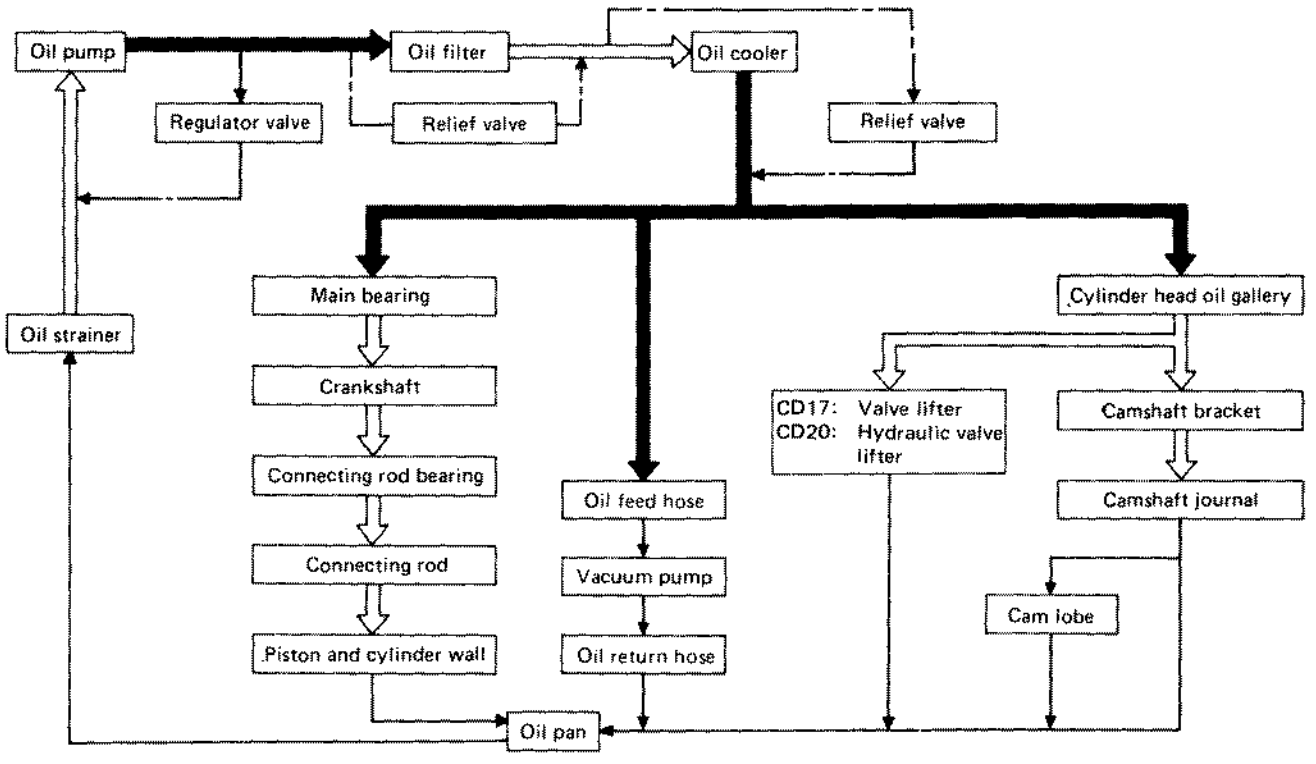
O.K.

Check radiator fan relay. If N.G., replace with a new one.

Lubrication Circuit



Note: : Oil gallery in cylinder block
: Oil passage
: By-pass passage



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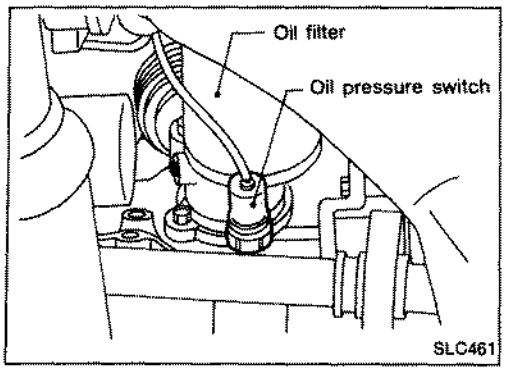
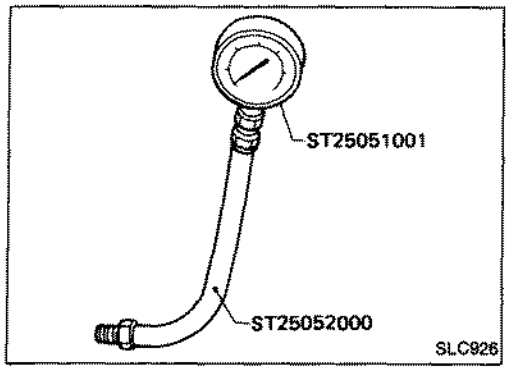


Oil Pressure Check

WARNING:

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

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

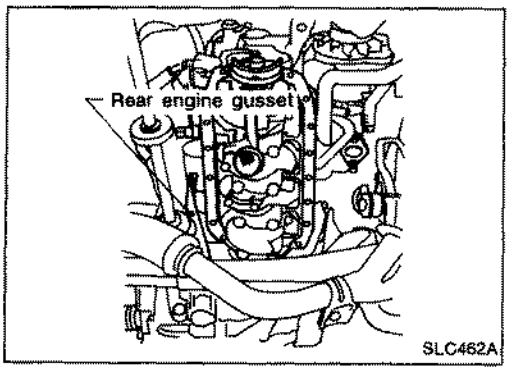


3. Install pressure gauge.
4. Start engine and warm it up to normal operating temperature.
5. Check oil pressure with engine running under no-load.

Engine rpm	Approximate discharge pressure kPa (bar, kg/cm^2, psi)
Idle speed	More than 59 (0.59, 0.6, 9)
2,000	294 (2.9, 3, 43)

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

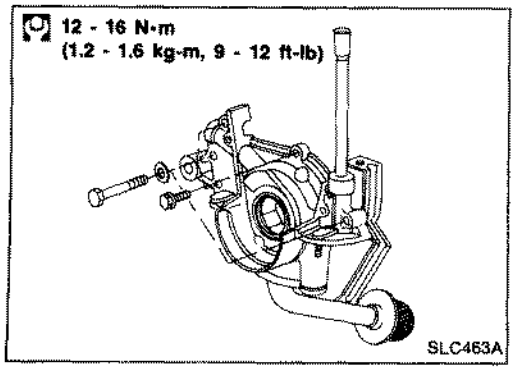
6. Install oil pressure switch with sealant.



Oil Pump

REMOVAL AND INSTALLATION

1. Drain engine coolant and engine oil.
2. Remove upper radiator hose, drive belts, crank pulley, timing belt covers, front engine mounting (CD20) bracket and timing belt.
3. Remove exhaust front tube, timing belt pulley and rear engine gusset (bar type), then remove oil pan.



4. Remove oil pump assembly with oil strainer.
5. Reinstall any part removed. Refill engine oil and engine coolant.

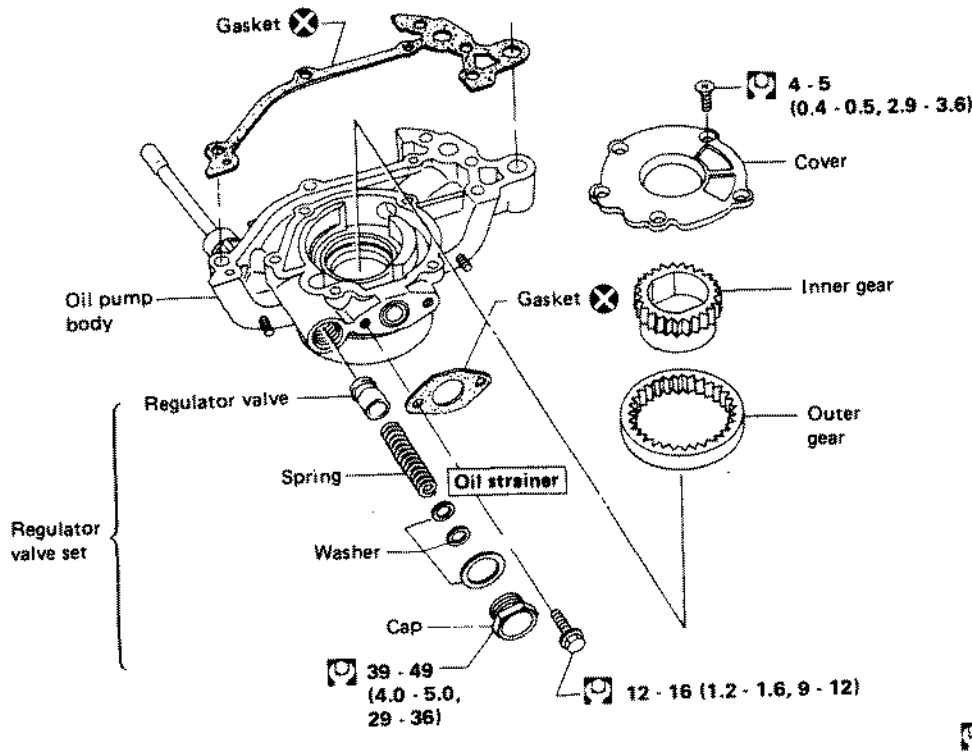
- Install new oil pump gasket. (CD17)
- Apply liquid gasket to oil pump. (CD20)
- Apply liquid gasket to oil pan.
- Apply liquid gasket to both ends of oil pan oil seals.
- Install oil pan, fitting oil seals in the correct position.

Oil Pump (Cont'd)

DISASSEMBLY AND ASSEMBLY

When installing oil pump, apply engine oil to inner and outer gears.

CD17



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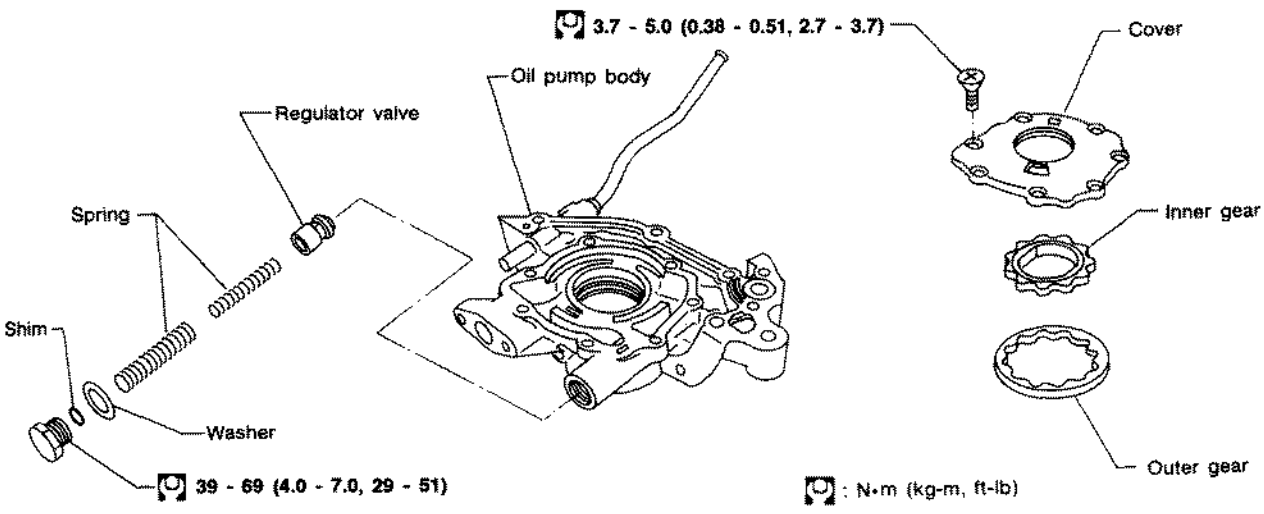
CD20



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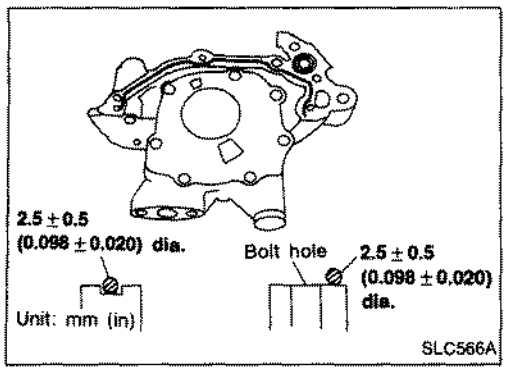
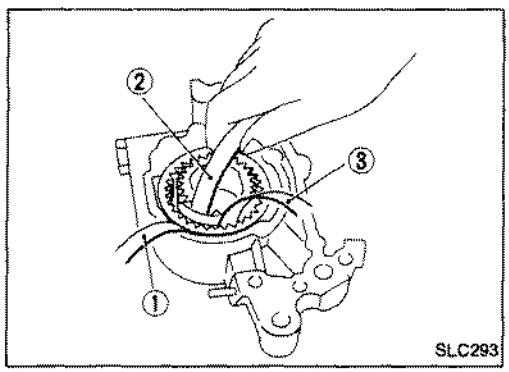
Oil Pump (Cont'd)



- Apply liquid gasket when installing oil pump onto engine.

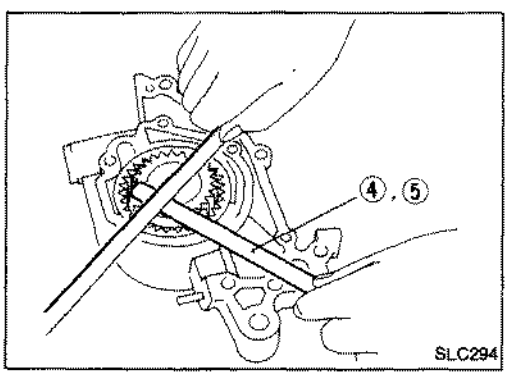


INSPECTION — CD17

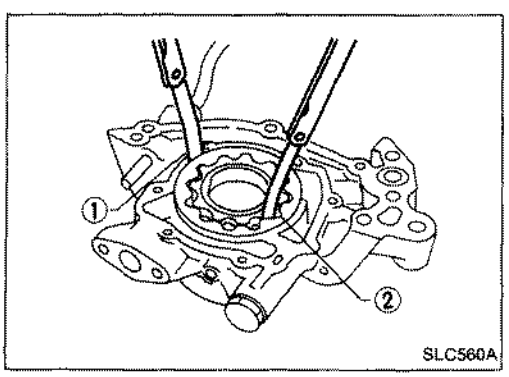
Using a feeler gauge, check the following clearances.

Unit: mm (in)

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



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

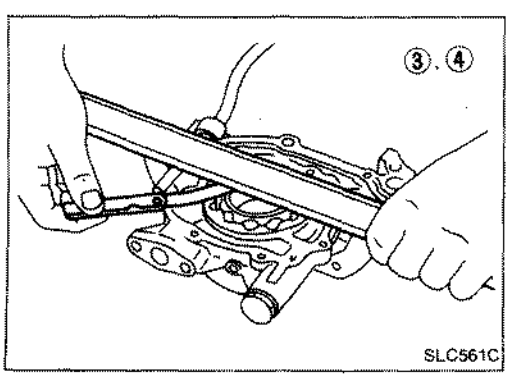


INSPECTION — CD20

Using a feeler gauge, check the following clearances.

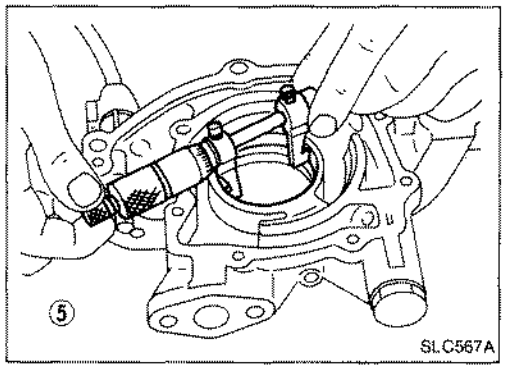
Unit: mm (in)

Body to outer gear clearance ①	0.12 - 0.20 (0.0047 - 0.0079)
Outer gear to inner gear clearance ②	less than 0.18 (0.0071)
Housing to inner gear clearance ③	0.05 - 0.09 (0.0020 - 0.0035)
Housing to outer gear clearance ④	0.05 - 0.11 (0.0020 - 0.0043)
Inner gear to housing clearance ⑤	0.05 - 0.09 (0.0020 - 0.0035)



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

Oil Pump (Cont'd)



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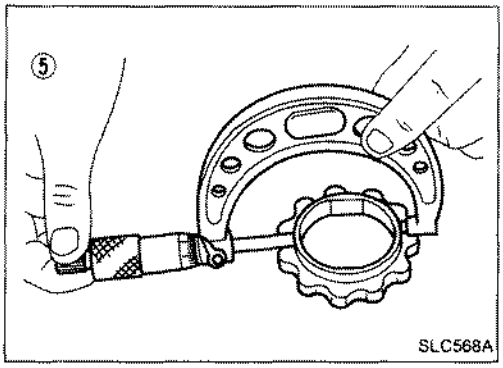

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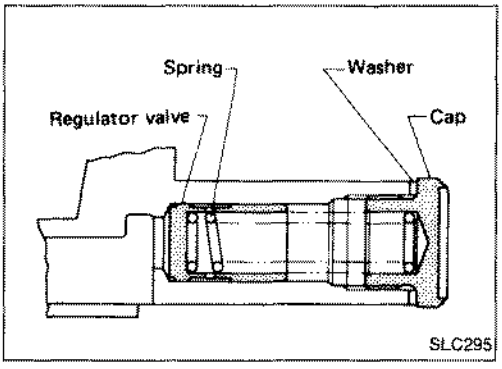
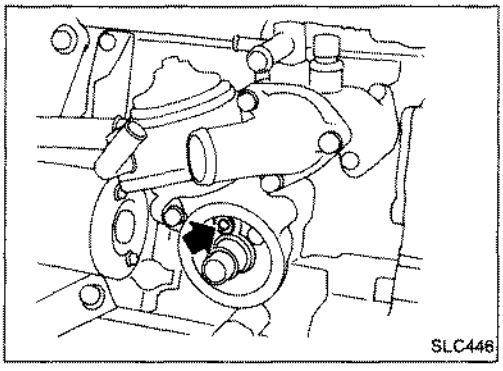


SLC295

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.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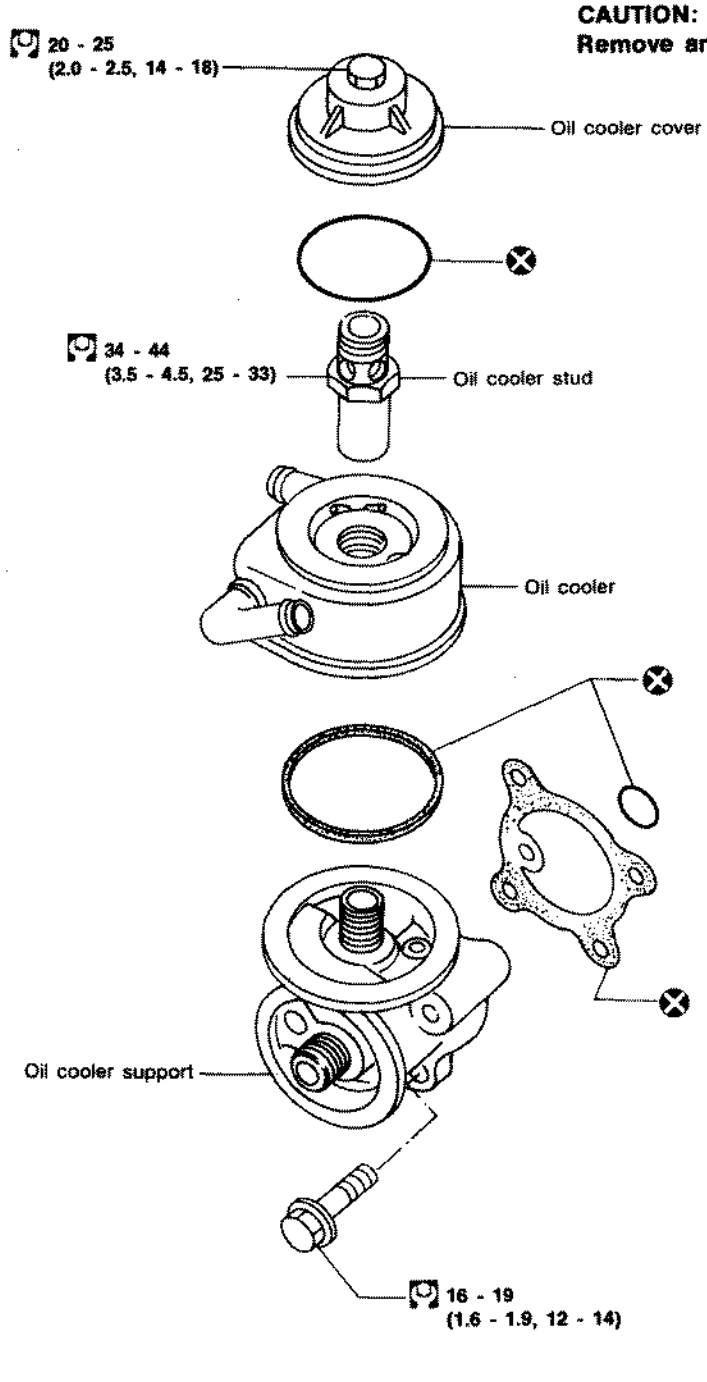
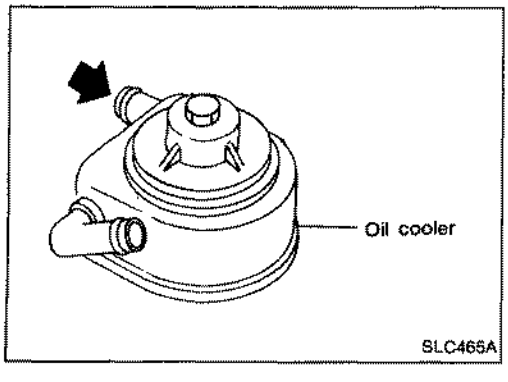
OIL PRESSURE RELIEF VALVE INSPECTION

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

Oil Cooler

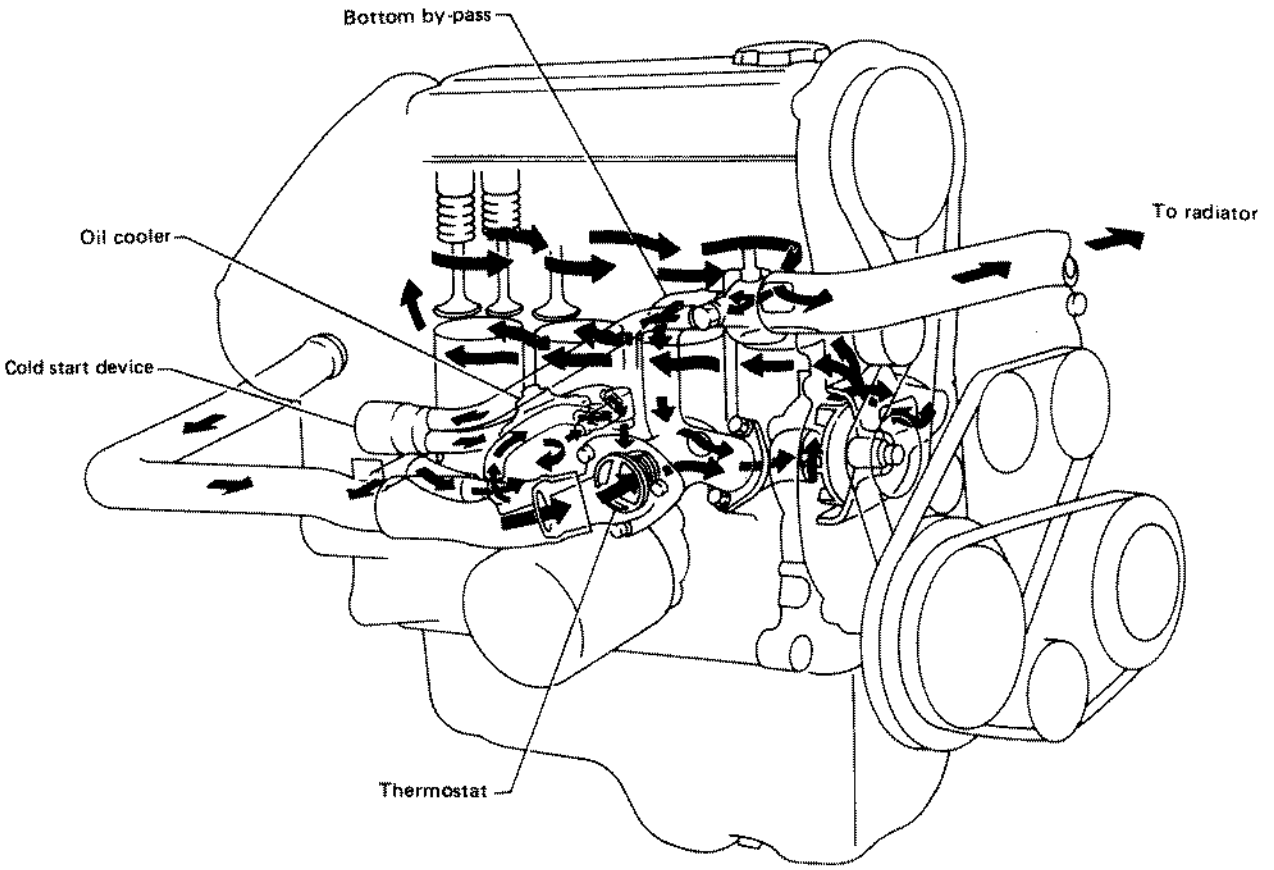


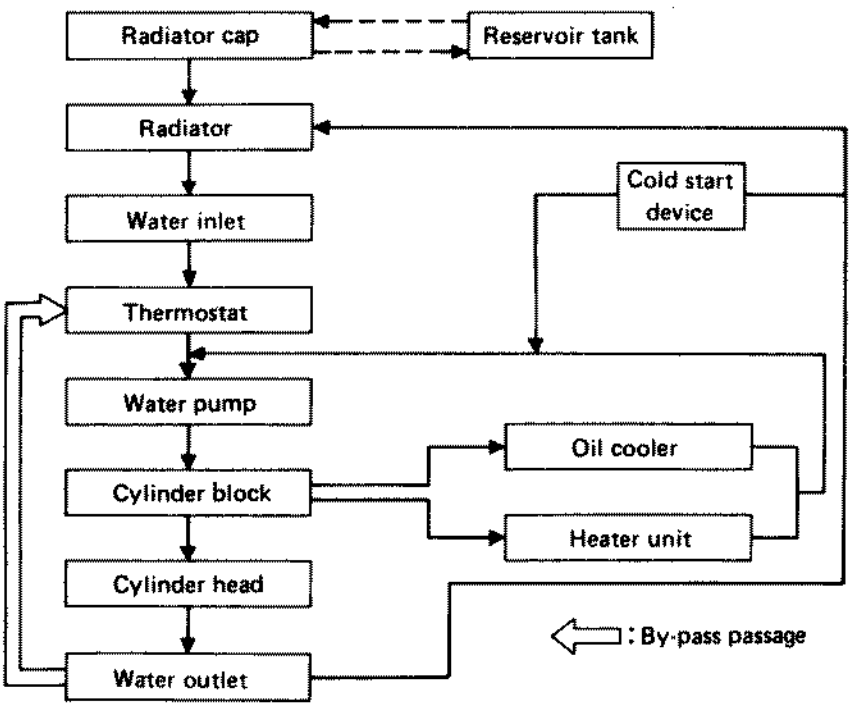


INSPECTION

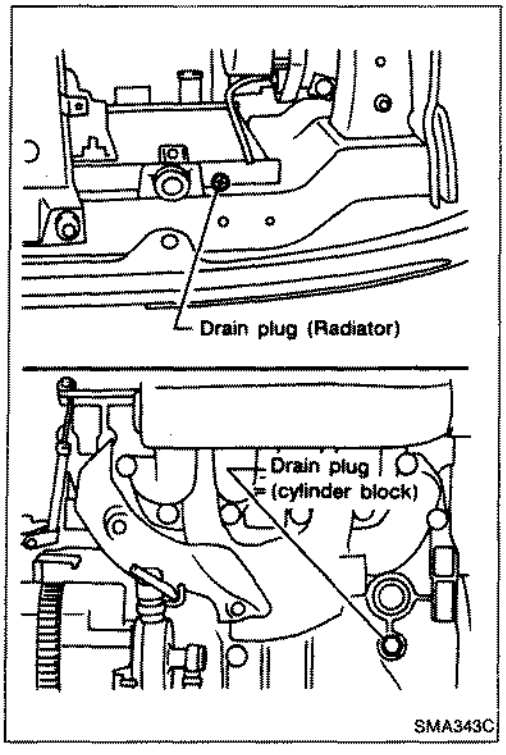
1. Check oil cooler element and housing for cracks.
2. Check coolant inlet of oil cooler for clogging by blowing through it.
   Replace it if necessary.

Cooling Circuit





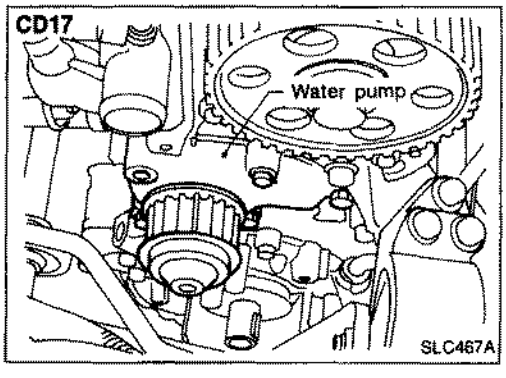
SLC407



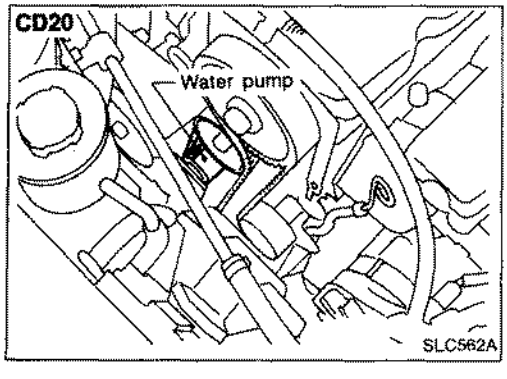
Water Pump

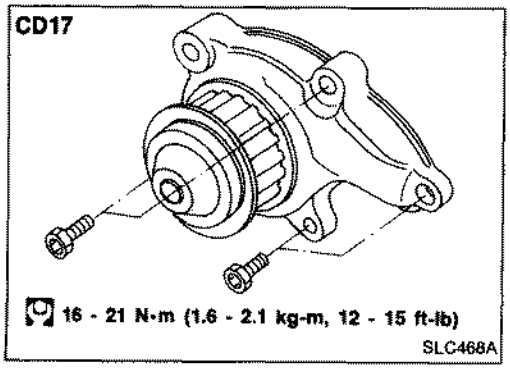
REMOVAL AND INSTALLATION

1. Drain engine coolant from radiator and cylinder block.
2. Remove upper radiator hose, timing belt covers, front engine mounting bracket and timing belt.
3. Remove timing belt tensioner and idler and timing belt lower back cover.



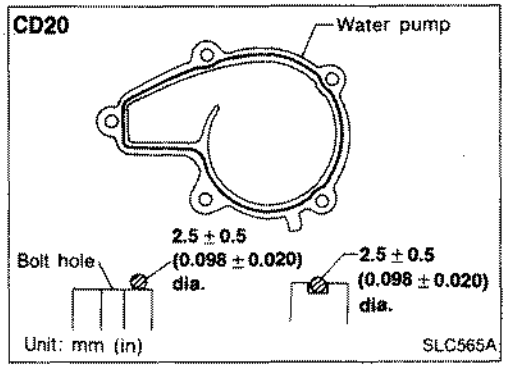
4. Remove water pump.

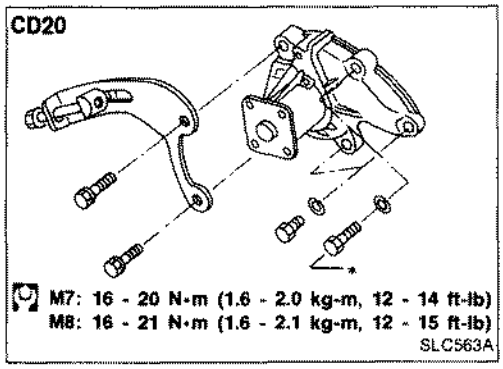




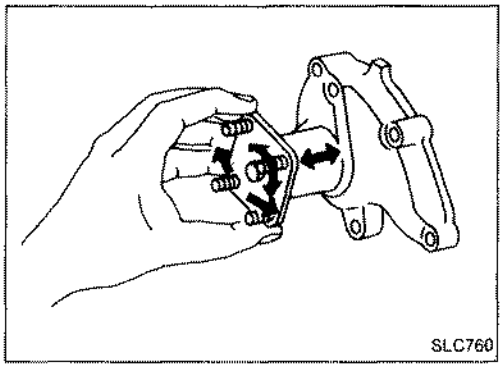
5. Install water pump with a new gasket. (CD17)
   Install water pump with liquid gasket. (CD20)

Water Pump (Cont'd)





*: Apply liquid sealant to the thread.

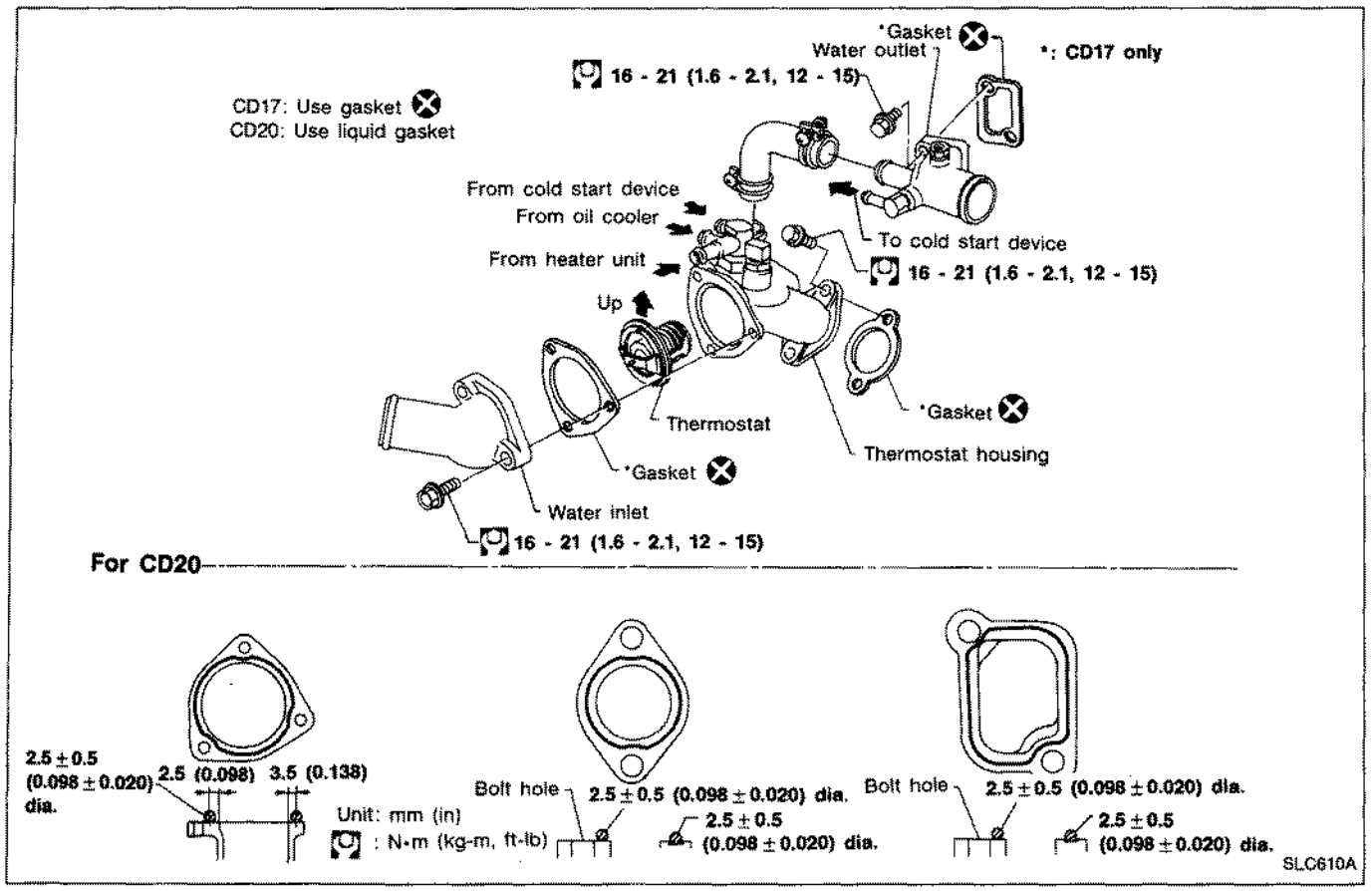


INSPECTION

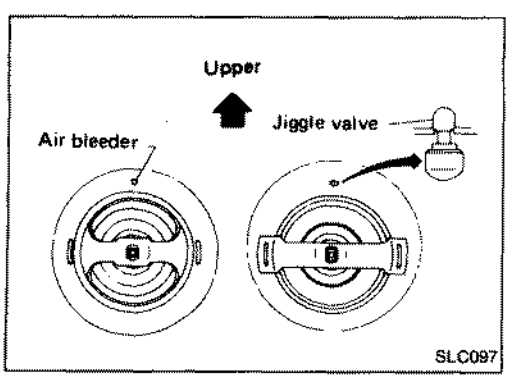
1. Check for badly rusted or corroded body assembly and vane.
2. Check for rough operation due to excessive end play.

Thermostat

REMOVAL AND INSTALLATION

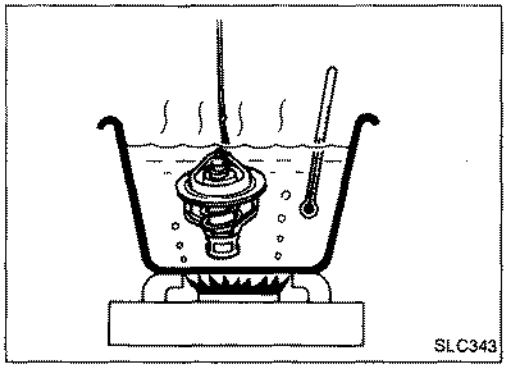


- Use new gasket. (CD17)
- Apply liquid gasket to water outlet, thermostat housing and water inlet. (CD20)



- Install thermostat with jiggle valve uppermost.
- **After installation, run engine for a few minutes, and check for leaks.**

Thermostat (Cont'd)



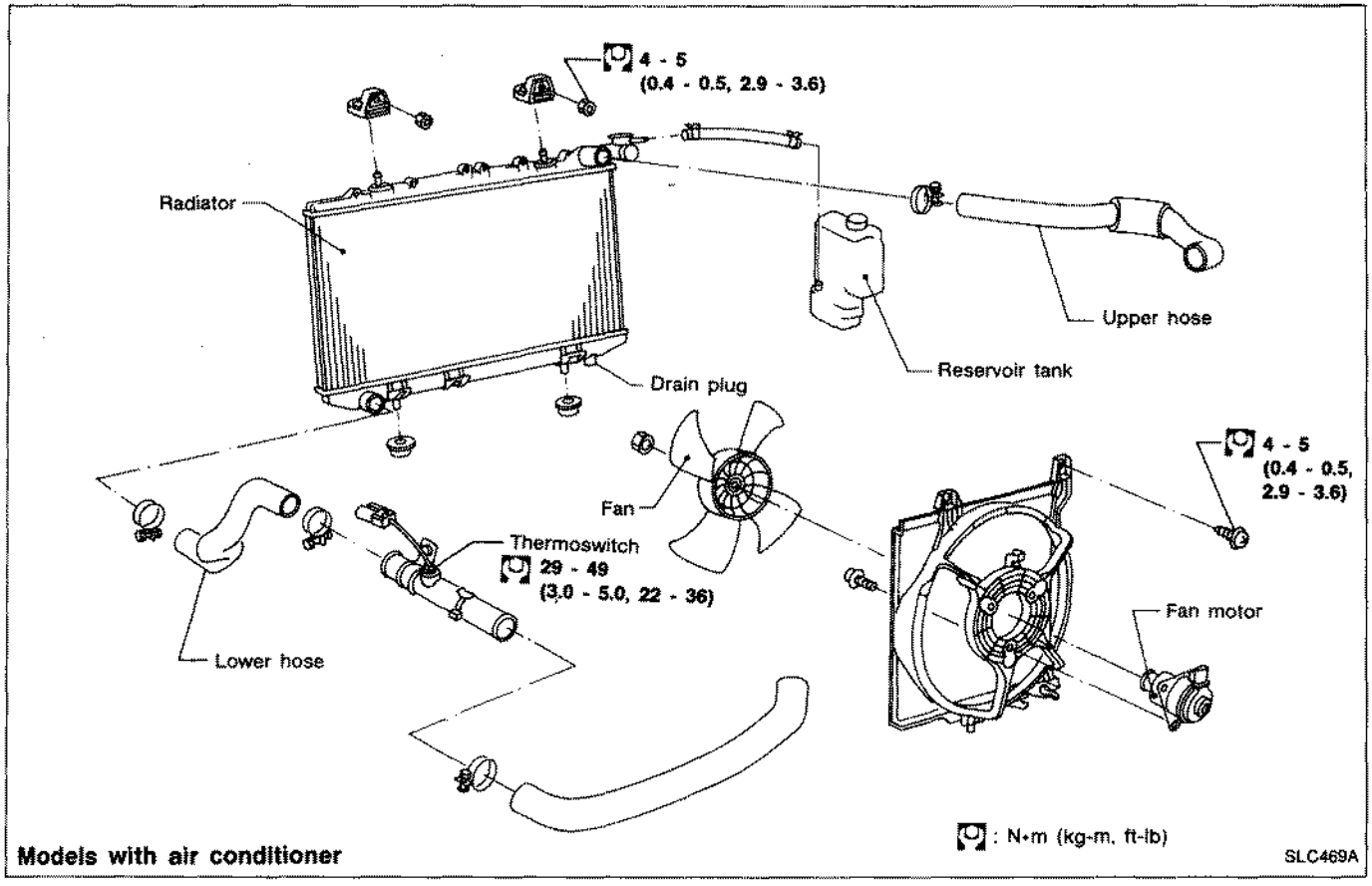
INSPECTION

1. Check for valve seating condition at ordinary temperatures. It should seat tightly.
2. Check valve opening temperature and maximum valve lift.

	CD17	CD20
Valve opening temperature °C (°F)	82 (180)	88 (190)
Max. valve lift mm/°C (in/°F)	8/95 (0.31/203)	8/100 (0.31/212)

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

Radiator

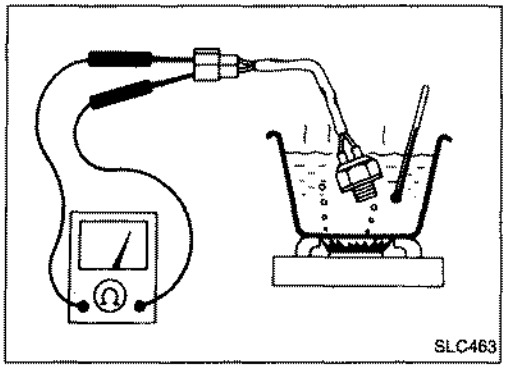


Models with air conditioner

Radiator Fan Motor

OPERATION

Water temperature °C (°F)	Fan motor operation	
	A/C OFF	A/C ON
Below 90 (194)	OFF	ON
Above 90 (194)	ON	



THERMOSWITCH INSPECTION

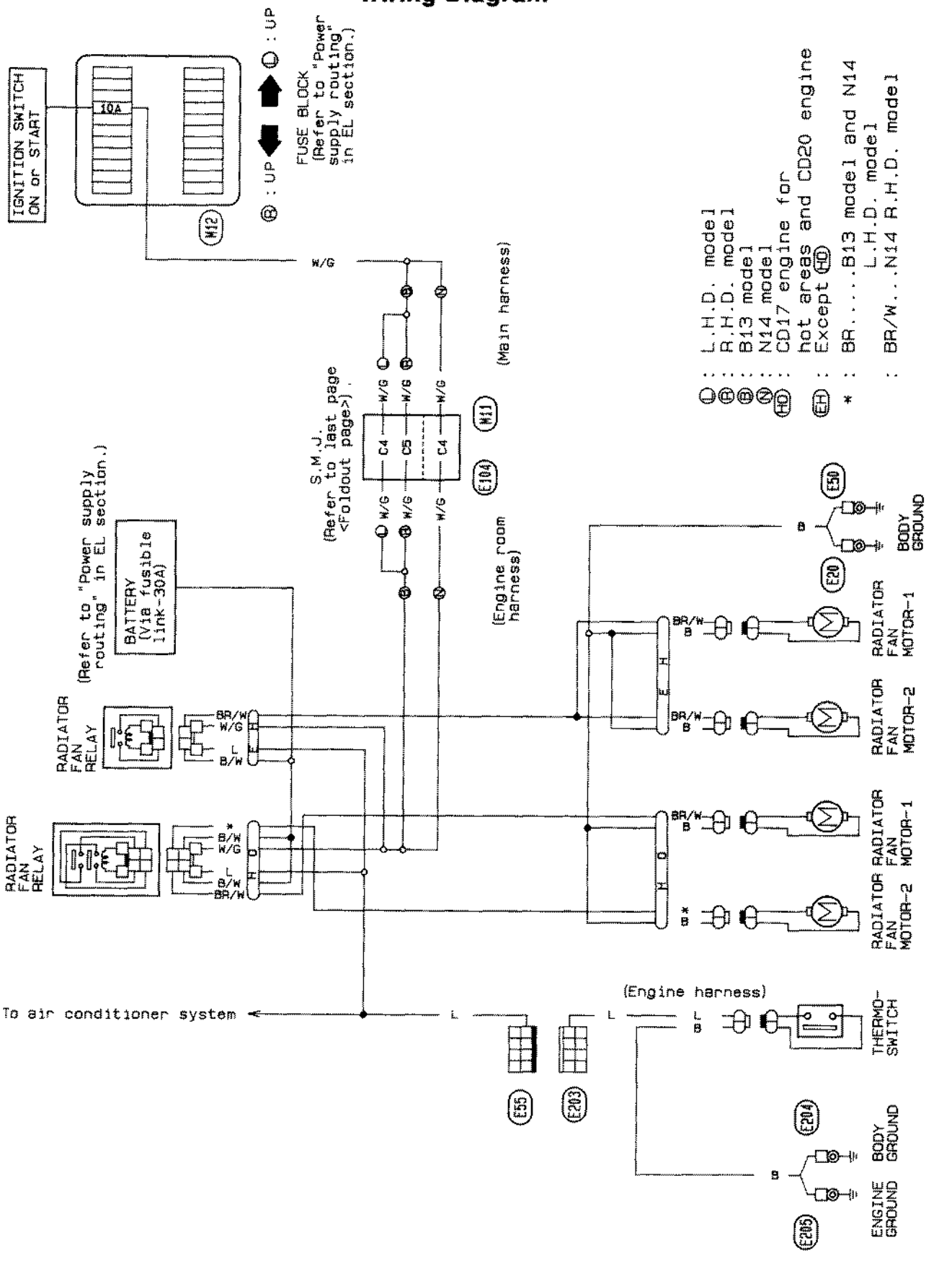
Check thermoswitch for proper operation.

Operating temperature:

OFF → ON 90°C (194°F)

ON → OFF 83°C (181°F)

Wiring Diagram



SLC633A

Engine Lubrication System

Oil pressure check

Engine rpm	Approximate discharge pressure kPa (bar, kg/cm^2, psi)
Idle speed	49 - 186 (0.49 - 1.86, 0.5 - 1.9, 7 - 27)
3,000	343 - 441 (3.43 - 4.41, 3.5 - 4.5, 50 - 64)

Oil pump

Unit: mm (in)

Body to outer gear clearance ①	0.110 - 0.200 (0.0043 - 0.0079)
Inner gear to crescent clearance ②	0.217 - 0.327 (0.0085 - 0.0129)
Outer gear to crescent clearance ③	0.21 - 0.32 (0.0083 - 0.0126)
Body to inner gear clearance ④	0.05 - 0.09 (0.0020 - 0.0035)
Body to outer gear clearance ⑤	0.05 - 0.11 (0.0020 - 0.0043)
Inner gear to brazed portion of housing clearance ⑥	0.045 - 0.091 (0.0018 - 0.0036)

Engine Cooling System

Thermostat

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

Thermoswitch (Electrical cooling fan)

	Except for A/T models for hot areas	A/T models for hot areas
Operating temperature (OFF → ON) °C (°F)	82 - 88 (180 - 190)	Low: 82 - 88 (180 - 190) High: 102 - 108 (216 - 226)

Engine Lubrication System

Oil pressure check

Engine rpm	Approximate discharge pressure kPa (bar, kg/cm^2, psi)
Idle speed	SR20DE: More than 98 (0.98, 1.0, 14) SR20DET: More than 98 (0.98, 1.0, 14)
3,200	SR20DE: 324 - 422 (3.24 - 4.22, 3.3 - 4.3, 47 - 61) SR20DET: 343 - 441 (3.43 - 4.41, 3.5 - 4.5, 50 - 64)

Oil pump inspection

Unit: mm (in)

Body to outer gear clearance	0.114 - 0.200 (0.0045 - 0.0079)
Inner gear to outer gear tip clearance	Below 0.18 (0.0071)
Body to inner gear clearance	0.05 - 0.09 (0.0020 - 0.0035)
Body to outer gear clearance	0.05 - 0.11 (0.0020 - 0.0043)
Inner gear to brazed portion of housing clearance	0.045 - 0.091 (0.0018 - 0.0036)

Regulator valve inspection

Unit: mm (in)

Regulator valve to oil pump cover clearance	0.040 - 0.097 (0.0016 - 0.0038)

Engine Cooling System

Thermostat

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

Engine Lubrication System

Oil pressure check

Engine rpm	Approximate discharge pressure kPa (bar, kg/cm^2, psi)
Idle speed	More than 59 (0.59, 0.6, 9)
3,000	363 - 520 (3.63 - 5.20, 3.7 - 5.3, 53 - 75)

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)	0.05 - 0.12 (0.0020 - 0.0047)

Engine Cooling System

Thermostat

	Frigid type	Standard type	Tropical type
Valve opening temperature °C (°F)	88 (190)	82 (180)	76.5 (170)
Max. valve lift mm/°C (in/°F)	8/100 (0.31/212)	8/95 (0.31/203)	8/90 (0.31/194)

Thermoswitch (Electrical cooling fan)

Operating temperature (OFF → ON) °C (°F)	87 - 93 (189 - 199)

Engine Lubrication System

Oil pressure check

Engine rpm	Approximate discharge pressure kPa (bar, kg/cm^2, psi)
Idle speed	More than 59 (0.59, 0.6, 9)
2,000	294 (2.9, 3, 43)

Oil pump inspection — CD17

Unit: mm (in)

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

Oil pump inspection — CD20

Unit: mm (in)

Body to outer gear clearance	0.12 - 0.20 (0.0047 - 0.0079)
Outer gear to inner gear clearance	Less than 0.18 (0.0071)
Housing to inner gear clearance	0.05 - 0.09 (0.0020 - 0.0035)
Housing to outer gear clearance	0.05 - 0.11 (0.0020 - 0.0043)
Inner gear to housing clearance	0.05 - 0.09 (0.0020 - 0.0035)

Engine Cooling System

Thermostat

	CD17	CD20
Valve opening temperature °C (°F)	82 (180)	88 (190)
Max. valve lift mm/°C (in/°F)	8/95 (0.31/203)	8/100 (0.31/212)

Thermoswitch

Operating temperature	
OFF → ON	90°C (194°F)
ON → OFF	83°C (181°F)

Radiator

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

Leakage test pressure	157 (1.57, 1.6, 23)

Tightening Torque

Unit		N·m	kg-m	ft-lb
Oil pressure switch		10 - 16	1.0 - 1.6	7 - 12
Oil pan drain plug		29 - 39	3.0 - 4.0	22 - 29
Oil pan	CD20	7 - 8	0.7 - 0.8	5.1 - 5.8
	CD17	5 - 7	0.5 - 0.7	3.6 - 5.1
Oil pump mounting bolt		12 - 16	1.2 - 1.6	9 - 12
Oil strainer bolt		16 - 19	1.6 - 1.9	12 - 14
Oil strainer bracket bolt		7	0.7	5.1
Thermoswitch		29 - 49	3.0 - 5.0	22 - 36
Cylinder block drain plug		54 - 74	5.5 - 7.5	40 - 54

ENGINE FUEL & EMISSION CONTROL SYSTEM

SECTION EF & EC

CONTENTS

Contents (Cont'd)

Note: Refer to Foldout page for "E.C.C.S. WIRING DIAGRAM".

E

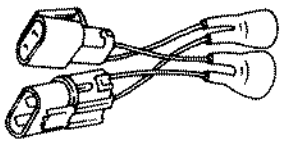
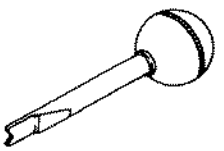
CD

GA, SR, E, CD

For assistance with 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

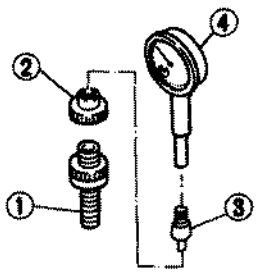
Tool number Tool name	Description	Engine application		
		GA13DS, GA14DS & GA16DS	GA16DE	SR
EG11160000 Adapter harness	 Measuring engine speed	—	X	X
KV10108300 Idle adjusting screwdriver		X *	—	—

* Only for models for Hong Kong and Singapore

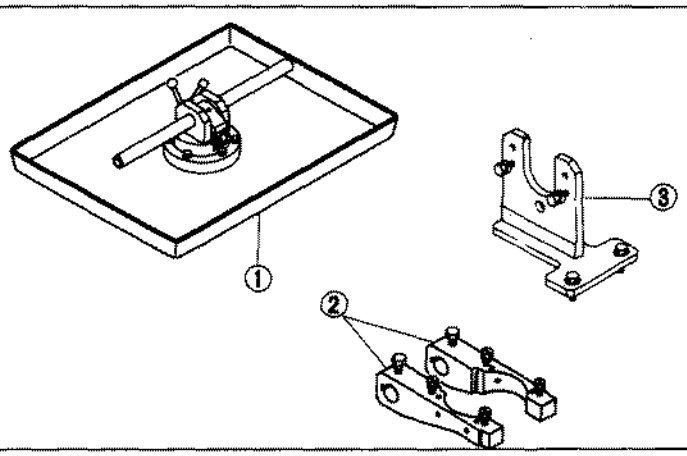
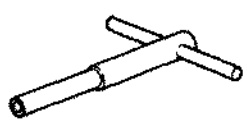
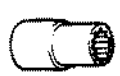
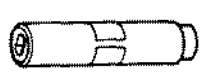
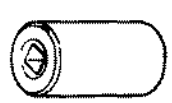
SPECIAL SERVICE TOOLS

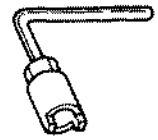
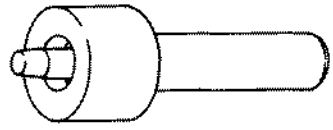
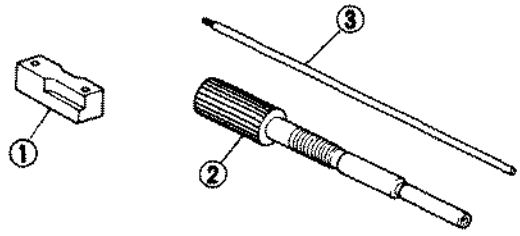
For VE-type injection pump

Adjusting device on vehicle

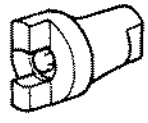
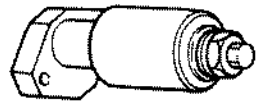
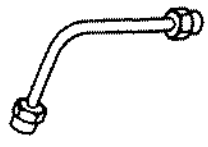
Tool number Tool name	Description	
KV11229352 Measuring device ① KV11229350 Holder ② KV11229360 Nut ③ KV11229370 Pin ④ KV11254410 Dial gauge		Measuring set length of plunger spring

Disassembling and assembling tools

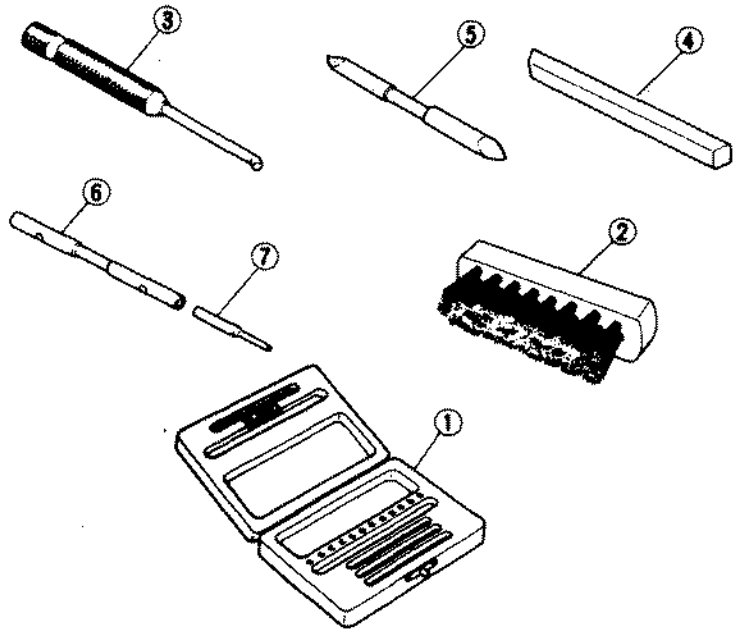
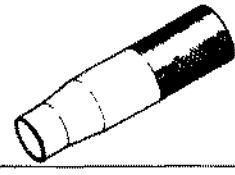
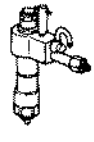
① KV11244852 Universal vise ② KV11244872 Bracket ③ KV11244792 Bracket	
KV11229072 Insert device	
KV11214110 Socket wrench for delivery valve	
KV11214270 Socket wrench for governor pivot bolt	
KV11214260 Socket wrench for regulating valve	
KV11214250 Socket wrench for distributor head plug	

Tool number Tool name	Description
KV11215262 Governor shaft adjusting device	
KV11229542 Feed pump holder	
KV11229852 "MS" measuring device set ① KV11229110 Block gauge ② KV11229820 Dummy shaft ③ KV11229830 Rod	
KV11229042 "K" & "KF" measuring device	

Adjusting device on pump tester

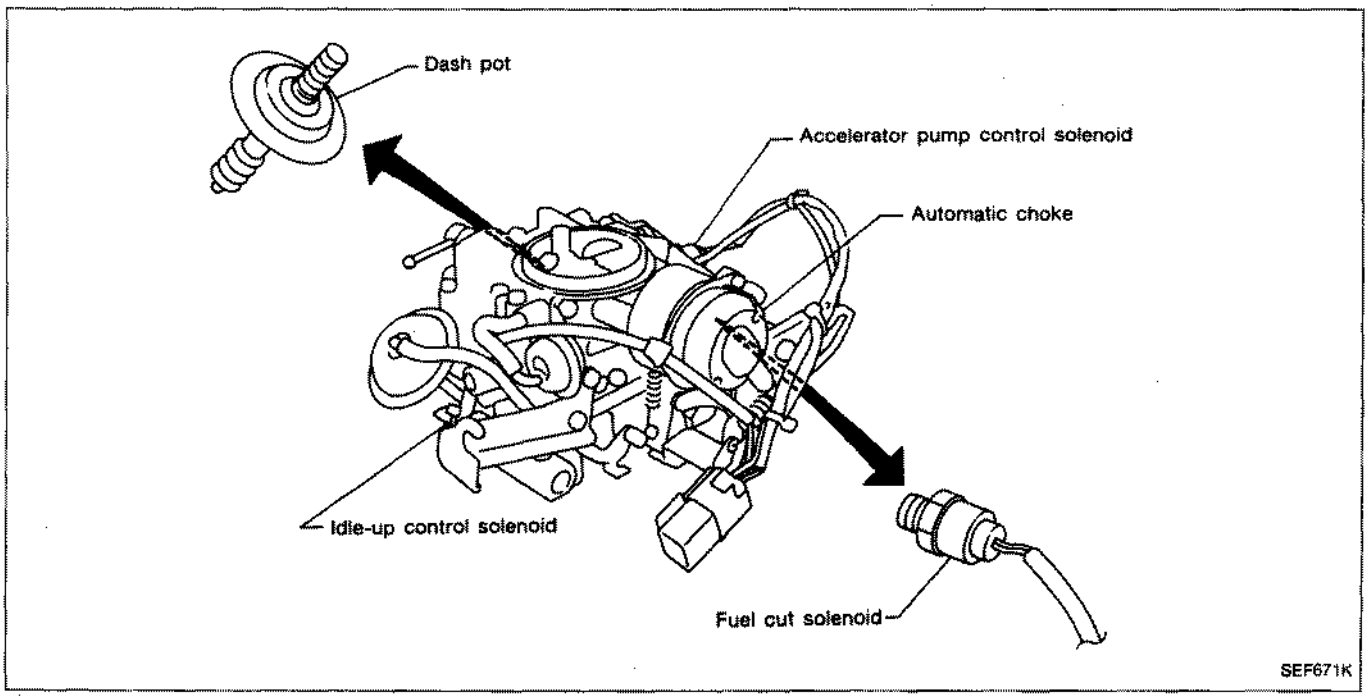
KV11281036 Fixing stand	
KV11242442 Coupling	
KV11282815 Measuring device (for high-pressure side) KV11282819 Measuring device (for low-pressure side)	Measuring timer advance angle 
KV11205032 Injection pipe	 840 mm (33.07 in)

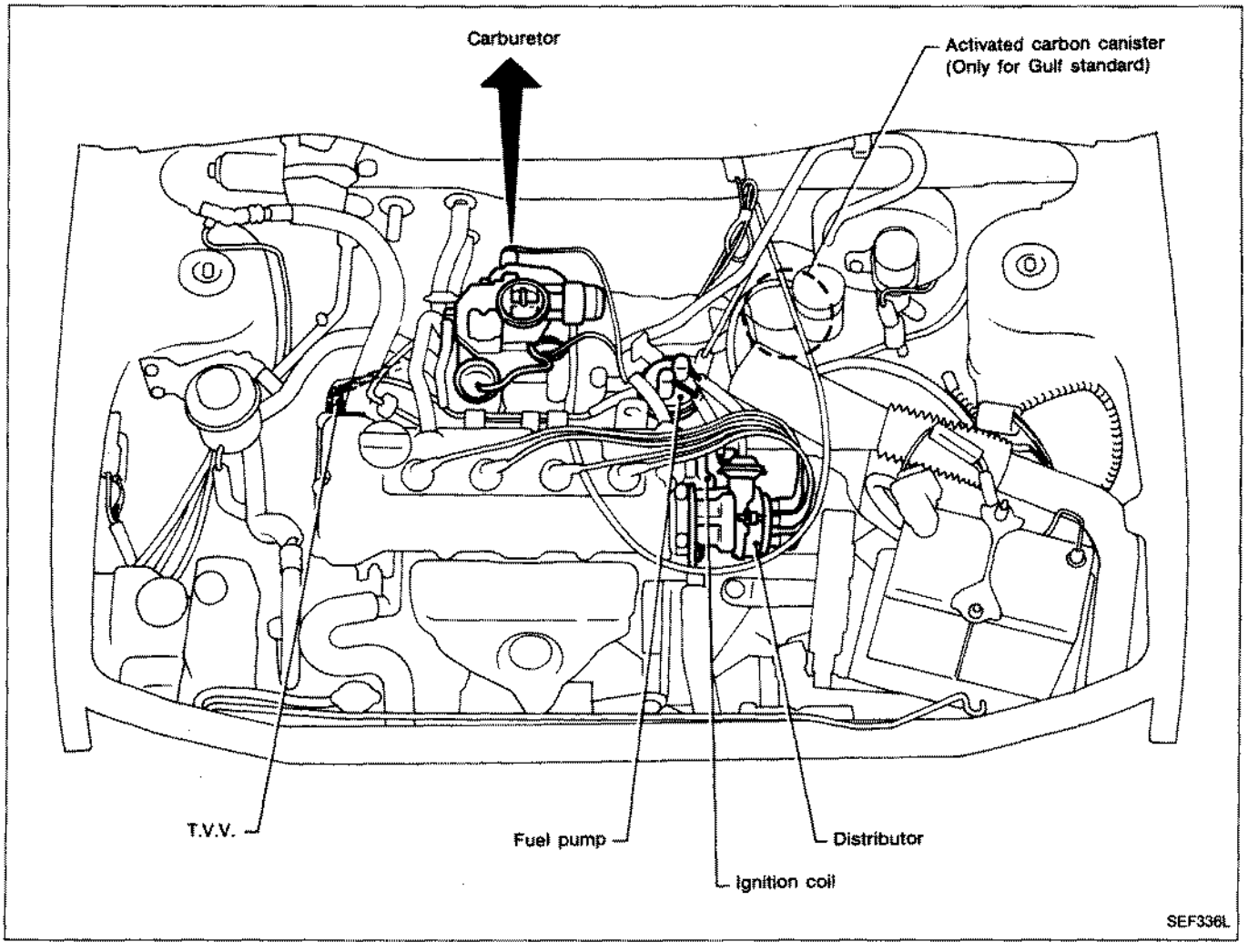
For injection nozzle

Tool number Tool name	Description
KV11289004 Nozzle cleaning kit ① KV11290012 Box ② KV11290110 Brush ③ KV11290122 Nozzle oil sump scraper ④ KV11290140 Nozzle needle tip cleaner ⑤ KV11290150 Nozzle seat scraper ⑥ KV11290210 Nozzle holder ⑦ KV11290220 Nozzle hole cleaning needle	
KV11292010 Nozzle centering device	
KV11100300 Nozzle holder socket	
KV11229462 Extractor	Disassembling of regulating valve 
KV11229522 Insert device	Assembling of regulating valve 
KV11257802 Nozzle holder (Bosch type EF8511-9A)	
KV11257800 Nozzle (Bosch type DN12SD12T)	

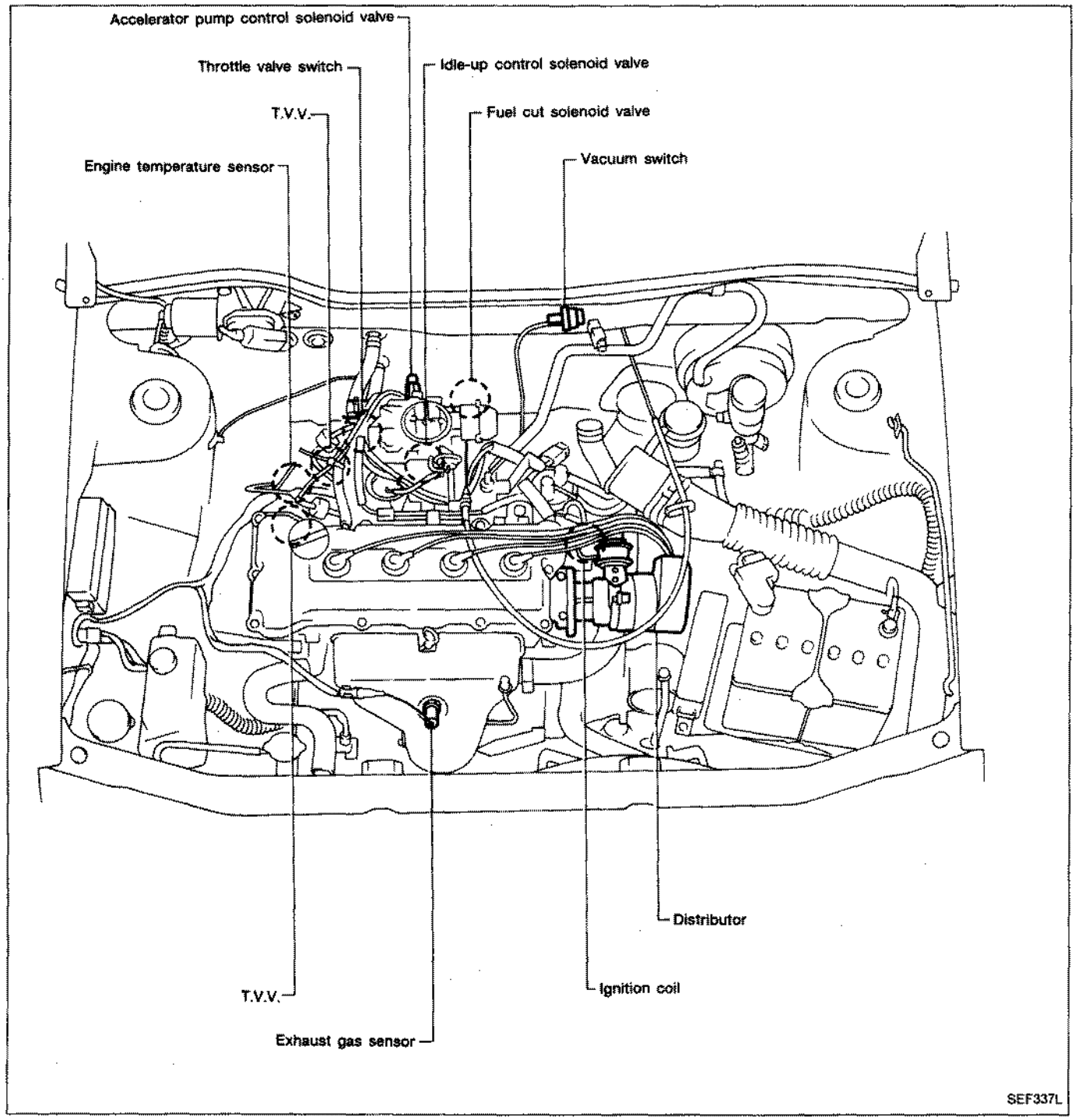
Component Parts Location

Models Without Catalyzer

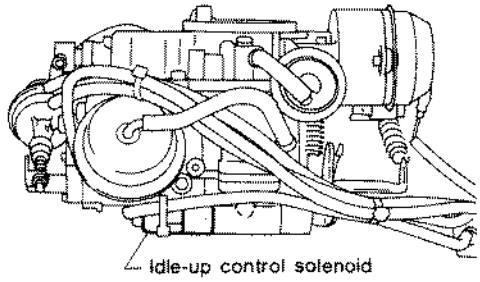




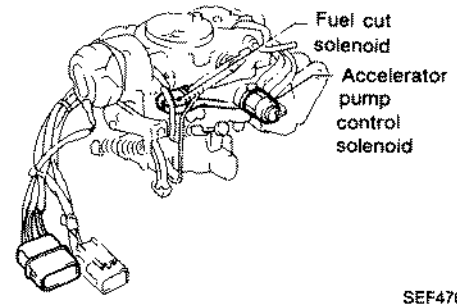
GA14DS With Catalyzer Without E.G.R.



GA14DS With Catalyzer Without E.G.R. (Cont'd)



SEF292K



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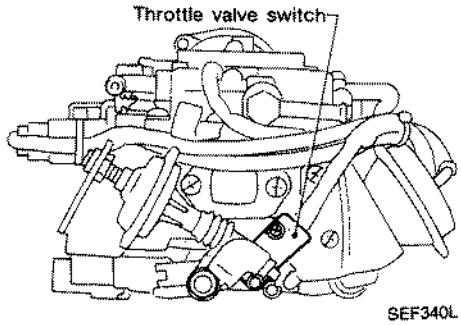
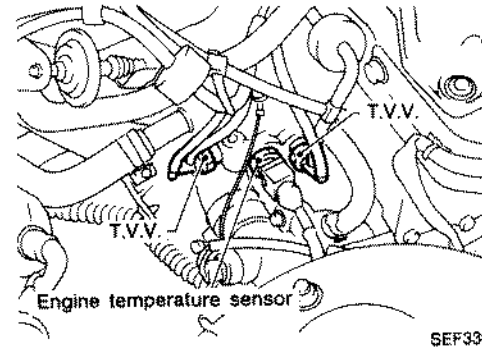
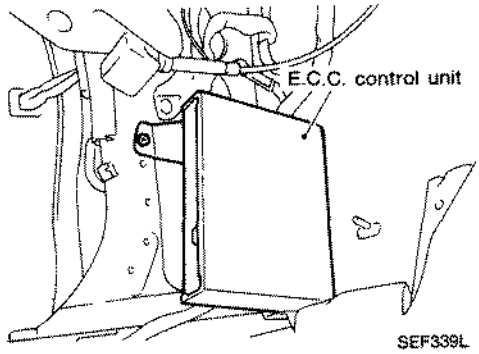


SEF340L

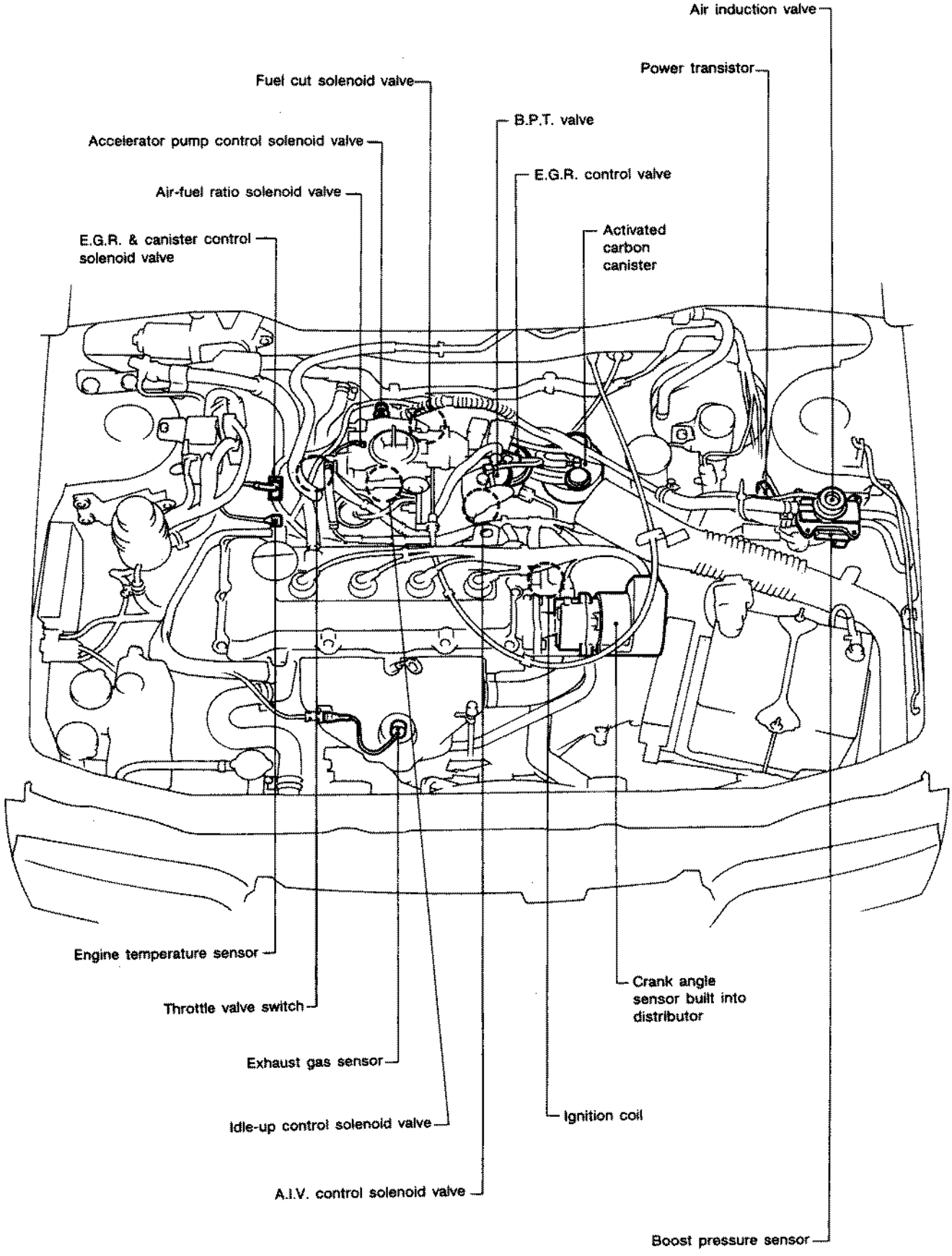


SEF338L



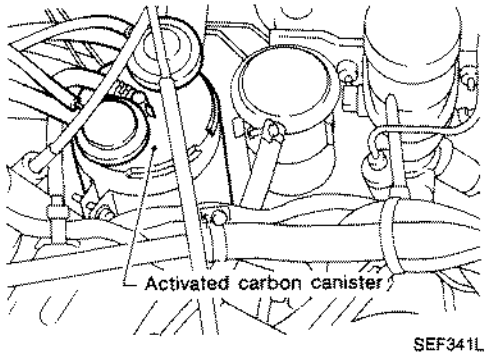
SEF339L

Models With Catalyzer and E.G.R.

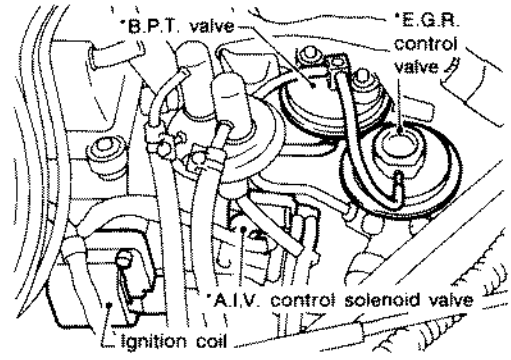


SEF356L

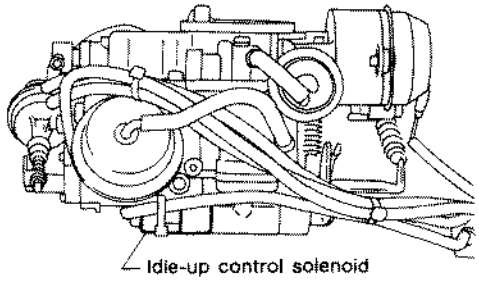
Models With Catalyzer and E.G.R. (Cont'd)



SEF341L



SEF813L



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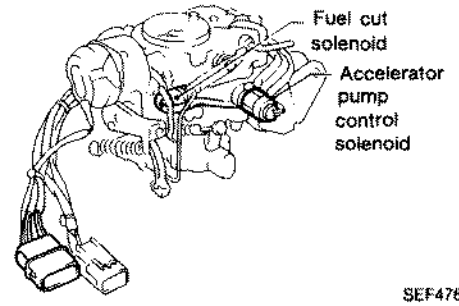

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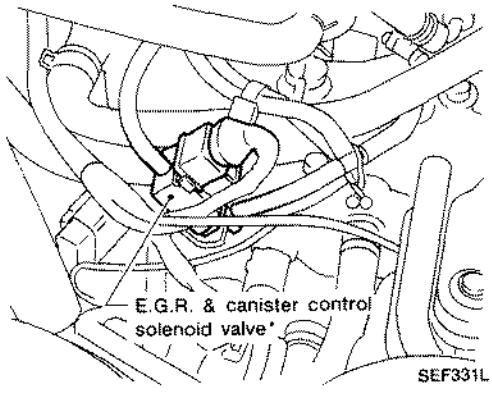
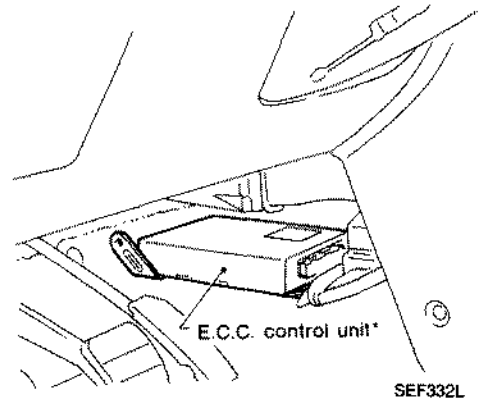


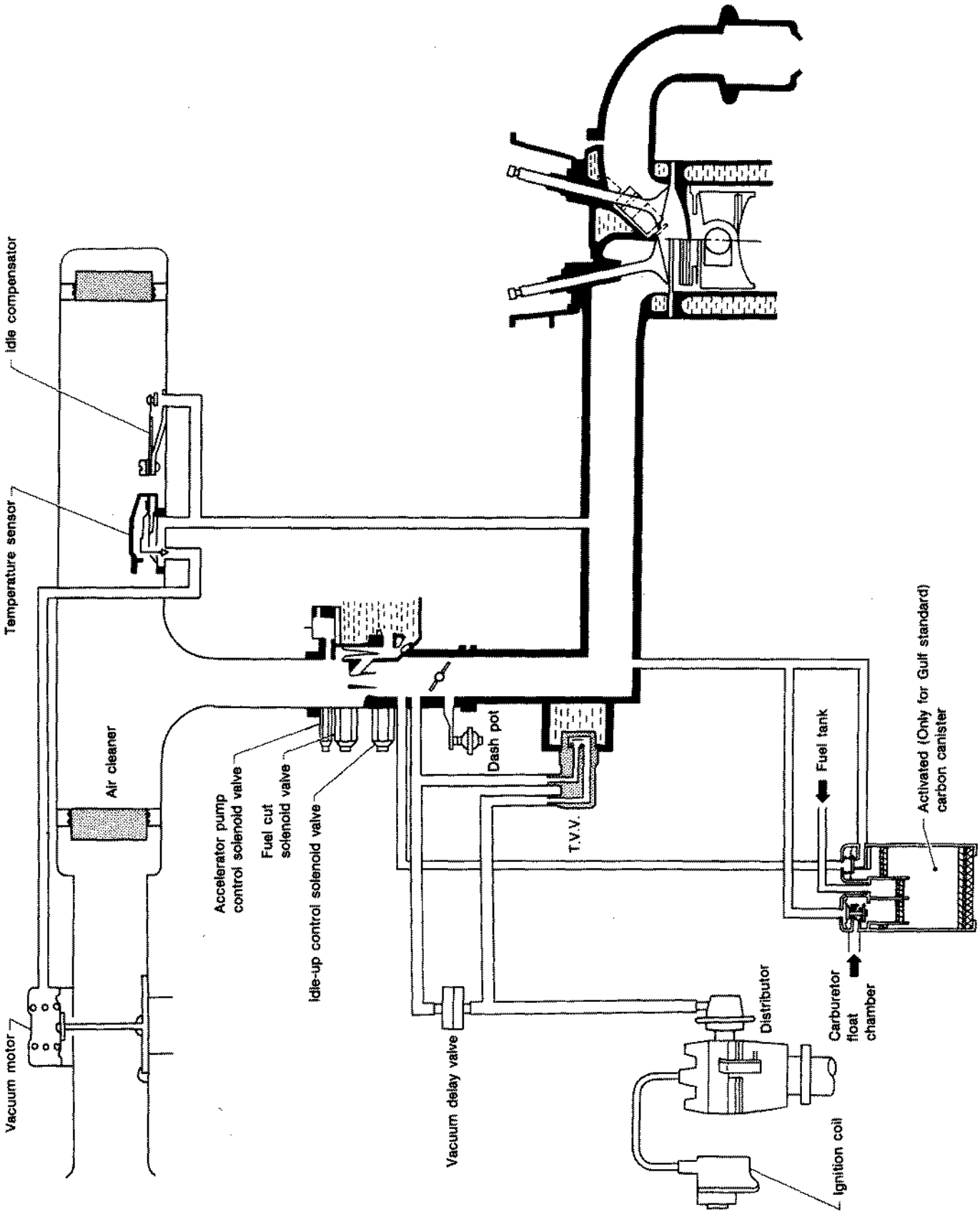
SEF331L



SEF332L

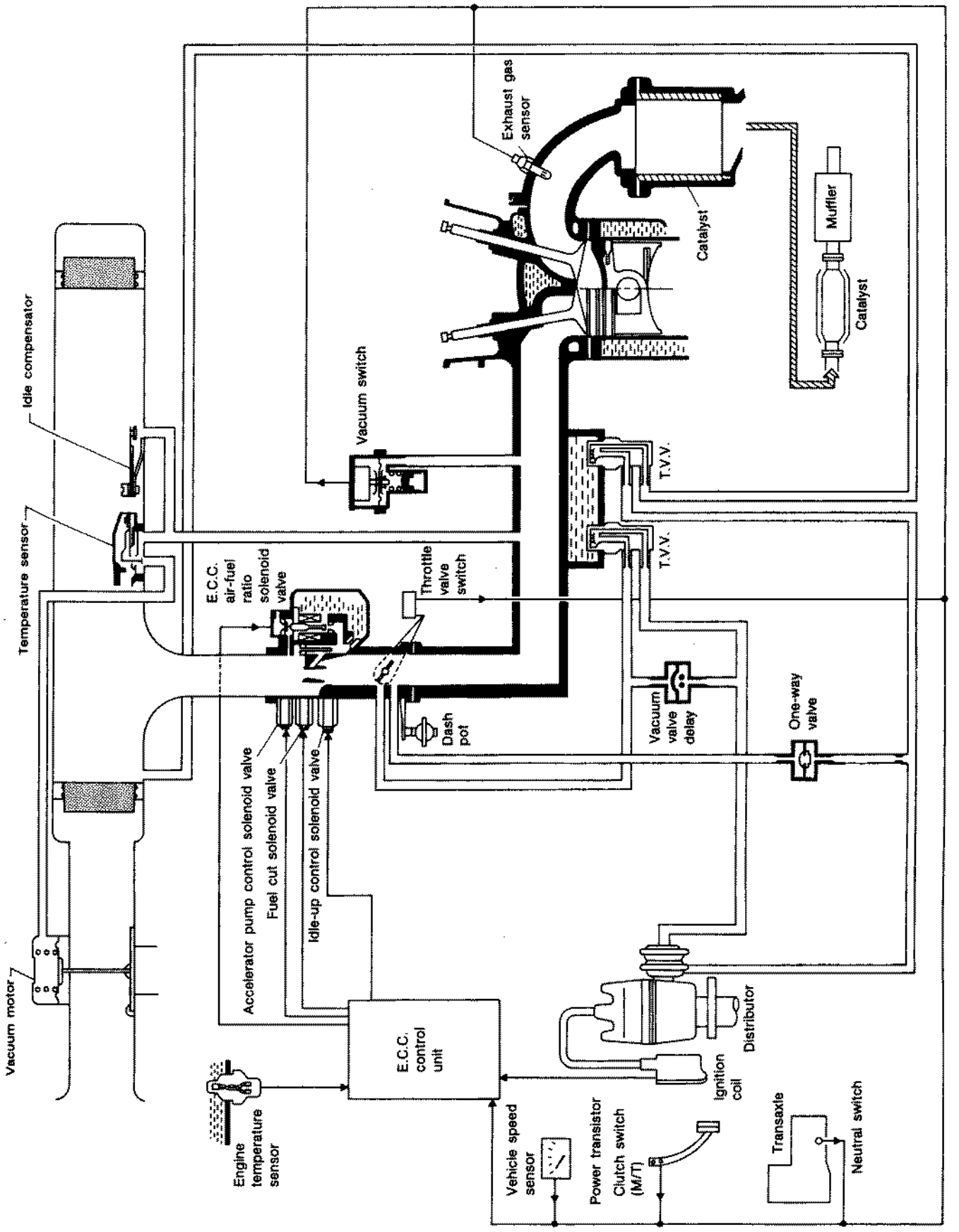
*For models with catalyzer only

Models Without Catalyzer



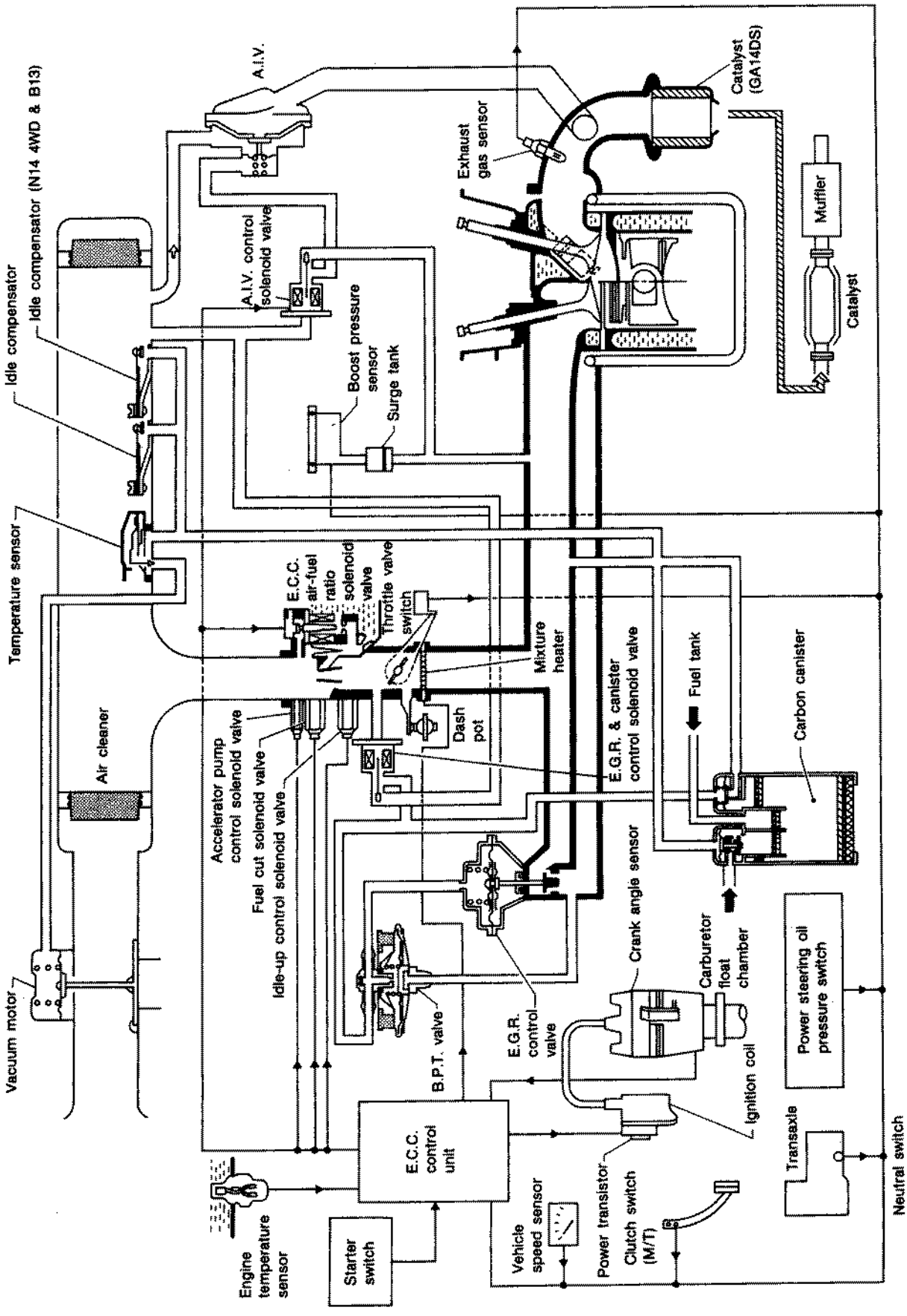
SEF335L

GA14DS With Catalyzer Without E.G.R.



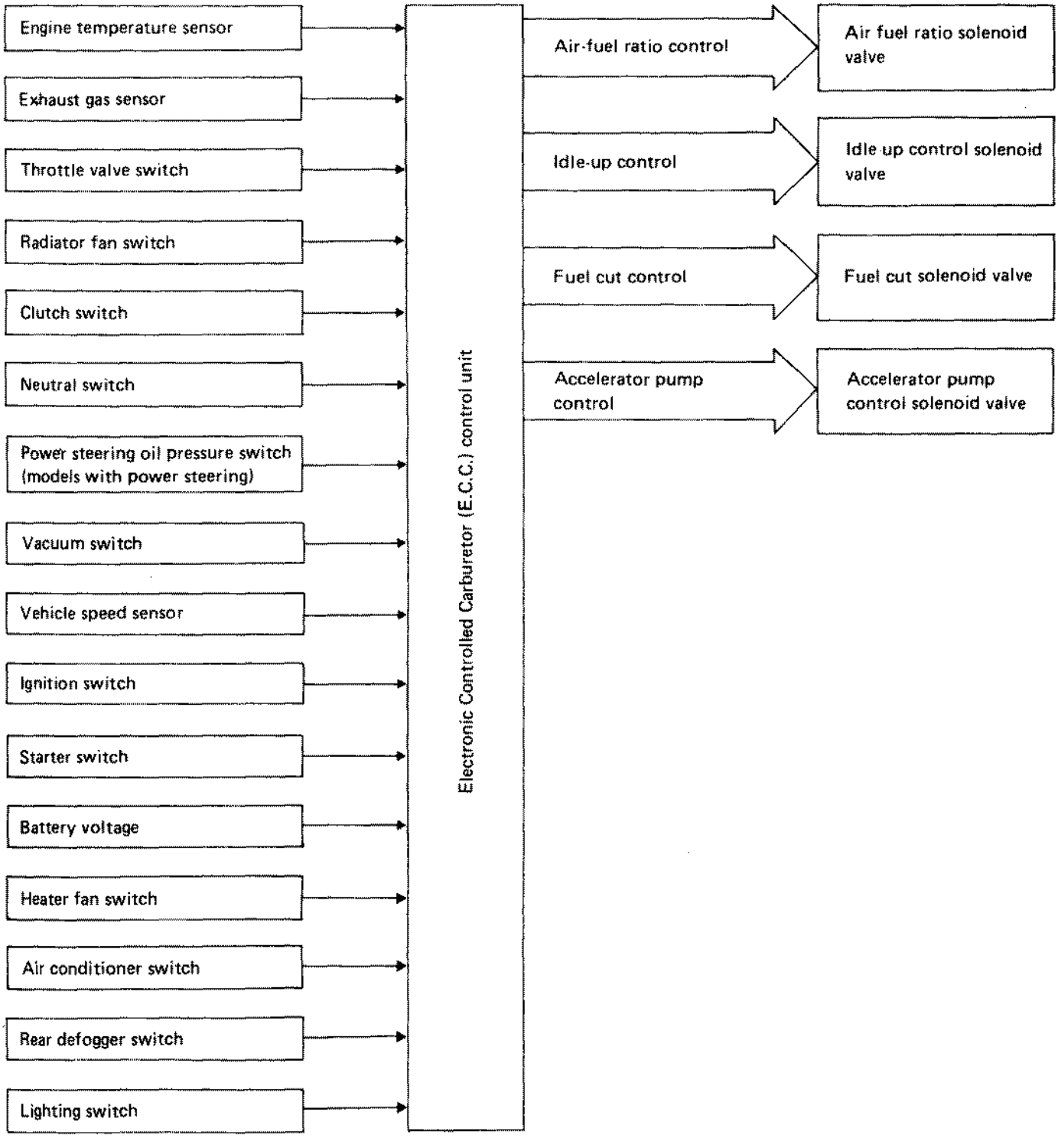
SEF334L

Models With Catalyzer and E.G.R.

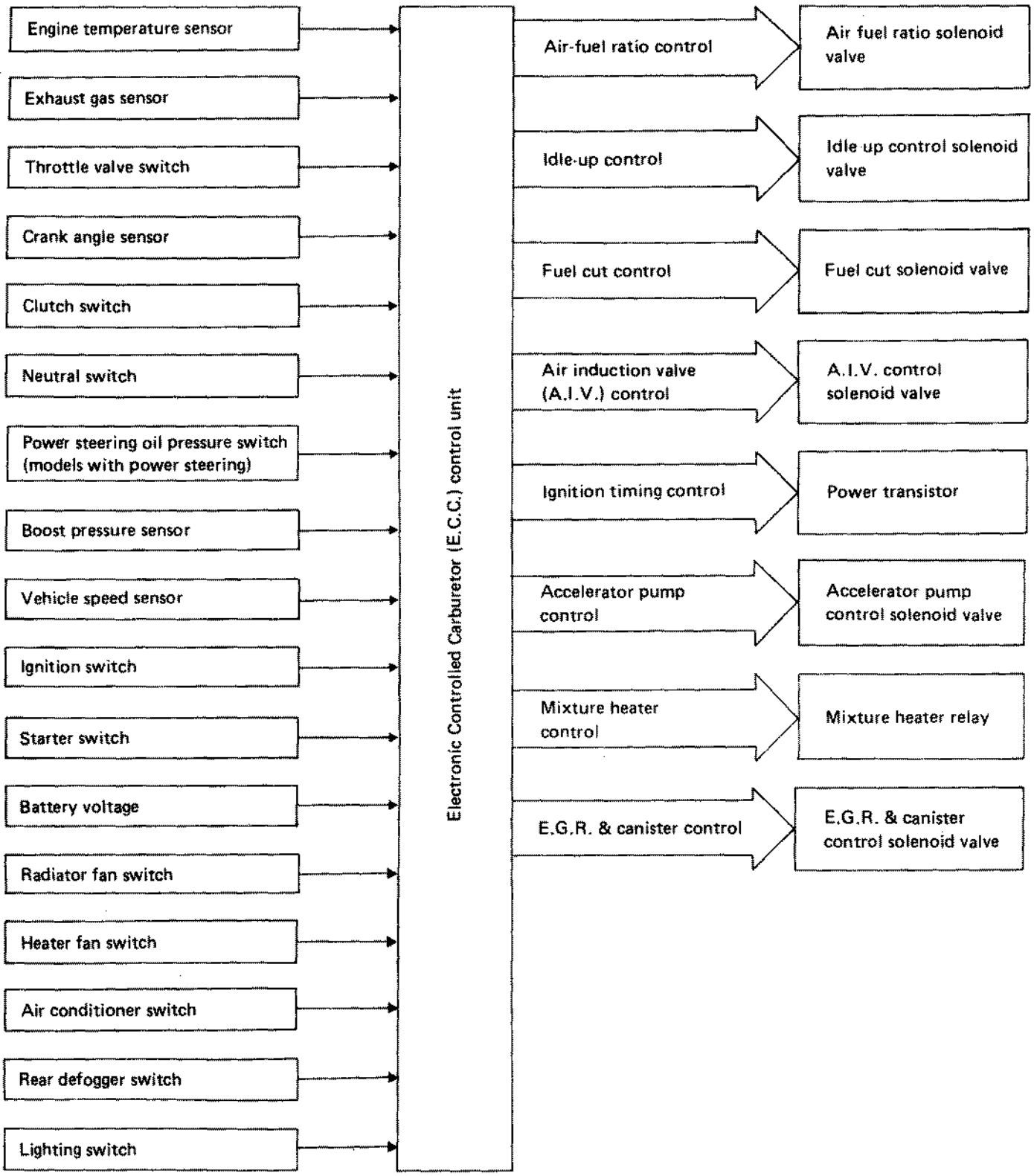


SEF333L

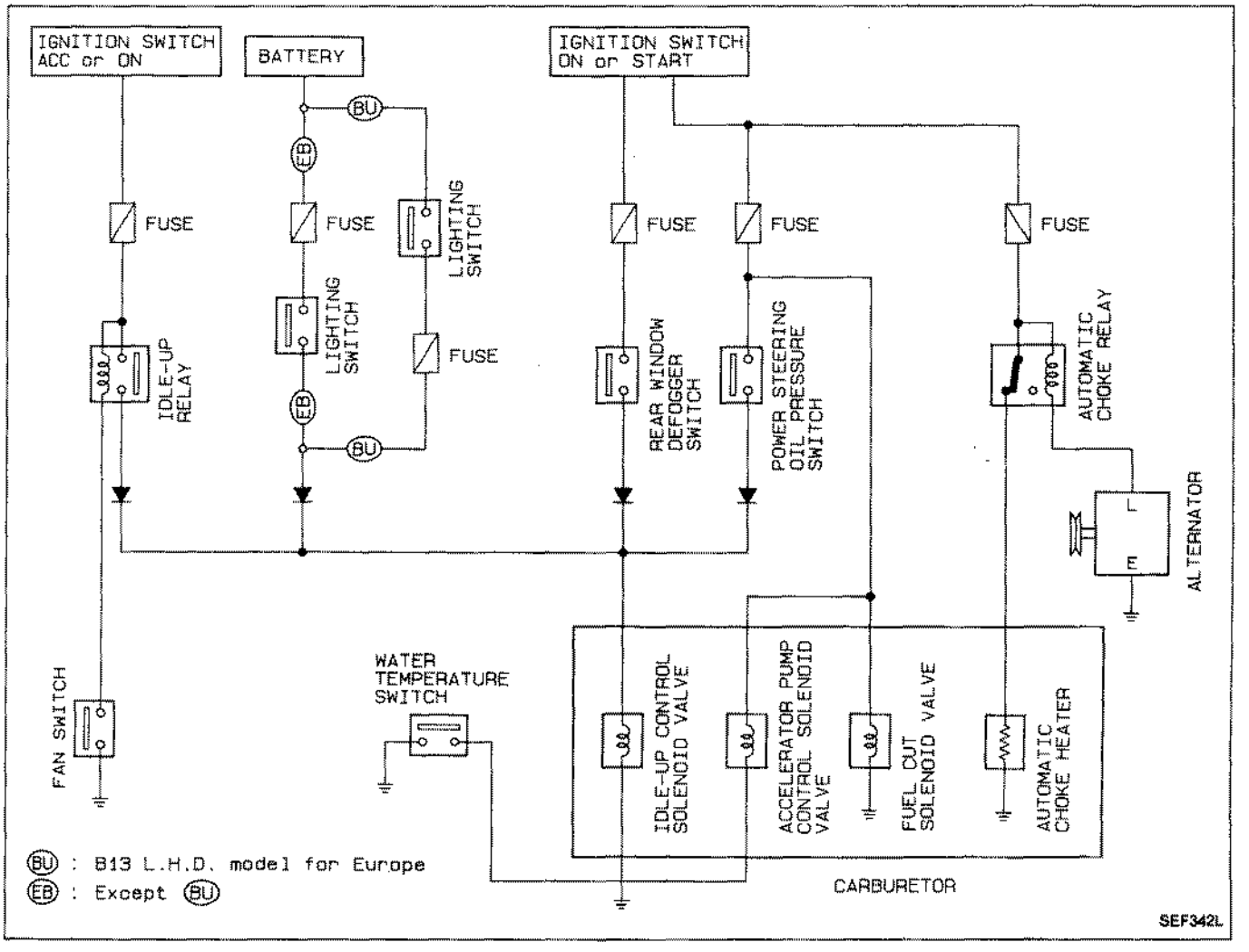
GA14DS WITH CATALYZER WITHOUT E.G.R.



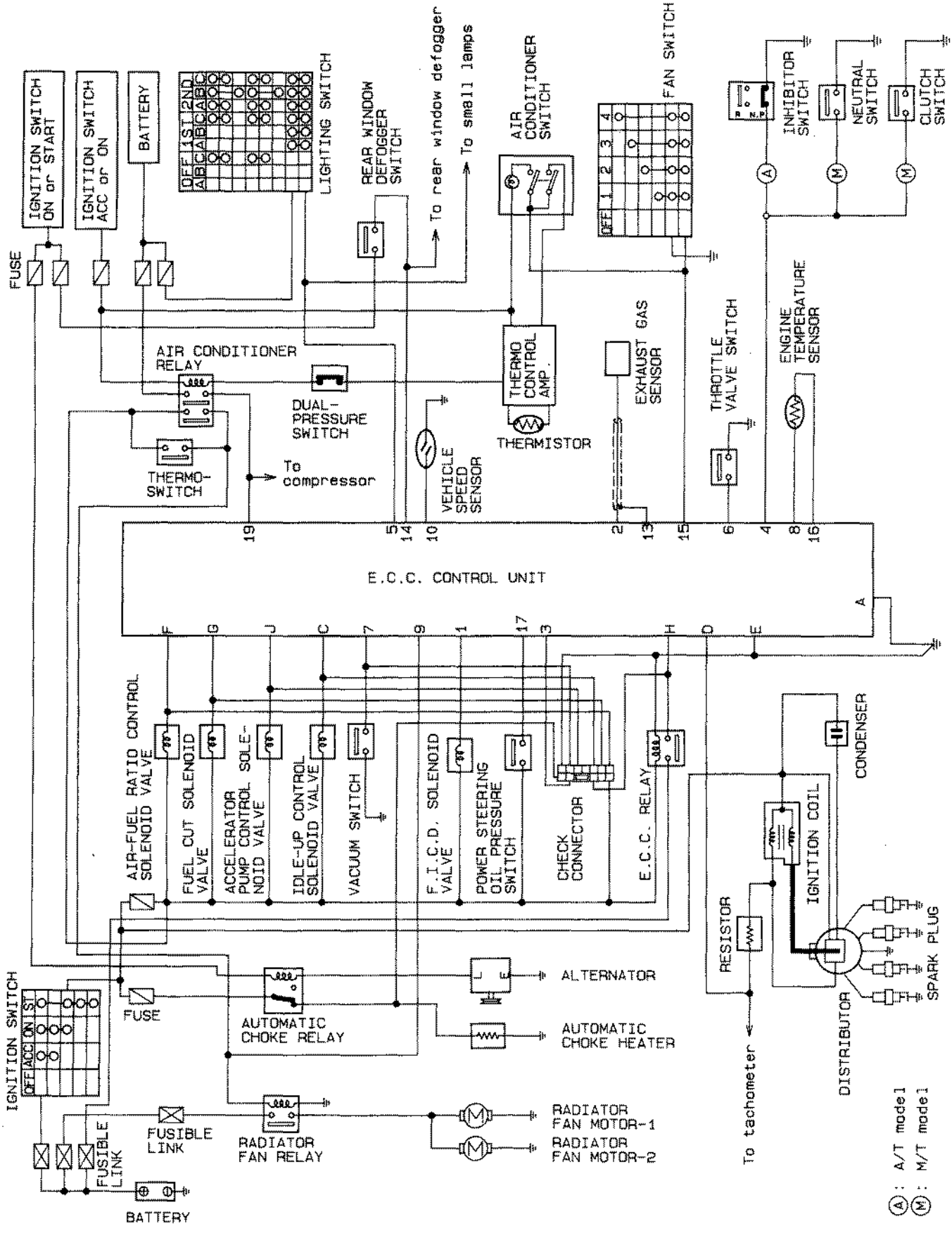
MODELS WITH CATALYZER AND E.G.R.



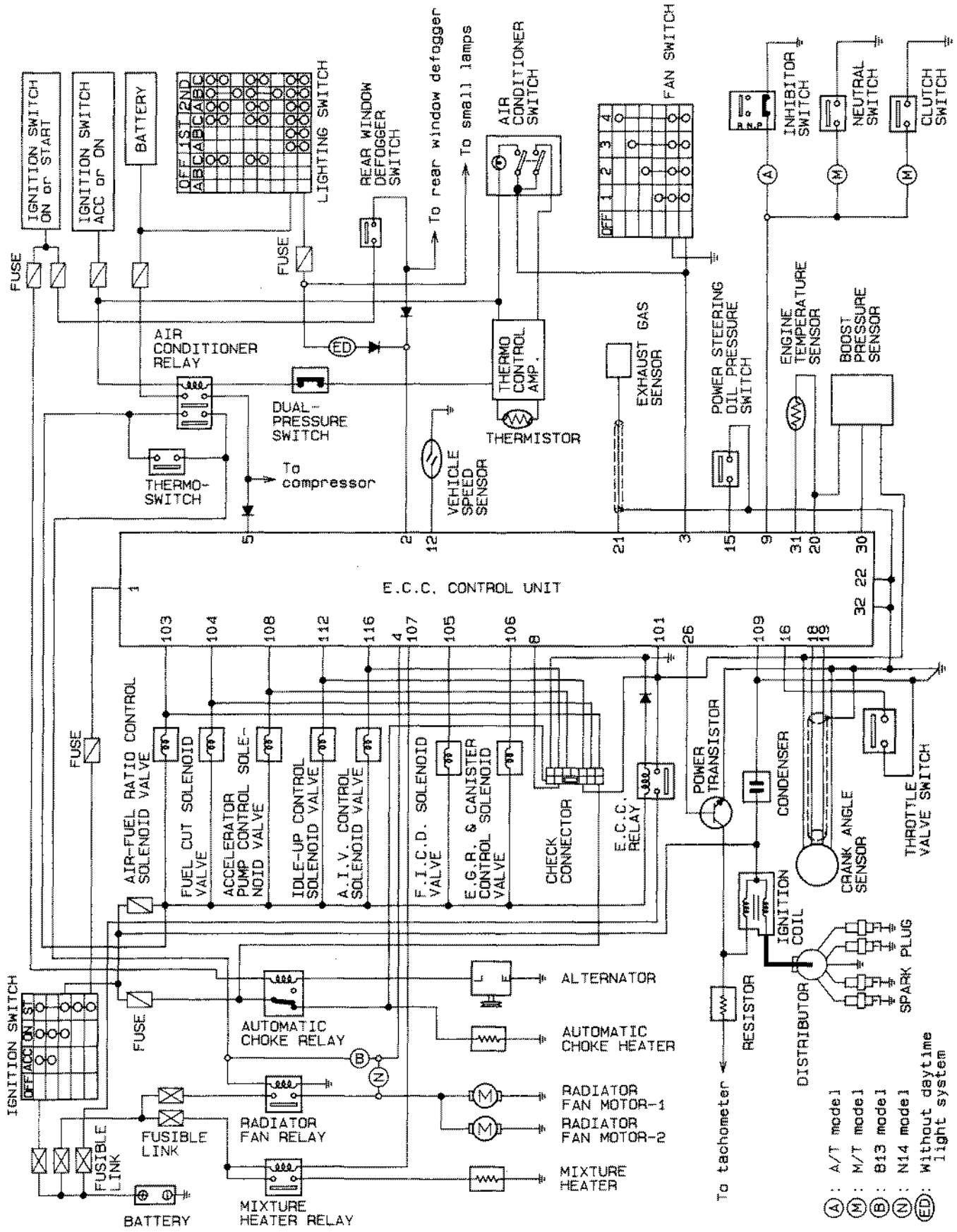
MODELS WITHOUT CATALYZER



GA14DS WITH CATALYZER WITHOUT E.G.R.

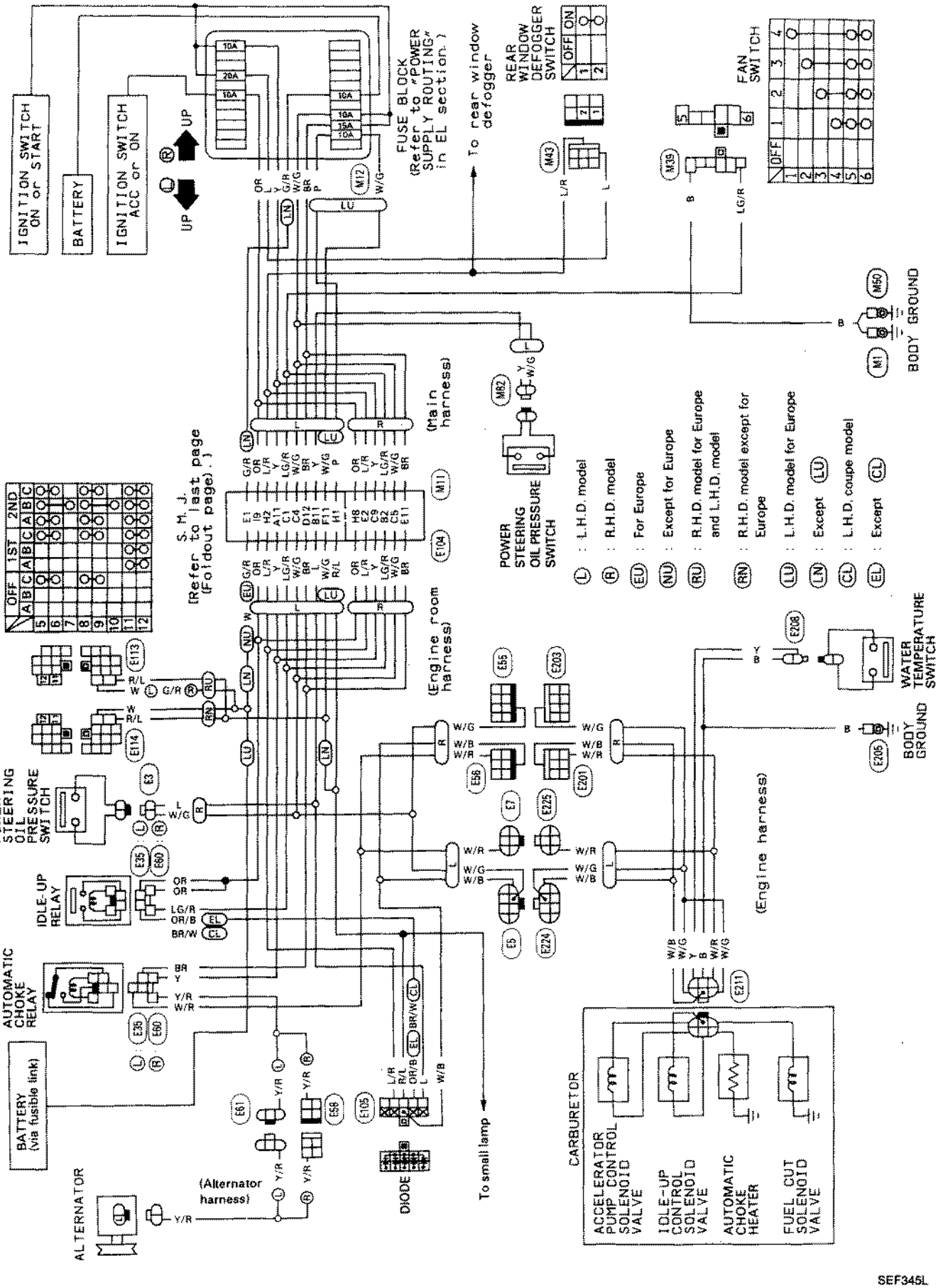


SEF343L


IGNITION SWITCH ON or START
IGNITION SWITCH ACC or ON
BATTERY
OFF 1ST 2ND
LIGHTING SWITCH
REAR WINDOW DEFOGGER SWITCH
To rear window defogger
To small lamps
AIR CONDITIONER SWITCH
FAN SWITCH
INHIBITOR SWITCH
NEUTRAL SWITCH
CLUTCH SWITCH
FUSE
AIR CONDITIONER RELAY
DUAL-PRESSURE SWITCH
THERMO-SWITCH
To compressor
THERMO CONTROL AMP.
THERMISTOR
VEHICLE SPEED SENSOR
EXHAUST GAS SENSOR
POWER STEERING OIL PRESSURE SWITCH
ENGINE TEMPERATURE SENSOR
BOOST PRESSURE SENSOR
E.C.C. CONTROL UNIT
AIR-FUEL RATIO CONTROL SOLENOID VALVE
FUEL CUT SOLENOID VALVE
ACCELERATOR PUMP CONTROL SOLENOID VALVE
IDLE-UP CONTROL SOLENOID VALVE
A.I.V. CONTROL SOLENOID VALVE
F.I.C.D. SOLENOID VALVE
E.G.R. & CANISTER CONTROL SOLENOID VALVE
CHECK CONNECTOR
E.C.C. RELAY
POWER TRANSISTOR
CONDENSER
CRANK ANGLE SENSOR
THROTTLE VALVE SWITCH
IGNITION COIL
DISTRIBUTOR
SPARK PLUG
RESISTOR
To tachometer
IGNITION SWITCH
AUTOMATIC CHOKE RELAY
ALTERNATOR
AUTOMATIC CHOKE HEATER
RADIATOR FAN RELAY
RADIATOR FAN MOTOR-1
RADIATOR FAN MOTOR-2
FUSIBLE LINK
MIXTURE HEATER
MIXTURE HEATER RELAY
BATTERY
Ⓐ : A/T model
Ⓜ : M/T model
Ⓑ : B13 model
Ⓝ : N14 model
ED : Without daytime light system

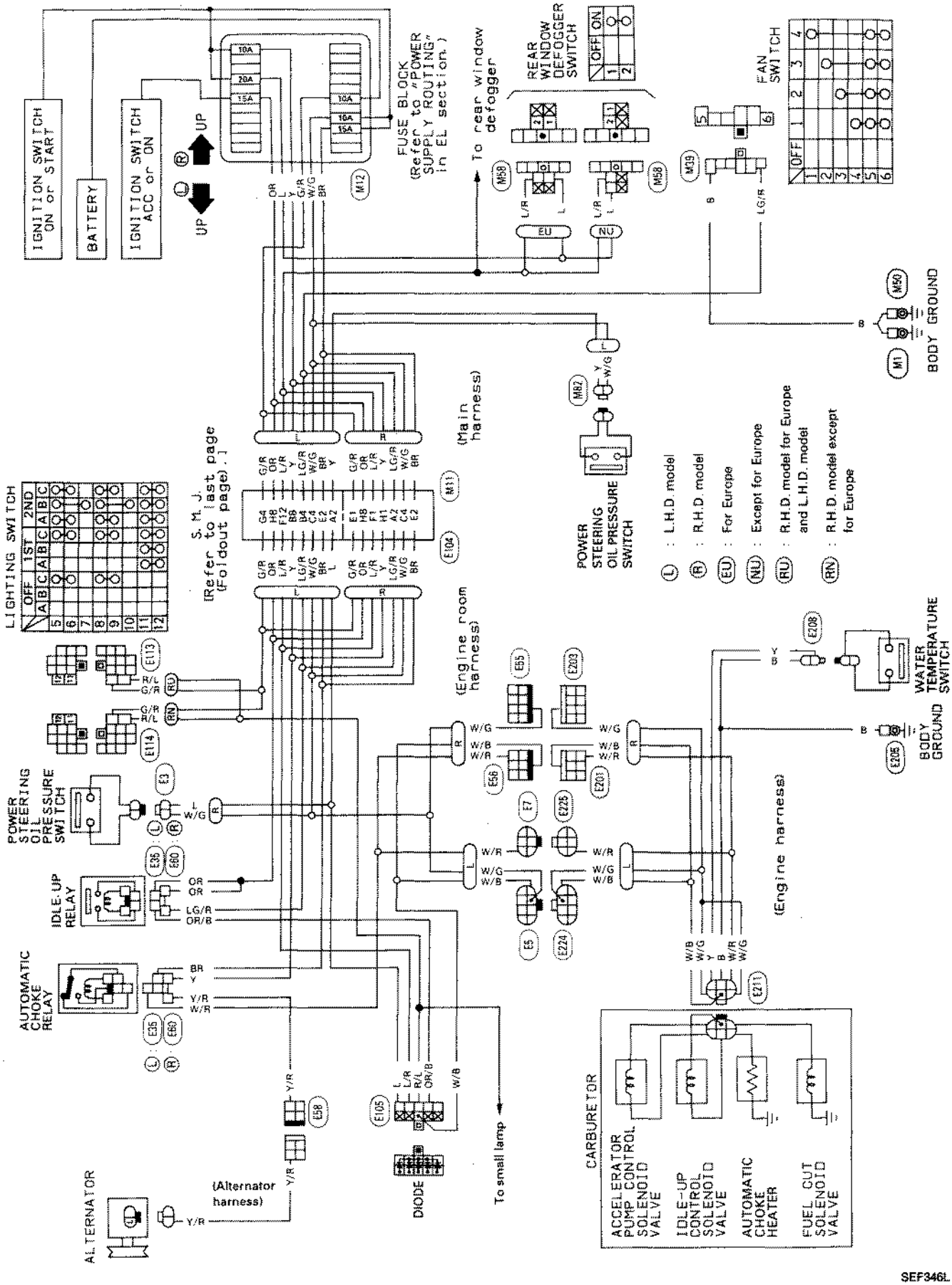
SEF344L

B13 MODELS WITHOUT CATALYZER



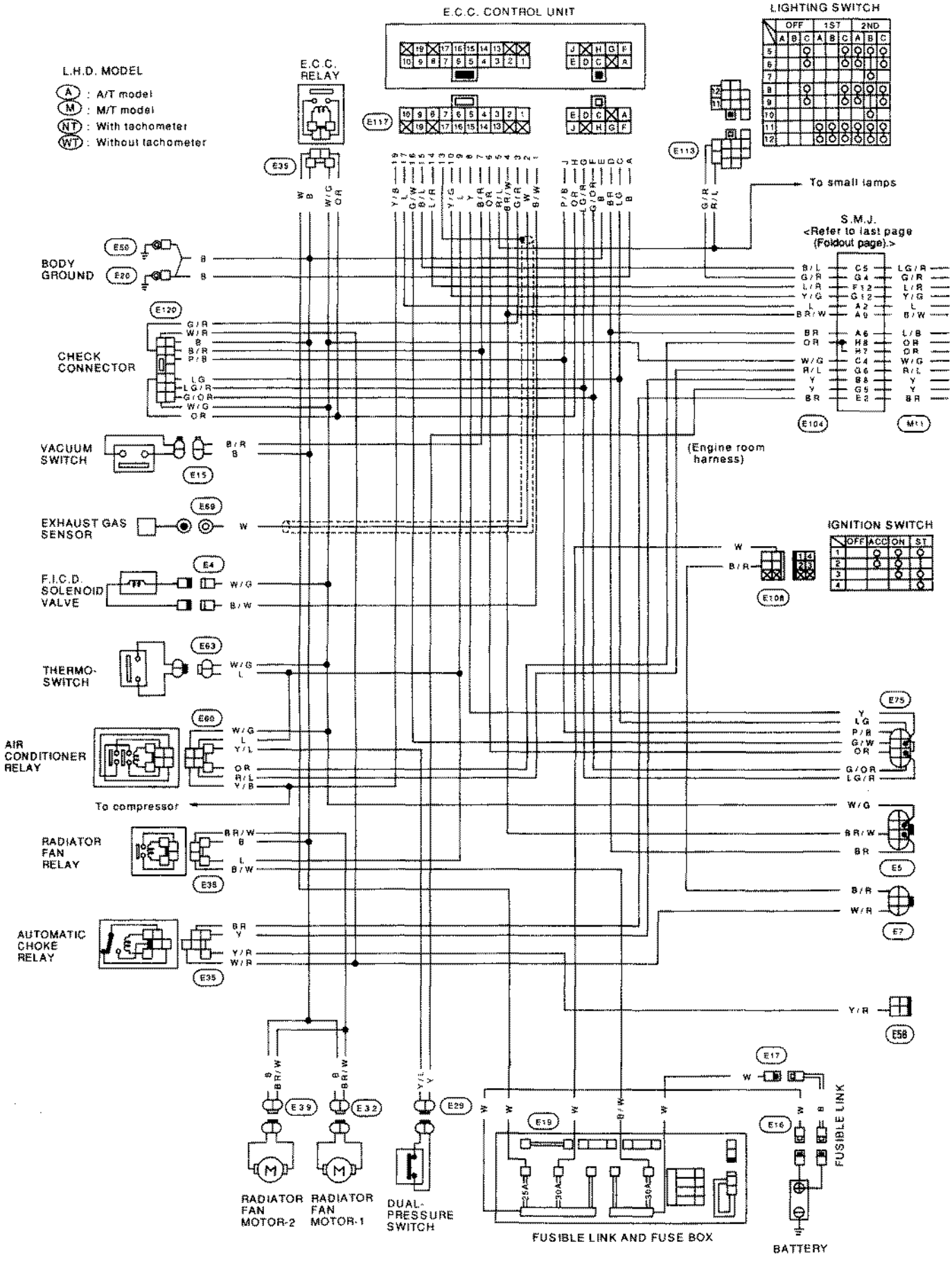
SEF345L

N14 MODELS WITHOUT CATALYZER



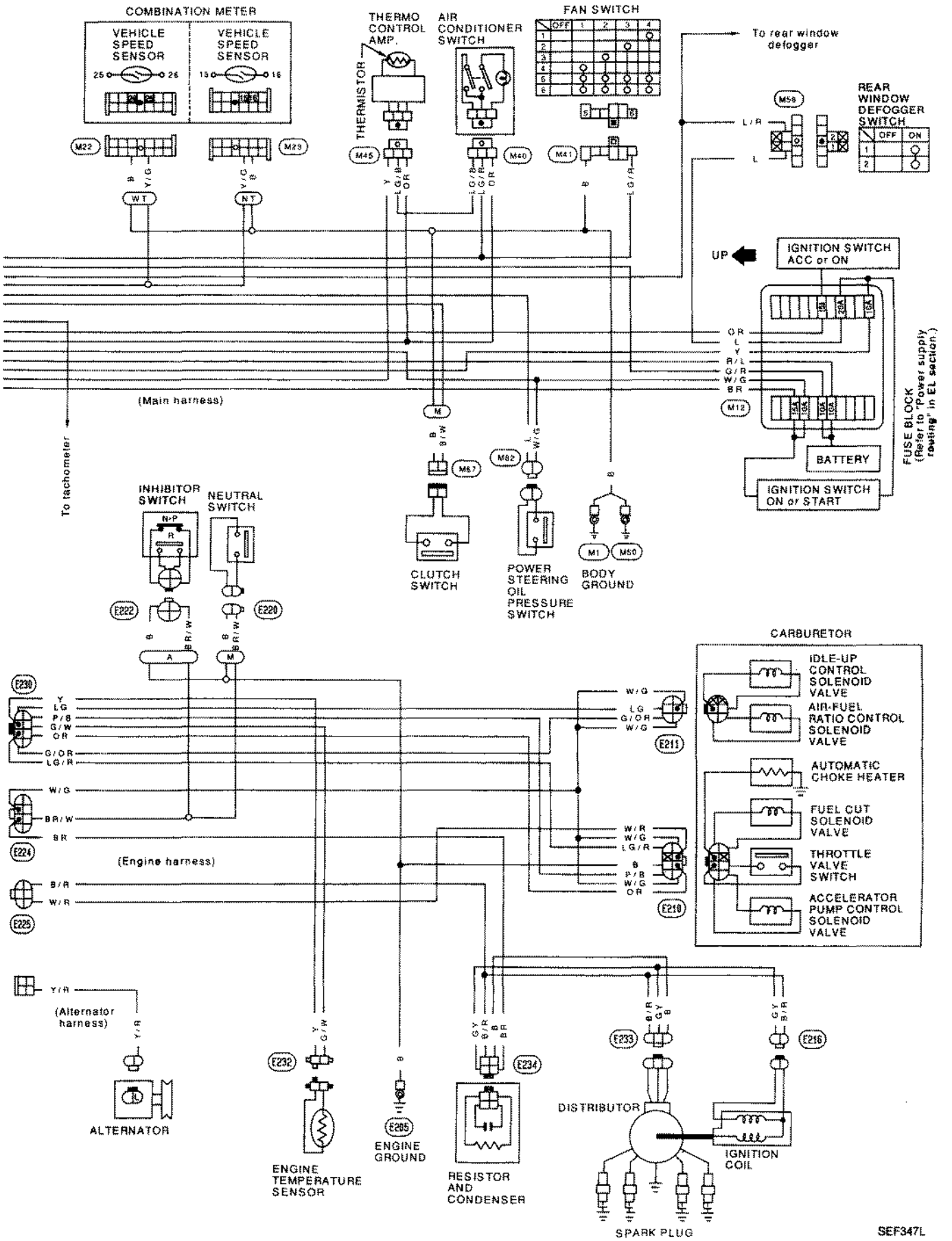
SEF346L

N14 L.H.D. MODELS (GA14DS with catalyzer without E.G.R.)

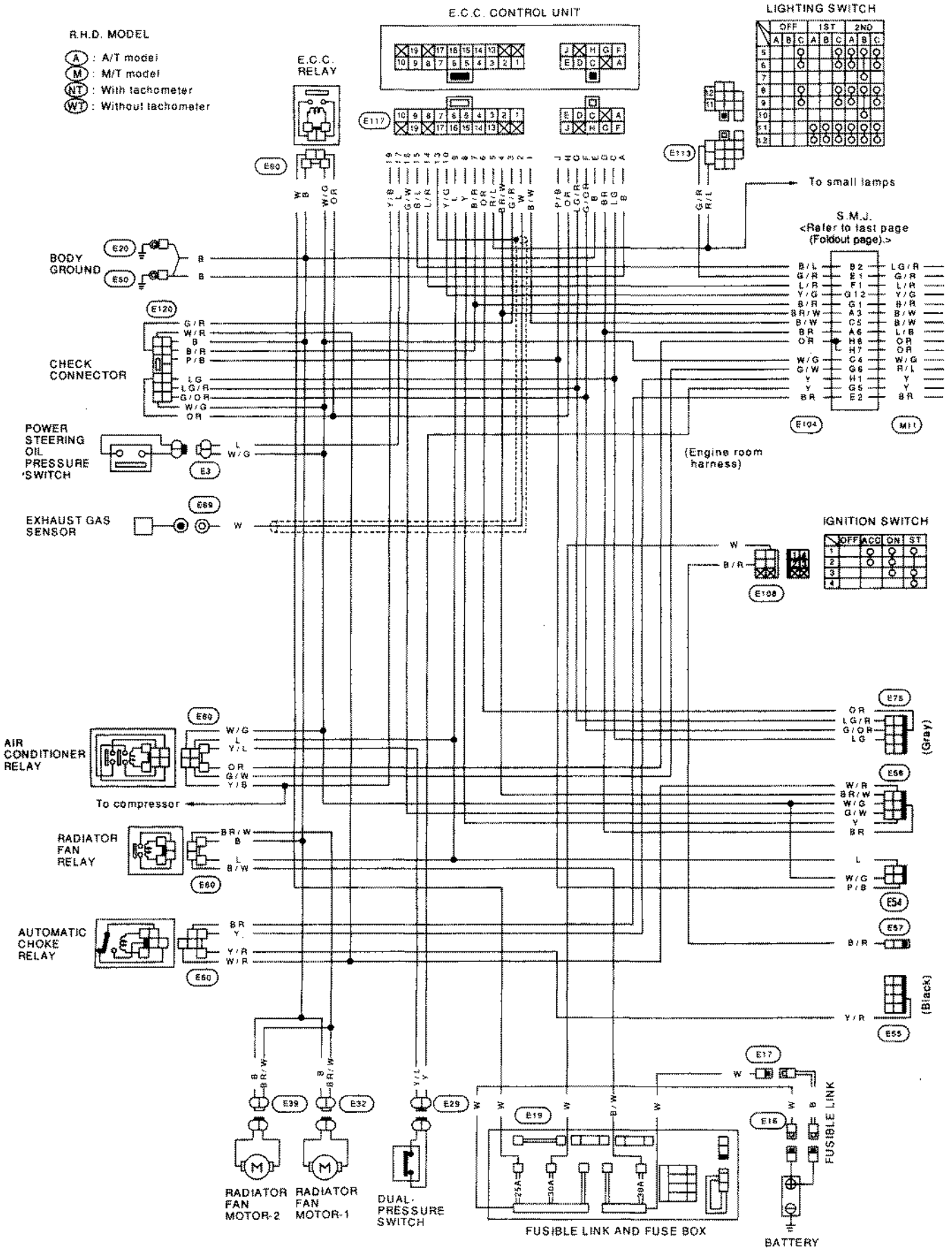


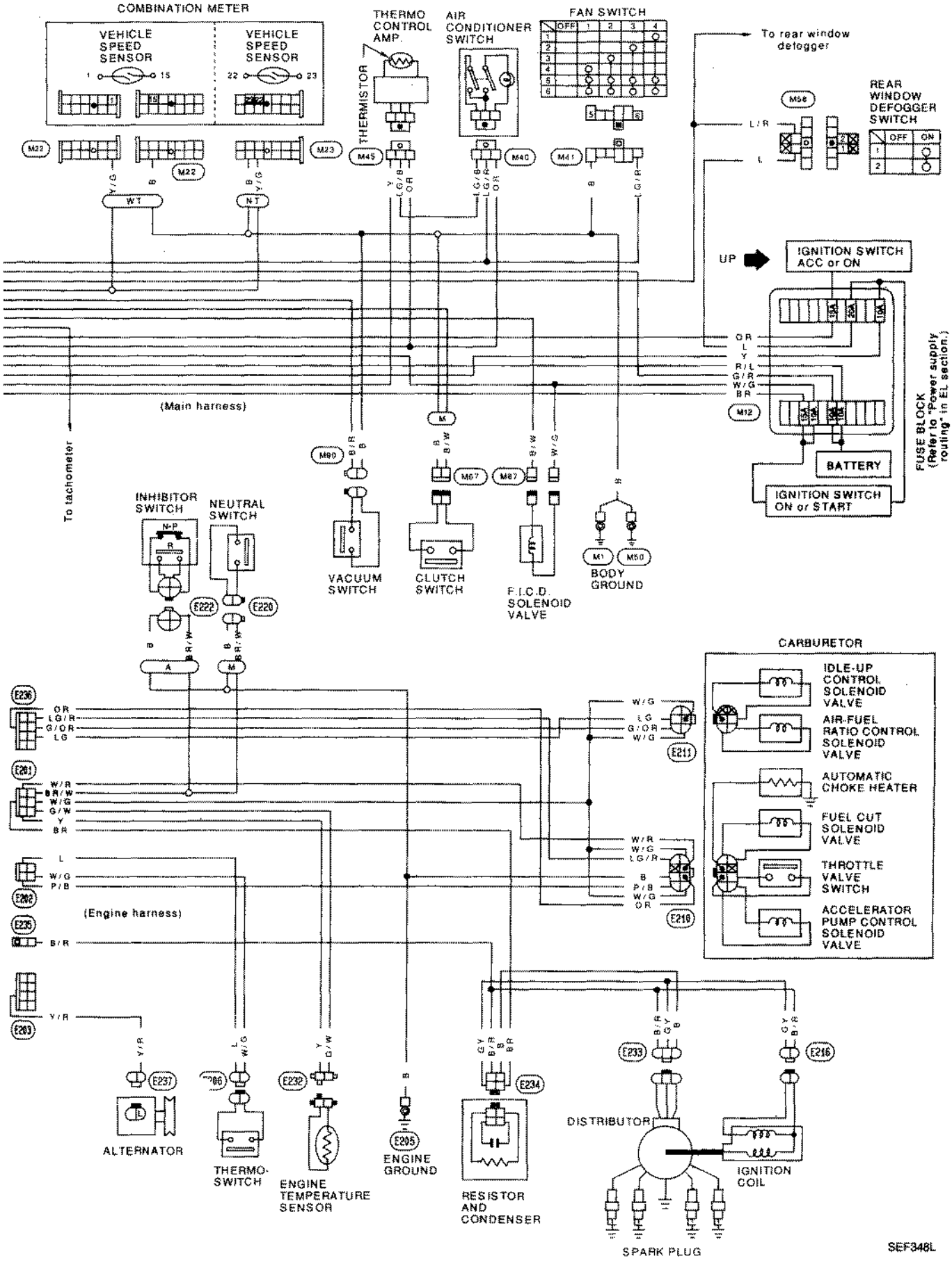
ENGINE AND EMISSION CONTROL CIRCUIT DIAGRAM

GA13DS, GA14DS & GA16DS

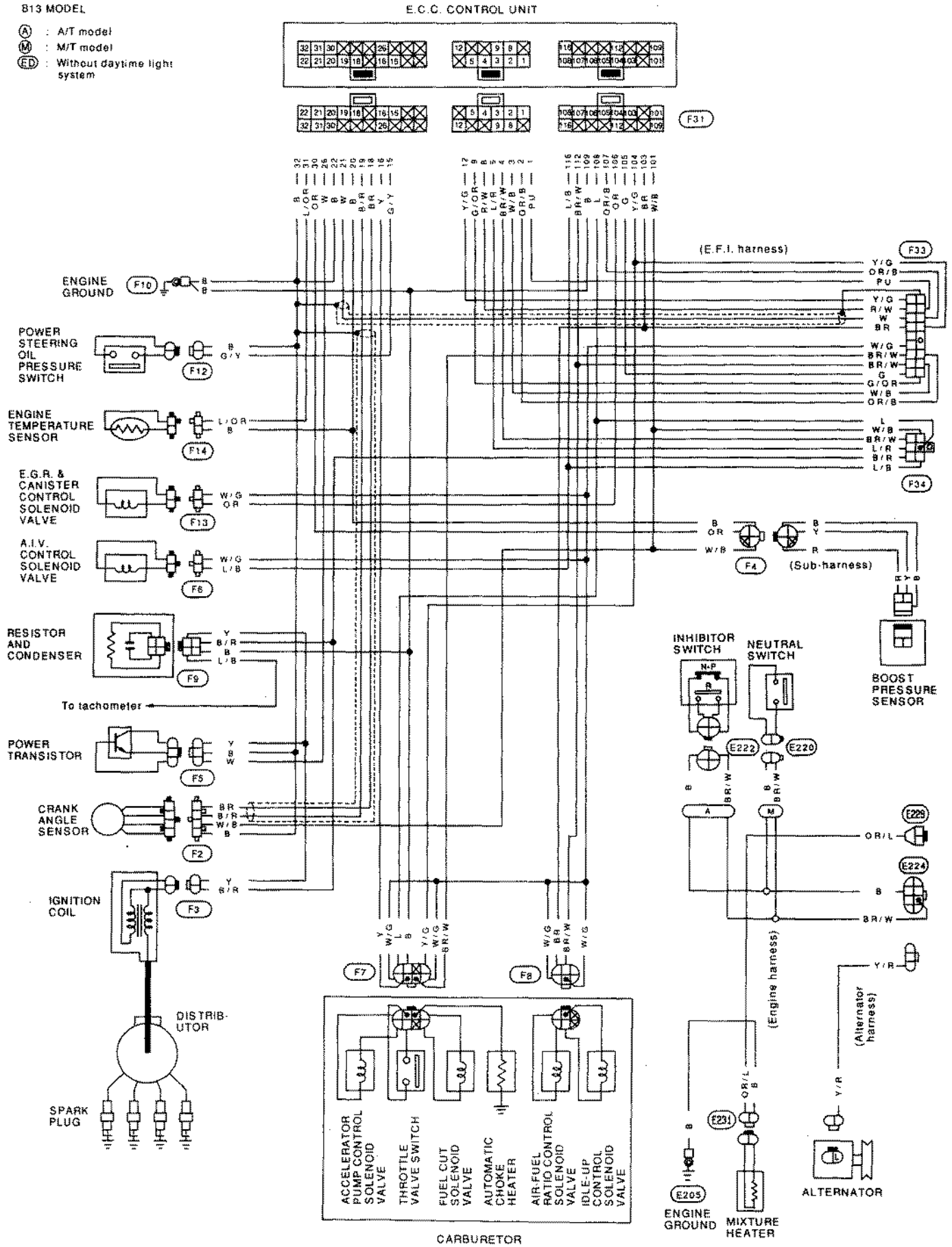


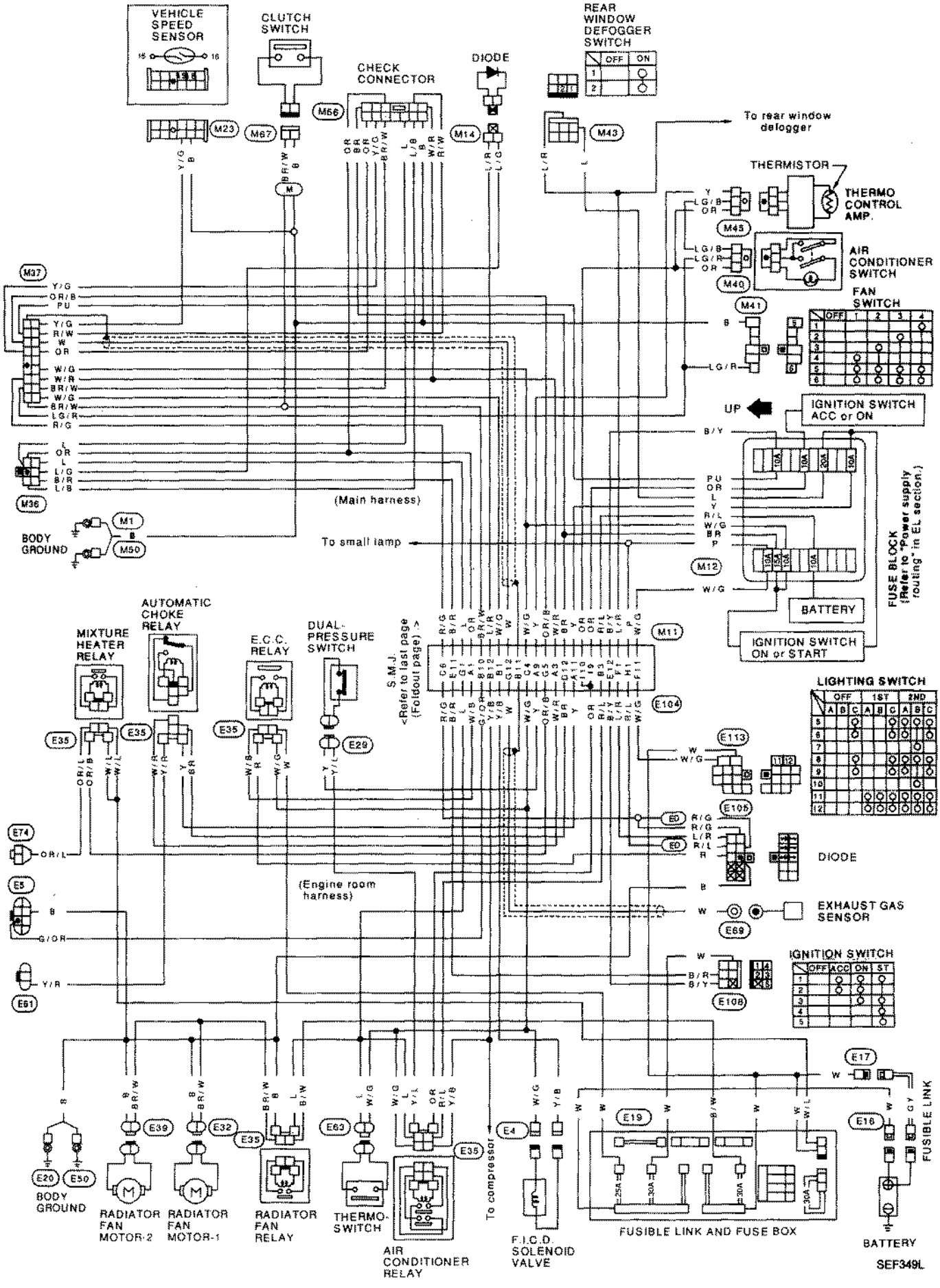
N14 R.H.D. MODELS (GA14DS with catalyzer without E.G.R.)



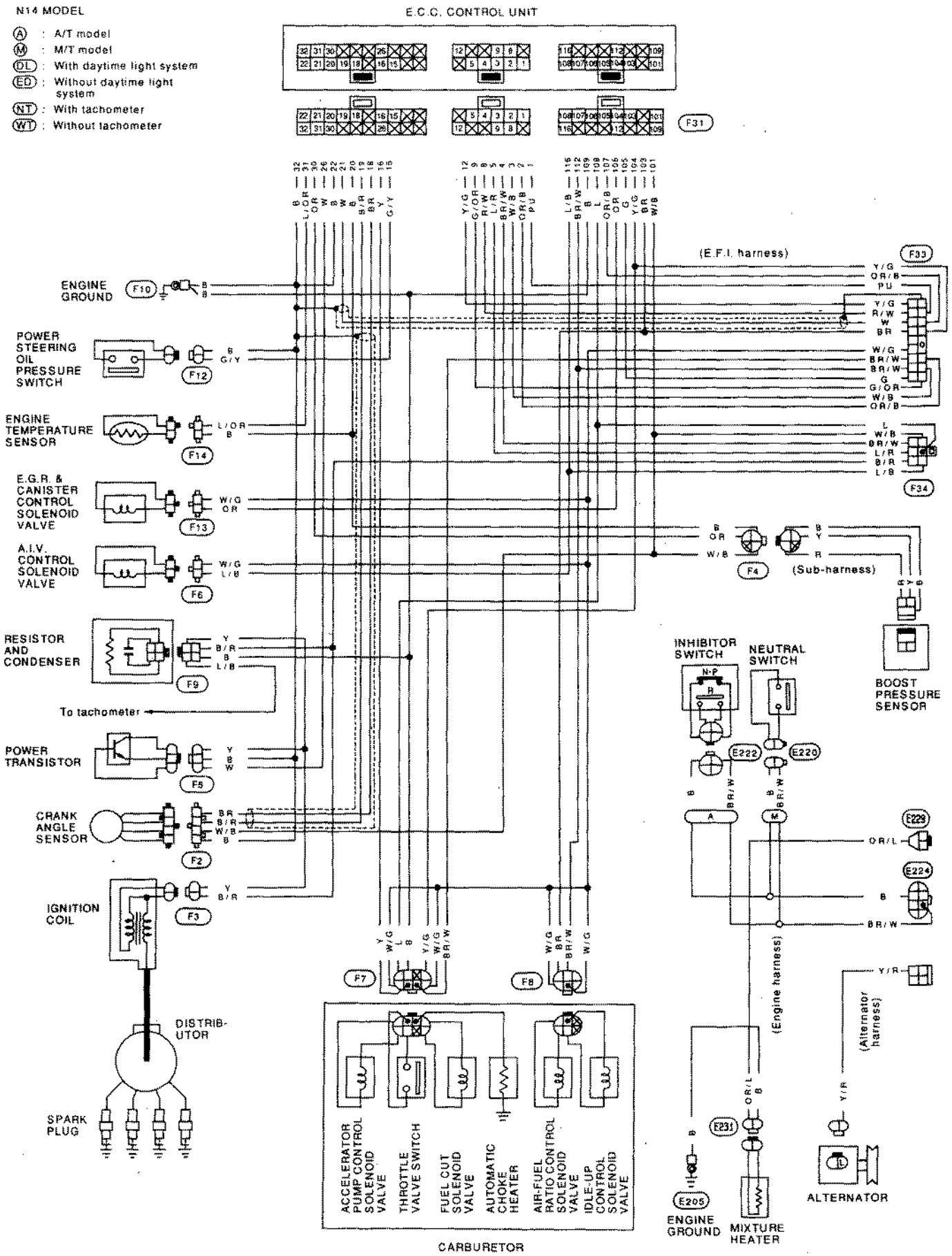

COMBINATION METER
VEHICLE SPEED SENSOR
VEHICLE SPEED SENSOR
THERMO CONTROL AMP.
THERMISTOR
AIR CONDITIONER SWITCH
FAN SWITCH
To rear window defogger
REAR WINDOW DEFOGGER SWITCH
OFF
ON
UP
IGNITION SWITCH ACC or ON
IGNITION SWITCH ON or START
BATTERY
FUSE BLOCK (Refer to "Power supply routing" in EL section.)
(Main harness)
To tachometer
INHIBITOR SWITCH
NEUTRAL SWITCH
VACUUM SWITCH
CLUTCH SWITCH
F.I.C.D. SOLENOID VALVE
BODY GROUND
CARBURETOR
IDLE-UP CONTROL SOLENOID VALVE
AIR-FUEL RATIO CONTROL SOLENOID VALVE
AUTOMATIC CHOKE HEATER
FUEL CUT SOLENOID VALVE
THROTTLE VALVE SWITCH
ACCELERATOR PUMP CONTROL SOLENOID VALVE
(Engine harness)
ALTERNATOR
THERMO-SWITCH
ENGINE TEMPERATURE SENSOR
ENGINE GROUND
RESISTOR AND CONDENSER
DISTRIBUTOR
IGNITION COIL
SPARK PLUG
SEF348L

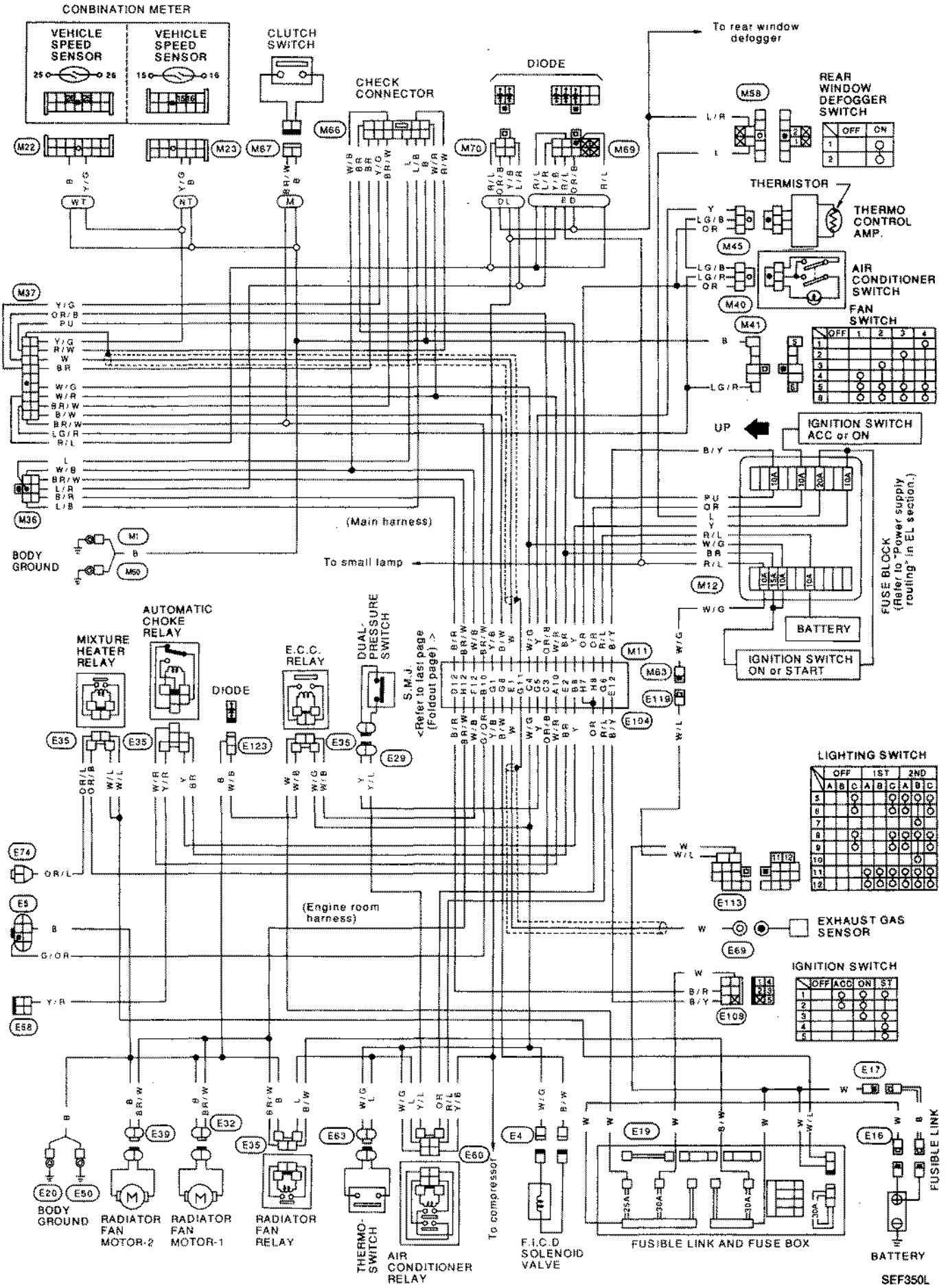
B13 MODELS WITH CATALYZER AND E.G.R.




VEHICLE SPEED SENSOR
CLUTCH SWITCH
CHECK CONNECTOR
DIODE
REAR WINDOW DEFOGGER SWITCH
To rear window defogger
THERMISTOR
THERMO CONTROL AMP.
AIR CONDITIONER SWITCH
FAN SWITCH
IGNITION SWITCH ACC or ON
UP
FUSE BLOCK (Refer to "Power supply routing" in EL section.)
BATTERY
IGNITION SWITCH ON or START
(Main harness)
To small lamp
BODY GROUND
AUTOMATIC CHOKE RELAY
MIXTURE HEATER RELAY
E.C.C. RELAY
DUAL-PRESSURE SWITCH
S.M.J.
<Refer to last page (Foldout page).>
LIGHTING SWITCH
(Engine room harness)
EXHAUST GAS SENSOR
IGNITION SWITCH
RADIATOR FAN MOTOR-2
RADIATOR FAN MOTOR-1
RADIATOR FAN RELAY
THERMO-SWITCH
AIR CONDITIONER RELAY
To compressor
F.I.C.D. SOLENOID VALVE
FUSIBLE LINK AND FUSE BOX
FUSIBLE LINK
SEF349L

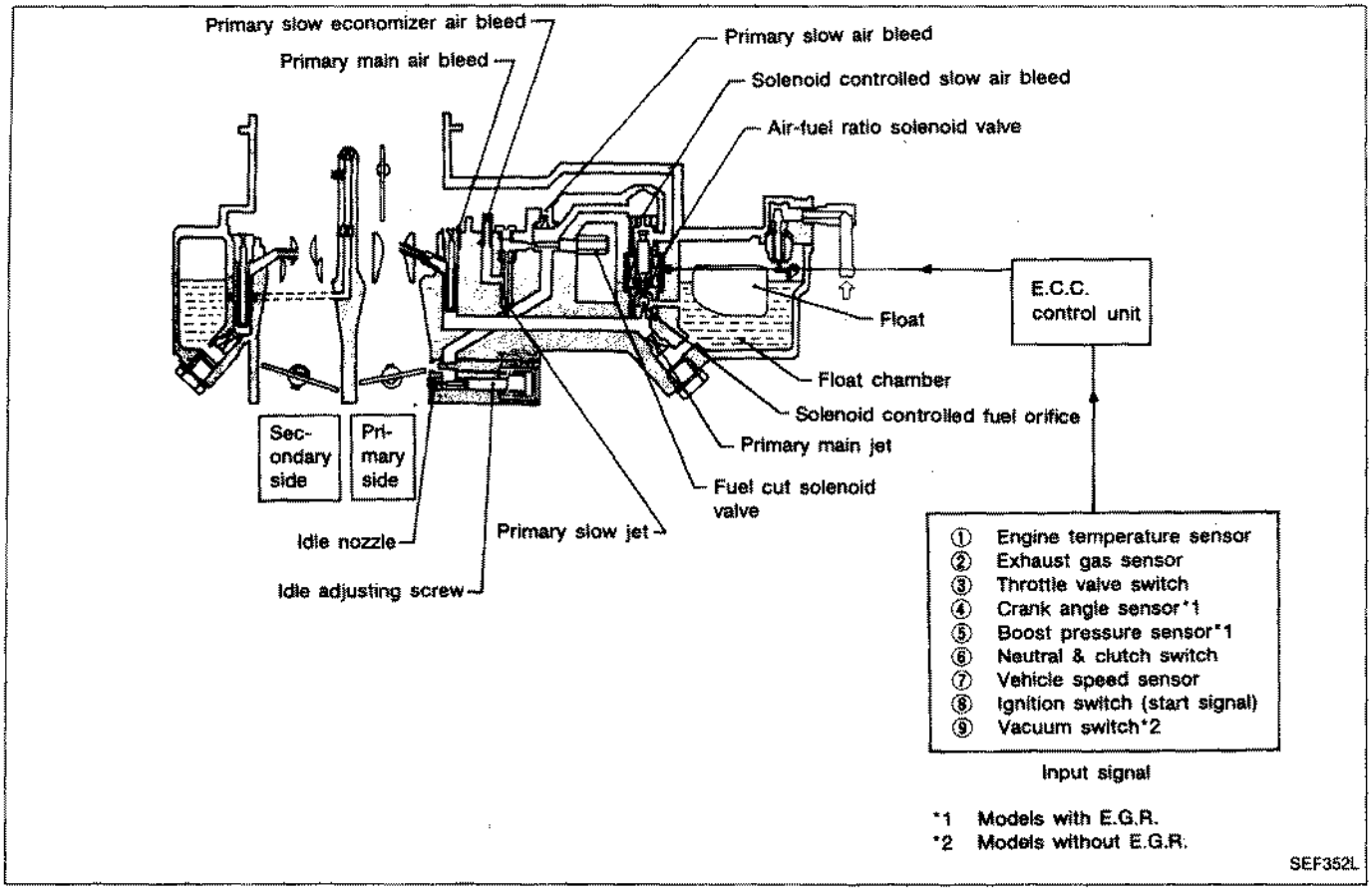
N14 MODELS WITH CATALYZER AND E.G.R.

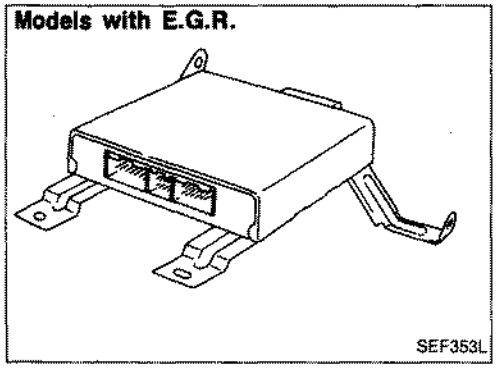


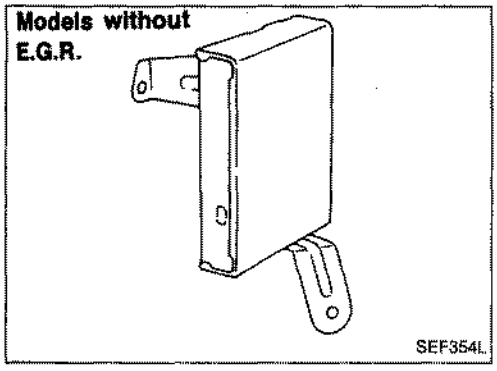

CONBINATION METER
VEHICLE SPEED SENSOR
VEHICLE SPEED SENSOR
CLUTCH SWITCH
CHECK CONNECTOR
DIODE
To rear window defogger
REAR WINDOW DEFOGGER SWITCH
THERMISTOR
THERMO CONTROL AMP.
AIR CONDITIONER SWITCH
FAN SWITCH
IGNITION SWITCH ACC or ON
IGNITION SWITCH ON or START
BATTERY
FUSE BLOCK (Refer to "Power supply routing" in EL section.)
(Main harness)
To small lamp
BODY GROUND
AUTOMATIC CHOKE RELAY
MIXTURE HEATER RELAY
E.C.C. RELAY
DUAL PRESSURE SWITCH
S.M.J.
<Refer to last page (Foldout page) >
(Engine room harness)
LIGHTING SWITCH
EXHAUST GAS SENSOR
IGNITION SWITCH
BODY GROUND
RADIATOR FAN MOTOR-2
RADIATOR FAN MOTOR-1
RADIATOR FAN RELAY
THERMO-SWITCH
AIR CONDITIONER RELAY
To compressor
F.I.C.D SOLENOID VALVE
FUSIBLE LINK AND FUSE BOX
FUSIBLE LINK
BATTERY
SEF350L

General Description

The carburetor is equipped with an air-fuel ratio control on-off valve instead of a power valve. This on-off valve opens or closes the compensating air bleed and main jet to compensate for rich/lean air-fuel ratio, depending on varying conditions, such as acceleration, deceleration, low coolant temperature, low voltage, etc. These varying conditions are detected by various sensors which transmit corresponding signals to provide air-fuel ratio compensation.







Components

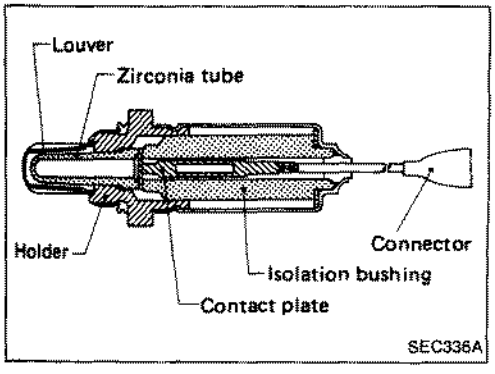
E.C.C. CONTROL UNIT (E.C.U.)

The E.C.C. control unit consists of a micro-computer, connectors for signal input and output and power supply. The control unit controls the feedback pulse width and fuel shut-off operation, etc.

WARNING:

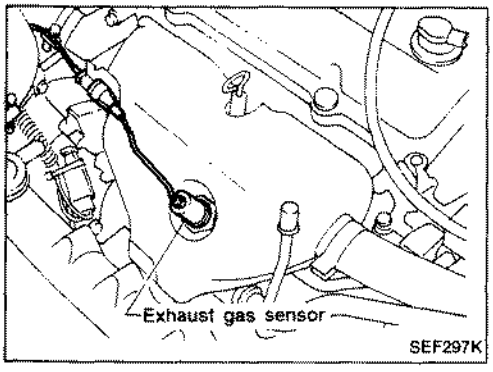
- **When installing CB ham radio equipment or a vehicle phone, be sure to observe the following as it may adversely affect electronic control systems depending on its installation location.**

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

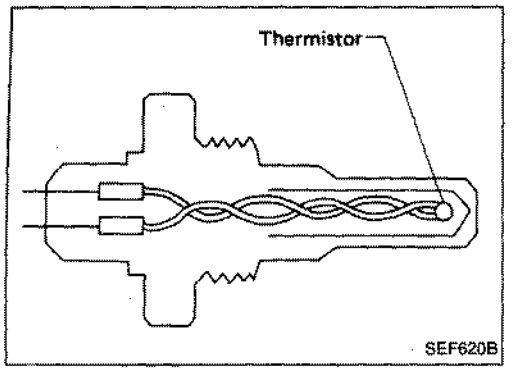


EXHAUST GAS SENSOR

The exhaust gas sensor, which is built into the exhaust manifold, monitors the density of oxygen in the exhaust gas. It consists of a closed-end tube made of ceramic zirconia and other components. Porous platinum electrodes cover the tubes inner and outer surfaces. The closed-end of the tube is exposed to the exhaust gas in the exhaust manifold The tubes outer surface contacts the exhaust gas while the inner surface contacts the air.

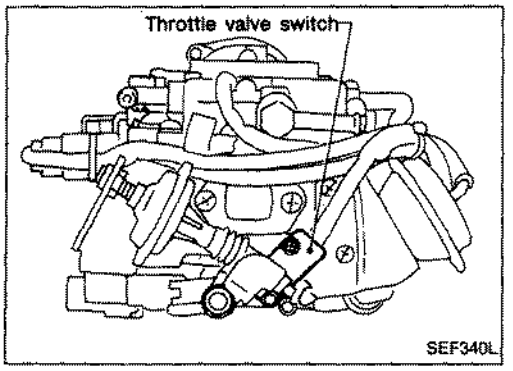


Components (Cont'd)



ENGINE TEMPERATURE SENSOR

The engine temperature sensor, built into the water jacket of the intake manifold, monitors change in water temperature and transmits a signal to the E.C.U.
The temperature sensing unit employs a thermistor which is very sensitive in the low temperature range.
The electrical resistance of the thermistor decreases in response to the temperature rise.



THROTTLE VALVE SWITCH

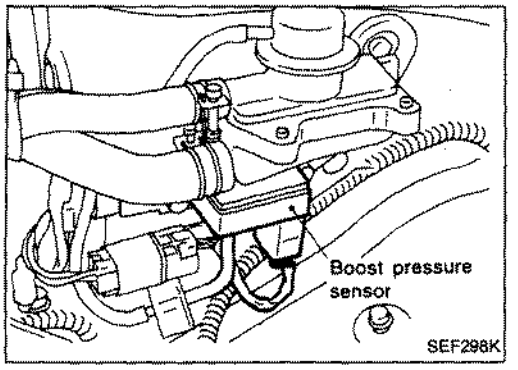
The throttle valve switch is attached to the carburetor and actuates in response to accelerator pedal movement.
This switch has the idle contact.
The idle contact opens when the throttle valve is positioned at idle and closes when it is at any other position.

NEUTRAL SWITCH

The neutral switch detects the transmission gear selector's position and transmits an electric signal to the control unit.

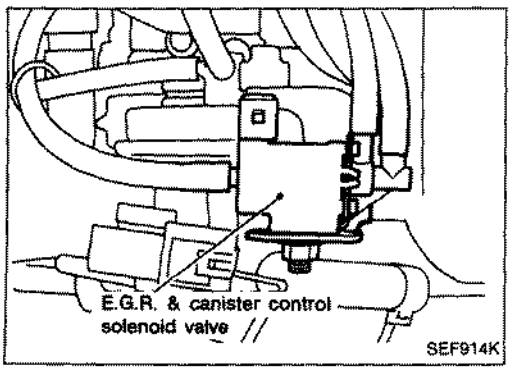
CLUTCH SWITCH

The clutch switch detects the clutch position (depressed or released) and transmits an electric signal to the control unit.



BOOST PRESSURE SENSOR (Models with E.G.R.)

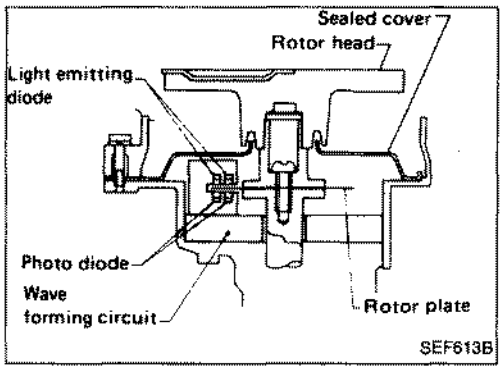
Boost pressure sensor detects the low intake manifold vacuum and transmits an electrical signal to the control unit.



E.G.R. & CANISTER CONTROL SOLENOID VALVE (Models with E.G.R.)

The E.G.R. and canister systems are controlled only by the E.C.U. At both low- and high-speed revolutions of engine, the solenoid valve turns on and accordingly the E.G.R. control valve and canister cut the exhaust gas and fuel vapor leading to the intake manifold.

Components (Cont'd)

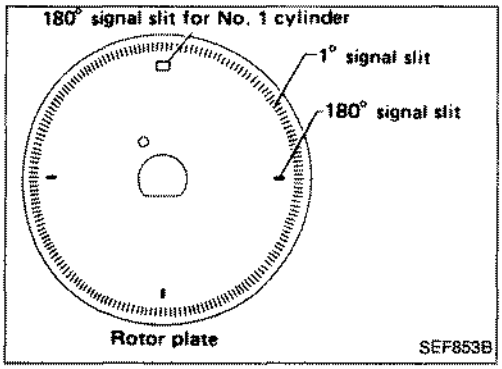


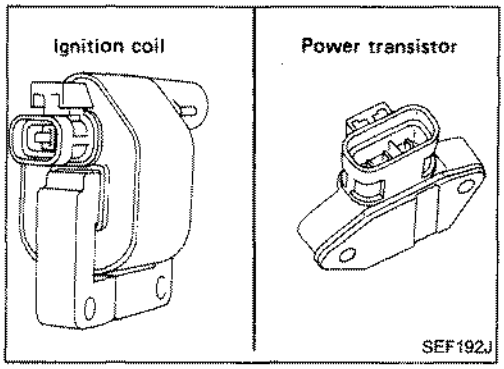
CRANK ANGLE SENSOR (Models with E.G.R.)

The crank angle sensor is a basic component of the entire E.C.U. It monitors engine speed and piston position, and sends to the E.C.U. signals on which the controls of ignition timing and other functions are based.

The crank angle sensor has a rotor plate and a wave forming circuit. The rotor plate has 360 slits for 1° signal (engine speed signal) and 4 slits for 180° signal (crank angle signal). Light Emitting Diodes (L.E.D.) and Photo Diodes are built in the wave forming circuit.

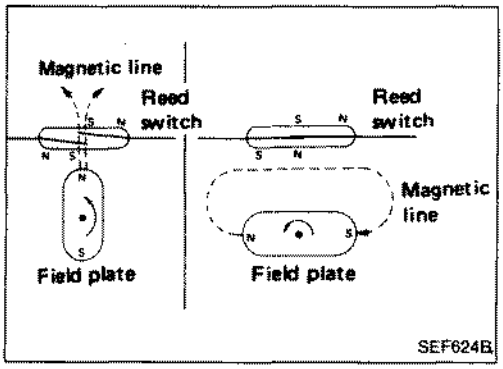
When the rotor plate passes the space between the L.E.D. and the Photo Diode, the slits of the rotor plate continually cut the light which is sent to the photo diode from the L.E.D. This causes generating rough-shaped pulses. They are then converted into on-off pulses by the wave forming circuit, which are sent to the E.C.U.





POWER TRANSISTOR & IGNITION COIL (Models with E.G.R.)

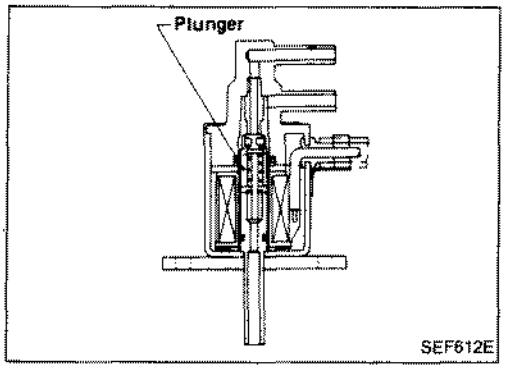
The ignition signal from the E.C.U. is amplified by the power transistor, which turns the ignition coil primary circuit on and off, inducing the proper high voltage in the secondary circuit. The ignition coil is a small, molded type.



VEHICLE SPEED SENSOR

The vehicle speed sensor provides a vehicle speed signal to the E.C.U.

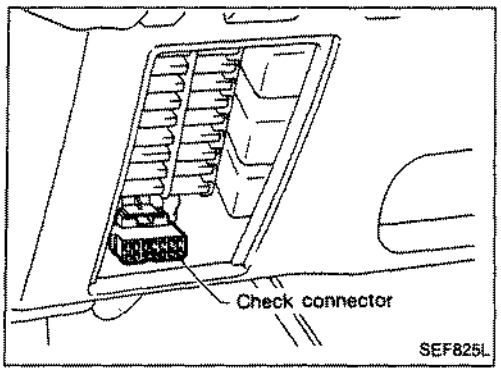
The speed sensor consists of a reed switch, which is installed in the speed meter unit and transforms vehicle speed into a pulse signal.



A.I.V. CONTROL SOLENOID VALVE (Models with E.G.R.)

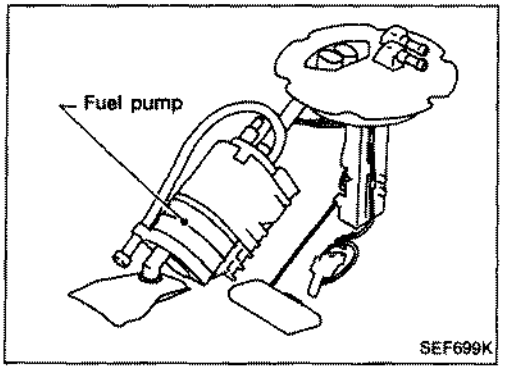
This three-port solenoid valve controls the "cold" A.I.V. vacuum line, based on signals supplied by the E.C.U. The second A.I.V. line, called the "hot" line is not controlled by the E.C.U. Refer to A.I.V. description for further details.

Components (Cont'd)



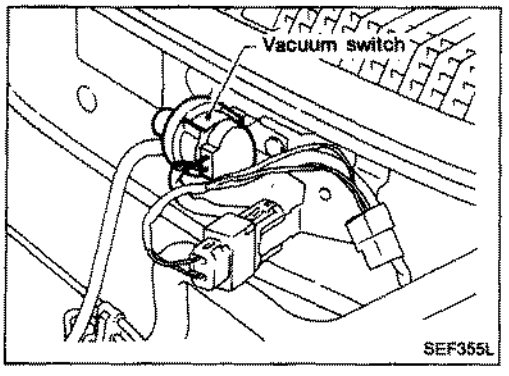
CHECK CONNECTOR FOR EXHAUST GAS SENSOR

The check connector for exhaust gas sensor is below fuse box.



FUEL PUMP (N14 4WD models)

A turbine type design fuel pump is used and is situated in the fuel tank.

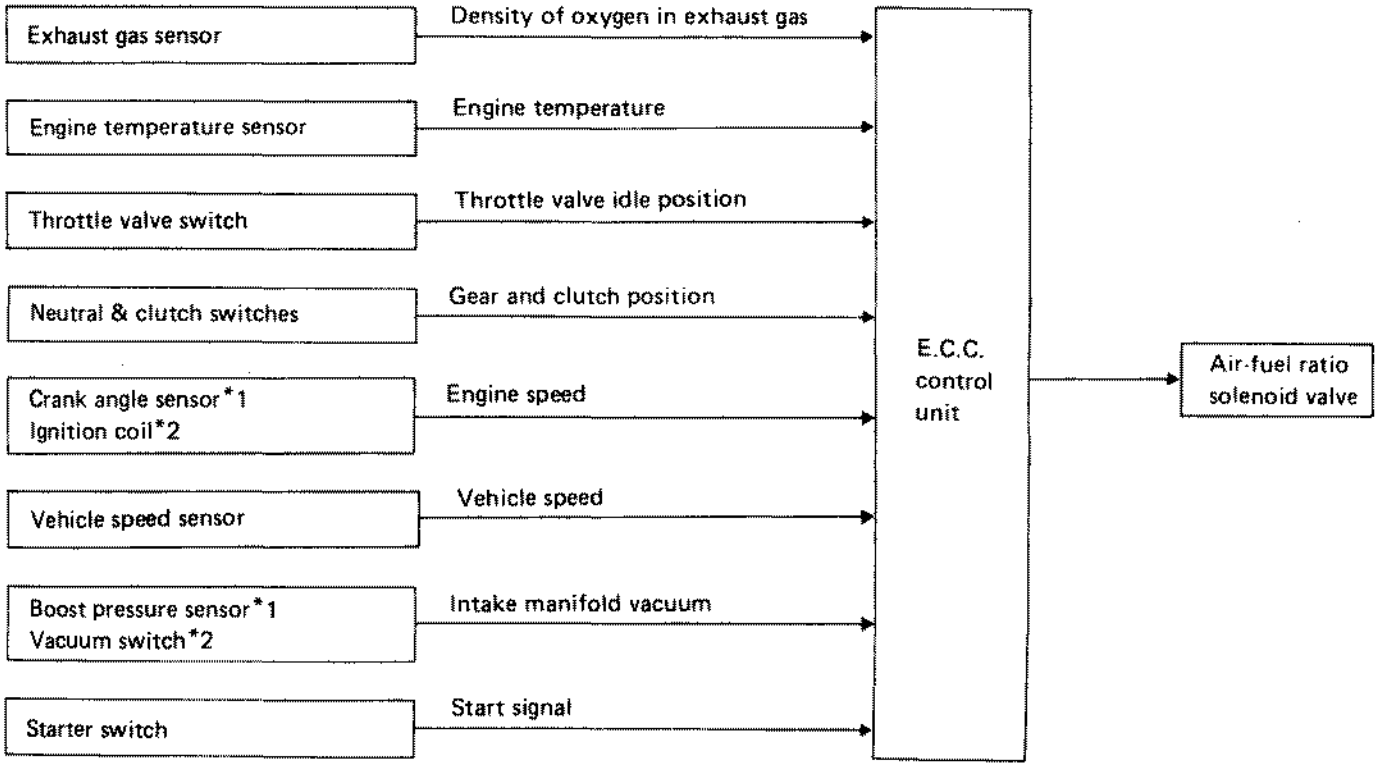


VACUUM SWITCH (Models without E.G.R.)

Vacuum switch detects low intake manifold vacuum and transmits an electrical signal to the control unit.

Air-fuel Ratio Control

There are two ways to control the air-fuel ratio. These are open loop control and closed loop control, which are switched back and forth by the signal of water temperature, engine rpm, exhaust gas sensor signal, manifold vacuum and so on.



*1 Model with E.G.R. only
*2 Models without E.G.R. only

OPEN-LOOP CONTROL

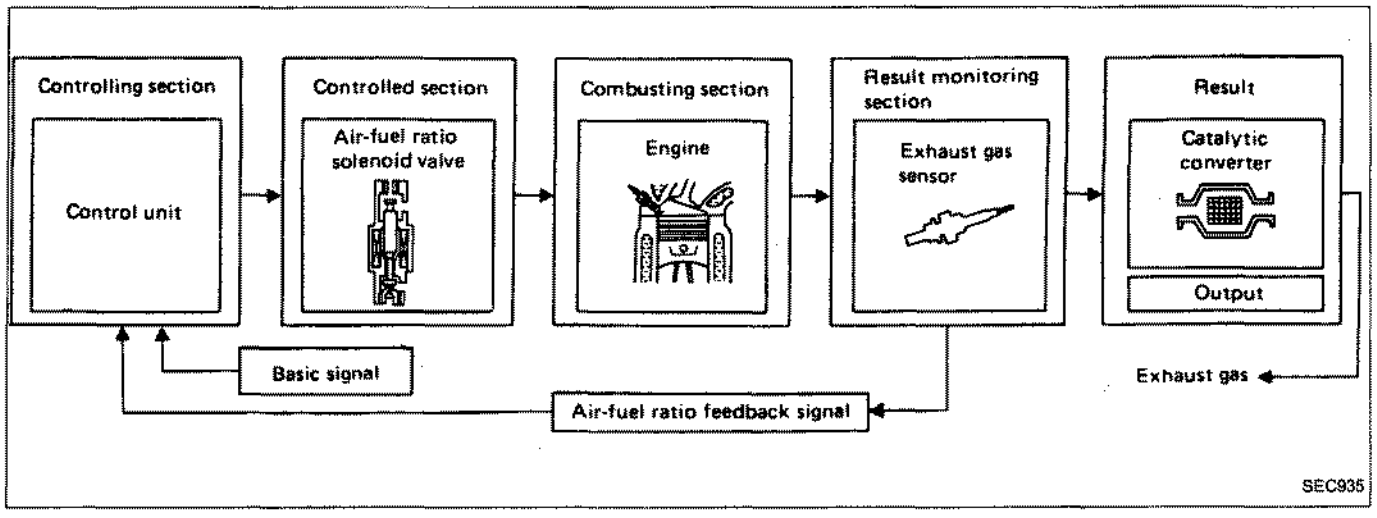
For improved driveability, air fuel ratio solenoid is controlled by open-loop control under the following conditions.
With open-loop control, the air-fuel ratio is determined by the E.C.C. control unit, corresponding to the condition as shown below:

a	When starting engine
b	When engine is cold
c	During deceleration (Fuel cut system is in operation.)
d	When driving at high speeds
e	At full throttle
f	When exhaust gas sensor in not activated
g	When engine is idling

Air-fuel Ratio Control (Cont'd)

CLOSED-LOOP CONTROL
(Air-fuel ratio feedback control)

This system is designed to control the air-fuel ratio precisely to the stoichiometric point so that the three-way catalyst can minimize CO, HC and NOx emissions simultaneously. The system uses the exhaust gas sensor located in the exhaust manifold to give an indication of whether the air-fuel ratio is richer or leaner than the stoichiometric point. The sensor transmits a nonlinear voltage to the E.C.U. The control unit adjusts the feedback pulse width according to the sensor voltage so the mixture ratio will be within the narrow window of the three-way catalyst. During engine warm-up period, however, this system remains open until the sensor reaches the operating temperature.

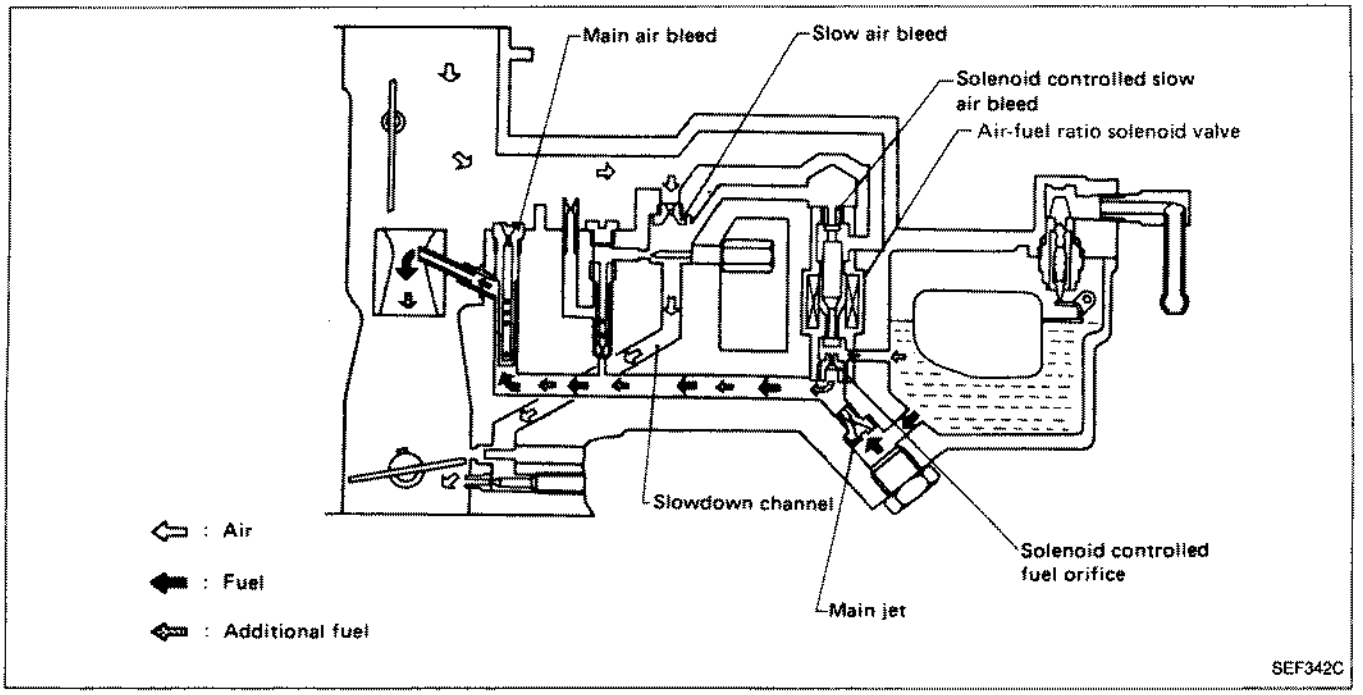


Air-fuel Ratio Control (Cont'd)

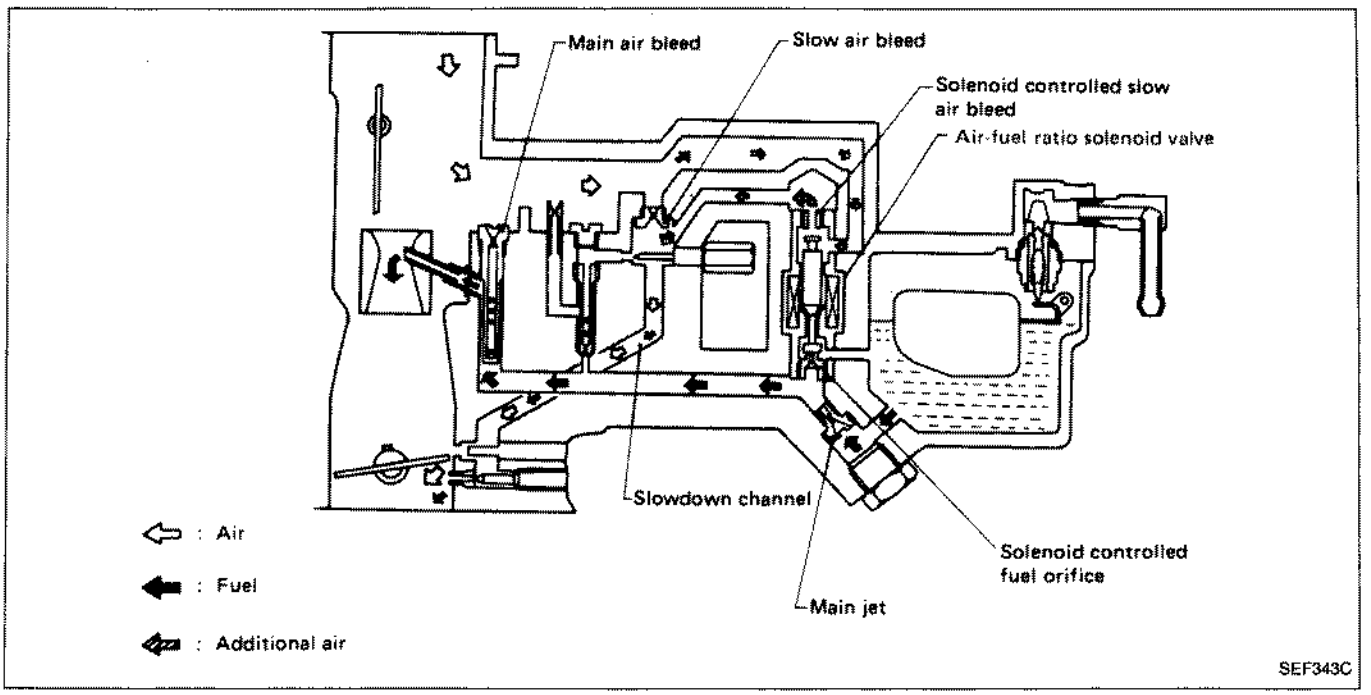
AIR-FUEL RATIO CONTROL SOLENOID VALVE

This solenoid valve is opened or closed repeatedly every 65 msec.
Under closed-loop control, the percentage of opening time and closing time is feedback controlled in E.C.U. by the signal from exhaust gas sensor.
Under the open-loop control, the percentage of opening time and closing time is kept at the specified level according to condition of engine.

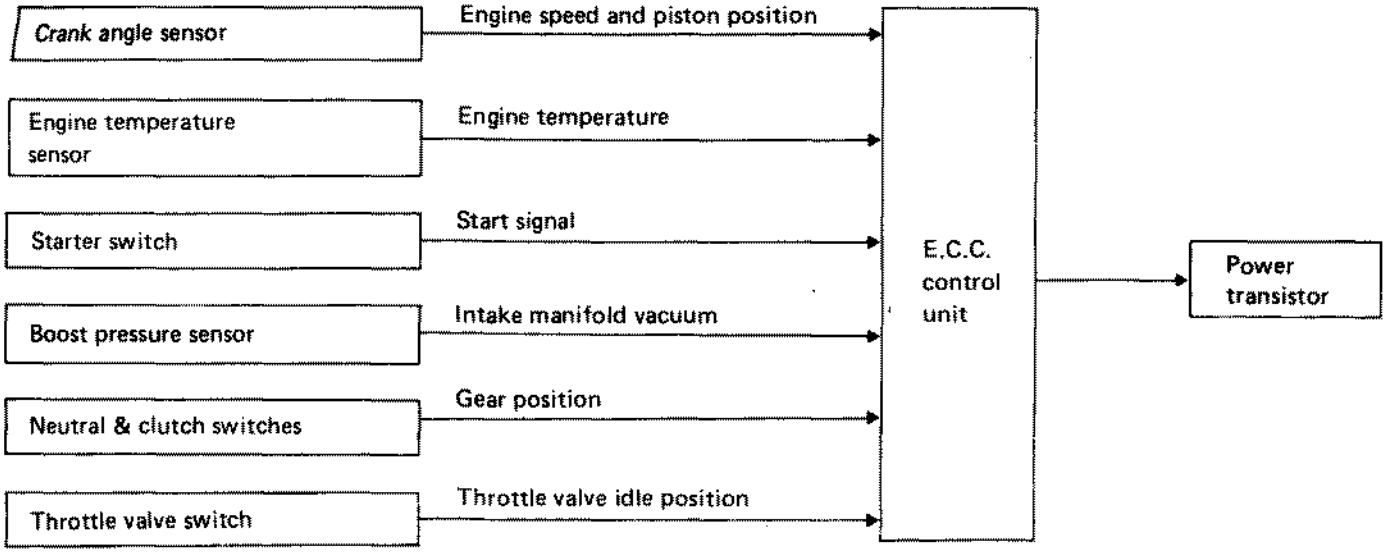
Air-fuel ratio solenoid valve: ON



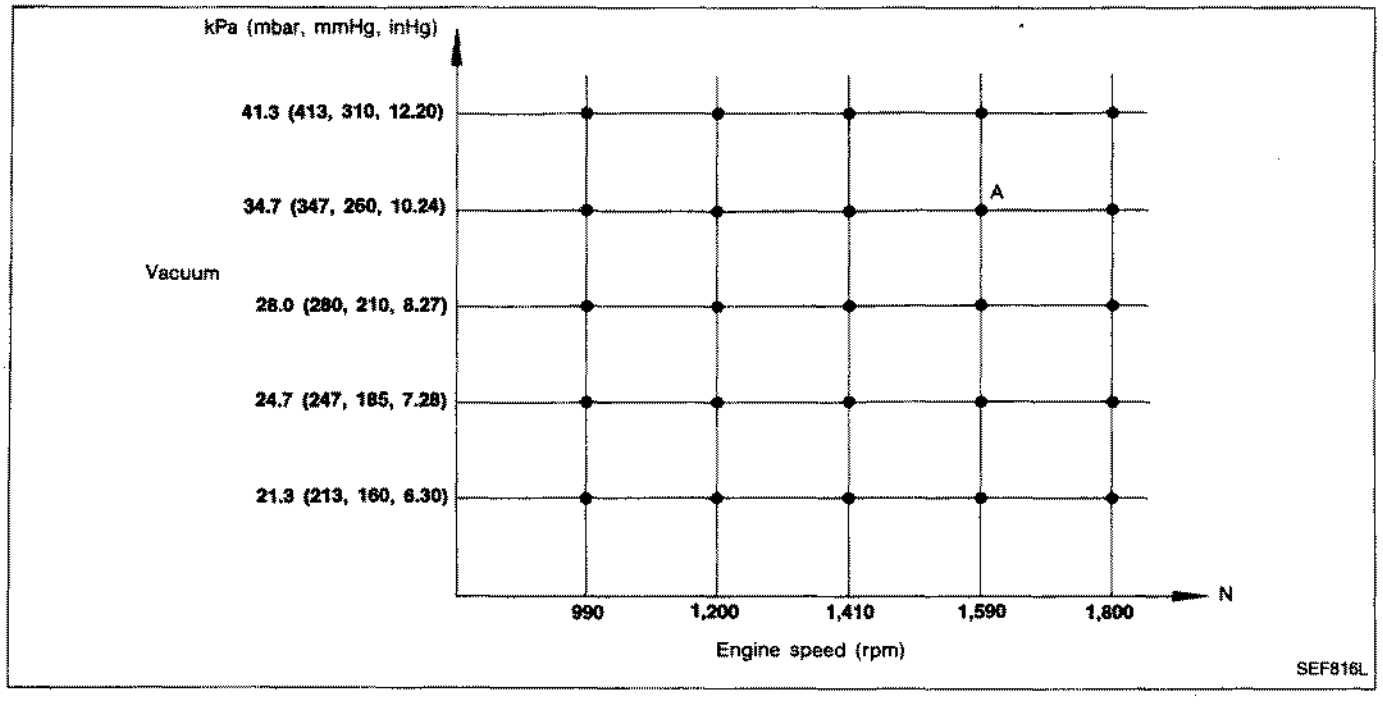
Air-fuel ratio solenoid valve: OFF

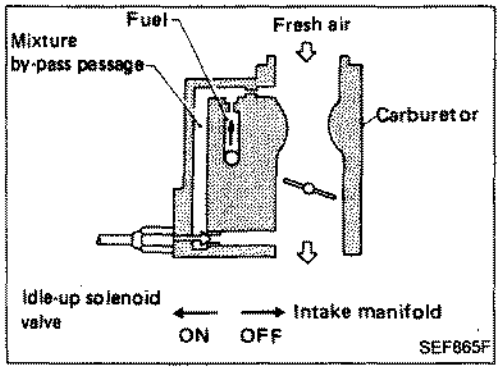


Ignition Timing Control (Models with E.G.R.)



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 intake manifold vacuum and crank angle sensor signal which varies every moment. Then responding to this information, ignition signals are transmitted to the power transistor.
In addition to this, at starting, the ignition timing is revised by the E.C.U. according to the other data stored in the ROM.



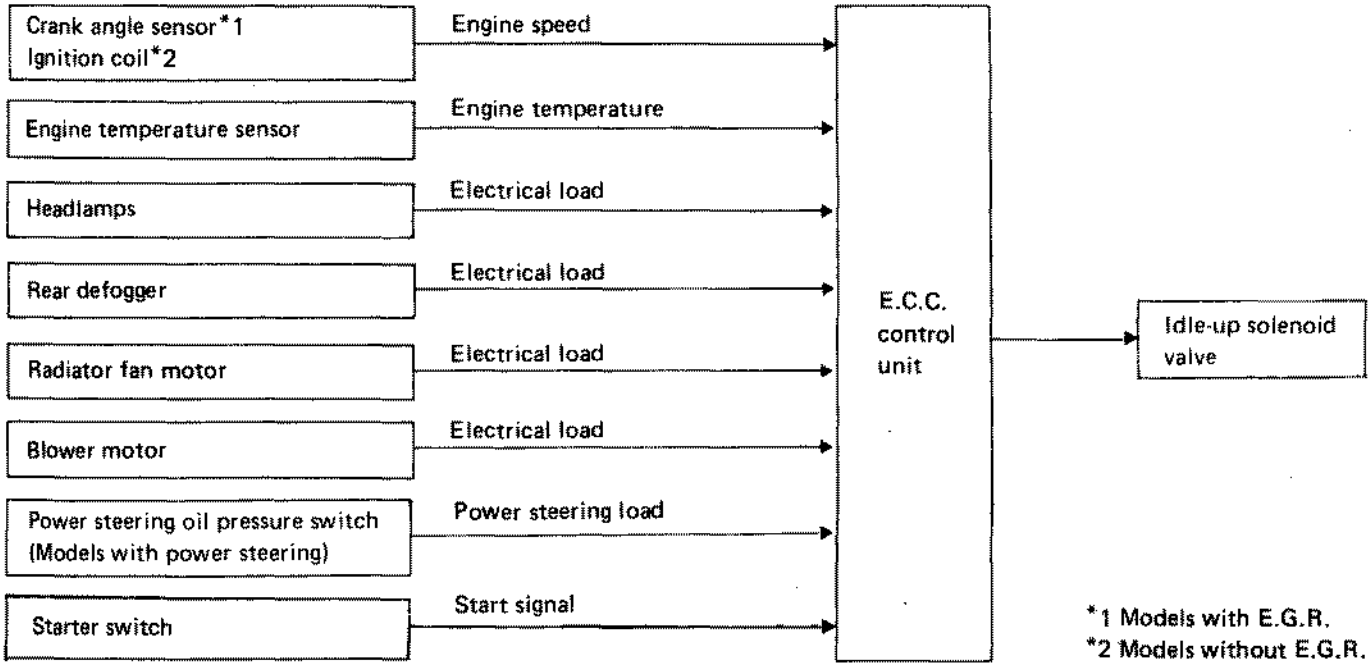


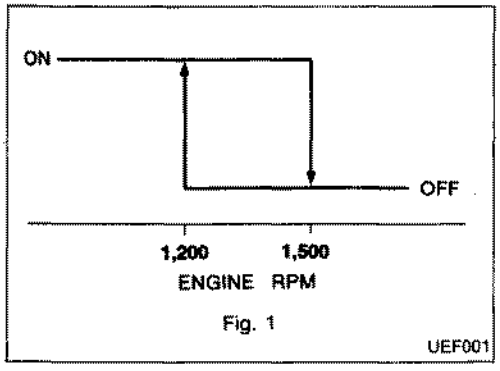
Idle-up Control

This system prevents poor battery charging and erratic idling when the following units are operating:

- Headlamps
- Rear defogger
- Radiator fan motor
- Blower motor
- Power steering pump

In this system, the proper fuel is added to keep a constant idle speed when solenoid valve attached to carburetor are in the "ON" position.





OPERATION

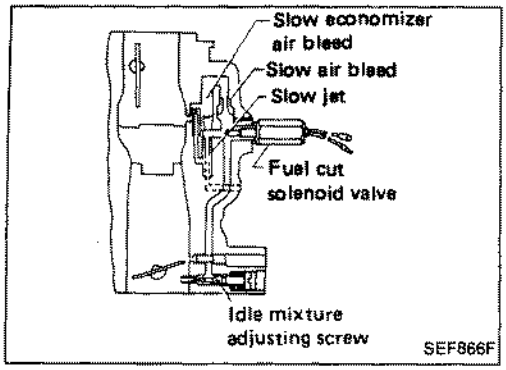
① Water temperature: Between −10°C (14°F) and 75°C (167°F)
Engine rpm: As shown in Fig. 1

② Water temperature: Above 30°C (86°F)
At least one switch ON:
- Headlamps
- Rear defogger
- Radiator fan motor
- Blower motor
- Power steering oil pressure switch
(Models with power steering only)

Engine rpm: As shown in Fig. 1

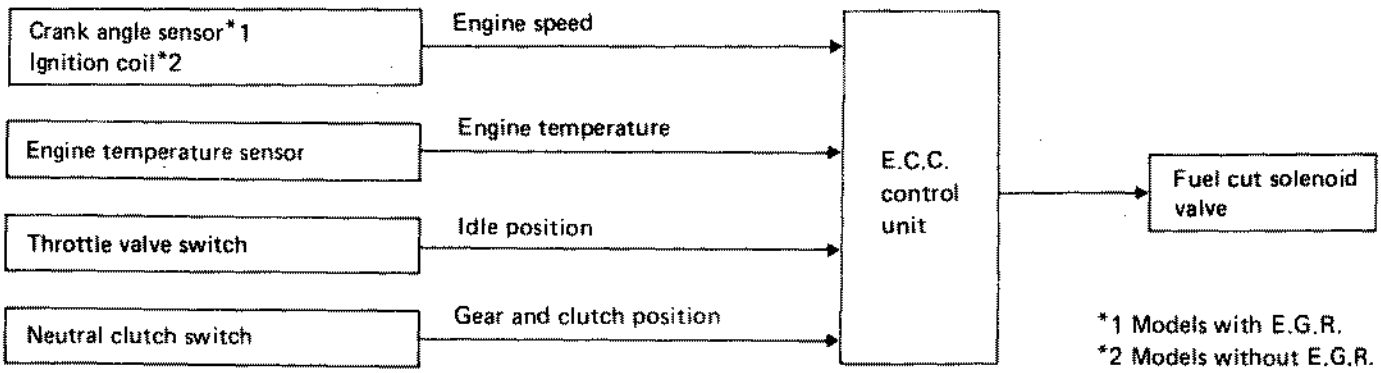
③ Water temperature: Above 60°C (140°F)
Starter switch: ON → OFF
During 15 seconds*1, 10 seconds*2
Engine rpm: As shown in Fig. 1

*1 Models with E.G.R.
*2 Models without E.G.R.



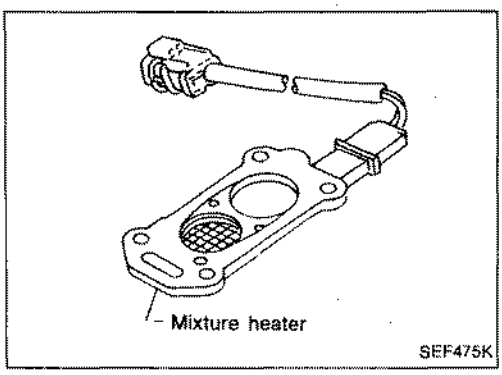
Fuel Cut Control

The fuel cut solenoid valve is attached to the carburetor with its needle valve facing the fuel passage of the primary slow system. When current flows through the fuel cut solenoid valve, the needle valve retracts, allowing the fuel to flow through the primary slow system. When current does not flow through this system, the fuel will be shut off.



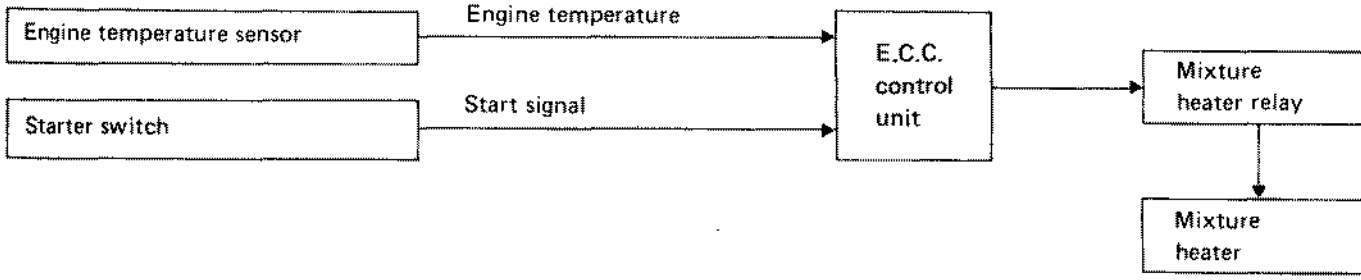
OPERATION

Conditions	Fuel cut system operation
Engine rpm: 4,200 or more (M/T), 3,690 (A/T) Water temperature: 63°C (145°F) or more Throttle valve switch: OFF Neutral and clutch switch: OFF	ON
Except above	OFF



Mixture Heater Control (Models with E.G.R.)

The mixture heater is located between the carburetor and the intake manifold. It is designed to atomize fuel during cold engine starts. It is controlled by the E.C.U.

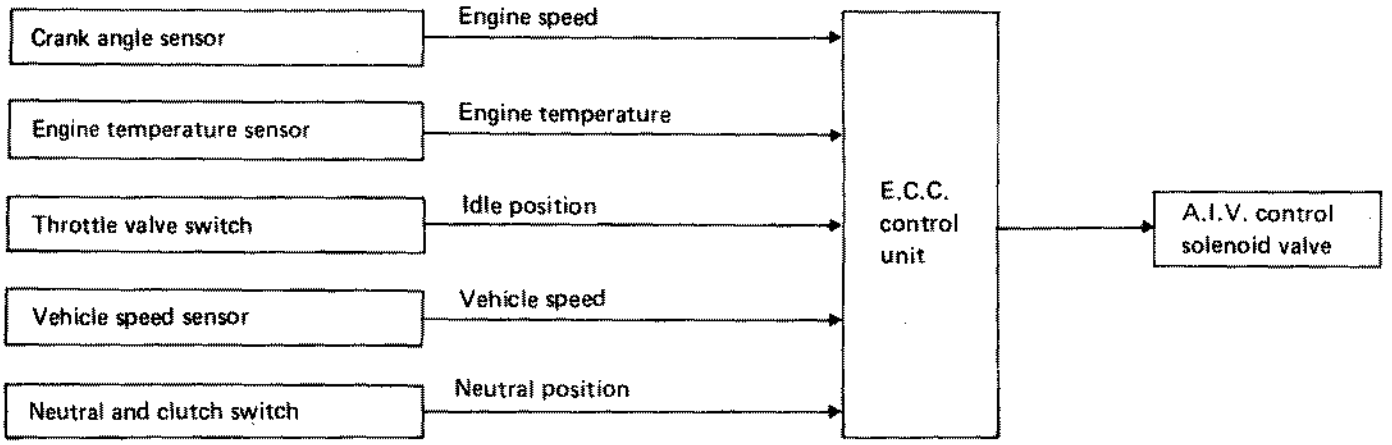


OPERATION

Condition	Mixture heater operation
Water temperature After starting engine: 75°C (167°F) or more	ON
Except above	OFF

A.I.V. Control (Models with E.G.R.)

The Air Induction Valve (A.I.V.) is utilized to reduce HC and CO emissions by supplying filtered air through the A.I.V. into the exhaust tube.
This valve induces secondary air into the exhaust tube by the inherent exhaust pressure pulsations.
The valve is designed for one-way flow operation, and consists of a one-way lead valve and stopper.
While exhaust pressure is below atmospheric pressure, the valves are open and induce air into the exhaust tube.
While exhaust pressure is above atmospheric pressure, the valves are closed and air is not induced into the exhaust tube.

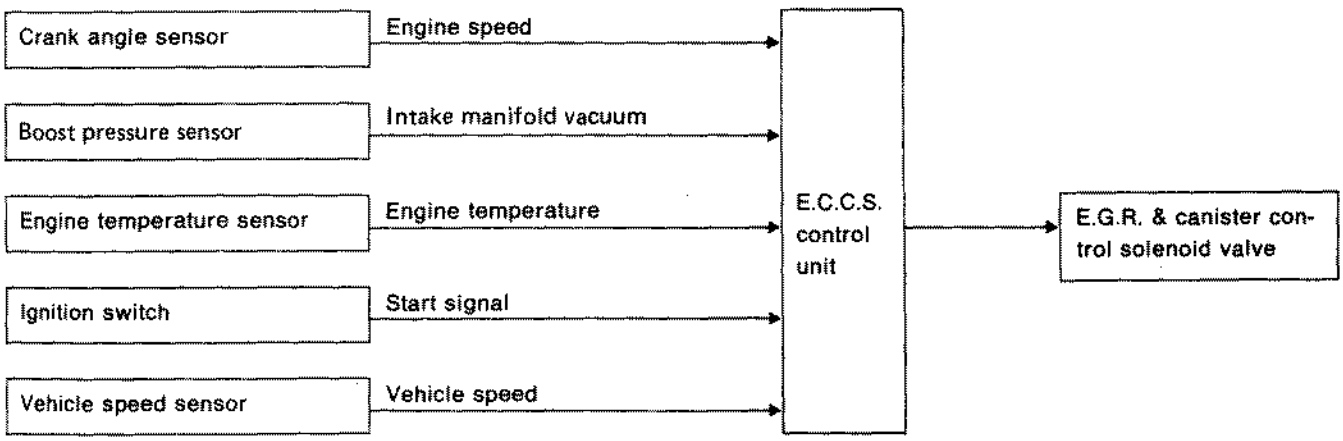


OPERATION

Conditions	A.I.V. control system
① During warm up Idle or deceleration	ON
② After warming up Neutral and clutch switch: ON Throttle valve switch: OFF Vehicle speed: 4 km/h (2 MPH) or less	
Except above	OFF

E.G.R. (Exhaust Gas Recirculation) & Canister Control (Models with E.G.R.)

INPUT/OUTPUT SIGNAL LINE

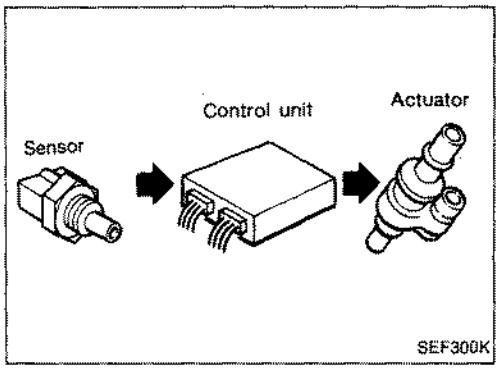


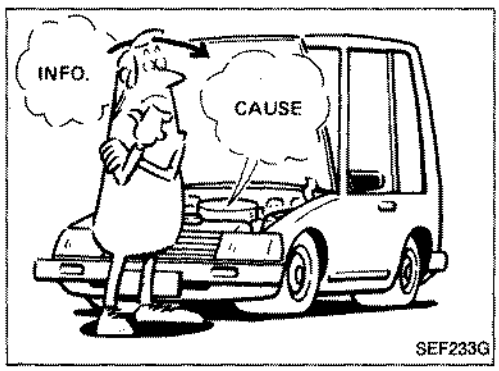
SYSTEM DESCRIPTION

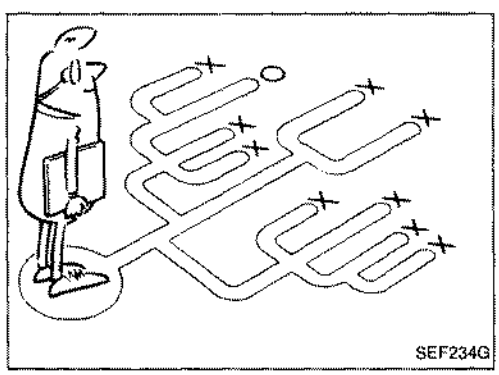
In addition, a system is provided which precisely cuts and controls port vacuum applied to the E.G.R. control valve and canister to suit engine operating conditions. This cut-and-control operation is accomplished through the E.C.U. When the E.C.U. detects any of the following conditions, current flows through the solenoid valve in the E.G.R. and canister control vacuum line.

This causes the port vacuum to be discharged into the atmosphere so that the E.G.R. control valve and canister remain closed.

1) During warm-up
2) Engine starting
3) High-speed engine operation
4) Engine idling
5) Excessively high engine temperature







How to Perform Trouble Diagnoses for Quick and Accurate Repair

INTRODUCTION

The engine has an electronic control unit to control major systems such as idle-up control, ignition control, fuel cut 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.

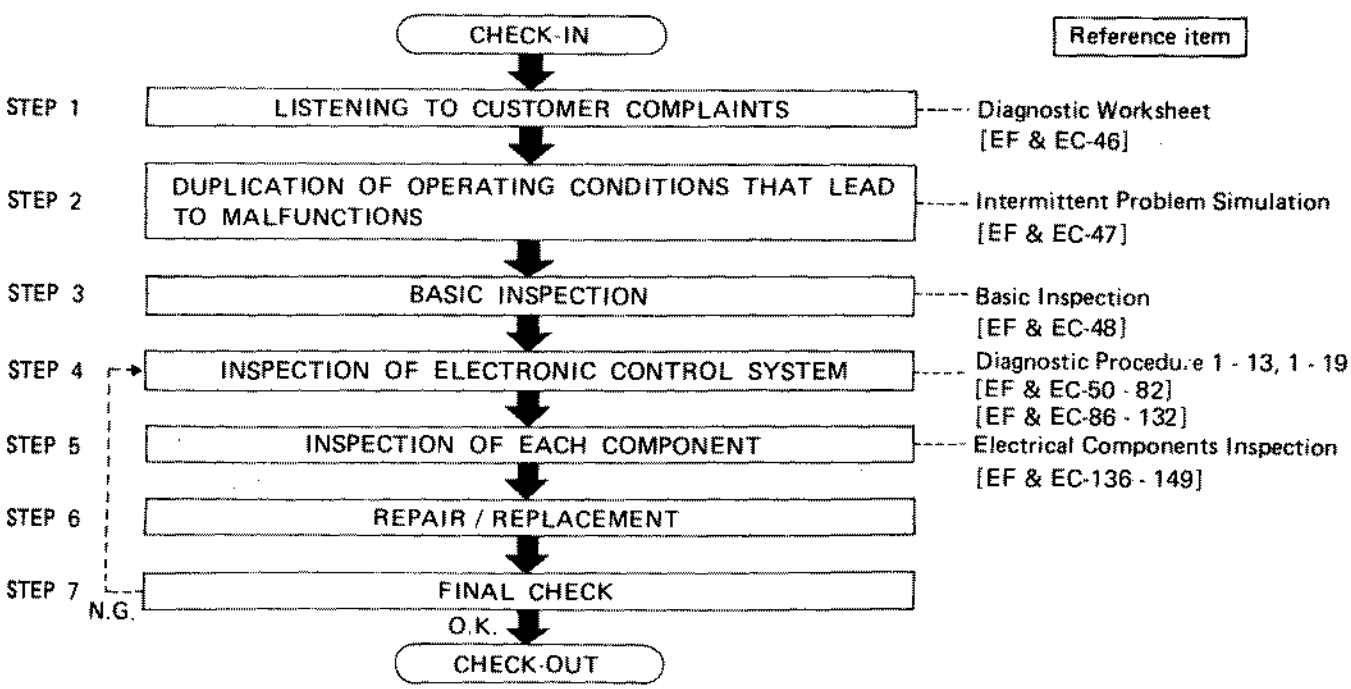
It is much more difficult to diagnose a problem that occurs intermittently rather than continuously. Most intermittent problems are caused by poor electric connections or faulty wiring. In this case, careful checking of suspicious circuits may help prevent the replacement of good parts.

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.

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

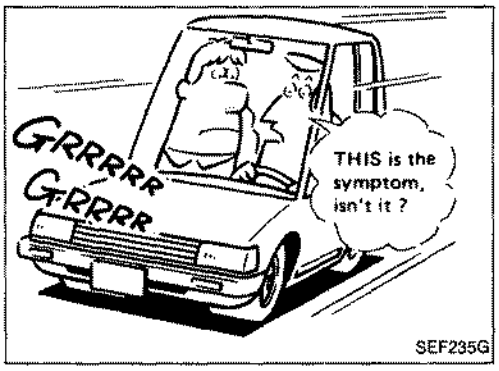
DIAGNOSTIC WORKSHEET

There are many kinds of operating conditions that lead to malfunctions on engine components.
A good grasp of such conditions can make troubleshooting 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 [ ]	
Symptoms — ☐ Idling	☐ No fast idle ☐ Unstable ☐ High idle ☐ Low idle ☐ Others [ ]	
Symptoms — ☐ Driveability	☐ Stumble ☐ Surge ☐ Detonation ☐ Lack of power ☐ Intake backfire ☐ Exhaust backfire ☐ Others [ ]	
Symptoms — ☐ Engine stall	☐ At the time of start ☐ While idling ☐ While accelerating ☐ While decelerating ☐ Just after stopping ☐ While loading	
Incident occurrence	☐ Just after delivery ☐ Recently ☐ In the morning ☐ At night ☐ In the daytime	
Frequency	☐ All the time ☐ Under certain conditions ☐ Sometimes	
Weather conditions	☐ Not affected	
Weather	☐ Fine ☐ Raining ☐ Snowing ☐ Others [ ]	
Temperature	☐ Hot ☐ Warm ☐ Cool ☐ Cold ☐ Humid °F	
Engine conditions	☐ Cold ☐ During warm-up ☐ After warm-up Engine speed 0 2,000 4,000 6,000 8,000 rpm	
Road conditions	☐ In town ☐ In suburbs ☐ Highway ☐ Off road (up/down)	
Driving conditions	☐ Not affected ☐ At starting ☐ While idling ☐ At racing ☐ While accelerating ☐ While cruising ☐ While decelerating ☐ While turning (RH/LH) Vehicle speed 0 10 20 30 40 50 60 MPH	
Check engine light	☐ Turned on ☐ Not turned on	

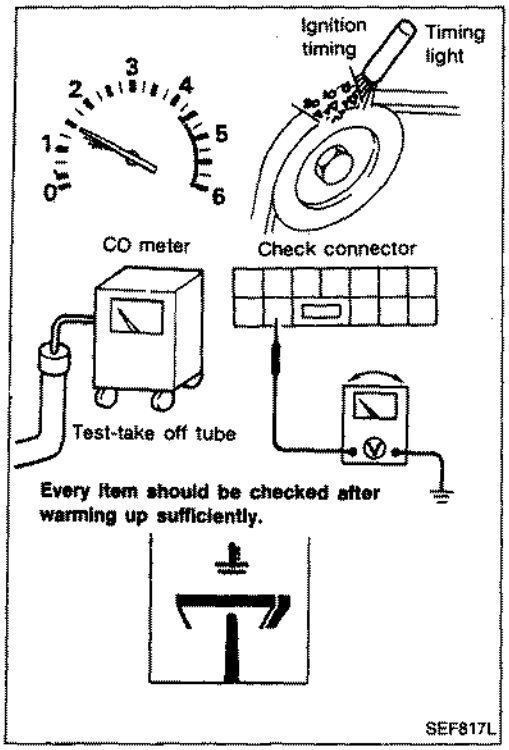
How to Perform Trouble Diagnoses for Quick and Accurate Repair (Cont'd)



INTERMITTENT PROBLEM SIMULATION

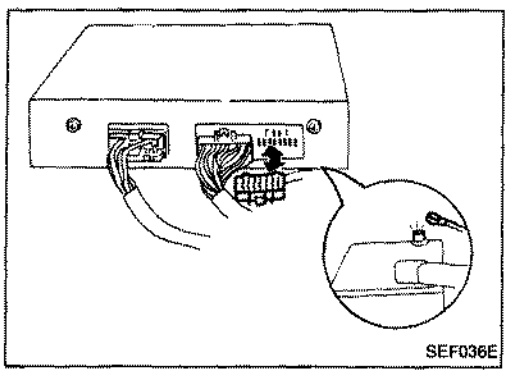
In order to duplicate an intermittent problem, it is effective to create similar conditions for component parts, under which the problem might occur.
Perform the activity listed under Service procedure and note the result.

	Variable factor	Influential part	Target condition	Service procedure
1	Air-fuel ratio	Air-fuel ratio solenoid	Made lean	Supply it with battery voltage.
			Made rich	Disconnect carburetor harness connector (F8).
2	Ignition timing	Distributor	Advanced	Rotate distributor counterclockwise.
			Retarded	Rotate distributor clockwise.
3	Air-fuel ratio feedback control	Exhaust gas sensor	Suspended	Disconnect exhaust gas sensor harness connector.
		Control unit	Operation check	Refer to "Checking Exhaust Gas Sensor" in MA section.
4	Idle speed	Carburetor	Raised	Turn throttle adjusting screw clockwise.
			Lowered	Turn throttle adjusting screw counterclockwise.
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 headlamps, air conditioner, rear defogger, etc.
9	Throttle valve switch condition	Control unit	ON-OFF switching	Push throttle valve switch.
10	Ignition spark	Timing light	Spark power check	Try to flash timing light for each cylinder.



Basic Inspection

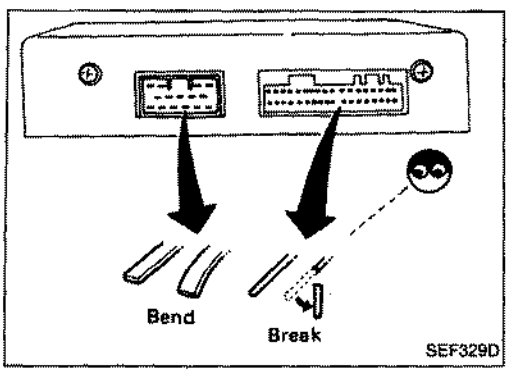
1) Idle speed
   750 ± 50 rpm
2) Ignition timing
   10° ± 2° B.T.D.C.
3) Idle CO
   1.0 ± 0.5% (test-take off tube)
   - **A.I.V. control solenoid valve harness connector disconnected (No A.I.V. controlled condition).**
   - **Exhaust gas sensor harness connector disconnected.**
4) Air-fuel ratio at approximately 2,000 rpm of engine speed.
   Number of fluctuations of voltage meter
   5 times or more/10 seconds (Refer to section MA.)
5) Engine speed of idle switch OFF → ON
   1,200 rpm



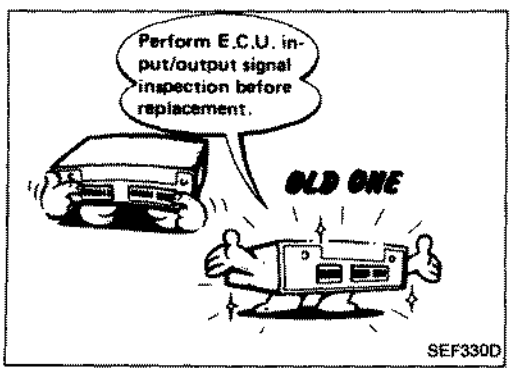
Diagnostic Procedure

CAUTION:

1. **Before connecting or disconnecting 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. Otherwise, there may be damage to the E.C.C. control unit.**

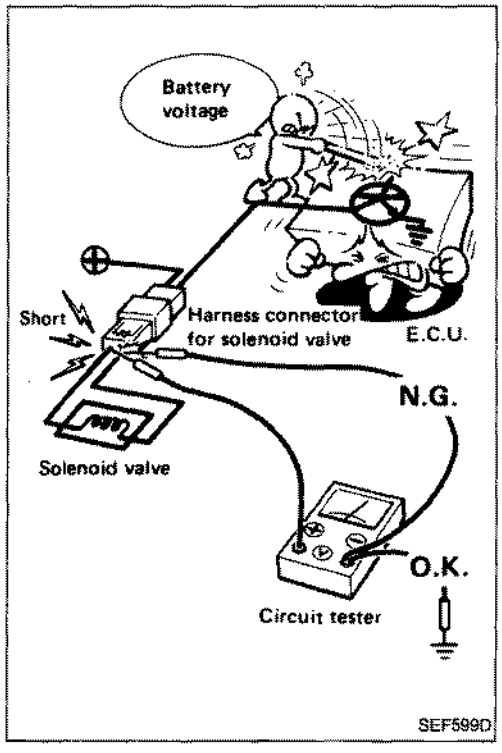


2. **When connecting pin connectors into E.C.U. or disconnecting them from E.C.U., take care not to damage pin terminal of E.C.U. (Bend or break).**
3. **Make sure that there are not any bends or breaks on E.C.U. pin terminal, when connecting pin connectors into E.C.U..**



4. **Before replacing E.C.U., perform E.C.U. input/output signal inspection and make sure whether E.C.U. functions properly or not. (See page EF & EC-136.)**
5. **After performing this "Diagnostic Procedure", perform driving test.**

Diagnostic Procedure (Cont'd)



6. When measuring supply voltage of E.C.U. controlled components 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 power transistor of the control unit.

7. When measuring voltage or resistance at connector with tester probes, there are two methods of measurement; one is done from terminal side and the other from harness side. Before measuring, confirm symbol mark again.

   H.S. : Inspection should be done from harness side.

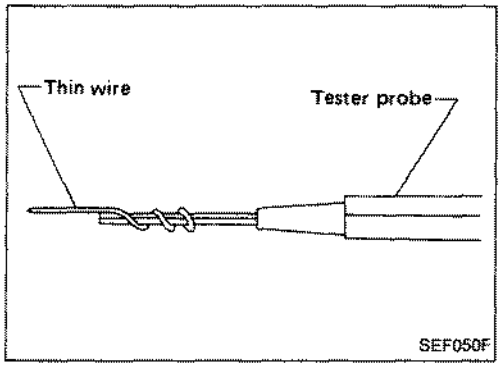
   T.S. : Inspection should be done from terminal side.

Refer to GI section.

8. As for continuity check of joint connector, refer to EL section.
9. Key to symbols

   DISCONNECT : Check after disconnecting the connector to be measured.

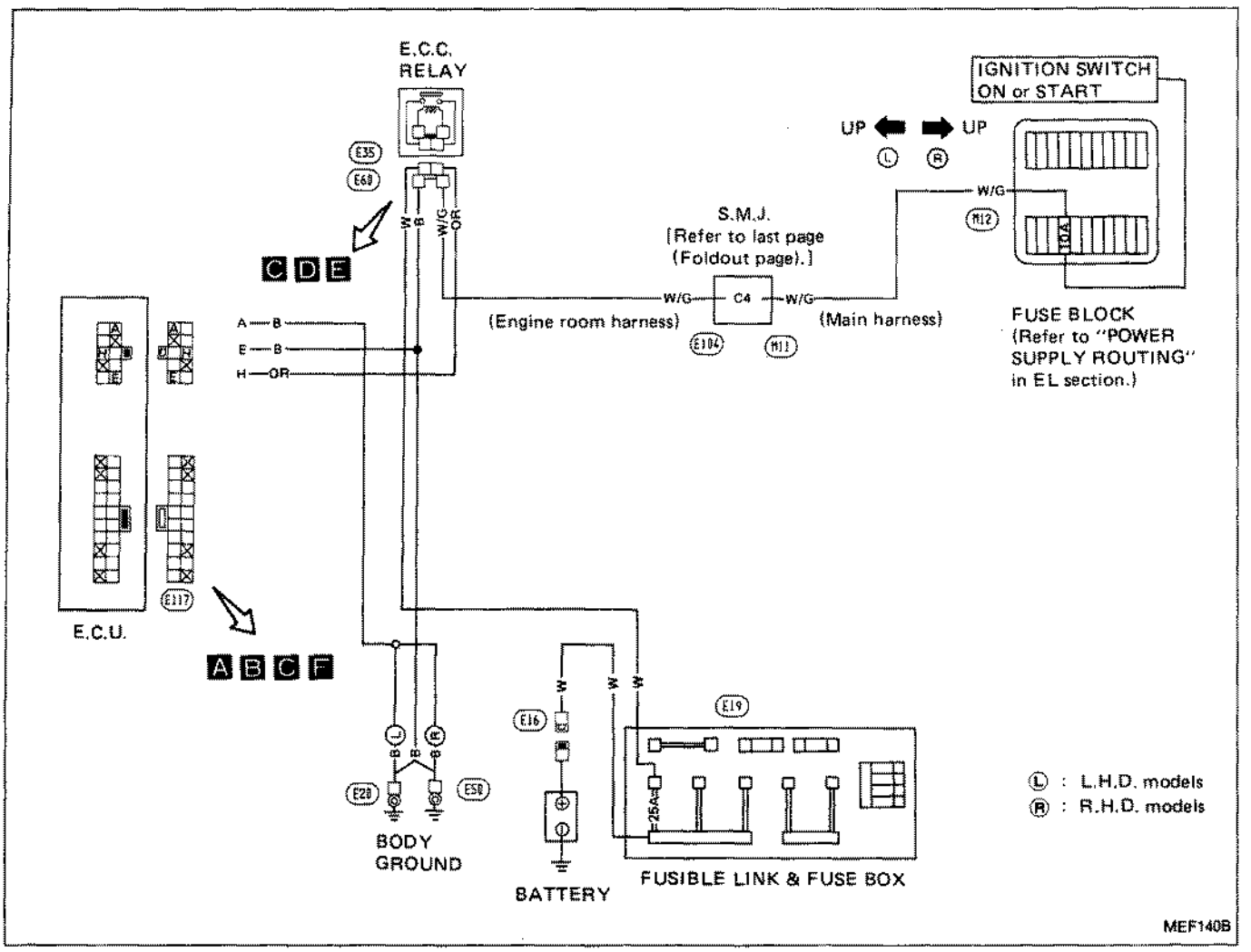
   CONNECT : Check after connecting the connector to be measured.



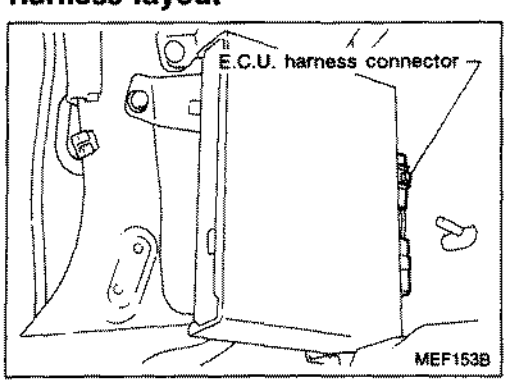
10. Improve tester probe as shown to perform test easily.
11. For the first trouble-shooting procedure, perform POWER SOURCE & GROUND CIRCUIT FOR E.C.C. control unit check.

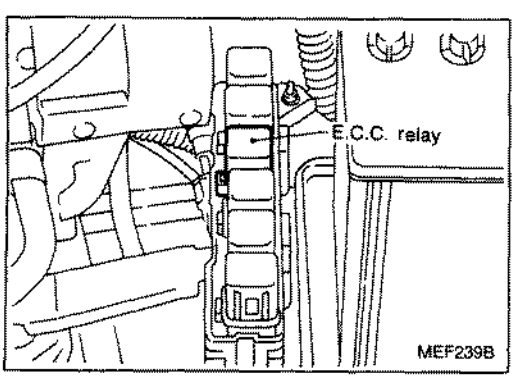
Diagnostic Procedure 1

MAIN POWER SUPPLY AND GROUND CIRCUIT (Not self-diagnostic item)



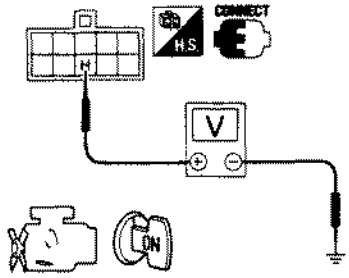
Harness layout





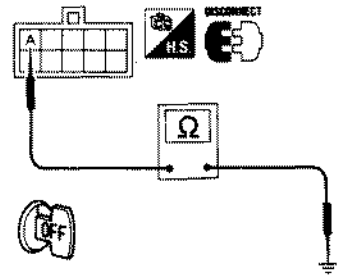
Diagnostic Procedure 1 (Cont'd)

A



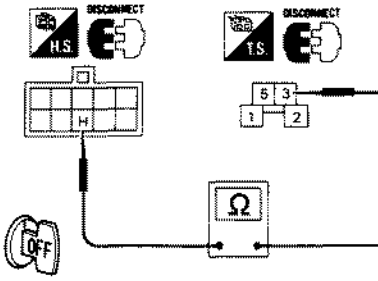
MEF161B

B



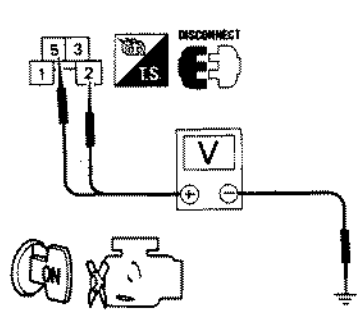
MEF162B

C



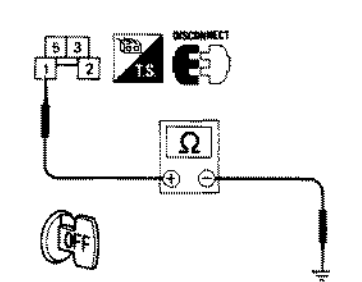
MEF163B

D



MEF164B

E



MEF165B

INSPECTION START

A CHECK POWER SUPPLY.
1) Turn ignition switch "ON".
2) Check voltage between E.C.U. terminal Ⓗ and ground.
Voltage: Battery voltage

O.K. → **B** CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal Ⓐ and body ground.
Continuity should exist.
If N.G., repair harness or connectors.

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

N.G. ↓

C CHECK HARNESS CONTINUITY BETWEEN E.C.C. RELAY AND E.C.U.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Disconnect E.C.C. relay.
4) Check harness continuity between E.C.U. terminal Ⓗ and terminal ③.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

D CHECK VOLTAGE BETWEEN E.C.C. RELAY AND GROUND.
1) Turn ignition switch "ON".
2) Check voltage between terminals ②, ⑤ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (M31), (E104)
- 25A fusible link
- 10A fuse
- Harness continuity between E.C.C. relay and battery
- Harness continuity between E.C.C. relay and fuse

If N.G., repair harness or connectors.

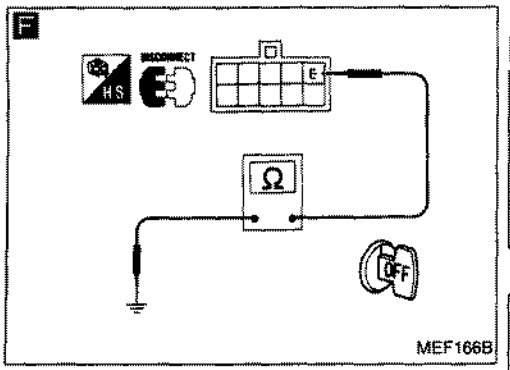
O.K. ↓

E CHECK HARNESS CONTINUITY BETWEEN E.C.C. RELAY AND GROUND.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ① and body ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓ Ⓐ

Diagnostic Procedure 1 (Cont'd)



Ⓐ

CHECK GROUND CIRCUIT.
1) Check harness continuity between E.C.U. terminal Ⓔ and body ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

CHECK COMPONENT
(E.C.C. relay).
Refer to "Electrical Components Inspection".
(See page EF & EC-147.)

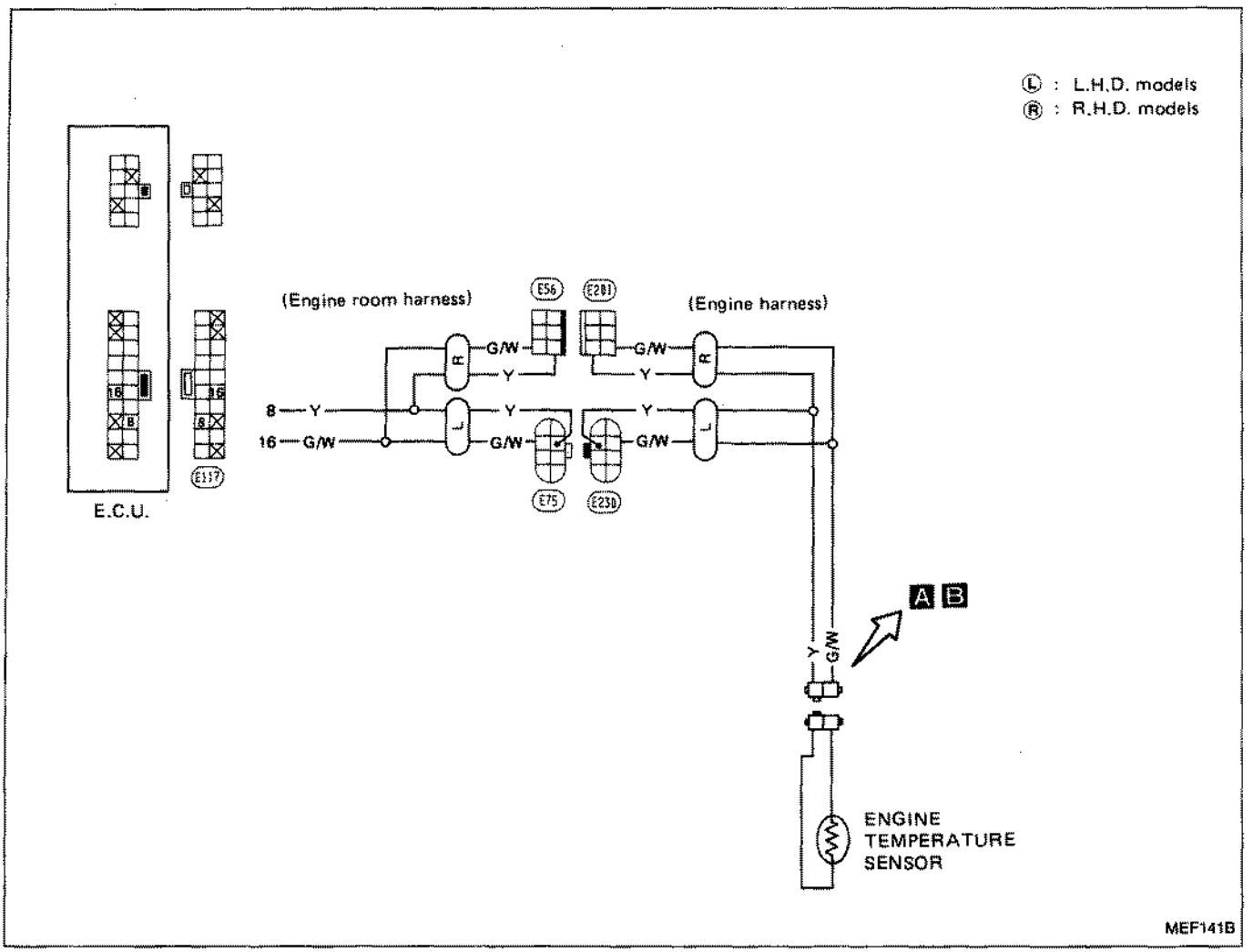
N.G. → Replace E.C.C. relay.

O.K. ↓

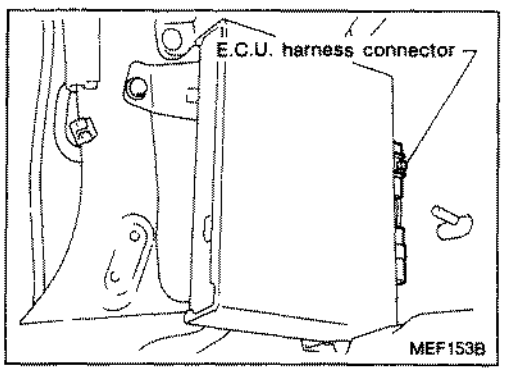
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

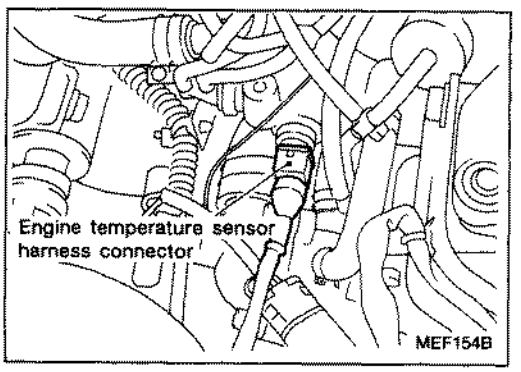
Diagnostic Procedure 2

ENGINE TEMPERATURE SENSOR (Not self-diagnostic item)

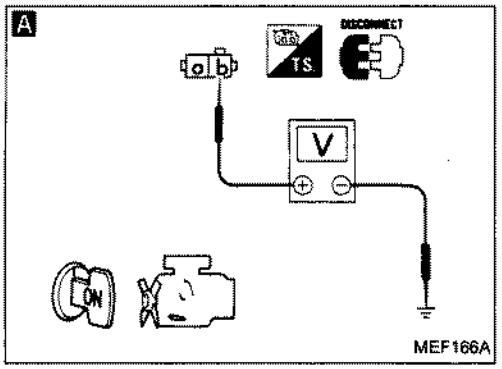


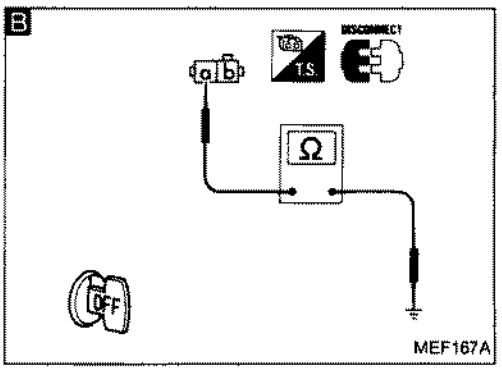
Harness layout





Diagnostic Procedure 2 (Cont'd)





INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect engine temperature sensor harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓑ and ground.
Voltage: Approximately 5V

N.G. → Check the following.
- Harness connectors (E75), (E230) (L.H.D. models)
- Harness connectors (E56), (E201) (R.H.D. models)
- Harness continuity between E.C.U. and engine temperature sensor

If N.G., repair harness or connectors.

O.K. ↓

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓐ and body ground.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (E75), (E238) (L.H.D. models)
- Harness connectors (E56), (E201) (R.H.D. models)
- Harness continuity between E.C.U. and engine temperature sensor

If N.G., repair harness or connectors.

O.K. ↓

CHECK COMPONENT
(Engine temperature sensor).
Refer to "Electrical Components Inspection".
(See page EF & EC-143.)

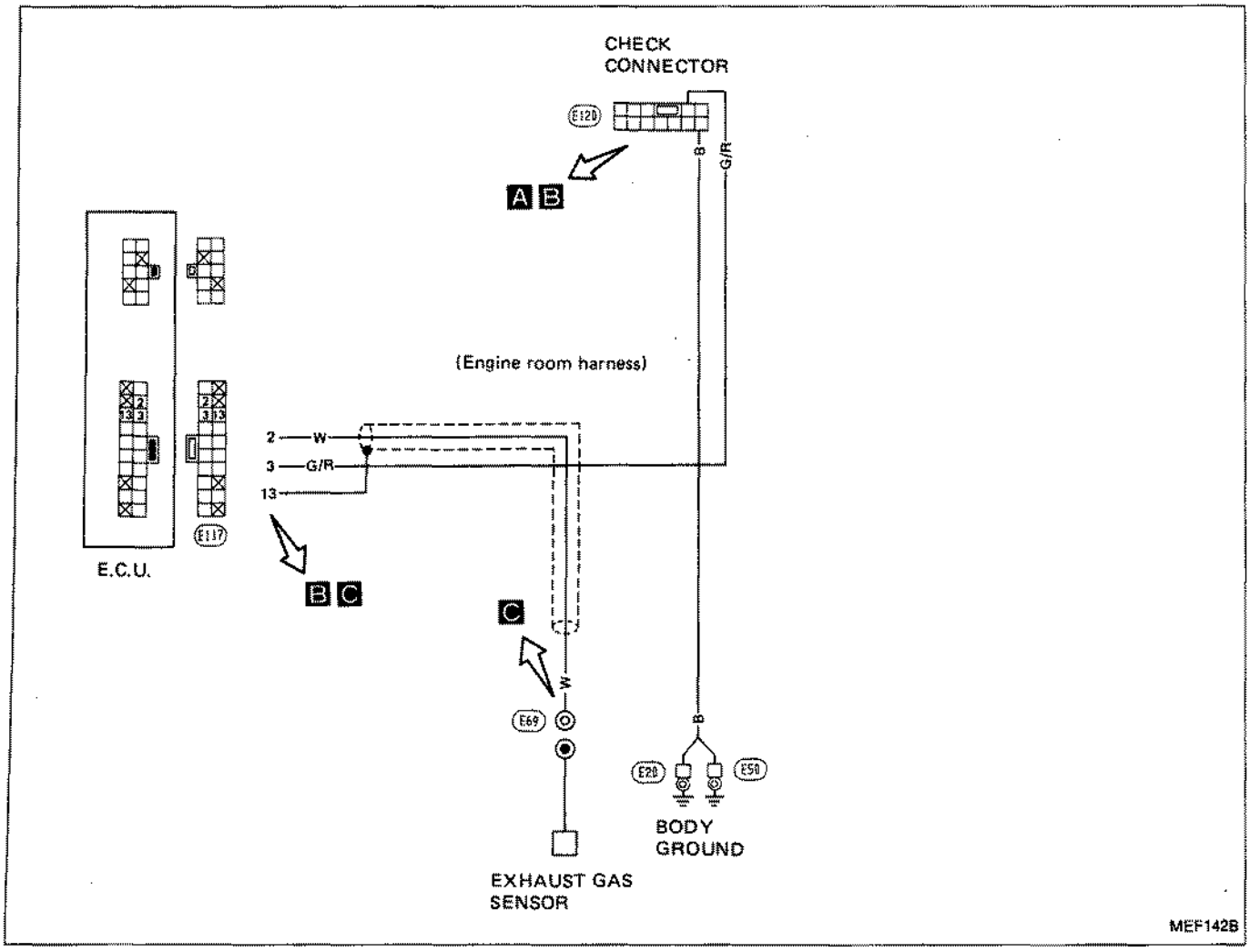
N.G. → Replace engine temperature sensor.

O.K. ↓

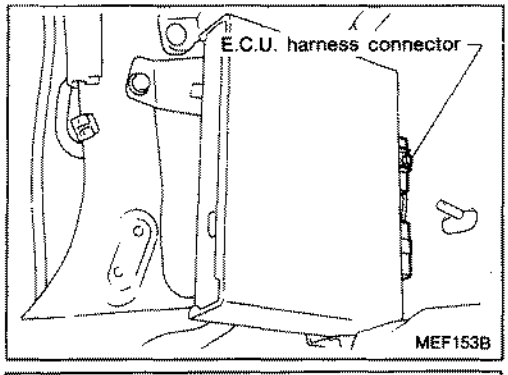
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

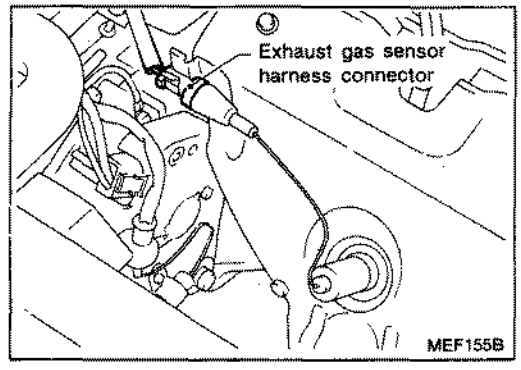
Diagnostic Procedure 3

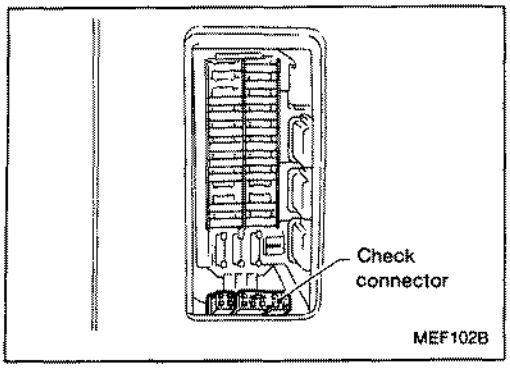
EXHAUST GAS SENSOR (Not self-diagnostic item)



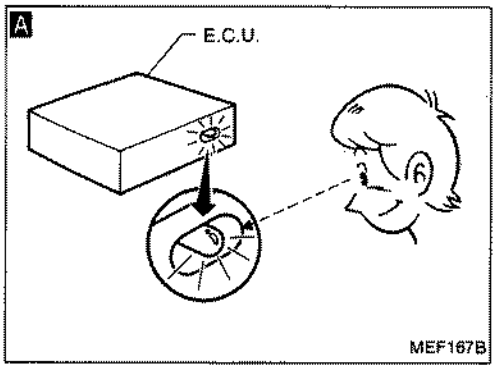
Harness layout

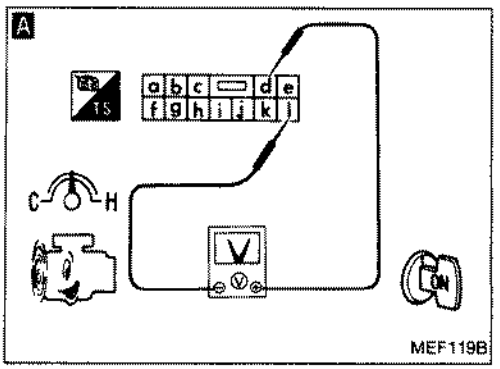


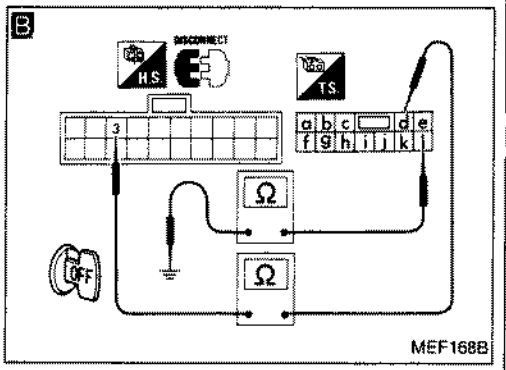


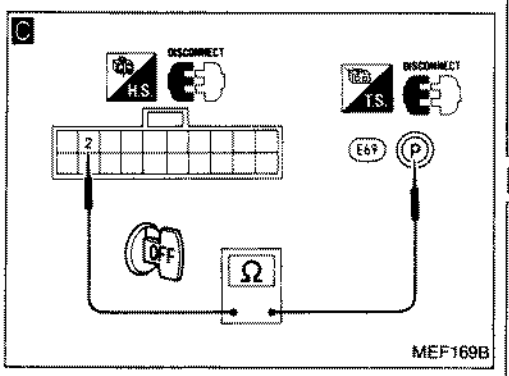


Diagnostic Procedure 3 (Cont'd)









INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Run engine at about 2,500 rpm for about 5 minutes under no-load.
3) Keep engine speed at 2,000 rpm under no-load, make sure that green L.E.D. on E.C.U. goes on and off periodically more than 5 times during 10 seconds.

O.K. → INSPECTION END

OR

3) Keep engine speed at 2,000 rpm under no-load, check voltage between terminal ⓓ and terminal ① on check connector.
Needle of voltmeter should fluctuate between approximately 0V and battery voltage more than 5 times during 10 seconds.

N.G.

B

CHECK HARNESS CONTINUITY BETWEEN E.C.U. AND CHECK CONNECTOR.
1) Stop engine.
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal ③ and terminal ⓓ, terminal ① and body ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

C

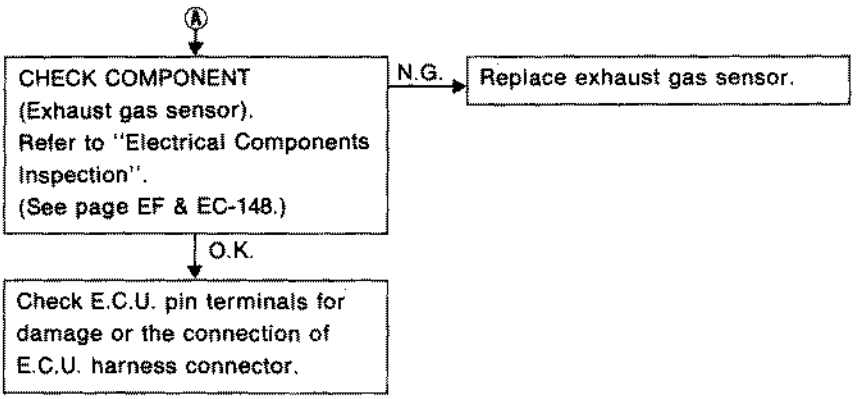
CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect exhaust gas sensor harness connector.
2) Check harness continuity between E.C.U. terminal ② and terminal ⓟ (Harness side connector (E69)).
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

Ⓐ

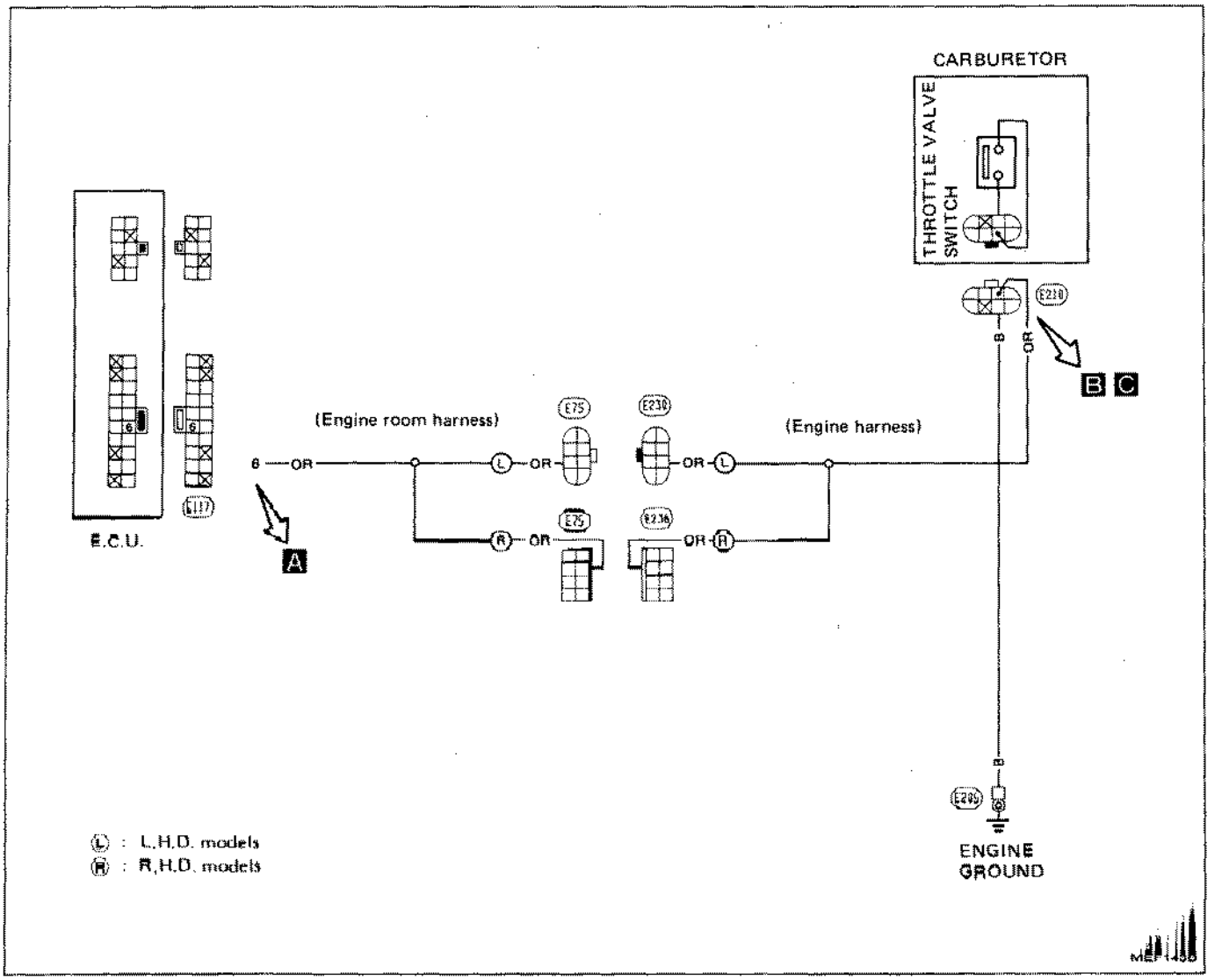
Diagnostic Procedure 3 (Cont'd)



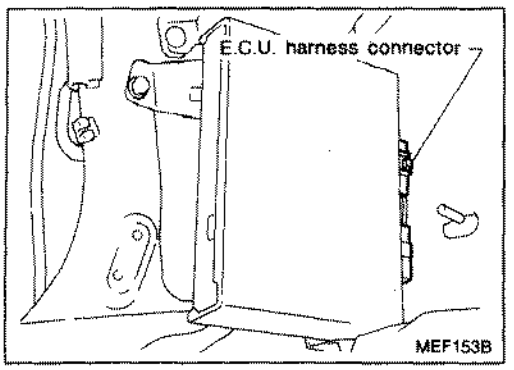
NOTE

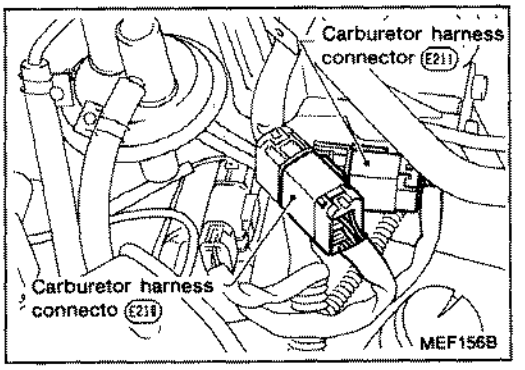
Diagnostic Procedure 4

THROTTLE VALVE SWITCH (Not self-diagnostic item)

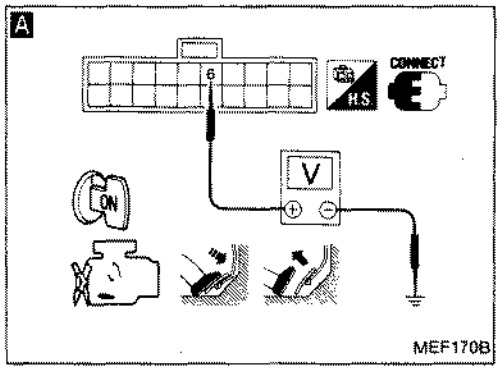


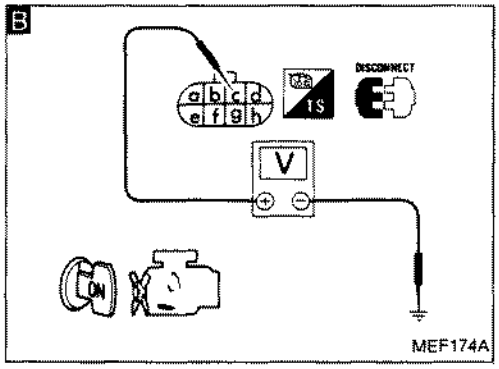
Harness layout

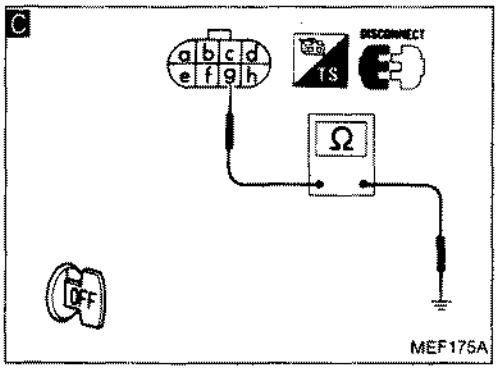




Diagnostic Procedure 4 (Cont'd)







INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Turn ignition switch "ON".
2) Check voltage between E.C.U. terminal ⑥ and ground.
Voltage:
Accelerator pedal is released
Approximately 0V
Accelerator pedal is depressed
Approximately 8V

O.K. → INSPECTION END

N.G. ↓

B

CHECK POWER SUPPLY.
1) Turn ignition switch "OFF".
2) Disconnect carburetor harness connector (E218).
3) Turn ignition switch "ON".
4) Check voltage between terminal ⑧ and ground.
Voltage: Approximately 8V

N.G. → Check the following.
- Harness connectors (E75), (E238) (L.H.D. models)
- Harness connectors (E75), (E236) (R.H.D. models)
- Harness continuity between E.C.U. and carburetor

If N.G., repair harness or connectors.

O.K. ↓

C

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⑨ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

CHECK COMPONENT
(Throttle valve switch).
Refer to "Electrical Components Inspection".
(See page EF & EC-145.)

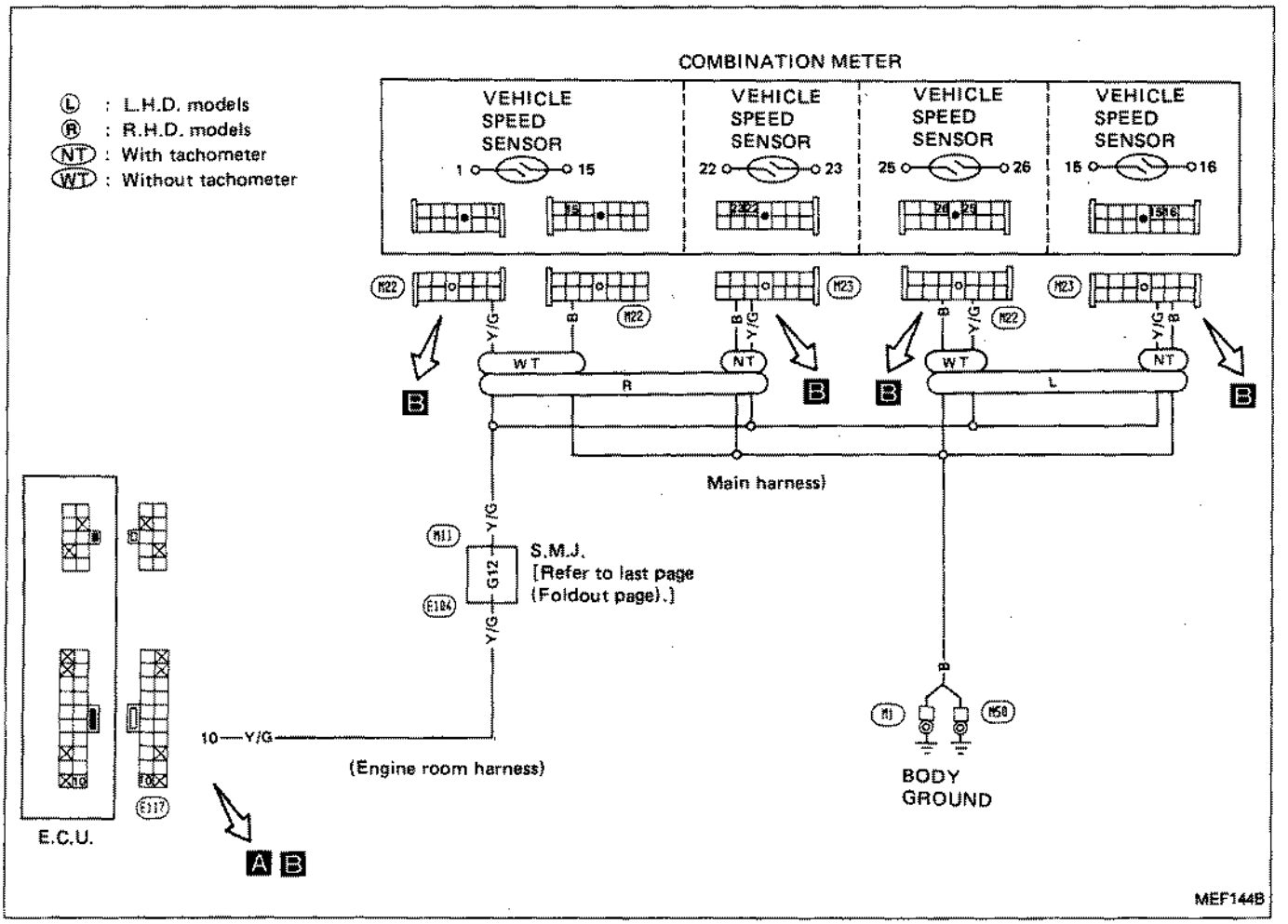
N.G. → Replace throttle valve switch.

O.K. ↓

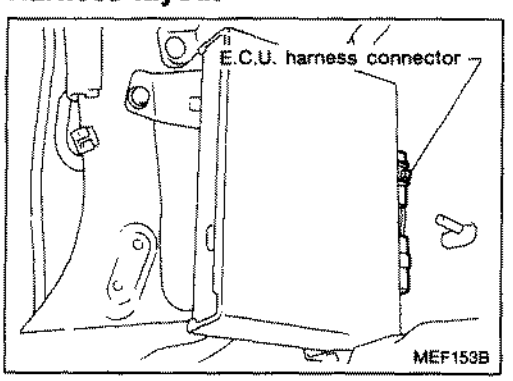
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Diagnostic Procedure 5

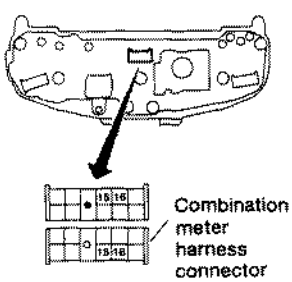
VEHICLE SPEED SENSOR (Not self-diagnostic item)



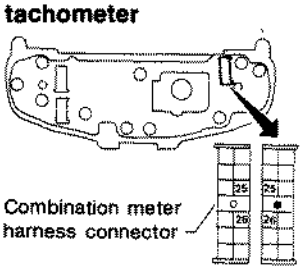
Harness layout



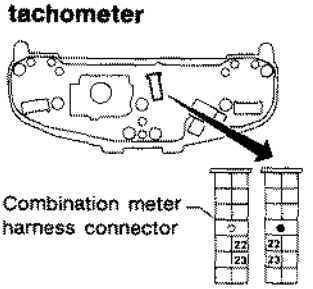
L.H.D. models with tachometer



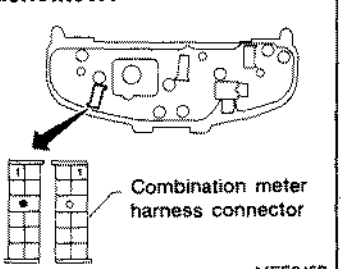
L.H.D. models without tachometer



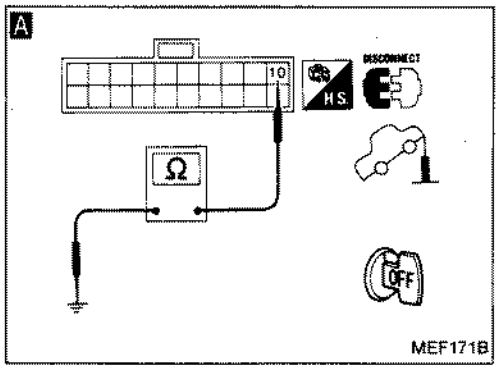
R.H.D. models with tachometer

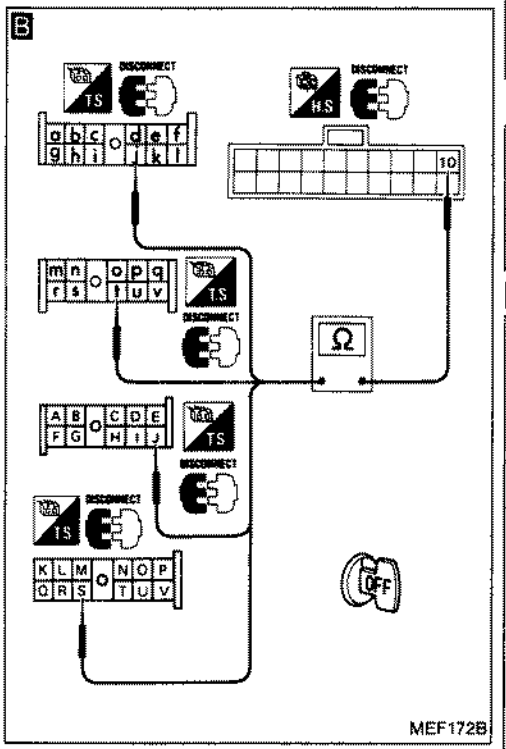


R.H.D. models without tachometer



Diagnostic Procedure 5 (Cont'd)





INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Jack up front wheels.
2) Disconnect E.C.U. harness connector.
3) Rotate front wheel by hand.
4) Check harness continuity between E.C.U. terminal ⑩ and body ground.
Continuity should come and go.

O.K. → INSPECTION END

N.G.

CHECK SPEEDOMETER FUNCTION.
Make sure that speedometer functions properly.

N.G. → Check vehicle speed sensor and circuit.
(Refer to EL section.)

O.K.

B

CHECK INPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect combination meter harness connector.
3) Check harness continuity between E.C.U. terminal ⑩ and terminal ⓘ (L.H.D. models without tachometer), terminal ① (L.H.D. models with tachometer), terminal ⓙ (R.H.D. models without tachometer), terminal ⑤ (R.H.D. models with tachometer).
Continuity should exist.

N.G. → Check the following.
- Harness connectors (M11), (E104)
- Harness continuity between E.C.U. and combination meter

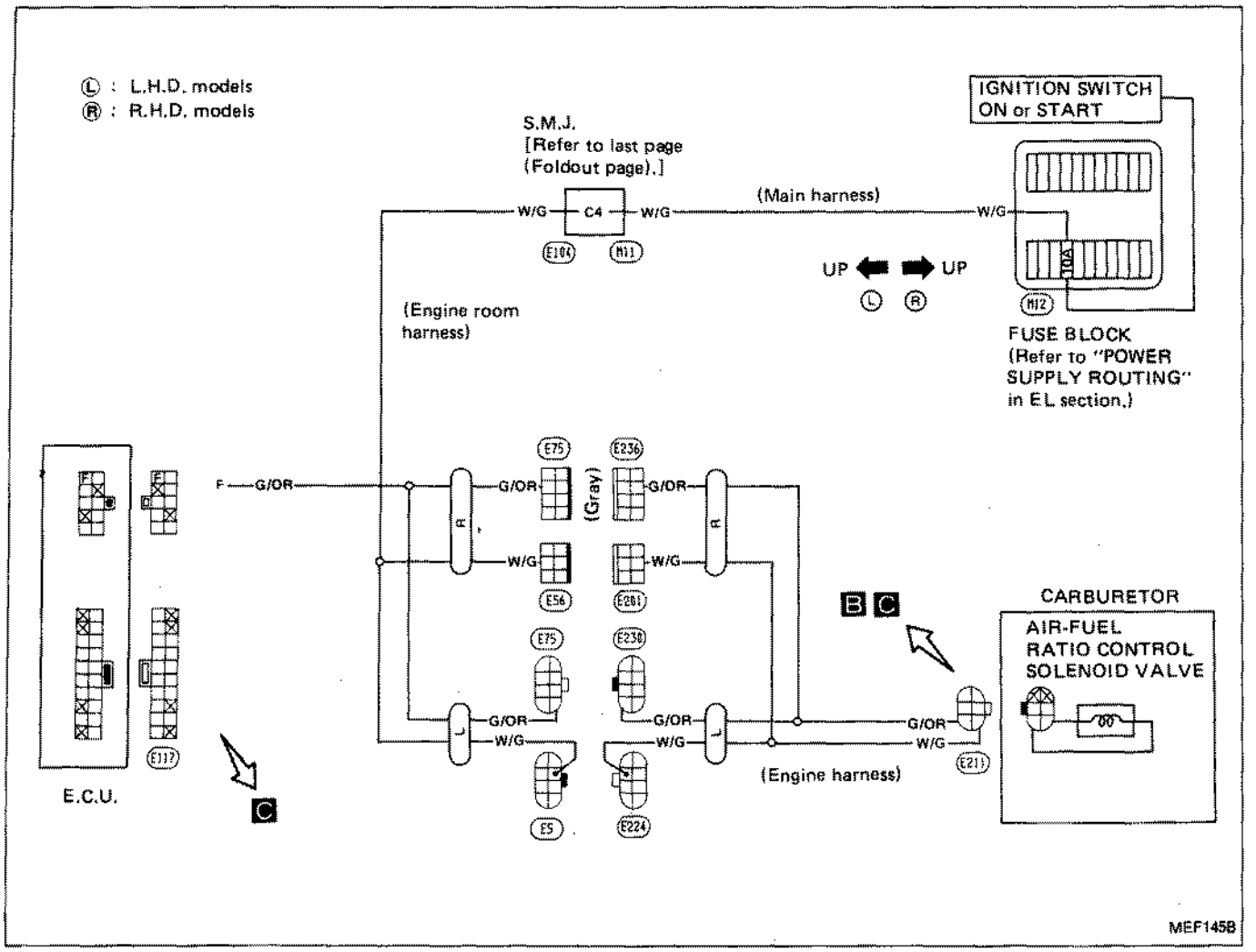
If N.G., repair harness or connectors.

O.K.

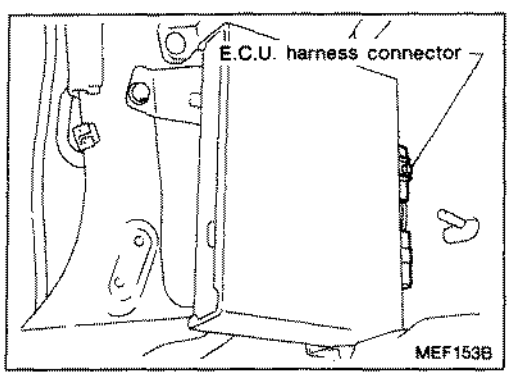
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

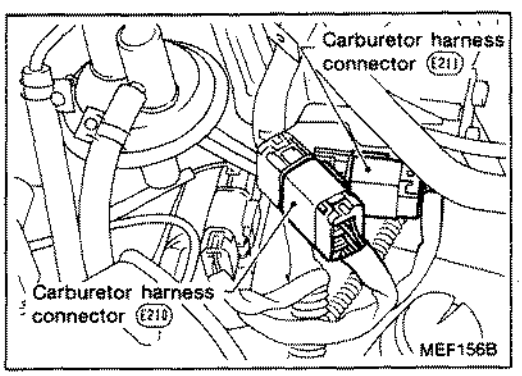
Diagnostic Procedure 6

AIR-FUEL RATIO CONTROL SOLENOID VALVE (Not self-diagnostic item)



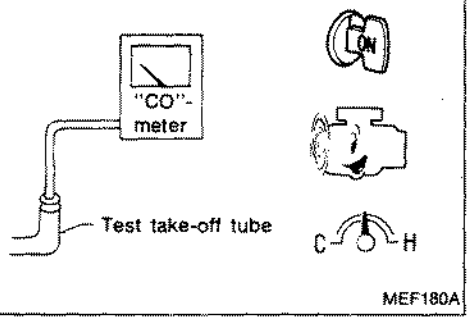
Harness layout



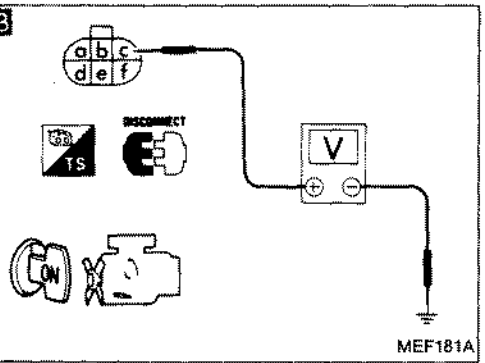


Diagnostic Procedure 6 (Cont'd)

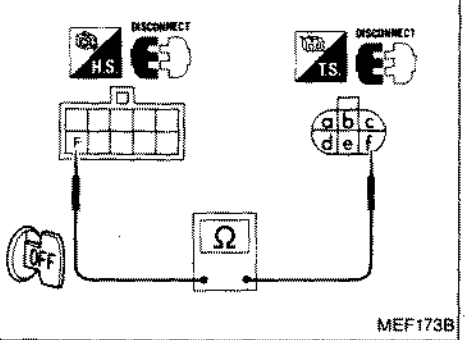
A



B



C



INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Inspect and adjust idle speed and mixture ratio. (Refer to page EF & EC-156.)
2) Stop engine.
3) Disconnect exhaust gas sensor harness connector and A.I.V. control solenoid valve harness connector.
4) Set "CO"-meter on test take-off tube.
5) Start engine and run it at idle.
6) Check idle "CO"%.
Idle "CO"%: 0.5 - 1.5%
= α%
If N.G., adjust idle "CO"%. (Refer to page EF & EC-156.)
7) Disconnect carburetor harness connector (E211).
8) Recheck idle "CO"%.
Idle "CO"%: more than α%

O.K. → INSPECTION END

N.G.

B

CHECK POWER SUPPLY.
1) Stop engine.
2) Turn ignition switch "ON".
3) Check voltage between terminal (E) and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (M11), (E184)
- Harness connectors (E5), (E224) (L.H.D. models)
- Harness connectors (E56), (E201) (R.H.D. models)
- 10A fuse
- Harness continuity between carburetor and fuse

If N.G., repair harness or connectors.

O.K.

C

CHECK OUTPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal (F) and terminal (f).
Continuity should exist.

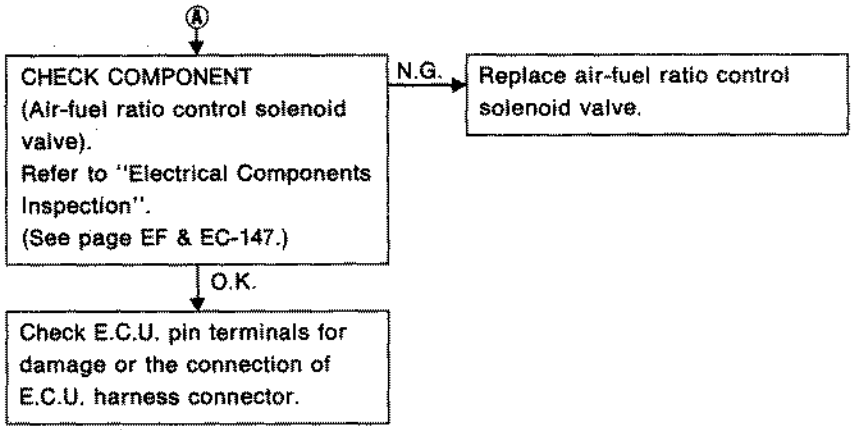
N.G. → Check the following.
- Harness connectors (E75), (E236) (L.H.D. models)
- Harness connectors (E75), (E236) (R.H.D. models)
- Harness continuity between E.C.U. and carburetor

If N.G., repair harness or connectors.

O.K.

(A)

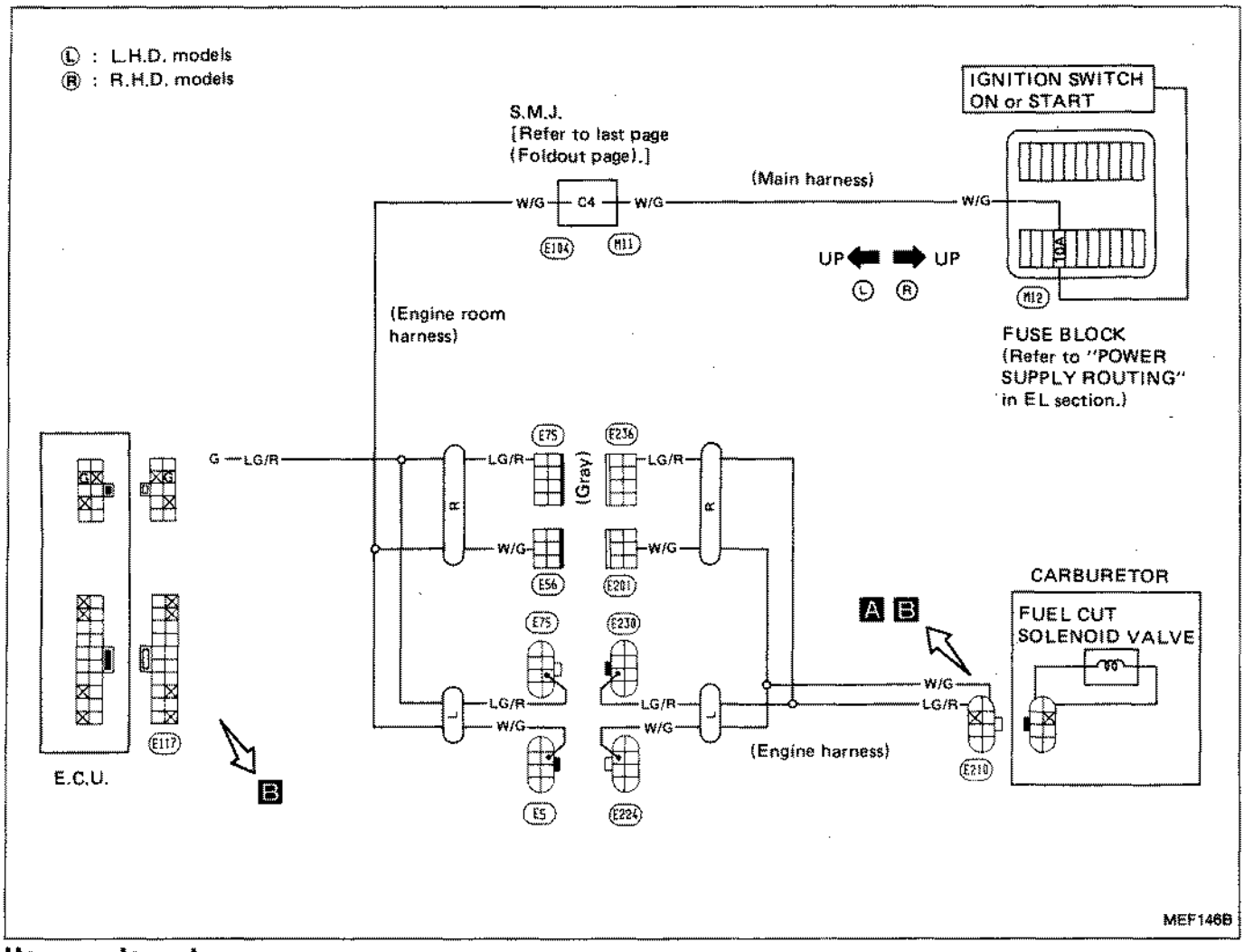
Diagnostic Procedure 6 (Cont'd)



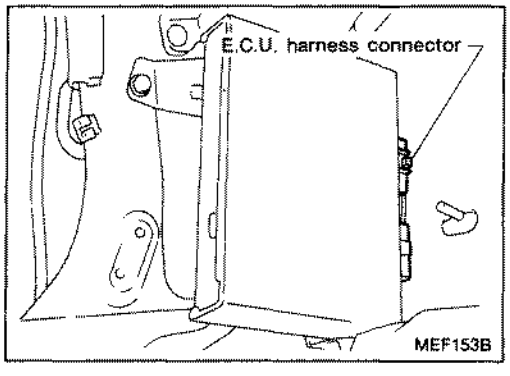
NOTE

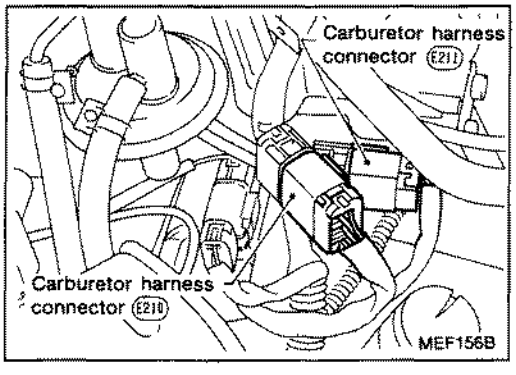
Diagnostic Procedure 7

FUEL CUT SOLENOID VALVE (Not self-diagnostic item)



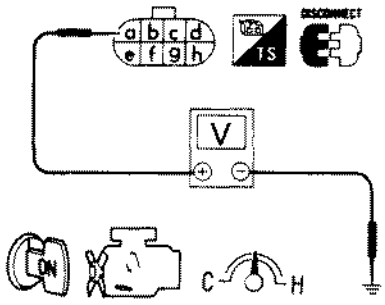
Harness layout





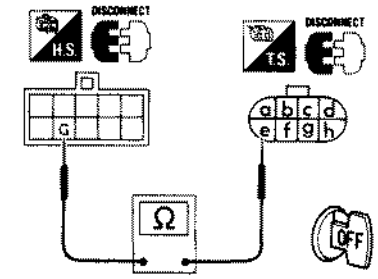
Diagnostic Procedure 7 (Cont'd)

A



MEF183A

B



MEF174B

INSPECTION START

CHECK OVERALL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Stop engine.
3) Turn ignition switch "ON".
4) Listen to fuel cut solenoid valve operating sound.
Clicking noise should be heard.

O.K. → INSPECTION END

N.G. ↓

A

CHECK POWER SUPPLY.
1) Turn ignition switch "OFF".
2) Disconnect carburetor harness connector (E218).
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓖ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (M11), (E184)
- Harness connectors (E5), (E224) (L.H.D. models)
- Harness connectors (E56), (E201) (R.H.D. models)
- 10A fuse
- Harness continuity between carburetor and fuse

If N.G., repair harness, fuse or connectors.

O.K. ↓

B

CHECK OUTPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal (6) and terminal (8).
Continuity should exist.

N.G. → Check the following.
- Harness connectors (E75), (E238) (L.H.D. models)
- Harness connectors (E75), (E234) (R.H.D. models)
- Harness continuity between E.C.U. and carburetor

If N.G., repair harness or connectors.

O.K. ↓

CHECK COMPONENT
(Fuel cut solenoid valve).
Refer to "Electrical Components Inspection".
(See page EF & EC-145.)

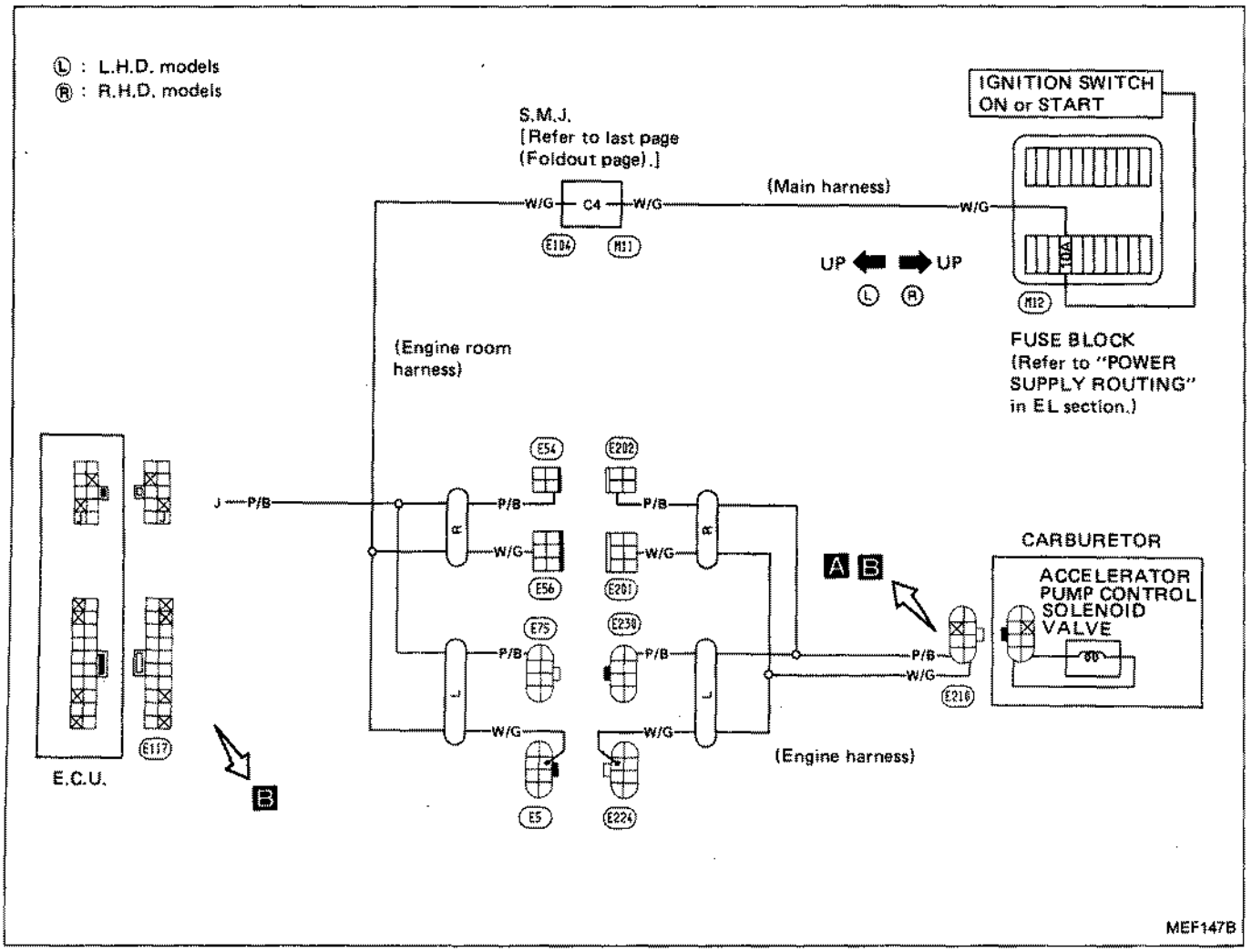
N.G. → Replace fuel cut solenoid valve.

O.K. ↓

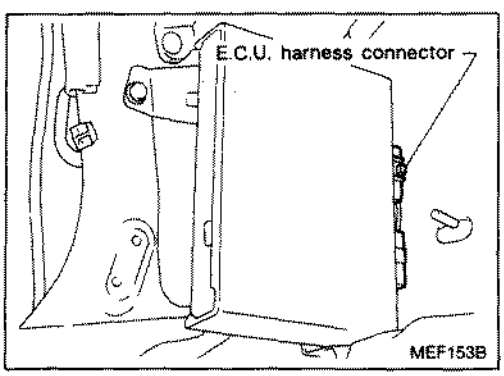
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

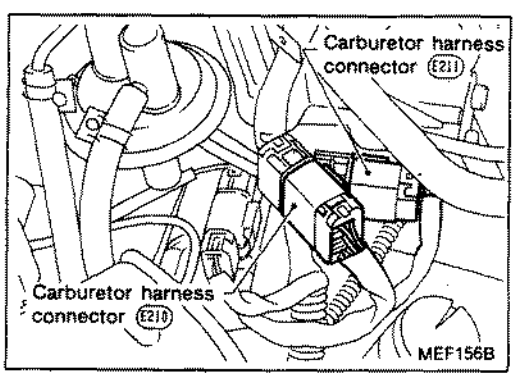
Diagnostic Procedure 8

ACCELERATOR PUMP CONTROL SOLENOID VALVE (Not self-diagnostic item)

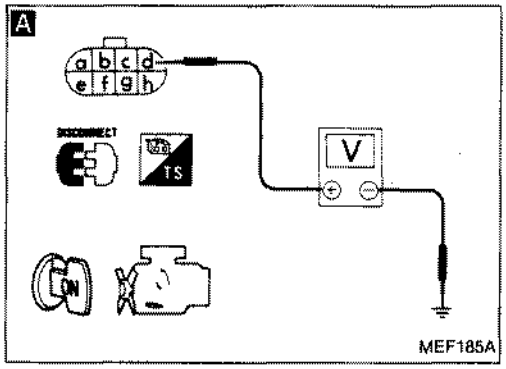


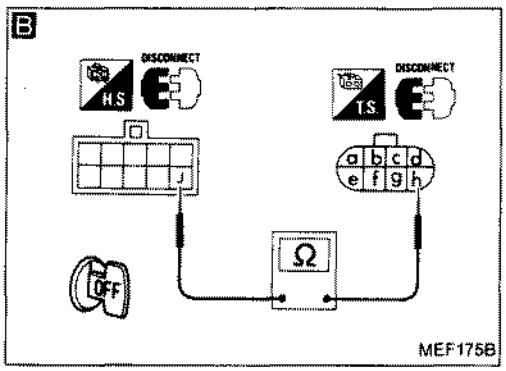
Harness layout





Diagnostic Procedure 8 (Cont'd)





INSPECTION START

CHECK OVERALL FUNCTION.
1) Make sure that engine is cold.
[Engine temperature is below 75°C (167°F) (M/T models), 65°C (149°F) (A/T models).]
2) Turn ignition switch "ON".
3) Listen to accelerator pump control solenoid valve operating sound.
Clicking noise should be heard.

O.K. → INSPECTION END

N.G. ↓

A

CHECK POWER SUPPLY.
1) Turn ignition switch "OFF".
2) Disconnect carburetor harness connector (E218).
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓓ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (M11), (E104)
- Harness connectors (E5), (E224) (L.H.D. models)
- Harness connectors (E56), (E281) (R.H.D. models)
- 10A fuse
- Harness continuity between carburetor and fuse

If N.G., repair harness or connectors.

O.K. ↓

B

CHECK OUTPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal ⓙ and terminal ⓗ.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (E75), (E238) (L.H.D. models)
- Harness connectors (E54), (E282) (R.H.D. models)
- Harness continuity between E.C.U. and carburetor

If N.G., repair harness or connectors.

O.K. ↓

CHECK COMPONENT
(Accelerator pump control solenoid valve).
Refer to "Electrical Components Inspection".
(See page EF & EC-146.)

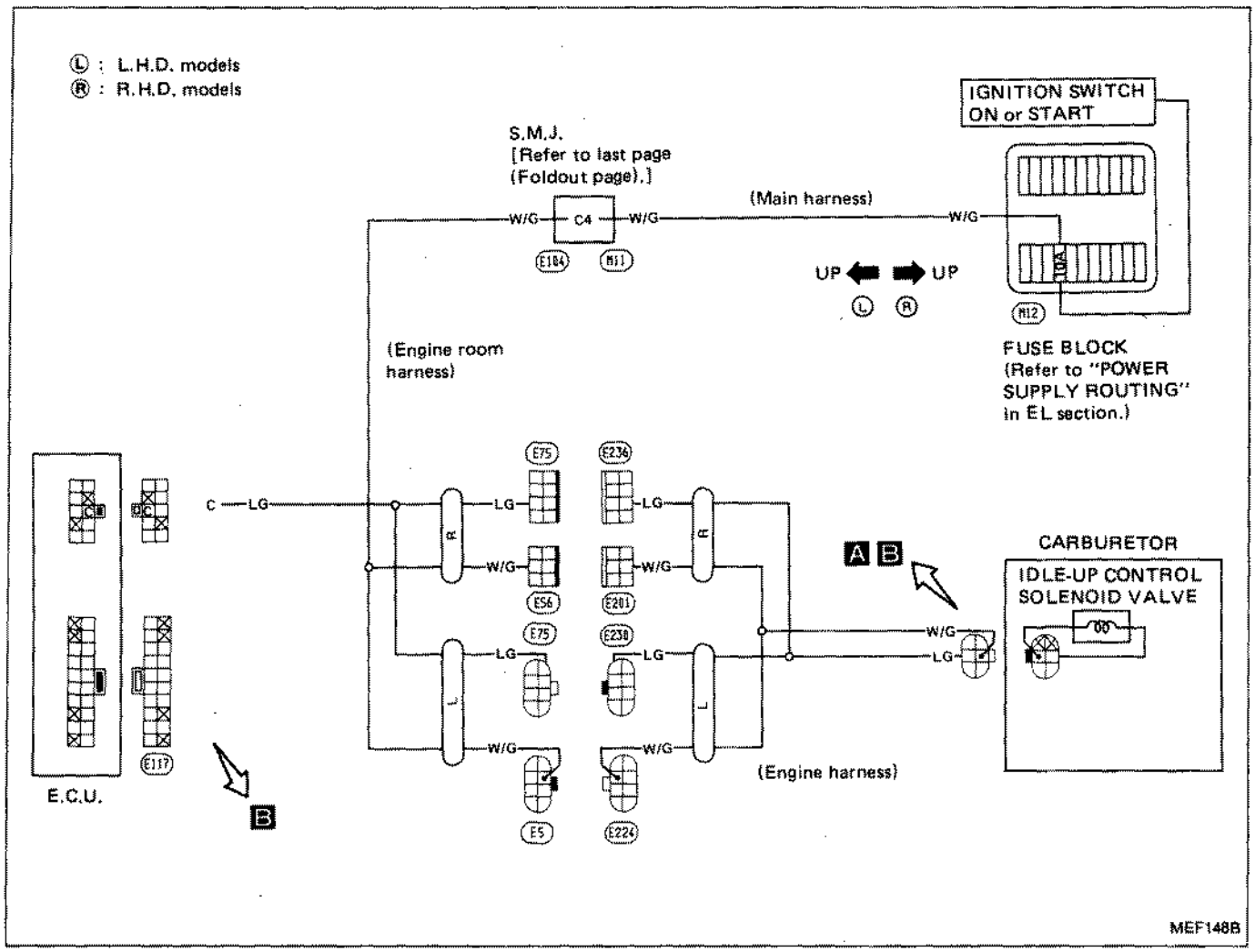
N.G. → Replace accelerator pump control solenoid valve.

O.K. ↓

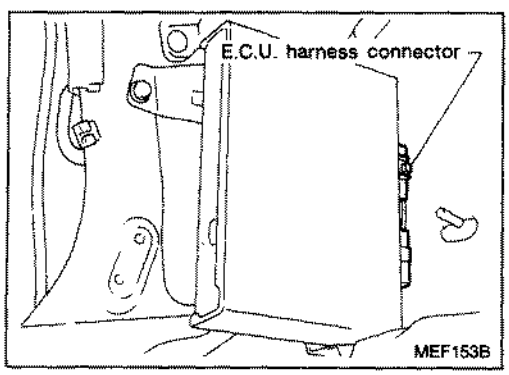
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

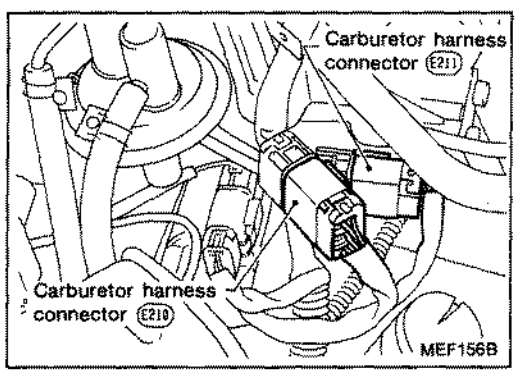
Diagnostic Procedure 9

IDLE-UP CONTROL SOLENOID VALVE (Not self-diagnostic item)



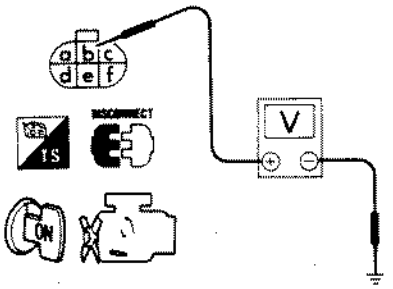
Harness layout





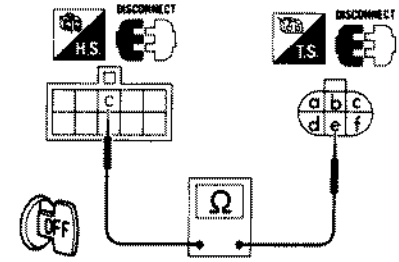
Diagnostic Procedure 9 (Cont'd)

A



MEF187A

B



MEF176B

INSPECTION START

CHECK OVERALL FUNCTION.
1) Make sure that engine is cold.
[Engine temperature is below 65°C (149°F).]
2) Turn ignition switch "ON".
3) Listen to idle-up control solenoid valve operating sound.
Clicking noise should be heard.

O.K. → INSPECTION END

N.G. ↓

A

CHECK POWER SUPPLY.
1) Turn ignition switch "OFF".
2) Disconnect carburetor harness connector (E211).
3) Turn ignition switch "ON".
4) Check voltage between terminal (b) and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (M11), (E184)
- Harness connectors (E5), (E224) (L.H.D. models)
- Harness connectors (E56), (E201) (R.H.D. models)
- 10A fuse
- Harness continuity between carburetor and fuse

If N.G., repair harness, fuse or connectors.

O.K. ↓

B

CHECK OUTPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal (c) and terminal (e).
Continuity should exist.

N.G. → Check the following.
- Harness connectors (E75), (E238) (L.H.D. models)
- Harness connectors (E75), (E236) (R.H.D. models)
- Harness continuity between E.C.U. and carburetor

If N.G., repair harness or connectors.

O.K. ↓

CHECK COMPONENT (Idle-up control solenoid valve).
Refer to "Electrical Components Inspection".
(See page EF & EC-145.)

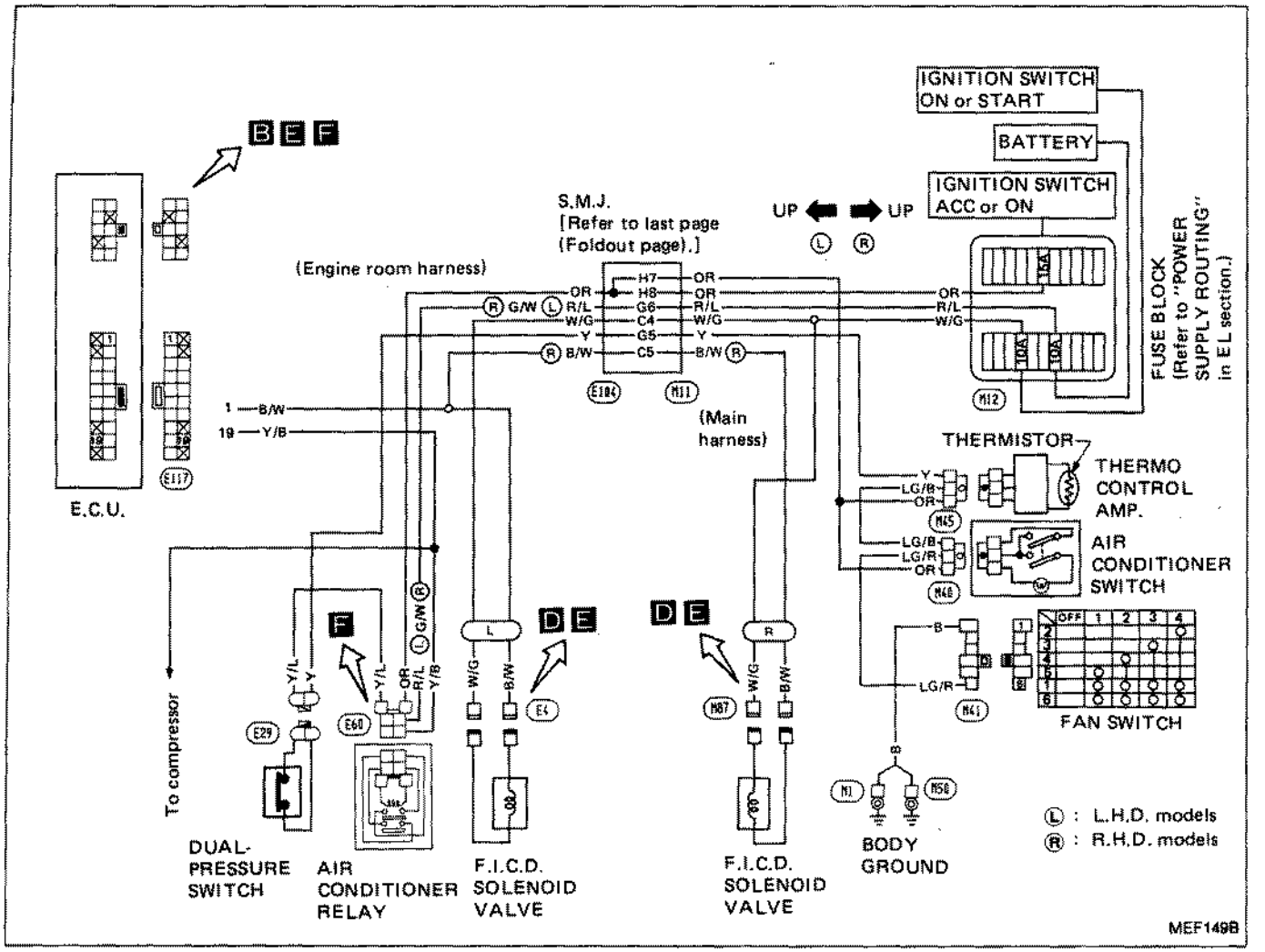
N.G. → Replace idle-up control solenoid valve.

O.K. ↓

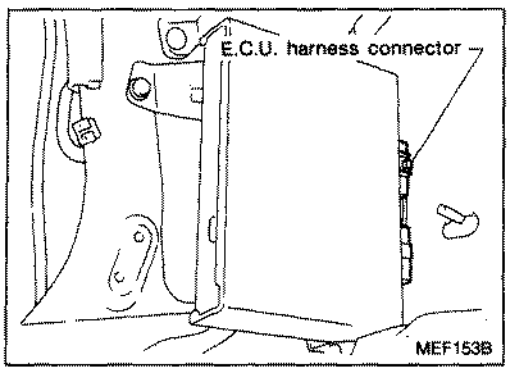
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

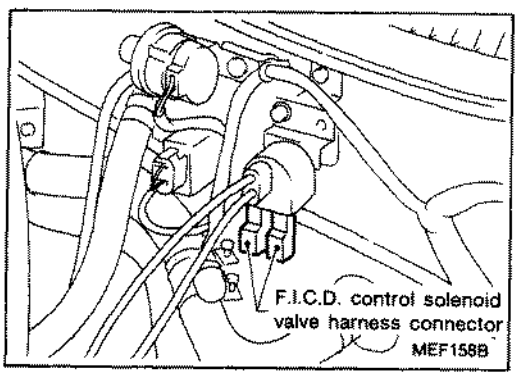
Diagnostic Procedure 10

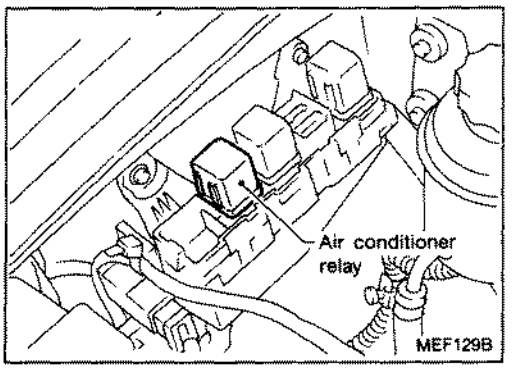
F.I.C.D. CONTROL SOLENOID VALVE (Not self-diagnostic item)



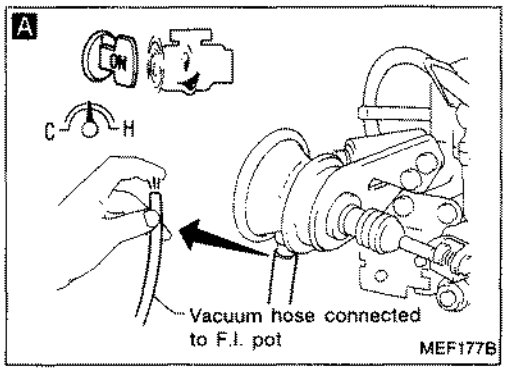
Harness layout

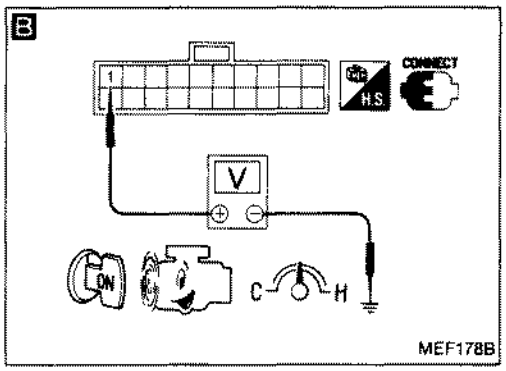


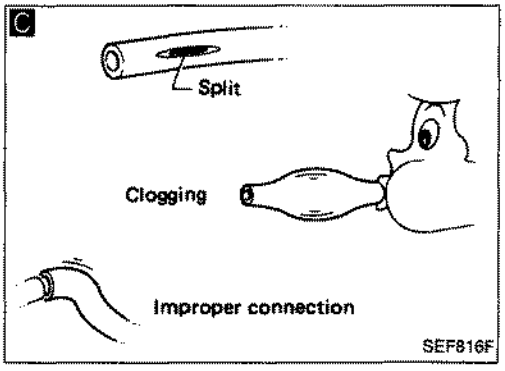


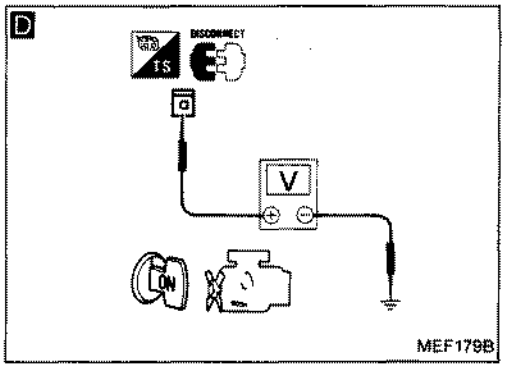


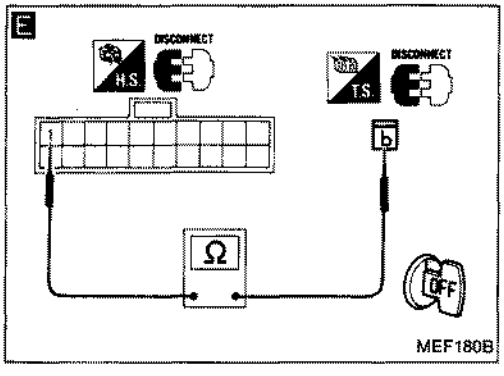
Diagnostic Procedure 10 (Cont'd)











INSPECTION START

CHECK OVERALL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Check idle speed.
M/T: 750 ± 50 rpm
A/T: 850 ± 50 rpm
If N.G., adjust idle speed.
3) Turn both air conditioner switch and blower fan switch "ON", then recheck idle speed.
M/T: 850 ± 50 rpm
A/T: 850 ± 50 rpm

O.K. → INSPECTION END

N.G.

Check if air conditioner compressor functions normally.

N.G. → Refer to HA section.

O.K.

A

CHECK VACUUM SOURCE TO F.I. POT.
1) Disconnect vacuum hose to F.I. pot.
2) Make sure that vacuum exists under the following condition.
Air conditioner switch "OFF":
Vacuum should not exist.
Air conditioner switch "ON":
Vacuum should exist.

O.K. → CHECK COMPONENT (F.I. pot).
Refer to "Electrical Components Inspection".
(See page EF & EC-149.)

N.G. → Replace F.I. pot.

N.G.

B

CHECK CONTROL FUNCTION.
1) Check voltage between E.C.U. terminal ① and ground under the following condition.
Voltage:
Air conditioner switch "OFF"
Battery voltage
Air conditioner switch "ON"
Approximately 0V

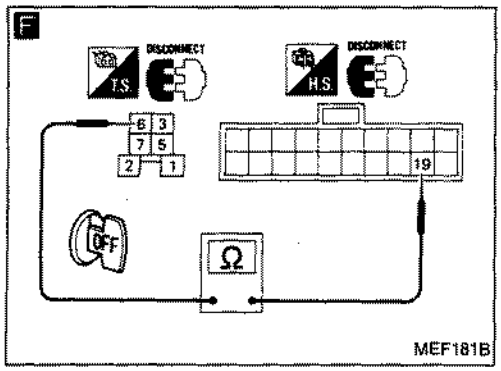
O.K. → C
Check vacuum hose for clogging, cracks and proper connection.

N.G.

Ⓐ

Diagnostic Procedure 10 (Cont'd)

F



D

Ⓐ

CHECK POWER SUPPLY.
1) Stop engine.
2) Disconnect F.I.C.D. control solenoid valve harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓖ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (M11), (E104) (L.H.D. models)
- 10A fuse
- Harness continuity between F.I.C.D. control solenoid valve and fuse

If N.G., repair harness, or connectors.

O.K. ↓

E

CHECK OUTPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal ① and terminal ⓑ.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (M11), (E104) (R.H.D. models)
- Harness continuity between E.C.U. and F.I.C.D. control solenoid valve

If N.G., repair harness or connectors.

O.K. ↓

F

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect air conditioner relay.
2) Check harness continuity between E.C.U. terminal ⑲ and terminal ⑥.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

CHECK COMPONENT (F.I.C.D. control solenoid valve).
Refer to "Electrical Components Inspection".
(See page EF & EC-149.)

N.G. → Replace F.I.C.D. control solenoid valve.

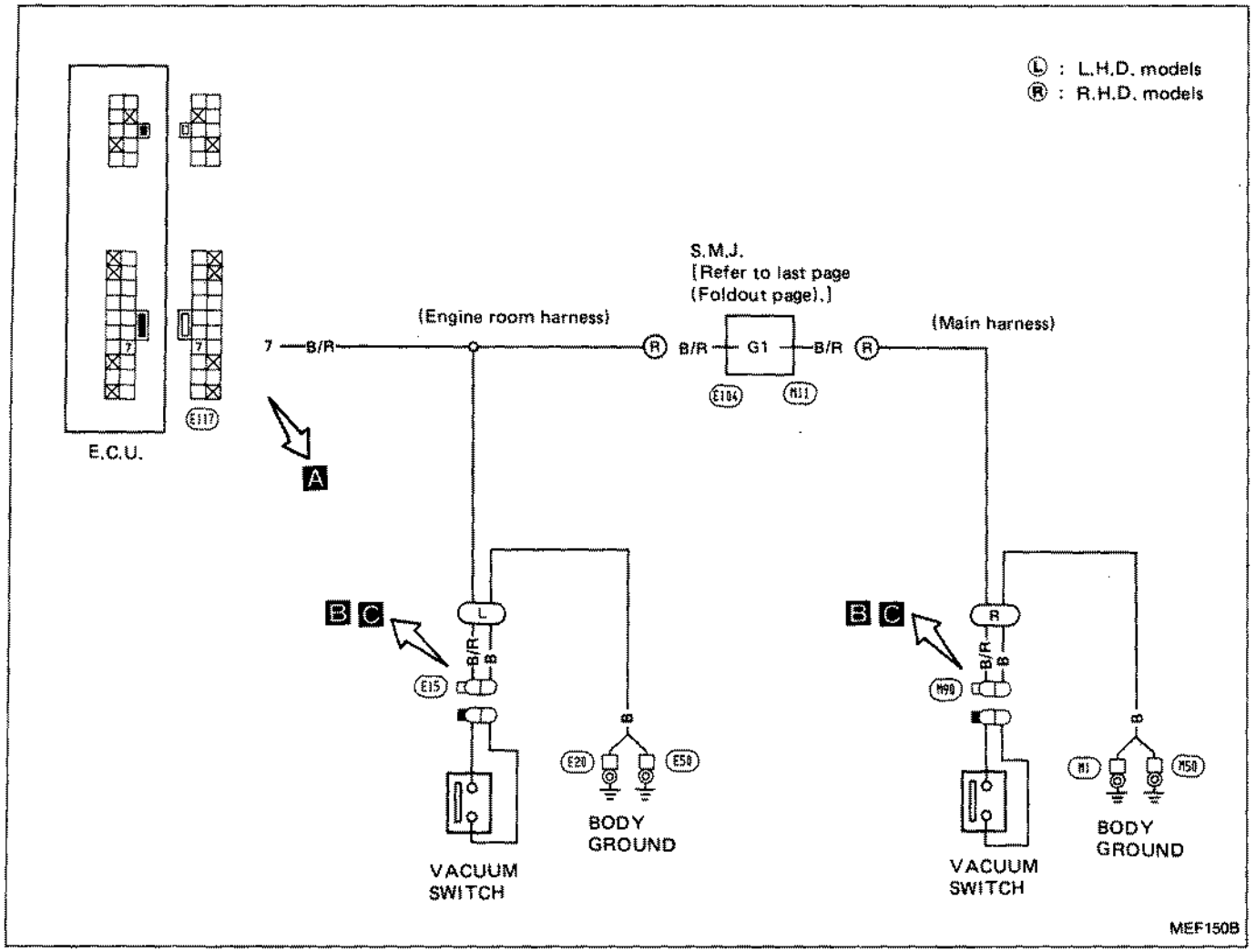
O.K. ↓

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

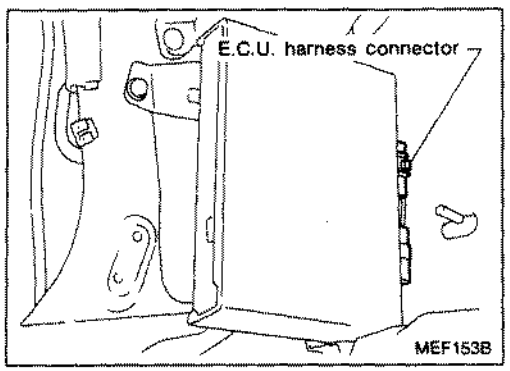
NOTE

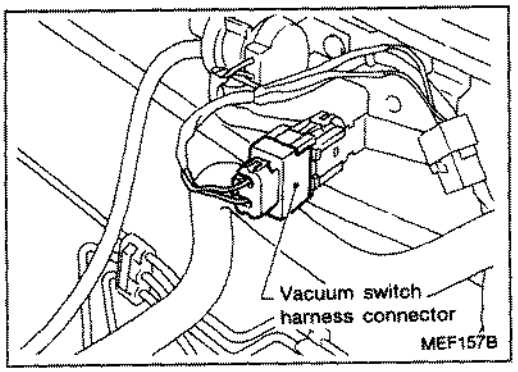
Diagnostic Procedure 11

VACUUM SWITCH (Not self-diagnostic item)



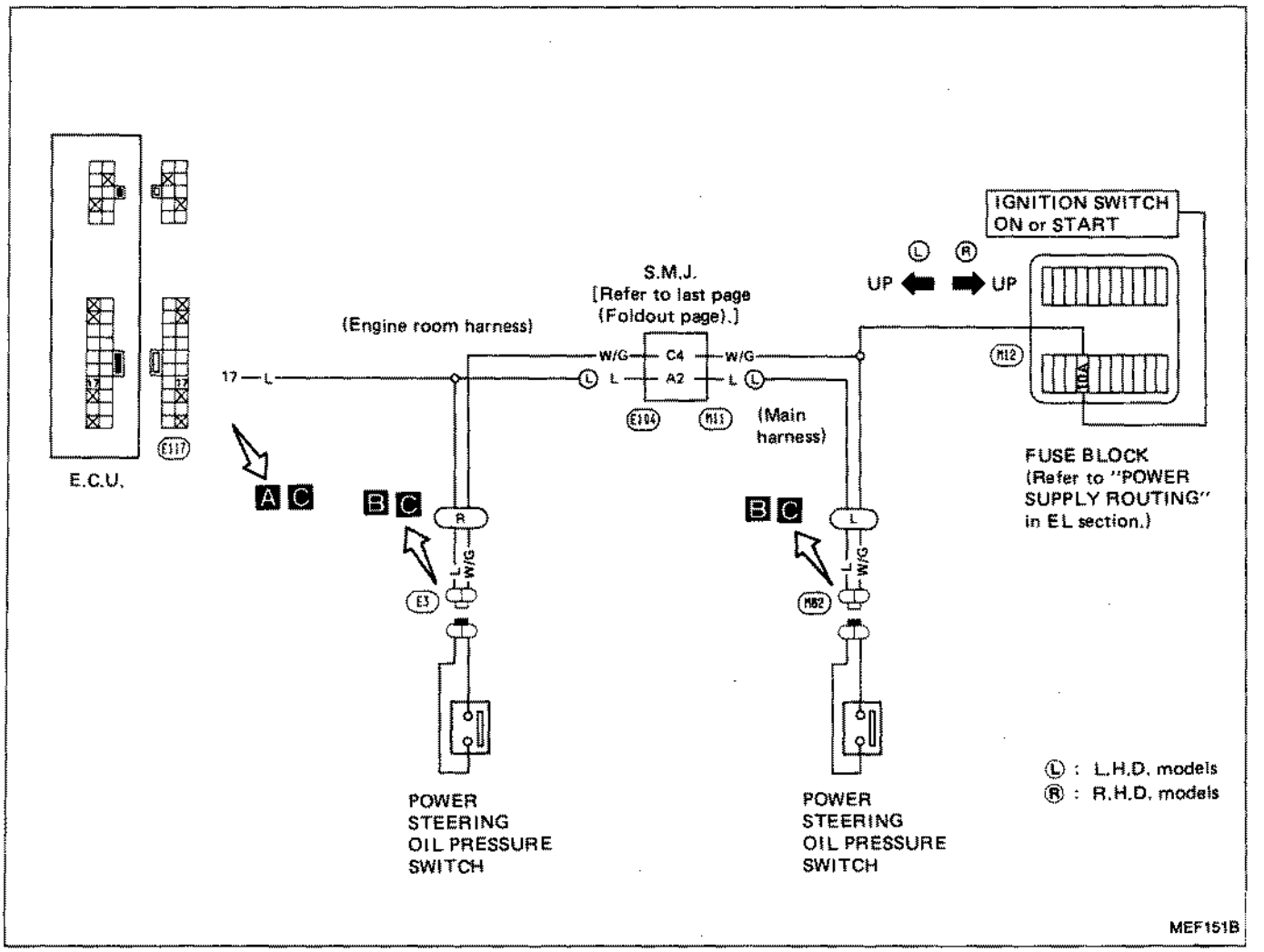
Harness layout



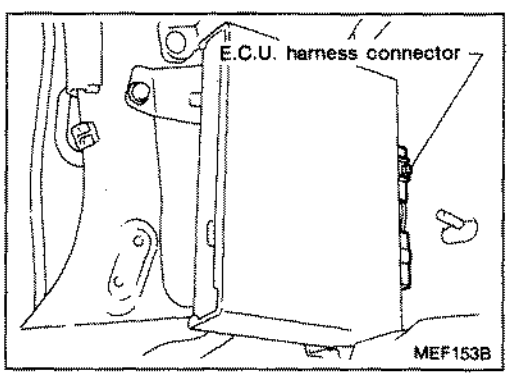


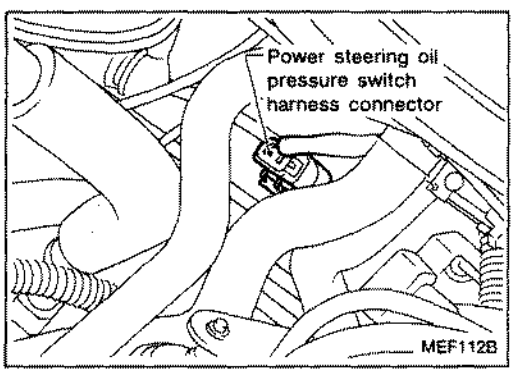
Diagnostic Procedure 12

POWER STEERING OIL PRESSURE SWITCH (Not self-diagnostic item)



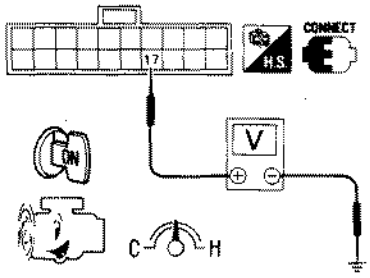
Harness layout





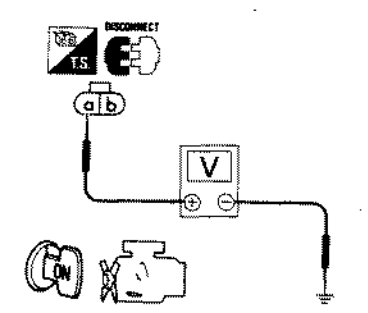
Diagnostic Procedure 12 (Cont'd)

A



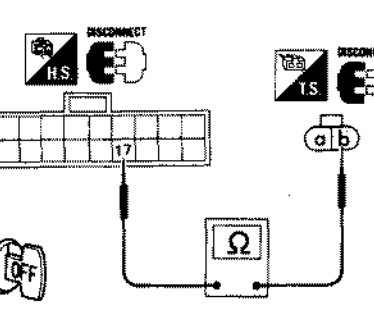
MEF185B

B



MEF186B

C



MEF187B

INSPECTION START

A

CHECK CONTROL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Check voltage between E.C.U. terminal ⑰ and ground under the following conditions.
Voltage:
When steering wheel is turned quickly
Battery voltage
Except above
Approximately 0V

O.K. → INSPECTION END

N.G. ↓

B

CHECK POWER SUPPLY.
1) Stop engine.
2) Disconnect power steering oil pressure switch harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓐ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (M11), (E104) (R.H.D. models)
- 10A fuse
- Harness continuity between power steering oil pressure switch and fuse

If N.G., repair harness or connectors.

O.K. ↓

C

CHECK INPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal ⑰ and terminal ⓑ.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (M11), (E104) (L.H.D. models)
- Harness continuity between E.C.U. and power steering oil pressure switch

If N.G., repair harness or connectors.

O.K. ↓

CHECK COMPONENT
(Power steering oil pressure switch).
Refer to "Electrical Components Inspection".
(See page EF & EC-146.)

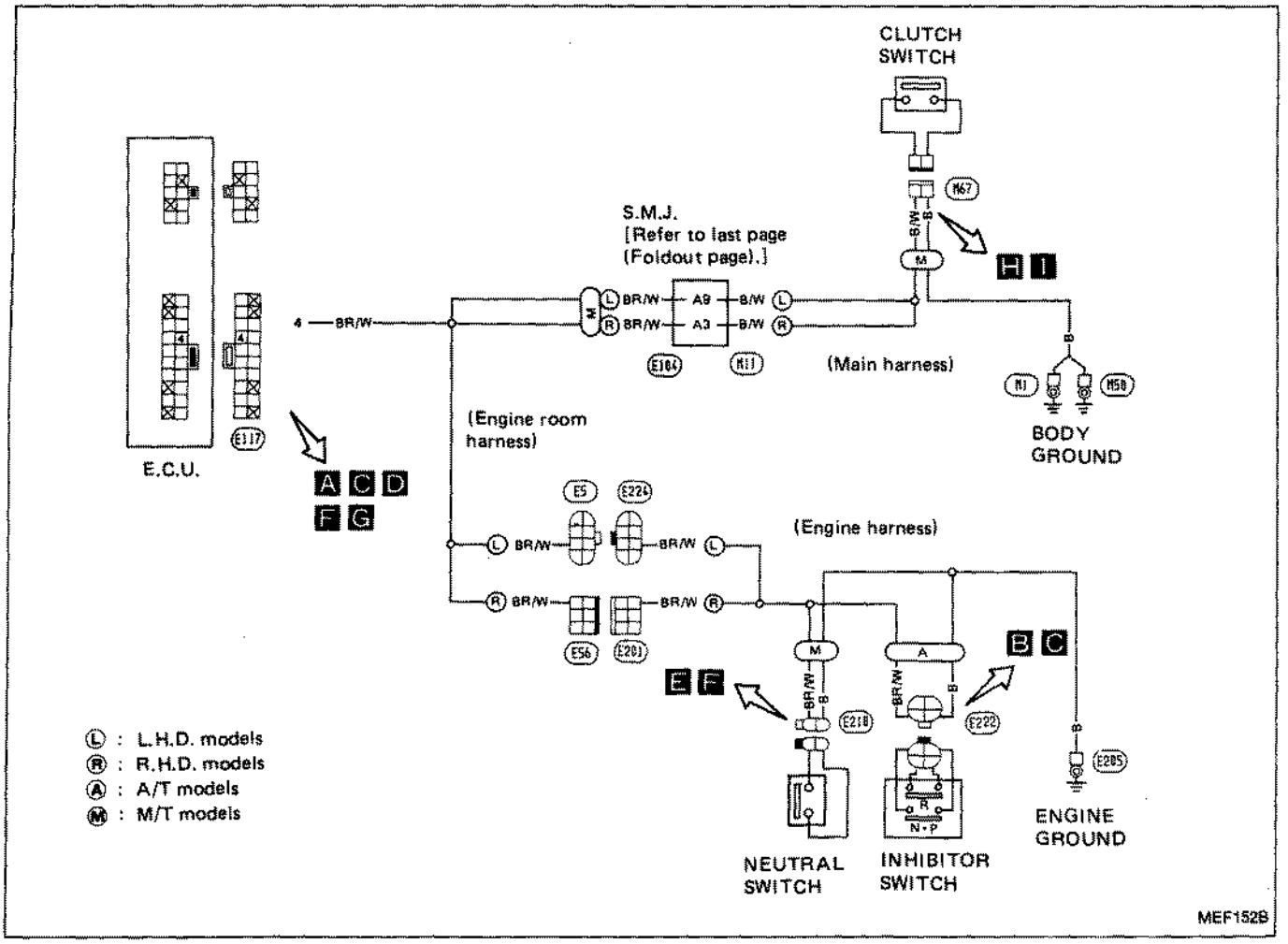
N.G. → Replace power steering oil pressure switch.

O.K. ↓

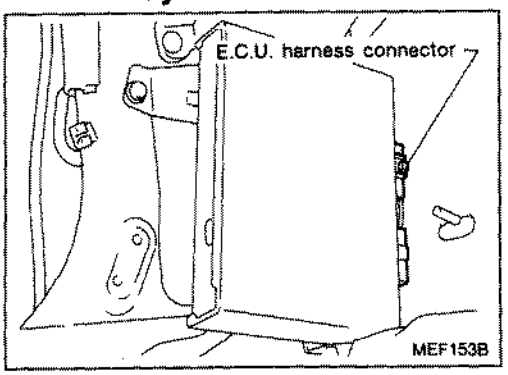
Check E.C.U. pin terminals for damage or the connection of the E.C.U. harness connector.

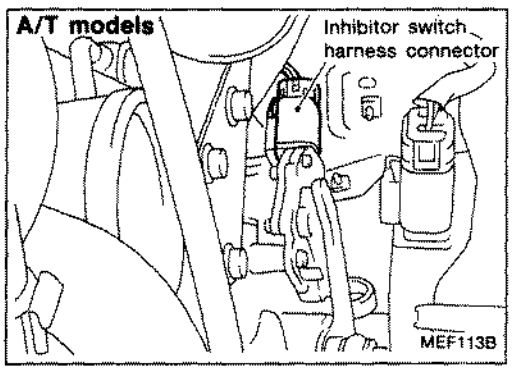
Diagnostic Procedure 13

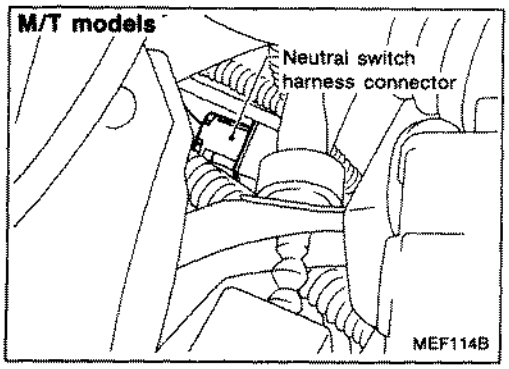
INHIBITOR/NEUTRAL/CLUTCH SWITCH (Not self-diagnostic item)

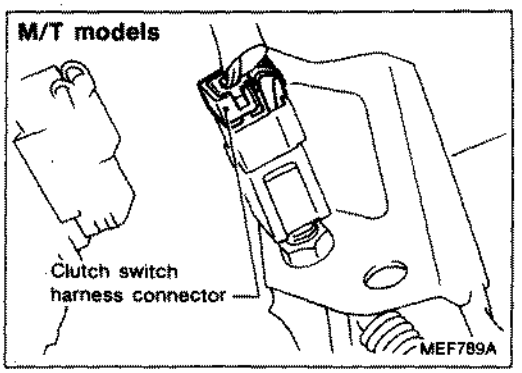


Harness layout



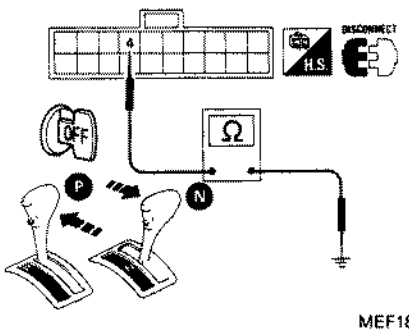






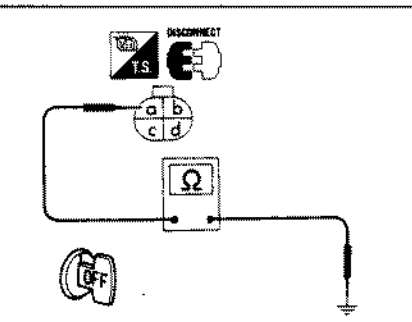
Diagnostic Procedure 13 (Cont'd)

A



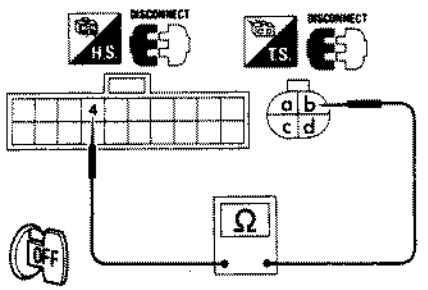
MEF188B

B



MEF189B

C



MEF190B

Inhibitor switch

INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Shift selector lever to "P" position.
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal ④ and engine ground.
Continuity should exist.
4) Shift selector lever to "N" position.
5) Check harness continuity between E.C.U. terminal ④ and engine ground.
Continuity should exist.

O.K. → INSPECTION END

N.G. ↓

B

CHECK GROUND CIRCUIT.
1) Disconnect inhibitor switch harness connector.
2) Check harness continuity between terminal ⓐ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

C

CHECK INPUT SIGNAL CIRCUIT.
1) Check harness continuity between E.C.U. terminal ④ and terminal ⓑ.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (E5), (E224) (L.H.D. models)
- Harness connectors (E56), (E201) (R.H.D. models)
- Harness continuity between E.C.U. and inhibitor switch

If N.G., repair harness or connectors.

O.K. ↓

CHECK COMPONENT (Inhibitor switch).
Refer to "Electrical Components Inspection".
(See page EF & EC-143.)

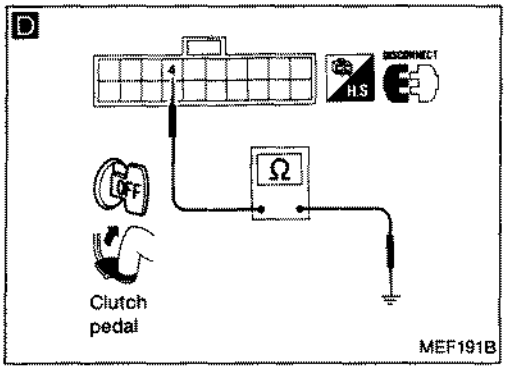
N.G. → Replace inhibitor switch.

O.K. ↓

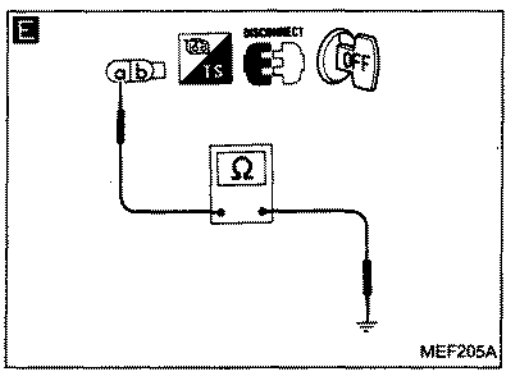
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Diagnostic Procedure 13 (Cont'd)

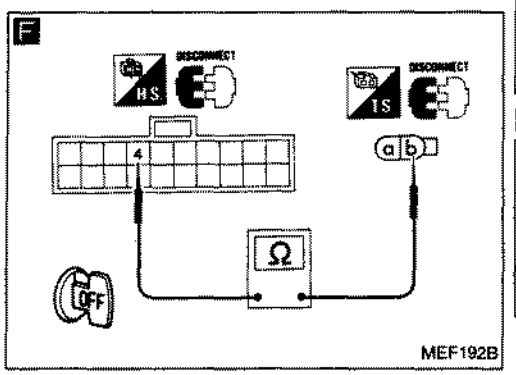
D



E



F



Neutral switch

INSPECTION START

D

CHECK OVERALL FUNCTION.
1) Set shift lever to the neutral position.
2) Make sure that clutch pedal is fully released.
3) Disconnect E.C.U. harness connector.
4) Check harness continuity between E.C.U. terminal ④ and body ground.
Continuity should exist.

O.K. → INSPECTION END

N.G.

E

CHECK GROUND CIRCUIT.
1) Disconnect neutral switch harness connector.
2) Check harness continuity between terminal ⓐ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

F

CHECK INPUT SIGNAL CIRCUIT.
1) Check harness continuity between E.C.U. terminal ④ and terminal ⓑ.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (E5), (E224) (L.H.D. models)
- Harness connectors (E54), (E201) (R.H.D. models)
- Harness continuity between E.C.U. and neutral switch

If N.G., repair harness or connectors.

O.K.

CHECK COMPONENT
(Neutral switch).
Refer to "Electrical Components Inspection".
(See page EF & EC-147.)

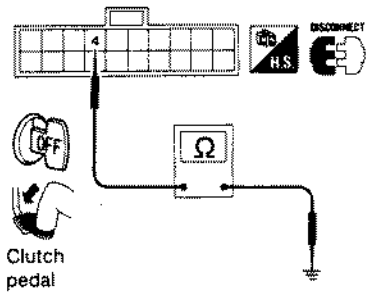
N.G. → Replace neutral switch.

O.K.

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

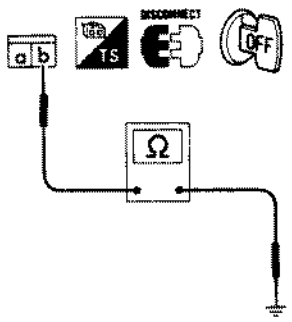
Diagnostic Procedure 13 (Cont'd)

G



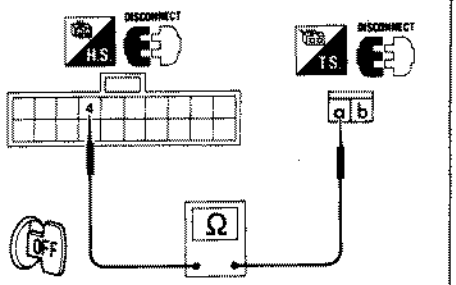
MEF193B

H



MEF208A

I



MEF194B

Clutch switch

INSPECTION START

G

CHECK OVERALL FUNCTION.
1) Set shift lever to any position except the neutral position.
2) Disconnect E.C.U. harness connector.
3) Depress clutch pedal.
4) Check harness continuity between E.C.U. terminal ④ and body ground.
Continuity should exist.

O.K. → INSPECTION END

N.G.

H

CHECK GROUND CIRCUIT.
1) Disconnect clutch switch harness connector.
2) Check harness continuity between terminal ⑤ and body ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

I

CHECK INPUT SIGNAL CIRCUIT.
1) Check harness continuity between E.C.U. terminal ④ and terminal ⓐ.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (M11), (E104)
- Harness continuity between E.C.U. and clutch switch

If N.G., repair harness or connectors.

O.K.

CHECK COMPONENT
(Clutch switch).
Refer to "Electrical Components Inspection".
(See page EF & EC-147.)

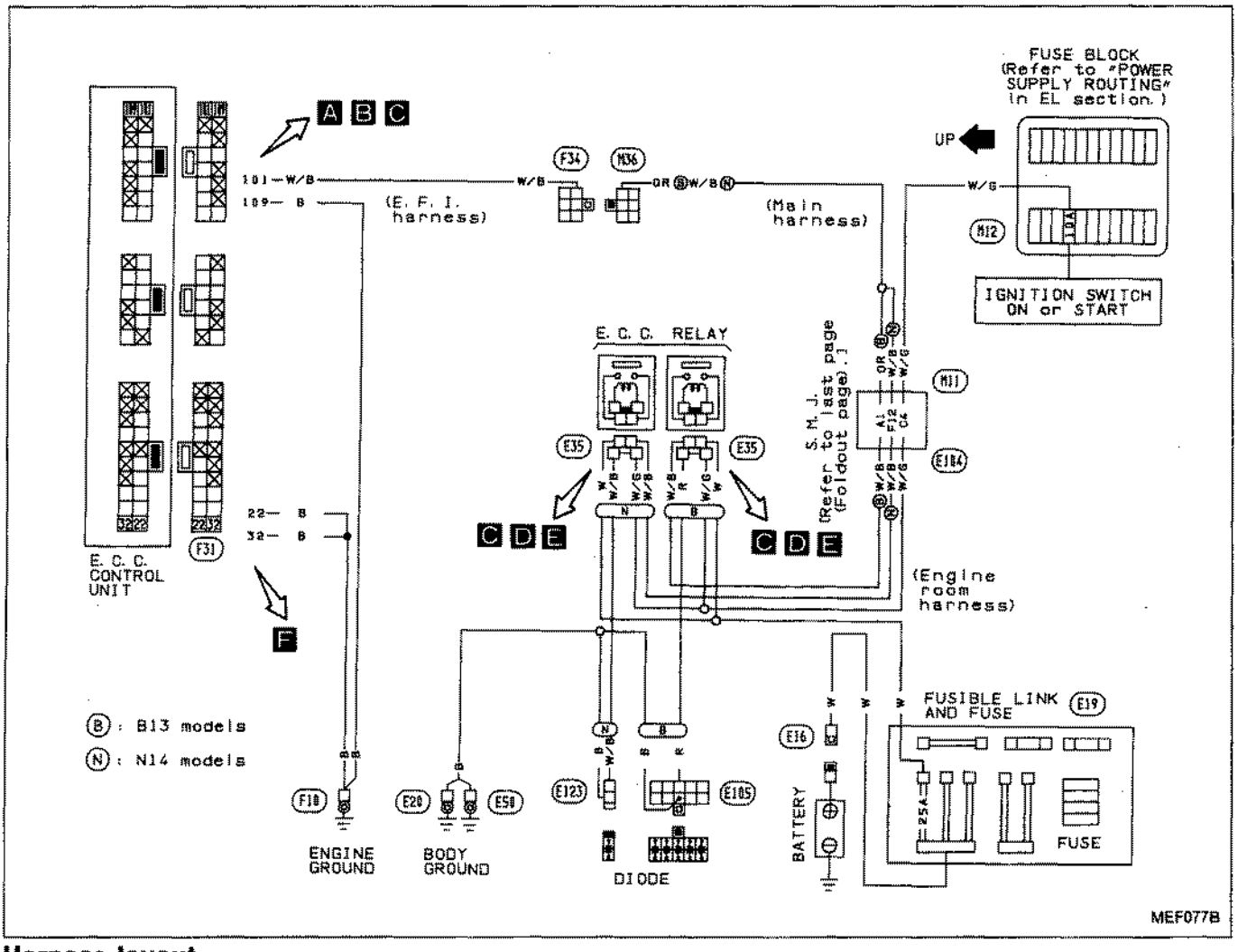
N.G. → Replace clutch switch.

O.K.

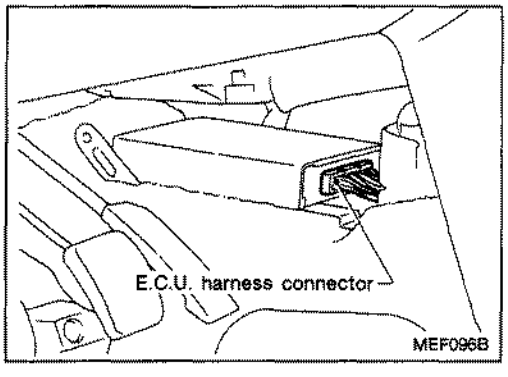
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

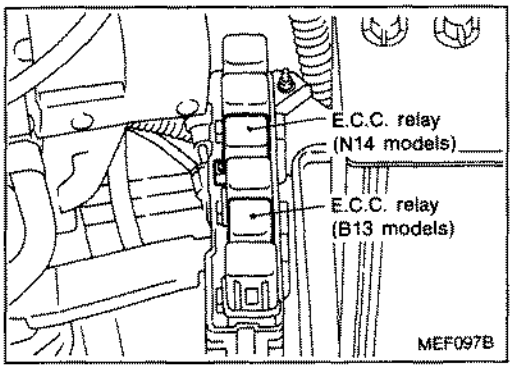
Diagnostic Procedure 1

MAIN POWER SUPPLY AND GROUND CIRCUIT (Not self-diagnostic item)



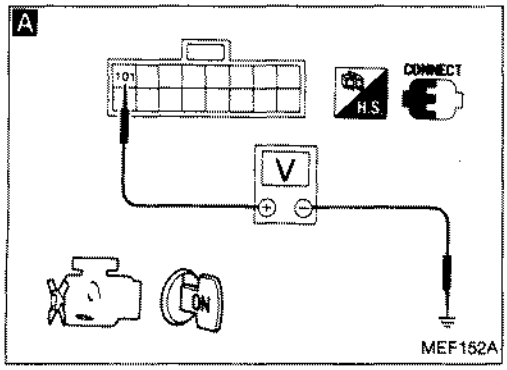
Harness layout





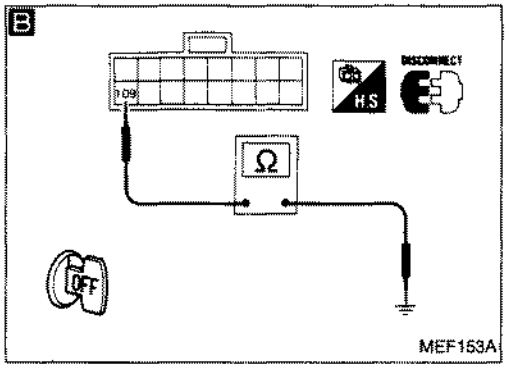
Diagnostic Procedure 1 (Cont'd)

A



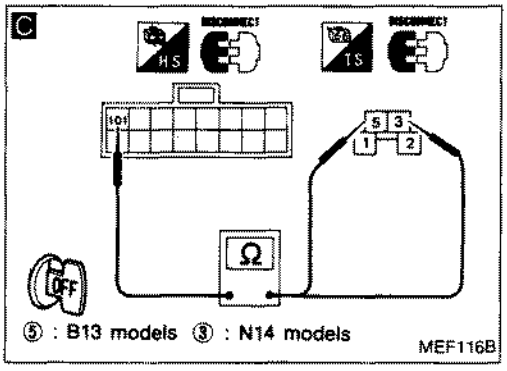
MEF152A

B



MEF153A

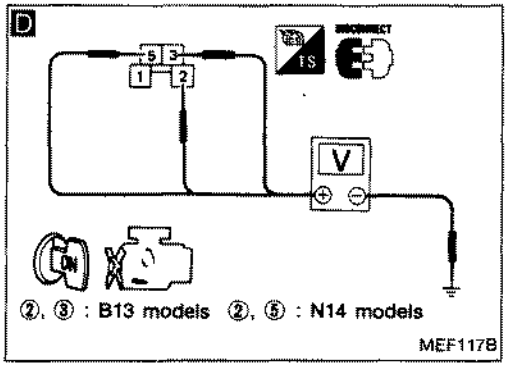
C



⑤ : B13 models ③ : N14 models

MEF116B

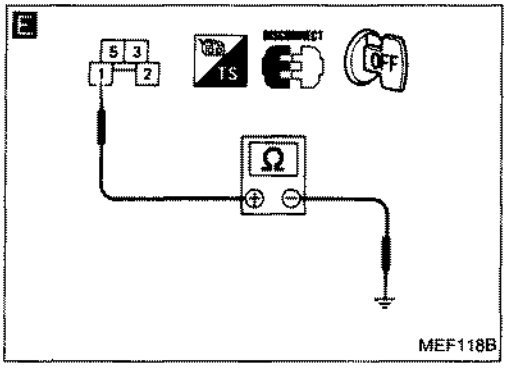
D



②, ③ : B13 models ②, ⑤ : N14 models

MEF117B

E



MEF118B

INSPECTION START

A

CHECK POWER SUPPLY.
1) Turn ignition switch "ON".
2) Check voltage between E.C.U. terminal (101) and ground.
Voltage: Battery voltage

O.K. → **B**

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal (109) and engine ground.
Continuity should exist.
If N.G., repair harness or connectors.

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

N.G. ↓

C

CHECK HARNESS CONTINUITY BETWEEN E.C.C. RELAY AND E.C.U.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Disconnect E.C.C. relay.
4) Check harness continuity between E.C.U. terminal (101) and terminal ⑤ (B13 models), terminal ③ (N14 models).
Continuity should exist.

N.G. →
Check the following.
- Harness connectors (F34), (K36)
- Harness connectors (M11), (E104)
- Harness continuity between E.C.U. and E.C.C. relay

If N.G., repair harness or connectors.

O.K. ↓

D

CHECK VOLTAGE BETWEEN E.C.C. RELAY AND GROUND.
1) Turn ignition switch "ON".
2) Check voltage between terminals ②, ③ (B13 models), terminals ②, ⑤ (N14 models) and ground.
Voltage: Battery voltage

N.G. →
Check the following.
- Harness connectors (M11), (E104)
- 25A fusible link
- 10A fuse
- Harness continuity between E.C.C. relay and battery
- Harness continuity between E.C.C. relay and fuse

If N.G., repair harness or connectors.

O.K. ↓

E

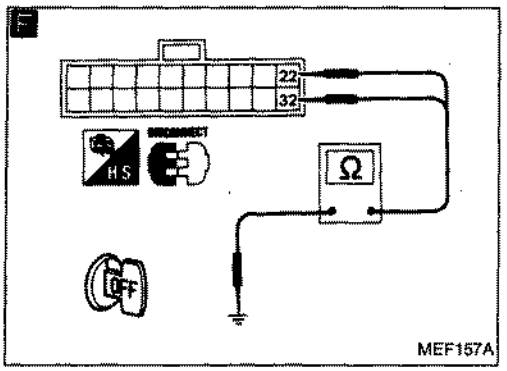
CHECK HARNESS CONTINUITY BETWEEN E.C.C. RELAY AND GROUND.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ① and body ground.
Continuity should exist.

N.G. →
Check the following.
- Diode (E105) (B13 models)
- Diode (E123) (N14 models)
- Harness continuity between diode and E.C.C. relay
- Harness continuity between diode and body ground

If N.G., repair harness or connectors.

O.K. ↓
Ⓐ

Diagnostic Procedure 1 (Cont'd)



Ⓐ

CHECK GROUND CIRCUIT.
1) Check harness continuity between E.C.U. terminals ㉒, ㉜ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

CHECK COMPONENT
(E.C.C. relay).
Refer to "Electrical Components Inspection".
(See page EF & EC-147.)

N.G. → Replace E.C.C. relay.

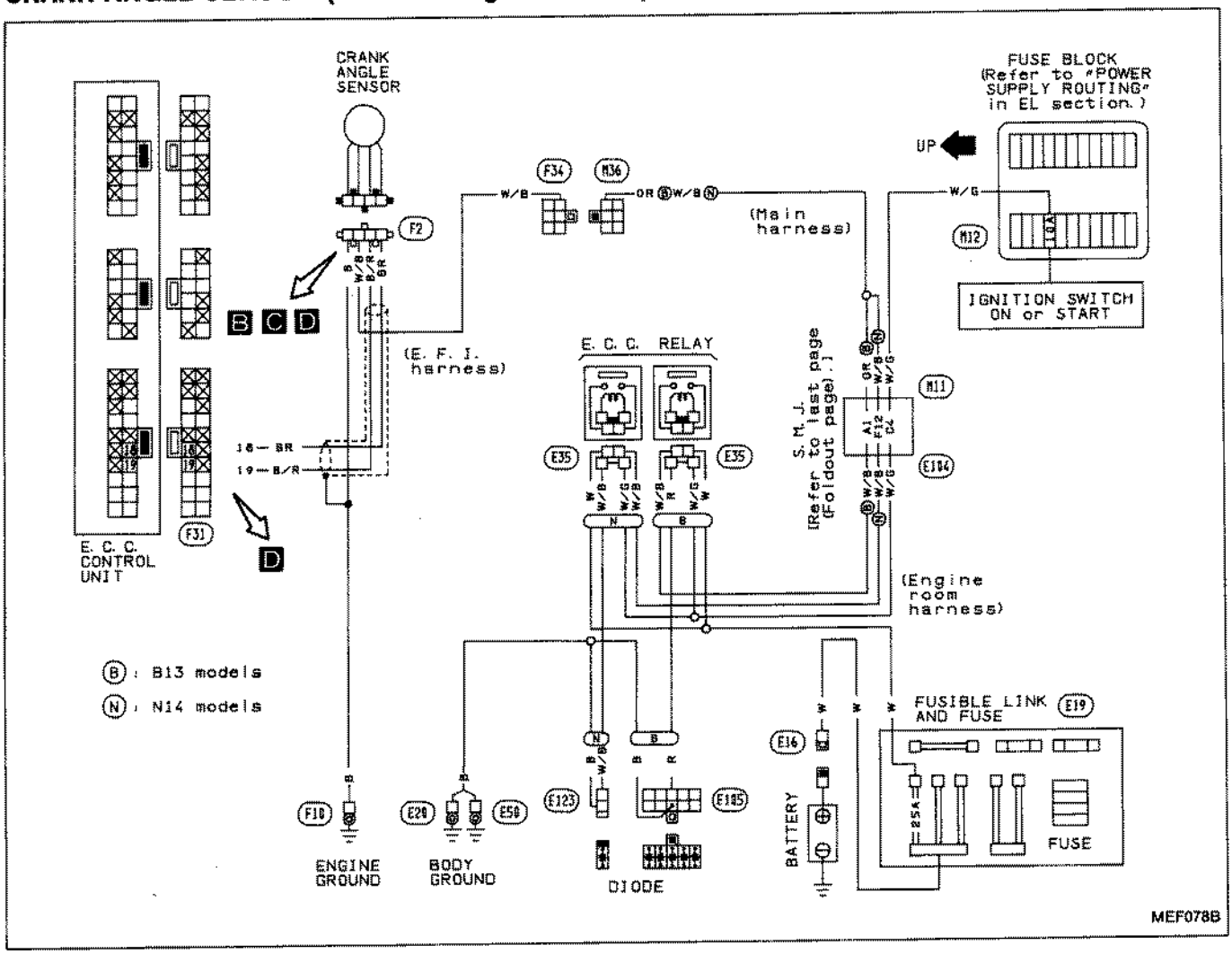
O.K. ↓

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

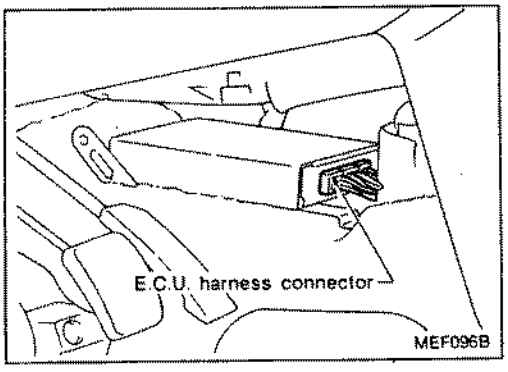
NOTE

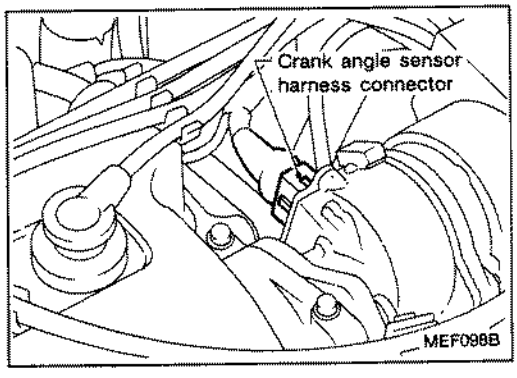
Diagnostic Procedure 2

CRANK ANGLE SENSOR (Not self-diagnostic item)



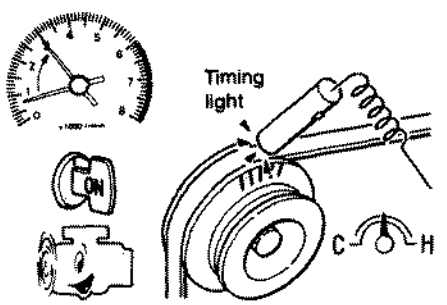
Harness layout





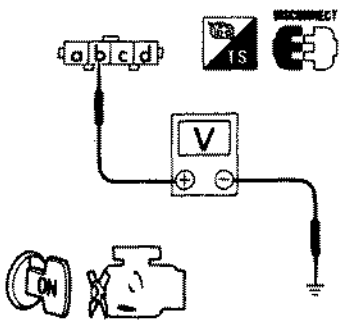
Diagnostic Procedure 2 (Cont'd)

A



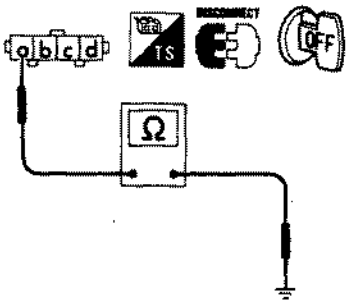
MEF158A

B



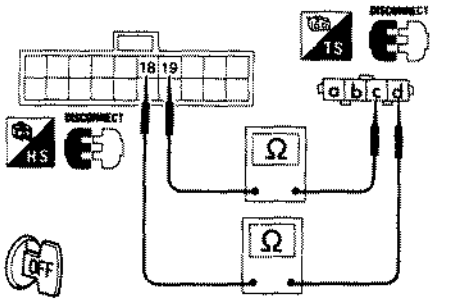
MEF159A

C



MEF160A

D



MEF161A

INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Set timing light on high tension cable.
3) Check ignition timing while racing engine from idle speed to about 3,000 rpm under no-load.
Ignition timing should advance.

O.K. → INSPECTION END

N.G.

B

CHECK POWER SUPPLY.
1) Stop engine.
2) Disconnect crank angle sensor harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓑ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (F34), (M36)
- Harness connectors (M11), (E104)
- Harness continuity between crank angle sensor and E.C.C. relay

If N.G., repair harness or connectors.

O.K.

C

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓐ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

D

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between terminal ⓒ and E.C.U. terminal ⑱ (1° signal), terminal ⓓ and E.C.U. terminal ⑲ (180° signal).
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

CHECK COMPONENT
(Crank angle sensor).
Refer to "Electrical Components Inspection".
(See page EF & EC-143.)

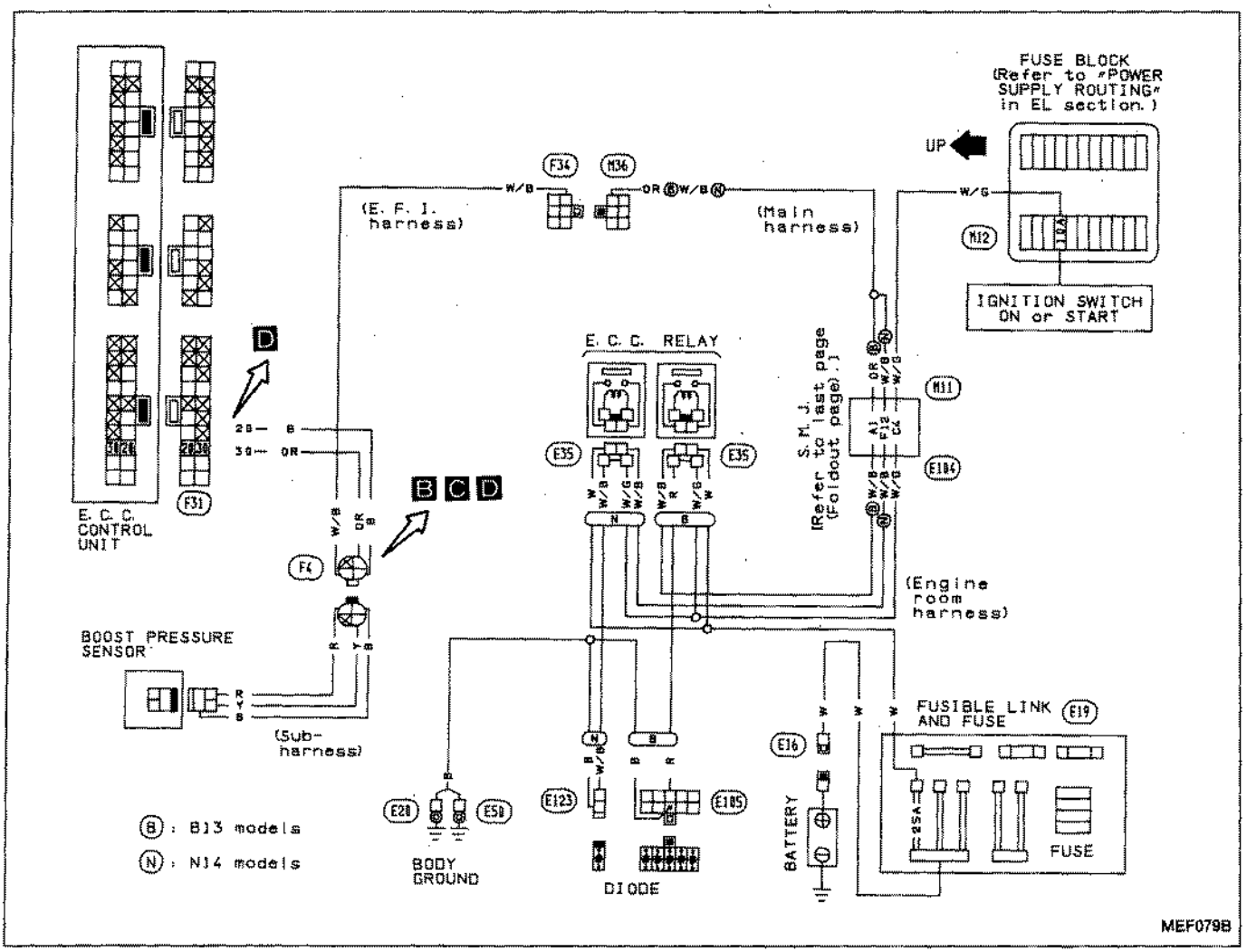
N.G. → Replace crank angle sensor.

O.K.

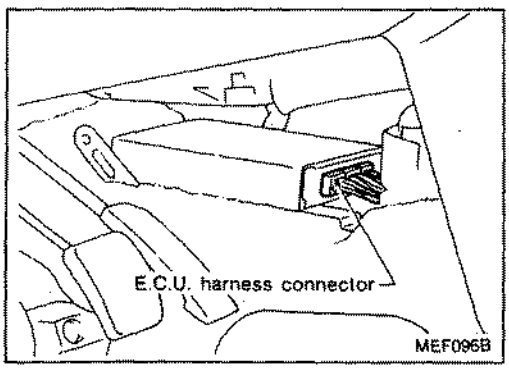
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

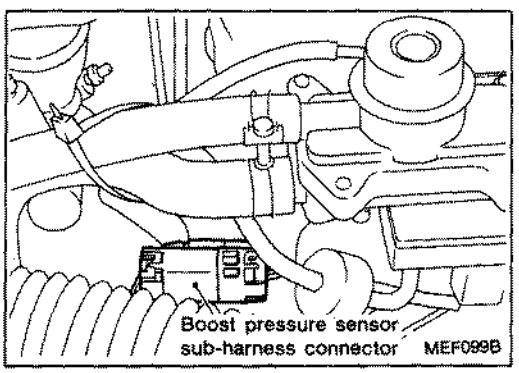
Diagnostic Procedure 3

BOOST PRESSURE SENSOR (Not self-diagnostic item)

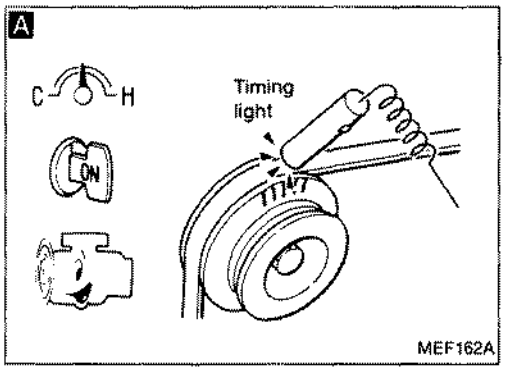


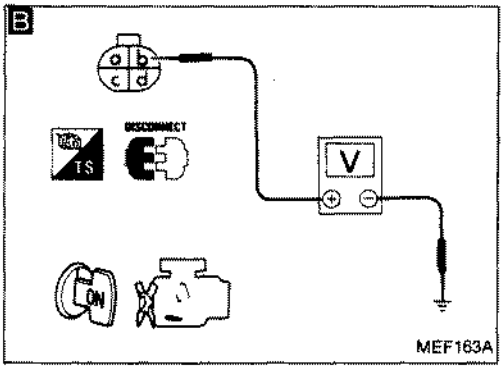
Harness layout

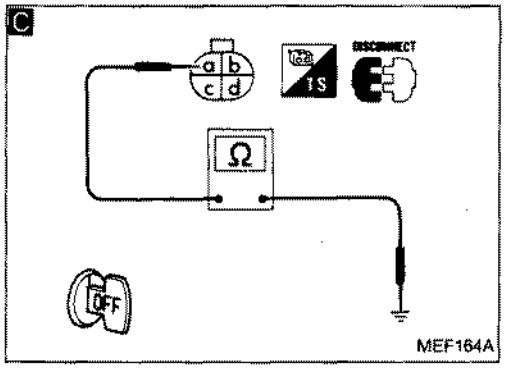


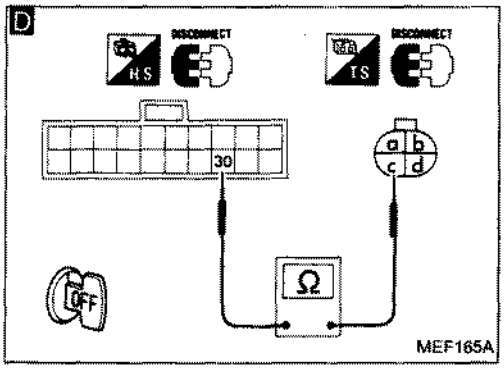


Diagnostic Procedure 3 (Cont'd)









INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Set timing light on high tension cable.
3) Check ignition timing at idle under no-load.
4) Disconnect vacuum hose connected to boost pressure sensor and plug vacuum hose. Recheck ignition timing.
Ignition timing should retard.

O.K. → INSPECTION END

N.G. ↓

B

CHECK POWER SUPPLY.
1) Stop engine.
2) Disconnect boost pressure sensor sub-harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓑ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (F34), (M36)
- Harness connectors (M11), (E104)
- Harness continuity between boost pressure sensor sub-harness connector and E.C.C. relay

If N.G., repair harness or connectors.

O.K. ↓

C

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓓ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

D

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal ㉚ and terminal ⓒ.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

CHECK COMPONENT (Boost pressure sensor).
Refer to "Electrical Components Inspection".
(See page EF & EC-144.)

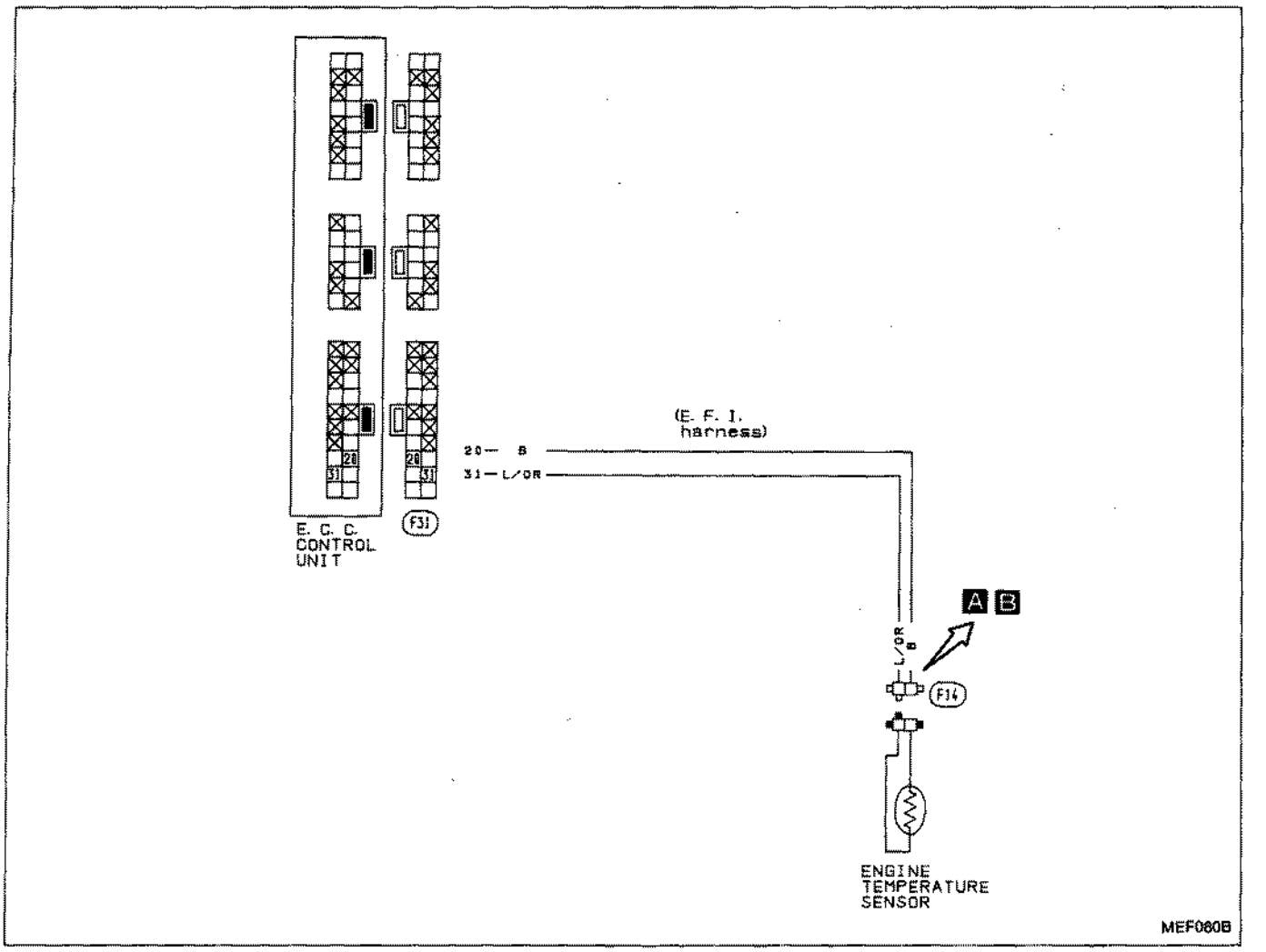
N.G. → Replace boost pressure sensor.

O.K. ↓

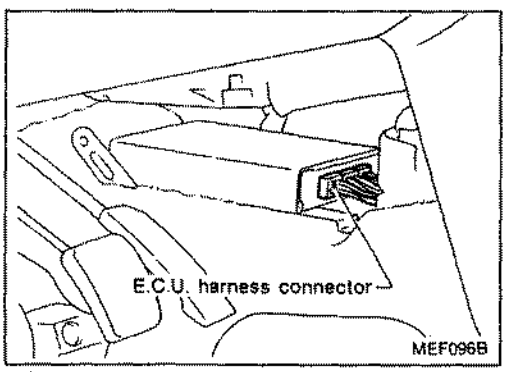
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

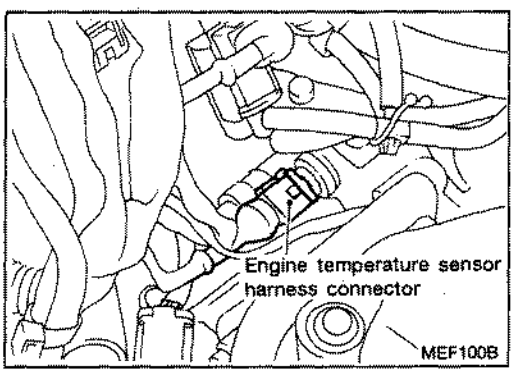
Diagnostic Procedure 4

ENGINE TEMPERATURE SENSOR (Not self-diagnostic item)

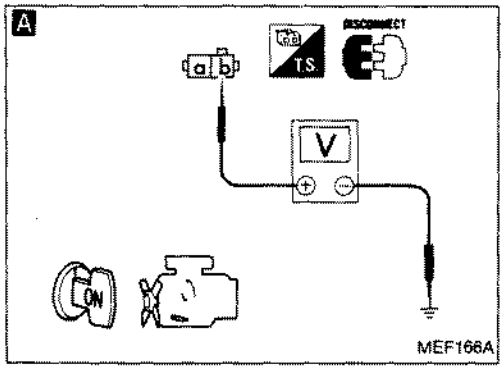


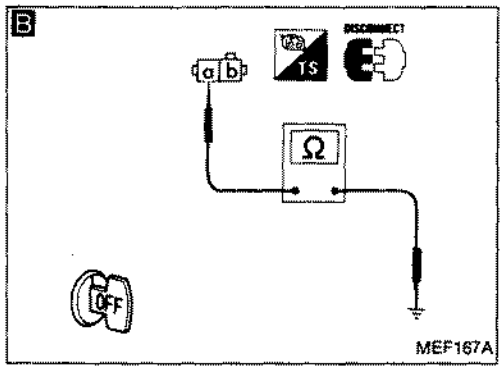
Harness layout





Diagnostic Procedure 4 (Cont'd)





INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect engine temperature sensor harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓑ and ground.
Voltage: Approximately 5V

N.G. → Repair harness or connectors.

O.K.

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓖ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

CHECK COMPONENT
(Engine temperature sensor).
Refer to "Electrical Components Inspection".
(See page EF & EC-143.)

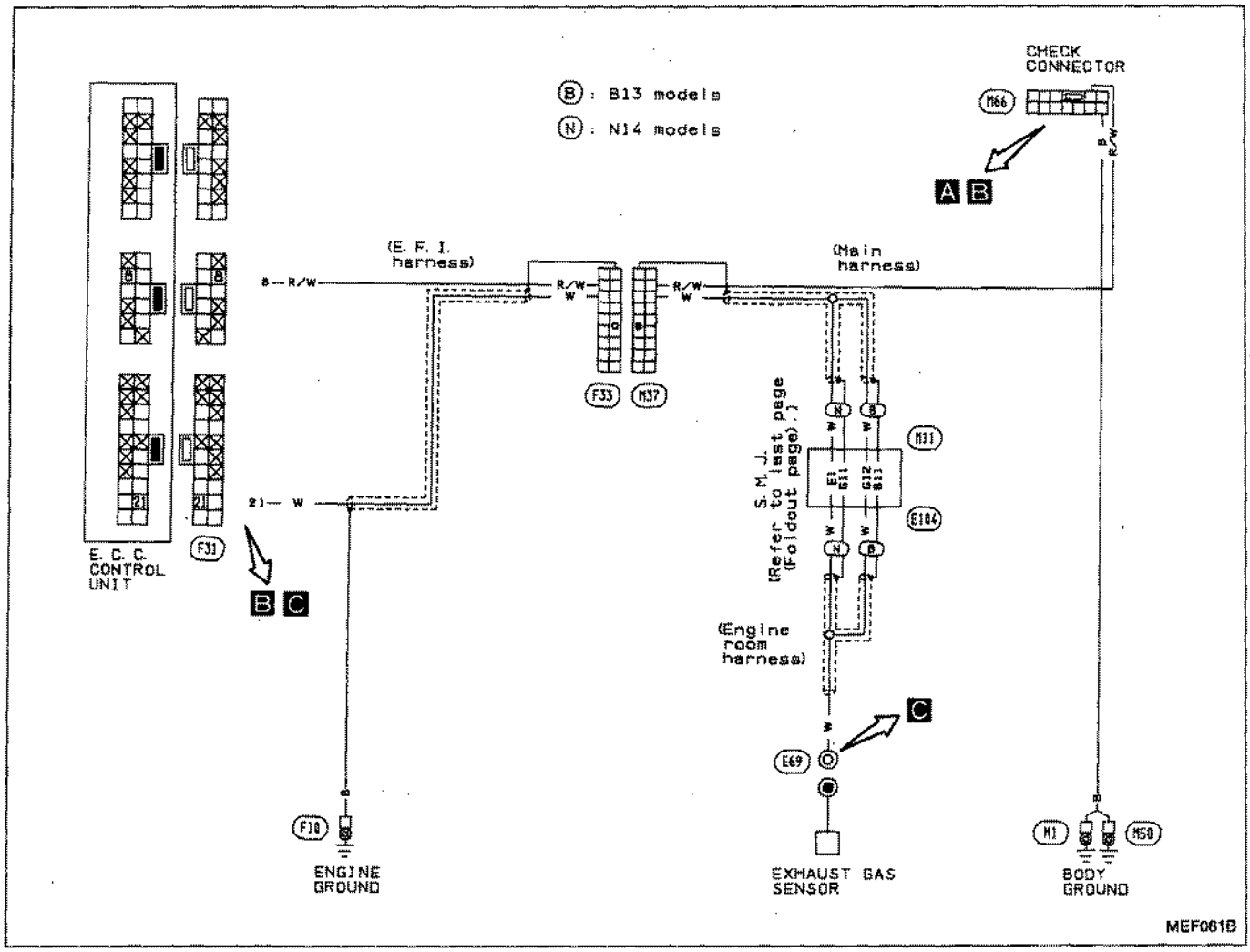
N.G. → Replace engine temperature sensor.

O.K.

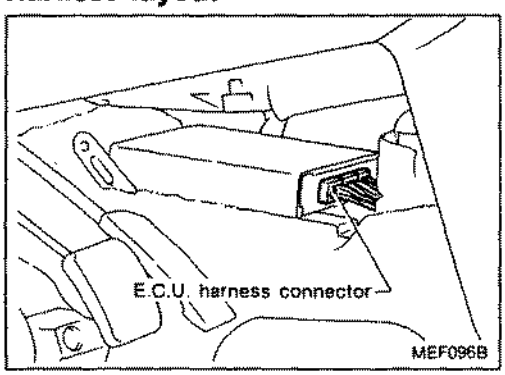
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

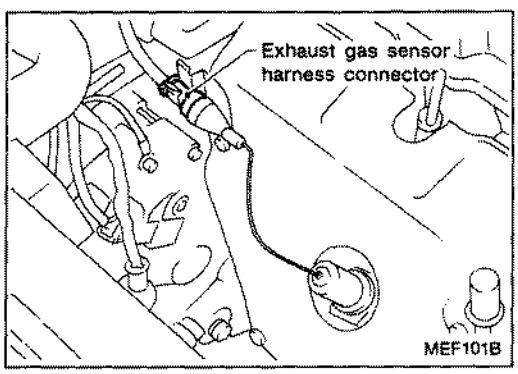
Diagnostic Procedure 5

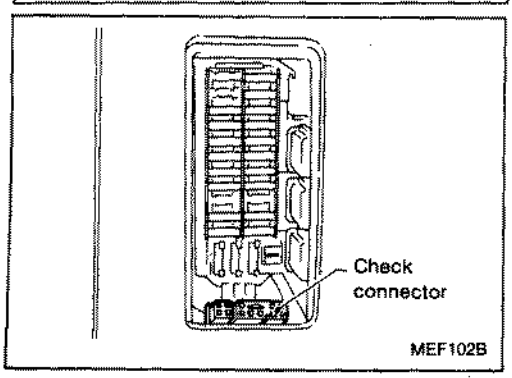
EXHAUST GAS SENSOR (Not self-diagnostic item)



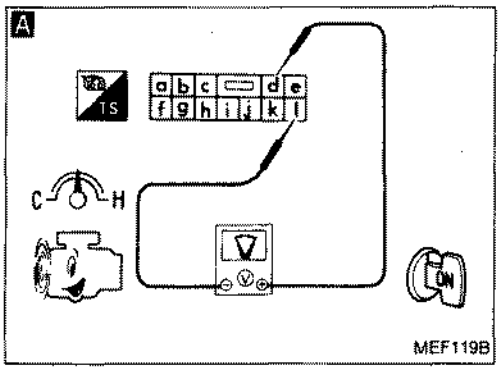
Harness layout

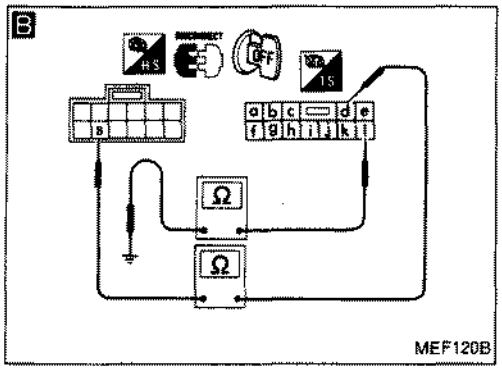


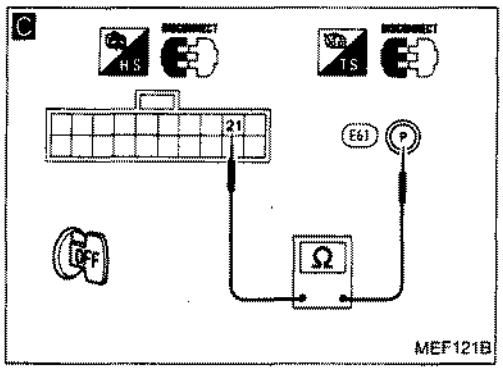




Diagnostic Procedure 5 (Cont'd)







INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Run engine at about 2,500 rpm for about 5 minutes under no- load.
3) Keep engine speed at 2,000 rpm under no-load, check voltage between terminal ⓓ and terminal Ⓘ on check connector.
Needle of voltmeter should fluctuate between approximately 0V and battery voltage more than 5 times during 10 seconds.

O.K. → INSPECTION END

N.G. ↓

B

CHECK HARNESS CONTINUITY BETWEEN E.C.U. AND CHECK CONNECTOR.
1) Stop engine.
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal ⑧ and terminal ⓓ , terminal Ⓘ and body ground.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (F33) , (M37)
- Check connector
- Harness continuity between E.C.U. and check connector
- Harness continuity between check connector and body ground

If N.G., repair harness or connectors.

O.K. ↓

C

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect exhaust gas sensor harness connector.
2) Check harness continuity between E.C.U. terminal ㉑ and terminal Ⓟ (Harness side connector (E61)).
Continuity should exist.

N.G. → Check the following.
- Harness connectors (F33) , (M37)
- Harness connectors (M11) , (E104)
- Harness continuity between E.C.U. and exhaust gas sensor

If N.G., repair harness or connectors.

O.K. ↓

CHECK COMPONENT (Exhaust gas sensor).
Refer to "Electrical Components Inspection".
(See page EF & EC-148.)

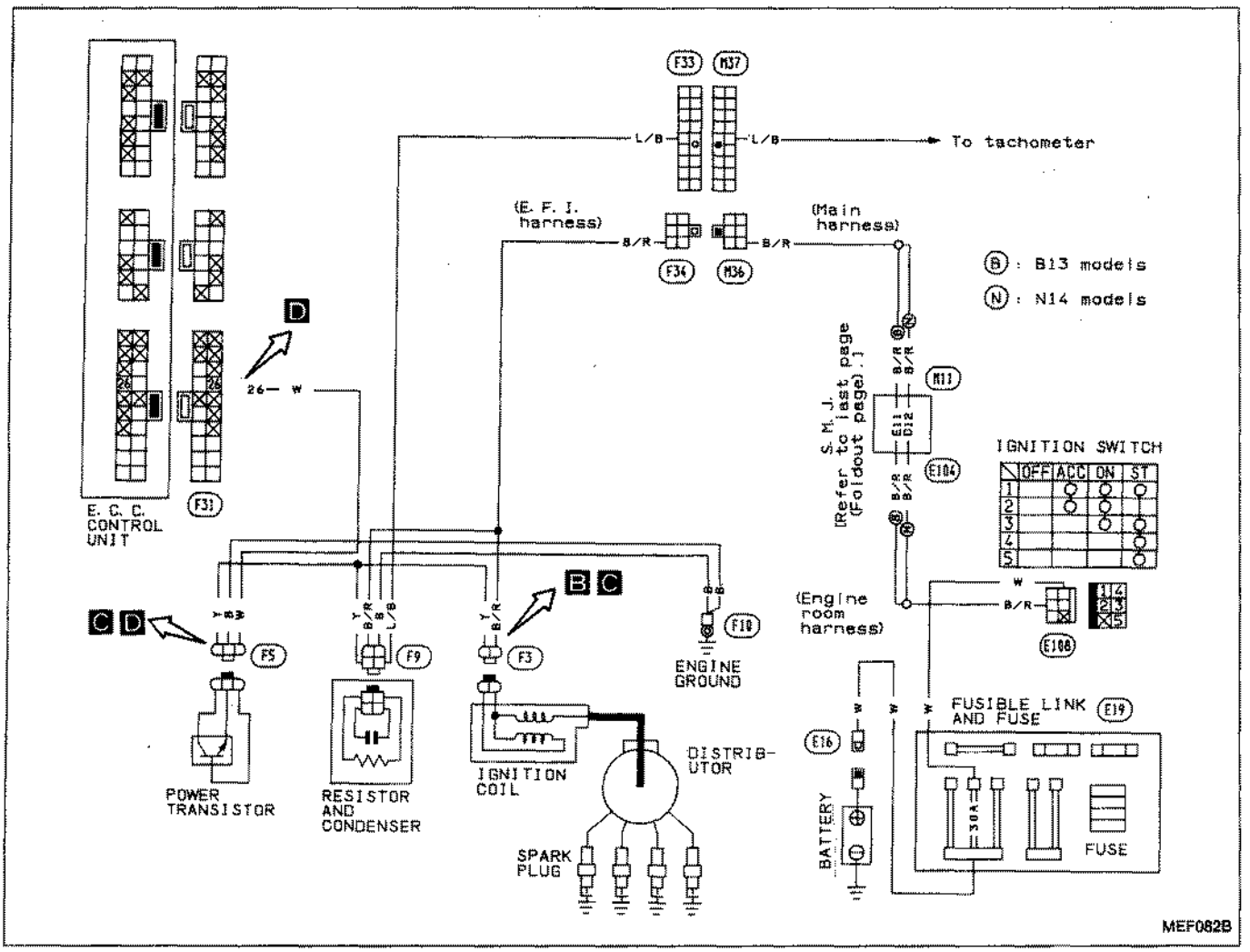
N.G. → Replace exhaust gas sensor.

O.K. ↓

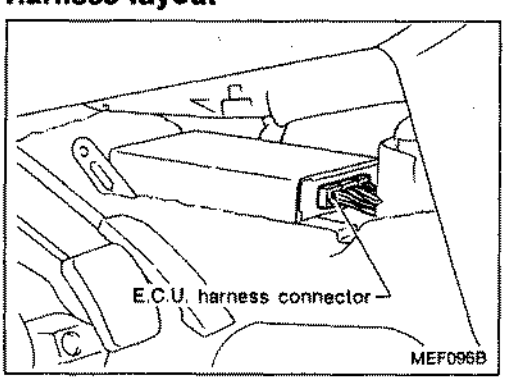
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

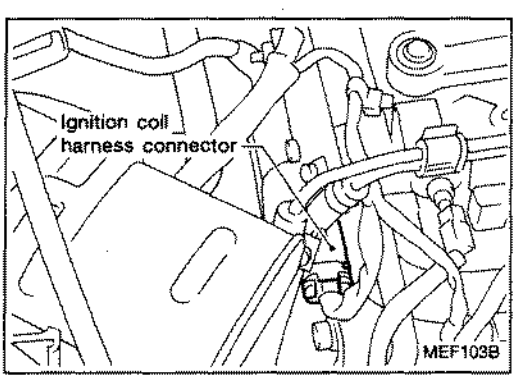
Diagnostic Procedure 6

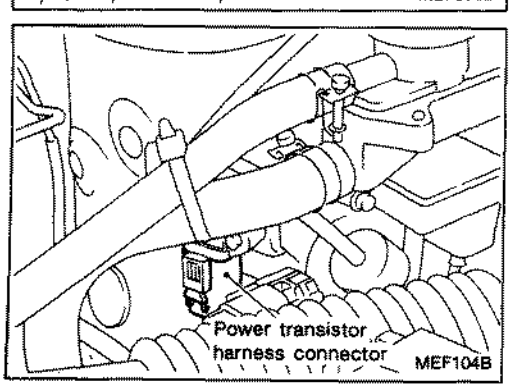
IGNITION SIGNAL (Not self-diagnostic item)



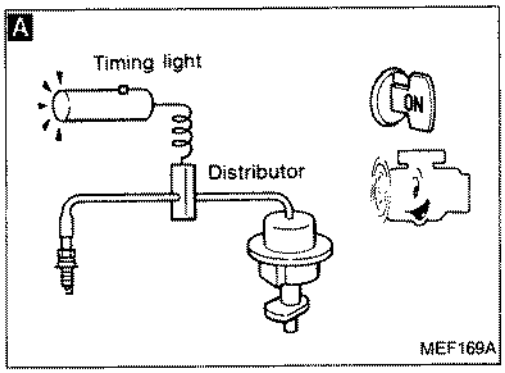
Harness layout







Diagnostic Procedure 6 (Cont'd)



INSPECTION START

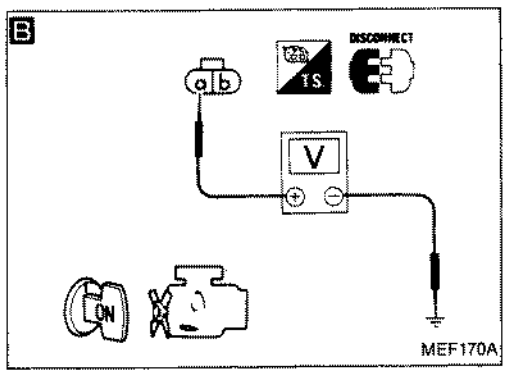
A

CHECK CONTROL FUNCTION.
1) Start engine.
2) Set timing light on high tension cables No. 1, No. 2, No. 3 and No. 4.
3) Check timing light flashes.

O.K. → CHECK COMPONENT (Spark plug).
Refer to "Checking Spark Plugs" in MA section.
If N.G., replace spark plug.

O.K. → INSPECTION END

N.G.



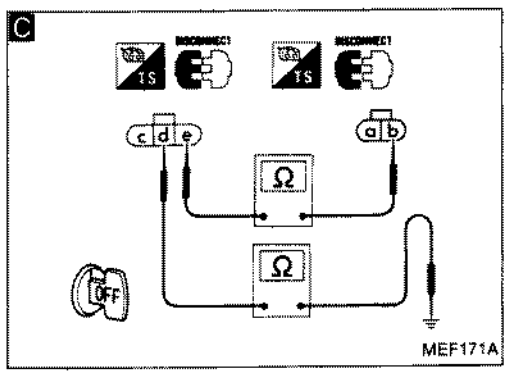
B

CHECK POWER SUPPLY.
1) Stop engine.
2) Disconnect ignition coil harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓐ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors F34, M36
- Harness connectors M11, E104
- Harness continuity between ignition coil and ignition switch

If N.G., repair harness or connectors.

O.K.

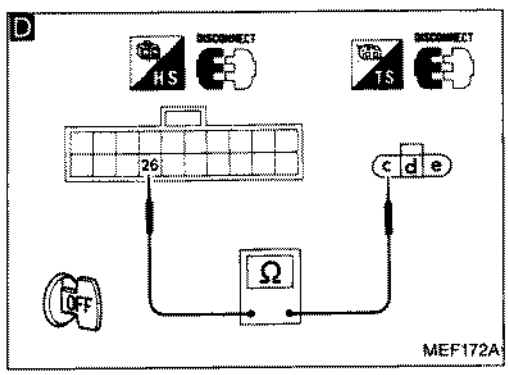


C

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect power transistor harness connector.
3) Check harness continuity between terminal ⓑ and terminal ⓔ, terminal ⓓ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.



D

CHECK OUTPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal ㉖ and terminal ⓔ.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

CHECK COMPONENTS (Ignition coil, power transistor and high tension cable).
Refer to "Electrical Components Inspection". (See pages EF & EC-143, 144 and "Checking Ignition Wires" in MA section.)

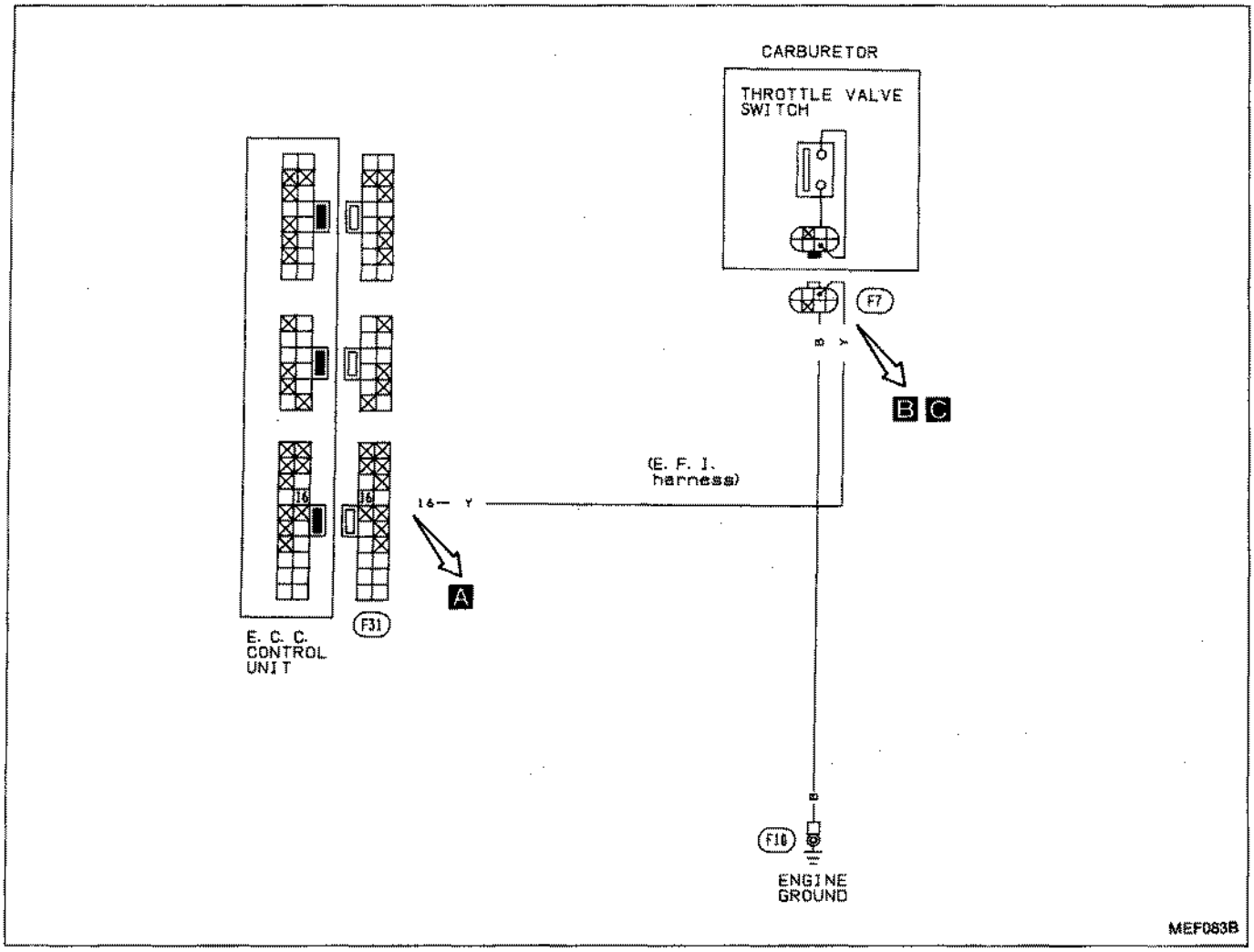
N.G. → Replace malfunctioning component(s).

O.K.

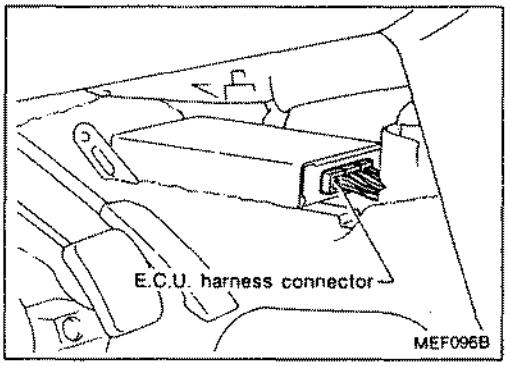
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

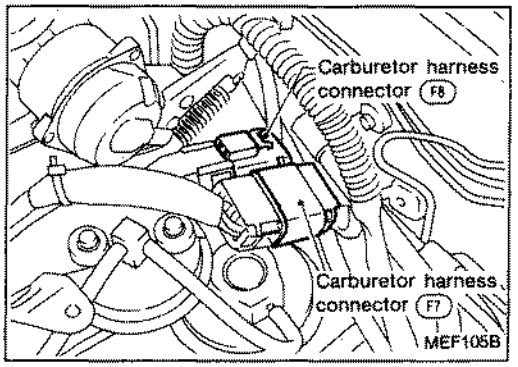
Diagnostic Procedure 7

THROTTLE VALVE SWITCH (Not self-diagnostic item)

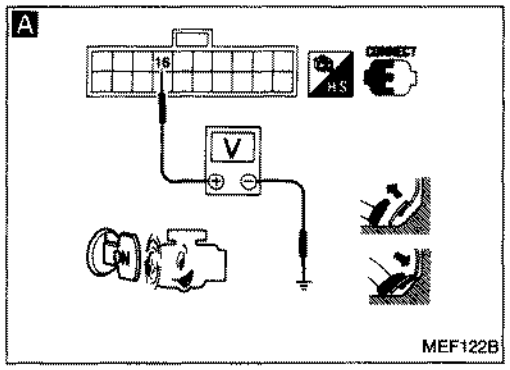


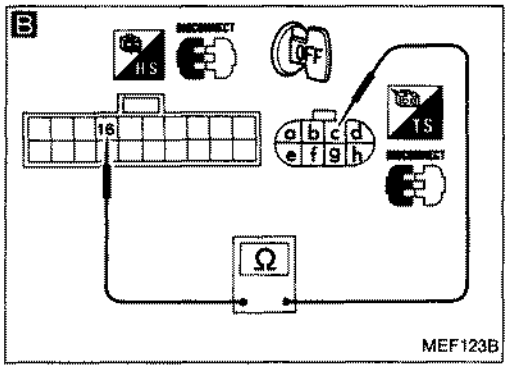
Harness layout

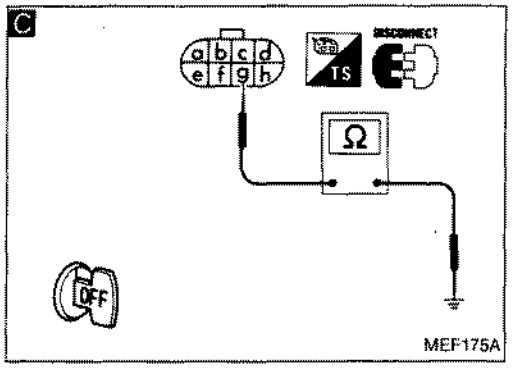




Diagnostic Procedure 7 (Cont'd)







INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Start engine and run it at idle.
2) Check voltage between E.C.U. terminal ⑯ and ground.
Voltage:
Accelerator pedal is depressed
Battery voltage
Accelerator pedal is released
Approximately 0V

O.K. → INSPECTION END

N.G. ↓

B

CHECK POWER SUPPLY.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector and carburetor harness connector (F7).
3) Check harness continuity between E.C.U. terminal ⑯ and terminal ⑥.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

C

CHECK GROUND CIRCUIT.
1) Check harness continuity between terminal ⑧ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

CHECK COMPONENT
(Throttle valve switch).
Refer to "Electrical Components Inspection".
(See page EF & EC-145.)

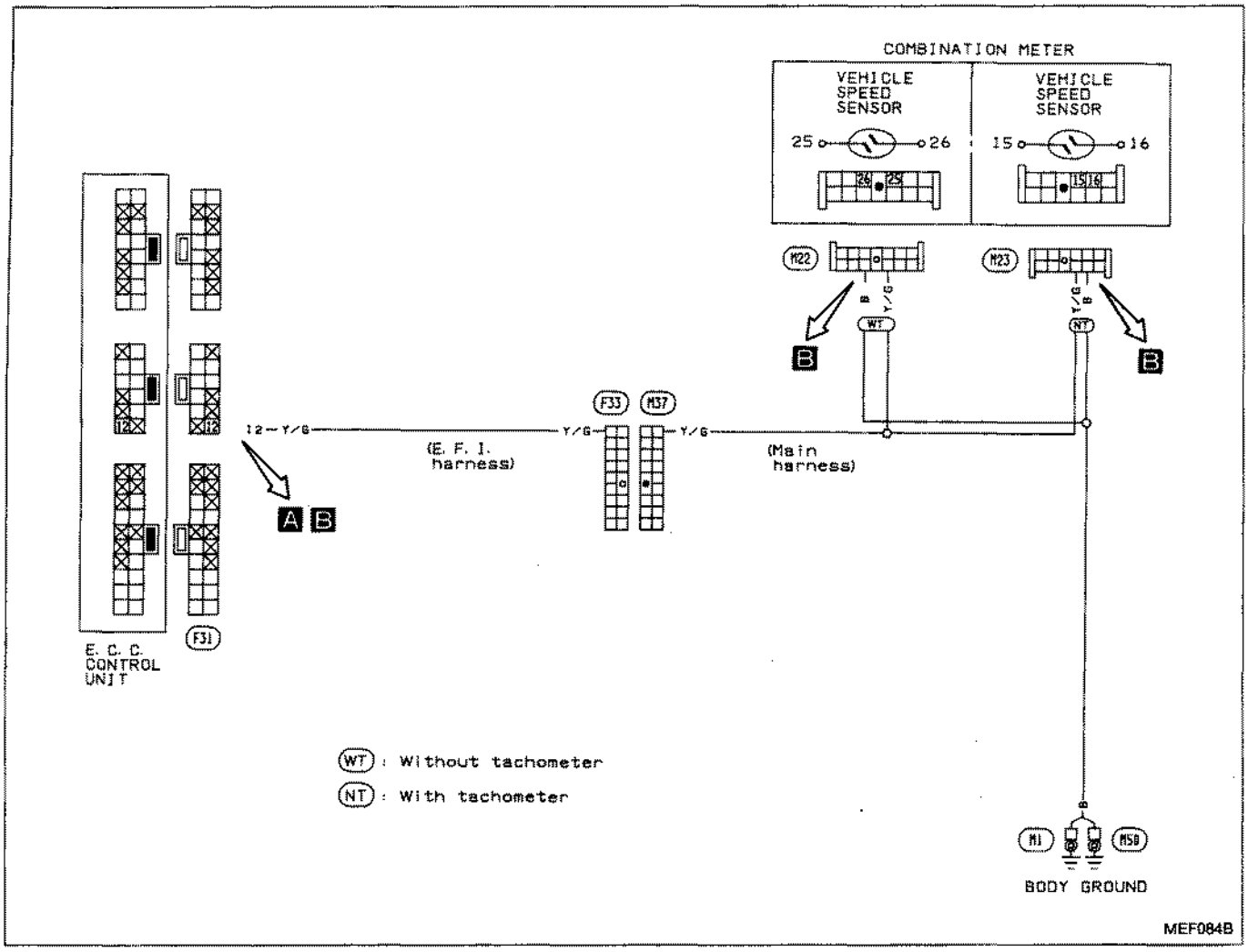
N.G. → Replace throttle valve switch.

O.K. ↓

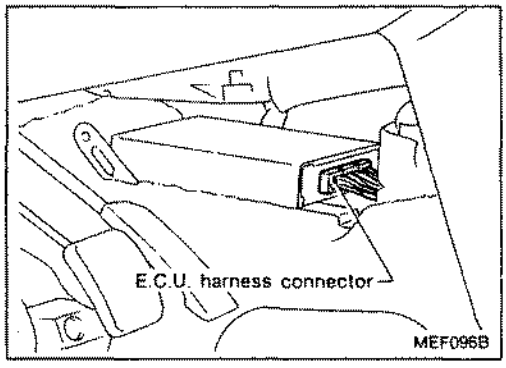
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Diagnostic Procedure 8

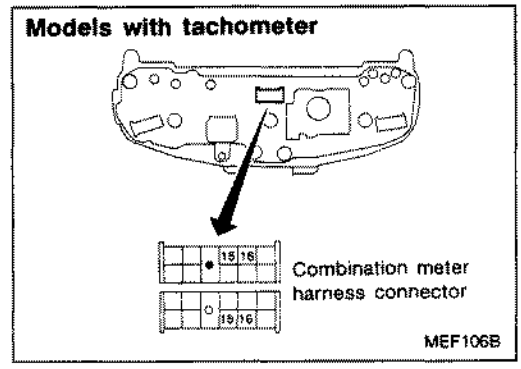
VEHICLE SPEED SENSOR (Not self-diagnostic item)



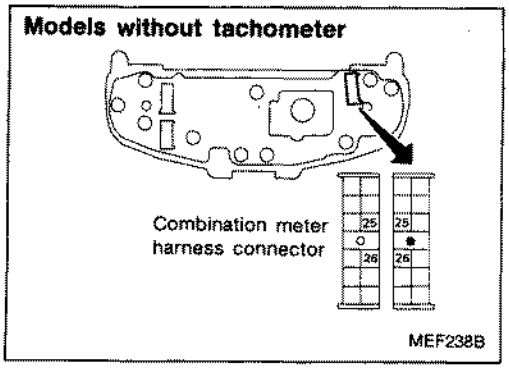
Harness layout



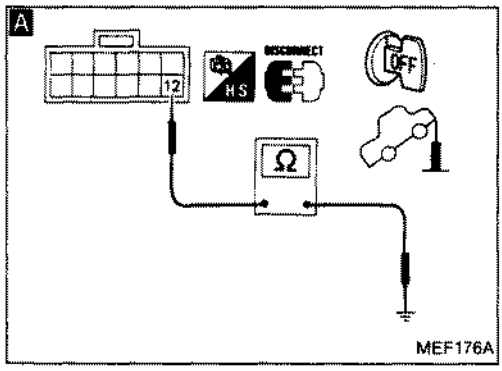
Models with tachometer

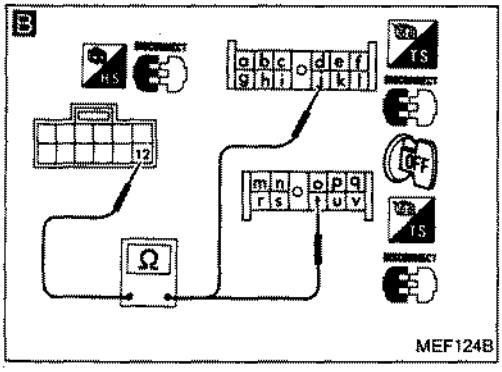


Models without tachometer



Diagnostic Procedure 8 (Cont'd)





INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Jack up front wheels.
2) Disconnect E.C.U. harness connector.
3) Rotate front wheel by hand.
4) Check harness continuity between E.C.U. terminal ⑫ and body ground.
Continuity should come and go.

O.K. → INSPECTION END

N.G.

CHECK SPEEDOMETER FUNCTION.
Make sure that speedometer functions properly.

N.G. → Check vehicle speed sensor and circuit.
(Refer to EL section.)

O.K.

B

CHECK INPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect combination meter harness connector.
3) Check harness continuity between E.C.U. terminal ⑫ and terminal ⓙ (Models without tachometer), terminal ① (Models with tachometer).
Continuity should exist.

N.G. → Check the following.
- Harness connectors (F33), (M57)
- Harness continuity between E.C.U. and combination meter

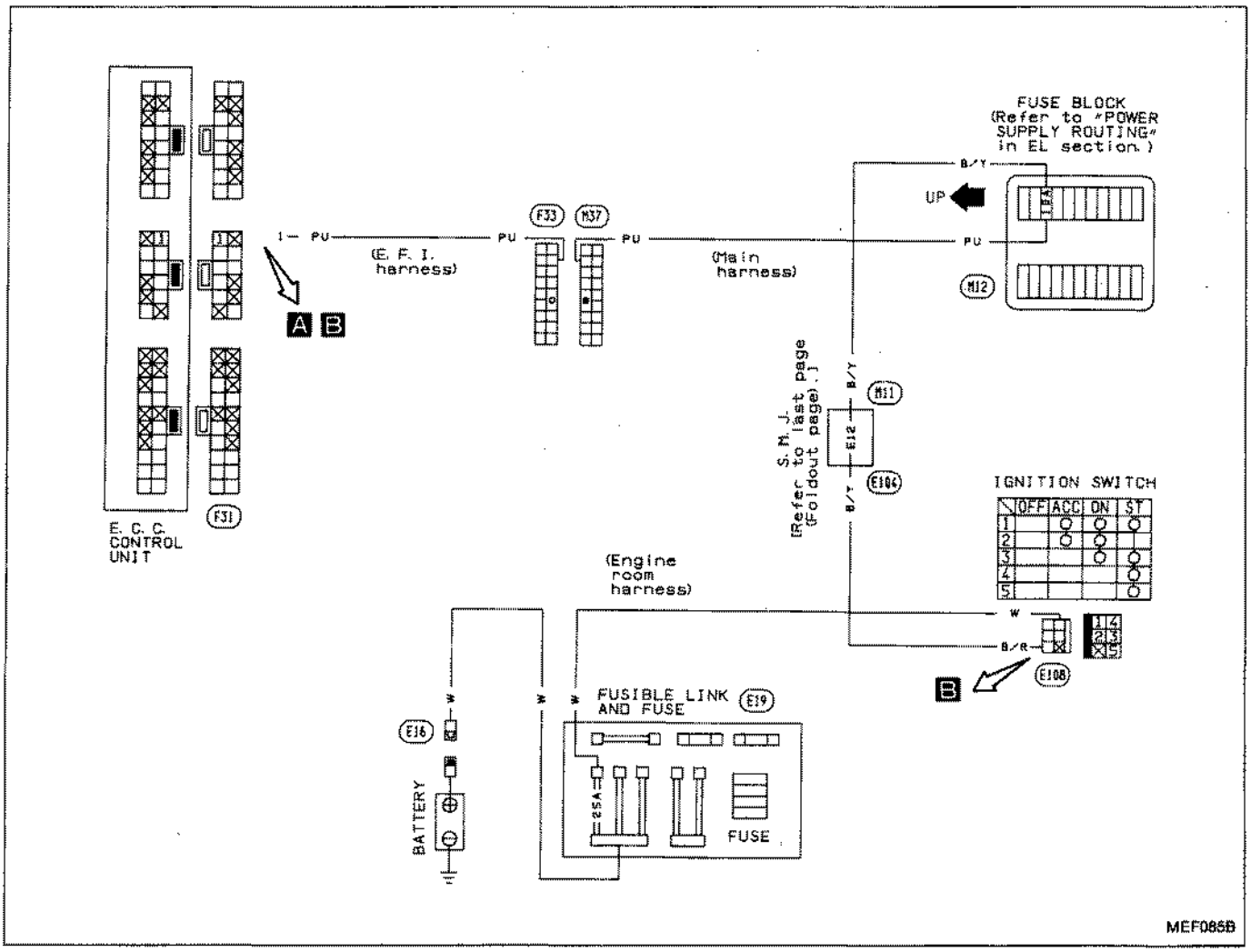
If N.G., repair harness or connectors.

O.K.

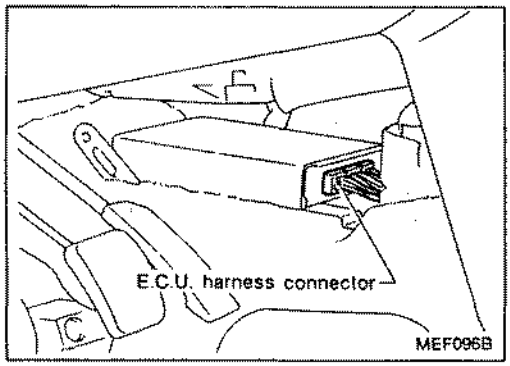
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Diagnostic Procedure 9

START SIGNAL (Not self-diagnostic item)

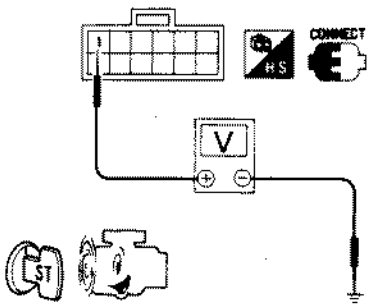


Harness layout



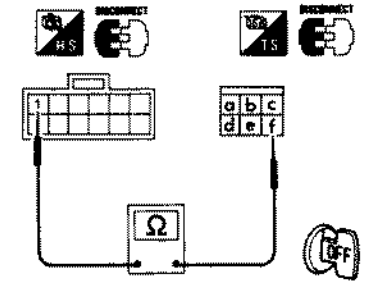
Diagnostic Procedure 9 (Cont'd)

A



MEF178A

B



MEF125B

INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Turn ignition switch to "START".
2) Check voltage between E.C.U. terminal ① and ground.
Voltage:
Ignition switch "START"
Battery voltage
Except above
Approximately 0V

O.K. → INSPECTION END

N.G.

B

CHECK INPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector and ignition switch harness connector.
3) Check harness continuity between E.C.U. terminal ① and terminal ⓕ.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (F33), (M37)
- Harness connectors (M11), (E104)
- 10A fuse
- Harness continuity between E.C.U. and ignition switch

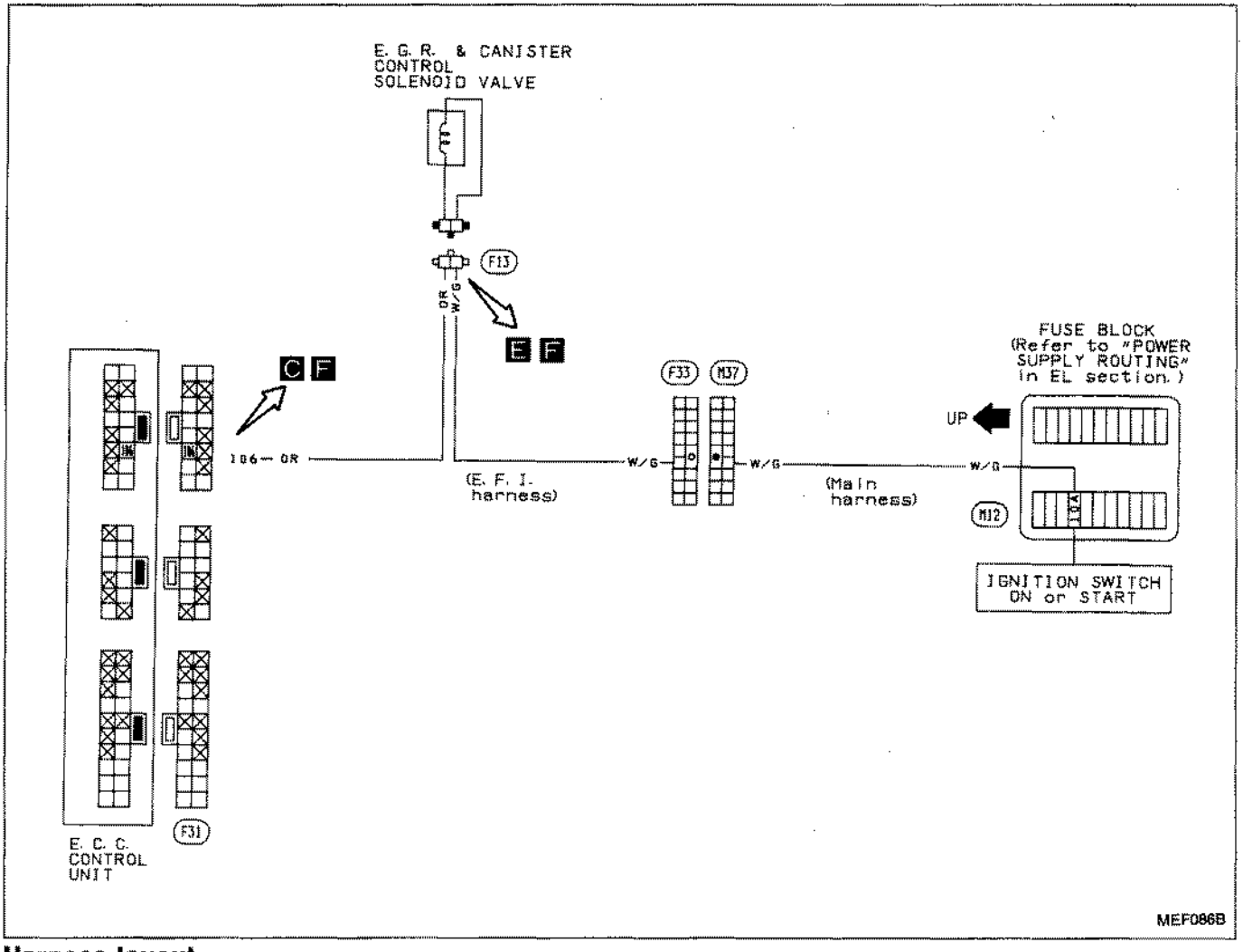
If N.G., repair harness or connectors.

O.K.

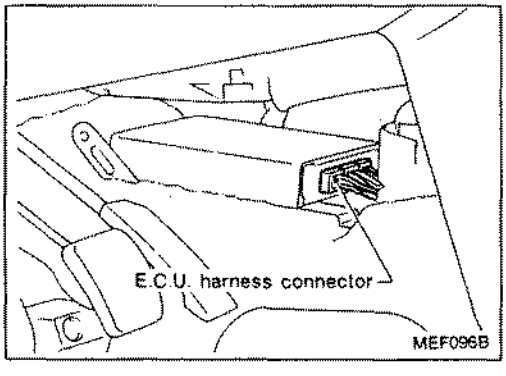
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

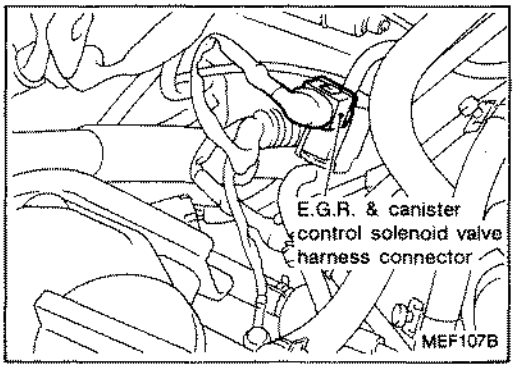
Diagnostic Procedure 10

E.G.R. & CANISTER CONTROL SOLENOID VALVE (Not self-diagnostic item)



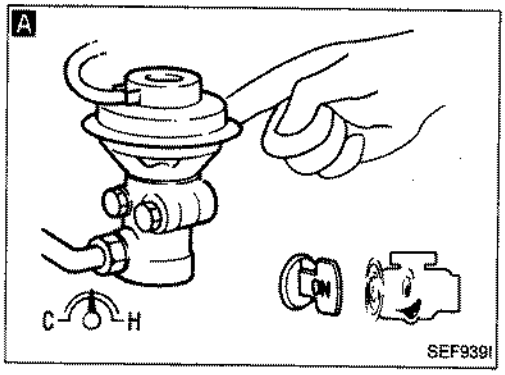
Harness layout





Diagnostic Procedure 10 (Cont'd)

A



SEF939I

INSPECTION START

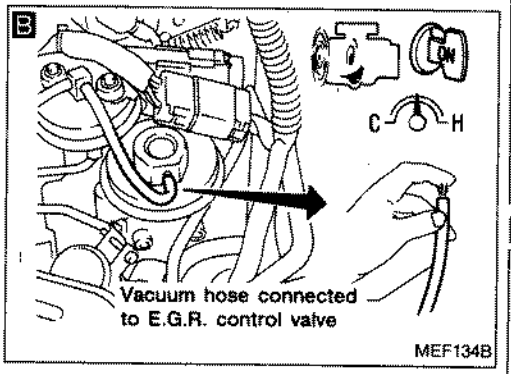
A

CHECK OVERALL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Stop engine and jack up drive wheels.
3) Disconnect boost pressure sensor harness connector.
4) Restart engine.
5) Shift selector lever to "1" position, and keep engine speed at about 3,000 rpm.
Make sure that E.G.R. control valve spring moves up and down. (Use your finger.)

O.K. → INSPECTION END

N.G. ↓

B



MEF134B

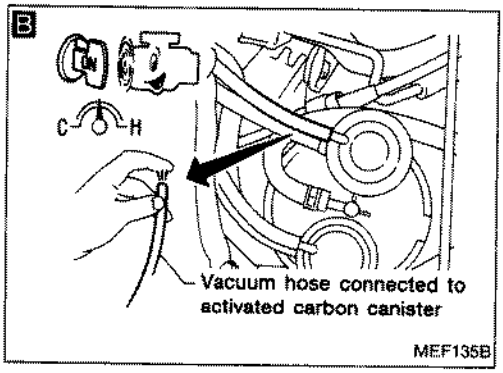
CHECK VACUUM SOURCE TO E.G.R. CONTROL VALVE AND ACTIVATED CARBON CANISTER.
1) Disconnect vacuum hose to E.G.R. control valve and activated carbon canister.
2) Make sure that vacuum exists under the following condition.
At idle (in "N" position):
Vacuum should not exist.
Engine speed is about 3,000 rpm (in "1" position):
Vacuum should exist.

O.K. → CHECK COMPONENTS (E.G.R. control valve, B.P.T. valve and activated carbon canister).
Refer to "Electrical Components Inspection".
(See pages EF & EC-149, 196.)

N.G. ↓

Replace malfunctioning component(s).

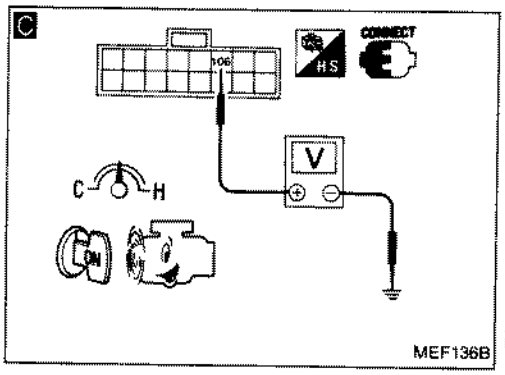
B



MEF135B

N.G. ↓

C



MEF136B

CHECK CONTROL FUNCTION.
1) Check voltage between E.C.U. terminal (106) and ground under the following condition.
Voltage:
At idle (In "N" position)
Approximately 0.8V
Engine speed is about 3,000 rpm (In "1" position)
Battery voltage

O.K. → D

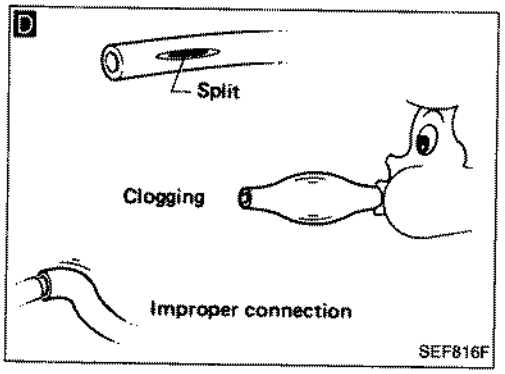
D

Check vacuum hose for clogging cracks and proper connection.

N.G. ↓

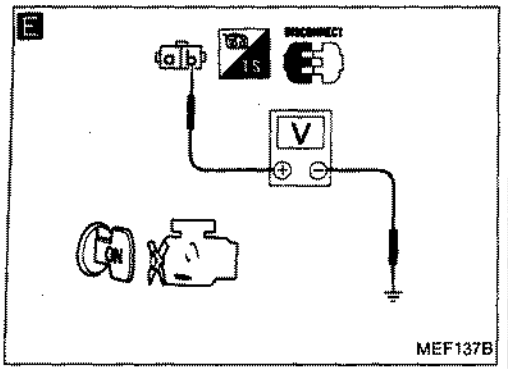
Ⓐ

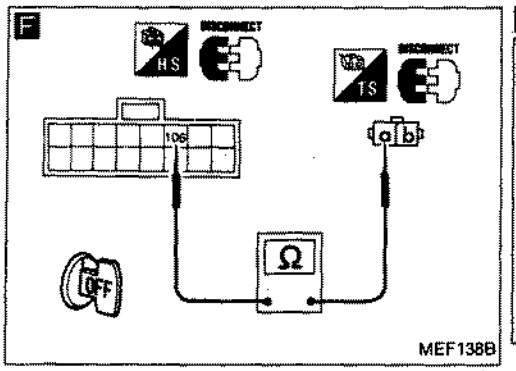
D



SEF816F

Diagnostic Procedure 10 (Cont'd)





Ⓐ

E

CHECK POWER SUPPLY.
1) Stop engine.
2) Disconnect E.G.R. & canister control solenoid valve harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓑ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (F33), (M37)
- 10A fuse
- Harness continuity between E.G.R. & canister control solenoid valve and fuse

If N.G., repair harness or connectors.

O.K. ↓

F

CHECK OUTPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal (106) and terminal ⓐ.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

CHECK COMPONENT
(E.G.R. & canister control solenoid valve).
Refer to "Electrical Components Inspection".
(See page EF & EC-145.)

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

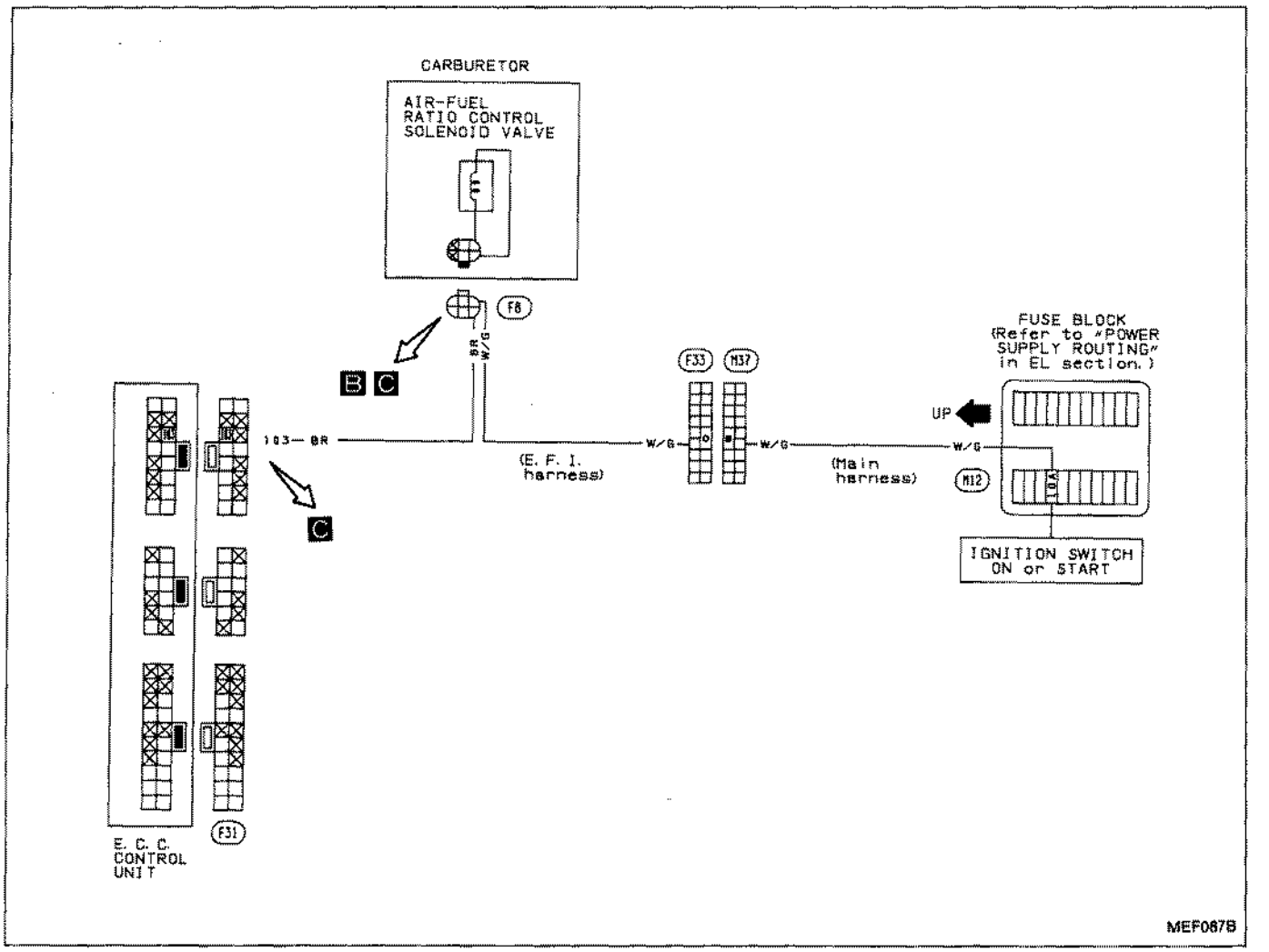
O.K. ↓

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

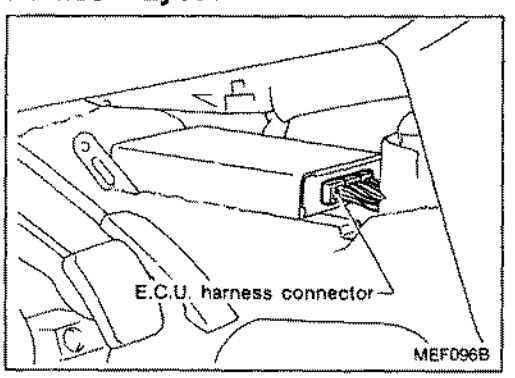
NOTE

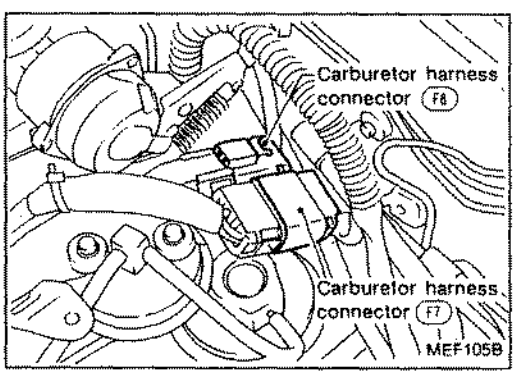
Diagnostic Procedure 11

AIR-FUEL RATIO CONTROL SOLENOID VALVE (Not self-diagnostic item)



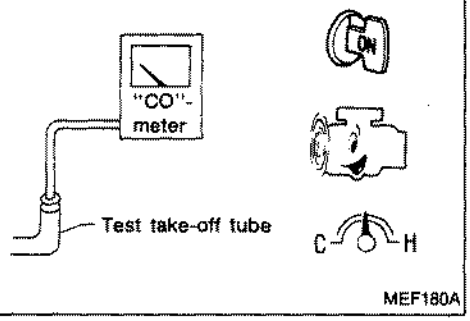
Harness layout



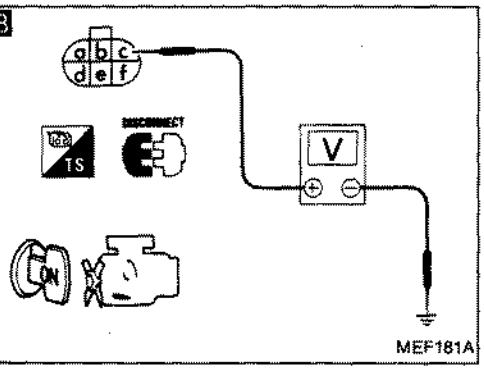


Diagnostic Procedure 11 (Cont'd)

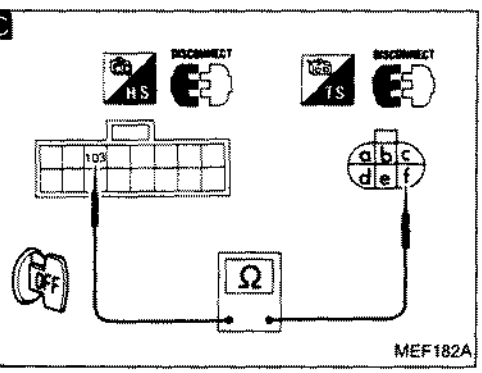
A



B



C



INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Inspect and adjust idle speed and mixture ratio. (Refer to page EF & EC-153.)
2) Stop engine.
3) Disconnect exhaust gas sensor harness connector and A.I.V. control solenoid valve harness connector.
4) Set "CO"-meter on test take-off tube.
5) Start engine and run it at idle.
6) Check idle "CO"%.
Idle "CO"%: 0.5 - 1.5% = α%
If N.G., adjust idle "CO"%. (Refer to page EF & EC-153.)
7) Disconnect carburetor harness connector (F8).
8) Recheck idle "CO"%.
Idle "CO"%: more than α%

O.K. → INSPECTION END

N.G.

B

CHECK POWER SUPPLY.
1) Stop engine.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓒ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (F33), (K17)
- 10A fuse
- Harness continuity between carburetor and fuse

If N.G., repair harness or connectors.

O.K.

C

CHECK OUTPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal (103) and terminal ⓕ.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

CHECK COMPONENT
(Air-fuel ratio control solenoid valve).
Refer to "Electrical Components Inspection".
(See page EF & EC-147.)

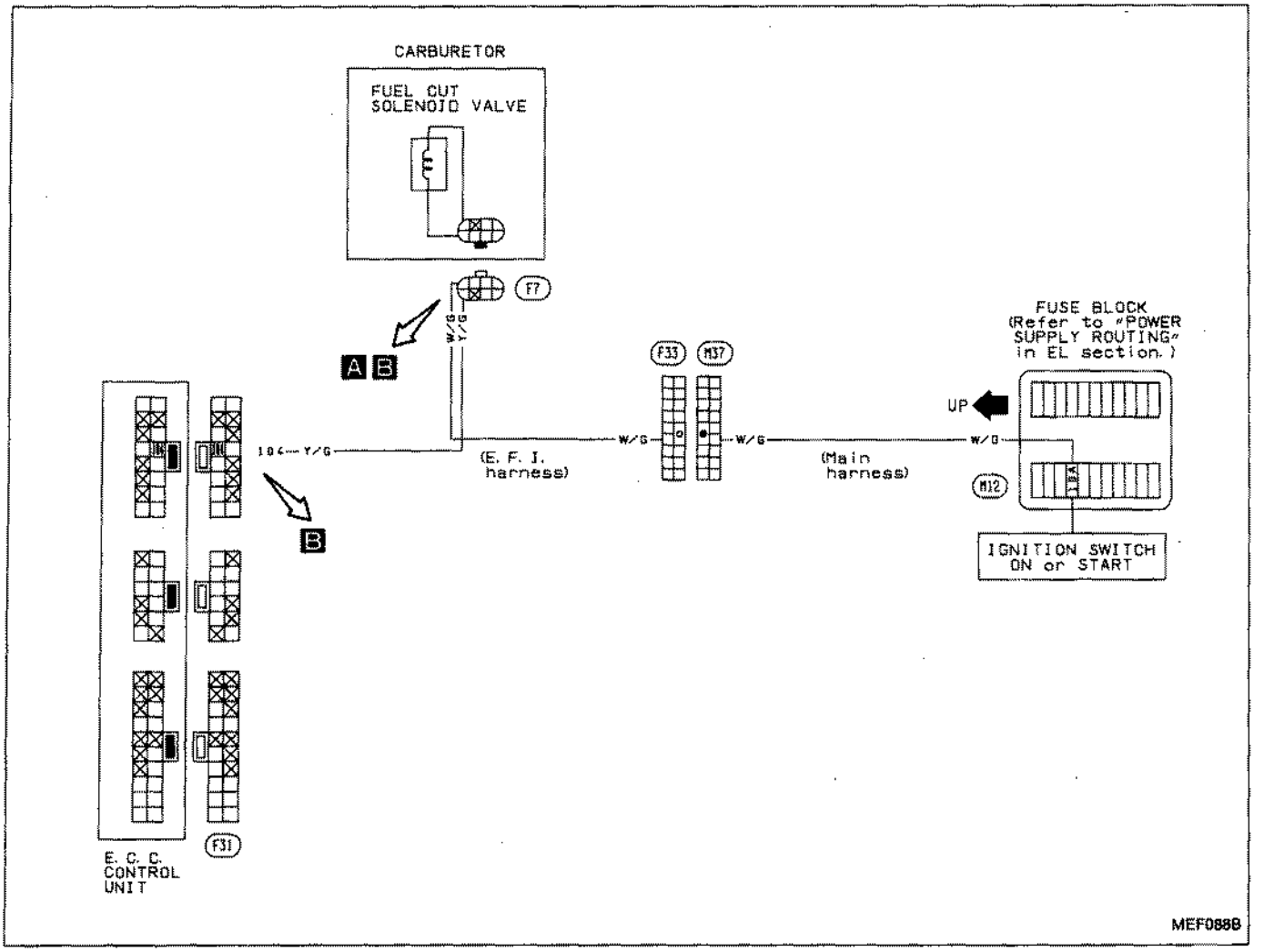
N.G. → Replace air-fuel ratio control solenoid valve.

O.K.

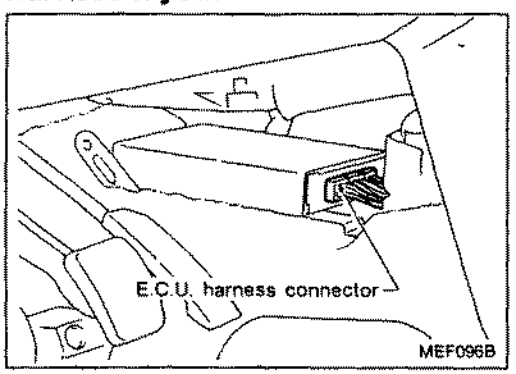
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

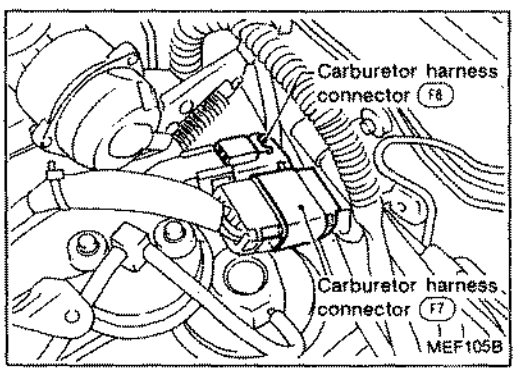
Diagnostic Procedure 12

FUEL CUT SOLENOID VALVE (Not self-diagnostic item)

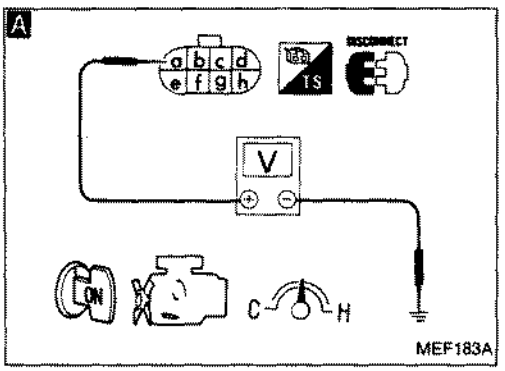


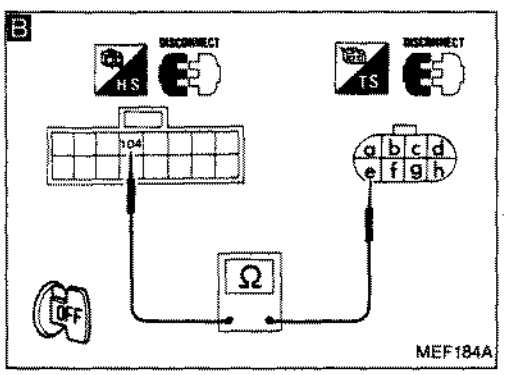
Harness layout





Diagnostic Procedure 12 (Cont'd)





INSPECTION START

CHECK OVERALL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Stop engine.
3) Turn ignition switch "ON".
4) Listen to fuel cut solenoid valve operating sound.
Clicking noise should be heard.

O.K. → INSPECTION END

N.G. ↓

A

CHECK POWER SUPPLY.
1) Turn ignition switch "OFF".
2) Disconnect carburetor harness connector (F7).
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓖ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (F33), (F37)
- 10A fuse
- Harness continuity between carburetor and fuse

If N.G., repair harness, fuse or connectors.

O.K. ↓

B

CHECK OUTPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal (104) and terminal ⓔ.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

CHECK COMPONENT
(Fuel cut solenoid valve).
Refer to "Electrical Components Inspection".
(See page EF & EC-145.)

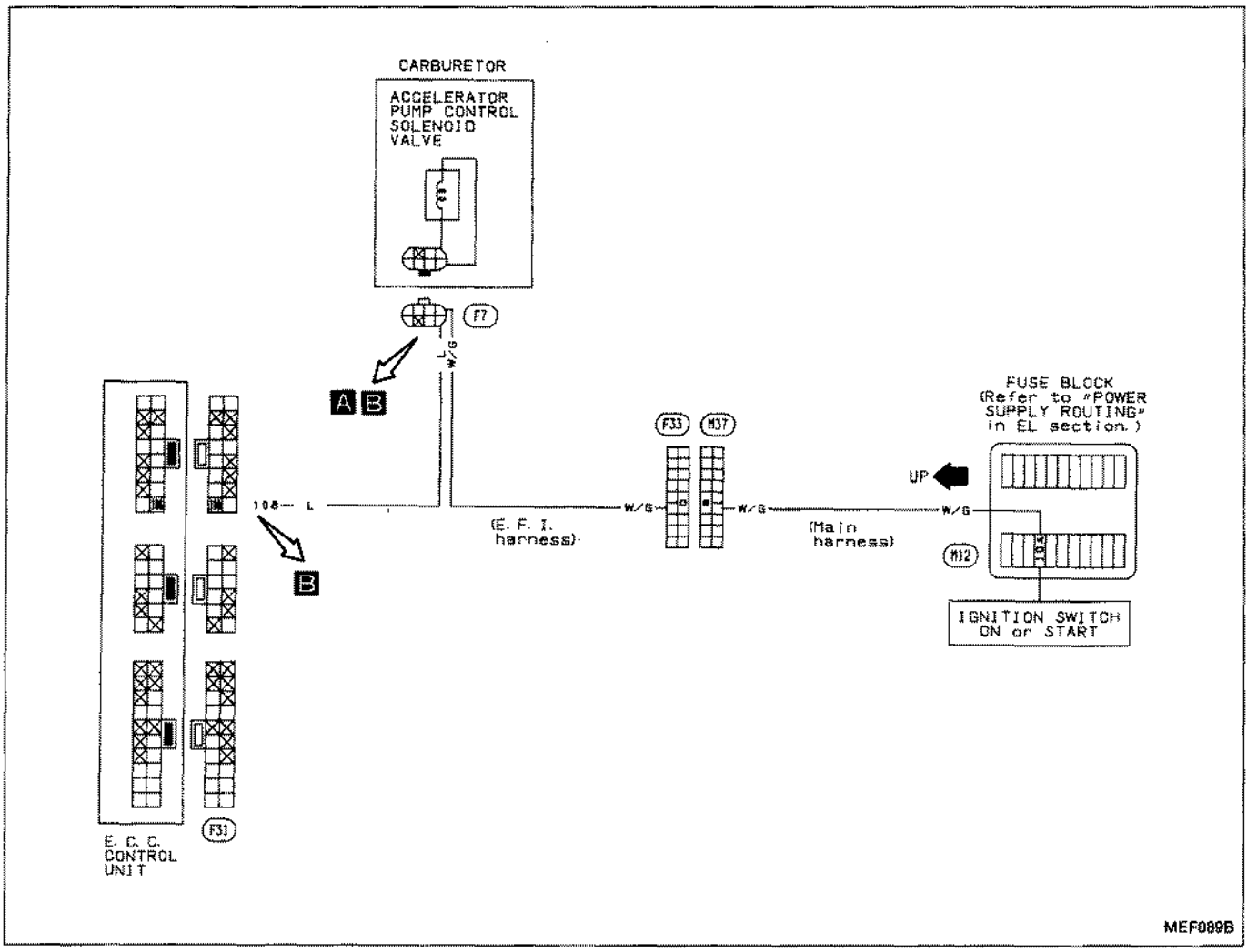
N.G. → Replace fuel cut solenoid valve.

O.K. ↓

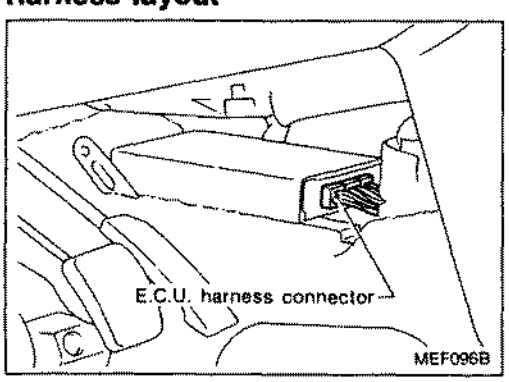
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

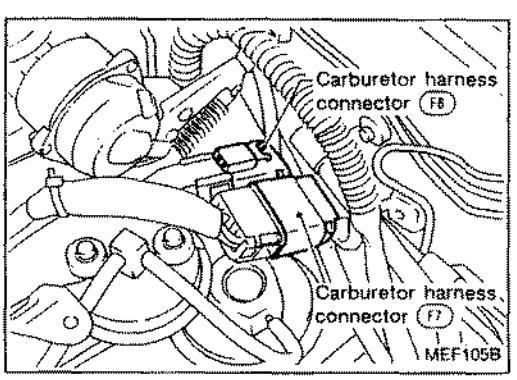
Diagnostic Procedure 13

ACCELERATOR PUMP CONTROL SOLENOID VALVE (Not self-diagnostic item)

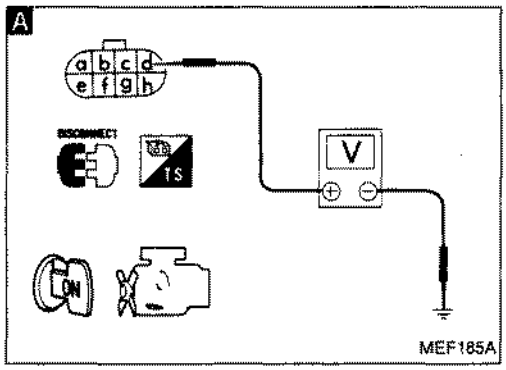


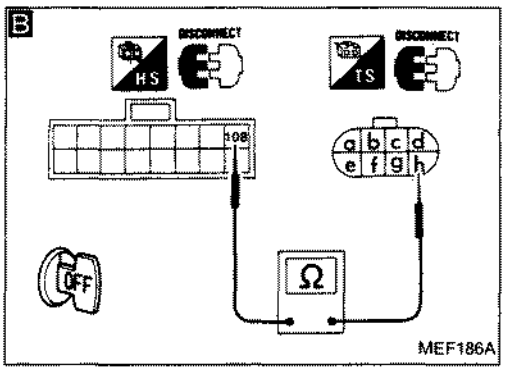
Harness layout





Diagnostic Procedure 13 (Cont'd)





INSPECTION START

CHECK OVERALL FUNCTION.
1) Make sure that engine is cold.
[Engine temperature is below 75°C (167°F) (2WD M/T models for Germany), 60°C (140°F) (Except 2WD M/T models for Germany).]
2) Turn ignition switch "ON".
3) Listen to accelerator pump control solenoid valve operating sound.
Clicking noise should be heard.

O.K. → INSPECTION END

N.G. ↓

A

CHECK POWER SUPPLY.
1) Turn ignition switch "OFF".
2) Disconnect carburetor harness connector (F7).
3) Turn ignition switch "ON".
4) Check voltage between terminal (d) and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (F33), (107)
- 10A fuse
- Harness continuity between carburetor and fuse

If N.G., repair harness or connectors.

O.K. ↓

B

CHECK OUTPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal (108) and terminal (h).
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

CHECK COMPONENT
(Accelerator pump control solenoid valve).
Refer to "Electrical Components Inspection".
(See page EF & EC-146.)

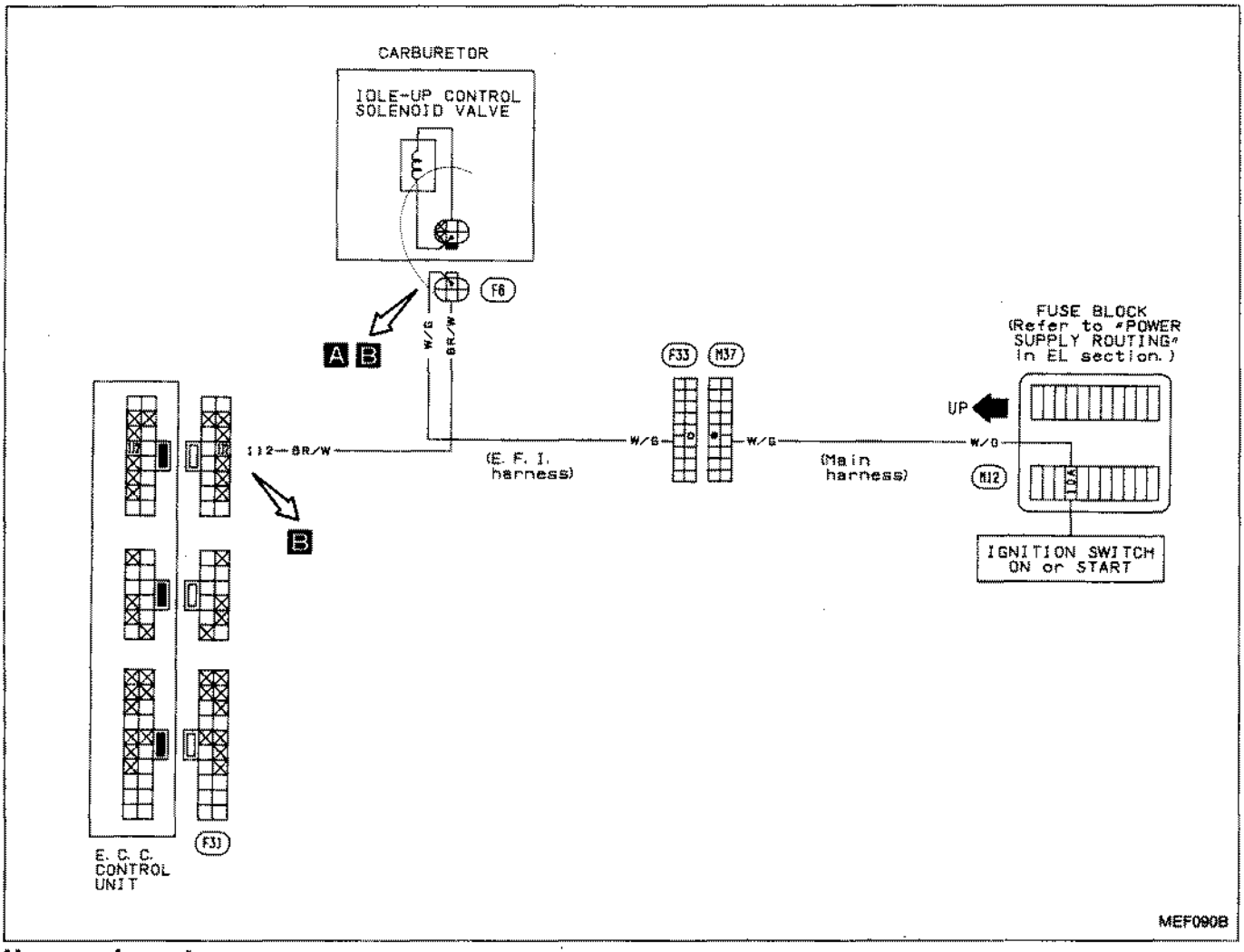
N.G. → Replace accelerator pump control solenoid valve.

O.K. ↓

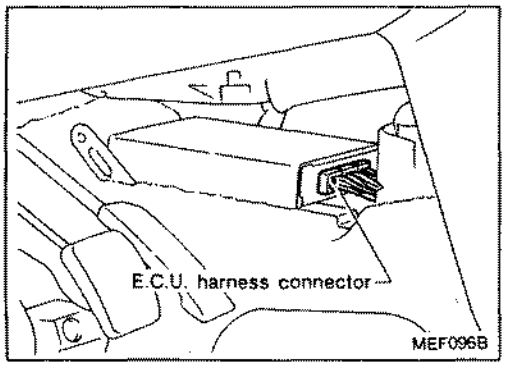
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

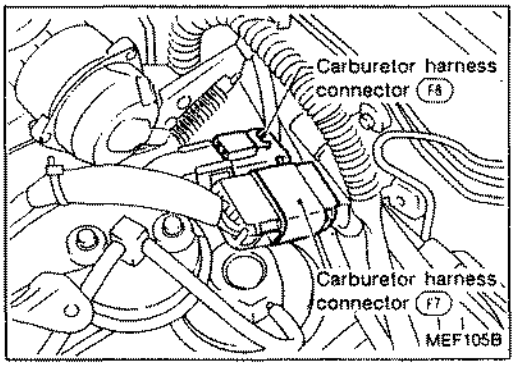
Diagnostic Procedure 14

IDLE-UP CONTROL SOLENOID VALVE (Not self-diagnostic item)



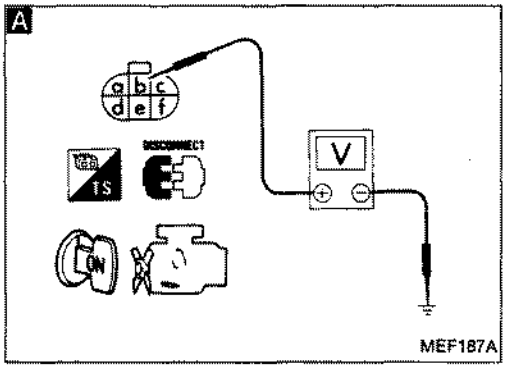
Harness layout





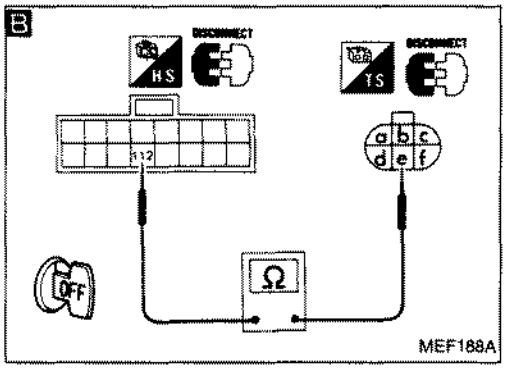
Diagnostic Procedure 14 (Cont'd)

A



MEF187A

B



MEF188A

INSPECTION START

CHECK OVERALL FUNCTION.
1) Make sure that engine is cold.
[Engine temperature is below 75°C (167°F).]
2) Turn ignition switch "ON".
3) Listen to idle-up control solenoid valve operating sound.
Clicking noise should be heard.

O.K. → INSPECTION END

N.G. ↓

A

CHECK POWER SUPPLY.
1) Turn ignition switch "OFF".
2) Disconnect carburetor harness connector (F8).
3) Turn ignition switch "ON".
4) Check voltage between terminal (b) and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (F33), (R37)
- 10A fuse
- Harness continuity between carburetor and fuse

If N.G., repair harness, fuse or connectors.

O.K. ↓

B

CHECK OUTPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal (12) and terminal (8).
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

CHECK COMPONENT
(Idle-up control solenoid valve).
Refer to "Electrical Components Inspection".
(See page EF & EC-145.)

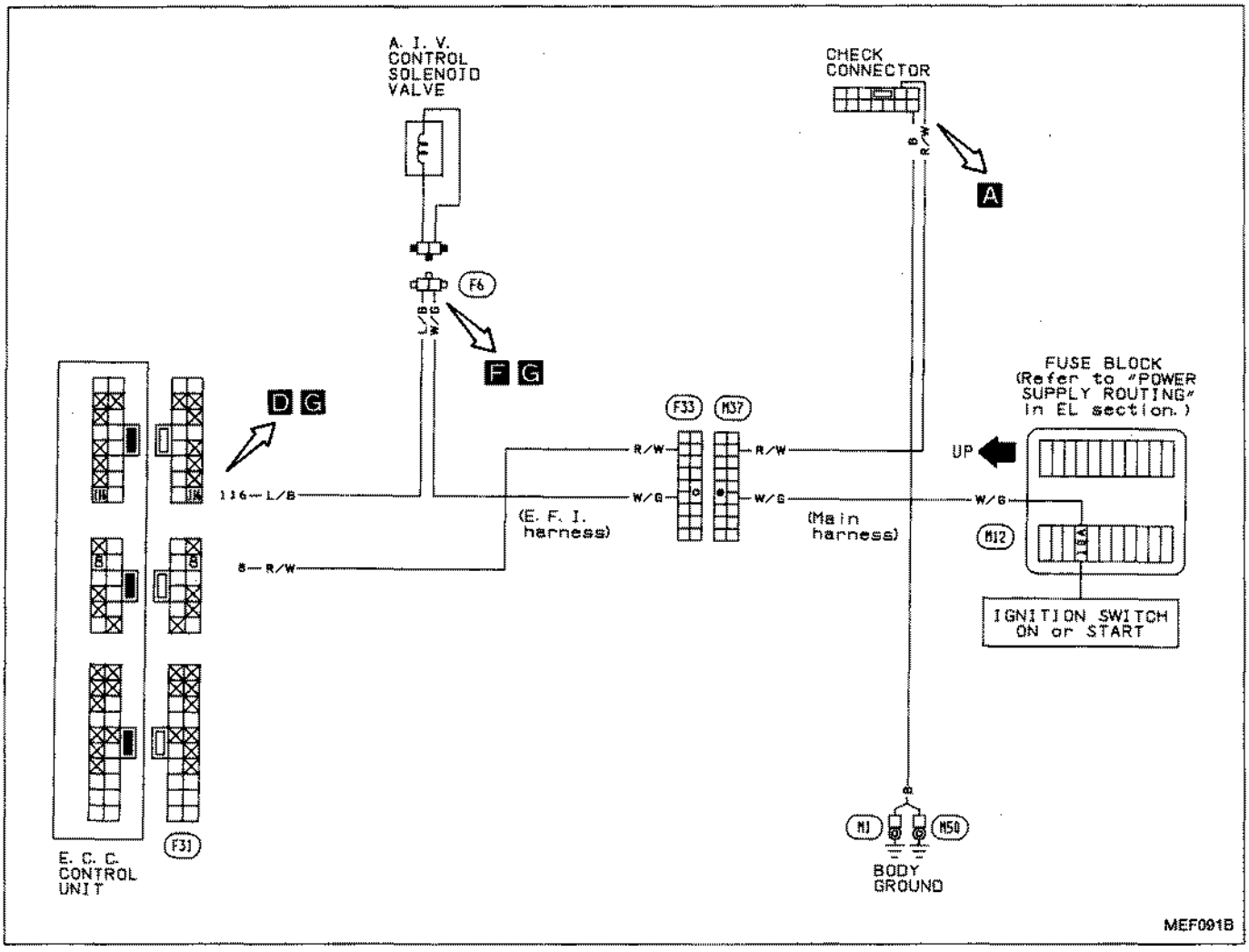
N.G. → Replace idle-up control solenoid valve.

O.K. ↓

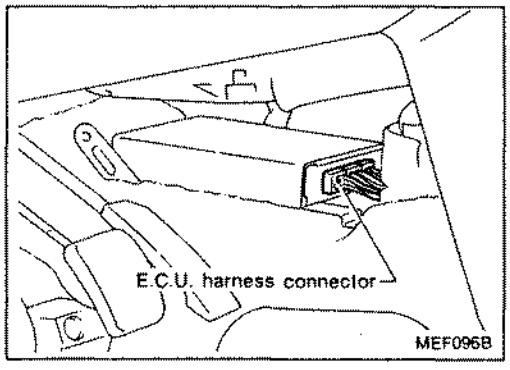
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

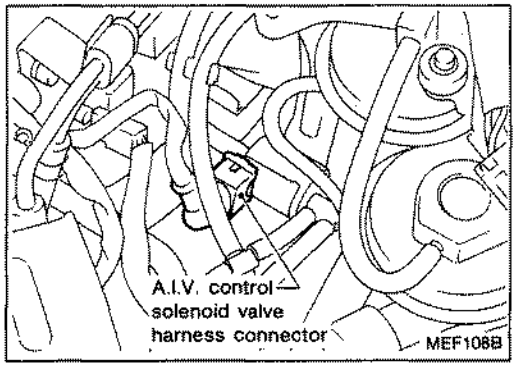
Diagnostic Procedure 15

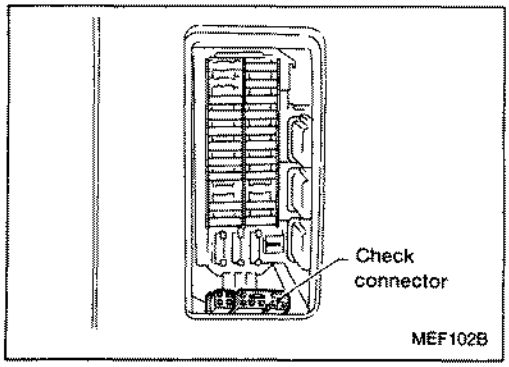
A.I.V. CONTROL SOLENOID VALVE (Not self-diagnostic item)



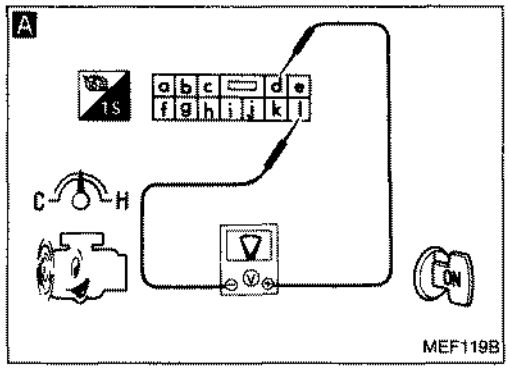
Harness layout

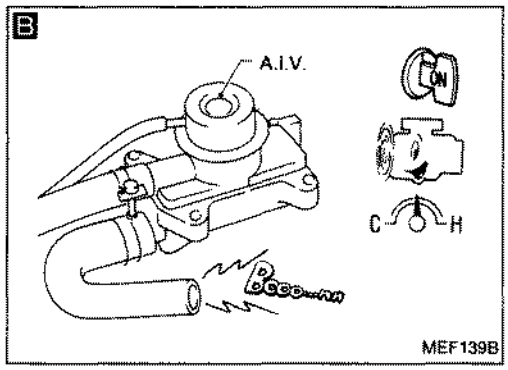


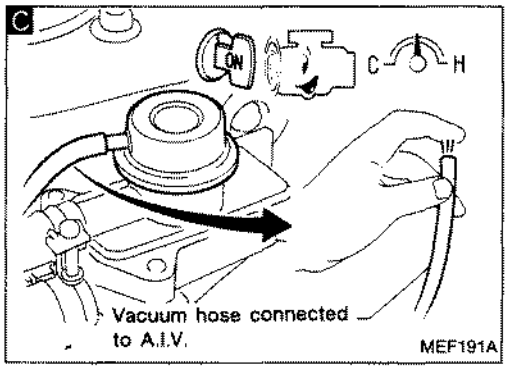


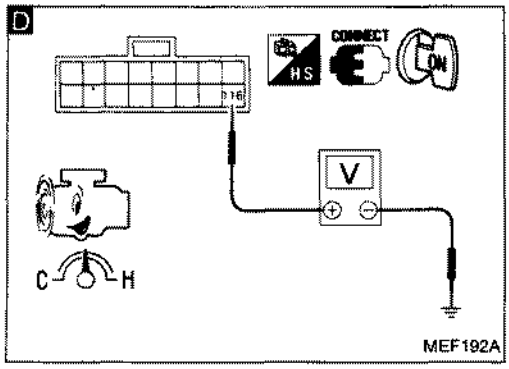


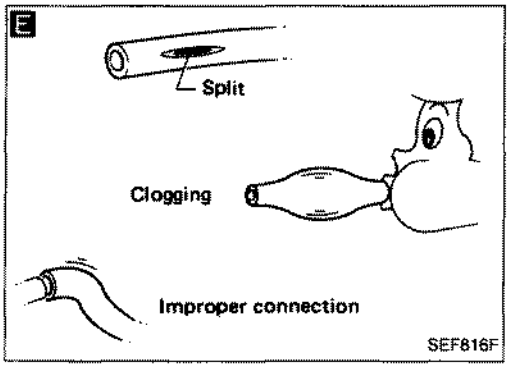
Diagnostic Procedure 15 (Cont'd)











INSPECTION START

CHECK OVERALL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Run engine at about 2,500 rpm for about 5 minutes under no-load.

A 3) Keep engine speed at 2,000 rpm under no-load, check voltage between terminal ⑱ and terminal ① on check connector. Make sure that needle of voltmeter fluctuates between approximately 0V and battery voltage more than 5 times during 10 seconds.
If N.G., go to Diagnostic Procedure 5.

4) Release accelerator pedal fully, and run engine at idle.

B 5) Listen to A.I.V. operating sound.
At idle:
A.I.V. should operate.
Except at idle:
A.I.V. should not operate.

O.K. → INSPECTION END

C N.G.

CHECK VACUUM SOURCE TO A.I.V.
1) Disconnect vacuum hose to A.I.V.
2) Make sure that vacuum exists under the following conditions.
At idle:
Vacuum should exist.
Except at idle:
Vacuum should not exist.

N.G. → CHECK COMPONENT (A.I.V.).
Refer to "Electrical Components Inspection".
(See page EF & EC-148.)

O.K.

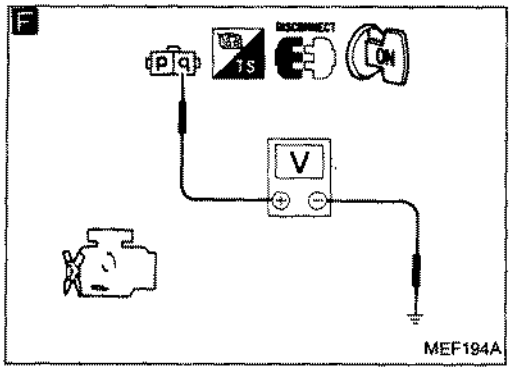
D CHECK CONTROL FUNCTION.
1) Check voltage between E.C.U. terminal ⑯ and ground.
Voltage:
At idle
Approximately 0.8V
Except at idle
Battery voltage

N.G. → E CHECK VACUUM HOSE.
Check vacuum hose for clogging, cracks and proper connection.

O.K.
Ⓐ

Diagnostic Procedure 15 (Cont'd)

F



Ⓐ

F

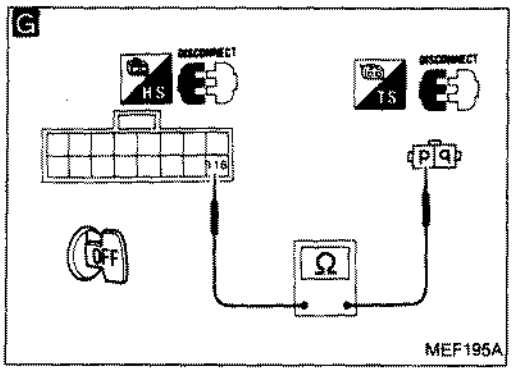
CHECK POWER SUPPLY.
1) Stop engine.
2) Disconnect A.I.V. control solenoid valve harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⑨ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (F33), (M57)
- 10A fuse
- Harness continuity between A.I.V. control solenoid valve and fuse

If N.G., repair harness, fuse or connectors.

O.K. ↓

G



G

CHECK OUTPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal ⑯ and terminal ⑨.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

CHECK COMPONENT
(A.I.V. control solenoid valve).
Refer to "Electrical Components Inspection".
(See page EF & EC-145.)

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

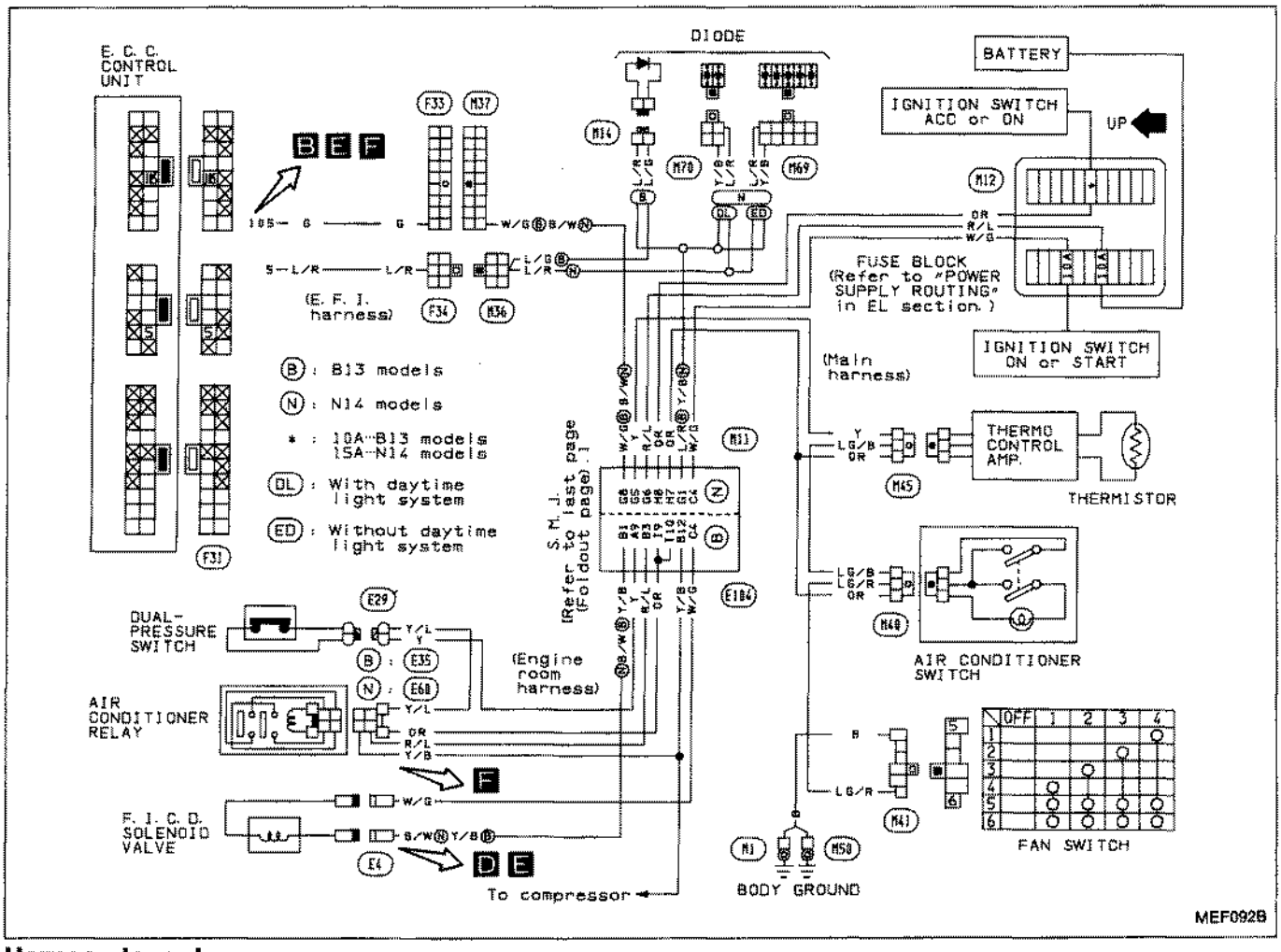
O.K. ↓

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

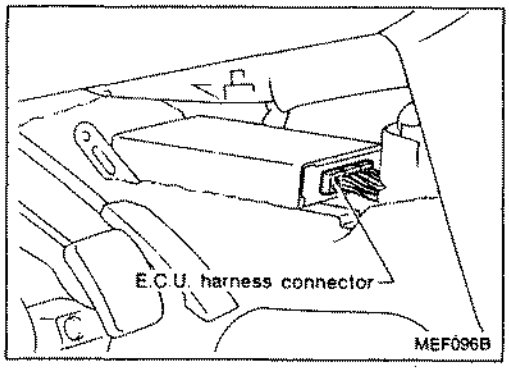
NOTE

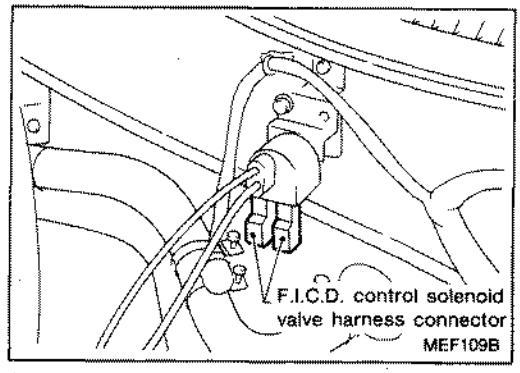
Diagnostic Procedure 16

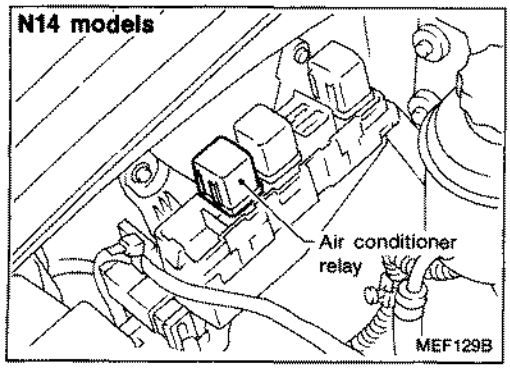
F.I.C.D. CONTROL SOLENOID VALVE (Not self-diagnostic item)

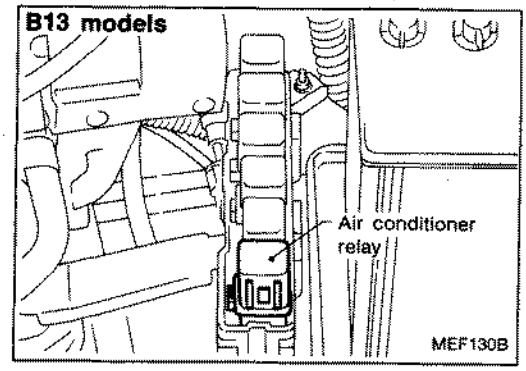


Harness layout

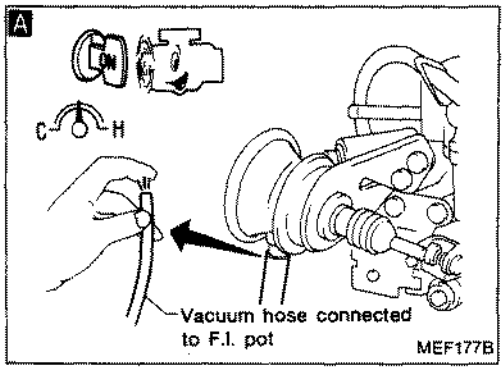


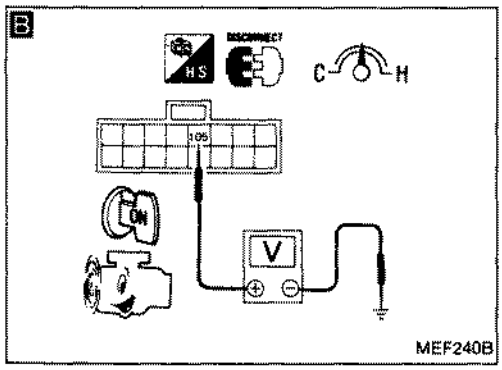


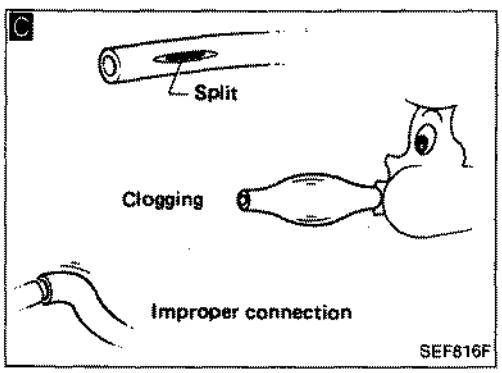


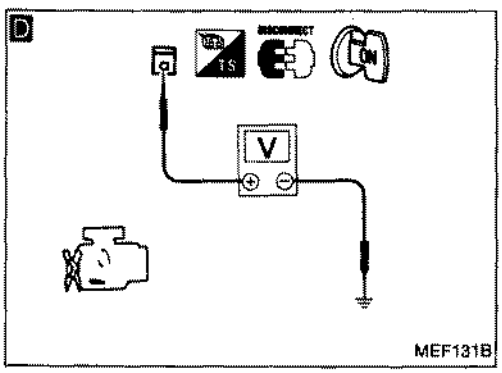


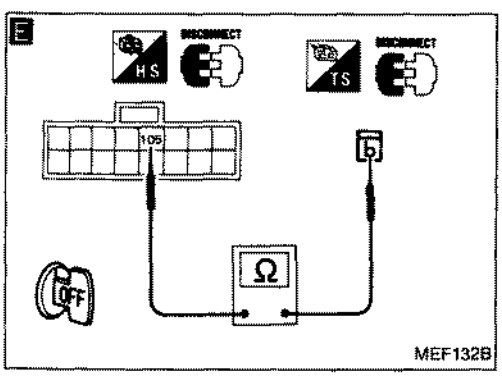
Diagnostic Procedure 16 (Cont'd)











INSPECTION START

CHECK OVERALL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Check idle speed.
M/T: 750 ± 50 rpm
A/T: 850 ± 50 rpm
If N.G., adjust idle speed.
3) Turn both air conditioner switch and blower fan switch "ON", then recheck idle speed.
M/T: 850 ± 50 rpm
A/T: 850 ± 50 rpm

O.K. → INSPECTION END

N.G.

Check if air conditioner compressor functions normally.

N.G. → Refer to HA section.

O.K.

A

CHECK VACUUM SOURCE TO F.I. POT
1) Disconnect vacuum hose to F.I. pot.
2) Make sure that vacuum exists under the following condition.
At conditioner switch "OFF":
Vacuum should not exist.
Air conditioner switch "ON":
Vacuum should exist.

O.K. → CHECK COMPONENTS (F.I. pot).
Refer to "Electrical Components Inspection".
(See page EF & EC-149.)

N.G.

Replace F.I. pot.

N.G.

B

CHECK CONTROL FUNCTION.
1) Check voltage between E.C.U. terminal (105) and ground under the following condition.
Voltage:
At conditioner switch "OFF".
Battery voltage
Air conditioner switch "ON"
Approximately 0V

O.K. → C
Check vacuum hose for clogging cracks and proper connection.

N.G.

D

CHECK POWER SUPPLY.
1) Stop engine.
2) Disconnect F.I.C.D. control solenoid valve harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓑ and ground.
Voltage: Battery voltage

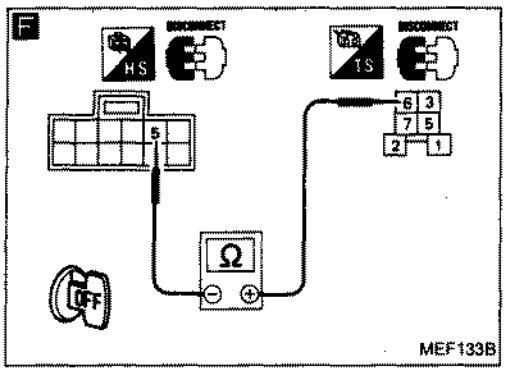
N.G. → Check the following.
- Harness connectors (M11), (E104)
- 10A fuse
- Harness continuity between F.I.C.D. control solenoid valve and fuse

If N.G., repair harness or connectors.

O.K.

Ⓐ

Diagnostic Procedure 16 (Cont'd)



Ⓐ

E

CHECK OUTPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal (105) and terminal Ⓑ.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (F33), (M37)
- Harness connectors (M11), (E184)
- Harness continuity between E.C.U. and F.I.C.D. control solenoid valve

If N.G., repair harness or connectors.

O.K. ↓

F

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect air conditioner relay.
2) Check harness continuity between E.C.U. terminal ⑤ and terminal ⑥.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (F34), (M36)
- Harness connectors (M11), (E184)
- Diode (M70) (N14 models with daytime light system)
- Diode (M69) (N14 models without daytime light system)
- Diode M14 (B13 models)
- Harness continuity between E.C.U. and air conditioner relay

If N.G., repair harness or connectors.

O.K. ↓

CHECK COMPONENT
(F.I.C.D. control solenoid valve).
Refer to "Electrical Components Inspection".
(See page EF & EC-149.)

N.G. → Replace F.I.C.D. control solenoid valve.

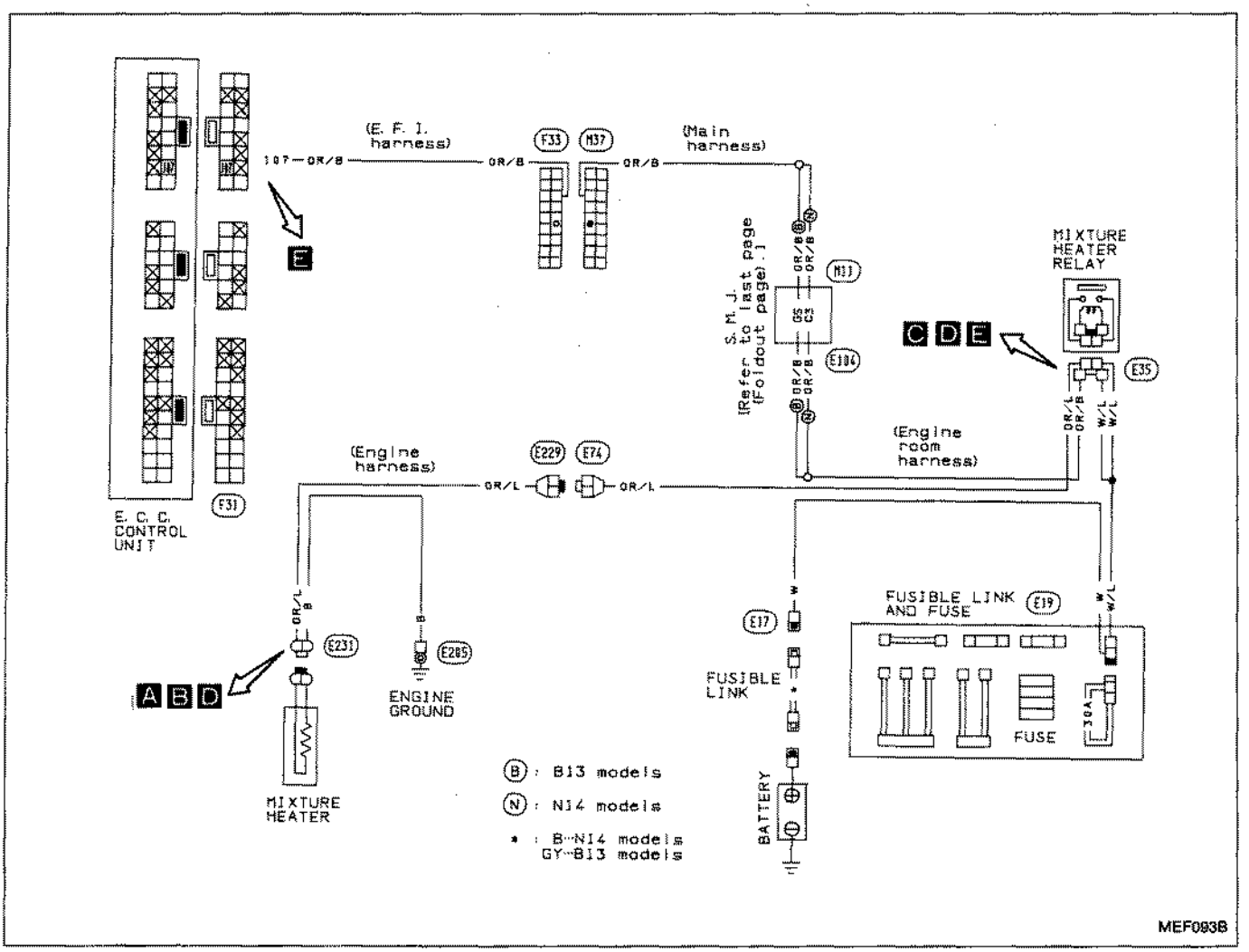
O.K. ↓

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

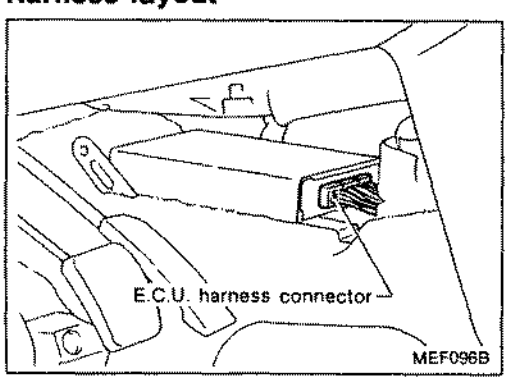
NOTE

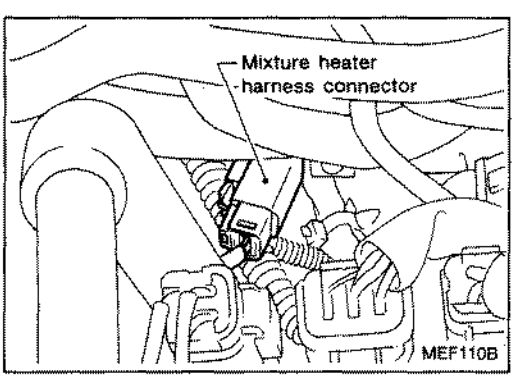
Diagnostic Procedure 17

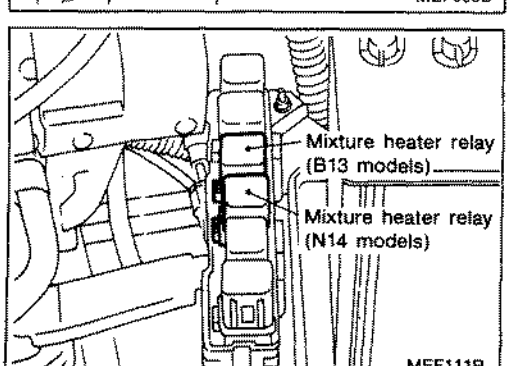
MIXTURE HEATER CONTROL (Not self-diagnostic item)



Harness layout

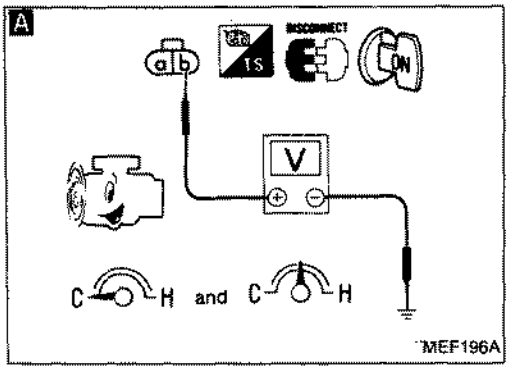






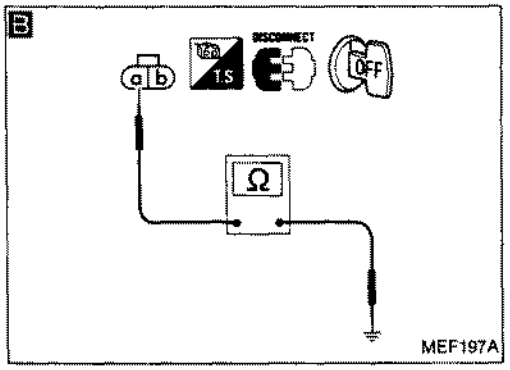
Diagnostic Procedure 17 (Cont'd)

A



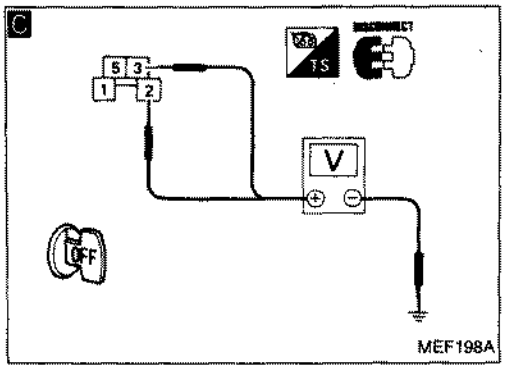
MEF196A

B



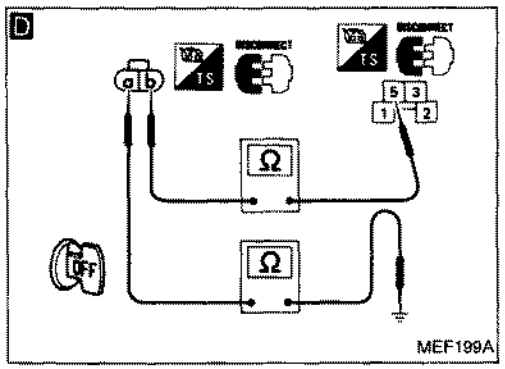
MEF197A

C



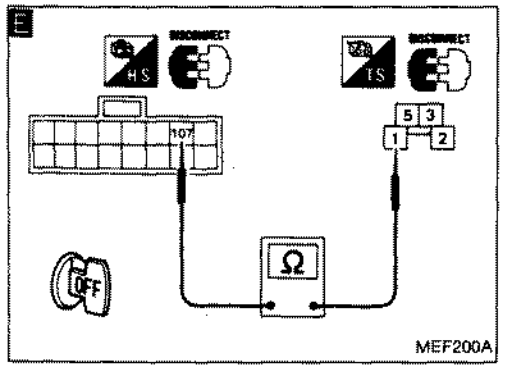
MEF198A

D



MEF199A

E



MEF200A

INSPECTION START

A

CHECK CONTROL FUNCTION.
1) Make sure that engine is cold.
[Engine temperature is below 75°C (167°F).]
2) Disconnect mixture heater harness connector.
3) Start engine.
4) Check voltage between terminal ⓑ and ground.
Voltage: Battery voltage
5) After engine is warmed up sufficiently, recheck voltage between terminal ⓑ and ground.
Voltage: Approximately 0V

O.K. → **B**

CHECK GROUND CIRCUIT.
1) Stop engine.
2) Check harness continuity between terminal ⓖ and engine ground.
Continuity should exist.
If N.G., repair harness or connectors.

O.K.

CHECK COMPONENT (Mixture heater).
Refer to "Electrical Components Inspection".
(See page EF & EC-146.)
If N.G., replace mixture heater.

O.K.

INSPECTION END

N.G.

C

CHECK POWER SUPPLY.
1) Stop engine.
2) Disconnect mixture heater relay.
3) Check voltage between terminals ② , ③ and ground.
Voltage: Battery voltage

N.G.

Check the following.
- 30A fusible link
- "GY" fusible link
- Harness continuity between mixture heater relay and battery

If N.G., repair harness, fusible link or connectors.

O.K.

D

CHECK GROUND CIRCUIT.
1) Check harness continuity between terminal ⑤ and terminal ⓑ, terminal ⓖ and engine ground.
Continuity should exist.

N.G.

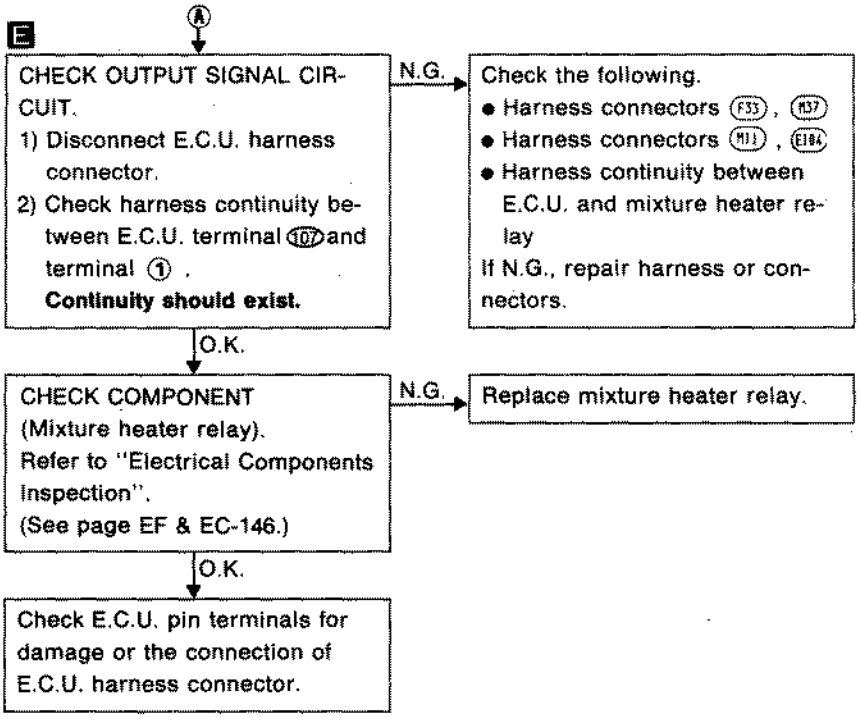
Check the following.
- Harness connectors (E74) , (E279)
- Harness continuity between mixture heater and mixture heater relay
- Harness continuity between mixture heater and engine ground

If N.G., repair harness or connectors.

O.K.

Ⓐ

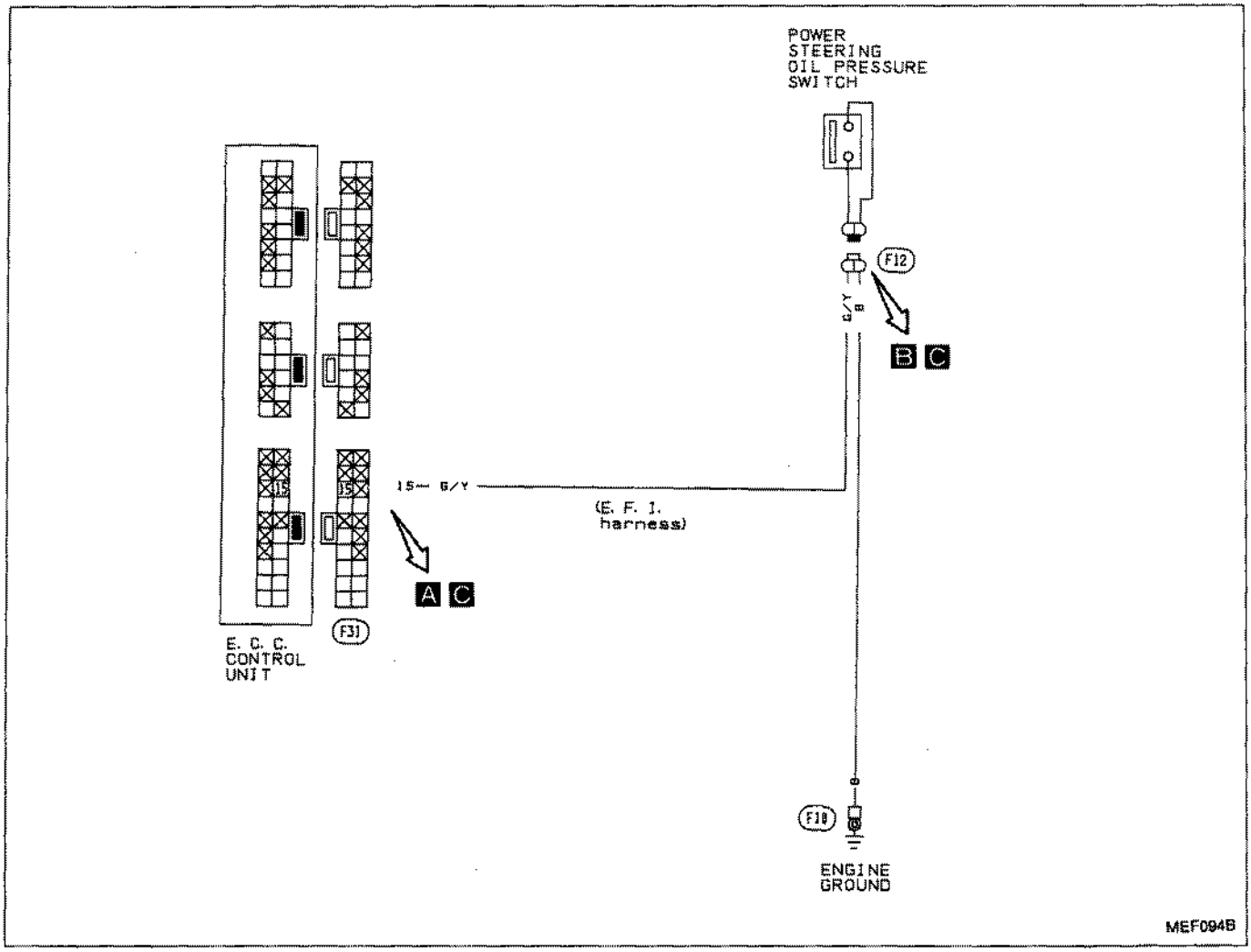
Diagnostic Procedure 17 (Cont'd)



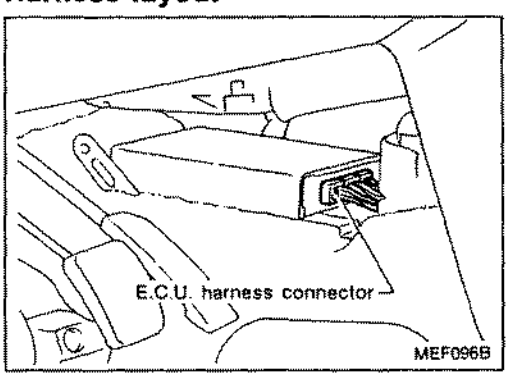
NOTE

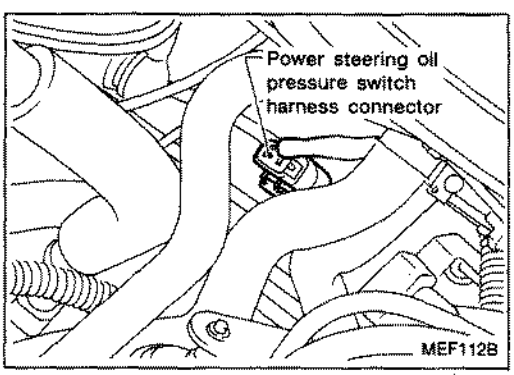
Diagnostic Procedure 18

POWER STEERING OIL PRESSURE SWITCH (Not self-diagnostic item)

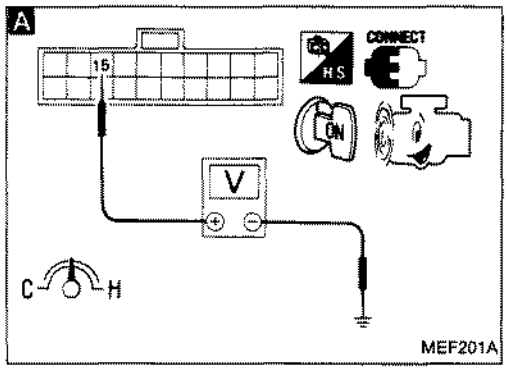


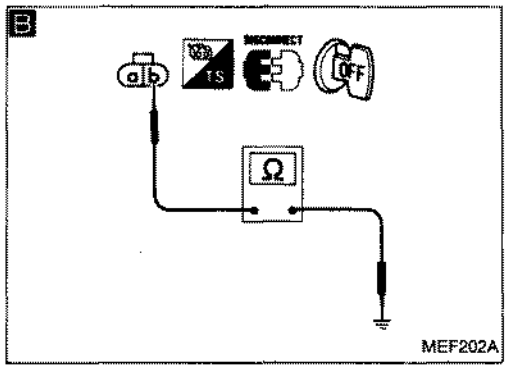
Harness layout

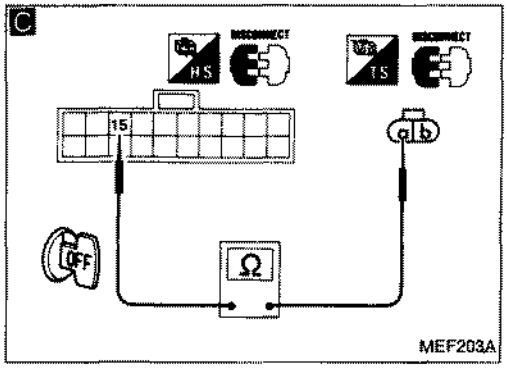




Diagnostic Procedure 18 (Cont'd)







INSPECTION START

A

CHECK CONTROL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Check voltage between E.C.U. terminal ⑮ and ground under the following conditions.

Voltage:
When steering wheel is turned quickly.
Approximately 0V
Except above
Approximately 11V

O.K. → INSPECTION END

N.G. ↓

B

CHECK GROUND CIRCUIT.
1) Stop engine.
2) Disconnect power steering oil pressure switch harness connector.
3) Check harness continuity between terminal ⓑ and engine ground.

Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

C

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal ⑮ and terminal ⓐ.

Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

CHECK COMPONENT
(Power steering oil pressure switch).
Refer to "Electrical Components Inspection".
(See page EF & EC-146.)

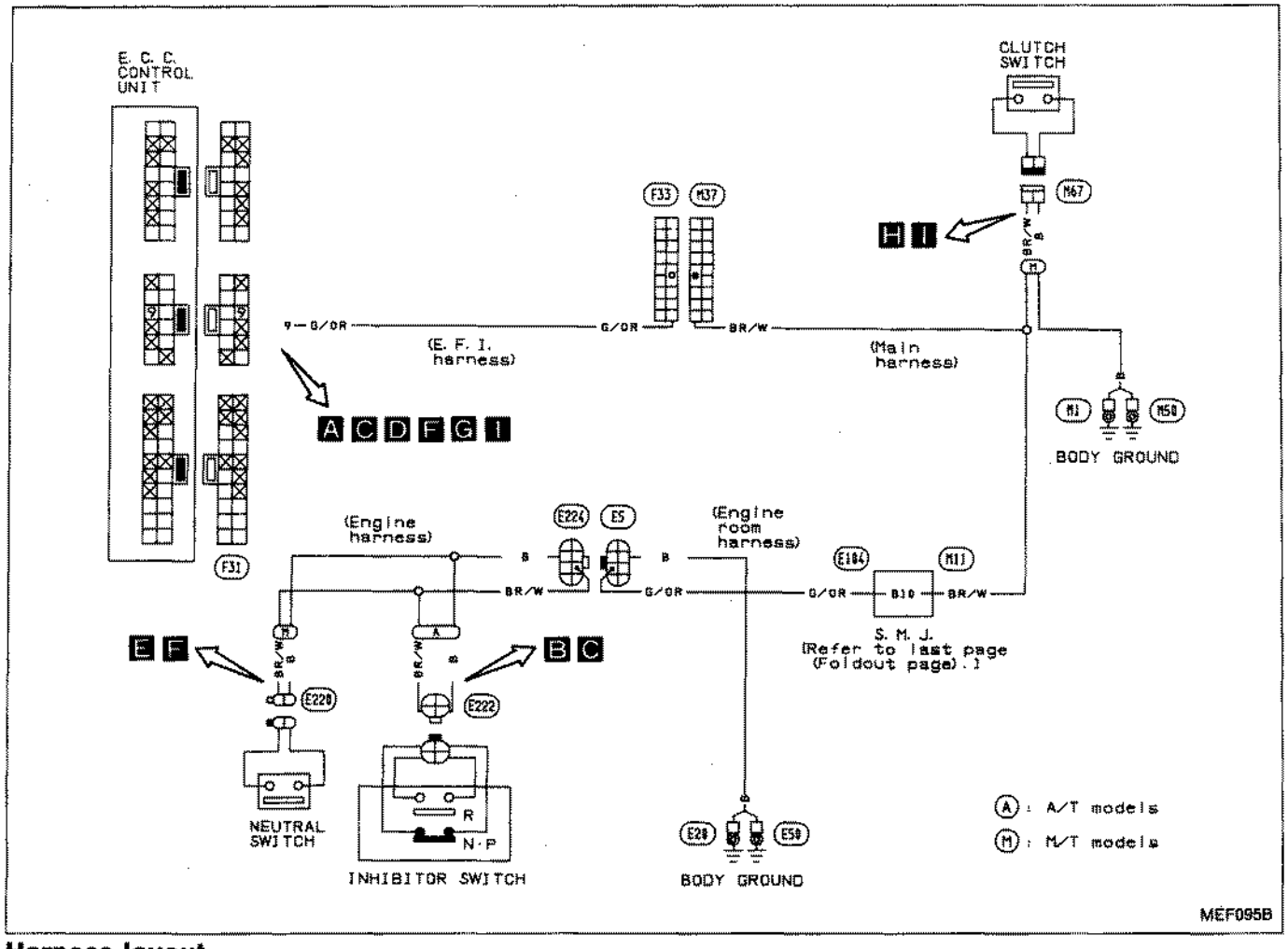
N.G. → Replace power steering oil pressure switch.

O.K. ↓

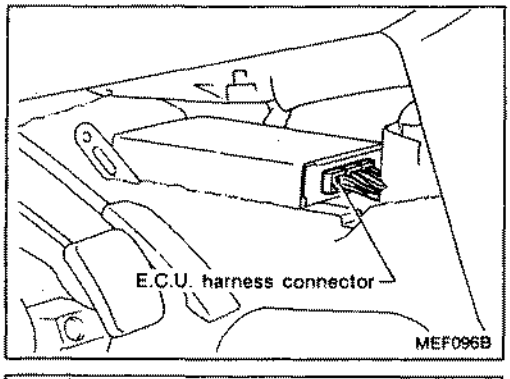
Check E.C.U. pin terminals for damage or the connection of the E.C.U. harness connector.

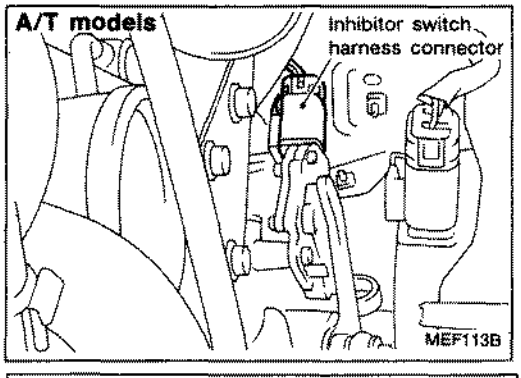
Diagnostic Procedure 19

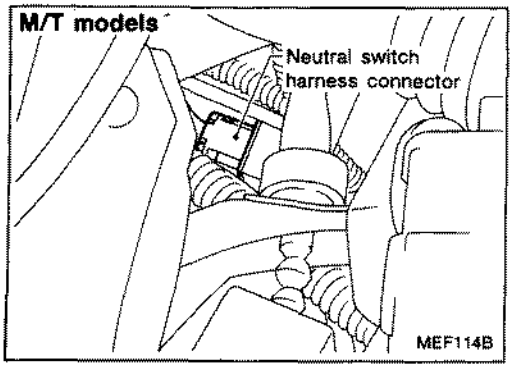
INHIBITOR/NEUTRAL/CLUTCH SWITCH (Not self-diagnostic item)

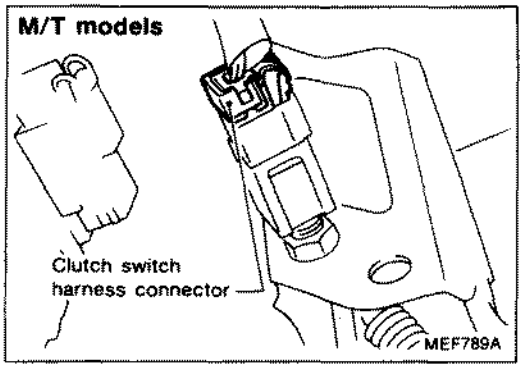


Harness layout

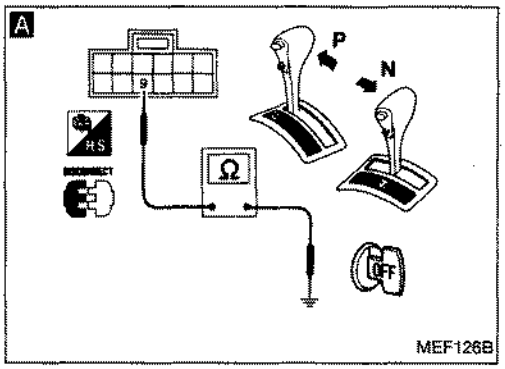


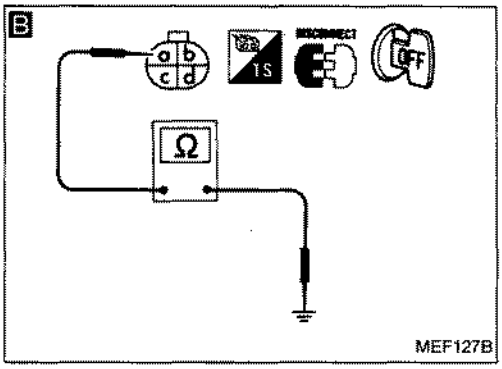


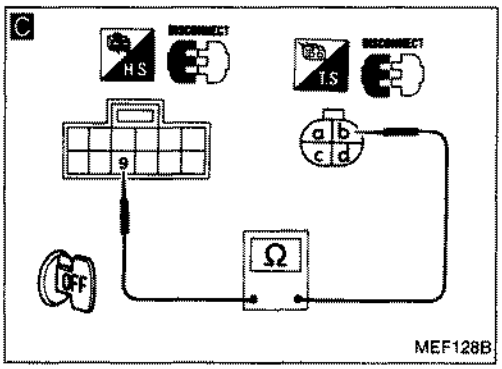




Diagnostic Procedure 19 (Cont'd)







Inhibitor switch

INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Shift selector lever to "P" position.
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal ⑨ and body ground.
Continuity should exist.
4) Shift selector lever to "N" position.
5) Check harness continuity between E.C.U. terminal ⑨ and body ground.
Continuity should exist.

O.K. → INSPECTION END

N.G.

B

CHECK GROUND CIRCUIT.
1) Disconnect inhibitor switch harness connector.
2) Check harness continuity between terminal ⓐ and body ground.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (E224), (E5)
- Harness continuity between inhibitor switch and body ground

If N.G., repair harness or connectors.

O.K.

C

CHECK INPUT SIGNAL CIRCUIT.
1) Check harness continuity between E.C.U. terminal ⑨ and terminal ⓑ.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (F33), (M37)
- Harness connectors (M11), (E104)
- Harness connectors (E5), (E224)
- Harness continuity between E.C.U. and inhibitor switch

If N.G., repair harness or connectors.

O.K.

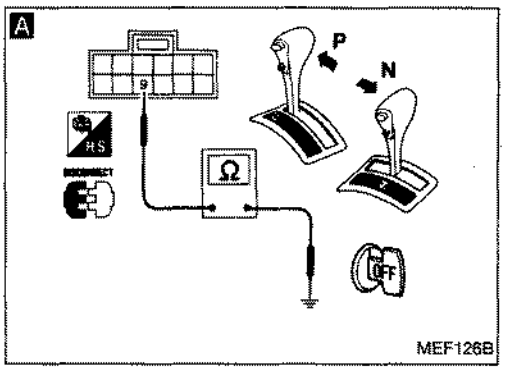
CHECK COMPONENT (Inhibitor switch).
Refer to "Electrical Components Inspection".
(See page EF & EC-143.)

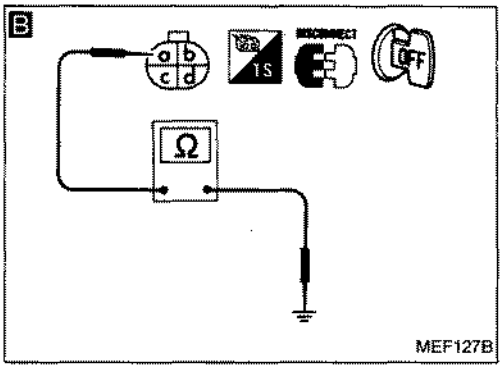
N.G. → Replace inhibitor switch.

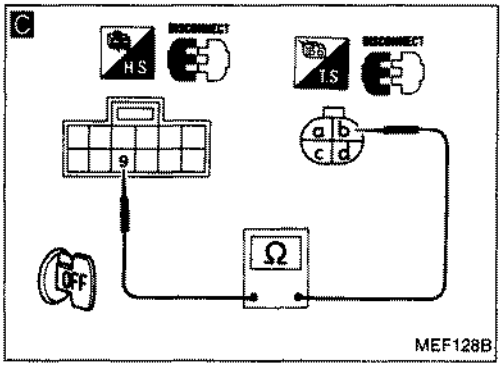
O.K.

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

Diagnostic Procedure 19 (Cont'd)







Inhibitor switch

INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Shift selector lever to "P" position.
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal ⑨ and body ground.
Continuity should exist.
4) Shift selector lever to "N" position.
5) Check harness continuity between E.C.U. terminal ⑨ and body ground.
Continuity should exist.

O.K. → INSPECTION END

N.G.

B

CHECK GROUND CIRCUIT.
1) Disconnect inhibitor switch harness connector.
2) Check harness continuity between terminal ⓓ and body ground.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (E224), (E5)
- Harness continuity between inhibitor switch and body ground

If N.G., repair harness or connectors.

O.K.

C

CHECK INPUT SIGNAL CIRCUIT.
1) Check harness continuity between E.C.U. terminal ⑨ and terminal ⓑ.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (F33), (K57)
- Harness connectors (M11), (E184)
- Harness connectors (E5), (E224)
- Harness continuity between E.C.U. and inhibitor switch

If N.G., repair harness or connectors.

O.K.

CHECK COMPONENT
(Inhibitor switch).
Refer to "Electrical Components Inspection".
(See page EF & EC-143.)

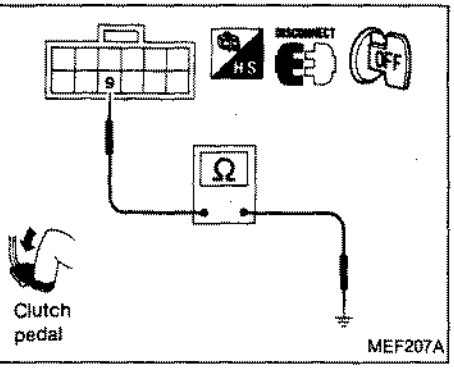
N.G. → Replace inhibitor switch.

O.K.

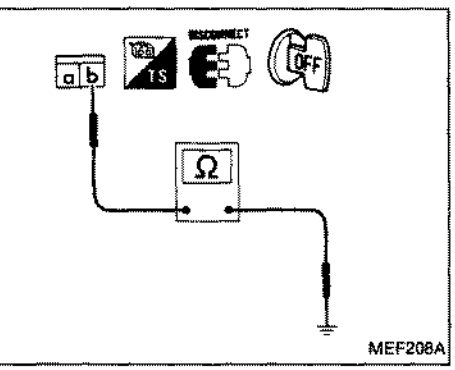
Check E.C.U. pin terminals for damage or connection of E.C.U. harness connector.

Diagnostic Procedure 19 (Cont'd)

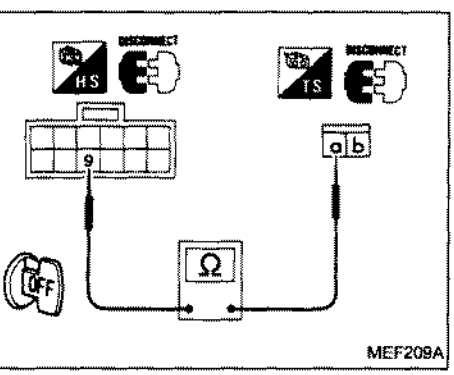
G



H



I



Clutch switch

INSPECTION START

G

CHECK OVERALL FUNCTION.
1) Set shift lever to any position except the neutral position.
2) Disconnect E.C.U. harness connector.
3) Depress clutch pedal.
4) Check harness continuity between E.C.U. terminal ⑨ and body ground.
Continuity should exist.

O.K. → INSPECTION END

N.G.

H

CHECK GROUND CIRCUIT.
1) Disconnect clutch switch harness connector.
2) Check harness continuity between terminal ⓑ and body ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

I

CHECK INPUT SIGNAL CIRCUIT.
1) Check harness continuity between E.C.U. terminal ⑨ and terminal ⓐ.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (F53), (R57)
- Harness continuity between E.C.U. and clutch switch

If N.G., repair harness or connectors.

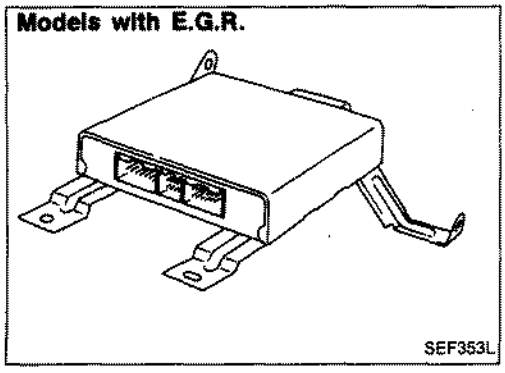
O.K.

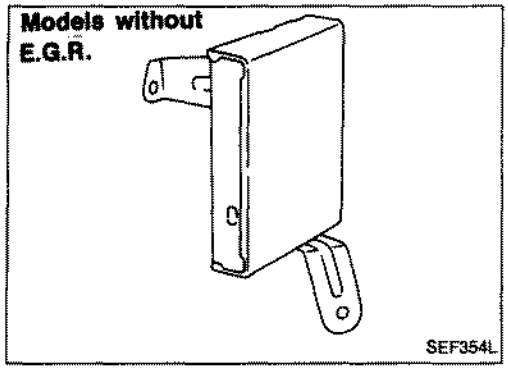
CHECK COMPONENT (Clutch switch).
Refer to "Electrical Components Inspection".
(See page EF & EC-147.)

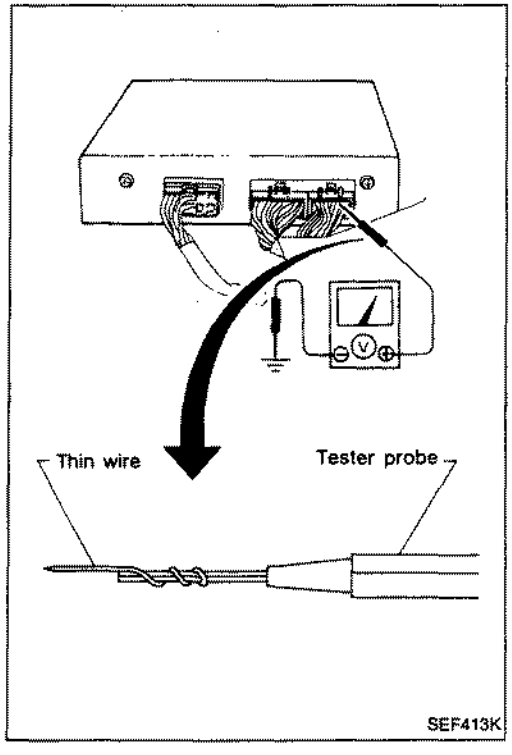
N.G. → Replace clutch switch.

O.K.

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







Electrical Components Inspection

E.C.C. CONTROL UNIT INPUT/OUTPUT SIGNAL INSPECTION

1. Models with E.G.R.:
   E.C.C. control unit is located behind center console. For this inspection, remove center console under cover.

   Models without E.G.R.:
   E.C.C. control unit is located at dash side. For this inspection, remove dash side finisher.

2. Perform all voltage measurements with the connectors connected. Extend tester probe as shown to perform tests easily.

Electrical Components Inspection (Cont'd)

E.C.U. INSPECTION TABLE — Models without E.G.R.

*Data are reference values.

1	F.I.C.D. control solenoid valve	Engine is running. - Idle speed - Air conditioner switch "ON"	Approximately 0V
		Engine is running. - Idle speed - Air conditioner switch "OFF"	BATTERY VOLTAGE (11 - 14V)
2	Exhaust gas sensor	Engine is running. - After warming up sufficiently	0 - Approximately 1.0V
4	Inhibitor/Neutral/Clutch switch	Ignition switch "ON" - Selector lever is in "N" or "P" position. - Shift lever is in neutral position. - Clutch pedal is depressed.	Approximately 0V
		Ignition switch "ON" - Except the above condition.	Approximately 8V
5	Headlamp switch	Ignition switch "ON" - Lighting switch "ON"	BATTERY VOLTAGE (11 - 14V)
		Ignition switch "ON" - Lighting switch "OFF"	Approximately 0V
6	Throttle valve switch	Ignition switch "ON" - Accelerator pedal is depressed.	Approximately 8V
		Ignition switch "ON" - Accelerator pedal is fully released.	Approximately 0V
7	Vacuum switch	Engine is running. - Idle speed	Approximately 8V
		Engine is running. - Accelerator pedal is quickly depressed.	Approximately 0V
8	Engine temperature sensor	Engine is running.	0 - 5.0V Output voltage varies with engine temperature.
9	Radiator fan relay	Engine is running. - Radiator fan motor is operating.	BATTERY VOLTAGE (11 - 14V)
		Engine is running. - Radiator fan motor is not operating.	Approximately 0V

Electrical Components Inspection (Cont'd)

*Data are reference values.

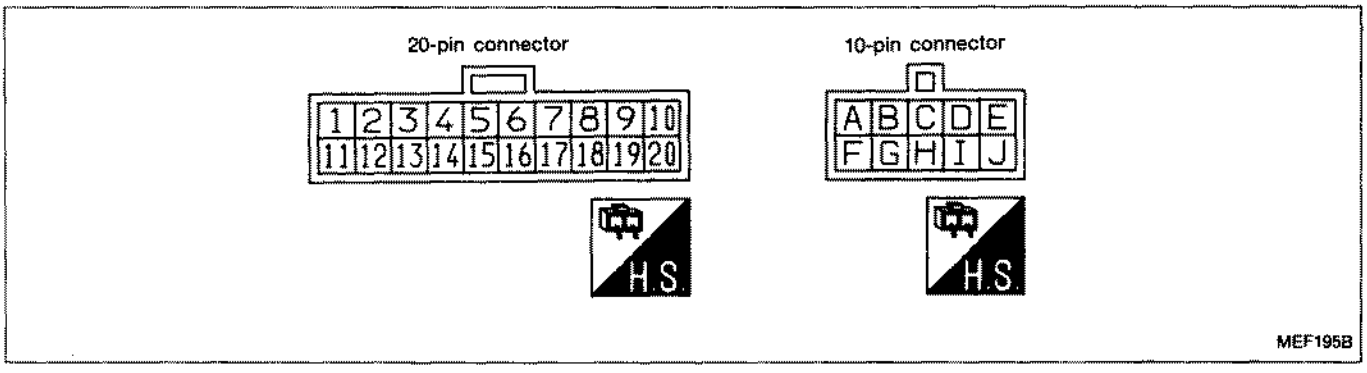
14	Rear window defogger switch	Ignition switch "ON" └Rear window defogger switch "ON"	BATTERY VOLTAGE (11 - 14V)
		Ignition switch "ON" └Rear window defogger switch "OFF"	Approximately 0V
15	Fan switch	Ignition switch "ON" └Fan switch "ON"	Approximately 0V
		Ignition switch "ON" └Fan switch "OFF"	BATTERY VOLTAGE (11 - 14V)
17	Power steering oil pressure switch	Ignition switch "ON" └Steering wheel is being turned.	BATTERY VOLTAGE (11 - 14V)
		Ignition switch "ON" └Except the above condition.	Approximately 0V
19	Air conditioner switch	Engine is running. └Both air conditioner switch and fan switch "ON"	BATTERY VOLTAGE (11 - 14V)
		Engine is running. └Air conditioner switch "OFF"	Approximately 0V
C	Idle-up control solenoid valve	Engine is running. ├After warming up └Idle speed	BATTERY VOLTAGE (11 - 14V)
		Engine is running. └Idle speed ├Lighting switch "ON" ├Rear window defogger switch "ON" ├Fan switch "ON" ├Air conditioner switch "ON" ├Power steering switch "ON" ├Radiator fan motor is operating. └Engine temperature is below 65°C (149°F).	Approximately 0.8V
F	Air-fuel ratio control solenoid valve	Engine is running.	Approximately 0 - 8V
G	Fuel cut solenoid valve	Engine is running. ├After warming up └Idle speed	Approximately 0V
		Engine is running. ├After warming up └Engine speed is decelerated from 5,000 rpm to idle.	BATTERY VOLTAGE (11 - 14V)
H	Power source	Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)

Electrical Components Inspection (Cont'd)

*Data are reference values.

J	Accelerator pump control solenoid valve	Engine is running. └Engine is cold and at idle.	Approximately 0.8V
		Engine is running. └Except the above condition.	BATTERY VOLTAGE (11 - 14V)

E.C.U. HARNESS CONNECTOR TERMINAL LAYOUT



Electrical Components Inspection (Cont'd)

E.C.U. INSPECTION TABLE — Models with E.G.R.

*Data are reference values.

1	Start signal	Ignition switch "ON"	Approximately 0V
		Ignition switch "START"	BATTERY VOLTAGE (11 - 14V)
2	Rear window defogger switch Headlamp switch (Models with daytime light system)	Ignition switch "ON" - Rear window defogger switch "ON" - Headlamp switch "ON"	BATTERY VOLTAGE (11 - 14V)
		Ignition switch "ON" - Except the above condition.	Approximately 0V
3	Fan switch	Ignition switch "ON" - Fan switch "ON"	Approximately 0V
		Ignition switch "ON" - Fan switch "OFF"	BATTERY VOLTAGE (11 - 14V)
4	Radiator fan relay	Ignition switch "ON" - Radiator fan motor is operating.	BATTERY VOLTAGE (11 - 14V)
		Ignition switch "ON" - Radiator fan motor is not operating.	Approximately 0V
5	Air conditioner switch	Engine is running. - Both air conditioner switch and blower fan switch "ON"	BATTERY VOLTAGE (11 - 14V)
		Engine is running. - Air conditioner switch "OFF"	Approximately 0V
9	Inhibitor/Neutral/clutch switch	Ignition switch "ON" - Selector lever is in "N" or "P" position. - Shift lever is in neutral position. - Clutch pedal is depressed.	Approximately 0V
		Ignition switch "ON" - Except the above condition.	Approximately 5V
15	Power steering oil pressure switch	Ignition switch "ON" - Steering wheel is being turned.	Approximately 0V
		Ignition switch "ON" - Except the above condition.	Approximately 11V
16	Throttle valve switch (Idle position)	Engine is running. - Accelerator pedal is depressed.	BATTERY VOLTAGE (11 - 14V)
		Engine is running. - Accelerator pedal is fully released.	Approximately 0V

Electrical Components Inspection (Cont'd)

*Data are reference values.

18	Crank angle sensor (Reference signal)	Engine is running. └**Do not run engine at high speed under no-load.**	0.2 - 0.5V Output voltage varies slightly with engine speed.
19	Crank angle sensor (Position signal)	Engine is running. └**Do not run engine at high speed under no-load.**	2.5 - 2.7V Output voltage varies slightly with engine speed.
21	Exhaust gas sensor	Engine is running. └After warming up sufficiently.	0 - Approximately 1.0V
26	Ignition signal	Engine is running. └Idle speed	0.3 - 0.5V
		Engine is running. └Engine speed is 2,000 rpm	0.9 - 1.1V
30	Boost pressure sensor	Engine is running.	0 - 4V
31	Engine temperature sensor	Engine is running.	0 - 5.0V Output voltage varies with engine temperature.
101	Power source	Ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
103	Air-fuel ratio control solenoid valve	Engine is running.	Approximately 0 - 10V
104	Fuel cut solenoid valve	Engine is running. (Warmed-up) └Idle speed	Approximately 0V
		Engine is running. (Warmed-up) └Engine speed is decelerated from 3,000 rpm to idle.	BATTERY VOLTAGE (11 - 14V)
105	F.I.C.D. control solenoid valve	Engine is running. ├Idle speed └Air conditioner switch "ON"	Approximately 0.8V
		Engine is running. ├Idle speed └Air conditioner switch "OFF"	BATTERY VOLTAGE (11 - 14V)
106	E.G.R. & canister control solenoid valve	Engine is running. └Idle speed	Approximately 0.8V
		Engine is running. └E.G.R. system is operating.	BATTERY VOLTAGE (11 - 14V)

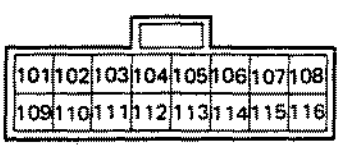
Electrical Components Inspection (Cont'd)

*Data are reference values.

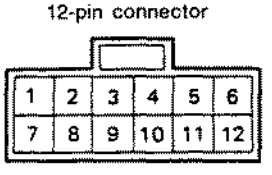
107	Mixture heater relay	Engine is running. └Engine is cold and at idle.	Approximately 0.8V
		Engine is running. └Except the above condition.	BATTERY VOLTAGE (11 - 14V)
108	Accelerator pump control solenoid valve	Engine is running. └Engine is cold and at idle.	Approximately 0.8V
		Engine is running. └Except the above condition.	BATTERY VOLTAGE (11 - 14V)
112	Idle-up control solenoid valve	Engine is running. ├After warming up └Idle speed	BATTERY VOLTAGE (11 - 14V)
		Engine is running. ├After warming up └Idle speed ├Headlamp is in high position. ├Radiator fan motor is operating. ├Rear defogger is "ON". ├Fan switch is "ON". └Power steering switch is "ON".	Approximately 0.8V
116	A.I.V. control solenoid valve	Engine is running. └During warm up	Approximately 0.8V
		Engine is running. └After warming up	BATTERY VOLTAGE (11 - 14V)

E.C.U. HARNESS CONNECTOR TERMINAL LAYOUT

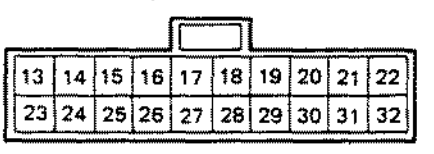
16-pin connector



12-pin connector



20-pin connector



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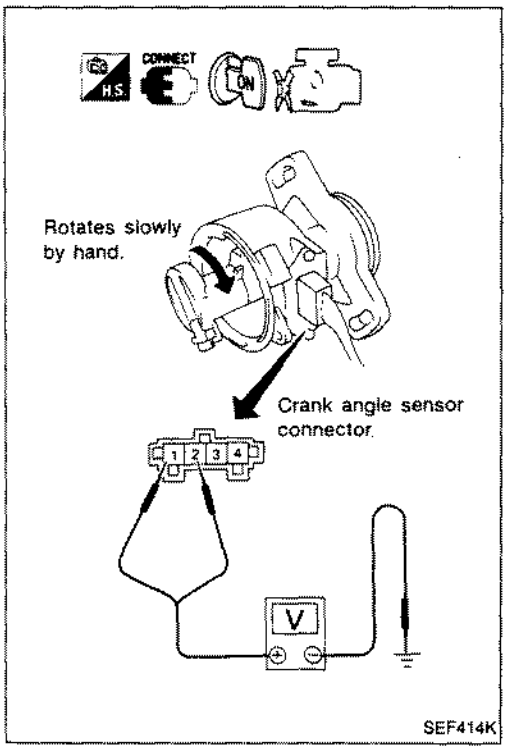
Electrical Components Inspection (Cont'd)

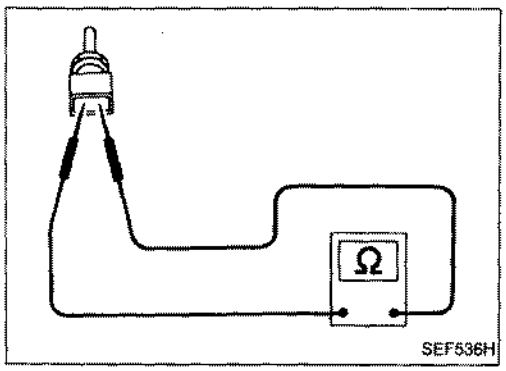


CRANK ANGLE SENSOR

1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Disconnect ignition wires.
3. Turn ignition switch "ON".
4. Rotate distributor shaft slowly by hand and check voltage between terminals ③, ④ and ground.

Terminal	Voltage
① (180° signal)	Tester's pointer fluctuates between 5V and 0V.
② (1° signal)	

If N.G., replace distributor assembly with crank angle sensor.

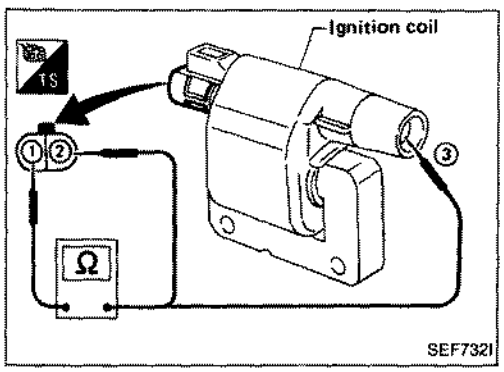


ENGINE TEMPERATURE SENSOR

1. Disconnect engine temperature sensor harness connector.
2. Check resistance as shown in the figure.

Temperature °C (°F)	Resistance kΩ
20 (68)	2.1 - 2.9
50 (122)	0.68 - 1.00
80 (176)	0.30 - 0.33

If N.G., replace engine temperature sensor.

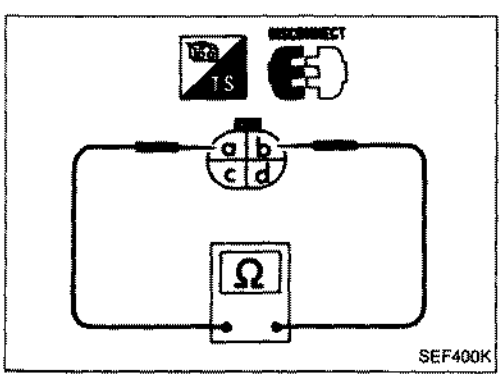


IGNITION COIL

1. Disconnect ignition coil harness connector.
2. Check resistance as shown in the figure.

Terminal	Resistance
① - ②	Approximately 0.9Ω
① - ③	Approximately 9.5 kΩ

If N.G., replace ignition coil.



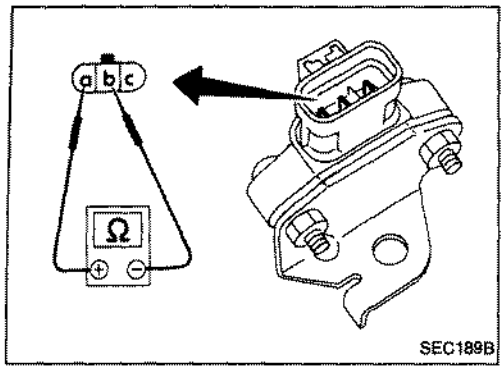
INHIBITOR SWITCH

Check continuity between terminals ⓐ and ⓑ.

Conditions	Continuity
Shift to "P" position	Yes
Shift to "N" position	Yes
Shift to position other than "P" and "N"	No

If N.G., replace inhibitor switch.

Electrical Components Inspection (Cont'd)



POWER TRANSISTOR

1. Disconnect power transistor harness connector.
2. Check power transistor continuity between terminals as shown in the illustration.

⊕ side: ⓐ
⊖ side: ⓑ
Resistance: ∞ Ω
N.G.
↓ O.K.

⊕ side: ⓐ
⊖ side: ⓒ
Resistance: ∞ Ω
N.G.
↓ O.K.

⊕ side: ⓑ
⊖ side: ⓐ
Resistance: Not ∞ or 0Ω
N.G.
↓ O.K.

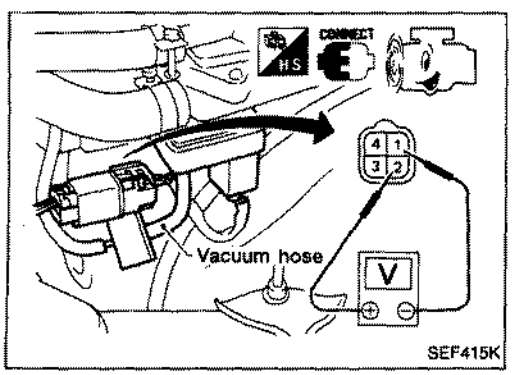
⊕ side: ⓑ
⊖ side: ⓒ
Resistance: Not ∞ or 0Ω
N.G.
↓ O.K.

⊕ side: ⓒ
⊖ side: ⓐ
Resistance: Not ∞ or 0Ω
N.G.
↓ O.K.

⊕ side: ⓒ
⊖ side: ⓑ
Resistance: Not ∞ or 0Ω
N.G.
↓ O.K.

INSPECTION END

→ Replace power transistor unit.



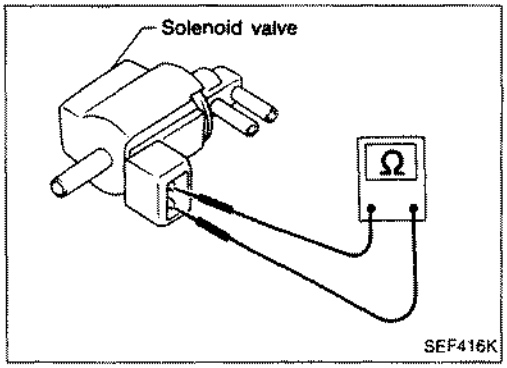
BOOST PRESSURE SENSOR

1. Turn ignition switch "ON".
2. Start engine.
3. Check voltage between ① and ②.

Condition	Voltage
Vacuum hose connected	Approximately 1.0V
Vacuum hose disconnected	Approximately 4.0V

If N.G., replace boost pressure sensor.

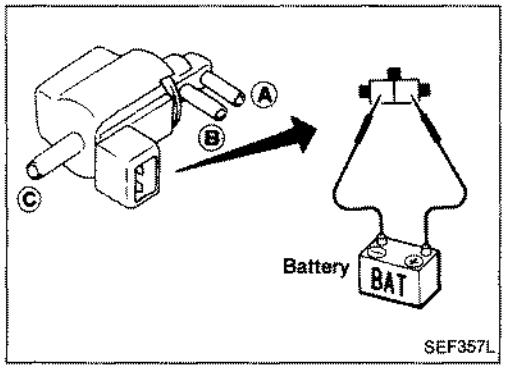
Electrical Components Inspection (Cont'd)



AIR INDUCTION CONTROL SOLENOID VALVE AND E.G.R. & CANISTER CONTROL SOLENOID VALVE

1. Check it for electric continuity.

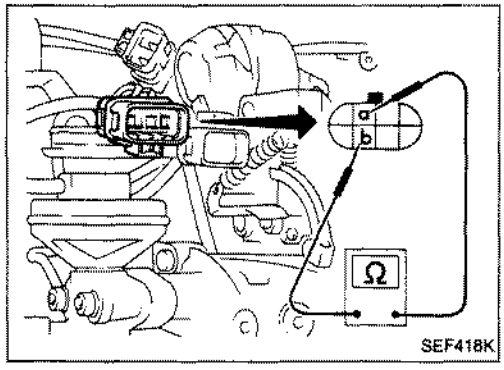
Continuity should exist.



2. Check the solenoid valve for normal operation. Supply it with battery voltage, and check whether there is continuity between ports Ⓐ, Ⓑ and Ⓒ as shown below.

Item \ Solenoid valve	OFF	ON
Continuity	Ⓑ-Ⓒ	Ⓐ-Ⓑ

If N.G., replace air induction control solenoid valve.

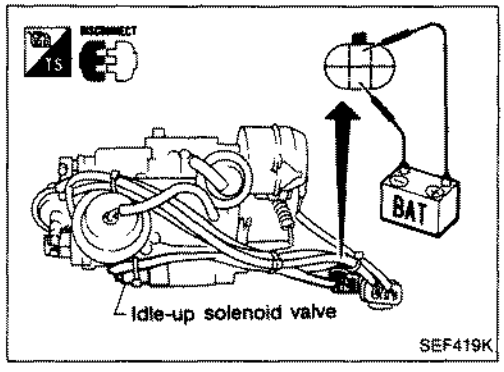


THROTTLE VALVE SWITCH

1. Disconnect throttle valve switch connector.
2. Check continuity between terminals ⓐ and ⓑ.

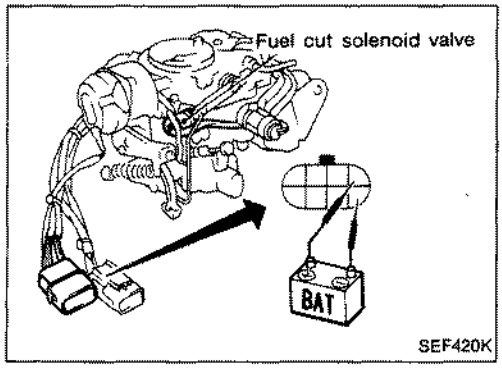
Accelerator pedal condition	Continuity
Released	No
Depressed	Yes

If N.G., replace throttle valve switch.



IDLE-UP CONTROL SOLENOID VALVE

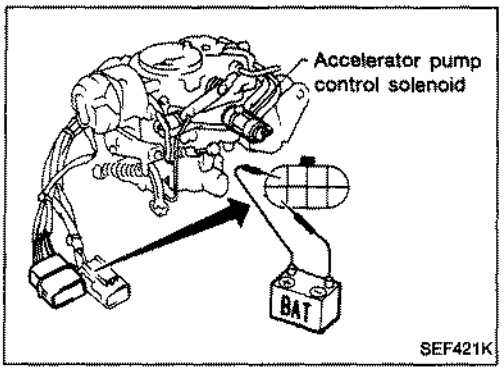
1. Disconnect solenoid harness connector.
2. Connect solenoid harness connector to battery.
3. Check "click" sound is heard from solenoid when battery is connected and disconnected.
   If N.G., replace idle-up solenoid.



FUEL CUT SOLENOID VALVE

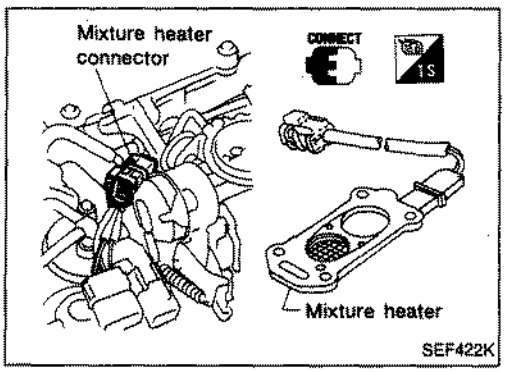
1. Disconnect solenoid harness connector.
2. Connect solenoid harness connector to battery.
3. Check "click" sound is heard from solenoid when battery is connected and disconnected.
   If N.G., replace fuel cut solenoid.

Electrical Components Inspection (Cont'd)



ACCELERATOR PUMP CONTROL SOLENOID VALVE

1. Disconnect solenoid harness connector.
2. Connect solenoid harness connector to battery.
3. Check "click" sound is heard from solenoid when battery is connected and disconnected.
   If N.G., replace accelerator pump control solenoid.

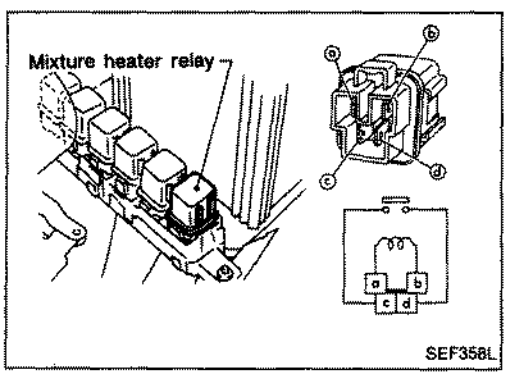


MIXTURE HEATER

1. Disconnect mixture heater harness connector.
2. Check resistance between terminals ⓐ and ⓑ.

Continuity should exist.

If N.G., replace mixture heater.

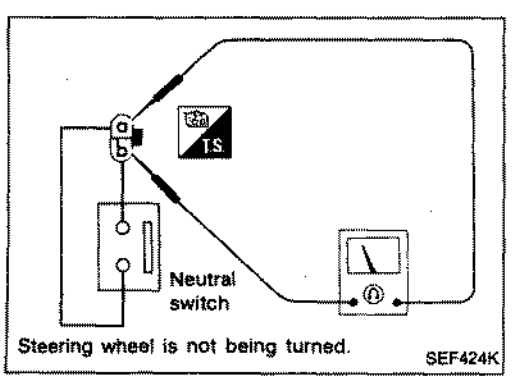


MIXTURE HEATER RELAY

1. Disconnect mixture heater relay.
2. Check continuity between terminals ⓒ and ⓓ as shown below.

Condition	Continuity between terminals ⓒ and ⓓ
12V direct current supplied between terminals ⓐ and ⓑ	Yes
No supply	No

If N.G., replace mixture heater relay.



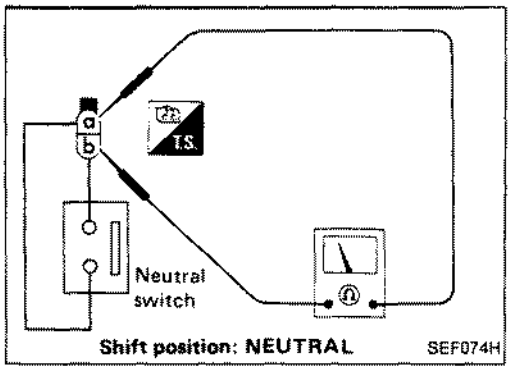
POWER STEERING OIL PRESSURE SWITCH

1. Disconnect power steering oil pressure switch harness connector.
2. Check continuity between terminals.

Condition	Continuity
Steering wheel is being turned	Yes
Steering wheel is not being turned	No

If N.G., replace power steering oil pressure switch.

Electrical Components Inspection (Cont'd)

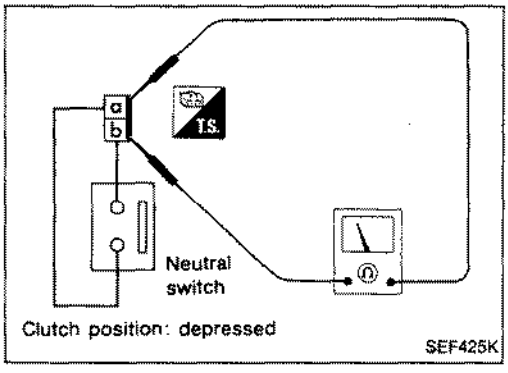


NEUTRAL SWITCH

1. Disconnect neutral switch harness connector.
2. Check continuity between terminals.

Condition	Continuity between terminals ⓐ and ⓑ
Shift to "Neutral"	Yes
Shift to other positions	No

If N.G., replace neutral switch.

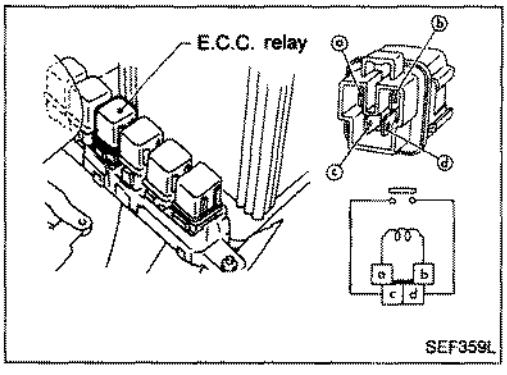


CLUTCH SWITCH

1. Disconnect clutch switch harness connector.
2. Check continuity between terminals.

Clutch position	Continuity between terminals ⓒ and ⓓ
Released	Yes
Depressed	No

If N.G., replace clutch switch.

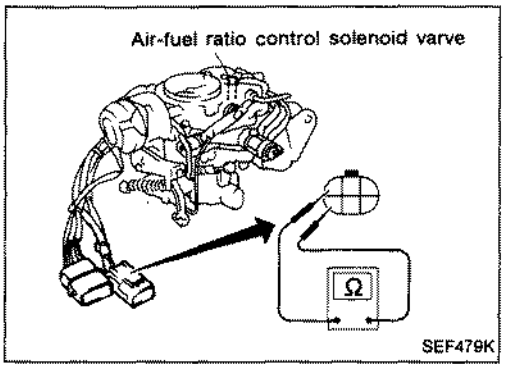


E.C.C. RELAY

1. Disconnect E.C.C. relay.
2. Check continuity between terminals ⓒ and ⓓ as shown below.

Condition	Continuity between terminals ⓒ and ⓓ
12V direct current supplied between terminals ⓐ and ⓑ	Yes
No supply	No

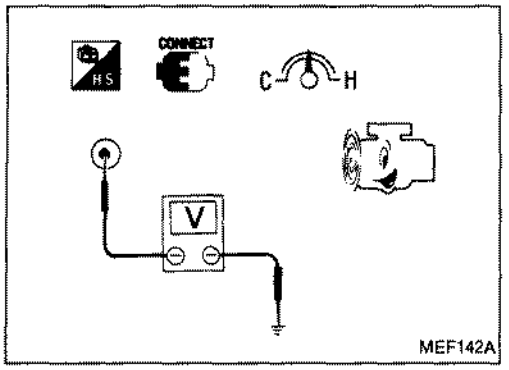
If N.G., replace E.C.C. relay.



AIR-FUEL RATIO CONTROL SOLENOID VALVE

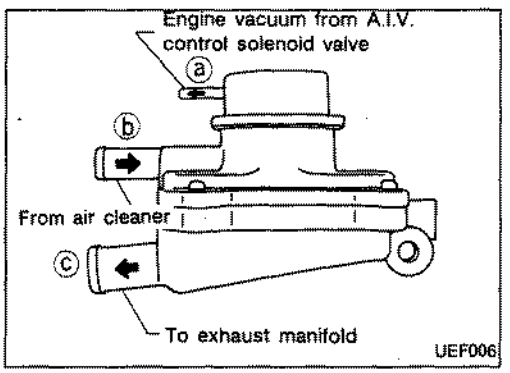
1. Disconnect solenoid harness connector.
2. Check continuity between terminals.
   If N.G., replace air-fuel ratio control solenoid valve.

Electrical Components Inspection (Cont'd)



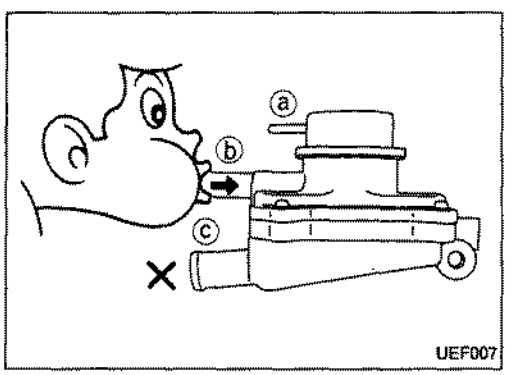
EXHAUST GAS SENSOR

1. Start engine and warm it up until water temperature indicator points to middle of gauge.
2. Run engine at about 2,000 rpm for about 2 minutes under no-load.
3. Check voltage between terminal ⓖ and ground. Make sure that needle of voltmeter fluctuates between approx. 0 and 1V, more than 5 times in 10 seconds at 2,000 rpm.
   If N.G., replace exhaust gas sensor.

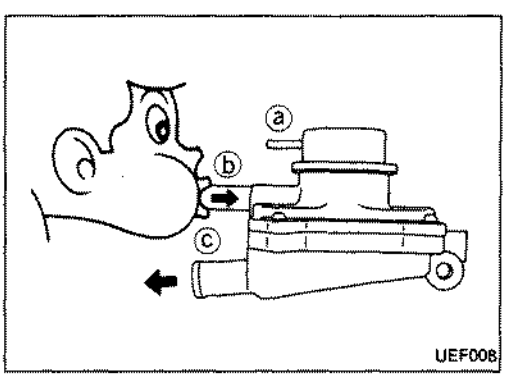


AIR INDUCTION VALVE (A.I.V.)

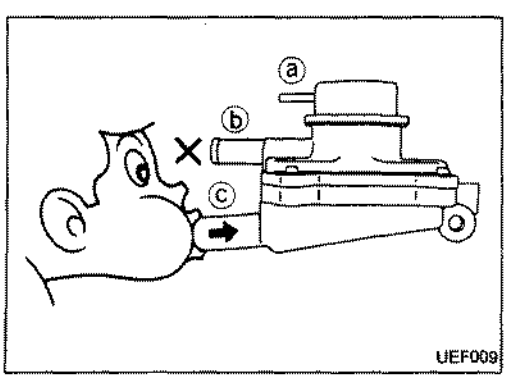
1. Disconnect vacuum hoses.
2. Check air flow between ⓑ and ⓒ in the following situations:



a. No vacuum at ⓐ.
   No air flow exists at ⓒ.

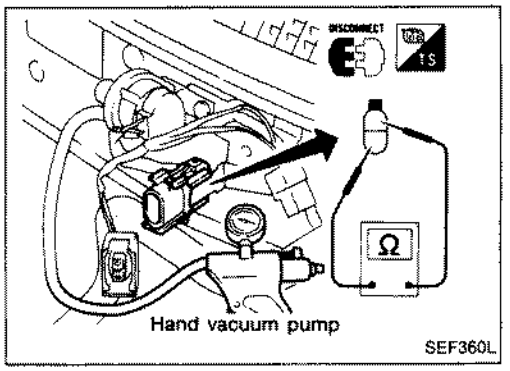


b. Vacuum at ⓐ.
   Air flow exists at ⓒ.



c. No air flow at ⓑ.
   With or without vacuum at ⓐ.

Electrical Components Inspection (Cont'd)

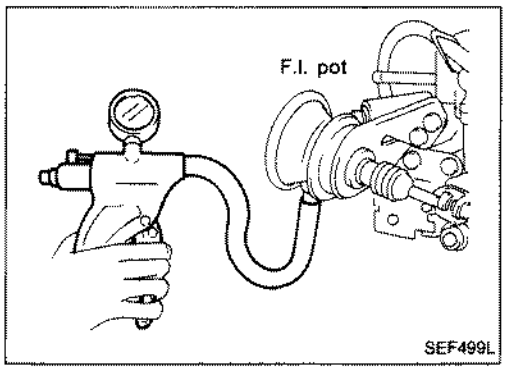


VACUUM SWITCH

1. Disconnect vacuum switch connector.
2. Check continuity between terminals.
3. Apply vacuum to vacuum switch port with a hand vacuum pump.

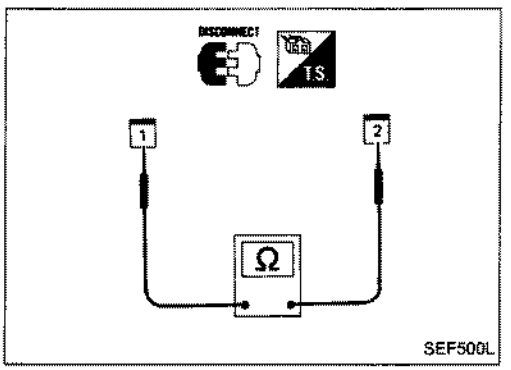
Applied vacuum –kPa (–bar, –mmHg, –inHg)	Continuity
Above 20.0 (200, 150, 5.91)	Yes
Below 20.0 (200, 150, 5.91)	No

If N.G. replace vacuum switch.



F.I. POT

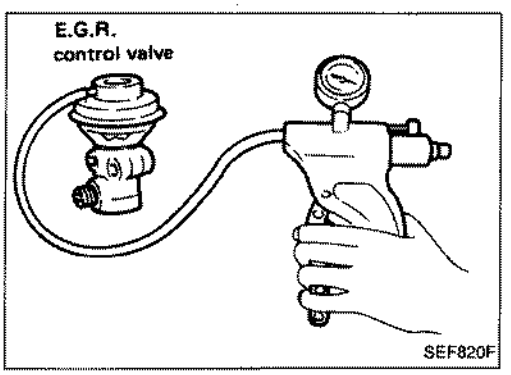
Apply vacuum to F.I. pot with a handy vacuum pump.
Rod of F.I. pot should pull out.



F.I.C.D. SOLENOID VALVE

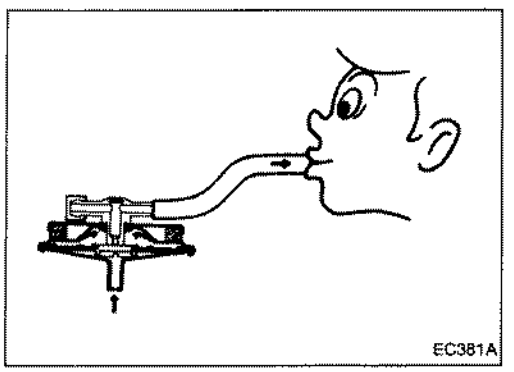
1. Disconnect F.I.C.D. harness connector.
2. Check continuity between terminals.

If N.G., replace F.I.C.D. solenoid valve.



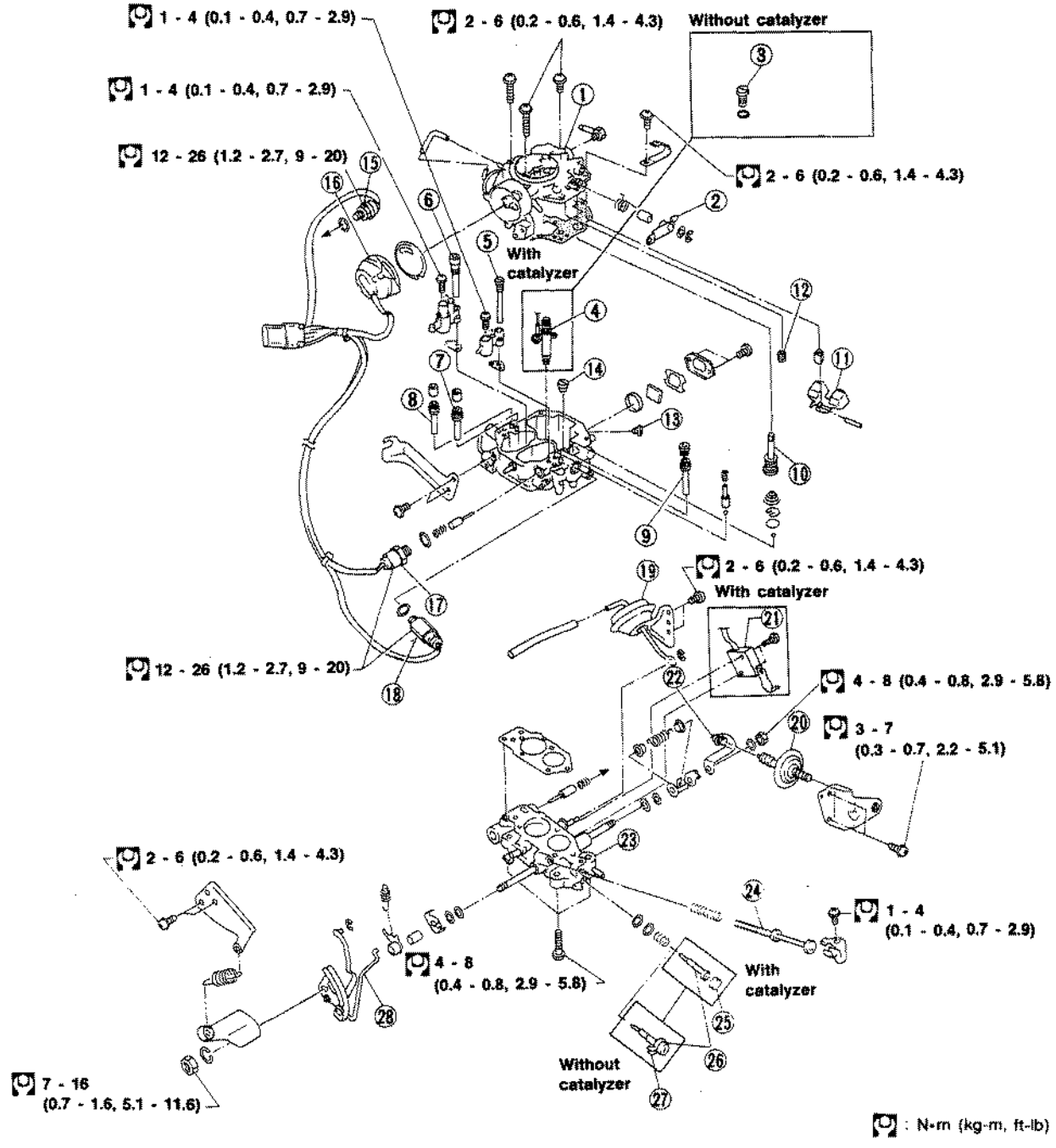
E.G.R. CONTROL VALVE

Apply vacuum to E.G.R. vacuum port with a hand vacuum pump.
E.G.R. control valve spring should lift.



B.P.T. VALVE

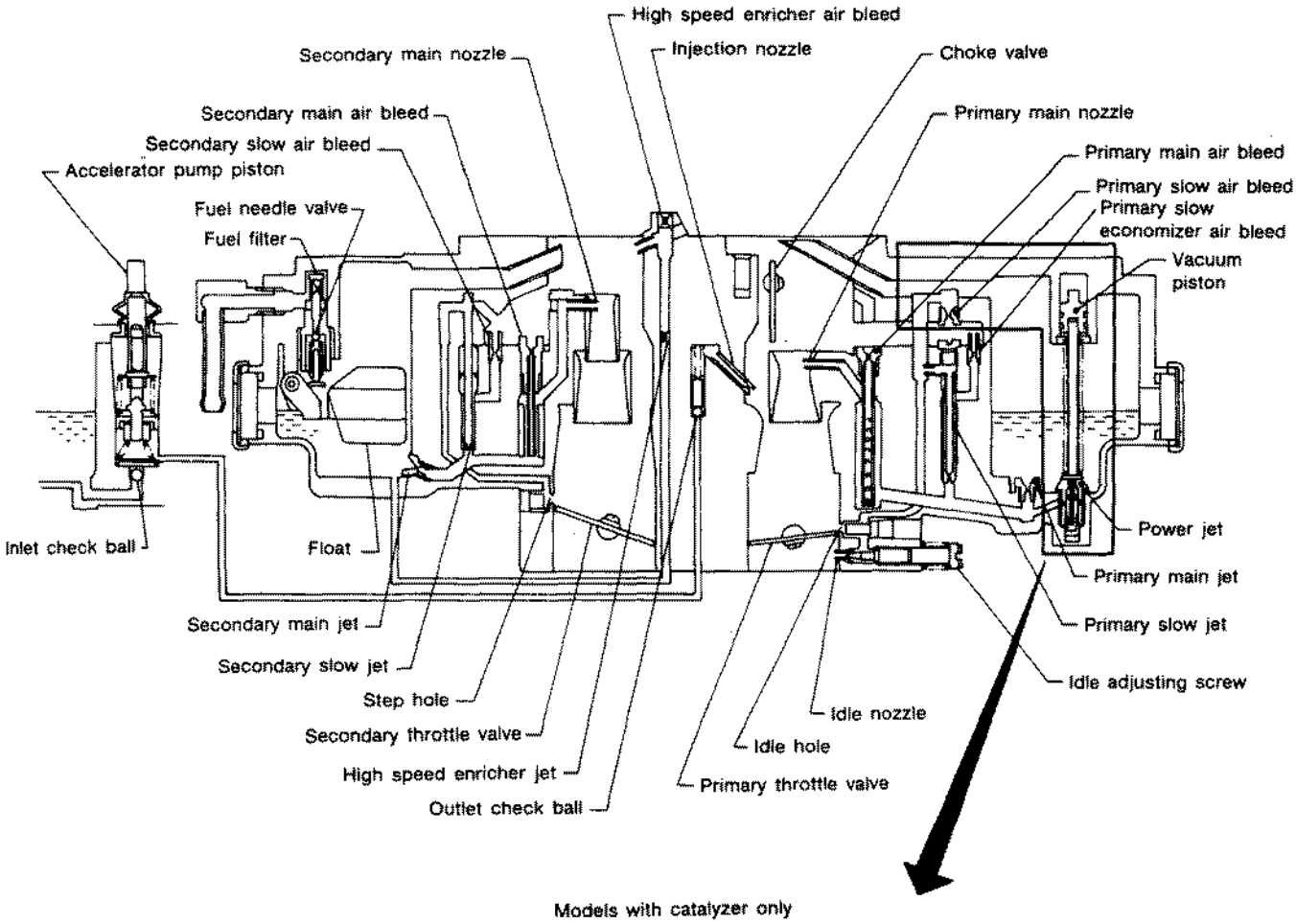
Plug one of two ports of B.P.T. valve.
Apply a pressure above 0.490 kPa (4.90 mbar, 50 mmH_2O, 1.97 in H_2O) to check for leakage. If a leak is noted, replace valve.



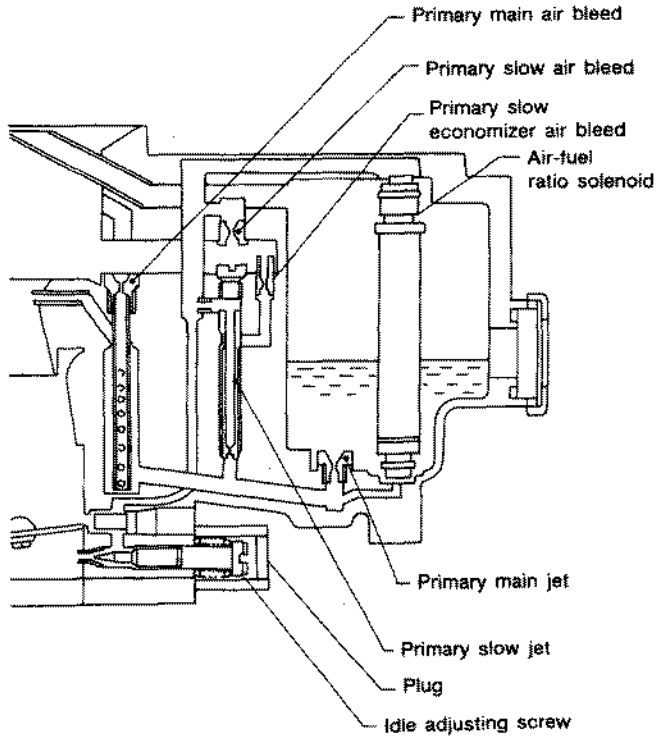
SEF820L

① Choke chamber
② Accelerator pump lever
③ Power jet
④ Air-fuel ratio control valve
⑤ Primary main air bleed
⑥ Secondary main air bleed
⑦ Secondary slow jet
⑧ Idle-up jet
⑨ Primary slow jet
⑩ Accelerator pump piston
⑪ Float
⑫ Primary slow air bleed
⑬ Secondary main jet
⑭ Primary main jet
⑮ Idle-up control solenoid
⑯ Auto-choke heater
⑰ Fuel cut solenoid
⑱ Accelerator pump control solenoid
⑲ Diaphragm for secondary system
⑳ Dash pot
㉑ Throttle valve switch
㉒ Dash pot adjusting screw
㉓ Throttle chamber
㉔ Throttle adjusting screw
㉕ Seal plug
㉖ Idle adjusting screw
㉗ Limiter cap
㉘ Accelerator pump connecting rod

Construction



Models with catalyzer only



SEF428K

Major Service Operation

The perfectly adjusted carburetor delivers the proper fuel and air ratios at all speeds for the particular engine for which it was designed.
The carburetor should be maintained in its original condition and will continue to deliver the proper ratios.
To maintain accurate carbureting through passages and discharge holes, extreme care must be taken in cleaning.
Use only carburetor solvent and compressed air to clean all passages and discharge holes. Never use wire or other pointed instrument to clean or carburetor calibration will be affected.

REMOVAL

Remove carburetor from engine, taking sufficient care to the following:

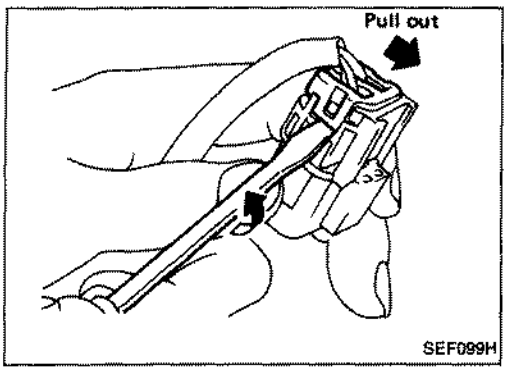
PRECAUTIONS:

a. **When disconnecting fuel lines, do not spill fuel from fuel pipe.**
b. **When removing carburetor, do not drop any nut or bolt into intake manifold.**
c. **Be careful not to bend or scratch any part.**

CLEANING AND INSPECTION

Dirt, gum, water or carbon contamination in or on exterior moving parts of a carburetor often results in unsatisfactory performance. For this reason, efficient carbureting depends upon careful cleaning and inspection while servicing.
Before assembling and installing the carburetor, blow all passages and castings with compressed air and blow off all parts until dry.

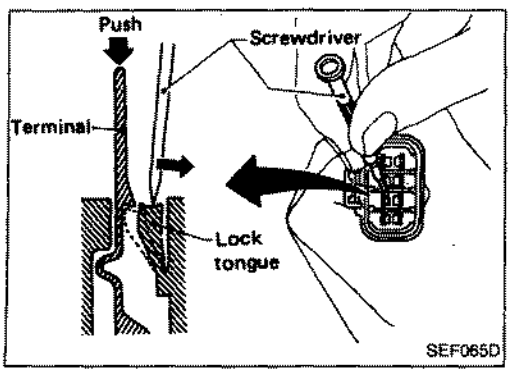
Do not pass drills or wires through calibrated jets or passages as this may enlarge orifice and seriously affect carburetor calibration.



Disassembling Carburetor Harness Connector

When replacing fuel cut solenoid, throttle valve switch, automatic choke heater (choke chamber assembly) idle-up solenoid, accelerator pump control solenoid or air-fuel ratio solenoid, it will be necessary to disassemble carburetor harness connector.

1. Remove rear clip.



2. With a small screwdriver, tilt lock tongue and, at the same time, push out terminal.

CAUTION:

- **When extracting terminal, do not pull wire harness. Always push the top of terminal.**
- **Take care not to damage seal boot at the bottom of terminal.**
- **Do not let oil or gasoline adhere to seal boot.**

Idle Speed and Mixture Ratio (Models with catalyzer and E.G.R.)

CAUTION:

a. Idle mixture ratio is adjusted at factory and requires no further adjustment. If it becomes necessary to adjust it, proceed with the following steps.
b. Do not attempt to screw the idle adjusting screw down completely. Doing so could cause damage to tip, which in turn will tend to cause malfunctions.
c. After adjusting idle speed and mixture ratio, be sure to check items below, and if necessary, adjust them.
   (1) Fast idle adjustment
   (2) Dash pot touch speed
   (3) Throttle valve switch operating speed

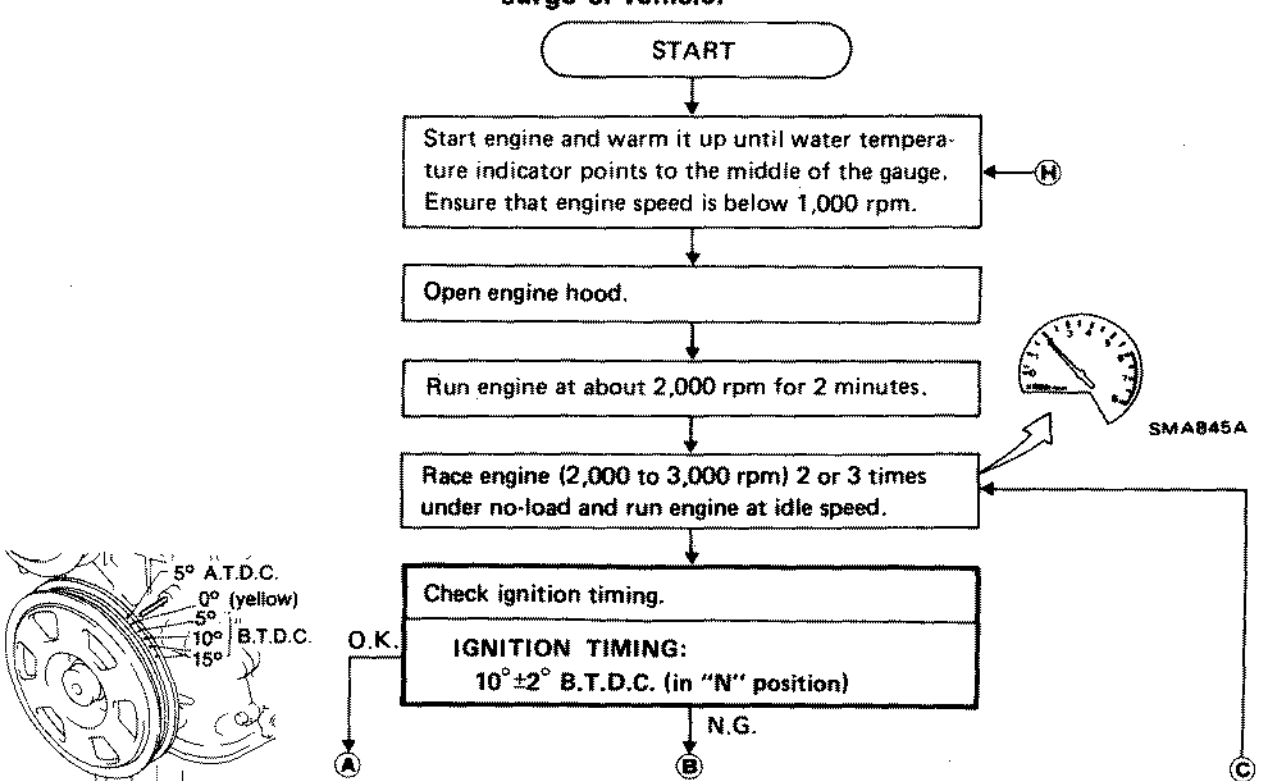
PREPARATION

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.)
- Engine compression
- E.G.R. control valve operation
- Throttle valve

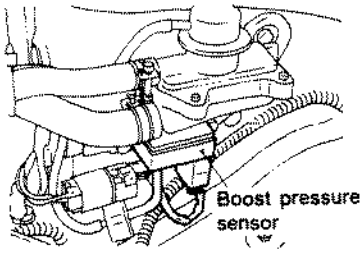
2. Turn off headlamps, heater blower and rear defogger.
3. Keep front wheels pointed straight ahead.
4. Make the check after the radiator fan has stopped.

WARNING:

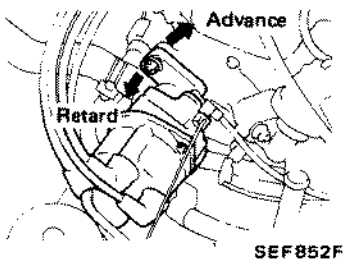
Depress brake pedal while racing the engine to prevent forward surge of vehicle.



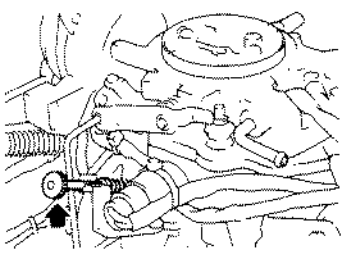
Idle Speed and Mixture Ratio (Models with catalyzer and E.G.R.) (Cont'd)

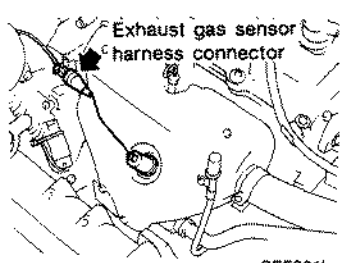


SEF298K

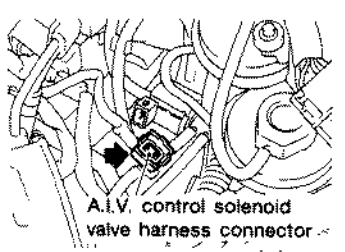


SEF852F

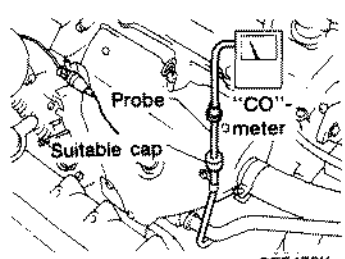

SEF468K



SEF361L



SEF362L



SEF470K

Disconnect boost pressure sensor vacuum hose and install blind plug to hose.

Loosen distributor securing bolt, and adjust ignition timing by turning distributor, until ignition timing is 2° B.T.D.C.
2° B.T.D.C. (GA16DS)
0° B.T.D.C. (GA14DS) (in "N" position)

Connect boost pressure sensor vacuum hose.

Race engine (2,000 to 3,000 rpm) 2 or 3 times under no-load and run engine at idle speed.


SMA845A

Check idle speed.

IDLE SPEED:
M/T: 750±50 rpm
A/T: 850±50 rpm (in "N" position)

O.K.

N.G.

Adjust idle speed by turning throttle adjusting screw.

O.K.

N.G.

Correct or replace carburetor. → (H)

Turn off engine and disconnect exhaust gas sensor harness connector and A.I.V. control solenoid valve harness connector. ← (G)

Remove test-take off plug and insert "CO" meter probe into test-take off tube sealing with a suitable cap.

Start engine.


SMA845A

Race engine (2,000 to 3,000 rpm) 2 or 3 times under no-load and run engine at idle speed. ← (I)

Check idle "CO"% (at test-take off)

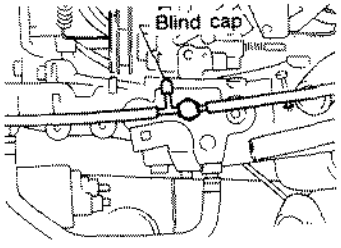
IDLE "CO"%:
1.0±0.5%

N.G. → (E)

O.K. → (D)

(A) (B) (C) (F)

Idle Speed and Mixture Ratio (Models with catalyzer and E.G.R.) (Cont'd)



SEF363L


SMA845A

Idle Speed and Mixture Ratio (Models with catalyzer without E.G.R.)

CAUTION:

a. Idle mixture ratio is adjusted at factory and requires no further adjustment. If it becomes necessary to adjust it, proceed with the following steps.
b. Do not attempt to screw the idle adjusting screw down completely. Doing so could cause damage to tip, which in turn will tend to cause malfunctions.
c. After adjusting idle speed and mixture ratio, be sure to check items below, and if necessary, adjust them.
   (1) Fast idle adjustment
   (2) Dash pot touch speed
   (3) Throttle valve switch operating speed

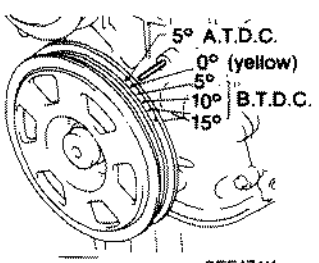
PREPARATION

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.)
- Engine compression
- E.G.R. control valve operation
- Throttle valve

2. Turn off headlamps, heater blower and rear defogger.
3. Keep front wheels pointed straight ahead.
4. Make the check after the radiator fan has stopped.

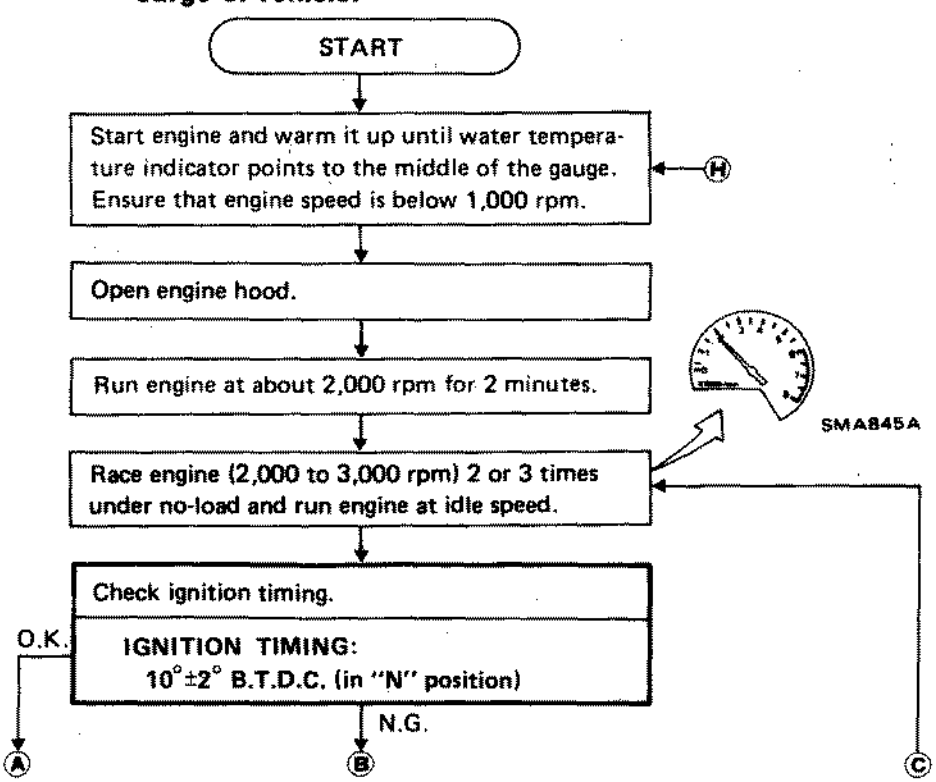
WARNING:

Depress brake pedal while racing the engine to prevent forward surge of vehicle.

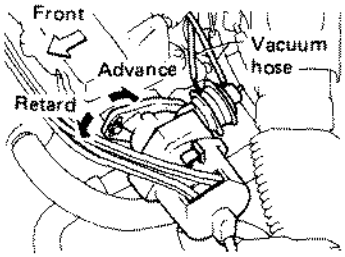


SEF471K

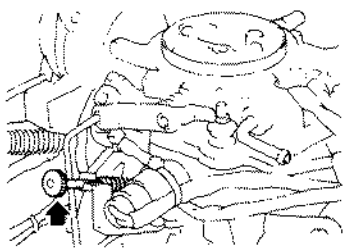
SMA845A

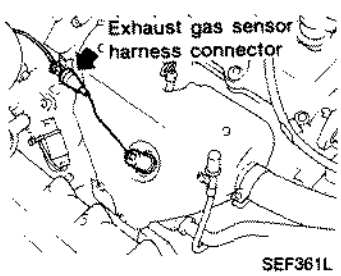


Idle Speed and Mixture Ratio (Models with catalyzer without E.G.R.) (Cont'd)

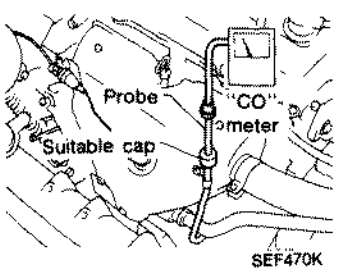


SMA060C


SEF468K



SEF361L



SEF470K

Ⓐ Ⓑ Ⓒ

Disconnect distributor vacuum hose on carburetor connector side and install blind plug to hose.

Loosen distributor securing bolt, and adjust ignition timing by turning distributor, until ignition timing is 0° B.T.D.C. (in "N" position)

Connect distributor vacuum hose to carburetor connector.

Race engine (2,000 to 3,000 rpm) 2 or 3 times under no-load and run engine at idle speed.


SMA845A

Check idle speed.

IDLE SPEED:
M/T: 750±50 rpm
A/T: 850±50 rpm (in "N" position)

O.K.

N.G.

Adjust idle speed by turning throttle adjusting screw.

O.K.

N.G.

Correct or replace carburetor. → Ⓗ

Turn off engine and disconnect exhaust gas sensor harness connector. ← Ⓖ

Remove test-take off plug and insert "CO" meter probe into test-take off tube sealing with a suitable cap.

Start engine.


SMA845A

Race engine (2,000 to 3,000 rpm) 2 or 3 times under no-load and run engine at idle speed. ← Ⓘ

Check idle "CO"% (at test-take off)

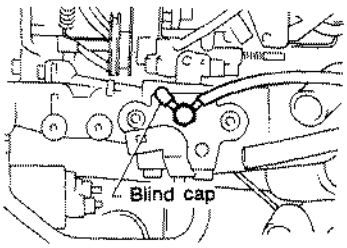
IDLE "CO"%:
1.0±0.5%

N.G. → Ⓔ

O.K. → Ⓓ

Ⓕ

Idle Speed and Mixture Ratio (Models with catalyzer without E.G.R.) (Cont'd)



SEF365L


SMA845A

Ⓓ

Does engine run smoothly?

YES

NO

Check the following.
- Vacuum hoses for proper connections
- Air leaks at carburetor mounting and intake manifold

O.K.

N.G.

Correct or replace malfunctioning parts.

Adjust idle mixture ratio by turning idle adjusting screw until idle "CO" 1.0±0.5% is obtained at test-take off tube and install idle mixture seal plug. (Refer to Idle Mixture Adjusting Procedure.)

O.K.

N.G.

Correct or replace carburetor.

Disconnect idle compensator vacuum hose from vacuum connector on intake manifold and install suitable blind cap to vacuum connector.
Check idle CO %
(at test-take off)

IDLE "CO" %
0.5 - 2.0 %

N.G.

O.K.

Reconnect idle compensator vacuum hose to vacuum connector.

Ⓘ

Turn off engine and connect exhaust gas sensor harness connector. Also reconnect idle compensator vacuum hose to vacuum connector.

Disconnect "CO"-meter probe and install cap on test-take off rube.

Start engine.

Race engine (2,000 to 3,000 rpm) 2 or 3 times under no-load, and run engine at idle speed.

Check idle speed.

IDLE SPEED:
M/T: 750±50 rpm
A/T: 850±50 rpm (in "N" position)

O.K.

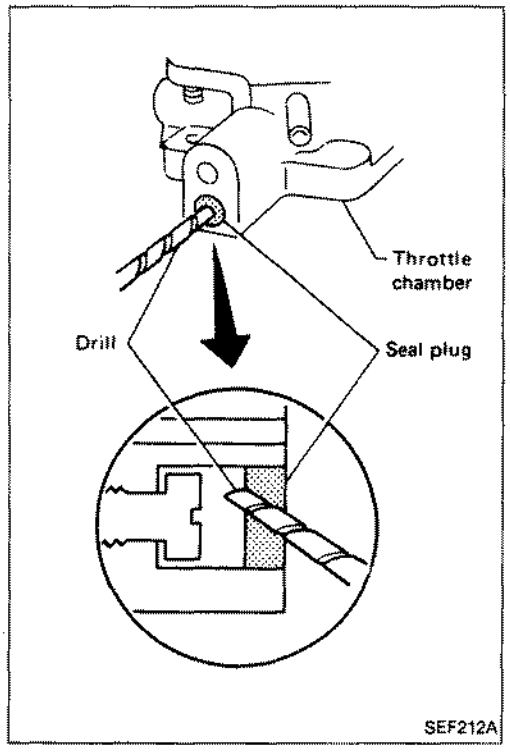
END

N.G.

Adjust idle speed by turning throttle adjusting screw.

IDLE SPEED:
M/T: 750±50 rpm
A/T: 850±50 rpm (in "N" position)

Ⓖ (on previous page)



Idle Mixture Adjusting Procedure (Models with catalyzer)

CAUTION:

a. Removal of idle adjusting screw seal plug should be performed only when idle mixture adjustment or carburetor overhaul is necessary.

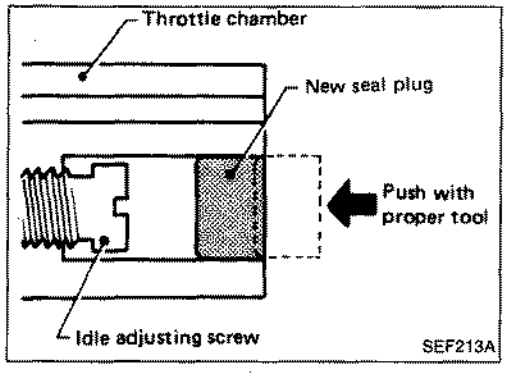
b. When installing carburetor, be sure to tighten nuts to specified torque.

1. Remove carburetor from engine.
2. Carefully drill idle adjusting screw seal plug and remove it from plug hole with suitable tool.

a. Be careful to prevent metal chips from entering carburetor, and be sure that sliding surface of link and shaft are not scratched.

b. When drilling seal plug, be careful not to damage head of idle adjusting screw.

3. After performing step 2, mount carburetor on engine.
4. Start engine, adjust idle RPM and adjust idle "CO"% by turning idle adjusting screw.
5. If proper idle "CO"% is not obtained by adjustment, turn off engine and overhaul carburetor or replace it with a new one. Then adjust idle "CO"% by turning idle adjusting screw.



6. After adjusting carburetor idle-rpm and mixture ratio, turn off engine and install new seal plug on carburetor.

7. Finally, check idle "CO"% again. If idle "CO"% is abnormal, readjust it by starting from step 4.

Checking and Adjusting Idle-rpm, Ignition Timing and Mixture Ratio (Models without catalyzer)

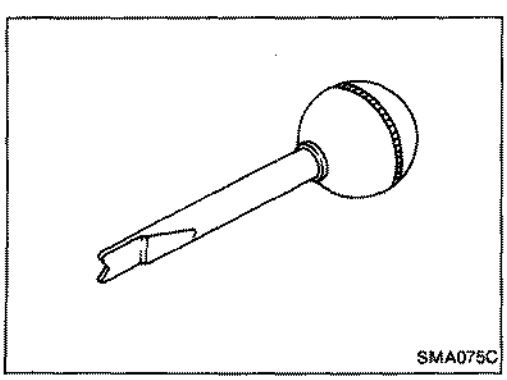
CAUTION

a. Idle mixture ratio is adjusted at factory and requires no further adjustment. If it becomes necessary to adjust it, proceed with the following steps.
b. Do not attempt to screw the idle adjusting screw down completely. Doing so could cause damage to tip, which in turn will tend to cause malfunctions.
c. After adjusting idle speed and mixture ratio, be sure to check items below, and if necessary, adjust them.
   (1) Fast idle adjustment
   (2) Dash pot touch speed

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.)
- Engine compression
- Throttle valve

2. On air conditioner equipped models, checks should be carried out while the air conditioner is "OFF".
3. When measuring "CO" percentage, insert probe more than 40 cm (15.7 in) into tail pipe.
4. Turn off headlamps, heater blower, rear defogger.
5. Keep front wheels pointed straight ahead.
6. Make the check after the radiator fan has stopped.


SMA075C

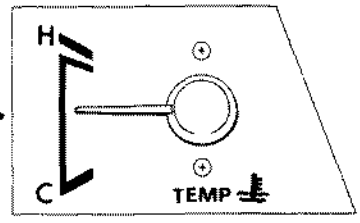
7. Use idle adjusting screwdriver when adjusting idle adjusting screw.

WARNING:
Depress brake pedal while racing the engine to prevent forward surge of vehicle.

Checking and Adjusting Idle-rpm, Ignition Timing and Mixture Ratio (Models without catalyzer) (Cont'd)

START

Start engine and warm it up until water temperature indicator points to normal operating temperature.

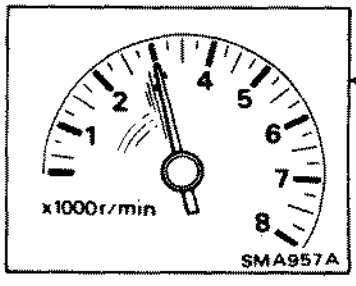


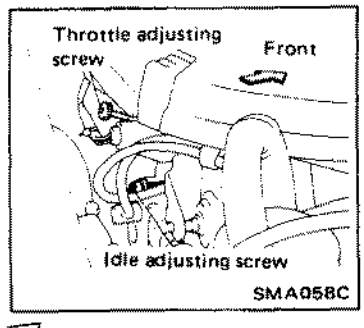
Open engine hood.

Run engine at idle speed for 2 minutes.

Disconnect distributor vacuum hose on carburetor connector side and install blind cap to connector.

Race engine (2,000 - 3,000 rpm) 2 or 3 times under no-load, and then run engine at idle speed.





Check idle speed.

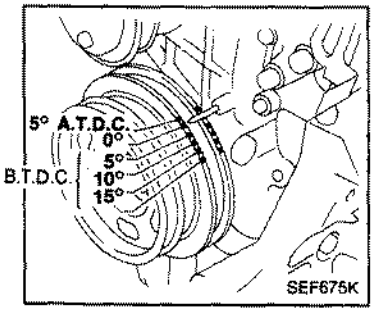
Idle speed:
Below 1,000 rpm

O.K. N.G.

Adjust idle speed by turning throttle adjusting screw.

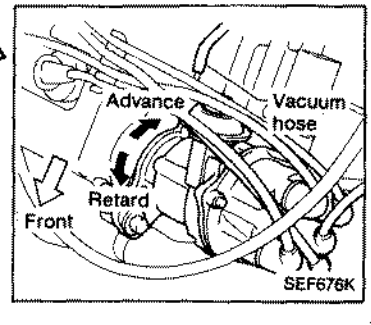
Check ignition timing at idle speed.

Ignition timing: degree B.T.D.C. (in "N" position)
GA13DS –2 ± 2
GA14DS 0 ± 2
GA16DS –3 ± 2, 2 ± 2*
***For Europe, Hong Kong, Singapore and Middle East**



O.K. N.G.

Adjust ignition timing by turning distributor.



Connect distributor vacuum hose to carburetor connector.

Ⓐ

Ⓑ

Checking and Adjusting Idle-rpm, Ignition Timing and Mixture Ratio (Models without catalyzer) (Cont'd)

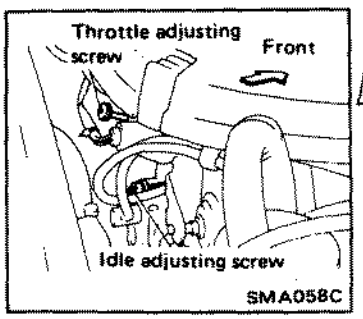
Ⓐ

Race engine (2,000 - 3,000 rpm) 2 or 3 times under no-load, and then run engine at idle speed.

Adjust idle speed by turning throttle adjusting screw.

Idle speed: rpm (in "N" position)

GA13DS	**M/T**	**750 ± 50**
GA14DS	**M/T**	**750 ± 50**
	A/T	**850 ± 50**
GA16DS	**M/T**	**750 ± 50**
	A/T	**850 ± 50**



Confirm ignition timing at idle speed.

Ignition timing: degree B.T.D.C. (In "N" position)
GA13DS 9 ± 5
GA14DS 10 ± 5
GA16DS 12 ± 5, 10 ± 5*
***For Europe, Hong Kong, Singapore and Middle East**

O.K. / N.G.

N.G. → Check distributor and vacuum hoses.

Check distributor and vacuum hoses. → Repair or replace distributor or vacuum controller.

Repair or replace distributor or vacuum controller. → Clean or replace vacuum hoses.

Clean or replace vacuum hoses. → Race engine (2,000 - 3,000 rpm) 2 or 3 times under no-load, and then run engine at idle speed.

O.K. → Without "CO"-meter → Ⓒ

O.K. → With "CO"-meter

With "CO"-meter → Check "CO"% at idle speed.

Idle "CO": %
1.5 ± 0.5

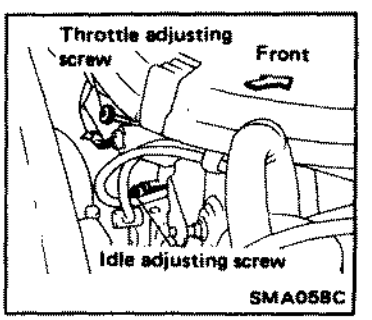
O.K. → Disconnect idle compensator vacuum hose from vacuum connector on intake manifold and install suitable blind cap to vacuum connector. Check idle "CO"%.

Idle "CO" %
1.0 - 2.5%

O.K. → Reconnect idle compensator vacuum hose to vacuum connector.

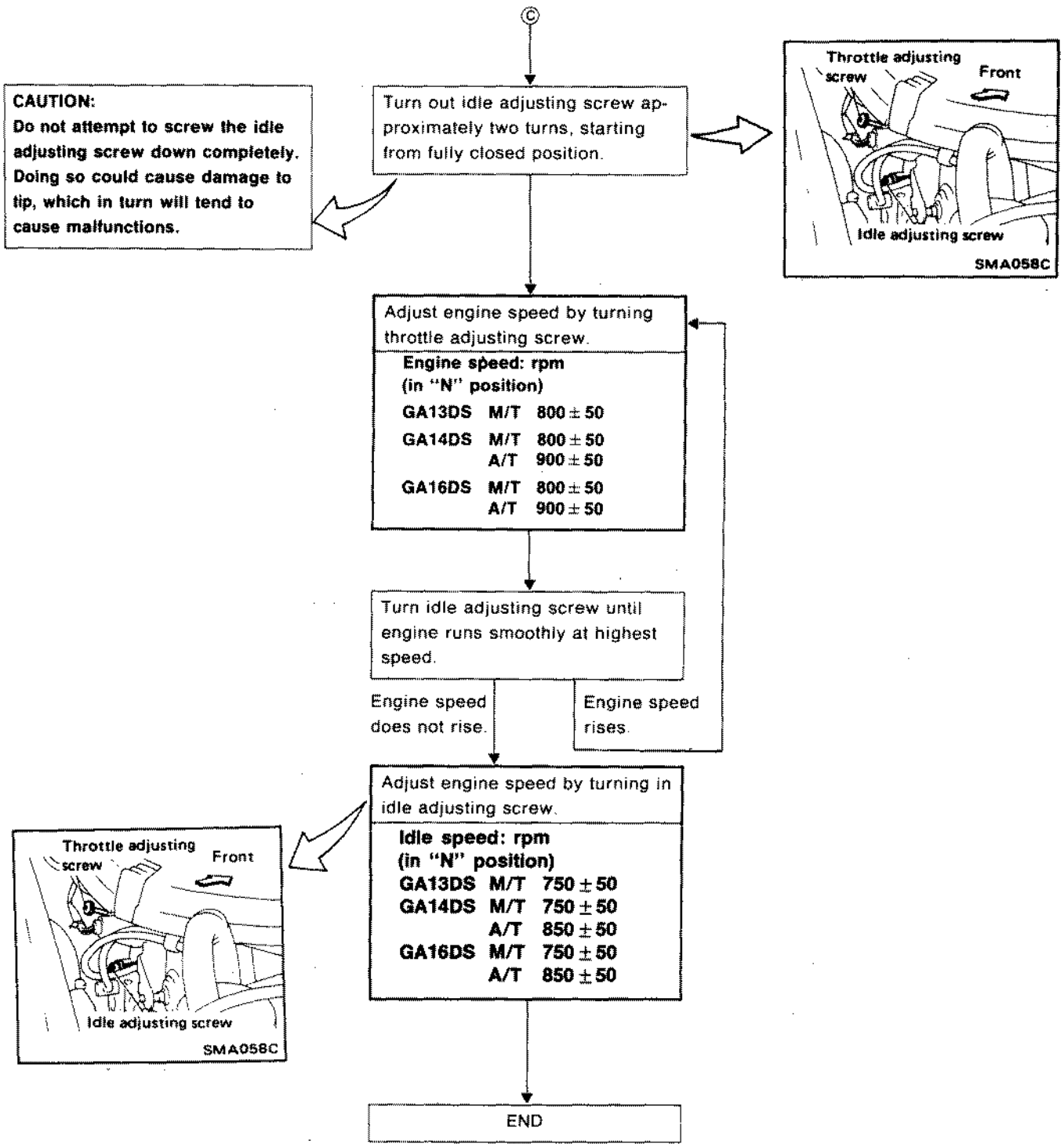
Reconnect idle compensator vacuum hose to vacuum connector. → END

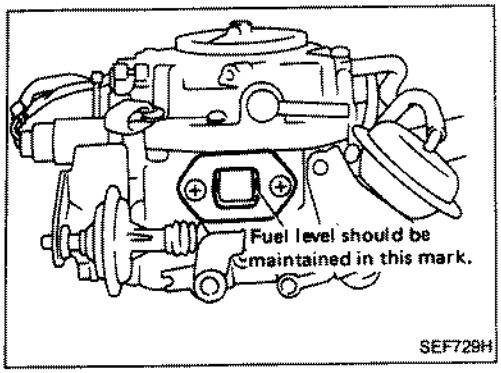
N.G. → Adjust idle "CO"% to 1.5 ± 0.5% by turning idle adjusting screw.



Adjust idle "CO"% to 1.5 ± 0.5% by turning idle adjusting screw. → Ⓑ

Checking and Adjusting Idle-rpm, Ignition Timing and Mixture Ratio (Models without catalyzer) (Cont'd)

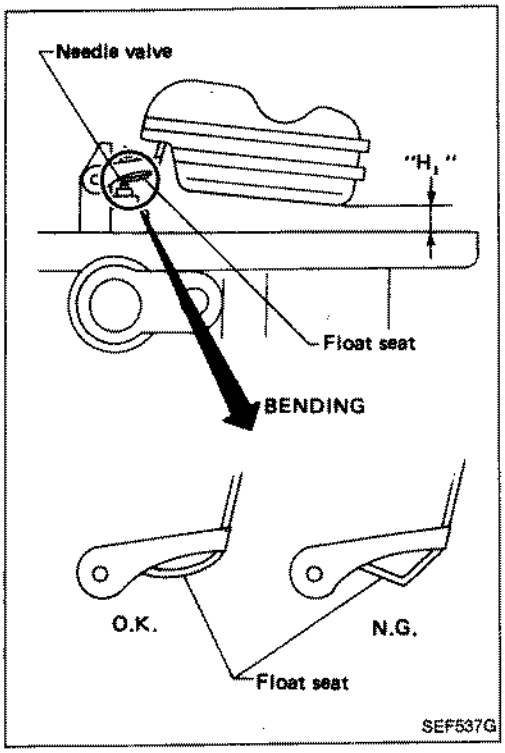




Fuel Level

INSPECTION

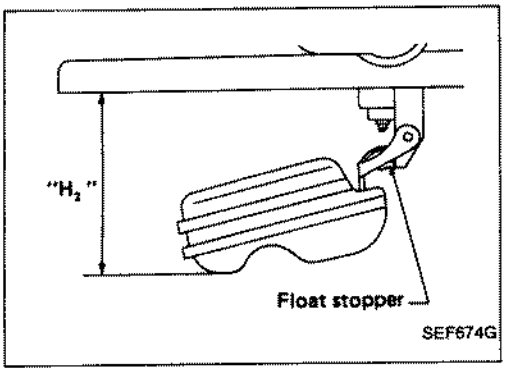
Place vehicle on a level surface. With engine idling, check fuel level.



ADJUSTMENT

1. Remove carburetor from engine.
2. Remove choke chamber from carburetor.
3. Turn choke chamber upside down, and fix it horizontally.
4. Raise float fully, then lower it slowly until float seat contacts needle valve, and in this position, check height "H_1".
   Height "H_1":
   9.5 - 10.5 mm (0.374 - 0.413 in)

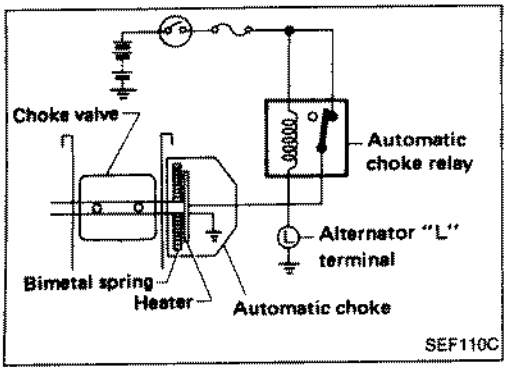
If out of specification, adjust by bending float seat. Make sure needle valve slides smoothly on float seat.



5. Lower float slowly until float stopper contacts carburetor, and in this position, check height "H_2".
   Height "H_2":
   43.0 - 44.0 mm (1.693 - 1.732 in)

If out of specification, adjust by bending float stopper.

6. Install choke chamber and then place carburetor on engine.
7. Perform "FUEL LEVEL INSPECTION".

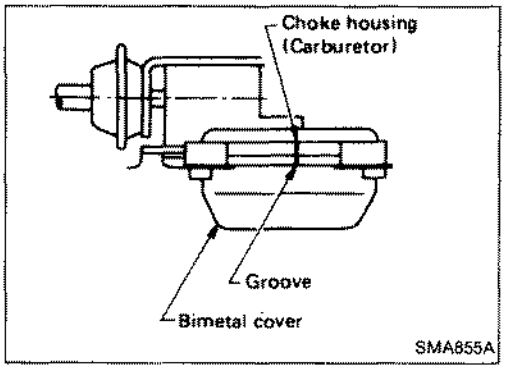


Automatic Choke

MECHANICAL CHECK

1. Before starting engine, fully open throttle valve and ensure that choke valve closes properly.
2. Push choke valve with your finger to check for smooth movement.

Automatic Choke (Cont'd)

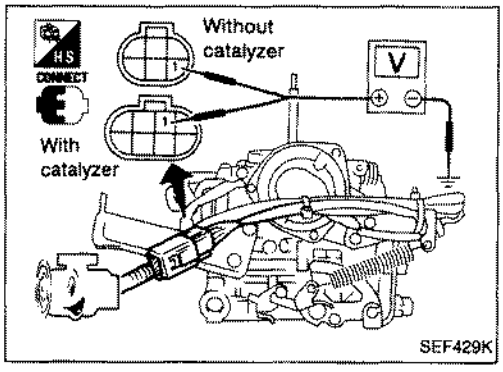


3. Make sure bimetal cover index mark is aligned with center of choke housing index mark.
4. Check wiring connection, and start engine.
5. After warming up engine, ensure that choke valve is fully open.
   If not, check automatic choke circuit and heater.

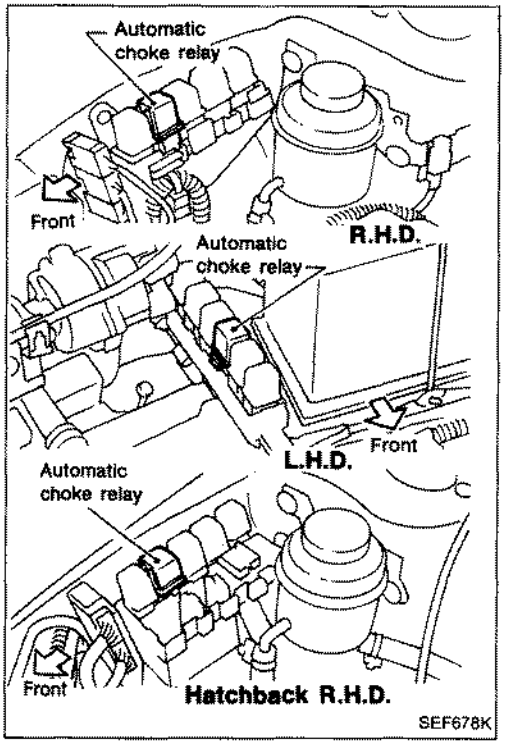
ENTIRE SYSTEM

Do not attach test leads of a circuit tester to those other than designated.

1. Start engine.



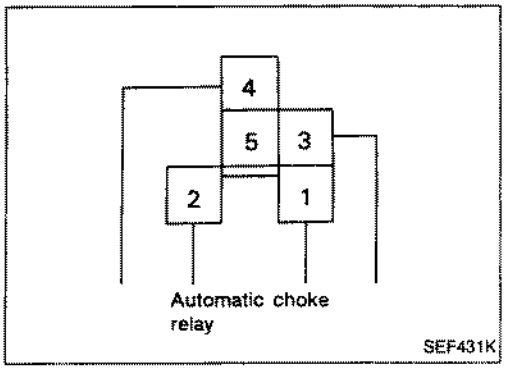
2. Check voltage between terminal ① and ground, with engine running.
   Voltage: Approximately 9 - 12V
   If no voltage appears, check the following items.
   - Automatic choke relay
   - Automatic choke circuit
   - Fuse



AUTOMATIC CHOKE RELAY

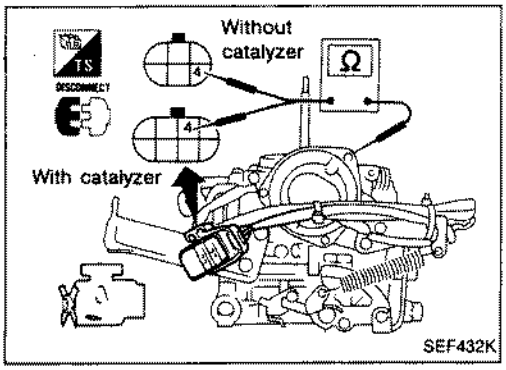
Check relay for proper operation.

Automatic Choke (Cont'd)



AUTOMATIC CHOKE CIRCUIT

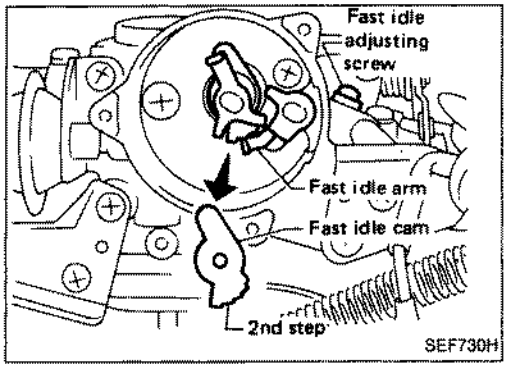
1. Disconnect automatic choke relay and then connect a suitable jumper wire between terminals ① and ④.
2. Check resistance between connector terminal ② and fuse.
   Resistance: Approximately 0Ω
   If N.G., check or repair the harness.



AUTOMATIC CHOKE HEATER

1. Disconnect carburetor harness connector.
2. Check for continuity between choke heater connector terminal ④ and choke housing.

Continuity should exist.



Fast Idle (Automatic choke model)

1. Warm up engine. Set fast idle arm on 2nd step of fast idle cam.
2. Check fast idle speed.

Fast idle speed (at 2nd cam step):

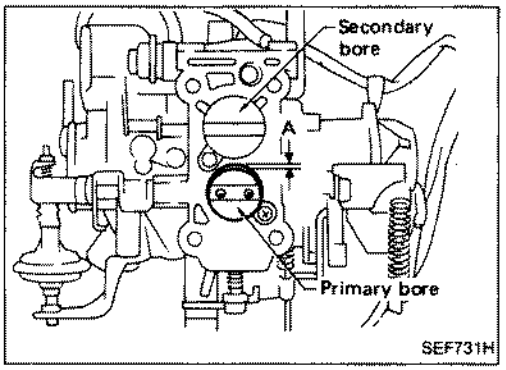
Unit: rpm

	M/T	A/T
GA13DS and GA14DS	2,400 ± 200, 2,200 ± 200*	2,700 ± 200, 2,500 ± 200*
GA16DS	2,100 ± 200	2,400 ± 200

* Models with catalyzer

Make sure that engine is completely adjusted (idle rpm, ignition timing, etc.) before checking or adjusting fast idle speed.

Fast Idle (Automatic choke model) (Cont'd)



3. If out of specification, remove carburetor and make fast idle adjustments as follows:

1) Place fast idle arm on 2nd step of fast idle cam, in the same manner as in step 1. above.
2) Adjust clearance "A" between primary throttle valve and inner carburetor wall by turning fast idle adjusting screw.

Clearance "A":

GA13DS & GA14DS

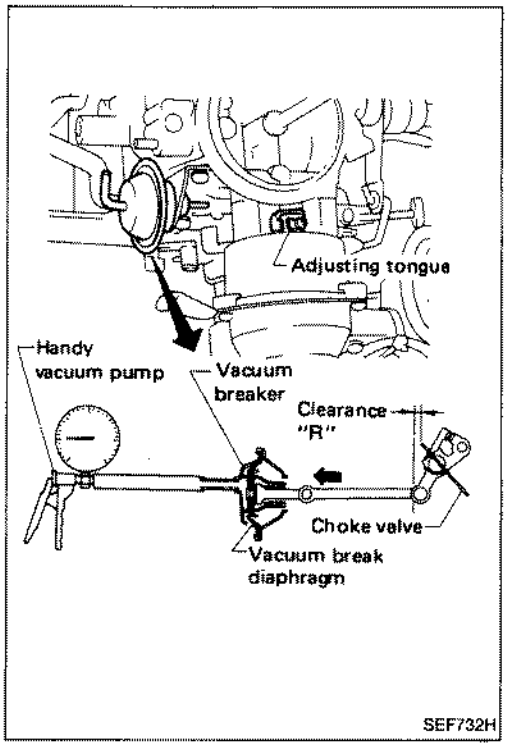
M/T 0.62 ± 0.07 mm (0.0244 ± 0.0028 in),
0.59 ± 0.07 mm (0.0232 ± 0.0028 in)*
A/T 0.79 ± 0.07 mm (0.0311 ± 0.0028 in),
0.75 ± 0.07 mm (0.0295 ± 0.0028 in)*
*** For models with catalyzer**

GA16DS

M/T 0.59 ± 0.07 mm (0.0232 ± 0.0028 in)
A/T 0.75 ± 0.07 mm (0.0295 ± 0.0028 in)

4. After adjusting clearance "A", install carburetor on engine and check engine speed.

Following installation, do not attempt further adjustment of clearance "A" even if fast idle speed is incorrect.

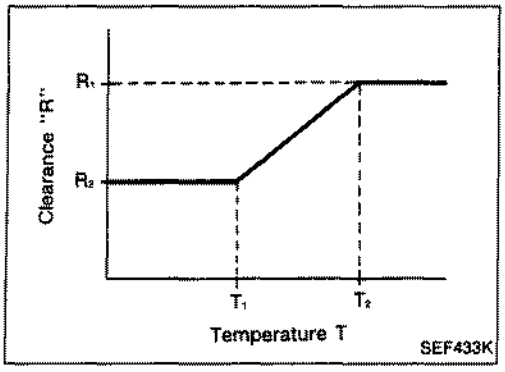


Vacuum Break

1. When engine is cold, close choke valve completely.
2. Apply vacuum to vacuum break diaphragm with a handy vacuum pump.

Approximately –53.3 kPa
(–533 mbar, –400 mmHg, –15.75 inHg)

Vacuum Break (Cont'd)

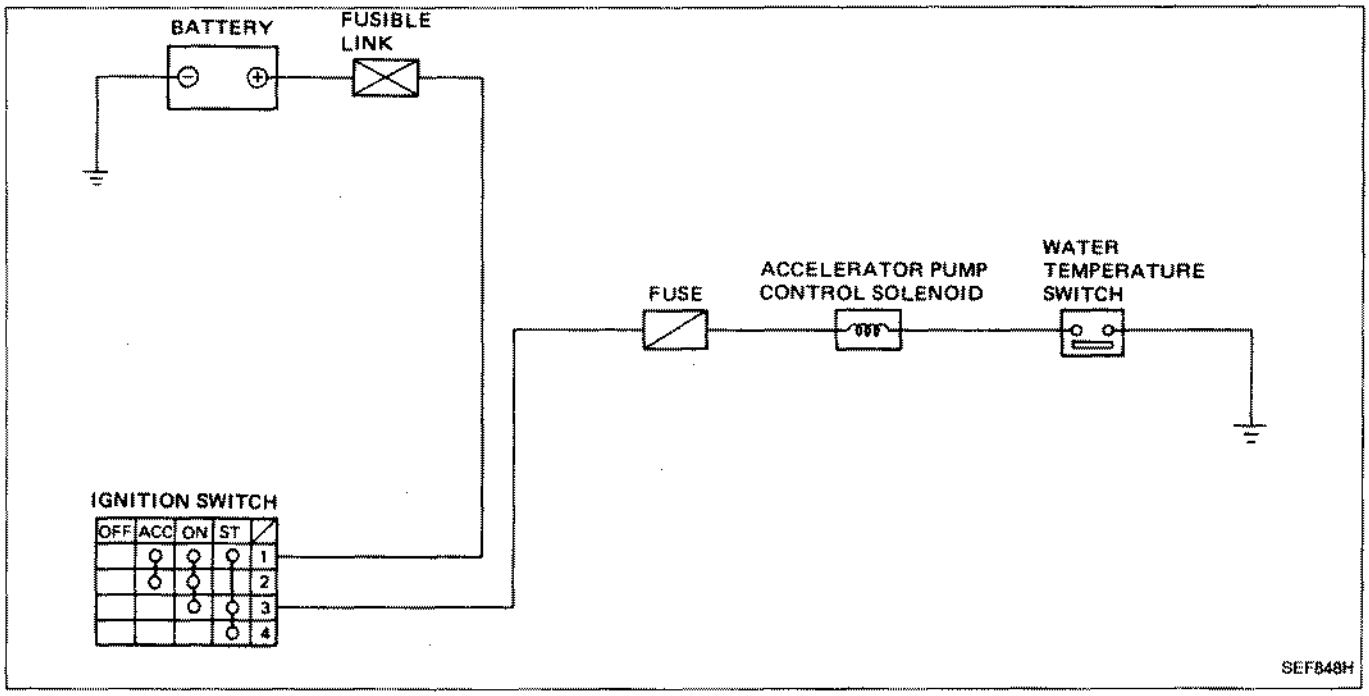


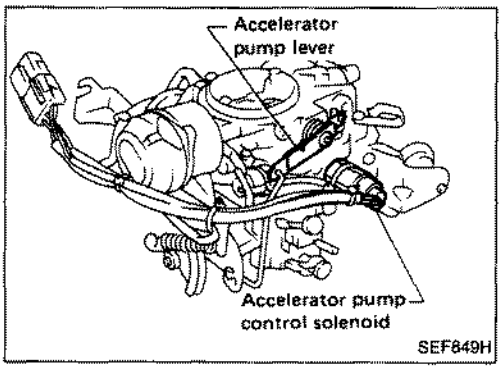
Temperature T °C (°F)	Models with catalyzer and E.G.R.	Models without catalyzer, Models with catalyzer without E.G.R.
T_1	0 ± 4 (32 ± 7.2)	14 ± 4 (57 ± 7.2)
T_2	20 ± 4 (68 ± 7.2)	31 ± 4 (88 ± 7.2)

Temperature T	Clearance R mm (in)	
	Models with catalyzer	Models without catalyzer
Below T_1	1.44 ± 0.13 (0.0567 ± 0.0051)	1.22 ± 0.14 (0.0480 ± 0.0055)
Above T_2	2.42 ± 0.32 (0.0953 ± 0.0126)	2.15 ± 0.32 (0.0846 ± 0.0126)

3. In this condition, check clearance "R" between choke valve and carburetor body.
4. If out of specification, adjust "R" by bending tongue.

Automatic Temperature Control Accelerator Pump (Models without catalyzer)



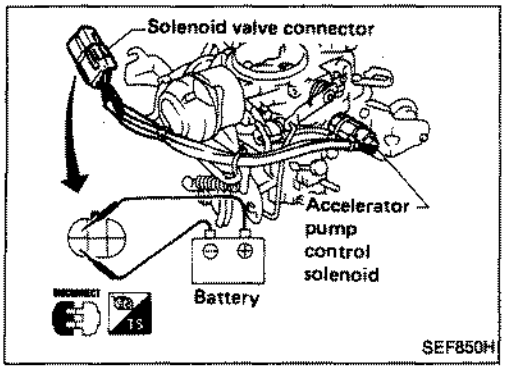


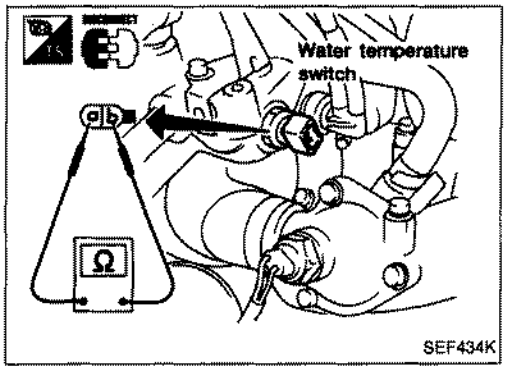
Operate accelerator pump by opening throttle lever with engine stopped. Check if pump nozzle located at primary port injects fuel smoothly without delay.
If N.G., check accelerator pump piston or linkage. Amount of fuel injected is controlled by the water temperature.

OPERATION

Ignition switch position	Water temperature switch °C (°F)	Accelerator pump control solenoid	Amount of fuel injected
"ON" or "START"	ON Below 70 (158)	ON	High
	OFF Above 70 (158)	OFF	Normal
"OFF"	—		

Automatic Temperature Control Accelerator Pump (Models without catalyzer)





INSPECTION (Cont'd)

Accelerator pump control solenoid valve

1. Connect solenoid valve connector to battery.
2. Check "click" sound from solenoid valve when battery is connected and disconnected.
3. If no sound is heard from solenoid valve, replace with a new one.

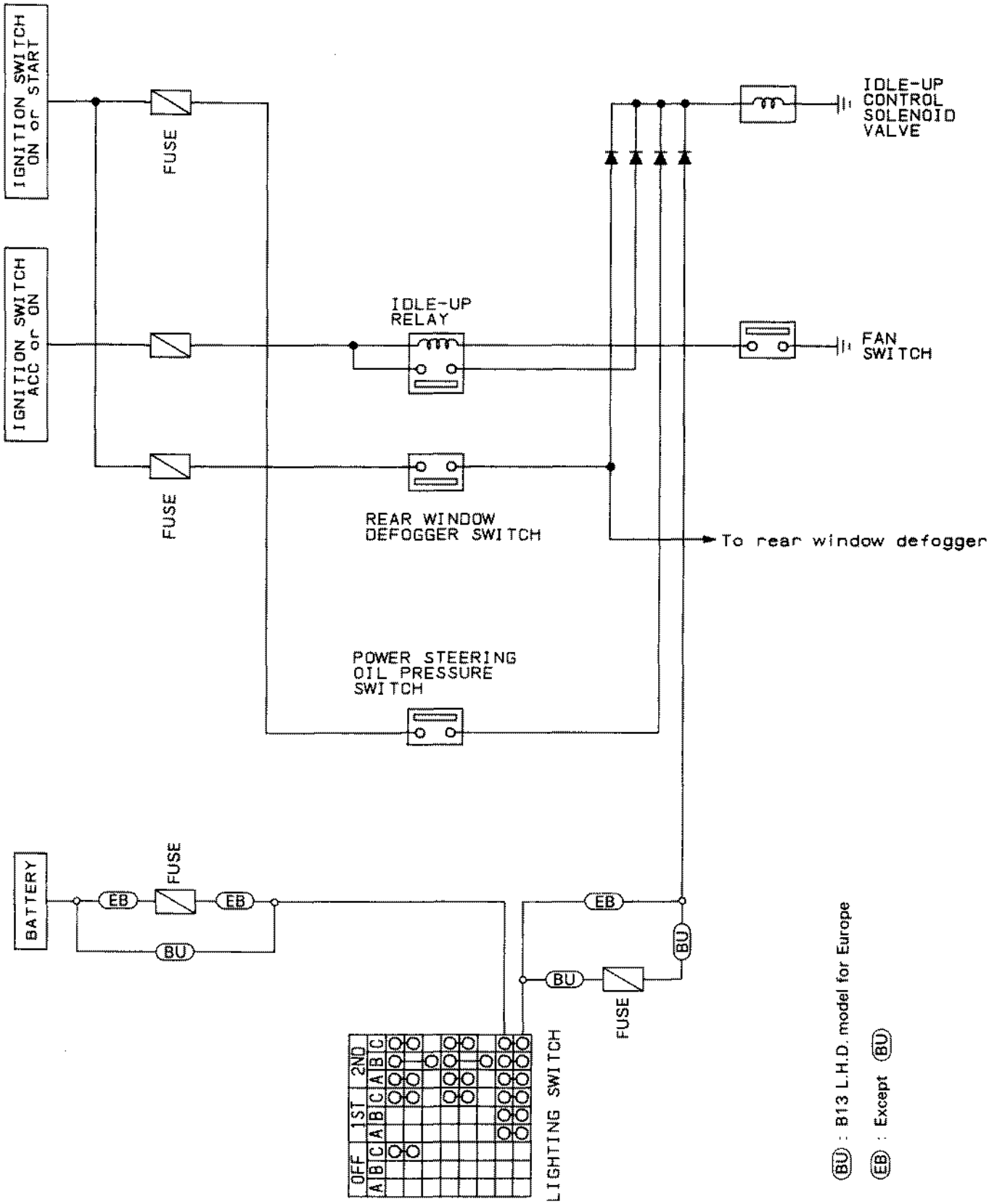
1) Disconnect harness from harness connector.
2) Remove solenoid valve from carburetor.
3) Install new solenoid valve. After replacement, check that solenoid valve is in good condition.

Water temperature switch

Water temperature °C (°F)	Continuity between terminals ⓐ and ⓑ
Below 70 (158)	Yes
Above 70 (158)	No

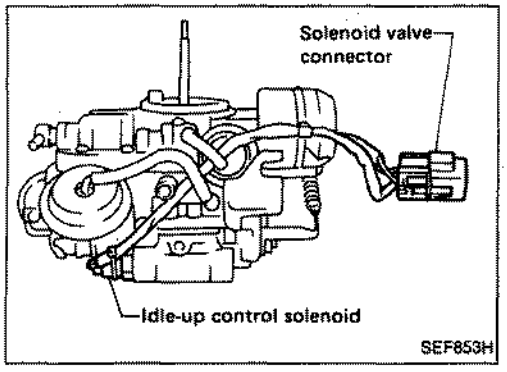
If N.G., replace with a new one.

Idle-up Control (Models without catalyzer)



SEF375L

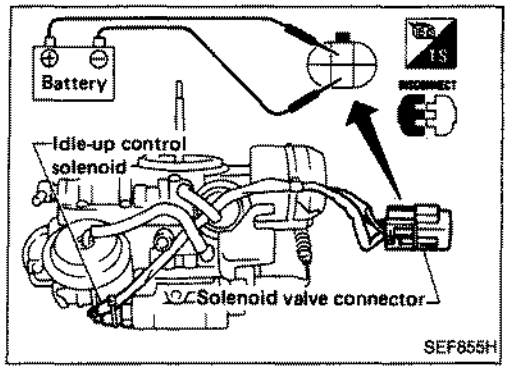
Idle-up Control (Models without catalyzer) (Cont'd)



This system prevents poor battery charging and erratic idling when the following load switches are operating.

- Headlamps
- Rear defogger
- Blower motor
- Power steering switch

In this system, the proper fuel is added when solenoid valve attached to carburetor is in the "ON" position.

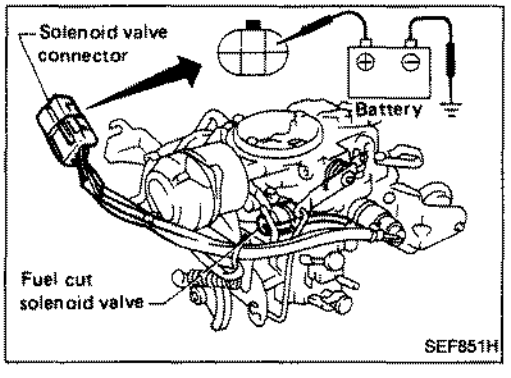


INSPECTION

Idle-up control solenoid valve

1. Connect solenoid valve connector to battery.
2. Check "click" sound from solenoid valve when battery is connected and disconnected.
3. If no sound is heard from solenoid valve, replace with a new one.

1) Disconnect harness from harness connector.
2) Remove solenoid valve from carburetor.
3) Install new solenoid valve. After replacement, check that solenoid valve is in good condition.



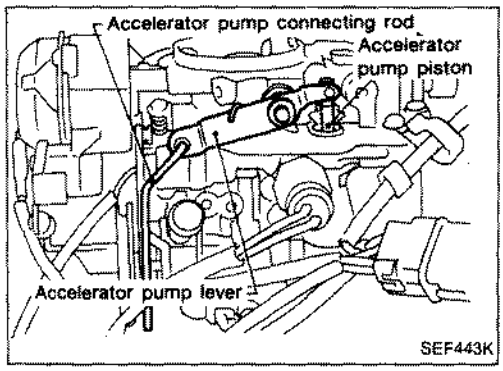
Fuel Cut Solenoid Valve (Models without catalyzer)

1. Connect solenoid valve connector to battery.
2. Check "click" sound from solenoid valve when battery is connected and disconnected.

3. If no sound is heard from fuel cut solenoid valve, replace with a new one.

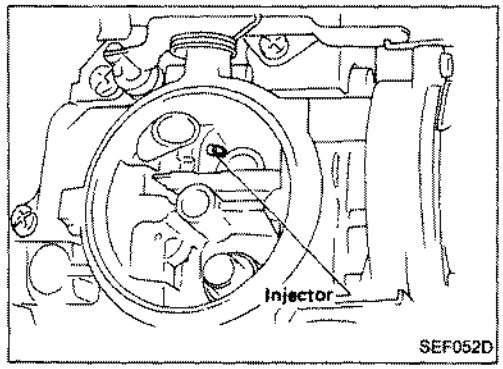
1) Disconnect harness from harness connector.
2) Remove fuel cut solenoid valve from carburetor.
3) Install new fuel cut solenoid valve.

After replacement, start engine and check that fuel cut solenoid is in good condition.

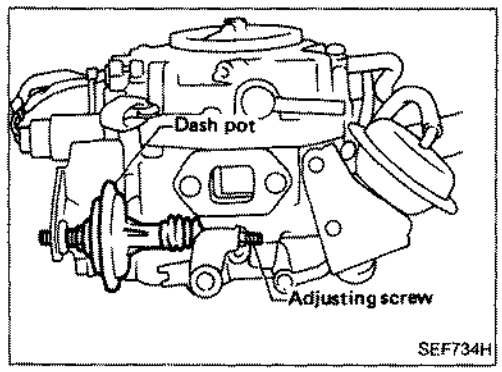


Accelerator Pump

1. After stopping the engine, make a visual check of the accelerator pump connecting rod and lever.
- If they are bent or twisted, replace them.



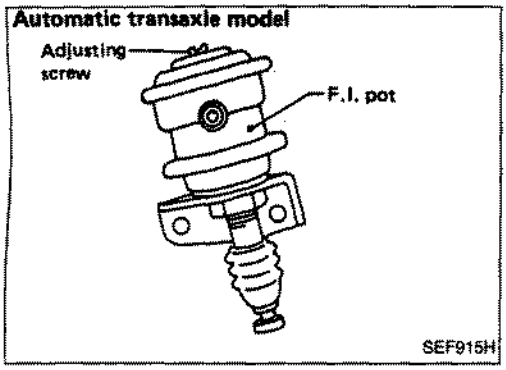
2. Turn the throttle lever and make sure that fuel is smoothly injected from the injector located in the primary port.
- If the accelerator pump is not functioning properly, check the pump piston.
  Replace it if necessary.



Dash Pot or F.I. (Fast Idle) Pot

1. Engine idle speed and mixture must be set properly and engine warmed up sufficiently.
2. Turn throttle valve by hand, and read engine speed when dash pot or F.I. pot just touches stopper lever.
   Dash pot or F.I. pot touch speed:
   GA13DS & GA14DS
   2,540 ± 200 rpm, 2,500 ± 200 rpm*
   ***For models with catalyzer**
   GA16DS
   2,500 ± 200 rpm
3. If out of specifications, adjust it by turning adjusting screw.
4. After adjusting, make sure that engine speed drops smoothly from 2,000 to 1,000 rpm in approximately three seconds.

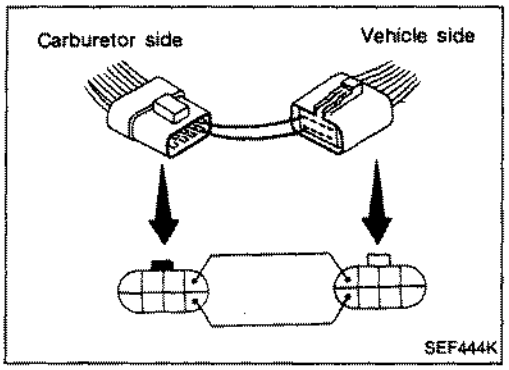
Dash Pot or F.I. (Fast Idle) Pot (Cont'd)



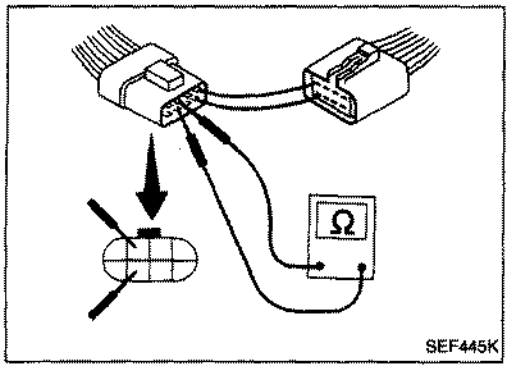
F.I. ACTUATOR

1. Warm up engine sufficiently.
2. Check idle speed and mixture ratio.
   Idle speed: rpm (in "N" position)
   M/T 750 ± 50
   A/T 850 ± 50
   Idle "CO":
   1.5 ± 0.5% (Models without catalyzer)
   1.0 ± 0.5%* (Models with catalyzer)
   *** Disconnect exhaust gas sensor harness connector and A.I.V. control solenoid valve harness connector.**
3. Turn air conditioner switch "ON", and check idle speed.
   Idle speed: rpm (in "N" position)
   M/T 850 ± 50
   A/T 850 ± 50
4. If out of specification, adjust idle speed by turning adjusting screw.

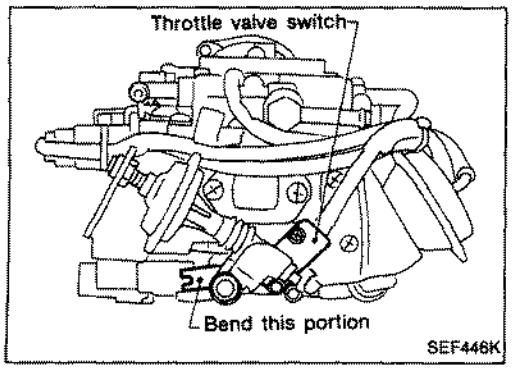
Throttle Valve Switch (Models with catalyzer)



1. Turn off engine and disconnect harness connector on carburetor.
2. Connect proper wires between the fuel cut solenoid valve harness terminals.

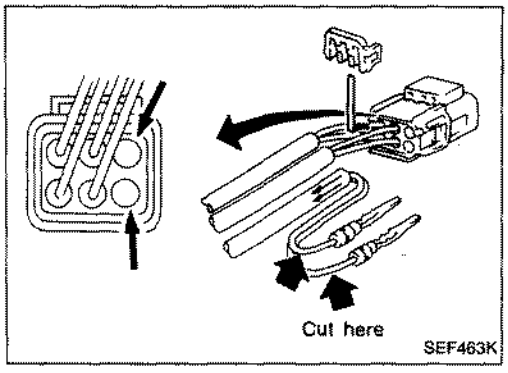


3. Verify that continuity does not exist between the throttle valve switch harness terminals.
4. Start engine and increase engine speed to about 2,000 rpm.
5. At this time, verify that continuity exists between the throttle valve harness terminals.



6. Then, decrease engine speed gradually to below.
   Engine speed:
   1,200 rpm

At that point, the circuit should break and cause the ohmmeter to indicate an open circuit.
If incorrect, adjust by bending plate until the ohmmeter indicates an open circuit.



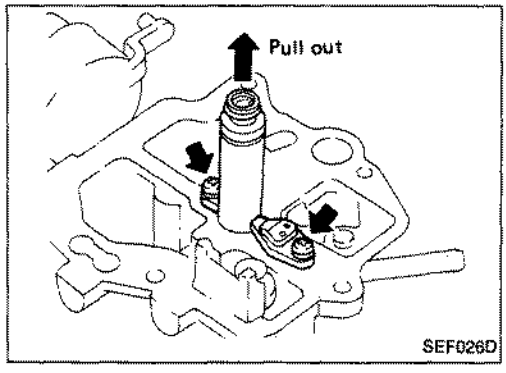
Replacing Air-fuel Ratio Solenoid Valve (Models with catalyzer)

1. Remove carburetor from engine.

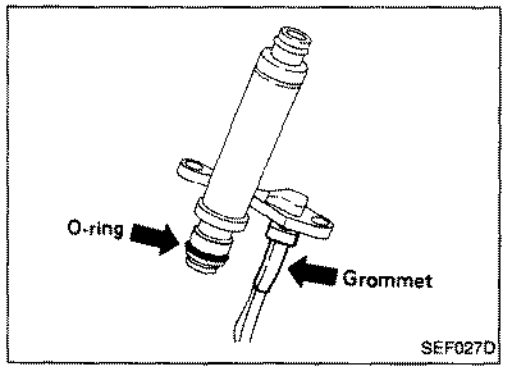
CAUTION:

Before removing carburetor, drain about one liter (7/8 Imp qt) of engine coolant.

2. Disconnect harness from harness connector and cut at the terminals.

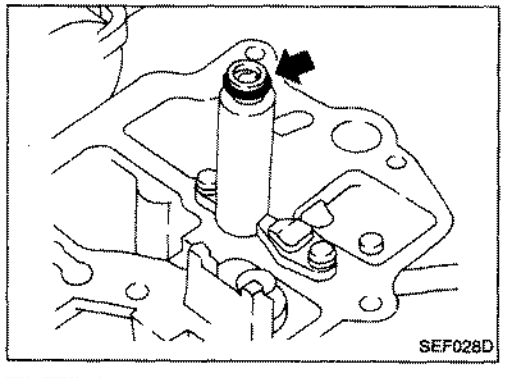


3. Remove choke chamber assembly from carburetor.
4. Remove air-fuel ratio solenoid from choke chamber.

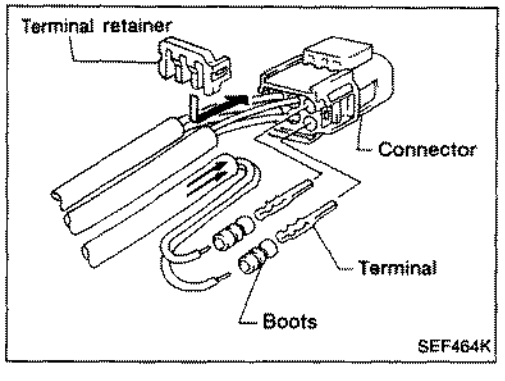


5. Install new air-fuel ratio solenoid valve to choke chamber.
- Apply silicon grease to O-ring.
- Always use new grommet.
- Take care not to damage O-ring when installing.
- If mounting bolts are damaged, replace with new ones.

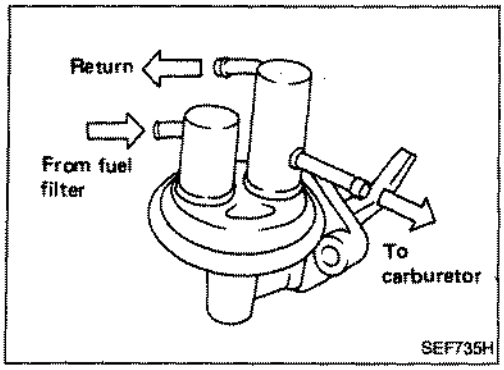
(O): 1.5 - 3.9 N·m (0.15 - 0.40 kg-m, 1.1 - 2.9 ft-lb)



6. Install choke chamber assembly.
- Apply silicon grease to O-ring.
- Take care not to damage O-ring.
- Always use new choke chamber gasket.

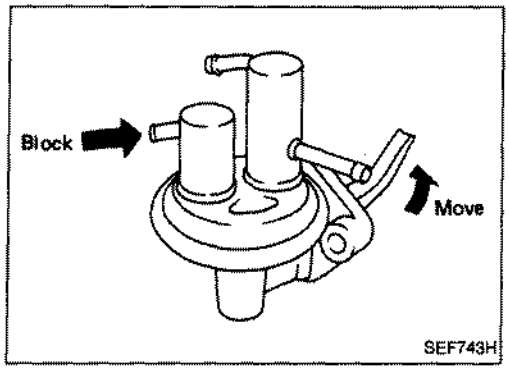


7. Fix new boots and terminal ends to harness with terminal pliers, and then place terminals in connector.



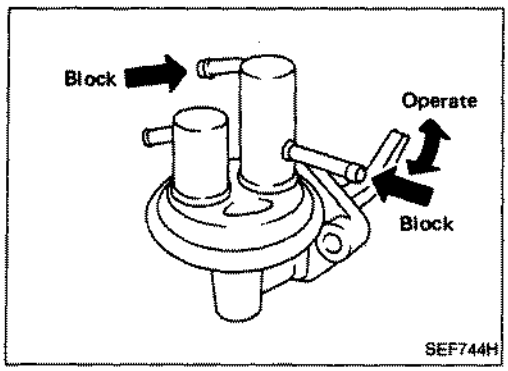
Fuel Pump

The fuel pump is a mechanical type and is mounted on the cylinder head. The end of the pump lever rests on the camshaft. When the camshaft rotates, the lever moves in a reciprocating motion to deliver fuel from the fuel tank to the carburetor.



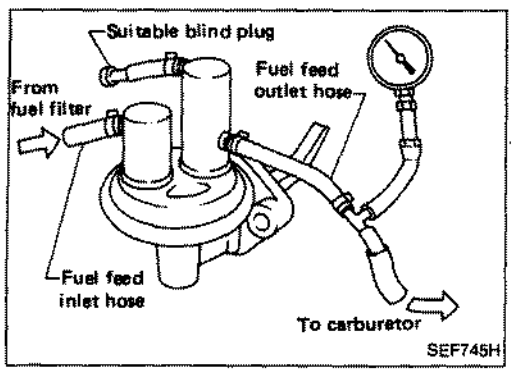
Operation

1. Flush pump by immersing it in a fuel bath and operating rocker arm several times.
2. Drain fuel from fuel pump. Then block off the inlet port and check that pump arm does not move.
3. Remove your finger from the inlet port and listen for a suction sound which will confirm that sufficient suction was produced.



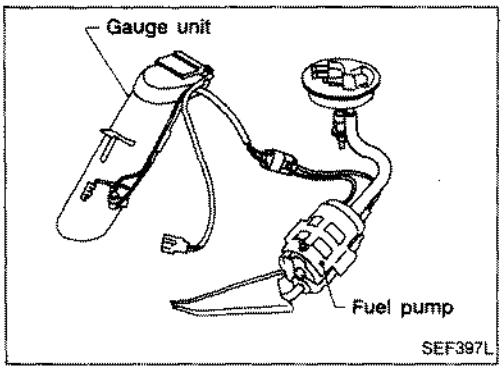
4. Block off outlet port and return port. Once again operate rocker arm. After air pressure has been built up, confirm that pressure remains for two or three seconds after.
5. Put a finger over outlet port and again build up pressure in pump. Then submerse pump in a fuel bath and check for air leaks.

WARNING:
Before starting to work on any part of fuel system, disconnect ground cable from battery. When disconnecting fuel hoses, use a container to catch fuel remaining in hoses.



Fuel Pressure

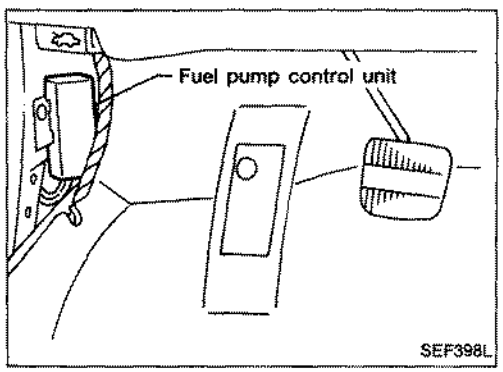
1. Disconnect fuel return hose and plug with a suitable blind plug.
2. Disconnect fuel feed outlet hose and connect fuel pressure gauge between fuel pump and carburetor.
3. Check fuel pressure with engine running at various speeds.
   Fuel pressure:
   20.6 - 34.3 kPa
   (0.206 - 0.343 bar, 0.21 - 0.35 kg/cm^2, 3.0 - 5.0 psi)
   If out of specification, check for fuel filter clogging or improper fuel pump operation.



Component Parts Description

ELECTRIC FUEL PUMP

The fuel pump, which is located in the fuel tank, is a turbine type pump.

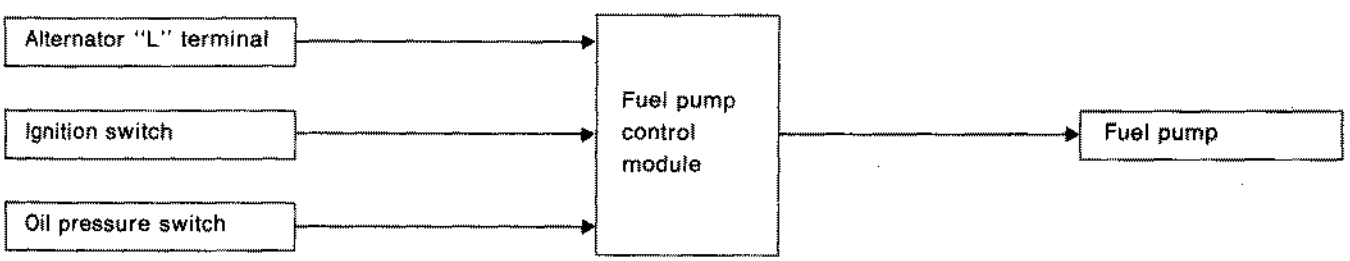


FUEL PUMP CONTROL UNIT

The fuel pump control unit is located at dash side.
Electric fuel pump is controlled by fuel pump control unit. This unit drives electric fuel pump in response to the signals from alternator "L" terminal, ignition switch and oil pressure switch.

System Description

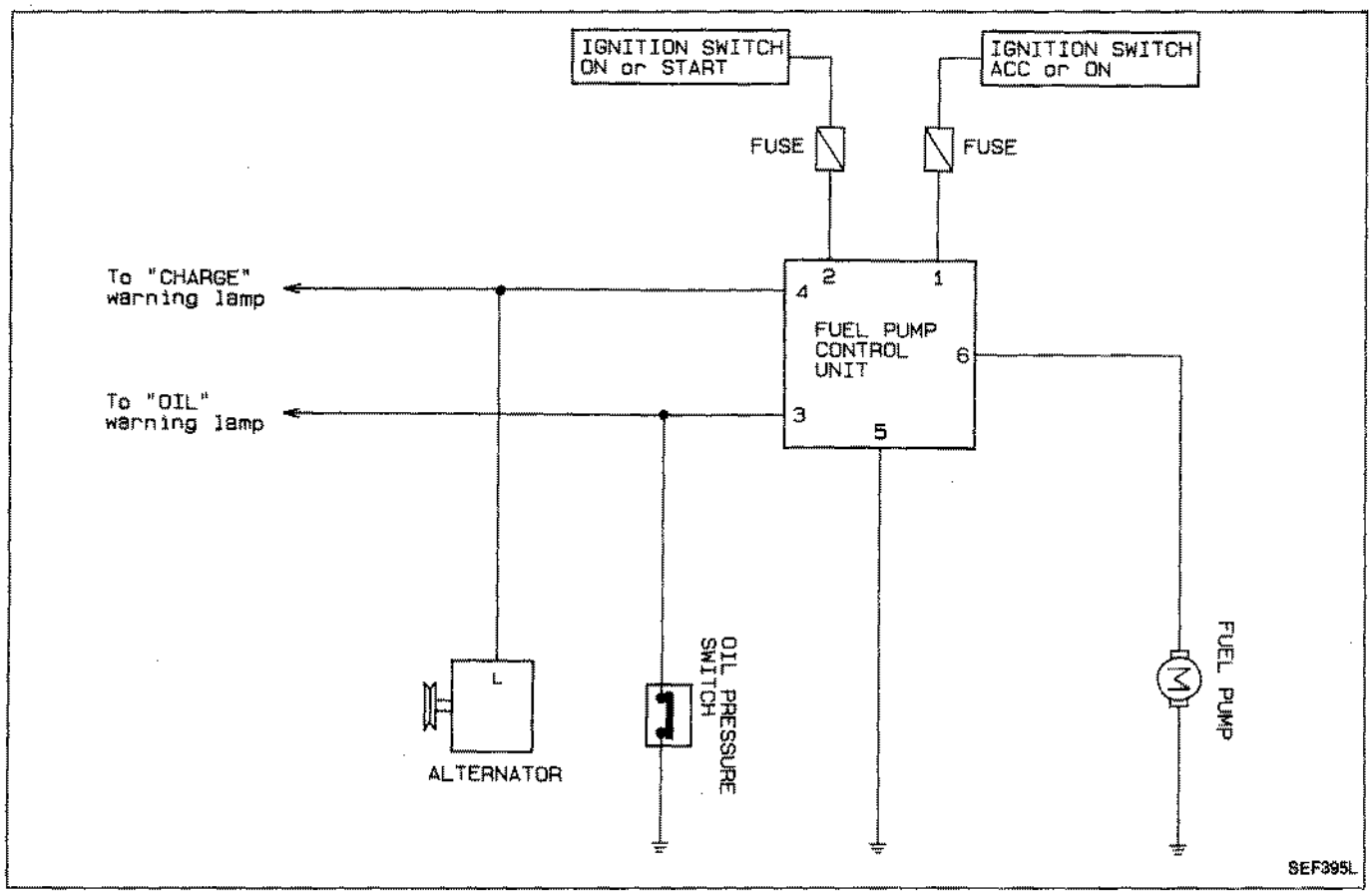
The electric fuel pump is controlled by the fuel pump control unit. This unit drives the electric fuel pump in response to signals from the alternator "L" terminal, ignition switch and oil pressure switch.



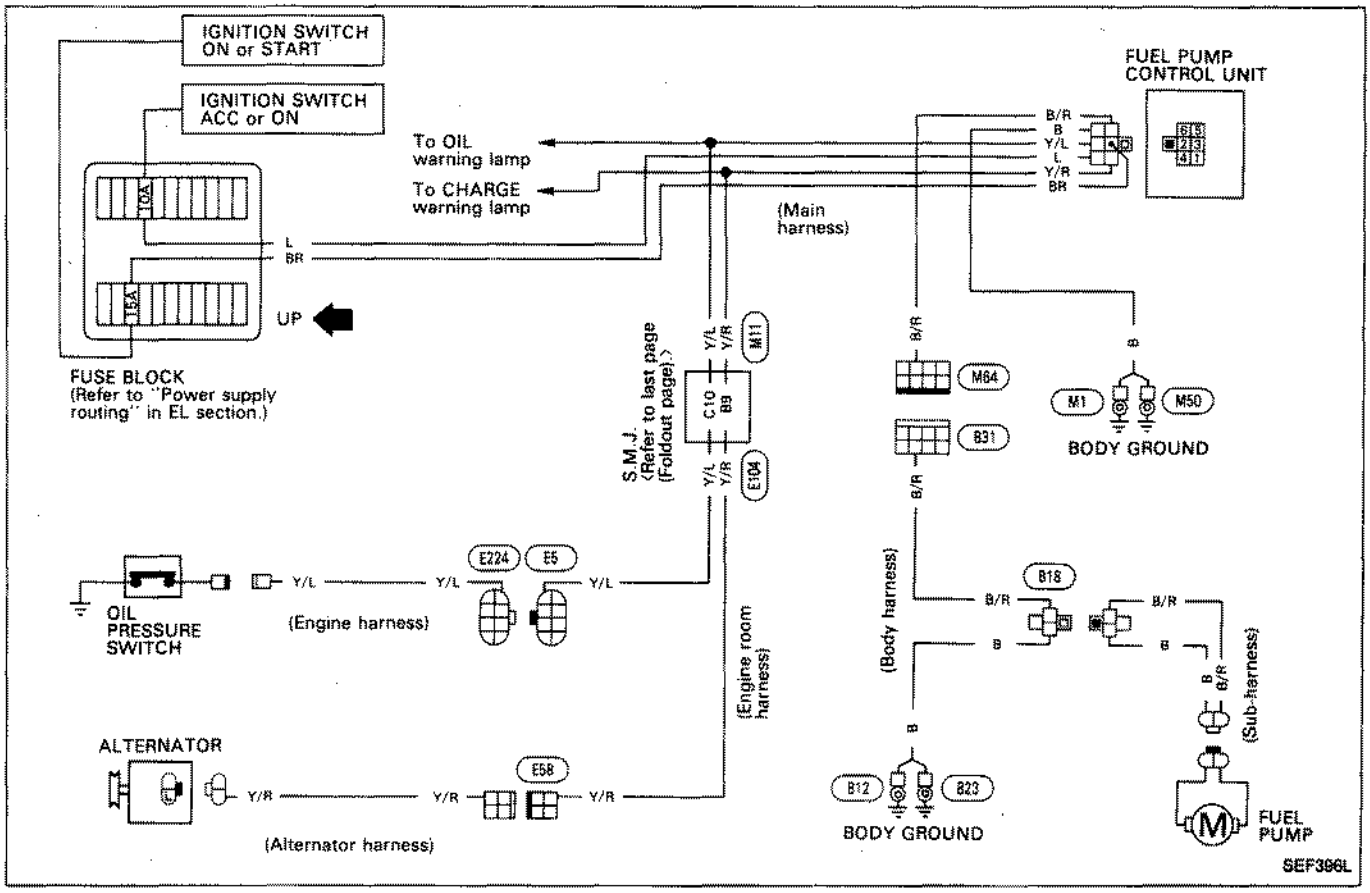
Operation

Ignition switch position	Engine	Alternator	Oil pressure	Fuel pump
OFF	Stopped	Not generating	No pressure	Not operating
ACC				
ON				
START	Cranking	Generating	Low pressure	Operating
		Not generating	Normal	
ON	Running	Generating		
		Failure		
		Generating	Failure	

Schematic



Wiring Diagram



Inspection

ELECTRIC CHECK

1. Crank or start engine.
2. Check voltage between terminal ③ and ground.
   Voltage: Battery voltage should exist.
   If N.G., check the following:
   1) Input signal to control unit
   2) Electric fuel pump control unit
   3) Circuit continuity

INPUT SIGNAL CHECK

Check input signals in each terminal of fuel pump control unit, following the table shown below.
If N.G., check harness continuity between fuel pump control unit and each component, or check each component individually. If O.K., perform fuel pump control unit check.

Check terminals			Condition	Circuit tester	
	+	−		Range	Reading
Ground	⑥	Body earth	—	Ω	0Ω
Battery (ON or START)	②		Ignition switch "ON"	V	Battery voltage
			Ignition switch "START"*		
Battery (ACC or ON)	④		Ignition switch "ON"		
			Ignition switch "START"*		0V
Alternator "L" terminal	①		Engine running		Battery voltage
			Engine stopped		0V
Oil pressure switch	⑤		Engine running		Battery voltage
			Engine stopped		0V

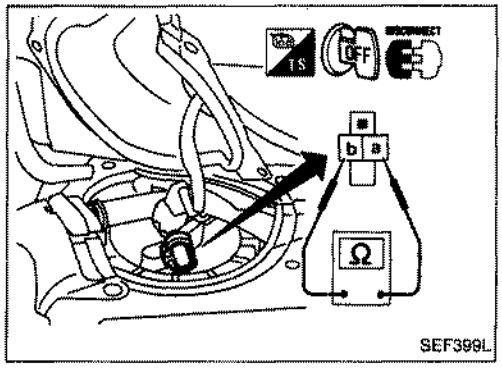
*: Disconnect starter motor "S" terminal before turning ignition switch to "START".

Inspection (Cont'd)

FUEL PUMP CONTROL UNIT CHECK

- **First, disconnect starter motor "S" terminal.**
- **This check should be performed without starting engine. Check fuel pump control unit, following the table shown below.**

Step	Condition			Output voltage of terminal ③
	Alternator "L" terminal	Oil pressure switch terminal	Ignition switch	
1	Connected	Connected	OFF	0V
2			ACC	
3			ON	
4			START	Battery voltage
5	Disconnected		ON	
6			START	
7		Disconnected	ON	
8			START	
9	Connected		ON	
10			START	



FUEL PUMP COMPONENT CHECK

1) Make sure that ignition switch is "OFF".
2) Disconnect fuel pump harness connector.
3) Check continuity between terminals ⓐ and ⓑ.

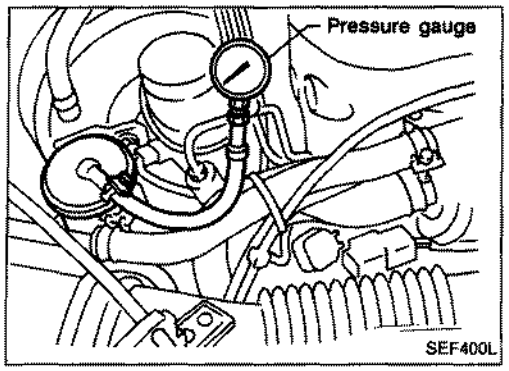
Continuity should exist.

FUEL PRESSURE CHECK

WARNING:

a. Keep flammables away during the test.
b. For safety, the test must be completed in as short a time as possible.

Inspection (Cont'd)



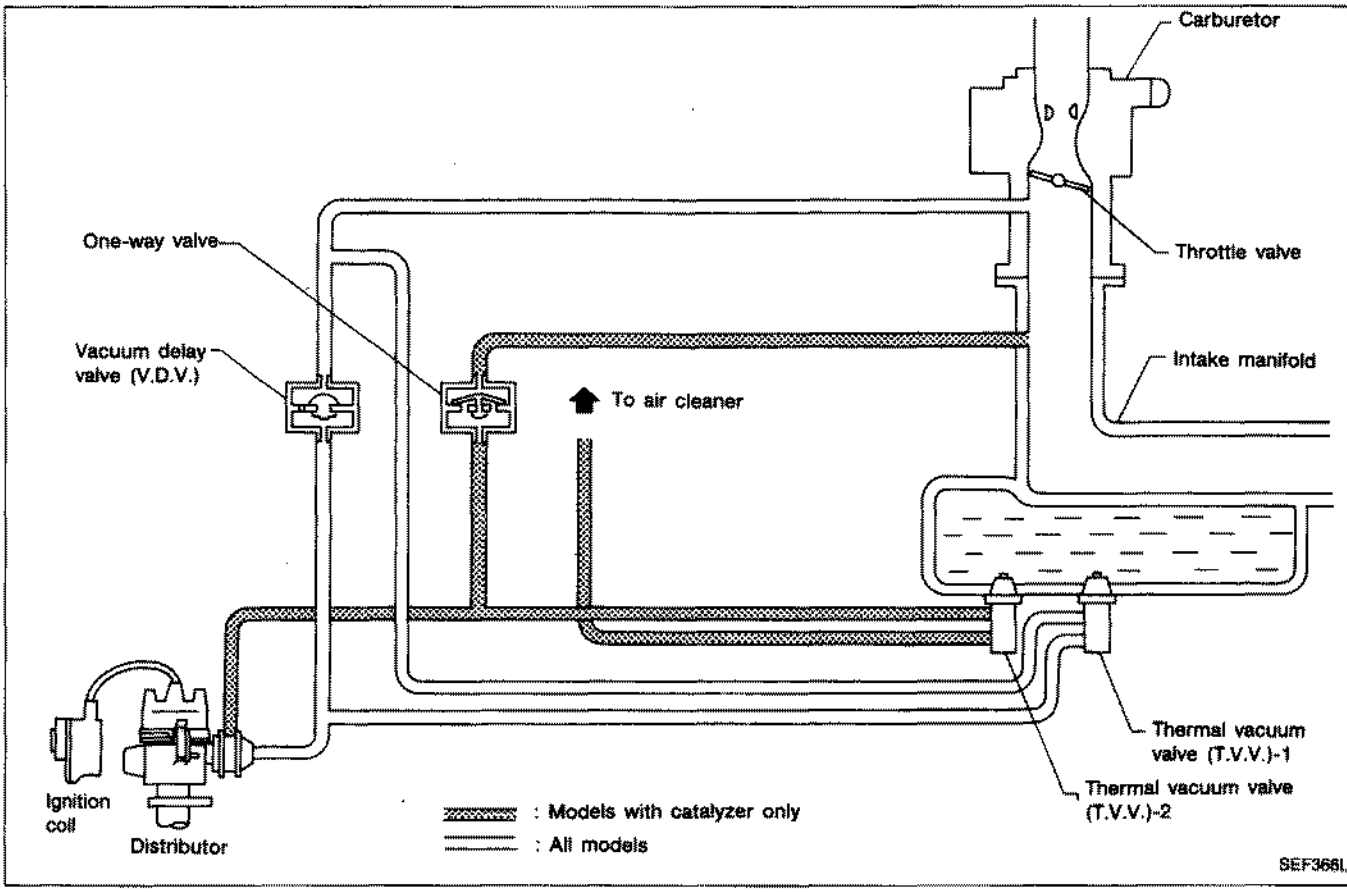
1. Connect a suitable fuel pressure gauge.
2. Check fuel pressure.

Fuel pressure (Approximately):

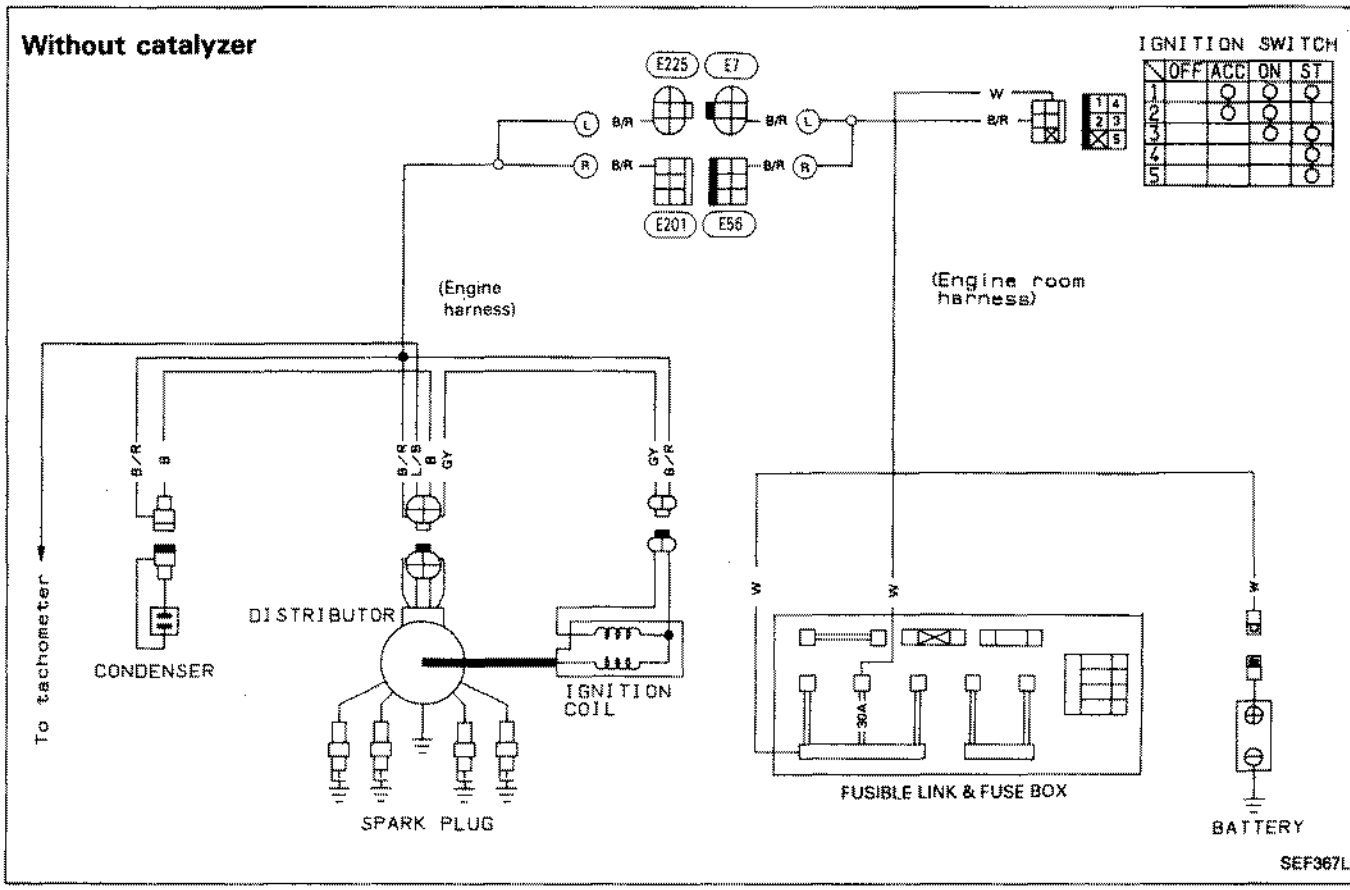
14.7 kPa

(0.147 bar, 0.15 kg/cm^2, 2.1 psi)

If fuel pressure or fuel quantity is extremely low, check if fuel filter is clogged.



Wiring Diagram



System Description

Ignition timing is controlled by two systems built into the distributor to meet varying conditions during engine operation:

1) Governor advance system
   Advances ignition timing in response to engine speed.
2) Vacuum advance system
   Advances ignition timing by compensating for combustion speed delay when intake vacuum is high.

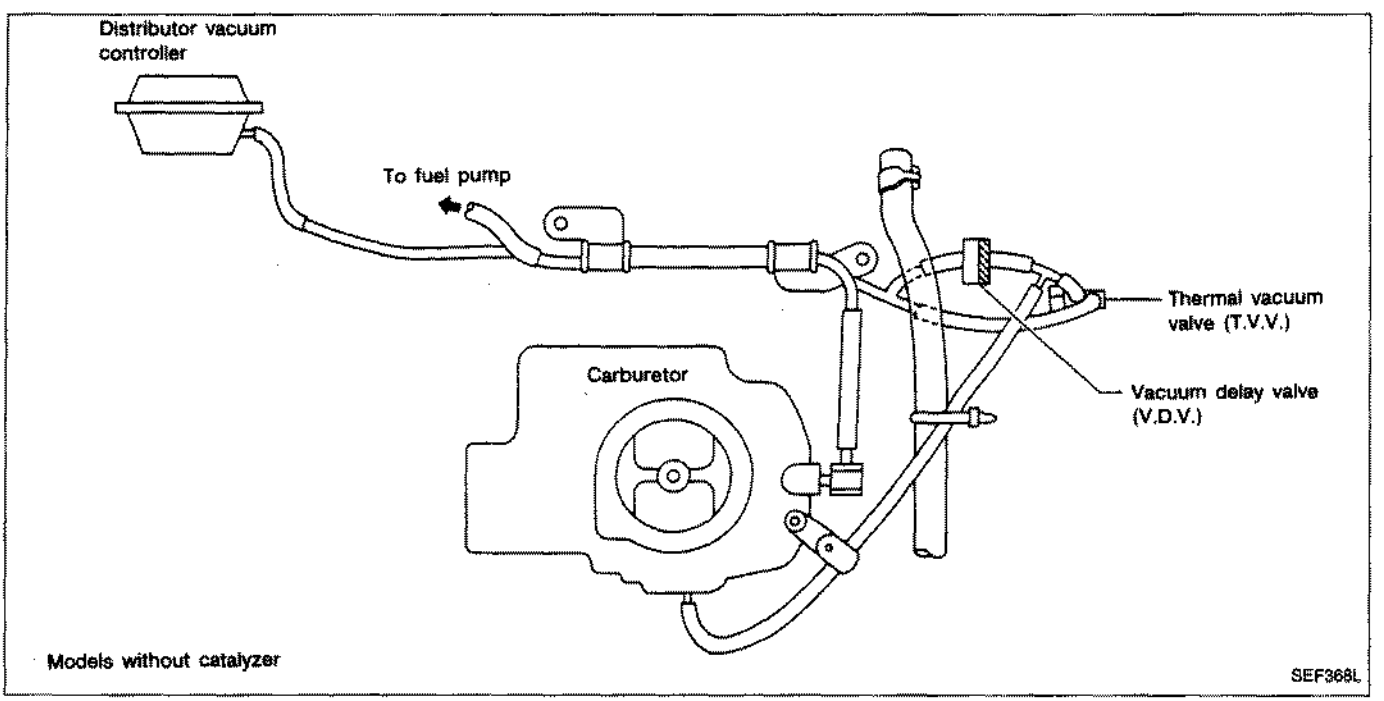
The thermal vacuum valve is located in the distributor vacuum line. It prevents vacuum advance during engine warm-up and improves operating performance.

OPERATION

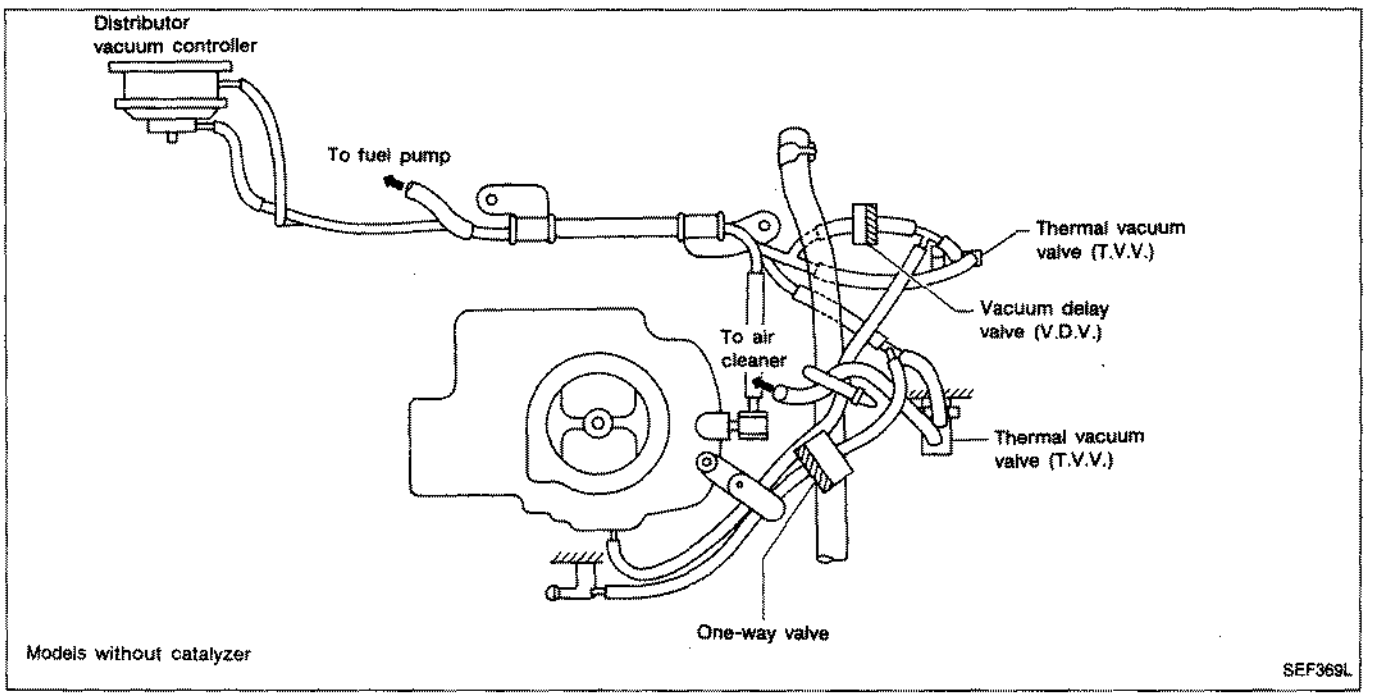
Water temperature °C (°F)	T.V.V.-1	T.V.V.-2 Models with catalyzer only	Vacuum advance	
			Models with catalyzer	Models without catalyzer
Below 20 (68)	Close	Close	Fully advanced*	Normal*
Between 20 (68) and 50 (122)	Close	Open	Normal*	
Above 50 (122)	Open	Open	Normal	Normal

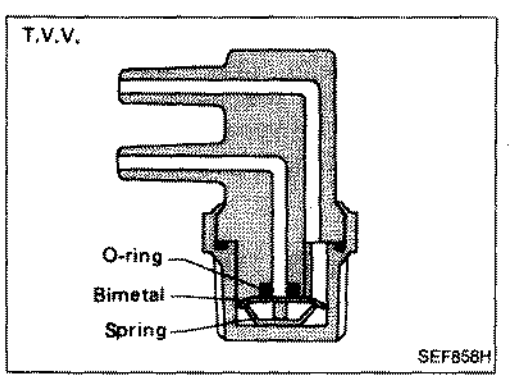
* Ignition timing is prevented from retarding suddenly by V.D.V. when depressing accelerator pedal.

Component Parts Description



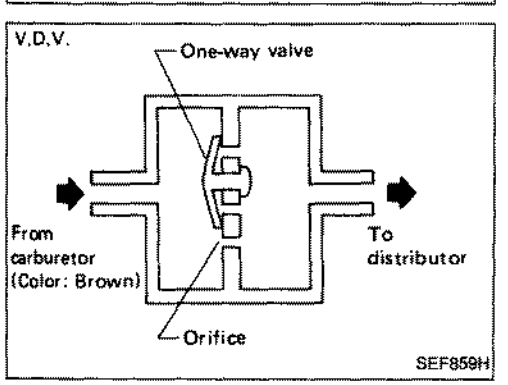
Component Parts Description (Cont'd)





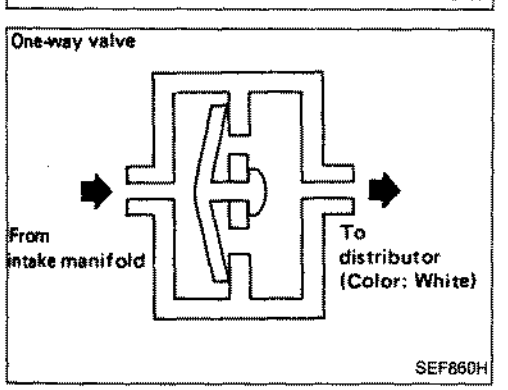
THERMAL VACUUM VALVE (T.V.V.)

This thermal vacuum valve is mounted on the front side of the intake manifold. It detects engine coolant temperature by means of a built-in bimetal, and opens or closes the vacuum passage in the thermal vacuum valve.



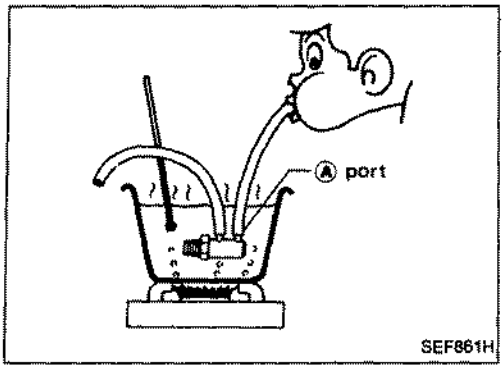
VACUUM DELAY VALVE (V.D.V.)

The vacuum delay valve is installed in the vacuum control line to the distributor. This valve prevents ignition timing from retarding suddenly when the throttle valve is opened rapidly.



ONE-WAY VALVE

The one-way valve is installed in the vacuum control line to the distributor. This valve restricts air flow to one way.

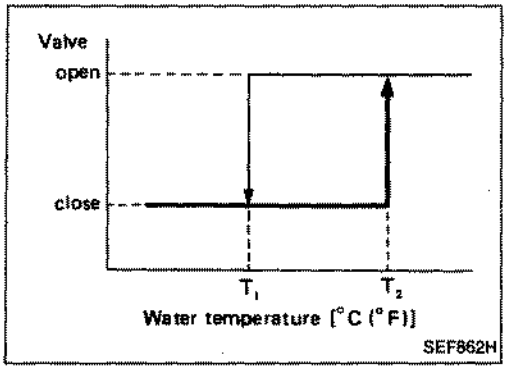


Component Parts Inspection

THERMAL VACUUM VALVE (T.V.V.)

Remove T.V.V. from engine.
Blow air from Ⓐ port and check to be sure that T.V.V. opens or closes in response to its temperature.

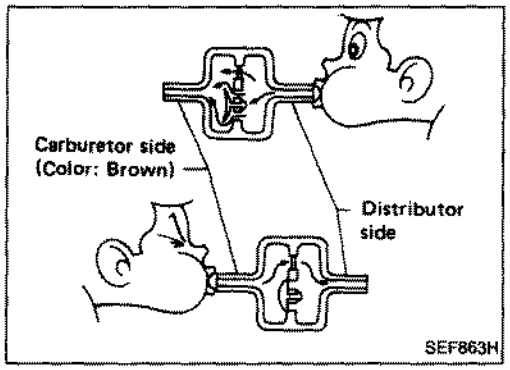
CAUTION:
Do not allow water to get inside the T.V.V.



Operation of T.V.V.

Unit: °C (°F)

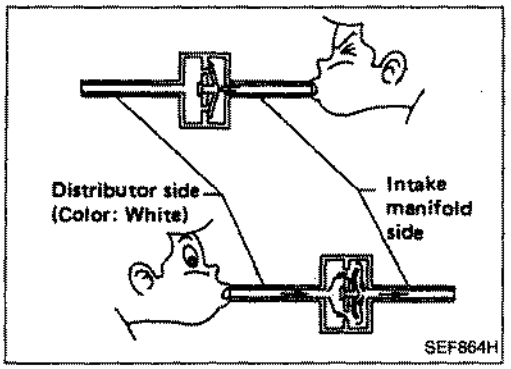
	T.V.V.-1	T.V.V.-2
T_1	30 (86) or more	5 (41) or more
T_2	40 (104)	20 (68)



VACUUM DELAY VALVE

1. Blow air from the port of the distributor side. The valve is in good condition if the air flows through the valve.
2. Try again from the opposite side of the valve. The valve is in good condition if the air flow resistance is greater than in step 1 above.

CAUTION:
Be careful to avoid entry of oil or dirt into valve.

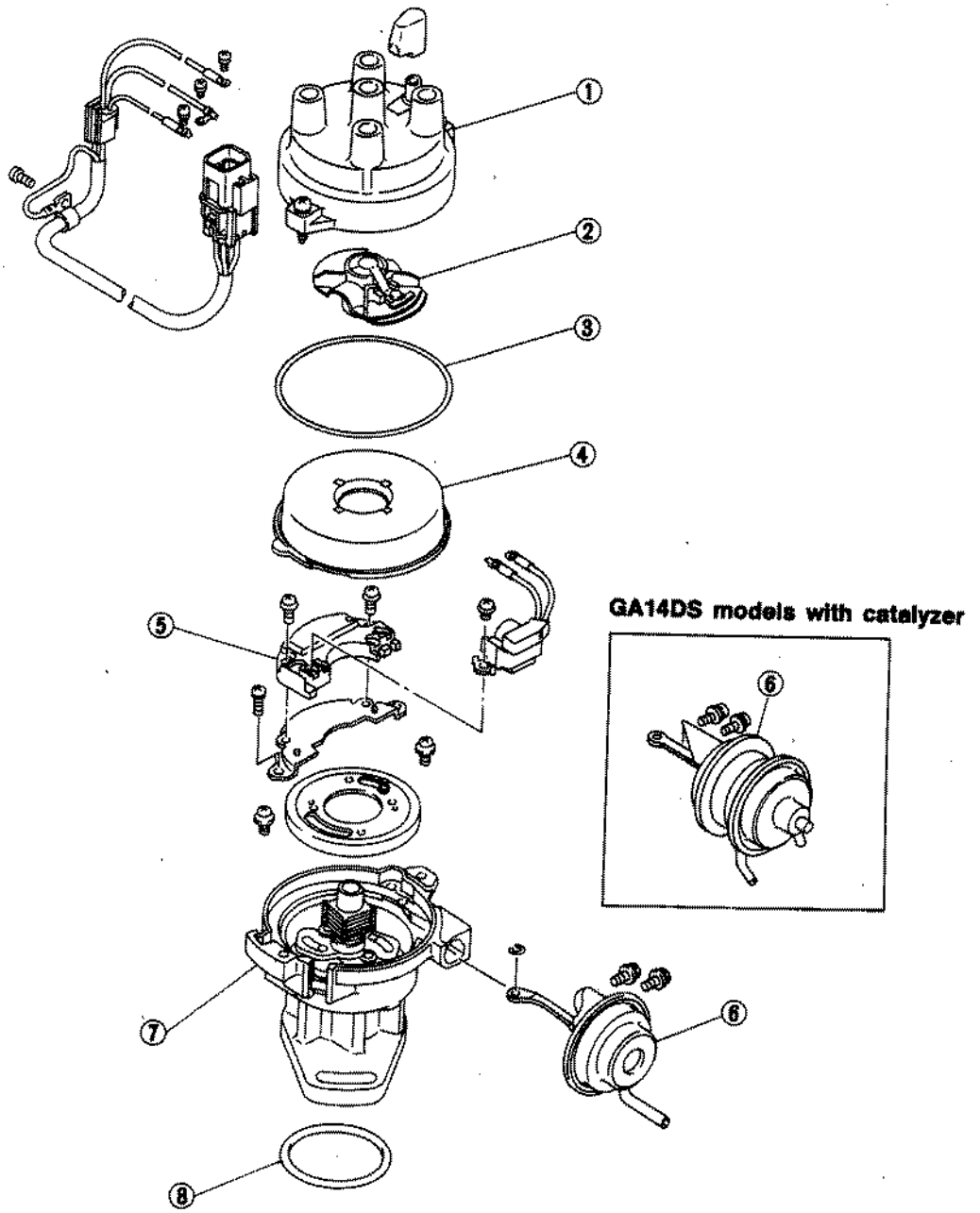


ONE-WAY VALVE

1. Blow air from the port of the intake manifold side. The one-way valve is in good condition if the air does not flow through the valve.
2. Try again from the opposite side of (White-faced side) of the valve. The valve is in good condition if the air flow resistance is greater.

CAUTION:
Be careful to avoid entry of oil or dirt into valve.

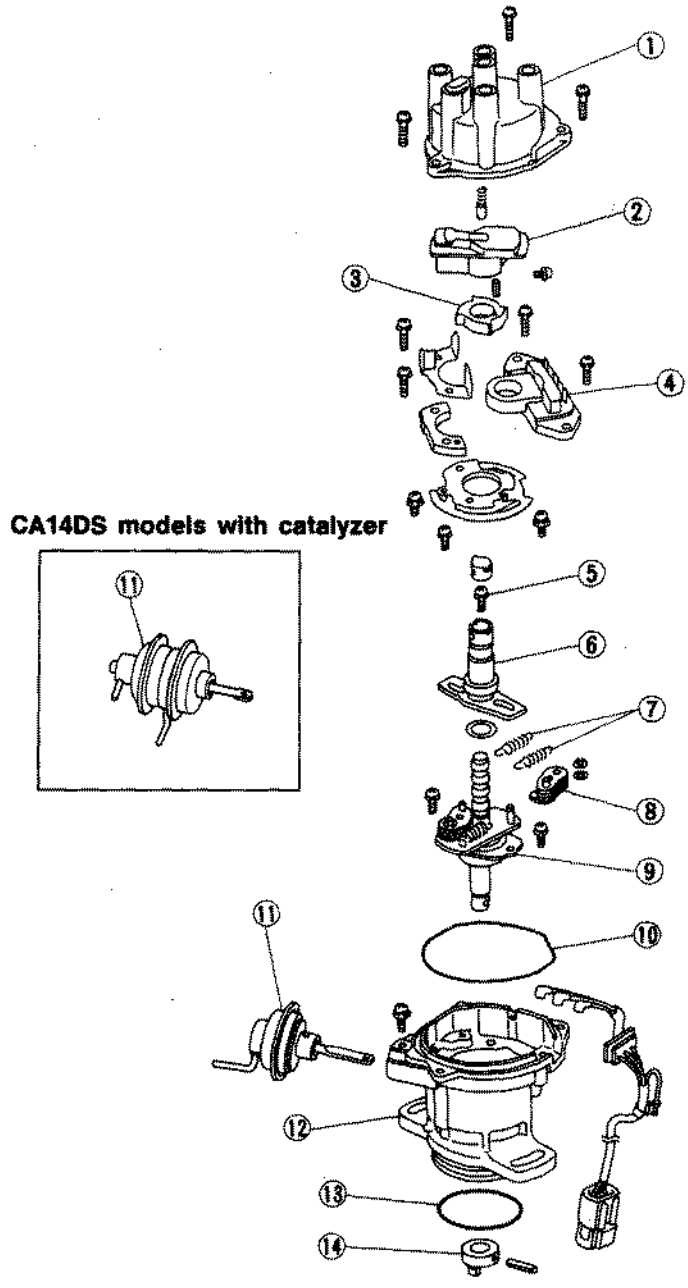
MITSUBISHI make



① Cap
② Rotor
③ Rubber ring
④ Cover
⑤ IC ignition unit
⑥ Vacuum controller
⑦ Housing assembly
⑧ O-ring

SEF370L

HITACHI make



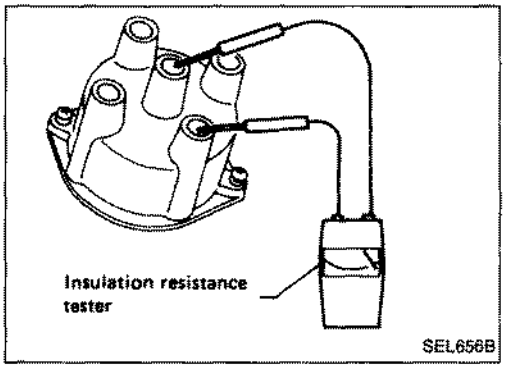
SEF371L

① Cap
② Rotor head
③ Reluctor
④ IC ignition unit
⑤ Rotor shaft setting screw
⑥ Rotor shaft
⑦ Governor spring
⑧ Governor weight
⑨ Shaft assembly
⑩ Rubber ring
⑪ Vacuum controller
⑫ Housing
⑬ O-ring
⑭ Coupling

Disassembly

Carefully observe the following instructions during disassembly.

- **Put a matchmark across cam and shaft so that original combination can be restored at assembly.**
- **Inscribe a matchmark across spring and mating parts so that spring can be replaced in its original position during assembly.**
  Be careful not to stretch or deform governor spring.

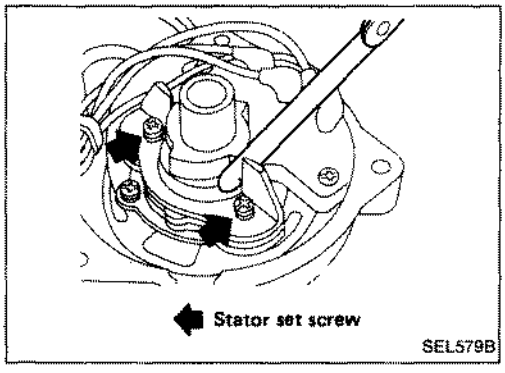


Distributor Component Check

CAP AND ROTOR HEAD

1. Check cap and rotor head for dust, carbon deposits and cracks.
2. Measure insulation resistance between electrodes on ignition coil and spark plug sides on cap.
   Insulation resistance:
   More than 50 MΩ

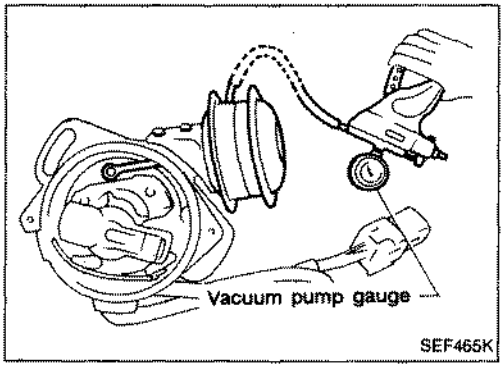
- Less than specified value ... Replace.



CHECKING AIR GAP

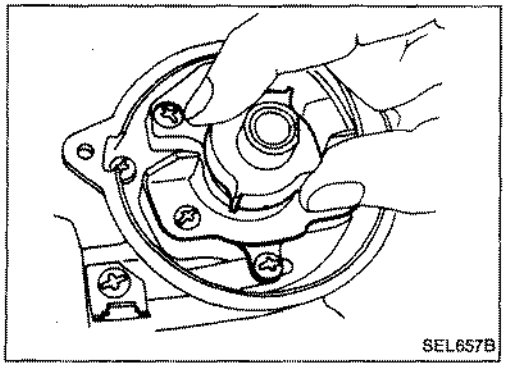
Check air gap between reluctor and stator.

Air gap:
0.3 - 0.5 mm (0.012 - 0.020 in)



VACUUM ADVANCE

1. Connect vacuum pump gauge to vacuum controller and gradually draw a vacuum while watching breaker plate movement. Check for smooth operation with no evidence of binding.
2. Turn breaker plate right and left to check for freedom of movement.



GOVERNOR ADVANCE

Turn head of cam assembly counterclockwise, release it, then check that it returns smoothly to the original position.

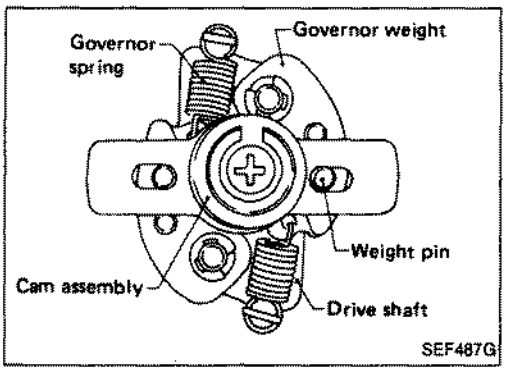
Assembly

Carefully observe the following instructions.

GREASE POINT

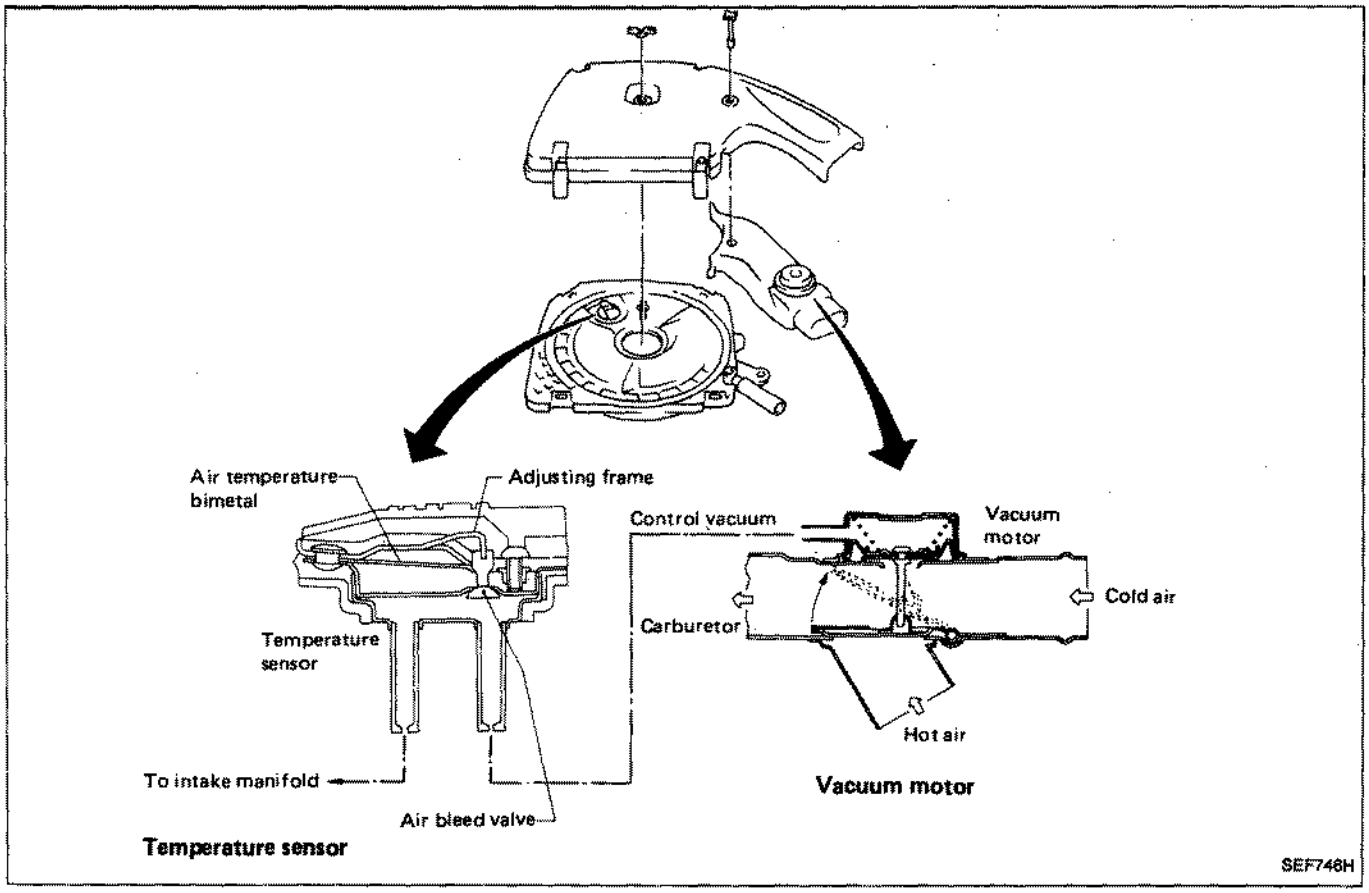
Apply high-temperature grease to:

- Governor spring
- Frictional surface of governor weight
- Frictional surface of breaker plate
- Vacuum control shaft
- Cam and cam head



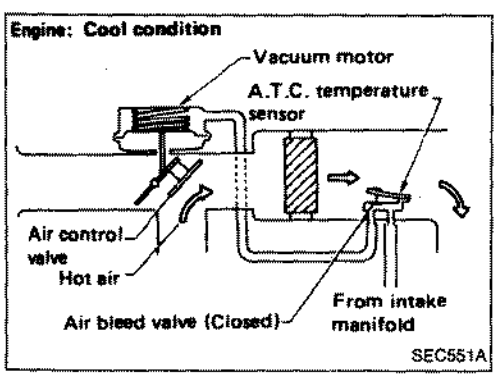
INSTALLATION OF GOVERNOR

Install governor springs, governor weights and cam assembly to drive shaft as shown in figure.



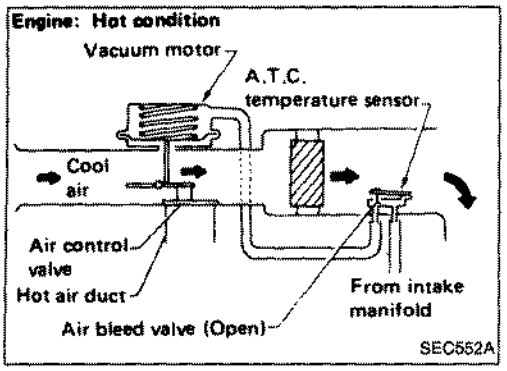
System Description

The automatic temperature control system maintains the temperature of air entering the carburetor. In addition, the automatic temperature control system improves the warm-up characteristics of the engine and prevents the fuel from icing.
The automatic temperature control system is controlled by the inlet air temperature and the load condition of the engine. The inlet air temperature is detected by the sensor, installed in the air cleaner box, and the vacuum motor is actuated by the intake manifold vacuum.



When the engine is not warmed up sufficiently, since the A.T.C. temperature sensor passes the intake manifold vacuum to the vacuum motor, the motor actuates and hot air is introduced into the air cleaner. In this step, the higher the intake manifold vacuum is, the wider the air control valve opens.

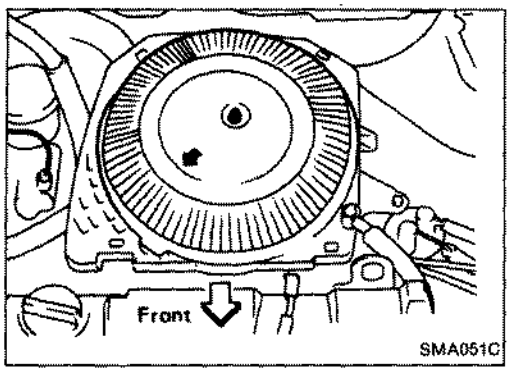
System Description (Cont'd)



When the engine is warmed up, the A.T.C. temperature sensor releases to the atmosphere the intake manifold vacuum leading to the vacuum motor. Therefore, the vacuum motor deactivates. In this step, the air control valve shuts off hot air, allowing normal temperature air to flow to the air cleaner.

Operation

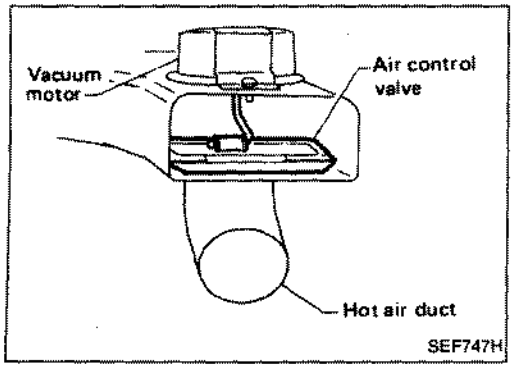
Temperature sensor		Vacuum motor		Inlet air
Ambient temperature around sensor °C (°F)	Operation	Intake manifold vacuum –kPa (–mbar, –mmHg, –inHg)	Operation	
Below 38 (100)	Closed	Above 16.7 (167, 125, 4.92)	Raised	Hot
		4.7 - 16.7 (47 - 167, 35 - 125, 1.38 - 4.92)	Partially raised	Cold + Hot
		Below 4.7 (47, 35, 1.38)	Down	Cold
Above 48 (118)	Open	Any value	Down	



Inspection

AIR CLEANER FILTER (Viscous paper type)

Viscous paper type air cleaner filter does not need cleaning between renewals. The filter should never be brushed or blasted because both cause clogging and enrich the mixture ratio.



AUTOMATIC TEMPERATURE CONTROL SYSTEM

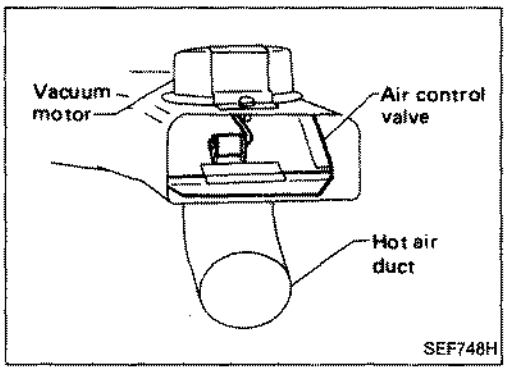
- Engine stall or hesitation
- Increase in fuel consumption
- Lack of power

If these phenomena occur, check A.T.C. system before inspecting carburetor.

1. Check hoses for cracks, distortion and improper position.
2. Check A.T.C. system for proper function while engine is cool. Check air control valve position.

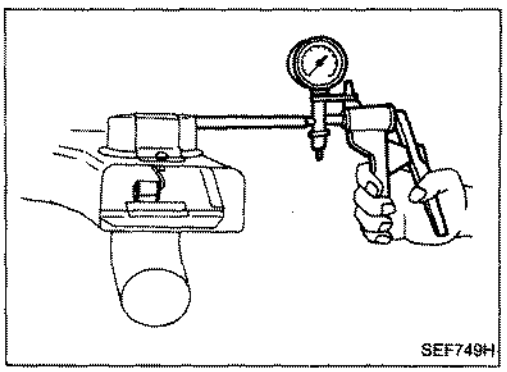
Air control valve is correct if it is in the lower position.

Inspection (Cont'd)



3. Start engine and immediately check the air control valve position. If it rises, it is correct.
4. Make sure that air control valve moves up and down when engine speed is quickly increased and decreased.
5. Make sure that air control valve partially rises when engine warm-up advances.

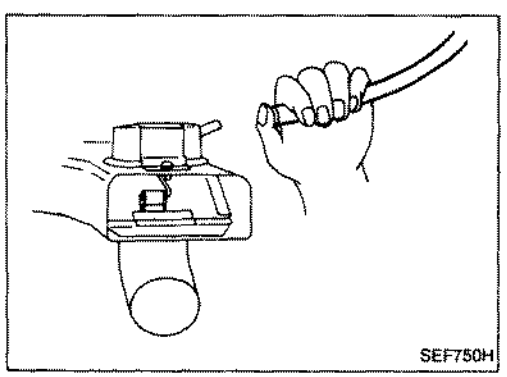
If the above test reveals any malfunction in the operation of the air control valve, carry out the following test:



Vacuum motor

Disconnect the inlet vacuum hose of vacuum motor, and connect another hose to the inlet to apply vacuum to vacuum motor. Then, confirm that air control valve moves.

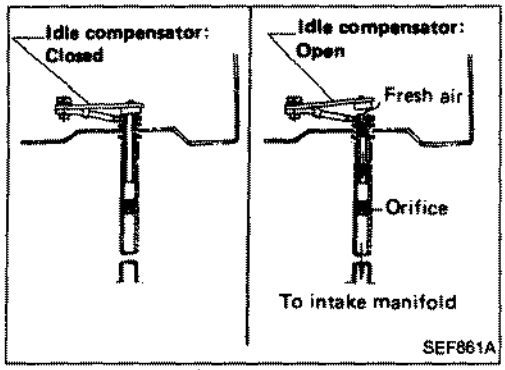
Air control valve operating vacuum:
–kPa (–mbar, –mmHg, –inHg)
Opening starts
6.7 ± 2.0 (67 ± 20, 50 ± 15, 1.97 ± 0.59)
Full opening
13.3 ± 3.3 (133 ± 33, 100 ± 25, 3.94 ± 0.98)

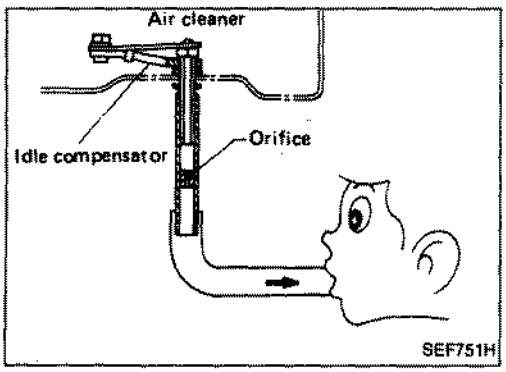


Temperature sensor

While engine is cool and idling, disconnect inlet vacuum hose of vacuum motor and make sure that intake manifold vacuum is present at the end of vacuum hose. If vacuum is weak or is nonexistent, check vacuum hose for leakage.

Replace temperature sensor if vacuum hoses are in good condition. After engine warms up, make sure no vacuum exists. If necessary, replace temperature sensor.





Idle Compensator

The idle compensator is basically a thermostatic valve which introduces air directly from the air cleaner to the intake manifold to compensate for abnormal enrichment of mixture in high idle temperatures and to stabilize the engine. The idle compensator is installed on the air cleaner.
N14 4WD for Europe, B13 GA16DS for Europe and Gulf standard models have idle compensators No. 1 and No. 2. The others have only idle compensator No. 1.

Inspection

1. Remove air cleaner.
2. Suck on hose to make sure neither idle compensator opens.

Idle compensator opening temperature

Idle compensator No. 1

Intake air temperature °C (°F)	Bimetal function
Below 55 (131)	Fully closed
55 - 65 (131 - 149)	Closed or open
Above 65 (149)	Fully open

Idle compensator No. 2

Intake air temperature °C (°F)	Bimetal function
Below 65 (149)	Fully closed
65 - 75 (149 - 167)	Closed or open
Above 75 (167)	Fully open

3. Direct warm air to idle compensator with a heat gun. And measure operating temperature of idle compensator.

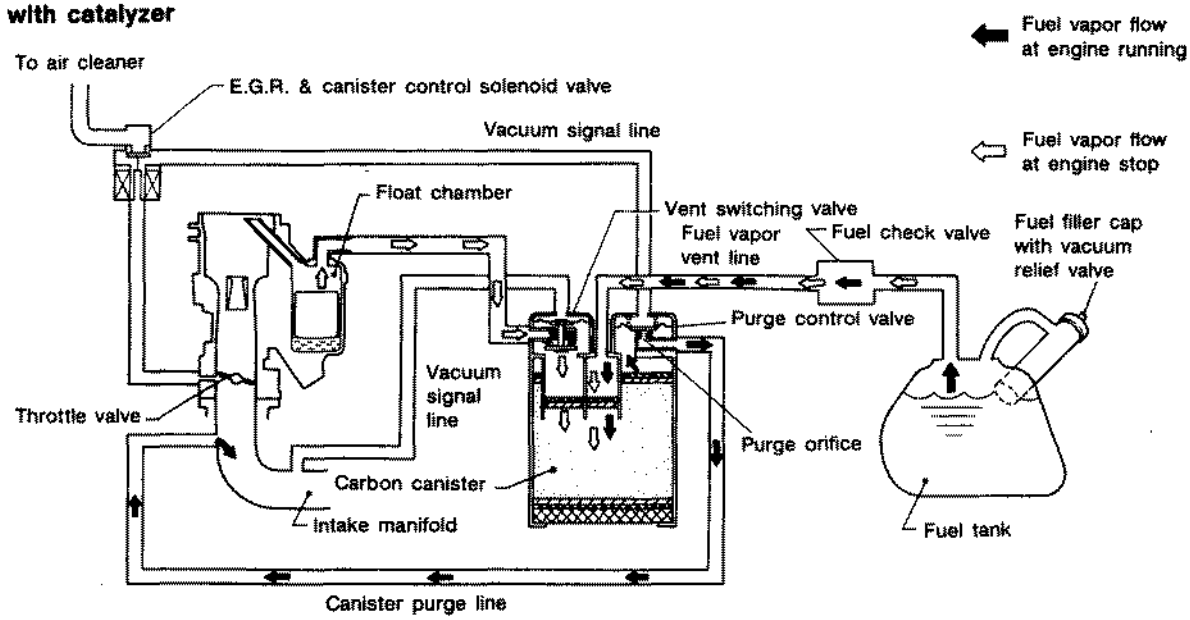
- **Place thermometer as close as possible to idle compensator sensor.**

4. Idle compensator is in good condition if airflow opens idle compensator when it reaches operating temperature.

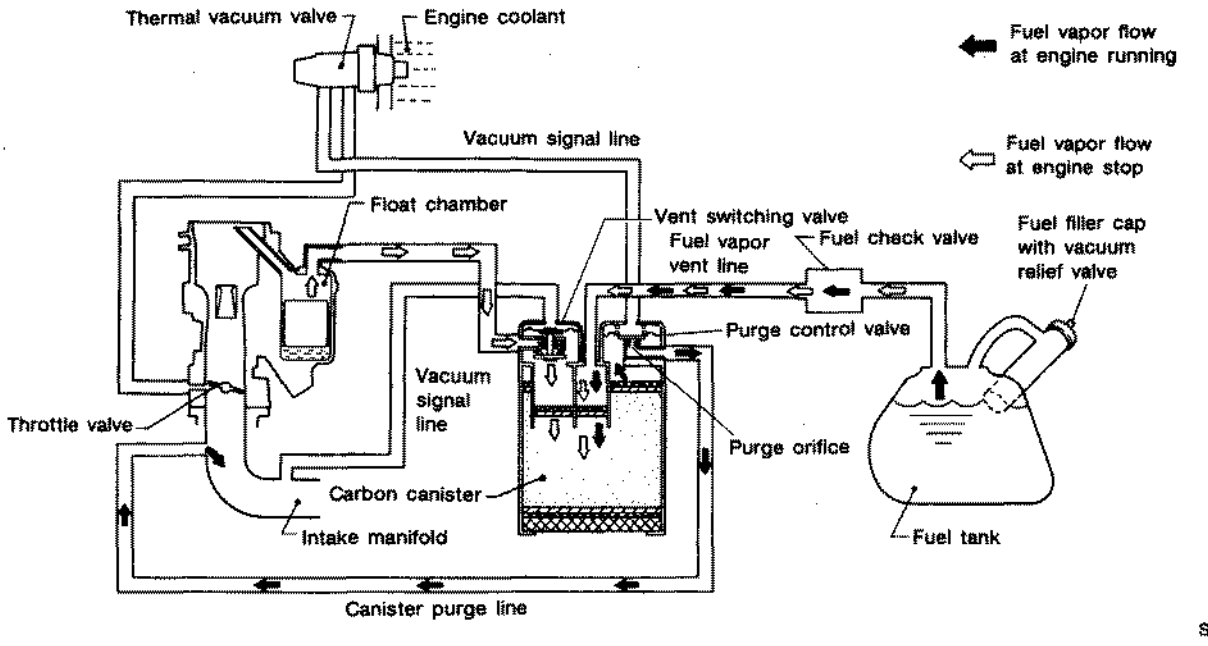
- **Take care not to bend or damage bimetals of idle compensator.**

Description

Models with catalyzer



Models for Gulf standard



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

The fuel vapor from the sealed fuel tank is led into the canister which contains activated carbon and the vapor is stored there when the engine is not running.

The canister retains the fuel vapor until the canister is purged by the air drawn through the bottom of the canister to the intake manifold when the engine is running. When the engine runs at idle, the purge control valve is closed.

Only a small amount of stored vapor flows into the intake manifold through the constant purge orifice. As the engine speed increases, and the throttle vacuum rises higher, the

Description (Cont'd)

purge control valve opens and the vapor is sucked into the intake manifold through both the main purge orifice and the constant purge orifice.

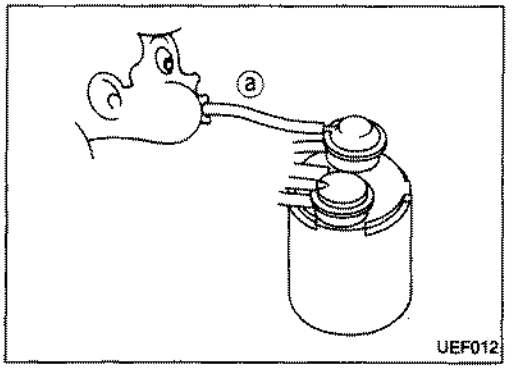
Inspection

FUEL TANK AND VAPOR VENT LINE

Refer to MA section for inspection of fuel tank and vapor vent line.

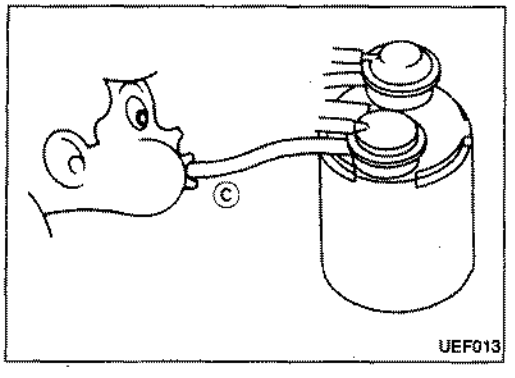
THERMAL VACUUM VALVE

The thermal vacuum valve is used with the ignition control system. Refer to page EF & EC-185.

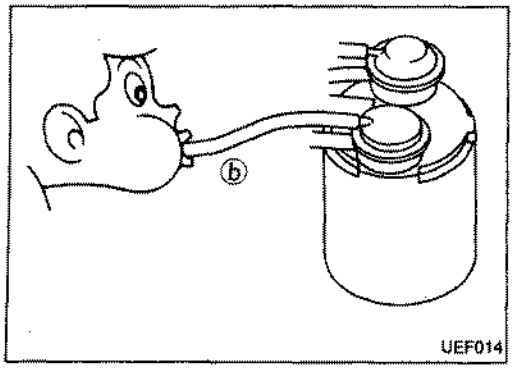


CARBON CANISTER PURGE CONTROL VALVE

1. Disconnect rubber hose in the line between T-connector and carbon canister, at T-connector (hose ⓐ).
2. With engine running, suck air from the opening of the rubber hose ⓐ, and make sure that there is no leak. Also, when sucking, engine rpm should increase.
   If N.G., replace canister.

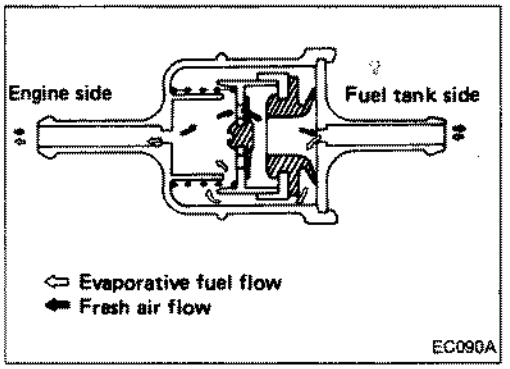


3. Disconnect rubber hose ⓒ, leading to carburetor float chamber.
4. With engine running blow air through rubber hose ⓒ, and make sure that there is no leak.
5. With engine off make sure there is a leak.
   If N.G., replace canister.



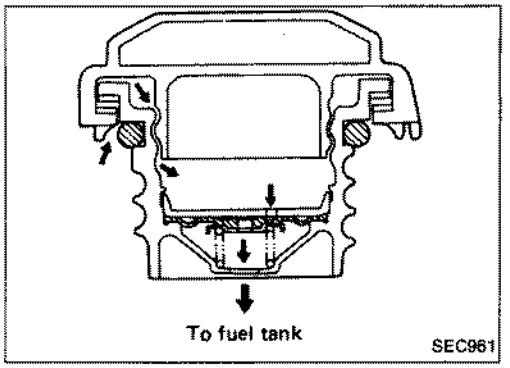
6. Disconnect rubber hose ⓑ, leading to intake manifold.
7. Blow or suck air to or from the opening of rubber hose ⓑ, and make sure that there is no leak.
   If N.G., replace canister.

Inspection (Cont'd)



FUEL CHECK VALVE

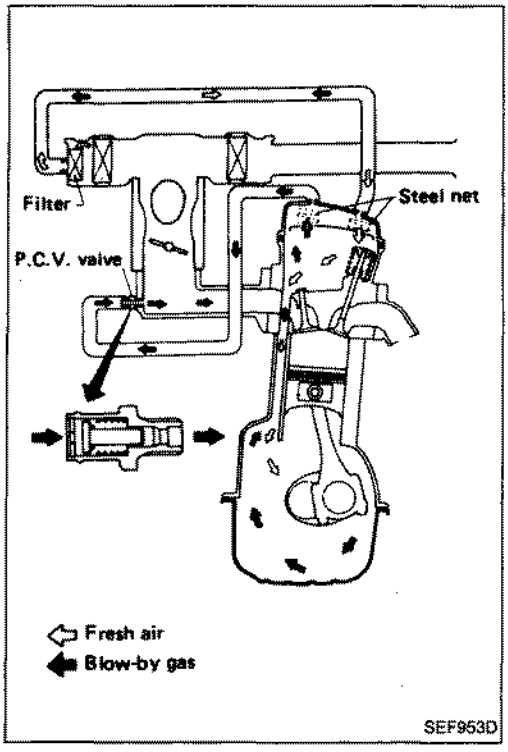
1. Blow air through connector on fuel tank side.
   A considerable resistance should be felt at the mouth and a portion of air flow be directed toward the engine.
2. Blow air through connector on engine side.
   Air flow should be smoothly directed toward fuel tank.
3. If fuel check valve is suspected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



FUEL TANK VACUUM RELIEF VALVE

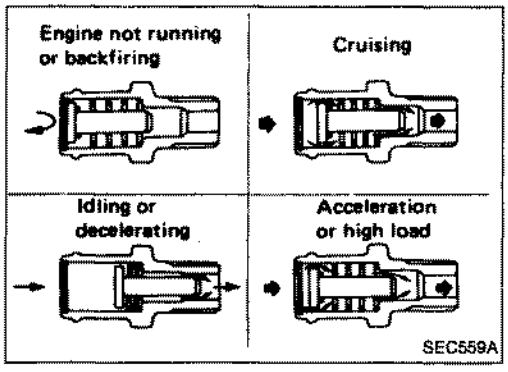
Remove fuel filler cap and make sure it functions properly.

1. Wipe clean valve housing and place it in your mouth.
2. Suck air. A slight resistance accompanied by valve indicates that valve is in good mechanical condition. Note also that, by further sucking air, the resistance should disappear with valve clicks.
3. If valve is clogged, or if no resistance is felt, replace cap as an assembled unit.



Description

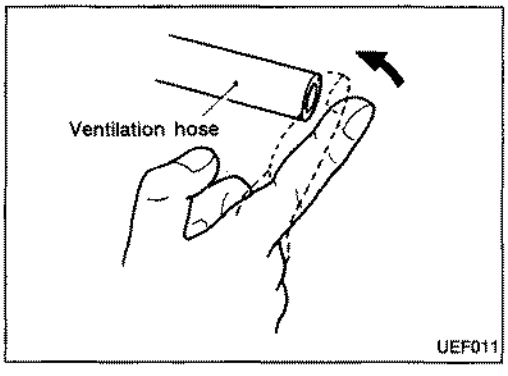
This system returns blow-by gas to both the intake manifold and air cleaner.
The positive crankcase ventilation (P.C.V.) valve is provided to conduct crankcase blow-by gas to the intake manifold.
During partial throttle operation of the engine, the intake manifold sucks the blow-by gas through the P.C.V. valve.
Normally, the capacity of the valve is sufficient to handle any blow-by and a small amount of ventilating air.
The ventilating air is then drawn from the air cleaner, through the hose connecting air cleaner to rocker cover, into the crankcase.
Under full-throttle condition, the manifold vacuum is insufficient to draw the blow-by flow through the valve, and its flow goes through the hose connection in the reverse direction.
On vehicles with an excessively high blow-by some of the flow will go through the hose connection to the air cleaner under all conditions.



Inspection

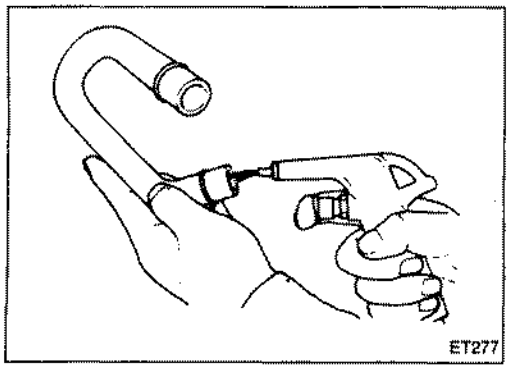
P.C.V. VALVE

With engine running at idle, remove ventilation hose from rocker cover; if P.C.V. 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 hose inlet.
If N.G., check ventilation hose first.
If hose is O.K., replace P.C.V. valve.



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.

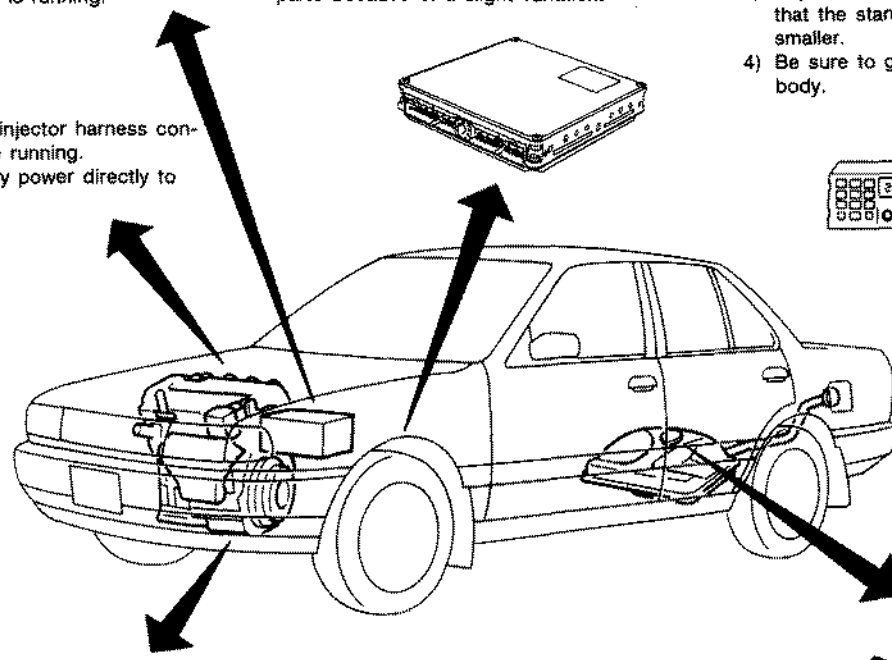


BATTERY
- Always use a 12 volt battery as power source.
- Do not attempt to disconnect battery cables while engine is running.

INJECTOR
- Do not disconnect injector harness connectors with engine running.
- Do not apply battery power directly to injectors.

E.C.C.S. PARTS HANDLING
- Handle air flow meter carefully to avoid damage.
- Do not disassemble air flow meter.
- Do not clean air flow meter with any type of detergent.
- Do not disassemble auxiliary air control valve.
- Even a slight leak in the air intake system can cause serious problems.
- Do not shock or jar the crank angle sensor.

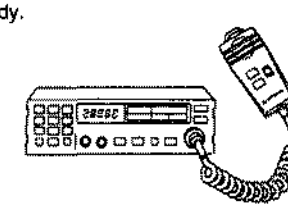
E.C.U.
- Do not disassemble E.C.C.S. control unit (E.C.U.).
- Do not turn diagnosis mode selector forcibly.
- If a battery terminal is disconnected, the memory will return to the ROM value. The E.C.C.S. will now start to self-control at its initial value. Engine operation can vary slightly when the terminal is disconnected. However this is not an indication of a problem. Do not replace parts because of a slight variation.

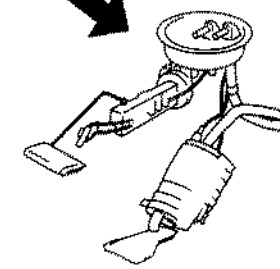


WHEN STARTING
- Do not depress accelelator pedal when starting.
- Immediately after starting, do not rev up engine unnecessarily.
- Do not rev up engine just prior to shutdown.

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

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



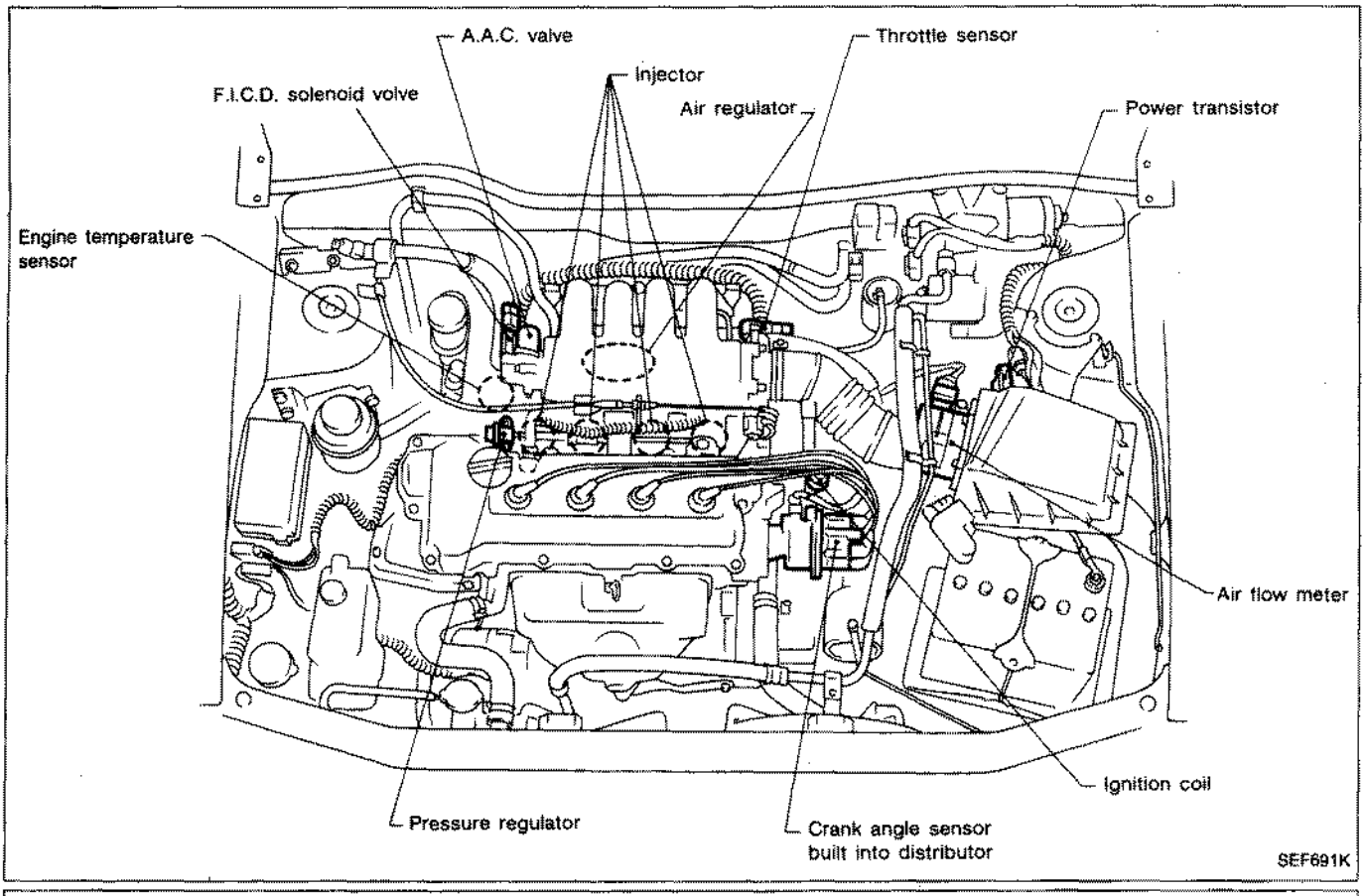


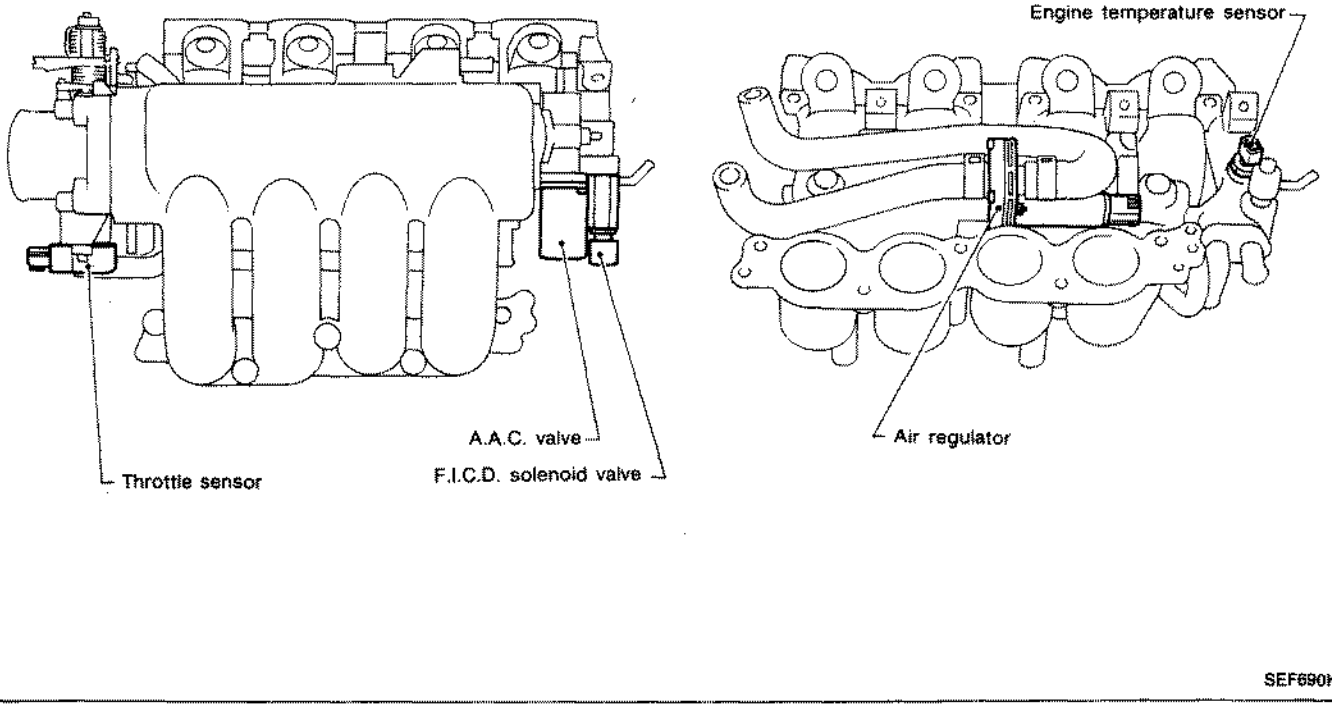
FUEL PUMP
- Do not operate fuel pump when there is no fuel in lines.
- Tighten fuel hose clamps to the specified torque.

E.C.C.S. HARNESS HANDLING
- Securely connect E.C.C.S. harness connectors.
  A poor connection can cause an extremely high (surge) voltage to develop in coil and condenser, thus resulting in damage to ICs.
- Keep E.C.C.S. harness at least 10 cm (3.9 in) away from adjacent harnesses, to prevent an E.C.C.S. system malfunction due to receiving external noise, degraded operation of ICs, etc.
- Keep E.C.C.S. parts and harnesses dry.
- Before removing parts, turn off ignition switch and then disconnect battery ground cable.

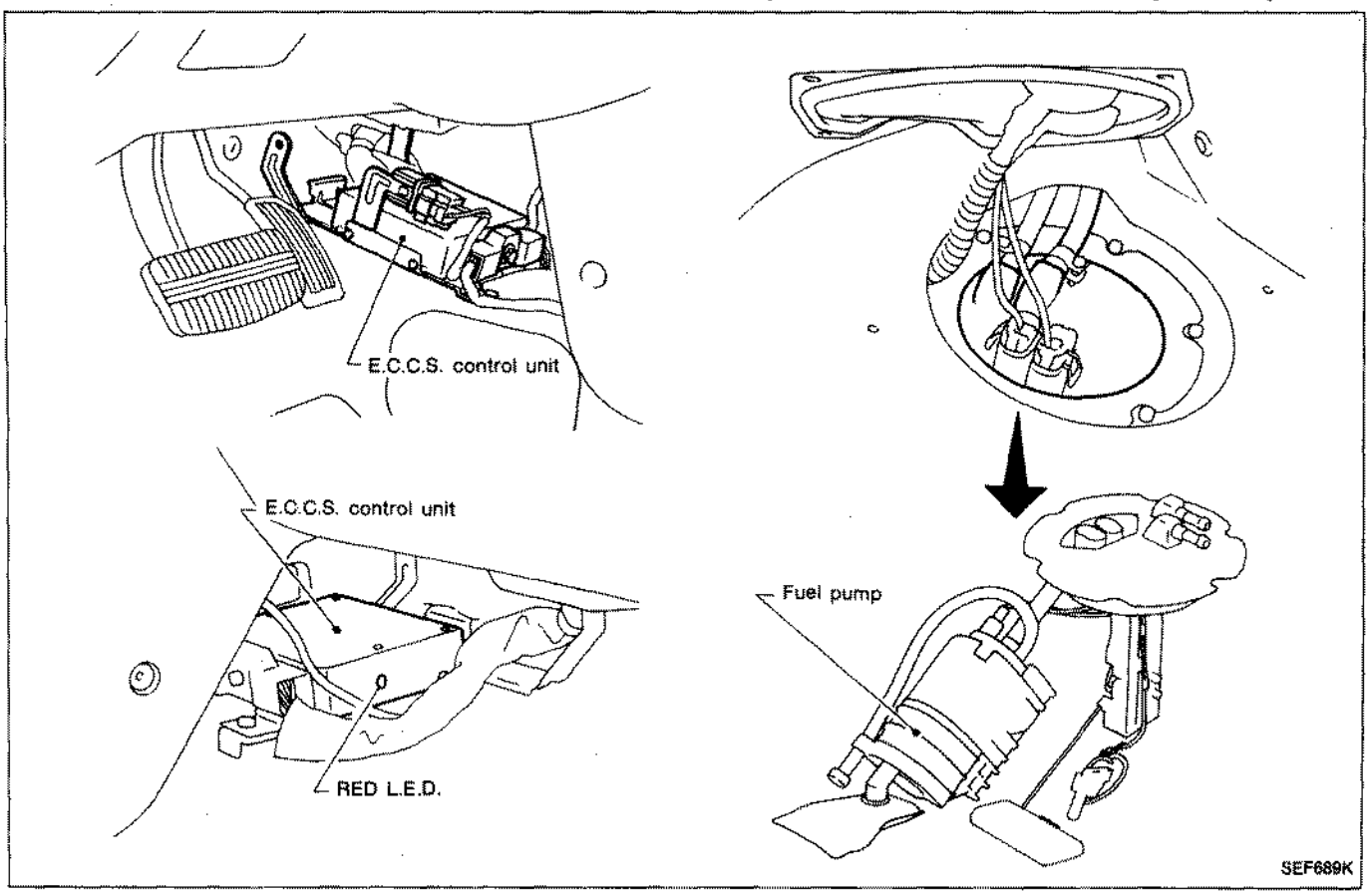
SEF688K

E.C.C.S. Component Parts Location

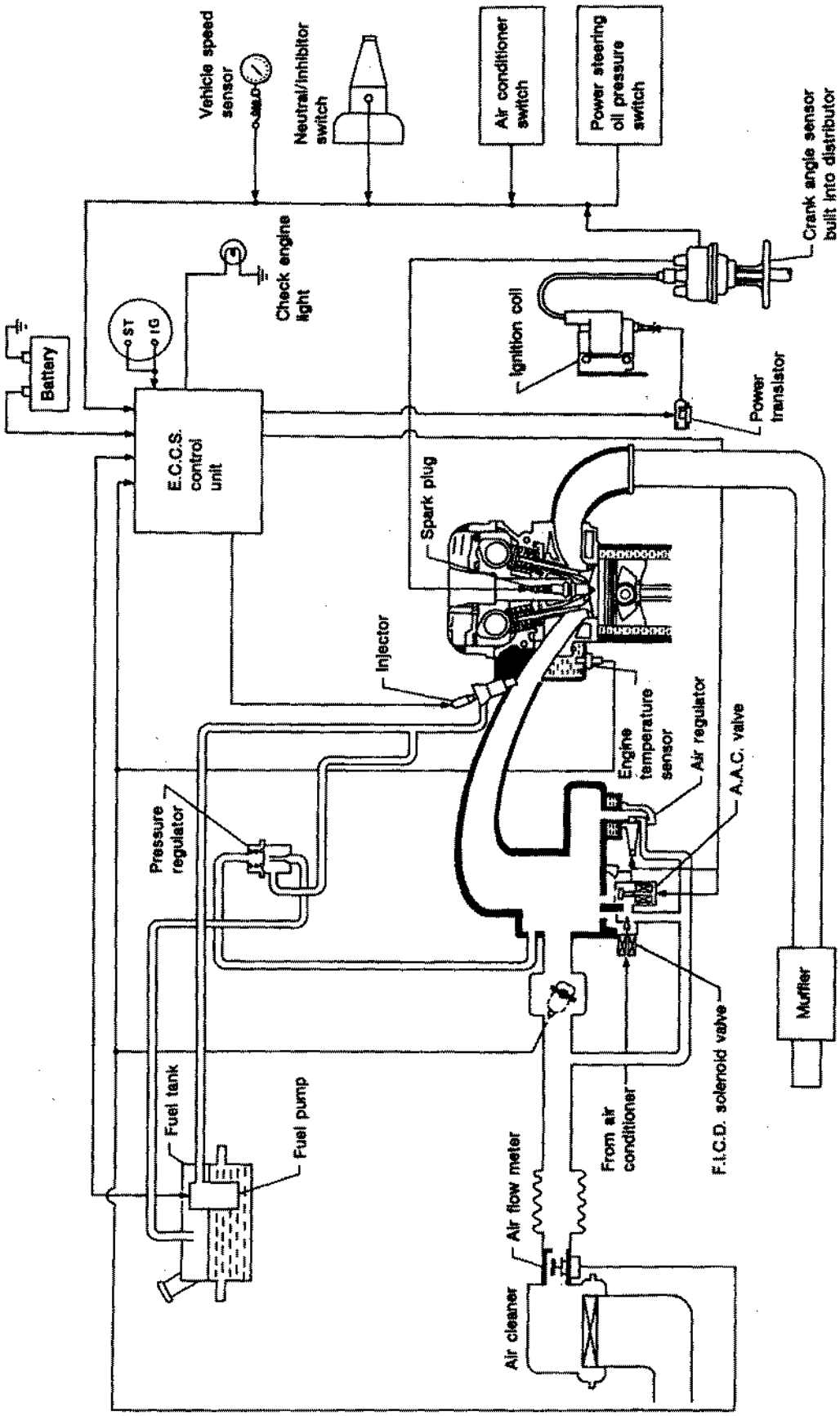




E.C.C.S. Component Parts Location (Cont'd)

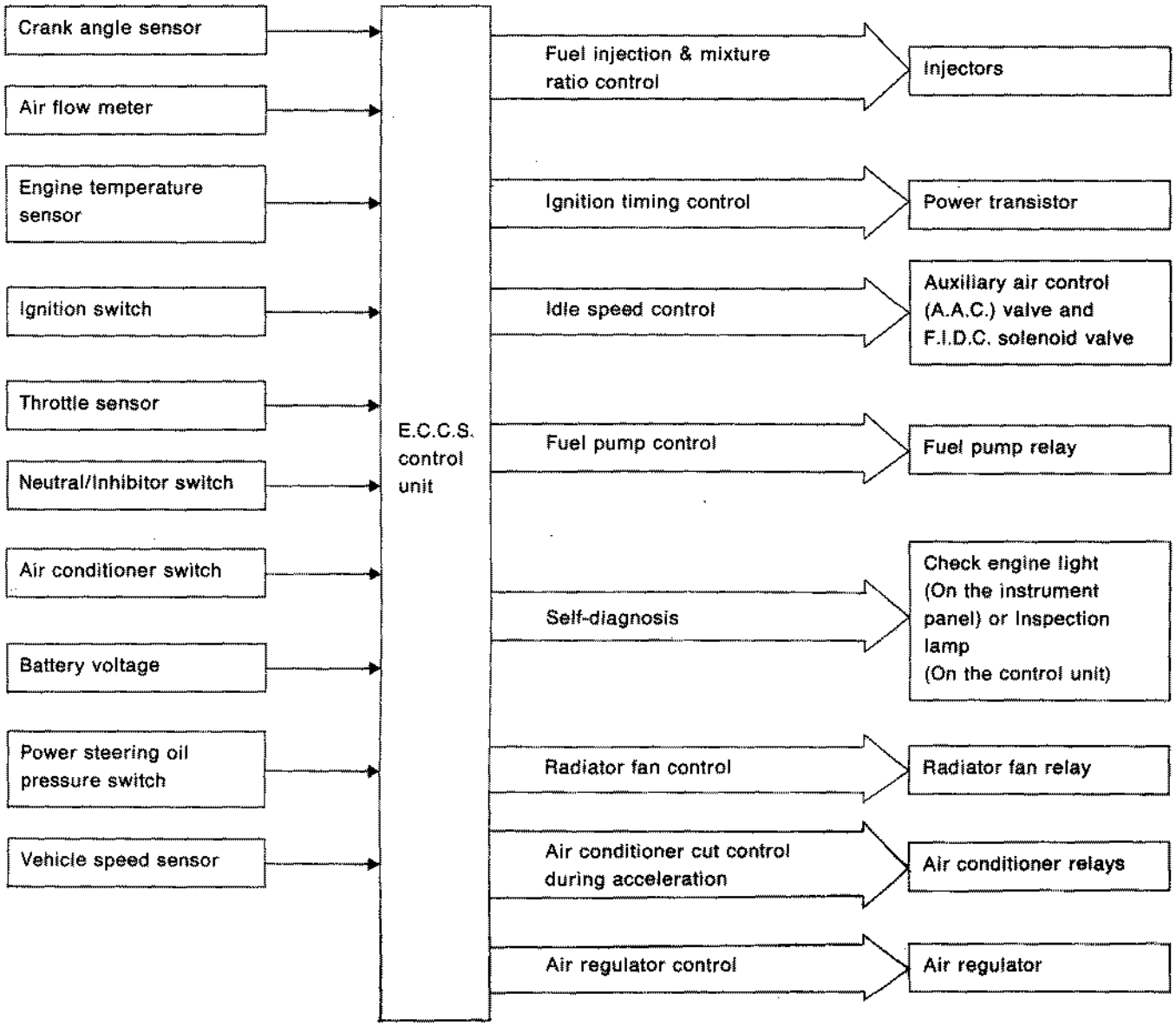


System Diagram

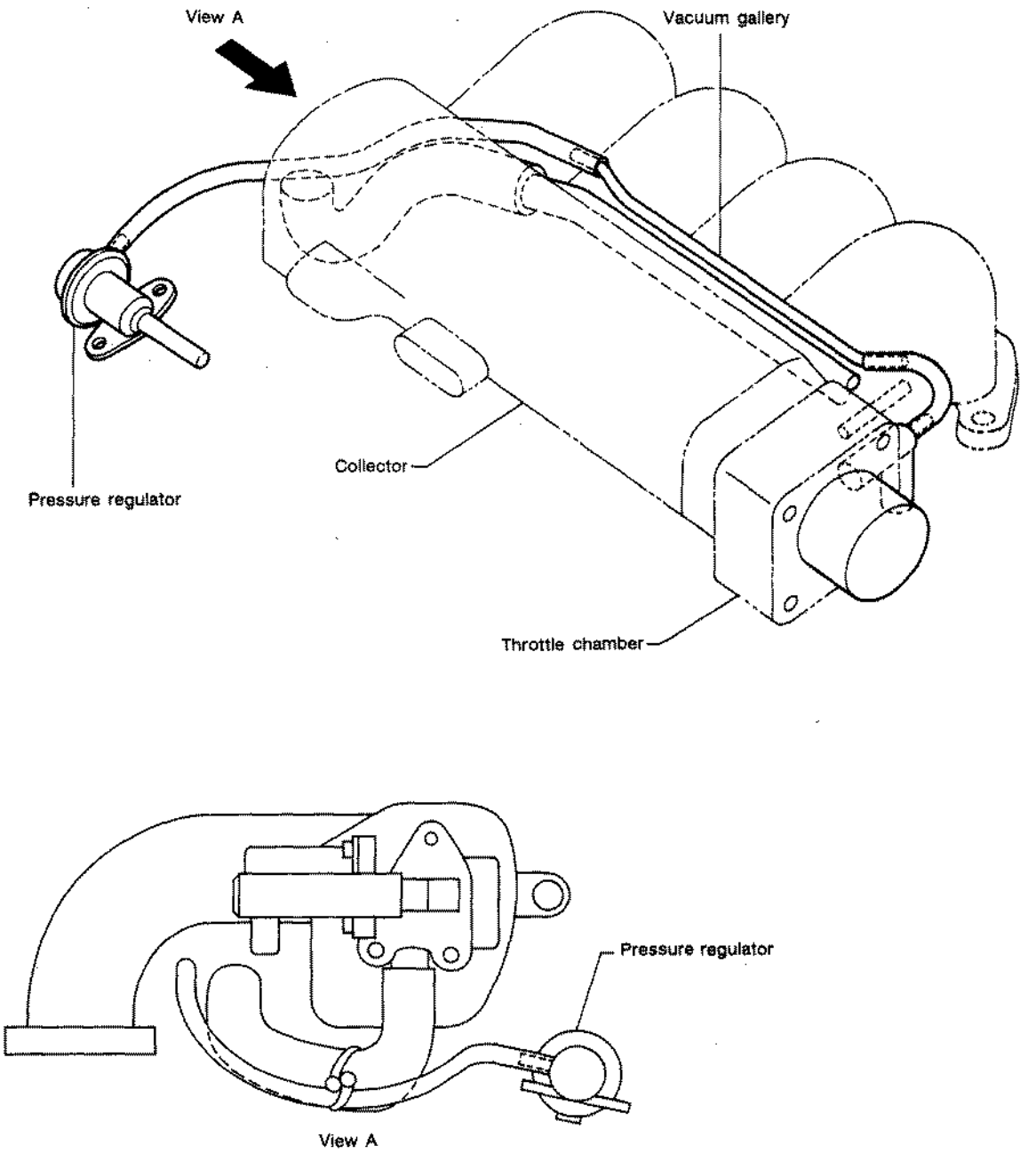


SEF351L

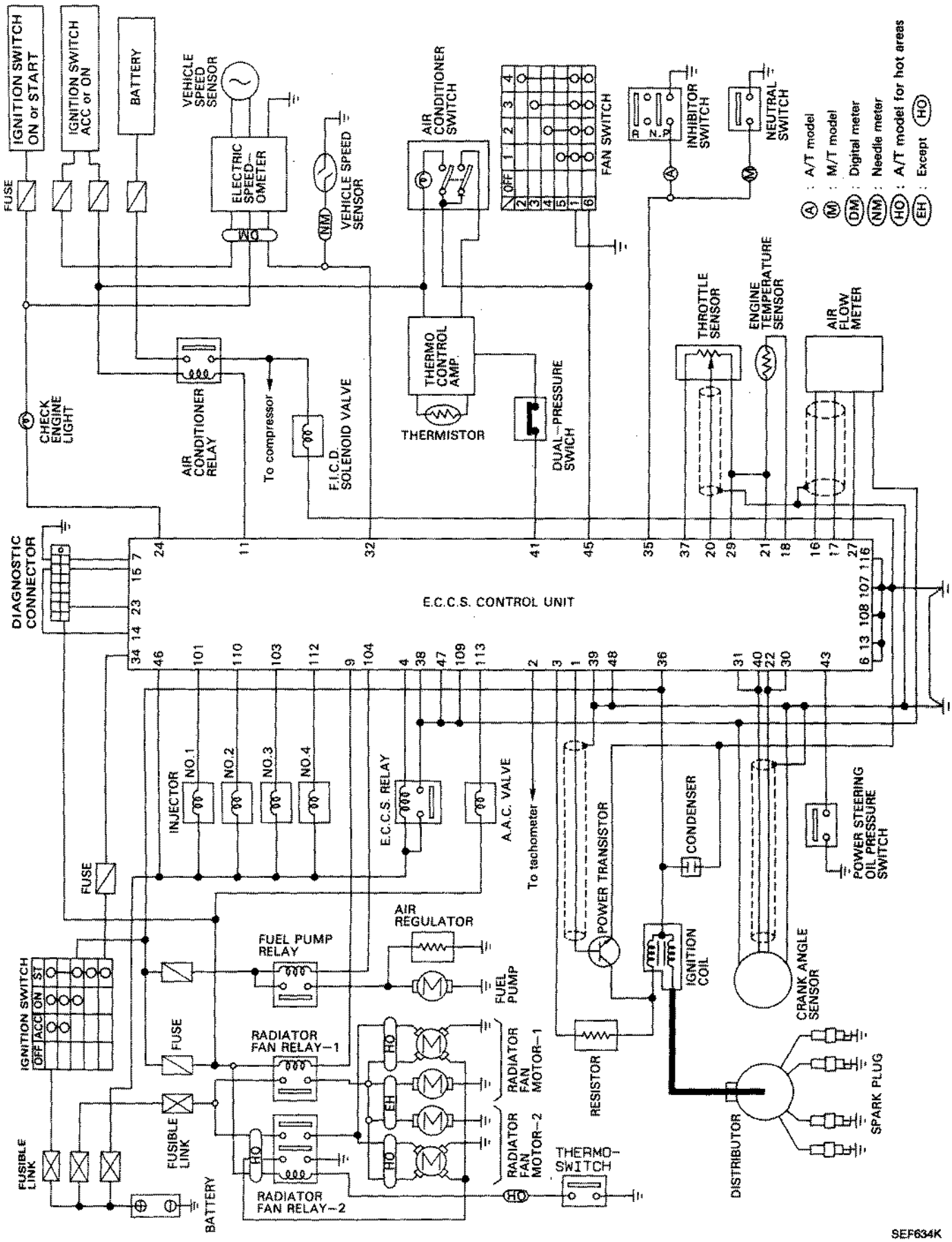
System Chart



Vacuum Hose Drawing

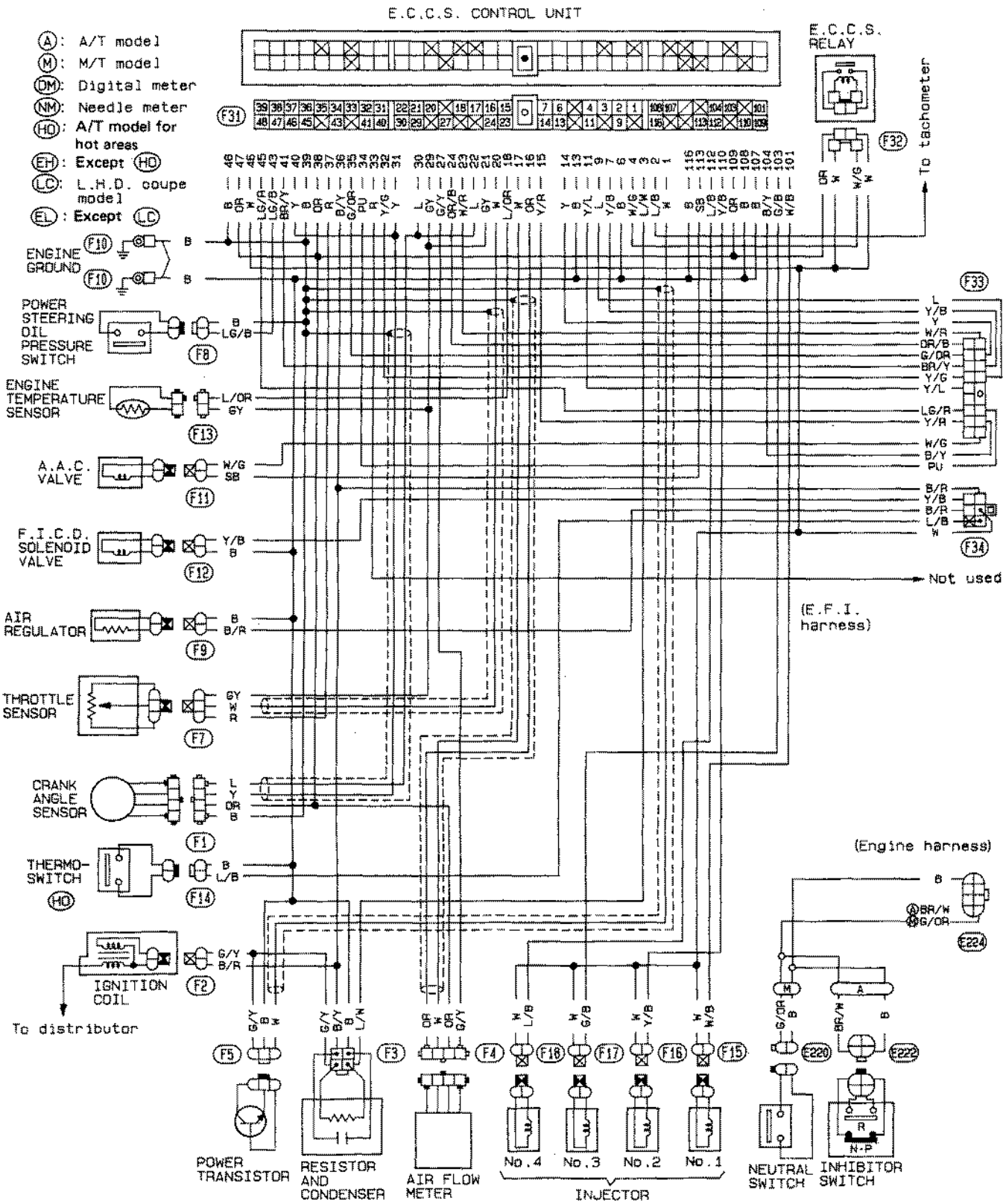


Circuit Diagram

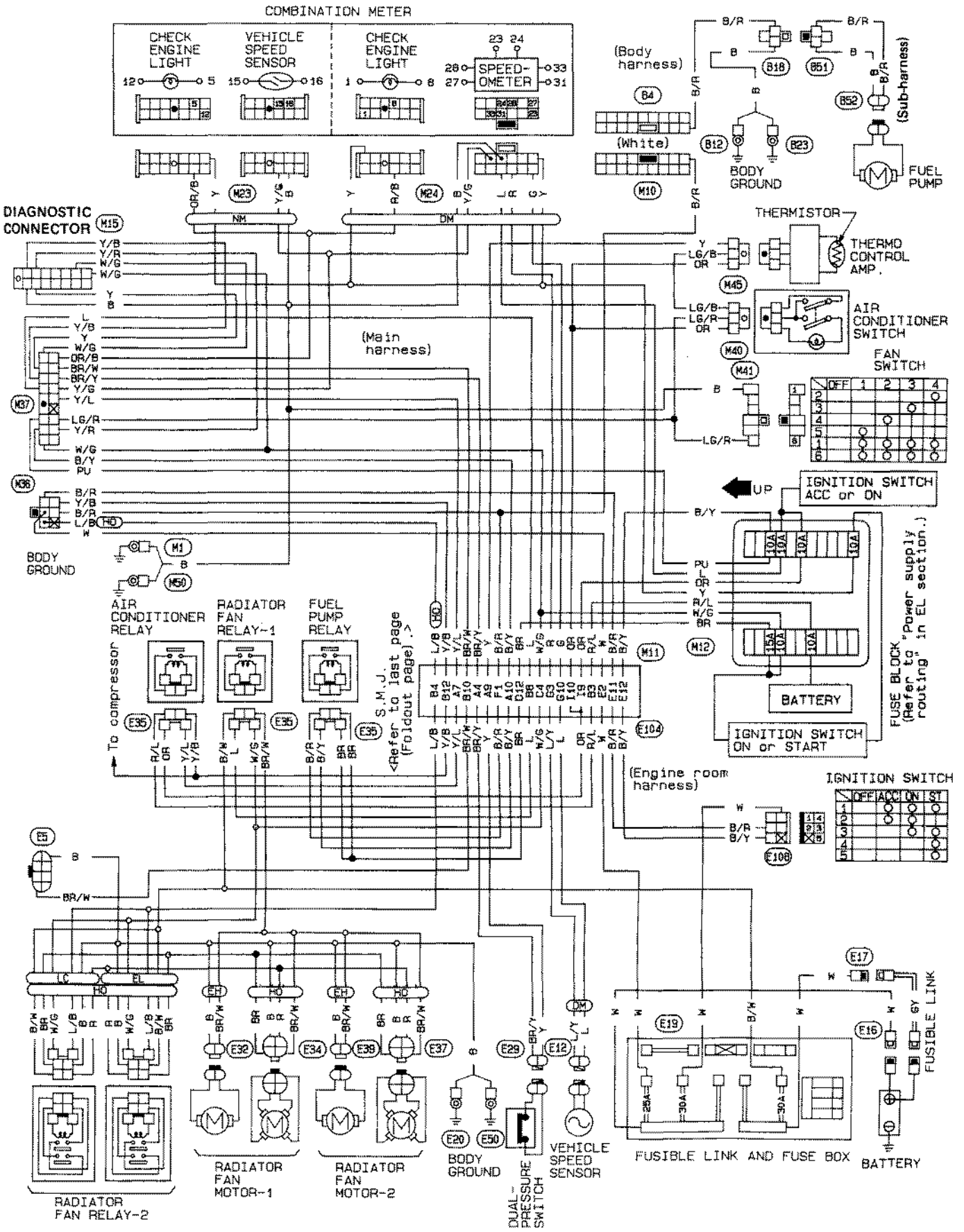


Wiring Diagram

L.H.D. MODELS



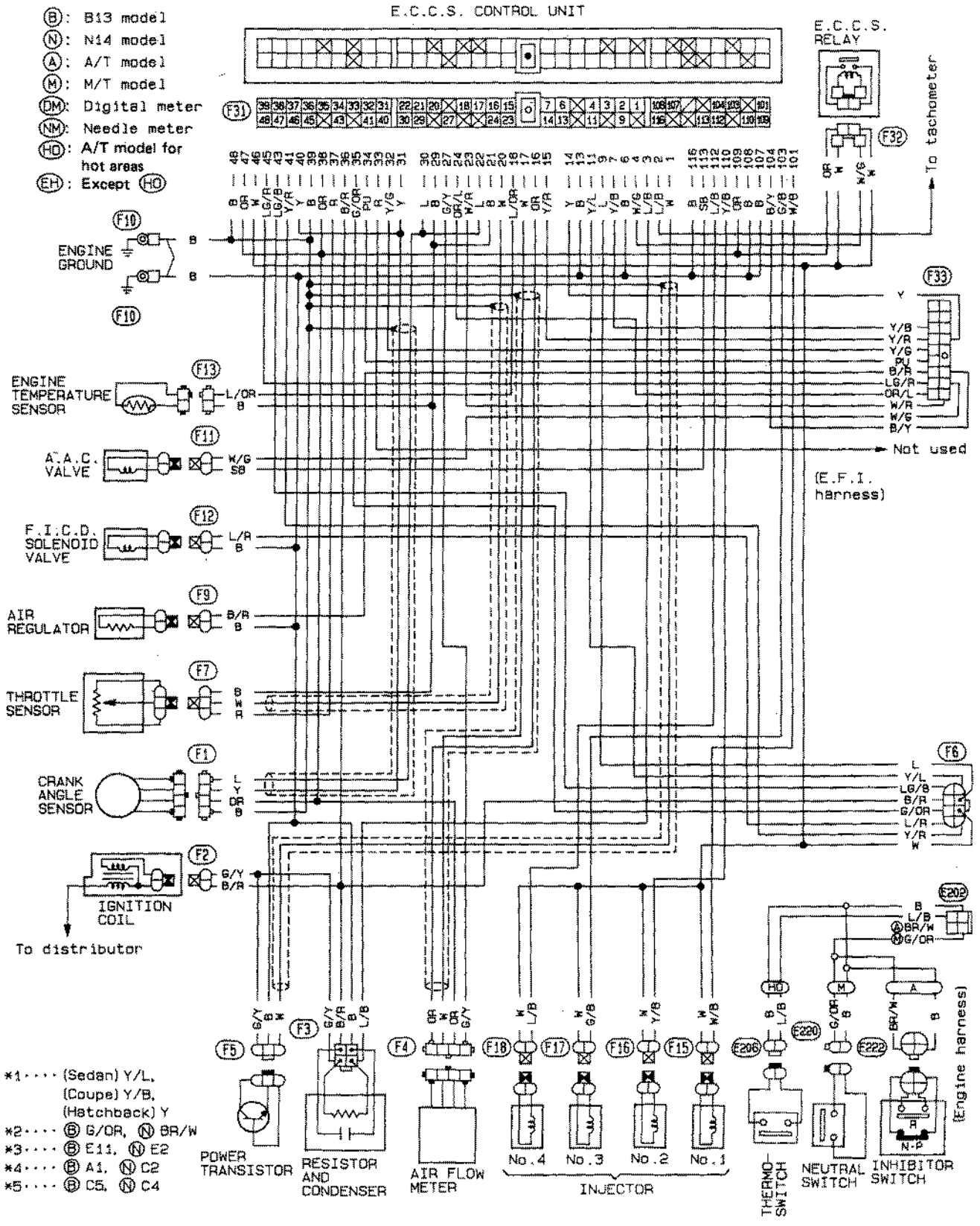
Wiring Diagram (Cont'd)



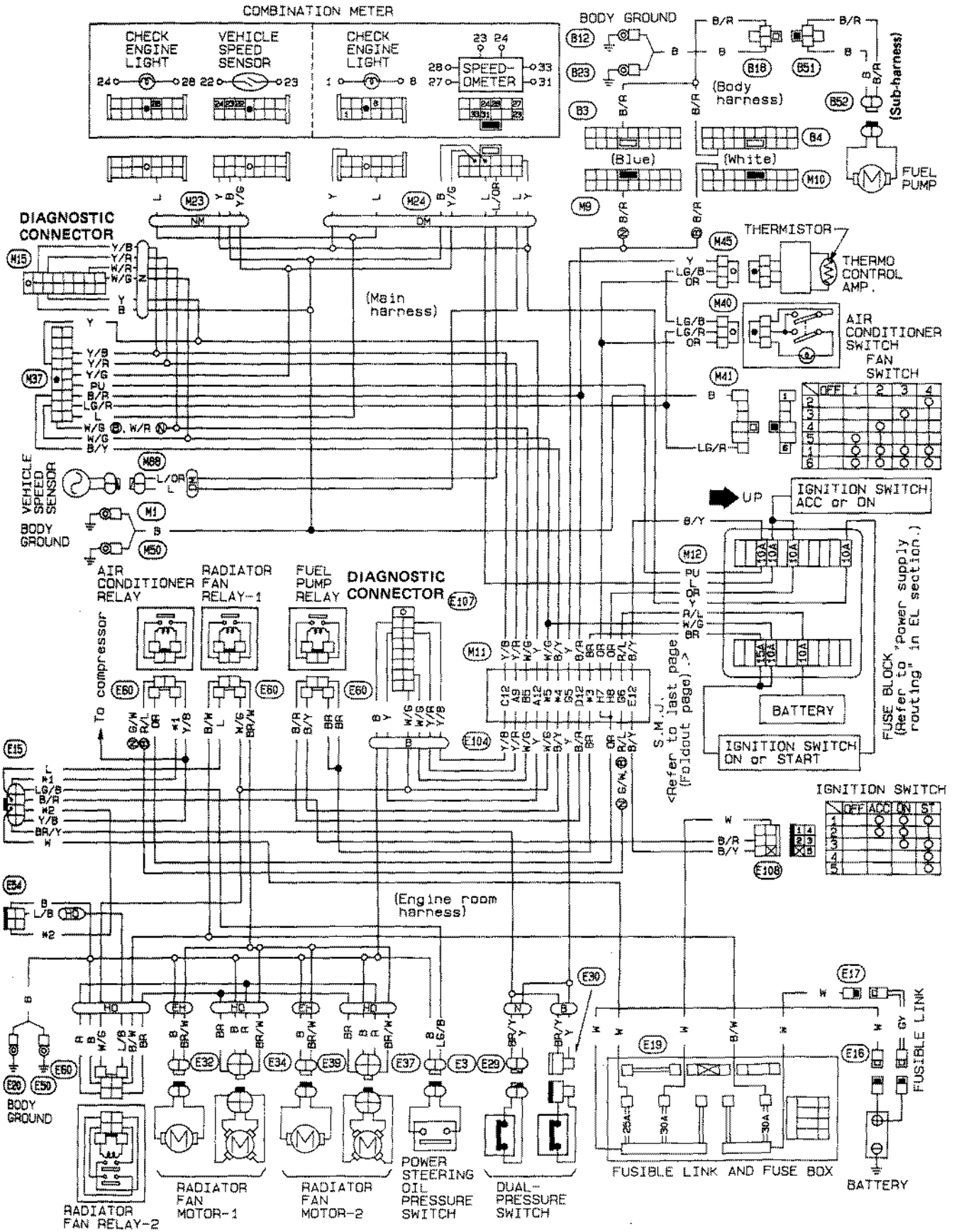
SEF635K

Wiring Diagram (Cont'd)

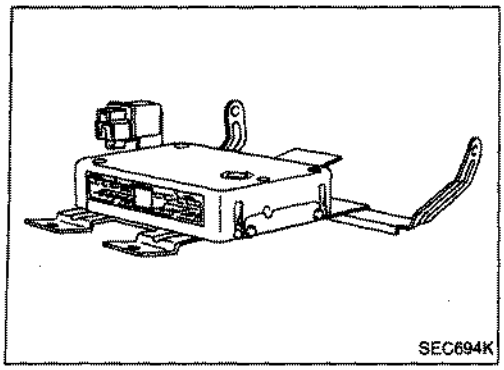
R.H.D. MODELS



Wiring Diagram (Cont'd)

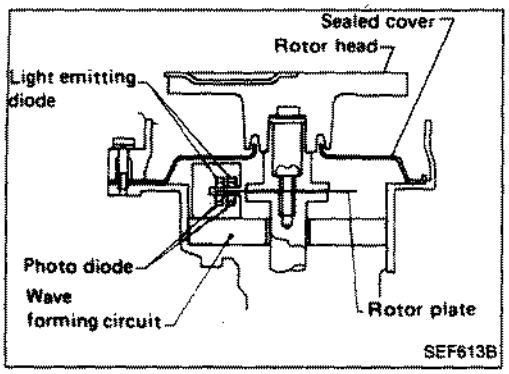


SEF636K


SEC694K

E.C.C.S. Control Unit (E.C.U.)

The E.C.U. consists of a microcomputer, inspection lamp, a diagnostic mode selector, and connectors for signal input and output and for power supply. The unit controls the engine.

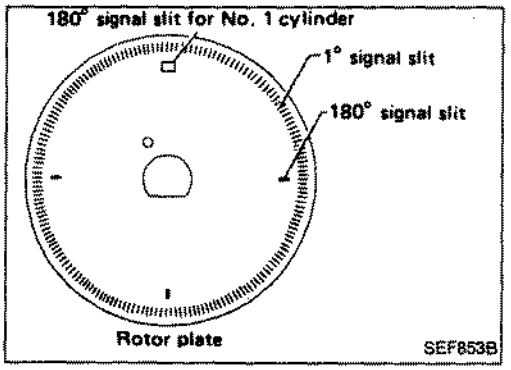


SEF613B

Crank Angle Sensor

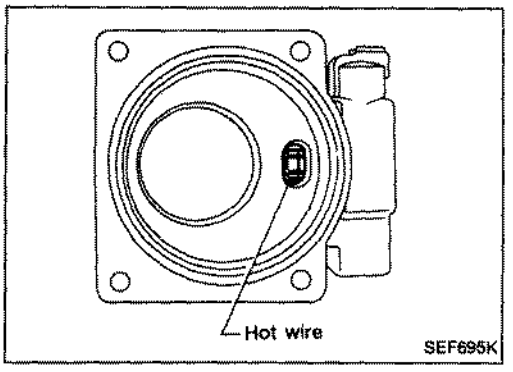
The crank angle sensor is a basic component of the entire E.C.C.S. It monitors engine speed and piston position, and sends signals to the E.C.U. to control fuel injection, ignition timing and other functions.

The crank angle sensor has a rotor plate and a wave-forming circuit. The rotor plate has 360 slits for 1° signal and 4 slits for 180° signal. Light Emitting Diodes (L.E.D.) and photo diodes are built in the wave-forming circuit.



SEF853B

When the rotor plate passes between the L.E.D. and the photo diode, the slits in the rotor plate continually cut the light being transmitted to the photo diode from the L.E.D. This generates rough-shaped pulses which are converted into on-off pulses by the wave-forming circuit, which are sent to the E.C.U.



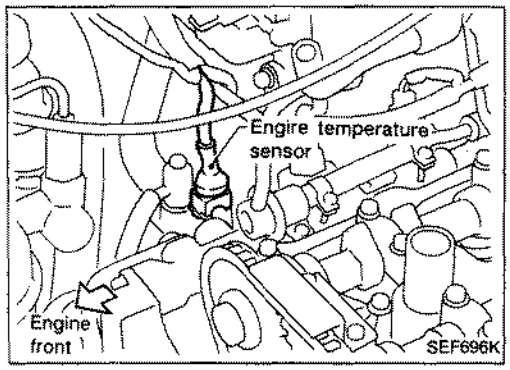
SEF695K

Air Flow Meter

The air flow meter measures the intake air flow rate by taking a part of the entire flow. Measurements are made in such a manner that the E.C.U. receives electrical output signals varied by the amount of heat emitting from the hot wire placed in the stream of the intake air.

When intake air flows into the intake manifold through a route around the hot wire, the heat generated from the hot wire is taken away by the air. The amount of heat depends on the air flow. On the other hand, the temperature of the hot wire is automatically controlled to a certain number of degrees.

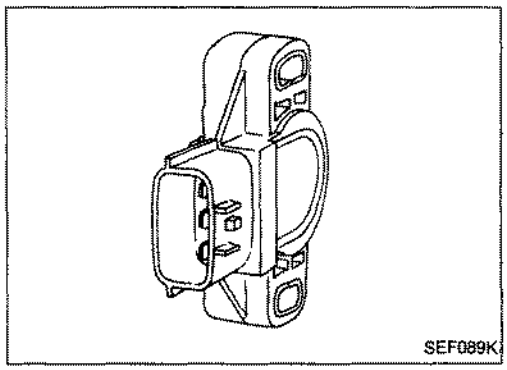
Therefore, it is necessary to supply the hot wire with more electric current in order to maintain the temperature of the hot wire. The E.C.U. knows the air flow by means of the electric change.



Engine Temperature Sensor

The engine temperature sensor, located on the intake manifold, detects engine coolant temperature and transmits a signal to the E.C.U.

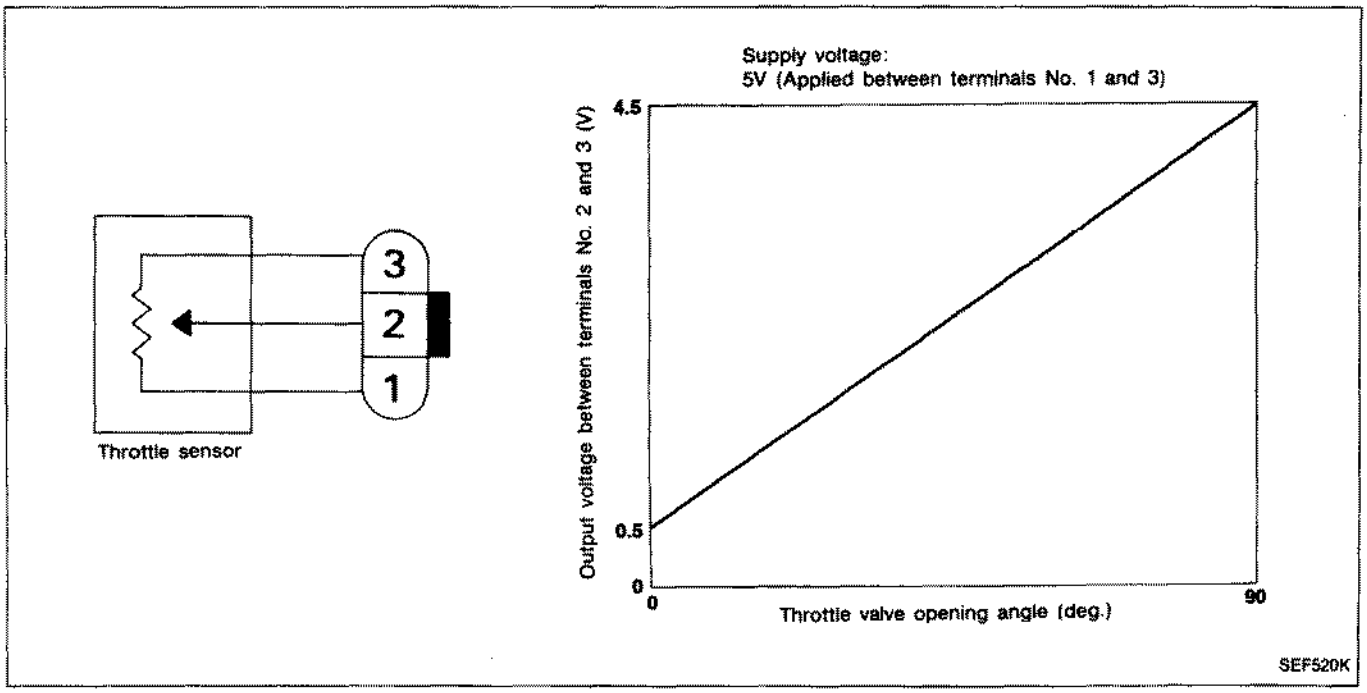
The temperature sensing unit employs a thermistor which is sensitive to the change in temperature. Electrical resistance of the thermistor decreases in response to the temperature rise.

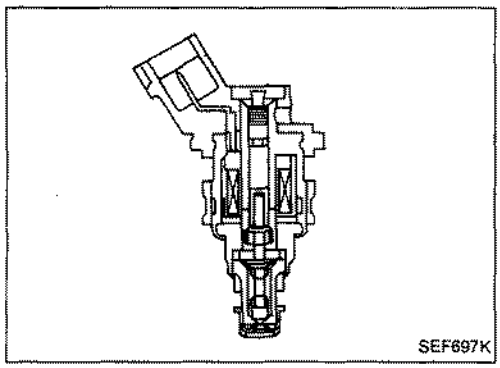


Throttle Sensor & Soft Idle Switch

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

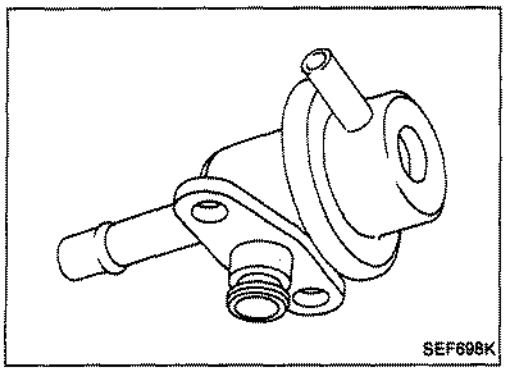
Idle position of the throttle valve is determined by the E.C.U. receiving the signal from the throttle sensor. This system is called "soft idle switch". This one controls engine operation such as fuel cut.





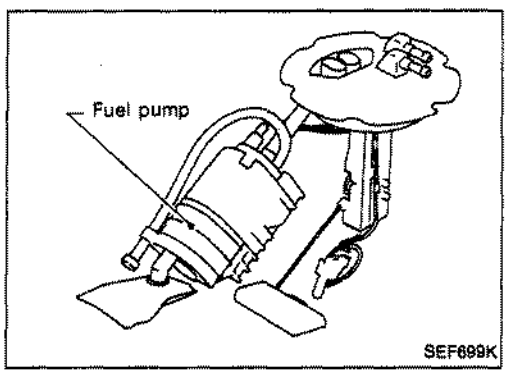
Fuel Injector

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.


SEF698K

Pressure Regulator

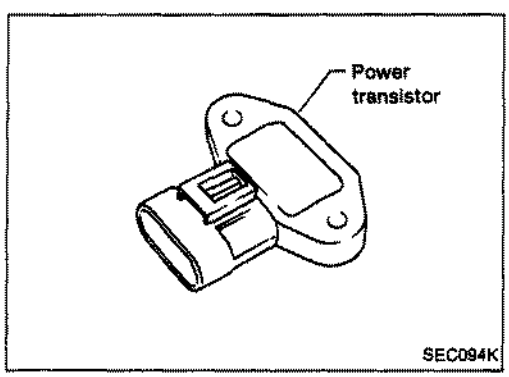
The pressure regulator maintains the fuel pressure at 299.1 kPa (2.991 bar, 3.05 kg/cm^2, 43.4 psi). Since the injected fuel amount depends on injection pulse duration, it is necessary to maintain the pressure at the above value.



SEF699K

Fuel Pump

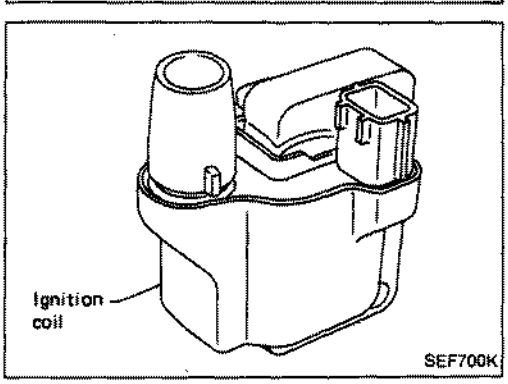
A turbine type design fuel pump is used and is situated in the fuel tank.



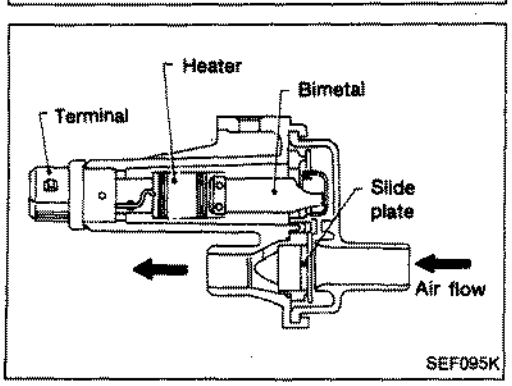
SEC094K

Power Transistor & Ignition Coil

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



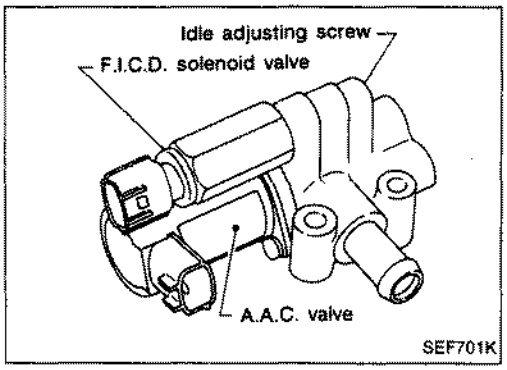
SEF700K



SEF095K

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.

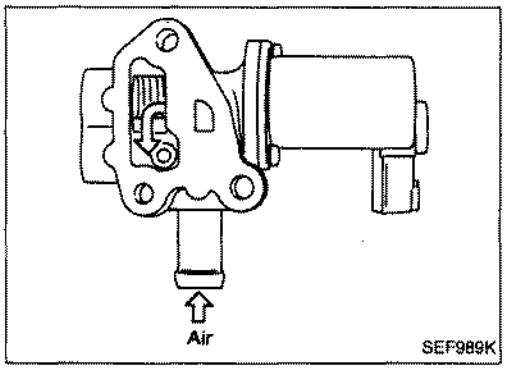


Idle Air Adjusting (I.A.A.) Unit

The I.A.A. unit is made up of the A.A.C. valve, F.I.C.D. solenoid valve and idle adjusting screw. It receives the signal from the E.C.U. and controls the idle speed at the preset value.

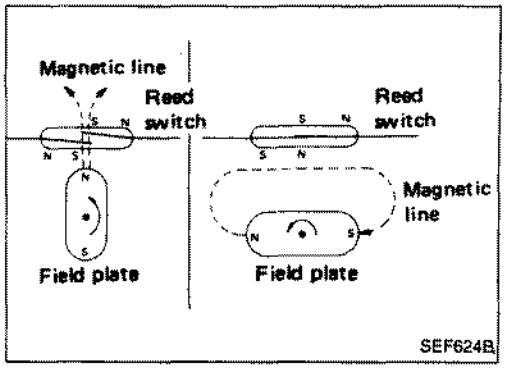
Fast Idle Control Device (F.I.C.D.) Solenoid Valve

The F.I.C.D. solenoid valve provides additional air when the air conditioner switch is turned on.



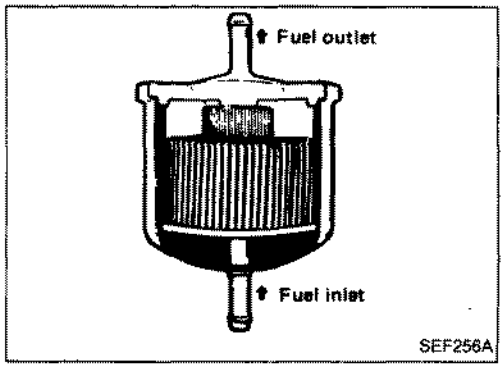
Auxiliary Air Control (A.A.C.) Valve

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



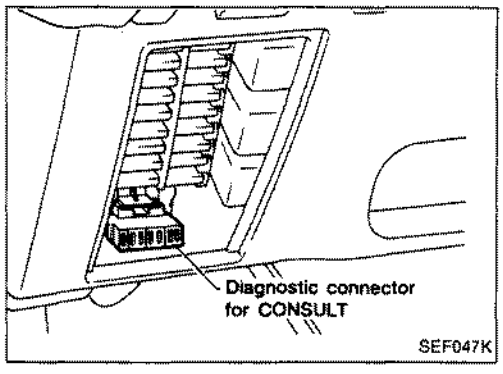
Vehicle Speed Sensor

The vehicle speed sensor provides a vehicle speed signal to the E.C.U.
The speed sensor consists of a reed switch, which is installed in the speedometer unit and transforms vehicle speed into a pulse signal.



Fuel Filter

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

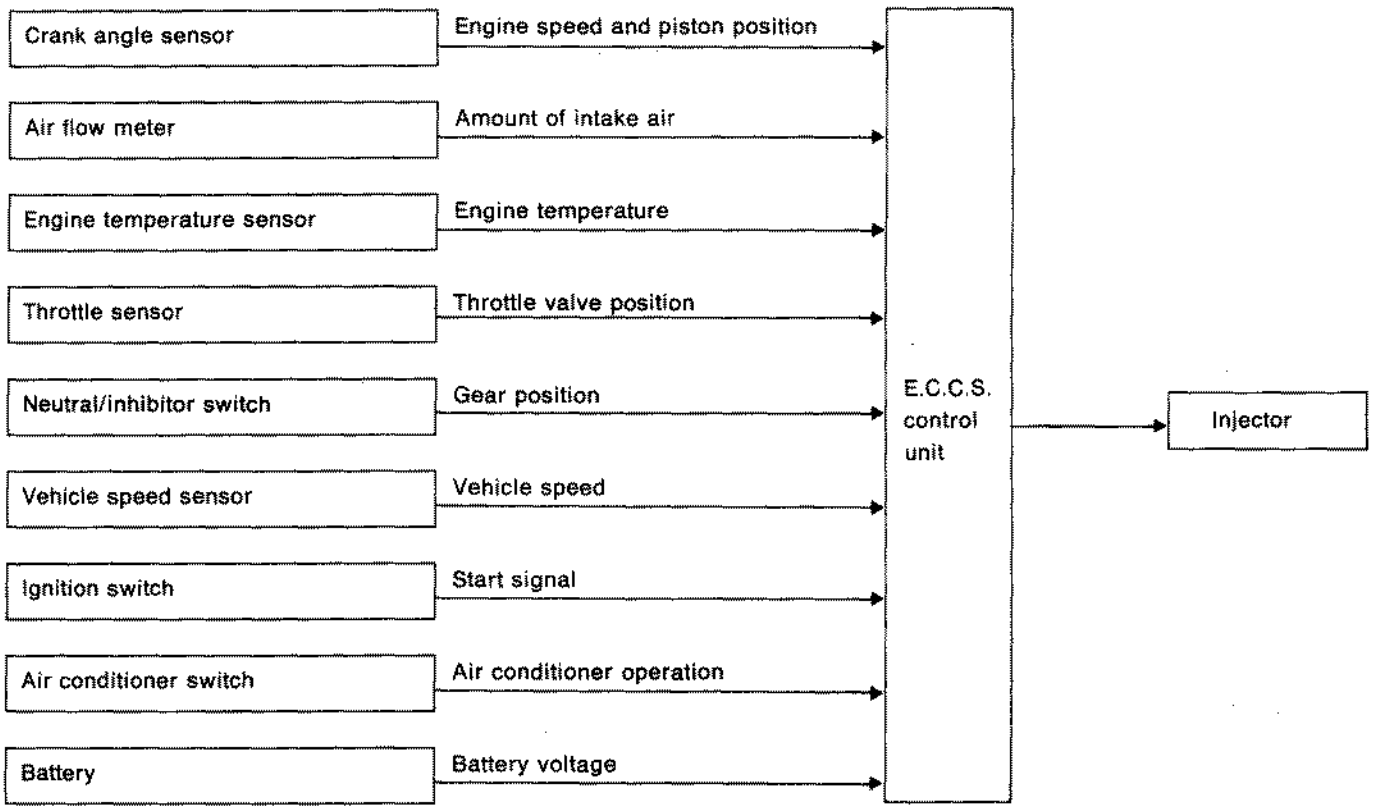


Diagnostic Connector for CONSULT

The diagnostic connector for CONSULT is located behind the fuse box cover.

Fuel Injection Control

INPUT/OUTPUT SIGNAL LINE



BASIC FUEL INJECTION CONTROL

The amount of fuel injected from the fuel injector, or the length of time the valve remains open, is determined by the E.C.U. The basic amount of fuel injected is a program value mapped in the E.C.U. ROM memory. In other words, the program value is preset by engine operating conditions determined by input signals (for engine rpm and air intake) from both the crank angle sensor and the air flow meter.

VARIOUS FUEL INJECTION INCREASE/DECREASE COMPENSATION

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

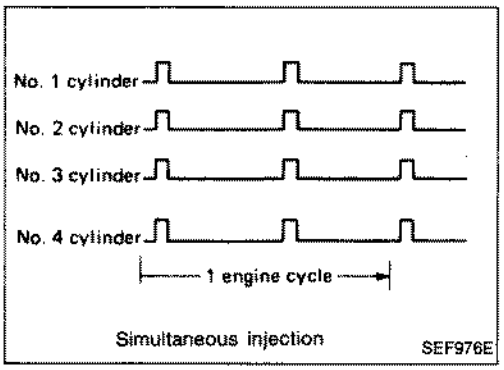
<Fuel increase>

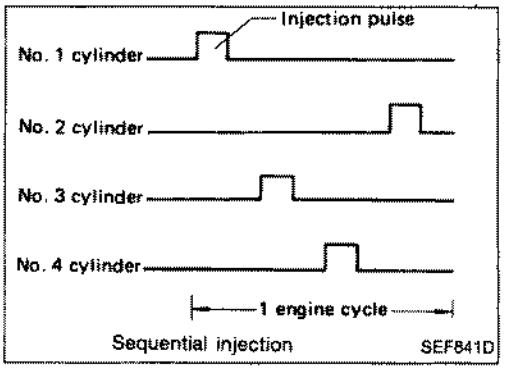
1) During warm-up
2) When starting the engine
3) During acceleration
4) Hot-engine operation
5) When selector lever is changed from "N" to "D" (A/T models only)

<Fuel decrease>

1) During deceleration

Fuel Injection Control (Cont'd)





FUEL INJECTION TIMING

Two types of fuel injection systems are used — simultaneous injection and sequential injection. In the former, fuel is injected into all four cylinders simultaneously twice each engine cycle. In other words, pulse signals of the same width are simultaneously transmitted from the E.C.U. to the four injectors two times for each engine cycle.

In the sequential injection system, fuel is injected into each cylinder during each engine cycle according to the firing order. When the engine is being started and/or if the fail-safe system (C.P.U. of E.C.U.) is operating, simultaneous fuel injection is used.

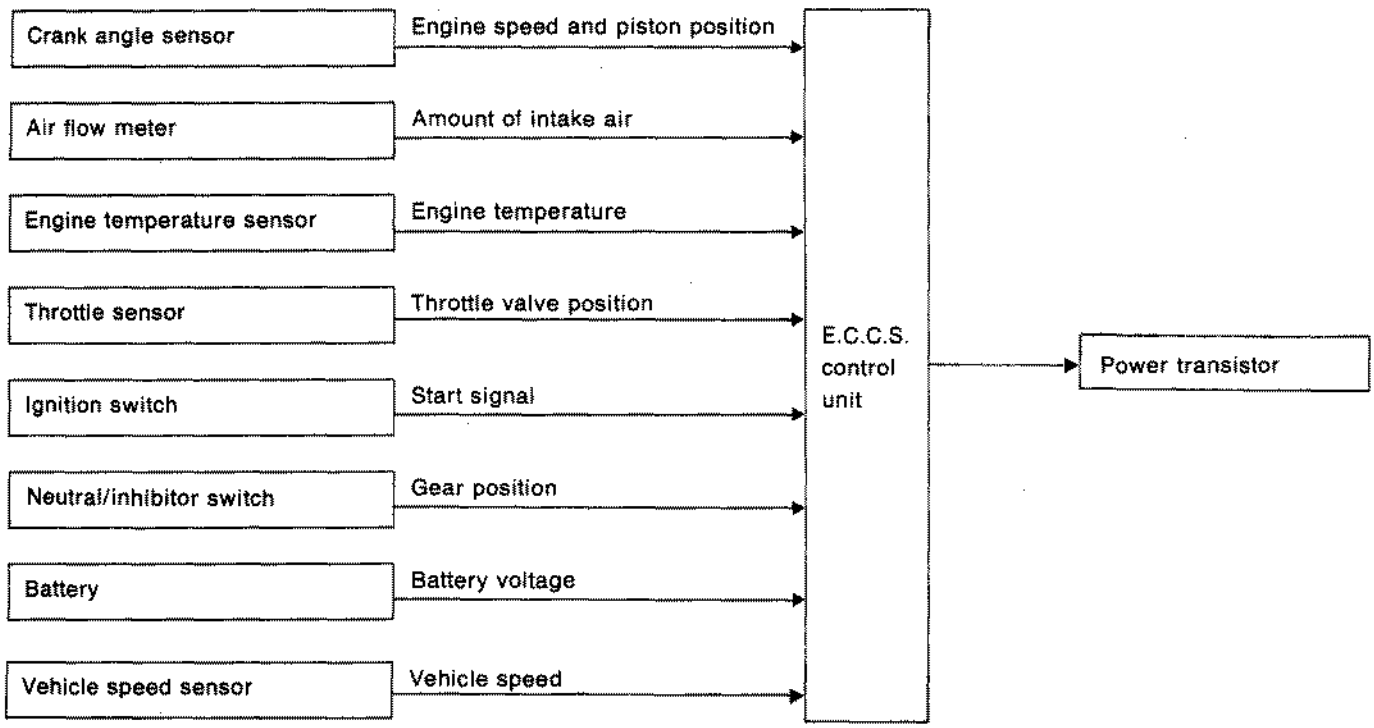
When the engine is running sequential fuel injection is used.

FUEL SHUT-OFF

Fuel to each cylinder is cut off during deceleration or operation of the engine at excessively high speeds.

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.

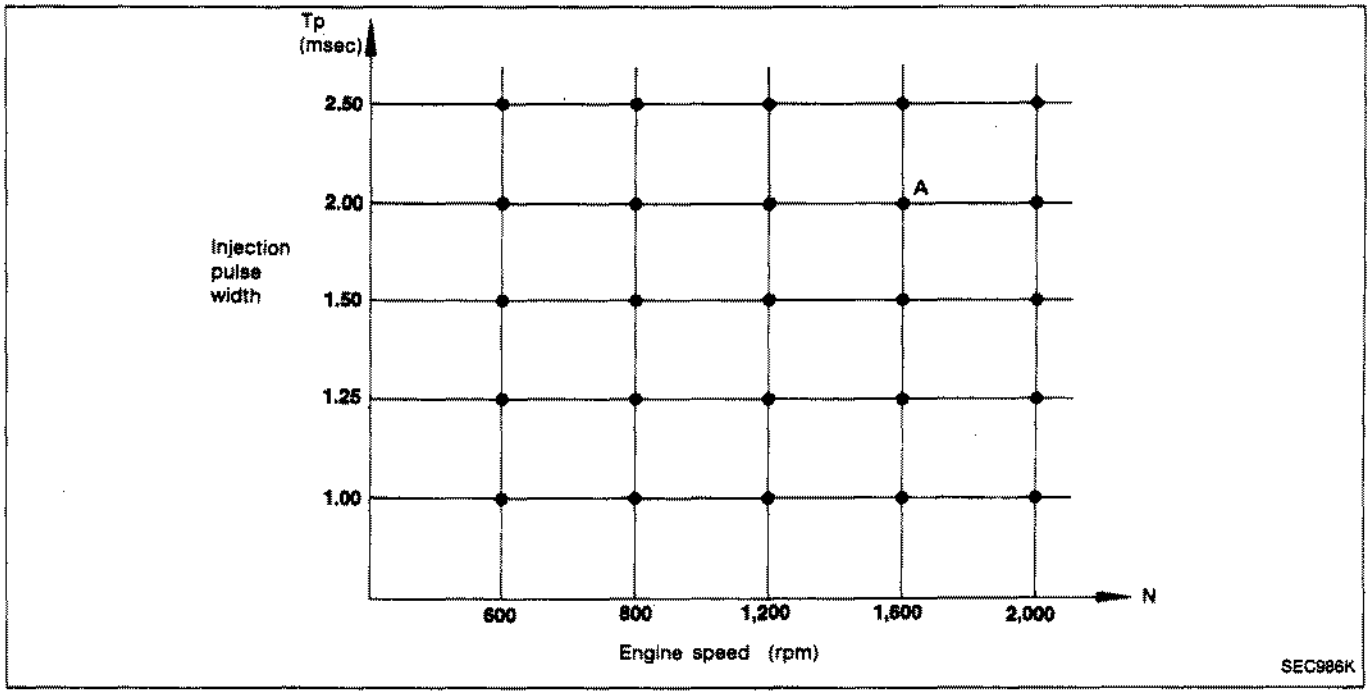
The E.C.U. detects information such as the injection pulse width and crank angle sensor signal which varies every moment. Then responding to this information, ignition signals are transmitted to the power transistor.

e.g. N: 1,800 rpm, Tp: 1.50 msec
A °B.T.D.C.

In addition to this,

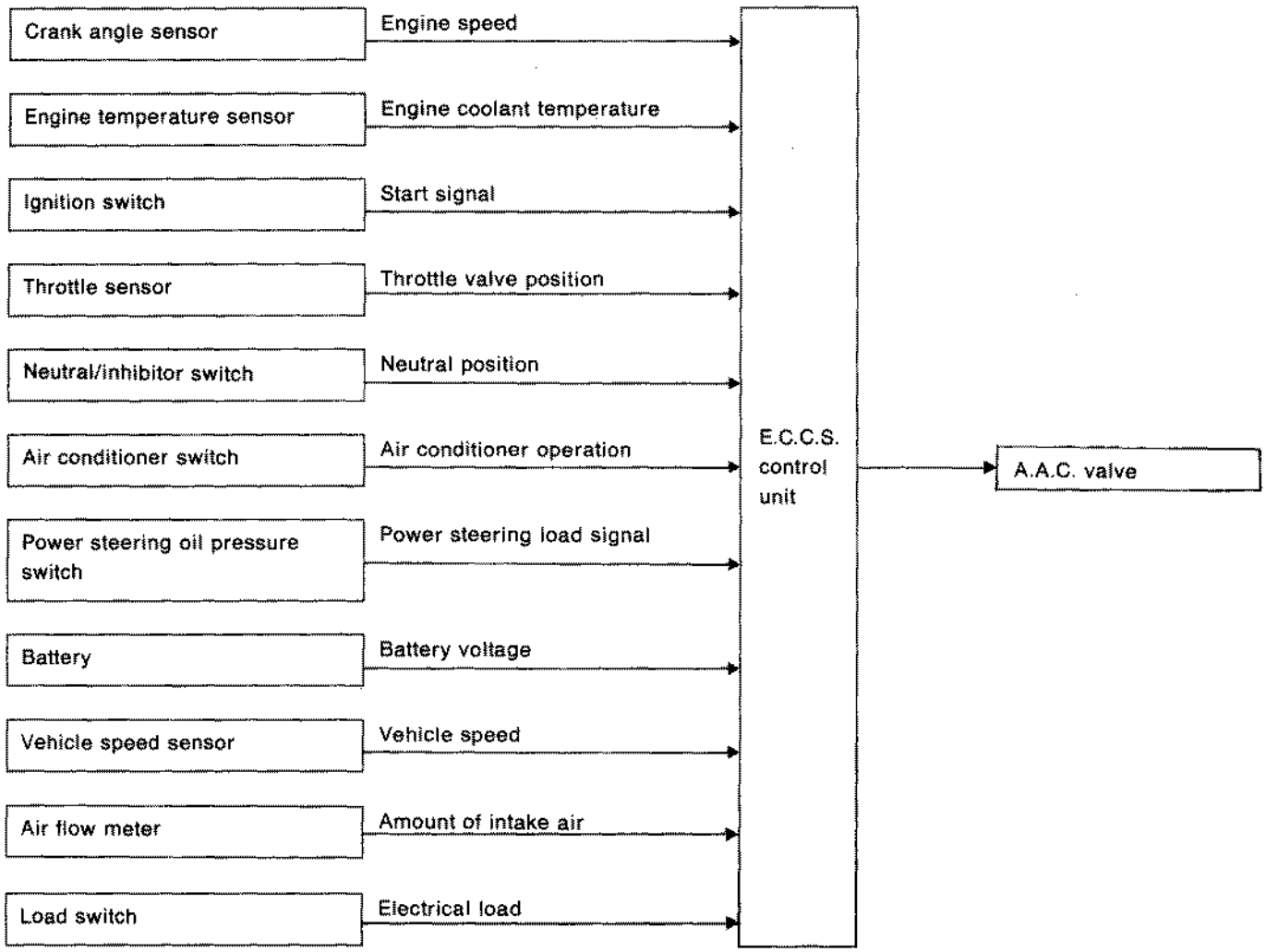
1) At starting
2) During warm-up
3) At idle
4) At low battery voltage
5) At acceleration
6) Hot-engine operation

the ignition timing is revised by the E.C.U. according to the other data stored in the ROM.



Idle Speed Control

INPUT/OUTPUT SIGNAL LINE

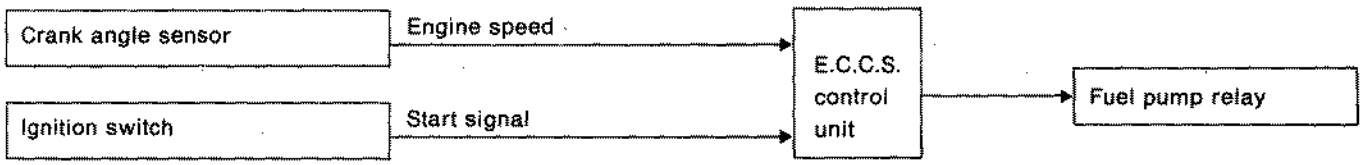


SYSTEM DESCRIPTION

This system automatically controls engine idle speed to a specified level. Idle speed is controlled through fine adjustment of the amount of air which by-passes the throttle valve via A.A.C. valve. The A.A.C. valve repeats ON/OFF operation according to the signal sent from the E.C.U. The crank angle sensor detects the actual engine speed and sends a signal to the E.C.U. The E.C.U. then controls the ON/OFF time of the A.A.C. valve so that engine speed coincides with the target value memorized in ROM. The target engine speed is the lowest speed at which the engine can operate steadily. The optimum value stored in the ROM is determined by taking into consideration various engine conditions, such as warming up and during deceleration, fuel consumption, and engine load (air conditioner, electrical load).

Fuel Pump Control

INPUT/OUTPUT SIGNAL LINE



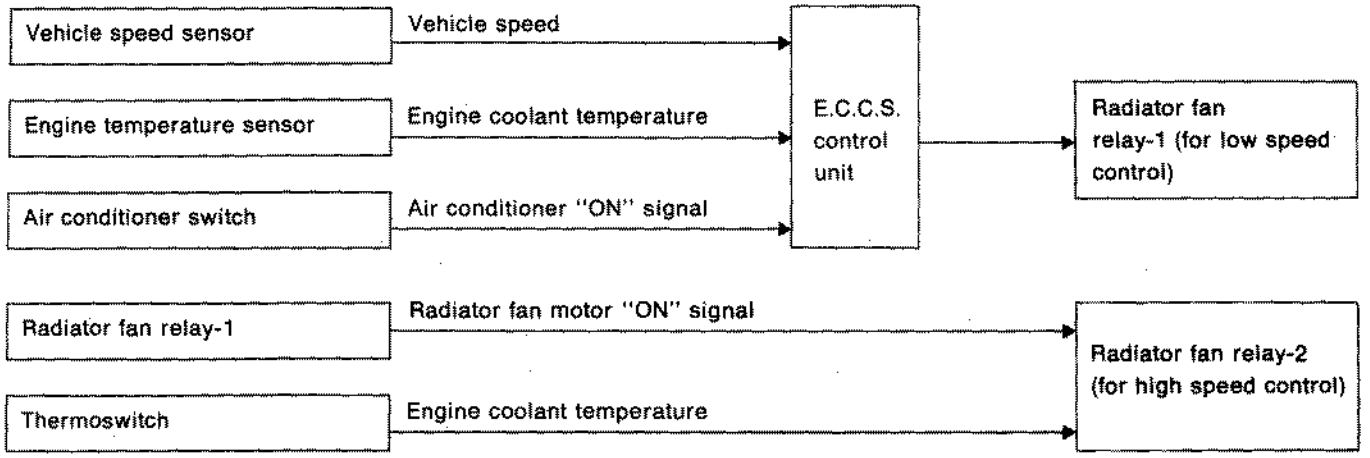
SYSTEM DESCRIPTION

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 180° signal from the crank angle sensor, it knows that the engine is rotating, and causes the pump to perform. If the 180° 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 turned to ON.	Operates for 5 seconds
Engine running and cranking	Operates
When engine is stopped	Stops in 1 second
Except as shown above	Stops

Radiator Fan Control

INPUT/OUTPUT SIGNAL LINE



The E.C.U. controls the radiator fan corresponding to the vehicle speed, engine temperature, and air conditioner ON signal. The control system for models for hot areas has 2-step controls [Low/High speed].

OPERATION

Air conditioner switch is "OFF"

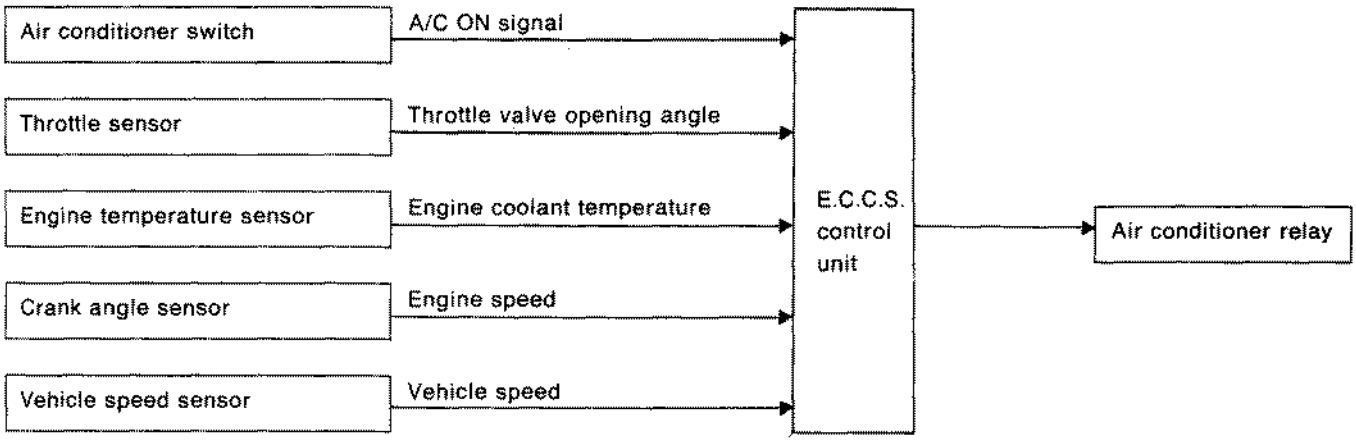
Engine coolant temperature °C (°F)	Radiator fans	Remarks
90 (194) or less	OFF	—
Between 91 (196) and 94 (201)	Low speed	Vehicle speed is 19 km/h (12 MPH) or less
	OFF	Vehicle speed is 20 km/h (12 MPH) or more
Between 95 (203) and 99 (210)	Low speed	—
100 (212) or more	Low speed	Except for the below models
	High speed	A/T models for hot areas, A/T models with front spoiler and M/T models with front spoiler for hot areas

Air conditioner switch is "ON"

Engine coolant temperature °C (°F)	Radiator fans	Remarks
94 (201) or less	OFF	Vehicle speed is 80 km/h (50 MPH) or more
	Low speed	Vehicle speed is 79 km/h (49 MPH) or less
Between 95 (203) and 99 (210)	Low speed	—
100 (212) or more	Low speed	Except for the below models
	High speed	A/T models for hot areas, A/T models with front spoiler and M/T models with front spoiler for hot areas

Air Conditioner Cut Control During Acceleration

INPUT/OUTPUT SIGNAL LINE



SYSTEM DESCRIPTION

When the accelerator pedal is fully depressed or engine temperature is extremely high, the air conditioner is turned off for a few seconds.
This system improves acceleration when the air conditioner is used.

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

Fail-safe System

C.P.U. MALFUNCTION OF E.C.U.

Outline

The fail-safe system makes engine starting possible if there is something malfunctioning in the E.C.U.'s C.P.U. circuit. In former models, engine starting was difficult under the conditions mentioned above. But with the provisions provided in this fail-safe system, it is possible to start the engine.

Fail-safe system activating condition when E.C.U. is malfunctioning

The computing function of the E.C.U. was judged to be malfunctioning.
When the fail-safe system activates, i.e. if the E.C.U. detects a malfunction condition in the C.P.U. of E.C.U., the CHECK ENGINE LIGHT on the instrument panel lights to warn the driver.

Engine control, with fail-safe system, operates when E.C.U. is malfunctioning

When the fail-safe system is operating, fuel injection, ignition timing, fuel pump operation, A.A.C. valve operation and radiator fan operation are controlled under certain limitations.

Operation

	Operation
Fuel injection	Simultaneous injection
Ignition timing	Ignition timing is fixed at the preset valve.
Fuel pump	Fuel pump relay is "ON" when engine is running and "OFF" when engine stalls.
A.A.C. valve	Full open
Radiator fans	Radiator fan relay "ON"

Cancellation of fail-safe system when E.C.U. is malfunctioning

Activation of the fail-safe system is canceled each time the ignition switch is turned OFF. The system is reactivated if all of the above-mentioned activating conditions are satisfied after turning the ignition switch from OFF to ON.

Fail-safe System (Cont'd)

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

Engine condition	Starter switch	Fail-safe system	Fail-safe functioning
Stopped	ANY	Does not operate	—
Cranking	ON	Operates	Engine will be started by a pre-determined injection pulse on E.C.U.
Running	OFF		Engine speed will not rise above 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	40°C (104°F)
More than 4 minutes after ignition ON or Start	80°C (176°F)
Except as shown above	40 - 80°C (104 - 176°F) (Depends on the time)

THROTTLE SENSOR MALFUNCTION

Description

When the output signal of throttle sensor is abnormal the E.C.U. judges it as a malfunctioning of throttle sensor.

The E.C.U. does not use the throttle sensor signal, but judges the idle position by the amount of fuel injected and the engine rpm.

Operation

	Driving condition
When engine is idling	Normal
When accelerating	Poor acceleration

PREPARATION

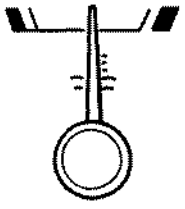
1. Make sure that the following parts are in good order.
- Battery
- Ignition system
- Engine oil and coolant levels
- Fuses
- E.C.U. harness connector
- Vacuum hoses
- Air intake system
  (Oil filler cap, oil level gauge, etc.)
- Fuel pressure
- Engine compression
- Throttle valve

2. On air conditioner equipped models, checks should be carried out while the air conditioner is "OFF".
3. On automatic transaxle equipped models, when checking idle rpm, ignition timing and mixture ratio, checks should be carried out while shift lever is in "N" position.
4. When measuring "CO" percentage, insert probe more than 40 cm (15.7 in) into tail pipe.
5. Turn off headlamps, heater blower, rear defogger.
6. Keep front wheels pointed straight ahead.
7. Make the check after the radiator fan has stopped.

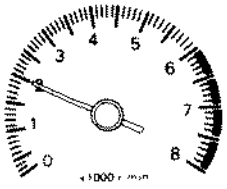
CHECKING AND ADJUSTING IDLE RPM AND IGNITION TIMING

START

Visually check the following:
- Air cleaner clogging
- Hoses and ducts for leaks
- Electrical connectors
- Gasket
- Throttle valve and throttle sensor operation



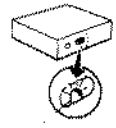
Start engine and warm it up until water temperature indicator points to the middle of gauge.
Ensure engine stays below 1,000 rpm.



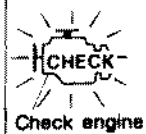
SEF247F

Open engine hood and run engine at about 2,000 rpm for about 2 minutes under no-load.

Perform E.C.C.S. self-diagnosis (Mode II).



RED L.E.D.



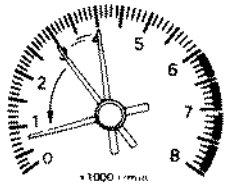
Check engine light

SEF621K

O.K.

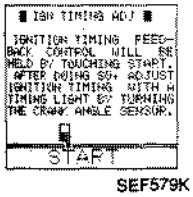
N.G.

Repair or replace components as necessary.



SEF248F

Run engine at about 2,000 rpm for about 2 minutes under no-load.
Race engine two or three times under no-load, then run engine for about 1 minute at idle speed.

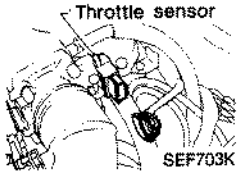


SEF579K

1) Select "IGN TIMING ADJ" in "WORK SUPPORT" mode.
2) Touching "START"

OR

1) Turn off engine and disconnect throttle sensor harness connector.
2) Start engine.



SEF703K

Race engine (2,000 - 3,000 rpm) 2 or 3 times under no-load and then run engine at idle speed.

Check ignition timing with a timing light.

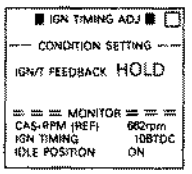
10° ± 2° B.T.D.C. (in "N" position)

O.K.

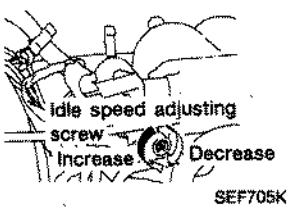
N.G.

Ⓐ

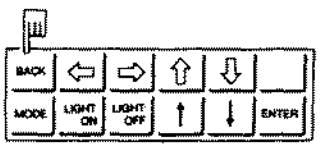
①



SEF704K



SEF705K



SEF913J

Ⓐ

Ⓘ

Adjust ignition timing to the specified value by turning distributor after loosing bolts which secure distributor.
10° B.T.D.C. (In "N" position)

Check idle speed.

- Read idle speed in "IGN TIMING ADJ" in "WORK SUPPORT" mode.

OR

- Check idle speed.

M/T: 675 ± 50 rpm
A/T: 725 ± 50 rpm (in "N" position)

O.K. N.G.

Race engine (2,000 - 3,000 rpm) 2 or 3 times under no-load and run engine at idle speed.

Adjust idle speed by turning idle speed adjusting screw.

M/T: 675 rpm
A/T: 725 rpm (in "N" position)

1) Touch "BACK".

OR

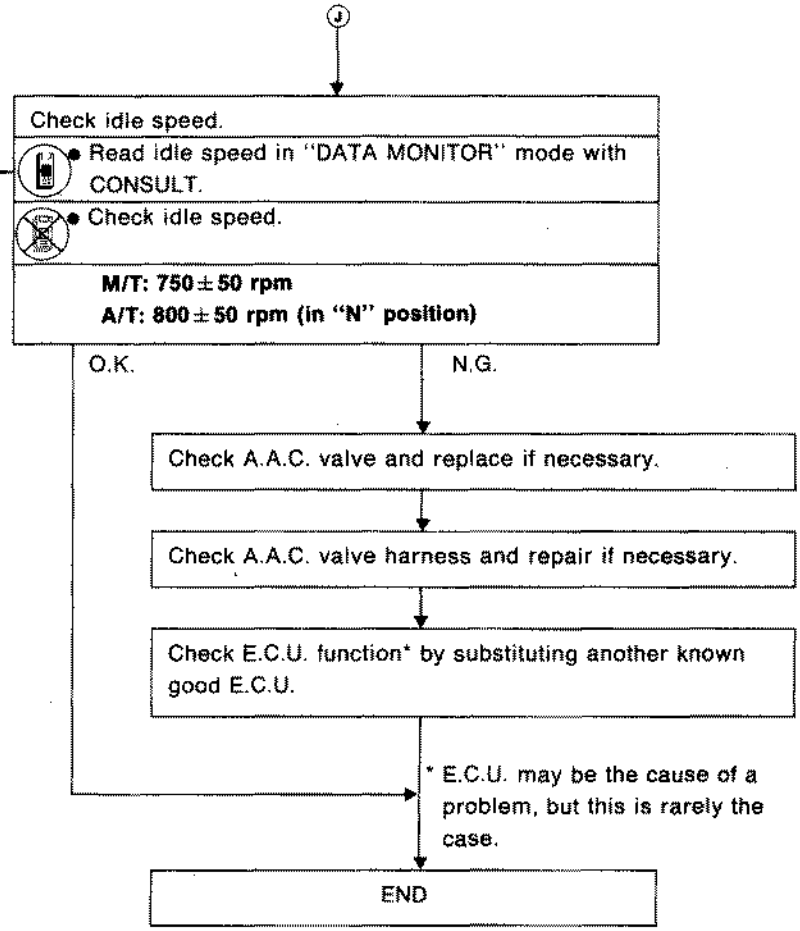
1) Turn off engine and connect throttle sensor harness connector.
2) Start engine

Race engine (2,000 - 3,000 rpm) 2 or 3 times under no-load and run engine at idle speed.

Ⓙ


MONITOR
CAS-RPM/REF
RECORD

SEF135K


J
Check idle speed.
Read idle speed in "DATA MONITOR" mode with CONSULT.
Check idle speed.
M/T: 750±50 rpm
A/T: 800±50 rpm (in "N" position)
O.K.
N.G.
Check A.A.C. valve and replace if necessary.
Check A.A.C. valve harness and repair if necessary.
Check E.C.U. function* by substituting another known good E.C.U.
* E.C.U. may be the cause of a problem, but this is rarely the case.
END

MIXTURE RATIO INSPECTION

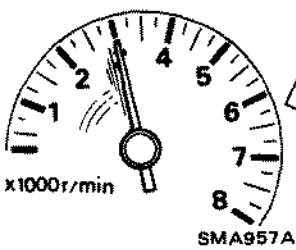
With "CO"-meter

INSPECTION START

Check and adjust idle speed and ignition timing.
(Refer to EF & EC-66.)

Idle speed: M/T 750 ± 50 rpm
A/T 800 ± 50 rpm (in "N" position)
Ignition timing: 10° ± 2° B.T.D.C.

O.K.



SMA957A

Race engine (2,000 - 3,000 rpm) 2 or 3 times under no-load, then run engine at idle speed.

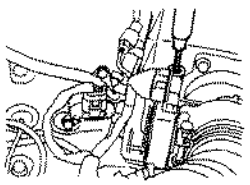
Check "CO" with "CO"-meter.

Idle "CO"%: 1.5 ± 0.5

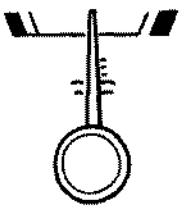
O.K. → (B)

N.G.

Turn off engine and remove air flow meter from vehicle.

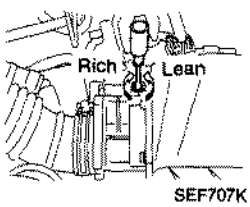

SEF706K

Drill a hole in seal plug which seals variable resistor of air flow meter and remove seal plug.


SMA955A

Install air flow meter on vehicle. Start engine and warm it up until water temperature indicator reads normal operating temperature.

Race engine (2,000 - 3,000 rpm) 2 or 3 times under no-load, then run engine at idle speed.

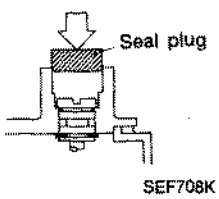


SEF707K

Adjust "CO"% by turning variable resistor on air flow meter.

Idle "CO"%: 1.5 ± 0.5

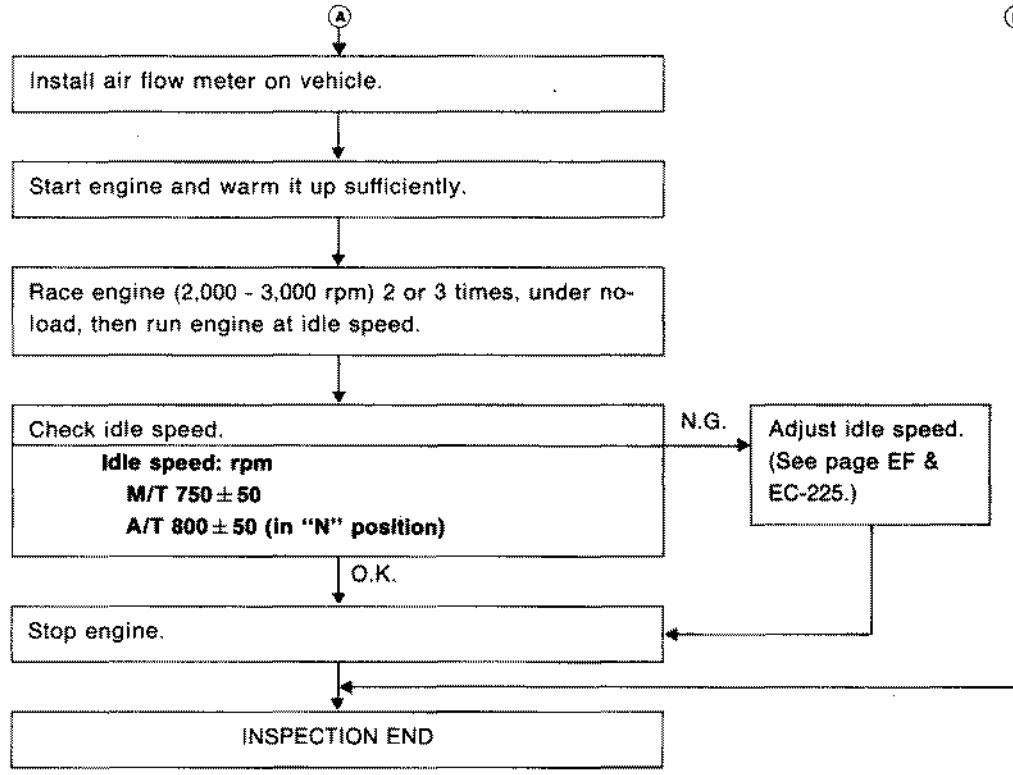
Turn off engine and remove air flow meter from vehicle.



SEF708K

Insert new seal plug into variable resistor hole. Tap seal plug with a suitable bar, thereby installing seal plug on air flow meter.

(A)

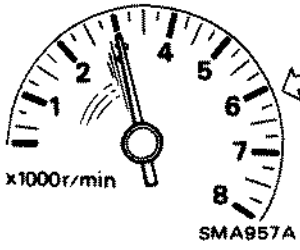

A
B
Install air flow meter on vehicle.
Start engine and warm it up sufficiently.
Race engine (2,000 - 3,000 rpm) 2 or 3 times, under no-load, then run engine at idle speed.
Check idle speed.
Idle speed: rpm
M/T 750 ± 50
A/T 800 ± 50 (in "N" position)
N.G.
Adjust idle speed. (See page EF & EC-225.)
O.K.
Stop engine.
INSPECTION END

Without "CO"-meter

INSPECTION START

Check and adjust idle speed and ignition timing.
(Refer to EF & EC-66.)

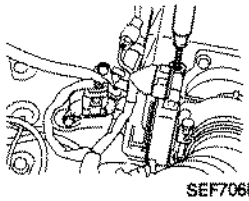
Idle speed: M/T 750 ± 50 rpm
A/T 800 ± 50 rpm (in "N" position)
Ignition timing: 10° ± 2° B.T.D.C.



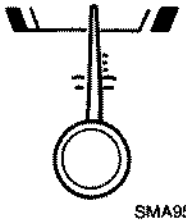
SMA957A

Race engine (2,000 - 3,000 rpm) 2 or 3 times under no-load, then run engine at idle.

Turn off engine and remove air flow meter from vehicle.

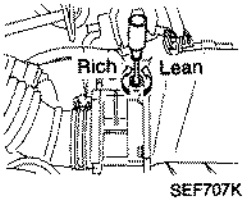

SEF706K

Drill a hole in seal plug which seals variable resistor of air flow meter and remove seal plug.


SMA955A

Install air flow meter on vehicle. Start engine and warm it up until water temperature indicator reads normal operating temperature.

Race engine (2,000 - 3,000 rpm) 2 or 3 times under no-load, then run engine at idle speed.

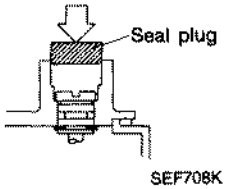


SEF707K

Adjust mixture ratio with engine speed set at maximum by turning variable resistor.

Turn variable resistor of air flow meter one full turn counterclockwise.

Turn off engine and remove air flow meter from vehicle.

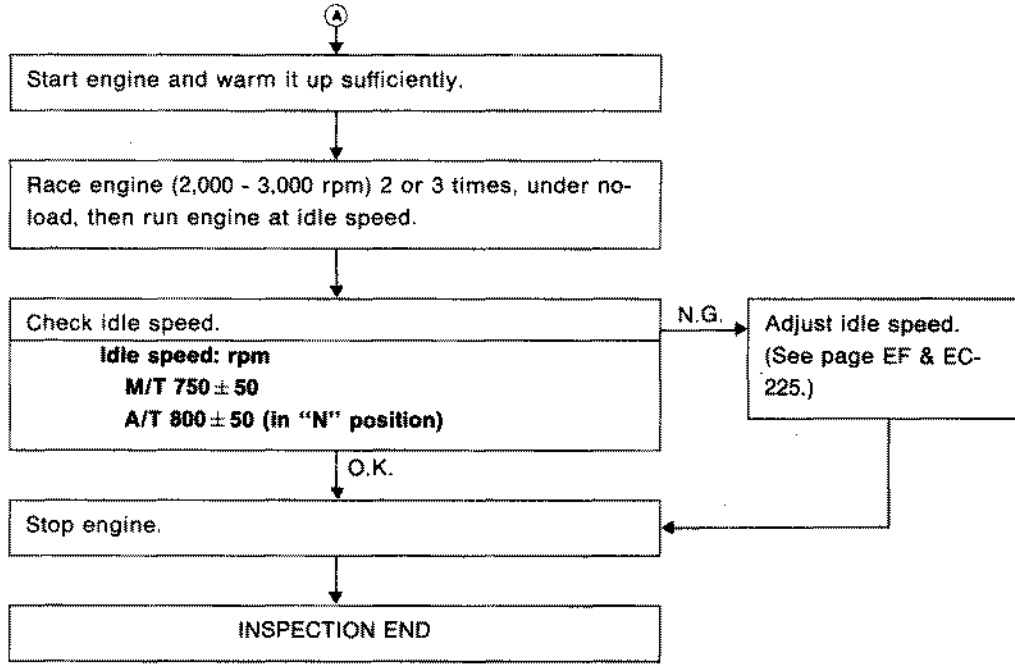


SEF708K

Insert new seal plug into variable resistor hole. Tap seal plug with a suitable bar, thereby installing seal plug on air flow meter.

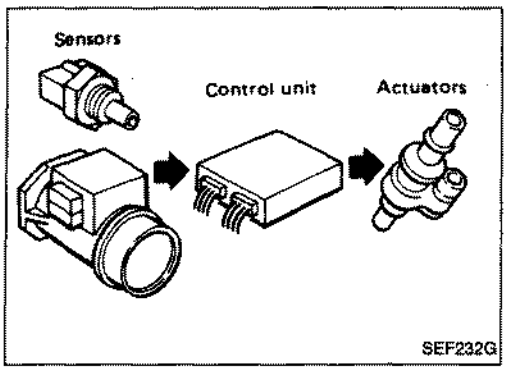
Install air flow meter on vehicle.

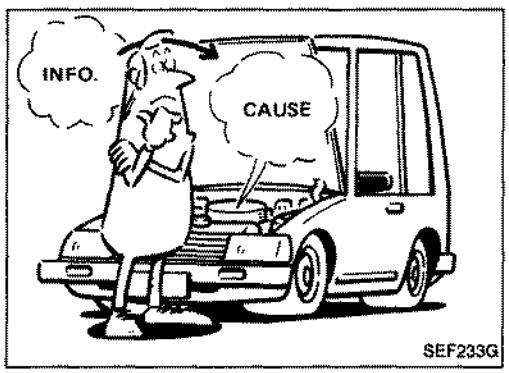
Ⓐ

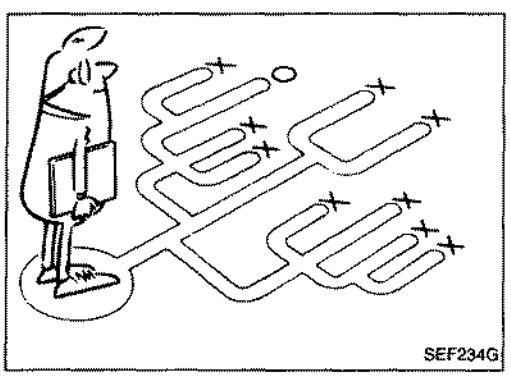

Ⓐ
Start engine and warm it up sufficiently.
Race engine (2,000 - 3,000 rpm) 2 or 3 times, under no-load, then run engine at idle speed.
Check idle speed.
Idle speed: rpm
M/T 750 ± 50
A/T 800 ± 50 (in "N" position)
N.G.
Adjust idle speed. (See page EF & EC-225.)
O.K.
Stop engine.
INSPECTION END

Contents

Contents (Cont'd)







How to Perform Trouble Diagnoses for Quick and Accurate Repair

INTRODUCTION

The engine has an electronic control unit to control major systems such as fuel control, ignition control, idle speed control, etc. The control unit accepts input signals from sensors and instantly drives actuators. It is essential that both kinds of signals are proper and stable. At the same time, it is important that there are no conventional problems such as vacuum leaks, fouled spark plugs, or other problems with the engine.

It is much more difficult to diagnose a problem that occurs intermittently rather than continuously. Most intermittent problems are caused by poor electric connections or improper wiring. In this case, careful checking of suspected circuits may help prevent the replacement of good parts.

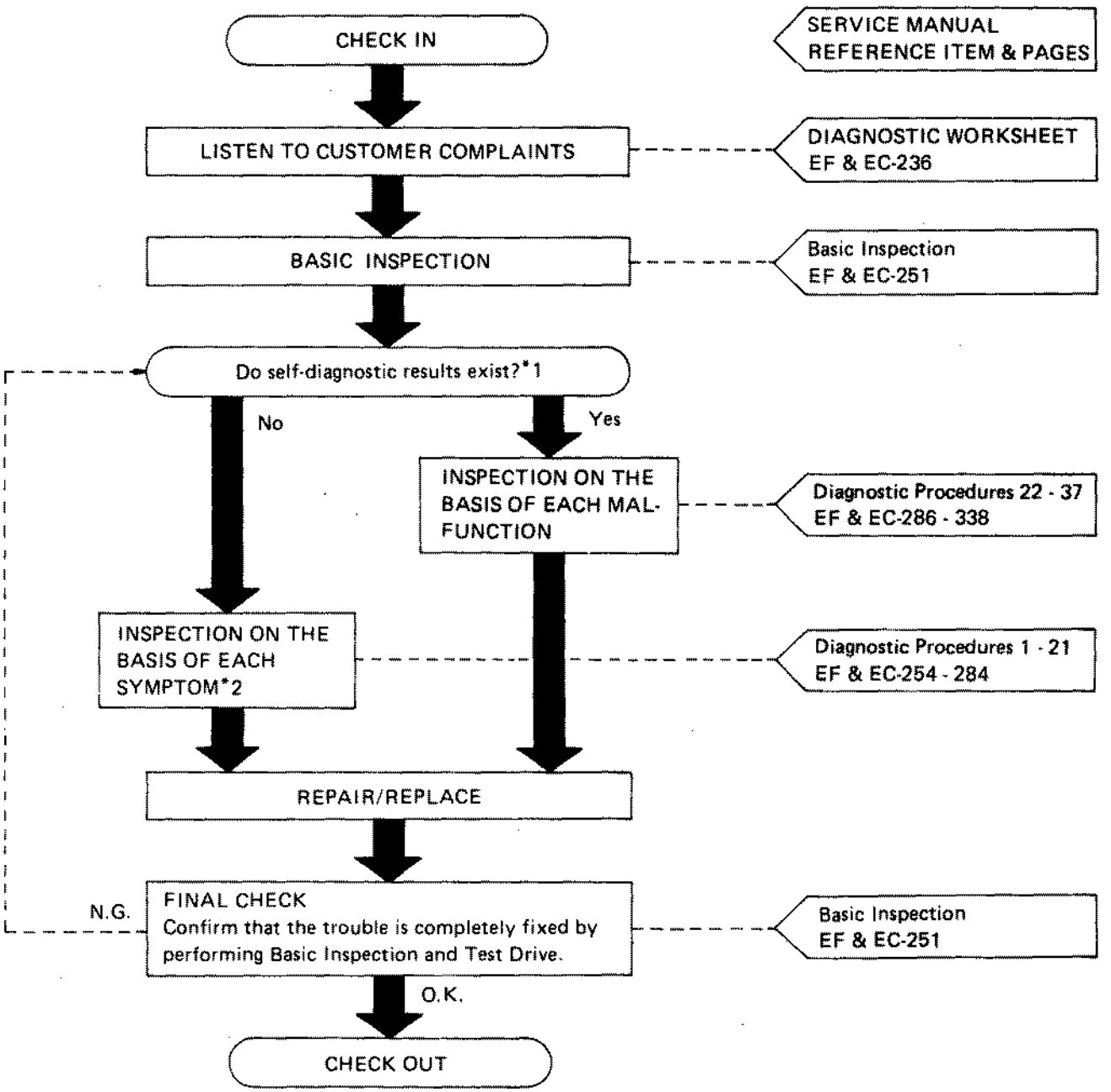
A visual check only may not find the cause of the problems, so a road test with a circuit tester connected to a suspected circuit should be performed.

Before undertaking actual checks, take just a few minutes to talk with a customer who approaches with a driveability complaint. The customer is a very good supplier of information on such problems, especially intermittent ones. Through interaction with the customer, find out what symptoms are present and under what conditions they occur.

Start your diagnosis by looking for "conventional" problems first. This is one of the best ways to troubleshoot driveability problems on an electronically controlled engine vehicle.

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

WORK FLOW



***1: If the self-diagnosis cannot be performed, check main power supply and ground circuit. (See Diagnostic Procedure 22.)**

***2: If the trouble is not duplicated, see INTERMITTENT PROBLEM SIMULATION (EF & EC-237).**

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

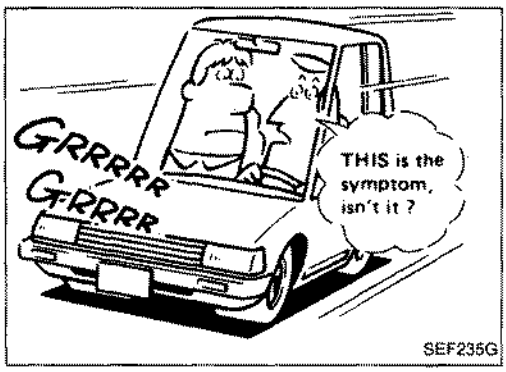
DIAGNOSTIC WORKSHEET

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 [ ]	
Symptoms — ☐ Idling	☐ No fast idle ☐ Unstable ☐ High idle ☐ Low idle ☐ Others [ ]	
Symptoms — ☐ Driveability	☐ Stumble ☐ Surge ☐ Detonation ☐ Lack of power ☐ Intake backfire ☐ Exhaust backfire ☐ Others [ ]	
Symptoms — ☐ Engine stall	☐ At the time of start ☐ While idling ☐ While accelerating ☐ While decelerating ☐ Just after stopping ☐ While loading	
Incident occurrence	☐ Just after delivery ☐ Recently ☐ In the morning ☐ At night ☐ In the daytime	
Frequency	☐ All the time ☐ Under certain conditions ☐ Sometimes	
Weather conditions	☐ Not affected	
Weather	☐ Fine ☐ Raining ☐ Snowing ☐ Others [ ]	
Temperature	☐ Hot ☐ Warm ☐ Cool ☐ Cold ☐ Humid °F	
Engine conditions	☐ Cold ☐ During warm-up ☐ After warm-up Engine speed 0 2,000 4,000 6,000 8,000 rpm	
Road conditions	☐ In town ☐ In suburbs ☐ Highway ☐ Off road (up/down)	
Driving conditions	☐ Not affected ☐ At starting ☐ While idling ☐ At racing ☐ While accelerating ☐ While cruising ☐ While decelerating ☐ While turning (RH/LH) Vehicle speed 0 10 20 30 40 50 60 MPH	
Check engine light	☐ Turned on ☐ Not turned on	

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

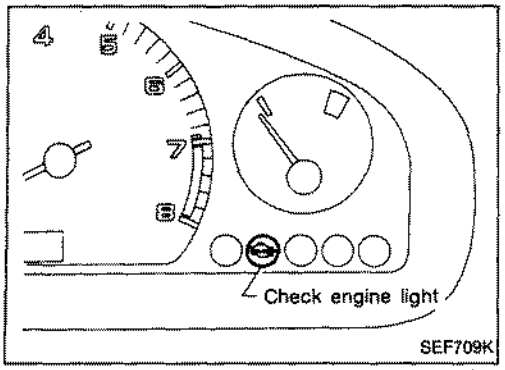


INTERMITTENT PROBLEM SIMULATION

In order to duplicate an intermittent problem, it is effective to create similar conditions for component parts, under which the problem might occur.
Perform the activity listed under Service procedure and note the result.

	Variable factor	Influential part	Target condition	Service procedure
1	Mixture ratio	Pressure regulator	Made lean	Remove vacuum hose and apply vacuum.
			Made rich	Remove vacuum hose and apply pressure.
2	Ignition timing	Crank angle sensor	Advanced	Rotate distributor clockwise.
			Retarded	Rotate distributor counterclockwise.
3	Idle speed	A.A.C. valve	Raised	Turn idle adjusting screw counterclockwise.
			Lowered	Turn idle adjusting screw clockwise.
4	Electrical connection (Electric continuity)	Harness connectors and wires	Poor electrical connection or improper wiring	Tap or wiggle.
				Race engine rapidly. See if the torque reaction of the engine unit causes electric breaks.
5	Temperature	Control unit	Cooled	Cool with an icing spray or similar device.
			Warmed	Heat with a hair drier. **[WARNING: Do not overheat the unit.]**
6	Moisture	Electric parts	Damp	Wet. **[WARNING: Do not directly pour water on components. Use a mist sprayer.]**
7	Electric loads	Load switches	Loaded	Turn on headlamps, air conditioner, rear defogger, etc.
8	Idle switch condition	Control unit	ON-OFF switching	Rotate throttle sensor body.
9	Ignition spark	Timing light	Spark power check	Try to flash timing light for each cylinder.

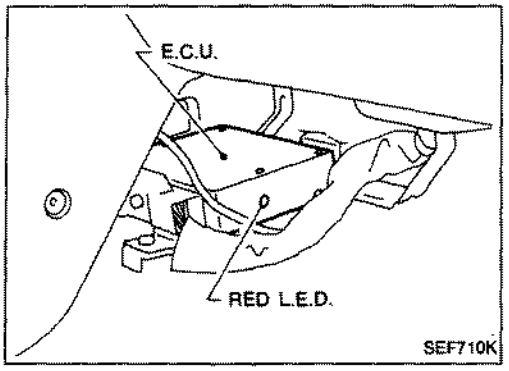
*: Models with catalyzer only



Self-diagnosis

CHECK ENGINE LIGHT

A check engine light has been adopted on all models. This light blinks simultaneously with the RED L.E.D. on the E.C.U.



E.C.U. L.E.D.

The E.C.U. has only one RED L.E.D.

SELF-DIAGNOSTIC FUNCTION

Condition \ Mode		Mode I	Mode II
Ignition switch in "ON" position	Engine stopped	BULB CHECK	SELF-DIAGNOSTIC RESULTS
	Engine running	MALFUNCTION WARNING	—

Self-diagnosis (Cont'd)

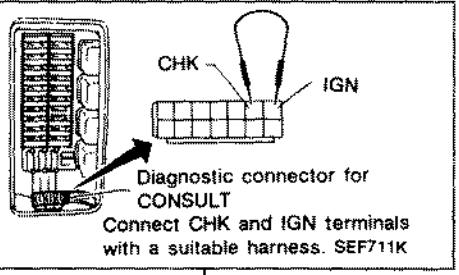
HOW TO SWITCH MODES

Turn ignition switch "ON". (Do not start engine.)

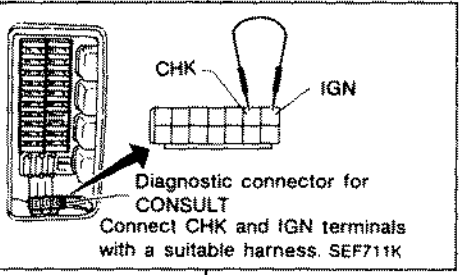
Mode I — BULB CHECK

Start engine.

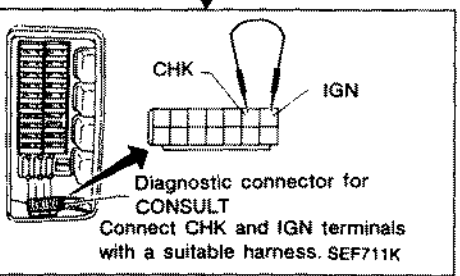
Mode I — MALFUNCTION WARNING



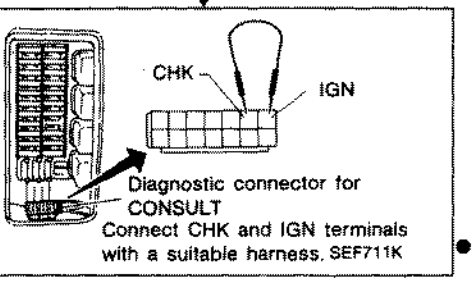
Wait at least 2 seconds.



Mode II — SELF-DIAGNOSTIC RESULTS



Wait at least 2 seconds.



- **Switching the modes is not possible when the engine is running.**
- **When the ignition switch is turned off during diagnosis in each mode, and then turned back on again after power to the E.C.U. has dropped off completely, the diagnosis will automatically return to Mode I.**

Self-diagnosis — Mode I

MODE I — BULB CHECK

In this mode, the RED L.E.D. in the E.C.U. and the CHECK ENGINE LIGHT in the instrument panel stay "ON".
If either remain "OFF", check the bulb in the CHECK ENGINE LIGHT or the RED L.E.D.

MODE I — MALFUNCTION WARNING

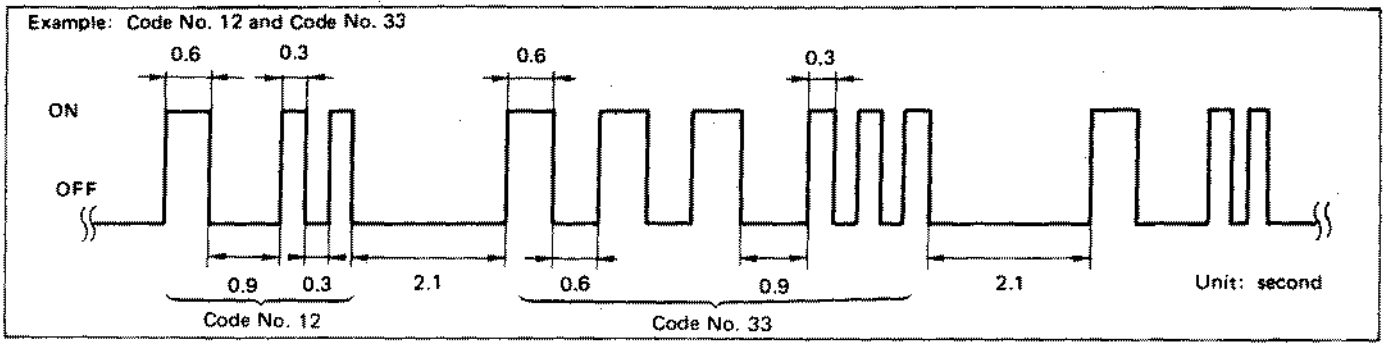
CHECK ENGINE LIGHT and RED L.E.D.	Condition
ON	When the E.C.U.'s C.P.U. is malfunctioning.
OFF	O.K.

- **The RED L.E.D. and the CHECK ENGINE LIGHT will turn off when normal condition is detected.**

Self-diagnosis — Mode II (Self-diagnostic results)

DESCRIPTION

In this mode, a malfunction code is indicated by the number of flashes from the RED L.E.D. or the CHECK ENGINE LIGHT as shown below:



Long (0.6 second) blinking indicates the number of ten digits and short (0.3 second) blinking indicates the number of single digits.
For example, the red L.E.D. flashes once for 0.6 seconds and then it flashes twice for 0.3 seconds. This indicates the number "12" and refers to a malfunction in the air flow meter. In this way, all the problems are classified by their code numbers.
The diagnostic results will remain in E.C.U. memory.

Display code table

Code No.	Detected items
11*	Crank angle sensor circuit
12	Air flow meter circuit
13	Engine temperature sensor circuit
14	Vehicle speed sensor circuit
21*	Ignition signal circuit
43	Throttle sensor circuit
55	No malfunction in the above circuits

*: Check items causing a malfunction of crank angle sensor circuit first, if both code No. 11 and 21 are displayed at the same time.

Self-diagnosis — Mode II (Self-diagnostic results) (Cont'd)

Code No.	Detected items	Malfunction is detected when ...	Check item (remedy)
*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.	• Harness and connector (If harness and connector are normal, replace crank angle sensor.)
12	Air flow meter circuit	• The air flow meter circuit is open or shorted. (An abnormally high or low voltage is entered.)	• Harness and connector (If harness and connector are normal, replace air flow meter.)
13	Engine temperature sensor circuit	• The engine temperature sensor circuit is open or shorted. (An abnormally high or low output voltage is entered.)	• Harness and connector • Engine temperature sensor
14	Vehicle speed sensor circuit	• The vehicle speed sensor circuit is open or shorted.	• Harness and connector • Vehicle speed sensor (reed switch)
*21	Ignition signal circuit	• The ignition signal in the primary circuit is not entered during engine cranking or running.	• Harness and connector • Power transistor unit
43	Throttle sensor circuit	• The throttle sensor circuit is open or shorted. (An abnormally high or low voltage is entered.)	• Harness and connector • Throttle sensor

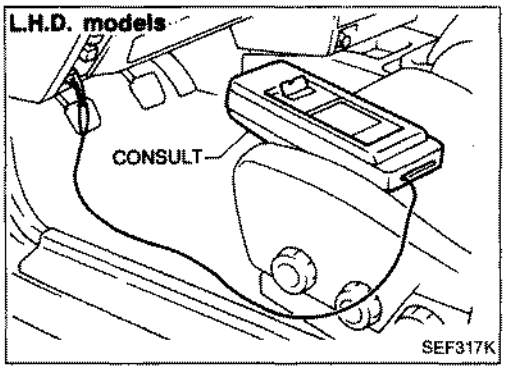
*: Check items causing a malfunction of crank angle sensor circuit first, if both code No. 11 and 21 come out at the same time.

HOW TO ERASE SELF-DIAGNOSTIC RESULTS

The malfunction code is erased from the backup memory on the E.C.U. when the diagnostic mode is changed from Mode II to Mode I. (Refer to "HOW TO SWITCH MODES".)

- **When the battery terminal is disconnected, the malfunction code will be lost from the backup memory within 24 hours.**
- **Before starting self-diagnosis, do not erase the stored memory before beginning self-diagnosis.**

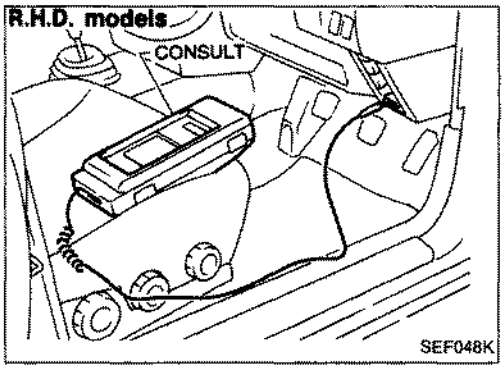
NOTE

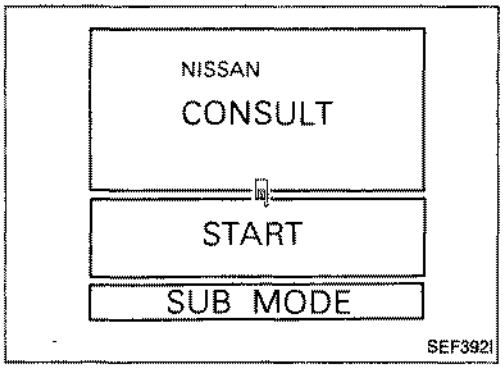


Consult

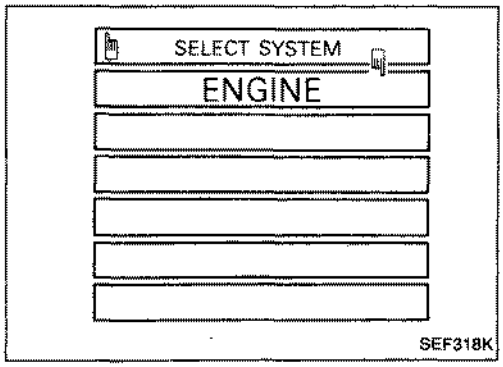
CONSULT INSPECTION PROCEDURE

1. Turn off ignition switch.
2. Connect "CONSULT" to diagnostic connector.
   (Diagnostic connector is located behind the fuse box cover.)

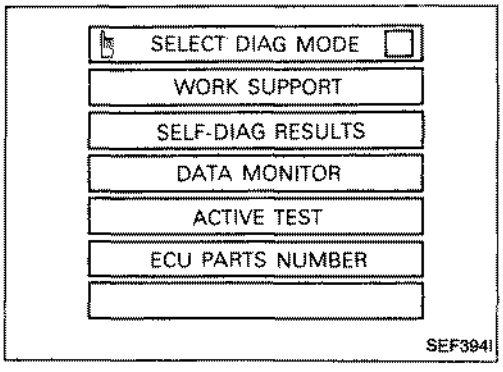




3. Turn on ignition switch.
4. Touch "START".



5. Touch "ENGINE".



6. Perform each diagnostic mode according to the inspection sheet as follows:

For further information, see the CONSULT Operation Manual.

Consult (Cont'd)

E.C.C.S. COMPONENT PARTS APPLICATION

E.C.C.S. COMPONENT PARTS \ MODE		WORK SUPPORT	SELF-DIAGNOSTIC RESULTS	DATA MONITOR	ACTIVE TEST
INPUT	Crank angle sensor		X	X	
	Air flow meter		X	X	
	Engine temperature sensor		X	X	X
	Vehicle speed sensor		X	X	
	Throttle sensor	X	X	X	
	Ignition switch (start signal)			X	
	Air conditioner switch			X	
	Neutral switch			X	
	Power steering oil pressure switch			X	
	Load switch			X	
	Battery			X	
OUTPUT	Injectors			X	X
	Power transistor (ignition signal)	X (Ignition timing)	X	X (Ignition timing)	X
	A.A.C. valve	X		X	X
	Air conditioner relay			X	
	Fuel pump relay	X		X	X
	Radiator fan			X	X

X: Applicable

FUNCTION

Diagnostic mode	Function
Work support	This mode enables a technician to adjust some devices faster and more accurately by following the indications on the CONSULT unit.
Self-diagnostic results	Self-diagnostic results can be read and erased quickly.
Data monitor	Input/Output data in the control unit can be read.
Active test	Mode in which CONSULT drives some actuators apart from the control units and also shifts some parameters in a specified range.
E.C.U. part numbers	E.C.U. part numbers can be read.

Consult (Cont'd)

WORK SUPPORT MODE

WORK ITEM	CONDITION	USAGE
THROTTLE SENSOR ADJUSTMENT	CHECK THE THROTTLE SENSOR SIGNAL. ADJUST IT TO THE SPECIFIED VALUE BY ROTATING THE SENSOR BODY UNDER THE FOLLOWING CONDITIONS. • IGN SW "ON" • ENG NOT RUNNING • ACC PEDAL NOT PRESSED	When adjusting throttle sensor initial position.
IGNITION TIMING ADJUSTMENT	• IGNITION TIMING FEEDBACK CONTROL WILL BE HELD BY TOUCHING "START". AFTER DOING SO, ADJUST IGNITION TIMING WITH A TIMING LIGHT BY TURNING THE CRANK ANGLE SENSOR.	When adjusting initial ignition timing.
AAC VALVE ADJUSTMENT	SET ENGINE RPM AT THE SPECIFIED VALUE UNDER THE FOLLOWING CONDITIONS. • ENGINE WARMED UP • NO-LOAD	When adjusting idle speed.
FUEL PRESSURE RELEASE	• FUEL PUMP WILL STOP BY TOUCHING "START" DURING IDLING. CRANK A FEW TIMES AFTER ENGINE STALLS.	When releasing fuel pressure from fuel line.

Consult (Cont'd)

SELF-DIAGNOSTIC RESULTS MODE

DIAGNOSTIC ITEM	DIAGNOSTIC ITEM IS DETECTED WHEN ...	CHECK ITEM (REMEDY)
CRANK ANGLE SENSOR*	• 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.	• Harness and connector (If harness and connector are normal, replace crank angle sensor.)
AIR FLOW METER	• The air flow meter circuit is open or shorted. (An abnormally high or low voltage is entered.)	• Harness and connector (If harness and connector are normal, replace air flow meter.)
ENGINE TEMP SENSOR	• The engine temperature sensor circuit is open or shorted. (An abnormally high or low output voltage is entered.)	• Harness and connector • Engine temperature sensor
VEHICLE SPEED SENSOR	• The vehicle speed sensor circuit is open or shorted.	• Harness and connector • Vehicle speed sensor
IGN SIGNAL-PRIMARY*	• The ignition signal in primary circuit is not entered during engine cranking or running.	• Harness and connector • Power transistor unit
THROTTLE SENSOR	The throttle sensor circuit is open or shorted. (An abnormally high or low voltage is entered.)	• Harness and connector • Throttle sensor

*: Check items causing a malfunction of crank angle sensor circuit first, if both "CRANK ANGLE SENSOR" and "IGN SIGNAL-PRIMARY" come out at the same time.

Consult (Cont'd)

DATA MONITOR MODE

Remarks:

- Specification data are reference values.
- Specification data are output/input values which are detected or supplied by the E.C.U. at the connector.
  * Specification data may not be directly related to their components signals/values/operations.
  i.e. Adjust ignition timing with a timing light before monitoring IGN TIMING, because the monitor may show the specification data in spite of the ignition timing not being adjusted to the specification data. This IGN TIMING monitors the data calculated by the E.C.U. according to the signals input from the crank angle sensor and other ignition timing related sensors.

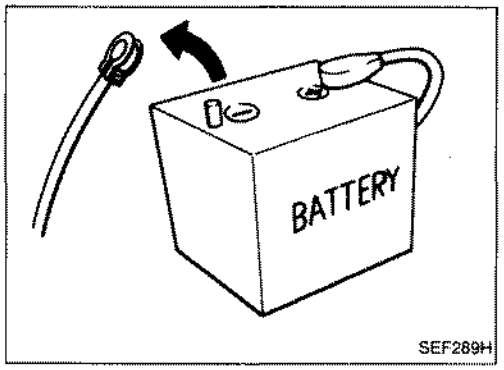
MONITOR ITEM	CONDITION		SPECIFICATION	CHECK ITEM WHEN OUTSIDE SPEC.
CAS, RPM (REF)	• Tachometer: Connect • Run engine and compare tachometer indication with the CONSULT value.		Almost the same speed as the CONSULT value.	• Harness and connector • Crank angle sensor
AIR FLOW MTR	• Engine: After warming up, idle the engine • A/C switch "OFF" • Shift lever "N"	Idle	0.7 - 1.1V	• Harness and connector • Air flow meter
		2,000 rpm	1.1 - 1.5V	
ENG TEMP SEN	• Engine: After warming up		More than 70°C (158°F)	• Harness and connector • Engine temperature sensor
CAR SPEED SEN	• Turn drive wheels and compare speedometer indication with the CONSULT value		Almost the same speed as the CONSULT value	• Harness and connector • Vehicle speed sensor
BATTERY VOLT	• Ignition switch: ON (Engine stopped)		11 - 14V	• Battery • E.C.U. power supply circuit
THROTTLE SEN	• Ignition switch: ON (Engine stopped)	Throttle valve fully closed	Approx. 0.5V	• Harness and connector • Throttle sensor • Throttle sensor adjustment
		Throttle valve fully opened	Approx. 5.0V	
START SIGNAL	• Ignition switch: ON → START		OFF → ON	• Harness and connector • Starter switch
IDLE POSITION	• Ignition switch: ON (Engine stopped)	Throttle valve: Idle position	ON	• Harness and connector • Throttle sensor • Throttle sensor adjustment
		Throttle valve: Slightly open	OFF	
AIR COND SIG	• Engine: After warming up, idle the engine	A/C switch "OFF"	OFF	• Harness and connector • Air conditioner switch
		A/C switch "ON"	ON	
NEUTRAL SW	• Ignition switch: ON	Shift lever "P" or "N"	ON	• Harness and connector • Neutral switch
		Except above	OFF	
PW/ST SIGNAL	• Engine: After warming up, idle the engine	Steering wheel in neutral (forward direction)	OFF	• Harness and connector • Power steering oil pressure switch
		The steering wheel is turned	ON	
FUEL PUMP RLY	• Ignition switch is turned to ON (Operates for 5 seconds) • Engine running and cranking • When engine is stopped (stops in 1.0 seconds)		ON	• Harness and connector • Fuel pump relay
	Except as shown above		OFF	
RADIATOR FAN	• Engine: After warming up, idle the engine. • A/C switch "OFF"	Engine temperature is below 90°C (194°F)	OFF	• Harness and connector • Radiator fan relay • Radiator fan
		Engine temperature is above 91°C (196°F)	ON	

Consult (Cont'd)

MONITOR ITEM	CONDITION		SPECIFICATION	CHECK ITEM WHEN OUTSIDE SPEC.
INJ PULSE	• Engine: After warming up • A/C switch "OFF" • Shift lever "N" • No-load	Idle	2.5 - 3.3 msec.	• Harness and connector • Injector • Air flow meter • Intake air system
		2,000 rpm	2.5 - 3.3 msec.	
IGN TIMING	ditto	Idle	10° B.T.D.C.	• Harness and connector • Crank angle sensor
		2,000 rpm	More than 20° B.T.D.C.	
AAC VALVE	ditto	Idle	20 - 40%	• Harness and connector • A.A.C. valve
		2,000 rpm	—	
AIR COND RLY	• Air conditioner switch OFF → ON		OFF → ON	• Harness and connector • Air conditioner switch • Air conditioner relay

ACTIVE TEST MODE

TEST ITEM	CONDITION	JUDGMENT	CHECK ITEM (REMEDY)
FUEL INJECTION TEST	• Engine: Return to the original trouble condition • Change the amount of fuel injection using CONSULT.	If trouble symptom disappears, see CHECK ITEM.	• Harness and connector • Fuel injectors • Exhaust gas sensor
AAC/V OPENING TEST	• Engine: After warming up, idle the engine. • Change the AAC valve opening percent using CONSULT.	Engine speed changes according to the opening percent.	• Harness and connector • AAC valve
ENGINE TEMP TEST	• Engine: Return to the original trouble condition • Change the engine coolant temperature using CONSULT.	If trouble symptom disappears, see CHECK ITEM.	• Harness and connector • Engine temperature sensor • Fuel injectors
IGN TIMING TEST	• Engine: Return to the original trouble condition • Timing light: Set • Retard the ignition timing using CONSULT.	If trouble symptom disappears, see CHECK ITEM.	• Adjust initial ignition timing
POWER BALANCE TEST	• Engine: After warming up, idle the engine. • A/C switch "OFF" • Shift lever "N" • Cut off each injector signal one at a time using CONSULT.	Engine runs rough or dies.	• Harness and connector • Compression • Injectors • Power transistor • Spark plugs • Ignition coils
RADIATOR FAN TEST	• Ignition switch: ON • Turn the radiator fan "ON" and "OFF" using CONSULT.	Radiator fan moves and stops.	• Harness and connector • Radiator fan motor
FUEL PUMP RLY TEST	• Ignition switch: ON (Engine stopped) • Turn the fuel pump relay "ON" and "OFF" using CONSULT and listen to operating sound.	Fuel pump relay makes the operating sound.	• Harness and connector • Fuel pump relay

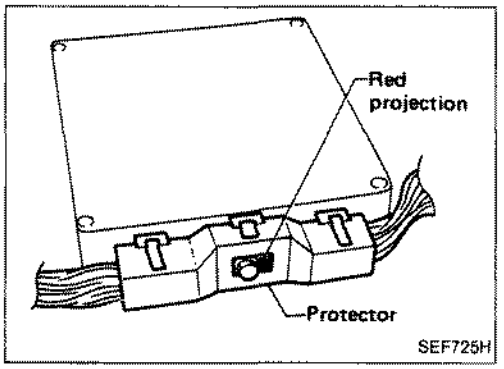


SEF289H

Diagnostic Procedure

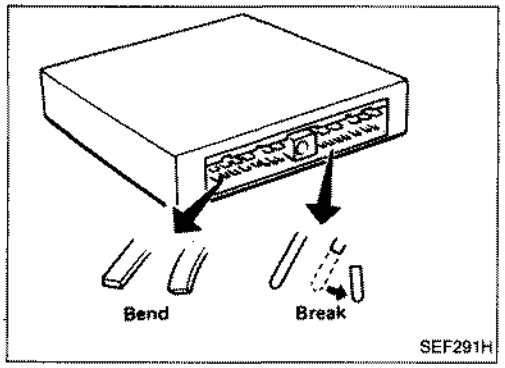
CAUTION:

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



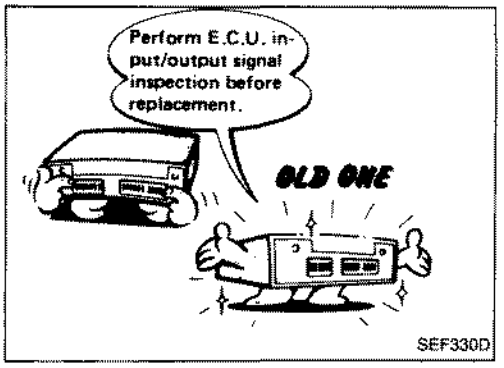
SEF725H

2. **When connecting E.C.U. harness connector, tighten securing bolt until red projection is in line with connector face.**



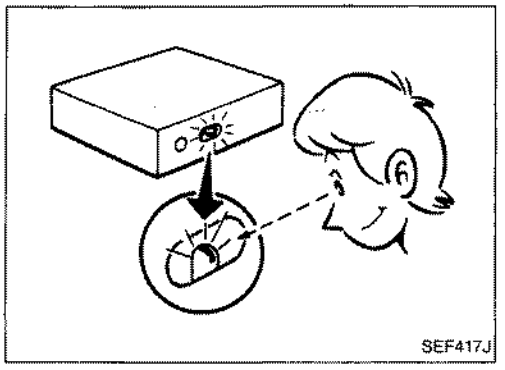
SEF291H

3. **When connecting or disconnecting pin connectors into or from E.C.U., take care not to damage pin terminals (bend or break).**
4. **Make sure that there are not any bends or breaks on E.C.U. pin terminal, when connecting pin connectors.**



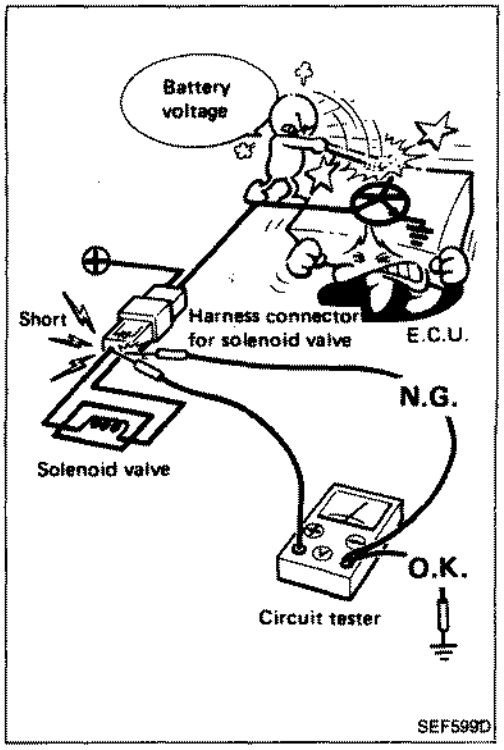
SEF330D

5. **Before replacing E.C.U., perform E.C.U. input/output signal inspection and make sure whether E.C.U. functions properly or not. (See page EF & EC-343.)**


SEF417J

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

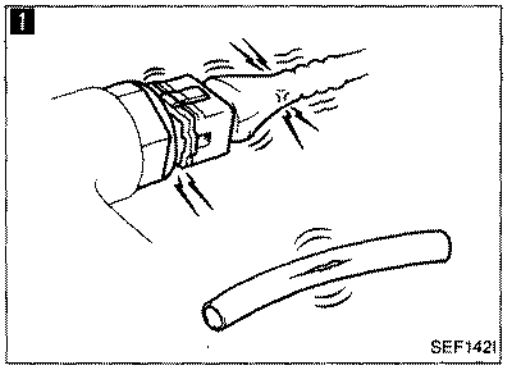
Diagnostic Procedure (Cont'd)



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.

Basic Inspection

1


SEF142I

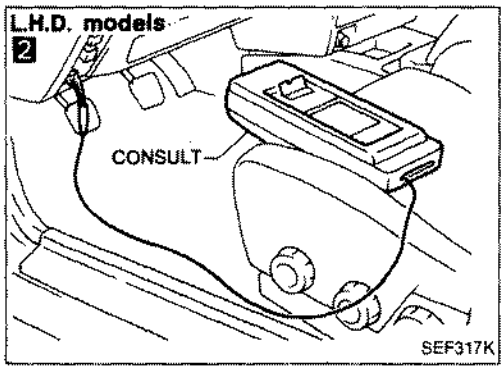
BEFORE STARTING

1. Check service records for any recent repairs that may indicate a related problem, or the current need for scheduled maintenance.
2. Open engine hood and check the following:

- Harness connectors for proper connections
- Vacuum hoses for splits, kinks, and proper connections
- Wiring for proper connections, pinches, and cuts

2

L.H.D. models

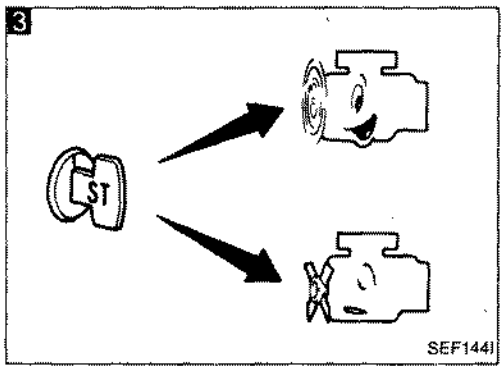


SEF317K

CONNECT CONSULT TO THE VEHICLE

Connect "CONSULT" to the diagnostic connector and select "ENGINE" from the menu. (Refer to page EF & EC-243.)

3



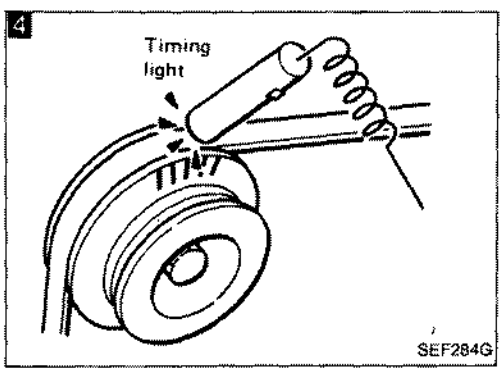
SEF144I

DOES ENGINE START?

No → Go to 6 .

Yes

4



SEF284G

CHECK IGNITION TIMING.

Warm up engine sufficiently and check ignition timing at idle using timing light. (Refer to page EF & EC-225.)

Ignition timing:

10° ± 2° B.T.D.C.

N.G. → Adjust ignition timing by turning crank angle sensor.

O.K.

(Go to Ⓐ on next page.)

Basic Inspection (Cont'd)

5

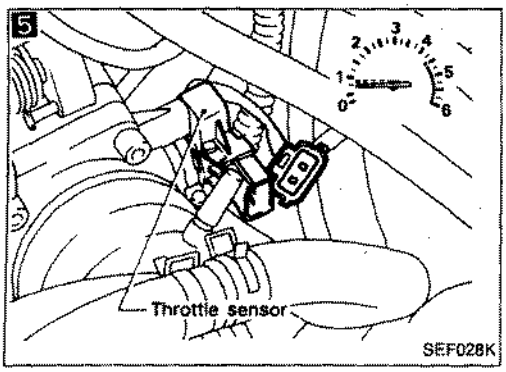
■ IGN TIMING ADJ ■

IGNITION TIMING FEEDBACK CONTROL WILL BE HELD BY TOUCHING START.
AFTER DOING SO, ADJUST IGNITION TIMING WITH A TIMING LIGHT BY TURNING THE CRANK ANGLE SENSOR.

START

SEF579K

5



SEF028K

6

■ THROTTLE SEN ADJ ■

**** ADJ MONITOR ****

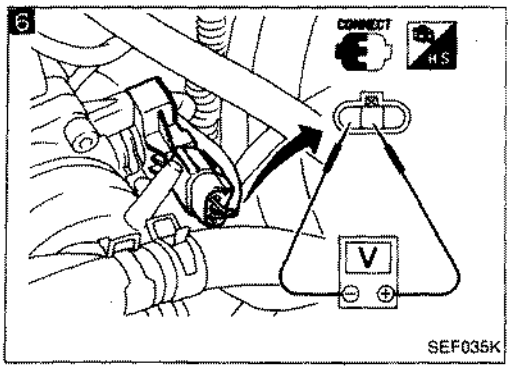
THROTTLE SEN 0.50V

MONITOR

CAS•RPM (REF) 0rpm
IDLE POSITION ON

SEF581K

6



SEF035K

Ⓐ

5

CHECK IDLE ADJ. SCREW INITIAL SET RPM.

1. Select "IGN TIMING ADJ" in "WORK SUPPORT" mode.
2. When touching "START", does engine rpm fall to 675 ± 50 rpm (M/T), 725 ± 50 rpm (A/T) (in "N" position)?

No → Adjust engine rpm by turning idle adjusting screw.

— OR —

When disconnecting throttle sensor harness connector, does engine rpm fall to 675 ± 50 rpm (M/T), 725 ± 50 rpm (A/T) (in "N" position)?

Yes ↓

6

CHECK THROTTLE SENSOR IDLE POSITION.

1. Perform "THROTTLE SEN. ADJ" in "WORK SUPPORT" mode.
2. Check that output voltage of throttle sensor is 0.45 to 0.55V. (Throttle valve fully closes.) and "IDLE POSITION" stays "ON".

N.G. →
1. Adjust output voltage by rotating throttle sensor body.
2. Disconnect throttle sensor harness connector for a few seconds and then reconnect it.
3. Confirm that "IDLE POSITION" stays "ON".

— OR —

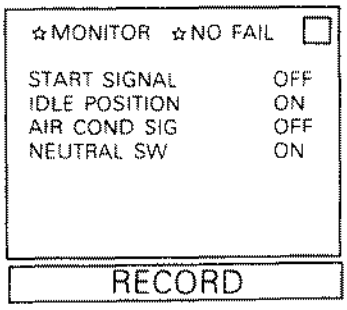
Measure output voltage of throttle sensor using voltmeter, and check that it is 0.45 to 0.55V. (Throttle valve fully closed.)

O.K. ↓

(Go to Ⓑ on next page.)

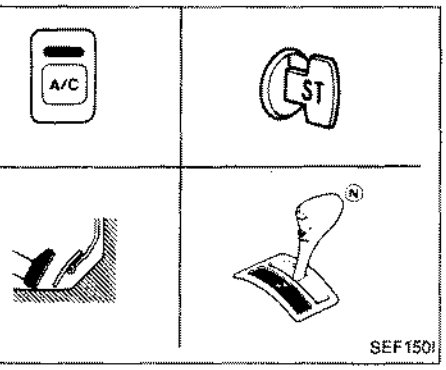
Basic Inspection (Cont'd)

7



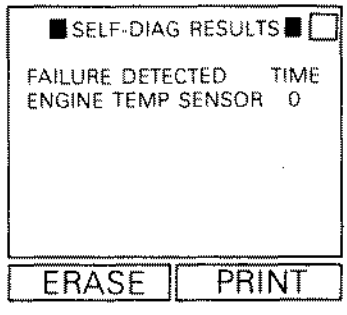
SEF384J

7



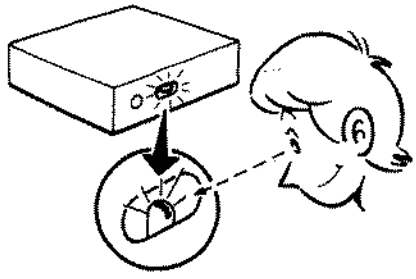
SEF150I

8



SEF151I

8



SEF417J

Ⓑ

7

CHECK SWITCH INPUT SIGNAL.

Select the following switches in "DATA MONITOR" mode,
a) Start signal,
b) Idle position,
c) Air conditioner signal,
d) Neutral (Parking) switch,
and check the switches' ON-OFF operation.

N.G. → Repair or replace the malfunctioning switch or its circuit.

OR

Remove E.C.U. from behind audio system panel and check the above switches' ON-OFF operation using voltmeter at each E.C.U. terminal.

Switch	Condition	Voltage (V)
Start signal	IGN → IGN ON → START	0 → Battery voltage
Idle position	—	—
A/C signal	A/C OFF → A/C ON (Engine running)	Battery voltage → 0 - 0.3
Neutral (Parking) switch	Shift lever is Neutral position → Except Neutral position	0 → Battery voltage

O.K.

8

READ SELF-DIAGNOSTIC RESULTS.

1. Perform "SELF-DIAG RESULTS" mode.
2. Read out self-diagnostic results.
3. Is a failure detected?

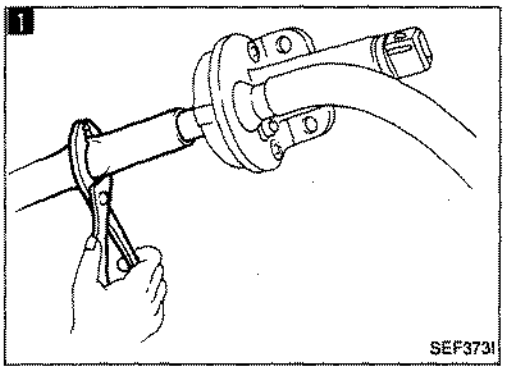
Yes → Go to the relevant inspection procedure.

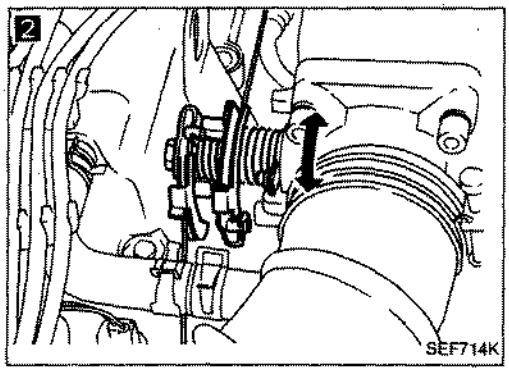
OR

1. Set "Self-diagnostic results mode" in Mode II. (Refer to page EF & EC-240.)
2. Count the number of RED L.E.D. flashes and read out the codes.
3. Are the codes shown?

No

INSPECTION END





Diagnostic Procedure 1 — High Idling after Warm-up

1

CHECK AIR REGULATOR.
When pinching the air regulator hose, does the engine speed drop?

Yes → Check air regulator and circuit. (See page EF & EC-322.)

No ↓

2

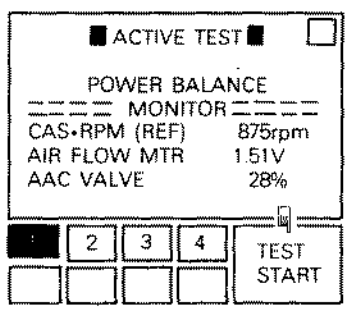
CHECK THROTTLE LINKAGE.
1. Check that throttle linkage moves smoothly.
2. Confirm that throttle valve both fully opens and fully closes.

N.G. → Repair throttle linkage or sticking of throttle valve.

O.K. ↓

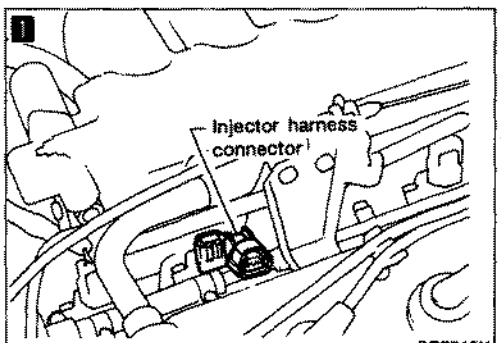
INSPECTION END

1



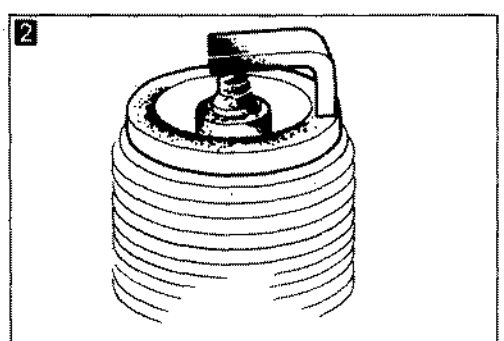
SEF325K

1



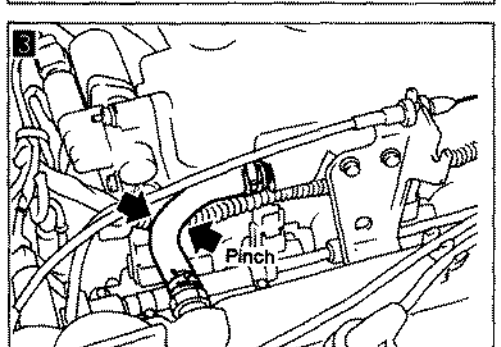
SEF715K

2



SEF156I

3



SEF716K

Diagnostic Procedure 2 — Hunting

1

PERFORM POWER BALANCE TEST.

1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

No → Go to 3.

— OR —

When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

Yes ↓

2

CHECK SPARK PLUGS.
Remove the spark plugs and check for fouling, etc.

N.G. → Repair or replace spark plug(s).

O.K. ↓

3

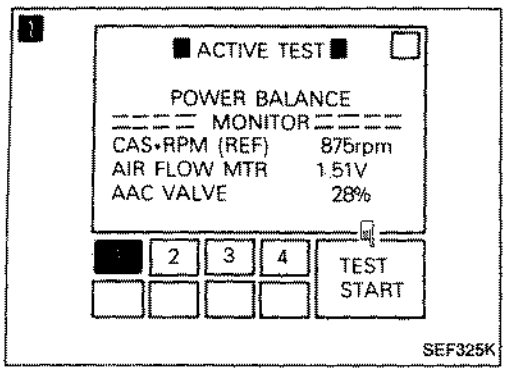
CHECK FOR INTAKE AIR LEAK.
When pinching blow-by hose (lowering the blow-by air supply), does the engine speed rise?

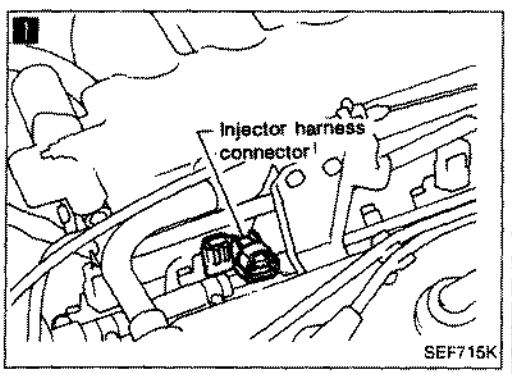
Yes → Discover air leak location and repair.

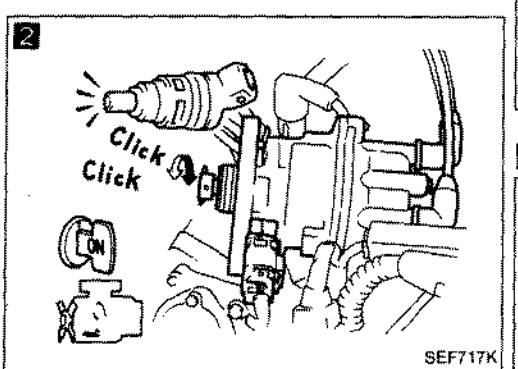
No ↓

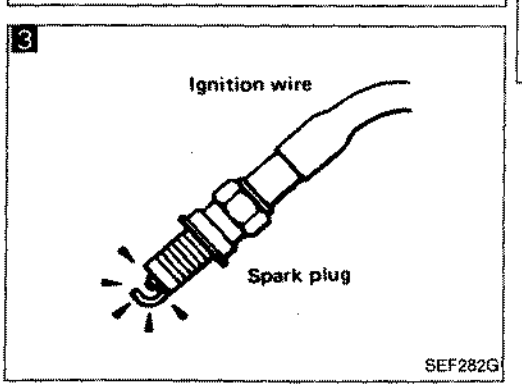
INSPECTION END

Diagnostic Procedure 3 — Unstable Idle









1

PERFORM POWER BALANCE TEST.

1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

No → Go to 6.

OR

When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

Yes ↓

2

CHECK INJECTOR.

1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Turn ignition switch ON. (Do not start engine.)
3. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

No → Check injector(s) and circuit(s).

Yes ↓

3

CHECK IGNITION SPARK.

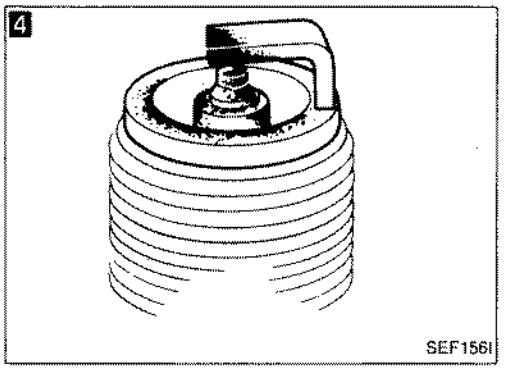
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

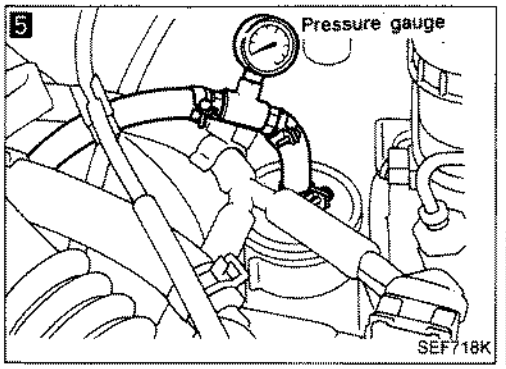
N.G. → Check ignition coil, power transistor unit and their circuits. (See page EF & EC-304.)

O.K. ↓

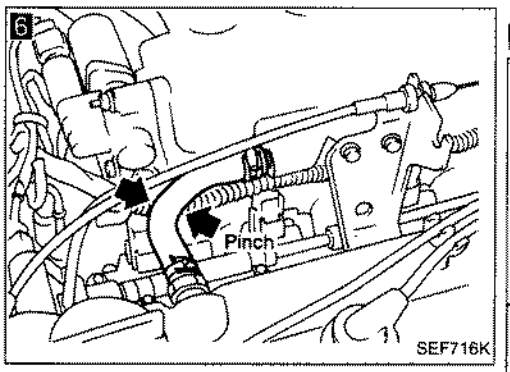
(Go to Ⓐ on next page.)

Diagnostic Procedure 3 — Unstable Idle (Cont'd)

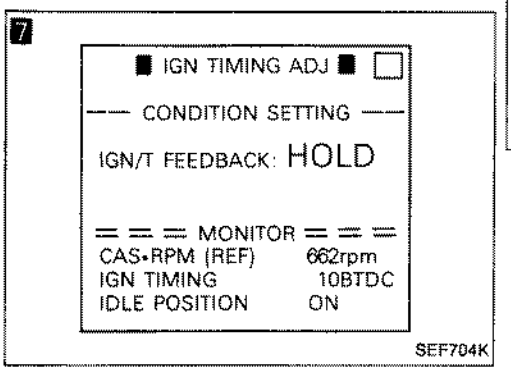

SEF156I



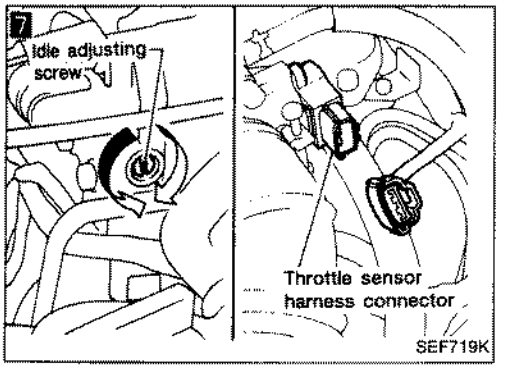
SEF718K



SEF716K



SEF704K



SEF719K

Ⓐ

4 **CHECK SPARK PLUGS.**
Remove the spark plugs and check for fouling, etc.
N.G. → Repair or replace spark plug(s).
O.K.

5 **CHECK FUEL PRESSURE.**
1. Release fuel pressure to zero. (Refer to page EF & EC-353.)
2. Install fuel pressure gauge and check fuel pressure.
   At idle:
   Approx. 245 kPa
   (2.45 bar, 2.5 kg/cm², 36 psi)

N.G. → Check fuel pump and circuit.
O.K.

6 **CHECK FOR INTAKE AIR LEAK.**
When pinching blow-by hose (lowering the blow-by air supply), does the engine speed rise?
Yes → Discover air leak location and repair.
No

7 **CHECK IDLE ADJ. SCREW CLOGGING.**
1. Perform "IGN TIMING ADJ" in "WORK SUPPORT" mode.
2. Can you set engine rpm at 800 ± 50 rpm (in "N" position) by turning idle adjusting screw?

OR

1. Disconnect throttle sensor harness connector.
2. Can you set engine rpm at 800 ± 50 rpm (in "N" position) by turning idle adjusting screw?

No → Check for IAS clogging or throttle valve clogging.
Yes

(Go to Ⓑ on next page.)

Diagnostic Procedure 3 — Unstable Idle (Cont'd)

8

COMPRESSION PRESSURE

SEF309G

Ⓑ

8

CHECK COMPRESSION PRESSURE.

- Check compression pressure.

Standard:

kPa (bar, kg/cm², psi)/350 rpm

1,324 (13.24, 13.5, 192)

Minimum:

kPa (bar, kg/cm², psi)/350 rpm

1,128 (11.28, 11.5, 164)

Difference between each cylinder:

kPa (bar, kg/cm², psi)/350 rpm

98 (0.98, 1.0, 14)

N.G. → Check pistons, piston rings, valves, valve seats and cylinder head gaskets.

O.K.

9

CHECK E.C.U. HARNESS CONNECTOR.

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

N.G. → Repair or replace.

O.K.

10

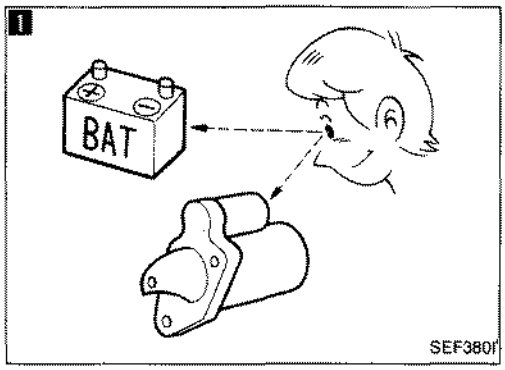
TRY A KNOWN GOOD E.C.U.*

INSPECTION END

*: E.C.U. may be the cause of a problem, but this is rarely the case.

Diagnostic Procedure 4 — Hard to Start or Impossible to Start when the Engine is Cold

1



SEF380I

CHECK BATTERY AND STARTER.
Check battery and starter condition.
(Refer to EL section.)

N.G. → Repair or replace.

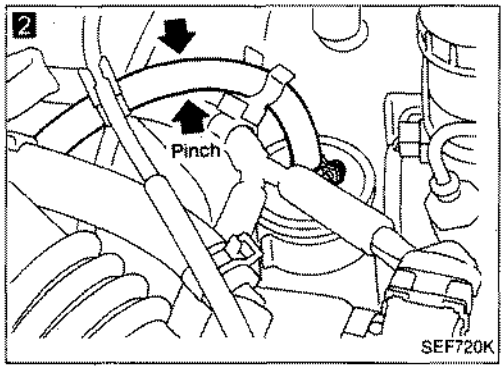
O.K. ↓

2

CHECK FUEL PRESSURE.
1. Pinch fuel feed hose with fingers.
2. When cranking the engine, is there any pressure on the fuel feed hose?

No → Check fuel pump and circuit. (See page EF & EC-318.)

Yes ↓



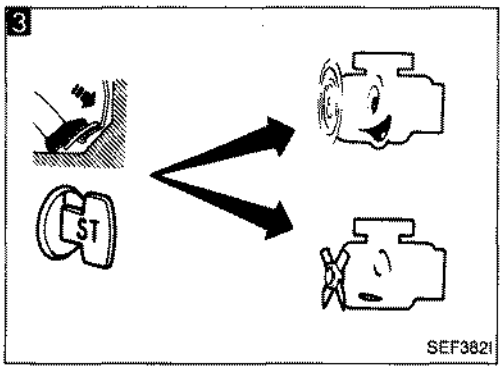
SEF720K

3

CHECK AIR REGULATOR AND A.A.C. VALVE.
When pressing accelerator pedal fully, can you start the engine.

Yes → Check A.A.C. valve, air regulator and circuits. (See pages EF & EC-322.)

No ↓



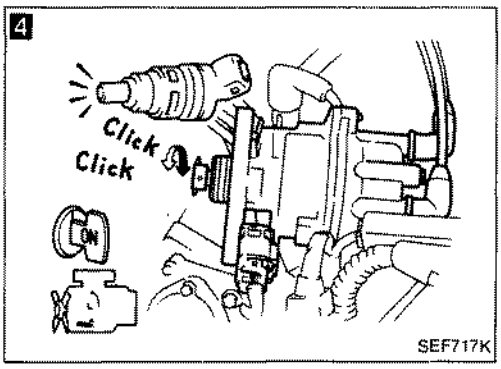
SEF382I

4

CHECK INJECTOR.
1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Turn ignition switch ON. (Do not start engine.)
3. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

No → Check injector(s) and circuit(s).

Yes ↓



SEF717K

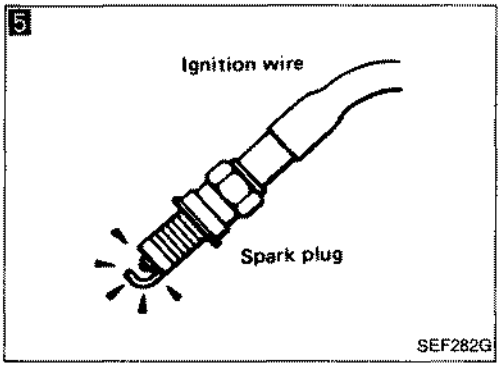
5

CHECK IGNITION SPARK.
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

N.G. → Check ignition coil, power transistor unit and their circuits. (See page EF & EC-304.)

O.K. ↓

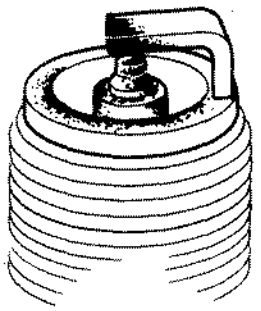
(Go to Ⓐ on next page.)



SEF282G

Diagnostic Procedure 4 — Hard to Start or Impossible to Start when the Engine is Cold (Cont'd)

6



SEF156I

Ⓐ

6 **CHECK SPARK PLUGS.**
Remove the spark plugs and check for fouling, etc.
N.G. → Repair or replace spark plug(s).
O.K. ↓

7 **CHECK E.C.U. HARNESS CONNECTOR.**
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.
N.G. → Repair or replace.
O.K. ↓

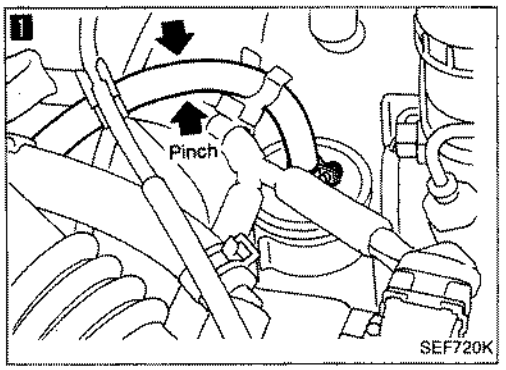
8 **CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.**
Refer to page EF & EC-286.
N.G. → Repair or replace.
O.K. ↓

9 **TRY A KNOWN GOOD E.C.U.***

INSPECTION END

*: E.C.U. may be the cause of a problem, but this is rarely the case.

1



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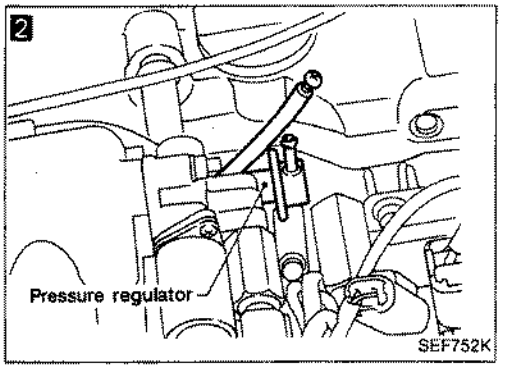

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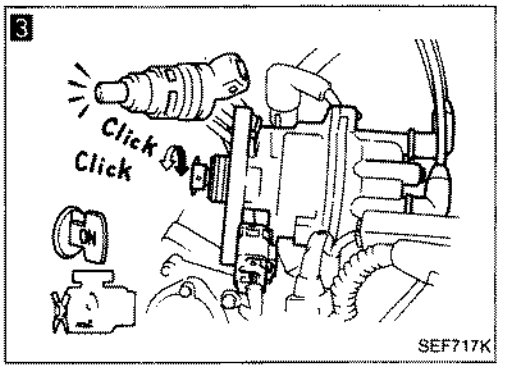
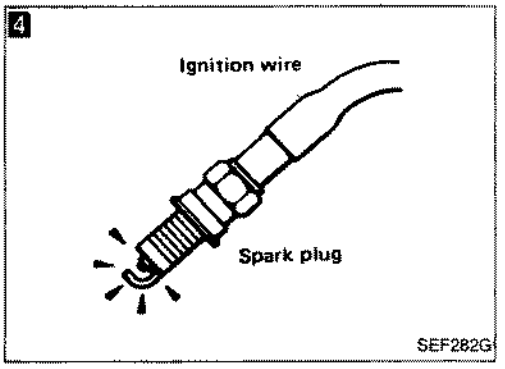


4



Diagnostic Procedure 5 — Hard to Start or Impossible to Start when the Engine is Hot

1

CHECK FUEL PRESSURE.
1. Pinch fuel feed hose with fingers.
2. When cranking the engine, is there any pressure on the fuel feed hose?

No → Check fuel pump and circuit. (See page EF & EC-318.)

Yes ↓

2

CHECK FUEL VAPOR.
1. Disconnect fuel pressure regulator vacuum hose and plug hose.
2. Can you start engine?

Yes → Check fuel properties.

No ↓

3

CHECK INJECTOR.
1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Turn ignition switch ON. (Do not start engine.)
3. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

No → Check injector(s) and circuit(s).

Yes ↓

4

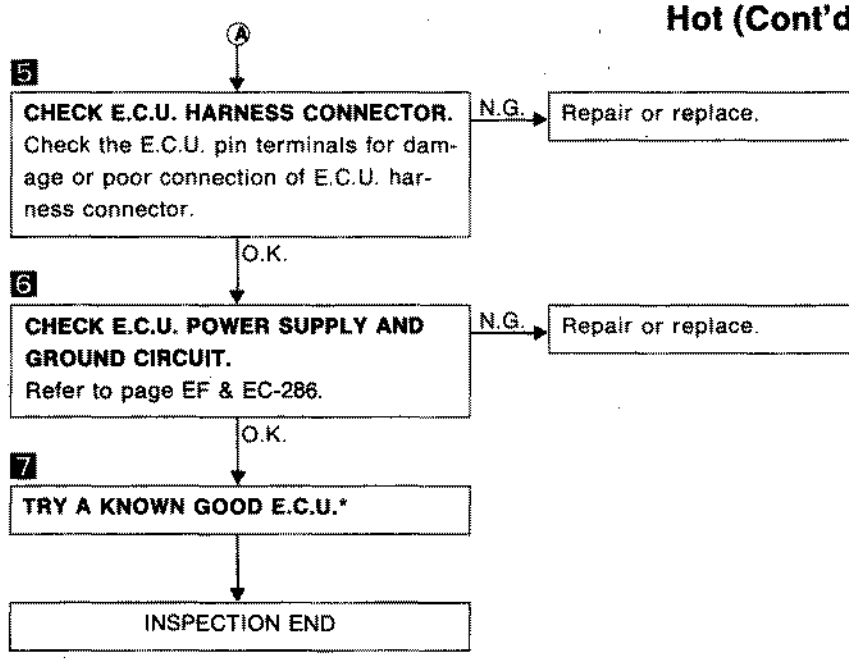
CHECK IGNITION SPARK.
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

N.G. → Check ignition coil, power transistor unit and circuits. (See page EF & EC-304.)

O.K. ↓

(Go to Ⓐ on next page.)

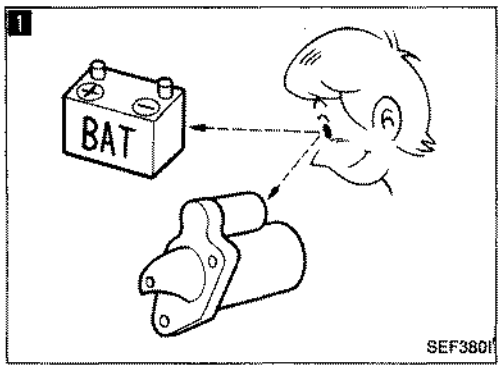
Diagnostic Procedure 5 — Hard to Start or Impossible to Start when the Engine is Hot (Cont'd)



*: E.C.U. may be the cause of a problem, but this is rarely the case.

Diagnostic Procedure 6 — Hard to Start or Impossible to Start under Normal Conditions

1



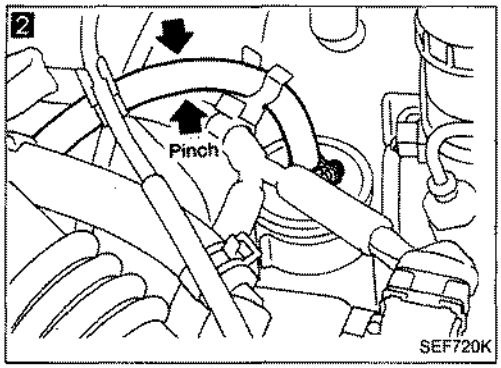
SEF380I

CHECK BATTERY AND STARTER.
Check battery and starter operation.
(Refer to EL section.)

N.G. → Repair or replace.

O.K. ↓

2



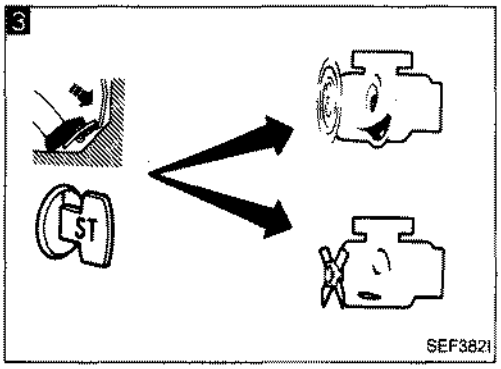
SEF720K

CHECK FUEL PRESSURE.
1. Pinch fuel feed hose with fingers.
2. When cranking the engine, is there any pressure on the fuel feed hose?

No → Check fuel pump and circuit. (See page EF & EC-318.)

Yes ↓

3



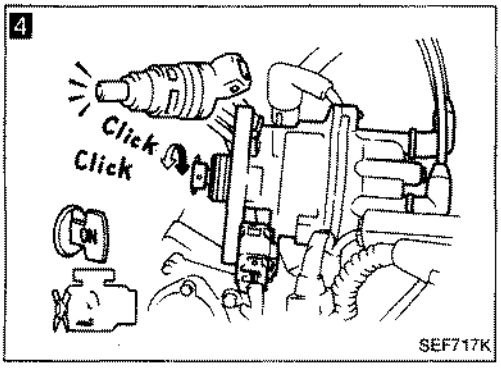
SEF382I

CHECK INJECTOR FOR LEAKAGE.
When pressing accelerator pedal fully, can you start the engine.

Yes → Check injector(s) for leakage.

No ↓

4



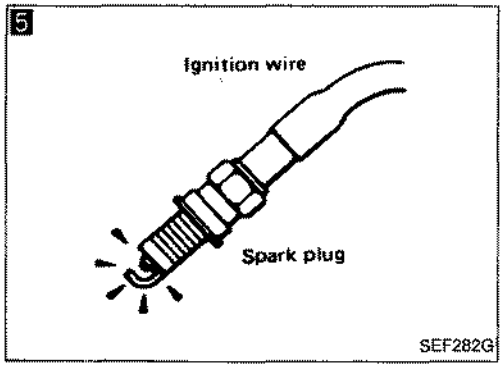
SEF717K

CHECK INJECTOR.
1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Turn ignition switch ON. (Do not start engine.)
3. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

No → Check injectors and circuits.

Yes ↓

5



SEF282G

CHECK IGNITION SPARK.
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

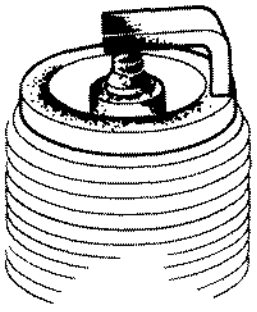
N.G. → Check ignition coil, power transistor unit and circuits. (See page EF & EC-304.)

O.K. ↓

(Go to Ⓐ on next page.)

Diagnostic Procedure 6 — Hard to Start or Impossible to Start under Normal Conditions (Cont'd)

6



SEF156I

Ⓐ

6

CHECK SPARK PLUGS.
Remove the spark plugs and check for fouling, etc.

N.G. → Repair or replace spark plug(s).

O.K.

7

CHECK E.C.U. HARNESS CONNECTOR.
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.

N.G. → Repair or replace.

O.K.

8

CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.
Refer to page EF & EC-286.

N.G. → Repair or replace.

O.K.

9

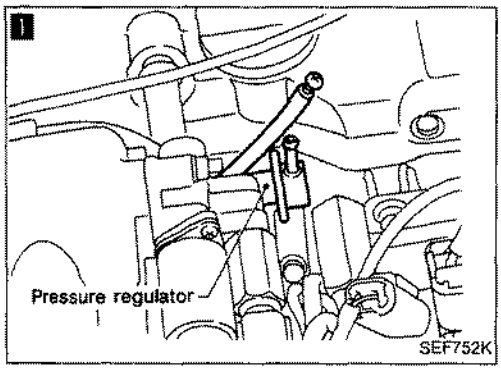
TRY A KNOWN GOOD E.C.U.*

Trouble is fixed. → Replace E.C.U.

Trouble is not fixed.

INSPECTION END

*: E.C.U. may be the cause of a problem, but this is rarely the case.



Diagnostic Procedure 7 — Hesitation when the Engine is Hot

1

CHECK FUEL VAPOR.
1. Disconnect fuel pressure regulator vacuum hose and plug hose.
2. Perform cruise test.
3. Does the hesitation disappear?

Yes → Check fuel properties.

No ↓

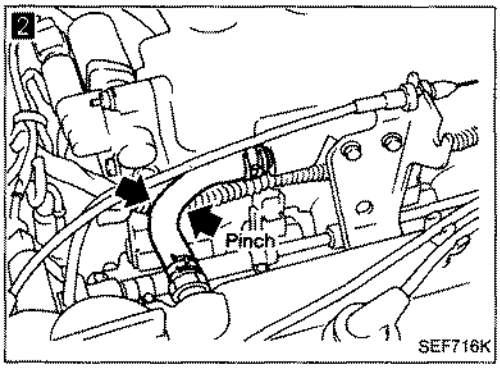
2

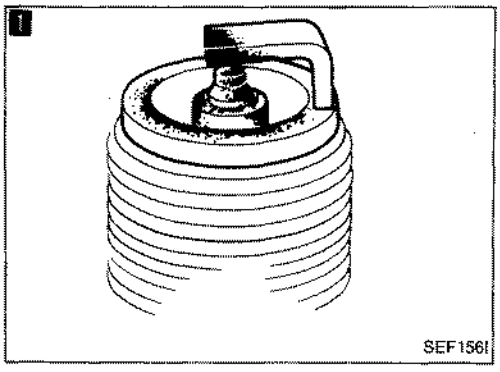
CHECK FOR INTAKE AIR LEAK.
When pinching blow-by hose (lowering the blow-by air supply), does the engine speed rise?

Yes → Discover air leak location and repair.

No ↓

INSPECTION END





Diagnostic Procedure 8 — Hesitation when the Engine is Cold

1

CHECK SPARK PLUGS.
Remove spark plugs and check for fouling, etc.

N.G. → Repair or replace spark plug(s).

O.K. ↓

2

CHECK FOR INTAKE AIR LEAK.
When pinching blow-by hose (lowering the blow-by air supply), does the engine speed rise?

Yes → Discover air leak location and repair.

No ↓

3

TRY A KNOWN GOOD AIR FLOW METER.

Trouble is fixed. → Replace air flow meter.

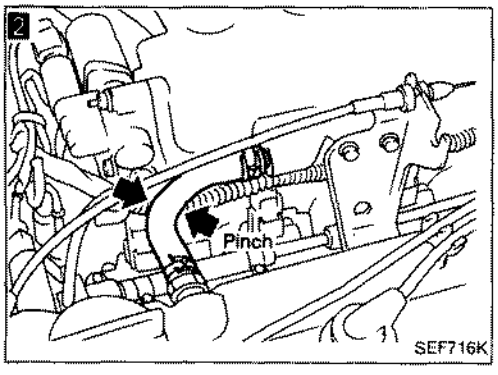
Trouble is not fixed. ↓

4

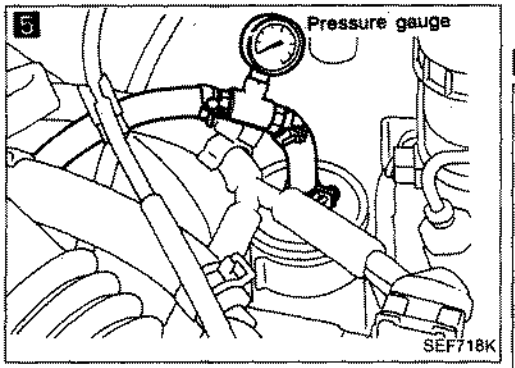
CHECK FOR INTAKE VALVE DEPOSITS.
If there are deposits on intake valves, remove them.

↓

INSPECTION END



Diagnostic Procedure 10 — Engine Stalls when Turning (Cont'd)



Ⓐ

5

CHECK FUEL PRESSURE.
1. Release fuel pressure to zero. (Refer to page EF & EC-353.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:
Approx. 245 kPa
(2.45 bar, 2.5 kg/cm², 36 psi)
The moment throttle valve is fully open:
Approx. 294 kPa
(2.94 bar, 3.0 kg/cm², 43 psi)

N.G. → Check fuel pressure regulator diaphragm.

O.K. ↓

6

CHECK E.C.U. HARNESS CONNECTOR.
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.

N.G. → Repair or replace.

O.K. ↓

7

CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.
Refer to page EF & EC-286.

N.G. → Repair or replace.

O.K. ↓

8

TRY A KNOWN GOOD E.C.U.*

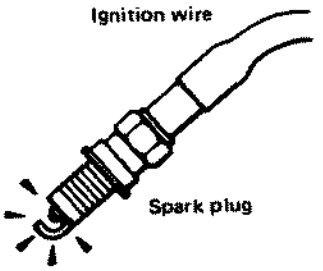
↓

INSPECTION END

*: E.C.U. may be the cause of a problem, but this is rarely the case.

Diagnostic Procedure 11 — Engine Stalls when the Engine is Hot (Cont'd)

4



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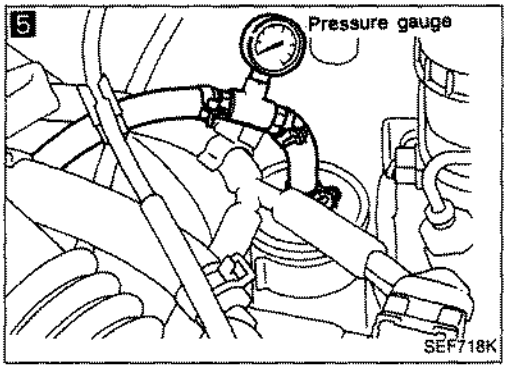


Ⓐ

4 **CHECK IGNITION SPARK.**

1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

N.G. → Check ignition coil, power transistor unit and their circuits. (See page EF & EC-304.)

O.K. ↓

5 **CHECK FUEL PRESSURE.**

1. Release fuel pressure to zero. (Refer to page EF & EC-353.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:
Approx. 245 kPa
(2.45 bar, 2.5 kg/cm², 36 psi)
The moment throttle valve is fully open:
Approx. 294 kPa
(2.94 bar, 3.0 kg/cm², 43 psi)

N.G. → Check fuel pressure regulator diaphragm.

O.K. ↓

6 **CHECK E.C.U. HARNESS CONNECTOR.**
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.

N.G. → Repair or replace.

O.K. ↓

7 **CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.**
Refer to page EF & EC-286.

N.G. → Repair or replace.

O.K. ↓

8 **TRY A KNOWN GOOD E.C.U.***

Trouble is fixed. → Replace E.C.U.

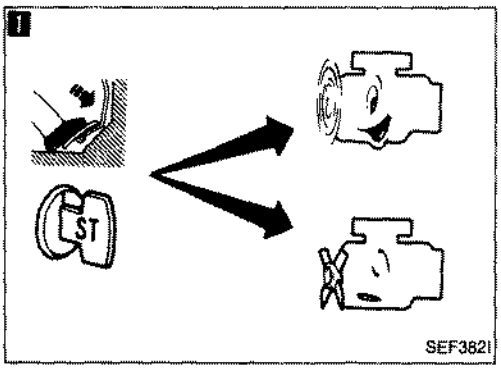
Trouble is not fixed. ↓

INSPECTION END

*: E.C.U. may be the cause of a problem, but this is rarely the case.

Diagnostic Procedure 12 — Engine Stalls when the Engine is Cold

1



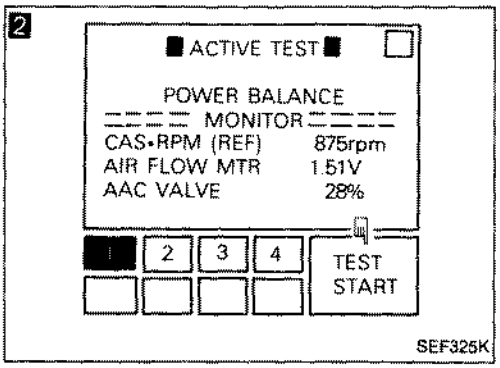
SEF382I

CHECK AIR REGULATOR AND A.A.C. VALVE.
When the engine is cold, can you start the engine when pressing accelerator pedal fully?

N.G. → Check A.A.C. valve, air regulator and circuits. (See pages EF & EC-324.)

O.K. ↓

2



SEF325K

PERFORM POWER BALANCE TEST.

1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

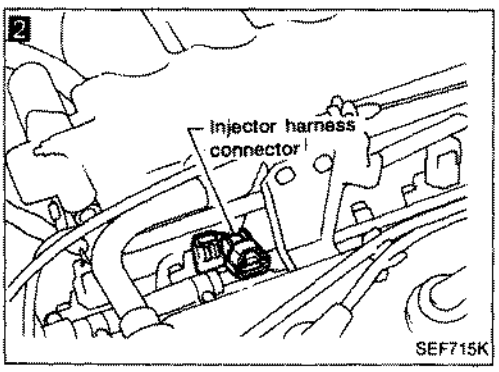
No → Go to 6.

— OR —

When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

Yes ↓

2



SEF715K

3

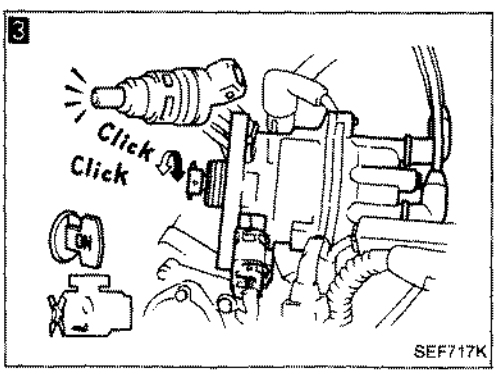
CHECK INJECTOR.

1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Turn ignition switch ON. (Do not start engine.)
3. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

N.G. → Check injector(s) and circuit(s).

O.K. ↓

3



SEF717K

4

CHECK IGNITION SPARK.

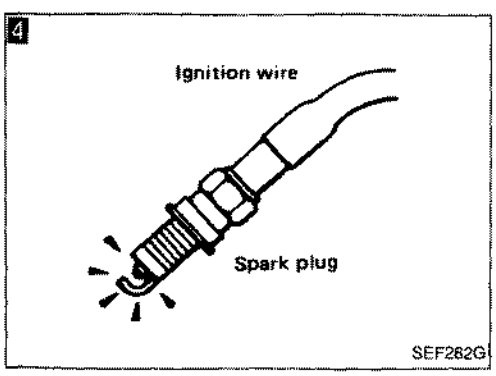
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

N.G. → Check ignition coil, power transistor unit and circuits. (See page EF & EC-304.)

O.K. ↓

(Go to Ⓐ on next page.)

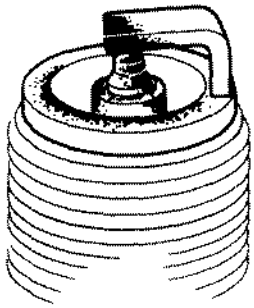
4



SEF262G

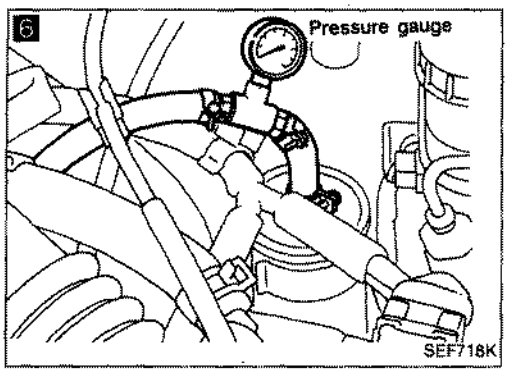
Diagnostic Procedure 12 — Engine Stalls when the Engine is Cold (Cont'd

5



SEF156I

6



SEF718K

Ⓐ

5 **CHECK SPARK PLUGS.**
Remove the spark plugs and check for fouling, etc.
N.G. → Repair or replace spark plug(s).
O.K.

6 **CHECK FUEL PRESSURE.**
1. Release fuel pressure to zero. (Refer to page EF & EC-353.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:
Approx. 245 kPa
(2.45 bar, 2.5 kg/cm², 36 psi)
The moment throttle valve is fully open:
Approx. 294 kPa
(2.94 bar, 3.0 kg/cm², 43 psi)

N.G. → Check fuel pressure regulator diaphragm.
O.K.

7 **CHECK E.C.U. HARNESS CONNECTOR.**
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.
N.G. → Repair or replace.
O.K.

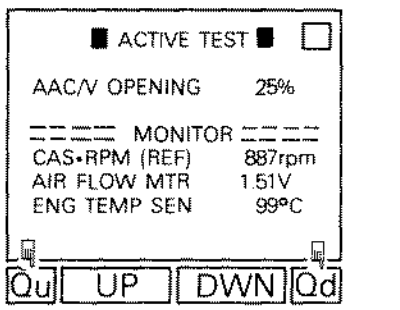
8 **CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.**
Refer to page EF & EC-286.
N.G. → Repair or replace.
O.K.

9 **TRY A KNOWN GOOD E.C.U.***

INSPECTION END

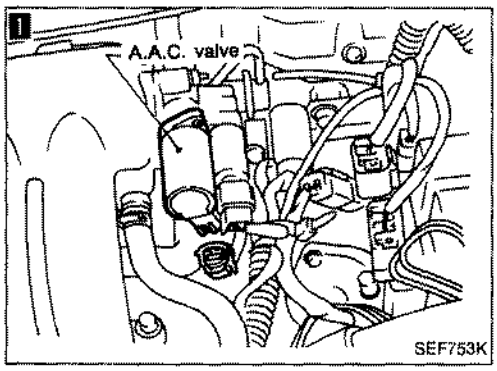
*: E.C.U. may be the cause of a problem, but this is rarely the case.

1



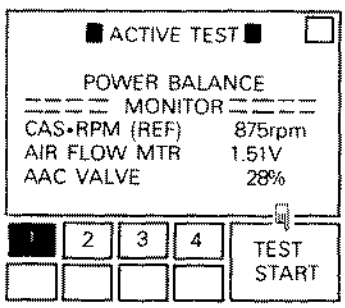
SEF328K

1



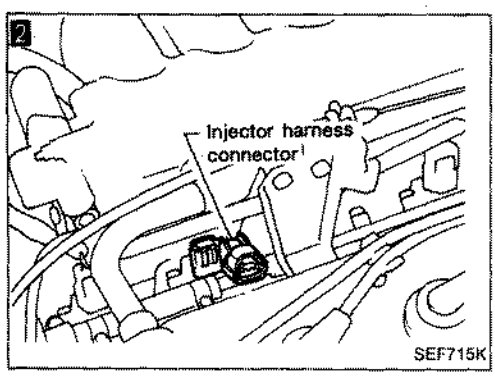
SEF753K

2



SEF325K

2



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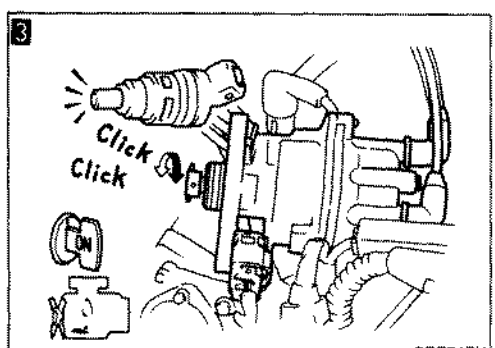


SEF717K

Diagnostic Procedure 13 — Engine Stalls when Stepping on the Accelerator Momentarily

1

CHECK A.A.C. VALVE.

1. Select "A.A.C. VALVE OPENING" in "ACTIVE TEST" mode.
2. When touching "Qu" and "Qd", does the engine speed change according to the percent of A.A.C. valve opening?

No → Check A.A.C. valve and circuit. (See page EF & EC-324.)

OR

When disconnecting A.A.C. valve harness connector, does the engine speed drop?

Yes ↓

2

PERFORM POWER BALANCE TEST.

1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

No → Go to **5**.

OR

When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

Yes ↓

3

CHECK INJECTOR.

1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Turn ignition switch ON. (Do not start engine.)
3. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

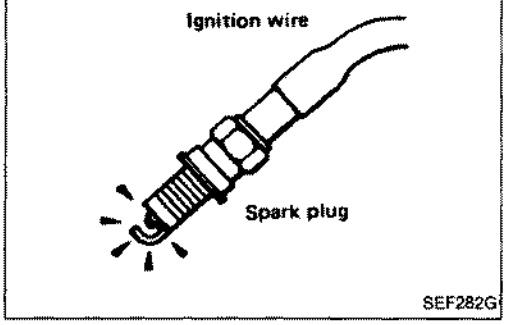
No → Check injector(s) and their circuit(s).

Yes ↓

(Go to Ⓐ on next page.)

Diagnostic Procedure 13 — Engine Stalls when Stepping on the Accelerator Momentarily (Cont'd)

4



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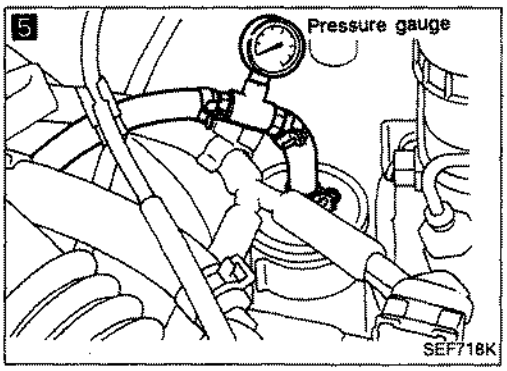


Ⓐ

4

CHECK IGNITION SPARK.
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against an earth point with engine cranking.
4. Check for spark.

N.G. → Check ignition coil, power transistor unit and their circuits. (See page EF & EC-304.)

O.K. ↓

5

CHECK FUEL PRESSURE.
1. Release fuel pressure to zero. (Refer to page EF & EC-353.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:
Approx. 245 kPa
(2.45 bar, 2.5 kg/cm², 36 psi)
The moment throttle valve is fully open:
Approx. 294 kPa
(2.94 bar, 3.0 kg/cm², 43 psi)

N.G. → Check fuel pressure regulator diaphragm.

O.K. ↓

6

CHECK E.C.U. HARNESS CONNECTOR.
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.

N.G. → Repair or replace.

O.K. ↓

7

CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.
Refer to page EF & EC-286.

N.G. → Repair or replace.

O.K. ↓

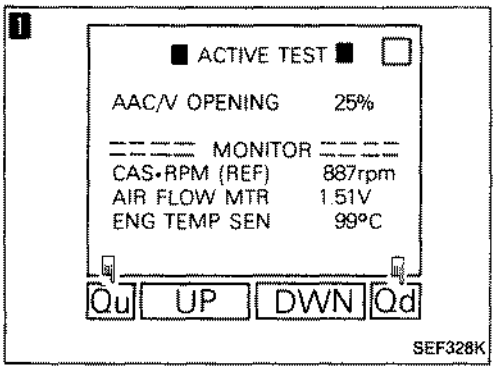
8

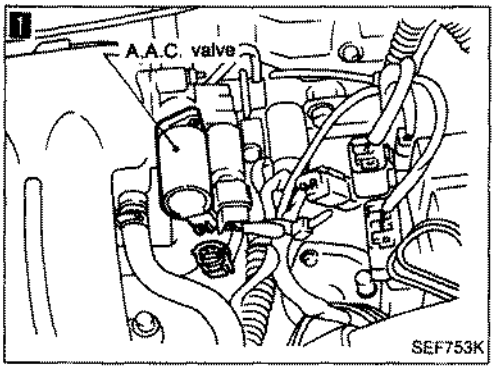
TRY A KNOWN GOOD E.C.U.*

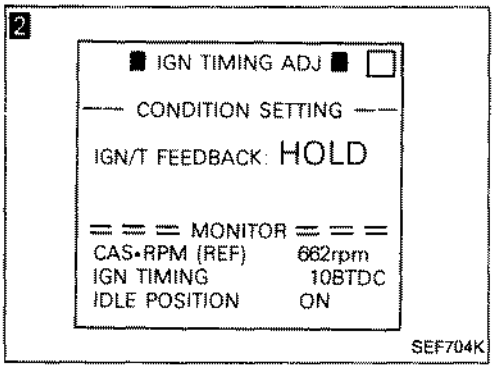
↓

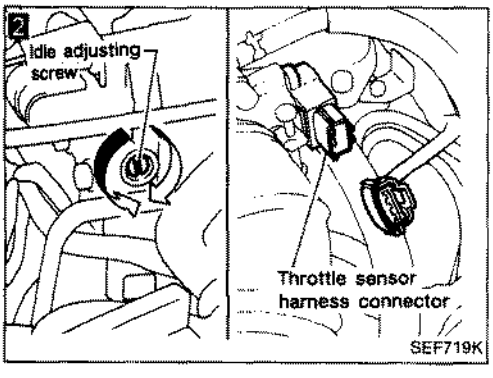
INSPECTION END

*: E.C.U. may be the cause of a problem, but this is rarely the case.









Diagnostic Procedure 14 — Engine Stalls after Decelerating

1

CHECK A.A.C. VALVE.

1. Select "A.A.C. VALVE OPENING" in "ACTIVE TEST" mode.
2. When touching "Qu" and "Qd", does the engine speed change according to the percent of A.A.C. valve opening?

No → Check A.A.C. valve and circuit. (See page EF & EC-324.)

OR

When disconnecting A.A.C. valve harness connector, does the engine speed drop?

Yes

2

CHECK IDLE ADJ. SCREW CLOGGING.

1. Perform "IGN TIMING ADJ" in "WORK SUPPORT" mode.
2. Can you set engine rpm at 675±50 rpm (M/T), 725±50 rpm (A/T) (in "N" position) by turning idle adjusting screw?

No → Check for IAS clogging or throttle chamber clogging.

OR

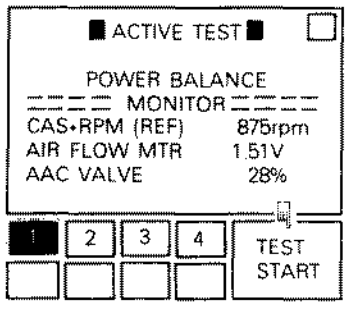
1. Disconnect throttle sensor harness connector.
2. Can you set engine rpm at 675±50 rpm (M/T), 725±50 rpm (A/T) (in "N" position) by turning idle adjusting screw?

Yes

(Go to Ⓐ on next page.)

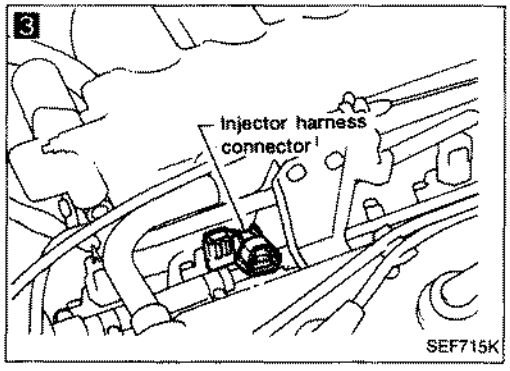
Diagnostic Procedure 14 — Engine Stalls after Decelerating (Cont'd)

3



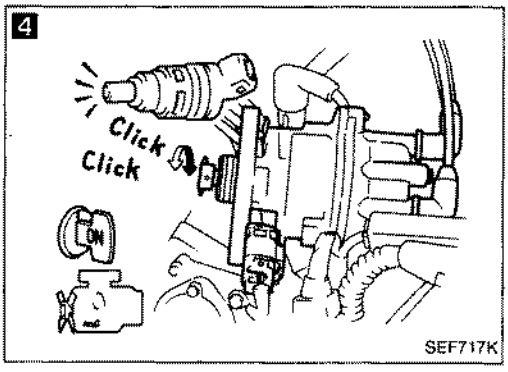
SEF325K

3



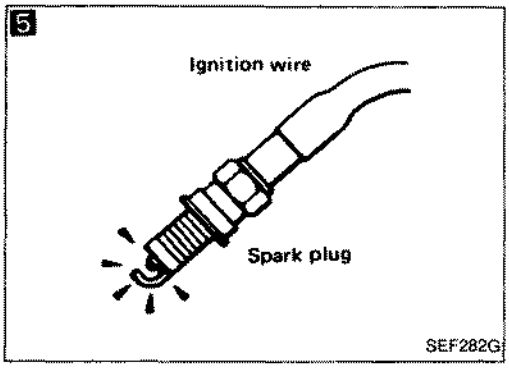
SEF715K

4



SEF717K

5



SEF282G

Ⓐ

3 **PERFORM POWER BALANCE TEST.**

1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

No → Go to **6**.

OR

When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

Yes ↓

4 **CHECK INJECTOR.**

1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Turn ignition switch ON. (Do not start engine.)
3. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

No → Check injector(s) and circuit(s).

Yes ↓

5 **CHECK IGNITION SPARK.**

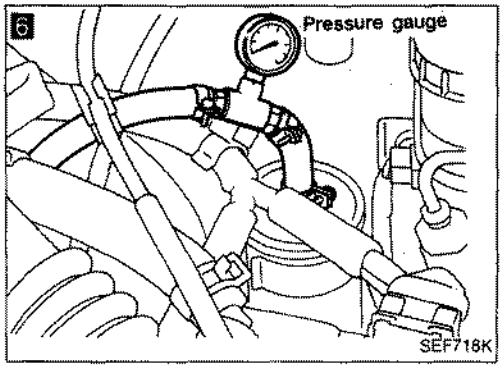
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

No → Check ignition coil, power transistor unit and circuits. (See page EF & EC-304.)

Yes ↓

(Go to Ⓑ on next page.)

Diagnostic Procedure 14 — Engine Stalls after Decelerating (Cont'd)



Ⓑ

6

CHECK FUEL PRESSURE.

1. Release fuel pressure to zero. (Refer to page EF & EC-353.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:

Approx. 245 kPa
(2.45 bar, 2.5 kg/cm², 36 psi)

The moment throttle valve is fully open:

Approx. 294 kPa
(2.94 bar, 3.0 kg/cm², 43 psi)

N.G. → Check fuel pressure regulator diaphragm.

O.K.

7

CHECK E.C.U. HARNESS CONNECTOR.
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.

N.G. → Repair or replace.

O.K.

8

CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.
Refer to page EF & EC-286.

N.G. → Repair or replace.

O.K.

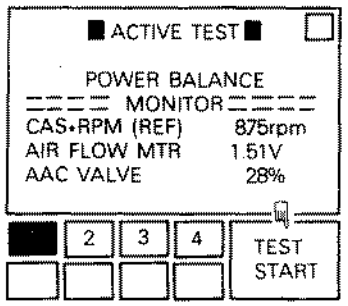
9

TRY A KNOWN GOOD E.C.U.*

INSPECTION END

*: E.C.U. may be the cause of a problem, but this is rarely the case.

1



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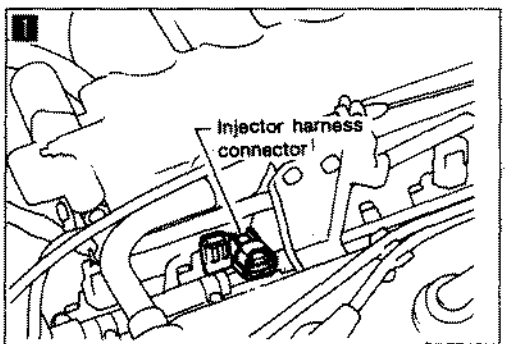
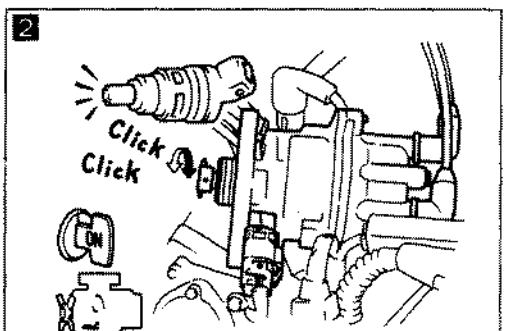
1



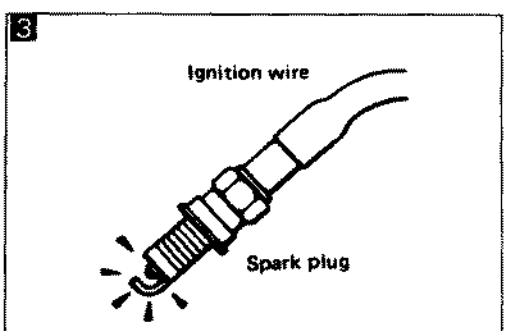
SEF715K

2



SEF717K

3



SEF282G

Diagnostic Procedure 15 — Engine Stalls when Accelerating or when Driving at Constant Speed

1

PERFORM POWER BALANCE TEST.

1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

No → Go to **4**.

— OR —

When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

Yes ↓

2

CHECK INJECTOR.

1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Turn ignition switch ON. (Do not start engine.)
3. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

No → Check injector(s) and circuit(s).

Yes ↓

3

CHECK IGNITION SPARK.

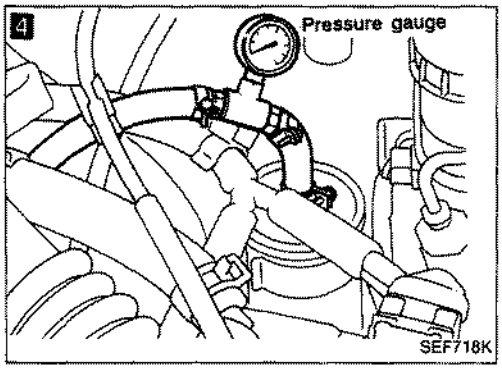
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

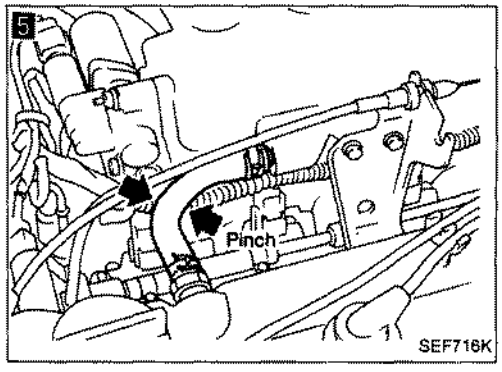
No → Check ignition coil, power transistor unit and circuits. (See page EF & EC-304.)

Yes ↓

(Go to Ⓐ on next page.)

Diagnostic Procedure 15 — Engine Stalls when Accelerating or when Driving at Constant Speed (Cont'd)





Ⓐ

4

CHECK FUEL PRESSURE.
1. Release fuel pressure to zero. (Refer to page EF & EC-353.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:
Approx. 245 kPa
(2.45 bar, 2.5 kg/cm², 36 psi)
The moment throttle valve is fully open:
Approx. 294 kPa
(2.94 bar, 3.0 kg/cm², 43 psi)

N.G. → Check fuel pump, circuit and fuel pressure regulator.

O.K.

5

CHECK FOR INTAKE AIR LEAK.
When pinching blow-by hose (lowering the blow-by air supply), does the engine speed rise?

Yes → Discover air leak location and repair.

No

6

CHECK E.C.U. HARNESS CONNECTOR.
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.

N.G. → Repair or replace.

O.K.

7

CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.
Refer to page EF & EC-286.

Yes → Repair or replace.

No

8

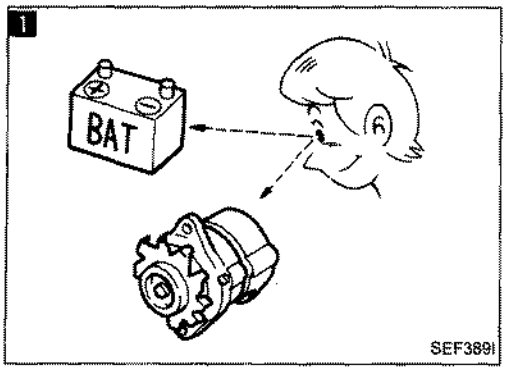
TRY A KNOWN GOOD E.C.U.*

INSPECTION END

*: E.C.U. may be the cause of a problem, but this is rarely the case.

Diagnostic Procedure 16 — Engine Stalls when the Electrical Load is Heavy

1



SEF389I

CHECK BATTERY AND ALTERNATOR.
Check battery and alternator condition. (Refer to EL section.)

N.G. → Repair or replace.

O.K. ↓

2

PERFORM POWER BALANCE TEST.

1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

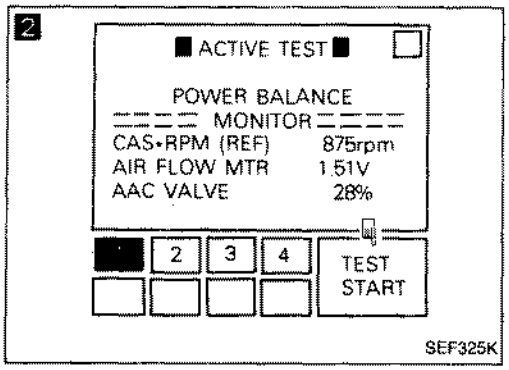
No → Go to 5.

OR

When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

Yes ↓

2



SEF325K

3

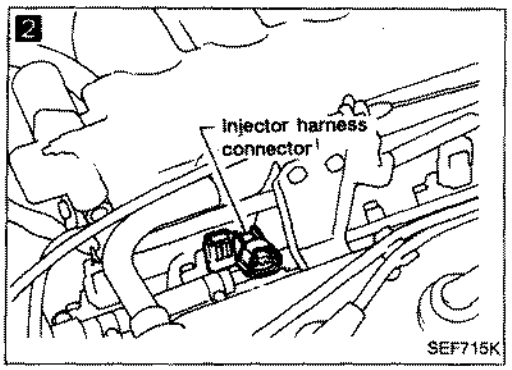
CHECK INJECTOR.

1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Turn ignition switch ON. (Do not start engine.)
3. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

No → Check injector(s) and circuit(s).

Yes ↓

2



SEF715K

4

CHECK IGNITION SPARK.

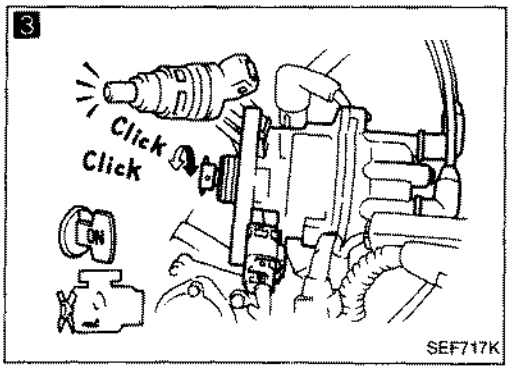
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

N.G. → Check ignition coil, power transistor unit and circuits. (See page EF & EC-304.)

O.K. ↓

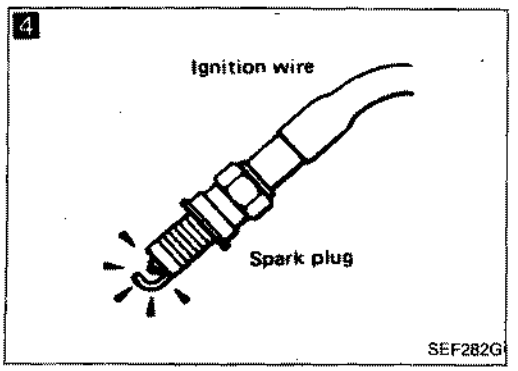
(Go to Ⓐ on next page.)

3



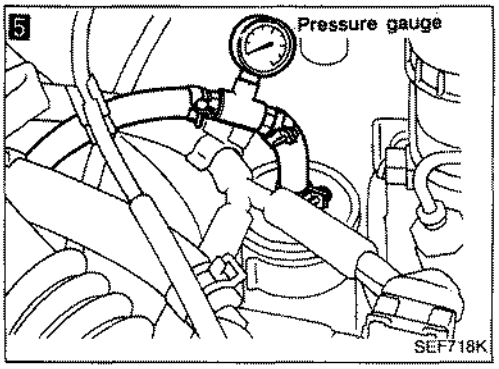
SEF717K

4



SEF282G

Diagnostic Procedure 16 — Engine Stalls when the Electrical Load is Heavy (Cont'd)



Ⓐ

5

CHECK FUEL PRESSURE.
1. Release fuel pressure to zero. (Refer to page EF & EC-353.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:
Approx. 245 kPa
(2.45 bar, 2.5 kg/cm², 36 psi)
The moment throttle valve is fully open:
Approx. 294 kPa
(2.94 bar, 3.0 kg/cm², 43 psi)

N.G. → Check fuel pressure regulator diaphragm.

O.K. ↓

6

CHECK E.C.U. HARNESS CONNECTOR.
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.

N.G. → Repair or replace.

O.K. ↓

7

CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.
Refer to page EF & EC-286.

N.G. → Repair or replace.

O.K. ↓

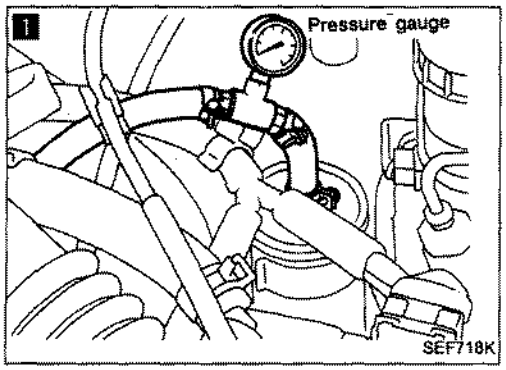
8

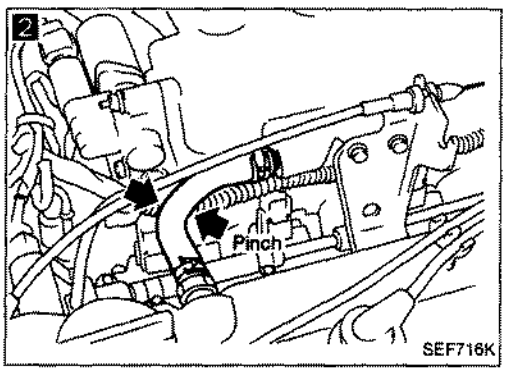
TRY A KNOWN GOOD E.C.U.*

↓

INSPECTION END

*: E.C.U. may be the cause of a problem, but this is rarely the case.





Diagnostic Procedure 17 — Lack of Power and Stumble

1

CHECK FUEL PRESSURE.

1. Release fuel pressure to zero. (Refer to page EF & EC-353.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:

Approx. 245 kPa

(2.45 bar, 2.5 kg/cm², 36 psi)

The moment throttle valve is fully open:

Approx. 294 kPa

(2.94 bar, 3.0 kg/cm², 43 psi)

N.G. → Check fuel pressure regulator diaphragm.

O.K. ↓

2

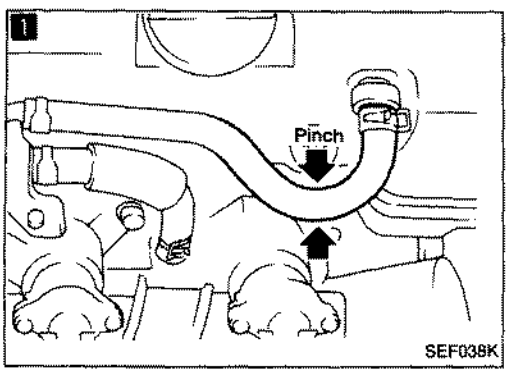
CHECK FOR INTAKE AIR LEAK.

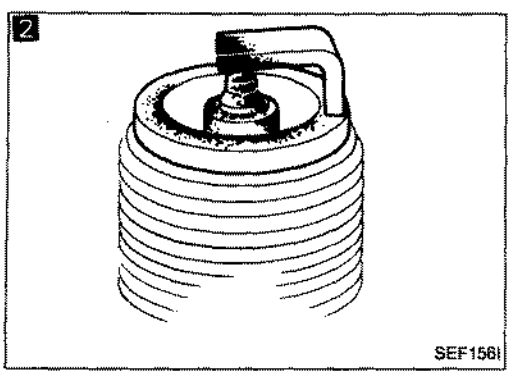
When pinching blow-by hose (lowering the blow-by air supply), does the engine speed rise?

Yes → Discover air leak location and repair.

No ↓

INSPECTION END





Diagnostic Procedure 18 — Detonation

1

CHECK FOR INTAKE AIR LEAK.

When pinching blow-by hose (lowering the blow-by air supply), does the engine rpm rise?

Yes → Discover air leak location and repair.

No ↓

2

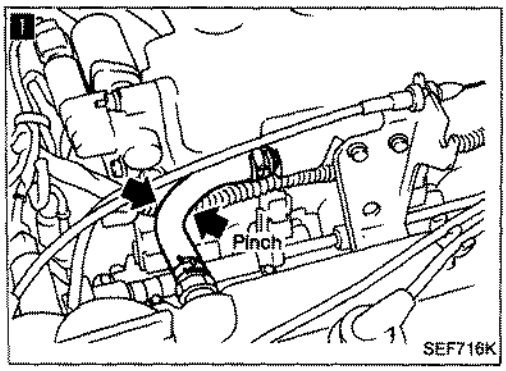
CHECK FOR OIL LEAK TO COMBUSTION CHAMBER.

Remove spark plugs and check for fouling with oil.

Yes → Check pistons, piston rings, valves, valve seats, valve oil seal, engine oil level, etc.

No ↓

INSPECTION END



Diagnostic Procedure 19 — Surge

1

CHECK INTAKE AIR LEAK.
When pinching blow-by hose (lowering the blow-by air supply), does the engine speed rise?

Yes → Discover air leak location and repair.

No ↓

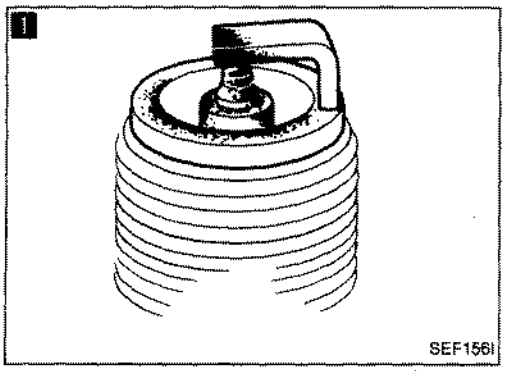
2

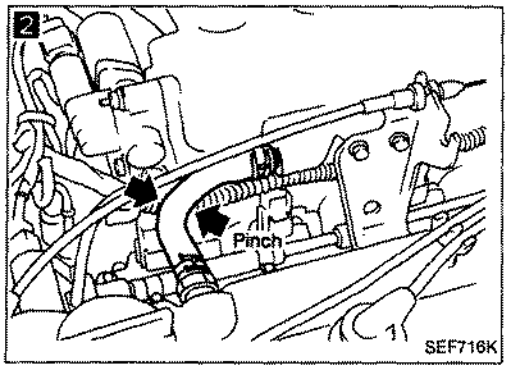
TRY A KNOWN GOOD E.C.U.*

↓

INSPECTION END

*: E.C.U. may be the cause of a problem, but this is rarely the case.





Diagnostic Procedure 20 — Backfire through the Intake

1

CHECK SPARK PLUGS.
Remove the spark plugs and check for fouling, etc.

N.G. → Repair or replace spark plug(s).

O.K. ↓

2

CHECK INTAKE AIR LEAK.
When pinching blow-by hose (lowering the blow-by air supply), does the engine speed rise?

Yes → Discover air leak location and repair.

No ↓

3

CHECK FOR INTAKE VALVE DEPOSITS.
If there are deposits on intake valves, remove them.

↓

INSPECTION END

Diagnostic Procedure 21 — Backfire through the Exhaust

1

CHECK ENGINE TEMPERATURE SENSOR.
Check engine temperature sensor and its circuit. (See page EF & EC-298.)

N.G. → Replace or repair.

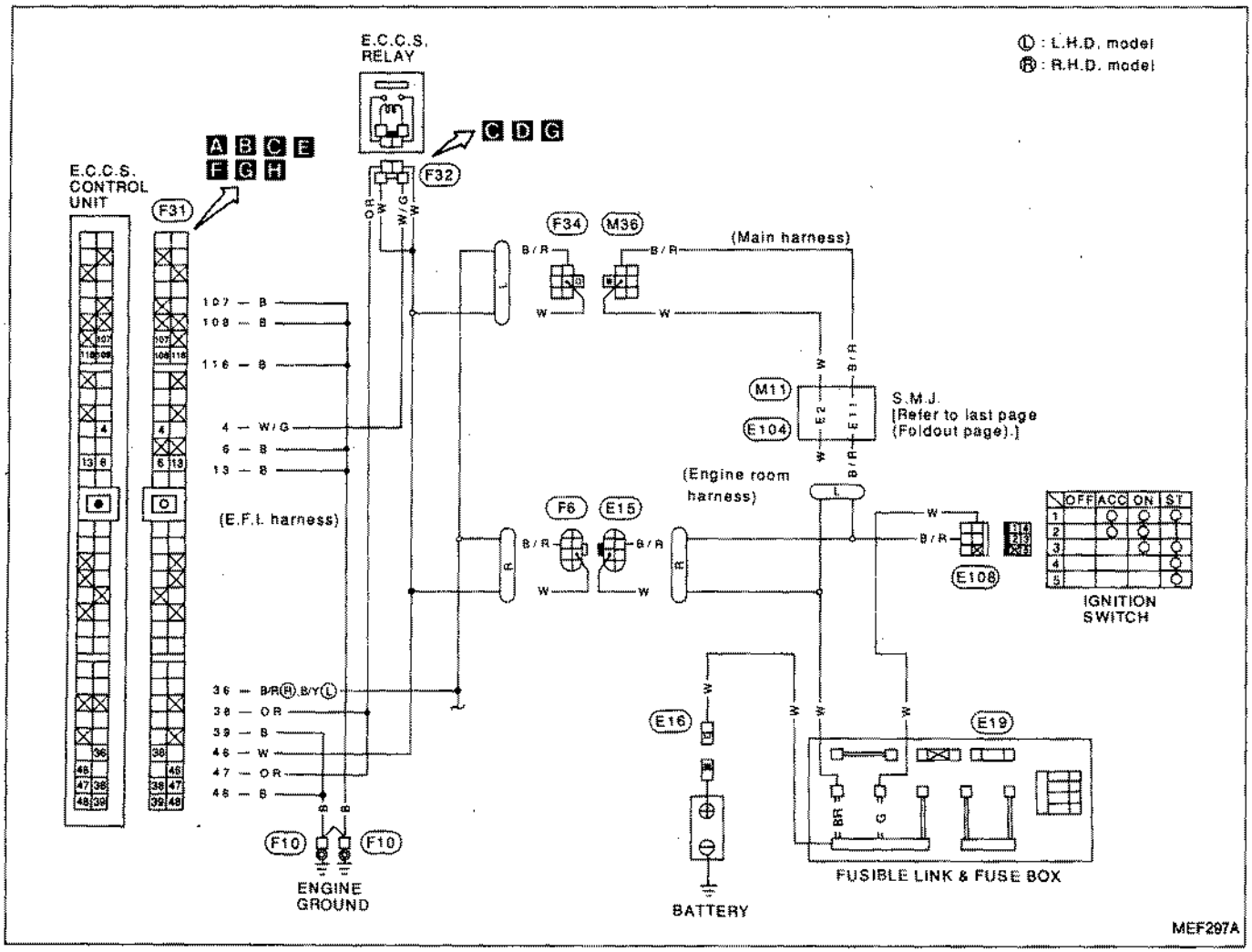
O.K. ↓

INSPECTION END

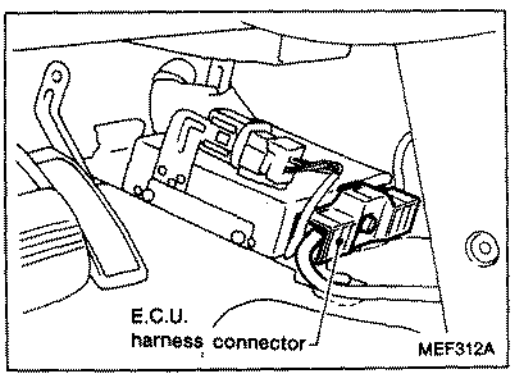
NOTE

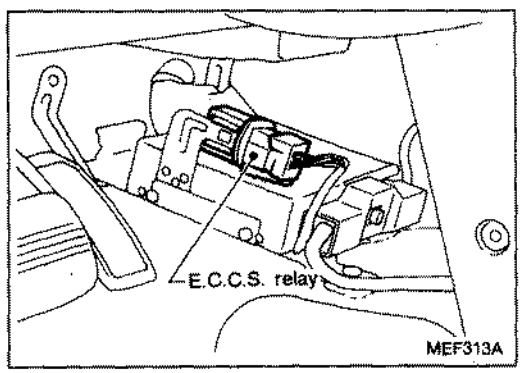
Diagnostic Procedure 22

MAIN POWER SUPPLY AND GROUND CIRCUIT (Not self-diagnostic item)



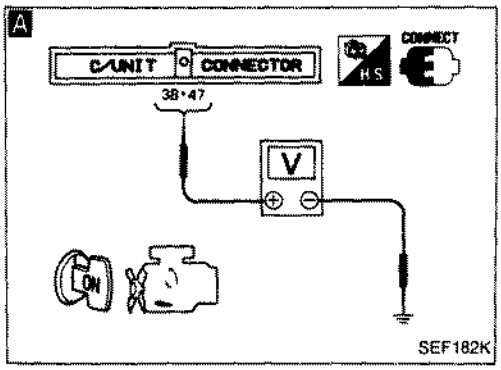
Harness layout





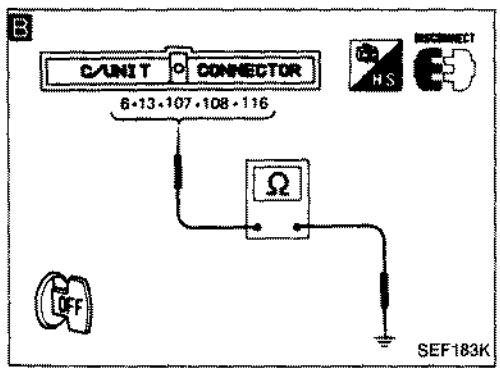
Diagnostic Procedure 22 (Cont'd)

A



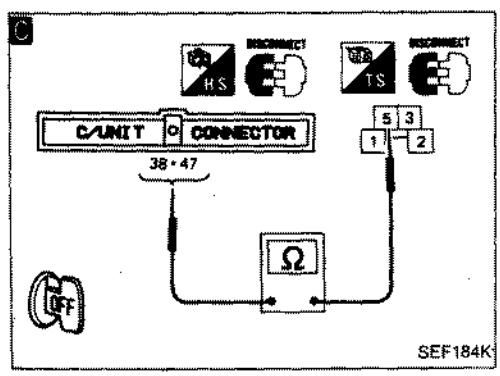
SEF182K

B



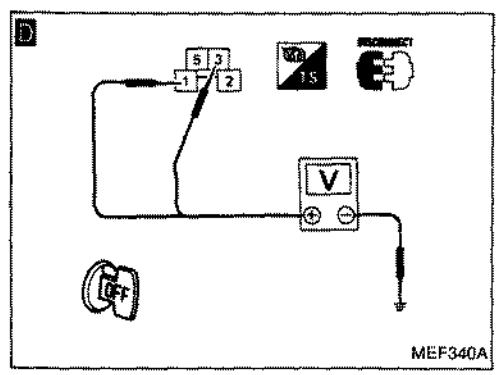
SEF183K

C



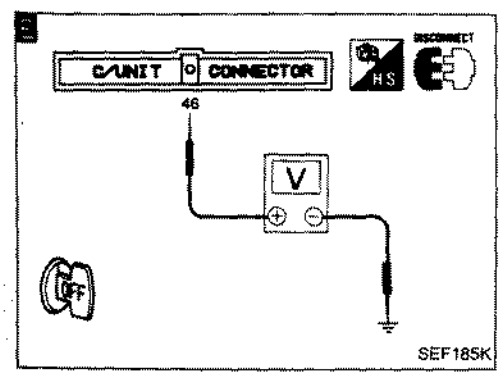
SEF184K

D



MEF340A

E



SEF185K

INSPECTION START

A

CHECK POWER SUPPLY.
1) Turn ignition switch "ON".
2) Check voltage between E.C.U. terminals (38), (47) and ground.
Voltage: Battery voltage

O.K. → **B**

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminals (6), (13), (107), (108), (116) and engine ground.
Continuity should exist.
If N.G., repair harness or connectors.

O.K. ↓

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

N.G. ↓

C

CHECK HARNESS CONTINUITY BETWEEN E.C.C.S. RELAY AND E.C.U.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Disconnect E.C.C.S. relay.
4) Check harness continuity between E.C.U. terminals (38), (47) and terminal (5).
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

D

CHECK VOLTAGE BETWEEN E.C.C.S. RELAY AND GROUND.
1) Check voltage between terminals (1), (3) and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (M11), (E104) (L.H.D. models)
- Harness connectors (F34), (M36) (L.H.D. models)
- Harness connectors (F6), (E15) (R.H.D. models)
- "BR" fusible link
- Harness continuity between E.C.C.S. relay and battery

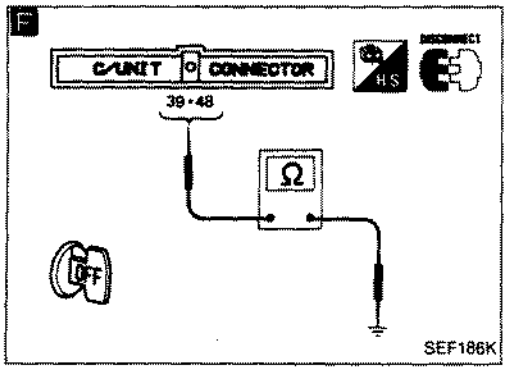
If N.G., repair harness or connectors.

O.K. ↓

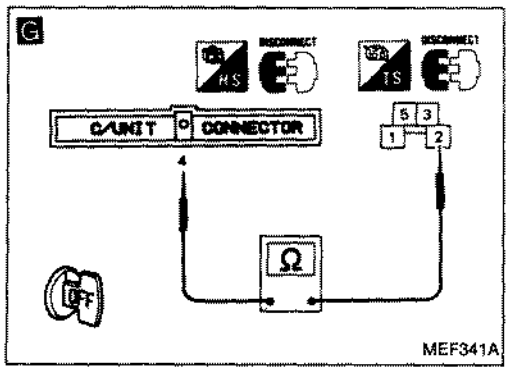
(A)

Diagnostic Procedure 22 (Cont'd)

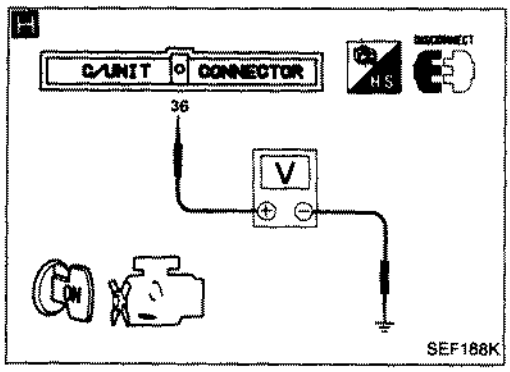
F



G



H



E

(A)

CHECK VOLTAGE BETWEEN E.C.U. AND GROUND.
1) Check voltage between E.C.U. terminal (48) and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (F34), (M36) (L.H.D. models)
- Harness connectors (M11), (E104) (L.H.D. models)
- Harness connectors (F6), (E15) (R.H.D. models)
- "BR" fusible link
- Harness continuity between E.C.U. and battery

If N.G., repair harness or connectors.

O.K. ↓

F

CHECK GROUND CIRCUIT.
1) Check harness continuity between E.C.U. terminals (39), (48) and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

G

CHECK OUTPUT SIGNAL CIRCUIT.
1) Check harness continuity between E.C.U. terminal (4) and terminal (2).
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

H

CHECK INPUT SIGNAL CIRCUIT.
1) Turn ignition switch "ON".
2) Check voltage between E.C.U. terminal (36) and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (F34), (M36) (L.H.D. models)
- Harness connectors (M11), (E104) (L.H.D. models)
- Harness connectors (F6), (E15) (R.H.D. models)
- Harness continuity between E.C.U. and ignition switch

If N.G., repair harness or connectors.

O.K. ↓

CHECK COMPONENT (E.C.C.S. relay).
Refer to "Electrical Components Inspection".
(See page EF & EC-351.)

N.G. → Replace E.C.C.S. relay.

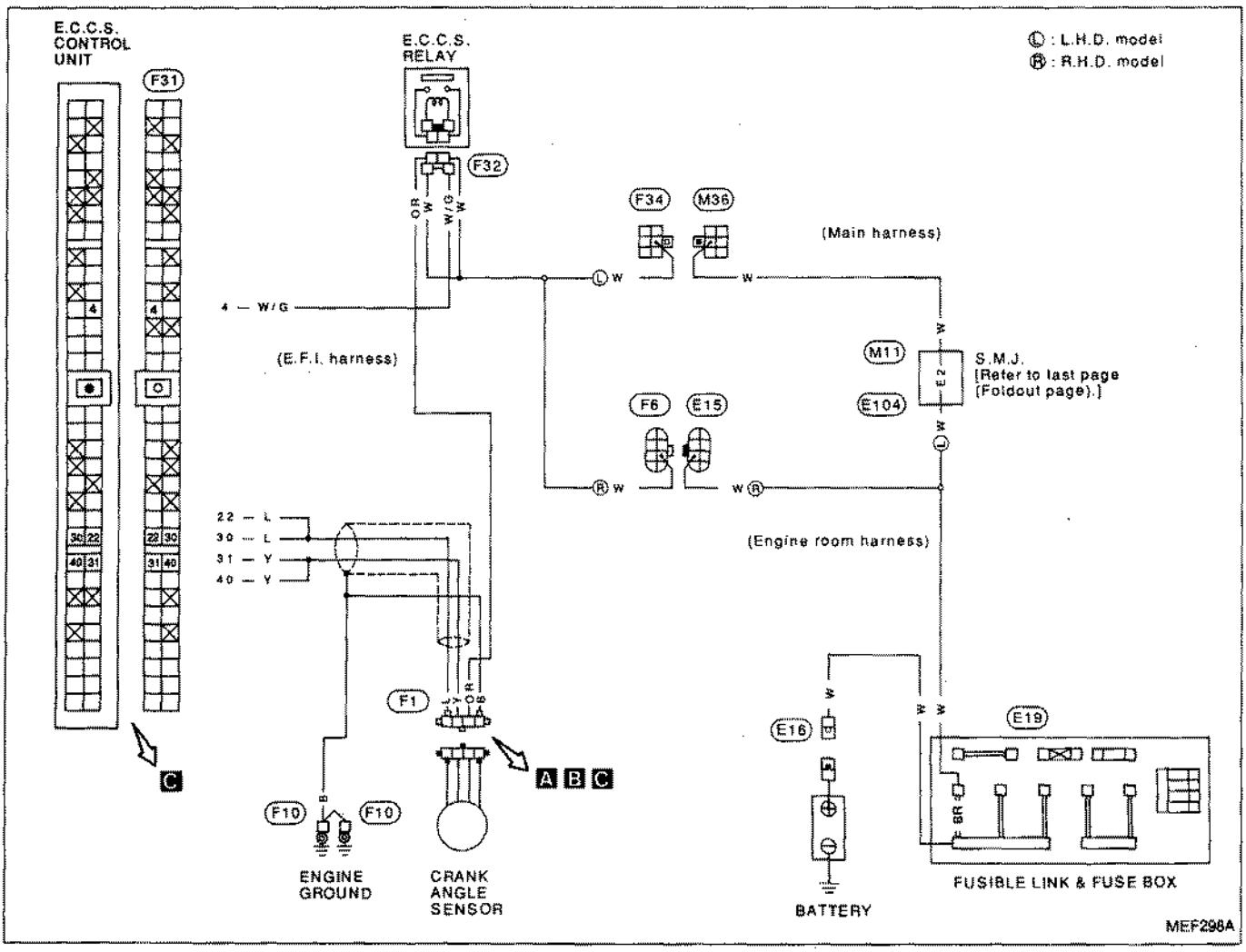
O.K. ↓

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

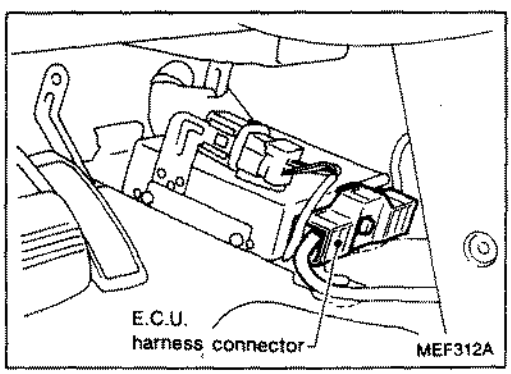
NOTE

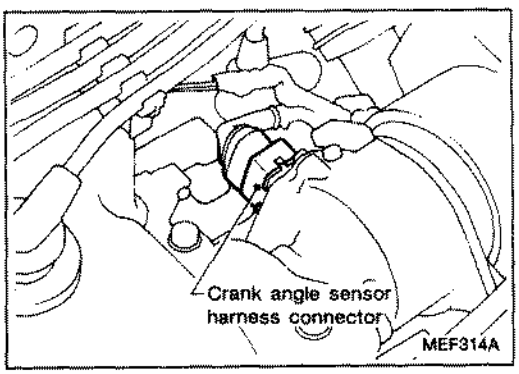
Diagnostic Procedure 23

CRANK ANGLE SENSOR (Code No. 11)



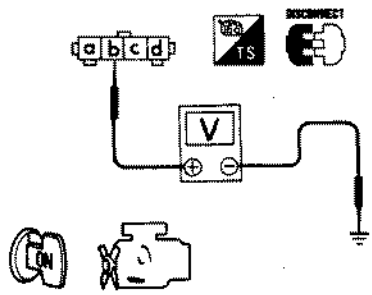
Harness layout





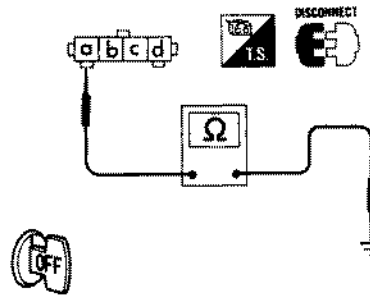
Diagnostic Procedure 23 (Cont'd)

A



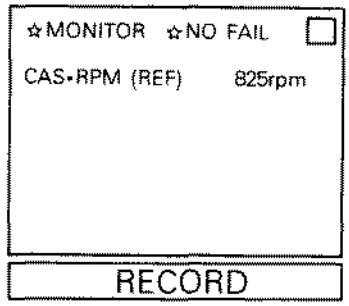
MEF342A

B



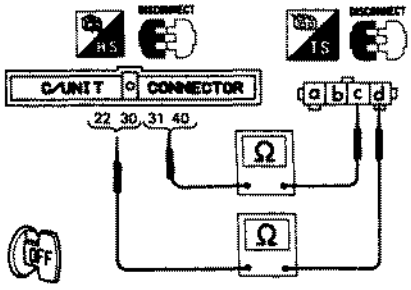
MEF343A

C



SEF135K

C



MEF344A

INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect crank angle sensor harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓑ and ground.
Voltage: Battery voltage

N.G. → Repair harness or connectors.

O.K.

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓐ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

C

CHECK INPUT SIGNAL CIRCUIT.
1) Reconnect crank angle sensor harness connector.
2) Start engine.
3) Read crank angle sensor signals in "DATA MONITOR" mode with CONSULT.
rpm: M/T: 750 ± 50
A/T: 800 ± 50

N.G. → Repair harness or connectors.

OR

1) Disconnect E.C.U. harness connector.
2) Check harness continuity between terminal ⓒ and E.C.U. terminals ㉛, ㊵ (1° signal), terminal ⓓ and E.C.U. terminals ㉒, ㉚ (180° signal).
Continuity should exist.

O.K.

CHECK COMPONENT (Crank angle sensor).
Refer to "Electrical Components Inspection".
(See page EF & EC-347.)

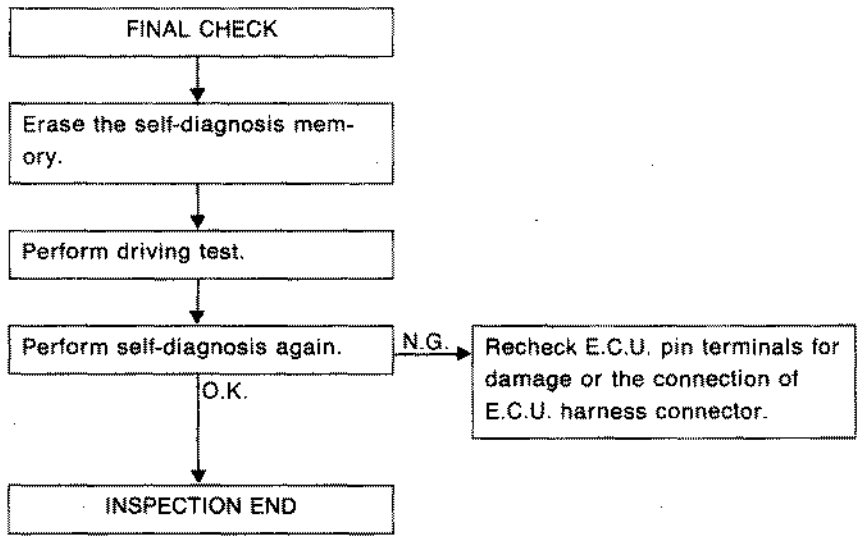
N.G. → Replace crank angle sensor.

O.K.

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

Diagnostic Procedure 23 (Cont'd)

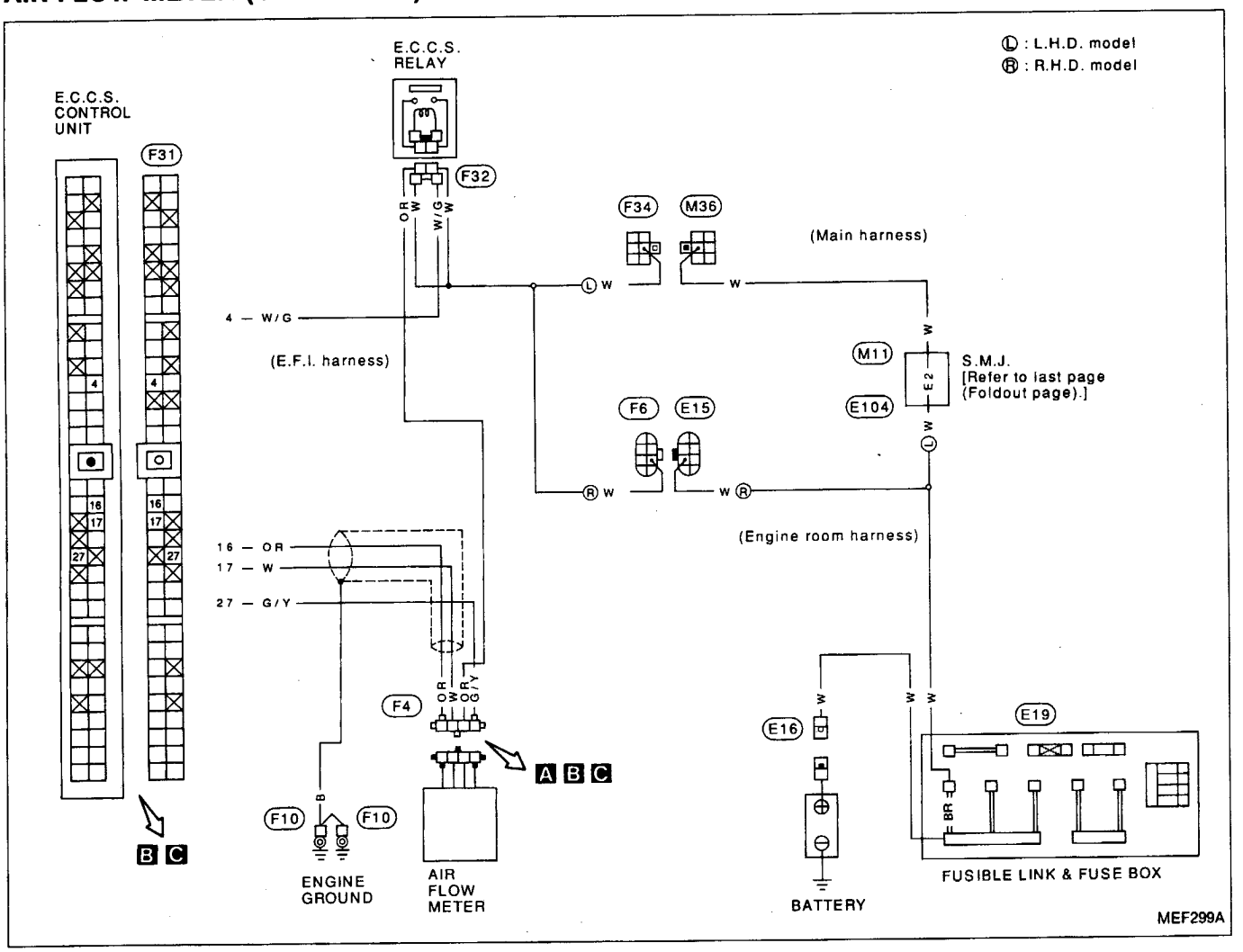
Perform FINAL CHECK by the following procedure after repair is completed.



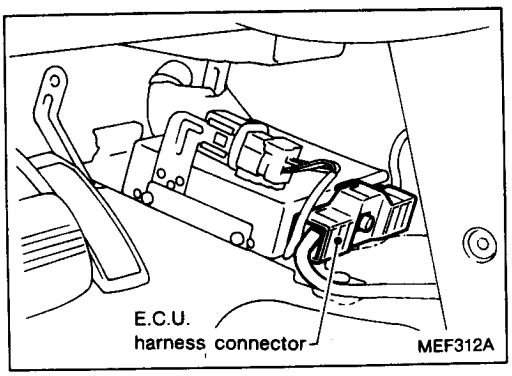
NOTE

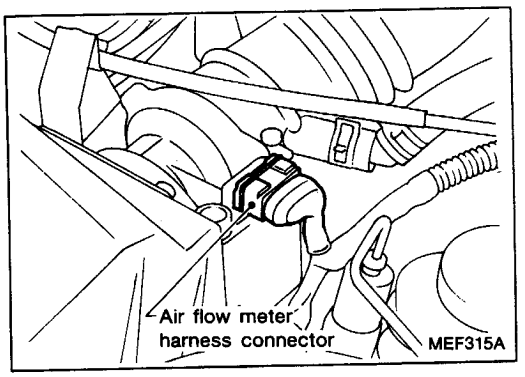
Diagnostic Procedure 24

AIR FLOW METER (Code No. 12)



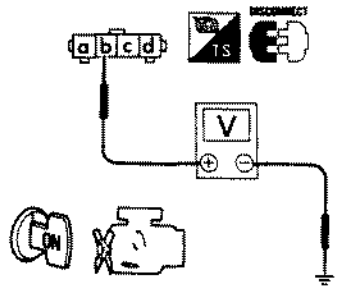
Harness layout





Diagnostic Procedure 24 (Cont'd)

A



MEF345A

INSPECTION START

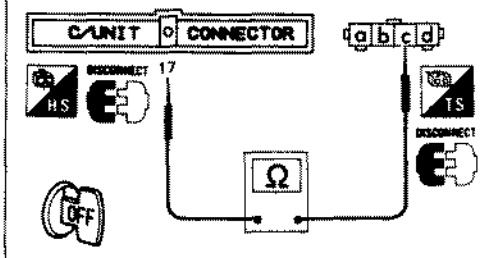
A

CHECK POWER SUPPLY.
1) Disconnect air flow meter harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓑ and ground.
Voltage: Battery voltage

N.G. → Repair harness or connectors.

O.K. ↓

B



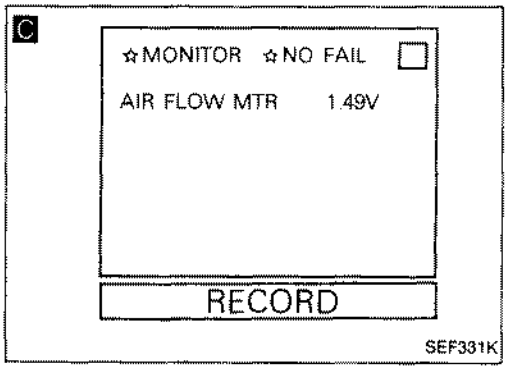
MEF346A

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between terminal ⓒ and E.C.U. terminal ⑰.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

C



SEF331K

CHECK INPUT SIGNAL CIRCUIT.

1) Reconnect air flow meter harness connector and E.C.U. harness connector.
2) Start engine and warm it up sufficiently.
3) Read air flow meter signal in "DATA MONITOR" mode with CONSULT.
Voltage: 0.8 - 1.5V
(At idle)

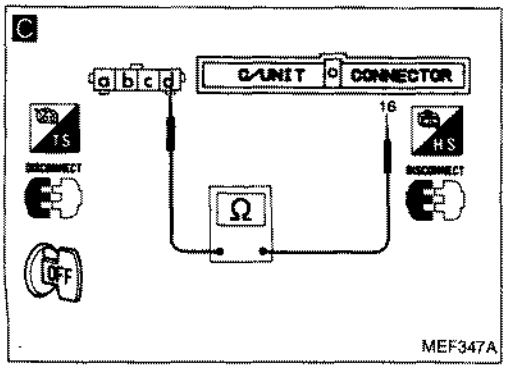
N.G. → Repair harness or connectors.

— OR —

1) Check harness continuity between terminal ⓓ and E.C.U. terminal ⑯.
Continuity should exist.

O.K. ↓

C



MEF347A

CHECK COMPONENT
(Air flow meter).
Refer to "Electrical Components Inspection".
(See page EF & EC-347.)

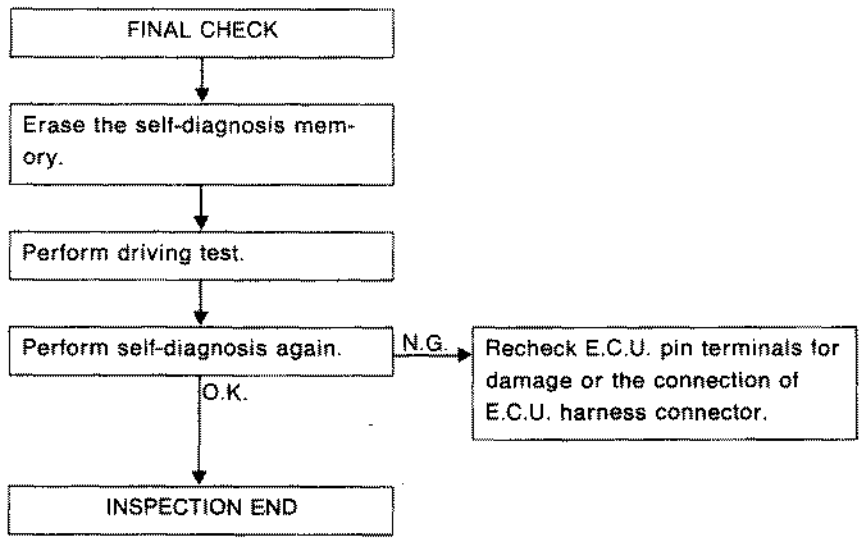
N.G. → Replace air flow meter.

O.K. ↓

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

Diagnostic Procedure 24 (Cont'd)

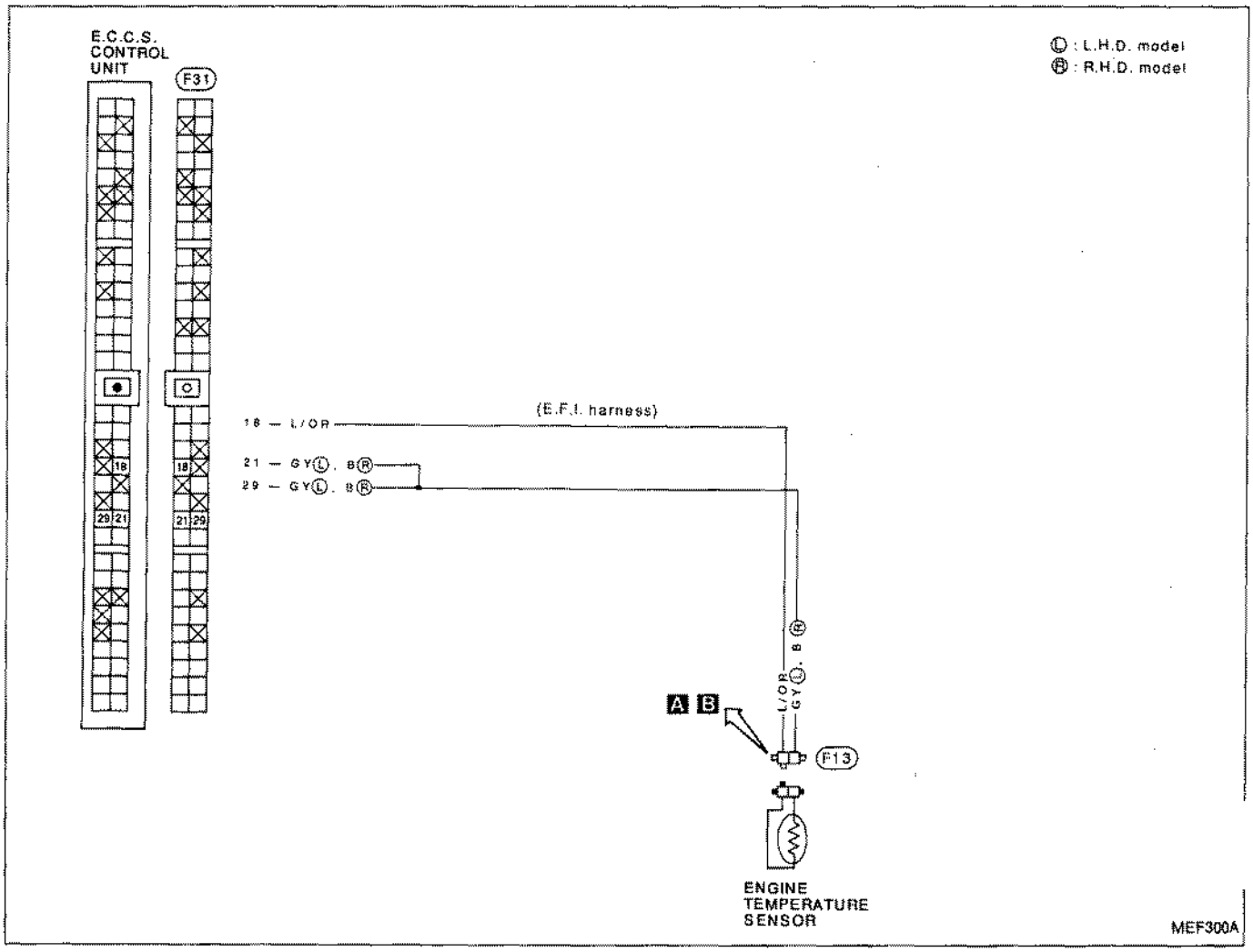
Perform FINAL CHECK by the following procedure after repair is completed.



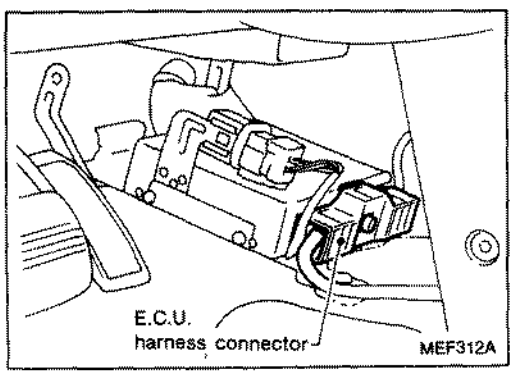
NOTE

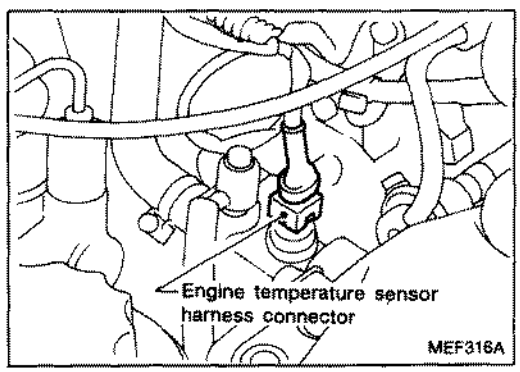
Diagnostic Procedure 25

ENGINE TEMPERATURE SENSOR (Code No. 13)

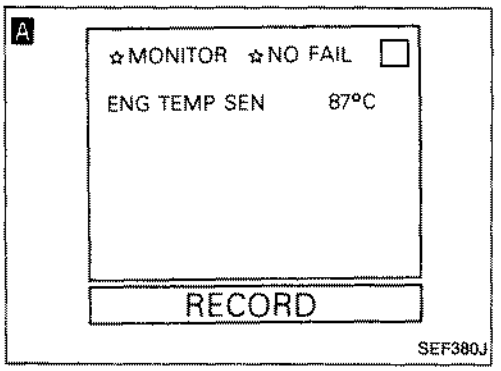


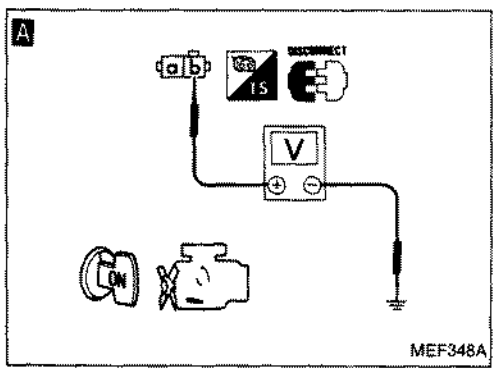
Harness layout

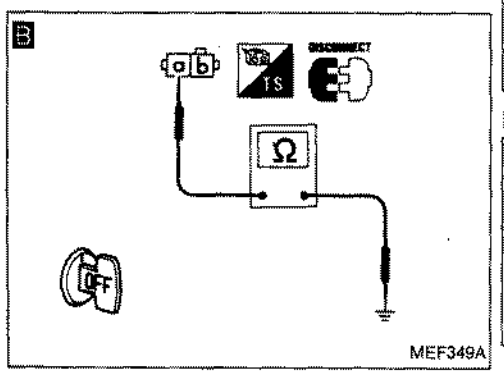




Diagnostic Procedure 25 (Cont'd)







INSPECTION START

A

CHECK POWER SUPPLY.

1) Start engine.
2) Read engine temperature sensor signal in "DATA MONITOR" mode with CONSULT.
Engine temperature should gradually rise and reach more than 70°C (158°F) after engine warm-up.

N.G. → Repair harness or connectors.

OR

1) Disconnect engine temperature sensor harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓑ and ground.
Voltage: Approximately 5V

O.K.

B

CHECK GROUND CIRCUIT.

1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓐ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

CHECK COMPONENT (Engine temperature sensor). Refer to "Electrical Components Inspection". (See page EF & EC-348.)

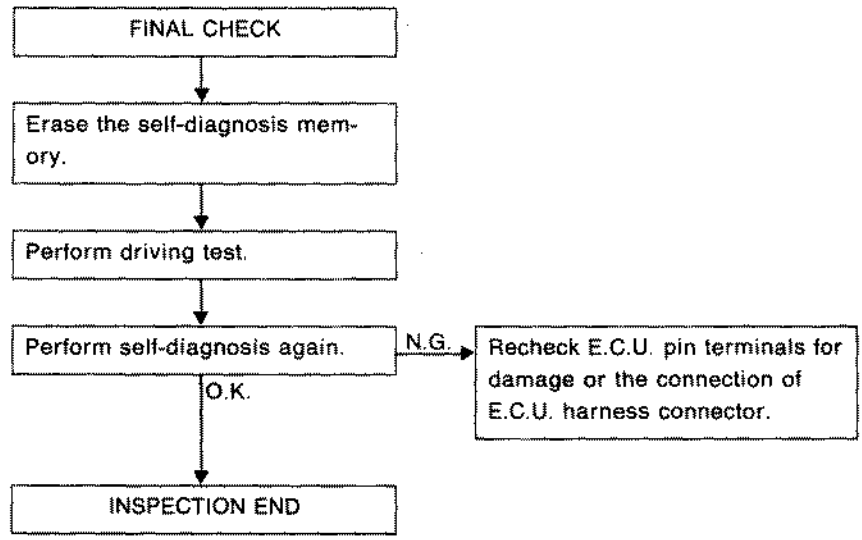
N.G. → Replace engine temperature sensor.

O.K.

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

Diagnostic Procedure 25 (Cont'd)

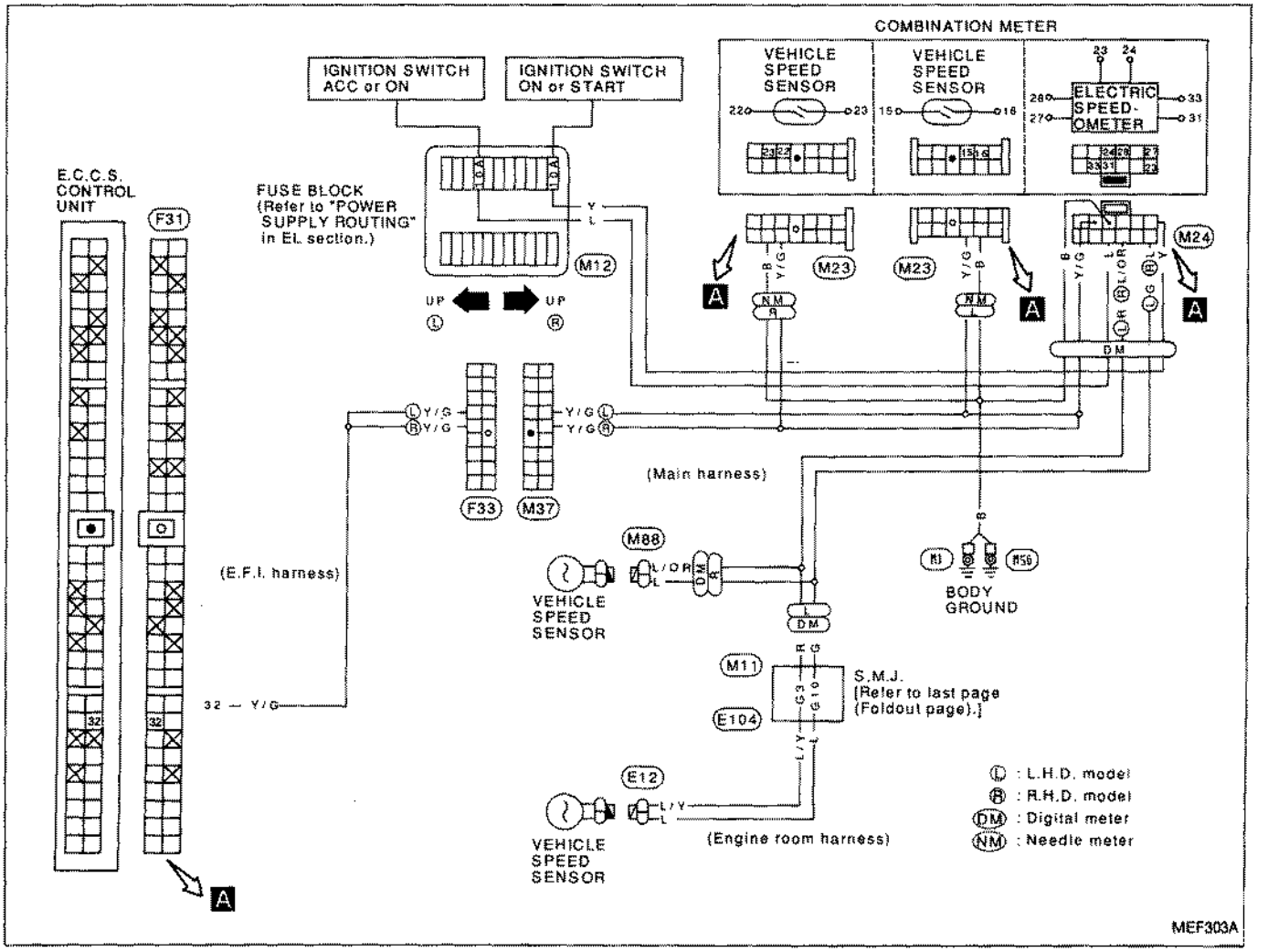
Perform FINAL CHECK by the following procedure after repair is completed.



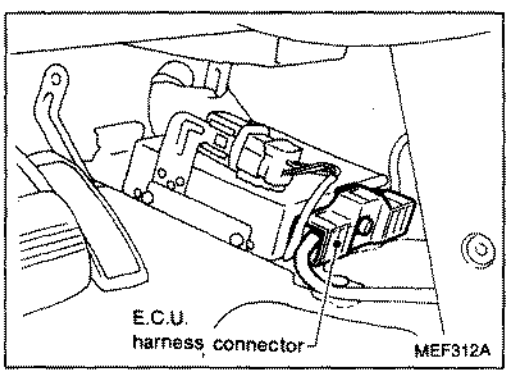
NOTE

Diagnostic Procedure 26

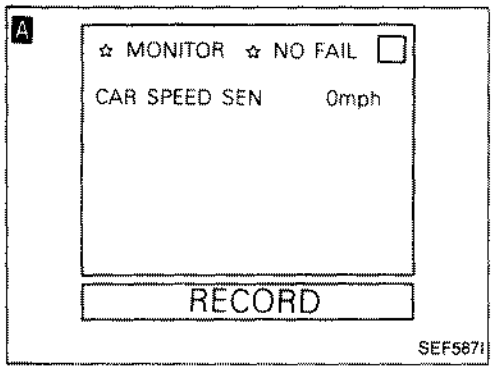
VEHICLE SPEED SENSOR (Code No. 14)

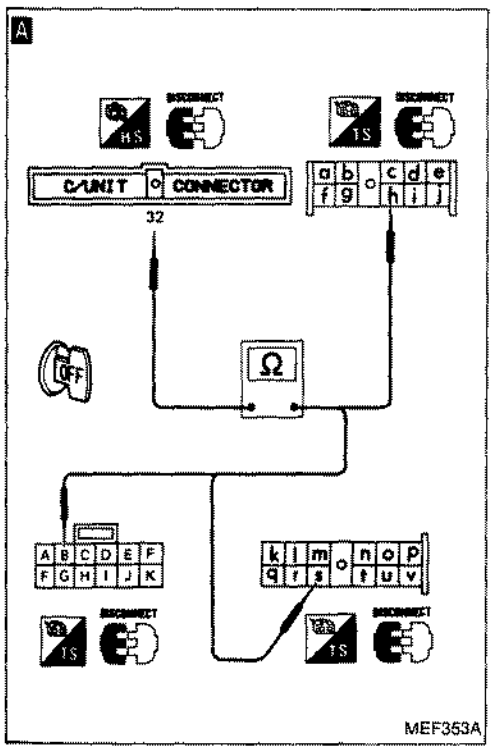


Harness layout



Diagnostic Procedure 26 (Cont'd)





INSPECTION START

CHECK SPEEDOMETER FUNCTION.
Make sure that speedometer functions properly.

N.G. → Check vehicle speed sensor and circuit.
(Refer to EL section.)

O.K.

A

CHECK INPUT SIGNAL CIRCUIT.

1) Read vehicle speed sensor signal in "DATA MONITOR" mode with CONSULT. **CONSULT value should be the same as the speedometer indication.**

N.G. → Check the following.
- Harness connectors (F33), (M37)
- Harness continuity between E.C.U. and combination meter

If N.G., repair harness or connectors.

OR

1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector and combination meter harness connector.
3) Check harness continuity between E.C.U. terminal (32) and terminal (h) (L.H.D. models with needle meter), (s) (R.H.D. models with needle meter), (B) (Digital meter model). **Continuity should exist.**

O.K.

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

Perform FINAL CHECK by the following procedure after repair is completed.

FINAL CHECK

Start engine.

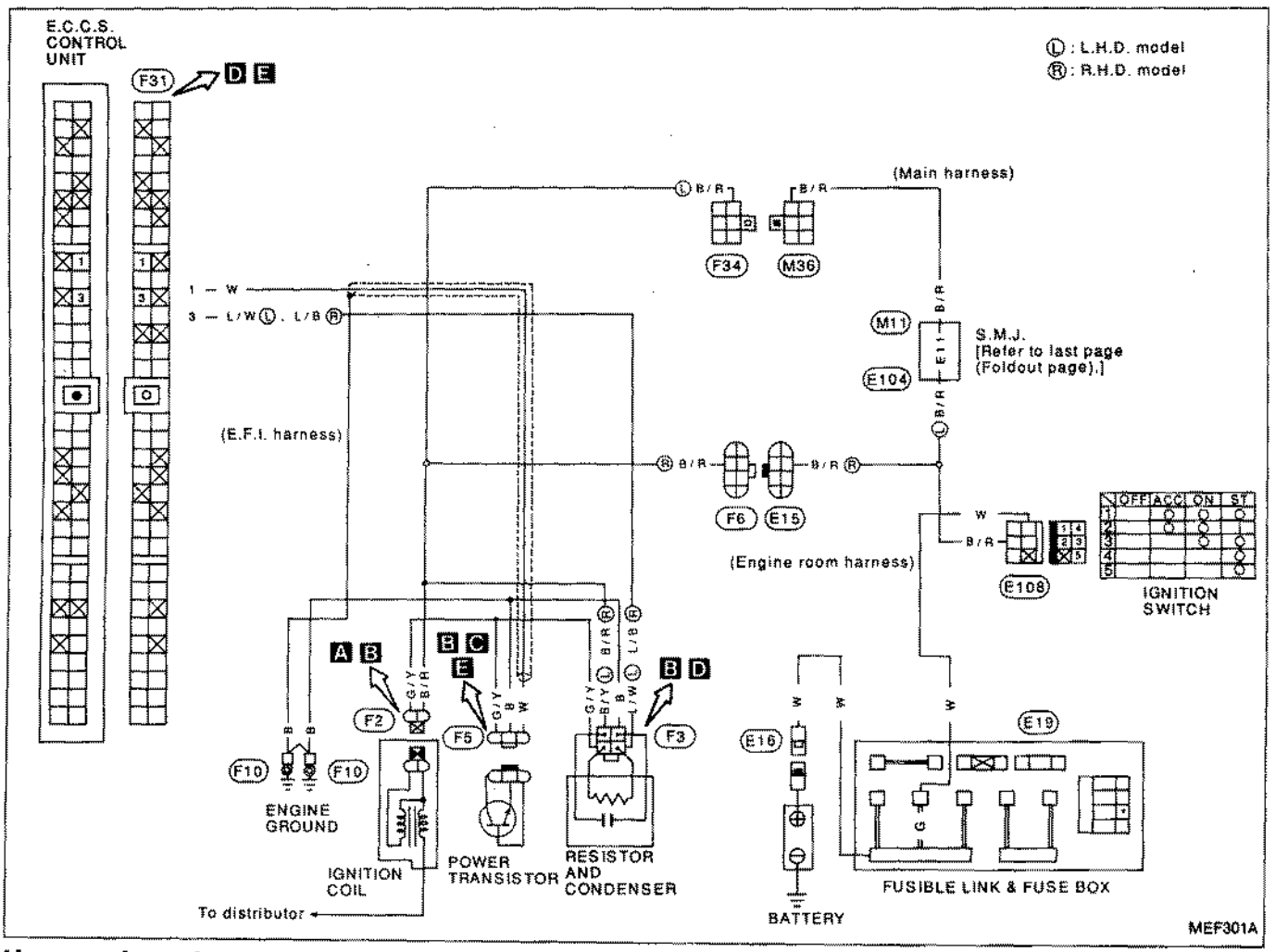
Perform self-diagnosis (Mode II). N.G. → Recheck E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K.

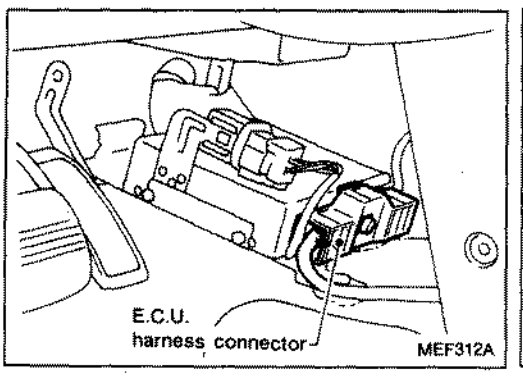
INSPECTION END

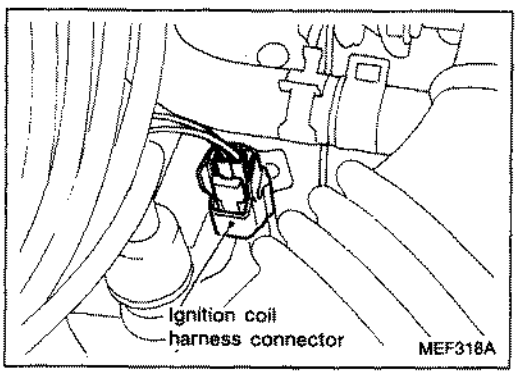
Diagnostic Procedure 27

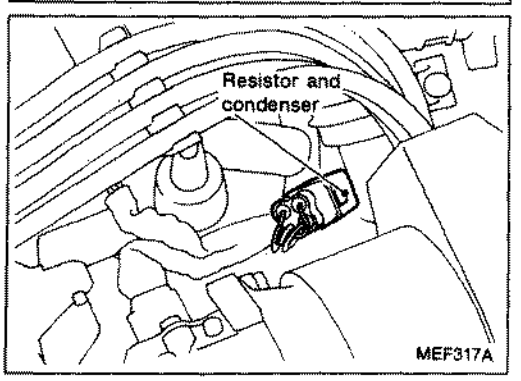
IGNITION SIGNAL (Code No. 21)

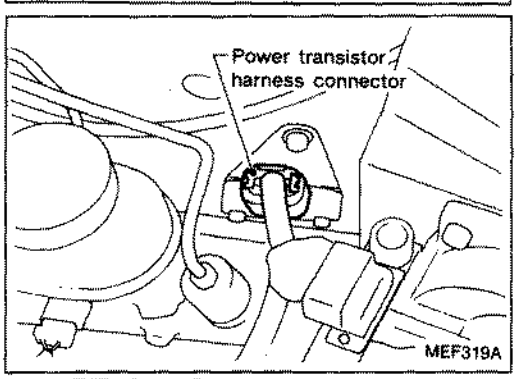


Harness layout

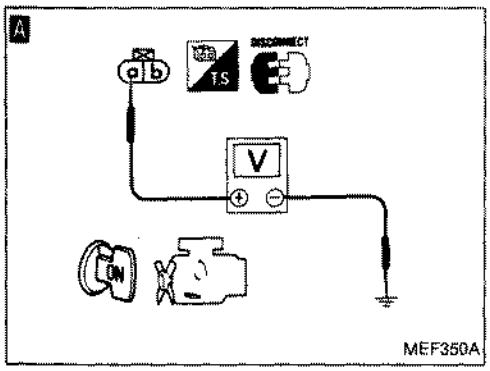


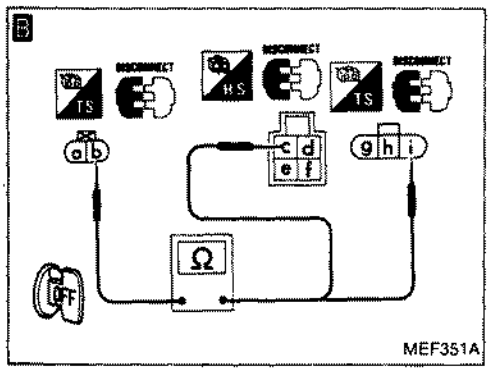


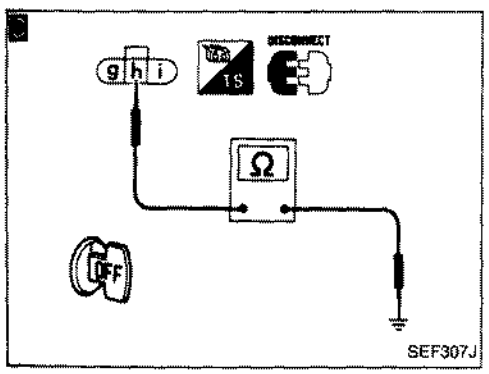


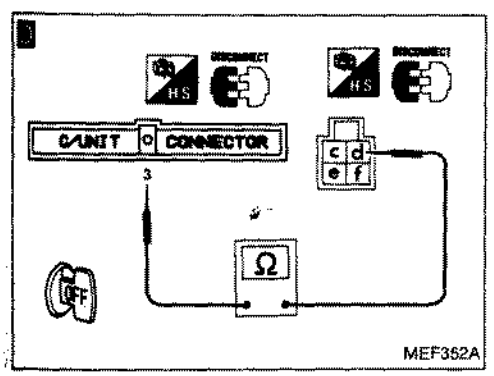


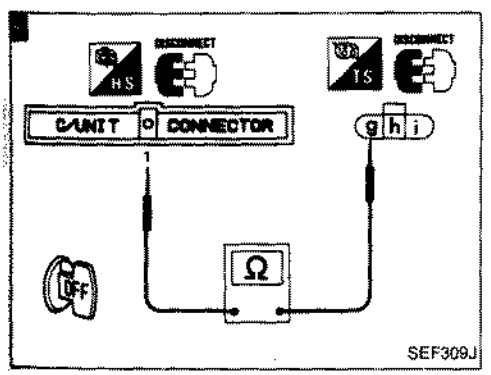
Diagnostic Procedure 27 (Cont'd)











INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect ignition coil harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓐ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (F34), (M36) (L.H.D. models)
- Harness connectors (M11), (E104) (L.H.D. models)
- Harness connectors (F6), (E15) (R.H.D. models)
- Harness continuity between ignition coil and ignition switch

If N.G., repair harness or connectors.

O.K.

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect resistor and condenser harness connector.
3) Disconnect power transistor harness connector.

B 4) Check harness continuity between terminal ⓑ and terminal ⓒ, ⓘ.
Continuity should exist.

C 5) Check harness continuity between terminal ⓗ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

D

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between terminal ⓓ and E.C.U. terminal ③.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

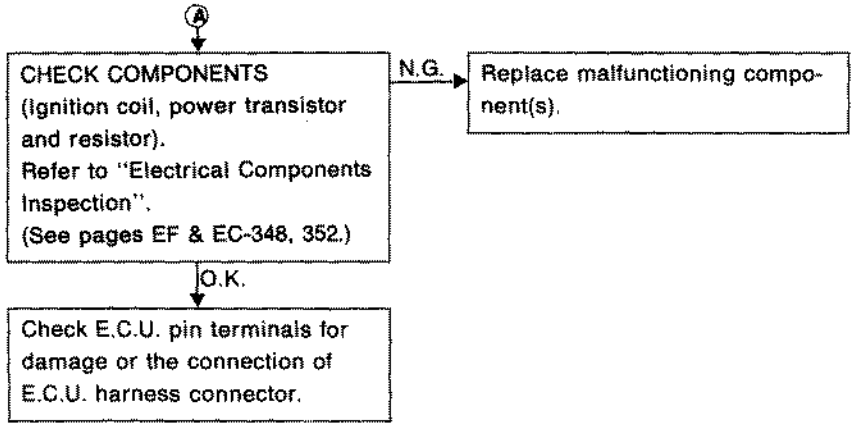
E

CHECK OUTPUT SIGNAL CIRCUIT.
1) Check harness continuity between terminal ⓖ and E.C.U. terminal ①.
Continuity should exist.

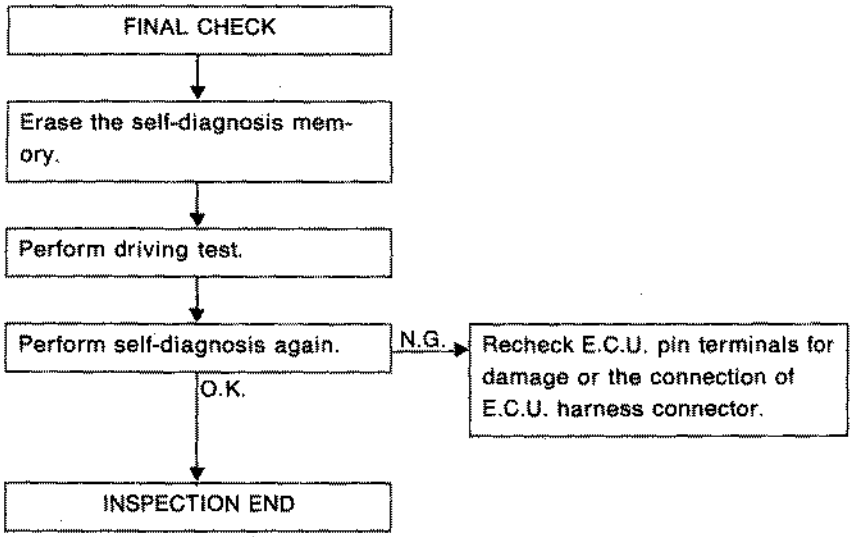
N.G. → Repair harness or connectors.

O.K. → Ⓐ

Diagnostic Procedure 27 (Cont'd)



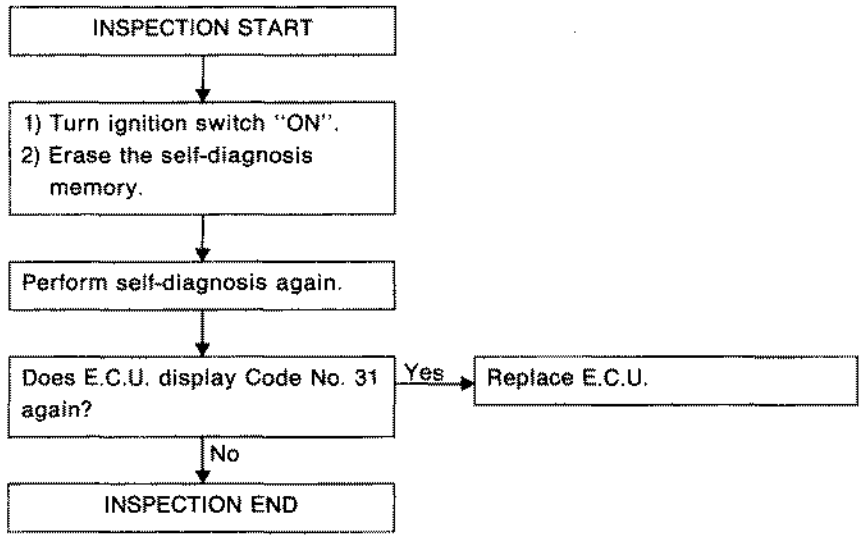
Perform FINAL CHECK by the following procedure after repair is completed.



NOTE

Diagnostic Procedure 28

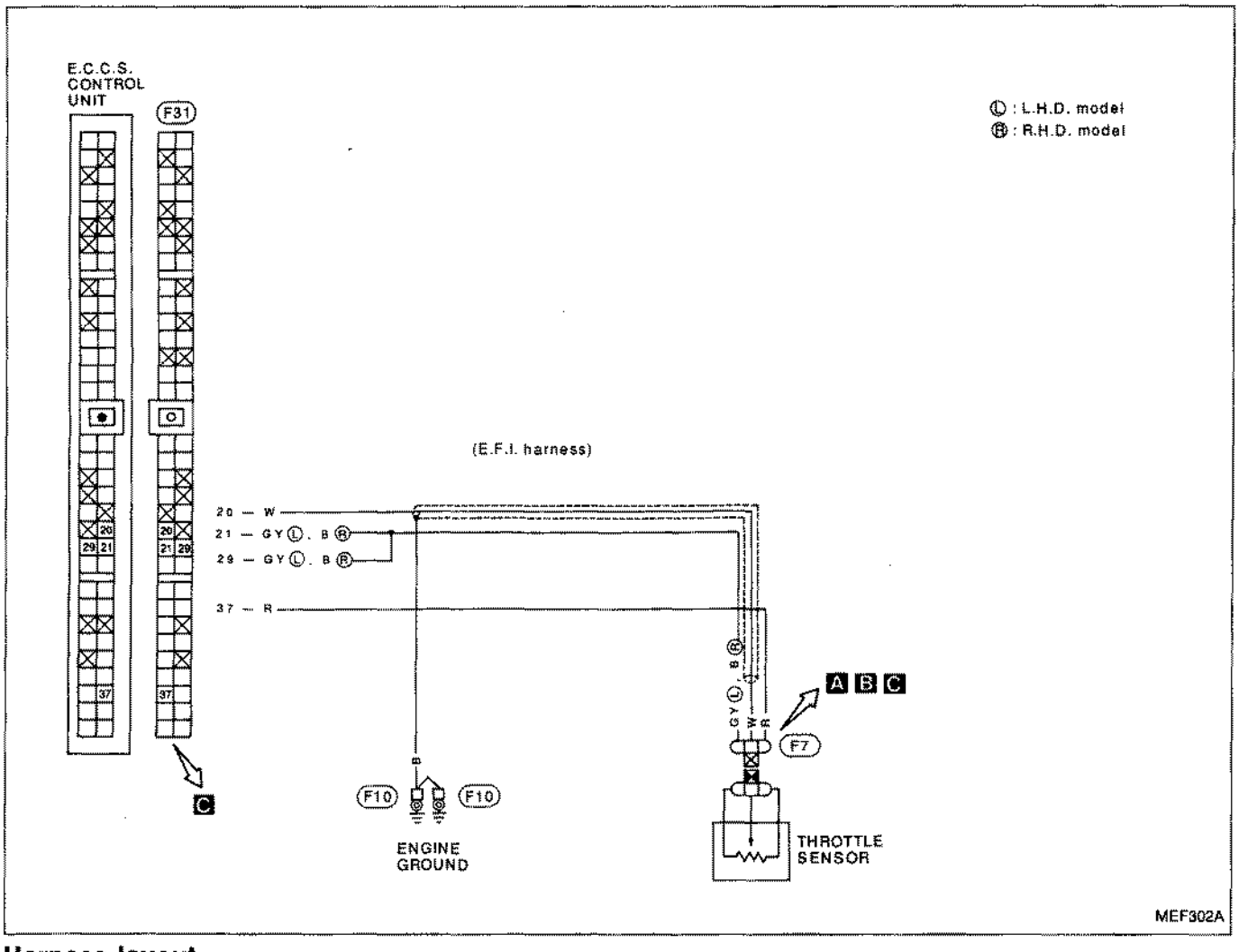
E.C.C.S. CONTROL UNIT (Code No. 31)



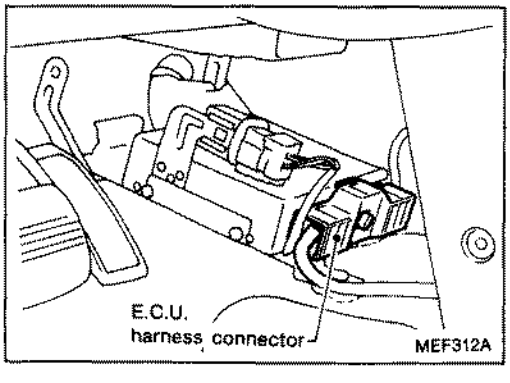
NOTE

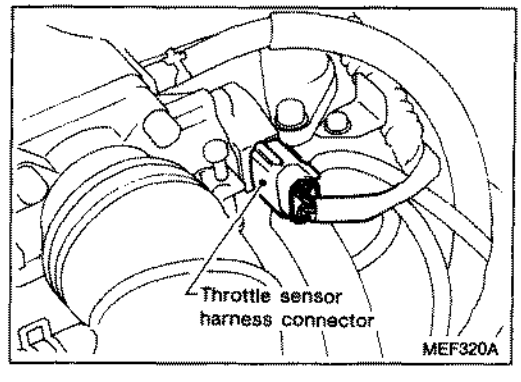
Diagnostic Procedure 29

THROTTLE SENSOR (Code No. 43)

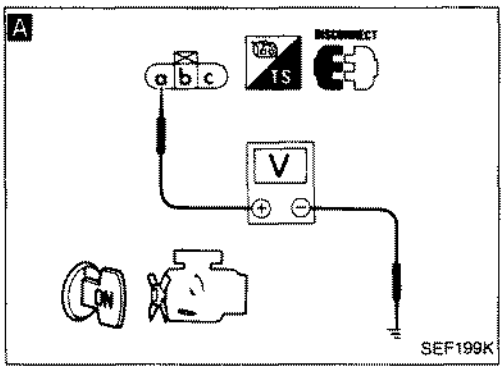


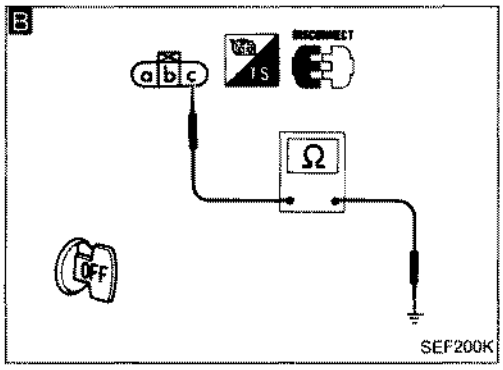
Harness layout

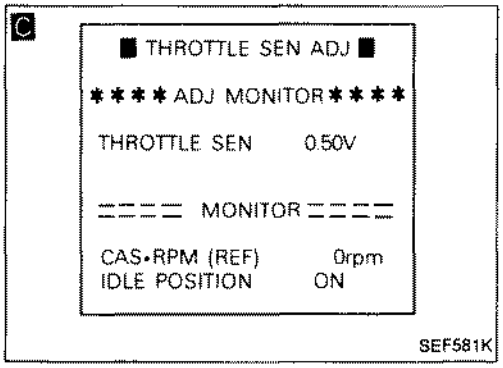


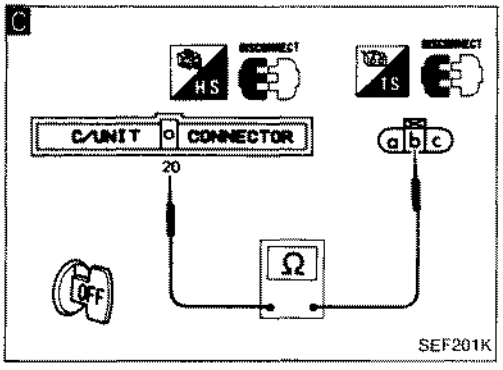


Diagnostic Procedure 29 (Cont'd)









INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect throttle sensor harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓐ and ground.
Voltage: Approximately 5V

N.G. → Repair harness or connectors.

O.K. ↓

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓒ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

C

CHECK INPUT SIGNAL CIRCUIT.
1) Reconnect throttle sensor harness connector.
2) Turn ignition switch "ON".
3) Read throttle sensor output voltage in "WORK SUPPORT" mode with CONSULT.
Throttle valve fully closed:
0.45 - 0.55V
Throttle valve fully open:
Approx. 5.0V

N.G. → Repair harness or connectors.

— OR —

1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal ⑳ and terminal ⓑ.
Continuity should exist.

O.K. ↓

CHECK COMPONENT (Throttle sensor).
Refer to "Electrical Components Inspection".
(See page EF & EC-349.)

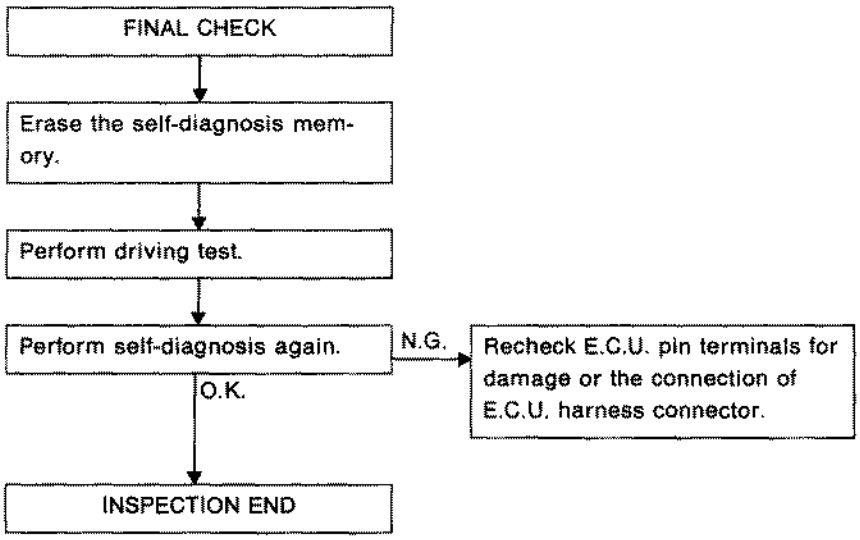
N.G. → Replace throttle sensor.

O.K. ↓

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

Diagnostic Procedure 29 (Cont'd)

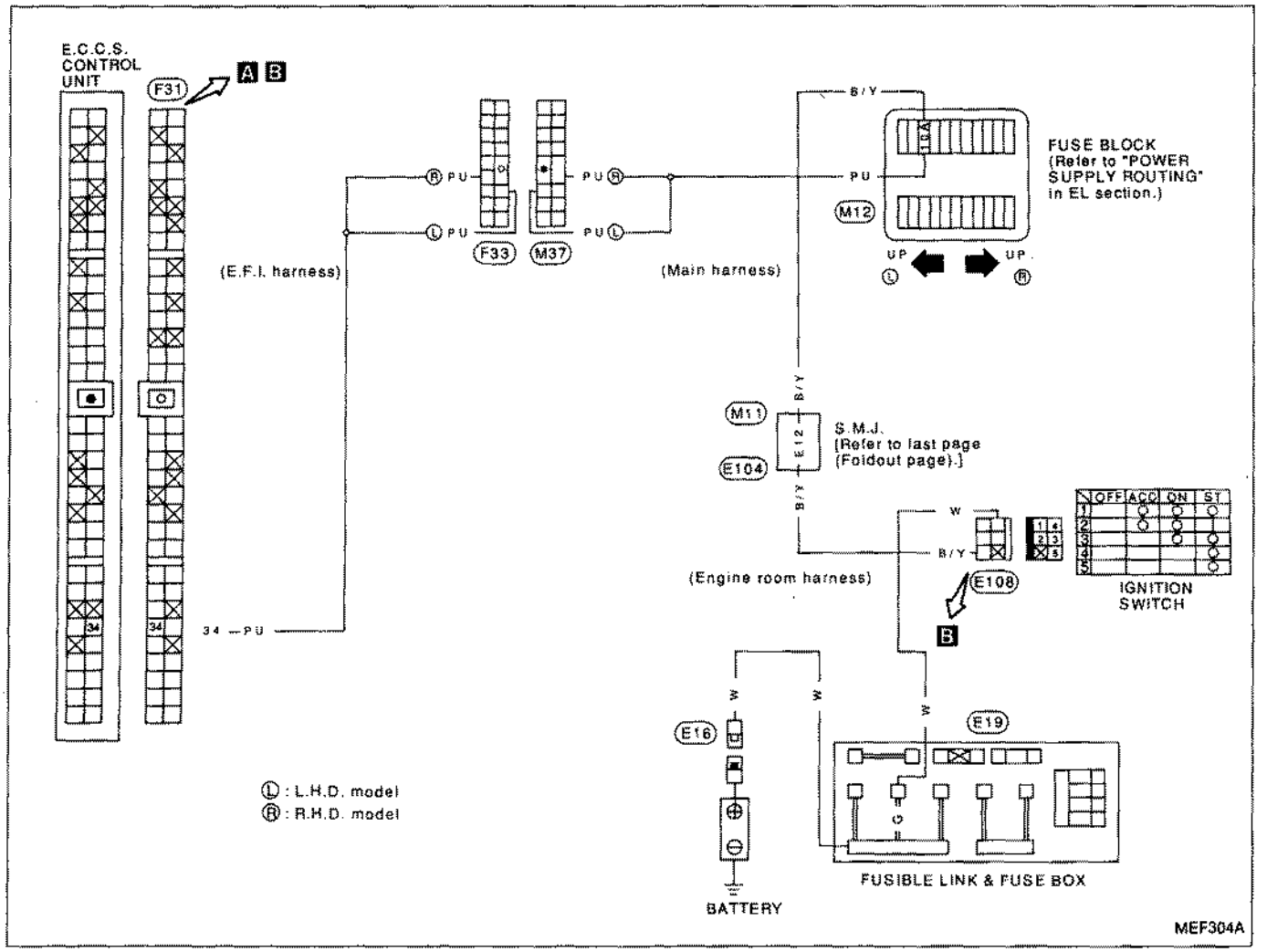
Perform FINAL CHECK by the following procedure after repair is completed.



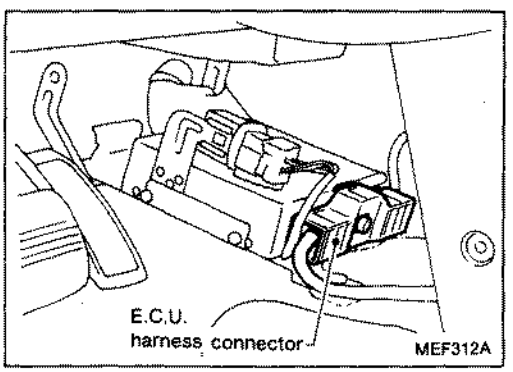
NOTE

Diagnostic Procedure 30

START SIGNAL (Not self-diagnostic item)



Harness layout



Diagnostic Procedure 30 (Cont'd)

A

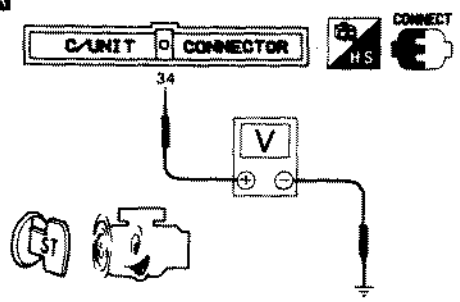
☆MONITOR ☆NO FAIL

START SIGNAL	OFF
IDLE POSITION	ON
AIR COND SIG	OFF
NEUTRAL SW	ON

RECORD

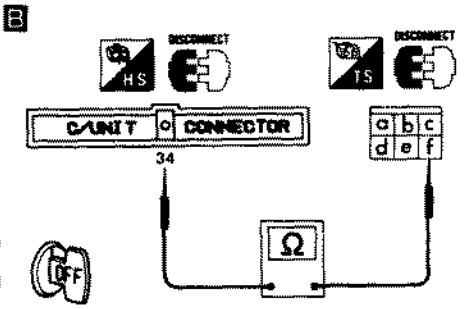
SEF384J

A



SEF202K

B



MEF354A

INSPECTION START

A

CHECK OVERALL FUNCTION.

1) Turn ignition switch "ON".
2) Check start signal in "DATA MONITOR" mode with CONSULT.

IGN "ON"	OFF
IGN "START"	ON

O.K. → INSPECTION END

OR

1) Turn ignition switch to "START".
2) Check voltage between E.C.U. terminal ㉞ and ground.

Voltage:
Ignition switch "START"
Battery voltage
Except above
Approximately 0V

N.G.

B

CHECK INPUT SIGNAL CIRCUIT.

1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector and ignition switch harness connector.
3) Check harness continuity between E.C.U. terminal ㉞ and terminal ⓕ.

Continuity should exist.

N.G. →

Check the following.
- Harness connectors (F33), (M37)
- Harness connectors (M11), (E104)
- 10A fuse
- Harness continuity between E.C.U. and ignition switch

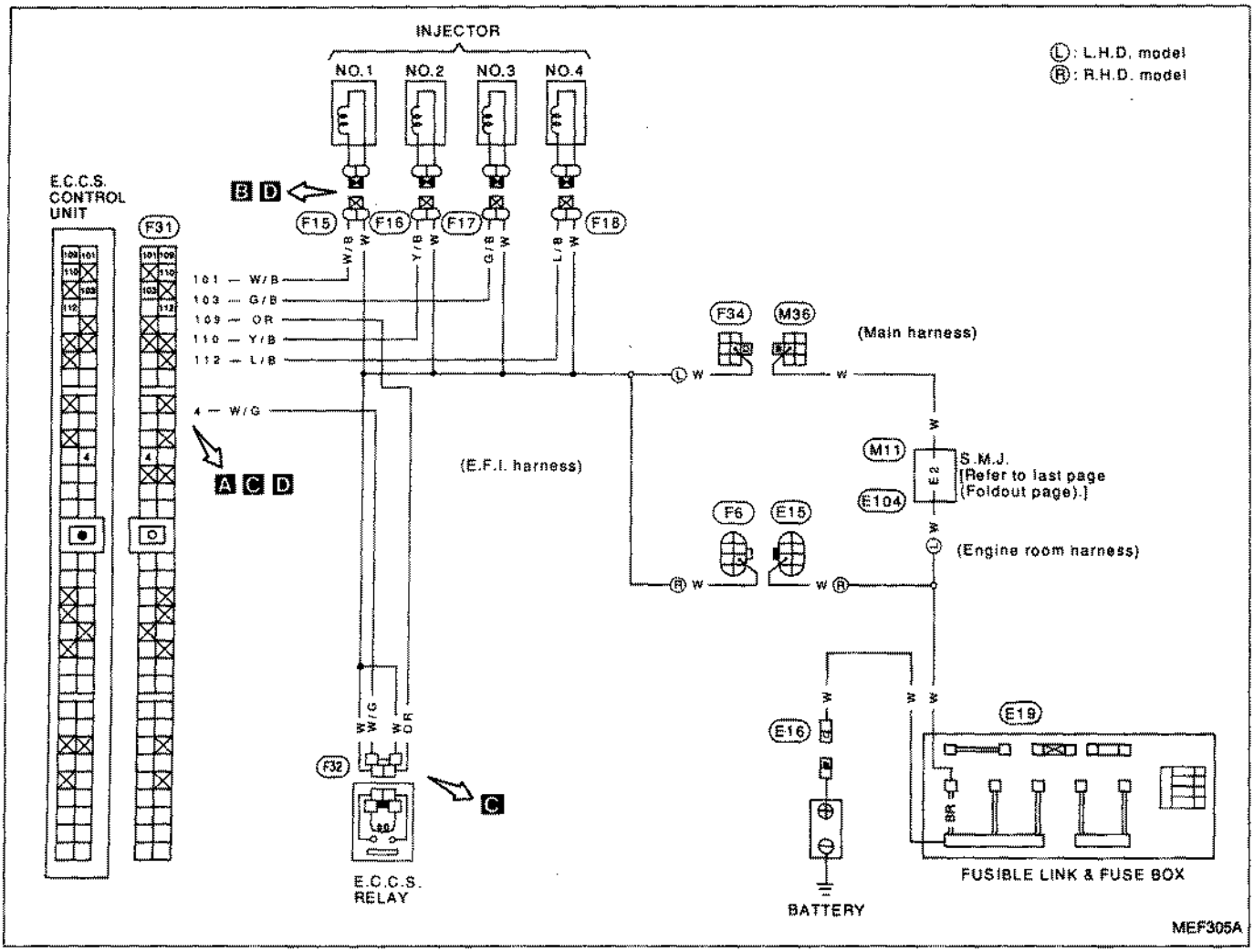
If N.G., repair harness or connectors.

O.K.

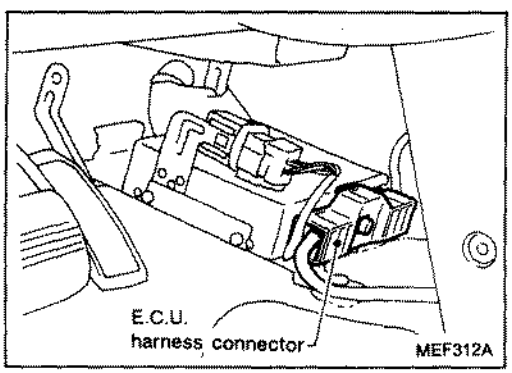
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

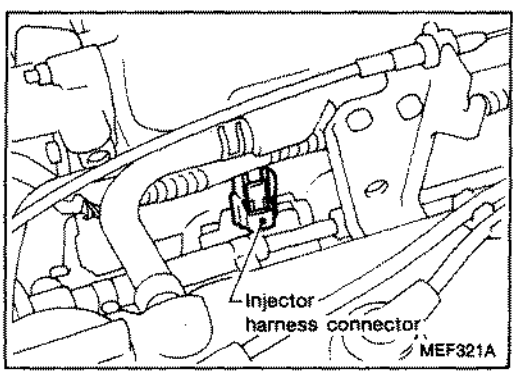
Diagnostic Procedure 31

INJECTOR (Not self-diagnostic item)



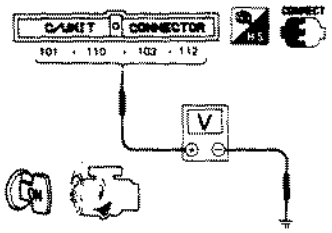
Harness layout





Diagnostic Procedure 31 (Cont'd)

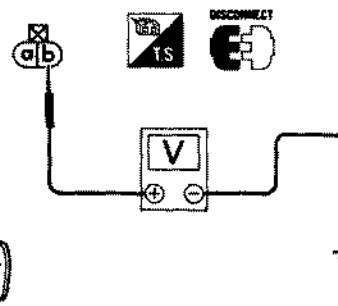
A



(101) : No. 1 cylinder (103) : No. 3 cylinder
(110) : No. 2 cylinder (112) : No. 4 cylinder

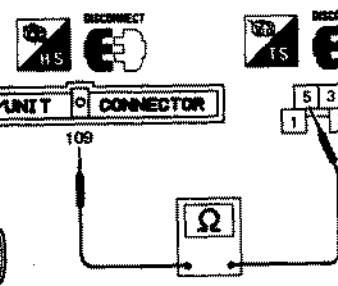
SEF974I

B



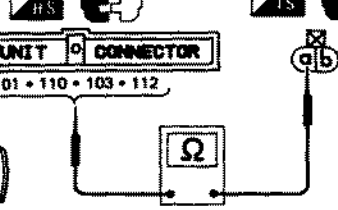
MEF355A

C



MEF356A

D



(101) : No. 1 cylinder (103) : No. 3 cylinder
(110) : No. 2 cylinder (112) : No. 4 cylinder

MEF357A

INSPECTION START

A

CHECK CONTROL FUNCTION.
1) Start engine.
2) Check voltage between E.C.U. terminals (101), (110), (103), (112) and ground.
Voltage: Battery voltage

O.K. → INSPECTION END

N.G.

CHECK POWER SUPPLY.
1) Stop engine.
2) Disconnect injector harness connector and E.C.U. harness connector.

B 3) Check voltage between terminal (b) and ground.
Voltage: Battery voltage

C 4) Disconnect E.C.C.S. relay.
5) Check harness continuity between E.C.U. terminal (109) and terminal (5).
Continuity should exist.

N.G. → Check the following.
- Harness connectors (F34), (M36) (L.H.D. models)
- Harness connectors (M11), (E186) (L.H.D. models)
- Harness connectors (F6), (E15) (R.H.D. models)
- "BR" fusible link
- Harness continuity between battery and injector
- Harness continuity between E.C.U. and E.C.C.S. relay

If N.G., repair harness or connectors.

O.K.

D

CHECK OUTPUT SIGNAL CIRCUIT.
1) Check harness continuity between terminal (a) and E.C.U. terminals (101), (110), (103), (112).
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

CHECK COMPONENT (Injector).
Refer to "Electrical Components Inspection".
(See page EF & EC-351.)

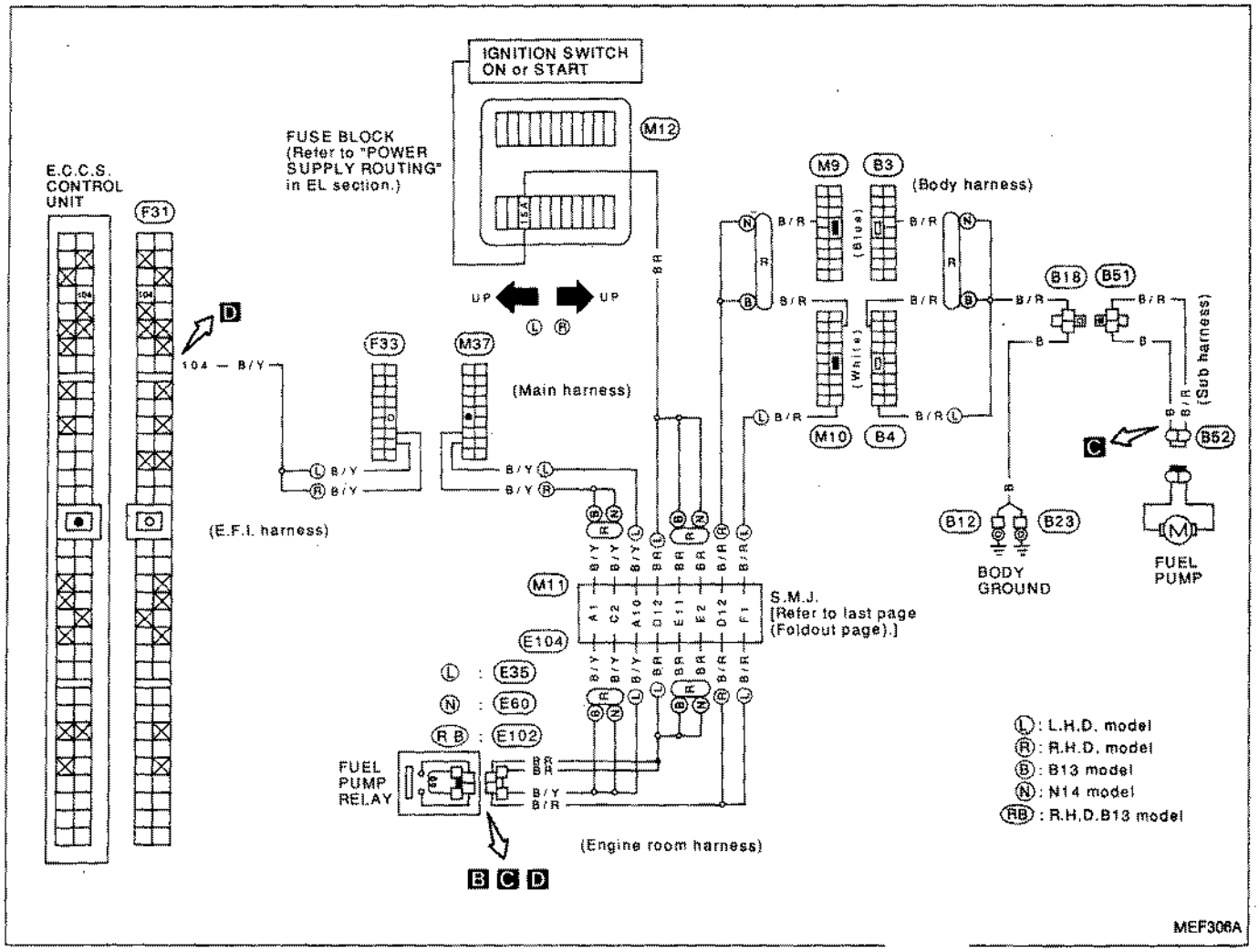
N.G. → Replace injector.

O.K.

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

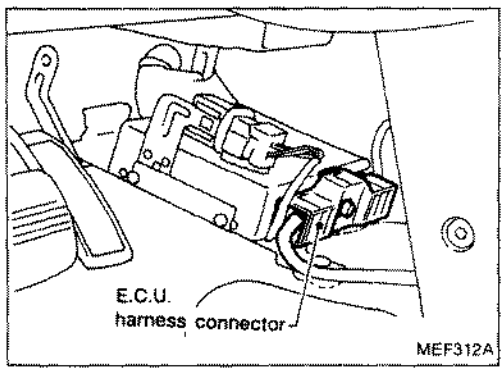
Diagnostic Procedure 32

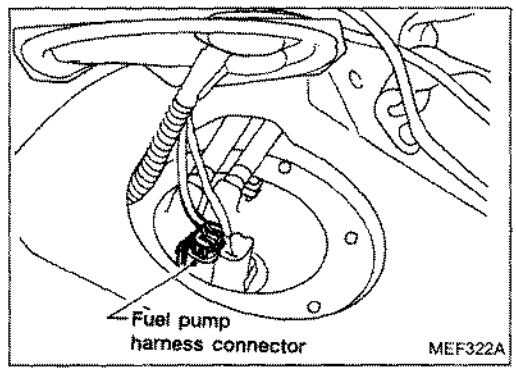
FUEL PUMP (Not self-diagnostic item)

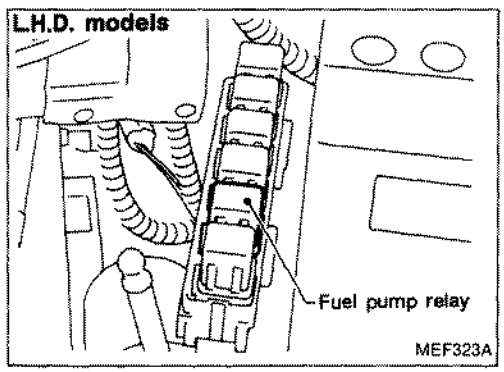


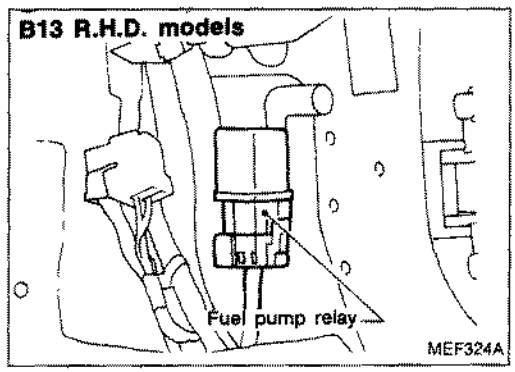
Diagnostic Procedure 32 (Cont'd)

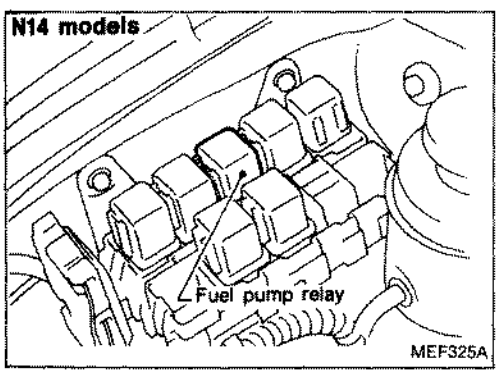
Harness layout





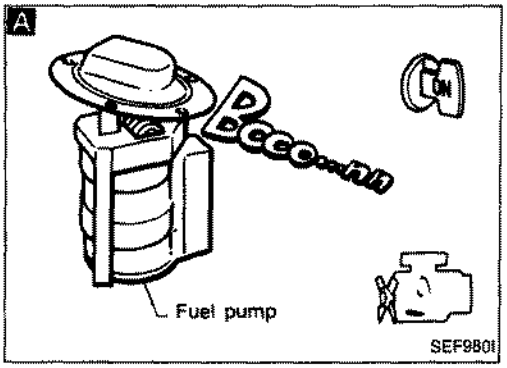




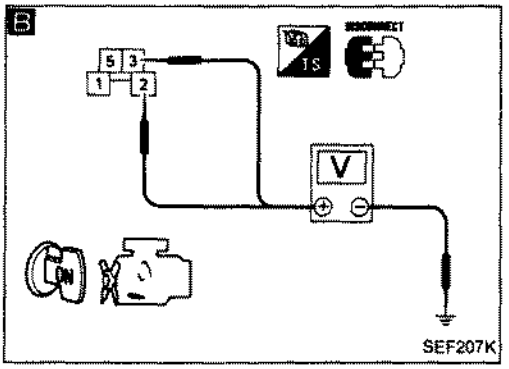


Diagnostic Procedure 32 (Cont'd)

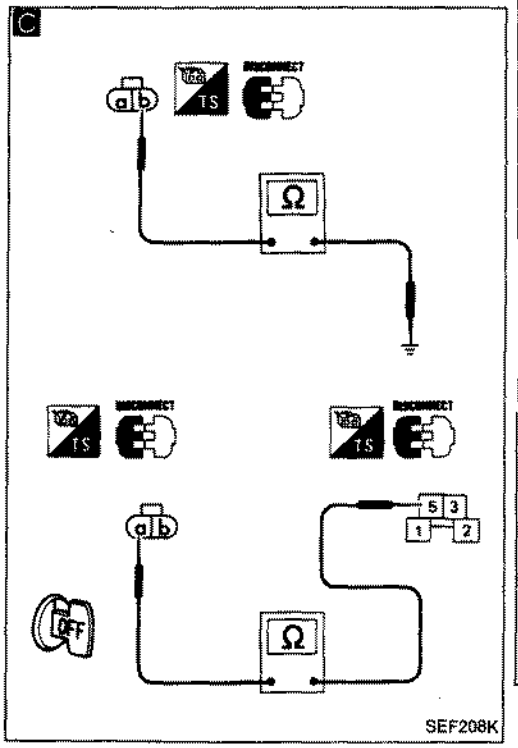
A



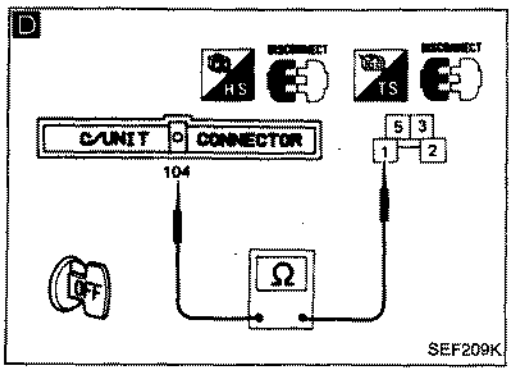
B



C



D



INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Turn ignition switch "ON".
2) Listen to fuel pump operating sound.
Fuel pump should operate for 5 seconds after ignition switch is turned "ON".

O.K. → INSPECTION END

N.G.

B

CHECK POWER SUPPLY.
1) Turn ignition switch "OFF".
2) Disconnect fuel pump relay.
3) Turn ignition switch "ON".
4) Check voltage between terminals ②, ③ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (M11), (E104)
- 15A fuse
- Harness continuity between fuse and fuel pump relay

If N.G., repair harness or connectors.

O.K.

C

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect fuel pump harness connector.
3) Check harness continuity between terminal ⓑ and body ground, terminal ⓐ and terminal ⑤.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (M11), (E104)
- Harness connectors (M18), (B4) (Model B13).
- Harness connectors (M9), (B3) (Model N14).
- Harness connectors (B18), (B51)
- Harness continuity between fuel pump and body ground
- Harness continuity between fuel pump and fuel pump relay

If N.G., repair harness or connectors.

O.K.

D

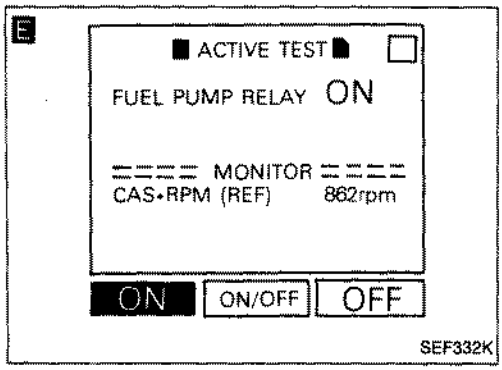
CHECK OUTPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal (104) and terminal ①.
Continuity should exist.

N.G. → Check the following:
- Harness connectors (F33), (M37)
- Harness connectors (M11), (E104)
- Harness continuity between E.C.U. and fuel pump relay

If N.G., repair harness or connectors.

O.K. → Ⓐ

Diagnostic Procedure 32 (Cont'd)



E

Ⓐ

CHECK COMPONENT
(Fuel pump relay).

1) Reconnect fuel pump relay, fuel pump harness connector and E.C.U. harness connector.
2) Ignition switch "ON".
3) Turn fuel pump relay "ON" and "OFF" in "ACTIVE TEST" mode with CONSULT and check operating sound.

OR

Refer to "Electrical Components Inspection".
(See page EF & EC-351.)

N.G. → Replace fuel pump relay.

O.K. ↓

CHECK COMPONENT
(Fuel pump).
Refer to "Electrical Components Inspection".
(See page EF & EC-349.)

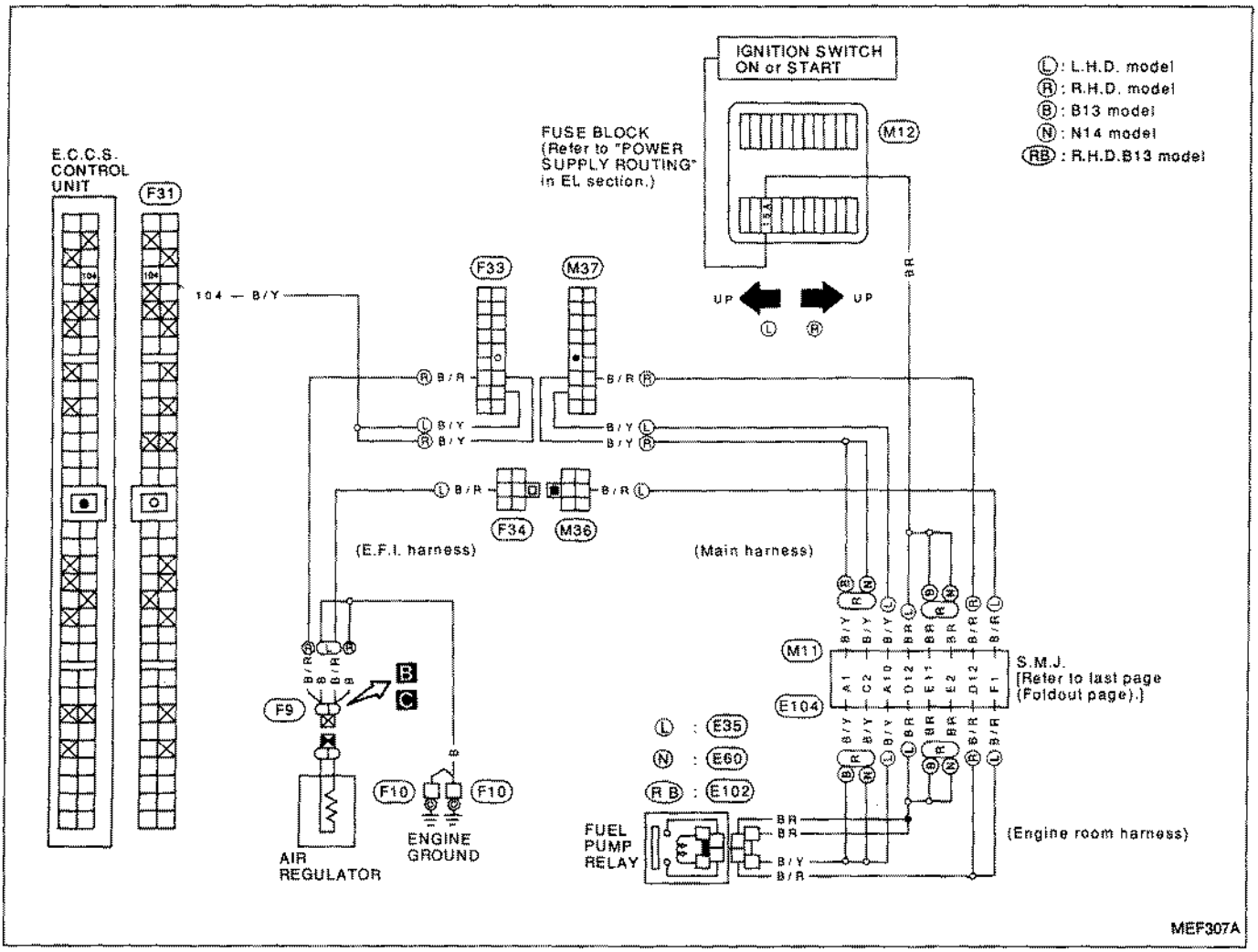
N.G. → Replace fuel pump.

O.K. ↓

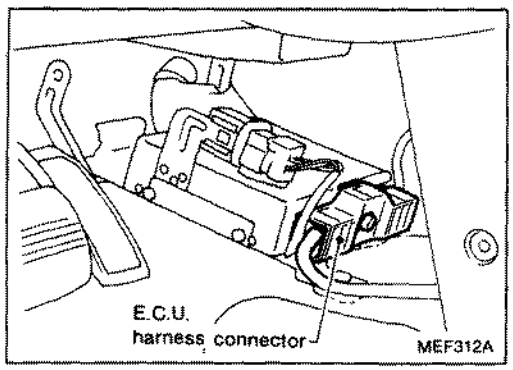
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

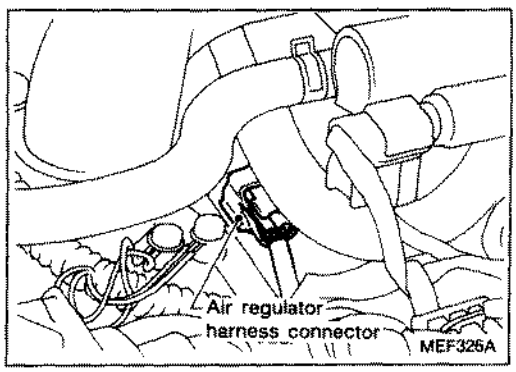
Diagnostic Procedure 33

AIR REGULATOR (Not self-diagnostic item)



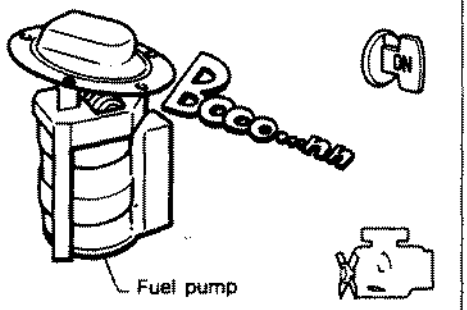
Harness layout



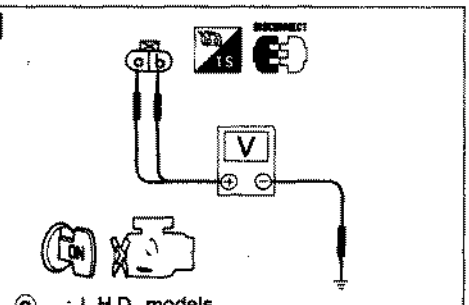


Diagnostic Procedure 33 (Cont'd)

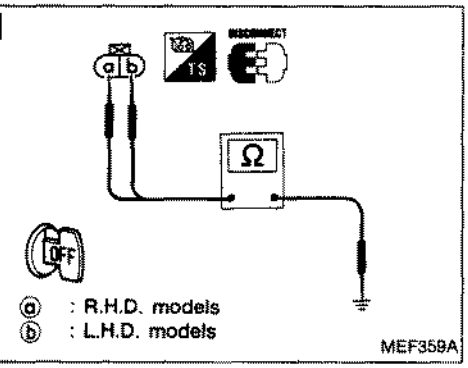
A



B



C



INSPECTION START

A

CHECK CONTROL FUNCTION.
1) Turn ignition switch "ON".
2) Listen to fuel pump operating sound.
Fuel pump should operate for 5 seconds after ignition switch is turned "ON".

N.G. → Check fuel pump control circuit. (See page EF & EC-318.)

O.K.

B

CHECK POWER SUPPLY.
1) Turn ignition switch "OFF".
2) Disconnect air regulator harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓐ and ground (L.H.D. models), terminal ⓑ and ground (R.H.D. models).
Battery voltage should exist for 5 seconds after ignition switch is turned "ON".

N.G. → Check the following.
- Harness connectors (F34), (M36) (L.H.D. models)
- Harness connectors (F33), (M37) (R.H.D. models)
- Harness connectors (M31), (E104)
- Harness continuity between air regulator and fuel pump relay

If N.G., repair harness or connectors.

O.K.

C

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓑ and body ground (L.H.D. models), terminal ⓐ and ground (R.H.D. models).
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

CHECK COMPONENT (Air regulator).
Refer to "Electrical Components Inspection".
(See page EF & EC-350.)

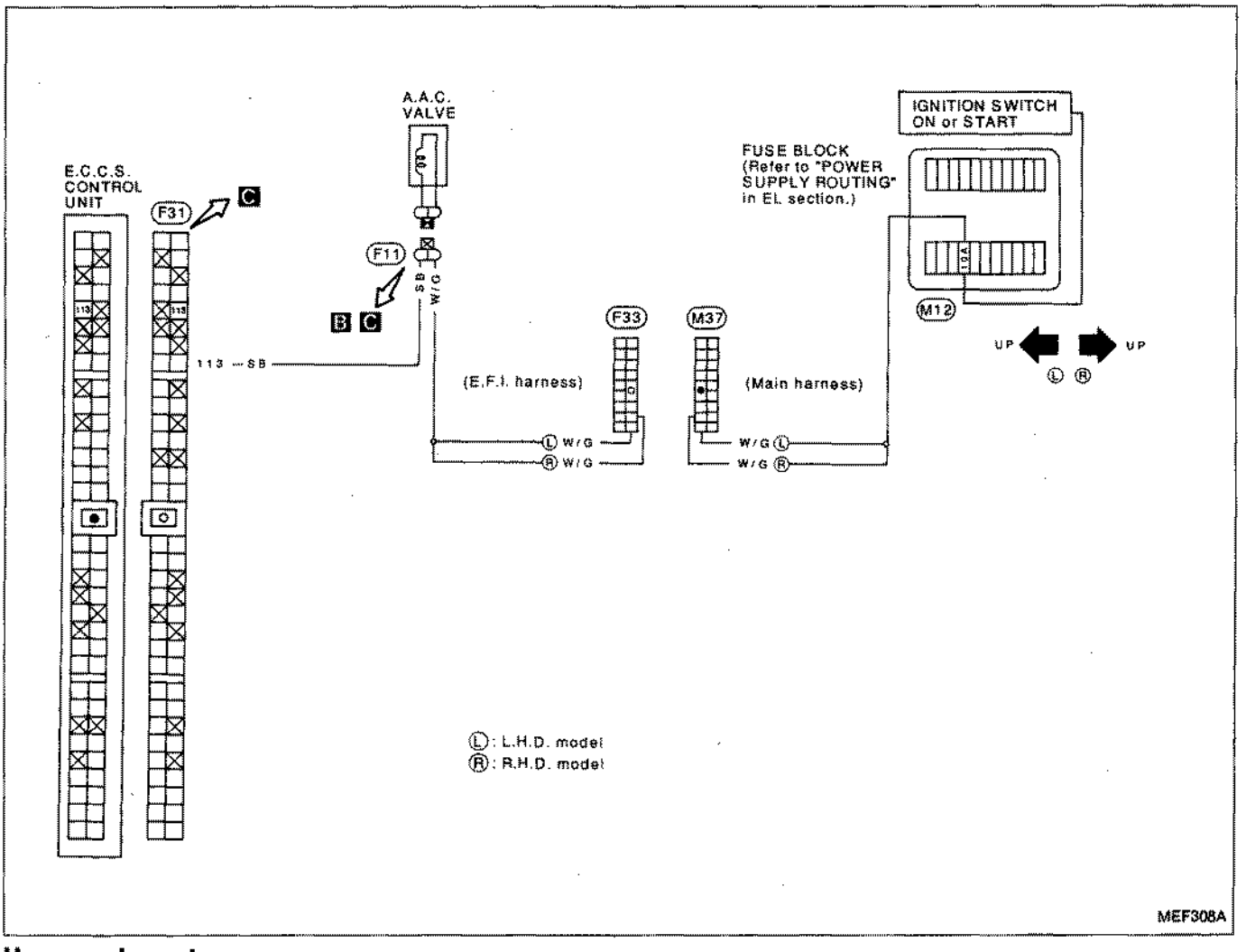
N.G. → Replace air regulator.

O.K.

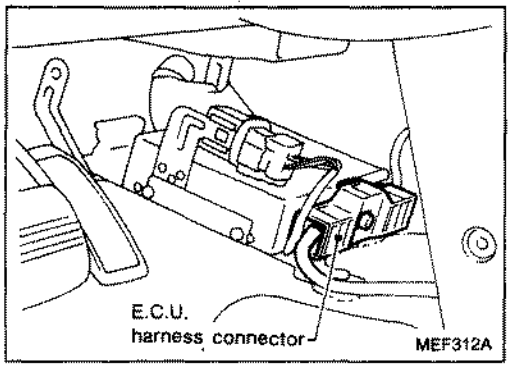
INSPECTION END

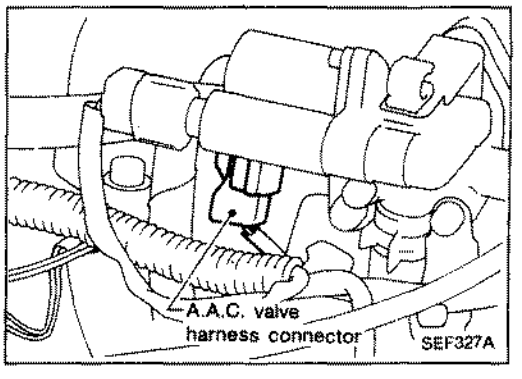
Diagnostic Procedure 34

A.A.C. VALVE (Not self-diagnostic item)

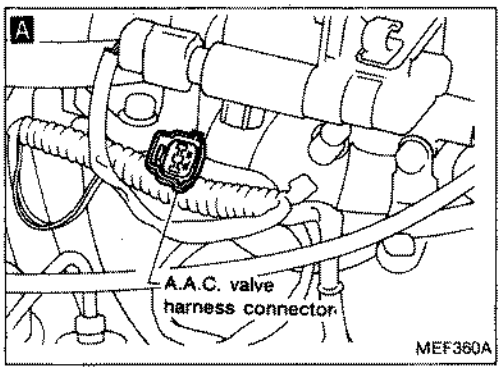


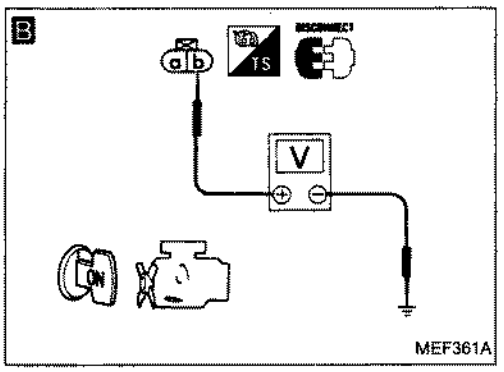
Harness layout

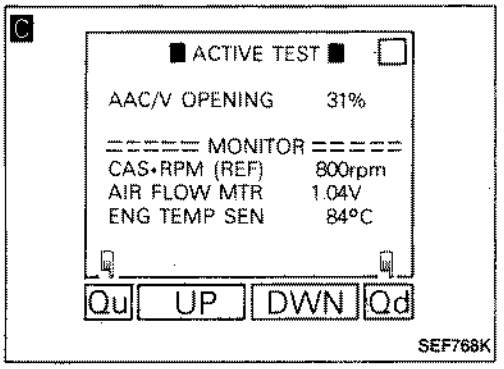


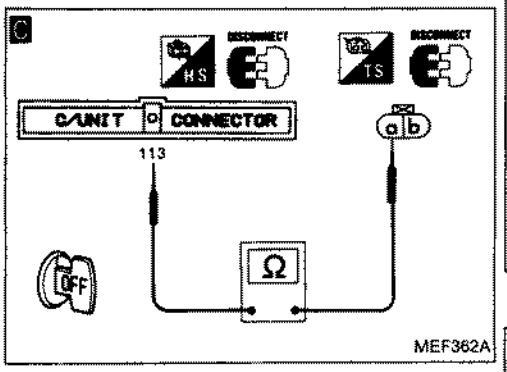


Diagnostic Procedure 34 (Cont'd)









INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Check idle speed.
   750 ± 50 rpm (M/T)
   800 ± 50 rpm (A/T) (in "N" position)
3) Disconnect A.A.C. valve harness connector.
4) Make sure that idle speed drops.

Drops → INSPECTION END

Does not drop

B

CHECK POWER SUPPLY.
1) Stop engine.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓑ and ground.
   Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (F33), (R37)
- 10A fuse
- Harness continuity between A.A.C. valve and fuse

If N.G., repair harness or connectors.

O.K.

C

CHECK OUTPUT SIGNAL CIRCUIT.
1) Reconnect A.A.C. valve harness connector.
2) Perform "AAC VALVE OPENING TEST" in "ACTIVE TEST" mode with CONSULT.

N.G. → Repair harness or connectors.

OR

1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal (113) and terminal ⓐ.
   Continuity should exist.

O.K.

CHECK COMPONENT (A.A.C. valve).
Refer to "Electrical Components Inspection".
(See page EF & EC-350.)

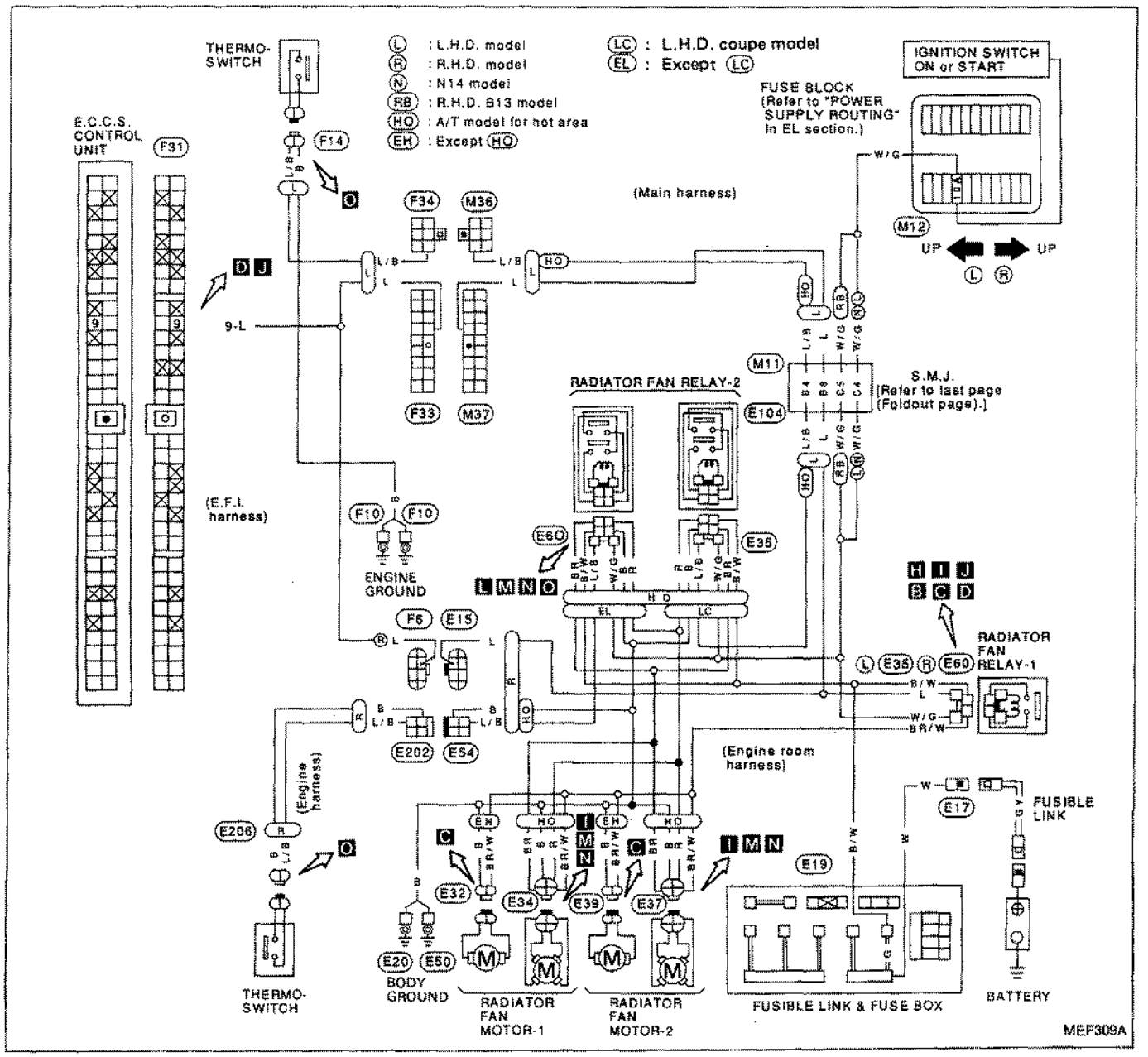
N.G. → Replace A.A.C. valve.

O.K.

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

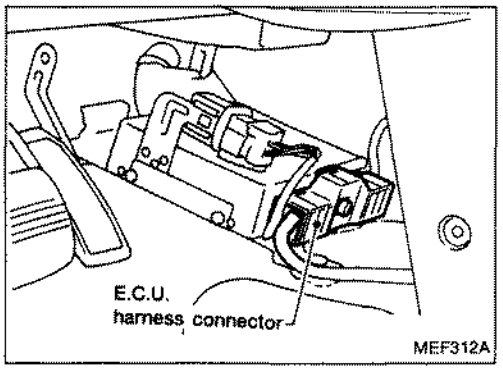
Diagnostic Procedure 35

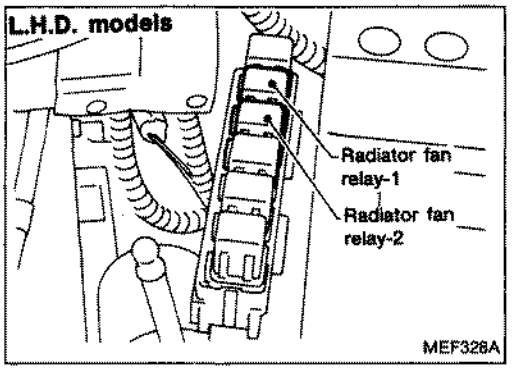
RADIATOR FAN CONTROL (Not self-diagnostic item)

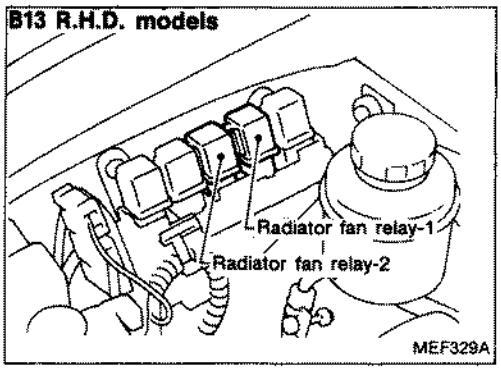


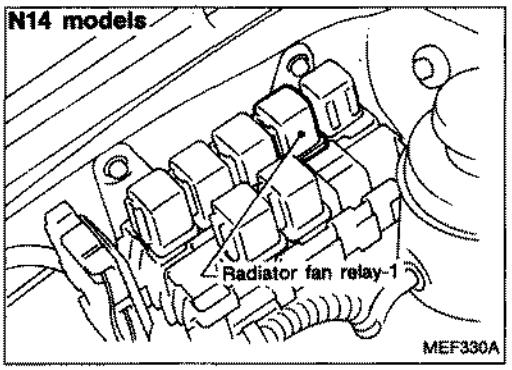
Diagnostic Procedure 35 (Cont'd)

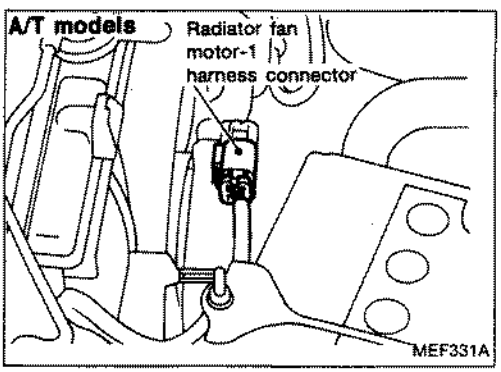
Harness layout

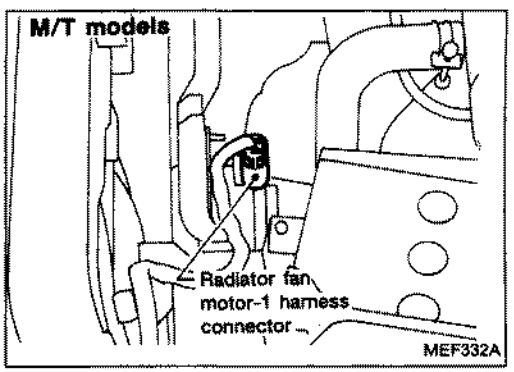


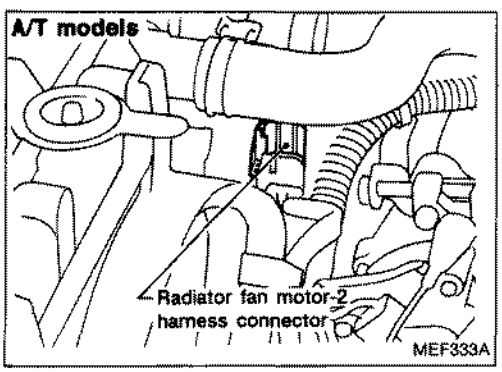


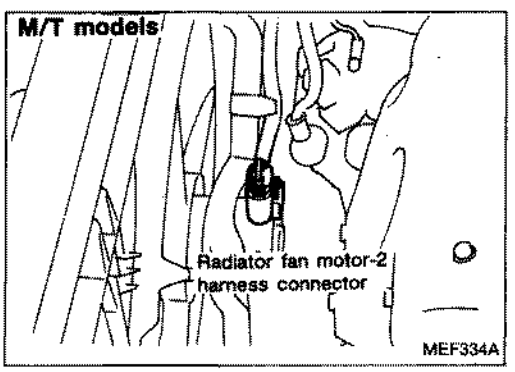


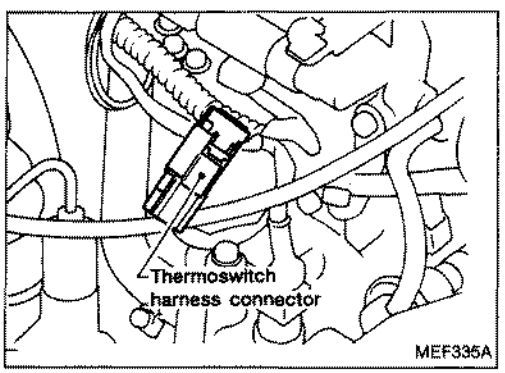






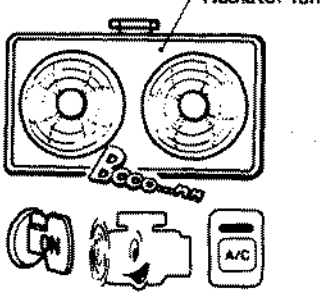




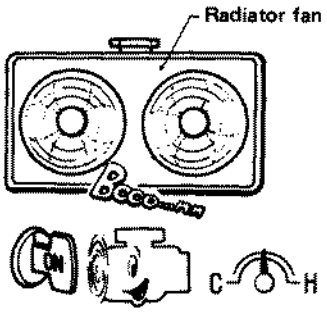


Diagnostic Procedure 35 (Cont'd)

A With air conditioner

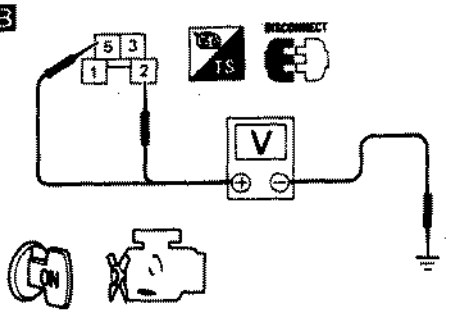


Without air conditioner



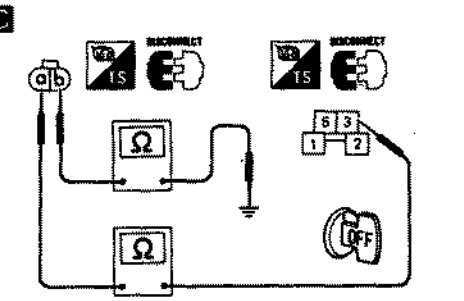
SEF997I

B



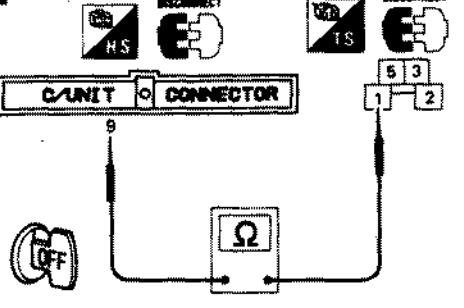
MEF365A

C



MEF366A

D



SEF999I

Except A/T models for hot areas

INSPECTION START

A

CHECK RADIATOR FAN OPERATION.

With air conditioner

1) Start engine.
2) Set temperature lever at full cold position.
3) Turn air conditioner switch "ON".
4) Turn blower fan switch "ON".
5) Run engine at idle for a few minutes with air conditioner operating.
6) Make sure that radiator fan operates.

Without air conditioner

1) Start engine.
2) Keep engine speed at about 2,000 rpm until engine is warmed up sufficiently.
3) Make sure that radiator fan begins to operate during warm-up.

O.K. → INSPECTION END

N.G. ↓

B

CHECK POWER SUPPLY.

1) Turn air conditioner switch "OFF".
2) Turn blower fan switch "OFF".
   (Step 1) and 2) are only performed for model with air conditioner.)
3) Stop engine.
4) Disconnect radiator fan relay-1.
5) Turn ignition switch "ON".
6) Check voltage between terminals ②, ⑤ and ground.
   Voltage: Battery voltage

N.G. → Check the following.

- Harness connectors (M1), (E105)
- "GY" fusible link
- "G" fusible link
- 10A fuse
- Harness continuity between fuse and radiator fan relay-1
- Harness continuity between battery and radiator fan relay-1

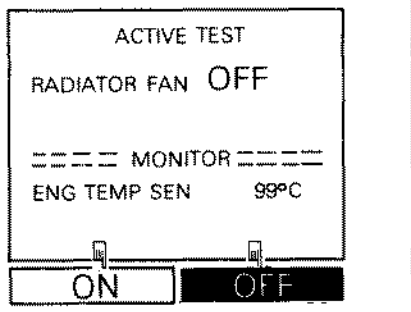
If N.G., repair harness or connectors.

O.K. ↓

Ⓐ

Diagnostic Procedure 35 (Cont'd)

E



Ⓐ

C

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect radiator fan motor-1 harness connector and radiator fan motor-2 harness connector.
3) Check harness continuity between terminal ⓒ and terminal ③, terminal ⓑ and body ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

D

CHECK OUTPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal ⑨ and terminal ①.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (F33), (M37) (L.H.D. models)
- Harness connectors (M31), (E194) (L.H.D. models)
- Harness connectors (F6), (E15) (R.H.D. models)
- Harness continuity between E.C.U. and radiator fan relay-1

If N.G., repair harness or connectors.

O.K. ↓

E

CHECK COMPONENT
(Radiator fan relay-1).
Refer to "Electrical Components Inspection".
(See page EF & EC-351.)

N.G. → Replace radiator fan relay.

O.K. ↓

CHECK COMPONENTS
(Radiator fan motors).

1) Reconnect radiator fan relay, radiator fan motor harness connectors and E.C.U. harness connector.
2) Start engine.
3) Perform "RADIATOR FAN TEST" in "ACTIVE TEST" mode with CONSULT.

OR

Refer to "Electrical Components Inspection".
(See page EF & EC-351.)

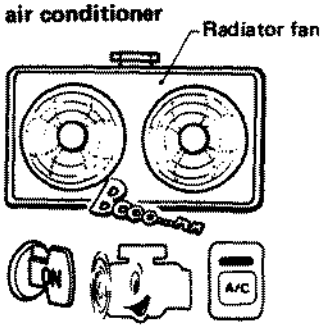
N.G. → Replace radiator fan motors.

O.K. ↓

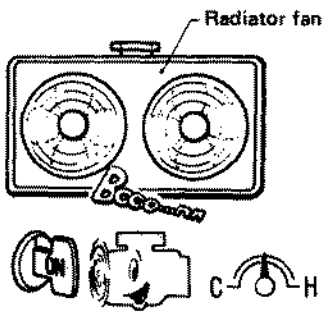
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Diagnostic Procedure 35 (Cont'd)

F With air conditioner

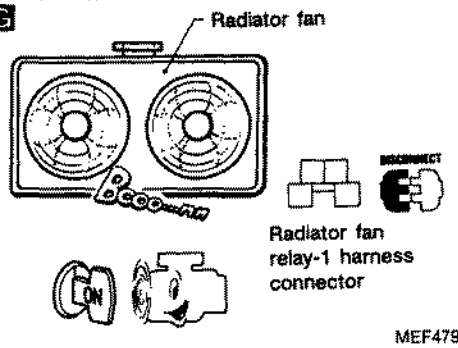


Without air conditioner



SEF997I

G



MEF479A

A/T models for hot areas

INSPECTION START

F

CHECK RADIATOR FAN LOW SPEED OPERATION.

With air conditioner

1) Start engine.
2) Set temperature lever at full cold position.
3) Turn air conditioner switch "ON".
4) Turn blower fan switch "ON".
5) Run engine at idle for a few minutes with air conditioner operating.
6) Make sure that radiator fan operates at low speed.

Without air conditioner

1) Start engine.
2) Keep engine speed at about 2,000 rpm until engine is warmed up sufficiently.
3) Make sure that radiator fan begins to operate at low speed during warm-up.

N.G. → Check radiator fan low speed control circuit. (Go to PROCEDURE A .)

O.K.

G

CHECK RADIATOR FAN HIGH SPEED OPERATION.

1) Turn air conditioner switch "OFF".
2) Turn blower fan switch "OFF".
   (Step 1) and 2) are only performed for model with air conditioner.)
3) Stop engine.
4) Disconnect radiator fan relay-1.
5) Restart engine and warm it up until engine is extremely hot [Engine temperature is above 105°C (221°F)].
   Make sure that radiator fan operates at high speed.

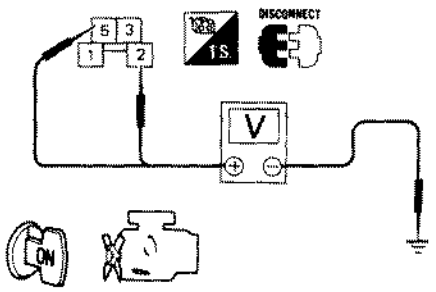
N.G. → Check radiator fan high speed control circuit. (Go to PROCEDURE B .)

O.K.

INSPECTION END

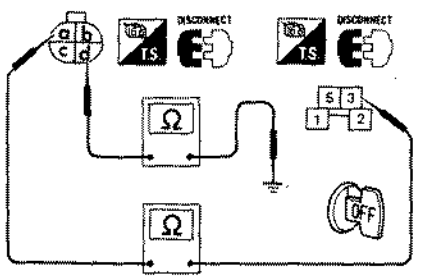
Diagnostic Procedure 35 (Cont'd)

H



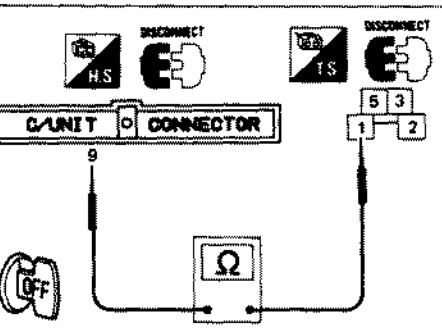
SEF365K

I



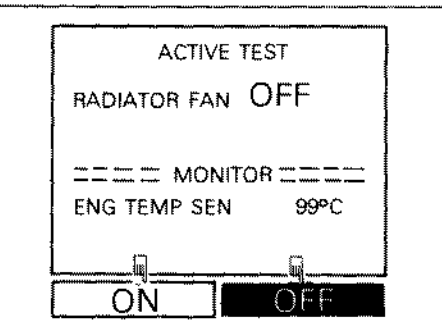
MEF480A

J



SEF999I

K



SEF333K

PROCEDURE A

INSPECTION START

H

CHECK POWER SUPPLY.
1) Stop engine.
2) Disconnect radiator fan relay-1.
3) Turn ignition switch "ON".
4) Check voltage between terminals ②, ⑤ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (M11), (E104)
- 10A fuse
- "G" fusible link
- "GY" fusible link
- Harness continuity between radiator fan relay-1 and fuse
- Harness continuity between radiator fan relay-1 and battery

If N.G., repair harness or connectors.

O.K. ↓

I

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect radiator fan motor-1 harnes connector and radiator fan motor-2 harness connector.
3) Check harness continuity between terminals ③ and terminal ⓒ, terminal ⓓ and body ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

J

CHECK OUTPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal ⑨ and terminal ①.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (F33), (M37) (L.H.D. models)
- Harness connectors (M11), (E104) (L.H.D. models)
- Harness connectors (F6), (E15) (R.H.D. models)
- Harness continuity between radiator fan relay-1 and E.C.U.

If N.G., repair harness or connectors.

O.K. ↓

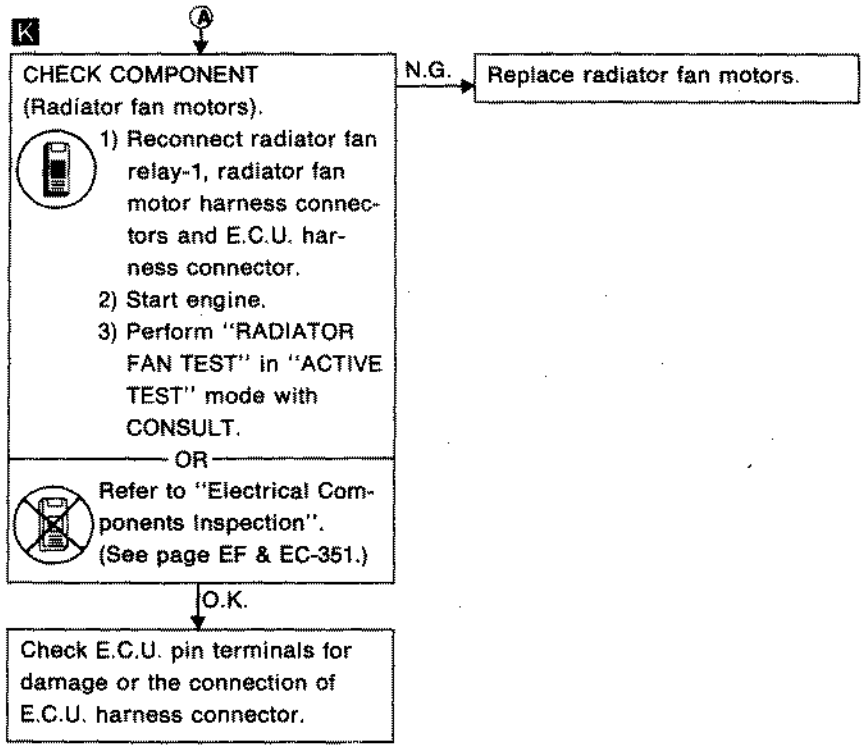
CHECK COMPONENT
(Radiator fan relay-1).
Refer to "Electrical Components Inspection".
(See page EF & EC-351.)

N.G. → Replace radiator fan relay.

O.K. ↓

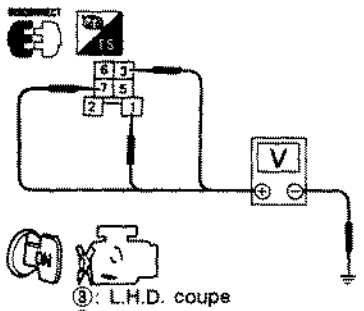
Ⓐ

Diagnostic Procedure 35 (Cont'd)



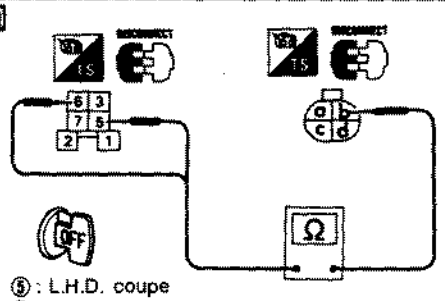
Diagnostic Procedure 35 (Cont'd)

L



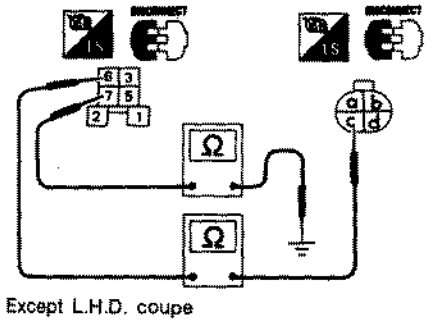
③: L.H.D. coupe
⑦: Except L.H.D. coupe
MEF481A

M

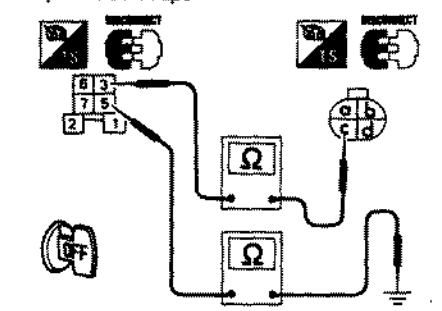


⑤: L.H.D. coupe
⑥: Except L.H.D. coupe
MEF482A

N L.H.D. coupe

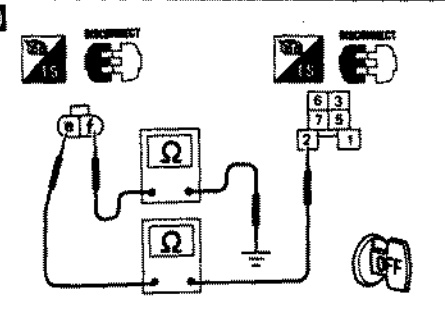


Except L.H.D. coupe



MEF483A

O



MEF484A

PROCEDURE B

INSPECTION START

L

CHECK POWER SUPPLY.
1) Stop engine.
2) Disconnect radiator fan relay- 2.
3) Turn ignition switch "ON".
4) Check voltage between terminals ①, ③ (L.H.D. coupe), ⑦ (Except L.H.D. coupe) and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (M11), (E104)
- 10A fuse
- "G" fusible link
- "GY" fusible link
- Harness continuity between radiator fan relay-2 and fuse
- Harness continuity between radiator fan relay-2 and battery

If N.G., repair harness or connectors.

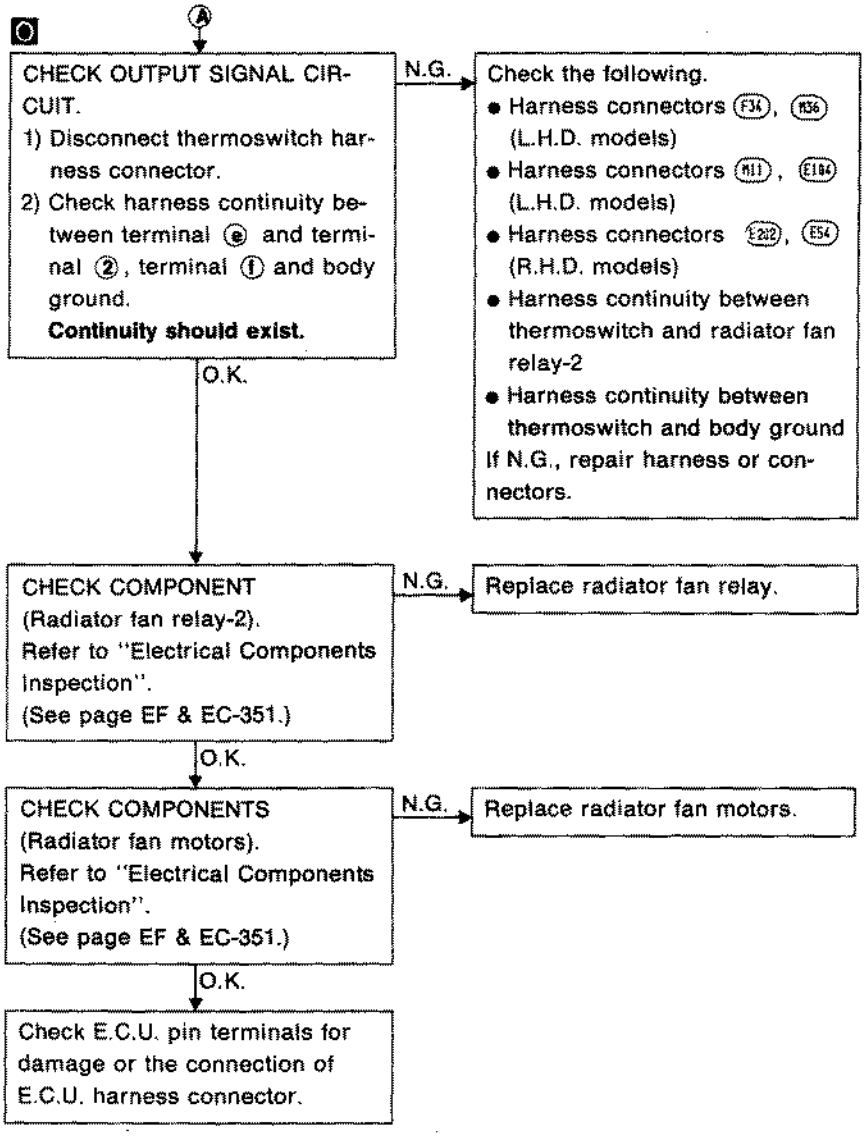
O.K. ↓

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect radiator fan motor-1 harness connector and radiator fan motor-2 harness connector.
M 3) Check harness continuity between terminal ⓑ and terminal ⑤ (L.H.D. coupe), ⑥ (Except L.H.D. coupe).
Continuity should exist.
N 4) Check harness continuity between terminal ⓒ and terminal ⑥ (L.H.D. coupe), ③ (Except L.H.D. coupe), terminal ⑦ (L.H.D. coupe), ⑤ (Except L.H.D. coupe) and body ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓ Ⓐ

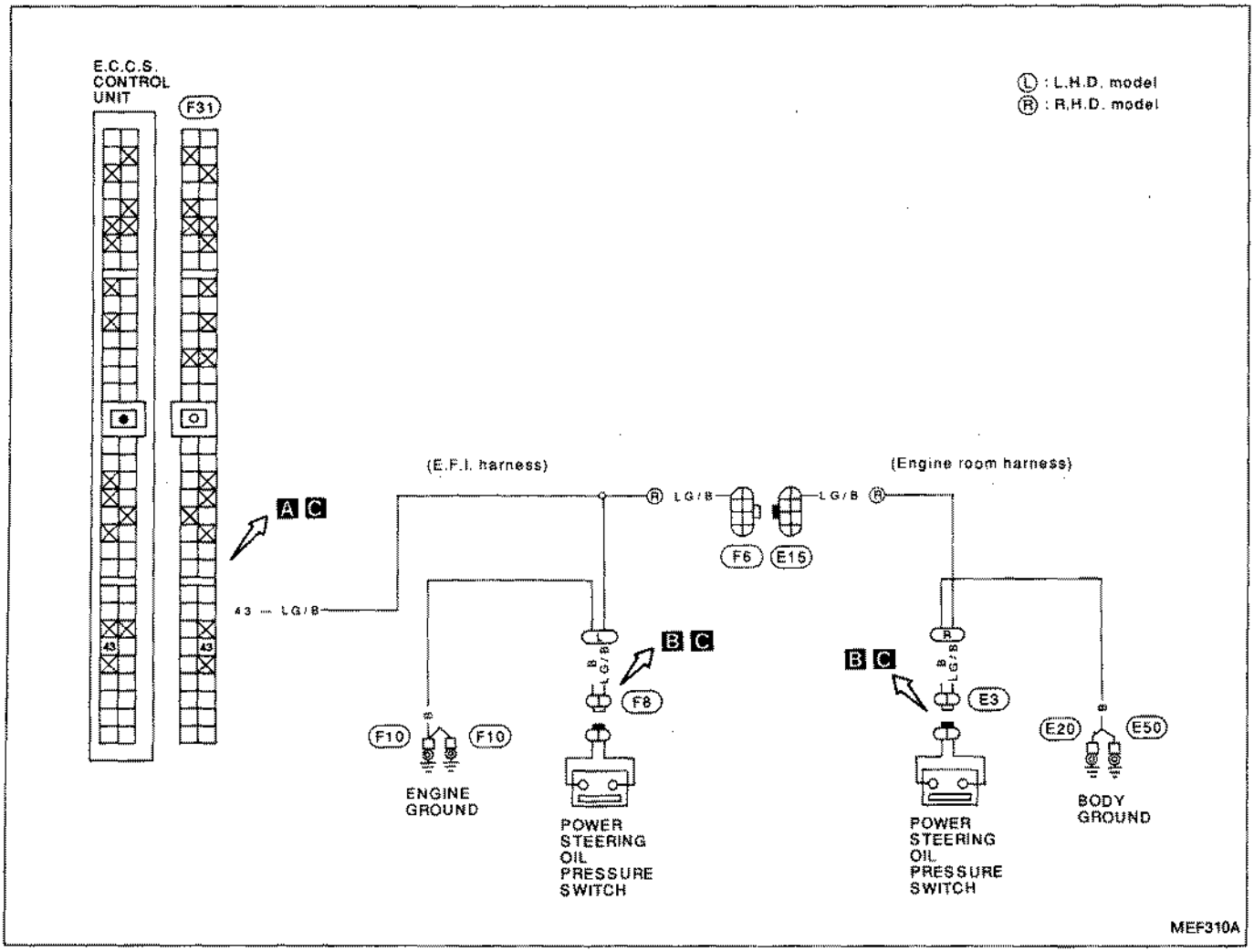
Diagnostic Procedure 35 (Cont'd)



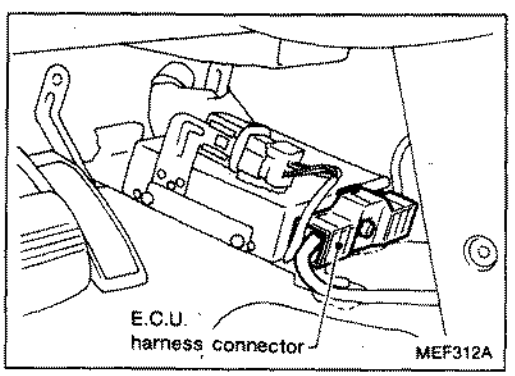
NOTE

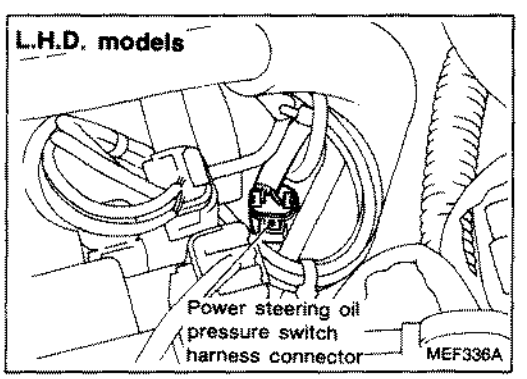
Diagnostic Procedure 36

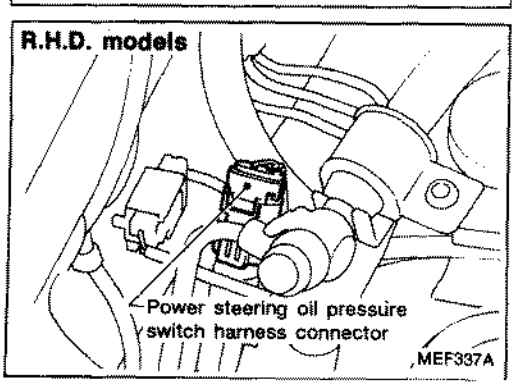
POWER STEERING OIL PRESSURE SWITCH (Not self-diagnostic item)



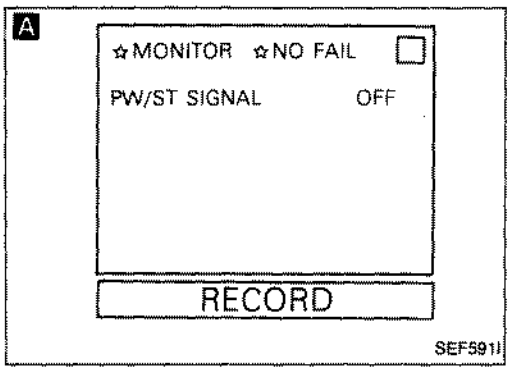
Harness layout

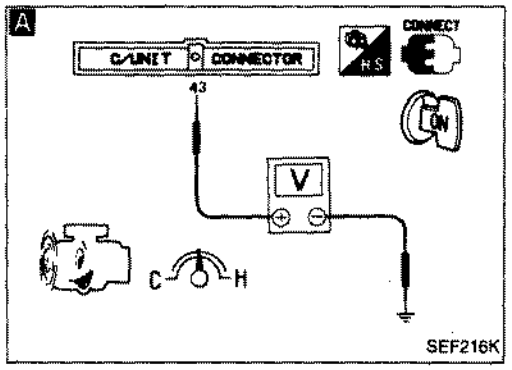


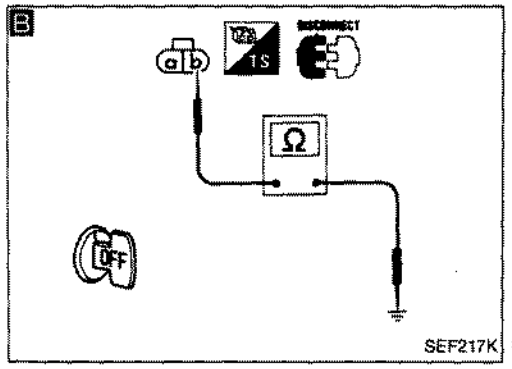


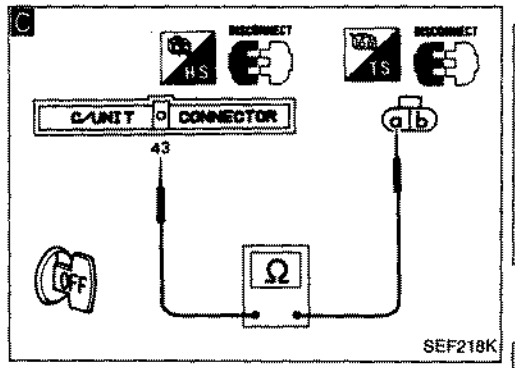


Diagnostic Procedure 36 (Cont'd)









INSPECTION START

A

CHECK CONTROL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Check power steering oil pressure switch signal in "DATA MONITOR" mode with CONSULT.
Steering is neutral: OFF
Steering is turned: ON

OR

2) Check voltage between E.C.U. terminal ㊸ and ground.
Voltage:
When steering wheel is turned quickly.
Approximately 0V
Except above
Approximately 5V

O.K. → INSPECTION END

N.G.

B

CHECK GROUND CIRCUIT.
1) Stop engine.
2) Disconnect power steering oil pressure switch harness connector.
3) Check harness continuity between terminal ⓑ and body ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

C

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal ㊸ and terminal ⓐ.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (F6), (E15) (R.H.D. models)
- Harness continuity between E.C.U. and power steering oil pressure switch

If N.G., repair harness or connectors.

O.K.

CHECK COMPONENT
(Power steering oil pressure switch).
Refer to "Electrical Components Inspection".
(See page EF & EC-352.)

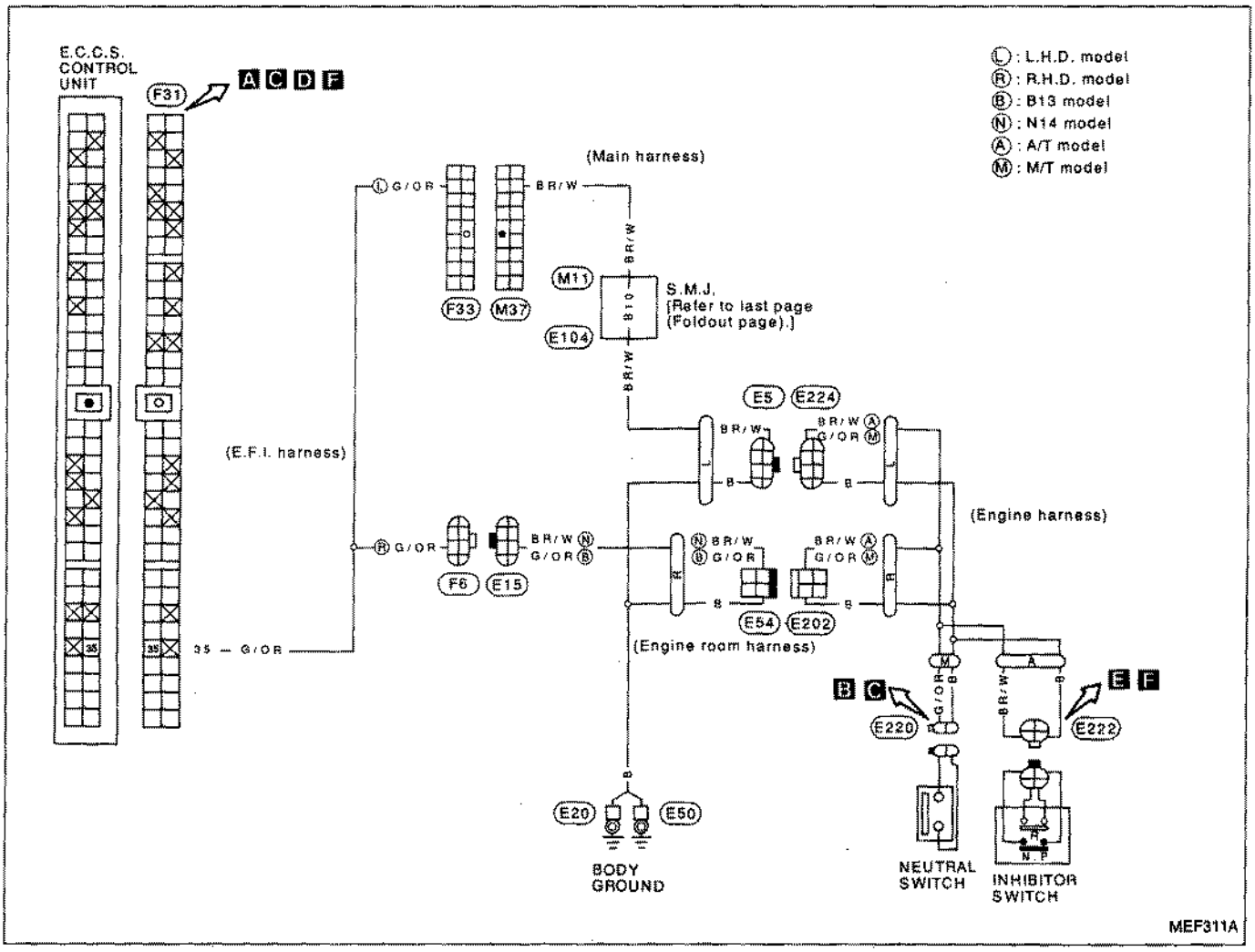
N.G. → Replace power steering oil pressure switch.

O.K.

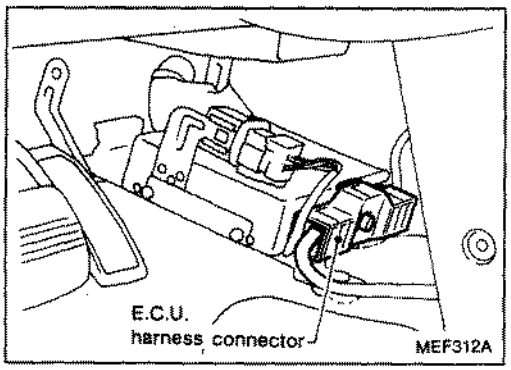
Check E.C.U. pin terminals for damage or the connection of the E.C.U. harness connector.

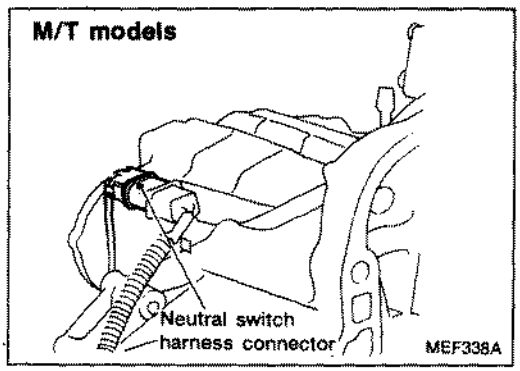
Diagnostic Procedure 37

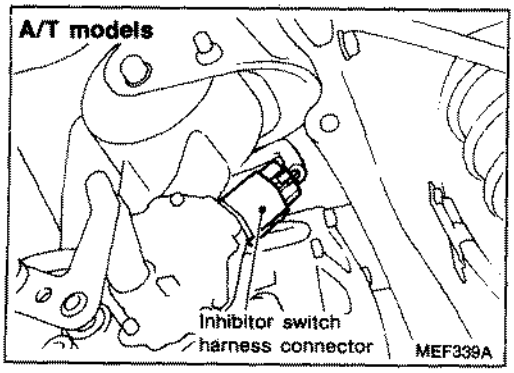
NEUTRAL/INHIBITOR SWITCH (Not self-diagnostic item)



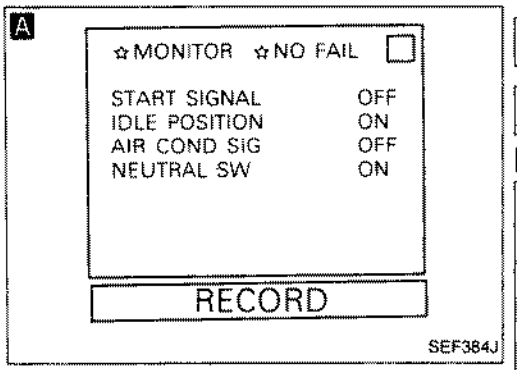
Harness layout

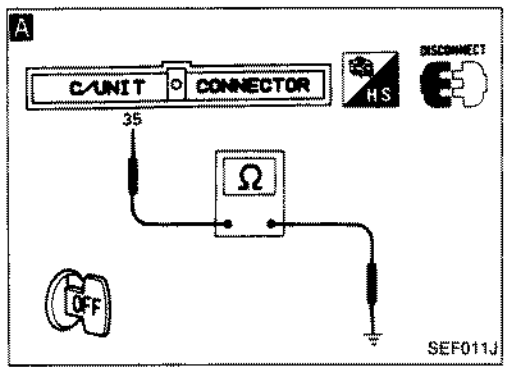


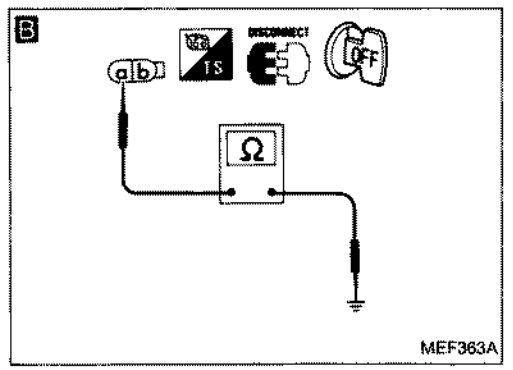


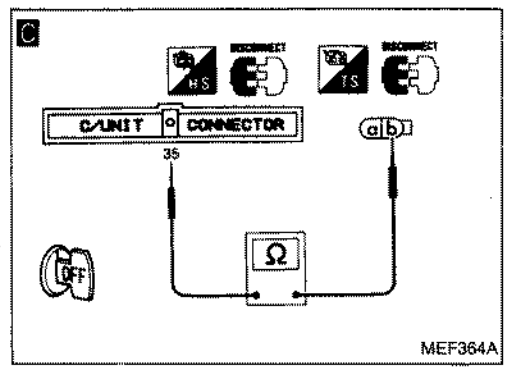


Diagnostic Procedure 37 (Cont'd)









Neutral switch

INSPECTION START

A

CHECK OVERALL FUNCTION.

1) Turn ignition switch "ON".
2) Check neutral switch signal in "DATA MONITOR" mode with CONSULT.

Neutral position: ON
Except above: OFF

O.K. → INSPECTION END

OR

1) Set shift lever to the neutral position.
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal (35) and body ground.

Continuity should exist.

N.G.

Turn ignition switch "OFF".

B

CHECK GROUND CIRCUIT.

1) Disconnect neutral switch harness connector.
2) Check harness continuity between terminal ⓐ and body ground.

Continuity should exist.

N.G. → Check the following.
- Harness connectors (E5), (E224) (L.H.D. models)
- Harness connectors (E54), (E282) (R.H.D. models)
- Harness continuity between neutral switch and body ground

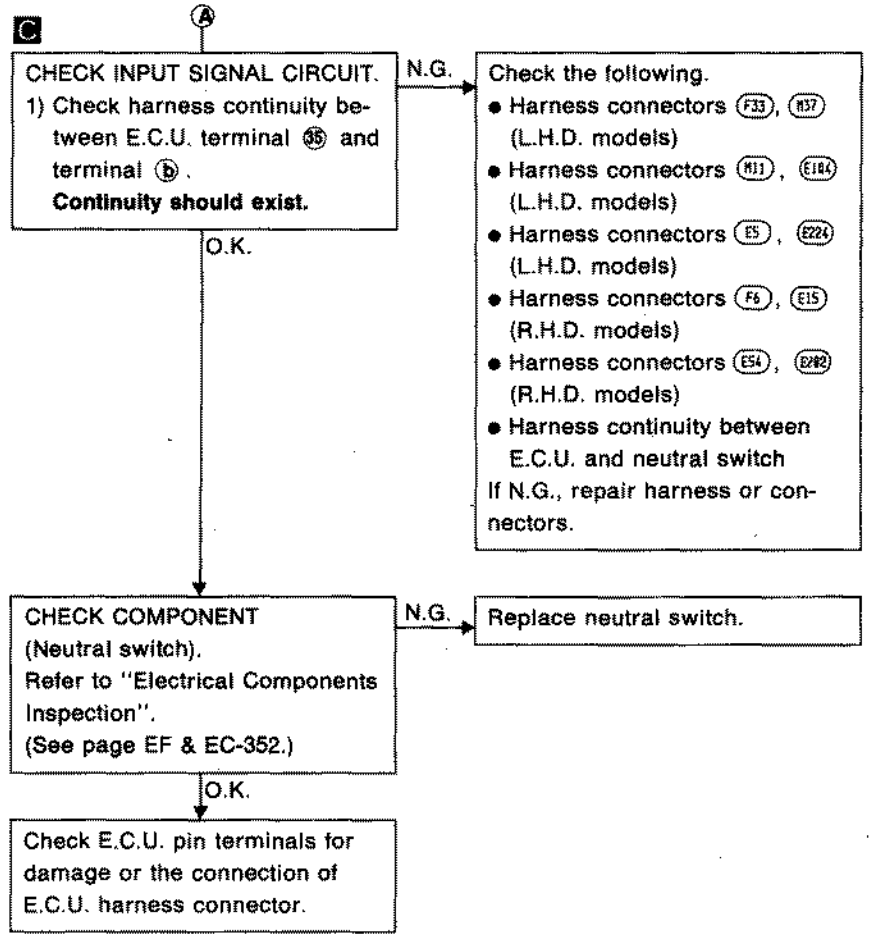
If N.G., repair harness or connectors.

O.K.

Disconnect E.C.U. harness connector.

Ⓐ

Diagnostic Procedure 37 (Cont'd)



Diagnostic Procedure 37 (Cont'd)

D

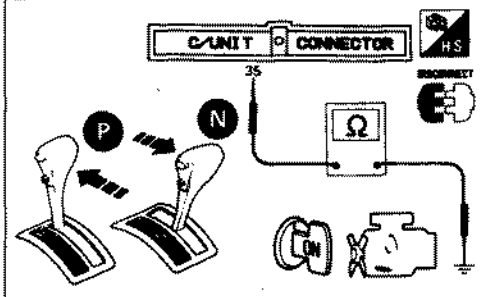
☆MONITOR ☆NO FAIL

START SIGNAL	OFF
IDLE POSITION	ON
AIR COND SIG	OFF
NEUTRAL SW	ON

RECORD

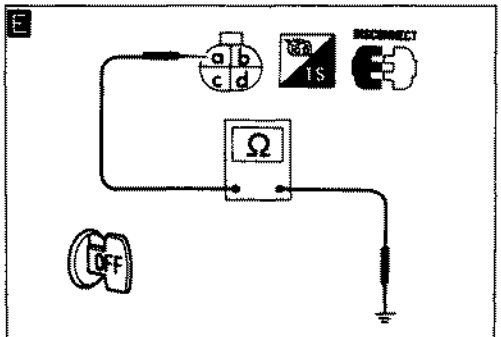
SEF384J

D



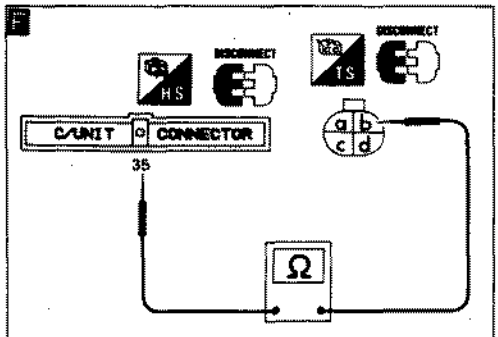
SEF014J

E



SEF286K

F



SEF287K

Inhibitor switch

INSPECTION START

D

CHECK OVERALL FUNCTION.

1) Turn ignition switch "ON".
2) Check neutral switch signal in "DATA MONITOR" mode with CONSULT.
   "N" or "P": ON
   Except above: OFF

O.K. → INSPECTION END

OR

1) Shift selector lever to "P" range.
2) Disconnect E.C.U. harness connector.
3) Turn ignition switch "ON".
4) Check harness continuity between E.C.U. terminal (35) and body ground.
   Continuity should exist.
5) Shift selector lever to "N" range.
6) Check harness continuity between E.C.U. terminal (36) and body ground.
   Continuity should exist.

N.G.

E

CHECK GROUND CIRCUIT.

1) Turn ignition switch "OFF".
2) Disconnect inhibitor switch harness connector.
3) Check harness continuity between terminal ⓖ and body ground.
   Continuity should exist.

N.G. → Check the following.
- Harness connectors (E5), (E224) (L.H.D. models)
- Harness connectors (E54), (E202) (R.H.D. models)
- Harness continuity between inhibitor switch and body ground

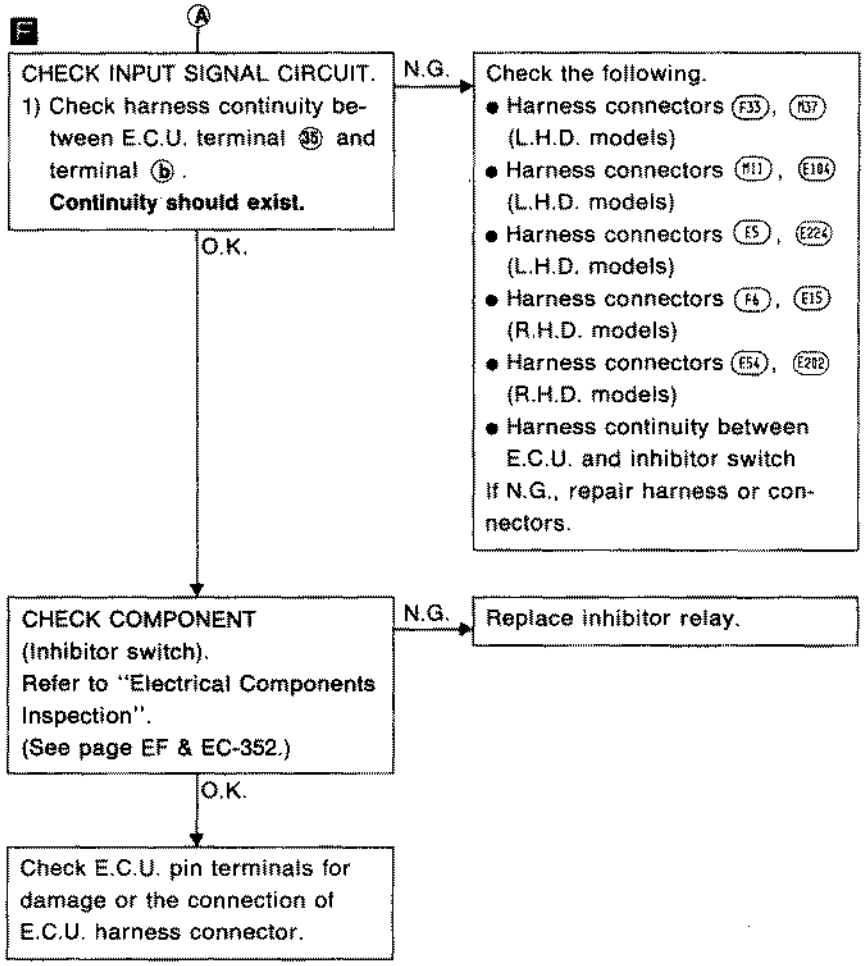
If N.G., repair harness or connectors.

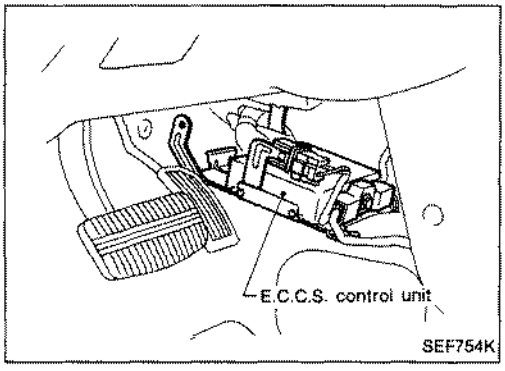
O.K.

Disconnect E.C.U. harness connector.

Ⓐ

Diagnostic Procedure 37 (Cont'd)

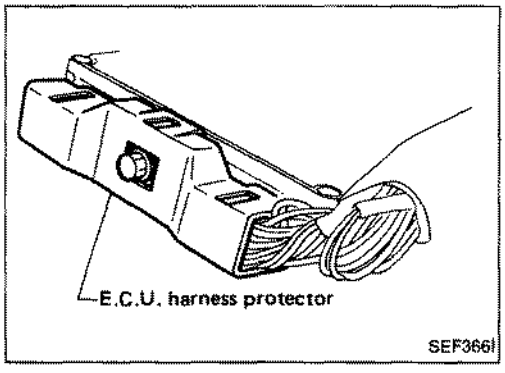




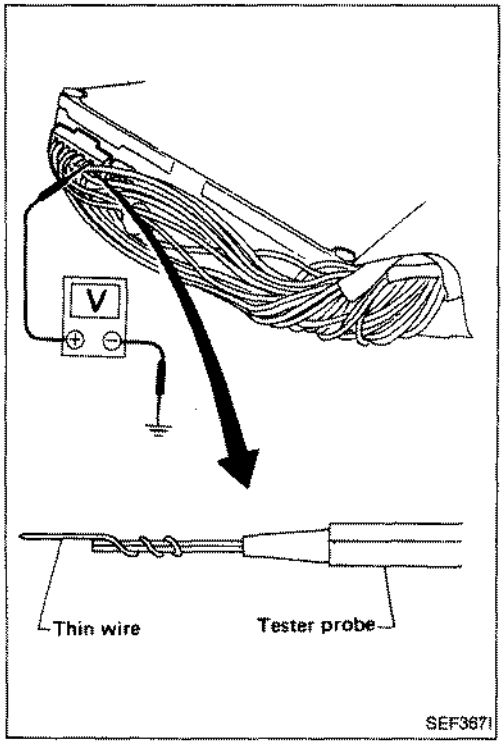
Electrical Components Inspection

E.C.U. INPUT/OUTPUT SIGNAL INSPECTION

1. E.C.U. is located behind the center console panel. For this inspection, remove the center console under cover.



2. Remove E.C.U. harness protector.



3. Perform all voltage measurements with the connectors connected. Extend tester probe as shown to perform tests easily.

Electrical Components Inspection (Cont'd)

E.C.U. inspection table

*Date are reference values.

TERMINAL NO.	ITEM	CONDITION	*DATA
1	Ignition signal	Engine is running. └ Idle speed	0.3 - 0.5V
		Engine is running. └Engine speed is 2,000 rpm	Approximately 0.9V
3	Ignition check	Engine is running. └Idle speed	Approximately 13V
4	E.C.C.S. relay (Self-shutoff)	Engine is running. Ignition switch "OFF" └For approximately 5 seconds after turning ignition switch "OFF"	0 - 1V
		Ignition switch "OFF" └Approximately 5 seconds after turning ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)
9	Radiator fan relay	Engine is running. └Radiator fan is not operating.	BATTERY VOLTAGE (11 - 14V)
		Engine is running. └Radiator fan is operating.	Approximately 0V
11	Air conditioner relay	Engine is running. └Both A/C switch and blower switch are "ON".	Approximately 0V
		Engine is running └A/C switch is "OFF".	BATTERY VOLTAGE (11 - 14V)
16	Air flow meter	Engine is running.	0.7 - 3.0V Output voltage varies with engine revolution.
18	Engine temperature sensor	Engine is running.	0 - 5.0V Output voltage varies with engine water temperature.
20	Throttle sensor	Ignition switch "ON"	0.5 - Approximately 5V 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 - 1.3V

Electrical Components Inspection (Cont'd)

*Date are reference values.

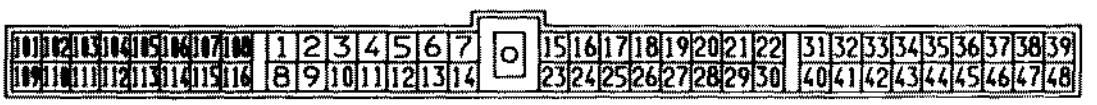
TER-MINAL NO.	ITEM	CONDITION	*DATA
31 40	Crank angle sensor (Position signal)	Engine is running. └**Do not run engine at high speed under no-load.**	2.0 - 3.0V
34	Start signal	Ignition switch "ON"	Approximately 0V
		Ignition switch "START"	BATTERY VOLTAGE (11 - 14V)
35	Neutral switch	Ignition switch "ON" └Neutral	0V
		Ignition switch "ON" └Except the above gear position	Approximately 5V
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".	Approximately 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.	0V
		Engine is running. └Steering wheel is not being turned.	Approximately 5V
45	Fan switch	Engine is running. └Fan switch is "ON".	Approximately 0V
		Engine is running. └Fan switch is "OFF".	BATTERY VOLTAGE (11 - 14V)
46	Power supply (Back-up)	Ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)

Electrical Components Inspection (Cont'd)

*Date are reference values.

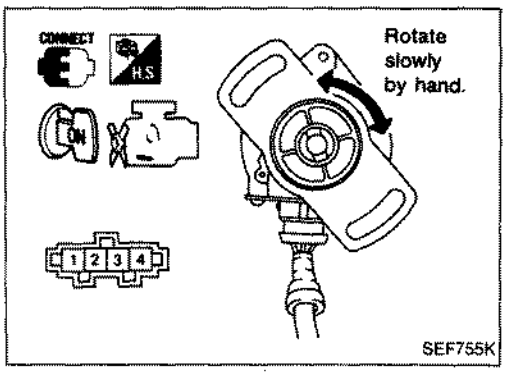
TER-MINAL NO.	ITEM	CONDITION	*DATA
101	Injector No. 1	Engine is running	BATTERY VOLTAGE (11 - 14V)
103	Injector No. 3		
110	Injector No. 2		
112	Injector No. 4		
104	Fuel pump relay	Ignition switch "ON" └For 5 seconds after turning ignition switch "ON" Engine is running.	Approximately 0V
		Ignition switch "ON" └5 seconds after turning ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
113	A.A.C. valve	Engine is running. └Idle speed	9 - 14V
		Engine is running. -Steering wheel is being turned. -Air conditioner is operating. -Rear defogger is "ON". └Headlamp are in high position.	5 - 9V

E.C.U. HARNESS CONNECTOR TERMINAL LAYOUT



SEF419H

Electrical Components Inspection (Cont'd)

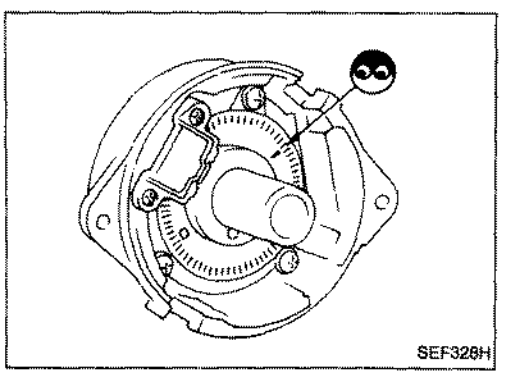


CRANK ANGLE SENSOR

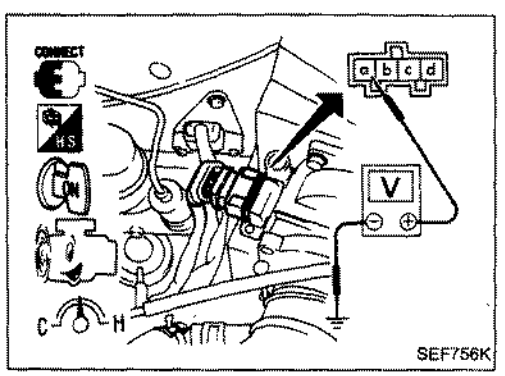
1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Disconnect ignition wires.
3. Turn ignition switch "ON".
4. Rotate distributor shaft slowly by hand and check voltage between terminals ②, ① and ground.

Terminal	Voltage
① (180° signal)	Tester's pointer fluctuates between 5V and 0V.
② (1° signal)	

If N.G., replace distributor assembly with crank angle sensor.



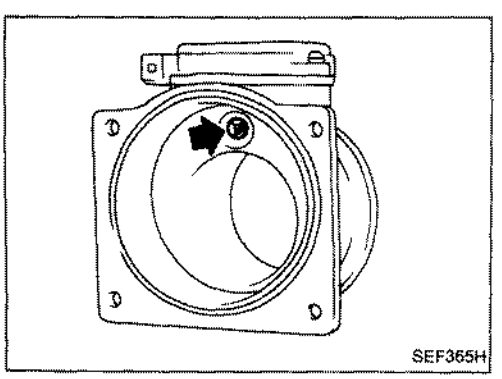
5. Visually check signal plate for damage or dust.



AIR FLOW METER

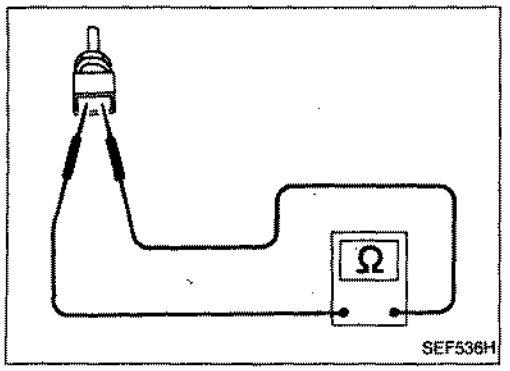
1. Peel air flow meter harness connector rubber as shown in the figure if the harness connector is connected.
2. Turn ignition switch "ON".
3. Start engine and warm it up sufficiently.
4. Check voltage between terminal ⓒ and ground.

Conditions	Voltage V
Ignition switch "ON" (Engine stopped.)	Less than 1.0
Idle (Engine is warm-up sufficiently.)	0.7 - 1.1



5. If N.G., remove air flow meter from air duct. Check hot wire for damage or dust.

Electrical Components Inspection (Cont'd)

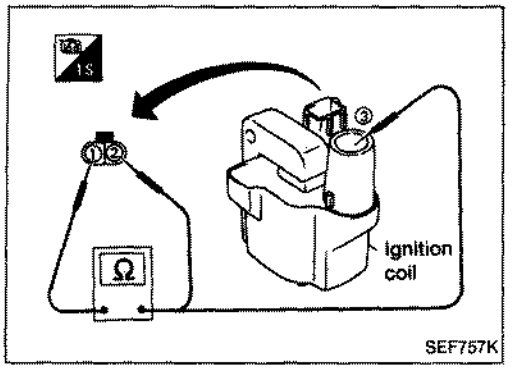


ENGINE TEMPERATURE SENSOR

1. Disconnect engine temperature sensor harness connector.
2. Check resistance as shown in the figure.

Temperature °C (°F)	Resistance kΩ
20 (68)	2.3 - 2.7
90 (194)	0.24 - 0.26
110 (230)	0.14 - 0.15

If N.G., replace engine temperature sensor.

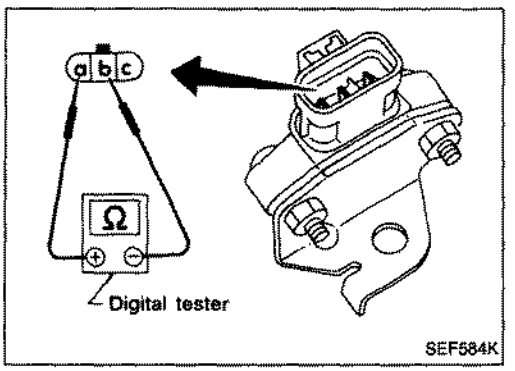


IGNITION COIL

1. Disconnect ignition coil harness connector.
2. Check resistance as shown in the figure.

Terminal	Resistance
① - ②	Approximately 0.9 Ω
① - ③	Approximately 13.0 kΩ

If N.G., replace ignition coil.



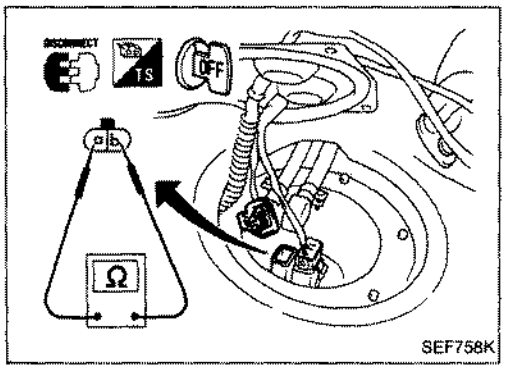
POWER TRANSISTOR

1. Disconnect power transistor harness connector.
2. Check power transistor continuity between terminals with a digital tester as shown in the figure.

⊖terminal side / ⊕terminal side	Terminal ⓐ		Terminal ⓑ		Terminal ⓒ	
	Resistance Ω	Result	Resistance Ω	Result	Resistance Ω	Result
Terminal ⓐ	—	—	∞	O.K.	∞	O.K.
	—	—	Not ∞ or 0	N.G.	Not ∞ or 0	N.G.
	—	—	0	N.G.	0	N.G.
Terminal ⓑ	∞	N.G.	—	—	∞	N.G.
	Not ∞ or 0	O.K.	—	—	Not ∞ or 0	O.K.
	0	N.G.	—	—	0	N.G.
Terminal ⓒ	∞	N.G.	∞	N.G.	—	—
	Not ∞ or 0	O.K.	Not ∞ or 0	O.K.	—	—
	0	N.G.	0	N.G.	—	—

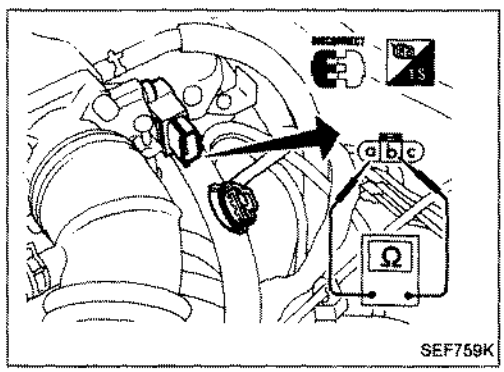
If N.G., replace power transistor.

Electrical Components Inspection (Cont'd)



FUEL PUMP

1. Disconnect fuel pump harness connector.
2. Check resistance between terminals ⓐ and ⓑ.
   Resistance: Approximately 0.7Ω
   If N.G., replace fuel pump.



THROTTLE SENSOR

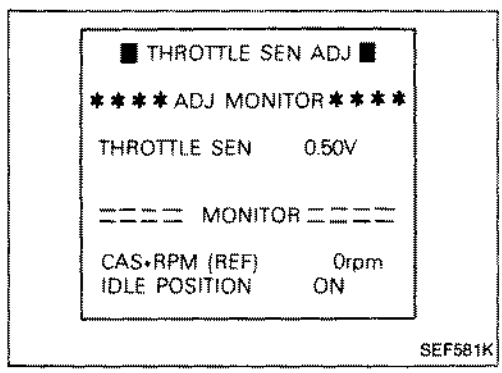
1. Disconnect throttle sensor harness connector.
2. Make sure that resistance between terminals ⓐ and ⓑ changes when opening throttle valve manually.

Accelerator pedal conditions	Resistance kΩ
Completely released	Approximately 0.5
Partially released	0.5 - 4
Completely depressed	Approximately 4

If N.G., replace throttle sensor.

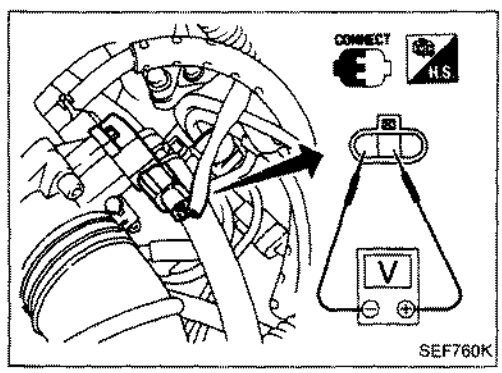
Adjustment

If throttle sensor is replaced or removed, it is necessary to install in proper position, by following the procedure as shown below:



1. Install throttle sensor body in throttle chamber. Do not tighten bolts. Leave bolts loose.
2. Connect throttle sensor and idle switch harness connector.
3. Start engine and warm it up sufficiently.
4. Perform "THROTTLE SEN ADJ" in "WORK SUPPORT" mode.

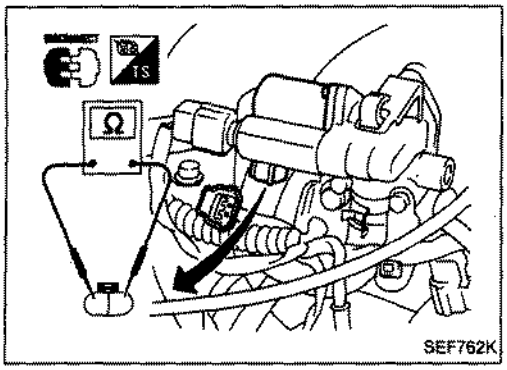
   Measure output voltage of throttle sensor using voltmeter.



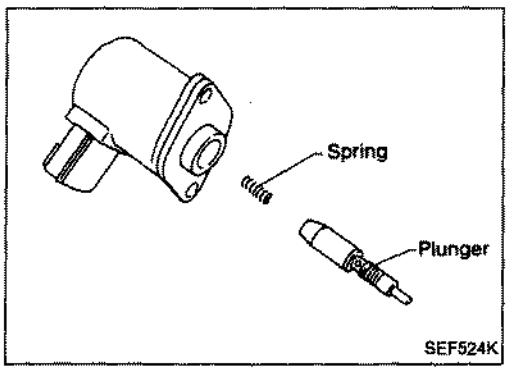
5. Adjust by rotating throttle sensor body so that output voltage is 0.45 to 0.55V.
6. Tighten mounting bolts.
7. Disconnect throttle sensor harness connector for a few seconds and then reconnect it.

Electrical Components Inspection (Cont'd)

A.A.C. VALVE

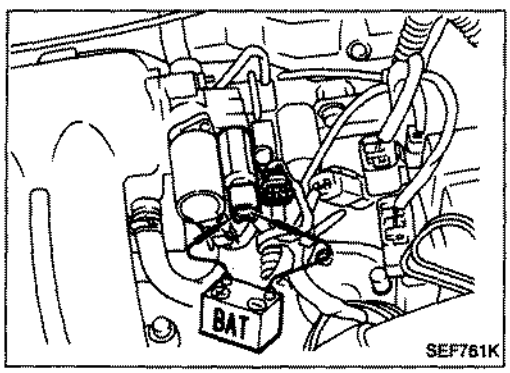


- Check A.A.C. valve resistance.
  Resistance:
  Approximately 10Ω

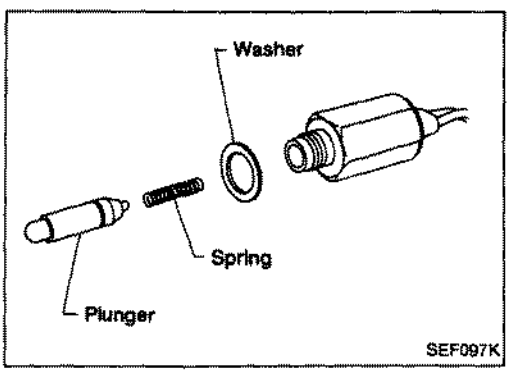


- Check plunger for seizing or sticking.
- Check for broken spring.

F.I.C.D. SOLENOID VALVE

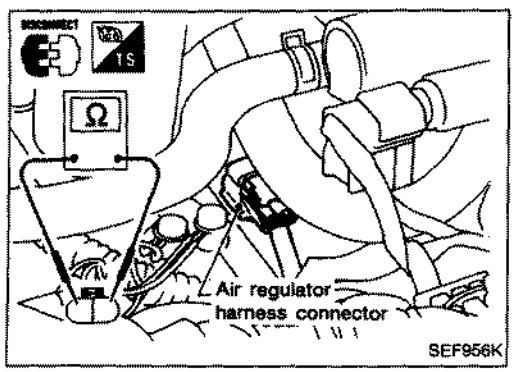


- Check for clicking sound when applying 12V direct current to terminals.



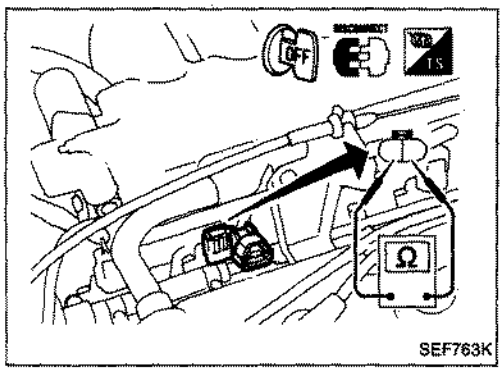
- Check plunger for seizing or sticking.
- Check for broken spring.

AIR REGULATOR



- Check air regulator resistance.
  Resistance:
  Approximately 70 - 80Ω
- Check air regulator for clogging.

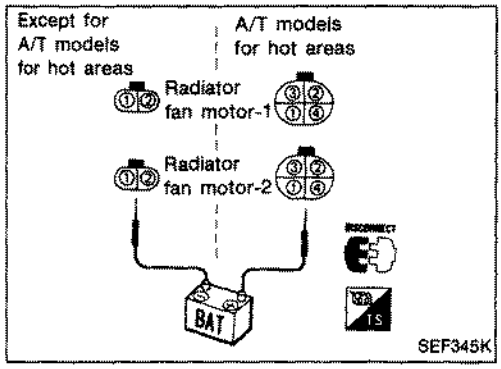
Electrical Components Inspection (Cont'd)



INJECTOR

1. Disconnect injector harness connector.
2. Check resistance between terminals as shown in the figure.
   Resistance: Approximately 10Ω

If N.G., replace injector.

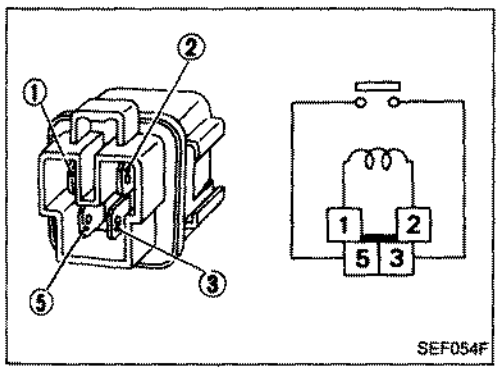


RADIATOR FAN MOTOR

Disconnect radiator fan motor harness connectors and supply radiator fan motor terminals with battery voltage.

Supply battery voltage		Radiator fan operation	Remarks
⊕	⊖		
②	①	Low speed	A/T models for hot areas
②	①	Low speed	Except for above
② ③	① ④	High speed	

If N.G., replace radiator fan motor.

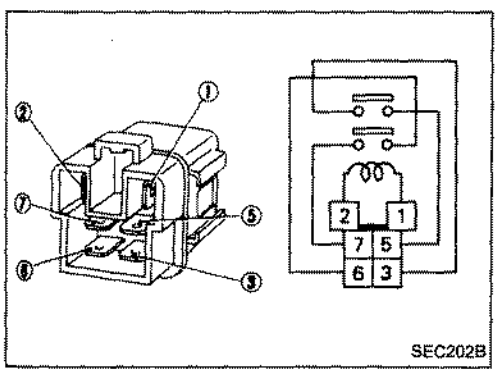


E.C.C.S. RELAY, RADIATOR FAN RELAY-1 AND FUEL PUMP RELAY

Check continuity between terminals ③ and ⑤.

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

If N.G., replace relay.



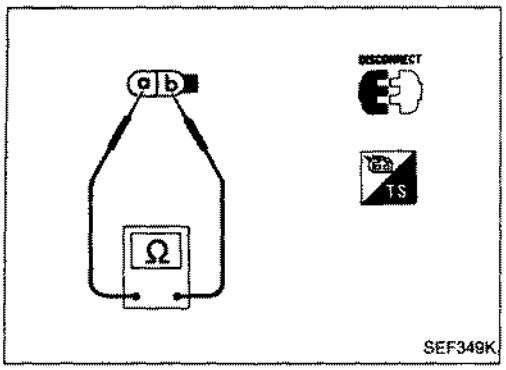
RADIATOR FAN RELAY-2

Check continuity between terminals ③ and ⑤, ⑥ and ⑦.

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

If N.G., replace relay.

Electrical Components Inspection (Cont'd)

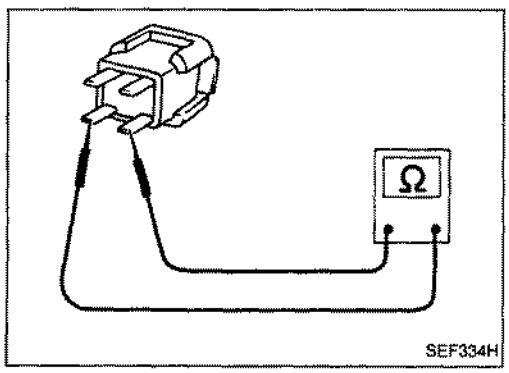


NEUTRAL SWITCH

Check continuity between terminals ⓐ and ⓑ.

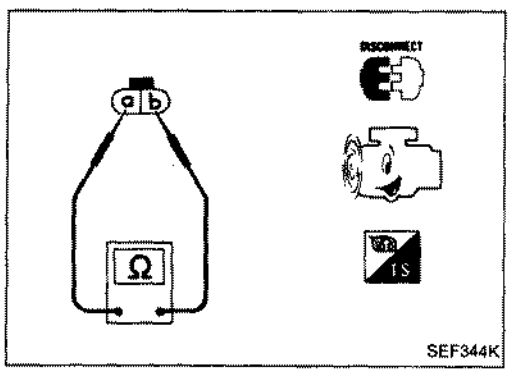
Conditions	Continuity
Shift to Neutral	Yes
Shift to other position	No

If N.G., replace relay.



RESISTOR

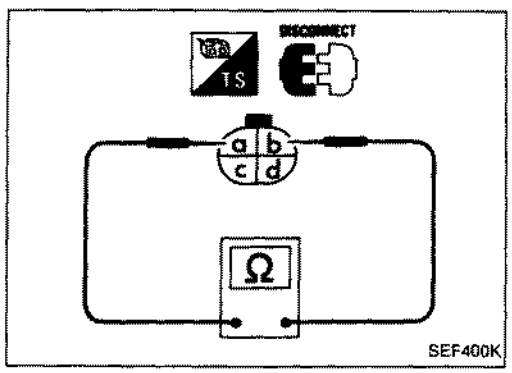
1. Disconnect resistor harness connector.
2. Check resistance between terminals ⓐ and ⓑ.
   Resistance: Approximately 2.2kΩ
   If N.G., replace resistor.



POWER STEERING OIL PRESSURE SWITCH

1. Disconnect power steering oil pressure switch harness connector.
2. Start engine.
3. Check continuity between terminals ⓐ and ⓑ.

Conditions	Continuity
Steering wheel is being turned	Yes
Steering wheel is not being turned	No

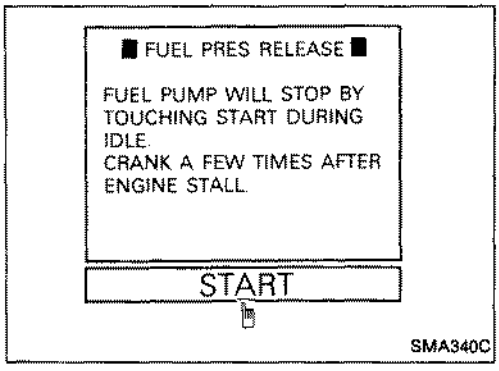


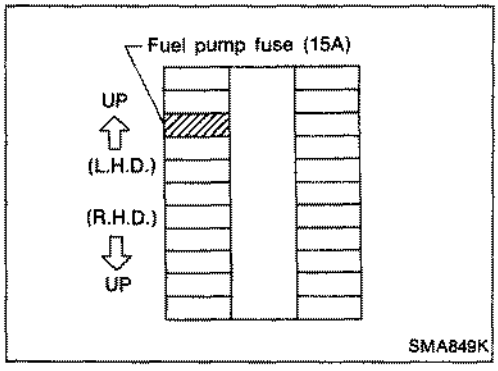
INHIBITOR SWITCH

Check continuity between terminals ⓐ and ⓑ.

Conditions	Continuity
Shift to "P" position	Yes
Shift to "N" position	Yes
Shift to position other than "P" and "N"	No

If N.G., replace inhibitor switch.





Releasing Fuel Pressure

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

1. Turn ignition switch "ON".
2. Perform "FUEL PRESSURE RELEASE" in "WORK SUPPORT" mode with CONSULT.
3. Start engine.
4. After engine stalls, crank it two or three times to release all fuel pressure.
5. Turn ignition switch off.

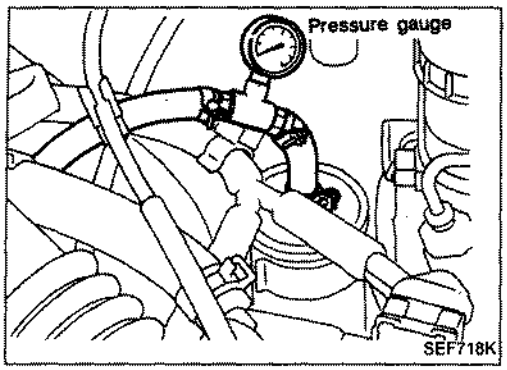
1. Remove fuse for fuel pump.
2. Start engine.
3. After engine stalls, crank it two or three times to release all fuel pressure.
4. Turn ignition switch off and reconnect fuel pump relay.

Fuel Pressure Check

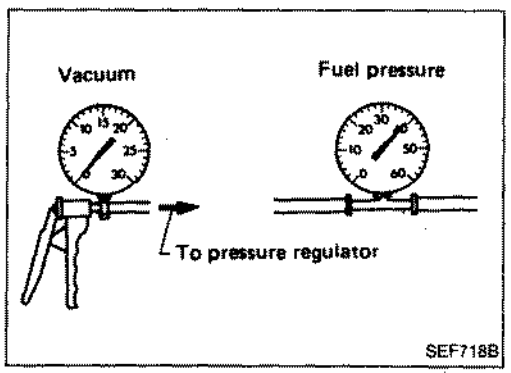
a. When reconnecting fuel line, always use new clamps.
b. Make sure that clamp screw does not contact adjacent parts.
c. Use a torque driver to tighten clamps.
d. Use Pressure Gauge to check fuel pressure.
e. Do not perform fuel pressure check while fuel pressure regulator control system is operating; 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.

Fuel Pressure Check (Cont'd)



5. Read the indication of fuel pressure gauge.
   At idling:
   When fuel pressure regulator valve vacuum hose is connected.
   Approximately 245 kPa (2.45 bar, 2.5 kg/cm^2, 36 psi)
   When fuel pressure regulator valve vacuum hose is disconnected.
   Approximately 294 kPa (2.94 bar, 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.

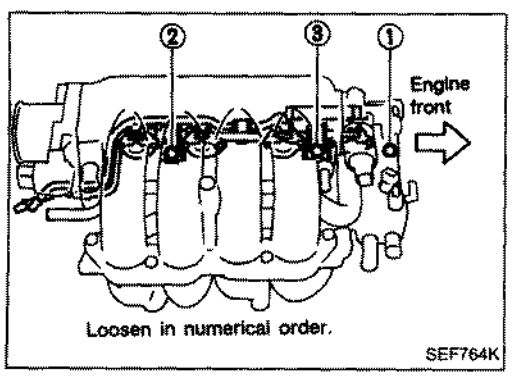


9. Start engine and read indication of fuel pressure gauge as vacuum is changed.

Fuel pressure should decrease as vacuum increases. If results are unsatisfactory, replace fuel pressure regulator.

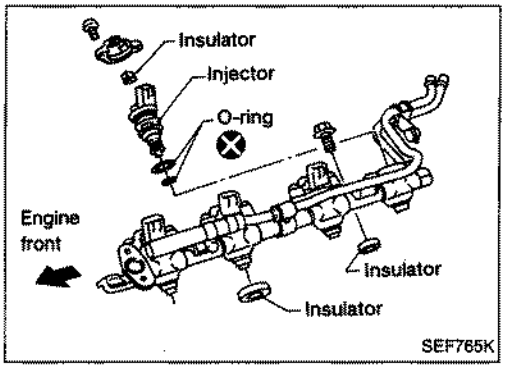
Injector Removal and Installation

1. Release fuel pressure to zero.
2. Disconnect injector harness connectors.
3. Disconnect vacuum hose from pressure regulator.
4. Disconnect fuel hoses from fuel tube assembly.



5. Remove injectors with fuel tube assembly.

Injector Removal and Installation (Cont'd)

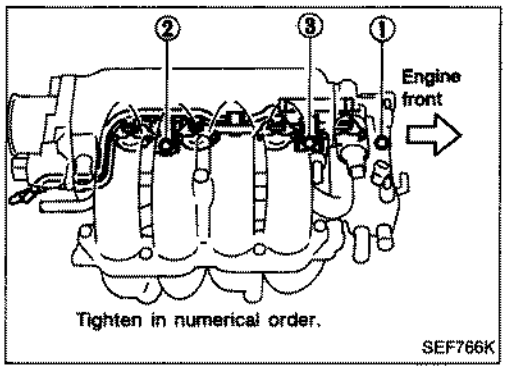


6. Push out any malfunctioning injector from fuel tube assembly.

Do not extract injector by pinching connector.

7. Replace or clean injector as necessary.
8. Install injector to fuel tube assembly.

Always replace O-rings and insulators with new ones.
Lubricate O-rings with a smear of silicone oil.



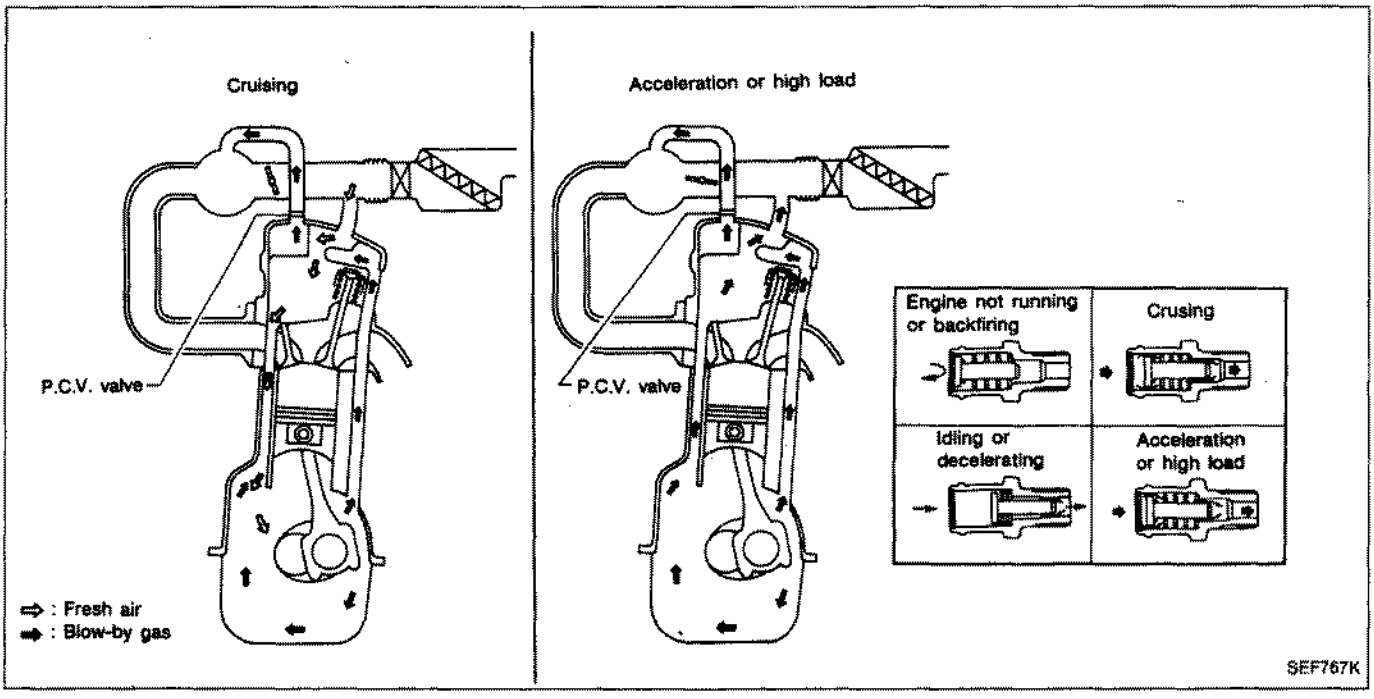
9. Install injectors with fuel tube assembly to intake manifold. Tighten fuel tube bolts to the specified torque.
   Tightening procedure:
   1) **Tighten all bolts to 9.3 to 10.8 N·m (0.95 to 1.1 kg-m, 6.9 to 8.0 ft-lb).**
   2) **Tighten all bolts to 16 to 21 N·m (1.6 to 2.1 kg-m, 12 - 15 ft-lb).**
10. Install fuel tubes to fuel tube assembly.

Lubricate fuel tubes with a smear of silicone oil.

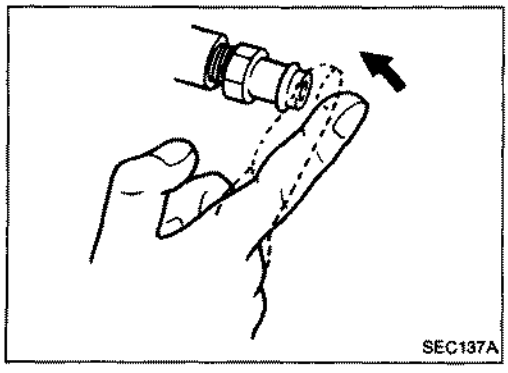
11. Reinstall any parts removed in reverse order of removal.

CAUTION:
After properly connecting fuel hose to injector and fuel tube assembly, check connection for fuel leakage.

Description



This system returns blow-by gas to both the intake manifold and air inlet tubes.
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 inlet tubes, through the hose connecting air inlet tubes 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 inlet tubes under all conditions.

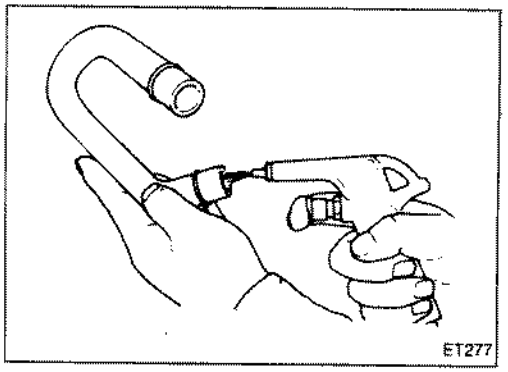


Inspection

P.C.V. (Positive Crankcase Ventilation)

With engine running at idle, remove ventilation hose from P.C.V. valve; if the 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.

Inspection (Cont'd)



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.

Engine Fuel & Emission Control System

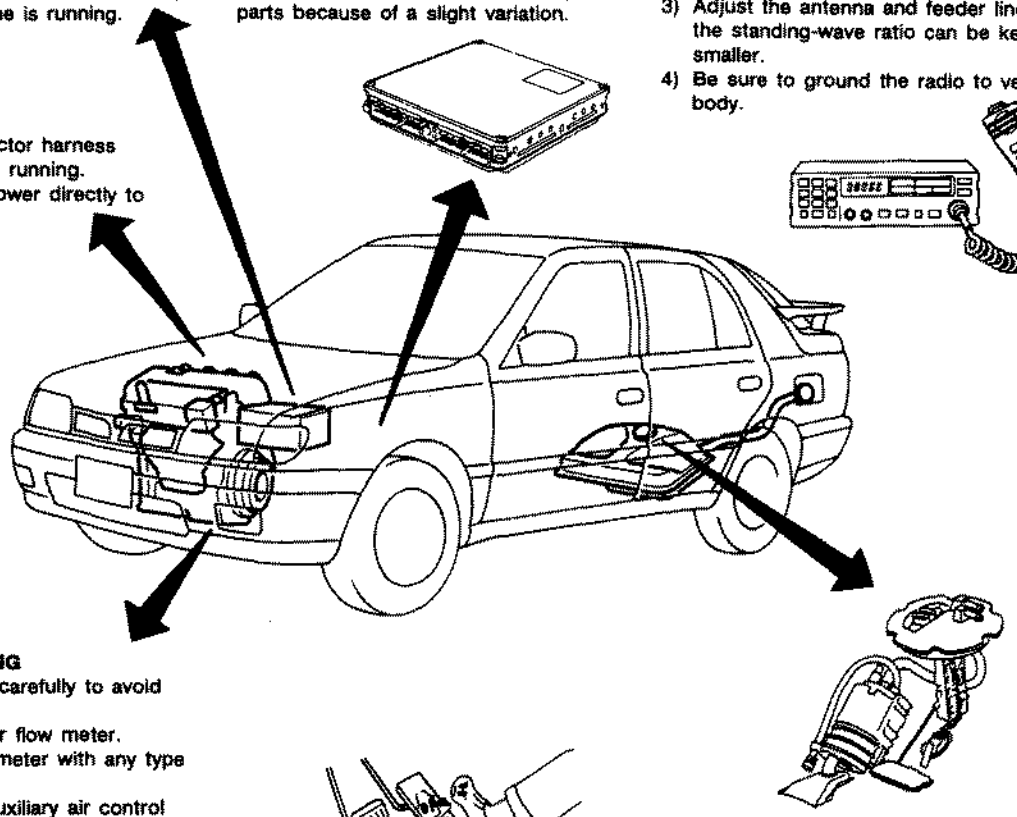
BATTERY
- Always use a 12 volt battery as power source.
- Do not attempt to disconnect battery cables while engine is running.

INJECTOR
- Do not disconnect injector harness connectors with engine running.
- Do not apply battery power directly to injectors.

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.

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

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



E.C.C.S. PARTS HANDLING
- Handle air flow meter carefully to avoid damage.
- Do not disassemble air flow meter.
- Do not clean air flow meter with any type of detergent.
- Do not disassemble auxiliary air control valve.
- Even a slight leak in the air intake system can cause serious problems.
- Do not shock or jar the crank angle sensor.

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.

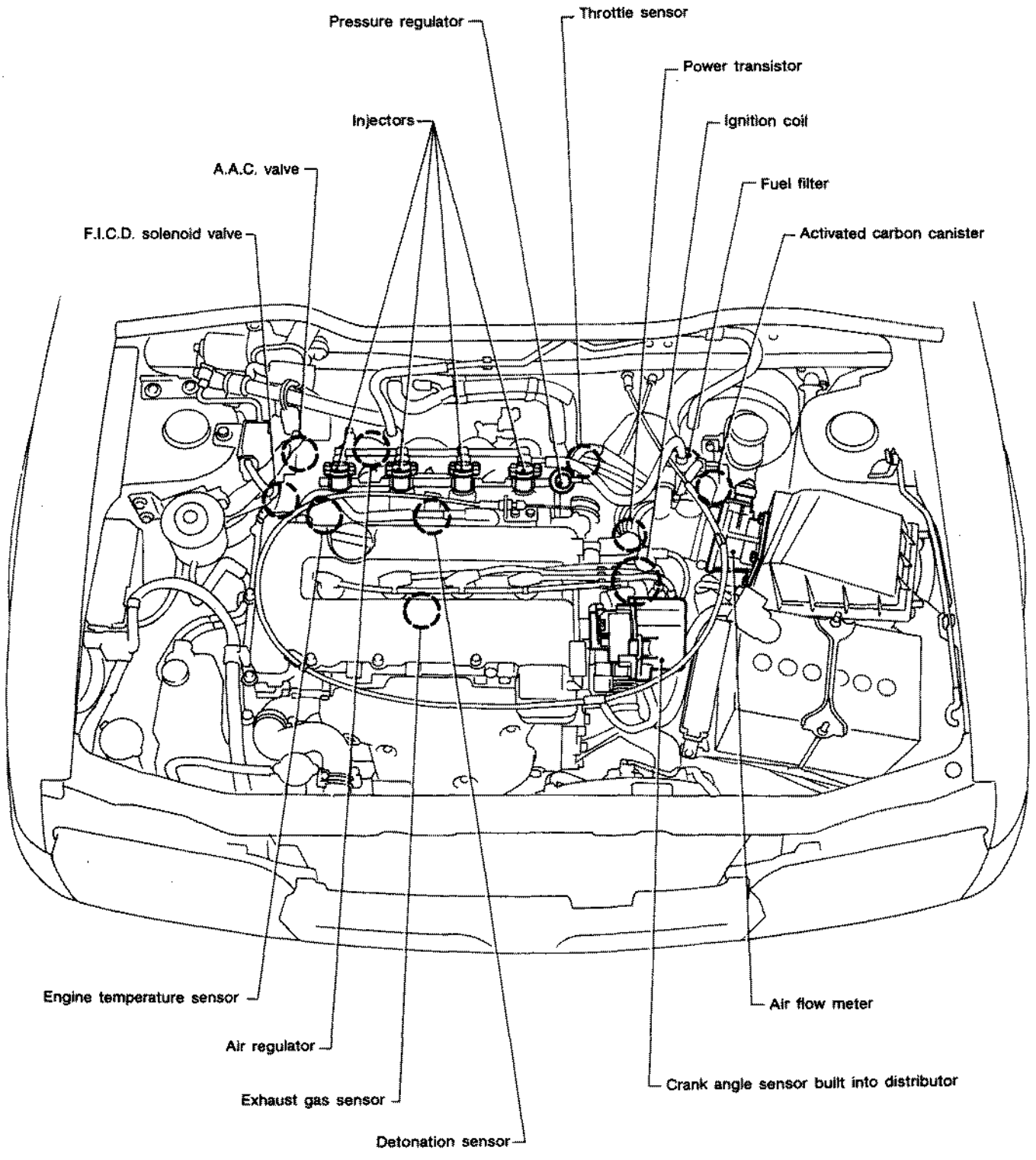
FUEL PUMP
- Do not operate fuel pump when there is no fuel in lines.
- Tighten fuel hose clamps to the specified torque.

E.C.C.S. HARNESS HANDLING
- Securely connect E.C.C.S. harness connectors.
  A poor connection can cause an extremely high (surge) voltage to develop in coil and condenser, thus resulting in damage to ICs.
- Keep E.C.C.S. harness at least 10 cm (3.9 in) away from adjacent harnesses, to prevent an E.C.C.S. system malfunction due to receiving external noise, degraded operation of ICs, etc.
- Keep E.C.C.S. parts and harnesses dry.
- Before removing parts, turn off ignition switch and then disconnect battery ground cable.

SEF315L

E.C.C.S. Component Parts Location

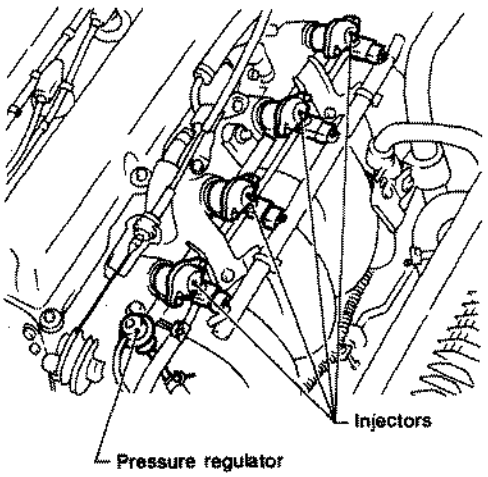
SR20DE

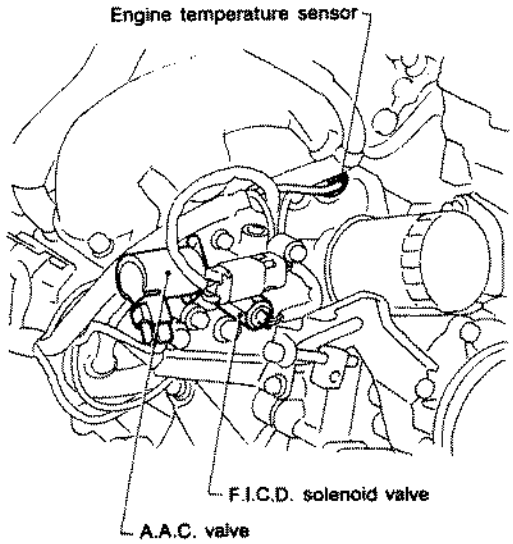


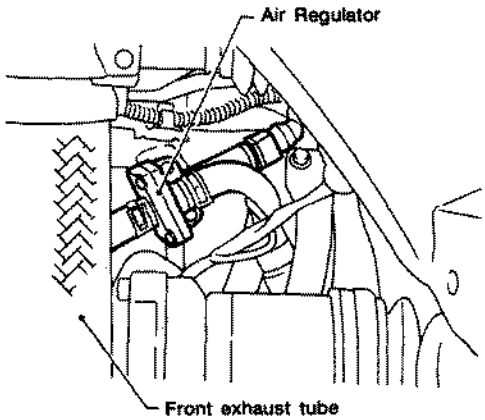
SEF270L

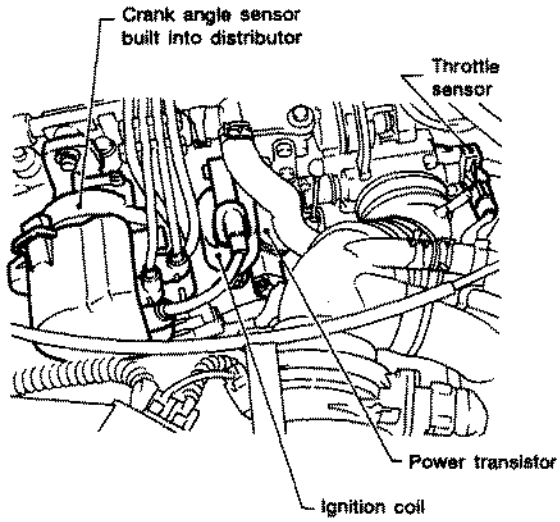
E.C.C.S. Component Parts Location (Cont'd)

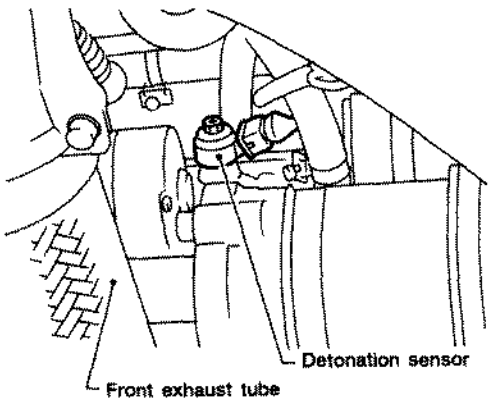
SR20DE

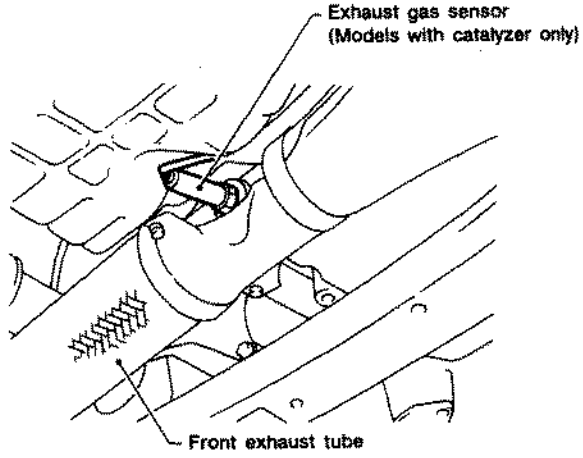








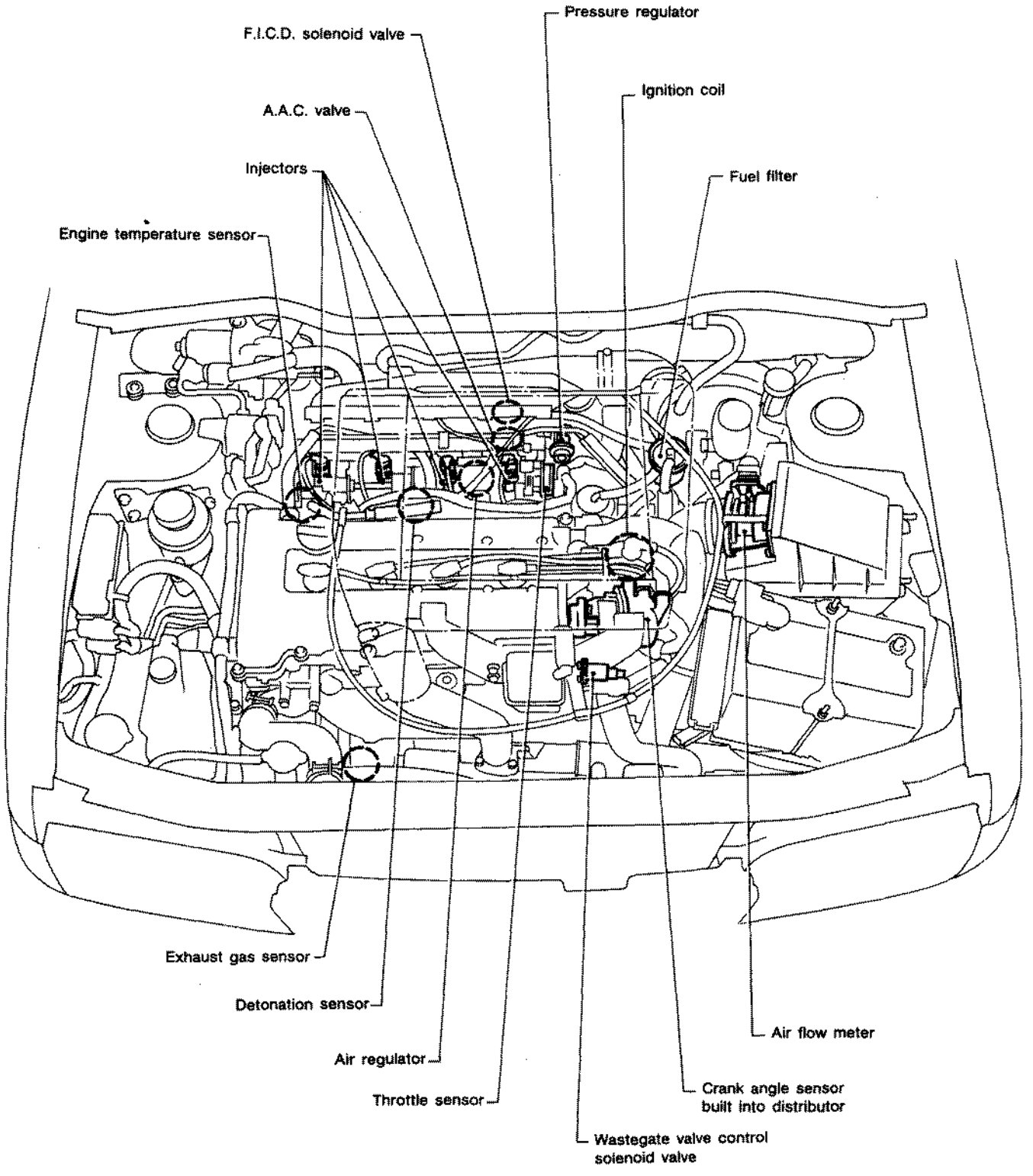




SEF271L

E.C.C.S. Component Parts Location (Cont'd)

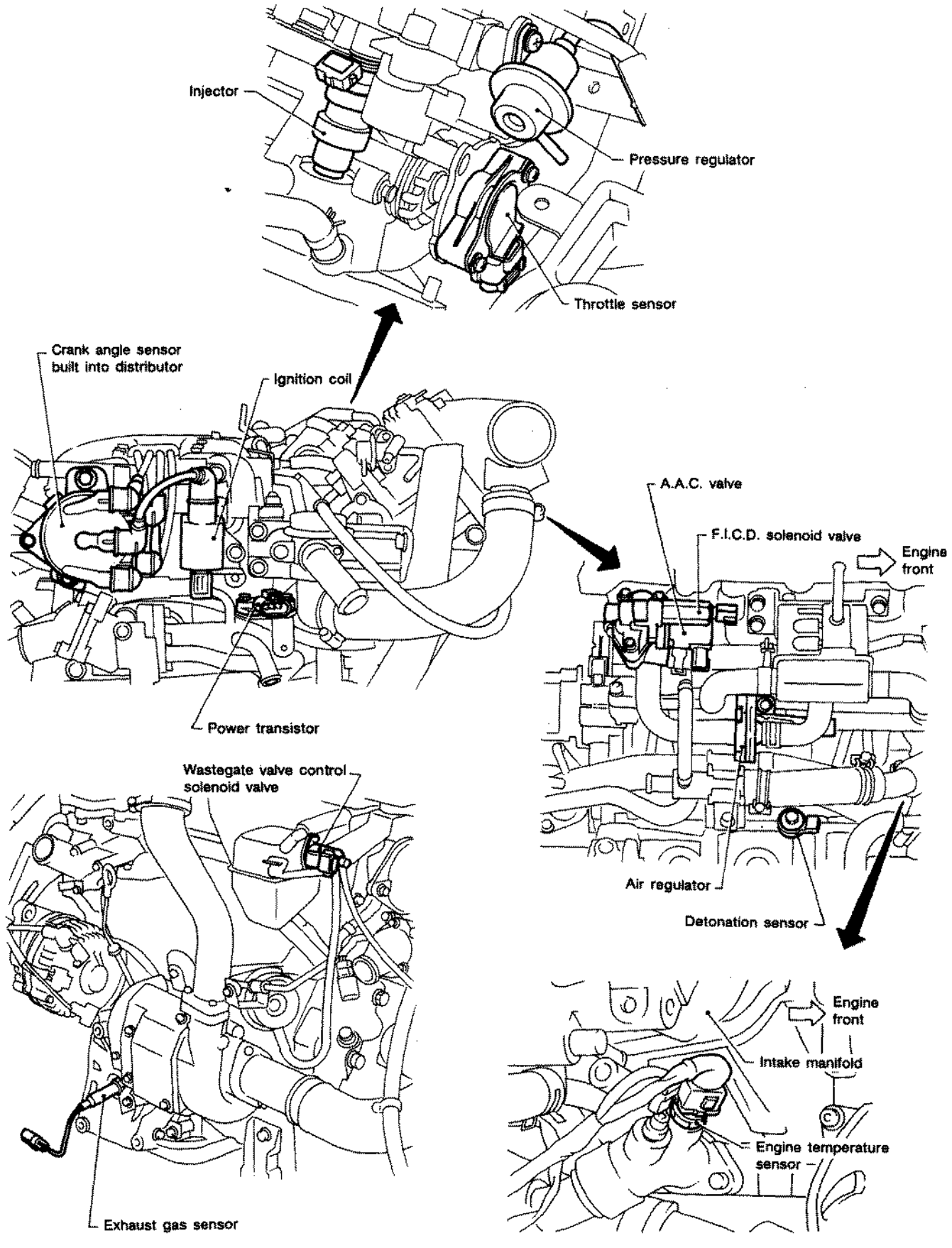
SR20DET



SEF258L

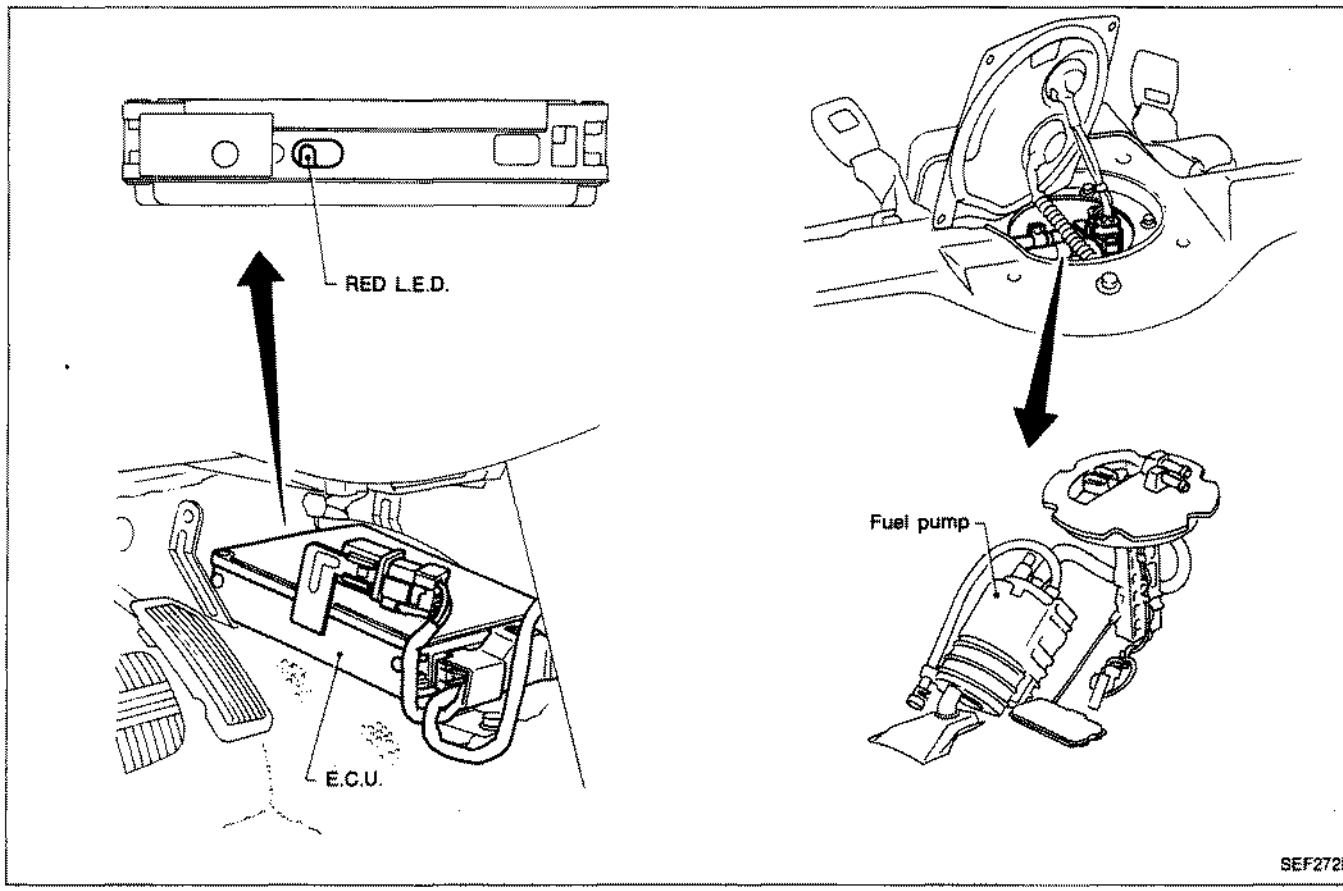
E.C.C.S. Component Parts Location (Cont'd)

SR20DET



SEF259L

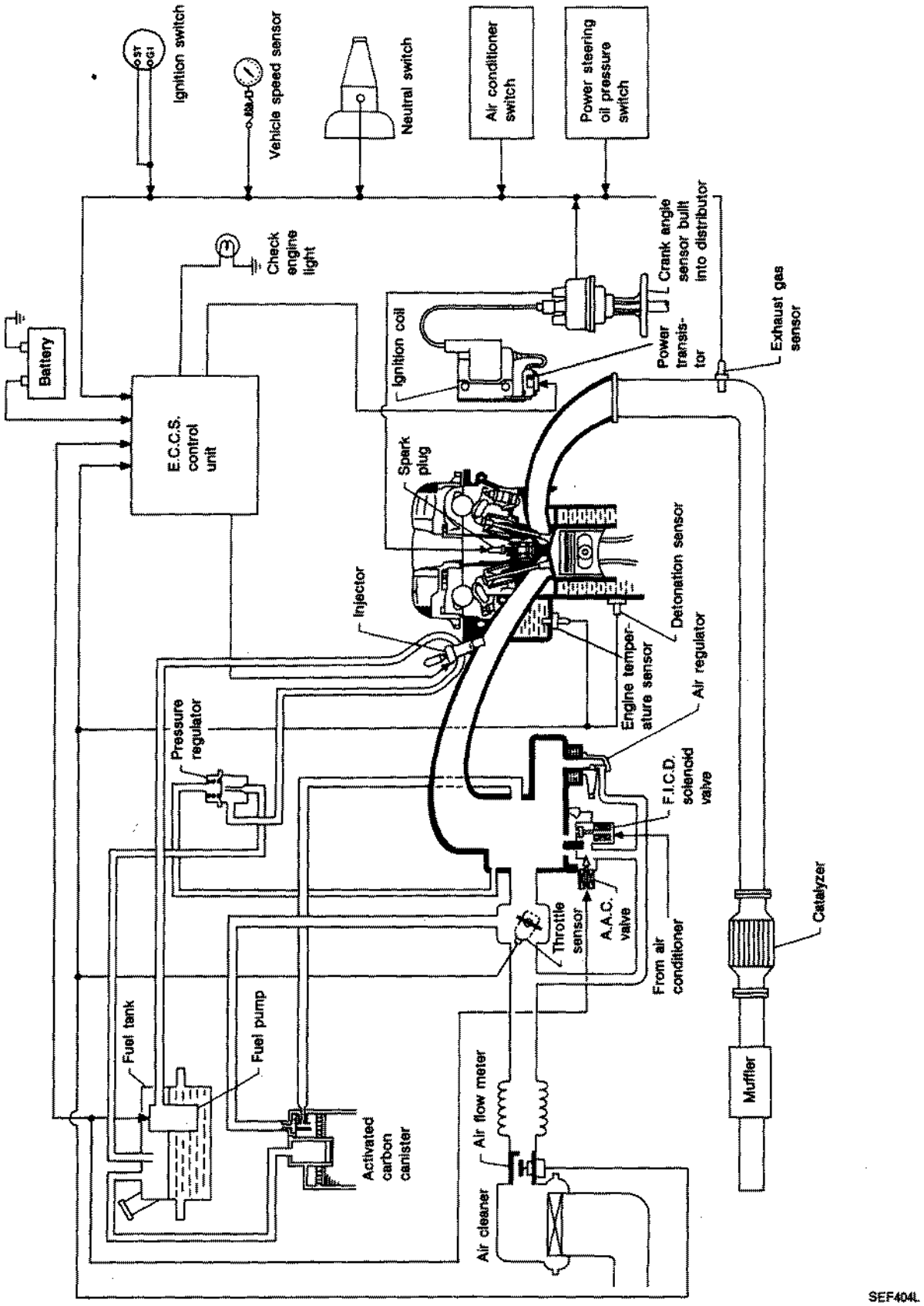
E.C.C.S. Component Parts Location (Cont'd)



System Diagram

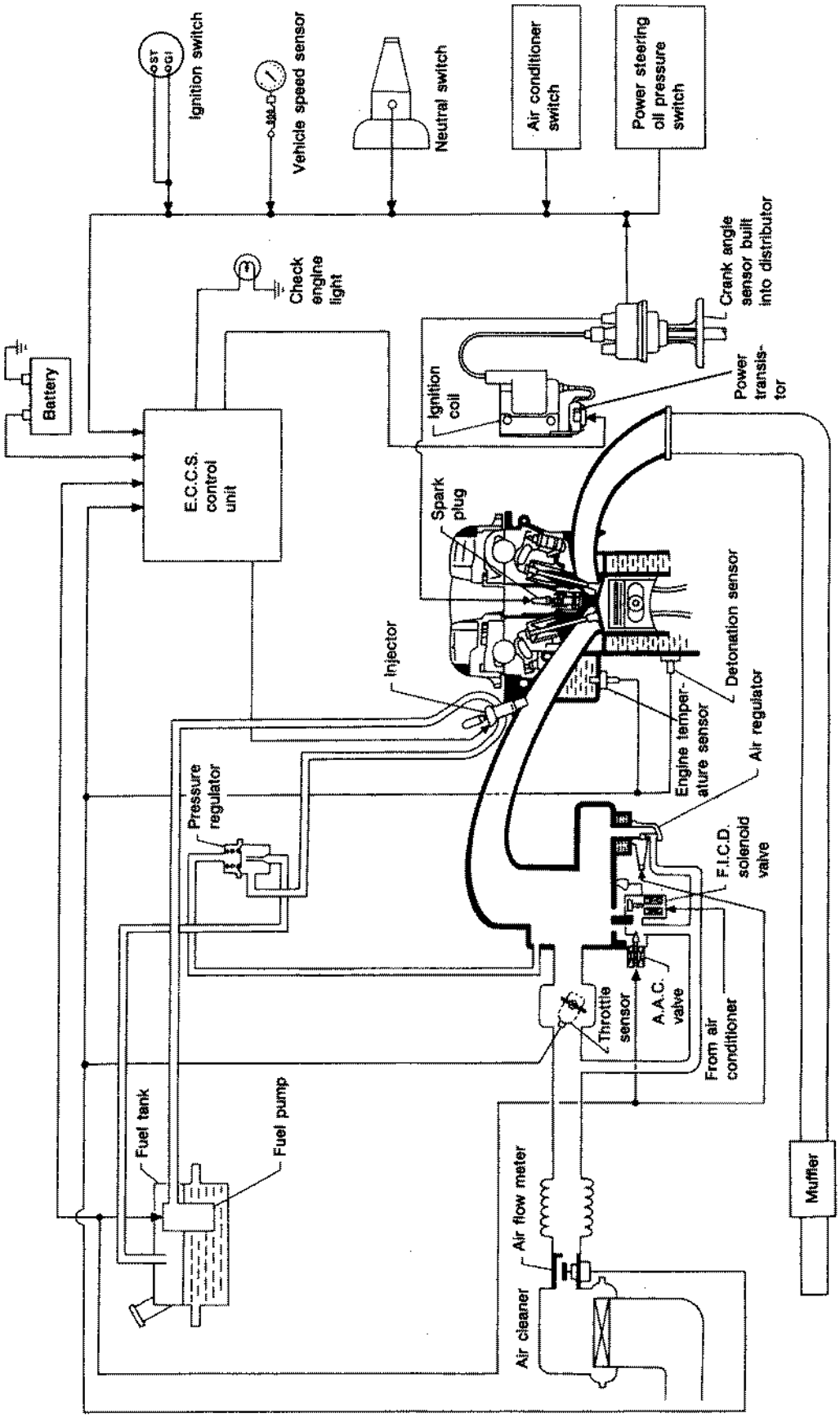
SR20DE

Models with catalyzer



System Diagram (Cont'd)

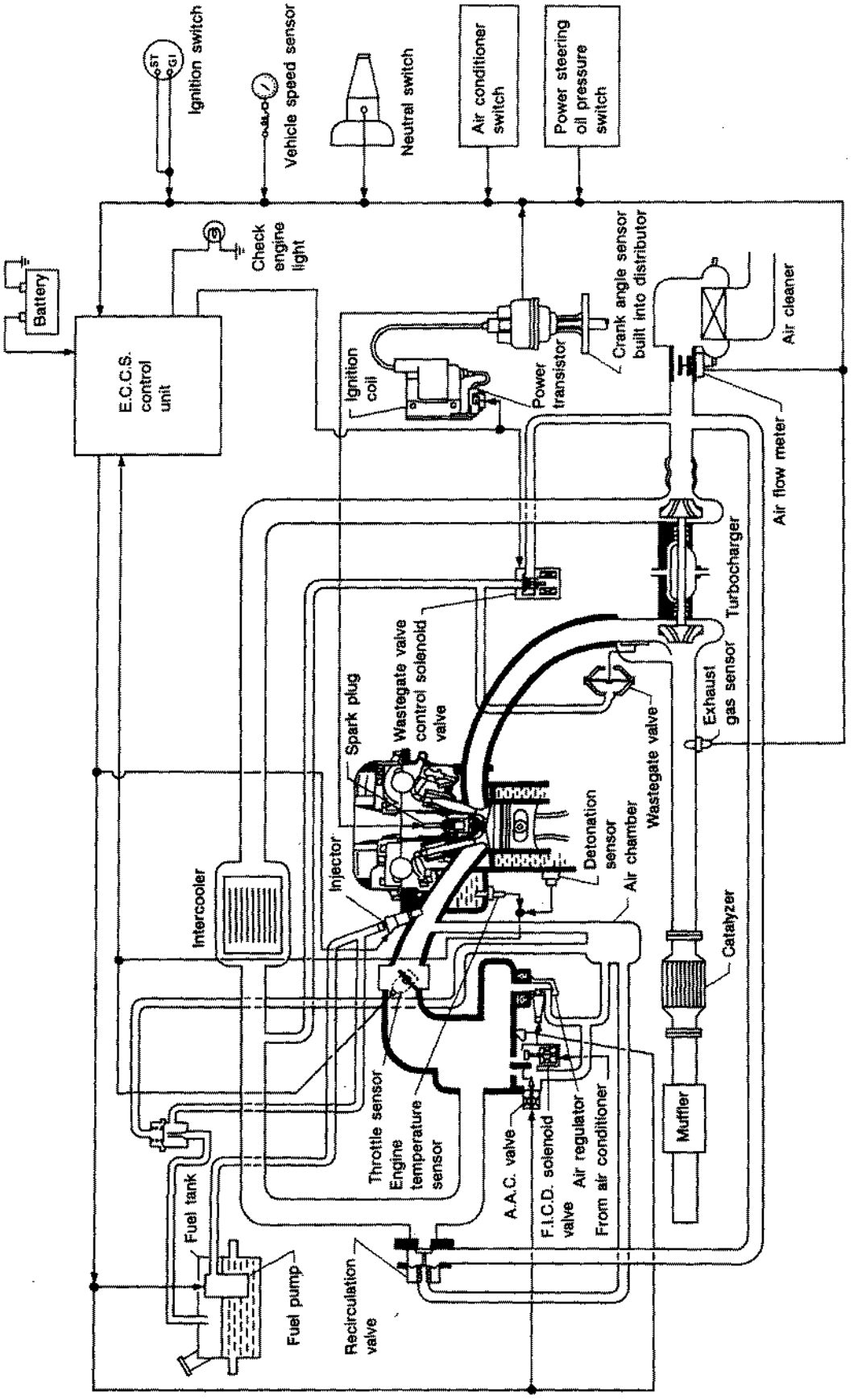
Models without catalyzer



SEF405L

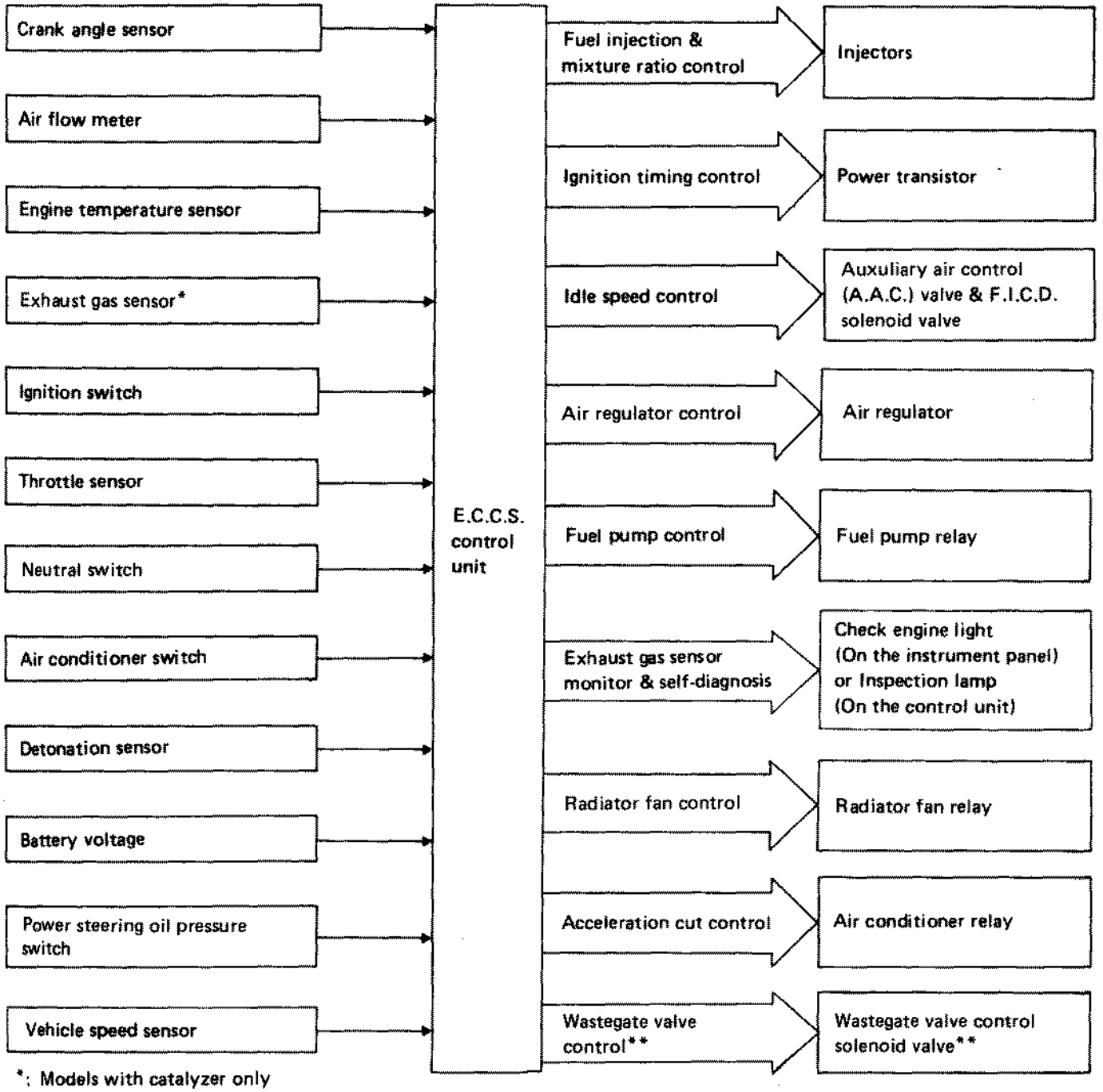
System Diagram (Cont'd)

SR20DET



SEF288L

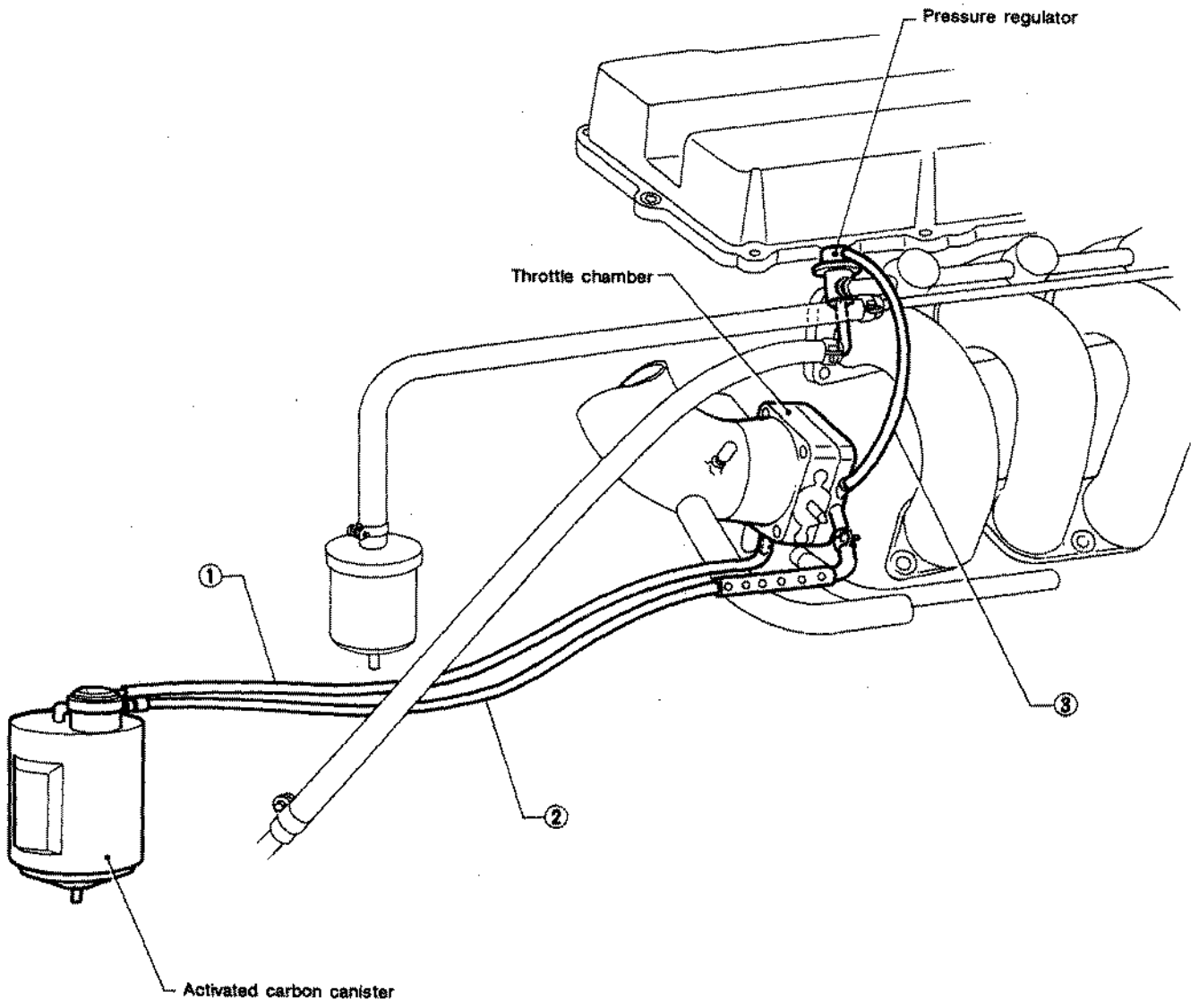
System Chart



*: Models with catalyzer only
**: Models with turbocharger only

Vacuum Hose Drawing

SR20DE



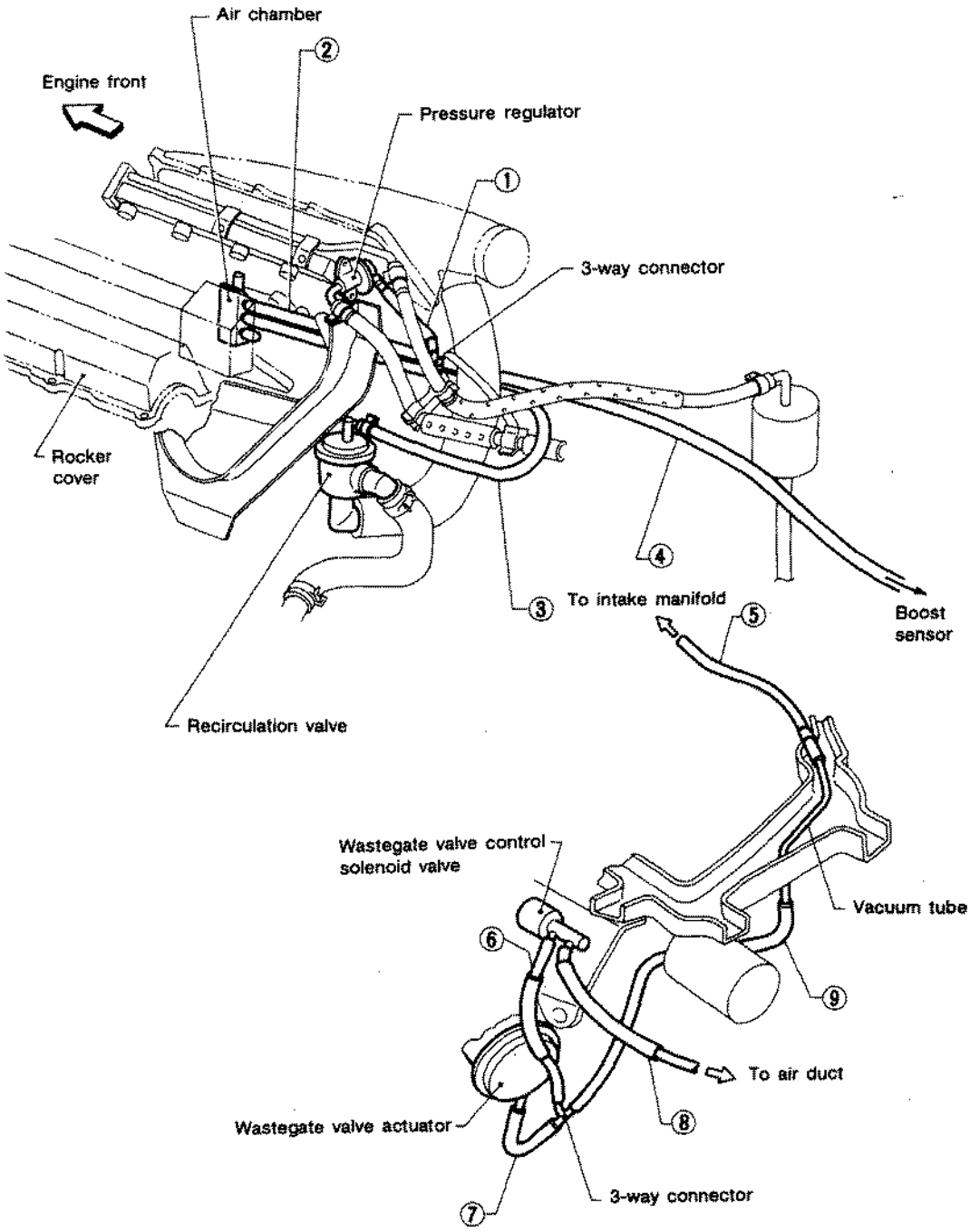
	Models with catalyzer	Models without catalyzer
① Activated carbon canister (vacuum port) to throttle chamber	X	–
② Activated carbon canister (purge port) to intake manifold	X	–
③ Pressure regulator to intake manifold collector	X	X

X: Applicable

SEF260L

Vacuum Hose Drawing (Cont'd)

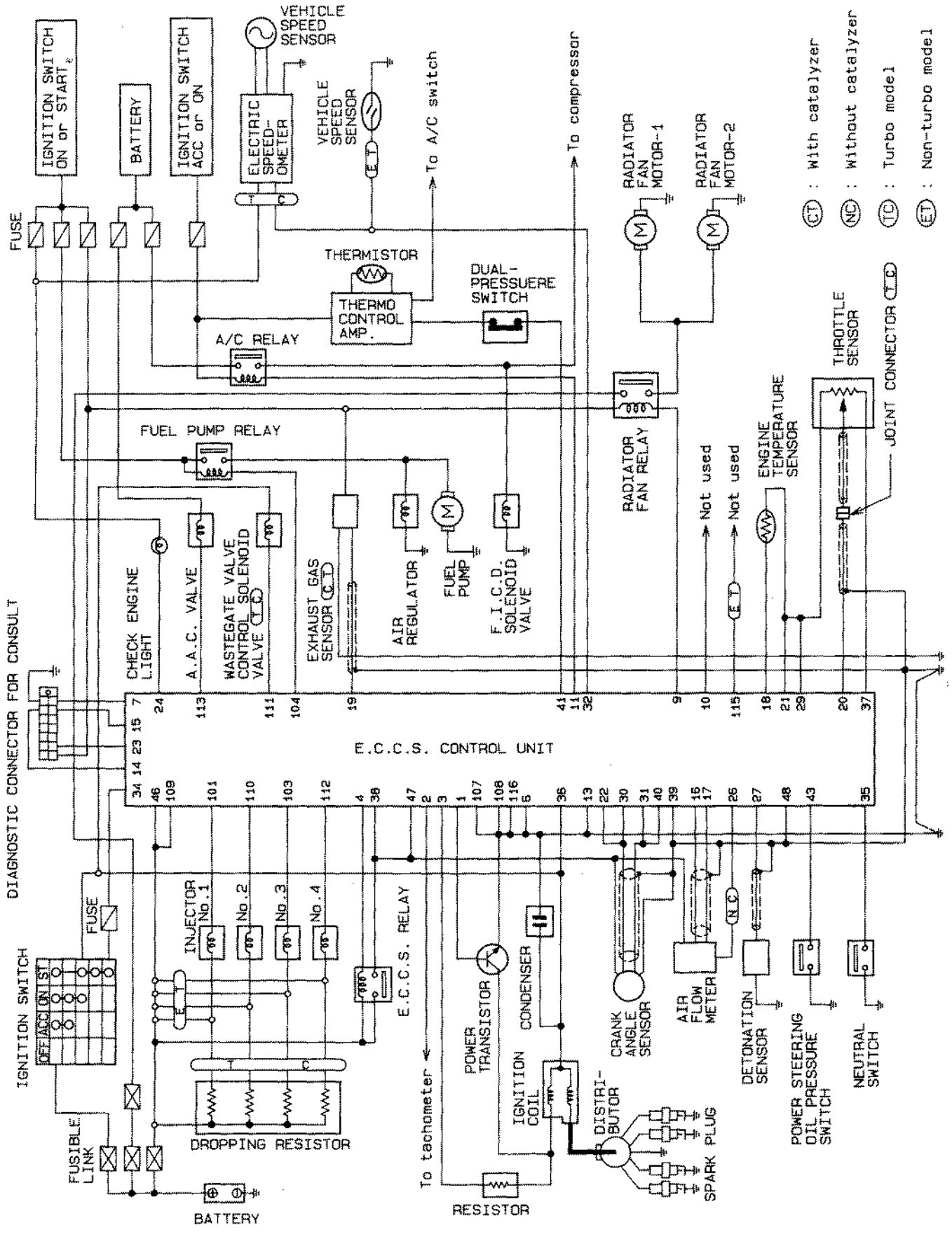
SR20DET



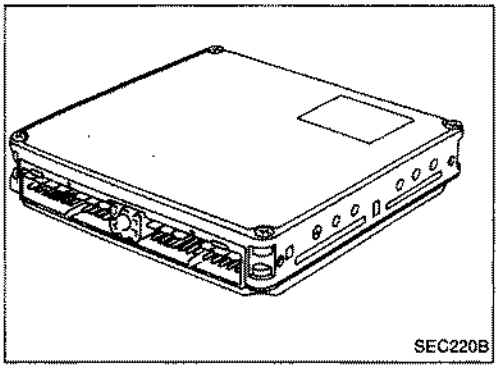
SEF261L

① Pressure regulator to 3-way connector
② Air chamber to 3-way connector
③ Air chamber to recirculation valve
④ 3-way connector to boost sensor
⑤ Intake manifold to vacuum tube
⑥ Wastegate valve control solenoid valve to 3-way connector
⑦ Wastegate valve actuator to 3-way connector
⑧ Wastegate valve control solenoid valve to air duct
⑨ Vacuum tube to 3-way connector

Circuit Diagram

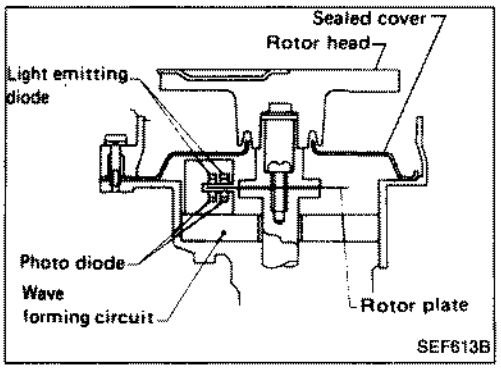


SEF430L


SEC220B

E.C.C.S. Control Unit (E.C.U.)

The E.C.U. consists of a microcomputer, inspection lamp, a diagnostic mode selector, and connectors for signal input and output and for power supply. The unit controls the engine.

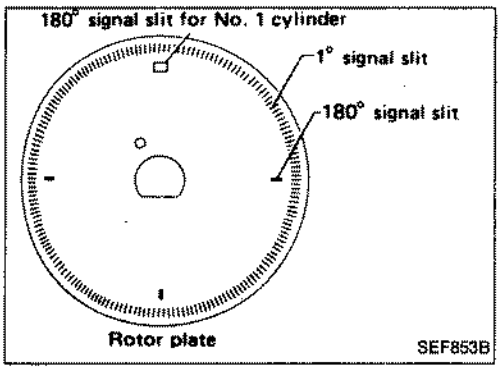


SEF613B

Crank Angle Sensor

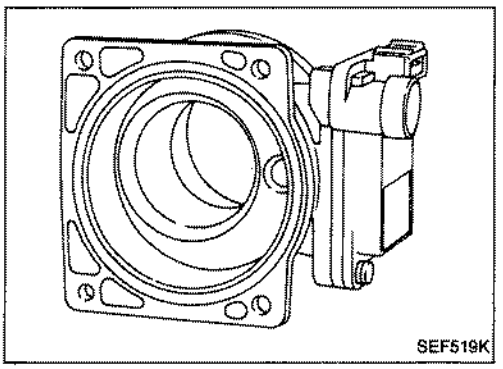
The crank angle sensor is a basic component of the entire E.C.C.S. It monitors engine speed and piston position, and sends signals to the E.C.U. to control fuel injection, ignition timing and other functions.

The crank angle sensor has a rotor plate and a wave-forming circuit. The rotor plate has 360 slits for 1° signal and 4 slits for 180° signal. Light Emitting Diodes (L.E.D.) and photo diodes are built in the wave-forming circuit.



SEF853B

When the rotor plate passes between the L.E.D. and the photo diode, the slits in the rotor plate continually cut the light being transmitted to the photo diode from the L.E.D. This generates rough-shaped pulses which are converted into on-off pulses by the wave-forming circuit, which are sent to the E.C.U.

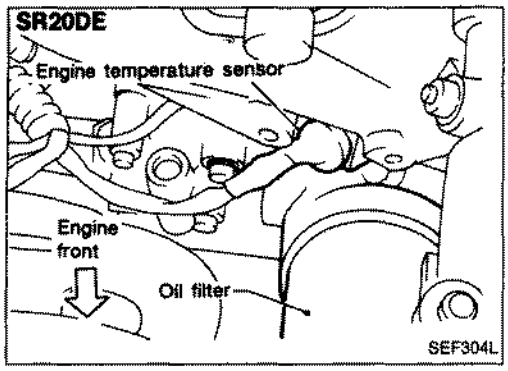

SEF519K

Air Flow Meter

The air flow meter measures the intake air flow rate by taking a part of the entire flow. Measurements are made in such a manner that the E.C.U. receives electrical output signals varied by the amount of heat emitting from the hot wire placed in the stream of the intake air.

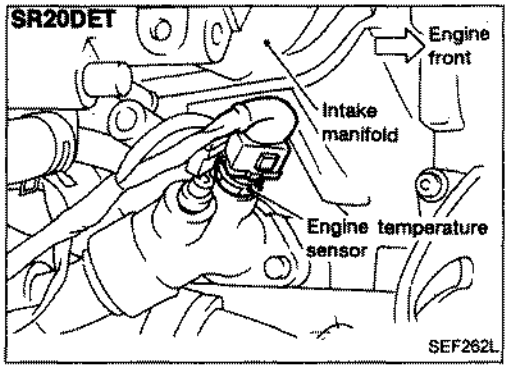
When intake air flows into the intake manifold through a route around the hot wire, some of the heat generated from the hot wire is taken away by the air. The amount of heat lost depends on the air flow velocity. However, the temperature of the hot wire is automatically controlled within a certain number of degrees.

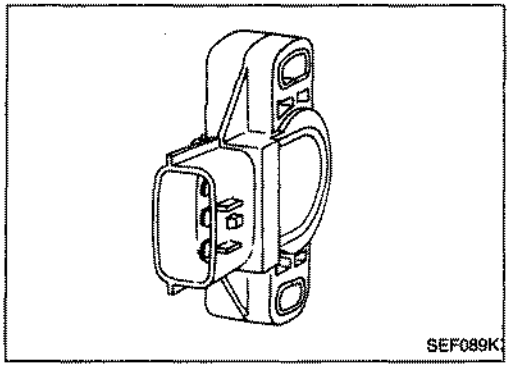
Therefore, it is necessary to supply the hot wire with more electric current in order to maintain the temperature of the hot wire. The E.C.U. then knows the air flow velocity by means of the electric change.



Engine Temperature Sensor

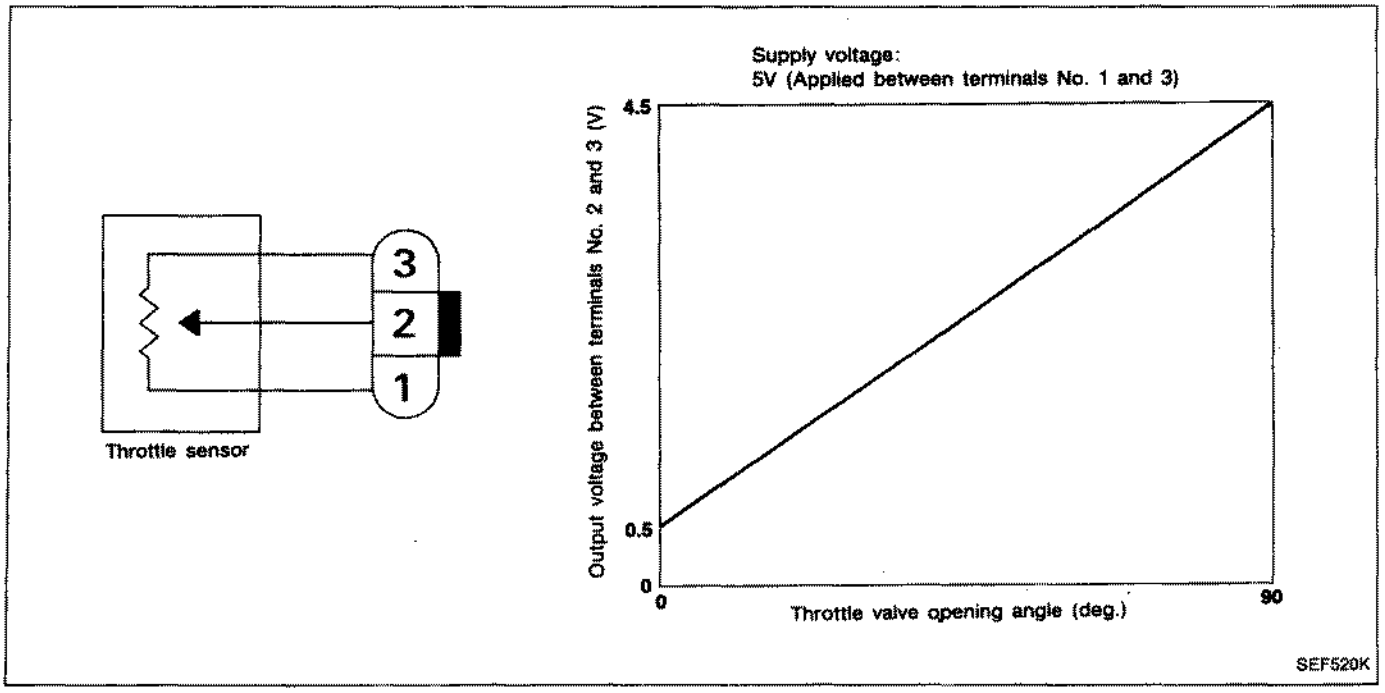
The engine temperature sensor, located behind the oil filter, detects engine coolant temperature and transmits a signal to the E.C.U.
The temperature sensing unit employs a thermistor which is sensitive to the change in temperature. Electrical resistance of the thermistor decreases in response to the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



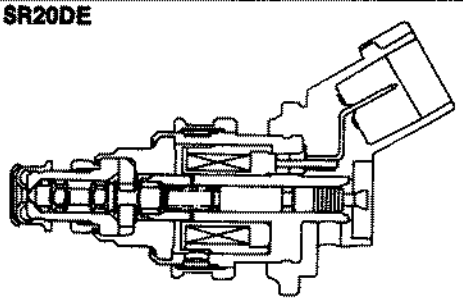


Throttle Sensor & Soft Idle Switch

The throttle sensor responds to the accelerator pedal movement. This sensor is a kind of potentiometer which transforms the throttle valve position into output voltage, and emits the voltage signal to the E.C.U. In addition, the sensor detects the opening and closing speed of the throttle valve and feeds the voltage signal to the E.C.U.
Idle position of the throttle valve is determined by the E.C.U. receiving the signal from the throttle sensor. This system is called "soft idle switch". This one controls engine operation such as fuel cut.



SR20DE

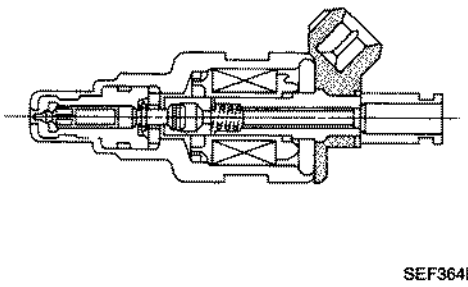


SEF406L

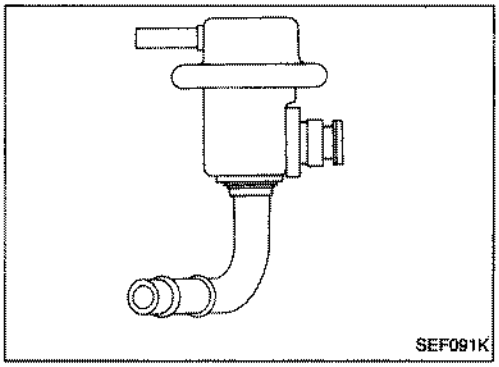
Fuel Injector

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.

SR20DET



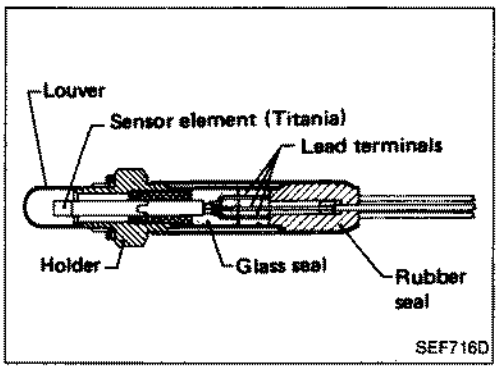
SEF364L



SEF091K

Pressure Regulator

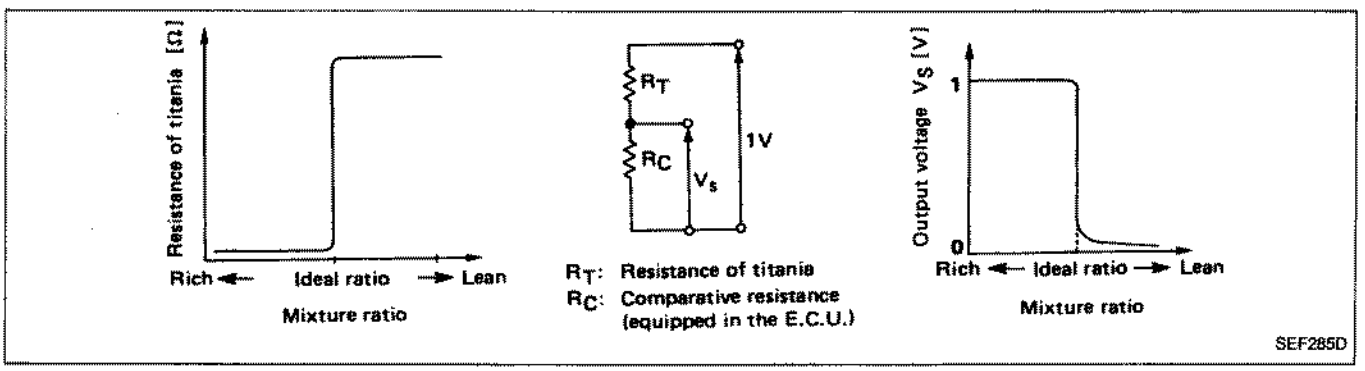
The pressure regulator maintains the fuel pressure at 299.1 kPa (2.991 bar, 3.05 kg/cm^2, 43.4 psi). Since the injected fuel amount depends on injection pulse duration, it is necessary to maintain the pressure at the above value.



SEF716D

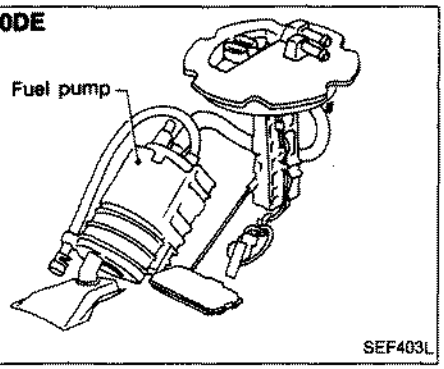
Exhaust Gas Sensor (Models with catalyzer only)

The exhaust gas sensor, located in the exhaust tube, monitors the oxygen level in the exhaust gas.
This sensor is made of ceramic titania, the electric resistance of which drastically changes at the ideal air-fuel ratio.
The E.C.U. supplies the sensor with approximately 1V and then measures the output voltage depending on its resistance. In order to activate the sensor element, it is equipped with a heater.



SEF285D

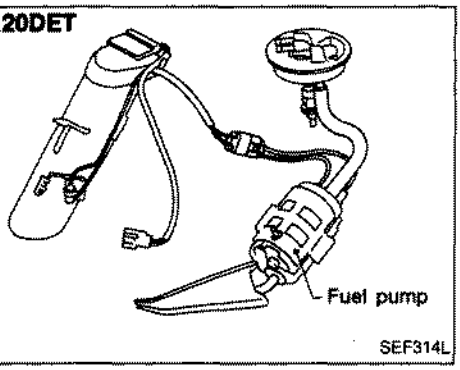
SR20DE

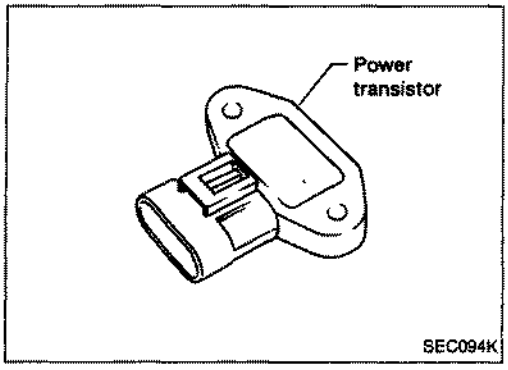


Fuel Pump

A turbine type design fuel pump is used and is situated in the fuel tank.

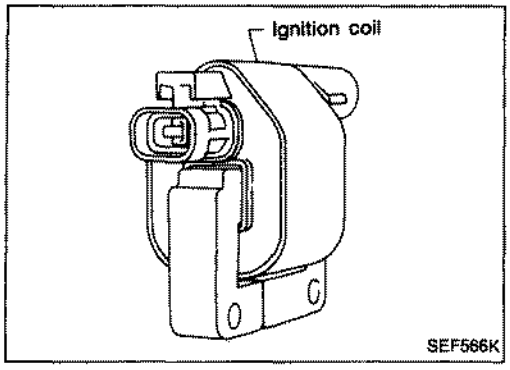
SR20DET

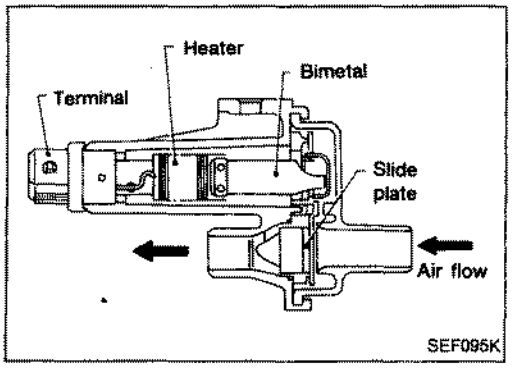




Power Transistor & Ignition Coil

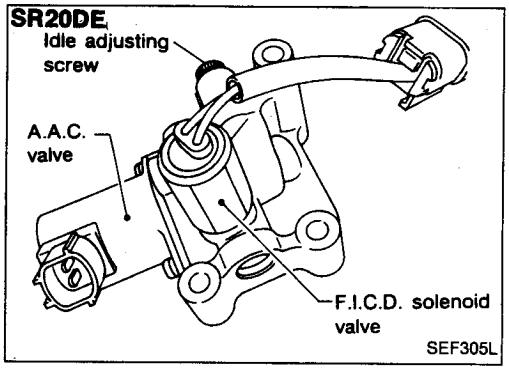
The ignition signal from the E.C.U. is amplified by the power transistor, which turns the ignition coil primary circuit on and off, inducing the proper high voltage in the secondary circuit. The ignition coil is a small, molded type.





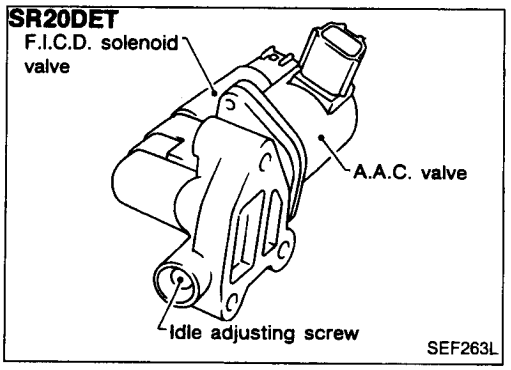
Air Regulator

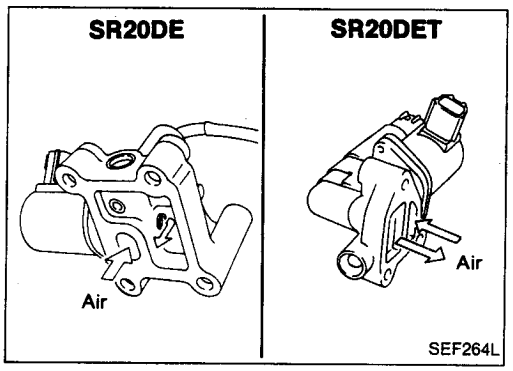
The air regulator provides an air by-pass when the engine is cold for a fast idle during warm-up.
A bimetal, heater and rotary shutter are built into the air regulator. When the bimetal temperature is low, the air by-pass port opens. As the engine starts and electric current flows through a heater, the bimetal begins to turn the shutter to close the by-pass port. The air passage remains closed until the engine stops and the bimetal temperature drops.



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

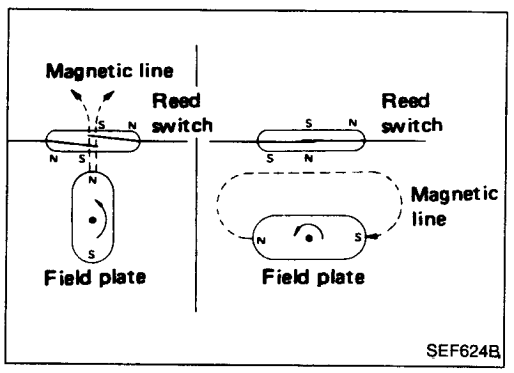
The I.A.A. unit is made up of the A.A.C. valve, F.I.C.D. solenoid valve and idle adjusting screw. It receives the signal from the E.C.U. and controls the idle speed at the preset value.





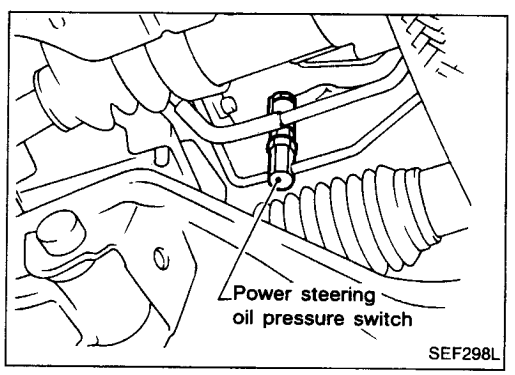
Auxiliary Air Control (A.A.C.) Valve

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



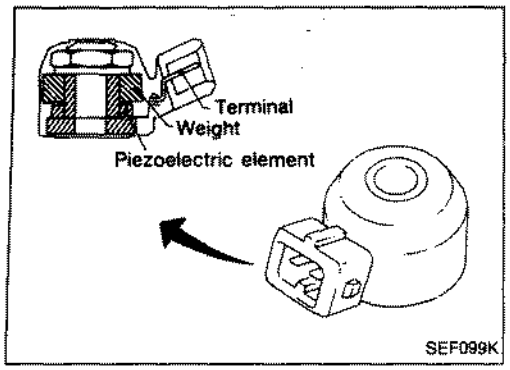
Vehicle Speed Sensor

The vehicle speed sensor provides a vehicle speed signal to the E.C.U.
The speed sensor consists of a reed switch, which is installed in the speedometer unit and transforms vehicle speed into a pulse signal.



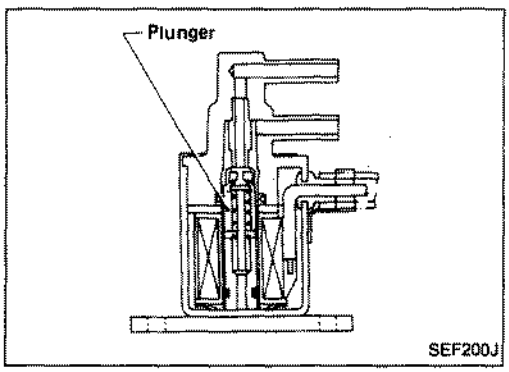
Power Steering Oil Pressure Switch

The power steering oil pressure switch is attached to the power steering high-pressure tube and detects the power steering load, sending the load signal to the E.C.U. The E.C.U. then sends the idle-up signal to the A.A.C. valve.



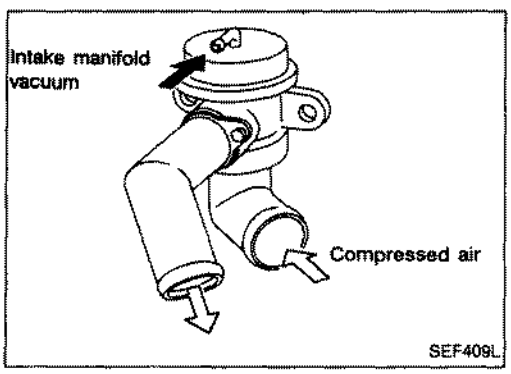
Detonation Sensor

The detonation sensor is attached to the cylinder block and senses engine knocking conditions.
A knocking vibration from the cylinder block is applied as pressure to the piezoelectric element. This vibrational pressure is then converted into a voltage signal which is delivered as output.



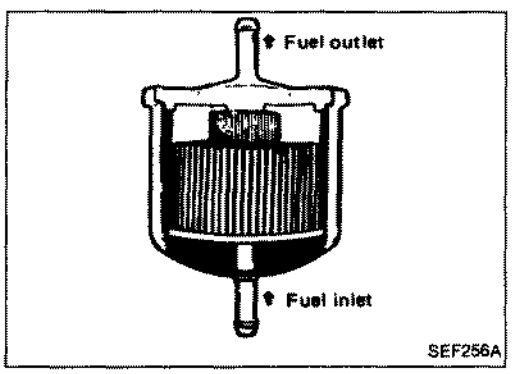
Wastegate Valve Control Solenoid Valve (SR20DET only)

The solenoid valve responds to the ON/OFF signal from the E.C.U. When it is ON, a vacuum signal from the suction pipe or compressor outlet is fed into the wastegate valve actuator. The actuator is hard to open at this time. When the control unit sends an OFF signal, the coil pulls the plunger upward and cuts the route to the suction pipe.



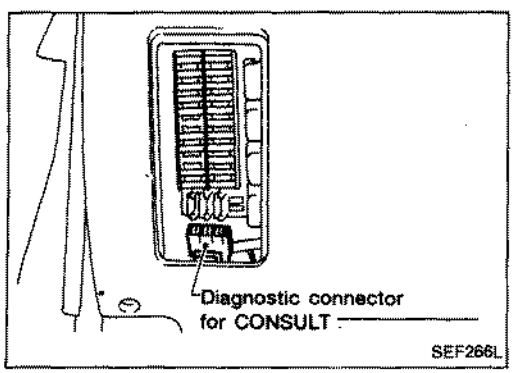
Recirculation Valve (SR20DET only)

The recirculation valve reduces the noise occurring in the compressor of the turbocharger during deceleration. This valve recirculates air compressed downstream of the intercooler to upstream of the compressor using the intake manifold vacuum that occurs when the throttle chamber is suddenly closed.
The recirculation valve also must not be disassembled or adjusted.



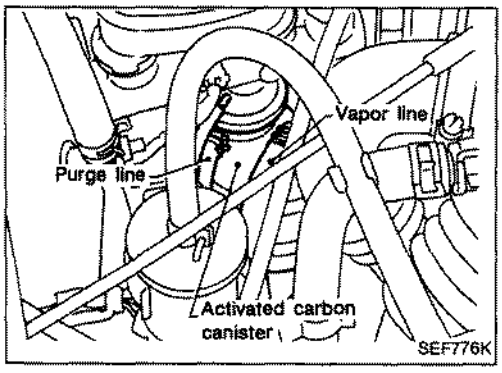
Fuel Filter

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



Diagnostic Connector for CONSULT

The diagnostic connector for CONSULT is located behind the fuse box cover.

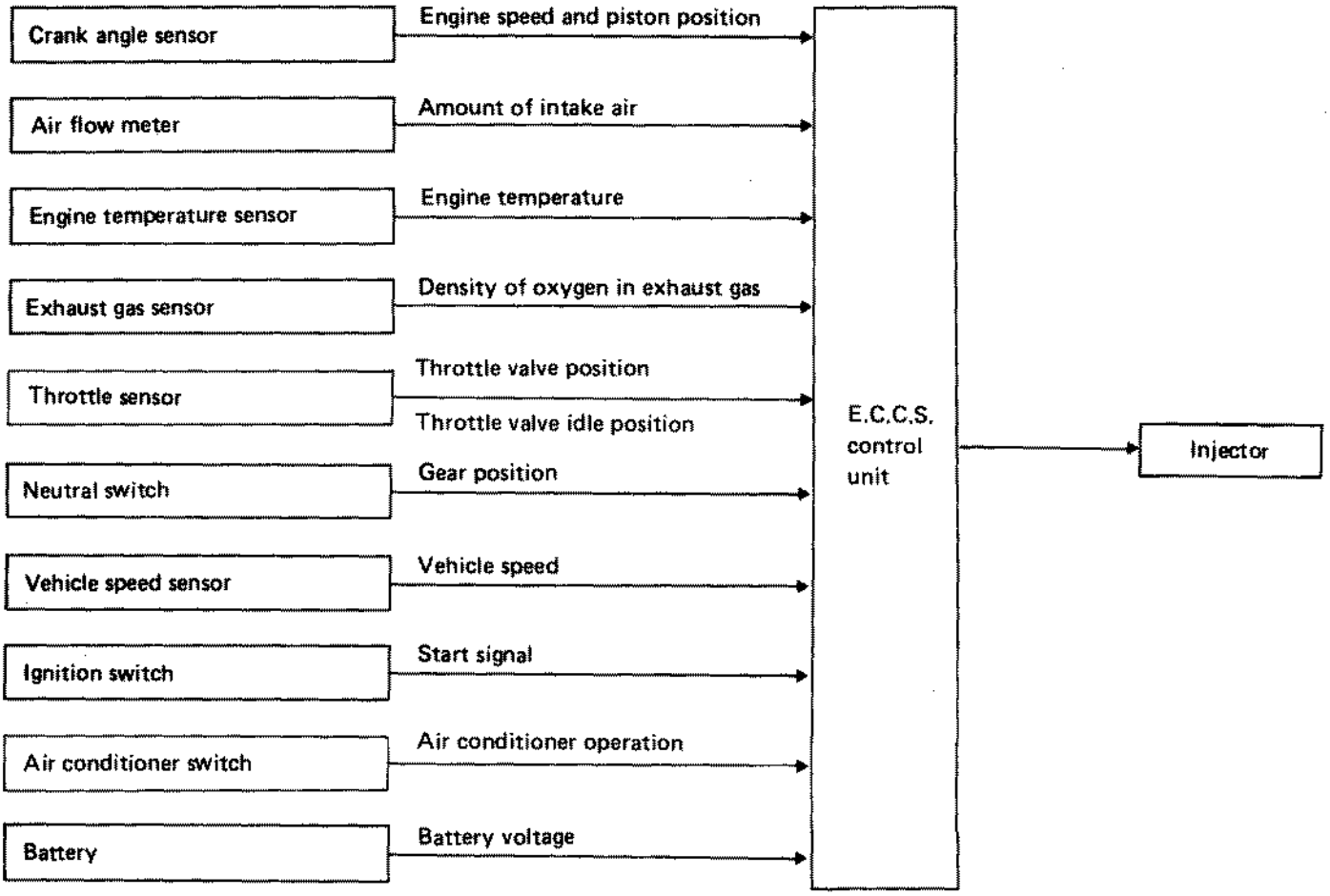


Activated Carbon Canister (SR20DE engine models with catalyzer only)

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.

Fuel Injection Control

INPUT/OUTPUT SIGNAL LINE



BASIC FUEL INJECTION CONTROL

The amount of fuel injected from the fuel injector, or the length of time the valve remains open, is determined by the E.C.U. The basic amount of fuel injected is a program value mapped in the E.C.U. ROM memory. In other words, the program value is preset by engine operating conditions determined by input signals (for engine rpm and air intake) from both the crank angle sensor and the air flow meter.

VARIOUS FUEL INJECTION INCREASE/DECREASE COMPENSATION

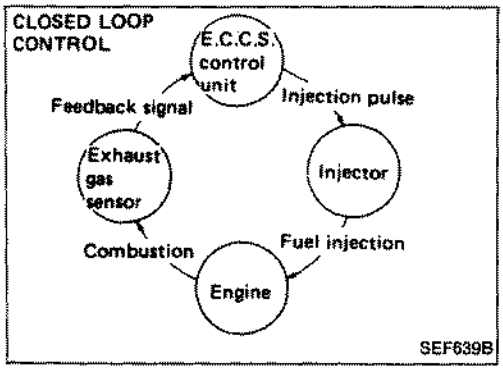
In addition, the amount of fuel injection is compensated for to improve engine performance under various operating conditions as listed below.

<Fuel increase>

1) During warm-up
2) When starting the engine
3) During acceleration

<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 operation
3) Engine idling
4) Malfunction of exhaust gas sensor or its circuit
5) Insufficient activation of exhaust gas sensor at low engine temperature
6) Engine starting
7) When all of the following conditions are met:

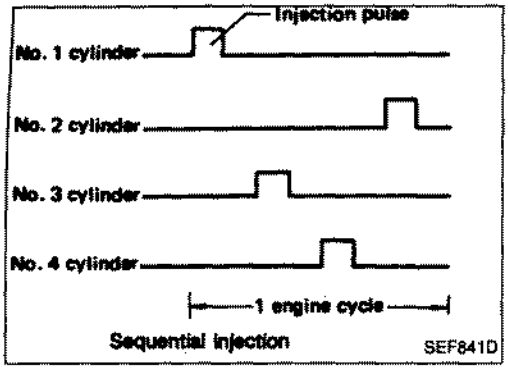
- Ignition switch "ON"
- Soft idle switch "ON"
- Neutral switch "OFF"
- Engine running at idle speed
- Vehicle running at slow speed

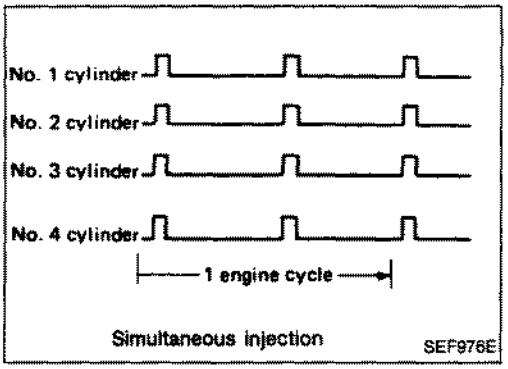
MIXTURE RATIO SELF-LEARNING CONTROL

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 Control (Cont'd)





FUEL INJECTION TIMING

Two types of fuel injection systems are used — simultaneous injection and sequential injection. In the former, fuel is injected into all four cylinders simultaneously twice each engine cycle. In other words, pulse signals of the same width are simultaneously transmitted from the E.C.U. to the four injectors two times for each engine cycle.

In the sequential injection system, fuel is injected into each cylinder during each engine cycle according to the firing order. When the engine is being started and/or if the fail-safe system (C.P.U. of E.C.U.) is operating, simultaneous fuel injection is used.

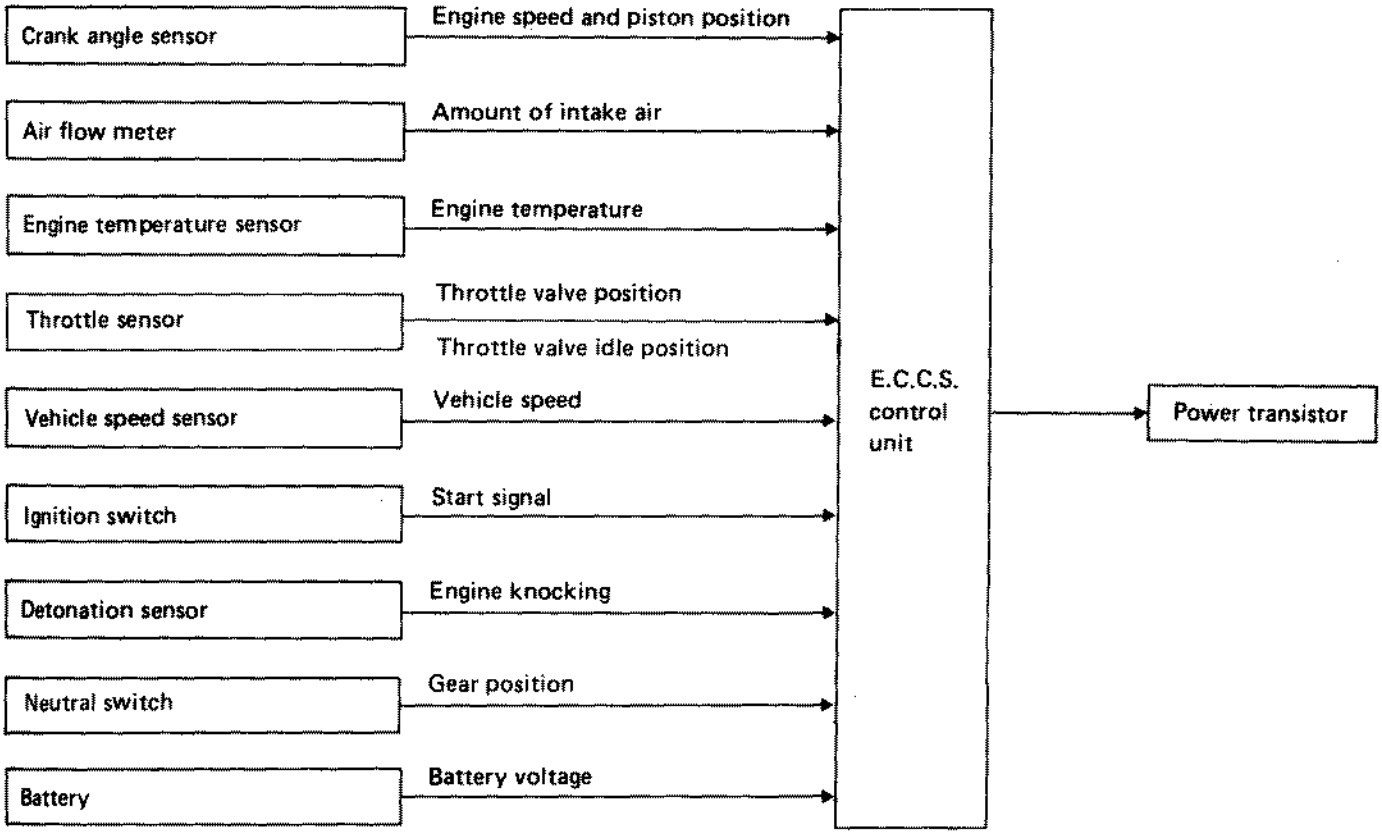
When the engine is running sequential fuel injection is used.

FUEL SHUT-OFF

Fuel to each cylinder is cut off during deceleration or operation of the engine at excessively high speeds.

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.

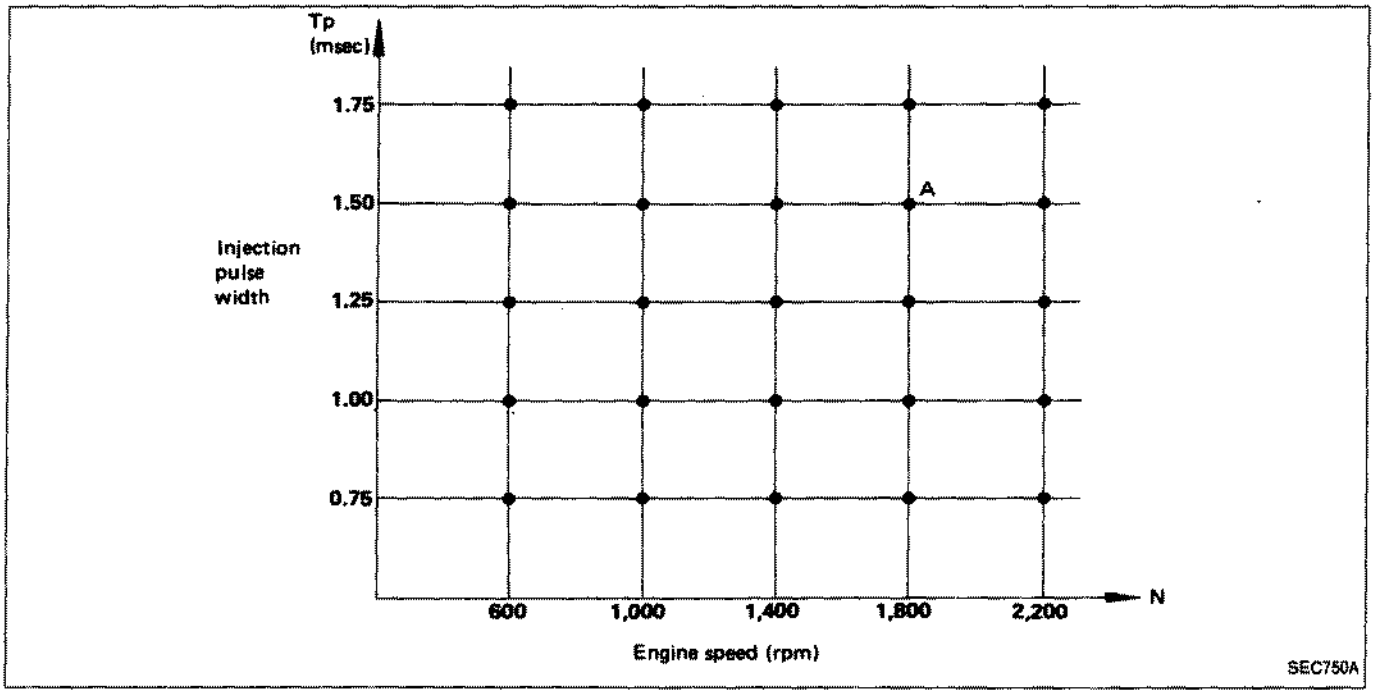
The E.C.U. detects information such as the injection pulse width and crank angle sensor signal which varies every moment. Then responding to this information, ignition signals are transmitted to the power transistor.

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 acceleration

the ignition timing is revised by the E.C.U. according to the other data stored in the ROM.

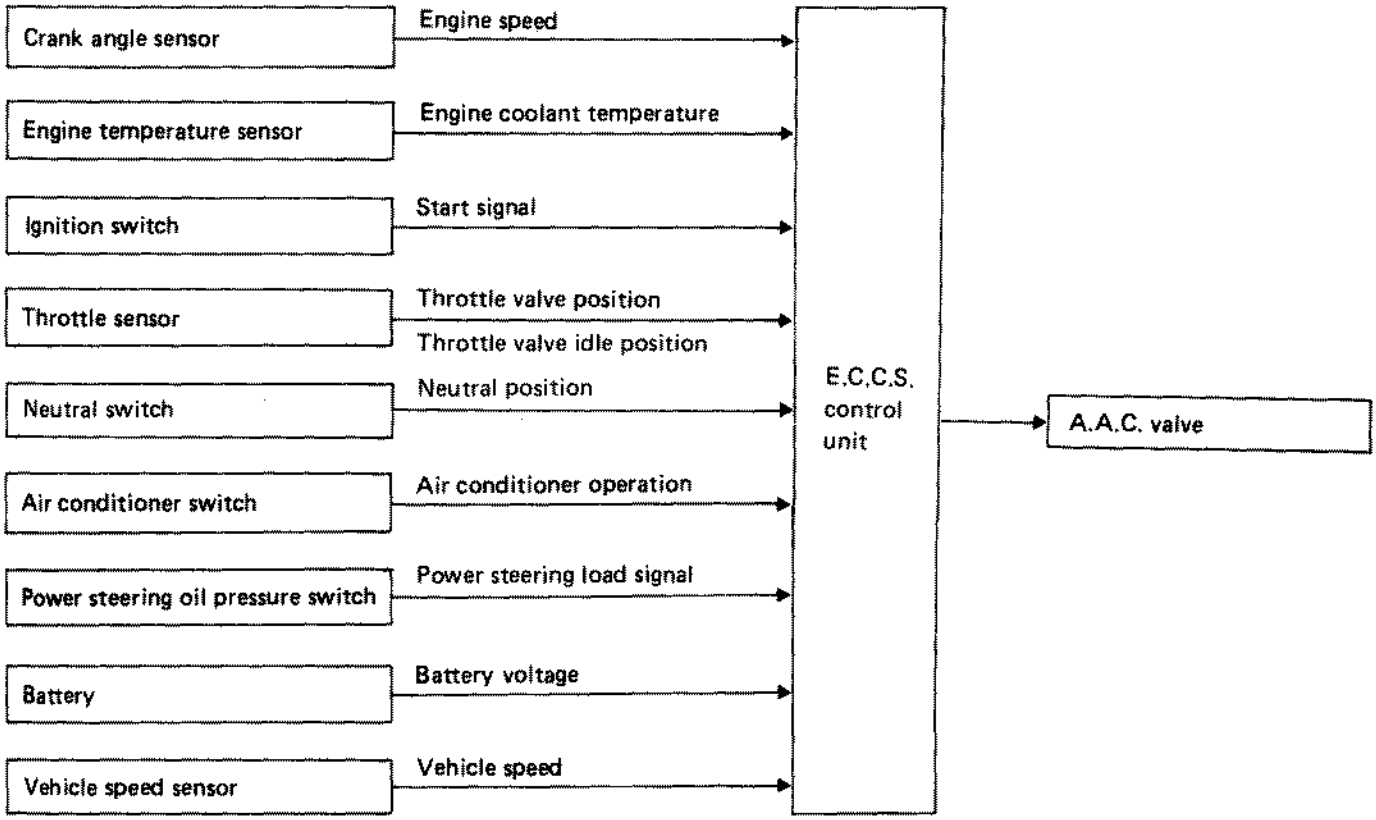


The retard system actuated by the detonation sensor is designed only for emergencies. The basic ignition timing is pre-programmed within the anti-knocking zone, even if recommended fuel is used under dry conditions. Consequently, the retard system does not operate under normal driving conditions.

However, if engine knocking occurs, the detonation sensor monitors the condition and the signal is transmitted to the E.C.C.S. control unit. After receiving it, the control unit retards the ignition timing to avoid the knocking condition.

Idle Speed Control

INPUT/OUTPUT SIGNAL LINE

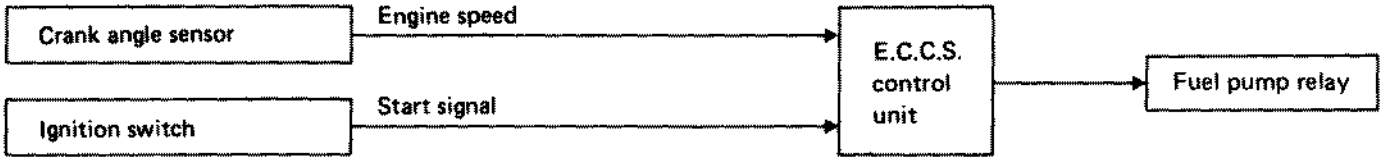


SYSTEM DESCRIPTION

This system automatically controls engine idle speed to a specified level. Idle speed is controlled through fine adjustment of the amount of air which by-passes the throttle valve via A.A.C. valve. The A.A.C. valve repeats ON/OFF operation according to the signal sent from the E.C.U. The crank angle sensor detects the actual engine speed and sends a signal to the E.C.U. The E.C.U. then controls the ON/OFF time of the A.A.C. valve so that engine speed coincides with the target value memorized in ROM. The target engine speed is the lowest speed at which the engine can operate steadily. The optimum value stored in the ROM is determined by taking into consideration various engine conditions, such as warming up and during deceleration, fuel consumption, and engine load (air conditioner, electrical load).

Fuel Pump Control

INPUT/OUTPUT SIGNAL LINE



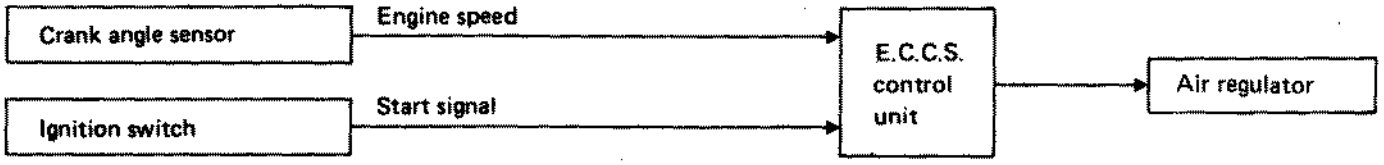
SYSTEM DESCRIPTION

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 180° signal from the crank angle sensor, it knows that the engine is rotating, and causes the pump to perform. If the 180° 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 turned to ON.	SR20DE: Operates for 5 seconds SR20DET: Operates for 1 second
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



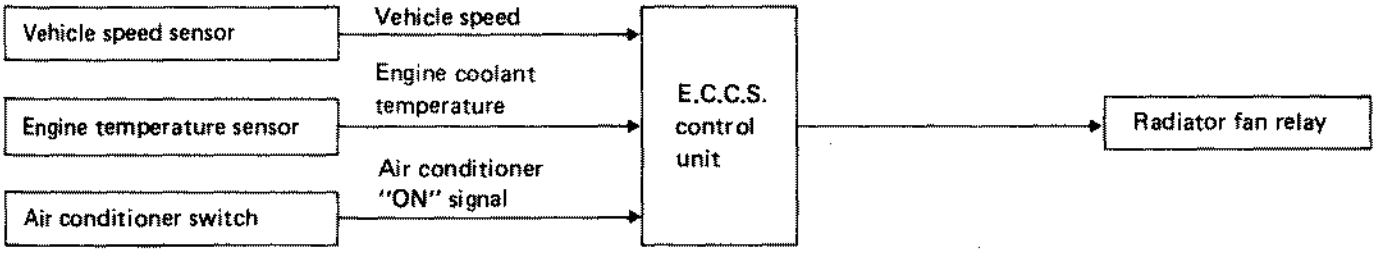
SYSTEM DESCRIPTION

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 ON	SR20DE: Operates for 5 seconds SR20DET: Operates for 1 second
While engine is running and cranking	Operates
When engine is stopped	OFF in 1 second
Except as shown above	OFF

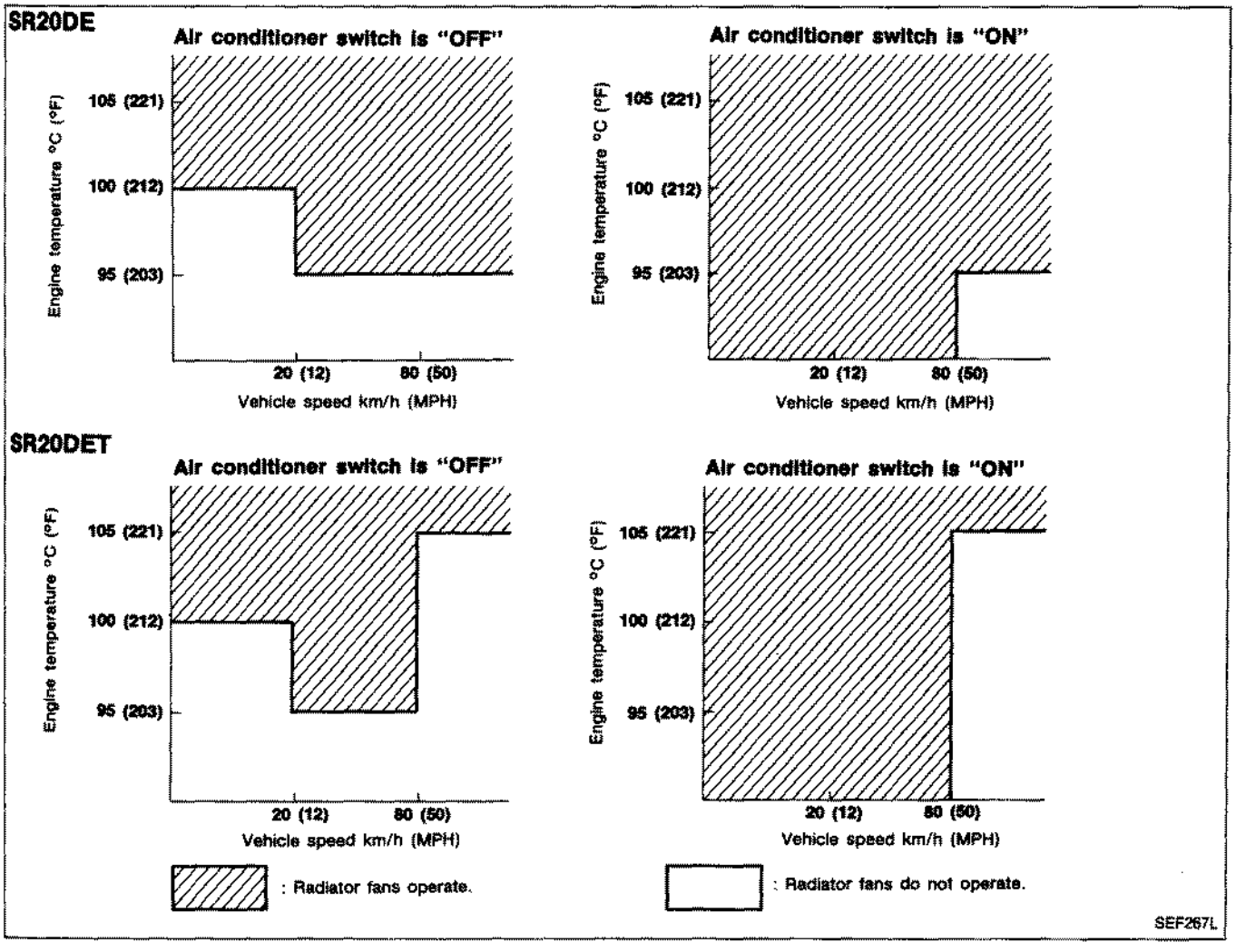
Radiator Fan Control

INPUT/OUTPUT SIGNAL LINE



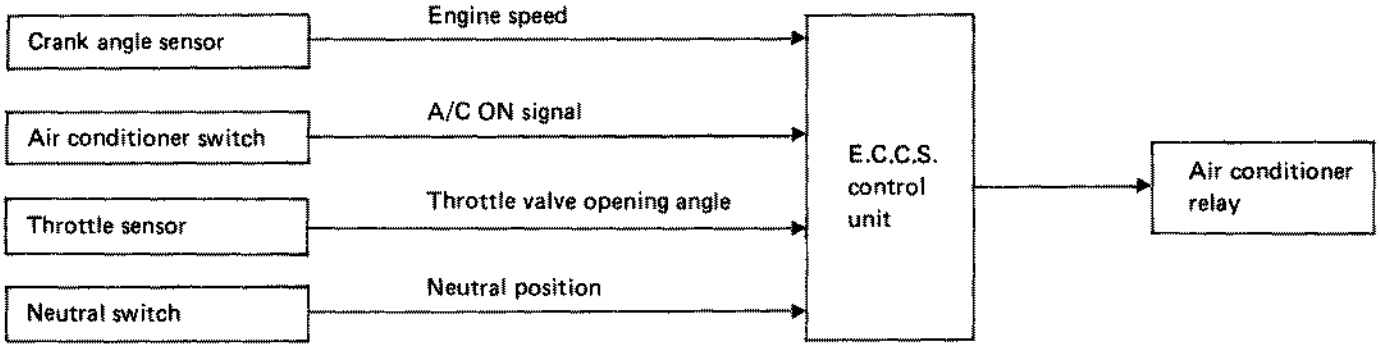
The E.C.U. controls the radiator fan corresponding to the vehicle speed, engine temperature, and air conditioner ON signal. The control system has 2-step control [ON/OFF].

OPERATION



Acceleration Cut Control

INPUT/OUTPUT SIGNAL LINE



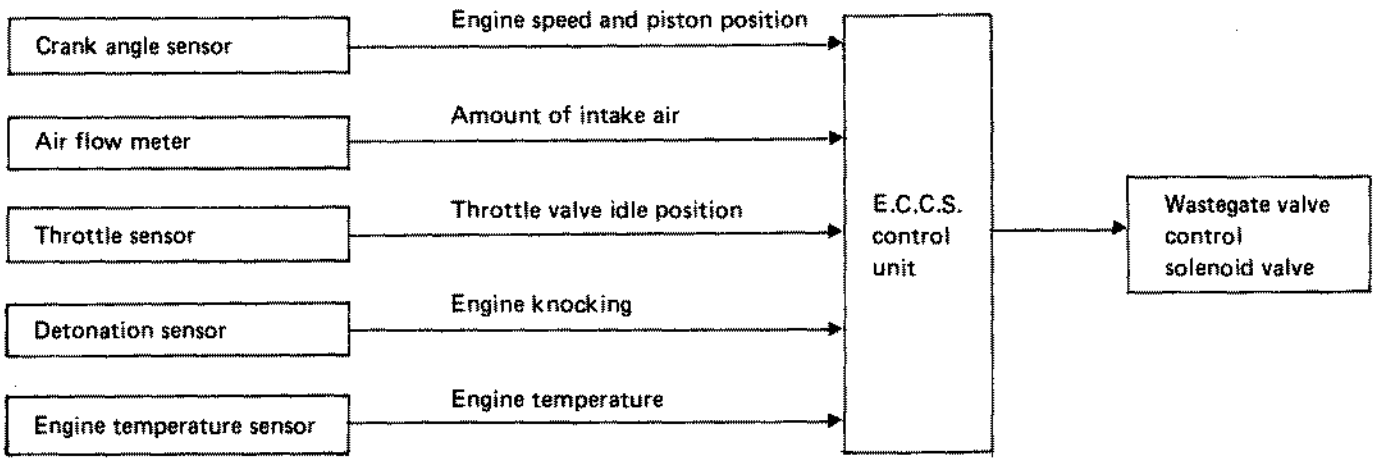
SYSTEM DESCRIPTION

When the accelerator pedal is fully depressed, the air conditioner is turned off for a few seconds.

This system improves acceleration when the air conditioner is used.

Wastegate Valve Control (SR20DET only)

INPUT/OUTPUT SIGNAL LINE



SYSTEM DESCRIPTION

The wastegate valve control solenoid valve changes the source vacuum which activates the actuator. This results in a suitable turbo-pressure.

When detonation signs are detected, which means a low octane fuel is being used, the solenoid valve turns OFF, and turbocharger pressure becomes low.

OPERATION

Engine conditions	Wastegate valve control solenoid valve	Vacuum to wastegate valve actuator	Turbocharger pressure
• Engine stopped. • C.P.U. of E.C.U. is malfunctioning. • Detonation sensor is malfunctioning. • Throttle valve is in idle position. • Judged fuel quality: low octane (Detecting sign of detonation)	OFF (When any of the conditions at left are present.)	Leads to wastegate valve actuator.	Low
Except the above	ON	Leads to suction pipe & wastegate valve actuator.	High

Fail-safe System

C.P.U. MALFUNCTION OF E.C.U.

Outline

The fail-safe system makes engine starting possible if there is something malfunctioning in the E.C.U.'s C.P.U. circuit. In former models, engine starting was difficult under the conditions mentioned above. But with the provisions provided in this fail-safe system, it is possible to start the engine.

Fail-safe system activating condition when E.C.U. is malfunctioning

The computing function of the E.C.U. was judged to be malfunctioning.
When the fail-safe system activates, i.e. if the E.C.U. detects a malfunction condition in the C.P.U. of E.C.U., the CHECK ENGINE LIGHT on the instrument panel lights to warn the driver.

Engine control, with fail-safe system, operates when E.C.U. is malfunctioning

When the fail-safe system is operating, fuel injection, ignition timing, fuel pump operation, A.A.C. valve operation and radiator fan operation are controlled under certain limitations.

Operation

	Operation
Fuel injection	Simultaneous injection
Ignition timing	Ignition timing is fixed at the preset valve.
Fuel pump	Fuel pump relay is "ON" when engine is running and "OFF" when engine stalls.
A.A.C. valve	Full open
Radiator fans	Radiator fan relay "ON"

Cancellation of fail-safe system when E.C.U. is malfunctioning

Activation of the fail-safe system is canceled each time the ignition switch is turned OFF. The system is reactivated if all of the above-mentioned activating conditions are satisfied after turning the ignition switch from OFF to ON.

AIR FLOW METER MALFUNCTION

If the air flow meter output voltage is above or below the specified value, the E.C.U. senses an air flow meter malfunction. In case of a malfunction, the throttle sensor 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

Engine condition	Starter switch	Fail-safe system	Fail-safe functioning
Stopped	ANY	Does not operate	—
Cranking	ON	Operates	Engine will be started by a pre-determined injection pulse on E.C.U.
Running	OFF		Engine speed will not rise above 2,400 rpm

Fail-safe System (Cont'd)

ENGINE TEMPERATURE SENSOR MALFUNCTION

When engine temperature sensor output voltage is below or above the specified value, water temperature is fixed at the preset value as follows:

Operation

Condition	Engine temperature decided
Just as ignition switch is turned ON or Start	20°C (68°F)
More than 6 minutes after ignition ON or Start	80°C (176°F)
Except as shown above	20 - 80°C (68 - 176°F) (Depends on the time)

DETONATION SENSOR MALFUNCTION

When the output signal of the detonation sensor is abnormal, the E.C.U. judges it to be malfunctioning. When detonation sensor is malfunctioning, ignition timing will retard according to operating conditions.

THROTTLE SENSOR MALFUNCTION

Description

When the output signal of throttle sensor is abnormal the E.C.U. judges it as a malfunctioning of throttle sensor.
The E.C.U. does not use the throttle sensor signal, but judges the idle position by the amount of fuel injected and the engine rpm.

Operation

	Driving condition
When engine is idling	Normal
When accelerating	Poor acceleration

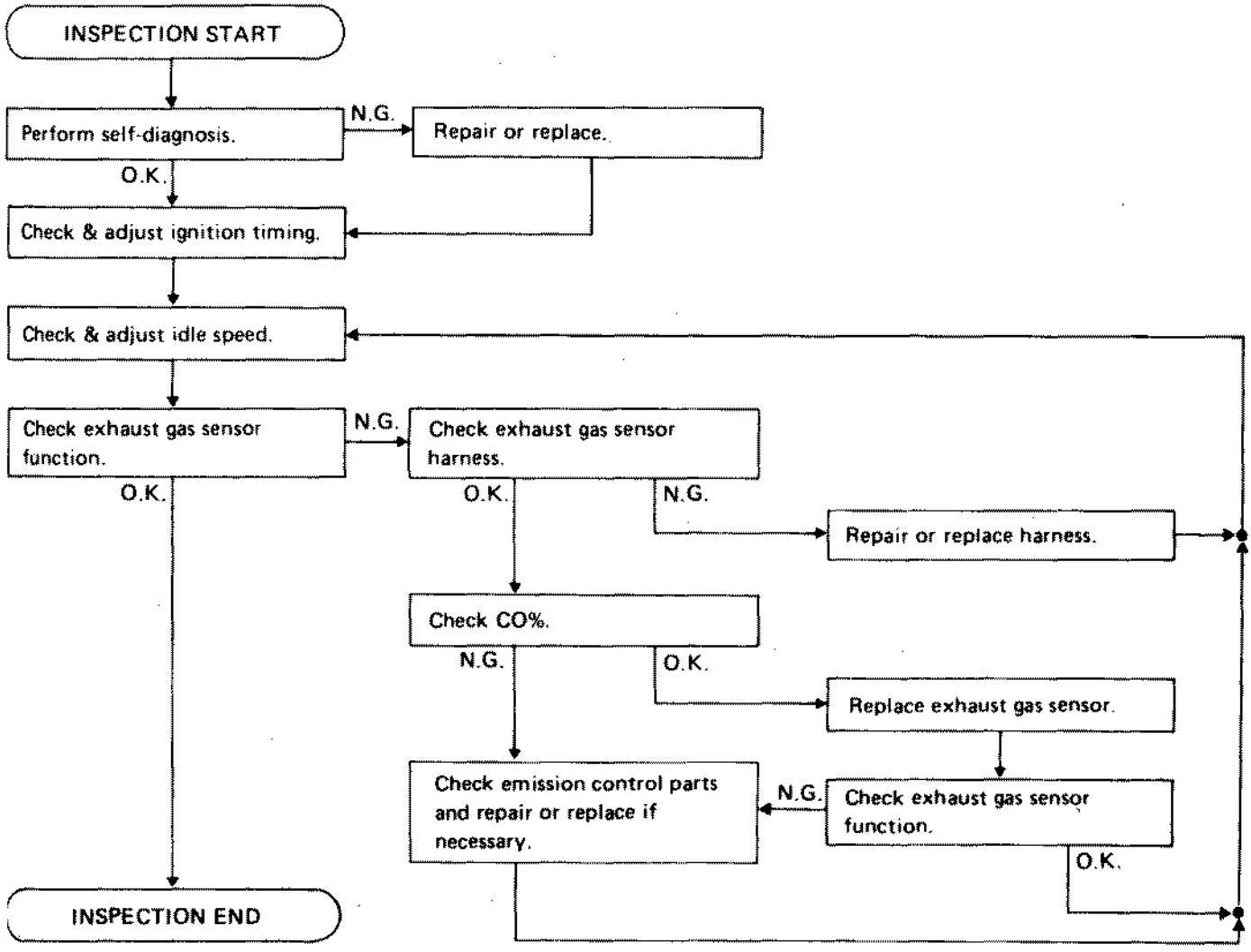
PREPARATION

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
- Engine compression
- Throttle valve

2. On air conditioner equipped models, checks should be carried out while the air conditioner is "OFF".
3. On automatic transaxle equipped models, when checking idle rpm, ignition timing and mixture ratio, checks should be carried out while shift lever is in "N" position.
4. When measuring "CO" percentage, insert probe more than 40 cm (15.7 in) into tail pipe.
5. Turn off headlamps, heater blower, rear defogger.
6. Keep front wheels pointed straight ahead.
7. Make the check after the radiator fan has stopped.

FOR MODELS WITH CATALYZER

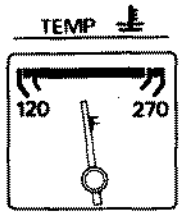
Overall inspection sequence



Idle check and procedure

START

Visually check the following:
- Air cleaner clogging
- Hoses and ducts for leaks
- Electrical connectors
- Gasket
- Throttle valve and throttle sensor operation



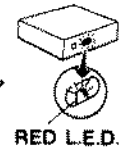
SEF246F

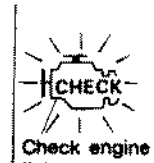
Start engine and warm it up until water temperature indicator points to the middle of gauge.
Ensure engine stays below 1,000 rpm.


SEF247F

Open engine hood and run engine at about 2,000 rpm for about 2 minutes under no-load.

Perform E.C.C.S. self-diagnosis (mode II).

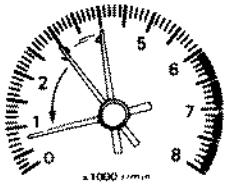

RED L.E.D.



Check engine light
SEF621K

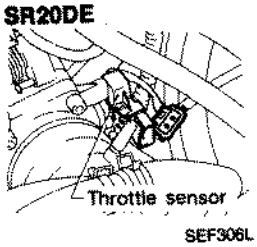
O.K. / N.G.

Repair or replace components as necessary.


SEF248F

Run engine at about 2,000 rpm for about 2 minutes under no-load.
Race engine two or three times under no-load, then run engine for about 1 minute at idle speed.

SR20DE

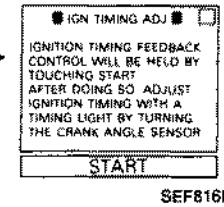


SEF306L

1) Select "IGN TIMING ADJ" in "WORK SUPPORT" mode.
2) Touching "START".

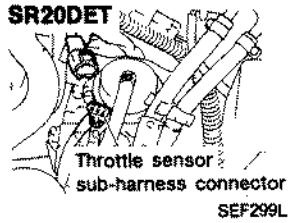
OR

1) Turn off engine and disconnect throttle sensor harness connector.
2) Start engine.



SEF816K

SR20DET



SEF299L

Race engine (2,000 - 3,000 rpm) 2 or 3 times under no-load and then run engine at idle speed.

Check ignition timing with a timing light.

SR20DE: 15°±2° B.T.D.C.
SR20DET: 20°±2° B.T.D.C.

O.K. → Ⓐ
N.G. → ①

Ⓐ Ⓘ

Adjust ignition timing to the specified value by turning distributor after loosening bolts which secure distributor.

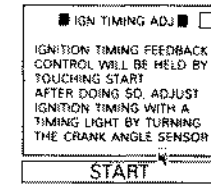
SR20DE: 15° B.T.D.C.
SR20DET: 20° B.T.D.C.

Ⓔ

1) Select "IGN TIMING ADJ" in "WORK SUPPORT" mode.
2) Touching "START".

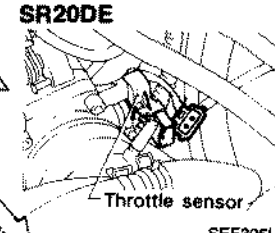
OR

1) Turn off engine and disconnect throttle sensor harness connector.
2) Start engine.



SEF316L

SR20DE



SEF306L

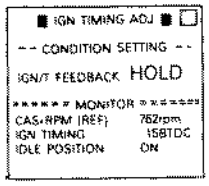
Check idle speed.

- Read idle speed in "IGN TIMING ADJ" in "WORK SUPPORT" mode.

OR

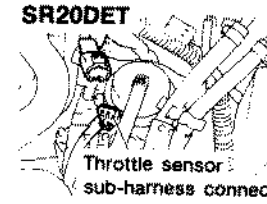
- Check idle speed.

SR20DE: 800±50 rpm
SR20DET: 850±50 rpm



SEF786K

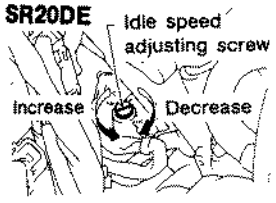
SR20DET



SEF299L

O.K. N.G.

SR20DE



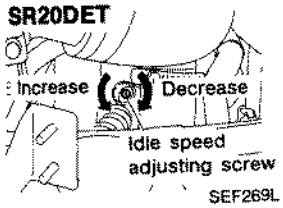
SEF268L

Race engine (2,000 - 3,000 rpm) 2 or 3 times under no-load and run engine at idle speed.

Adjust idle speed by turning idle speed adjusting screw.

SR20DE: 800 rpm
SR20DET: 850 rpm

SR20DET

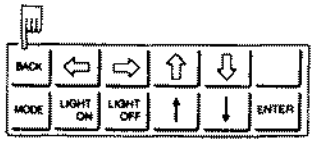


SEF269L

1) Touch "BACK".

OR

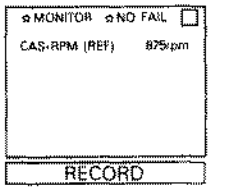
1) Turn off engine and connect throttle sensor harness connector.
2) Start engine.



SEF913J

Race engine (2,000 - 3,000 rpm) 2 or 3 times under no-load and run engine at idle speed.

Ⓙ



SEF317L

Ⓙ

Check idle speed.

- Read idle speed in "DATA MONITOR" mode with CONSULT.
- Check idle speed.

SR20DE: 850±50 rpm

SR20DET: 925^{+25}_{-75} rpm

O.K.

N.G.

Check A.A.C. valve and replace if necessary.

Check A.A.C. valve harness and repair if necessary.

Check E.C.U. function* by substituting another known good E.C.U.

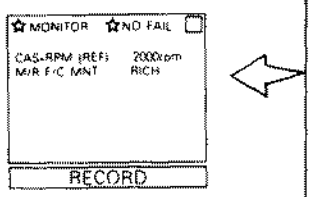
* E.C.U. may be the cause of a problem, but this is rarely the case.

Ⓑ

Ⓑ

1. See "M/R F/C MNT" in "Data monitor" mode.
2. Run engine at about 2,000 rpm for about 2 minutes under no-load.
3. Maintaining engine at 2,000 rpm under no-load (engine is warmed up sufficiently.), check that the monitor fluctuates between "LEAN" and "RICH" more than 5 times during 10 seconds.

RICH → LEAN → RICH →
1 time 2 times
LEAN → RICH .....

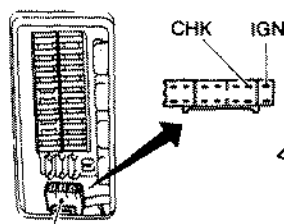


SEF818K

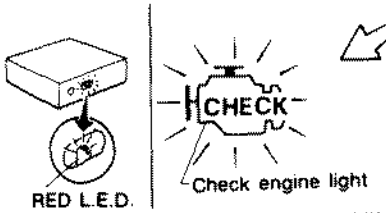
OR

1. Set "Exhaust gas sensor monitor" in the self-diagnostic mode II.
(See page EF & EC-412.)
2. Run engine at about 2,000 rpm for about 2 minutes under no-load.
3. Maintaining engine at 2,000 rpm under no-load, check to make sure that the RED L.E.D. on the E.C.U. or the check engine light on the instrument panel goes ON and OFF more than 5 times during 10 seconds.

N.G. → Ⓒ

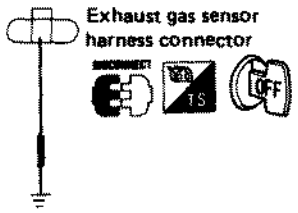


Diagnostic connector for CONSULT
(Connect CHK and IGN terminals with a suitable harness.)
SEF265L



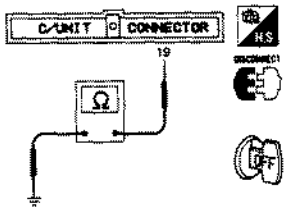
SEF621K

END



As for the location of exhaust gas sensor harness connector, refer to pages EF & EC-486, 582.

SEC240B



SEF587K

Check exhaust gas sensor harness:
1) Turn off engine and disconnect battery ground cable.
2) Disconnect E.C.U. S.M.J. harness connector from E.C.U.
3) Disconnect exhaust gas sensor harness connector and connect main harness side terminal for exhaust gas sensor to ground with a jumper wire.
4) Check for continuity between terminal No. 19 of E.C.U. S.M.J. harness connector and body ground.

Continuity exists . . . . . O.K.
Continuity does not exist . . . . . N.G.

O.K.

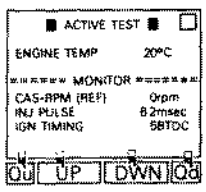
N.G.

Repair or replace harness.

Ⓔ

Connect E.C.U. S.M.J. harness connector to control unit.

Connect battery ground cable.

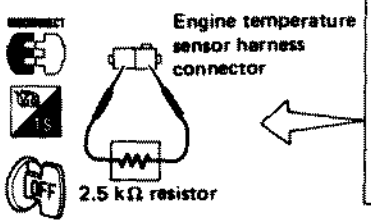


SEF788K

1) Select "ENG TEMPERATURE" in "ACTIVE TEST" mode.
2) Set "ENGINE TEMP" to 20°C (68°F) by touching "Qu" and "Qd" and "UP", "DOWN".

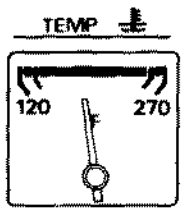
OR

1) Disconnect engine temperature sensor harness connector.
2) Connect a resistor (2.5 kΩ) between terminals of engine temperature sensor harness connector.



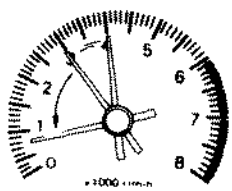
SEC242B

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



SEF246F

Ⓓ


SEF248F

Race engine two or three times under no-load, then run engine at idle speed.

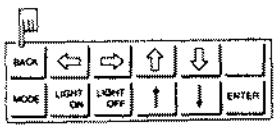
Check "CO" %.

Idle CO: Less than 10%

After checking CO%,

1) Touch "BACK".

O.K.


SEF913J

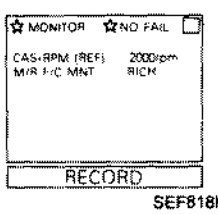
1) Disconnect the resistor from terminals of engine temperature sensor harness connector.
2) Connect engine temperature sensor harness connector to engine temperature sensor.

N.G.

Replace exhaust gas sensor.

1. See "M/R F/C MNT" in "Data monitor" mode.
2. Maintaining engine at 2,000 rpm under no-load (engine is warmed up sufficiently.), check that the monitor fluctuates between "LEAN" and "RICH" more than 5 times during 10 seconds.

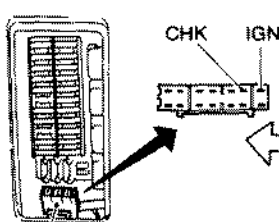
RICH → LEAN → RICH →
1 time 2 times
LEAN → RICH .....



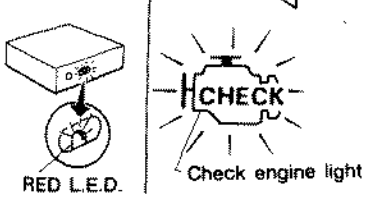
SEF818K

OR

1. Set "Exhaust gas sensor monitor" in the self-diagnostic mode II. (See page EF & EC-412.)
2. Maintaining engine at 2,000 rpm under no-load, check to make sure that the RED L.E.D. on the E.C.U. or the check engine light on the instrument panel goes ON and OFF more than 5 times during 10 seconds.

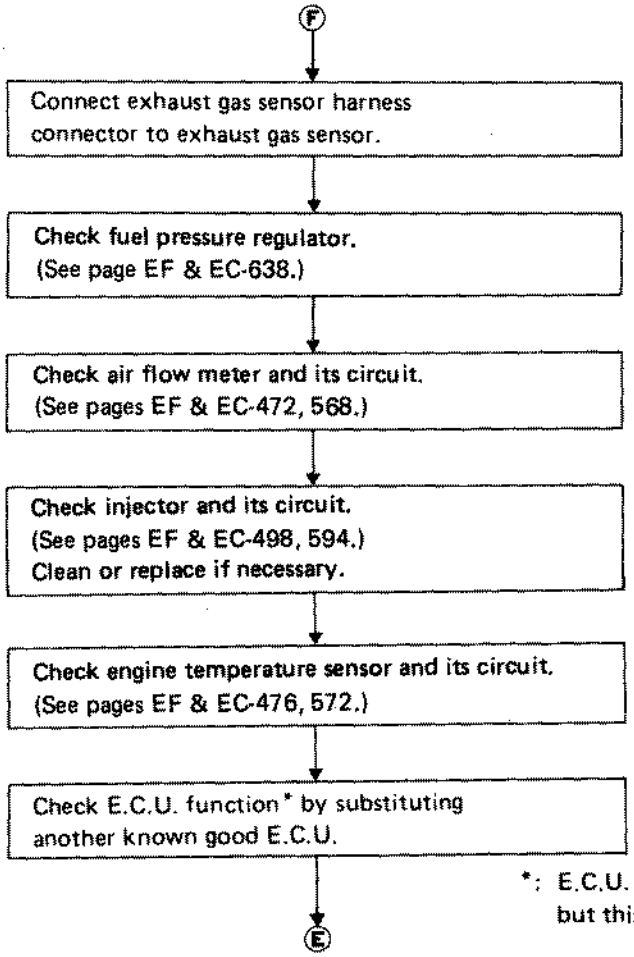


Diagnostic connector for CONSULT
(Connect CHK and IGN terminals with a suitable harness.)
SEF265L



RED L.E.D.
Check engine light
SEF621K

Ⓕ Ⓔ



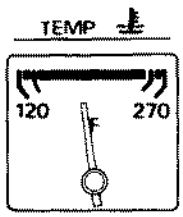
*: E.C.U. may be the cause of a problem, but this is rarely the case.

FOR MODELS WITHOUT CATALYZER (SR20DE only)

Checking and adjusting idle rpm and ignition timing

START

Visually check the following:
- Air cleaner clogging
- Hoses and ducts for leaks
- Electrical connectors
- Gasket
- Throttle valve and throttle sensor operation



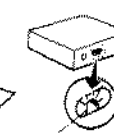
SEF246F

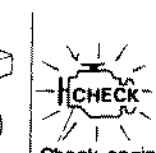
Start engine and warm it up until water temperature indicator points to the middle of gauge.
Ensure engine stays below 1,000 rpm.


SEF247F

Open engine hood and run engine at about 2,000 rpm for about 2 minutes under no-load.

Perform E.C.C.S. self-diagnosis (mode II).

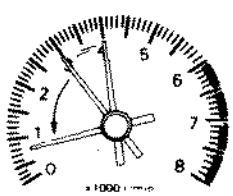

RED L.E.D.



Check engine light
SEF621K

O.K. N.G.

Repair or replace components as necessary.


SEF248F

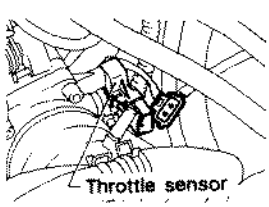
Run engine at about 2,000 rpm for about 2 minutes under no-load.
Race engine two or three times under no-load, then run engine for about 1 minute at idle speed.

SEF316L

1) Select "IGN TIMING ADJ" in "WORK SUPPORT" mode.
2) Touching "START".

OR

1) Turn off engine and disconnect throttle sensor harness connector.
2) Start engine.



SEF317L

Race engine (2,000 - 3,000 rpm) 2 or 3 times under no-load and then run engine at idle speed.

Check ignition timing with a timing light.

15°±2° B.T.D.C.

O.K. N.G.

Ⓐ Ⓘ

Ⓐ Ⓘ

Adjust ignition timing to the specified value by turning distributor after loosening bolts which secure distributor.

15° B.T.D.C.

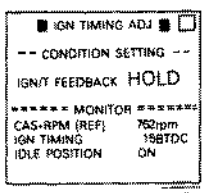
Check idle speed.

- Read idle speed in "IGN TIMING ADJ" in "WORK SUPPORT" mode.

OR

- Check idle speed.

800±50 rpm

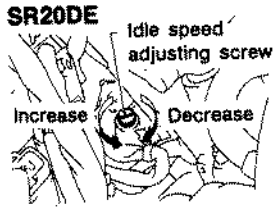


SEF786K

O.K. N.G.

Race engine (2,000 - 3,000 rpm) 2 or 3 times under no-load and run engine at idle speed.

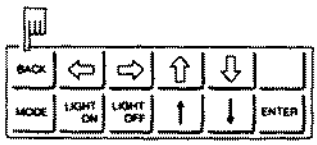
SR20DE



SEF268L

Adjust idle speed by turning idle speed adjusting screw.

800 rpm



SEF913J

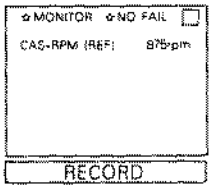
1) Touch "BACK".

OR

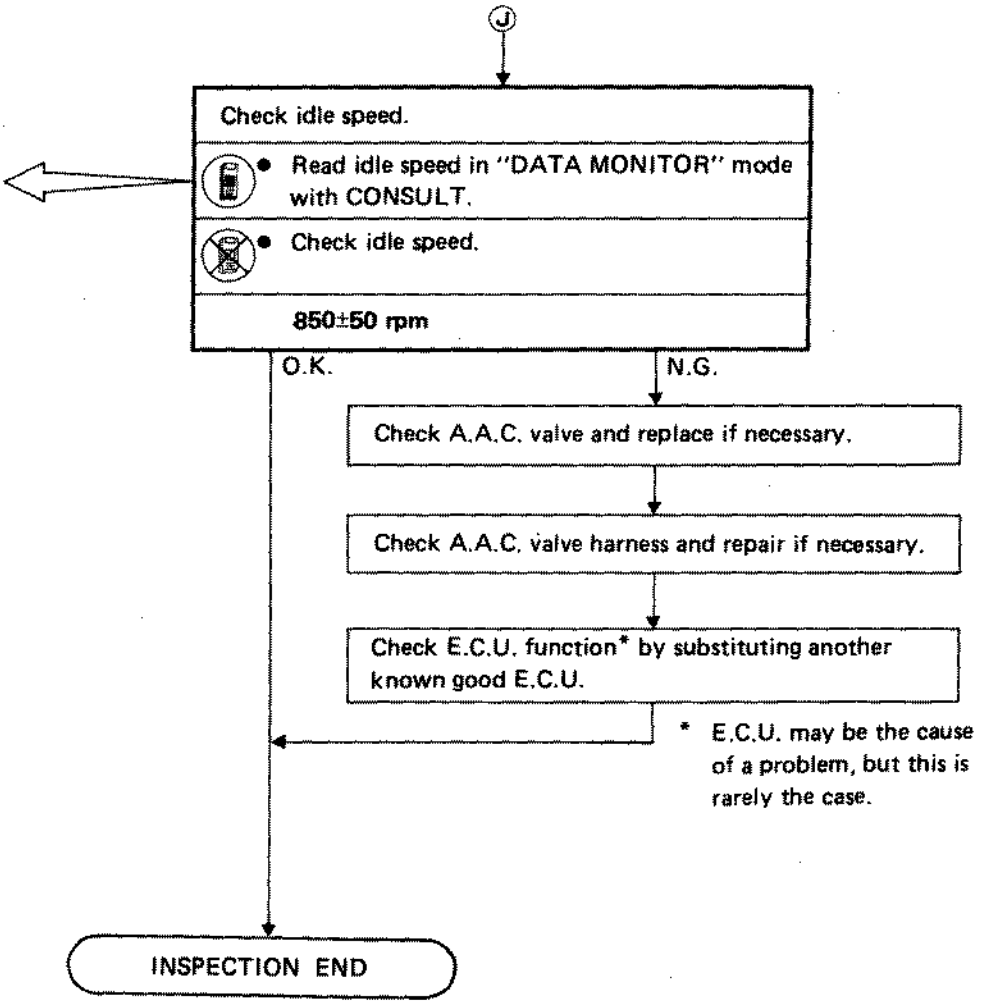
1) Turn off engine and connect throttle sensor harness connector.
2) Start engine.

Race engine (2,000 - 3,000 rpm) 2 or 3 times under no-load and run engine at idle speed.

Ⓙ


☆MONITOR ☆NO FAIL
CAS-RPM (REF) 875rpm
RECORD

SEF317L


J
Check idle speed.
Read idle speed in "DATA MONITOR" mode with CONSULT.
Check idle speed.
850±50 rpm
O.K.
N.G.
Check A.A.C. valve and replace if necessary.
Check A.A.C. valve harness and repair if necessary.
Check E.C.U. function* by substituting another known good E.C.U.
* E.C.U. may be the cause of a problem, but this is rarely the case.
INSPECTION END

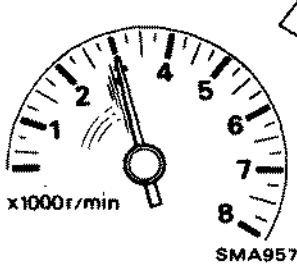
Checking and adjusting mixture ratio [With "CO"-meter]

INSPECTION START

Check and adjust idle speed and ignition timing. (Refer to EF & EC-397.)

Idle speed: 850±50 rpm
Ignition timing: 15°±2° B.T.D.C.

Race engine (2,000 - 3,000 rpm) 2 or 3 times under no-load, then run engine at idle speed.



SMA957A

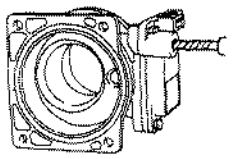
Check "CO" with "CO"-meter.

Idle "CO" %
Below 2.0

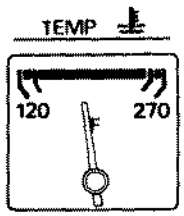
O.K.

N.G.

Turn off engine and remove air flow meter from vehicle.


SEF567K

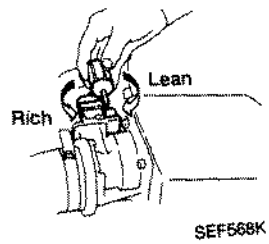
Drill a hole in seal plug which seals variable resistor of air flow meter and remove seal plug.



SEF246F

Install air flow meter on vehicle. Start engine and warm it up until water temperature indicator reads normal operating temperature.

Race engine (2,000 - 3,000 rpm) 2 or 3 times under no-load, then run engine at idle speed.

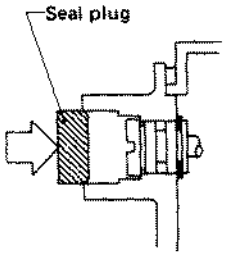


SEF568K

Adjust "CO"% by turning variable resistor on air flow meter.

Idle "CO" %
0.5±0.5

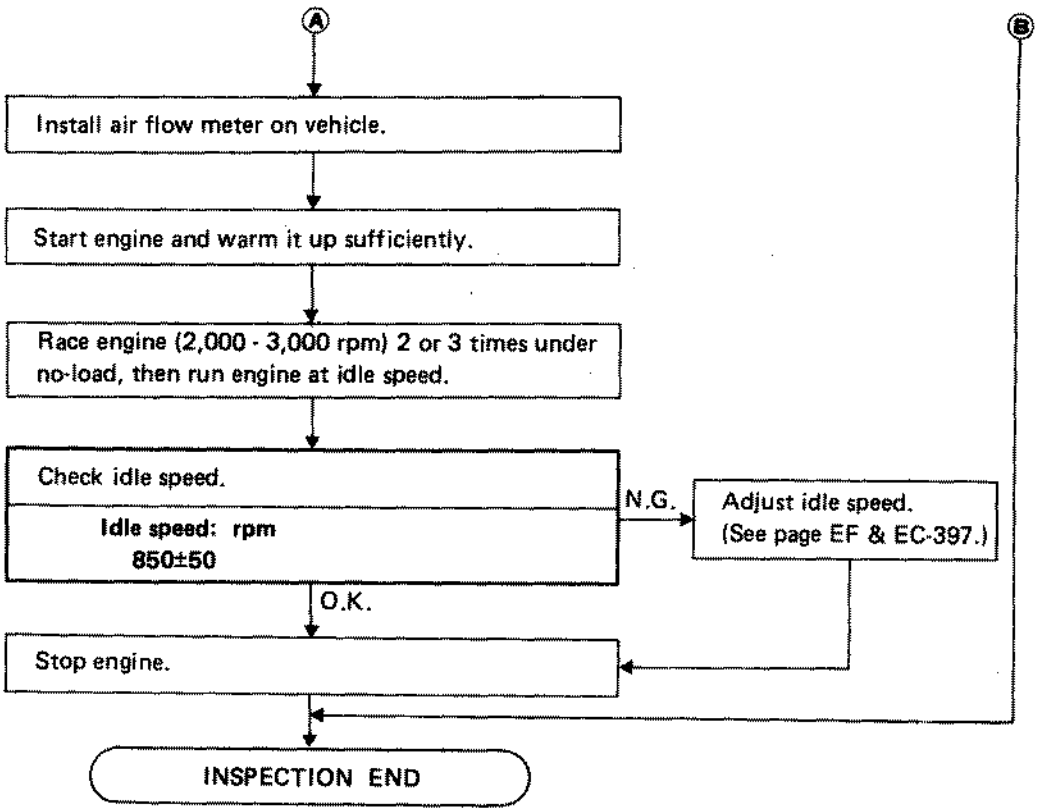
Turn off engine and remove air flow meter from vehicle.



SEF713B

Insert new seal plug into variable resistor hole. Tap seal plug with a suitable bar, thereby installing seal plug on air flow meter.

Ⓐ

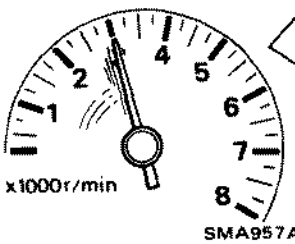

A
B
Install air flow meter on vehicle.
Start engine and warm it up sufficiently.
Race engine (2,000 - 3,000 rpm) 2 or 3 times under no-load, then run engine at idle speed.
Check idle speed.
Idle speed: rpm
850±50
N.G.
Adjust idle speed.
(See page EF & EC-397.)
O.K.
Stop engine.
INSPECTION END

[Without "CO"-meter]

INSPECTION START

Check and adjust idle speed and ignition timing.
(Refer to EF & EC-397.)

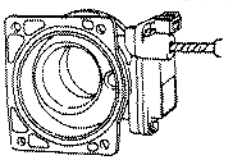
Idle speed: 850±50 rpm
Ignition timing: 15°±2° B.T.D.C.



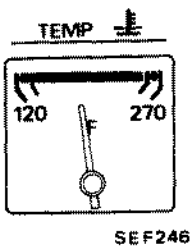
SMA957A

Race engine (2,000 - 3,000 rpm) 2 or 3 times under no-load, then run engine at idle.

Turn off engine and remove air flow meter from vehicle.


SEF567K

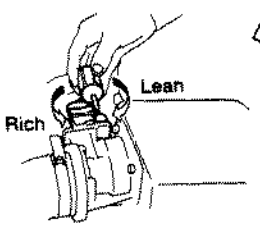
Drill a hole in seal plug which seals variable resistor of air flow meter and remove seal plug.



SEF246F

Install air flow meter on vehicle. Start engine and warm it up until water temperature indicator reads normal operating temperature.

Race engine (2,000 - 3,000 rpm) 2 or 3 times under no-load, then run engine at idle speed.

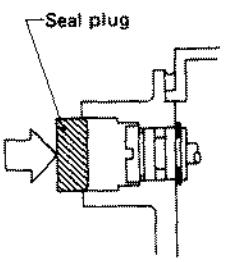


SEF568K

Adjust mixture ratio with engine speed set at maximum by turning variable resistor.

Turn variable resistor of air flow meter one full turn counterclockwise.

Turn off engine and remove air flow meter from vehicle.

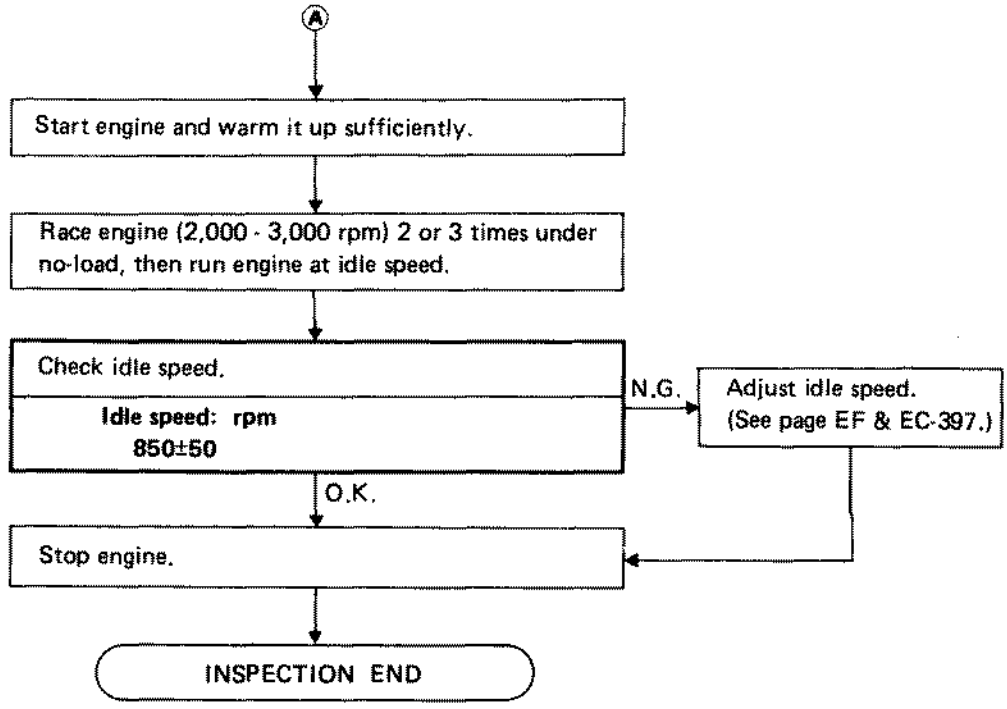


SEF713B

Insert new seal plug into variable resistor hole.
Tap seal plug with a suitable bar, thereby installing seal plug on air flow meter.

Install air flow meter on vehicle.

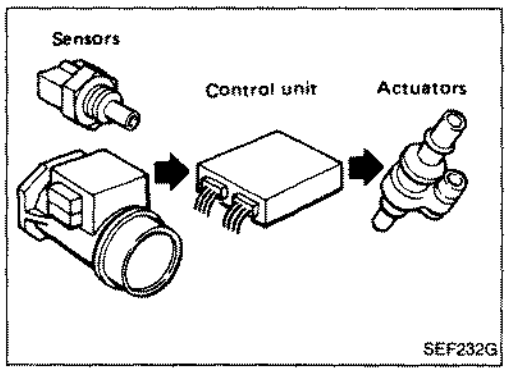
Ⓐ

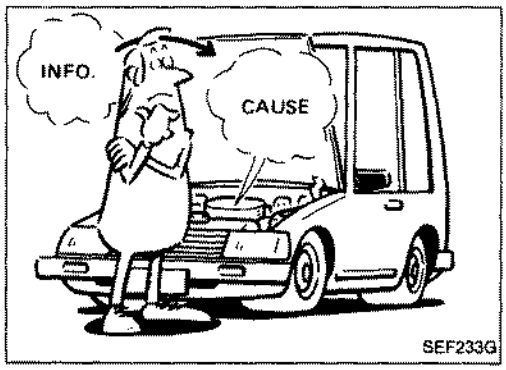

Ⓐ
Start engine and warm it up sufficiently.
Race engine (2,000 - 3,000 rpm) 2 or 3 times under no-load, then run engine at idle speed.
Check idle speed.
Idle speed: rpm
850±50
N.G.
Adjust idle speed.
(See page EF & EC-397.)
O.K.
Stop engine.
INSPECTION END

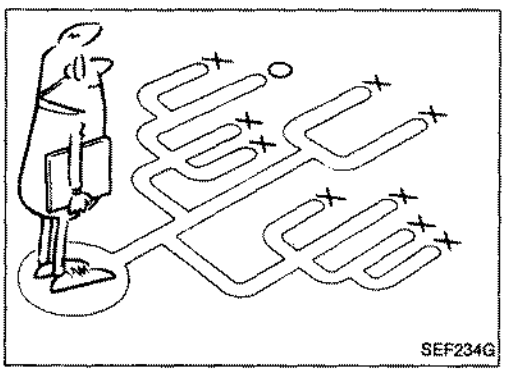
Contents

Contents (Cont'd)

Contents (Cont'd)







How to Perform Trouble Diagnoses for Quick and Accurate Repair

INTRODUCTION

The engine has an electronic control unit to control major systems such as fuel control, ignition control, idle speed control, etc. The control unit accepts input signals from sensors and instantly drives actuators. It is essential that both kinds of signals are proper and stable. At the same time, it is important that there are no conventional problems such as vacuum leaks, fouled spark plugs, or other problems with the engine.

It is much more difficult to diagnose a problem that occurs intermittently rather than continuously. Most intermittent problems are caused by poor electric connections or improper wiring. In this case, careful checking of suspected circuits may help prevent the replacement of good parts.

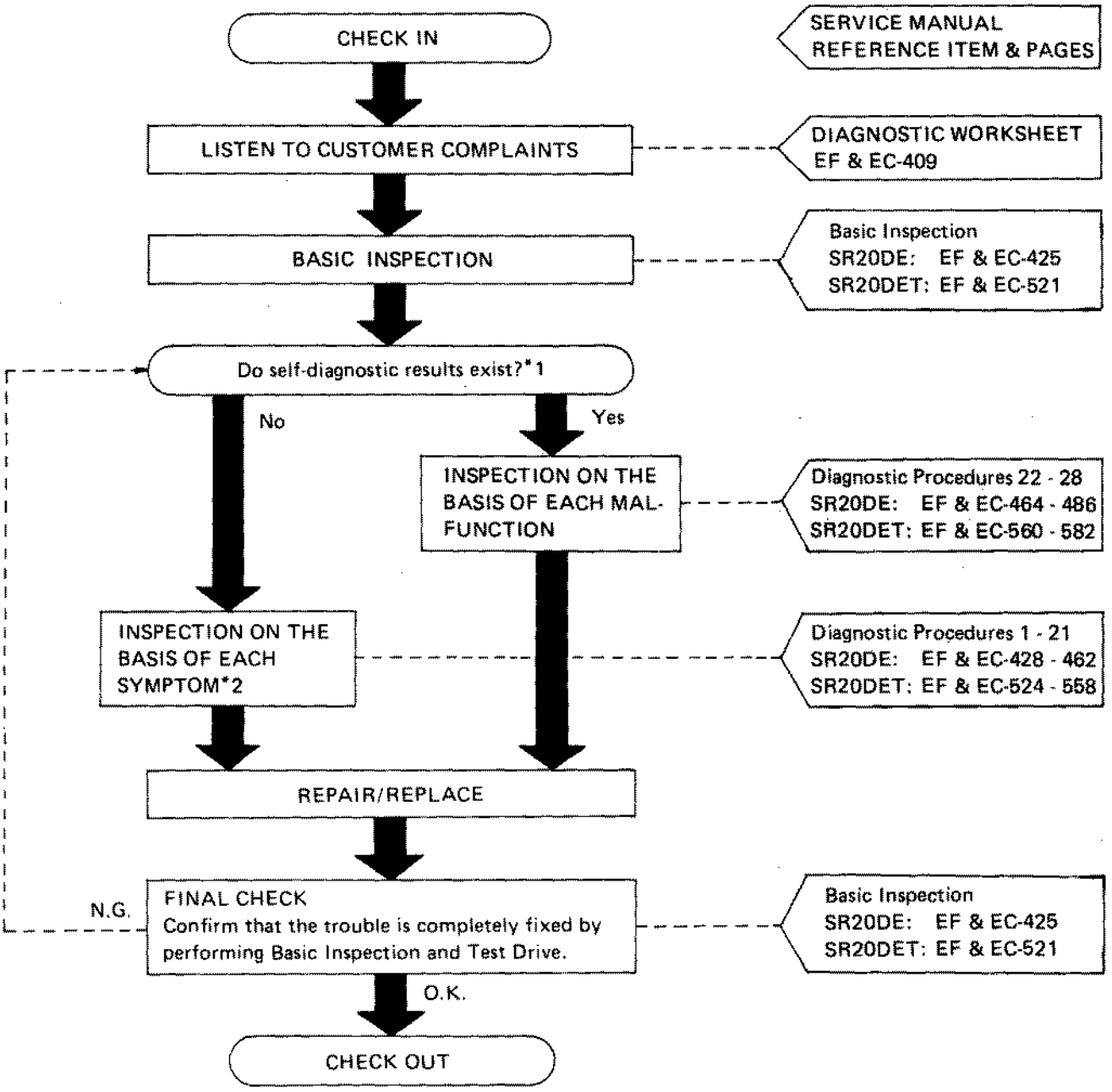
A visual check only may not find the cause of the problems, so a road test with a circuit tester connected to a suspected circuit should be performed.

Before undertaking actual checks, take just a few minutes to talk with a customer who approaches with a driveability complaint. The customer is a very good supplier of information on such problems, especially intermittent ones. Through interaction with the customer, find out what symptoms are present and under what conditions they occur.

Start your diagnosis by looking for "conventional" problems first. This is one of the best ways to troubleshoot driveability problems on an electronically controlled engine vehicle.

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

WORK FLOW



*1: If the self-diagnosis cannot be performed, check main power supply and ground circuit. (See Diagnostic Procedure 22.)
*2: If the trouble is not duplicated, see INTERMITTENT PROBLEM SIMULATION (EF & EC-410).

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

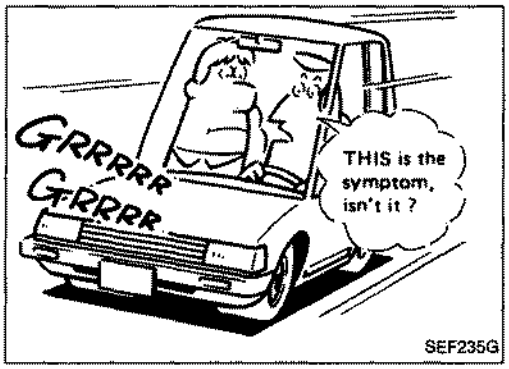
DIAGNOSTIC WORKSHEET

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 affected	
	Weather	☐ Fine ☐ Raining ☐ Snowing ☐ Others [ ]	
	Temperature	☐ Hot ☐ Warm ☐ Cool ☐ Cold ☐ Humid °F	
Engine conditions		☐ Cold ☐ During warm-up ☐ After warm-up Engine speed 0 2,000 4,000 6,000 8,000 rpm	
Road conditions		☐ In town ☐ In suburbs ☐ Highway ☐ Off road (up/down)	
Driving conditions		☐ Not affected ☐ At starting ☐ While idling ☐ At racing ☐ While accelerating ☐ While cruising ☐ While decelerating ☐ While turning (RH/LH) Vehicle speed 0 10 20 30 40 50 60 MPH	
Check engine light		☐ Turned on ☐ Not turned on	

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

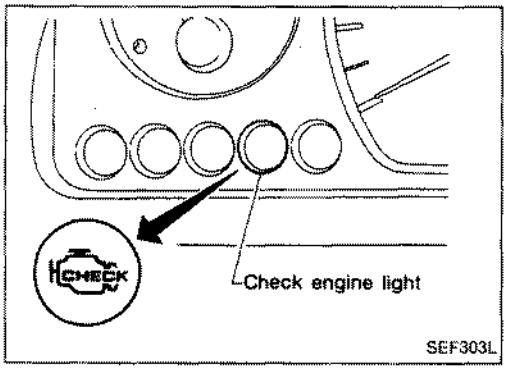


INTERMITTENT PROBLEM SIMULATION

In order to duplicate an intermittent problem, it is effective to create similar conditions for component parts, under which the problem might occur.
Perform the activity listed under Service procedure and note the result.

	Variable factor	Influential part	Target condition	Service procedure
1	Mixture ratio	Pressure regulator	Made lean	Remove vacuum hose and apply vacuum.
			Made rich	Remove vacuum hose and apply pressure.
2	Ignition timing	Crank angle sensor	Advanced	Rotate distributor 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 II) at 2,000 rpm.
4	Idle speed	A.A.C. valve	Raised	Turn idle adjusting screw counterclockwise.
			Lowered	Turn idle adjusting screw clockwise.
5	Electrical connection (Electric continuity)	Harness connectors and wires	Poor electrical connection or improper wiring	Tap or wiggle.
				Race engine rapidly. See if the torque reaction of the engine unit causes electric breaks.
6	Temperature	Control unit	Cooled	Cool with an icing spray or similar device.
			Warmed	Heat with a hair drier. **[WARNING: Do not overheat the unit.]**
7	Moisture	Electric parts	Damp	Wet. **[WARNING: Do not directly pour water on components. Use a mist sprayer.]**
8	Electric loads	Load switches	Loaded	Turn on headlamps, air conditioner, rear defogger, etc.
9	Idle switch condition	Control unit	ON-OFF switching	Rotate throttle sensor body.
10	Ignition spark	Timing light	Spark power check	Try to flash timing light for each cylinder using ignition coil adapter (S.S.T.).

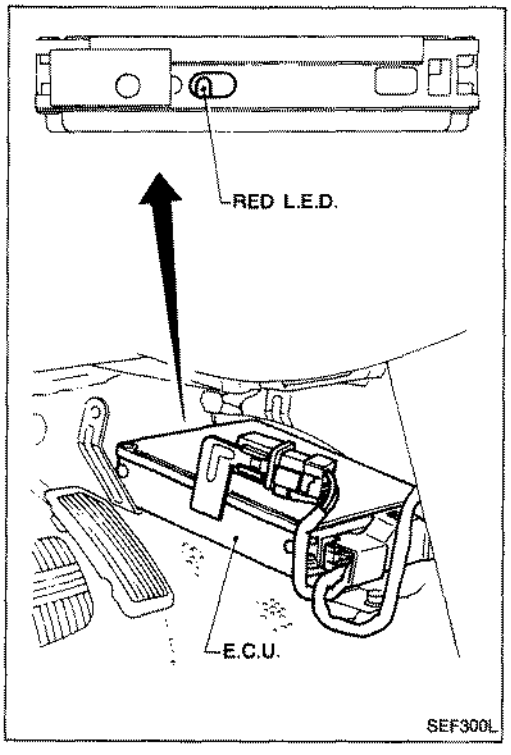
*: Models with catalyzer only



Self-diagnosis

CHECK ENGINE LIGHT

A check engine light has been adopted on all models. This light blinks simultaneously with the RED L.E.D. on the E.C.U.



E.C.U. L.E.D.

The E.C.U. has only one RED L.E.D.

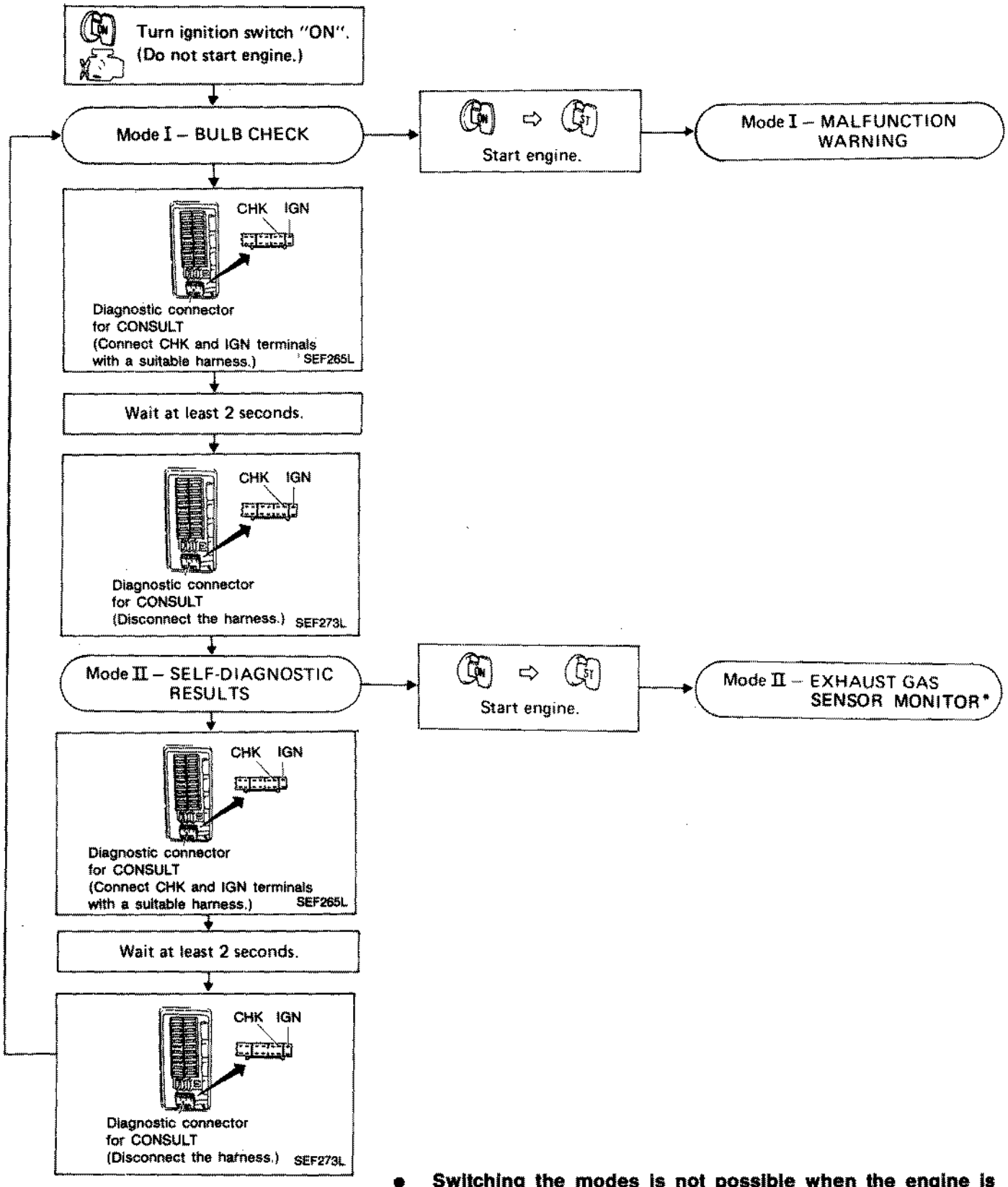
SELF-DIAGNOSTIC FUNCTION

Condition	Mode	Mode I	Mode II
Ignition switch in "ON" position	Engine stopped	BULB CHECK	SELF-DIAGNOSTIC RESULTS
	Engine running	MALFUNCTION WARNING	EXHAUST GAS SENSOR MONITOR*

*: Models with catalyzer only

Self-diagnosis (Cont'd)

HOW TO SWITCH MODES



*: Models with catalyzer only

- **Switching the modes is not possible when the engine is running.**
- **When the ignition switch is turned off during diagnosis in each mode, and then turned back on again after power to the E.C.U. has dropped off completely, the diagnosis will automatically return to Mode I.**

Self-diagnosis — Mode I

MODE I — BULB CHECK

In this mode, the RED L.E.D. in the E.C.U. and the CHECK ENGINE LIGHT in the instrument panel stay "ON".
If either remain "OFF", check the bulb in the CHECK ENGINE LIGHT or the RED L.E.D.

MODE I — MALFUNCTION WARNING

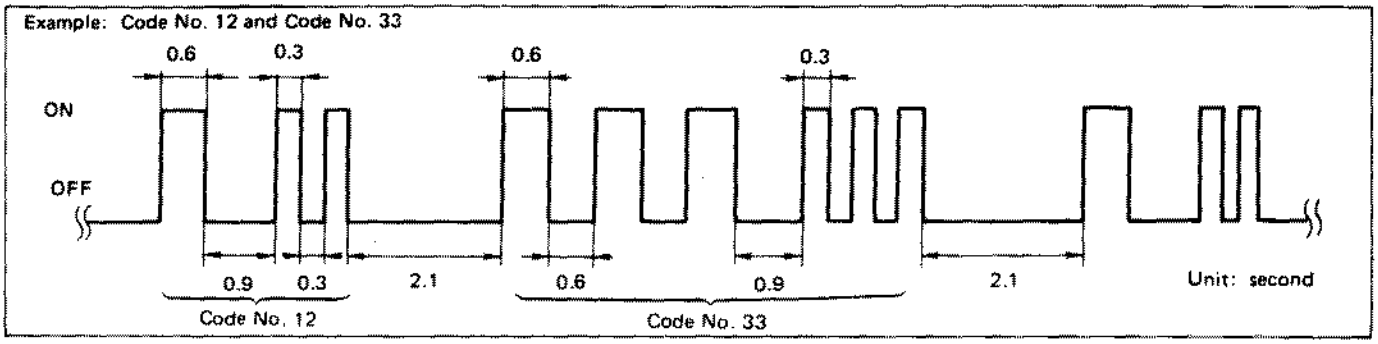
CHECK ENGINE LIGHT and RED L.E.D.	Condition
ON	When the E.C.U.'s C.P.U. is malfunctioning.
OFF	O.K.

- **The RED L.E.D. and the CHECK ENGINE LIGHT will turn off when normal condition is detected.**

Self-diagnosis — Mode II (Self-diagnostic results)

DESCRIPTION

In this mode, a malfunction code is indicated by the number of flashes from the RED L.E.D. or the CHECK ENGINE LIGHT as shown below:



Long (0.6 second) blinking indicates the number of ten digits and short (0.3 second) blinking indicates the number of single digits.
For example, the red L.E.D. flashes once for 0.6 seconds and then it flashes twice for 0.3 seconds. This indicates the number "12" and refers to a malfunction in the air flow meter. In this way, all the problems are classified by their code numbers.
The diagnostic results will remain in E.C.U. memory.

Display code table

Code No.	Detected items
11*	Crank angle sensor circuit
12	Air flow meter circuit
13	Engine temperature sensor circuit
21*	Ignition signal circuit
34	Detonation sensor circuit
43	Throttle sensor circuit
55	No malfunction in the above circuits

*: Check items causing a malfunction of crank angle sensor circuit first, if both code No. 11 and 21 are displayed at the same time.

NOTE

Self-diagnosis — Mode II (Exhaust gas sensor monitor — Models with catalyzer only)

DESCRIPTION

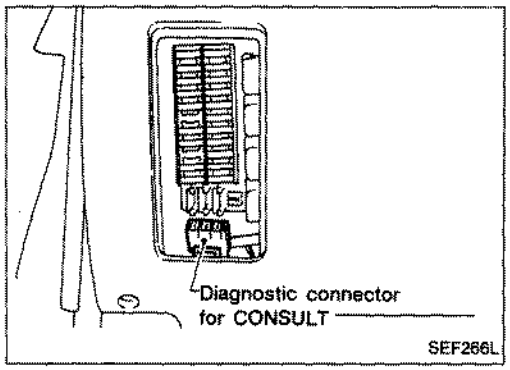
In this mode, the CHECK ENGINE LIGHT and RED L.E.D. display the condition of the fuel mixture (lean or rich) which is monitored by the exhaust gas sensor.

CHECK ENGINE LIGHT and RED L.E.D.	Fuel mixture condition in the exhaust gas	Air fuel ratio feedback control condition
ON	Lean	Closed loop control
OFF	Rich	
*Remains ON or OFF	Any condition	Open loop control

*: Maintains conditions just before switching to open loop.

HOW TO CHECK EXHAUST GAS SENSOR

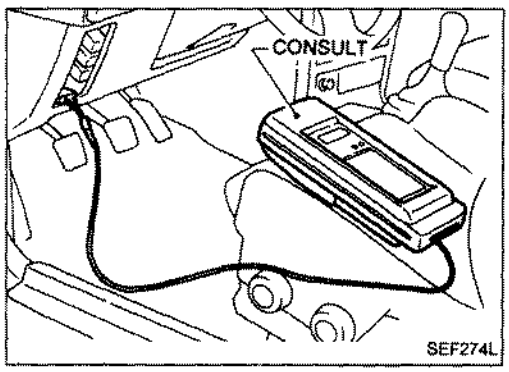
1. Set Mode II. (Refer to "HOW TO SWITCH MODES".)
2. Start engine and warm it up until engine coolant temperature indicator points to the middle of the gauge.
3. Run engine at about 2,000 rpm for about 2 minutes under no-load conditions.
4. Make sure RED L.E.D. or CHECK ENGINE LIGHT goes ON and OFF more than 5 times every 10 seconds; measured at 2,000 rpm under no-load.



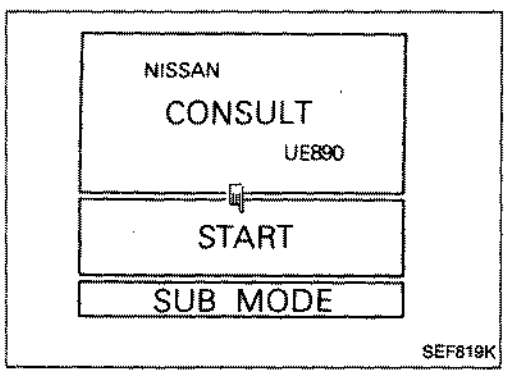
Consult

CONSULT INSPECTION PROCEDURE

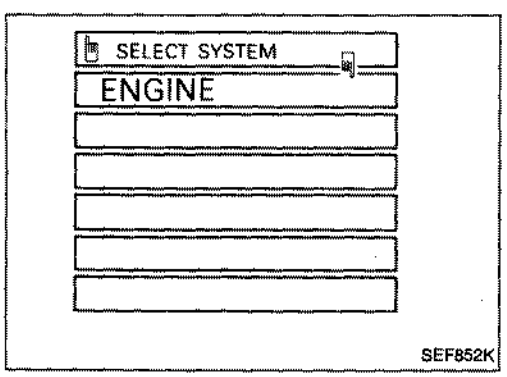
1. Turn off ignition switch.
2. Connect "CONSULT" to diagnostic connector.
   (Diagnostic connector is located behind the fuse box cover.)



3. Turn on ignition switch.
4. Touch "START".

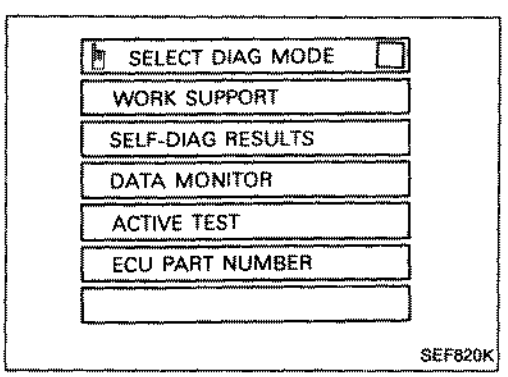


5. Touch "ENGINE".



6. Perform each diagnostic mode according to the inspection sheet as follows:

For further information, see the CONSULT Operation Manual.



Consult (Cont'd)

E.C.C.S. COMPONENT PARTS APPLICATION

E.C.C.S. COMPONENT PARTS \ MODE		WORK SUPPORT	SELF- DIAGNOSTIC RESULTS	DATA MONITOR	ACTIVE TEST
INPUT	Crank angle sensor		X	X	
	Air flow meter		X	X	
	Engine temperature sensor		X	X	X
	Exhaust gas sensor*			X*	
	Vehicle speed sensor			X	
	Throttle sensor	X	X	X	
	Detonation sensor		X		
	Ignition switch (start signal)			X	
	Air conditioner switch			X	
	Neutral switch			X	
	Power steering oil pressure switch			X	
	Battery			X	
OUTPUT	Injectors			X	X
	Power transistor (ignition signal)	X (Ignition timing)	X	X (Ignition timing)	X
	A.A.C. valve	X		X	X
	Air conditioner relay			X	
	Fuel pump relay	X		X	X
	Radiator fan			X	X
	Wastegate valve control solenoid valve**			X**	

X: Applicable
*: Models with catalyzer only
**: For SR20DET engine only

FUNCTION

Diagnostic mode	Function
Work support	This mode enables a technician to adjust some devices faster and more accurately by following the indications on the CONSULT unit.
Self-diagnostic results	Self-diagnostic results can be read and erased quickly.
Data monitor	Input/Output data in the control unit can be read.
Active test	Mode in which CONSULT drives some actuators apart from the control units and also shifts some parameters in a specified range.
E.C.U. part numbers	E.C.U. part numbers can be read.

Consult (Cont'd)

WORK SUPPORT MODE

WORK ITEM	CONDITION	USAGE
THROTTLE SENSOR ADJUSTMENT	CHECK THE THROTTLE SENSOR SIGNAL. ADJUST IT TO THE SPECIFIED VALUE BY ROTATING THE SENSOR BODY UNDER THE FOLLOWING CONDITIONS. • IGN SW "ON" • ENG NOT RUNNING • ACC PEDAL NOT PRESSED	When adjusting throttle sensor initial position.
IGNITION TIMING ADJUSTMENT	• IGNITION TIMING FEEDBACK CONTROL WILL BE HELD BY TOUCHING "START". AFTER DOING SO, ADJUST IGNITION TIMING WITH A TIMING LIGHT BY TURNING THE CRANK ANGLE SENSOR.	When adjusting initial ignition timing.
AAC VALVE ADJUSTMENT	SET ENGINE RPM AT THE SPECIFIED VALUE UNDER THE FOLLOWING CONDITIONS. • ENGINE WARMED UP • NO-LOAD	When adjusting idle speed.
FUEL PRESSURE RELEASE	• FUEL PUMP WILL STOP BY TOUCHING "START" DURING IDLING. CRANK A FEW TIMES AFTER ENGINE STALLS.	When releasing fuel pressure from fuel line.

SELF-DIAGNOSTIC RESULTS MODE

DIAGNOSTIC ITEM	DIAGNOSTIC ITEM IS DETECTED WHEN ...	CHECK ITEM (REMEDY)
CRANK ANGLE SENSOR*	• 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.	• Harness and connector (If harness and connector are normal, replace crank angle sensor.)
AIR FLOW METER	• The air flow meter circuit is open or shorted. (An abnormally high or low voltage is entered.)	• Harness and connector (If harness and connector are normal, replace air flow meter.)
ENGINE TEMP SENSOR	• The engine temperature sensor circuit is open or shorted. (An abnormally high or low output voltage is entered.)	• Harness and connector • Engine temperature sensor
IGN SIGNAL-PRIMARY*	• The ignition signal in primary circuit is not entered during engine cranking or running.	• Harness and connector • Power transistor unit
DETONATION SENSOR	• The detonation circuit is open or shorted. (An abnormally high or low voltage is entered.)	• Harness and connector • Detonation sensor
THROTTLE SENSOR	The throttle sensor circuit is open or shorted. (An abnormally high or low voltage is entered.)	• Harness and connector • Throttle sensor

*: Check items causing a malfunction of crank angle sensor circuit first, if both "CRANK ANGLE SENSOR" and "IGN SIGNAL-PRIMARY" come out at the same time.

Consult (Cont'd)

DATA MONITOR MODE

Remarks:

- The monitor item marked "*" is applicable to models with turbocharger only.
- The monitor item marked "**" is applicable to vehicles with catalyzer only.
- Specification data are reference values.
- Specification data are output/input values which are detected or supplied by the E.C.U. at the connector.
  * Specification data may not be directly related to their components signals/values/operations.
  i.e. Adjust ignition timing with a timing light before monitoring IGN TIMING, because the monitor may show the specification data in spite of the ignition timing not being adjusted to the specification data. This IGN TIMING monitors the data calculated by the E.C.U. according to the signals input from the crank angle sensor and other ignition timing related sensors.

MONITOR ITEM	CONDITION		SPECIFICATION	CHECK ITEM WHEN OUTSIDE SPEC.
CAS, RPM (REF)	• Tachometer: Connect • Run engine and compare tachometer indication with the CONSULT value.		Almost the same speed as the CONSULT value.	• Harness and connector • Crank angle sensor
AIR FLOW MTR	• Engine: After warming up, idle the engine • A/C switch "OFF" • Shift lever "N"	Idle	SR20DE: 1.3 - 1.8V SR20DET: 1.0 - 1.5V	• Harness and connector • Air flow meter
		2,000 rpm	SR20DE: 1.6 - 2.1V SR20DET: 1.3 - 1.8V	
ENG TEMP SEN	• Engine: After warming up		More than 70°C (158°F)	• Harness and connector • Engine temperature sensor
EXH GAS SEN**	• Engine: After warming up	Maintaining engine speed at 2,000 rpm	0 - 0.3V ↔ Approx. 0.6 - 1.0V	• Harness and connector • Exhaust gas sensor • Intake air leaks • Injectors
M/R F/C MNT**			LEAN ↔ RICH Changes more than 5 times during 10 seconds.	
CAR SPEED SEN	• Turn drive wheels and compare speedometer indication with the CONSULT value		Almost the same speed as the CONSULT value	• Harness and connector • Vehicle speed sensor
BATTERY VOLT	• Ignition switch: ON (Engine stopped)		11 - 14V	• Battery • E.C.U. power supply circuit
THROTTLE SEN	• Ignition switch: ON (Engine stopped)	Throttle valve fully closed	0.45 - 0.55V	• Harness and connector • Throttle sensor • Throttle sensor adjustment
		Throttle valve fully opened	Approx. 4.0V	
START SIGNAL	• Ignition switch: ON → START		OFF → ON	• Harness and connector • Starter switch
IDLE POSITION	• Ignition switch: ON (Engine stopped)	Throttle valve: Idle position	ON	• Harness and connector • Throttle sensor • Throttle sensor adjustment
		Throttle valve: Slightly open	OFF	
AIR COND SIG	• Engine: After warming up, idle the engine	A/C switch "OFF"	OFF	• Harness and connector • Air conditioner switch
		A/C switch "ON"	ON	
NEUTRAL SW	• Ignition switch: ON	Shift lever "P" or "N"	ON	• Harness and connector • Neutral switch
		Except above	OFF	
PW/ST SIGNAL	• Engine: After warming up, idle the engine	Steering wheel in neutral (forward direction)	OFF	• Harness and connector • Power steering oil pressure switch
		The steering wheel is turned	ON	
FUEL PUMP RLY	• Ignition switch is turned to ON (SR20DE: Operates for 5 seconds, SR20DET: Operates for 1 second) • Engine running and cranking • When engine is stopped (stops in 1.0 seconds)		ON	• Harness and connector • Fuel pump relay
	Except as shown above		OFF	

Consult (Cont'd)

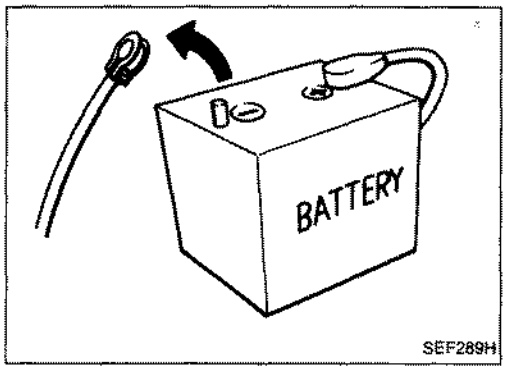
MONITOR ITEM	CONDITION		SPECIFICATION	CHECK ITEM WHEN OUTSIDE SPEC.
RADIATOR FAN	• Engine: After warming up, idle the engine. • A/C switch "OFF"	Engine temperature is 99°C (210°F) or less	OFF	• Harness and connector • Radiator fan relay • Radiator fan
		Engine temperature is 100°C (212°F) or more	ON	
INJ PULSE	• Engine: After warming up • A/C switch "OFF" • Shift lever "N" • No-load	Idle	SR20DE: 2.4 - 3.2 msec. SR20DET: 1.7 - 2.5 msec.	• Harness and connector • Injector • Air flow meter • Intake air system
		2,000 rpm	SR20DE: 1.9 - 2.8 msec. SR20DET: 1.5 - 2.3 msec.	
IGN TIMING	ditto	Idle	SR20DE: 15° B.T.D.C. SR20DET: 20° B.T.D.C.	• Harness and connector • Crank angle sensor
		2,000 rpm	SR20DE: More than 25° B.T.D.C. SR20DET: More than 30° B.T.D.C.	
AAC VALVE	ditto	Idle	20 - 40%	• Harness and connector • A.A.C. valve
		2,000 rpm	—	
A/F ALPHA	• Engine: After warming up	Maintaining engine speed at 2,000 rpm	75 - 125%	• Harness and connector • Injector • Air flow meter • Exhaust gas sensor • Canister purge line • Intake air system
AIR COND RLY	• Air conditioner switch OFF → ON		OFF → ON	• Harness and connector • Air conditioner switch • Air conditioner relay
W/G CONT S/V*	• Use unleaded premium fuel. • Shift lever "N"	Idle	OFF	• Harness and connector • Wastegate valve control solenoid valve
		Race engine up to 2,000 rpm.	ON	

Consult (Cont'd)

ACTIVE TEST MODE

TEST ITEM	CONDITION	JUDGMENT	CHECK ITEM (REMEDY)
FUEL INJECTION TEST	• Engine: Return to the original trouble condition • Change the amount of fuel injection using CONSULT.	If trouble symptom disappears, see CHECK ITEM.	• Harness and connector • Fuel injectors • Exhaust gas sensor
AAC/V OPENING TEST	• Engine: After warming up, idle the engine. • Change the AAC valve opening percent using CONSULT.	Engine speed changes according to the opening percent.	• Harness and connector • AAC valve
ENGINE TEMP TEST	• Engine: Return to the original trouble condition • Change the engine coolant temperature using CONSULT.	If trouble symptom disappears, see CHECK ITEM.	• Harness and connector • Engine temperature sensor • Fuel injectors
IGN TIMING TEST	• Engine: Return to the original trouble condition • Timing light: Set • Retard the ignition timing using CONSULT.	If trouble symptom disappears, see CHECK ITEM.	• Adjust initial ignition timing
POWER BALANCE TEST	• Engine: After warming up, idle the engine. • A/C switch "OFF" • Shift lever "N" • Cut off each injector signal one at a time using CONSULT.	Engine runs rough or dies.	• Harness and connector • Compression • Injectors • Power transistor • Spark plugs • Ignition coils
RADIATOR FAN TEST	• Ignition switch: ON • Turn the radiator fan "ON" and "OFF" using CONSULT.	Radiator fan moves and stops.	• Harness and connector • Radiator fan motor
FUEL PUMP RLY TEST	• Ignition switch: ON (Engine stopped) • Turn the fuel pump relay "ON" and "OFF" using CONSULT and listen to operating sound.	Fuel pump relay makes the operating sound.	• Harness and connector • Fuel pump relay
SELF-LEARN CONT TEST*	• In this test, the coefficient of self-learning control mixture ratio returns to the original coefficient by touching "CLEAR" on the screen.		

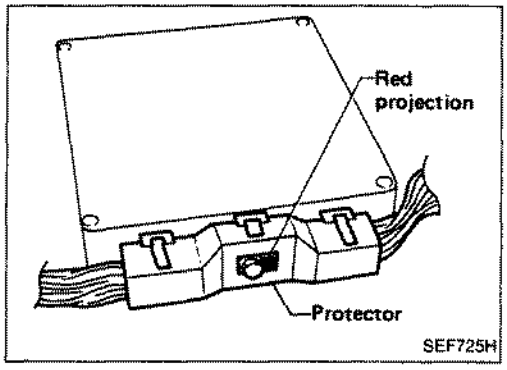
Remarks: The monitor item marked "*" is applicable to vehicles with catalyzer only.



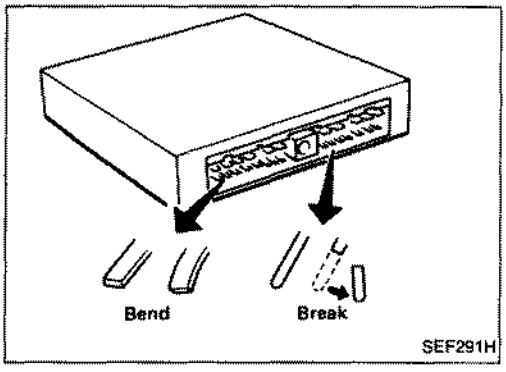
Diagnostic Procedure

CAUTION:

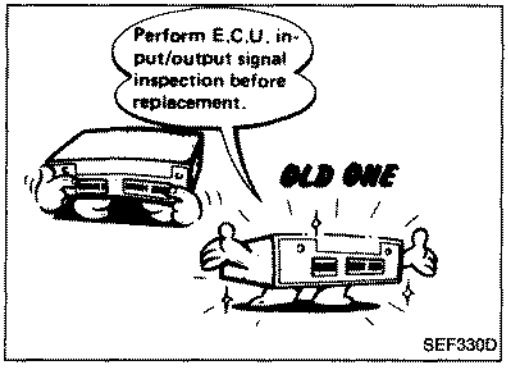
1. **Before connecting or disconnecting the E.C.U. harness connector to or from any E.C.U., be sure to turn the ignition switch to the "OFF" position and disconnect the negative battery terminal in order not to damage E.C.U. as battery voltage is applied to E.C.U. even if ignition switch is turned off.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



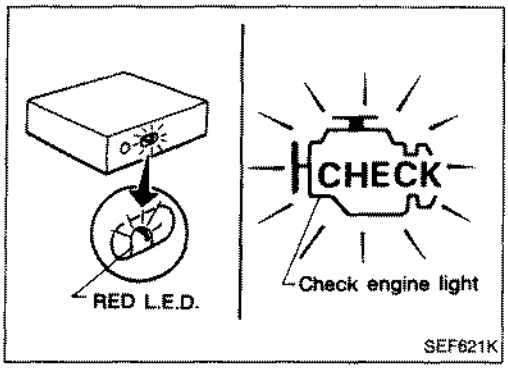
2. **When connecting E.C.U. harness connector, tighten securing bolt until red projection is in line with connector face.**



3. **When connecting or disconnecting pin connectors into or from E.C.U., take care not to damage pin terminals (bend or break).**
4. **Make sure that there are not any bends or breaks on E.C.U. pin terminal, when connecting pin connectors.**

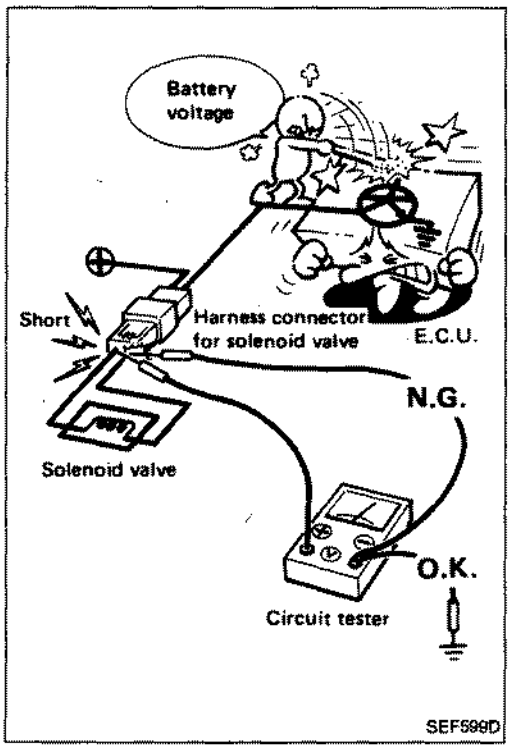


5. **Before replacing E.C.U., perform E.C.U. input/output signal inspection and make sure whether E.C.U. functions properly or not. (See page EF & EC-621.)**



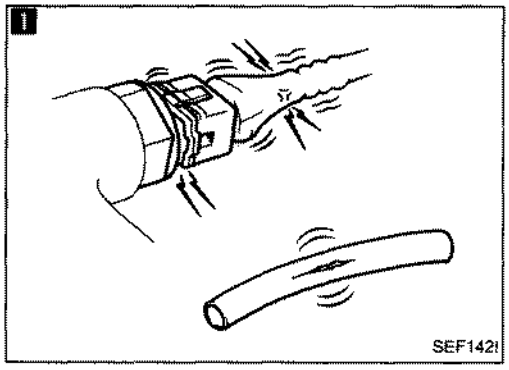
6. **After performing this "Diagnostic Procedure", perform E.C.C.S. self-diagnosis and driving test.**

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.

Basic Inspection

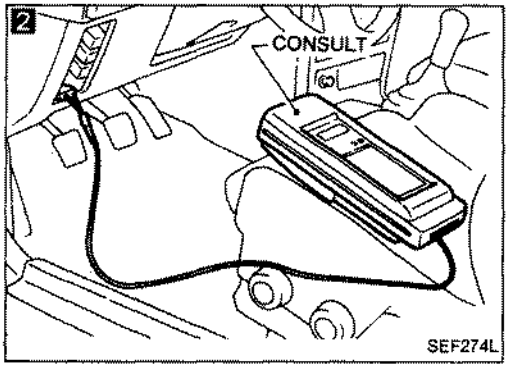


1

BEFORE STARTING

1. Check service records for any recent repairs that may indicate a related problem, or the current need for scheduled maintenance.
2. Open engine hood and check the following:

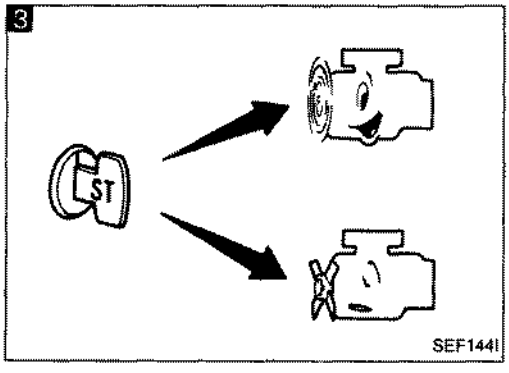
- Harness connectors for proper connections
- Vacuum hoses for splits, kinks, and proper connections
- Wiring for proper connections, pinches, and cuts



2

CONNECT CONSULT TO THE VEHICLE

Connect "CONSULT" to the diagnostic connector and select "ENGINE" from the menu. (Refer to page EF & EC-417.)



3

DOES ENGINE START? — No → Go to **6**.

Yes

4

CHECK IGNITION TIMING.

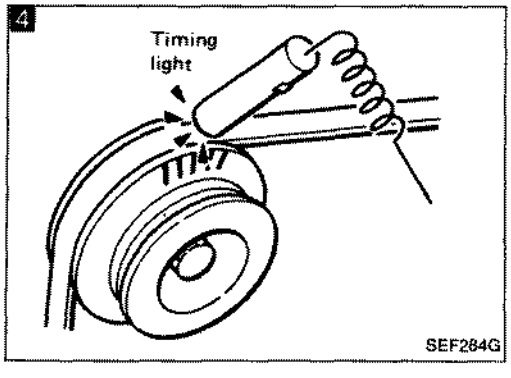
Warm up engine sufficiently and check ignition timing at idle using timing light. (Refer to page EF & EC-389.)

Ignition timing:

15° ± 2° B.T.D.C.

N.G. → Adjust ignition timing by turning crank angle sensor.

O.K.



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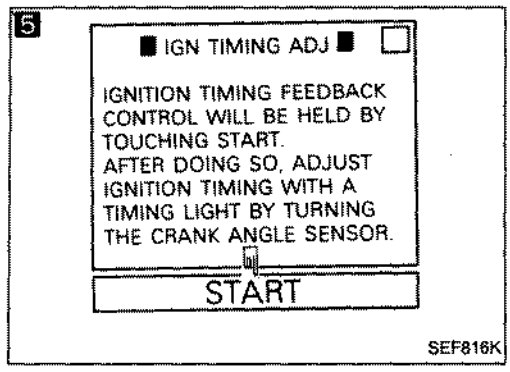
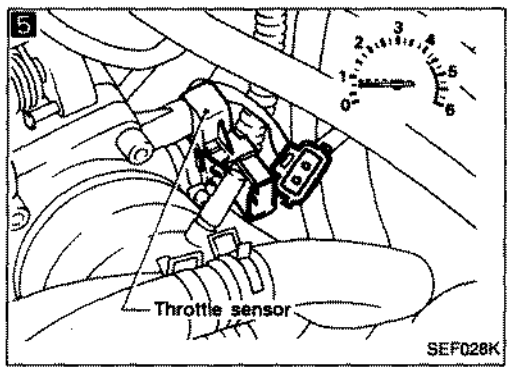
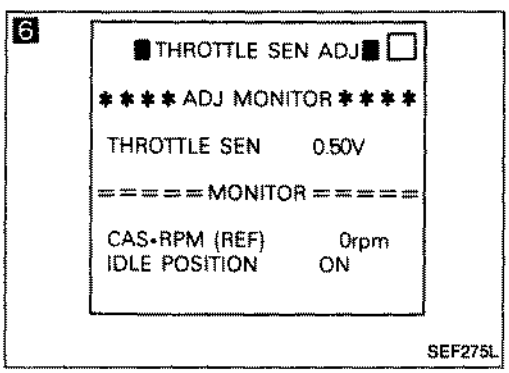
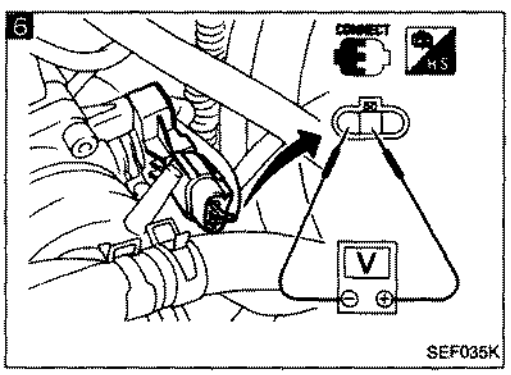
Basic Inspection (Cont'd)









Ⓐ

5 **CHECK IDLE ADJ. SCREW INITIAL SET RPM.**

1. Select "IGN TIMING ADJ" in "WORK SUPPORT" mode.
2. When touching "START", does engine rpm fall to 800±50 rpm (in "N" position)?

No → Adjust engine rpm by turning idle adjusting screw.

OR

When disconnecting throttle sensor harness connector, does engine rpm fall to 800±50 rpm (in "N" position)?

Yes

6 **CHECK THROTTLE SENSOR IDLE POSITION.**

1. Perform "THROTTLE SEN. ADJ" in "WORK SUPPORT" mode.
2. Check that output voltage of throttle sensor is 0.45 to 0.55V. (Throttle valve fully closes.) and "IDLE POSITION" stays "ON".

N.G. →
1. Adjust output voltage by rotating throttle sensor body.
2. Disconnect throttle sensor harness connector for a few seconds and then reconnect it.
3. Confirm that "IDLE POSITION" stays "ON".

OR

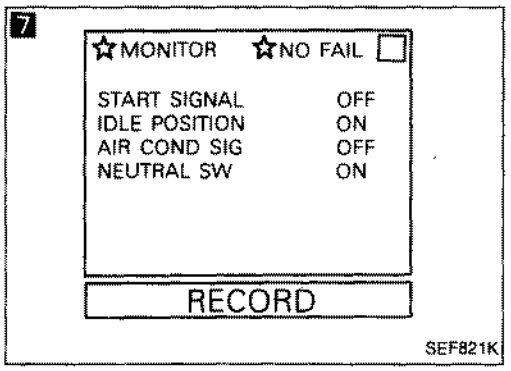
Measure output voltage of throttle sensor using voltmeter, and check that it is 0.45 to 0.55V. (Throttle valve fully closed.)

O.K.

(Go to Ⓑ on next page.)

Basic Inspection (Cont'd)

7



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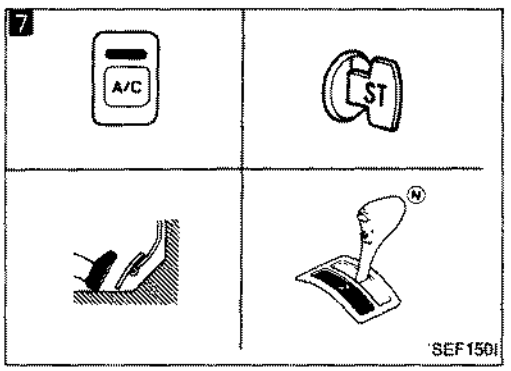
7



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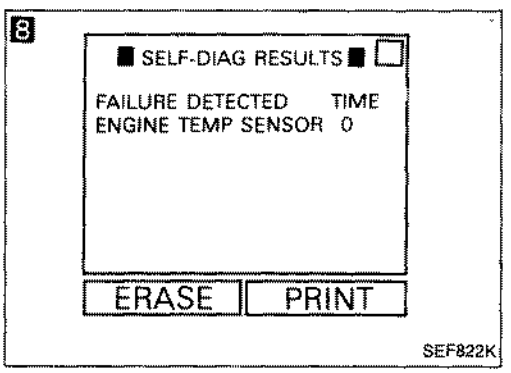
8



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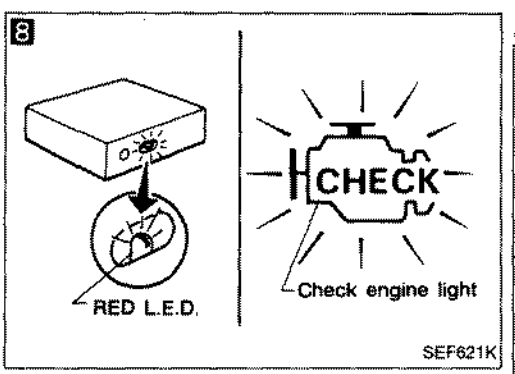


SEF621K

Ⓑ

7

CHECK SWITCH INPUT SIGNAL.

Select the following switches in "DATA MONITOR" mode,
a) Start signal,
b) Idle position,
c) Air conditioner signal,
d) Neutral (Parking) switch,
and check the switches' ON-OFF operation.

N.G. → Repair or replace the malfunctioning switch or its circuit.

OR

Remove E.C.U. from behind audio system panel and check the above switches' ON-OFF operation using voltmeter at each E.C.U. terminal.

Switch	Condition	Voltage (V)
Start signal	IGN ON → IGN START	0 → Battery voltage
Idle position	Accelerator pedal released → Accelerator pedal fully depressed	0.45 - 0.55 → Approx. 4.0
A/C signal	A/C OFF → A/C ON (Engine running)	Battery voltage → Approx. 0
Neutral (Parking) switch	Shift lever is Neutral position → Except Neutral position	0 → Approx. 6.0

O.K.

8

READ SELF-DIAGNOSTIC RESULTS.

1. Perform "SELF-DIAG RESULTS" mode.
2. Read out self-diagnostic results.
3. Is a failure detected?

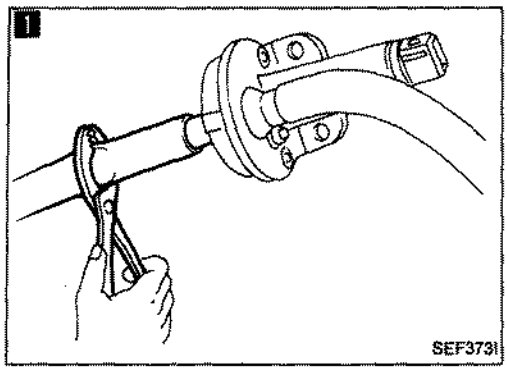
Yes → Go to the relevant inspection procedure.

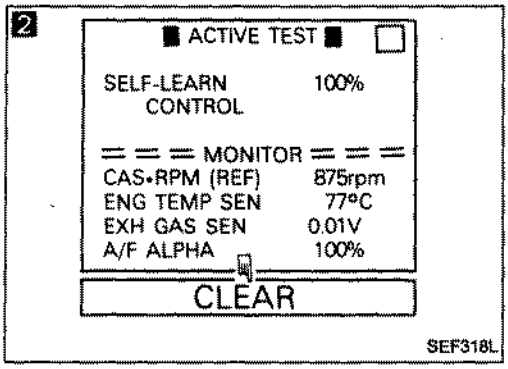
OR

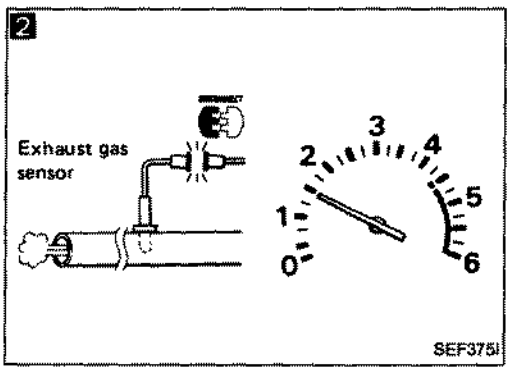
1. Set "Self-diagnostic results mode" in Mode II. (Refer to page EF & EC-412.)
2. Count the number of RED L.E.D. or check engine light flashes and read out the codes.
3. Does the code shown correspond to any malfunction?

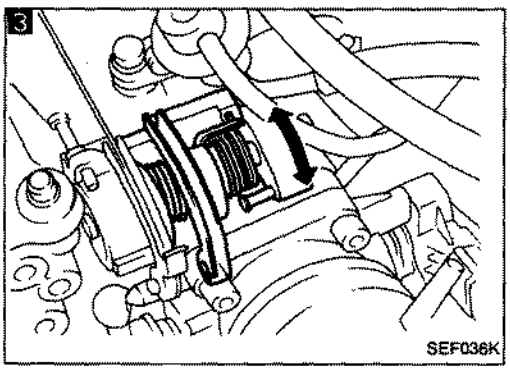
No

INSPECTION END









Diagnostic Procedure 1 — High Idling after Warm-up

1

CHECK AIR REGULATOR.
When pinching the air regulator hose, does the engine speed drop?

Yes → Check air regulator and circuit. (See page EF & EC-504.)

No ↓

2

CHECK INTAKE AIR LEAK.
(MODELS WITH CATALYZER ONLY)

1. Select "SELF-LEARNING CONT" in "ACTIVE TEST" mode.
2. Clear the self-learning control coefficient by touching "CLEAR".
3. Does the engine speed drop?

Yes → Discover air leak location and repair.

OR

1. Disconnect exhaust gas sensor harness connector.
2. After racing engine at 2,000 rpm under no-load for about 30 seconds, does the engine speed drop?

No ↓

3

CHECK THROTTLE LINKAGE.
1. Check that throttle linkage moves smoothly.
2. Confirm that throttle valve both fully opens and fully closes.

N.G. → Repair throttle linkage or sticking of throttle valve.

O.K. ↓

INSPECTION END

Diagnostic Procedure 2 — Hunting

1

CHECK EXHAUST GAS SENSOR. (MODELS WITH CATALYZER ONLY)
When disconnecting exhaust gas sensor harness connector, is the hunting fixed?

Yes → Check exhaust gas sensor. (See page EF & EC-494.)

No ↓

2

PERFORM POWER BALANCE TEST.

1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

— OR —

When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

No → Go to 4.

Yes ↓

3

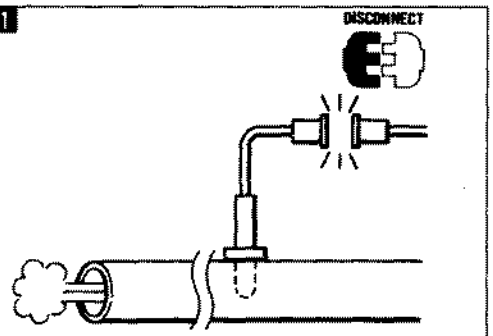
CHECK SPARK PLUGS.
Remove the spark plugs and check for fouling, etc.

N.G. → Repair or replace spark plug(s).

O.K. ↓

(Go to Ⓐ on next page.)

1



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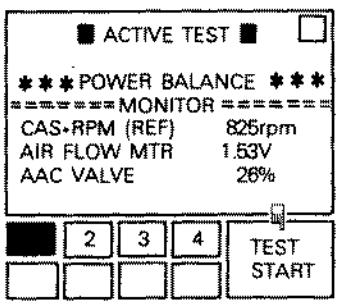
2



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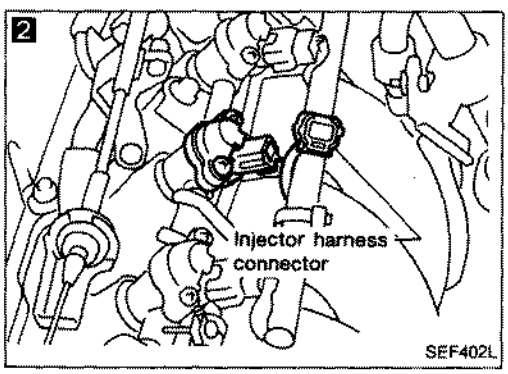
2



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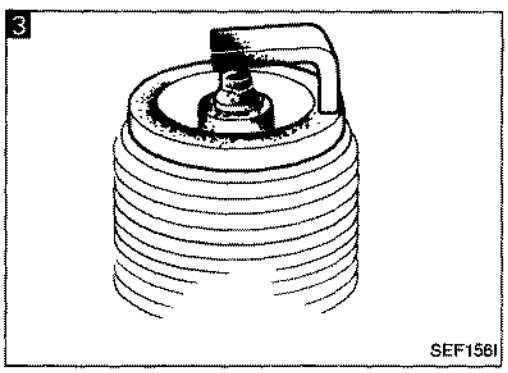
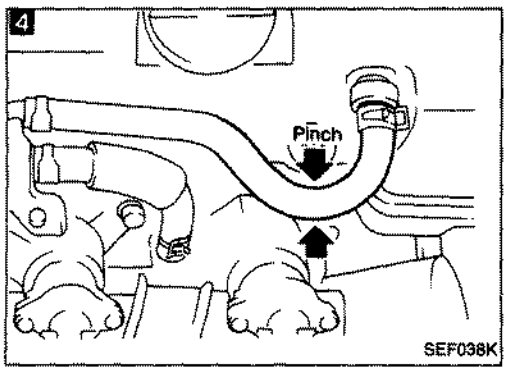
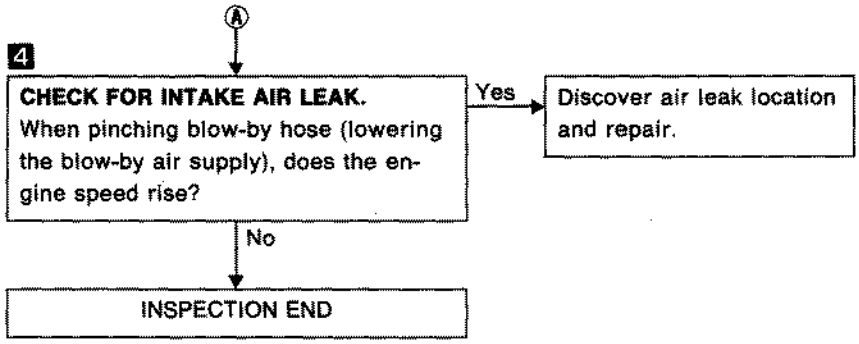

SEF156I

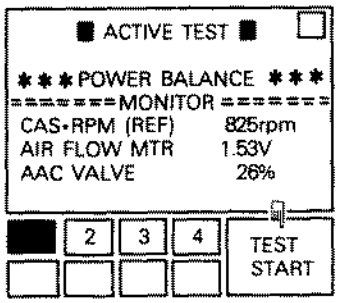
Diagnostic Procedure 2 — Hunting (Cont'd)





Diagnostic Procedure 3 — Unstable Idle

1



SEF797K

PERFORM POWER BALANCE TEST.

1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

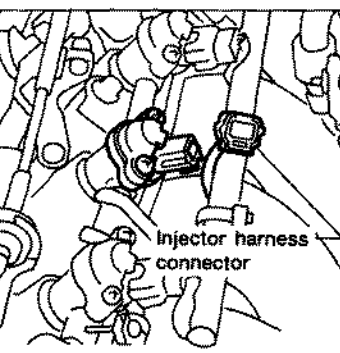
No → Go to 6 .

OR

When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

Yes ↓

1



SEF402L

2

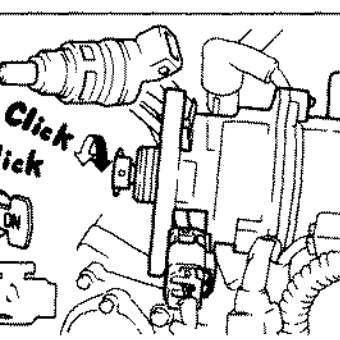
CHECK INJECTOR.

1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Disconnect ignition wires.
3. ignition switch ON. (Do not start engine.)
4. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

No → Check injector(s) and circuit(s).

Yes ↓

2



SEF326K

3

CHECK IGNITION SPARK.

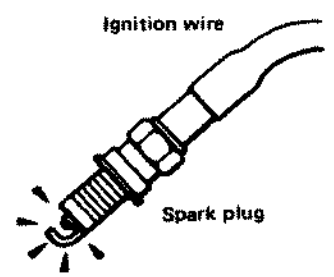
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

N.G. → Check ignition coil, power transistor and their circuits. (See page EF & EC-480.)

O.K. ↓

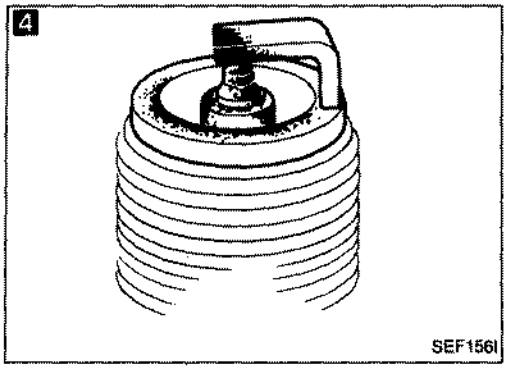
(Go to Ⓐ on next page.)

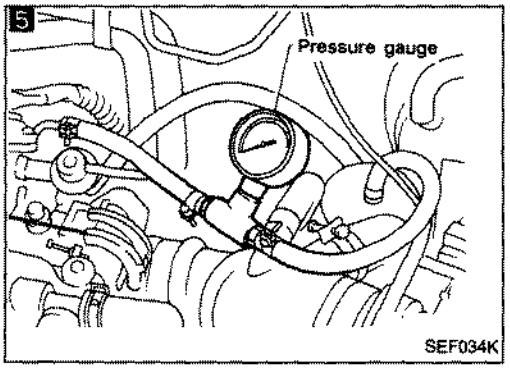
3



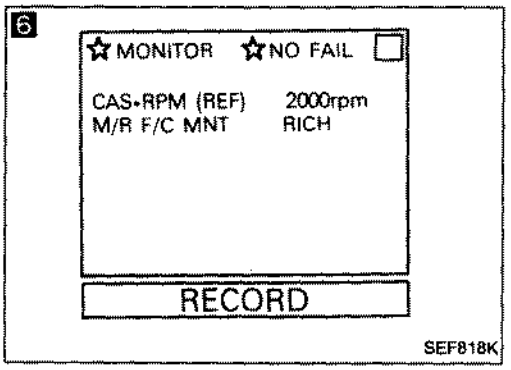
SEF282G

Diagnostic Procedure 3 — Unstable Idle (Cont'd)

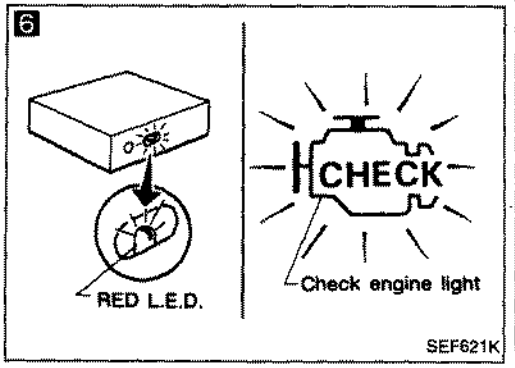

SEF156I



SEF034K



SEF818K



SEF621K

Ⓐ

4 **CHECK SPARK PLUGS.**
Remove the spark plugs and check for fouling, etc.
N.G. → Repair or replace spark plug(s).
O.K.

5 **CHECK FUEL PRESSURE.**
1. Release fuel pressure to zero. (Refer to page EF & EC-638.)
2. Install fuel pressure gauge and check fuel pressure.
At idle:
Approx. 245 kPa
(2.45 bar, 2.5 kg/cm², 36 psi)

N.G. → Check fuel pump and circuit.
O.K.

6 **CHECK EXHAUST GAS SENSOR. (MODELS WITH CATALYZER ONLY)**
1. See "M/R F/C MNT" in "Data monitor" mode.
2. Maintaining engine at 2,000 rpm under no-load (engine is warmed up sufficiently.), check that the monitor fluctuates between "LEAN" and "RICH" more than 5 times during 10 seconds.
RICH→LEAN→RICH→
1 time 2 times
LEAN→RICH.....

N.G. → Replace exhaust gas sensor.

OR

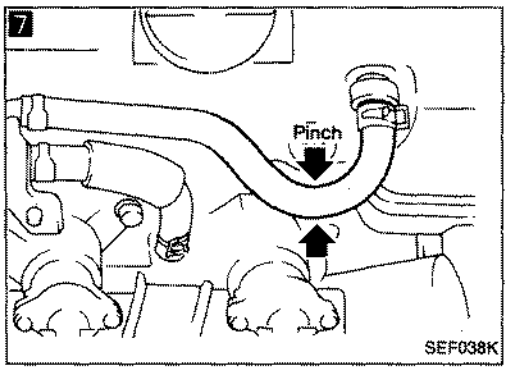
1. Set "Exhaust gas sensor monitor" in the self-diagnostic Mode Ⅱ. (See page EF & EC-412.)
2. Maintaining engine at 2,000 rpm under no-load, check to make sure that the RED L.E.D. on the E.C.U. or the check engine light on the instrument panel goes ON and OFF more than 5 times during 10 seconds.

O.K.

(Go to Ⓑ on next page.)

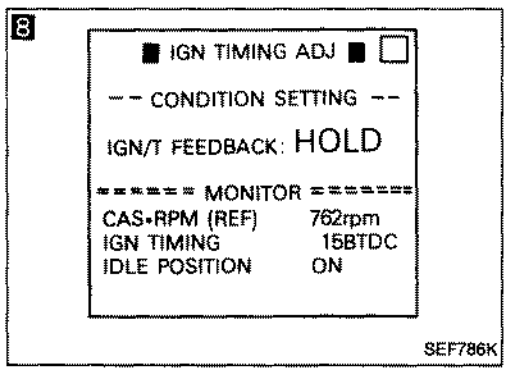
Diagnostic Procedure 3 — Unstable Idle (Cont'd)

7



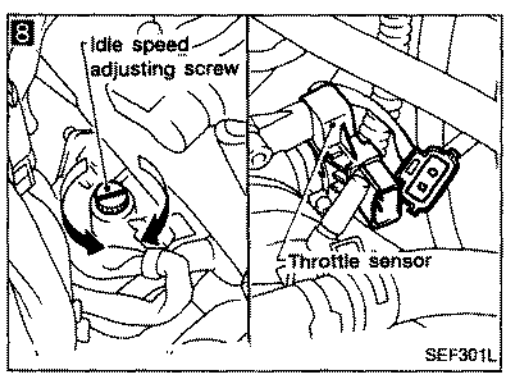
SEF038K

8



SEF786K

8



SEF301L

9

COMPRESSION PRESSURE

SEF309G

(8)

7 **CHECK FOR INTAKE AIR LEAK.**
When pinching blow-by hose (lowering the blow-by air supply), does the engine speed rise?

Yes → Discover air leak location and repair.

No

8 **CHECK IDLE ADJ. SCREW CLOGGING.**

1. Perform "IGN TIMING ADJ" in "WORK SUPPORT" mode.
2. Can you set engine rpm at 800 ± 50 rpm (in "N" position) by turning idle adjusting screw?

OR

1. Disconnect throttle sensor harness connector.
2. Can you set engine rpm at 800 ± 50 rpm (in "N" position) by turning idle adjusting screw?

No → Check for I.A.S. clogging or throttle valve clogging.

Yes

9 **CHECK COMPRESSION PRESSURE.**

- Check compression pressure.

Standard:
kPa (bar, kg/cm², psi)/300 rpm
1,275 (12.75, 13.0, 185)
Minimum:
kPa (bar, kg/cm², psi)/300 rpm
1,079 (10.79, 11.0, 156)
Difference between each cylinder:
kPa (bar, kg/cm², psi)/300 rpm
98 (0.98, 1.0, 14)

N.G. → Check pistons, piston rings, valves, valve seats and cylinder head gaskets.

O.K.

10 **CHECK E.C.U. HARNESS CONNECTOR.**
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.

N.G. → Repair or replace.

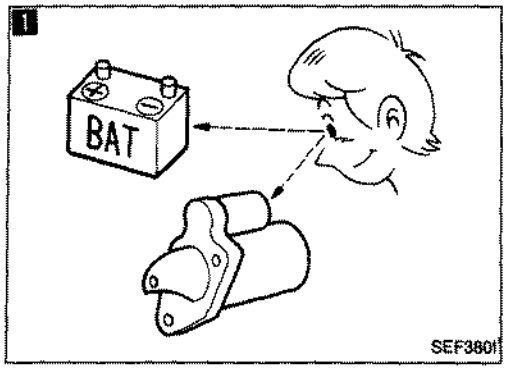
O.K.

11 **TRY A KNOWN GOOD E.C.U.***

INSPECTION END

*: E.C.U. may be the cause of a problem, but this is rarely the case.

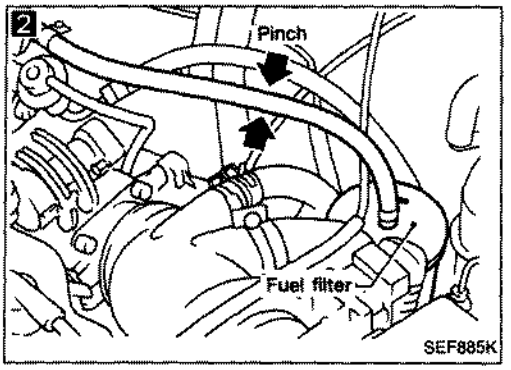
Diagnostic Procedure 4 — Hard to Start or Impossible to Start when the Engine is Cold



1 **CHECK BATTERY AND STARTER.**
Check battery and starter condition.
(Refer to EL section.)

N.G. → Repair or replace.

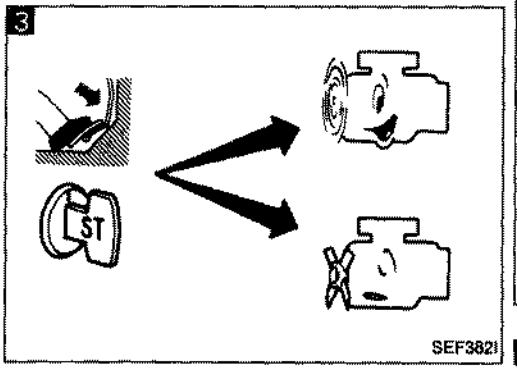
O.K. ↓



2 **CHECK FUEL PRESSURE.**
1. Pinch fuel feed hose with fingers.
2. When cranking the engine, is there any pressure on the fuel feed hose?

No → Check fuel pump and circuit. (See page EF & EC-500.)

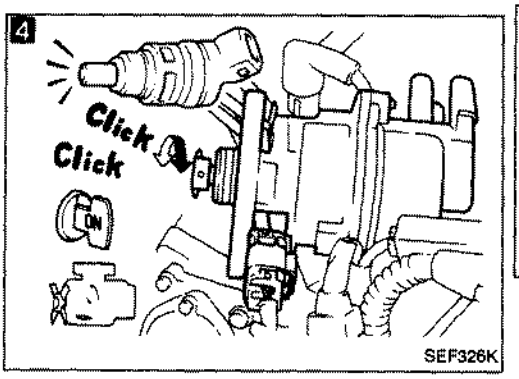
Yes ↓



3 **CHECK AIR REGULATOR AND A.A.C. VALVE.**
When pressing accelerator pedal fully, can you start the engine.

Yes → Check A.A.C. valve, air regulator and circuits. (See pages EF & EC-504, 506.)

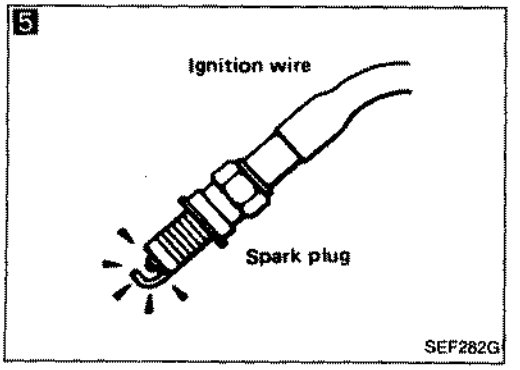
No ↓



4 **CHECK INJECTOR.**
1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Disconnect ignition wires.
3. Turn ignition switch ON. (Do not start engine.)
4. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

No → Check injector(s) and circuit(s).

Yes ↓



5 **CHECK IGNITION SPARK.**
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

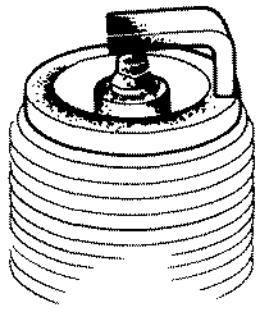
N.G. → Check ignition coil, power transistor and their circuits. (See page EF & EC-480.)

O.K. ↓

(Go to Ⓐ on next page.)

Diagnostic Procedure 4 — Hard to Start or Impossible to Start when the Engine is Cold (Cont'd)

6



SEF156I

Ⓐ

6 **CHECK SPARK PLUGS.**
Remove the spark plugs and check for fouling, etc.
N.G. → Repair or replace spark plug(s).
O.K. ↓

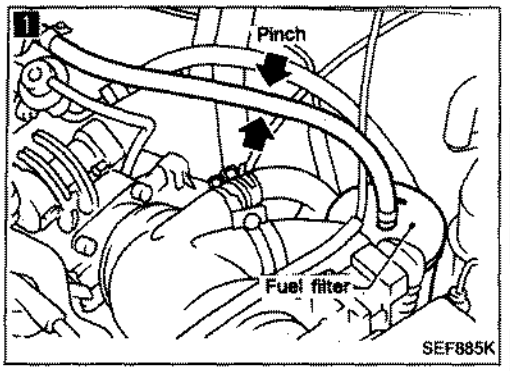
7 **CHECK E.C.U. HARNESS CONNECTOR.**
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.
N.G. → Repair or replace.
O.K. ↓

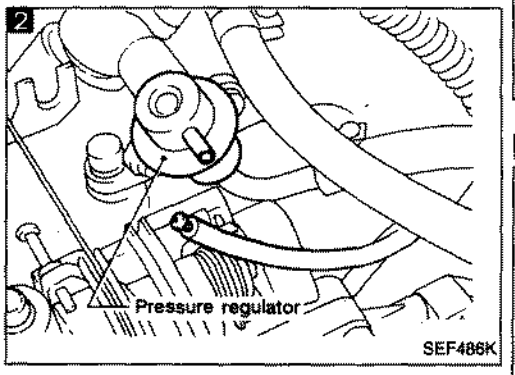
8 **CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.**
Refer to page EF & EC-464.
N.G. → Repair or replace.
O.K. ↓

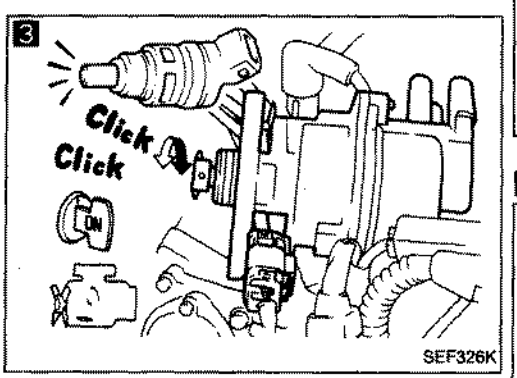
9 **TRY A KNOWN GOOD E.C.U.***
Trouble is fixed. → Replace E.C.U.
Trouble is not fixed. ↓

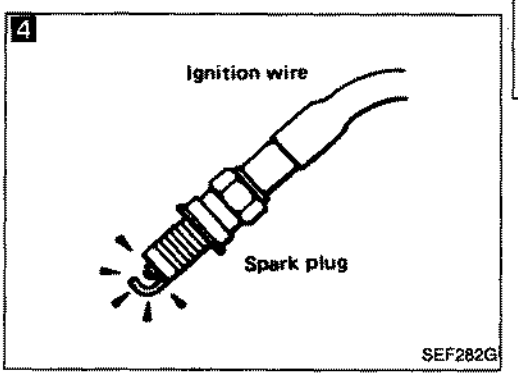
INSPECTION END

*: E.C.U. may be the cause of a problem, but this is rarely the case.









Diagnostic Procedure 5 — Hard to Start or Impossible to Start when the Engine is Hot

1

CHECK FUEL PRESSURE.
1. Pinch fuel feed hose with fingers.
2. When cranking the engine, is there any pressure on the fuel feed hose?

No → Check fuel pump and circuit. (See page EF & EC-500.)

Yes ↓

2

CHECK FUEL VAPOR.
1. Disconnect fuel pressure regulator vacuum hose and plug hose.
2. Can you start engine?

Yes → Check fuel properties.

No ↓

3

CHECK INJECTOR.
1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Disconnect ignition wires.
3. Turn ignition switch ON. (Do not start engine.)
4. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

No → Check injector(s) and circuit(s).

Yes ↓

4

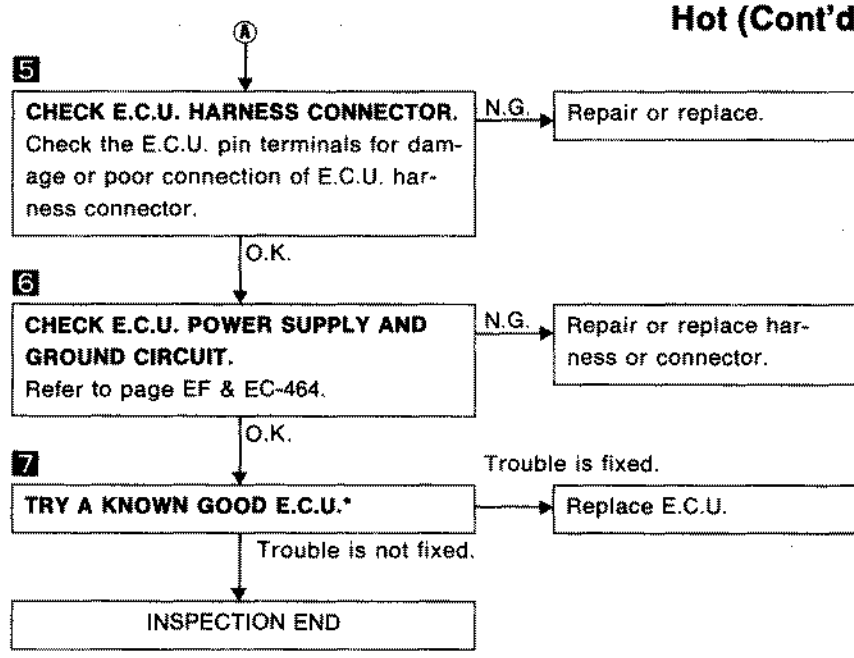
CHECK IGNITION SPARK.
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

N.G. → Check ignition coil, power transistor and circuits. (See page EF & EC-480.)

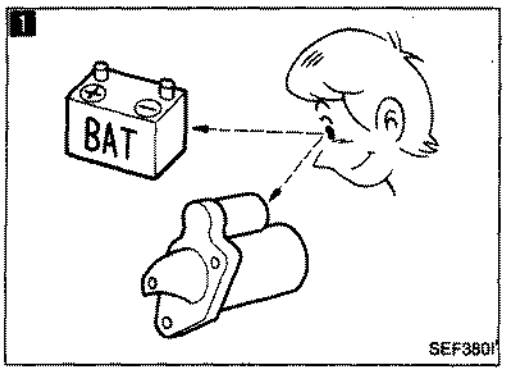
O.K. ↓

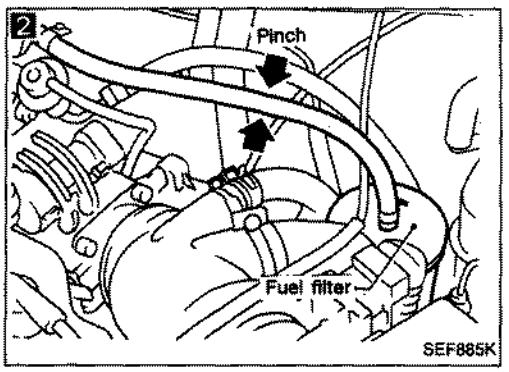
(Go to Ⓐ on next page.)

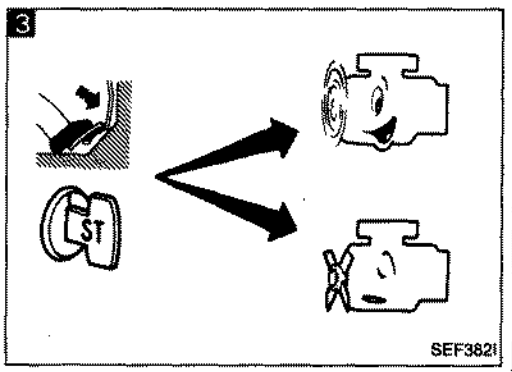
Diagnostic Procedure 5 — Hard to Start or Impossible to Start when the Engine is Hot (Cont'd)

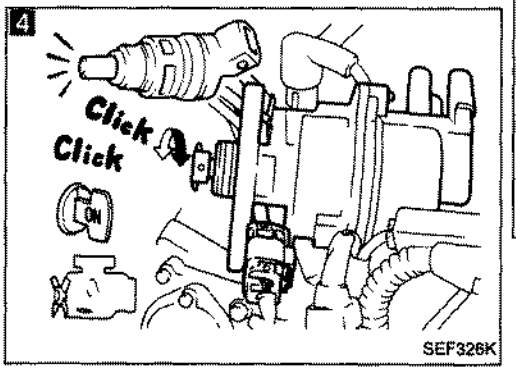


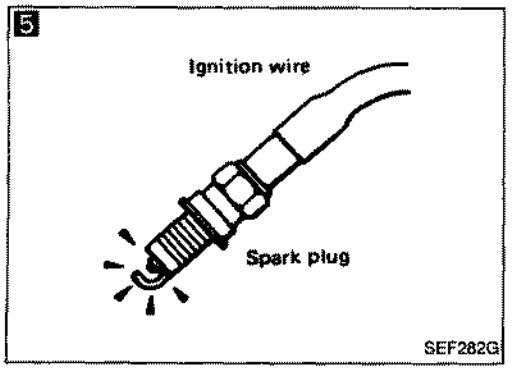
*: E.C.U. may be the cause of a problem, but this is rarely the case.











Diagnostic Procedure 6 — Hard to Start or Impossible to Start under Normal Conditions

1

CHECK BATTERY AND STARTER.
Check battery and starter operation.
(Refer to EL section.)

N.G. → Repair or replace.

O.K. ↓

2

CHECK FUEL PRESSURE.
1. Pinch fuel feed hose with fingers.
2. When cranking the engine, is there any pressure on the fuel feed hose?

No → Check fuel pump and circuit. (See page EF & EC-500.)

Yes ↓

3

CHECK INJECTOR FOR LEAKAGE.
When pressing accelerator pedal fully, can you start the engine.

Yes → Check injector(s) for leakage.

No ↓

4

CHECK INJECTOR.
1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Disconnect ignition wires.
3. Turn ignition switch ON. (Do not start engine.)
4. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

No → Check injectors and circuits.

Yes ↓

5

CHECK IGNITION SPARK.
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

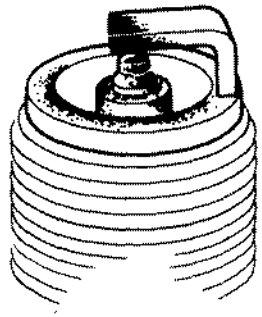
N.G. → Check ignition coil, power transistor and circuits. (See page EF & EC-480.)

O.K. ↓

(Go to Ⓐ on next page.)

Diagnostic Procedure 6 — Hard to Start or Impossible to Start under Normal Conditions (Cont'd)

6



SEF156I

Ⓐ

6 **CHECK SPARK PLUGS.**
Remove the spark plugs and check for fouling, etc.
N.G. → Repair or replace spark plug(s).
O.K. ↓

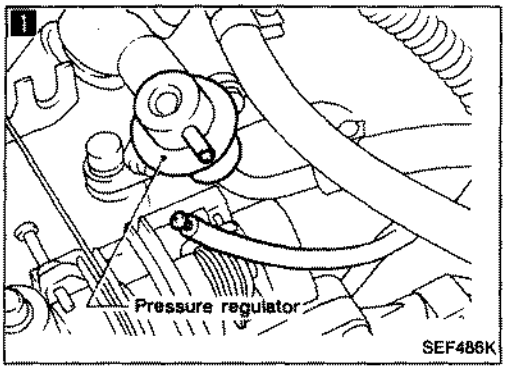
7 **CHECK E.C.U. HARNESS CONNECTOR.**
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.
N.G. → Repair or replace.
O.K. ↓

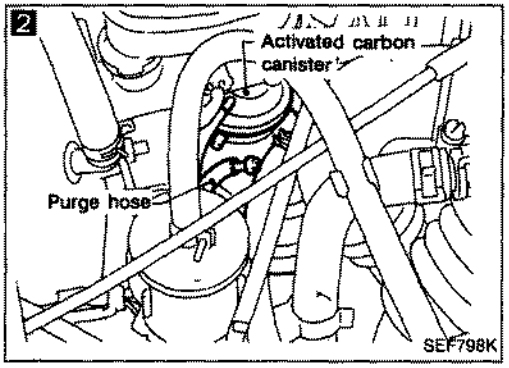
8 **CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.**
Refer to page EF & EC-464.
N.G. → Repair or replace.
O.K. ↓

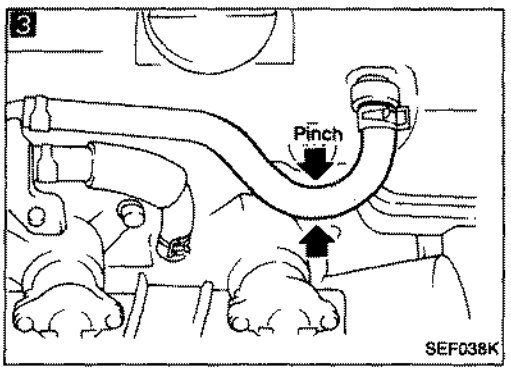
9 **TRY A KNOWN GOOD E.C.U.***
Trouble is fixed. → Replace E.C.U.
Trouble is not fixed. ↓

INSPECTION END

*: E.C.U. may be the cause of a problem, but this is rarely the case.







Diagnostic Procedure 7 — Hesitation when the Engine is Hot

1

CHECK FUEL VAPOR.
1. Disconnect fuel pressure regulator vacuum hose and plug hose.
2. Test drive.
3. Does the hesitation disappear?

Yes → Check fuel properties.

No ↓

2

CHECK CANISTER PURGE. (MODELS WITH CATALYZER ONLY)
1. Disconnect canister purge line hose and plug hose.
2. Test drive.
3. Does the hesitation disappear?

Yes → Check purge and vacuum line.

No ↓

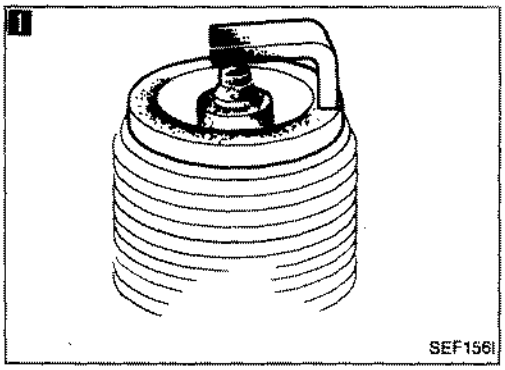
3

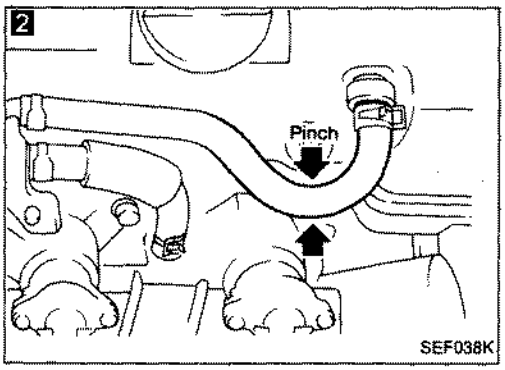
CHECK FOR INTAKE AIR LEAK.
When pinching blow-by hose (lowering the blow-by air supply), does the engine speed rise?

Yes → Discover air leak location and repair.

No ↓

INSPECTION END





Diagnostic Procedure 8 — Hesitation when the Engine is Cold

1

CHECK SPARK PLUGS.
Remove spark plugs and check for fouling, etc.

N.G. → Repair or replace spark plug(s).

O.K. ↓

2

CHECK FOR INTAKE AIR LEAK.
When pinching blow-by hose (lowering the blow-by air supply), does the engine speed rise?

Yes → Discover air leak location and repair.

No ↓

3

TRY A KNOWN GOOD AIR FLOW METER.

Trouble is fixed. → Replace air flow meter.

Trouble is not fixed. ↓

4

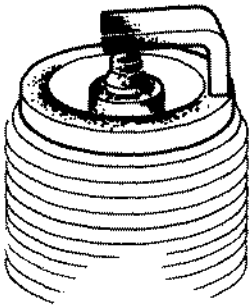
CHECK FOR INTAKE VALVE DEPOSITS.
If there are deposits on intake valves, remove them.

↓

INSPECTION END

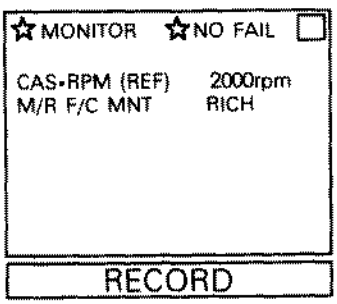
Diagnostic Procedure 9 — Hesitation under Normal Conditions

1



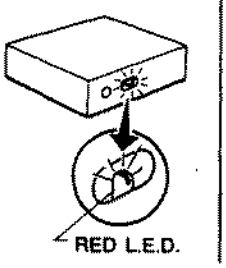
SEF156I

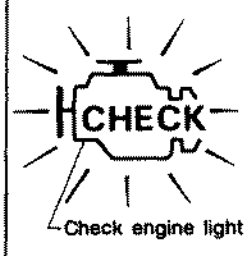
2



SEF818K

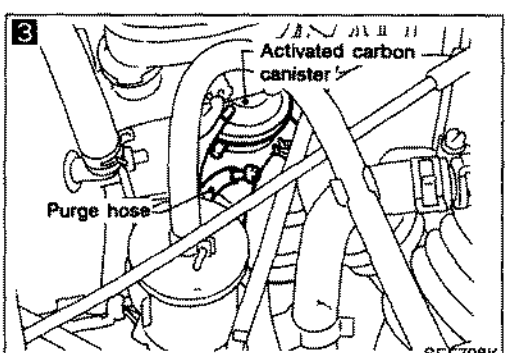
3





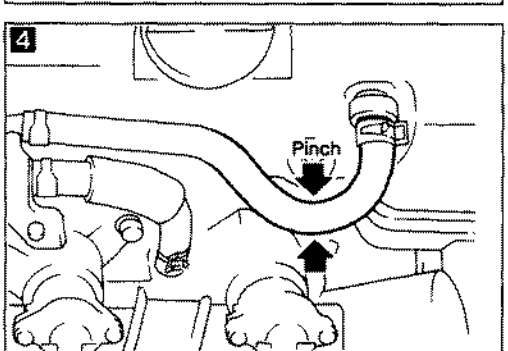
SEF621K

3



SEF798K

4



SEF038K

1

CHECK SPARK PLUGS.
Remove spark plugs and check for fouling, etc.

N.G. → Repair or replace spark plug(s).

O.K.

2

CHECK EXHAUST GAS SENSOR. (MODELS WITH CATALYZER ONLY)

1. See "M/R F/C MNT" in "DATA MONITOR" mode.
2. Maintaining engine at 2,000 rpm under no-load (with engine warmed up sufficiently.), check to make sure that the monitor fluctuates between "LEAN" and "RICH" more than 5 times during 10 seconds.

RICH→LEAN→RICH→ LEAN→RICH.....
1 time **2 times**

N.G. → Replace exhaust gas sensor.

OR

1. Set "Exhaust gas sensor monitor" in the self-diagnostic Mode II. (See page EF & EC-412.)
2. Maintaining engine at 2,000 rpm under no-load, check that the RED L.E.D. on the E.C.U. or the check engine light on the instrument panel goes ON and OFF more than 5 times during 10 seconds.

O.K.

3

CHECK CANISTER PURGE. (MODELS WITH CATALYZER ONLY)

1. Disconnect canister purge line hose and plug hose.
2. Perform cruise test.
3. Does the hesitation disappear?

Yes → Check purge and vacuum line.

No

4

CHECK FOR INTAKE AIR LEAK.
When pinching blow-by hose (lowering the blow-by air supply), does the engine speed rise?

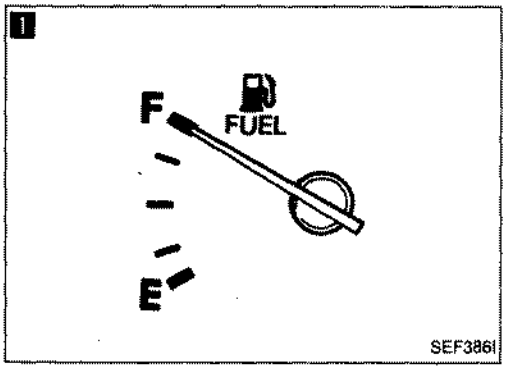
Yes → Discover air leak location and repair.

No

INSPECTION END

Diagnostic Procedure 10 — Engine Stalls when Turning

1



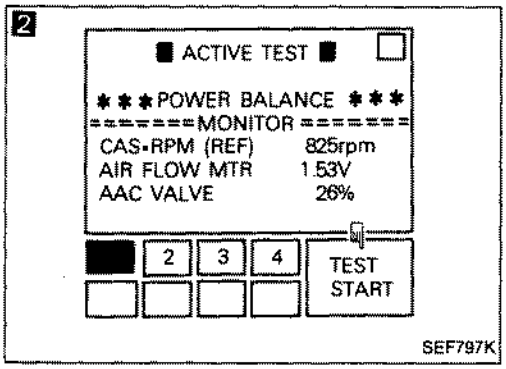
SEF386I

CHECK FUEL LEVEL.
Check to see that there is enough fuel in tank.

N.G. → Fill fuel tank with fuel.

O.K.

2



SEF797K

PERFORM POWER BALANCE TEST.

1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

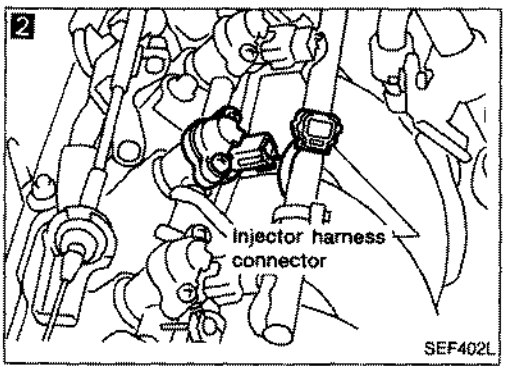
OR

When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

No → Go to 5.

Yes

2



SEF402L

3

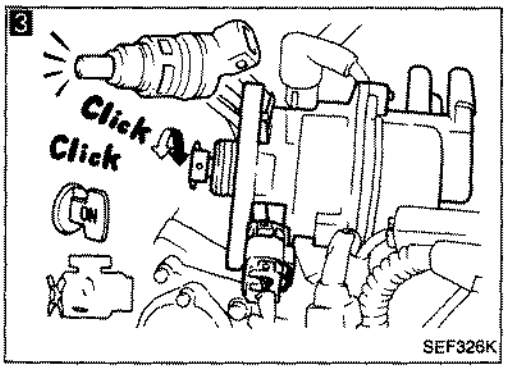
CHECK INJECTOR.

1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Disconnect ignition wires.
3. Turn ignition switch ON. (Do not start engine.)
4. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

No → Check injector(s) and circuit(s).

Yes

3



SEF326K

4

CHECK IGNITION SPARK.

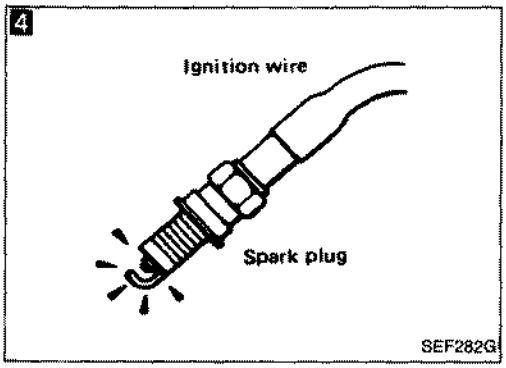
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

N.G. → Check ignition coil, power transistor and circuits. (See page EF & EC-480.)

O.K.

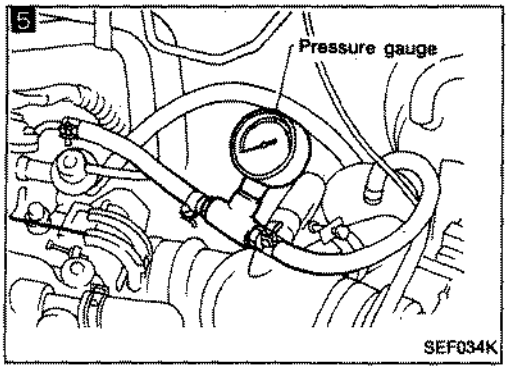
(Go to Ⓐ on next page.)

4



SEF282G

Diagnostic Procedure 10 — Engine Stalls when Turning (Cont'd)



Ⓐ

5 **CHECK FUEL PRESSURE.**
1. Release fuel pressure to zero. (Refer to page EF & EC-638.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:
Approx. 245 kPa
(2.45 bar, 2.5 kg/cm², 36 psi)
A few seconds after ignition switch is turned from OFF to ON:
Approx. 294 kPa
(2.94 bar, 3.0 kg/cm², 43 psi)

N.G. → Check fuel pressure regulator diaphragm.

O.K. ↓

6 **CHECK E.C.U. HARNESS CONNECTOR.**
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.

N.G. → Repair or replace.

O.K. ↓

7 **CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.**
Refer to page EF & EC-464.

N.G. → Repair or replace.

O.K. ↓

8 **TRY A KNOWN GOOD E.C.U.***

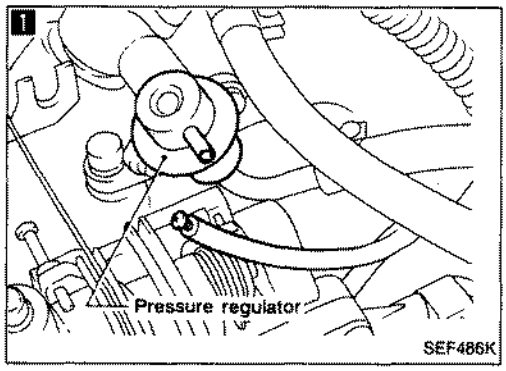
↓

INSPECTION END

*: E.C.U. may be the cause of a problem, but this is rarely the case.

Diagnostic Procedure 11 — Engine Stalls when the Engine is Hot

1



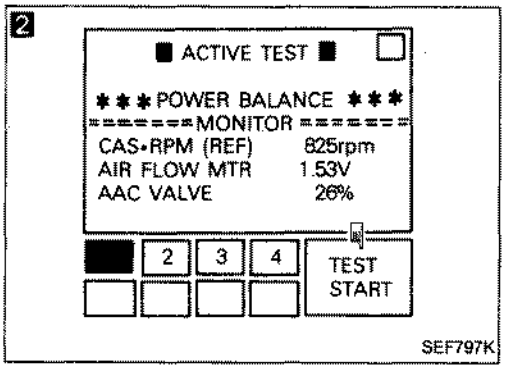
CHECK FUEL VAPOR.

1. Disconnect fuel pressure regulator vacuum hose and plug hose.
2. Perform cruise test.
3. Does the engine stall disappear?

Yes → Check fuel properties.

No ↓

2



PERFORM POWER BALANCE TEST.

1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

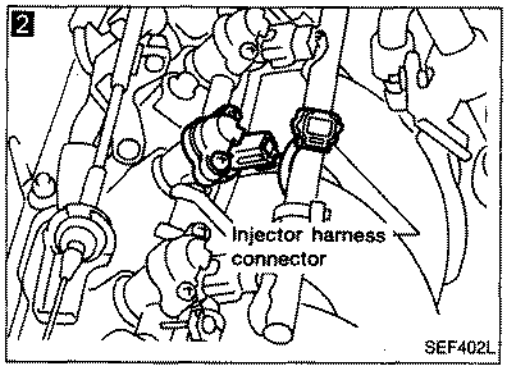
No → Go to 5.

OR

When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

Yes ↓

2



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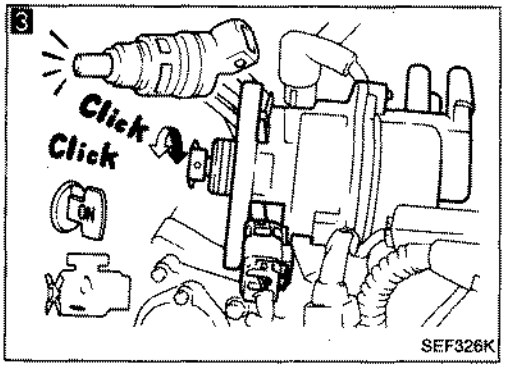


CHECK INJECTOR.

1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Disconnect ignition wires.
3. Turn ignition switch ON. (Do not start engine.)
4. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

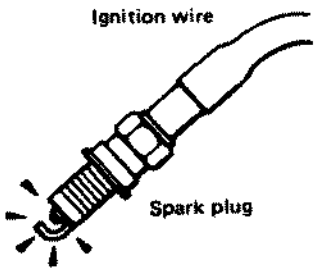
No → Check injector(s) and circuit(s).

Yes ↓

(Go to Ⓐ on next page.)

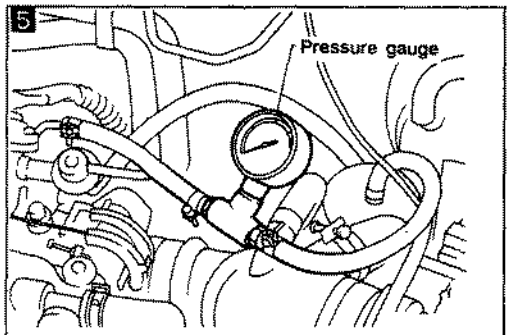
Diagnostic Procedure 11 — Engine Stalls when the Engine is Hot (Cont'd)

4



SEF282G

5



SEF034K

Ⓐ

4 **CHECK IGNITION SPARK.**

1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

N.G. → Check ignition coil, power transistor and their circuits. (See page EF & EC-480.)

O.K. ↓

5 **CHECK FUEL PRESSURE.**

1. Release fuel pressure to zero. (Refer to page EF & EC-638.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:
Approx. 245 kPa
(2.45 bar, 2.5 kg/cm^2, 36 psi)
A few seconds after ignition switch is turned from OFF to ON:
Approx. 294 kPa
(2.94 bar, 3.0 kg/cm^2, 43 psi)

N.G. → Check fuel pressure regulator diaphragm.

O.K. ↓

6 **CHECK E.C.U. HARNESS CONNECTOR.**
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.

N.G. → Repair or replace.

O.K. ↓

7 **CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.**
Refer to page EF & EC-464.

N.G. → Repair or replace.

O.K. ↓

8 **TRY A KNOWN GOOD E.C.U.***

Trouble is fixed. → Replace E.C.U.

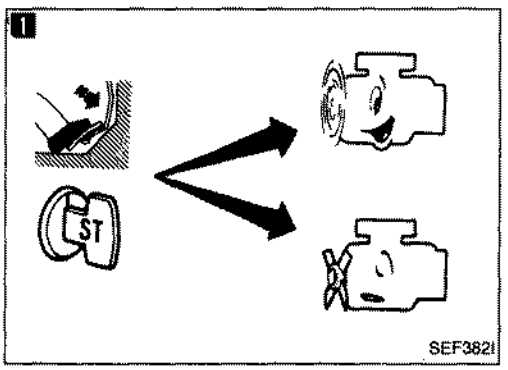
Trouble is not fixed. ↓

INSPECTION END

*: E.C.U. may be the cause of a problem, but this is rarely the case.

Diagnostic Procedure 12 — Engine Stalls when the Engine is Cold

1



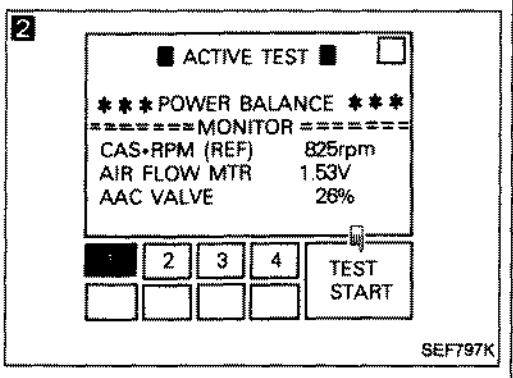
SEF382I

CHECK AIR REGULATOR AND A.A.C. VALVE.
When the engine is cold, can you start the engine when pressing accelerator pedal fully?

N.G. → Check A.A.C. valve, air regulator and circuits. (See pages EF & EC-504, 506.)

O.K. ↓

2



SEF797K

PERFORM POWER BALANCE TEST.

1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

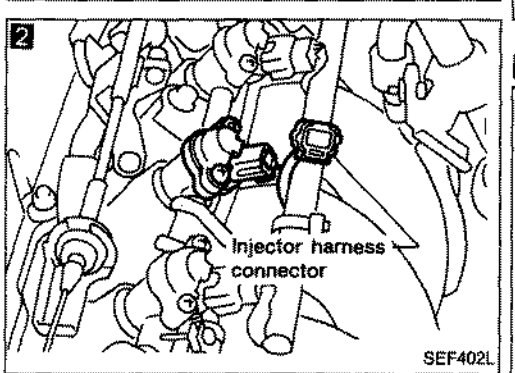
OR

When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

No → Go to 6.

Yes ↓

2



SEF402L

3

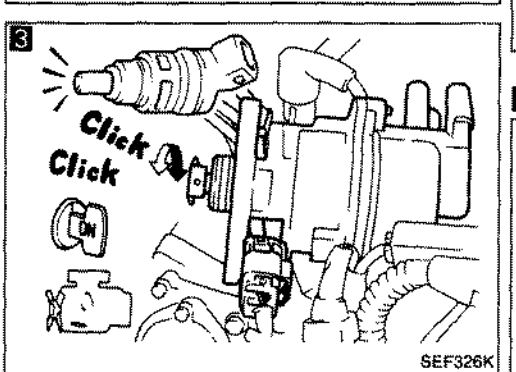
CHECK INJECTOR.

1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Disconnect ignition wires.
3. Turn ignition switch ON. (Do not start engine.)
4. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

N.G. → Check injector(s) and circuit(s).

O.K. ↓

3



SEF326K

4

CHECK IGNITION SPARK.

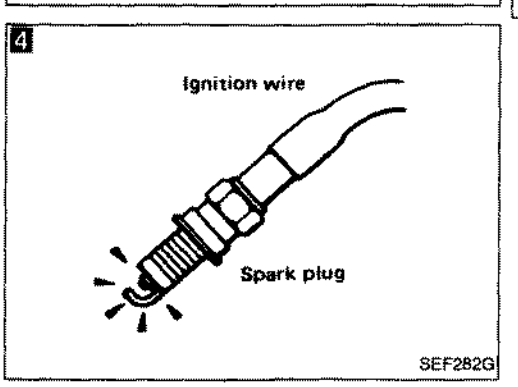
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

N.G. → Check ignition coil, power transistor and circuits. (See page EF & EC-480.)

O.K. ↓

(Go to Ⓐ on next page.)

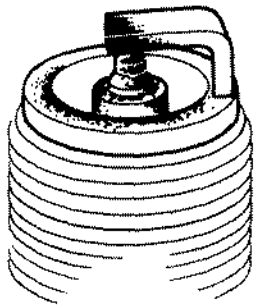
4



SEF282G

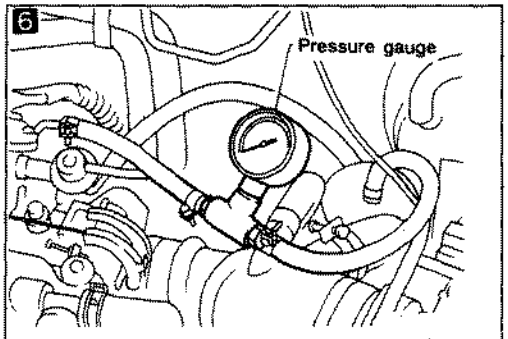
Diagnostic Procedure 12 — Engine Stalls when the Engine is Cold (Cont'd)

5



SEF156I

6



SEF034K

Ⓐ

5 **CHECK SPARK PLUGS.**
Remove the spark plugs and check for fouling, etc.
N.G. → Repair or replace spark plug(s).
O.K. ↓

6 **CHECK FUEL PRESSURE.**
1. Release fuel pressure to zero. (Refer to page EF & EC-638.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:
Approx. 245 kPa
(2.45 bar, 2.5 kg/cm², 36 psi)
A few seconds after ignition switch is turned from OFF to ON:
Approx. 294 kPa
(2.94 bar, 3.0 kg/cm², 43 psi)

N.G. → Check fuel pressure regulator diaphragm.
O.K. ↓

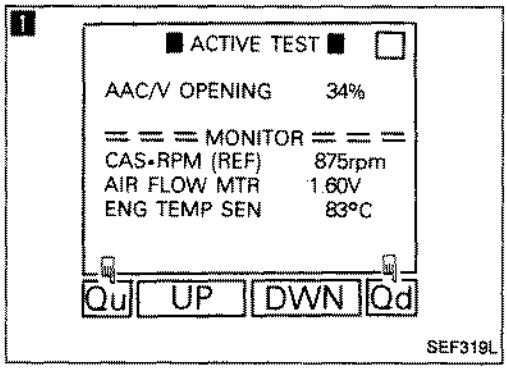
7 **CHECK E.C.U. HARNESS CONNECTOR.**
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.
N.G. → Repair or replace.
O.K. ↓

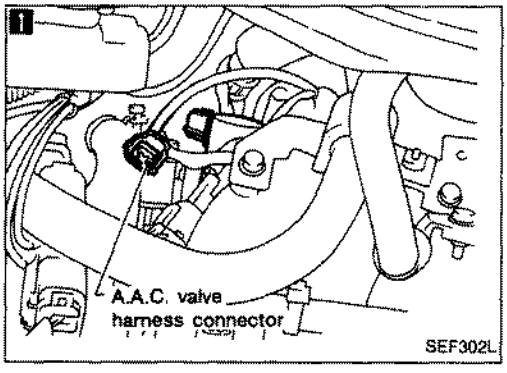
8 **CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.**
Refer to page EF & EC-464.
N.G. → Repair or replace.
O.K. ↓

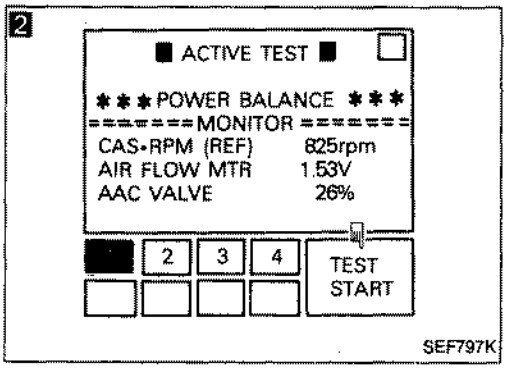
9 **TRY A KNOWN GOOD E.C.U.***
Trouble is fixed. → Replace E.C.U.
Trouble is not fixed. ↓

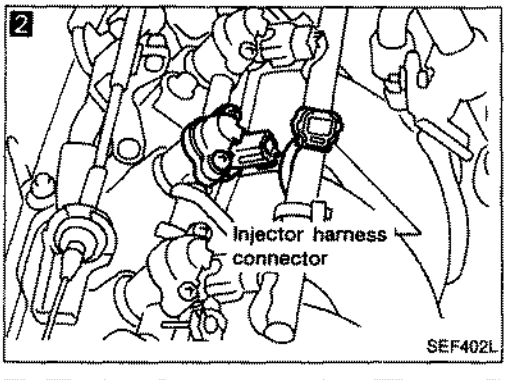
INSPECTION END

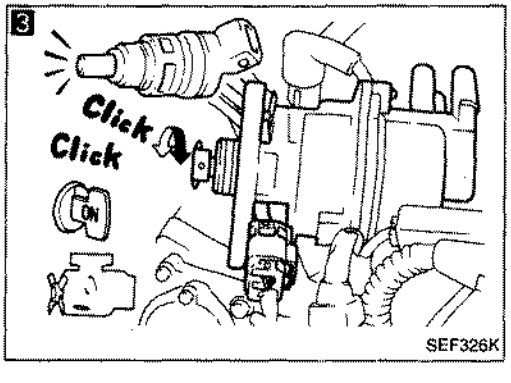
*: E.C.U. may be the cause of a problem, but this is rarely the case.











Diagnostic Procedure 13 — Engine Stalls when Stepping on the Accelerator Momentarily

1

CHECK A.A.C. VALVE.

1. Select "A.A.C. VALVE OPENING" in "ACTIVE TEST" mode.
2. When touching "Qu" and "Qd", does the engine speed change according to the percent of A.A.C. valve opening?

OR

When disconnecting A.A.C. valve harness connector, does the engine speed drop?

No → Check A.A.C. valve and circuit. (See page EF & EC-506.)

Yes

2

PERFORM POWER BALANCE TEST.

1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

OR

When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

No → Go to **5**.

Yes

3

CHECK INJECTOR.

1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Disconnect ignition wires.
3. Turn ignition switch ON. (Do not start engine.)
4. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

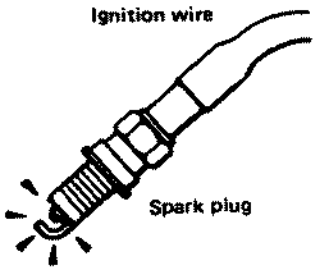
No → Check injector(s) and their circuit(s).

Yes

(Go to Ⓐ on next page.)

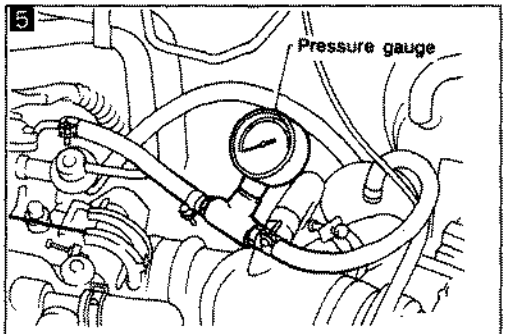
Diagnostic Procedure 13 — Engine Stalls when Stepping on the Accelerator Momentarily (Cont'd)

4



SEF282G

5



SEF034K

Ⓐ

4 **CHECK IGNITION SPARK.**

1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against an earth point with engine cranking.
4. Check for spark.

N.G. → Check ignition coil, power transistor and their circuits. (See page EF & EC-480.)

O.K.

5 **CHECK FUEL PRESSURE.**

1. Release fuel pressure to zero. (Refer to page EF & EC-638.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:
Approx. 245 kPa
(2.45 bar, 2.5 kg/cm², 36 psi)
A few seconds after ignition switch is turned from OFF to ON:
Approx. 294 kPa
(2.94 bar, 3.0 kg/cm², 43 psi)

N.G. → Check fuel pressure regulator diaphragm.

O.K.

6 **CHECK E.C.U. HARNESS CONNECTOR.**
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.

N.G. → Repair or replace.

O.K.

7 **CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.**
Refer to page EF & EC-464.

N.G. → Repair or replace.

O.K.

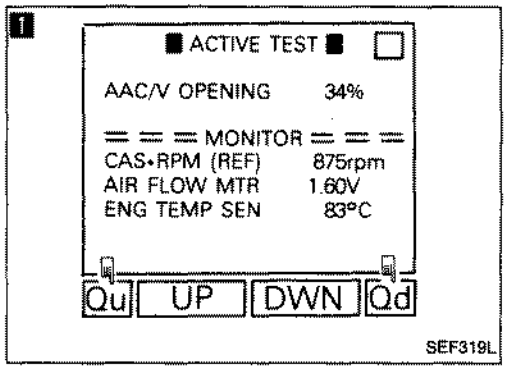
8 **TRY A KNOWN GOOD E.C.U.***

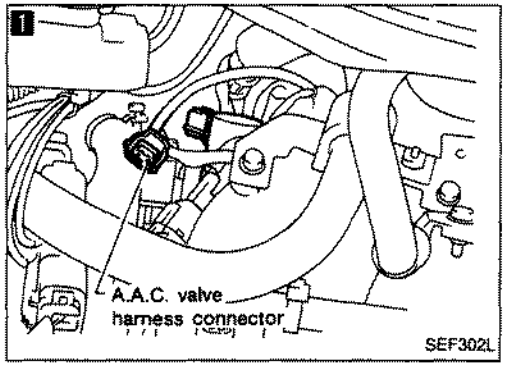
Trouble is not fixed. → Replace E.C.U.

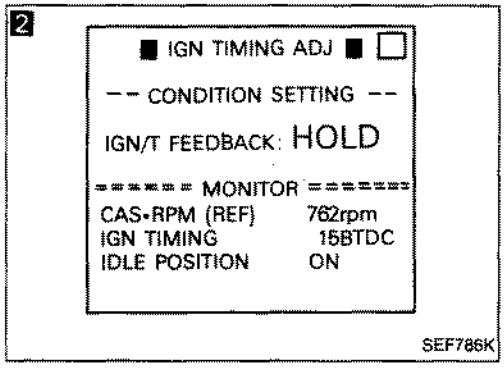
Trouble is fixed

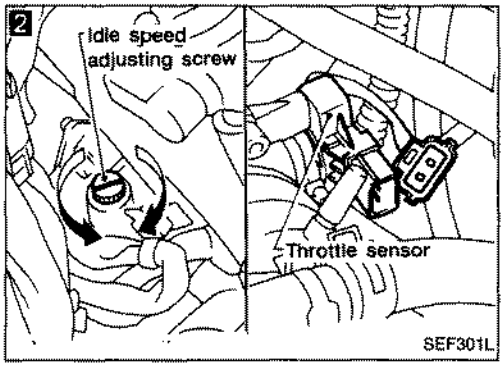
INSPECTION END

*: E.C.U. may be the cause of a problem, but this is rarely the case.









Diagnostic Procedure 14 — Engine Stalls after Decelerating

1

CHECK A.A.C. VALVE.

1. Select "A.A.C. VALVE OPENING" in "ACTIVE TEST" mode.
2. When touching "Qu" and "Qd", does the engine speed change according to the percent of A.A.C. valve opening?

No → Check A.A.C. valve and circuit. (See page EF & EC-506.)

OR

When disconnecting A.A.C. valve harness connector, does the engine speed drop?

Yes

2

CHECK IDLE ADJ. SCREW CLOGGING.

1. Perform "IGN TIMING ADJ" in "WORK SUPPORT" mode.
2. Can you set engine rpm at 800±50 rpm (in "N" position) by turning idle adjusting screw?

No → Check for I.A.S. clogging or throttle chamber clogging.

OR

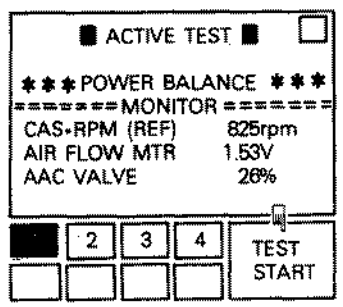
1. Disconnect throttle sensor harness connector.
2. Can you set engine rpm at 800±50 rpm (in "N" position) by turning idle adjusting screw?

Yes

(Go to Ⓐ on next page.)

Diagnostic Procedure 14 — Engine Stalls after Decelerating (Cont'd)

3



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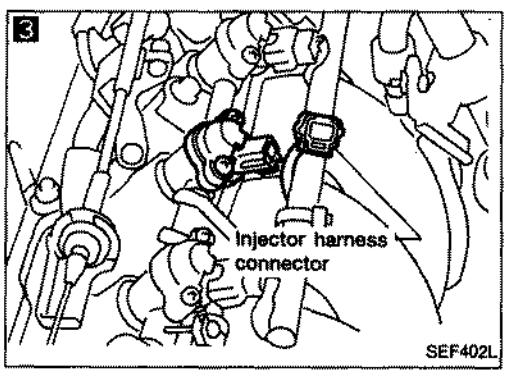
3



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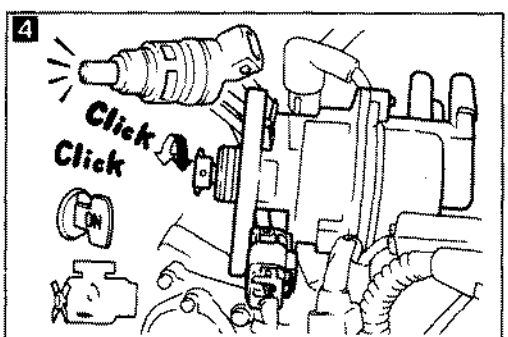

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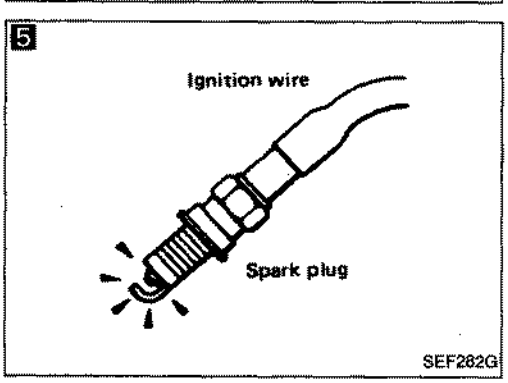


SEF282G

Ⓐ

3 **PERFORM POWER BALANCE TEST.**

1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

No → Go to **6**.

OR

When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

Yes ↓

4 **CHECK INJECTOR.**

1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Disconnect ignition wires.
3. Turn ignition switch ON. (Do not start engine.)
4. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

No → Check injector(s) and circuit(s).

Yes ↓

5 **CHECK IGNITION SPARK.**

1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

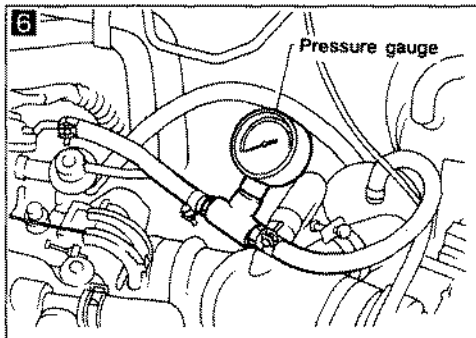
No → Check ignition coil, power transistor and circuits. (See page EF & EC-480.)

Yes ↓

(Go to Ⓑ on next page.)

Diagnostic Procedure 14 — Engine Stalls after Decelerating (Cont'd)

6



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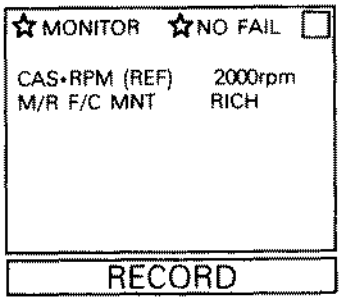
7



SEF818K

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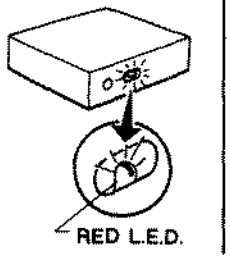
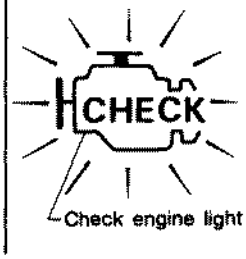




SEF621K

Ⓑ

6

CHECK FUEL PRESSURE.

1. Release fuel pressure to zero. (Refer to page EF & EC-638.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:

Approx. 245 kPa
(2.45 bar, 2.5 kg/cm², 36 psi)

A few seconds after ignition switch is turned from OFF to ON:

Approx. 294 kPa
(2.94 bar, 3.0 kg/cm², 43 psi)

N.G. → Check fuel pressure regulator diaphragm.

O.K.

7

CHECK EXHAUST GAS SENSOR. (MODELS WITH CATALYZER ONLY)

1. See "M/R F/C MNT" in "DATA MONITOR" mode.
2. Maintaining engine at 2,000 rpm under no-load (with engine warmed up sufficiently.), check to make sure that the monitor fluctuates between "LEAN" and "RICH" more than 5 times during 10 seconds.

RICH→LEAN→RICH→
(1 time) (2 times)
LEAN→RICH.....

N.G. → Replace exhaust gas sensor.

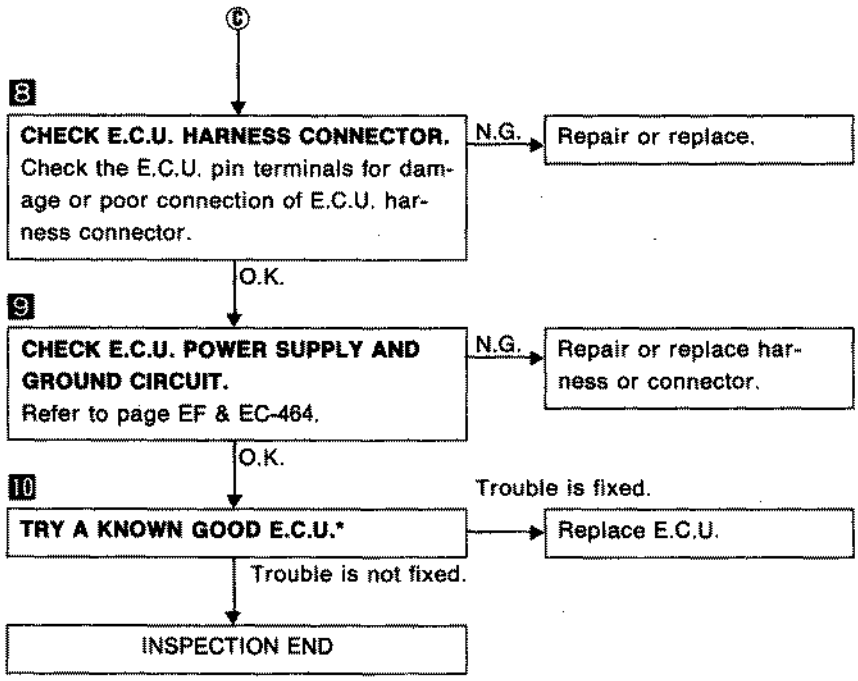
OR

1. Set "Exhaust gas sensor monitor" in the self-diagnostic Mode II. (See page EF & EC-412.)
2. Maintaining engine at 2,000 rpm under no load, check that the RED L.E.D. on the E.C.U. or the check engine light on the instrument panel goes ON and OFF more than 5 times during 10 seconds.

O.K.

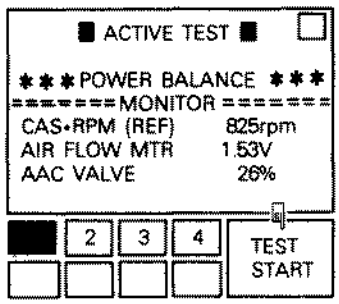
(Go to Ⓒ on next page.)

Diagnostic Procedure 14 — Engine Stalls after Decelerating (Cont'd)



*: E.C.U. may be the cause of a problem, but this is rarely the case.

1



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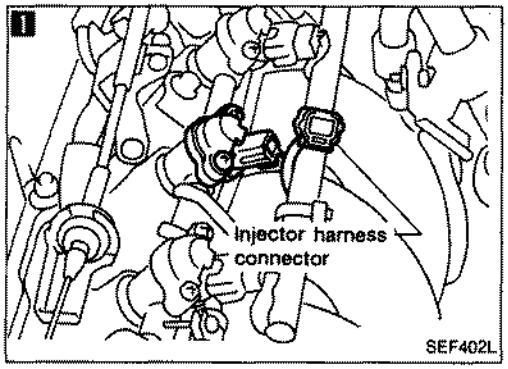
1



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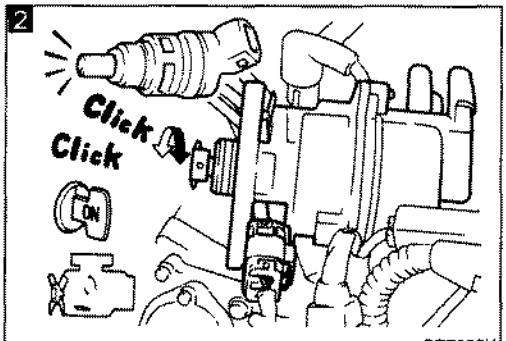
2



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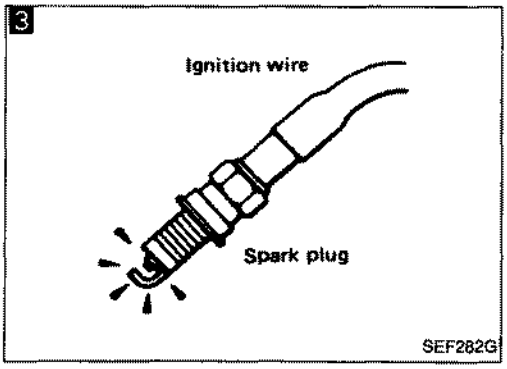
3



SEF282G

Diagnostic Procedure 15 — Engine Stalls when Accelerating or when Driving at Constant Speed

1

PERFORM POWER BALANCE TEST.

1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

No → Go to **4**.

OR

When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

Yes ↓

2

CHECK INJECTOR.

1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Disconnect ignition wires.
3. Turn ignition switch ON. (Do not start engine.)
4. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

No → Check injector(s) and circuit(s).

Yes ↓

3

CHECK IGNITION SPARK.

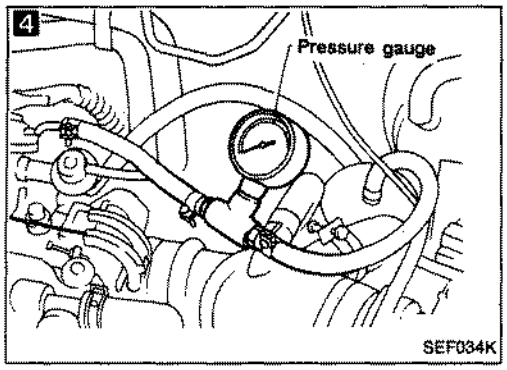
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

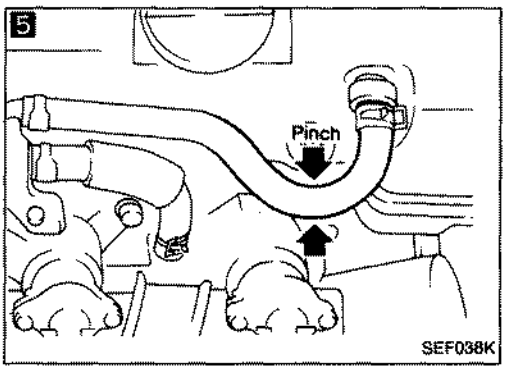
No → Check ignition coil, power transistor and circuits. (See page EF & EC-480.)

Yes ↓

(Go to Ⓐ on next page.)

Diagnostic Procedure 15 — Engine Stalls when Accelerating or when Driving at Constant Speed (Cont'd)





Ⓐ

4 **CHECK FUEL PRESSURE.**
1. Release fuel pressure to zero. (Refer to page EF & EC-638.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:
Approx. 245 kPa
(2.45 bar, 2.5 kg/cm², 36 psi)
A few seconds after ignition switch is turned from OFF to ON:
Approx. 294 kPa
(2.94 bar, 3.0 kg/cm², 43 psi)

N.G. → Check fuel pump, circuit and fuel pressure regulator.

O.K. ↓

5 **CHECK FOR INTAKE AIR LEAK.**
When pinching blow-by hose (lowering the blow-by air supply), does the engine speed rise?

Yes → Discover air leak location and repair.

No ↓

6 **CHECK E.C.U. HARNESS CONNECTOR.**
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.

N.G. → Repair or replace.

O.K. ↓

7 **CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.**
Refer to page EF & EC-464.

Yes → Repair or replace.

No ↓

8 **TRY A KNOWN GOOD E.C.U.***

Trouble is fixed. → Replace E.C.U.

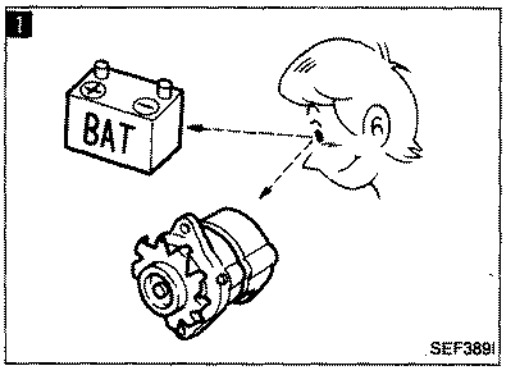
Trouble is not fixed. ↓

INSPECTION END

*: E.C.U. may be the cause of a problem, but this is rarely the case.

Diagnostic Procedure 16 — Engine Stalls when the Electrical Load is Heavy

1



SEF389I

CHECK BATTERY AND ALTERNATOR.
Check battery and alternator condition. (Refer to EL section.)

N.G. → Repair or replace.

O.K. ↓

2

PERFORM POWER BALANCE TEST.

1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

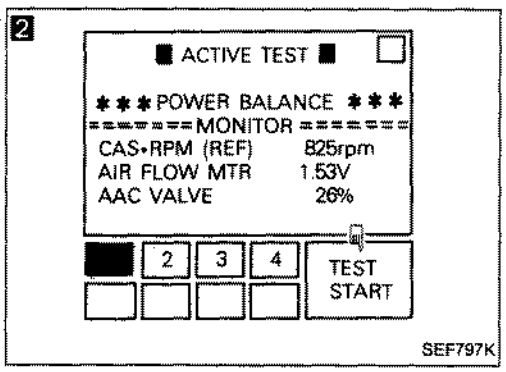
No → Go to 5.

— OR —

When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

Yes ↓

2



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3

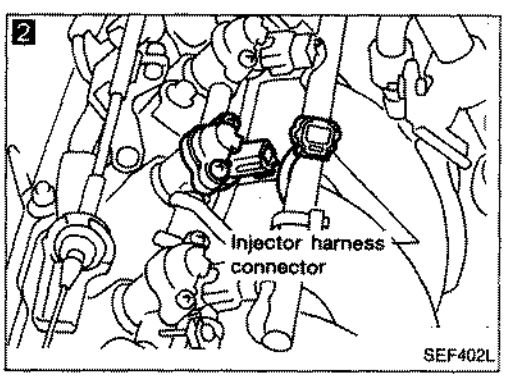
CHECK INJECTOR.

1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Disconnect ignition wires.
3. Turn ignition switch ON. (Do not start engine.)
4. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

No → Check injector(s) and circuit(s).

Yes ↓

2



SEF402L

4

CHECK IGNITION SPARK.

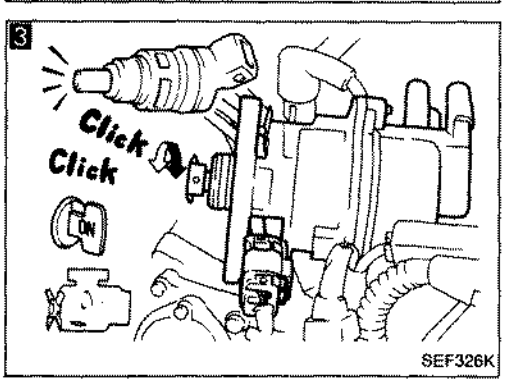
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

N.G. → Check ignition coil, power transistor and circuits. (See page EF & EC-480.)

O.K. ↓

(Go to Ⓐ on next page.)

3



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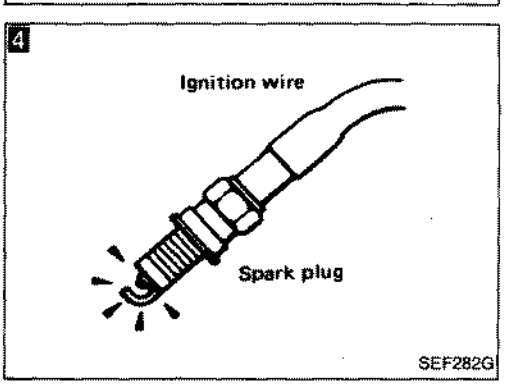
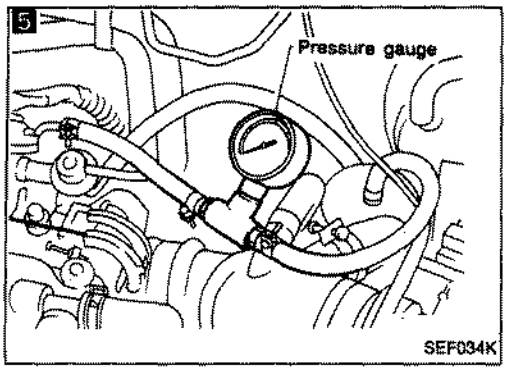
4



SEF282G

Diagnostic Procedure 16 — Engine Stalls when the Electrical Load is Heavy (Cont'd)



Ⓐ

5 **CHECK FUEL PRESSURE.**
1. Release fuel pressure to zero. (Refer to page EF & EC-638.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:
Approx. 245 kPa
(2.45 bar, 2.5 kg/cm², 36 psi)
A few seconds after ignition switch is turned from OFF to ON:
Approx. 294 kPa
(2.94 bar, 3.0 kg/cm², 43 psi)

N.G. → Check fuel pressure regulator diaphragm.

O.K.

6 **CHECK E.C.U. HARNESS CONNECTOR.**
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.

N.G. → Repair or replace.

O.K.

7 **CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.**
Refer to page EF & EC-464.

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

O.K.

8 **TRY A KNOWN GOOD E.C.U.***

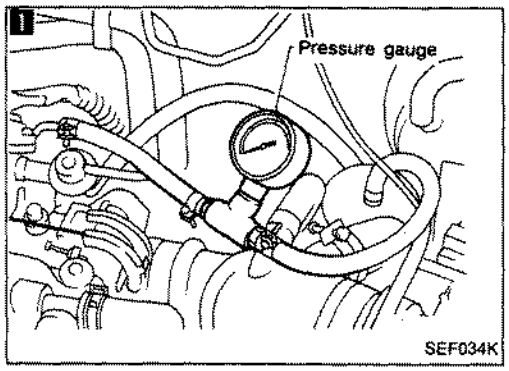
Trouble is fixed. → Replace E.C.U.

Trouble is not fixed.

INSPECTION END

*: E.C.U. may be the cause of a problem, but this is rarely the case.

1



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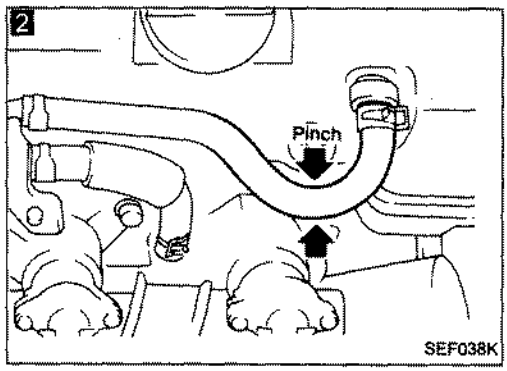


Diagnostic Procedure 17 — Lack of Power and Stumble

1

CHECK FUEL PRESSURE.

1. Release fuel pressure to zero. (Refer to page EF & EC-638.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:

Approx. 245 kPa

(2.45 bar, 2.5 kg/cm², 36 psi)

A few seconds after ignition switch is turned from OFF to ON:

Approx. 294 kPa

(2.94 bar, 3.0 kg/cm², 43 psi)

N.G. → Check fuel pressure regulator diaphragm.

O.K. ↓

2

CHECK FOR INTAKE AIR LEAK.

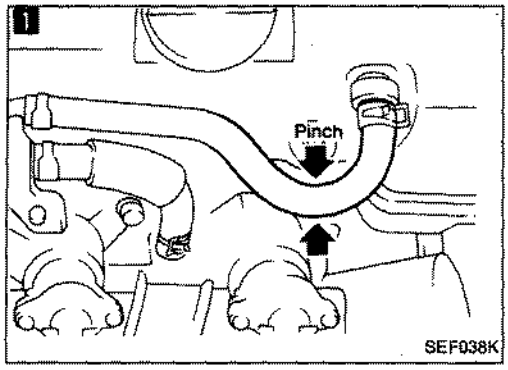
When pinching blow-by hose (lowering the blow-by air supply), does the engine speed rise?

Yes → Discover air leak location and repair.

No ↓

INSPECTION END

1



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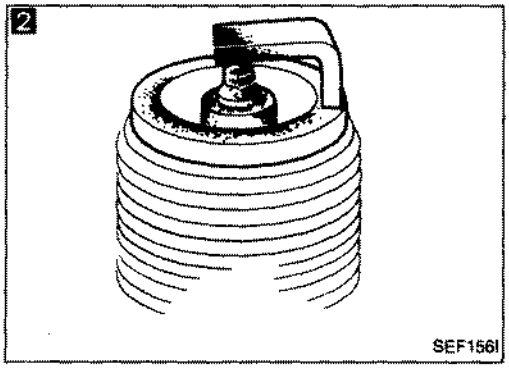


Diagnostic Procedure 18 — Detonation

1

CHECK FOR INTAKE AIR LEAK.
When pinching blow-by hose (lowering the blow-by air supply), does the engine rpm rise?

Yes → Discover air leak location and repair.

No ↓

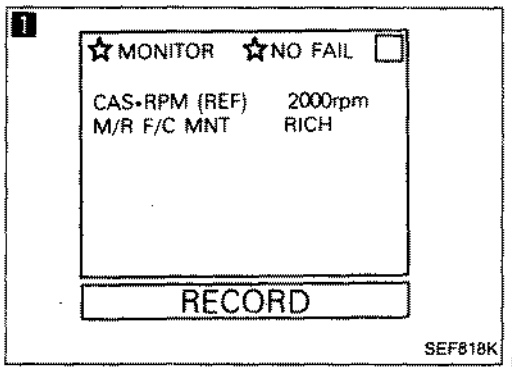
2

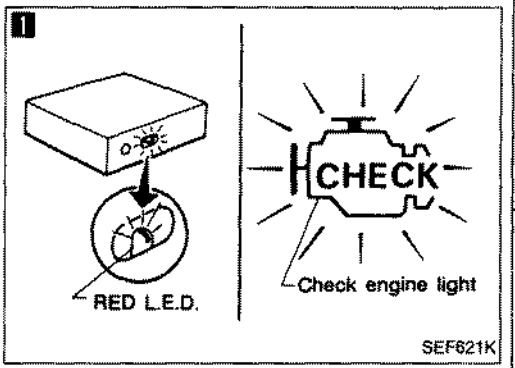
CHECK FOR OIL LEAK TO COMBUSTION CHAMBER.
Remove spark plugs and check for fouling with oil.

Yes → Check pistons, piston rings, valves, valve seats, valve oil seal, engine oil level, etc.

No ↓

INSPECTION END





Diagnostic Procedure 19 — Surge

CHECK EXHAUST GAS SENSOR. (MODELS WITH CATALYZER ONLY)

1. See "M/R F/C MNT" in "DATA MONITOR" mode.
2. Maintaining engine at 2,000 rpm under no-load (with engine warmed up sufficiently.), check to make sure that the monitor fluctuates between "LEAN" and "RICH" more than 5 times during 10 seconds.

RICH→LEAN→RICH→ LEAN→RICH.....
(1 time, 2 times)

N.G. → Replace exhaust gas sensor.

OR

1. Set "Exhaust gas sensor monitor" in the self-diagnostic Mode II. (See page EF & EC-412.)
2. Maintaining engine at 2,000 rpm under no load, check that the RED L.E.D. on the E.C.U. or the check engine light on the instrument panel goes ON and OFF more than 5 times during 10 seconds.

O.K. ↓

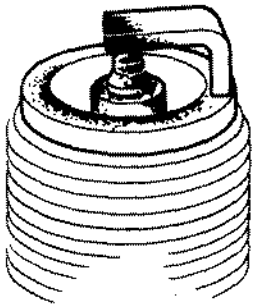
TRY A KNOWN GOOD E.C.U.* → Trouble is fixed. → Replace E.C.U.

Trouble is not fixed. ↓

INSPECTION END

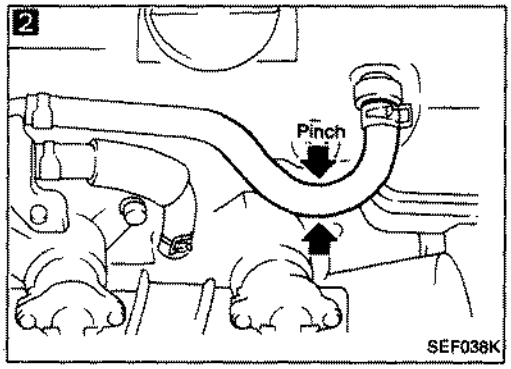
*: E.C.U. may be the cause of a problem, but this is rarely the case.

1



SEF156I

2



SEF038K

Diagnostic Procedure 20 — Backfire through the Intake

1

CHECK SPARK PLUGS.
Remove the spark plugs and check for fouling, etc.

N.G. → Repair or replace spark plug(s).

O.K.

2

CHECK INTAKE AIR LEAK.
When pinching blow-by hose (lowering the blow-by air supply), does the engine speed rise?

Yes → Discover air leak location and repair.

No

3

CHECK FOR INTAKE VALVE DEPOSITS.
If there are deposits on intake valves, remove them.

INSPECTION END

Diagnostic Procedure 21 — Backfire through the Exhaust

1

CHECK ENGINE TEMPERATURE SENSOR.
Check engine temperature sensor and its circuit. (See page EF & EC-476.)

N.G. → Replace or repair.

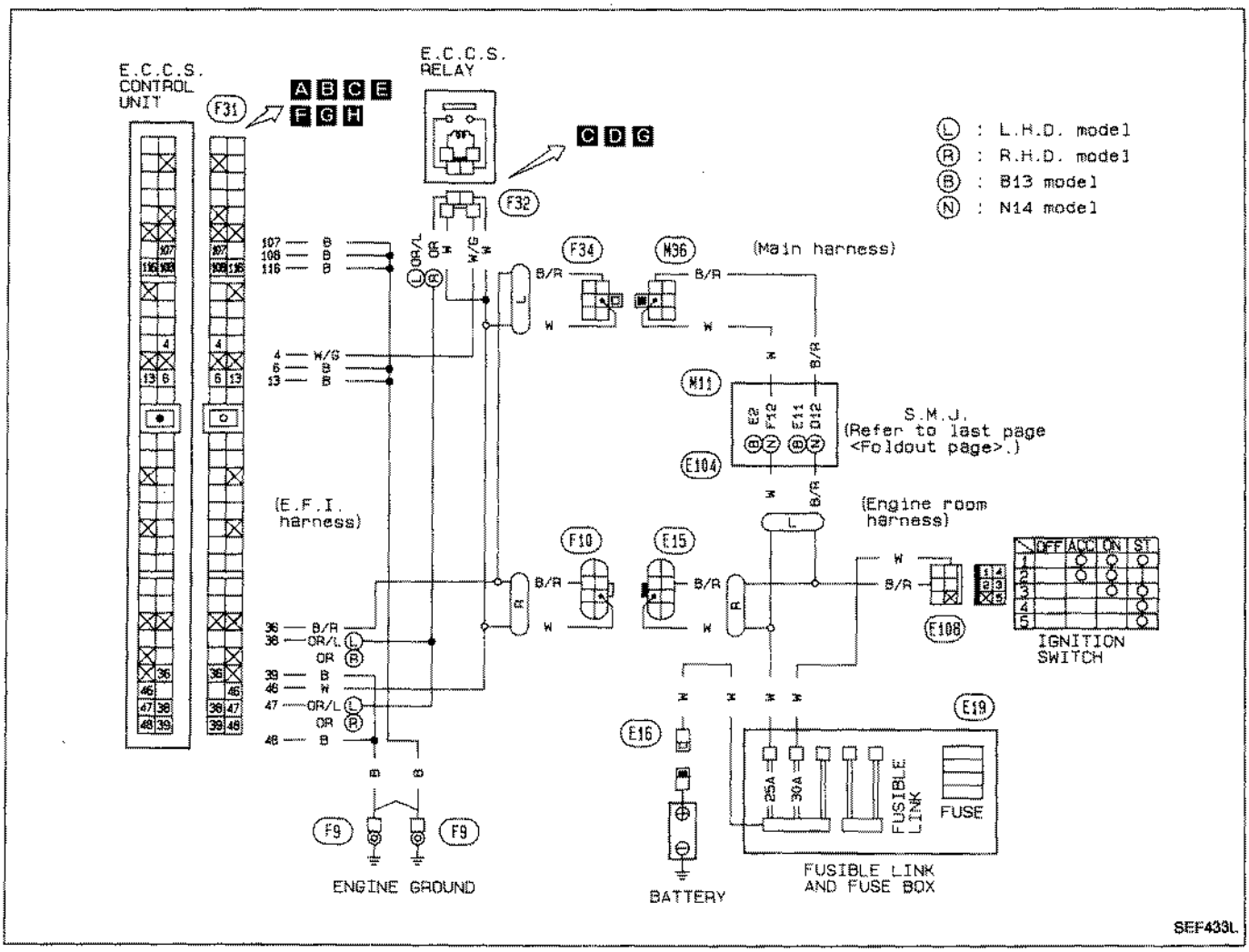
O.K.

INSPECTION END

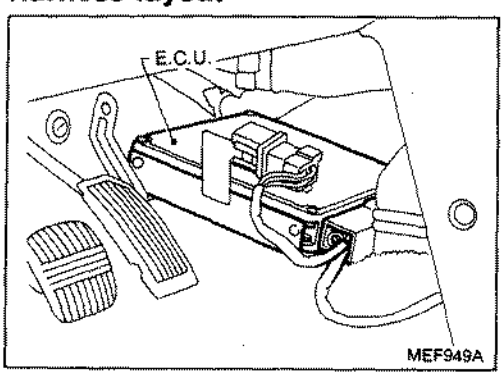
NOTE

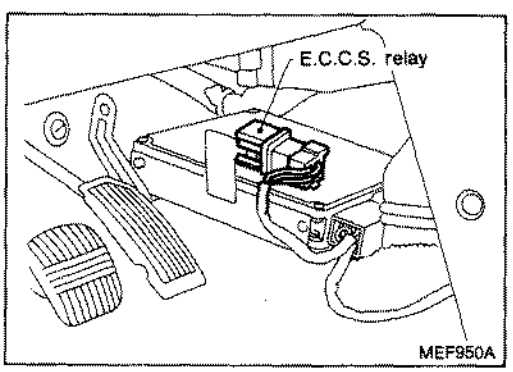
Diagnostic Procedure 22

MAIN POWER SUPPLY AND GROUND CIRCUIT (Not self-diagnostic item)



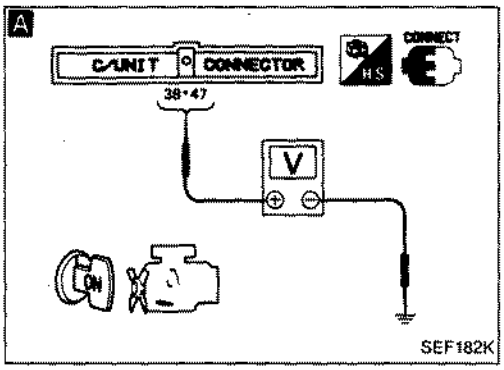
Harness layout





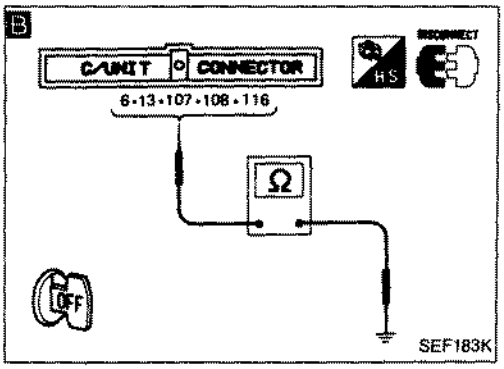
Diagnostic Procedure 22 (Cont'd)

A



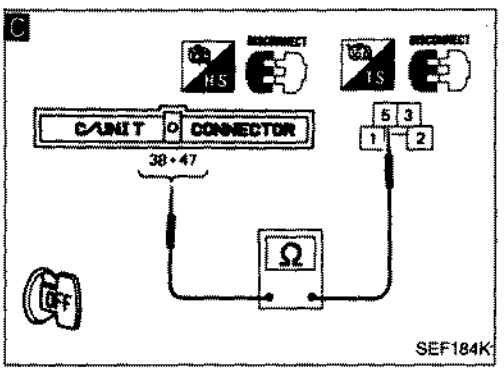
SEF182K

B



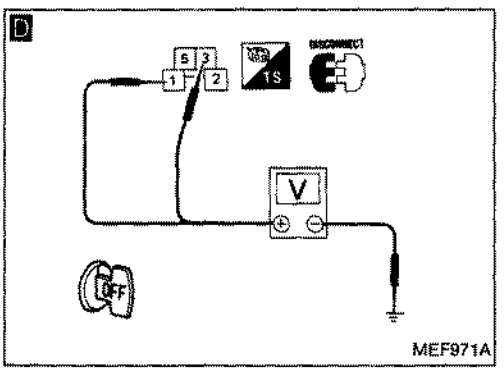
SEF183K

C



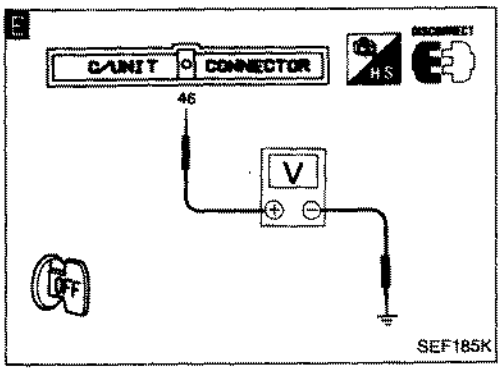
SEF184K

D



MEF971A

E



SEF185K

INSPECTION START

A

CHECK POWER SUPPLY.
1) Turn ignition switch "ON".
2) Check voltage between E.C.U. terminals (38), (47) and ground.
Voltage: Battery voltage

O.K. → **B**

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminals (6), (13), (107), (108), (116) and engine ground.
Continuity should exist.
If N.G., repair harness or connectors.

O.K. ↓

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

N.G. ↓

C

CHECK HARNESS CONTINUITY BETWEEN E.C.C.S. RELAY AND E.C.U.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Disconnect E.C.C.S. relay.
4) Check harness continuity between E.C.U. terminals (38), (47) and terminal (5).
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

D

CHECK VOLTAGE BETWEEN E.C.C.S. RELAY AND GROUND.
1) Check voltage between terminals (1), (3) and ground.
Voltage: Battery voltage

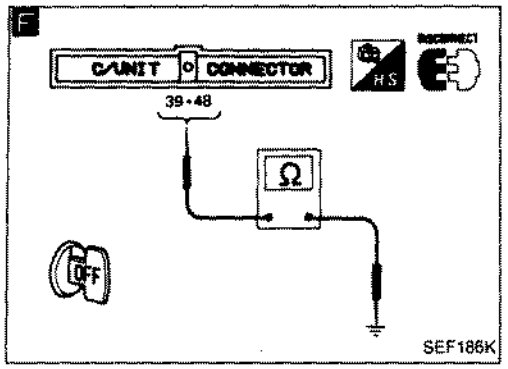
N.G. → Check the following.
- Harness connectors (F34), (R36) (L.H.D. models)
- Harness connectors (H11), (E104) (L.H.D. models)
- Harness connectors (F10), (E15) (R.H.D. models)
- "25A" fusible link
- Harness continuity between E.C.C.S. relay and battery

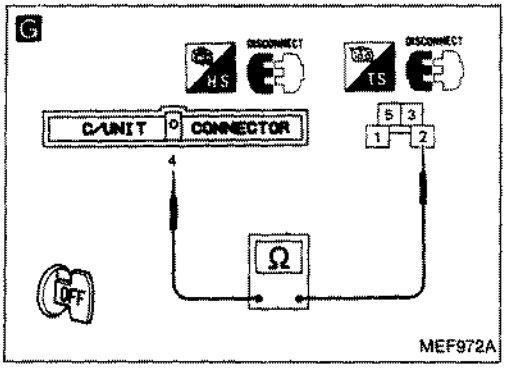
If N.G., repair harness or connectors.

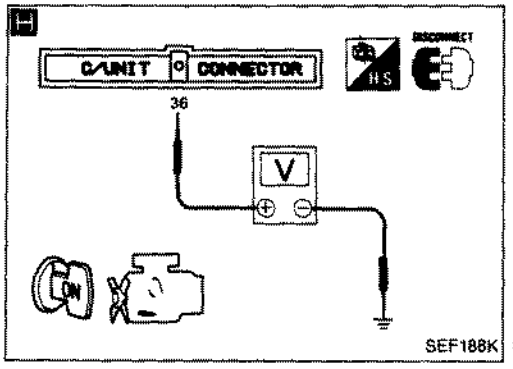
O.K. ↓

(A)

Diagnostic Procedure 22 (Cont'd)







Ⓐ

E CHECK VOLTAGE BETWEEN E.C.U. AND GROUND.
1) Check voltage between E.C.U. terminal ㊻ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (F34), (M36) (L.H.D. models)
- Harness connectors (M11), (E104) (L.H.D. models)
- Harness connectors (F10), (E15) (R.H.D. models)
- 25A fusible link
- Harness continuity between E.C.U. and battery

If N.G., repair harness or connectors.

O.K. ↓

F CHECK GROUND CIRCUIT.
1) Check harness continuity between E.C.U. terminals ㊴, ㊽ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

G CHECK OUTPUT SIGNAL CIRCUIT.
1) Check harness continuity between E.C.U. terminal ④ and terminal ②.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

H CHECK INPUT SIGNAL CIRCUIT.
1) Turn ignition switch "ON".
2) Check voltage between E.C.U. terminal ㊱ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (F34), (M36) (L.H.D. models)
- Harness connectors (M11), (E104) (L.H.D. models)
- Harness connectors (F10), (E15) (R.H.D. models)
- Harness continuity between E.C.U. and ignition switch

If N.G., repair harness or connectors.

O.K. ↓

CHECK COMPONENT (E.C.C.S. relay).
Refer to "Electrical Components Inspection".
(See page EF & EC-635.)

N.G. → Replace E.C.C.S. relay.

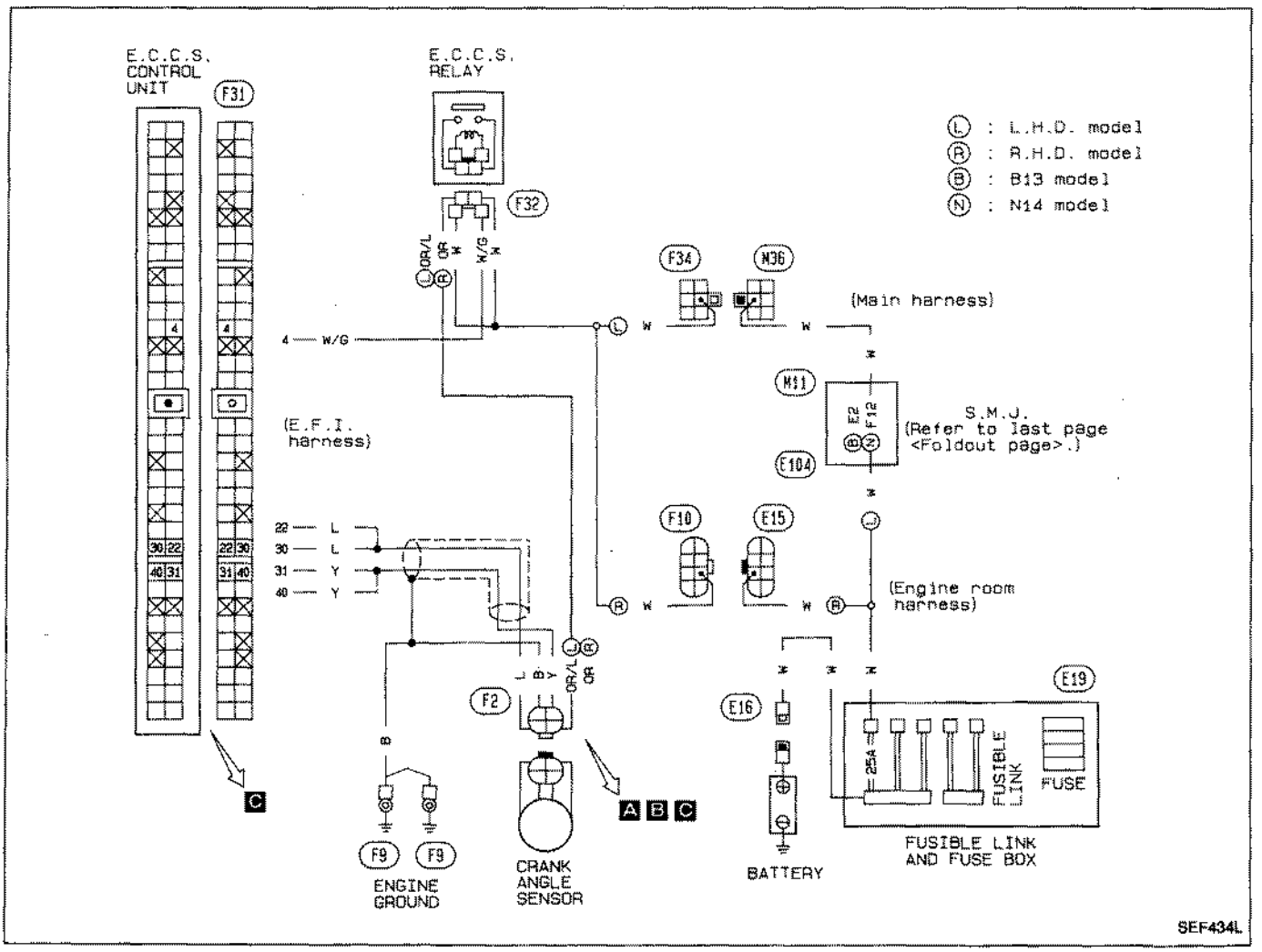
O.K. ↓

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

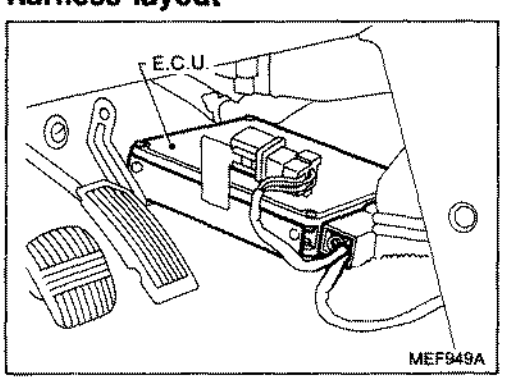
NOTE

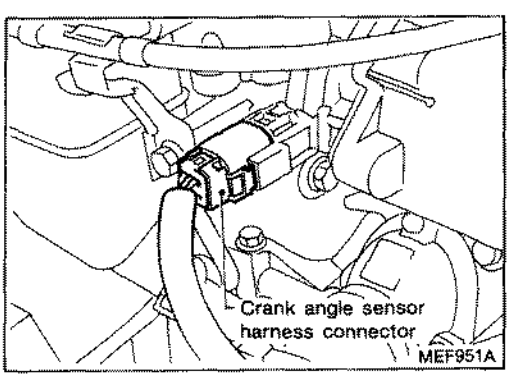
Diagnostic Procedure 23

CRANK ANGLE SENSOR (Code No. 11)

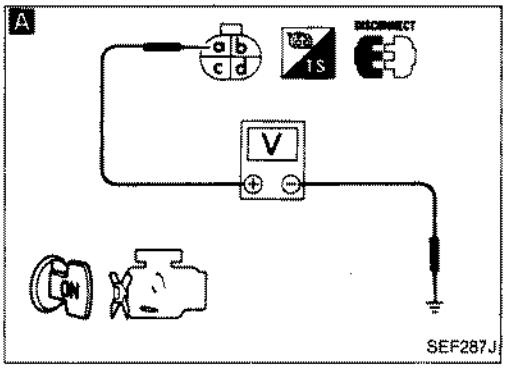


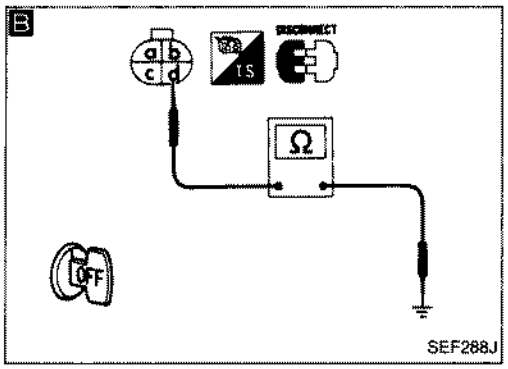
Harness layout

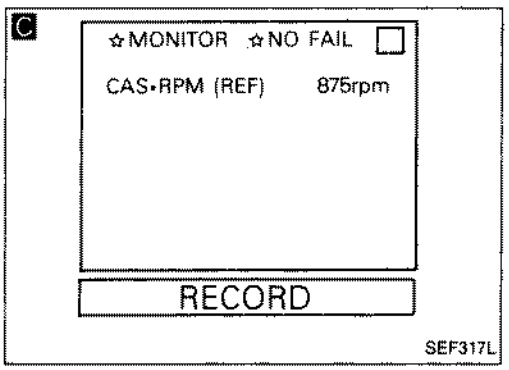


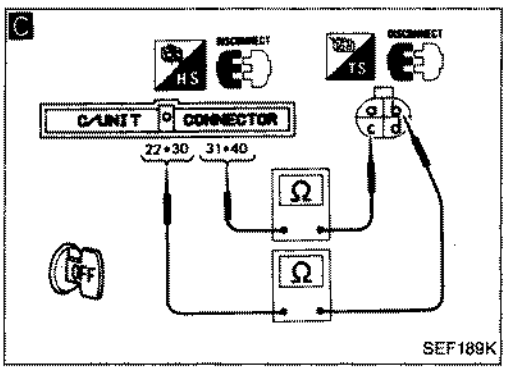


Diagnostic Procedure 23 (Cont'd)









INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect crank angle sensor harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓐ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness continuity between crank angle sensor and E.C.C.S. relay

If N.G., repair harness or connectors.

O.K.

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓓ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

C

CHECK INPUT SIGNAL CIRCUIT.

1) Reconnect crank angle sensor harness connector.
2) Start engine.
3) Read crank angle sensor signals in "DATA MONITOR" mode with CONSULT.
rpm: 850 ± 50

OR

1) Disconnect E.C.U. harness connector.
2) Check harness continuity between terminal ⓒ and E.C.U. terminals ㉛, ㊵ (1° signal), terminal ⓑ and E.C.U. terminals ㉒, ㉚ (180° signal).
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

CHECK COMPONENT (Crank angle sensor).
Refer to "Electrical Components Inspection".
(See page EF & EC-629.)

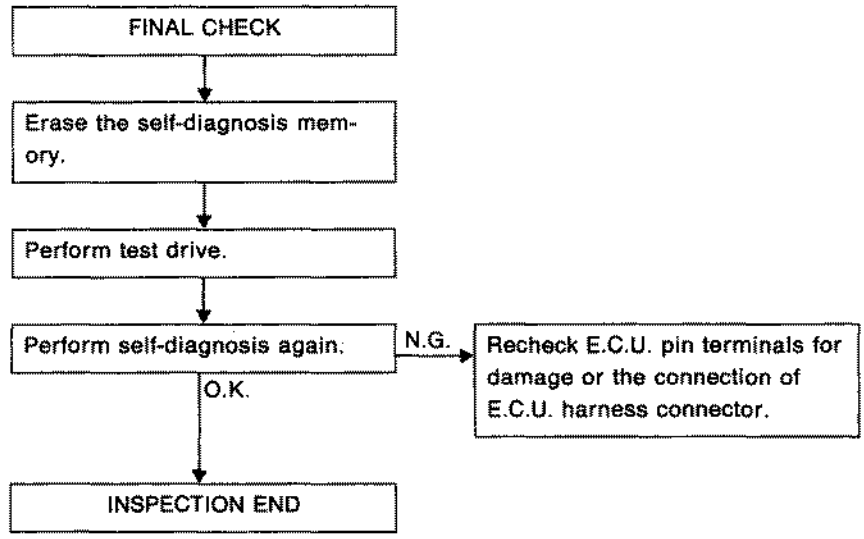
N.G. → Replace crank angle sensor.

O.K.

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

Diagnostic Procedure 23 (Cont'd)

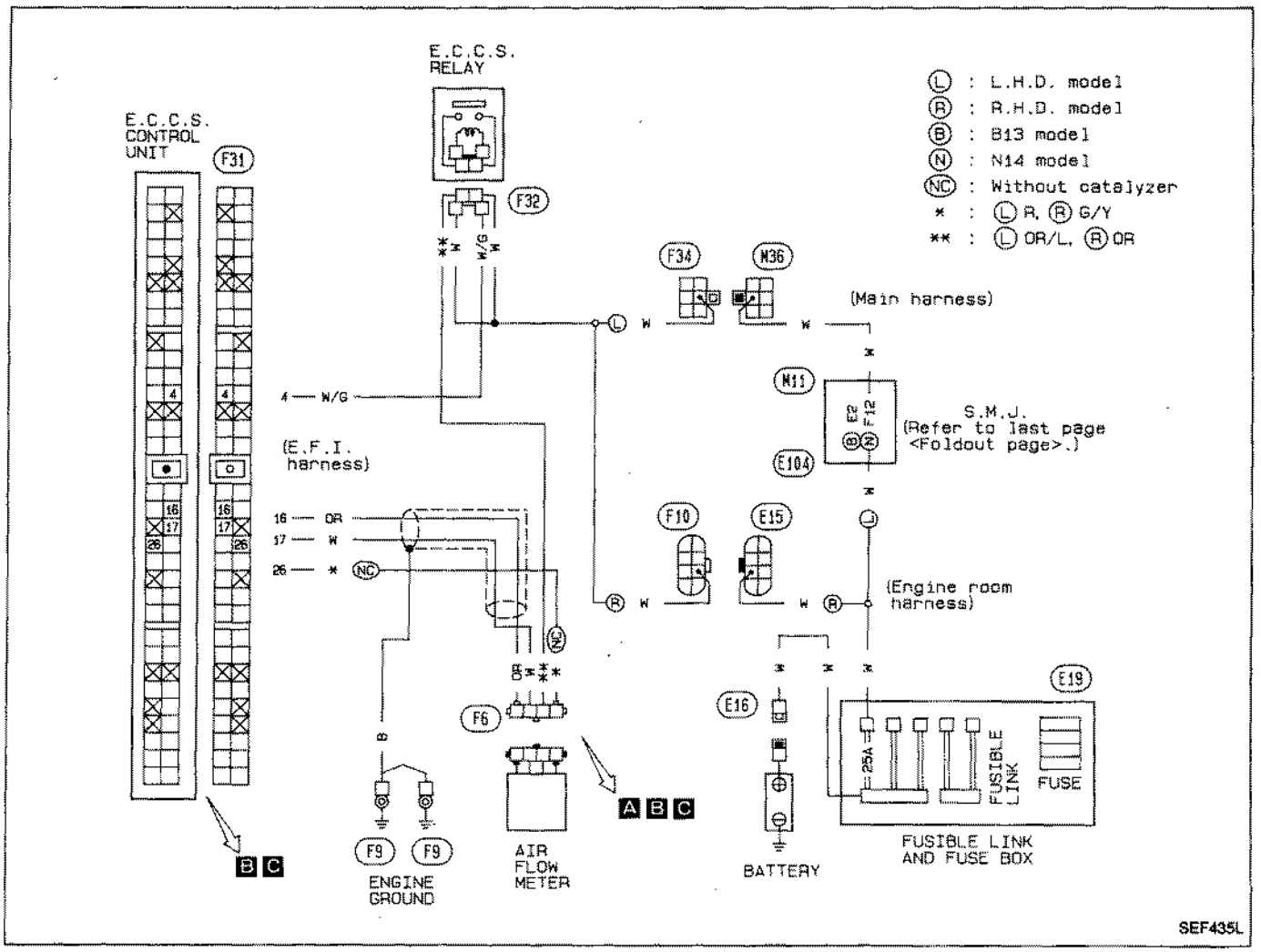
Perform FINAL CHECK by the following procedure after repair is completed.



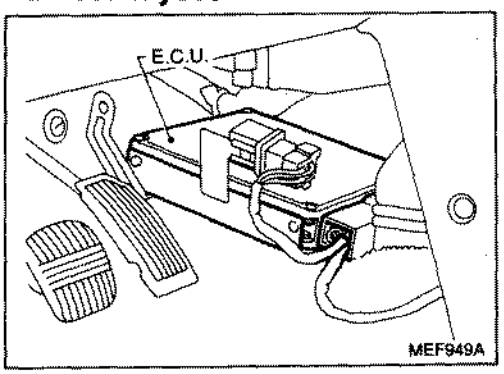
NOTE

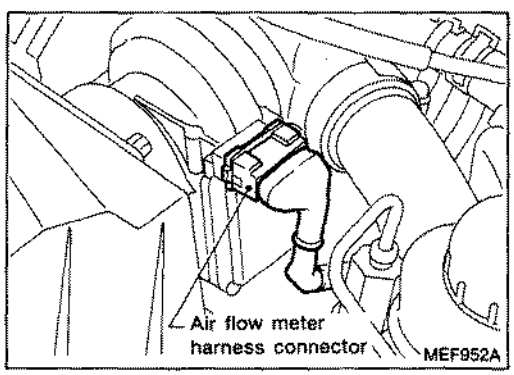
Diagnostic Procedure 24

AIR FLOW METER (Code No. 12)



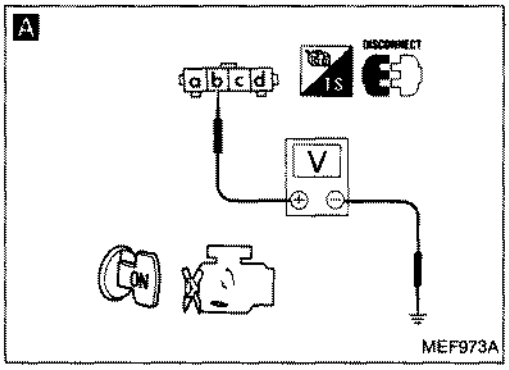
Harness layout





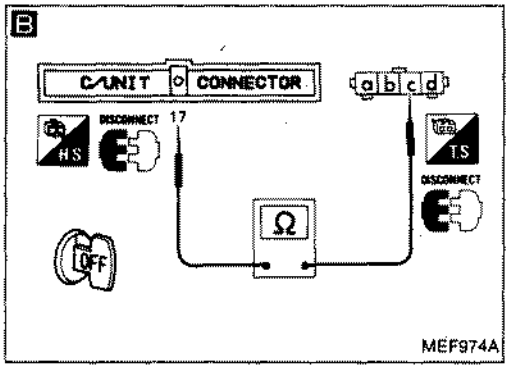
Diagnostic Procedure 24 (Cont'd)

A



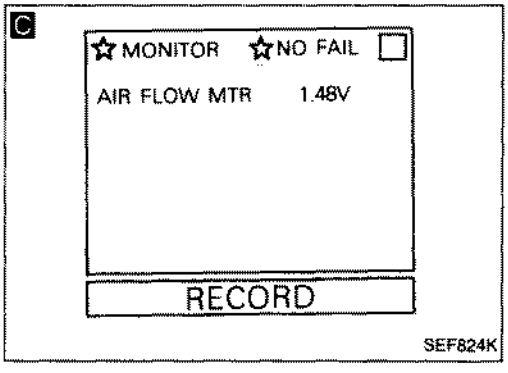
MEF973A

B



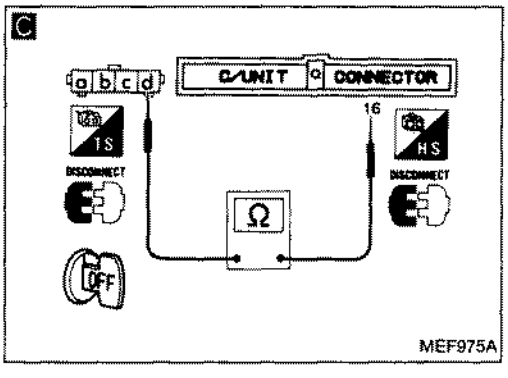
MEF974A

C



SEF824K

C



MEF975A

INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect air flow meter harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓑ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness continuity between air flow meter and E.C.C.S. relay

If N.G., repair harness or connectors.

O.K. ↓

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between terminal ⓒ and E.C.U. terminal ⑰.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

C

CHECK INPUT SIGNAL CIRCUIT.

1) Reconnect air flow meter harness connector and E.C.U. harness connector.
2) Start engine and warm it up sufficiently.
3) Read air flow meter signal in "DATA MONITOR" mode with CONSULT.
Voltage: 1.3 - 1.8V
(At idle)

OR

1) Check harness continuity between terminal ⓓ and E.C.U. terminal ⑯.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

CHECK COMPONENT
(Air flow meter).
Refer to "Electrical Components Inspection".
(See page EF & EC-629.)

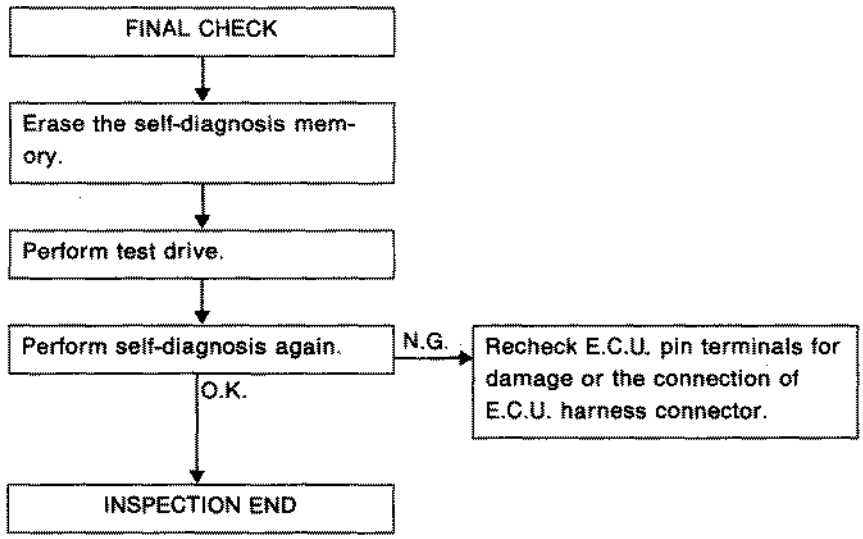
N.G. → Replace air flow meter.

O.K. ↓

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

Diagnostic Procedure 24 (Cont'd)

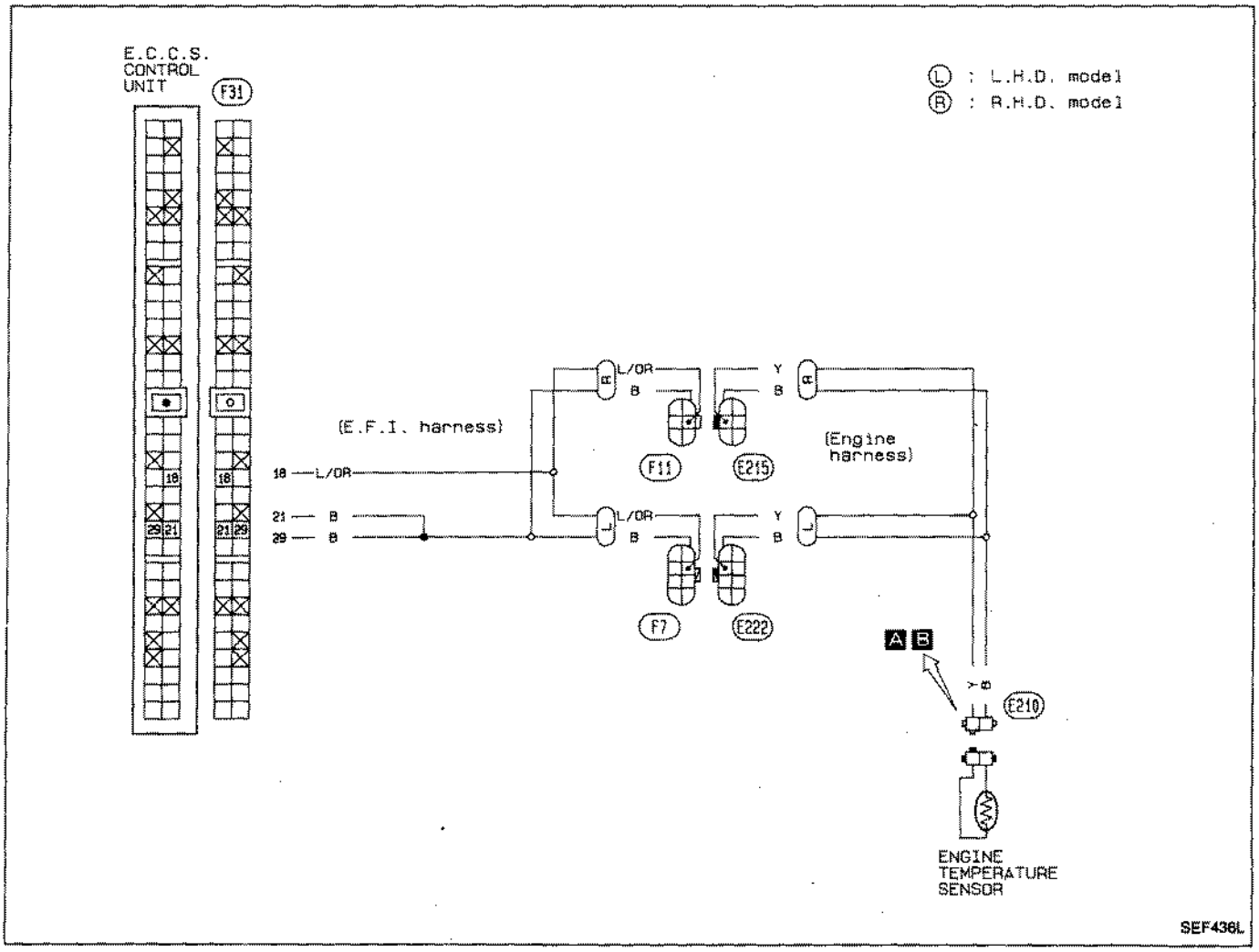
Perform FINAL CHECK by the following procedure after repair is completed.



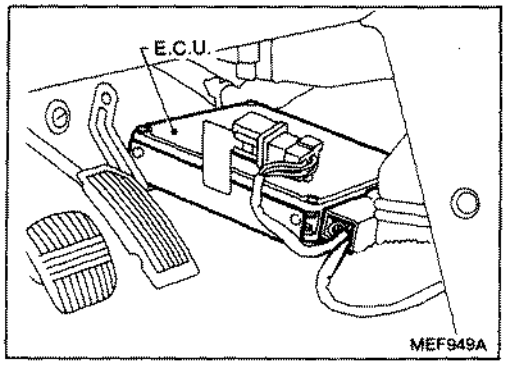
NOTE

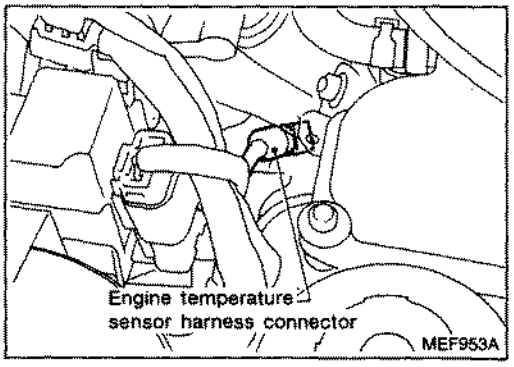
Diagnostic Procedure 25

ENGINE TEMPERATURE SENSOR (Code No. 13)



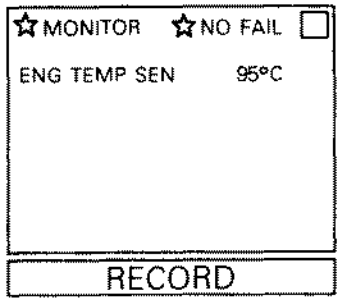
Harness layout





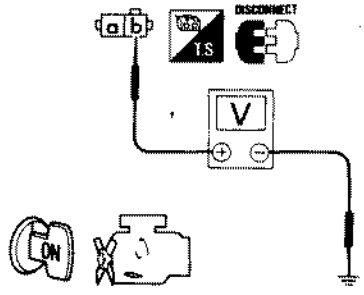
Diagnostic Procedure 25 (Cont'd)

A



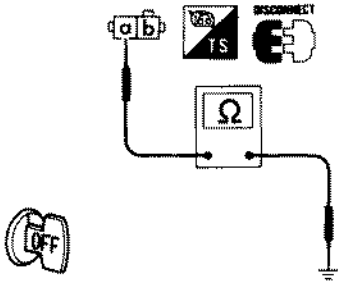
SEF825K

A



MEF976A

B



MEF977A

INSPECTION START

A

CHECK POWER SUPPLY.

1) Start engine and warm it up sufficiently.
2) Select engine temperature sensor signal in "DATA MONITOR" mode with CONSULT.
3) Stop engine
4) When restarting engine make sure that CONSULT indicates "ENG.TEMP SEN" is 50°C (122°F) or more.

OR

1) Disconnect engine temperature sensor harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓑ and ground.
Voltage: Approximately 5V

N.G. → Check the following.
- Harness connectors (F7), (E222) (L.H.D. models)
- Harness connectors (F11), (E215) (R.H.D. models)
- Harness continuity between E.C.U. and engine temperature sensor.

If N.G., repair harness or connectors.

O.K. ↓

B

CHECK GROUND CIRCUIT.

1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓐ and engine ground.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (F7), (E222) (L.H.D. models)
- Harness connectors (F11), (E215) (R.H.D. models)
- Harness continuity between E.C.U. and engine temperature sensor.

If N.G., repair harness or connectors.

O.K. ↓

CHECK COMPONENT (Engine temperature sensor).
Refer to "Electrical Components Inspection".
(See page EF & EC- 630.)

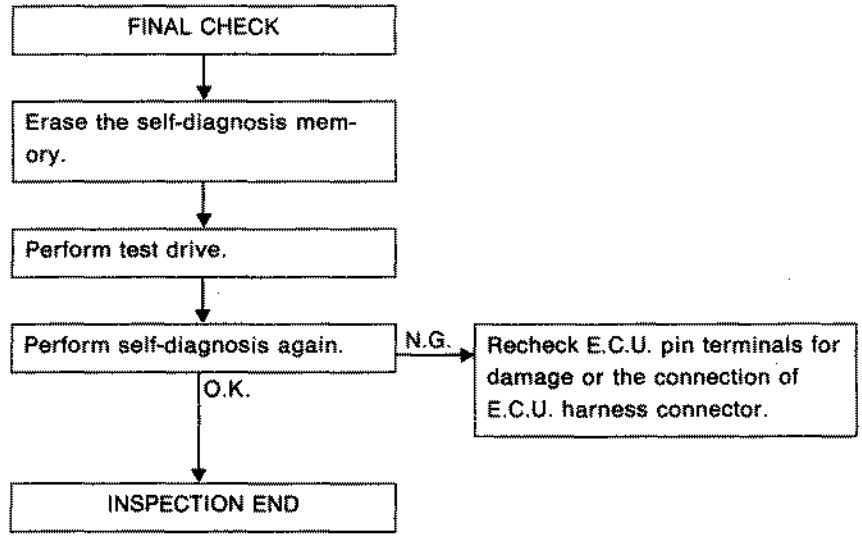
N.G. → Replace engine temperature sensor.

O.K. ↓

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

Diagnostic Procedure 25 (Cont'd)

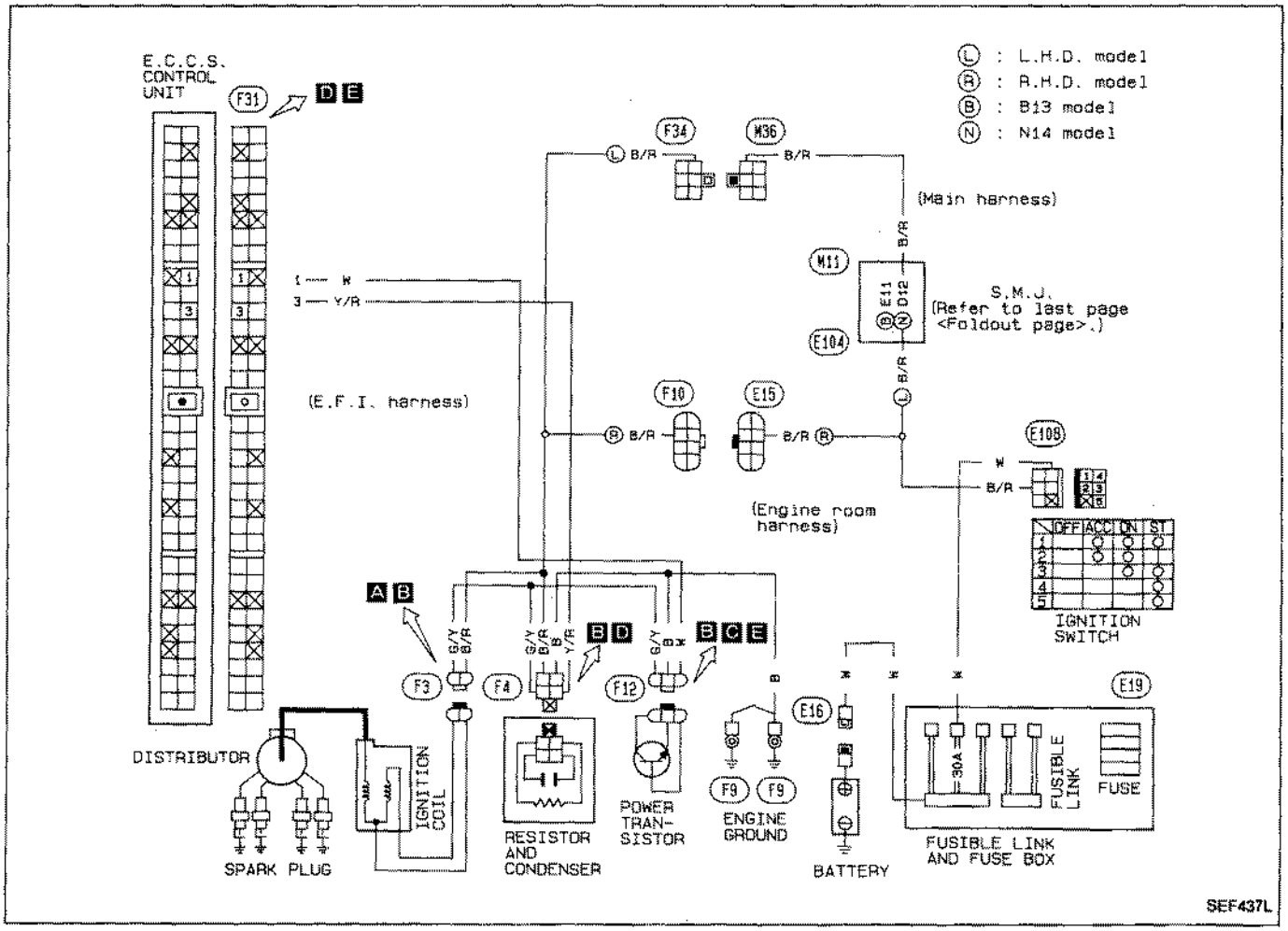
Perform FINAL CHECK by the following procedure after repair is completed.



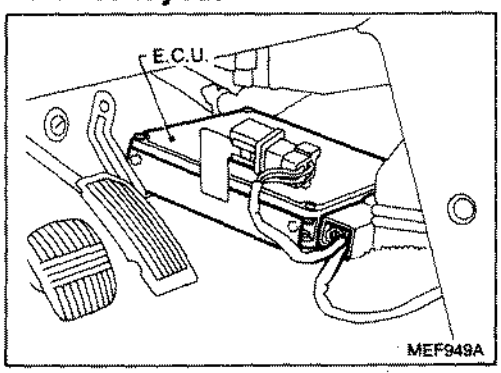
NOTE

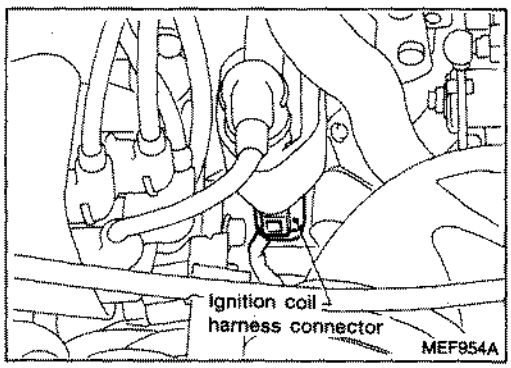
Diagnostic Procedure 26

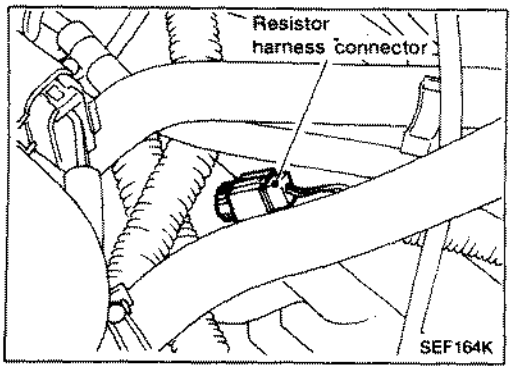
IGNITION SIGNAL (Code No. 21)

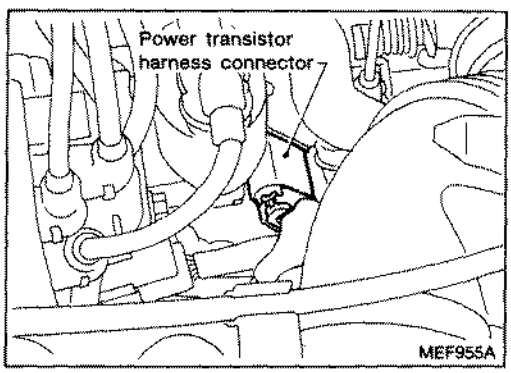


Harness layout



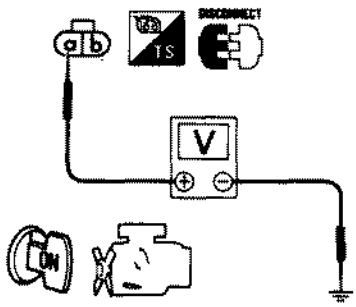






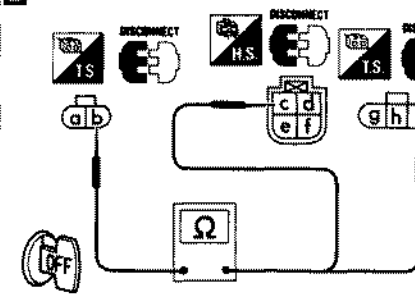
Diagnostic Procedure 26 (Cont'd)

A



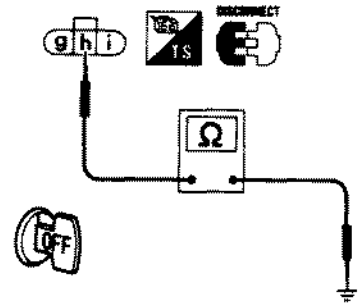
SEF305J

B



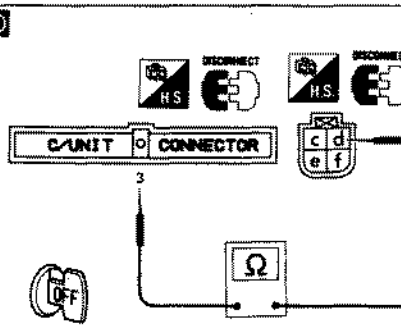
MEF978A

C



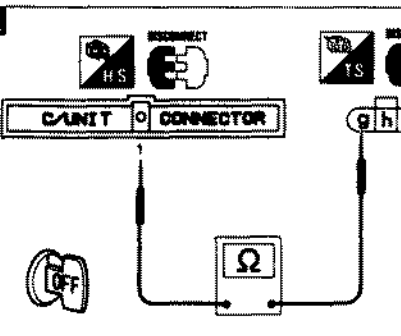
SEF307J

D



MEF979A

E



SEF309J

INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect ignition coil harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓖ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (F34), (M36) (L.H.D. models)
- Harness connectors (M11), (E184) (L.H.D. models)
- Harness connectors (F10), (E15) (R.H.D. models)
- Harness continuity between ignition coil and ignition switch

If N.G., repair harness or connectors.

O.K. ↓

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect resistor harness connector.
3) Disconnect power transistor harness connector.

B 4) Check harness continuity between terminal ⓑ and terminals ⓒ, ⓘ.
Continuity should exist.

C 5) Check harness continuity between terminal ⓗ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

D

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between terminal ⓓ and E.C.U. terminal ③.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

E

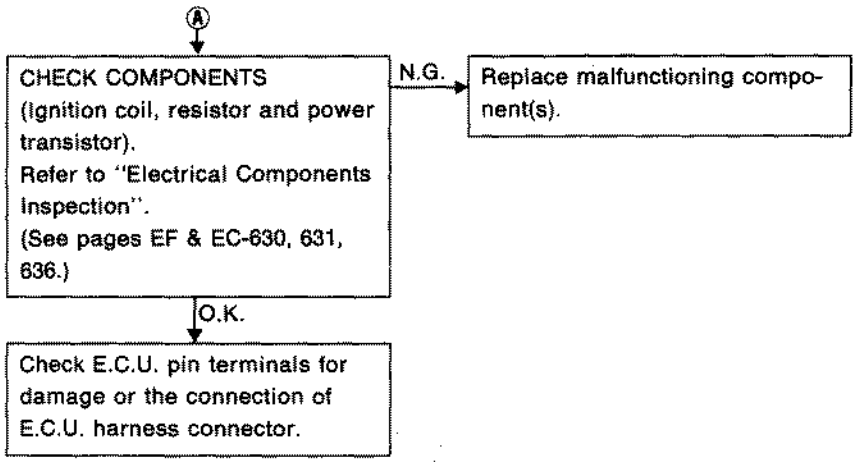
CHECK OUTPUT SIGNAL CIRCUIT.
1) Check harness continuity between terminal ⓖ and E.C.U. terminal ①.
Continuity should exist.

N.G. → Repair harness or connectors.

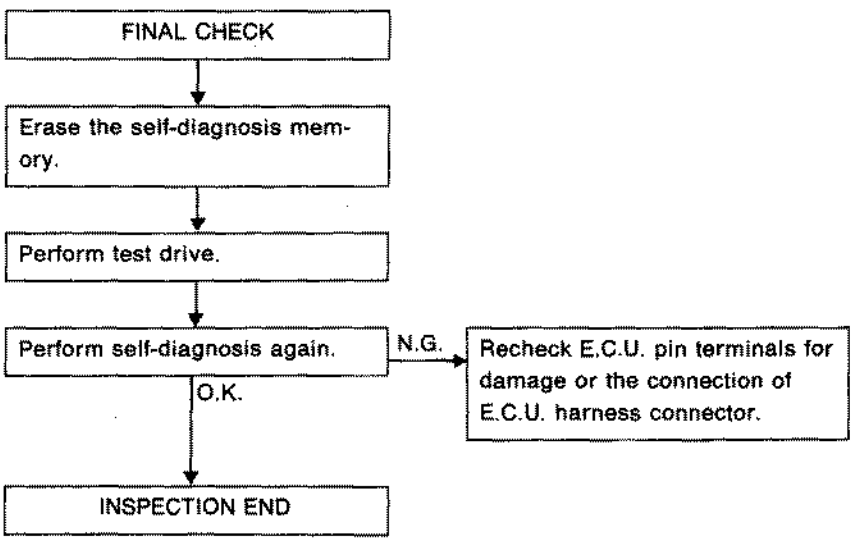
O.K. ↓

Ⓐ

Diagnostic Procedure 26 (Cont'd)



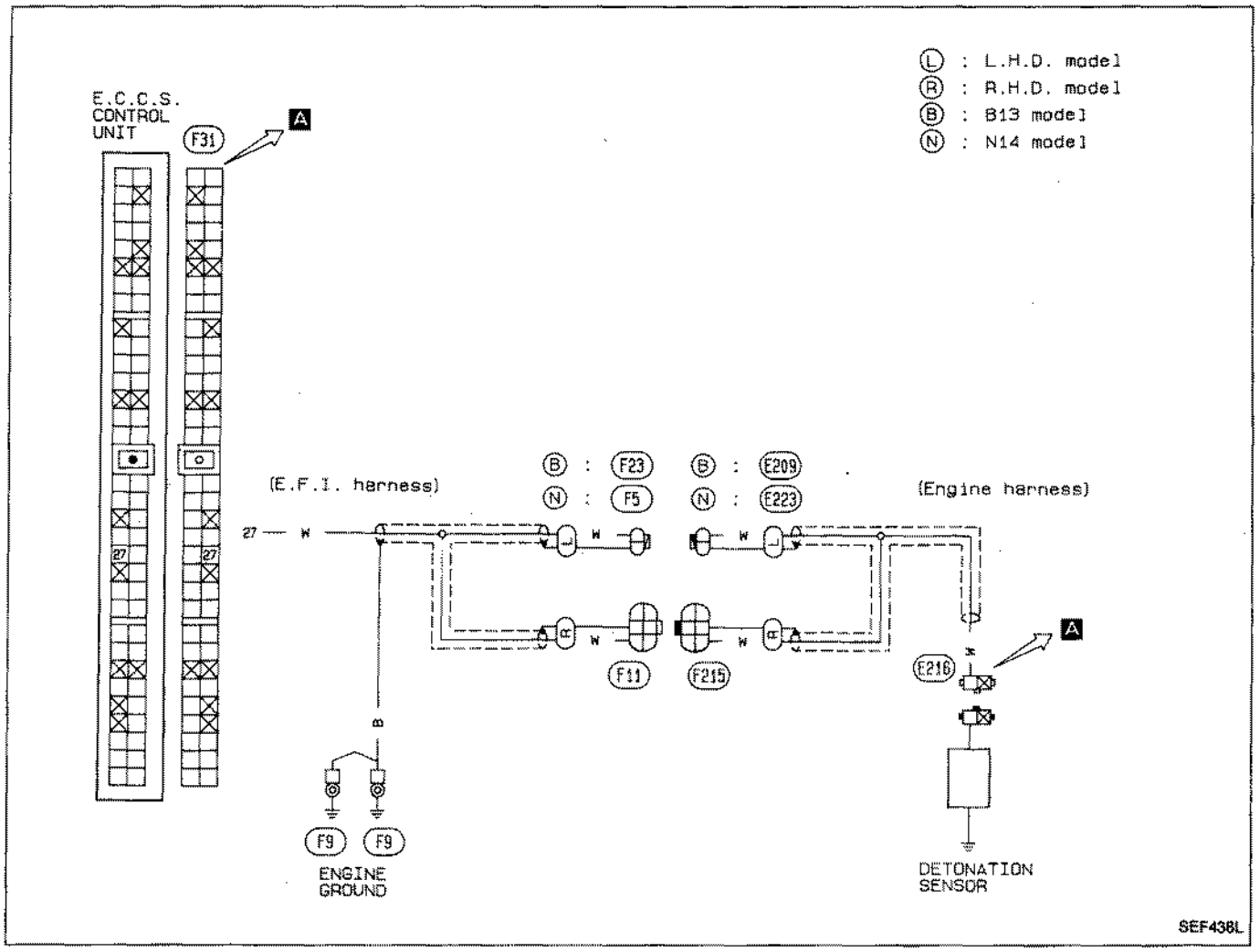
Perform FINAL CHECK by the following procedure after repair is completed.



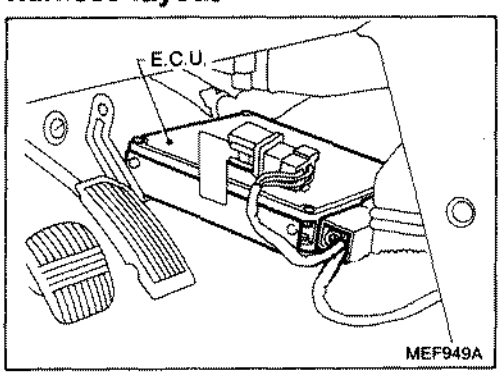
NOTE

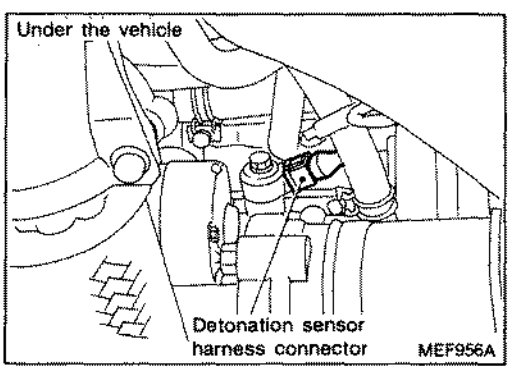
Diagnostic Procedure 27

DETONATION SENSOR (Code No. 34)

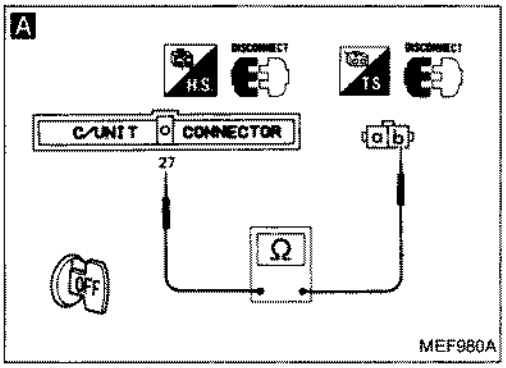


Harness layout





Diagnostic Procedure 27 (Cont'd)



INSPECTION START

A

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector and detonation sensor harness connector.
2) Check harness continuity between terminal (b) and E.C.U. terminal (27).
Continuity should exist.

N.G. → Check the following.
- Harness connectors (F23), (E289) (B13 L.H.D. models)
- Harness connectors (F5), (E223) (N14 L.H.D. models)
- Harness connectors (F11), (E215) (R.H.D. models)
- Harness continuity between E.C.U. and detonation sensor

If N.G., repair harness or connectors.

O.K. ↓

CHECK COMPONENT (Detonation sensor).
Refer to "Electrical Components Inspection".
(See page EF & EC-634.)

N.G. → Replace detonation sensor.

O.K. ↓

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

Perform FINAL CHECK by the following procedure after repair is completed.

FINAL CHECK ↓

Erase the self-diagnosis memory. ↓

Perform test drive. ↓

Perform self-diagnosis again.

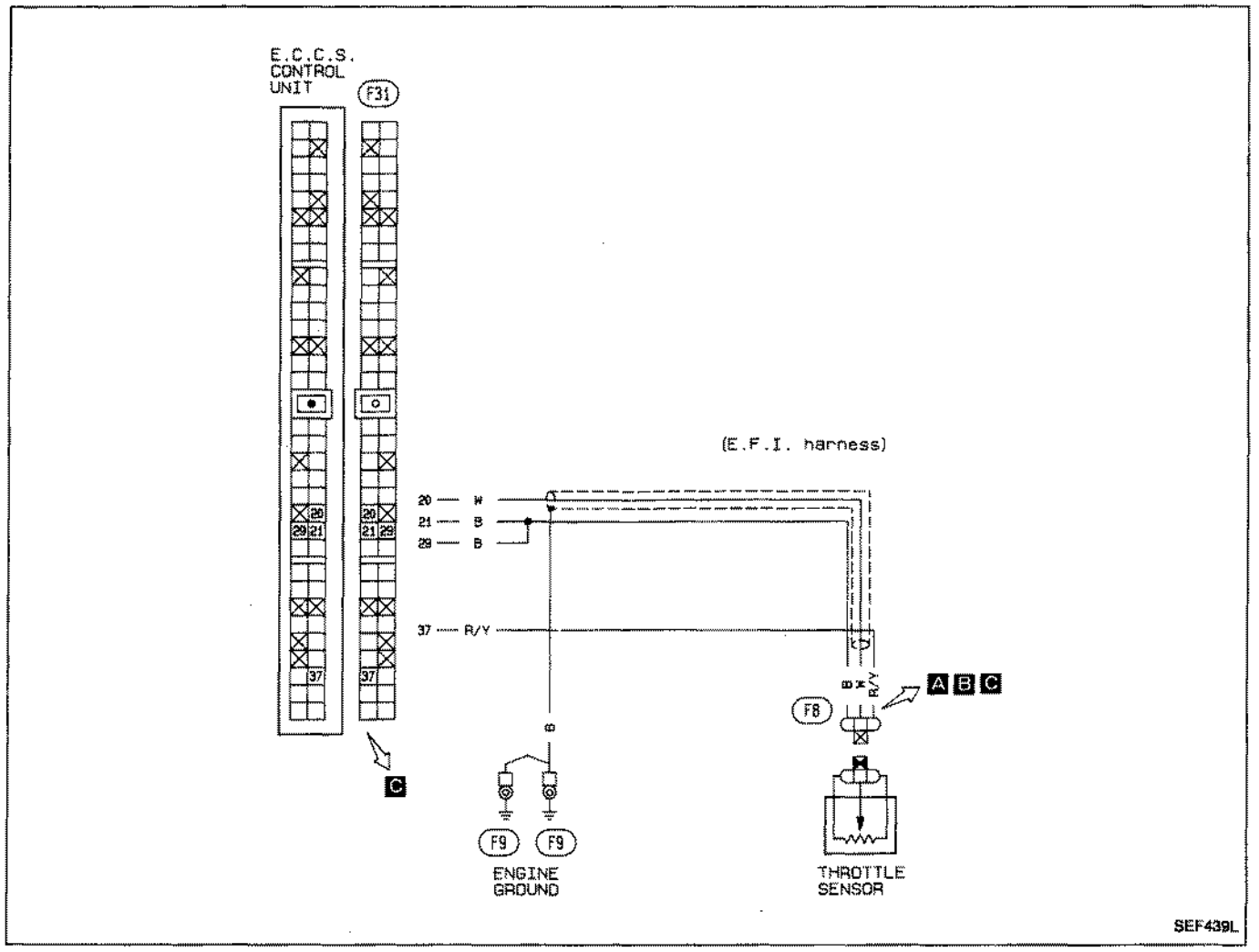
N.G. → Recheck E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K. ↓

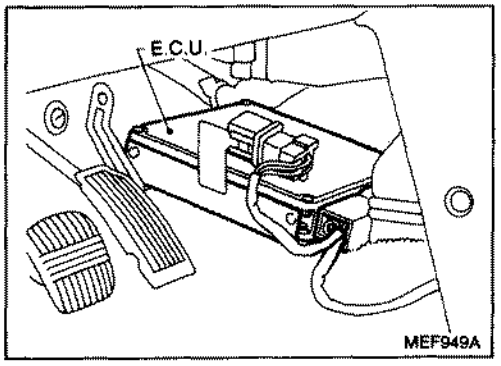
INSPECTION END

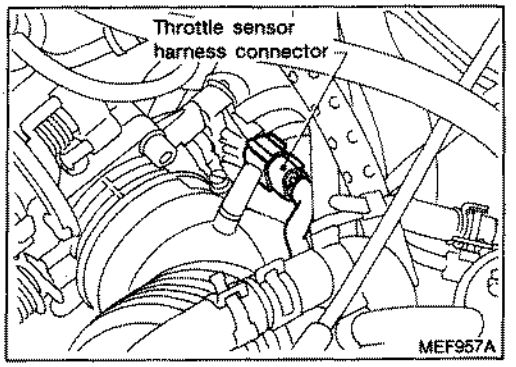
Diagnostic Procedure 28

THROTTLE SENSOR (Code No. 43)

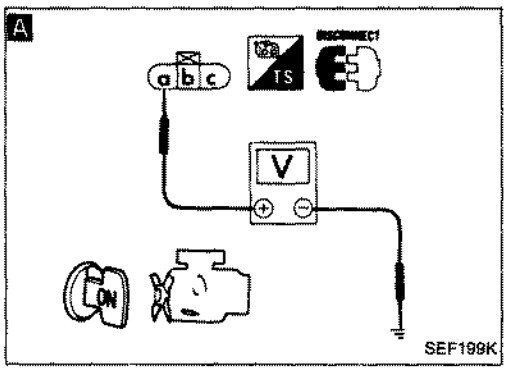


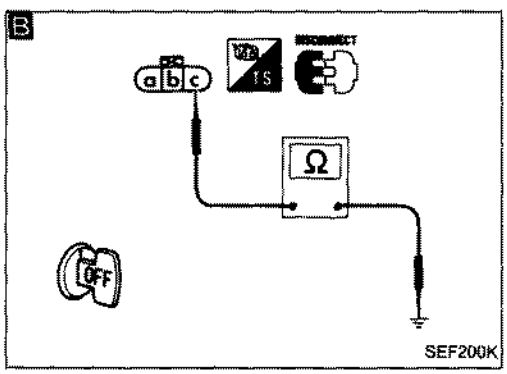
Harness layout

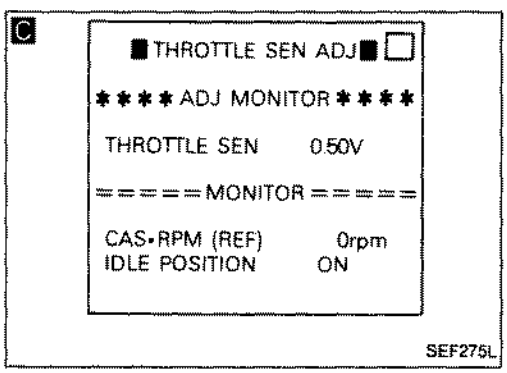


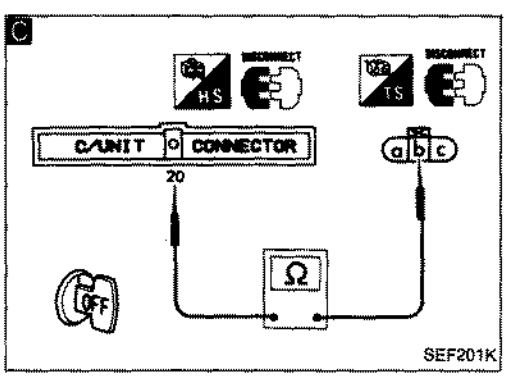


Diagnostic Procedure 28 (Cont'd)









INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect throttle sensor harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓐ and ground.
Voltage: Approximately 5V

N.G. → Repair harness or connectors.

O.K.

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓒ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

C

CHECK INPUT SIGNAL CIRCUIT.

1) Reconnect throttle sensor harness connector.
2) Turn ignition switch "ON".
3) Read throttle sensor output voltage in "WORK SUPPORT" mode with CONSULT.
Throttle valve fully closed:
0.45 - 0.55V
Throttle valve fully open:
Approx. 4.0V

N.G. → Repair harness or connectors.

— OR —

1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal ⑳ and terminal ⓑ.
Continuity should exist.

O.K.

CHECK COMPONENT (Throttle sensor).
Refer to "Electrical Components Inspection".
(See page EF & EC-632.)

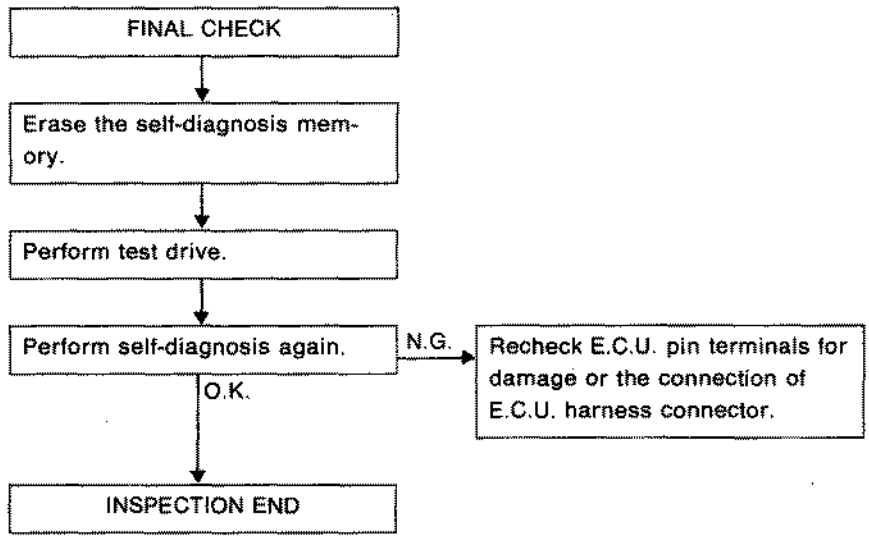
N.G. → Replace throttle sensor.

O.K.

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

Diagnostic Procedure 28 (Cont'd)

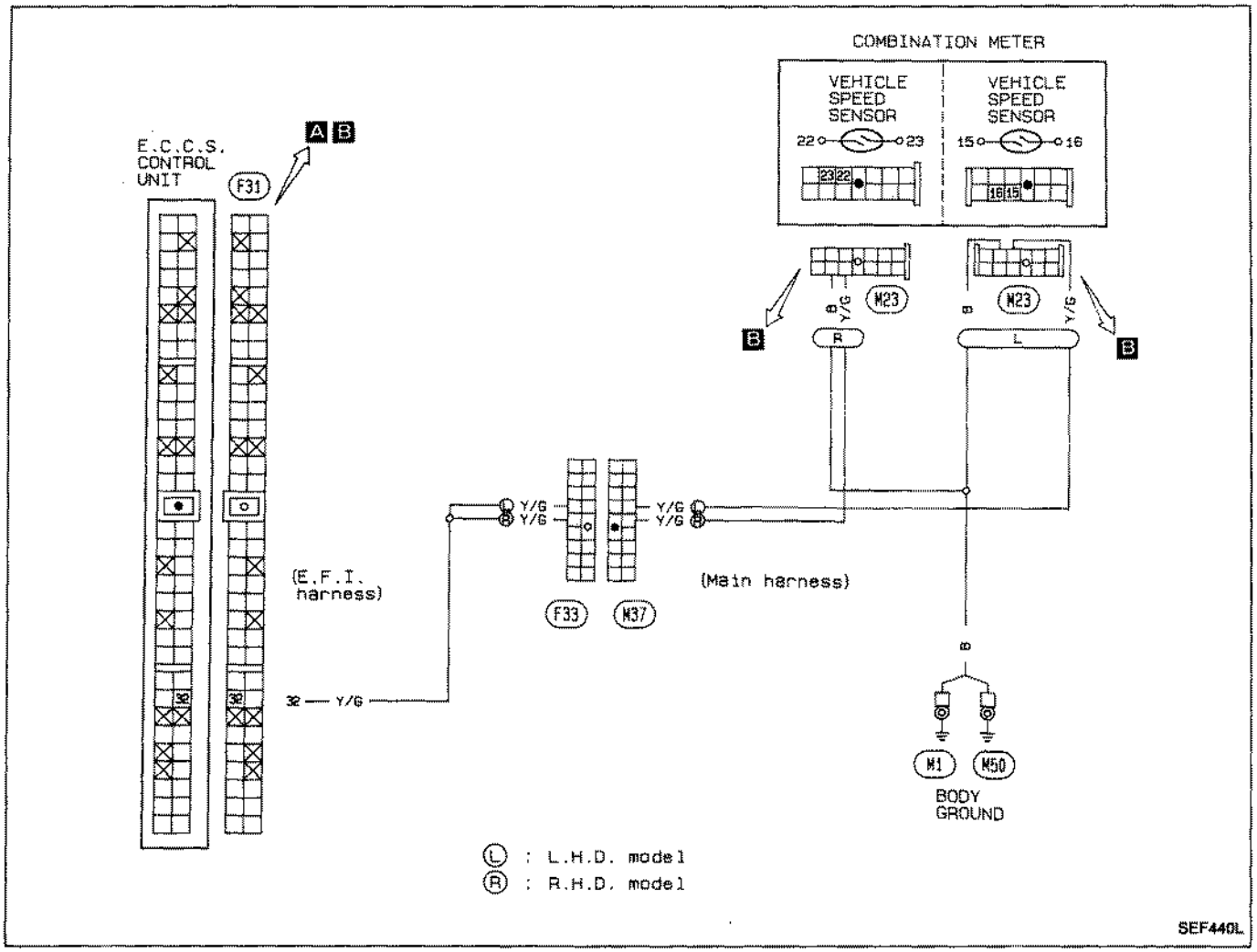
Perform FINAL CHECK by the following procedure after repair is completed.



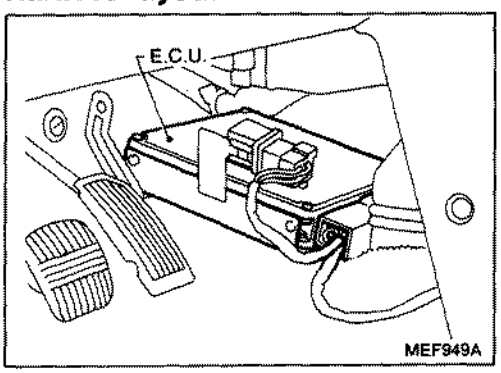
NOTE

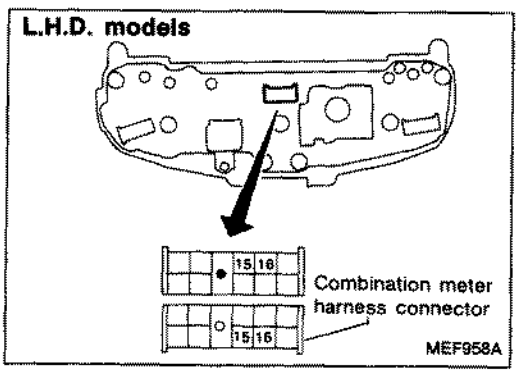
Diagnostic Procedure 29

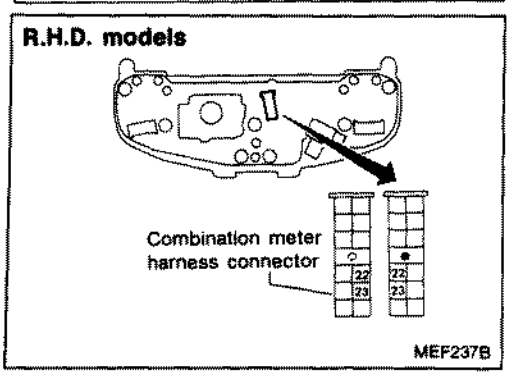
VEHICLE SPEED SENSOR (Not self-diagnostic item)



Harness layout

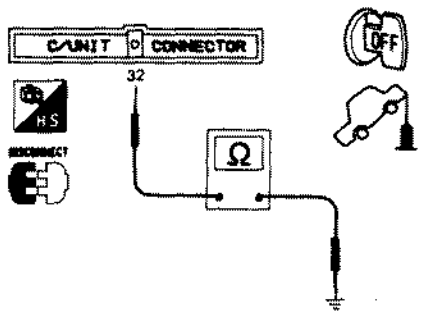




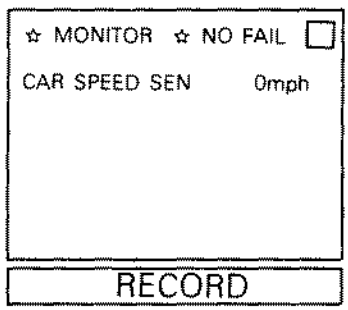


Diagnostic Procedure 29 (Cont'd)

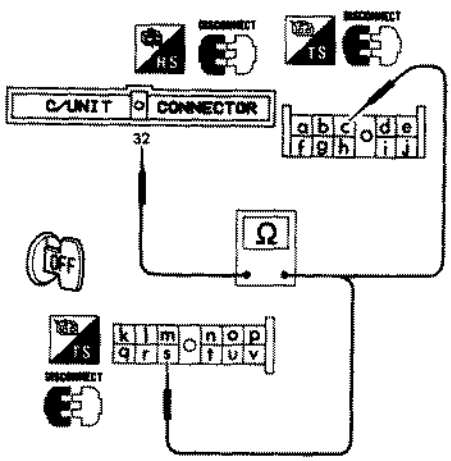
A



B



B



INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Jack up front wheels.
2) Disconnect E.C.U. harness connector.
3) Rotate front wheel by hand.
4) Check harness continuity between E.C.U. terminal (32) and body ground.
Continuity should come and go.

O.K. → INSPECTION END

N.G.

CHECK SPEEDOMETER FUNCTION.
Make sure that speedometer functions properly.

N.G. → Check vehicle speed sensor and circuit.
(Refer to EL section.)

O.K.

B

CHECK INPUT SIGNAL CIRCUIT.
1) Reconnect E.C.U. harness connector.
2) Read vehicle speed sensor signal in "DATA MONITOR" mode with CONSULT.
CONSULT value should be the same as the speedometer indication.

N.G. → Check the following.
- Harness connectors (F33), (M37)
- Harness continuity between E.C.U. and combination meter

If N.G., repair harness or connectors.

OR

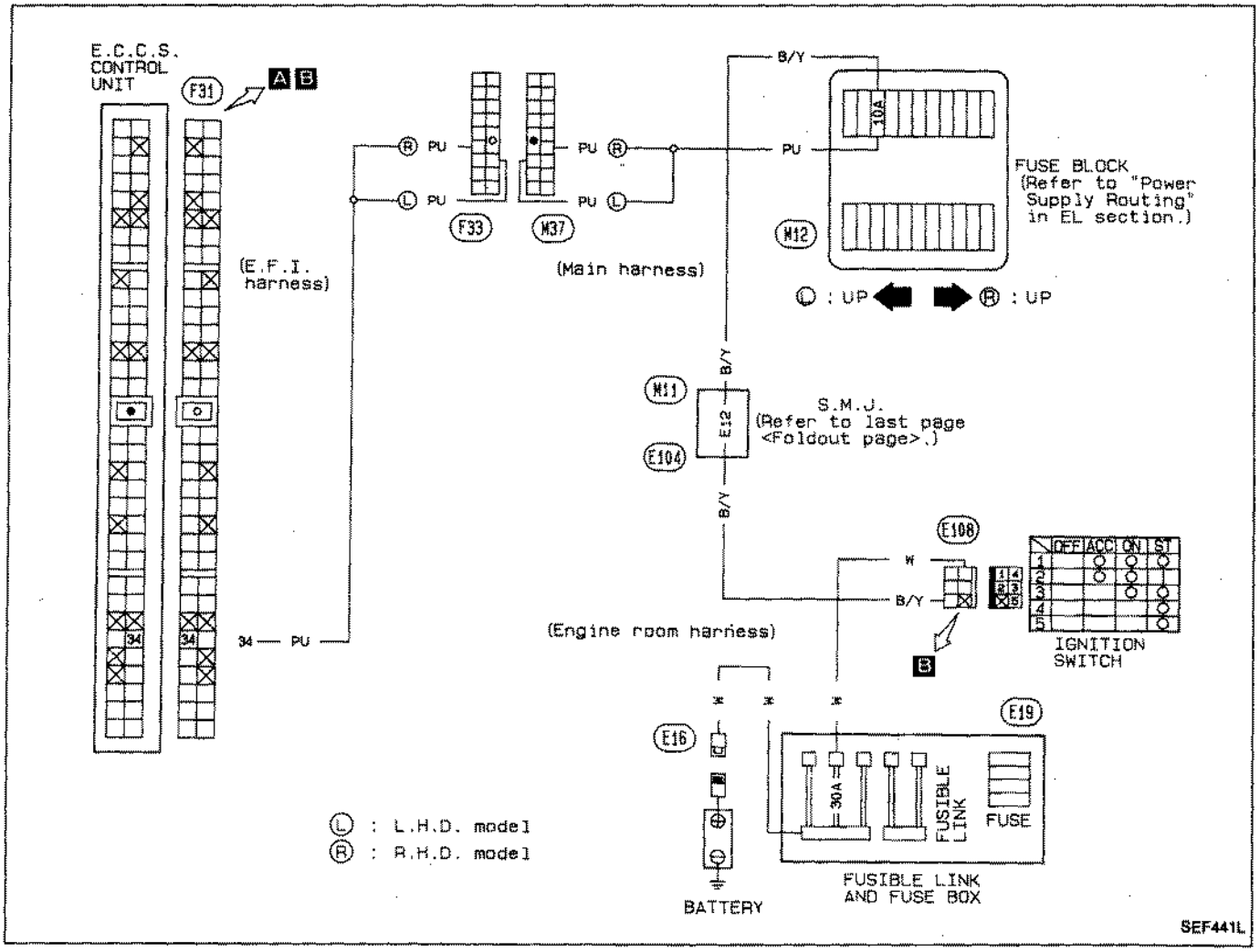
1) Turn ignition switch "OFF".
2) Disconnect combination meter harness connector.
3) Check harness continuity between E.C.U. terminal (32) and terminal (E) (L.H.D. models), terminal (S) (R.H.D. models).
Continuity should exist.

O.K.

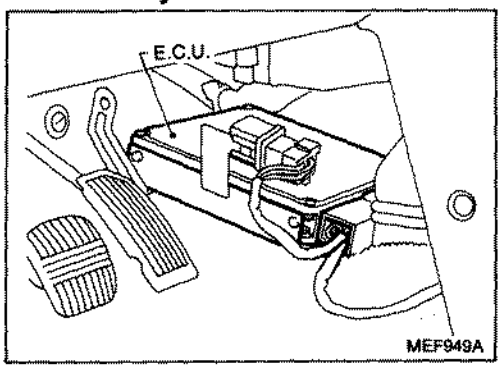
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Diagnostic Procedure 30

START SIGNAL (Not self-diagnostic item)

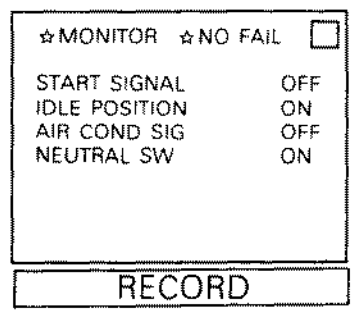


Harness layout



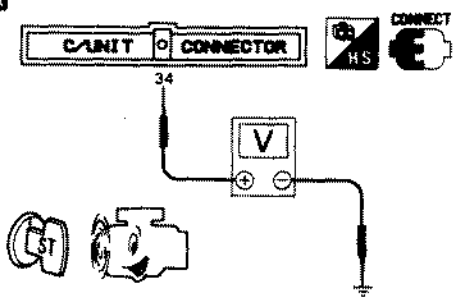
Diagnostic Procedure 30 (Cont'd)

A



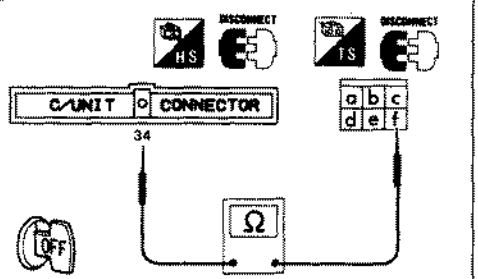
SEF384J

A



SEF202K

B



MEF982A

INSPECTION START

A

CHECK OVERALL FUNCTION.

1) Turn ignition switch "ON".
2) Check start signal in "DATA MONITOR" mode with CONSULT.

IGN "ON"	OFF
IGN "START"	ON

O.K. → INSPECTION END

OR

1) Turn ignition switch to "START".
2) Check voltage between E.C.U. terminal ㉞ and ground.

Voltage:
Ignition switch "START"
Battery voltage
Except above
Approximately 0V

N.G.

B

CHECK INPUT SIGNAL CIRCUIT.

1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector and ignition switch harness connector.
3) Check harness continuity between E.C.U. terminal ㉞ and terminal ⓕ.

Continuity should exist.

N.G. → Check the following.
- Harness connectors (F33), (M37)
- Harness connectors (M11), (E164)
- 10A fuse
- Harness continuity between E.C.U. and ignition switch

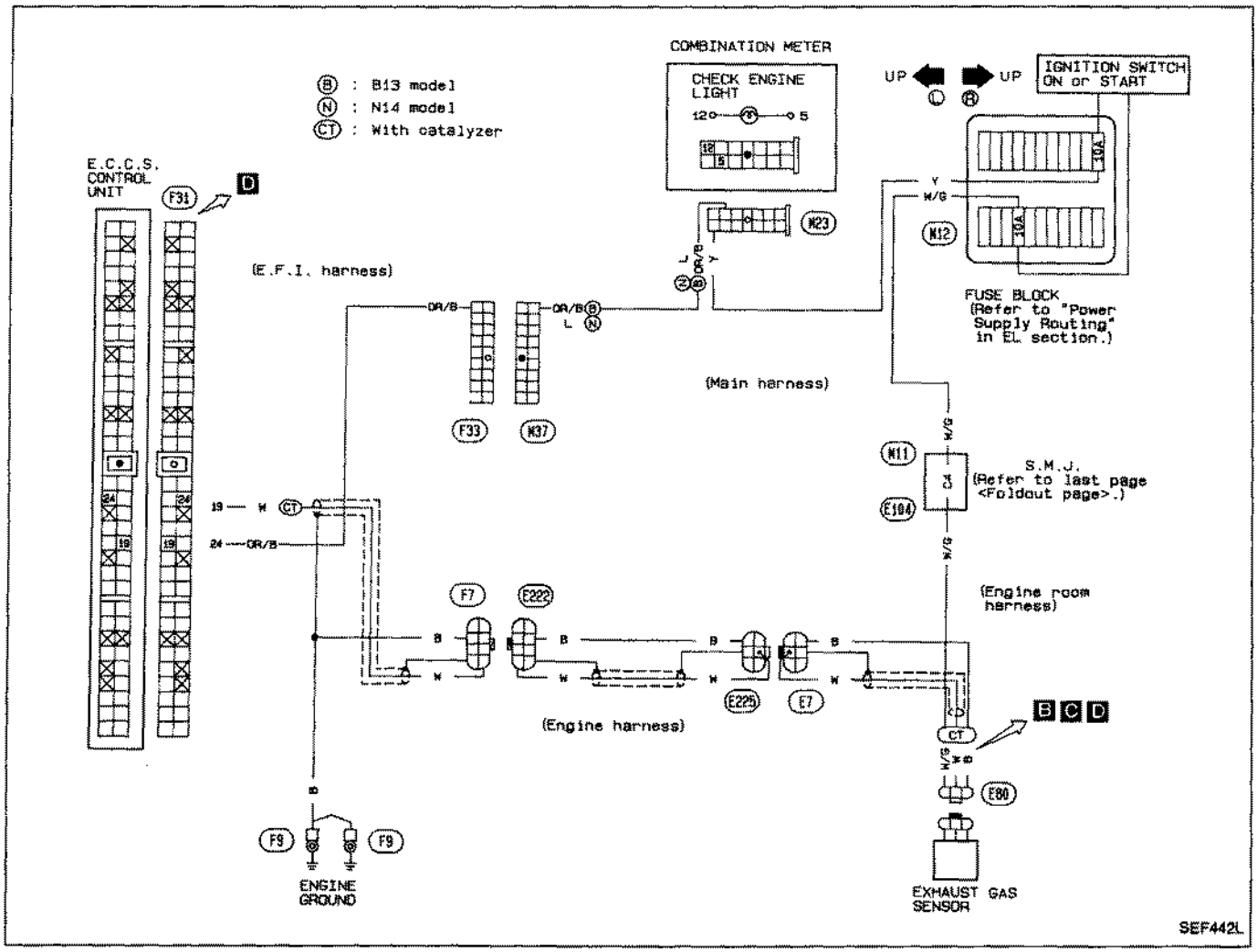
If N.G., repair harness or connectors.

O.K.

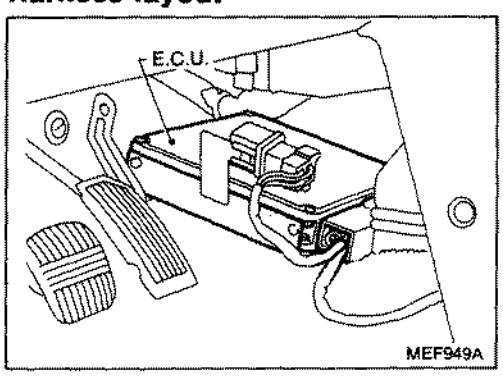
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

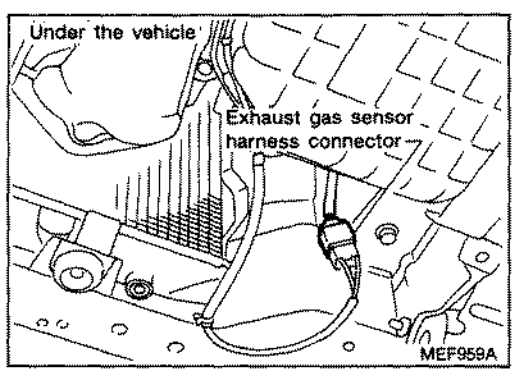
Diagnostic Procedure 31

EXHAUST GAS SENSOR (Not self-diagnostic item)

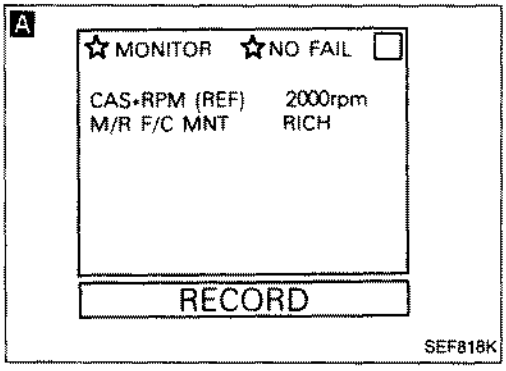


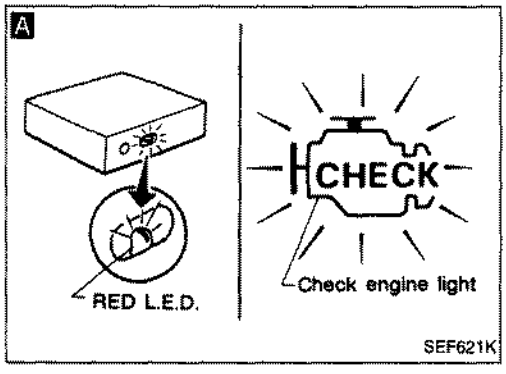
Harness layout

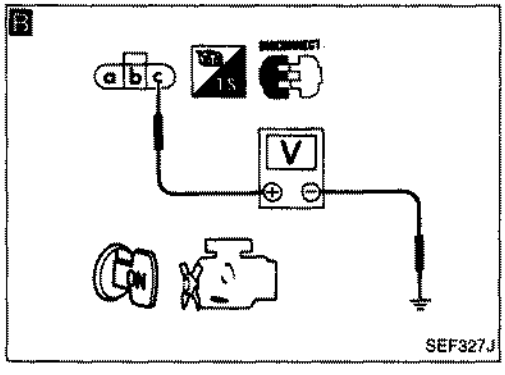


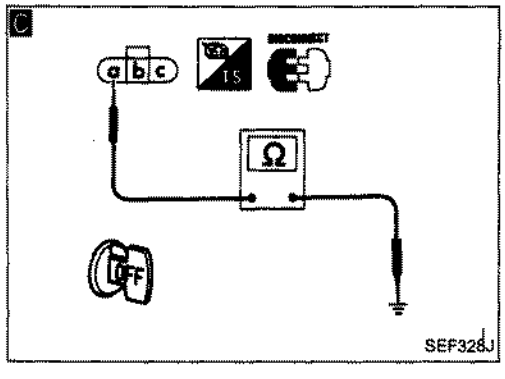


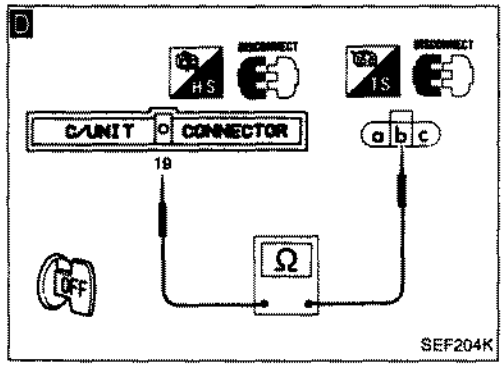
Diagnostic Procedure 31 (Cont'd)











INSPECTION START

A

CHECK EXHAUST GAS SENSOR CIRCUIT.

1) Start engine and warm it up sufficiently.
2) Make sure that "M/R F/C MNT" in "DATA MONITOR" mode indicates "RICH" and "LEAN" periodically more than 5 times during 10 seconds at 2,000 rpm.

O.K. → INSPECTION END

OR

1) Start engine and warm it up sufficiently.
2) Run engine at about 2,000 rpm for about 2 minutes under no-load.
3) Set E.C.U. diagnosis mode to Mode II.
4) Keep engine speed at 2,000 rpm and make sure that the RED L.E.D. on E.C.U. or the check engine light on the instrument panel goes on and off more than 5 times during 10 seconds.

N.G.

B

CHECK POWER SUPPLY.

1) Stop engine.
2) Disconnect exhaust gas sensor harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓒ and ground.

Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (M1), (E104)
- 10A fuse
- Harness continuity between exhaust gas sensor and fuse

If N.G., repair harness or connectors.

O.K.

C

CHECK GROUND CIRCUIT.

1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓐ and engine ground.

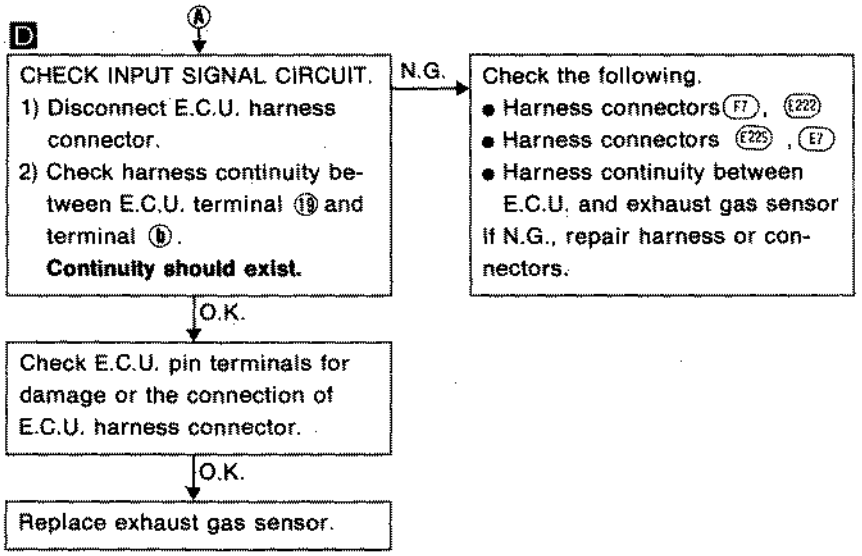
Continuity should exist.

N.G. → Check the following.
- Harness connectors (F7), (E222)
- Harness connectors (E225), (E7)
- Harness continuity between exhaust gas sensor and engine ground

If N.G., repair harness or connectors.

O.K. → Ⓐ

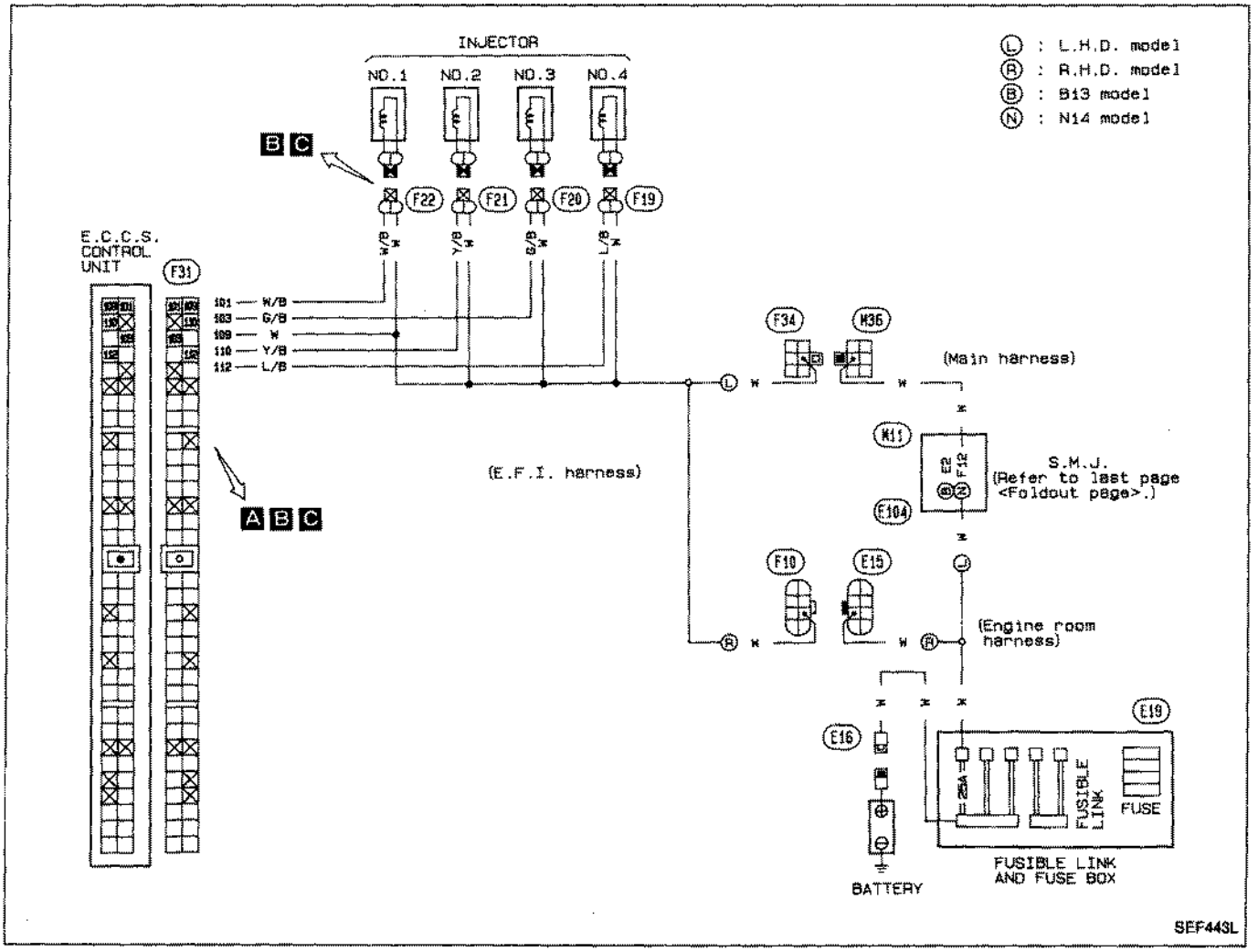
Diagnostic Procedure 31 (Cont'd)



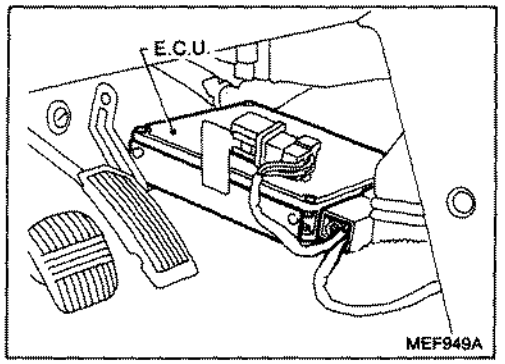
NOTE

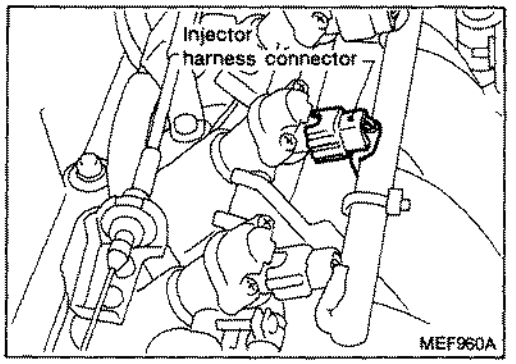
Diagnostic Procedure 32

INJECTOR (Not self-diagnostic item)



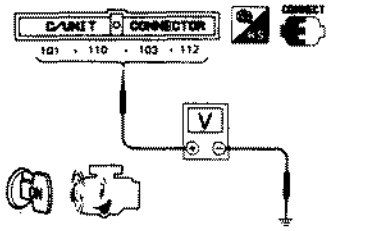
Harness layout





Diagnostic Procedure 32 (Cont'd)

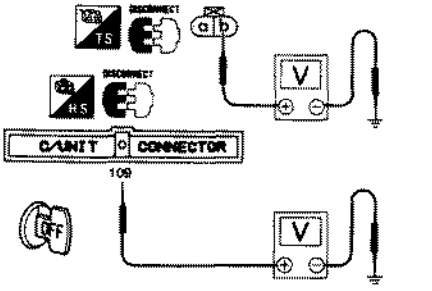
A



(101) : No. 1 cylinder (103) : No. 3 cylinder
(110) : No. 2 cylinder (112) : No. 4 cylinder

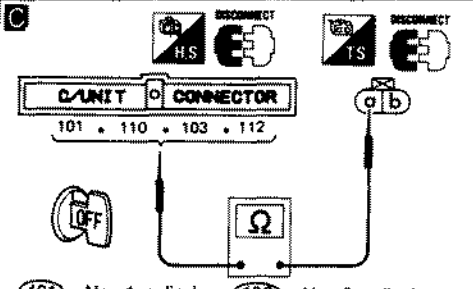
SEF974I

B



MEF983A

C



(101) : No. 1 cylinder (103) : No. 3 cylinder
(110) : No. 2 cylinder (112) : No. 4 cylinder

MEF984A

INSPECTION START

A

CHECK CONTROL FUNCTION.
1) Start engine.
2) Check voltage between E.C.U. terminals (101), (110), (103), (112) and ground.
Voltage: Battery voltage

O.K. → INSPECTION END

N.G.

B

CHECK POWER SUPPLY.
1) Stop engine.
2) Disconnect injector harness connector and E.C.U. harness connector.
3) Check voltage between terminal ⓑ and ground, E.C.U. terminal (109) and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (F34), (M56) (L.H.D. models)
- Harness connectors (M11), (E104) (L.H.D. models)
- Harness connectors (F10), (E15) (R.H.D. models)
- 25A fusible link
- Harness continuity between battery and injector
- Harness continuity between battery and E.C.U.

If N.G., repair harness or connectors.

O.K.

C

CHECK OUTPUT SIGNAL CIRCUIT.
1) Check harness continuity between terminal ⓐ and E.C.U. terminals (101), (110), (103), (112).
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

CHECK COMPONENT (Injector).
Refer to "Electrical Components Inspection".
(See page EF & EC-635.)

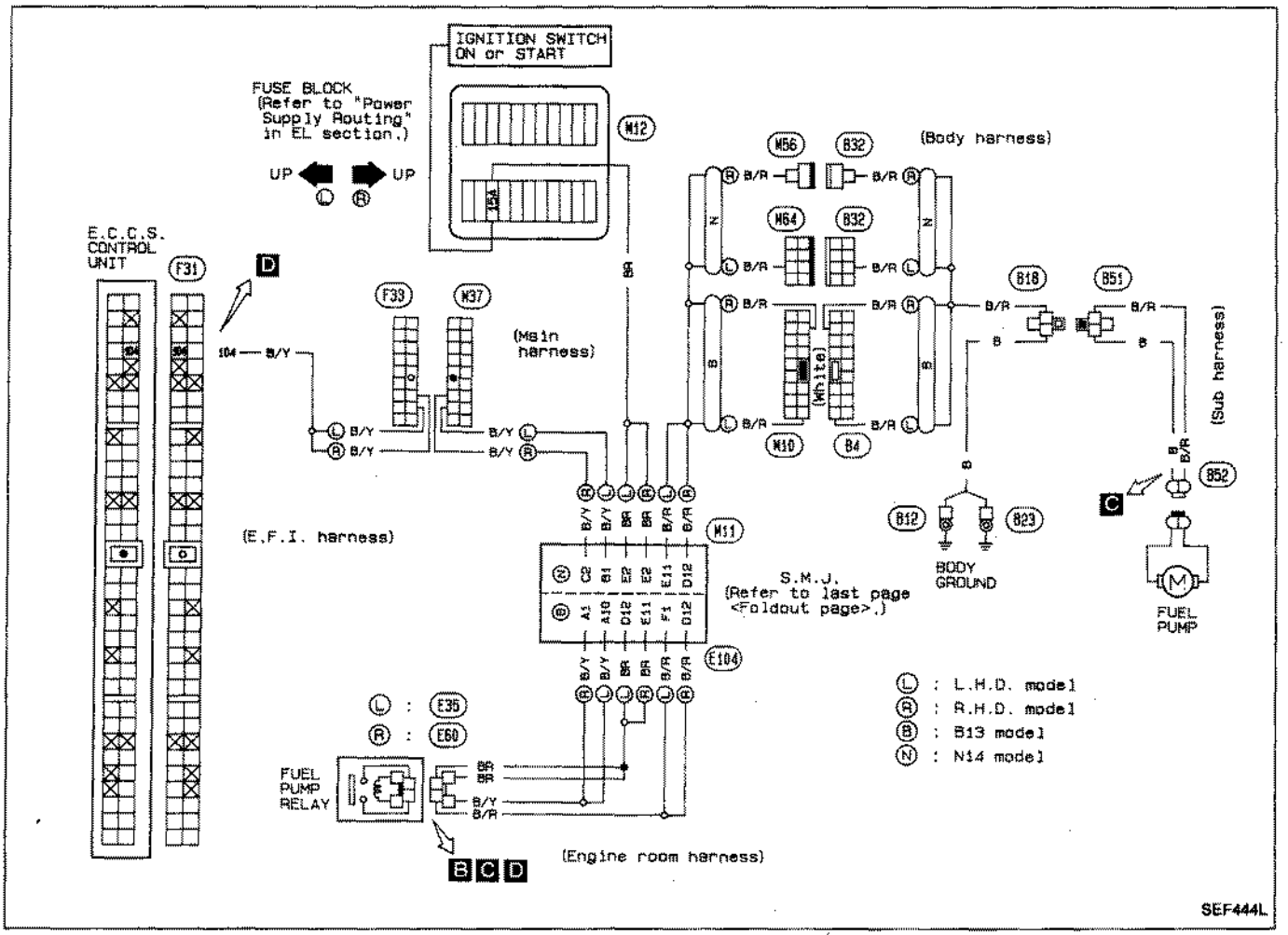
N.G. → Replace injector.

O.K.

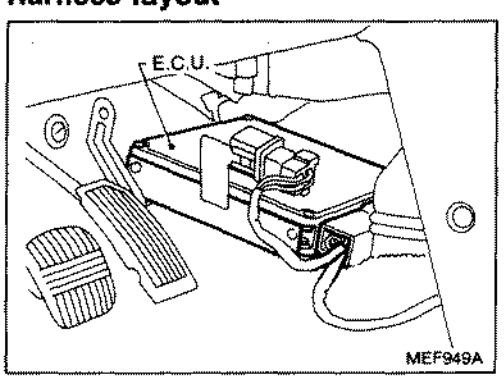
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

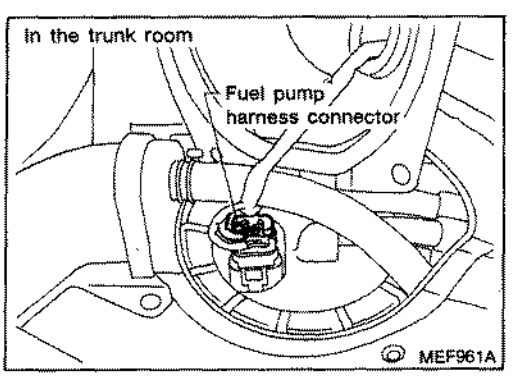
Diagnostic Procedure 33

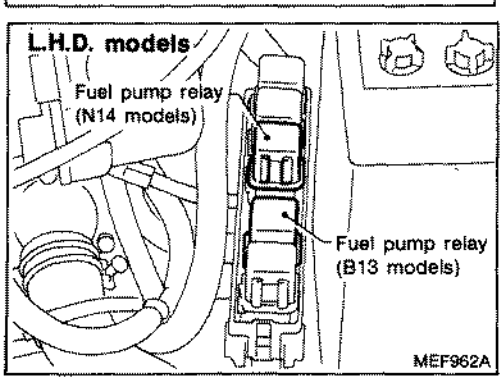
FUEL PUMP (Not self-diagnostic item)

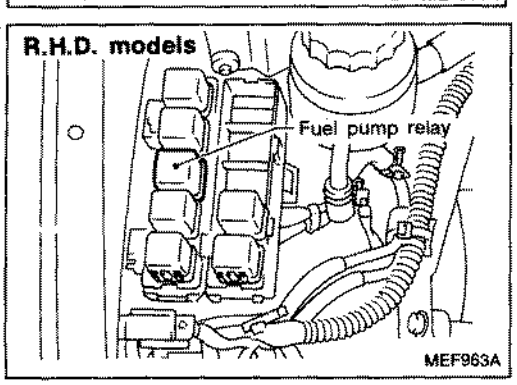


Harness layout



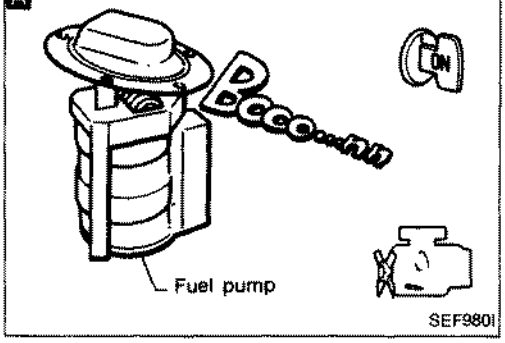




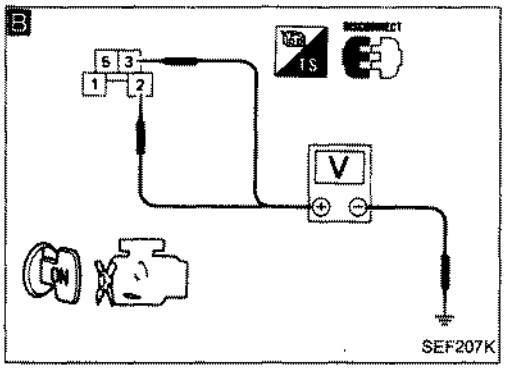


Diagnostic Procedure 33 (Cont'd)

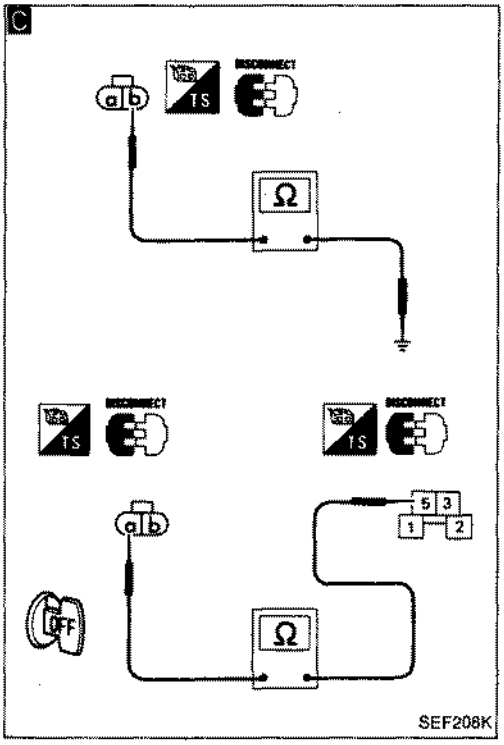
A



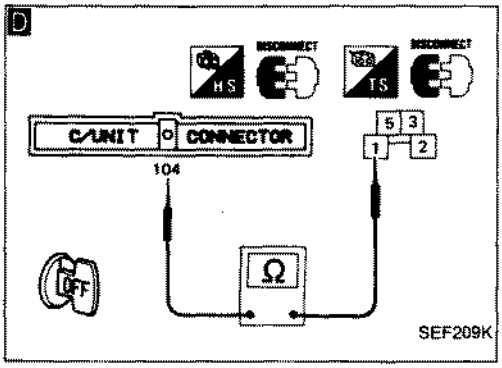
B



C



D



INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Turn ignition switch "ON".
2) Listen to fuel pump operating sound.
Fuel pump should operate for 5 seconds after ignition switch is turned "ON".

O.K. → INSPECTION END

N.G.

B

CHECK POWER SUPPLY.
1) Turn ignition switch "OFF".
2) Disconnect fuel pump relay.
3) Turn ignition switch "ON".
4) Check voltage between terminals ②, ③ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (M11), (E104)
- 15A fuse
- Harness continuity between fuse and fuel pump relay

If N.G., repair harness or connectors.

O.K.

C

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect fuel pump harness connector.
3) Check harness continuity between terminal ⓑ and body ground, terminal ⓐ and terminal ⑤.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (B16), (B51)
- Harness connectors (M11), (E104)
- Harness connectors (M10), (B4) (B13 models)
- Harness connectors (M64), (B32) (N14 L.H.D. models)
- Harness connectors (M56), (B32) (N14 R.H.D. models)
- Harness continuity between fuel pump and body ground
- Harness continuity between fuel pump and fuel pump relay

If N.G., repair harness or connectors.

O.K.

D

CHECK OUTPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal (104) and terminal ①.
Continuity should exist.

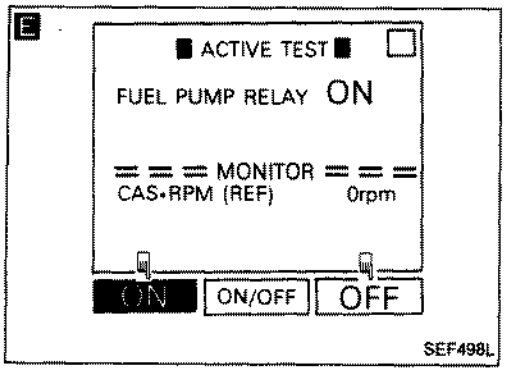
N.G. → Check the following.
- Harness connectors (M11), (E104)
- Harness connectors (F39), (B37)
- Harness continuity between E.C.U. and fuel pump relay

If N.G., repair harness or connectors.

O.K.

Ⓐ

Diagnostic Procedure 33 (Cont'd)



Ⓐ

CHECK COMPONENT
(Fuel pump relay).

1) Reconnect fuel pump relay, fuel pump harness connector and E.C.U. harness connector.
2) Ignition switch "ON".
3) Turn fuel pump relay "ON" and "OFF" in "ACTIVE TEST" mode with CONSULT and check operating sound.

N.G. → Replace fuel pump relay.

OR

Refer to "Electrical Components Inspection". (See page EF & EC-635.)

O.K. ↓

CHECK COMPONENT
(Fuel pump).
Refer to "Electrical Components Inspection".
(See page EF & EC-631.)

N.G. → Replace fuel pump.

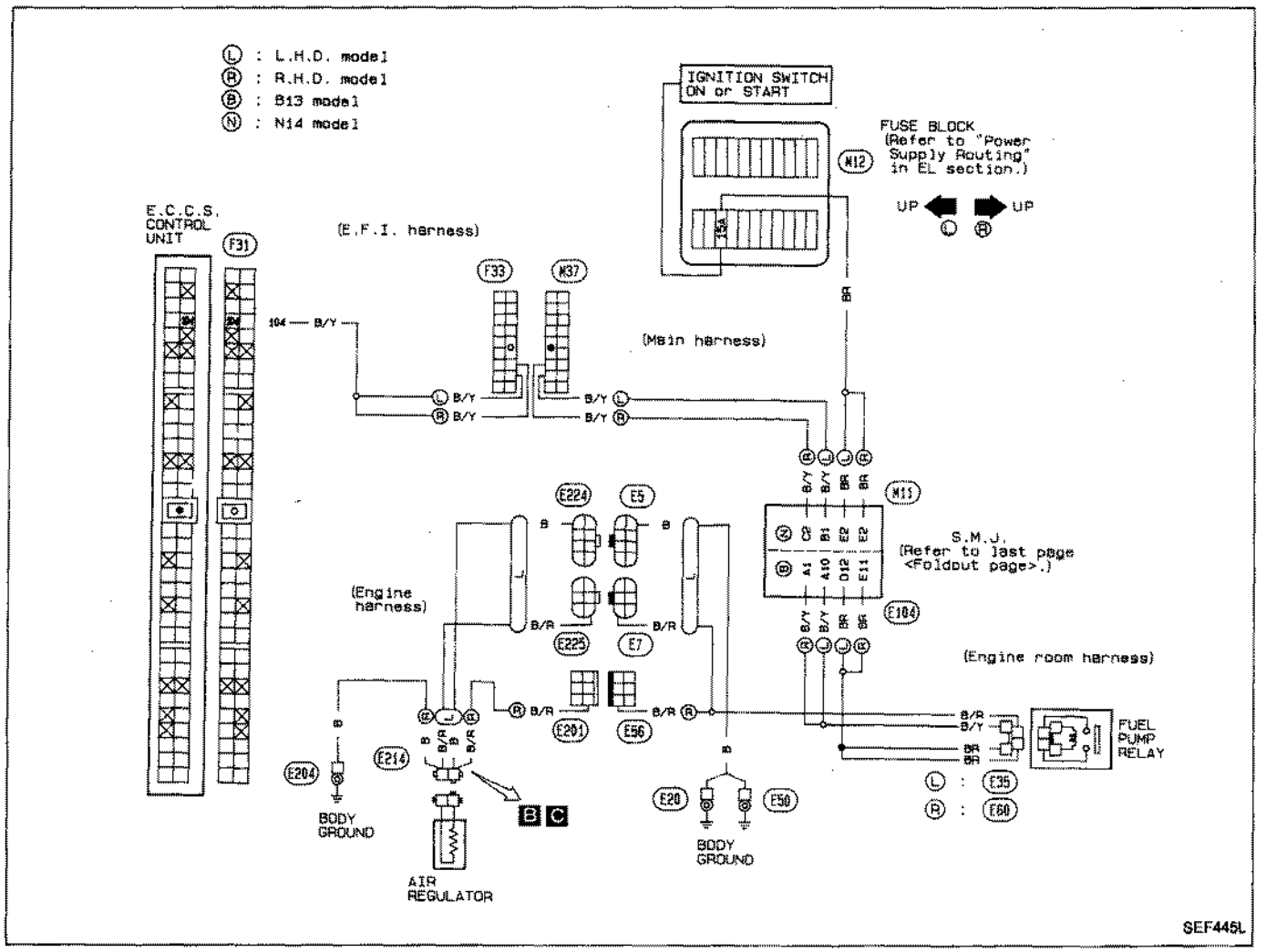
O.K. ↓

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

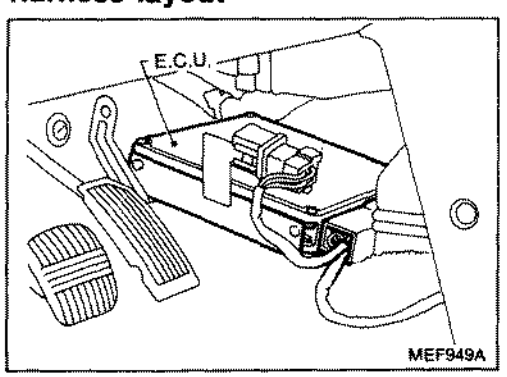
NOTE

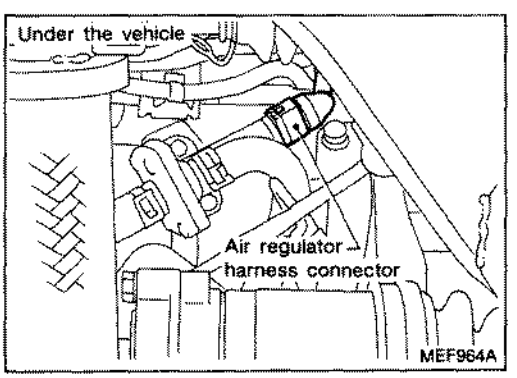
Diagnostic Procedure 34

AIR REGULATOR (Not self-diagnostic item)



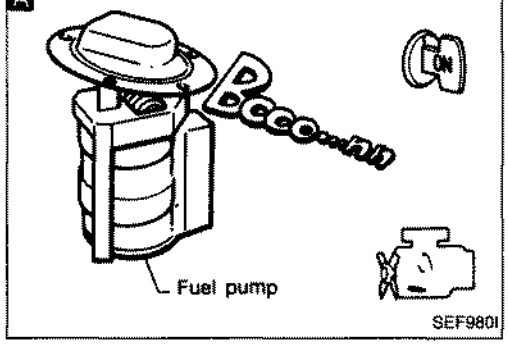
Harness layout





Diagnostic Procedure 34 (Cont'd)

A



INSPECTION START

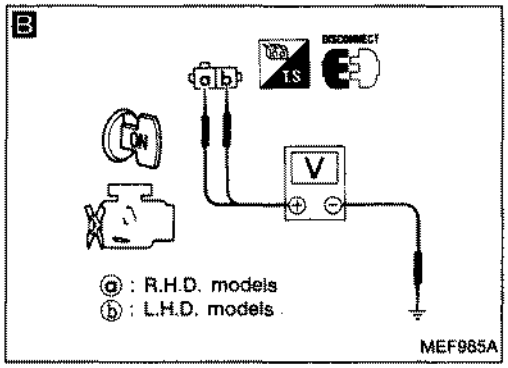
A

CHECK CONTROL FUNCTION.
1) Turn ignition switch "ON".
2) Listen to fuel pump operating sound.
Fuel pump should operate for 5 seconds after ignition switch is turned "ON".

N.G. → Check fuel pump control circuit. (See page EF & EC-500.)

O.K.

B



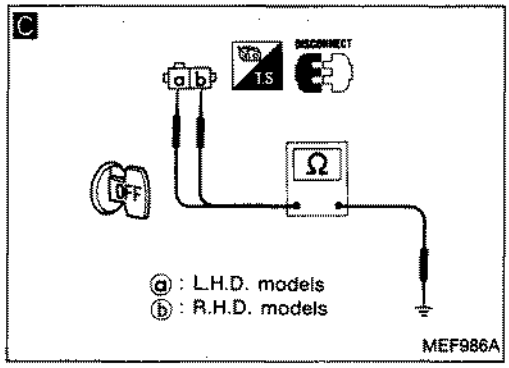
CHECK POWER SUPPLY.
1) Turn ignition switch "OFF".
2) Disconnect air regulator harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓐ (R.H.D. models), terminal ⓑ (L.H.D. models) and ground.
Battery voltage should exist for 5 seconds after ignition switch is turned "ON".

N.G. → Check the following.
- Harness connectors E225 , E7 (L.H.D. models)
- Harness connectors E281 , E56 (R.H.D. models)
- Harness continuity between air regulator and fuel pump relay

If N.G., repair harness or connectors.

O.K.

C



CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓑ (R.H.D. models), terminal ⓐ (L.H.D. models) and body ground.
Continuity should exist.

N.G. → Check the following.
- Harness connectors E224 , E5 (L.H.D. models)
- Harness continuity between air regulator and body ground

If N.G., repair harness or connectors.

O.K.

CHECK COMPONENT (Air regulator).
Refer to "Electrical Components Inspection".
(See page EF & EC-634.)

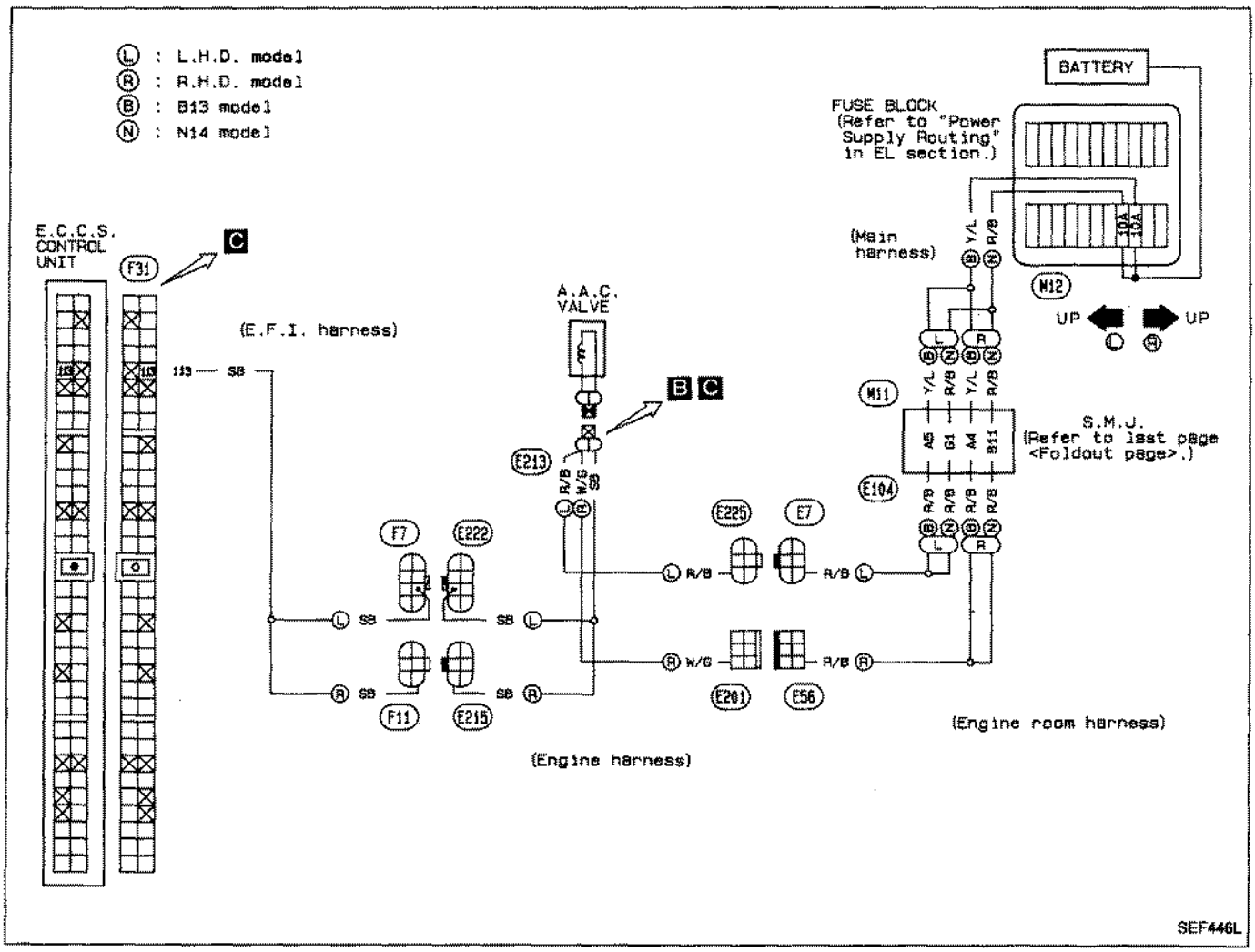
N.G. → Replace air regulator.

O.K.

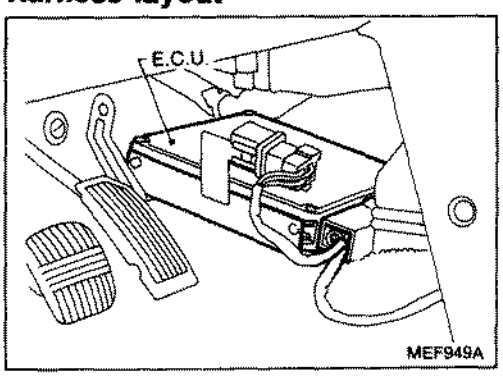
INSPECTION END

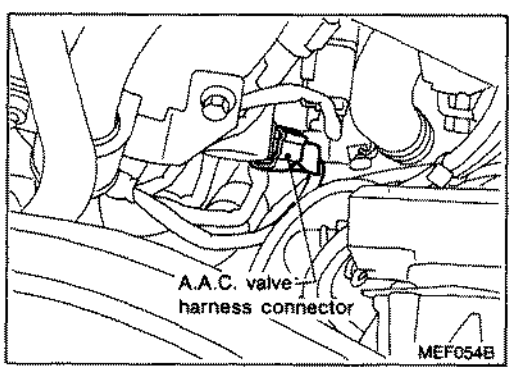
Diagnostic Procedure 35

A.A.C. VALVE (Not self-diagnostic item)

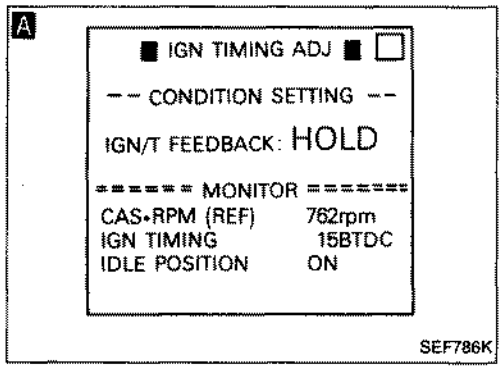


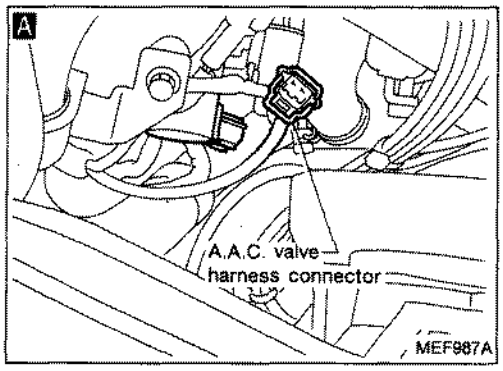
Harness layout

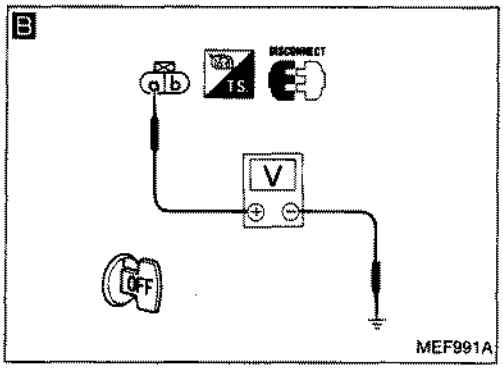


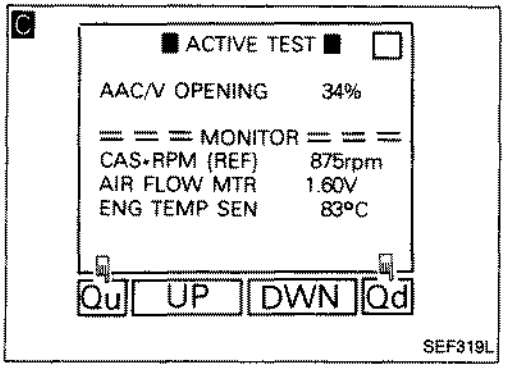


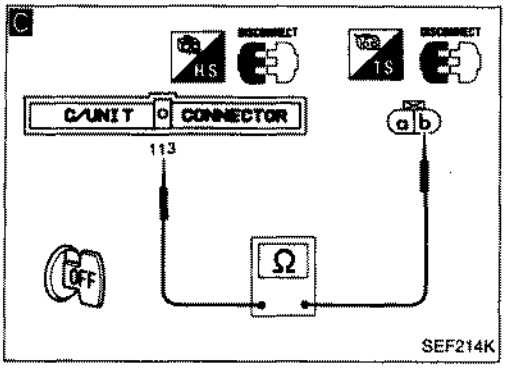
Diagnostic Procedure 35 (Cont'd)











INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Check idle speed.
850 ± 50 rpm
3) ● Perform "IGN TIMING ADJ" in "WORK SUPPORT" mode.
● Disconnect A.A.C. valve harness connector.
4) Make sure that idle speed drops.

Drops → INSPECTION END

Does not drop ↓

B

CHECK POWER SUPPLY.
1) Stop engine.
2) Check voltage between terminal ⓐ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (E225), (E7) (L.H.D. models)
- Harness connectors (E201), (E56) (R.H.D. models)
- Harness connectors (M11), (E104)
- 10A fuse
- Harness continuity between A.A.C. valve and fuse

If N.G., repair harness or connectors.

O.K. ↓

C

CHECK OUTPUT SIGNAL CIRCUIT.
1) Reconnect A.A.C. valve harness connector.
2) Perform "AAC VALVE OPENING TEST" in "ACTIVE TEST" mode with CONSULT.

OR

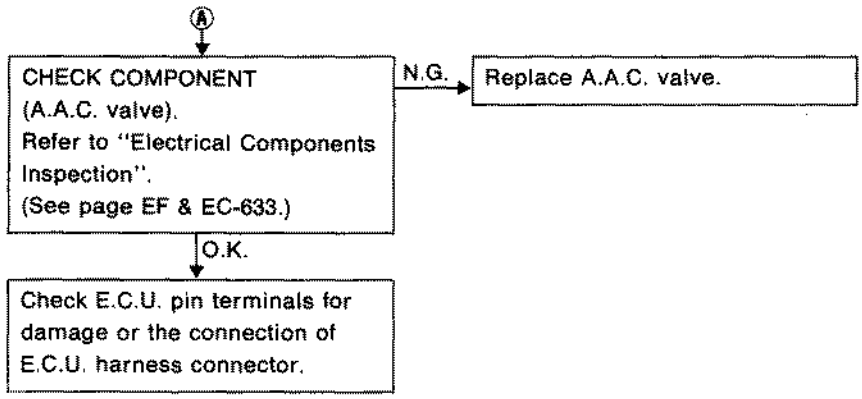
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal (13) and terminal ⓑ.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (F7), (E222) (L.H.D. models)
- Harness connectors (F11), (E215) (R.H.D. models)
- Harness continuity between E.C.U. and A.A.C. valve

If N.G., repair harness or connectors.

O.K. ↓ Ⓐ

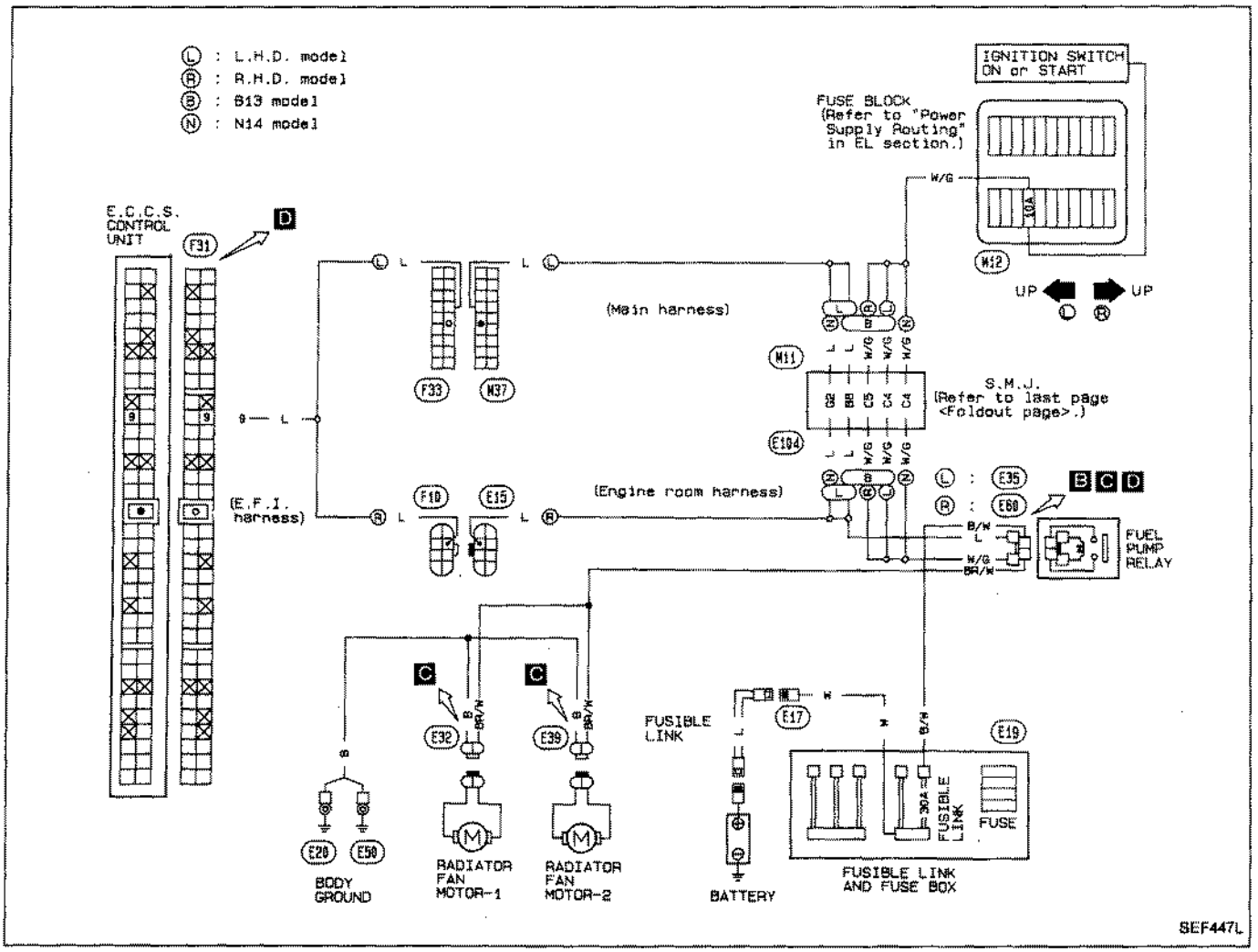
Diagnostic Procedure 35 (Cont'd)



NOTE

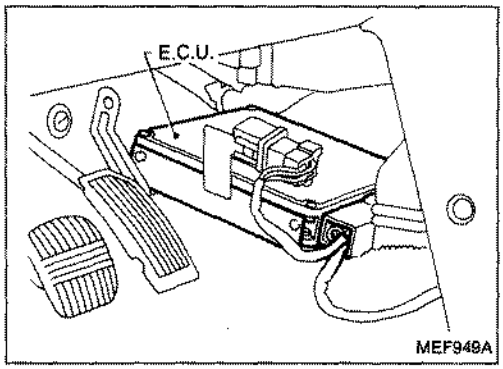
Diagnostic Procedure 36

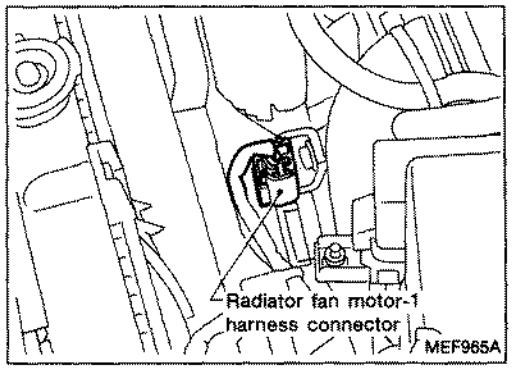
RADIATOR FAN CONTROL (Not self-diagnostic item)

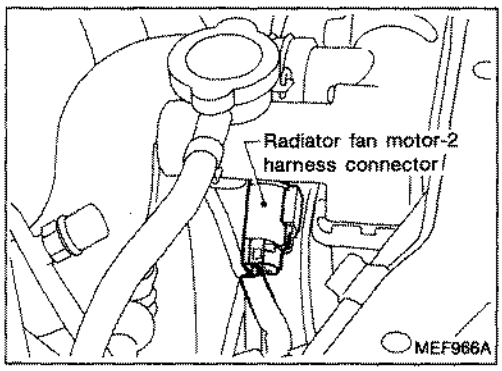


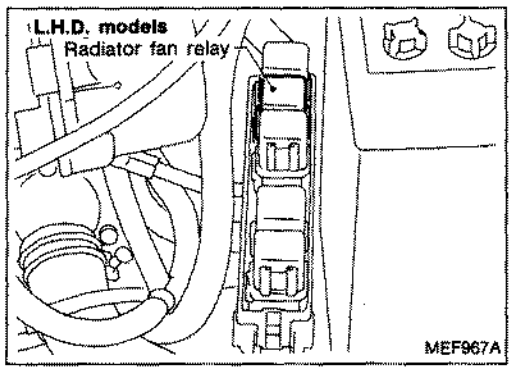
Diagnostic Procedure 36 (Cont'd)

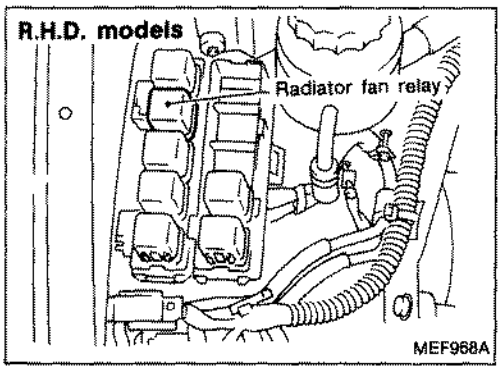
Harness layout







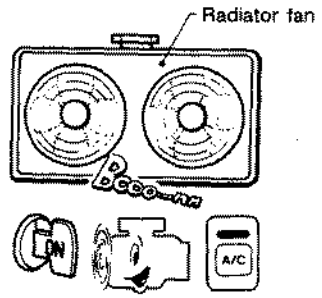




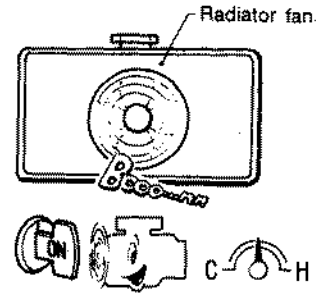
Diagnostic Procedure 36 (Cont'd)

A

With air conditioner

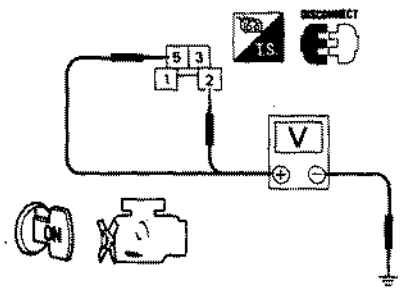


Without air conditioner



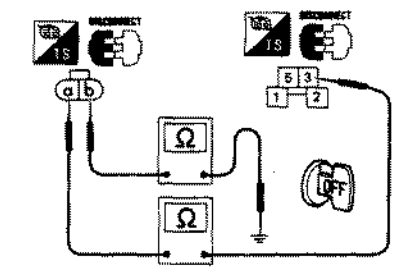
MEF988A

B



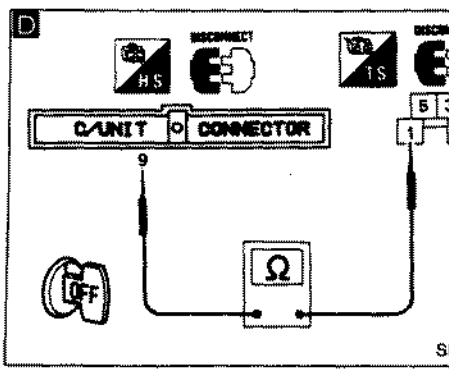
MEF989A

C



MEF990A

D



SEF999I

INSPECTION START

A

CHECK RADIATOR FAN OPERATION.

With air conditioner

1) Start engine.
2) Set temperature lever at full cold position.
3) Turn air conditioner switch "ON".
4) Turn blower fan switch "ON".
5) Run engine at idle for a few minutes with air conditioner operating.
6) Make sure that radiator fan operates.

Without air conditioner

1) Start engine.
2) Keep engine speed at about 2,000 rpm until engine is warmed up sufficiently.
3) Make sure that radiator fan begins to operate during warm-up.

O.K. → INSPECTION END

N.G. ↓

B

CHECK POWER SUPPLY.

1) Turn air conditioner switch "OFF".
2) Turn blower fan switch "OFF".
   (Step 1) and 2) are only performed for model with air conditioner.)
3) Stop engine.
4) Disconnect radiator fan relay.
5) Turn ignition switch "ON".
6) Check voltage between terminals ②, ⑤ and ground.

Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (M11), (E104)
- "L" fusible link
- 30A fusible link
- 10A fuse
- Harness continuity between battery and radiator fan relay
- Harness continuity between fuse and radiator fan relay

If N.G., repair harness or connectors.

O.K. ↓

C

CHECK GROUND CIRCUIT.

1) Turn ignition switch "OFF".
2) Disconnect radiator fan motor-1 harness connector and radiator fan motor-2 harness connector.
3) Check harness continuity between terminal ⓐ and terminal ③, terminal ⓑ and body ground.

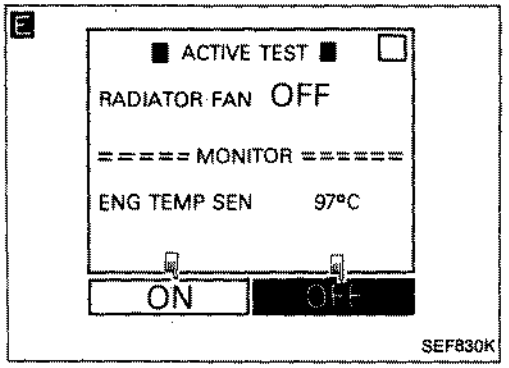
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

Ⓐ

Diagnostic Procedure 36 (Cont'd)



Ⓐ

D

CHECK OUTPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal ⑨ and terminal ①.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (F33), (M37) (L.H.D. models)
- Harness connectors (M11), (E104) (L.H.D. models)
- Harness connectors (F10), (E15) (R.H.D. models)
- Harness continuity between E.C.U. and radiator fan relay

If N.G., repair harness or connectors.

O.K. ↓

CHECK COMPONENT (Radiator fan relay).
Refer to "Electrical Components Inspection".
(See page EF & EC-635.)

N.G. → Replace radiator fan relay.

O.K. ↓

E

CHECK COMPONENTS (Radiator fan motors).
1) Reconnect radiator fan relay, radiator fan motor harness connectors and E.C.U. harness connector.
2) Start engine.
3) Perform "RADIATOR FAN TEST" in "ACTIVE TEST" mode with CONSULT.

N.G. → Replace radiator fan motors.

OR

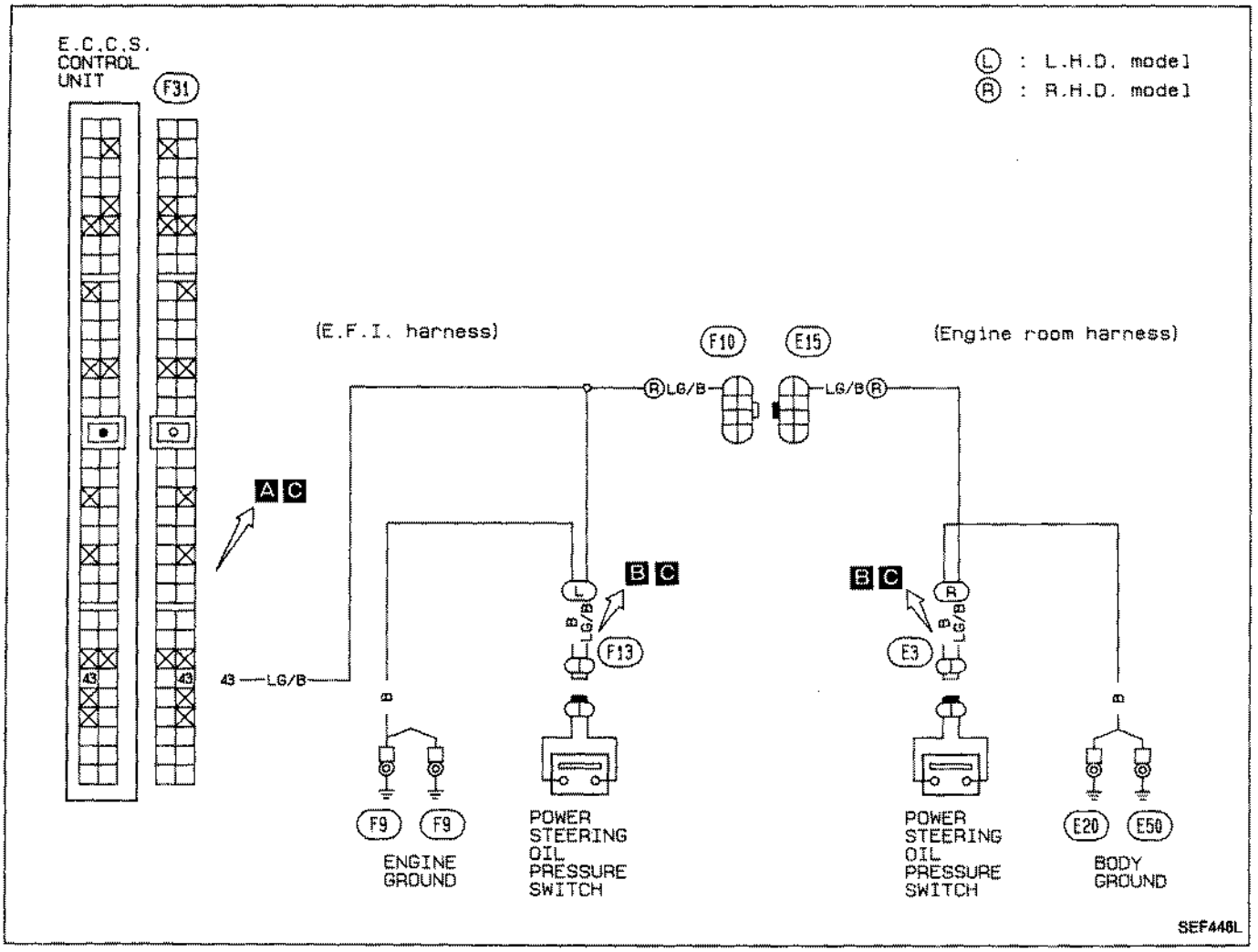
Refer to "Electrical Components Inspection".
(See page EF & EC-635.)

O.K. ↓

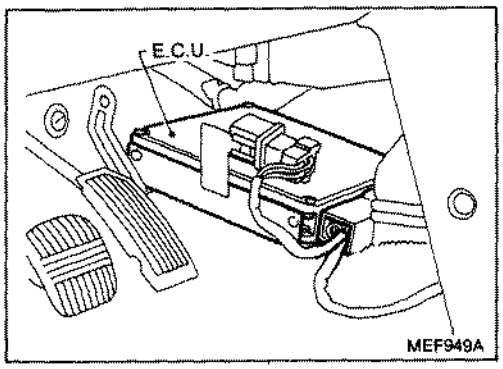
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

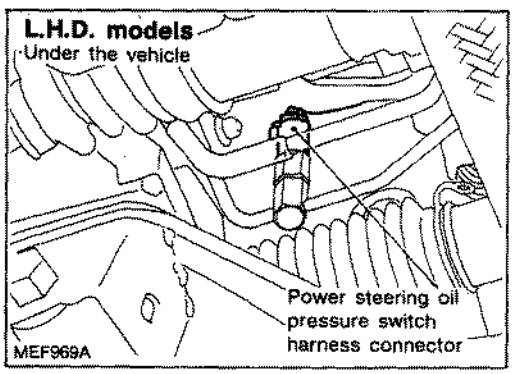
Diagnostic Procedure 37

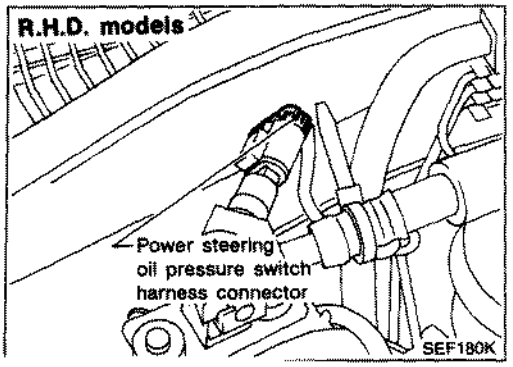
POWER STEERING OIL PRESSURE SWITCH (Not self-diagnostic item)



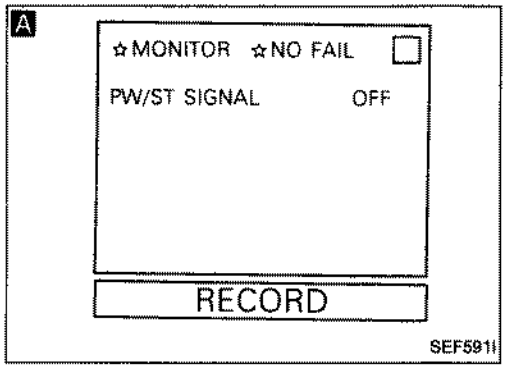
Harness layout

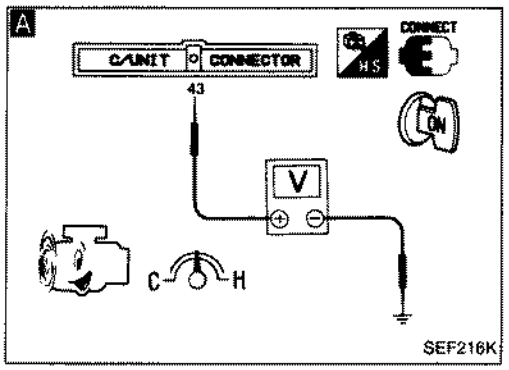


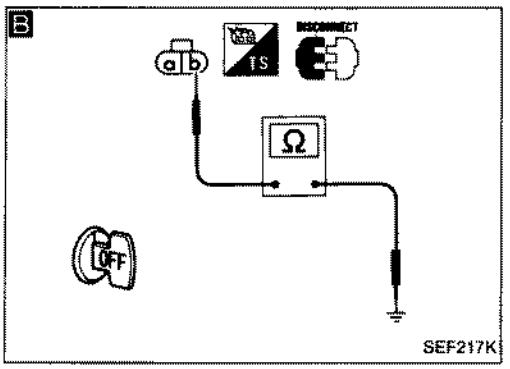


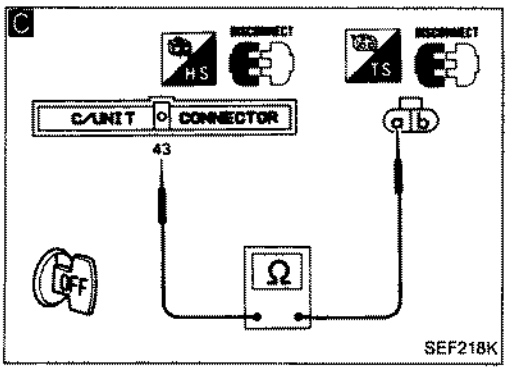


Diagnostic Procedure 37 (Cont'd)









INSPECTION START

A

CHECK CONTROL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Check power steering oil pressure switch signal in "DATA MONITOR" mode with CONSULT.
Steering is neutral: OFF
Steering is turned: ON

OR

2) Check voltage between E.C.U. terminal ㊸ and ground.
Voltage:
When steering wheel is turned quickly.
Approximately 0V
Except above
Approximately 8 - 10V

O.K. → INSPECTION END

N.G. ↓

B

CHECK GROUND CIRCUIT.
1) Stop engine.
2) Disconnect power steering oil pressure switch harness connector.
3) Check harness continuity between terminal ⓑ and body ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

C

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal ㊸ and terminal ⓐ.
Continuity should exist.

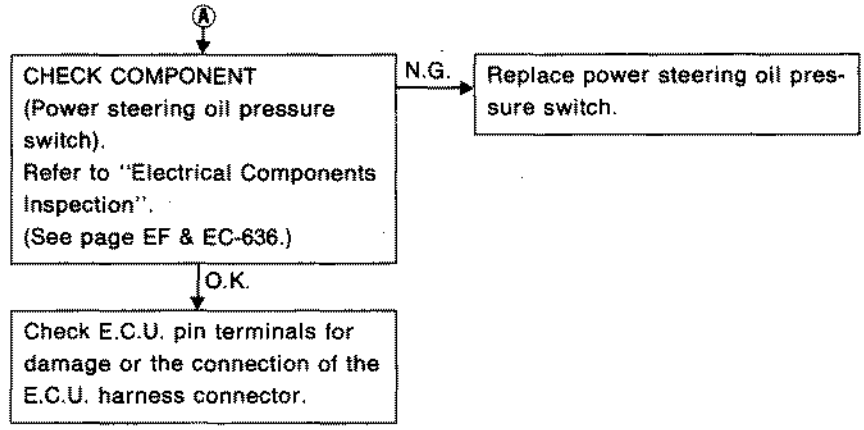
N.G. → Check the following.
- Harness connectors (F18), (E15) (R.H.D. models)
- Harness continuity between E.C.U. and power steering oil pressure switch

If N.G., repair harness or connectors.

O.K. ↓

Ⓐ

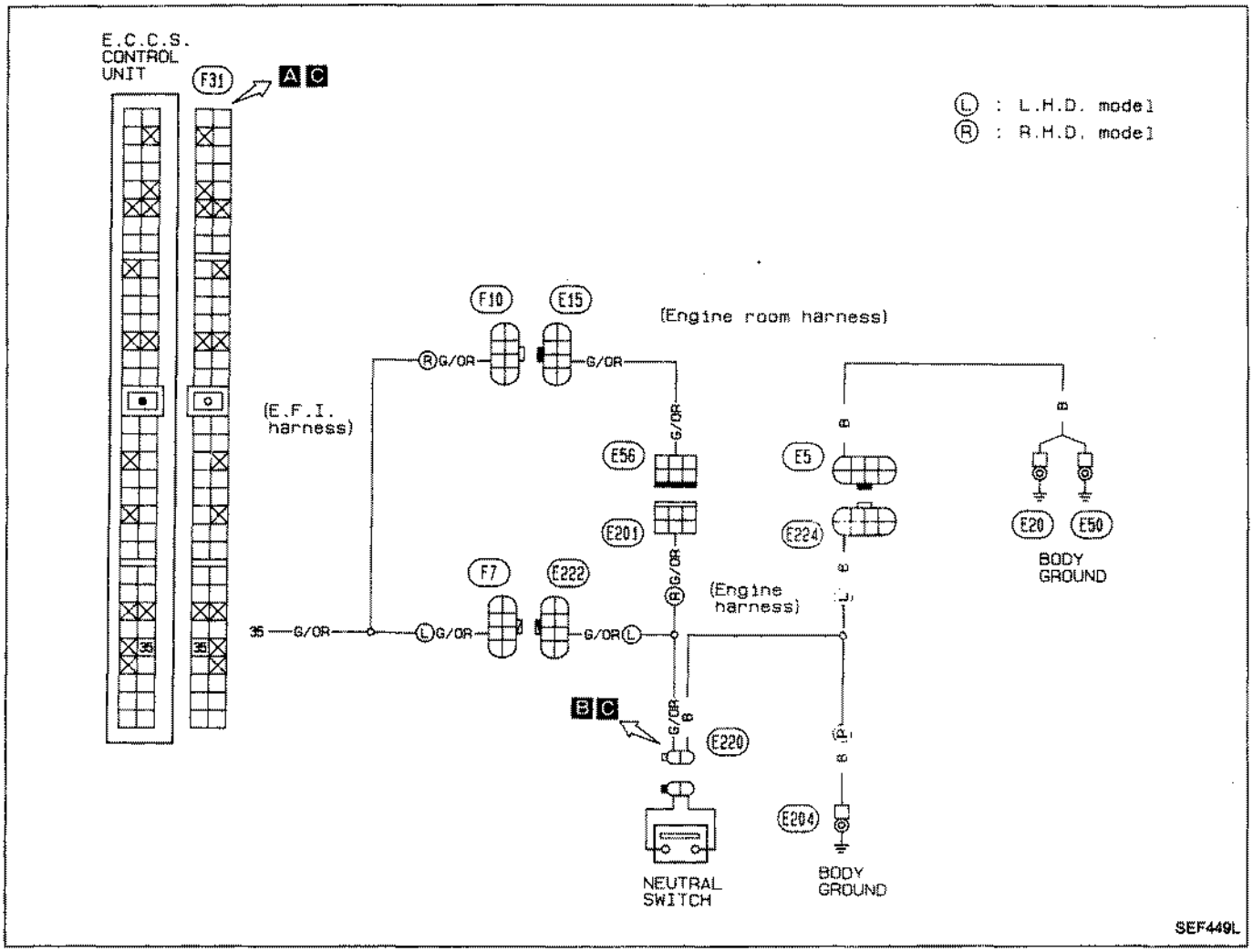
Diagnostic Procedure 37 (Cont'd)



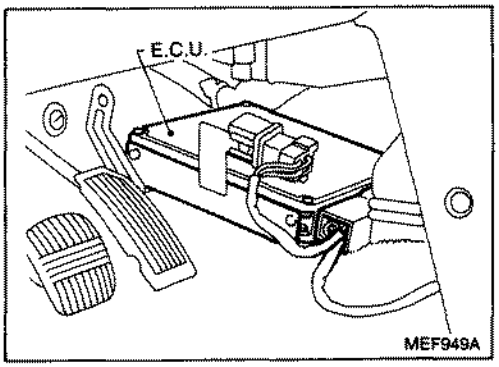
NOTE

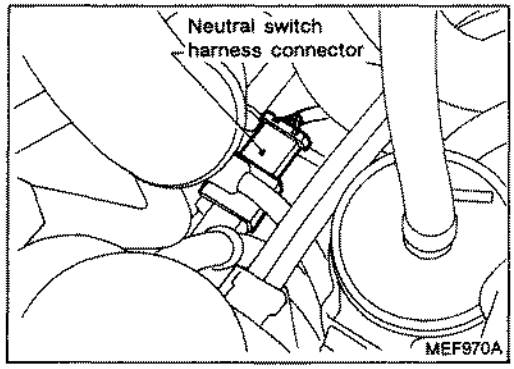
Diagnostic Procedure 38

NEUTRAL SWITCH (Not self-diagnostic item)

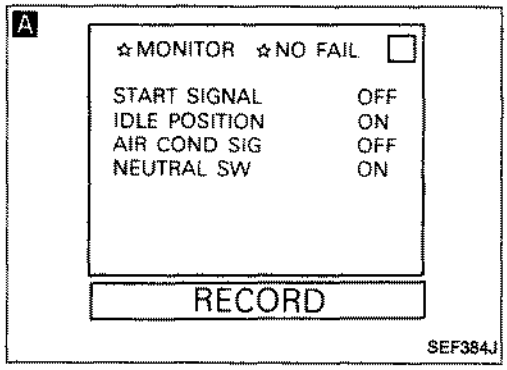


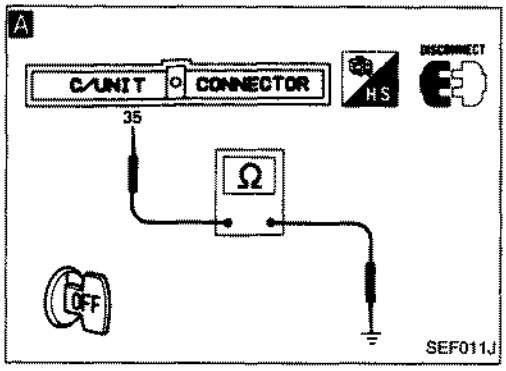
Harness layout

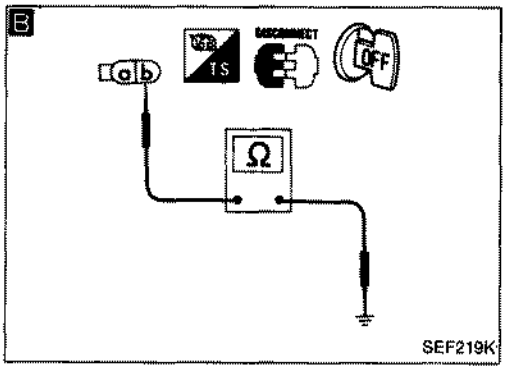


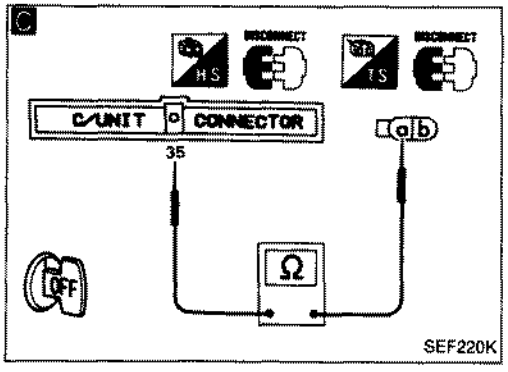


Diagnostic Procedure 38 (Cont'd)









INSPECTION START

A

CHECK OVERALL FUNCTION.

1) Turn ignition switch "ON".
2) Check neutral switch signal in "DATA MONITOR" mode with CONSULT.

Neutral position: ON
Except above: OFF

O.K. → INSPECTION END

OR

1) Set shift lever to the neutral position.
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal ㉟ and body ground.

Continuity should exist.

N.G.

Turn ignition switch "OFF".

B

CHECK GROUND CIRCUIT.

1) Disconnect neutral switch harness connector.
2) Check harness continuity between terminal ⓑ and body ground.

Continuity should exist.

N.G. → Check the following.
- Harness connectors (E5), (E224) (L.H.D. models)
- Harness continuity between neutral switch and body ground

If N.G., repair harness or connectors.

O.K.

Disconnect E.C.U. harness connector.

C

CHECK INPUT SIGNAL CIRCUIT.

1) Check harness continuity between E.C.U. terminal ㉟ and terminal ⓐ.

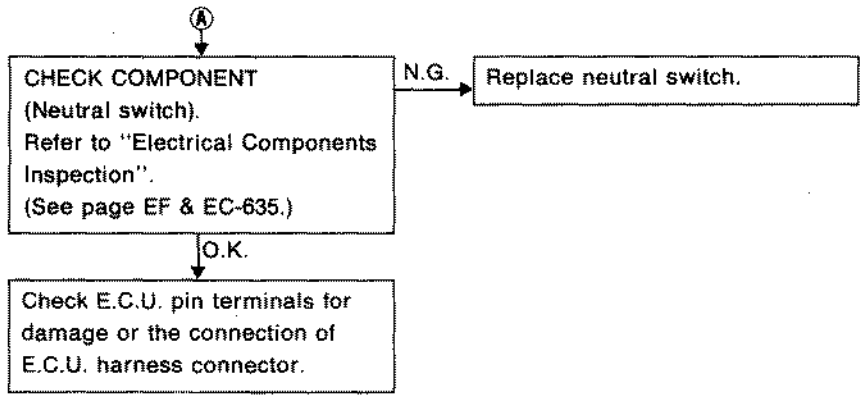
Continuity should exist.

N.G. → Check the following.
- Harness connectors (F7), (E222) (L.H.D. models)
- Harness connectors (F10), (E15) (R.H.D. models)
- Harness connectors (E56), (E201) (R.H.D. models)
- Harness continuity between E.C.U. and neutral switch

If N.G., repair harness or connectors.

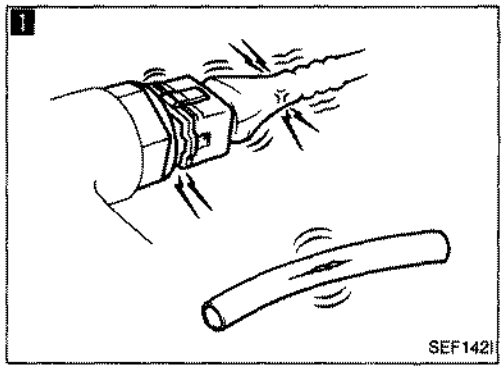
O.K. → Ⓐ

Diagnostic Procedure 38 (Cont'd)



Basic Inspection

1

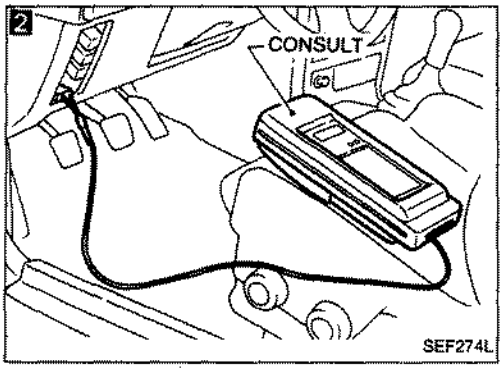

SEF142I

BEFORE STARTING

1. Check service records for any recent repairs that may indicate a related problem, or the current need for scheduled maintenance.
2. Open engine hood and check the following:

- Harness connectors for proper connections
- Vacuum hoses for splits, kinks, and proper connections
- Wiring for proper connections, pinches, and cuts

2

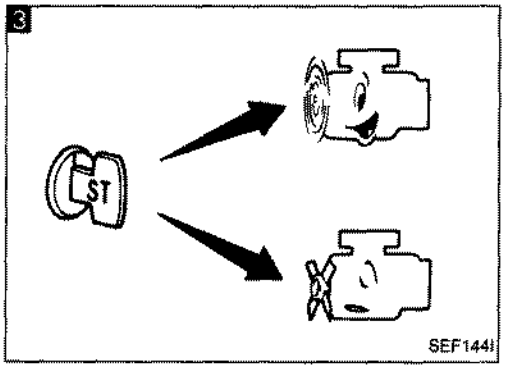


SEF274L

CONNECT CONSULT TO THE VEHICLE

Connect "CONSULT" to the diagnostic connector and select "ENGINE" from the menu. (Refer to page EF & EC-417.)

3



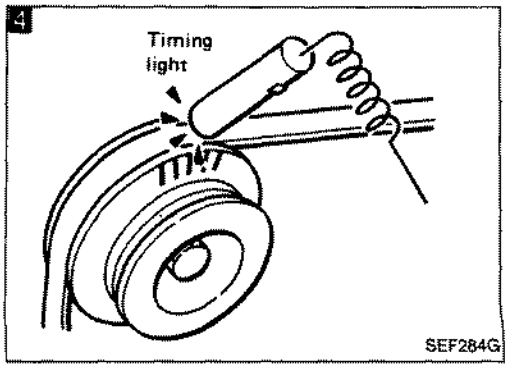
SEF144I

DOES ENGINE START?

No → Go to 6 .

Yes

4



SEF284G

CHECK IGNITION TIMING.

Warm up engine sufficiently and check ignition timing at idle using timing light. (Refer to page EF & EC-389.)

Ignition timing:

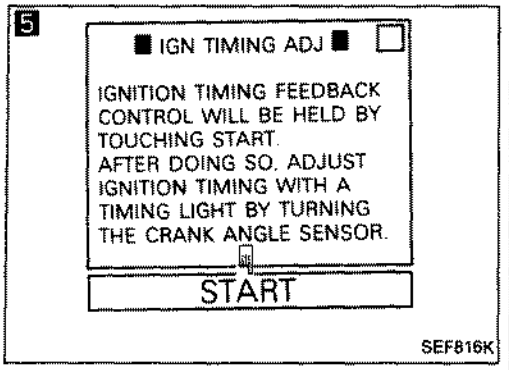
20° ± 2° B.T.D.C.

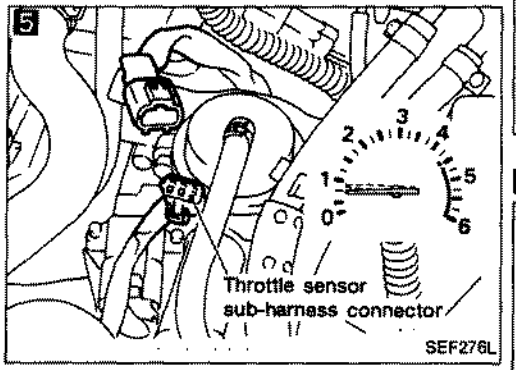
N.G. → Adjust ignition timing by turning crank angle sensor.

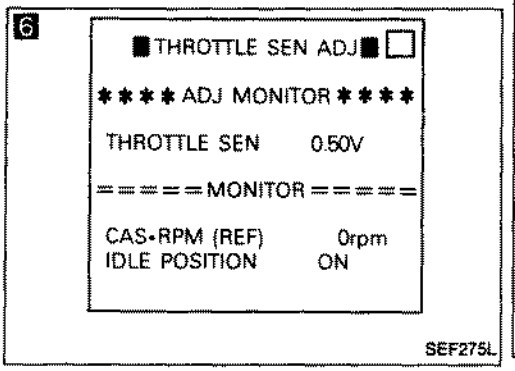
O.K.

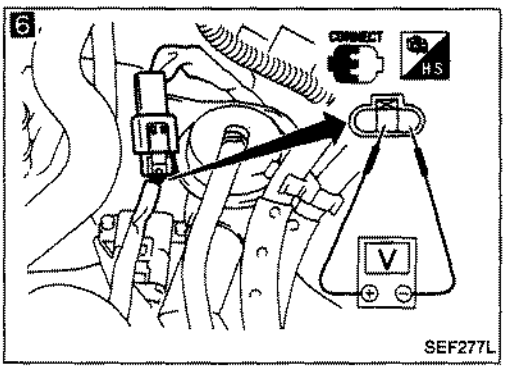
(Go to Ⓐ on next page.)

Basic Inspection (Cont'd)









Ⓐ

5 **CHECK IDLE ADJ. SCREW INITIAL SET RPM.**

1. Select "IGN TIMING ADJ" in "WORK SUPPORT" mode.
2. When touching "START", does engine rpm fall to 850±50 rpm (in "N" position)?

No → Adjust engine rpm by turning idle adjusting screw.

OR

When disconnecting throttle sensor sub-harness connector, does engine rpm fall to 850±50 rpm (in "N" position)?

Yes

6 **CHECK THROTTLE SENSOR IDLE POSITION.**

1. Perform "THROTTLE SEN. ADJ" in "WORK SUPPORT" mode.
2. Check that output voltage of throttle sensor is 0.45 to 0.55V. (Throttle valve fully closes.) and "IDLE POSITION" stays "ON".

N.G. →
1. Adjust output voltage by rotating throttle sensor body.
2. Disconnect throttle sensor harness connector for a few seconds and then reconnect it.
3. Confirm that "IDLE POSITION" stays "ON".

OR

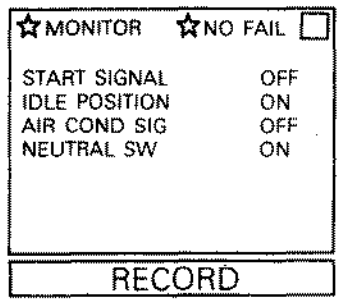
Measure output voltage of throttle sensor using voltmeter, and check that it is 0.45 to 0.55V. (Throttle valve fully closed.)

O.K.

(Go to Ⓑ on next page.)

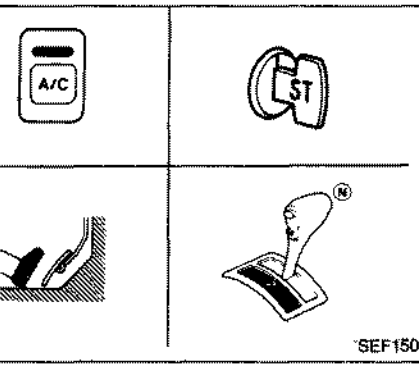
Basic Inspection (Cont'd)

7



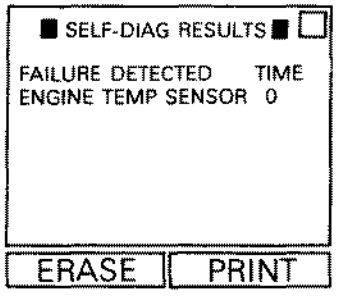
SEF821K

7



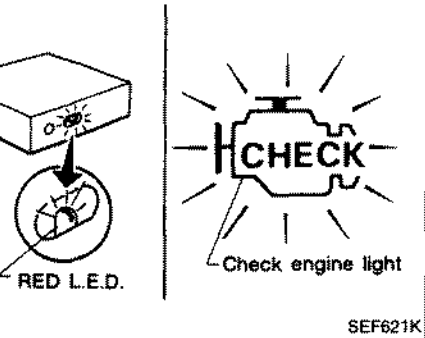
SEF150I

8



SEF822K

8



SEF621K

Ⓑ

7

CHECK SWITCH INPUT SIGNAL.

Select the following switches in "DATA MONITOR" mode,
a) Start signal,
b) Idle position,
c) Air conditioner signal,
d) Neutral (Parking) switch,
and check the switches' ON-OFF operation.

N.G. → Repair or replace the malfunctioning switch or its circuit.

OR

Remove E.C.U. from behind audio system panel and check the above switches' ON-OFF operation using voltmeter at each E.C.U. terminal.

Switch	Condition	Voltage (V)
Start signal	IGN → IGN ON → START	0 → Battery voltage
Idle position	Accelerator pedal released → Accelerator pedal fully depressed	0.45 - 0.55 → Approx. 4.0
A/C signal	A/C OFF → A/C ON (Engine running)	Approx. 8.0 → Approx. 0
Neutral (Parking) switch	Shift lever is Neutral position → Except Neutral position	0 → Approx. 6.0

O.K.

8

READ SELF-DIAGNOSTIC RESULTS.

1. Perform "SELF-DIAG RESULTS" mode.
2. Read out self-diagnostic results.
3. Is a failure detected?

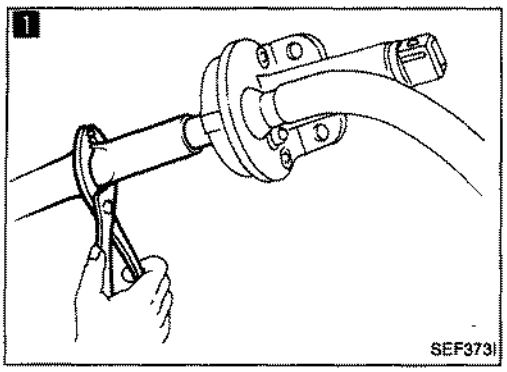
Yes → Go to the relevant inspection procedure.

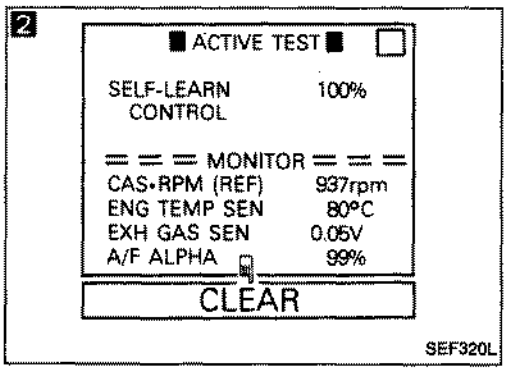
OR

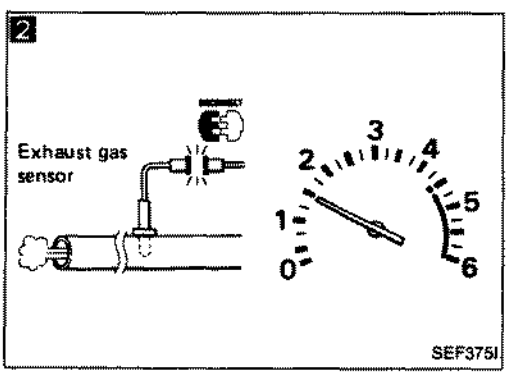
1. Set "Self-diagnostic results mode" in Mode II. (Refer to page EF & EC-412.)
2. Count the number of RED L.E.D. or check engine light flashes and read out the codes.
3. Does the code shown correspond to any malfunction?

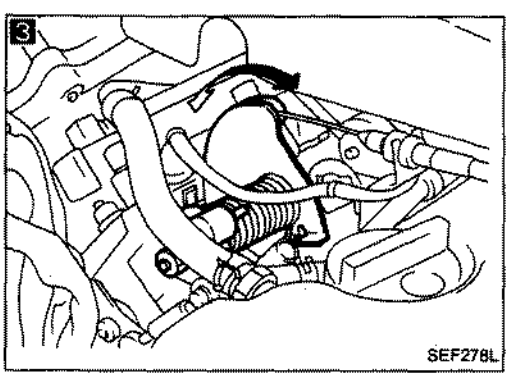
No

INSPECTION END









Diagnostic Procedure 1 — High Idling after Warm-up

1

CHECK AIR REGULATOR.
When pinching the air regulator hose, does the engine speed drop?

Yes → Check air regulator and circuit. (See page EF & EC-600.)

No ↓

2

CHECK INTAKE AIR LEAK.

1. Select "SELF-LEARNING CONT" in "ACTIVE TEST" mode.
2. Clear the self-learning control coefficient by touching "CLEAR".
3. Does the engine speed drop?

Yes → Discover air leak location and repair.

OR

1. Disconnect exhaust gas sensor harness connector.
2. After racing engine at 2,000 rpm under no-load for about 30 seconds, does the engine speed drop?

No ↓

3

CHECK THROTTLE LINKAGE.

1. Check that throttle linkage moves smoothly.
2. Confirm that throttle valve both fully opens and fully closes.

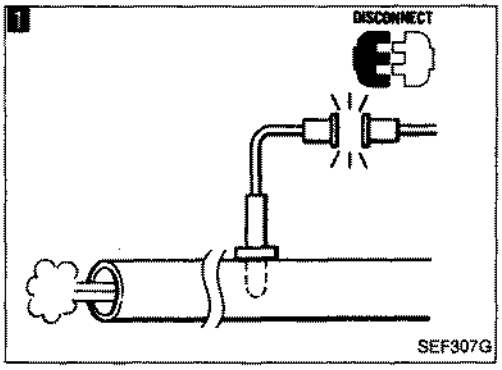
N.G. → Repair throttle linkage or sticking of throttle valve.

O.K. ↓

INSPECTION END

Diagnostic Procedure 2 — Hunting

1

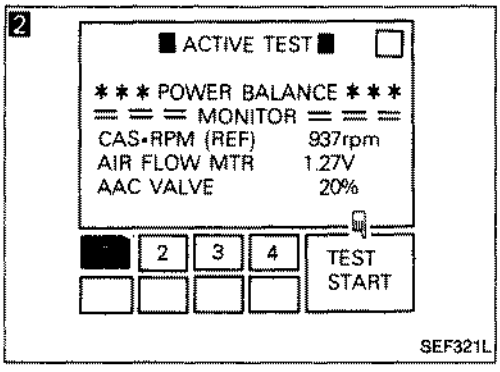


CHECK EXHAUST GAS SENSOR.
When disconnecting exhaust gas sensor harness connector, is the hunting fixed?

Yes → Check exhaust gas sensor. (See page EF & EC-590.)

No ↓

2



PERFORM POWER BALANCE TEST.

1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

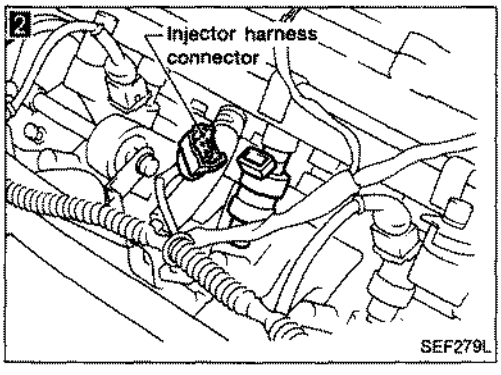
No → Go to 4.

— OR —

When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

Yes ↓

3



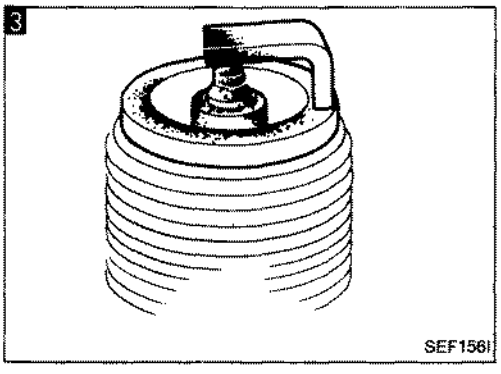
CHECK SPARK PLUGS.
Remove the spark plugs and check for fouling, etc.

N.G. → Repair or replace spark plug(s).

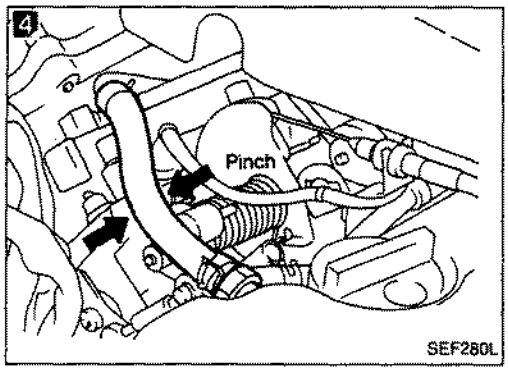
O.K. ↓

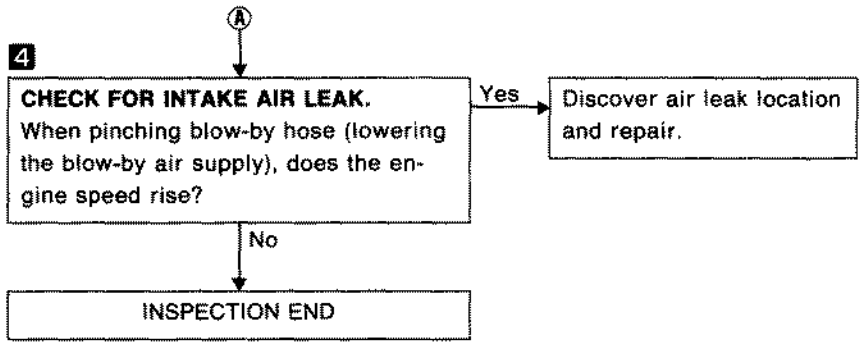
(Go to Ⓐ on next page.)

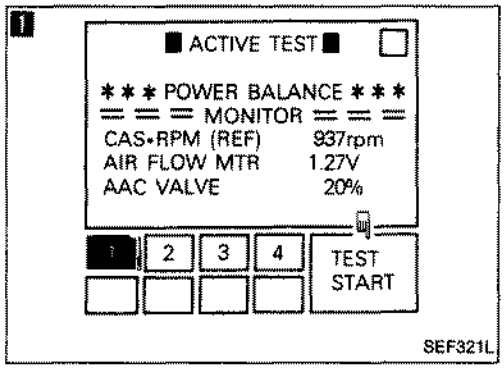
3

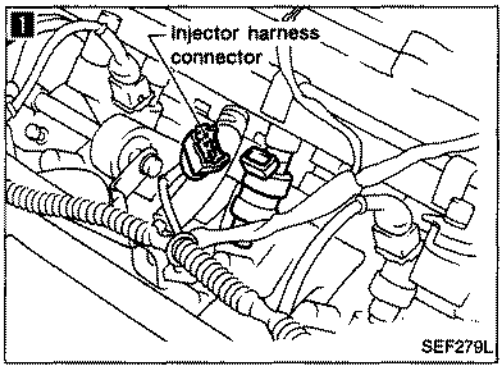


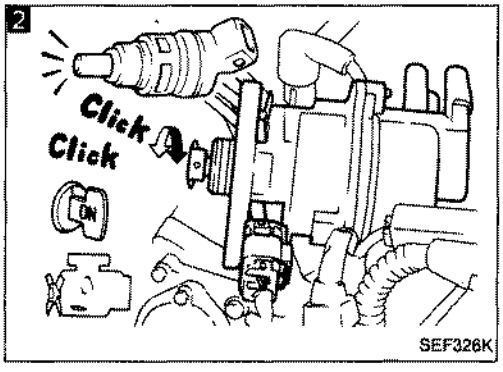
Diagnostic Procedure 2 — Hunting (Cont'd)

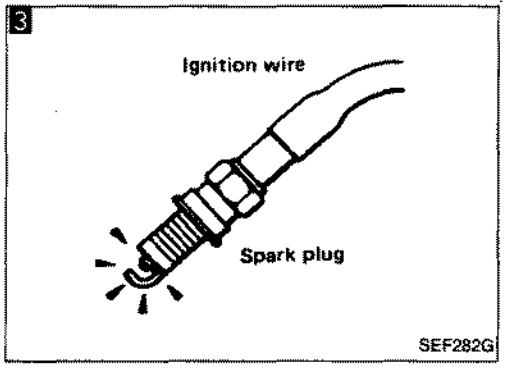












Diagnostic Procedure 3 — Unstable Idle

1

PERFORM POWER BALANCE TEST.

1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

No → Go to 5.

OR

When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

Yes

2

CHECK INJECTOR.

1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Disconnect ignition wires.
3. ignition switch ON. (Do not start engine.)
4. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

No → Check injector(s) and circuit(s).

Yes

3

CHECK IGNITION SPARK.

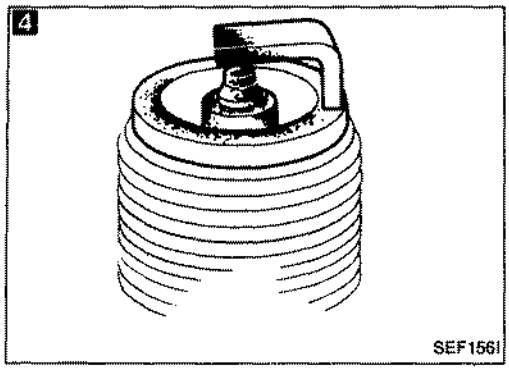
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

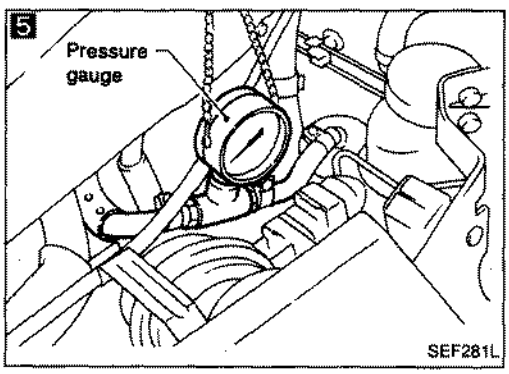
N.G. → Check ignition coil, power transistor and their circuits. (See page EF & EC-576.)

O.K.

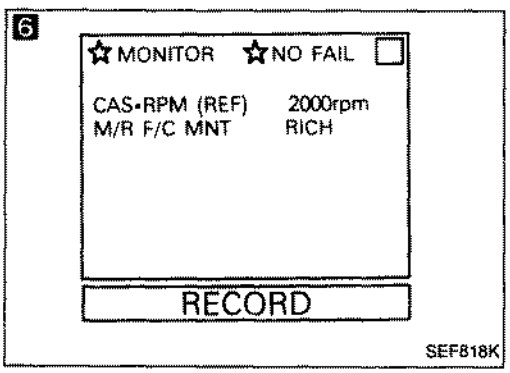
(Go to Ⓐ on next page.)

Diagnostic Procedure 3 — Unstable Idle (Cont'd)

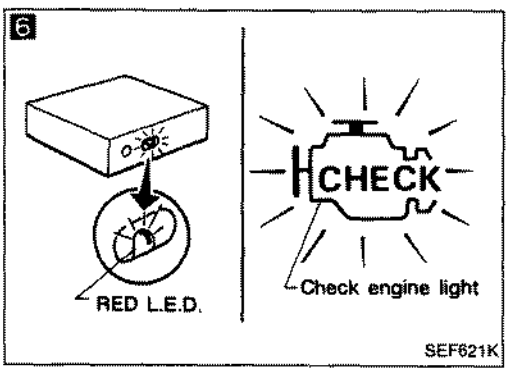

SEF156I



SEF281L



SEF818K



SEF621K

Ⓐ

4 **CHECK SPARK PLUGS.**
Remove the spark plugs and check for fouling, etc.
N.G. → Repair or replace spark plug(s).
O.K.

5 **CHECK FUEL PRESSURE.**
1. Release fuel pressure to zero. (Refer to page EF & EC-638.)
2. Install fuel pressure gauge and check fuel pressure.
   At idle:
   Approx. 245 kPa
   (2.45 bar, 2.5 kg/cm², 36 psi)

N.G. → Check fuel pump and circuit.
O.K.

6 **CHECK EXHAUST GAS SENSOR.**
1. See "M/R F/C MNT" in "Data monitor" mode.
2. Maintaining engine at 2,000 rpm under no-load (engine is warmed up sufficiently.), check that the monitor fluctuates between "LEAN" and "RICH" more than 5 times during 10 seconds.
   RICH→LEAN→RICH→ (1 time, 2 times)
   LEAN→RICH.....

N.G. → Replace exhaust gas sensor.

OR

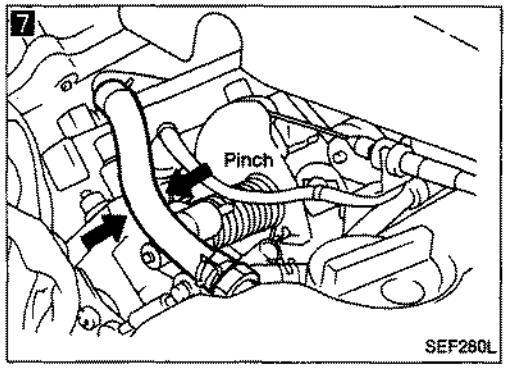
1. Set "Exhaust gas sensor monitor" in the self-diagnostic Mode II. (See page EF & EC-412.)
2. Maintaining engine at 2,000 rpm under no-load, check to make sure that the RED L.E.D. on the E.C.U. or the check engine light on the instrument panel goes ON and OFF more than 5 times during 10 seconds.

O.K.

(Go to Ⓑ on next page.)

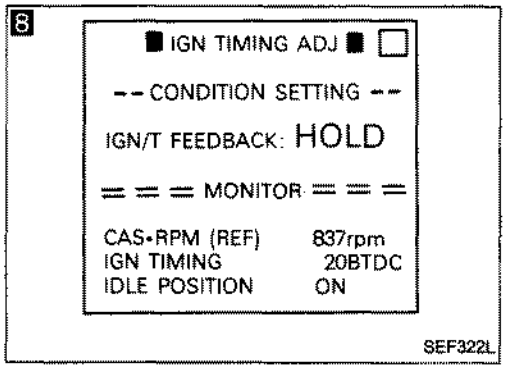
Diagnostic Procedure 3 — Unstable Idle (Cont'd)

7



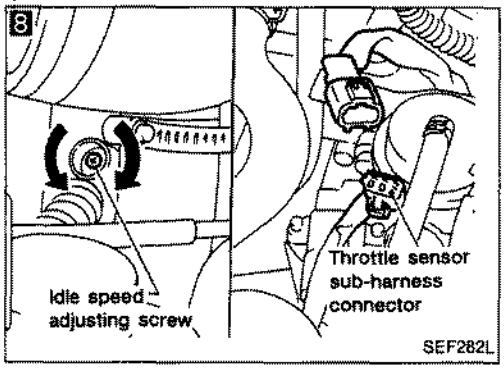
SEF280L

8



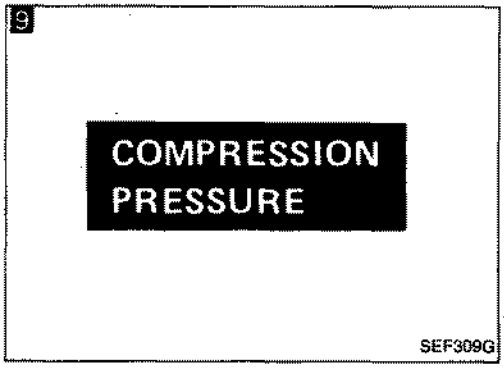
SEF322L

8



SEF282L

9



SEF309G

Ⓑ

7 **CHECK FOR INTAKE AIR LEAK.**
When pinching blow-by hose (lowering the blow-by air supply), does the engine speed rise?

Yes → Discover air leak location and repair.

No

8 **CHECK IDLE ADJ. SCREW CLOGGING.**

1. Perform "IGN TIMING ADJ" in "WORK SUPPORT" mode.
2. Can you set engine rpm at 850 ± 50 rpm (in "N" position) by turning idle adjusting screw?

OR

1. Disconnect throttle sensor harness connector.
2. Can you set engine rpm at 850 ± 50 rpm (in "N" position) by turning idle adjusting screw?

No → Check for I.A.S. clogging or throttle valve clogging.

Yes

9 **CHECK COMPRESSION PRESSURE.**

- Check compression pressure.

Standard:
kPa (bar, kg/cm², psi)/300 rpm
1,126 (11.28, 11.5, 164)
Minimum:
kPa (bar, kg/cm², psi)/300 rpm
932 (9.32, 9.5, 135)
Difference between each cylinder:
kPa (bar, kg/cm², psi)/300 rpm
98 (0.98, 1.0, 14)

N.G. → Check pistons, piston rings, valves, valve seats and cylinder head gaskets.

O.K.

10 **CHECK E.C.U. HARNESS CONNECTOR.**
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.

N.G. → Repair or replace.

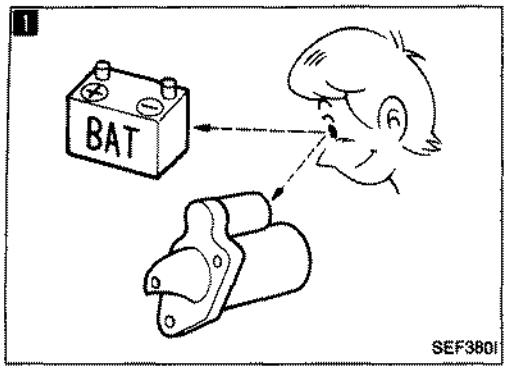
O.K.

11 **TRY A KNOWN GOOD E.C.U.***

INSPECTION END

*: E.C.U. may be the cause of a problem, but this is rarely the case.

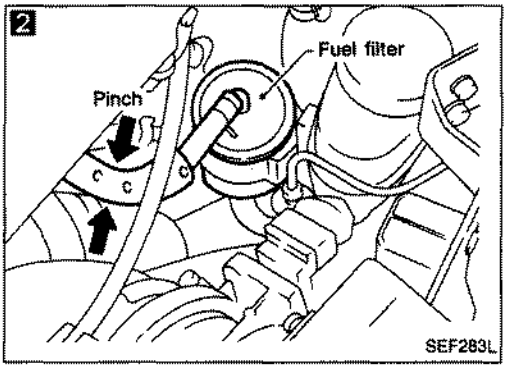
Diagnostic Procedure 4 — Hard to Start or Impossible to Start when the Engine is Cold



1 **CHECK BATTERY AND STARTER.**
Check battery and starter condition.
(Refer to EL section.)

N.G. → Repair or replace.

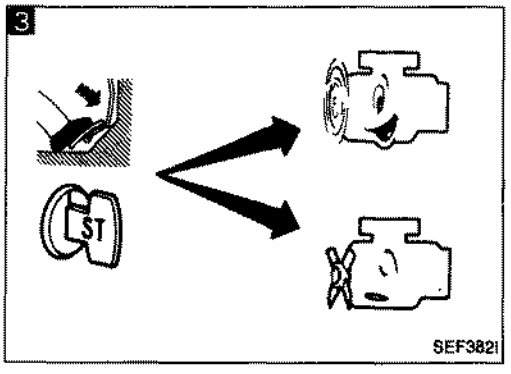
O.K. ↓



2 **CHECK FUEL PRESSURE.**
1. Pinch fuel feed hose with fingers.
2. When cranking the engine, is there any pressure on the fuel feed hose?

No → Check fuel pump and circuit. (See page EF & EC-596.)

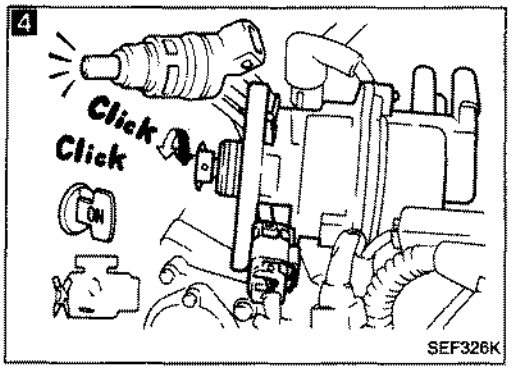
Yes ↓



3 **CHECK AIR REGULATOR AND A.A.C. VALVE.**
When pressing accelerator pedal fully, can you start the engine.

Yes → Check A.A.C. valve, air regulator and circuits. (See pages EF & EC-600, 606.)

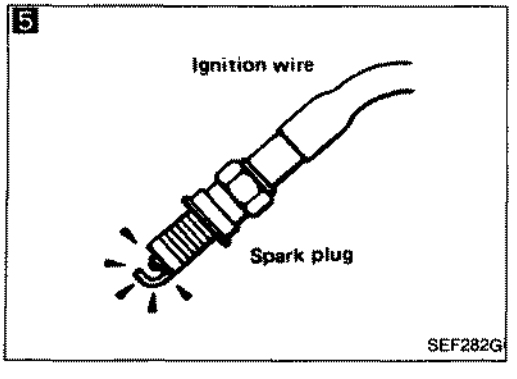
No ↓



4 **CHECK INJECTOR.**
1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Disconnect ignition wires.
3. Turn ignition switch ON. (Do not start engine.)
4. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

No → Check injector(s) and circuit(s).

Yes ↓



5 **CHECK IGNITION SPARK.**
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

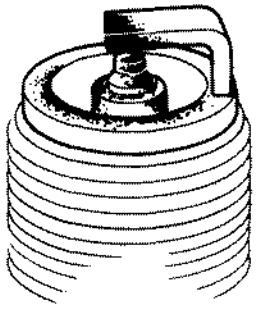
N.G. → Check ignition coil, power transistor and their circuits. (See page EF & EC-576.)

O.K. ↓

(Go to Ⓐ on next page.)

Diagnostic Procedure 4 — Hard to Start or Impossible to Start when the Engine is Cold (Cont'd)

6



SEF156I

Ⓐ

6 **CHECK SPARK PLUGS.**
Remove the spark plugs and check for fouling, etc.
N.G. → Repair or replace spark plug(s).
O.K. ↓

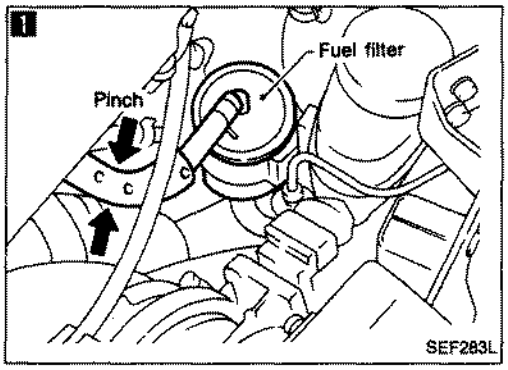
7 **CHECK E.C.U. HARNESS CONNECTOR.**
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.
N.G. → Repair or replace.
O.K. ↓

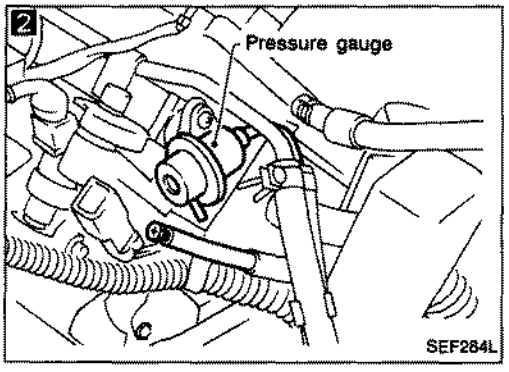
8 **CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.**
Refer to page EF & EC-560.
N.G. → Repair or replace.
O.K. ↓

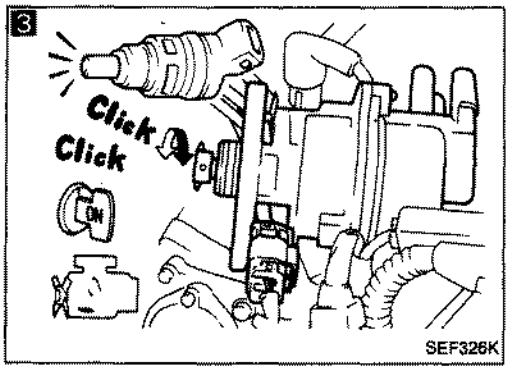
9 **TRY A KNOWN GOOD E.C.U.***
Trouble is fixed. → Replace E.C.U.
Trouble is not fixed. ↓

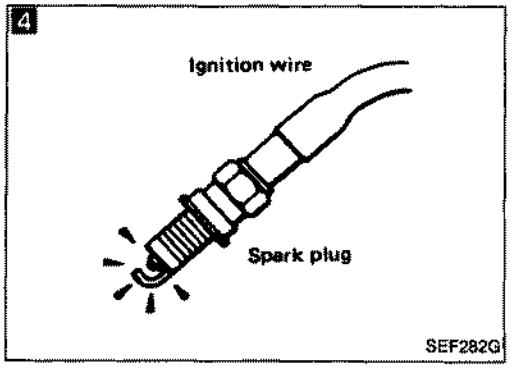
INSPECTION END

*: E.C.U. may be the cause of a problem, but this is rarely the case.









Diagnostic Procedure 5 — Hard to Start or Impossible to Start when the Engine is Hot

1

CHECK FUEL PRESSURE.
1. Pinch fuel feed hose with fingers.
2. When cranking the engine, is there any pressure on the fuel feed hose?

No → Check fuel pump and circuit. (See page EF & EC-596.)

Yes ↓

2

CHECK FUEL VAPOR.
1. Disconnect fuel pressure regulator vacuum hose and plug hose.
2. Can you start engine?

Yes → Check fuel properties.

No ↓

3

CHECK INJECTOR.
1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Disconnect ignition wires.
3. Turn ignition switch ON. (Do not start engine.)
4. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

No → Check injector(s) and circuit(s).

Yes ↓

4

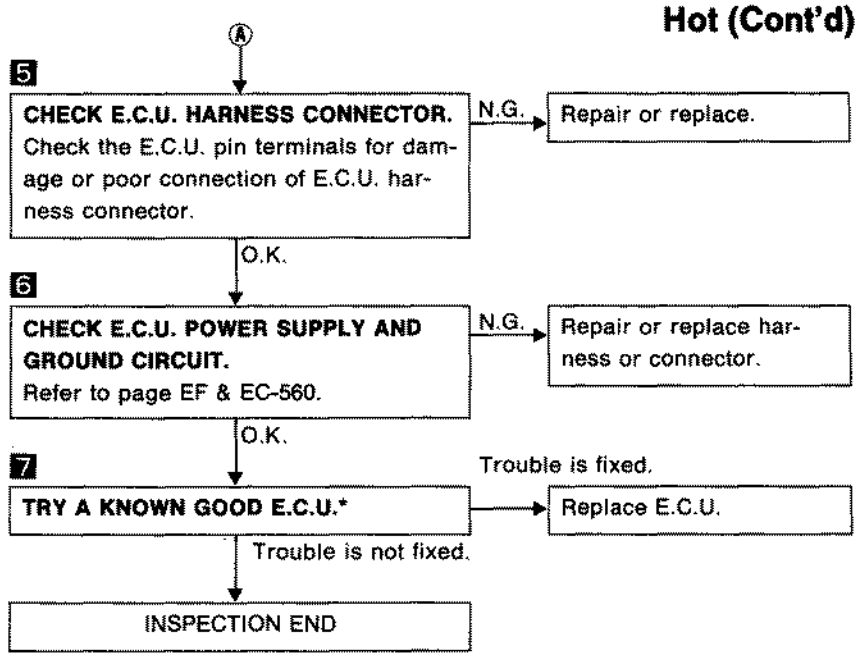
CHECK IGNITION SPARK.
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

N.G. → Check ignition coil, power transistor and circuits. (See page EF & EC-576.)

O.K. ↓

(Go to Ⓐ on next page.)

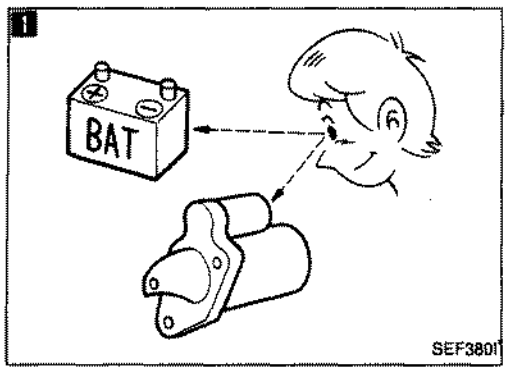
Diagnostic Procedure 5 — Hard to Start or Impossible to Start when the Engine is Hot (Cont'd)



*: E.C.U. may be the cause of a problem, but this is rarely the case.

Diagnostic Procedure 6 — Hard to Start or Impossible to Start under Normal Conditions

1



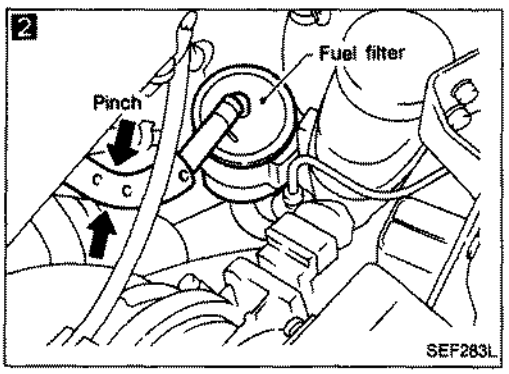
SEF380I

CHECK BATTERY AND STARTER.
Check battery and starter operation. (Refer to EL section.)

N.G. → Repair or replace.

O.K. ↓

2



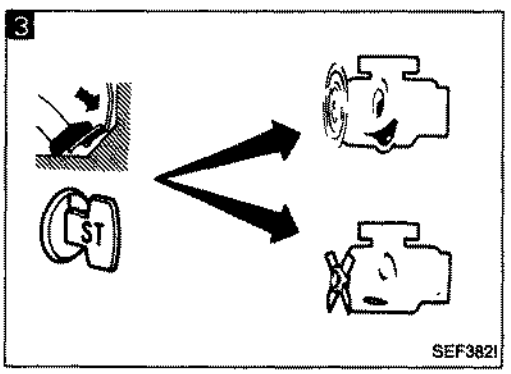
SEF283L

CHECK FUEL PRESSURE.
1. Pinch fuel feed hose with fingers.
2. When cranking the engine, is there any pressure on the fuel feed hose?

No → Check fuel pump and circuit. (See page EF & EC-596.)

Yes ↓

3



SEF382I

CHECK INJECTOR FOR LEAKAGE.
When pressing accelerator pedal fully, can you start the engine.

Yes → Check injector(s) for leakage.

No ↓

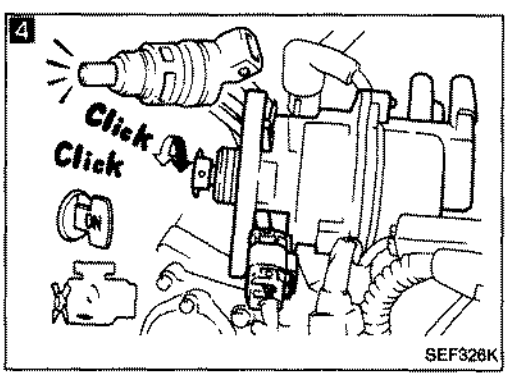
4

CHECK INJECTOR.
1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Disconnect ignition wires.
3. Turn ignition switch ON. (Do not start engine.)
4. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

No → Check injectors and circuits.

Yes ↓

5



SEF326K

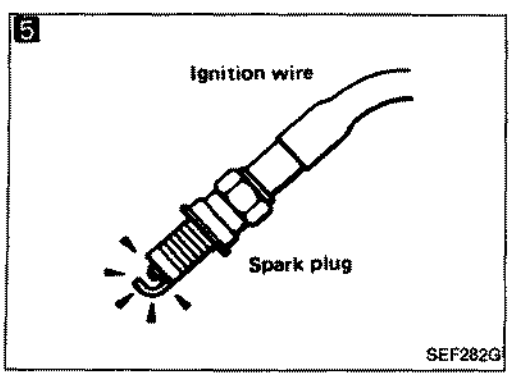
CHECK IGNITION SPARK.
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

N.G. → Check ignition coil, power transistor and circuits. (See page EF & EC-576.)

O.K. ↓

(Go to Ⓐ on next page.)

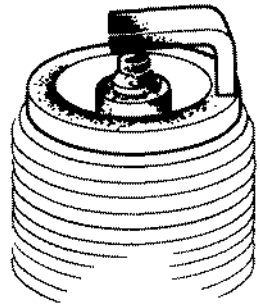
5



SEF282G

Diagnostic Procedure 6 — Hard to Start or Impossible to Start under Normal Conditions (Cont'd)

6



SEF156I

Ⓐ

6

CHECK SPARK PLUGS.
Remove the spark plugs and check for fouling, etc.

N.G. → Repair or replace spark plug(s).

O.K.

7

CHECK E.C.U. HARNESS CONNECTOR.
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.

N.G. → Repair or replace.

O.K.

8

CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.
Refer to page EF & EC-560.

N.G. → Repair or replace.

O.K.

9

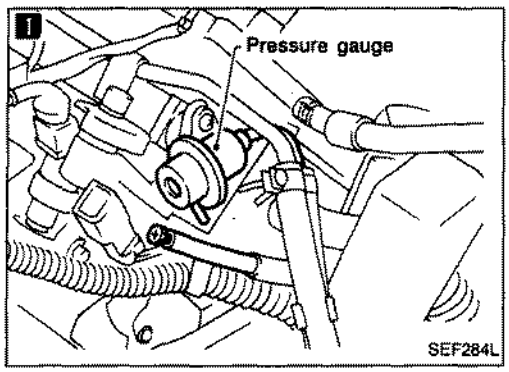
TRY A KNOWN GOOD E.C.U.*

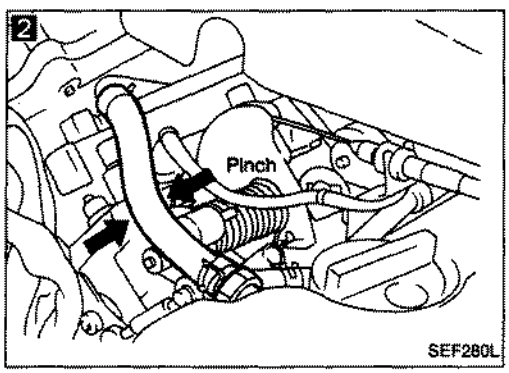
Trouble is fixed. → Replace E.C.U.

Trouble is not fixed.

INSPECTION END

*: E.C.U. may be the cause of a problem, but this is rarely the case.





Diagnostic Procedure 7 — Hesitation when the Engine is Hot

1

CHECK FUEL VAPOR.
1. Disconnect fuel pressure regulator vacuum hose and plug hose.
2. Test drive.
3. Does the hesitation disappear?

Yes → Check fuel properties.

No ↓

2

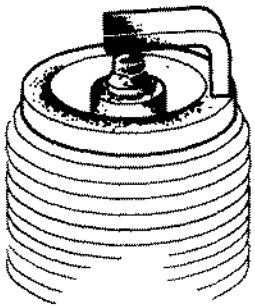
CHECK FOR INTAKE AIR LEAK.
When pinching blow-by hose (lowering the blow-by air supply), does the engine speed rise?

Yes → Discover air leak location and repair.

No ↓

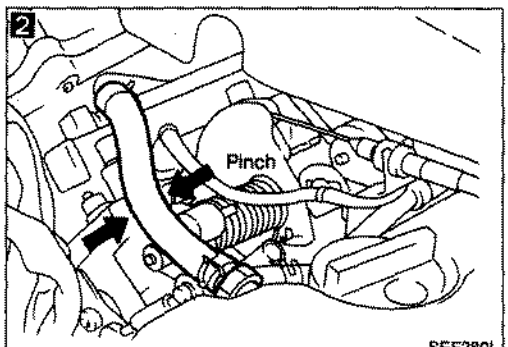
INSPECTION END

1



SEF156I

2



SEF280L

Diagnostic Procedure 8 — Hesitation when the Engine is Cold

1

CHECK SPARK PLUGS.
Remove spark plugs and check for fouling, etc.

N.G. → Repair or replace spark plug(s).

O.K.

2

CHECK FOR INTAKE AIR LEAK.
When pinching blow-by hose (lowering the blow-by air supply), does the engine speed rise?

Yes → Discover air leak location and repair.

No

3

TRY A KNOWN GOOD AIR FLOW METER.

Trouble is fixed. → Replace air flow meter.

Trouble is not fixed.

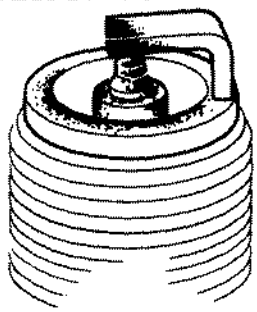
4

CHECK FOR INTAKE VALVE DEPOSITS.
If there are deposits on intake valves, remove them.

INSPECTION END

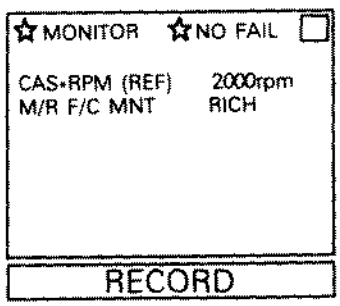
Diagnostic Procedure 9 — Hesitation under Normal Conditions

1



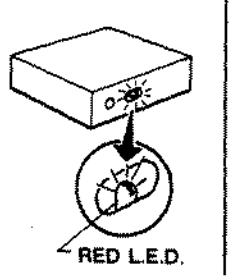
SEF156I

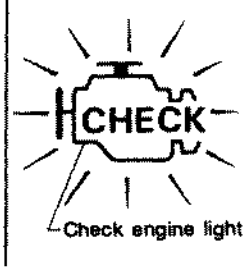
2



SEF818K

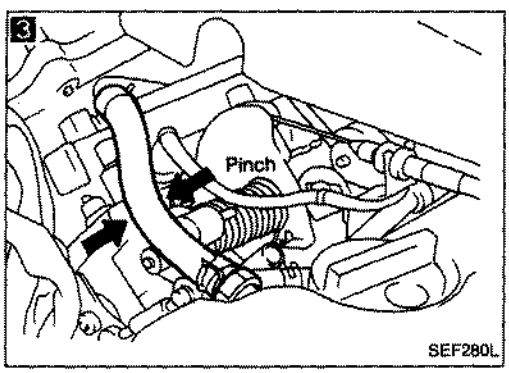
2





SEF621K

3



SEF280L

1

CHECK SPARK PLUGS.
Remove spark plugs and check for fouling, etc.

N.G. → Repair or replace spark plug(s).

O.K.

2

CHECK EXHAUST GAS SENSOR.

1. See "M/R F/C MNT" in "DATA MONITOR" mode.
2. Maintaining engine at 2,000 rpm under no-load (with engine warmed up sufficiently.), check to make sure that the monitor fluctuates between "LEAN" and "RICH" more than 5 times during 10 seconds.

RICH→LEAN→RICH→ (1 time, 2 times) LEAN→RICH.....

N.G. → Replace exhaust gas sensor.

OR

1. Set "Exhaust gas sensor monitor" in the self-diagnostic Mode II. (See page EF & EC-412.)
2. Maintaining engine at 2,000 rpm under no-load, check that the RED L.E.D. on the E.C.U. or the check engine light on the instrument panel goes ON and OFF more than 5 times during 10 seconds.

O.K.

3

CHECK FOR INTAKE AIR LEAK.
When pinching blow-by hose (lowering the blow-by air supply), does the engine speed rise?

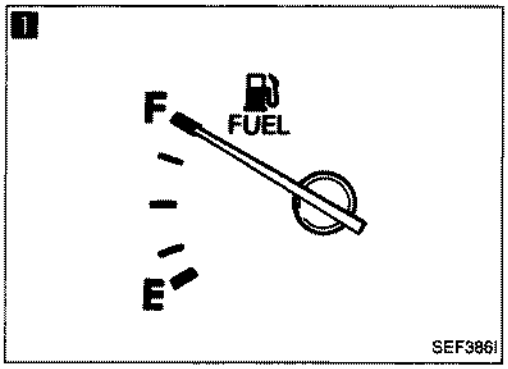
Yes → Discover air leak location and repair.

No

INSPECTION END

Diagnostic Procedure 10 — Engine Stalls when Turning

1



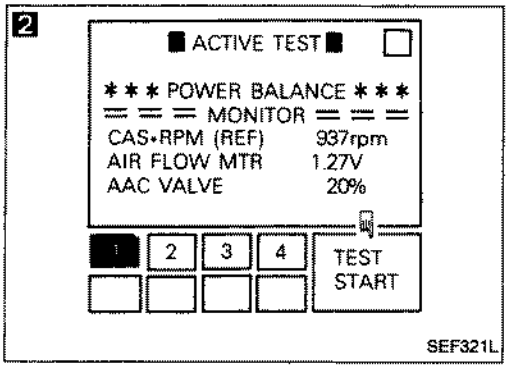
SEF386I

CHECK FUEL LEVEL.
Check to see that there is enough fuel in tank.

N.G. → Fill fuel tank with fuel.

O.K.

2



SEF321L

PERFORM POWER BALANCE TEST.

1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

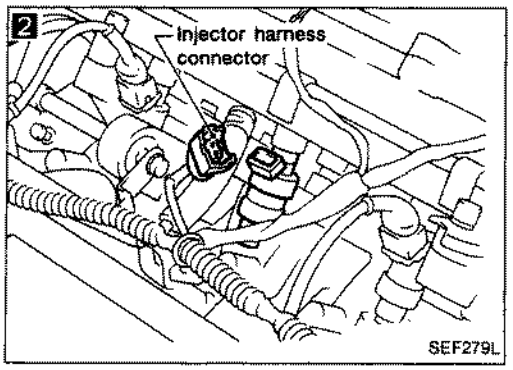
No → Go to 5 .

OR

When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

Yes

2



SEF279L

3

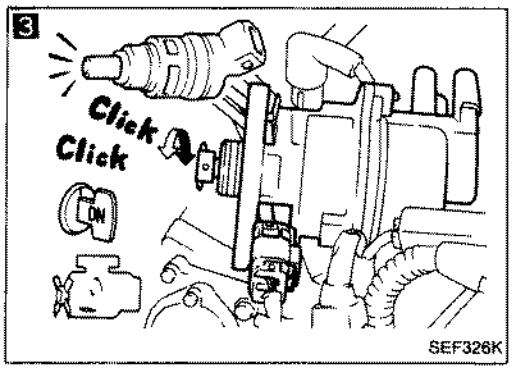
CHECK INJECTOR.

1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Disconnect ignition wires.
3. Turn ignition switch ON. (Do not start engine.)
4. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

No → Check injector(s) and circuit(s).

Yes

3



SEF326K

4

CHECK IGNITION SPARK.

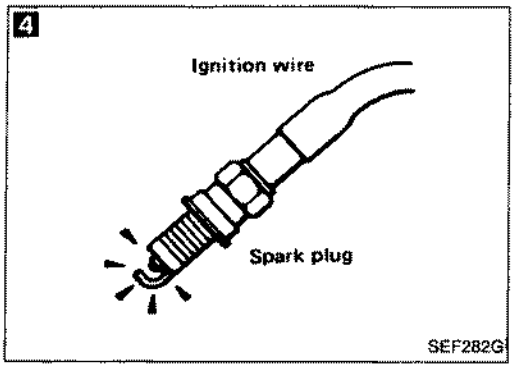
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

N.G. → Check ignition coil, power transistor and circuits. (See page EF & EC-576.)

O.K.

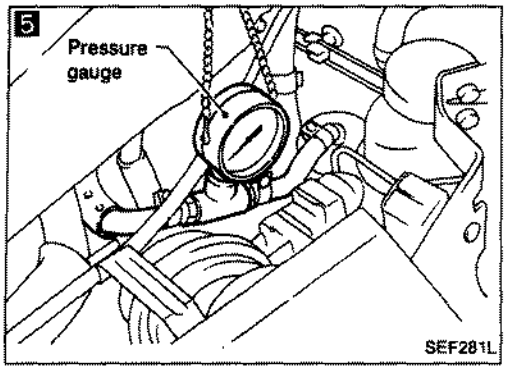
(Go to Ⓐ on next page.)

4



SEF282G

Diagnostic Procedure 10 — Engine Stalls when Turning (Cont'd)



Ⓐ

5

CHECK FUEL PRESSURE.

1. Release fuel pressure to zero. (Refer to page EF & EC-638.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:

Approx. 245 kPa (2.45 bar, 2.5 kg/cm², 36 psi)

A few seconds after ignition switch is turned from OFF to ON:

Approx. 294 kPa (2.94 bar, 3.0 kg/cm², 43 psi)

N.G. → Check fuel pressure regulator diaphragm.

O.K. ↓

6

CHECK E.C.U. HARNESS CONNECTOR.
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.

N.G. → Repair or replace.

O.K. ↓

7

CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.
Refer to page EF & EC-560.

N.G. → Repair or replace.

O.K. ↓

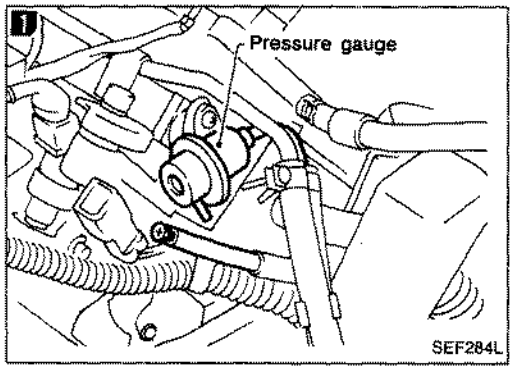
8

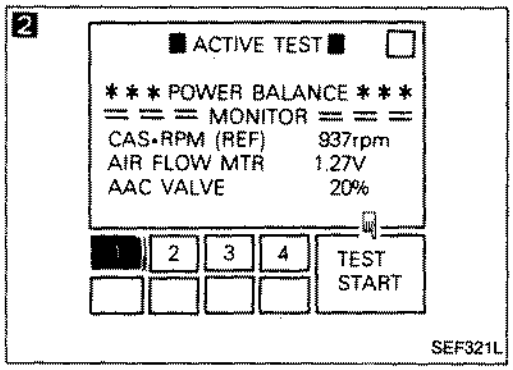
TRY A KNOWN GOOD E.C.U.*

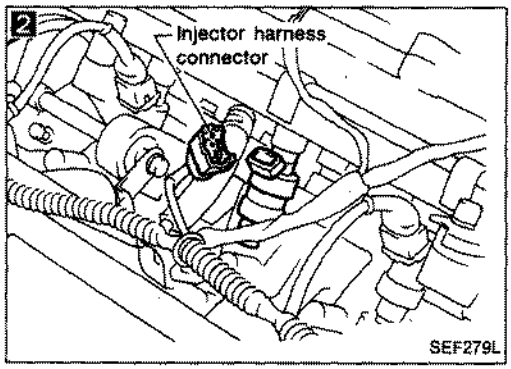
↓

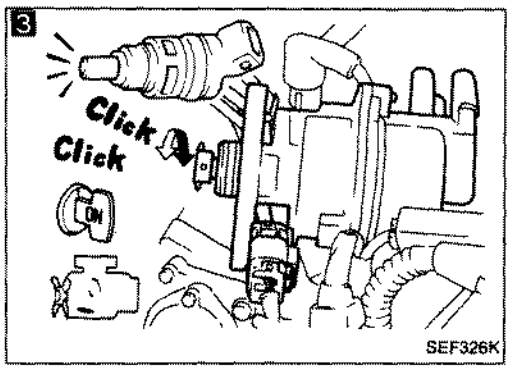
INSPECTION END

*: E.C.U. may be the cause of a problem, but this is rarely the case.









Diagnostic Procedure 11 — Engine Stalls when the Engine is Hot

1

CHECK FUEL VAPOR.
1. Disconnect fuel pressure regulator vacuum hose and plug hose.
2. Perform cruise test.
3. Does the engine stall disappear?

Yes → Check fuel properties.

No ↓

2

PERFORM POWER BALANCE TEST.
1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

No → Go to **5**.

— OR —

When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

Yes ↓

3

CHECK INJECTOR.
1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Disconnect ignition wires.
3. Turn ignition switch ON. (Do not start engine.)
4. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

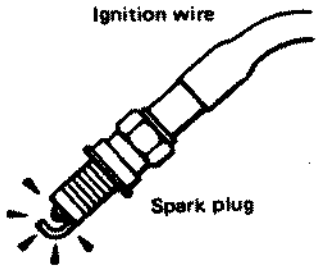
No → Check injector(s) and circuit(s).

Yes ↓

(Go to Ⓐ on next page.)

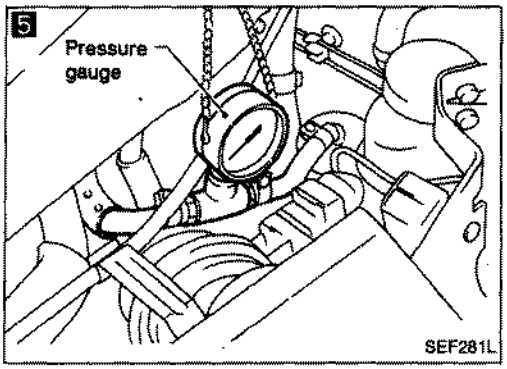
Diagnostic Procedure 11 — Engine Stalls when the Engine is Hot (Cont'd)

4



SEF282G

5



SEF281L

Ⓐ

4 **CHECK IGNITION SPARK.**

1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

N.G. → Check ignition coil, power transistor and their circuits. (See page EF & EC-576.)

O.K. ↓

5 **CHECK FUEL PRESSURE.**

1. Release fuel pressure to zero. (Refer to page EF & EC-638.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:
Approx. 245 kPa
(2.45 bar, 2.5 kg/cm², 36 psi)
A few seconds after ignition switch is turned from OFF to ON:
Approx. 294 kPa
(2.94 bar, 3.0 kg/cm², 43 psi)

N.G. → Check fuel pressure regulator diaphragm.

O.K. ↓

6 **CHECK E.C.U. HARNESS CONNECTOR.**
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.

N.G. → Repair or replace.

O.K. ↓

7 **CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.**
Refer to page EF & EC-560.

N.G. → Repair or replace.

O.K. ↓

8 **TRY A KNOWN GOOD E.C.U.***

Trouble is fixed. → Replace E.C.U.

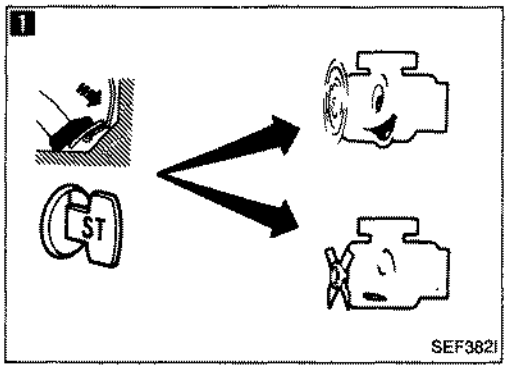
Trouble is not fixed. ↓

INSPECTION END

*: E.C.U. may be the cause of a problem, but this is rarely the case.

Diagnostic Procedure 12 — Engine Stalls when the Engine is Cold

1



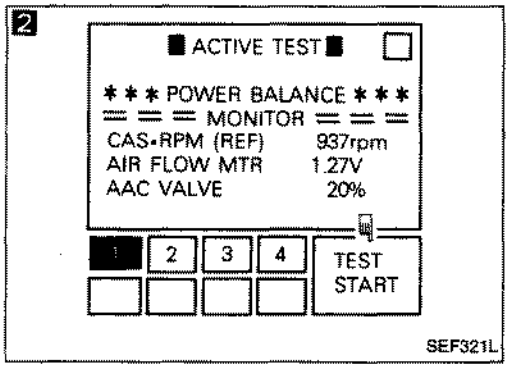
SEF382I

CHECK AIR REGULATOR AND A.A.C. VALVE.
When the engine is cold, can you start the engine when pressing accelerator pedal fully?

N.G. → Check A.A.C. valve, air regulator and circuits. (See pages EF & EC-600, 606.)

O.K. ↓

2



SEF321L

PERFORM POWER BALANCE TEST.

1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

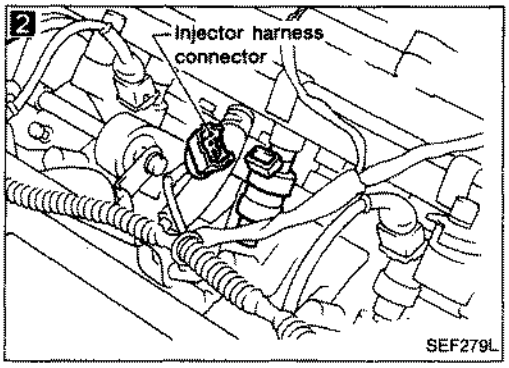
No → Go to 6.

— OR —

When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

Yes ↓

2



SEF279L

3

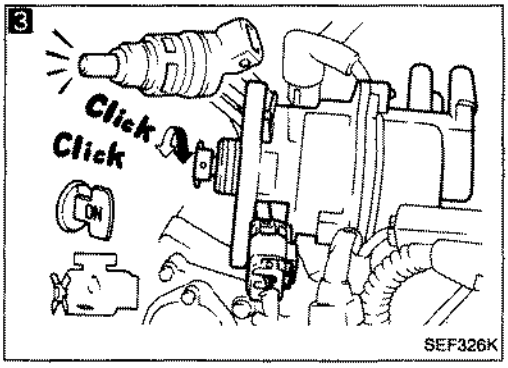
CHECK INJECTOR.

1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Disconnect ignition wires.
3. Turn ignition switch ON. (Do not start engine.)
4. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

N.G. → Check injector(s) and circuit(s).

O.K. ↓

3



SEF326K

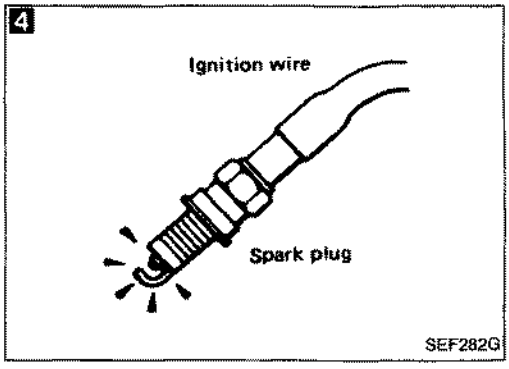
4

CHECK IGNITION SPARK.

1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

N.G. → Check ignition coil, power transistor and circuits. (See page EF & EC-576.)

O.K. ↓

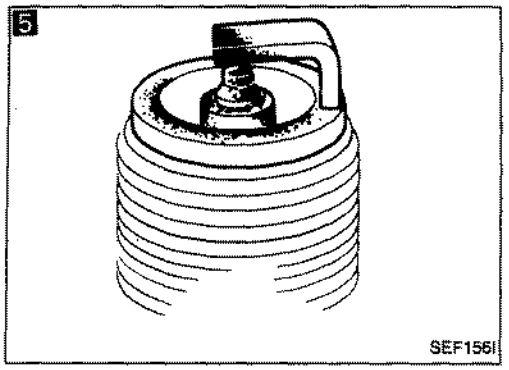


SEF282G

(Go to Ⓐ on next page.)

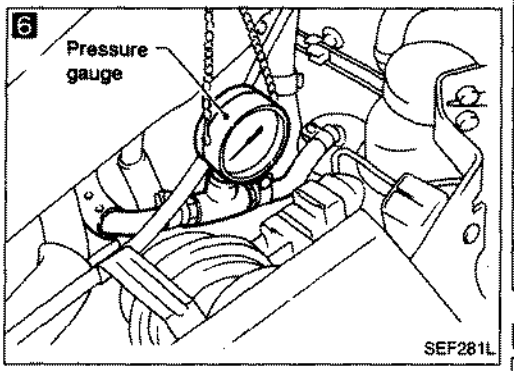
Diagnostic Procedure 12 — Engine Stalls when the Engine is Cold (Cont'd)

5



SEF156I

6



SEF281L

Ⓐ

5 **CHECK SPARK PLUGS.**
Remove the spark plugs and check for fouling, etc.
N.G. → Repair or replace spark plug(s).
O.K. ↓

6 **CHECK FUEL PRESSURE.**
1. Release fuel pressure to zero. (Refer to page EF & EC-638.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:
Approx. 245 kPa
(2.45 bar, 2.5 kg/cm², 36 psi)
A few seconds after ignition switch is turned from OFF to ON:
Approx. 294 kPa
(2.94 bar, 3.0 kg/cm², 43 psi)

N.G. → Check fuel pressure regulator diaphragm.
O.K. ↓

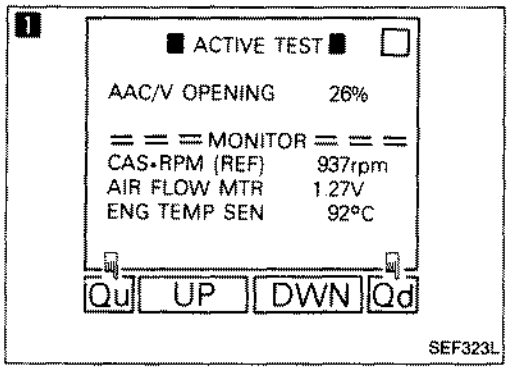
7 **CHECK E.C.U. HARNESS CONNECTOR.**
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.
N.G. → Repair or replace.
O.K. ↓

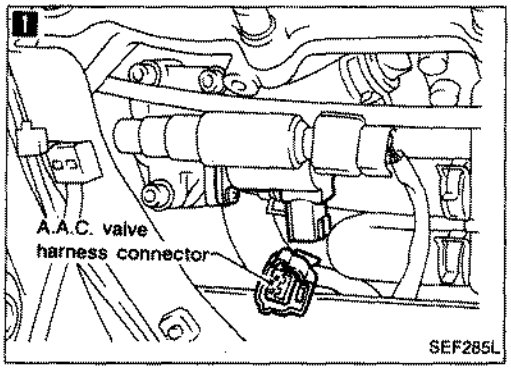
8 **CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.**
Refer to page EF & EC-560.
N.G. → Repair or replace.
O.K. ↓

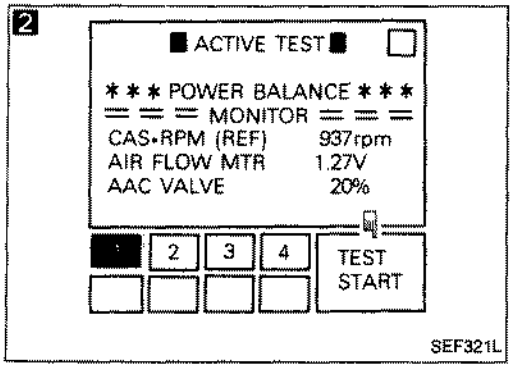
9 **TRY A KNOWN GOOD E.C.U.***
Trouble is fixed. → Replace E.C.U.
Trouble is not fixed. ↓

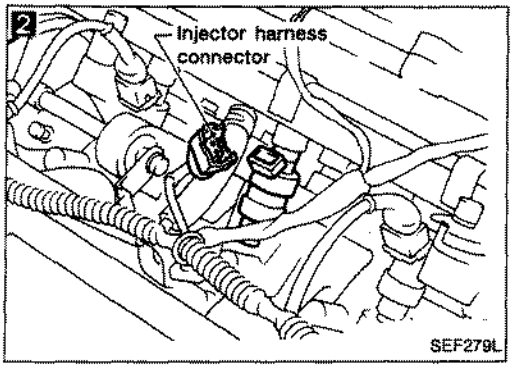
INSPECTION END

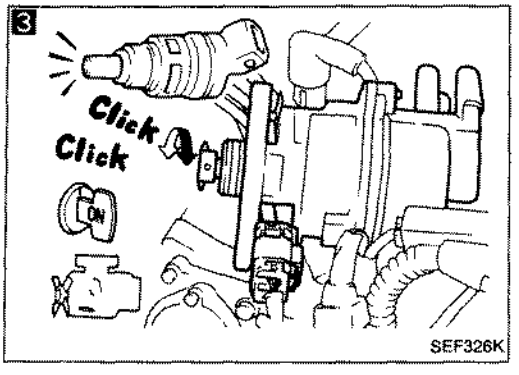
*: E.C.U. may be the cause of a problem, but this is rarely the case.











Diagnostic Procedure 13 — Engine Stalls when Stepping on the Accelerator Momentarily

1

CHECK A.A.C. VALVE.

1. Select "A.A.C. VALVE OPENING" in "ACTIVE TEST" mode.
2. When touching "Qu" and "Qd", does the engine speed change according to the percent of A.A.C. valve opening?

No → Check A.A.C. valve and circuit. (See page EF & EC-606.)

OR

When disconnecting A.A.C. valve harness connector, does the engine speed drop?

Yes ↓

2

PERFORM POWER BALANCE TEST.

1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

No → Go to 5.

OR

When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

Yes ↓

3

CHECK INJECTOR.

1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Disconnect ignition wires.
3. Turn ignition switch ON. (Do not start engine.)
4. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

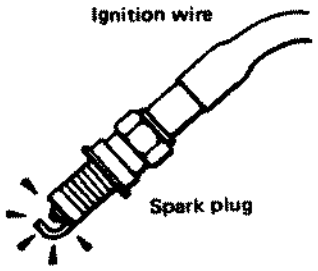
No → Check injector(s) and their circuit(s).

Yes ↓

(Go to Ⓐ on next page.)

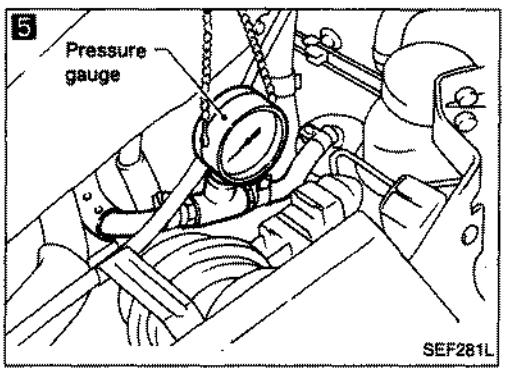
Diagnostic Procedure 13 — Engine Stalls when Stepping on the Accelerator Momentarily (Cont'd)

4



SEF282G

5



SEF281L

Ⓐ

4 **CHECK IGNITION SPARK.**

1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against an earth point with engine cranking.
4. Check for spark.

N.G. → Check ignition coil, power transistor and their circuits. (See page EF & EC-576.)

O.K. ↓

5 **CHECK FUEL PRESSURE.**

1. Release fuel pressure to zero. (Refer to page EF & EC-638.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:
Approx. 245 kPa
(2.45 bar, 2.5 kg/cm², 36 psi)
A few seconds after ignition switch is turned from OFF to ON:
Approx. 294 kPa
(2.94 bar, 3.0 kg/cm², 43 psi)

N.G. → Check fuel pressure regulator diaphragm.

O.K. ↓

6 **CHECK E.C.U. HARNESS CONNECTOR.**
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.

N.G. → Repair or replace.

O.K. ↓

7 **CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.**
Refer to page EF & EC-560.

N.G. → Repair or replace.

O.K. ↓

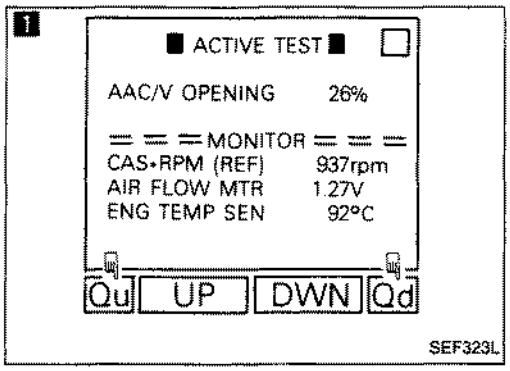
8 **TRY A KNOWN GOOD E.C.U.***

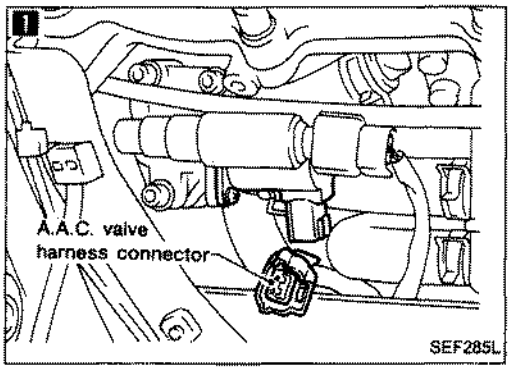
Trouble is not fixed. → Replace E.C.U.

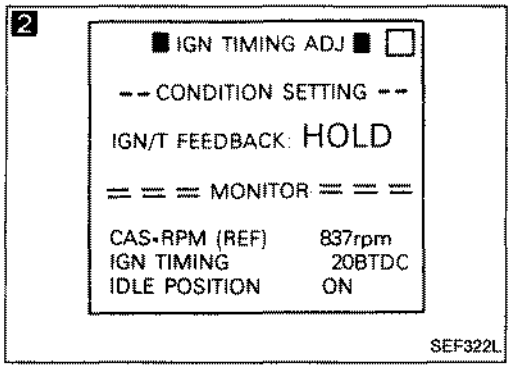
Trouble is fixed ↓

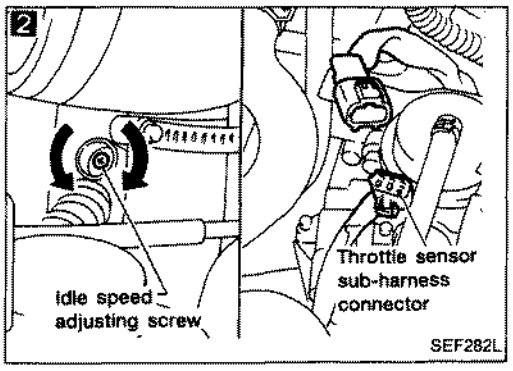
INSPECTION END

*: E.C.U. may be the cause of a problem, but this is rarely the case.









Diagnostic Procedure 14 — Engine Stalls after Decelerating

1

CHECK A.A.C. VALVE.

1. Select "A.A.C. VALVE OPENING" in "ACTIVE TEST" mode.
2. When touching "Qu" and "Qd", does the engine speed change according to the percent of A.A.C. valve opening?

No → Check A.A.C. valve and circuit. (See page EF & EC-606.)

OR

When disconnecting A.A.C. valve harness connector, does the engine speed drop?

Yes

2

CHECK IDLE ADJ. SCREW CLOGGING.

1. Perform "IGN TIMING ADJ" in "WORK SUPPORT" mode.
2. Can you set engine rpm at 850 ± 50 rpm (in "N" position) by turning idle adjusting screw?

No → Check for I.A.S. clogging or throttle chamber clogging.

OR

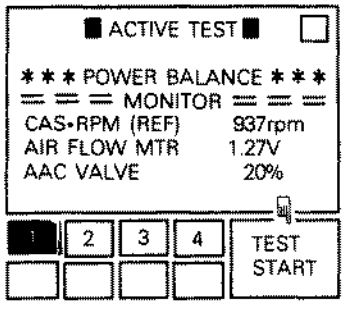
1. Disconnect throttle sensor harness connector.
2. Can you set engine rpm at 850 ± 50 rpm (in "N" position) by turning idle adjusting screw?

Yes

(Go to Ⓐ on next page.)

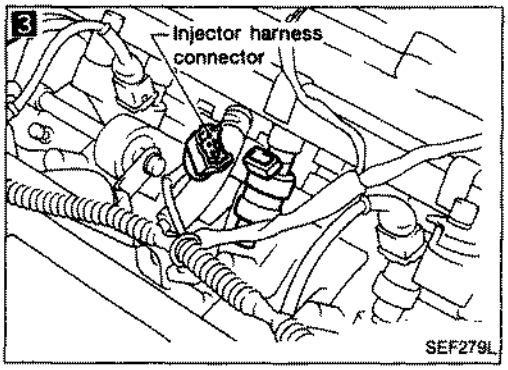
Diagnostic Procedure 14 — Engine Stalls after Decelerating (Cont'd)

3



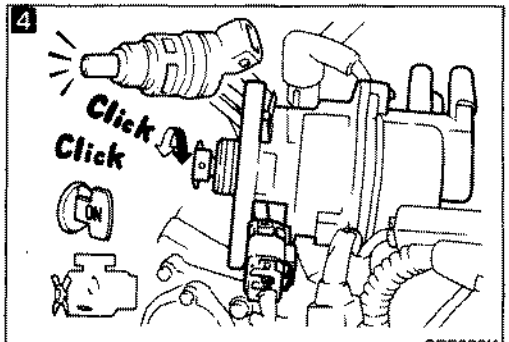
SEF321L

3



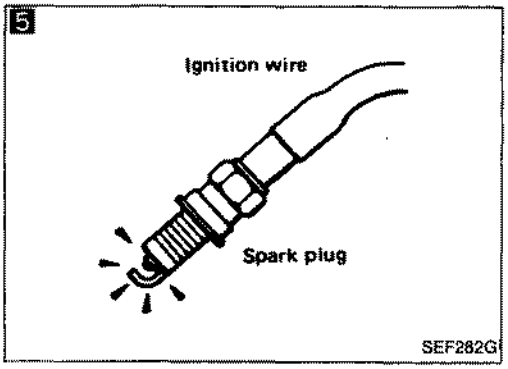
SEF279L

4



SEF326K

5



SEF282G

Ⓐ

3

PERFORM POWER BALANCE TEST.

1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

No → Go to 6.

OR

When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

Yes

4

CHECK INJECTOR.

1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Disconnect ignition wires.
3. Turn ignition switch ON. (Do not start engine.)
4. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

No → Check injector(s) and circuit(s).

Yes

5

CHECK IGNITION SPARK.

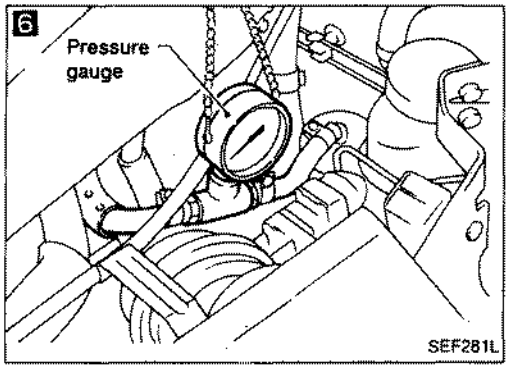
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

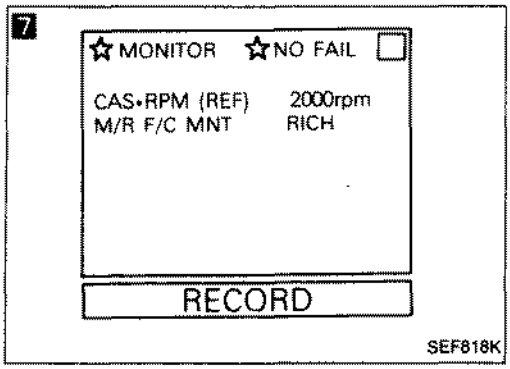
No → Check ignition coil, power transistor and circuits. (See page EF & EC-576.)

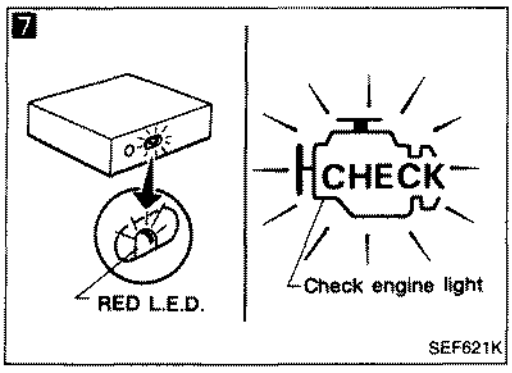
Yes

(Go to Ⓑ on next page.)

Diagnostic Procedure 14 — Engine Stalls after Decelerating (Cont'd)







Ⓑ

6 **CHECK FUEL PRESSURE.**

1. Release fuel pressure to zero. (Refer to page EF & EC-638.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:
Approx. 245 kPa
(2.45 bar, 2.5 kg/cm², 36 psi)
A few seconds after ignition switch is turned from OFF to ON:
Approx. 294 kPa
(2.94 bar, 3.0 kg/cm², 43 psi)

N.G. → Check fuel pressure regulator diaphragm.

O.K. ↓

7 **CHECK EXHAUST GAS SENSOR.**

1. See "M/R F/C MNT" in "DATA MONITOR" mode.
2. Maintaining engine at 2,000 rpm under no-load (with engine warmed up sufficiently.), check to make sure that the monitor fluctuates between "LEAN" and "RICH" more than 5 times during 10 seconds.

RICH→LEAN→RICH→ (1 time, 2 times)
LEAN→RICH.....

N.G. → Replace exhaust gas sensor.

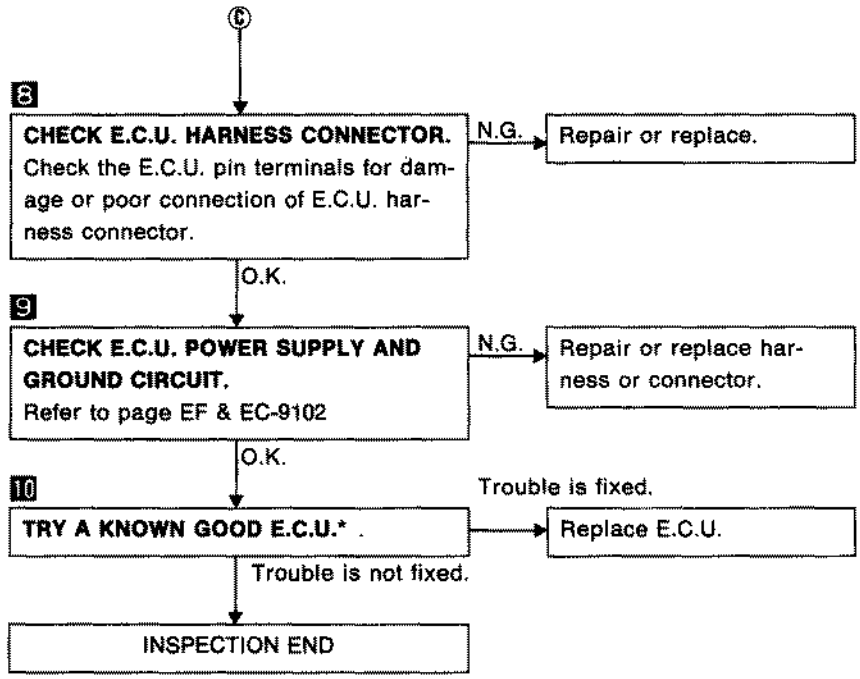
OR

1. Set "Exhaust gas sensor monitor" in the self-diagnostic Mode II. (See page EF & EC-412.)
2. Maintaining engine at 2,000 rpm under no load, check that the RED L.E.D. on the E.C.U. or the check engine light on the instrument panel goes ON and OFF more than 5 times during 10 seconds.

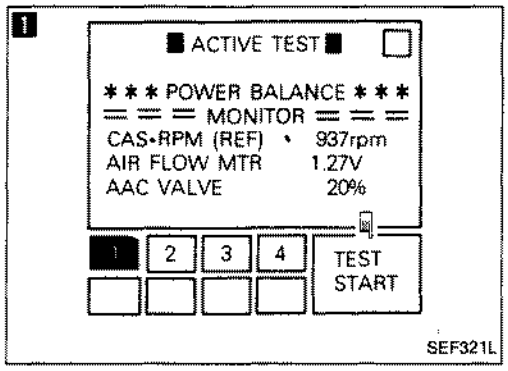
O.K. ↓

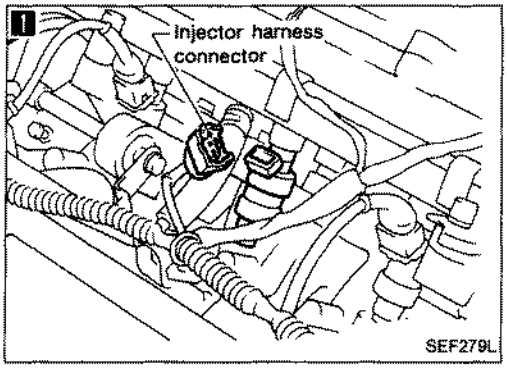
(Go to Ⓒ on next page.)

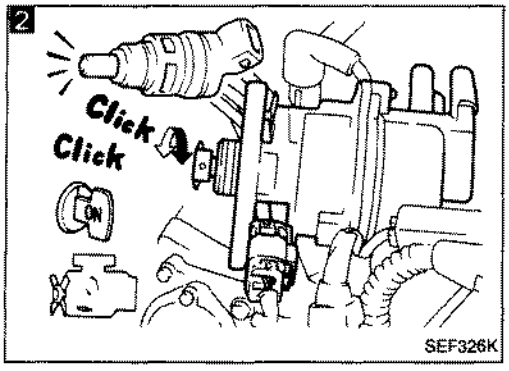
Diagnostic Procedure 14 — Engine Stalls after Decelerating (Cont'd)

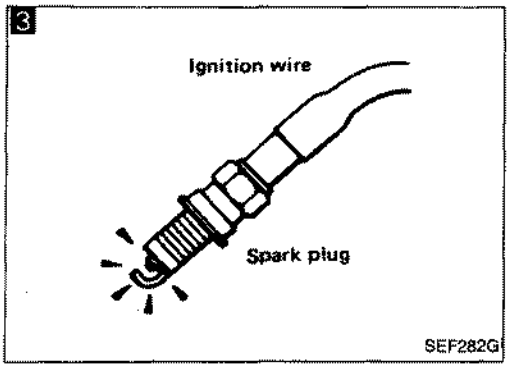


*: E.C.U. may be the cause of a problem, but this is rarely the case.









Diagnostic Procedure 15 — Engine Stalls when Accelerating or when Driving at Constant Speed

1

PERFORM POWER BALANCE TEST.

1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

— OR —

When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

No → Go to **4**.

Yes ↓

2

CHECK INJECTOR.

1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Disconnect ignition wires.
3. Turn ignition switch ON. (Do not start engine.)
4. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

No → Check injector(s) and circuit(s).

Yes ↓

3

CHECK IGNITION SPARK.

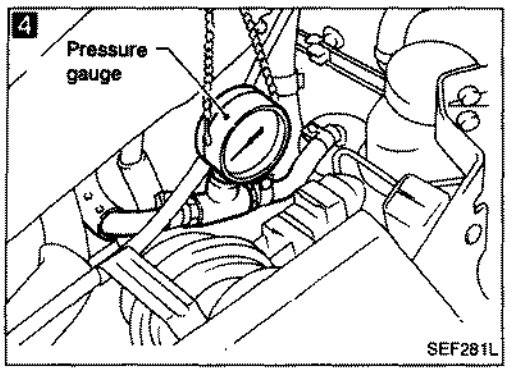
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

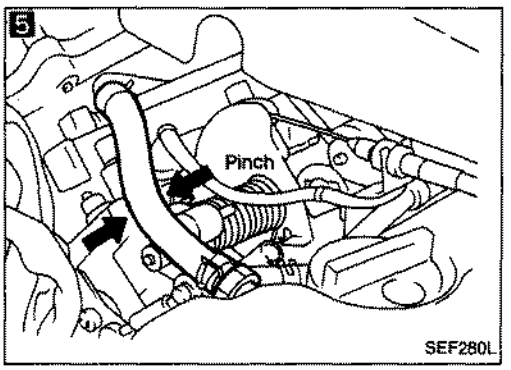
No → Check ignition coil, power transistor and circuits. (See page EF & EC-576.)

Yes ↓

(Go to Ⓐ on next page.)

Diagnostic Procedure 15 — Engine Stalls when Accelerating or when Driving at Constant Speed (Cont'd)





Ⓐ

4 **CHECK FUEL PRESSURE.**
1. Release fuel pressure to zero. (Refer to page EF & EC-638.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:
Approx. 245 kPa (2.45 bar, 2.5 kg/cm², 36 psi)
A few seconds after ignition switch is turned from OFF to ON:
Approx. 294 kPa (2.94 bar, 3.0 kg/cm², 43 psi)

N.G. → Check fuel pump, circuit and fuel pressure regulator.

O.K. ↓

5 **CHECK FOR INTAKE AIR LEAK.**
When pinching blow-by hose (lowering the blow-by air supply), does the engine speed rise?

Yes → Discover air leak location and repair.

No ↓

6 **CHECK E.C.U. HARNESS CONNECTOR.**
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.

N.G. → Repair or replace.

O.K. ↓

7 **CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.**
Refer to page EF & EC-560.

Yes → Repair or replace.

No ↓

8 **TRY A KNOWN GOOD E.C.U.***

Trouble is fixed. → Replace E.C.U.

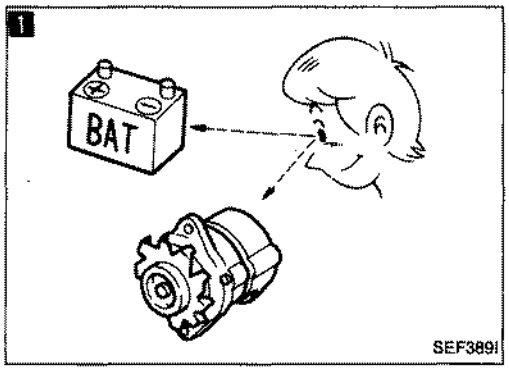
Trouble is not fixed. ↓

INSPECTION END

*: E.C.U. may be the cause of a problem, but this is rarely the case.

Diagnostic Procedure 16 — Engine Stalls when the Electrical Load is Heavy

1



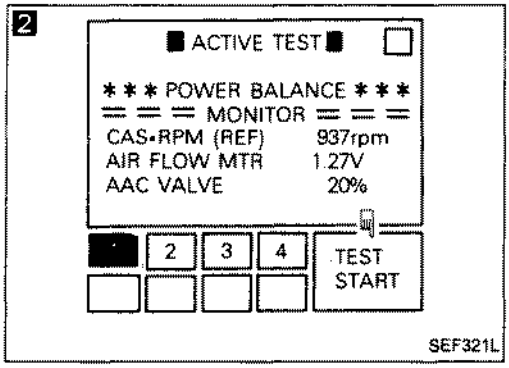
SEF389I

CHECK BATTERY AND ALTERNATOR.
Check battery and alternator condition. (Refer to EL section.)

N.G. → Repair or replace.

O.K. ↓

2



SEF321L

PERFORM POWER BALANCE TEST.

1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

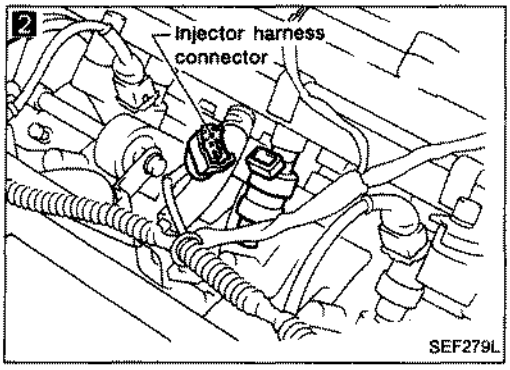
No → Go to 5.

OR

When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

Yes ↓

2



SEF279L

3

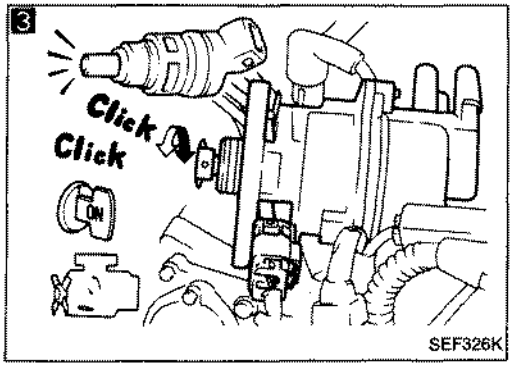
CHECK INJECTOR.

1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Disconnect ignition wires.
3. Turn ignition switch ON. (Do not start engine.)
4. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

No → Check injector(s) and circuit(s).

Yes ↓

3



SEF326K

4

CHECK IGNITION SPARK.

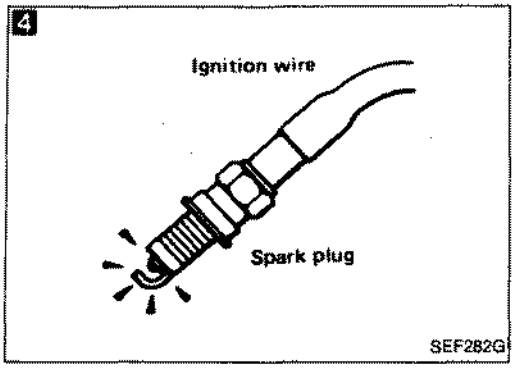
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

N.G. → Check ignition coil, power transistor and circuits. (See page EF & EC-576.)

O.K. ↓

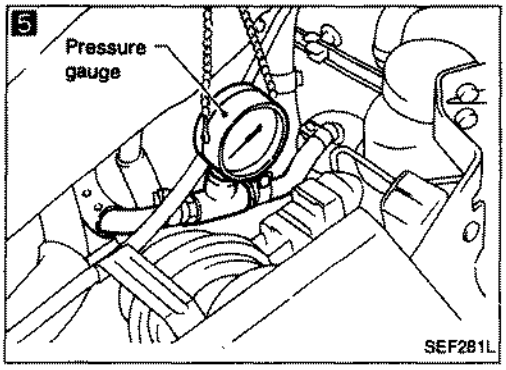
(Go to Ⓐ on next page.)

4



SEF282G

Diagnostic Procedure 16 — Engine Stalls when the Electrical Load is Heavy (Cont'd)



Ⓐ

5

CHECK FUEL PRESSURE.
1. Release fuel pressure to zero. (Refer to page EF & EC-638.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:
Approx. 245 kPa
(2.45 bar, 2.5 kg/cm², 36 psi)

A few seconds after ignition switch is turned from OFF to ON:
Approx. 294 kPa
(2.94 bar, 3.0 kg/cm², 43 psi)

N.G. → Check fuel pressure regulator diaphragm.

O.K. ↓

6

CHECK E.C.U. HARNESS CONNECTOR.
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.

N.G. → Repair or replace.

O.K. ↓

7

CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.
Refer to page EF & EC-560.

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

O.K. ↓

8

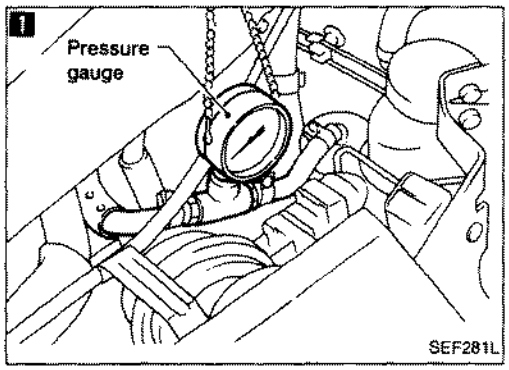
TRY A KNOWN GOOD E.C.U.*

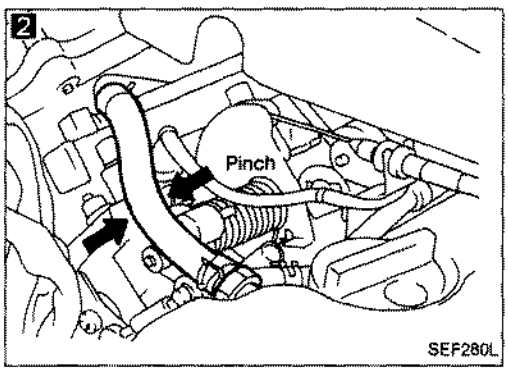
Trouble is fixed. → Replace E.C.U.

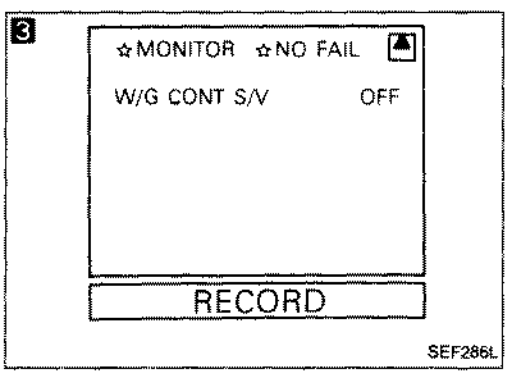
Trouble is not fixed. ↓

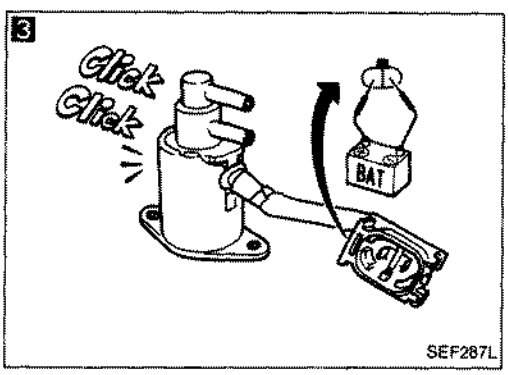
INSPECTION END

*: E.C.U. may be the cause of a problem, but this is rarely the case.









Diagnostic Procedure 17 — Lack of Power and Stumble

1

CHECK FUEL PRESSURE.

1. Release fuel pressure to zero. (Refer to page EF & EC-638.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:
Approx. 245 kPa
(2.45 bar, 2.5 kg/cm², 36 psi)
A few seconds after ignition switch is turned from OFF to ON:
Approx. 294 kPa
(2.94 bar, 3.0 kg/cm², 43 psi)

N.G. → Check fuel pressure regulator diaphragm.

O.K. ↓

2

CHECK FOR INTAKE AIR LEAK.
When pinching blow-by hose (lowering the blow-by air supply), does the engine speed rise?

Yes → Discover air leak location and repair.

No ↓

3

CHECK WASTEGATE VALVE CONTROL SOLENOID VALVE.

1. Check "W/G CONT S/V" in "DATA MONITOR" mode.
   At idle: OFF
   During acceleration: ON

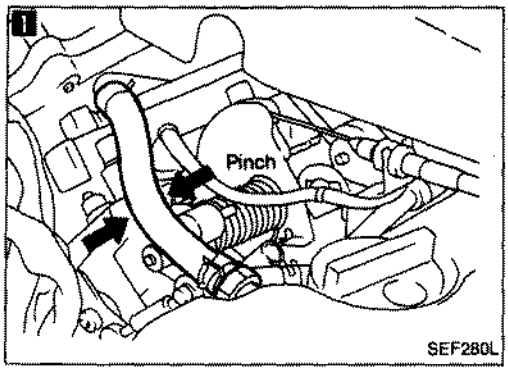
Yes → check wastegate valve control solenoid valve and circuit.

1. Disconnect wastegate valve control solenoid valve harness connector.
2. Supply wastegate valve control solenoid valve terminals with battery current and check operating sound.

No ↓

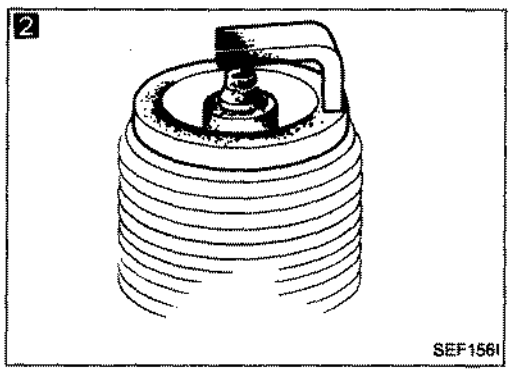
INSPECTION END

1



SEF280L

2



SEF156I

Diagnostic Procedure 18 — Detonation

1

CHECK FOR INTAKE AIR LEAK.
When pinching blow-by hose (lowering the blow-by air supply), does the engine rpm rise?

Yes → Discover air leak location and repair.

No ↓

2

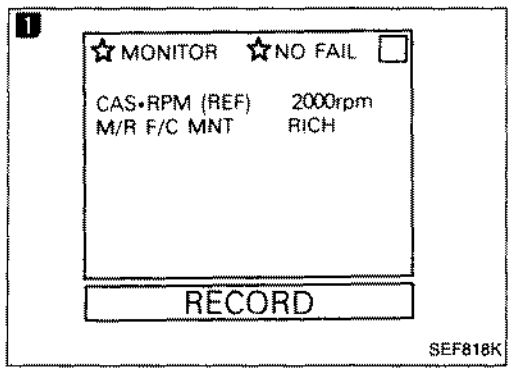
CHECK FOR OIL LEAK TO COMBUSTION CHAMBER.
Remove spark plugs and check for fouling with oil.

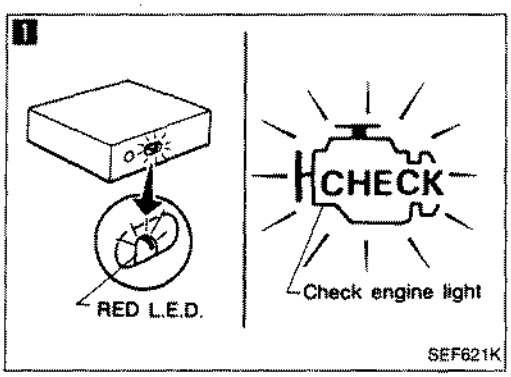
Yes → Check pistons, piston rings, valves, valve seats, valve oil seal, engine oil level, etc.

No ↓

INSPECTION END

Diagnostic Procedure 19 — Surge





CHECK EXHAUST GAS SENSOR.

1. See "M/R F/C MNT" in "DATA MONITOR" mode.
2. Maintaining engine at 2,000 rpm under no-load (with engine warmed up sufficiently.), check to make sure that the monitor fluctuates between "LEAN" and "RICH" more than 5 times during 10 seconds.

RICH→LEAN→RICH→ LEAN→RICH.....
(1 time, 2 times)

N.G. → Replace exhaust gas sensor.

OR

1. Set "Exhaust gas sensor monitor" in the self-diagnostic Mode II. (See page EF & EC-412.)
2. Maintaining engine at 2,000 rpm under no load, check that the RED L.E.D. on the E.C.U. or the check engine light on the instrument panel goes ON and OFF more than 5 times during 10 seconds.

O.K. ↓

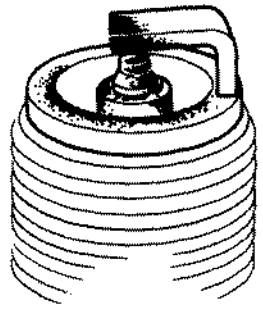
TRY A KNOWN GOOD E.C.U.* → Trouble is fixed. → Replace E.C.U.

Trouble is not fixed. ↓

INSPECTION END

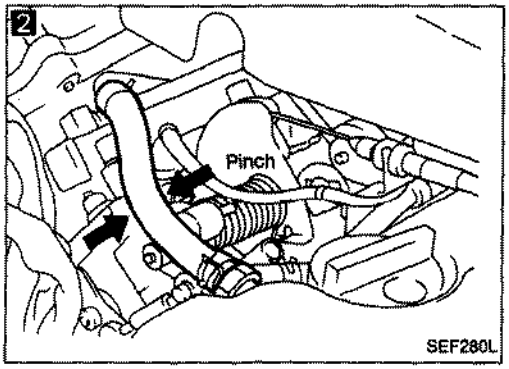
*: E.C.U. may be the cause of a problem, but this is rarely the case.

1



SEF156I

2



SEF280L

Diagnostic Procedure 20 — Backfire through the Intake

1

CHECK SPARK PLUGS.
Remove the spark plugs and check for fouling, etc.

N.G. → Repair or replace spark plug(s).

O.K. ↓

2

CHECK INTAKE AIR LEAK.
When pinching blow-by hose (lowering the blow-by air supply), does the engine speed rise?

Yes → Discover air leak location and repair.

No ↓

3

CHECK FOR INTAKE VALVE DEPOSITS.
If there are deposits on intake valves, remove them.

↓

INSPECTION END

Diagnostic Procedure 21 — Backfire through the Exhaust

1

CHECK ENGINE TEMPERATURE SENSOR.
Check engine temperature sensor and its circuit. (See page EF & EC-572.)

N.G. → Replace or repair.

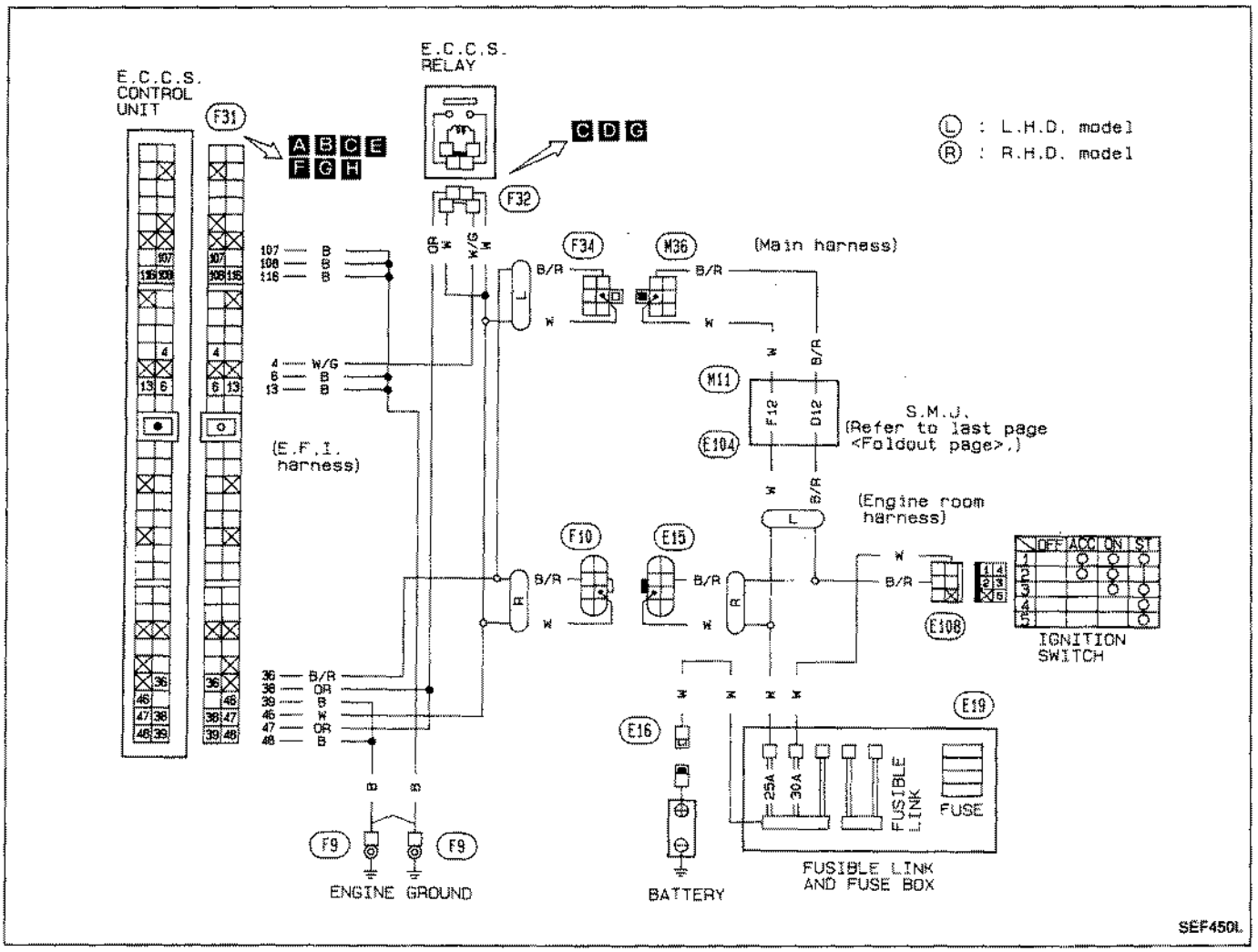
O.K. ↓

INSPECTION END

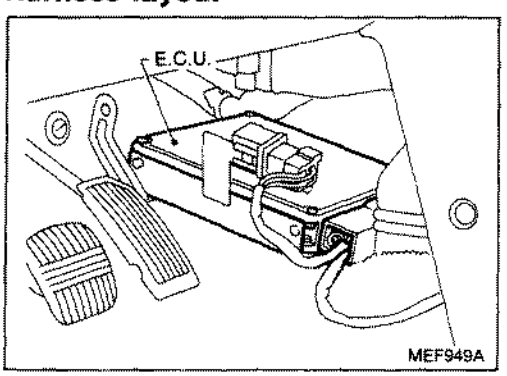
NOTE

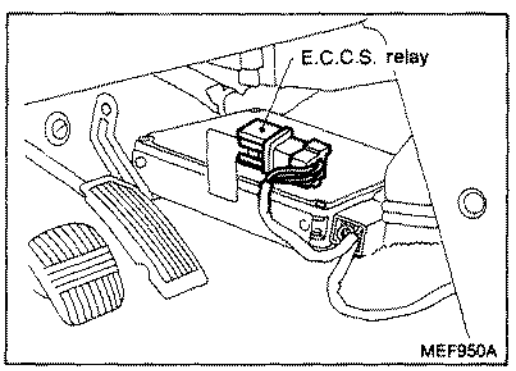
Diagnostic Procedure 22

MAIN POWER SUPPLY AND GROUND CIRCUIT (Not self-diagnostic item)

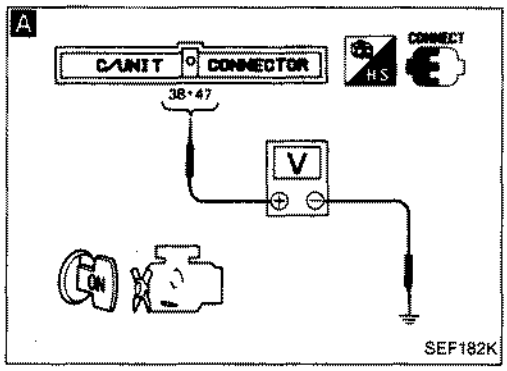


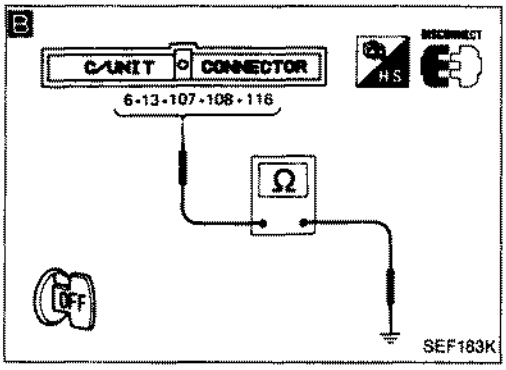
Harness layout

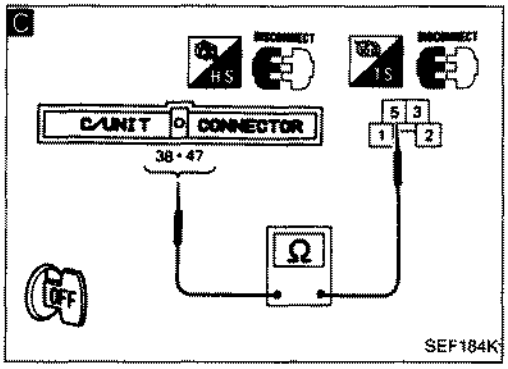


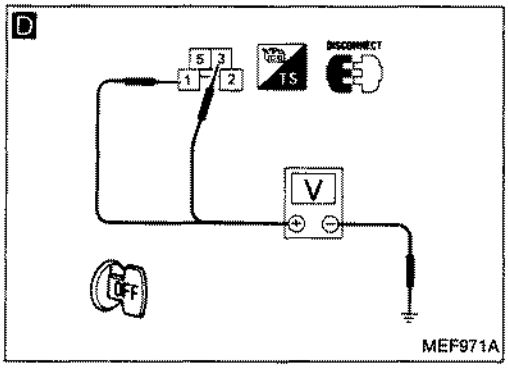


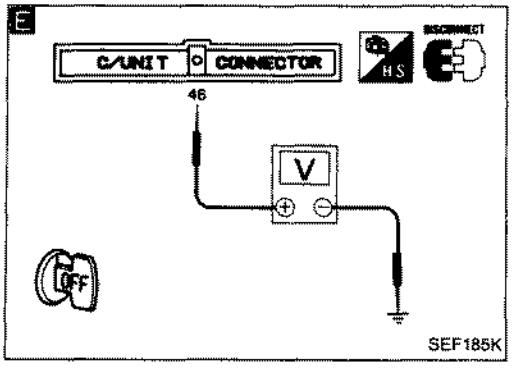
Diagnostic Procedure 22 (Cont'd)











INSPECTION START

A

CHECK POWER SUPPLY.
1) Turn ignition switch "ON".
2) Check voltage between E.C.U. terminals (38), (47) and ground.
Voltage: Battery voltage

O.K. → **B**

N.G. ↓

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminals (6), (13), (107), (108), (116) and engine ground.
Continuity should exist.
If N.G., repair harness or connectors.

O.K. ↓

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

C

CHECK HARNESS CONTINUITY BETWEEN E.C.C.S. RELAY AND E.C.U.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Disconnect E.C.C.S. relay.
4) Check harness continuity between E.C.U. terminals (38), (47) and terminal (5).
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

D

CHECK VOLTAGE BETWEEN E.C.C.S. RELAY AND GROUND.
1) Check voltage between terminals (1), (3) and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (F34), (M36) (L.H.D. models)
- Harness connectors (M11), (E104) (L.H.D. models)
- Harness connectors (F10), (E15) (R.H.D. models)
- "25A" fusible link
- Harness continuity between E.C.C.S. relay and battery

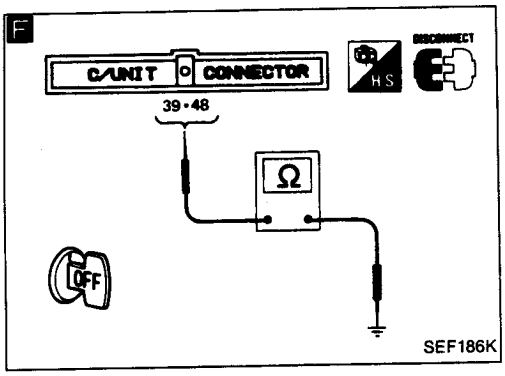
If N.G., repair harness or connectors.

O.K. ↓

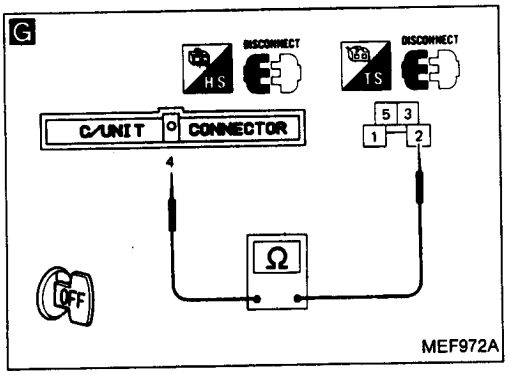
(A)

Diagnostic Procedure 22 (Cont'd)

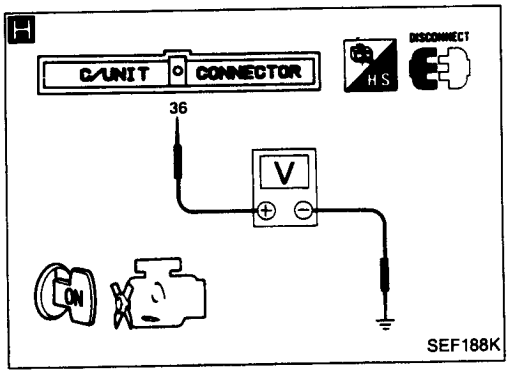
F



G



H



Ⓐ

E

CHECK VOLTAGE BETWEEN E.C.U. AND GROUND.
1) Check voltage between E.C.U. terminal ㊻ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (F34), (M36) (L.H.D. models)
- Harness connectors (M11), (E104) (L.H.D. models)
- Harness connectors (F10), (E15) (R.H.D. models)
- 25A fusible link
- Harness continuity between E.C.U. and battery

If N.G., repair harness or connectors.

O.K. ↓

F

CHECK GROUND CIRCUIT.
1) Check harness continuity between E.C.U. terminals ㊴, ㊽ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

G

CHECK OUTPUT SIGNAL CIRCUIT.
1) Check harness continuity between E.C.U. terminal ④ and terminal ②.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

H

CHECK INPUT SIGNAL CIRCUIT.
1) Turn ignition switch "ON".
2) Check voltage between E.C.U. terminal ㊱ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (F34), (M36) (L.H.D. models)
- Harness connectors (M11), (E104) (L.H.D. models)
- Harness connectors (F10), (E15) (R.H.D. models)
- Harness continuity between E.C.U. and ignition switch

If N.G., repair harness or connectors.

O.K. ↓

CHECK COMPONENT (E.C.C.S. relay).
Refer to "Electrical Components Inspection".
(See page EF & EC-635.)

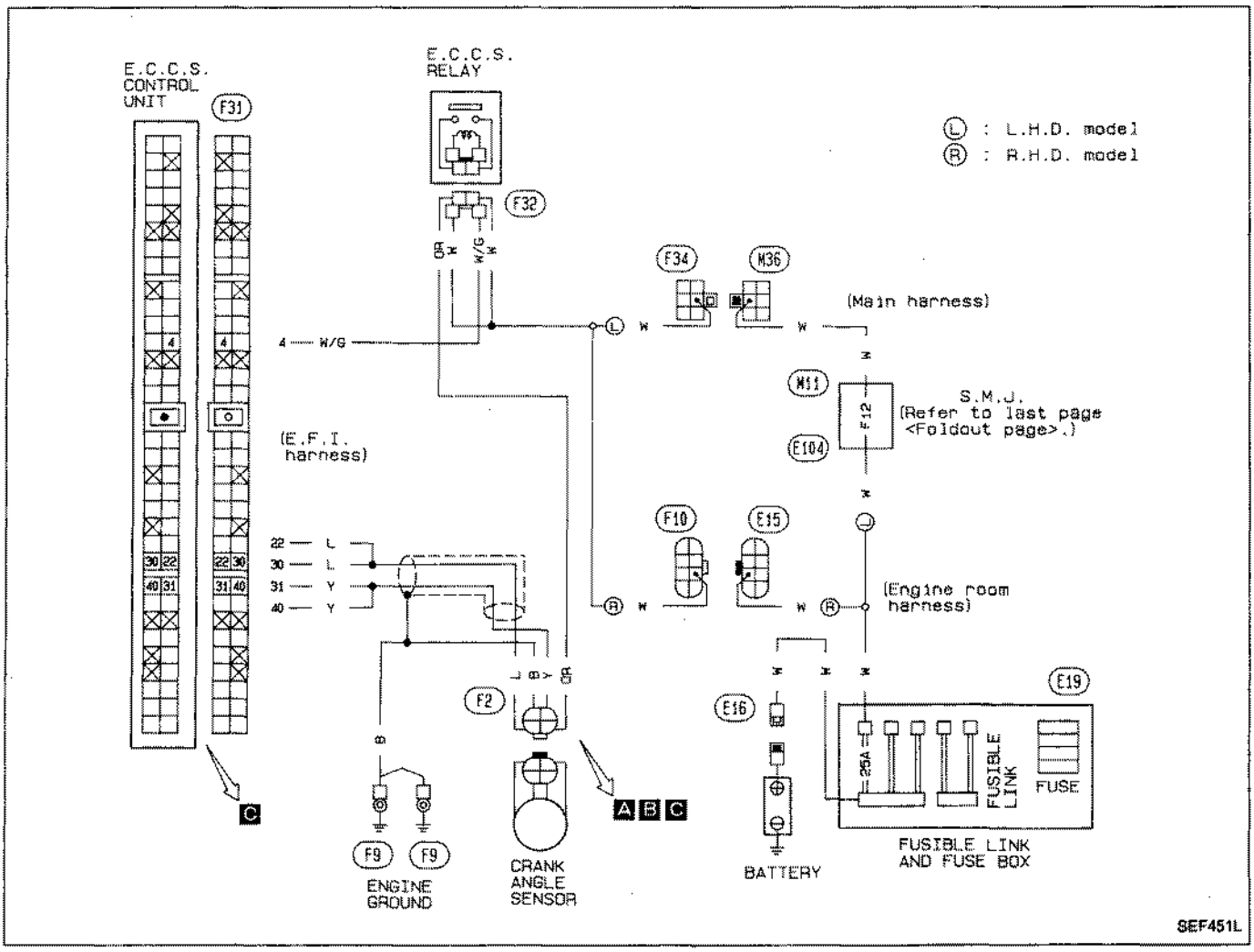
N.G. → Replace E.C.C.S. relay.

O.K. ↓

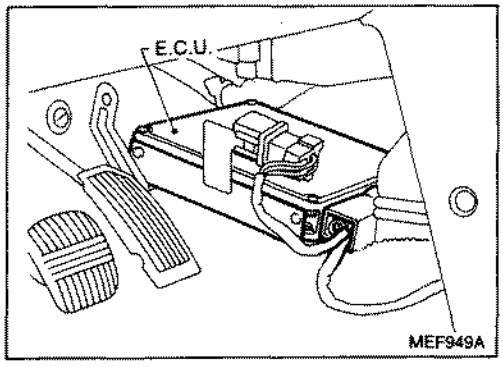
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

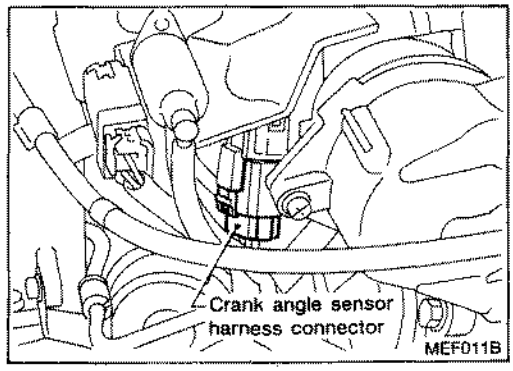
Diagnostic Procedure 23

CRANK ANGLE SENSOR (Code No. 11)

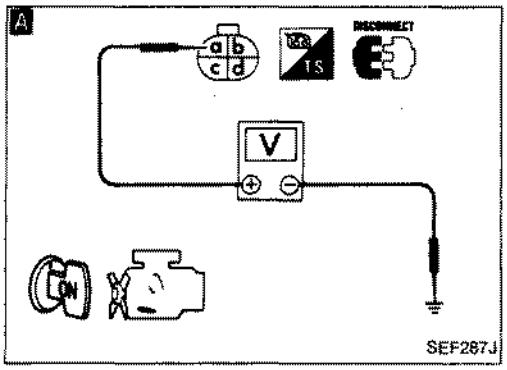


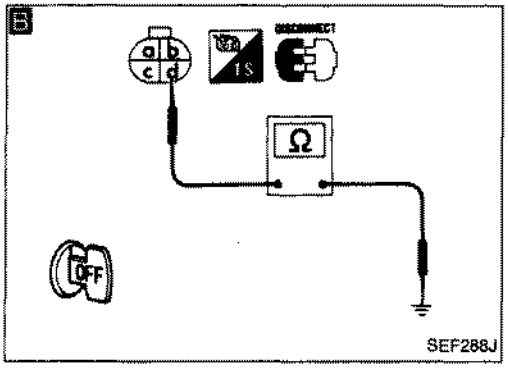
Harness layout

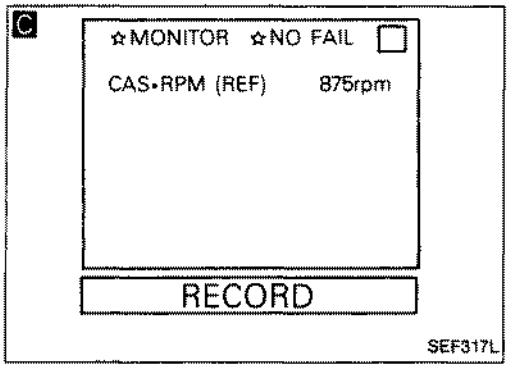


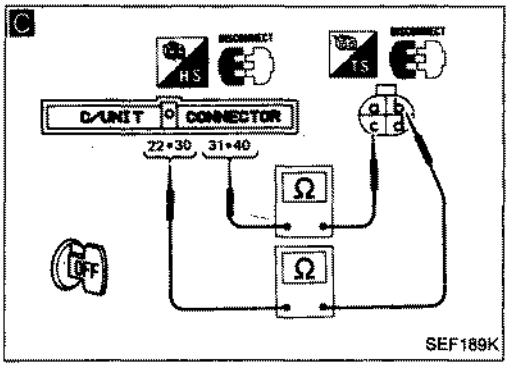


Diagnostic Procedure 23 (Cont'd)









INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect crank angle sensor harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓐ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness continuity between crank angle sensor and E.C.C.S. relay

If N.G., repair harness or connectors.

O.K. ↓

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓓ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

C

CHECK INPUT SIGNAL CIRCUIT.

1) Reconnect crank angle sensor harness connector.
2) Start engine.
3) Read crank angle sensor signals in "DATA MONITOR" mode with CONSULT.
rpm: 925 $^{+25}_{-75}$

N.G. → Repair harness or connectors.

— OR —

1) Disconnect E.C.U. harness connector.
2) Check harness continuity between terminal ⓒ and E.C.U. terminals ㉛, ㊵ (1° signal), terminal ⓑ and E.C.U. terminals ㉒, ㉚ (180° signal).
Continuity should exist.

O.K. ↓

CHECK COMPONENT (Crank angle sensor).
Refer to "Electrical Components Inspection".
(See page EF & EC-629.)

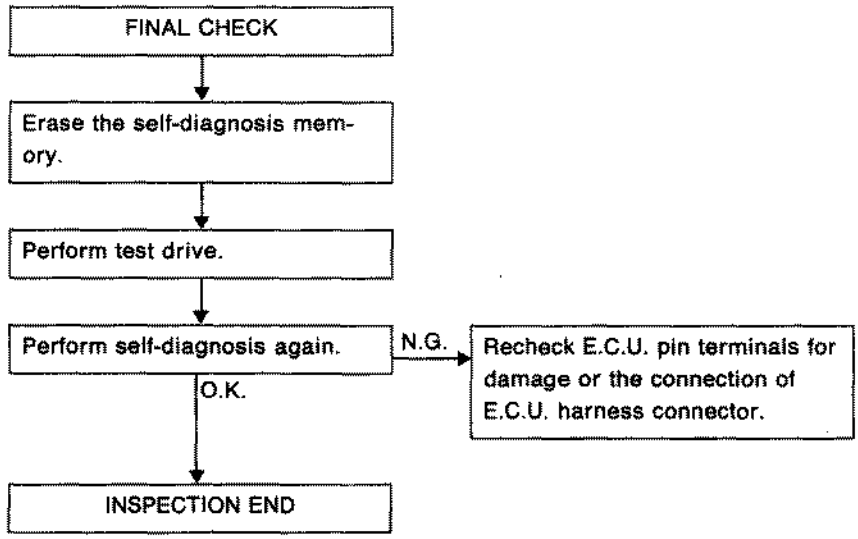
N.G. → Replace crank angle sensor.

O.K. ↓

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

Diagnostic Procedure 23 (Cont'd)

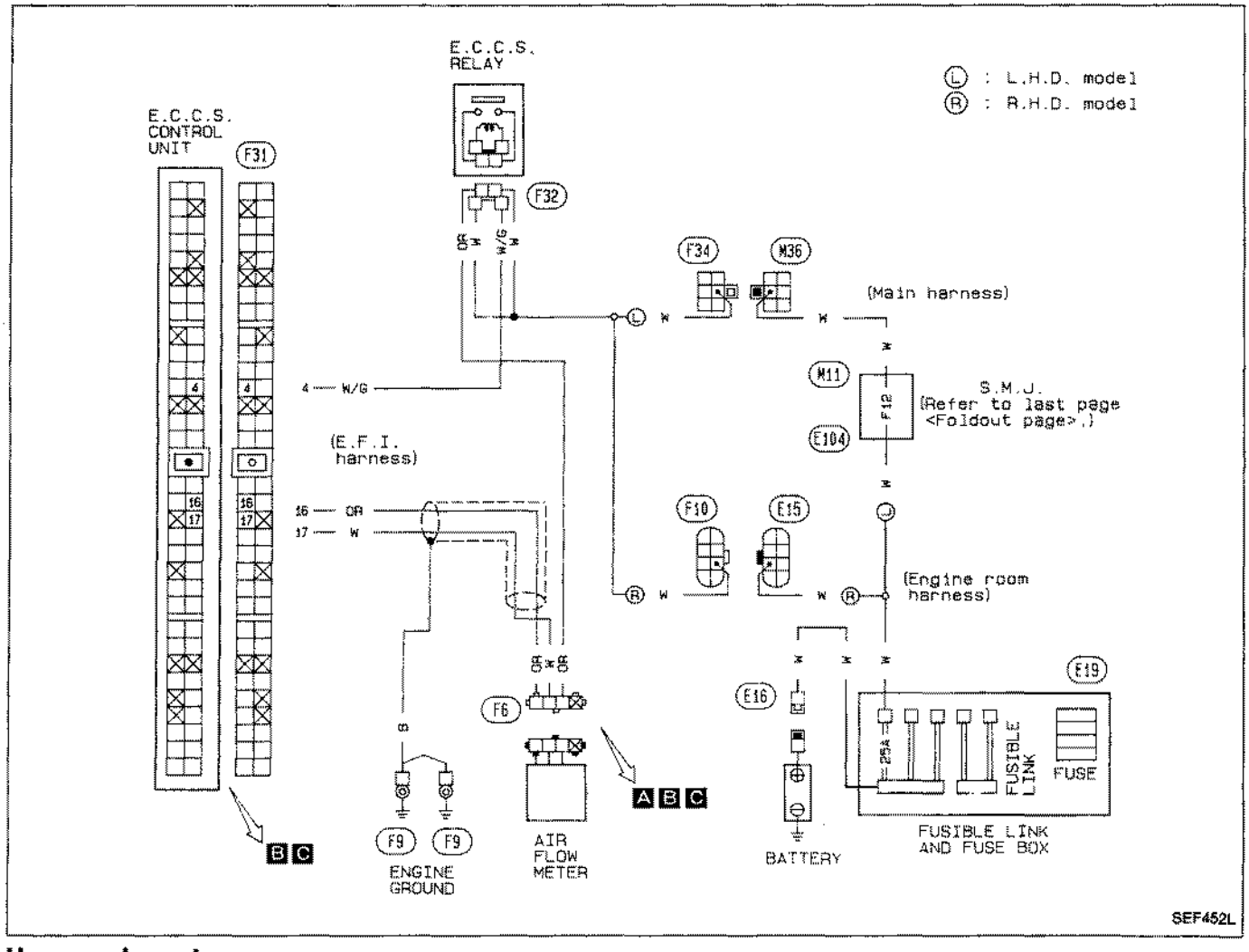
Perform FINAL CHECK by the following procedure after repair is completed.



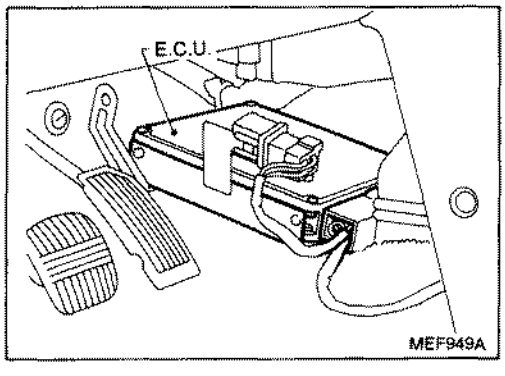
NOTE

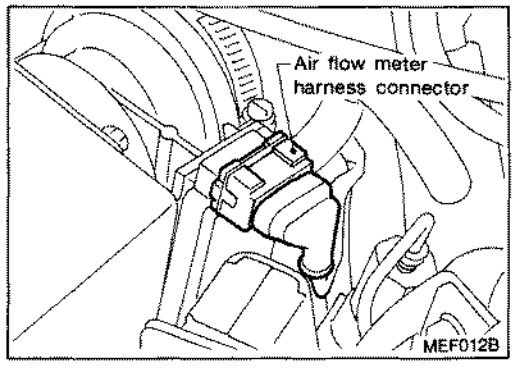
Diagnostic Procedure 24

AIR FLOW METER (Code No. 12)



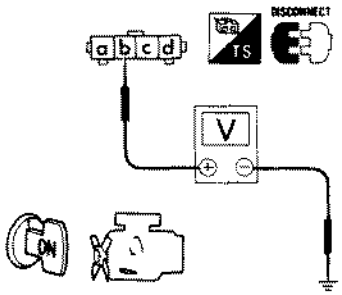
Harness layout





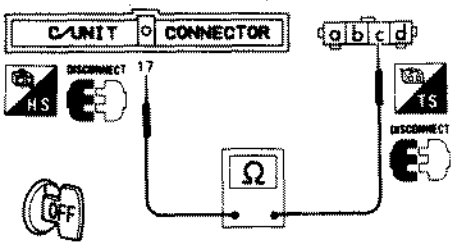
Diagnostic Procedure 24 (Cont'd)

A



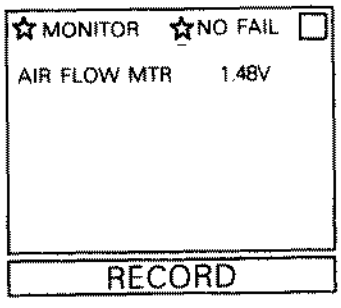
MEF973A

B



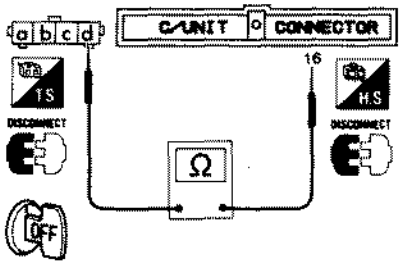
MEF974A

C



SEF824K

C



MEF975A

INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect air flow meter harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓑ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness continuity between air flow meter and E.C.C.S. relay

If N.G., repair harness or connectors.

O.K. ↓

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between terminal ⓒ and E.C.U. terminal ⑰.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

C

CHECK INPUT SIGNAL CIRCUIT.
1) Reconnect air flow meter harness connector and E.C.U. harness connector.
2) Start engine and warm it up sufficiently.
3) Read air flow meter signal in "DATA MONITOR" mode with CONSULT.
Voltage: 1.0 - 1.5V
(At idle)

N.G. → Repair harness or connectors.

OR

1) Check harness continuity between terminal ⓓ and E.C.U. terminal ⑯.
Continuity should exist.

O.K. ↓

CHECK COMPONENT (Air flow meter).
Refer to "Electrical Components Inspection".
(See page EF & EC-629.)

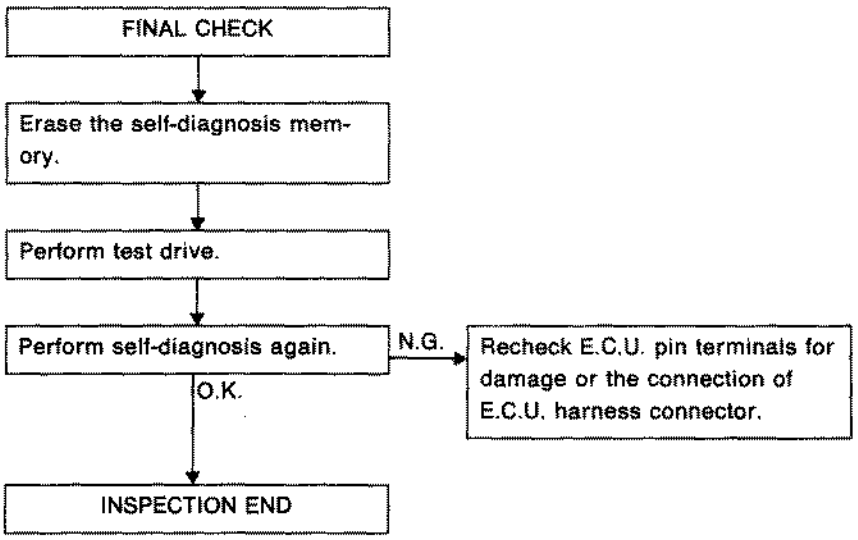
N.G. → Replace air flow meter.

O.K. ↓

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

Diagnostic Procedure 24 (Cont'd)

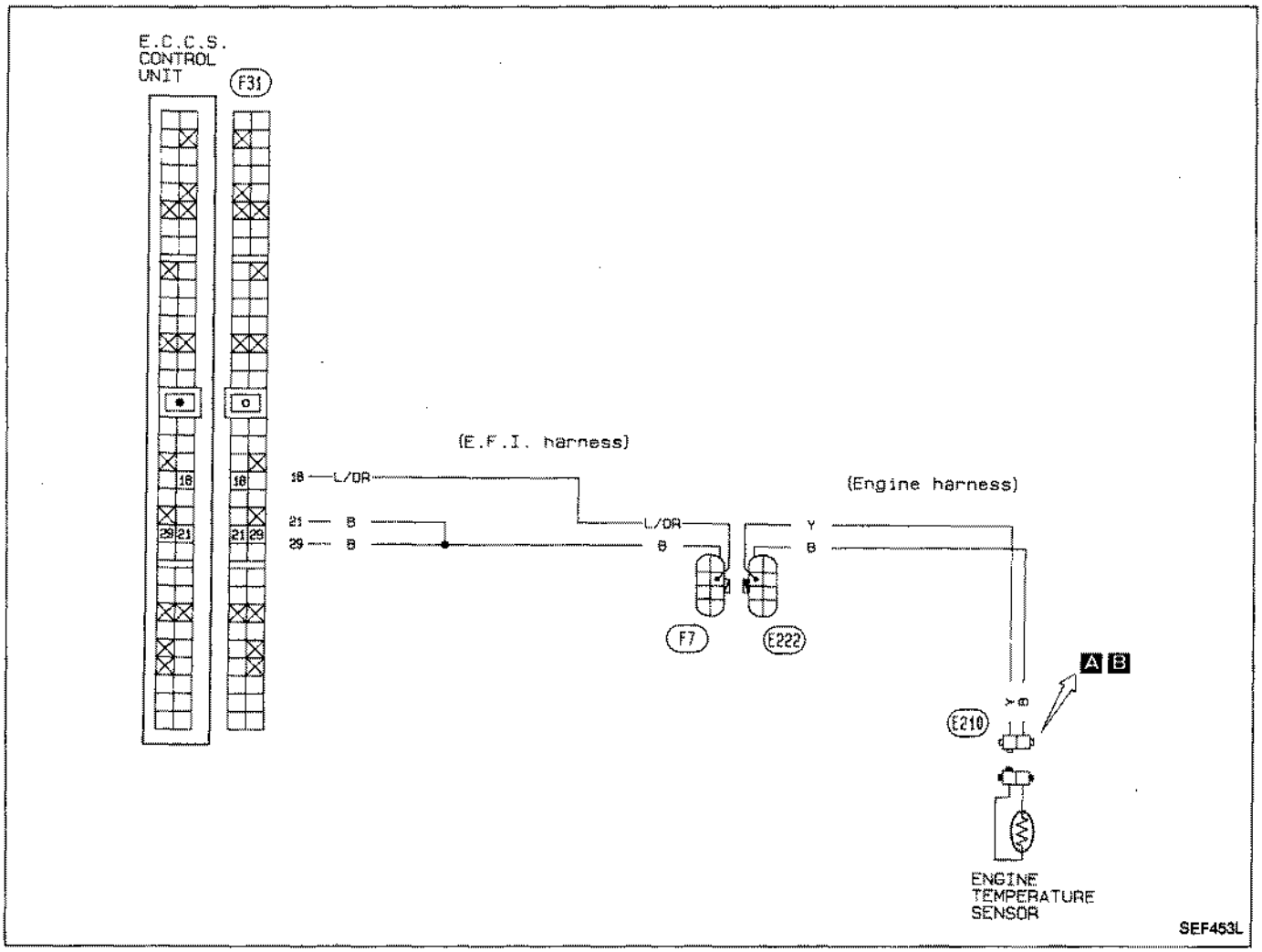
Perform FINAL CHECK by the following procedure after repair is completed.



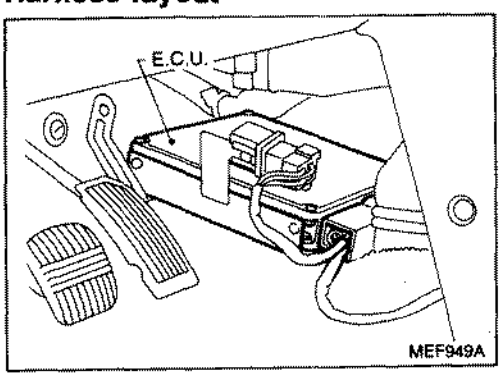
NOTE

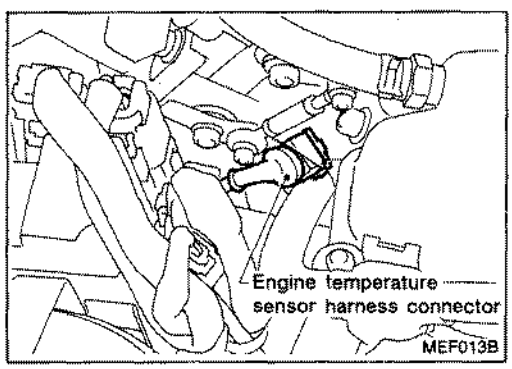
Diagnostic Procedure 25

ENGINE TEMPERATURE SENSOR (Code No. 13)



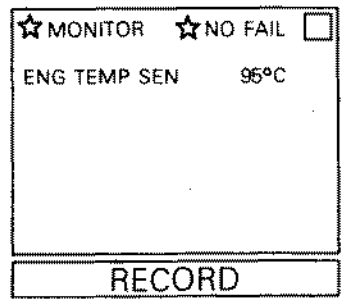
Harness layout





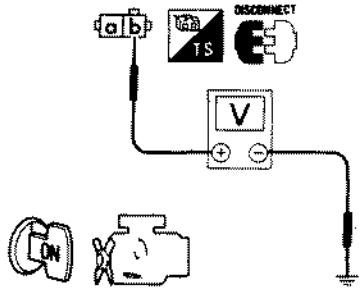
Diagnostic Procedure 25 (Cont'd)

A



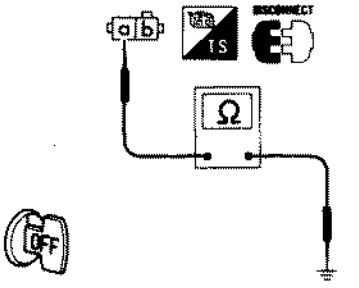
SEF825K

A



MEF976A

B



MEF977A

INSPECTION START

A

CHECK POWER SUPPLY.

1) Start engine and warm it up sufficiently.
2) Select engine temperature sensor signal in "DATA MONITOR" mode with CONSULT.
3) Stop engine
4) When restarting engine make sure that CONSULT indicates "ENG.TEMP SEN" is 50°C (122°F) or more.

N.G. → Check the following.
- Harness connectors (F7), (E222)
- Harness continuity between E.C.U. and engine temperature sensor.

If N.G., repair harness or connectors.

OR

1) Disconnect engine temperature sensor harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal (b) and ground.
Voltage: Approximately 5V

O.K.

B

CHECK GROUND CIRCUIT.

1) Turn ignition switch "OFF".
2) Check harness continuity between terminal (a) and engine ground.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (F7), (E222)
- Harness continuity between E.C.U. and engine temperature sensor.

If N.G., repair harness or connectors.

O.K.

CHECK COMPONENT (Engine temperature sensor). Refer to "Electrical Components Inspection". (See page EF & EC- 630.)

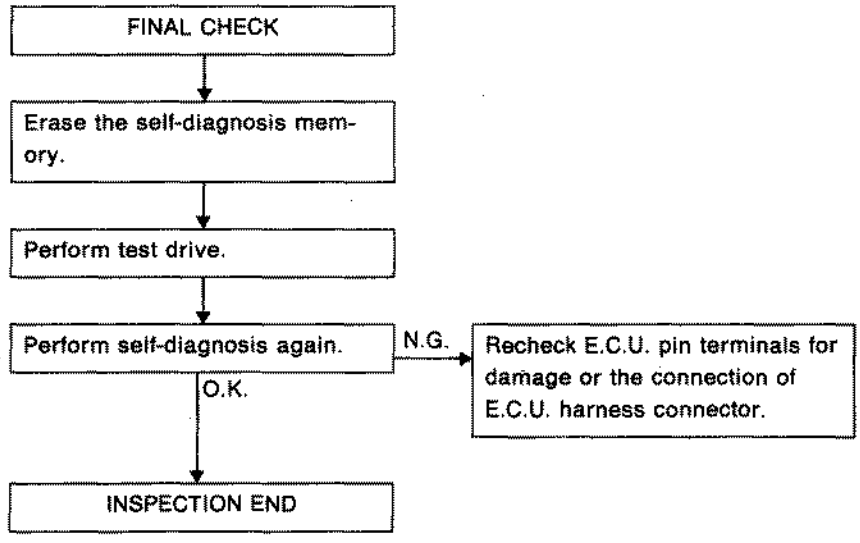
N.G. → Replace engine temperature sensor.

O.K.

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

Diagnostic Procedure 25 (Cont'd)

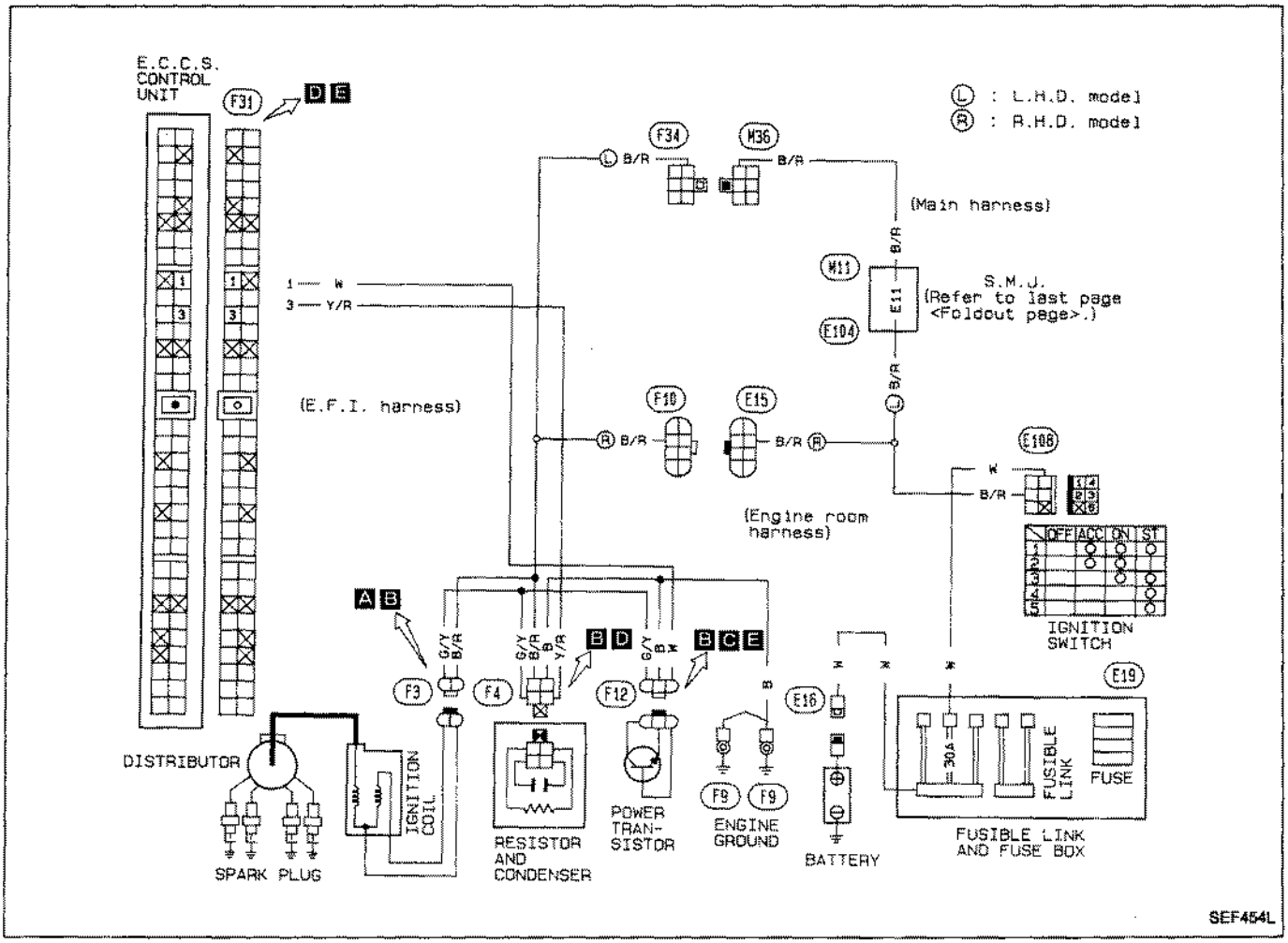
Perform FINAL CHECK by the following procedure after repair is completed.



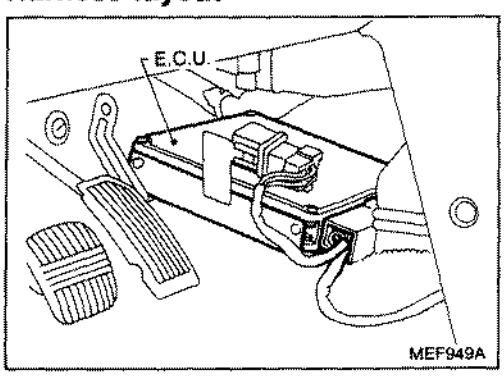
NOTE

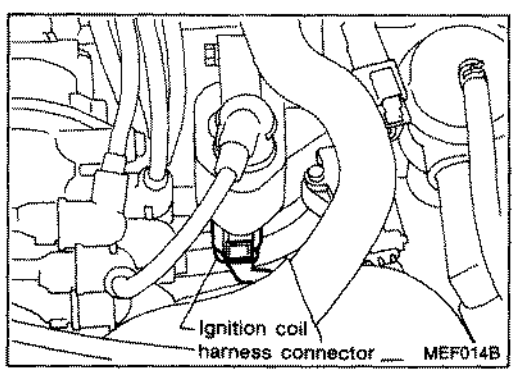
Diagnostic Procedure 26

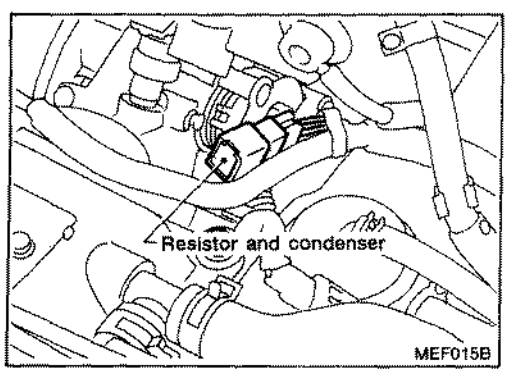
IGNITION SIGNAL (Code No. 21)

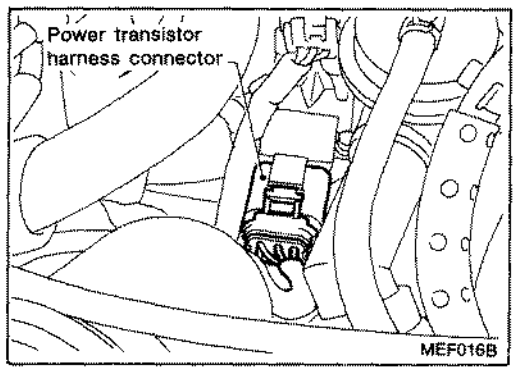


Harness layout

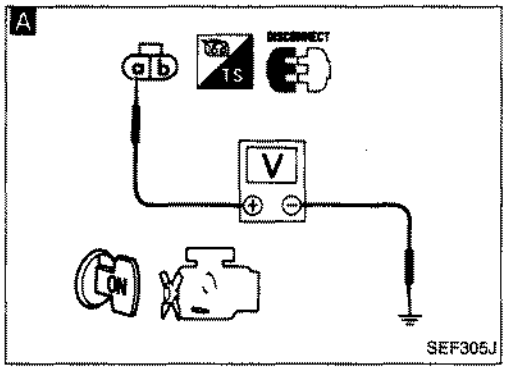


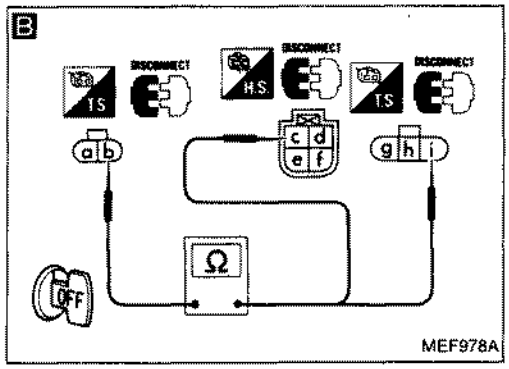


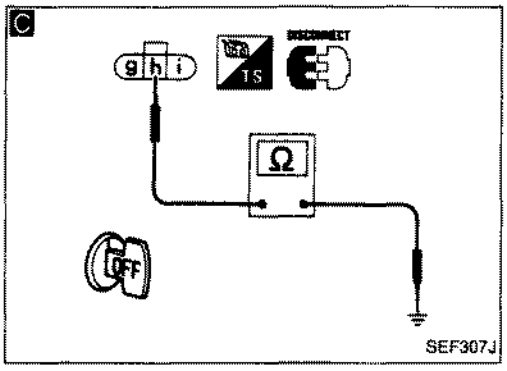


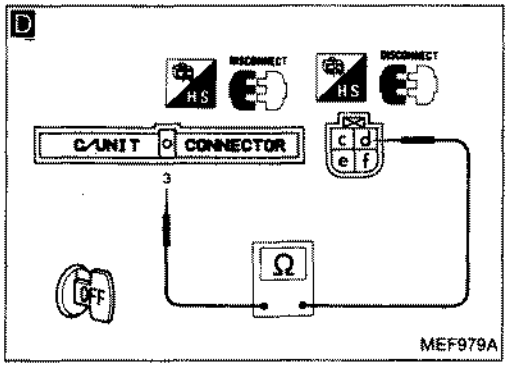


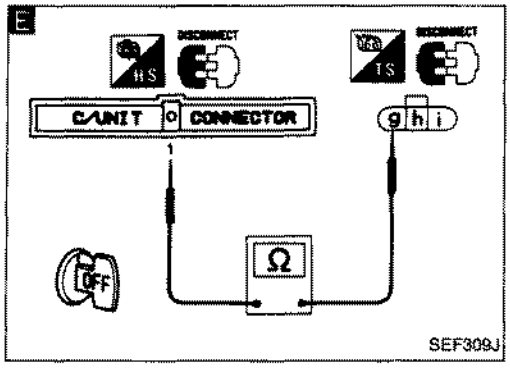
Diagnostic Procedure 26 (Cont'd)











INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect ignition coil harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓐ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors F34 , M56 (L.H.D. models)
- Harness connectors M31 , E104 (L.H.D. models)
- Harness connectors F18 , E15 (R.H.D. models)
- Harness continuity between ignition coil and ignition switch

If N.G., repair harness or connectors.

O.K. ↓

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect resistor harness connector.
3) Disconnect power transistor harness connector.

B 4) Check harness continuity between terminal ⓑ and terminals ⓒ , ⓘ .
Continuity should exist.

C 5) Check harness continuity between terminal ⓗ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

D

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between terminal ⓓ and E.C.U. terminal ③ .
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

E

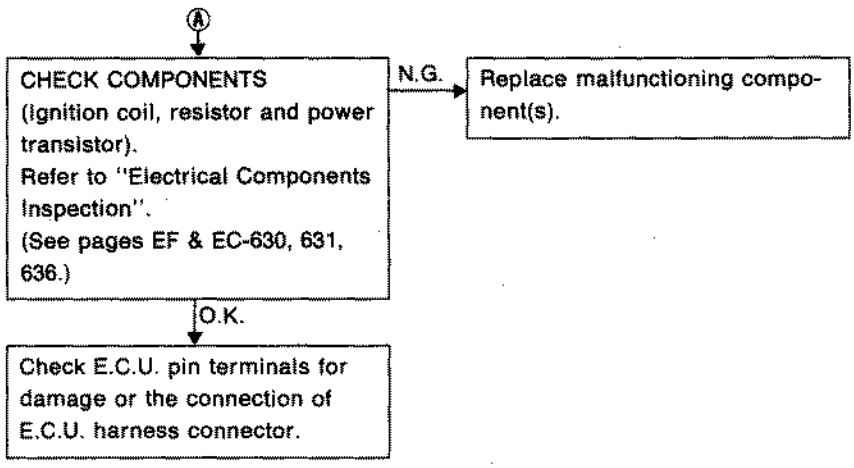
CHECK OUTPUT SIGNAL CIRCUIT.
1) Check harness continuity between terminal ⓖ and E.C.U. terminal ① .
Continuity should exist.

N.G. → Repair harness or connectors.

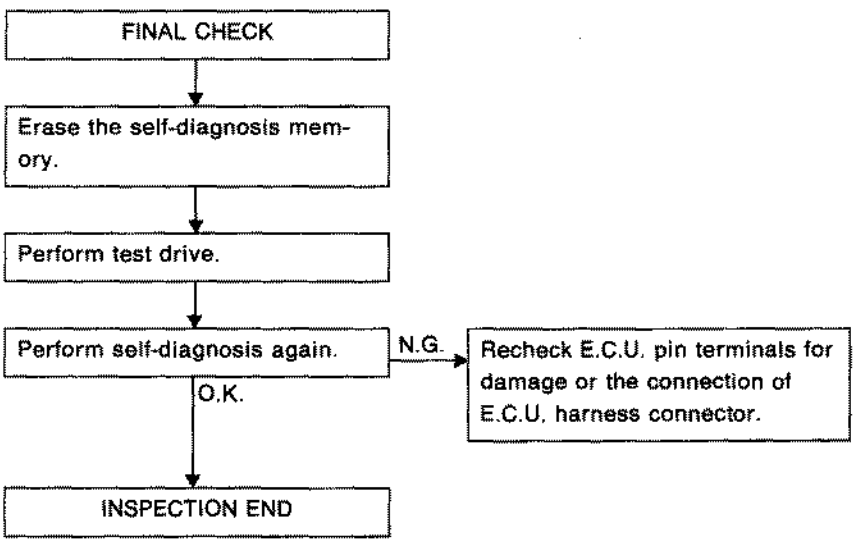
O.K. ↓

Ⓐ

Diagnostic Procedure 26 (Cont'd)



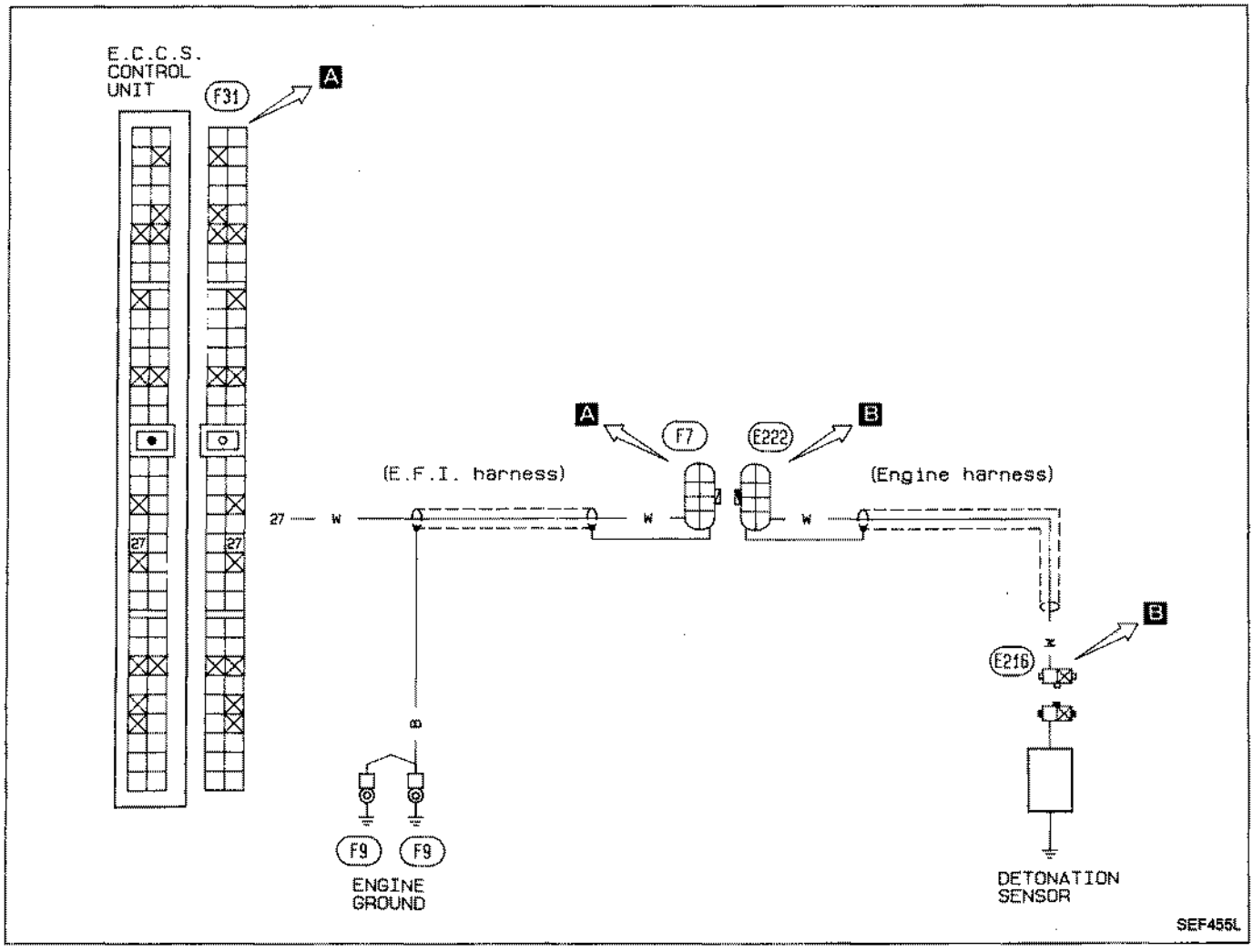
Perform FINAL CHECK by the following procedure after repair is completed.



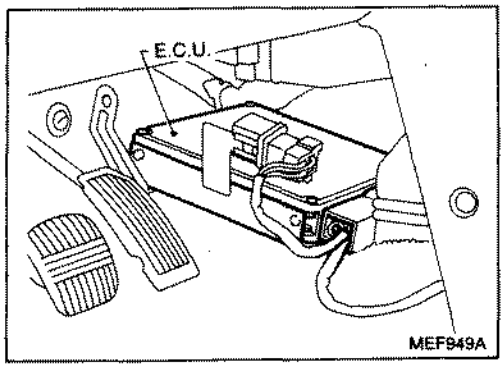
NOTE

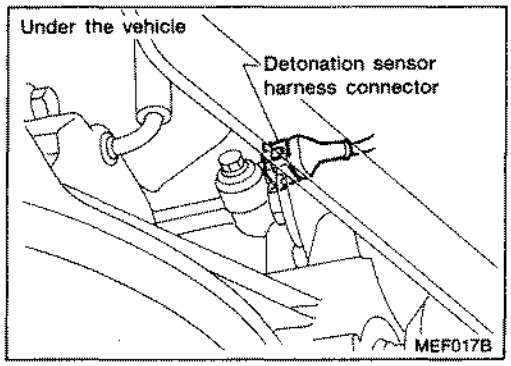
Diagnostic Procedure 27

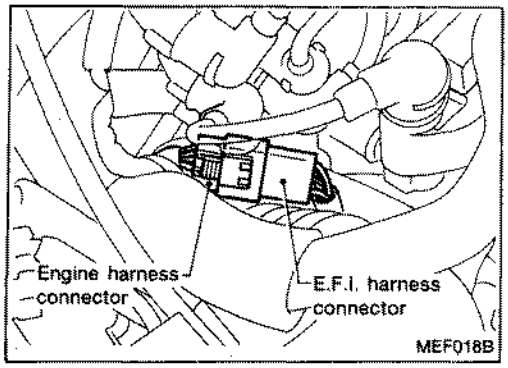
DETONATION SENSOR (Code No. 34)



Harness layout

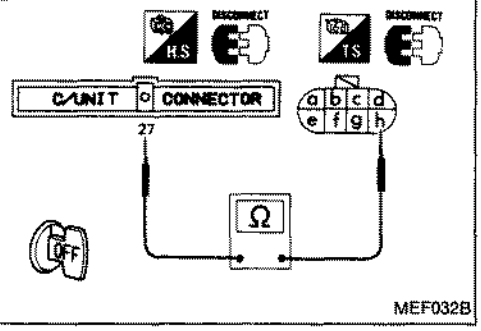






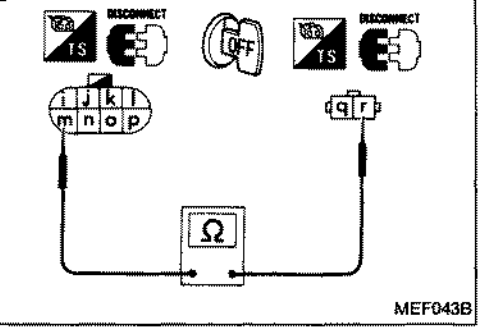
Diagnostic Procedure 27 (Cont'd)

A



MEF032B

B



MEF043B

INSPECTION START

CHECK INPUT SIGNAL CIRCUIT.
A 1) Disconnect E.C.U. harness connector, E.F.I. harness connector and engine harness connector.
2) Check harness continuity between terminal ⓗ and E.C.U. terminal ㉗.
Continuity should exist.
3) Disconnect detonation sensor harness connector.
B 4) Check harness continuity between terminal ⓜ and terminal ⓡ.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

CHECK COMPONENT (Detonation sensor).
Refer to "Electrical Components Inspection".
(See page EF & EC-634.)

N.G. → Replace detonation sensor.

O.K.

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

Perform FINAL CHECK by the following procedure after repair is completed.

FINAL CHECK

Erase the self-diagnosis memory.

Perform test drive.

Perform self-diagnosis again.

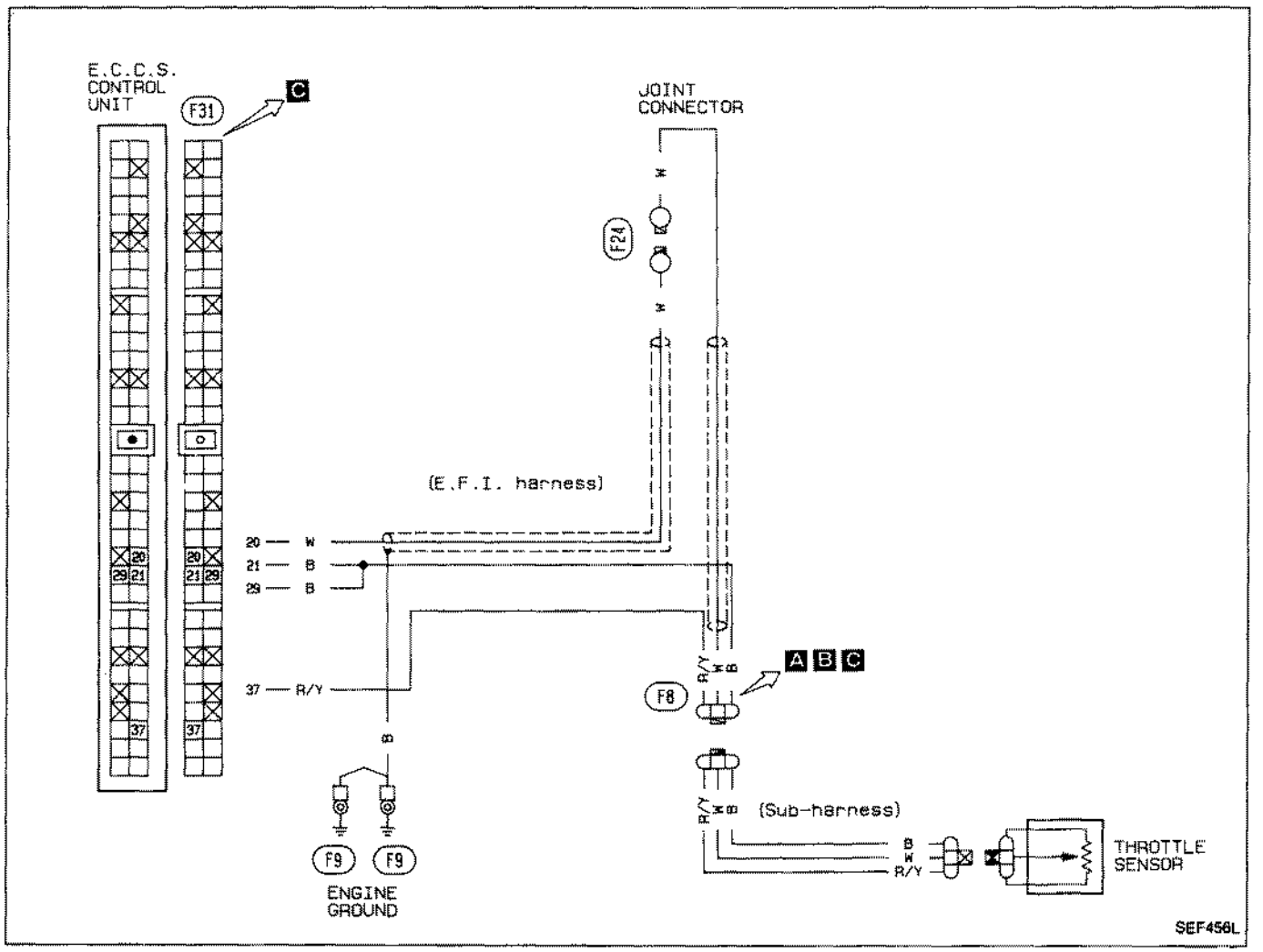
N.G. → Recheck E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K.

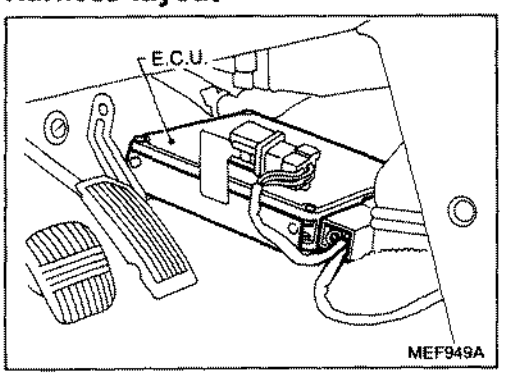
INSPECTION END

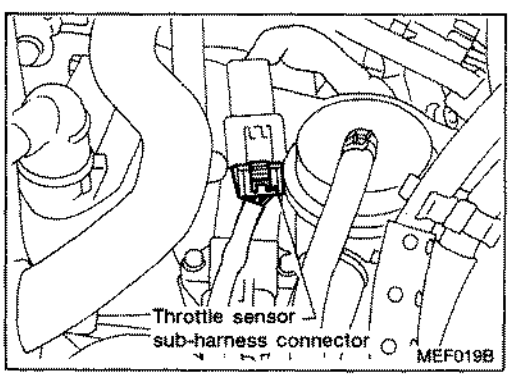
Diagnostic Procedure 28

THROTTLE SENSOR (Code No. 43)



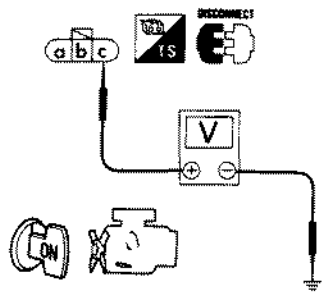
Harness layout





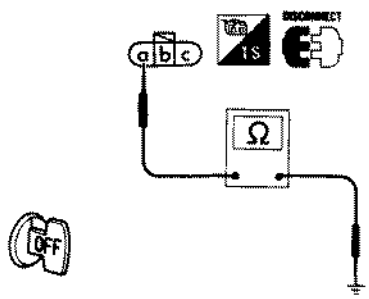
Diagnostic Procedure 28 (Cont'd)

A



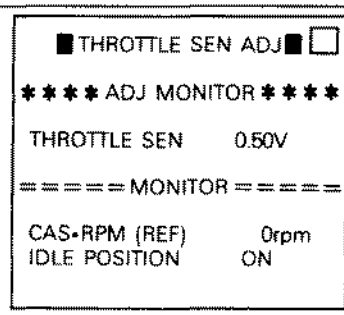
SEF033B

B



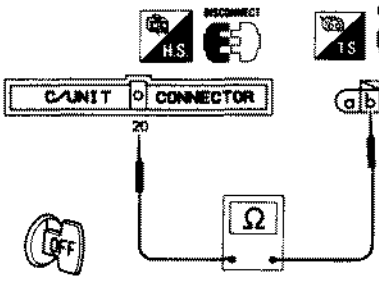
MEF034B

C



SEF275L

C



MEF035B

INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect throttle sensor sub-harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓒ and ground.
Voltage: Approximately 5V

N.G. → Repair harness or connectors.

O.K.

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓐ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

C

CHECK INPUT SIGNAL CIRCUIT.

1) Reconnect throttle sensor sub-harness connector.
2) Turn ignition switch "ON".
3) Read throttle sensor output voltage in "WORK SUPPORT" mode with CONSULT.
Throttle valve fully closed:
0.45 - 0.55V
Throttle valve fully open:
Approx. 4.0V

N.G. → Check the following.
- Joint connector (F24)
- Harness continuity between E.C.U. and throttle sensor

If N.G., repair harness or connectors.

OR

1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal ⑳ and terminal ⓑ.
Continuity should exist.

O.K.

CHECK COMPONENT (Throttle sensor).
Refer to "Electrical Components Inspection".
(See page EF & EC-632.)

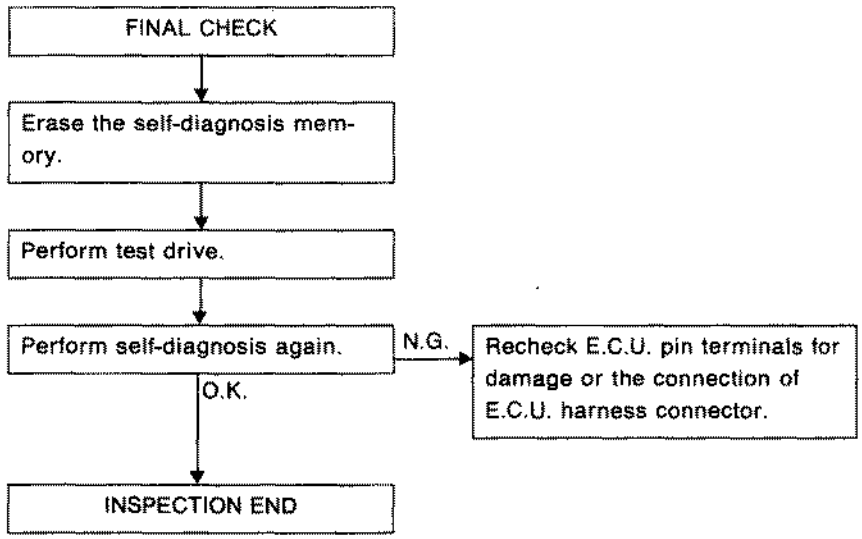
N.G. → Replace throttle sensor.

O.K.

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

Diagnostic Procedure 28 (Cont'd)

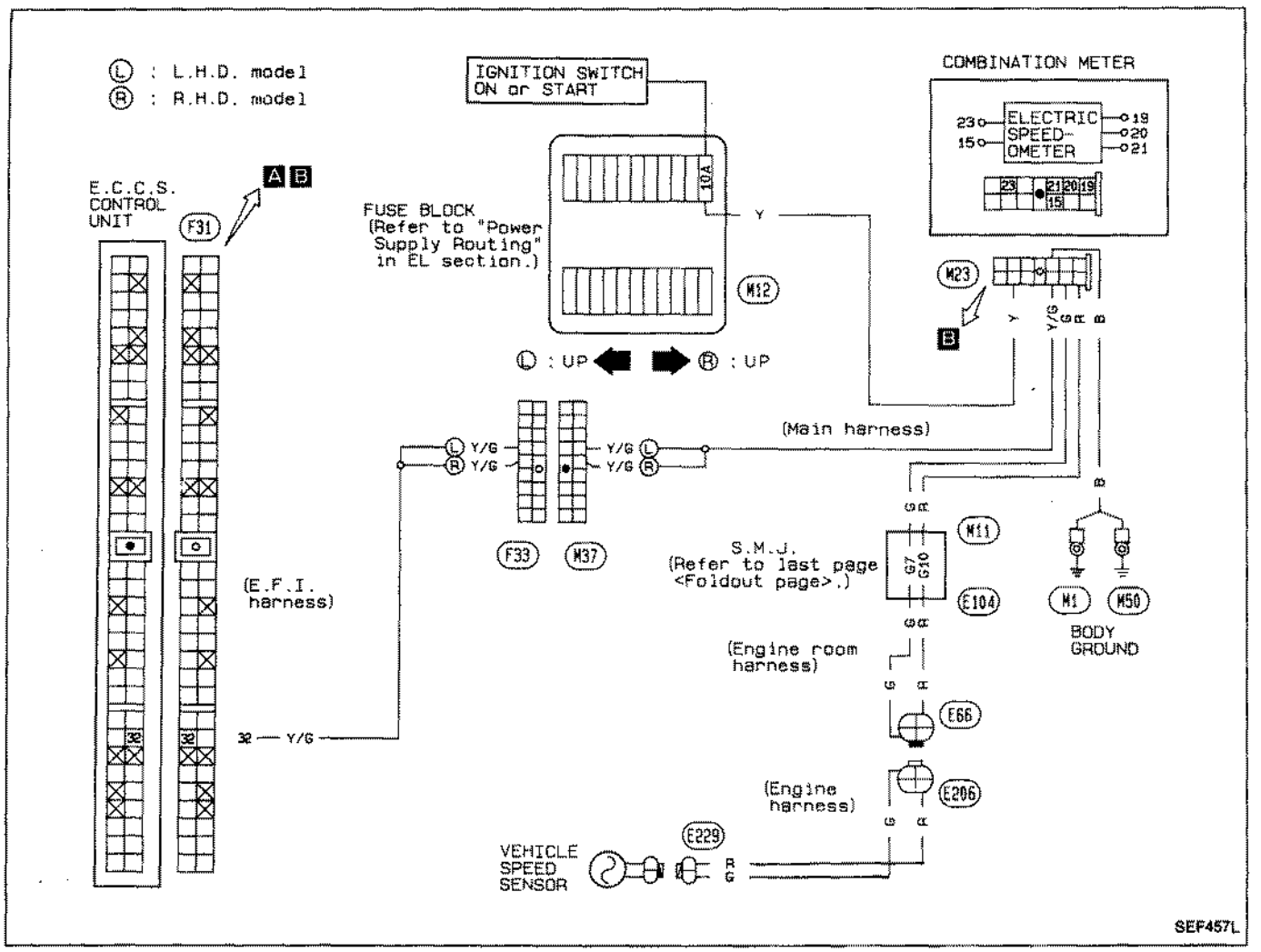
Perform FINAL CHECK by the following procedure after repair is completed.



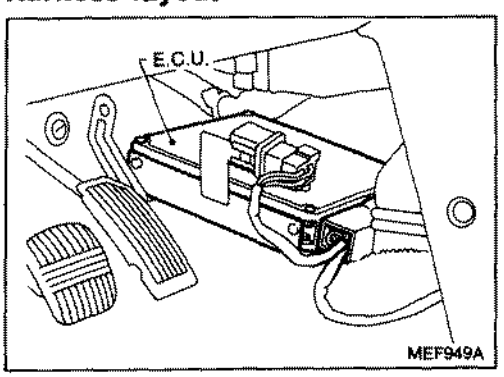
NOTE

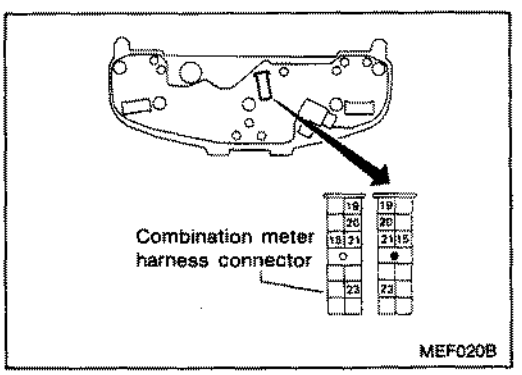
Diagnostic Procedure 29

VEHICLE SPEED SENSOR (Not self-diagnostic item)

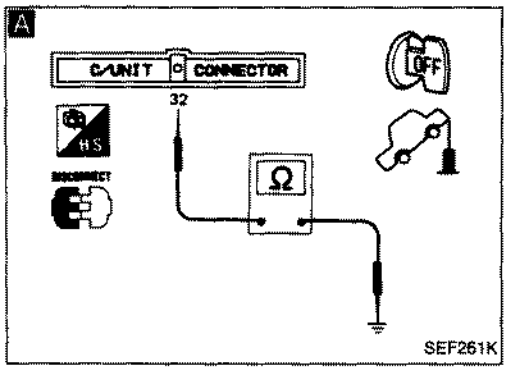


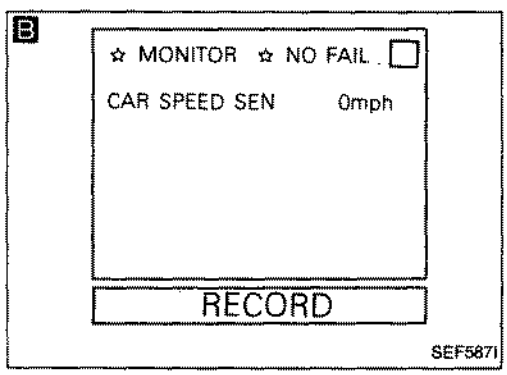
Harness layout

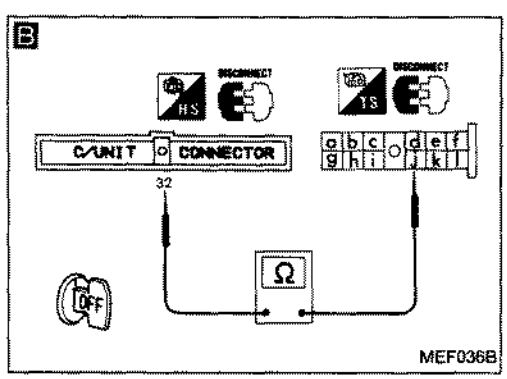




Diagnostic Procedure 29 (Cont'd)







INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Jack up front wheels.
2) Disconnect E.C.U. harness connector.
3) Rotate front wheel by hand.
4) Check harness continuity between E.C.U. terminal (32) and body ground.
Continuity should come and go.

O.K. → INSPECTION END

N.G.

CHECK SPEEDOMETER FUNCTION.
Make sure that speedometer functions properly.

N.G. → Check vehicle speed sensor and circuit.
(Refer to EL section.)

O.K.

B

CHECK INPUT SIGNAL CIRCUIT.
1) Reconnect E.C.U. harness connector.
2) Read vehicle speed sensor signal in "DATA MONITOR" mode with CONSULT.
CONSULT value should be the same as the speedometer indication.

N.G. → Check the following.
- Harness connectors (F33), (M37)
- Harness continuity between E.C.U. and combination meter

If N.G., repair harness or connectors.

OR

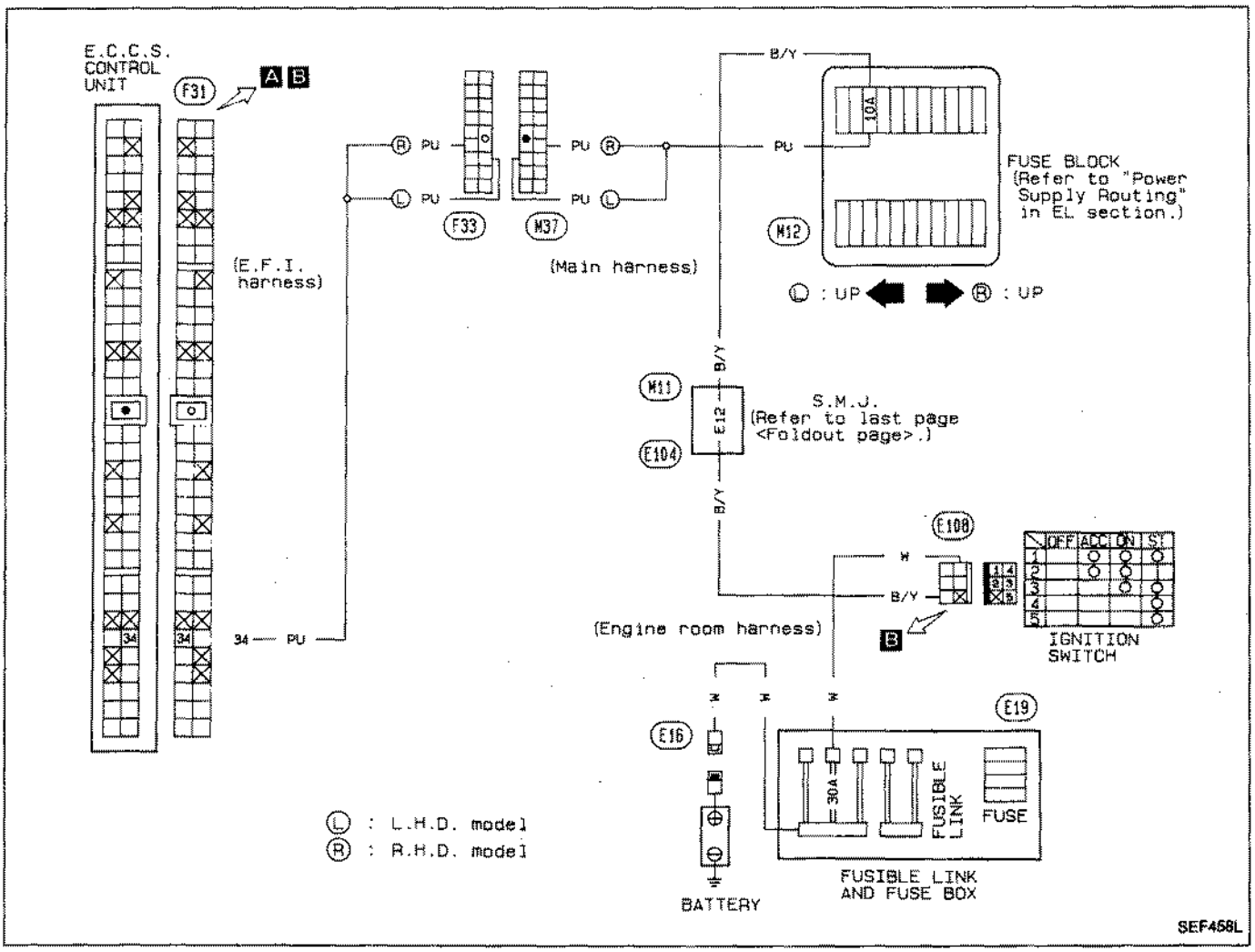
1) Turn ignition switch "OFF".
2) Disconnect combination meter harness connector.
3) Check harness continuity between E.C.U. terminal (32) and terminal (j).
Continuity should exist.

O.K.

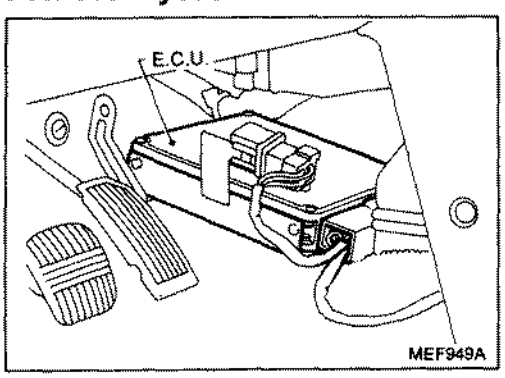
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Diagnostic Procedure 30

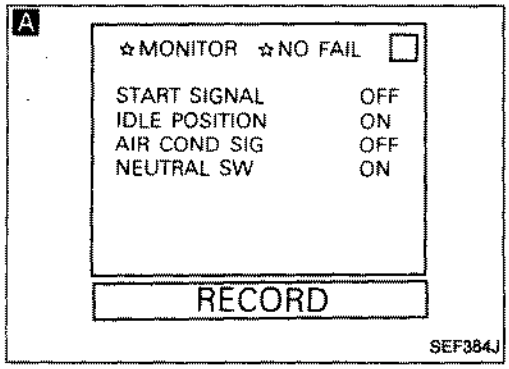
START SIGNAL (Not self-diagnostic item)

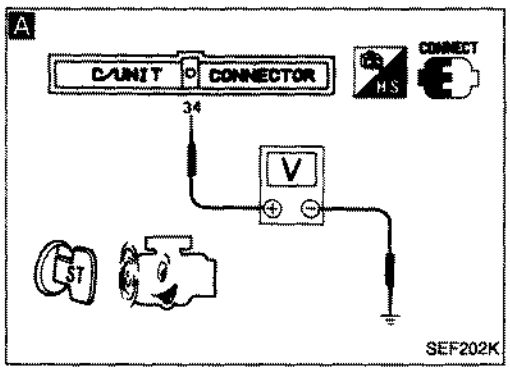


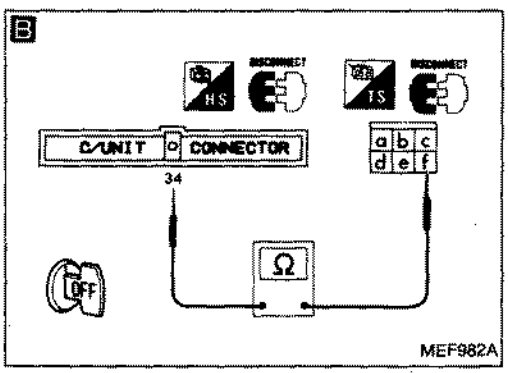
Harness layout



Diagnostic Procedure 30 (Cont'd)







INSPECTION START

A

CHECK OVERALL FUNCTION.

1) Turn ignition switch "ON".
2) Check start signal in "DATA MONITOR" mode with CONSULT.

IGN "ON"	OFF
IGN "START"	ON

O.K. → INSPECTION END

OR

1) Turn ignition switch to "START".
2) Check voltage between E.C.U. terminal ㉞ and ground.

Voltage:
Ignition switch "START"
Battery voltage
Except above
Approximately 0V

N.G.

B

CHECK INPUT SIGNAL CIRCUIT.

1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector and ignition switch harness connector.
3) Check harness continuity between E.C.U. terminal ㉞ and terminal ⓕ.

Continuity should exist.

N.G. → Check the following.
- Harness connectors (F33), (M57)
- Harness connectors (M11), (E104)
- 10A fuse
- Harness continuity between E.C.U. and ignition switch

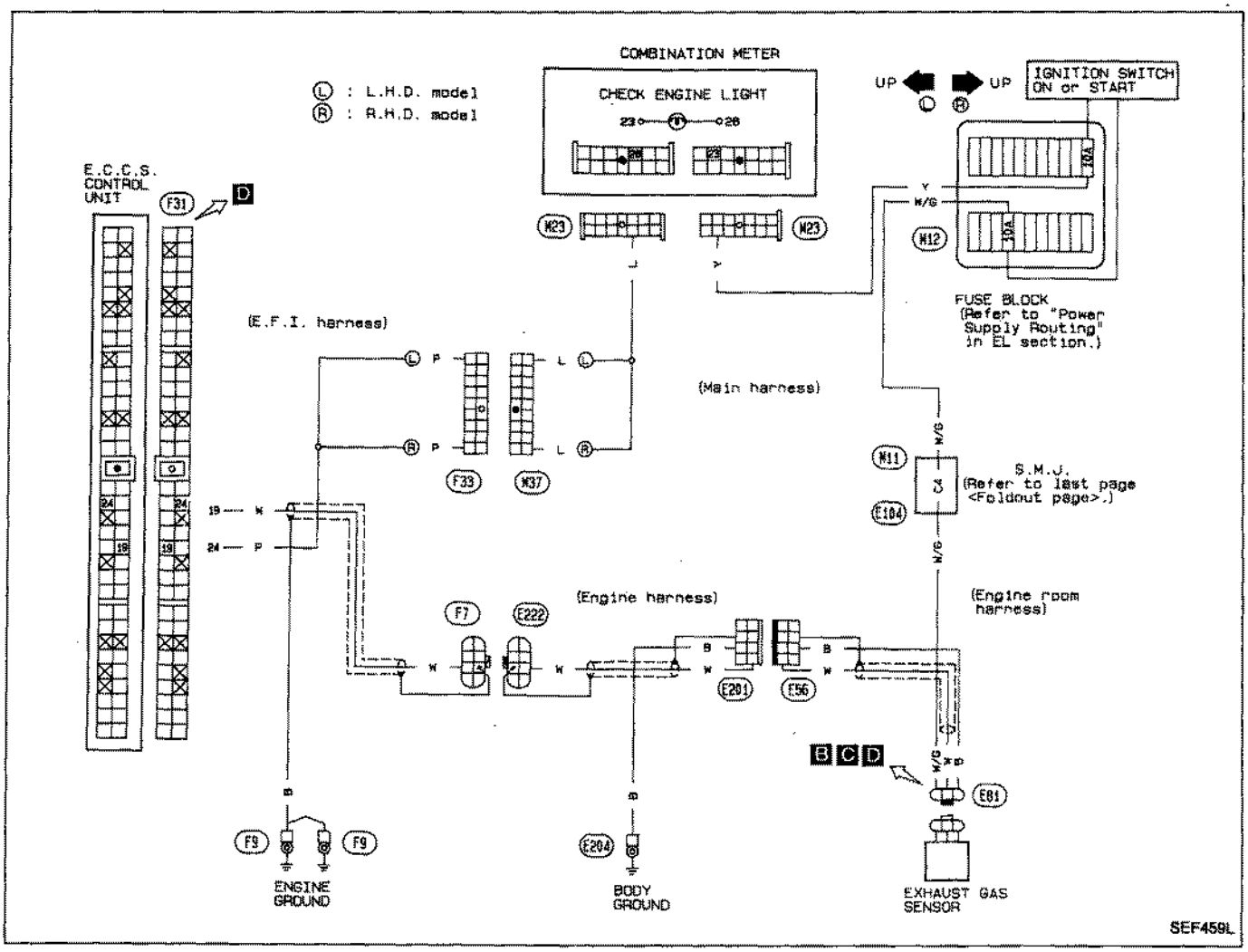
If N.G., repair harness or connectors.

O.K.

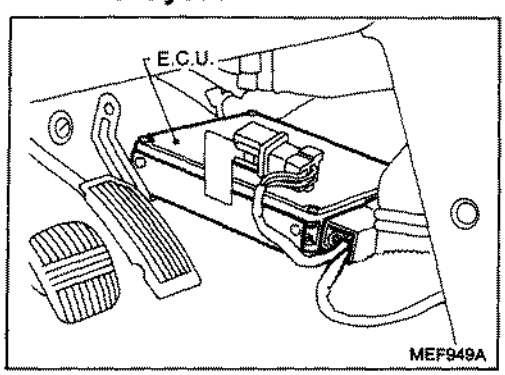
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

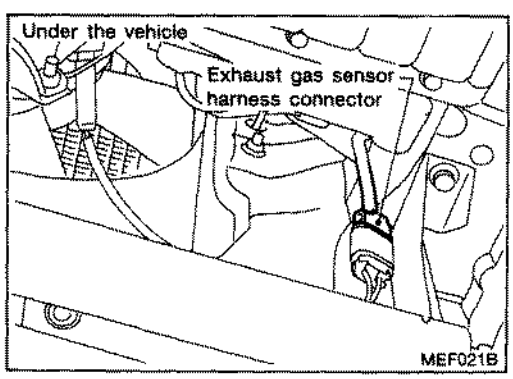
Diagnostic Procedure 31

EXHAUST GAS SENSOR (Not self-diagnostic item)



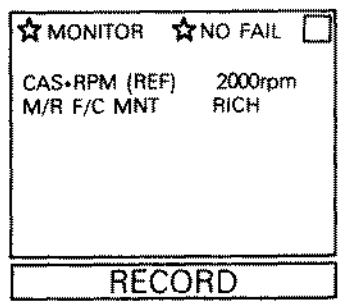
Harness layout





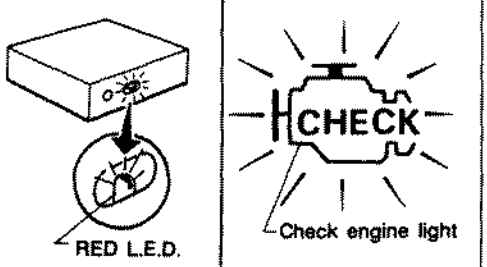
Diagnostic Procedure 31 (Cont'd)

A



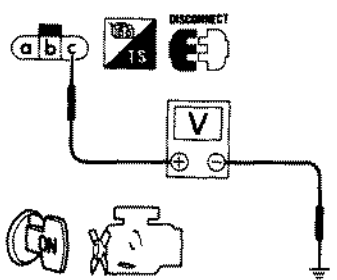
SEF818K

A



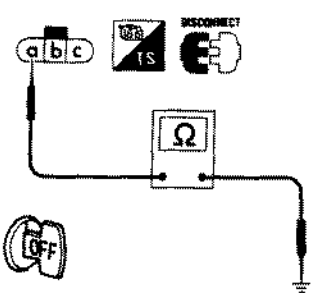
SEF621K

B



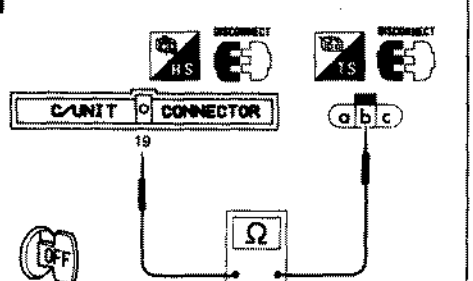
MEF037B

C



MEF038B

D



MEF039B

INSPECTION START

A

CHECK EXHAUST GAS SENSOR CIRCUIT.

1) Start engine and warm it up sufficiently.
2) Make sure that "M/R F/C MNT" in "DATA MONITOR" mode indicates "RICH" and "LEAN" periodically more than 5 times during 10 seconds at 2,000 rpm.

OR

1) Start engine and warm it up sufficiently.
2) Run engine at about 2,000 rpm for about 2 minutes under no-load.
3) Set E.C.U. diagnosis mode to Mode II.
4) Keep engine speed at 2,000 rpm and make sure that the RED L.E.D. on E.C.U. or the check engine light on the instrument panel goes on and off more than 5 times during 10 seconds.

O.K. → INSPECTION END

N.G. ↓

B

CHECK POWER SUPPLY.

1) Stop engine.
2) Disconnect exhaust gas sensor harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⑥ and ground.

Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (M11) , (E144)
- 10A fuse
- Harness continuity between exhaust gas sensor and fuse

If N.G., repair harness or connectors.

O.K. ↓

C

CHECK GROUND CIRCUIT.

1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⑧ and body ground.

Continuity should exist.

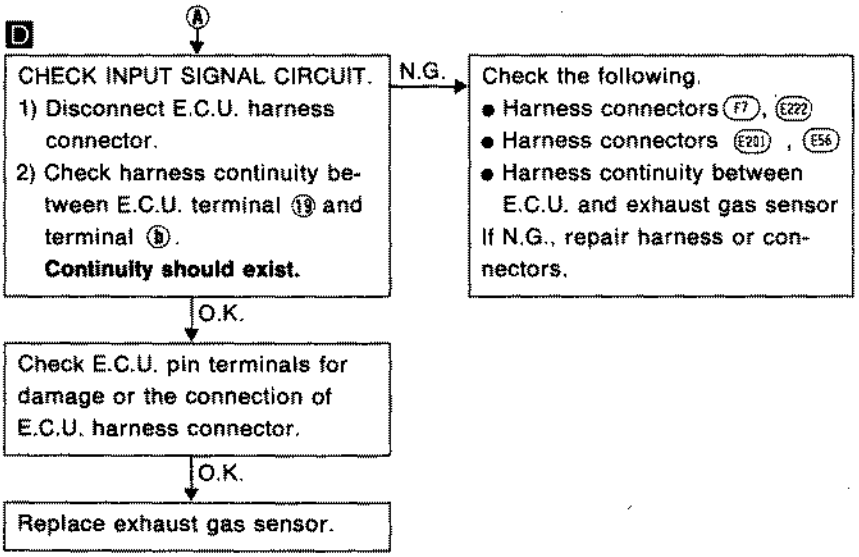
N.G. → Check the following.
- Harness connectors (E56) , (E201)
- Harness continuity between exhaust gas sensor and body ground

If N.G., repair harness or connectors.

O.K. ↓

Ⓐ

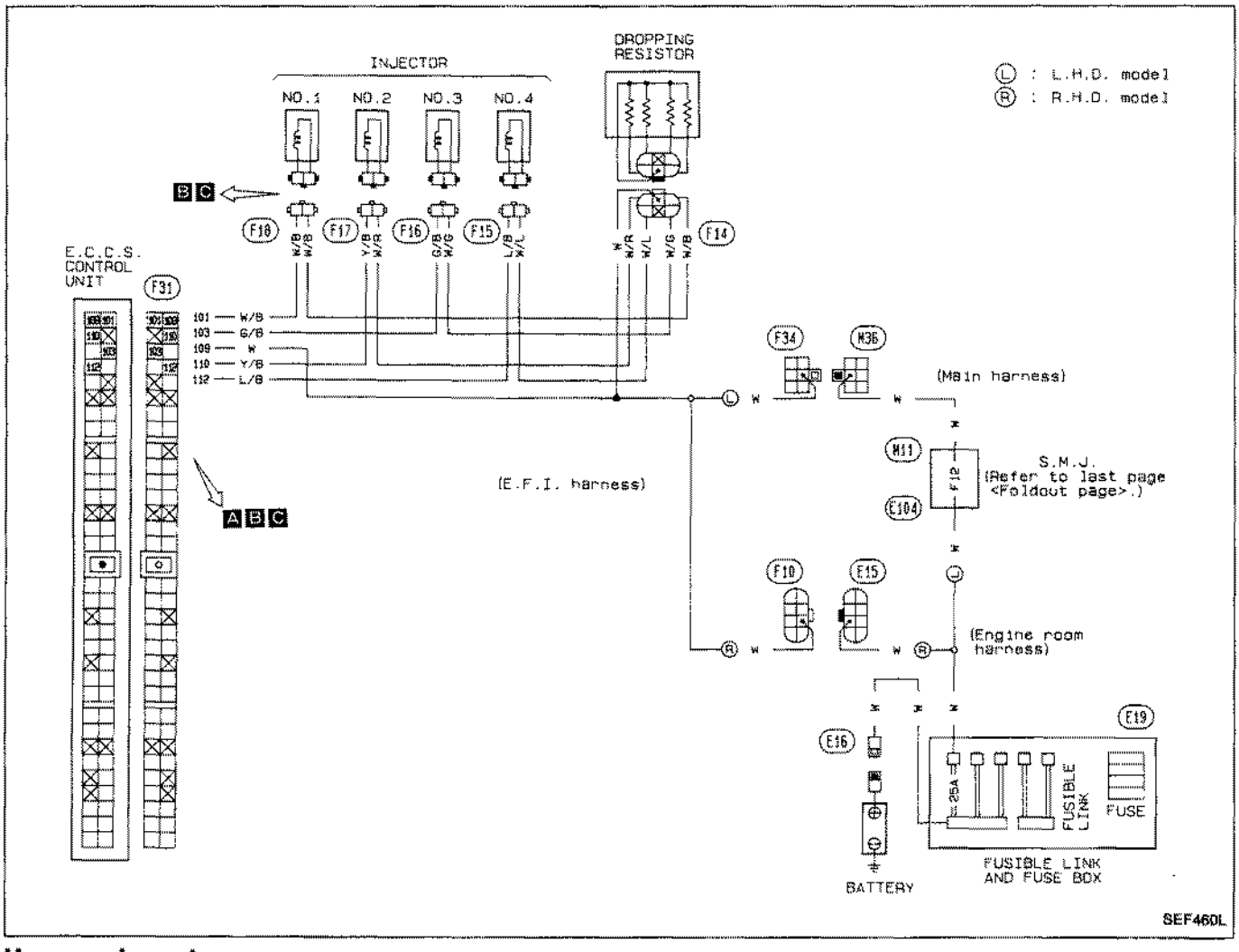
Diagnostic Procedure 31 (Cont'd)



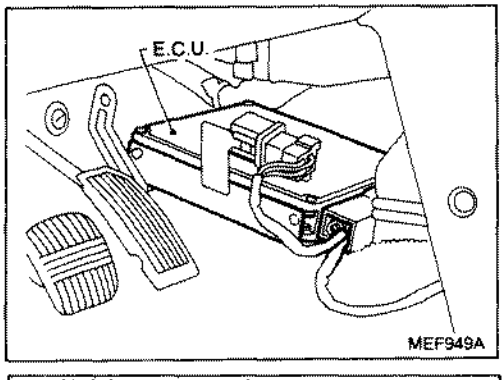
NOTE

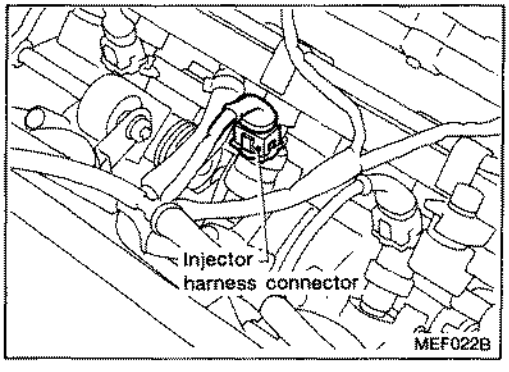
Diagnostic Procedure 32

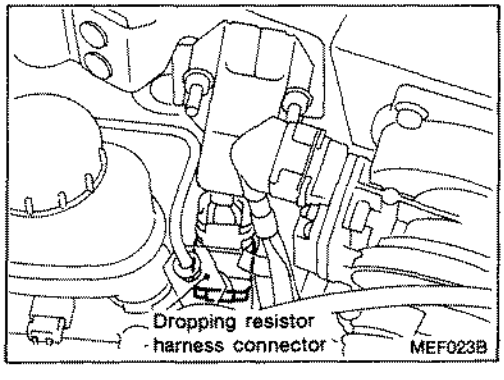
INJECTOR (Not self-diagnostic item)



Harness layout

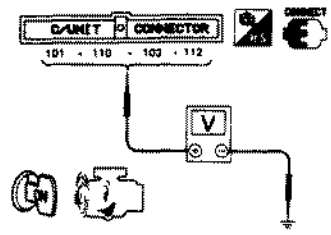






Diagnostic Procedure 32 (Cont'd)

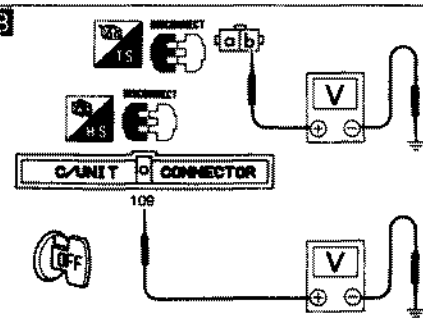
A



(101) : No. 1 cylinder (103) : No. 3 cylinder
(110) : No. 2 cylinder (112) : No. 4 cylinder

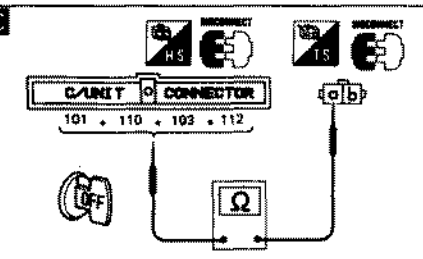
SEF974I

B



SEF205K

C



(101) : No. 1 cylinder (103) : No. 3 cylinder
(110) : No. 2 cylinder (112) : No. 4 cylinder

SEF206K

INSPECTION START

A

CHECK CONTROL FUNCTION.
1) Start engine.
2) Check voltage between E.C.U. terminals (101), (110), (103), (112) and ground.
Voltage: Battery voltage

O.K. → INSPECTION END

N.G.

B

CHECK POWER SUPPLY.
1) Stop engine.
2) Disconnect injector harness connector and E.C.U. harness connector.
3) Check voltage between terminal (b) and ground, E.C.U. terminal (109) and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (F34), (M36) (L.H.D. models)
- Harness connectors (M11), (E104) (L.H.D. models)
- Harness connectors (F10), (E15) (R.H.D. models)
- 25A fusible link
- Dropping resistor
  Refer to "Electrical Components Inspection".
  (See page EF & EC-636.)
- Harness continuity between battery and injector
- Harness continuity between battery and E.C.U.

If N.G., repair harness or connectors.

O.K.

C

CHECK OUTPUT SIGNAL CIRCUIT.
1) Check harness continuity between terminal (g) and E.C.U. terminals (101), (110), (103), (112).
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

CHECK COMPONENT (Injector).
Refer to "Electrical Components Inspection".
(See page EF & EC-635.)

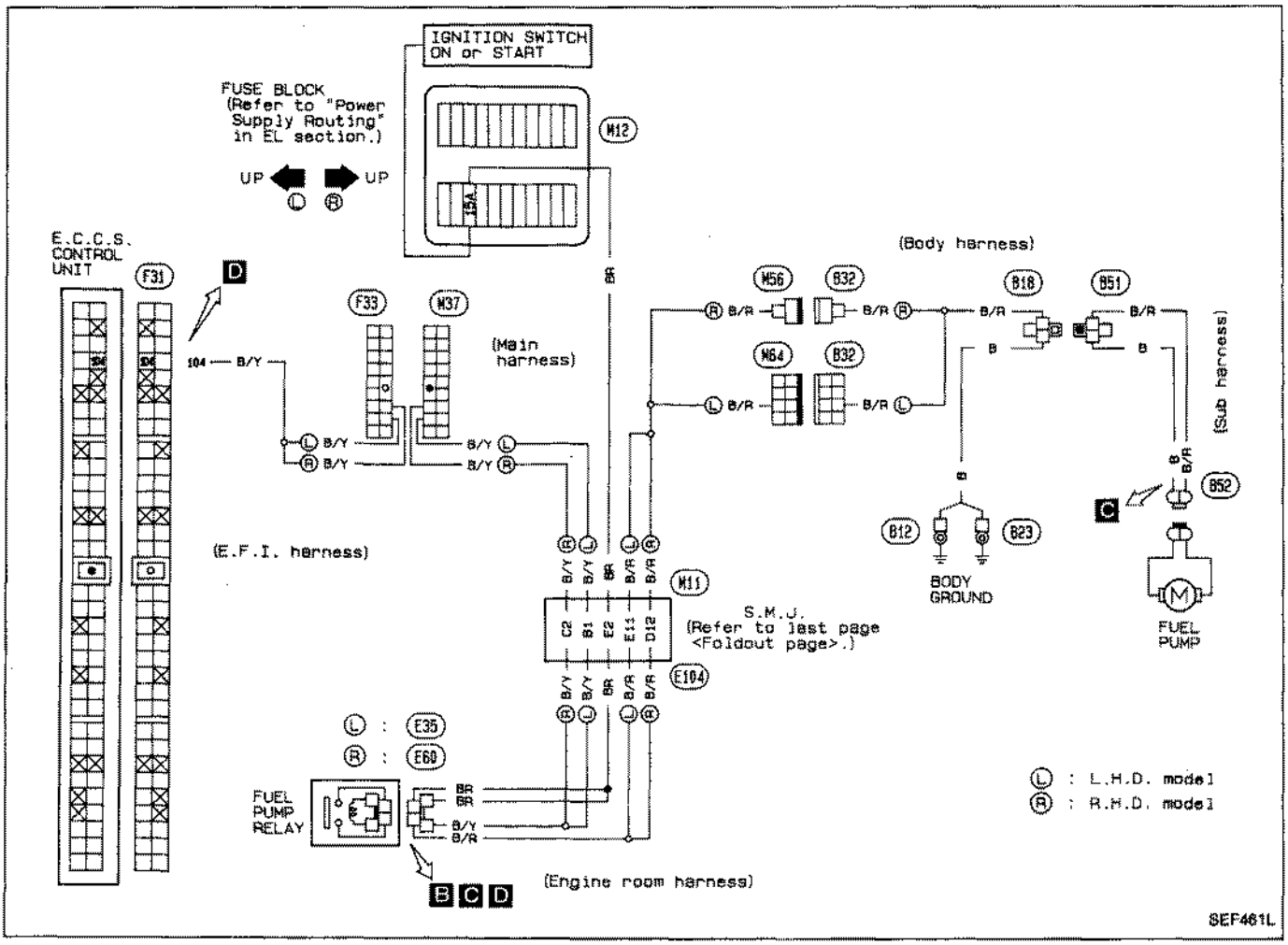
N.G. → Replace injector.

O.K.

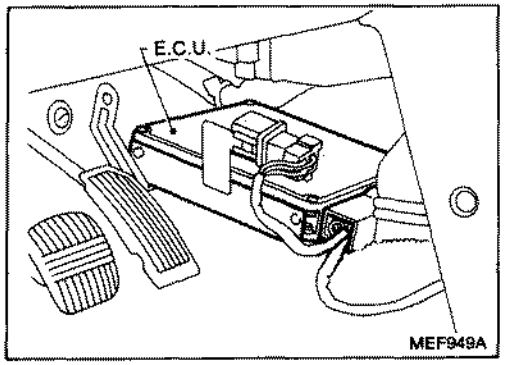
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

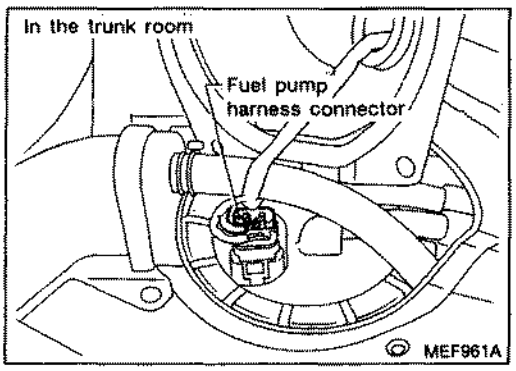
Diagnostic Procedure 33

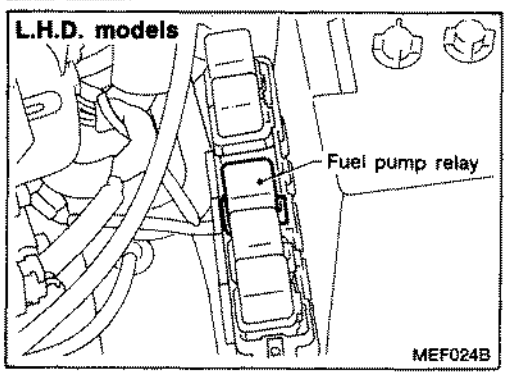
FUEL PUMP (Not self-diagnostic item)

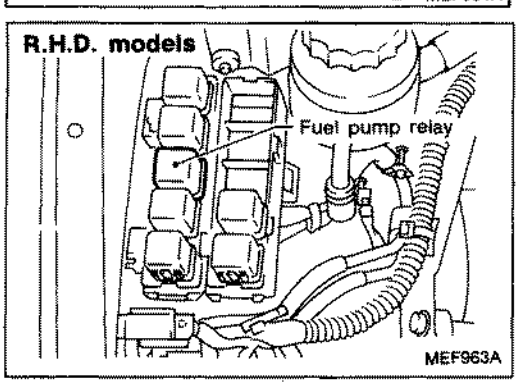


Harness layout



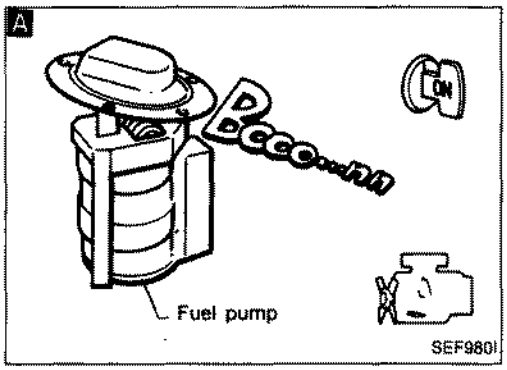






Diagnostic Procedure 33 (Cont'd)

A



INSPECTION START

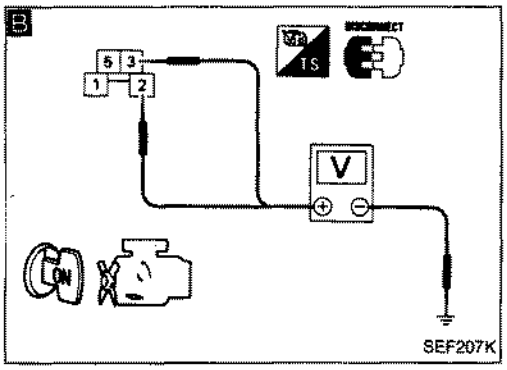
A

CHECK OVERALL FUNCTION.
1) Turn ignition switch "ON".
2) Listen to fuel pump operating sound.
Fuel pump should operate for 1 second after ignition switch is turned "ON".

O.K. → INSPECTION END

N.G.

B



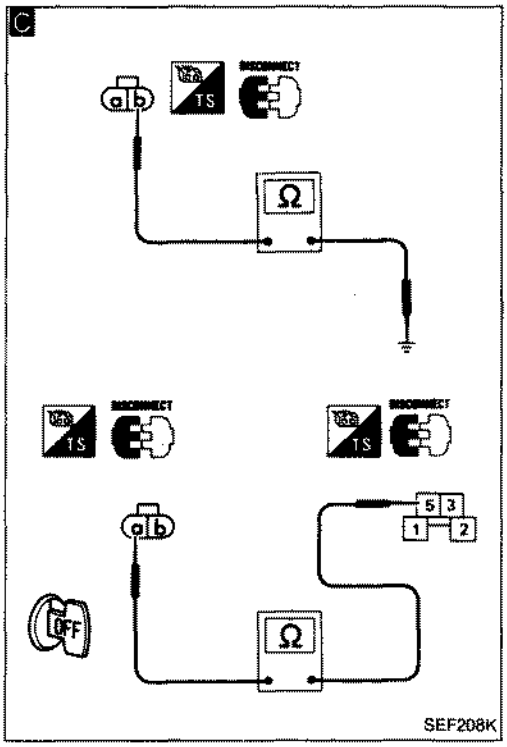
CHECK POWER SUPPLY.
1) Turn ignition switch "OFF".
2) Disconnect fuel pump relay.
3) Turn ignition switch "ON".
4) Check voltage between terminals ②, ③ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (M11), (E104)
- 15A fuse
- Harness continuity between fuse and fuel pump relay

If N.G., repair harness or connectors.

O.K.

C



CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect fuel pump harness connector.
3) Check harness continuity between terminal ⓑ and body ground, terminal ⓐ and terminal ⑤.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (B18), (B51)
- Harness connectors (M11), (E104)
- Harness connectors (M64), (B32) (L.H.D. models)
- Harness connectors (M56), (B32) (R.H.D. models)
- Harness continuity between fuel pump and body ground
- Harness continuity between fuel pump and fuel pump relay

If N.G., repair harness or connectors.

O.K.

D

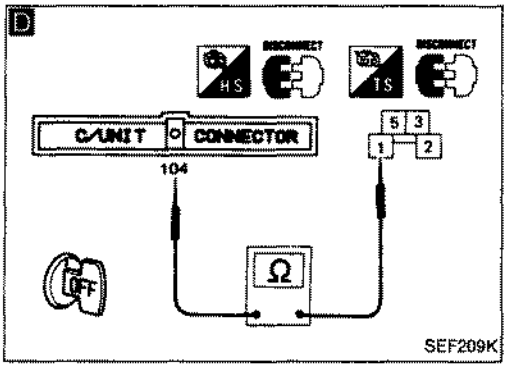
CHECK OUTPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal (104) and terminal ①.
Continuity should exist.

N.G. → Check the following:
- Harness connectors (F35), (M37)
- Harness connectors (M11), (E104)
- Harness continuity between E.C.U. and fuel pump relay

If N.G., repair harness or connectors.

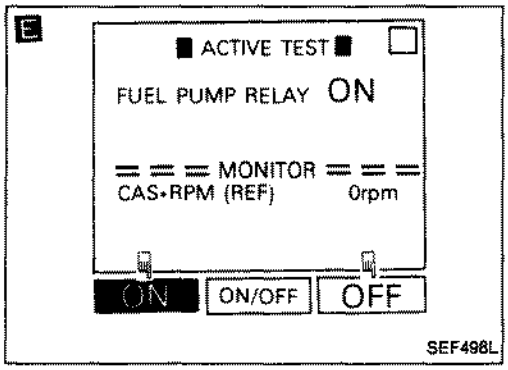
O.K.

D



Ⓐ

Diagnostic Procedure 33 (Cont'd)



E

Ⓐ

CHECK COMPONENT
(Fuel pump relay).

1) Reconnect fuel pump relay, fuel pump harness connector and E.C.U. harness connector.
2) Ignition switch "ON".
3) Turn fuel pump relay "ON" and "OFF" in "ACTIVE TEST" mode with CONSULT and check operating sound.

N.G. → Replace fuel pump relay.

OR

Refer to "Electrical Components Inspection". (See page EF & EC-635.)

O.K.

CHECK COMPONENT
(Fuel pump).
Refer to "Electrical Components Inspection".
(See page EF & EC-631.)

N.G. → Replace fuel pump.

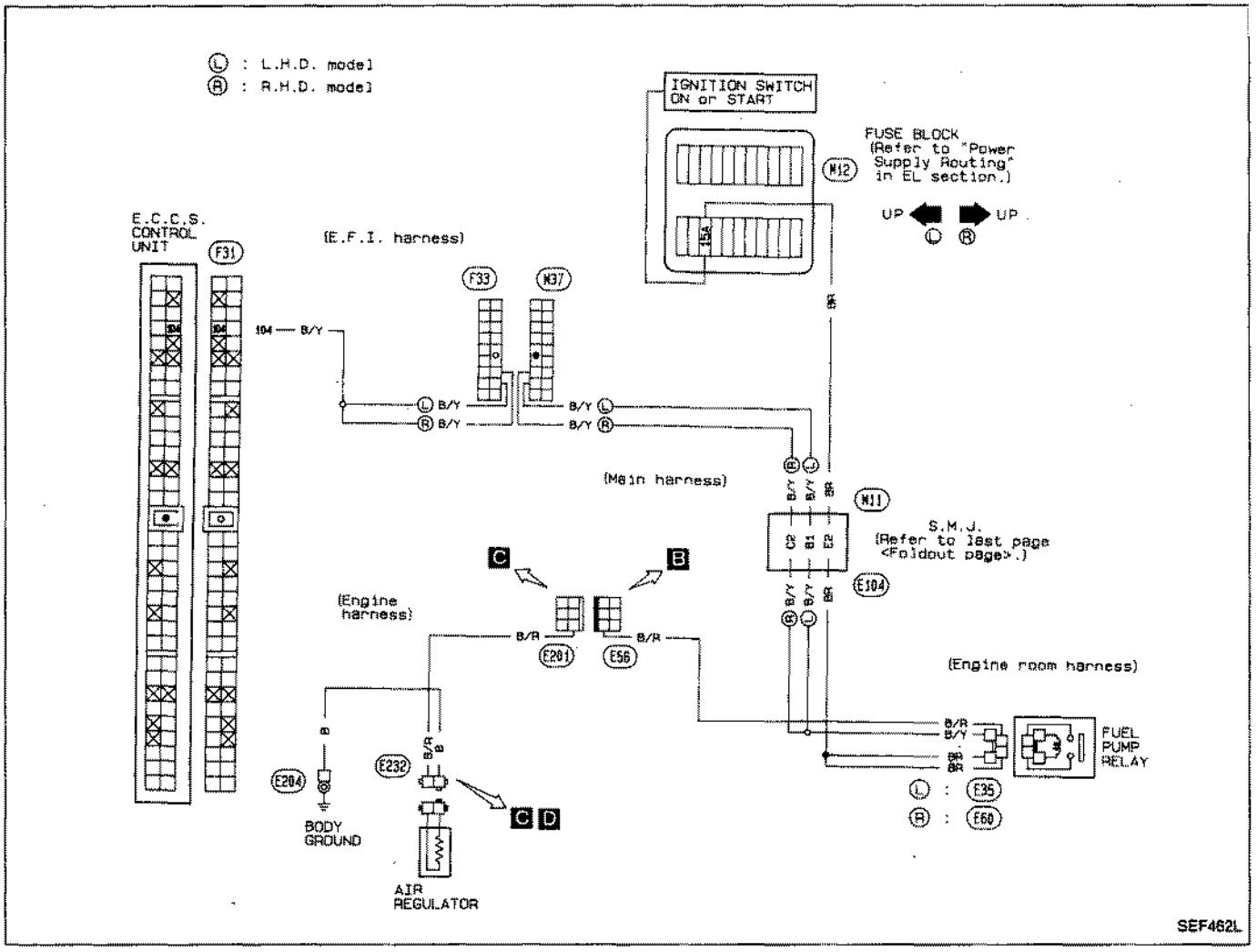
O.K.

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

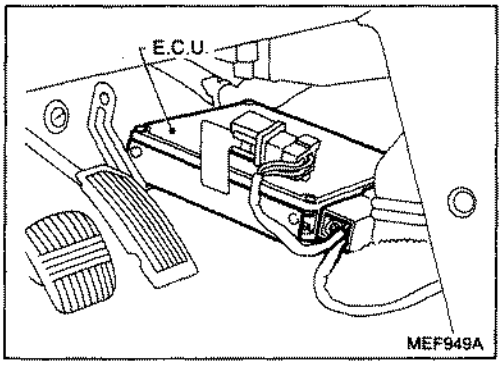
NOTE

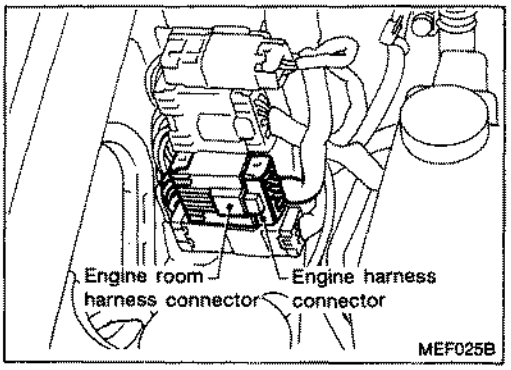
Diagnostic Procedure 34

AIR REGULATOR (Not self-diagnostic item)



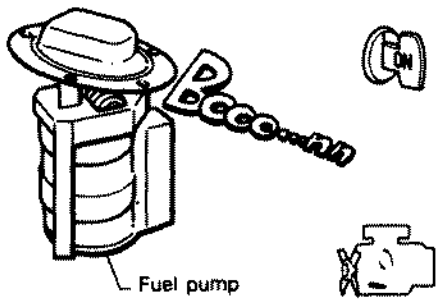
Harness layout





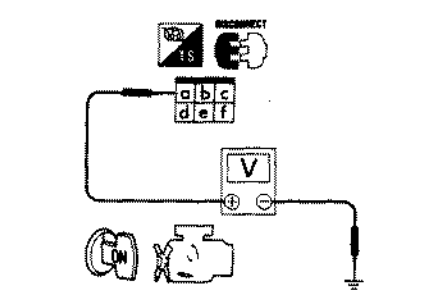
Diagnostic Procedure 34 (Cont'd)

A



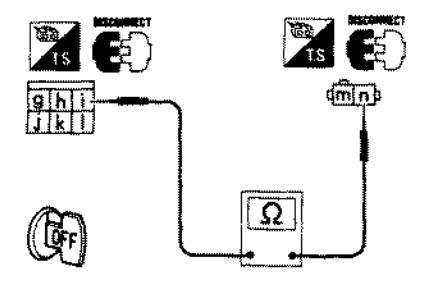
SEF980I

B



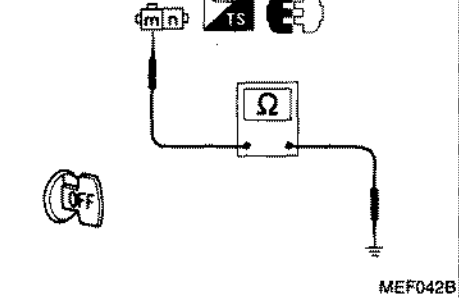
MEF040B

C



MEF041B

D



MEF042B

INSPECTION START

A

CHECK CONTROL FUNCTION.
1) Turn ignition switch "ON".
2) Listen to fuel pump operating sound.
Fuel pump should operate for 1 second after ignition switch is turned "ON".

N.G. → Check fuel pump control circuit. (See page EF & EC-596.)

O.K.

CHECK POWER SUPPLY.
B 1) Turn ignition switch "OFF".
2) Disconnect engine room harness connector and engine harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓐ and ground.
Battery voltage should exist for 1 second after ignition switch is turned "ON".
5) Turn ignition switch "OFF".
6) Disconnect air regulator harness connector.
C 7) Check harness continuity between terminal ⓘ and terminal ⓝ.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

D

CHECK GROUND CIRCUIT.
1) Check harness continuity between terminal ⓜ and body ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

CHECK COMPONENT (Air regulator).
Refer to "Electrical Components Inspection".
(See page EF & EC-634.)

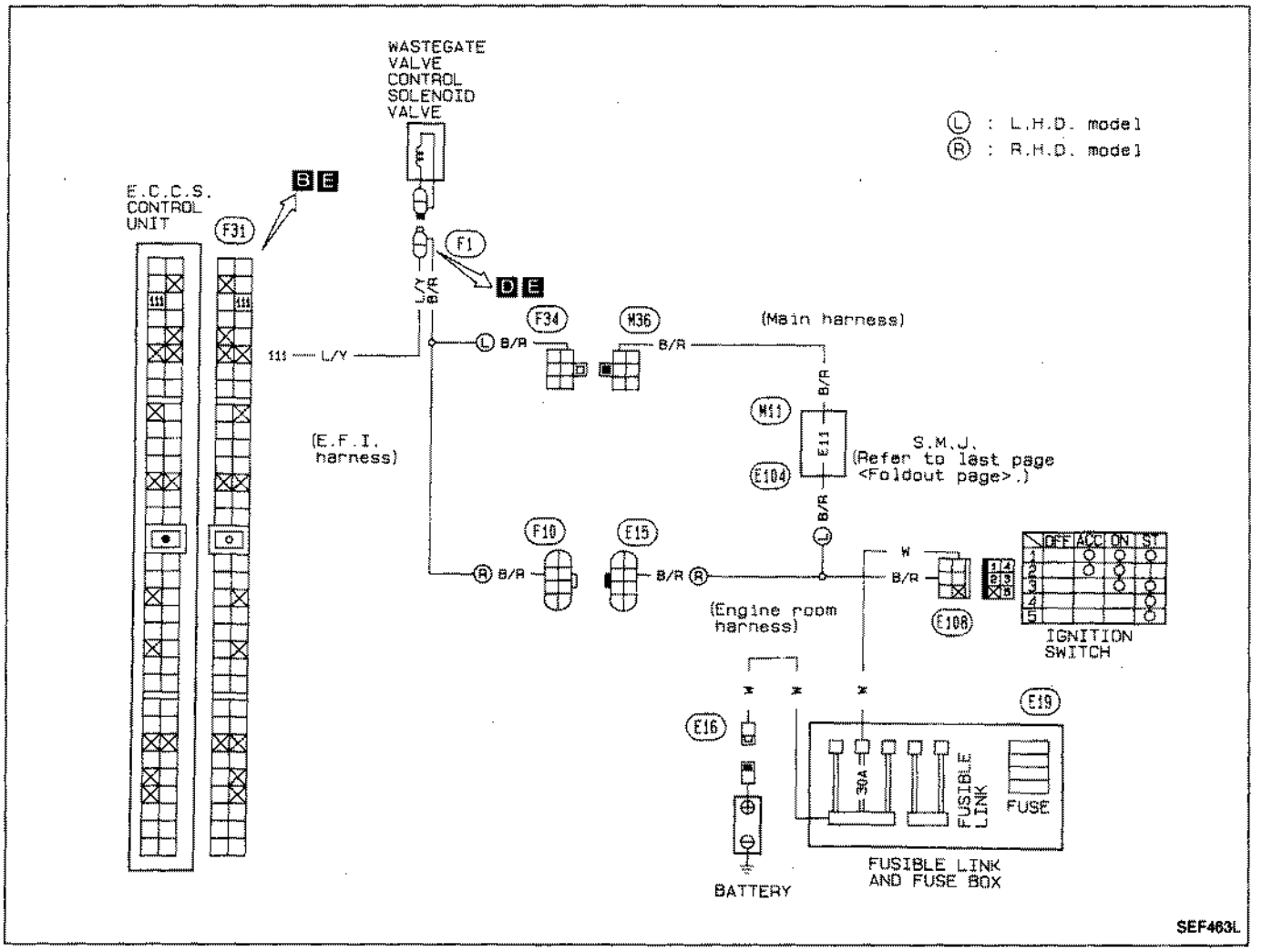
N.G. → Replace air regulator.

O.K.

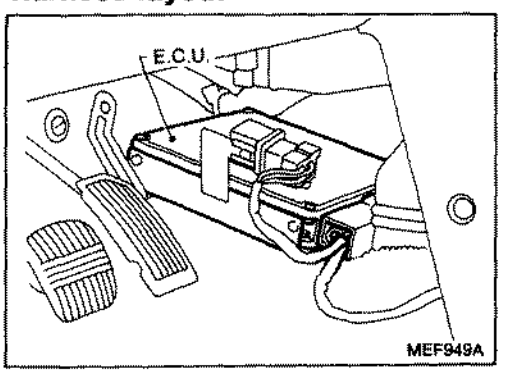
INSPECTION END

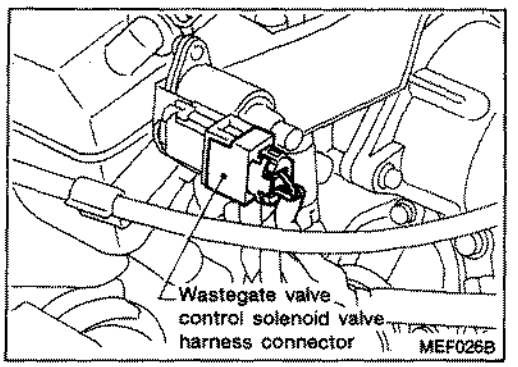
Diagnostic Procedure 35

WASTEGATE VALVE CONTROL (Not self-diagnostic item)



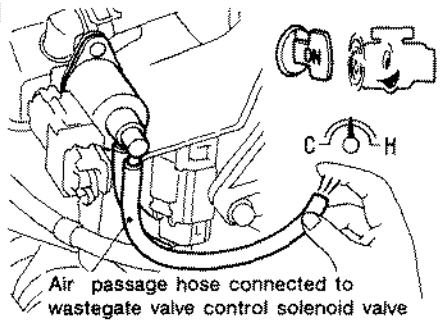
Harness layout



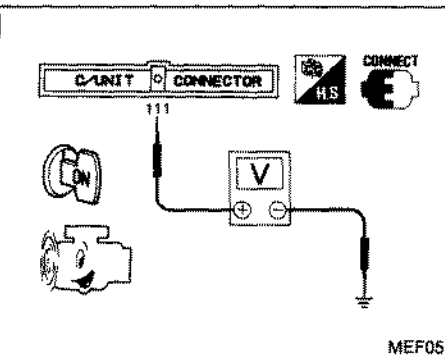


Diagnostic Procedure 35 (Cont'd)

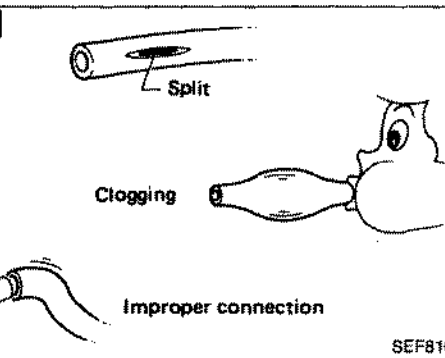
A



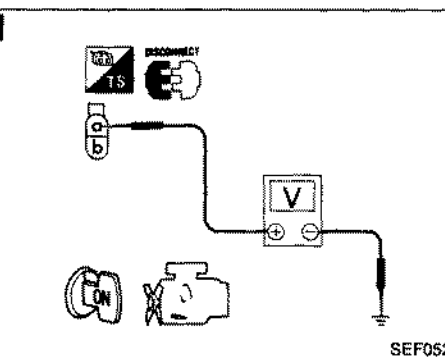
B



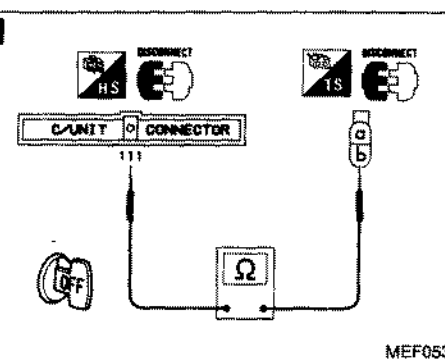
C



D



E



INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Perform self-diagnosis. Make sure that Code No. 34 is not displayed.
3) Stop engine.
4) Disconnect air passage hose to wastegate valve control solenoid valve and restart engine.
5) Make sure that boost pressure exists under the following conditions.
At idle:
Boost pressure should not exist.
When accelerator pedal is quickly depressed and released:
Boost pressure should exist.

O.K. → CHECK COMPONENT (Wastegate valve actuator).
Refer to "Electrical Components Inspection". (See page EF & EC-637.)
If N.G., replace wastegate valve actuator.

O.K. → INSPECTION END

N.G.

B

CHECK CONTROL FUNCTION.
1) Check voltage between E.C.U. terminal (11) and ground under the following conditions.
Voltage:
At idle
Battery voltage
When accelerator pedal is quickly depressed and released
Approximately 0 - 1.0V

O.K. → **C**
Check air passage hose for clogging, cracks and proper connection.

N.G.

D

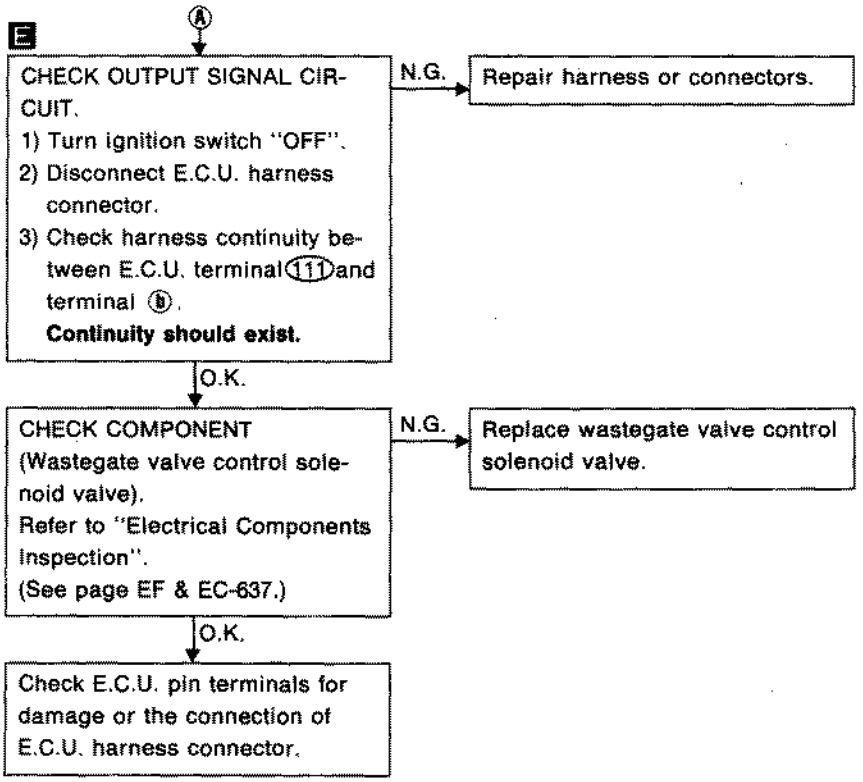
CHECK POWER SUPPLY.
1) Stop engine.
2) Disconnect wastegate valve control solenoid valve harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓐ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (F34), (R36) (L.H.D. models)
- Harness connectors (M11), (E104) (L.H.D. models)
- Harness connectors (F10), (E15) (R.H.D. models)
- Harness continuity between wastegate valve control solenoid valve and ignition switch.

If N.G., repair harness or connectors.

O.K. → Ⓐ

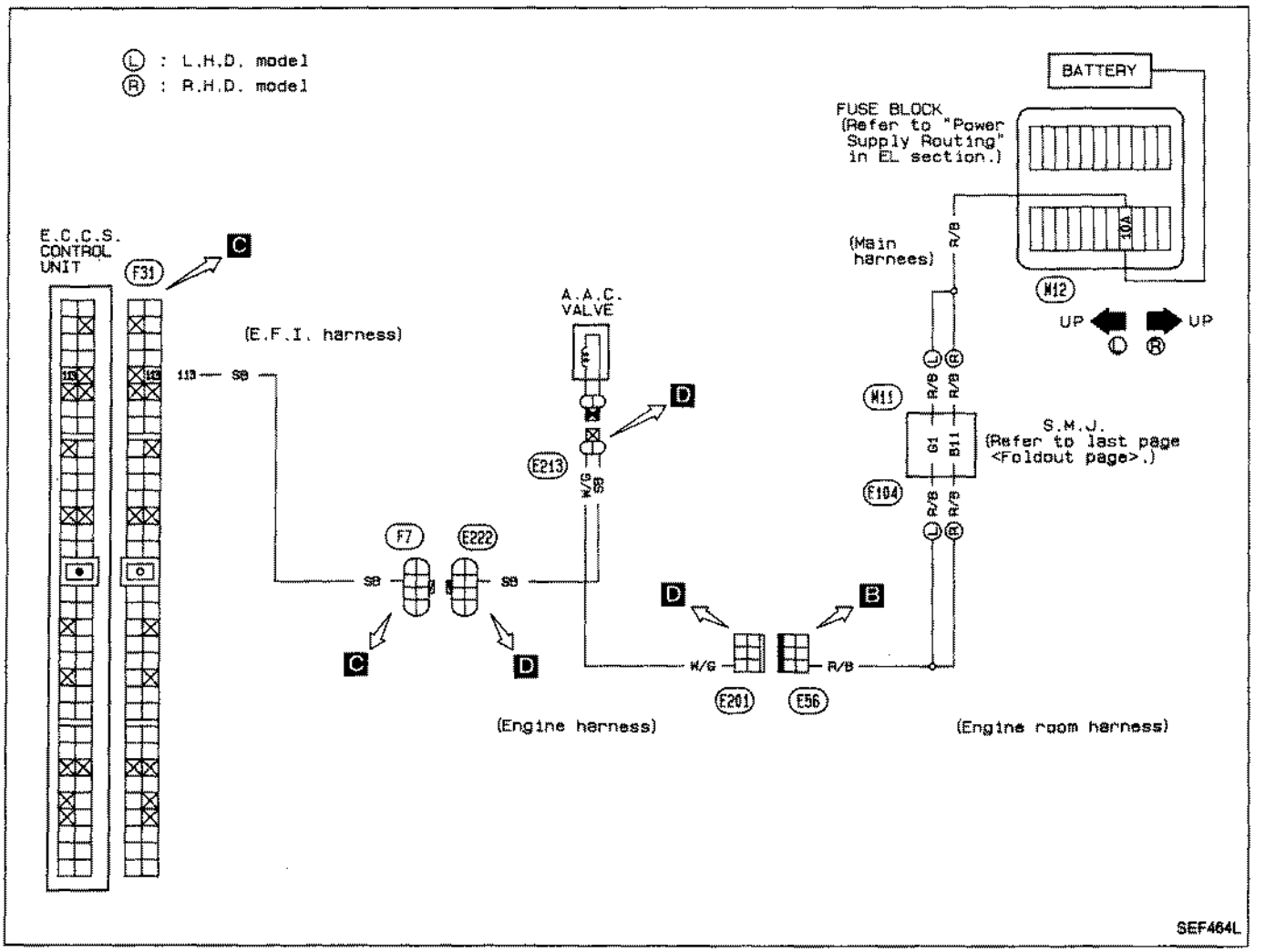
Diagnostic Procedure 35 (Cont'd)



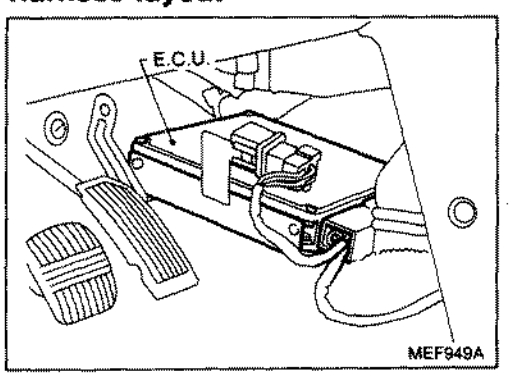
NOTE

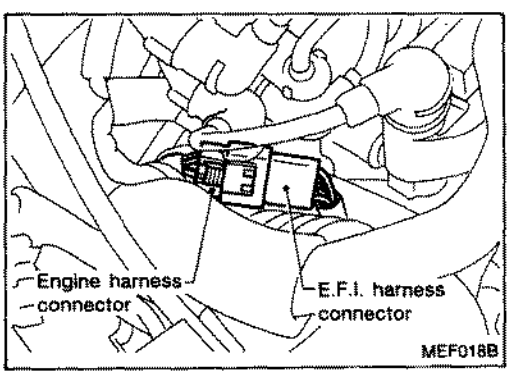
Diagnostic Procedure 36

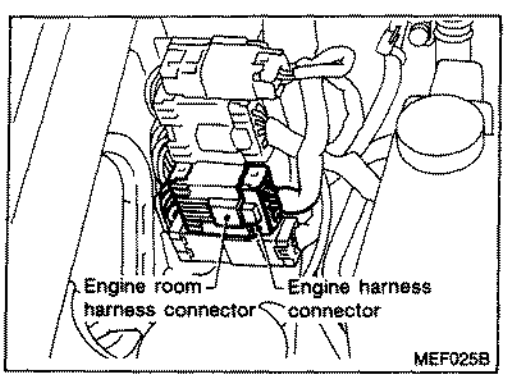
A.A.C. VALVE (Not self-diagnostic item)



Harness layout

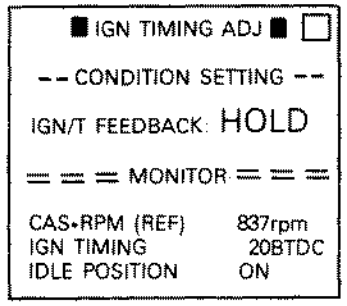






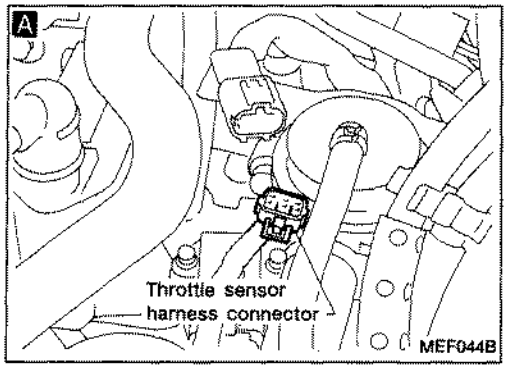
Diagnostic Procedure 36 (Cont'd)

A



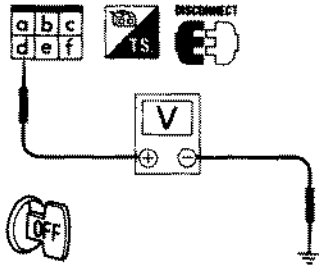
SEF322L

A



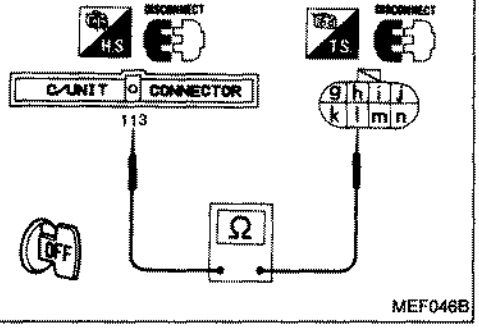
MEF044B

B



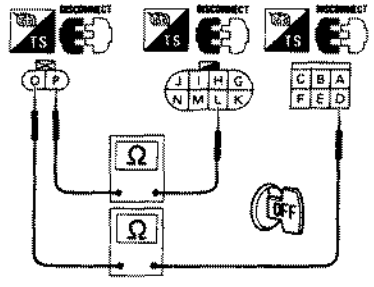
MEF045B

C



MEF046B

D



MEF047B

INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Check idle speed.
925 $^{+25}_{-75}$ rpm

3)● Perform "IGN TIMING ADJ" in "WORK SUPPORT" mode.
● Disconnect throttle sensor sub-harness connector.
4) Make sure that idle speed drops.

O.K. → INSPECTION END

N.G.

B

CHECK POWER SUPPLY.
1) Stop engine.
2) Disconnect engine room harness connector and engine harness connector.
3) Check voltage between terminal ⓓ and ground.
Voltage: Battery voltage

N.G. → Check the following.
● Harness connectors (M1), (E14)
● 10A fuse
● Harness continuity between engine room harness connector and fuse
If N.G., repair harness or connectors.

O.K.

C

CHECK OUTPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector, E.F.I. harness connector and engine harness connector.
2) Check harness continuity between E.C.U. terminal (113) and terminal Ⓘ.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

D

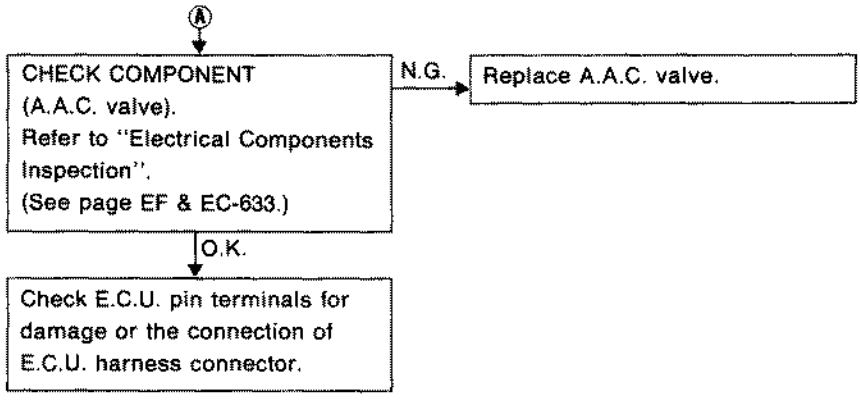
CHECK HARNESS CONTINUITY BETWEEN A.A.C. VALVE AND ENGINE HARNESS CONNECTORS.
1) Check harness continuity between terminal Ⓞ and terminal Ⓓ, terminal Ⓟ and terminal Ⓛ.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

Ⓐ

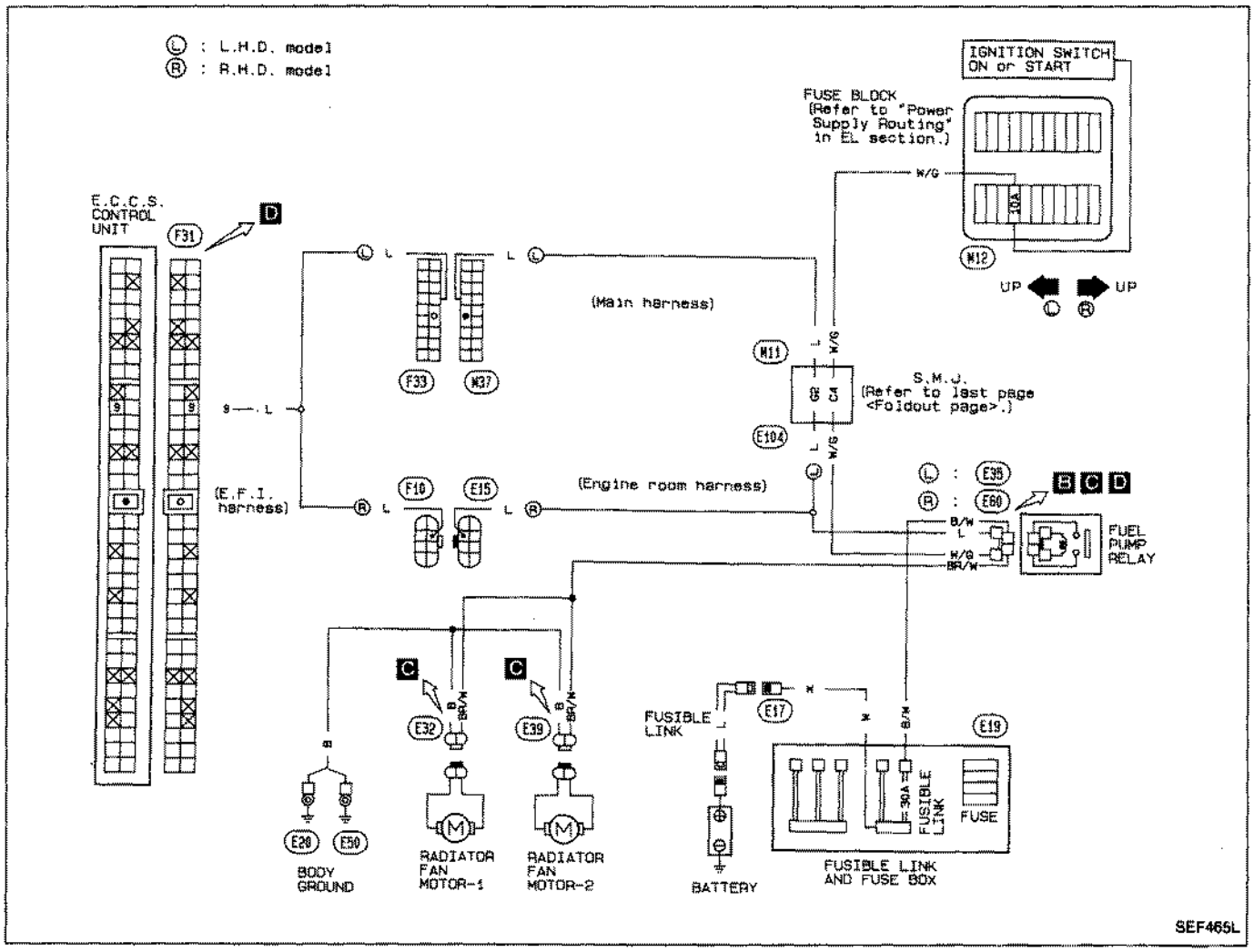
Diagnostic Procedure 36 (Cont'd)



NOTE

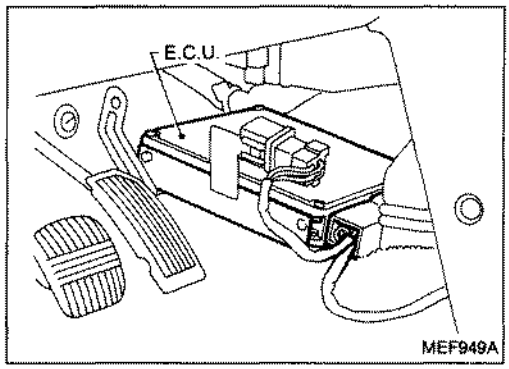
Diagnostic Procedure 37

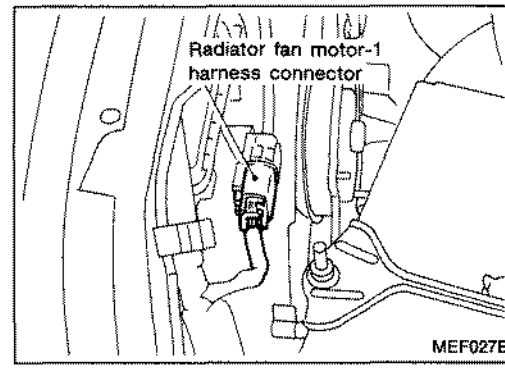
RADIATOR FAN CONTROL (Not self-diagnostic item)

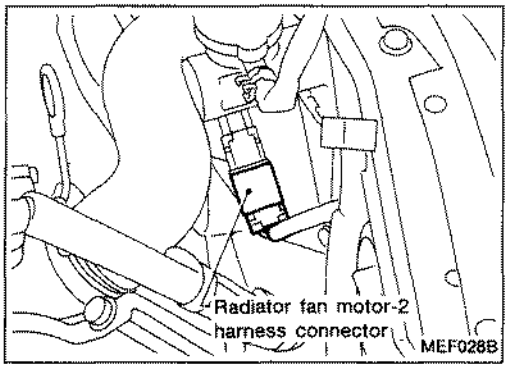


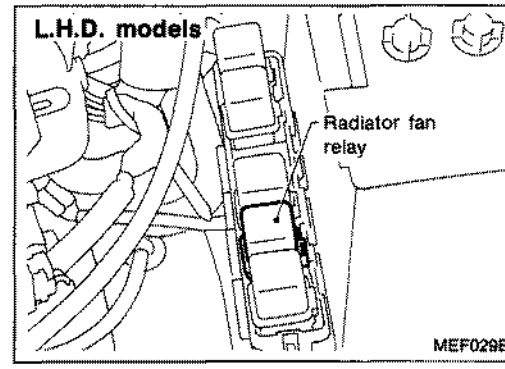
Diagnostic Procedure 37 (Cont'd)

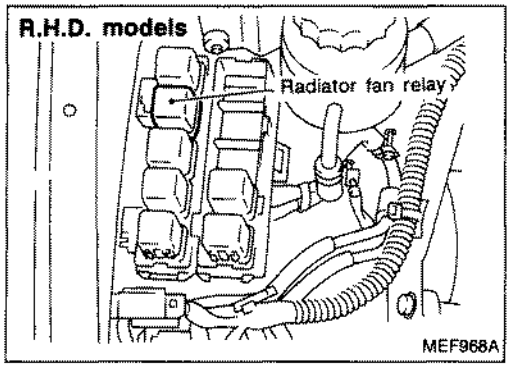
Harness layout



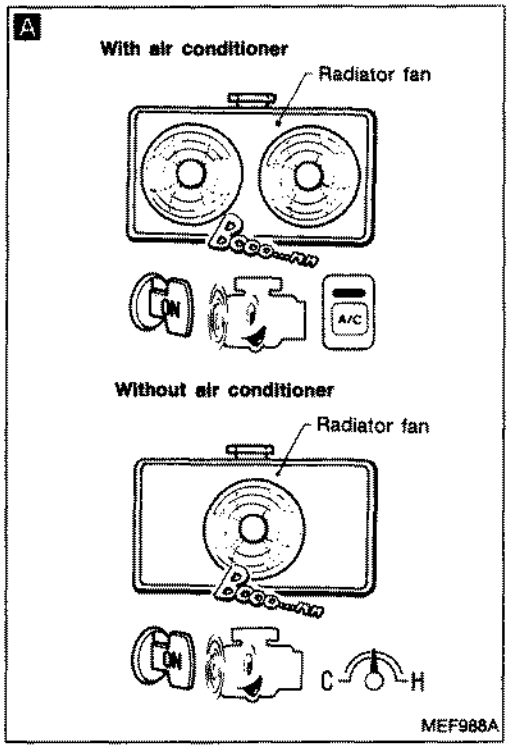


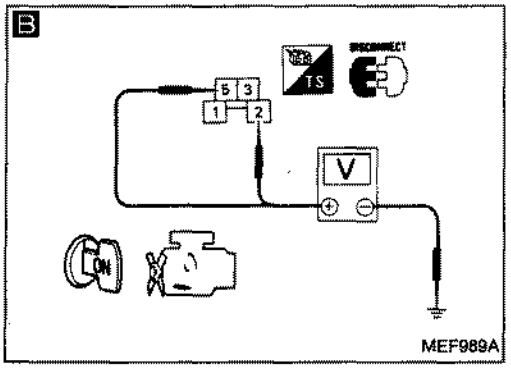


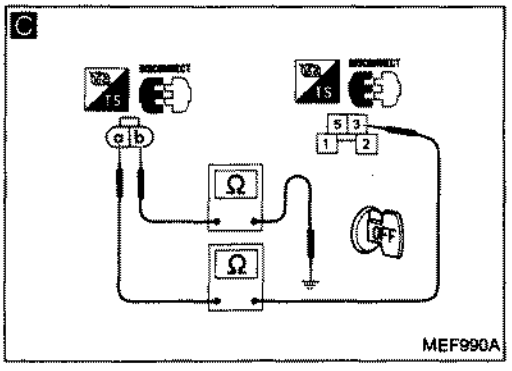


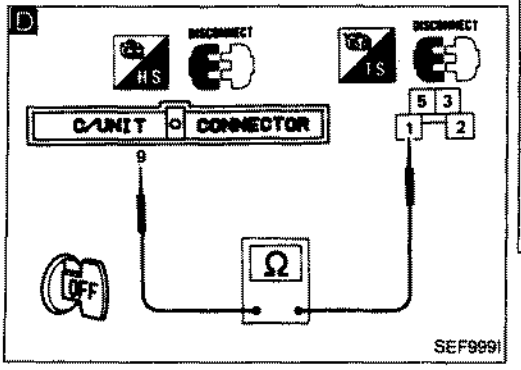


Diagnostic Procedure 37 (Cont'd)









INSPECTION START

A

CHECK RADIATOR FAN OPERATION.

With air conditioner

1) Start engine.
2) Set temperature lever at full cold position.
3) Turn air conditioner switch "ON".
4) Turn blower fan switch "ON".
5) Run engine at idle for a few minutes with air conditioner operating.
6) Make sure that radiator fan operates.

Without air conditioner

1) Start engine.
2) Keep engine speed at about 2,000 rpm until engine is warmed up sufficiently.
3) Make sure that radiator fan begins to operate during warm-up.

O.K. → INSPECTION END

N.G. ↓

B

CHECK POWER SUPPLY.

1) Turn air conditioner switch "OFF".
2) Turn blower fan switch "OFF".
   (Step 1) and 2) are only performed for model with air conditioner.)
3) Stop engine.
4) Disconnect radiator fan relay.
5) Turn ignition switch "ON".
6) Check voltage between terminals ②, ⑤ and ground.
   Voltage: Battery voltage

N.G. → Check the following.
- Harness connectors (M11), (E104)
- "L" fusible link
- 30A fusible link
- 10A fuse
- Harness continuity between battery and radiator fan relay
- Harness continuity between fuse and radiator fan relay

If N.G., repair harness or connectors.

O.K. ↓

C

CHECK GROUND CIRCUIT.

1) Turn ignition switch "OFF".
2) Disconnect radiator fan motor-1 harness connector and radiator fan motor-2 harness connector.
3) Check harness continuity between terminal ⓐ and terminal ③, terminal ⑤ and body ground.
   Continuity should exist.

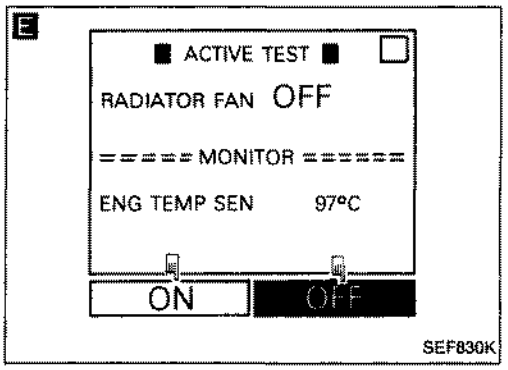
N.G. → Repair harness or connectors.

O.K. ↓

Ⓐ

Diagnostic Procedure 37 (Cont'd)

E



D

Ⓐ

CHECK OUTPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal ⑨ and terminal ①.
Continuity should exist.

N.G. → Check the following.
- Harness connectors (F33), (M57) (L.H.D. models)
- Harness connectors (M11), (E104) (L.H.D. models)
- Harness connectors (F18), (E15) (R.H.D. models)
- Harness continuity between E.C.U. and radiator fan relay

If N.G., repair harness or connectors.

O.K. ↓

CHECK COMPONENT (Radiator fan relay).
Refer to "Electrical Components Inspection".
(See page EF & EC-635.)

N.G. → Replace radiator fan relay.

O.K. ↓

E

CHECK COMPONENTS (Radiator fan motors).
1) Reconnect radiator fan relay, radiator fan motor harness connectors and E.C.U. harness connector.
2) Start engine.
3) Perform "RADIATOR FAN TEST" in "ACTIVE TEST" mode with CONSULT.

N.G. → Replace radiator fan motors.

OR

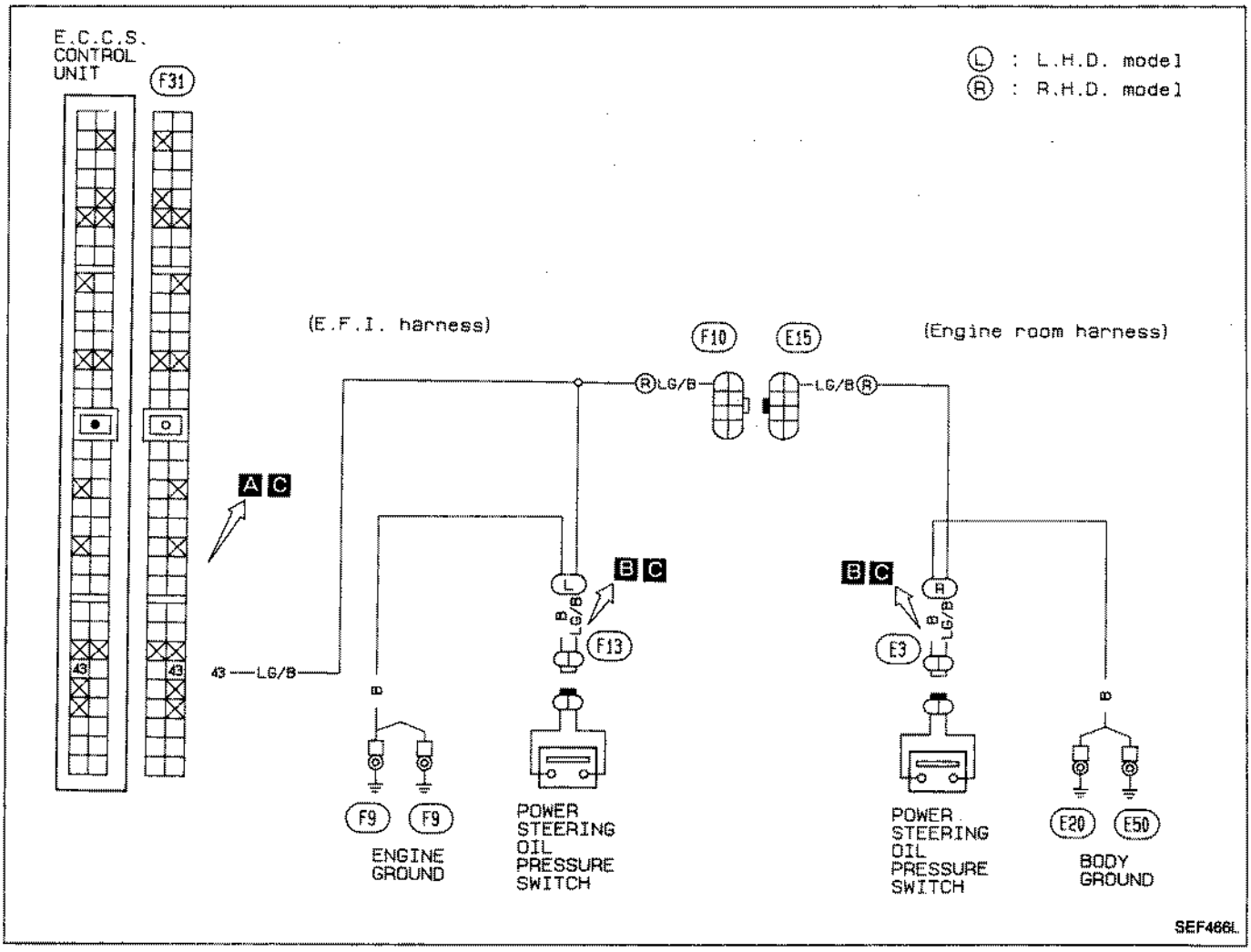
Refer to "Electrical Components Inspection".
(See page EF & EC-635.)

O.K. ↓

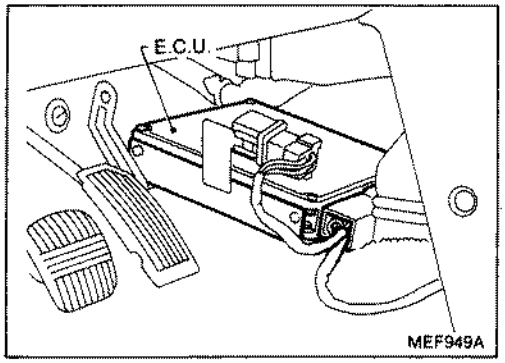
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

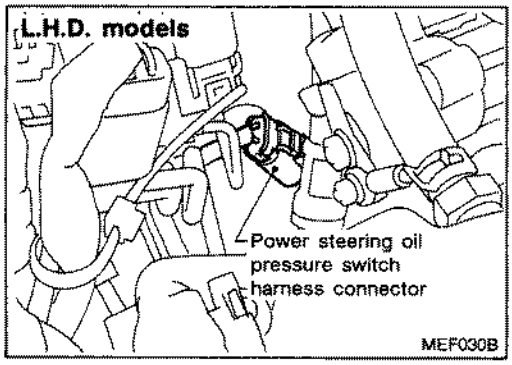
Diagnostic Procedure 38

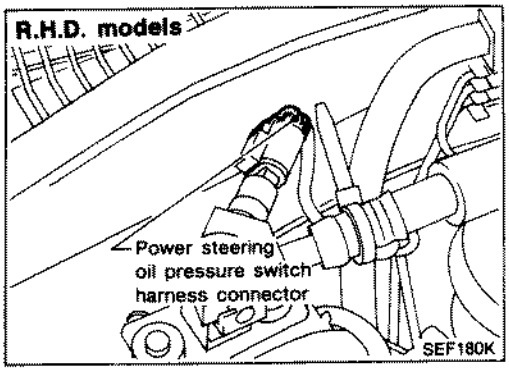
POWER STEERING OIL PRESSURE SWITCH (Not self-diagnostic item)



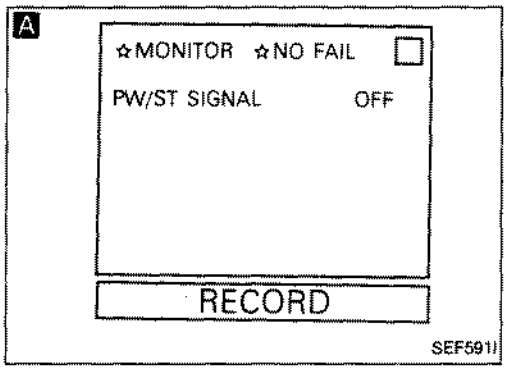
Harness layout

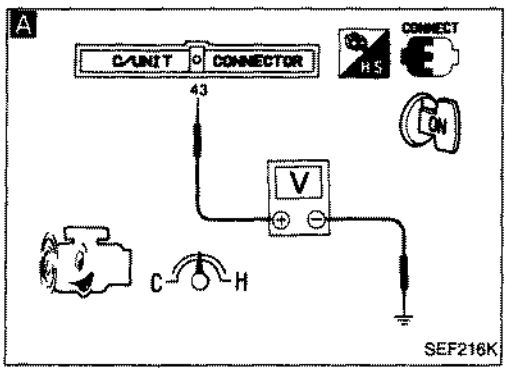


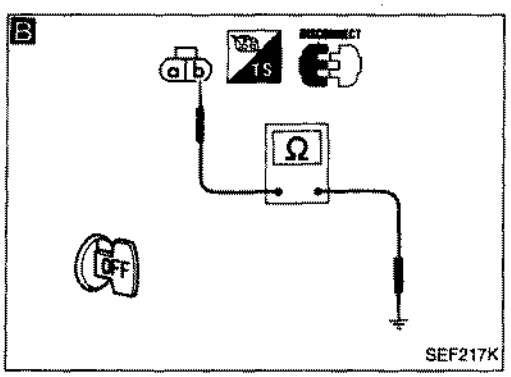


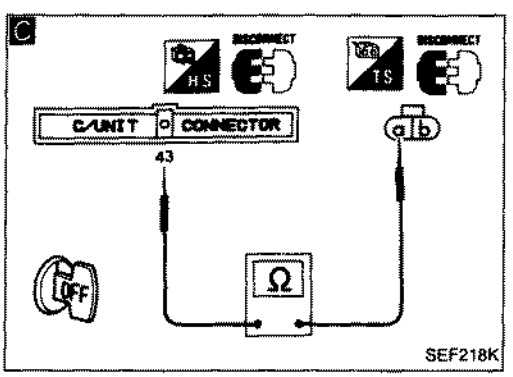


Diagnostic Procedure 38 (Cont'd)









INSPECTION START

A

CHECK CONTROL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Check power steering oil pressure switch signal in "DATA MONITOR" mode with CONSULT.
Steering is neutral: OFF
Steering is turned: ON

— OR —

2) Check voltage between E.C.U. terminal ㊸ and ground.
Voltage:
When steering wheel is turned quickly.
Approximately 0V
Except above
Approximately 8 - 10V

O.K. → INSPECTION END

N.G.

B

CHECK GROUND CIRCUIT.
1) Stop engine.
2) Disconnect power steering oil pressure switch harness connector.
3) Check harness continuity between terminal ⓑ and body ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

C

CHECK INPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal ㊸ and terminal ⓐ.
Continuity should exist.

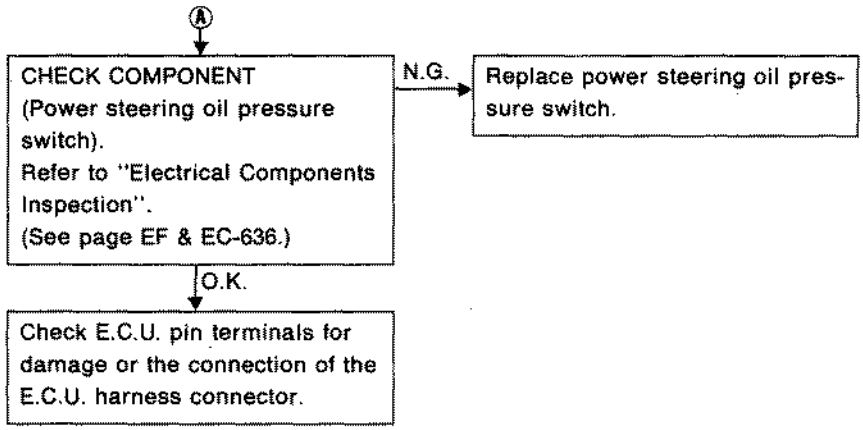
N.G. → Check the following.
- Harness connectors (F16), (E15) (R.H.D. models)
- Harness continuity between E.C.U. and power steering oil pressure switch

If N.G., repair harness or connectors.

O.K.

Ⓐ

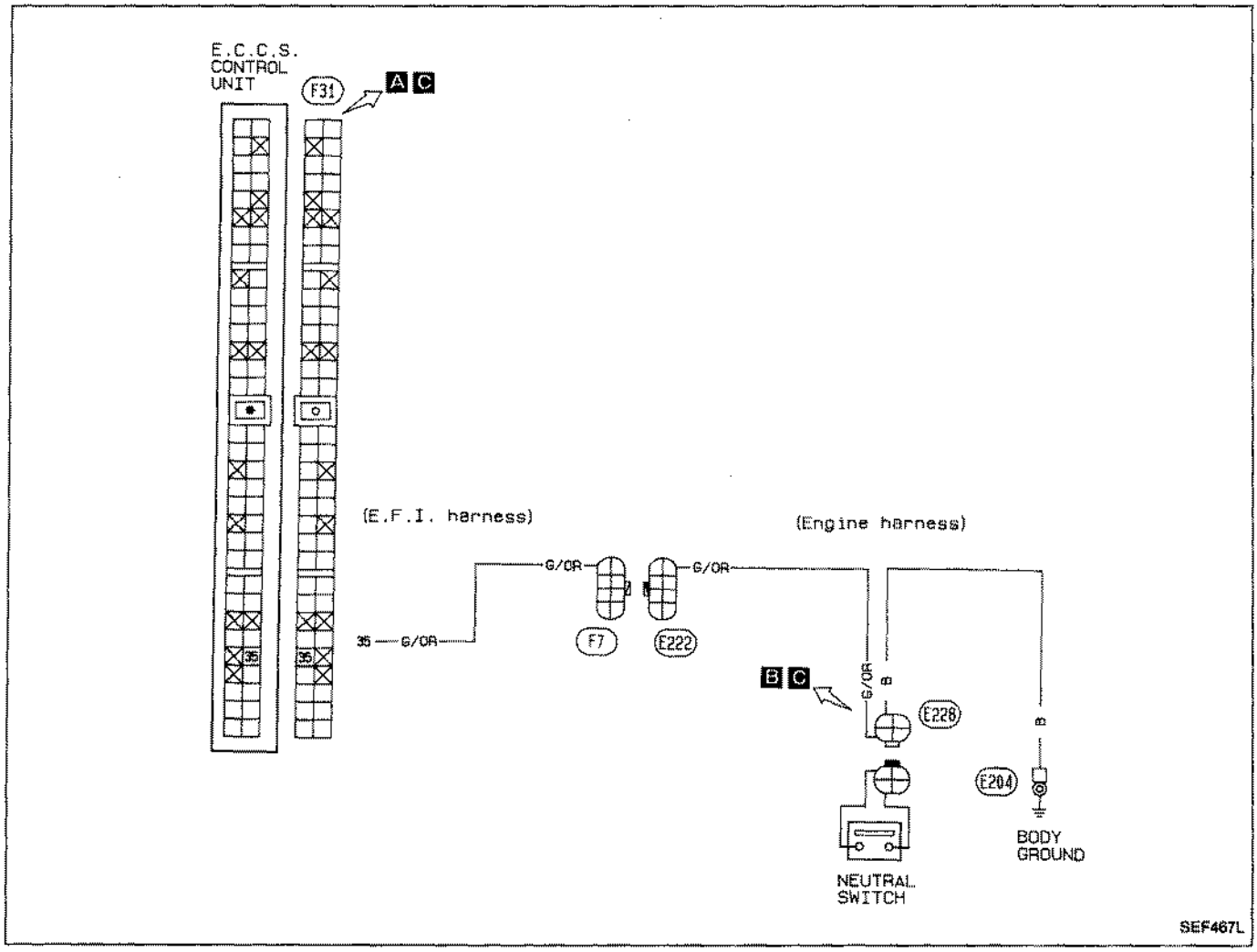
Diagnostic Procedure 38 (Cont'd)



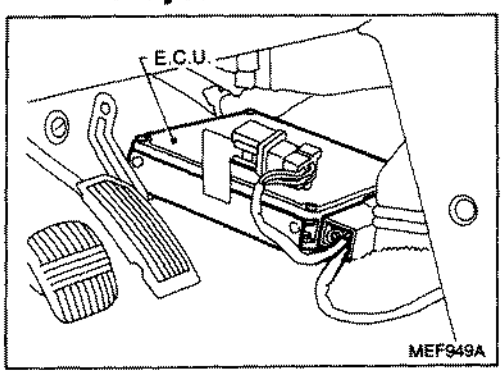
NOTE

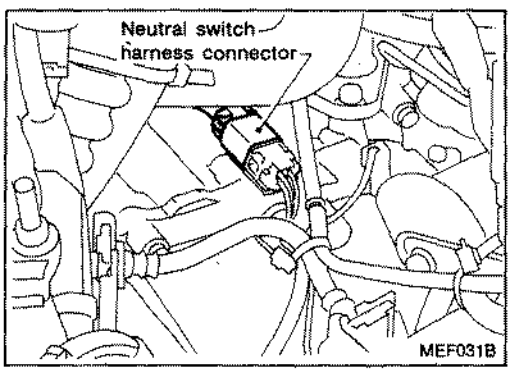
Diagnostic Procedure 39

NEUTRAL SWITCH (Not self-diagnostic item)



Harness layout





Diagnostic Procedure 39 (Cont'd)

A

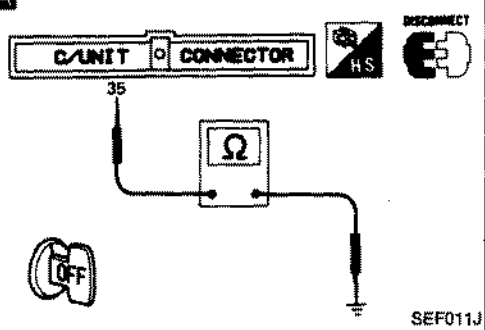
☆MONITOR ☆NO FAIL ☐

START SIGNAL	OFF
IDLE POSITION	ON
AIR COND SIG	OFF
NEUTRAL SW	ON

RECORD

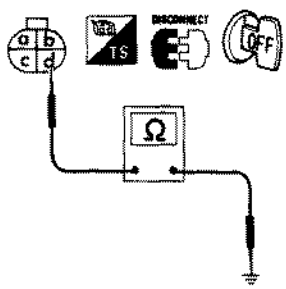
SEF384J

A



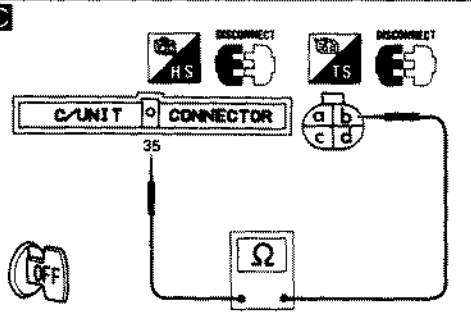
SEF011J

B



MEF048B

C



MEF049B

INSPECTION START

A

CHECK OVERALL FUNCTION.

1) Turn ignition switch "ON".
2) Check neutral switch signal in "DATA MONITOR" mode with CONSULT.

Neutral position: ON
Except above: OFF

O.K. → INSPECTION END

OR

1) Set shift lever to the neutral position.
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal ㉟ and body ground.

Continuity should exist.

N.G.

Turn ignition switch "OFF".

B

CHECK GROUND CIRCUIT.

1) Disconnect neutral switch harness connector.
2) Check harness continuity between terminal ⓓ and body ground.

Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

Disconnect E.C.U. harness connector.

C

CHECK INPUT SIGNAL CIRCUIT.

1) Check harness continuity between E.C.U. terminal ㉟ and terminal ⓑ.

Continuity should exist.

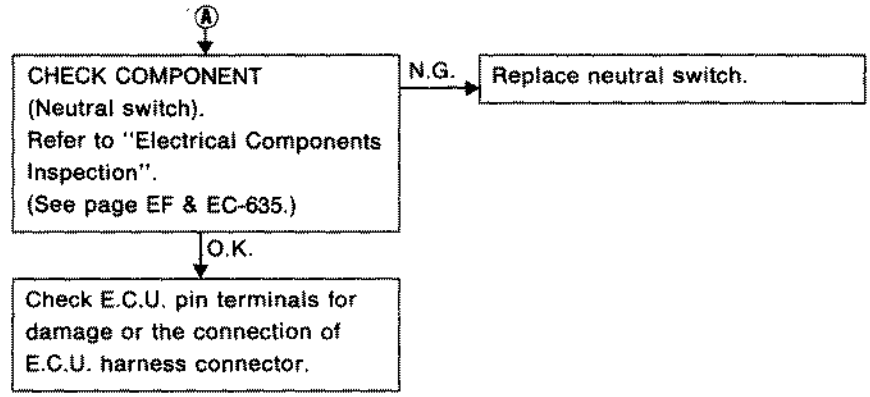
N.G. → Check the following.
- Harness connectors (F7), (E222)
- Harness continuity between E.C.U. and neutral switch

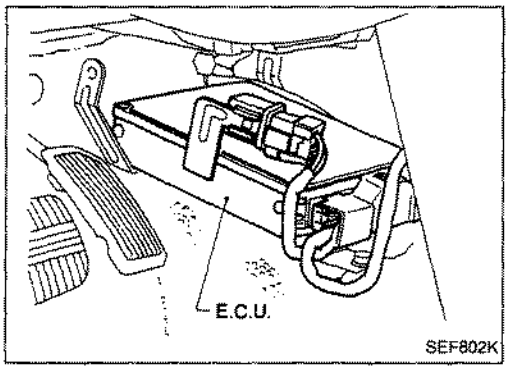
If N.G., repair harness or connectors.

O.K.

Ⓐ

Diagnostic Procedure 39 (Cont'd)

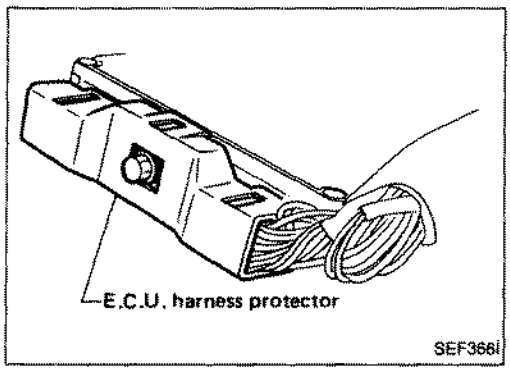




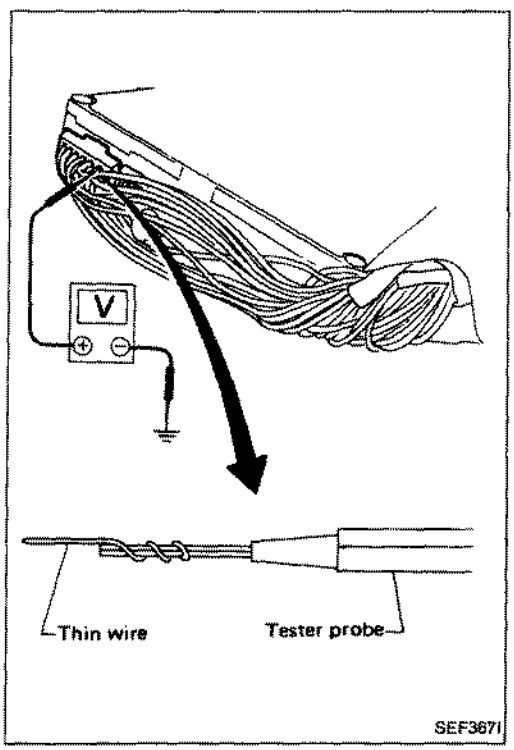
Electrical Components Inspection

E.C.U. INPUT/OUTPUT SIGNAL INSPECTION

1. E.C.U. is located behind the center console panel. For this inspection, remove the center console under cover.



2. Remove E.C.U. harness protector.



3. Perform all voltage measurements with the connectors connected. Extend tester probe as shown to perform tests easily.

Electrical Components Inspection (Cont'd)

E.C.U. inspection table

*Date are reference values.

TER-MINAL NO.	ITEM	CONDITION	*DATA
1	Ignition signal	Engine is running. └ Idle speed	0.3 - 0.5V
		Engine is running. └ Engine speed is 2,000 rpm	0.7 - 0.8V
3	Ignition check	Engine is running. └ Idle speed	Approximately 12V
4	E.C.C.S. relay (Self-shut off)	Engine is running. Ignition switch "OFF" └ For approximately 2 seconds after turning ignition switch "OFF"	0 - 1V
		Ignition switch "OFF" └ Approximately 2 seconds after turning ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)
9	Radiator fan relay	Engine is running. └ Radiator fan is not operating.	BATTERY VOLTAGE (11 - 14V)
		Engine is running. └ Radiator fan is operating.	0.6 - 0.8V
11	Air conditioner relay	Engine is running. └ Both A/C switch and blower switch are "ON".	0.5 - 1V
		Engine is running. └ A/C switch is "OFF".	BATTERY VOLTAGE (11 - 14V)
16	Air flow meter	Engine is running. (Warm-up condition) └ Idle speed	1.3 - 1.8V
		Engine is running. (Warm-up condition) └ Engine speed is 2,000 rpm.	1.6 - 2.1V
18	Engine temperature sensor	Engine is running.	0 - 5.0V Output voltage varies with engine water temperature.
19	Exhaust gas sensor	Engine is running. └ After warming up sufficiently.	0 - Approximately 1.5V

Electrical Components Inspection (Cont'd)

*Date are reference values.

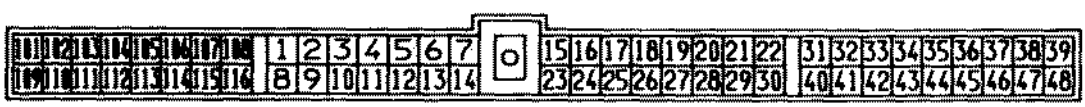
TER-MINAL NO.	ITEM	CONDITION	*DATA
20	Throttle sensor	Ignition switch "on" └Accelerator pedal released	0.45 - 0.55V
		Ignition switch "on" └Accelerator pedal fully depressed	Approximately 4V
22 30	Crank angle sensor (Reference signal)	Engine is running. └**Do not run engine at high speed under no-load.**	0.2 - 0.5V
27	Detonation sensor	Engine is running. └Idle speed	2.0 - 3.0V
31 40	Crank angle sensor (Position signal)	Engine is running. └**Do not run engine at high speed under no-load.**	2.0 - 3.0V
34	Start signal	Ignition switch "ON"	Approximately 0V
		Ignition switch "START"	BATTERY VOLTAGE (11 - 14V)
35	Neutral switch	Ignition switch "ON" └Neutral	0V
		Ignition switch "ON" └Except the above gear position	Approximately 6V
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".	Approximately 0V
		Engine is running. └Air conditioner switch is "OFF".	BATTERY VOLTAGE (11 - 14V)

Electrical Components Inspection (Cont'd)

*Date are reference values.

TER-MINAL NO.	ITEM	CONDITION	*DATA
43	Power steering oil pressure switch	Engine is running. └Steering wheel is being turned.	0V
		Engine is running. └Steering wheel is not being turned.	8 - 10V
46	Power supply (Back-up)	Ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)
101	Injector No. 1	Engine is running	BATTERY VOLTAGE (11 - 14V)
103	Injector No. 3		
110	Injector No. 2		
112	Injector No. 4		
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" └5 seconds after turning ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
113	A.A.C. valve	Engine is running. └Idle speed	7 - 9V
		Engine is running. ├Steering wheel is being turned. ├Air conditioner is operating. ├Rear defogger is "ON". └Headlamp are in high position.	3 - 6V

E.C.U. HARNESS CONNECTOR TERMINAL LAYOUT



H.S.

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Electrical Components Inspection (Cont'd)

E.C.U. inspection table

*Date are reference values.

TERMINAL NO.	ITEM	CONDITION	*DATA
1	Ignition signal	Engine is running. └ Idle speed	0.3 - 0.5V
		Engine is running. └ Engine speed is 2,000 rpm	0.7 - 0.8V
3	Ignition check	Engine is running. └ Idle speed	Approximately 12V
4	E.C.C.S. relay (Self-shut off)	Engine is running. Ignition switch "OFF" └ For approximately 2 seconds after turning ignition switch "OFF"	0 - 1V
		Ignition switch "OFF" └ Approximately 2 seconds after turning ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)
9	Radiator fan relay	Engine is running. └ Radiator fan is not operating.	BATTERY VOLTAGE (11 - 14V)
		Engine is running. └ Radiator fan is operating.	0.6 - 0.8V
11	Air conditioner relay	Engine is running. └ Both A/C switch and blower switch are "ON".	0.5 - 1V
		Engine is running. └ A/C switch is "OFF".	BATTERY VOLTAGE (11 - 14V)
16	Air flow meter	Engine is running. (Warm-up condition) └ Idle speed	1.0 - 1.5V
		Engine is running. (Warm-up condition) └ Engine speed is 2,000 rpm.	1.3 - 1.8V
18	Engine temperature sensor	Engine is running.	0 - 5.0V Output voltage varies with engine water temperature.
19	Exhaust gas sensor	Engine is running. └ After warming up sufficiently.	0 - Approximately 1.5V

Electrical Components Inspection (Cont'd)

*Date are reference values.

TER-MINAL NO.	ITEM	CONDITION	*DATA
20	Throttle sensor	Ignition switch "on" └Accelerator pedal released	0.45 - 0.55V
		Ignition switch "on" └Accelerator pedal fully depressed	Approximately 4V
22 30	Crank angle sensor (Reference signal)	Engine is running. └**Do not run engine at high speed under no-load.**	0.2 - 0.5V
27	Detonation sensor	Engine is running. └Idle speed	2.0 - 3.0V
31 40	Crank angle sensor (Position signal)	Engine is running. └**Do not run engine at high speed under no-load.**	2.0 - 3.0V
34	Start signal	Ignition switch "ON"	Approximately 0V
		Ignition switch "START"	BATTERY VOLTAGE (11 - 14V)
35	Neutral switch	Ignition switch "ON" └Neutral	0V
		Ignition switch "ON" └Except the above gear position	Approximately 6V
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".	Approximately 0V
		Engine is running. └Air conditioner switch is "OFF".	Approximately 8V

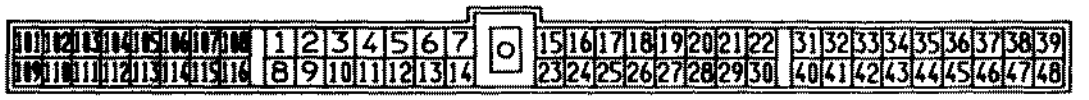
Electrical Components Inspection (Cont'd)

*Date are reference values.

TER-MINAL NO.	ITEM	CONDITION	*DATA
43	Power steering oil pressure switch	Engine is running. └Steering wheel is being turned.	0V
		Engine is running. └Steering wheel is not being turned.	8 - 10V
46	Power supply (Back-up)	Ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)
101	Injector No. 1	Engine is running	BATTERY VOLTAGE (11 - 14V)
103	Injector No. 3		
110	Injector No. 2		
112	Injector No. 4		
104	Fuel pump relay	Ignition switch "ON" └For 1 second after turning ignition switch "ON" Engine is running.	0.7 - 0.9V
		Ignition switch "ON" └1 second after turning ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
111	Wastegate valve control solenoid valve	Engine is running. └Idle speed	BATTERY VOLTAGE (11 - 14V)
		Engine is running. └Accelerator pedal is quickly depressed and released.	0 - 1.0V
113	A.A.C. valve	Engine is running. └Idle speed	9 - 14V
		Engine is running. - Steering wheel is being turned. - Air conditioner is operating. - Rear defogger is "ON". └Headlamp are in high position.	5 - 9V

Electrical Components Inspection (Cont'd)

E.C.U. HARNESS CONNECTOR TERMINAL LAYOUT



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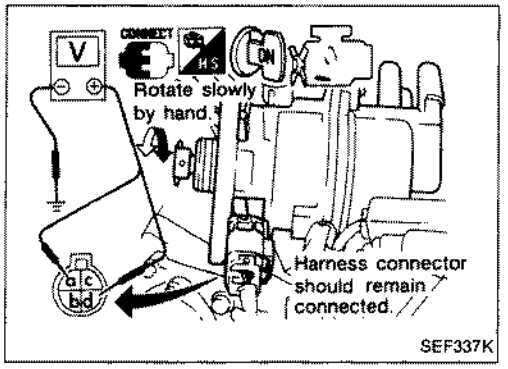
Electrical Components Inspection (Cont'd)

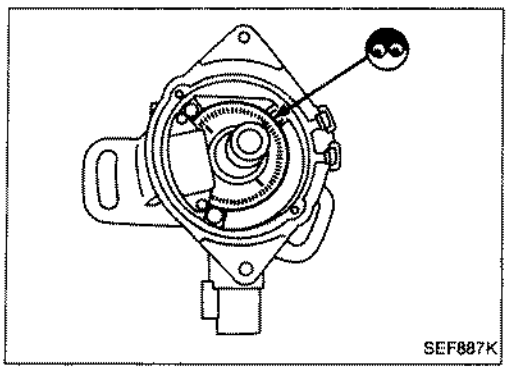


CRANK ANGLE SENSOR

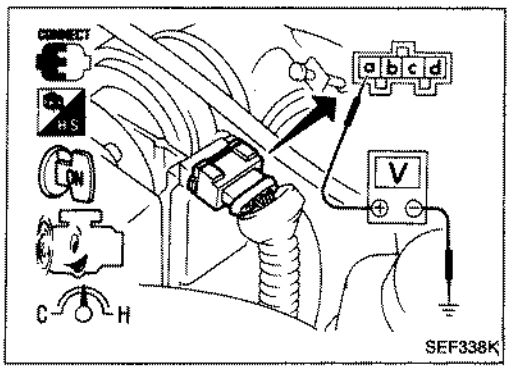
1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Disconnect ignition wires.
3. Turn ignition switch "ON".
4. Rotate distributor shaft slowly by hand and check voltage between terminals ⓐ, ⓓ and ground.

Terminal	Voltage
ⓐ (180° signal)	Tester's pointer fluctuates between 5V and 0V.
ⓓ (1° signal)	

If N.G., replace distributor assembly with crank angle sensor.



5. Visually check signal plate for damage or dust.

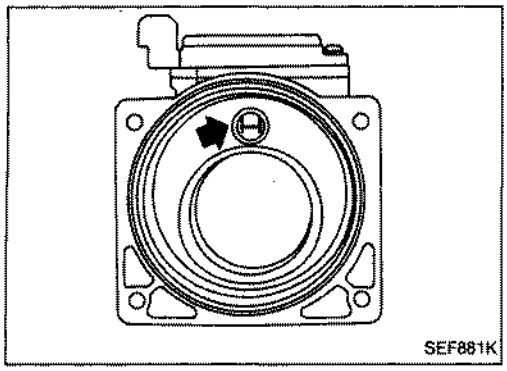


AIR FLOW METER

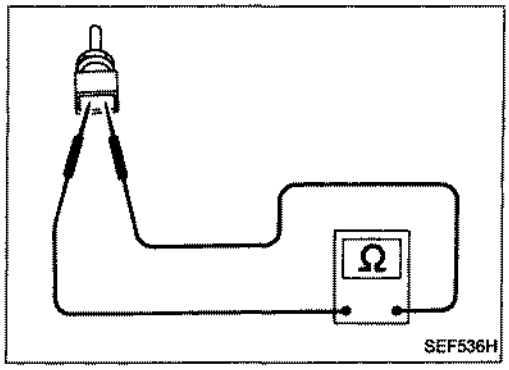
1. Peel air flow meter harness connector rubber as shown in the figure if the harness connector is connected.
2. Turn ignition switch "ON".
3. Start engine and warm it up sufficiently.
4. Check voltage between terminal ⓐ and ground.

Conditions	Voltage V
Ignition switch "ON" (Engine stopped.)	Less than 1.0
Idle (Engine is warmed-up sufficiently.)	SR20DE: 1.3 - 1.8V SR20DET: 1.0 - 1.5V

Electrical Components Inspection (Cont'd)


SEF881K

5. If N.G., remove air flow meter from air duct. Check hot wire for damage or dust.



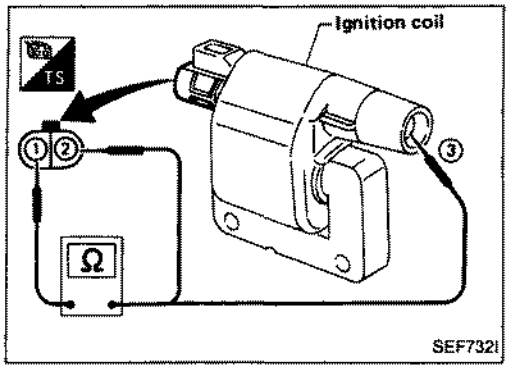
SEF536H

ENGINE TEMPERATURE SENSOR

1. Disconnect engine temperature sensor harness connector.
2. Check resistance as shown in the figure.

Temperature °C (°F)	Resistance kΩ
20 (68)	2.1 - 2.9
50 (122)	0.68 - 1.0
80 (176)	0.30 - 0.33

If N.G., replace engine temperature sensor.



SEF732I

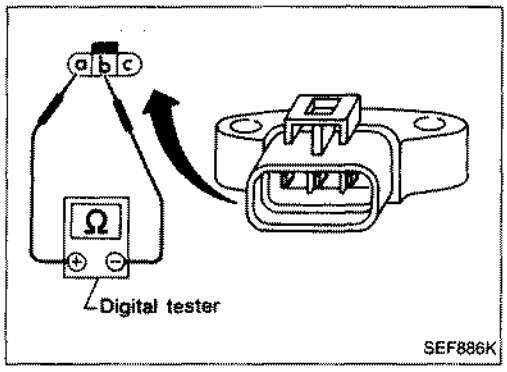
IGNITION COIL

1. Disconnect ignition coil harness connector.
2. Check resistance as shown in the figure.

Terminal	Resistance
① - ②	Approximately 1.0Ω
① - ③	Approximately 10 kΩ

If N.G., replace ignition coil.

Electrical Components Inspection (Cont'd)

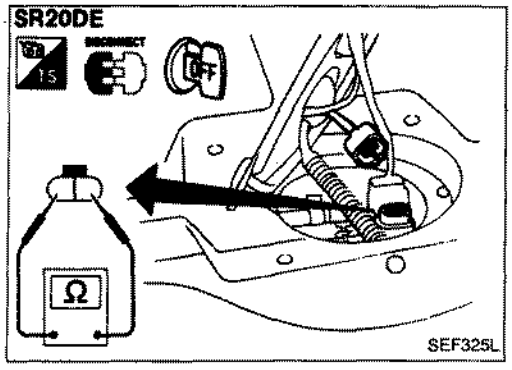


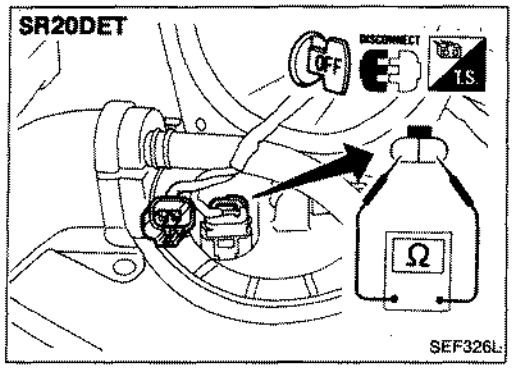
POWER TRANSISTOR

1. Disconnect power transistor harness connector.
2. Check power transistor continuity between terminals with a digital tester as shown in the figure.

⊖terminal side / ⊕terminal side	Terminal ⓐ		Terminal ⓑ		Terminal ⓒ	
	Resistance Ω	Result	Resistance Ω	Result	Resistance Ω	Result
Terminal ⓐ	—	—	∞	O.K.	∞	O.K.
	—	—	Not ∞ or 0	N.G.	Not ∞ or 0	N.G.
	—	—	0	N.G.	0	N.G.
Terminal ⓑ	∞	N.G.	—	—	∞	N.G.
	Not ∞ or 0	O.K.	—	—	Not ∞ or 0	O.K.
	0	N.G.	—	—	0	N.G.
Terminal ⓒ	∞	N.G.	∞	N.G.	—	—
	Not ∞ or 0	O.K.	Not ∞ or 0	O.K.	—	—
	0	N.G.	0	N.G.	—	—

If N.G., replace power transistor.





FUEL PUMP

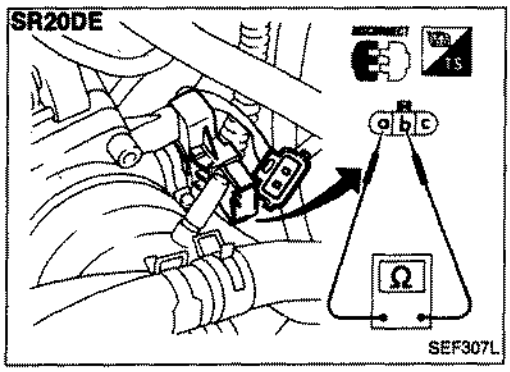
1. Disconnect fuel pump harness connector.
2. Check resistance between terminals ⓐ and ⓑ.
   Resistance: Approximately 0.7Ω

If N.G., replace fuel pump.

Electrical Components Inspection (Cont'd)

EXHAUST GAS SENSOR

Refer to "Diagnostic Procedure 31".
(See page EF & EC-494, 590.)

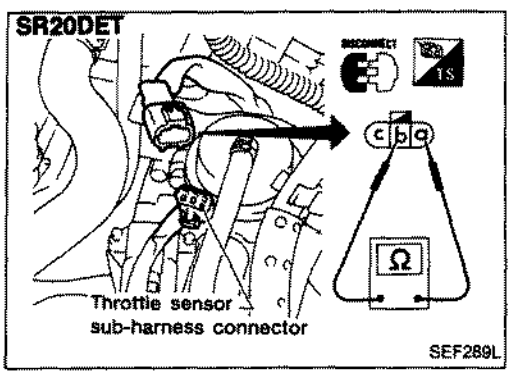


THROTTLE SENSOR

1. Disconnect throttle sensor harness connector.
2. Make sure that resistance between terminals ⓐ and ⓑ changes when opening throttle valve manually.

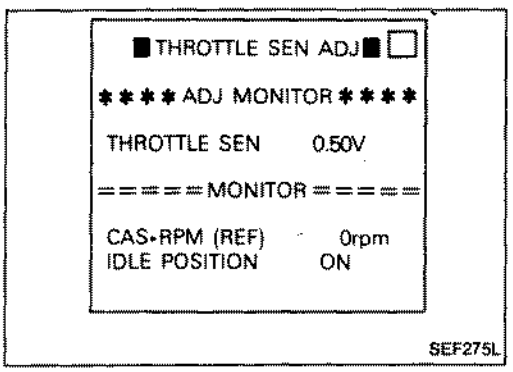
Accelerator pedal conditions	Resistance kΩ
Completely released	Approximately 2
Partially released	2 - 11
Completely depressed	Approximately 11

If N.G., replace throttle sensor.



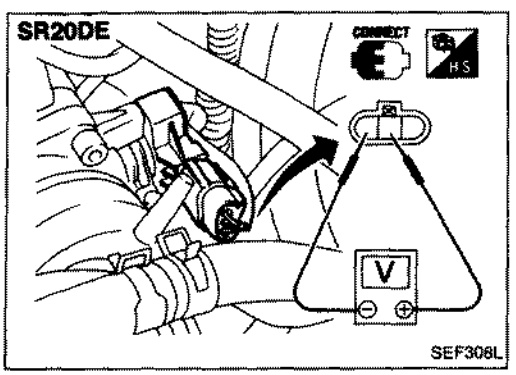
Adjustment

If throttle sensor is replaced or removed, it is necessary to install in proper position, by following the procedure as shown below:

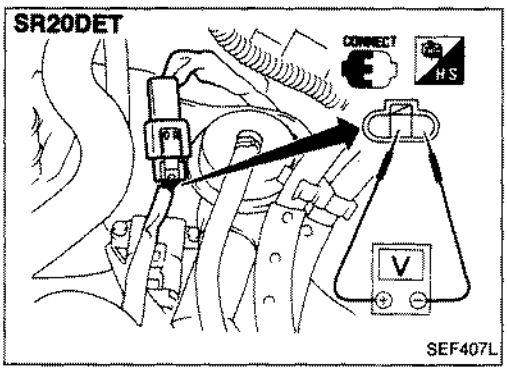


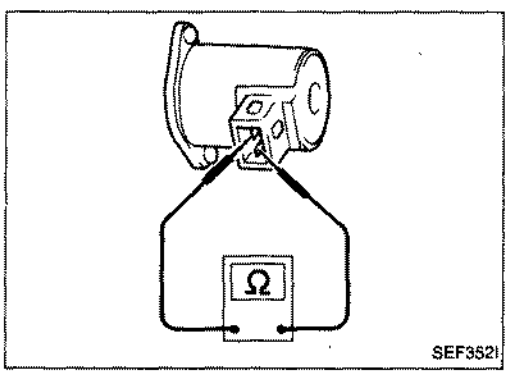
1. Install throttle sensor body in throttle chamber. Do not tighten bolts. Leave bolts loose.
2. Connect throttle sensor harness connector.
3. Start engine and warm it up sufficiently.
4. Perform "THROTTLE SEN ADJ" in "WORK SUPPORT" mode.

   Measure output voltage of throttle sensor using voltmeter.



5. Adjust by rotating throttle sensor body so that output voltage is 0.45 to 0.55V.
6. Tighten mounting bolts.
7. Disconnect throttle sensor harness connector for a few seconds and then reconnect it.





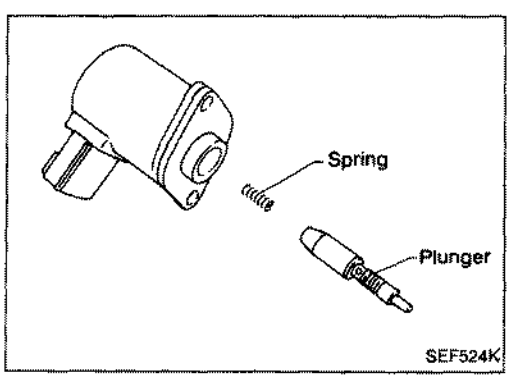
A.A.C. VALVE

Disconnect A.A.C. valve harness connector.

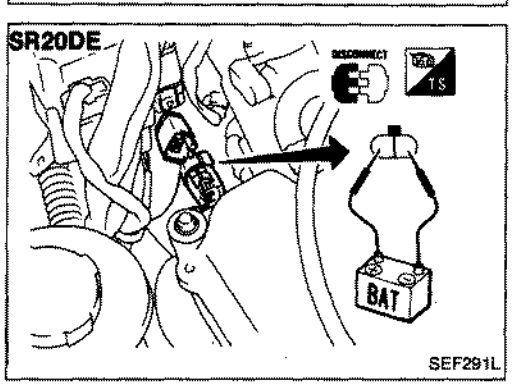
- Check A.A.C. valve resistance.

  Resistance:

  Approximately 10Ω



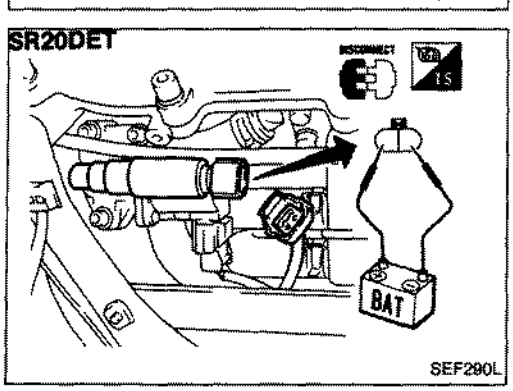
- Check plunger for seizing or sticking.
- Check for broken spring.



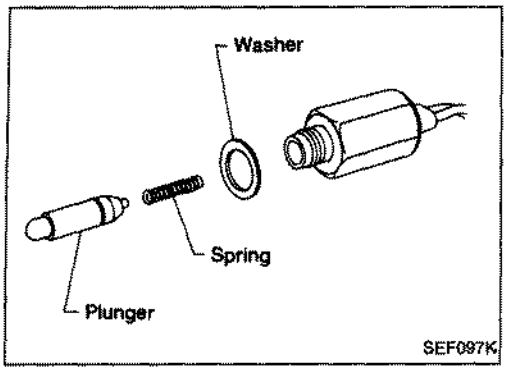
F.I.C.D. SOLENOID VALVE

Disconnect F.I.C.D. solenoid valve harness connector.

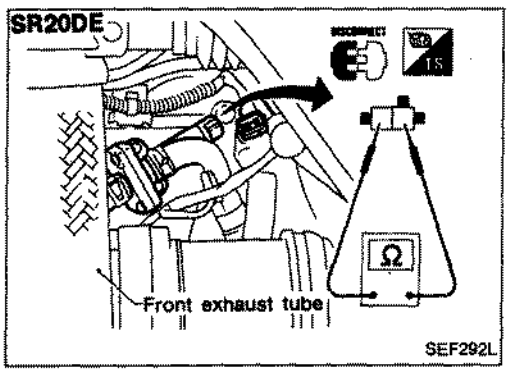
- Check for clicking sound when applying 12V direct current to terminals.



Electrical Components Inspection (Cont'd)



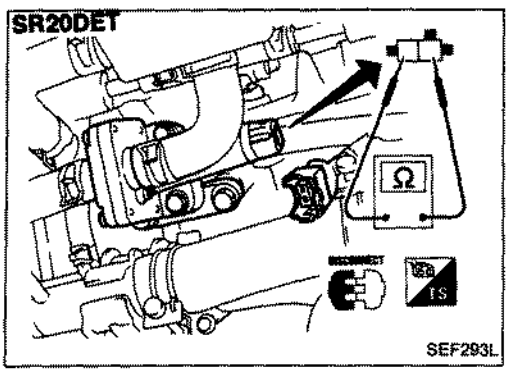
- Check plunger for seizing or sticking.
- Check for broken spring.

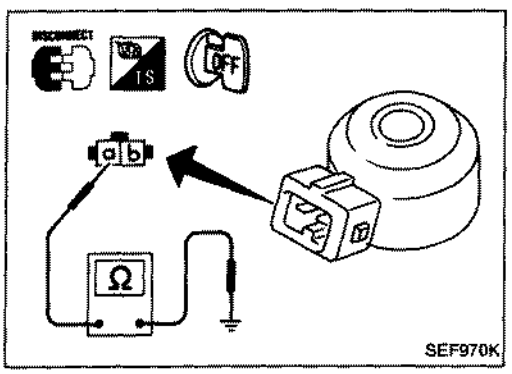


AIR REGULATOR

Disconnect air regulator harness connector.

- Check air regulator resistance.
  Resistance:
  Approximately 70 - 80Ω
- Check air regulator for clogging.





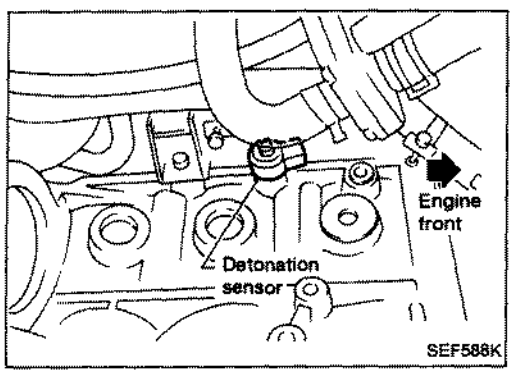
DETONATION SENSOR

1. Disconnect detonation sensor harness connector.
2. Check continuity between terminal ⓐ and ground.

Continuity should exist.

- It is necessary to use an ohmmeter which can measure more than 10 MΩ.

CAUTION:
Discard any detonation sensor which has been dropped or undergone shocks; use a new one.

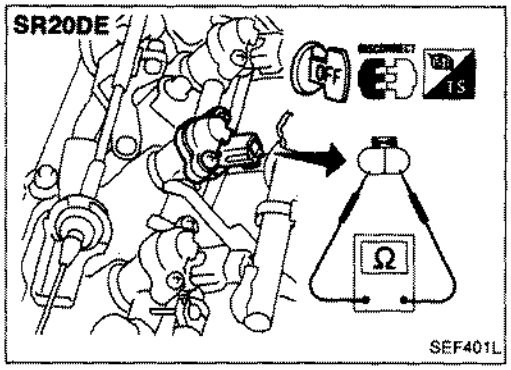


Installation

Install detonation sensor with connector side facing engine front.

- When installing detonation sensor, ensure both upper and lower sides of detonation sensor and cylinder block mating surface are clean and free from foreign particles.
- When tightening detonation sensor, be careful not to apply excessive force to connector.
- Make sure detonation sensor is not in contact with any adjacent part after installing.

Electrical Components Inspection (Cont'd)



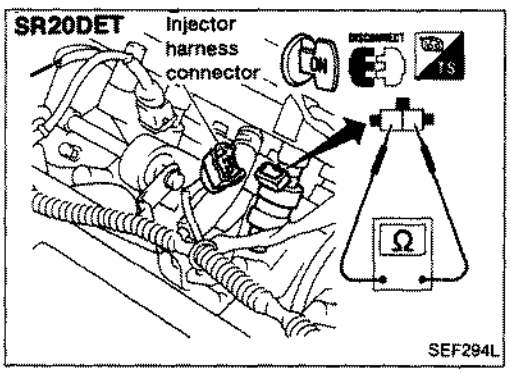
INJECTOR

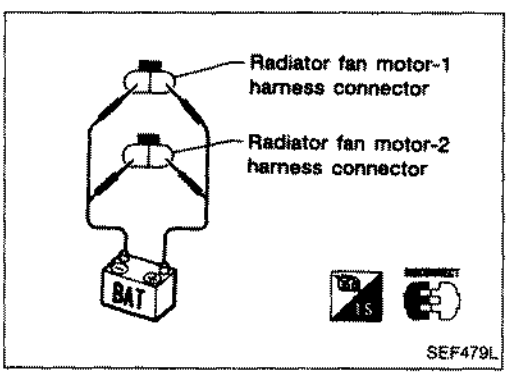
1. Disconnect injector harness connector.
2. Check resistance between terminals as shown in the figure.

Resistance:

SR20DE	10 - 14Ω
SR20DET	1 - 3Ω

If N.G., replace injector.



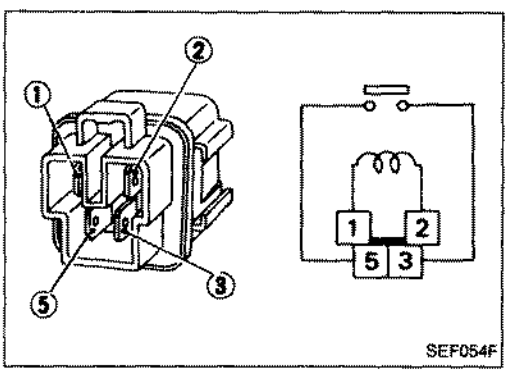


RADIATOR FAN MOTORS-1 AND -2

1. Disconnect radiator fan motor harness connectors.
2. Supply radiator fan motor terminals with battery voltage and check operation.

Radiator fan motor should operate.

If N.G., replace radiator fan motor.

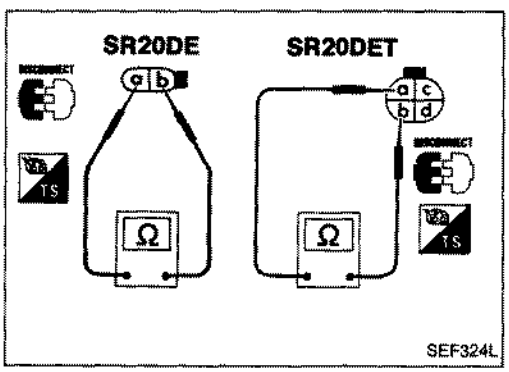


E.C.C.S. RELAY, RADIATOR FAN RELAY AND FUEL PUMP RELAY

Check continuity between terminals ③ and ⑤.

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

If N.G., replace neutral switch.



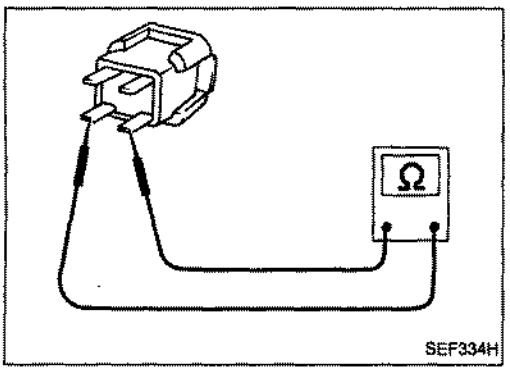
NEUTRAL SWITCH

Check continuity between terminals ⓐ and ⓑ.

Conditions	Continuity
Shift to Neutral	Yes
Shift to other position	No

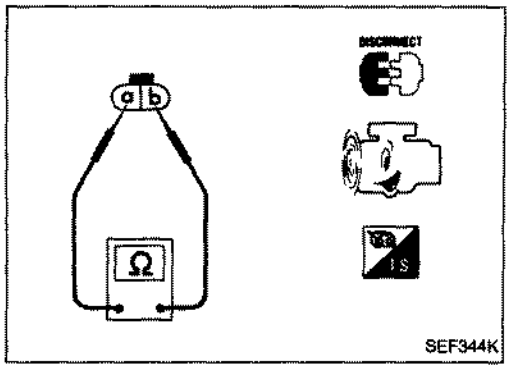
If N.G., replace neutral switch.

Electrical Components Inspection (Cont'd)



RESISTOR

1. Disconnect resistor harness connector.
2. Check resistance between terminals ⓐ and ⓑ.
   Resistance: Approximately 2.2kΩ
   If N.G., replace resistor.

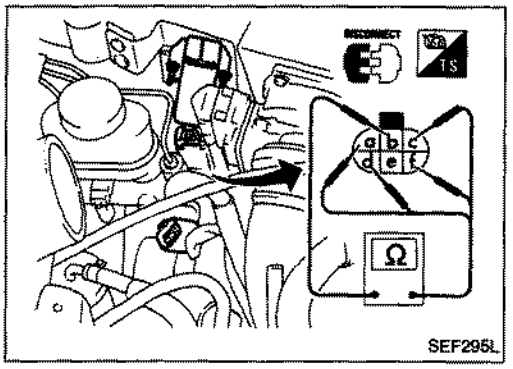


POWER STEERING OIL PRESSURE SWITCH

1. Disconnect power steering oil pressure switch harness connector.
2. Start engine.
3. Check continuity between terminals ⓐ and ⓑ.

Conditions	Continuity
Steering wheel is being turned	Yes
Steering wheel is not being turned	No

If N.G., replace power steering oil pressure switch.



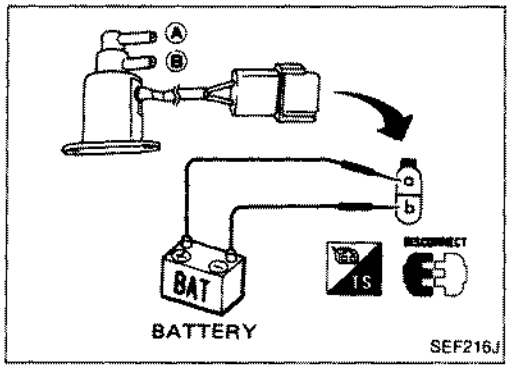
DROPPING RESISTOR

1. Disconnect dropping resistor harness connector.
2. Check resistance as shown in the figure.

Terminals	Resistance
ⓑ - ⓐ	5 - 7Ω
ⓑ - ⓒ	
ⓑ - ⓓ	
ⓑ - ⓕ	

If N.G., replace dropping resistor.

Electrical Components Inspection (Cont'd)

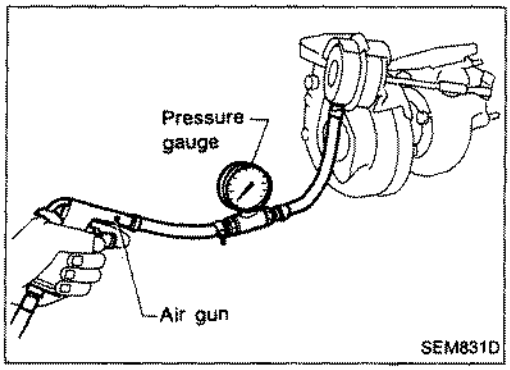


WASTEGATE VALVE CONTROL SOLENOID VALVE

Check air passage continuity.

condition	Air passage continuity between Ⓐ and Ⓑ
12V direct current supply between terminals ⓐ and ⓑ	Yes
No supply	No

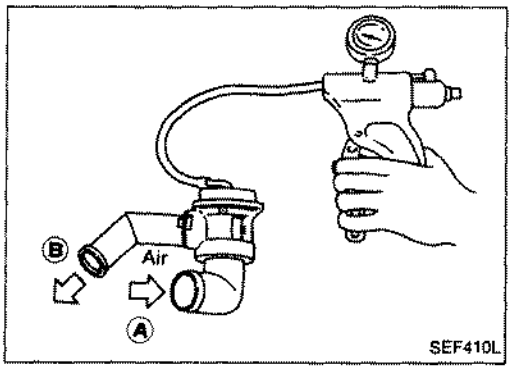
If N.G., replace solenoid valve.



WASTEGATE VALVE ACTUATOR

Apply compressed air to wastegate valve actuator and check it for smooth movement.

- **Do not applying compressed air to the actuator continuously.**
- **The air pressure should be in the range of 59 to 69 kPa (0.59 to 0.69 bar, 0.6 to 0.7 kg/cm^2, 9 to 10 psi).**



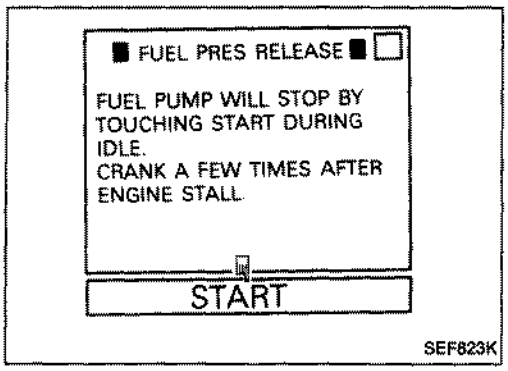
RECIRCULATION VALVE

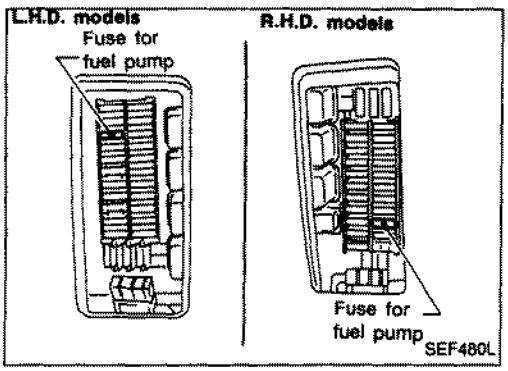
Check air passage continuity.

Condition	Air passage continuity between Ⓐ and Ⓑ
A vacuum of above –17.3 kPa (–173 mbar, –130 mmHg, –5.12 inHg) is applied to vacuum port	Yes
No vacuum applied	No

If N.G., replace recirculation valve.

Do not disassemble and adjust recirculation valve.





Releasing Fuel Pressure

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

1. Turn ignition switch "ON".
2. Perform "FUEL PRESSURE RELEASE" in "WORK SUPPORT" mode with CONSULT.
3. Start engine.
4. After engine stalls, crank it two or three times to release all fuel pressure.
5. Turn ignition switch off.

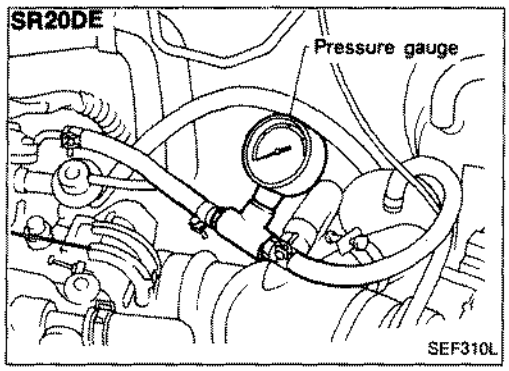
1. Remove fuse for fuel pump.
2. Start engine.
3. After engine stalls, crank it two or three times to release all fuel pressure.
4. Turn ignition switch off and re-insert fuel pump fuse.

Fuel Pressure Check

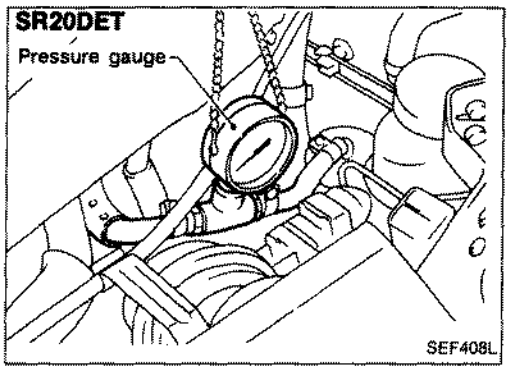
a. When reconnecting fuel line, always use new clamps.
b. Make sure that clamp screw does not contact adjacent parts.
c. Use a torque driver to tighten clamps.
d. Use Pressure Gauge to check fuel pressure.
e. Do not perform fuel pressure check while fuel pressure regulator control system is operating; otherwise, fuel pressure gauge might indicate incorrect readings.

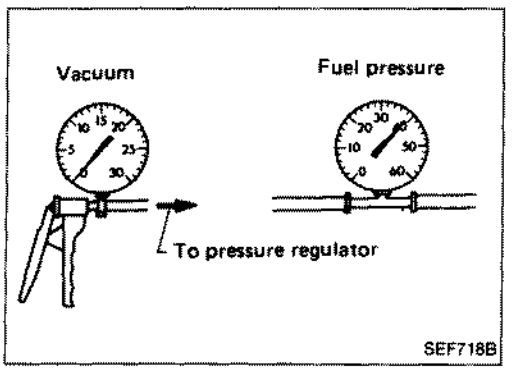
1. Release fuel pressure to zero.
2. Disconnect fuel hose between fuel filter and fuel tube (engine side).
3. Install pressure gauge between fuel filter and fuel tube.
4. Start engine and check for fuel leakage.

Fuel Pressure Check (Cont'd)



5. Read the indication of fuel pressure gauge.
   At idling:
   When fuel pressure regulator valve vacuum hose is connected
   Approximately 245 kPa (2.45 bar, 2.5 kg/cm^2, 36 psi)
   A few seconds after ignition switch is turned from OFF to ON
   Approximately 294 kPa (2.94 bar, 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.



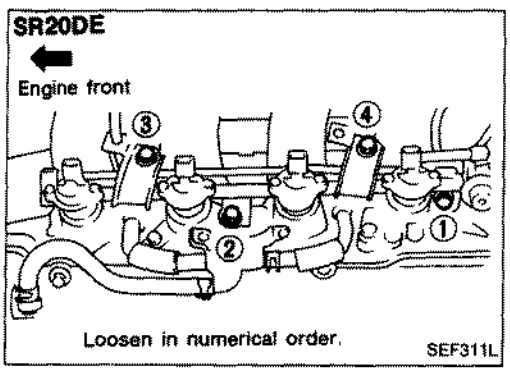


9. Start engine and read indication of fuel pressure gauge as vacuum is changed.

Fuel pressure should decrease as vacuum increases. If results are unsatisfactory, replace fuel pressure regulator.

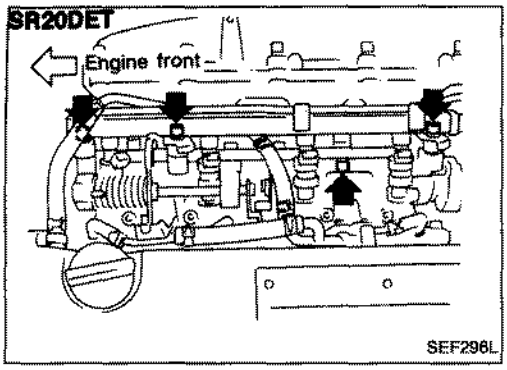
Injector Removal and Installation

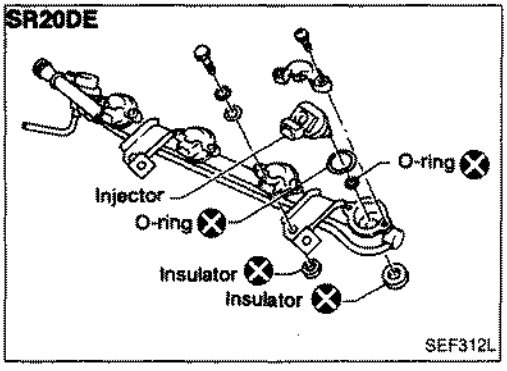
1. Release fuel pressure to zero.
2. Remove intercooler. (SR20DET only)
3. Disconnect injector harness connectors.
4. Disconnect vacuum hose from pressure regulator.
5. Disconnect fuel hoses from fuel tube assembly.



6. Remove injectors with fuel tube assembly.

Injector Removal and Installation (Cont'd)





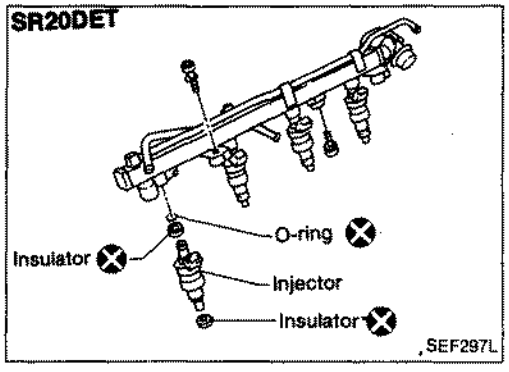
7. SR20DE: Push out any malfunctioning injector from fuel tube assembly.

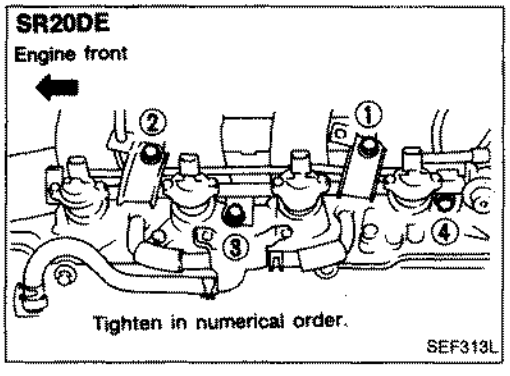
Do not extract injector by pinching connector.

SR20DET: Remove any malfunctioning injector from fuel tube assembly.

8. Replace or clean injector as necessary.
9. Install injector to fuel tube assembly.

Always replace O-rings and insulators with new ones.
Lubricate O-rings with a smear of silicone oil.





10. Install injectors with fuel tube assembly to intake manifold. Tighten fuel tube bolts to the specified torque.

Tightening procedure:

(SR20DE)

1) Tighten all bolts to 9.3 to 10.8 N·m (0.95 to 1.1 kg-m, 6.9 to 8.0 ft-lb).
2) Tighten all bolts to 21 to 26 N·m (2.1 to 2.7 kg-m, 15 to 20 ft-lb).

(SR20DET)

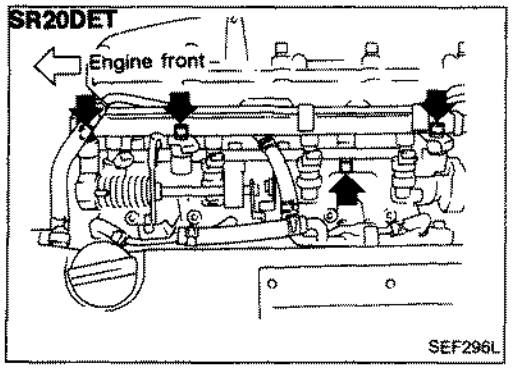
1) Tighten all bolts to 16 to 19 N·m (1.6 to 1.9 kg-m, 12 to 14 ft-lb).

11. Install fuel hoses to fuel tube assembly.

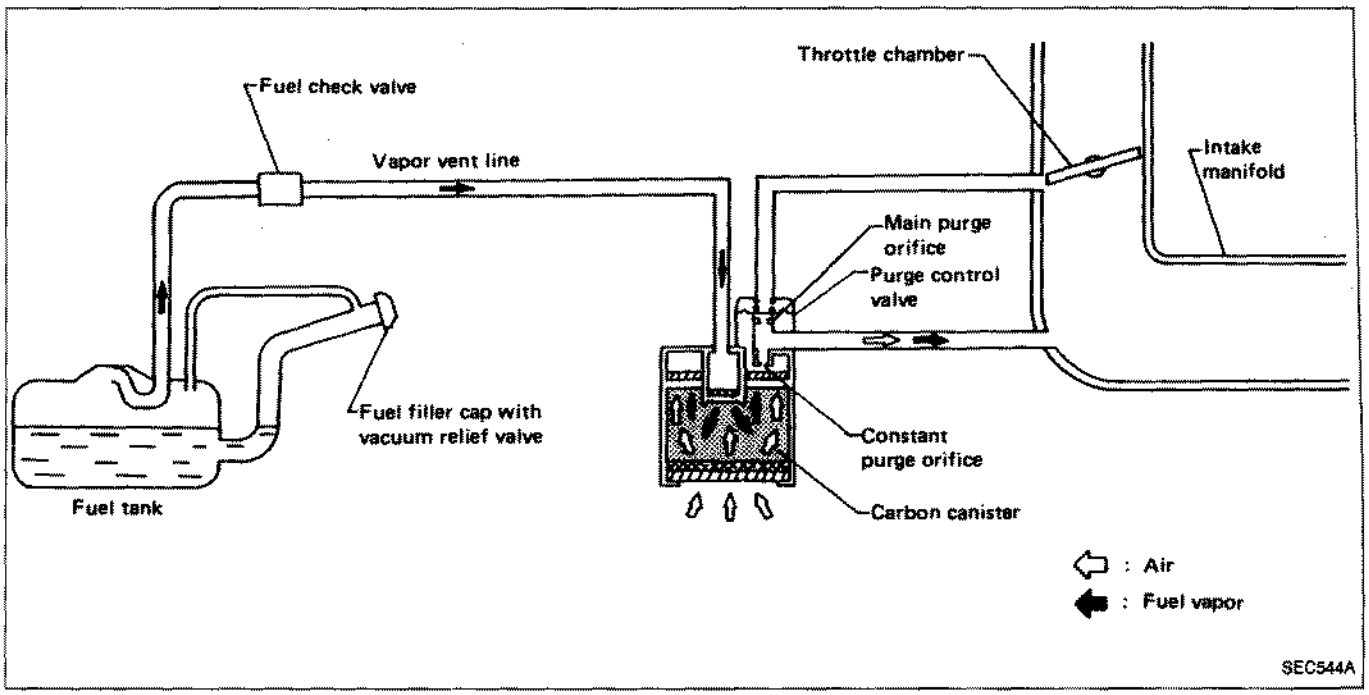
Lubricate fuel hoses with a smear of silicone oil.

12. Reinstall any parts removed in reverse order of removal.

CAUTION:
After properly connecting fuel hose to fuel tube and injector assembly, check connections for fuel leaks.



Description

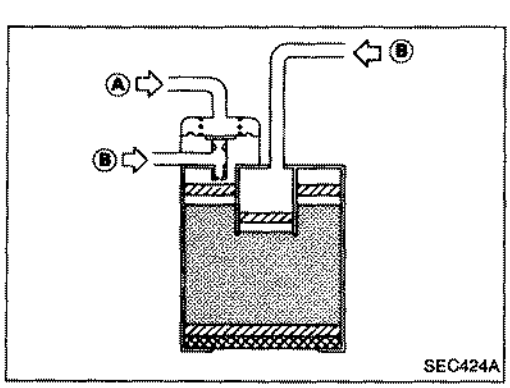


The evaporative emission control system is used to reduce hydrocarbons emitted into the atmosphere from the fuel system. This reduction of hydrocarbons is accomplished by activated charcoals in the carbon canister.

The fuel vapor from the sealed fuel tank is led into the canister which contains activated carbon and the vapor is stored there when the engine is not running.

The canister retains the fuel vapor until the canister is purged by the air drawn through the bottom of the canister to the intake manifold when the engine is running. When the engine runs at idle, the purge control valve is closed.

Only a small amount of stored vapor flows into the intake manifold through the constant purge orifice. As the engine speed increases, and the throttle vacuum rises higher, the purge control valve opens and the vapor is sucked into the intake manifold through both the main purge orifice and the constant purge orifice.



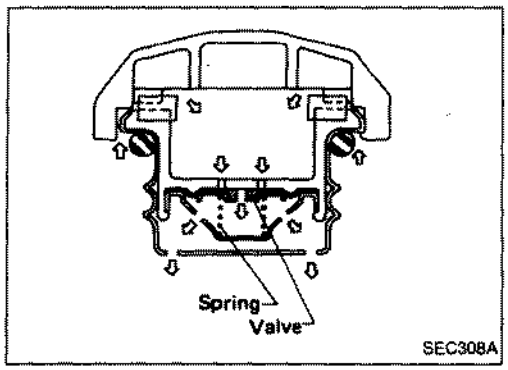
Inspection

CARBON CANISTER

Check carbon canister as follows:

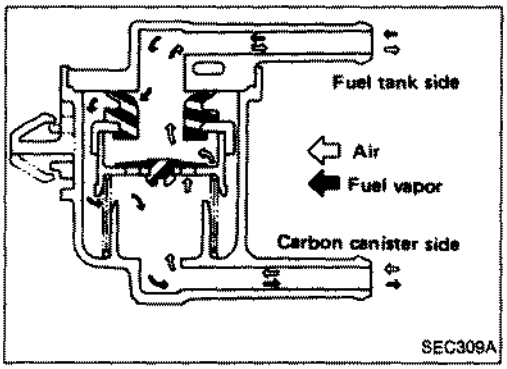
Ⓐ : Blow air and ensure that there is no leakage.
Ⓑ : Blow air and ensure that there is leakage.

Inspection (Cont'd)



FUEL TANK VACUUM RELIEF VALVE

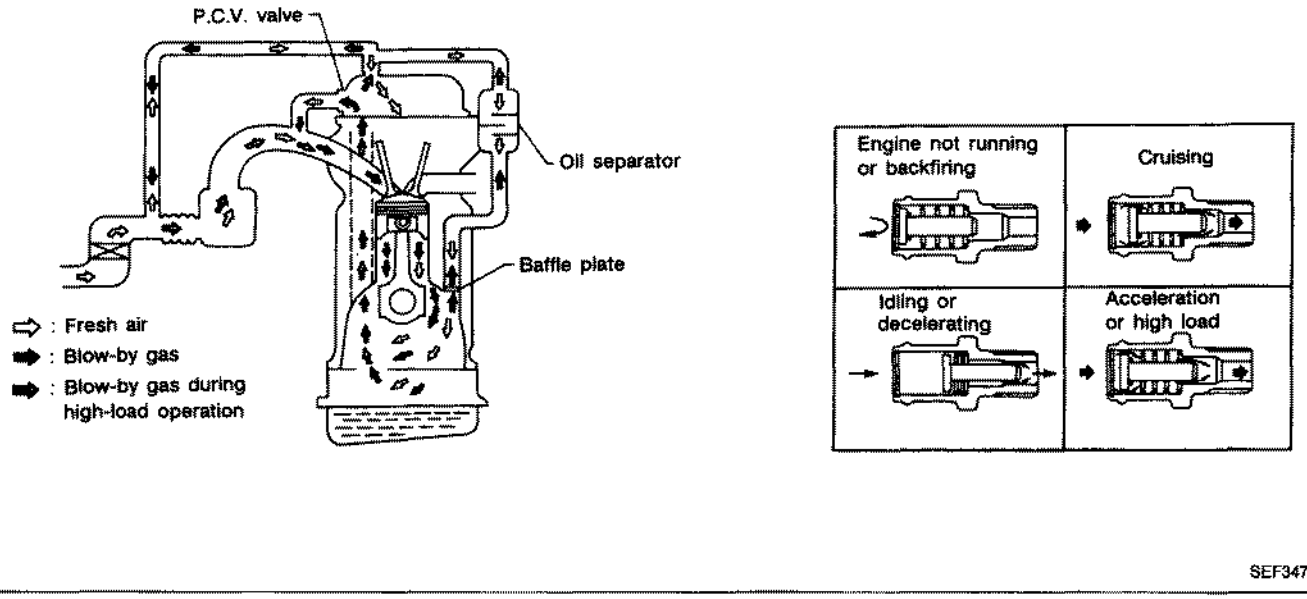
1. Wipe clean valve housing.
2. Suck air through the cap. A slight resistance accompanied by valve clicks indicates that valve is in good mechanical condition. Note also that, by further sucking air, the resistance should disappear with valve clicks.
3. If valve is clogged or if no resistance is felt,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



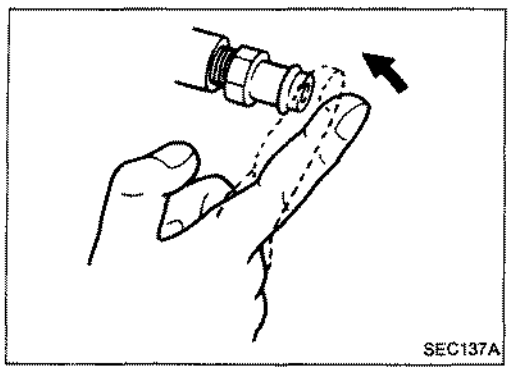
FUEL CHECK VALVE

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 inlet tubes.
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 inlet tubes, through the hose connecting air inlet tubes 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 inlet tubes under all conditions.

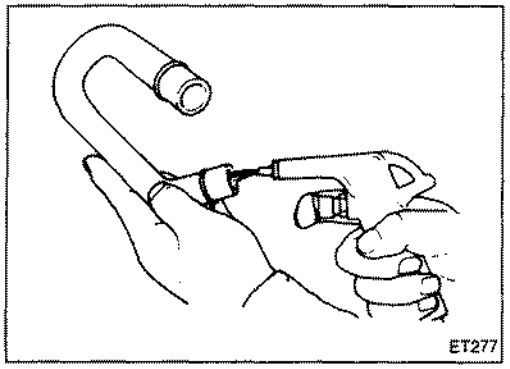


Inspection

P.C.V. (Positive Crankcase Ventilation)

With engine running at idle, remove ventilation hose from P.C.V. valve; if the 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.

Inspection (Cont'd)



VENTILATION HOSE

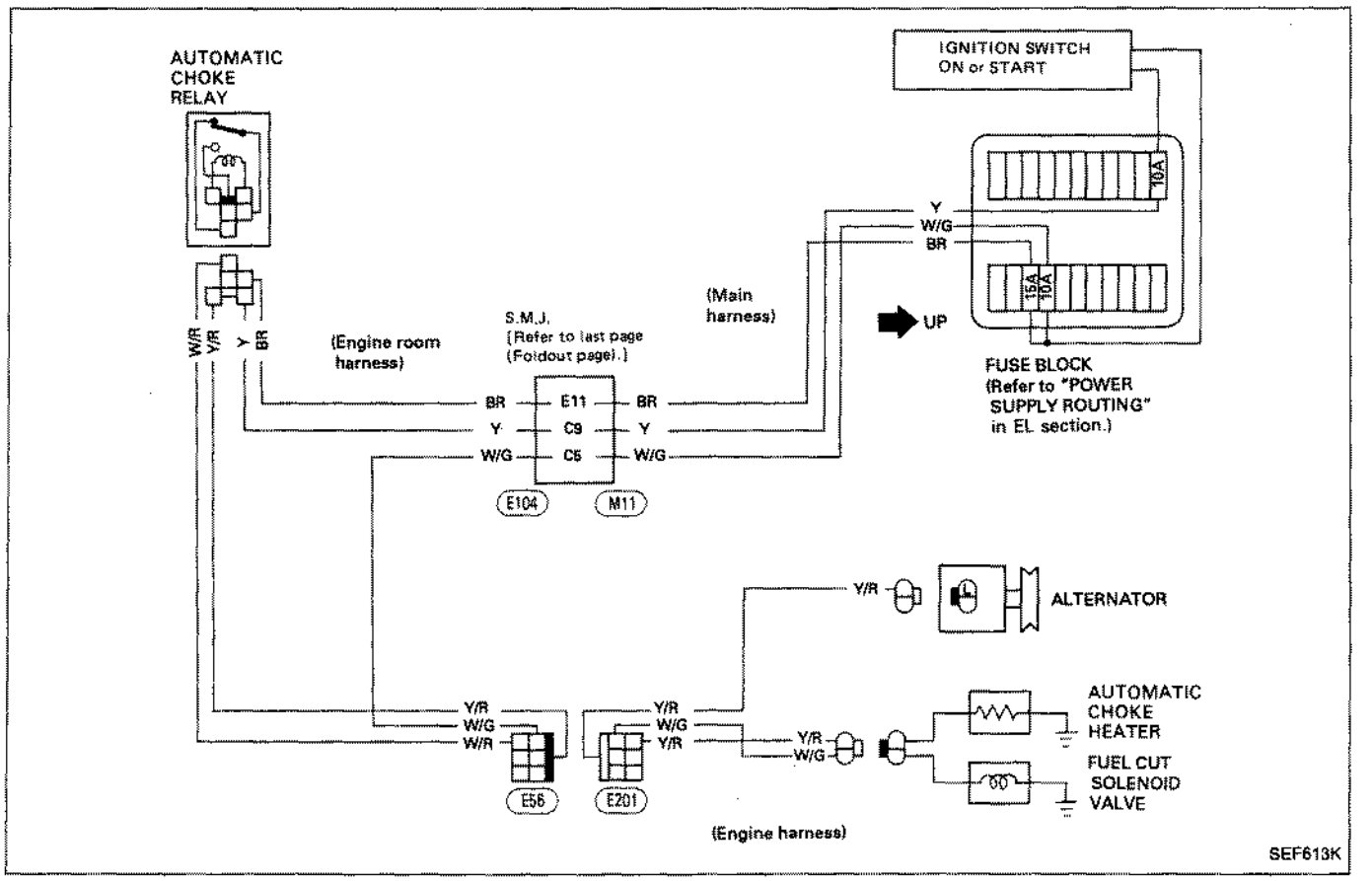
1. Check hoses and hose connections for leaks.
2. Disconnect all hoses and clean with compressed air. If any hose cannot be freed of obstructions, replace.

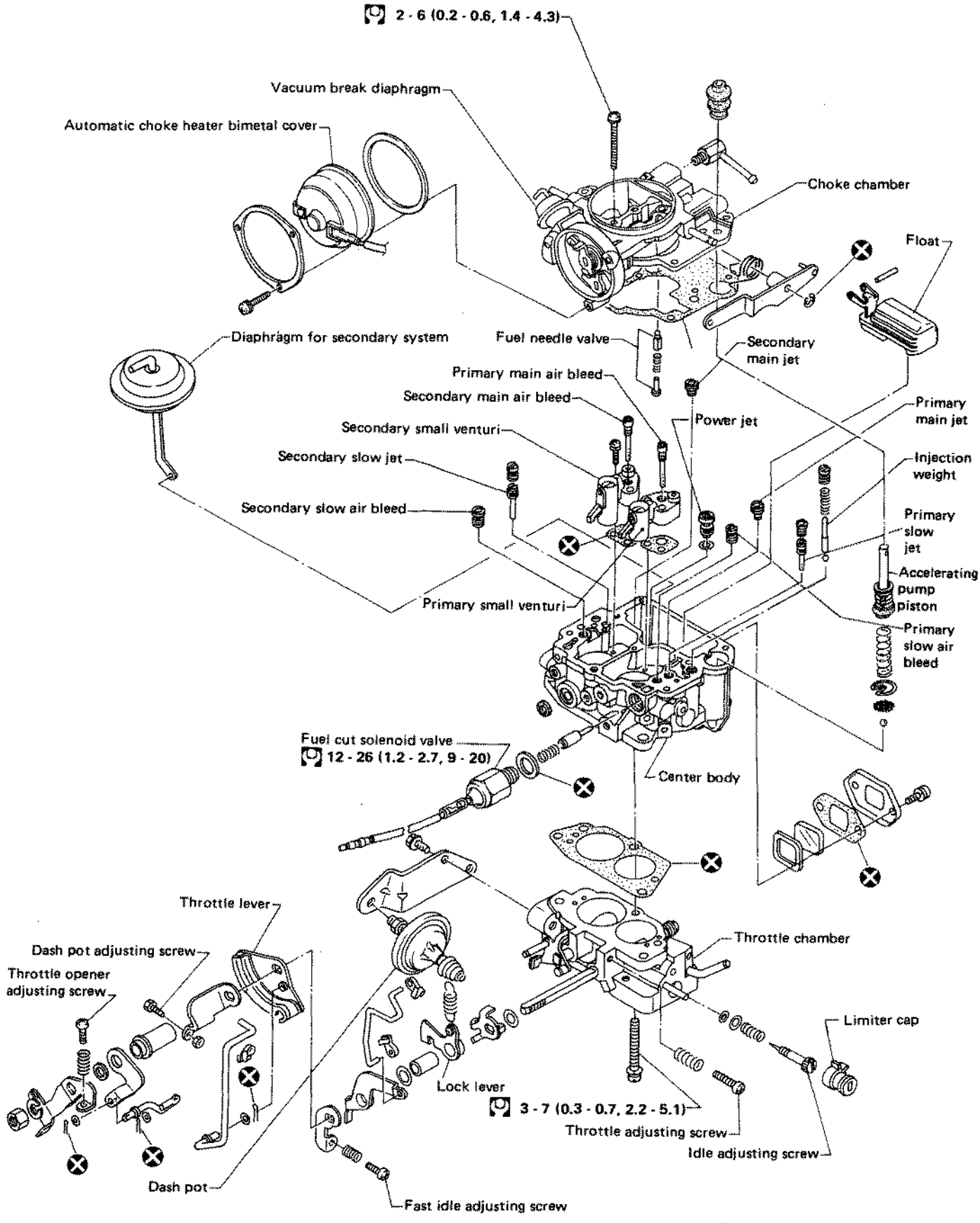
System Application

System \ Engine	E10S
A.T.C. air cleaner	X
Idle compensator	X
Automatic choke	X
Dash pot	X
Distributor vacuum advance system	X
Crankcase emission control system	X

X: Available

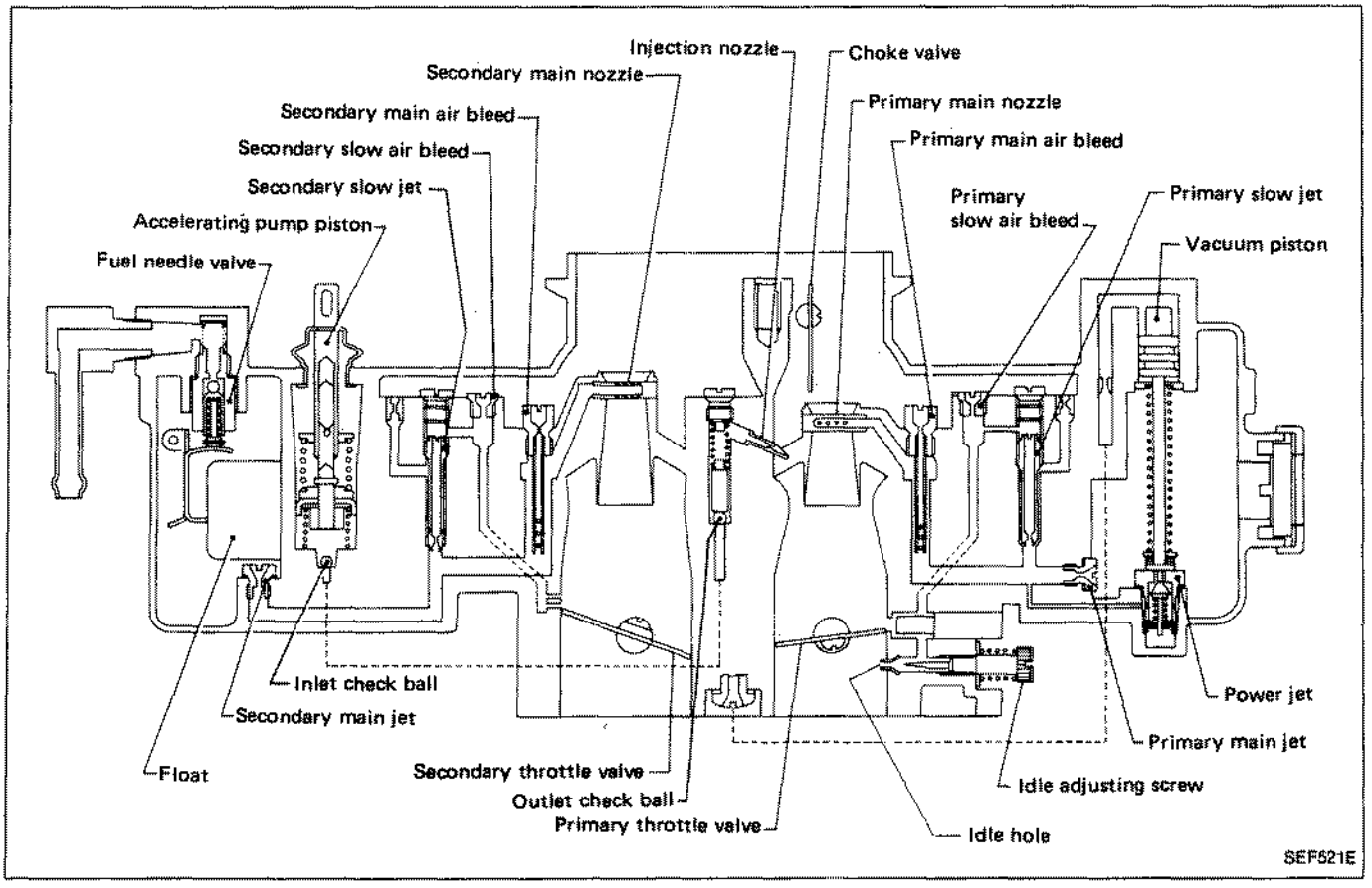
Wiring Diagram




2 - 6 (0.2 - 0.6, 1.4 - 4.3)
Vacuum break diaphragm
Automatic choke heater bimetal cover
Choke chamber
Float
Diaphragm for secondary system
Fuel needle valve
Secondary main jet
Primary main air bleed
Secondary main air bleed
Power jet
Primary main jet
Secondary small venturi
Secondary slow jet
Injection weight
Secondary slow air bleed
Primary slow jet
Accelerating pump piston
Primary small venturi
Primary slow air bleed
Fuel cut solenoid valve
12 - 26 (1.2 - 2.7, 9 - 20)
Center body
Throttle lever
Dash pot adjusting screw
Throttle opener adjusting screw
Throttle chamber
Limiter cap
Lock lever
3 - 7 (0.3 - 0.7, 2.2 - 5.1)
Throttle adjusting screw
Idle adjusting screw
Dash pot
Fast idle adjusting screw
: N·m (kg-m, ft-lb)

SEF914E

Structure


Injection nozzle
Choke valve
Secondary main nozzle
Primary main nozzle
Secondary main air bleed
Primary main air bleed
Secondary slow air bleed
Primary slow jet
Secondary slow jet
Primary slow air bleed
Accelerating pump piston
Vacuum piston
Fuel needle valve
Inlet check ball
Power jet
Secondary main jet
Primary main jet
Float
Secondary throttle valve
Idle adjusting screw
Outlet check ball
Primary throttle valve
Idle hole
SEF521E

Major Service Operation

The perfectly adjusted carburetor delivers the proper fuel and air ratios at all speeds for the particular engine for which it was designed.
The carburetor should be maintained in its original condition and will continue to deliver the proper ratios.
To maintain accurate carbureting through passages and discharge holes, extreme care must be taken in cleaning.

REMOVAL

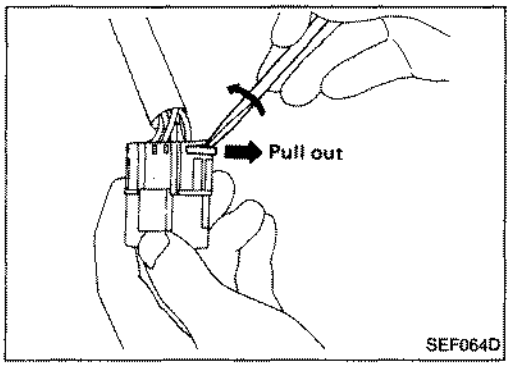
When removing carburetor from engine, take sufficient care to the following:

a. **When disconnecting fuel lines, do not spill fuel from fuel pipe.**
b. **When removing carburetor, do not drop any nut or bolt into intake manifold.**
c. **Be careful not to bend or scratch any part.**

CLEANING AND INSPECTION

Dirt, gum, water or carbon contamination in or on exterior moving parts of a carburetor often results in unsatisfactory performance. For this reason, efficient carbureting depends upon careful cleaning and inspection while servicing.
Before assembling and installing the carburetor, blow all passages and castings with compressed air and blow off all parts until dry.

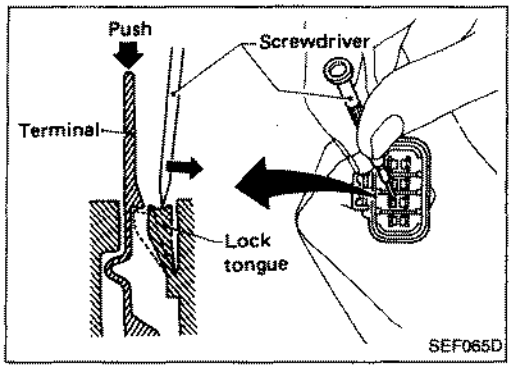
Do not pass drills or wires through calibrated jets or passages as this may enlarge orifice and seriously affect carburetor calibration.



Disassembling Carburetor Harness Connector

When replacing fuel cut solenoid and automatic choke heater (choke chamber assembly), it will be necessary to disassemble carburetor harness connector.

1. Remove rear clip.



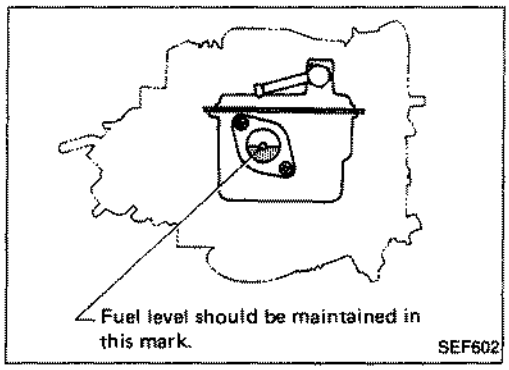
2. With a small screwdriver, tilt lock tongue and, at the same time, push out terminal.

CAUTION:

- **When extracting terminal, do not pull wire harness. Always push the top of terminal.**
- **Take care not to damage seal boot at the bottom of terminal.**
- **Do not let oil or gasoline adhere to seal boot.**

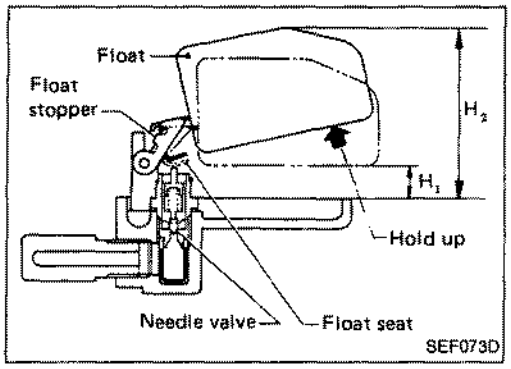
Idle Speed and Mixture Ratio

Refer to MA section for Inspection and Adjustment of idle speed and mixture ratio.



Fuel Level

Place vehicle in a level area and with engine idling, check fuel level through sight glass.
If N.G., adjust as follows.



1. Remove choke chamber.
2. Turn choke chamber upside down, raise float, then lower it until float seat contacts with needle valve and in that position check clearance H_1.
   H_1: 14.5 - 15.5 mm (0.571 - 0.610 in)
   If out of specification, adjust by bending float seat.
3. Raise float until float stopper touches the choke chamber, and check height H_2.
   H_2: 44.5 - 45.5 mm (1.752 - 1.791 in)
   If out of specification, adjust by bending float stopper.
4. Install choke chamber and recheck fuel level with engine idling.

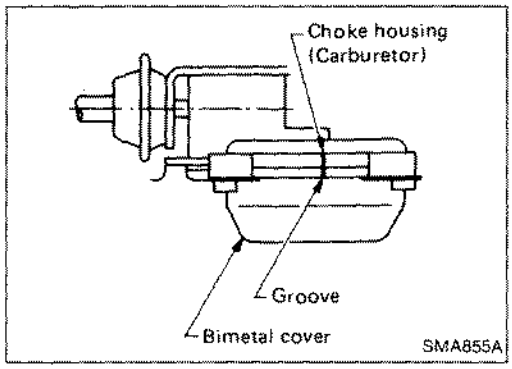
CAUTION:
Always replace choke chamber gasket with a new one.

Automatic Choke

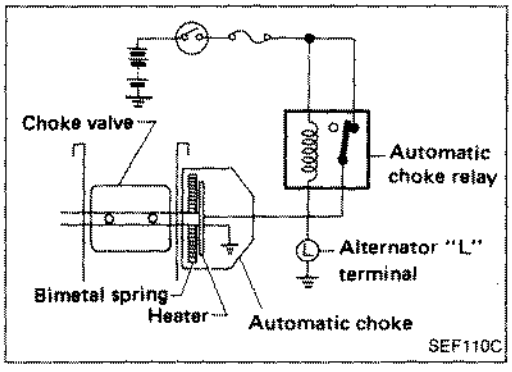
AUTOMATIC CHOKE ADJUSTMENT

1. With the engine cold and before starting it, fully open throttle valve and ensure that choke valve closes properly.
2. Push choke valve with a finger, and check for smooth movement.

Automatic Choke (Cont'd)



3. Check bimetal cover mark and choke housing mark. When bimetal cover is replaced, set bimetal cover mark so that it will be aligned with choke housing mark.



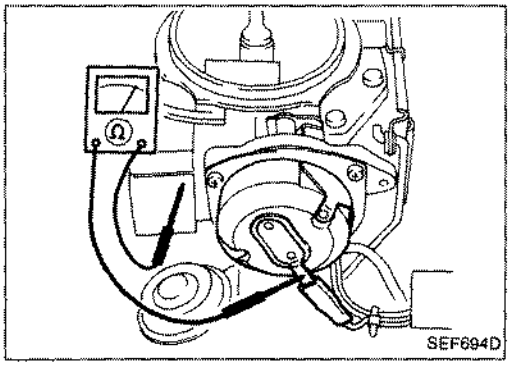
AUTOMATIC CHOKE INSPECTION

1. Check automatic choke heater source wiring for proper connection, then start engine.
2. After warming up the engine, ensure that choke valve is fully open.
3. If choke valve does not operate after warm-up, check choke heater circuit, choke heater and choke relay.

Choke heater circuit

Check continuity of circuit.

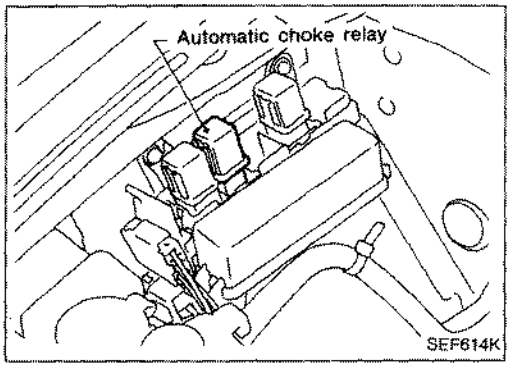
Refer to "Circuit Diagram" and "Wiring Diagram" in "ENGINE ELECTRICAL SYSTEM".



Choke heater

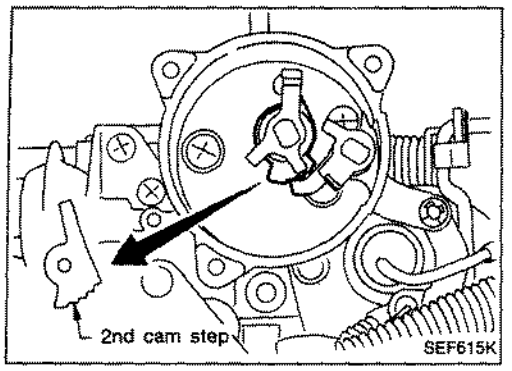
Check for continuity between choke heater connector and choke housing.

Continuity should exist.



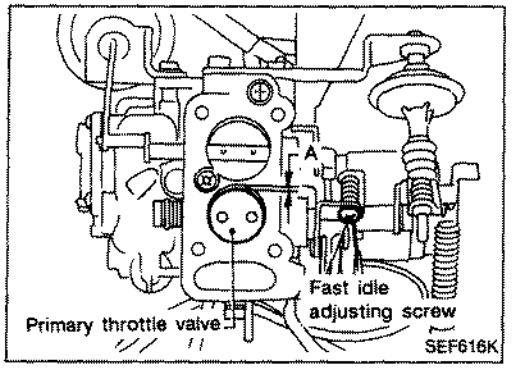
Choke relay

Automatic choke relay is installed in the engine room.
Check relay for proper operation.
Refer to "STANDARDIZED RELAY" in EL section.

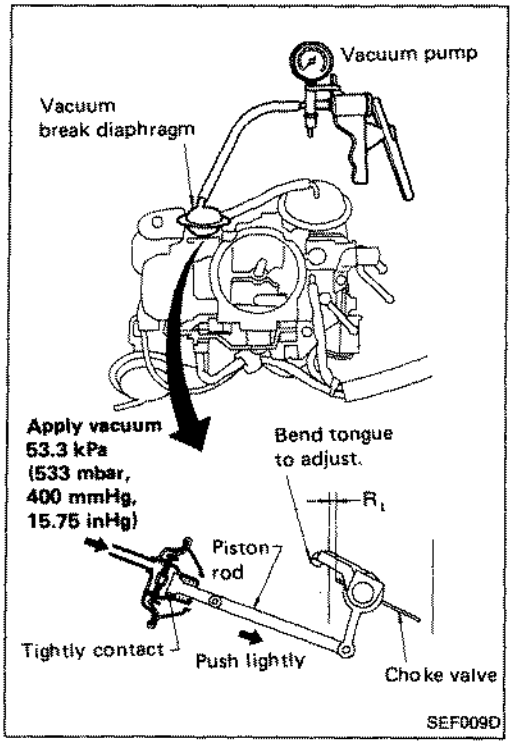


Fast Idle

1. Warm up engine. Remove automatic choke heater bimetal cover and set fast idle arm on 2nd cam step of fast idle cam.
2. Read engine speed.
   Fast idle speed (at 2nd cam step):
   2,200 ± 200 rpm

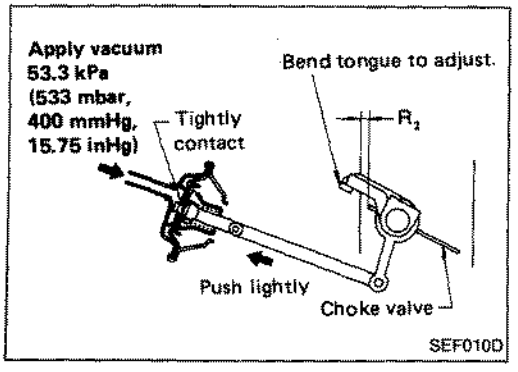


3. If out of specifications, remove carburetor and make fast idle adjustments as follows.
1) Place fast idle arm on 2nd step of fast idle cam.
2) Adjust clearance "A" between primary throttle valve and inner carburetor wall by turning fast idle adjusting screw.
   Clearance "A":
   0.47 ± 0.07 mm (0.0185 ± 0.0028 in)
4. After adjusting clearance "A", install carburetor on engine and check engine speed.
5. Install automatic choke heater bimetal cover.



Vacuum Break

1. With engine cold, visually check that choke valve is fully closed.
2. Apply vacuum to vacuum break diaphragm.
3. Lightly push piston rod in the direction that closes choke valve and check clearance "R_1".
   Clearance "R_1":
   1.31 ± 0.14 mm (0.0516 ± 0.0055 in)
   If out of specification, adjust "R_1" by bending tongue.



4. Lightly push piston rod toward diaphragm and check clearance "R_2".
   Clearance "R_2":
   1.84 ± 0.28 mm (0.0724 ± 0.0110 in)
   If out of specification, recheck and adjust clearance "R_1".

Accelerating Pump

1. With engine stopped, turn the throttle lever and ensure that the fuel is injected smoothly through the injector located in primary port.

A pump stroke limiter serves to inject a small amount of fuel immediately after throttle lever movement.

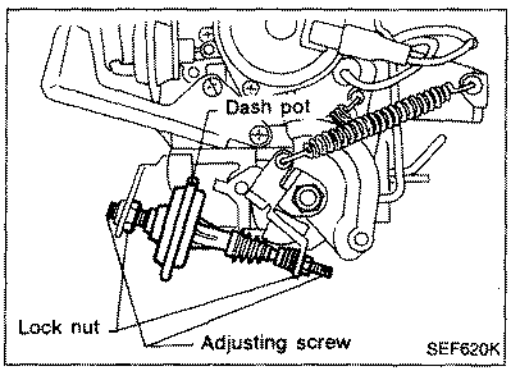
2. If accelerating pump is out of order, check link, lever pump piston, limiter, etc.

Do not bend stroke limiter.

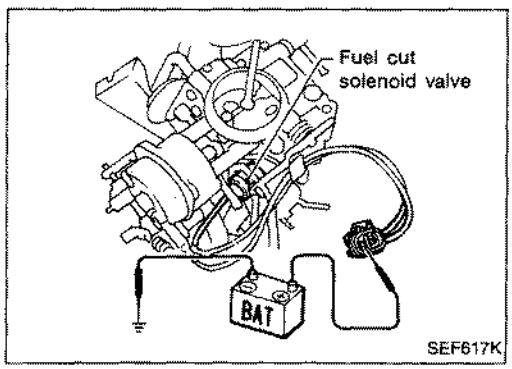
Dash Pot

1. Warm up engine sufficiently. Idle speed of engine and mixture must be well tuned.
2. Turn throttle lever by hand, and read engine speed when dash pot stem just touches stopper lever.

Dash pot touch speed:
1,900 ± 200 rpm



3. If out of specifications, adjust it by turning adjusting screws.
4. After adjusting, make sure that dash pot operates smoothly.



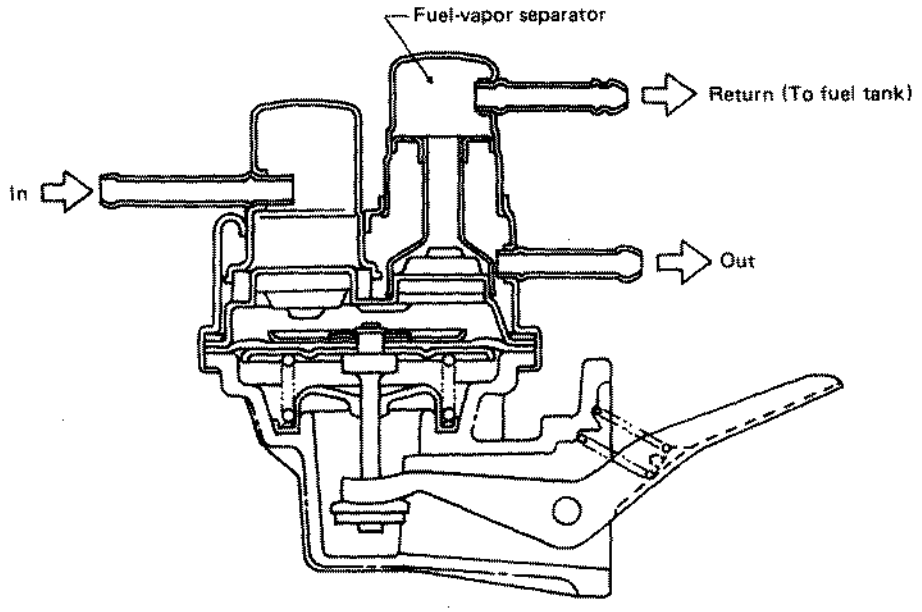
Fuel Cut Solenoid Valve

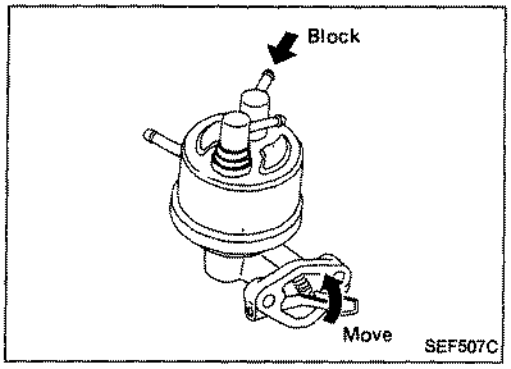
If the engine does not stop when the carburetor harness connector is disconnected, the solenoid valve is stuck or broken.

Connect solenoid valve lead wire to battery. Check "clicking" sound from solenoid valve when battery is connected and disconnected. If N.G., replace the solenoid valve.

After replacement, start engine and check to be sure that fuel is not leaking, and that fuel cut solenoid valve is in good condition.

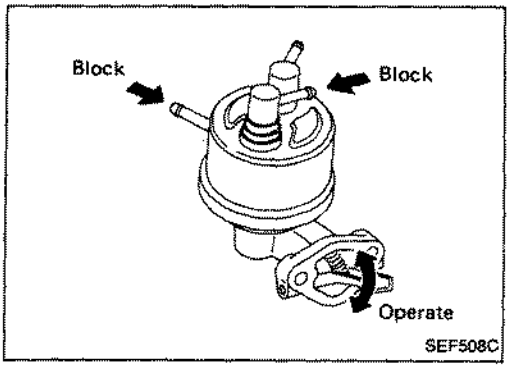
The fuel pump cannot be disassembled.



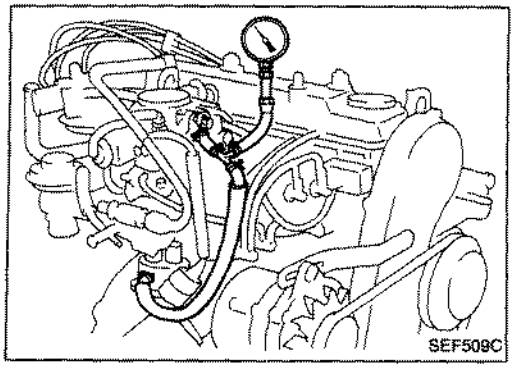


WARNING:
Before starting to work on any part of fuel system, disconnect ground cable from battery.
When disconnecting fuel hoses, use a container to catch fuel remaining in the hoses.

1. Flush pump by immersing it in a fuel bath and operating rocker arm a number of times.
2. Drain fuel from fuel pump. Then block off the inlet port and check that pump arm does not move.



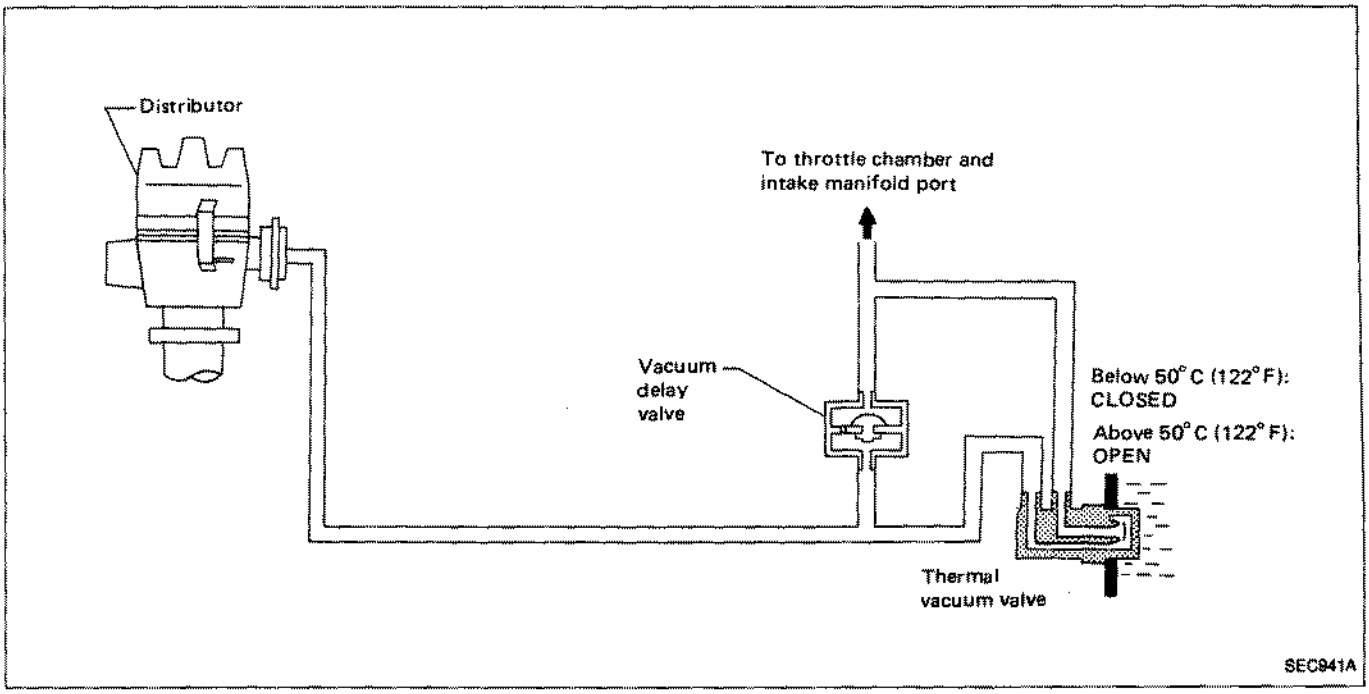
3. Remove your finger from the inlet port and listen for a suction sound which will confirm that a sufficient suction was produced.
4. Block off outlet port and return port and once again operate the pump arm. After air pressure has been built up, confirm that the pressure remains for two or three seconds.
5. Put a finger over the outlet port and return port and again build up pressure in the pump. Then submerse the pump in a fuel bath and check for air leaks.



Fuel pressure test

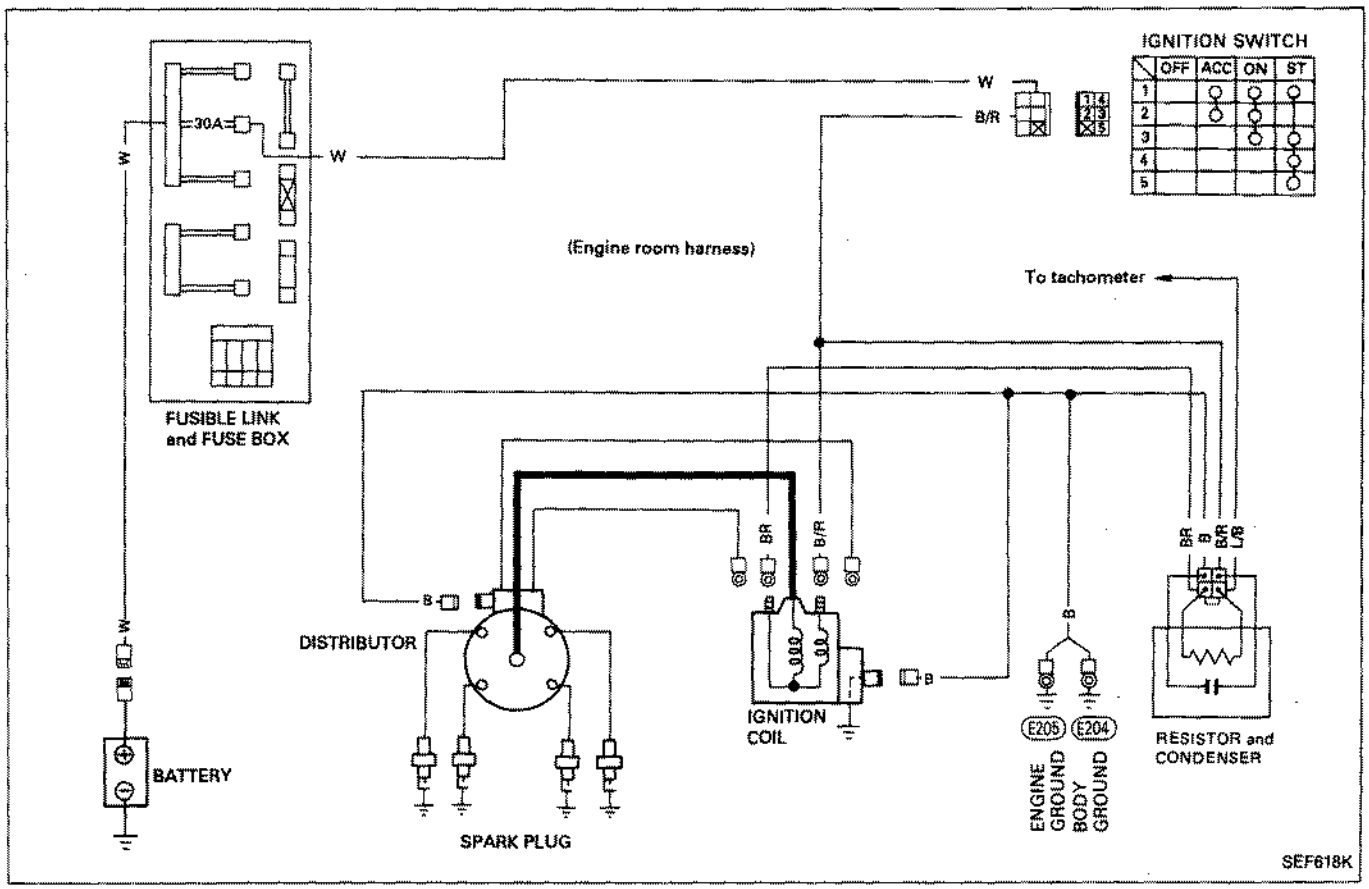
1. Connect T-connector and a suitable pressure gauge.
2. Disconnect fuel return hose and plug up outlet tube for return.
3. Check fuel pressure with engine running at various speeds.
   Fuel pump pressure:
   19.6 - 26.5 kPa (0.196 - 0.265 bar, 0.20 - 0.27 kg/cm^2, 2.8 - 3.8 psi)
   If out of specification, replace fuel pump.

Description



This system is designed to improve driveability when the engine is cold.

Wiring Diagram



Trouble-shooting

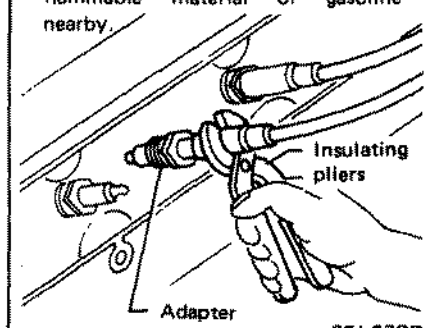
Engine turns erratically.

Engine turns but does not start.

Check ignition timing.
- N.G. → Adjust.
- O.K. →

Attach adapter *1 to high tension wire and position tip of adapter approx. 6 mm (0.24 in) away from cylinder block. With adapter held in that position, crank engine to see if spark jumps across gaps between tip and cylinder block at regular intervals.

Before cranking, disconnect harness connector to carburetor. Before operation, make sure there is no flammable material or gasoline nearby.



SEL578B

- N.G. → Check high-tension wires. Refer to MA section.
- O.K. →

Check air gap between reluctor and stator.
- O.K. →

Check IC ignition system.
IC Ignition System is checked using a volt-ohmmeter.
Follow the steps in the sequence indicated. If a fault is in found, correct the problem before continuing. If all tests indicate "O.K." replace the IC Ignition Unit. DO NOT REPLACE THE UNIT UNTIL ALL TESTS HAVE BEEN COMPLETED AND INDICATE "O.K.".

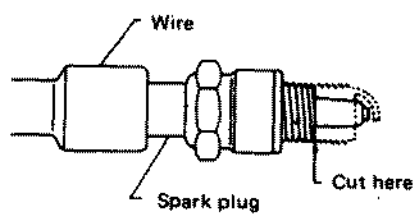
Go to test table.

Check for burned or fouled spark plug.
- N.G. → Clean or replace.
- O.K. → Check fuel system.

WARNING:
When current is flowing, never touch with bare hand high tension wires or any other parts with high voltage. If parts are moist, touching them could cause an electric shock, even if they are insulated. Always wear dry, well-insulated gloves or wrap affected parts with dry cloth before handling.

NOTE:
1. **When performing the following tests, use a multitester which can measure accurately in the following ranges; 0 to 20V. D.C.; 0 to 1,000Ω; 0 to 10V A.C.; 0 to 50,000Ω.**
2. **If possible, start the vehicles and let it run for 5 to 15 minutes with the hood closed. This will bring all components to normal operating temperature, and will make it easier to diagnose intermittent problems.**
3. **It is not necessary to disconnect the harness connectors when performing the tests which follow. Simply insert the meter probes into the back of appropriate connector cavity.**

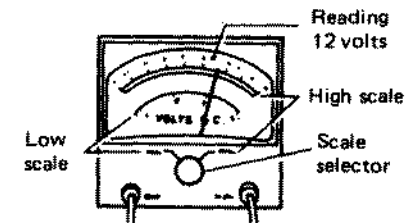
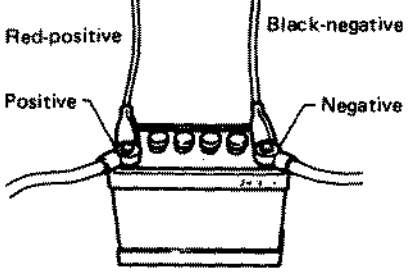
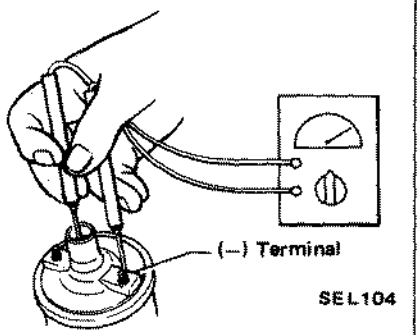
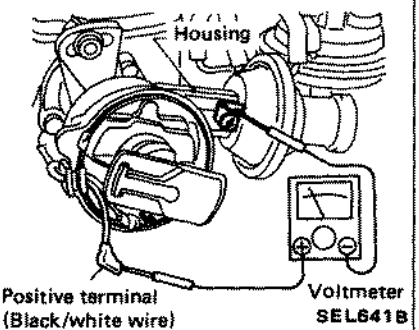
*1:
Preparation of spark plug for checking
Many things can be utilized as an adapter. However, it is recommended that a used spark plug whose threaded portion has been half cut off as shown in the figure be utilized.



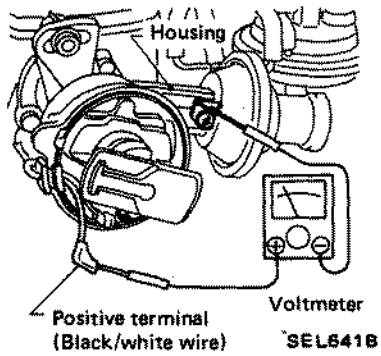
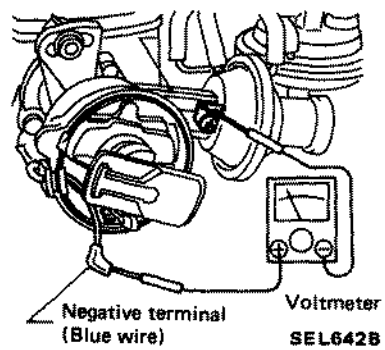
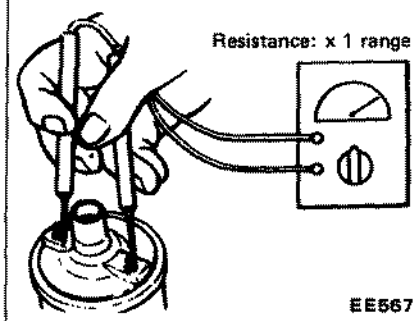
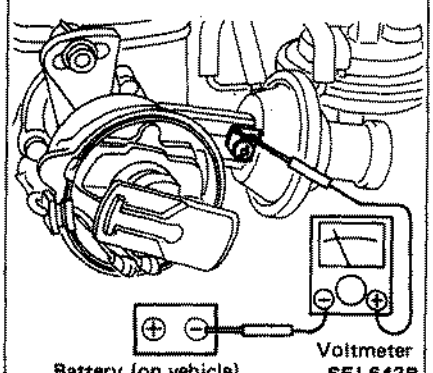
SEL581B

Trouble-shooting (Cont'd)

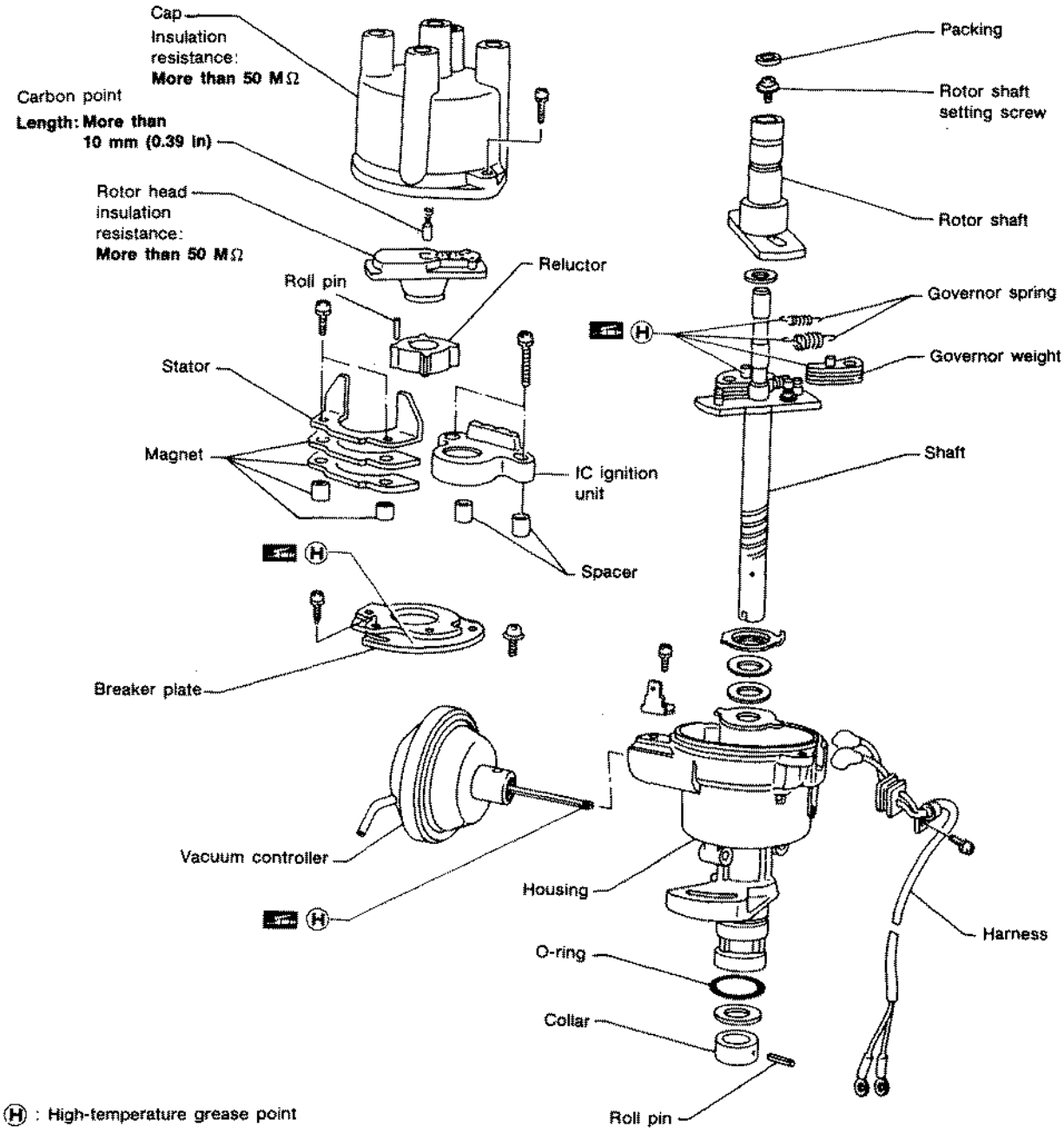
TEST TABLE

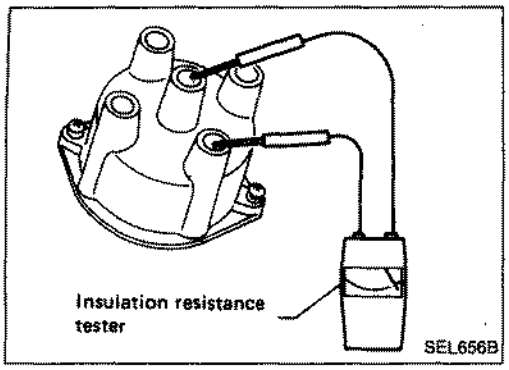
TEST STEP	TEST METHOD	CONDITIONS	RESULT	ACTION
1. Battery Voltage (no-load)		1. Ignition key in "OFF" position. 2. Connect voltmeter as illustrated and set to appropriate scale. 3. Read and record battery voltage reading.	11.5 - 12.5 volts	Proceed to Step 2.
			Below 11.5 volts	Battery, charging system or starting system — Faulty. Refer to applicable section in Service Manual to correct the situation.
2. Battery Cranking Voltage	 SEL103	1. Connect voltmeter as illustrated and set to appropriate scale. 2. Remove coil wire from distributor cap and ground it. 3. Read voltmeter while cranking engine for approximately 15 seconds. 4. Record battery cranking voltage reading.	Voltage reading greater than 9.6 volts	Battery O.K. Proceed to Step 3.
			Voltage reading less than 9.6 volts	Battery, charging system or starting system — Faulty. Refer to applicable sections in Service Manual to correct the situation.
3. Ignition Coil Secondary Circuit	 SEL104	1. Ignition key in "OFF" position. 2. Remove coil wire from coil. 3. Connect ohmmeter as illustrated.	Specified value (Refer to "Service Data and Specifications".)	Ignition coil secondary windings — O.K. Proceed to Step 4.
			Not within the specified values	Faulty ignition coil — replace.
4. Power Supply Circuit	 SEL641B	1. Connect voltmeter as illustrated and set to appropriate scale. 2. Turn ignition key to "ON" position.	11.5 - 12.5 volts	Proceed to Step 5.
			Below 11.5 volts	Check wiring from ignition switch to IC unit.

Trouble-shooting (Cont'd)

TEST STEP	TEST METHOD	CONDITIONS	RESULT	ACTION
5. Power Supply Circuit (Cranking)		1. Connect voltmeter as illustrated and set to appropriate scale. 2. Pull out coil wire from distributor cap and ground it. 3. Turn key to "START" position and observe voltmeter while engine is cranking.	Voltage reading is less than 1 volt below battery cranking voltage and is greater than 8.6 volts.	Proceed to Step 6.
			Voltage reading is more than 1 volt below battery cranking voltage and/or is below 8.6 volts.	Check ignition switch and wiring from switch to IC unit.
6. Ignition Primary Circuit		1. Connect voltmeter as illustrated and set to appropriate scale. 2. Ignition key in "ON" position.	11.5 - 12.5 volts	Proceed to Step 8.
			Below 11.5 volts	Proceed to Step 7.
7. Ignition Coil Primary Circuit		1. Ignition key in "OFF" position. 2. Coil wire removed from coil. 3. Connect ohmmeter as illustrated.	1.04 - 1.27 ohms	Ignition coil primary winding O.K. Check ignition switch and wiring from ignition switch to coil and IC unit.
			Resistance reading not between 1.04 - 1.27 ohms	Faulty ignition coil — replace.
8. I.C. Unit Ground Circuit		1. Connect voltmeter as illustrated and set to appropriate scale. 2. Pull out coil wire from distributor cap and ground it. 3. Turn key to "START" position and observe voltmeter while engine is cranking.	0.5 volts or less	Replace IC ignition unit assembly.
			More than 0.5 volts	Check distributor ground, wiring from chassis ground to battery including battery cable connections.

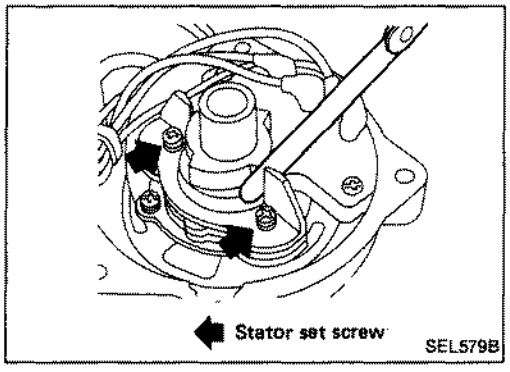
Construction





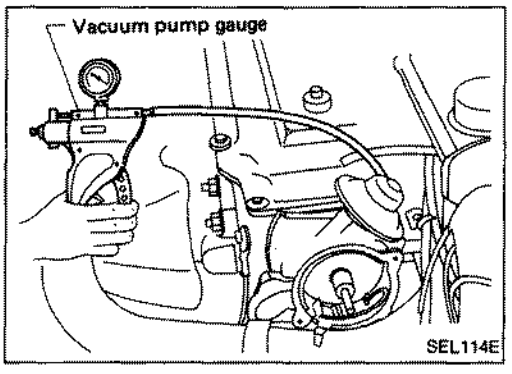
Cap and Rotor Head

1. Check cap and rotor head for dust, carbon deposits and cracks.
2. Measure insulation resistance between electrodes on ignition coil and side of spark plug.
   Insulation resistance:
   More than 50 [MΩ]
   - Less than specified value ... Replace.



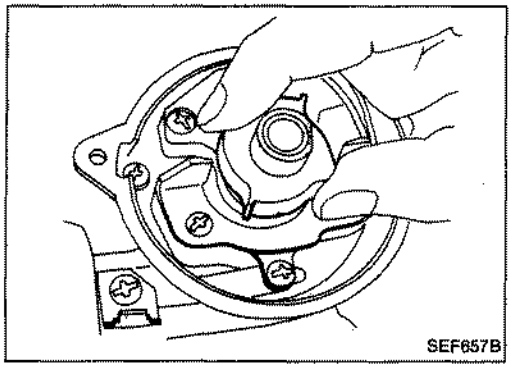
Air Gap Adjustment

- Adjust air gap between reluctor and stator.
  Loosen stator set screw and adjust gap with a gap gauge.
  Air gap:
  0.3 - 0.5 mm (0.012 - 0.020 in)



Vacuum Advance Check

1. Connect vacuum pump gauge to the vacuum controller and gradually draw a vacuum while watching breaker plate movement. Check for smooth operation with no evidence of binding.
2. Turn breaker plate right and left to check for freedom of movement.



Governor Advance Check

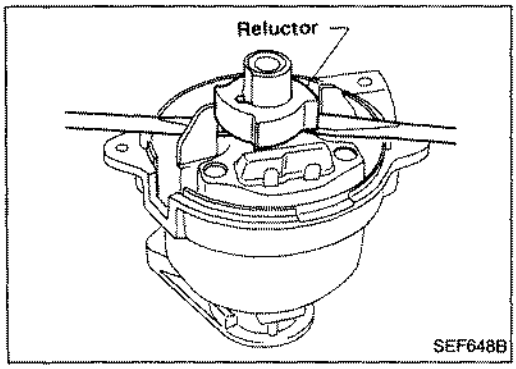
- Turn the reluctor counterclockwise, release it and check that the reluctor returns smoothly to the original position.

Disassembly

Carefully observe the following instructions during disassembly.

- **Put match mark across cam and shaft so that original combination can be restored at assembly.**
- **Inscribe a match mark across spring and mating parts so that spring can be replaced in its original position during assembly.**
  Be careful not to stretch or deform governor spring.

Disassembly (Cont'd)



RELUCTOR

When removing reluctor, be careful not to distort or damage the teeth.

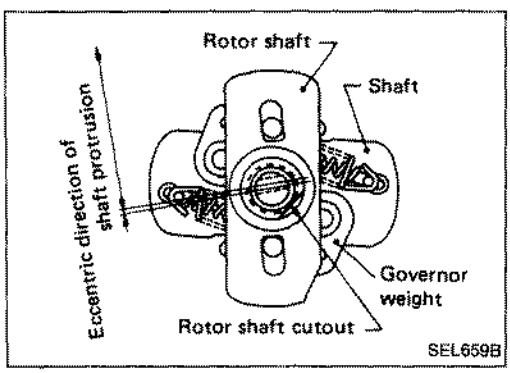
Assembly

Carefully observe the following instructions.

GREASE POINT

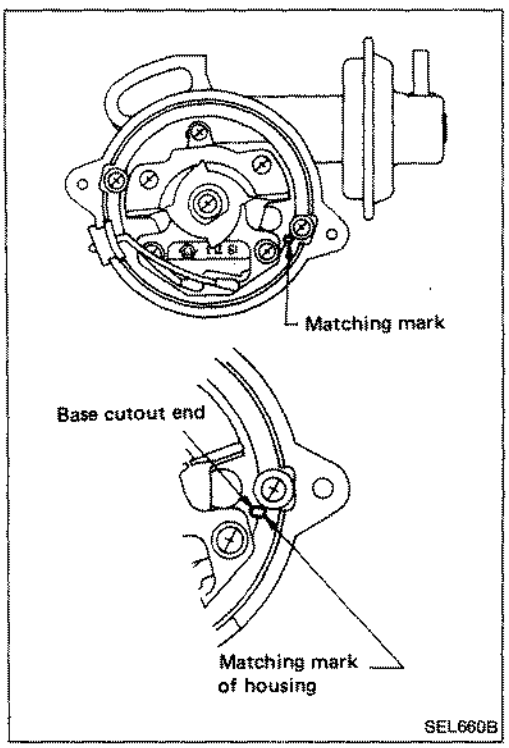
Apply high-temperature grease to:

- Shaft bearing metal
- Governor spring
- Frictional surface of governor weight
- Frictional surface of breaker plate



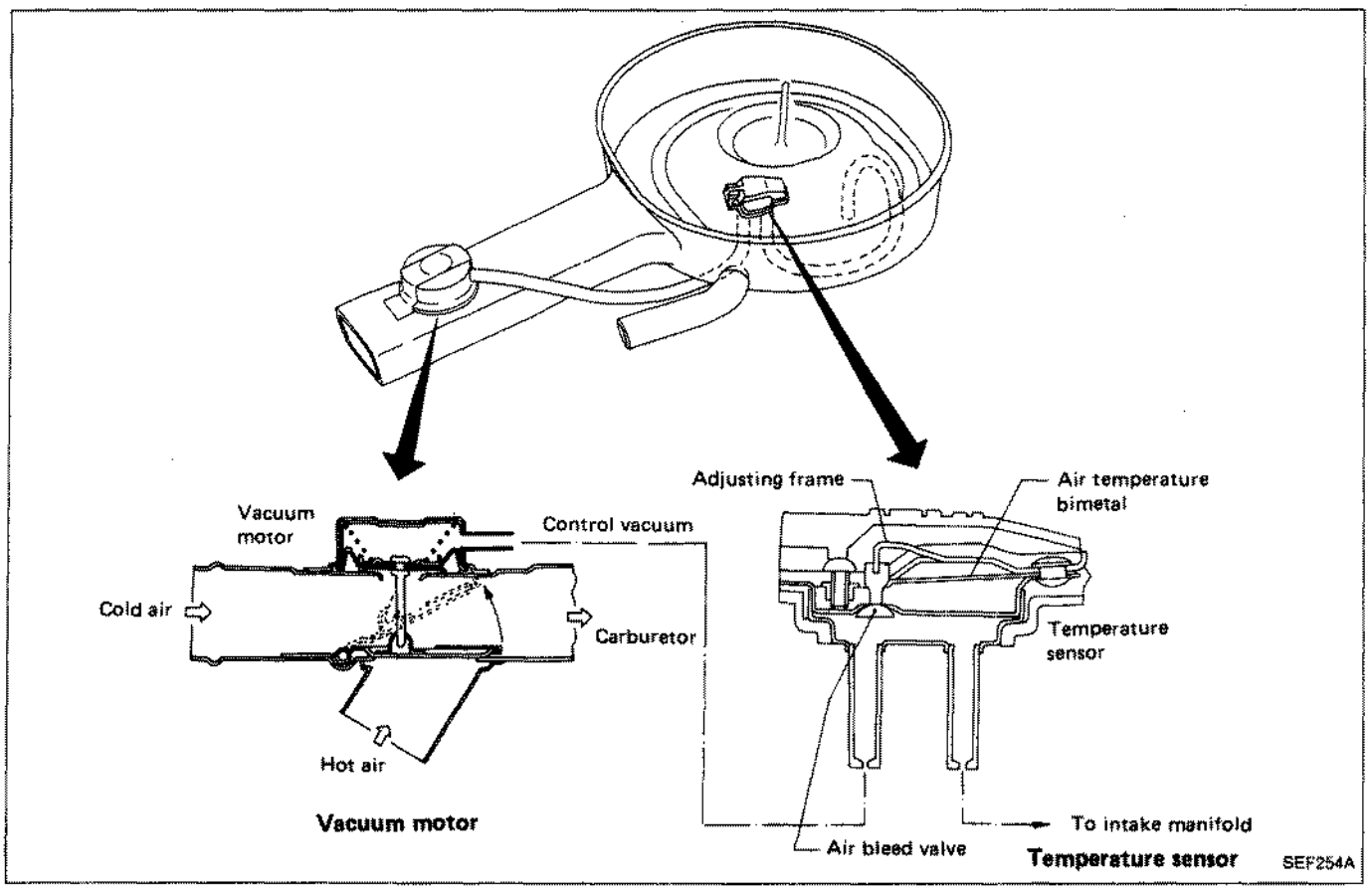
INSTALLATION OF ROTOR SHAFT

Position cutout direction of rotor shaft and eccentric direction of drive shaft protrusion as shown below; then install rotor shaft to drive shaft.



INSTALLATION OF BREAKER PLATE

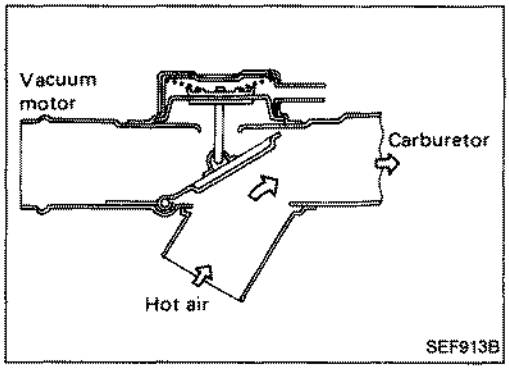
Ensure that aligning marks on breaker plate and housing are lined up properly.



The automatic temperature control system maintains the temperature of air sucked in the carburetor within a constant range, thereby enabling lean setting for carburetor calibration. In addition to this, the automatic temperature control system is effective in improving warm-up characteristics of the engine and to prevent carburetor from icing.

Operation

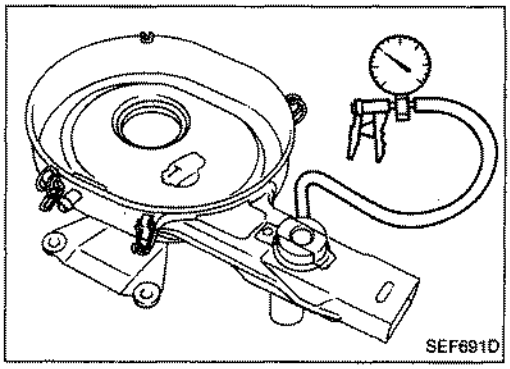
Temperature sensor		Vacuum motor		Inlet air
Ambient temperature around sensor °C (°F)	Operation	Intake manifold vacuum kPa (mbar, mmHg, inHg)	Operation	
Below 38 (100)	Closed	Above 25.3 (253, 190, 7.48)	Raised	Hot
		8.0 - 25.3 (80 - 253, 60 - 190, 2.36 - 7.48)	Partially raised	Cold + Hot
		Below 8.0 (80, 60, 2.36)	Down	Cold
Above 55 (131)	Open	Any value	Down	



Inspection

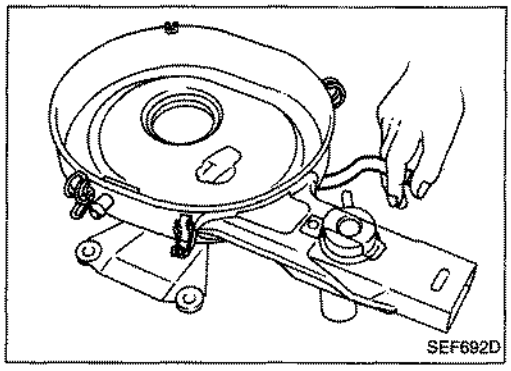
VACUUM HOSE

Check hoses for cracks, distortion and improper position.



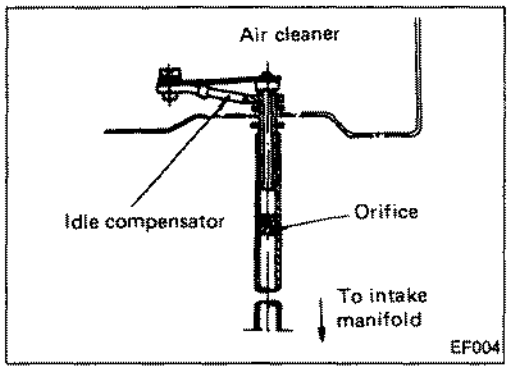
VACUUM MOTOR

Disconnect vacuum motor inlet vacuum hose, and connect another hose to the inlet to apply vacuum to vacuum motor. Then, confirm that the air control valve moves.



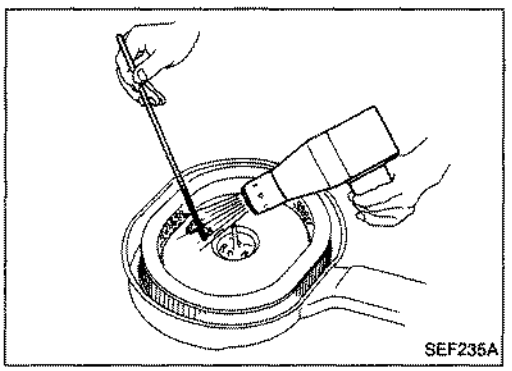
TEMPERATURE SENSOR

While engine is cold and idling, disconnect vacuum motor inlet vacuum hose and make sure that intake vacuum is present at end of vacuum hose. If vacuum is weak or is not present at all, check vacuum hoses for leakage. Replace temperature sensor if vacuum hoses are in good order.



Idle compensator opening temperature

Intake air temperature °C (°F)	Bimetal function
Below 55 (131)	Fully closed
55 - 65 (131 - 149)	Closed or open
Above 65 (149)	Fully open



Inspection

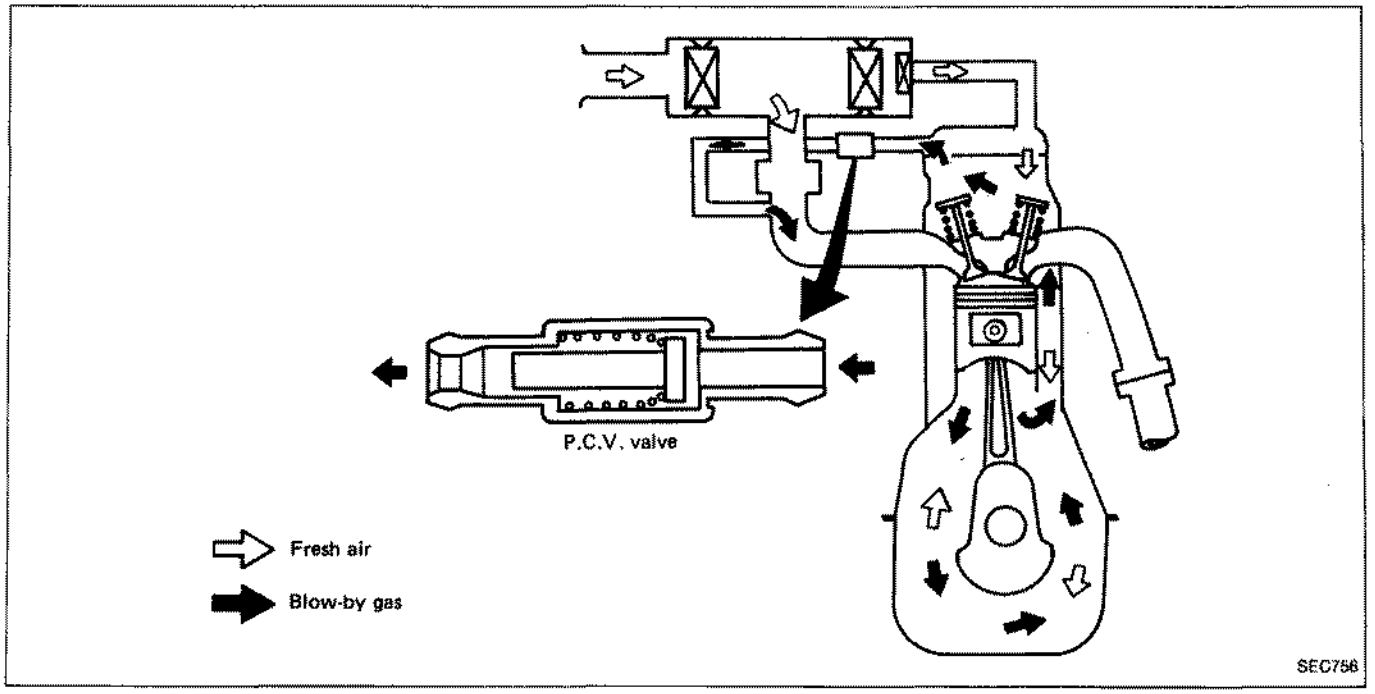
1. Warm up engine completely.
2. Open engine hood and remove air cleaner cover.
3. Direct warm air to idle compensator with a heat gun.
   And measure operating temperature of idle compensator.

Place thermometer as close as possible to idle compensator sensor.

4. Idle compensator is in good order if a "hissing" sound is heard when its temperature reaches operating temperature.
   If not, replace idle compensator.

Take care not to bend or damage bimetals of idle compensator.

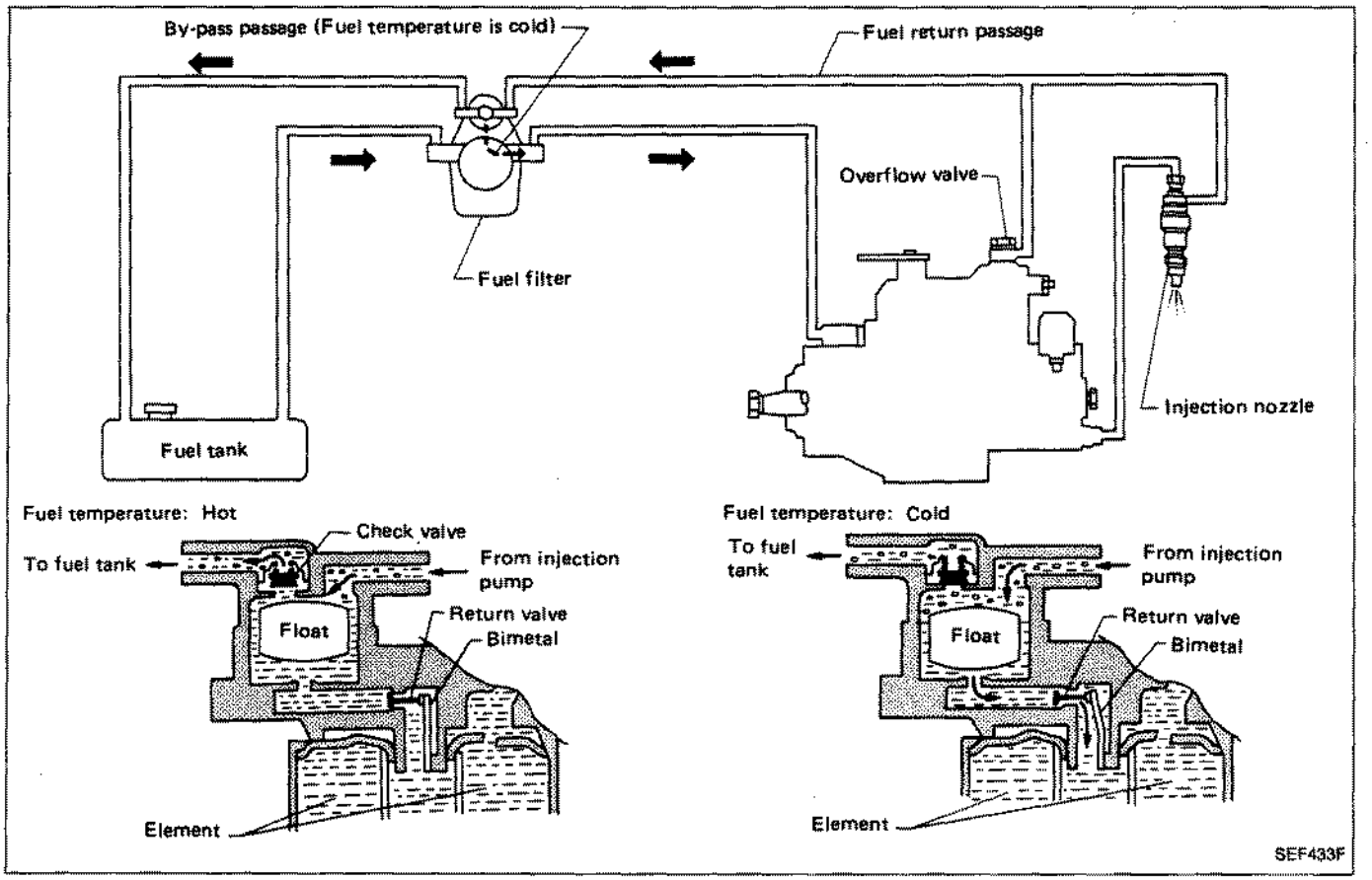
Description

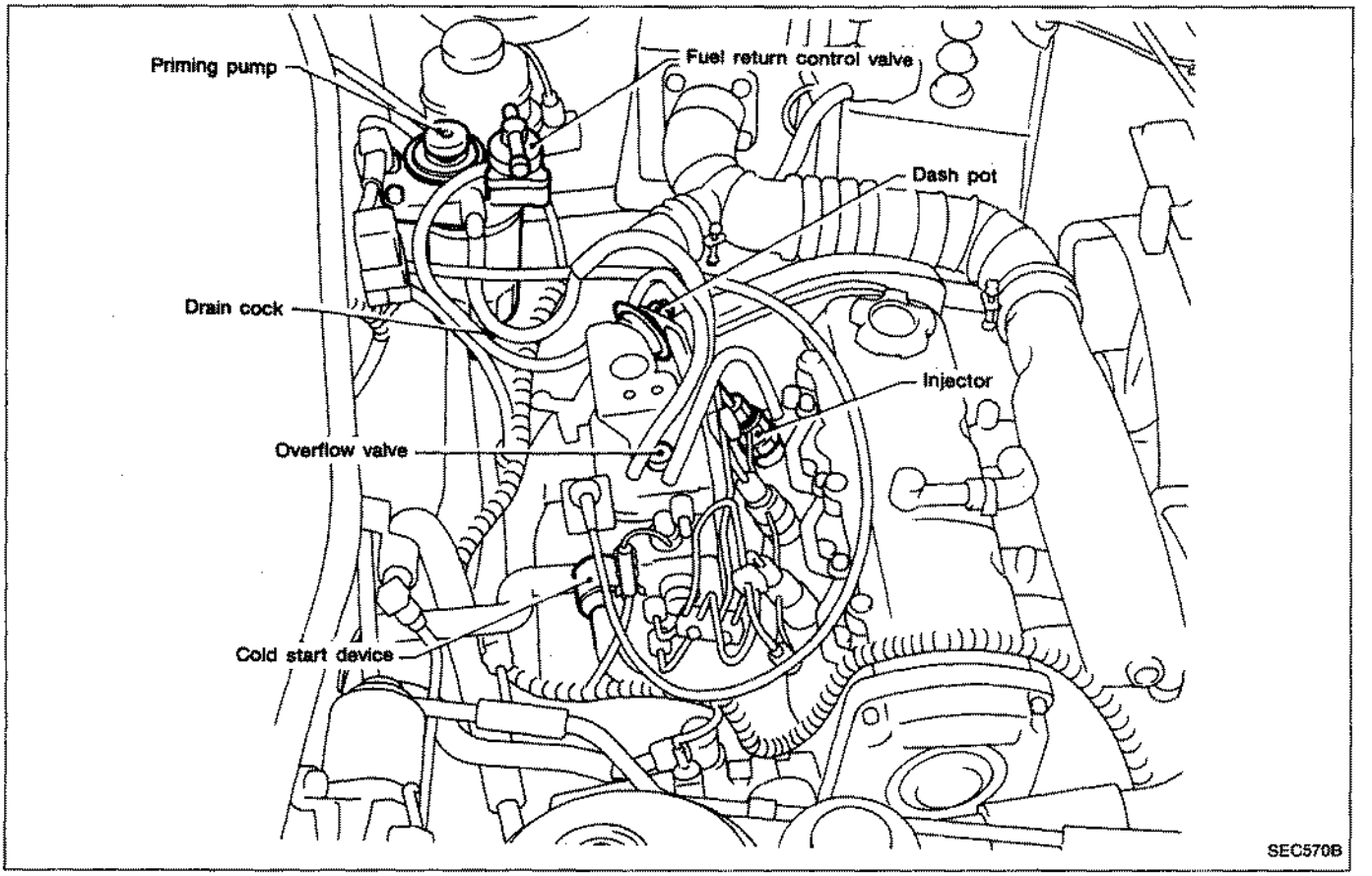


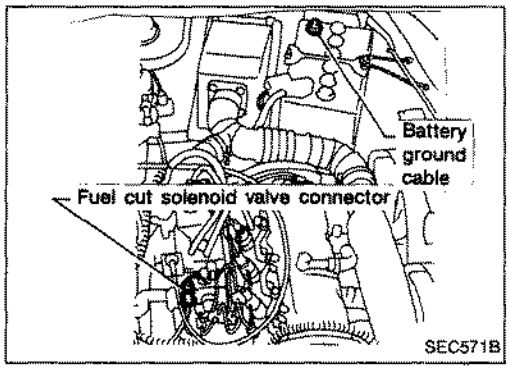
This system is designed to return the blow-by gas to the intake manifold and to charge fresh air into the crankcase. The positive crankcase ventilation (P.C.V.) valve is provided.

Inspection

Refer to MA section.

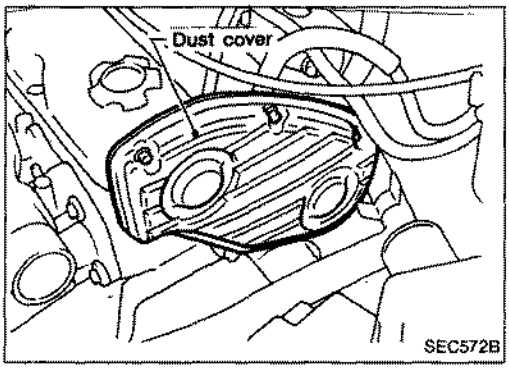

By-pass passage (Fuel temperature is cold)
Fuel return passage
Overflow valve
Fuel filter
Injection nozzle
Fuel tank
Fuel temperature: Hot
Check valve
To fuel tank
From injection pump
Float
Return valve
Bimetal
Element
Fuel temperature: Cold
To fuel tank
From injection pump
Float
Return valve
Bimetal
Element
SEF433F


Priming pump
Fuel return control valve
Dash pot
Drain cock
Injector
Overflow valve
Cold start device
SEC570B

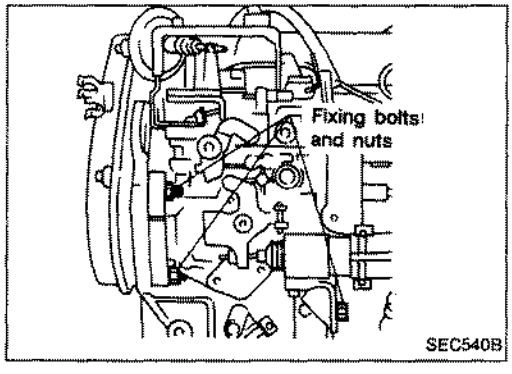


Removal

1. Disconnect battery ⊖ cable, fuel cut solenoid valve connector and accelerator wire.
2. Set No. 1 piston at T.D.C. on its compression stroke.
   T.D.C.: White painted mark
3. Disconnect water hoses for cold start device.
4. Remove fuel hoses (supply, return and spill) and injection tubes.



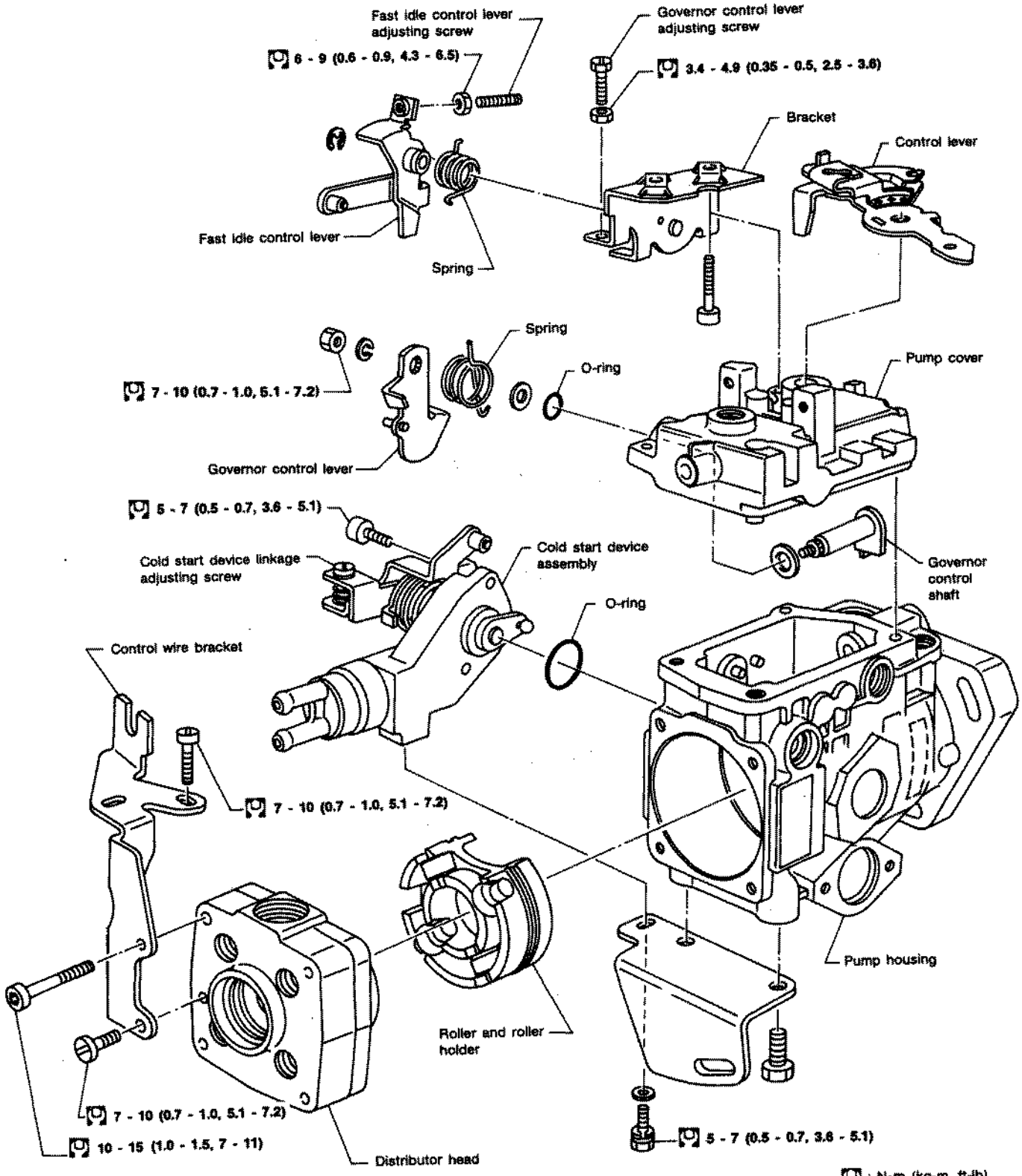
5. Remove air duct and injection pump timing belt cover.



6. Remove injection pump timing belt and sprocket.
7. Remove injection pump assembly.

Disassembly

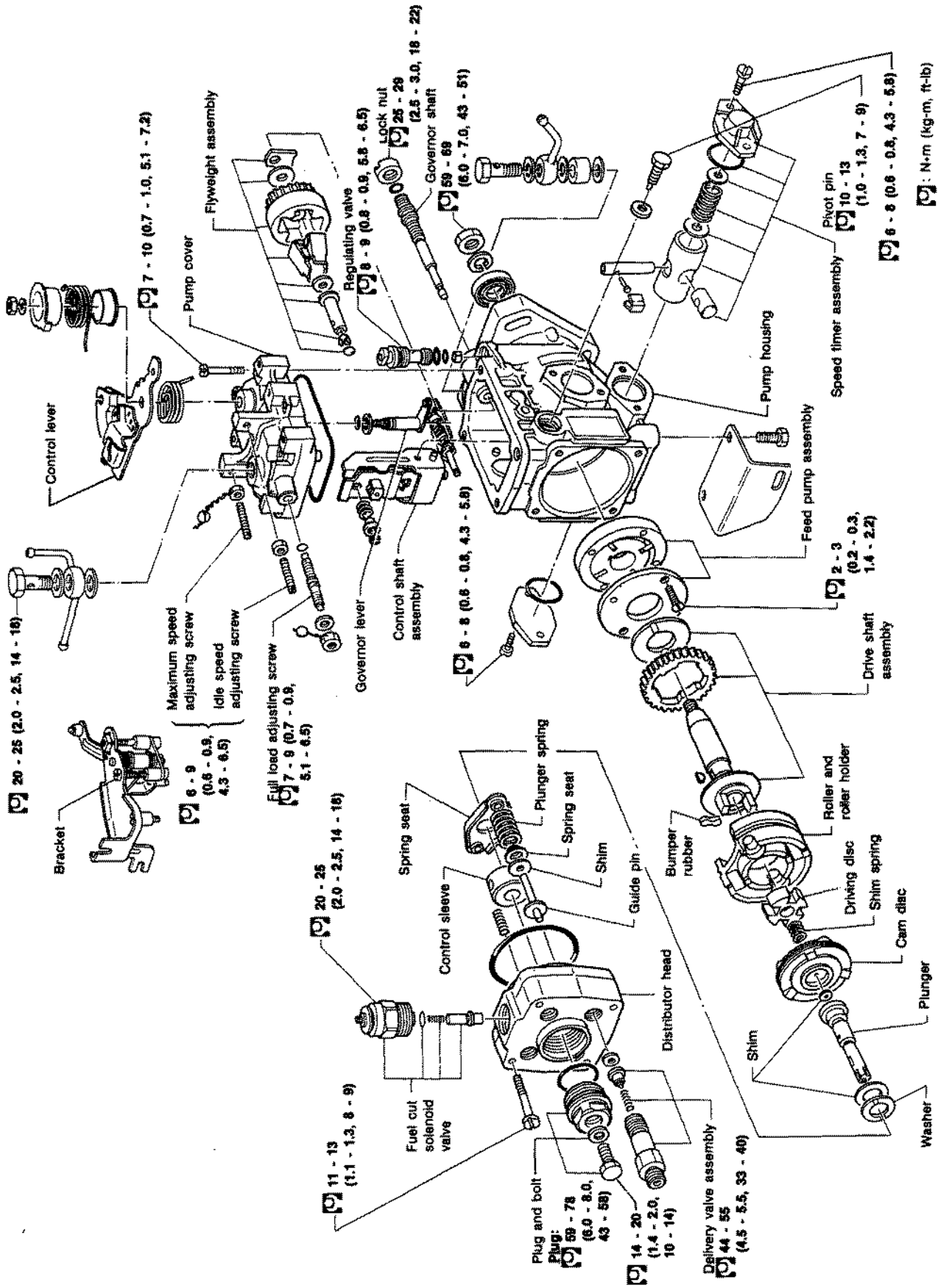
WITH COLD START DEVICE



SEF784A

Disassembly (Cont'd)

WITHOUT COLD START DEVICE



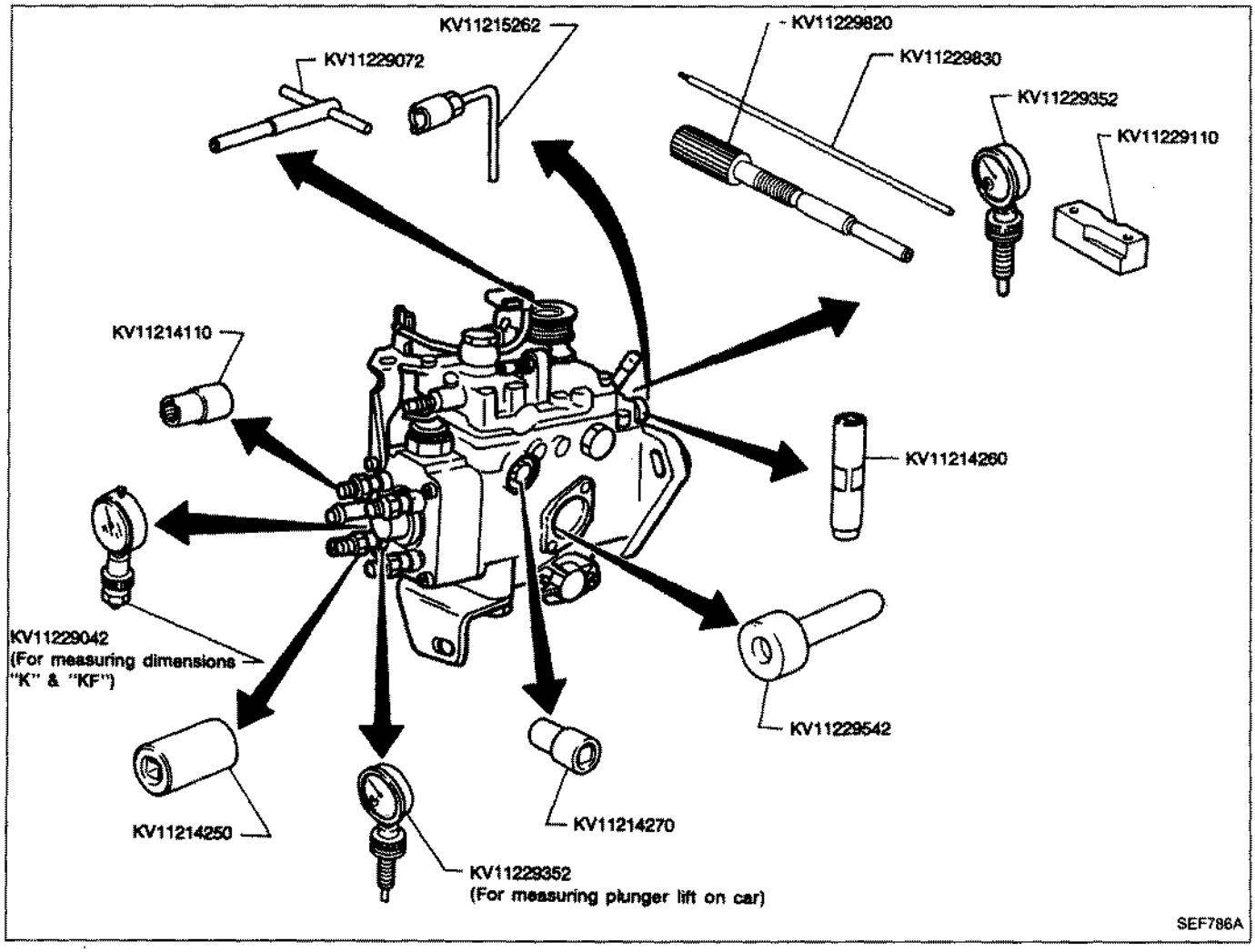
SEM449D

Disassembly (Cont'd)

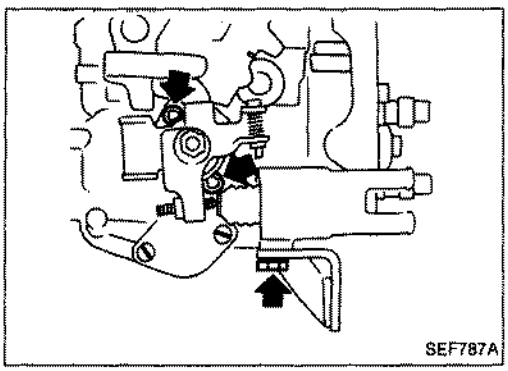
PREPARATION

- Before performing disassembly and adjustment, test fuel injection pump and note test results except when testing is impossible.
- Prior to beginning disassembly of fuel injection pump, clean all dust and dirt from its exterior.
- Disconnect overflow valve, and drain fuel.
- Clean work bench completely, removing all foreign matter.
- Collect only those service tools necessary for disassembling and reassembling.
- Be careful not to bend or scratch any parts.

Special tools are needed for disassembling and reassembling fuel injection pump.



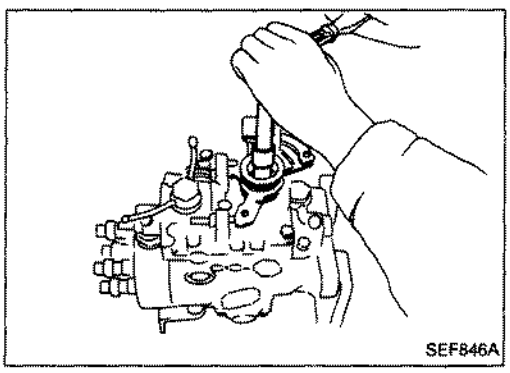
Disassembly (Cont'd)


SEF787A

COLD START DEVICE

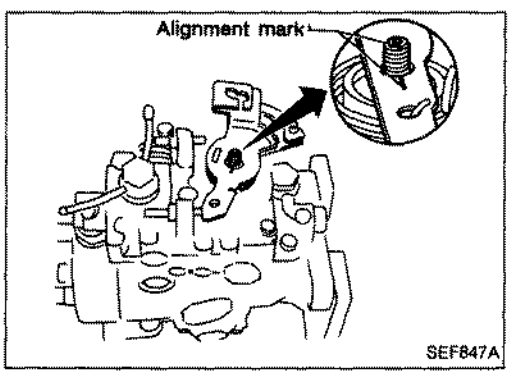
Remove cold start device assembly.

Never disassemble cold start device linkage.


SEF846A

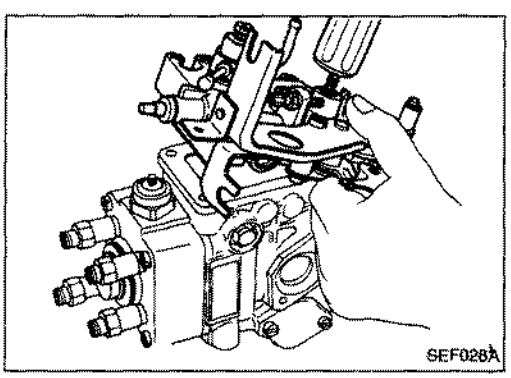
GOVERNOR COVER

1. Remove nut, spring washer, spring seat and spring from control lever.



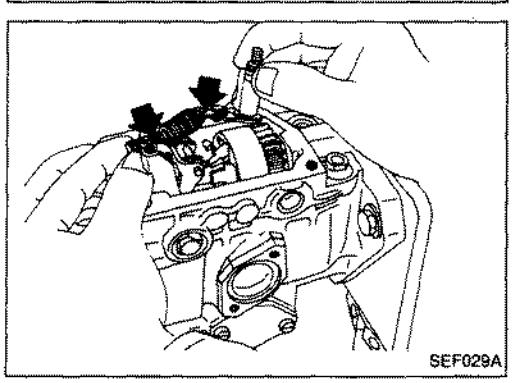
SEF847A

2. Draw alignment marks on control lever and control shaft.


SEF028A

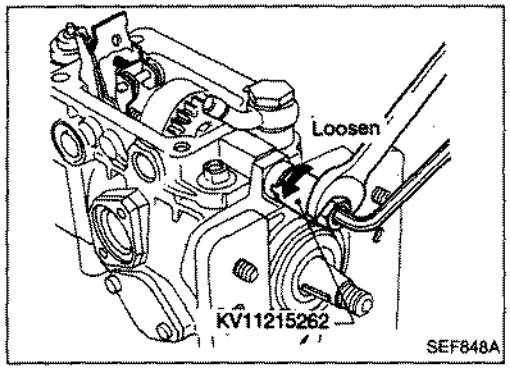
3. Remove governor cover.

Move control shaft down by lightly tapping end with a wooden mallet.


SEF029A

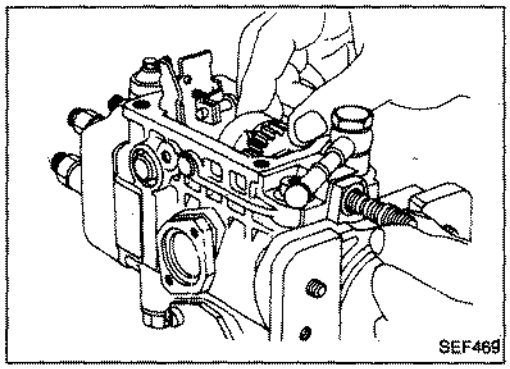
4. Remove control shaft from tension lever.

Disassembly (Cont'd)

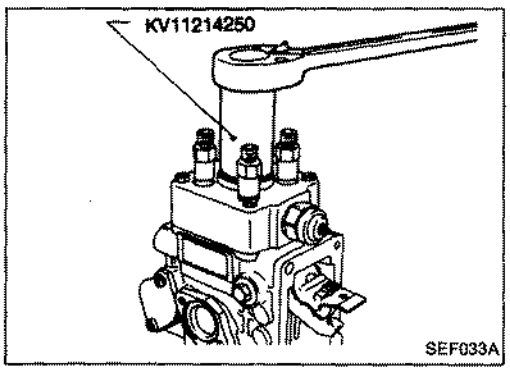


5. Remove governor shaft.

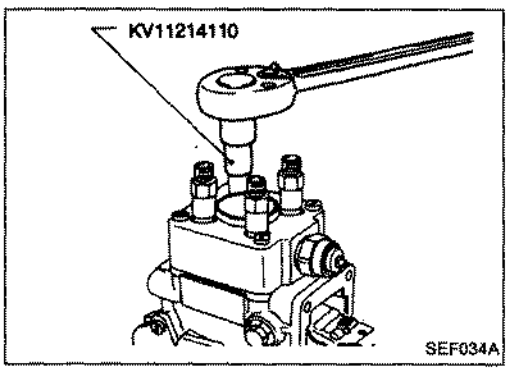
Loosen lock nut by turning it counterclockwise.



6. Remove governor sleeve, washer and flyweight, along with flyweight holder, then remove washer and shim(s).

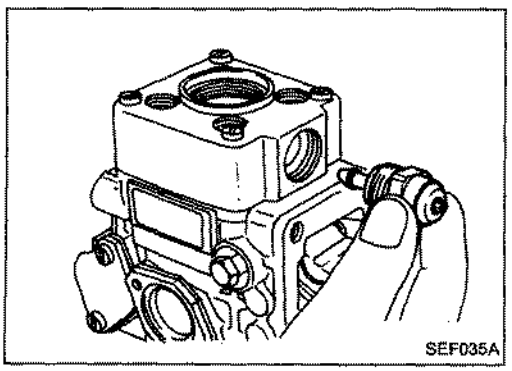


7. Remove plug.



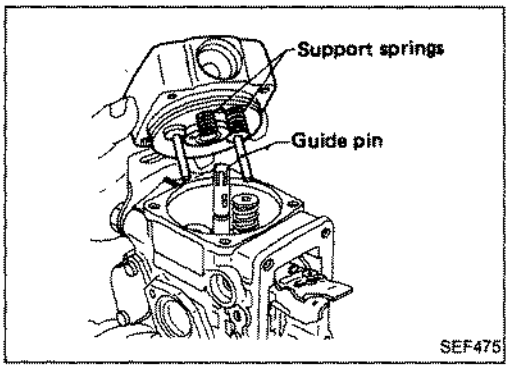
8. Remove delivery holder, spring, delivery valve and gasket.

Distributor head has letters (A, B, C and D) stamped on it. Remove lettered parts in alphabetical order and arrange neatly.



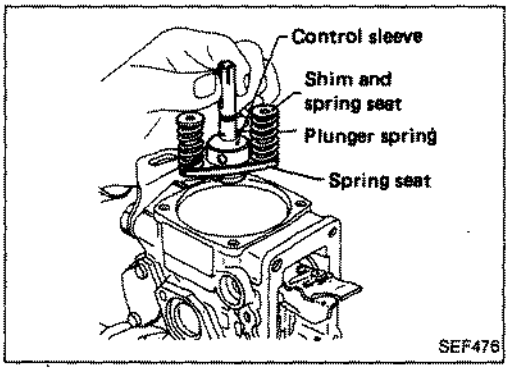
9. Remove fuel cut solenoid valve.

Disassembly (Cont'd)



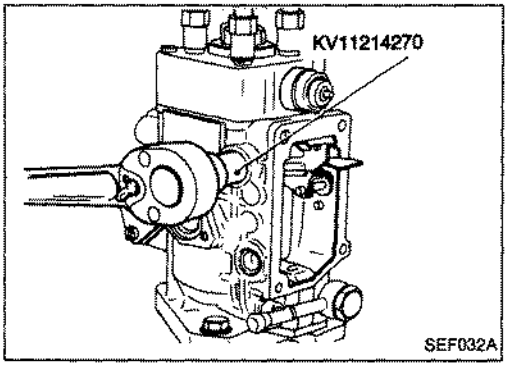
10. Remove distributor head.

Be careful not to drop the two support springs and guide pins.

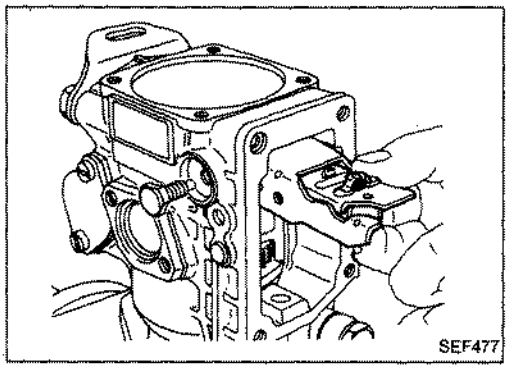


11. Remove plunger assembly.

Lift plunger, along with control sleeve, shim, spring seat and plunger spring.

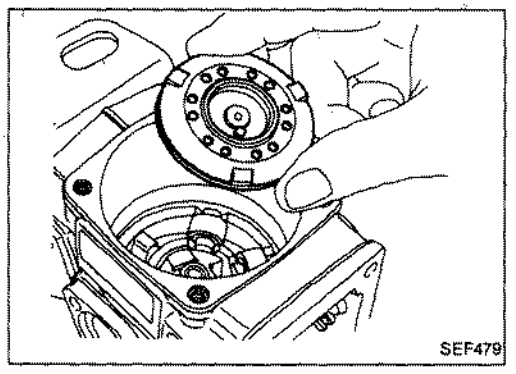


12. Loosen left and right governor pivot bolts.



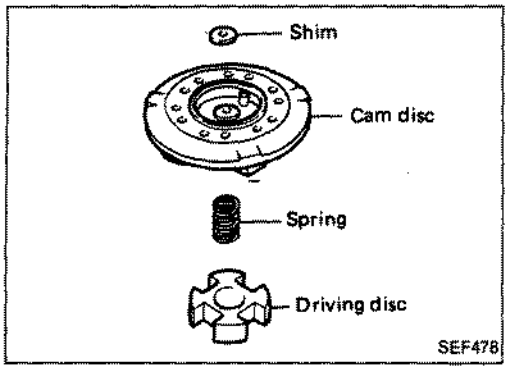
13. Remove governor lever assembly.

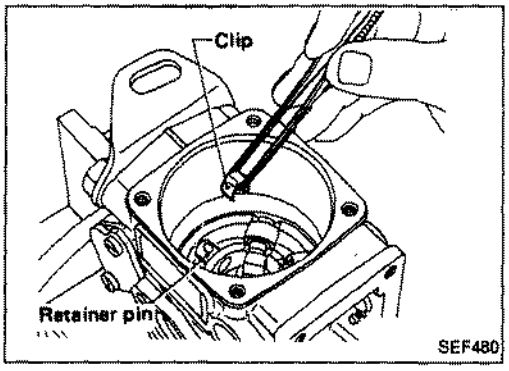
Avoid pulling on start spring and start idle spring.



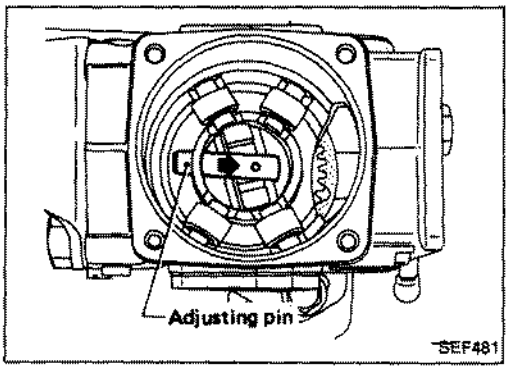
14. Remove shim, cam disc, spring and driving disc.

Disassembly (Cont'd)

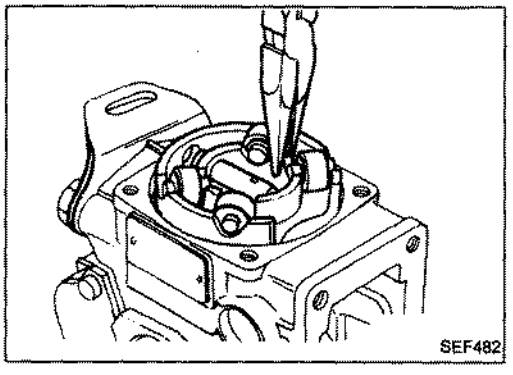




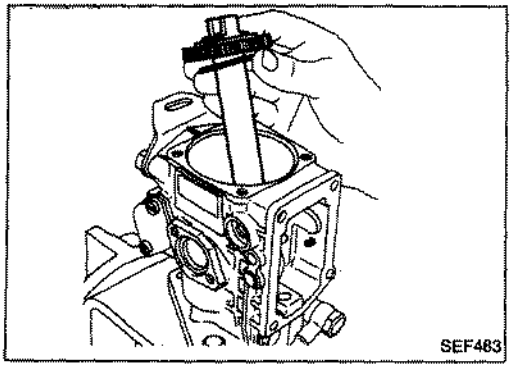
15. Remove clips and pins.



16. Move adjusting pin to center of roller holder, as shown.

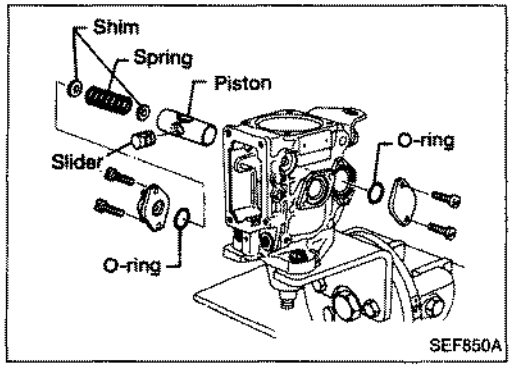


17. Lift out roller holder with rollers without tilting.
Be careful not to drop rollers.

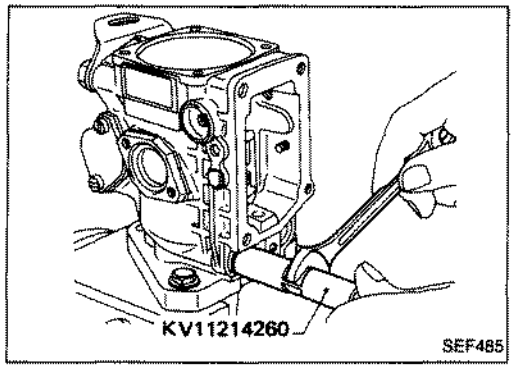


18. Remove drive shaft.
   a. **Be careful not to scratch inner surface of fuel injection pump body.**
   b. **Be careful not to drop the key.**

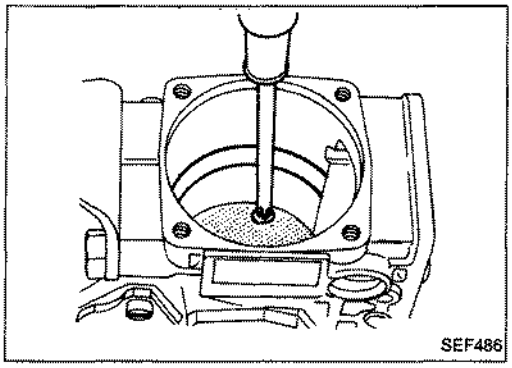
Disassembly (Cont'd)



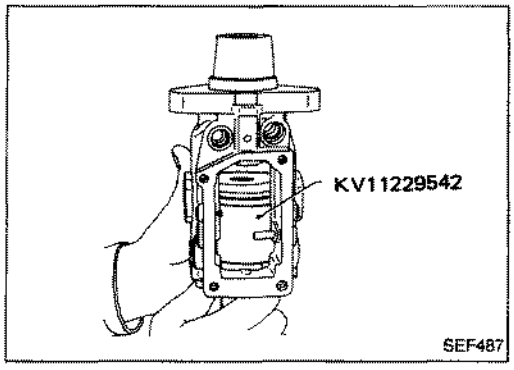
19. Remove speed timer cover, O-ring, shims, spring, piston and slider.



20. Remove regulating valve.



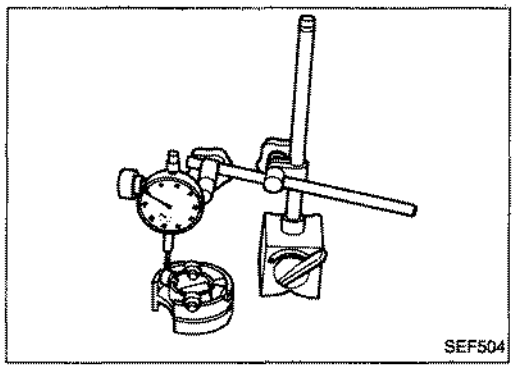
21. Loosen screw from feed pump cover.



22. Remove cover and feed pump assembly as a unit.
(1) Insert feed pump holder (KV11229542) into fuel injection pump housing.
(2) Turn injection pump's top side down, as shown.
(3) Remove cover and feed pump assembly as a unit.

a. If cover and feed pump assembly are hard to remove or are stuck midway, strike pump body lightly.

b. Do not move position of vanes.



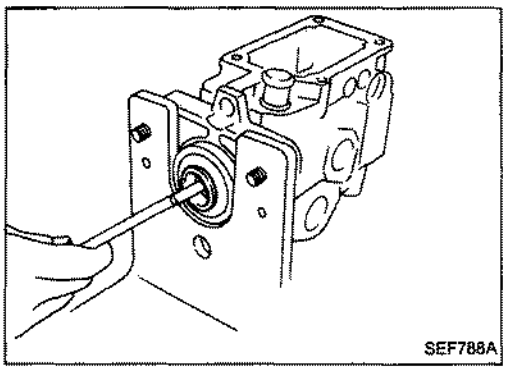
Inspection

1. Wash all parts completely.
2. Replace worn or damaged parts.
3. Control edge of plunger must be sharp and contact surfaces must not exhibit any noticeable running tracks. If such is not the case, replace plunger.
4. Check height of all rollers.

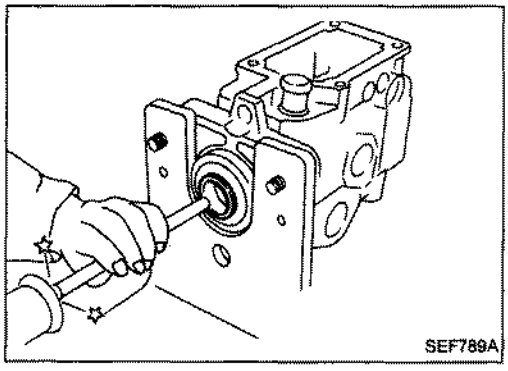
Difference in max. and min. roller height should be less than 0.02 mm (0.0008 in).

Inspection (Cont'd)

REPLACEMENT OF OIL SEAL


SEF788A

1. Remove oil seal.

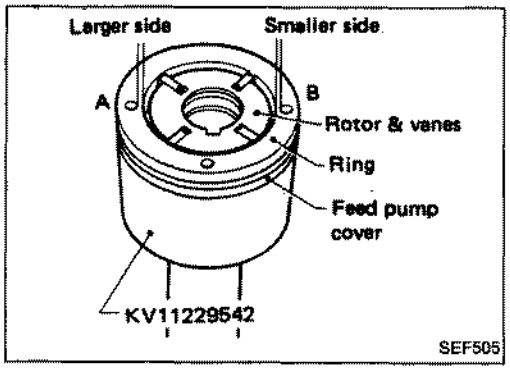

SEF789A

2. Apply grease to oil seal.
3. Install oil seal.

Assembly

Always replace the following service parts as assembly units.

- Distributor head, control sleeve and plunger
- Feed pump assembly (pump impeller and vanes with eccentric ring)
- Plunger spring kit
- Roller assembly
- Flyweight kit
- Governor lever assembly



SEF505

PREPARATION

Dip all movable parts and O-rings in test oil and clean.

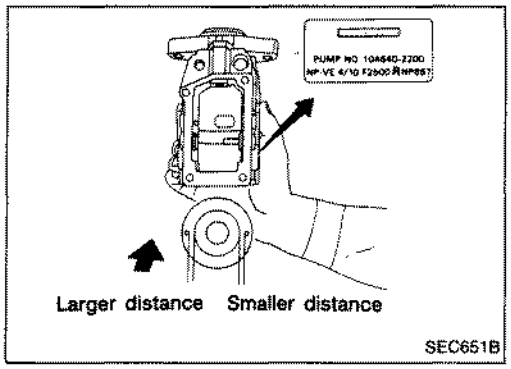
1. Set feed pump cover, rotor with vanes, and ring on special service tool KV11229542.

(1) Align the three holes in feed pump cover and ring.
(2) Do not change positions of vanes.
(3) Holes A and B in ring are not equally spaced to inner wall of ring.

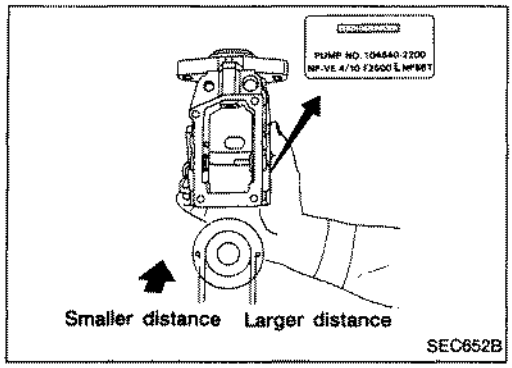
2. Install feed pump cover, rotor with vanes, and ring to pump housing.

Be careful to install liner correctly. If left and right are reversed, fuel will not be discharged from feed pump.

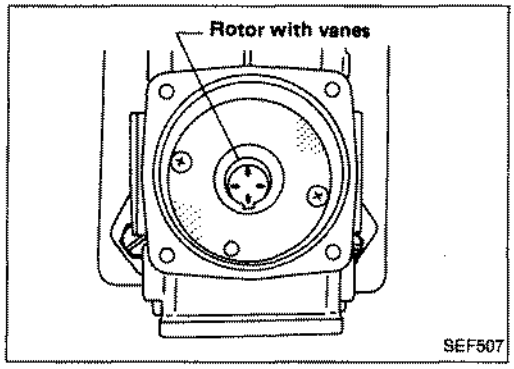
Assembly (Cont'd)



When fuel injection pump rotates in direction "R"



When fuel injection pump rotates in direction "L"

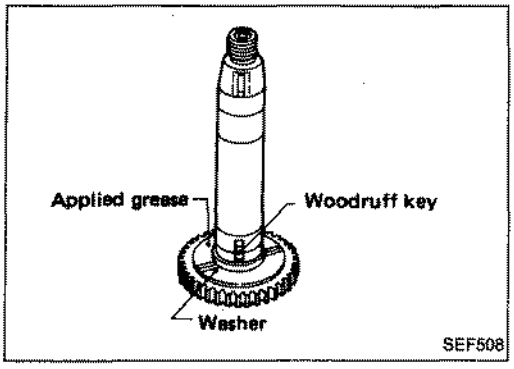


The following description applies to fuel injection pumps that rotate in direction "R".

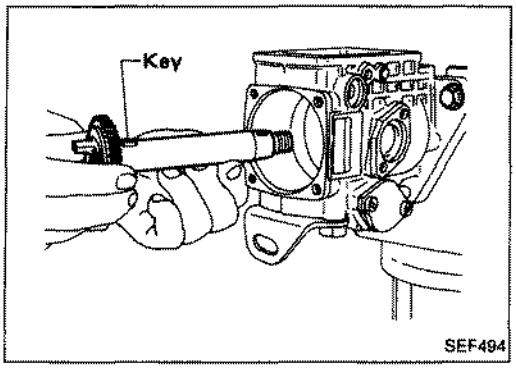
3. Turn fuel injection pump 180°, and remove service tool KV11229542. Tighten screw to retain pump cover.

a. When tightening screws, be careful not to scratch inner wall of pump housing.

b. After tightening screws, make sure rotor with vanes moves smoothly.



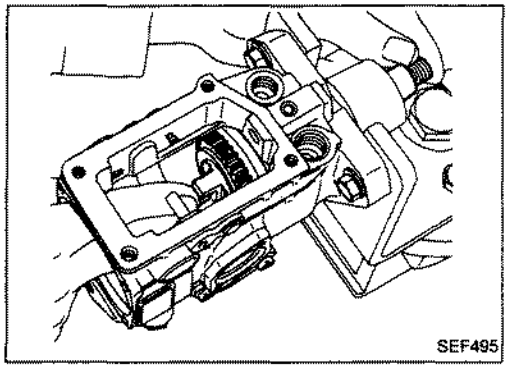
4. make sure drive shaft and gear are assembled properly, as shown.

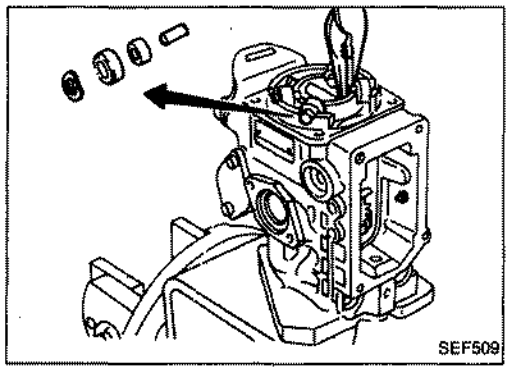


5. Install drive shaft to housing while key in drive shaft engages with key groove in rotor.

Be careful not to scratch oil seals and inner wall of housing.

Assembly (Cont'd)

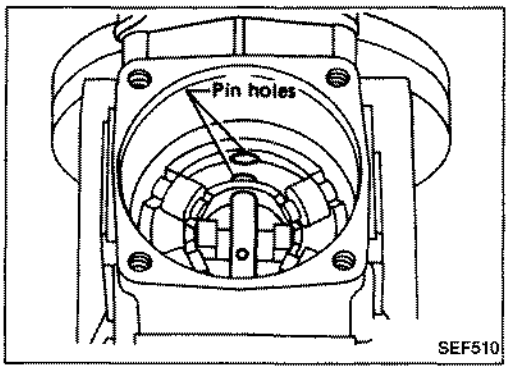

SEF495


SEF509

6. Set drive shaft's nail parallel to timer.
7. Install roller and holder.

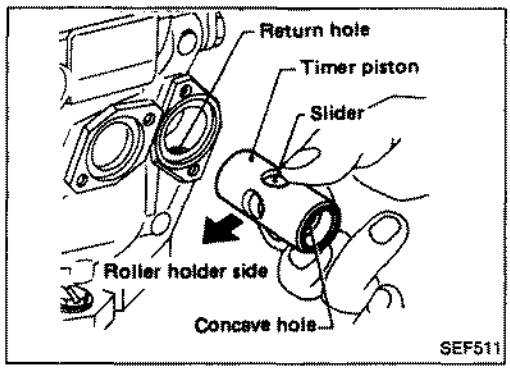
a. Do not interchange roller positions. If they are interchanged, refer to Inspection for correction.

b. Make sure washer is situated outward of rollers.



SEF510

8. Align holder and timer adjusting pin holes.

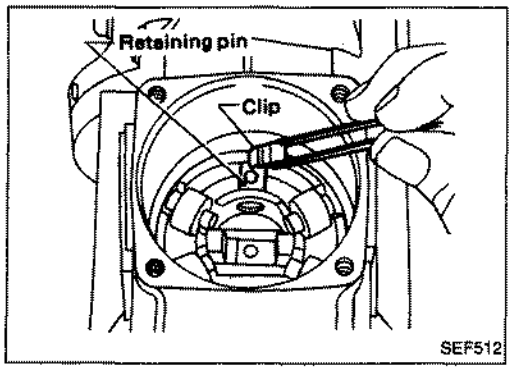


SEF511

9. Install timer piston and slider as a unit.

a. Make sure hole in slider faces towards roller holder.

b. Make sure concave hole in piston is on same side as return hole.

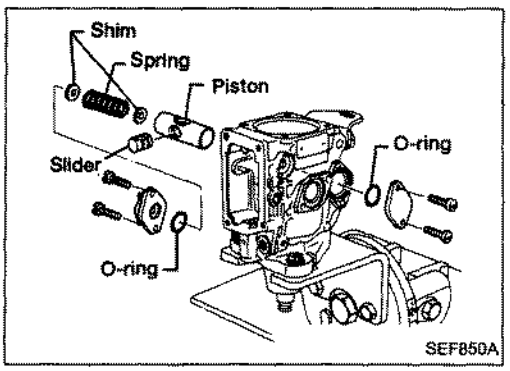


SEF512

10. Insert timer adjusting pin into timer piston slider, and secure with retaining pin and clip.

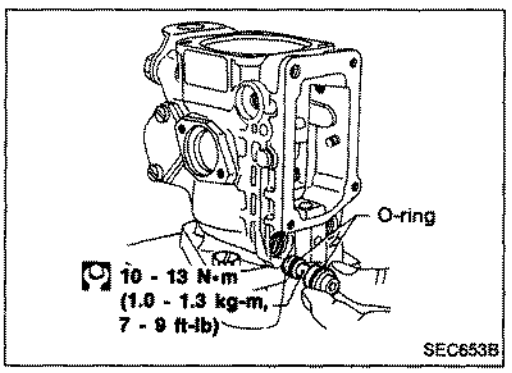
Make sure timer piston moves smoothly.

Assembly (Cont'd)



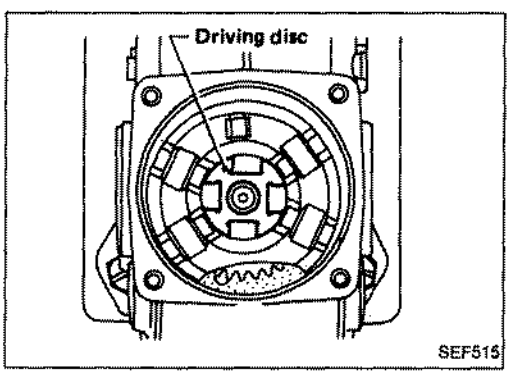
11. Install timer, using a 0.6 mm (0.024 in) thick shim, then install timer spring, shim, O-ring and cover, in that order.

a. Use at least one shim on each side of timer spring.
b. Use shims that were selected during bench test.

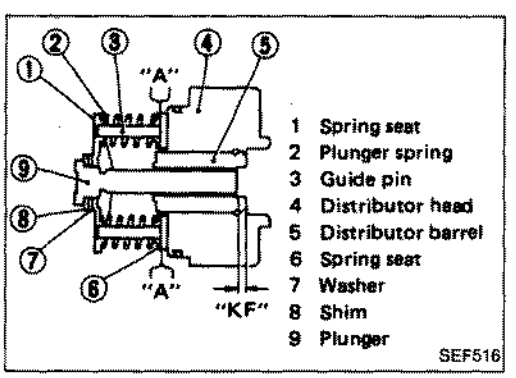


12. Install regulating valve.

Be careful not to scratch O-rings.



13. Install driving disc with its concave side facing up.

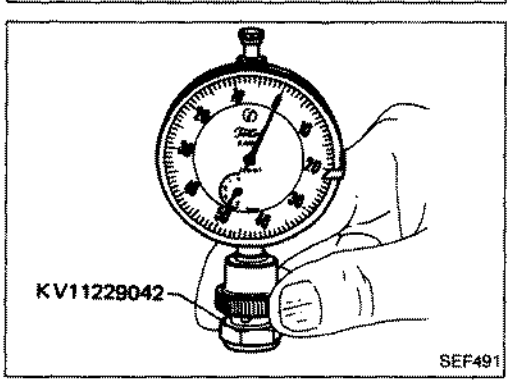


14. Measurement of plunger spring set length (dimension "KF")

Dimension "KF" is the distance between the end face of the distributor barrel and the end face of the plunger.

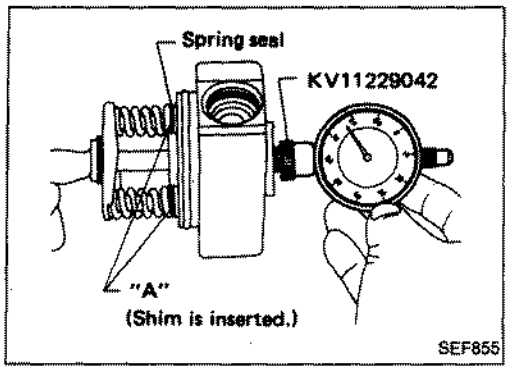
(1) Install distributor head, as shown.

Do not insert shim into "A" portion before measuring.



(2) Set dial gauge so that it can compress 10 mm (0.39 in), and reset to zero.

Assembly (Cont'd)



(3) Apply force (not enough to compress plunger spring) to plunger's bottom in axial direction, and measure dimension "KF" with dial gauge, as shown.

(4) Determine the shim to be used by calculating difference between standard and measured dimensions.

Refer to S.D.S. for "KF".

[Example]

When measured (dial gauge reading) value is 5.2 mm,

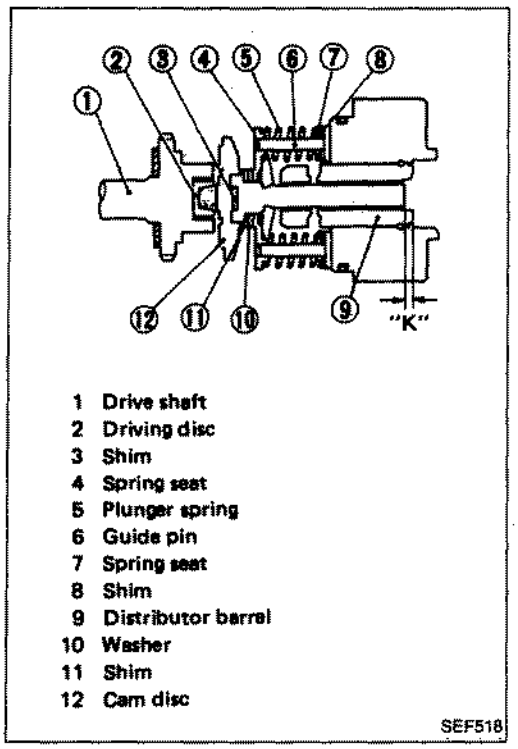
"KF" – 5.2 mm = Shim thickness to be used

a. When there are no shims available of a thickness which matches specified dimensions, use slightly thicker shims.

b. Use selected shim with distributor head.

c. Use the same size shim on each side of distributor head.

d. Refer to S.D.S. for available service parts.



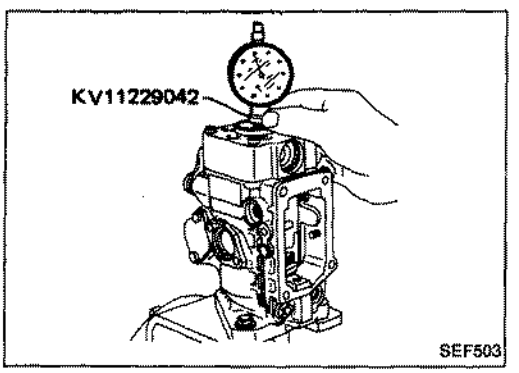
15. Adjustment of plunger dimensions (Measurement of dimension "K")

Dimension "K" is the distance from the end face of the distributor barrel to the end face of the plunger top, when the plunger is at the bottom dead center position.

(1) Install parts as shown.

a. Do not install "spring" on driving disc.

b. When inserting plunger and shim into cam disc, make sure drive pin is situated in groove at bottom of plunger.

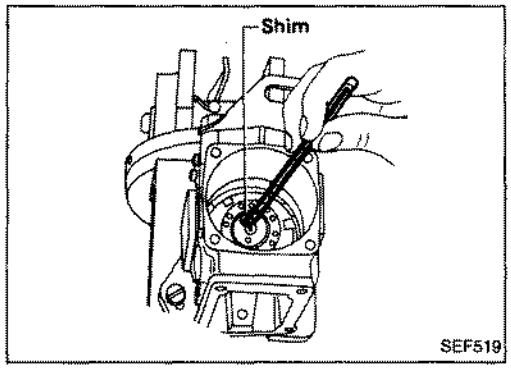


(2) Using a dial gauge, measure dimension as shown.

a. Rotate drive shaft so that plunger is set at bottom dead center.

b. Securely mount distributor head with screws.

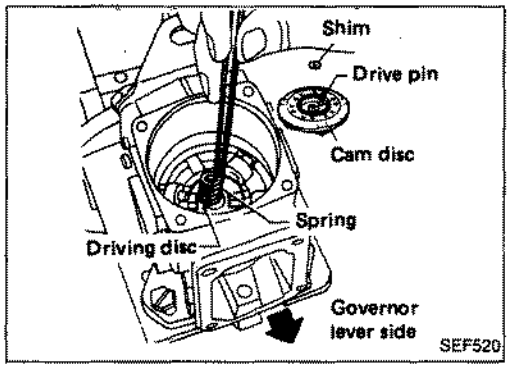
Assembly (Cont'd)



(3) Determine shim to be used by calculating difference between measured (dial gauge reading) value and standard dimension "K", and position that shim on plunger's bottom.

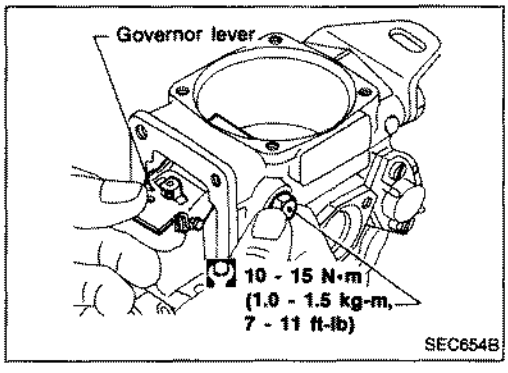
Refer to S.D.S. for "K".

a. When measured value is greater than standard dimension "K", use a thicker shim.
b. After shim has been positioned, measure dimension again to ensure that it is correct.
c. Refer to S.D.S. for available service parts.



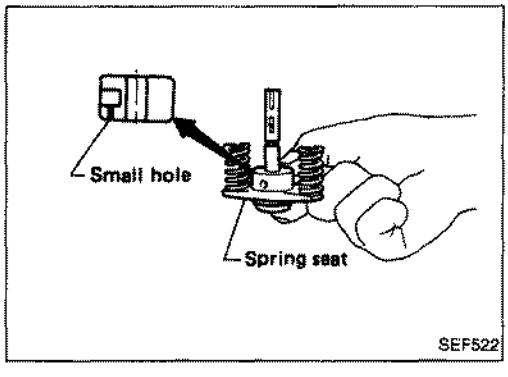
16. Install spring in top of driving disc, and install cam disc and shim in that order.

Make sure cam disc drive pin and drive shaft key way face governor lever side.



17. Install governor lever.

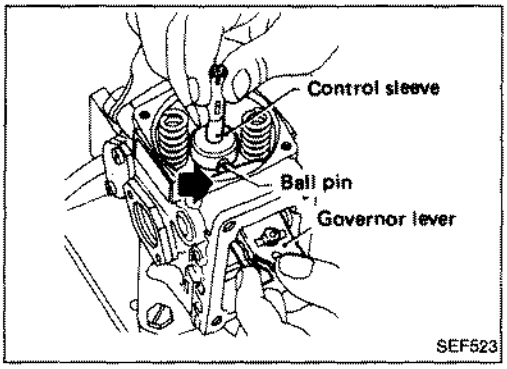
Avoid pulling on start spring and start idle spring.



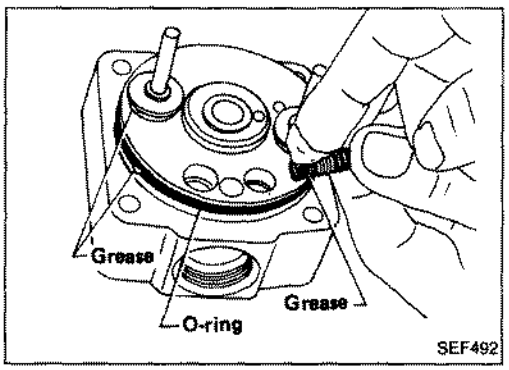
18. Install plunger assembly.

a. Make sure control sleeve is installed with its small hole facing spring seat side.

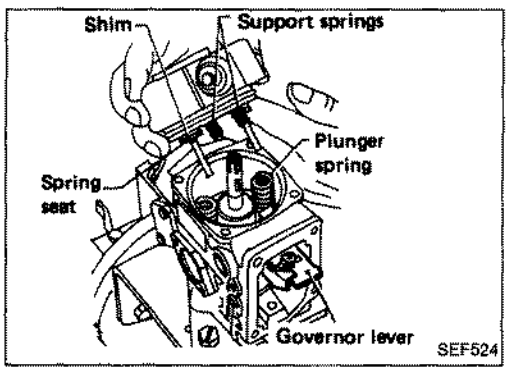
Assembly (Cont'd)



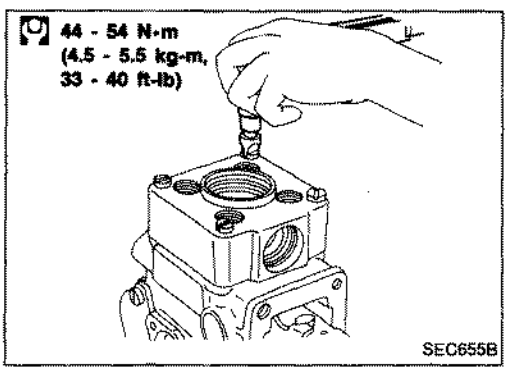
b. Insert ball pin for governor lever into hole in control sleeve (shown by arrow).



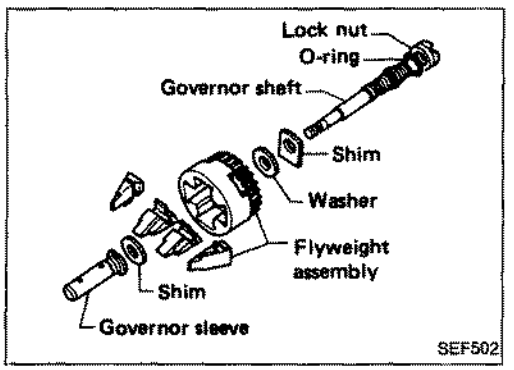
19. Apply a coat of grease to guide pin, shim and spring seat, and attach these parts to distributor head.



20. Install distributor head.
a. Always face support spring toward governor lever.
b. Be careful not to drop spring.
c. Make sure ball pin for governor lever is inserted properly into hole in control sleeve.
d. After installing distributor head, make sure plunger spring is at guide hole in spring seat.

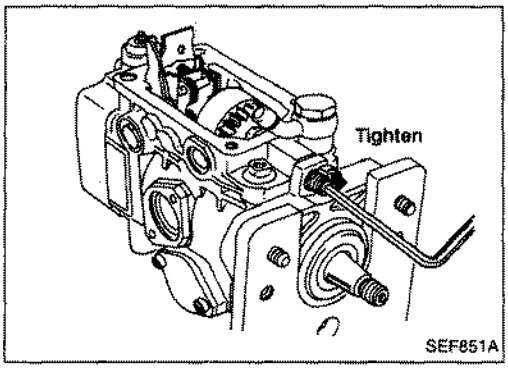


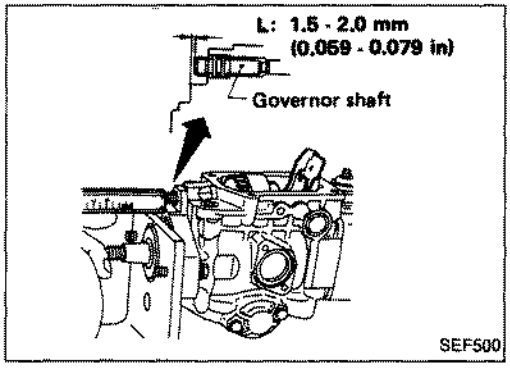
21. Tighten distributor head.



22. Attach flyweight assembly.
When installing governor shaft, be careful not to scratch O-rings.

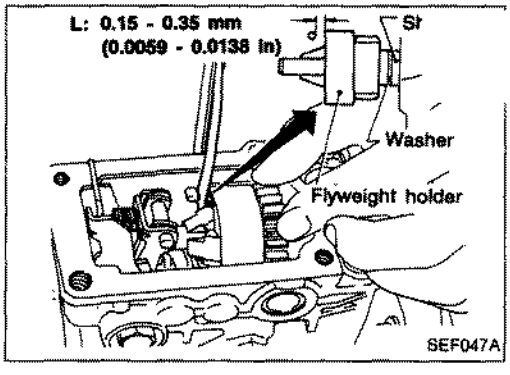
Assembly (Cont'd)



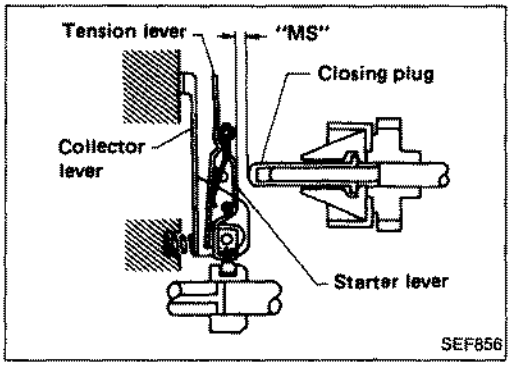


23. Adjust dimension "L", as shown.
    "L": 1.5 - 2.0 mm (0.059 - 0.079 in)

Governor shaft has a left-hand thread for injection pumps designed to rotate in "R" direction, and a right-hand thread for those rotating in "L" direction.

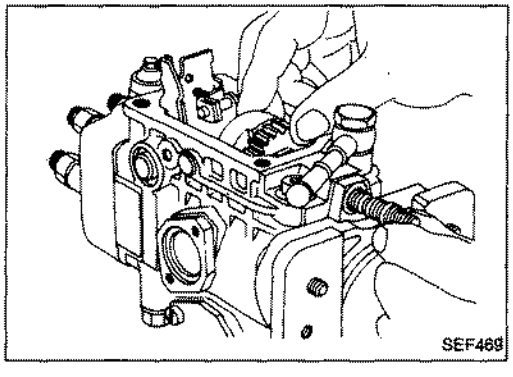


24. Measure axial play of flyweight holder. If it is not within specified range, adjust it by means of shim.
    "L": 0.15 - 0.35 mm (0.0059 - 0.0138 in)



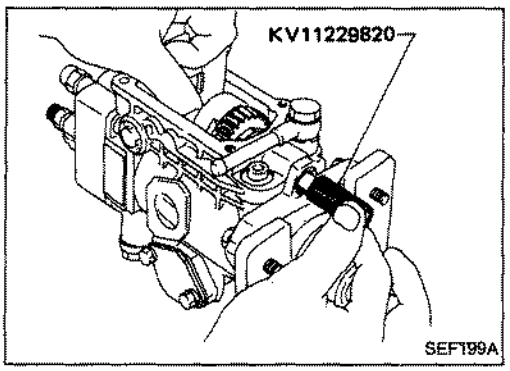
25. Measurement of dimension "MS" (for determining starting amount of fuel injection)

Dimension "MS" is the distance from closing plug to start lever.



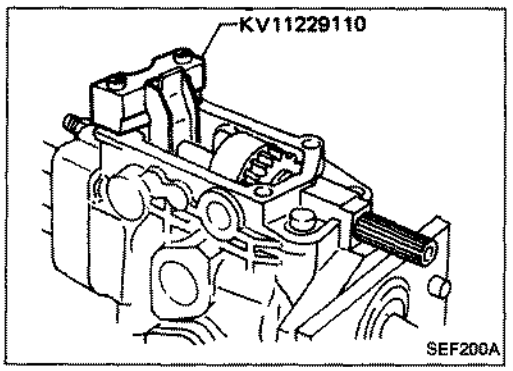
(1) Remove lock nut, governor shaft and flyweight assembly.

Assembly (Cont'd)

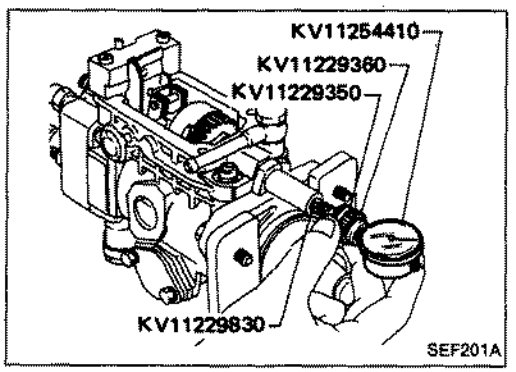


(2) Install Tool and flyweight assembly in place of governor shaft.

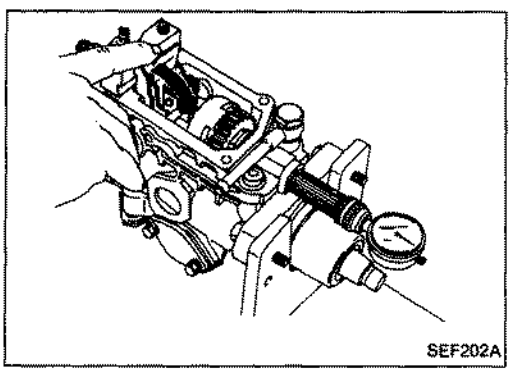
Be sure to install shim and washer when installing flyweight assembly.



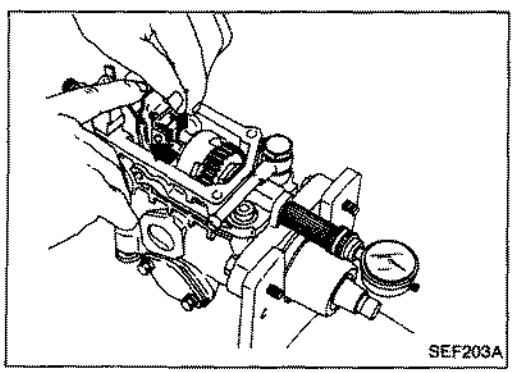
(3) Set Tool, as shown.



(4) Install dial gauge together with rod.



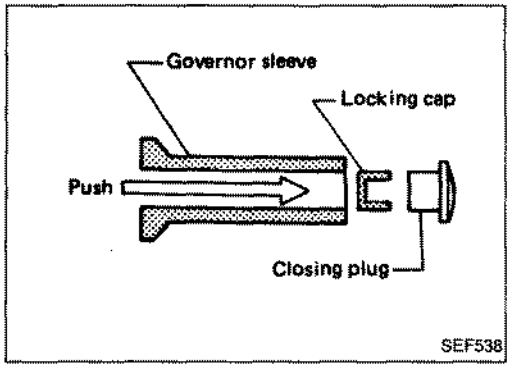
(5) Press governor sleeve to flyweight and set dial gauge to "0".



(6) Push tension lever until it contacts stopper pin. Return governor sleeve until start lever contacts tension lever, and read dial gauge.

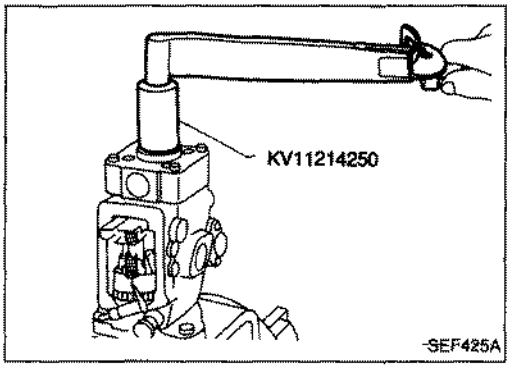
Refer to S.D.S. for "MS".

Assembly (Cont'd)



(7) If dial gauge indication is not within this range, replace closing plug and adjust dimension "MS" to that range.

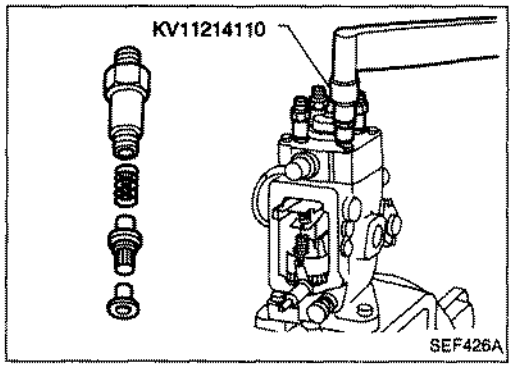
Refer to S.D.S. for available service parts.



26. Install new plug with new O-ring.

Always replace plugs with new ones.

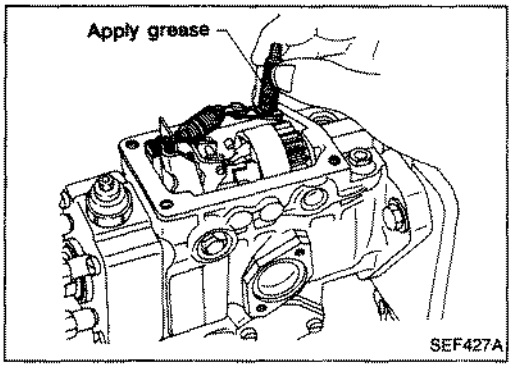
27. Install fuel cut solenoid valve.



28. Install delivery valve.

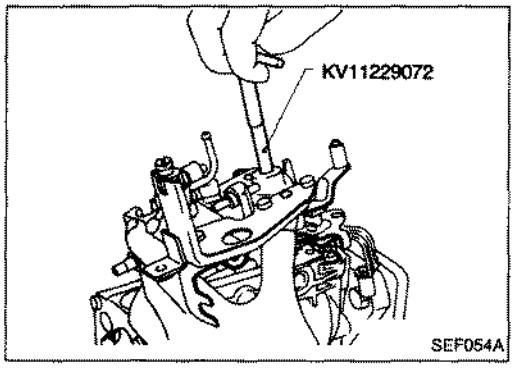
a. Always use new washers.

b. Make sure delivery valve is reinstalled in its original position.



29. Install control lever shaft.

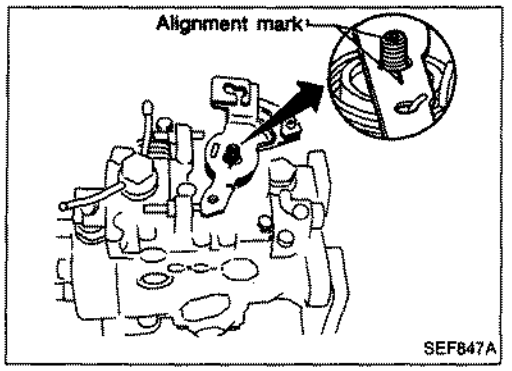
Apply a coat of grease to lever shaft end.



GOVERNOR COVER

1. Install governor cover.

Assembly (Cont'd)



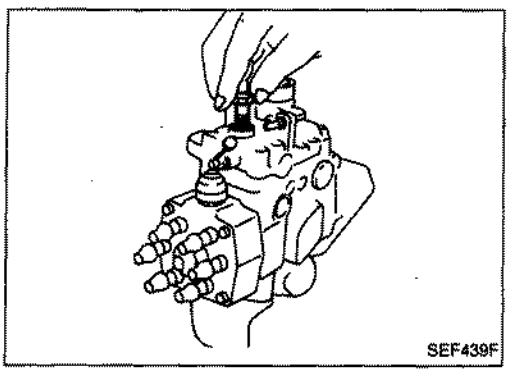
2. Install control lever assembly.

Align alignment marks of speed control lever and control lever shaft.

COLD START DEVICE

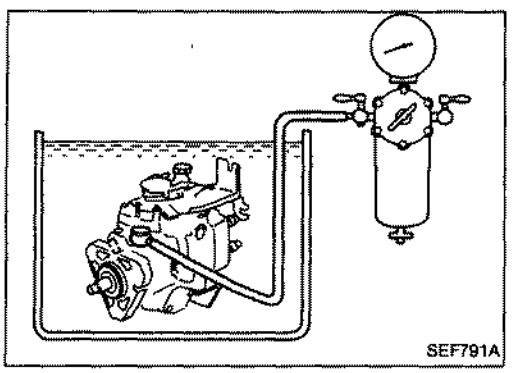
Install cold start device assembly.

Always use a new O-ring.



AIR TIGHTNESS TEST

1. Replace overflow connector with a bolt.



2. Connect an air hose to fuel inlet and immerse fuel injection pump in diesel fuel.

3. Apply grease of 392 kPa (3.9 bar, 4 kg/cm^2, 57 psi) and check that there are no leaks. If there is any leakage, repair it.

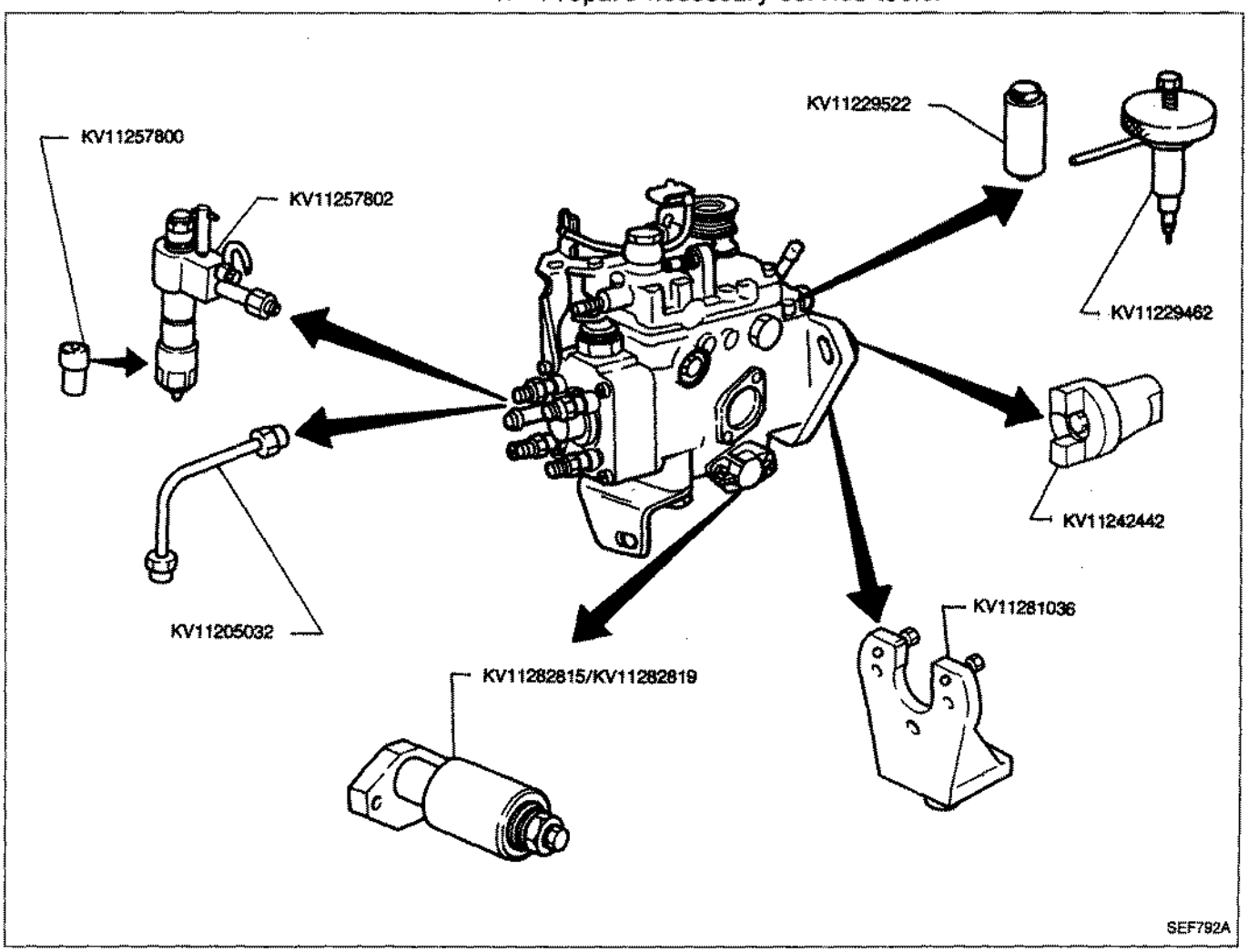
Testing of Injection Pump

PREPARATION

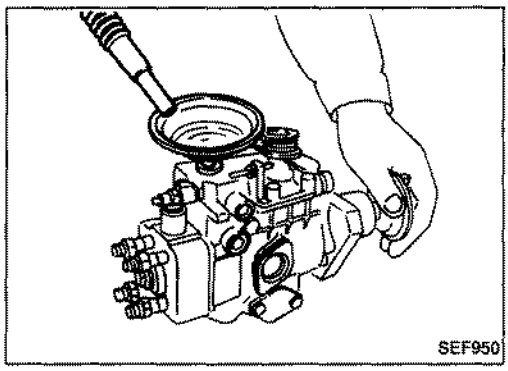
Injection pump test conditions

Nozzle		KV11257800
Nozzle holder		KV11257802
Nozzle starting pressure	kPa (bar, kg/cm^2, psi)	14,711 - 15,201 (147.1 - 152.0, 150 - 155, 2,133 - 2,204)
Nozzle tube Inner dia. × outer dia. × length	mm (in)	KV11205032 2.0 × 6.0 × 840 (0.079 × 0.236 × 33.07)
Fuel feed pressure	kPa (bar, kg/cm^2, psi)	20 (0.20, 0.2, 2.8)
Fuel (test oil)		ISO4113 or SAE J967d
Fuel temperature	°C (°F)	45 - 50 (113 - 122)
Rotating direction		Right (observed from the drive shaft)
Injection sequence		1-3-4-2

1. Prepare necessary service tools.

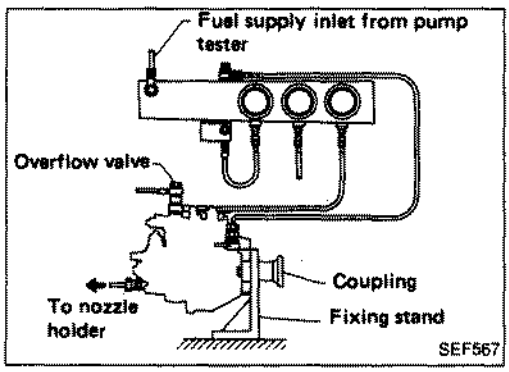


Testing of Injection Pump (Cont'd)


SEF950

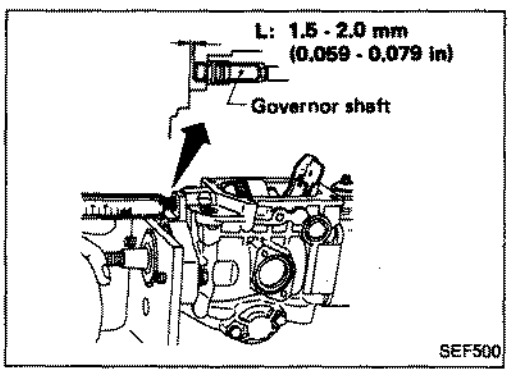
2. Pour test oil into fuel injection pump.

Test oil should be ISO4113, SAE J967d test oil or its equivalent.



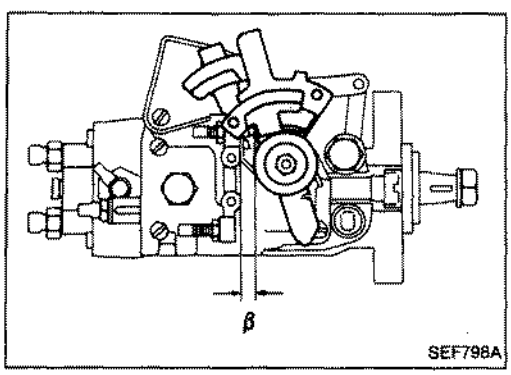
SEF567

3. Install fuel injection pump to pump tester.
4. Connect pump tester piping.



SEF500

5. Make sure governor shaft is properly installed.



SEF798A

6. Run in fuel injection pump as follows:
(1) Maintain test oil in tank at 45 to 50°C (113 to 122°F).
(2) Set control lever at "full-load" using a spring.

Set maximum speed adjusting screw in position shown, by turning counterclockwise.

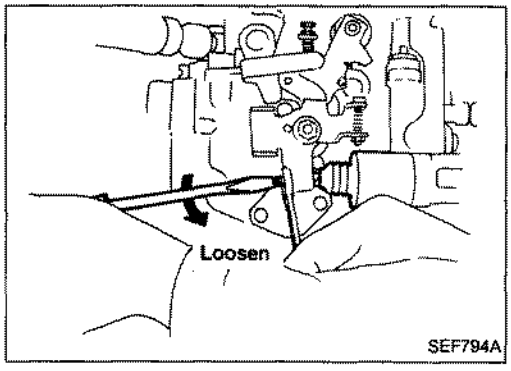
β: Refer to S.D.S.

(3) Furnish voltage of 12 volts to activate fuel cut solenoid valve.
(4) Rotate fuel injection pump by hand to see if it moves smoothly.
(5) Rotate fuel injection pump at 300 rpm to make sure all air inside pump chamber is discharged through overflow valve.
(6) Set feed oil pressure at 20 kPa (0.20 bar, 0.2 kg/cm^2, 2.8 psi).

Testing of Injection Pump (Cont'd)

(7) Run in fuel injection pump by rotating it at 1,000 rpm for ten minutes.

If fuel leakage, fuel injection failure or unusual noise is noticed, immediately halt pump tester operation and check fuel injection pump for abnormalities.



ADJUSTMENT

Preparation for vehicles with cold start device

Before adjustment, fully loosen cold start device adjusting screw.

m

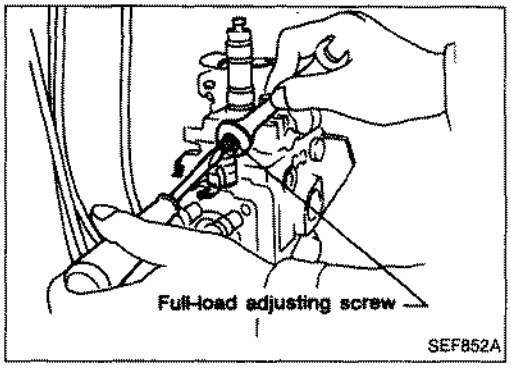
Preadjustment of full-load delivery

1. Set control lever at "full-load" by pulling spring or using a suitable equipment.

Set maximum speed adjusting screw in position shown, by turning counterclockwise. Refer to step 6-(2) in PREPARATION.

2. Furnish voltage of 12 volts to activate fuel cut solenoid valve.
3. Rotate fuel injection pump at specified rpm, and measure amount of fuel injection.

Refer to S.D.S. for full-load fuel injection quantity of adjustment value on fuel injection tester.

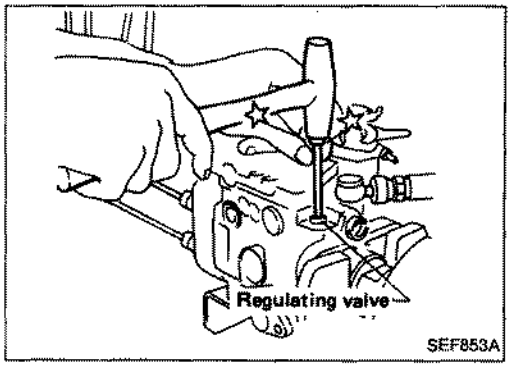


4. Calculate allowable imbalance of fuel injection quantity.

$$\text{Allowable imbalance} = \text{Max. or Min. injection volume among delivery valves} - \text{Mean injection volume of all delivery valves}$$

5. If the value of allowable imbalance is out of specification, change delivery valve assembly.

Turn adjusting screw clockwise to increase fuel injection.



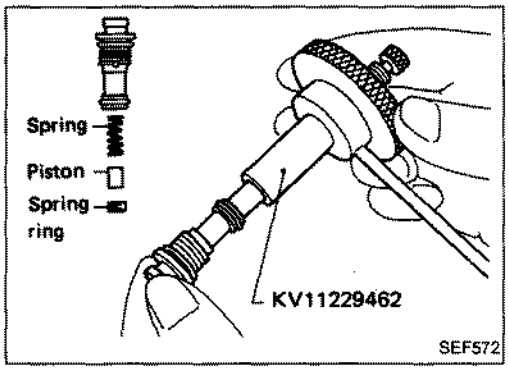
Adjustment of feed pump pressure

Measure feed pump pressure at specified fuel injection pump rpm.

a. When measured pressure is lower than specifications.

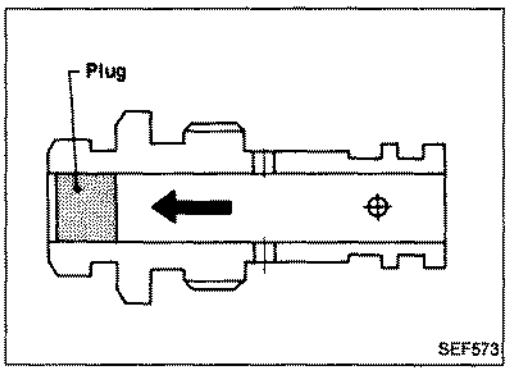
Push in plug that is driven into regulating valve body. Be careful not to push plug in too far.

Testing of Injection Pump (Cont'd)

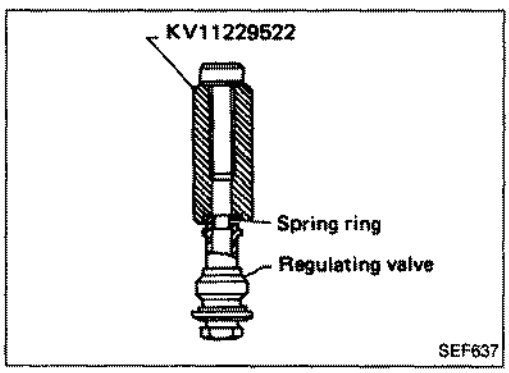


b. When measured pressure is higher than specifications.

(1) Remove regulating valve from fuel injection pump, and disassemble regulating valve using Tool.

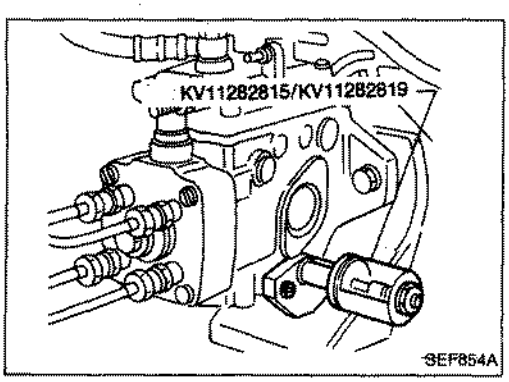


(2) Drive plug out until it is flush with end face of regulating valve.



(3) Install spring, piston and spring ring, in that order, to regulating valve.
Make sure spring ring is flush with end face of regulating valve body when it is pushed in.

(4) Attach regulating valve to fuel injection pump.
(5) Adjust feed pump pressure to specifications.



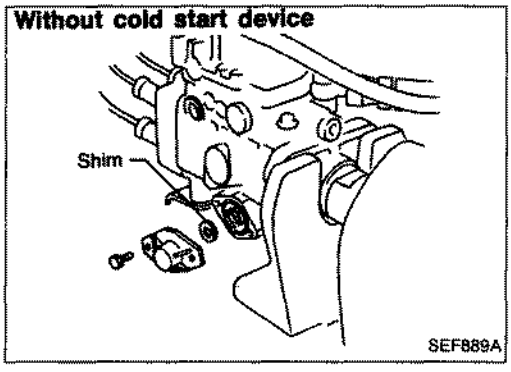
Adjustment of speed timer

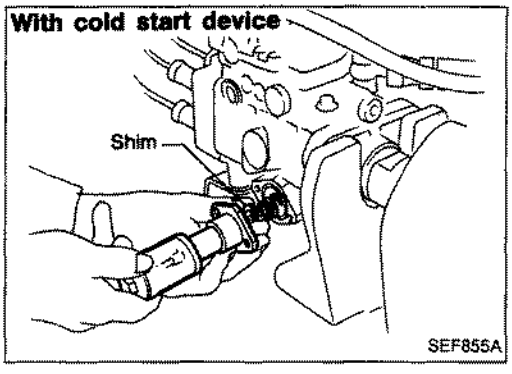
1. Remove cover of timer, and attach Tool to that side.
   Without cold start device:
   High pressure side (Side without spring)
   With cold start device:
   Low pressure side (Spring side)

Testing of Injection Pump (Cont'd)

2. Measure timer piston strokes at specified fuel injection pump rpm.

Refer to S.D.S. for timer piston stroke of adjustment value.

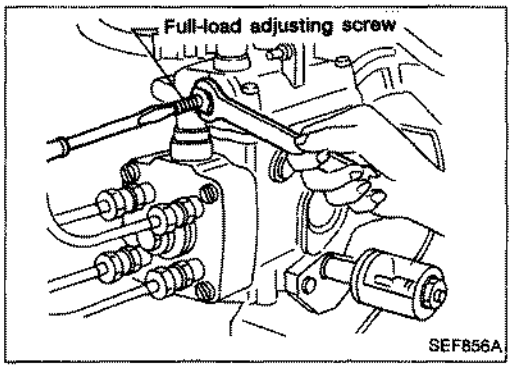




3. If timer piston stroke is not within specified range, remove cover from low-pressure side of timer and adjust piston stroke by adding shim(s).

a. Make sure at least one shim is used on each side of timer spring.

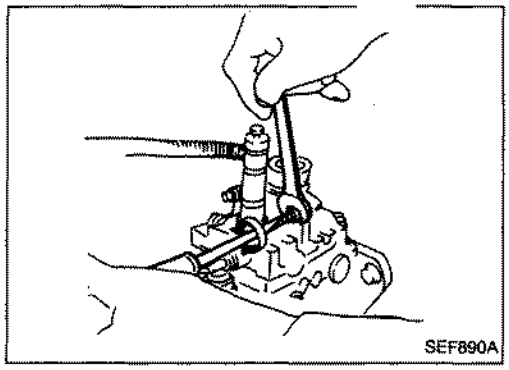
b. Refer to S.D.S. for available service parts.



Adjustment of fuel injection under full-load

1. Set control lever at "full-load" by pulling spring or using a suitable equipment.
2. Furnish voltage of 12 volts to activate fuel cut solenoid valve.
3. Measure fuel injection at specified fuel injection pump rpm.
4. If fuel injection is not within standard range, adjust by turning full-load adjusting screw.

Testing of Injection Pump (Cont'd)


SEF890A

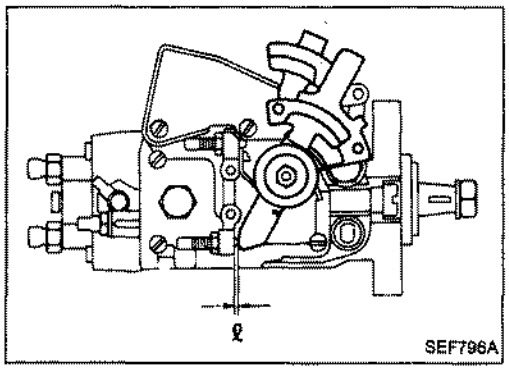
Adjustment of fuel injection during idle

1. Set control lever at idle speed position.
2. Furnish voltage of 12 volts to activate fuel cut solenoid valve.
3. Measure fuel injection at specified fuel injection pump rpm.

Refer to S.D.S. for idle fuel injection amount of adjustment value.

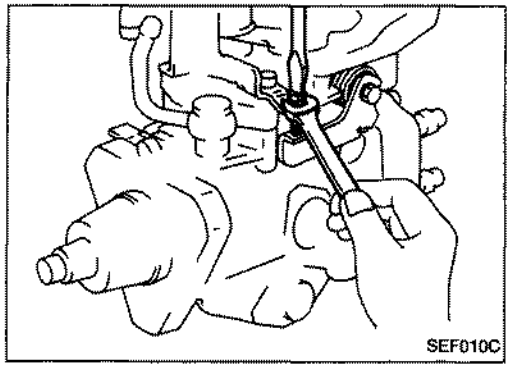
4. If fuel injection is not within specified range, adjust by turning idle speed adjusting screw.

a. Tightening this screw may change fuel injection amount.



SEF796A

b. Make sure control lever angle is set at the specified range. Refer to S.D.S.
If control lever angle is not within specified range, adjust by repositioning control lever on control shaft. (One serration pitch: 15°)
After control lever has been repositioned, be sure to measure amount of fuel injection at idle speed again.


SEF010C

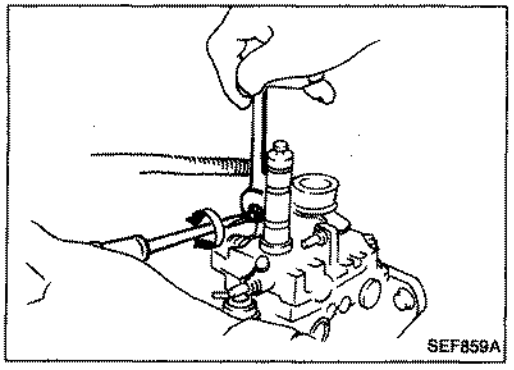
Adjustment of fuel injection during start

1. Set control lever at "full-load" by pulling spring or using a suitable equipment.
2. Furnish voltage of 12 volts to activate fuel cut solenoid valve.
3. Measure fuel injection at specified fuel injection pump rpm.

Refer to S.D.S. for start fuel injection amount of adjustment value.

4. If not within specifications, check to make sure "MS" dimension is within specification. Refer to step 25 for Injection Pump Assembly.

For vehicles with cold start device, refer to cold start device adjustment.


SEF859A

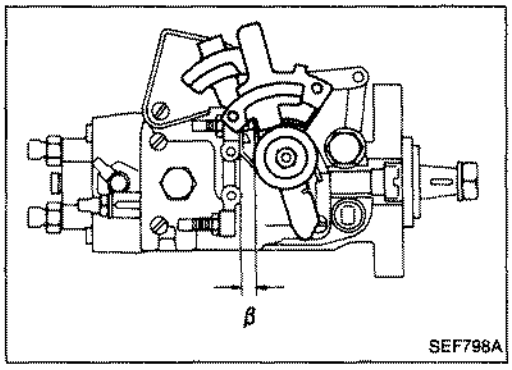
Adjustment of fuel injection at max. pump rpm

1. Set control lever at "full-load" by pulling spring or using a suitable equipment.
2. Furnish voltage of 12 volts to activate fuel cut solenoid valve.
3. Measure fuel injection at specified fuel injection rpm.

Refer to S.D.S. for max. pump speed fuel injection amount of adjustment value.

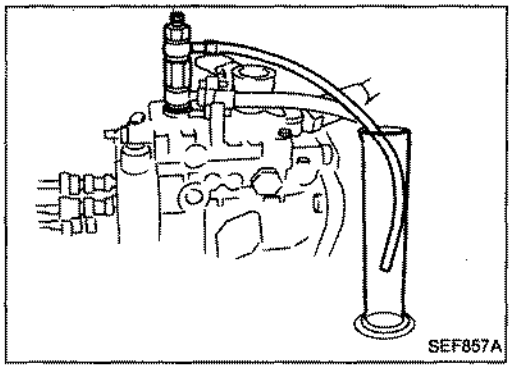
4. If fuel injection is not within standard range, adjust by turning max. speed adjusting screw.

Testing of Injection Pump (Cont'd)



a. Tightening screw may change fuel injection.
b. Make sure control lever angle is within the specified range. Refer to S.D.S.

5. Check injection pump condition, referring to inspection value.



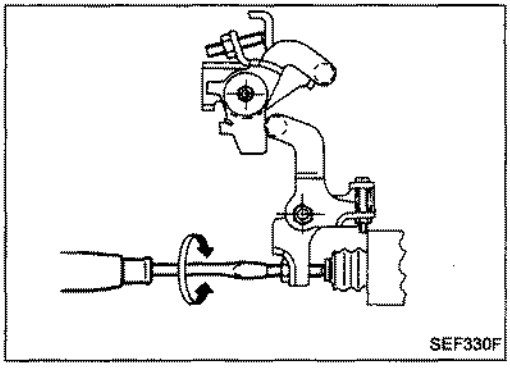
Measurement of overflow amount

1. Set control lever at "full-load" by pulling spring or using a suitable equipment.
2. Furnish voltage of 12 volts to activate fuel cut solenoid valve.
3. Measure fuel overflow at specified fuel injection rpm.

Refer to S.D.S. for overflow amount of inspection value.

Operation check of fuel cut solenoid valve

When engine is idling and fuel cut solenoid valve current is OFF, be sure there is no injection. This check has to be done for approx. 5 seconds.

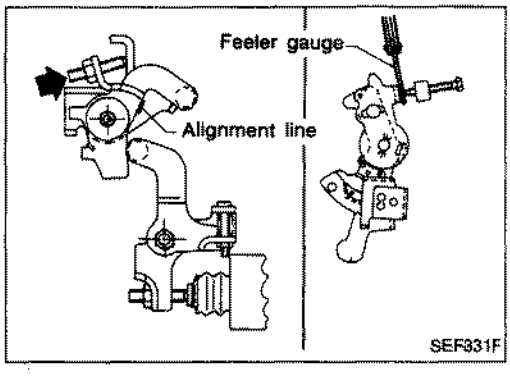


Cold start device adjustment — CD17

Cold start device adjustment should be done after all injection pump adjustments have finished.

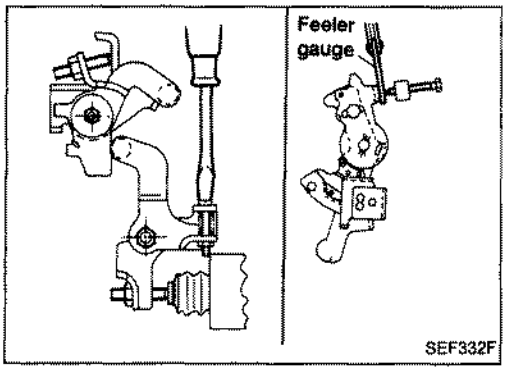
1. Measure ambient temperature with a thermometer.
2. At this time, ensure that speed timer piston stroke is the specified value.
   If not within specification, adjust timer stroke with cold start device adjusting screw.

Refer to S.D.S. for speed timer piston stroke and ambient temperature.



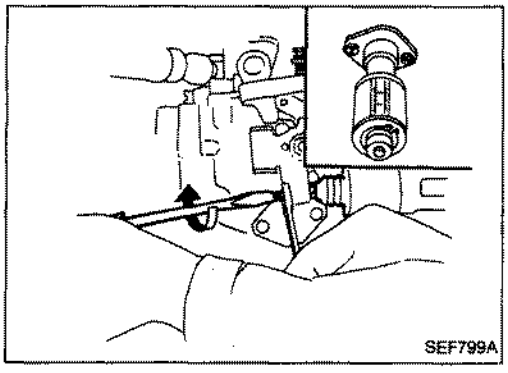
3. Insert 4.1±0.05 mm (0.1614±0.0020 in) feeler gauge between idle adjusting screw and control lever and align alignment line with fast idle control lever by adjusting fast idle control lever adjusting screw.

Testing of Injection Pump (Cont'd)



4. Fully loosen cold start device lever adjusting screw, select feeler gauge whose thickness equals the specified clearance [obtained from S.D.S.: $\ell \pm 0.05$ mm (0.0020 in)] between idle adjusting screw and stopper, and retighten cold start device lever adjusting screw until cold start device lever contacts fast idle control lever.

Temperature should be below 30°C (86°F) during adjustment.



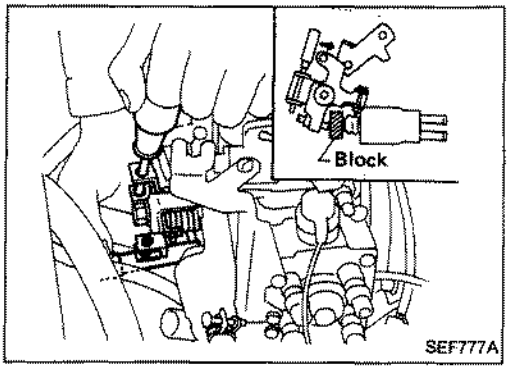
Cold start device adjustment — CD20

- **Cold start device adjustment should be done after all injection pump adjustments have finished.**
- **Temperature should be below 30°C (86°F) during adjustment.**

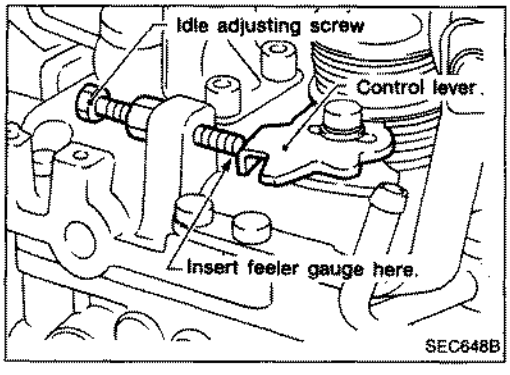
1. Measure ambient temperature with a thermometer.
2. At this time, ensure that speed timer piston stroke is the specified value.
   If not within specification, adjust timer stroke with cold start device adjusting screw.

Refer to S.D.S. for speed timer piston stroke and clearance.

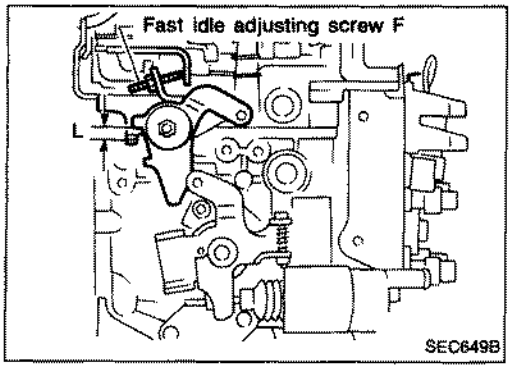
Preparation of cold start device



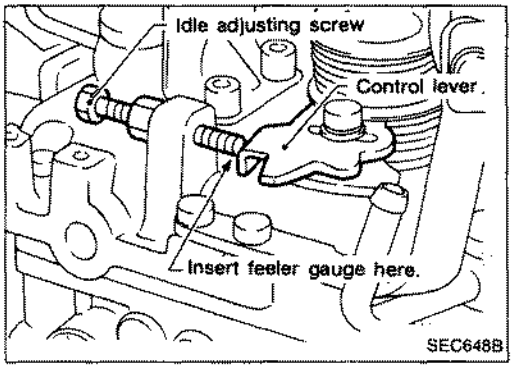
1. Turn cold start device linkage clockwise to disengage cold start device.
2. Set a suitable block [Thickness: about 15 mm (0.59 in)] between cold start device plunger and linkage rod.



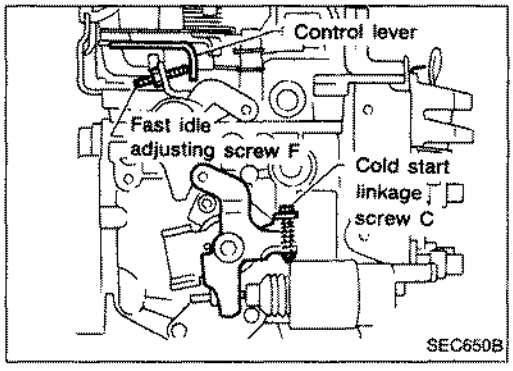
3. Insert 3.0 ± 0.05 mm (0.1181 ± 0.0020 in) feeler gauge between idle adjusting screw and control lever.
4. Adjust clearance L to 5.3 ± 0.05 mm (0.2087 ± 0.0020 in) by turning fast idle adjusting screw F.
5. Tighten fast idle adjusting screw lock nut.



Testing of Injection Pump (Cont'd)

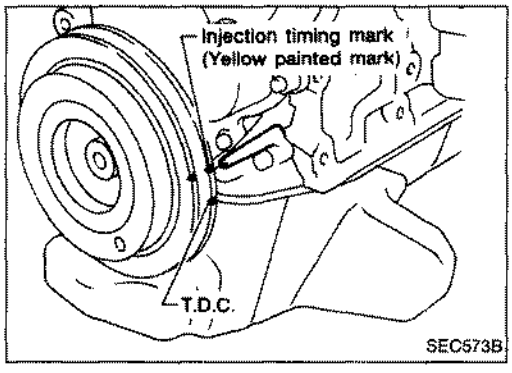


6. Select feeler gauge whose thickness equals the specified clearance [obtained from S.D.S.: $\ell \pm 0.05$ mm (0.0020 in)] between idle adjusting screw and control lever.
7. Insert the feeler gauge between idle adjusting screw and control lever.

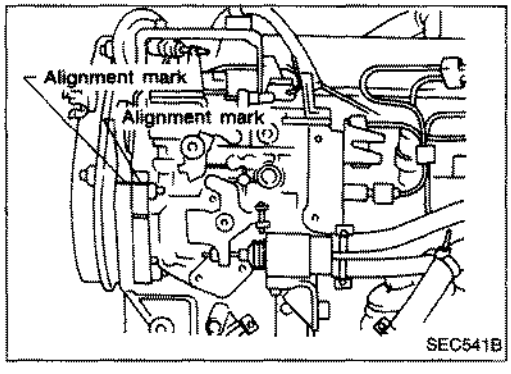


8. Turn cold start linkage screw C such that fast idle adjusting screw F slightly contacts control lever.

Installation



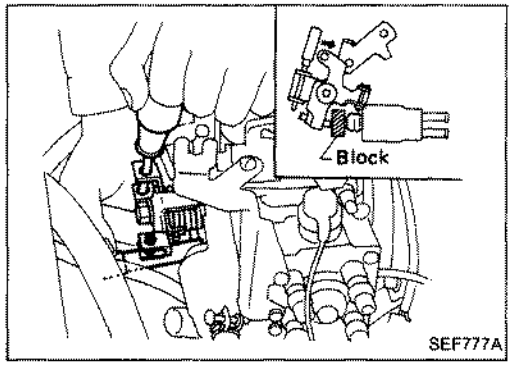
1. Set No. 1 piston at injection timing mark on its compression stroke.
   Injection timing mark: Yellow painted mark
   CD17: 11° ATDC
   CD20: 9° ATDC



2. Install injection pump and timing belt.
- Refer to MA section for installing timing belt.
- Temporarily secure injection pump bolts so alignment mark on injection pump flange meets the mark on injection pump bracket.

3. Adjust injection timing.

Adjustment

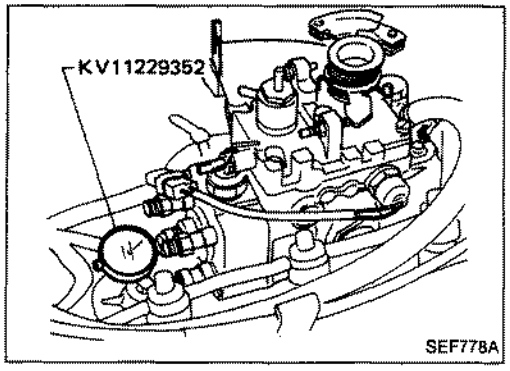


INJECTION TIMING ADJUSTMENT (Plunger lift adjustment)

Preparation of cold start device

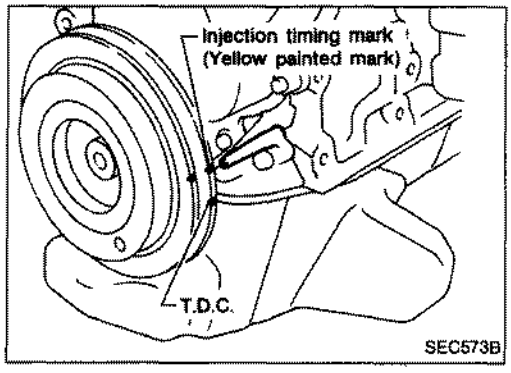
1. Turn cold start device linkage clockwise.
2. Set a suitable block [Thickness: about 15 mm (0.59 in)] between cold start device plunger and linkage rod.
3. Turn crankshaft 2 turns clockwise to set the device to normal position.

Adjustment (Cont'd)



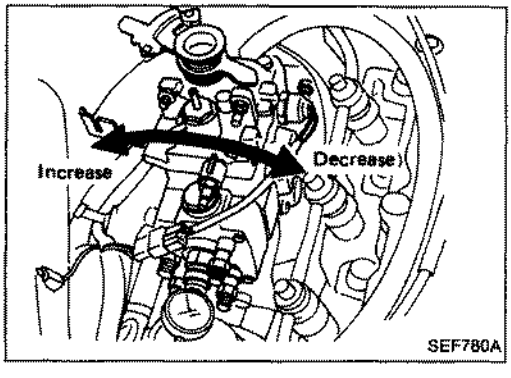
Checking

1. Set No. 1 piston at T.D.C. on its compression stroke.
   T.D.C.: White painted mark
2. Remove injection tubes and air bleeder on the back of injection pump.
3. Set dial gauge so its indicator points to somewhere between 1.0 and 2.0 mm (0.039 and 0.079 in) on the scale.
4. Turn crankshaft 1 turn clockwise and check that dial gauge indicates the same value again.



5. Turn crankshaft counterclockwise about 20 to 25 degrees, then set dial gauge indicator to 0 mm (0 in).
6. Turn crankshaft clockwise and set the pump timing mark to the mark on the crankshaft pulley.
   Pump timing mark: Yellow painted mark
   CD17: 11° ATDC
   CD20: 9° ATDC
7. Read plunger lift.
   Plunger lift:
   0.79 - 0.85 mm (0.0311 - 0.0335 in) at pump timing mark

- **When repeating the checking, start with step 5.**

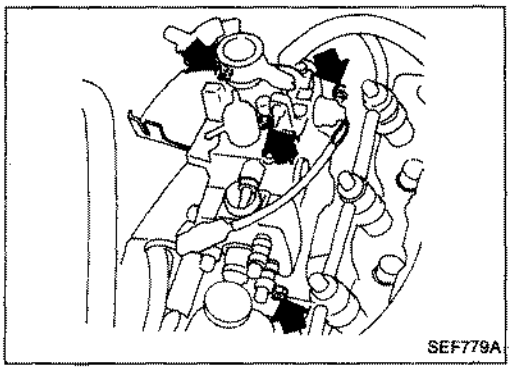


Adjusting

1. If plunger lift is not within the specified value, adjust by turning injection pump.

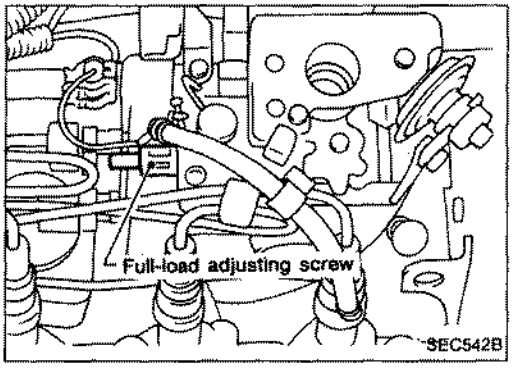
- **If indication is smaller than the specified value, turn pump body away from engine.**
- **If indication is larger than the specified value, turn pump body towards engine.**

Adjustment (Cont'd)

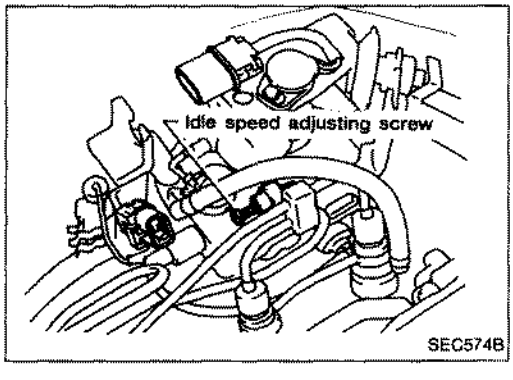

SEF779A

2. Tighten injection pump securing bolts and nuts.
   Nut:
   : 13 - 18 m
   (1.3 - 1.8 kg-m, 9 - 13 ft-lb)
   Bolt:
   : 45 - 60 N·m
   (4.6 - 6.1 kg-m, 33 - 44 ft-lb)
3. Remove dial gauge and install air bleeder with new washer.
4. Install injection tubes.
   Flare nut:
   : 22 - 25 N·m
   (2.2 - 2.5 kg-m, 16 - 18 ft-lb)
5. Bleed air from fuel system.

Refer to MA section.



SEC542B



SEC574B

IDLE SPEED AND MAXIMUM SPEED ADJUSTMENT

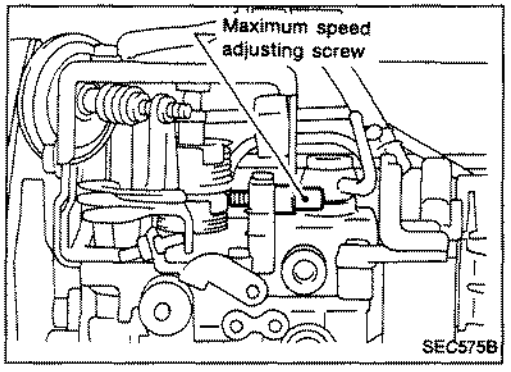
CAUTION:

- **Do not remove sealing caps unless absolutely necessary.**
- **Never disturb full-load adjusting screw because this alters the mixture ratio and may result in serious engine problems.**
- **Do not adjust maximum speed adjusting screw to a point exceeding specifications, because exceeding the maximum speed may cause engine damage.**
- **When attaching tachometer pickup, remove fuel tube clamps. (Refer to tachometer instructions.)**

Idle speed adjustment

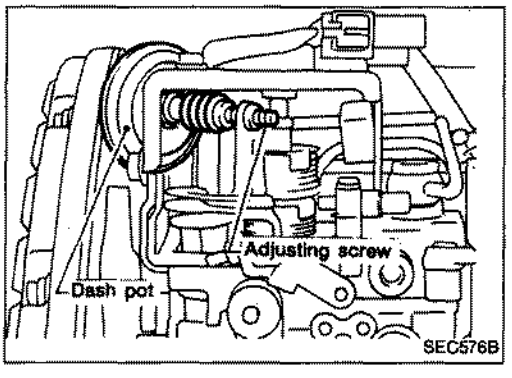
- Refer to MA section.
  Idle speed: 700^{+50}_{-0} rpm (M/T models)

Adjustment (Cont'd)



Maximum speed adjustment

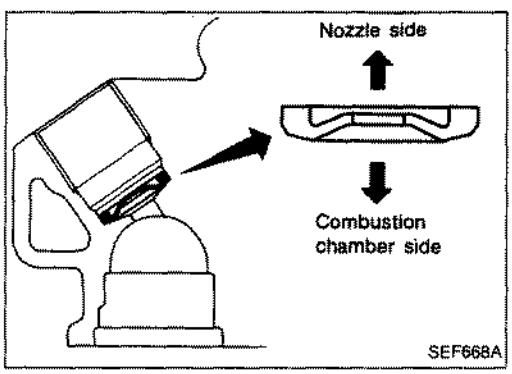
1. Start engine and warm it up until coolant temperature indicator points to middle of gauge.
2. Connect tachometer pickup to No. 1 fuel injection tube.
- Refer to the instructions on tachometer.
3. Depress accelerator pedal fully under no-load and read the tachometer indication.
   Maximum engine speed (Under no-load):
   CD17: 5,200 - 5,500 rpm
   CD20: 5,400 - 5,600 rpm
4. If indication is lower than specified maximum engine speed, adjust using maximum speed adjusting screw.
5. After adjustment, tighten lock nut securely and plug it with a sealing cap.



Dash pot adjustment

1. Warm up engine to normal operating temperature.
2. Attach tachometer and adjust touch speed using adjusting screw.
   Touch speed: 1,300 rpm

CAUTION:
Plug flare nut with a cap or rag so that no dust enters the nozzle.
Cover nozzle tip for protection of needle.



Removal and Installation

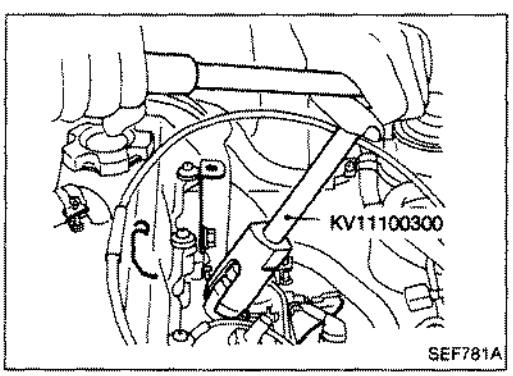
1. Remove fuel injection tube and spill tube.
2. Remove injection nozzle assembly.

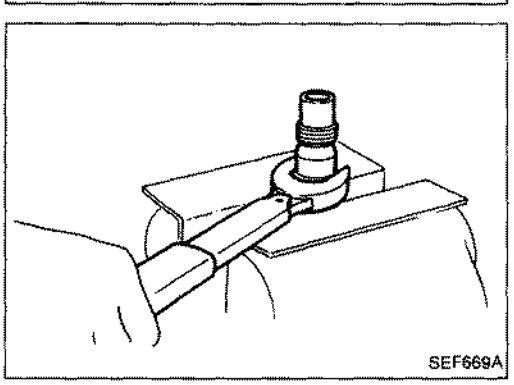
Also remove washers from nozzle end.

3. Install injection nozzle in the reverse order of removal.

Injection nozzle to engine:
: 59 - 69 N·m
(6.0 - 7.0 kg-m, 43 - 51 ft-lb)
Injection nozzle to tube:
: 22 - 25 N·m
(2.2 - 2.5 kg-m, 16 - 18 ft-lb)
Spill tube:
: 39 - 49 N·m
(4.0 - 5.0 kg-m, 29 - 36 ft-lb)

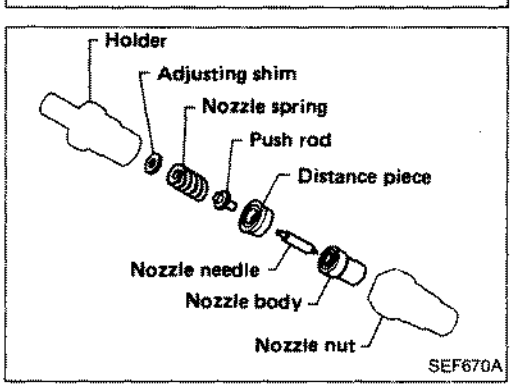
a. Always clean the nozzle holes.
b. Always use new injection nozzle gasket.
c. Note that small washer should be installed in specified direction.
d. Bleed air from fuel system.





Disassembly

1. Loosen nozzle nut while preventing nozzle top from turning.

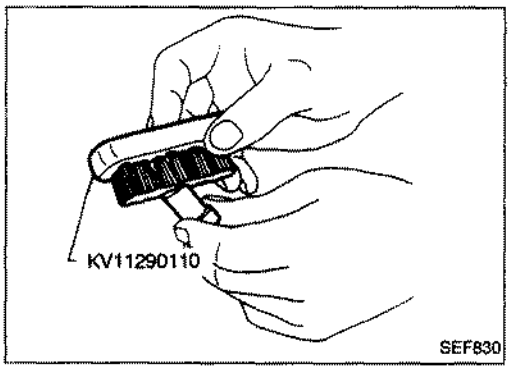


2. Arrange all disassembled parts in the order shown at left.

Inspection

Thoroughly clean all disassembled parts with fresh kerosene or solvent.

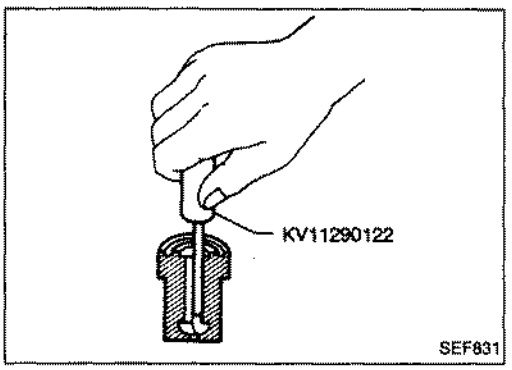
- If nozzle needle is damaged or fused, replace nozzle assembly with a new one.
- If end of nozzle needle is seized or excessively discolored, replace nozzle assembly.
- Check nozzle body and distance piece for proper contact. If excessively worn or damaged, replace nozzle assembly or distance piece.
- Check distance piece and nozzle holder for proper contact. If excessively worn or damaged, replace distance piece or nozzle holder.
- Check nozzle spring for excessive wear or damage. If excessively worn or damaged, replace it with a new spring.



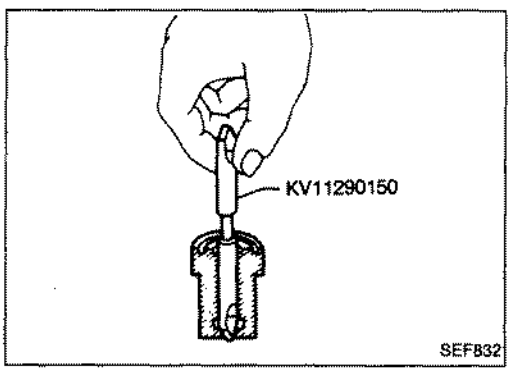
Cleaning

a. Do not touch the nozzle mating surface with your fingers.
b. To wash the nozzles, use a wooden stick and brass brush with clean diesel fuel.

1. Remove any carbon from exterior of nozzle body (except wrapping angle portion) by using Tool.



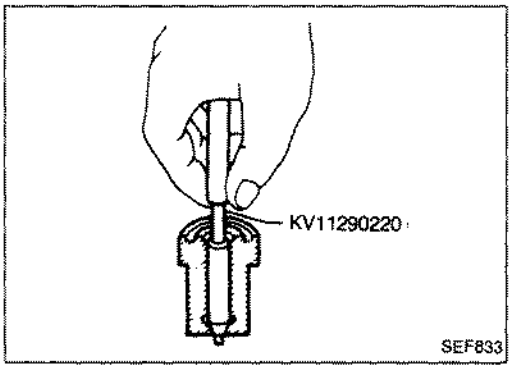
2. Clean oil sump of nozzle body using Tool.



3. Clean nozzle seat by using Tool.

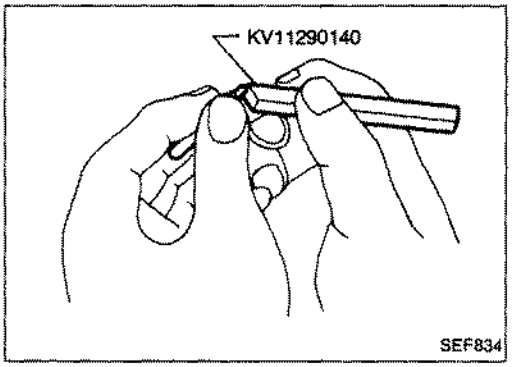
This job should be performed with extra precautions, since efficiency of nozzle depends greatly on a good nozzle seat.

Cleaning (Cont'd)

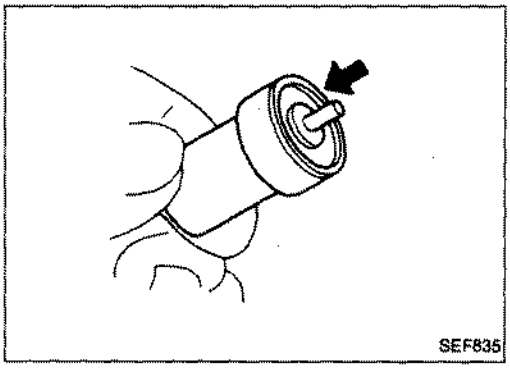


4. Clean spray hole of nozzle body by using Tool.

To prevent spray hole from canting, always clean it by starting with inner side and working towards outside.

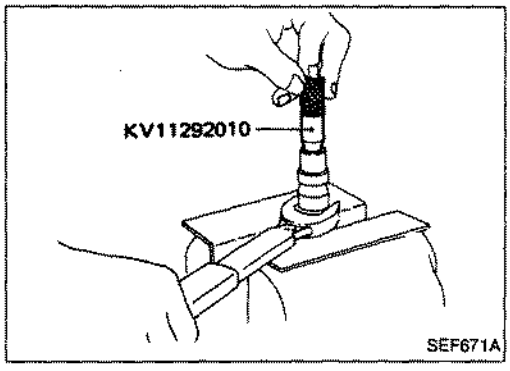


5. Decarbonate nozzle needle tip by using Tool.



6. Check needle sinking.
(1) Pull needle about halfway out from body and then release it.
(2) Needle should sink into body very smoothly from just its own weight.
(3) Repeat this test and rotate needle slightly each time.

If needle fails to sink smoothly from any position, replace both needle and body as a unit.



Assembly

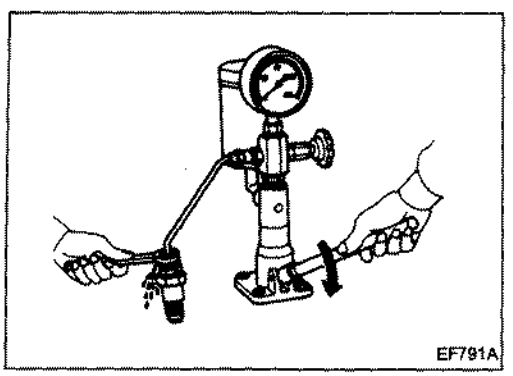
Assemble in the reverse order of disassembly, observing the following.

If nozzle body is not installed properly, Tool cannot be removed and nozzle body may be damaged.

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

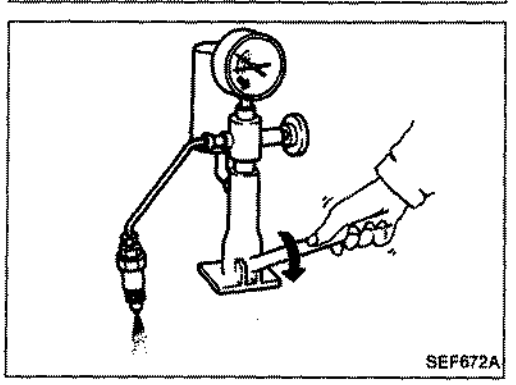
Test and Adjustment

WARNING:
When using nozzle tester, be careful not to allow diesel fuel sprayed from nozzle to contact your hands or body, and make sure your eyes are properly protected with goggles.


EF791A

INJECTION PRESSURE TEST

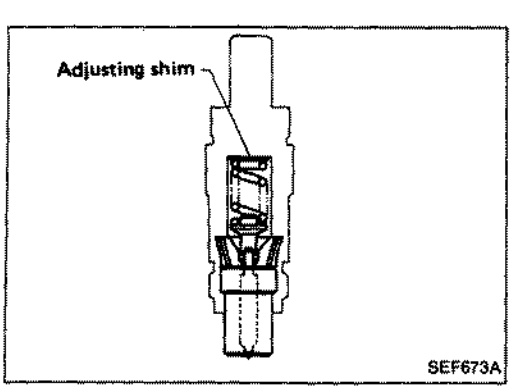
1. Install nozzle to injection nozzle tester and bleed air from flare nut.


SEF672A

2. Pump the tester handle slowly (one time per second) and watch the pressure gauge.
3. Read the pressure gauge when the injection pressure just starts dropping.

Initial injection pressure:
Used
12,259 - 13,239 kPa (122.6 - 132.4 bar, 125 - 135 kg/cm^2, 1,778 - 1,920 psi)
New
12,749 - 13,534 kPa (127.5 - 135.3 bar, 130 - 138 kg/cm^2, 1,849 - 1,962 psi)

Always check initial injection pressure using a new nozzle.



SEF673A

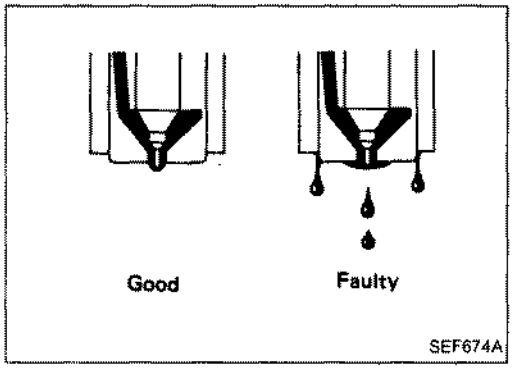
4. To adjust injection pressure, change adjusting shims.

a. Increasing the thickness of adjusting shims increases initial injection pressure. Decreasing thickness reduces initial pressure.

b. A shim thickness of 0.04 mm (0.0016 in) corresponds approximately to a difference of 471 kPa (4.71 bar, 4.8 kg/cm^2, 68 psi) in initial injection pressure.

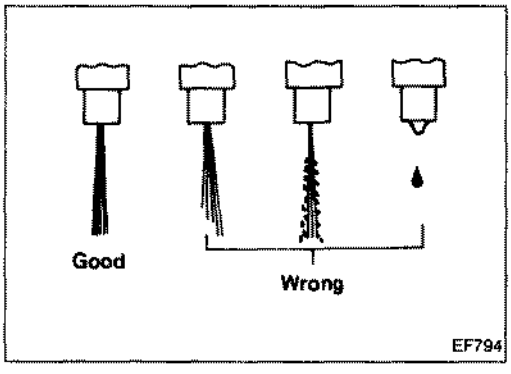
Refer to S.D.S. for adjusting shim.

Test and Adjustment (Cont'd)



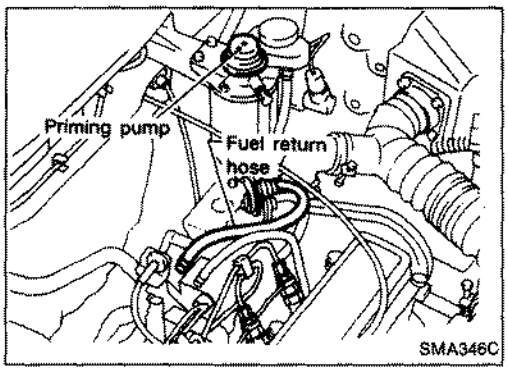
LEAKAGE TEST

1. Maintain the pressure at about 981 to 1,961 kPa (9.8 to 19.6 bar, 10 to 20 kg/cm^2, 142 to 284 psi) below initial injection pressure.
2. Check that there is no dripping from the nozzle tip or around the body.
3. If there is leakage, clean, overhaul or replace nozzle.



SPRAY PATTERN TEST

1. Pump the tester handle one time per second.
2. Check the spray pattern.
3. If the spray pattern is not correct, clean or replace nozzle.



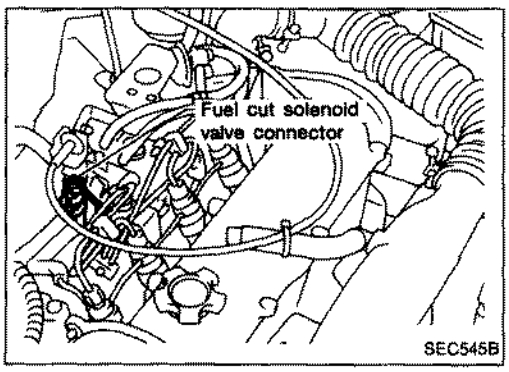
Priming Pump Check

Before checking priming pump, make sure that fuel filter is filled with fuel.

1. Disconnect fuel return hose.

Place a suitable container beneath hose end.

2. Pump priming pump and check that the fuel overflows from the hose end. If not, replace priming pump.

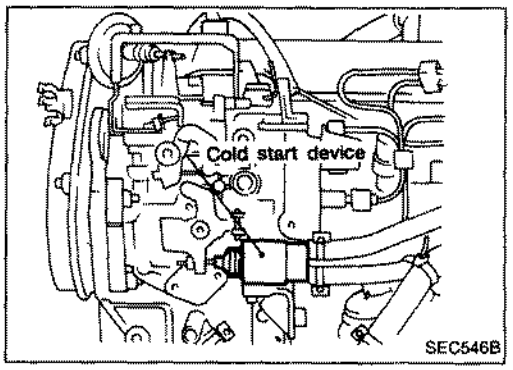


Fuel Cut Solenoid Valve

1. Disconnect fuel cut solenoid valve harness connector and check voltage.

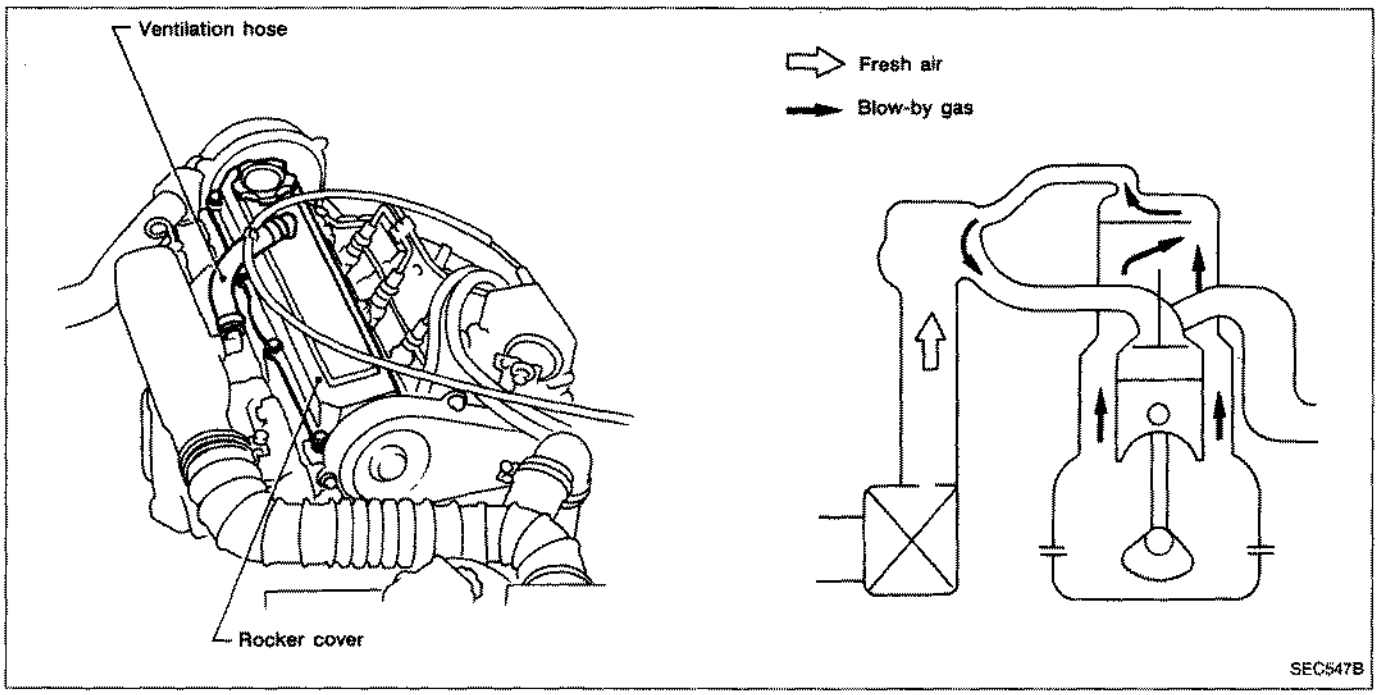
Ignition switch	Voltage
OFF	0V
ON	Battery voltage

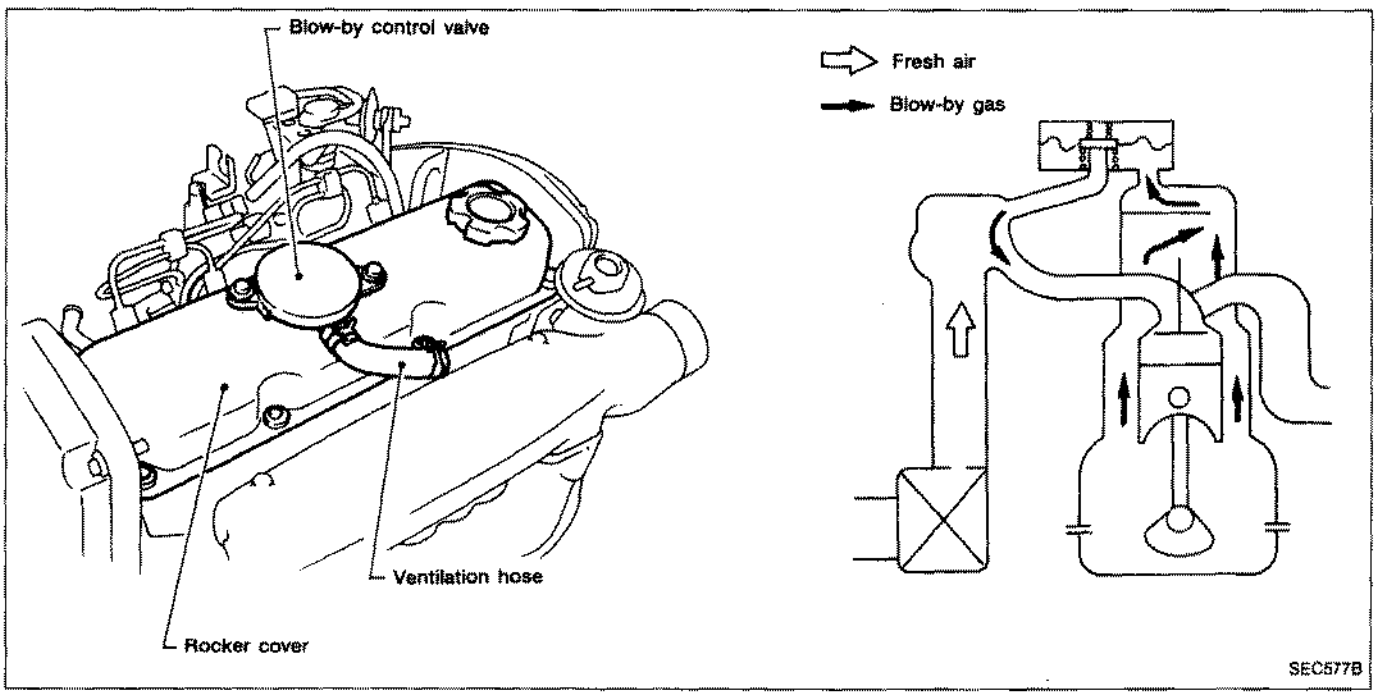
2. Check fuel cut solenoid valve for circuit continuity.
3. Remove fuel cut solenoid valve and check that plunger moves smoothly and that spring is normal.

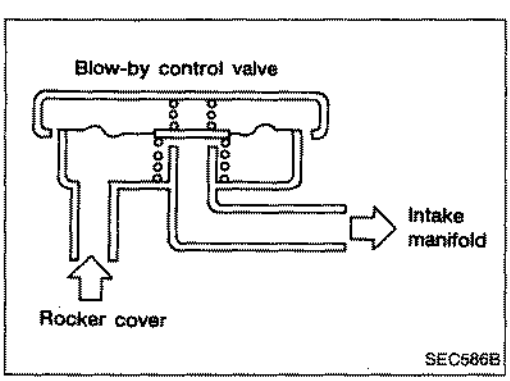


Cold Start Device

Refer to VE-TYPE INJECTION PUMP.





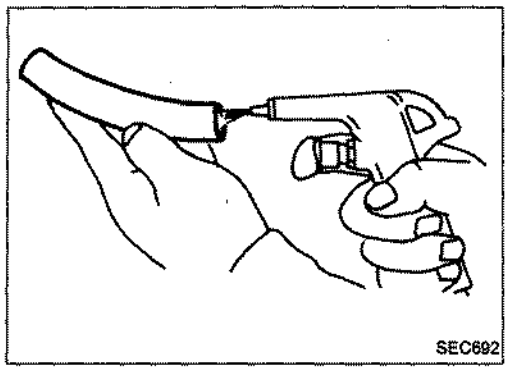


Blow-by Control Valve

- Check control valve for clogging and abnormalities.

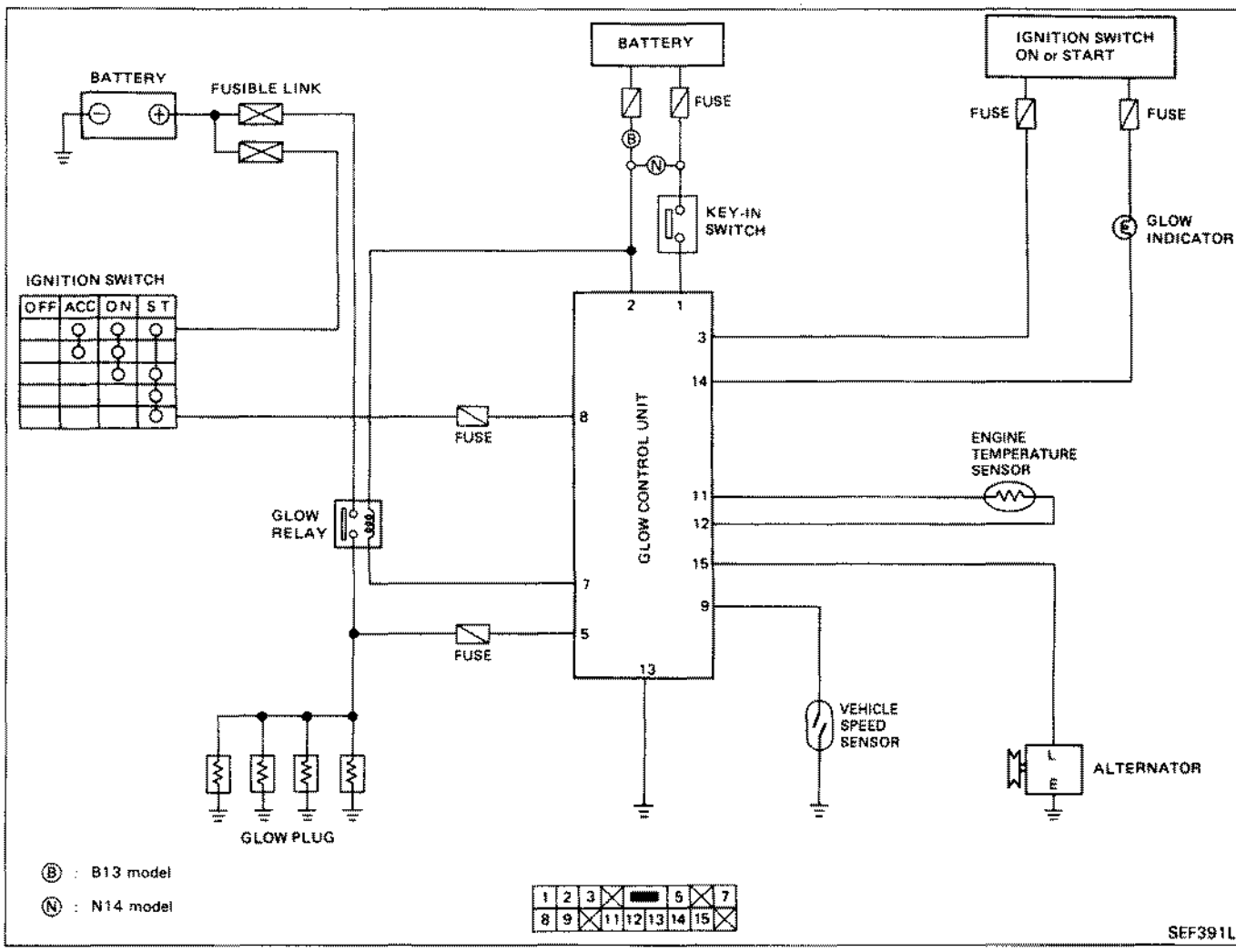
Blow-by Control Valve (Cont'd)

Ventilation Hose

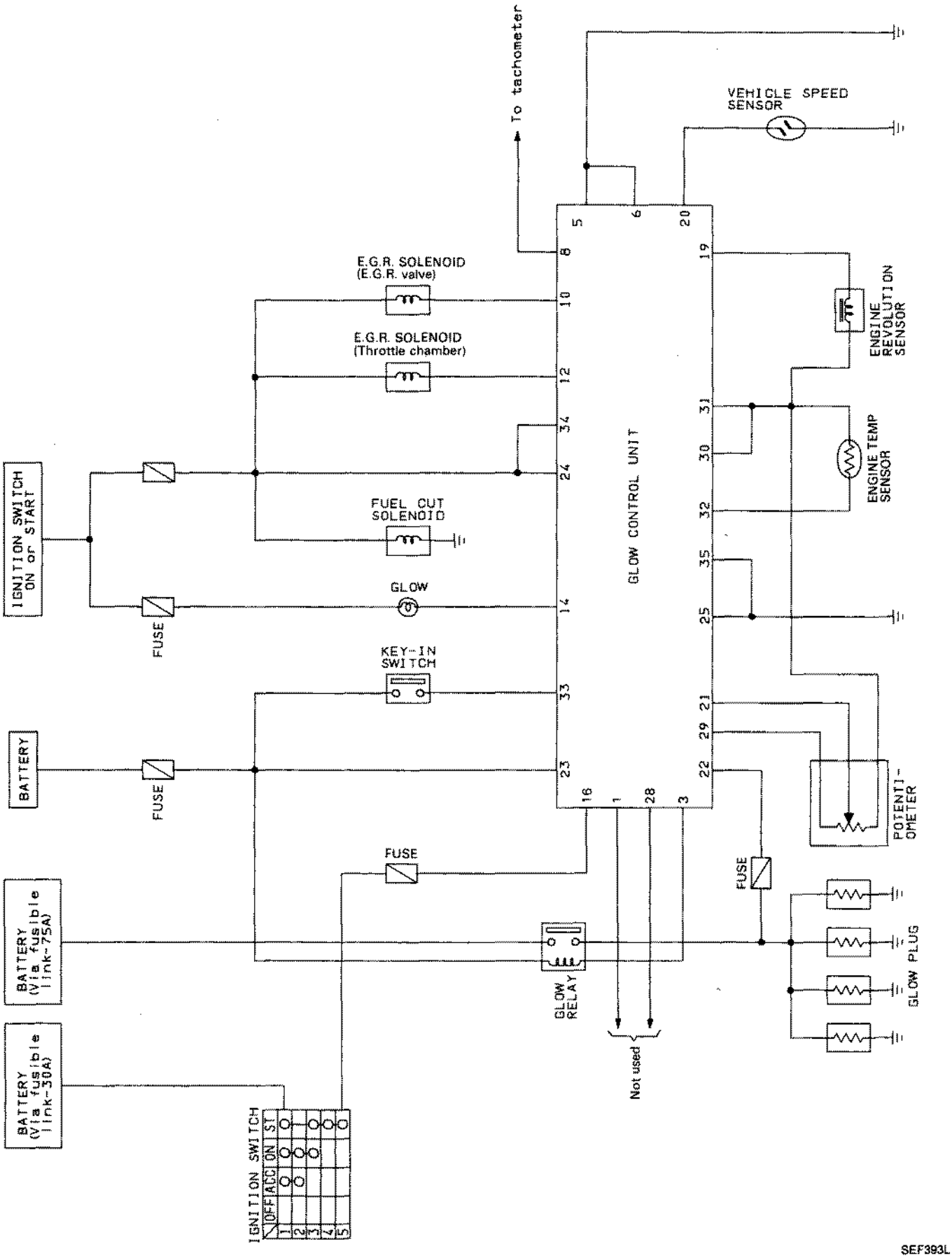

SEC692

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.

Schematic — Without E.G.R. system

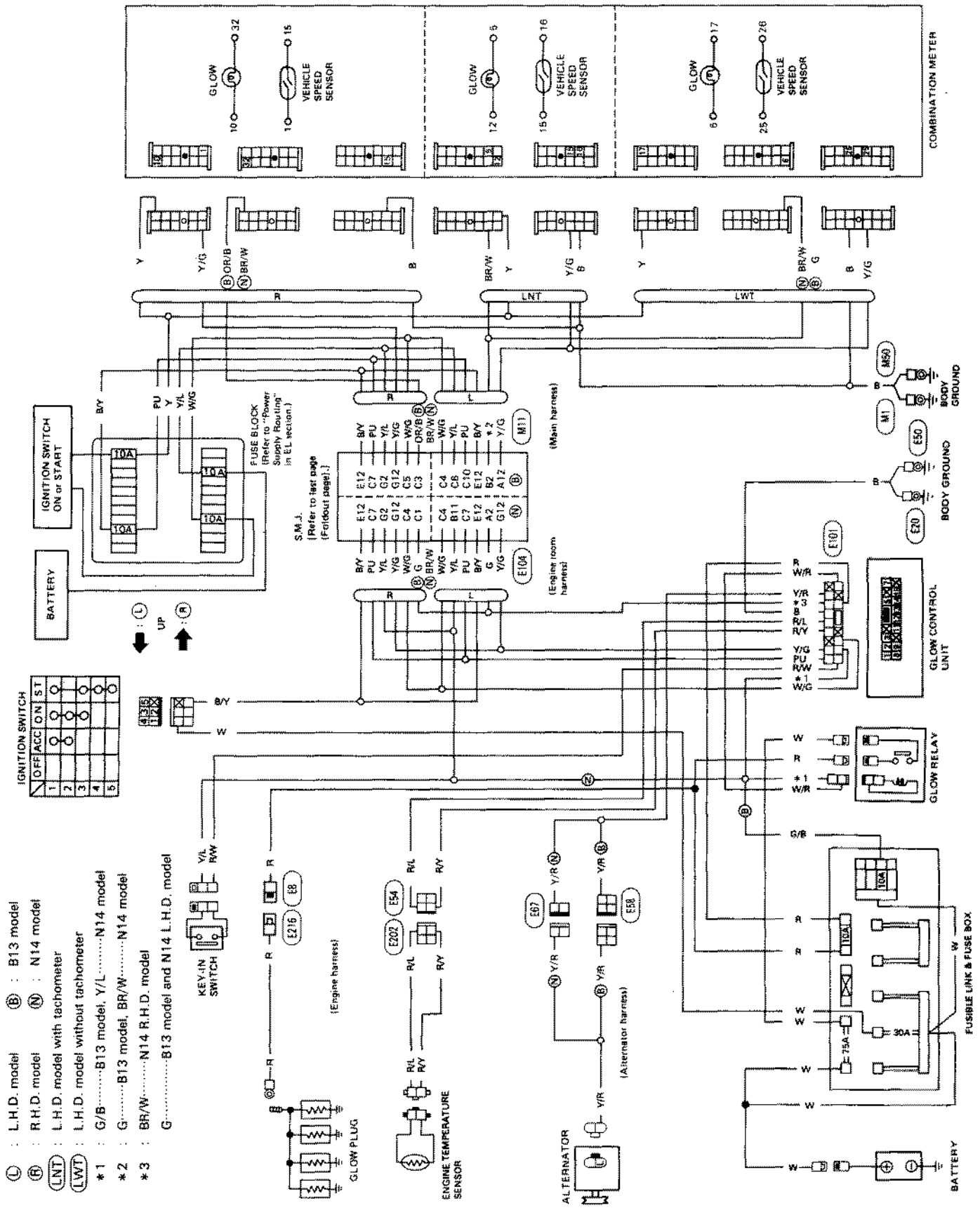


Schematic — With E.G.R. system



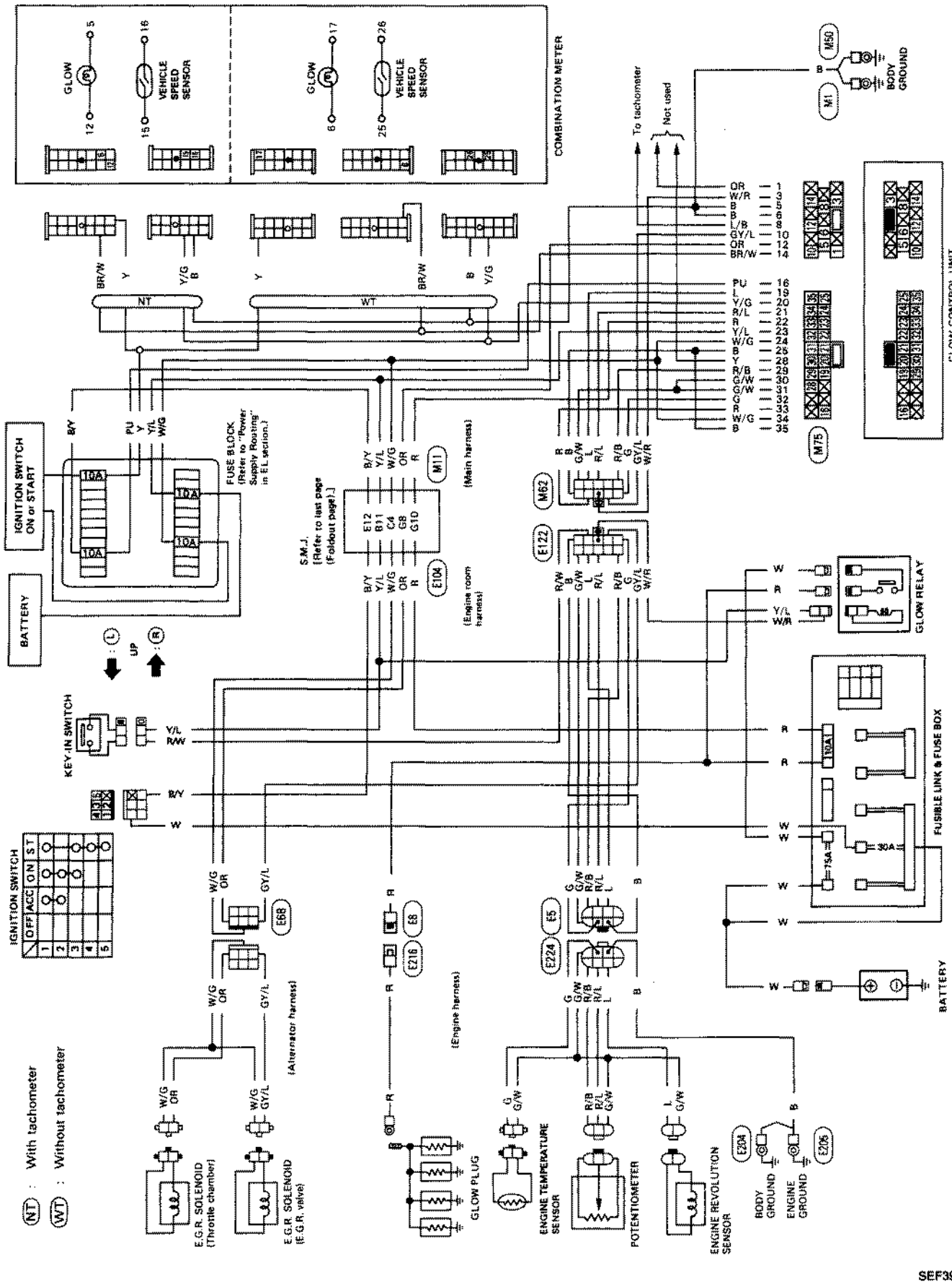
SEF393L

Wiring Diagram — Without E.G.R. system



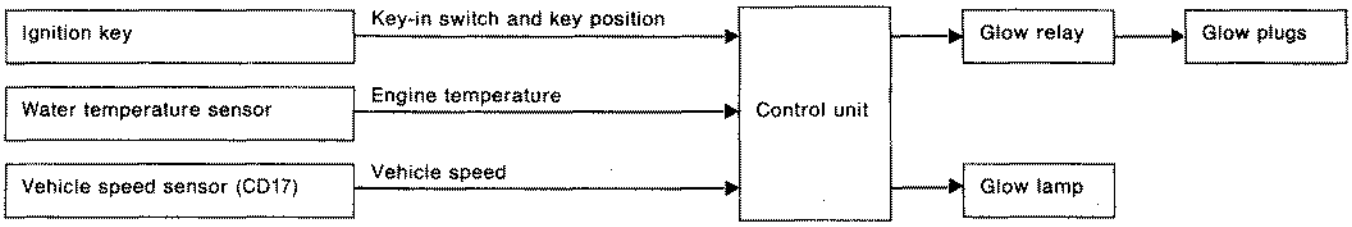
SEF392L

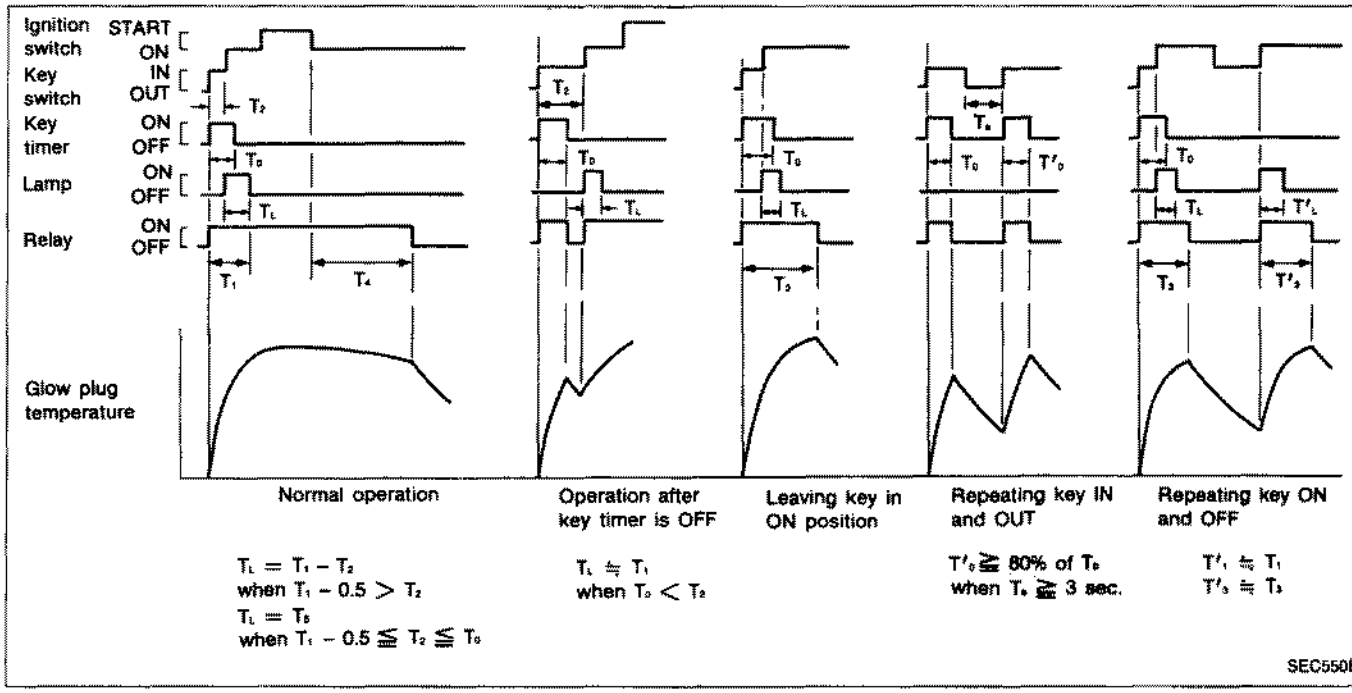
Wiring Diagram — With E.G.R. system



SEF394L

Description





When the ignition key is inserted into the key cylinder, the control unit turns on the relay and the "high-level" electric current flows through the glow plugs and heats them up quickly. When the ignition switch is turned on, the control unit turns on the indicator. After T_1 seconds have passed from key in, the control unit turns off the indicator.

While cranking, the relay remains on. The relay automatically turns off after T_4 seconds have passed from the engine start.

For CD17: When vehicle speed exceeds 12 km/h (7 MPH), the control unit stops the electric current to glow plugs to protect them.

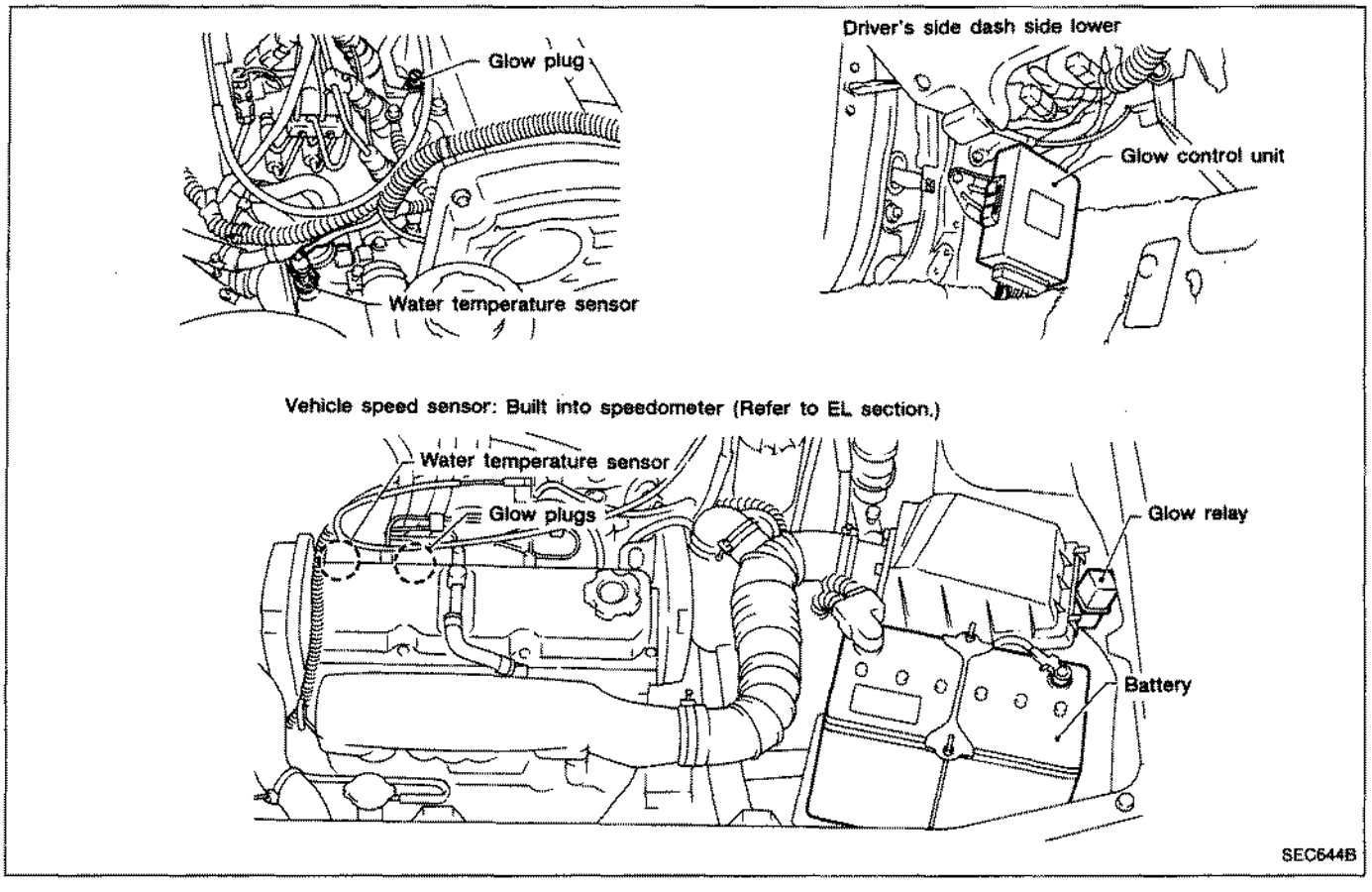
	Second	Water temp. sensor		Remarks
		Water temp. °C (°F)	Resistance (kΩ)	
T_5	2.8 - 3.8	—	—	
T_1	5.0 - 7.0	−25 (−13)	19.7	
	1.8 - 3.2	20 (68)	2.5	
	0.8 - 2.2	60 (140)	0.6	
T_3	17.0 - 23.0	Lower than 60 (140)	More than 0.6	
	4.0 - 6.0	Higher than 60 (140)	Less than 0.6	
T_4	255 - 345	Lower than 60 (140)	More than 0.6	When alternator is working
	Less than 10	Higher than 60 (140)	Less than 0.6	
(T_4)	15 - 25	Lower than 60 (140)	More than 0.6	When alternator is not working
	3 - 7	Higher than 60 (140)	Less than 0.6	
T_5	0.1 - 0.9	—	—	

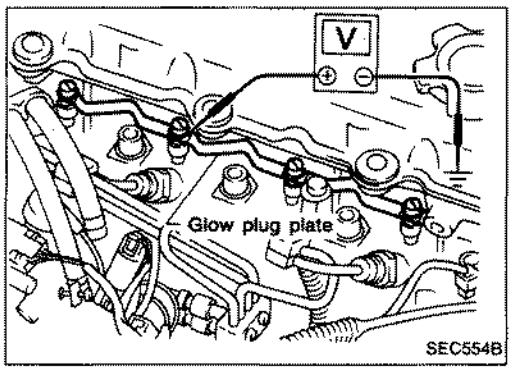
Trouble Diagnosis

ENGINE SYMPTOM	PARTS									
	QUICK-GLOW CONTROL UNIT	GLOW RELAY	ENGINE COOLANT TEMP SENSOR	GLOW PLUG	ALTER-NATOR	KEY-IN SWITCH	IGNITION SWITCH	GLOW INDI-CATOR LAMP	FUSE FUSIBLE LINK	BATTERY
Cannot be started	X	X	X	X		X	X		X	X
Hard to start	X	X	X	X		X	X		X	X
White smoke after starting	X	X	X	X	X		X		X	X
Rough idle after starting	X	X	X	X	X		X		X	X
Glow indicator does not come "ON"	X						X	X	X	X
Glow indicator does not go "OFF"	X						X	X		X

- Before checking quick-glow system, check engine condition, fuel ingredients and fuel injection system.
- Before checking component parts, check battery condition, fuse and fusible link.
- When checking component parts, check their related harnesses and connectors at the same time.
- Before replacing quick-glow control unit check all other component parts.

Parts Location

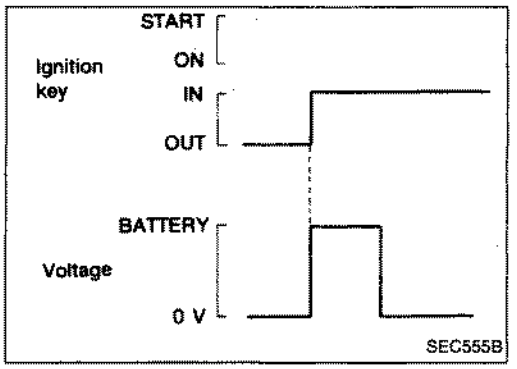




Component Parts Basic Check

ENTIRE SYSTEM CHECK

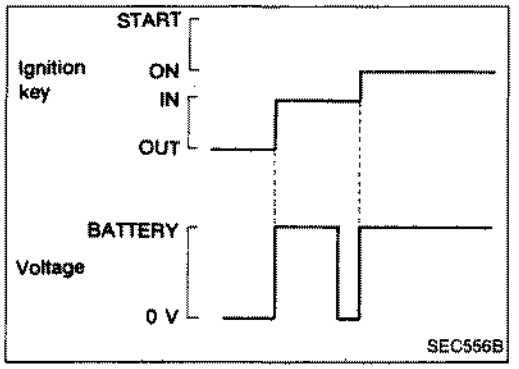
Set voltmeter between glow plug and engine body.



1. Key-in glow system
- Read voltage when ignition key is inserted into ignition switch.

Voltage:

Battery voltage for about 3 seconds



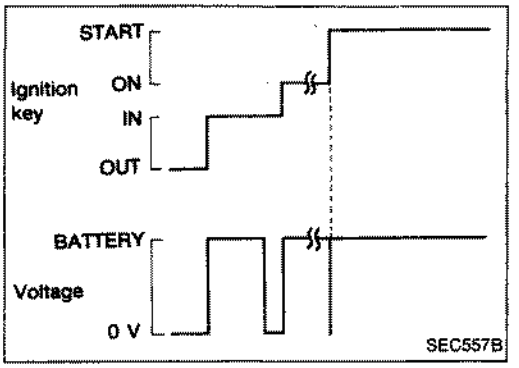
2. Quick-glow (Pre-glow) system
1) Turn ignition switch "ON" 3 or more seconds after key-in.
2) Read voltage

Voltage:

Battery voltage for about 20* seconds

*** Coolant temperature is lower than 60°C (140°F).**

*** Repeating ignition key "ON" and "OFF" may change the time.**

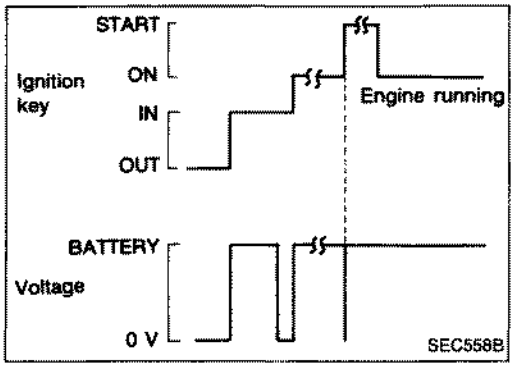


3. Quick-glow (Cranking) system
1) Disconnect "S" terminal for starter motor to prevent engine from cranking.
2) Read voltage when ignition key is turned to "START".

Voltage:

Battery voltage*

*** For about 20 seconds after returning ignition switch to "ON".**



4. After-glow system
1) Connect "S" terminal to starter motor.
2) Start engine and read voltage.

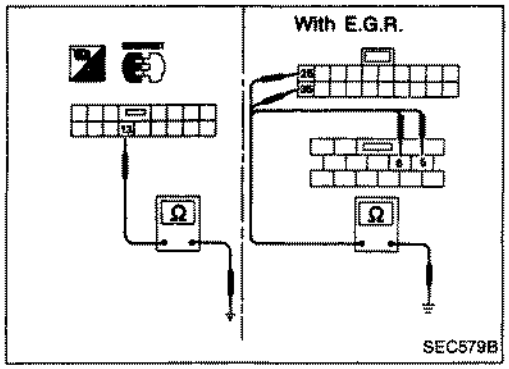
Voltage:

Battery voltage for 5* minutes

*** Coolant temperature is lower than 60°C (140°F).**

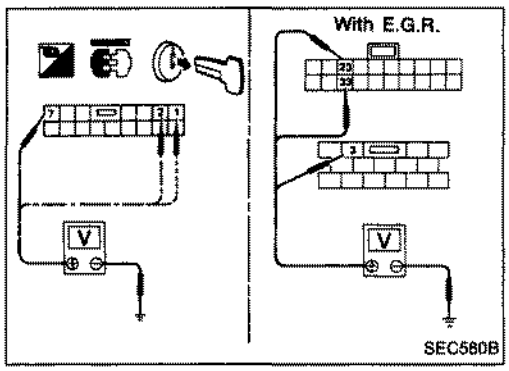
Component Parts Basic Check (Cont'd)

POWER SUPPLY FOR GLOW CONTROL UNIT



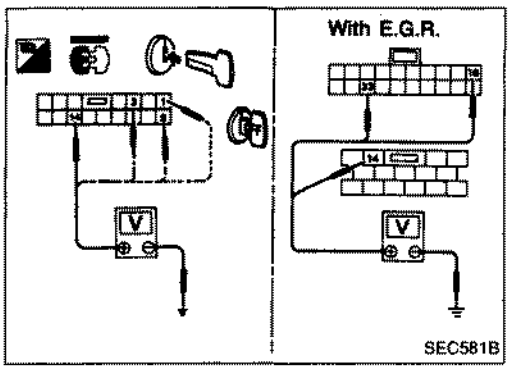
1. Disconnect "S" terminal for starter motor to prevent engine from cranking.
2. Disconnect glow control unit harness connector.
3. Check terminal(s) ⑬ (Models with E.G.R.: ⑤, ⑥, ㉕ and ㉟) for ground continuity.
   Continuity should exist (0Ω).

- If N.G., check ground harness.



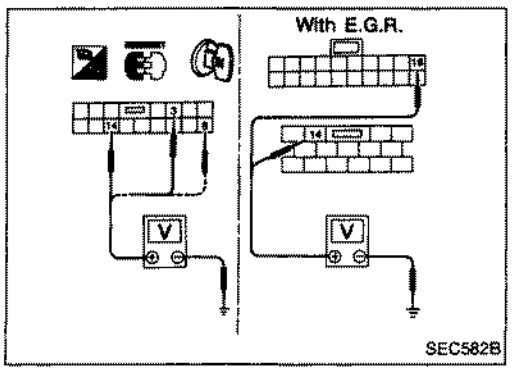
4. Check voltage at each terminal according to the following chart.

Terminal No.		Ignition switch position		Voltage
	E.G.R.			
②	㉓	OFF (Not inserted)		Battery voltage
⑦	③	OFF (Not inserted)		Battery voltage
①	㉝	OFF (Not inserted)		0V
		OFF (Inserted)		Battery voltage
③	㉔, ㉞	OFF		0V
		ON	START	Battery voltage
⑭	⑭	OFF		0V
		ON	START	Battery voltage
⑧	⑯	OFF	ON	0V
		START		Battery voltage

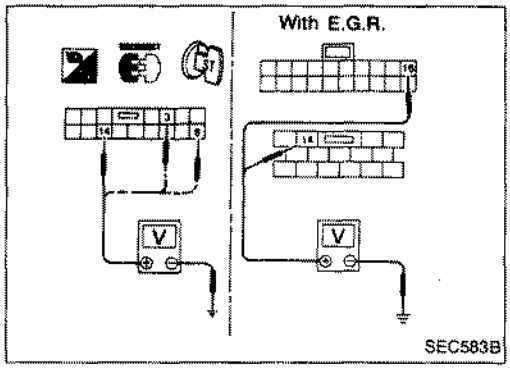


- If N.G., check component parts and their related harness according to the following chart.

Terminal No.		Parts which should be checked						
	E.G.R.	Battery	Fuse /Fusible link	Glow relay	Key-in switch	Ignition switch	Glow indicator bulb	Harness
②	㉓	X	X					X
⑦	③	X	X	X				X
①	㉝	X	X		X			
③	㉔, ㉞	X	X			X		X
⑭	⑭	X	X			X	X	X
⑧	⑯	X	X			X		X



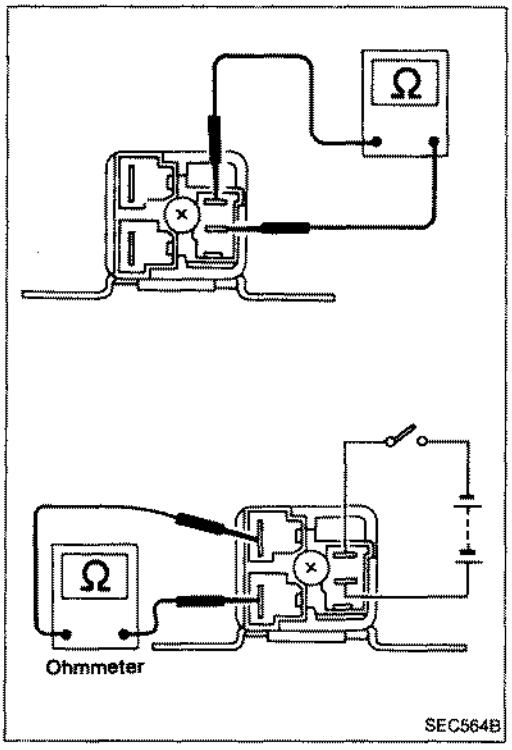
Component Parts Basic Check (Cont'd)



GLOW RELAY

1. Check relay for coil continuity.
   Continuity should exist.
2. Check relay for proper operation.

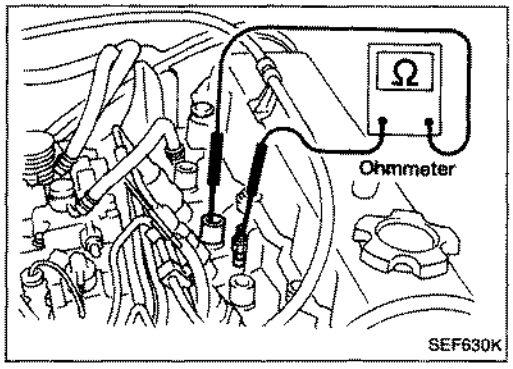
Coil voltage	Continuity	Contact point
0V	No	OFF
12V	Yes	ON



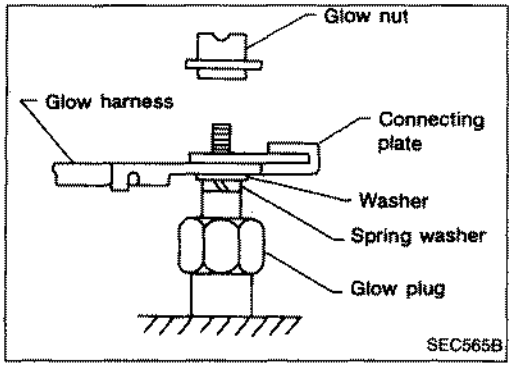
GLOW PLUG

1. Disconnect glow control unit harness connector.
2. Check continuity between ground and terminal ⑤ of glow control unit harness connector.
   Continuity should exist.
3. Remove glow plug connecting plate.
4. Check each glow plug for continuity.
   Continuity should exist:
   Approximately 0.65Ω

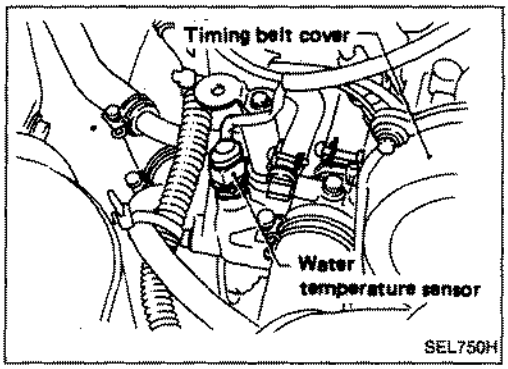
- If N.G., replace glow plug.



5. Install glow plug connecting plate securely.



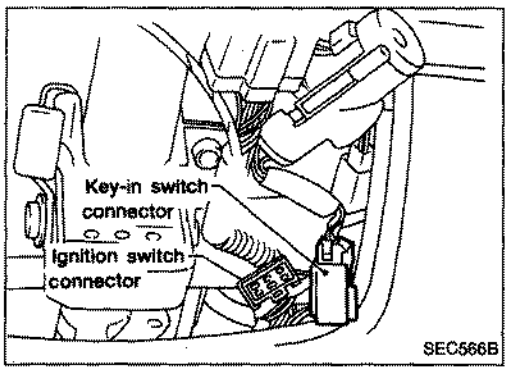
Component Parts Basic Check (Cont'd)



WATER TEMPERATURE SENSOR

Check water temperature sensor resistance.

Coolant temp. °C (°F)	Resistance kΩ
–15 (5)	11.5
0 (32)	5.6
10 (50)	3.7
40 (104)	1.2



KEY-IN SWITCH

Check continuity between terminals of key-in switch connector.

Ignition key	Continuity
Not inserted	No continuity
Inserted	Continuity should exist.

IGNITION KEY AND ALTERNATOR

Refer to EL section.

VEHICLE SPEED SENSOR

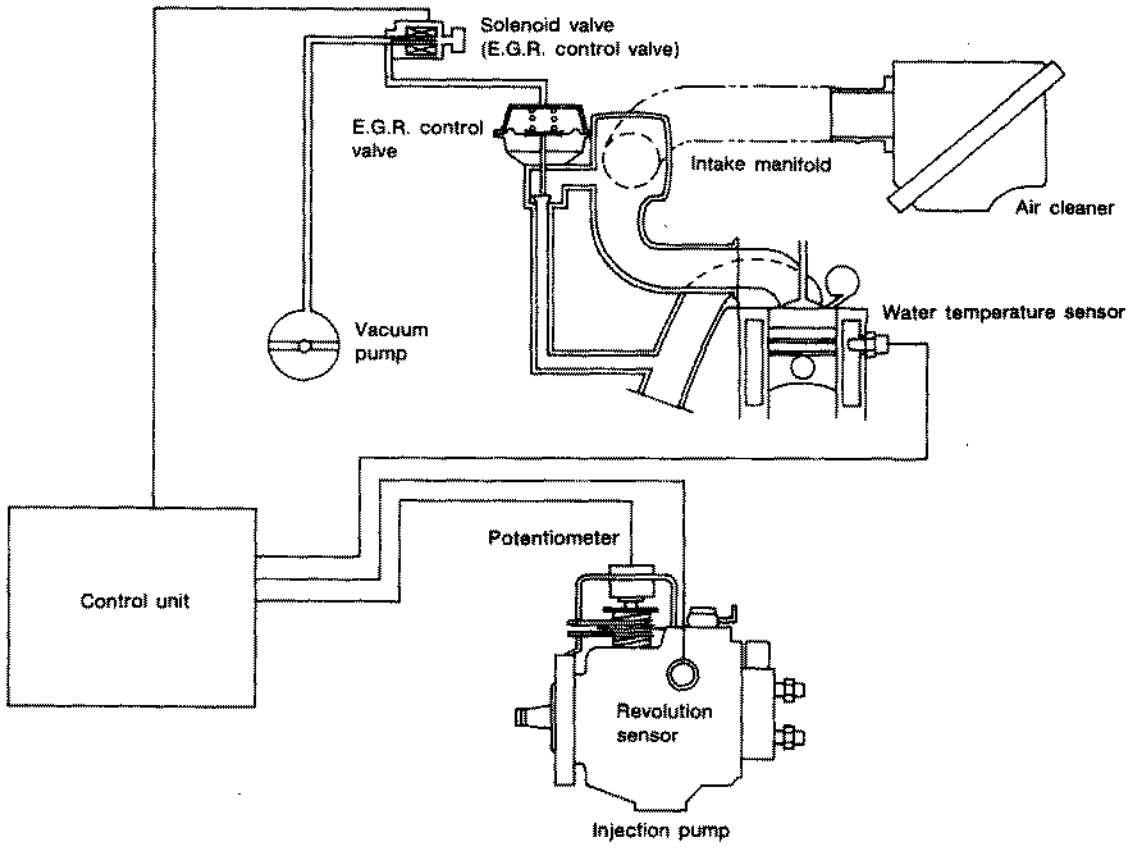
Read pulse from vehicle speed sensor.

Pulse: 637 pulses/min at 60 km/h (37 MPH)

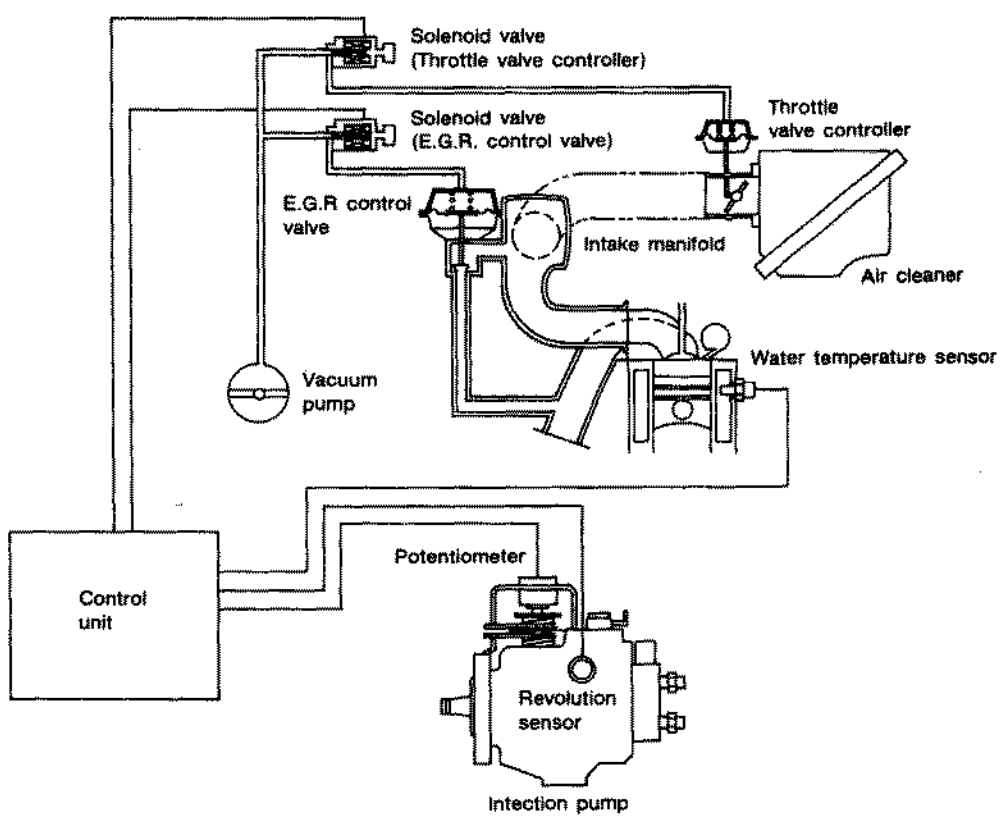
Refer to EL section.

System Diagram

CD17



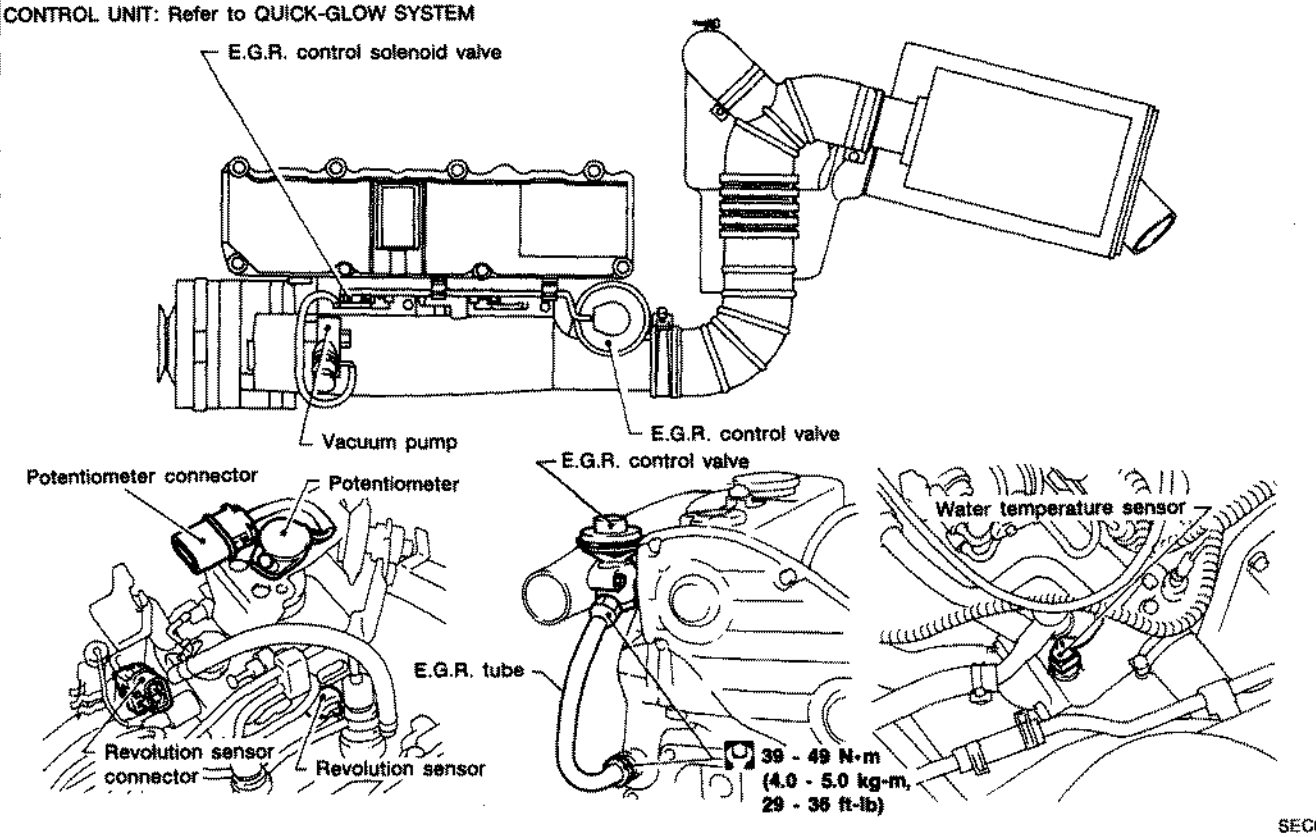
CD20



Parts Location

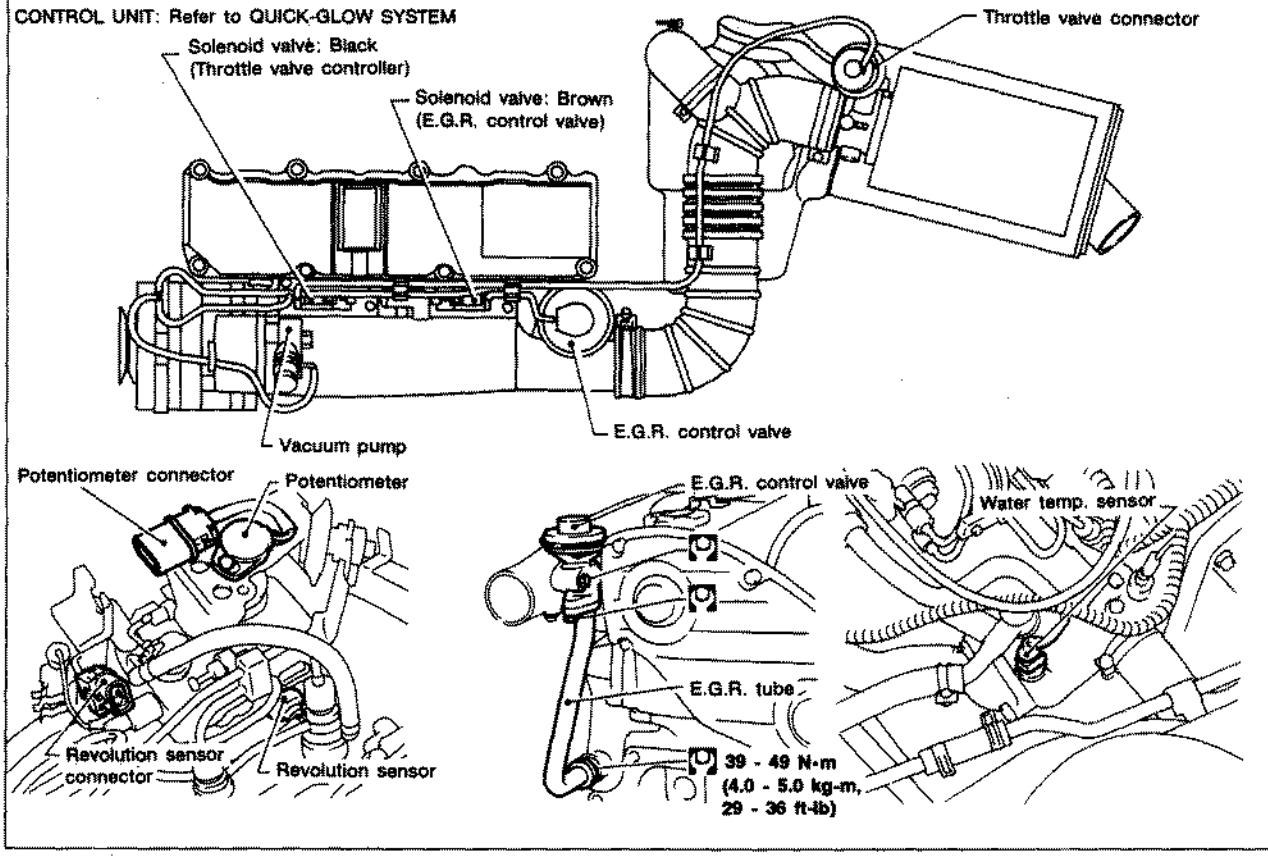
CD17

CONTROL UNIT: Refer to QUICK-GLOW SYSTEM



CD20

CONTROL UNIT: Refer to QUICK-GLOW SYSTEM



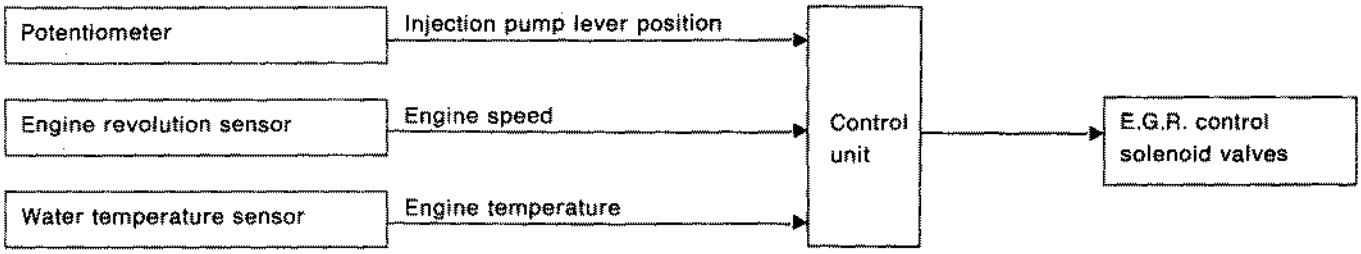
Schematic

Refer to QUICK-GLOW SYSTEM.

Wiring Diagram

Refer to QUICK-GLOW SYSTEM.

Description



The E.G.R. system is designed to control the formation of NOx emission by recirculating the exhaust gas into the intake manifold passage through the E.G.R. control valve.

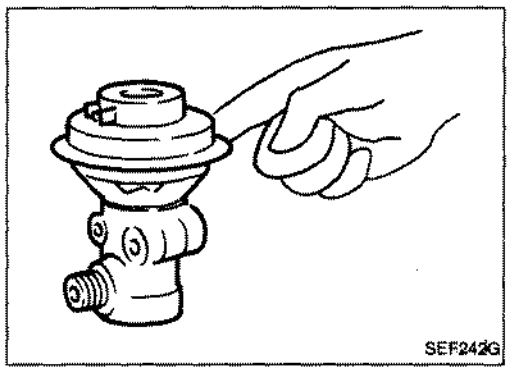
Operation

CD17

Water temperature °C (°F)	Load	E.G.R. control solenoid valve	E.G.R. control valve
Below 70 (158)	All	OFF (Closed)	Closed
Above 70 (158)	Light load	ON (Open)	Open
	Middle load	ON (Open)	Open
	Heavy load	OFF (Closed)	Closed

CD20

Water temperature °C (°F)	Load	Control solenoid valve		E.G.R. control valve	Throttle chamber control valve	Amount of E.G.R. gas
		E.G.R. valve	Throttle valve			
Below 60 (140)	All	OFF (Closed)	OFF (Closed)	Closed	Open	—
Above 60 (140)	Low load	ON (Open)	ON (Open)	Open	Closed	High
	Middle load	ON (Open)	OFF (Closed)	Open	Open	Low
	High load	OFF (Closed)	OFF (Closed)	Closed	Open	—

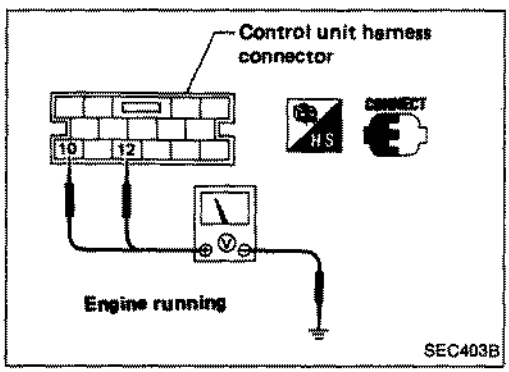

SEF242G

Inspection

ENTIRE SYSTEM

1. Check the vacuum hoses for loosening, flatting damage or improper connections.
2. Warm up engine sufficiently.
3. Place your finger on E.G.R. control valve diaphragm to ensure that the valve functions while racing engine.

- **Take care not to let your finger get caught between diaphragm and E.G.R. control valve body.**
- **Make sure that all harness connectors are connected securely.**



SEC403B

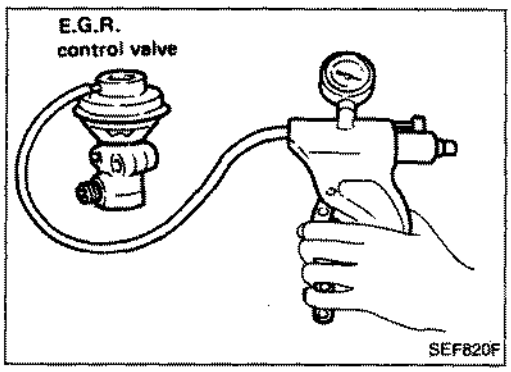
CONTROL UNIT OUTPUT SIGNAL

1. Check voltage between control unit terminals ⑩, ⑫ and ground.

Water temperature °C (°F)	Voltage of control unit terminals ⑩, ⑫
Below 60 (140)	Battery voltage
Above 60 (140)	0V

Terminal availability

	CD17	CD20
⑩	Yes	Yes
⑫	No	Yes



SEF820F

E.G.R. CONTROL VALVE

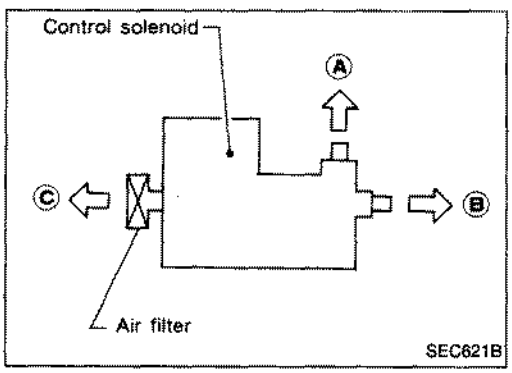
1. Supply the E.G.R. control valve with a vacuum of 40.0 kPa (400 mbar, 300 mmHg, 11.81 inHg) using a handy vacuum pump.
2. Place a finger on the diaphragm of the valve, and make sure that the diaphragm lifts up and down in response to the vacuum leading to the valve.

- **Do not supply the valve with an excessively high vacuum.**

Inspection (Cont'd)

THROTTLE CHAMBER CONTROL VALVE — CD20

Ensure that throttle chamber control valve is held (closed) at stopper when a vacuum pressure of approximately greater than –13.3 kPa (–133 mbar, –100 mmHg, –3.94 inHg) is applied from a vacuum handy pump to vacuum port.

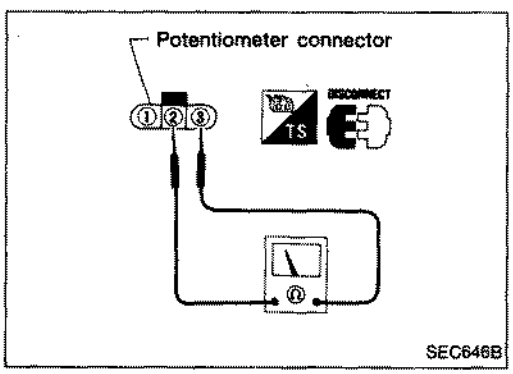


E.G.R. CONTROL SOLENOID VALVES

Check the solenoid valves for normal operation, after disconnecting the connector and all the vacuum hoses.
Supply the solenoid valves with battery voltage, and check whether there is continuity between ports A, B and C.

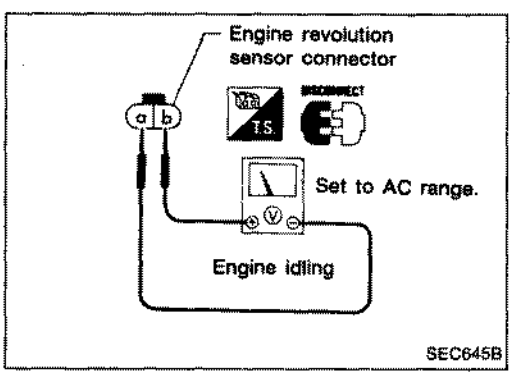
Item \ solenoid	OFF	ON
Continuity	A-C	A-B

Resistance: Approx. 35Ω



POTENTIOMETER

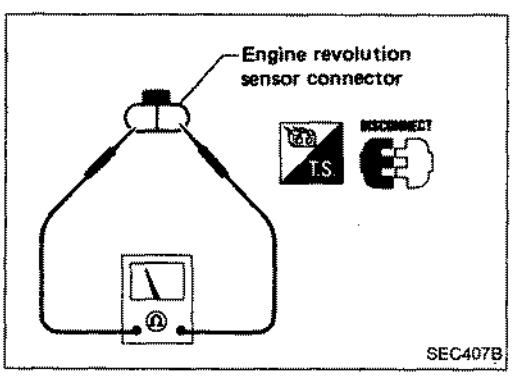
1. Disconnect potentiometer connector and connect ohmmeter as shown.
2. Make sure that the resistance changes when the control lever opening angle of the fuel injection pump is changed.
   Resistance: ① - ③ Approx. 5 kΩ



ENGINE REVOLUTION SENSOR

1. While idling engine, check AC voltage across terminal ⓐ and ⓑ.
   Engine idling: Approx. 0.8V

Check that AC voltage increases when engine speed is increased.



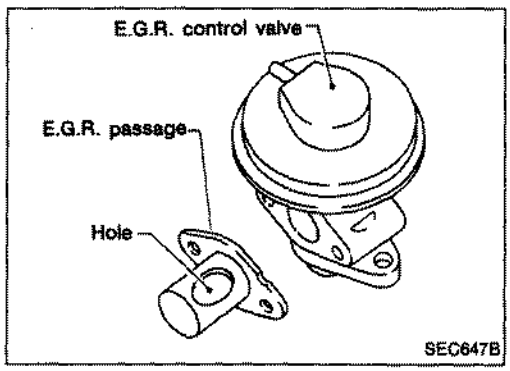
2. If voltage is not within specifications, conduct a continuity test.
   Resistance:
   Approx. 1.36 - 1.84 kΩ (continuity established)
3. Read pulse.
   Pulse: 37 pulses/8 engine revolutions

Inspection (Cont'd)

WATER TEMPERATURE SENSOR

- Check resistance of water temperature sensor. Resistance is shown in the illustration.

Refer to QUICK-GLOW SYSTEM.



Assembly

E.G.R. CONTROL VALVE

When installing gas passage, set open side up.

General Specifications

CARBURETOR

Engine				G13DS, GA14DS	GA14DS						
Destination				General areas		Europe, Hong Kong and Singapore (Models without catalyzer)		Europe (Models with catalyzer without E.G.R.)		Europe (Models with catalyzer and E.G.R.)	
Transaxle				M/T	A/T	M/T	A/T	M/T	A/T	M/T	A/T
Carburetor model				21L282-08	21L282-09	21L282-12	21L282-13	21L304-15	21L304-16	21L304-17	21L304-18
Throttle chamber bore mm (in)			P	28 (1.10)				30 (1.18)			
			S	32 (1.26)				34 (1.34)			
Large venturi diameter mm (in)			P	22 (0.87)							
			S	30 (1.18)							
Jet and air bleed size	Main jet	Standard	P	#96				#88			
			S	#135							
	Main air bleed		P	#70							
			S	#60							
	Slow jet		P	#40				#50			
			S	#80							
	Slow air bleed		P	#80							
			S	#80*1							
	Power jet			#55				—			
Choke type				Automatic choke							
Fast idle adjustment (At 2nd cam step)	Fast idle speed (A/T model in "N" position) rpm			2,400	M/T: 2,400 A/T: 2,700			M/T: 2,200 A/T: 2,500			
	Clearance "A" mm (in)			M/T: 0.62 ± 0.07 (0.0244 ± 0.0028) A/T: 0.79 ± 0.07 (0.0311 ± 0.0028)				M/T: 0.59 ± 0.07 (0.0232 ± 0.0028) A/T: 0.75 ± 0.07 (0.0295 ± 0.0028)			
Vacuum break adjustment mm (in)	Clearance "R_1"			1.22 ± 0.14 (0.0480 ± 0.0055)				1.44 ± 0.13 (0.0567 ± 0.0051)			
	Clearance "R_2"			2.15 ± 0.32 (0.0846 ± 0.0126)				2.42 ± 0.32 (0.0953 ± 0.0126)			
Dash pot or F.I. pot touch speed rpm				2,540 ± 200				2,500 ± 200			
Idle speed (A/T model in "N" position) rpm	Normal			750 ± 50	850 ± 50	750 ± 50	850 ± 50	750 ± 50	850 ± 50	750 ± 50	850 ± 50
	Air conditioner: ON			850 ± 50							
Idle CO%				1.5 ± 0.5				1.0 ± 0.5 *2			

P: Primary S: Secondary #: 1/100 mm
*1: This air bleed cannot be removed from carburetor.
*2: Disconnect exhaust gas sensor harness connector and A.I.V. control solenoid valve harness connector.

General Specifications (Cont'd)

Engine			GA16DS						GA14DS		GA16DS	
Destination			General areas		Europe (Models without catalyzer		Europe (Models with catalyzer)		Gulf standard			
Transaxle			M/T	A/T	M/T	A/T	M/T	A/T	M/T	A/T	M/T	A/T
Carburetor model			21L304-07	21L304-08	21L304-11	21L304-12	21L304-13	21L304-14	21L282-10	21L282-11	21L304-09	21L304-10
Throttle chamber bore mm (in)		P	30 (1.18)						28 (1.10)		30 (1.18)	
		S	34 (1.34)						32 (1.26)		34 (1.34)	
Large venturi diameter mm (in)		P	22 (0.87)									
		S	30 (1.18)									
Jet and air bleed size	Main jet	Standard P	#100				#92		#96		#100	
		S	#135									
	Main air bleed	P	#80				#70			#60	#80	#70
		S	#60									
	Slow jet	P	#40				#50		#40			
		S	#80									
	Slow air bleed	P	#80									
		S	#80*1									
	Power jet		#55				—		#55			
Choke type			Automatic choke									
Fast idle adjustment (At 2nd cam step)	Fast idle speed (A/T model in "N" position) rpm		M/T: 2,100 A/T: 2,400						M/T: 2,400 A/T: 2,700		M/T: 2,100 A/T: 2,400	
	Clearance "A" mm (in)		M/T: 0.59 ± 0.07 (0.0232 ± 0.0028) A/T: 0.75 ± 0.07 (0.0295 ± 0.0028)						M/T: 0.62 ± 0.07 (0.0244 ± 0.0028) A/T: 0.79 ± 0.07 (0.0311 ± 0.0028)		M/T: 0.59 ± 0.07 (0.0232 ± 0.0028) A/T: 0.75 ± 0.07 (0.0295 ± 0.0028)	
Vacuum break adjustment mm (in)	Clearance "R_1"		1.22 ± 0.14 (0.0480 ± 0.0055)				1.44 ± 0.13 (0.0567 ± 0.0051)		1.22 ± 0.14 (0.0480 ± 0.0055)			
	Clearance "R_2"		2.15 ± 0.32 (0.0846 ± 0.0126)				2.42 ± 0.32 (0.0953 ± 0.0126)		2.15 ± 0.32 (0.0846 ± 0.0126)			
Dash pot or F.I. pot touch speed rpm			2,500 ± 200						2,540 ± 200		2,500 ± 200	
Idle speed (A/T model in "N" position) rpm	Normal		750 ± 50	850 ± 50	750 ± 50	850 ± 50	750 ± 50	850 ± 50	750 ± 50	850 ± 50	750 ± 50	850 ± 50
	Air conditioner: ON		850 ± 50									
Idle CO%			1.5 ± 0.5				1.0 ± 0.5 *2		1.5 ± 0.5			

P: Primary S: Secondary #: 1/100 mm
*1: This air bleed cannot be removed from carburetor.
*2: Disconnect exhaust gas sensor harness connector and A.I.V. control solenoid valve harness connector.

Inspection and Adjustment

A.T.C. AIR CLEANER

Intake manifold vacuum –kPa (–mbar, –mmHg, –inHg)	Atmospheric temperature °C (°F)	
	Below 38 (100)	Above 48 (118)
Below 4.7 (47, 35, 1.38)	Cold air	Cold air
Above 16.7 (167, 125, 4.92)	Hot air	Cold air
VACUUM MOTOR –kPa (–mbar, –mmHg, –inHg)		
Opening starts	6.7 ± 2.0 (67 ± 20, 50 ± 15, 1.97 ± 0.59)	
Fully open	Over 13.3 ± 3.3 (133 ± 33, 100 ± 25, 3.94 ± 0.98)	

IDLE COMPENSATOR

Unit: °C (°F)

	GA16DS 4WD, B13 GA16DS for Europe, and Gulf standard	Others
Idle compensator partially opens (No. 1)	55 - 65 (131 - 149)	55 - 65 (131 - 149)
Idle compensator partially opens (No. 2)	65 - 75 (149 - 167)	—
Idle compensator fully opens	Above 65 (149) (No. 1) Above 75 (167) (No. 2)	65 (149)

IGNITION COIL

Primary voltage	V	12
Primary resistance [at 20°C (68°F)]	Ω	Approximately 1
Secondary resistance [at 20°C (68°F)]	kΩ	Approximately 10

MECHANICAL FUEL PUMP

Fuel pressure kPa (bar, kg/cm², psi)	20.6 - 34.3 (0.206 - 0.343, 0.21 - 0.35, 3.0 - 5.0)

DISTRIBUTOR AND CRANK ANGLE SENSOR

Firing order		1-3-4-2
Rotating direction		Counterclockwise
*Air gap	mm (in)	0.3 - 0.5 (0.012 - 0.020)
Cap insulation resistance	MΩ	More than 50
Rotor head insulation resistance	MΩ	More than 50
Cap carbon point length	mm (in)	10 (0.39)

*: Only for distributor

Inspection and Adjustment (Cont'd)

Ignition timing

Engine / Type	GA13DS	GA14DS	GA16DS		
			Gulf standard, Europe (Models without catalyzer)	Europe (Models with catalyzer)	General areas
Type I*1	2° ± 2° A.T.D.C.	0° ± 2° B.T.D.C.	2° ± 2° B.T.D.C.	2° ± 2° B.T.D.C.	3° ± 2° A.T.D.C.
Type II*2	9° ± 5° B.T.D.C.	10° ± 5° B.T.D.C.	10° ± 5° B.T.D.C.	10° ± 2° B.T.D.C.	12° ± 5° B.T.D.C.

*1: Type I: Distributor vacuum hose disconnected and plugged (models without catalyzer, and models with catalyzer without E.G.R.)
Boost sensor vacuum hose disconnected and plugged (models with catalyzer and E.G.R.)

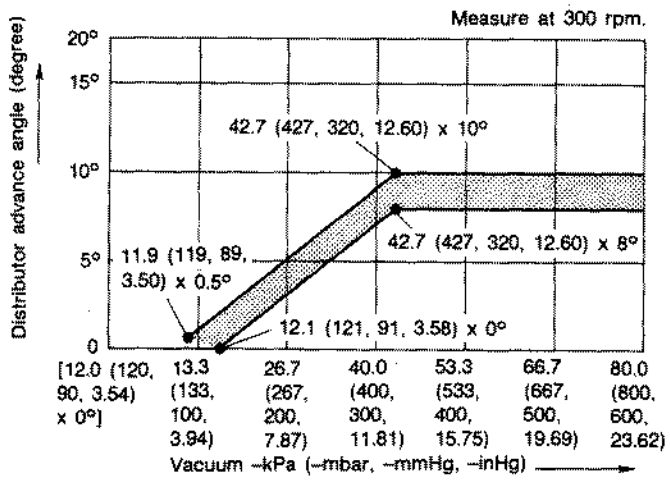
*2: Type II: Distributor vacuum hose connected (models without catalyzer, and models with catalyzer without E.G.R.)
Boost sensor vacuum hose connected (models with catalyzer and E.G.R.)

Distributor spark and advance curve

Engine / Advance curve	GA13DS	GA14DS					GA16DS				
Destination	General areas	General areas, Europe (Models without catalyzer)		Europe (Models with catalyzer without E.G.R.)	Gulf standard		General areas	Europe		Gulf standard	
Transaxle	M/T	M/T	A/T	M/T, A/T	M/T	A/T	M/T, A/T	M/T	A/T 4WD	M/T	A/T
Vacuum advance curve	Type A	Type B	Type C	Type D	Type B	Type F	Type B	Type E	Type F	Type F	Type G
Governor advance curve	Type I	Type II	Type II	Type II	Type II	Type II	Type III	Type IV	Type IV	Type IV	Type IV

Inspection and Adjustment (Cont'd)

Type A



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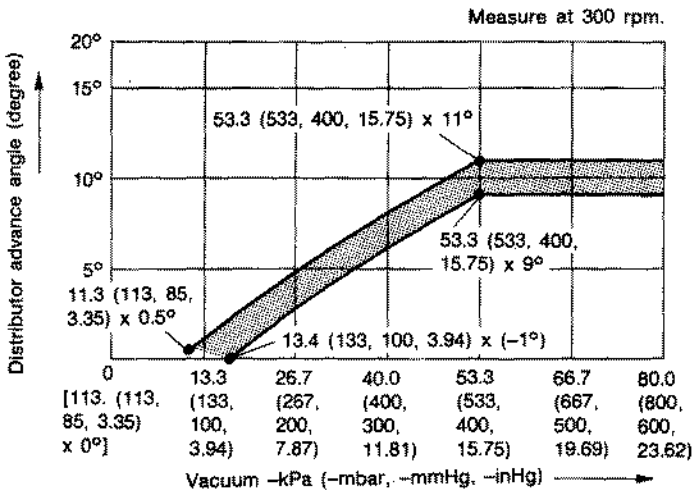
Type B



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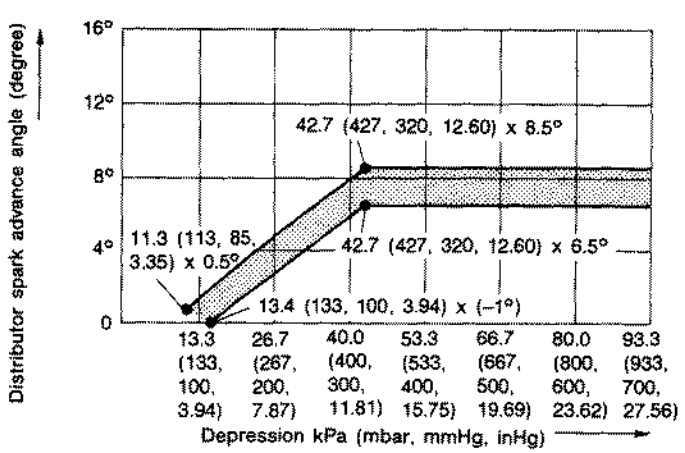
Type C



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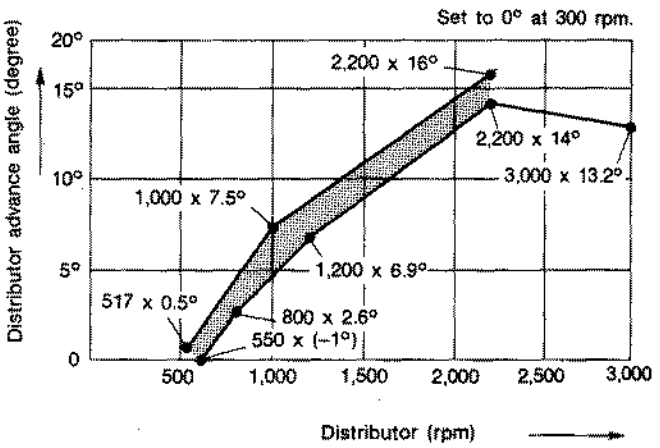
Type I



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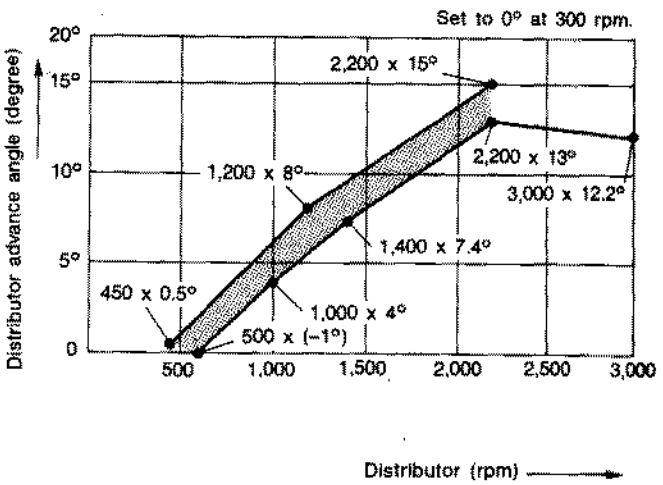
Type II



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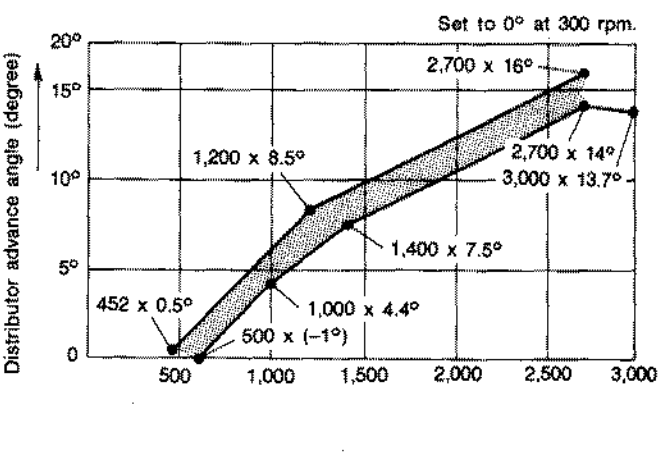
Type III



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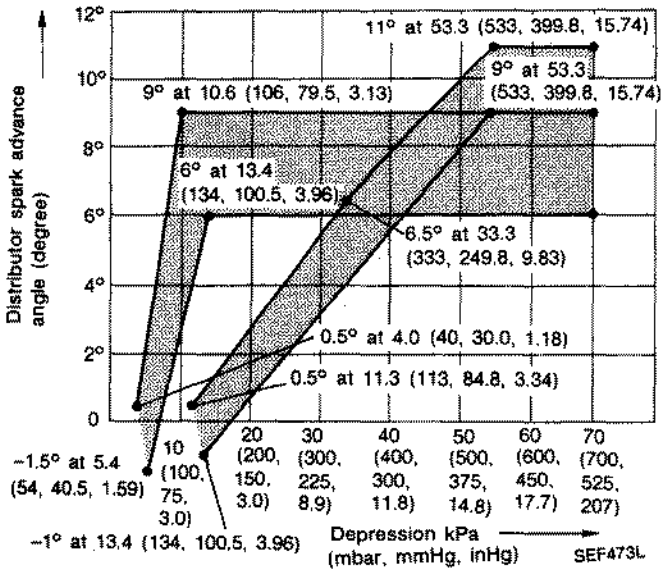
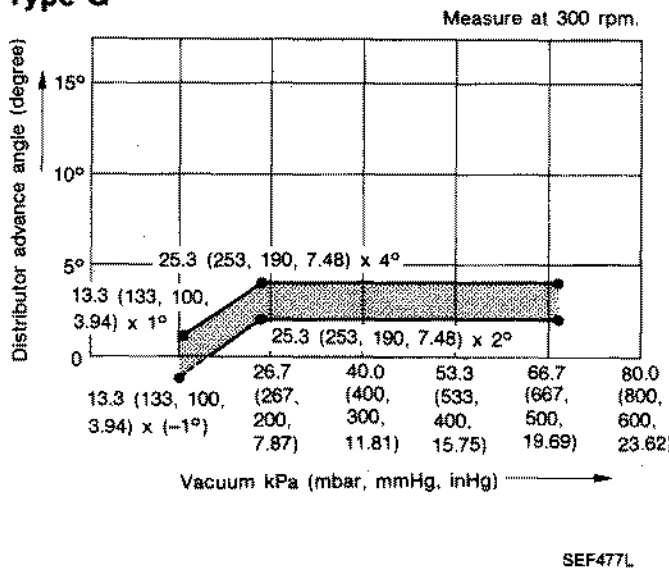
Inspection and Adjustment (Cont'd)

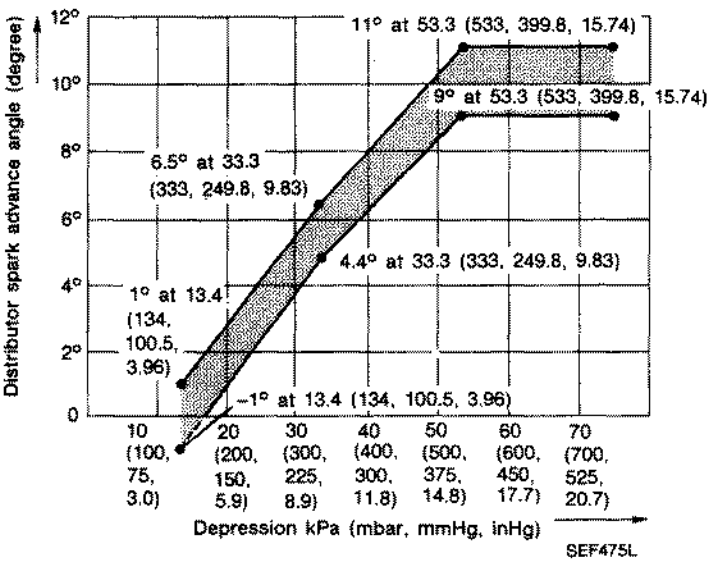
Type D



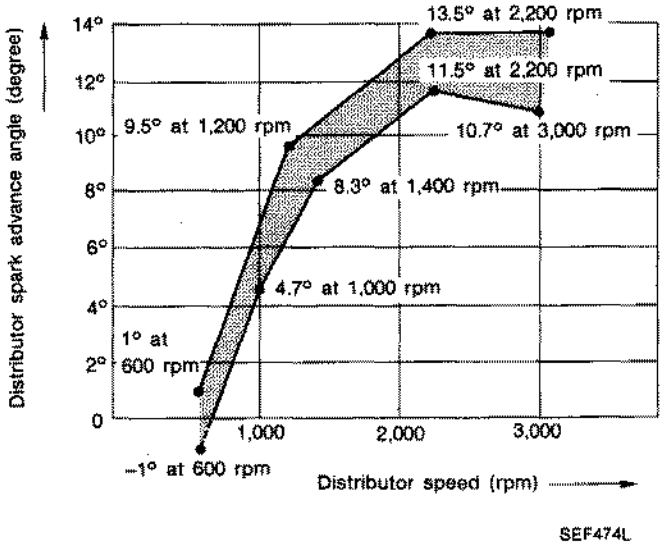
Type G



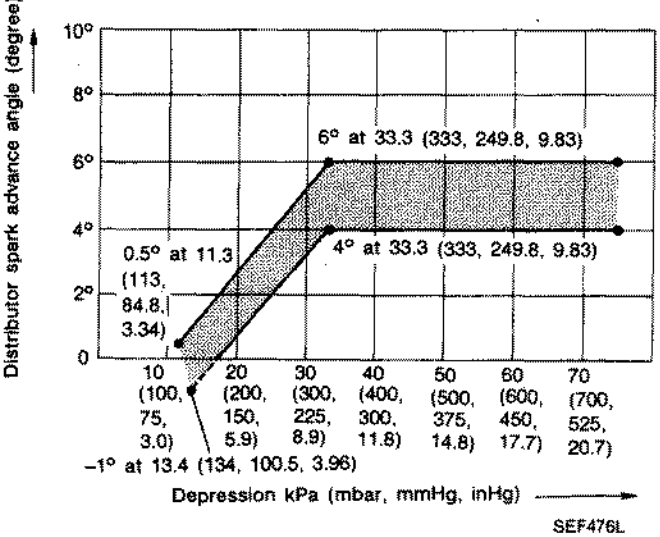
Type E



Type IV



Type F



General Specifications

PRESSURE REGULATOR	
Regulated pressure kPa (bar, kg/cm^2, psi)	299.1 (2.991, 3.05, 43.4)

Inspection and Adjustment

Idle speed*1 rpm	
No-load*2 (in "N" position)	M/T 750 ± 50 A/T 800 ± 50
Air conditioner: ON (in "N" position)	M/T 850 ± 50 A/T 850 ± 50
Ignition timing	10° ± 2° B.T.D.C.
Throttle sensor idle position V	0.40 - 0.60

*1: Feedback controlled and needs no adjustments
*2: Under the following conditions:
- Air conditioner switch: OFF
- Electric load: OFF (Lights, heater, fan & rear defogger)

IGNITION COIL

Primary voltage	V	12
Primary resistance [at 20°C (68°F)]	Ω	Approximately 0.9
Secondary resistance [at 20°C (68°F)]	kΩ	Approximately 13.0

AIR FLOW METER

Supply voltage	V	Battery voltage
Output voltage	V	1.0 - 1.5*

*: Engine is warmed up sufficiently and idling under no-load.

ENGINE TEMPERATURE SENSOR

Temperature °C (°F)	Resistance kΩ
20 (68)	2.3 - 2.7
90 (194)	0.24 - 0.26
110 (230)	0.14 - 0.15

FUEL PUMP

Resistance	Ω	Approximately 0.2

A.A.C. VALVE

Resistance	Ω	Approximately 10.0

INJECTOR

Resistance	Ω	Approximately 10.0

RESISTOR

Resistance	kΩ	Approximately 2.2

THROTTLE SENSOR

Accelerator pedal conditions	Resistance kΩ
Completely released	Approximately 0.5
Partially released	0.5 - 4
Completely depressed	Approximately 4

General Specifications

PRESSURE REGULATOR	
Fuel pressure at idling kPa (bar, kg/cm^2, psi)	
Vacuum hose is connected	Approximately 245 (2.45, 2.5, 36)
Vacuum hose is disconnected	Approximately 294 (2.94, 3.0, 43)

Inspection and Adjustment

Engine	SR20DE	SR20DET
Idle speed*1 rpm		
No-load*2 (in "N" position)	850 ± 50	925 $^{+25}_{-75}$
Air conditioner: ON (in "N" position)	850 ± 50	925 $^{+25}_{-75}$
Ignition timing	15° ± 2° B.T.D.C.	20° ± 2° B.T.D.C.
Throttle sensor idle position V	0.45 - 0.55	

*1: Feedback controlled and needs no adjustments
*2: Under the following conditions:
- Air conditioner switch: OFF
- Electric load: OFF (Lights, heater, fan & rear defogger)

IGNITION COIL

Primary voltage	V	12
Primary resistance [at 20°C (68°F)]	Ω	Approximately 1.0
Secondary resistance [at 20°C (68°F)]	kΩ	Approximately 10.0

AIR FLOW METER

Supply voltage	V	Battery voltage (11 - 14)
Output voltage	V	SR20DE: 1.3 - 1.8* SR20DET: 1.0 - 1.5*

*: Engine is warmed up sufficiently and idling under no-load.

ENGINE TEMPERATURE SENSOR

Temperature °C (°F)	Resistance kΩ
20 (68)	2.1 - 2.9
50 (122)	0.68 - 1.00
80 (176)	0.30 - 0.33

FUEL PUMP

Resistance	Ω	Approximately 0.7

A.A.C. VALVE

Resistance	Ω	Approximately 10.0

INJECTOR

Engine		SR20DE	SR20DET
Resistance	Ω	10 - 14	1 - 3

RESISTOR

Resistance	kΩ	Approximately 2.2

THROTTLE SENSOR

Accelerator pedal conditions	Resistance kΩ
Completely released	Approximately 2
Partially released	2 - 11
Completely depressed	Approximately 11

General Specifications

CARBURETOR

Carburetor model			217260-B7
Throttle chamber bore mm (in)		P	26 (1.02)
		S	30 (1.18)
Venturi diameter mm (in)		P	19 (0.75)
		S	27 (1.06)
Main jet	Standard	P	#89
		S	#145
	1,000 m (3,300 ft)	P	#87
		S	#140
	2,000 m (6,600 ft)	P	#85
		S	#135
	3,000 m (9,900 ft)	P	#82
		S	#131
	4,000 m (13,200 ft)	P	#79
		S	#129
Main air bleed		P	#70
		S	#60
Slow jet		P	#40
		S	#80
Slow air bleed		P	#80
		S	#80
Power jet			#50
Choke type			Automatic choke
Fast idle adjustment			
Fast idle speed		rpm	2,200 ± 200
Clearance "A" (at 2nd step)		mm (in)	0.47 ± 0.07 (0.0185 ± 0.0028)
Vacuum break adjustment		mm (in)	
Clearance R_1			1.31 ± 0.14 (0.0516 ± 0.0055)
Clearance R_2			1.84 ± 0.28 (0.0724 ± 0.0110)
Dash pot adjustment			
Dash pot touch speed		rpm	1,900 ± 200
Dash pot gap		mm (in)	0.47 ± 0.1 (0.0185 ± 0.0039)
Float height mm (in)		H_1	14.5 - 15.5 (0.571 - 0.610)
		H_2	44.5 - 45.5 (1.752 - 1.791)

P: Primary S: Secondary #: 1/100 mm

Inspection and Adjustment

DISTRIBUTOR

Type	D4R83-38 [HITACHI make]
Firing order	1-3-4-2
Rotating direction	Counterclockwise
Air gap mm (in)	0.3 - 0.5 (0.012 - 0.020)
Cap insulation resistance MΩ	More than 50
Rotor head insulation resistance MΩ	More than 50
Cap-carbon point length mm (in)	10 (0.39)
Vacuum advance [Distributor degree/distributor –kPa (–mbar, –mmHg, –inHg)]	0/16.0 (160, 120, 4.72) 6.1/34.7 (347, 260, 10.24) 9.5/49.3 (493, 370, 14.57)
Centrifugal advance [Distributor degree/distributor rpm]	0/550 10.0/1,600

IGNITION COIL

Type	STC-143 [HANSHIN make]
Primary resistance [at 20°C (68°F)] Ω	1.0 - 1.3
Secondary resistance [at 20°C (68°F)] kΩ	8.4 - 12.6

A.T.C. AIR CLEANER

Intake manifold vacuum kPa (mbar, mmHg, inHg)	Atmospheric temperature °C (°F)	
	Below 38 (100)	Above 55 (131)
Below 8.0 (80, 60, 2.36)	Cool air	Cool air
Above 25.3 (253, 190, 7.48)	Hot air	Cool air

IDLE COMPENSATOR

Unit: °C (°F)

Idle compensator partially opens	55 - 65 (131 - 149)
Idle compensator fully opens	Above 65 (149)

MECHANICAL FUEL PUMP

Fuel pump capacity (at 3,000 rpm) mℓ (Imp fl oz)/20 seconds	500 (17.6)
Fuel pressure kPa (bar, kg/cm^2, psi)	19.6 - 26.5 (0.196 - 0.265, 0.20 - 0.27, 2.8 - 3.8)

VE-type Injection Pump

GENERAL SPECIFICATIONS

Unit : rpm

Engine		CD17	CD20
Idle speed	F.I.C.D.: OFF	700 $^{+50}_{-0}$	
	F.I.C.D.: ON	800	
Dash pot touch speed		1,300	
Maximum engine speed		5,200 - 5,500	

INSPECTION AND ADJUSTMENT

Installation of injection pump

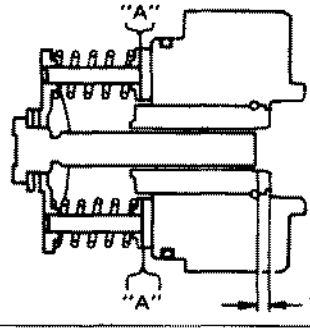
Engine		CD17	CD20
Plunger lift (Injection timing)	mm (in)	0.79 - 0.85 (0.0311 - 0.0335) (equivalent to 7° BTDC)	0.79 - 0.85 (0.0311 - 0.0335) (equivalent to 9° BTDC)

Pump numbers

Engine	Destination	Part number	Pump assembly number	Remarks
CD17	General areas	16700-59Y00	104740-2153	—
	Hong Kong	16700-63Y00	104740-2240	—
CD20	Europe	16700-57J00	104740-2183	Without tachometer
		16700-57J05	104740-2193	With tachometer
		16700-60J00	104740-2223	With E.G.R.

Use of adjustment value and adjusting shim when installing injection pump

Dimension "KF"	mm (in)	6.68 - 6.88 (0.2630 - 0.2709)



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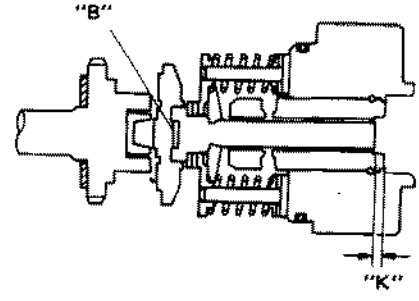
Adjusting shim ("A" position)

Part number	Thickness mm (in)
16882-V0700	0.5 (0.020)
16882-V0701	0.8 (0.031)
16882-V0702	1.0 (0.039)
16882-V0703	1.2 (0.047)
16882-V0704	1.5 (0.059)
16882-V0705	1.8 (0.071)
16882-V0706	2.0 (0.079)

Dimension "K"	mm (in)	3.2 - 3.4 (0.126 - 0.134)



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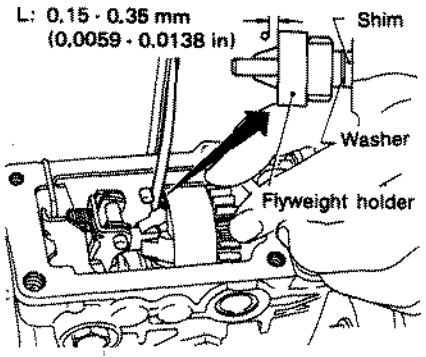
Adjusting shim ("B" position)

Part number	Thickness mm (in)
16884-V0700	1.92 (0.0756)
16884-V0701	2.00 (0.0787)
16884-V0702	2.08 (0.0819)
16884-V0703	2.16 (0.0850)
16884-V0704	2.24 (0.0882)
16884-V0705	2.32 (0.0913)
16884-V0706	2.40 (0.0945)
16884-V0707	2.48 (0.0976)
16884-V0708	2.56 (0.1008)
16884-V0709	2.64 (0.1039)
16884-V0710	2.72 (0.1071)
16884-V0711	2.80 (0.1102)
16884-V0712	2.88 (0.1134)

VE-type Injection Pump (Cont'd)

Axial play of flyweight holder "L" mm (in)	0.15 - 0.35 (0.0059 - 0.0138)



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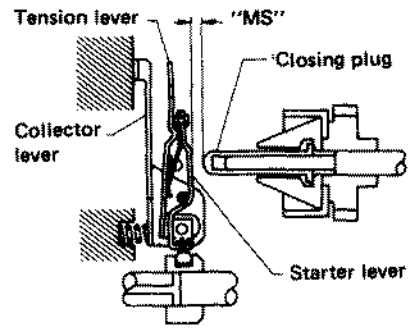
Adjusting shim

Part number	Thickness mm (in)
19208-V0700	1.05 (0.0413)
19208-V0701	1.25 (0.0492)
19208-V0702	1.45 (0.0571)
19208-V0703	1.65 (0.0650)
19208-V0704	1.85 (0.0728)

Dimension "MS" mm (in)	0.7 - 0.9 (0.028 - 0.035)

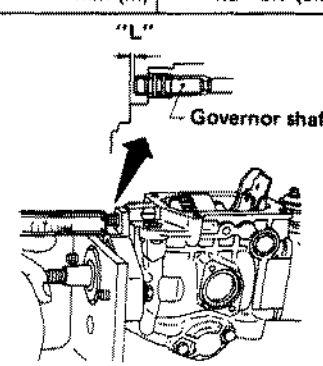


SEF856

Adjusting closing plug

Part number	Thickness mm (in)
19207-V0700	7.8 (0.307)
19207-V0701	8.0 (0.315)
19207-V0702	8.2 (0.323)
19207-V0703	8.4 (0.331)
19207-V0704	8.6 (0.339)
19207-V0705	8.8 (0.346)
19207-V0706	9.0 (0.354)
19207-V0707	9.2 (0.362)
19207-W1700	9.4 (0.370)
19207-W1701	9.6 (0.378)
19207-W1702	9.8 (0.386)
19207-W1703	10.0 (0.394)
19207-W1704	10.2 (0.402)
19207-W3400	10.4 (0.409)
19207-W3401	10.6 (0.417)

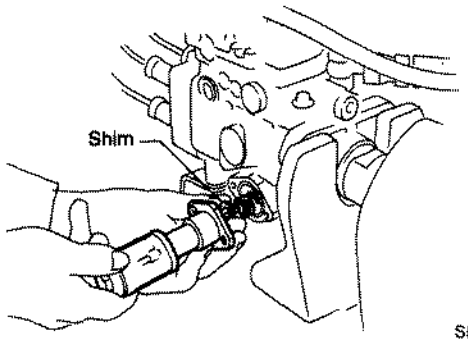
Dimension "L" mm (in)	1.5 - 2.0 (0.059 - 0.079)



SEF500

VE-type Injection Pump (Cont'd)

Speed timer adjusting shim



Part number	Thickness mm (in)
16880-43G10	0.1 (0.004)
16880-43G11	0.2 (0.008)
16880-43G12	0.25 (0.0098)
16880-43G13	1.0 (0.039)
16880-V7205	2.0 (0.079)
16880-59Y00	0.5 (0.020)
16880-59Y01	0.75 (0.0295)

Pump data is not yet available.
(Pump data will be given by Technical Bulletin or refer to CALIBRATION STANDARD published by ZEXEL.)

Adjustment values for injection pump tester

Feed pump pressure

Item / Part No. / Fuel injection pump rpm	Specified pressure kPa (bar, kg/cm^2, psi)
	16700-59Y00
1,200	294 - 373 (2.94 - 3.73, 3.0 - 3.8, 43 - 54)
1,800	432 - 510 (4.32 - 5.10, 4.4 - 5.2, 63 - 74)
2,500	598 - 677 (5.98 - 6.77, 6.1 - 6.9, 87 - 98)

Speed timer (Timer piston stroke)

Item / Part No. / Fuel injection pump rpm	Timer piston stroke mm (in)
	16700-59Y00
1,200	1.4 - 2.2 (0.055 - 0.087)
1,800	3.5 - 4.7 (0.138 - 0.185)
2,500	6.9 - 7.8 (0.272 - 0.307)

Fuel injection quantity

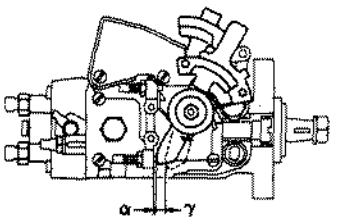
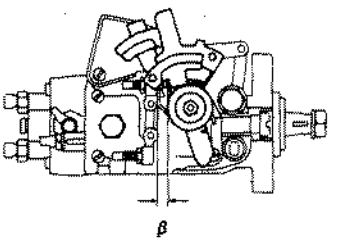
Item / Part No. / Setting condition of fuel injection pump	Fuel injection pump rpm	Standard fuel injection mℓ (Imp fl oz)/1,000 stroke
		16700-59Y00
Start	100	50.3 - 70.3 (1.77 - 2.47)
Idle	360	3.2 - 7.2 (0.11 - 0.25)
	600	Less than 3 (0.11)
Full-load	600	24.8 - 28.8 (0.87 - 1.01)
	1,000	26.6 - 28.6 (0.94 - 1.01)
	2,500	2.43 - 28.3 (0.86 - 1.00)
Partial-load*	700	2.2 - 11.2 (0.08 - 0.39)
Max. pump speed	2,700	11.3 - 18.3 (0.40 - 0.64)
	2,900	Less than 6 (0.21)
Fuel overflow		36 - 80 mℓ (1.27 - 2.82 Imp fl oz)/10 sec. at 1,200 rpm

*: This test is performed at control lever angle "γ".

VE-type Injection Pump (Cont'd)

Control lever angle adjustment (Adjusting screw length)

Unit: mm (in)

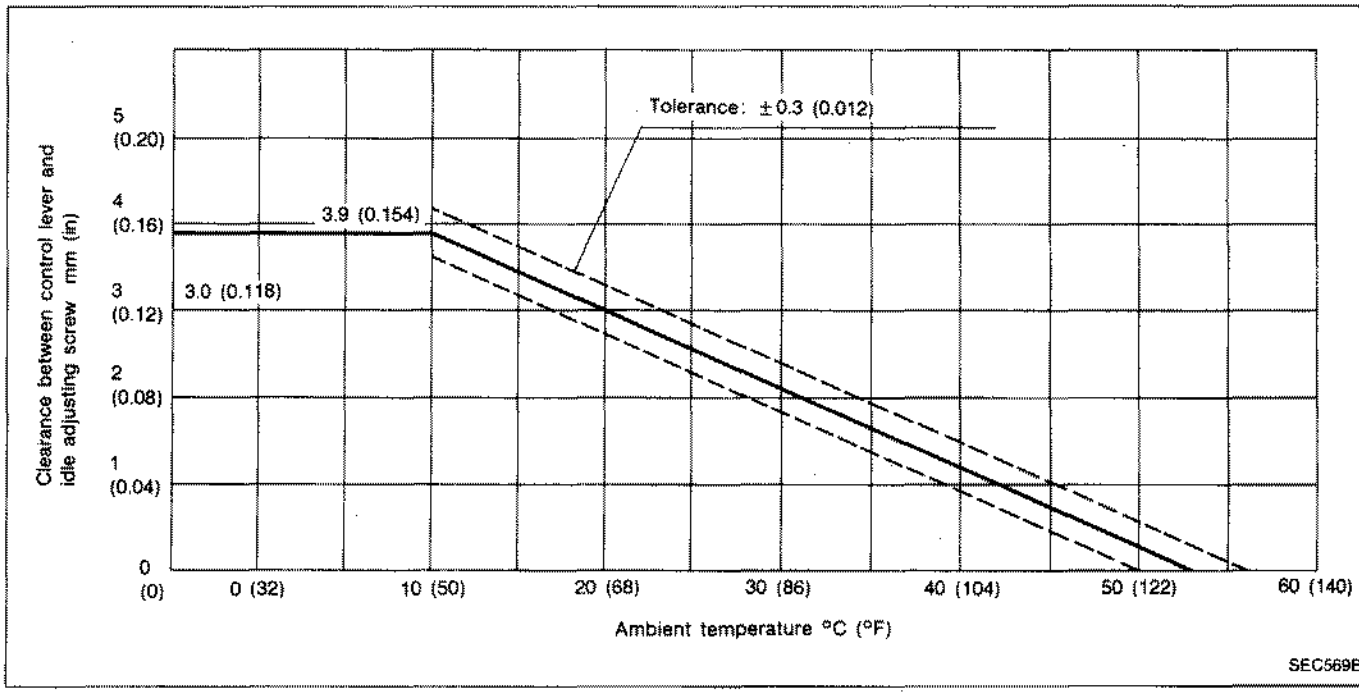
Illustration / Part number		16700-59Y00
 α: Idle γ: Partial load SEF283C	α	15.4 - 18.1 (0.606 - 0.713)
	γ	8.6 - 9.2 (0.339 - 0.362)
 SEF798A	β	11.0 - 16.0 (0.433 - 0.630)

VE-type Injection Pump (Cont'd)

Cold start device adjustment

Part number: 16700-59Y00

Relationship between speed timer stroke and clearance between idle adjusting screw and control lever



Cold start device specifications

Ambient temperature °C (°F)	Speed timer stroke mm (in)	Clearance between control lever and idle adjusting screw mm (in)	Remarks
20 ± 0.5 (68 ± 0.9)	.....	3.0 ± 0.3 (0.118 ± 0.012)	

VE-type Injection Pump (Cont'd)

TIGHTENING TORQUE

Unit	N·m	kg-m	ft-lb
Injection pump			
Securing bolt	45 - 60	4.6 - 6.1	33 - 44
Securing nut	13 - 18	1.3 - 1.8	9 - 13
Injection tube			
Flare nut	22 - 25	2.2 - 2.5	16 - 18

Injection Nozzle

INSPECTION AND ADJUSTMENT

Injection nozzle assembly

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

Initial injection pressure	
New	12,749 - 13,534 (127.5 - 135.3, 130 - 138, 1,849 - 1,962)
Used	12,259 - 13,239 (122.6 - 132.4, 125 - 135, 1,778 - 1,920)

Adjusting shims

Thickness mm (in)	Parts No.
0.50 (0.0197)	16613-V0700
0.54 (0.0213)	16613-V0702
0.58 (0.0228)	16613-V0704
0.62 (0.0244)	16613-V0706
0.66 (0.0260)	16613-V0708
0.70 (0.0276)	16613-V0710
0.74 (0.0291)	16613-V0712
0.78 (0.0307)	16613-V0714
0.82 (0.0323)	16613-V0716
0.86 (0.0339)	16613-V0718
0.90 (0.0354)	16613-V0720
0.94 (0.0370)	16613-V0722
0.98 (0.0386)	16613-V0724
1.00 (0.0394)	16613-V0760

TIGHTENING TORQUE

Unit	N·m	kg-m	ft-lb
Injection nozzle to engine	59 - 69	6.0 - 7.0	43 - 51
Injection to tube flare nut	22 - 25	2.2 - 2.5	16 - 18
Spill tube nut	39 - 49	4.0 - 5.0	29 - 36
Nozzle holder to nozzle nut	78 - 98	8.0 - 10.0	58 - 72

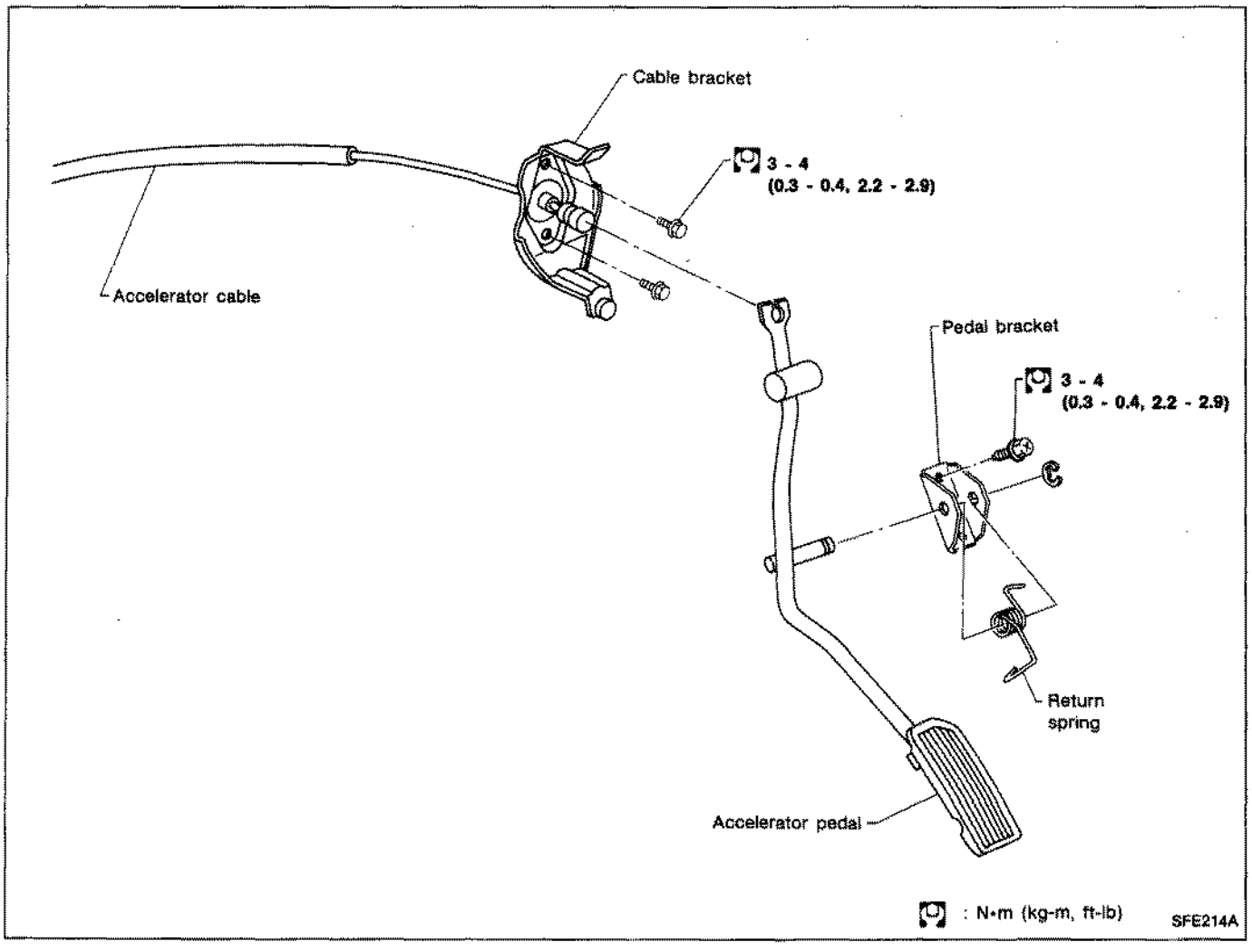
ACCELERATOR CONTROL, FUEL & EXHAUST SYSTEMS

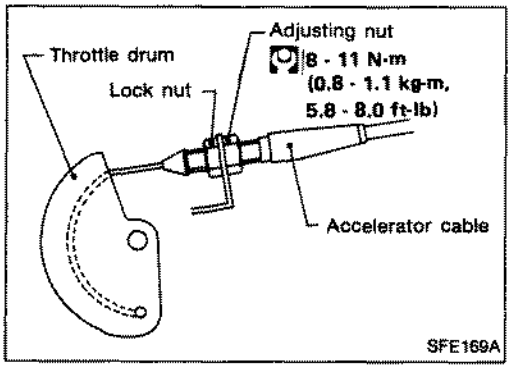
SECTION FE

CONTENTS

CAUTION:

- **When removing accelerator cable, make a mark to indicate lock nut's initial position.**
- **Check that throttle valve opens fully when accelerator pedal is fully depressed and that it returns to idle position when pedal is released.**
- **Check accelerator control parts for improper contact with any adjacent parts.**
- **When connecting accelerator cable, be careful not to twist or scratch its inner wire.**





Adjusting Accelerator Cable

1. Tighten adjusting nut until throttle drum starts to move.
2. From that position turn back adjusting nut 1.5 to 2 turns, and fasten it with lock nut.

WARNING:

- **Do not smoke while servicing fuel system. Keep open flames and sparks away from work area.**
- **Be sure to furnish workshop with a CO_2 fire extinguisher.**

CAUTION:

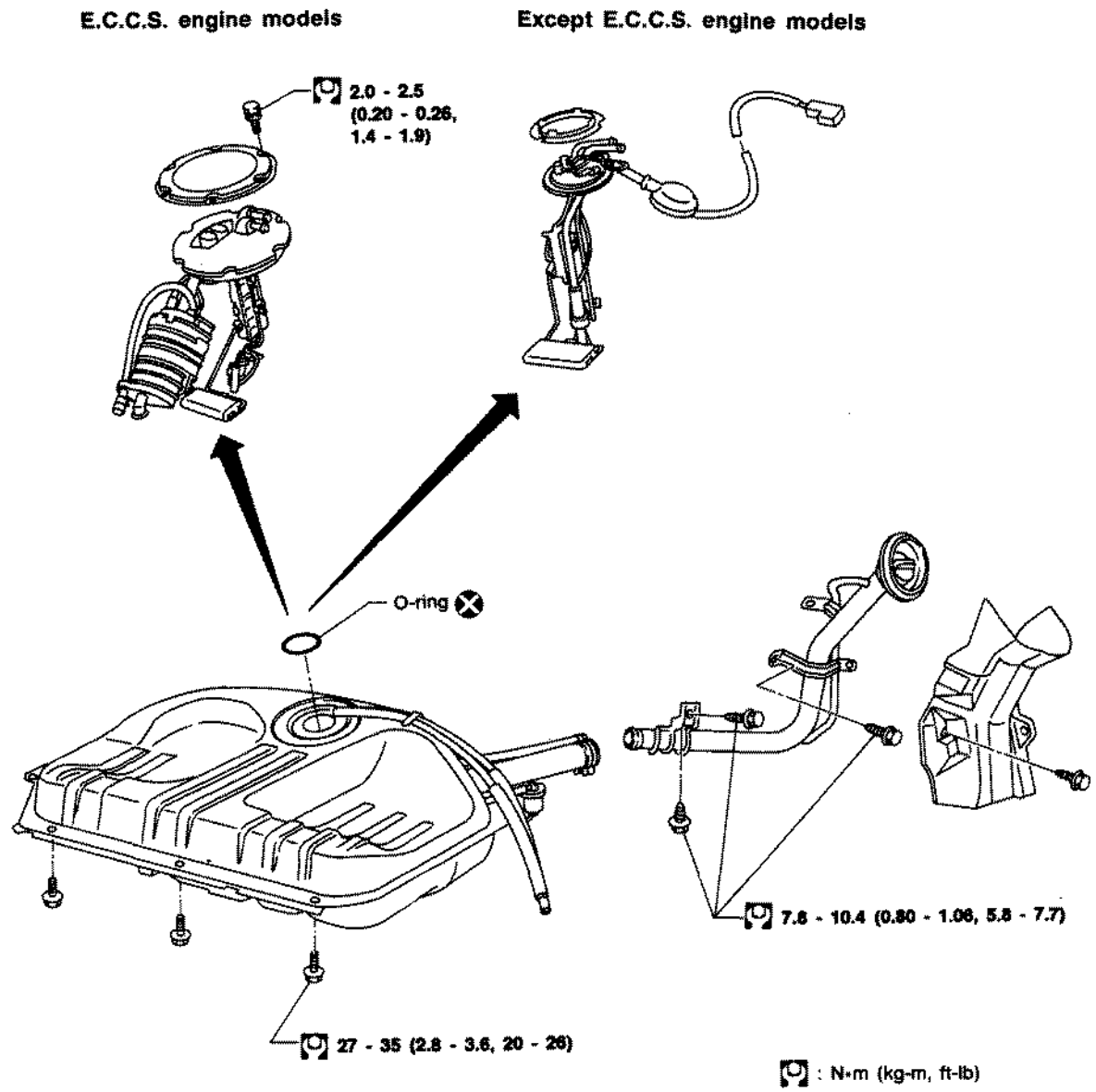
- **Before removing fuel line parts carry out the following procedures:**

a. **Put drained fuel in an explosion-proof container and put the lid on securely.**
b. **Release fuel pressure from fuel line. Refer to "Changing Fuel Filter" in MA section.**
c. **Disconnect battery ground cable.**

- **Always replace O-ring and clamps with new ones.**
- **Do not kink or twist tubes when they are being installed.**
- **After installing tubes, run engine and check for fuel leaks at connections.**

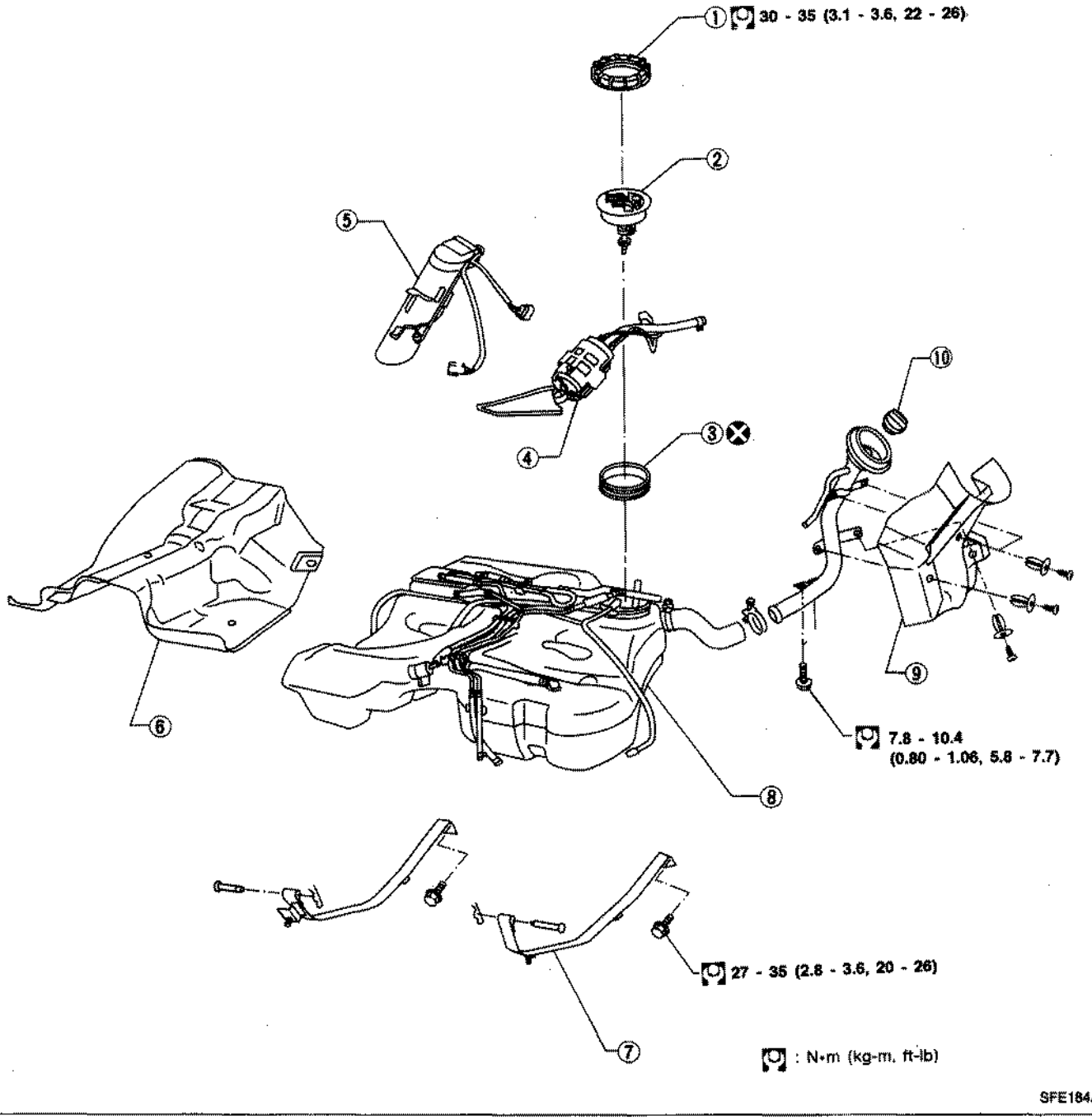
Fuel Tank

2WD models



Fuel Tank (Cont'd)

4WD models



① Lock ring
② Upper plate
③ O-ring
④ Fuel pump
⑤ Fuel gauge
⑥ Fuel tank protector
⑦ Mounting band
⑧ Fuel tank
⑨ Filler protector
⑩ Filler cap

Preparation

SPECIAL SERVICE TOOL

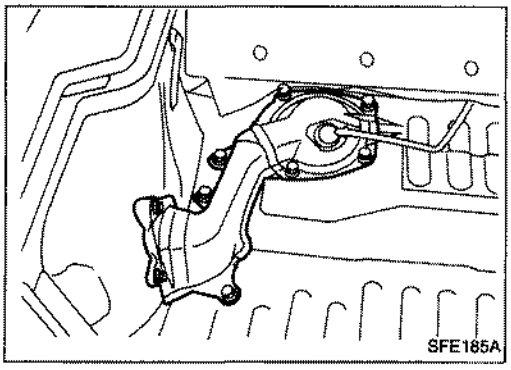
Tool number Tool name	Description
KV999G0010 Fuel tank lock ring socket	

Fuel tank

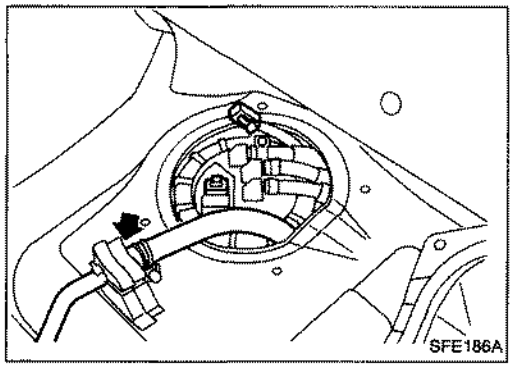
REMOVAL (4WD models)

CAUTION:

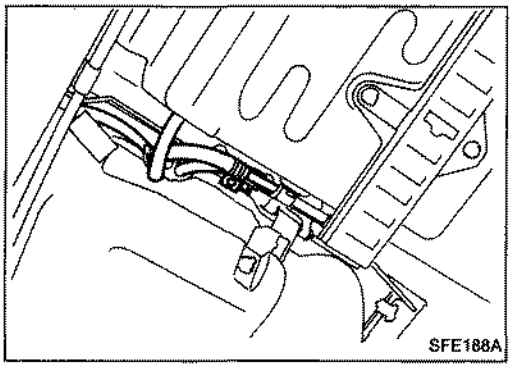
- **Do not disconnect any fuel line unless absolutely necessary.**
- **Plug hose and pipe openings to prevent entry of dust or oil.**



1. Release fuel pressure from fuel line.
   Refer to "Fuel Filter Replacement" in MA section.
2. Remove inspection hole cover and vent tube cover located on the luggage compartment floor.

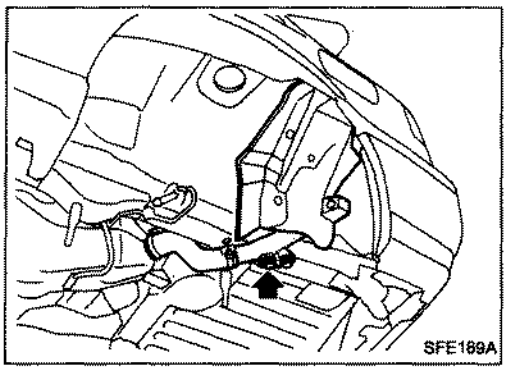


3. Disconnect fuel tubes and connector.

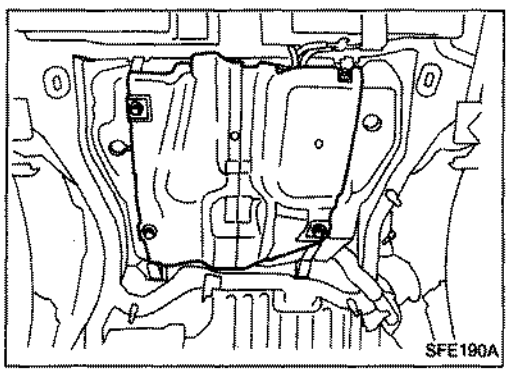


4. Remove propeller shaft, differential carrier, suspension member and drive shaft (Refer to RA section).
5. Disconnect tubes.

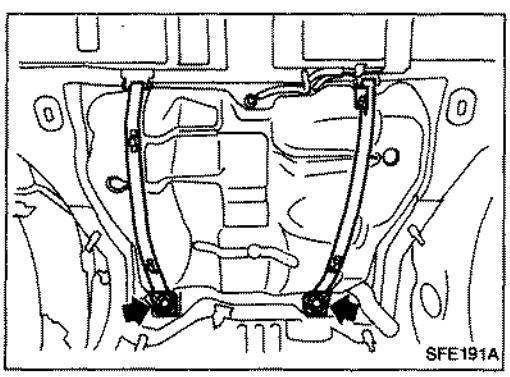
Fuel tank (Cont'd)



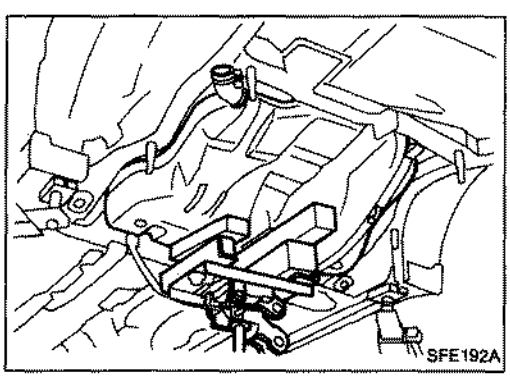
6. Remove filler protector and filler tube.



7. Remove fuel tank protector.



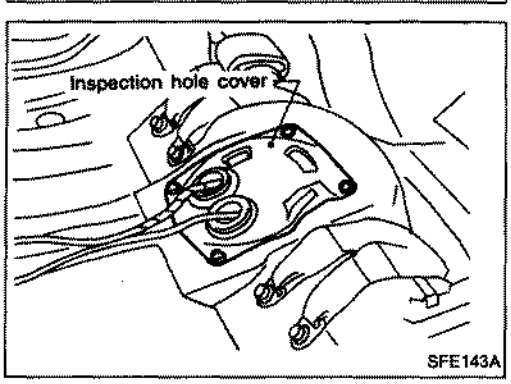
8. Remove tank mounting band bolts while supporting fuel tank.



9. Remove fuel tank.

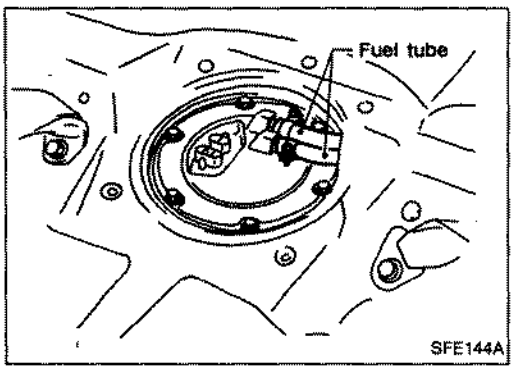
Fuel Pump and Gauge

REMOVAL (2WD E.C.C.S. engine models)

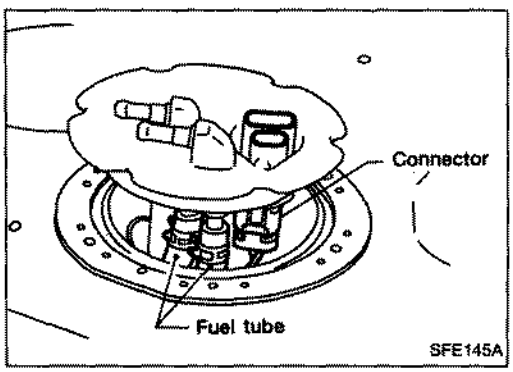


1. Release fuel pressure from fuel line.
   Refer to "Fuel Filter Replacement" in MA section.
2. Remove inspection hole cover located beneath the rear seat.

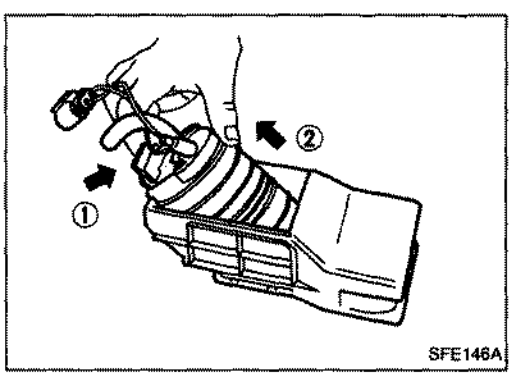
Fuel Pump and Gauge (Cont'd)



3. Disconnect fuel tubes and connectors.
4. Remove the six screws.



5. Remove fuel gauge assembly and disconnect tubes and connector.



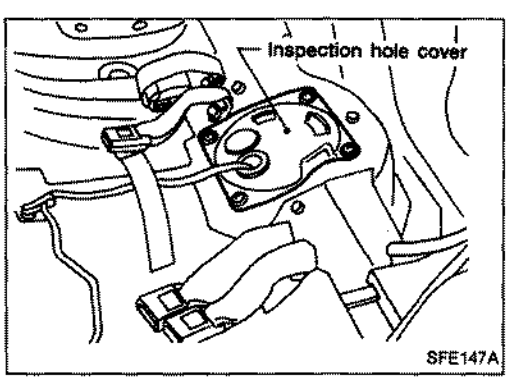
6. Remove fuel pump as shown in the figure.

INSTALLATION

Installation procedure is the reverse order of removal.

CAUTION:

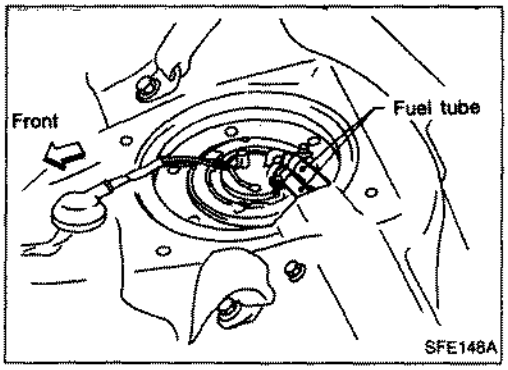
Tighten to specified torque.



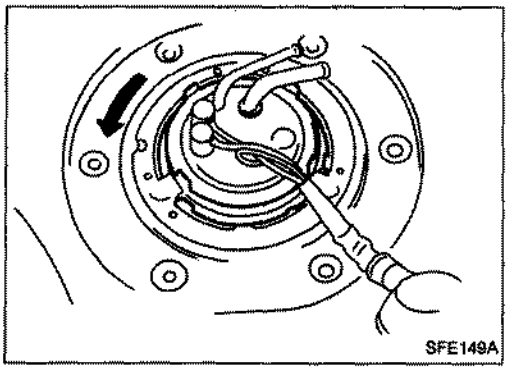
REMOVAL (2WD except E.C.C.S. engine models)

1. Remove inspection hole cover located beneath the rear seat.

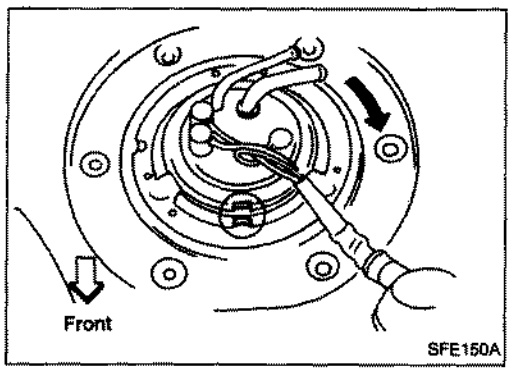
Fuel Pump and Gauge (Cont'd)



2. Disconnect fuel tubes.



3. Remove lock ring.
4. Remove fuel gauge.

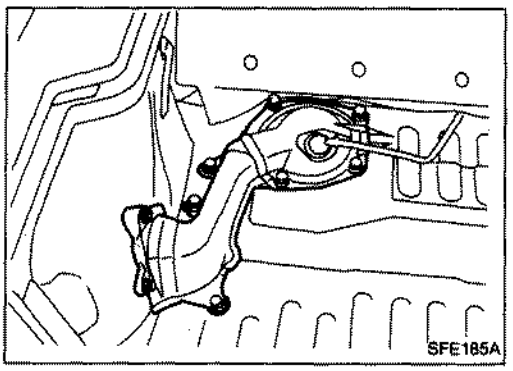


INSTALLATION

Installation procedure is the reverse order of removal.

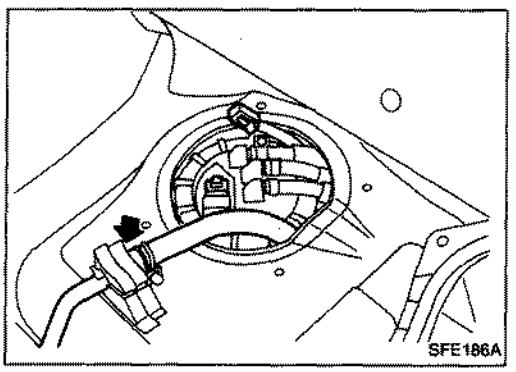
CAUTION:

- **Check alignment of the matchmarks.**
- **Lock the plate against the stopper.**



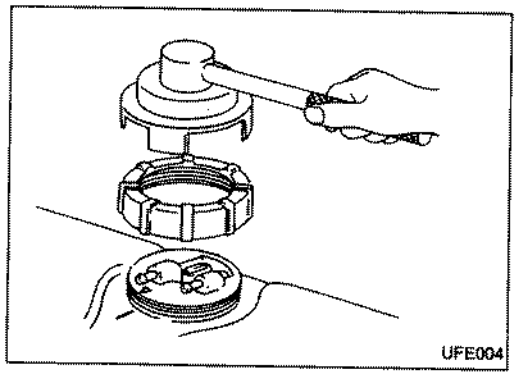
REMOVAL (4WD models)

1. Release fuel pressure from fuel line.
   Refer to "Fuel Filter Replacement" in MA section.
2. Remove inspection hole cover and vent tube cover located on the luggage compartment floor.

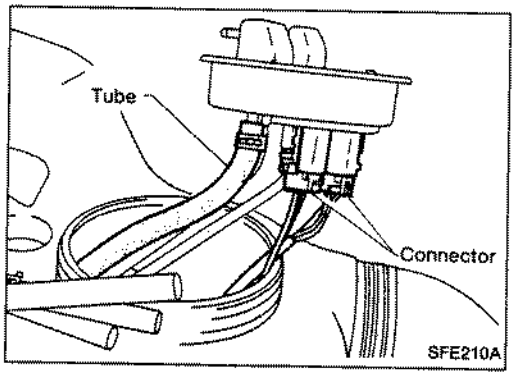


3. Disconnect fuel tubes and connector.

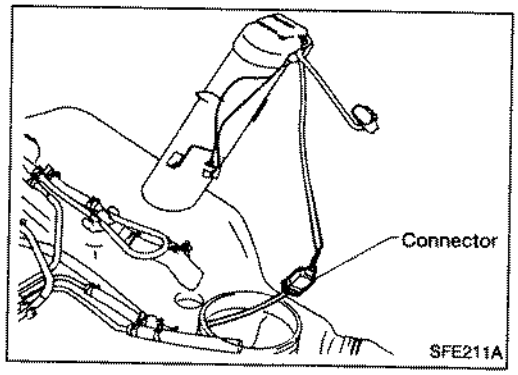
Fuel Pump and Gauge (Cont'd)



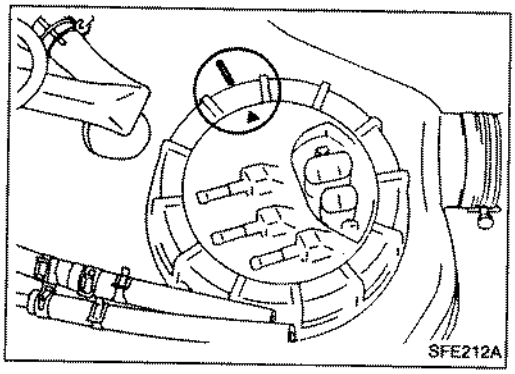
4. Remove lock nut using special service tool KV999G0010.
5. Remove upper plate.



6. While lifting upper plate, disconnect tube and harness connector and remove fuel pump.



7. Disconnect harness connector from inside of fuel tank and remove fuel gauge.

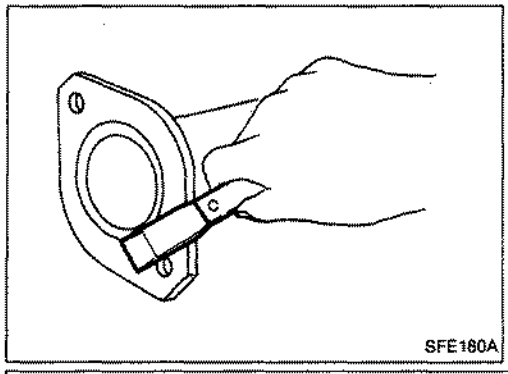


INSTALLATION

Installation procedure is the reverse order of removal.

CAUTION:

- **Check alignment on the matchmarks.**
- **Lock the lock nut.**

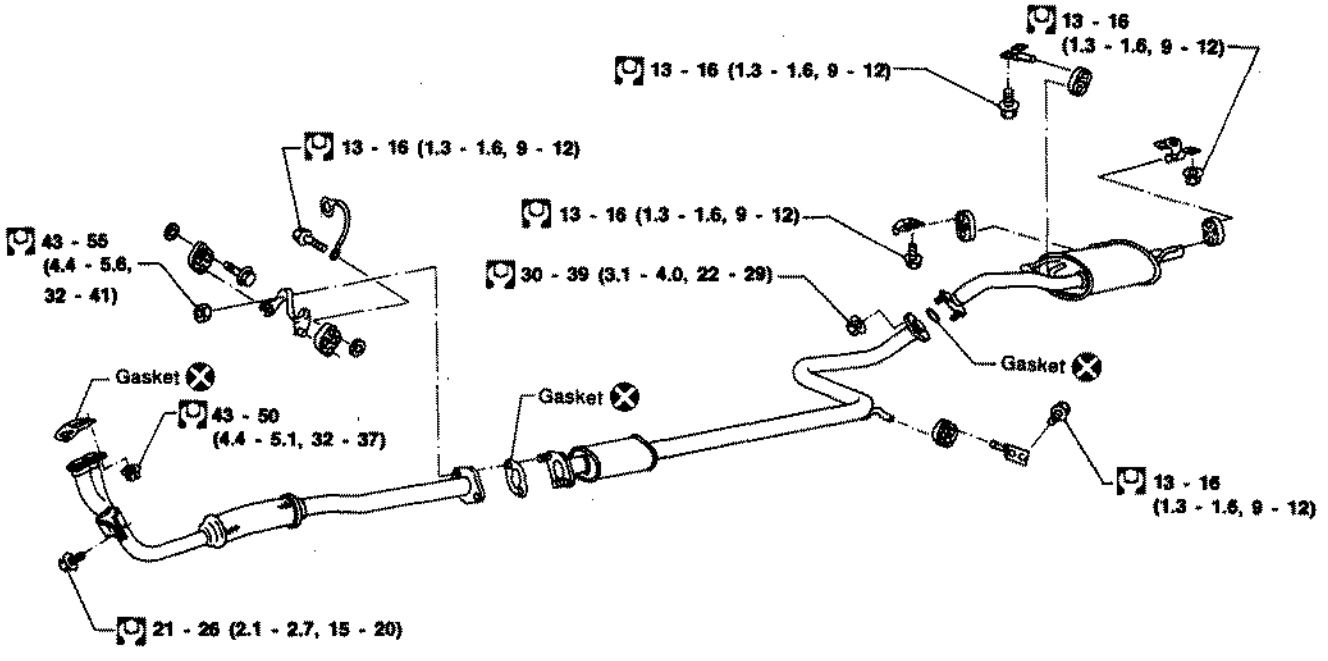


CAUTION:

- **Always replace exhaust gaskets with new ones when reassembling.**
  If gasket is left on flange surface, scrape off completely as shown at left.
- **With engine running, check all tube connections for exhaust gas leaks, and entire system for unusual noises.**
- **After installation, check to ensure that mounting brackets and mounting insulators are free from undue stress. If any of the above parts are not installed properly, excessive noise or vibration may be transmitted to the vehicle body.**

2WD models without catalytic converter

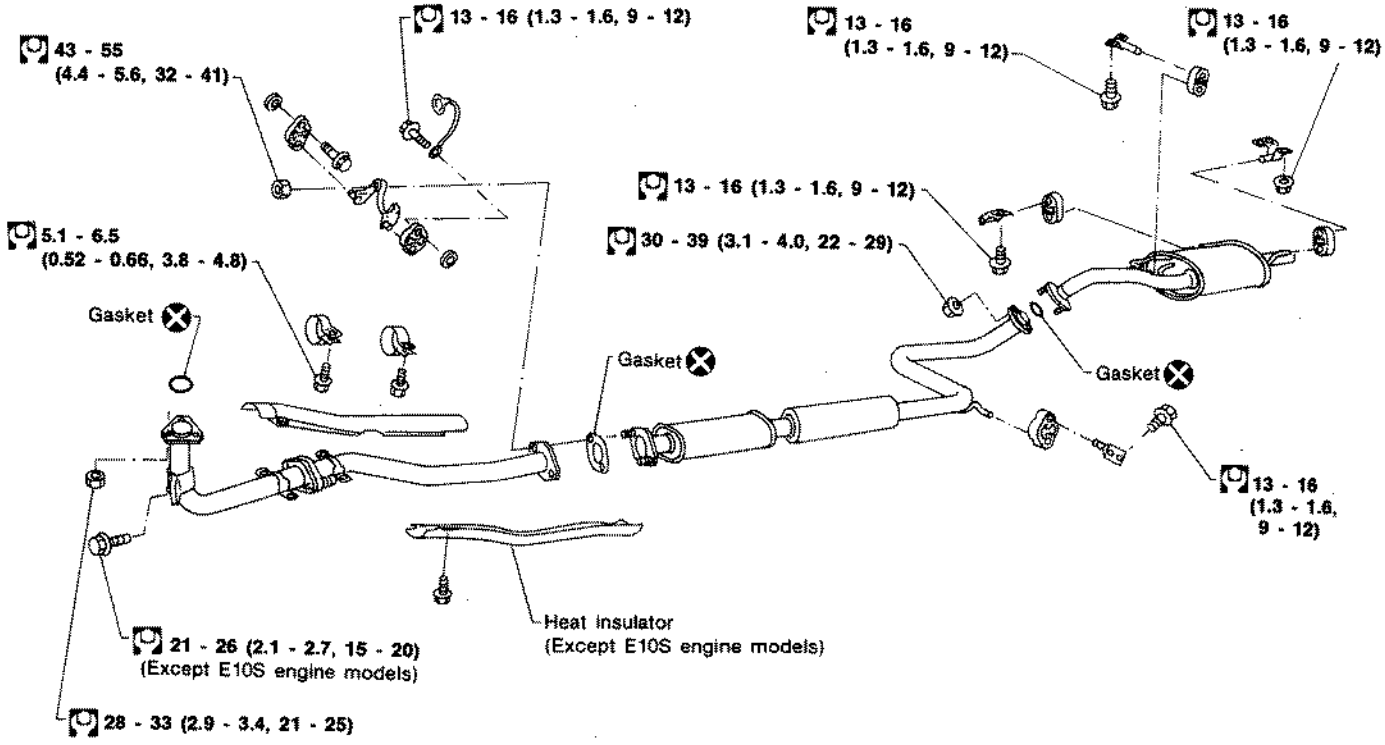
CD17 engine models



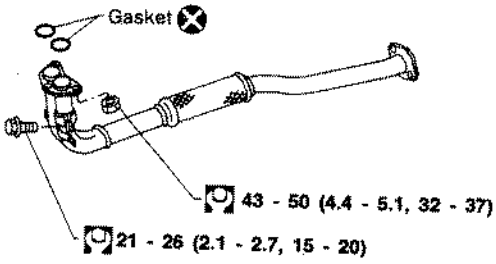
: N·m (kg-m, ft-lb)

SFE152A

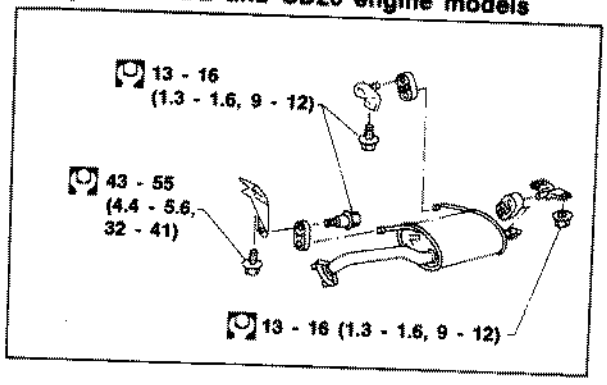
2WD models without catalytic converter



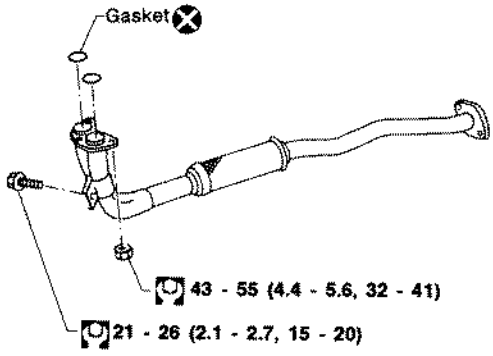
SR20DE engine models



Coupe, SR20DE and CD20 engine models



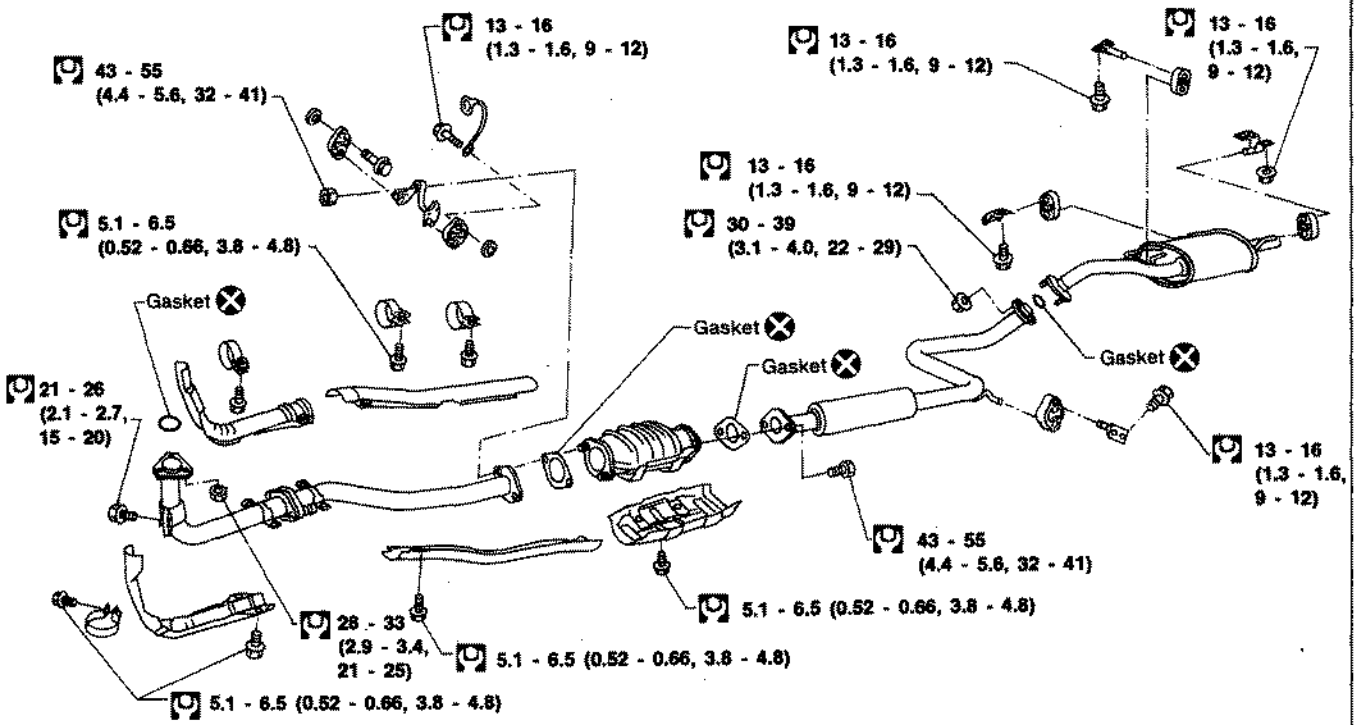
CD20 engine models



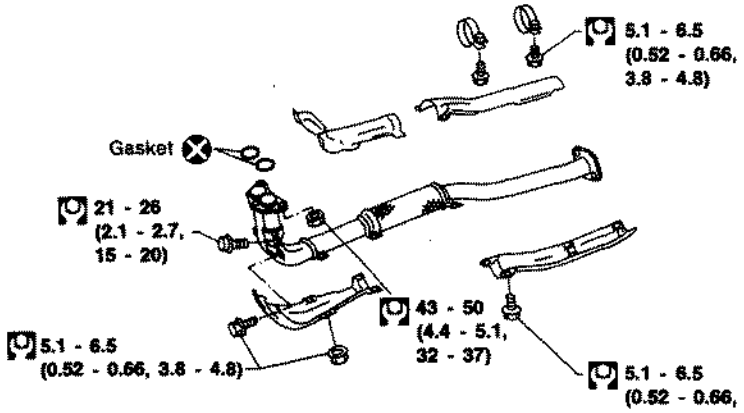
: N·m (kg-m, ft-lb)

SFE215A

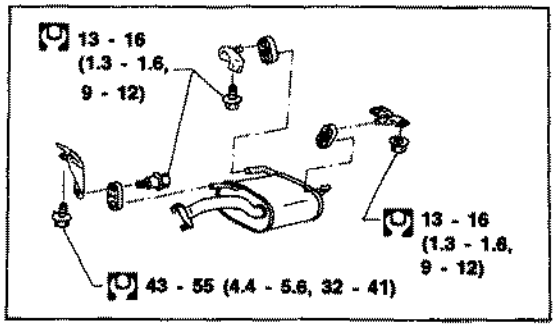
2WD models with catalytic converter



SR20DE engine models



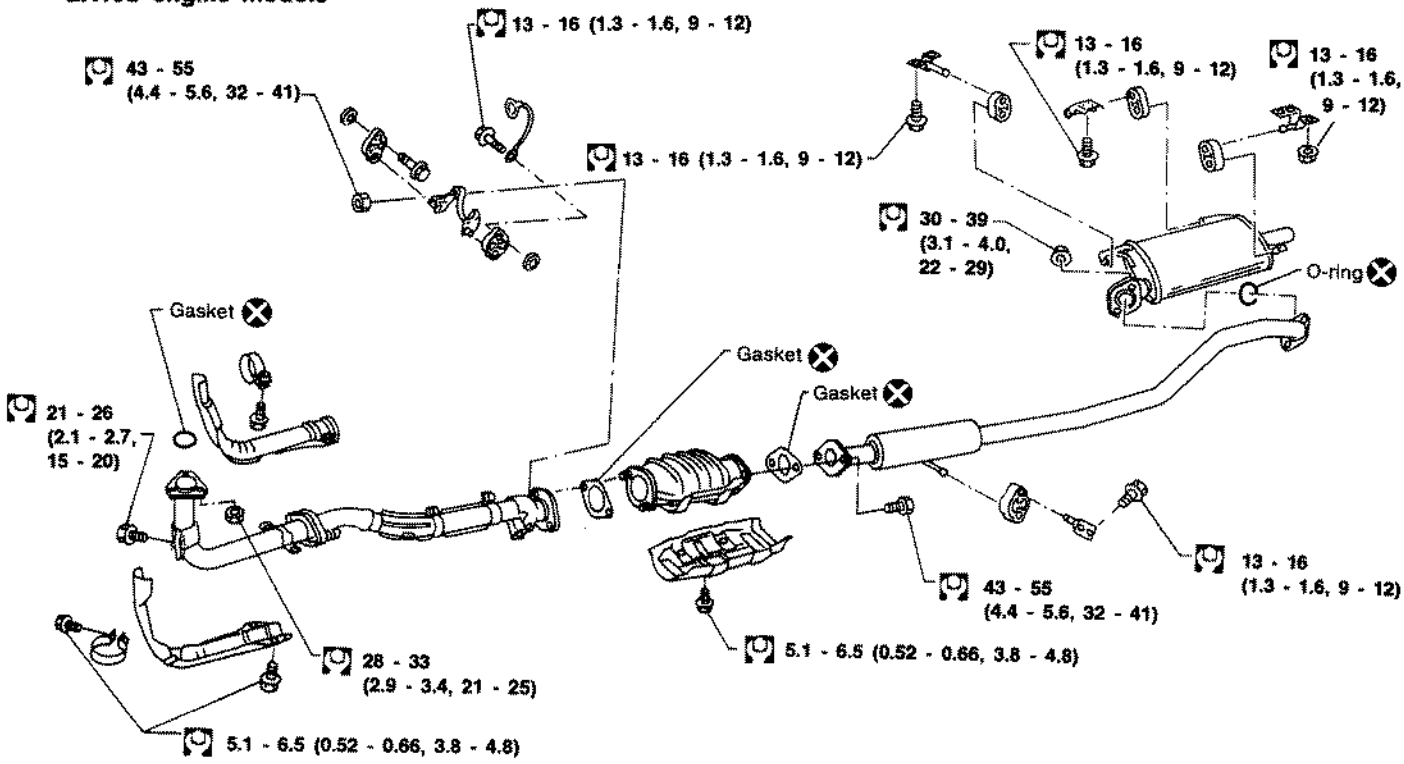
Coupe and SR20DE engine models



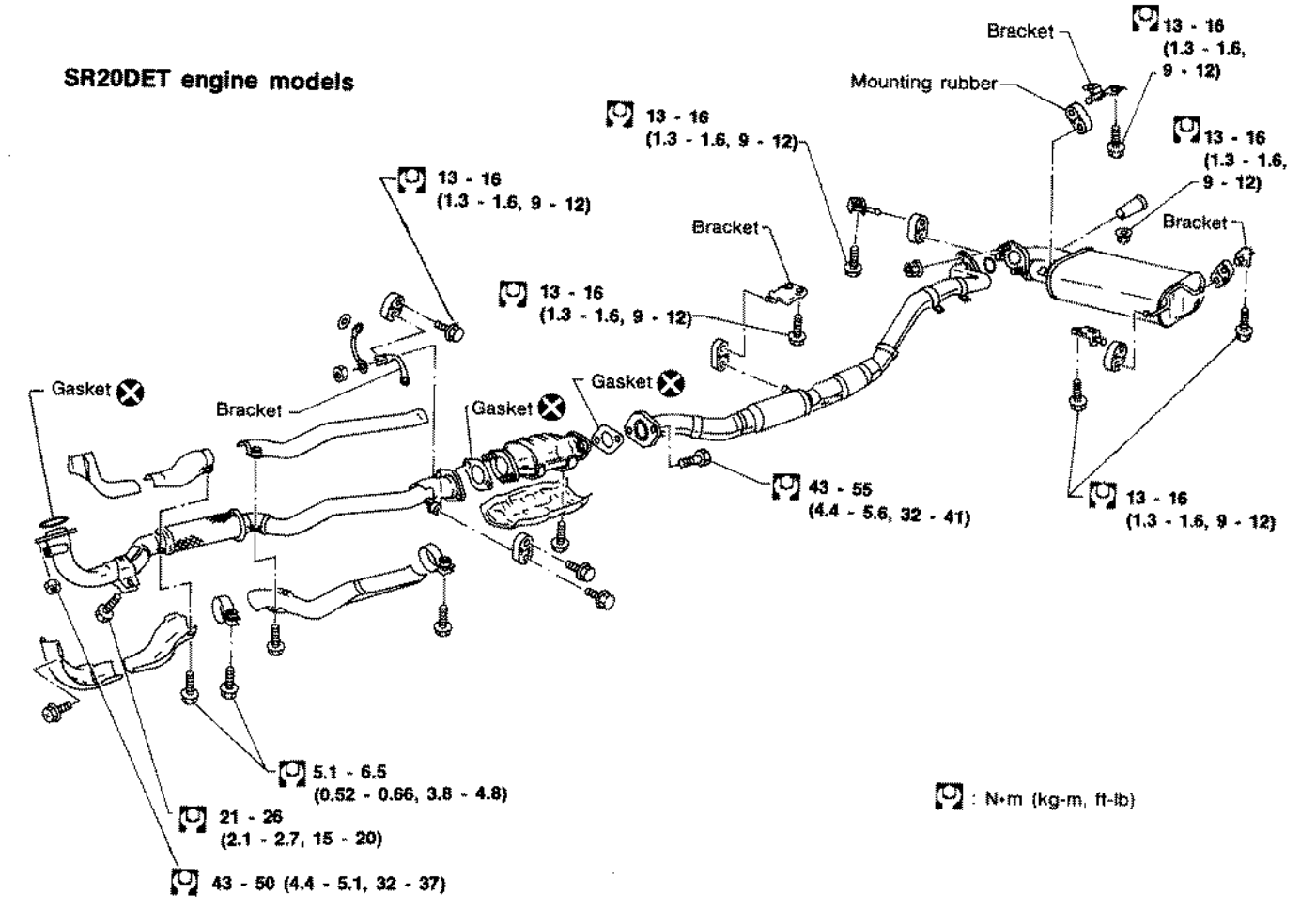
: N·m (kg-m, ft-lb)

SFE156A

4WD models
GA16S engine models

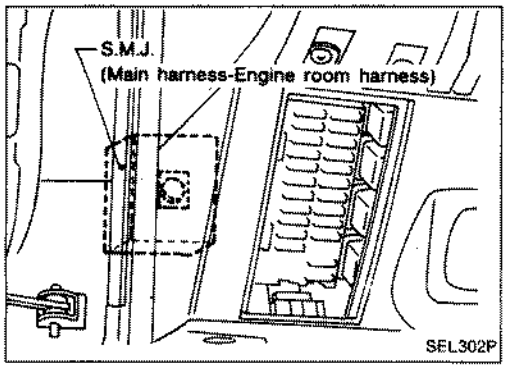


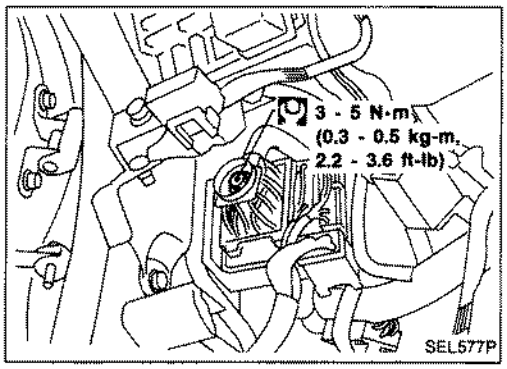
SR20DET engine models



: N•m (kg-m, ft-lb)

SFE193A





Terminal Arrangement

INSTALLATION

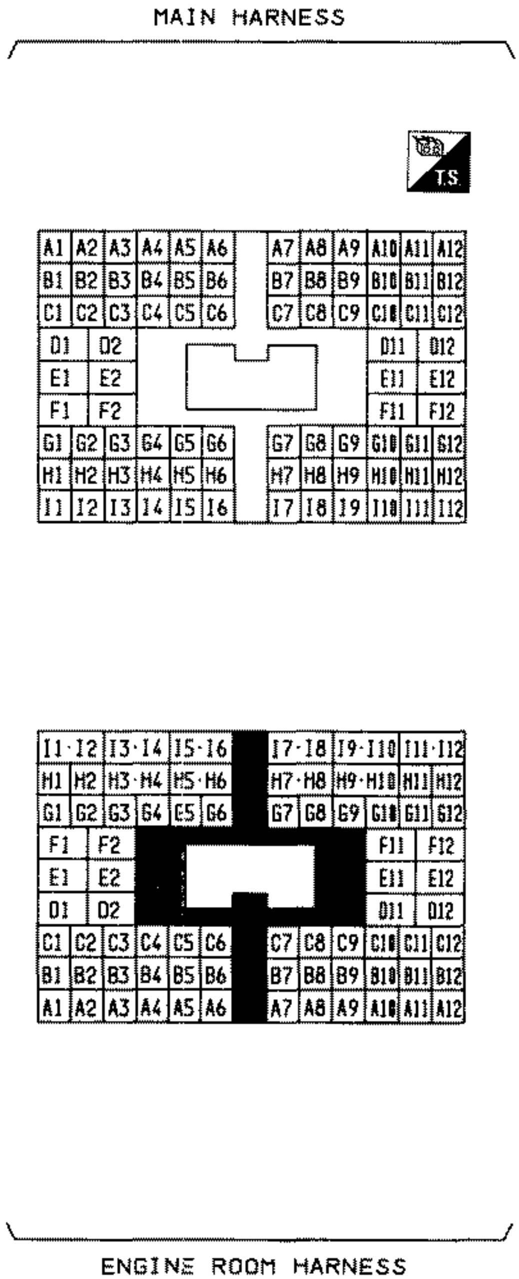
To install S.M.J., tighten to specified torque as required.

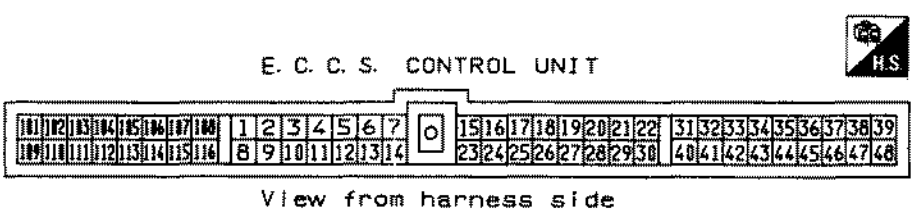
: 3 - 5 N·m
(0.3 - 0.5 kg-m, 2.2 - 3.6 ft-lb)

CAUTION:

Do not overtighten bolts, otherwise, they may be damaged.

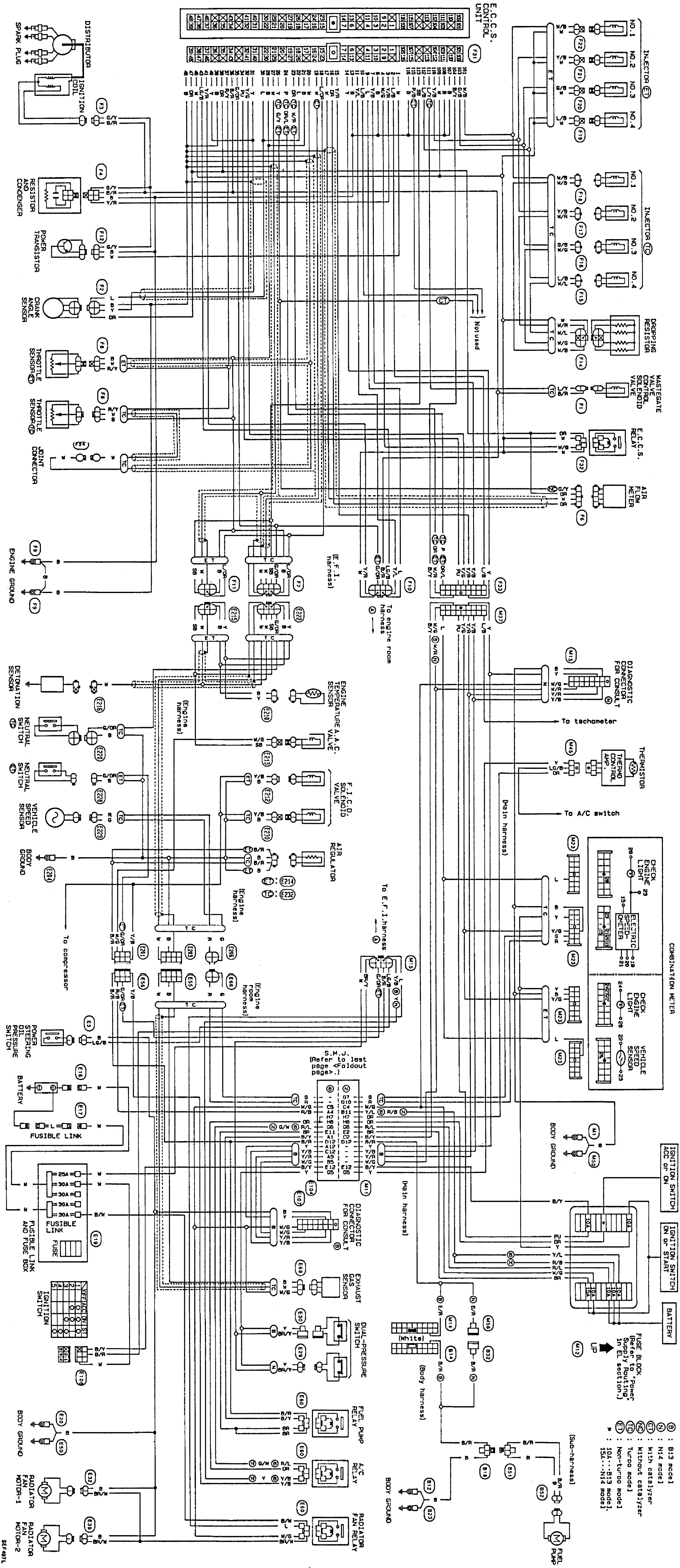
Terminal Arrangement (Cont'd)





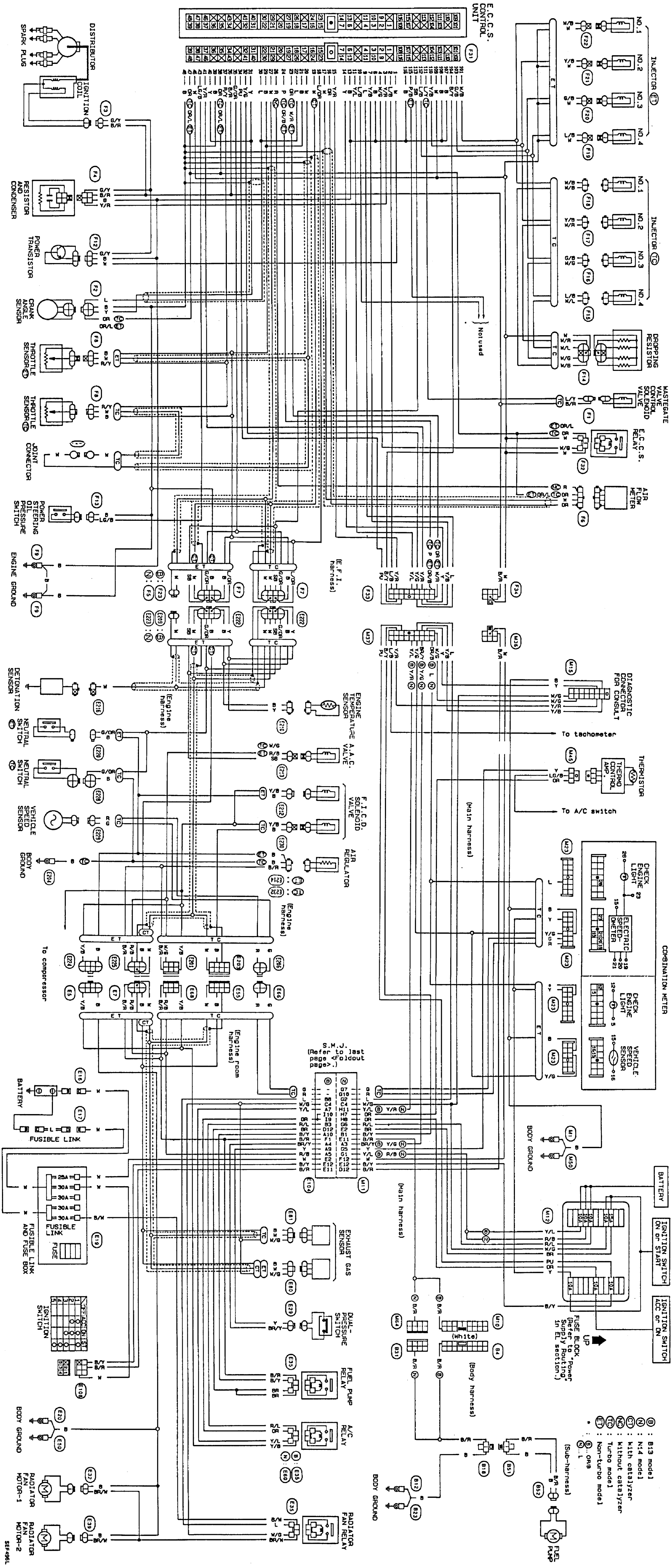
SEL224Q

NISSAN B13/N14 Series
(R.H.D. model with SR engine)
E.C.C.S. WIRING DIAGRAM



SEF497L

NISSAN B13/N14 Series
(L.H.D. model with SR engine)
E.C.C.S. WIRING DIAGRAM



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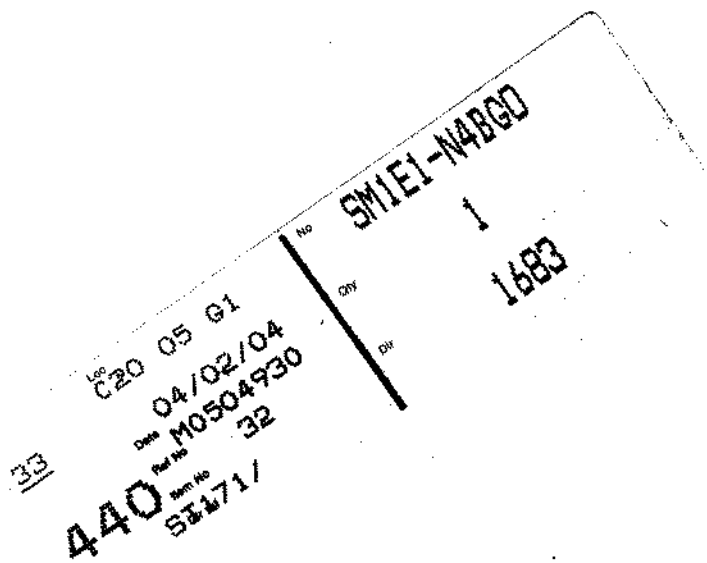
Tokyo, Japan



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