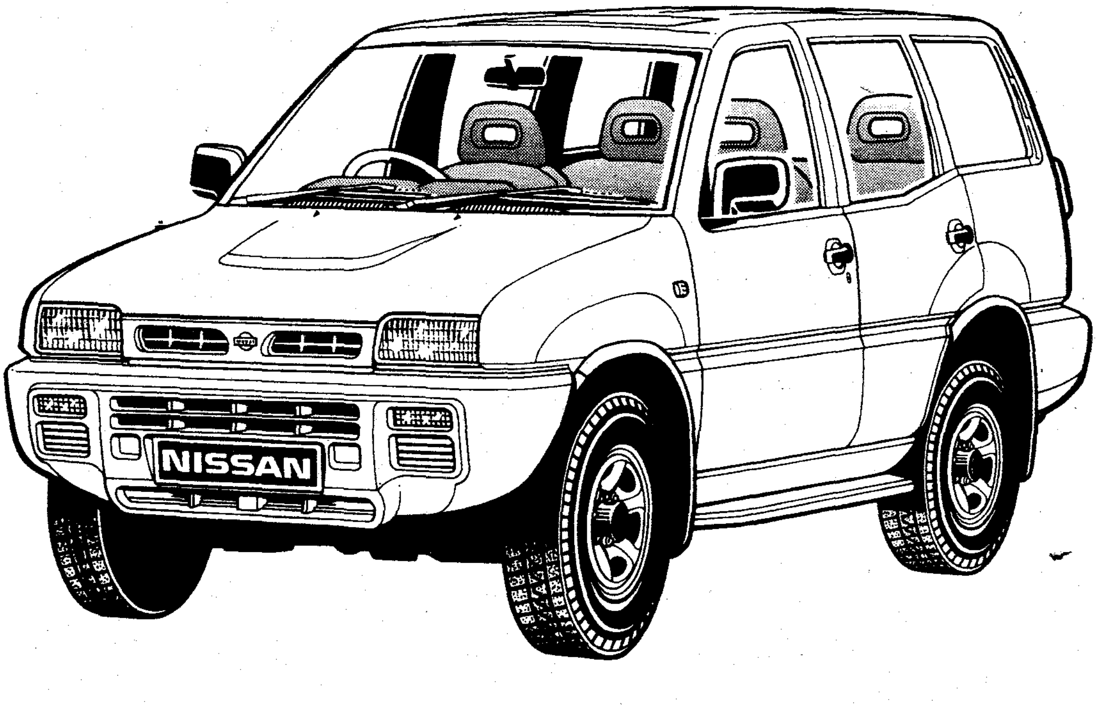
NISSAN TERRANO II

MODEL R20 SERIES

Volume 1



SERVICE MANUAL

NISSAN TERRANO II

MODEL R20 SERIES

Volume 1

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NISSAN EUROPE N.V.

FOREWORD

This manual contains maintenance and repair procedures for NISSAN TERRANO II, model R20 series.

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 EUROPE N.V.
Service Operations Section
Amsterdam, The Netherlands

GENERAL INFORMATION

SECTION GI

SECTION GI

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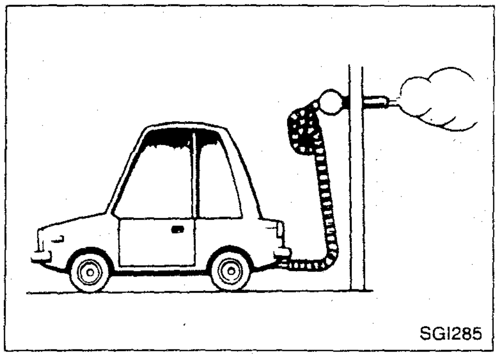
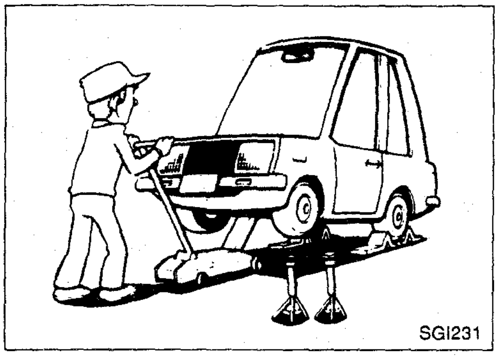
PRECAUTIONS

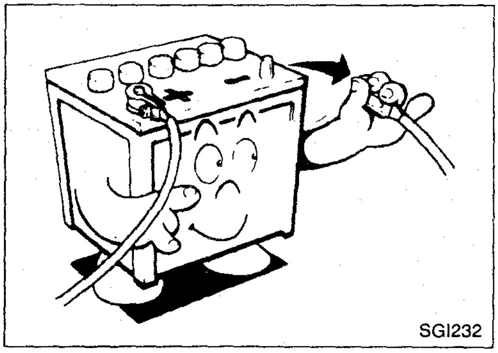
Observe the following precautions to ensure safe and proper servicing. These precautions are not described in each individual section.


SGI285

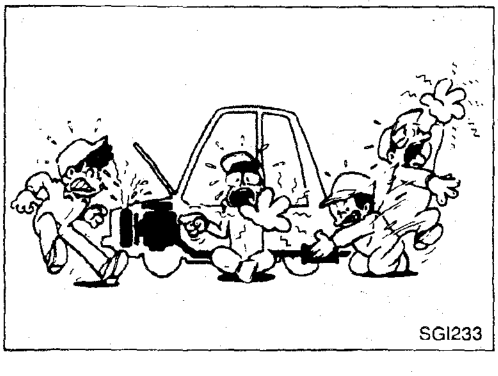
1. Do not operate the engine for an extended period of time without proper exhaust ventilation.
   Keep the work area well ventilated and free of any inflammable materials. Special care should be taken when handling any inflammable or poisonous materials, such as gasoline, refrigerant gas, etc. When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

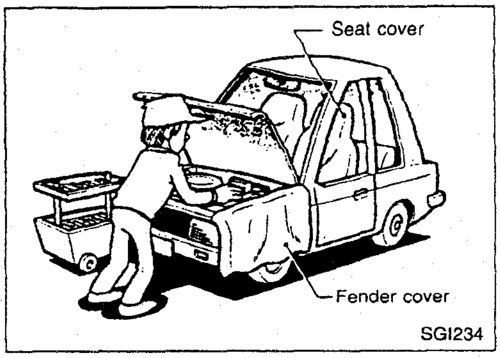
2. Before jacking up the vehicle, apply wheel chocks or other tire blocks to the wheels to prevent the vehicle from moving. After jacking up the vehicle, support the vehicle weight with safety stands at the points designated for proper lifting and towing before working on the vehicle.
   These operations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


SGI232

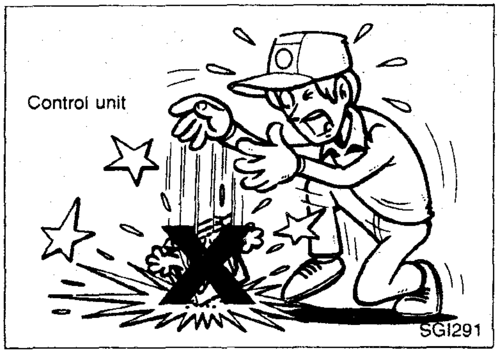
4. Before starting repairs which do not require battery power, always turn off the ignition switch, then disconnect the ground cable from the battery to prevent accidental short circuit.


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.



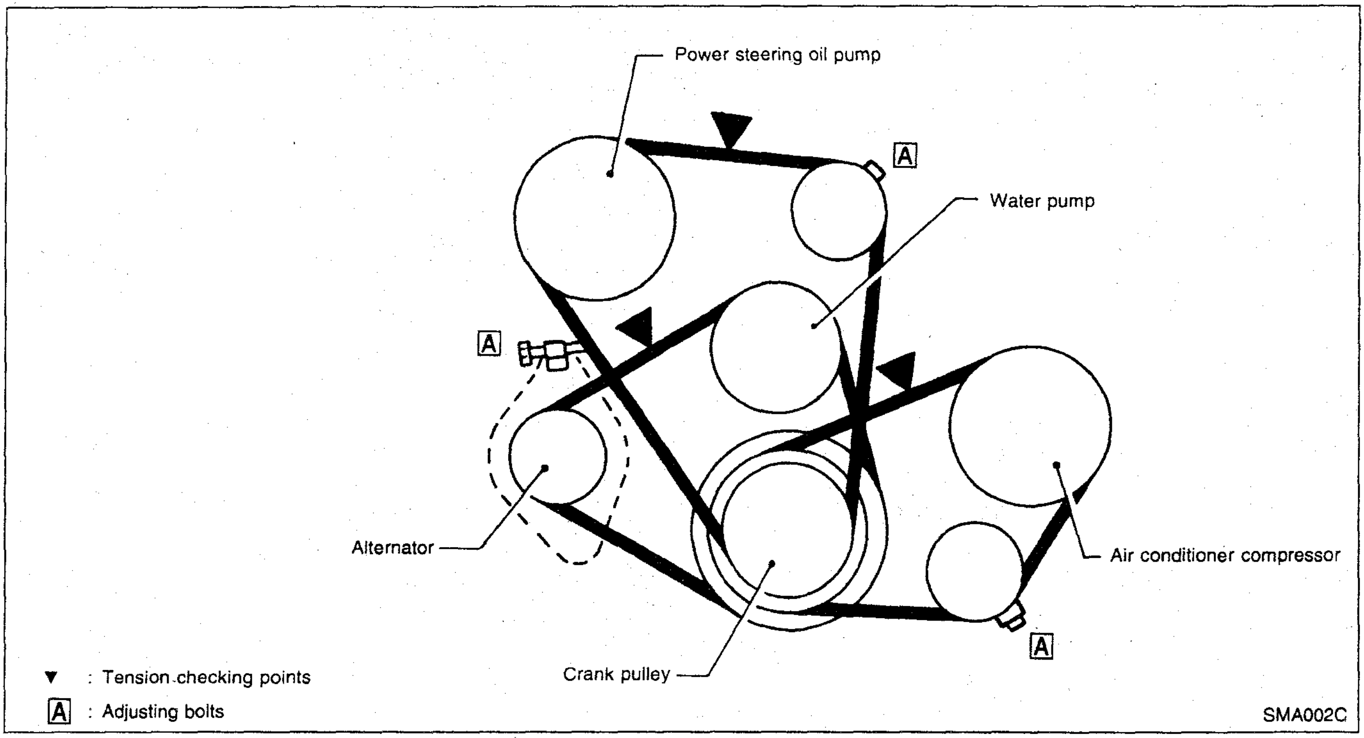
6. Before servicing the vehicle, protect fenders, upholstery and carpeting with appropriate covers.
   Take caution that keys, buckles or buttons on your person do not scratch the paint.
7. Clean all disassembled parts in the designated liquid or solvent prior to inspection or assembly.
8. Replace oil 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 whic 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. contr unit, be sure to turn the ignition switch to the "OFF" position and disconnect the negative battery terminal.
   Otherwise, there may be damage to the 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.

Checking Drive Belts



Inspect drive belt deflections when engine is cold.

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, as indicated with ▼.

Adjust if belt deflections exceed the limit.

Belt Deflection:

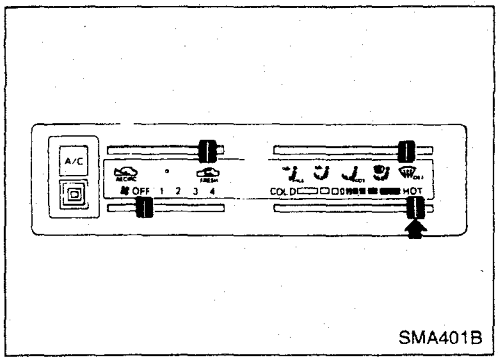
Unit: mm (in)

Drive belts	Used belt deflection		Deflection of new belt
	Limit	Deflection after adjustment	
Alternator	17 (0.67)	10 - 12 (0.39 - 0.49)	8 - 10 (0.32 - 0.39)
Air conditioner compressor	16 (0.63)	10 - 12 (0.39 - 0.49)	8 - 10 (0.32 - 0.39)
Power steering oil pump	15 (0.59)	9 - 11 (0.35 - 0.43)	7 - 9 (0.28 - 0.35)
Applied pushing force	98 N (10 kg, 22 lb)		

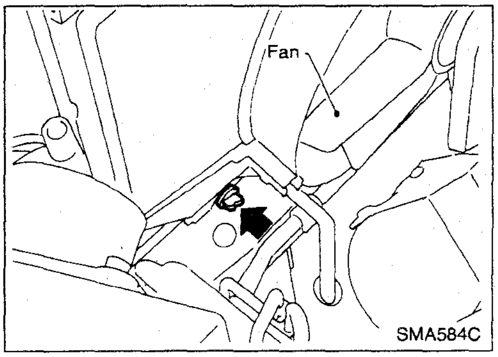
Changing Engine Coolant

WARNING:

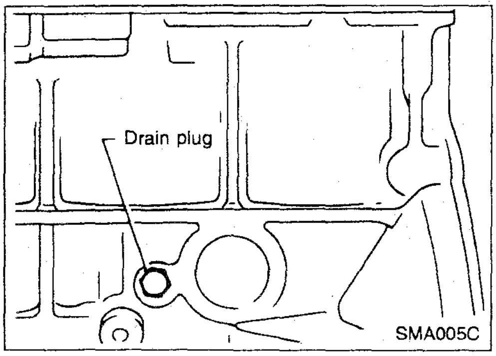
To avoid being scalded, never change the coolant when the engine is hot.

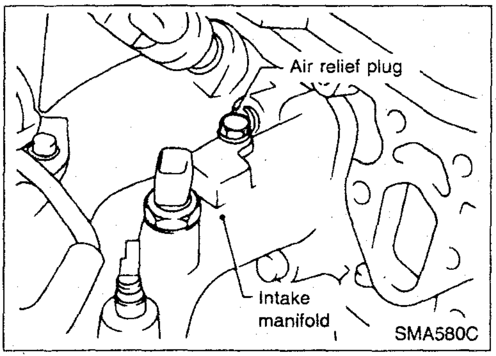


1. Move temperature control lever of the heater to the "HOT" position.
   Remove engine under cover.



2. Remove radiator drain plug.
   Remove radiator cap.
   Drain radiator.

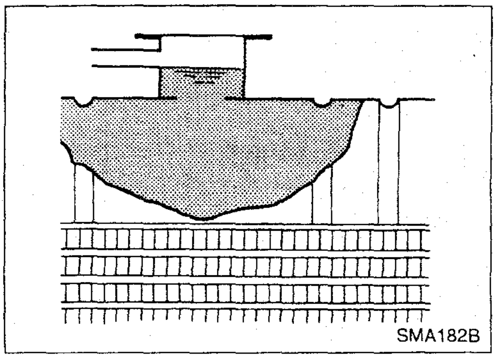




3. Remove cylinder block drain plug.
4. Close drain cock and tighten drain plug securely.

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

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



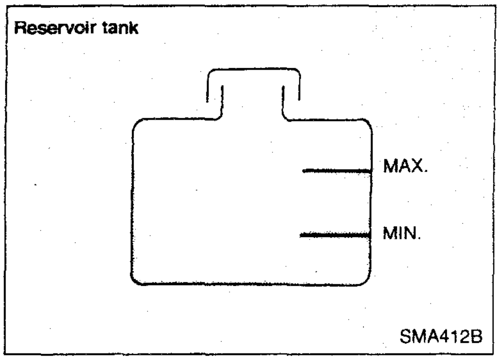
13. Fill radiator with coolant up to specified level.
    Follow instructions attached to anti-freeze container for mixing ratio of anti-freeze to water.

    Coolant capacity (with reservoir tank):
    6.9 ℓ (6-1/8 Imp qt)

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

14. Close air relief plug.
15. Remove reservoir tank, drain coolant, then clean reservoir tank.

Changing Engine Coolant (Cont'd)

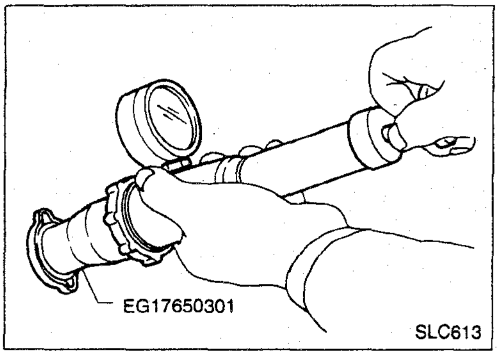


16. Install reservoir tank and fill it with coolant up to "MAX" level and then install radiator cap.
17. Repeat steps 7 through 9. Then add coolant as necessary up to "MAX" level.

Checking Cooling System

CHECKING HOSES

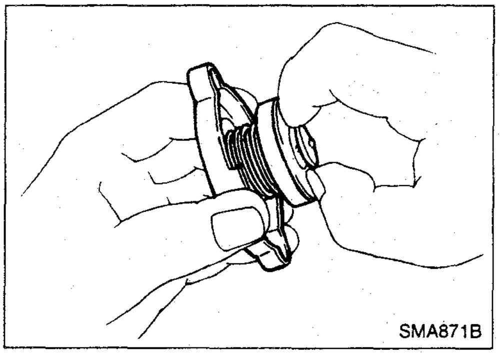
Check hoses for proper attachment, leaks, cracks, damage, loose connections, chafing and deterioration.



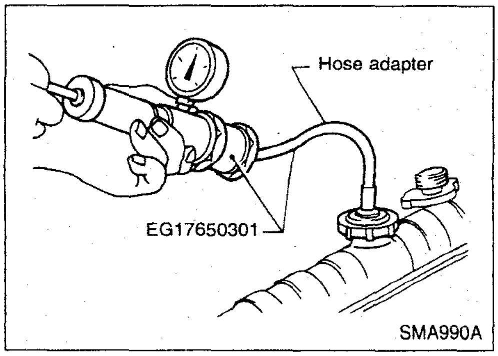
CHECKING RADIATOR CAP

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 - 1.0 bar, 0.8 - 1.0 kg/cm^2, 11 - 14 psi)



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



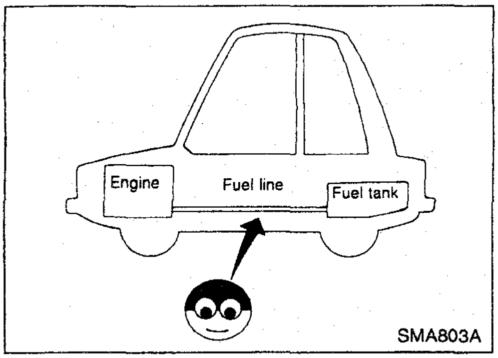
CHECKING COOLING SYSTEM FOR LEAKS

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)

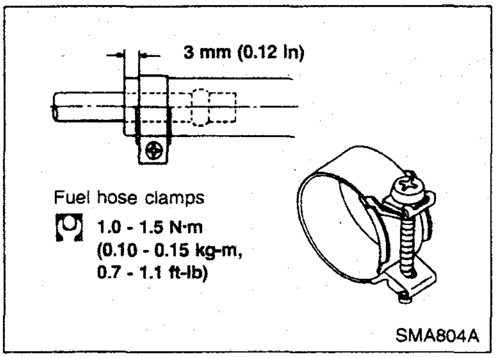
CAUTION:

Higher than the specified pressure may cause radiator damage.



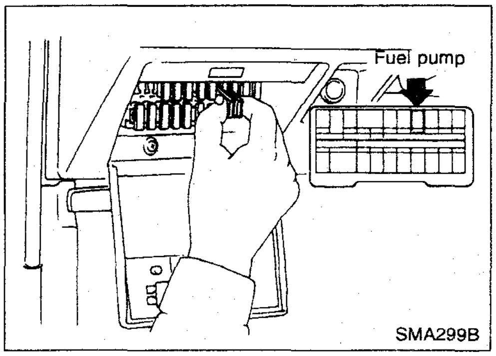
Checking Fuel Lines

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



CAUTION:

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

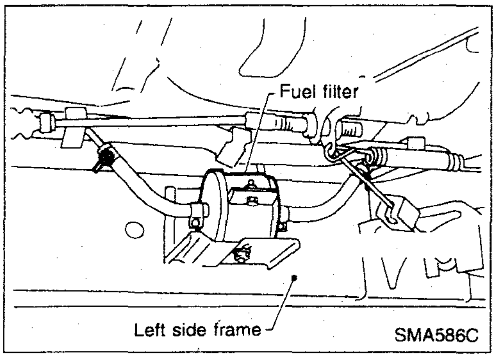


Changing Fuel Filter

WARNING:

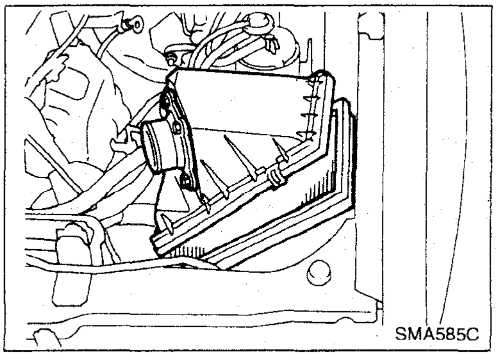
Before removing fuel filter, release fuel pressure from fuel line.

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



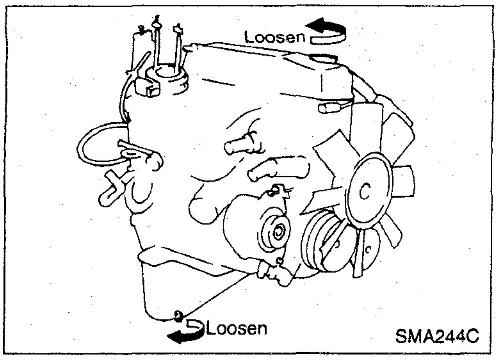
5. Loosen fuel hose clamps.
6. Replace fuel filter.

- **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 filter cap.
3. Drain oil and refill with new engine oil.

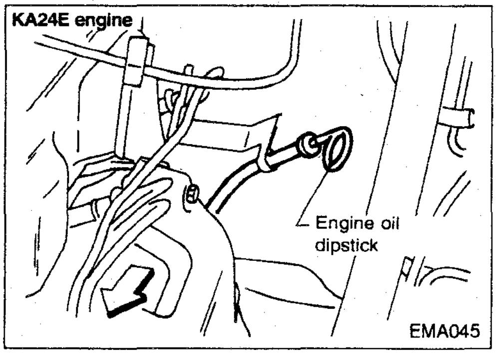
Refill oil capacity (Approximately):

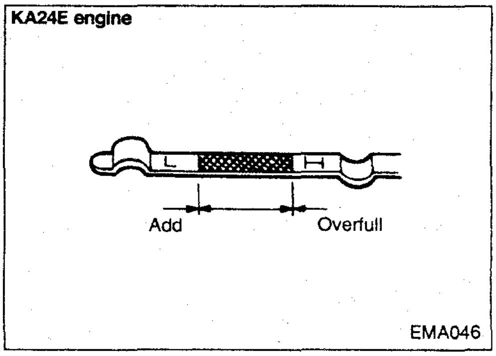
Unit: ℓ (Imp qt)

With oil filter change	4.3 (3 - 3/4)
Without oil filter change	3.9 (3 - 3/8)

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.**
- **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. See "RECOMMENDED FLUIDS AND LUBRICANTS".**





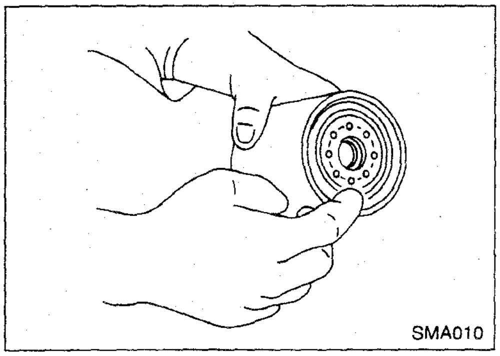
4. Check oil level.
5. Start engine and check area around drain plug and oil filter for oil leakage.
6. Run engine for a few minutes, then turn it off. After several minutes, check oil level.

Changing Oil Filter

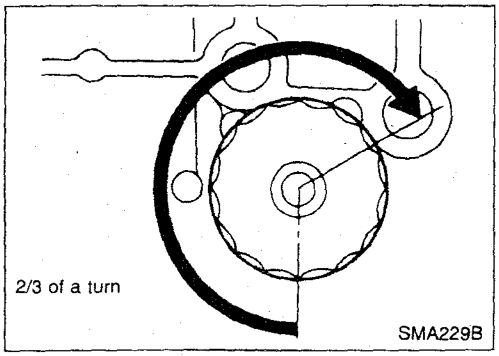
1. Remove oil filter with a suitable tool.

WARNING:

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

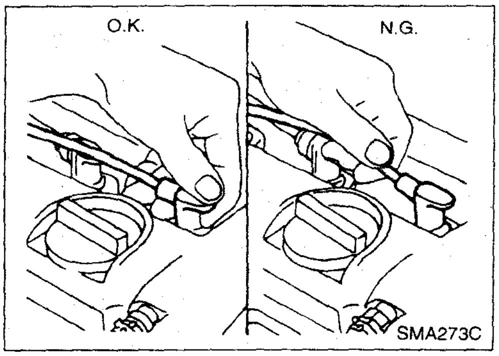


2. Before installing a new oil filter, clean the oil filter mounting surface on cylinder block and coat the rubber seal of the oil filter with a little engine oil.



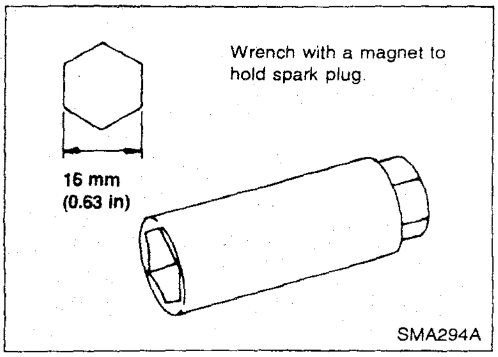
3. Screw in the oil filter until a slight resistance is felt, then tighten an additional 2/3 turn or more.
4. Add engine oil.

Refer to "Changing Engine Oil".



Checking and Changing Spark Plugs

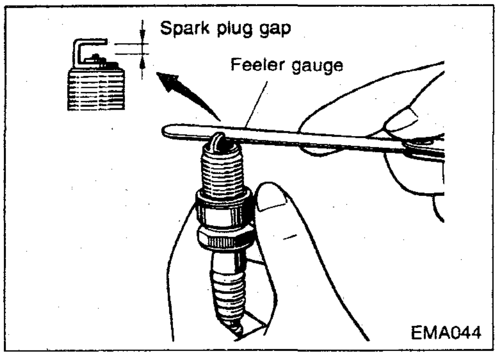
1. Disconnect ignition wires from spark plugs at boot. Do not pull on the wire.



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.

Checking and Changing Spark Plugs (Cont'd)

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



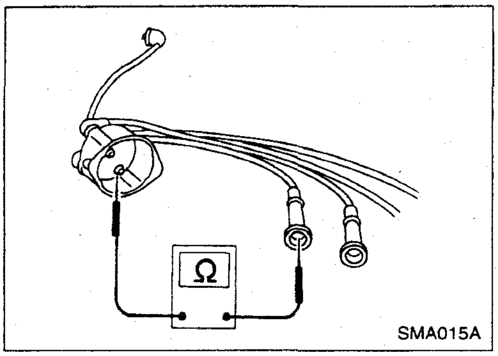
EMA044

5. Check spark plug gap.

Gap:
1.0 - 1.1 mm (0.039 - 0.043 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)



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Checking Ignition Wires

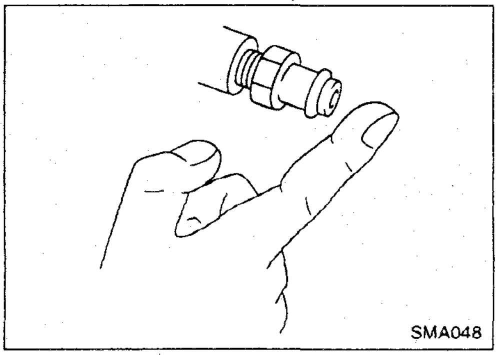
1. Check the high tension wires for cracks, damage, burned terminals and for proper fit.
2. Measure the resistance of the high tension wires, by shaking them and checking for intermittent breaks.

Resistance:

Unit: kΩ

Cable		Length mm (in)	Resistance
Coil to Distributor		650 - 710 (25.59 - 27.95)	20.4 ± 3
Distributor to Spark Plug	No. 1	240 - 300 (9.45 - 11.81)	8.1 ± 1.2
	No. 2	440 - 500 (17.32 - 19.68)	14.1 ± 2.1
	No. 3	400 - 460 (15.75 - 18.11)	13.2 ± 2
	No. 4	590 - 650 (23.23 - 25.59)	18.6 ± 2.8

Replace the ignition cable if the resistance exceeds the specification given.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Checking Positive Crankcase Ventilation (P.C.V.) System

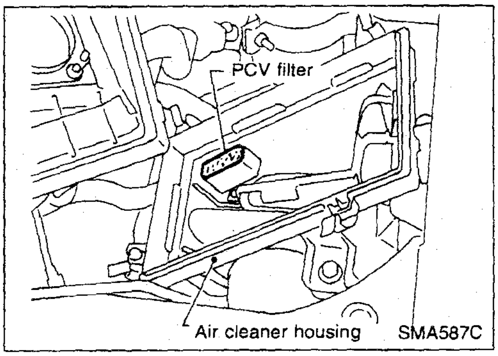
CHECKING P.C.V. VALVE

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.



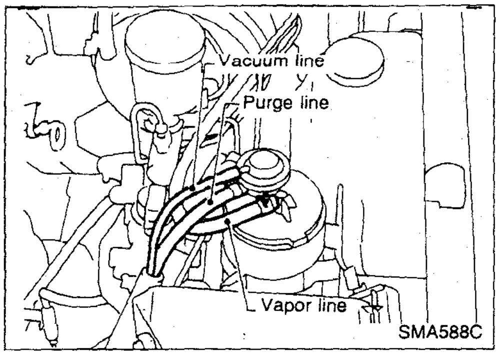
Changing Positive Crankcase Ventilation (P.C.V.) Filter

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 and deterioration.

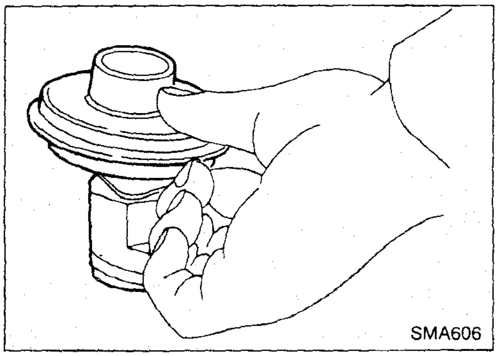
Refer to Vacuum Hose Drawing in ENGINE AND EMISSION CONTROL OVERALL SYSTEM in EF & EC section.



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 Recirculation (E.G.R.) Control System

1. Start engine and warm it up sufficiently.
2. Make sure that the E.G.R. control valve diaphragm moves when raising engine speed.
   If it does not move, check vacuum lines and B.P.T. valve.

Checking Exhaust Gas Sensor

Checking procedure

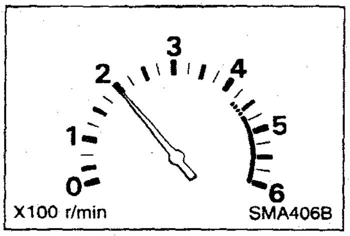
INSPECTION START

↓

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

↓

Run engine at about 2,000 rpm for about 2 minutes under no-load.

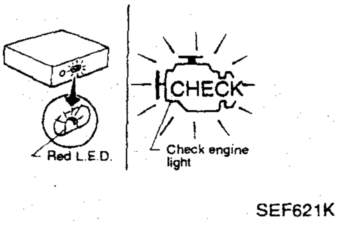


- Check that self-diagnosis mode selected is "I" or "II"
- Make sure that self-diagnosis mode selector is in the outermost left position

Refer to "Self-diagnosis" in EF & EC section.

↓

* Make sure that inspection light (red L.E.D.) on control unit or engine check light on dashboard goes on and off more than 5 times during 10 seconds, at 2,000 rpm under no-load.



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. → (back to "Start engine and warm it up until water temperature indicator points to the middle of gauge.")

INSPECTION END

Retightening Manifold Bolts and Nuts

MANIFOLD BOLTS AND NUTS

Intake:

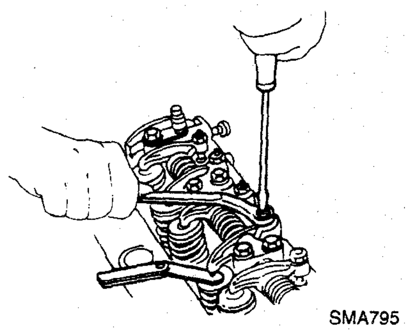
🔧: **13 - 19 N·m (1.3 - 1.9 kg-m, 9 - 14 ft-lb)**

Exhaust:

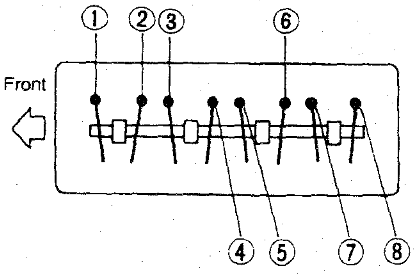
🔧: **29 - 34 N·m (3.0 - 3.5 kg-m, 22-25 ft-lb)**

Retightening should be performed while engine is cold [approximately 20°C (68°F)].

Adjusting Intake and Exhaust Valve Clearance



SMA795



SMA785B

Adjustment should be made while engine is warm but not running.

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.

Valve clearance:

Intake ①, ③, ⑤ and ⑦

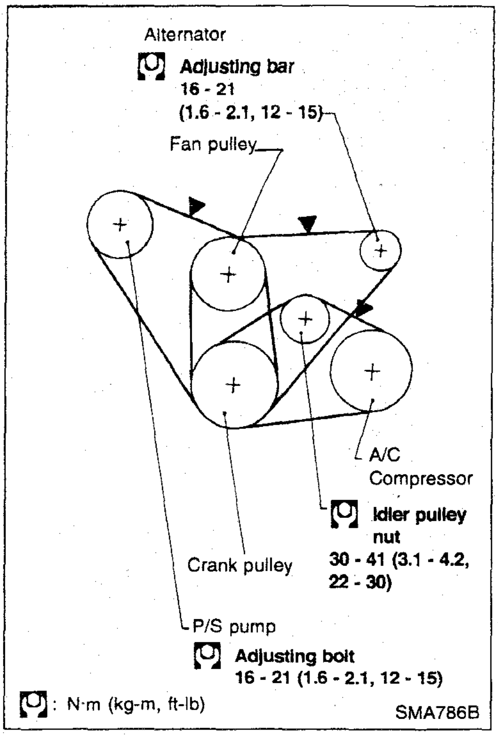
0.25 mm (0.0098 in)

Exhaust ②, ④, ⑥ and ⑧

0.25 mm (0.0098 in)

Adjusting screw lock nuts:

🔧: **14 - 18 N·m**
(1.4 - 1.8 kg-m, 10 - 13 ft-lb)



Drive Belt Inspection

1. Inspect for cracks, fraying, wear or oil adhesion. Replace if necessary.

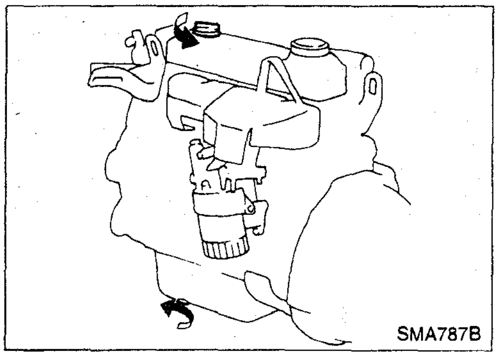
The belts should not touch the bottom of the pulley groove.

2. Check drive belt deflection by pushing on the belt midway between pulleys. (▼)
3. Adjust if belt deflections exceed the limit.

Unit: mm (in)

Drive belts	Used belt deflection		Deflection of new belt
	Limit	Deflection after adjustment	
Alternator	20 (0.79)	11 - 13 (0.43 - 0.51)	9 - 11 (0.35 - 0.43)
Air conditioner compressor	12 (0.47)	6 - 7.5 (0.236 - 0.295)	5 - 6.5 (0.197 - 0.256)
Power steering oil pump	15 (0.59)	8 - 9.5 (0.315 - 0.374)	7 - 8.5 (0.276 - 0.335)
Applied pushing force	98 N (10 kg, 22 lb)		

Check drive belt deflections when engine is cold.
If engine is hot, check deflections after 30 minutes or more.



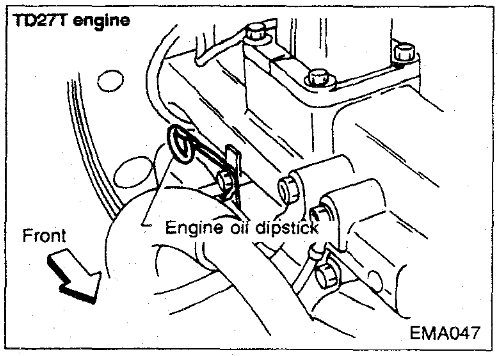
Changing Engine Oil

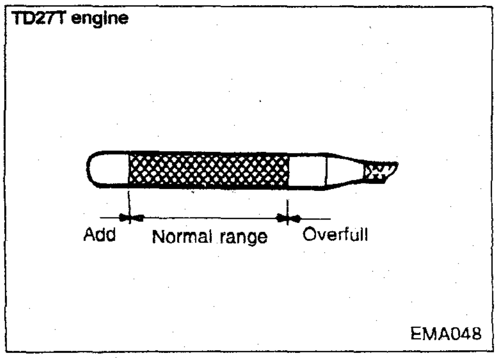
1. Warm up engine, and check for oil leakage from engine components.
2. Remove oil filler cap and drain plug.
3. Drain oil and fill with new engine oil.

Oil capacity:
See "RECOMMENDED FLUIDS AND LUBRICANTS".

WARNING:

- **Be careful not to burn yourself, as the engine oil may be hot.**
- **Be sure to clean and install oil pan drain plug and washer.**
  Drain plug:
  : 54 - 59 N·m (5.5 - 6.0 kg-m, 40-43 ft-lb)
- **Use recommended engine oil.**





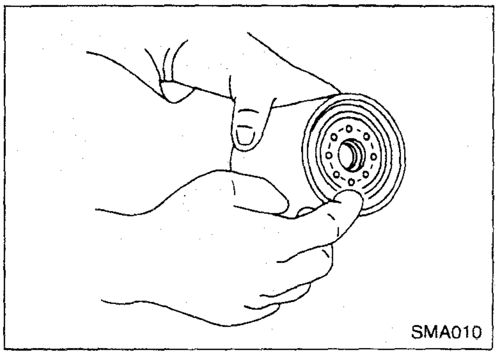
4. Check oil level.
5. Start engine. Check area around drain plug and oil filter for any sign of oil leakage.
6. Run engine for a few minutes, then turn it off. After several minutes check oil level.

Changing Oil Filter

1. Remove oil filter with a suitable wrench.

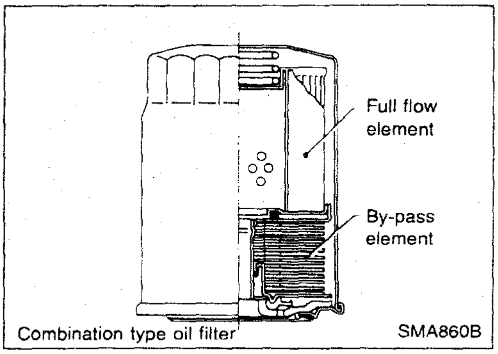
WARNING:

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


SMA010

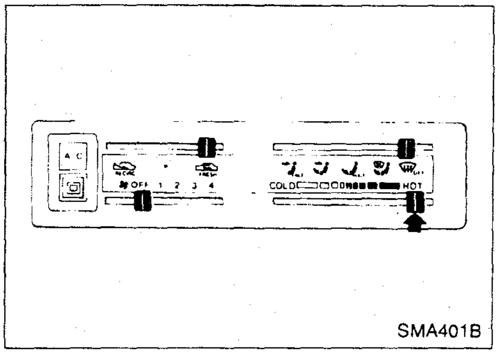
2. Before installing new oil filter, clean the oil filter mounting surface on cylinder block and coat the rubber seal of the oil filter with a little engine oil.
3. Install oil filter.
   When installing oil filter, screw it in until a slight resistance is felt, then tighten an additional 2/3 turn or more.
4. Add engine oil.

Refer to Changing Engine Oil.



Combination type oil filter SMA860B

Changing Engine Coolant

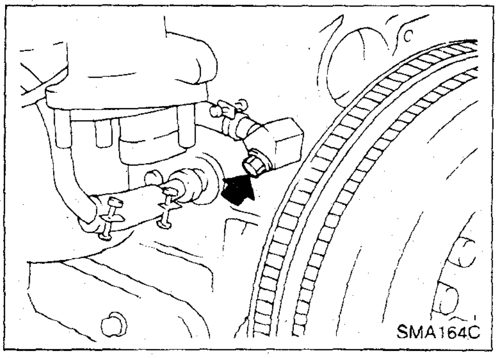


SMA401B

WARNING:

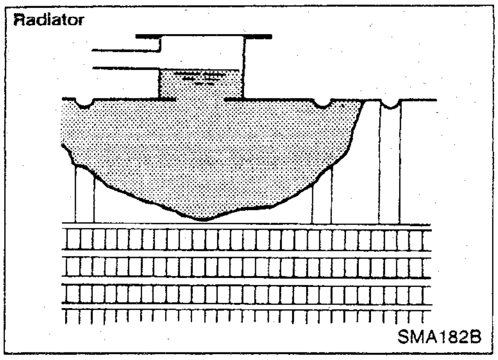
To avoid the danger of being scalded, never attempt to chang the coolant when the engine is hot.

1. Set heater "TEMP" control lever all the way to "HOT" position.
2. Open drain cock at the bottom of radiator, and remove radiator cap.


SMA164C

3. Remove cylinder block drain plug located at left rear of cylinder block.
4. Drain coolant and then tighten drain plug securely.
5. Fill radiator with water and warm up engine.
6. Stop engine and wait until it cools down.
7. Repeat step 2 through step 5 two or three times.
8. Drain water.

Changing Engine Coolant (Cont'd)



9. 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 (with reservoir tank):
   10.0 ℓ (8-3/4 Imp qt)

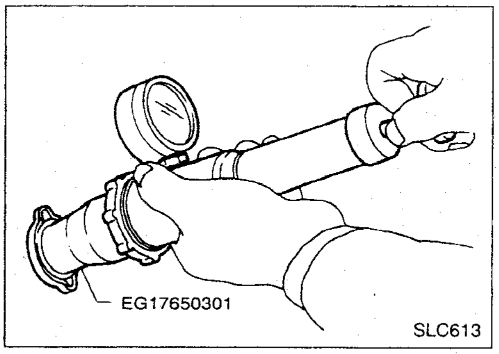
Slowly pour coolant through coolant filler neck to allow air in system to escape.

10. Fill reservoir tank up to "MAX" level.
11. Run the engine at approximately 2,000 rpm for about one minute.
12. Stop engine and cool it down, then refill the radiator and the reservoir tank.

Checking Cooling System

CHECKING HOSES

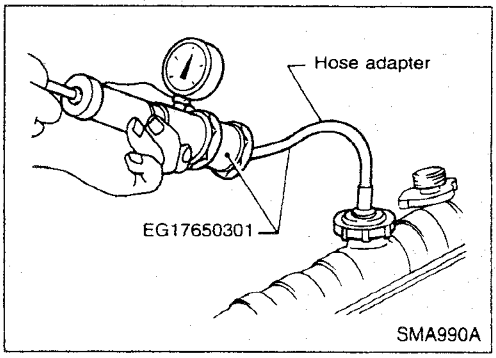
Check hoses for proper attachment, leaks, cracks, damage, loose connections, chafing and deterioration.



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 - 1.0 bar, 0.8 - 1.0 kg/cm^2, 11 - 14 psi)



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)

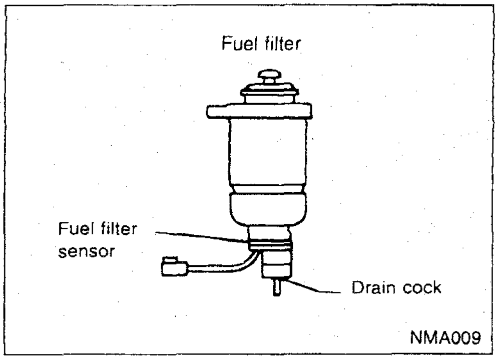
CAUTION:

Higher than the specified pressure may cause radiator damage.

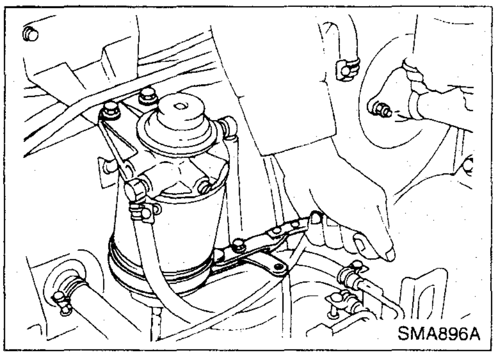
Checking and Replacing Fuel Filter and Draining Water

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

REPLACING FUEL FILTER

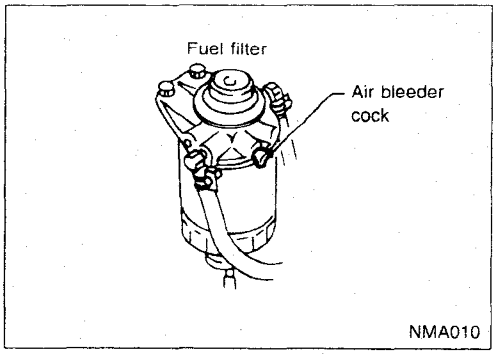


1. Remove fuel filter sensor and drain fuel.

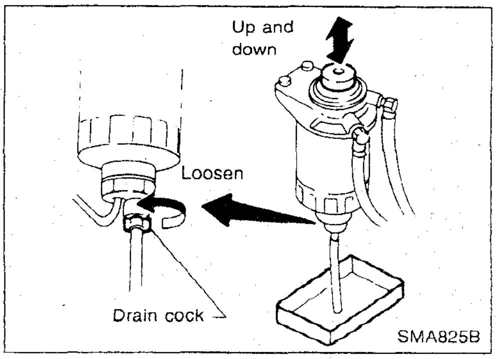


2. Remove fuel filter, using a suitable tool.
3. Wipe clean fuel filter mounting surface on fuel filter bracket and smear a little fuel on rubber seal of fuel filter.
4. Screw fuel filter on until a slight resistance is felt, then tighten an additional more than 2/3 turn.
5. Install fuel filter sensor to new filter.
6. Bleed air from fuel line.
   Refer to Bleeding Fuel System in EF & EC section.
7. Start engine and check for leaks.

DRAINING WATER



1. Loosen air bleeder cock of fuel filter cover (If equipped).

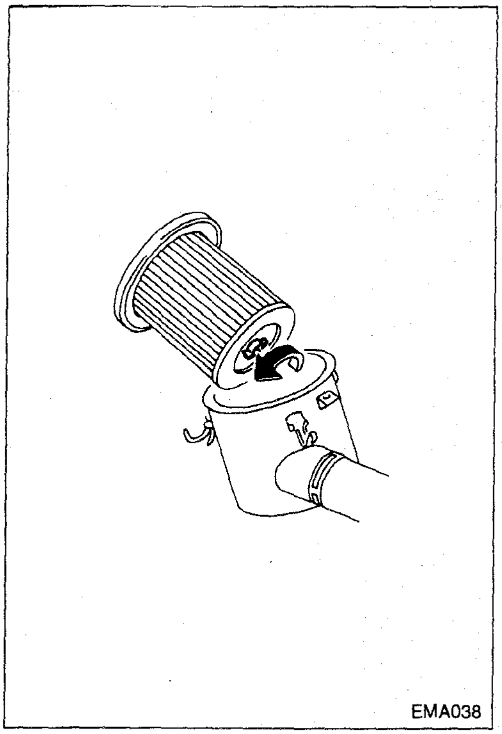


2. Loosen drain cock and drain water.

Loosening drain cock 4 to 5 turns causes water to start draining. Do not remove drain cock by loosening it excessively.

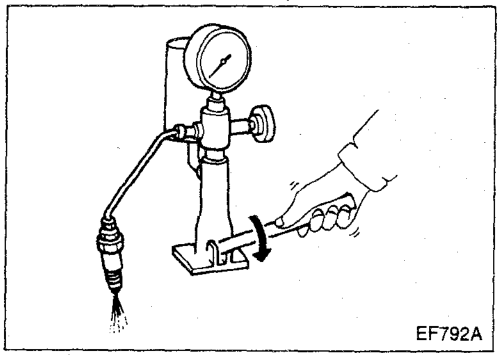
In the case of a fuel filter cover not equipped with an air bleeder cock, if water does not drain properly, move the priming pump up and down.

3. Bleed air.
   Refer to section EF & EC for fuel system bleeding instructions.



Replacing Air Cleaner Filter (Viscous paper type)

The viscous paper type air cleaner filter does not require any cleaning operation between changes.
Change every 40,000 Km (24,000 miles)



Checking Injection Nozzle

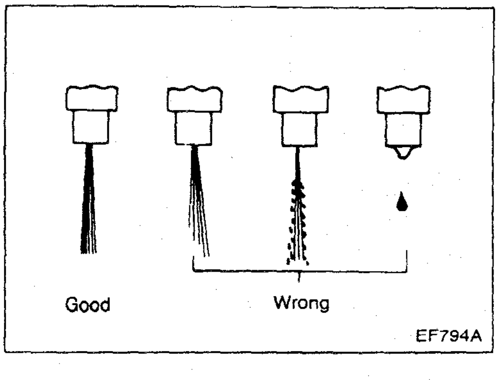
WARNING:

When using nozzle tester, do not allow fuel sprayed from nozzle to contact your hand or body, and make sure that your eyes are properly protected with goggles.

1. Check initial injection pressure by pumping tester handle one time per second.

   Initial injection pressure:
   Used Nozzle
   9,807 - 10,297 kPa
   (98.1 - 103.0 bar, 100 - 105 kg/cm^2,
   1,422 - 1,493 psi)
   New Nozzle
   10,297 - 11,278 kPa
   (103.0 - 112.8 bar, 105-115 kg/cm^2,
   1,493 - 1,635 psi)

- **Always check initial injection pressure before installing new nozzle.**



2. Check spray pattern by pumping tester handle 4 to 6 times or more per second.
3. If spray pattern is not correct, clean injection nozzle tip or replace it.

- **For details, refer to INJECTION NOZZLE ASSEMBLY in EF & EC section.**

Checking Injection Nozzle (Cont'd)

Injection nozzle to cylinder head:
🔧: 54 - 64 N·m
(5.5 - 6.5 kg-m, 40 - 47 ft-lb)
Spill tube nut:
🔧: 29 - 39 N·m
(3.0 - 4.0 kg-m, 22 - 29 ft-lb)
Injection tube:
🔧: 20 - 25 N·m
(2.0 - 2.5 kg-m, 14 - 18 ft-lb)

Checking Idle Speed

Preparation

1. Make sure that injection timing is correct.
2. Make sure that injection nozzles are in good condition.
3. Make sure that the following parts are in good condition.

- Air cleaner clogging
- Glow system
- Engine oil and coolant levels
- Valve clearance
- Air intake system (Oil filler cap, oil level gauge, etc.)

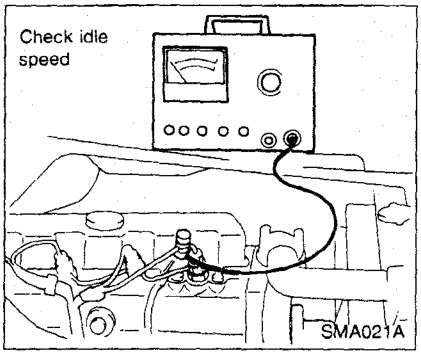
4. Set shift lever in "Neutral" position. Engage parking brake and lock both front and rear wheels with wheel chocks.
5. Turn off air conditioner, lights and accessories.

Checking Idle Speed (Cont'd)

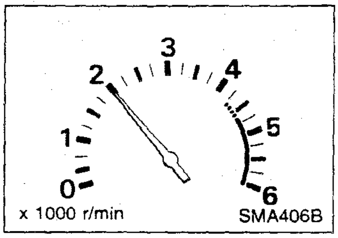
- Warm up engine until water temperature indicator points to middle of gauge.
- Lights, heater fan and all accessories are off.
- Attach tachometer's pick-up to No. 1 fuel injection tube.

In order to take accurate reading of engine rpm, remove clamps that secure No. 1 fuel injection tube.

Start engine.



Run engine at about 2,000 rpm for about 2 minutes under no-load.



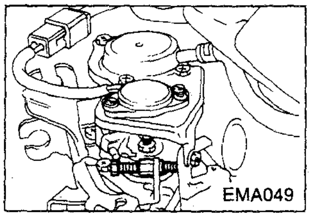
Run engine for one minute at idle speed.

Check idle speed.

IDLE SPEED:
700+ 50 rpm

O.K.

N.G.

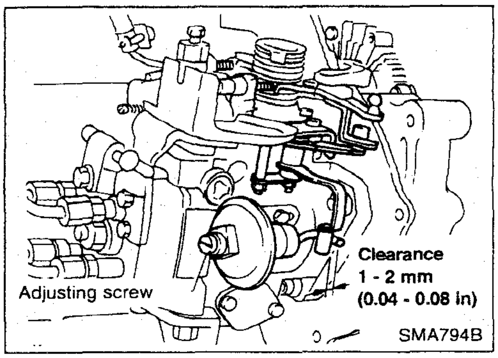


Adjust idle speed by turning idle speed adjusting screw.

END

- **Race engine two or three times and allow engine to return to idle speed. If idle speed is not within the specified range, check acceleration linkage for binding and correct it if necessary.**

Checking Idle Speed (Cont'd)



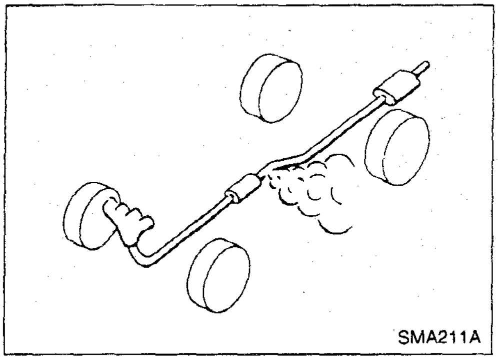
AIR CONDITIONER EQUIPPED MODEL

1. Make certain that the clearance between the actuator idle control lever pin and the injection pump control lever is within the specified limits.
2. Adjust idle speed to specified rpm without the air conditioner operating.
3. Then check the idle speed when the air conditioner is operating and make sure it is correct.

Unit: rpm

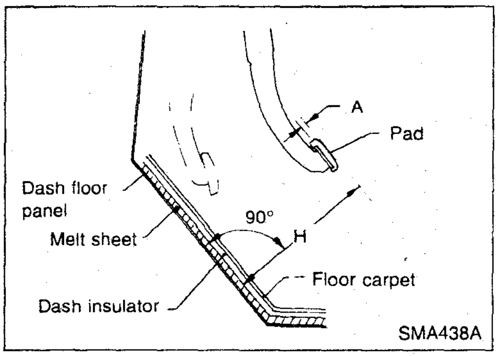
Idle speed (Air conditioner : "ON")	850 ± 50

If not, adjust it by turning F.I.C.D. actuator stroke adjusting screw.



Checking Exhaust System

Check exhaust pipes, muffler and mounting for proper attachment, leaks, cracks, damage, loose connections, chafing and deterioration. Replace all defective parts.

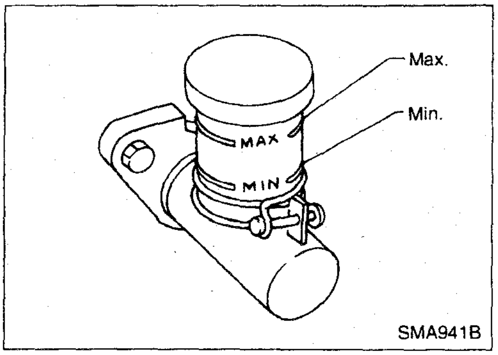


Checking Clutch Operation

Check clutch pedal height, free play and smooth operation.

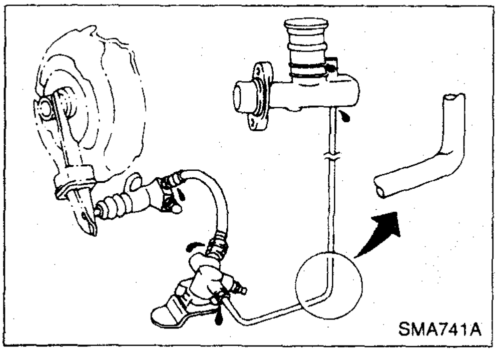
Pedal height "H":
217 - 227 mm (8.54 - 8.94 in)
Pedal free play "A":
1 - 3 mm (0.039 - 0.118 in)

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



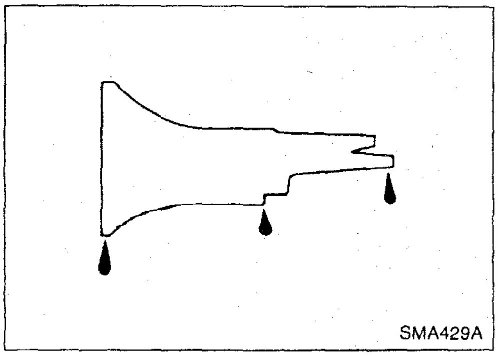
Checking Clutch Fluid Level and Leaks

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



Checking Clutch System

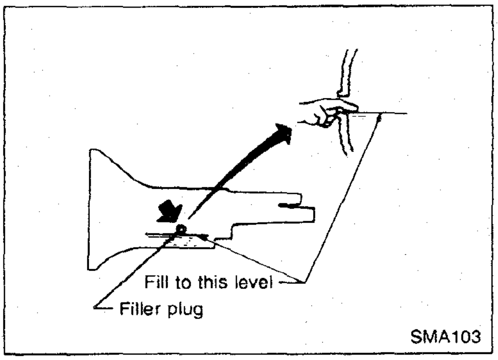
Check fluid lines and operating cylinder for improper attachment, cracks, damage, loose connections, chafing and deterioration.



Checking M/T Oil

1. Check for oil leakage.

Checking M/T Oil (Cont'd)



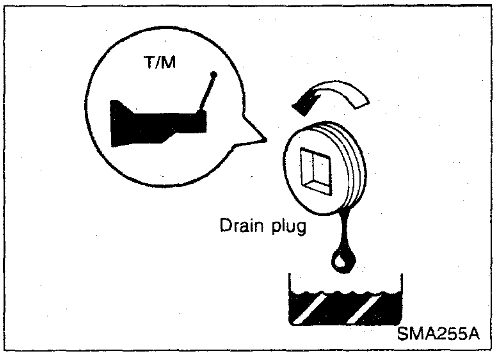
2. Check oil level.

Never start engine while checking oil level.

Filler plug:

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

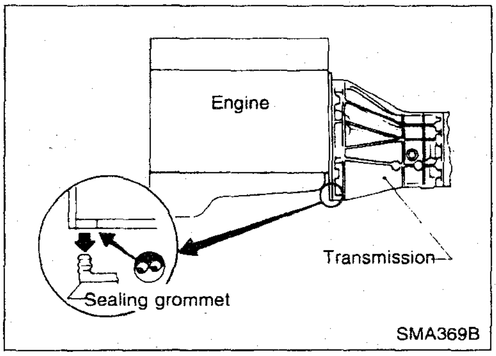
Changing M/T Oil



Oil capacity:

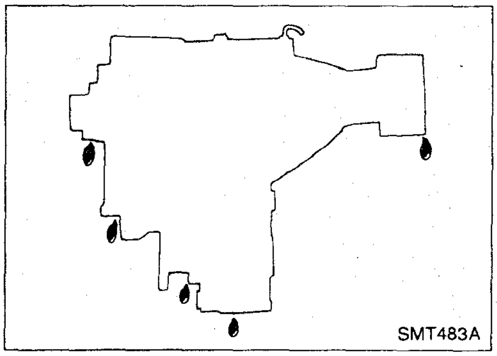
3.5 liters (6-1/8 Imp pt)

Checking Water Entry

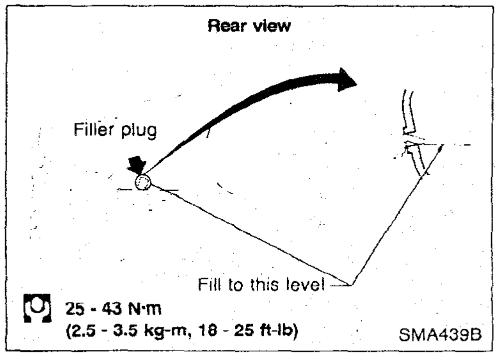


Check water entry in the clutch housing by removing the sealing grommet, whenever driving in deep water or mud.

Checking Transfer Oil



1. Check transfer for leakage.



2. Check oil level.

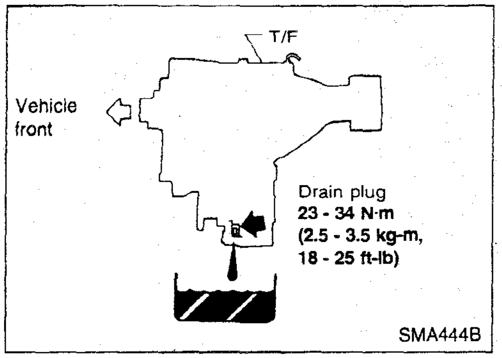
Never start engine while checking oil level.
"DEXRON^{TM}" type Automatic Transmission Fluid is used for the transfer in the factory. Never add gear oil (API GL-4) to Automatic Transmission Fluid.

Changing Transfer Oil

Oil capacity:
2.3 liters (2 Imp qt)

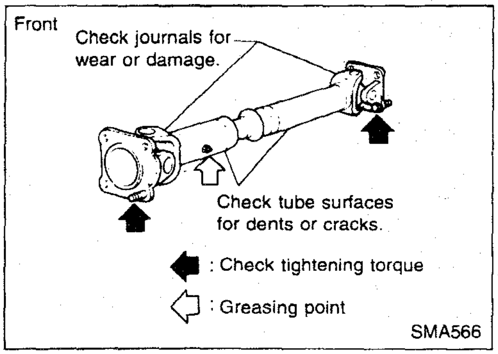
When changing transfer oil completely, either "DEXRON^{TM}" type Automatic Transmission Fluid or gear oil (API GL-4) may be used.

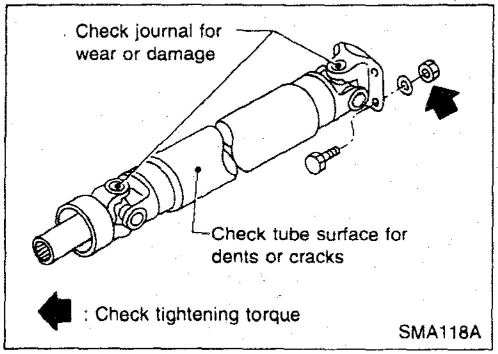
Do not mix Automatic Transmission Fluid and gear oil.



Checking Propeller Shaft

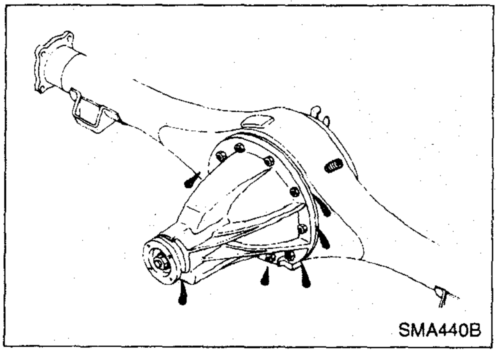
Check propeller shaft for damage, looseness or grease leakage.



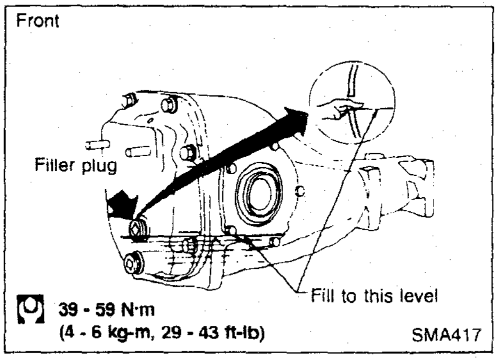


Checking Differential Gear Oil

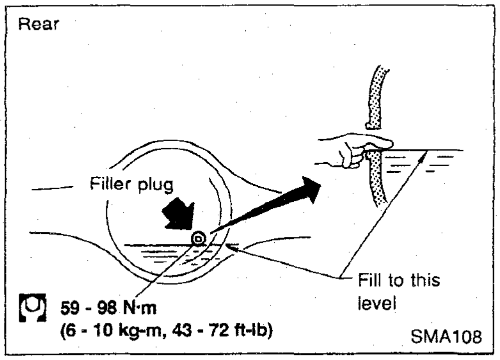
1. Check differential for oil leakage.



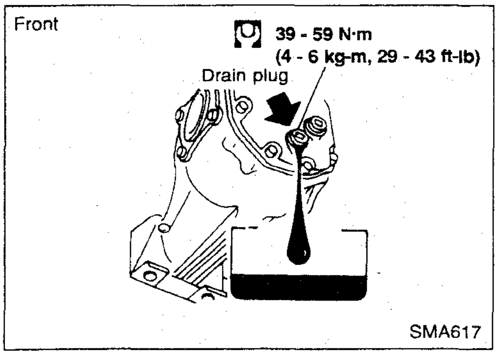
2. Check oil level.



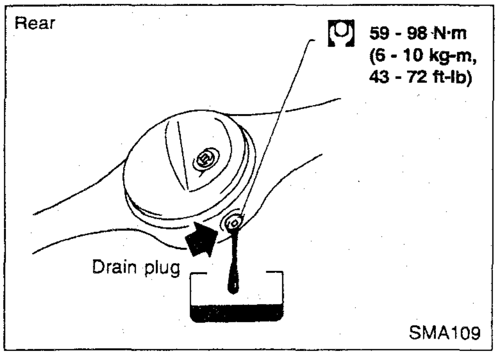
Checking Differential Gear Oil (Cont'd)



Changing Differential Gear Oil

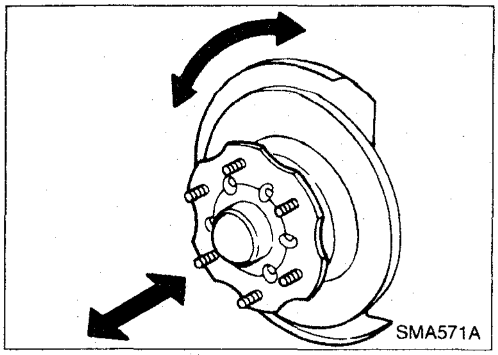


Oil capacity:
Front
  R180A
    1.3 liters (2-1/4 Imp pt)



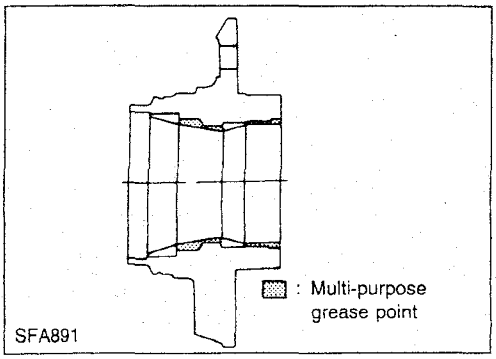
Oil capacity:
Rear
  H233B
    2.8 liters (4-7/8 Imp pt)

Checking Front Wheel Bearing Grease

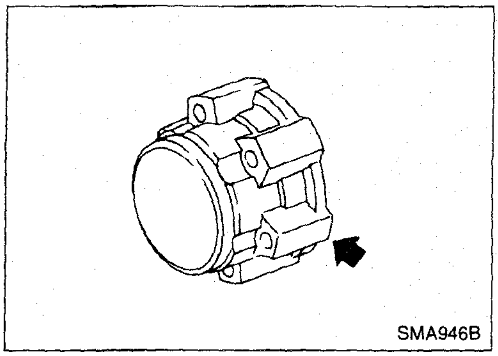


- Check that wheel bearings operate smoothly
- Check front wheel bearings for grease leakage and water or dust entry.
- Replace front wheel bearings or front wheel bearing greas if wheel bearings do not turn smoothly.

Repacking Front Wheel Bearing Grease

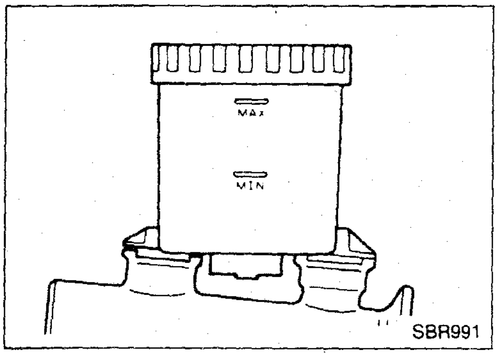


Apply multi-purpose grease sparingly to the following parts:
- Threaded portion of spindle
- Contact surface between wheel bearing washer and outer wheel bearing.
- Grease seal lip
- Hub cap or wheel hub (as shown at left)


SMA946B

Checking Free-running Hub Grease

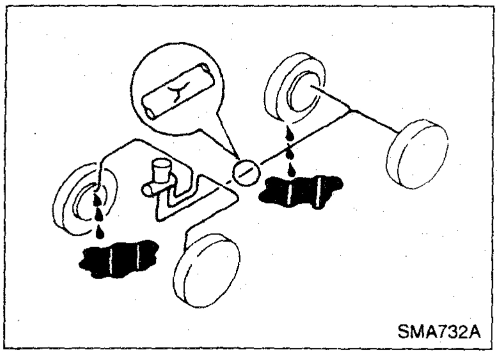
Check free-running hub grease for leakage and water or dust entry.



SBR991

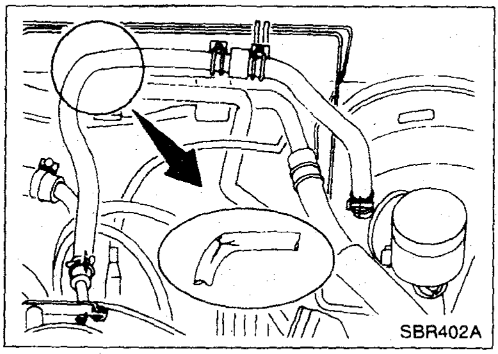
Checking Brake Fluid Level and Leaks

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


SMA732A

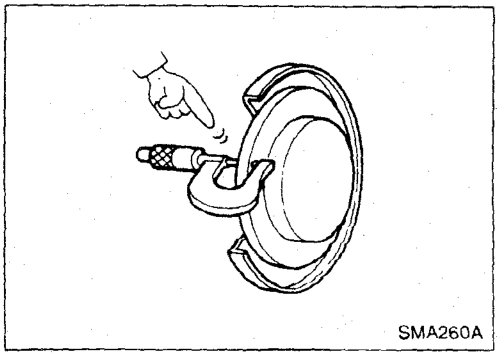
Checking Brake System

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


SBR402A

Checking Brake Booster, Vacuum Hoses, Connections and Check Valve

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


SMA260A

Checking Disc Brake

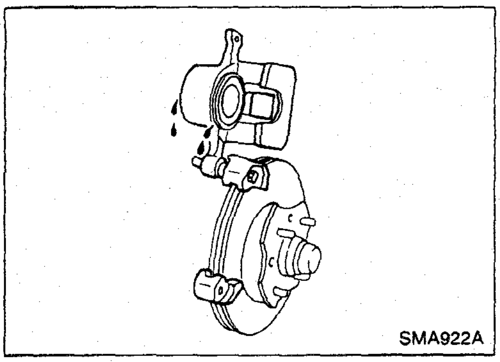
Check condition of disc brake components.

ROTOR

Check condition and thickness.

Standard thickness:
26 mm (1.02 in)
Minimum thickness:
24 mm (0.94 in)

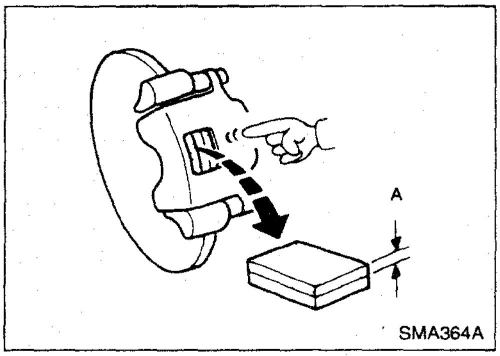
Checking Disc Brake (Cont'd)



SMA922A

CALIPER

Check operation and leakage.



SMA364A

PAD

Check wear or damage.

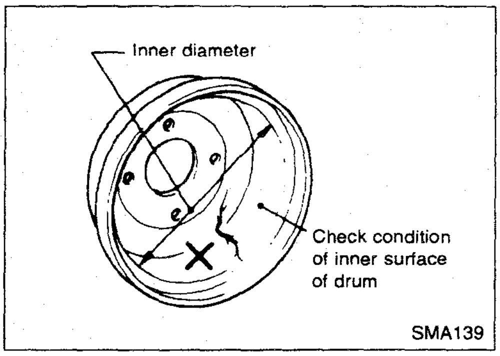
Standard thickness:
10 mm (0.39 in)
Minimum thickness:
2 mm (0.08 in)

Checking Drum Brake

Check condition of drum brake components.

WHEEL CYLINDER

Check operation and leakage.

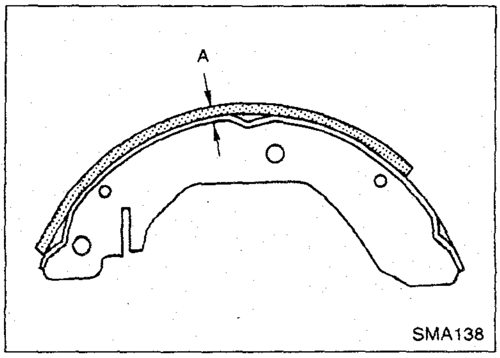


SMA139

DRUM

Check condition of inner surface.

Nominal diameter:
254 mm (10.0 in)
Maximum diameter:
255.5 mm (10.059 in)
Out of round maximum:
0.05 mm (0.002 in) or less

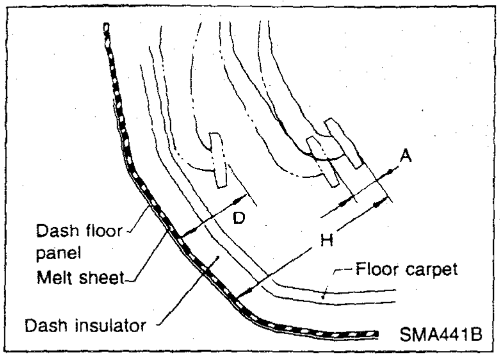


SMA138

LINING

Check wear or damage.

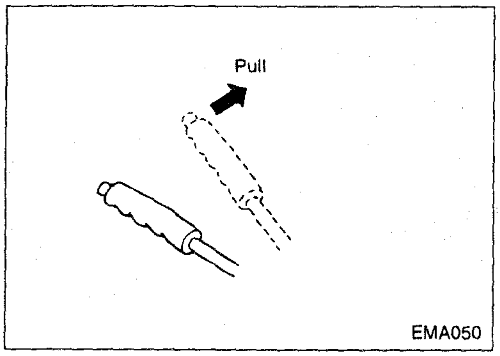
Standard thickness:
Rear: 4.3 mm (0.169 in)
Front: 5.8 mm (0.228 in)
Lining wear limit (Minimum thickness):
1.52 mm (0.06 in)



Checking Foot Brake Pedal Operation

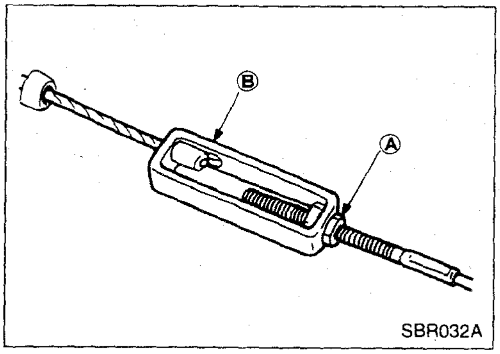
Check brake pedal free height, depressed height and for smooth operation.

H: Free height:
RHD: 196 - 206 mm (7.72 - 8.11 in)
LHD: 210 - 220 mm (8.27 - 8.66 in)
D: Depressed height:
Under force of 490 N (50 kg, 110 lb) with engine running
RHD: 137.7 mm (5.421 in)
LHD: 142.5 mm (5.61 in)
A: Pedal free play
1.0 - 3.0 mm (0.039 - 0.118 in)

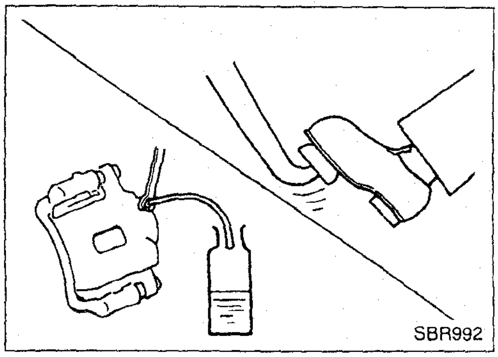


Checking Parking Brake

1. Pull lever with specified amount of force.
   Check lever stroke and for smooth operation.
   Number of notches
   [At pulling force of 196 N (20 kg, 44 lb)]:
   6 - 8



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



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.

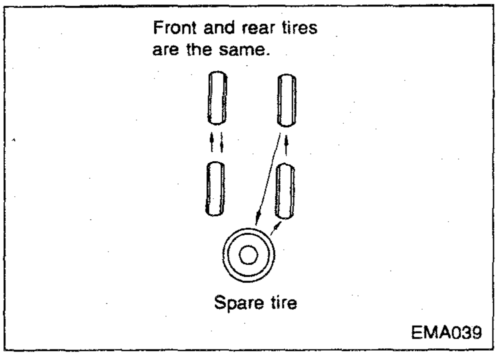
Refer to section BR

- **Refill with recommended brake fluid "DOT 4".**
- **Never reuse drained brake fluid.**
- **Be careful not to splash brake fluid on painted areas.**

Balancing Wheels

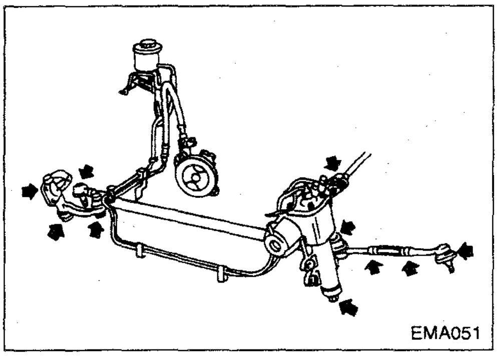
Adjust wheel balance using the road wheel center.

Radial runout limit:
0.5 mm (0.02 in)
Lateral runout limit:
0.8 mm (0.032 in)



Tire Rotation

Wheel nuts
⊡: 118 - 147 N·m (12 - 15 kg-m, 87 - 108 ft-lb)



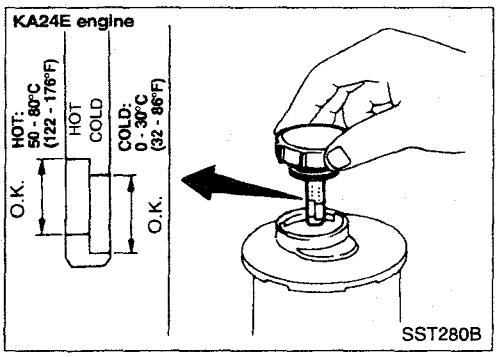
Checking Steering Gear and Linkage

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.

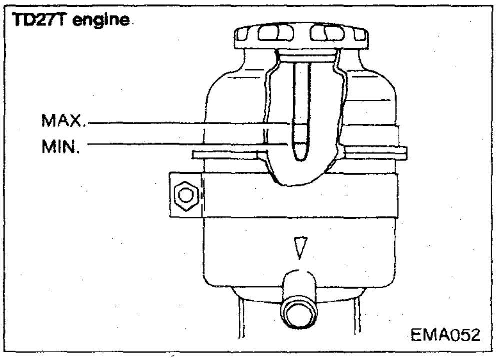


Checking Fluid Level and Leaks (Power steering)

Check fluid level.

KA24E ENGINE

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).



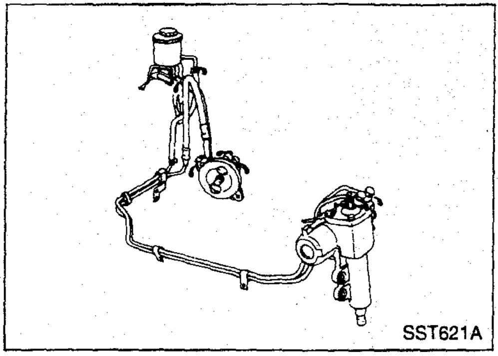
TD27T ENGINE

Fluid level should be checked at between 0° and 30 °C (32° to 86°F).

CAUTION:

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

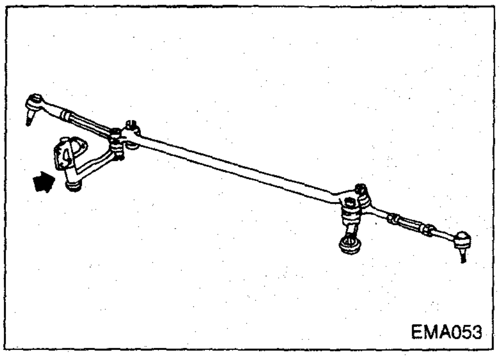
Checking Fluid Level and Leaks (Power steering) (Cont'd)



SST621A

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

Greasing Steering Linkage

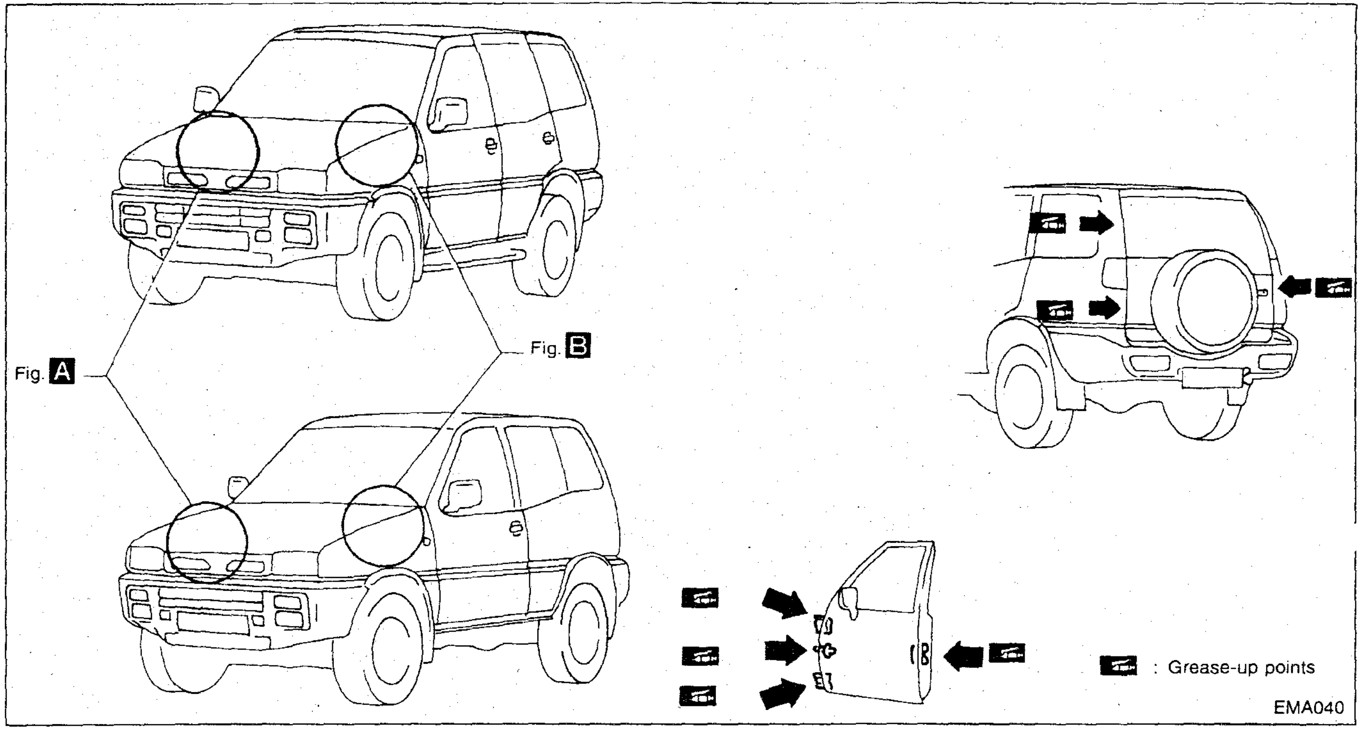


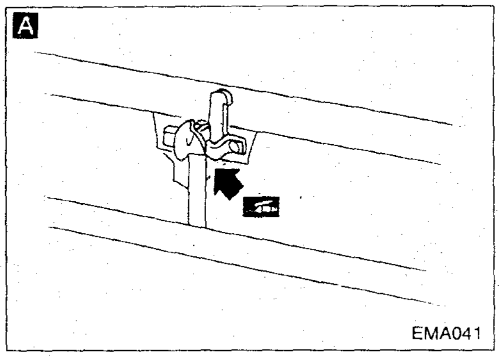
EMA053

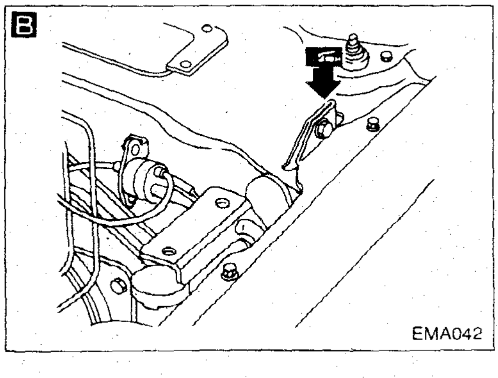
Apply multi-purpose grease to point shown in the illustration.

Body

LUBRICATING HOOD LATCHES, LOCKS AND HINGES

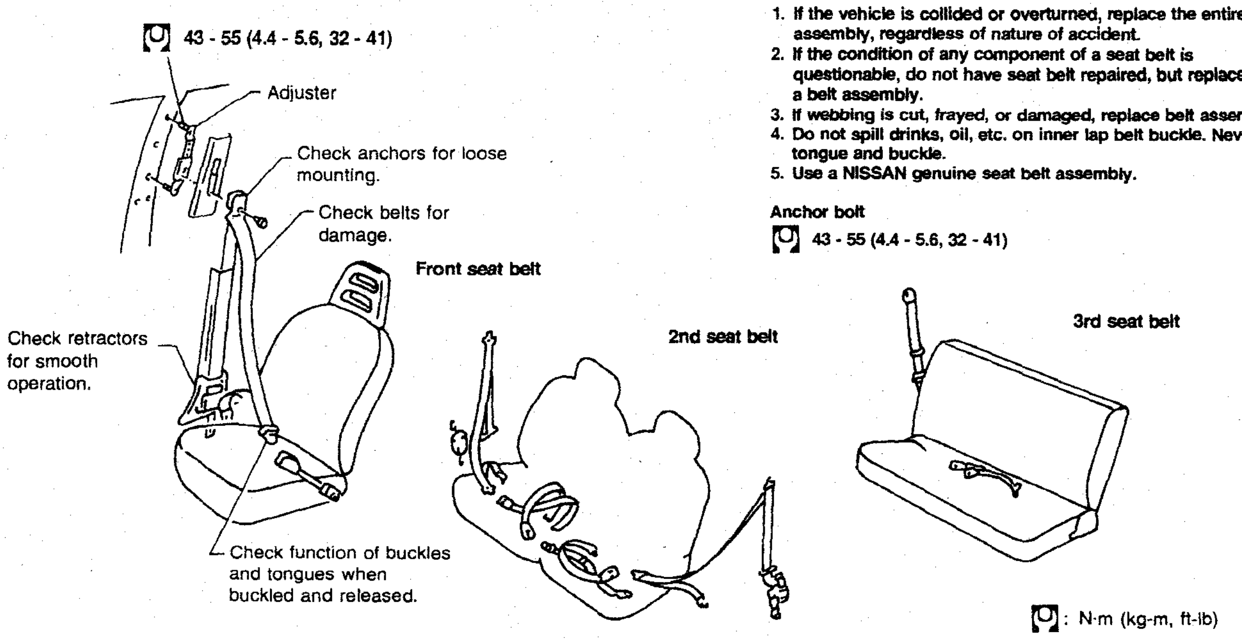






Body (Cont'd)

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, sun roof opening, fender wheel-arch flange, fuel filler lid flange, around holes in panel, etc.

Parts contact

Waist moulding, windshield moulding, 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.

SERVICE DATA AND SPECIFICATIONS (S.D.S.)

Engine Maintenance

INSPECTION AND ADJUSTMENT

Drive belt deflection

Unit: mm (in)

	Used belt deflection				Deflection of new belt	
	Limit		Deflection after adjustment			
Engine	KA24E	TD27T	KA24E	TD27T	KA24E	TD27T
Alternator	17 (0.67)	20 (0.79)	10 - 12 (0.39 - 0.47)	11 - 13 (0.43 - 0.51)	8 - 10 (0.32 - 0.39)	9 - 11 (0.35 - 0.43)
Air conditioner	16 (0.63)	12 (0.47)	10 - 12 (0.39 - 0.47)	6 - 7.5 (0.236 - 0.295)	8 - 10 (0.32 - 0.39)	5 - 6.5 (0.197 - 0.256)
Power steering oil pump	15 (0.59)	15 (0.59)	9 - 11 (0.35 - 0.43)	8 - 9.5 (0.315 - 0.374)	7 - 9 (0.28 - 0.35)	7 - 8.5 (0.276 - 0.335)
Applied pushing force	98 N (10 kg, 22 lb)					

Oil capacity (Refill capacity)

Unit: ℓ (Imp qt)

Engine	KA24E	TD27T
With oil filter change	4.3 (3-3/4)	7.2 (6-3/8)
Without oil filter change	3.9 (3-3/8)	6.5 (5-3/4)

Coolant capacity (Refill capacity)

Unit: ℓ (Imp qt)

Engine	KA24E	TD27T
Without reservoir tank	6.9 (6-1/8)	10 (8-3/4)
Reservoir tank	0.8 (3/4)	

Spark plug (KA24E)

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

Injection nozzle (TD27T)

Unit: kPa (bar, kg/cm², psi)

Initial injection pressure		
	New	9,807 - 10,297 (98,1 - 103.0, 100 - 105, 1,422 - 1,493)
	Used	10,297 - 11,278 (103.0 - 112.8, 105 - 115, 1,493 -1,635)

Valve clearance (Hot)

Unit: mm (in)

Engine	KA24E	TD27T
Intake	— (Hydraulic valve lifter)	0.25 (0.01)
Exhaust		

Idle speed

Unit: rpm

Engine	KA24E	TD27T
With A/C	800 ± 50	850 ± 50
Without A/C		700 ± 50

Chassis and Body Maintenance

INSPECTION AND ADJUSTMENT

Clutch

Unit: mm (in)

Vehicle model	All
Pedal free height	217 - 227 (8.54 - 8.94)
Pedal free play	1.0 - 3.0 (0.04 - 0.12)
Pedal free travel	145 (5.71)

Front axle and front suspension (Unladen)*1

Unit: degree

Model	HARDTOP WAGON
Camber	0°35′ ± 30′
Caster	1°40′ ± 30′
Kingpin inclination	7°36′ ± 8°36′
Toe-in A-B mm (in)	3 - 5 (0.12 - 0.20)
Front wheel turning angle (degrees) (Full turn) *2 Inside	35^{+0}_{-2}
Outside	33^{+0}_{-2}

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

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

Brake

Disc brake mm (in) LD28VA		
Pad		
Standard thickness	10 (0.39)	
Minimum thickness	2.0 (0.08)	
Rotor		
Standard thickness	26.0 (1.02)	
Minimum thickness	24.0 (0.94)	
Drum brake mm (in) LT25LD – Hardtop LT25LE – Wagon		
Lining		
Standard thickness		
Rear	4.3 (0.169)	
Front	5.8 (0.288)	
Minimum thickness	1.52 (0.06)	
Drum		
Standard diameter	254.0 (10.00)	
Maximum diameter	255.5 (10.059)	
Pedal mm (in)	RHD	LHD
Free height	196 - 206 (7.72 - 8.11)	210 - 220 (8.27 - 8.66)
Free play	1 - 3 (0.04 - 0.12)	
Full stroke	137.7 (5.421)	142.5 (5.61)
Parking brake Number of notches [at pulling force 196 N (20 kg, 44 lb)]	6 - 8	

Wheel balance

Unit: mm (in)

Wheel type	Steel
	15" x 6J
Radial runout limit	0.5 (0.02)
Lateral runout limit	0.8 (0.032)

Wheel bearing

Axial end play limit mm (in)	0
Lock nut Tightening torque N·m (kg-m, ft-lb)	78 - 98 (7.9 - 10, 57 - 72)
Retightening torque N·m(kg-m, ft-lb)	0.5 - 1.5 (0.05 - 0.15, 0.4 - 1.1)

TIGHTENING TORQUE

Unit	N·m	kg-m	ft-lb
Clutch			
Pedal stopper lock nut	12 - 15	1.2 - 1.5	9 - 11
Master cylinder push rod lock nut	8 - 11	0.8 - 1.1	5.8 - 8.0
Manual transmission			
Drain and filler plugs			
FS5W71C	25 - 34	2.5 - 3.5	18 - 25
Differential carrier			
Drain and filler plugs			
R180A	39 - 59	4 - 6	29 - 43
H 233 B	59 - 98	6 - 10	43 - 72
Front axle and front suspension			
Tie-rod lock nut	60 - 70	6.1 - 7.1	44 - 51
Brake system			
Air bleeder valve	7 - 9	0.7 - 0.9	5.1 - 6.5
Wheel and tire			
Wheel nut	118 - 147	12 - 15	87 - 108

ENGINE MECHANICAL

SECTION EM

ENGINE MECHANICAL

SECTION EM

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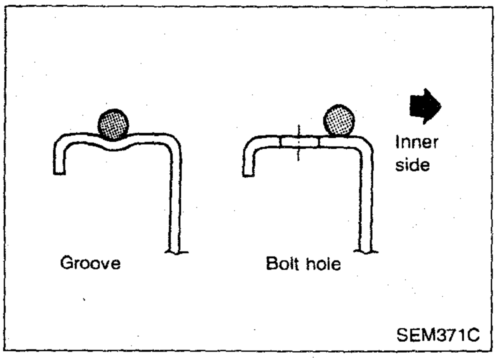
Parts Requiring Angular Tightening

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



SEM371C

Liquid Gasket Application Procedure

a. Before applying liquid gasket, use a scraper to remove all traces of old liquid gasket from mating surface and grooves, and then completely clean any oil stains from these portions.

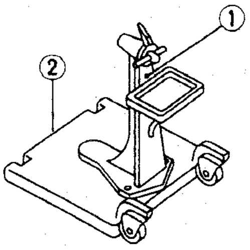
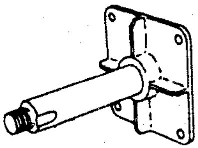
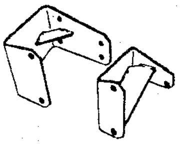
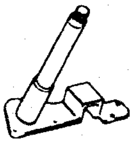
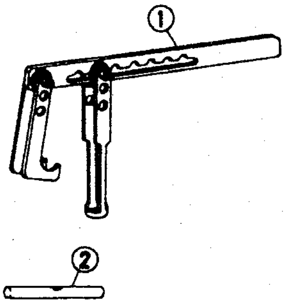
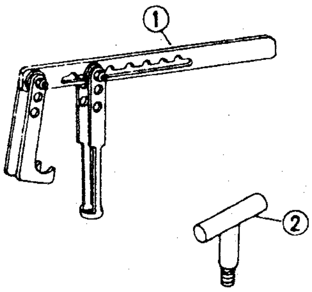
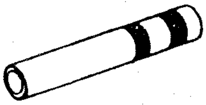
b. Apply a continuous bead of liquid gasket to mating surfaces. (Use Genuine Liquid Gasket or equivalent.)
  - **Be sure liquid gasket is 3.5 to 4.5 mm (0.138 to 0.177 in) wide (oil pan).**
  - **Be sure liquid gasket is 2.0 to 3.0 mm (0.079 to 0.118 in) wide (in areas except oil pan).**

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

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

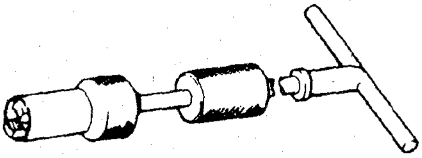
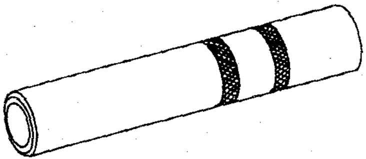
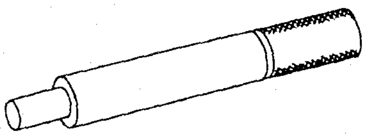
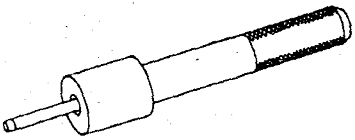
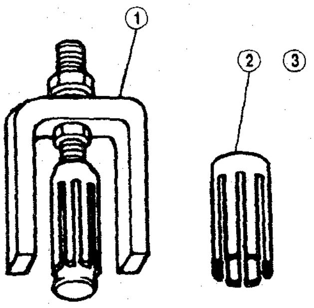
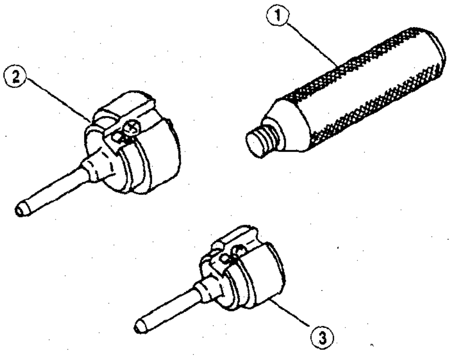
SPECIAL SERVICE TOOLS

*: Special tool or commercial equivalent

Tool number Tool name	Description	Engine application	
		KA24E	TD27T
ST0501S000* Engine stand assembly ① ST05011000 Engine stand ② ST05012000 Base	 Disassembling and assembling	X	X
KV10106500* Engine attachment		—	X
KV11103200* Engine sub-attachment		—	X
KV10105001 Engine attachment		X	—
KV101092S0 Valve spring compressor ① KV10109210 Compressor ② KV10109220 Adapter	 Disassembling and assembling valve components	X	—
① KV10109210* Valve spring compressor ② KV10111200* Adapter	 Disassembling and assembling valve components	—	X
KV109B0010 Valve oil seal drift	 Installing valve oil seal	X	—

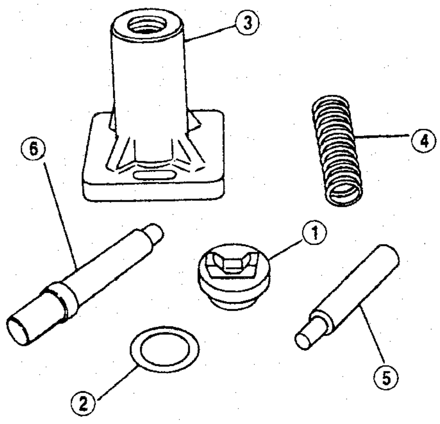
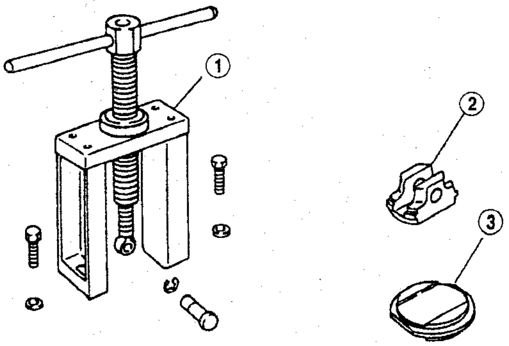
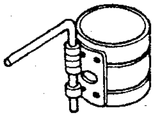
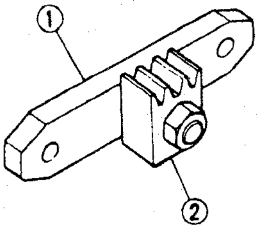
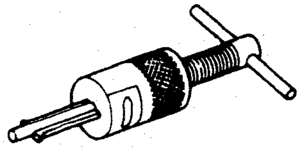
SPECIAL SERVICE TOOLS

*: Special tool or commercial equivalent

Tool number Tool name	Description	Engine application	
		KA24E	TD27T
KV10107900* Valve oil seal puller	 Disassembling valve oil seal	—	X
KV11103400 Valve oil seal drift	 Installing valve oil seal	—	X
ST11033000* Valve guide drift	 Removing valve guide	—	X
KV11103900* Valve guide drift	 Installing valve guide	—	X
① KV11101110 Valve seat remover ② KV11103610 Adapter (Intake) ③ KV11103620 Adapter (Exhaust)	 Removing valve seat	—	X
① ST15243000 Valve seat drift ② KV11103810 Adapter (Intake) ③ KV11103820 Adapter (Exhaust)	 Installing valve seat	—	X

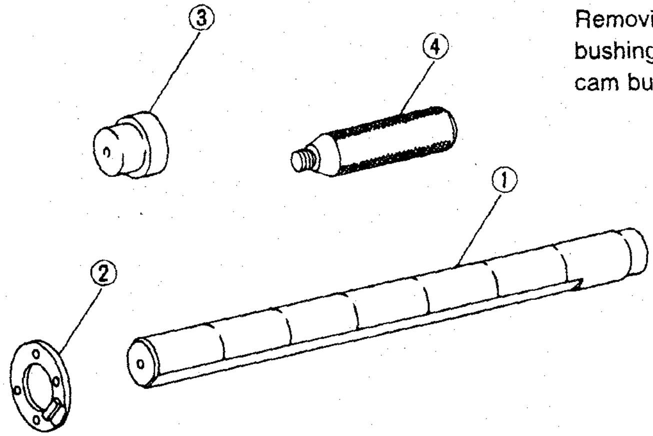
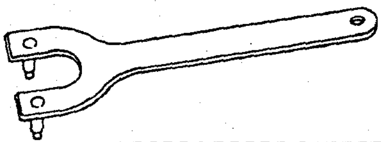
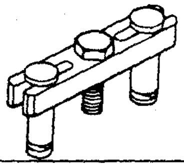
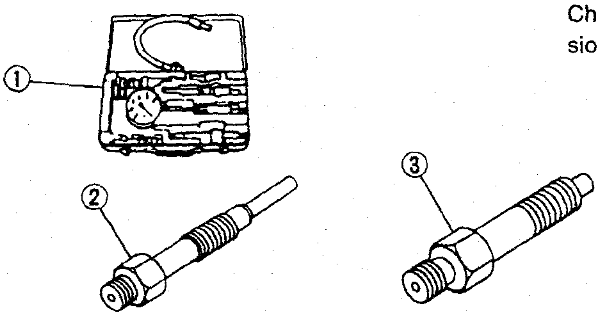
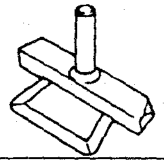
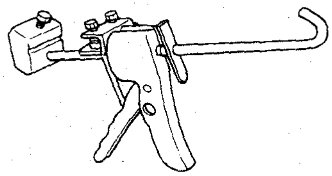
SPECIAL SERVICE TOOLS

*: Special tool or commercial equivalent

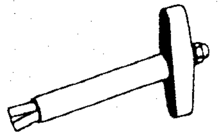
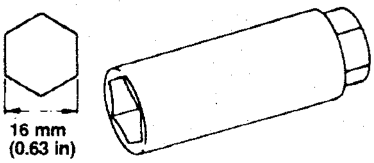
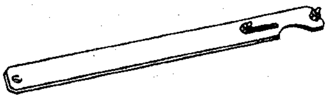
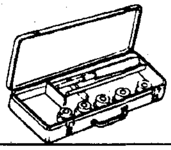
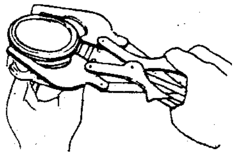
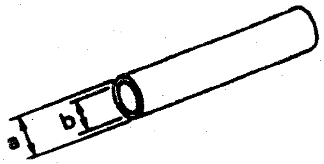
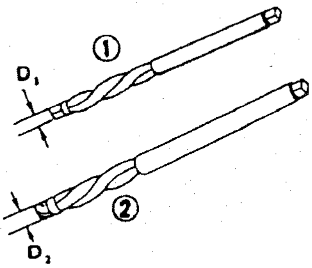
Tool number Tool name	Description		Engine application	
			KA24E	TD27T
KV10110300 Piston pin press stand assembly ① KV10110310 Cap ② KV10110330 Spacer ③ ST13030020 Press stand ④ ST13030030 Spring ⑤ KV10110340 Drift ⑥ KV10110320 Center shaft		Disassembling and assembling piston with connecting rod	X	—
① KV11104010 Cylinder liner tool ② KV11104110 Adapter for removing ③ KV11104030 Adapter for installing		Removing and installing cylinder liner	—	X
EM03470000* Piston ring compressor		Installing piston into cylinder	X	X
KV111033S0 Engine stopper ① KV11103310 Stopper plate ② KV10105630 Stopper gear		Preventing crankshaft from rotating	—	X
ST16610001* Pilot bushing puller		Removing pilot bushing	X	X

SPECIAL SERVICE TOOLS

*: Special tool or commercial equivalent

Tool number Tool name	Description		Engine application	
			KA24E	TD27T
KV111045SO Cam bushing replacer set ① KV11104510 Replacer bar ② KV1104520 Guide plate ③ KV11104530 Adapter (1st bushing) ④ ST15243000 Drift		Removing cam bushing or installing cam bushing	—	X
KV10109300* Injection pump drive gear holder		Preventing drive gear from rotating	—	X
KV11103000* Injection pump drive gear puller		Removing drive gear	—	X
① ED19601000 Compression gauge ② ED19600600 Compression gauge adapter (for glow plug hole) ③ ED19600700 Compression gauge adapter (for injector hole)		Checking compression pressure	—	X
KV10111100 Seal cutter		Removing oil pan	X	—
WS39930000* Tube presser		Pressing the tube of liquid gasket	X	X

COMMERCIAL SERVICE TOOLS

<table>
<tr><th rowspan="2">Tool name</th><th rowspan="2">Description</th><th colspan="2">Engine application</th></tr>
<tr><th>KA24E</th><th>TD27T</th></tr>
<tr><td>Valve oil seal remover</td><td>Removing valve oil seal
</td><td>X</td><td>—</td></tr>
<tr><td>Spark plug wrench</td><td>Removing and installing spark plug

 </td><td>X</td><td>—</td></tr>
<tr><td>Pulley holder</td><td>Holding camshaft pulley while tightening or loosening camshaft bolt
</td><td>X</td><td>—</td></tr>
<tr><td>Valve seat cutter set</td><td>Finishing valve seat dimensions
</td><td>X</td><td>—</td></tr>
<tr><td>Piston ring expander</td><td>Removing and installing piston ring
</td><td>X</td><td>X</td></tr>
<tr><td>Valve guide drift</td><td>Removing and installing valve guide
Diameter: mm (in)
<table>
<tr><th colspan="2"></th><th>Intake</th><th>Exhaust</th></tr>
<tr><td rowspan="2">KA24E</td><td>A</td><td>10.5 (0.413)</td><td>11.5 (0.453)</td></tr>
<tr><td>B</td><td>6.6 (0.260)</td><td>7.6 (0.299)</td></tr>
</table>

 </td><td>X</td><td>—</td></tr>
<tr><td>Valve guide reamer</td><td>Reaming valve guide ① or hole for oversize valve guide ②
Intake:
D_1 = 7.0 mm (0.276 in) dia.
D_2 = 11.2 mm (0.441 in) dia.
Exhaust:
D_1 = 8.0 mm (0.315 in) dia.
D_2 = 12.2 mm (0.480 in) dia.

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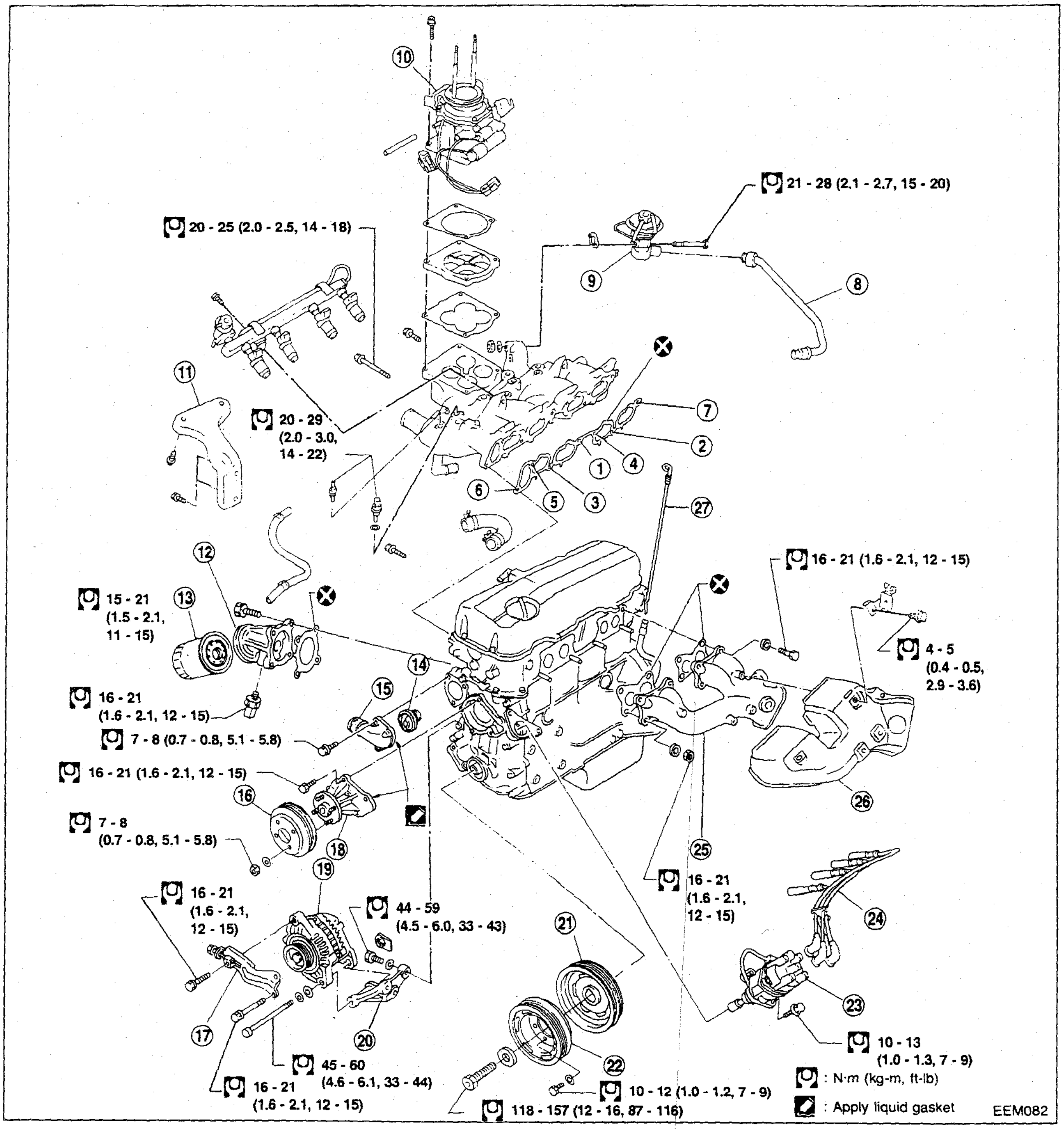
</table>

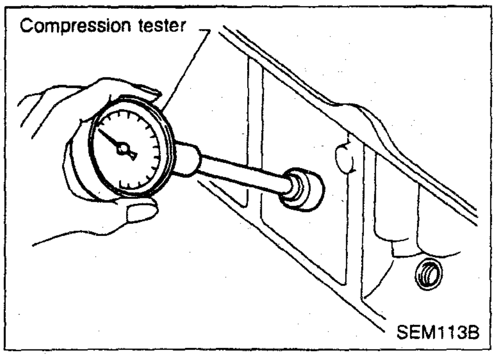
OUTER COMPONENT PARTS



①-⑦ Intake manifold installation
⑧ E.G.R. tube
⑨ E.G.R. valve
⑩ Throttle chamber
⑪ Manifold stay
⑫ Oil filter bracket
⑬ Oil filter
⑭ Thermostat
⑮ Water inlet
⑯ Water pump pulley
⑰ Adjusting bar
⑱ Water pump
⑲ Alternator
⑳ Alternator bracket
㉑ Crank pulley
㉒ Crank pulley damper
㉓ Distributor
㉔ High-tension cable
㉕ Exhaust manifold
㉖ Cover
㉗ Oil level gauge

Measurement of Compression Pressure

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



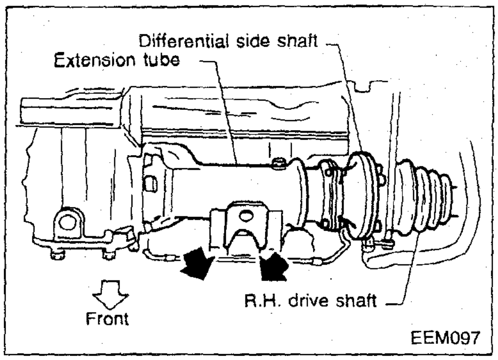
6. Attach a compression tester to No. 1 cylinder.
7. Depress accelerator pedal fully to keep throttle valve wide open.
8. Crank engine and record highest gauge indication.
9. Repeat the measurement on each cylinder as shown above.

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

Compression pressure: kPa (bar, kg/cm^2, psi)/rpm
Standard
1,324 (13.24, 13.5, 192)/300
Minimum
981 (9.8, 10, 142)/300
Difference limit between cylinders
98 (0.98, 1.0, 14)/300

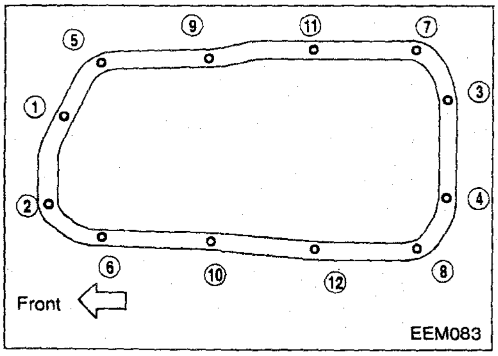
10. If cylinder compression in one or more cylinders is low, pour a small amount of engine oil into cylinders through spark plug holes and retest compression.

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

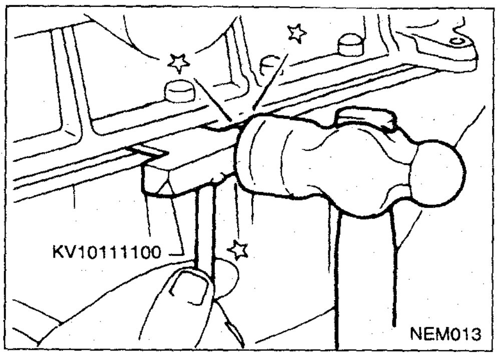


Removal

1. Raise vehicle and support it with safety stands.
2. Remove protecting covers.
3. Drain engine oil.
4. Remove R.H. lower shock absorber mounting bolt and move shock absorber up.
5 Disconnect R.H. drive shaft from axle by removing the six bolts. Then move the drive shaft toward the rear of the vehicle.
6 Disconnect differential side shaft from extension tube by removing bolts and pull out differential side shaft partly.
7. Disconnect extension tube from front differential by removing mounting bolts. Then remove extension tube with differential side shaft.



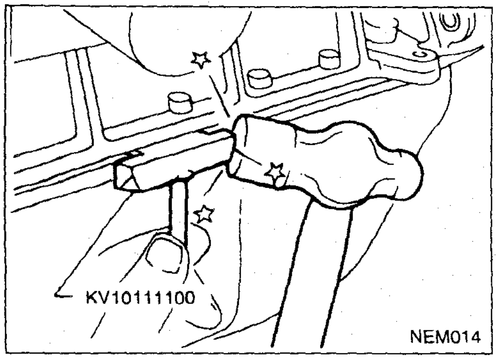
8. Remove oil pan bolts as shown at left.



9. Remove oil pan.

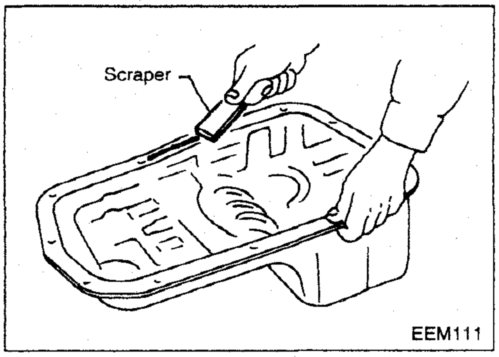
(1) Insert Tool between cylinder block and oil pan.

- **Do not drive seal cutter into oil pump or rear oil seal retainer portion, as aluminum mating face will be damaged.**
- **Do not insert screwdriver, as oil pan flange will be deformed.**

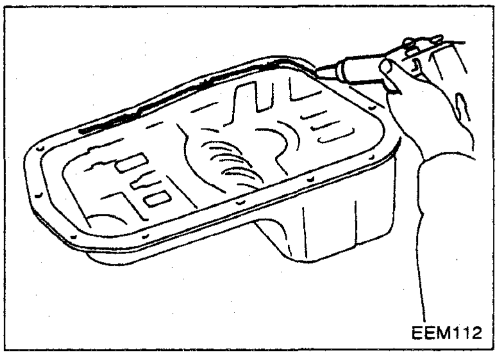


(2) Slide Tool by tapping its side with a hammer, and remove oil pan.

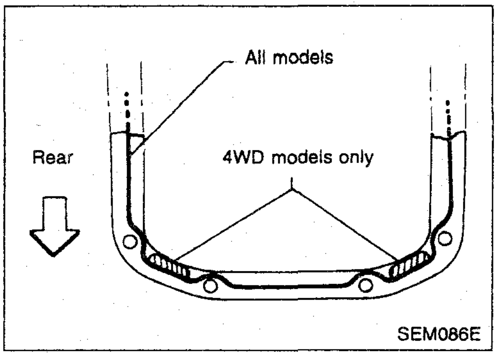
Installation

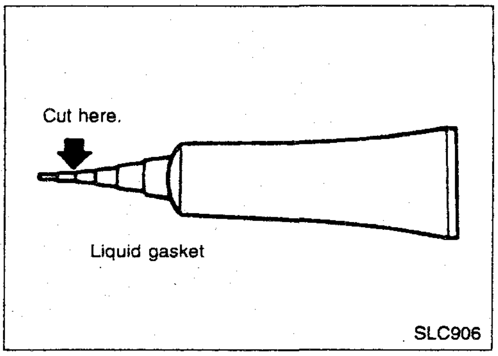


1. Before installing oil pan, remove all traces of liquid gasket from mating surface using a scraper.
- **Also remove traces of liquid gasket from mating surface of cylinder block.**

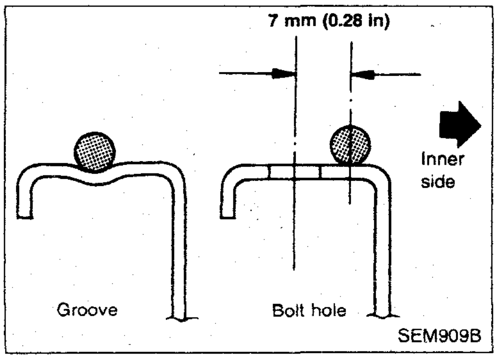


2. Apply a continuous bead of liquid gasket to mating surface of oil pan.
- **Use Genuine Liquid Gasket or equivalent.**



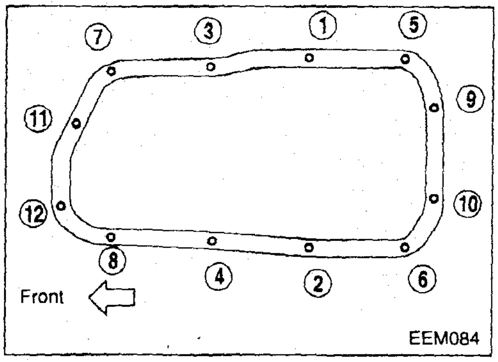


- Be sure liquid gasket is 3.5 to 4.5 mm (0.138 to 0.177 in) wide.

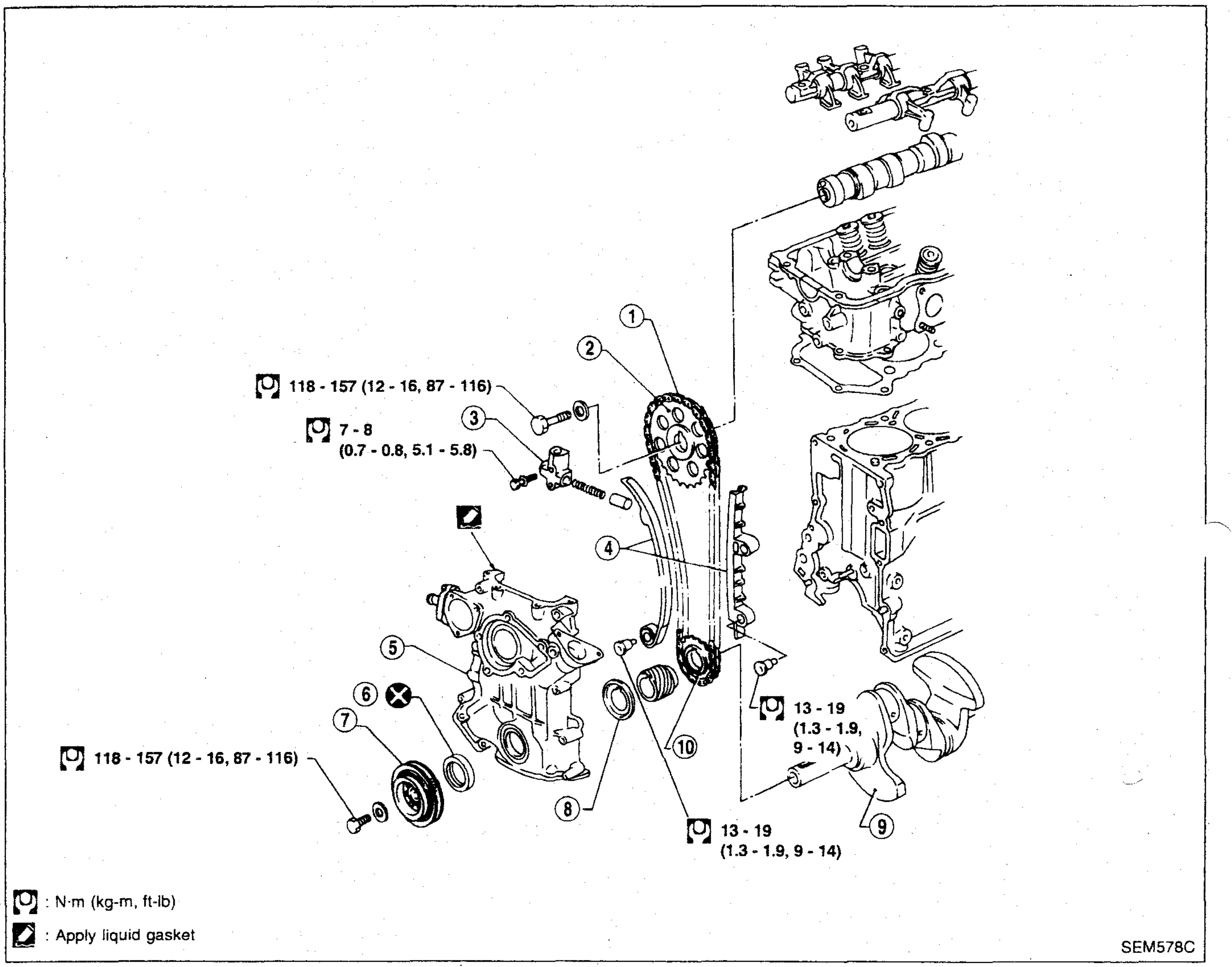


3. Apply liquid gasket to inner sealing surface as shown in figure.
- **Attaching should be done within 5 minutes after coating.**
4. Install oil pan.
- **Wait at least 30 minutes before refilling engine oil.**

Installation (Cont'd)



5. Tighten oil pan bolts as shown at left.
6 Install all removed parts in reverse order of removal.



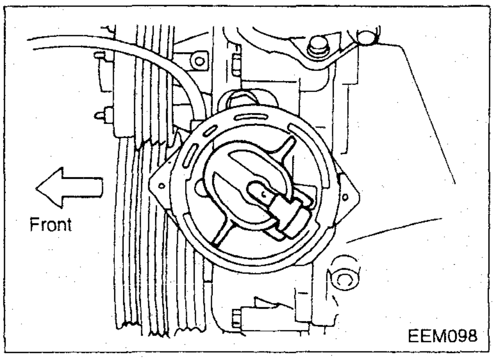
① Timing chain
② Camshaft sprocket
③ Chain tensioner
④ Chain guide
⑤ Front cover
⑥ Front oil seal
⑦ Crank pulley
⑧ Oil thrower
⑨ Crankshaft
⑩ Crankshaft sprocket

CAUTION:

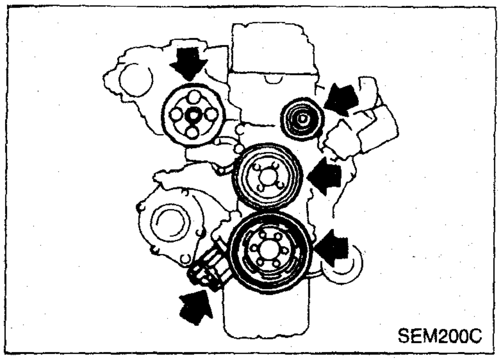
After removing timing chain, do not turn crankshaft and camshaft separately, or valves will strike piston heads.

Removal

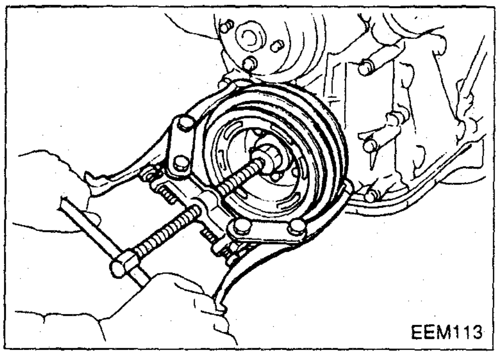
1. Disconnect-battery terminal.
2. Drain coolant from radiator.
3. Remove radiator shroud and cooling fan.
4. Remove the following belts.
- Power steering drive belt
- Compressor drive belt
- Alternator drive belt
5. Remove all spark plugs.
6. Set No. 1 piston at T.D.C. on its compression stroke.

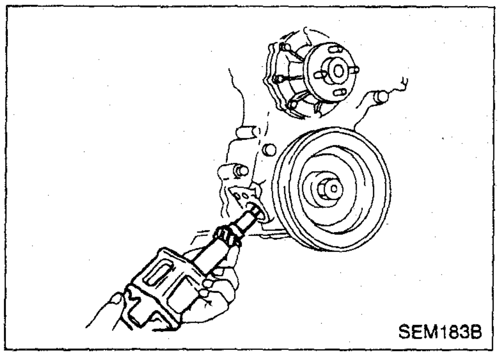


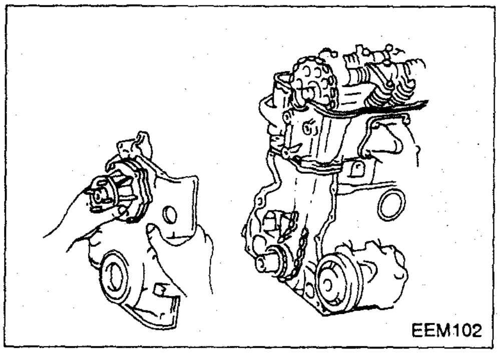
Removal (Cont'd)


SEM200C

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

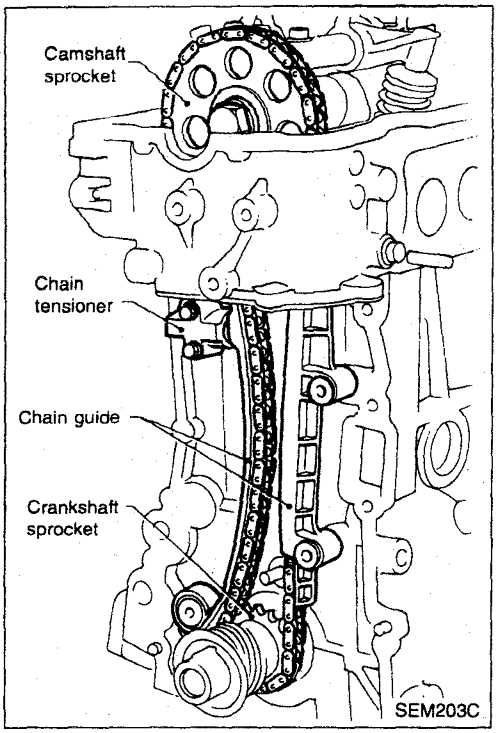

EEM113


SEM183B


EEM102

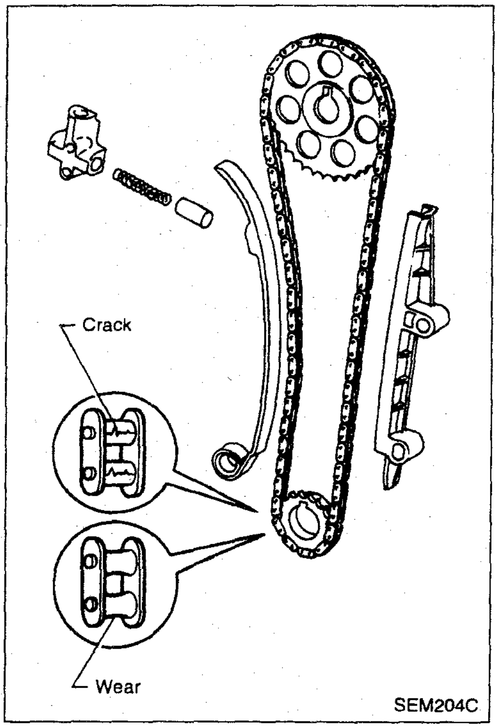
8. Remove oil pan. (Refer to "OIL PAN".)
9. Remove front cover.

Removal (Cont'd)



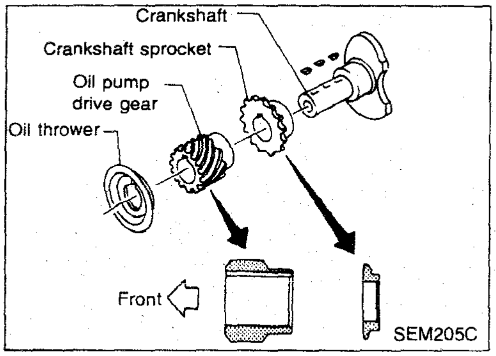
10. Remove the following parts.
- Chain tensioner
- Chain guides
- Timing chain and sprocket
- Oil thrower, oil pump drive gear and crankshaft sprocket

Inspection



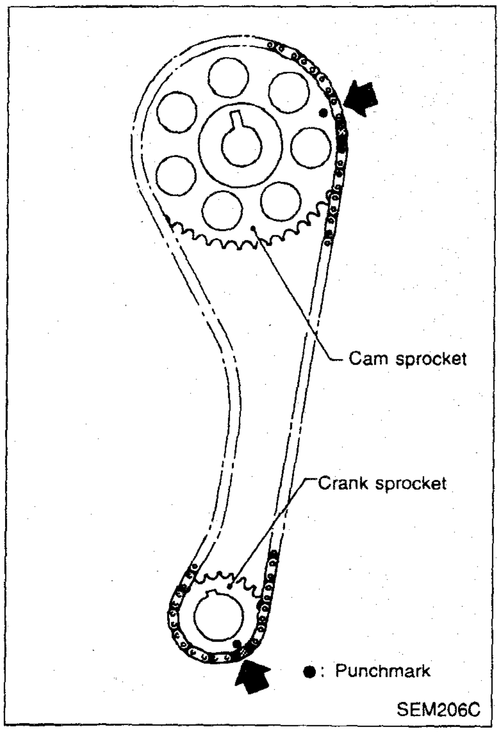
Check for cracks and excessive wear at roller links. Replace if necessary.

Installation



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

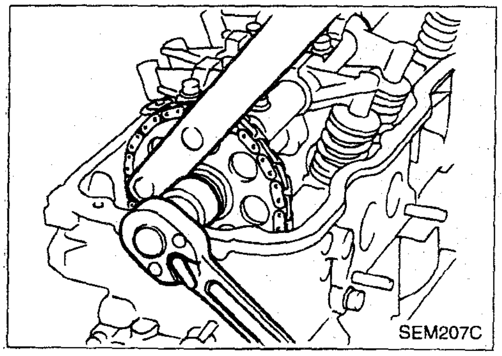
Installation (Cont'd)



SEM206C

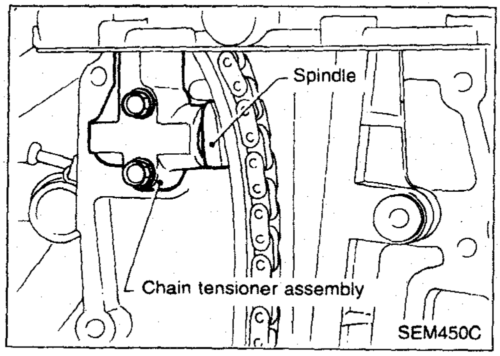
2. Install camshaft sprocket.
3. Confirm that No. 1 piston is set at T.D.C. on its compression stroke.
4. Install timing chain.

- **Set timing by aligning its mating marks with those of crankshaft sprocket and camshaft sprocket.**



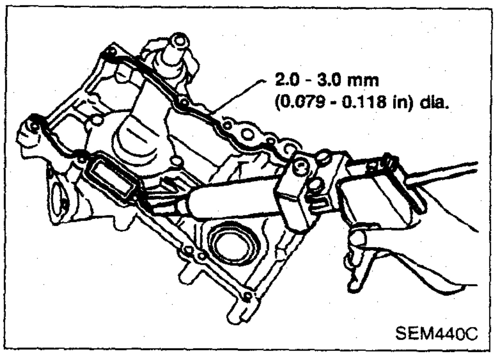
SEM207C

5. Tighten camshaft sprocket bolt.



SEM450C

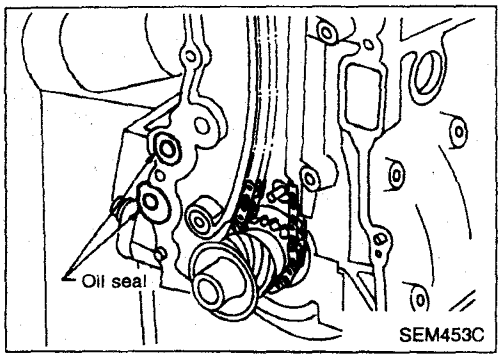
6. Install chain guides and chain tensioner.



SEM440C

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

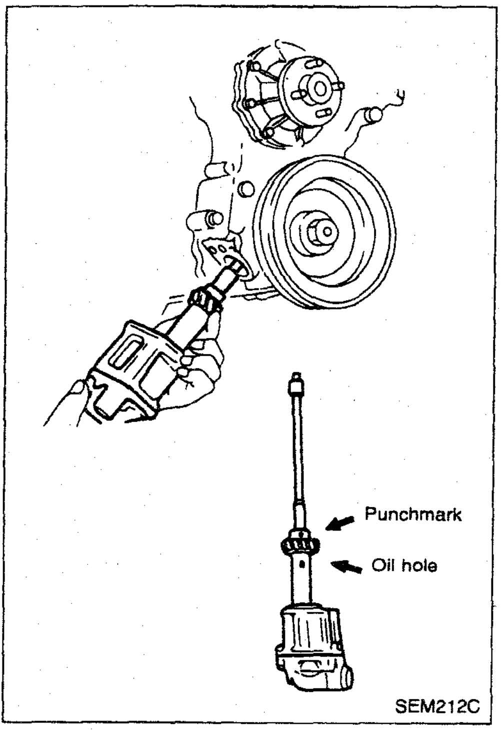
Installation (Cont'd)



9. Install front cover.

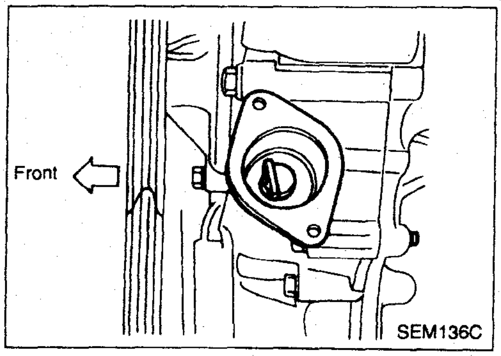
- **Be careful not to damage cylinder head gasket.**
- **Do not forget oil seals.**

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

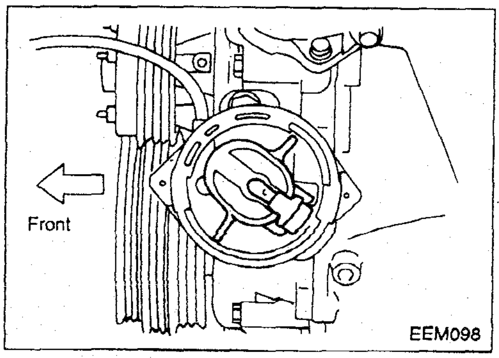


12. Install oil pump and distributor driving spindle with new gasket in front cover.

(1) Assemble oil pump and driving spindle, aligning punchmark on driving spindle with oil hole.

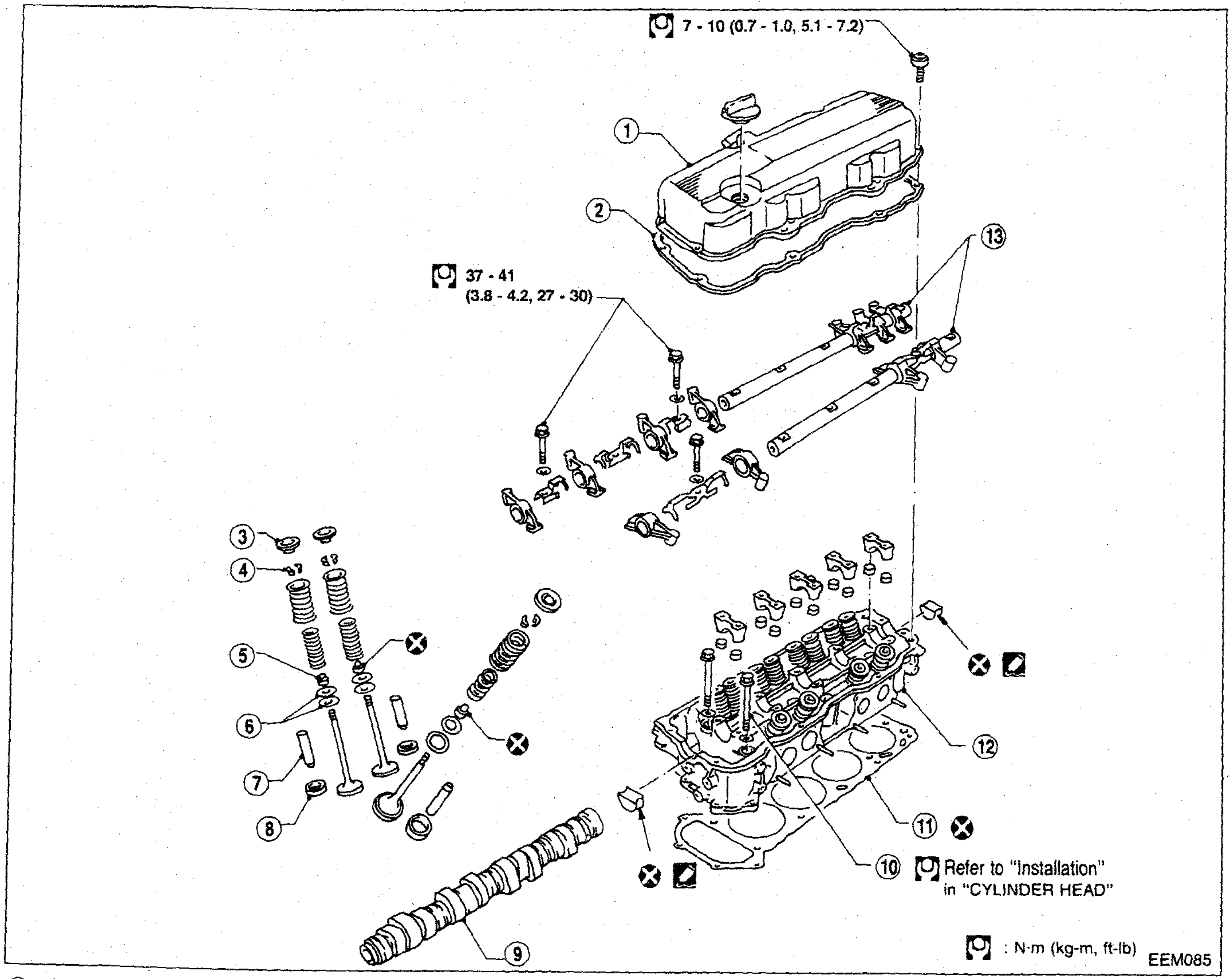


(2) Make sure that driving spindle is set as shown in figure.

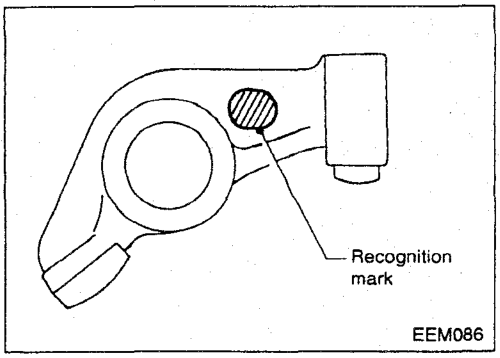


13. Install distributor.
14. Make sure that No. 1 piston is set at T.D.C. and that distributor rotor is set at No. 1 cylinder spark position.

CYLINDER HEAD

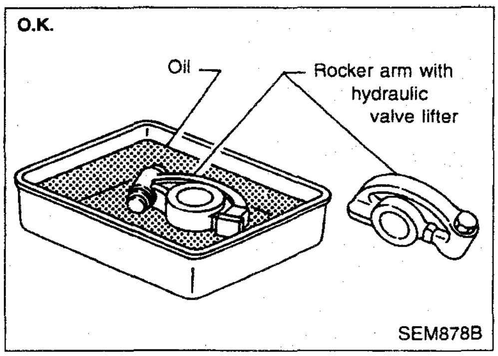


① Valve rocker cover	⑥ Spring seat	⑩ Head bolt
② Rocker cover gasket	⑦ Valve guide	⑪ Cylinder head gasket
③ Spring retainer	⑧ Valve seat	⑫ Cylinder head
④ Valve cotter	⑨ Camshaft	⑬ Valve rocker and shaft assembly
⑤ Oil seal		

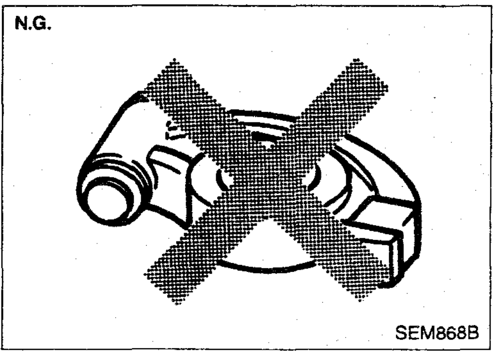


CAUTION:

- **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.**
- **Make use of the recognition mark to distinguish the 4 different rocker arms.**



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



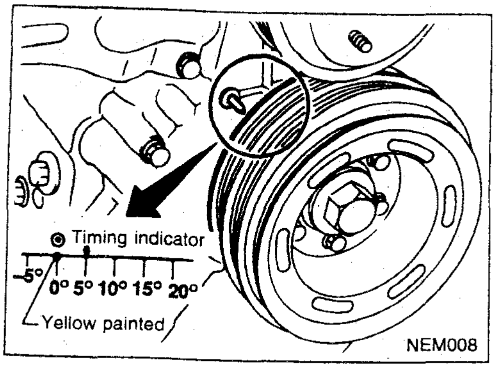
- **Do not disassemble hydraulic valve lifter.**
- **Attach tags to valve lifters so as not to mix them up.**

Removal

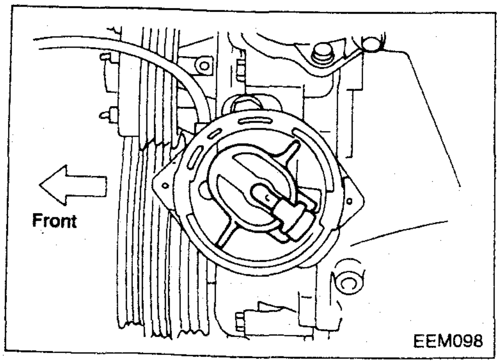
1. Drain coolant from radiator and drain plug of block.
2. Remove the following parts.
- Power steering drive belt
- Power steering pump, idler pulley and power steering brackets
- Vacuum hoses of S.C.V. and of pressure control solenoid valve
- Accelerator wire bracket
3. Disconnect E.G.R. tube from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

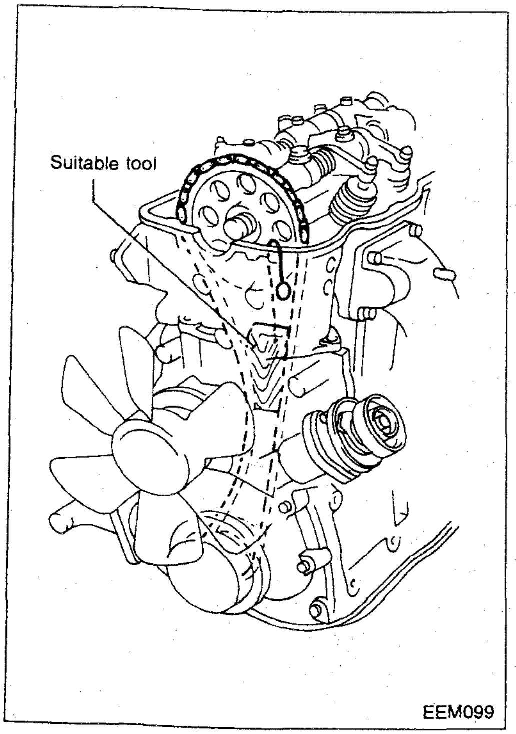
When removing rocker cover, do not hit rocker cover against rocker arms.

Removal (Cont'd)

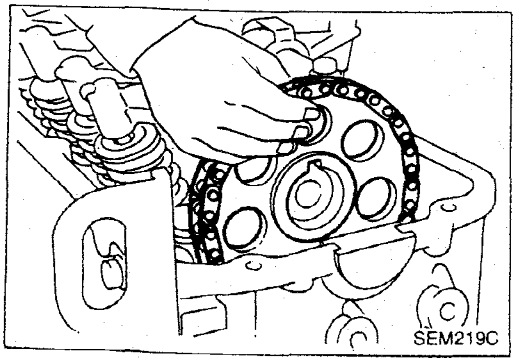


7. Set No. 1 piston at T.D.C. on its compression stroke.



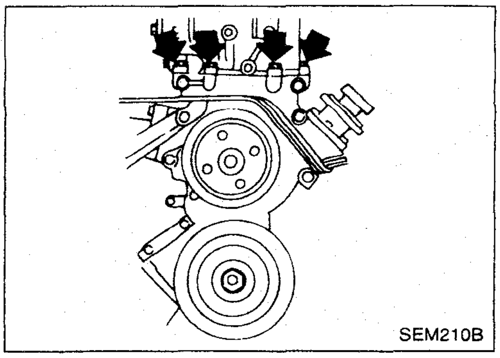


8. Loosen camshaft sprocket bolt.
- Support timing chain by using Tool as shown in figure.
- If mating marks on timing chain and camshaft sprocket are not aligned, make marks yourself in order to be able to install camshaft sprocket in the right postition.

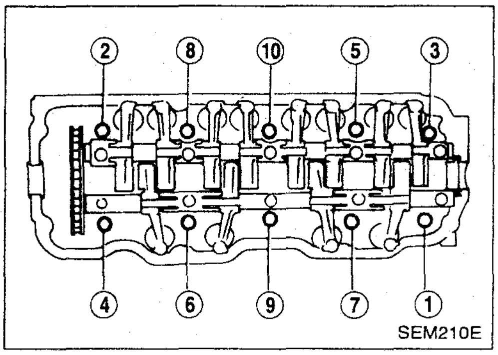


9. Remove camshaft sprocket.

Removal (Cont'd)

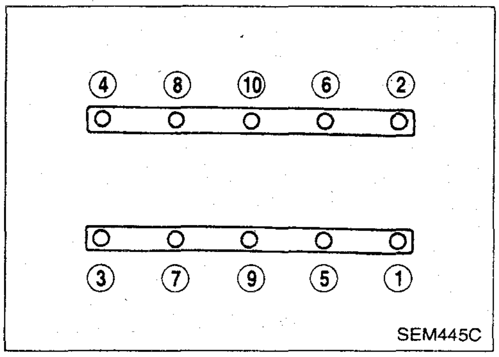


10. Remove front cover tightening bolts to cylinder head.



11. Remove cylinder head.

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



Disassembly

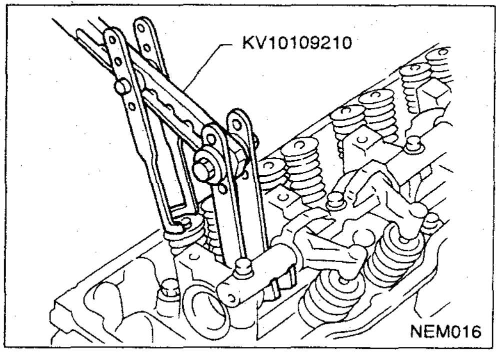
1. Remove rocker shaft assembly.

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

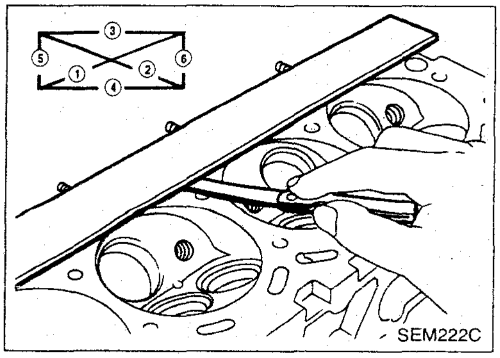
b. Bolts should be loosened in two or three steps.

2. Remove camshaft.

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



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



Inspection

CYLINDER HEAD DISTORTION

Head surface 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".

Inspection (Cont'd)

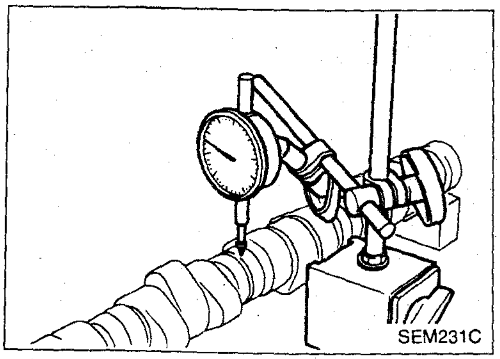
The maximum limit is as follows:
A + B = 0.2 mm (0.008 in)

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

Nominal cylinder head height:
98.8 - 99.0 mm (3.890 - 3.898 in)

CAMSHAFT VISUAL CHECK

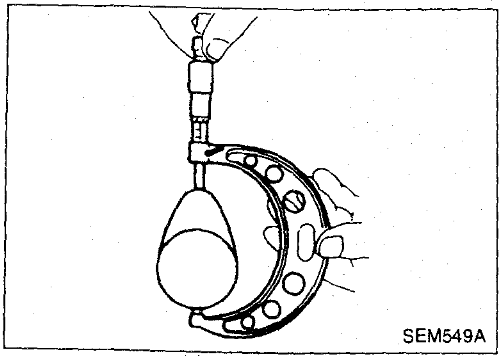
Check camshaft for scratches, seizure and wear.



SEM231C

CAMSHAFT RUNOUT

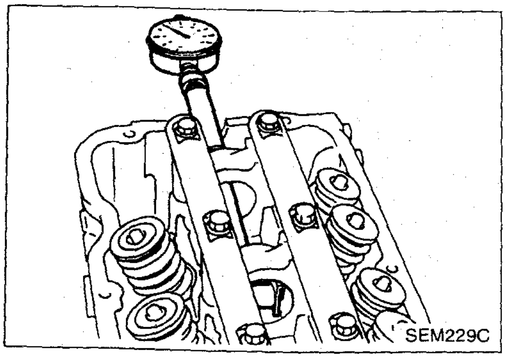
1. Measure camshaft runout at the center journal.
   Runout (Total indicator reading):
   0 - 0.02 mm (0 - 0.0008 in)
2. If is exceeds the limit, replace camshaft.



SEM549A

CAMSHAFT CAM HEIGHT

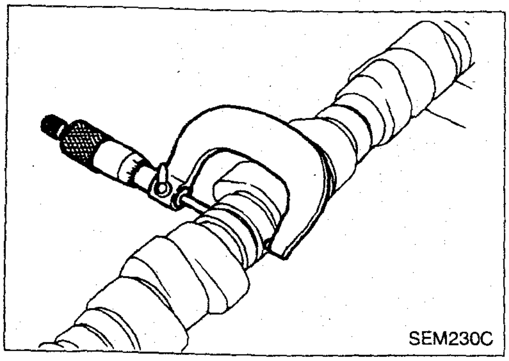
1. Measure camshaft cam height.
   Standard cam height:
   44.839 - 45.029 mm (1.7653 - 1.7728 in)
   Cam wear limit:
   0.2 mm (0.008 in)
2. If wear is beyond the limit, replace camshaft.



SEM229C

CAMSHAFT JOURNAL CLEARANCE

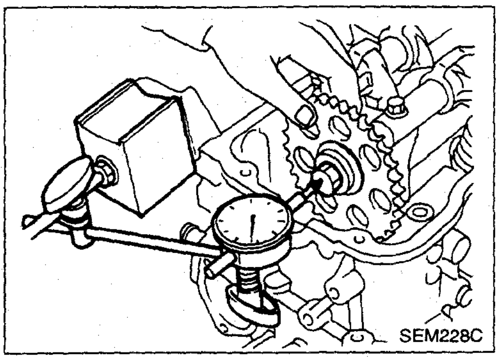
1. Install camshaft bracket and rocker shaft and tighten bolts to the specified torque.
2. Measure inner diameter of camshaft bearing.
   Standard inner diameter:
   33.000 - 33.025 mm (1.2992 - 1.3002 in)



SEM230C

3. Measure outer diameter of camshaft journal.
   Standard outer diameter:
   32.935 - 32.955 mm (1.2967 - 1.2974 in)
4. If clearance exceeds the limit, replace camshaft and/or cylinder head.
   Camshaft journal clearance:
   Standard
   0.045 - 0.090 mm (0.0018 - 0.0035 in)
   Limit
   0.12 mm (0.0047 in)

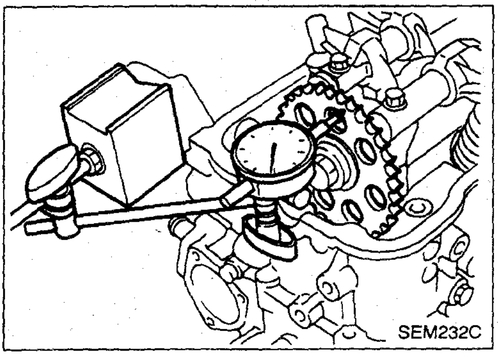
Inspection (Cont'd)


SEM228C

CAMSHAFT END PLAY

1. Install camshaft in cylinder head.
2. Measure camshaft end play.

Camshaft end play:
Standard
0.07 - 0.15 mm (0.0028 - 0.0059 in)
Limit
0.2 mm (0.008 in)

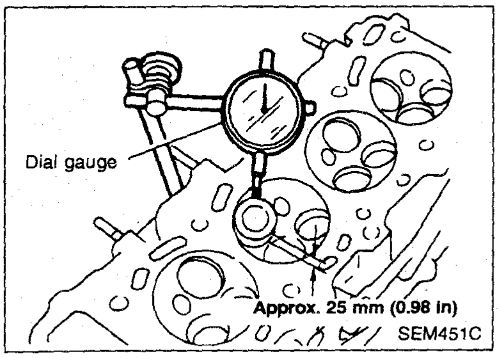

SEM232C

CAMSHAFT SPROCKET RUNOUT

1. Install sprocket on camshaft.
2. Measure camshaft sprocket runout.

Runout (Total indicator reading):
Limit 0.12 mm (0.0047 in)

3. If it exceeds the limit, replace camshaft sprocket.

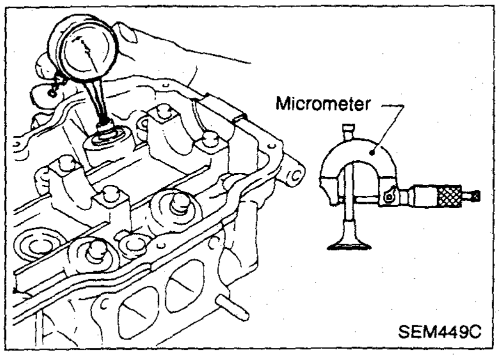


SEM451C

VALVE GUIDE CLEARANCE

1. Measure valve deflection in a right-angled direction with camshaft. (Valve and valve guide mostly wear in this direction.)

Valve deflection limit (Dial gauge reading):
0.15 mm (0.0059 in).

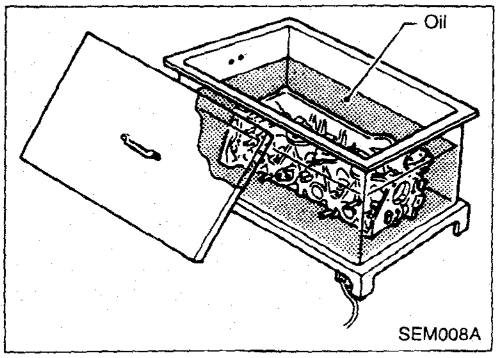


SEM449C

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

Valve to valve guide clearance:
Standard 0.020 - 0.053 mm
(0.0008 - 0.0021 in) (Intake)
0.040 - 0.070 mm
(0.0016 - 0.0028 in) (Exhaust)
Limit 0.1 mm (0.004 in)

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

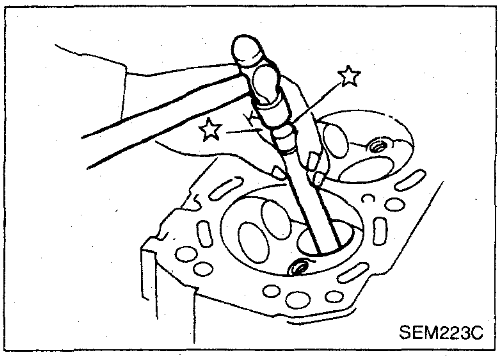


SEM008A

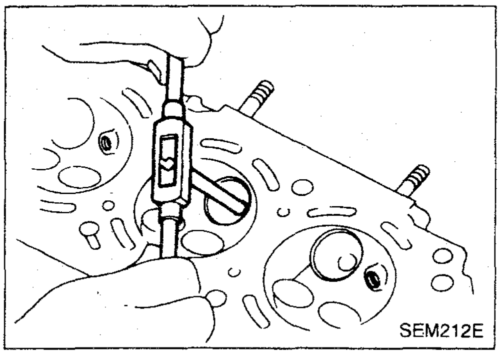
VALVE GUIDE REPLACEMENT

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

Inspection (Cont'd)



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



3. Ream cylinder head valve guide hole.

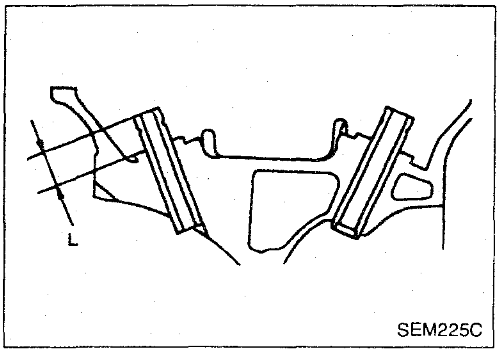
   Valve guide hole diameter (for service parts):

   Intake

   11.175 - 11.196 mm (0.4400 - 0.4408 in)

   Exhaust

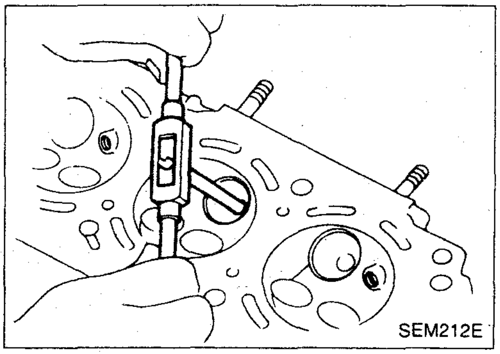
   12.175 - 12.196 mm (0.4793 - 0.4802 in)



4. Heat cylinder head to between 150 and 160°C (302 to 320°F) and press service valve guide into cylinder head.

   Projection "L":

   14.9 - 15.1 mm (0.587 - 0.594 in)



5. Ream valve guide.

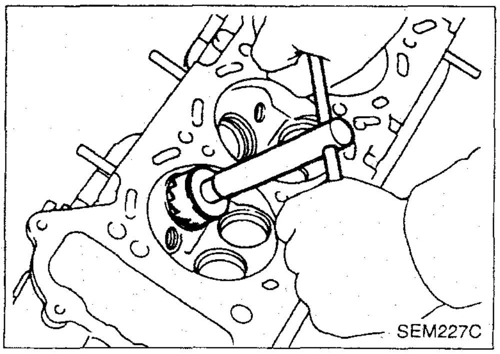
   Finished size:

   Intake

   7.000 - 7.018 mm (0.2756 - 0.2763 in)

   Exhaust

   8.000 - 8.018 mm (0.3150 - 0.3157 in)

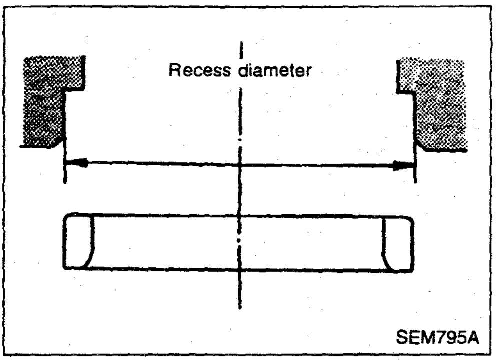


VALVE SEATS

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

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

Inspection (Cont'd)



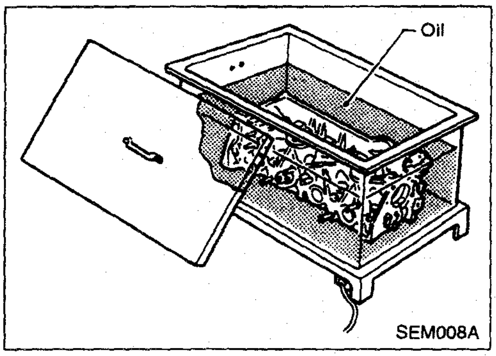
SEM795A

REPLACING VALVE SEAT FOR SERVICE PARTS

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

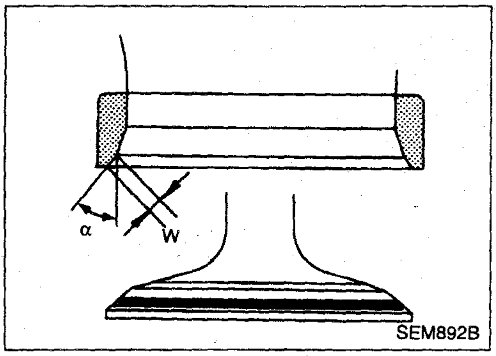
   Reaming bore for service valve seat
   Oversize [0.5 mm (0.020 in)]:
   Intake 36.500 - 36.516 mm (1.4370 - 1.4376 in)
   Exhaust 42.500 - 42.516 mm (1.6732 - 1.6739 in)

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



SEM008A

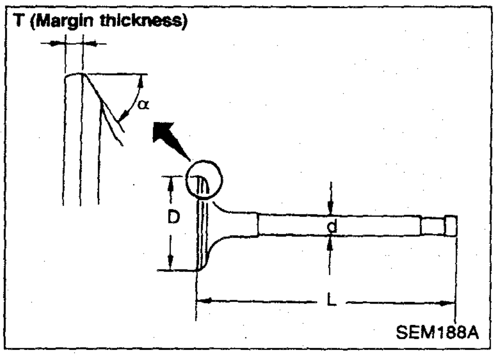
3. Heat cylinder head to between 150 and 160°C (302 to 320°F).
4. Install new valve seat.



SEM892B

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

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

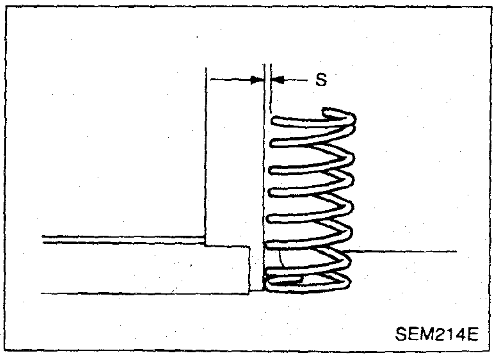


SEM188A

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.



SEM214E

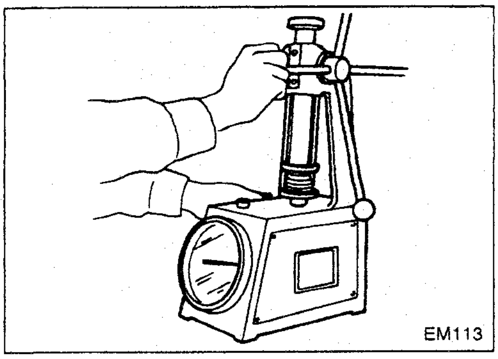
VALVE SPRING

Squareness

1. Measure "S" dimension.

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

Inspection (Cont'd)



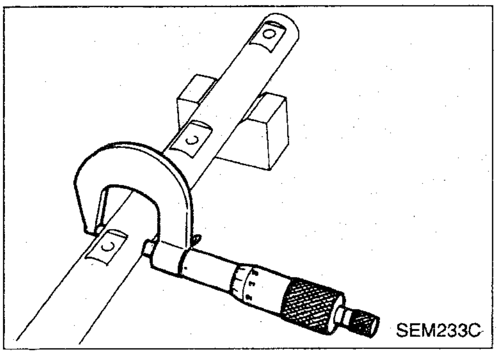
2. If it exceeds the limit, replace spring.

Pressure

Check valve spring pressure.

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

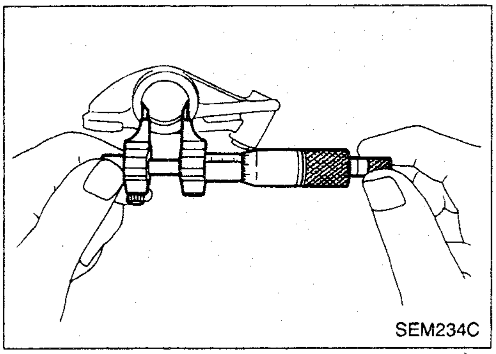
If it exceeds the limit, replace spring.



ROCKER SHAFT AND ROCKER ARM

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

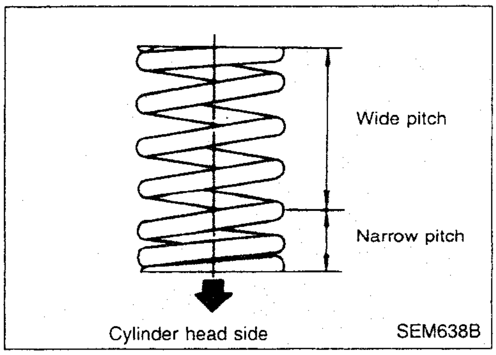
Diameter:
21.979 - 22.000 mm (0.8653 - 0.8661 in)



3. Check inner diameter of rocker arm.

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

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



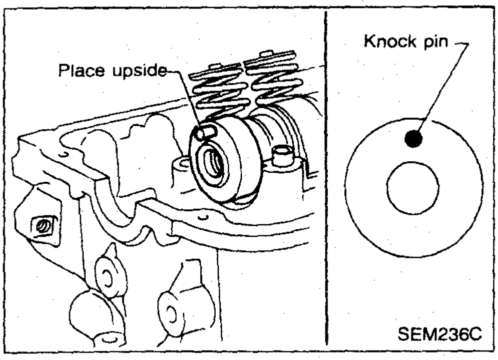
Assembly

1. Install valve component parts.

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

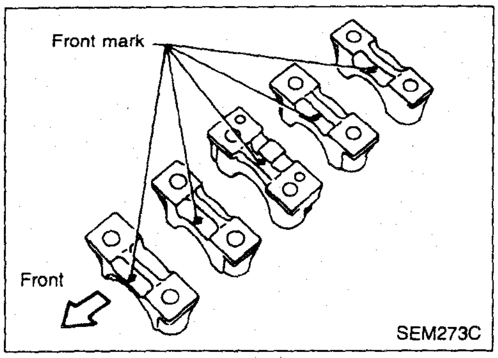
Assembly (Cont'd)

- **Exhaust valve springs are marked with a color point in order to distinguish them from intake valve springs.**



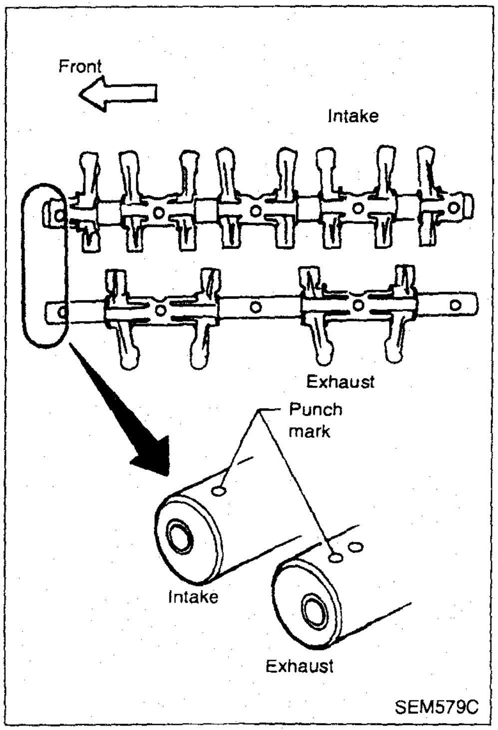
2. Mount camshaft onto cylinder head, placing knock pin at front end to top position.

Apply engine oil to camshaft when mounting onto cylinder head.



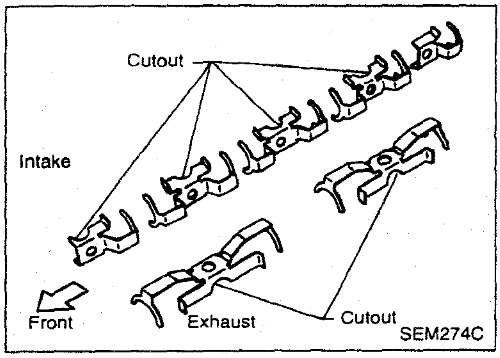
3. Install camshaft brackets.

Front mark is punched on the camshaft bracket.

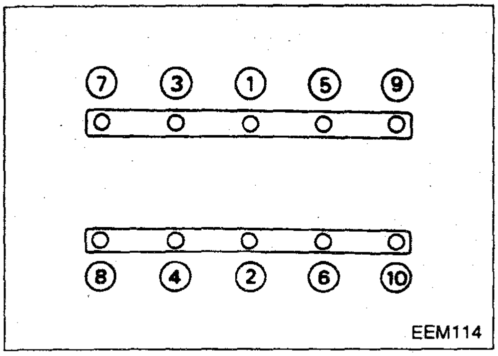


4. Install rocker shafts with rocker arms.

Assembly (Cont'd)

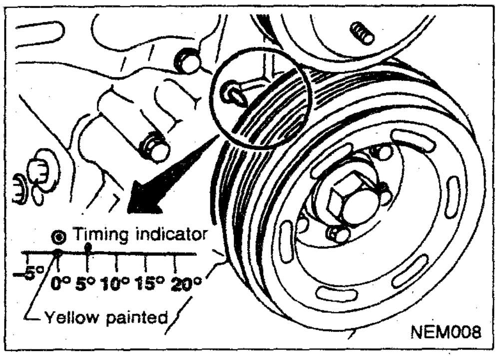


- Install retainer with cutout facing direction shown in figure at left.

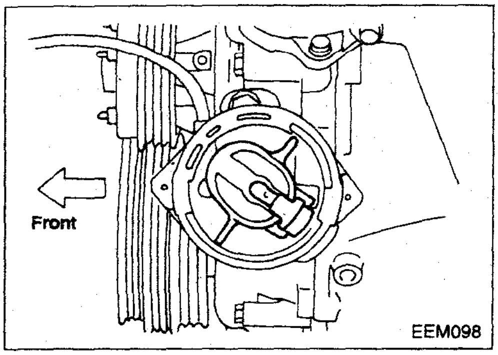


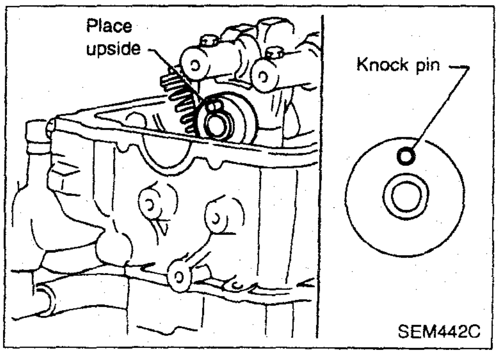
5. Tighten bolts as shown in figure at left.

Installation



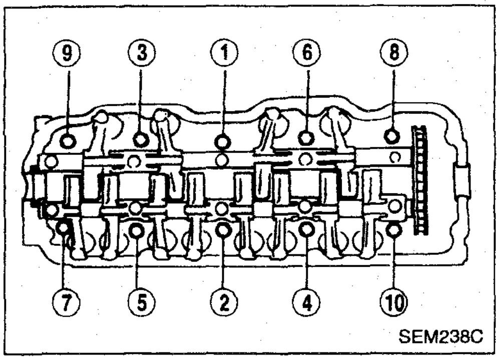
1. Confirm that No.1 piston is set at T.D.C. on its compression stroke.





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

Installation (Cont'd)



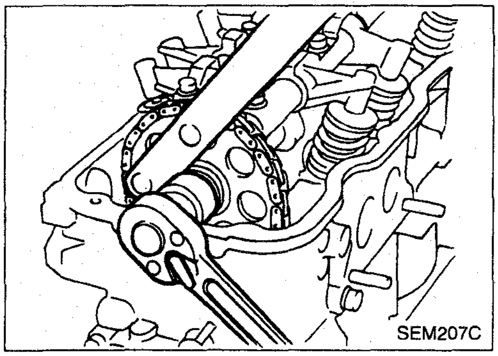
SEM238C

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

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

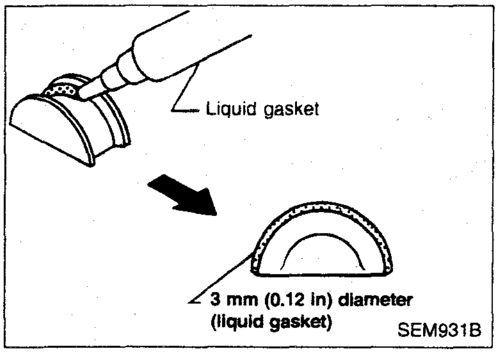
(1) Tighten all bolts to 29 N·m (3.0 kg-m, 22 ft-lb).
(2) Tighten all bolts to 78 N·m (8.0 kg-m, 58 ft-lb).
(3) Loosen all bolts completely.
(4) Tighten all bolts to 29 N·m (3.0 kg-m, 22 ft-lb).
(5) Turn all bolts 80 to 85 degrees clockwise with an angle wrench, or if an angle wrench is not available,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

4. Install front cover tightening bolts to cylinder head.
5. Set chain on camshaft sprocket by aligning each mating mark. Then install camshaft sprocket to camshaft.
6 Remove wooden tool, used to avoid timing chain from falling down.



SEM207C

7. Tighten camshaft sprocket bolt.



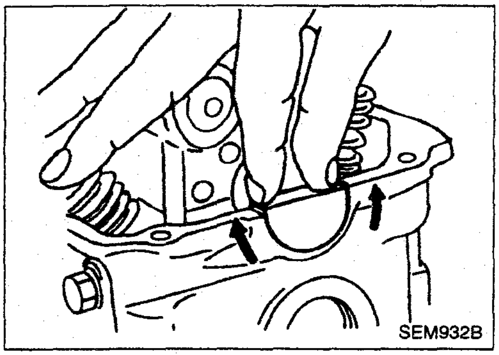
SEM931B

8. Install rubber plugs as follows:

(1) Apply liquid gasket to rubber plugs.

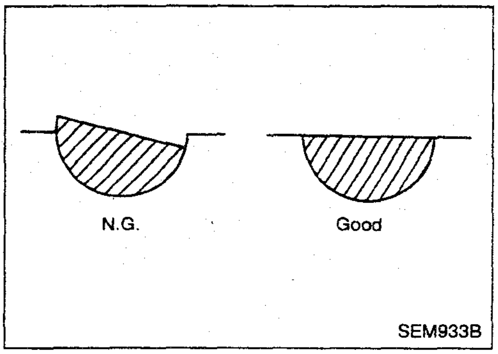
- **Rubber plugs should be replaced by new ones.**
- **Rubber plugs should be installed within 5 minutes of applying liquid gasket.**

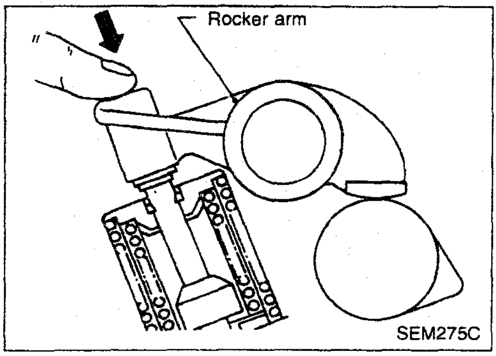
Installation (Cont'd)



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

- **Rubber plugs should be installed flush with the surface.**
- **Do not start the engine for 30 minutes after installin rocker cover.**
- **Remove excessive liquid gasket from cylinder head to surface.**





9. Check hydraulic valve lifter.

(1) Push hydraulic valve lifter forcefully with your finger.

- **Be sure to check it with rocker arm in its free position.**

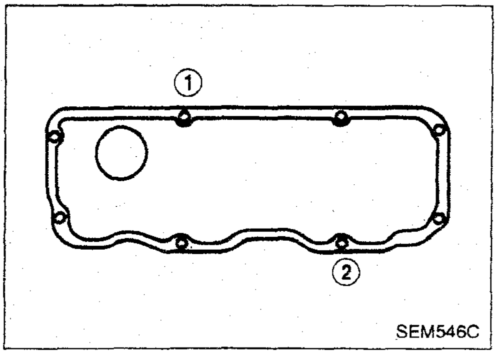
(2) If valve lifter moves more than 1 mm (0.04 in), air may be inside of it.

(3) Bleed air off by running engine at 1,000 rpm under no-load for about 20 minutes.

(4) If hydraulic valve lifters are still noisy, replace them and bleed air off again in the same manner as in step (3).

10. Install rocker cover.

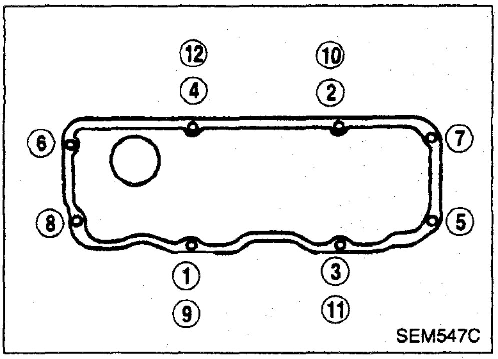
- **Be sure to avoid interference between rocker cover and rocker arms.**



11. Tighten bolts as follows:

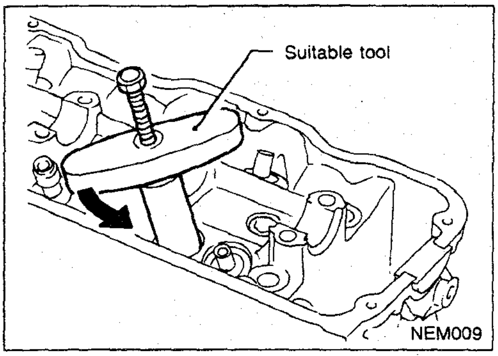
(1) Tighten 2 bolts to 3 N·m (0.3 kg-m, 2.2 ft-lb) temporarily in order shown in figure.

Installation (Cont'd)



(2) Then tighten all bolts to between 7 and 10 N·m (0.7 to 1.0 kg-m, 5.1 to 7.2 ft-lb) in order shown in figure.

12. Install any remaining parts.

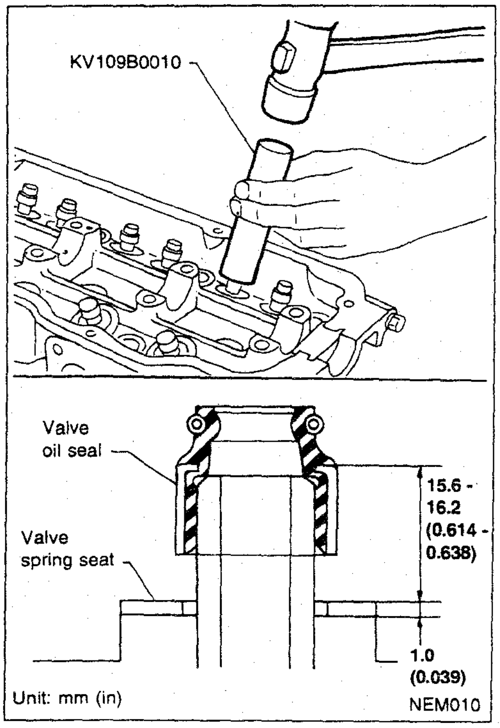


VALVE OIL SEAL

1. Remove rocker cover.
2. Remove rocker shaft assembly (Refer to "Disassembly" in "CYLINDER HEAD")
3. Remove valve springs and valve oil seal with suitable tool.

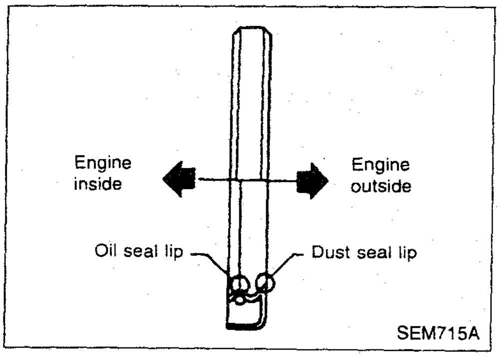
Piston concerned should be set at T.D.C. to prevent valve from falling.

NOTE: 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).



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

Before installing valve oil seal, install valve spring seat.



OIL SEAL INSTALLING DIRECTION

FRONT OIL SEAL

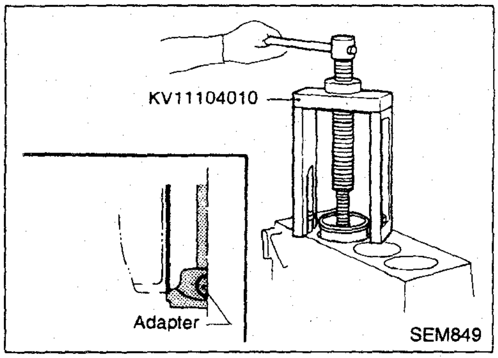
1. Remove protecting cover.
2 Remove radiator shroud and crankshaft pulley.
3. Remove front oil seal.

Be careful not to damage crankshaft.

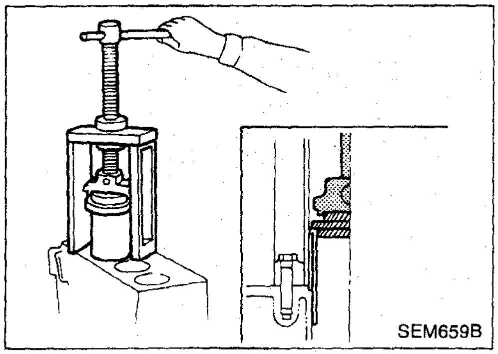
Inspection (Cont'd)

CYLINDER LINER

Replacement

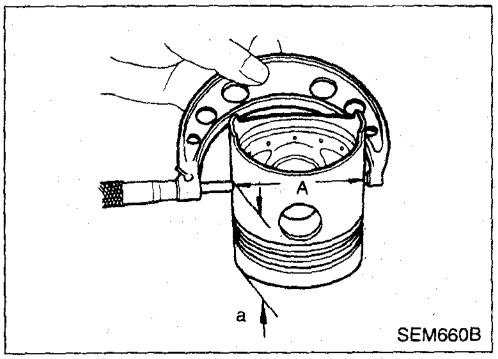


1. Remove cylinder with Tool.



2. Install cylinder liner with Tool.
3. Check amount of projection of cylinder liner.

PISTON TO CYLINDER WALL CLEARANCE

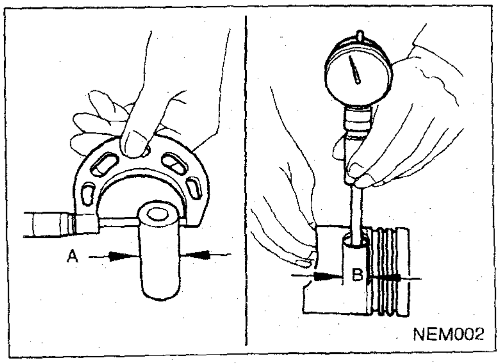


1. Measure-piston and cylinder bore diameter.

   Piston diameter "A":
   Refer to S.D.S.
   Measuring point "a" (Distance from the top):
   45.2 mm (1.78 in)
2. Check that piston clearance is within specification.

   Piston to cylinder liner clearance:
   0.043 - 0.077 mm
   (0.0017 - 0.0030 in)
   Measuring point "a" (distance from upper part):
   69.2 mm (2.72 in)

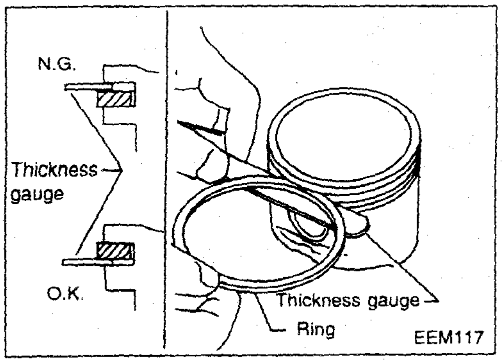
PISTON AND PISTON PIN CLEARANCE



Check clearance between pistons and piston pins.

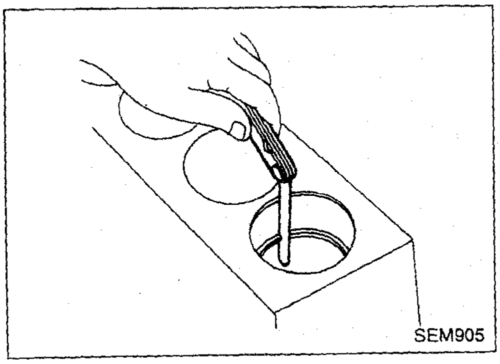
Clearance (A – B):
Standard
– 0.008 to 0.007 mm (– 0.0003 to 0.0003 in)
Limit
Less than 0.1 mm (0.004 in)

Inspection (Cont'd)



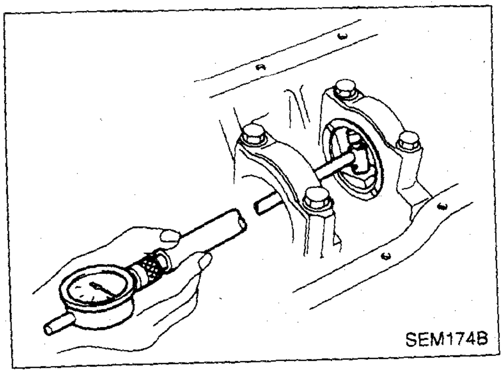
PISTON RING SIDE CLEARANCE

Side clearance:
Top ring
0.00 - 0.05 mm (0.0 - 0.0019 in)
2nd ring
0.04 - 0.072 mm (0.0016 - 0.0028 in)
Oil ring
0.035 - 0.040 mm (0.0014 - 0.0016 in)
Max. limit of side clearance:
Top ring
0.5 mm (0.020 in)
2nd ring
0.3 mm (0.012 in)
Oil ring
0.15 mm (0.0059 in)



PISTON RING END GAP

Standard ring gap:
Top ring
0.25 - 0.35 mm (0.0098 - 0.0138 in)
2nd ring
0.50 - 0.75 mm (0.0197 - 0.0295 in)
Oil ring
0.25 - 0.55 mm (0.0098 - 0.0217 in)
Max. limit of ring gap:
1.5 mm (0.059 in)



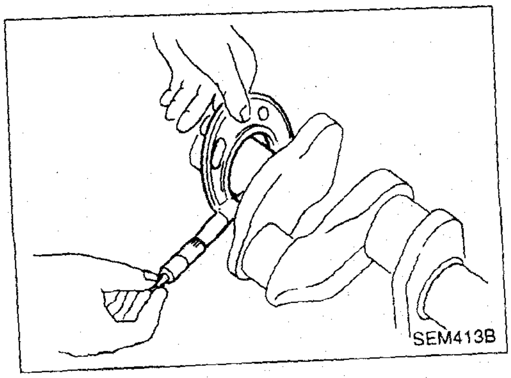
BEARING CLEARANCE

Main bearing

1. Install main bearings to cylinder block and main bearing cap.
2. Install main bearing cap to cylinder block.

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

3. Measure inside diameter "A" of main bearing.

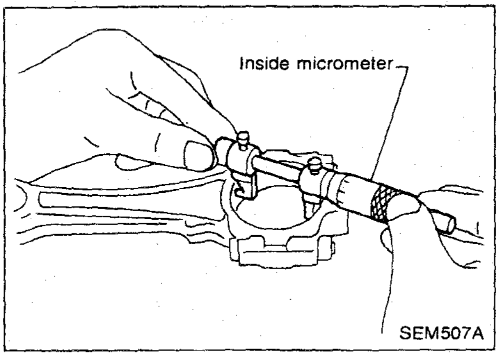


4. Measure outside diameter "Dm" of main journal in crankshaft.

Inspection (Cont'd)

5. Calculate main bearing clearance.

Main bearing clearance = A – Dm
Standard
0.035 - 0.087 mm (0.0014 - 0.0034 in)
Limit
Less than 0.15 mm (0.0059 in)



SEM507A

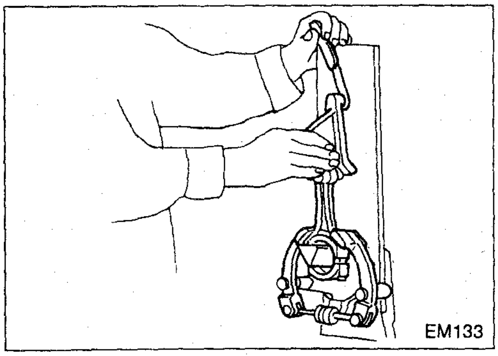
CONNECTING ROD BEARING (Big end)

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.

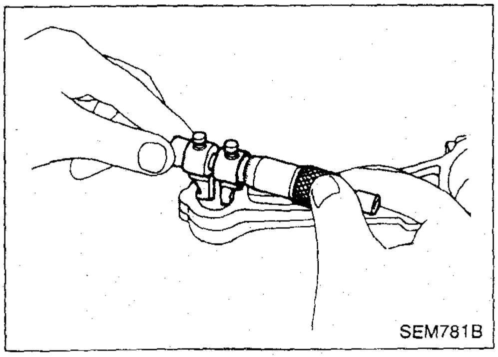
3. Measure inside diameter "A" of bearing.
4. Measure outside diameter "Dp" of pin journal in crankshaft.
5. Calculate connecting rod bearing clearance.

Connecting rod bearing clearance = A – Dp
Standard
0.035 - 0.081 mm
(0.0014 - 0.0032 in)
Limit
Less than 0.15 mm (0.0059 in)


EM133

CONNECTING ROD BEND AND TORSION

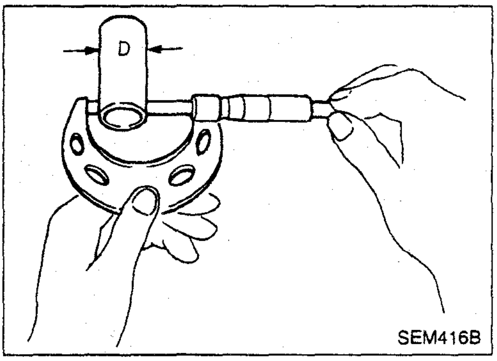
Bend and torsion:
Limit
0,15 mm (0.0059 in)
per 200 mm (7.87 in) length


SEM781B

CONNECTING ROD BUSHING CLEARANCE (Small end)

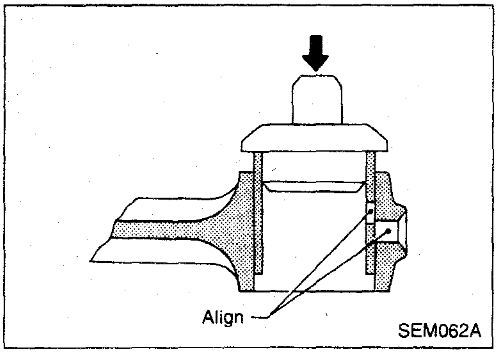
1. Measure inside diameter "A" of connecting rod small end bushings.

Inspection (Cont'd)



2. Measure outside diameter "D" of piston pin.
3. Calculate connecting rod small end bushing clearance.

Connecting rod small end bushing clearance = A – D
Standard
0.025 - 0.045 mm (0.0010 - 0.0018 in)
Limit
0.15 mm (0.0059 in)



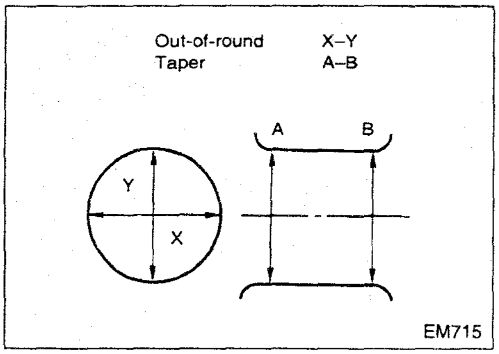
REPLACEMENT OF CONNECTING ROD BUSHING (Small end)

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

Be sure to align the oil holes.

2. After driving in the small end bushing, ream the bushing.

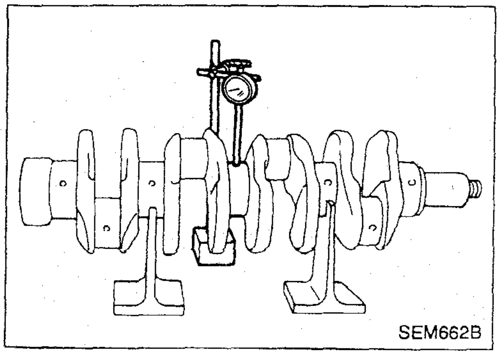
Small end bushing inside diameter:
Finished size
30.025 - 30.038 mm (1.1821 - 1.1826 in)



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.

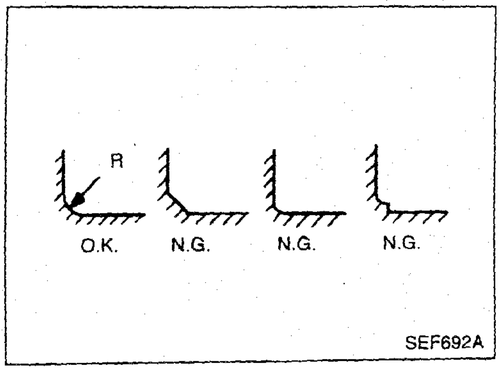
Out-of-round (X – Y):
Standard
Less than 0.01 mm (0.0004 in)
Limit
0.02 mm (0.0008 in)
Taper (A – B):
Standard
Less than 0.01 mm (0.0004 in)
Limit
0.02 mm (0.0008 in)



3. Check crankshaft runout.

Runout (Total Indicator Reading)
Standard
0 - 0.03 mm (0 - 0.0012 in)
Limit
0.10 mm (0.0039 in)

Inspection (Cont'd)



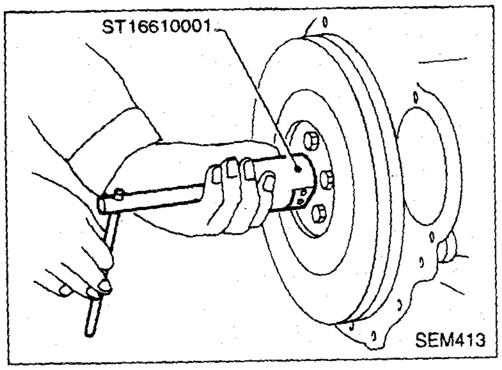
RESURFACING OF CRANKSHAFT JOURNAL AND CRANK PIN

When using undersize main bearings and connecting rod bearings, the crankshaft journals or crank pins must be finished to match the bearings.

R: Crank journal 3.0 mm (0.118 in)
Crank pin 3.5 mm (0.138 in)

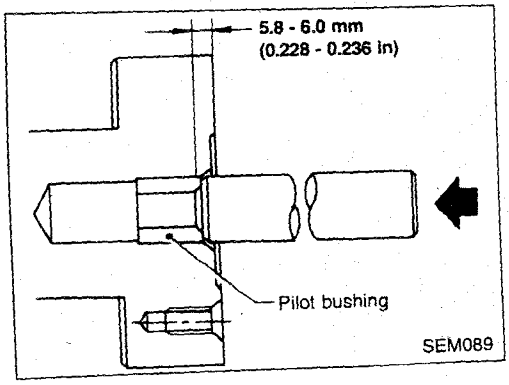
CAUTION:

- **At the same time make sure that the surface width does not increase.**
- **Do not attempt to cut counterweight of crankshaft.**



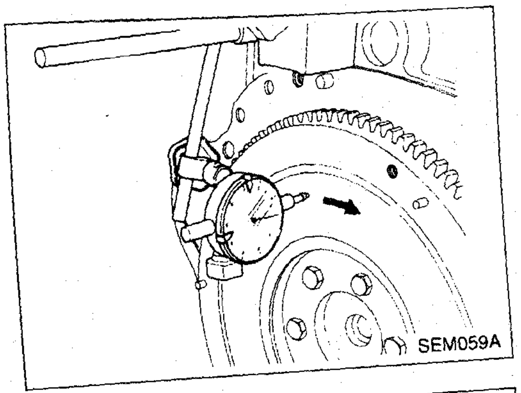
PILOT BUSHING REPLACEMENT

1. Pull out bushing with Tool.



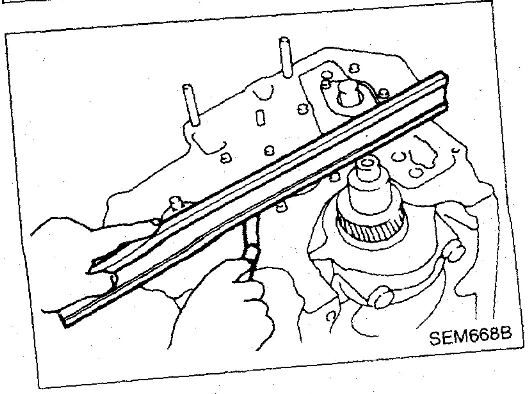
2. Insert pilot bushing until distance between flange end and bushing is specified value.

Distance:
Approx. 5.8 - 6.0 mm (0.228 - 0.236 in)



FLYWHEEL RUNOUT

Runout (Total Indicator Reading):
Less than 0.15 mm (0.0059 in)

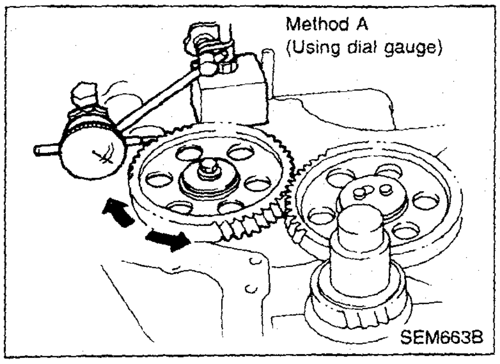


FRONT PLATE

Check front plate for warpage. If not within the limit, make flat or replace front plate.

Warpage limit:
0.2 mm (0.008 in)

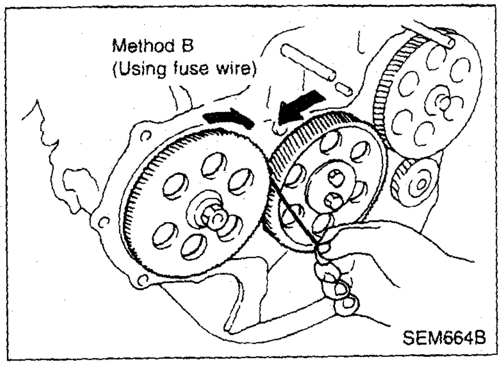
Inspection (Cont'd)



GEAR TRAIN

Camshaft drive gear, injection pump drive gear, oil pump gear, idler gear and crankshaft gear

1. If gear tooth and key have scratches or are excessively worn, replace gear and key.
2. Check gear train backlash before disassembling and after assembling.
   Method A (Using dial gauge)
   Method B (Using fuse wire)

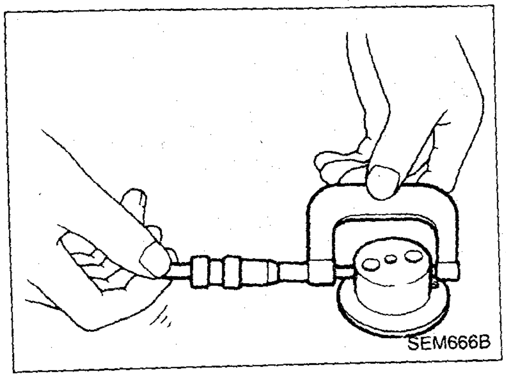


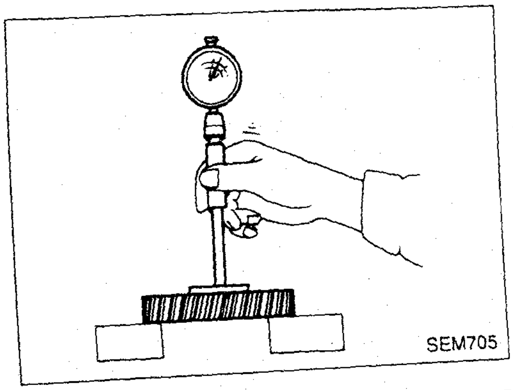
If beyond the limit, replace gear.

Backlash:
Standard
0.07 - 0.11 mm (0.0028 - 0.0043 in)
Limit
0.20 mm (0.0079 in)

IDLER GEAR BUSHING CLEARANCE

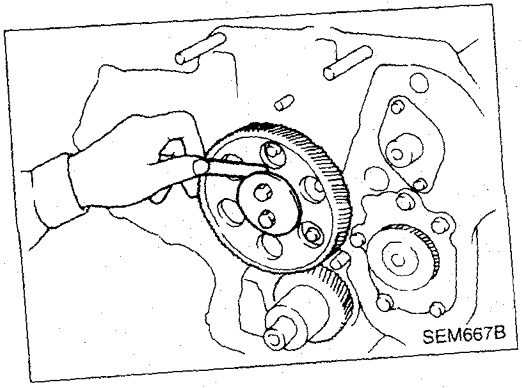
1. Measure idler gear shaft outer diameter.





2. Measure idler gear bushing inner diameter.
3. Calculate idler gear bushing clearance.

Bushing oil clearance:
Standard
0.025 - 0.061 mm (0.0010 - 0.0024 in)
Limit
0.20 mm (0.0079 in)

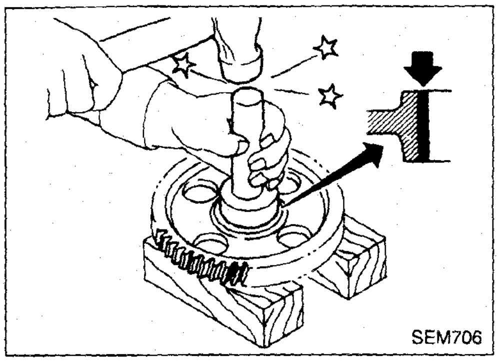


IDLER GEAR END PLAY

Measure idler gear end play between gear plate and gear.

Idler gear end play:
Standard
0.03 - 0.14 mm (0.0012 - 0.0055 in)
Limit
Less than 0.3 mm (0.012 in)

Inspection (Cont'd)



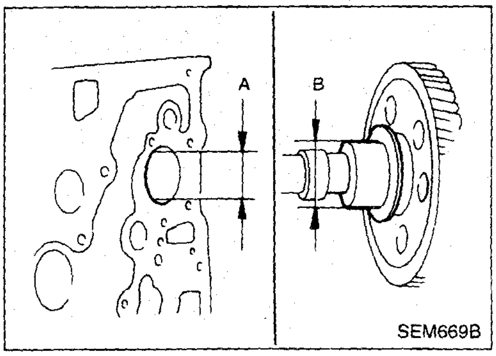
REPLACEMENT OF IDLER GEAR BUSHING

1. Use a suitable tool to replace bushing.
2. Ream idler gear bushing.

Finished size:
42.00 - 42.02 mm (1.6535 - 1.6543 in)

Idler gear shaft

Install idler gear shaft so that oil hole of shaft faces upward.

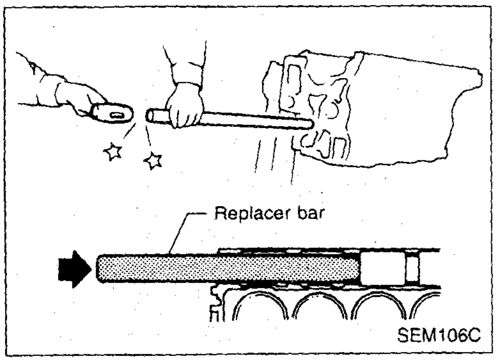


CAMSHAFT AND CAMSHAFT BUSHING

Camshaft bushing clearance

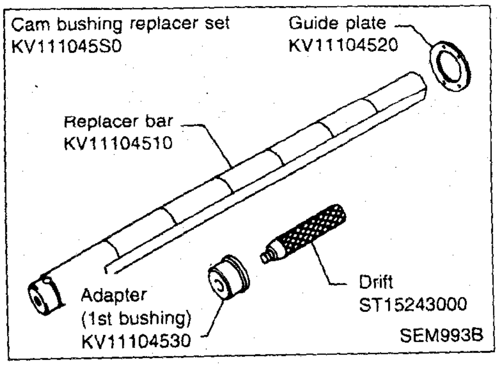
Measure inside diameter of camshaft bushing (A) and outside diameter of camshaft journal (B) with a suitable gauge.

Clearance between camshaft and bushing (A – B):
Standard
0.020 - 0.109 mm
(0.0008 - 0.0043 in)
Limit
Less than 0.15 mm (0.0059 in)

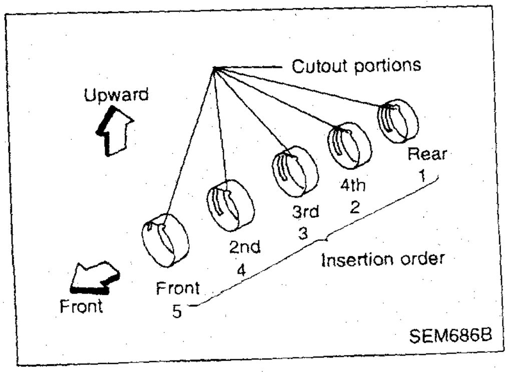


REPLACING CAMSHAFT BUSHING

1. Remove welch plug.
   Using Tool, remove camshaft bushings from the sylinder block. Some bushings must be broken in order to remove.

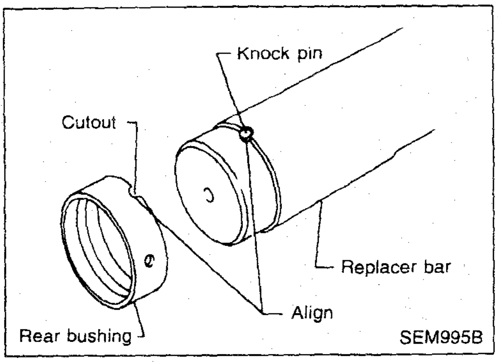


2. Using Tool, install camshaft bushings as follows:

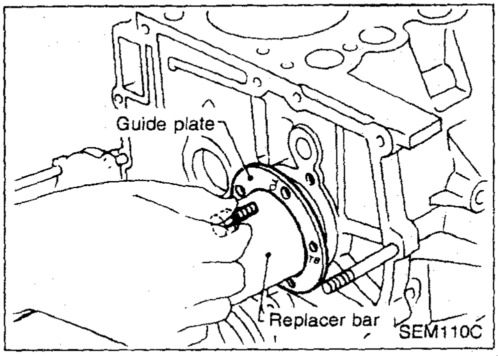


(1) Install camshaft bushings in the order of "rear", "4th", "3rd", "2nd" and "front". All bushings must be installed from the front.
(2) Face the cutout upward and toward the front of the engine during installation.

Inspection (Cont'd)

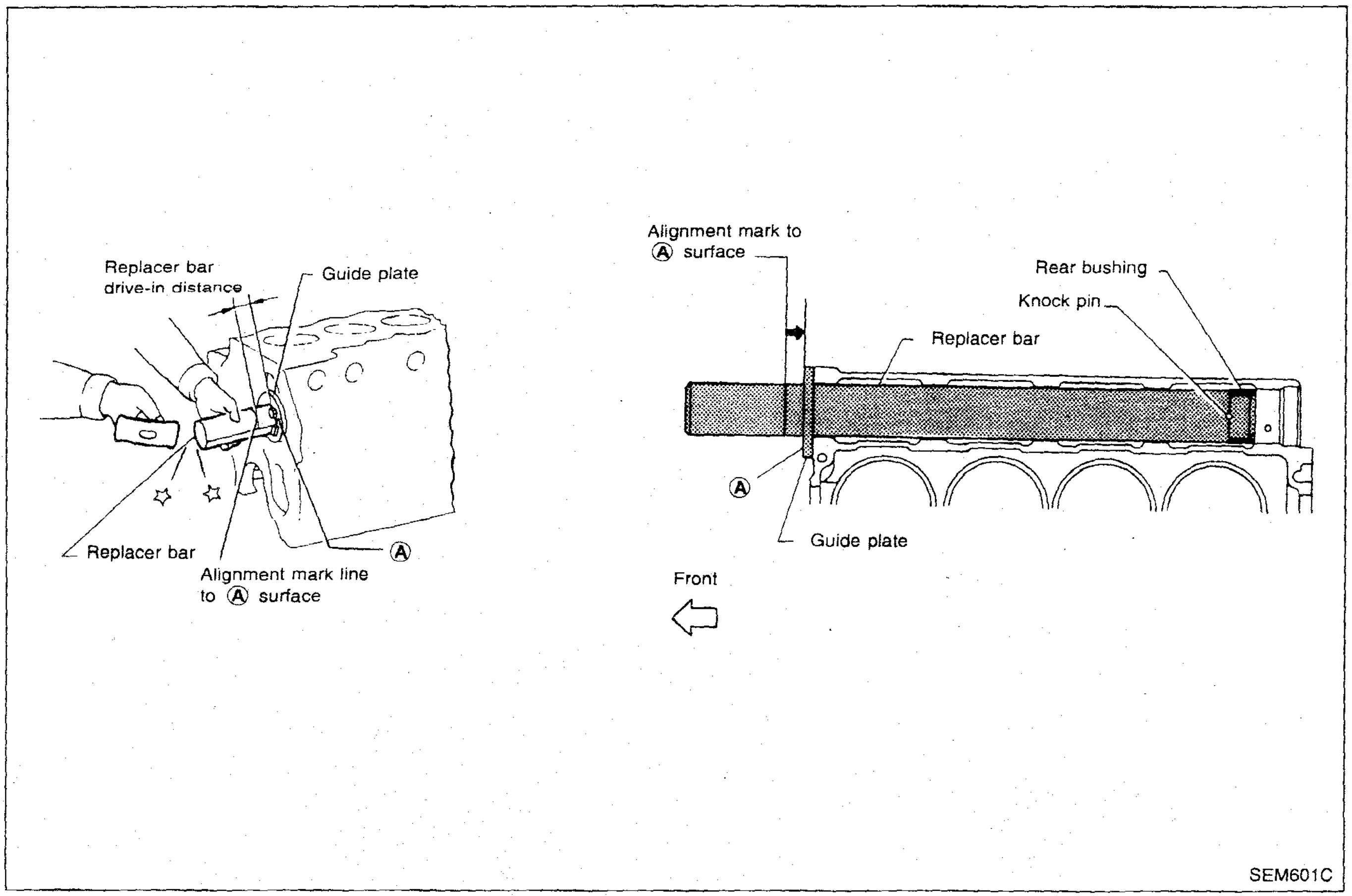


(3) Rear camshaft bushing
Align the cutout of rear bushing with knock pin of replacer bar before installation



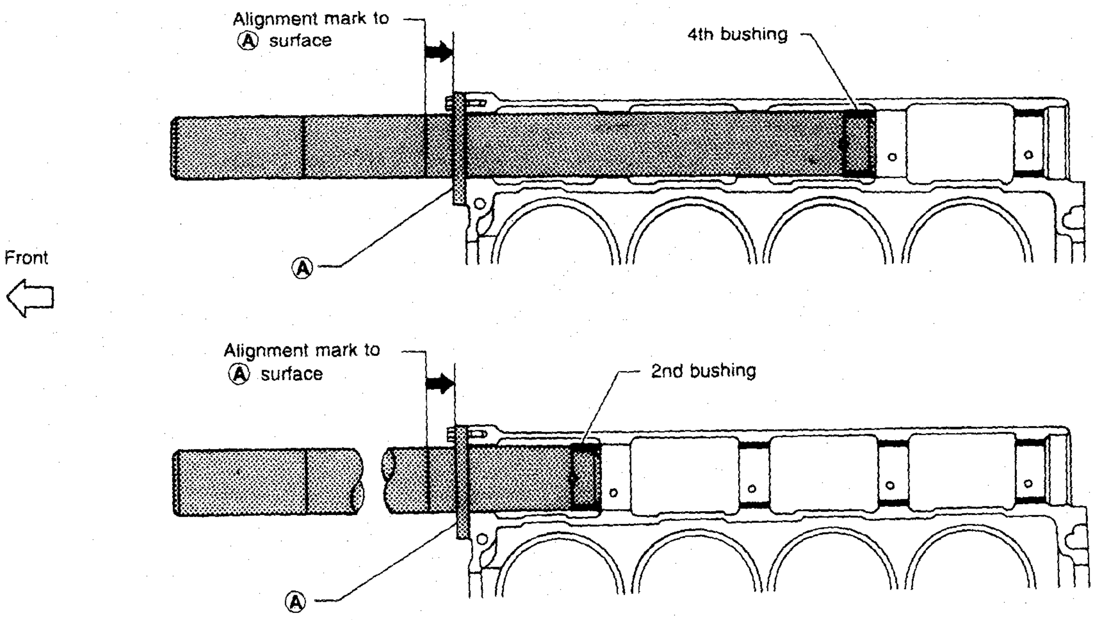
Insert rear bushing with replacer bar into the cylinder block. Install guide plate with bolt holes (on the "TD" mark side) facing upper side of cylinder block. Tighten bolts.

Drive replacer bar until the alignment mark on replacer bar is aligned with the end of replacer guide.
Remove replacer set.
After installation, check that oil hole in camshaft bushing are aligned with oil hole in cylinder block.

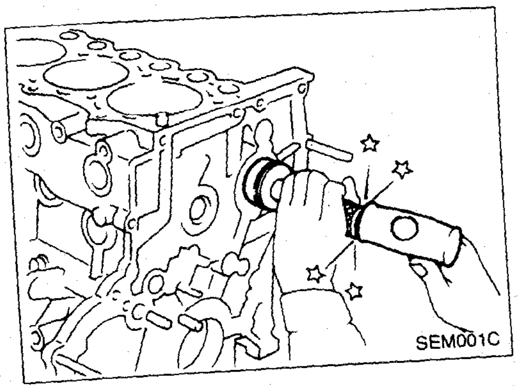


Inspection (Cont'd)

(4) 4th, 3rd and 2nd camshaft bushings
Install in the same manner as rear camshaft bushing.

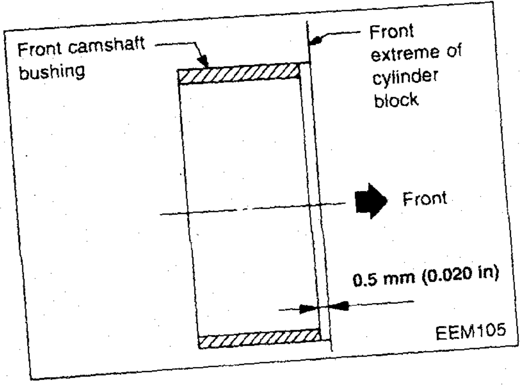


SEM602C



SEM001C

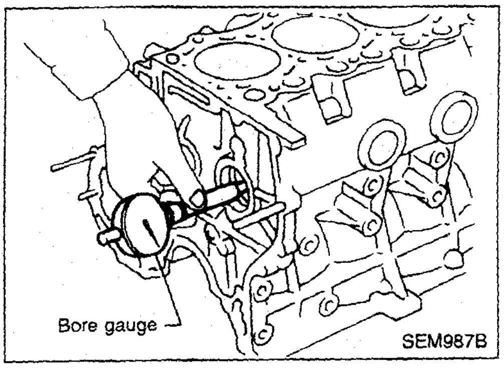
(5) Front camshaft bushing
Using 1st bushing adapter, position front camshaft bushing so that oil hole in cylinder block is aligned with oil hole in bushing.



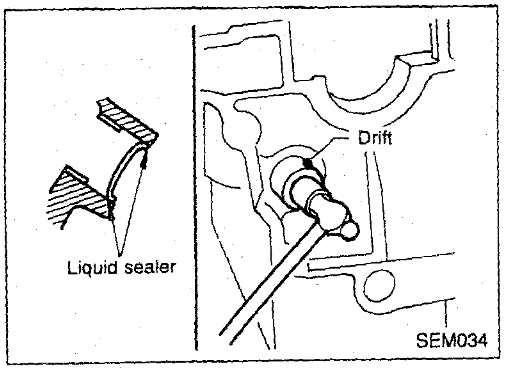
EEM105

The camshaft bushing of the front side must be inserted at 0.5 mm (0.020 in) from the front extreme of cylinder block.

Inspection (Cont'd)

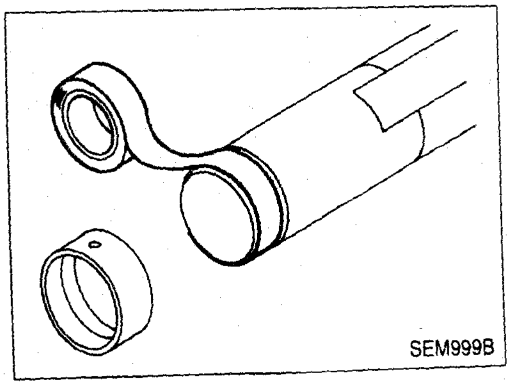


3. Check camshaft bushing clearance.

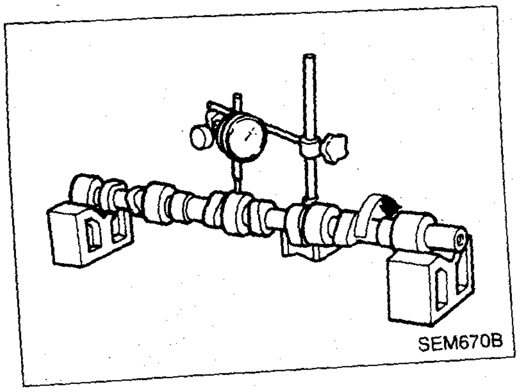


4. Install new welch plug with a drift.

Apply liquid sealer.



When setting 4th through 2nd bushings on replacer bar, tape the bar to prevent movement.

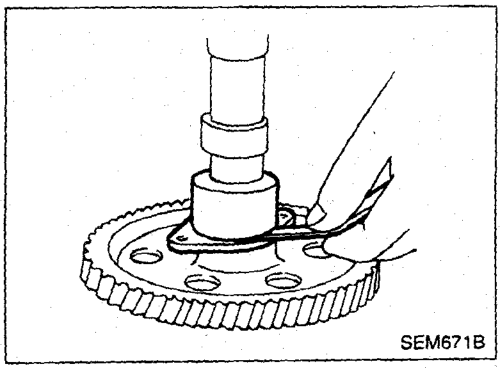


CAMSHAFT ALIGNMENT

1. Check camshaft journal and cam surface for cracks, wear of damage.
   If fault is beyond limit, replace.
2. Check camshaft runout at center journal.
   If runout is greater than specified limit, repair or replace camshaft.

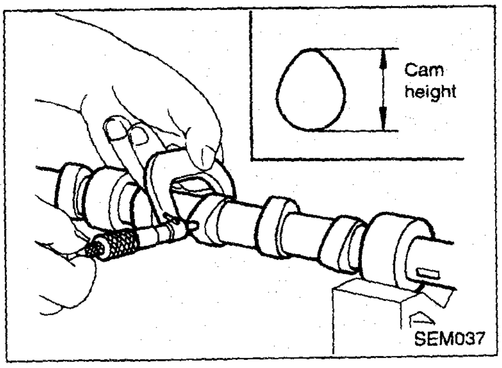
Camshaft runout
(Total indicator reading):
Standard
Less than 0.02 mm (0.0008 in)
Limit
Less than 0.06 mm (0.0024 in)

Inspection (Cont'd)



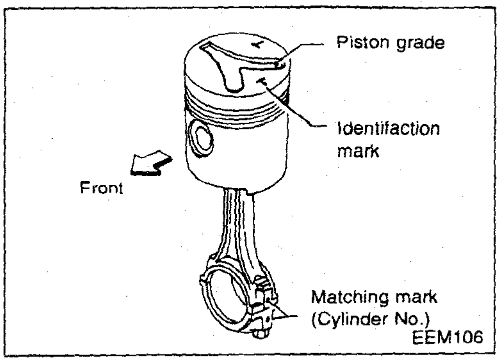
3. Measure camshaft end play between locating plate and gear. If beyond the specified limit, replace camshaft locating plate.

   Camshaft end play:
   Standard
   0.08 - 0.28 mm (0.0031 - 0.0110 in)
   Limit
   Less than 0.5 mm (0.020 in)



4. Measure camshaft cam height. If beyond the specified limit, replace camshaft.

   Cam height:
   Standard
   Intake
   41.900 mm (1.6496 in)
   Exhaust
   41.900 mm (1.6496 in)
   Limit
   Intake
   Less than 41.20 mm (1.6220 in)
   Exhaust
   Less than 41.40 mm (1.6299 in)

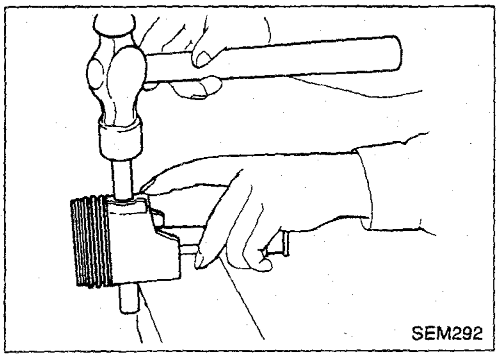


Assembly

PISTON

1. Assemble pistons, piston pins, snap rings and connecting rods.

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. **When inserting piston pin in connecting rod, heat piston with a heater or hot water [approximately 60 to 70°C (140 to 158°F)] and apply engine oil to pin and small end of connecting rod.**

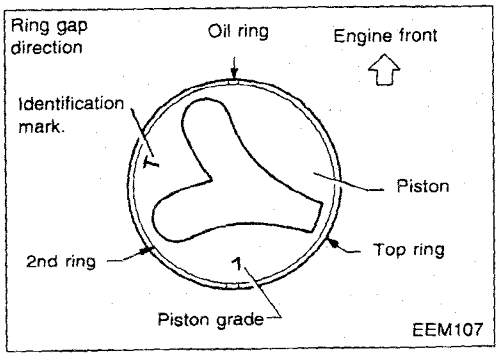
c. **After assembling, ascertain that piston swings smoothly.**

2. Install piston assembly.

CAUTION:

a. **Stretch the piston rings only enough to fit them in the piston grooves.**

b. **Be sure the manufacturer's mark faces upward.**



c. **Install No. 1 piston ring (oil ring) in such a way that its gap faces the direction of engine front, as shown in illustration at left; and then install 2nd and top rings so that their gap is positioned at 120° one to another.**

CRANKSHAFT

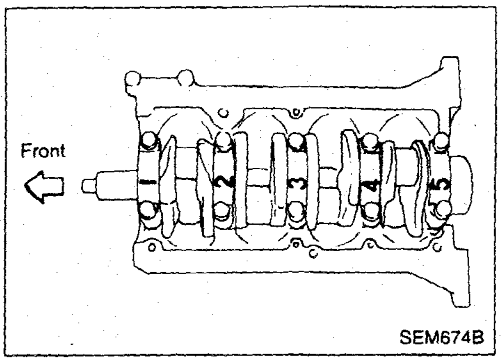
1. Install crankshaft.

(1) Set main bearings in the proper position on cylinder block.

a. **If either crankshaft, cylinder block or main bearing is reused again, it is necessary to measure main bearing clearance.**

b. **Upper bearings have oil hole and oil groove, however lower bearings do not.**

Assembly (Cont'd)



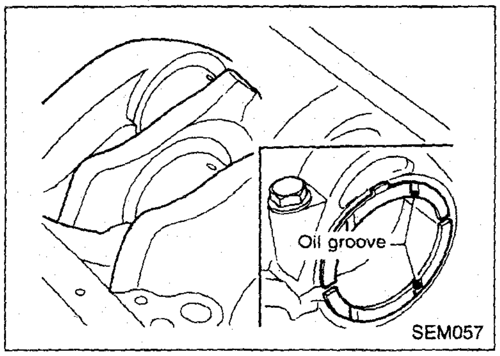
(2) Apply engine oil to crankshaft journal and pin and install crankshaft.

(3) Install main bearings caps.

a) Install main bearing cap with the lowest number facing the front of vehicle.

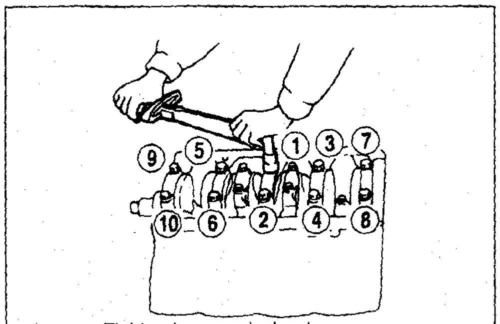
b) Apply engine oil to main bearing cap and cylinder block contact surfaces.

c) Install rear oil seal assembly. Apply engine oil to contact surface of rear end oil seal and crankshaft.



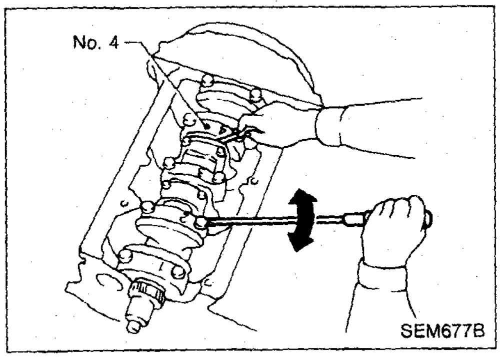
(4) Install crankshaft thrust washer at the 4th journal from front.

Install thrust washer so that oil groove can face crankshaft.



Tighten in numerical order.

(5) Tighten bearing cap bolts gradually in stages, starting from two to three separate stages, from center bearing and moving outward in sequence.



(6) Measure crankshaft free end play at No. 4 bearing.

Crankshaft free end play:

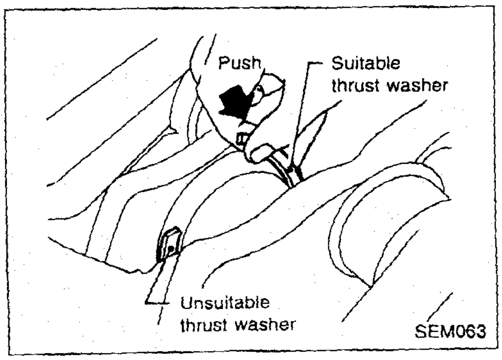
Standard

0.060 - 0.25 mm (0.002 - 0.01 in)

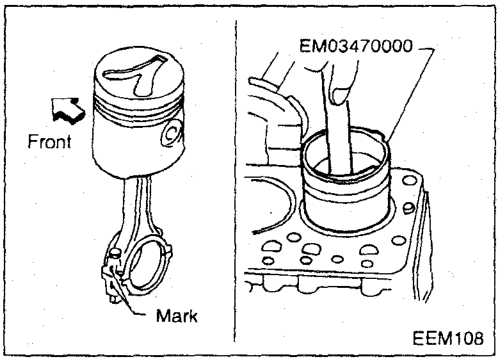
Limit

0.4 mm (0.016 in)

If beyond the limit, replace No. 4 main bearing thrust washer. Refer to S.D.S.

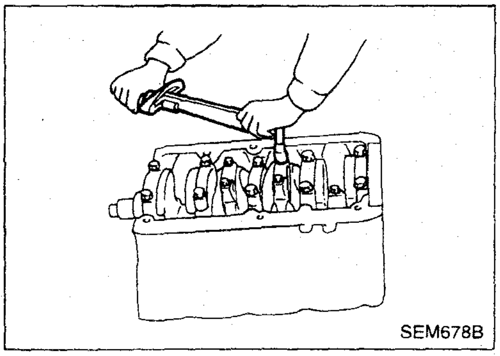


Assembly (Cont'd)

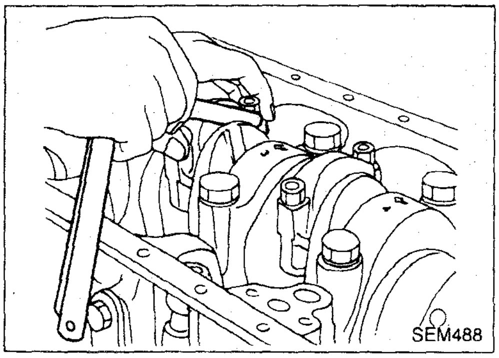


2. Install pistons with connecting rods.
(1) Install them into corresponding cylinder using Tool.

- **Be careful not to scratch cylinder wall with connecting rod.**
- **Apply engine oil to cylinder wall, piston and bearing.**
- **The leaf type combustion chamber on piston head must be facing toward the fuel pump side.**



(2) Install connecting rod bearing caps.

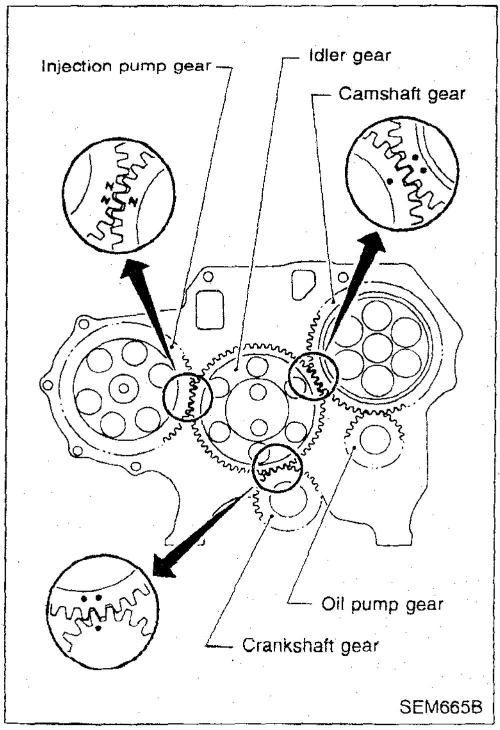


3. Measure connecting rod side clearance.

Connecting rod side clearance:
Standard
0.10 - 0.22 mm (0.0039 - 0.0087 in)
Limit
0.22 mm (0.0087 in)

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

4. Install oil strainer and oil pan.
5. Install all removed parts.



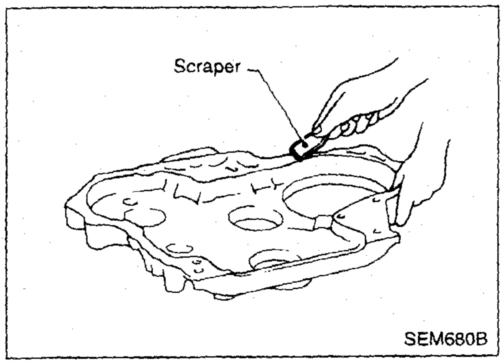
GEAR TRAIN

1. Set No. 1 piston at its Top Dead Center.
2. Align each gear mark and install gears.

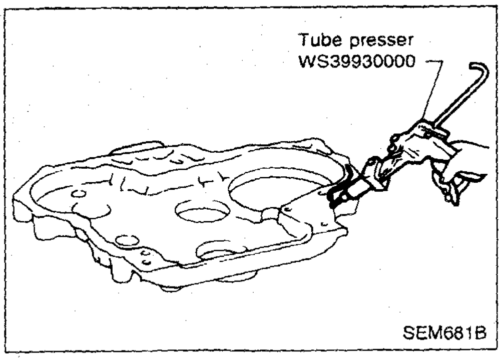
Assembly (Cont'd)

TIMING GEAR CASE

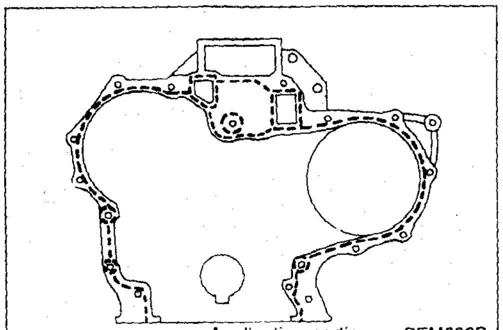
Installation

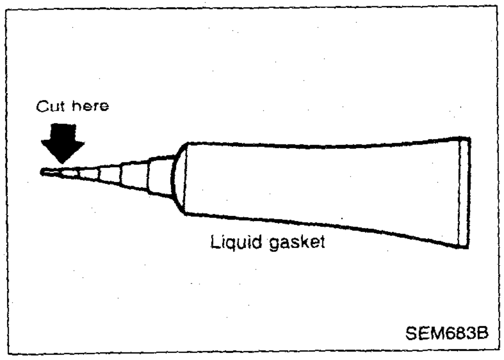


1. Before installing timing gear case, remove all traces of liquid gasket from mating surface using a scraper.
   Also remove traces of liquid gasket from mating surface of front plate.



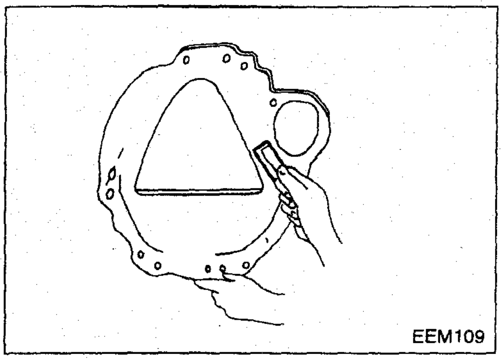
2. Apply a continuous bead of liquid gasket to mating surface of timing gear case.





- **Be sure liquid gasket is 2.5 to 3.5 mm (0.098 to 0.138 in) wide.**
- **Attach timing gear case to front plate within 20 minutes after coating.**
- **Wait at least 30 minutes before refilling engine coolant or starting engine.**
- **Use Genuine Liquid Gasket or equivalent.**

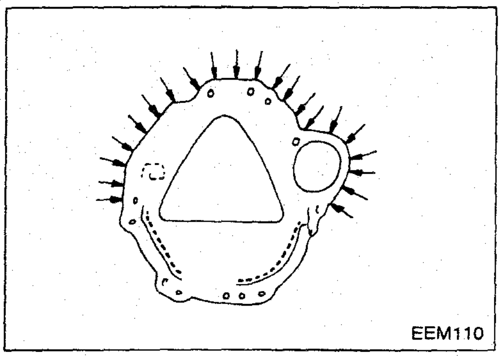
Assembly (Cont'd)



REAR PLATE

Installation

1. Before installing rear plate, 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 suface of cylinder block.
3. Fit the rear plate into the cylinder block and apply liquid gasket in the area indicated by discontinuous line.
4. After the transmission is installed, apply liquid gasket in the area indicated by arrows.
5. Install all removed parts.

General Specifications

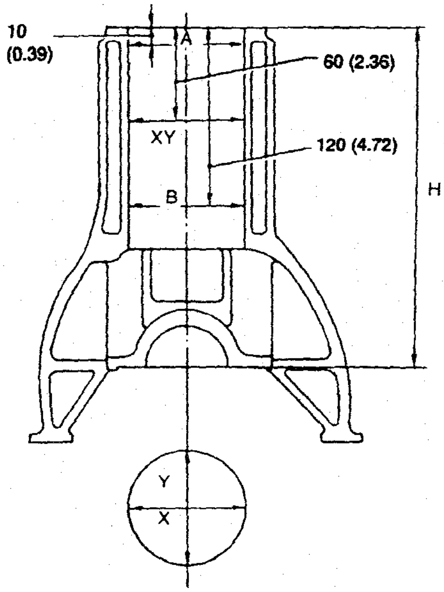
Engine model	KA24E
Cylinder arrangement	4 in-line
Displacement cm^3 (cu in)	2,389 (145.78)
Bore x stroke mm (in)	89 x 96 (3.50 x 3.78)
Valve arrangement	O.H.C.
Firing order	1-3-4-2
Number of piston rings	
Compression	2
Oil	1
Number of main bearings	5
Compression ratio	8.6

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

Compression pressure	
Standard	1,324 (13.24, 13.5, 192)/300
Minimum	981 (9.8, 10, 142)/300
Differential limit between cylinders	98 (0.98, 1.0, 14)/300

Inspection and Adjustment

CYLINDER BLOCK



SEM447C

Unit: mm (in)

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

* Wear limit

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

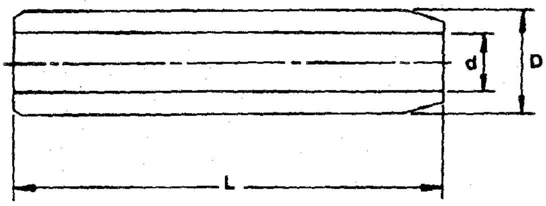
CYLINDER HEAD

Unit: mm (in)

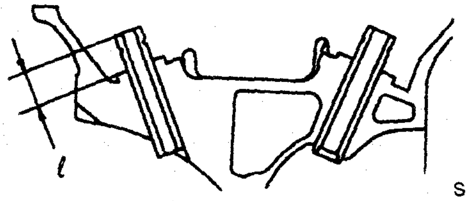
	Standard	Limit
Height (H)	98.8 - 99.0 (3.890 -3.898)	0.2 (0.008)*
Surface distortion	0.03 (0.0012)	0.1 (0.004)

* Total amount of cylinder head surfacing and cylinder block resurfacing

VALVE GUIDE



SEM571B



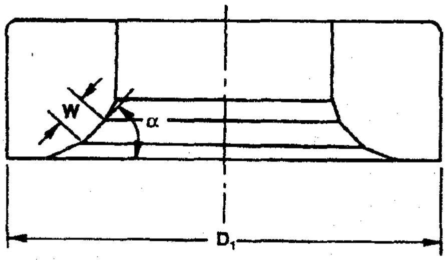
SEM225C

Unit: mm (in)

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

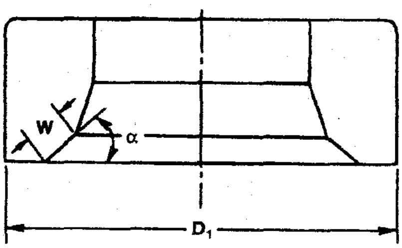
VALVE SEATS

Standard



SEM177

Service

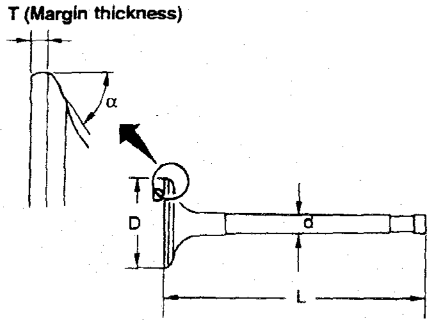


SEM178

Unit: mm (in)

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

VALVE



SEM188A

Unit: mm (in)

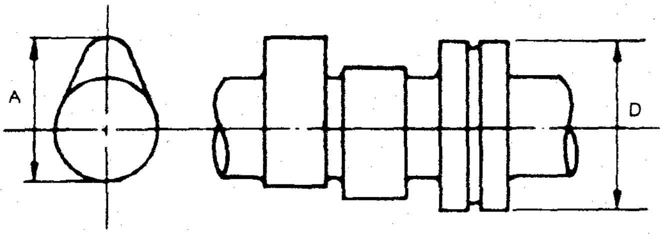
		Standard	Limit
Valve head diameter (D)	In.	34.0 - 34.2 (1.339 - 1.346)	—
	Ex.	40.0 - 40.2 (1.575 - 1.583)	—
Valve length (L)	In.	119.9 - 120.2 (4.720 - 4.732)	—
	Ex.	120.67 - 120.97 (4.7508 - 4.7626)	—
Valve stem diameter (d)	In.	6.965 - 6.980 (0.2742 - 0.2748)	—
	Ex.	7.948 - 7.960 (0.3129 - 0.3134)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

VALVE SPRING

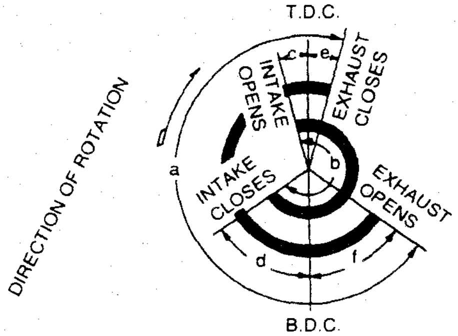
Unit: mm (in)

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

CAMSHAFT AND CAMSHAFT BEARING



SEM568A



EM120

Unit: mm (in)

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

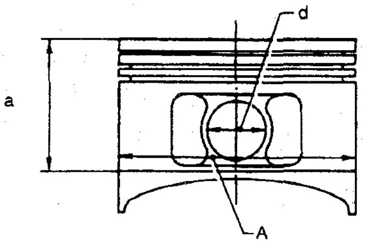
ROCKER ARM AND ROCKER SHAFT

Unit: mm (in)

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

PISTONS, PISTON RING AND PISTON PIN

Piston



SEM444C

Unit: mm (in)

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

Piston pin

Unit: mm (in)

	Standard
Piston pin outer diameter	20.994 - 20.996 (0.8265 - 0.8266)
Pin to piston pin hole clearance	0.008 - 0.012 (0.0003 - 0.0005)
Piston pin to connecting rod clearance	–0.015 to – 0.033 (–0.0006 to – 0.0013)

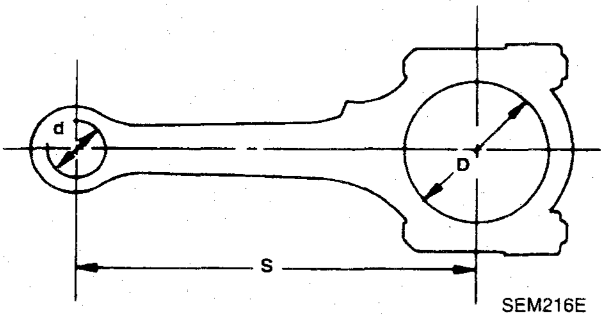
Piston ring

Unit: mm (in)

		Standard	Limit
Side clearance	Top	0.040 - 0.080 (0.0016 - 0.0031)	0.1 (0.004)
	2nd	0.030 - 0.070 (0.0012 - 0.0028)	0.1 (0.004)
	Oil	0.065 - 0.135 (0.0026 - 0.0053)*	0.1 (0.004)
Ring gap	Top	0.28 - 0.52 (0.0110 - 0.0205)	0.5 (0.020)
	2nd	0.45 - 0.69 (0.0177 - 0.0272)	0.5 (0.020)
	Oil (rail ring)	0.20 - 0.69 (0.0079 - 0.0272)	0.5 (0.020)

*: Riken-make

CONNECTING RODS

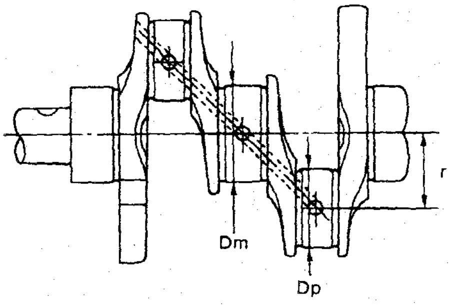


SEM216E

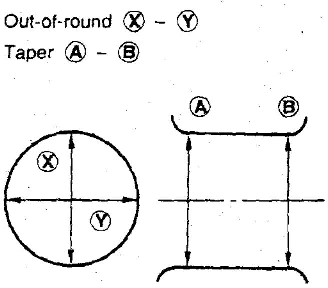
Unit: mm (in)

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

CRANKSHAFT



SEM394



EM715

Unit: mm (in)

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

* Total indicator reading

BEARING CLEARANCE

Unit: mm (in)

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

AVAILABLE MAIN BEARING

Standard

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

Undersize (service)

Unit: mm (in)

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

AVAILABLE CONNECTING ROD BEARING

Standard

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

Undersize (service)

Unit: mm (in)

	Thickness	Crank pin journal diameter "Dp"
0.08 (0.0031)	1.540 - 1.548 (0.060 - 0.0609)	Grind so that bearing clearance is the specified value.
0.12 (0.0047)	1.560 - 1.568 (0.0614 - 0.0617)	
0.25 (0.0098)	1.625 - 1.633 (0.0640 - 0.0643)	

MISCELLANEOUS COMPONENTS

Unit: mm (in)

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

* Total indicator reading

General Specifications

Engine model	TD27T
Cylinder arrangement	4, in-line
Displacement cm^3 (cu in)	2,663 (162.5)
Bore x stroke mm (in)	96 x 92 (3.8 x 3.6)
Valve arrangement	O.H.V.
Firing order	1-3-4-2
Number of piston rings	
Compression	2
Oil	1
Number of main bearings	5
Compression ratio	21.9 ± 0.2

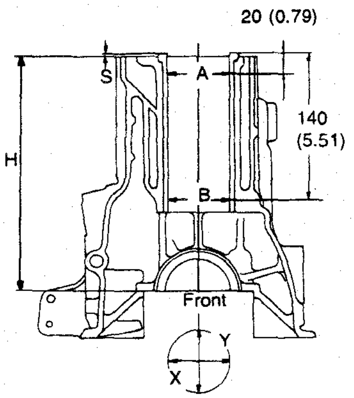
Unit: kPa (bar, kg/cm^2, psi)/rpm

Compression pressure	
Standard	2,942 (29.4, 30, 427)/200
Minimum	2,452 (24.5, 25, 356)/200
Differential limit between cylinders	294 (2.9, 3, 43)/200

Inspection and Adjustment

CYLINDER BLOCK AND CYLINDER LINER

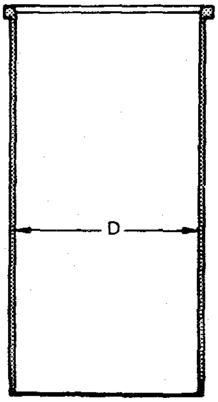
Unit: mm (in)



SEM950C

Nominal cylinder block height (H) (From crankshaft center)	54.95 - 55.05 (2.1634 - 2.1673)
Surface flatness (Without cylinder liner)	
Standard	Less than 0.05 (0.0020)
Limit	0.2 (0.008)
Cylinder bore	
Inner diameter	
Standard	99.000 - 99.020 (3.8976 - 3.8984)
Cylinder liner bore	
Inner diameter	
Standard	
Grade No. 1	96.000 - 96.010 (3.7795 - 3.7799)
Grade No. 2	96.010 - 96.020 (3.7799 - 3.7803)
Grade No. 3	96.020 - 96.030 (3.7803 - 3.7807)
Wear limit	0.20 (0.0079)
Out-of-round (X–Y)	Less than 0.020 (0.0008)
Taper (A–B)	Less than 0.20 (0.0079)
Projection "S"	0.02 - 0.09 (0.0008 - 0.0035)
Division of each cylinder	Less than 0.05 (0.0020)
Interference fit cylinder liner to block	–0.01 to 0.03 (–0.00044 to 0.0012)

Unit: mm (in)



SEM427

Cylinder liner diameter "D" (service)*	96.050 - 96.070 (3.7815 - 3.7823)

* Before installing in cylinder block

Inspection and Adjustment (Cont'd)

VALVE GUIDE

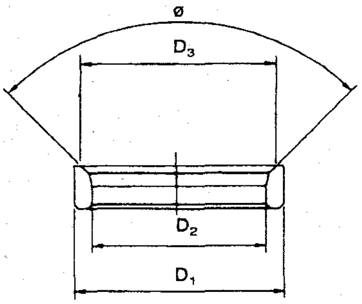
Unit: mm (in)

	Standard	Service
Valve guide outside diameter	12.033 - 12.044 (0.4737 - 0.4742)	—
Valve guide inner diameter (Finished size)	8.00 - 8.015 (0.3150 - 0.3156)	
Cylinder head valve guide hole diameter	12.00 - 12.011 (0.4724 - 0.4729)	—
Interference fit of valve guide	0.022 - 0.044 (0.0009 - 0.0017)	

	Standard	Limit
Valve to guide clearance		
Intake	0.020 - 0.050 (0.0008 - 0.0020)	0.15 (0.0059)
Exhaust	0.04 - 0.07 (0.0016 - 0.0028)	0.20 (0.0079)
Valve deflection limit		
Intake	0.30 (0.0118)	
Exhaust	0.40 (0.0157)	

VALVE SEAT

Unit: mm (in)



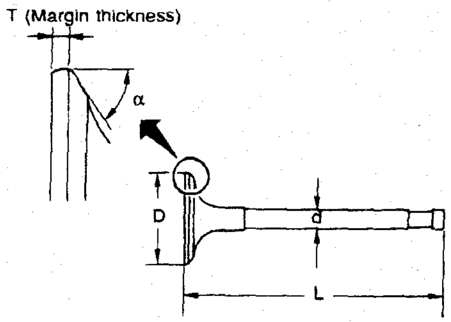
SEM953C

Intake	
Outer diameter "D₁"	44.535 - 44.545 (1.7533 - 1.7537)
Inner diameter "D₂"	38 ± 0.1 (1.50 ± 0.0039)
Diameter of seat "D₃"	42.4 - 42.6 (1.669 - 1.677)
Cylinder head valve seat diameter	44.500 - 44.515 (1.7520 - 1.7526)
Valve seat face angle "ø"	89° - 91°
Exhaust	
Outer diameter "D₁"	
Standard	39.535 - 39.545 (1.5565 - 1.5569)
0.2 (0.008) Oversize (Service)	39.735 - 39.745 (1.5644 - 1.5648)
0.4 (0.016) Oversize (Service)	39.935 - 39.945 (1.5722 - 1.5726)
Inner diameter "D₂"	32.9 - 33.1 (1.295 - 1.303)
Diameter of seat "D₃"	37.8 ± 0.1 (1.488 ± 0.0039)
Cylinder head valve seat diameter	
Standard	39.495 - 39.510 (1.5549 - 1.555)
0.2 (0.008) Oversize	39.695 - 39.710 (1.5628 - 1.5634)
0.4 (0.016) Oversize	39.895 - 39.910 (1.5707 - 1.5713)
Valve seat face angle "ø"	89° - 90°

Inspection and Adjustment (Cont'd)

VALVE

Unit: mm (in)



SEM188

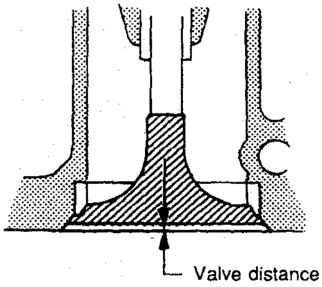
Valve head diameter "D"	
Intake	43.4 - 43.6 (1.709 - 1.717)
Exhaust	37.9 - 38.1 (1.492 - 1.500)
Valve length "L"	
Intake	117 (4.61)
Exhaust	
Valve stem diameter "d"	
Intake	7.965 - 7.980 (0.3136 - 0.3142)
Exhaust	7.945 - 7.960 (0.3128 - 0.3134)
Valve seat angle "α"	
Intake	45° - 45°30'
Exhaust	
Valve margin "T" limit	1.5 (0.059)
Valve stem end surface grinding limit	0.2 (0.008)
Valve clearance (Hot)	
Intake	0.25 (0.01)
Exhaust	

VALVE SPRING

Free length mm (in)	
Painted red	53.80 (2.118)
Pressure height mm/N (mm/kg, in/lb)	
Painted red	31.8/713.5 - 788.5 (31.8/72.7 - 80.4, 1.252/160.3 - 177.3)
Assembled height mm/N (mm/kg, in/lb)	
Standard	42.3/314.5 - 361.5 (42.3/32.1 - 36.9, 1.665/70.8 - 81.4)
Limit	42.3/296.7 (42.3/30.2, 1.665/66.6)
Out of square mm (in)	2.0 (0.079)

CYLINDER HEAD TO VALVE DISTANCE

Unit: mm (in)



SEM724C

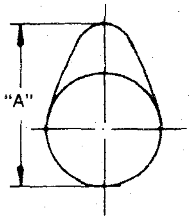
	Standard	Limit
Intake	0.79 - 1.19 (0.0311 - 0.0469)	Less than 1.75 (0.0689)
Exhaust	0.80 - 1.20 (0.0315 - 0.0472)	Less than 1.75 (0.0689)

Inspection and Adjustment (Cont'd)

CAMSHAFT AND CAMSHAFT BEARING

Unit: mm (in)

	Standard	Limit
Camshaft journal to bushing clearance	0.020 - 0.109 (0.0008 - 0.0043)	Less than 0.15 (0.0059)
Camshaft journal diameter		
Front	50.721 - 50.740 (1.9969 - 1.9976)	—
2nd	50.521 - 50.540 (1.9890 - 1.9898)	—
3rd	50.321 - 50.340 (1.9811 - 1.9819)	—
4th	50.121 - 50.140 (1.9733 - 1.9740)	—
Rear	49.921 - 49.940 (1.9654 - 1.9661)	—
Camshaft bend (Total indicator reading)	Less than 0.02 (0.0008)	Less than 0.06 (0.0024)
Camshaft end play	0.08 - 0.28 (0.0031 - 0.0110)	Less than 0.50 (0.0197)



EM671

	Standard	Limit
Cam height "A"		
Intake	41.900 (1.6220)	Less than 41.20 (1.6220)
Exhaust	41.900 (1.6496)	Less than 41.40 (1.6299)

VALVE LIFTER AND PUSH ROD

Unit: mm (in)

	Standard	Limit
Valve lifter outer diameter	24.960 - 24.970 (0.9827 - 0.9831)	—
Cylinder block valve lifter hole diameter	25.000 - 25.033 (0.9843 - 0.9855)	—
Valve lifter to lifter hole clearance	0.030 - 0.073 (0.0012 - 0.0029)	Less than 0.20 (0.0079)
Push rod bend (T.I.R.)*	Less than 0.3 (0.012)	Less than 0.5 (0.020)

*: Total indicator reading

ROCKER SHAFT AND ROCKER ARM

Unit: mm (in)

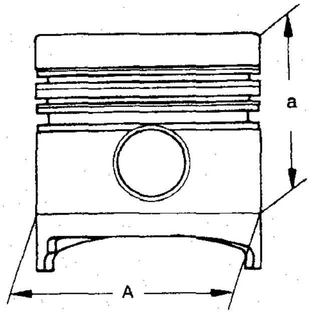
	Standard	Limit
Rocker shaft		
Outer diameter	19.979 - 20.00 (0.7866 - 0.7874)	—
Rocker shaft bend (T.I.R.)*	0 - 0.10 (0 - 0.0039)	Less than 0.30 (0.0188)
Rocker arm		
Inner diameter	20.014 - 20.035 (0.7880 - 0.7888)	—
Clearance between rocker arm and rocker shaft	0.014 - 0.056 (0.0006 - 0.0022)	Less than 0.15 (0.0059)

*: Total indicator reading

PISTON, PISTON RING AND PISTON PIN

Available piston

Unit: mm (in)



SEM778A

Piston skirt diameter "A"	
Standard	
Grade No. 1	95.890 - 95.900 (3.7752 - 3.7756)
Grade No. 2	95.900 - 95.910 (3.7756 - 3.7760)
Grade No. 3*	95.910 - 95.920 (3.7760 - 3.7764)
"a" dimension	45.2 (1.780)
Piston pin hole diameter	29.992 - 30.000 (1.1808 - 1.1811)
Piston to cylinder liner clearance	0.043 - 0.077 (0.0017 - 0.0030)
"a" dimension	69.2

* Grade No. 3 piston is not provided as a service part.

Piston pin

Unit: mm (in)

Piston pin outer diameter	29.993 - 30.000 (1.1808 - 1.1811)
Piston pin to piston clearance	−0.008 to 0.007 (−0.0003 to 0.0003)
Piston pin to connecting rod clearance	
Standard	0.025 - 0.045 (0.0010 - 0.0018)
Limit	0.15 (0.0059)

Piston ring

Unit: mm (in)

	Standard	Limit
Side clearance		
Top	0.00 - 0.05 (0.0 - 0.0019)	0.50 (0.0197)
2nd	0.04 - 0.072 (0.0016 - 0.0028)	0.30 (0.0118)
Oil	0.035 - 0.040 (0.0014 - 0.0016)	0.15 (0.0059)
Ring gap		1.5 (0.059)
Top	0.25 - 0.35 (0.0098 - 0.0014)	
2nd	0.50 - 0.75 (0.0197 - 0.0295)	
Oil (rail ring)	0.25 - 0.55 (0.0098 - 0.0217)	

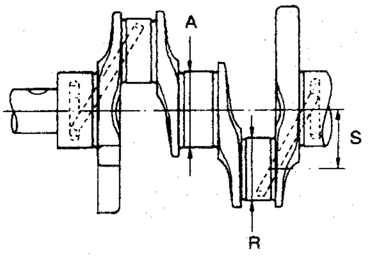
CONNECTING ROD

Unit: mm (in)

Center distance	156.975 - 157.025 (6.1801 - 6.1821)
Bend, torsion [per 200 (3.94)]	
Limit	0.15 (0.0059)
Piston pin bore dia.	30.025 - 30.038 (1.1821 - 1.1826)
Side clearance	
Standard	0.10 - 0.22 (0.0039 - 0.0087)
Limit	0.22 (0.0087)

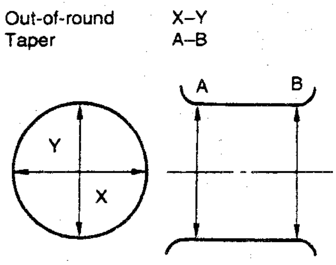
CRANKSHAFT

Unit: mm (in)



SEM100A

Journal diameter "A"	70.907 - 70.920 (2.7916 - 2.7921)
Pin diameter "B"	56.913 - 56.926 (2.2407 - 2.2411)
Center distance "S"	46.00 (1.8110)



EM715

Taper of journal and pin "A–B"	
Standard	Less than 0.01 (0.0004)
Limit	0.02 (0.0008)
Out-of-round of journal and pin "X–Y"	
Standard	Less than 0.01 (0.0004)
Limit	0.02 (0.0008)
Crankshaft bend	
Standard	0 - 0.03 (0 - 0.0012)
Limit	0.10 (0.0039)
Crankshaft end play	
Standard	0.060 - 0.25 (0.0024 - 0.0098)
Limit	0.40 (0.0157)

AVAILABLE MAIN BEARING

Bearing clearance

Unit: mm (in)

Main bearing clearance	
Standard	0.035 - 0.087 (0.0014 - 0.0034)
Limit	Less than 0.15 (0.0059)
Connecting rod bearing clearance	
Standard	0.035 - 0.081 (0.0014 - 0.0032)
Limit	Less than 0.15 (0.0059)

Main bearing undersize

Unit: mm (in)

	Crank journal diameter
Standard	70.907 - 70.920 (2.7916 - 2.7921)
Undersize	
0.25 (0.0098)	70.657 - 70.670 (2.7818 - 2.7823)
0.50 (0.0197)	70.407 - 70.420 (2.7719 - 2.7724)
0.75 (0.0295)	70.157 - 70.170 (2.7621 - 2.7626)
1.00 (0.0394)	69.907 - 69.920 (2.7522 - 2.7528)

AVAILABLE CONNECTING ROD BEARING

Connecting rod bearing undersize

Unit: mm (in)

	Crank pin journal diameter
Standard	56.913 - 56.926 (2.2407 - 2.2412)
Undersize	
0.25 (0.0098)	56.663 - 56.676 (2.2308 - 2.2313)
0.50 (0.0197)	56.413 - 56.676 (2.2210 - 2.2313)
0.75 (0.0295)	56.163 - 56.176 (2.2111 - 2.2116)
1.00 (0.0394)	55.913 - 55.926 (2.2013 - 2.2018)

Inspection and Adjustment (Cont'd)

AVAILABLE THRUST WASHER

Thrust washer undersize

Unit: mm (in)

	Thrust washer thickness
Standard	2.275 - 2.325 (0.0896 - 0.0915)
Oversize	
0.20 (0.0079)	2.475 - 2.525 (0.0974 - 0.0994)
0.40 (0.0157)	2.675 - 2.725 (0.1053 - 0.1073)

MISCELLANEOUS COMPONENTS

Unit: mm (in)

Gear train Backlash of each gear	
Standard	0.07 - 0.11 (0.0028 - 0.0043)
Limit	0.20 (0.0079)
Flywheel	
Runout (Total indicator reading)	Less than 0.15 (0.0059)
Front plate	
Warpage limit	0.2 (0.008)
Cylinder head	
Head surface distorsion	
Standard	Less than 0.07 (0.0028)
Limit	0.2 (0.008)
Minimum height	89.7 (3.532)

ENGINE LUBRICATION & COOLING SYSTEMS

SECTION LC

ENGINE LUBRICATION & COOLING SYSTEMS

SECTION LC

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KA24E

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TD27T

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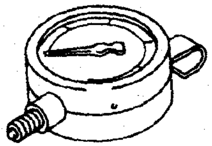
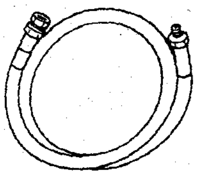
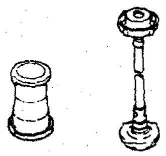
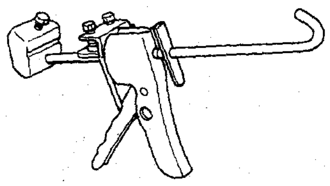
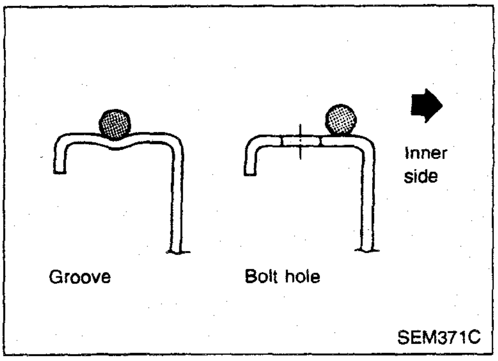
PREPARATION

SPECIAL SERVICE TOOLS

Tool number Tool name	Description	Engine application	
		KA24E	TD27T
ST25051001 Oil pressure gauge		X	X
ST25052000 Hose	Adapting oil pressure gauge to cylinder block 	X	X
EG17650301 Radiator cap tester adapter	Adapting radiator cap tester to radiator filler neck 	X	X
WS39930000 Tube presser	Pressing the tube of liquid gasket 	X	X



SEM371C

LIQUID GASKET APPLICATION PROCEDURE

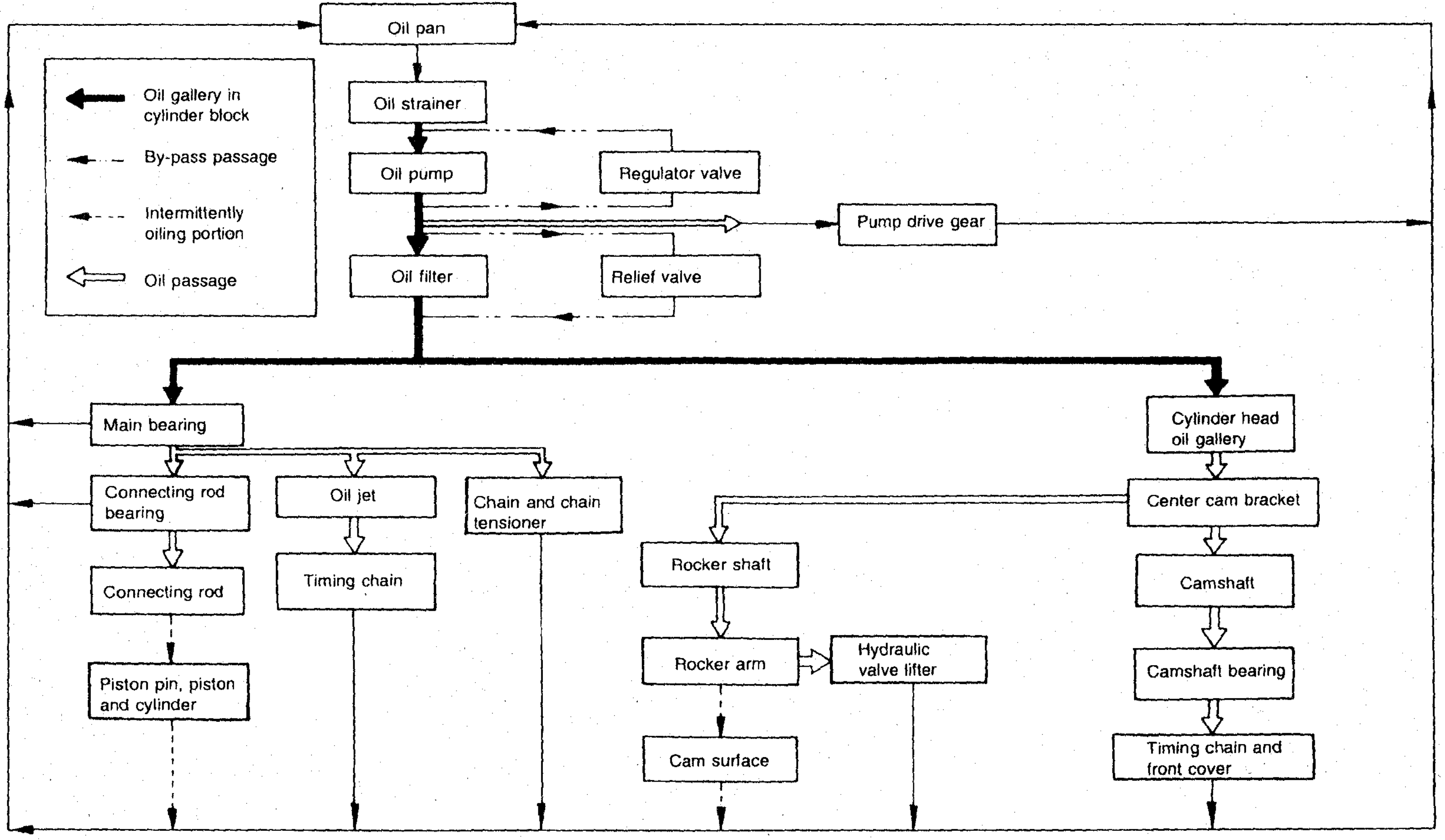
a. Before applying liquid gasket, use a scraper to remove all traces of old liquid gasket from mating surface.

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

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

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

Lubrication Circuit

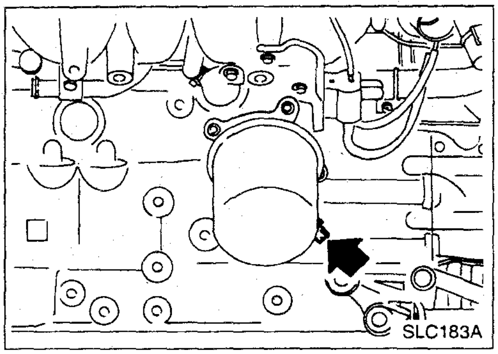


SLC182A

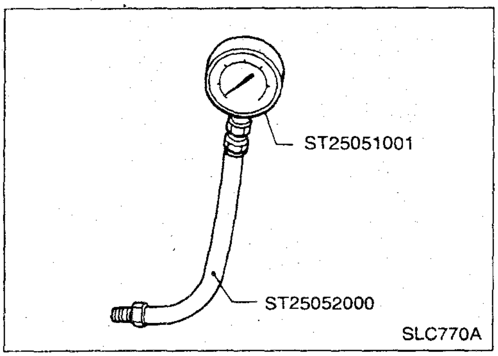
Oil Pressure Check

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 78 (0.78, 0.8, 11)
3,000	412 - 481 (4.12 - 4.81, 4.2 - 4.9, 60 - 70)

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

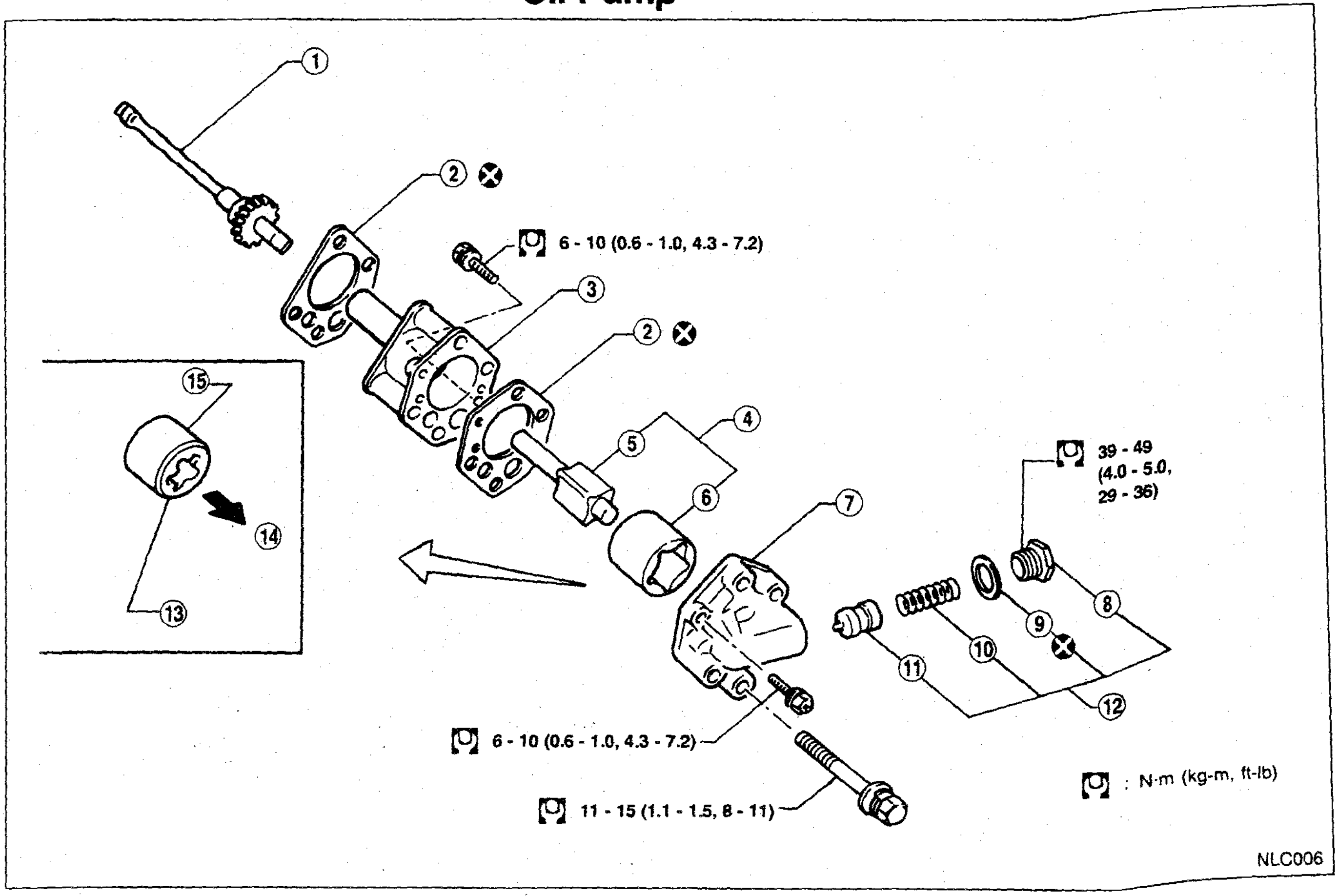
6. Install oil pressure switch with sealant.

Use proper liquid gasket.

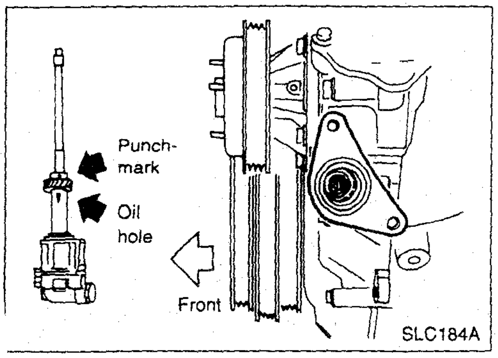
Oil pressure switch:

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

Oil Pump

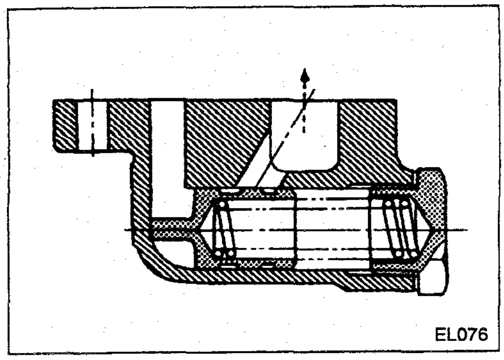


① Drive spindle
② Gasket
③ Pump body
④ Rotor assembly
⑤ Inner rotor
⑥ Outer rotor
⑦ Pump cover
⑧ Cap
⑨ Washer
⑩ Spring
⑪ Regulator valve
⑫ Regulator valve set
⑬ Chamfer
⑭ Pump cover
⑮ Outer rotor



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

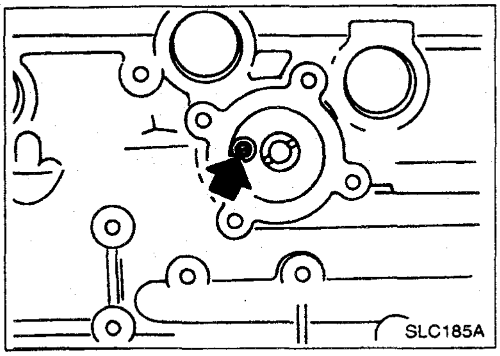
Oil Pump (Cont'd)



REGULATOR VALVE INSPECTION

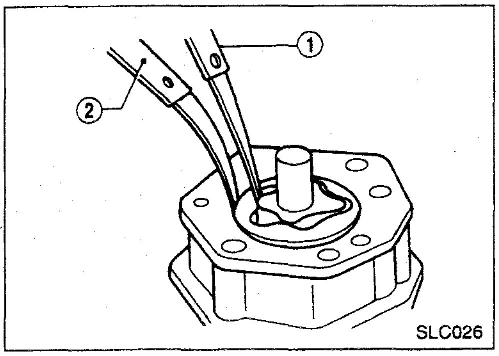
1. Visually inspect components for wear and damage.
2. Check oil pressure regulator valve sliding surface and valve spring.
3. Coat regulator valve with engine oil and check that it falls smoothly into the valve hole by its own weight.

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 suitable tool.
Install a new valve in place by tapping it.



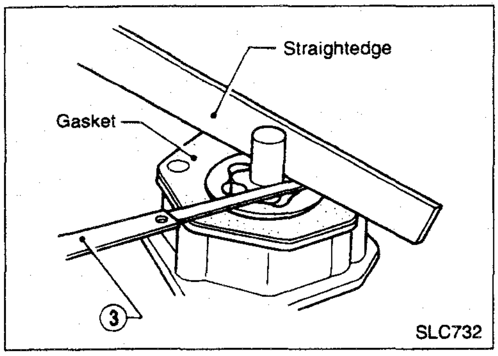
OIL PUMP INSPECTION

Using a feeler gauge, check the following clearances.

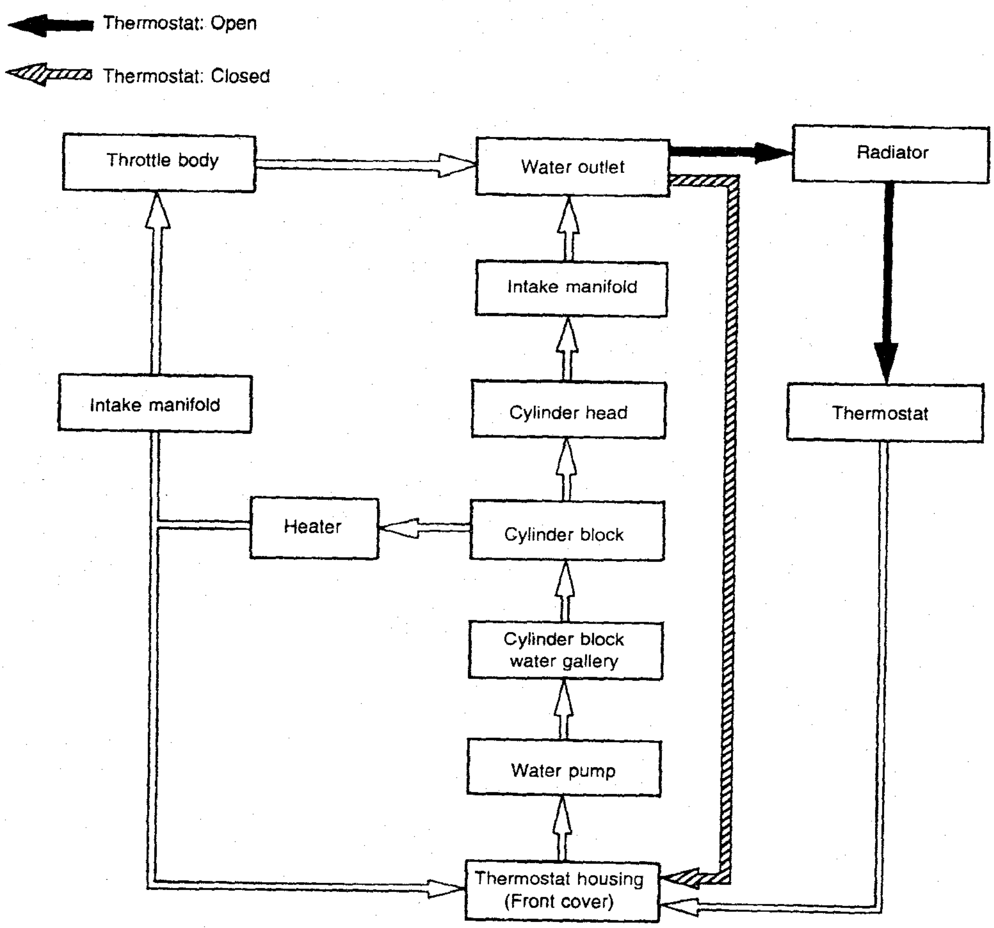
Unit: mm (in)

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

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



Cooling Circuit



SLC186A

System Check

WARNING:

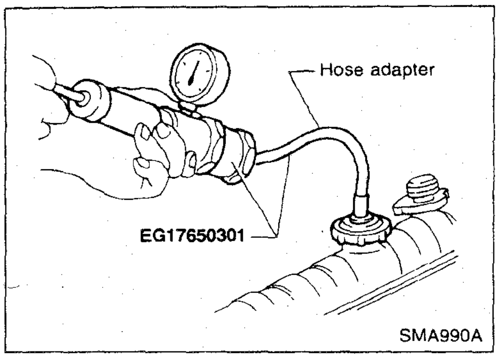
Never remove the radiator cap when the engine is hot; serious burns could be caused by high pressure fluid escaping from the radiator.

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

CHECKING COOLING SYSTEM HOSES

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

System Check (Cont'd)

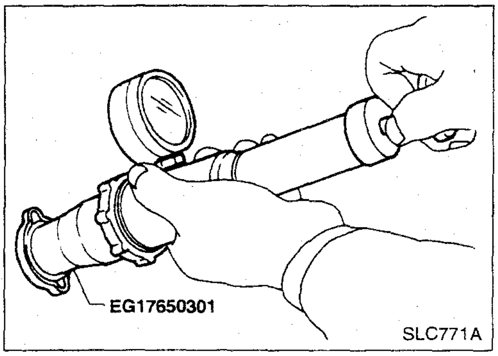


CHECKING COOLING SYSTEM FOR LEAKS

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

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

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

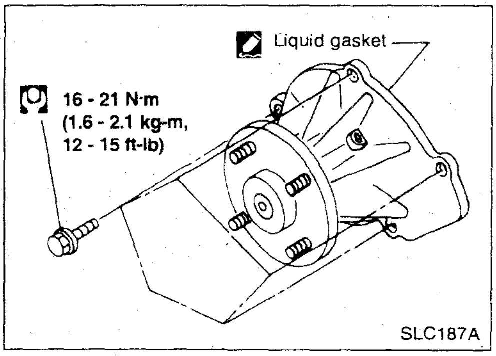


CHECKING RADIATOR CAP

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

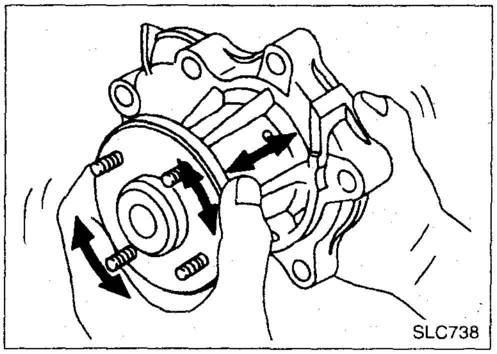
Radiator cap relief pressure:
78 - 98 kPa (0.78 - 0.98 bar, 0.8 - 1.0 kg/cm^2, 11 -14 psi)

Water Pump

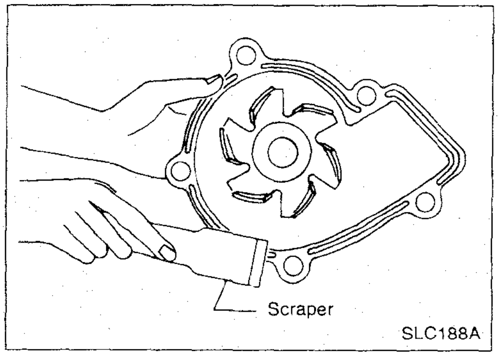


INSPECTION

Check for excessive end play and rough operation.

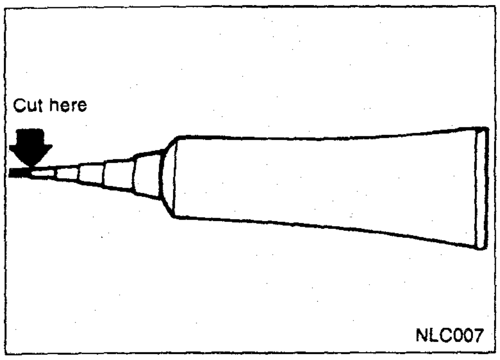


INSTALLATION

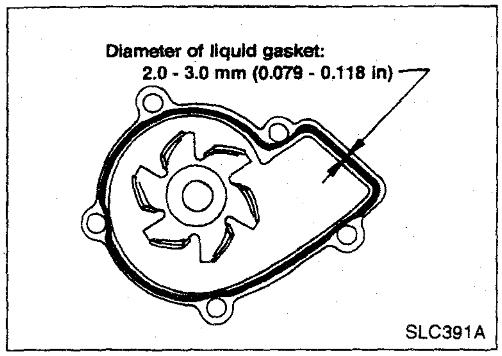


- Remove liquid gasket from mating surface of pump housing using a scraper.
  Be sure liquid gasket in grooves is also removed.
- Remove liquid gasket from mating surface of cylinder block.
- Clean all traces of liquid gasket using white gasoline.

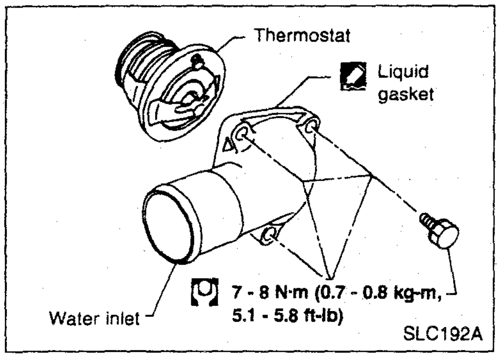
Water Pump (Cont'd)



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



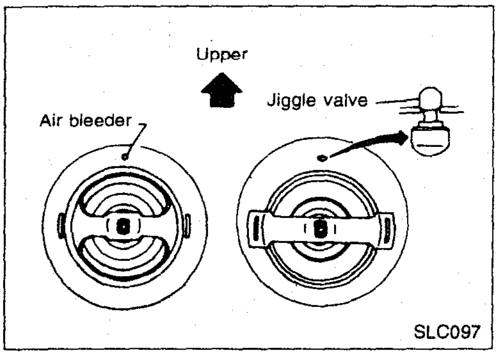
- Apply a continuous bead of liquid gasket to mating surface of pump housing as shown.



Thermostat

INSPECTION

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

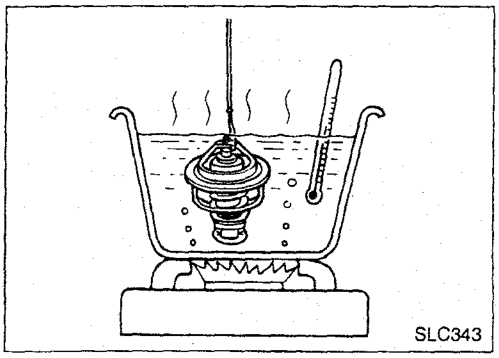


2. Check valve opening temperature and maximum valve lift.

	Standard type	Optional type
Valve opening temperature °C (°F)	76.5 (170)	82 (180)
Max. valve lift mm/°C (in/°F)	8/90 (0.31/194)	8/95 (0.31/203)

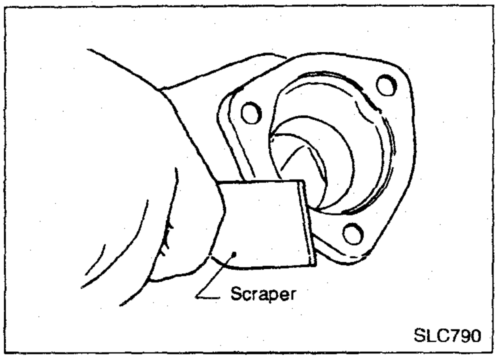
3. Then check if valve closes at 5°C (9°F) below valve opening temperature.

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

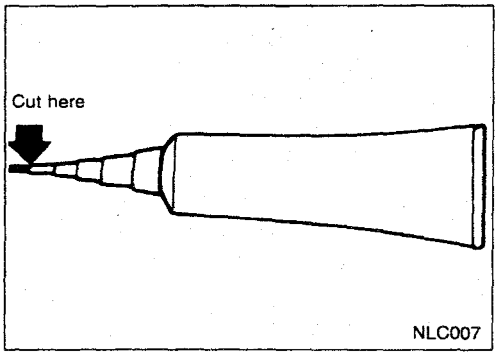


Thermostat (Cont'd)

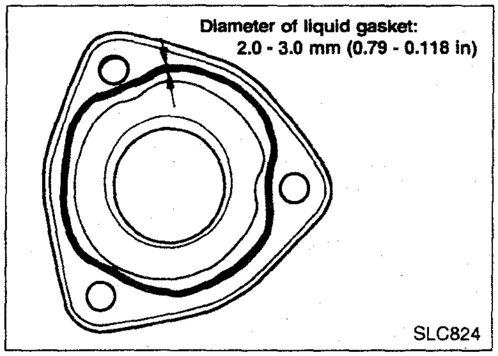
INSTALLATION



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

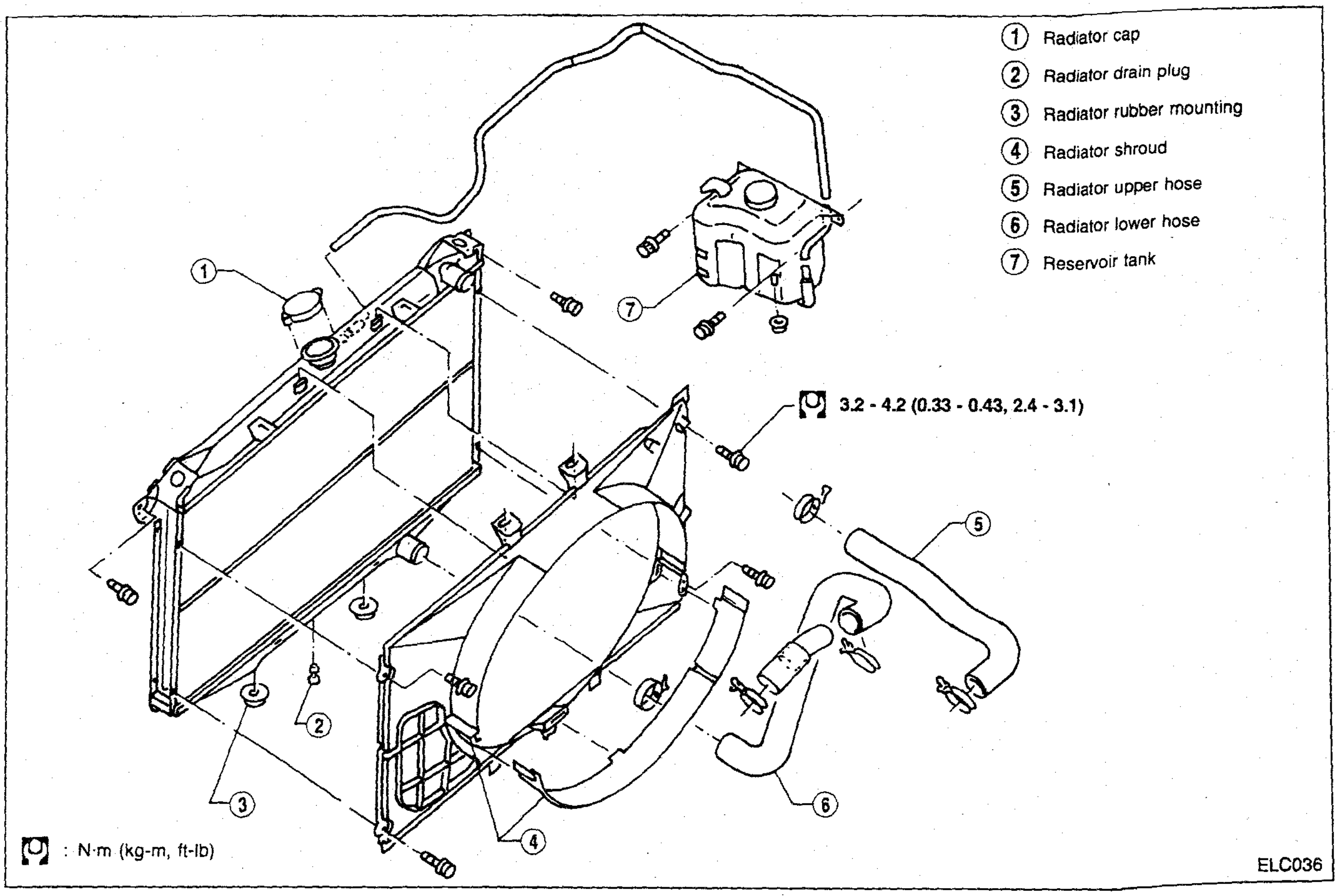


- Cut off tip of nozzle of liquid gasket tube at point shown in figure.
- Use Genuine Liquid Gasket or equivalent.



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

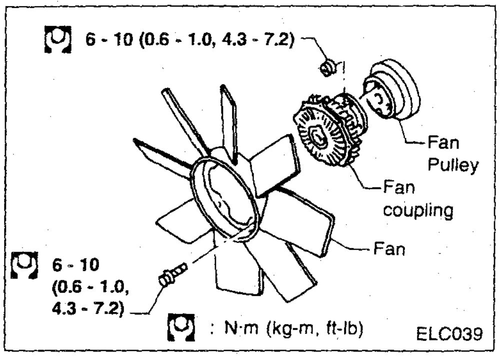
Radiator



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

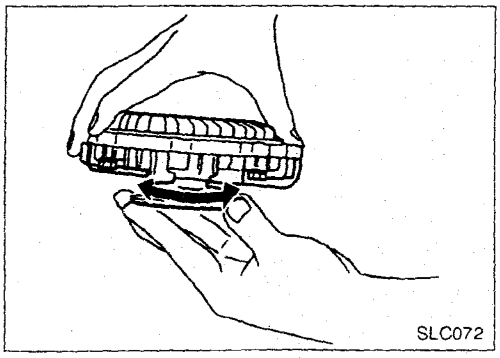
Cooling Fan

DISASSEMBLY AND ASSEMBLY

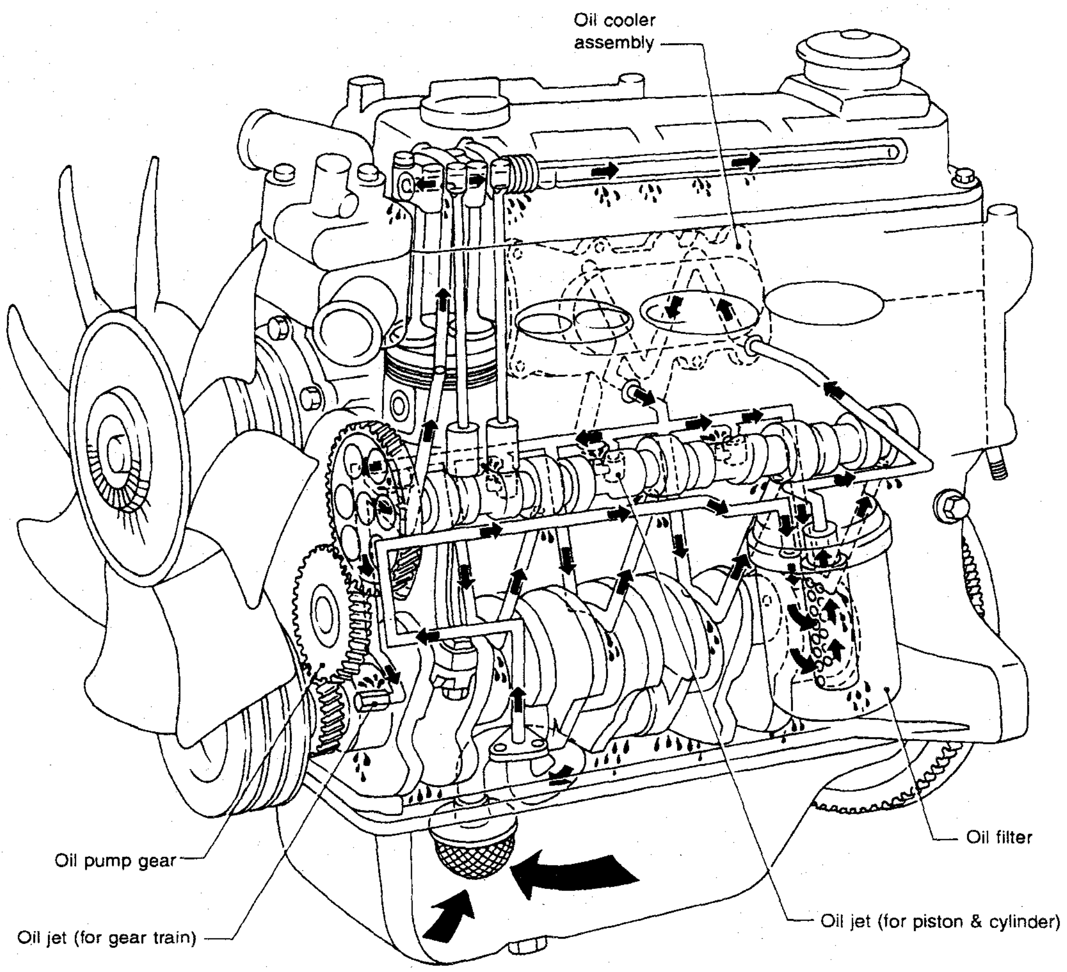


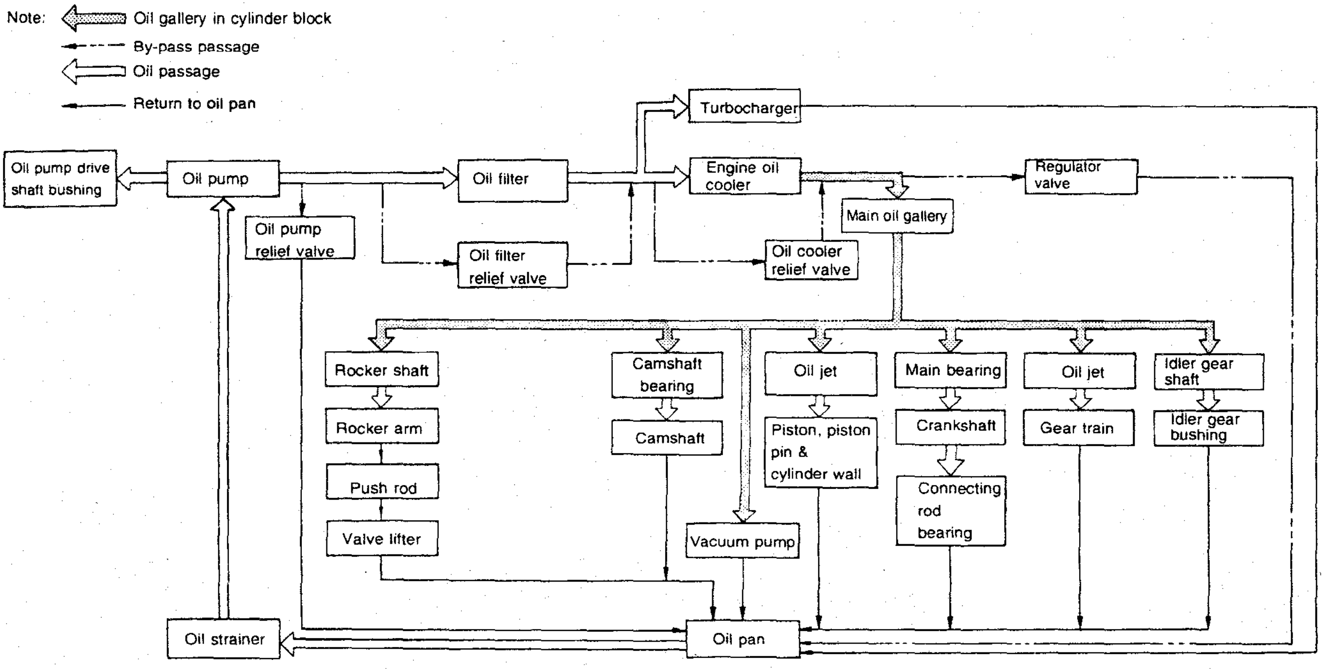
INSPECTION

Check that fan coupling operates smoothly, that there is no oil leakage and that bimetal is not bent.



Lubrication Circuit



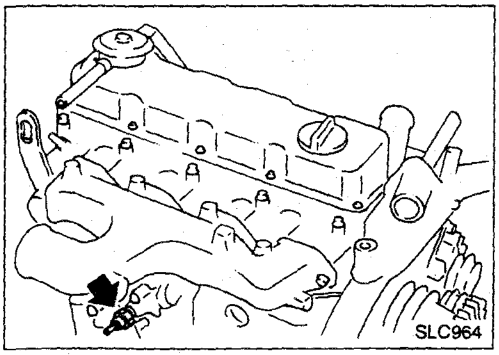


ELC037

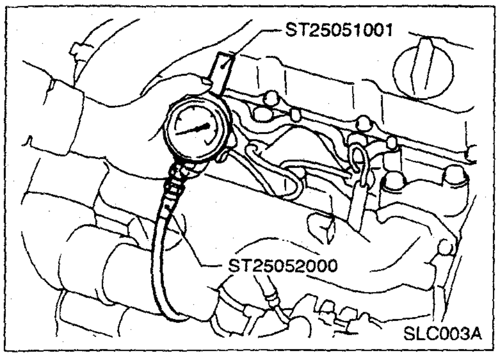
Oil Pressure Check

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/cm², psi)
Idle speed	More than 78 (0.78, 0.8, 11)
3,000	294 - 392 (2.94 - 3.92, 3.0 - 4.0, 43 - 57)

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

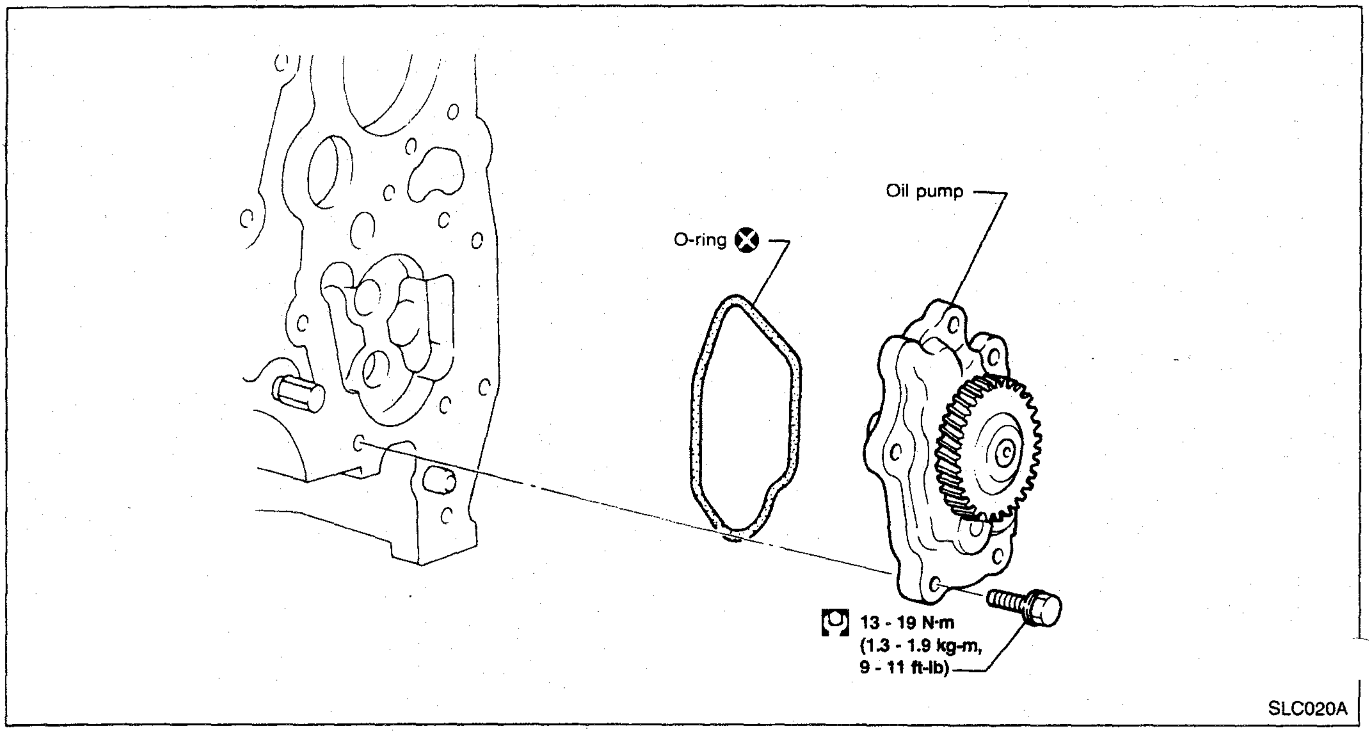
6. Install oil pressure switch.

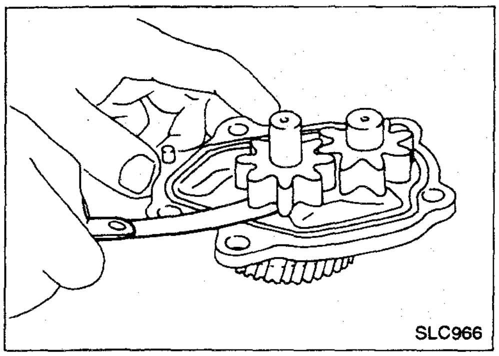
Use proper liquid sealant.

Oil pressure switch:

⍌: 10 - 13 N·m (1.0 - 1.3 kg-m, 7 - 9 ft-lb)

Oil Pump

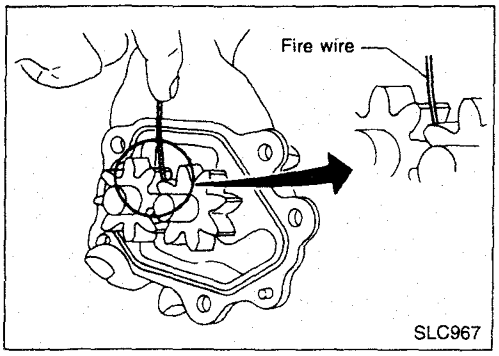




OIL PUMP INSPECTION

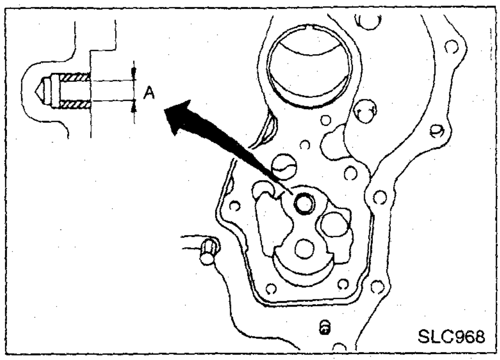
1. Inspect pump body, gears and drive shaft for wear and damage.
2. Using a feeler gauge and fuse wire, check the following clearances.

   Gear side clearance:
   Less than 0.13 mm (0.0051 in)

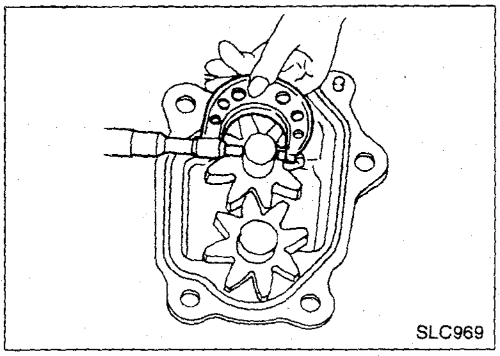


Gear backlash:
Less than 0.43 mm (0.0169 in)

Oil Pump (Cont'd)



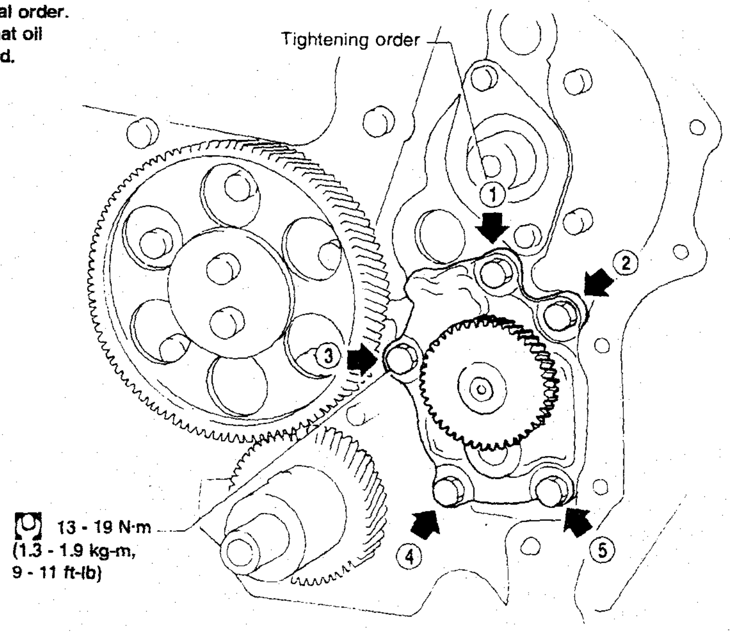
3. Measure inside diameter "A" of bushing.
   A: 13.012 - 13.098 mm (0.5123 - 0.5157 in)



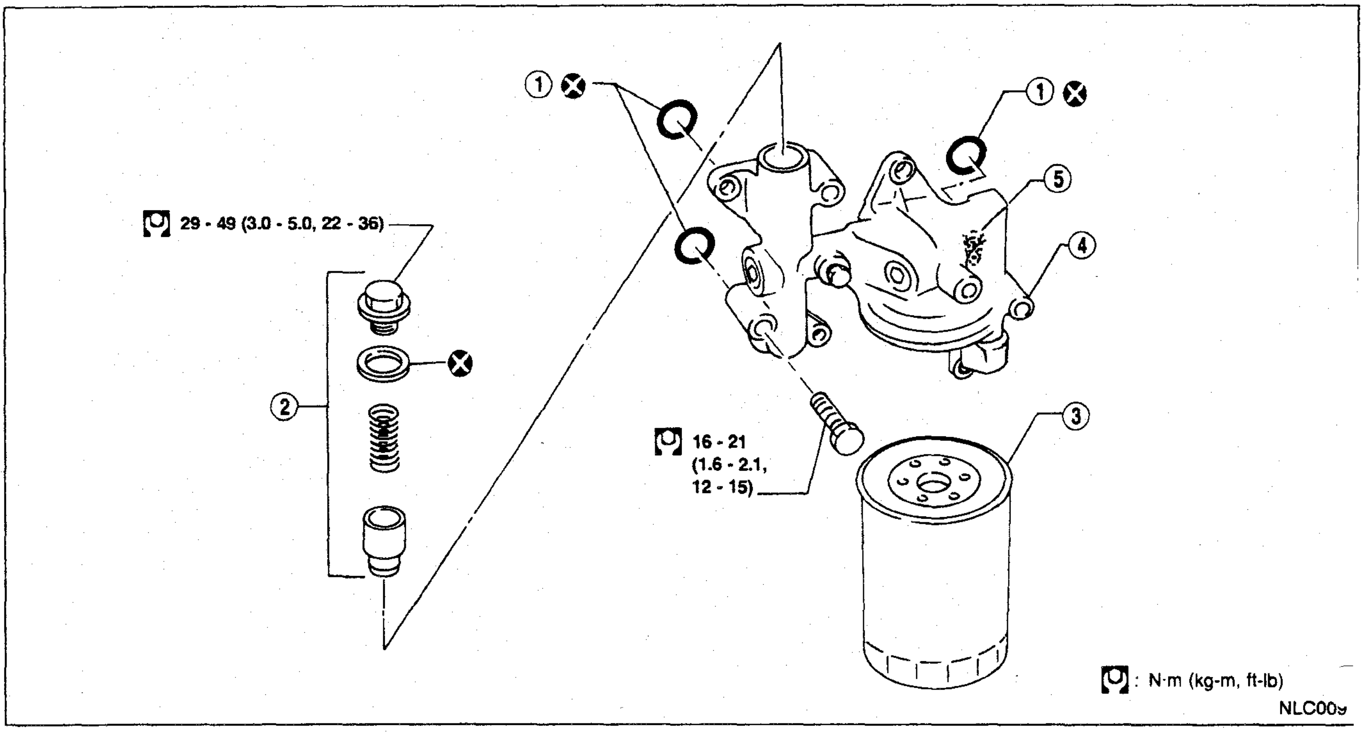
4. Measure outside diameter "B" of drive gear shaft.
   B: 12.974 - 12.992 mm (0.5108 - 0.5115 in)
5. Calculate oil pump bushing clearance.
   Oil pump bushing clearance (A – B):
   Less than 0.15 mm (0.0059 in)

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

- **When installing oil pump, the bolt should be tightened in two or three stages according to numerical order.**
- **After installation, ascertain that oil pump turns smoothly by hand.**



Oil Filter Bracket



① O-ring
② Oil pump relief valve
③ Oil filter
④ Oil filter bracket
⑤ Oil filter relief valve

OIL PUMP RELIEF VALVE INSPECTION

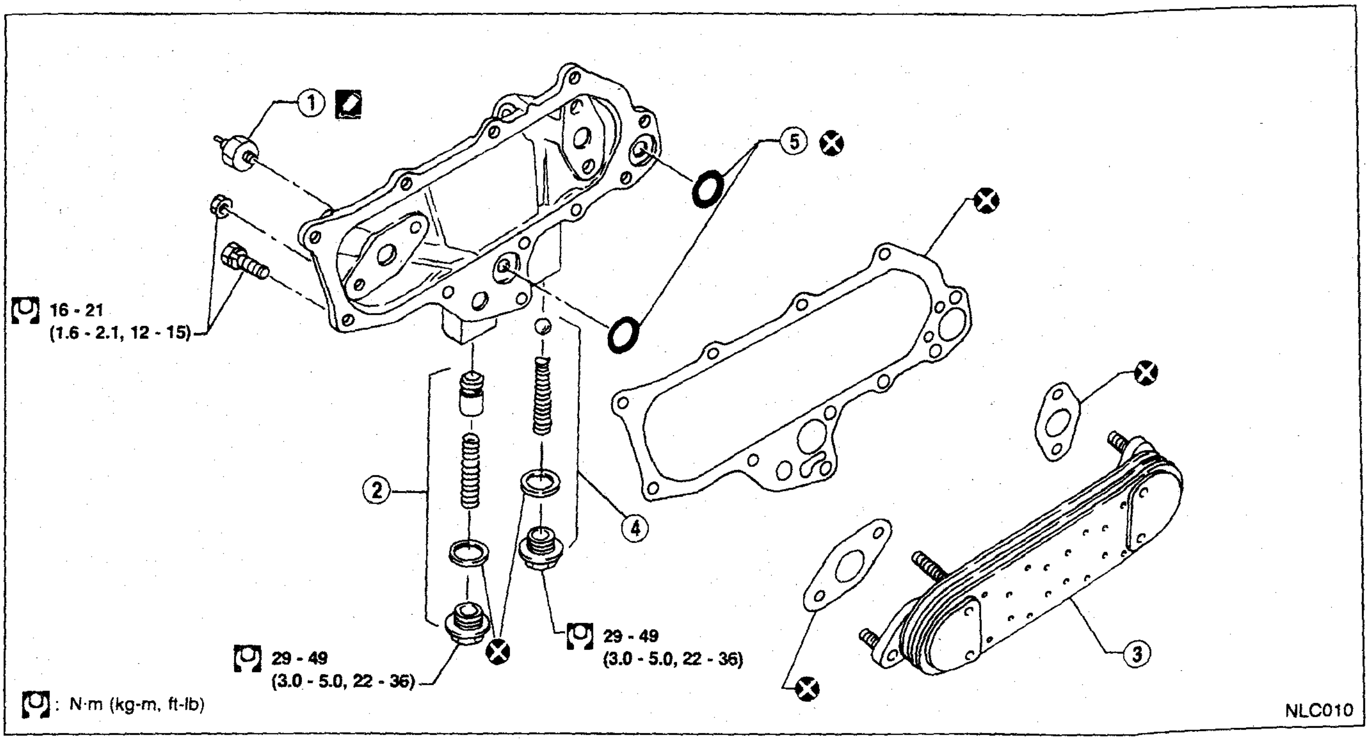
1. Visually inspect components for wear and damage.
2. Coat relief valve with engine oil and check that it falls smoothly into the valve holy by its own weight.

If damaged, replace oil pump relief valve set.

OIL FILTER RELIEF VALVE INSPECTION

Inspect oil filter short valve for movement, cracks and breaks by pushing the ball.
If damaged, replace oil filter bracket assembly.

Oil Cooler



① Oil pressure switch
② Regulator valve
③ Oil cooler element
④ Oil cooler relief valve
⑤ O-ring

OIL COOLER RELIEF VALVE INSPECTION

Inspect oil cooler relief valve for movement, cracks and breaks by pushing the ball.
If damaged, replace oil cooler relief valve set.

REGULATOR VALVE INSPECTION

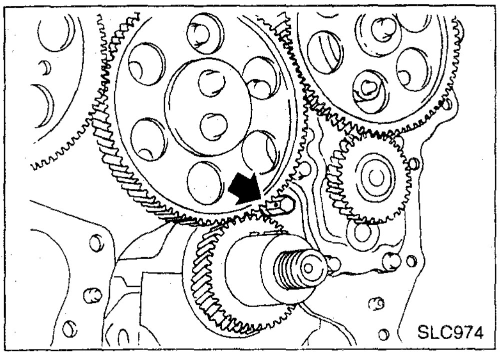
1. Visually inspect components for wear and damage.
2. Coat regulator valve with engine oil and check that it falls smoothly into the valve hole by its own weight.

If damaged, replace regulator valve set.

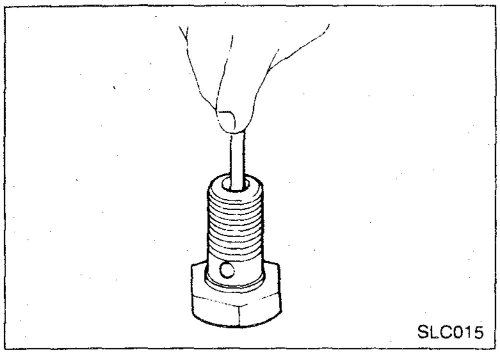
Oil Jet

INSPECTION (For gear train)

Make sure that the holes are not clogged. Clean them with a wire if necessary.

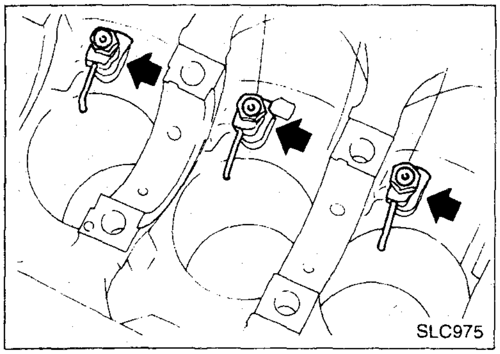


Oil jet has to be installed with oil hole facing crank gear and idler gear.



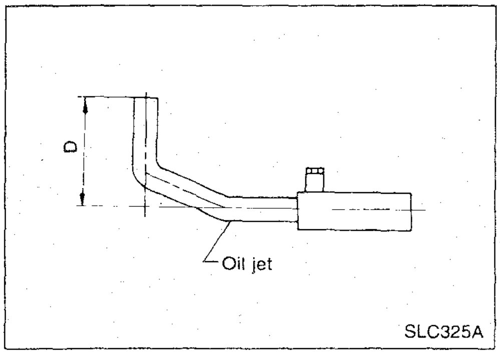
INSPECTION (For piston)

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.



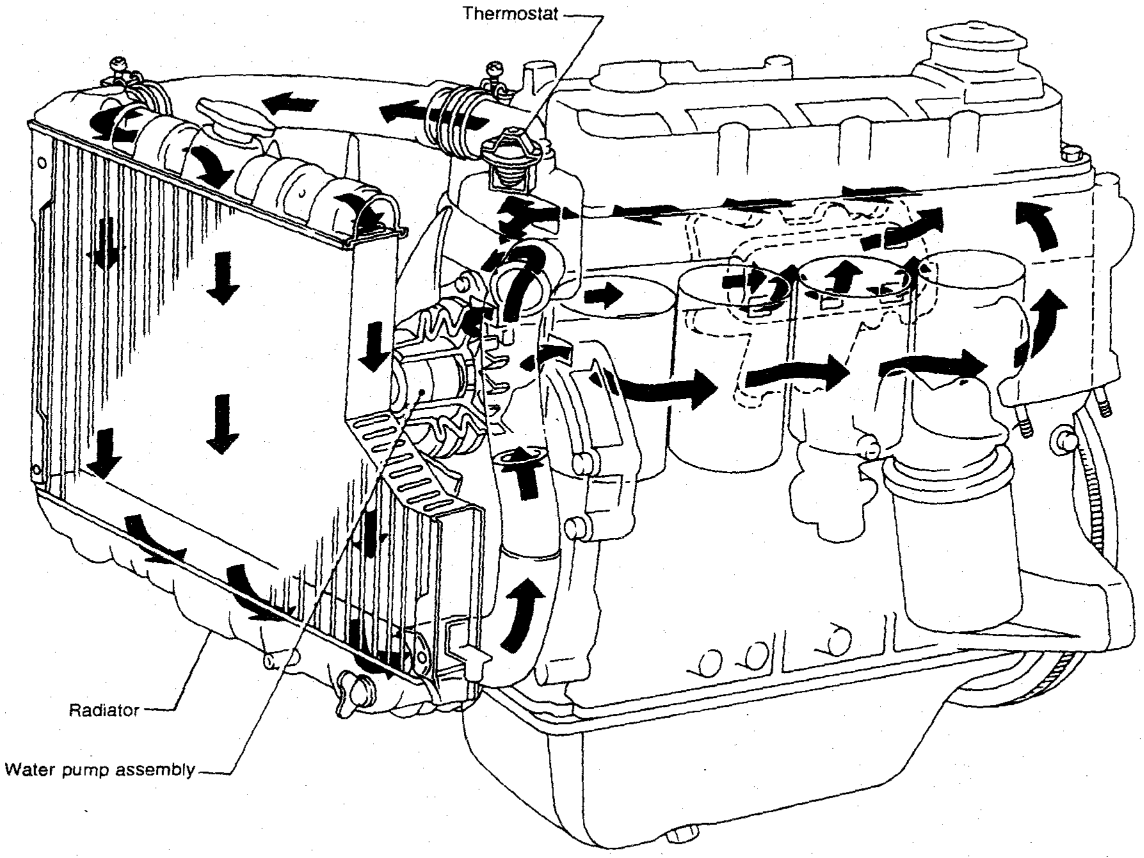
When installing oil jet, align oil jet's boss with hole on cylinder block.

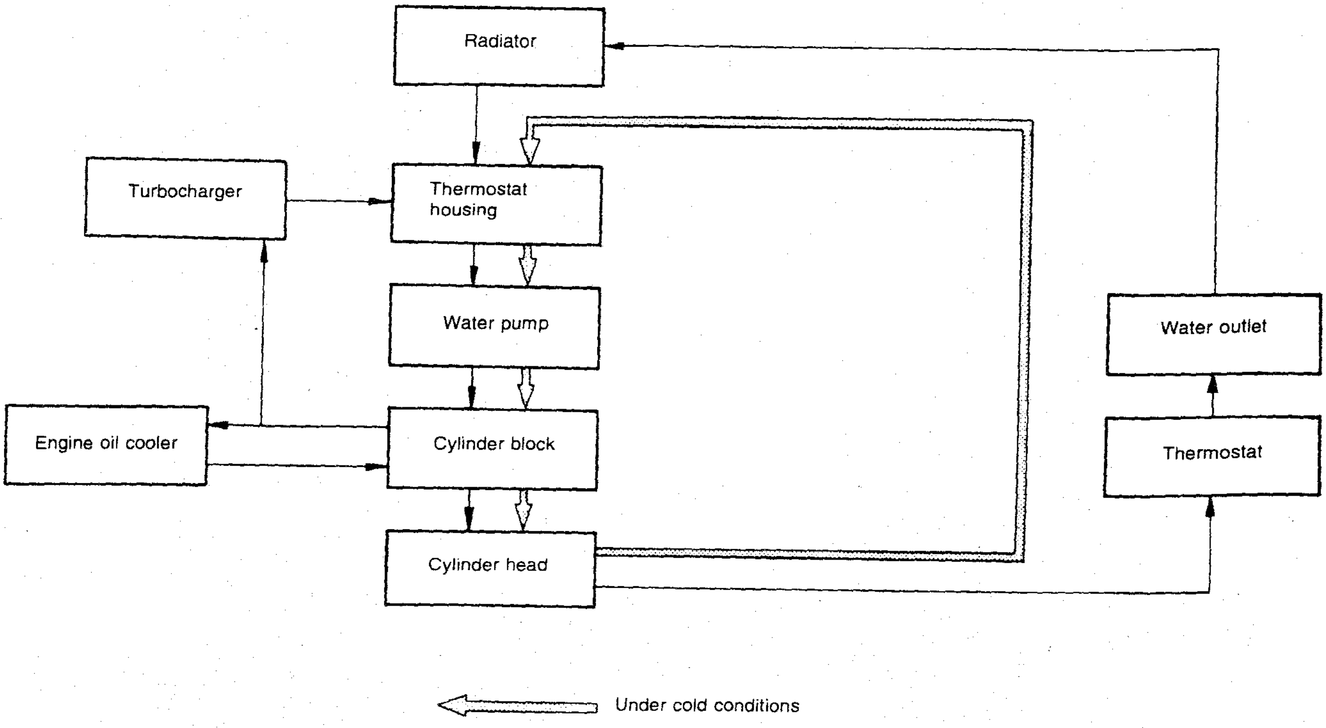
Oil jet bolt:
:29 - 39 N·m
(3.0 - 4.0 kg-m, 22 - 29 ft-lb)



Dimension "D":
22 mm (0.87 in)

Cooling Circuit



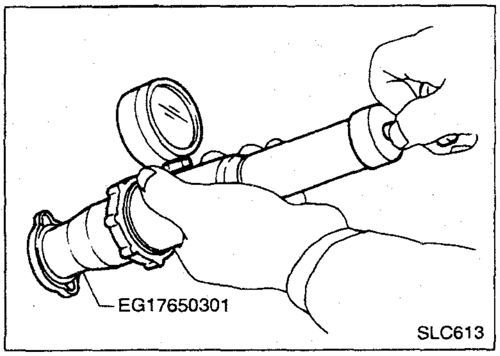


NLC011

System Inspection

CHECKING HOSES

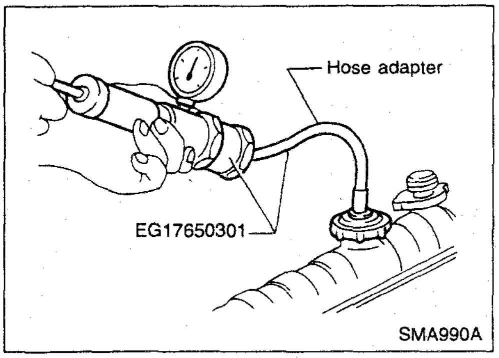
Check hoses for proper attachment, leaks, cracks, damage, loose connections, chafing and deterioration.



CHECKING RADIATOR CAP

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

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

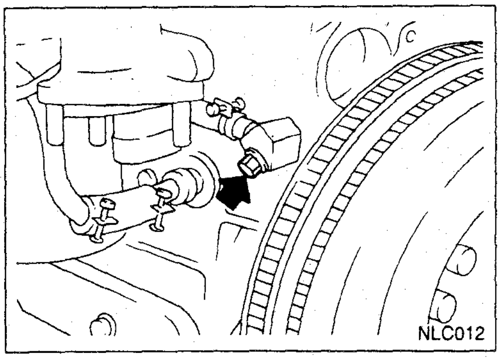


CHECKING COOLING SYSTEM FOR LEAKS

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.

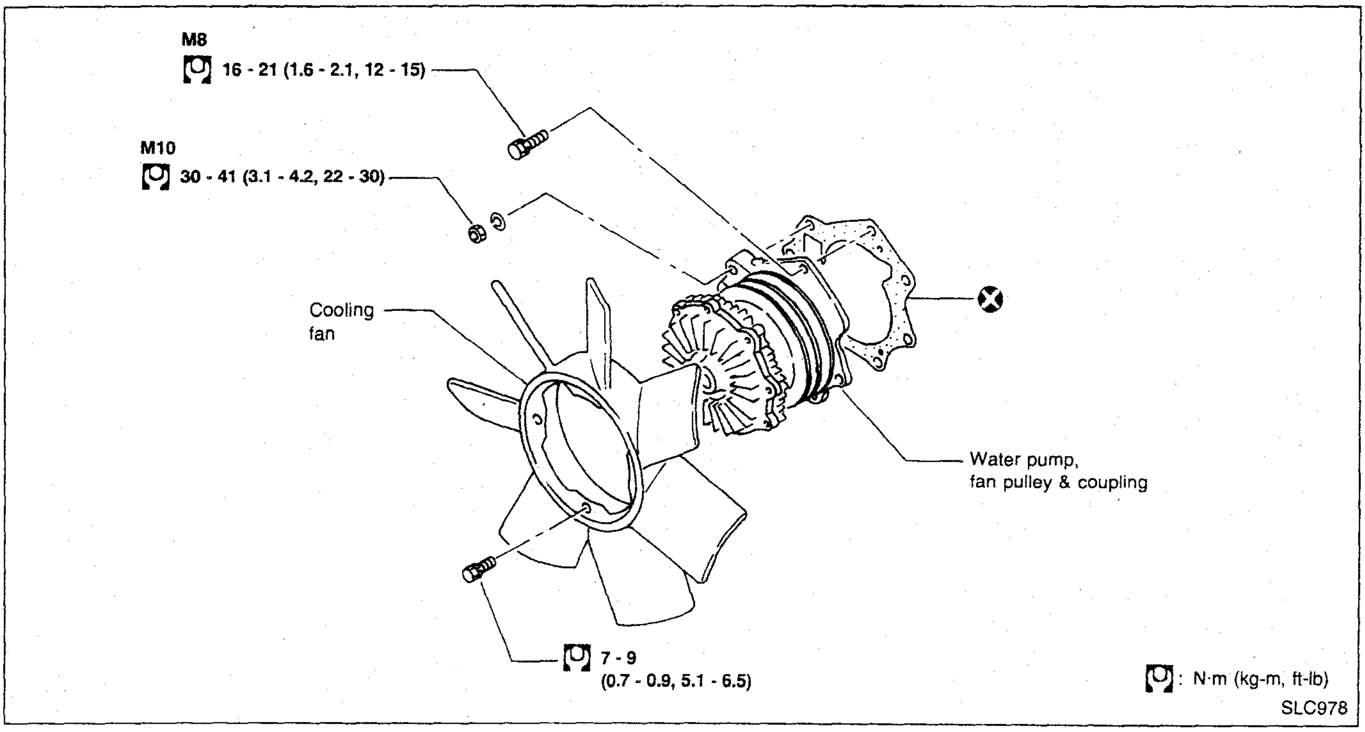


Water Pump

REMOVAL AND INSTALLATION

Drain coolant from drain plugs on cylinder block and radiator.

Cylinder block drain plug:
(Use proper sealant)
: 20 - 29 N·m
(2.0 - 3.0 kg-m, 14 - 22 ft-lb)

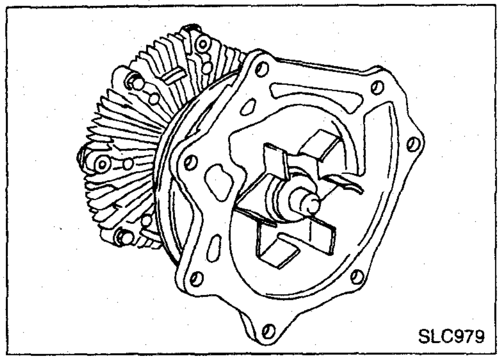


CAUTION:

- **When removing water pump assembly, be careful not to spill coolant on drive belt.**
- **Water pump cannot be disassembled and should be replaced as a unit.**
- **Always replace with new gasket.**
- **After installing water pump, connect hose and clamp securely, then check for leaks using radiator cap tester.**

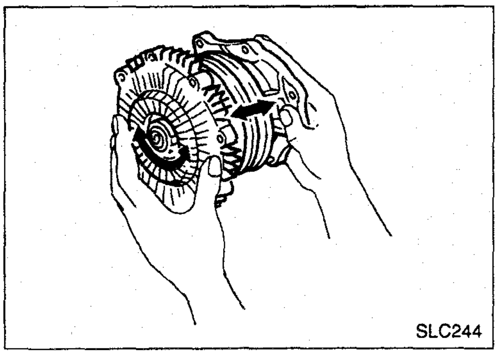
Water Pump (Cont'd)

INSPECTION



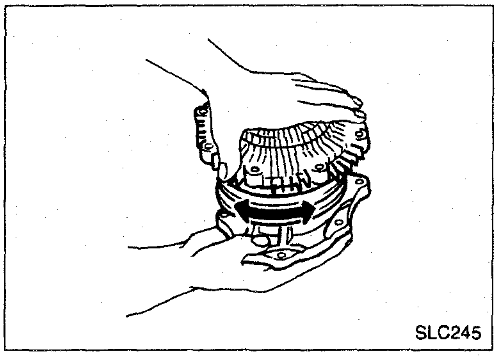
SLC979

1. Check for badly rusted or corroded body assembly and vane.



SLC244

2. Check the water pump bushing for excessive end play and irregular movement.

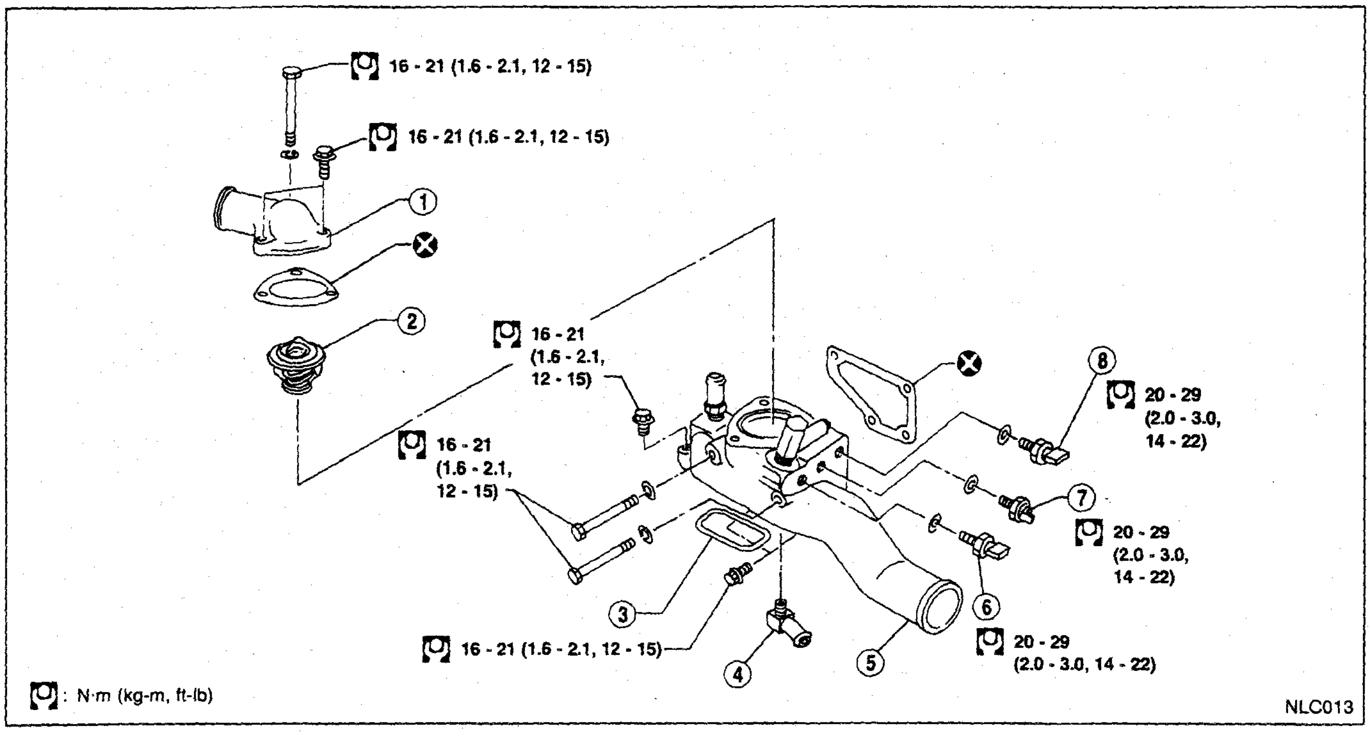


SLC245

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

The water pump and fan coupling cannot be disassembled and should be replaced as a unit.

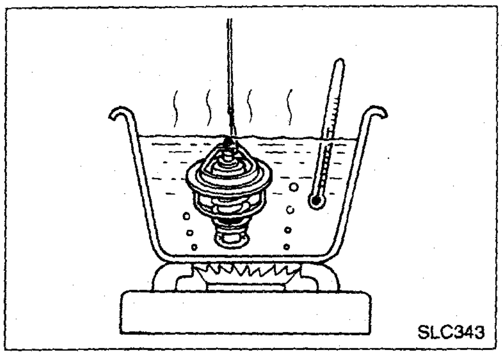
Thermostat



① Water outlet
② Thermostat with jiggle valve
③ Rubber seal
④ Water connector
⑤ Thermostat housing
⑥ Water temperature sensor (E.G.R.)
Cable colours:
Green/Red
Light green/White
⑦ Water temperature sensor
⑧ Water temperature sensor (Glow)
Cable colours:
Black
Yellow/Black

CAUTION:

- **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.**



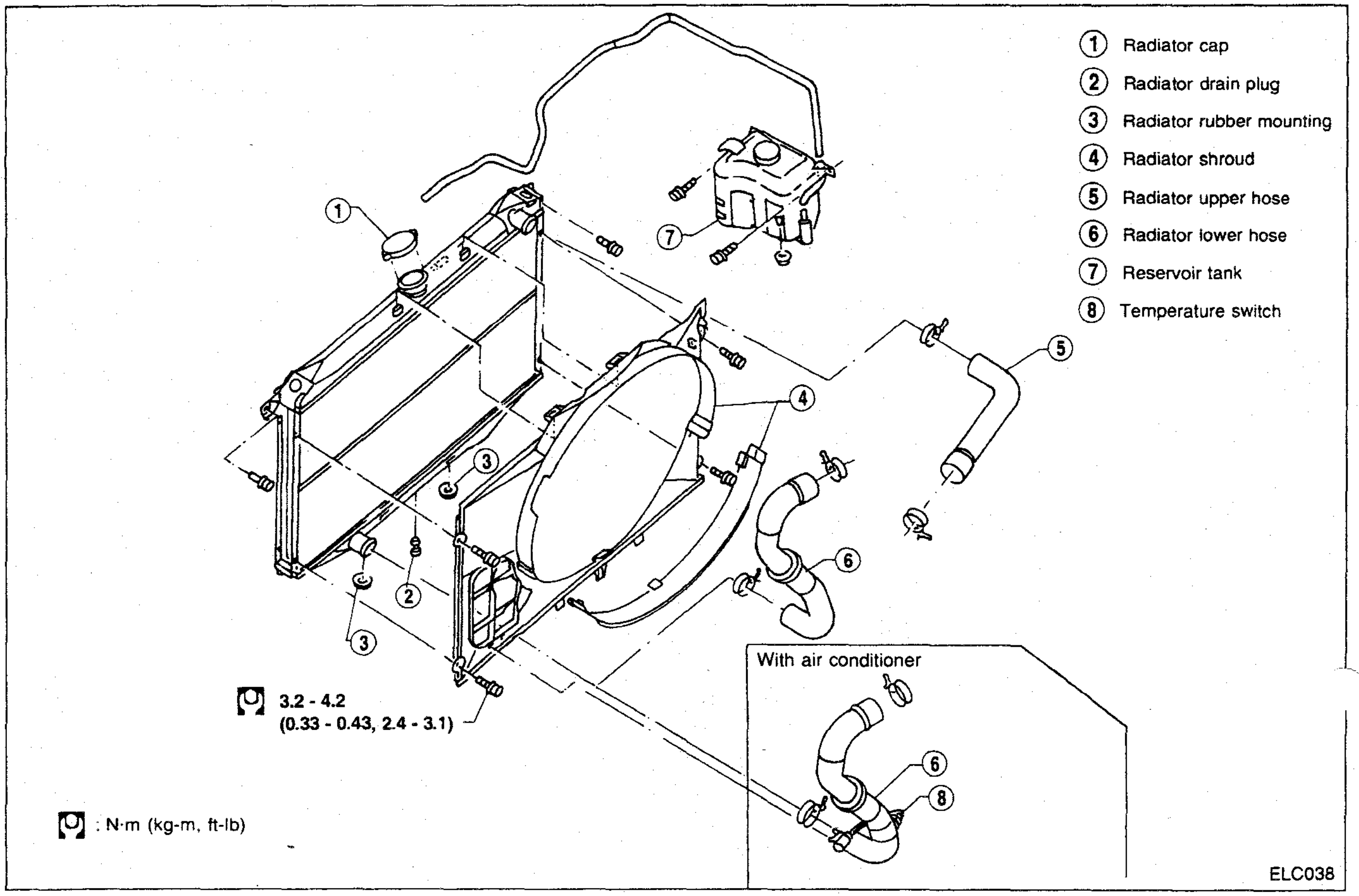
INSPECTION

1. Check for valve seating condition at ordinary temperatures. It should seat tightly.
2. Check valve opening temperature and maximum valve lift.

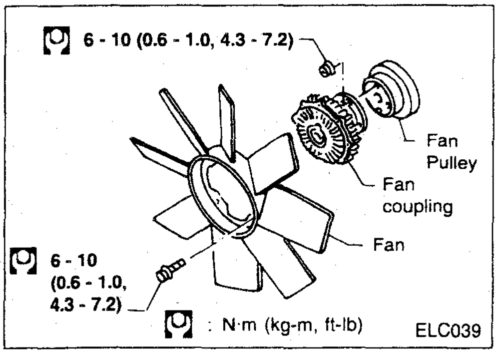
	Standard type	Optional type
Valve opening temperature °C (°F)	82 (180)	88 (190)
Max. valve lift mm/°C (in/°F)	8/95 (0.315/203)	8/100 (0.315/212)

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

Radiator

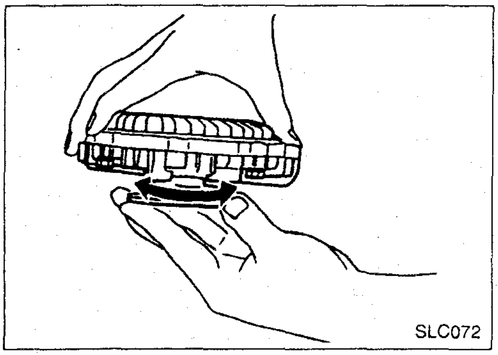


CAUTION:
When filling radiator with coolant, refer to MA section.



Cooling Fan

DISASSEMBLY AND ASSEMBLY



INSPECTION

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

Engine Lubrication System

Oil pressure check

Engine rpm	Approximate discharge pressure kPa (bar, kg/cm², psi)
Idle speed	More than 78 (0.78, 0.8, 11)
3,000	412 - 481 (4.12 - 4.81, 4.2 - 4.9, 60 - 70)

Oil pump

Unit: mm (in)

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

Engine Cooling System

Thermostat

	Standard type	Optional type
Valve opening temperature °C (°F)	76.5 (170)	82 (180)
Maximum valve lift mm/°C (in/°F)	8/90 (0.31/194)	8/95 (0.31/203)

Radiator

Unit: kPa (bar, kg/cm², psi)

Cap relief pressure	78 - 98 (0.78 - 0.98, 0.8 - 1.0, 11 - 14)
Leakage test pressure	98 (0.98, 1.0, 14)

Engine Lubrication System

Oil pressure check

Engine rpm	Approximate discharge pressure kPa (bar, kg/cm², psi)
Idle speed	More than 78 (0.78, 0.8, 11)
3,000	294 - 392 (2.94 - 3.92, 3.0 - 4.0, 43 - 57)

Oil pump

Unit: mm (in)

Gear side clearance	Less than 0.13 (0.0051)
Gear backlash	Less than 0.43 (0.0169)
Oil pump bushing clearance	Less than 0.15 (0.0059)
Oil pump bushing inside diameter	13.012 - 13.098 (0.5123 - 0.5157)
Drive gear shaft outside diameter	12.974 - 12.992 (0.5108 - 0.5115)

Engine Cooling System

Thermostat

	Standard type	Optional type
Valve opening temperature °C (°F)	82 (180)	88 (190)
Max. valve lift mm/°C (in/°F)	8/95 (0.315/203)	8/100 (0.315/212)

Radiator

Unit: kPa (bar, kg/cm², psi)

Cap relief pressure	78 - 98 (0.78 - 0.98, 0.8 - 1.0, 11 - 14)
Leakage test pressure	98 (0.98, 1.0, 14)

ENGINE FUEL & EMISSION CONTROL SYSTEM

SECTION EF & EC

ENGINE FUEL & EMISSION CONTROL SYSTEM

SECTION EF & EC

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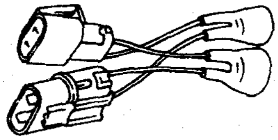
When you read wiring diagrams:

- **Read GI section, "HOW TO READ WIRING DIAGRAMS".**
- **See EL section, "POWER SUPPLY ROUTING" for power distribution circuit.**

When you perform trouble diagnoses, read GI section, "HOW TO FOLLOW FLOW CHART IN TROUBLE DIAGNOSES".

SPECIAL SERVICE TOOL

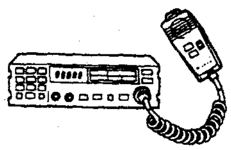
Tool number Tool name	Description	
EG11160000 Adapter harness		Measuring engine speed

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

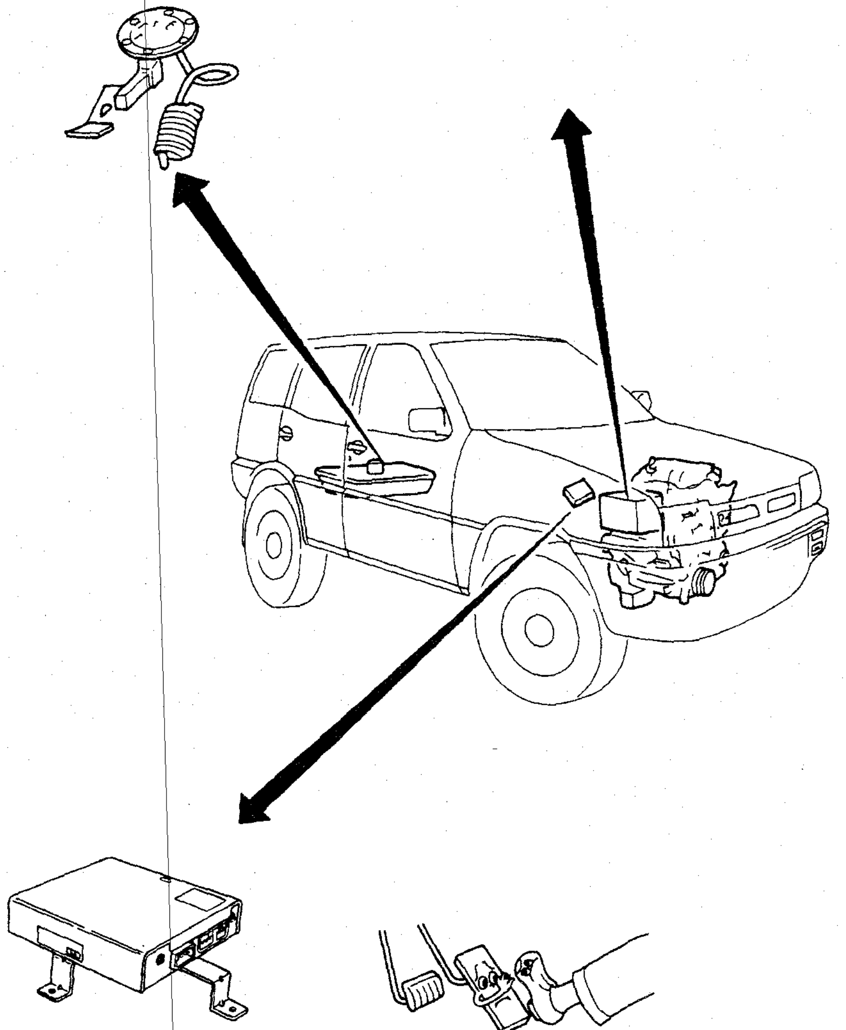
BATTERY
- Always use a 12 volt battery as power source.
- Do not attempt to disconnect battery cables while engine is running.

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

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



INJECTOR
- Do not disconnect injector harness connectors with engine running.
- Do not apply battery power directly to injectors.



E.C.U.
- Do not disassemble E.C.C.S. control unit (E.C.U.).
- Do not turn diagnosis mode selector forcibly.
- If a battery terminal is disconnected, the memory will return to the ROM value. The E.C.C.S. will now start to self-control at its initial value. Engine operation can vary slightly when the terminal is disconnected. However, this is not an indication of a problem. Do not replace parts because of a slight variation.

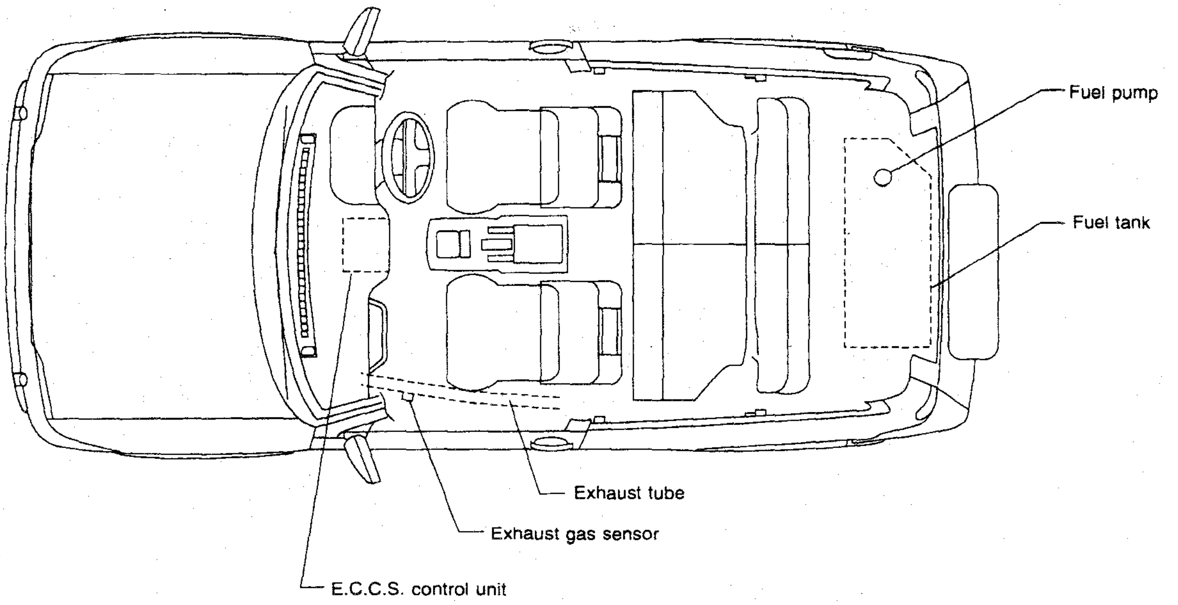
WHEN STARTING
- Do not depress accelerator pedal when starting.
- Immediately after starting, do not rev up engine unnecessarily.
- Do not rev up engine just prior to shutdown.

E.C.C.S. PARTS HANDLING
- Handle air flow meter carefully to avoid damage.
- Do not disassemble air flow meter.
- Do not clean air flow meter with any type of detergent.
- Do not disassemble auxiliary air control valve.
- Even a slight leak in the air intake system can cause serious problems.
- Do not shock or jar the crank angle sensor.

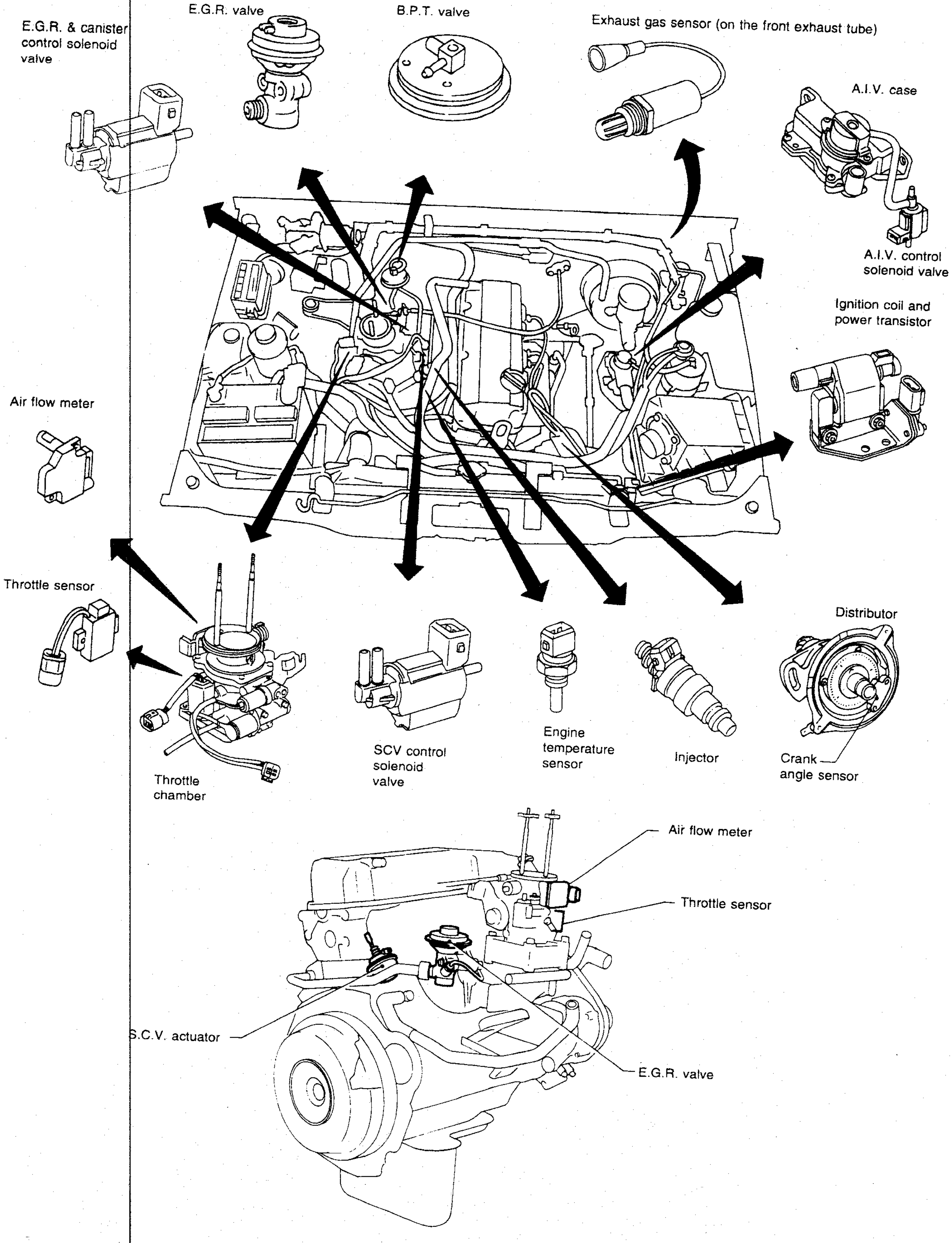
E.C.C.S. HARNESS HANDLING
- Securely connect E.C.C.S. harness connectors.
  A poor connection can cause an extremely high (surge) voltage to develop in coil and condenser, thus resulting in damage to ICs.
- Keep E.C.C.S. harness at least 10 cm (3.9 in) away from adjacent harnesses, to prevent an E.C.C.S. system malfunction due to receiving external noise, degraded operation of ICs, etc.
- Keep E.C.C.S. parts and harnesses dry.
- Before removing parts, turn off ignition switch and then disconnect battery ground cable.

EEF101

E.C.C.S. Component Parts Location

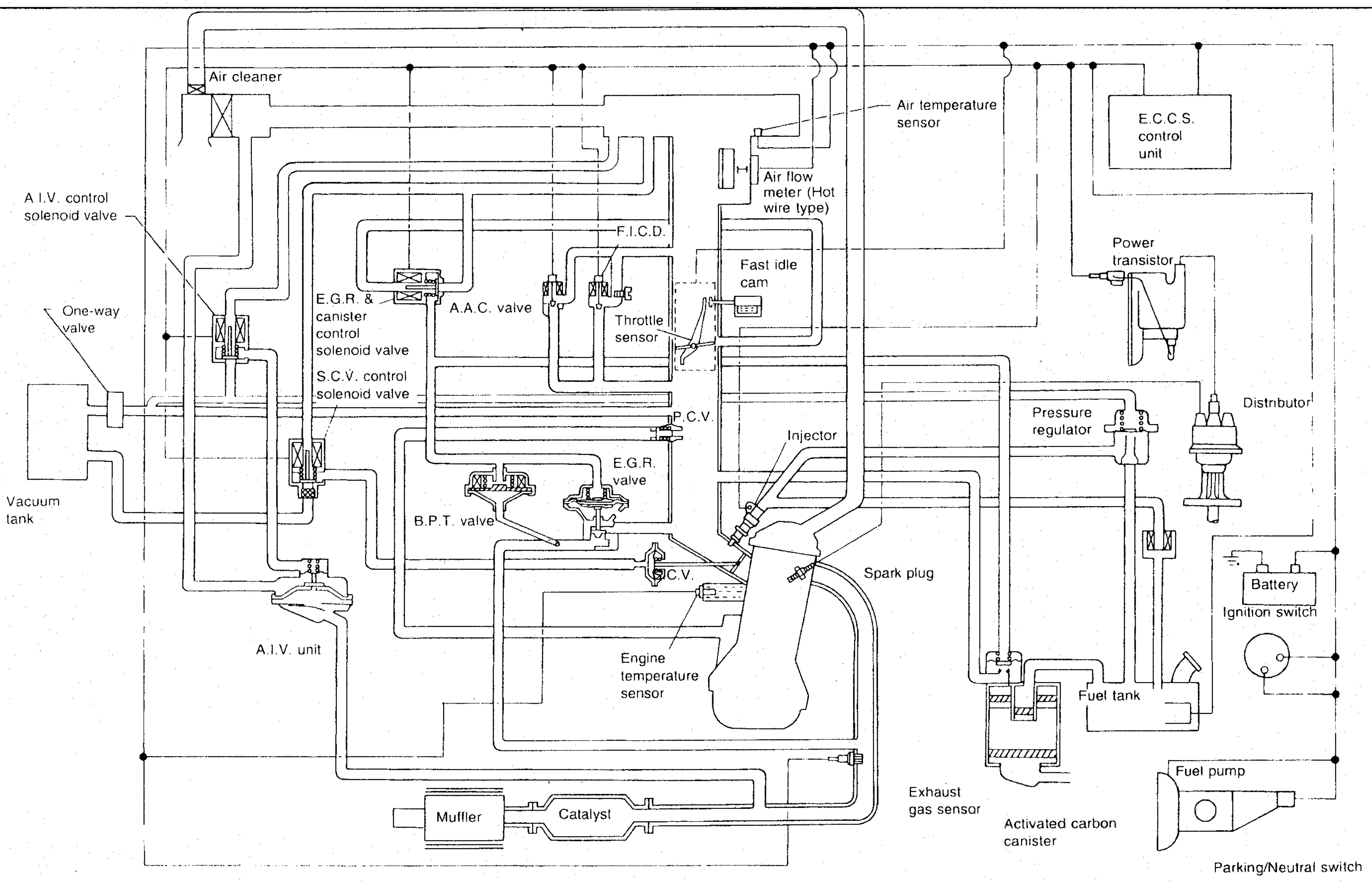


EEF102


E.G.R. & canister control solenoid valve
E.G.R. valve
B.P.T. valve
Exhaust gas sensor (on the front exhaust tube)
A.I.V. case
A.I.V. control solenoid valve
Ignition coil and power transistor
Air flow meter
Throttle sensor
Throttle chamber
SCV control solenoid valve
Engine temperature sensor
Injector
Distributor
Crank angle sensor
Air flow meter
Throttle sensor
S.C.V. actuator
E.G.R. valve

EEF103

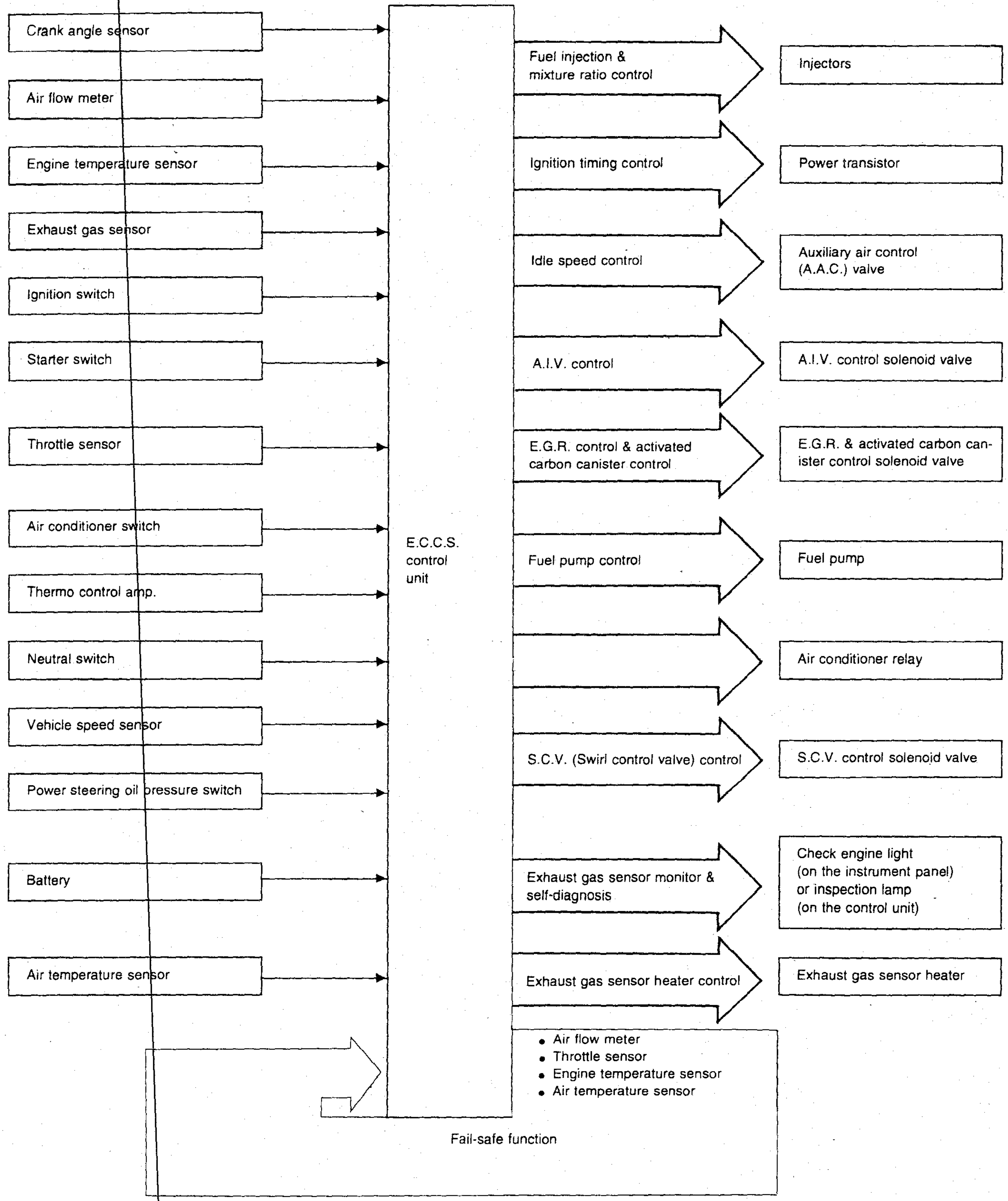
System Diagram



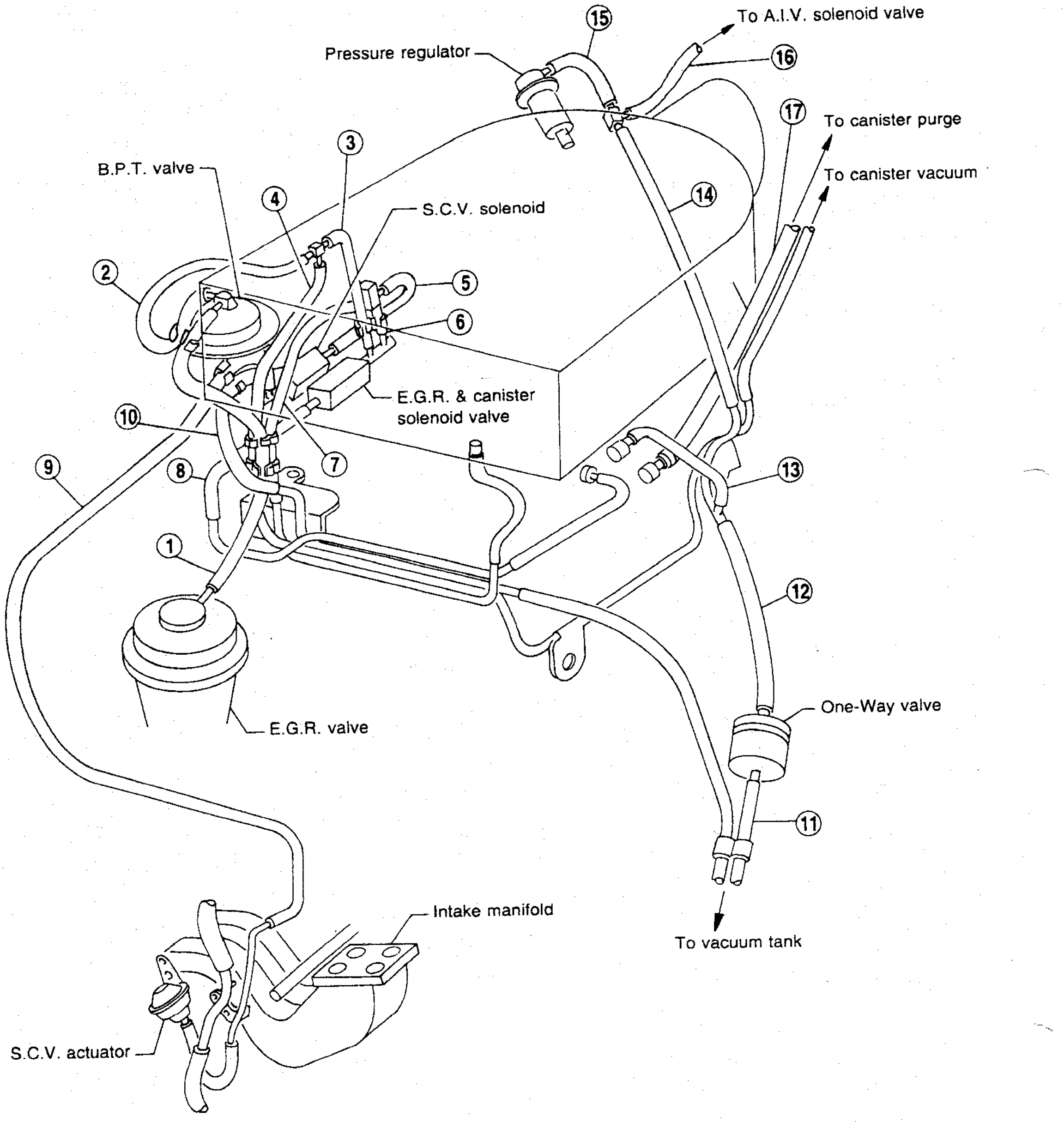
EEF104

System Chart

E.C.C.S. CONTROL SYSTEM



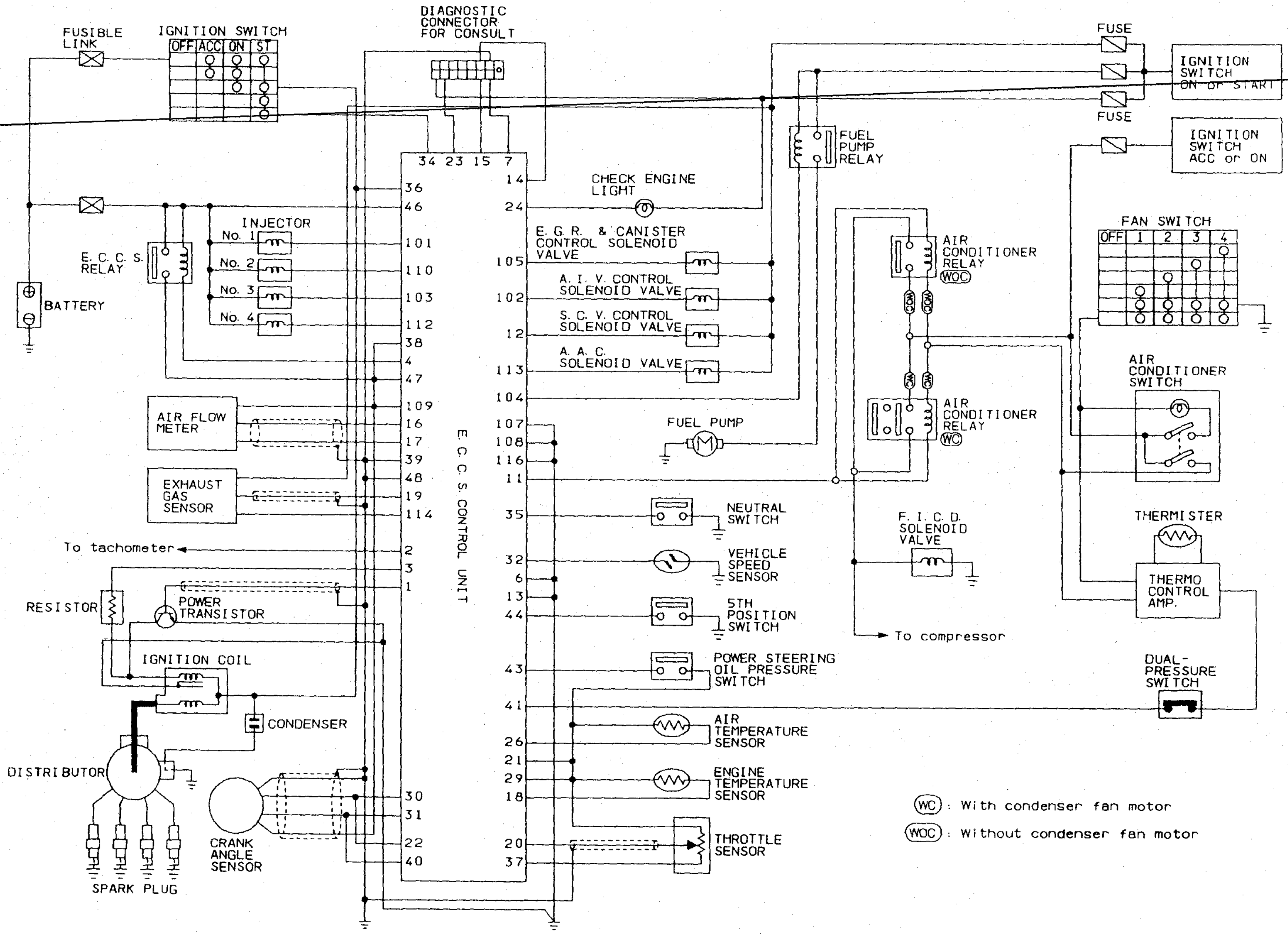
Vacuum Hose Drawing



EEF264

① E.G.R. valve to B.P.T. valve
② B.P.T. valve to 3-way connector
③ 3-way connector to E.G.R. & canister solenoid valve
④ 3-way connector to activated carbon canister (vacuum port)
⑤ S.C.V. solenoid valve to 3-way connector
⑥ E.G.R. & canister solenoid valve to 3-way connector
⑦ 3-way connector to throttle chamber
⑧ E.G.R. & canister solenoid valve to throttle chamber
⑨ S.C.V. solenoid valve to S.C.V. actuator
⑩ S.C.V. solenoid valve to vacuum tank
⑪ Vacuum tank to one-way valve
⑫ One-way valve to 3-way connector
⑬ 3-way connector to throttle chamber
⑭ 3-way connector to 3-way connector
⑮ 3-way connector to pressure regulator
⑯ 3-way connector to A.I.V. solenoid valve
⑰ Throttle chamber to activated carbon canister (purge port)

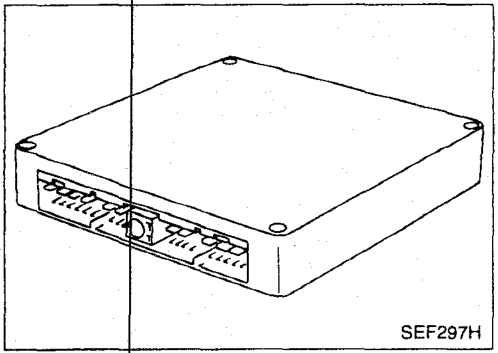
Circuit Diagram



WC : With condenser fan motor

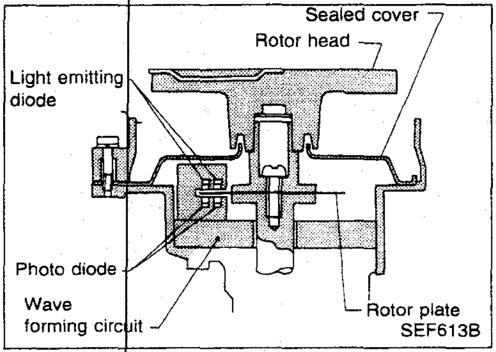
WOC : Without condenser fan motor

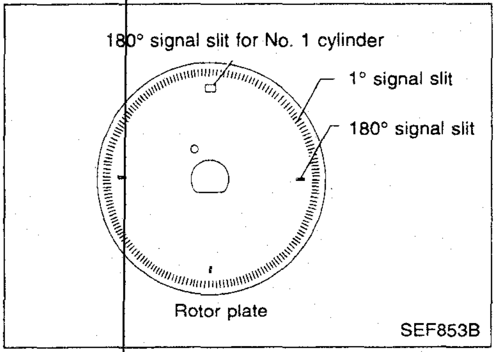
E.C.C.S. Control Unit (E.C.U.)



The E.C.U. consists of a microcomputer, an inspection lamp, a diagnostic mode selector, and connectors for signal input and output and for power supply. The unit controls the engine.

Crank Angle Sensor



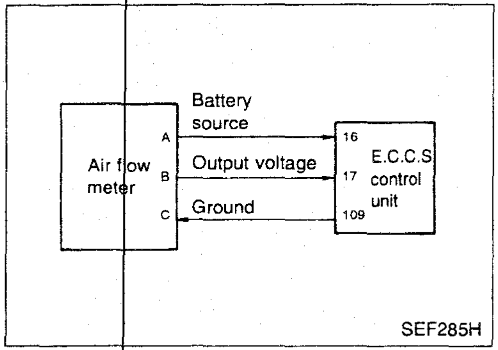


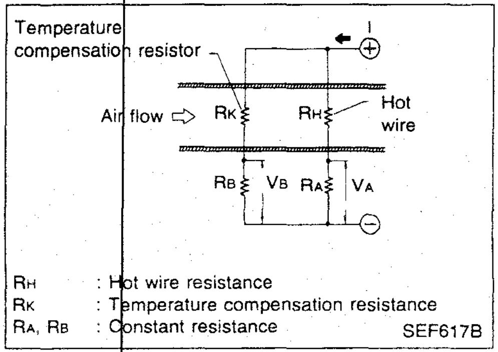
The crank angle sensor is a basic component of the entire E.C.C.S. It monitors engine speed and piston position, and sends signals to the E.C.U. to control fuel injection, ignition timing and other functions.

The crank angle sensor has a rotor plate and a wave-forming circuit. The rotor plate has 360 slits for 1° signal and 4 slits for 180° signal. Light Emitting Diodes (L.E.D.) and photo diode are built in the wave-forming circuit.

When the rotor plate passes between the L.E.D. and the photo diode, the slits in the rotor plate continually cut the light being transmitted to the photo diode from the L.E.D. This generates rough-shaped pulses which are converted into on-off signals by the wave-forming circuit, which are then sent to the E.C.U.

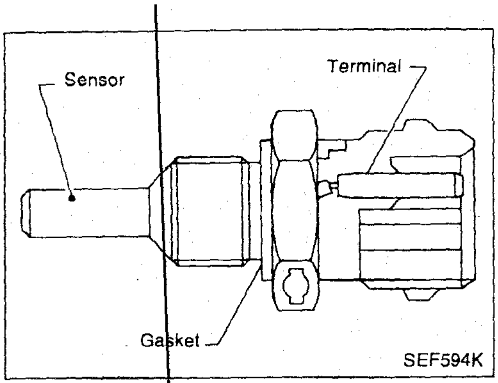
Air Flow Meter





The air flow meter measures the mass flow rate of intake air. Measurements are made so that the control circuit will emit an electrical output signal corresponding to the amount of he dissipated from a hot wire placed in the stream of intake air.

The airflow past the hot wire removes the heat from the hot wire. The temperature of the hot wire is very sensitive to the mass flow rate. The higher the temperature of the hot wire, the greater its resistance value. This temperature change (resistance) is determined by the mass air flow rate. The control circuit accurately regulates current (I) in relation to the varying resistance value (R_H) so that V_A always equals V_B. The air flow meter transmits a voltage value V_A to the control unit where the output is converted into an intake air signal.

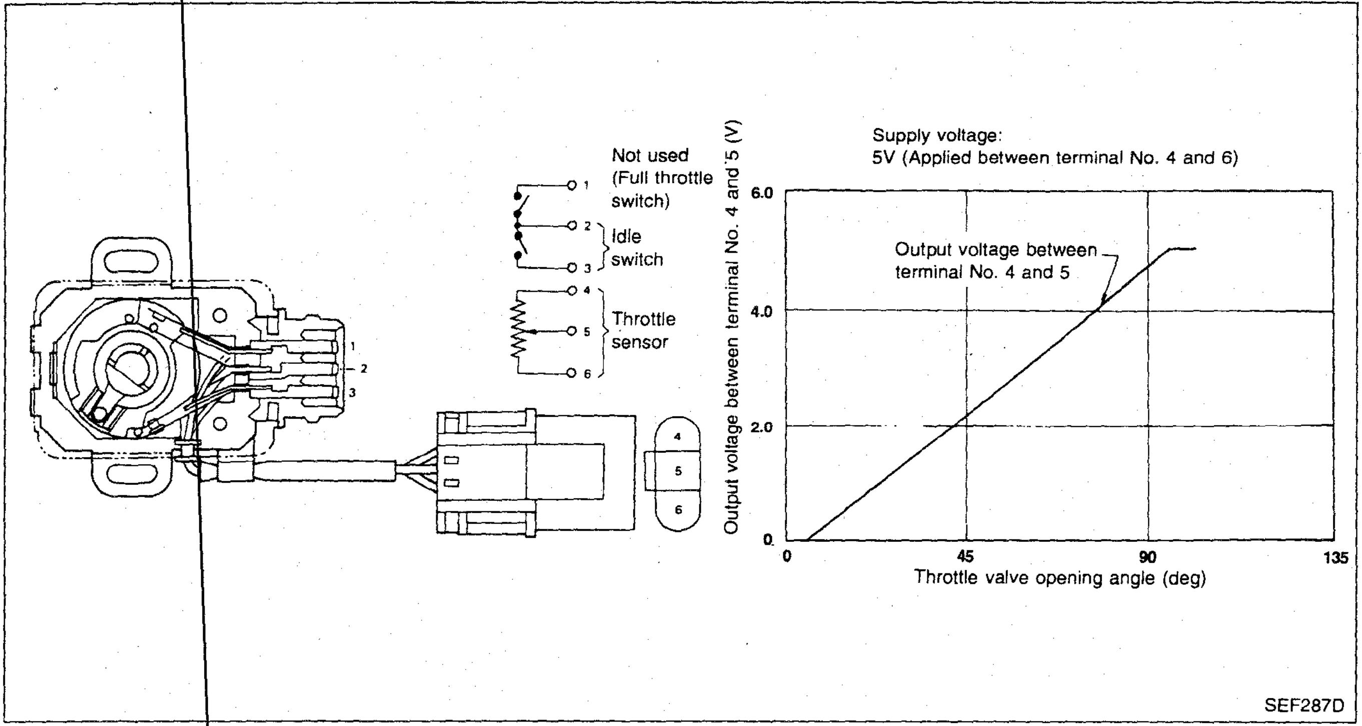


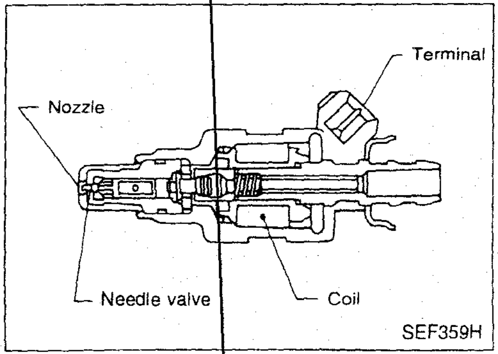
Engine Temperature Sensor

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

Throttle Sensor & Soft Idle Switch

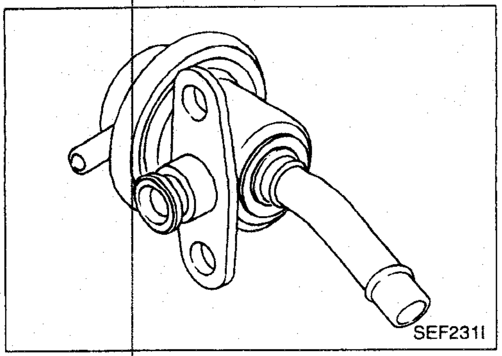
The throttle sensor responds to the throttle valve position which, in turn, is determined by accelerator pedal movement. This sensor is a kind of potentiometer which transforms the throttle valve position into an output voltage, and transmits it to the E.C.U. The sensor also detects the opening and closing speed of the throttle valve and feeds this information as a voltage signal to the E.C.U. too.
The throttle valve idle position is determined by the E.C.U. This positioning system is called the "soft idle switch" and controls engine operations such as fuel cut.





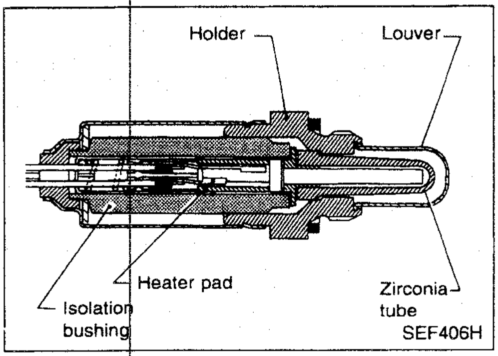
Fuel Injector

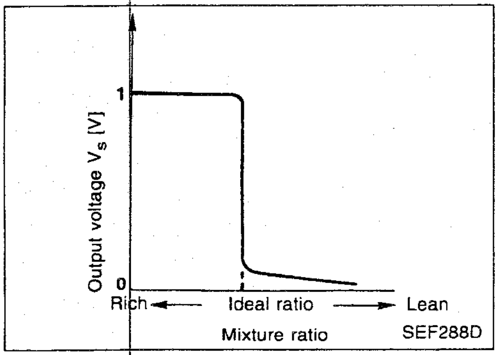
The fuel injector is a small, elaborate solenoid valve. As the E.C.U. sends injection signals to the injector, the coil in the injector pulls the needle valve back and fuel is released into the intake manifold through the nozzle. The injected fuel is controlled by the E.C.U. in terms of injection pulse duration.
Brass wire is used in the injector coil and thus the resistance is higher than a conventional injector.



Pressure Regulator

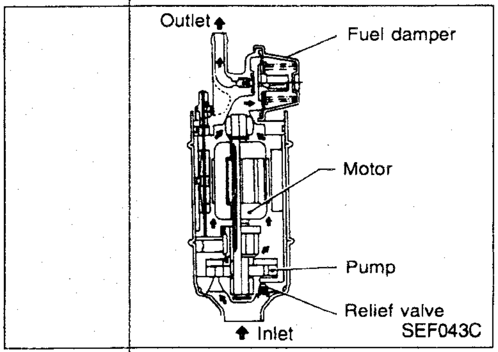
The pressure regulator maintains the fuel pressure at 299.1 kPa (2.991 bar, 3.05 kg/cm^2, 43.4 psi). Since the injected fuel amount depends on injection pulse duration, it is necessary to maintain the pressure at the above value.





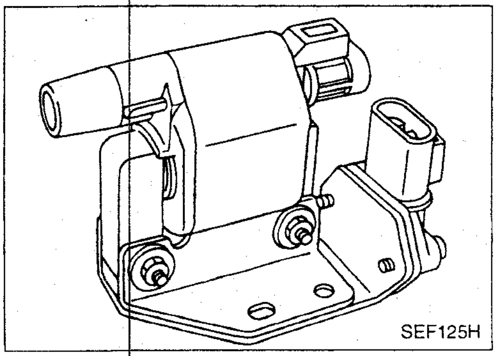
Exhaust Gas Sensor

The exhaust gas sensor, which is placed into the front exhaust tube, monitors the amount of oxygen in the exhaust gas.
The sensor has a closed-end tube made of ceramic zirconia. The outer surface of the tube is exposed to exhaust gas, and the inner surface to atmosphere. The zirconia of the tube compares the oxygen density of exhaust gas with that of atmosphere, and generates electricity. In order to improve the generating power of the zirconia, its tube is coated with platinum. The voltage is approximately 1V in a richer condition of the mixture ratio than the ideal air-fuel ratio, while approximately 0V in leaner conditions. The radical change from 1V to 0V occurs at around the ideal mixture ratio. In this way, the exhaust gas sensor detects the amount of oxygen in the exhaust gas and sends the signal of approximately 1V or 0V to the E.C.U. A heater is used to shorten the warming-up period.



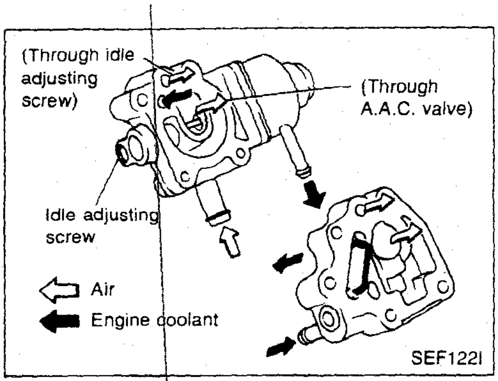
Fuel Pump

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



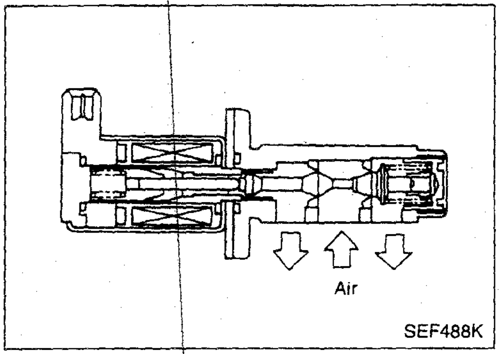
Power Transistor

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



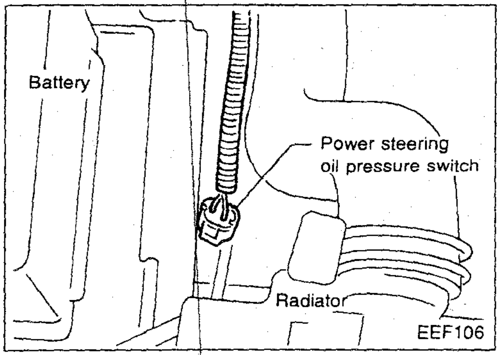
Idle Air Adjusting (I.A.A.) Unit

The I.A.A. unit is made up of the A.A.C. valve and air cut valve. It receives the signal from the E.C.U. and controls the idle speed at the preset value under various conditions.
The air cut valve prevents an abnormal rise of idle rpm when A.A.C. valve operates abnormally.



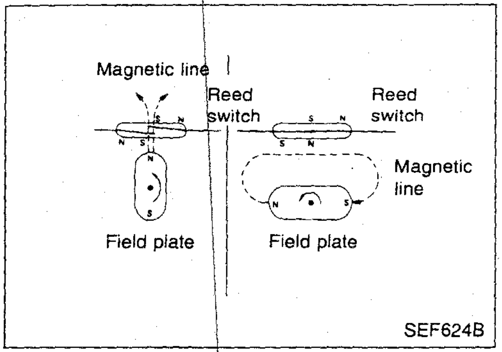
Auxiliary Air Control (A.A.C.) Valve

The A.A.C. valve is attached to the throttle chamber.
The E.C.U. actuates the A.A.C. valve by an ON/OFF pulse. The longer that ON pulse is received, the larger the amount of air that will flow through the A.A.C. valve.
The A.A.C. valve adjusts idle speed to the specified value.



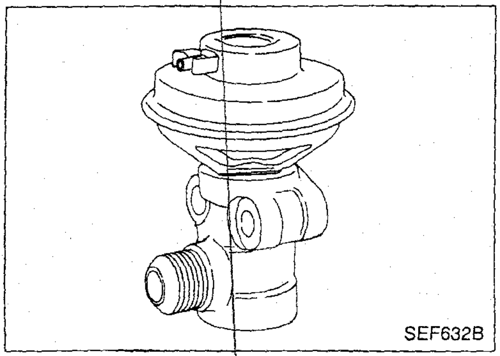
Power Steering Oil Pressure Switch

The power steering oil pressure switch is attached to the power steering high-pressure tube and detects the power steering load, sending the load signal to the E.C.U. The E.C.U. then sends the idle-up signal to the A.A.C. valve.



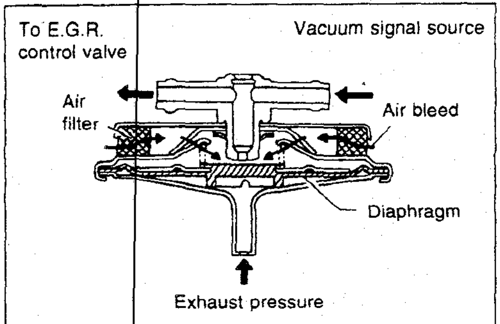
Vehicle Speed Sensor

The vehicle speed sensor provides a vehicle speed signal to the E.C.U.
The speed sensor consists of a reed switch, which is installed on the transmission unit and transforms vehicle speed into a pulse signal.



Exhaust Gas Recirculation (E.G.R.) Valve

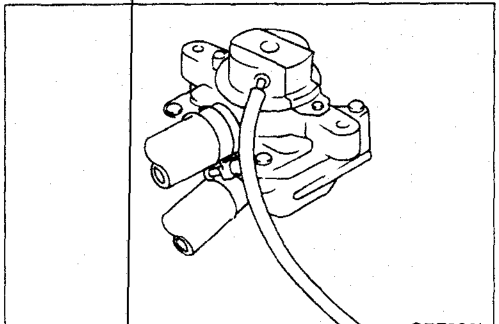
The E.G.R. valve controls the quantity of exhaust gas to be led to the intake manifold through vertical movement of the taper valve connected to the diaphragm, to which vacuum is applied in response to the opening of the throttle valve.



EC344A

Back Pressure Transducer (B.P.T.) Valve

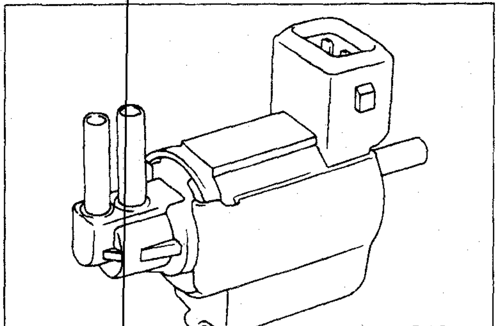
The B.P.T. valve monitors exhaust pressure to activate the diaphragm, controlling throttle chamber vacuum applied to the E.G.R. control valve. In other words, recirculated exhaust gas is controlled in response to positioning of the E.G.R. control valve or to engine operation.



SEF230I

Air Induction Valve (A.I.V.)

The air induction valve sends secondary air to the exhaust manifold, using a vacuum created by exhaust pulsation in the exhaust manifold. When the exhaust pressure is below atmospheric pressure (negative pressure), secondary air is sent to the exhaust manifold. When the exhaust pressure is above atmospheric pressure, the reed valves prevent secondary air from being sent back to the air cleaner.



SEF317I

A.I.V. Control Solenoid Valve

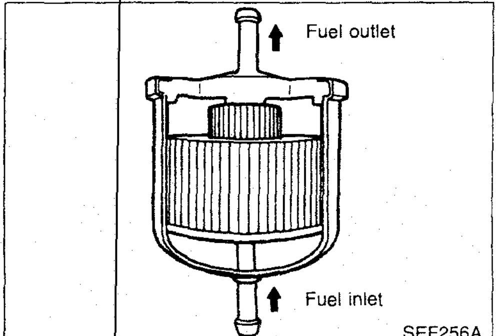
The A.I.V. control solenoid valve cuts the intake manifold vacuum signal for A.I.V. control valve. The A.I.V. control solenoid valve responses to the ON/OFF signal from the E.C.U. When the solenoid is off, the vacuum signal from the intake manifold is cut. When the control unit sends an ON signal, the coil pulls the plunger downward and feeds the vacuum signal to the A.I.V. control valve.

E.G.R. & Canister Control Solenoid Valve

The E.G.R. and canister control systems are controlled only by the E.C.U. At both low- and high-speed engine revolutions, the solenoid valve turns on and accordingly the E.G.R. valve cuts the exhaust gas leading to the intake manifold. At the same time the flow of vapor from the evaporative carbon canister to the intake manifold will be cut.

S.C.V. Control Solenoid Valve

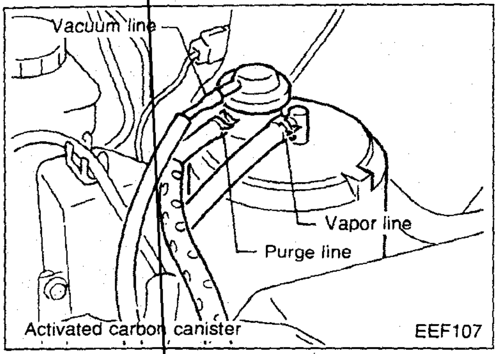
The S.C.V. control solenoid valve cuts the intake manifold vacuum signal for swirl control valve. It responds to the ON/OFF signal from the E.C.U. When the solenoid is off, the vacuum signal from the intake manifold is cut. When the control unit sends an ON signal the coil pulls the plunger and feeds the vacuum signal to the swirl control valve actuator.



SEF256A

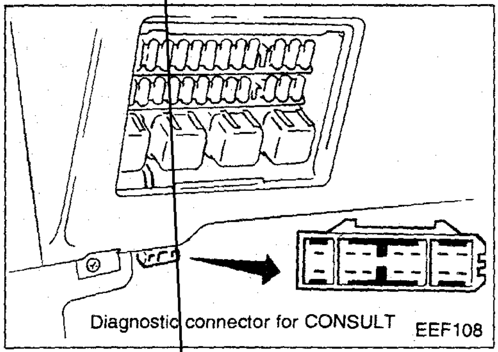
Fuel Filter

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



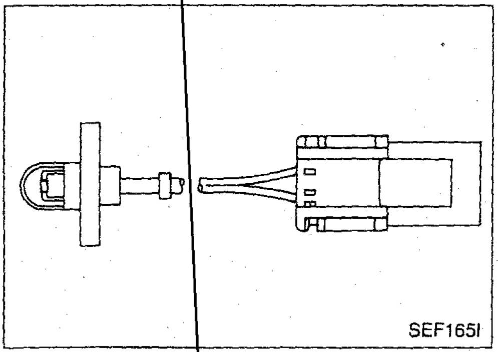
Carbon Canister

The carbon canister is filled with active charcoal to absorb evaporative gases produced in the fuel tank. These absorbed gases are then delivered to the intake manifold by manifold vacuum for combustion purposes.
The vacuum in the intake passage upstream of the throttle valve increases in response to the amount of the intake air.



Diagnostic Connector for CONSULT

The diagnostic connector for CONSULT is beside the fuse box.

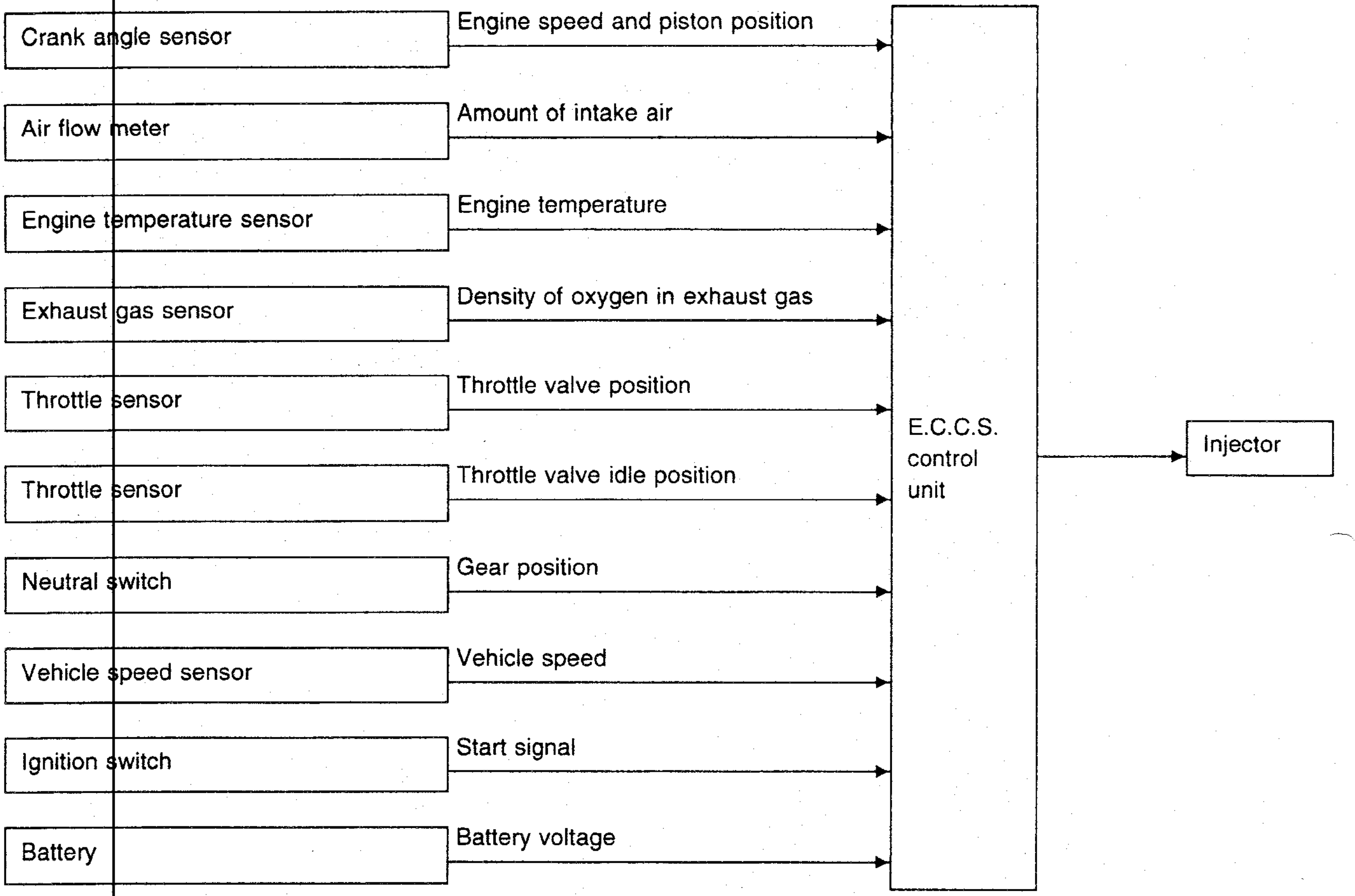


Air Temperature Sensor

The air temperature sensor controls ignition timing when the temperature of the intake air is extremely high, in order not to cause knocking.

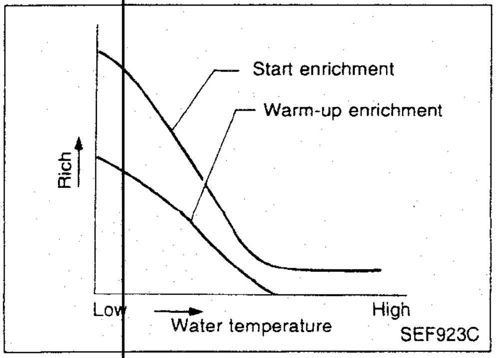
Fuel Injection Control

INPUT/OUTPUT SIGNAL LINE



BASIC FUEL INJECTION CONTROL

The amount of fuel injected from the fuel injector, or the length of time the valve remains open, is determined by the E.C.U The basic amount of fuel injected is a programmable value mapped in the E.C.U. ROM memory. In other words, the programmable value is preset by engine operating conditions determined by input signals (for engine rpm and air intake) from both the crank angle sensor and the air flow meter.



VARIOUS FUEL INJECTION INCREASE/DECREASE COMPENSATION

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

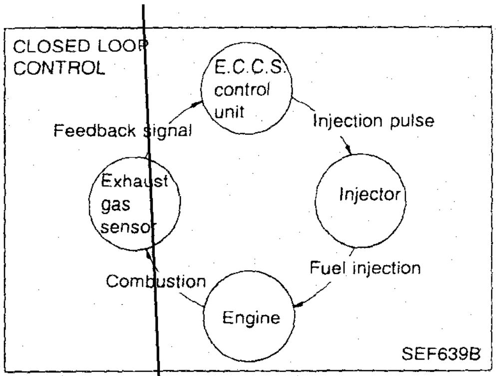
〈Fuel increase〉

1) When starting the engine
2) During warm-up
3) During acceleration
4) Hot-engine operation

〈Fuel decrease〉

1) During deceleration

MIXTURE RATIO FEEDBACK CONTROL



SEF639B

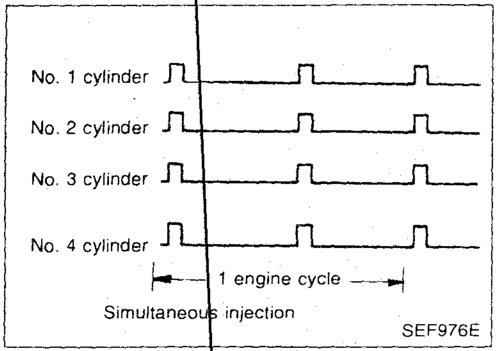
Mixture ratio feedback system is designed to precisely control the mixture ratio to the stoichiometric point so that the three-way catalyst can reduce CO, HC and NOx emissions. This system uses an exhaust gas sensor in the front exhaust tube to check the air-fuel ratio. The control unit adjusts the injection pulse width according to the sensor voltage so the mixture ratio will be within the range of the stoichiometric air-fuel ratio.
This stage refers to the closed-loop control condition. The open-loop control condition refers to that under which the E.C.U. detects any of the following conditions and feedback control stops in order to maintain stabilized fuel combustion.

1) Deceleration
2) High-load, high-speed operation
3) Engine idling
4) Malfunctioning of exhaust gas sensor or its circuit
5) Insufficient activation of exhaust gas sensor at low engine temperature
6) Engine starting

MIXTURE RATIO SELF-LEARNING CONTROL

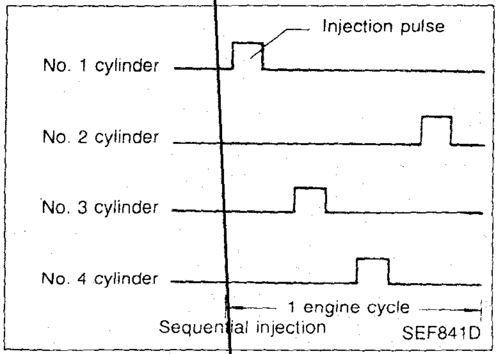
The mixture ratio feedback control system monitors the mixture ratio signal transmitted from the exhaust gas sensor. This feedback signal is then sent to the E.C.U. to control the amount of fuel injection to provide a basic mixture ratio as close to the theoretical mixture ratio as possible. However, the basic mixture ratio is not necessarily controlled as originally designed. This is due to manufacturing errors (e.g., air flow meter hot wire) and changes during operation (injector clogging, etc.) of E.C.C.S. parts which directly affect the mixture ratio.
Accordingly, a difference between the basic and theoretical mixture ratios is quantitatively monitored in this system. It is then computed in terms of "fuel injection duration" to automatically compensate for the difference between the two ratios.

FUEL INJECTION TIMING



SEF976E

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.



SEF841D

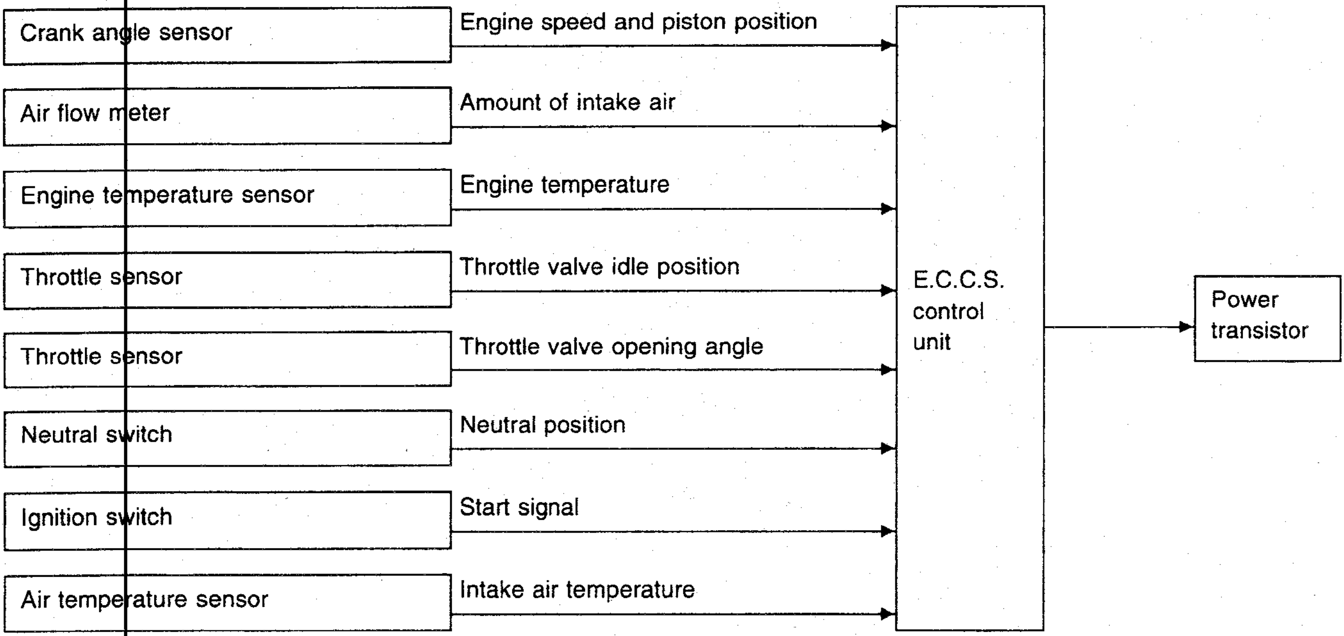
In the sequential injection system, fuel is injected into each cylinder during each engine cycle according to the firing order. When the engine is being started and/or if the fail-safe system (C.P.U. of E.C.U.) is operating, simultaneous fuel injection is used.
When the engine is running sequential fuel injection is used.

FUEL SHUT-OFF

Fuel to all cylinders is cut off during deceleration or high vehicle speed or high engine speed operation.

Ignition Timing Control

INPUT/OUTPUT SIGNAL LINE



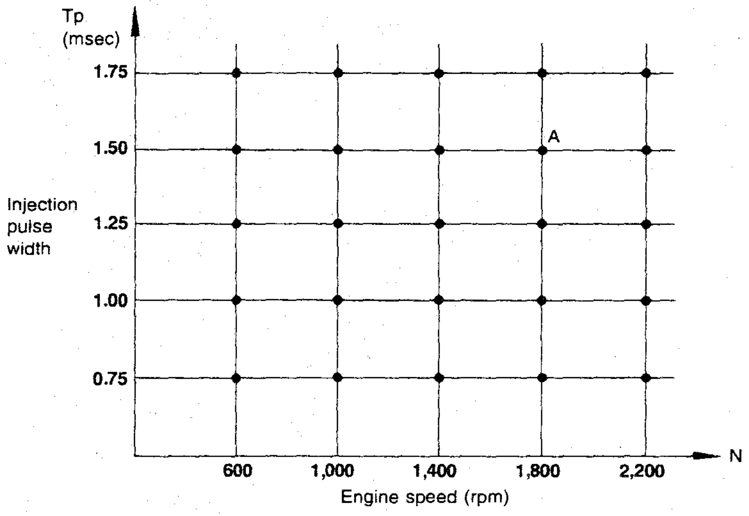
SYSTEM DESCRIPTION

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,

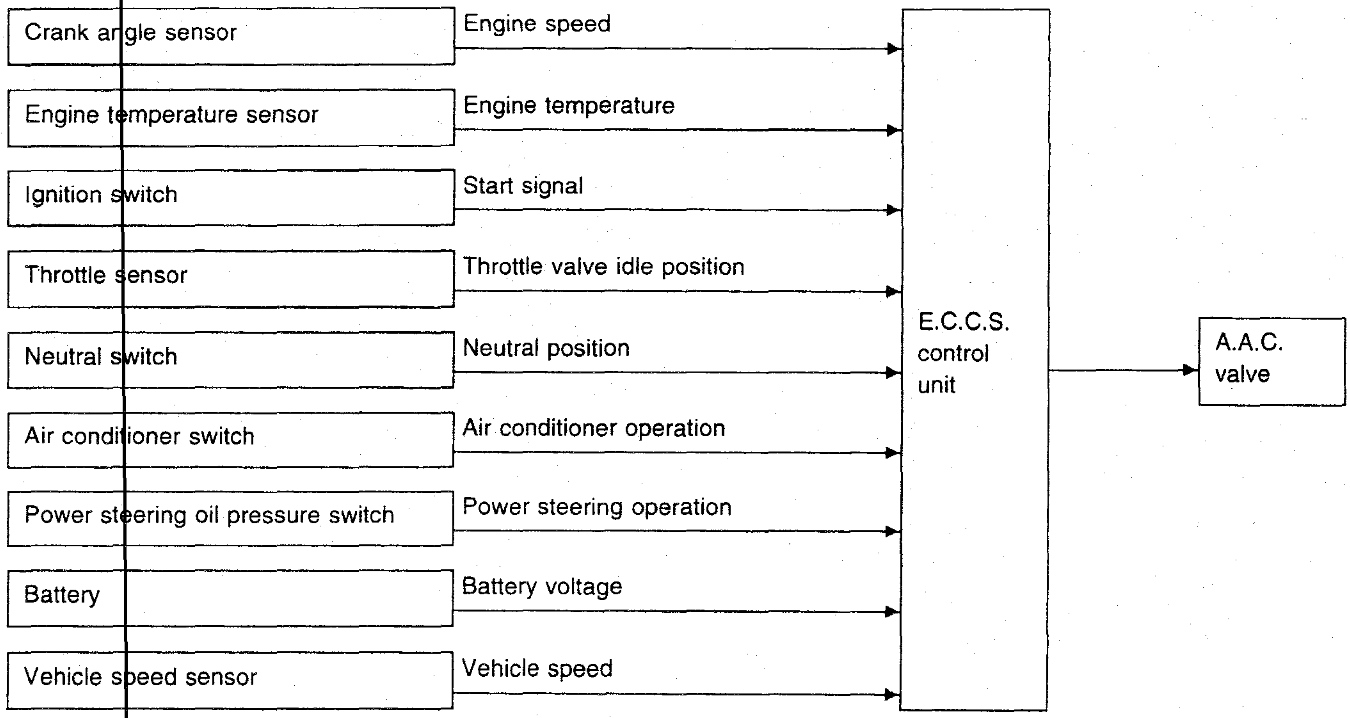
1 At starting
2 During engine warm-up
3 At idle
4 At low battery voltage
5 During swirl control valve operates
6 During hot engine operation
7 At acceleration
8 When intake air temperature is extremely high the ignition timing is revised by the E.C.U. according to the other data stored in the ROM.



SEC750A

Idle Speed Control

INPUT/OUTPUT SIGNAL LINE

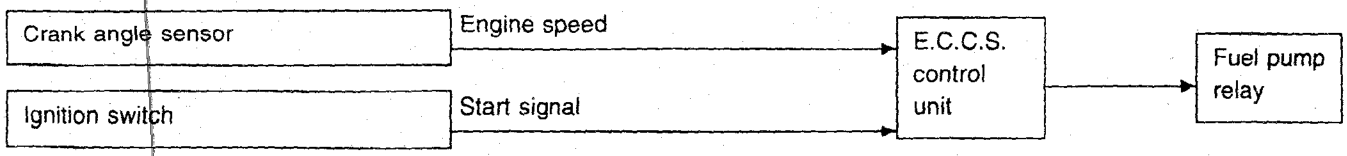


SYSTEM DESCRIPTION

This system automatically controls engine idle speed to a specified level. Idle speed is controlled through fine adjustment of the amount of air which by-passes the throttle valve via A.A.C. valve. The A.A.C. valve repeats ON/OFF operation according to the signal sent from the E.C.U. The crank angle sensor detects the actual engine speed and sends a signal to the E.C.U. The E.C.U. then controls the ON/OFF time of the A.A.C. valve so that engine speed coincides with the target value memorized in ROM. The target engine speed is the lowest speed at which the engine can operate steadily. The optimum value stored in the ROM is determined by taking into consideration various engine conditions, such as noise and vibration transmitted to the compartment, fuel consumption, and engine load.

Fuel Pump Control

INPUT/OUTPUT SIGNAL LINE



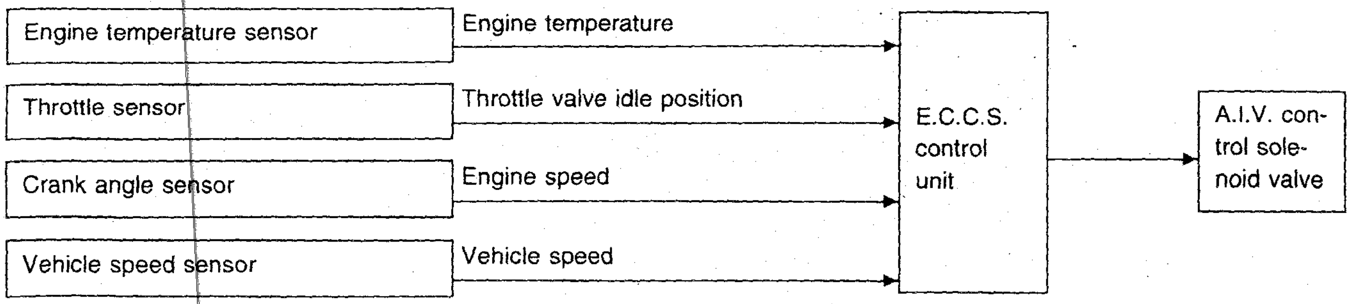
SYSTEM DESCRIPTION

The E.C.U. activates the fuel pump for several seconds after the ignition switch is turned on to improve engine startability. If the E.C.U. receives a 1° signal from the crank angle sensor, it knows that the engine is rotating, and causes the pump to perform. If the 1° signal is not received when the ignition switch is on, the engine stalls. The E.C.U. stops pump operation and prevents battery discharging, thereby improving safety. The E.C.U. does not directly drive the fuel pump. It controls the ON/OFF fuel pump relay, which in turn controls the fuel pump.

Condition	Fuel pump operation
Ignition switch is 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

Air Induction Valve (A.I.V.) Control

INPUT/OUTPUT SIGNAL LINE



SYSTEM DESCRIPTION

The air induction system is designed to send secondary air to the exhaust manifold, utilizing the vacuum caused by exhaust pulsation in the exhaust manifold.

The exhaust pressure in the exhaust manifold usually pulsates in response to the opening and closing of the exhaust valve and decreases below atmospheric pressure periodically.

If a secondary air intake pipe is opened to the atmosphere under vacuum conditions, secondary air can be drawn into the exhaust manifold in proportion to the vacuum.

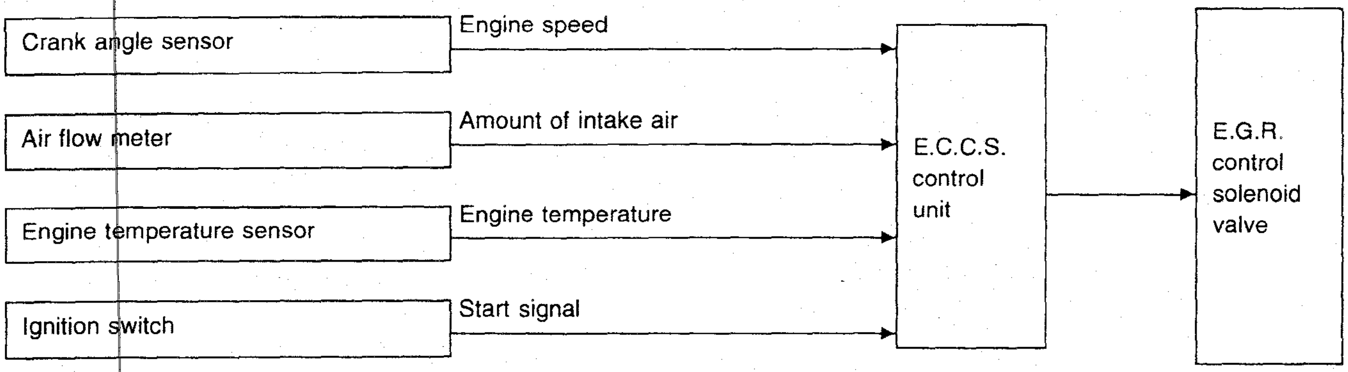
The air induction valve is controlled by the E.C.C.S. control unit, corresponding to the engine temperature. When the engine is cold, the A.I.V. control system operates to reduce HC and CO.

In extremely cold conditions, A.I.V. control system does not operate to reduce after-burning. This system also operates during deceleration for the purpose of blowing off water around the air induction valve.

Engine condition	Engine temperature °C (°F)	A.I.V. control solenoid valve	A.I.V. control system
Idle or deceleration	Between 40 (104) and 115 (239)	ON	Operates

E.G.R. (Exhaust Gas Recirculation) Control

INPUT/OUTPUT SIGNAL LINE



SYSTEM DESCRIPTION

In addition, a system is provided which precisely cuts and controls port vacuum applied to the E.G.R. valve to suit engine operating conditions. This cut-and-control operation is accomplished through the E.C.U. When the E.C.U. detects any of the following conditions, current flows through the solenoid valve in the E.G.R. control vacuum line. This causes the port vacuum to be discharged into the atmosphere so that the E.G.R. control valve remains closed.

1) Low engine temperature
2) Engine starting
3) High-speed engine operation
4) Engine idling

E.G.R. control solenoid valve operation

Condition			E.G.R. control solenoid valve
When starting			ON
Engine temperature	°C (°F)	Below 60 (140)	
		Above 115 (239)	
Idle & heavy load conditions			
Other conditions			OFF

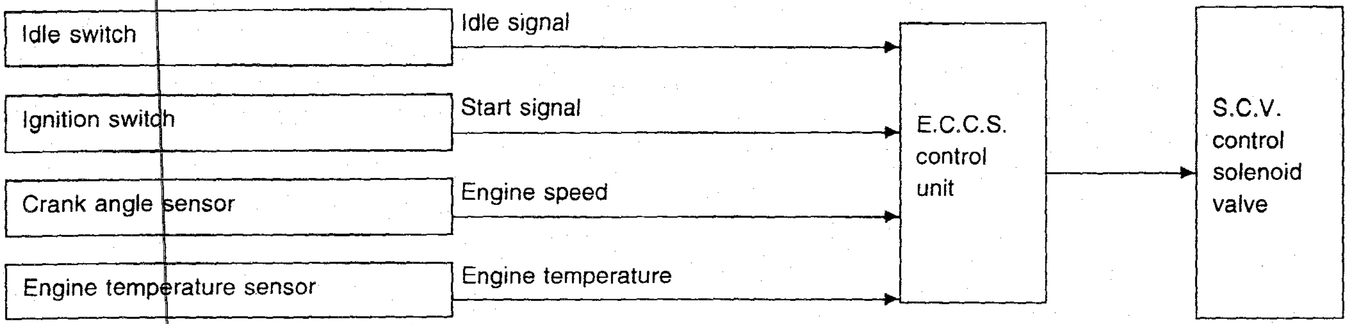
E.G.R. system operation

E.G.R. system operates under only the following conditions

Engine temperature °C (°F)	B.P.T. valve		Throttle position	E.G.R. control solenoid valve	E.G.R. system
	Exhaust gas pressure	Operation			
Between 60 (140) and 115 (239)	High	Closed	Partially open	OFF	Operates

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

INPUT/OUTPUT SIGNAL LINE



SYSTEM DESCRIPTION

This system has a swirl control valve (S.C.V.) in the intake passage of each cylinder.

While idling and during low engine speed operation, the S.C.V. closes. Thus the velocity of the air in the intake passage increases, promoting the vaporization of the fuel and producing a swirl in the combustion chamber.

Because of this operation, this system tends to increase the burning speed of the gas mixture, improve fuel consumption, and increase the stability in running conditions.

Also, except when idling and during low engine speed operation, this system opens the S.C.V. In this condition, this system tends to increase power by improving intake efficiency via reduction of intake flow resistance, intake flow.

The solenoid valve controls S.C.V.'s shut/open condition. This solenoid valve is operated by the E.C.U.

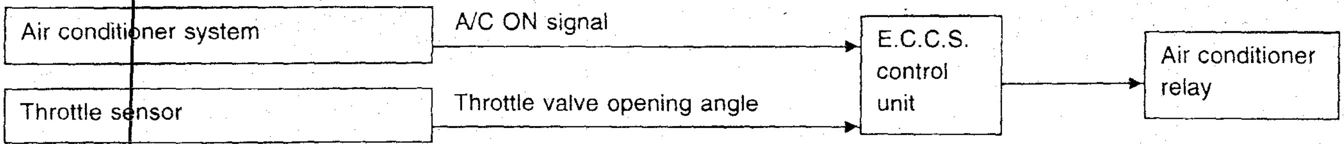
S.C.V. system operation (Engine is running)

Idle switch	Engine speed	Solenoid valve	S.C.V.
ON	Below 4,000 rpm	ON	Closed
OFF	Less than 2,800 rpm	ON	Closed
	More than 4,000 rpm	OFF	Open

When engine temperature is below 0°C (32°F) S.C.V. is kept open.

Acceleration Cut Control

INPUT/OUTPUT SIGNAL LINE

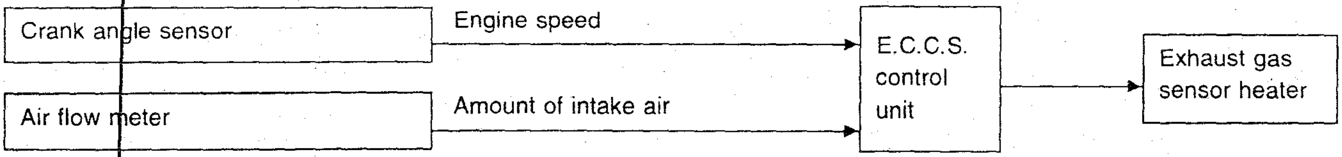


SYSTEM DESCRIPTION

When accelerator pedal is fully depressed, air conditioner is turned off for a few seconds.
This system improves acceleration when air conditioner is used.

Exhaust Gas Sensor Heater Control

INPUT/OUTPUT SIGNAL LINE



The E.C.U. performs ON/OFF control of the exhaust gas sensor heater corresponding to the engine speed and engine load.

Operation

Engine speed rpm	Engine load	Exhaust gas sensor heater
Above 4,000	Heavy load	OFF
	Middle or light load	OFF
Below 4,000	Heavy load	OFF
	Middle or light load	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

System	Fixed condition
E.G.R. control system	OFF
Idle speed control system	A duty ratio is fixed at the preprogrammed value.
Fuel injection control system	Fuel is shut off above 2,400 rpm. (Engine speed does not exceed 2,400 rpm.)

ENGINE TEMPERATURE SENSOR MALFUNCTION

When engine temperature sensor output voltage is below or above the specified value, water temperature is fixed at the preset value as follows:

Operation

Condition	Engine temperature decided
Just as ignition switch is turned ON or Start	20°C (68°F)
More than 6 minutes after ignition ON or Start	80°C (176°F)
Except as shown above	20 - 80°C (68 - 176°F) (Depends on the time)

THROTTLE SENSOR MALFUNCTION

When throttle sensor output voltage is below or above the specified value, throttle sensor output is fixed at the preset value.

AIR TEMPERATURE SENSOR MALFUNCTION

When air temperature sensor value is below or above the specified value, air temperature value is fixed at the preset value [20°C (68°F)].

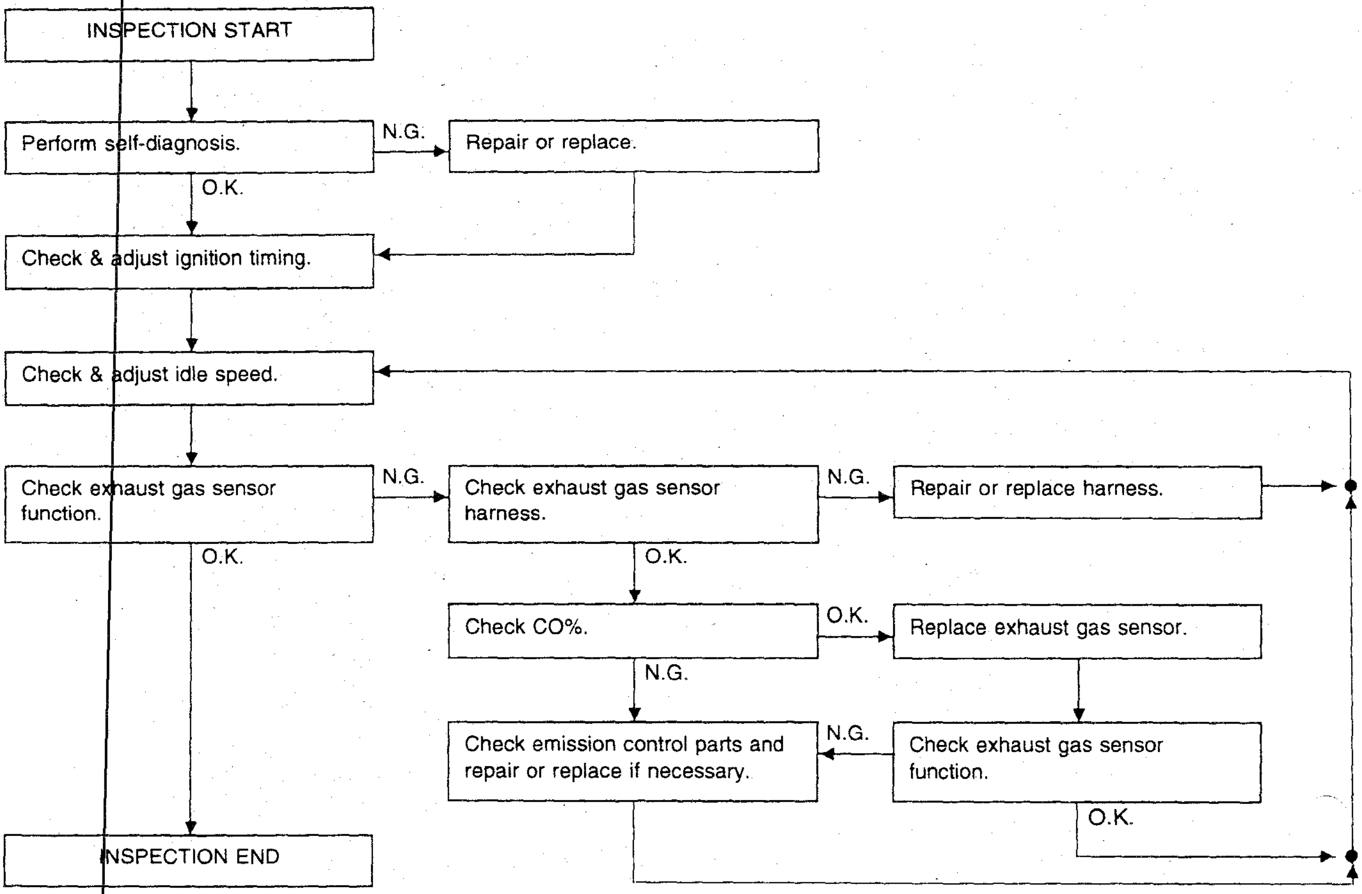
PREPARATION

1. Make sure that the following parts are in good order.

- Battery
- Ignition system
- Engine oil and coolant levels
- Fuses
- E.C.U. harness connector
- Vacuum hoses
- Air intake system
  (Oil filler cap, oil level gauge, etc.)
- Fuel pressure
- Engine compression
- Throttle valve
- AIV hose
- EGR valve operation

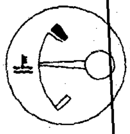
2. On air conditioner equipped models, checks should be carried out while the air conditioner is "OFF".
3. When measuring "CO" percentage, insert probe more than 40 cm (15.7 in) into tail pipe.
4. Turn off headlamps, heater blower, rear defogger.
5. Keep front wheels pointed straight ahead.

Overall inspection sequence



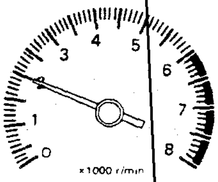
Idle check and procedure

INSPECTION START


EEF109

Visually check the following:
- Air cleaner clogging
- Hoses and ducts for leaks
- Electrical connectors
- Gaskets
- Throttle valve and throttle sensor operation

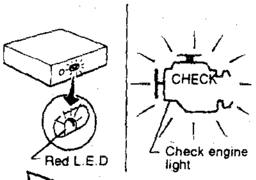
Start engine and warm it up until water temperature indicator points to the middle of gauge. Ensure engine stays below 1,000 rpm.



SEF247F

Open engine hood and run engine at about 2,000 rpm for about 2 minutes under no-load.

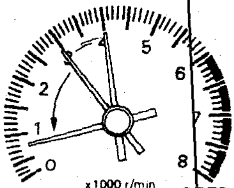
Perform E.C.C.S. self-diagnosis (mode II).



SEF621K

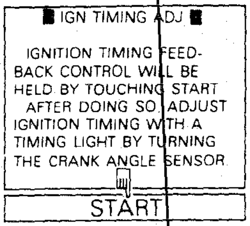
O.K. / N.G.

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.


■ IGN TIMING ADJ ■

IGNITION TIMING FEED-BACK CONTROL WILL BE HELD BY TOUCHING START AFTER DOING SO ADJUST IGNITION TIMING WITH A TIMING LIGHT BY TURNING THE CRANK ANGLE SENSOR

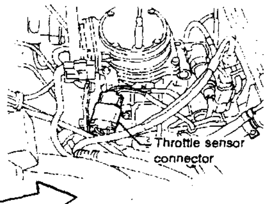
START

EEF110

1) Select "IGN TIMING ADJ" in "WORK SUPPORT" mode.
2) Touch "START".

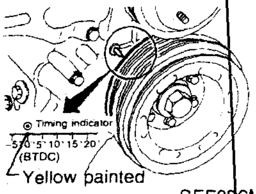
OR

1) Turn off engine and disconnect throttle sensor connector.
2) Start engine.



EEF111

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



SEF396M

Check ignition timing with a timing light.

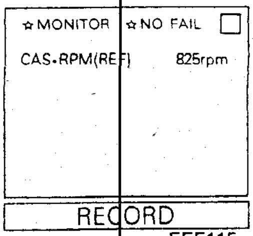
10° ±2° B.T.D.C.

O.K. → Ⓐ

N.G. → Ⓘ

Ⓐ

Ⓘ


☆MONITOR ☆NO FAIL ☐

CAS·RPM(REF) 825rpm

RECORD

EEF115

Adjust ignition timing to the specified value by turning distributor after loosening bolts which secure distributor.

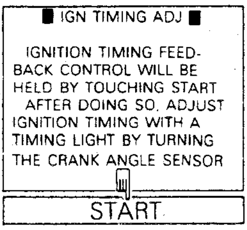
10° B.T.D.C.

Ⓔ

1) Select "IGN TIMING ADJ" in "WORK SUPPORT" mode.
2) Touch "START".

OR

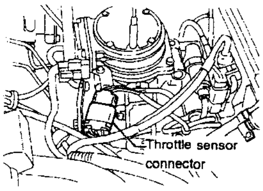
1) Turn off engine and disconnect throttle sensor connector.
2) Start engine.


■ IGN TIMING ADJ ■

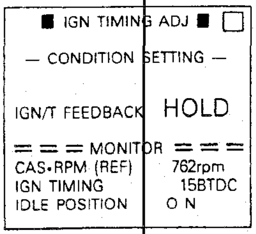
IGNITION TIMING FEEDBACK CONTROL WILL BE HELD BY TOUCHING START AFTER DOING SO, ADJUST IGNITION TIMING WITH A TIMING LIGHT BY TURNING THE CRANK ANGLE SENSOR

START

EEF110



EEF111


■ IGN TIMING ADJ ■ ☐

— CONDITION SETTING —

IGN/T FEEDBACK HOLD

=== MONITOR ===

CAS·RPM (REF) 762rpm

IGN TIMING 15BTDC

IDLE POSITION ON

EEF112

Check idle speed.

- Read idle speed in "IGN TIMING ADJ" in "WORK SUPPORT" mode.

OR

- Check idle speed.

700 ± 50 rpm

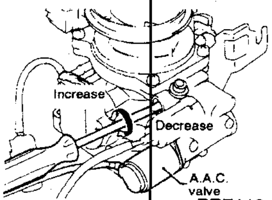
O.K.

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.

750 rpm

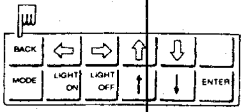


EEF113

1) Touch "BACK".

OR

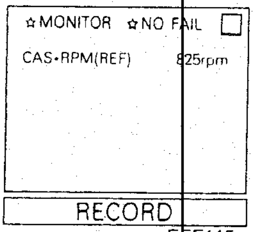
1) Turn off engine and connect throttle sensor harness connector.
2) Start engine.



SEF913J

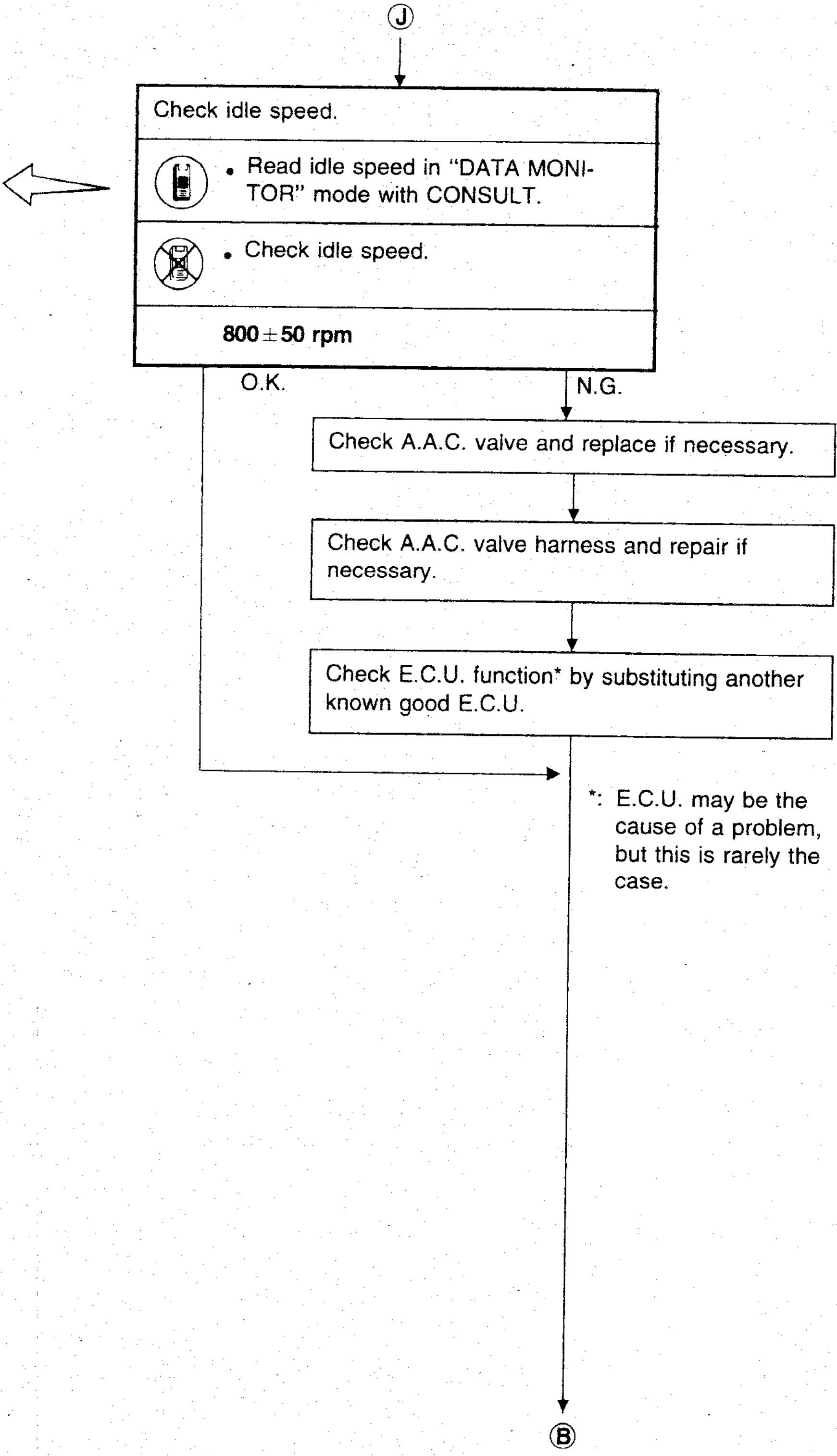
Race engine (2,000 - 3,000 rpm) 2 or 3 times under no-load and run engine at idle speed.

Ⓙ


☆MONITOR ☆NO FAIL ☐

CAS·RPM(REF) 825rpm

EEF115



Check idle speed.

- Read idle speed in "DATA MONITOR" mode with CONSULT.

- Check idle speed.

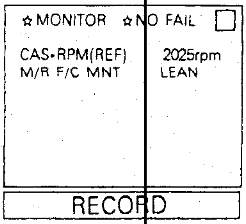
800±50 rpm

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.

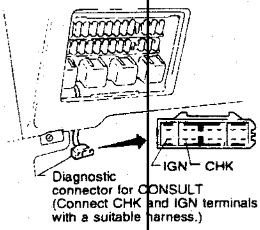

☆MONITOR ☆NO FAIL ☐

CAS·RPM(REF) 2025rpm

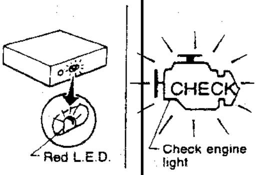
M/R F/C MNT LEAN

RECORD

EEF116



EEF117



SEF621K

Ⓑ

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 .....

OR

1. Set "EXHAUST GAS SENSOR MONITOR" in the self-diagnostic mode II. (See page EF & EC-45.)
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. → Ⓒ

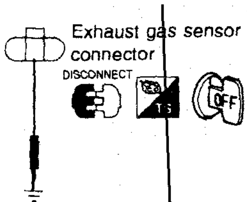
O.K.

END

Ⓒ

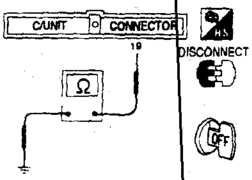
Check exhaust gas sensor harness:
1) Turn off engine and disconnect battery ground cable.
2) Disconnect E.C.U. connector from E.C.U.
3) Disconnect exhaust gas sensor harness connector and connect main harness side terminal for exhaust gas sensor to ground with a jumper wire.
4) Check for continuity between terminal No. 19 of E.C.U. connector and body ground.

Continuity exists .... O.K.
Continuity does not exist .... N.G.



As for the location of exhaust gas sensor connector, refer to page EF & EC-124.

SEC240B



SEF587K

N.G.: Repair or replace harness. → Ⓔ

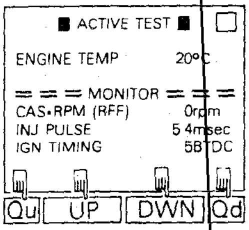
O.K.: Connect E.C.U. connector to E.C.U.

Connect battery ground cable.

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

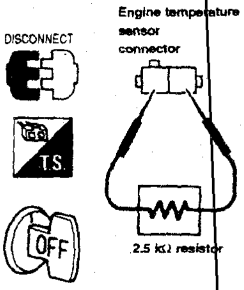
1) Disconnect engine temperature sensor harness connector.
2) Connect a resistor (2.5 kΩ) between terminals of engine temperature sensor harness connector.
3) Disconnect A.I.V. hose and install a suitable plug in A.I.V. pipe.
4) Connect battery ground cable.


■ ACTIVE TEST ■

ENGINE TEMP 20°C

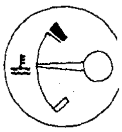
═══ MONITOR ═══
CAS•RPM (REF) 0rpm
INJ PULSE 5.4msec
IGN TIMING 5BTDC

EEF118



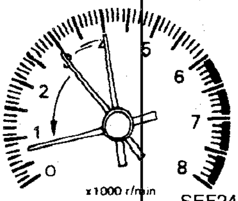
SEF322K

Start engine and warm it up until water temperature indicator points to middle of gauge. (Be careful to start engine after installing a 2.5 kΩ resistor.)



EEF10

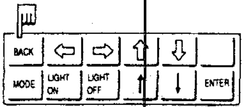
Ⓓ



SEF248F

Ⓓ

Race engine two or three times under no-load, then run engine at idle speed.



SEF913J

Check "CO" %.

Idle CO: Less than 5%

After checking CO%,

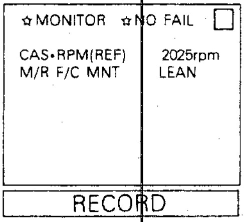
1) Touch "BACK".

1) Disconnect the resistor from terminals of engine temperature sensor harness connector.
2) Connect engine temperature sensor harness connector to engine temperature sensor.

O.K.

N.G.

Replace exhaust gas sensor.


☆MONITOR ☆NO FAIL ☐

CAS•RPM(REF) 2025rpm
M/R F/C MNT LEAN

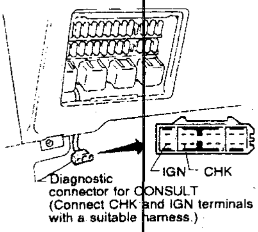
RECORD

EEF116

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 .....

— OR —



EEF117

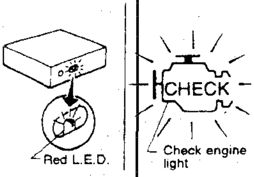
1. Set "EXHAUST GAS SENSOR MONITOR" in the self-diagnostic mode II. (See page EF & EC-45.)
2. Maintaining engine at 2,000 rpm under no-load, check to make sure that the RED L.E.D. on the E.C.U. or the check engine light on the instrument panel goes ON and OFF more than 5 times during 10 seconds.

N.G.

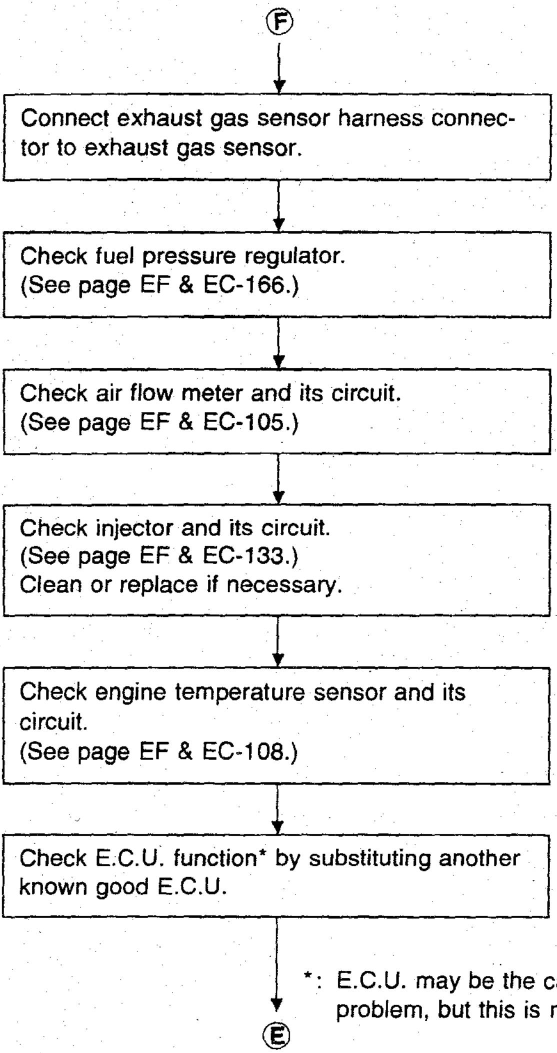
O.K.

Ⓕ

Ⓔ



SEF621K



Connect exhaust gas sensor harness connector to exhaust gas sensor.

Check fuel pressure regulator.
(See page EF & EC-166.)

Check air flow meter and its circuit.
(See page EF & EC-105.)

Check injector and its circuit.
(See page EF & EC-133.)
Clean or replace if necessary.

Check engine temperature sensor and its circuit.
(See page EF & EC-108.)

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.

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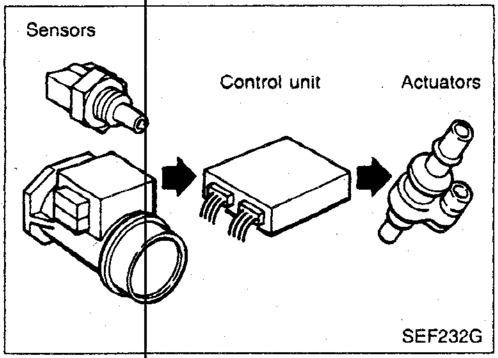


How to Perform Trouble Diagnoses for Quick and Accurate Repair

INTRODUCTION

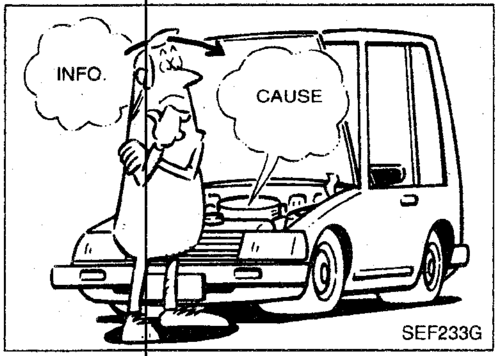
The engine has an electronic control unit to control major systems such as fuel control, ignition control, idle speed control, etc. The control unit accepts input signals from sensors and instantly drives actuators. It is essential that both kinds of signals are proper and stable. At the same time, it is important that there are no conventional problems such as vacuum leaks, fouled spark plugs, or other problems with the engine.

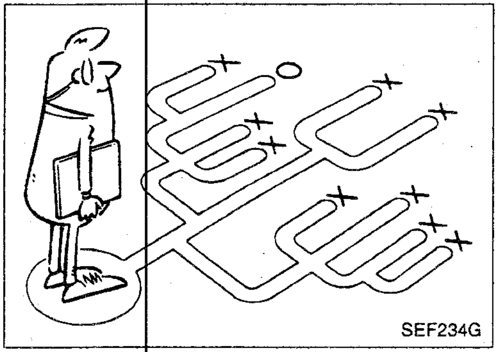
It is much more difficult to diagnose a problem that occurs intermittently rather than continuously. Most intermittent problems are caused by poor electric connections or faulty wiring. In this case, careful checking of suspicious circuits may help prevent the replacement of good parts.

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

Before undertaking actual checks, take just a few minutes to talk with a customer who approaches with a driveability complaint. The customer is a very good supplier of information c such problems, especially intermittent ones. Through the talks with the customer, find out what symptoms are present and under what conditions they occur.

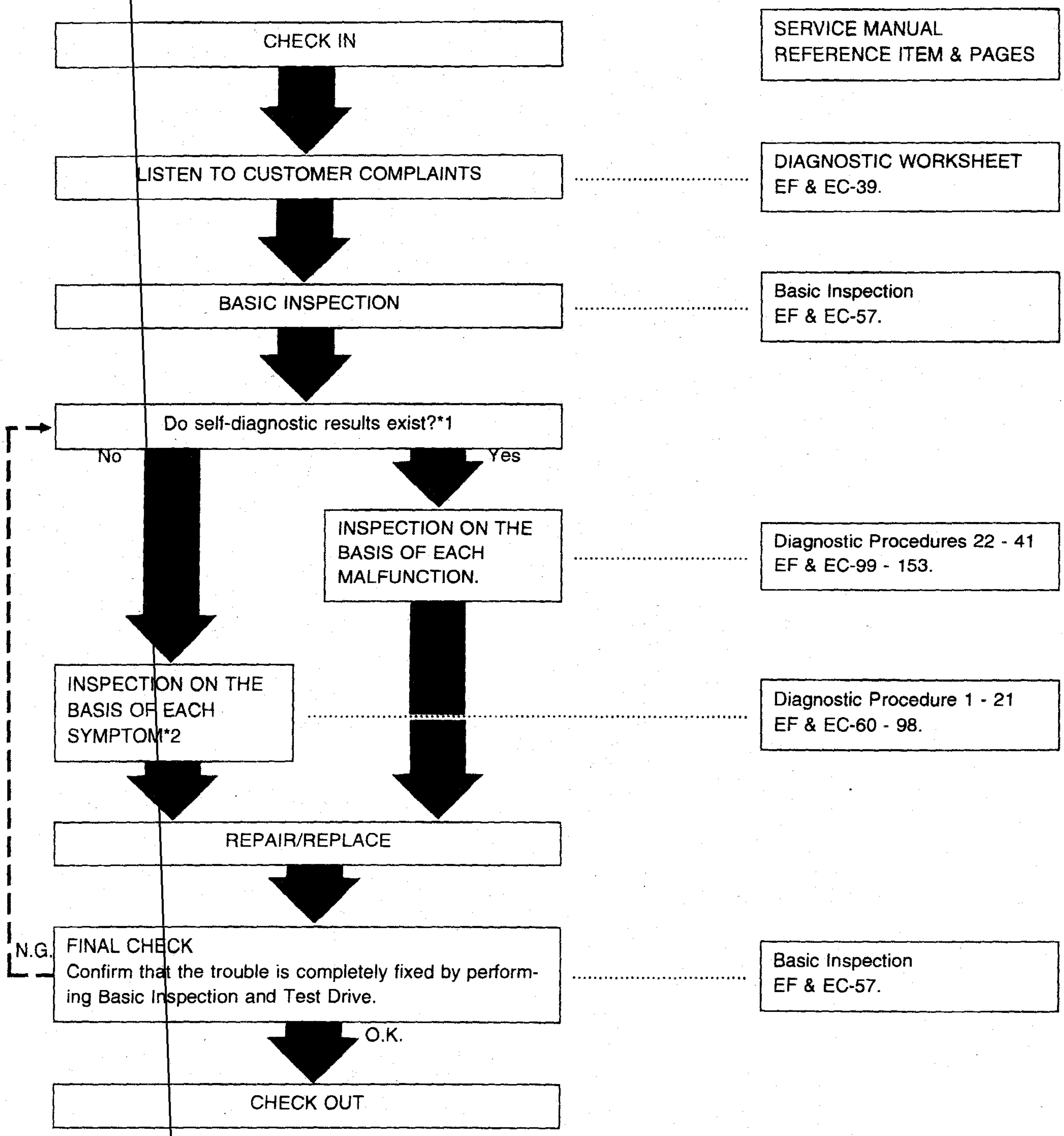
Start your diagnosis by looking for "conventional" problems first. This is one of the best ways to troubleshoot driveability problems on an electronically controlled engine vehicle.





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

WORK FLOW



*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-40).

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

DIAGNOSTIC WORKSHEET

KEY POINTS

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

SEF907L

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.

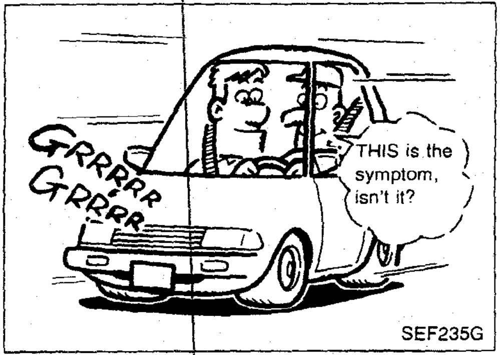
Make good use of a diagnostic worksheet such as the one shown below in order to utilize all the complaints for trouble-shooting.

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

* Vehicle identification number

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



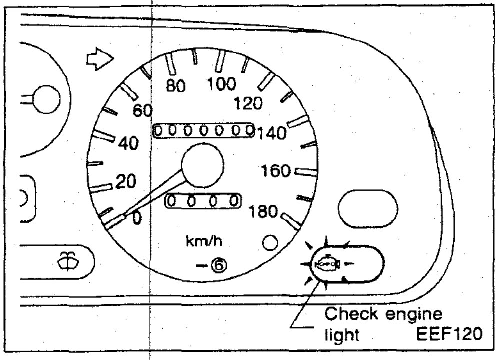
INTERMITTENT PROBLEM SIMULATION

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 Diagnostic Procedure and note the result.

	Variable factor	Influential part	Target condition	Service procedure
1	Mixture ratio	Pressure regulator	Made lean	Remove vacuum hose and apply vacuum.
			Made rich	Remove vacuum hose and apply pressure.
2	Ignition timing	Distributor	Advanced	Rotate distributor clockwise.
			Retarded	Rotate distributor counterclockwise.
3	Mixture ratio feedback control	Exhaust gas sensor	Suspended	Disconnect exhaust gas sensor harness connector.
		Control unit	Operation check	Perform self-diagnosis (Mode II) at 2,000 rpm.
4	Idle speed	I.A.A. unit	Raised	Turn idle adjusting screw counterclockwise.
			Lowered	Turn idle adjusting screw clockwise.
5	Electric connection (Electric continuity)	Harness connectors and wires	Poor electric connection or faulty wiring	Tap or wiggle.
				Race engine rapidly. See if the torque reaction of the engine unit causes electric breaks.
6	Temperature	Control unit	Cooled	Cool with an icing spray or similar device.
			Warmed	Heat with a hair drier. **[WARNING: Do not overheat the unit.]**
7	Moisture	Electric parts	Damp	Wet. **[WARNING: Do not directly pour water on components. Use a mist sprayer.]**
8	Electric loads	Load switches	Loaded	Turn on head lights, air conditioner, rear defogger, etc.
9	Idle switch condition	Control unit	ON-OFF switching	Adjust throttle sensor.
10	Ignition spark	Timing light	Spark power check	Try to flash timing light for each cylinder using ignition coil adapter (S.S.T.)

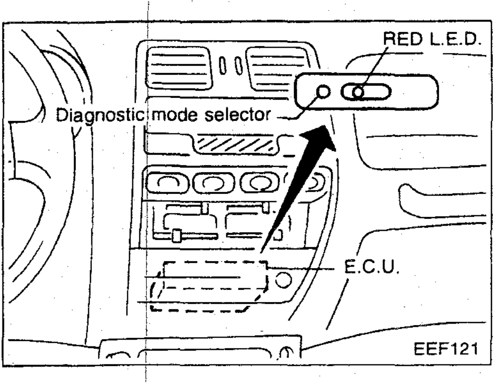
Self-diagnosis

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. is located behind the bottom of the instrument panel and only has one RED L.E.D.

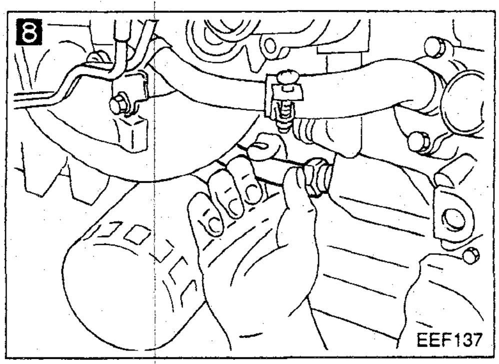
SELF-DIAGNOSTIC FUNCTION

Mode Condition		Mode I	Mode II
Ignition switch in "ON" position	Engine stopped	BULB CHECK	SELF-DIAGNOSTIC RESULTS
	Engine running	MALFUNCTION WARNING	EXHAUST GAS SENSOR MONITOR

Diagnostic Procedure 3 — Unstable Idle (Cont'd)

Ⓑ

8



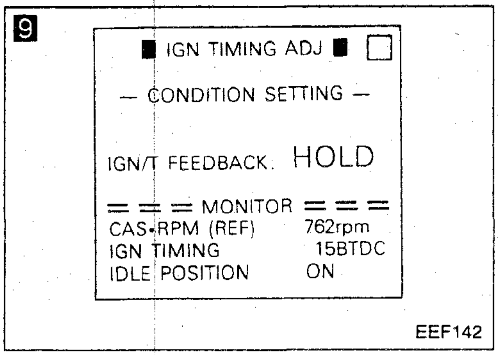
8

CHECK FOR INTAKE AIR LEAK.
When pinching cylinder block to intake manifold hose does the engine speed rise?

Yes → Discover air leak location and repair.

No ↓

9


■ IGN TIMING ADJ ■ ☐

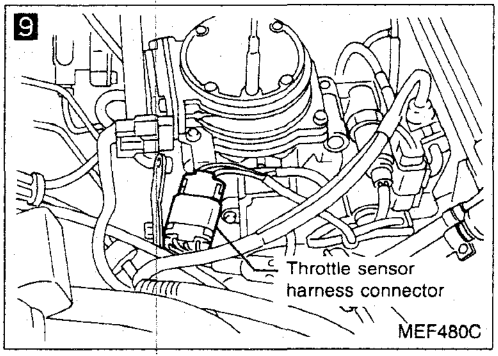
— CONDITION SETTING —

IGN/T FEEDBACK HOLD

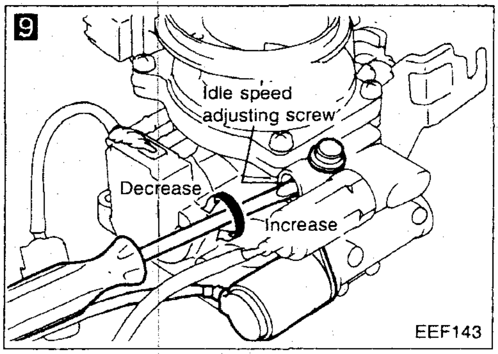
=== MONITOR ===

CAS·RPM (REF) 762rpm
IGN TIMING 15BTDC
IDLE POSITION ON

9



9



9

CHECK IDLE ADJ. SCREW CLOGGING.

1. Perform "IGN TIMING ADJ" in "WORK SUPPORT" mode.
2. Can you set engine rpm at 750±25 rpm (in "N" position) by turning idle adjusting screw?

OR

1. Disconnect throttle sensor harness connector.
2. Can you set engine rpm at 750±25 rpm (in "N" position) by turning idle speed adjusting screw?

No → Check for IAS clogging or throttle valve clogging.

Yes ↓

10

COMPRESSION PRESSURE

EEF144

10

CHECK COMPRESSION PRESSURE.

- Check compression pressure.

Standard:
kPa (bar, kg/cm², psi)/300 rpm
1,196 (11.96, 12.2, 173)
Minimum:
kPa (bar, kg/cm², psi)/300 rpm
883 (8.83, 9.0, 128)
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. ↓

11

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. ↓

12

TRY A KNOWN GOOD E.C.U.★

Trouble is fixed. → Replace E.C.U.

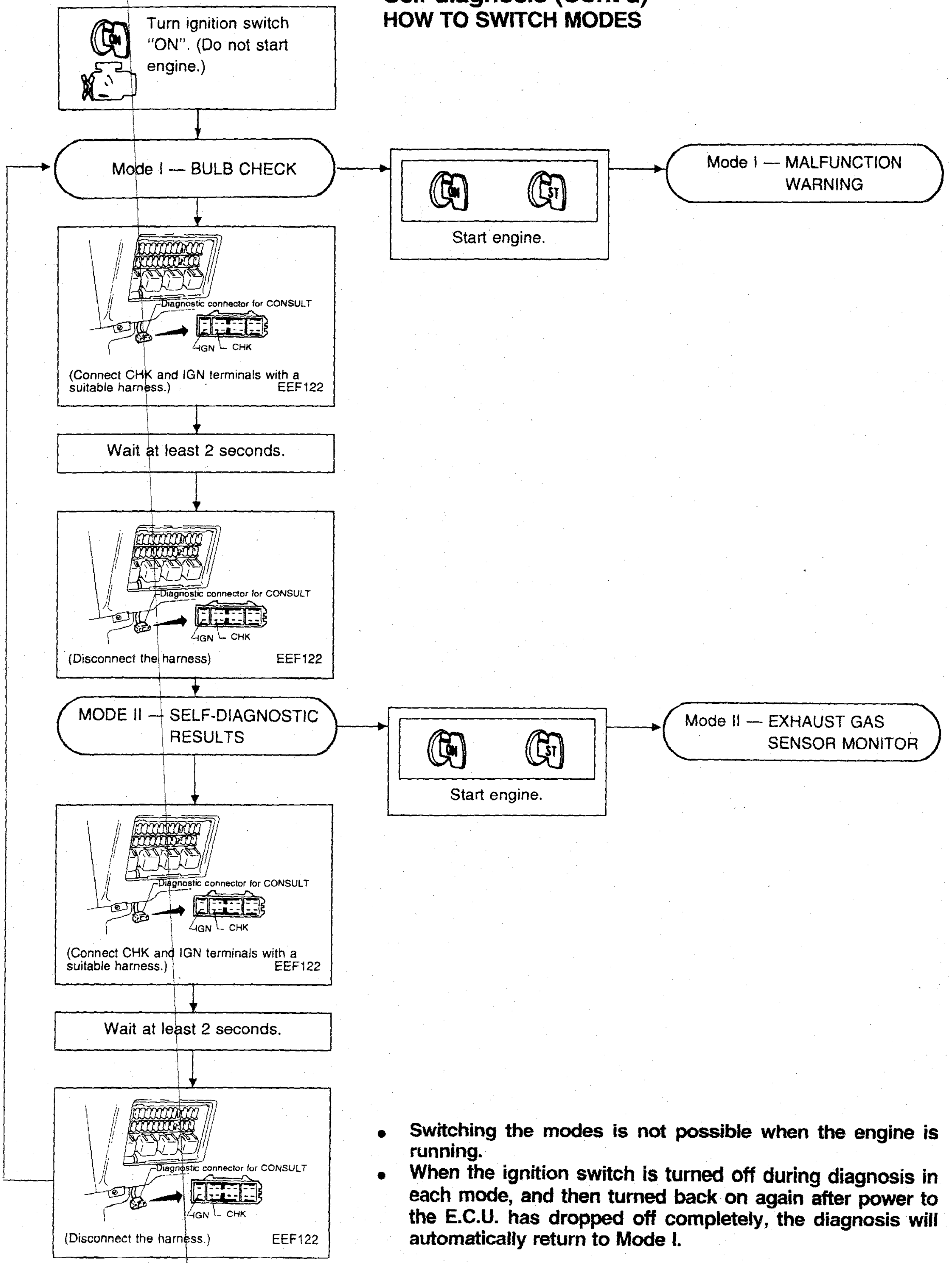
Trouble is not fixed. ↓

INSPECTION END

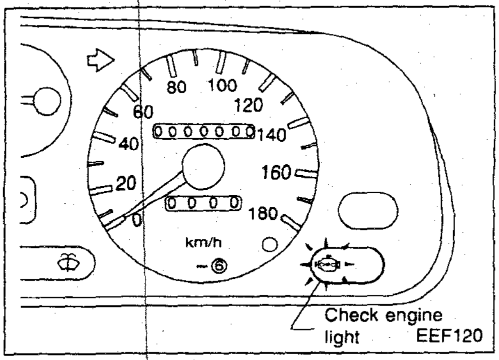
★: E.C.U. may be the cause of a problem, but this is rarely the case.

Self-diagnosis (Cont'd)

HOW TO SWITCH MODES



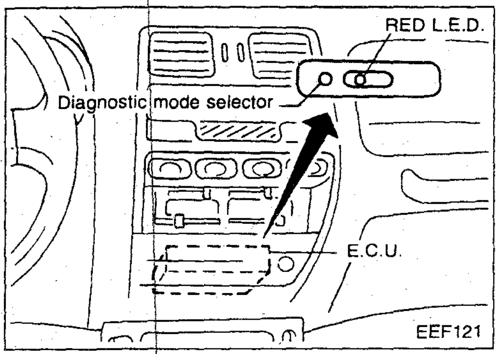
- **Switching the modes is not possible when the engine is running.**
- **When the ignition switch is turned off during diagnosis in each mode, and then turned back on again after power to the E.C.U. has dropped off completely, the diagnosis will automatically return to Mode I.**



Self-diagnosis

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.

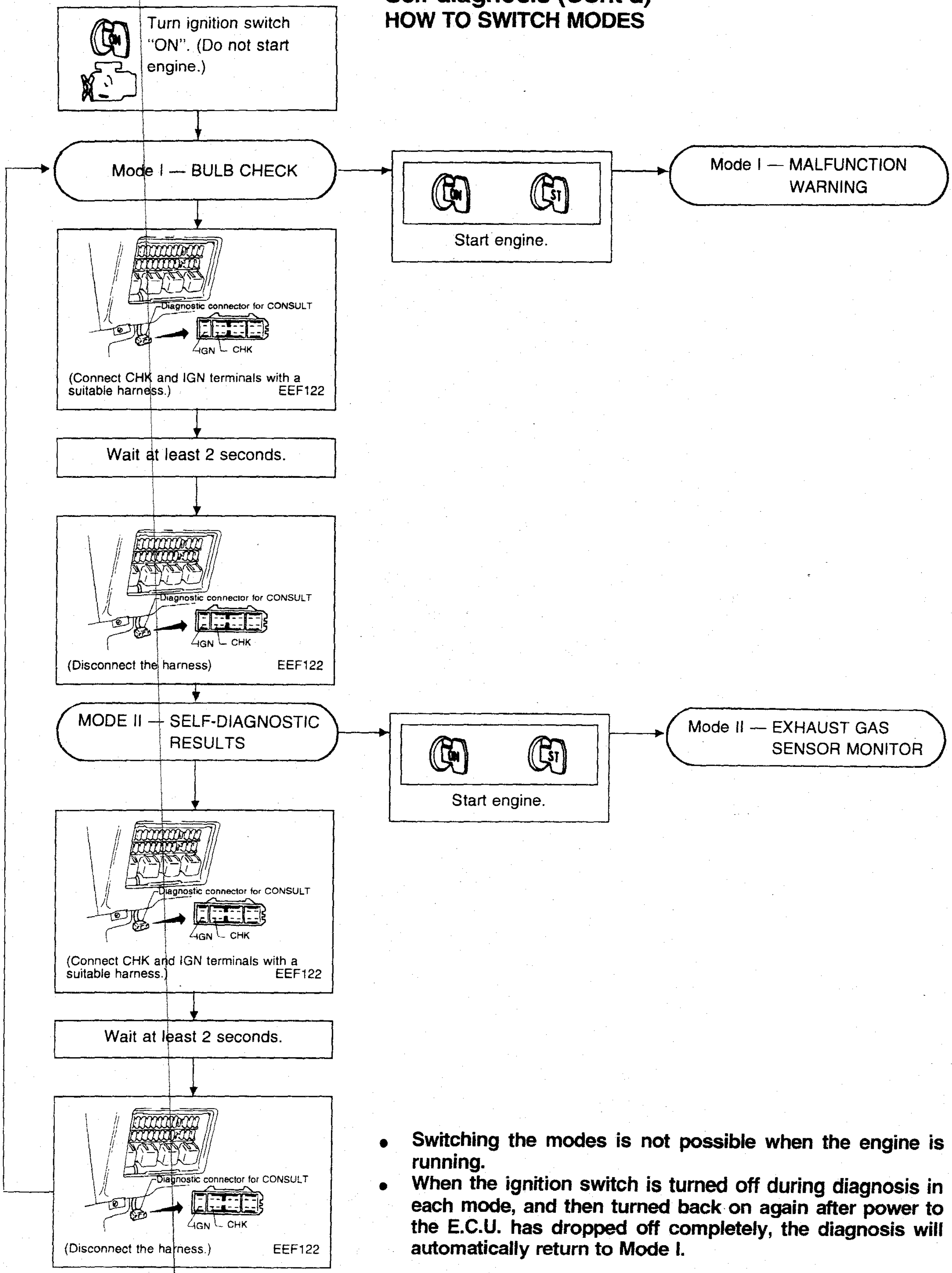
The E.C.U. is located behind the bottom of the instrument panel and only has one RED L.E.D.

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

Self-diagnosis (Cont'd)

HOW TO SWITCH MODES



- **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

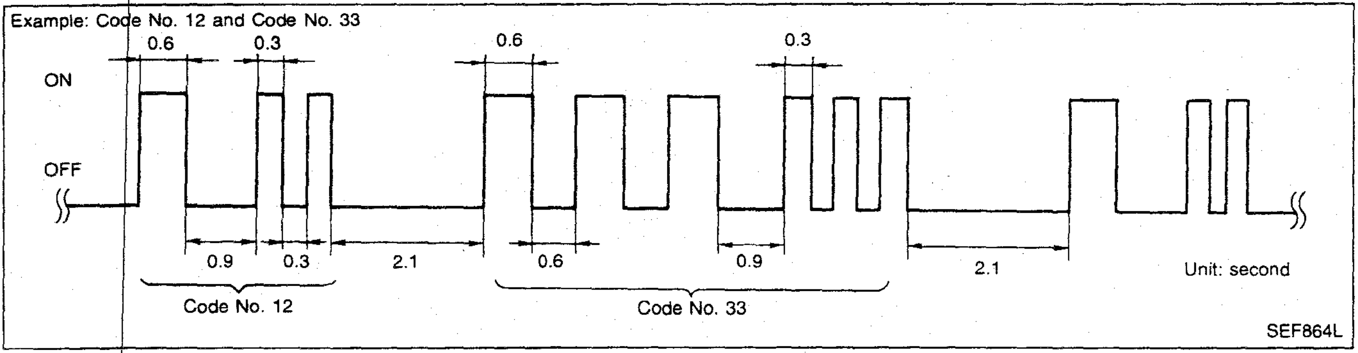
CHECK ENGINE LIGHT and RED L.E.D.	Condition
ON	When the E.C.U.'s C.P.U. is malfunctioning.
OFF	O.K.

- **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 self-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
41	Air temperature sensor
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.

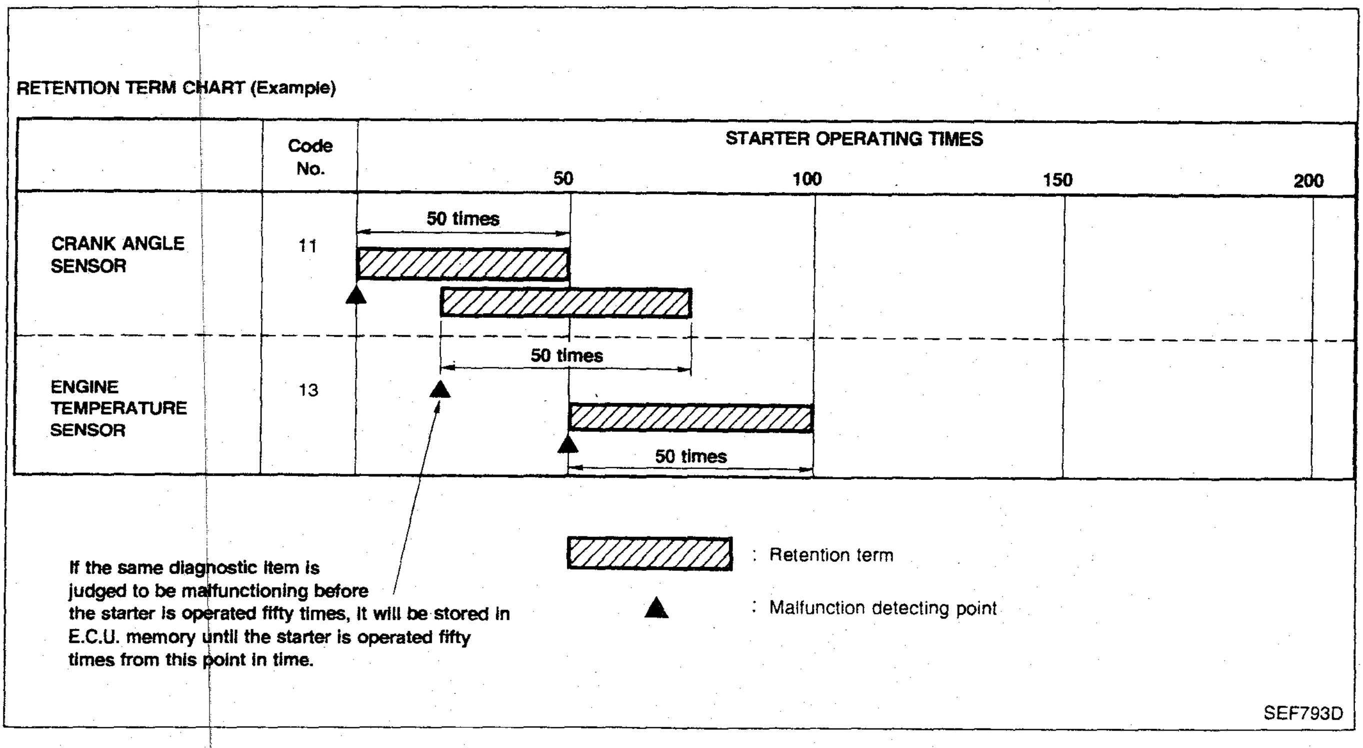
Self-diagnosis — Mode II (Self-diagnostic results) (Cont'd)

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
*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
41	Air temperature sensor circuit	The air temperature sensor circuit is open or shorted. (An abnormally high or low voltage is entered.)	• Harness and connector • Throttle sensor
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.

RETENTION OF DIAGNOSTIC RESULTS

The diagnostic results will remain in E.C.U. memory until the starter is operated fifty times after a diagnostic item has been judged to be malfunctioning. The diagnostic result will then be cancelled automatically. If a diagnostic item which has been judged to be malfunctioning and stored in memory is again judged to be malfunctioning before the starter is operated fifty times, the second result will replace the previous one. It will be stored in E.C.U. memory until the starter is operated fifty times more.



If the same diagnostic item is judged to be malfunctioning before the starter is operated fifty times, it will be stored in E.C.U. memory until the starter is operated fifty times from this point in time.

SEF793D

Self-diagnosis — Mode II (Self-diagnostic results) (Cont'd)

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.**

Self-diagnosis — Mode II (Exhaust gas sensor monitor)

DESCRIPTION

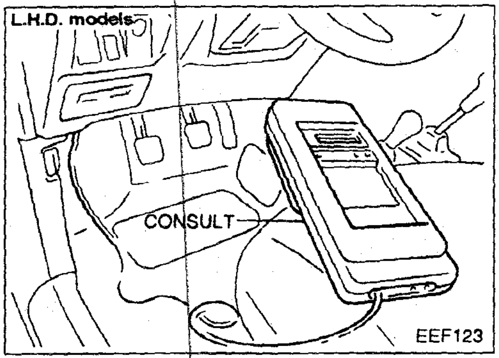
In this mode, the CHECK ENGINE LIGHT and RED L.E.D. display the condition of the fuel mixture (lean or rich) which is monitored by the exhaust gas sensor.

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

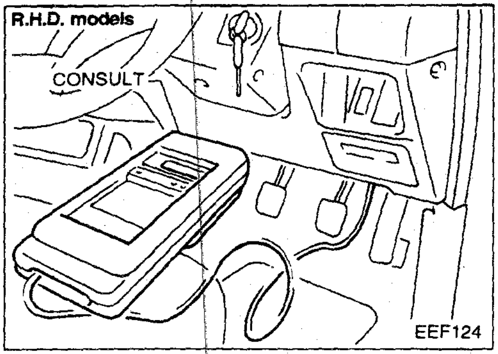
1. Set Mode II. (Refer to "HOW TO SWITCH MODES".)
2. Start engine and warm it up until engine coolant temperature indicator points to the middle of the gauge.
3. Run engine at about 2,000 rpm for about 2 minutes under no-load conditions.
4. Make sure RED L.E.D. or CHECK ENGINE LIGHT goes ON and OFF more than 5 times every 10 seconds; measured at 2,000 rpm under no-load.

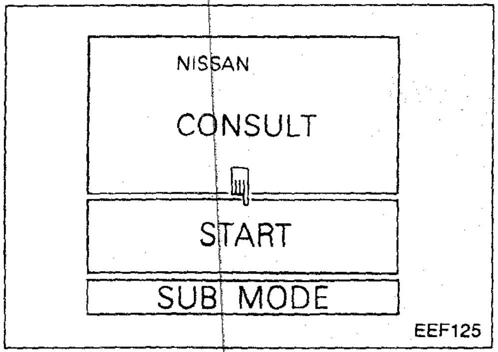


Consult

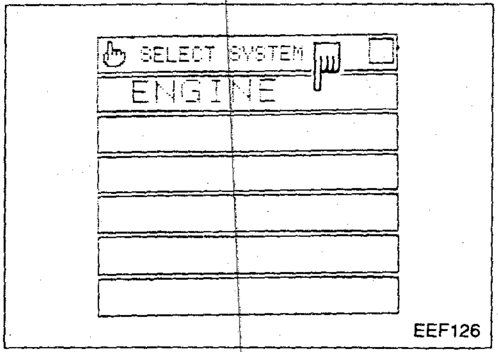
CONSULT INSPECTION PROCEDURE

1. Turn off ignition switch.
2. Connect "CONSULT" to diagnostic connector.
   (Diagnostic connector is located behind the fuse box cover.)

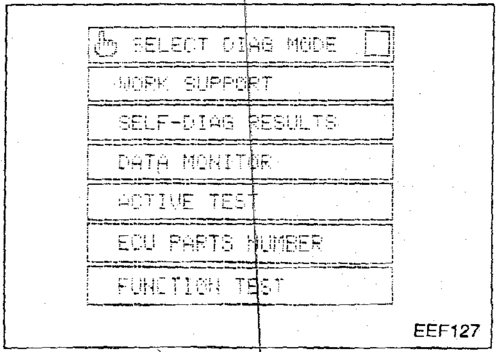




3. Turn on ignition switch.
4. Touch "START".



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

MODE E.C.C.S. COMPONENT PARTS		WORK SUPPORT	SELF-DIAGNOSTIC RESULTS	DATA MONITOR	ACTIVE TEST	FUNCTION TEST
INPUT	Crank angle sensor		X	X		
	Air flow meter		X	X		
	Engine temperature sensor		X	X	X	
	Exhaust gas sensor			X		X
	Vehicle speed sensor			X		X
	Throttle sensor	X	X	X		X
	Intake air temperature sensor		X	X		
	Ignition switch (start signal)			X		X
	Air conditioner switch			X		
	Neutral switch			X		X
	Power steering oil pump switch			X		X
	Battery			X		
OUTPUT	Injectors			X	X	X
	Power transistor (ignition timing)	X	X (Ignition signal)	X	X	X
	A.A.C. valve	X		X	X	X
	E.G.R. & canister control solenoid valve			X	X	X
	Air conditioner relay			X		
	S.C.V. control solenoid valve			X	X	X
	A.I.V. control solenoid valve			X	X	
	Fuel pump relay			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.
Function test	Conducted by CONSULT instead of a technician to determine whether each system is "OK" or "NG".

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.

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
THROTTLE SENSOR	• The throttle sensor circuit is open or shorted. (An abnormally high or low voltage is entered.)	• Harness and connector • Throttle sensor
AIR TEMPERATURE SENSOR	• The air temperature sensor circuit is open or shorted. (An abnormally high or lwo voltage is entered.)	• Harness and connector • Air temperature 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	1.3 - 1.8V	• Harness and connector • Air flow meter
		2,000 rpm	1.7 - 2.1V	
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	
INT/A TEMP SE	• Engine: After warming up		20°-60° C (68 - 140°F)	• Harness and connector • Intake air temperature sensor
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 in neutral	ON	• Harness and connect • 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	
INJ PULSE	• Engine: After warming up • A/C switch "OFF" • Shift lever "N" • No-load	Idle	2.4 - 3.6 msec.	• Harness and connector • Injector • Air flow meter • Intake air system
		2,000 rpm	1.9 - 3.2 msec.	

Consult (Cont'd)

MONITOR ITEM	CONDITION			SPECIFICATION	CHECK ITEM WHEN OUTSIDE SPEC.
IGN TIMING	ditto	Idle		10° B.T.D.C.	• Harness and connector • Crank angle sensor
		2,000 rpm		More than 25° 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 • Injectors • 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
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	
S.C.V. CONTROL SOLENOID VALVE	• The engine is running	Idle switch ON	Les than 4,000 rpm	ON	• Harness and connector • S.C.V. control solenoid valve
		Idle switch OFF	Less than 2,800 rpm	ON	
			More than 4,000 rpm	OFF	
V/SOL CNT AIV	• Engine: after warming up	Idle or deceleration		ON	• Harness and connector • A.I.V. control solenoid valve
EGR CONT S/V	• Engine: After warming up • A/C switch "OFF" • Shift lever "N" • No-load	Idle		ON	• Harness and connector • E.G.R. & canister control solenoid valve
		2,000 rpm		OFF	

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
EGR CONT SOL/V TEST	• Ignition switch: ON • Turn solenoid valve "ON" and "OFF" with the CONSULT and listen to operating sound.	Each solenoid valve makes an operating sound.	• Harness and connector • Solenoid valve
AIV CONT SOL VALVE	• Ignition switch: ON • Turn solenoid valve "ON" and "OFF" with the CONSULT and listen to operating sound.	Each solenoid valve makes an operating sound.	• Harness and connector • Solenoid valve
SWIRL CONT SOL VALVE	• Ignition switch: ON • Turn solenoid valve "ON" and "OFF" with the CONSULT and listen to operating sound.	Each solenoid valve makes an operating sound.	• Harness and connector • Solenoid valve
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 coil
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.		

Consult (Cont'd)

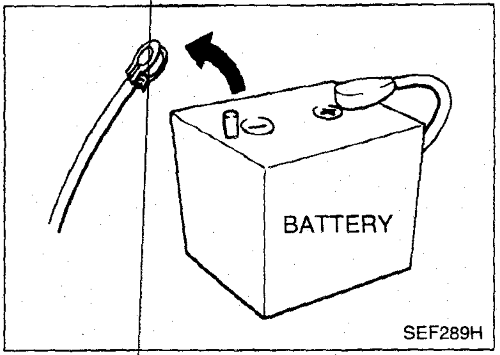
FUNCTION TEST MODE

FUNCTION TEST ITEM	CONDITION	JUDGEMENT		CHECK ITEM (REMEDY)
SELF-DIAG RESULTS	• Ignition switch: ON (Engine stopped) • Displays the results of self-diagnosis	—		• Objective system
IDLE POSITION (IDLE SWITCH CIRCUIT)	• Ignition switch: ON (Engine stopped) • Idle switch circuit is tested when throttle is opened and closed fully. ("IDLE POSITION" is the test item name for the vehicles in which idle is selected by throttle sensor.)	Throttle valve: opened	OFF	• Harness and connector • Throttle sensor (Idle switch) • Throttle sensor (Idle switch) adjustment • Throttle linkage • Verify operation in DATA MONITOR mode.
		Throttle valve: closed	ON	
THROTTLE SENSOR CKT	• Ignition switch: ON (Engine stopped) • Throttle sensor circuit is tested when throttle is opened and closed fully.	Range (Throttle valve fully opened — Throttle valve fully closed)	More than 3.0V	• Harness and connector • Throttle sensor • Throttle sensor adjustment • Throttle linkage • Verify operation in DATA MONITOR mode.
NEUTRAL SW CIRCUIT	• Ignition switch: ON (Engine stopped) • Neutral switch circuit is tested when shift lever is manipulated.	OUT OF N/P-RANGE	OFF	• Harness and connector • Neutral switch • Linkage
		IN N-RANGE	ON	
FUEL PUMP CIRCUIT	• Ignition switch: ON (Engine stopped) • Fuel pump circuit is tested by checking the pulsation in fuel pressure when fuel tube is pinched.	There is pressure pulsation on the fuel feed hose.		• Harness and connector • Fuel pump • Fuel pump relay • Fuel filter clogging • Fuel level
EGR CONT S/V CIRCUIT	• Ignition switch: ON (Engine stopped) • EGR control S/V circuit is tested by checking solenoid valve operating noise.	The solenoid valve makes an operating sound every 3 seconds.		• Harness and connector • EGR control solenoid valve

Consult (Cont'd)

FUNCTION TEST ITEM	CONDITION	JUDGEMENT		CHECK ITEM (REMEDY)
START SIGNAL CIRCUIT	• Ignition switch: ON → START • Start signal circuit is tested when engine is started by operating the starter. Battery voltage and water temperature before cranking, and average battery voltage, air flow meter output voltage and cranking speed during cranking are displayed.	Start signal: OFF → ON		• Harness and connector • Ignition switch
PW/ST SIGNAL CIRCUIT	• Ignition switch: ON (Engine running) • Power steering circuit is tested when steering wheel is rotated fully and then set to a straight line running position.	Locked position	ON	• Harness and connector • Power steering oil pressure switch • Power steering oil pump
		Neutral position	OFF	
SWIRL CONTROL S/V CIRCUIT	• Ignition switch: ON (Engine running) • Swirl control S/V circuit is tested by checking swirl control actuator operation.	The swirl control actuator moves every 3 seconds.		• Harness and connector • Swirl control solenoid valve • Swirl control actuator • Vacuum hose
CAR SPEED SEN CIRCUIT	• Vehicle speed sensor circuit is tested when vehicle is running at a speed of 10 km/h (6 mph) or higher.	Vehicle speed sensor input signal is greater than 4 km/h (2 MPH)		• Harness and connector • Vehicle speed sensor • Electric speedometer
IGN TIMING ADJ	• After warming up, idle the engine. • Ignition timing adjustment is checked by reading ignition timing with a timing light and checking whether it agrees with specifications.	The timing light indicates the same value on the screen.		• Adjust ignition timing (by moving crank angle sensor or distributor) • Crank angle sensor drive mechanism
MIXTURE RATIO TEST	• After warming-up, maintaining engine speed at 2,000 rpm. • Air-fuel ratio feedback circuit (injection system, ignition system, vacuum system, etc.) is tested by examining the exhaust gas sensor output at 2,000 rpm under non-loaded state.	—		• INJECTION SYS (Injector fuel pressure regulator, harness or connector) • IGNITION SYS (Spark plug, power transistor, ignition coil, harness or connector) • VACUUM SYS (Intake air leaks) • Exhaust gas sensor circuit • Exhaust gas sensor operation • Fuel pressure high or low • Air flow meter

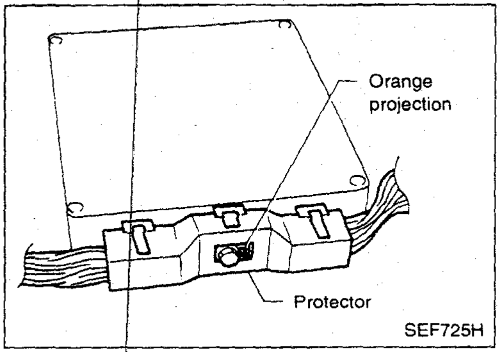
FUNCTION TEST ITEM	CONDITION	JUDGEMENT	CHECK ITEM (REMEDY)
POWER BALANCE	• After warming up, idle the engine. A/C switch "OFF", light switch "OFF" • Injector operation of each cylinder is stopped one after another, and resultant change in engine rotation is examined to evaluate combustion of each cylinder. (This is only displayed for models where a sequential injection system is used.)	Difference in engine rpm is greater than 25 rpm before and after cutting off the injector of each cylinder.	• Injector circuit (Injector, har ness or connector) • Ignition circuit (Spark plug, power transistor, ignition coil, harness or connector) • Compression • Valve timing
AAC VALVE SYSTEM	• After warming up, idle the engine. A/C switch "OFF", light switch "OFF" • AAC valve system is tested by detecting change in engine rpm when AAC valve opening is changed to 0%, 20% and 80%.	Difference in engine rpm is greater than 150 rpm between when valve opening is at 80% (102 steps) and at 20% (25 steps).	• Harness and connector • AAC valve • Air passage restriction between air inlet and AAC valve. • IAS (Idle adjusting screw) adjustment



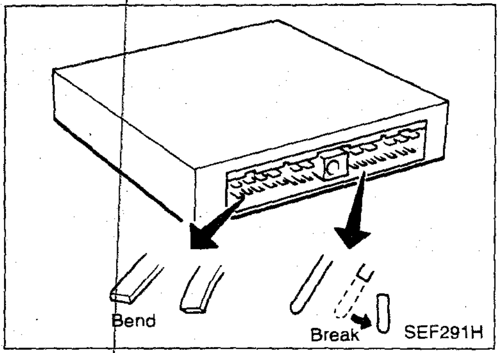
Diagnostic Procedure

CAUTION:

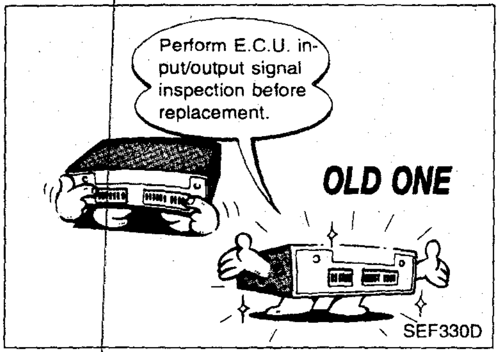
1. **Before connecting or disconnecting the E.C.U. harness connector to or from any E.C.U., be sure to turn the ignition switch to the "OFF" position and disconnect the negative battery terminal in order not to damage E.C.U. as battery voltage is applied to E.C.U. even if ignition switch is turned off.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



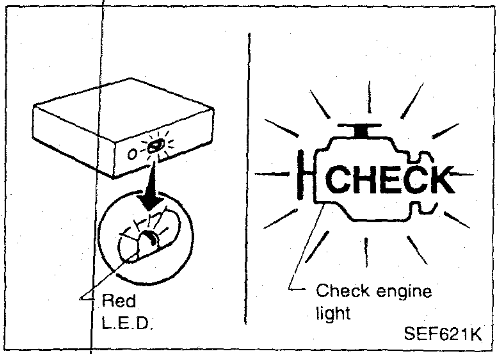
2. **When connecting E.C.U. harness connector, tighten securing bolt until orange projection is in line with connector face.**



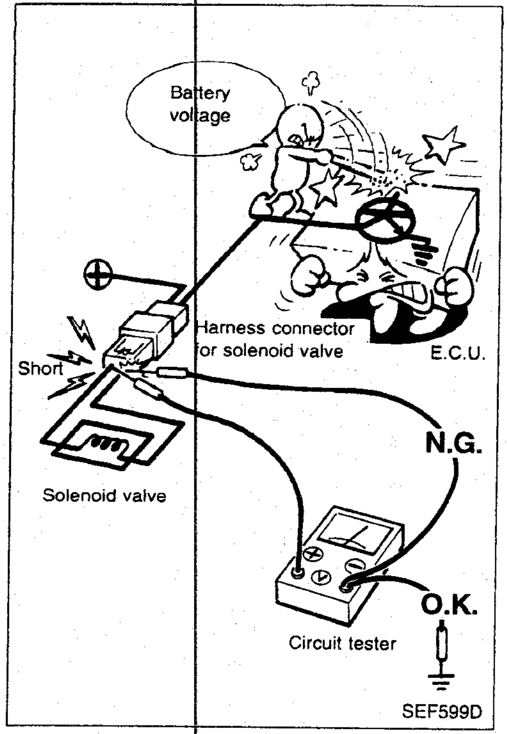
3. **When connecting or disconnecting pin connectors into or from E.C.U., take care not to damage pin terminals.**
4. **Make sure that there are not any bends or breaks on E.C.U. pin terminal, when connecting pin connectors.**



5. **Before replacing E.C.U., perform E.C.U. input/output signal inspection and make sure whether the E.C.U. unit functions are properly or not. (See page EF & EC-155.)**

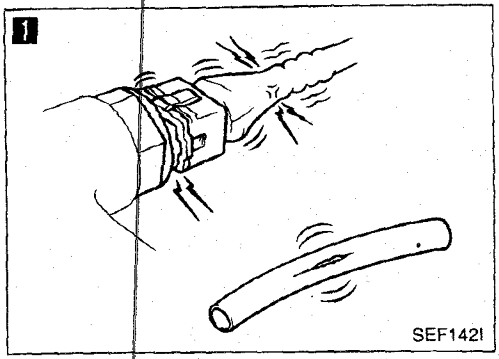


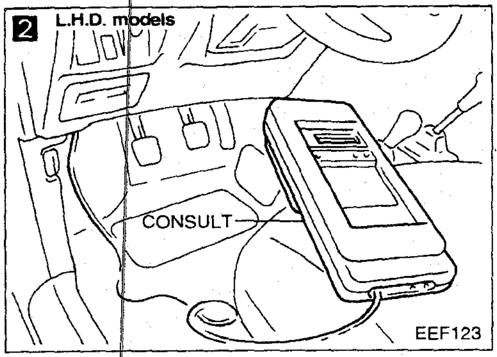
6. **After performing this "Diagnostic Procedure", perform E.C.C.S. self-diagnosis and driving test.**

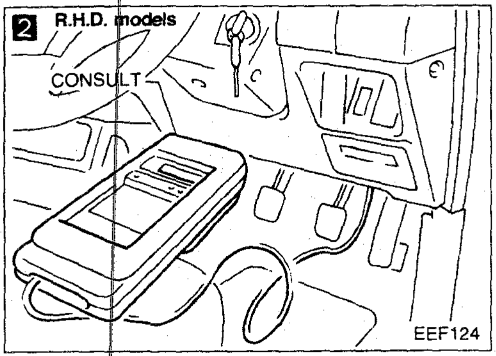


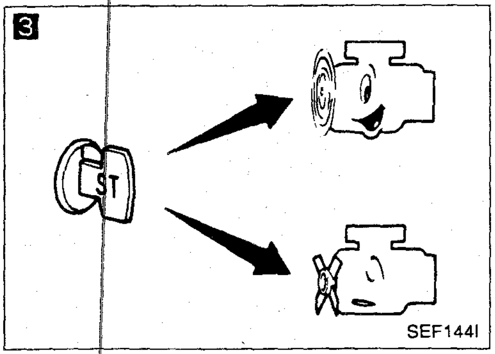
7. When measuring E.C.U. controlled components supply voltage with a circuit tester, separate one tester probe from the other.

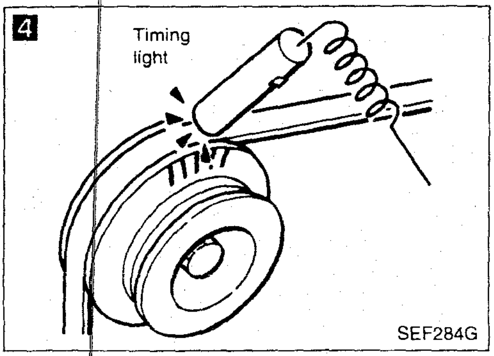
   If the two tester probes accidentally make contact with each other during measurement, the circuit will be shorted, resulting in damage to the control unit power transistor.











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-46.)

↓

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-28.)

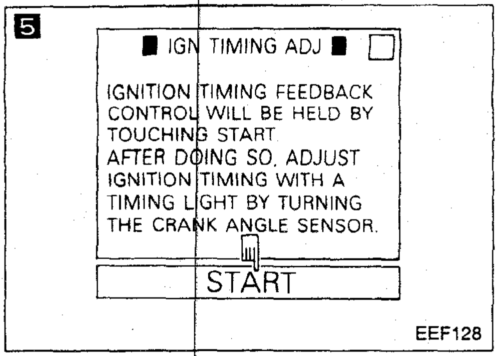
Ignition timing:
10° ± 2° B.T.D.C.

N.G. → Adjust ignition timing by turning crank angle sensor.

O.K. ↓

(Go to Ⓐ on next page.)

Basic Inspection (Cont'd)

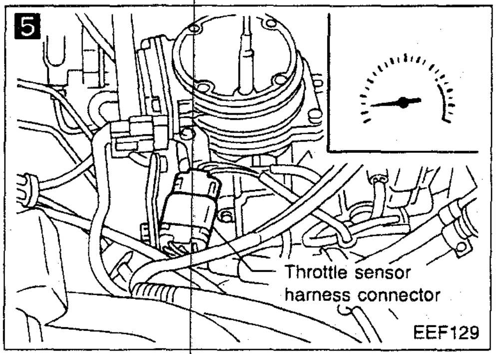


■ IGN TIMING ADJ ■ □

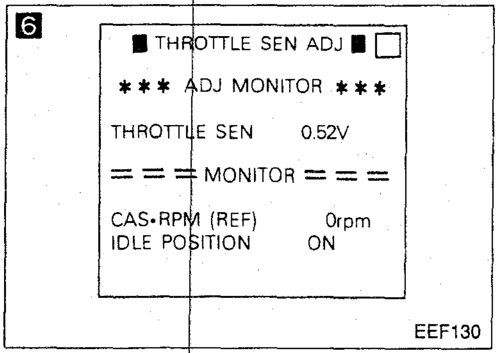
IGNITION TIMING FEEDBACK CONTROL WILL BE HELD BY TOUCHING START
AFTER DOING SO, ADJUST IGNITION TIMING WITH A TIMING LIGHT BY TURNING THE CRANK ANGLE SENSOR.

START

EEF128



EEF129



■ THROTTLE SEN ADJ ■ □

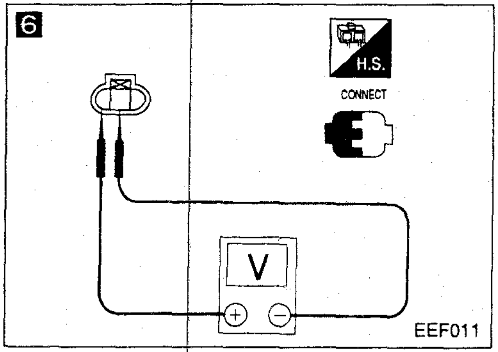
*** ADJ MONITOR ***

THROTTLE SEN 0.52V

=== MONITOR ===

CAS•RPM (REF) 0rpm
IDLE POSITION ON

EEF130



EEF011

Ⓐ

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 750 ± 50 rpm (in "N" position)?

OR

When disconnecting throttle sensor harness connector, does engine rpm fall to 750 ± 50 rpm (in "N" position)?

No → Adjust engine rpm by turning idle adjusting screw.

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 0.35 to 0.65V. (Throttle valve fully closes.) and "IDLE POSITION" stays "ON".

OR

Measure output voltage of throttle sensor using voltmeter, and check that it is 0.35 to 0.65V. (Throttle valve fully closed.)

N.G. →

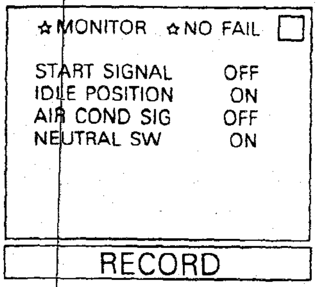
1. Adjust output voltage by rotating throttle sensor body.
2. Disconnect throttle sensor harness connector for a few seconds and then reconnect it.
3. Confirm that "IDLE POSITION" stays "ON".

O.K.

(Go to Ⓑ on next page.)

Basic Inspection (Cont'd)

7



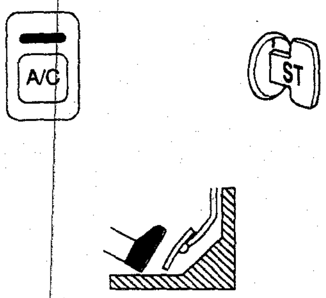
☆MONITOR ☆NO FAIL ☐

START SIGNAL OFF
IDLE POSITION ON
AIR COND SIG OFF
NEUTRAL SW ON

RECORD

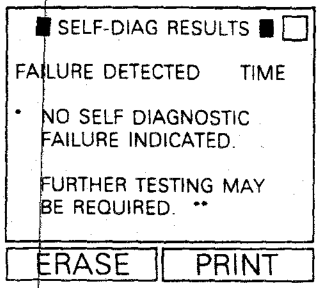
EEF131

7



EEF012

8



SELF-DIAG RESULTS ☐

FAILURE DETECTED TIME

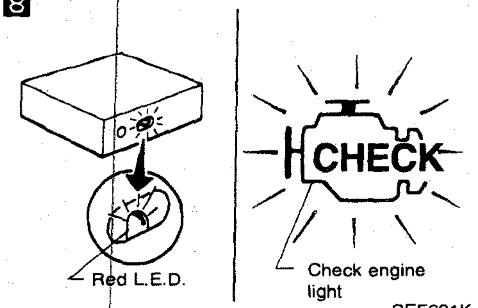
- NO SELF DIAGNOSTIC FAILURE INDICATED.

FURTHER TESTING MAY BE REQUIRED. **

ERASE PRINT

EEF132

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.

OR

Remove E.C.U. from front floor 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 → 8 - 12V
A/C signal	A/C OFF → A/C ON (Engine running)	Battery voltage → 0
Neutral (Parking switch)	Shift lever is Neutral position → Except Neutral position	0 → 6.7V

N.G. → Repair or replace the malfunctioning switch or its circuit.

O.K.

8

READ SELF-DIAGNOSTIC RESULTS.

1. Perform "SELF-DIAG RESULTS" mode.
2. Read out self-diagnostic results.
3. Is a failure detected?

OR

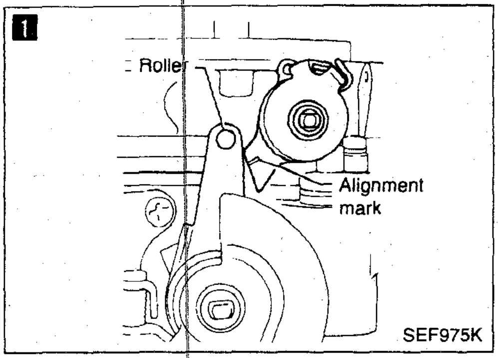
1. Set "Self-diagnostic results mode" in Mode II. (Refer to page EF & EC-45.)
2. Count the number of RED L.E.D. or check engine light flashes and read out the codes.
3. Are the codes shown?

Yes → Go to the relevant inspection procedure.

No

INSPECTION END

Diagnostic Procedure 1 — High Idling after Warm-up

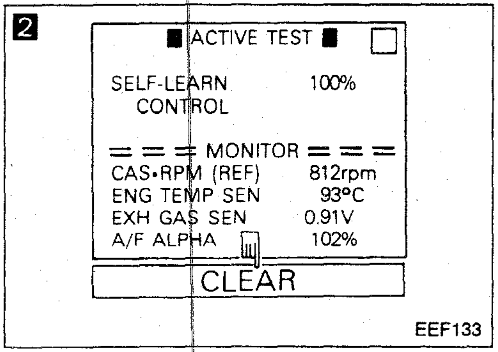


1

CHECK FAST IDLE CAM.
Does fast idle cam keep cam follower lever released?

Yes → Check fast idle cam adjustment. (See page EF & EC-167.)

No ↓

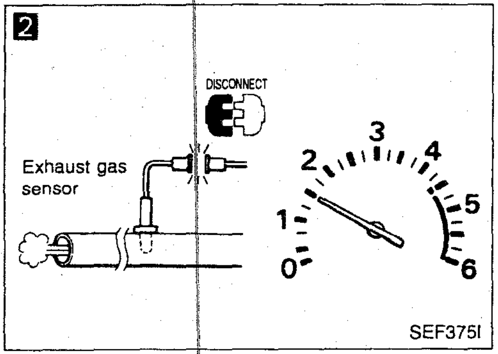


■ ACTIVE TEST ■ ☐

SELF-LEARN CONTROL 100%

=== MONITOR ===
CAS•RPM (REF) 812rpm
ENG TEMP SEN 93°C
EXH GAS SEN 0.91V
A/F ALPHA 102%

CLEAR



2

CHECK INTAKE AIR LEAK.

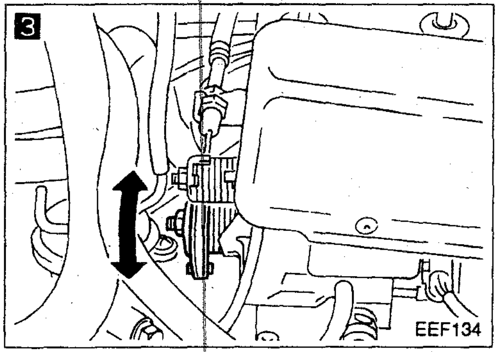
1. Select "SELF-LEARNING CONT" in "ACTIVE TEST" mode.
2. Clear the self-learning control coefficient by touching "CLEAR".
3. Does the engine speed drop?

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?

Yes → Discover air leak location and repair.

No ↓



3

CHECK THROTTLE LINKAGE.

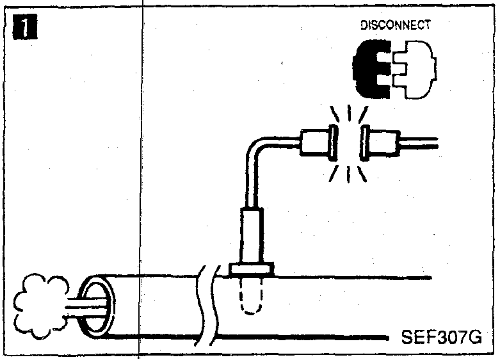
1. Check that throttle linkage moves smoothly.
2. Confirm that throttle valve both fully opens and fully closes.

N.G. → Repair throttle linkage or sticking of throttle valve.

O.K. ↓

INSPECTION END

Diagnostic Procedure 2 — Hunting



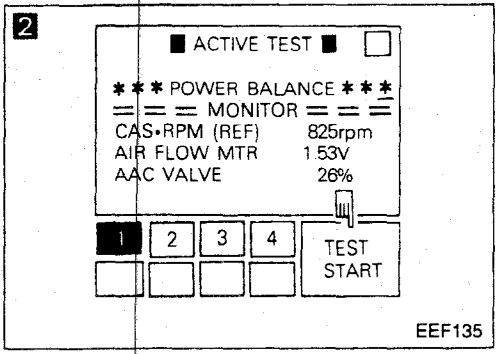
SEF307G

1

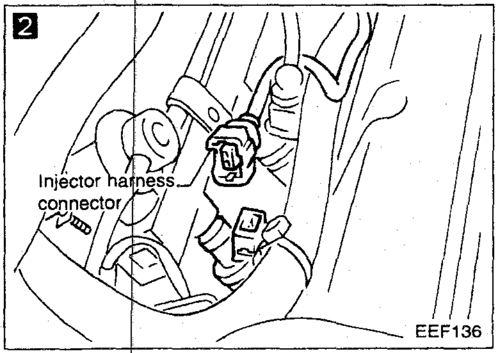
CHECK EXHAUST GAS SENSOR.
When disconnecting exhaust gas sensor harness connector, is the hunting fixed?

Yes → Check exhaust gas sensor. (See page EF & EC-124.)

No ↓



EEF135



EEF136

2

PERFORM POWER BALANCE TEST.

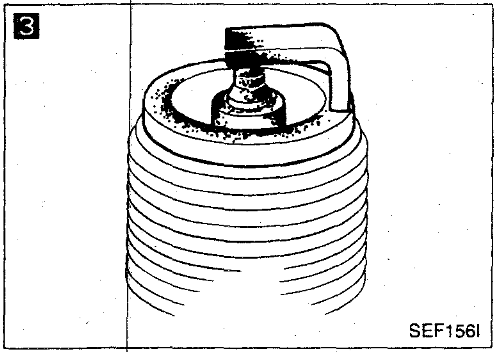
1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

— 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 ↓



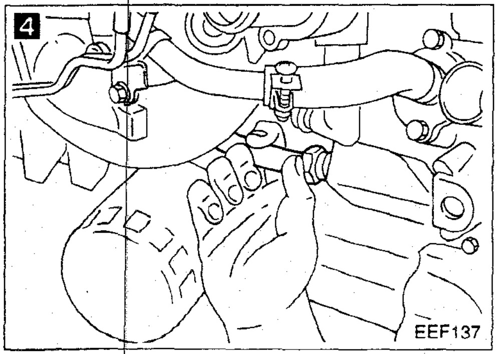
SEF156I

3

CHECK SPARK PLUGS.
Remove the spark plugs and check for fouling, etc.

N.G. → Repair or replace spark plug(s).

O.K. ↓



EEF137

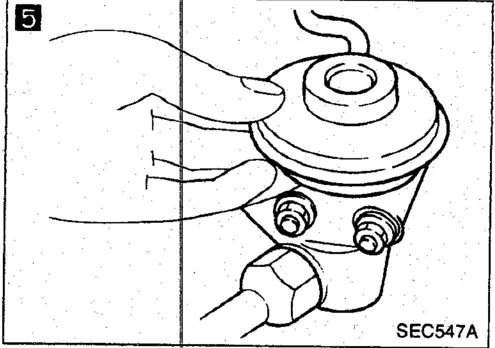
4

CHECK FOR INTAKE AIR LEAK.
When pinching cylinder block to intake manifold hose, does the engine speed rise?

Yes → Discover air leak location and repair.

No ↓

(Go to Ⓐ on next page.)



Ⓐ

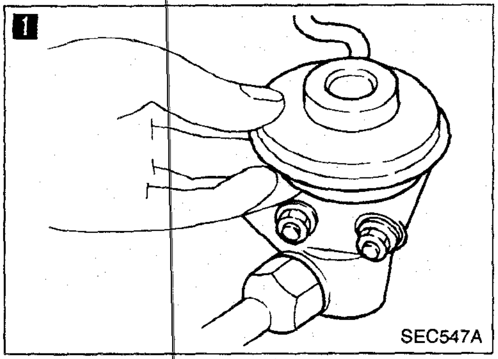
5

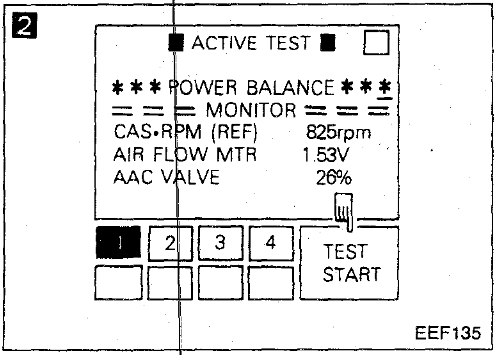
CHECK E.G.R. CONTROL VALVE.
Check E.G.R. control valve for sticking.

N.G. → Repair or replace.

O.K. ↓

INSPECTION END

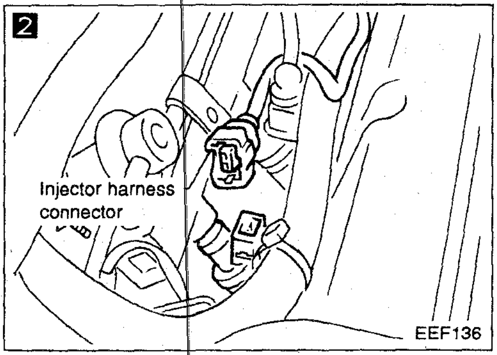


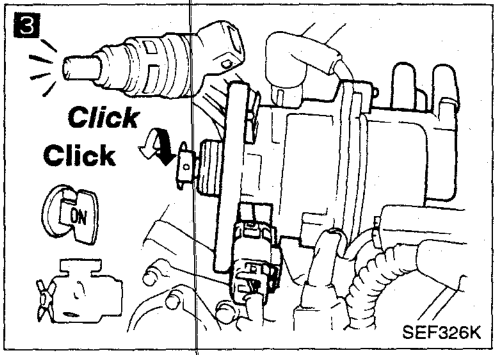


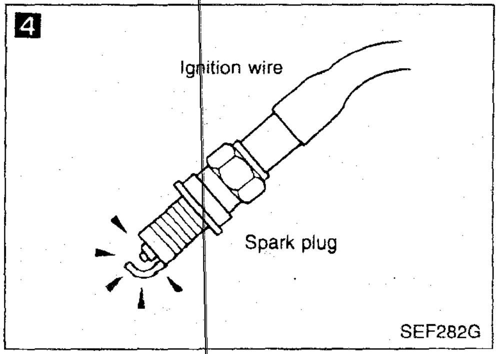
■ ACTIVE TEST ■ ☐

*** POWER BALANCE ***
=== MONITOR ===
CAS•RPM (REF) 825rpm
AIR FLOW MTR 1.53V
AAC VALVE 26%

1 2 3 4 TEST START







Diagnostic Procedure 3 — Unstable Idle

1

CHECK E.G.R. CONTROL VALVE.
Check E.G.R. control valve for sticking.

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?

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 ↓

3

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 ↓

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.

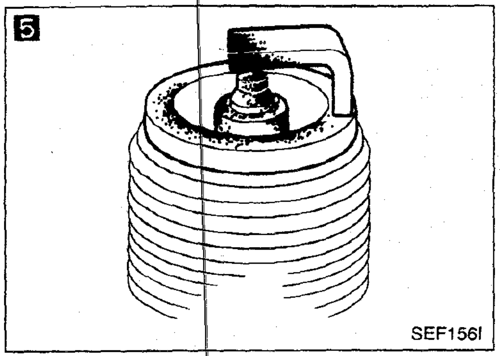
N.G. → Check ignition coil, power transistor and their circuits. (See page EF & EC-111.)

O.K. ↓

(Go to Ⓐ on next page.)

Diagnostic Procedure 3 — Unstable Idle (Cont'd)

Ⓐ

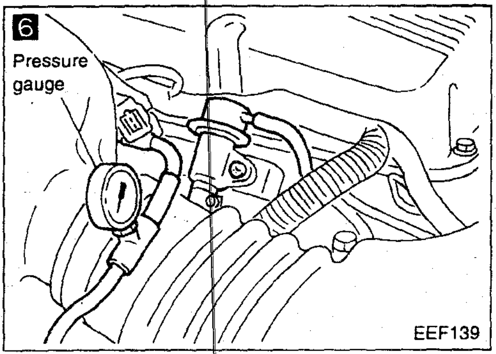


5

CHECK SPARK PLUGS.
Remove the spark plugs and check for fouling, etc.

N.G. → Repair or replace spark plug(s).

O.K.



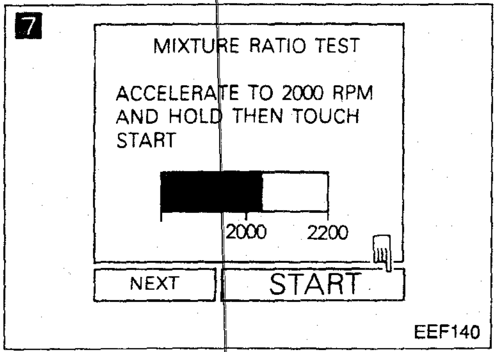
6

CHECK FUEL PRESSURE.

1. Release fuel pressure to zero. (Refer to page EF & EC-166.)
2. Install fuel pressure gauge and check fuel pressure.
   At idle:
   Approx. 226 kPa
   (2.26 bar, 2.3 kg/cm², 33 psi)

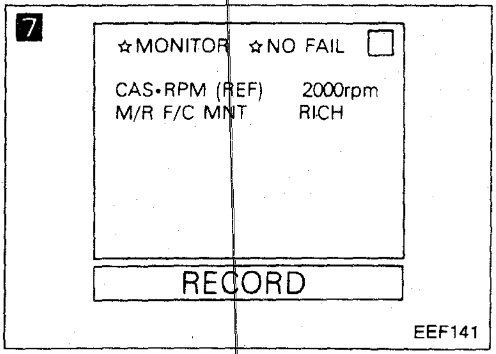
N.G. → Check fuel pump and circuit.

O.K.



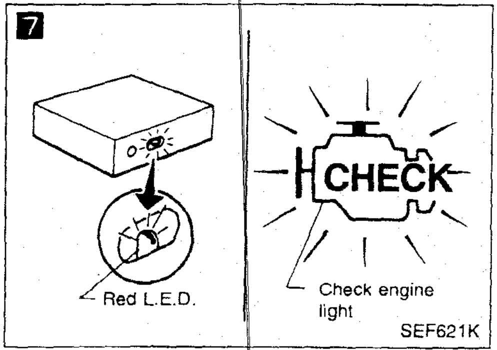
MIXTURE RATIO TEST

ACCELERATE TO 2000 RPM AND HOLD THEN TOUCH START



☆MONITOR ☆NO FAIL ☐

CAS•RPM (REF) 2000rpm
M/R F/C MNT RICH



7

CHECK EXHAUST GAS SENSOR.

1. Start engine and warm it up sufficiently.
2. Perform "MIXTURE RATIO TEST" in "FUNCTION TEST" mode.

OR

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.......

OR

1. Set "Exhaust gas sensor monitor" in the self-diagnostic Mode II. (See page EF & EC-45.)
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.

N.G. → Replace exhaust gas sensor.

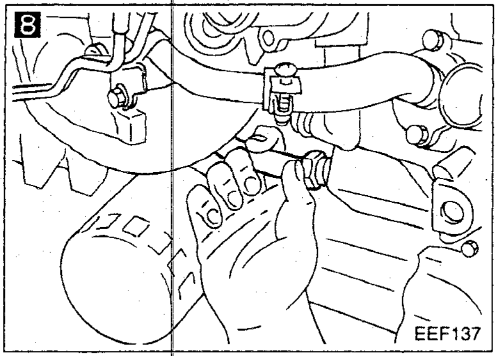
O.K.

(Go to Ⓑ on next page.)

Diagnostic Procedure 3 — Unstable Idle (Cont'd)

Ⓑ

8

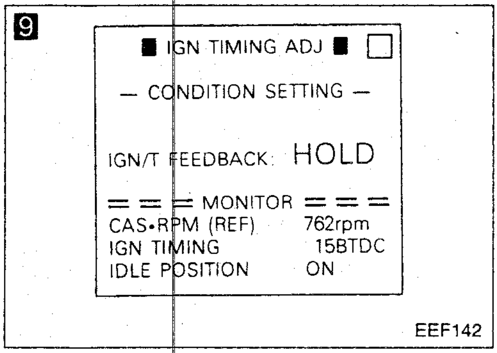


CHECK FOR INTAKE AIR LEAK.
When pinching cylinder block to intake manifold hose does the engine speed rise?

Yes → Discover air leak location and repair.

No ↓

9



■ IGN TIMING ADJ ■ ☐

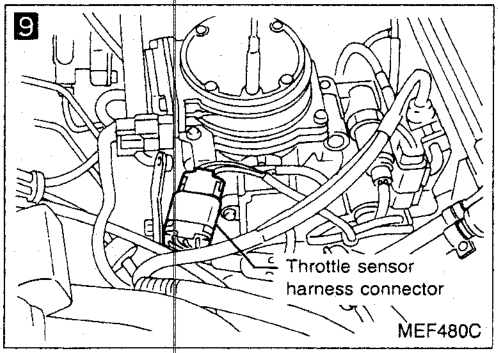
— CONDITION SETTING —

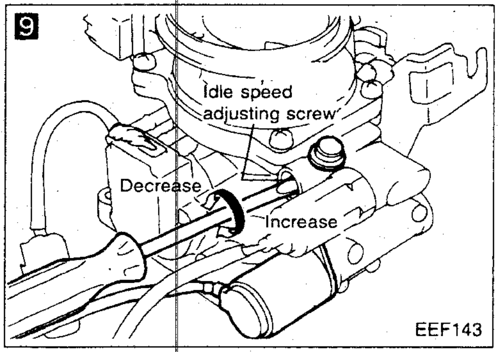
IGN/T FEEDBACK: HOLD

=== MONITOR ===

CAS•RPM (REF)	762rpm
IGN TIMING	15BTDC
IDLE POSITION	ON

EEF142





CHECK IDLE ADJ. SCREW CLOGGING.

1. Perform "IGN TIMING ADJ" in "WORK SUPPORT" mode.
2. Can you set engine rpm at 750±25 rpm (in "N" position) by turning idle adjusting screw?

— OR —

1. Disconnect throttle sensor harness connector.
2. Can you set engine rpm at 750±25 rpm (in "N" position) by turning idle speed adjusting screw?

No → Check for IAS clogging or throttle valve clogging.

Yes ↓

10

10

COMPRESSION PRESSURE

EEF144

CHECK COMPRESSION PRESSURE.

- Check compression pressure.

Standard:
kPa (bar, kg/cm^2, psi)/300 rpm
1,196 (11.96, 12.2, 173)
Minimum:
kPa (bar, kg/cm^2, psi)/300 rpm
883 (8.83, 9.0, 128)
Difference between each cylinder:
kPa (bar, kg/cm^2, psi)/300 rpm
98 (0.98, 1.0, 14)

N.G. → Check pistons, piston rings, valves, valve seats and cylinder head gaskets.

O.K. ↓

11

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. ↓

12

TRY A KNOWN GOOD E.C.U.★

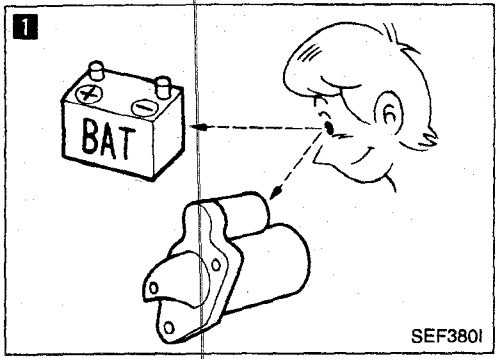
Trouble is fixed. → Replace E.C.U.

Trouble is not fixed. ↓

INSPECTION END

★: E.C.U. may be the cause of a problem, but this is rarely the case.

Diagnostic Procedure 4 — Hard to Start or Impossible to Start when the Engine is Cold

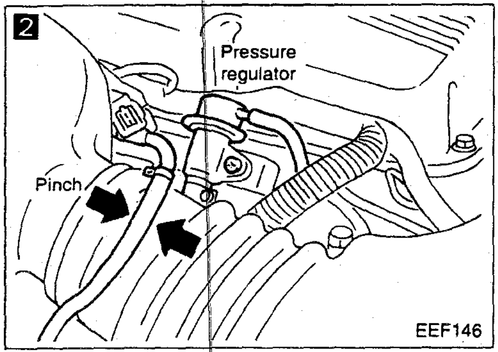


1

CHECK BATTERY AND STARTER.
Check battery and starter condition.
(Refer to EL section.)

N.G. → Repair or replace.

O.K. ↓

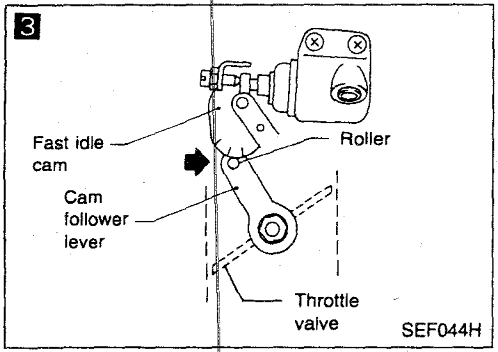


2

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-135.)

Yes ↓

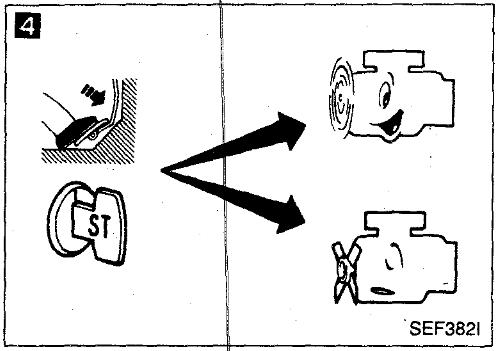


3

CHECK FAST IDLE CAM.
When the engine is cold, does fast idle cam keep cam follower lever in position?

No → Check fast idle cam adjustment. (See page EF & EC-167.)

Yes ↓



4

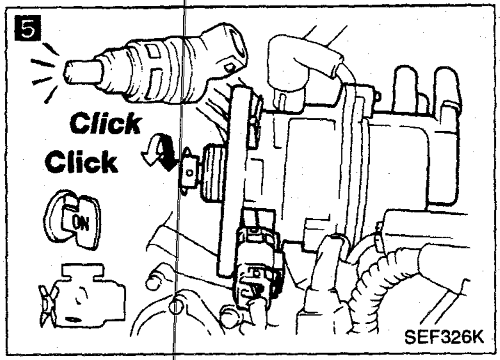
CHECK A.A.C. VALVE.
When pressing accelerator pedal fully, you can start the engine.

Yes → Check A.A.C. valve and circuit. (See page EF & EC-141.)

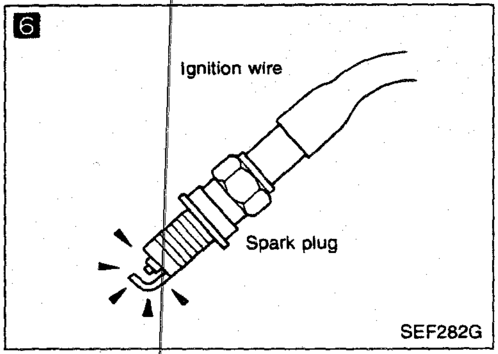
No ↓

(Go to Ⓐ on next page.)

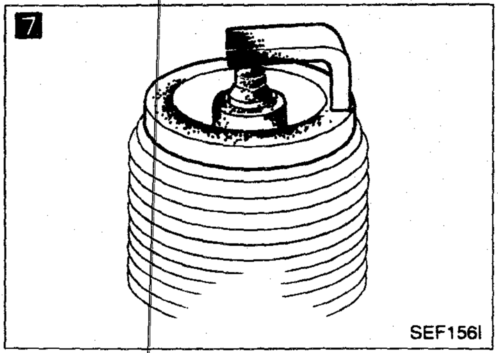
Diagnostic Procedure 4 — Hard to Start or Impossible to Start when the Engine is Cold (Cont'd)



SEF326K



SEF282G



SEF156I

Ⓐ

5

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 ↓

6

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-111.)

O.K. ↓

7

CHECK SPARK PLUGS.
Remove the spark plugs and check for fouling, etc.

N.G. → Repair or replace spark plug(s).

O.K. ↓

8

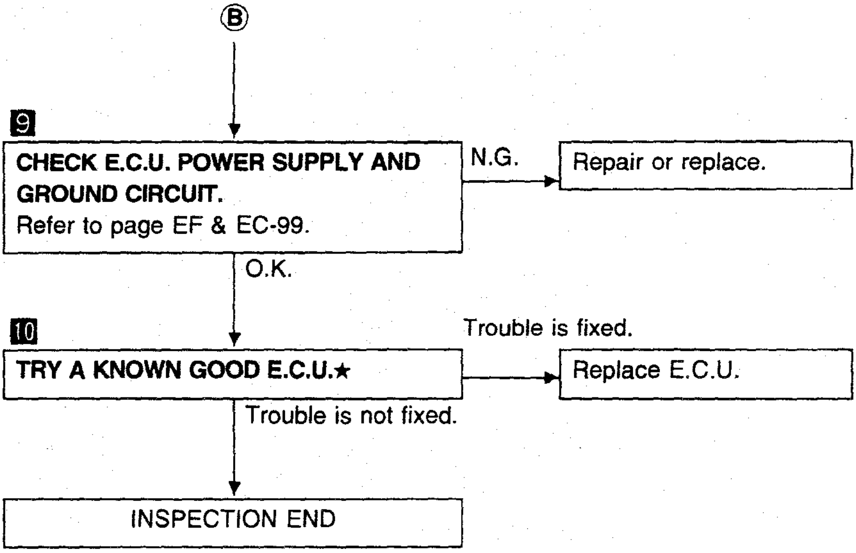
CHECK E.C.U. HARNESS CONNECTOR.
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.

N.G. → Repair or replace.

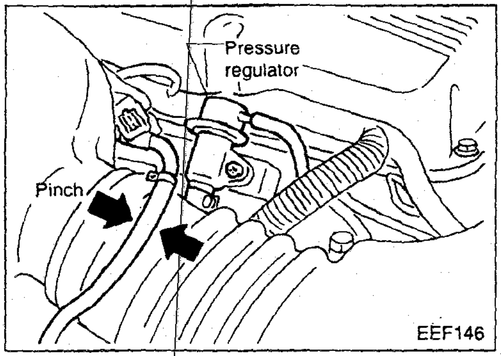
O.K. ↓

(Go to Ⓑ on next page.)

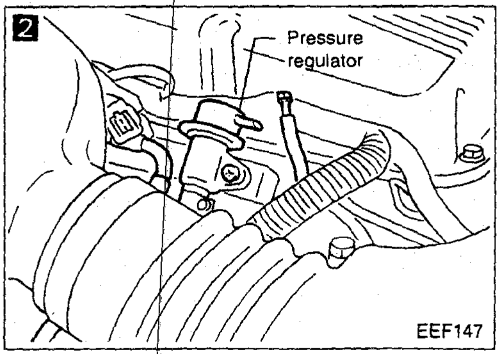
Diagnostic Procedure 4 — Hard to Start or Impossible to Start when the Engine is Cold (Cont'd)



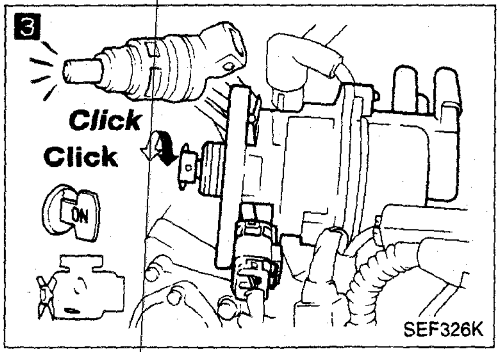
★: E.C.U. may be the cause of a problem, but this is rarely the case.



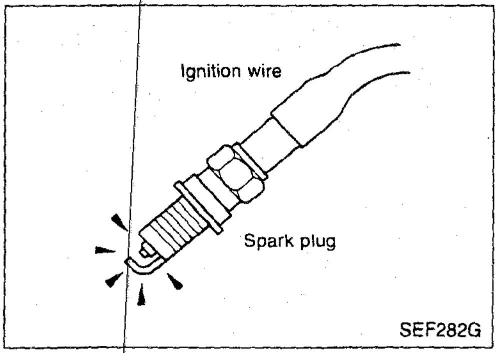
EEF146



EEF147



SEF326K



SEF282G

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-135.)

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.

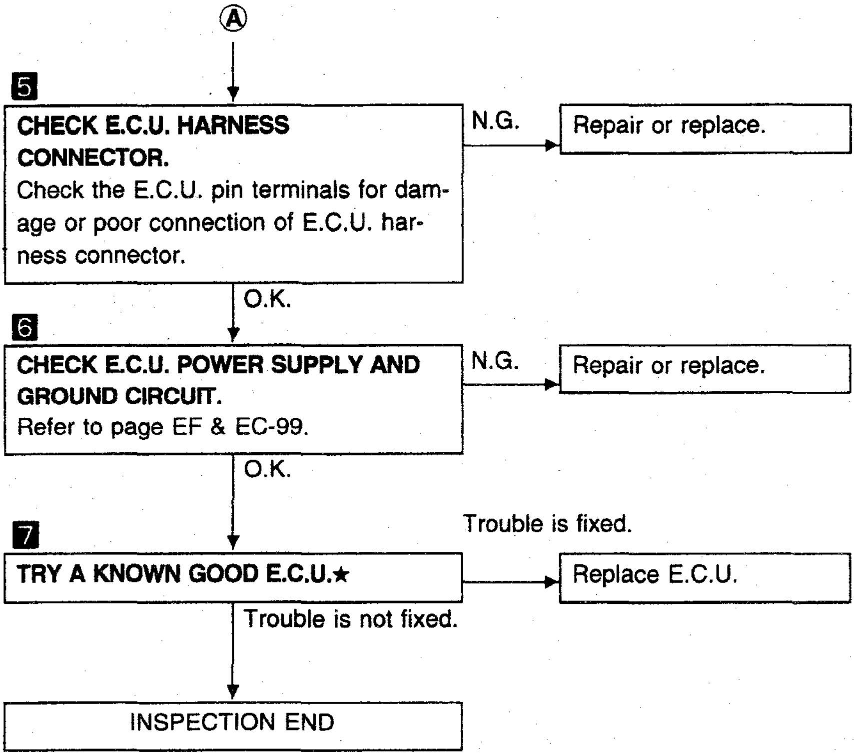
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

N.G. → Check ignition coil, power transistor and circuits. (See page EF & EC-111.)

O.K. ↓

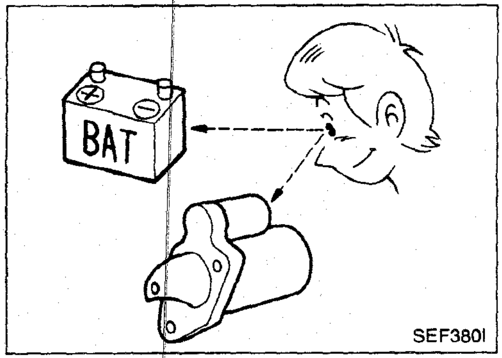
(Go to Ⓐ on next page.)

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.

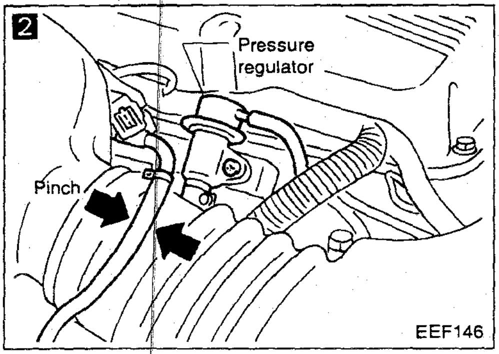
Diagnostic Procedure 6 — Hard to Start or Impossible to Start under Normal Conditions



SEF380I

CHECK BATTERY AND STARTER.
Check battery and starter operation.
(Refer to EL section.)

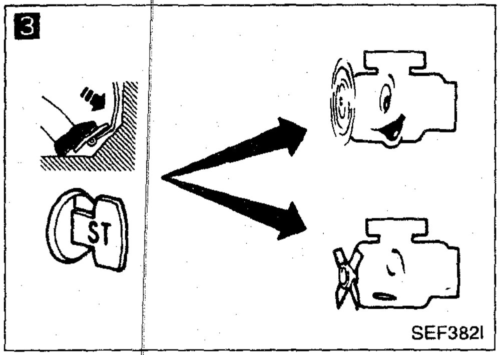
- N.G. → Repair or replace.
- O.K. ↓



EEF146

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?

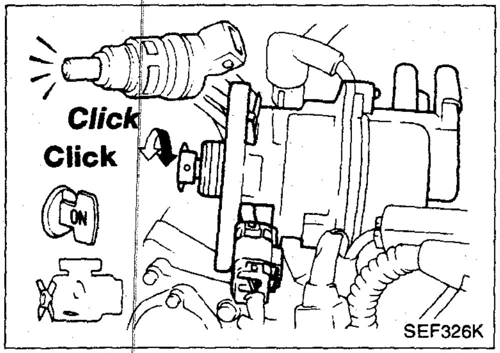
- No → Check fuel pump and circuit. (See page EF & EC-135.)
- Yes ↓



SEF382I

3 **CHECK INJECTOR FOR LEAKAGE.**
When pressing accelerator pedal fully, can you start the engine.

- Yes → Check injector(s) for leakage.
- No ↓



SEF326K

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?

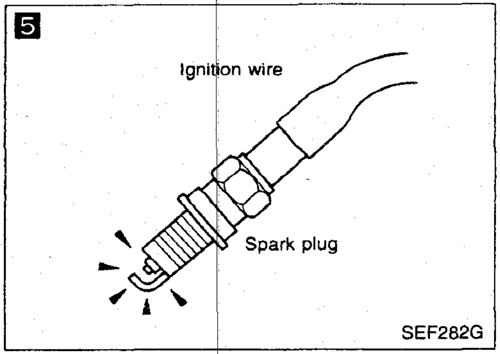
- No → Check injector(s) and circuit(s).
- Yes ↓

(Go to Ⓐ on next page.)

Diagnostic Procedure 6 — Hard to Start or Impossible to Start under Normal Conditions (Cont'd)

Ⓐ

5

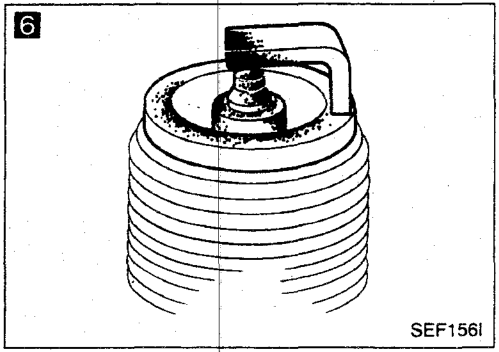


CHECK IGNITION SPARK.
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

N.G. → Check ignition coil, power transistor and circuits. (See page EF & EC-111.)

O.K. ↓

6

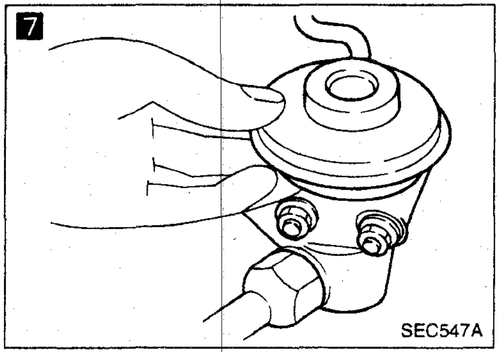


CHECK SPARK PLUGS.
Remove the spark plugs and check for fouling, etc.

N.G. → Repair or replace spark plug(s).

O.K. ↓

7



CHECK E.C.U. CONTROL VALVE.
Check the E.G.R. control valve for sticking.

N.G. → Repair or replace.

O.K. ↓

8

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. ↓

9

CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.
Refer to page EF & EC-99.

N.G. → Repair or replace.

O.K. ↓

10

TRY A KNOWN GOOD E.C.U.★

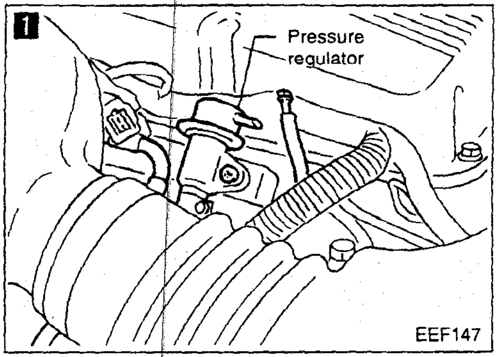
Trouble is fixed. → Replace E.C.U.

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

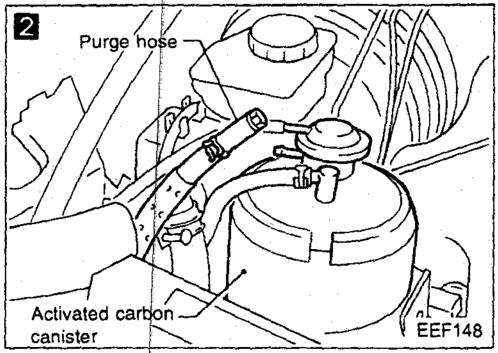


1

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 ↓

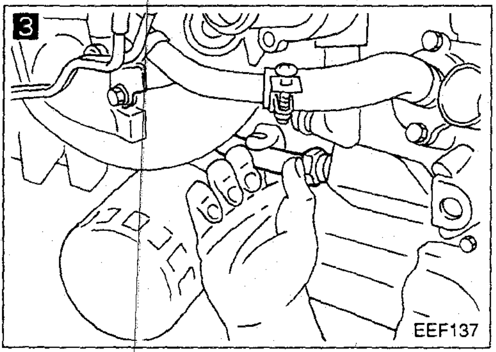


2

CHECK CANISTER PURGE.
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 ↓



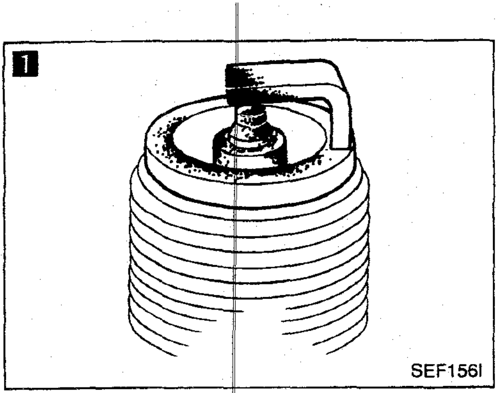
3

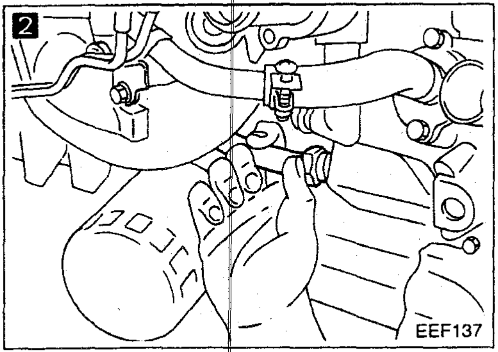
CHECK FOR INTAKE AIR LEAK.
When pinching cylinder block to intake manifold hose, does the engine speed rise?

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 cylinder block to intake manifold hose, 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.

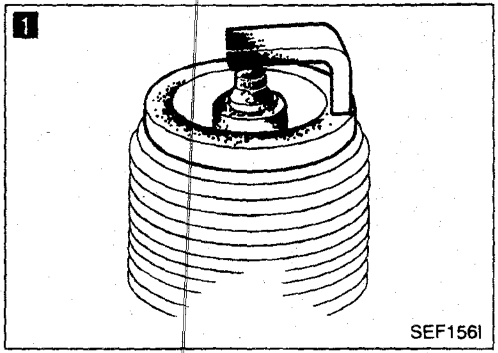
Trouble is not fixed.

4

CHECK FOR INTAKE VALVE DEPOSITS.
If there are deposits on intake valves, clean them.

INSPECTION END

Diagnostic Procedure 9 — Hesitation under Normal Conditions

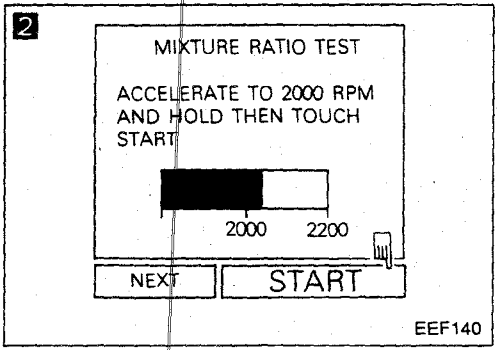


1

CHECK SPARK PLUGS.
Remove spark plugs and check for fouling, etc.

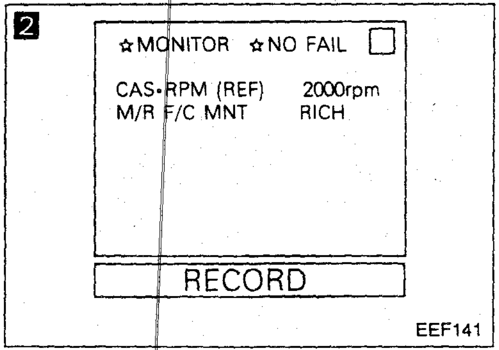
N.G. → Repair or replace spark plug(s).

O.K. ↓



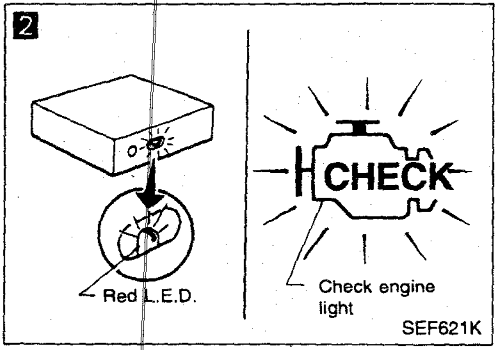
MIXTURE RATIO TEST

ACCELERATE TO 2000 RPM AND HOLD THEN TOUCH START



☆MONITOR ☆NO FAIL ☐

CAS·RPM (REF) 2000rpm
M/R F/C MNT RICH



2

CHECK EXHAUST GAS SENSOR.

1. Start engine and warm it up sufficiently.
2. Perform "MIXTURE RATIO TEST" in "FUNCTION TEST" mode.

OR

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.

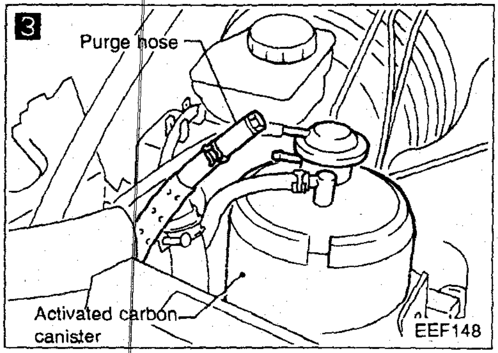
$$\underbrace{\textbf{RICH}\rightarrow\textbf{LEAN}\rightarrow}_{\textbf{1 time}}\underbrace{\textbf{RICH}\rightarrow\textbf{LEAN}\rightarrow\textbf{RICH}}_{\textbf{2 times}}\textbf{.......}$$

OR

1. Set "Exhaust gas sensor monitor" in the self-diagnostic Mode II. (See page EF & EC- 45.)
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.

N.G. → Replace exhaust gas sensor.

O.K. ↓



3

CHECK CANISTER PURGE.

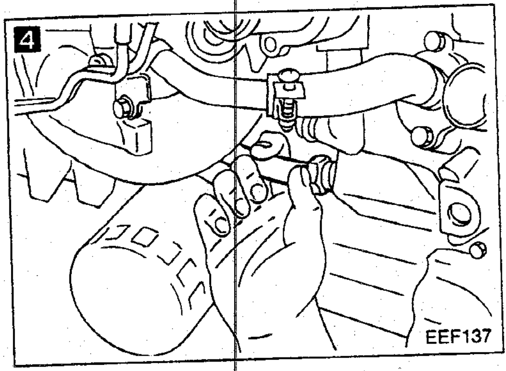
1. Disconnect canister purge line hose and plug hose.
2. Perform cruise test.
3. Does the hesitation disappear?

Yes → Check purge and vacuum line.

No ↓

(Go to Ⓐ on next page.)

Diagnostic Procedure 9 — Hesitation under Normal Conditions (Cont'd)



Ⓐ

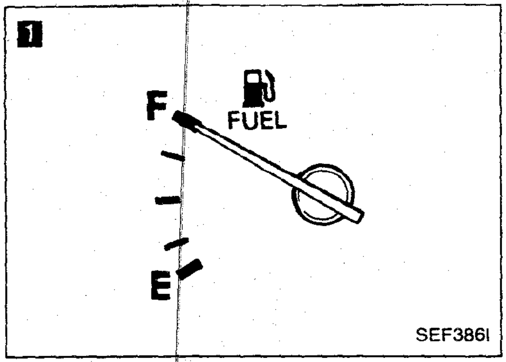
4

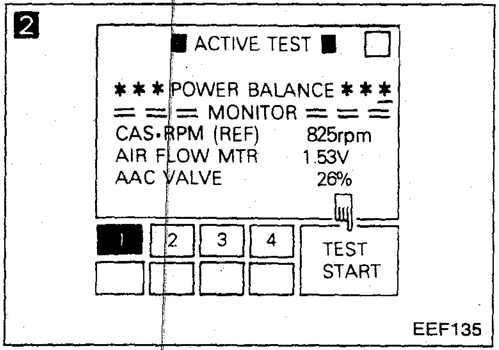
CHECK FOR INTAKE AIR LEAK.
When pinching cylinder block to intake manifold hose, does the engine speed rise?

Yes → Discover air leak location and repair.

No ↓

INSPECTION END

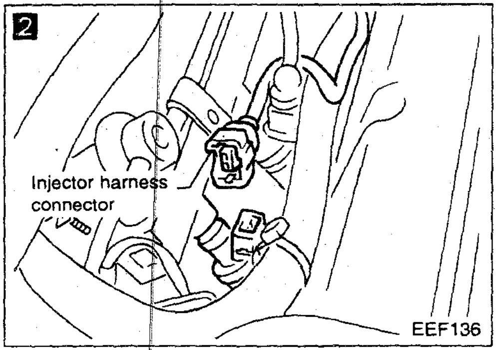


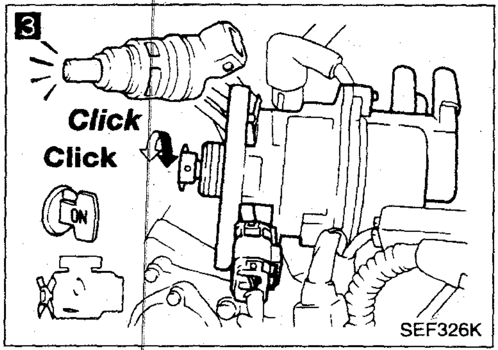


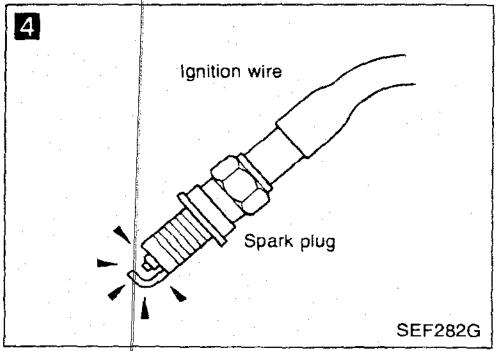
■ ACTIVE TEST ■ ☐

✱✱✱ POWER BALANCE ✱✱✱
═══ MONITOR ═══
CAS·RPM (REF) 825rpm
AIR FLOW MTR 1.53V
AAC VALVE 26%

1 2 3 4 TEST START







Diagnostic Procedure 10 — Engine Stalls when Turning

1

CHECK FUEL LEVEL.
Check to see that there is enough fuel in tank.

N.G. → Fill fuel tank with fuel.

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?

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 circuit(s).

Yes ↓

4

CHECK IGNITION SPARK.

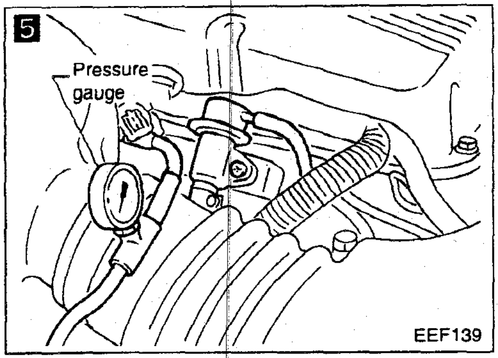
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

N.G. → Check ignition coil, power transistor and circuits. (See page EF & EC-111.)

O.K. ↓

(Go to Ⓐ on next page.)

Diagnostic Procedure 10 — Engine Stalls when Turning (Cont'd)



Ⓐ

5

CHECK FUEL PRESSURE.

1. Release fuel pressure to zero. (Refer to page EF & EC-166.)
2. Install fuel pressure gauge and check fuel pressure.

   At idle:

   Approx. 226 kPa
   (2.26 bar, 2.3 kg/cm^2, 33 psi)

   A few seconds after ignition switch is turned 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-99.

N.G. → Repair or replace.

O.K.

8

TRY A KNOWN GOOD E.C.U.★

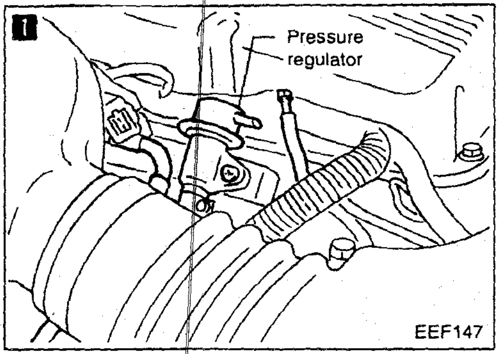
Trouble is fixed. → Replace E.C.U.

Trouble is not fixed.

INSPECTION END

★: E.C.U. may be the cause of a problem, but this is rarely the case.

Diagnostic Procedure 11 — Engine Stalls when the Engine is Hot

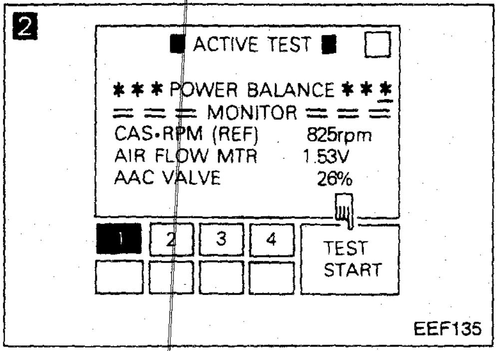


1

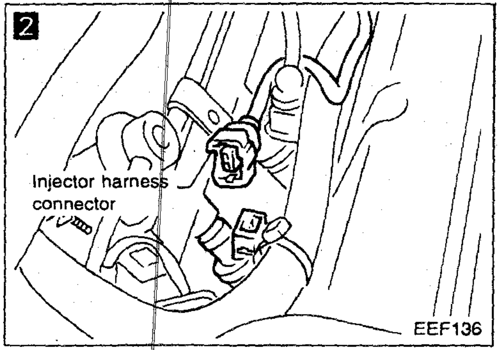
CHECK FUEL VAPOR.
1. Disconnect fuel pressure regulator vacuum hose and plug hose.
2. Perform cruise test.
3. Does the engine stall disappear?

Yes → Check fuel properties.

No ↓



*** POWER BALANCE ***
=== MONITOR ===
CAS•RPM (REF) 825rpm
AIR FLOW MTR 1.53V
AAC VALVE 26%



2

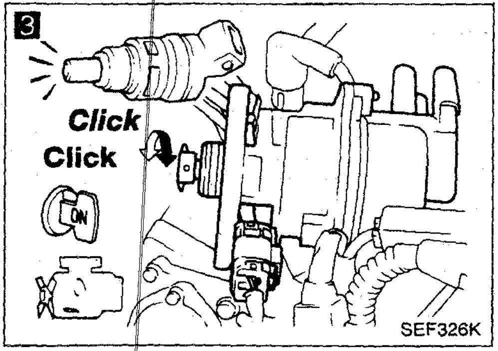
PERFORM POWER BALANCE TEST.
1. Perform "POWER BALANCE" in "ACTIVE TEST" mode.
2. Is there any cylinder which does not produce a momentary engine speed drop?

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?

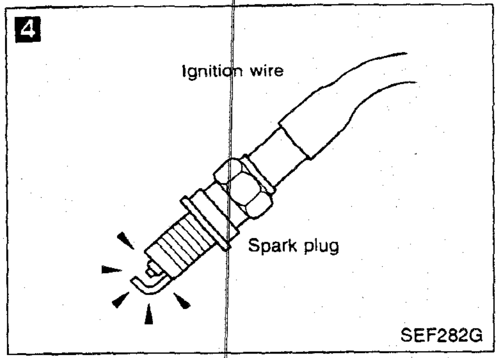
No → Check injector(s) and circuit(s).

Yes ↓

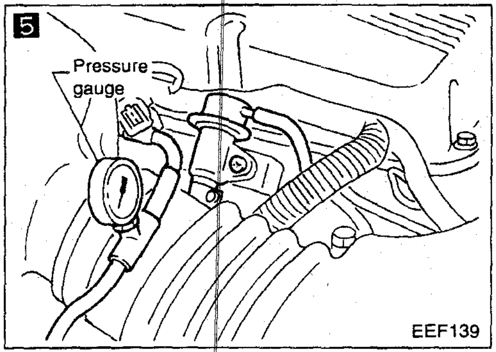
(Go to Ⓐ on next page.)

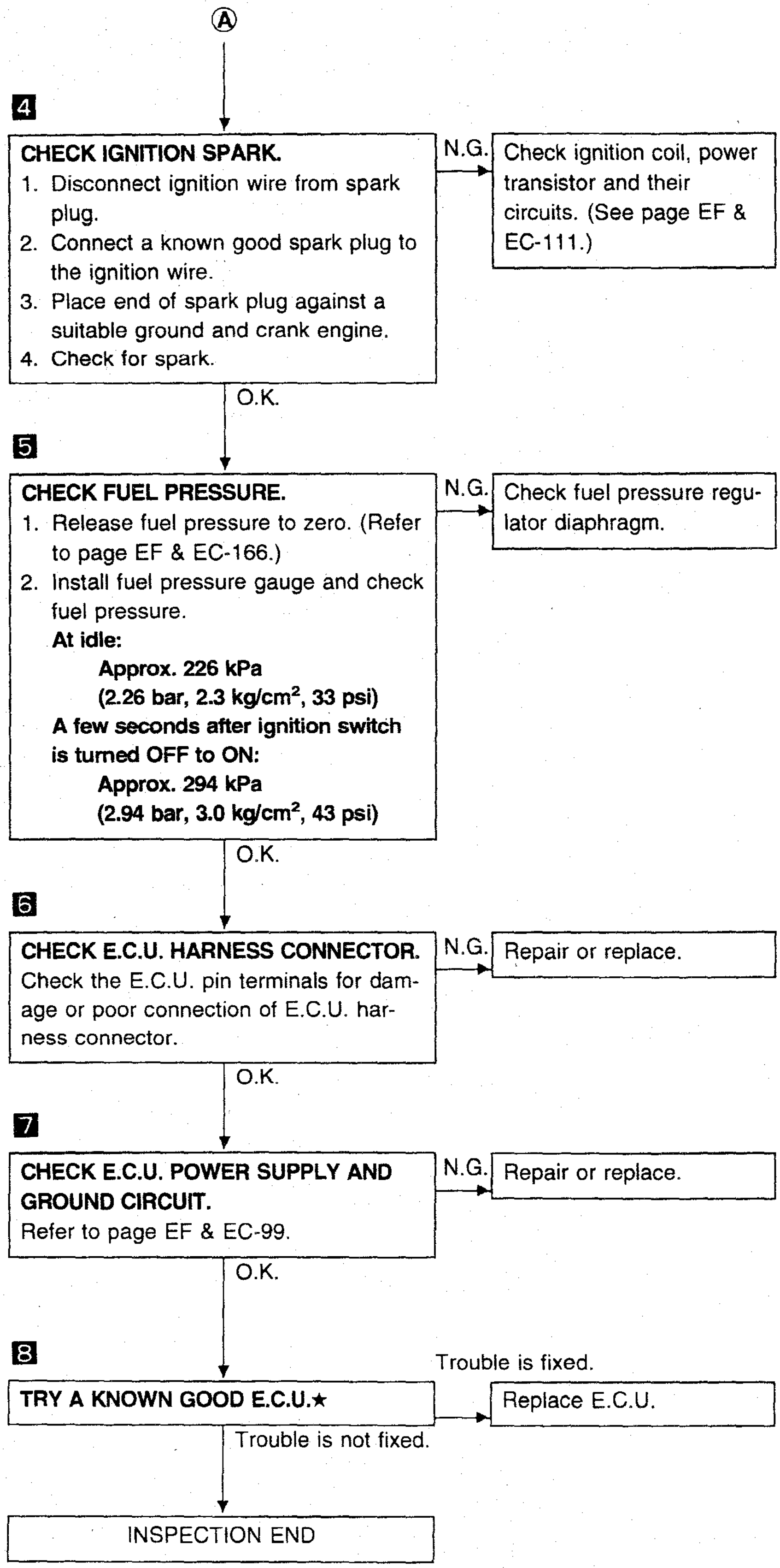
Diagnostic Procedure 11 — Engine Stalls when the Engine is Hot (Cont'd)

4



5





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-111.)

O.K. ↓

5

CHECK FUEL PRESSURE.
1. Release fuel pressure to zero. (Refer to page EF & EC-166.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:

Approx. 226 kPa
(2.26 bar, 2.3 kg/cm^2, 33 psi)

A few seconds after ignition switch is turned 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-99.

N.G. → Repair or replace.

O.K. ↓

8

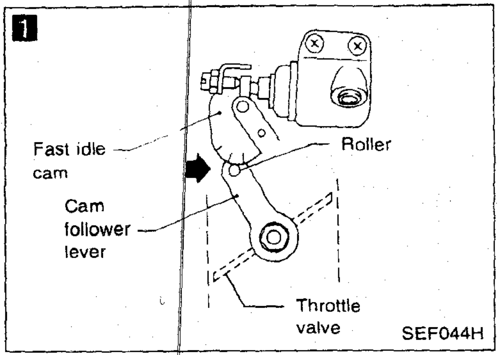
TRY A KNOWN GOOD E.C.U.★

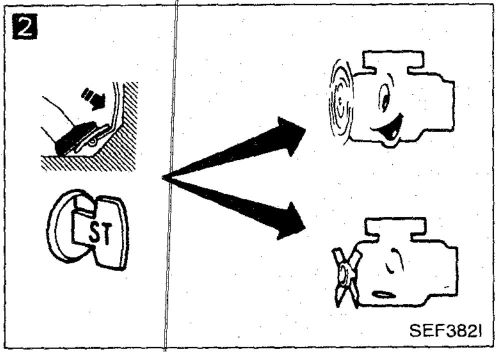
Trouble is fixed. → Replace E.C.U.

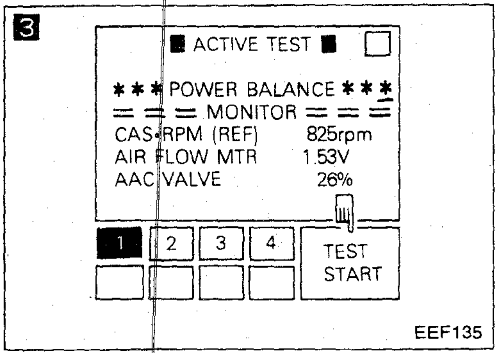
Trouble is not fixed. ↓

INSPECTION END

★: E.C.U. may be the cause of a problem, but this is rarely the case.

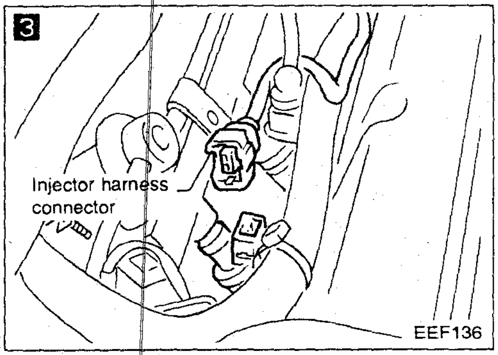


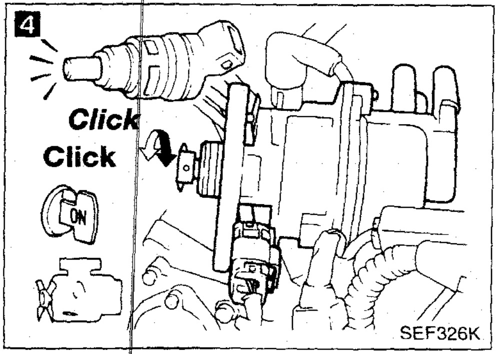




■ ACTIVE TEST ■

*** POWER BALANCE ***
=== MONITOR ===
CAS·RPM (REF) 825rpm
AIR FLOW MTR 1.53V
AAC VALVE 26%





Diagnostic Procedure 12 — Engine Stalls when the Engine is Cold

1

CHECK FAST IDLE CAM.
When the engine is cold, does fast idle cam keep follower lever in position?

No → Check fast idle cam adjustment. (See page EF & EC-167).

Yes

2

CHECK 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 and circuit. (See pages EF & EC-141.)

O.K.

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?

OR

When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

N.G. → Go to 6.

O.K.

4

CHECK INJECTOR.

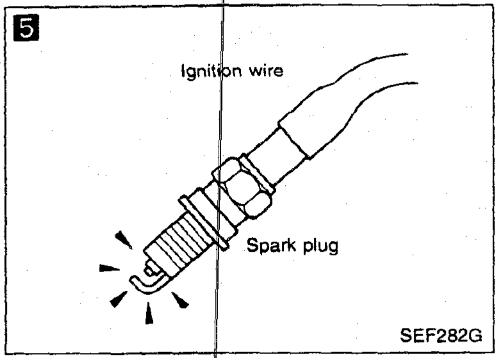
1. Remove distributor from engine. (Crank angle sensor harness connector should remain connected.)
2. Disconnect ignition wires.
3. Turn ignition switch ON. (Do not start engine.)
4. When rotating distributor shaft slowly by hand, does each injector make an operating sound?

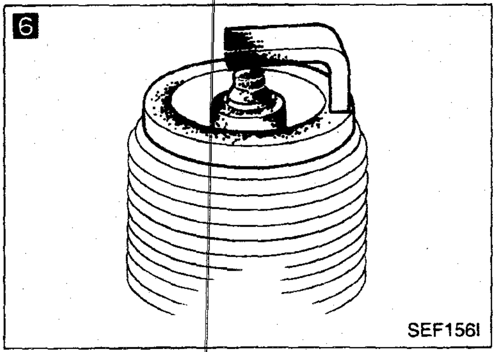
N.G. → Check injector(s) and circuit(s).

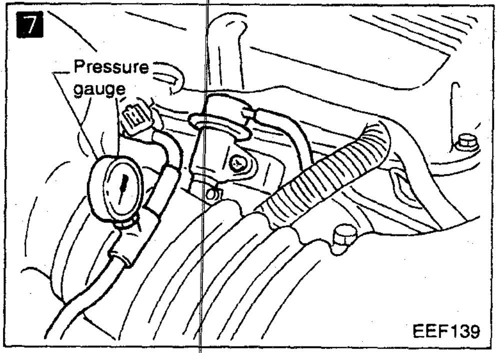
O.K.

(Go to Ⓐ on next page.)

Diagnostic Procedure 12 — Engine Stalls when the Engine is Cold (Cont'd)







Ⓐ

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-111.)

O.K.

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 FUEL PRESSURE.
1. Release fuel pressure to zero. (Refer to page EF & EC-166.)
2. Install fuel pressure gauge and check fuel pressure.
   At idle:
   Approx. 226 kPa
   (2.26 bar, 2.3 kg/cm^2, 33 psi)
   A few seconds after ignition switch is turned 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.

8

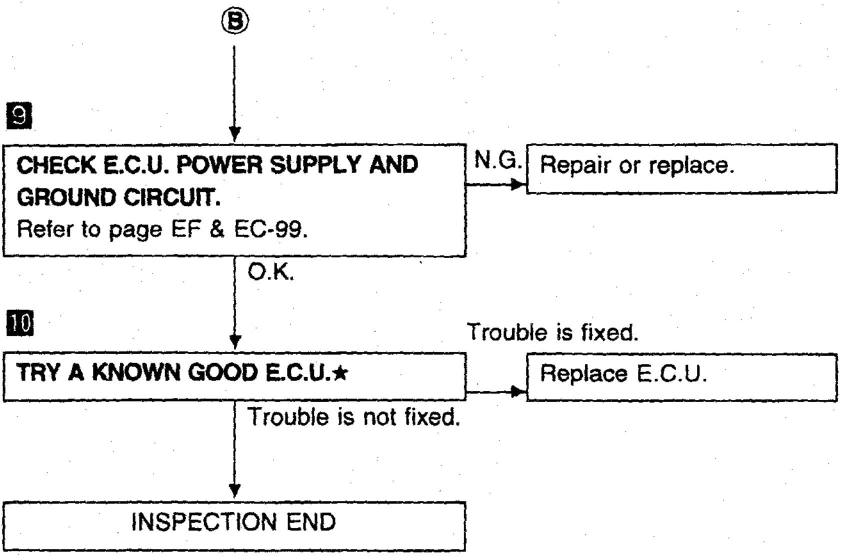
CHECK E.C.U. HARNESS CONNECTOR.
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.

N.G. → Repair or replace.

O.K.

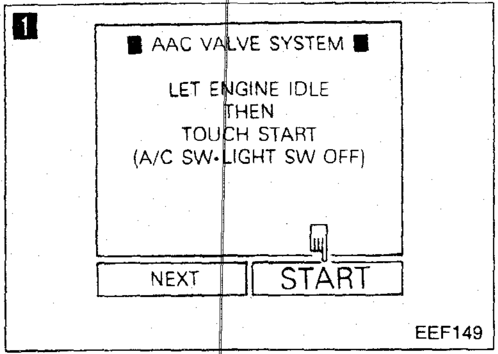
(Go to Ⓑ on next page.)

Diagnostic Procedure 12 — Engine Stalls when the Engine is Cold (Cont'd)



★: E.C.U. may be the cause of a problem, but this is rarely the case.

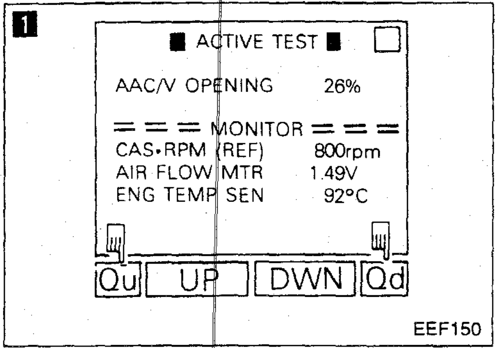
1


■ AAC VALVE SYSTEM ■

LET ENGINE IDLE
THEN
TOUCH START
(A/C SW•LIGHT SW OFF)

EEF149

1

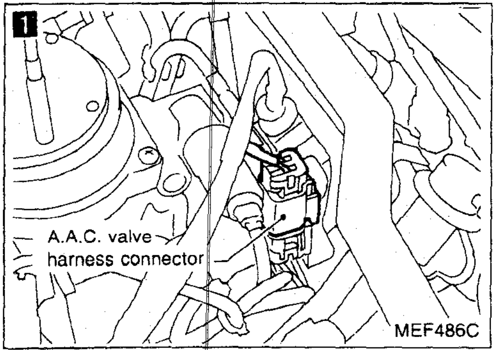

■ ACTIVE TEST ■ ☐

AAC/V OPENING 26%

= = = MONITOR = = =
CAS•RPM (REF) 800rpm
AIR FLOW MTR 1.49V
ENG TEMP SEN 92°C

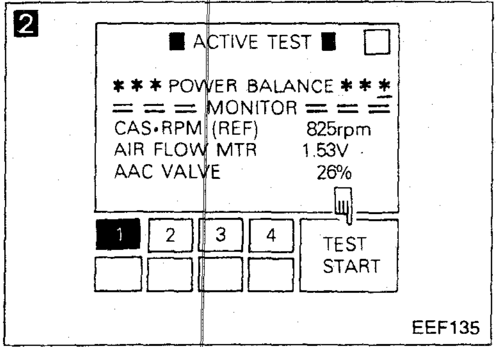
EEF150

1



MEF486C

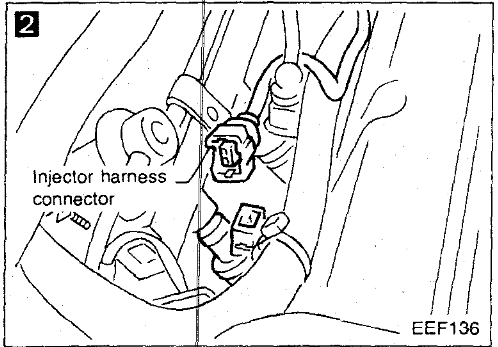
2


■ ACTIVE TEST ■ ☐

* * * POWER BALANCE * * *
= = = MONITOR = = =
CAS•RPM (REF) 825rpm
AIR FLOW MTR 1.53V
AAC VALVE 26%

EEF135

2



EEF136

Diagnostic Procedure 13 — Engine Stalls when Stepping on the Accelerator Momentarily

1

CHECK A.A.C. VALVE.

1. Start engine and warm it up sufficiently.
2. Perform "AAC VALVE SYSTEM" in "FUNCTION TEST" mode.

OR

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-141.)

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

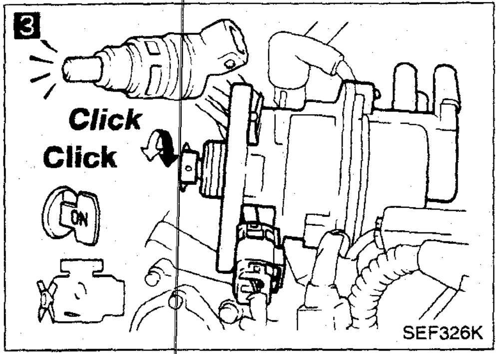
When disconnecting each injector harness connector one at a time, is there any cylinder which does not produce a momentary engine speed drop?

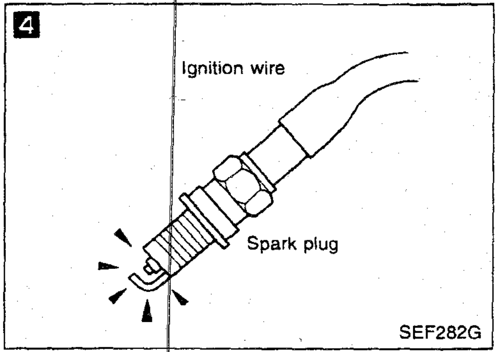
No → Go to **5**

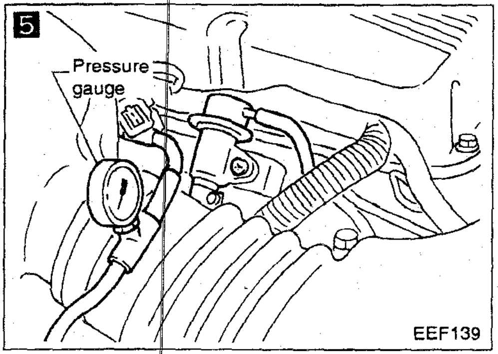
Yes ↓

(Go to Ⓐ on next page.)

Diagnostic Procedure 13 — Engine Stalls when Stepping on the Accelerator Momentarily (Cont'd)







Ⓐ

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

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-111.)

O.K.

5

CHECK FUEL PRESSURE.

1. Release fuel pressure to zero. (Refer to page EF & EC-166.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:

Approx. 226 kPa
(2.26 bar, 2.3 kg/cm^2, 33 psi)

A few seconds after ignition switch is turned 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-99.

N.G. → Repair or replace.

O.K.

8

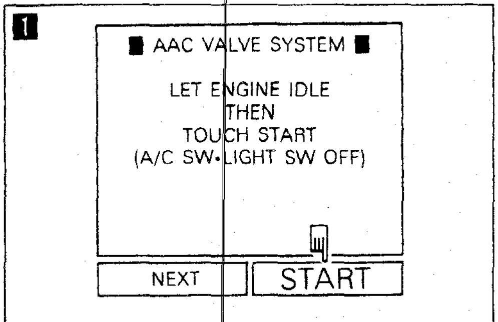
TRY A KNOWN GOOD E.C.U.★

Trouble is fixed. → Replace E.C.U.

Trouble is not fixed.

INSPECTION END

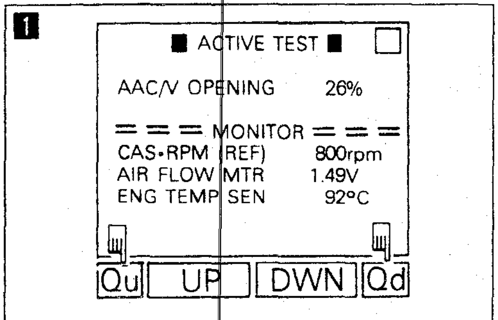
★: E.C.U. may be the cause of a problem, but this is rarely the case.



■ AAC VALVE SYSTEM ■

LET ENGINE IDLE
THEN
TOUCH START
(A/C SW•LIGHT SW OFF)

EEF149

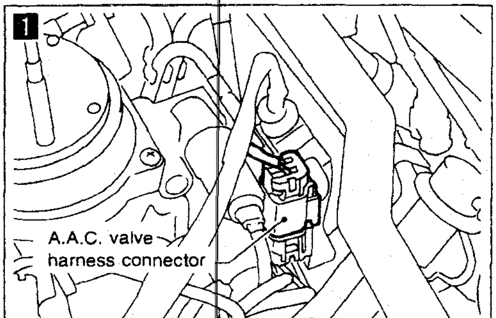


■ ACTIVE TEST ■

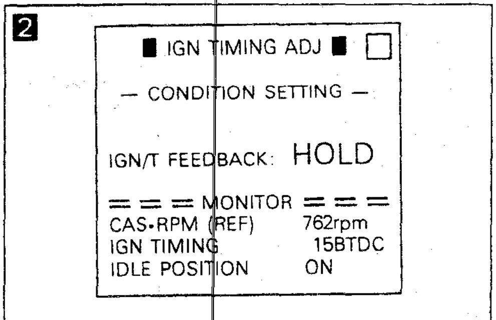
AAC/V OPENING 26%

=== MONITOR ===
CAS•RPM (REF) 800rpm
AIR FLOW MTR 1.49V
ENG TEMP SEN 92°C

EEF150



MEF486C



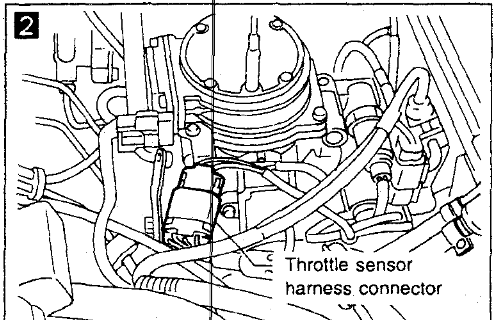
■ IGN TIMING ADJ ■

— CONDITION SETTING —

IGN/T FEEDBACK: HOLD

=== MONITOR ===
CAS•RPM (REF) 762rpm
IGN TIMING 15BTDC
IDLE POSITION ON

EEF142



MEF480C

Diagnostic Procedure 14 — Engine Stalls after Decelerating

1

CHECK A.A.C. VALVE.

1. Start engine and warm it up sufficiently.
2. Perform "AAC VALVE SYSTEM" in "FUNCTION TEST" mode.

— OR —

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-141.)

Yes ↓

2

CHECK IDLE ADJ. SCREW CLOGGING.

1. Perform "IGN TIMING ADJ" in "WORK SUPPORT" mode.
2. Can you set engine rpm at 750 ± 25 rpm (in "N" position) by turning idle adjusting screw?

— OR —

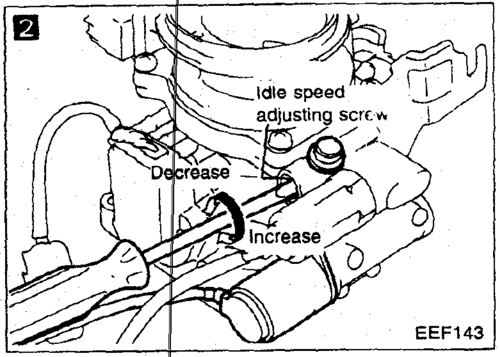
1. Disconnect throttle sensor harness connector.
2. Can you set engine rpm at 750 ± 25 rpm (in "N" position) by turning idle adjusting screw?

No → Check for IAS clogging or throttle chamber clogging.

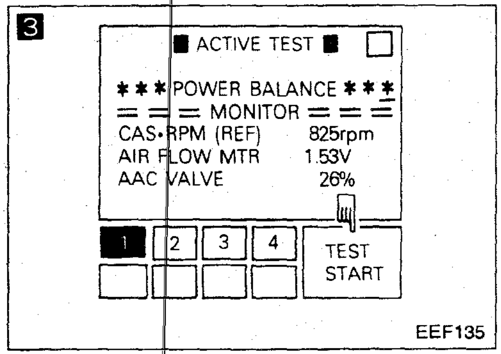
Yes ↓

(Go to Ⓐ on next page.)

Diagnostic Procedure 14 — Engine Stalls after Decelerating (Cont'd)



EEF143



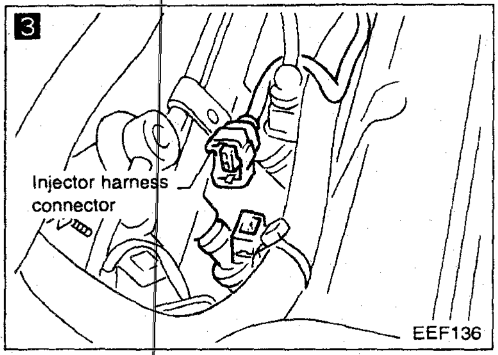
■ ACTIVE TEST ■ ☐

*** POWER BALANCE ***

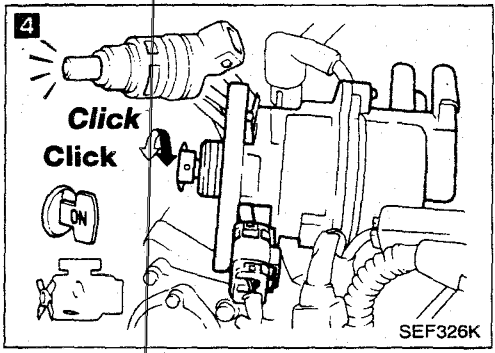
=== MONITOR ===

CAS·RPM (REF)	825rpm
AIR FLOW MTR	1.53V
AAC VALVE	26%

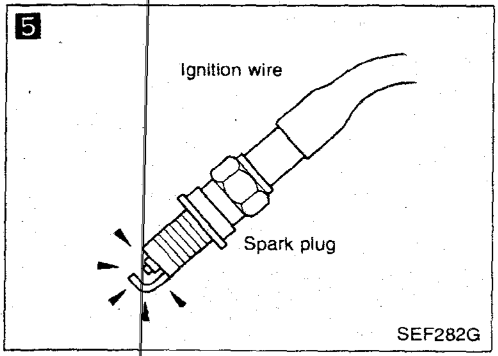
EEF135



EEF136



SEF326K



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?

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 ↓

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.

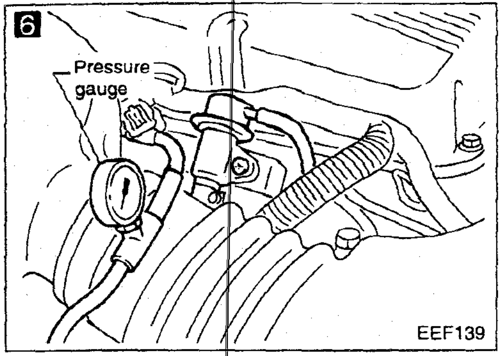
1. Disconnect ignition wire from spark plug.
2. Connect a known good spark plug to the ignition wire.
3. Place end of spark plug against a suitable ground and crank engine.
4. Check for spark.

No → Check ignition coil, power transistor and circuits. (See page EF & EC-111.)

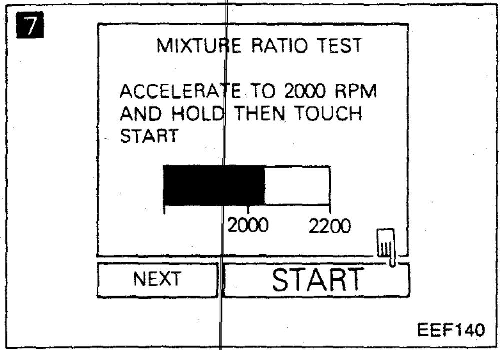
Yes ↓

(Go to Ⓑ on next page.)

Diagnostic Procedure 14 — Engine Stalls after Decelerating (Cont'd)



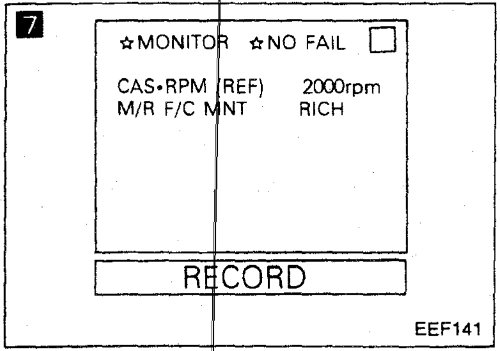
EEF139



MIXTURE RATIO TEST

ACCELERATE TO 2000 RPM AND HOLD THEN TOUCH START

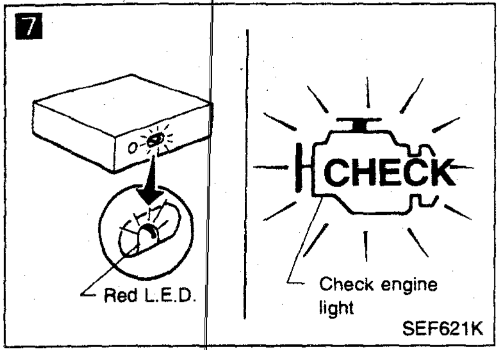
EEF140



☆MONITOR ☆NO FAIL ☐

CAS•RPM (REF) 2000rpm
M/R F/C MNT RICH

EEF141



SEF621K

Ⓑ

6

CHECK FUEL PRESSURE.

1. Release fuel pressure to zero. (Refer to page EF & EC-166.)
2. Install fuel pressure gauge and check fuel pressure.

At idle:

Approx. 226 kPa
(2.26 bar, 2.3 kg/cm^2, 33 psi)

A few seconds after ignition switch is turned 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.

7

CHECK EXHAUST GAS SENSOR.

1. Start engine and warm it up sufficiently.
2. Perform "MIXTURE RATIO TEST" in "FUNCTION TEST" mode.

OR

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.

$\underbrace{\textbf{RICH}\rightarrow\textbf{LEAN}\rightarrow\textbf{RI}}_{\textbf{1 time}}\underbrace{\textbf{CH}\rightarrow\textbf{LEAN}\rightarrow\textbf{RI}}_{\textbf{2 times}}\textbf{CH}\ldots\ldots$

OR

1. Set "Exhaust gas sensor monitor" in the self-diagnostic Mode II. (See page EF & EC-45.)
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.

N.G. → Replace exhaust gas sensor.

O.K.

8

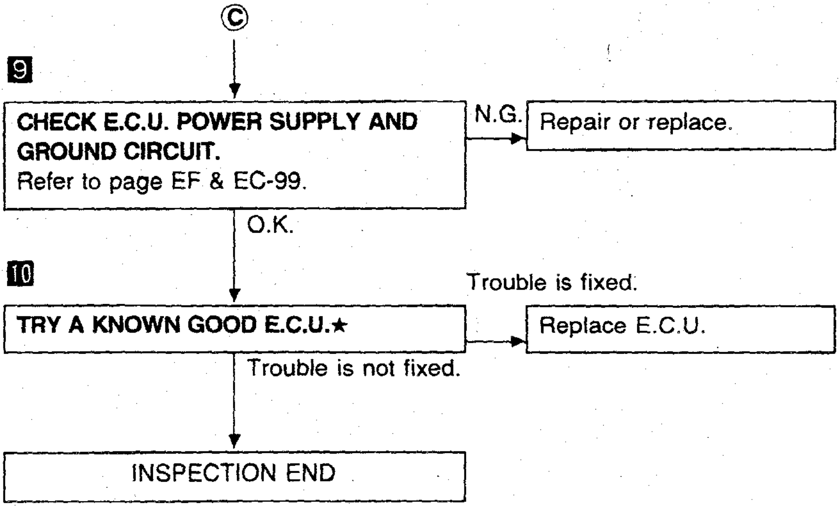
CHECK E.C.U. HARNESS CONNECTOR.
Check the E.C.U. pin terminals for damage or poor connection of E.C.U. harness connector.

N.G. → Repair or replace.

O.K.

(Go to Ⓒ on the next page.)

Diagnostic Procedure 14 — Engine Stalls after Decelerating (Cont'd)



Ⓒ

9

CHECK E.C.U. POWER SUPPLY AND GROUND CIRCUIT.
Refer to page EF & EC-99.

N.G. → Repair or replace.

O.K.

10

TRY A KNOWN GOOD E.C.U.★

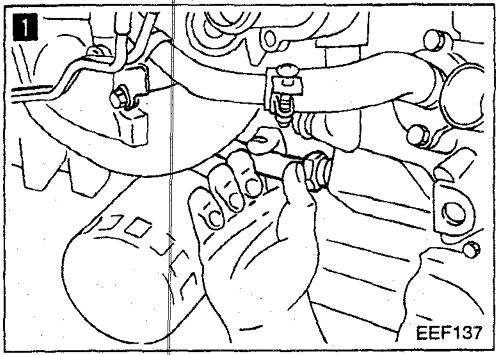
Trouble is fixed. → Replace E.C.U.

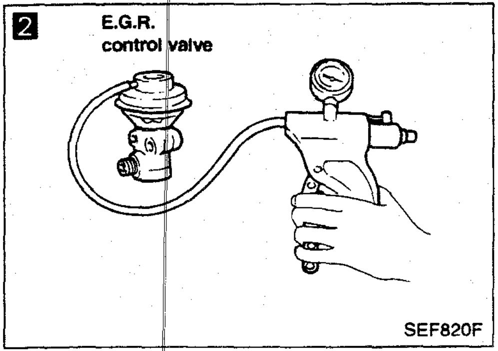
Trouble is not fixed.

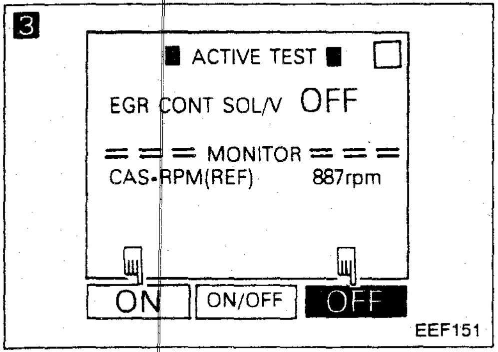
INSPECTION END

★: E.C.U. may be the cause of a problem, but this is rarely the case.

Diagnostic Procedure 18 — Detonation





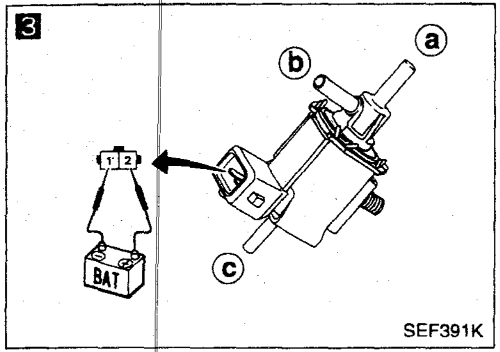


ACTIVE TEST

EGR CONT SOL/V OFF

=== MONITOR ===

CAS•RPM(REF) 887rpm



1

CHECK FOR INTAKE AIR LEAK.
When pinching cylinder block to intake manifold hose, does the engine rpm rise?

Yes → Discover air leak location and repair.

No ↓

2

CHECK E.G.R. OPERATION.
1. Apply vacuum directly to the E.G.R. valve using a handy vacuum pump.
2. Check to see that the engine runs rough or dies.

No → Check E.G.R. valve for sticking.

Yes ↓

3

CHECK E.G.R. & CANISTER CONTROL SOLENOID VALVE.
1. Select "E.G.R. CONT SOL VALVE" in "ACTIVE TEST" mode.
2. Turn E.G.R. & canister control solenoid valve ON and OFF.
3. Check operating sound.

OR

1. Disconnect E.G.R. & canister control solenoid valve harness connector.
2. Supply E.G.R. & canister control solenoid valve terminals with battery current and check operating sound.

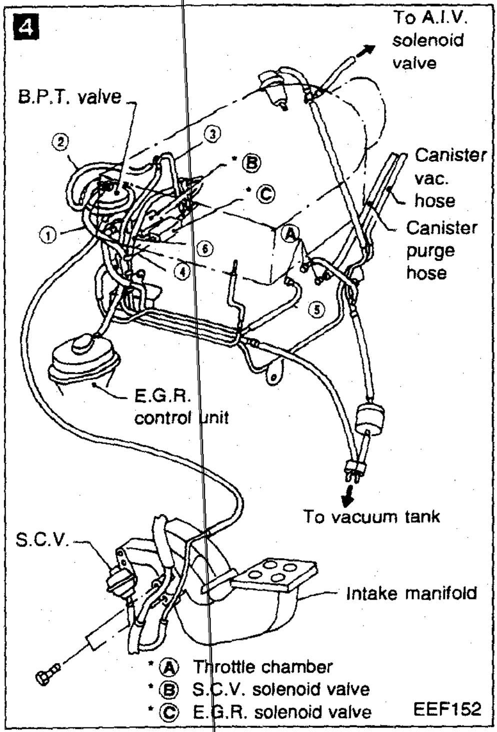
N.G. → Check solenoid valve and circuit.

O.K. ↓

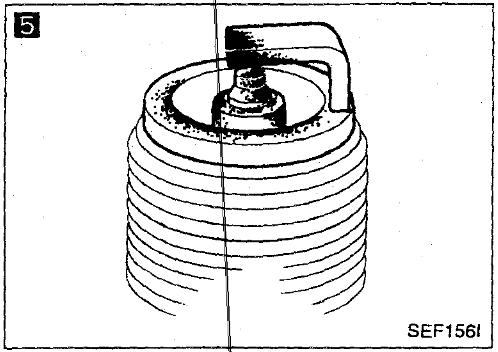
(Go to Ⓐ on next page.)

Diagnostic Procedure 18 — Detonation (Cont'd)

4



5



Ⓐ

4

CHECK VACUUM HOSES.
Check the following vacuum hoses for clogging, cracks and poor connection.

① E.G.R. valve to B.P.T. valve
② B.P.T. valve to 3-way connector
③ 3-way connector to E.G.R. & canister control solenoid valve
④ E.G.R. & canister control solenoid valve to vacuum tube
⑤ Vacuum tube to throttle chamber
⑥ 3-way connector to vacuum port

N.G. → Repair or replace.

O.K.

5

CHECK FOR OIL LEAK TO COMBUSTION CHAMBER.
Remove spark plugs and check for fouling with oil.

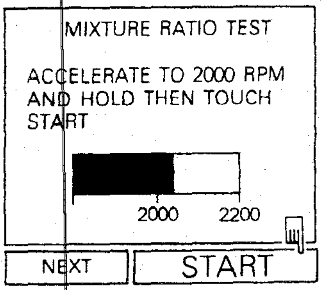
Yes → Check pistons, piston rings, valves, valve seats, valve oil seal and engine oil level, etc.

No

INSPECTION END

Diagnostic Procedure 19 — Surge

1

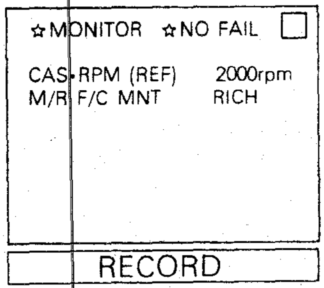


MIXTURE RATIO TEST

ACCELERATE TO 2000 RPM AND HOLD THEN TOUCH START

EEF140

1

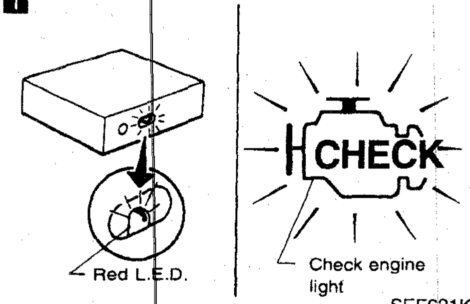


☆MONITOR ☆NO FAIL ☐

CAS·RPM (REF) 2000rpm
M/R F/C MNT RICH

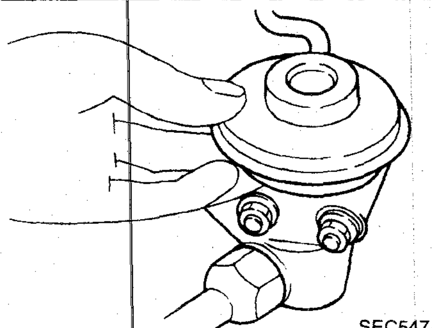
EEF141

1



SEF621K

2



SEC547A

1

CHECK EXHAUST GAS SENSOR.

1. Start engine and warm it up sufficiently.
2. Perform "MIXTURE RATIO TEST" in "FUNCTION TEST" mode.

— OR —

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.......

— OR —

1. Set "Exhaust gas sensor monitor" in the self-diagnostic Mode II. (See page EF & EC-45.)
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.

N.G. → Replace exhaust gas sensor.

O.K. ↓

2

CHECK E.G.R. CONTROL VALVE.
Check E.G.R. control valve for sticking.

N.G. → Repair or replace.

O.K. ↓

3

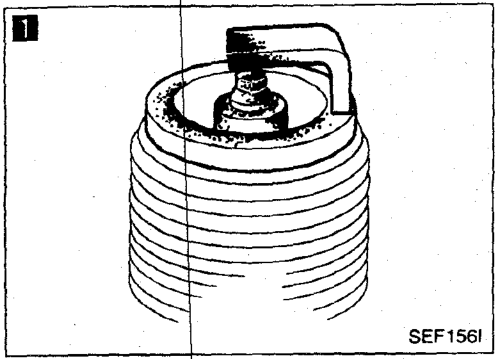
TRY A KNOWN GOOD E.C.U.★

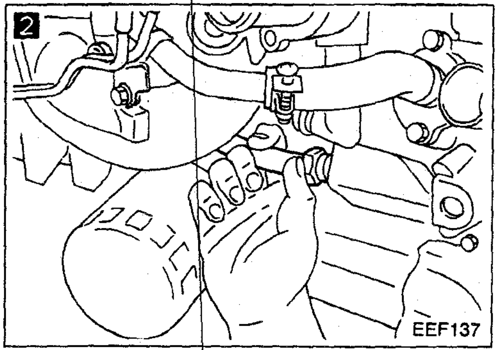
Trouble is fixed. → Replace E.C.U.

Trouble is not fixed. ↓

INSPECTION END

★: E.C.U. may be the cause of a problem, but this is rarely the case.





Diagnostic Procedure 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 cylinder block to intake manifold hose, 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

CHECK ENGINE TEMPERATURE SENSOR.
Check engine temperature sensor and its circuit. (See page EF & EC-108.)

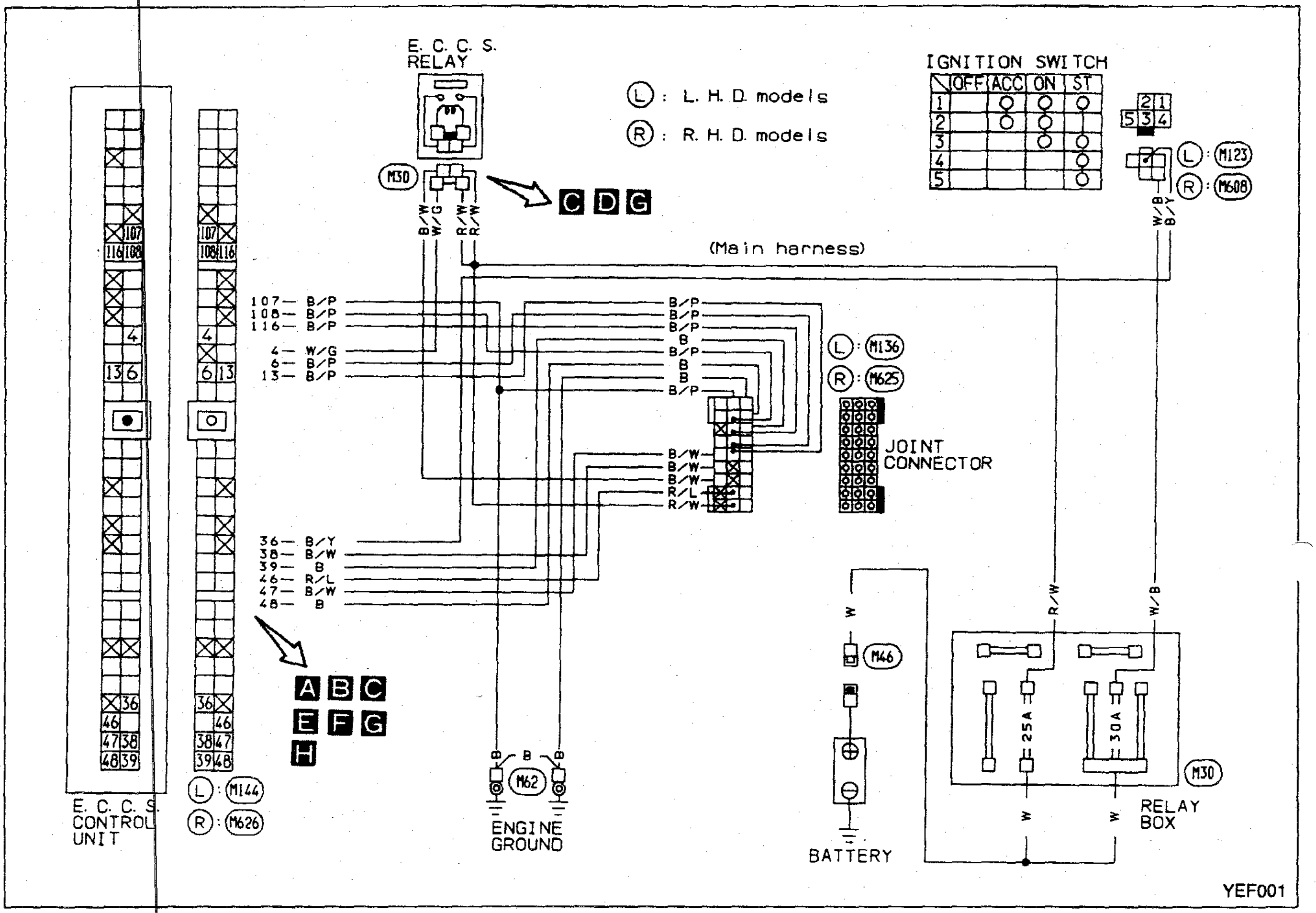
N.G. → Replace or repair.

O.K. ↓

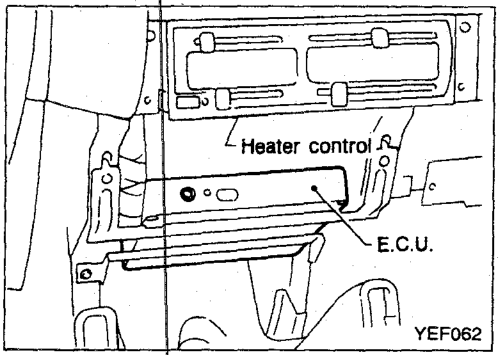
INSPECTION END

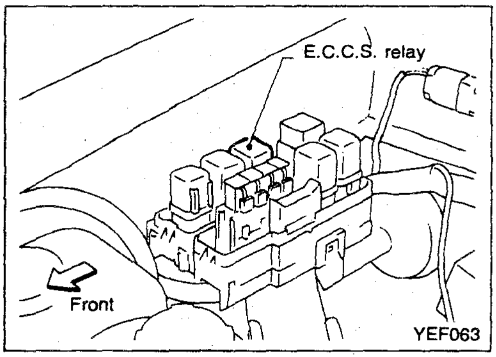
Diagnostic Procedure 22

MAIN POWER SUPPLY AND GROUND CIRCUIT (Not self-diagnostic item)



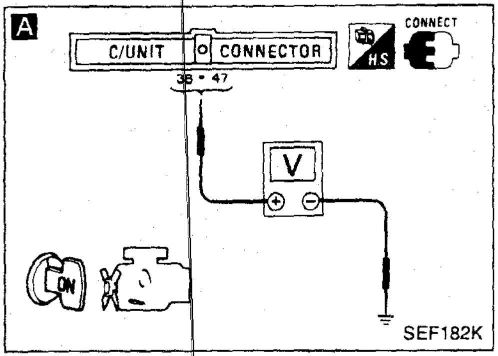
Harness layout





Diagnostic Procedure 22 (Cont'd)

INSPECTION START

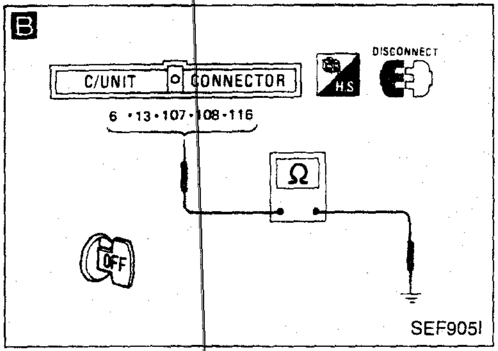


SEF182K

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. → C



SEF905I

B

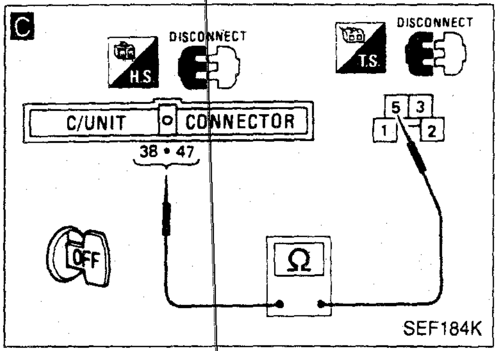
CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminals ⑥, ⑬, 107, 108, 116 and engine ground.
Continuity should exist.

If N.G., check the following.
- Joint connector M136 (L.H.D. models), M625 (R.H.D. models)
- Harness continuity between E.C.U. and engine ground

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.



SEF184K

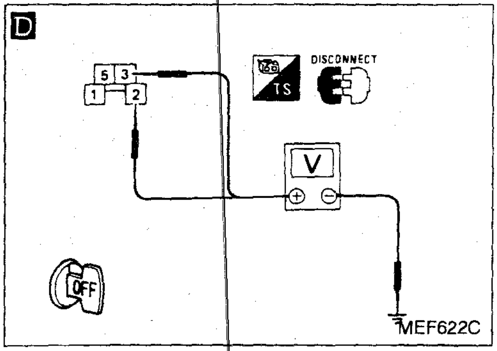
C

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. → Check the following.
- Joint connector M136 (L.H.D. models), M625 (R.H.D. models)
- Harness continuity between E.C.U. and E.C.C.S. relay

If N.G., repair harness or connectors.

O.K.



MEF622C

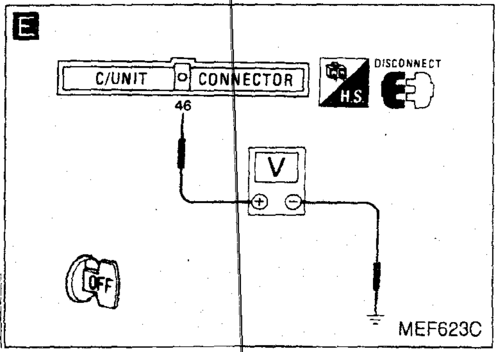
D

CHECK VOLTAGE BETWEEN E.C.C.S. RELAY AND GROUND.
1) Check voltage between terminals ②, ③ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- 25A fusible link (In the relay box)
- Harness continuity between E.C.C.S. relay and battery

If N.G., repair harness or connectors.

O.K.



MEF623C

E

CHECK VOLTAGE BETWEEN E.C.U. AND GROUND.
1) Check voltage between E.C.U. terminal ㊻ and ground.
Voltage: Battery voltage

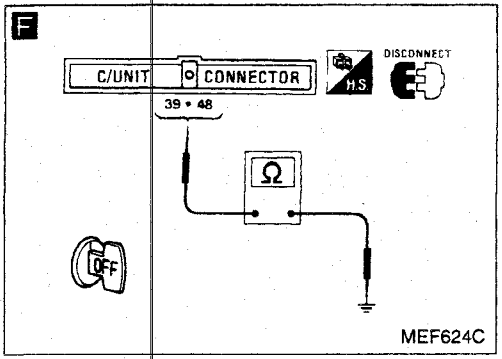
N.G. → Repair harness or connectors.

O.K.

(Go to Ⓐ on next page)

Diagnostic Procedure 22 (Cont'd)

Ⓐ



MEF624C

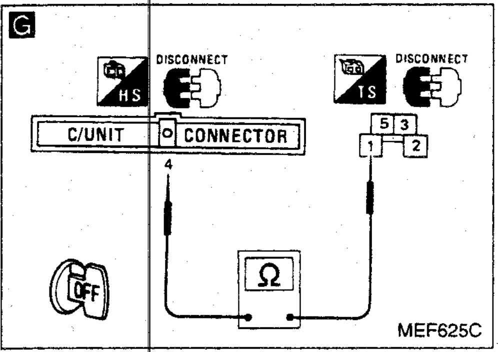
F

CHECK GROUND CIRCUIT.
1) Check harness continuity between E.C.U. terminals ㊴, ㊽ and engine ground.
Continuity should exist.

N.G. → Check the following.
- Joint connector
  - M136 (L.H.D. models),
  - M625 (R.H.D. models)
- Harness continuity between E.C.U. and engine ground

If N.G., repair harness or connectors.

O.K.



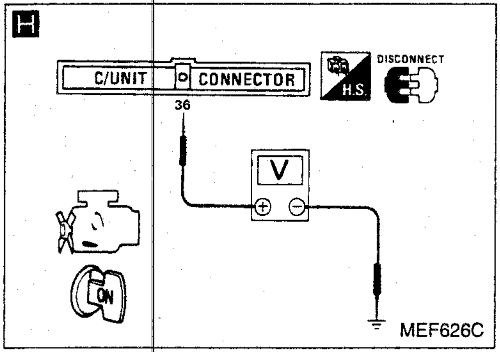
MEF625C

G

CHECK OUTPUT SIGNAL CIRCUIT.
1) Check harness continuity between E.C.U. terminal ④ and terminal ①.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.



MEF626C

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. → Repair harness or connectors.

O.K.

CHECK COMPONENT
(E.C.C.S. relay).
Refer to "Electrical Components Inspection".
(See page EF & EC-159.)

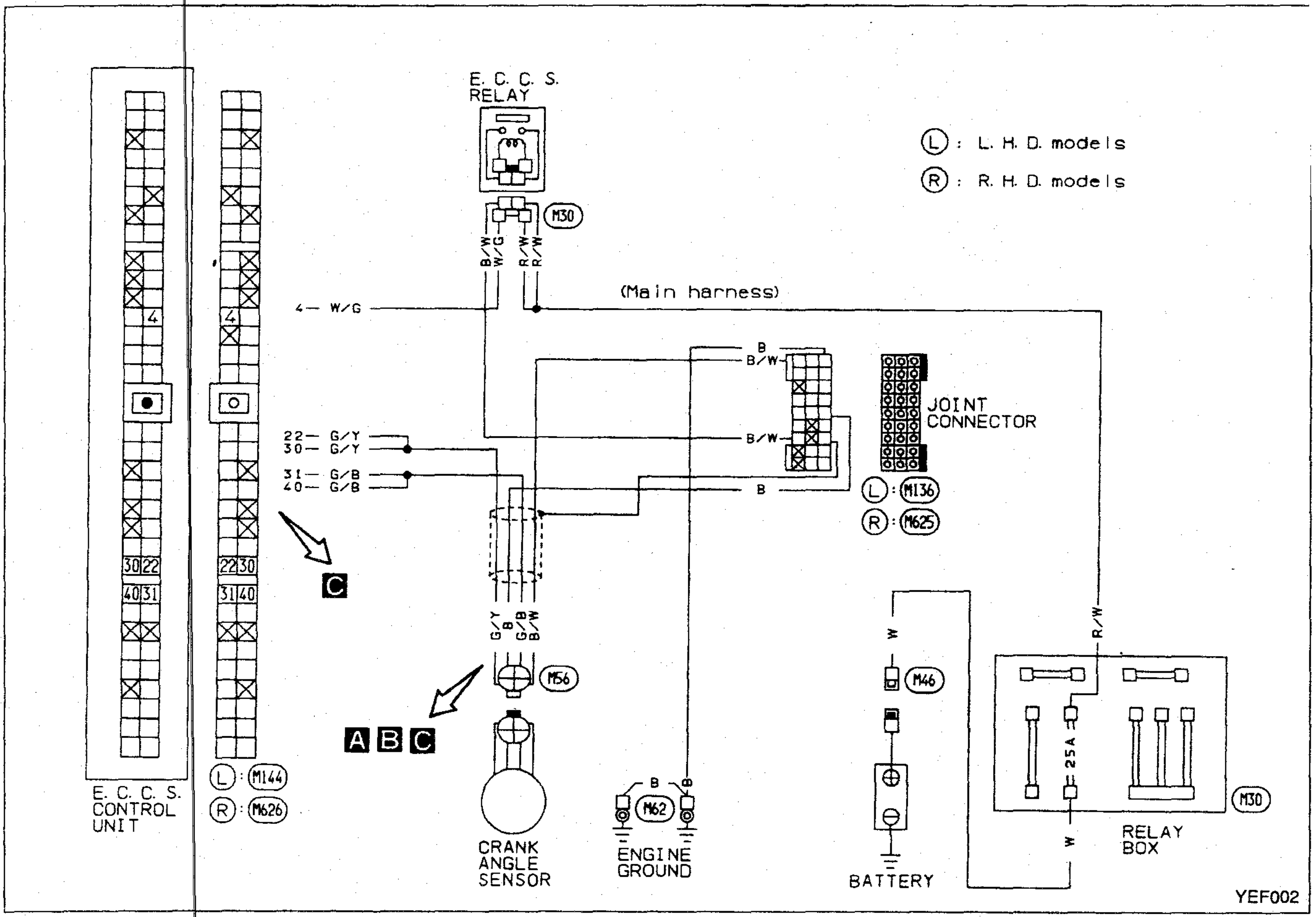
N.G. → Replace E.C.C.S. relay.

O.K.

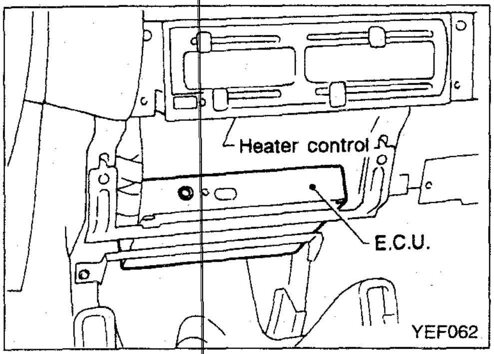
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

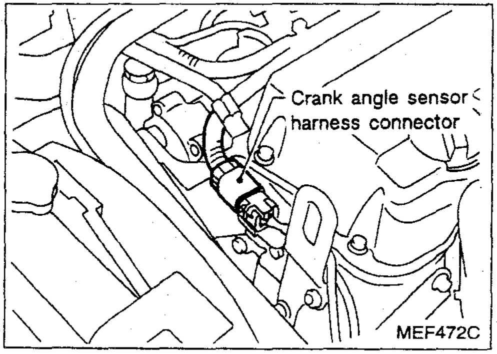
Diagnostic Procedure 23

CRANK ANGLE SENSOR (Code No. 11)

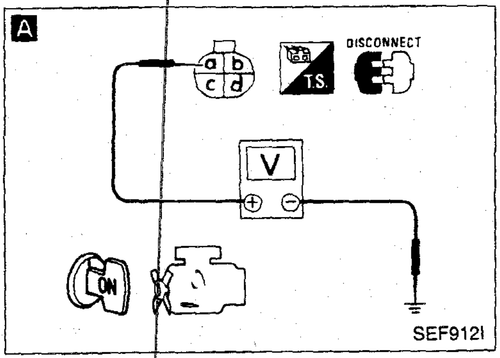


Harness layout

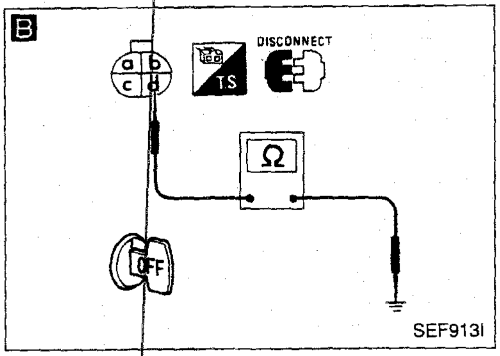




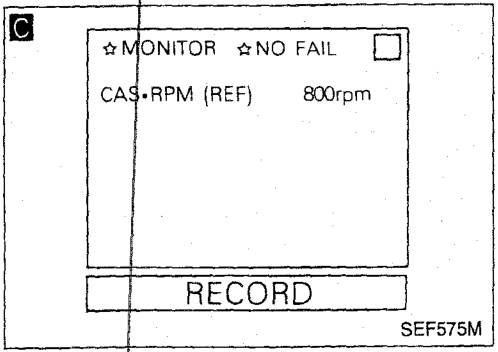
Diagnostic Procedure 23 (Cont'd)



SEF912I



SEF913I

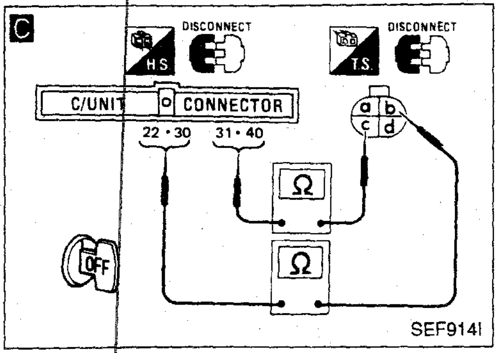


☆MONITOR ☆NO FAIL ☐

CAS•RPM (REF) 800rpm

RECORD

SEF575M



SEF914I

INSPECTION START

A

CHECK POWER SUPPLY.
1) Disconnect crank angle sensor harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓐ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Joint connector
  M136 (L.H.D. models),
  M625 (R.H.D. models)
- Harness continuity between crank angle sensor and E.C.C.S. relay

If N.G., repair harness or connectors.

O.K.

B

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓓ and engine ground.
Continuity should exist.

N.G. → Check the following.
- Joint connector
  M136 (L.H.D. models),
  M625 (R.H.D. models)
- Harness continuity between crank angle sensor and engine ground

If 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: 800 ± 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-160.)

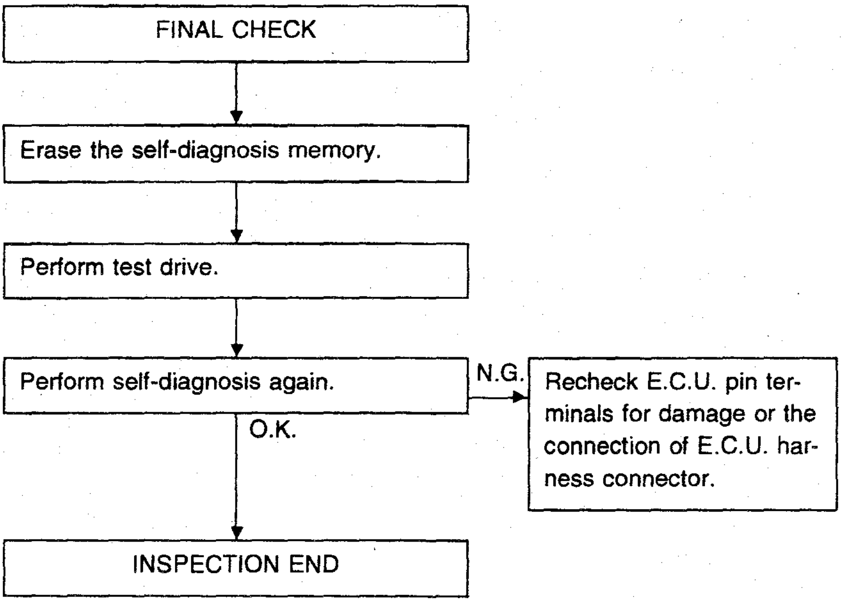
N.G. → Replace crank angle sensor.

O.K.

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

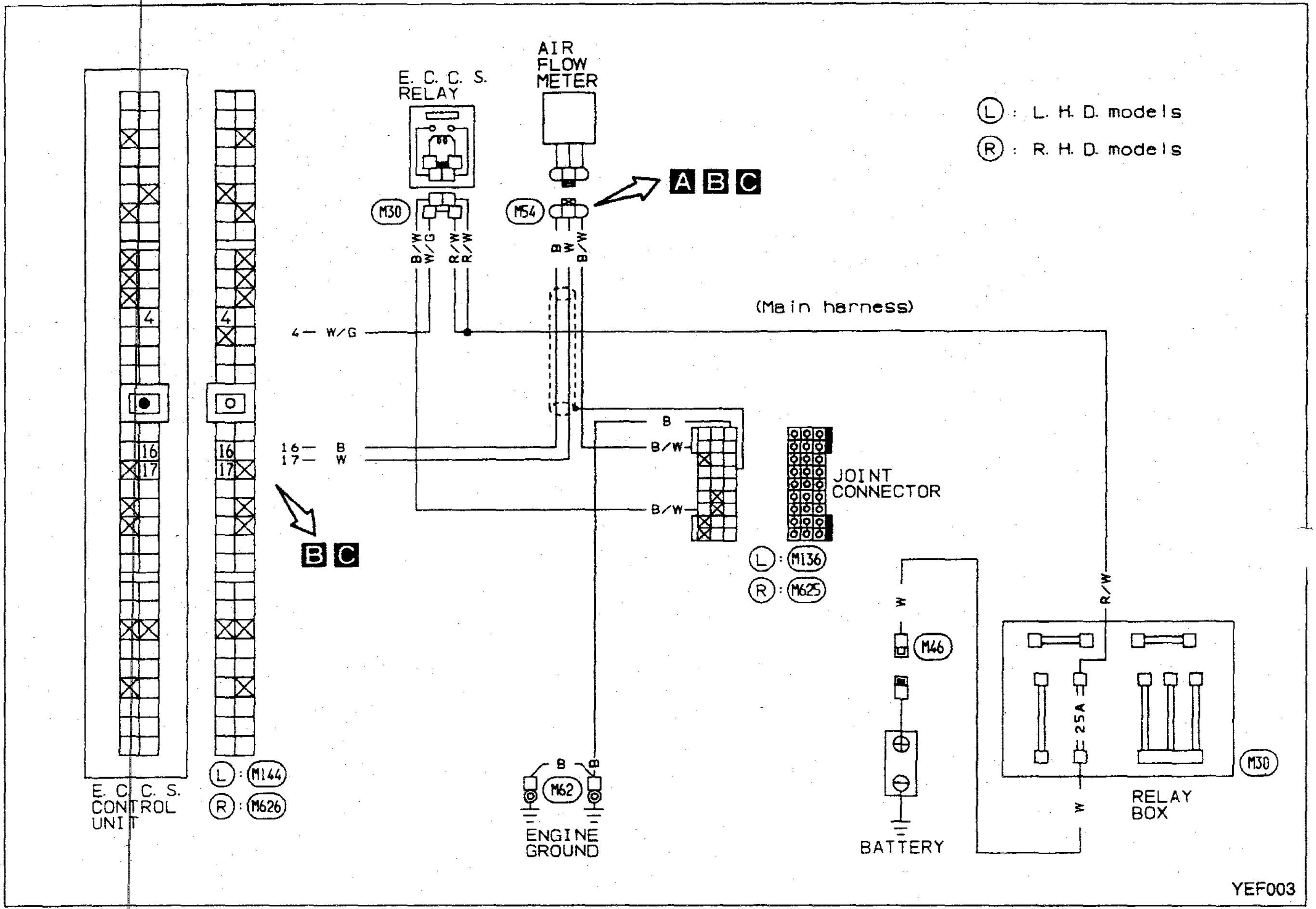
Diagnostic Procedure 23 (Cont'd)

Perform FINAL CHECK by the following procedure after repair is completed.

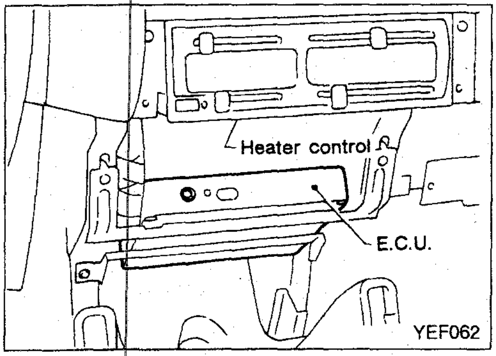


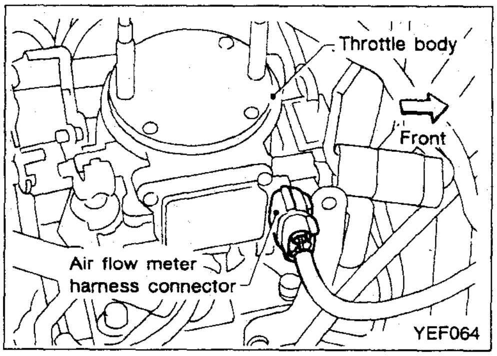
Diagnostic Procedure 24

AIR FLOW METER (Code No. 12)

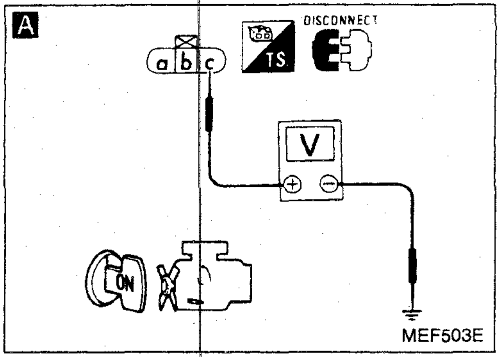


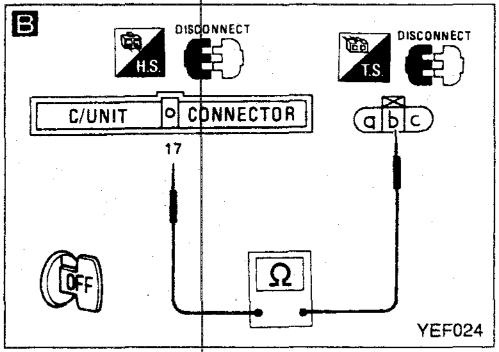
Harness layout

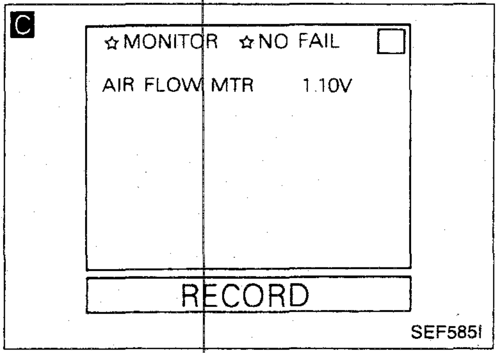




Diagnostic Procedure 24 (Cont'd)



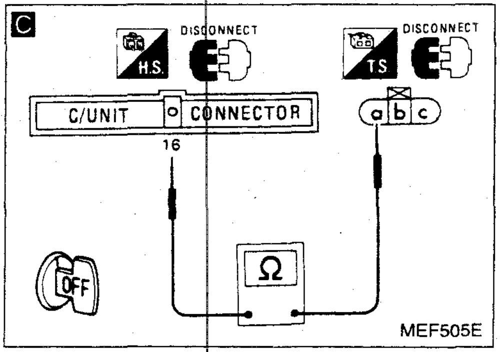




☆MONITOR ☆NO FAIL ☐

AIR FLOW MTR 1.10V

RECORD



INSPECTION START

A

CHECK POWER SUPPLY.

1) Disconnect air flow meter harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓒ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- Joint connector M136 (L.H.D. models), M625 (R.H.D. models)
- Harness continuity between E.C.C.S. relay and air flow meter

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 - 3.0V

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-160.)

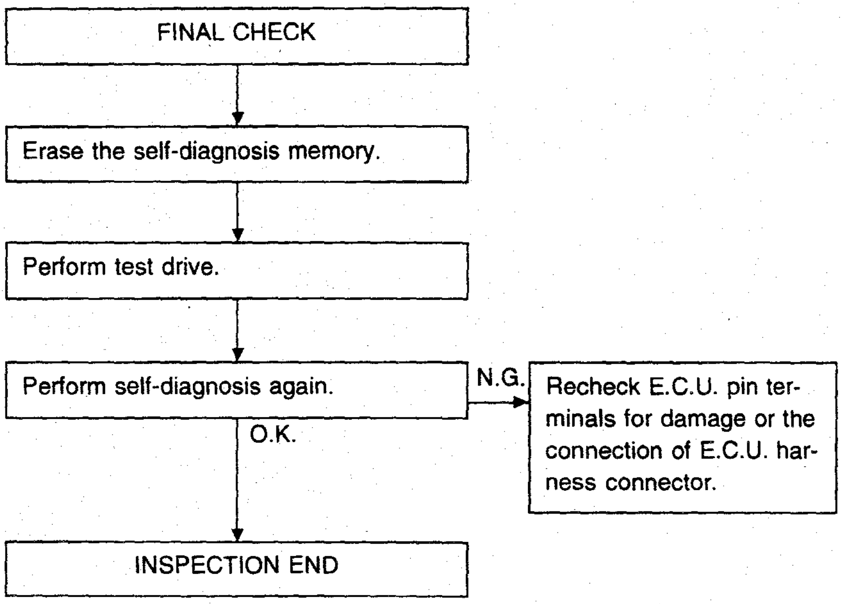
N.G. → Replace air flow meter.

O.K.

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

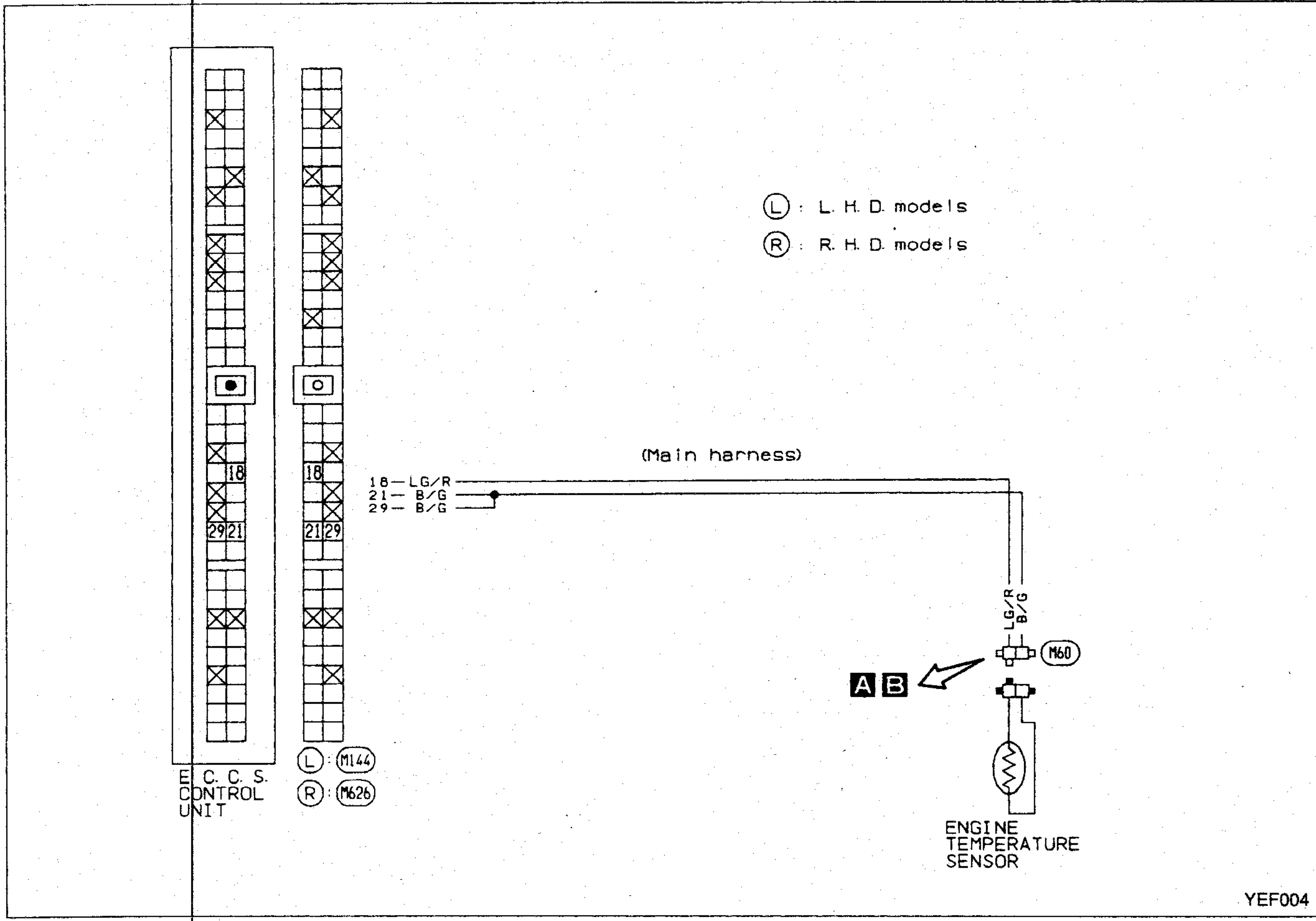
Diagnostic Procedure 24 (Cont'd)

Perform FINAL CHECK by the following procedure after repair is completed.

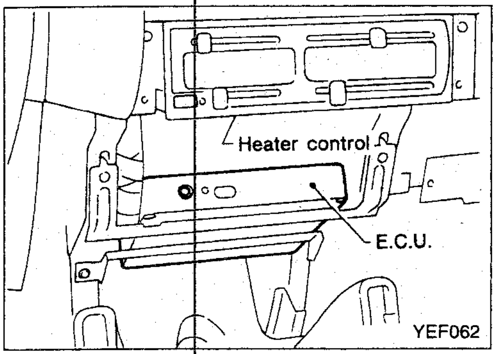


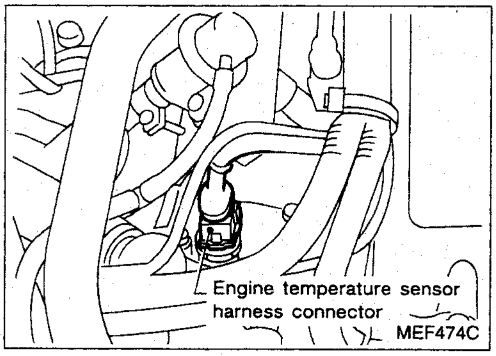
Diagnostic Procedure 25

ENGINE TEMPERATURE SENSOR (Code No. 13)

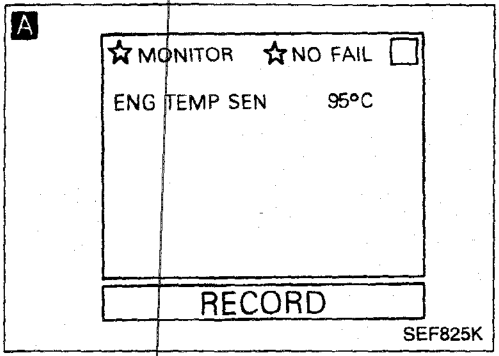


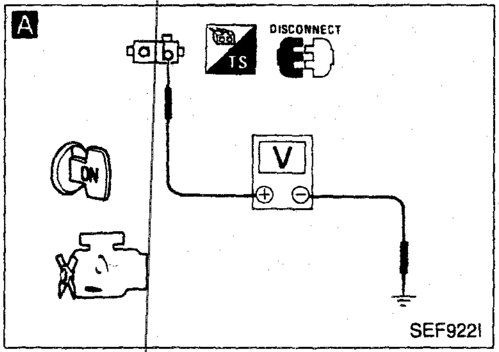
Harness layout

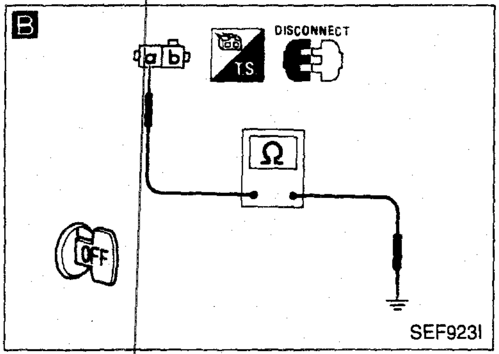




Diagnostic Procedure 25 (Cont'd)







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 81°C (178°F) after engine warm-up.

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. → 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-160.)

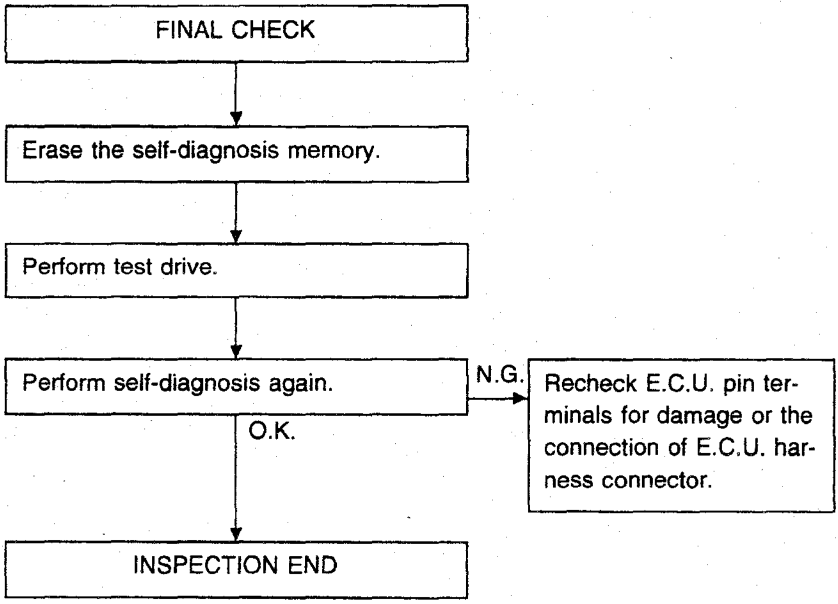
N.G. → Replace engine temperature sensor.

O.K.

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

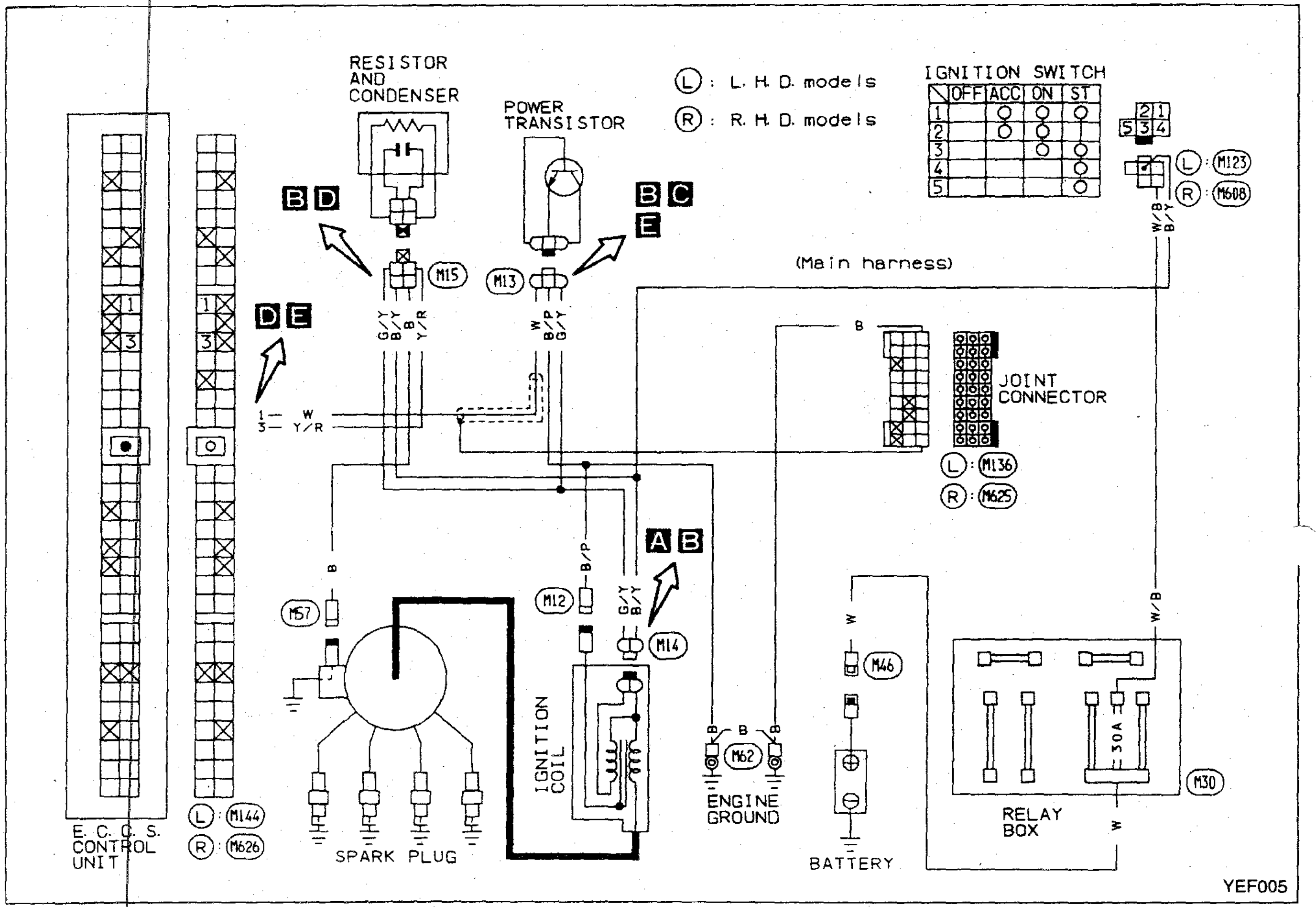
Diagnostic Procedure 25 (Cont'd)

Perform FINAL CHECK by the following procedure after repair is completed.

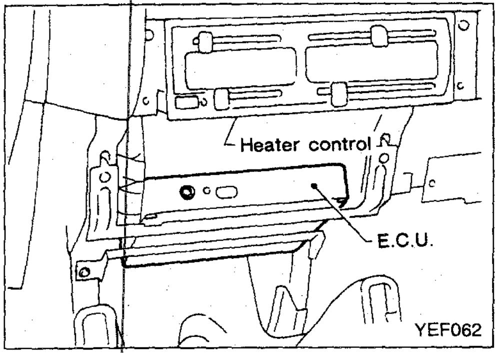


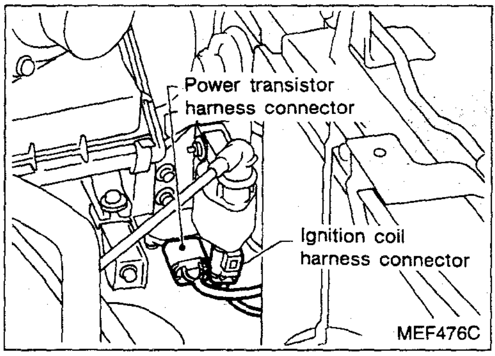
Diagnostic Procedure 26

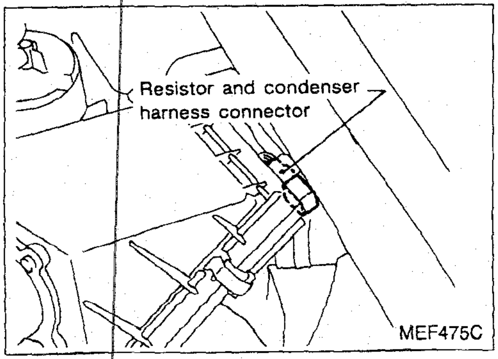
IGNITION SIGNAL (Code No. 21)



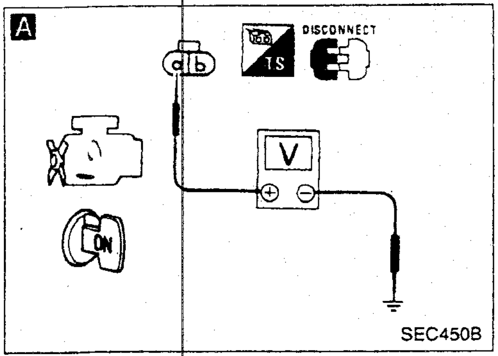
Harness layout

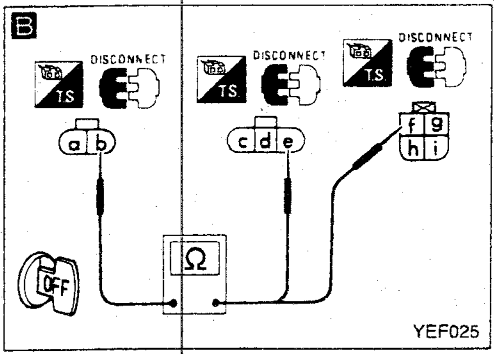


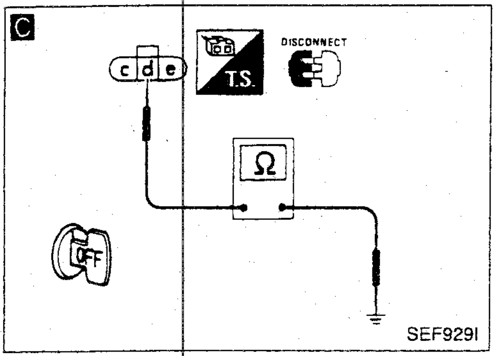


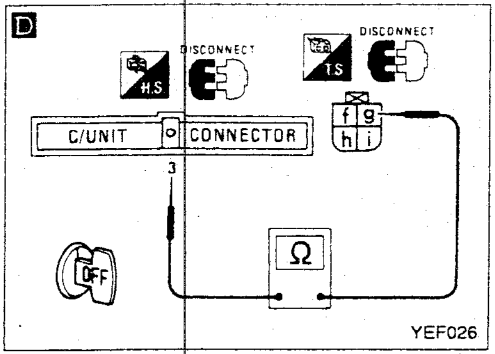


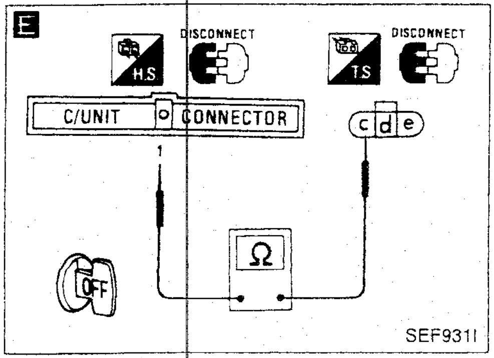
Diagnostic Procedure 26 (Cont'd)











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. → Repair harness or connectors.

↓ O.K.

CHECK GROUND CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect resistor & condenser 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 E.C.U. terminal ③ and terminal ⓖ.
Continuity should exist.

N.G. → Repair harness or connectors.

↓ O.K.

E

CHECK OUTPUT SIGNAL CIRCUIT.
1) Check harness continuity between E.C.U. terminal ① and terminal ⓒ.
Continuity should exist.

N.G. → Repair harness or connectors.

↓ O.K.

CHECK COMPONENTS
(Ignition coil, power transistor, resistor and condenser)
Refer to "Electrical Components Inspection".
(See pages EF & EC-160, 161 and 165.)

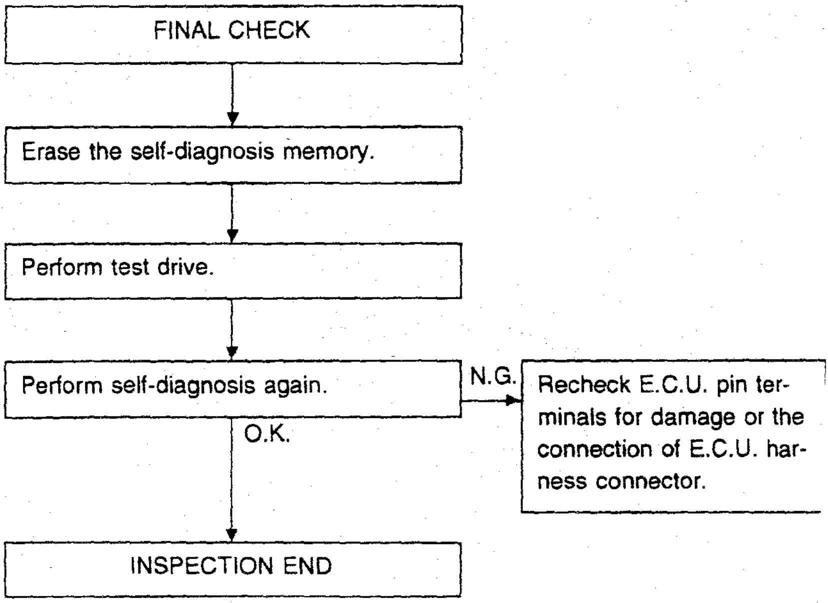
N.G. → Replace malfunctioning component(s).

↓ O.K.

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

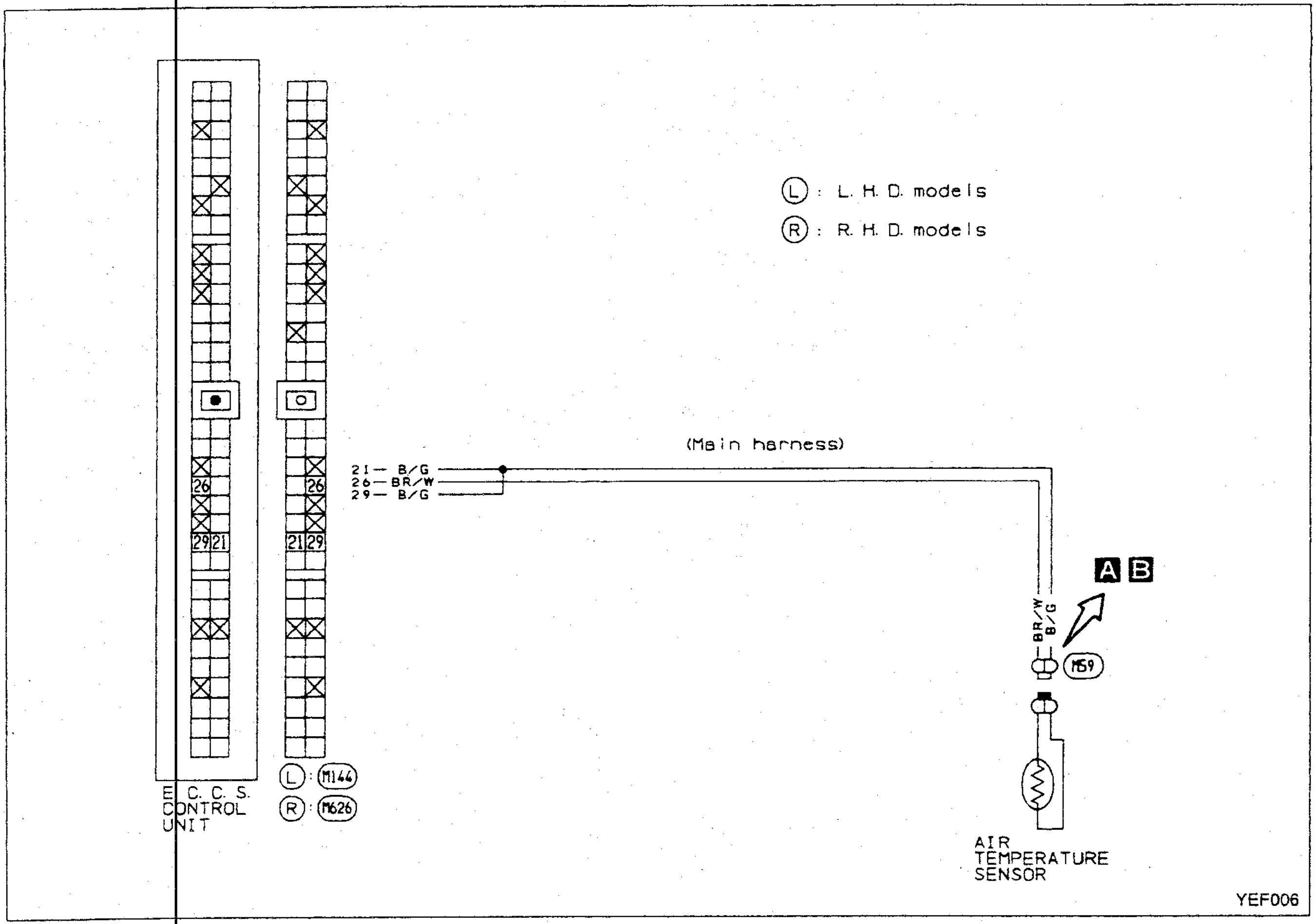
Diagnostic Procedure 26 (Cont'd)

Perform FINAL CHECK by the following procedure after repair is completed.

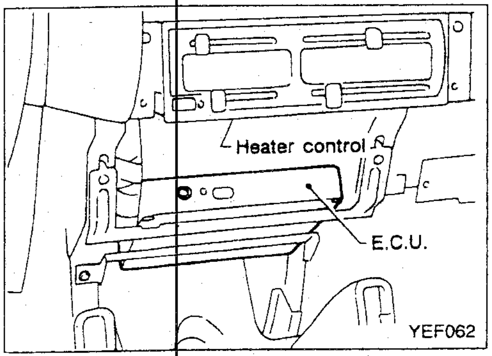


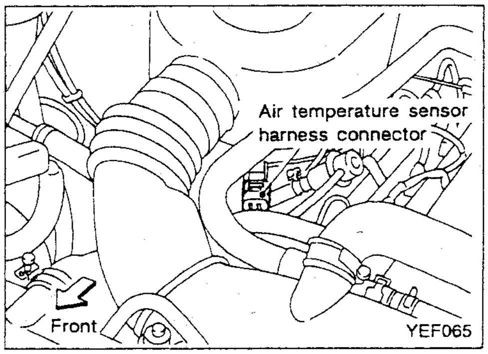
Diagnostic Procedure 27

AIR TEMPERATURE SENSOR (Code No. 41)

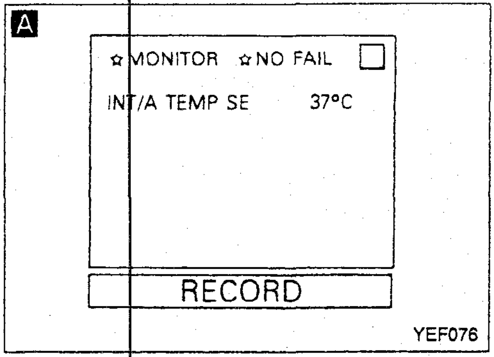


Harness layout





Diagnostic Procedure 27 (Cont'd)

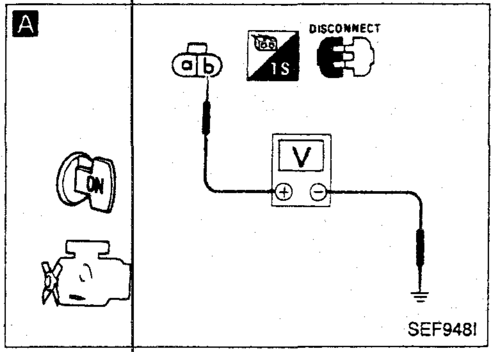


☆MONITOR ☆NO FAIL ☐

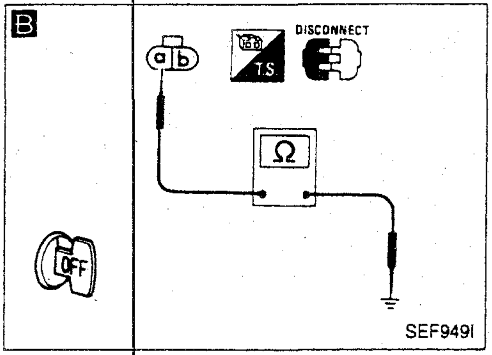
INT/A TEMP SE 37°C

RECORD

YEF076



SEF948I



SEF949I

INSPECTION START

↓

A

CHECK POWER SUPPLY.

1) Read air temperature sensor signal in "DATA MONITOR" mode with CONSULT after engine warm-up.
Intake air temperature:
20 - 60°C (68 - 140°F)

OR

1) Disconnect air temperature sensor harness connector.
2) Turn ignition switch "ON".
3) Check voltage between terminal ⓑ and ground.
Voltage: Approximately 5V

N.G. → Repair harness or connectors.

O.K. ↓

B

CHECK GROUND CIRCUIT.

1) Turn ignition switch "OFF".
2) Check harness continuity between terminal ⓐ and engine ground.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

CHECK COMPONENT

(Air temperature sensor).
Refer to "Electrical Components Inspection".
(See page EF & EC-164.)

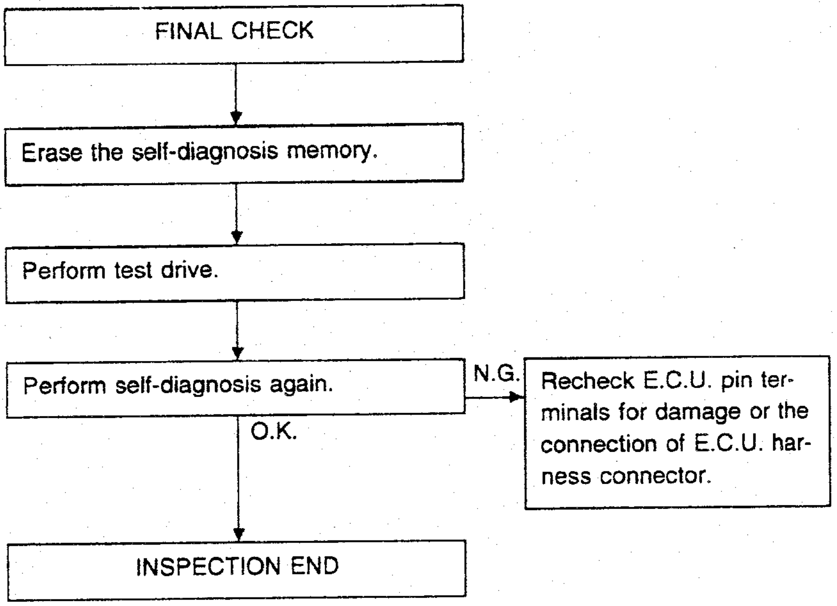
N.G. → Replace air temperature sensor.

O.K. ↓

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

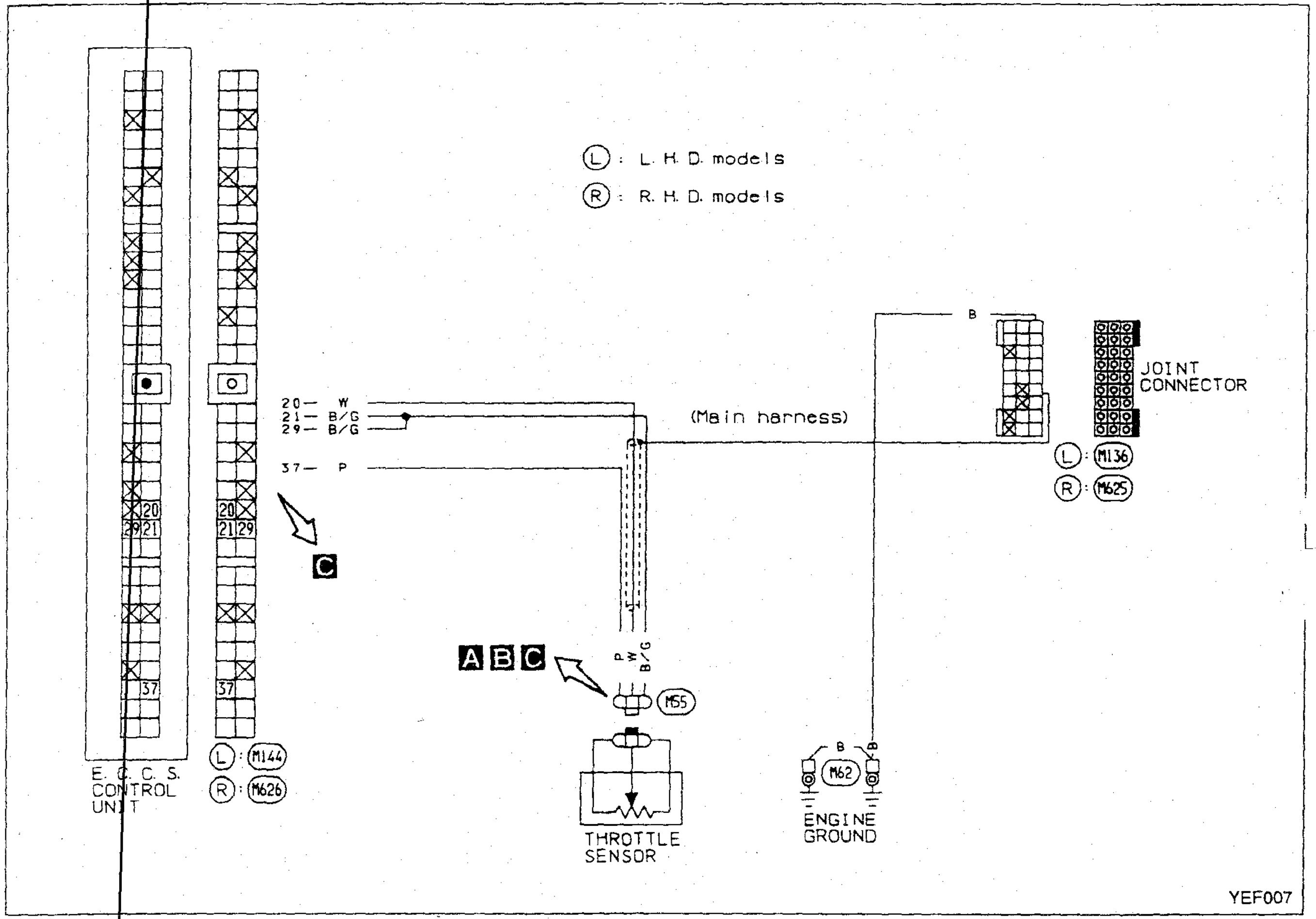
Diagnostic Procedure 27 (Cont'd)

Perform FINAL CHECK by the following procedure after repair is completed.

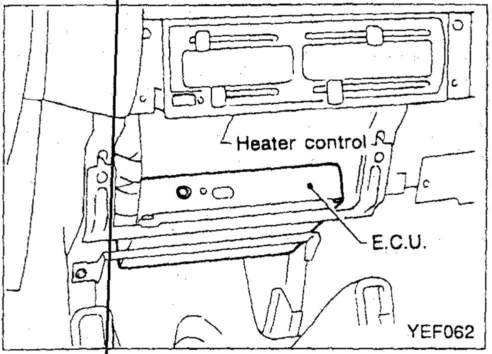


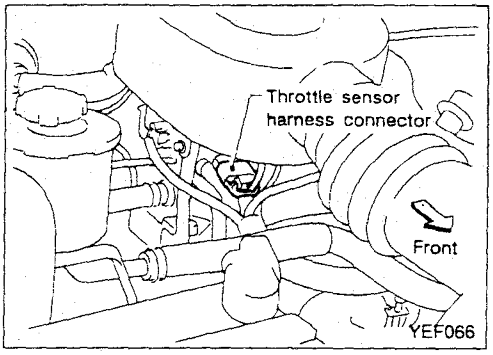
Diagnostic Procedure 28

THROTTLE SENSOR (Code No. 43)

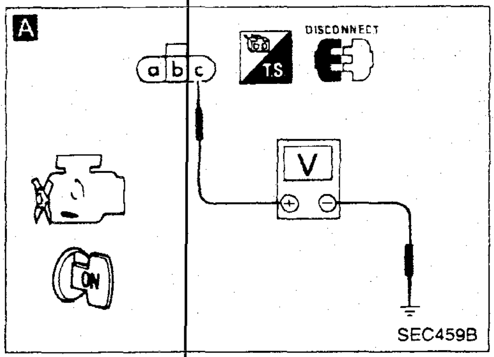


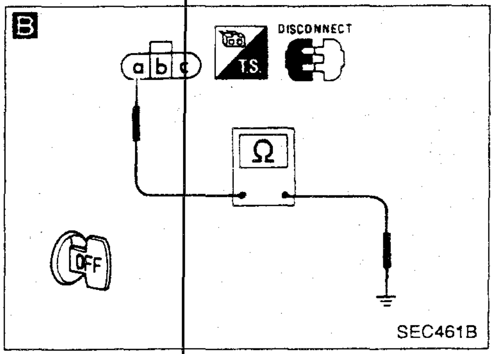
Harness layout

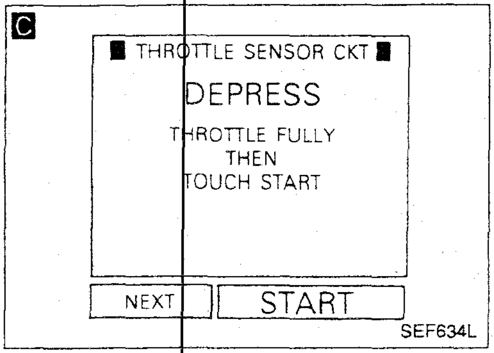




Diagnostic Procedure 28 (Cont'd)





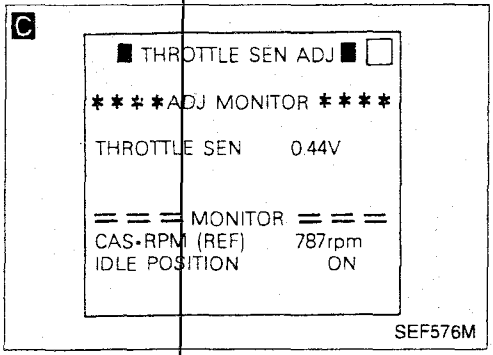


■ THROTTLE SENSOR CKT ■

DEPRESS

THROTTLE FULLY
THEN
TOUCH START

NEXT START

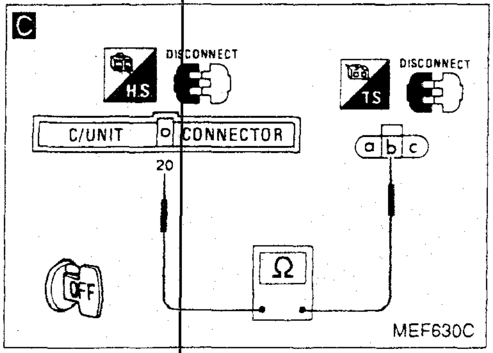


■ THROTTLE SEN ADJ ■ ☐

＊＊＊＊ADJ MONITOR ＊＊＊＊

THROTTLE SEN 0.44V

═══ MONITOR ═══
CAS·RPM (REF) 787rpm
IDLE POSITION ON



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) Perform "THROTTLE SENSOR CKT" in "FUNCTION TEST" mode with CONSULT.

OR

3) Read throttle sensor output voltage in "WORK SUPPORT" mode with CONSULT.
Voltage:
Throttle valve fully closed
0.3 - 0.7V
Throttle valve fully open
Approx. 4.0V

OR

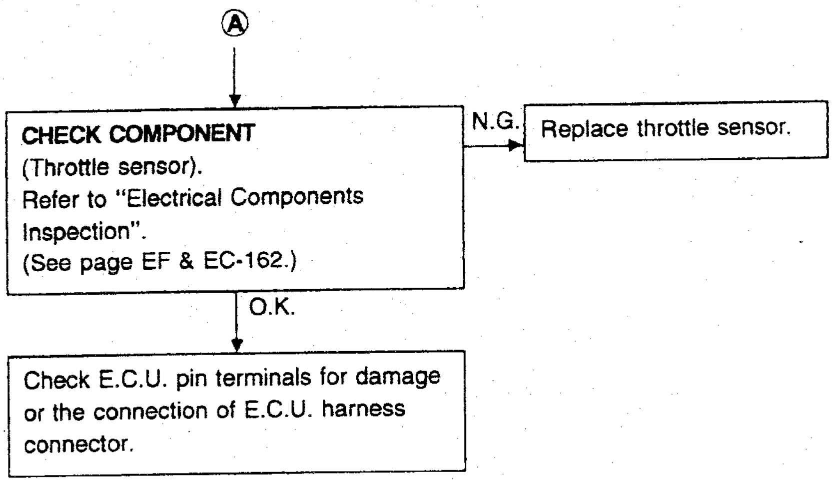
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal ⑳ and terminal ⓑ.
Continuity should exist.

N.G. → Repair harness or connectors.

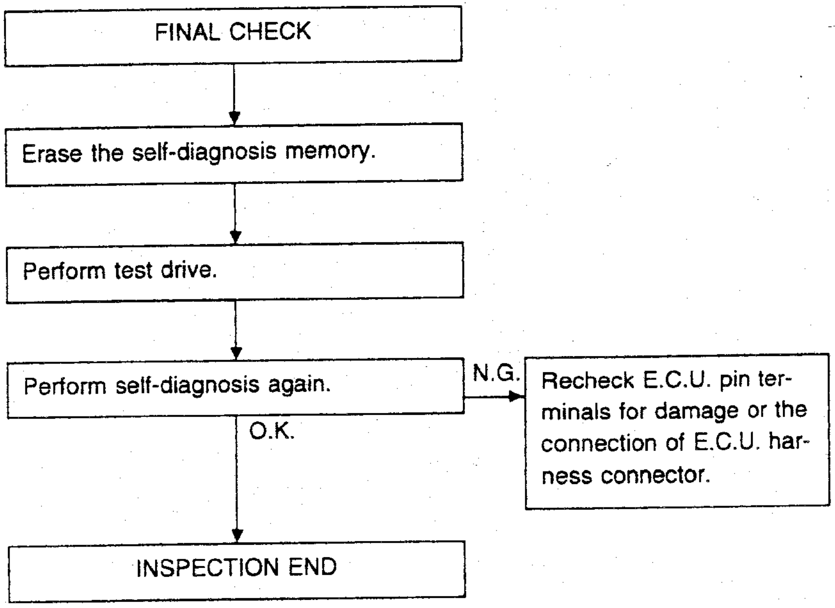
O.K.

(Go to Ⓐ on next page.)

Diagnostic Procedure 28 (Cont'd)

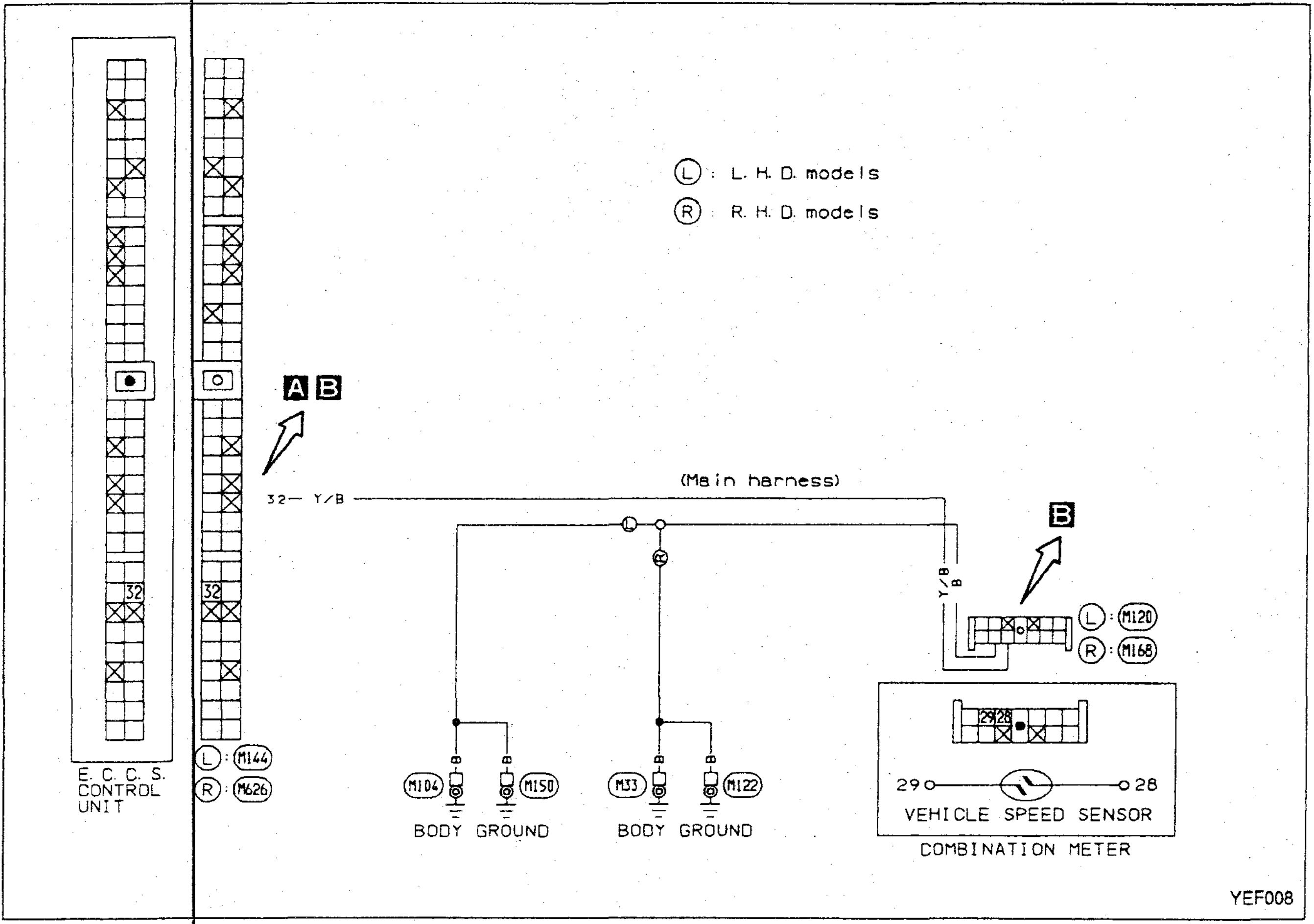


Perform FINAL CHECK by the following procedure after repair is completed.

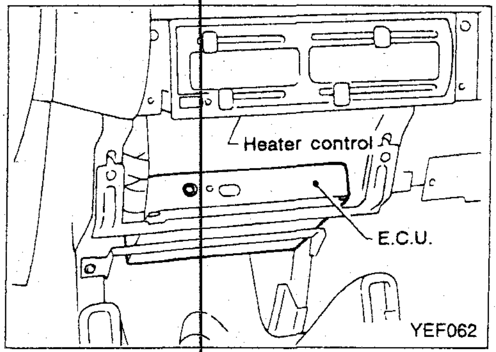


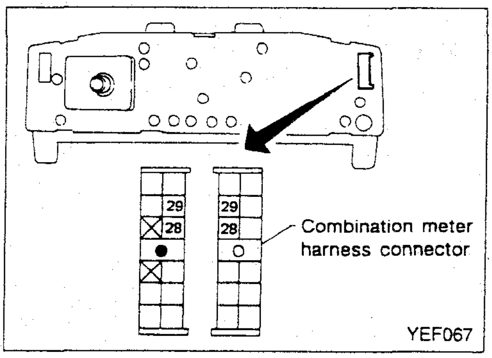
Diagnostic Procedure 29

VEHICLE SPEED SENSOR (Not self-diagnostic item)



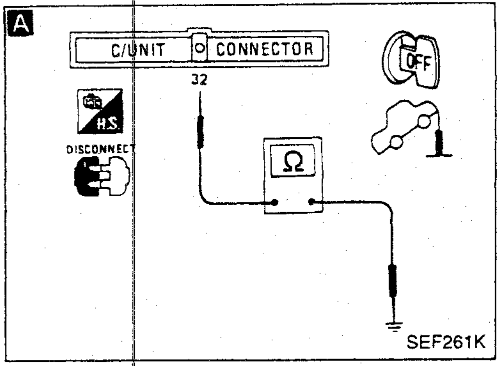
Harness layout





Diagnostic Procedure 29 (Cont'd)

INSPECTION START



SEF261K

A

CHECK OVERALL FUNCTION.
1) Jack up drive wheels.
2) Disconnect E.C.U. harness connector.
3) Rotate drive wheels by hand.
4) Check harness continuity between E.C.U. terminal ㉜ and body ground.
Continuity should come and go.

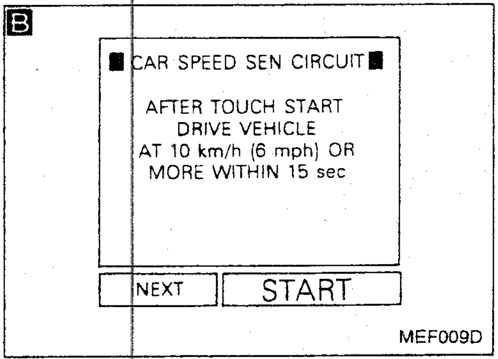
O.K. → INSPECTION END

N.G. ↓

CHECK SPEEDOMETER FUNCTION.
Make sure that speedometer functions properly.

N.G. → Check vehicle speed sensor and its circuit. (Refer to EL section.)

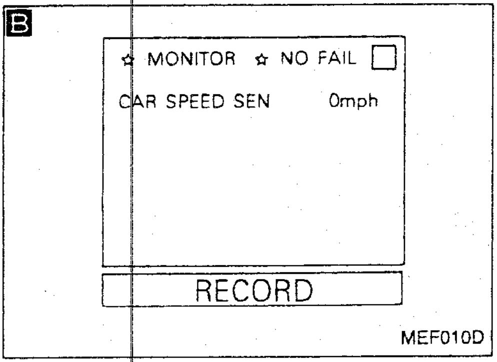
O.K. ↓



CAR SPEED SEN CIRCUIT

AFTER TOUCH START DRIVE VEHICLE AT 10 km/h (6 mph) OR MORE WITHIN 15 sec

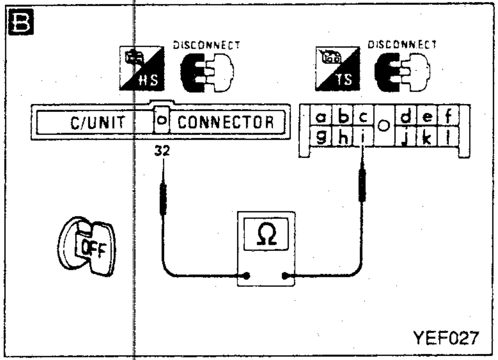
MEF009D



☆ MONITOR ☆ NO FAIL ☐

CAR SPEED SEN 0mph

MEF010D



YEF027

B

CHECK INPUT SIGNAL CIRCUIT.
1) Reconnect E.C.U. harness connector.
2) Perform "CAR SPEED SEN CIRCUIT" in "FUNCTION TEST" mode with CONSULT.

OR

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.

OR

1) Turn ignition switch "OFF".
2) Disconnect combination meter harness connector M120 (L.H.D. models), M168 (R.H.D. models).
3) Check harness continuity between E.C.U. terminal ㉜ and terminal ⓘ.
Continuity should exist.

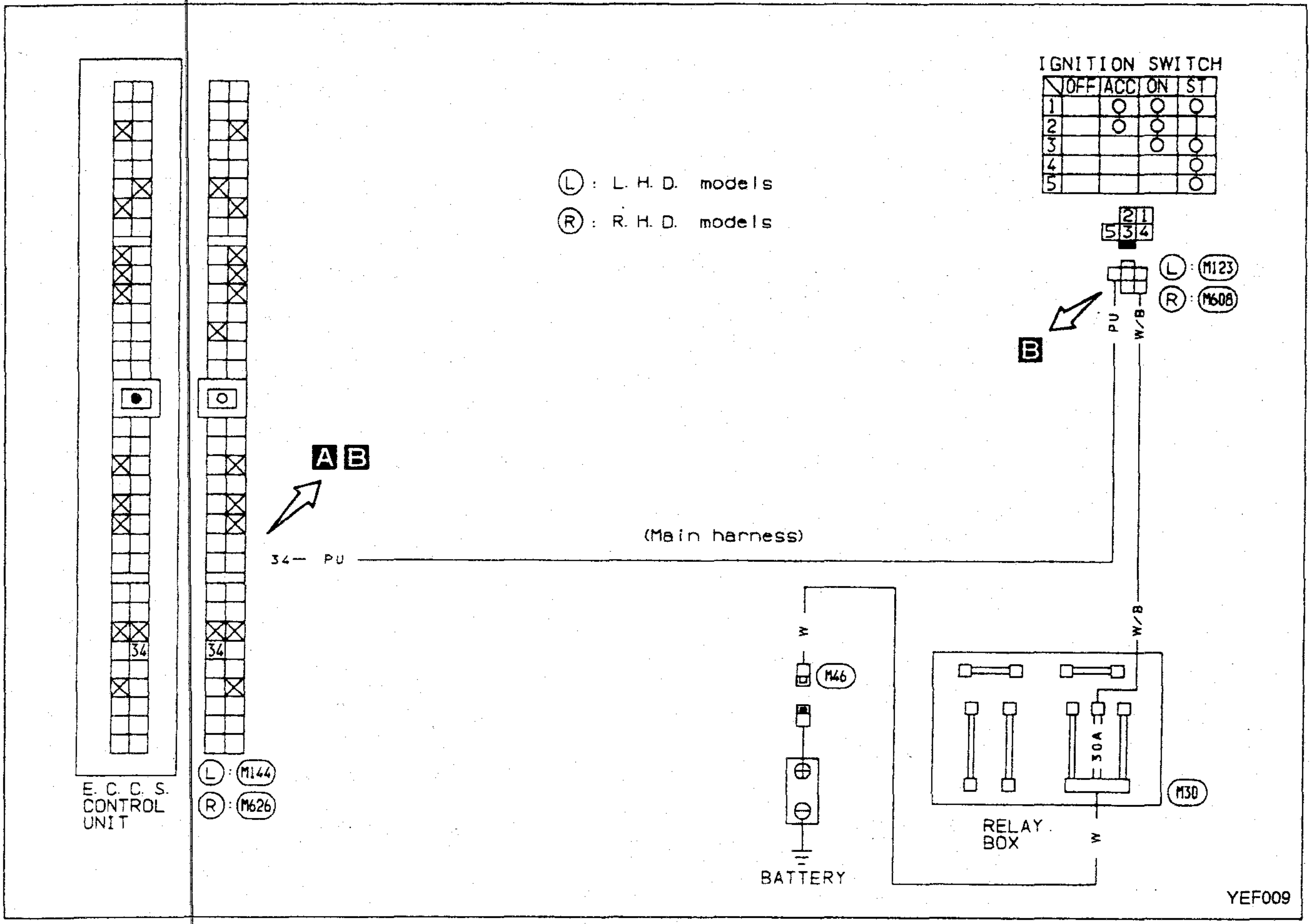
N.G. → Repair harness or connectors.

O.K. ↓

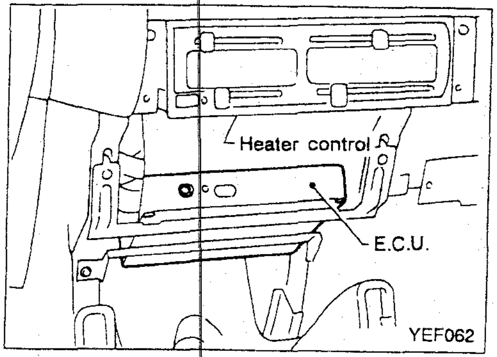
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

Diagnostic Procedure 30

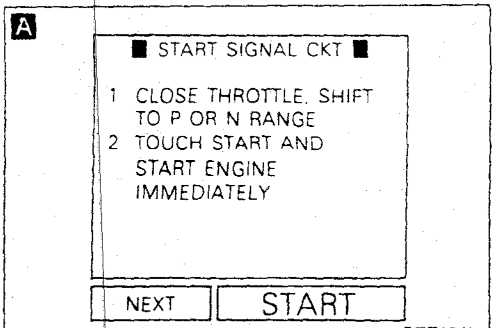
START SIGNAL (Not self-diagnostic item)



Harness layout



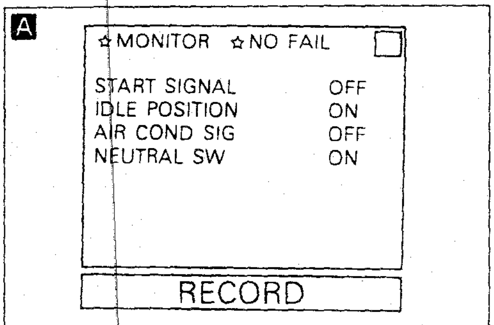
Diagnostic Procedure 30 (Cont'd)



■ START SIGNAL CKT ■

1 CLOSE THROTTLE, SHIFT TO P OR N RANGE
2 TOUCH START AND START ENGINE IMMEDIATELY

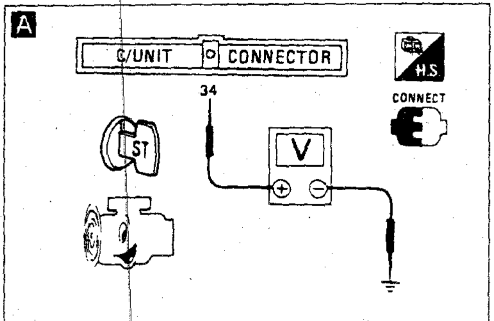
SEF191L



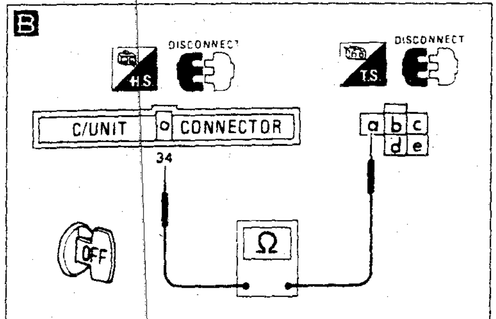
☆MONITOR ☆NO FAIL ☐

START SIGNAL	OFF
IDLE POSITION	ON
AIR COND SIG	OFF
NEUTRAL SW	ON

SEF149I



SEF958I



YEF028

INSPECTION START

A

CHECK OVERALL FUNCTION.

1) Turn ignition switch "ON".
2) Perform "START SIGNAL CIRCUIT" in "FUNCTION TEST" mode with CONSULT.

OR

1) Turn ignition switch "ON".
2) Check start signal in "DATA MONITOR" mode with CONSULT.

IGN "ON"	OFF
IGN "START"	ON

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

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 ㉞ and terminal ⓐ.
   Continuity should exist.

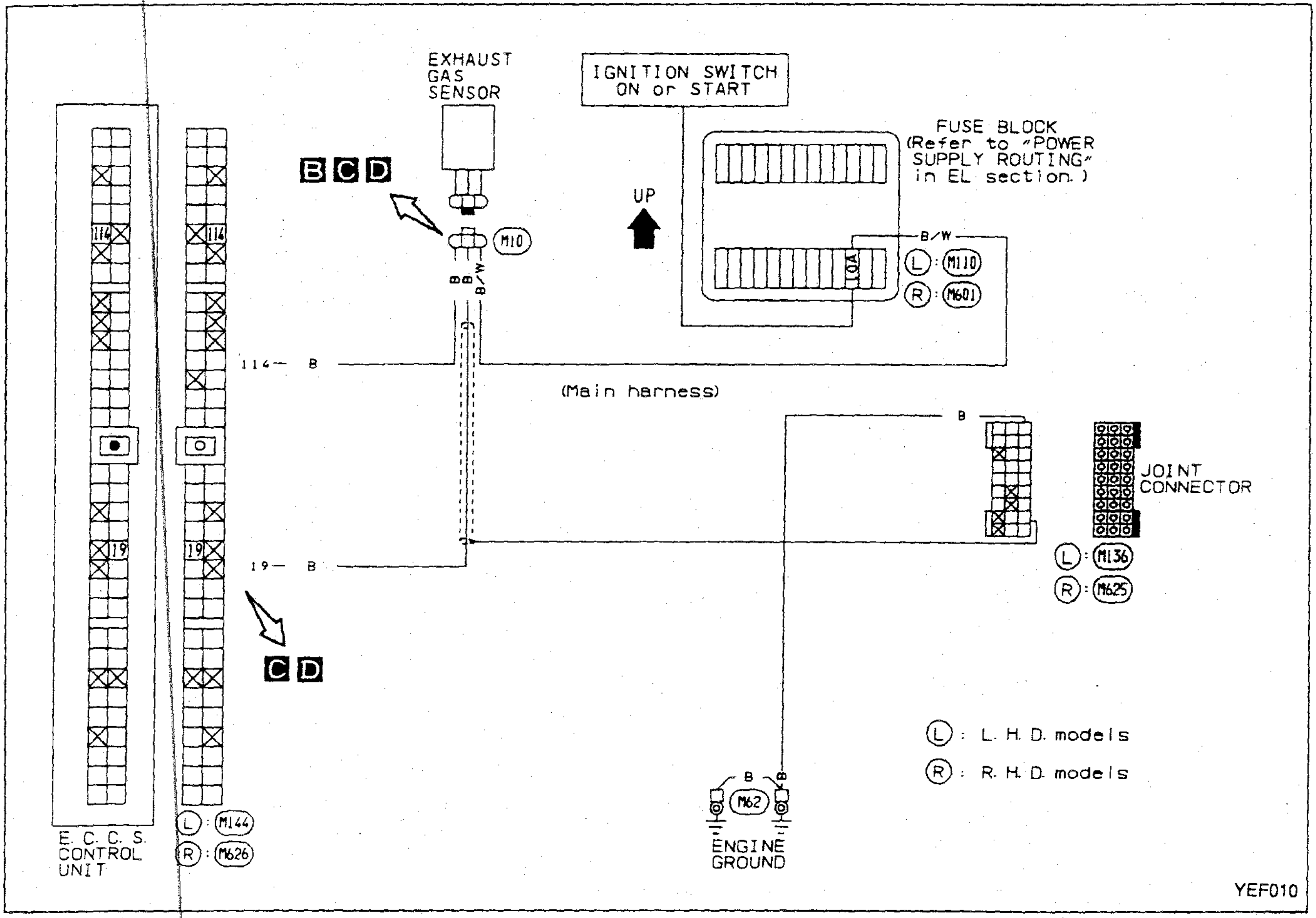
N.G. → Repair harness or connectors.

O.K.

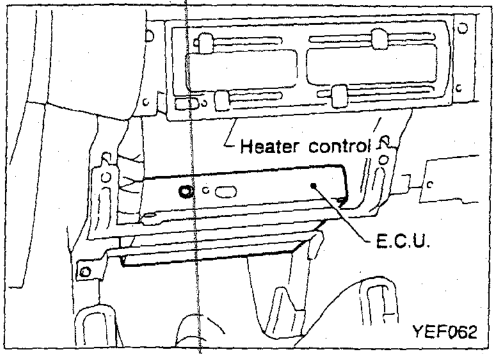
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

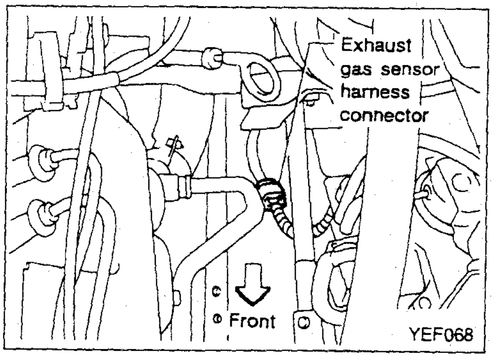
Diagnostic Procedure 31

EXHAUST GAS SENSOR (Not self-diagnostic item)

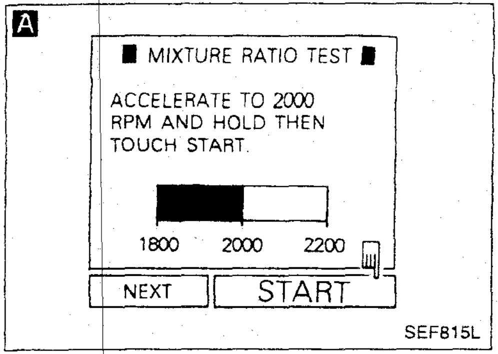


Harness layout





Diagnostic Procedure 31 (Cont'd)

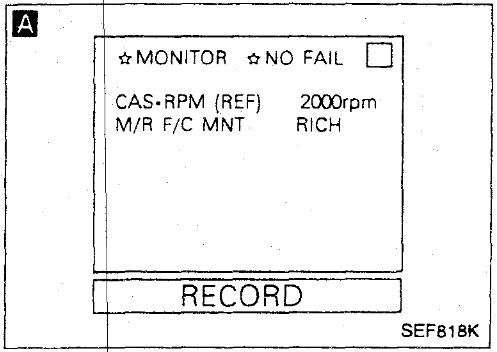


■ MIXTURE RATIO TEST ■

ACCELERATE TO 2000 RPM AND HOLD THEN TOUCH START.

1800 2000 2200

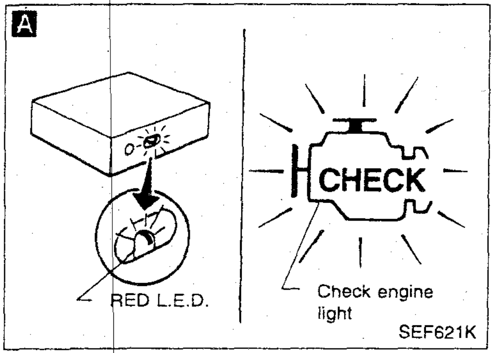
NEXT START

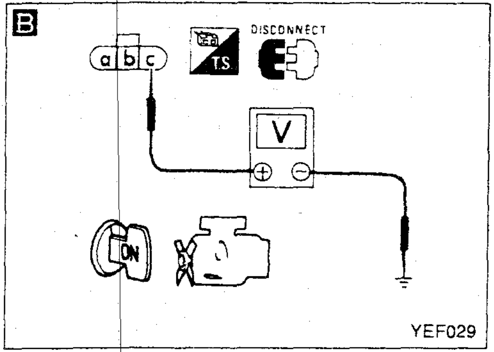


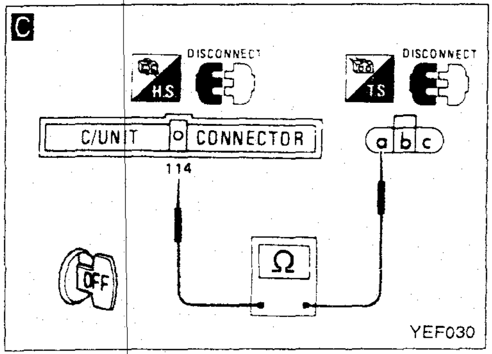
☆MONITOR ☆NO FAIL ☐

CAS·RPM (REF)	2000rpm
M/R F/C MNT	RICH

RECORD







INSPECTION START

A

CHECK EXHAUST GAS SENSOR CIRCUIT.

1) Start engine and warm it up sufficiently.
2) Perform "MIXTURE RATIO TEST" in "FUNCTION TEST" mode with CONSULT.

OR

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. (Refer to "HOW TO SWITCH MODES", EF & EC -42.)
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 ⓒ and ground.

Voltage: Battery voltage

N.G. → Check the following.
- 10A 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 terminal ⓐ and E.C.U. terminal (114).

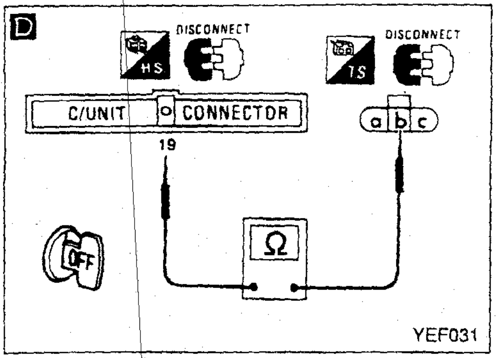
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

(Go to Ⓐ on next page.)

Diagnostic Procedure 31 (Cont'd)



Ⓐ

D

CHECK INPUT SIGNAL CIRCUIT.
1) Check harness continuity between E.C.U. terminal ⑲ and terminal ⓑ.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

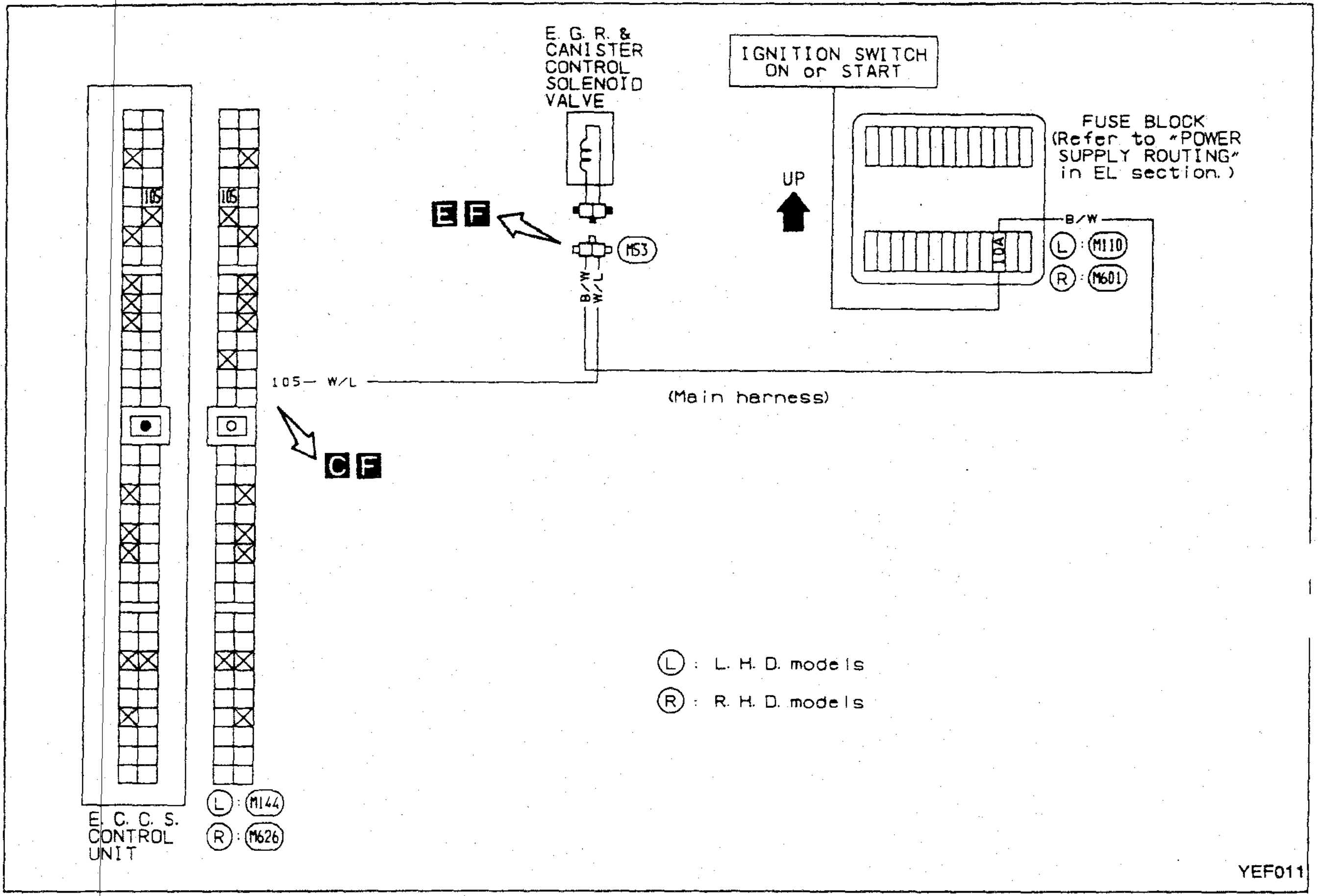
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

O.K. ↓

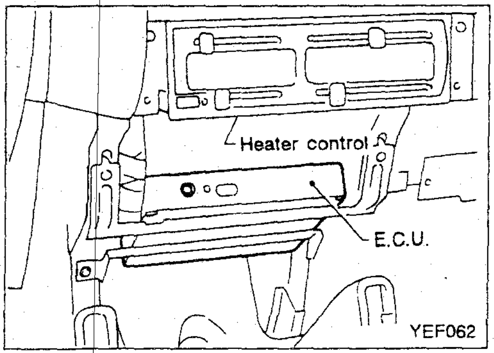
Replace exhaust gas sensor.

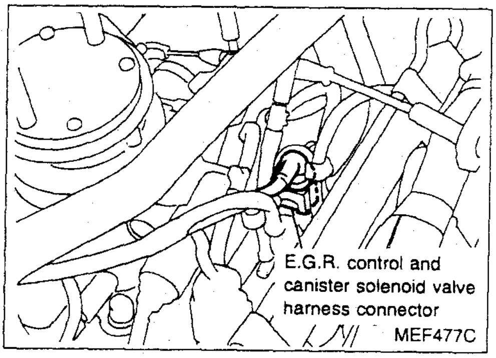
Diagnostic Procedure 32

E.G.R. CONTROL (Not self-diagnostic item)

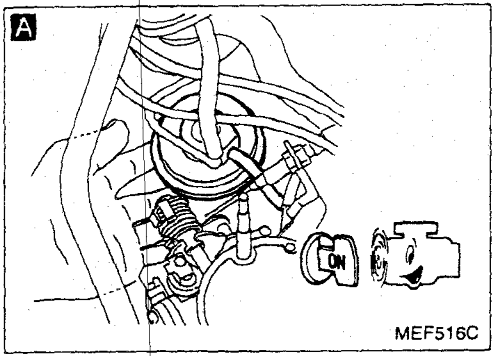


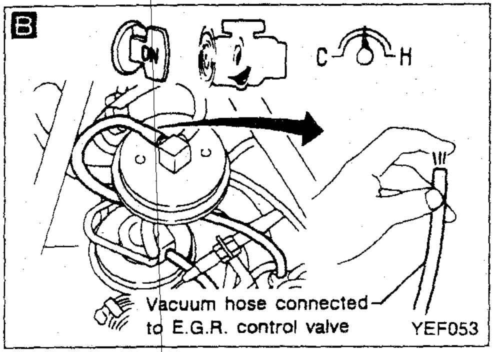
Harness layout

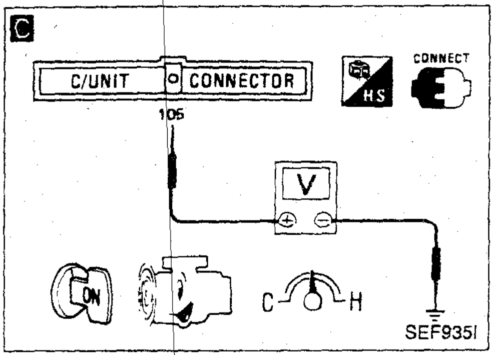


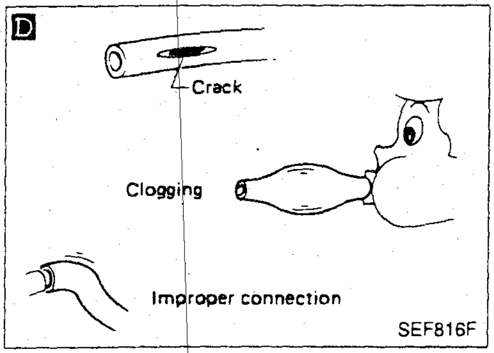


Diagnostic Procedure 32 (Cont'd)









INSPECTION START

A

CHECK OVERALL FUNCTION.

1) Start engine and warm it up sufficiently.
2) Perform self-diagnosis. Make sure that code No. 12 is not displayed.
3) Keep engine at about 2,000 rpm. Make sure that E.G.R. control valve spring is lifted up and down when racing engine. (Use your finger.)

Moves up and down. → INSPECTION END

Does not move up and down.

B

CHECK VACUUM SOURCE TO E.G.R. CONTROL VALVE.

1) Disconnect vacuum hose to E.G.R. control valve.
2) Make sure that vacuum exists under the following conditions.
   At idle:
   Vacuum should not exist.
   Racing engine from about 2,000 rpm:
   Vacuum should exist.

O.K. → **CHECK COMPONENTS.** (E.G.R. control valve and B.P.T. valve). Refer to "Electrical Components Inspection". (See page EF & EC-161.)

N.G. → Replace malfunctioning component(s).

N.G.

C

CHECK CONTROL FUNCTION.

1) Check voltage between E.C.U. terminal ⑩⑤ and ground under the following conditions.
   Voltage:
   At idle
   Approximately 0 - 1.0V
   Racing engine from about 2,000 rpm
   Battery voltage

O.K. → **D** **CHECK VACUUM HOSE.**

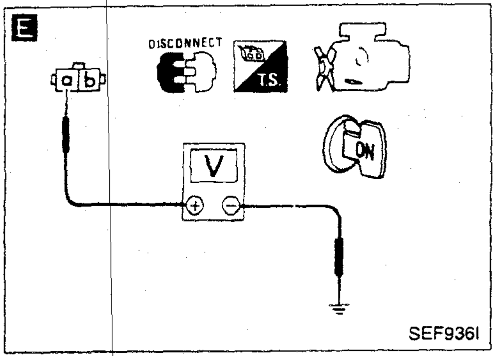
1) Check vacuum hose for clogging, cracks and proper connection.

N.G.

(Go to Ⓐ on next page)

Diagnostic Procedure 32 (Cont'd)

Ⓐ



SEF936I

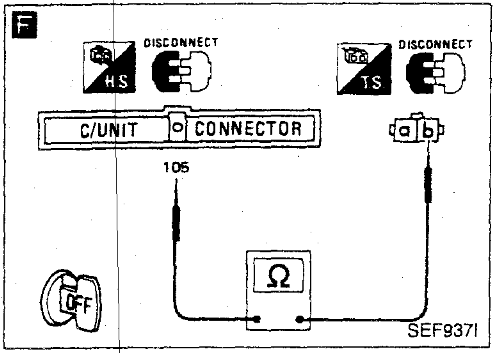
E

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.
- 10A fuse

If N.G., repair harness or connectors.

O.K. ↓



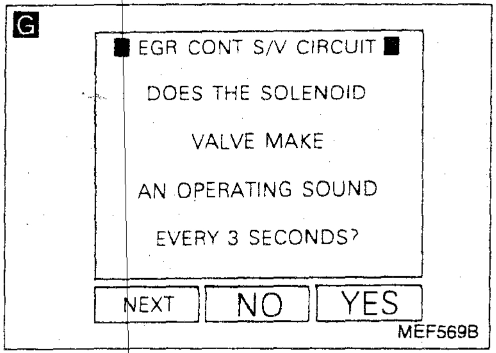
SEF937I

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 (105) and terminal ⓑ.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

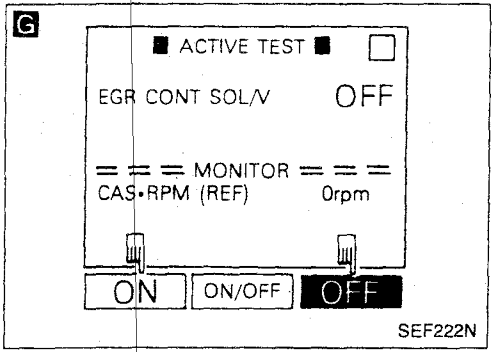


■ EGR CONT S/V CIRCUIT ■

DOES THE SOLENOID VALVE MAKE AN OPERATING SOUND EVERY 3 SECONDS?

NEXT NO YES

MEF569B



■ ACTIVE TEST ■ ☐

EGR CONT SOL/V OFF

=== MONITOR ===
CAS•RPM (REF) 0rpm

ON ON/OFF OFF

SEF222N

G

CHECK COMPONENT.
(E.G.R. & canister control solenoid valve).
1) Reconnect E.C.U. harness connector and E.G.R. & canister control solenoid valve harness connector.
2) Turn ignition switch "ON".
3) Perform "EGR CONT S/V CIRCUIT" in "FUNCTION TEST" mode with CONSULT.

OR

1) Reconnect E.G.R. & canister control solenoid valve harness connector and E.C.U. harness connector.
2) Turn ignition switch "ON".
3) Turn E.G.R. & canister control solenoid valve "ON" and "OFF" in "ACTIVE TEST" mode with CONSULT and check operating sound.

OR

Refer to "Electrical Components Inspection".
(See page EF & EC-162.)

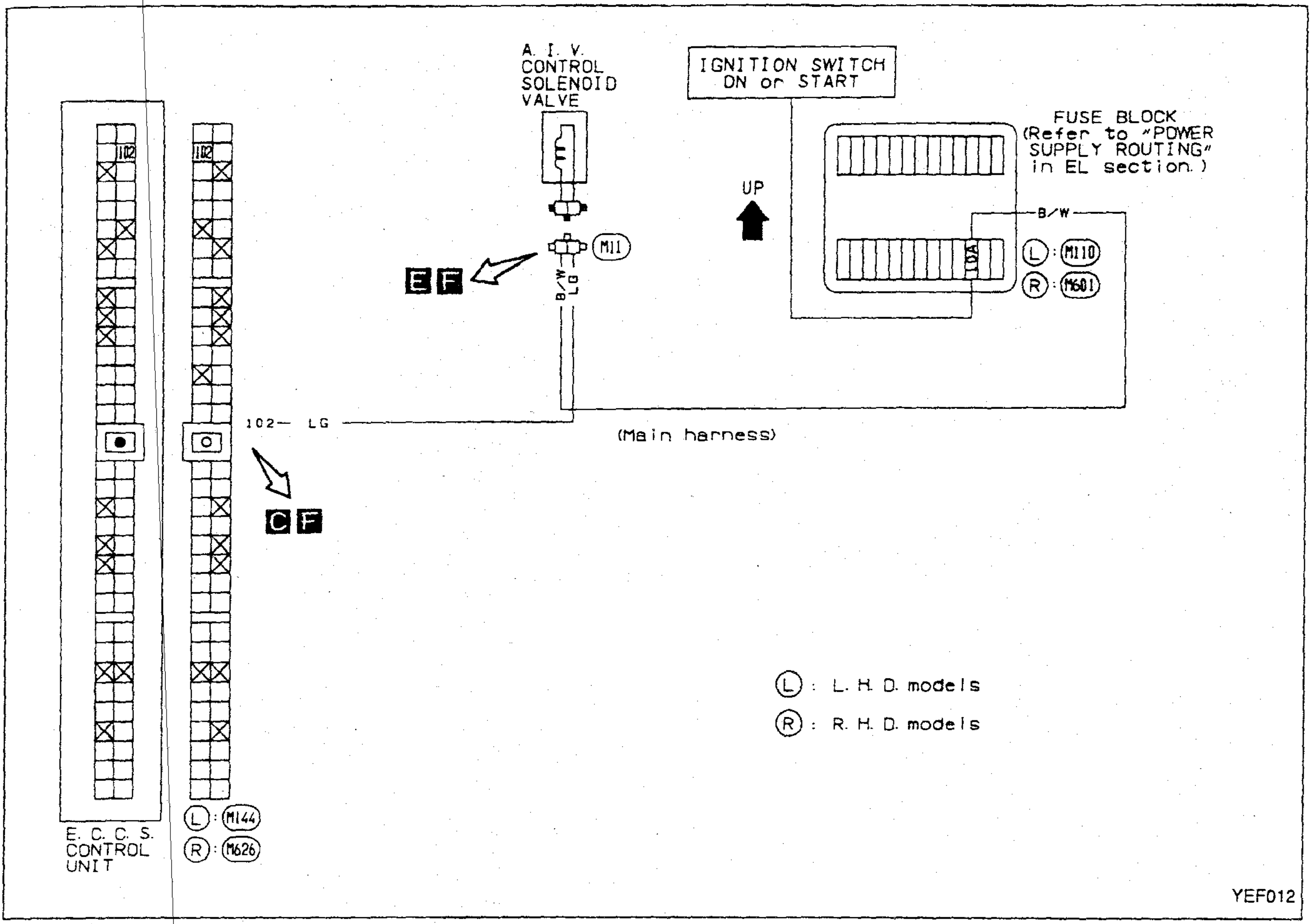
N.G. → Replace E.G.R. & canister control solenoid valve.

O.K. ↓

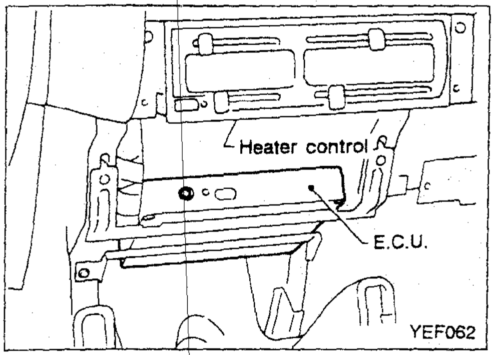
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

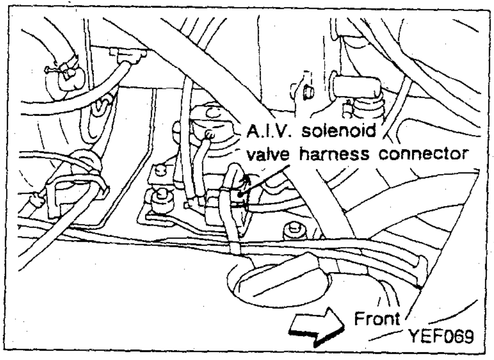
Diagnostic Procedure 33

A.I.V. CONTROL (Not self-diagnostic item)

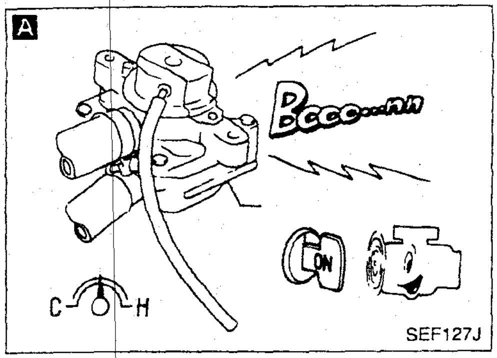


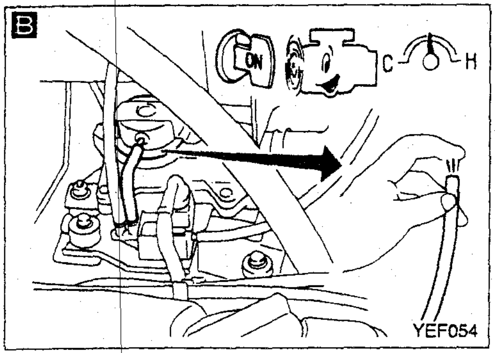
Harness layout

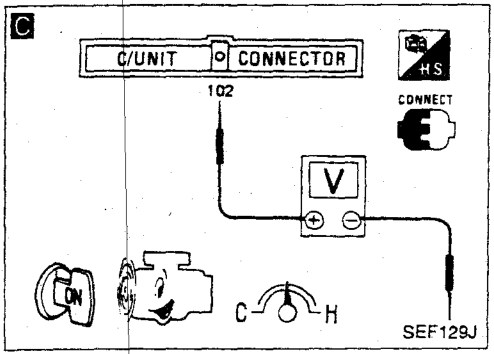


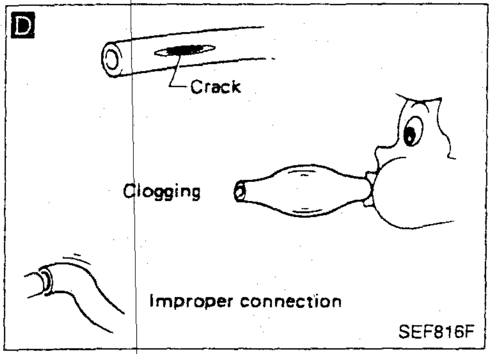


Diagnostic Procedure 33 (Cont'd)









INSPECTION START

A

CHECK OVERALL FUNCTION.

1) Start engine and warm it up sufficiently.
2) Run engine at about 2,000 rpm for about 2 minutes under no-load.
3) Release accelerator pedal fully, and run engine at Idle.
4) Shift the gear position from "N" to any other position with clutch pedal depressed, then return to "N" position.
5) Listen to A.I.V. operating sound.

At idle:
A.I.V. should operate.
2,000 rpm ("N" position):
A.I.V. should not operate.

O.K. → INSPECTION END

N.G. ↓

B

CHECK VACUUM SOURCE TO A.I.V.

1) Disconnect vacuum hose to A.I.V.
2) Make sure that vacuum exists under the following conditions.

At idle:
Vacuum should exist.
2,000 rpm:
Vacuum should not exist.

O.K. → **CHECK COMPONENT** (A.I.V.). Refer to "Electrical Components Inspection". (See page EF & EC-164.)

N.G. ↓

C

CHECK CONTROL FUNCTION.

1) Check voltage between E.C.U. terminal (102) and ground.

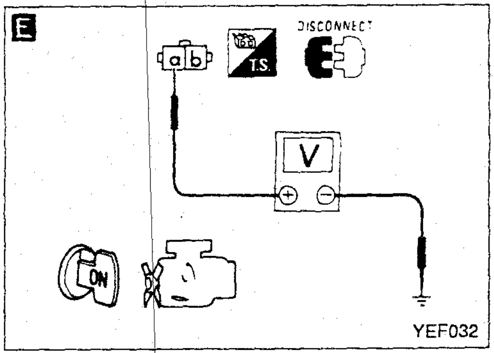
Voltage:
At idle and during deceleration:
Approximately 0V
2,000 above:
Battery voltage

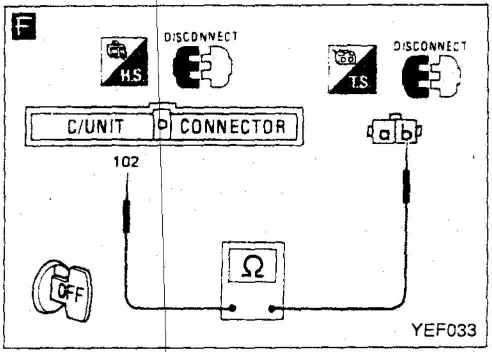
O.K. → **D** **CHECK VACUUM HOSE** Check vacuum hose for clogging, cracks and proper connections.

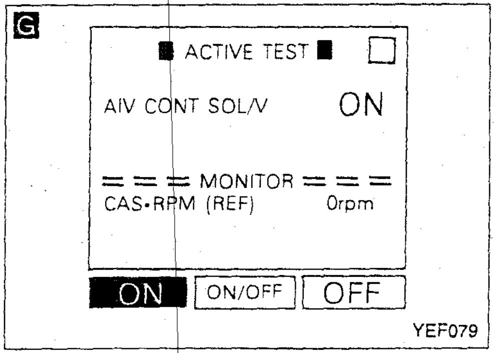
N.G. ↓

(Go to Ⓐ on next page.)

Diagnostic Procedure 33 (Cont'd)







■ ACTIVE TEST ■ ☐

AIV CONT SOL/V ON

=== MONITOR ===

CAS•RPM (REF) 0rpm

Ⓐ

E

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

N.G. → Check the following.
- 10A fuse
- Harness continuity between ignition switch and A.I.V. control solenoid valve

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 (102) and terminal ⓑ.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K.

G

CHECK COMPONENT.
(A.I.V. control solenoid valve).
1) Reconnect E.C.U. harness connector and A.I.V. control solenoid valve harness connector.
2) Turn ignition switch "ON".
3) Perform "A.I.V. CONTROL SOLENOID VALVE TEST" in "ACTIVE TEST" mode with CONSULT.

OR

Refer to "Electrical Components Inspection".
(See page EF & EC-162.)

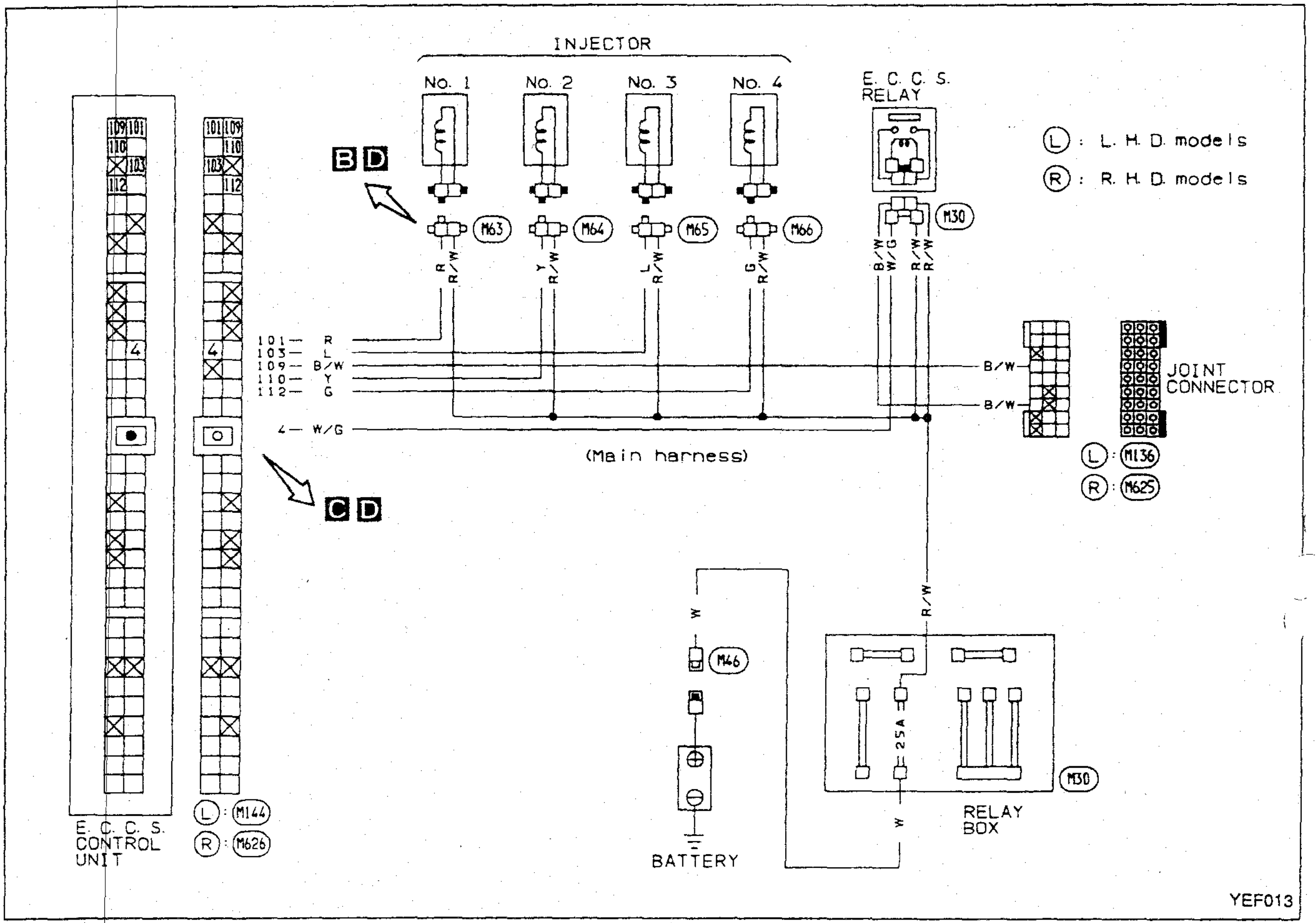
N.G. → Replace A.I.V. control solenoid valve.

O.K.

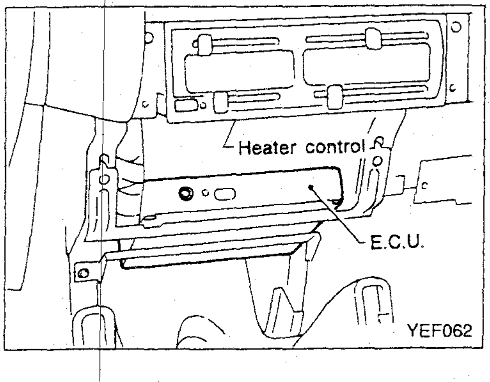
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

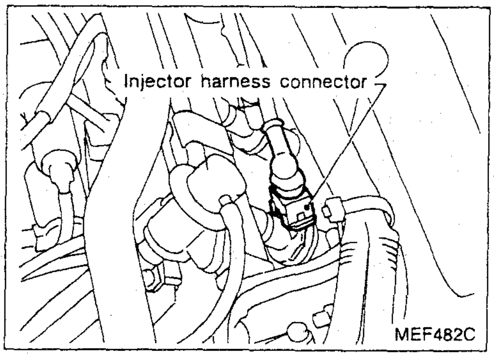
Diagnostic Procedure 34

INJECTOR (Not self-diagnostic item)



Harness layout

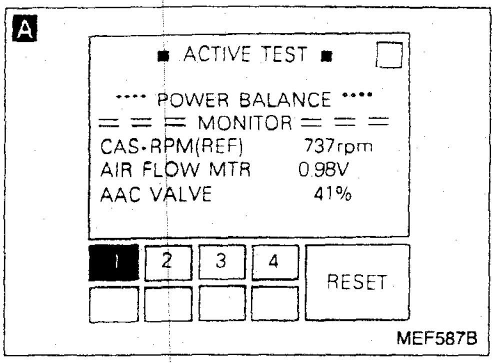




Diagnostic Procedure 34 (Cont'd)

INSPECTION START

A


A

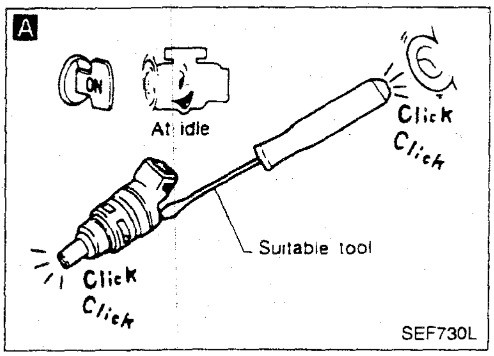
■ ACTIVE TEST ■

···· POWER BALANCE ····

= = = MONITOR = = =

CAS·RPM(REF)	737rpm
AIR FLOW MTR	0.98V
AAC VALVE	41%

MEF587B



SEF730L

CHECK OVERALL FUNCTION.

1) Start engine.

2) Perform "POWER BALANCE" in "ACTIVE TEST" mode with CONSULT.

3) Make sure that each circuit produces a momentary engine speed drop.

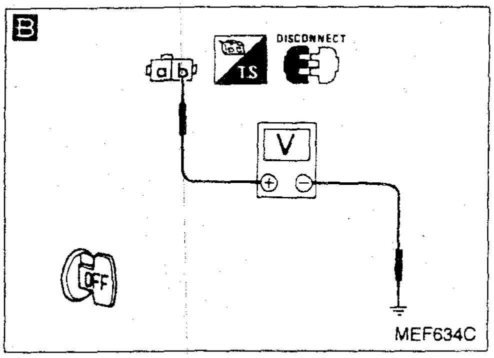
OR

2) Listen to each injector operating sound.

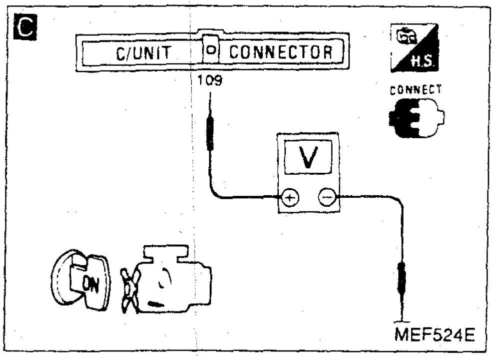
Clicking noise could be heard.

O.K. → INSPECTION END

N.G. ↓



MEF634C



MEF524E

CHECK POWER SUPPLY.

1) Stop engine.

2) Disconnect injector harness connector.

B 3) Check voltage between terminal ⓑ and ground.

Voltage: Battery voltage

4) Turn ignition switch "ON".

C 5) Check voltage between E.C.U. terminal (109) and ground.

Voltage: Battery voltage

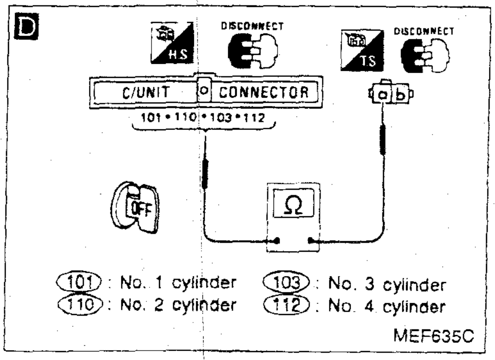
N.G. → Check the following.

- Joint connector (M136) (L.H.D. models), (M625) (R.H.D. models)
- 25A fusible link (In the relay box)
- Harness continuity between injector and battery

If N.G., repair harness or connectors.

O.K. ↓

D



MEF635C

CHECK OUTPUT SIGNAL CIRCUIT.

1) Turn ignition switch "OFF".

2) Disconnect E.C.U. harness connector.

3) Check harness continuity between terminal ⓐ and E.C.U. terminals (101), (110), (103), (112).

Continuity should exist.

N.G. → Repair harness or connector.

O.K. ↓

CHECK COMPONENT.

(Injector).

Refer to "Electrical Components Inspection".

(See page EF & EC-163.)

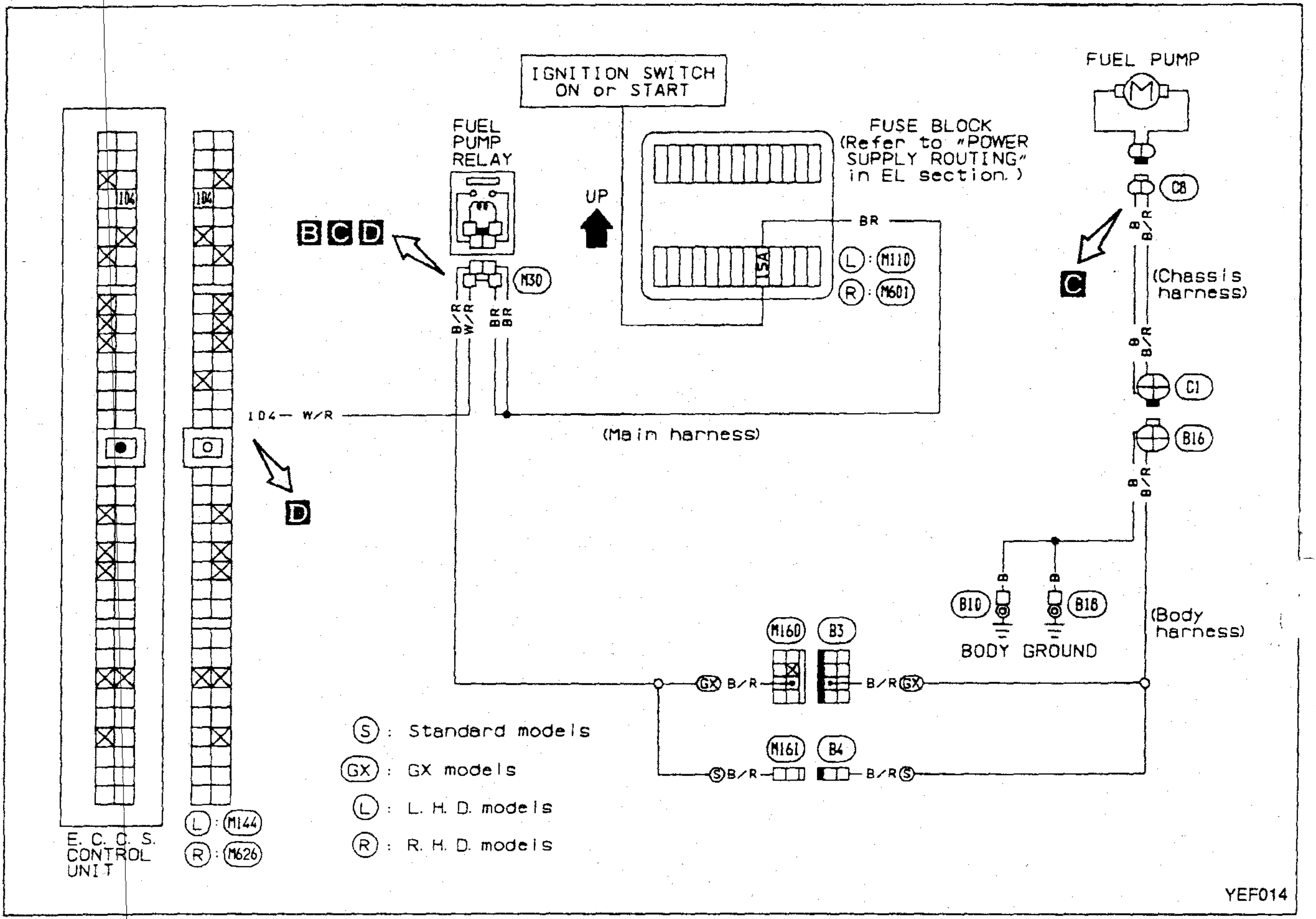
N.G. → Replace injector.

O.K. ↓

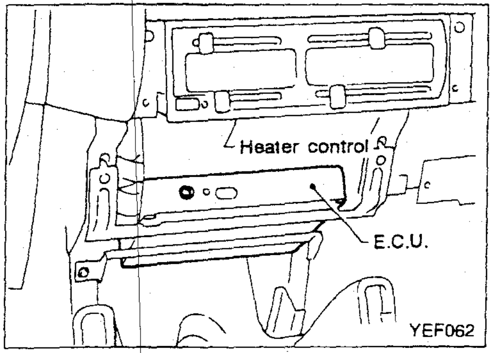
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

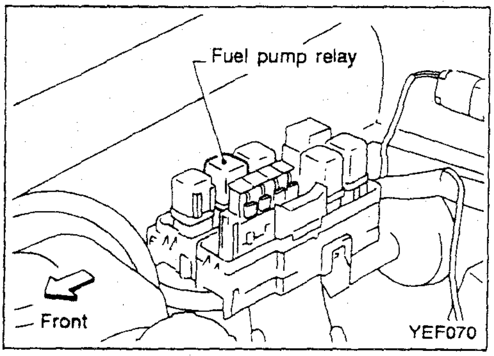
Diagnostic Procedure 35

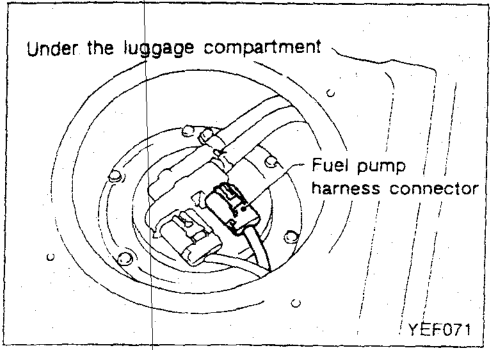
FUEL PUMP (Not self-diagnostic item)



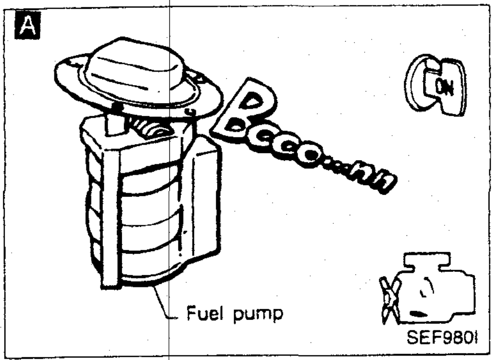
Harness layout







Diagnostic Procedure 35 (Cont'd)



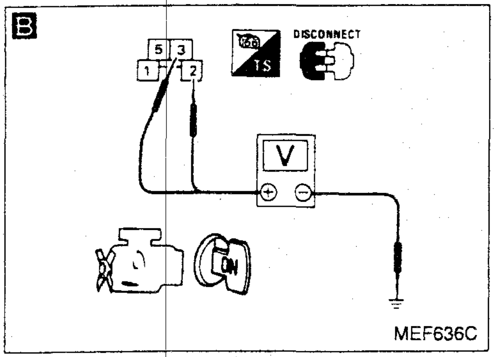
INSPECTION START

A

CHECK OVERALL FUNCTION.
1) Turn ignition switch "ON".
2) Listen to fuel pump operating sound.
Fuel pump should operate for 5 seconds after ignition switch is turned "ON".

O.K. → INSPECTION END

N.G. ↓



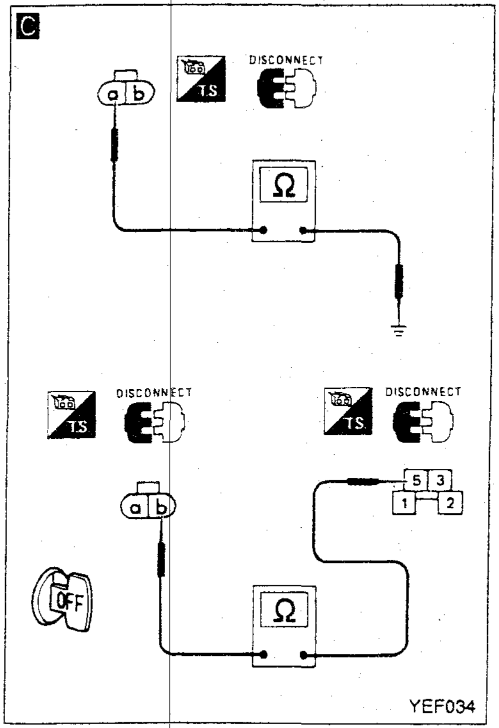
B

CHECK POWER SUPPLY.
1) Turn ignition switch "OFF".
2) Disconnect fuel pump relay.
3) Turn ignition switch "ON".
4) Check voltage between terminals ②, ③ and ground.
Voltage: Battery voltage

N.G. → Check the following.
- 15A fuse
- Harness continuity between fuse and fuel pump relay

If N.G., repair harness or connectors.

O.K. ↓

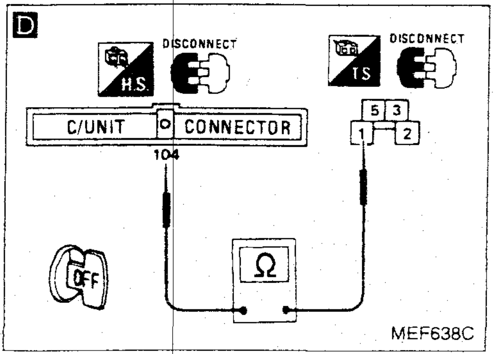


C

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. → Repair harness or connectors.

O.K. ↓



D

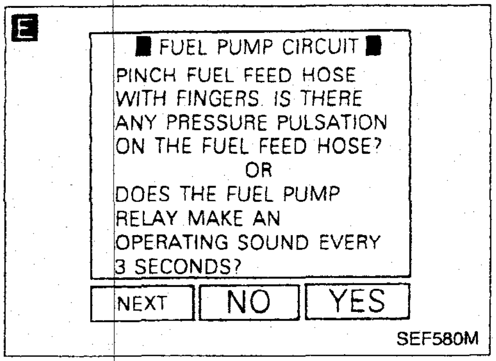
CHECK OUTPUT SIGNAL CIRCUIT.
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal (104) and terminal ①.
Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

(Go to Ⓐ on next page)

Diagnostic Procedure 35 (Cont'd)



■ FUEL PUMP CIRCUIT ■

PINCH FUEL FEED HOSE WITH FINGERS. IS THERE ANY PRESSURE PULSATION ON THE FUEL FEED HOSE?

OR

DOES THE FUEL PUMP RELAY MAKE AN OPERATING SOUND EVERY 3 SECONDS?

SEF580M

Ⓐ

CHECK COMPONENTS.

(Fuel pump and fuel pump relay).

1) Reconnect fuel pump relay, fuel pump harness connector and E.C.U. harness connector.
2) Turn ignition switch "ON".
3) Perform "FUEL PUMP CIRCUIT" in "FUNCTION TEST" mode with CONSULT.

OR

Refer to "Electrical Components Inspection".
(See page EF & EC-163.)

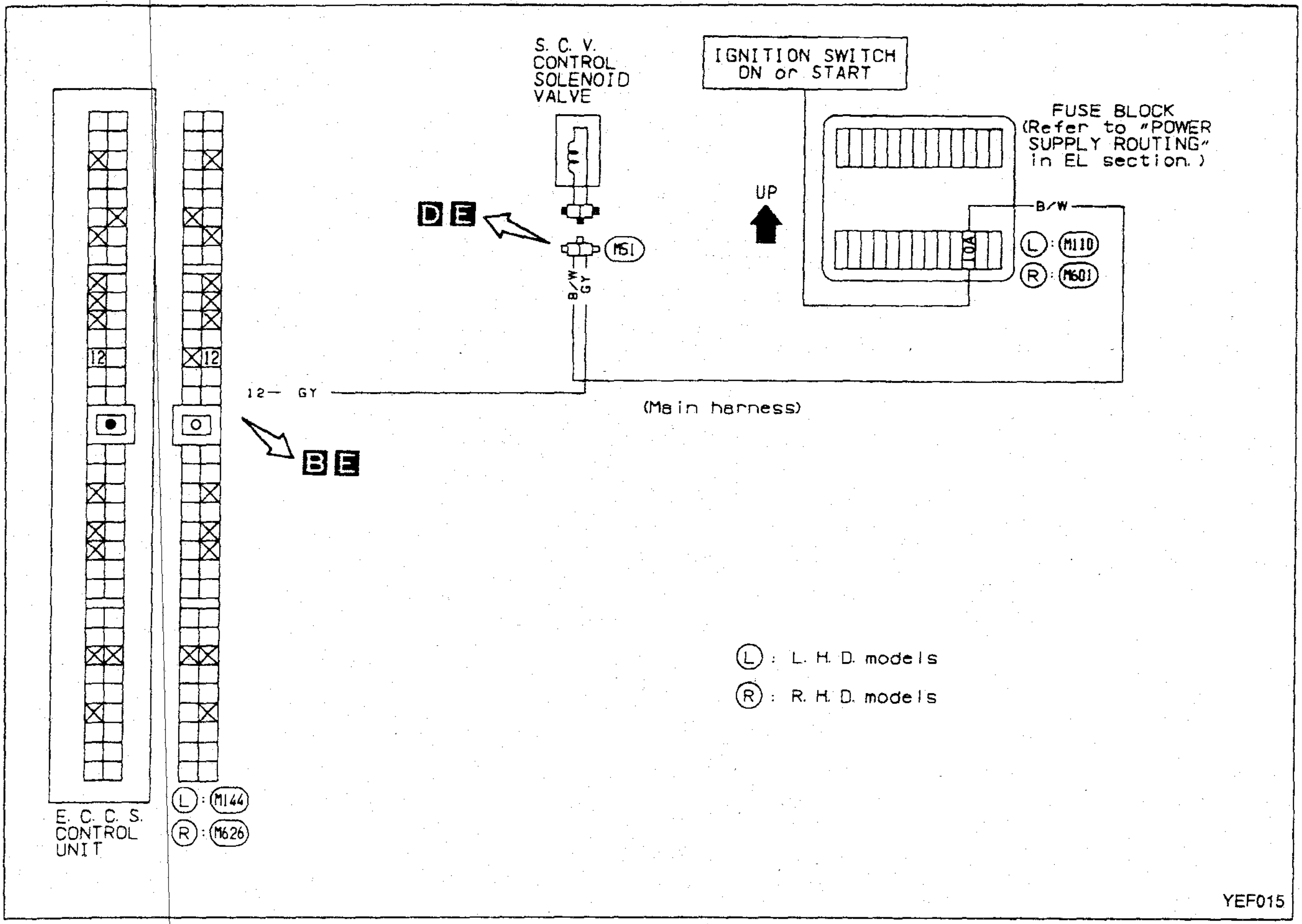
N.G. → Replace malfunctioning component(s).

O.K. ↓

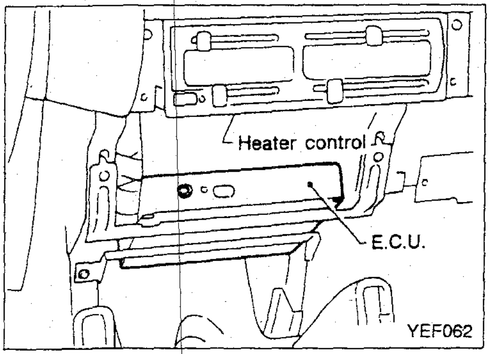
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

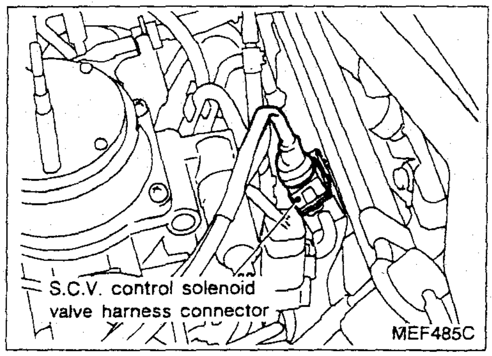
Diagnostic Procedure 36

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



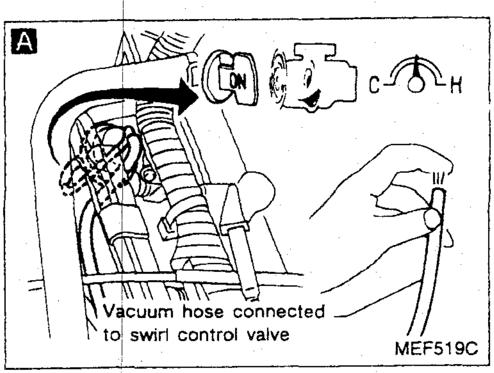
Harness layout





Diagnostic Procedure 36 (Cont'd)

INSPECTION START



A

CHECK VACUUM SOURCE TO SWIRL CONTROL VALVE.

1) Start engine and warm it up sufficiently.
2) Stop engine.
3) After a few seconds, disconnect vacuum hose to swirl control valve and restart engine.
4) Make sure that vacuum exists under the following conditions.

At idle:

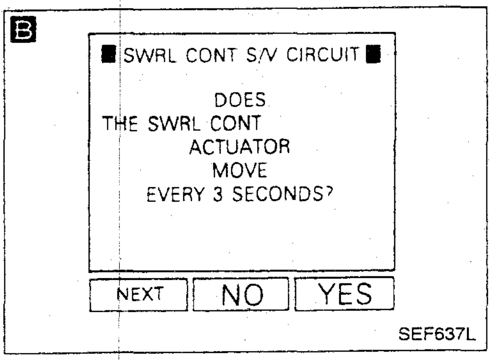
Vacuum should exist.

Engine speed is about 3,800 rpm:

Vacuum should not exist.

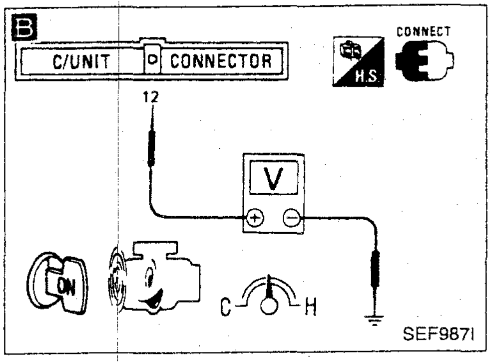
O.K. → INSPECTION END

N.G. ↓



■ SWRL CONT S/V CIRCUIT ■

DOES THE SWRL CONT ACTUATOR MOVE EVERY 3 SECONDS?



B

CHECK CONTROL FUNCTION.

1) Turn ignition switch "ON".
2) Perform "SWRL CONT S/V CIRCUIT" in "FUNCTION TEST" mode with CONSULT.

OR

2) Check voltage between E.C.U. terminal ⑫ and ground.

Voltage:

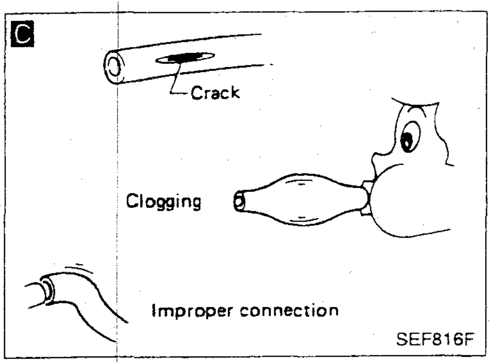
At idle

Approximately 0 - 1.0V

Engine speed is about 3,800 rpm:

Battery voltage

O.K. ↓

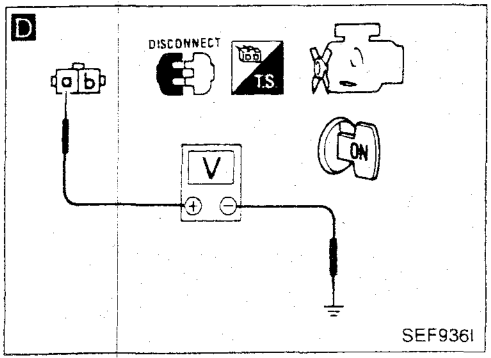


C

CHECK VACUUM HOSE AND SWIRL CONTROL VALVE (S.C.V.).

1) Check vacuum hose and swirl control valve for clogging, cracks and proper connection.

N.G. ↓



D

CHECK POWER SUPPLY.

1) Stop engine.
2) Disconnect S.C.V. control solenoid valve harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓐ and ground.

Voltage: Battery voltage

N.G. → Check the following.

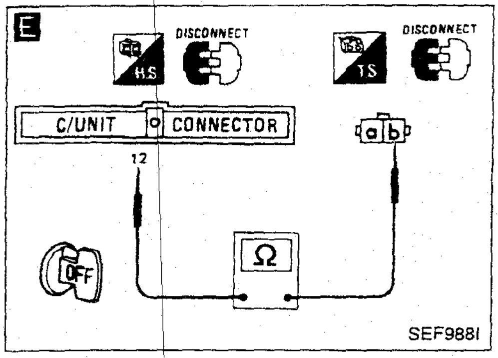
- 10A fuse

If N.G., repair harness or connectors.

O.K. ↓

(Go to Ⓐ on next page.)

Diagnostic Procedure 36 (Cont'd)



SEF988I

Ⓐ

↓

E

CHECK OUTPUT SIGNAL CIRCUIT.
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal ⑫ and terminal ⓑ.
Continuity should exist.

N.G. → Repair harness or connectors.

↓ O.K.

CHECK COMPONENT.
(S.C.V. control solenoid valve).
Refer to "Electrical Components Inspection".
(See page EF & EC-162.)

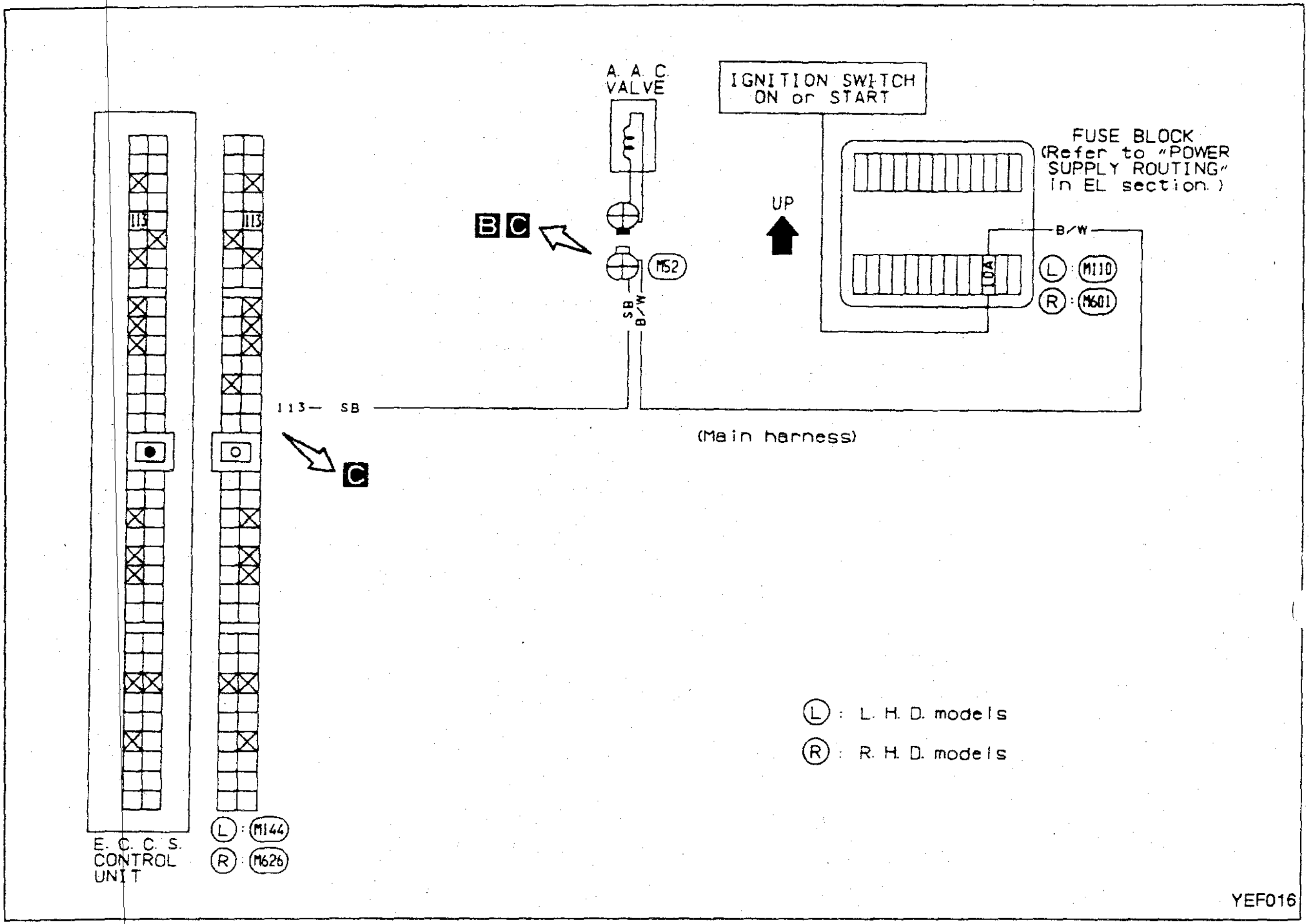
N.G. → Replace S.C.V. control solenoid valve.

↓ O.K.

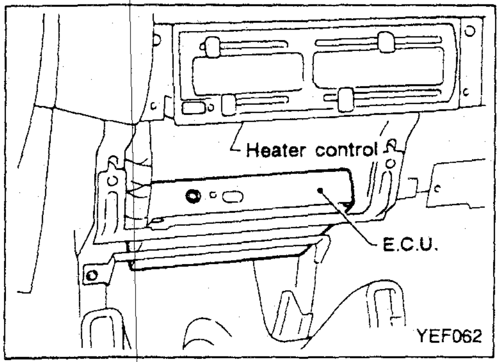
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

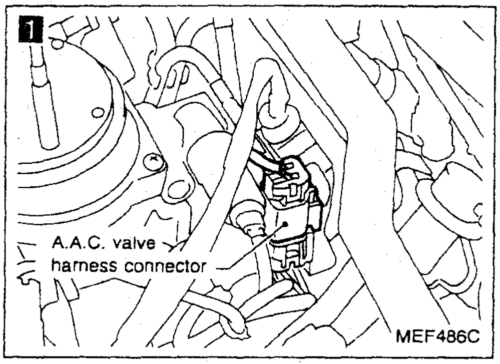
Diagnostic Procedure 37

A.A.C. VALVE (Not self-diagnostic item)



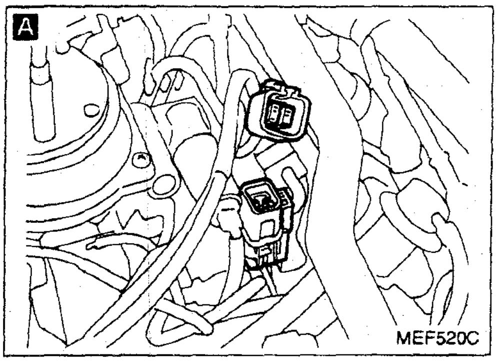
Harness layout





Diagnostic Procedure 37 (Cont'd)

INSPECTION START



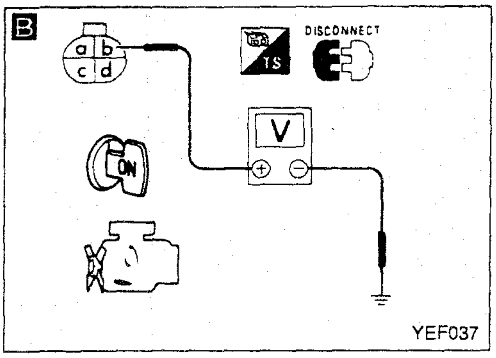
A

CHECK OVERALL FUNCTION.

1) Start engine and warm it up sufficiently.
2) Check idle speed.
   750 ± 25 rpm
   If N.G., adjust idle speed.
3) Disconnect A.A.C. valve harness connector.
4) Make sure that idle speed drops.

Drops. → INSPECTION END

Does not drop. ↓



B

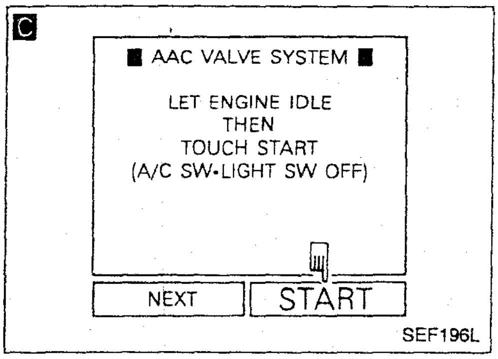
CHECK POWER SUPPLY.

1) Stop engine.
2) Disconnect A.A.C. valve harness connector.
3) Turn ignition switch "ON".
4) Check voltage between terminal ⓑ and ground.
   Voltage: Battery voltage

N.G. → Check the following.
- 10A fuse

If N.G., repair harness or connectors.

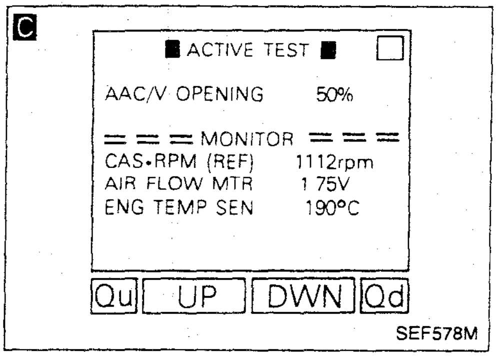
O.K. ↓



■ AAC VALVE SYSTEM ■

LET ENGINE IDLE
THEN
TOUCH START
(A/C SW•LIGHT SW OFF)

NEXT START

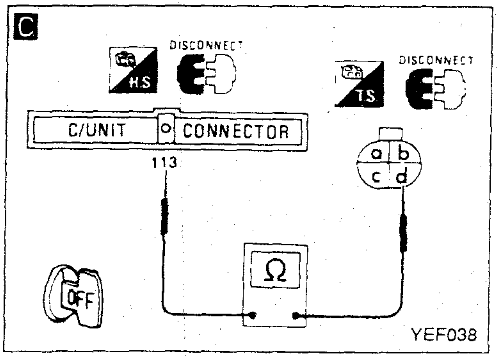


■ ACTIVE TEST ■ ☐

AAC/V OPENING 50%

=== MONITOR ===
CAS•RPM (REF) 1112rpm
AIR FLOW MTR 1.75V
ENG TEMP SEN 190°C

Qu UP DWN Qd



C

CHECK OUTPUT SIGNAL CIRCUIT.

1) Perform "AAC VALVE SYSTEM" in "FUNCTION TEST" mode with CONSULT.

OR

1) Reconnect throttle sensor harness connector.
2) Perform "AAC VALVE OPENING TEST" in "ACTIVE TEST" mode with CONSULT.

OR

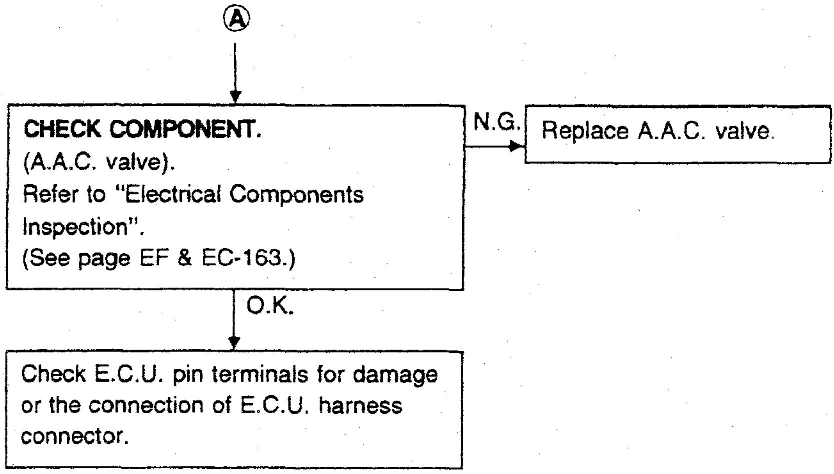
1) Turn ignition switch "OFF".
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal ⑪③ and terminal ⓓ.
   Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

(Go to Ⓐ on next page.)

Diagnostic Procedure 37 (Cont'd)



Ⓐ

CHECK COMPONENT.
(A.A.C. valve).
Refer to "Electrical Components Inspection".
(See page EF & EC-163.)

N.G.

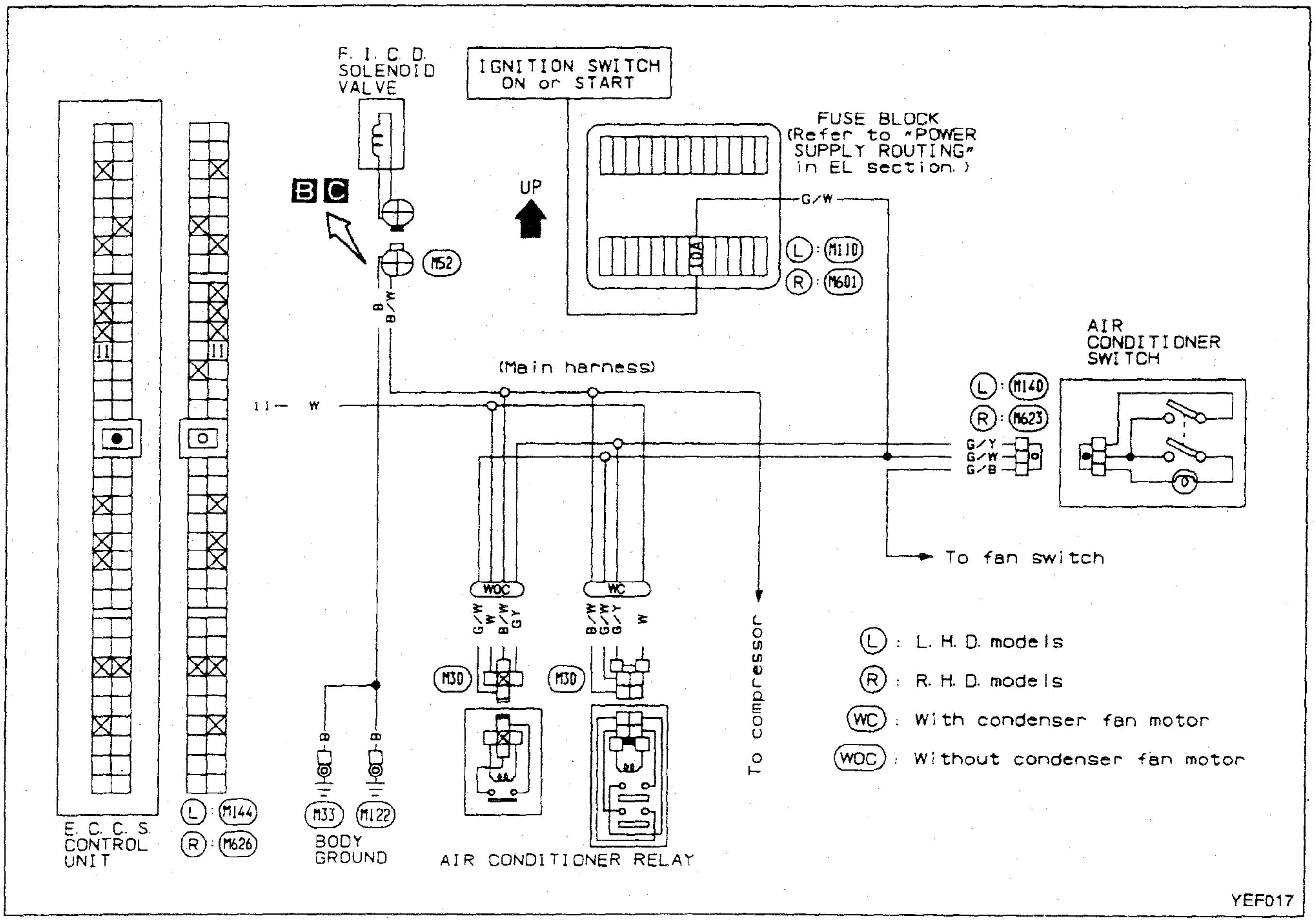
Replace A.A.C. valve.

O.K.

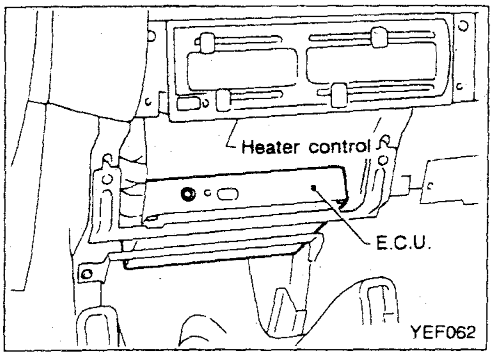
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

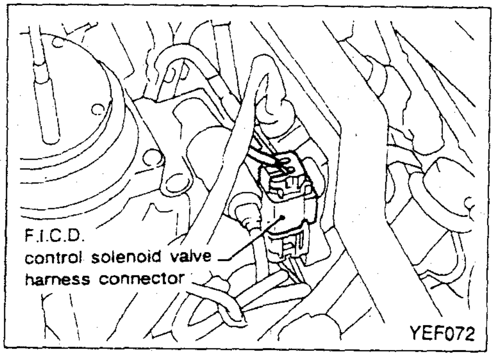
Diagnostic Procedure 38

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

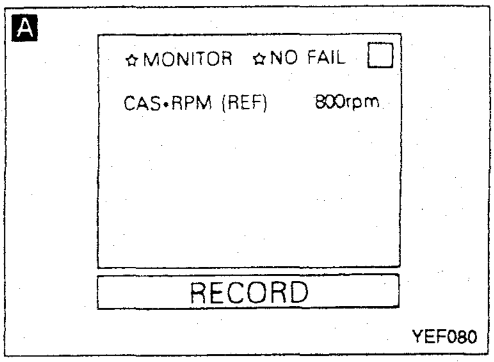


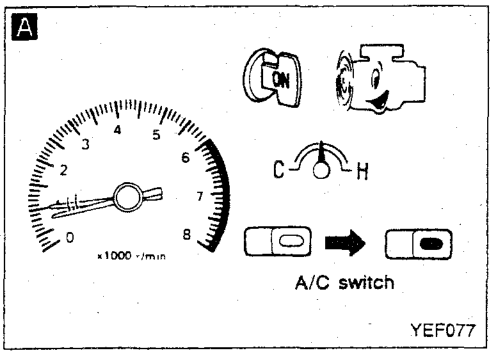
Harness layout

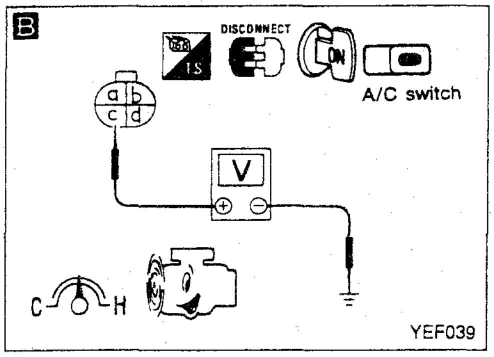


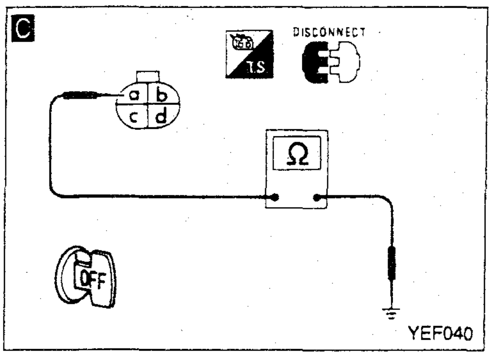


Diagnostic Procedure 38 (Cont'd)









INSPECTION START

↓

A

CHECK OVERALL FUNCTION.
1) Start engine and warm it up sufficiently.
2) Check idle speed.
   - Read idle speed in "DATA MONITOR" mode with CONSULT.

OR

   - Check idle speed.
     800 ± 50 rpm
     If N.G., adjust idle speed.
3) Turn air conditioner switch and blower fan switch "ON".
4) Recheck idle speed.
   900 rpm or more

O.K. → INSPECTION END

↓ N.G.

Check if air conditioner compressor functions normally.

N.G. → Refer to HA section.

↓ O.K.

B

CHECK POWER SUPPLY.
1) Stop engine and turn air conditioner switch and blower fan switch "OFF".
2) Disconnect F.I.C.D. control solenoid valve harness connector.
3) Restart engine and turn air conditioner switch and blower fan switch "ON".
4) Check voltage between terminal ⓒ and ground.
   Voltage: Battery voltage

N.G. → Repair harness or connectors.

↓ O.K.

C

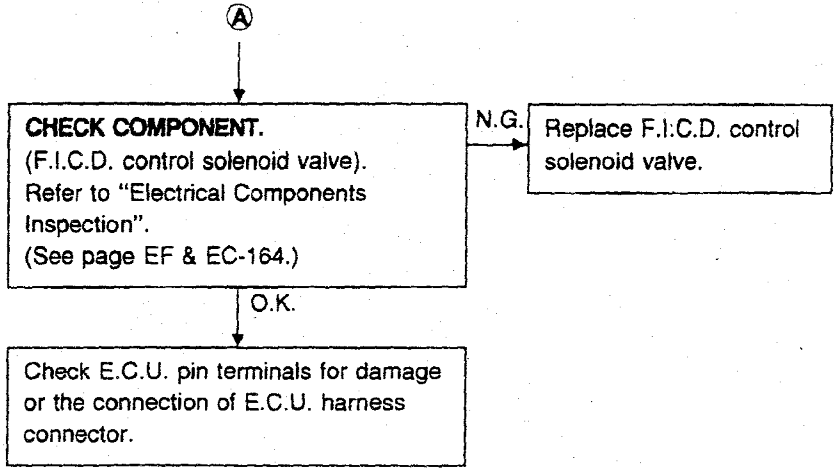
CHECK GROUND CIRCUIT.
1) Stop engine.
2) Check harness continuity between terminal ⓐ and engine ground.
   Continuity should exist.

N.G. → Repair harness or connectors.

↓ O.K.

(Go to Ⓐ on next page.)

Diagnostic Procedure 38 (Cont'd)



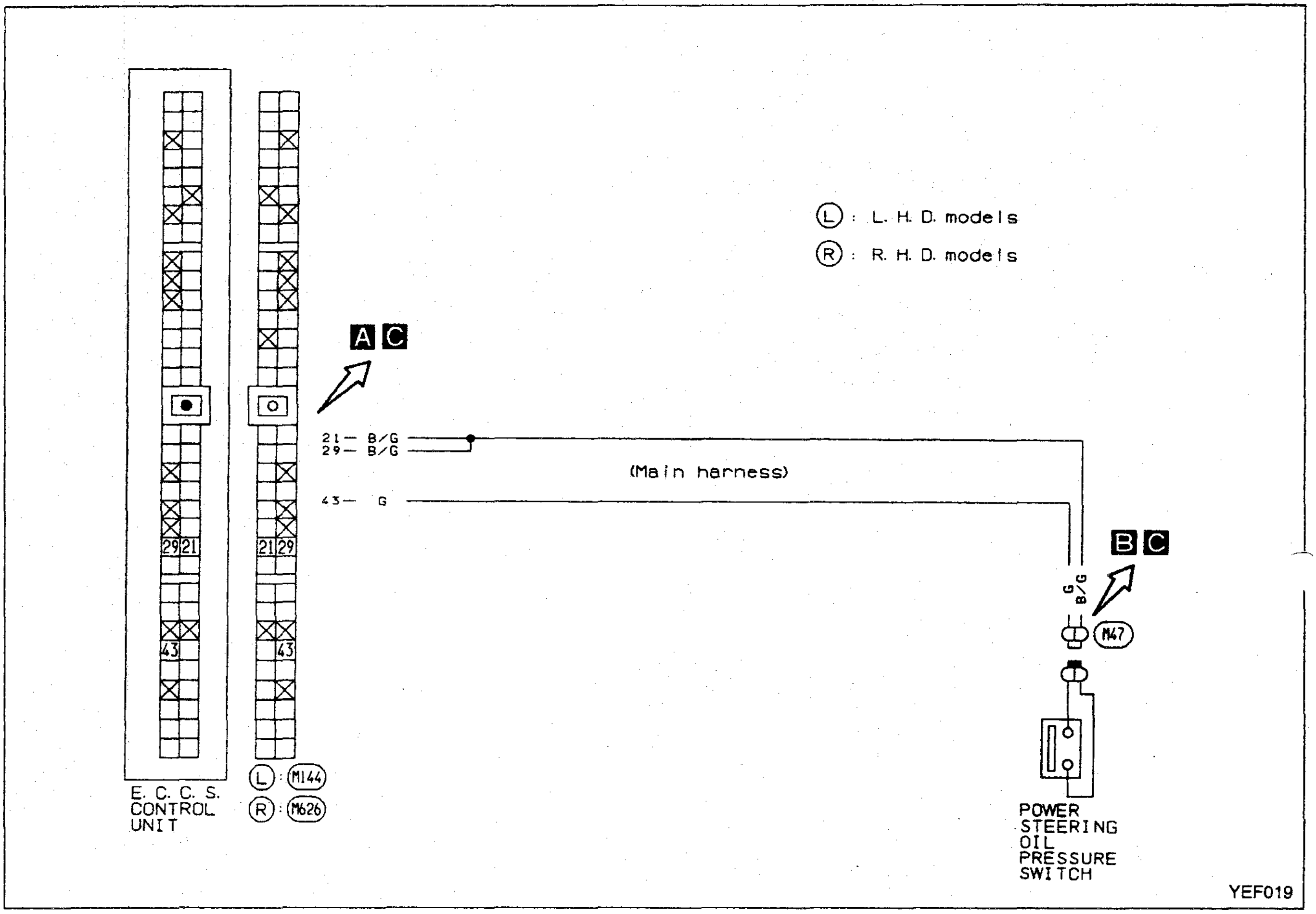
CHECK COMPONENT.
(F.I.C.D. control solenoid valve).
Refer to "Electrical Components Inspection".
(See page EF & EC-164.)

Replace F.I.C.D. control solenoid valve.

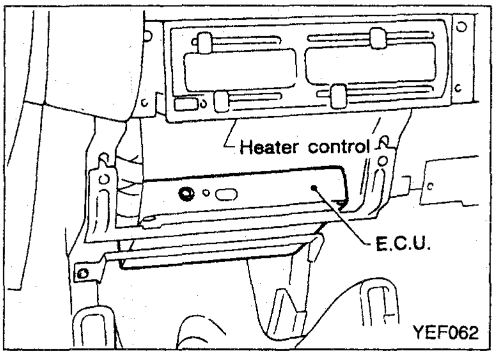
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

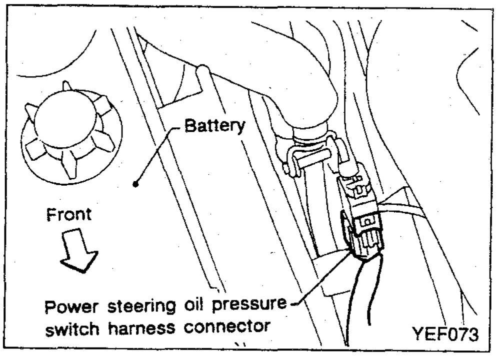
Diagnostic Procedure 39

POWER STEERING OIL PRESSURE SWITCH (Not self-diagnostic item)

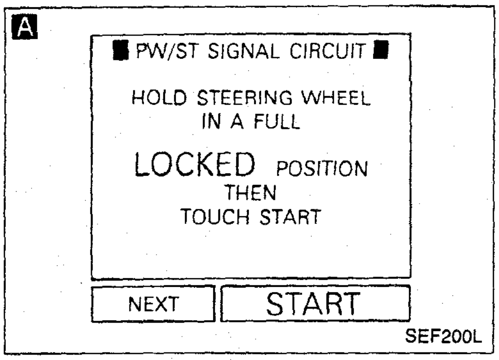


Harness layout





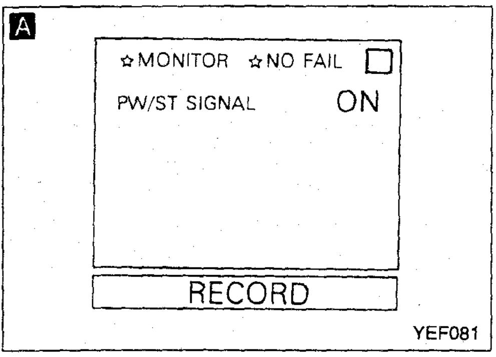
Diagnostic Procedure 39 (Cont'd)



■ PW/ST SIGNAL CIRCUIT ■

HOLD STEERING WHEEL IN A FULL LOCKED POSITION THEN TOUCH START

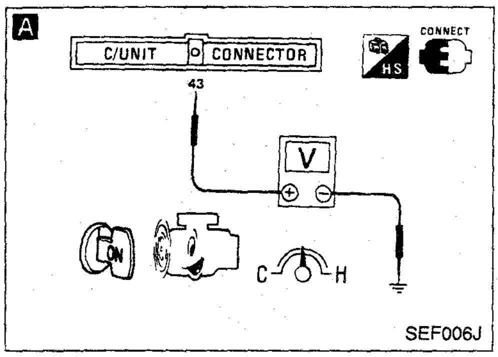
SEF200L



☆MONITOR ☆NO FAIL ☐

PW/ST SIGNAL ON

YEF081



SEF006J

INSPECTION START

↓

A

CHECK OVERALL FUNCTION.

1) Turn ignition switch "ON".
2) Perform "PW/ST SIGNAL CIRCUIT" in "FUNCTION TEST" mode with CONSULT.

OR

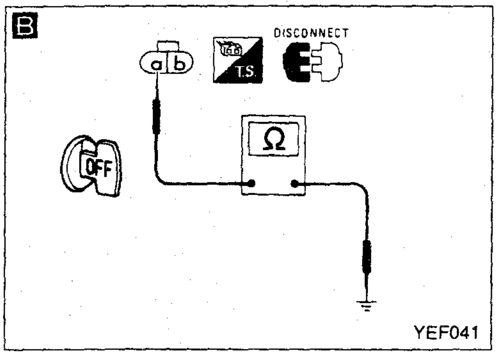
1) Start engine.
2) Check power steering oil pressure switch signal in "DATA MONITOR" mode with CONSULT.
   Steering is neutral: OFF
   Steering is turned: ON

OR

1) Start engine.
2) Check voltage between E.C.U. terminal ㊸ and ground.
   Voltage:
   When steering wheel is turned quickly
   Approximately 0V
   Steering wheel is not being turned.
   Approximately 8 - 9V

O.K. → INSPECTION END

N.G. ↓



YEF041

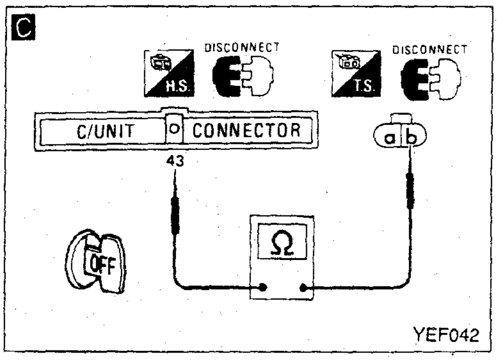
B

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. ↓



YEF042

C

CHECK INPUT SIGNAL CIRCUIT.

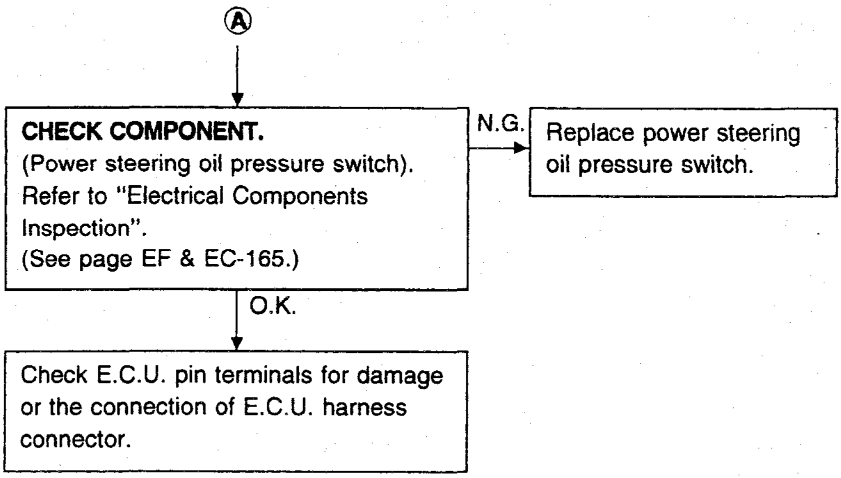
1) Disconnect E.C.U. harness connector.
2) Check harness continuity between E.C.U. terminal ㊸ and terminal ⓑ.
   Continuity should exist.

N.G. → Repair harness or connectors.

O.K. ↓

(Go to Ⓐ on next page.)

Diagnostic Procedure 39 (Cont'd)



Ⓐ

CHECK COMPONENT.
(Power steering oil pressure switch).
Refer to "Electrical Components Inspection".
(See page EF & EC-165.)

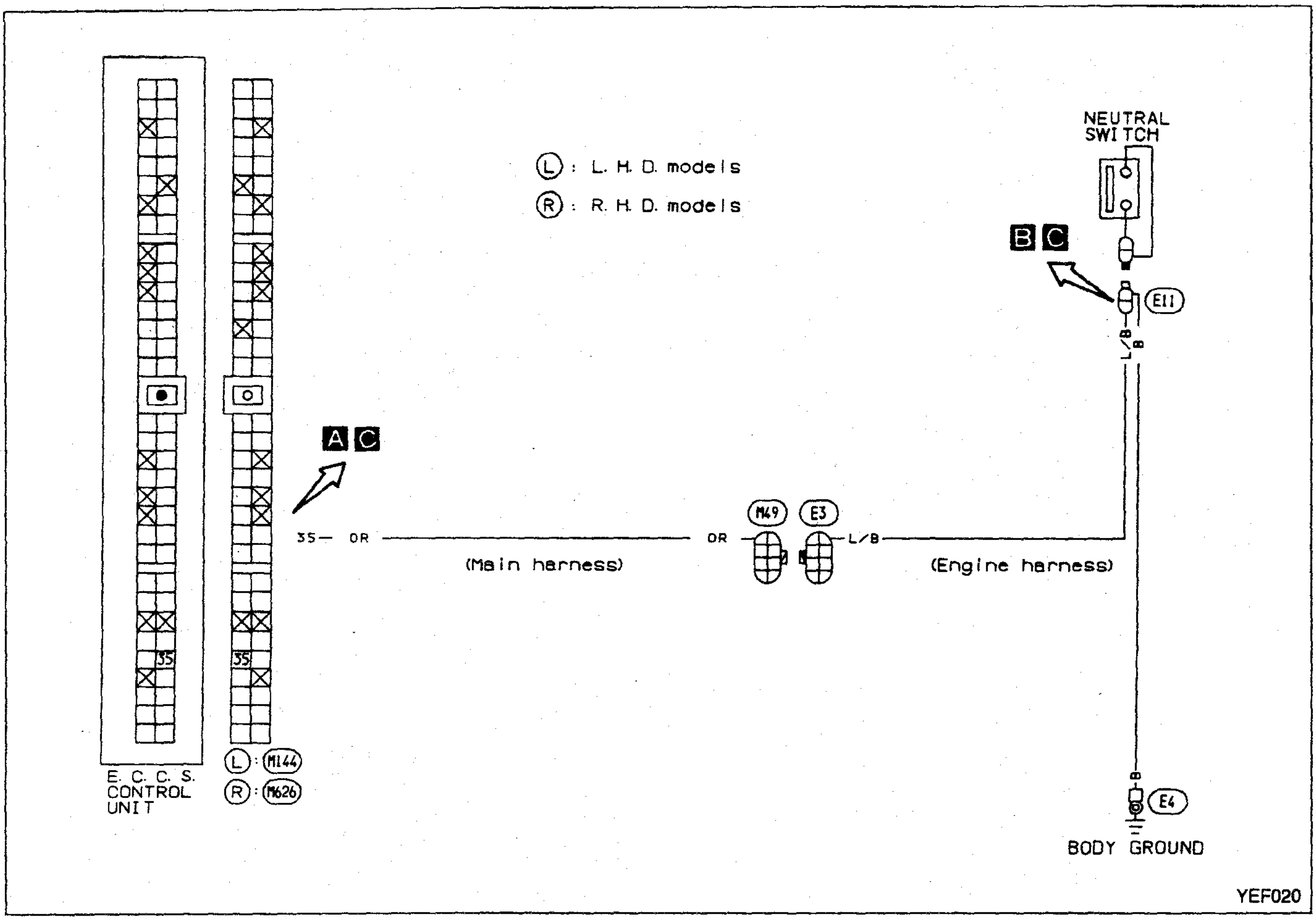
N.G. → Replace power steering oil pressure switch.

O.K. ↓

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

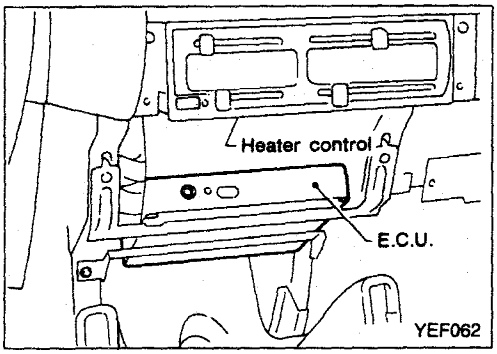
Diagnostic Procedure 40

NEUTRAL SWITCH (Not self-diagnostic item)

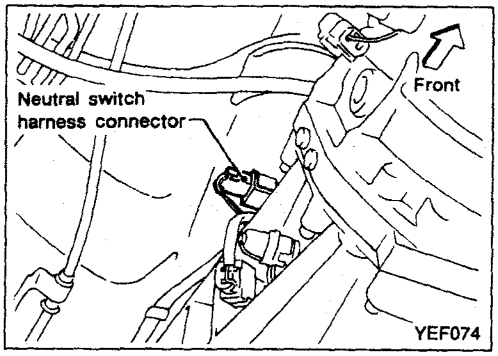


YEF020

Harness layout

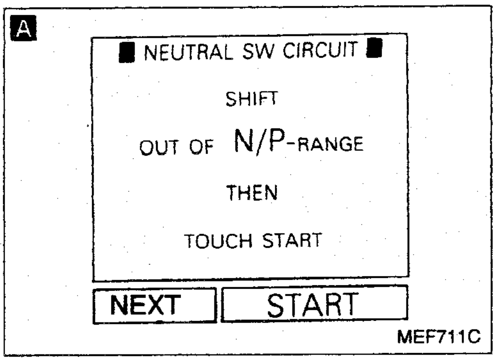


YEF062



YEF074

Diagnostic Procedure 40 (Cont'd)



■ NEUTRAL SW CIRCUIT ■

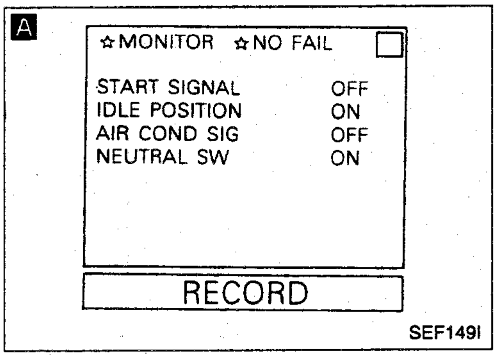
SHIFT

OUT OF N/P-RANGE

THEN

TOUCH START

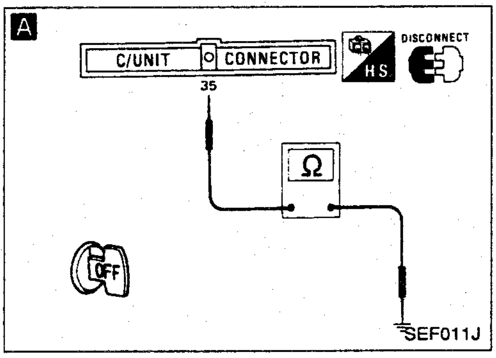
MEF711C



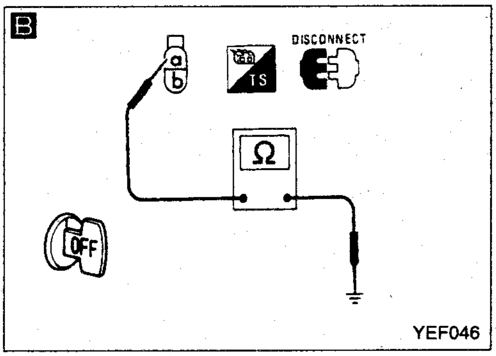
☆MONITOR ☆NO FAIL ☐

START SIGNAL	OFF
IDLE POSITION	ON
AIR COND SIG	OFF
NEUTRAL SW	ON

SEF149I



SEF011J



YEF046

INSPECTION START

↓

A

CHECK OVERALL FUNCTION.

1) Turn ignition switch "ON".
2) Perform "NEUTRAL SW CIRCUIT" in "FUNCTION TEST" mode with CONSULT.

— OR —

1) Turn ignition switch "ON".
2) Check neutral switch signal in "DATA MONITOR" mode with CONSULT.
   Neutral position: ON
   Except above: OFF

— 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.

O.K. → INSPECTION END

↓ 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.

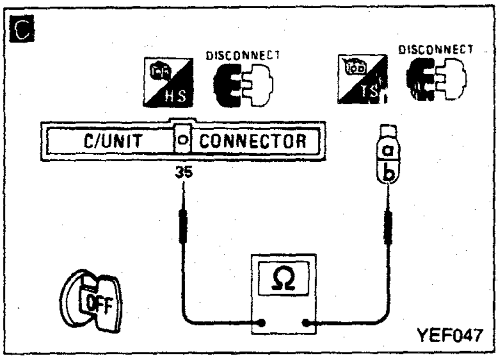
↓ O.K.

Disconnect E.C.U. harness connector.

↓

(Go to Ⓐ on next page.)

Diagnostic Procedure 40 (Cont'd)



Ⓐ

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 M49 , E3
- Harness continuity between E.C.U. and neutral switch

If N.G., repair harness or connectors.

O.K. ↓

CHECK COMPONENT.
(Neutral switch).
Refer to MT section.

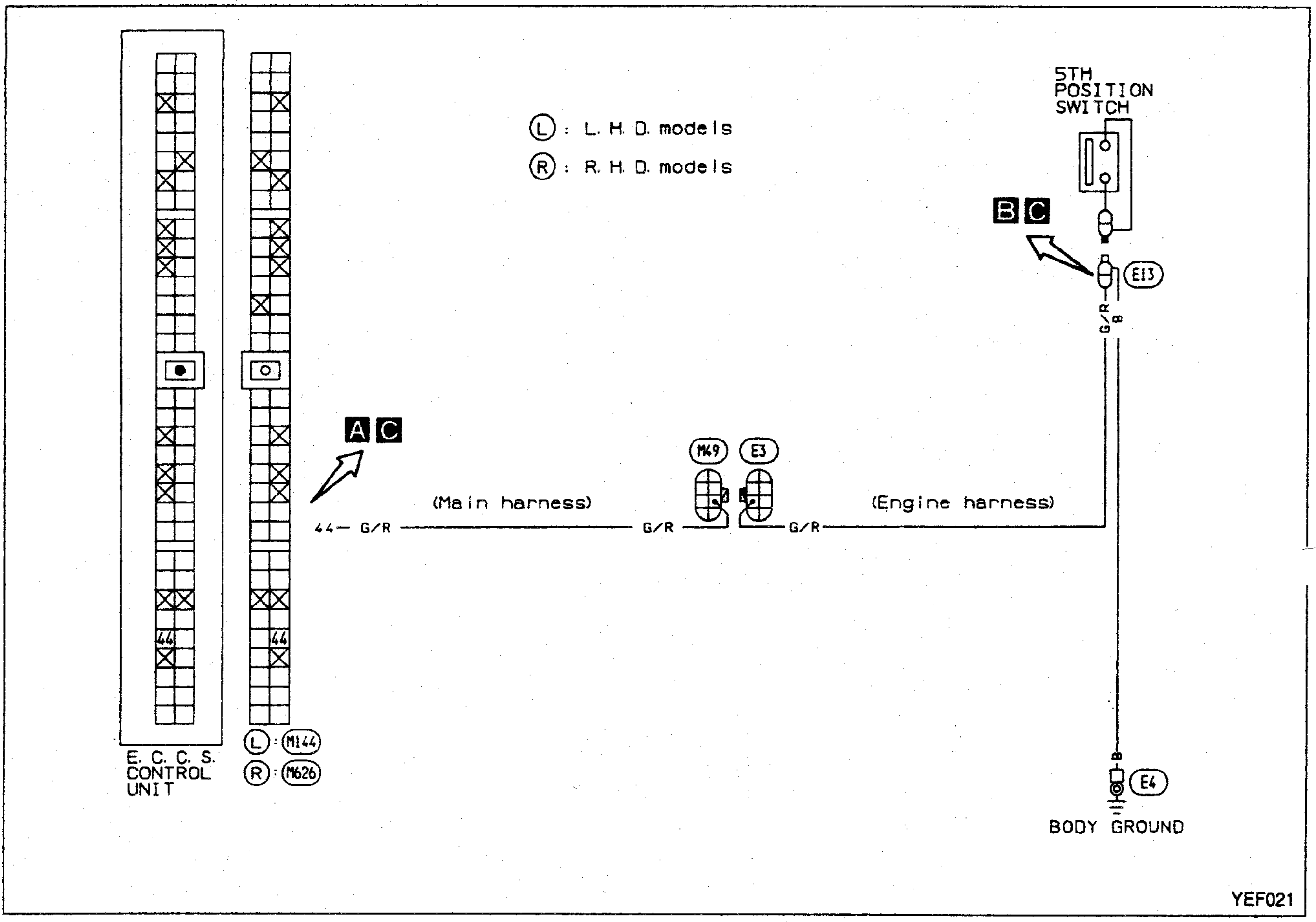
N.G. → Replace neutral switch.

O.K. ↓

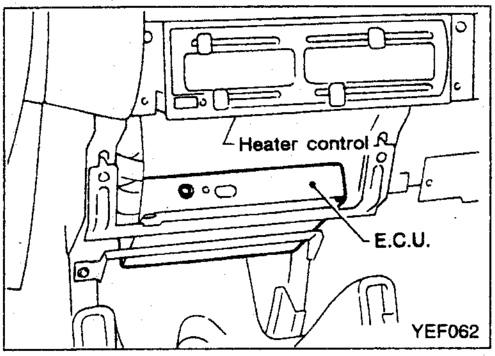
Check E.C.U. pin terminals for damage or the connection of E.C.U. harness connector.

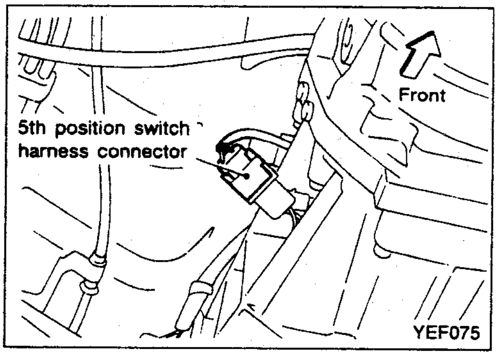
Diagnostic Procedure 41

5TH POSITION SWITCH (Not self-diagnostic item)

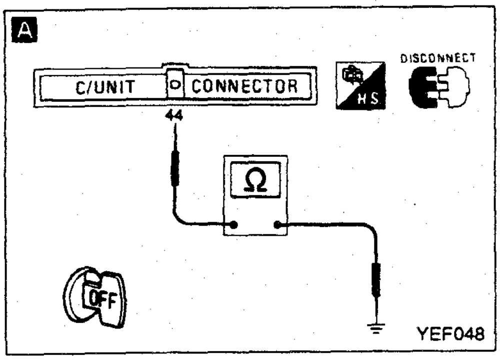


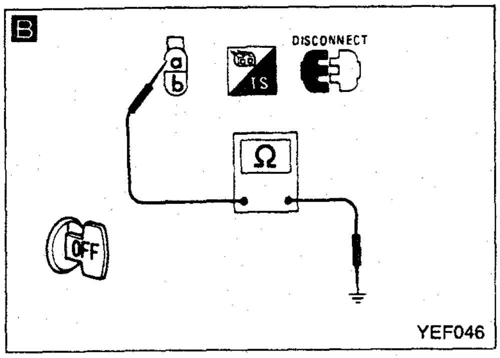
Harness layout

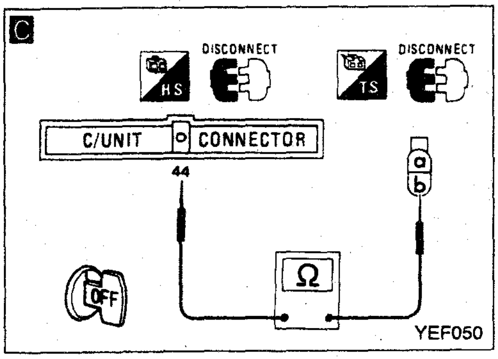




Diagnostic Procedure 41 (Cont'd)







INSPECTION START

↓

A

CHECK OVERALL FUNCTION.
1) Set shift lever to the 5th position.
2) Disconnect E.C.U. harness connector.
3) Check harness continuity between E.C.U. terminal ㊹ and body ground.
Continuity should exist.

O.K. → INSPECTION END

↓ N.G.

B

CHECK GROUND CIRCUIT.
1) Disconnect 5th position switch harness connector.
2) Check harness continuity between terminal ⓐ and body ground.
Continuity should exist.

N.G. → Repair harness or connectors.

↓ O.K.

C

CHECK INPUT SIGNAL CIRCUIT.
1) Check harness continuity between E.C.U. terminal ㊹ and terminal ⓑ.
Continuity should exist.

N.G. → Check the following.
- Harness connectors M49 , E3
- Harness continuity between E.C.U. and 5th position switch

If N.G., repair harness or connectors.

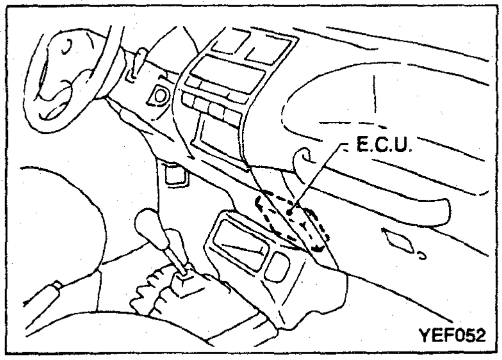
↓ O.K.

CHECK COMPONENT.
(5th position switch).
Refer to MT section.

N.G. → Replace 5th position 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.U. INPUT/OUTPUT SIGNAL INSPECTION

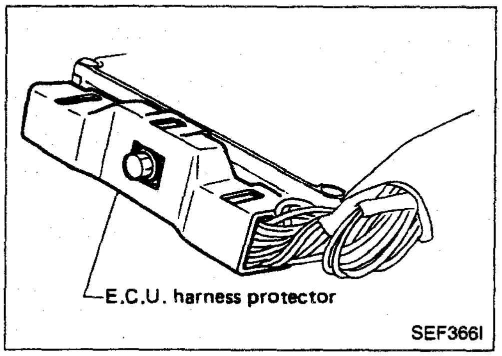
1. E.C.U. is located behind the bottom of the instrument panel.

Removal and Installation

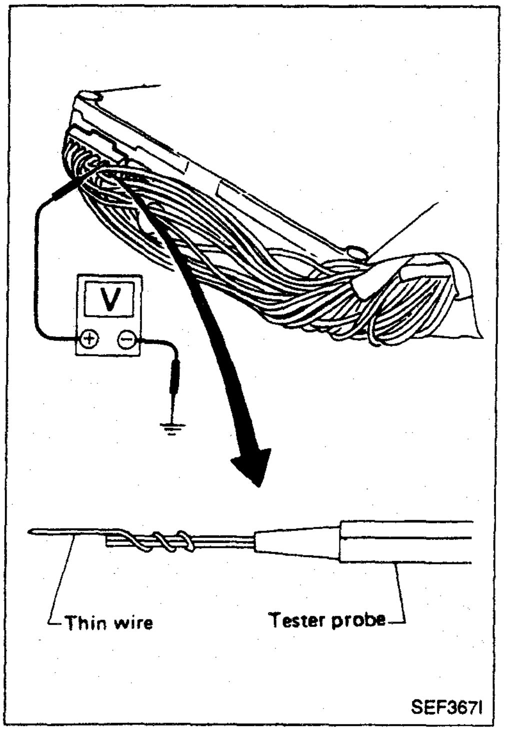
For this inspection remove the following parts:

1) Top of the instrument panel central area
2) Glove box
3) Cassette-holder tray
4) Instrument cluster bottom cover
5) Bottom of the instrument panel central area

For installation reverse order to removal.



2. Remove E.C.U. harness protector.



3. Perform all voltage measurements with the connectors connected.
   Improve tester probe as shown to perform tests easily.

E.C.U. inspection table

*Data are reference values.

TER-MINAL NO.	ITEM	CONDITION	*DATA
1	Ignition signal	Engine is running. └ Idle speed	0.3 - 0.6V
		Engine is running. └ Engine speed is 2,000 rpm	Approximately 1.0V
3	Ignition check	Engine is running. └ Idle speed	9 - 12V
4	E.C.C.S. relay (Main relay)	Engine is running. ↓ Ignition switch "OFF" └ Within a few seconds after turning ignition switch "OFF"	0 - 1V
		Ignition switch "OFF" └ For a few seconds after turning ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)
11	Air conditioner relay	Engine is running. A/C SW "ON", Fan SW "ON"	Approximately 0V
		A/C SW "ON", Fan SW "OFF"	Approximately 12V
		A/C SW "OFF", Fan SW "ON"	Approximately 0V
		A/C SW "OFF", Fan SW "OFF"	Approximately 0V
12	S.C.V. control solenoid valve	Engine is running. └ Idle speed	0 - 1.0V
		Engine is running. └ Engine speed is above 3,800 rpm.	BATTERY VOLTAGE (11 - 14V)
16	Air flow meter	Engine is running.	1.0 - 3.0V Output voltage varies with engine revolution.
18	Engine temperature sensor	Engine is running.	1.0 - 5.0V Output voltage varies with engine water temperature.
19	Exhaust gas sensor	Engine is running. └ After warming up sufficiently.	0 - Approximately 1.0V
20	Throttle sensor	Ignition switch "ON"	0.4 - Approximately 4V Output voltage varies with the throttle valve opening angle.
22 30	Crank angle sensor (Reference signal)	Engine is running. **Do not run engine at high speed under no-load.**	0.2 - 0.5V

Electrical Components Inspection (Cont'd)

*Data are reference values.

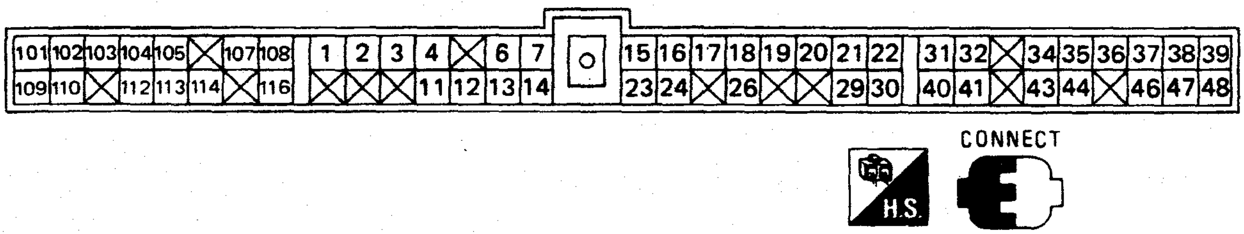
TER-MINAL NO.	ITEM	CONDITION	*DATA
26	Air temperature sensor	Ignition switch “ON” └ Temperature of intake air is 20°C (68°F)	Approximately 3.5V
		Ignition switch “ON” └ Temperature of intake air is 80°C (176°F)	Approximately 0.3V
31 40	Crank angle sensor (Position signal)	Engine is running. **Do not run engine at high speed under no-load.**	2.0 - 3.0V
34	Start signal	Cranking	8 - 12V
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. A/C SW “ON”, Fan SW “ON”	Approximately 0V
		A/C SW “ON”, Fan SW “OFF”	Approximately 12V
		A/C SW “OFF”, Fan SW “ON”	Approximately 9V
		A/C SW “OFF”, Fan SW “OFF”	Approximately 9V
43	Power steering oil pressure switch	Engine is running. └ Steering wheel is being turned.	0.1 - 0.3V
		Engine is running. └ Steering wheel is not being turned.	Approximately 5V
44	5th position switch	Ignition switch “ON” └ 5th position	0V
		Ignition switch “ON” └ Except the above gear position	Approximately 5V

Electrical Components Inspection (Cont'd)

*Data are reference values.

TERMINAL NO.	ITEM	CONDITION	*DATA
46	Power supply (Back-up)	Ignition switch "OFF"	BATTERY VOLTAGE (11 - 14V)
101	Injector No. 1	Engine is running.	BATTERY VOLTAGE (11 - 14V)
103	Injector No. 3		
110	Injector No. 2		
112	Injector No. 4		
102	A.I.V. control solenoide valve	Engine is running. (Warm-up condition) └ Idle speed	Approximately 0V
		Engine is running. └ Engine speed is at 2,000 rpm	BATTERY VOLTAGE (11 - 14V)
104	Fuel pump relay	Ignition switch "ON" └ For 5 seconds after turning ignition switch "ON" Engine is running.	0.7 - 0.9V
		Ignition switch "ON" └ Within 5 seconds after turning ignition switch "ON"	BATTERY VOLTAGE (11 - 14V)
105	E.G.R. & canister control solenoid valve	Engine is running. (Warm-up condition) └ Idle speed	0 - 1.0V
		Engine is running. (Warm-up condition) └ Engine is racing from 2,000 rpm	BATTERY VOLTAGE (11 - 14V)
113	A.A.C. valve	Engine is running. └ Idle speed	7 - 10V
		Engine is running. ├ Steering wheel is being turned. ├ Air conditioner is operating ├ Rear defogger is "ON". └ Headlamp are in high position.	4 - 7V
114	Exhaust gas sensor heater	Engine is running. └ Engine speed is below 4,000 rpm.	0V
		Engine is running. └ Engine speed is above 4,000 rpm.	BATTERY VOLTAGE (11 - 14V)

E.C.U. HARNESS CONNECTOR TERMINAL LAYOUT



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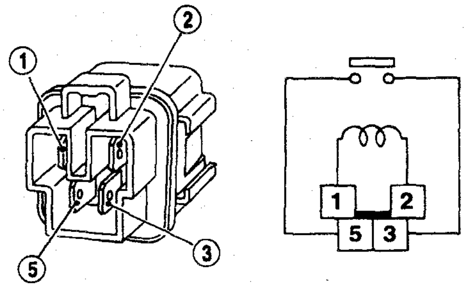


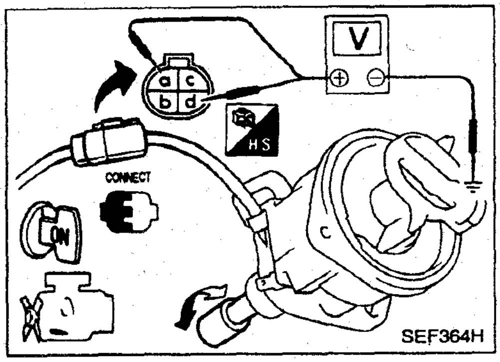
SEF054F

E.C.C.S. RELAY

Check continuity between terminals ③ and ⑤.

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

Electrical Components Inspection (Cont'd)

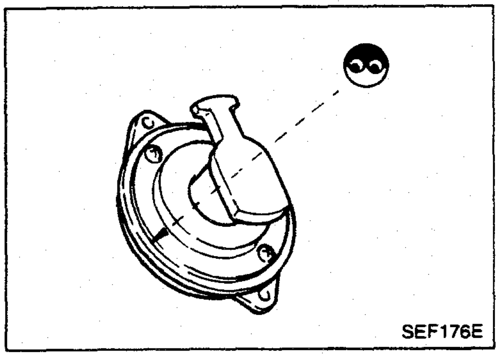


SEF364H

CRANK ANGLE SENSOR

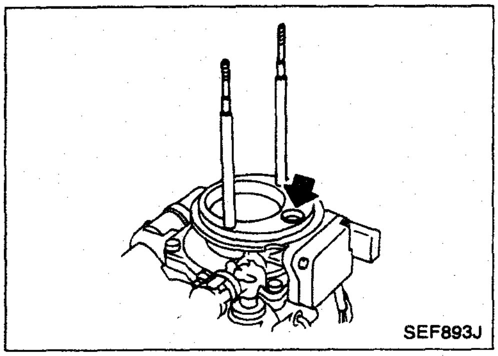
1. Remove distributor from engine. (crank angle sensor harness connector is connected.)
2. Turn ignition switch "ON".
3. Rotate crank angle sensor shaft slowly and check voltage between terminals ⓐ, ⓓ and ground.

Voltage fluctuates between 5V and 0V.



SEF176E

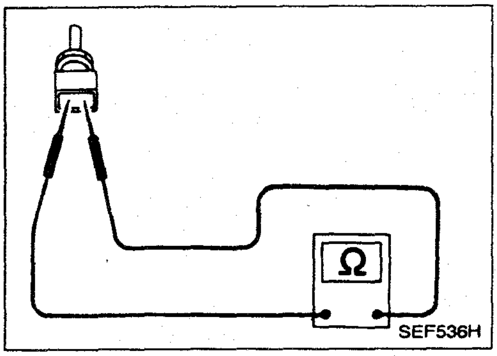
4. Visually check rotor plate for damage or dust.



SEF893J

AIR FLOW METER

- Visually check hot wire air passage for dust.

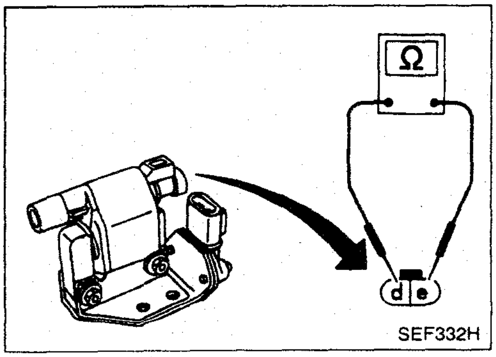


SEF536H

ENGINE TEMPERATURE SENSOR

Check engine temperature sensor resistance.

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



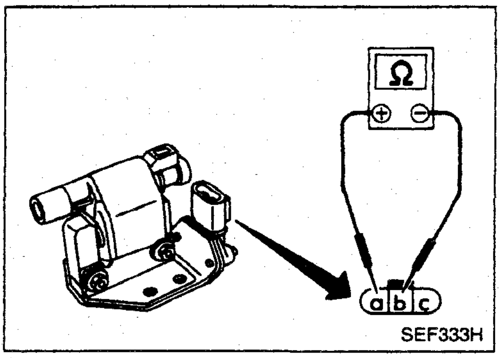
SEF332H

IGNITION COIL

Check ignition coil resistance.

Terminal	Resistance
ⓓ - ⓔ	Approximately 0.7Ω

Electrical Components Inspection (Cont'd)

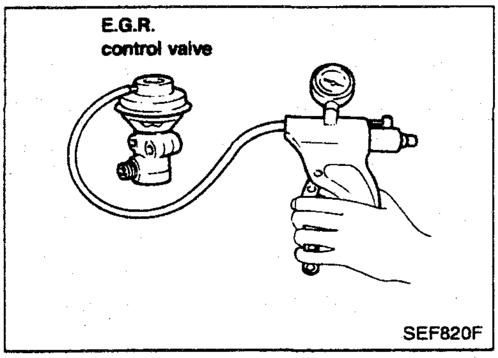


SEF333H

POWER TRANSISTOR

Check continuity between power transistor terminals.

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

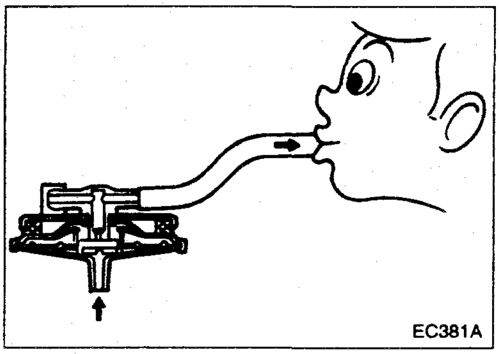


SEF820F

E.G.R. VALVE

Apply vacuum to E.G.R. vacuum port with a hand vacuum pump.

E.G.R. valve spring should lift.



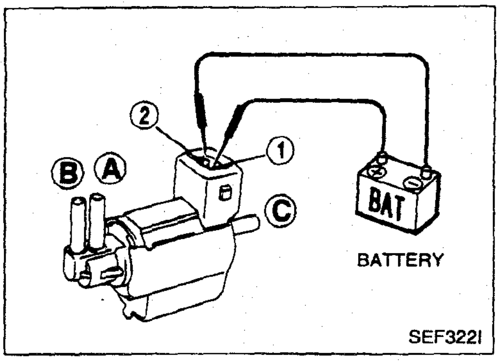
EC381A

B.P.T. VALVE

Plug one of two ports of B.P.T. valve.

Apply a pressure above 0.490 kPa (4.90 mbar, 50 mmH_2O, 1.97 inH_2O) to check for leakage. If a leak is noted, replace valve.

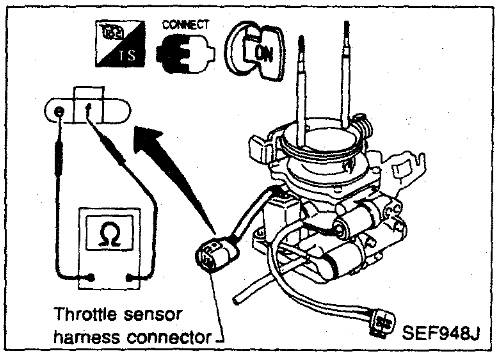
Electrical Components Inspection (Cont'd)



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

Check air passages continuity.

Condition	Air passage continuity between Ⓐ and Ⓑ	Air passage continuity between Ⓐ and Ⓒ
12V direct current supply between terminals ① and ②	Yes	No
No supply	No	Yes



THROTTLE SENSOR

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

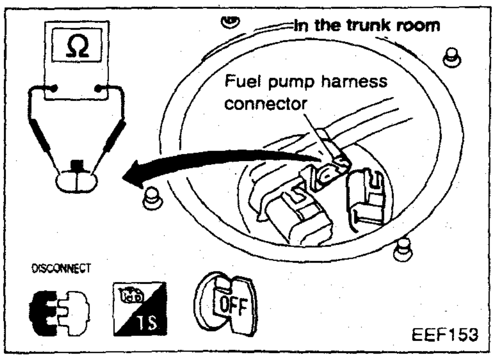
Resistance should change.

If N.G., replace throttle sensor.

Adjustment

If throttle sensor is replaced or removed, it is necessary to install it in the proper position, by following the procedure as shown below:

1. Install throttle sensor body in throttle chamber. Do not tighten bolts.
2. Connect throttle sensor harness connector.
3. Start engine and warm it up sufficiently.
4. Measure output voltage of throttle sensor using voltmeter.
5. Adjust by rotating throttle sensor body so that output voltage is 0.3 to 0.7V.
6. Tighten mounting bolts.
7. Disconnect throttle sensor harness connector for a few seconds and then reconnect it.

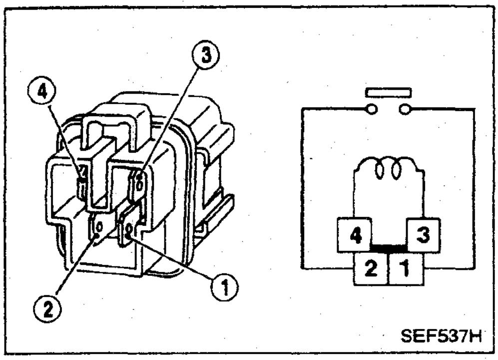


FUEL PUMP

Check continuity between terminals ⓐ and ⓒ.

Continuity should exist.

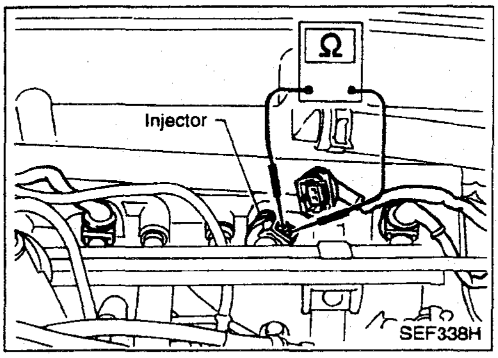
Electrical Components Inspection (Cont'd)



FUEL PUMP RELAY

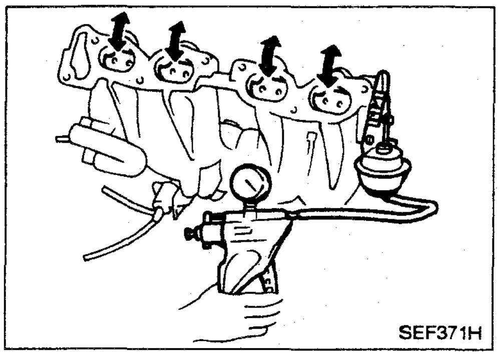
Check continuity between terminals ① and ②.

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



INJECTORS

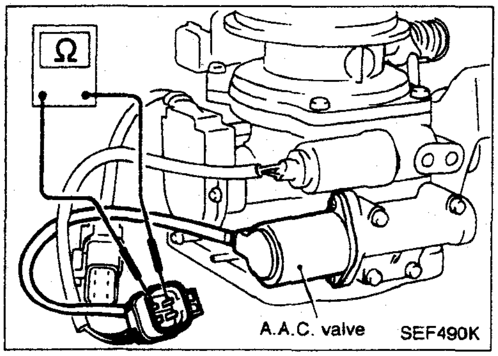
- Check injector resistance.
  Resistance:
  Approximately 10 - 15Ω
- Remove injector and check nozzle for clogging.



SWIRL CONTROL VALVE (S.C.V.)

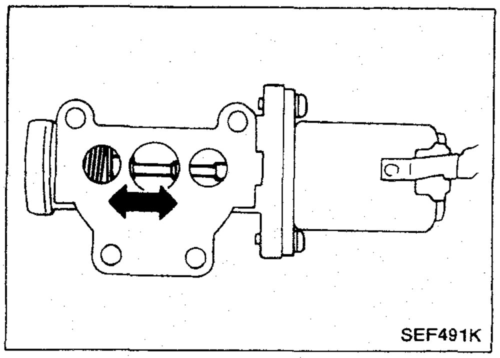
Supply vacuum to actuator and check swirl control valve operation.

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



A.A.C. VALVE

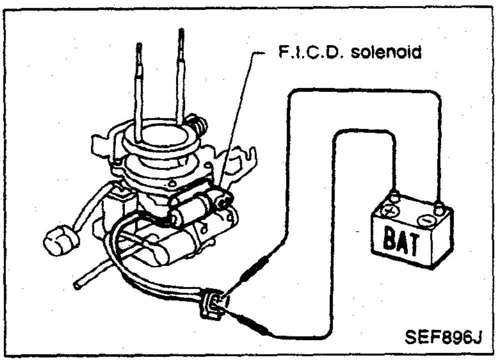
- Check A.A.C. valve resistance.
  Resistance:
  Approximately 10Ω



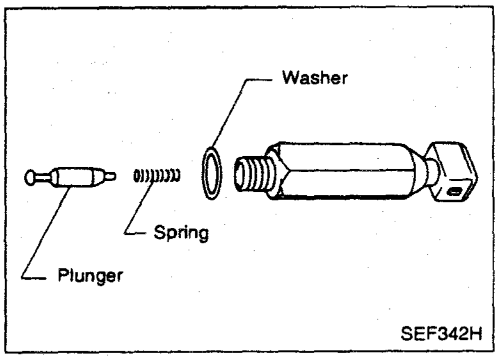
- Check plunger for seizure or sticking.
- Check spring for broken.

Electrical Components Inspection (Cont'd)

F.I.C.D. CONTROL SOLENOID VALVE

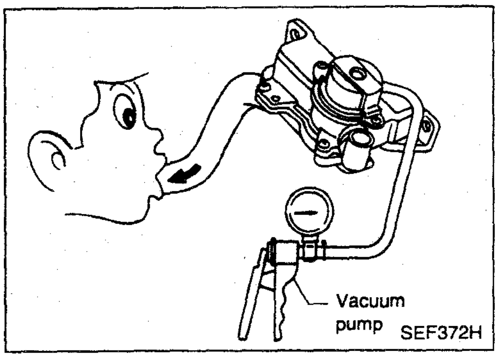


- Check that clicking sound is heard when applying 12V direct current to terminals.



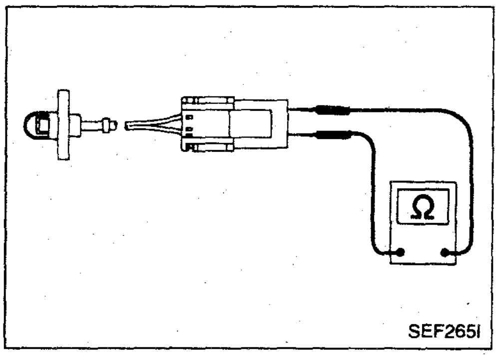
- Check plunger for seizure or sticking.
- Check for broken spring.

AIR INDUCTION VALVE (A.I.V.)



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

AIR TEMPERATURE SENSOR



Check air temperature sensor resistance.

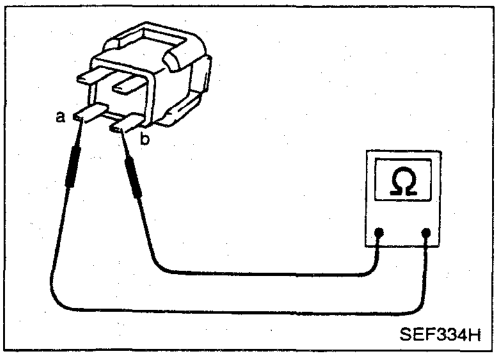
Temperature °C (°F)	Resistance kΩ
20 (68)	2.1 - 2.9
80 (176)	0.27 - 0.38

Electrical Components Inspection (Cont'd)

POWER STEERING OIL PRESSURE SWITCH

1. Disconnect power steering oil pressure switch harness connector.
2. Check continuity between terminals.

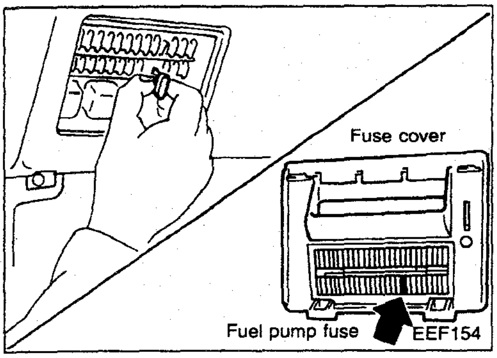
Conditions	Continuity
Steering wheel is being turned.	Yes
Steering wheel is not being turned.	No



SEF334H

RESISTOR AND CONDENSER

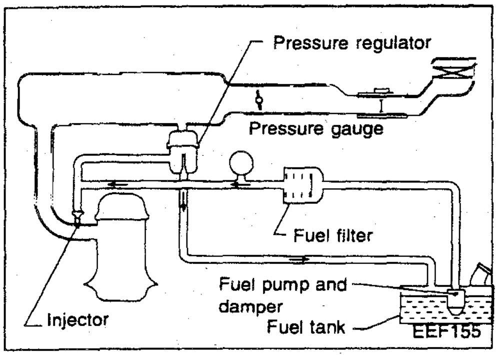
1. Disconnect harness connector.
2. Check resistance between terminals. ⓐ and ⓑ.
   Resistance: Approximately 2.2kΩ
   If N.G., replace resistor/condenser.



Releasing Fuel Pressure

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

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



Fuel Pressure Check

- **a. When reconnecting fuel line, always use new clamps.**
- **b. Make sure that clamp screw does not contact adjacent parts.**
- **c. Use a torque driver to tighten clamps.**
- **d. Use Pressure Gauge to check fuel pressure.**
- **e. Do not perform fuel pressure check while fuel pressure regulator control system is operating; otherwise, fuel pressure gauge might indicate incorrect readings.**

1. Release fuel pressure to zero.
2. Disconnect fuel hose between fuel filter and delivery tube (engine right side).
3. Install pressure gauge between fuel filter and delivery tube.
4. Start engine and check for fuel leakage.
5. Read the fuel pressure gauge indication.

At idling:

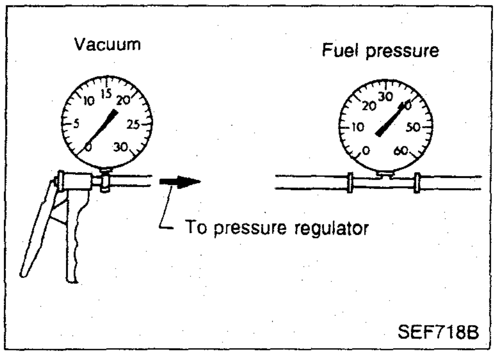
When fuel pressure regulator valve vacuum hose is connected.

More than 226 kPa (2.26 bar, 2.3 kg/cm^2, 33 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 fuel pressure gauge indication as vacuum changes.

Fuel pressure should decrease as vacuum increases. If results are unsatisfactory, replace fuel pressure regulator.

Injector Removal and Installation

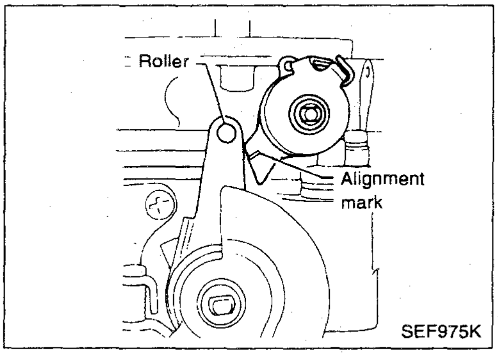
1. Release fuel pressure to zero.
2. Remove or disconnect the following:
- B.P.T. valve
- Fuel tube securing bolts
3. Remove injectors with fuel tube assembly.
4. Remove injector from fuel tube.
5. Install injector as follows:
1) Clean exterior of injector tail piece.
2) Use new O-rings.

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

6. Assemble injectors with fuel pipe to intake manifold.

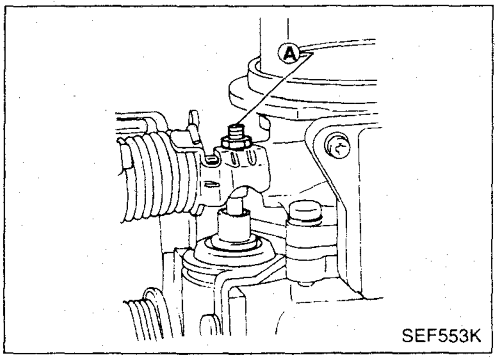
Fast Idle Inspection and Adjustment

1. Start engine and warm it up until engine temperature indicator points to the normal operating temperature.
2. Stop engine and remove air cleaner assembly.



SEF975K

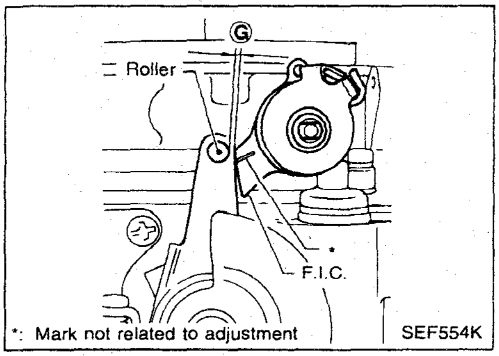
3. Be sure to set the mark to point to the roller center as shown in the figure.
- On throttle bodies, an alignment mark is impressed on the F.I.C. so that the top of the cam may be faced in the correct direction.



SEF553K

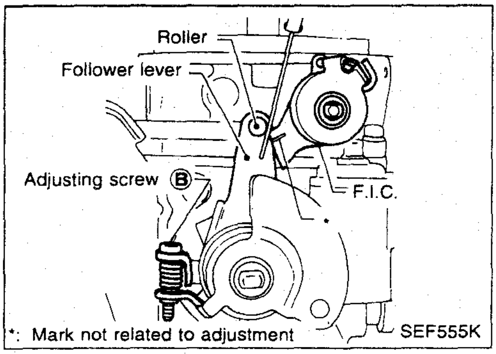
- If necessary, adjust the adjusting screw Ⓐ until the top of the cam faces the center of the lever roller.

Fast Idle Inspection and Adjustment (Cont'd)



4. Measure clearance Ⓖ between the roller and the top of the F.I.C. using a feeler gauge. (See figure.)

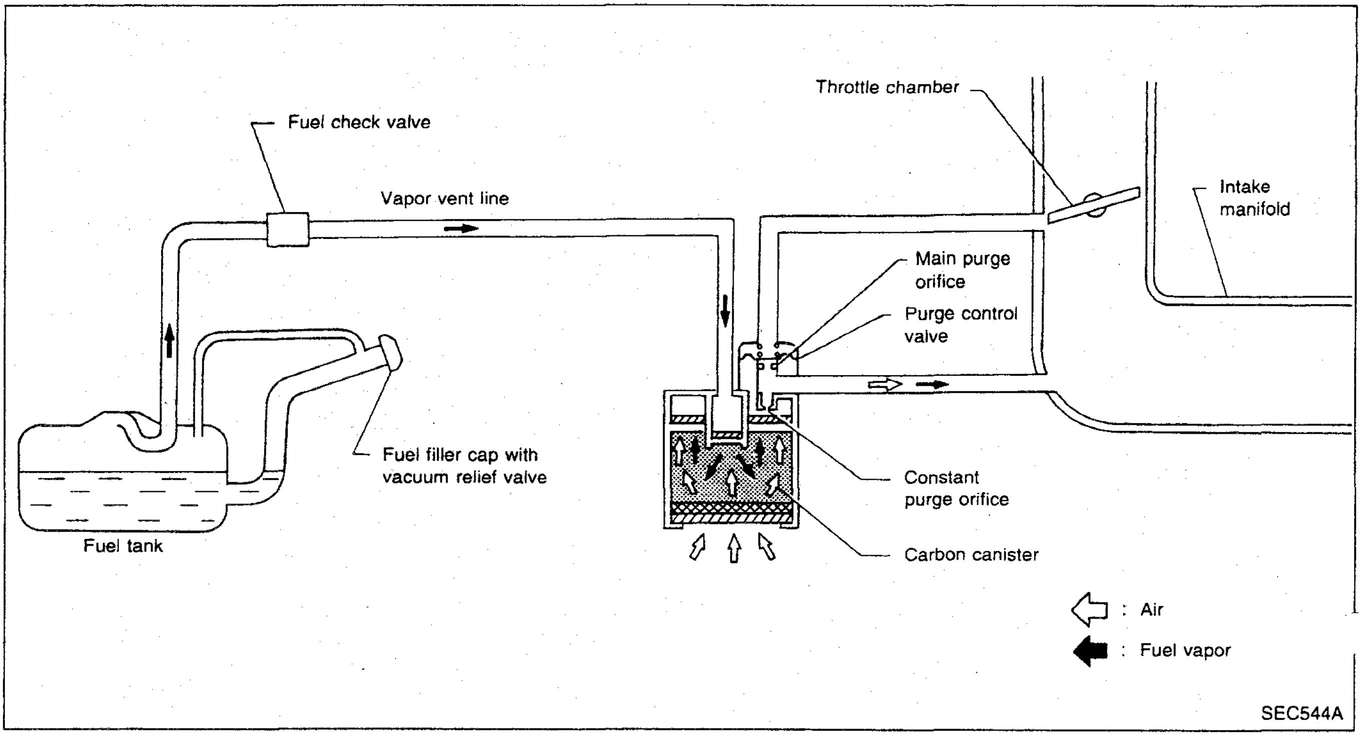
   Clearance Ⓖ:
   2.0 - 2.6 mm (0.079 - 0.102 in)



- If clearance Ⓖ is out of specification, adjust clearance Ⓖ using adjusting screw Ⓑ to 2.3 mm (0.091 in).

EVAPORATIVE EMISSION CONTROL SYSTEM

Description



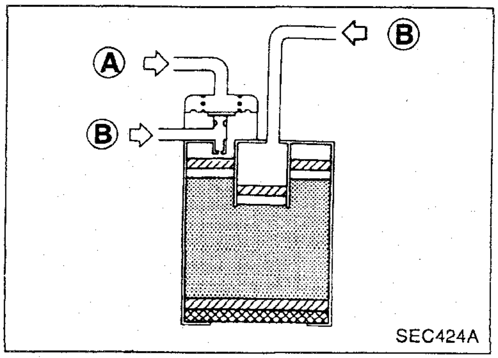
SEC544A

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

The fuel vapor from the sealed fuel tank is led into the canister which contains activated carbon and the vapor is stored there when the engine is not running.

The canister retains the fuel vapor until the canister is purged by the air drawn through the bottom of the canister to the intake manifold when the engine is running. When the engine runs at idle, the purge control valve is closed.

Only a small amount of stored vapor flows into the intake manifold through the constant purge orifice. As the engine speed increases, and the throttle vacuum increases, the purge control valve opens and the vapor is sucked into the intake manifold through both the main purge orifice and the constant purge orifice.



SEC424A

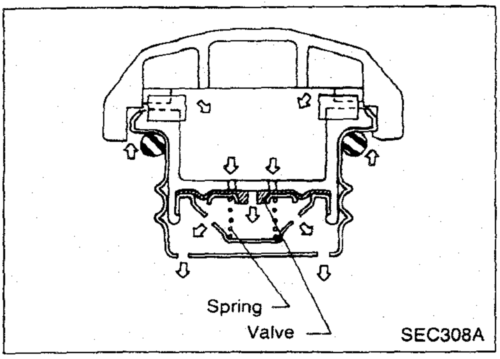
Inspection

ACTIVATED CARBON CANISTER

Check carbon canister as follows:

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

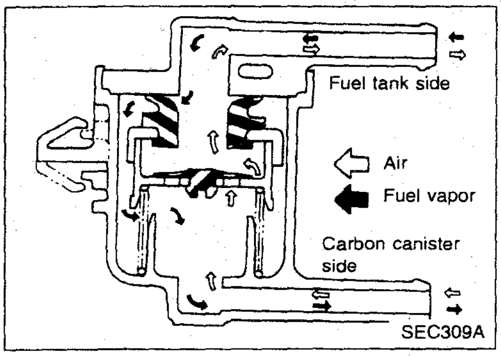
Inspection (Cont'd)



SEC308A

FUEL TANK VACUUM RELIEF VALVE

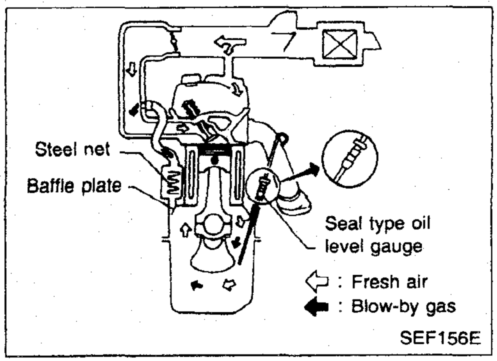
1. Wipe clean valve housing.
2. Suck air through the cap. A slight resistance accompanied by valve clicks indicates that valve is in good mechanical condition. Note also that, by further sucking air, the resistance should disappear with valve clicks.
3. If valve is clogged or if no resistance is felt,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



SEC309A

FUEL CHECK VALVE

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



Description

This system returns blow-by gas to both the intake manifold and air cleaner.

The positive crankcase ventilation (P.C.V.) valve is provided to conduct crankcase blow-by gas to the intake manifold.

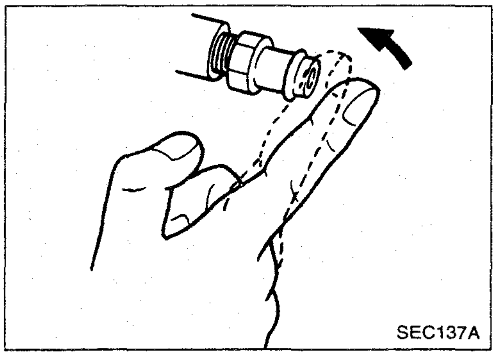
During partial throttle operation of the engine, the intake manifold sucks the blow-by gas through the P.C.V. valve.

Normally, the capacity of the valve is sufficient to handle any blow-by and a small amount of ventilating air.

The ventilating air is then drawn from the air cleaner, through the hose connecting the air cleaner to rocker cover, into the crankcase.

Under full-throttle condition, the manifold vacuum is insufficient to draw the blow-by flow through the valve, and its flow goes through the hose connection in the reverse direction.

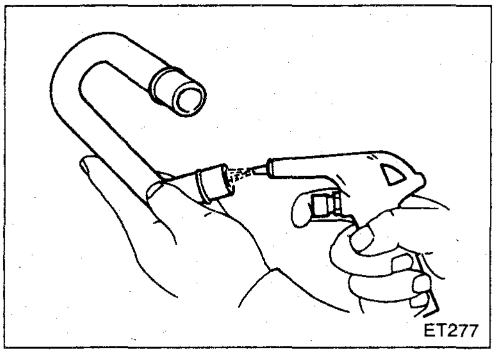
On vehicles with an excessively high blow-by some of the flow will go through the hose connection to the air cleaner under all conditions.



Inspection

P.C.V. (Positive Crankcase Ventilation)

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



VENTILATION HOSE

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

General Specifications

PRESSURE REGULATOR Fuel pressure kPa (bar, kg/cm², psi) At idling	Approximately 226 (2.26, 2.3, 33)
A few seconds after ignitions switch is turned OFF to ON	Approximately 294 (2.94, 3.0, 43)

Inspection and Adjustment

Idle speed*1 rpm	
No-load*2 (in "N" position)	800 ± 50
Air conditioner: ON (in "N" position)	800 ± 50
Ignition timing	10 ± 2° B.T.D.C.
Throttle sensor idle position V	0.3 - 0.7

*1: Feedback controlled and needs no adjustments
*2: Under the following conditions:
- Air conditioner switch: OFF
- Electric load: OFF (Lights, heater fan & rear defogger)

AIR FLOW METER

Supply voltage V	Battery voltage (11 - 14)
Output voltage V	1.0 - 3.0*

*: Engine is warmed up sufficiently and idling (under no-load).

ENGINE TEMPERATURE SENSOR

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

A.A.C. VALVE

Resistance Ω	Approximately 10.0

INJECTOR

Resistance Ω	10 - 15

RESISTOR

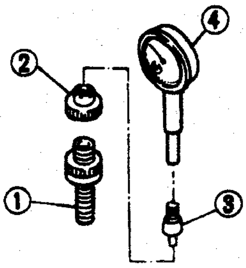
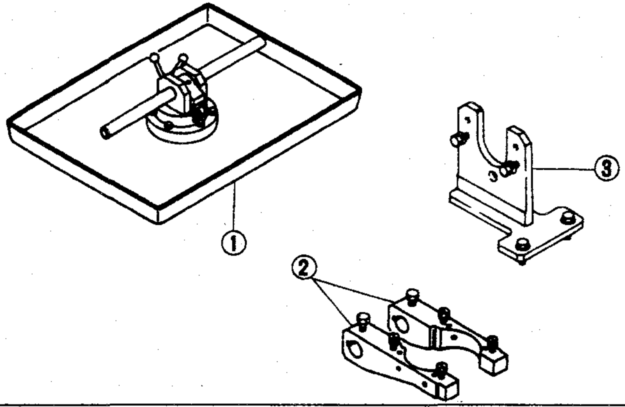
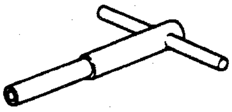
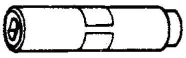
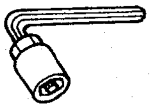
Resistance kΩ	Approximately 2.2

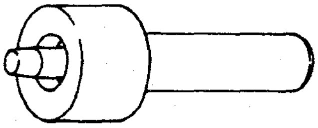
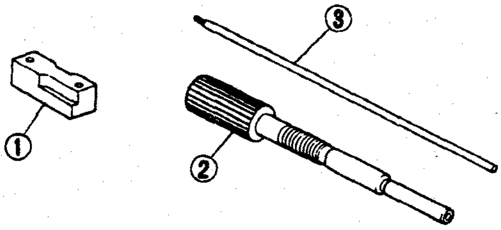
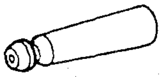
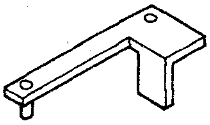
THROTTLE SENSOR

Accelerator pedal conditions	Resistance kΩ
Completely released	Approximately 2
Partially released	2 - 10
Completely depressed	Approximately 10

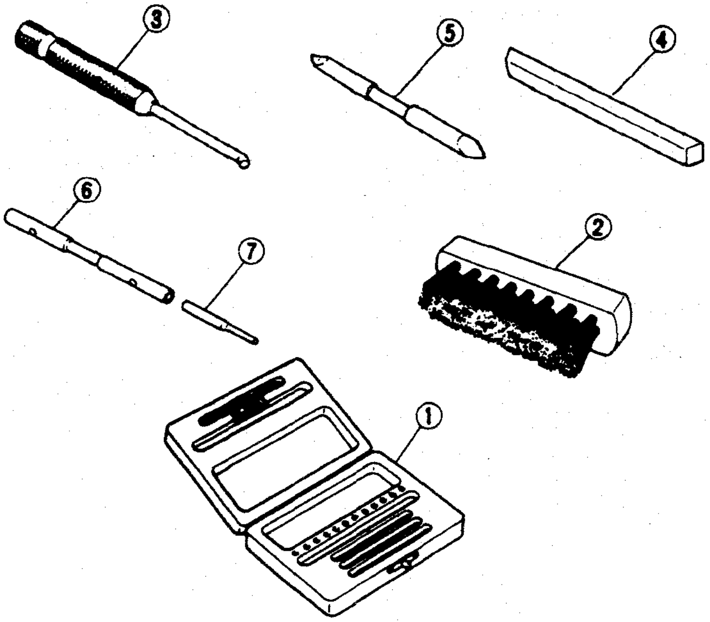
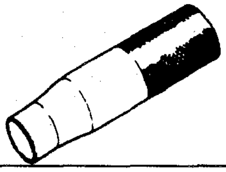
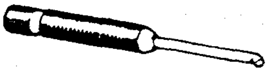
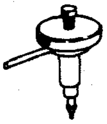
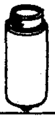
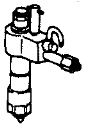
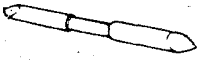
SPECIAL SERVICE TOOLS

Adjusting device on vehicle

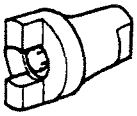
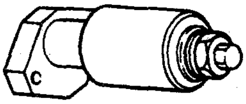
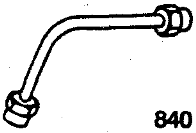
Tool number Tool name	Description
KV11229352 Measuring device ① KV11229350 Holder ② KV11229360 Nut ③ KV11229370 Pin ④ KV11254410 Dial gauge	 Measuring set length of plunger spring
Disassembling and assembling tools	
① KV11244852 Universal vise ② KV11244872 Bracket ③ KV11244792 Bracket	
KV11229072 Insert 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	
KV11215842 Governor shaft adjusting device	

Tool number Tool name	Description
KV11229542 Feed pump holder	
KV11229852 "MS" measuring device set ① KV11229110 Block gauge ② KV11241920 Dummy shaft ③ KV11229830 Rod	
KV11229042 "K" & "KF" measuring device	
KV11222090 Oil seal guide (For drive shaft)	
KV11229762 Block gauge (For high altitude compensator)	

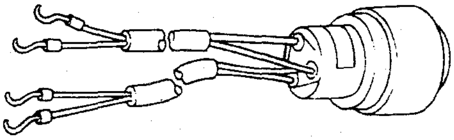
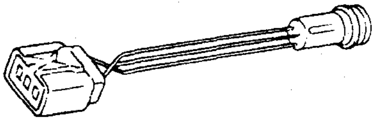
For injection nozzle

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	
KV11292210 Nozzle centering device	
KV11290632 Nozzle oil sump scraper	
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)	
KV11290620 Nozzle seat scraper	

Adjusting device on pump tester

Tool number Tool name	Description
KV11281036 Fixing stand	
KV11242442 Coupling	
KV11282815 Measuring device (for high-pressure side)	
KV11205032 Injection pipe	840 mm (33.07 in)

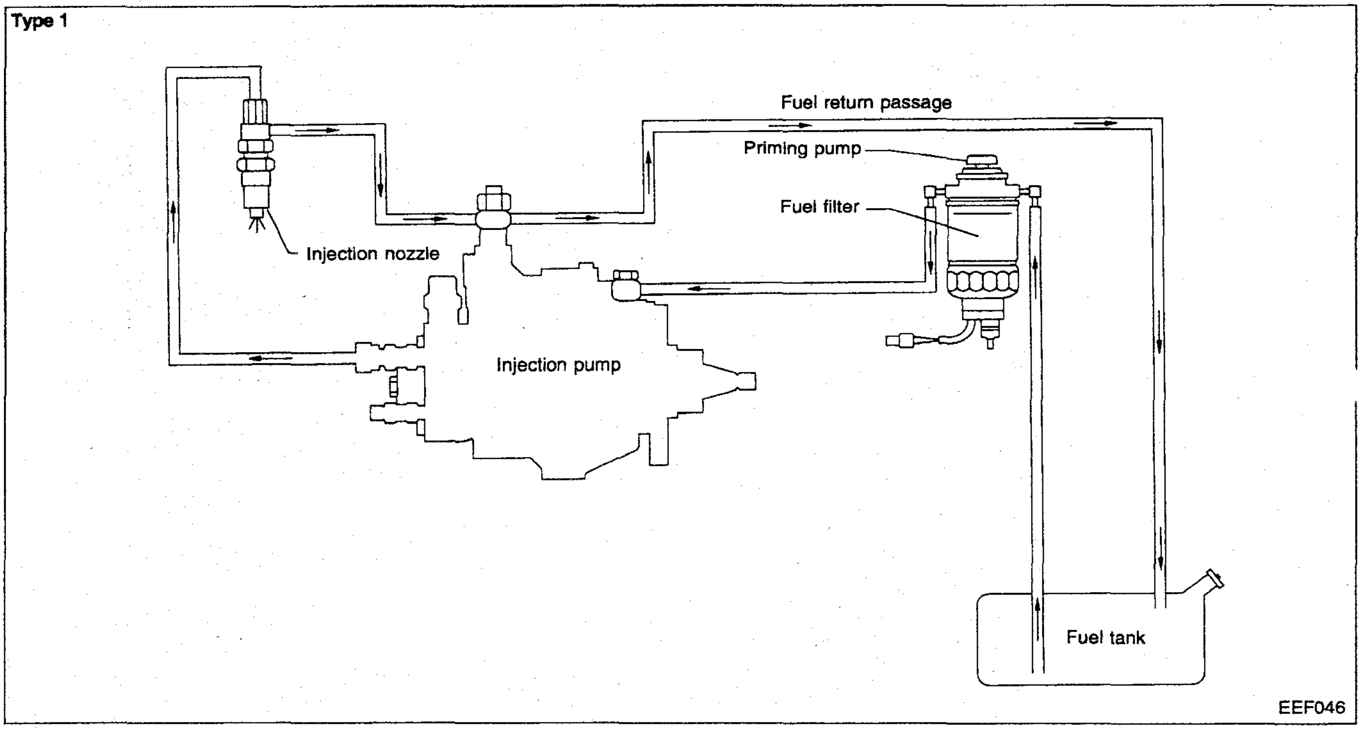
Adjusting device for potentiometer

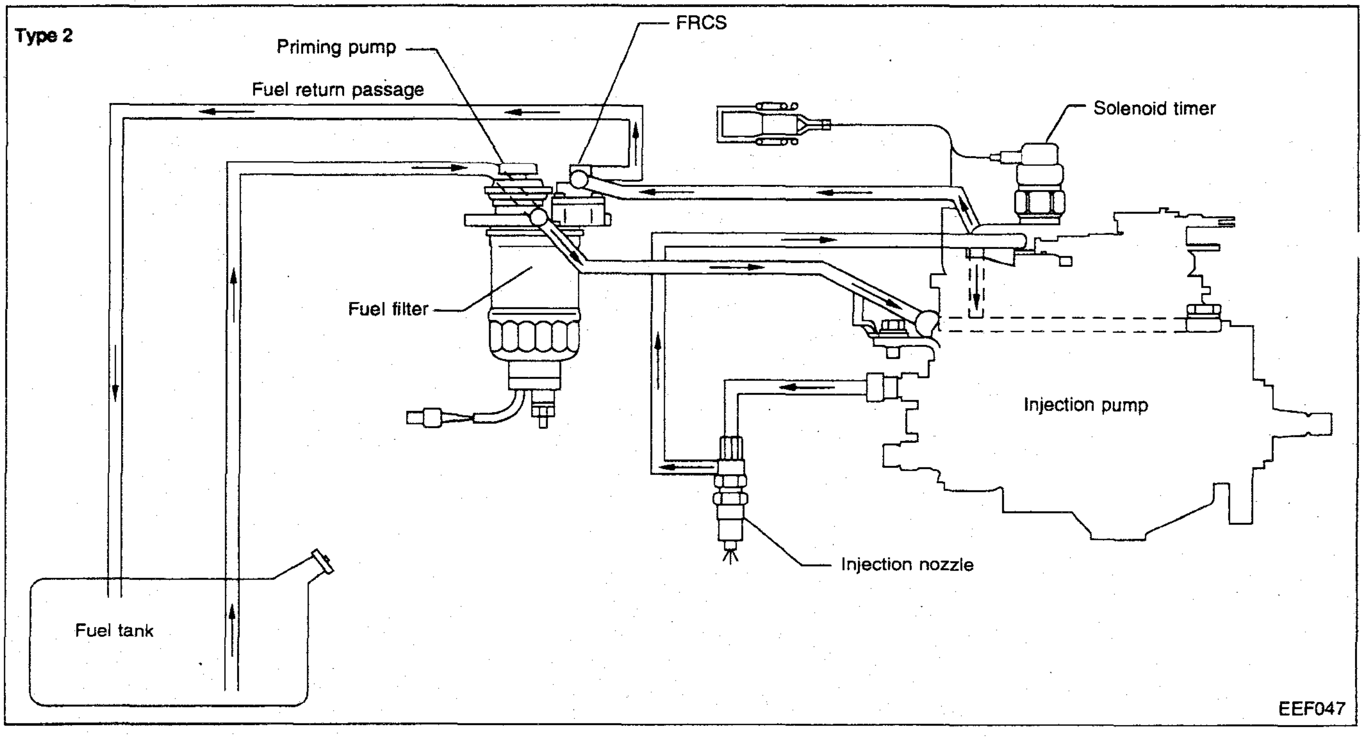
KV11229882 Voltage check harness	
KV11244582 Voltage adjusting harness	

CAUTION:

- **Disassembly and assembly of the injection pump should be done only in service shops authorized by NISSAN or by the pump manufacturer.**
- **The pump tester is required for servicing the pump.**
- **Before removing fuel injection pump from vehicle, check closely to make sure that it is definitely malfunctioning.**

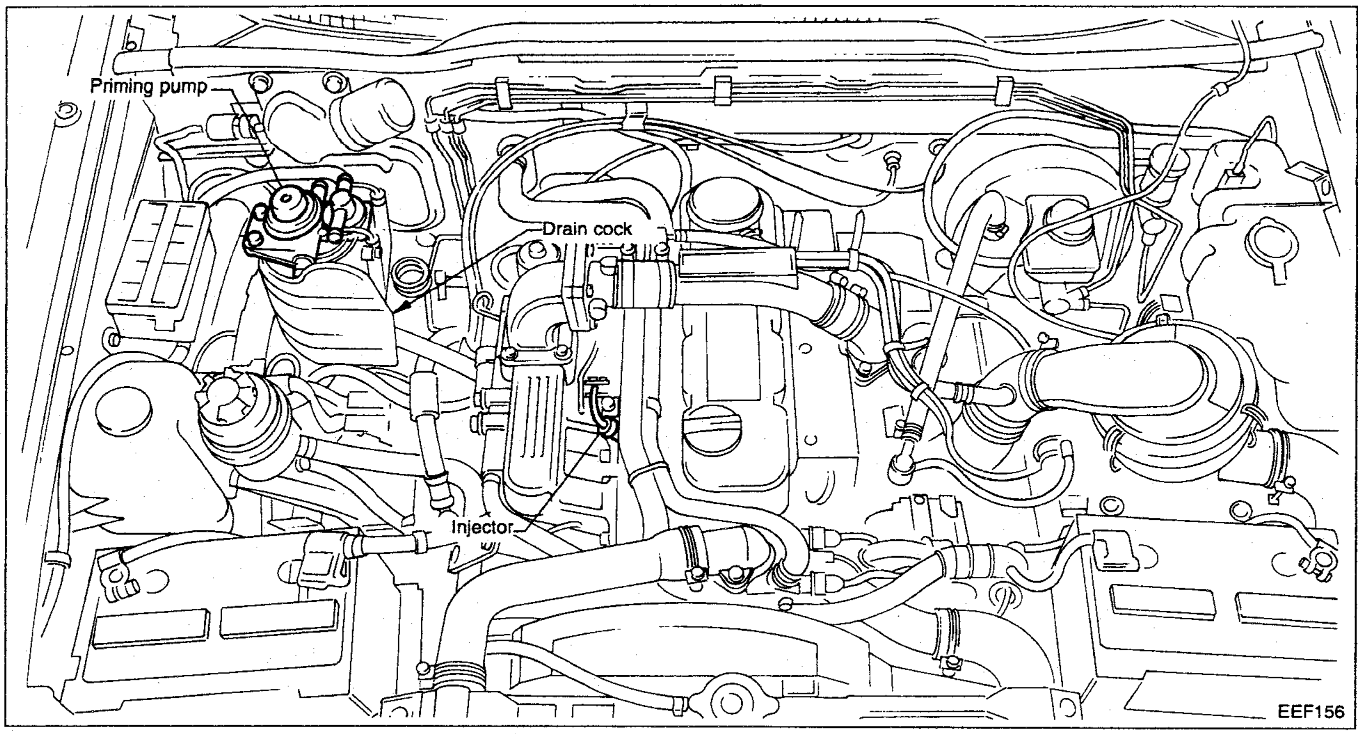
Fuel System

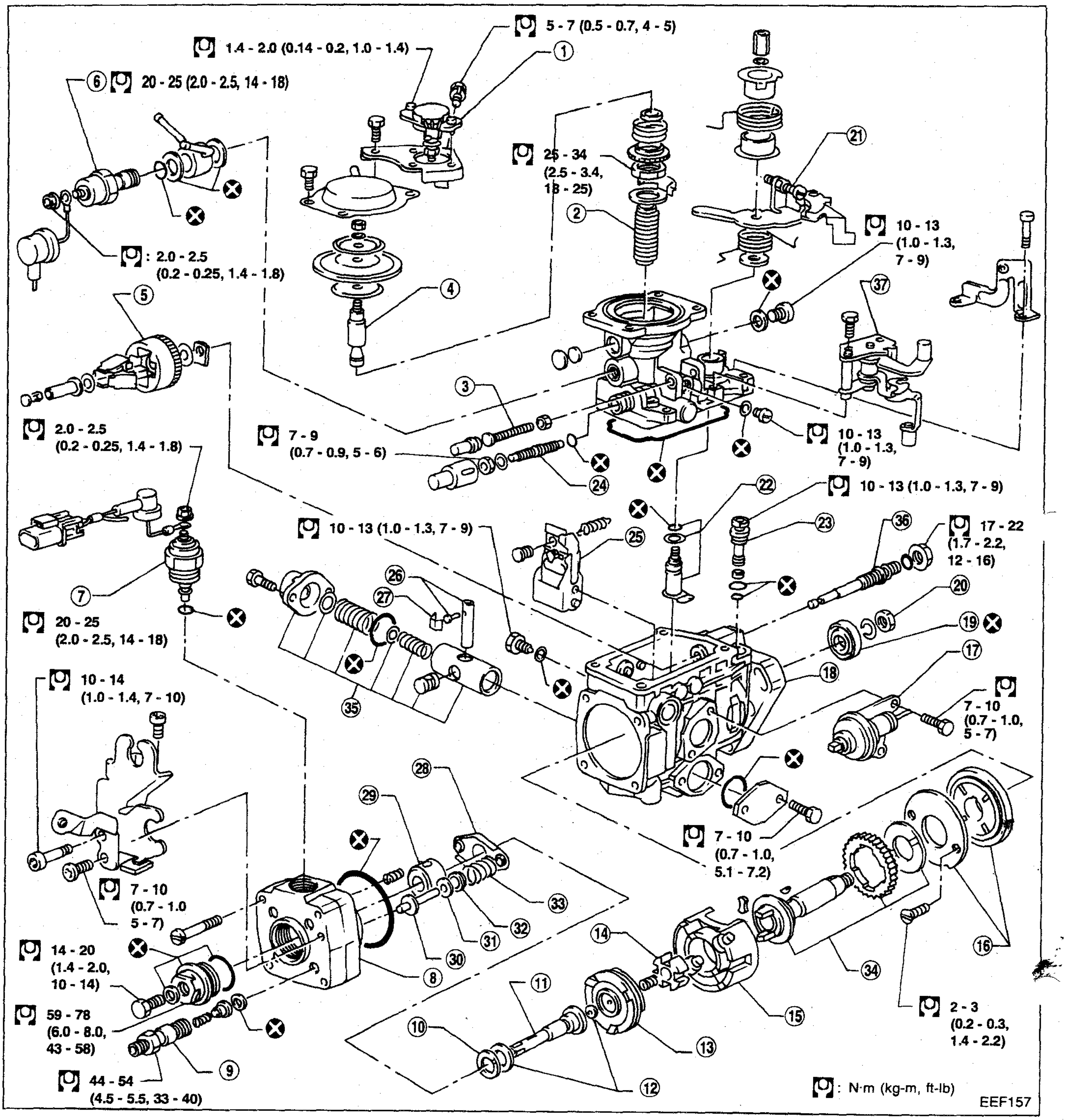




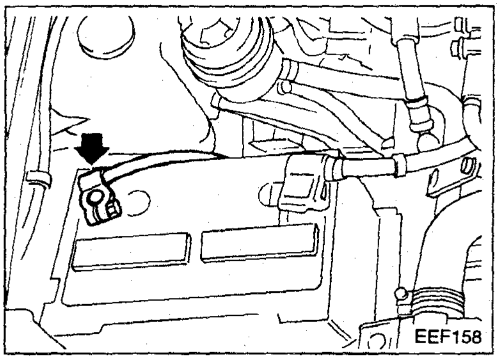
NOTE: Type 2 includes Fuel Return Control System (F.R.C.S.)

Fuel System (Cont'd)



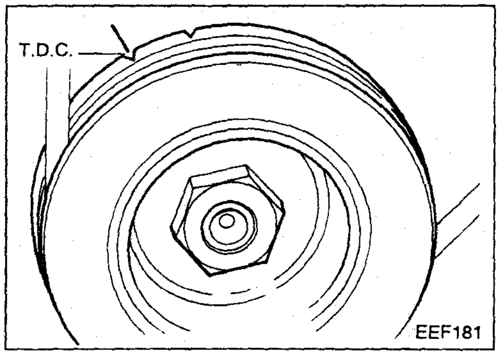


① Potentiometer	⑬ Cam disc	㉕ Governor lever
② Bushing	⑭ Driving disc	㉖ Retaining pin
③ Maximum speed adjusting screw	⑮ Roller and roller holder	㉗ Clip
④ Adjusting pin	⑯ Feed pump assembly	㉘ Spring seat
⑤ Flyweight assembly	⑰ Fast idle control device	㉙ Control sleeve
⑥ Solenoid timer	⑱ Pump housing	㉚ Guide pin
⑦ Fuel cut solenoid valve	⑲ Oil seal	㉛ Shim
⑧ Distributor head	⑳ Lock nut	㉜ Spring seat
⑨ Delivery valve assembly	㉑ Idle speed adjusting screw	㉝ Plunger spring
⑩ Washer	㉒ Control shaft assembly	㉞ Drive shaft assembly
⑪ Plunger	㉓ Regulating valve	㉟ Speed timer assembly
⑫ Shim	㉔ Full load adjusting screw	㊱ Governor shaft
		㊲ Cold start device assembly

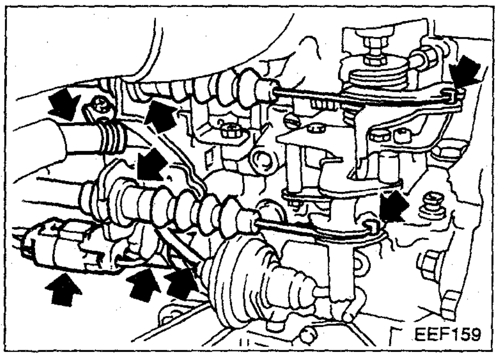


Removal

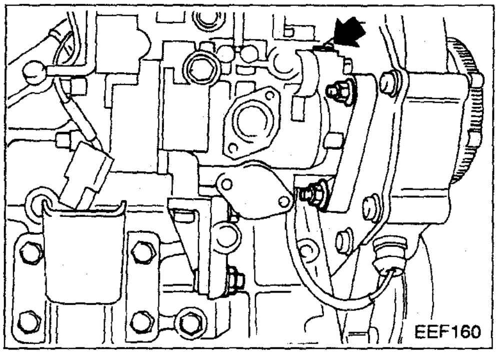
1. Disconnect battery ⊖ cable, fuel cut solenoid valve connector, accelerator wire, potentiometer connector and cold start wire.



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



3. Remove fuel hoses (supply, return and spill) and injection tubes.



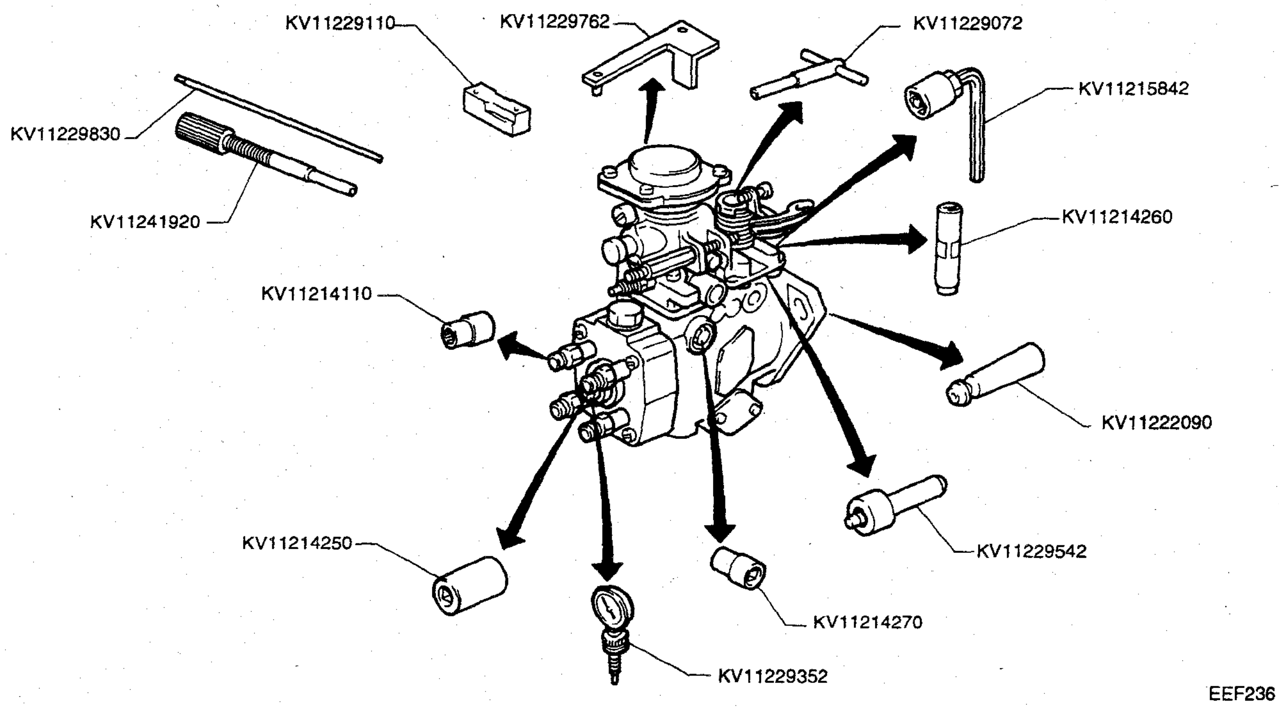
4. Remove dust cover and injection pump gear.
   Refer to EM section.
5. Remove fixing nuts and bolts. Then remove injection pump.

Disassembly

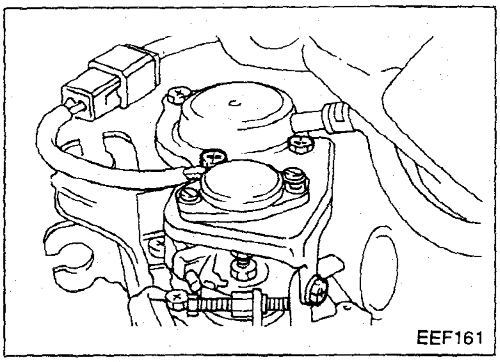
PREPARATION

- Before performing disassembly and adjustment, test fuel injection pump and note test results.
- Prior to starting 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 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.

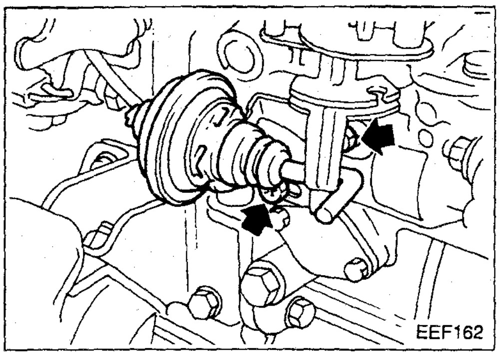


Disassembly (Cont'd)



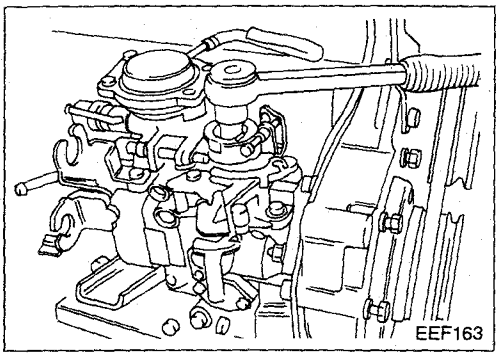
POTENTIOMETER

Remove potentiometer bracket.



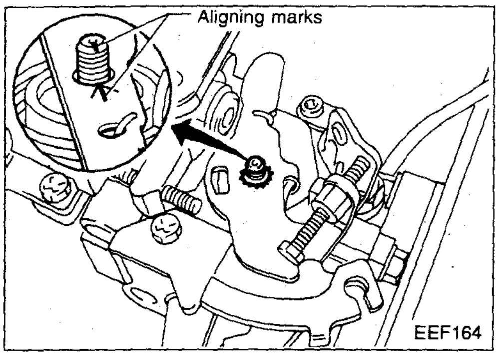
FAST IDLE CONTROL DEVICE (F.I.C.D.)

Remove fast idle control device bracket.

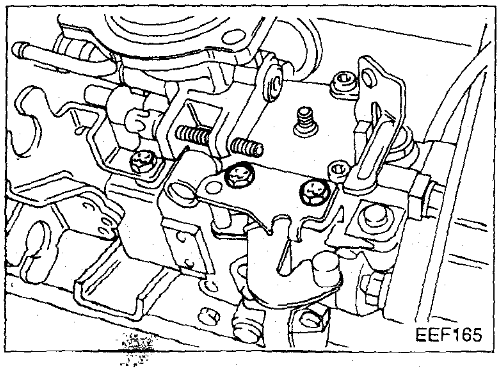


COLD START DEVICE

1. Remove nut, washer, spring seat and spring from control lever.



Make aligning marks on control shaft and control lever, in order to be able to install in the same position.

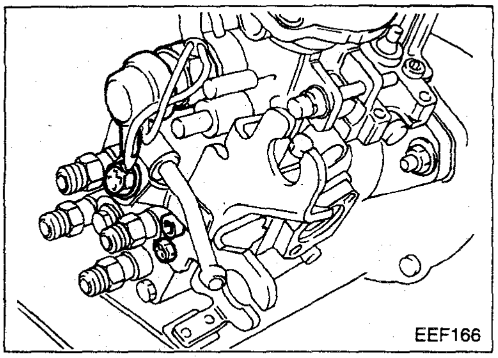


2. Remove cold start device assembly.

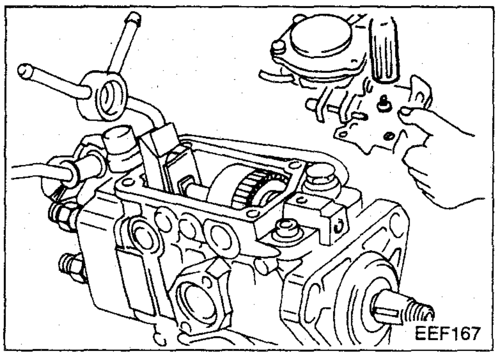
Never disassemble cold start device linkage.

Disassembly (Cont'd)

GOVERNOR COVER

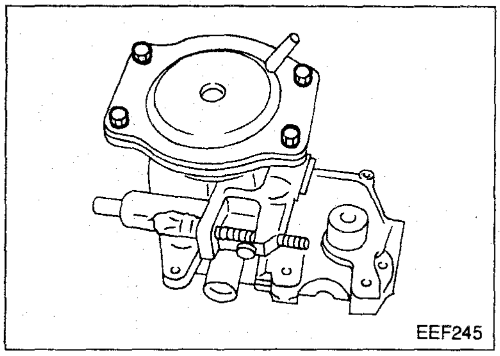


1. Remove accelerator wire and cold start device brackets.
2. Remove solenoid timer.

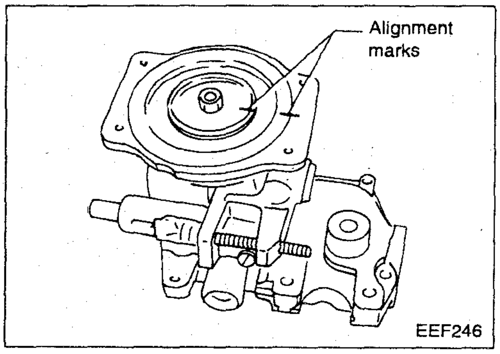


3. Remove governor cover.

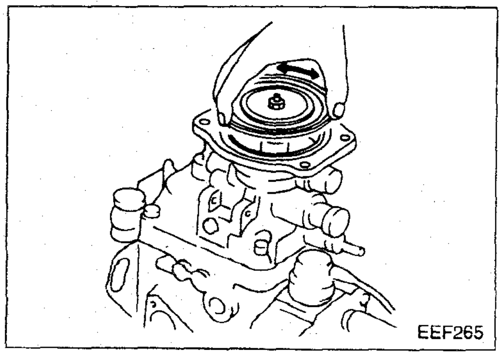
Push control shaft down by lightly tapping end with a wooden mallet.



4. Remove the cover of the turbocharger ancillary mechanism (B.C.S.).



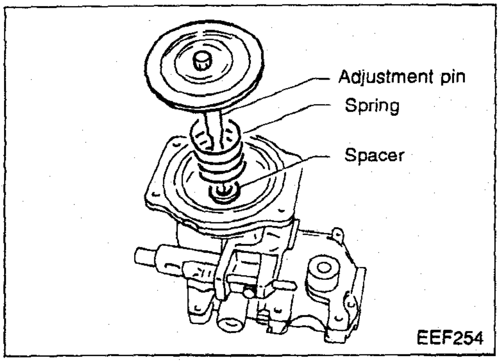
Before removing the diaphragm and the adjustment pin, make alignment marks on the diaphragm and regulator cover.



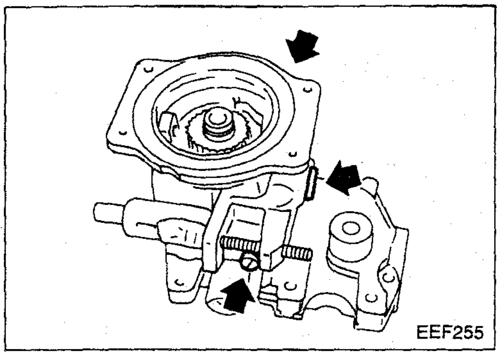
5. Remove diaphragm.

Turn diaphragm to find the position from which it can be taken out.

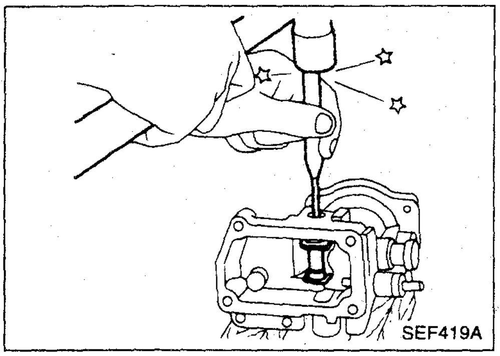
Disassembly (Cont'd)



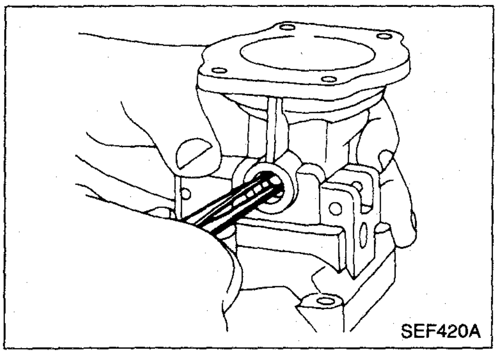
6. Remove the diaphragm and the adjustment pin together, as well as the spring and the casing.



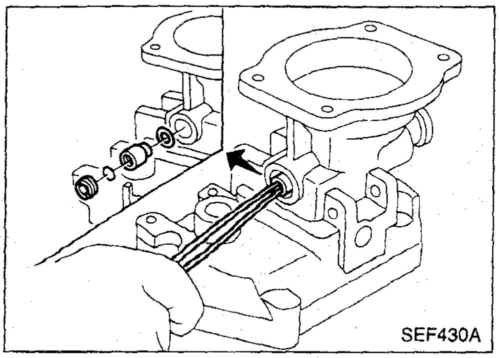
7. Remove the screws from the axle and the cap of the tappet rod.



8. Remove the axle from the crank using a punch by tapping from the right-hand side (seen from the drive side).

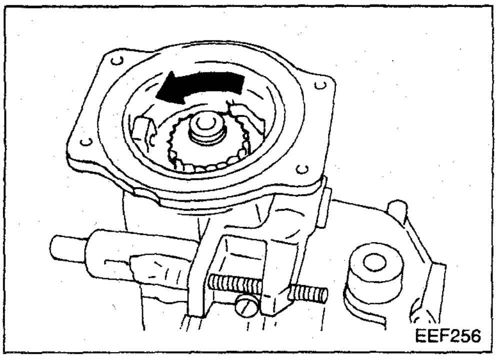


9. Remove the tappet rod.

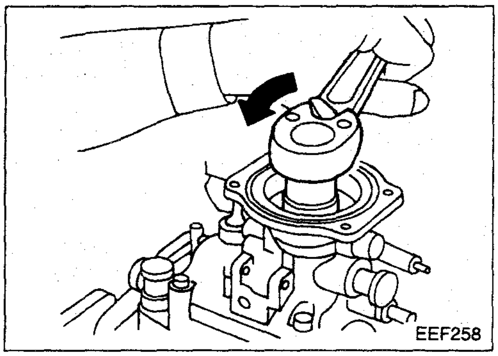


10. Remove the nut, the locking spring, the sleeve and the ring. **Use suitable pliers to remove the connector.**

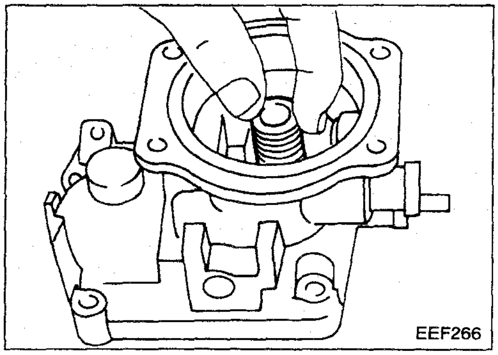
Disassembly (Cont'd)



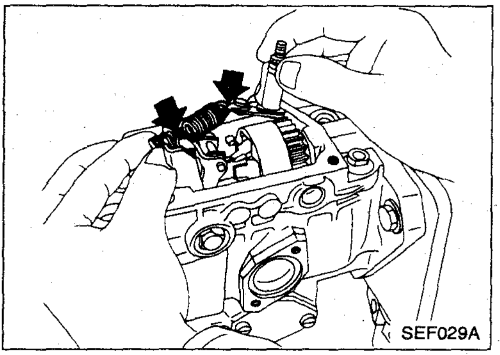
11. Remove the regulating disc.



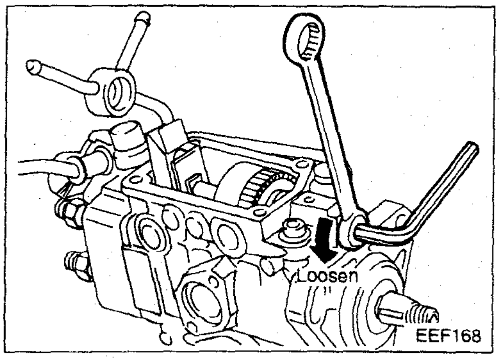
12. Remove the nut and the clamping mechanism of the regulating disc.



13. Remove bushing.



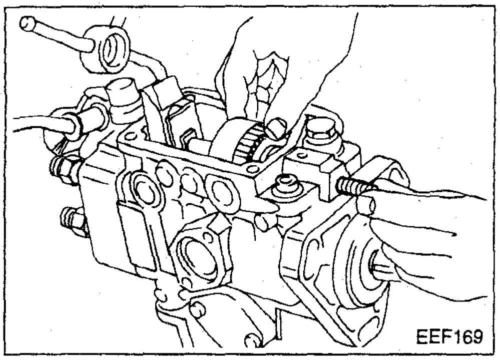
14. Remove control shaft from tension lever.



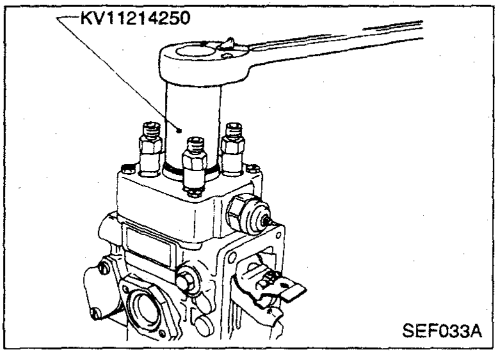
15. Remove governor shaft.

Loosen lock nut by turning it counterclockwise.

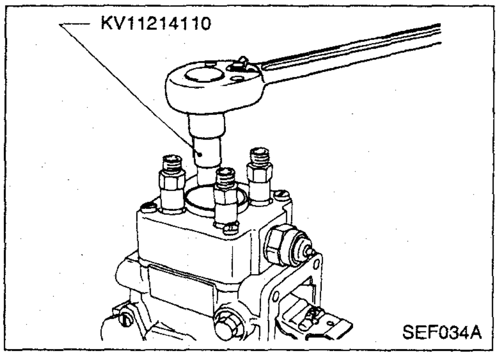
Disassembly (Cont'd)



16. Remove flyweight assembly along with washer and shim(s).

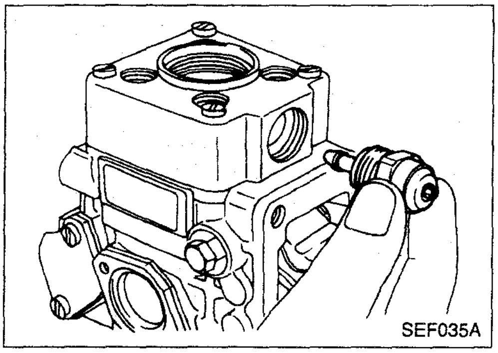


17. Remove distributor head plug.



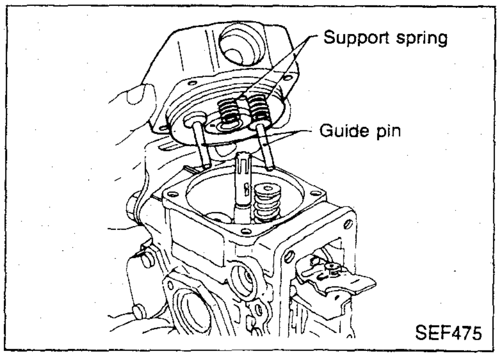
18. Remove delivery holder (spring, delivery valve and gasket).

Distributor head has letters (A, B, C and D) stamped on it. Remove lettered parts in alphabetical order and arrange neatly.



19. Remove fuel cut solenoid valve.

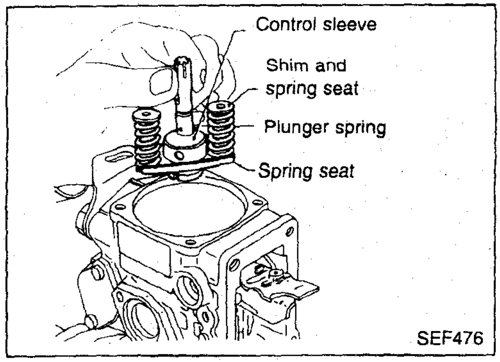
Be careful not to drop the spring and armature.



20. Remove distributor head.

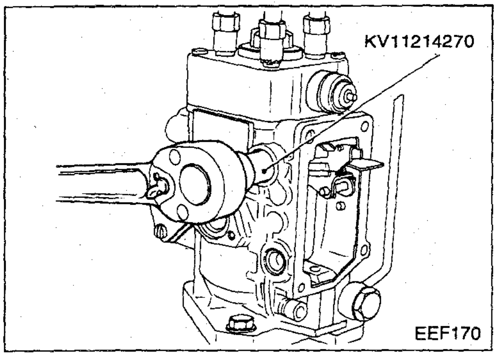
Be careful not to drop the two support springs and guide pins.

Disassembly (Cont'd)

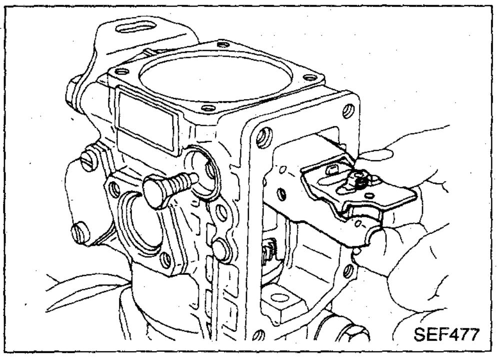


21. Remove plunger assembly.

Lift plunger, along with control sleeve, shim, spring seat anc plunger spring.

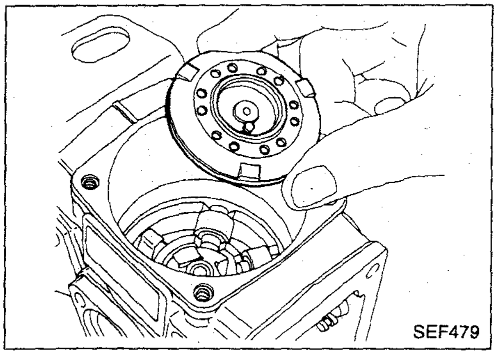


22. Loosen left and right governor pivot bolts.

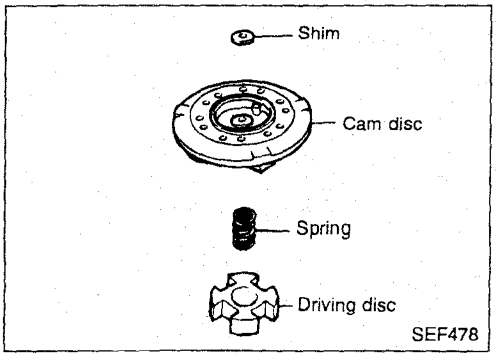


23. Remove governor lever assembly.

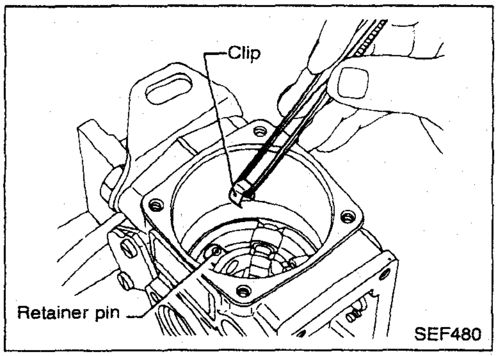
Avoid pulling on start spring and start idle spring.



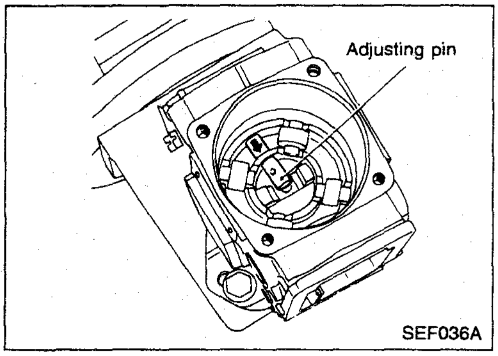
24. Remove shim, cam disc, spring and driving disc.



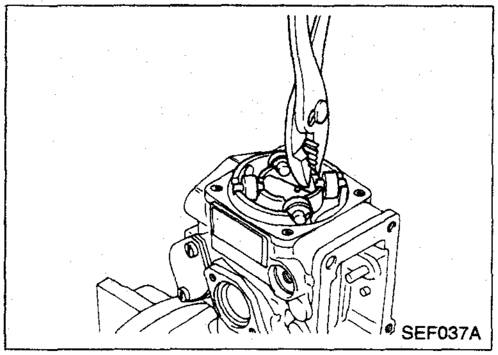
Disassembly (Cont'd)



25. Remove clips and pins.

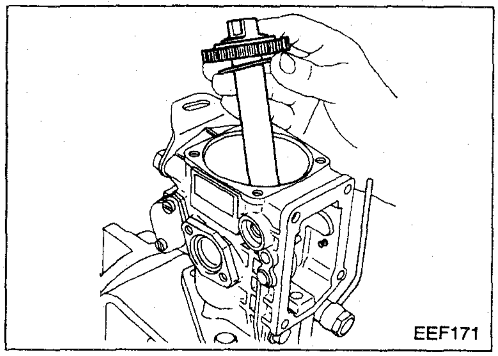


26. Move adjusting pin to center of roller holder, as shown.



27. Lift out roller holder with rollers without tilting.

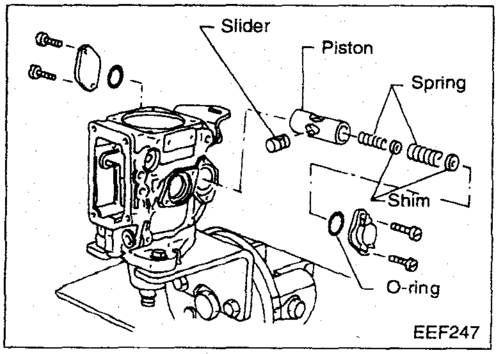
Be careful not to drop rollers.



28. Remove drive shaft.

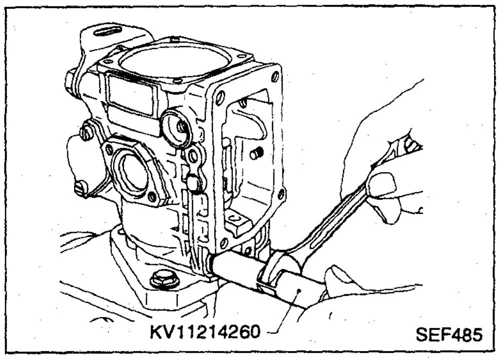
a. **Be careful not to scratch inner surface of fuel injection pump body.**

b. **Be careful not to drop the key.**

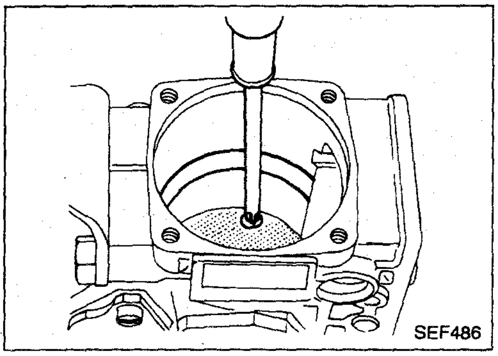


29. Remove speed timer cover, O-ring, shims, spring, piston and slider.

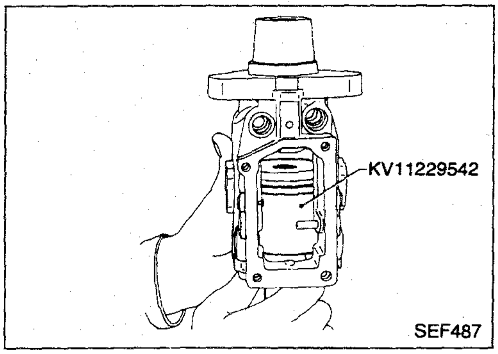
Disassembly (Cont'd)



30. Remove regulating valve.

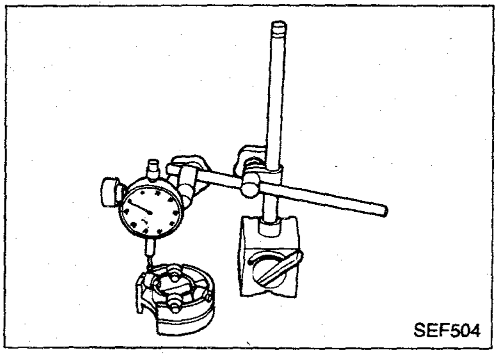


31. Loosen screw from feed pump cover.



32. 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.

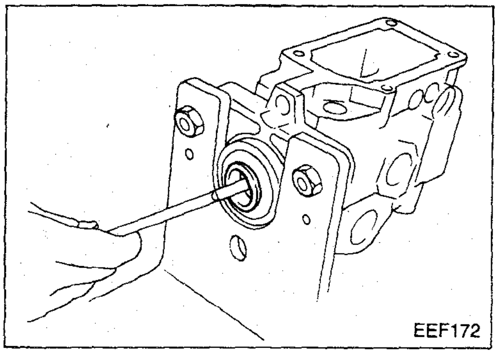
- **If cover and feed pump assembly are hard to remove or are stuck midway, strike pump body lightly.**
- **Do not move position of vanes.**



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. I: such is not the case, replace plunger.
4. Check height of all rollers.

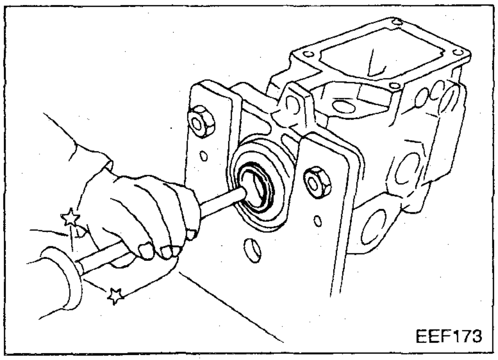
Difference in roller height should be less than 0.02 mm (0.0008 in).



REPLACEMENT OF SEAL

1. Remove seal.

Inspection (Cont'd)

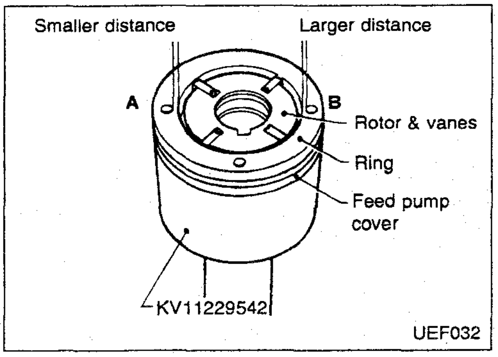


2. Apply grease to new seal.
3. Install new seal.

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



PREPARATION

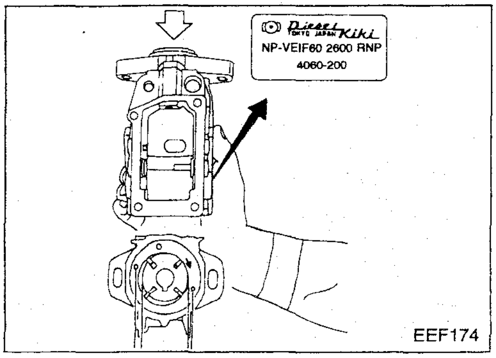
Dip all movable parts and O-rings in test oil and clean.

1. Locate 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.

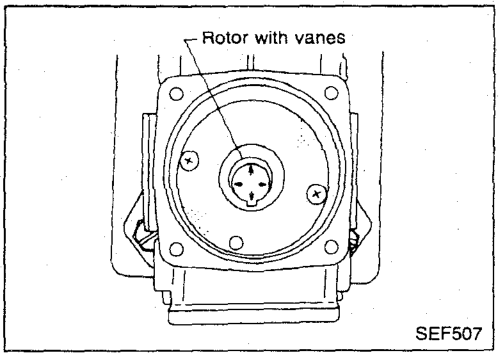
2. Install feed pump cover, rotor with vanes, and ring to pump housing.

Be careful to install liner correctly. If A and B are reversed, fuel will not be discharged from feed pump.



Fuel injection pump rotates in direction "R", as indicated on identification plate.

Assembly (Cont'd)

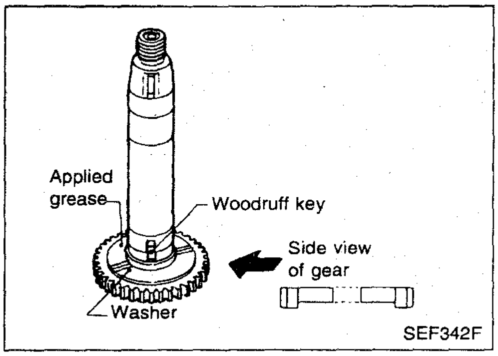


SEF507

3. Turn fuel injection pump 180°, and remove service tool KV11229542. Tighten screw to retain pump cover.

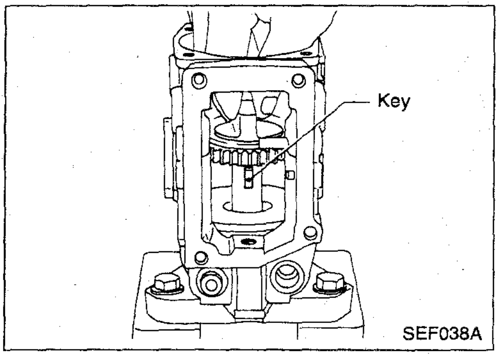
a. **When tightening screws, be careful not to scratch inner wall of pump housing.**

b. **After tightening screws, make sure rotor with vanes moves smoothly.**



SEF342F

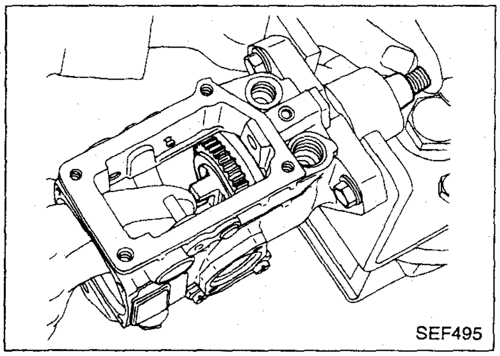
4. Make sure drive shaft and gear are assembled properly, as shown.



SEF038A

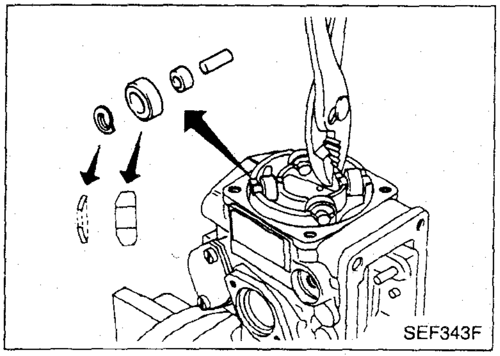
5. Install drive shaft to housing, engaging drive shaft key with key groove in rotor.

- **Before installing drive shaft, attach oil seal guide (KV11222090) onto drive shaft.**
- **Be careful not to scratch oil seal and inner wall of housing.**



SEF495

6. Set drive shaft's nail as shown.

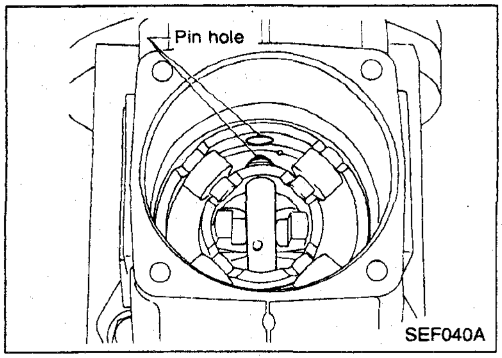


SEF343F

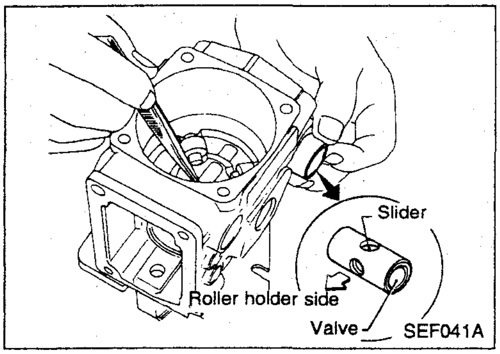
7. Install roller and holder.

- **Do not interchange roller positions. If they are interchanged, refer to Inspection for correction.**
- **Make sure washer is situated outside of rollers.**

Assembly (Cont'd)

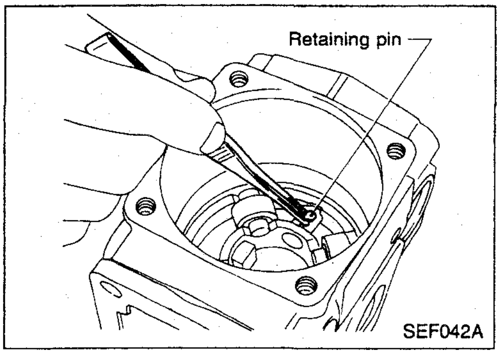


8. Align holder and timer retaining pin holes.



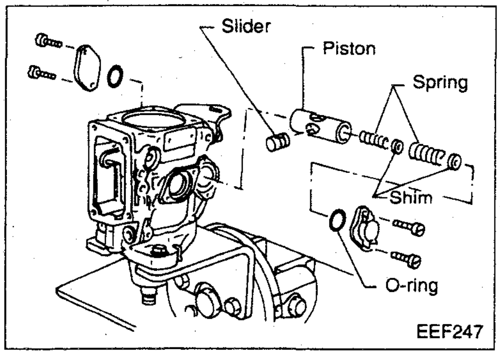
9. Install timer piston and slider as a unit.

- **Make sure hole in slider faces towards roller holder.**
- **Make sure valve in piston is on the same side as return hole.**



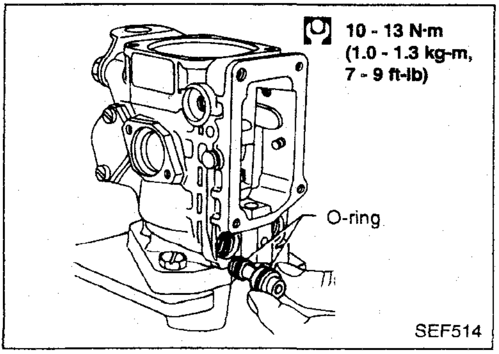
10. Insert timer retaining pin into timer piston slider, and secure with retaining pin and clip.

Make sure timer piston moves smoothly.



11. Fit the remaining parts of the feed unit using shims 0.6 mm (0.024 in) thick (one for each spring) and then fit the springs, the toroid link and the feed unit cover.

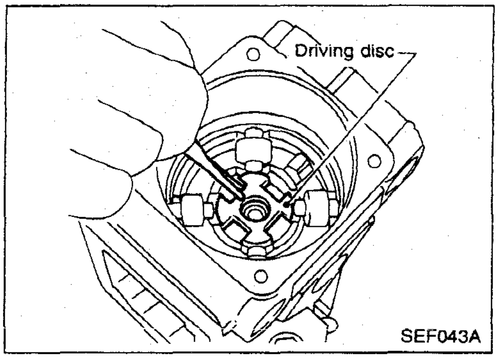
a. Use at least one shim.
b. Use shims that were selected during bench test.



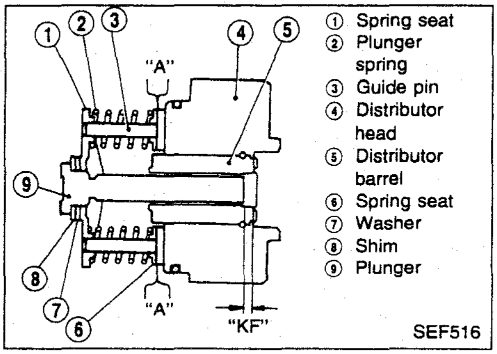
12. Install regulating valve.

Be careful not to scratch O-rings.

Assembly (Cont'd)



13. Fit the drive disc so that the inlet faces upwards where it is widest.



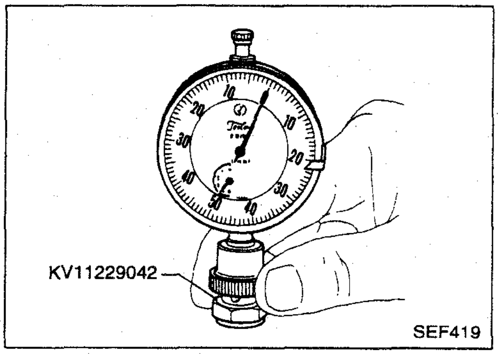
① Spring seat
② Plunger spring
③ Guide pin
④ Distributor head
⑤ Distributor barrel
⑥ Spring seat
⑦ Washer
⑧ Shim
⑨ Plunger

14. Measurement of plunger spring set length (dimension "KF")

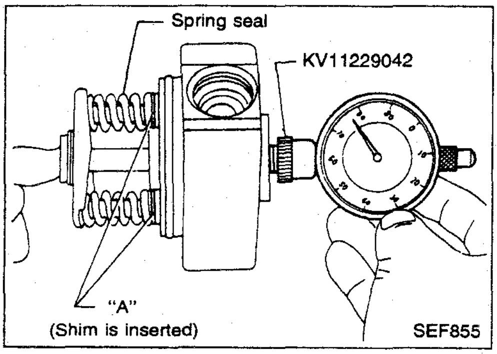
Dimension "KF" is the distance between the end face of the distributor barrel and the end face of the plunger.

(1) Install distributor head components, as shown.

Do not insert shim into "A" portion before measuring "KF" dimension.



(2) Set dial gauge so that it can compress 10 mm (0.39 in), and reset to zero.



(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 shims to be used at "A" by calculating difference between standard and measured dimensions.

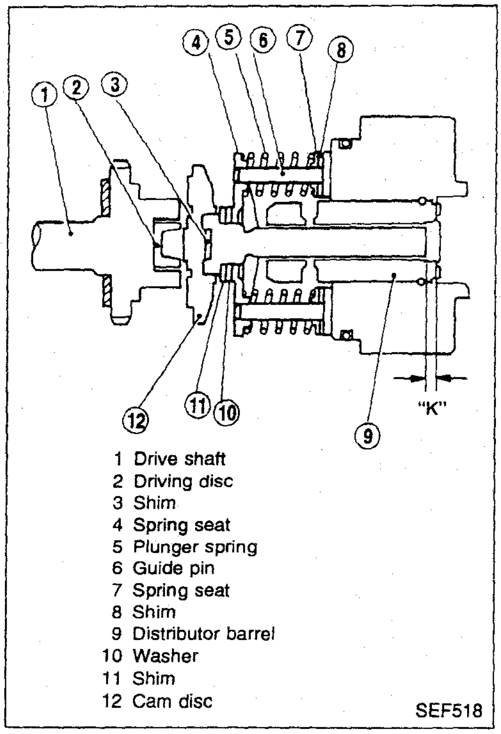
Refer to S.D.S. for "KF".

[Example]

When measured (dial gauge reading) value is 5.4 mm, "KF" − 5.4 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 of shim on each side of distributor head.**
d. **Refer to S.D.S. for available service parts.**

Assembly (Cont'd)



SEF518

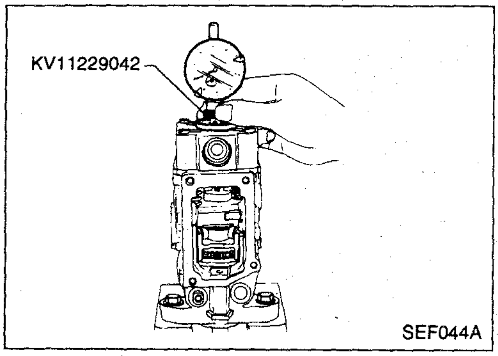
15. Adjustment of plunger dimensions (Measurement of dimension "K")

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" that is inserted between driving disc and cam disc.**

b. **When inserting plunger and shim into cam disc, make sure that knock pin of cam disc is situated in groove at bottom of plunger.**

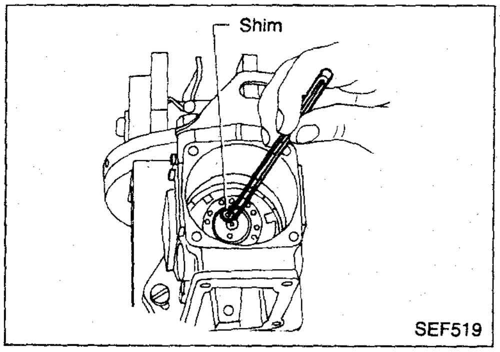


SEF044A

(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.**



SEF519

(3) Determine shim to be used by calculating difference between measured (dial gauge reading) value and standard dimension "K", and position that shim on the bottom of the plunger.

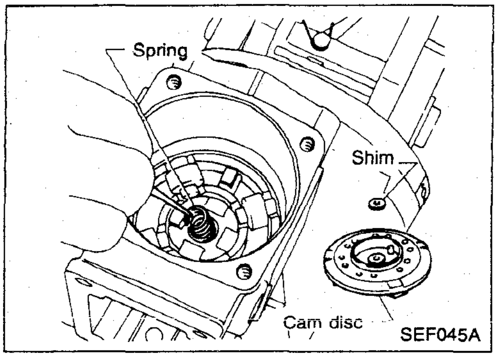
Refer to S.D.S. for "K".

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.**

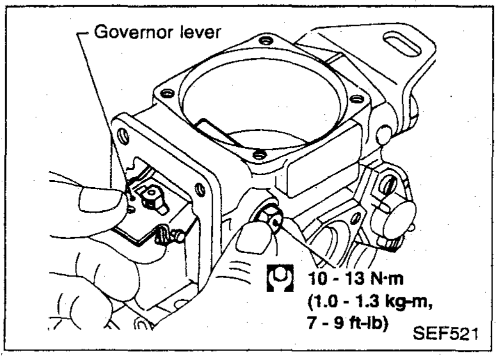
c. **Refer to S.D.S. for available service parts.**

Assembly (Cont'd)



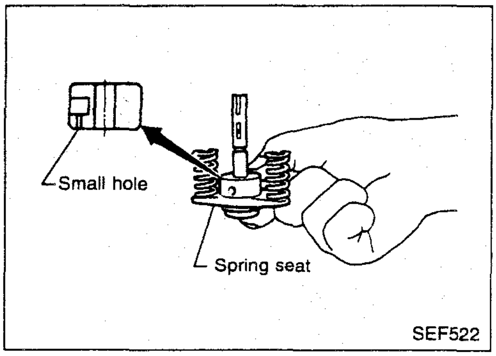
16. Install spring in top of driving disc and install cam disc and shim in that order.

Make sure cam disc drive pin and drive shaft key face governor lever.



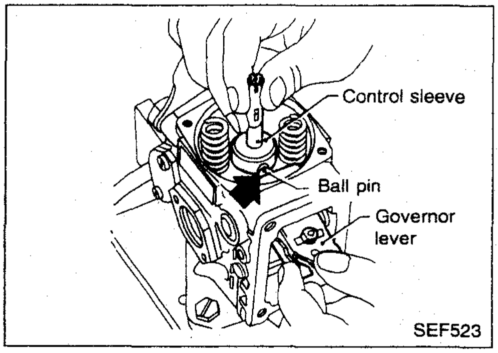
17. Install governor lever.

Avoid pulling on start spring and start idle spring.

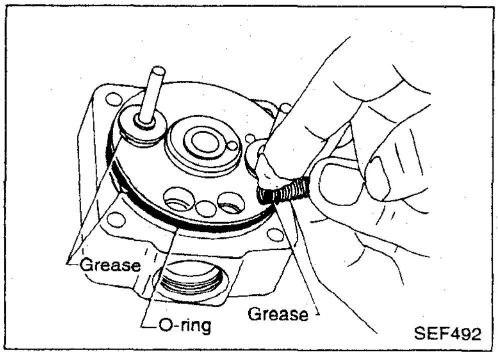


18. Install plunger assembly.

a. **Make sure control sleeve is installed with its small hole facing spring seat side.**

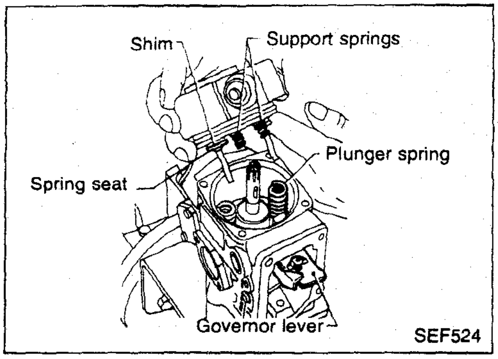


b. **When inserting plunger and shim into cam disc, make sure that knock pin of cam disc is situated in groove at bottom of plunger.**
c. **Insert ball pin for governor lever into hole in control sleeve (shown by arrow).**



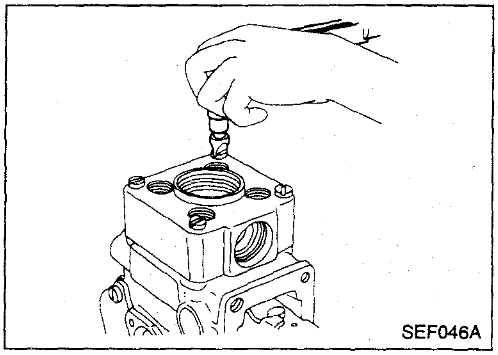
19. Apply a coat of grease to guide pin, shim and spring seat, and attach these parts to distributor head.

Assembly (Cont'd)



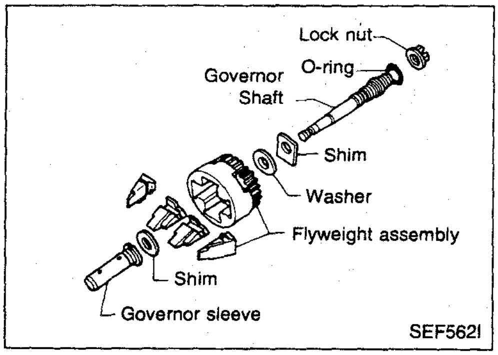
20. Install distributor head.

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.**



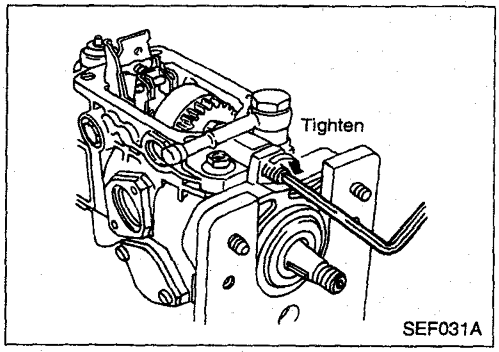
21. Tighten distributor head.

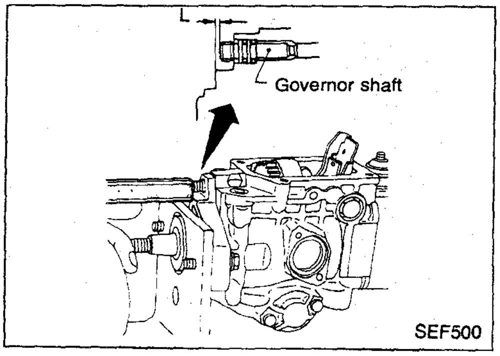
Distributor head screws:
🔧: 10 - 14 N·m (1.0 - 1.4 kg-m, 7.5 - 10.5 ft-lb)



22. Install flyweight assembly.

When installing governor shaft, be careful not to scratch O-rings.



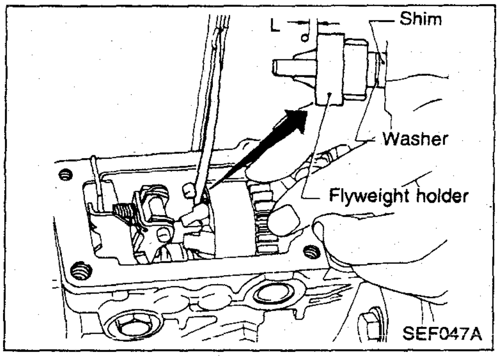


23. Adjust dimension "L", as shown.

"L": 1.5 - 2.0 mm (0.059 - 0.079 in)

Tighten lock nut to specified torque.
🔧: 17 - 22 N·m
(1.7 - 2.2 kg-m, 12 - 16 ft-lb)

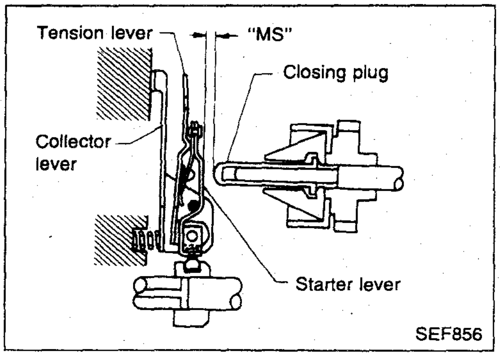
Assembly (Cont'd)



24. Measure axial play of flyweight holder. If it is not within specified range, adjust it by means of shim.

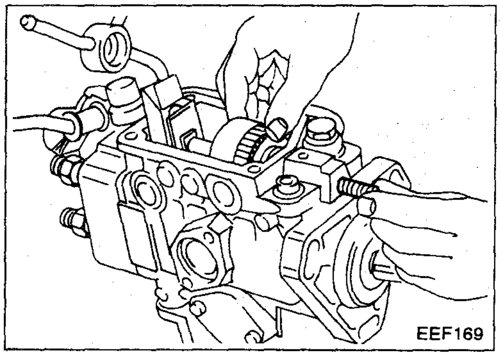
"L": 0.15 - 0.35 mm (0.0059 - 0.0138 in)

Refer to S.D.S. for available shims.

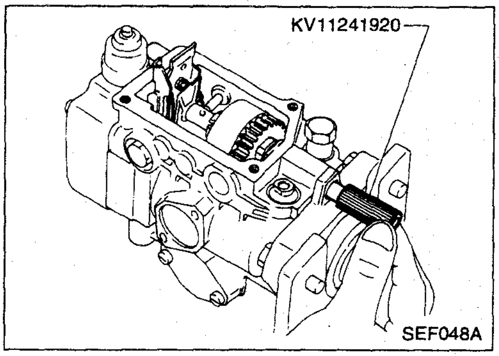


25. Measurement of dimension "MS" (for setting the fuel delivery during starting)

Dimension "MS" is the distance from closing plug to starter lever.

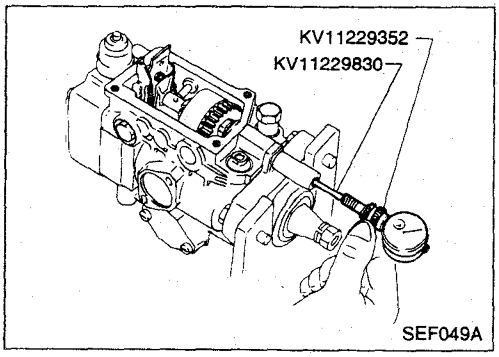


(1) Remove lock nut, governor shaft and flyweight assembly.



(2) Place the bearing springs on the main support.

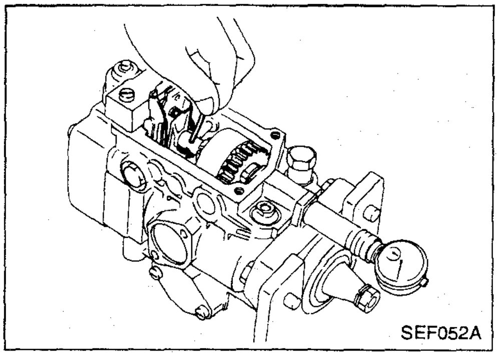
Be sure to install shim and washer when installing flyweight assembly.



(3) Set Tool, as shown.

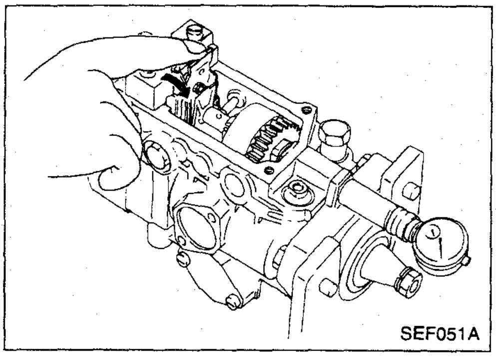
Assembly (Cont'd)

(4) Install dial gauge together with rod.



SEF052A

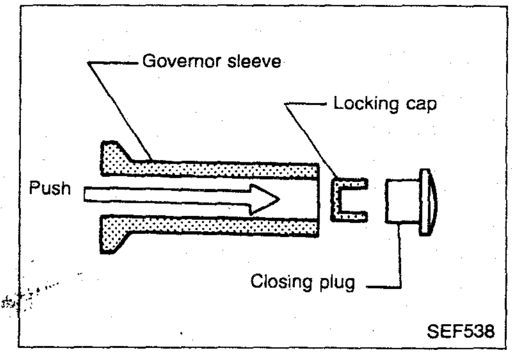
(5) Press governor sleeve to flyweight and set dial gauge to "0".



SEF051A

(6) Push tension lever until it contacts closing plug. Return governor sleeve until start lever contacts tension lever, and read dial gauge.

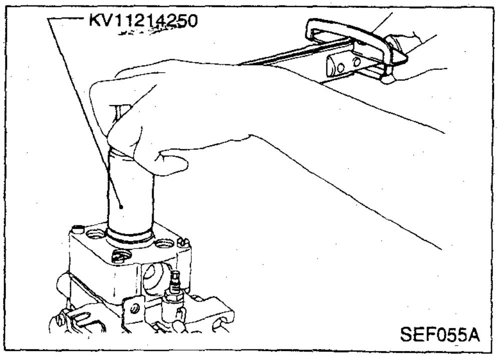
Refer to S.D.S. for dimension "MS" (distance between closing plug and starter lever).



SEF538

(7) If dial gauge indication is not within the specified range, replace closing plug and adjust dimension "MS" to that range.

Refer to S.D.S. for available service parts.



SEF055A

26. Install new plug with new O-ring.

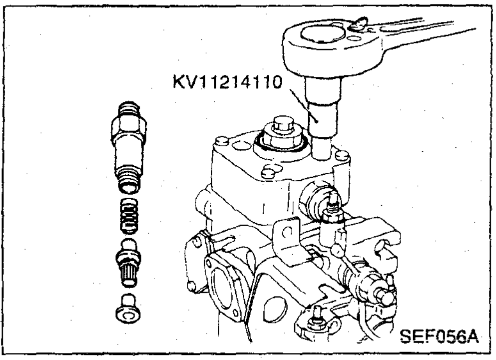
Always replace plugs with new ones.

Plug:

🔧: 59 - 78 N·m (6.0 - 8.0 kg-m, 43.5 - 57.5 ft-lb)

27. Install plug bolt with a new gasket.
28. Install fuel cut solenoid valve.

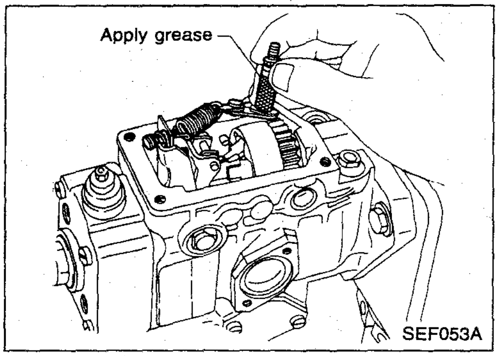
Assembly (Cont'd)



29. Install delivery valve assembly.
   a. **Always use new washers.**
   b. **Make sure delivery valve is reinstalled in its original position.**

Delivery valve:

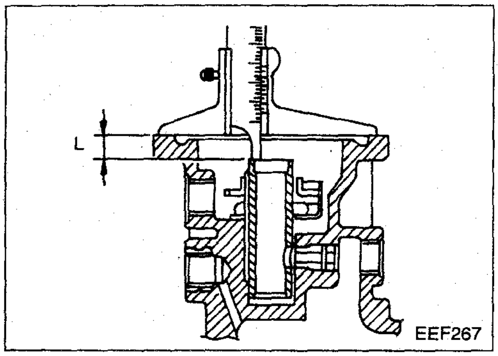
: 44 - 54 N·m (4.5 - 5.5 kg-m, 32.5 - 40 ft-lb)



30. Install control lever shaft.

Apply a coat of grease to lever shaft end.

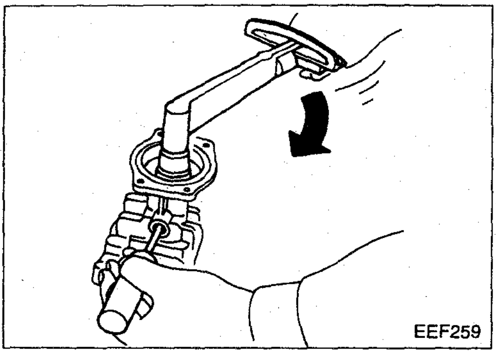
GOVERNOR COVER



1. Fit drive shaft so that height (L) between bushing and upper mating face of governor cover meets specified value.

L = 7.5 ± 0.5 mm (0.295 ± 0.020 in)

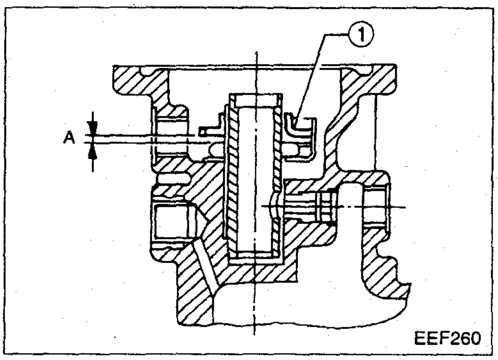
Check for proper alignment of adjustment holes at drive shaft and governor cover.



2. Fit the clamping mechanism of the regulating disc and the fastening nut.

Fastening nut:

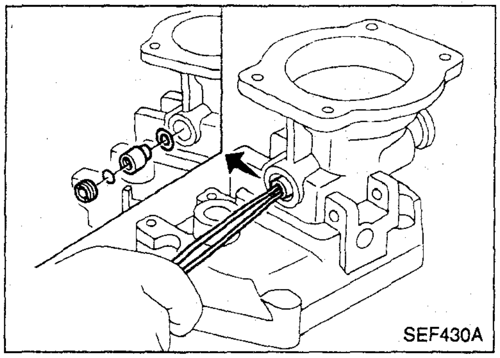
: 25 - 34 N·m (2.5 - 3.5 kg-m, 18 - 25 ft-lb)



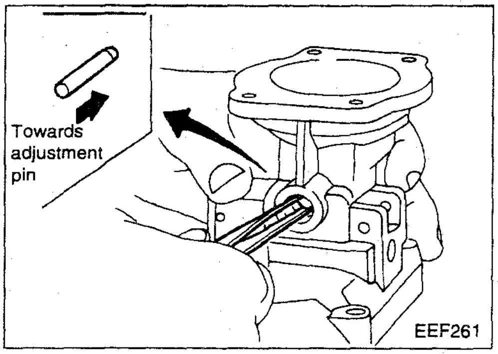
3. Fit the regulating disc lock nut ① by tightening it and subsequently loosening it by approx. 2.5 turns.

A = 2.5 mm (0.098 in)

Assembly (Cont'd)

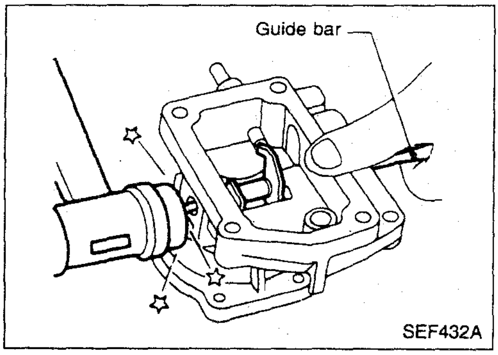


4. Fit the ring, the sleeve, the locking spring and the nut.



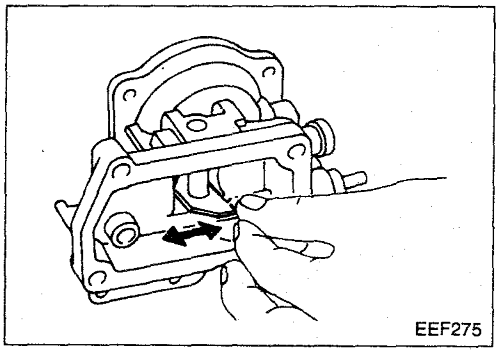
5. Fit the tappet rod.

Ensure that the slanting side faces the adjustment pin.

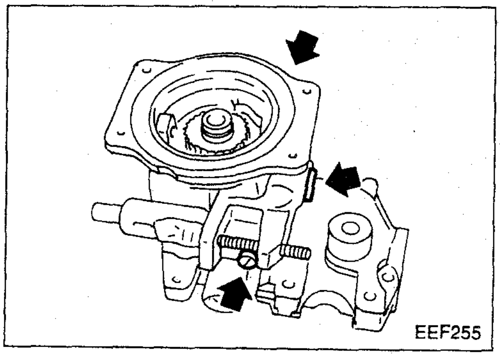


6. Fit lever shaft.

- **Use suitable punch to fit the shaft.**
- **Fit shaft from the RH side (seen from the drive side).**
- **Insert shaft until its ends are located approx. 10 mm (0.39 in) from the outer surface of the housing.**



- **Check lever for smooth operation.**



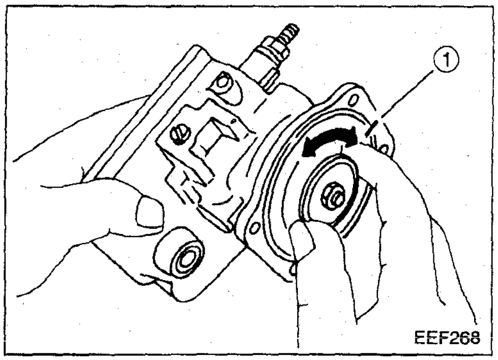
7. Fit the axle screws and the tappet rod cover.

Ensure that the rings are replaced with new ones.

Screws and cover of the tappet rod:

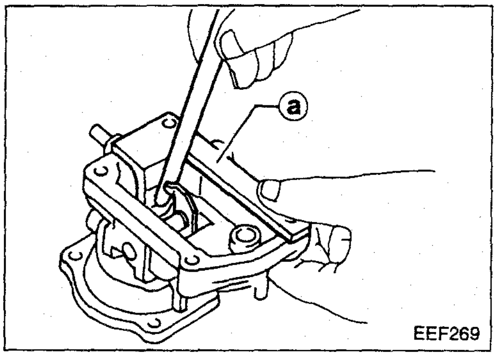
🔧: 10 - 13 N·m (1.0 - 1.3 kg-m, 7 - 9 ft-lb)

Assembly (Cont'd)



8. Check lever position.
a. Fit special tool ⓐ.
b. Fit diaphragm assembly together with adjustment pin.

Turn diaphragm until increased friction is felt. Make sure that alignment marks ① coincide.



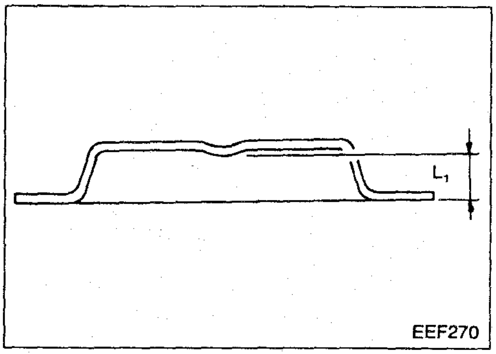
c. Fit regulator cover of compensator device (B.C.S.).
d. Measure the play between special tool and lever.

Play: 0.05 mm (0.002 in)

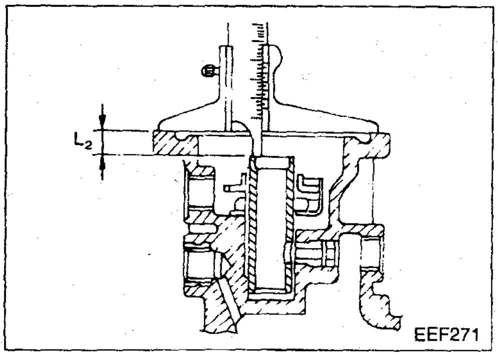
9. Determine thicknes of shim.

It will not be necessary to adjust the compensator stroke, if the following points have been observed during removal.

- **The diaphragm bolt located on the diaphragm cover has not been removed.**
- **The compensator spacer has not been changed.**
- **The diaphragm assembly has been replaced in the originally marked position.**

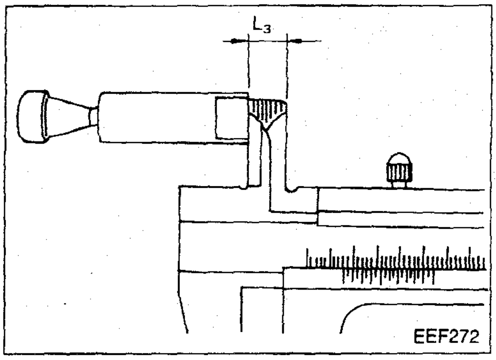


a. Remove the diaphragm cover and measure the distance (L_1) between the cover and the inner stop. See figure.



b. Measure the distance (L_2) between the bush and the governor cover.

Assembly (Cont'd)

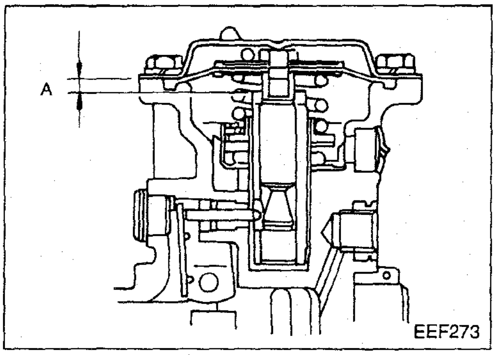


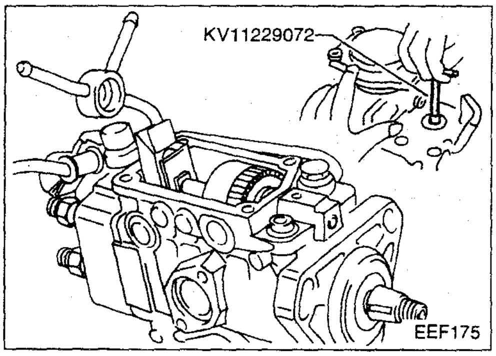
c. Measure the length (L_3) of the pin thread.

d. Determine the thickness of the spacers by means of the equation:

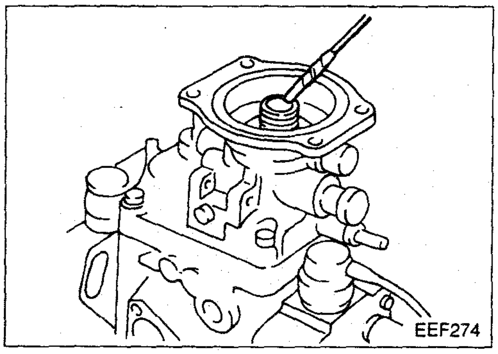
Spacer thickness
$=(L_1+L_2-L_3)$ – compensator stroke (A)
Example:
L_1 = 10.5 mm (0.413 in)
L_2 = 7.5 mm (0.295 in)
L_3 = 10.5 mm (0.413 in)
Compensator stroke = 3.9 mm (0.154 in)
Spacer thickness
= (10.5 + 7.5 – 10.5) – 3.9
(0.413 + 0.295 – 0.413) – 0.154
= 3.6 mm (0.142 in)

To determine the parts available and the compensator stroke, refer to S.D.S.





10. Fit governor cover.

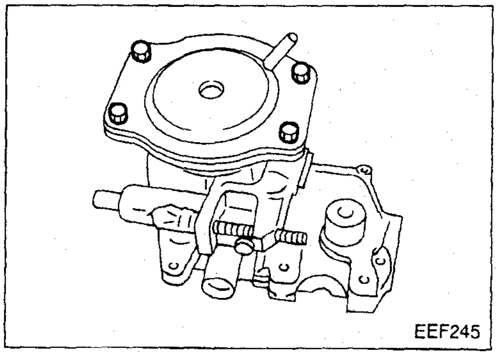


11. Fit compensation spring.
12. Fill bushing with recommended oil.

Recommended oil type: Shell Clavus
Quantity : 4 - 5 cm^3 (0.24 – 0.31 cu in)

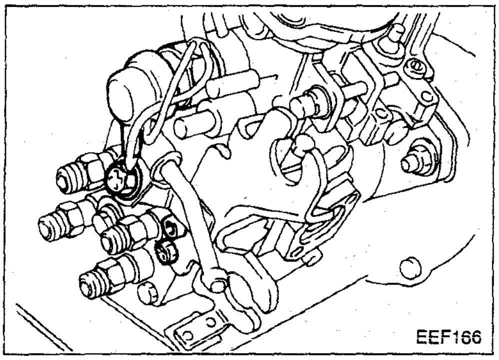
13. Install diaphragm assembly with shim.

Turn diaphragm assembly until increased friction is felt. Check that marks are aligned.



14. Install diaphragm cover.

Assembly (Cont'd)

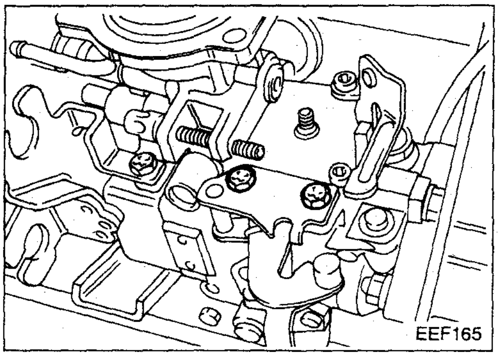


15. Install solenoid timer.

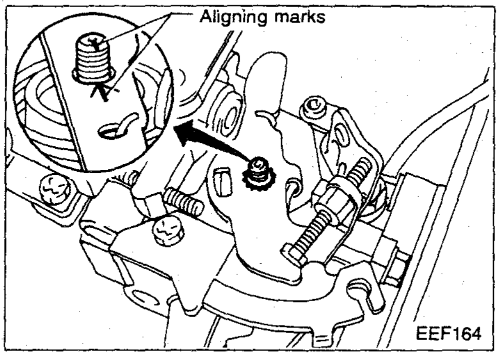
Always replace washers with new ones.

16. Install accelerator wire and cold start device brackets.

COLD START DEVICE



1. Install cold start device assembly.

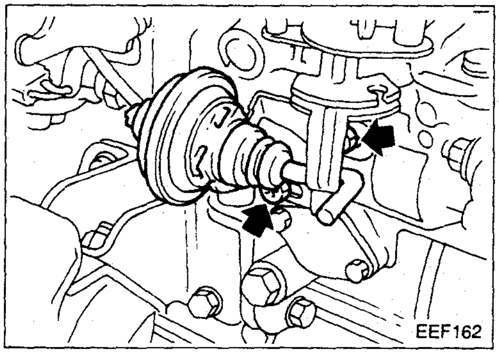


2. Install control lever assembly.

Align alignment marks of speed control lever and control lever shaft in order to install control lever in the original position.

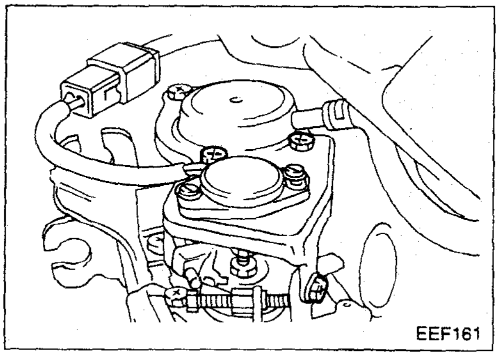
3. Install remaining pieces.

FAST IDLE CONTROL DEVICE (F.I.C.D.)



Install fast idle control device bracket.

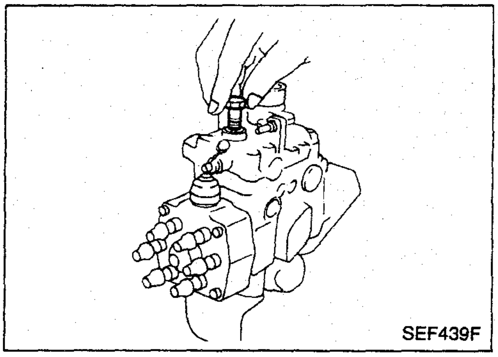
POTENTIOMETER



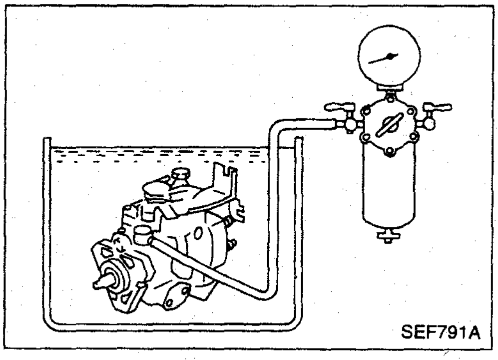
Install potentiometer bracket assembly.

Assembly (Cont'd)

AIR TIGHTNESS TEST


SEF439F

1. Replace overflow connector with a bolt.


SEF791A

2. Connect an air hose to fuel inlet and immerse fuel injection pump in diesel fuel.
3. Apply air at a pressure 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.

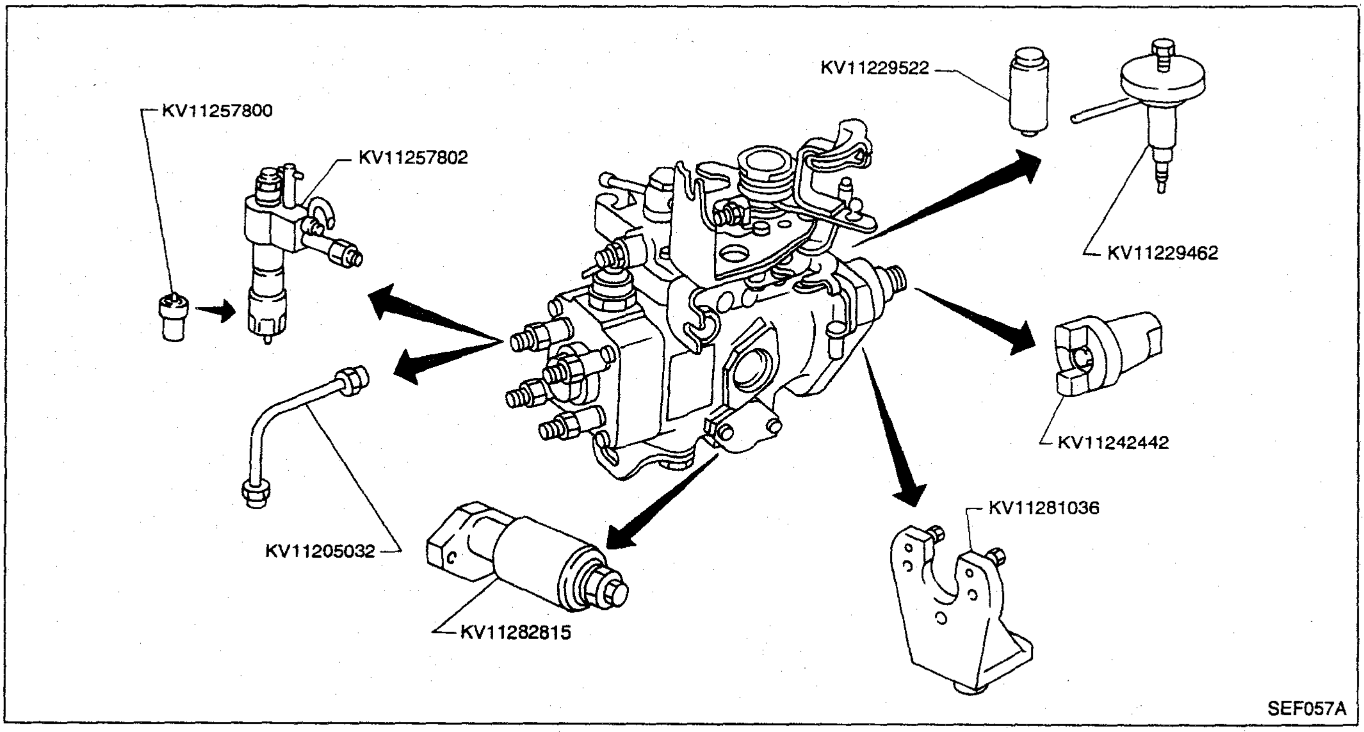
Testing of Injection Pump

PREPARATION

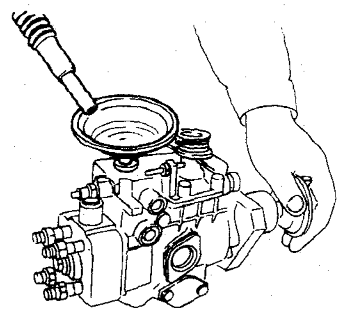
Injection pump test conditions

Nozzle		KV11257800
Nozzle holder		KV11257802
Nozzle starting pressure	kPa (bar, kg/cm², psi)	10,200 - 11,000 (102 - 112, 104 - 114, 1,479 - 1,621)
Nozzle tube		KV11205032
Inner dia. x outer dia. x length	mm (in)	2.0 x 6.0 x 450 (0.079 x 0.236 x 17.72)
Fuel feed pressure	kPa (bar, kg/cm², 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		Clockwise (observed from the drive shaft)
Injection sequence		1-3-4-2

1. Prepare necessary service tools.



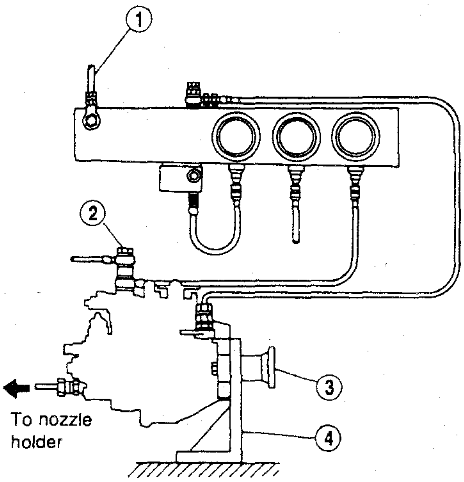
Testing of Injection Pump (Cont'd)



SEF950

2. Pour test oil into fuel injection pump.

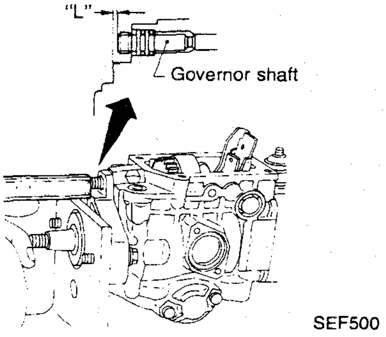
Test oil should be ISO4113, SAE J967d or its equivalent.



1 Fuel supply inlet from pump tester
2 Overflow valve
3 Coupling
4 Fixing stand

SEF378F

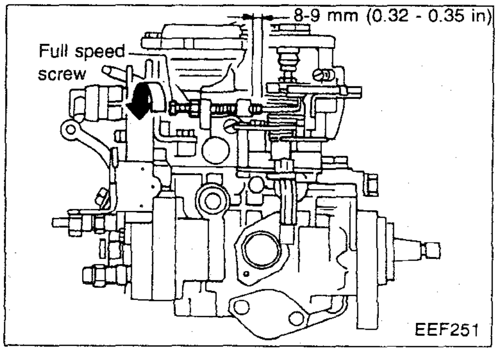
3. Install fuel injection pump to pump tester.
4. Connect pump tester tubing.



SEF500

5. Make sure governor shaft is properly installed.

Adjust "L" dimension:
"L": 1.5 - 2.0 mm (0.059 - 0.079 in)
Lock bolt governor shaft:
🔧: 17 - 22 N·m (1.7 - 2.2 kg-m, 43 - 51 ft-lb)



EEF251

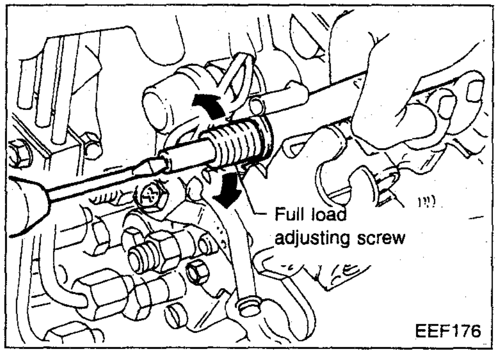
6. Run in fuel injection pump as follows:
(1) Maintain test oil in tank at 45 to 50°C (113 to 122 °F).
(2) Set control lever at "full-load" using a spring.

Set maximum speed adjusting screw in position shown, by turning counterclockwise.

Testing of Injection Pump (Cont'd)

(3) Apply 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).
(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.



ADJUSTMENT

Preadjustment of full-load delivery

NOTE:

This injection pump has a supercharger ancillary mechanism. To measure the yield, this mechanism should be on, with the lug at the point to be measured.

1. Set control lever at "full-load" by pulling spring or using suitable equipment.

Set maximum speed adjusting screw in position shown, by turning counterclockwise.

S: Refer to S.D.S.

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 on fuel injection tester.

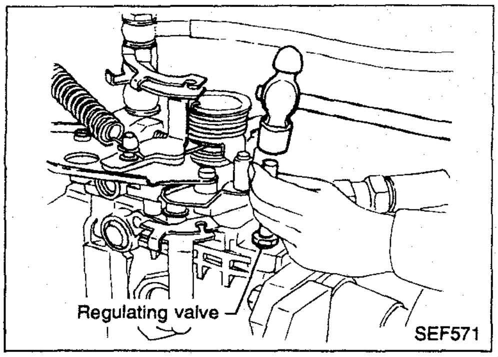
4. Calculate imbalance of fuel injection quantity.

$$\text{Imbalance} = \begin{array}{l}\text{Max. or Min. injection}\\ \text{volume amount deliv-}\\ \text{ery valves}\end{array} - \begin{array}{l}\text{Mean injection volume}\\ \text{of all delivery valves}\end{array}$$

5. If the imbalance is out of specified range, change delivery valve assembly.

Turn adjusting screw clockwise to increase fuel injection.

Testing of Injection Pump (Cont'd)



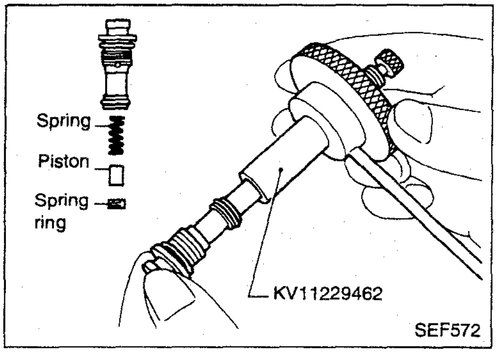
SEF571

Adjustment of feed pump pressure

1. Repeat steps 1 and 2 outlined under heading "Preadjustment of Full-Load Delivery".
2. Measure feed pump pressure at specified fuel injection pump rpm.

a. When measured pressure is lower than specifications.

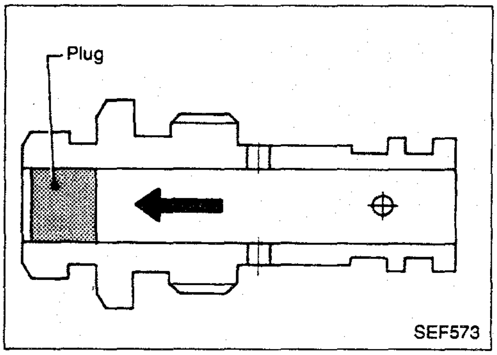
Push in plug that is driven into regulating valve body. Be careful not to push plug in too far.



SEF572

b. When measured pressure is higher than specifications.

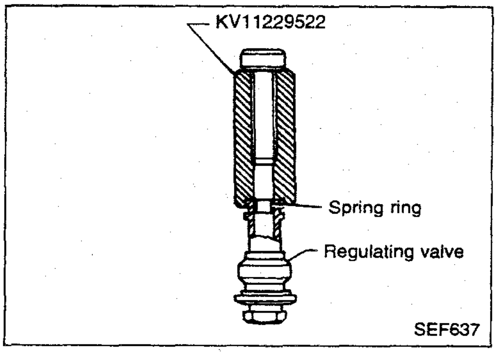
(1) Remove regulating valve from fuel injection pump, and disassemble regulating valve using Tool.



SEF573

(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 ring is flush with end face of regulating valve body when it is pushed in.



SEF637

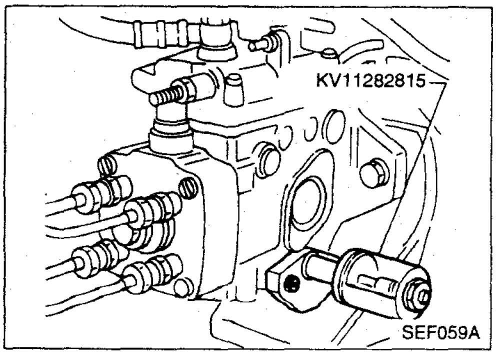
(4) Attach regulating valve to fuel injection pump.

Regulating valve:

[O]: 10 - 13 N·m (1.0 - 1.3 kg-m, 7.5 - 10 ft-lb)

(5) Adjust feed pump pressure to specifications.

3. Check injection pump condition, referring to inspection value on injection pump tester.



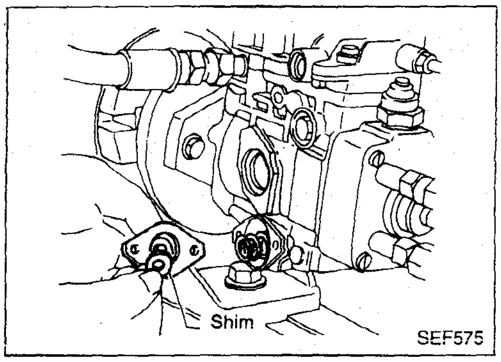
SEF059A

Adjustment of speed timer

1. Remove cover of timer at high pressure side (side without spring).
2. Install Tool, KV11282815, in the place of timer cover.
3. Measure timer piston strokes at specified fuel injection pump rpm.

Refer to S.D.S. for specified timer piston stroke values.

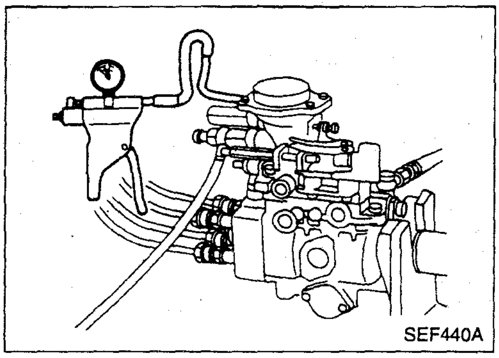
Testing of Injection Pump (Cont'd)



4. If timer piston stroke is not within specified range, remove cover of timer at low pressure side and adjust piston stroke by adding shim(s).

a. **Make sure at least one shim is used at each side of timer spring.**

b. **Refer to S.D.S. for available service parts.**



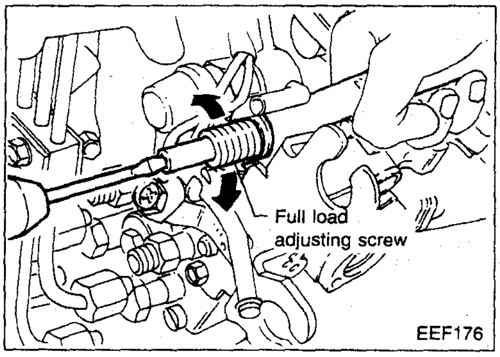
Adjustment of turbocharger ancillary mechanism (B.C.S.).

1. Fit all parts of the turbocharger ancillary mechanism.
2. Fit a vacuum pump.

Ensure that no loss of vacuum occurs.

3. Measure the fuel injection level.

Refer to S.D.S. for specifications regarding fuel injection quantities.



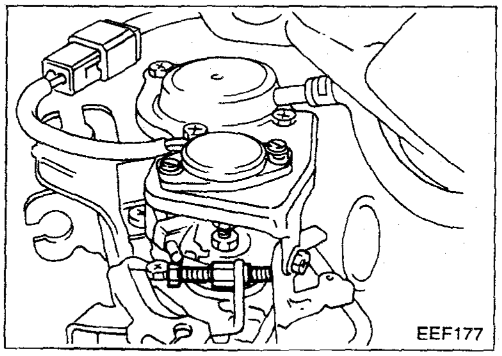
Adjustment of fuel injection under full load

NOTE:
This injection pump has a turbocharger ancillary mechanism. To measure the yield, this mechanism should be on, with the lug at the point to be measured.

1. Set control lever at "full-load" by pulling spring or using suitable equipment.
2. Apply 12 volts to activate fuel cut solenoid valve.
3. Measure fuel delivery at specified injection pump rpm.

Refer to S.D.S. for fuel delivery values.

4. If fuel delivery is not within standard range, adjust by turning full-load adjusting screw.
5. Check injection pump condition, referring to inspection values.



Adjustment of fuel injection during idle

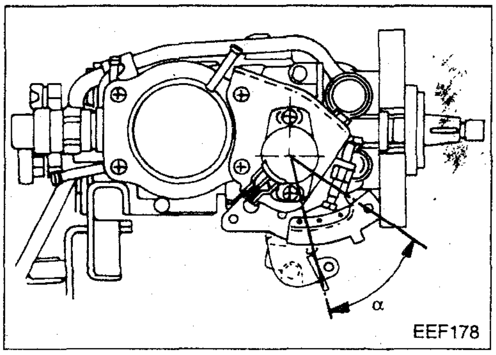
1. Pull spring until idle speed adjusting screw comes into contact with stopper.
2. Furnish voltage of 12 volts to activate fuel cut solenoid valve.
3. Measure fuel injection at specified fuel injection pump rpm.

Refer to S.D.S. for adjustment value of idle fuel injection amount.

4. If fuel injection is not within specified range, adjust by turning idle speed adjusting screw.

Testing of Injection Pump (Cont'd)

a. **Tightening this screw will increase fuel injection amount.**



EEF178

b. **Make sure that control lever angle is set at 31-41°.**
   If control lever angle is not within specified range, adjust it 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.

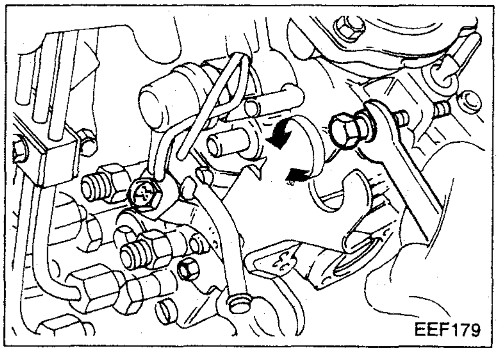
5. Check injection pump condition, referring to inspection value.

Adjustment of fuel injection during start

1. Set control lever at "full load" by pulling spring or using 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 adjustment value of start fuel injection amount.

4. If not within specifications, make sure "MS" dimension is within specification. Refer to step 25 in Assembly.



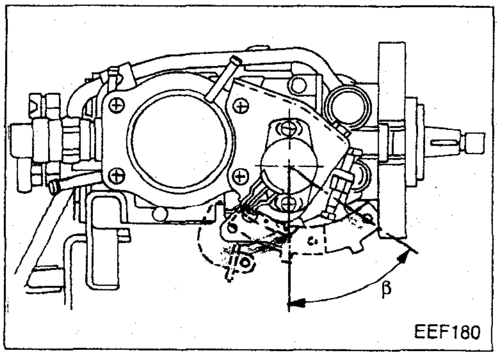
EEF179

Adjustment of fuel injection at max. pump rpm

1. Set control lever at "full-load" by pulling spring or using suitable equipment.
2. Furnish voltage of 12 volts to activate fuel cut solenoid valve.
3. Measure fuel delivery at specified injection pump rpm.

Refer to S.D.S. for max. pump speed fuel injection adjustment value.

4. If fuel delivery is not within standard range, adjust by turning max. speed adjusting screw.

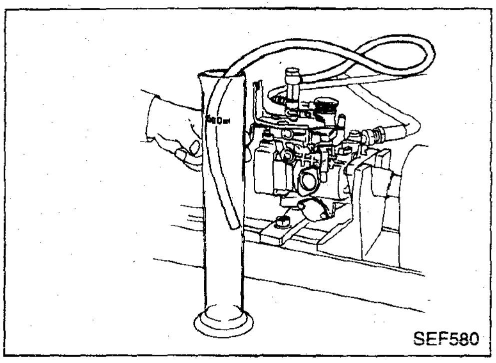


EEF180

a. **Tightening screw will increase fuel injection.**
b. **Make sure that control lever angle "α" is within 6° to 14° range.**

5. Check injection pump condition referring to inspection value.

Testing of Injection Pump (Cont'd)



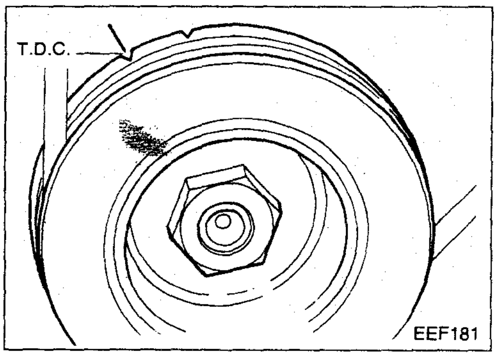
Measurement of overflow amount

1. Set control lever at "full-load" by pulling spring or using 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 inspection value of overflow amount.

Operation check of fuel cut solenoid valve

When engine is idling and fuel cut solenoid valve current is OFF, be sure there is no fuel being injected. This check has to be done for approx. 5 seconds.



Installation

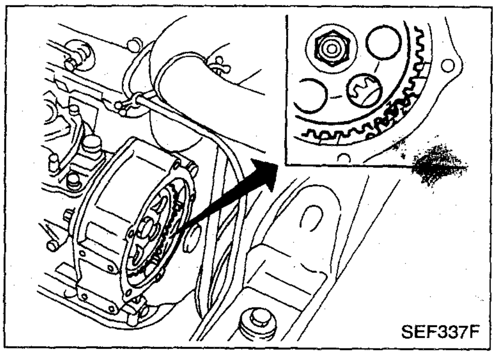
Install injection pump assembly in the reverse order of removal, observing the following:

1. Confirm that No. 1 cylinder is set at T.D.C. on its compression stroke.
2. Install injection pump (Refer to EM section).

(1) Temporarily set injection pump so that the flange of the pump is aligned with aligning mark on front cover.

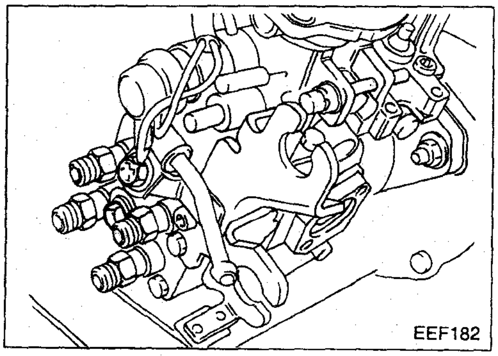
(2) Install injection pump gear.

🔧: 59 - 69 N·m (6 - 7 kg-m, 43.5 - 51 ft-lb)



Make sure that the key does not fall into the front cover.
Make sure that "Z" marks are aligned.

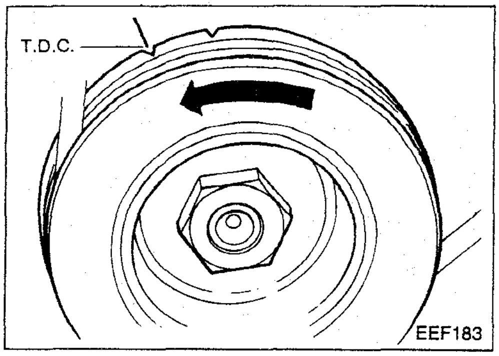
(3) Apply liquid gasket to mating surface of injection pump gear cover and install it.



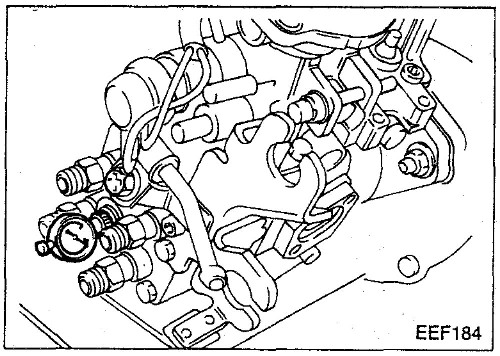
(4) Remove plug bolt from distributor head and install dial gauge.

(5) Do not tighten fixing nuts and bolts yet, as injection pump might have to be turned if plunger lift is not within specifications.

Installation (Cont'd)



(6) Turn crankshaft counterclockwise 50 to 60 degrees from No. 1 cylinder T.D.C. position.

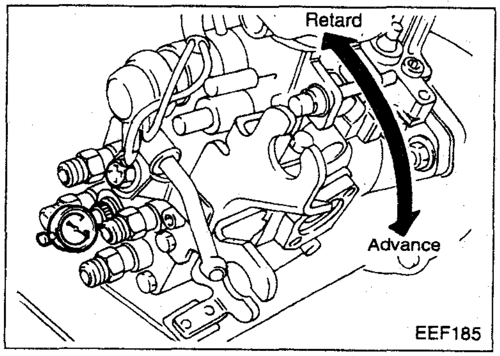


(7) Find the dial gauge needle rest point, then set the gauge to zero.

(8) Turn crankshaft clockwise until No. 1 cylinder is set at T.D.C. on its compression stroke.

(9) Read dial gauge indication.

Dial gauge indication must be:
0.38 ± 0.02 mm (0.0150 ± 0.0008 in)



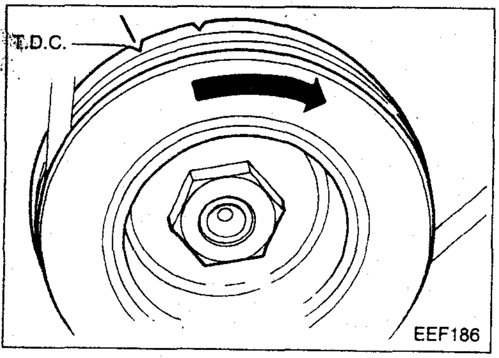
(10) If dial gauge indication is not within the above range, turn pump body until it is.

a. **If indication is smaller than the specified value, turn pump body counterclockwise.**

b. **If indication is larger than the specified value, turn pump body clockwise.**

(11) Tighten injection pump fixing nuts and bolts.

Nuts:
: 20 - 25 N·m (2.0 - 2.5 kg-m, 14 - 18.5 ft-lb)
Bolt:
: 32 - 42 N·m (3.3 - 4.3 kg-m, 24 - 31 ft-lb)

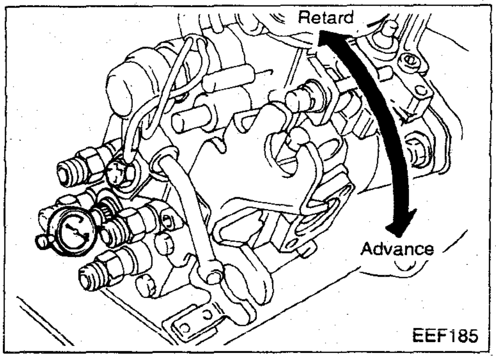


Checking

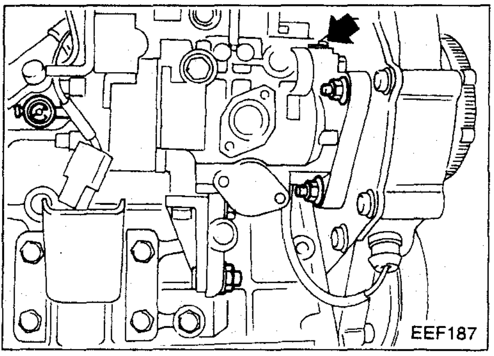
1. Rotate the crankshaft pulley clockwise two turns until the pulley and injection pump timing marks match (with the cylinder No. 1 at TDC on its compression stroke). Slowly rotate the crankshaft pulley so as not to surpass the injection pump housing mark and read plunger lift.

Dial gauge indication must be:
0.38 ± 0.02 mm (0.0150 ± 0.0008 in)

Installation (Cont'd)



2. If gauge reading is not within specified range, loosen the injection pump securing nuts and bolt until the pump can be manually rotated. Rotate the pump clockwise and restart the setting operation from point (5) in Installation.



3. Tighten injection pump securing nuts and bolt.

   Nuts:

   🔧: 20 - 25 N·m
   (2.0 - 2.5 kg-m, 14 - 18.5 ft-lb)

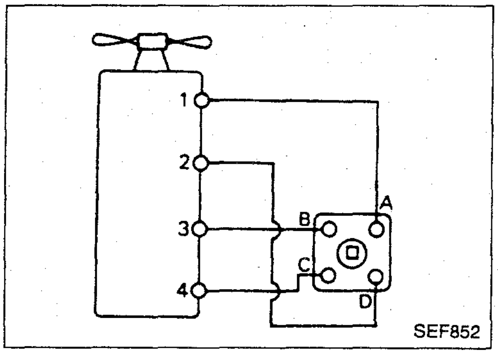
   Bolt:

   🔧: 32 - 42 N·m
   (3.3 - 4.3 kg-m, 24 - 31 ft-lb)

4. Remove special tool and install plug with new washer.

Always replace plug bolt gasket.

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

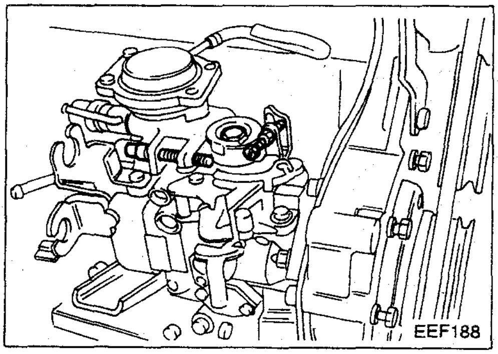


5. Connect fuel injection tubes in the order of 4, 3, 2 and 1.

   🔧: Injection tube flare nut
   20 - 25 N·m (2.0 - 2.5 kg-m, 16 - 18 ft-lb)

6. Bleed air from fuel system.

Refer to Bleeding the Fuel System (EF & EC 221).

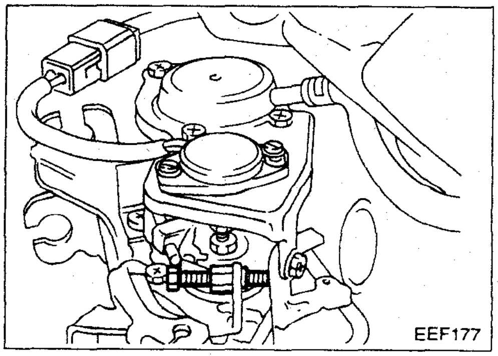


Adjustment

IDLE SPEED AND MAXIMUM SPEED ADJUSTMENT

CAUTION:

- **Do not remove sealing caps unless absolutely necessary.**
- **Never disturb the full-load adjusting screw because this alters the mixture ratio and may result in serious engine problems.**
- **Do not adjust the maximum speed adjusting screw to a point exceeding specifications; exceeding the maximum speed may cause engine damage.**

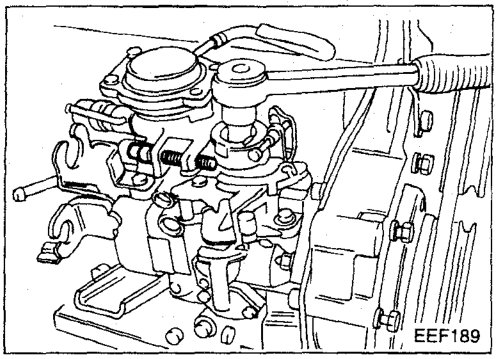


Idle speed adjustment

1. Push in idling control knob completely.
2. Start the engine and keep it idling until the operating temperature is reached.
3. Turn the screw operating on the acceleration control lever until the engine reaches specified value.

   Idle speed: 700 ± 50 rpm

Adjustment (Cont'd)

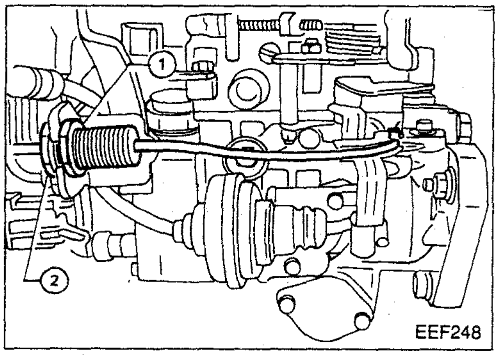


Maximum speed adjustment

1. Start up 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):
5,050 ± 100 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.



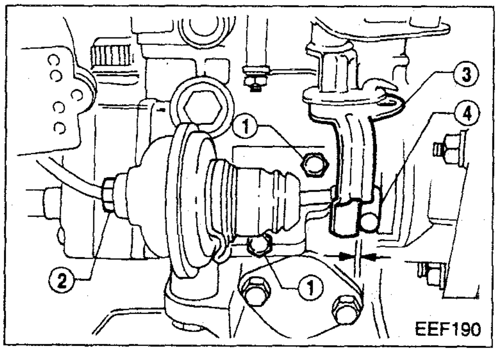
Adjustment of manual mechanism for a cold start

1. Press the cold-start button fully in.
2. Start the engine and wait until normal operating temperature has been reached.
3. Loosen the locking nut ① and adjust it ② until the revs. are within the specified values.

Engine speed:
1,500 - 2,000 rpm.

4. Tighten the locking nut ①.

🔧: 8 - 10 N·m (0.8 - 1.0 kg-m, 6 - 7 ft-lb)



F.I.C.D. adjustment (A/C models)

1. Secure the bracket of the F.I.C.D. with fixing bolts ①, so that the clearance between the F.I.C.D. lever ④ and the intermediate lever ③ is 1 - 2 mm (0.039 - 0.079 in).

🔧: 7 - 10 N·m (0.7 - 1.0 kg-m, 5 - 7 ft-lb)

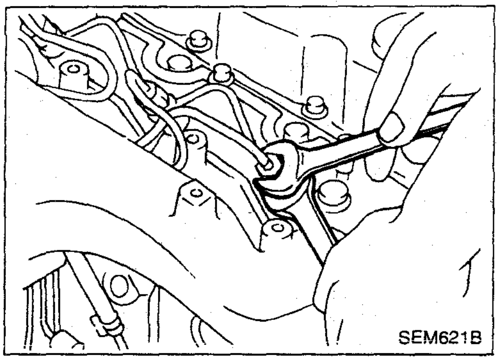
2. Warm up engine until normal operating temperature.
3. Switch on A/C and adjust idling speed, with adjustment screw ②, until engine rpm is within specifications.

Engine rpm: 850 ± 50 rpm

Potentiometer adjustment

Adjust potentiometer's installation position until the output voltage is within specifications.

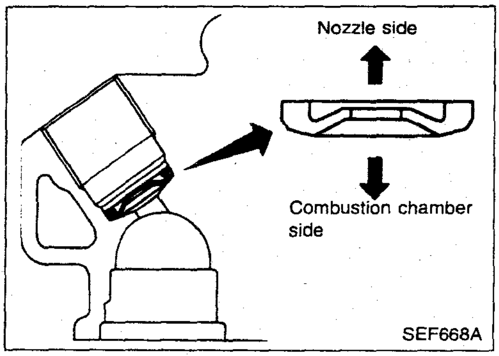
Refer to Potentiometer



SEM621B

CAUTION:

Plug flare nut with a cap or rag so that no dust enters the nozzle. Cover nozzle tip for protection of needle.



SEF668A

Removal and Installation

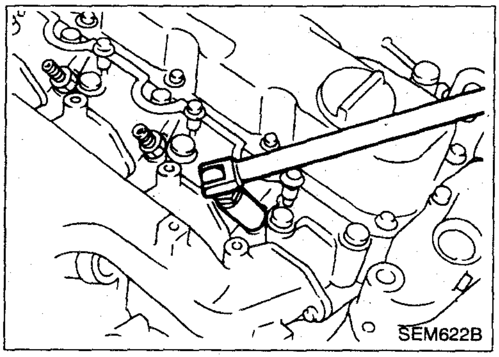
1. Remove fuel injection tube and spill tube.
2. Remove injection nozzle assembly.

Also remove washers from nozzle end.

3. Install injection nozzle in the reverse order of removal.

Injection nozzle to engine:
🔧: 54 - 64 N·m
(5.5 - 6.5 kg-m, 40 - 47 ft-lb)
Injection nozzle to tube:
🔧: 20 - 25 N·m
(2.0 - 2.5 kg-m, 16.5 - 18 ft-lb)
Spill tube:
🔧: 29 - 39 N·m
(3.0 - 4.0 kg-m, 21.5 - 29 ft-lb)

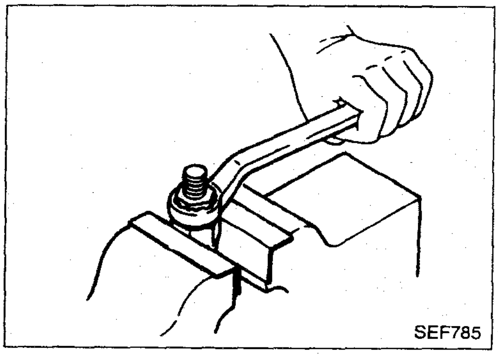
a. **Always clean the nozzle holes.**
b. **Always use new injection nozzle gasket.**
c. **Note that small washer should be installed in specified direction.**
d. **Bleed air from fuel system.**



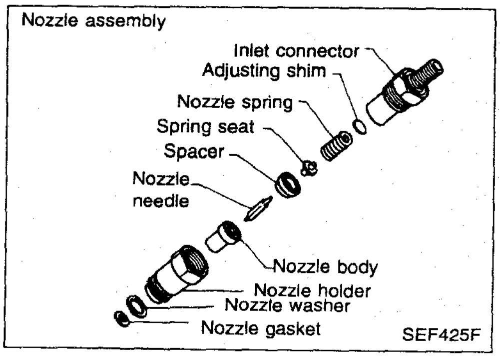
SEM622B

Disassembly

1. Loosen nozzle nut while preventing nozzle top from turning.



SEF785



SEF425F

2. Arrange all disassembled parts in the order shown at left.

Inspection

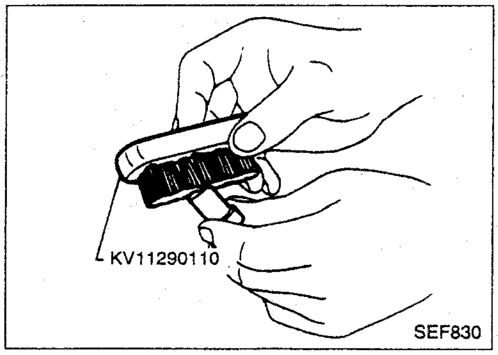
Thoroughly clean all disassembled parts with fresh kerosene or solvent.

- 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 nozzle spring for excessive wear or damage. If excessively worn or damaged, replace it with a new spring.
- Check distance piece and nozzle holder for proper contact. If excessively worn or damaged, replace nozzle holder assembly.

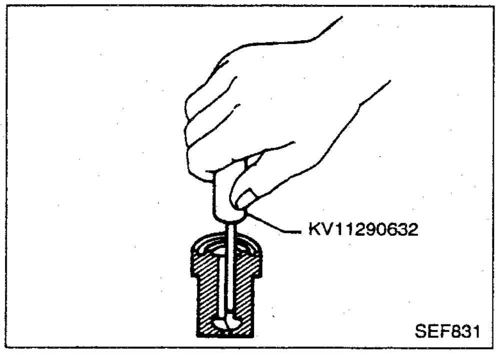
Cleaning

a. Do not touch the nozzle mating surface with your fingers.

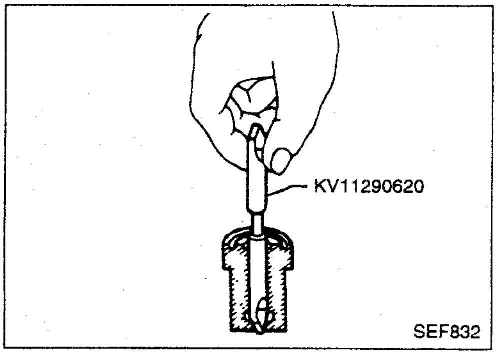
b. To wash the nozzles, use a wooden stick and brass brush with clean diesel fuel.



1. Remove any carbon from exterior of nozzle body (except wrapping angle portion) by using Tool.

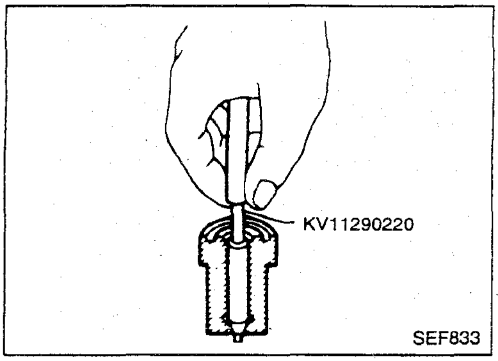


2. Clean oil sump of nozzle body using Tool.



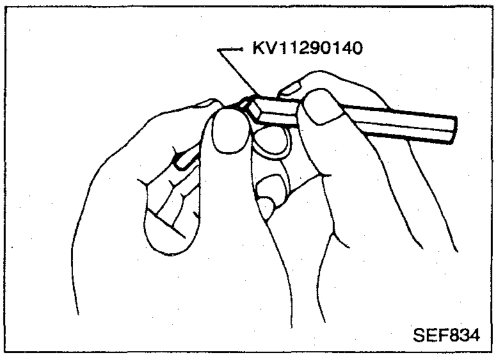
3. Clean nozzle seat by using Tool.

Take extra precautions when performing this job, since nozzle efficiency depends greatly on a good nozzle seat.

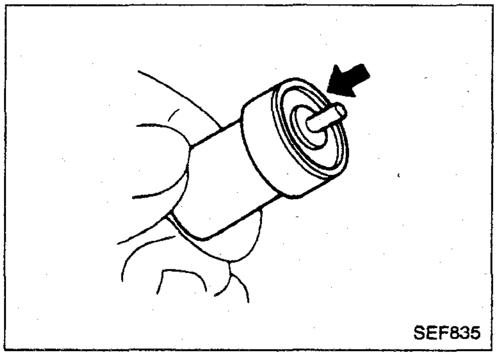


4. Clean spray hole of nozzle body by using Tool.

To prevent spray hole from canting, always clean it by starting with inner side and working towards the outside.

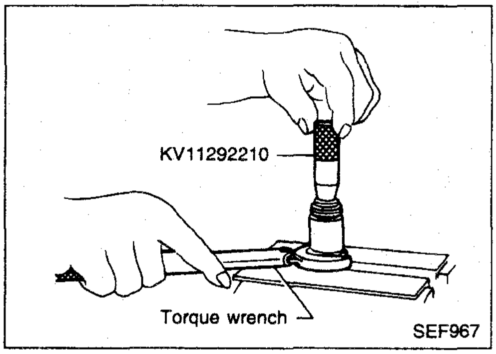


5. Decarbonate nozzle needle tip by using Tool.



6. Check needle sink.
(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

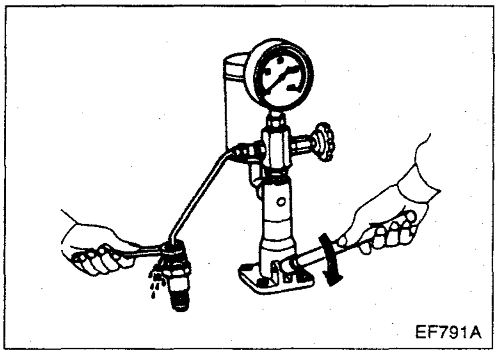
Assembly is in the reverse order of disassembly.

Holder to nozzle nut:
: 29 - 49 N·m
(3.0 - 5.0 kg-m, 22 - 36 ft-lb)

Test and Adjustment

WARNING:

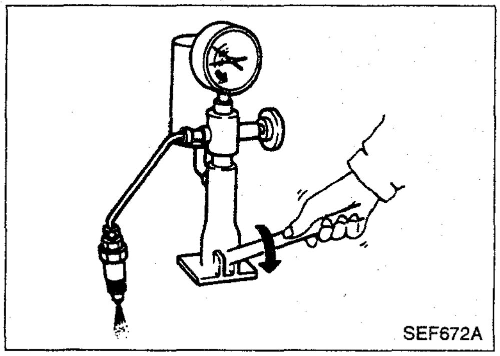
When using nozzle tester, be careful not to allow diesel fuel sprayed from nozzle to contact your hands or body, and make sure your eyes are properly protected with goggles.



EF791A

INJECTION PRESSURE TEST

1. Install nozzle to injection nozzle tester and bleed air from flare nut.



SEF672A

2. Pump the tester handle slowly (once per second) and watch the pressure gauge.
3. Read the pressure gauge when the injection pressure just starts dropping.

Initial injection pressure:

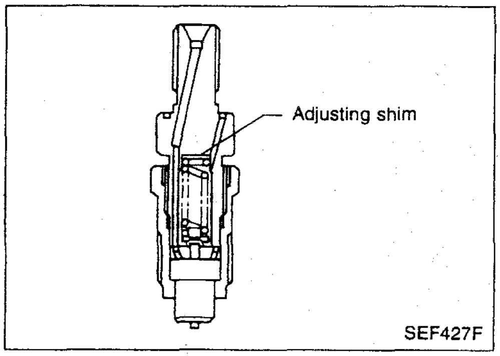
Used

9,807 - 10,297 kPa (98.1 - 103.0 bar, 100 - 105 kg/cm^2, 1422 - 1493 psi)

New

10,297 - 11,278 kPa (103.0 - 122.8 bar, 105 - 115 kg/cm^2, 1493 - 1635 psi)

Always check initial injection pressure using a new nozzle.



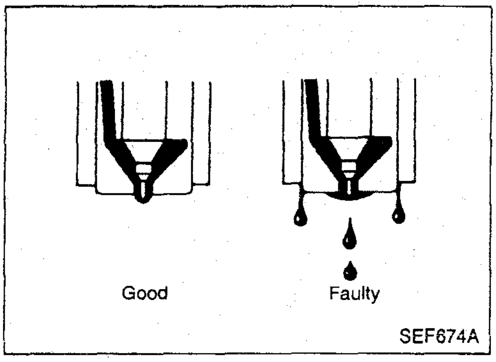
SEF427F

4. To adjust injection pressure, change adjusting shims.

a. **Increasing the thickness of adjusting shims increases initial injection pressure. Decreasing thickness reduces initial pressure.**

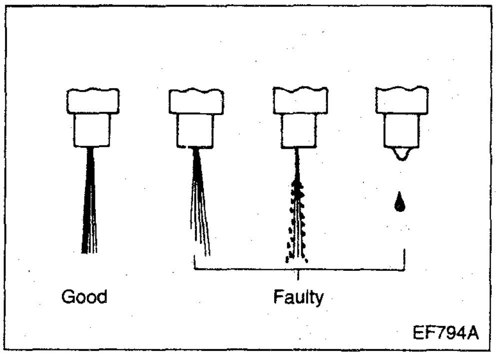
b. **A shim thickness of 0.04 mm (0.0016 in) corresponds approximately to a difference of 471 kPa (4.71 bar, 4.8 kg/cm^2, 68 psi) in initial injection pressure.**

Refer to S.D.S. for adjusting shim.



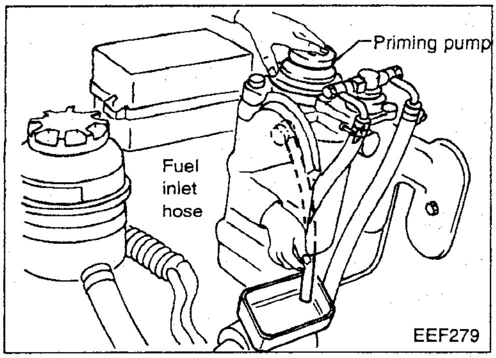
LEAKAGE TEST

1. Maintain the pressure at about 981 to 1,961 kPa (9.8 tc 19.6 bar, 10 to 20 kg/cm^2, 142 to 284 psi) below initial injection pressure.
2. Check that there is no leakage from the nozzle tip oı around the body.
3. If there is leakage, clean, overhaul or replace nozzle.



SPRAY PATTERN TEST

1. Pump the tester handle once per second.
2. Check the spray pattern.
3. If the spray pattern is not correct, clean or replace nozzle.



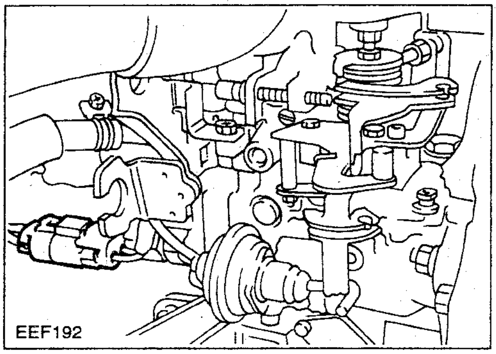
Priming Pump Check

Before checking priming pump, make sure that fuel filter is filled with fuel.

1. Disconnect fuel inlet 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.

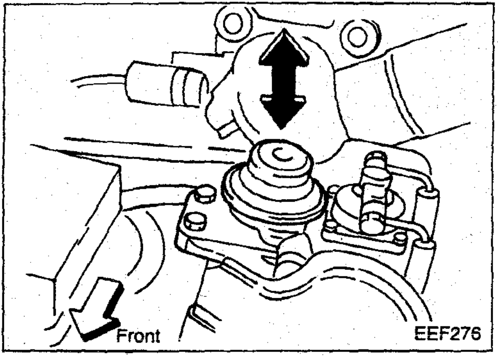
Ignition switch	Voltage
OFF	0V
ON	Battery voltage

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 Fast idle speed adjustment.

BLEEDING THE FUEL SYSTEM

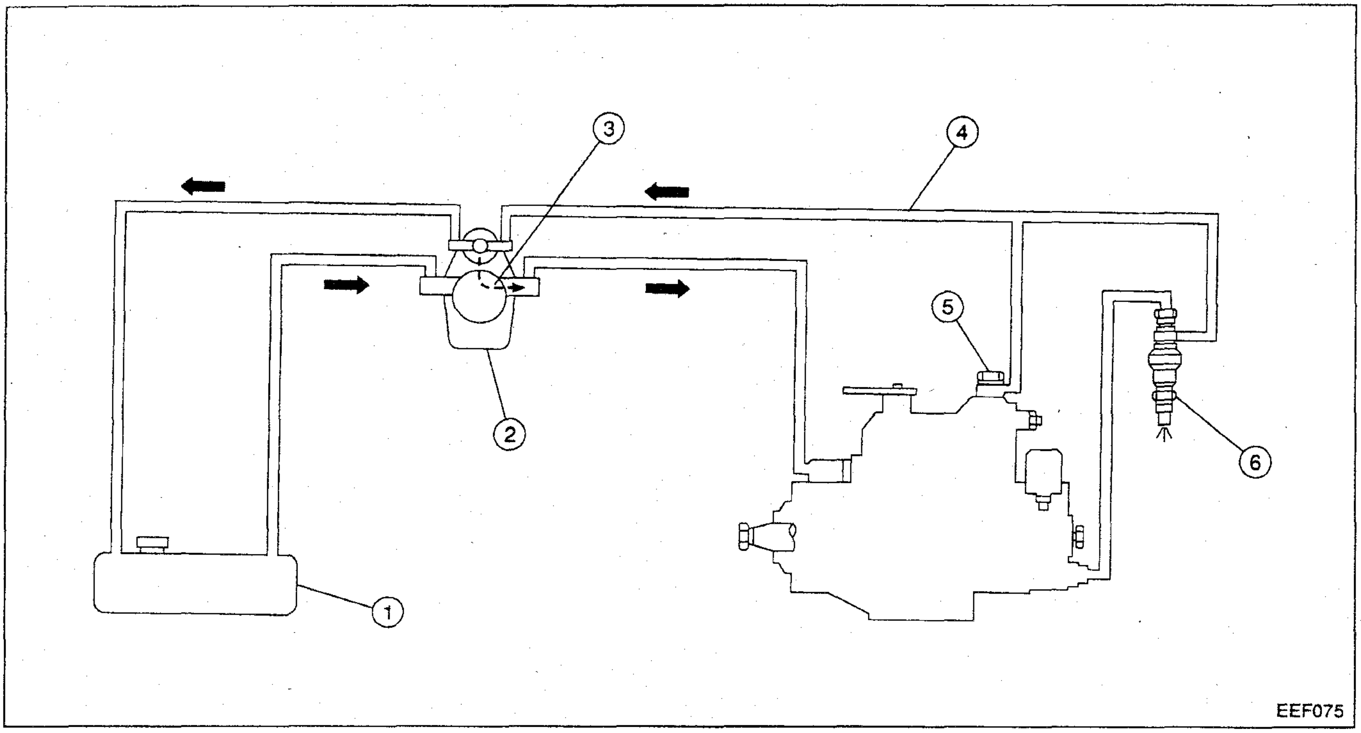


To bleed air from the fuel system, proceed as follows:

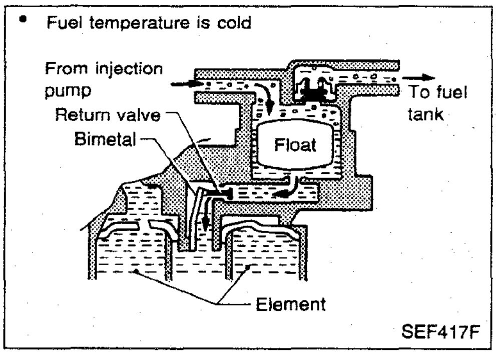
1. Move the priming pump up and down until there is suddenly more resistance in the movement then stop this action and start the engine.
2. If the engine does not operate smoothly after it has started, race it two or three times.

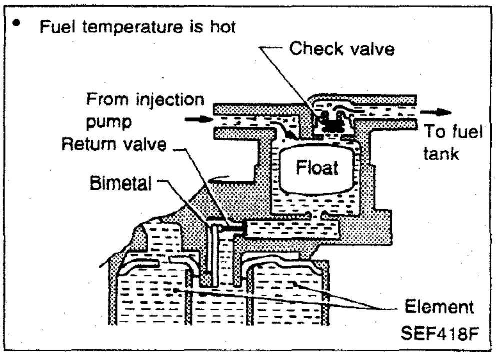
Fuel Return Control System

- **Models for Europe and cold areas incorporate the fuel return control system.**



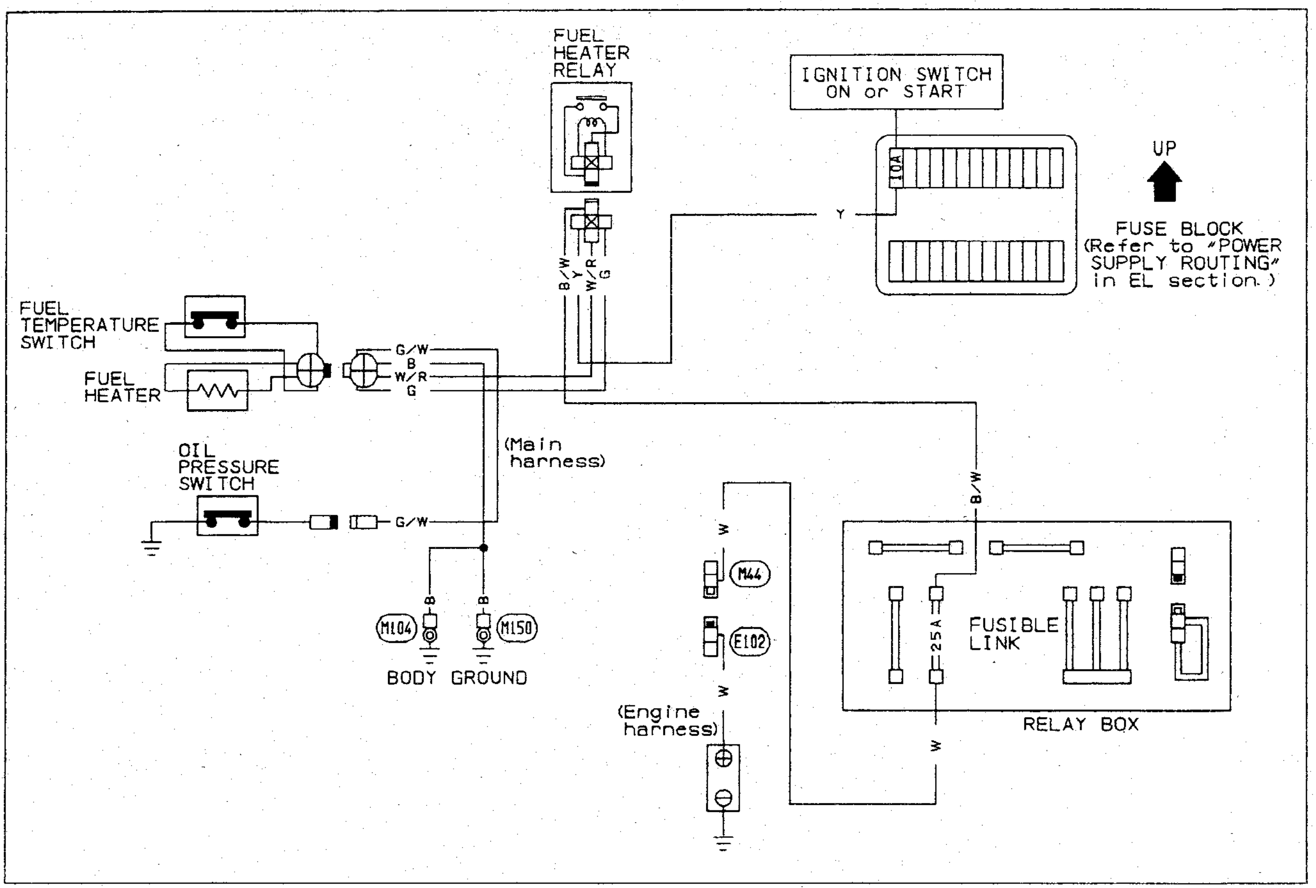
① Fuel tank
② Fuel filter
③ By-pass passage
(Fuel temperature is cold)
④ Fuel return passage
⑤ Overflow valve
⑥ Injection nozzle





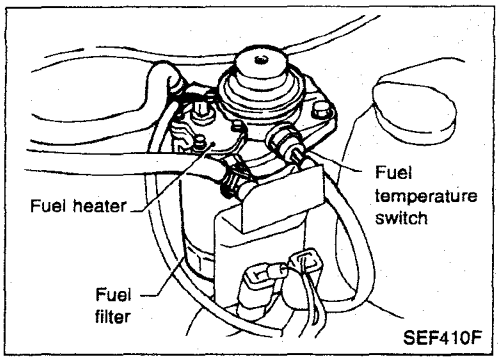
Fuel Return Control System (F.R.C.S.) prevents clogging of the fuel filter by circulating overflow fuel warmed by the fuel injection pump when ambient temperature is low. The float valve in the system prevents trapped air from circulating through the fuel line and the check valve prevents reverse flow of fuel from the fuel tank.
When the fuel temperature is above 30°C (86°F), a bimetal valve activates to stop fuel circulation.

Circuit Diagram



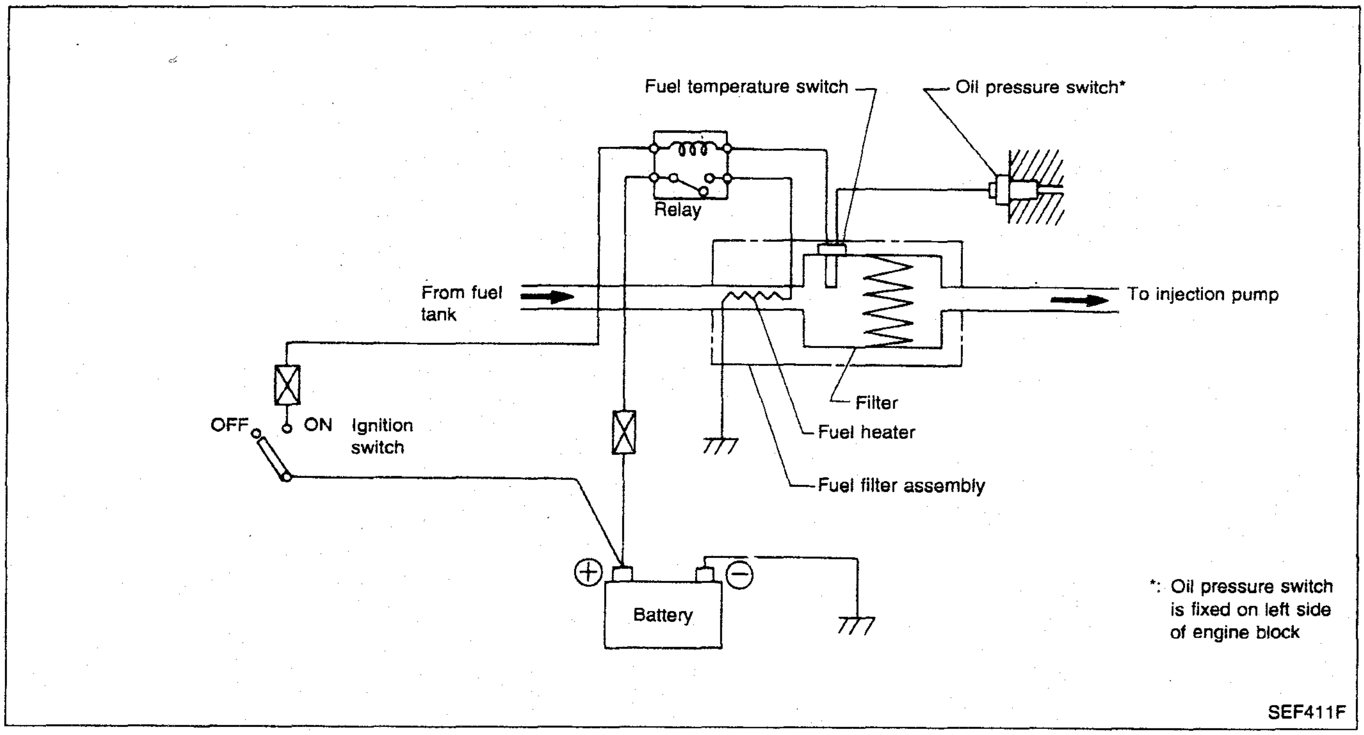
YEF055

FUEL HEATER SYSTEM

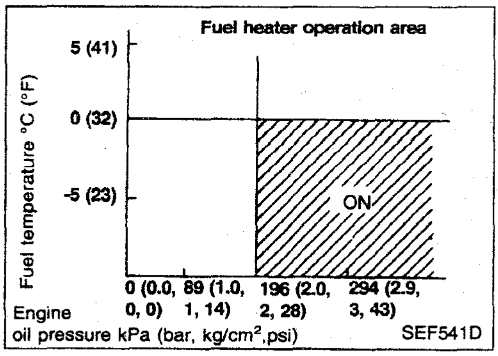


Description

Fuel heater system is designed to improve startability at low atmospheric temperatures for models destined for cold areas. This system prevents fuel filter from clogging with fuel wax.

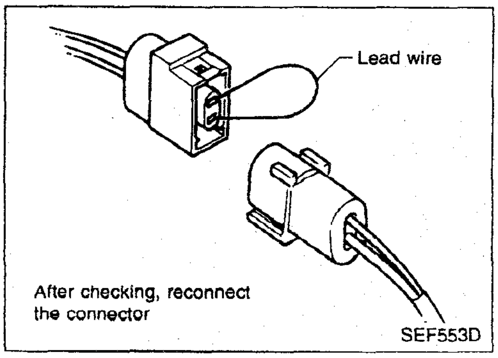


*: Oil pressure switch is fixed on left side of engine block



Operation

Fuel heater system operates when fuel temperature switch and oil pressure switch are on.

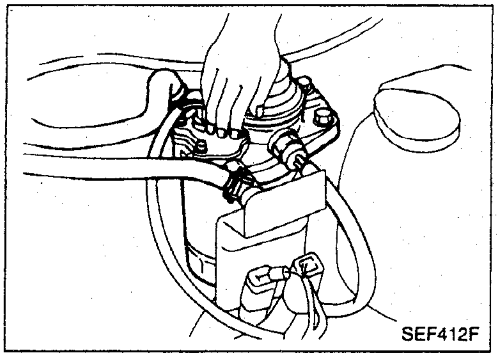


After checking, reconnect the connector

Inspection

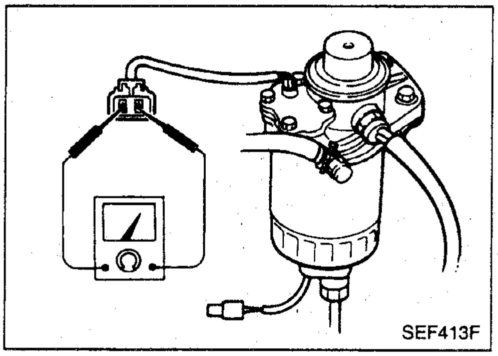
1. Connect a lead wire, as shown, between terminals of fuel temperature switch.

Inspection (Cont'd)


SEF412F

2. Run engine at about 1,000 rpm. After several minutes, make sure that fuel heater is hot.

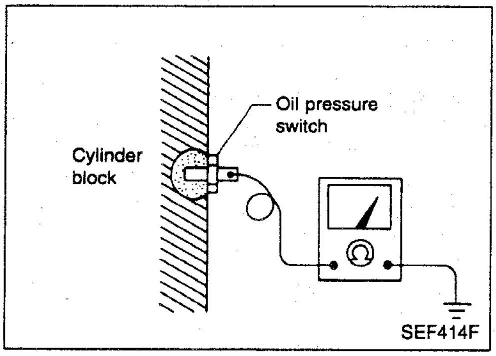
Be careful not to burn yourself.


SEF413F

3. If fuel heater does not operate, check fuel heater system as follows.

FUEL HEATER

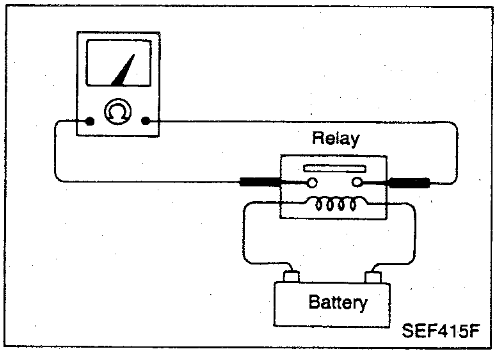
1. Check continuity for fuel heater.
2. If fuel heater has malfunction, replace fuel filter bracket.



SEF414F

OIL PRESSURE SWITCH

1. Run engine at about 1,000 rpm.
2. Check continuity for oil pressure switch.
3. If oil pressure switch has malfunction, replace it.



SEF415F

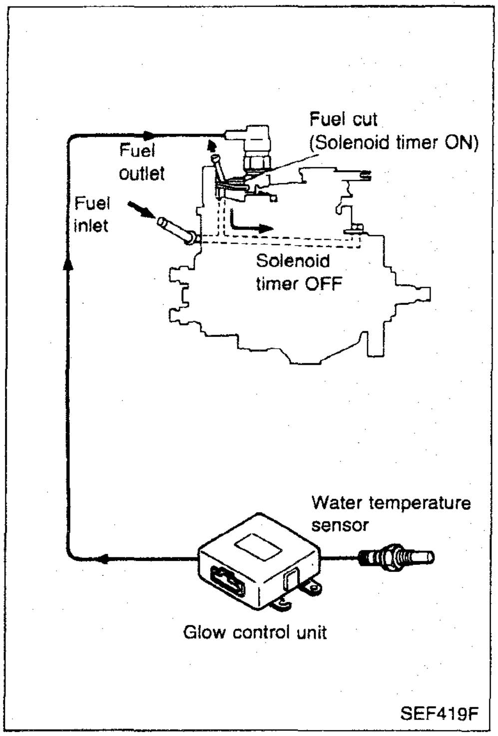
FUEL HEATER RELAY

1. Check fuel heater relay operation.
2. If fuel heater relay does not operate, replace it.

HARNESS

Check harness and fuse continuity.

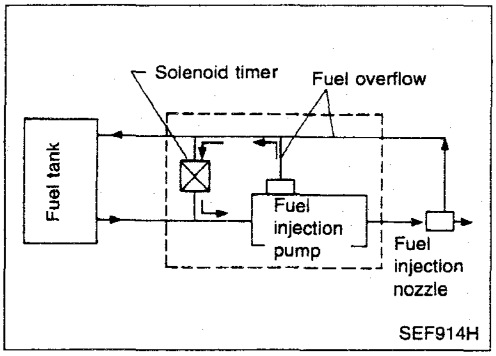
SOLENOID TIMER



Description

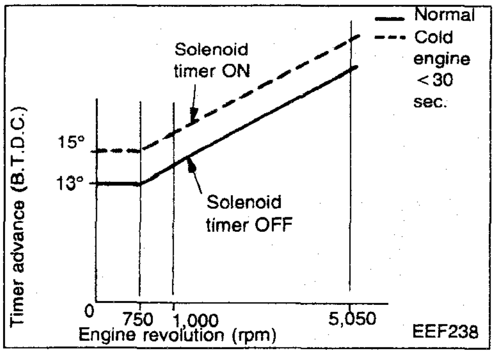
To improve startability, a solenoid timer is used on models for Europe and cold areas. Its purpose is to advance fuel injection in relation to coolant temperature for a certain period after starting the engine.

This timer is controlled by the signal from the glow control unit. The glow control unit sends a signal to activate the advance mechanism of the fuel injection pump during cold starting.



Operation

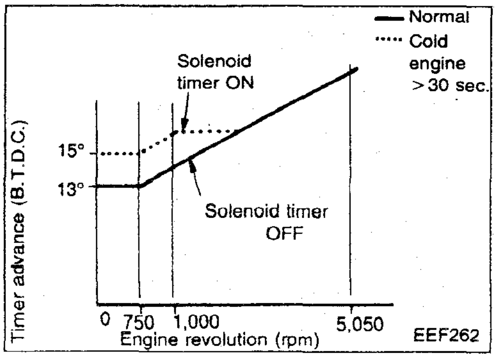
Part of the fuel in the return line returns to the fuel injection pump inlet, when the solenoid timer is OFF. When cold starting, the solenoid timer comes ON to stop the return of fuel to the inlet. This increases the fuel pressure in the fuel injection pump so that fuel injection advances.

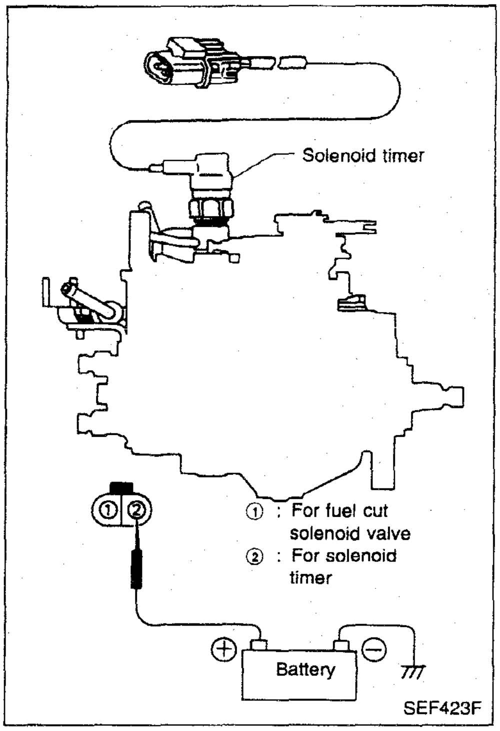


TIMER CHARACTERISTICS

The graphs show the differences in fuel injection timing in relation to engine speed when the solenoid timer is both ON and OFF.

When the solenoid timer turns ON, fuel injection timing advances approximately 2°. Thus, cold engine starting in cold weather is greatly improved.

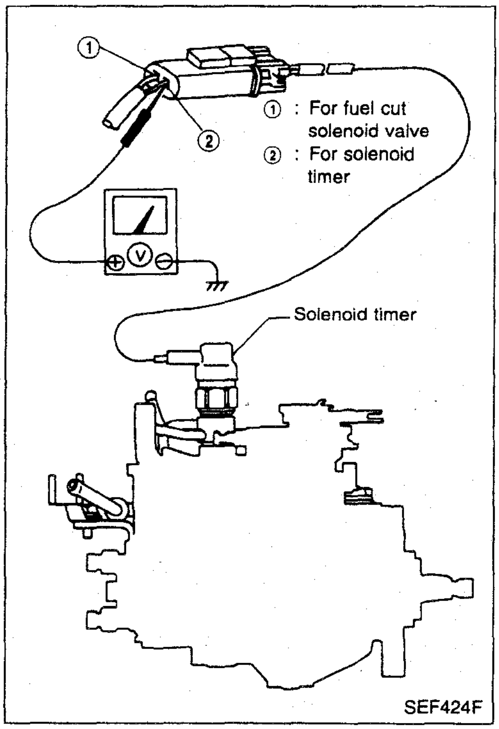




Inspection

1. Disconnect solenoid timer connector and check for "clicking" sound from solenoid when battery is connected and disconnected.
   If solenoid has malfunctioned, replace it.

After checking, reconnect the connector.



2. Disconnect water temperature sensor harness connector.
3. Start engine and check voltage between terminal ② and ground.

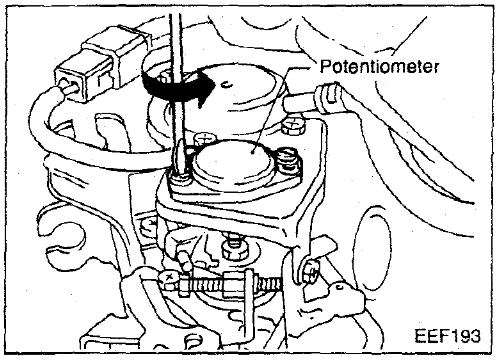
Battery voltage should exist for 30 seconds after starting engine.

If not, check harness and glow control unit.

TIMER PISTON STROKE (USING PUMP TESTER)

Measure timer piston strokes at specified fuel injection pump speed when solenoid timer is on and off.

Refer to Service Data and Specifications (S.D.S.) of injection pump.

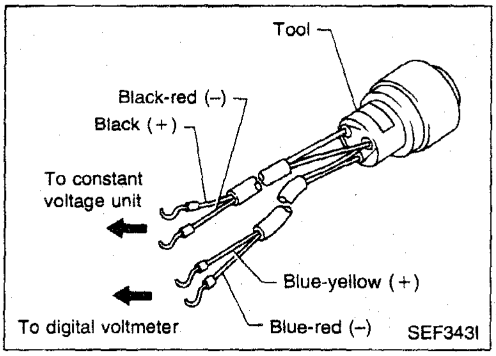


Removal

1. Loosen screws which secure potentiometer to bracket.
2. Remove potentiometer.
3. Remove bracket.

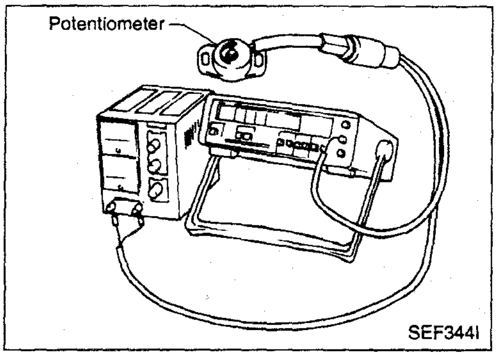
CAUTION:

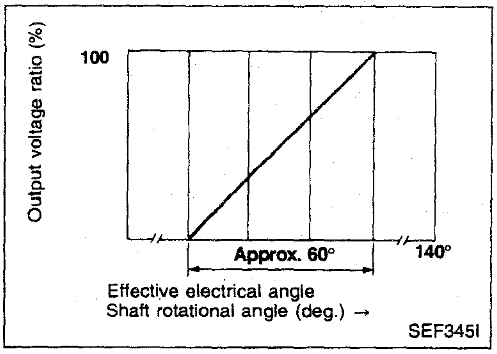
a. Do not remove adjusting bolts unless necessary.
b. Do not attempt to disassemble potentiometer.



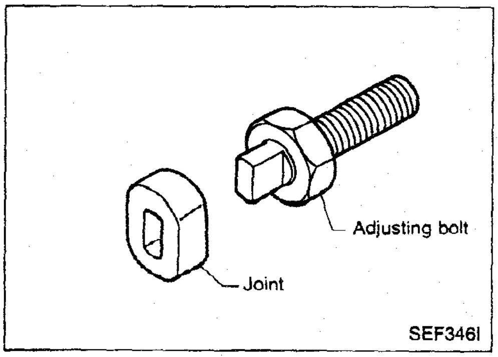
Inspection

1. Using Tool (KV11229882), connect potentiometer to digital voltmeter and voltage-regulating unit.
2. Apply an input of 5 volts.

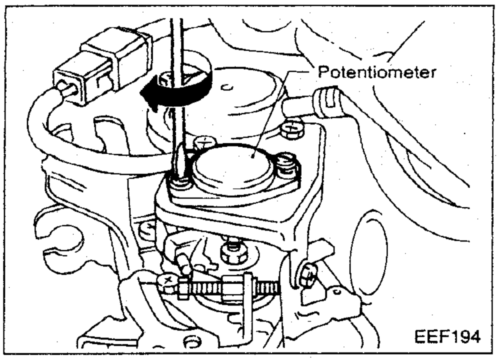




3. Ensure that the voltage indicated on the digital voltmeter reads higher when the potentiometer is turned to the right and, at the same time, that the output voltage is 5V when the operating handle is set at maximum.
4. Figure shows an example of potentiometer characteristics. Effective electrical angle of TD27T engine is 36°.



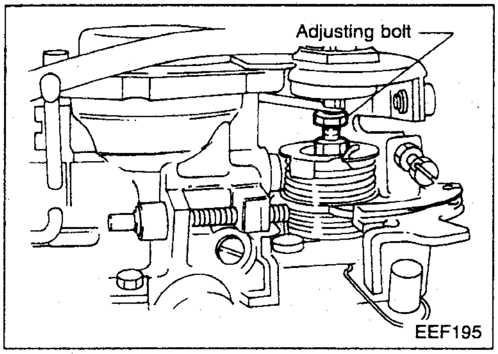
5. Position potentiometer pin and adjusting bolt in joint. Ensure that there is no free play.



Installation

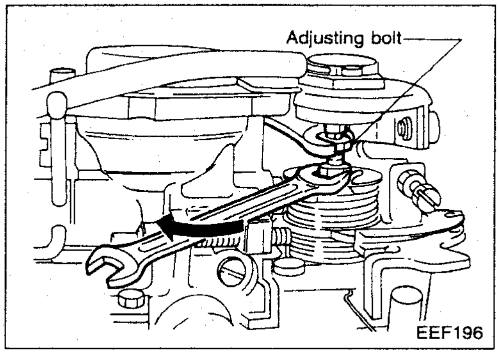
If adjusting bolt is removed during disassembly, install it as follows:

1. Temporarily install adjusting bolt, lock nut and potentiometer. Joint need not be installed.

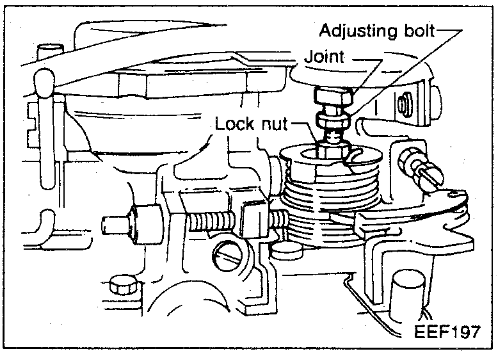


2. Tighten or loosen adjusting bolt so that clearance between adjusting bolt end surface and potentiometer pin is adjusted to specifications. Clearance can be measured using a feeler gauge.

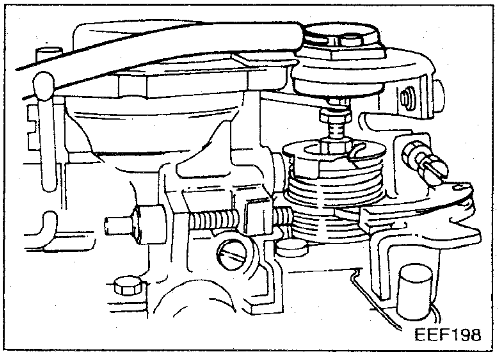
   Specified clearance:
   0.2 — 0.8 mm (0.008 — 0.031 in)



3. Secure adjusting bolt with a lock nut.

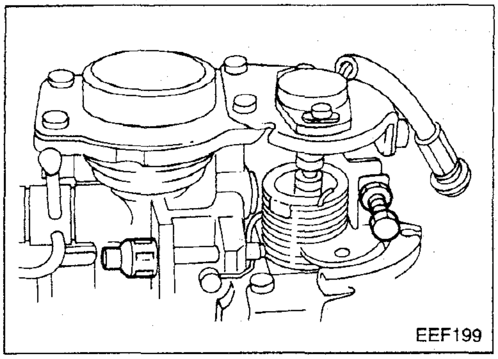


4. Remove potentiometer and install joint on adjusting bolt.



5. While positioning potentiometer pin in joint, install potentiometer on bracket.

Installation (Cont'd)



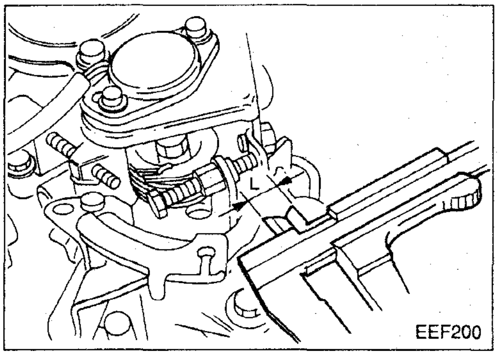
EEF199

6. Secure potentiometer using screws and spring washers.
7. Ensure that control lever moves smoothly.
8. Input 5V to the potentiometer and set the operating handle at maximum. Ensure that the output voltage of the potentiometer is 5V.

Adjustment on Test Bench

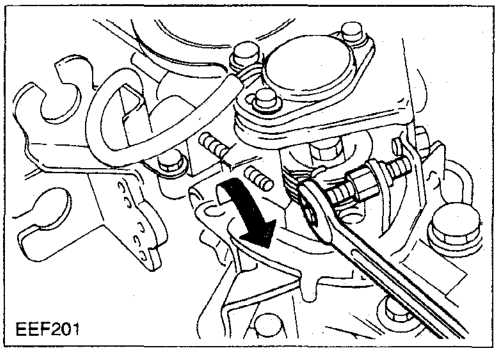
Adjustment conditions			Specified value	Remarks
Control lever position	Pump speed rpm	Fuel injection quantity cm^3/1,000 rev.	Output voltage (V)	
Measure	1,275	11.9 – 13.9	6.87 – 6.93	Adjusting point
Idle	—	—	1.0 – 3.0	Check point
Full speed	—	—	approx. 10	Check point

Input voltage: 10V
Turbocharger compensating pressure: 0 kPa (0mm Hg)



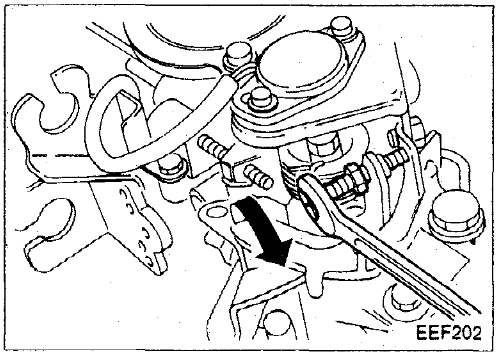
EEF200

1. Measure required "tightening" length "L" of idling stopper bolt in advance.



EEF201

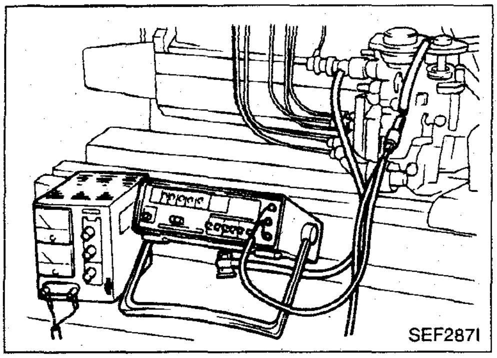
2. Remove idling stopper bolt and tighten dummy bolt (M6, pitch: 1.0 mm).
3. Apply 10V to the potentiometer.



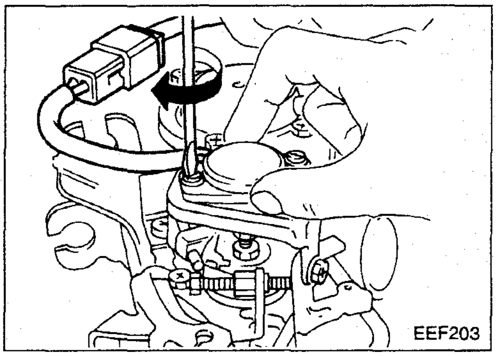
EEF202

4. Operate fuel injection pump at 1,275 rpm.
Adjust control lever position using dummy bolt so that injected fuel quantity is 11.9 – 13.9 cm^3/1,000 revolutions

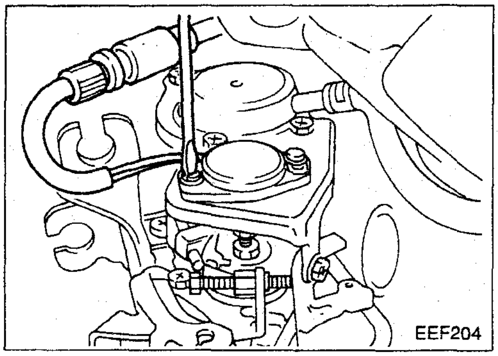
Adjustment on Test Bench (Cont'd)



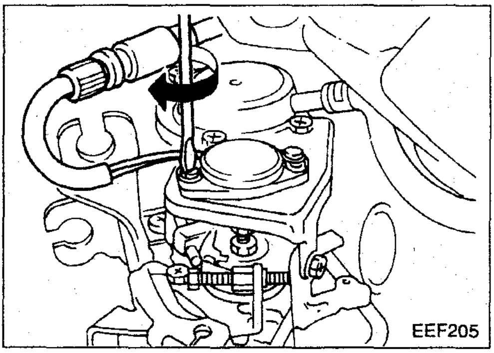
5. Connect Tool (KV11229882) to digital voltmeter and voltage-regulating unit.
6. Connect Tool (KV11244582) to potentiometer and Tool (KV11229882).



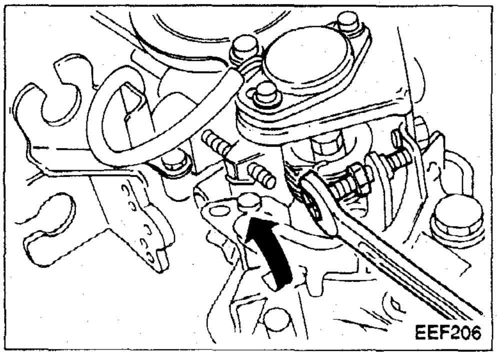
7. Adjust the potentiometer so that the output voltage is 6.87 – 6.93V. Lock the potentiometer setting and check that the output voltage is 10V when the operating handle is set at maximum.



8. If potentiometer output voltage is outside specifications, loosen adjustment screws and adjust potentiometer position.

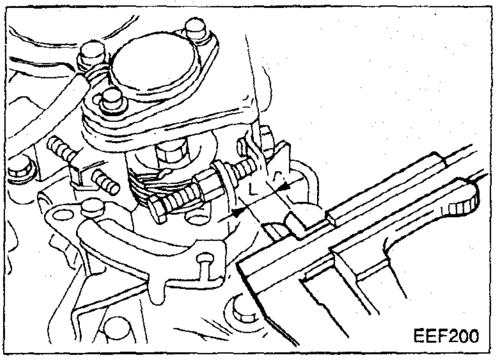


9. Tighten adjustment screws and reconfirm potentiometer output voltage.

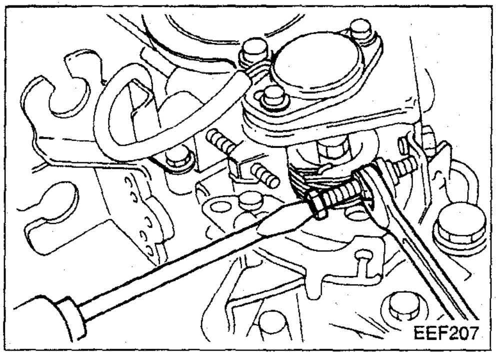


10. After properly positioning potentiometer, remove the dummy bolt.

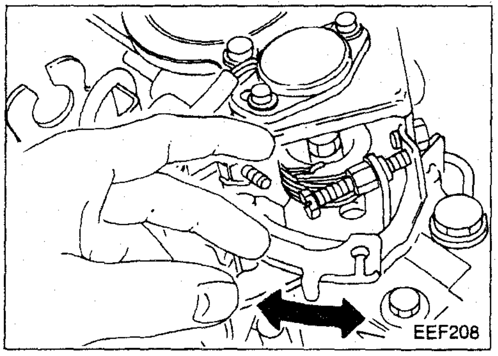
Adjustment on Test Bench (Cont'd)



11. Tighten and regulate idling stopper bolt so that "L" measured in step 1 is obtained.



12. Adjust idling stopper bolt so that fuel injected during idling is in the specified range.



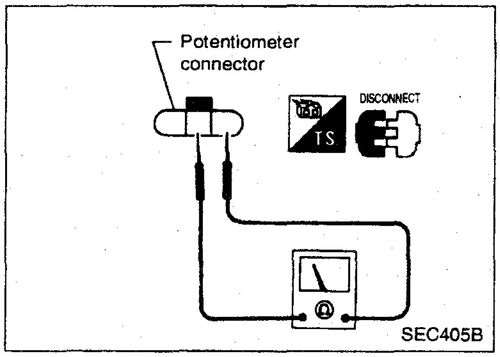
13. Ensure that control lever properly returns to the idle position by means of the spring.

Adjustment on Test Bench (Cont'd)

POTENTIOMETER ADJUSTMENT (ON THE VEHICLE)

Note:

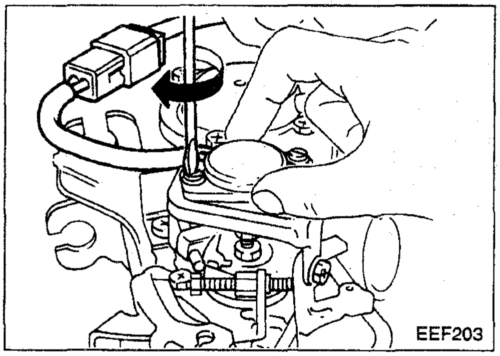
This procedure enables checking the internal resistance of the potentiometer and enables simultaneous adjustment.
For final adjustment, refer to "FINAL POTENTIOMETER ADJUSTMENT (ON THE VEHICLE)".



SEC405B

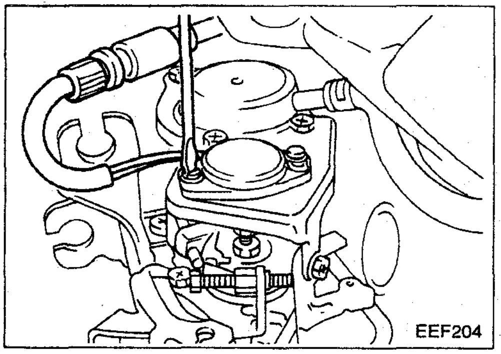
1. Using an ohmmeter, check resistance value between terminals of potentiometer.

   Resistance: 1,200 ± 50 Ω



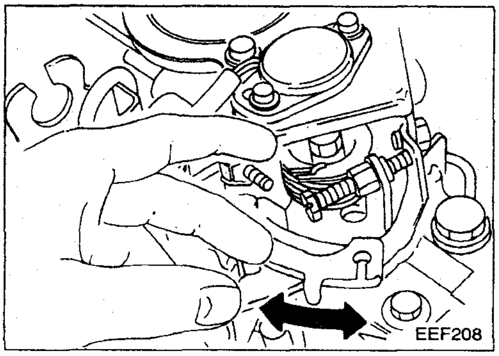
EEF203

2. If resistance is not within specified range, adjust position of potentiometer.



EEF204

3. Fixate potentiometer by tightening the potentiometer adjustment screws.



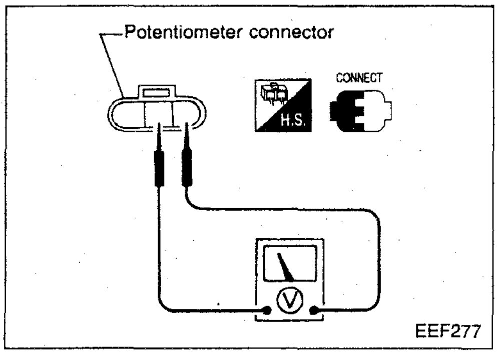
EEF208

4. Make sure that the control lever correctly returns to the idle position and that the resistance value returns to the value as specified.

Adjustment on Test Bench (Cont'd)

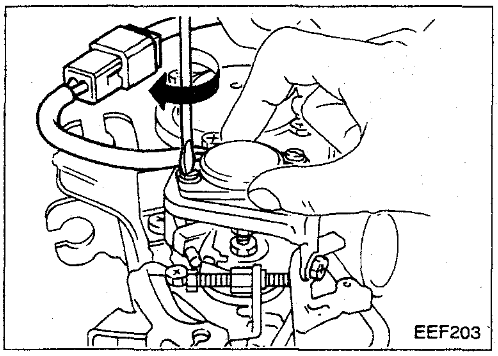
FINAL POTENTIOMETER ADJUSTMENT (ON THE VEHICLE)

1. Run engine until it reaches its operating temperature (above 80°C).
2. Make sure engine idle speed is within specified value and adjust if necessary.
   Idle speed: 700 ± 50 rpm
3 Stop engine
4. Turn ignition key to the "ON" position

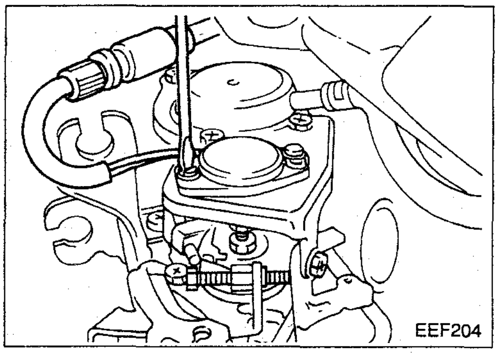


EEF277

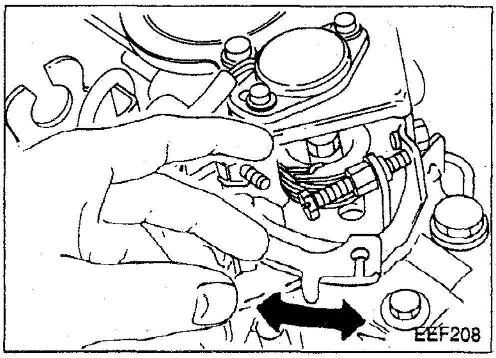
5. Check voltage between potentiometer output terminals
   Voltage: 1.10 ± 0.05 V


EEF203

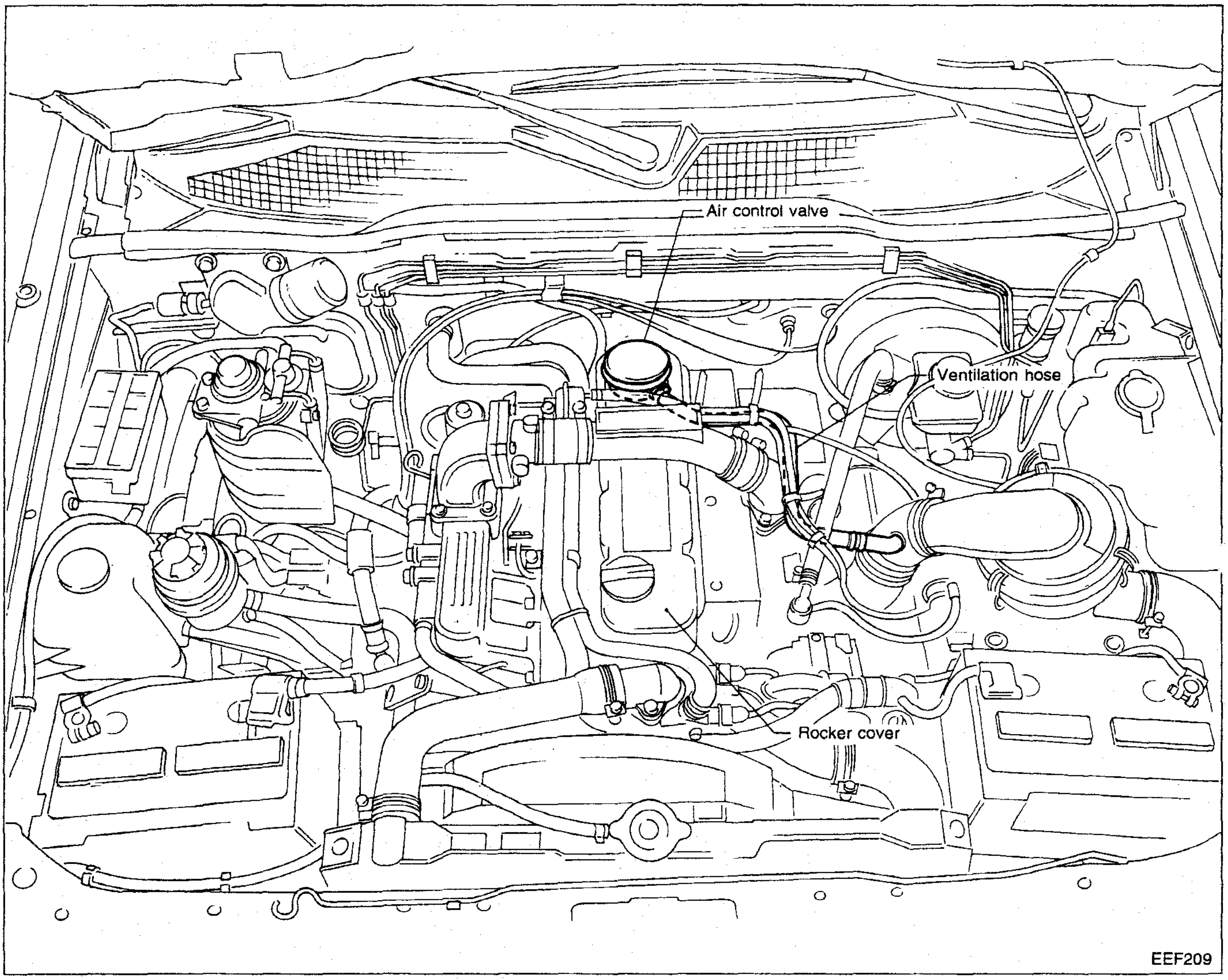
6. If the value is not within the specified range, modify measured voltage by adjusting potentiometer position relative to its fixation.

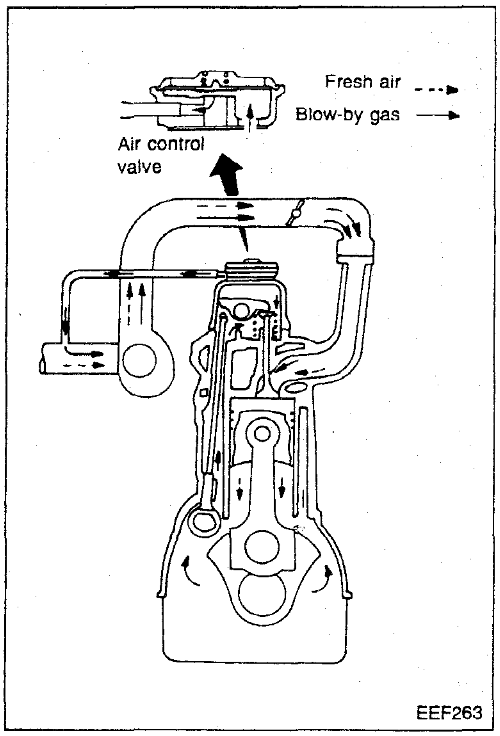

EEF204

7. Fixate potentiometer by tightening potentiometer fixation screws.


EEF208

8. Make sure that the control lever correctly returns to the idle position and that the voltage value returns to the adjusted value.

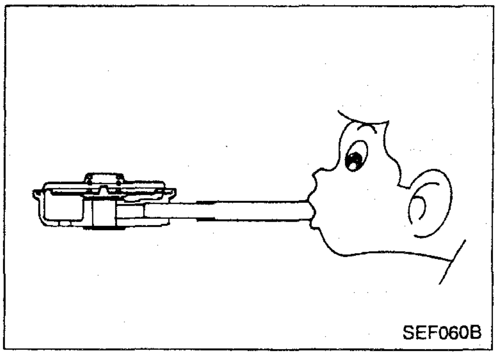

Air control valve
Ventilation hose
Rocker cover
EEF209



EEF263

Description

The closed-type crankcase ventilation system is utilized as a crankcase emission control system. The closed-type crankcase emission control system prevents blow-by gas from entering the atmosphere and keeps the internal crankcase pressure constant. During the valve operation, the blow-by gas is fed into the intake manifold by the air control valve. This is activated by the internal rocker cover pressure. When the intake air flow is restricted by the throttle chamber, the internal rocker cover pressure decreases. At this point, the crankcase emission control valve keeps the internal rocker cover pressure constant so that air or dust is not sucked in around the crankshaft oil seal.

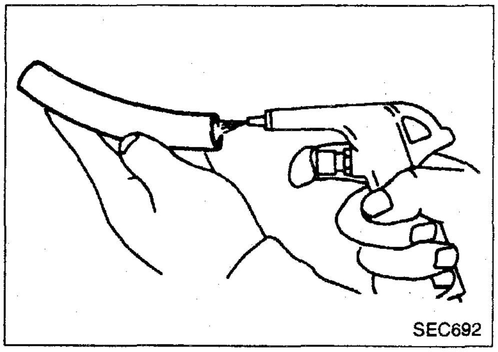


SEF060B

Inspection

AIR CONTROL VALVE

1. Remove rocker cover.
2. Remove control valve from rocker cover.
3. After plugging the center hole with adhesive tape, check that air flows from inlet by blowing air from outlet and that air does not flow by inhaling air.

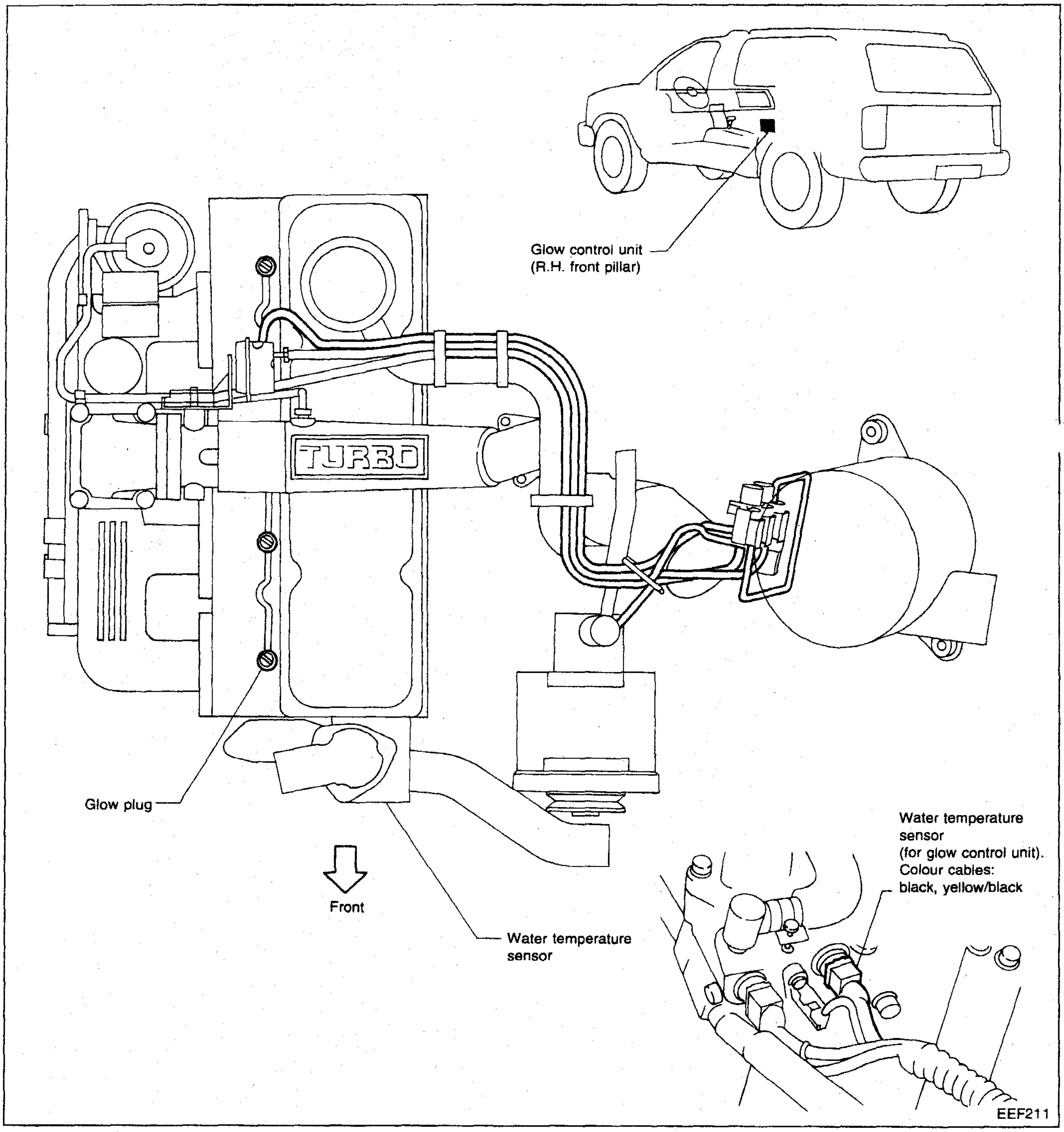


SEC692

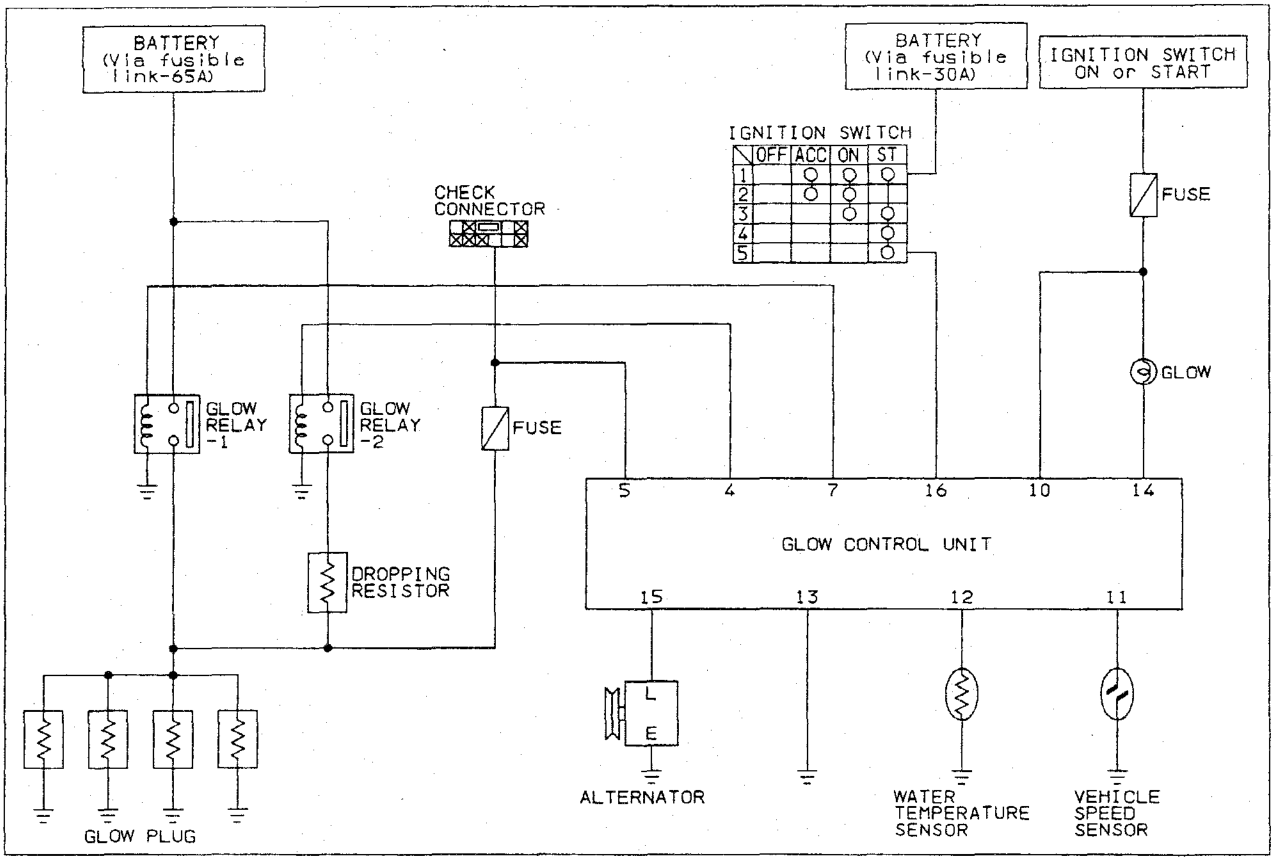
VENTILATION HOSE

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 Parts Location



Circuit Diagram

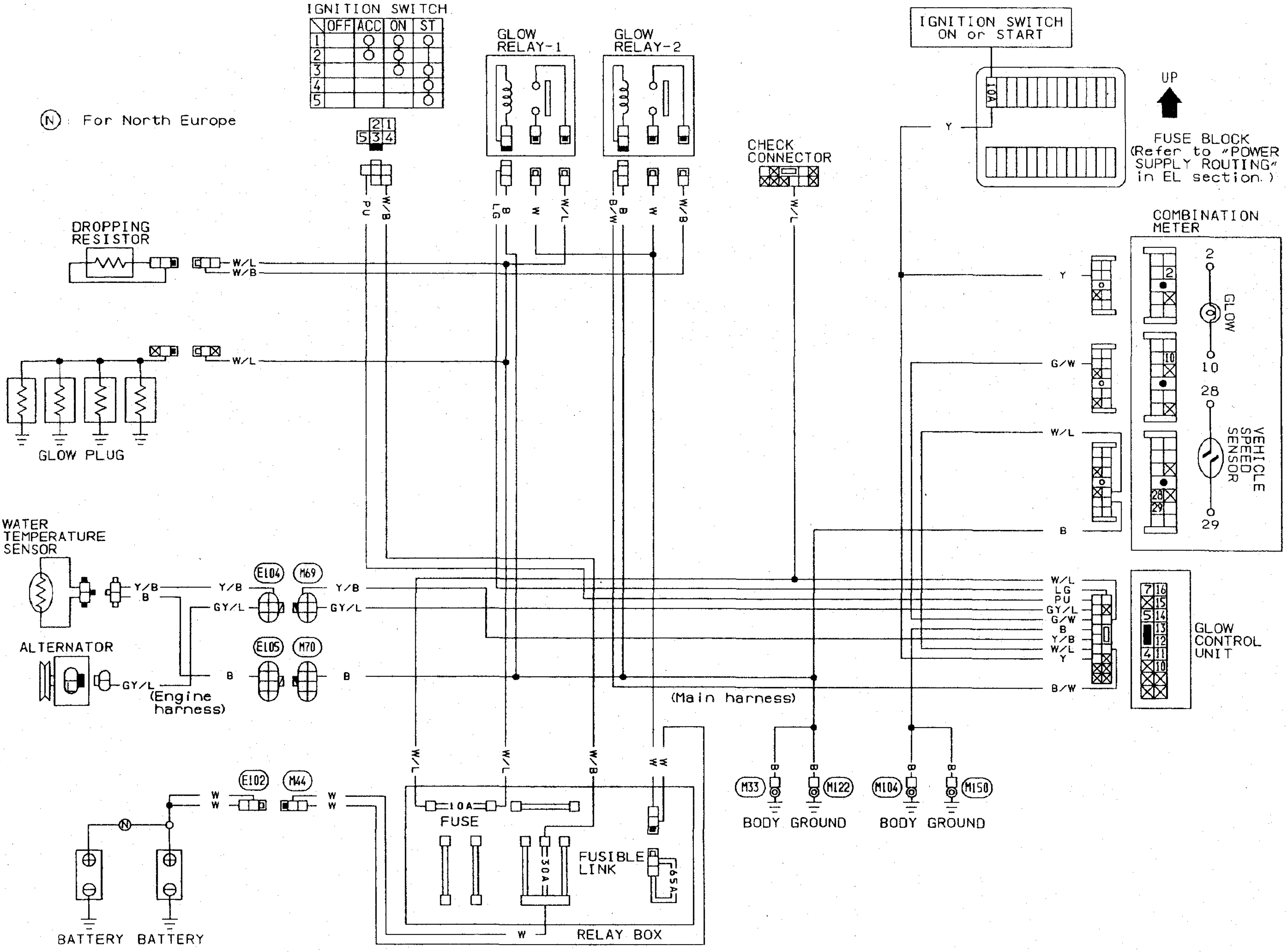


YEF056

QUICK-GLOW SYSTEM

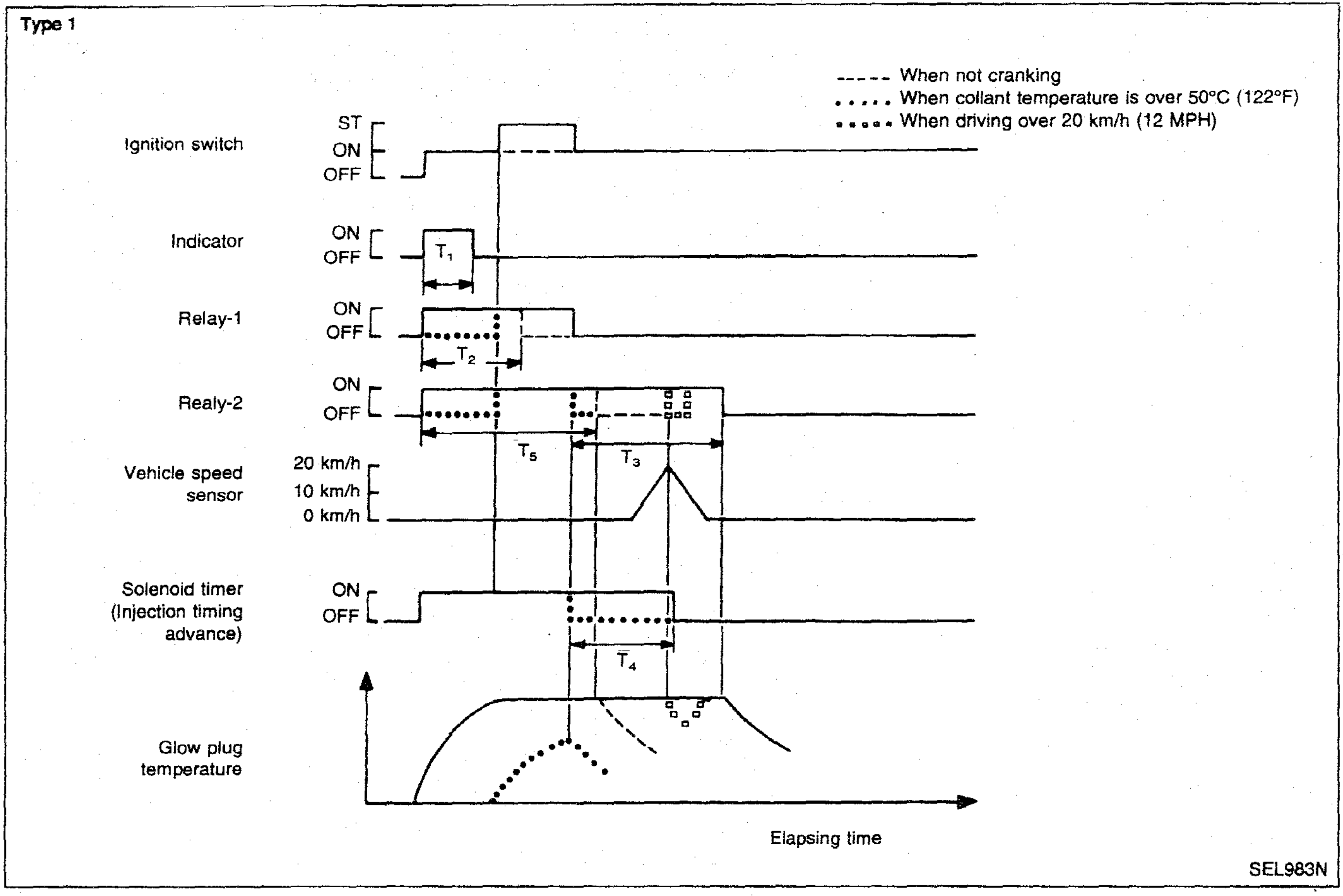
Wiring Diagram

TD27T



YEF057

Description



When coolant temperature is lower than 50 °C (122°F), relay-1 and relay-2 are turned on at the same time that the ignition switch is turned on. From this time, the "high-level" electric current flows through the glow plugs and heats them up quickly. After T_1 seconds have passed, the control unit turns off the indicator. The relay-1 automatically turns off after it has been on for T_2 seconds.

If you turn the key to the "START" position and keep it in this position, relays 1 and 2 will remain on ("high-level current"). When the engine is started, relay-1 will turn off and relay -2 will remain on during the post-heating time T_3. This may send the "low-level" current through the glow plugs.

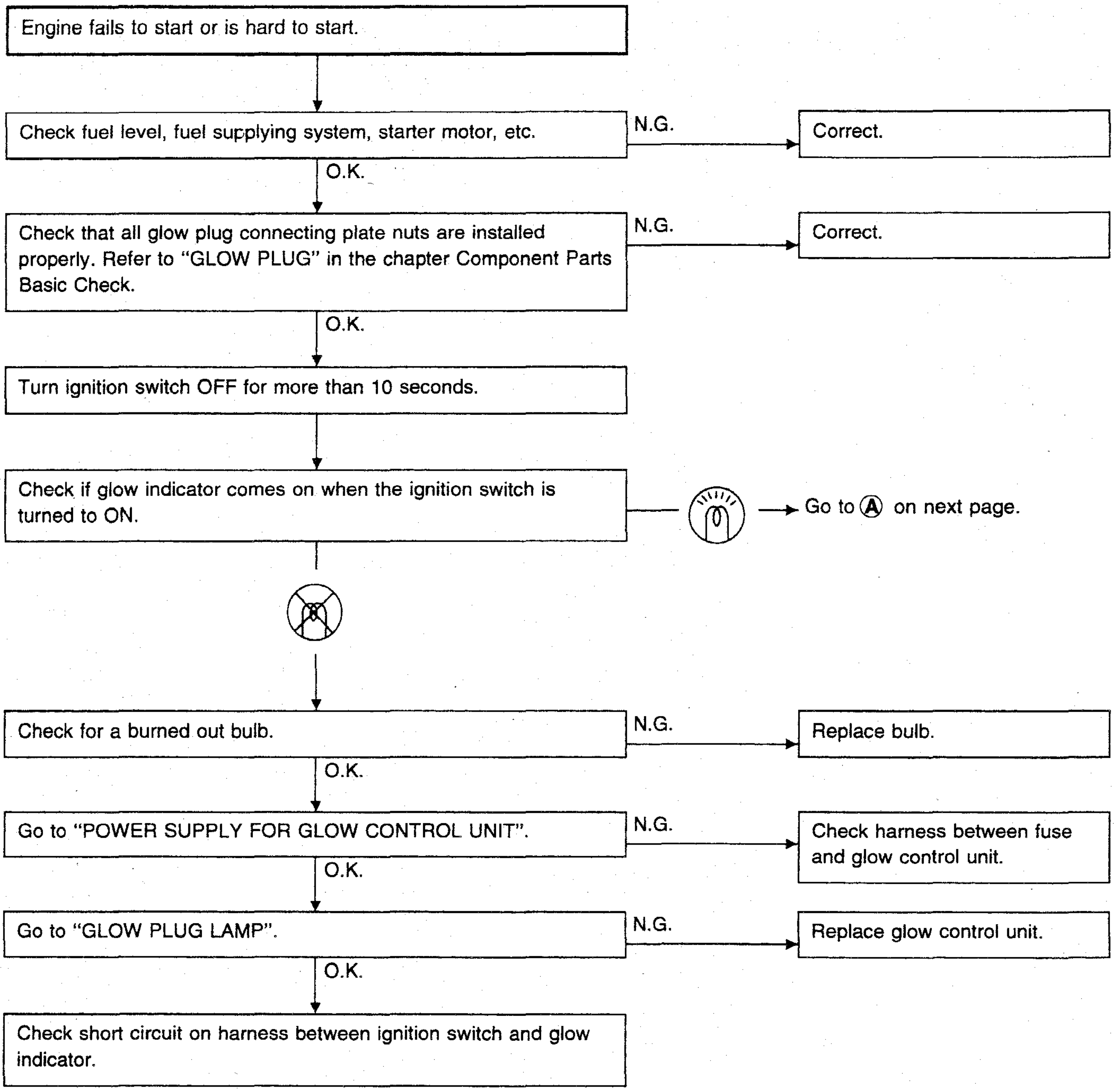
If you do not turn the key to the "START" position, relay 2 will turn off after T_5.

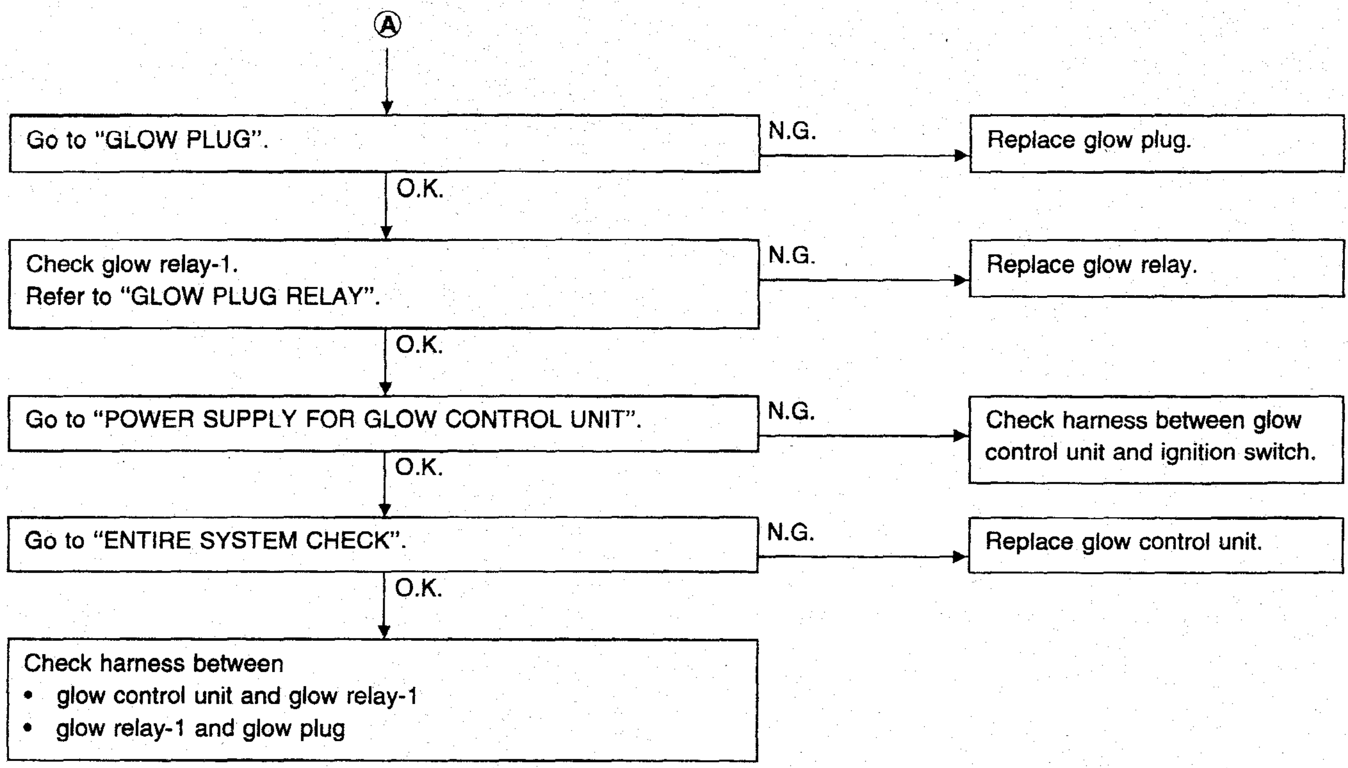
When the coolant temperature is higher than 50°C (122°F), relay-2 is turned on only when the key is in the "START" position.

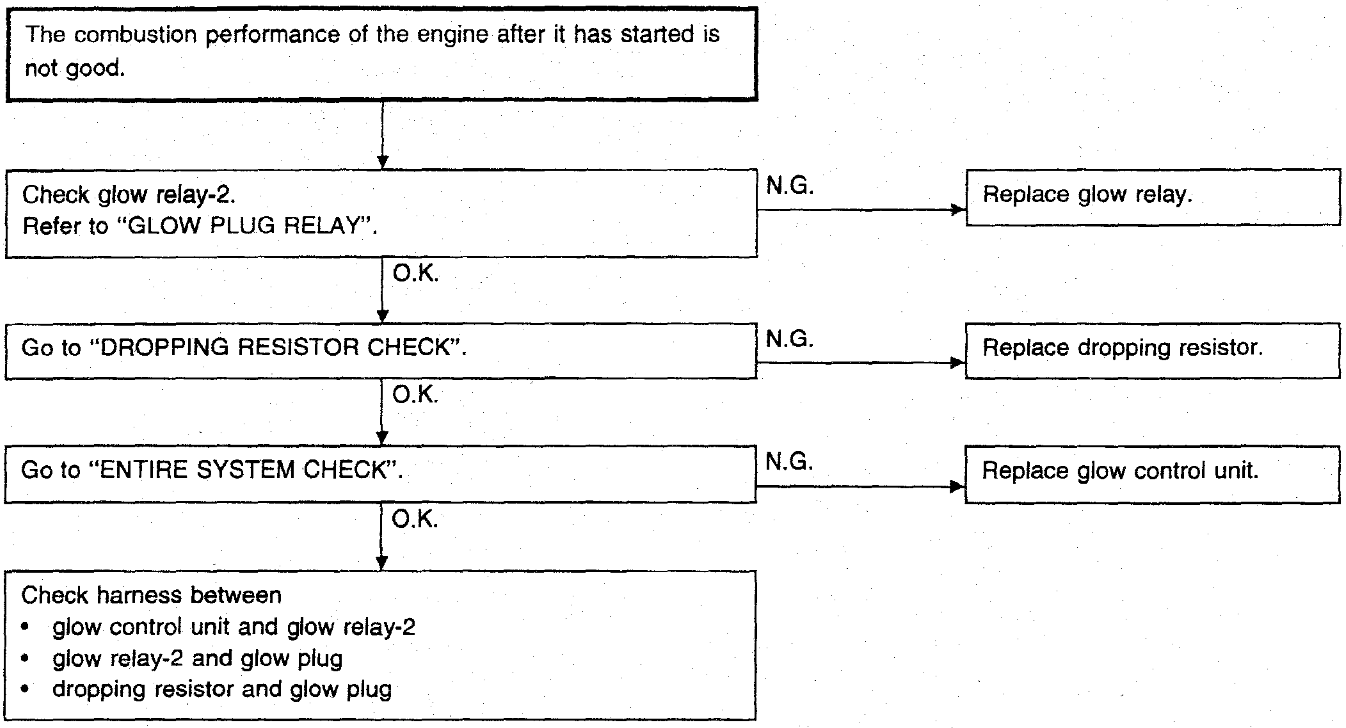
T_1 : approx. 2-6 [sec.] (Varies with coolant temperature and glow plug terminal voltage.)
T_2 : approx. 3-11 [sec.] (Varies with glow plug terminal voltage.)
T_3 : approx. 600 [sec.] [When coolant temperature is below 50°C (122°F).]
0 [sec.] [When coolant temperature is over 50°C (122°F).]
T_4, T_5 : approx. 30 [sec.] [When coolant temperature is below 10°C (50°F).]
0 [sec.] [When coolant temperature is over 10°C (50°F).]

- When the ignition switch is repeatedly turned "ON" and "OFF", T_2 becomes shorter.

Trouble Diagnoses




Ⓐ
Go to "GLOW PLUG".
N.G.
Replace glow plug.
O.K.
Check glow relay-1.
Refer to "GLOW PLUG RELAY".
N.G.
Replace glow relay.
O.K.
Go to "POWER SUPPLY FOR GLOW CONTROL UNIT".
N.G.
Check harness between glow control unit and ignition switch.
O.K.
Go to "ENTIRE SYSTEM CHECK".
N.G.
Replace glow control unit.
O.K.
Check harness between
• glow control unit and glow relay-1
• glow relay-1 and glow plug



The combustion performance of the engine after it has started is not good.

Check glow relay-2.
Refer to "GLOW PLUG RELAY".

N.G.

Replace glow relay.

O.K.

Go to "DROPPING RESISTOR CHECK".

N.G.

Replace dropping resistor.

O.K.

Go to "ENTIRE SYSTEM CHECK".

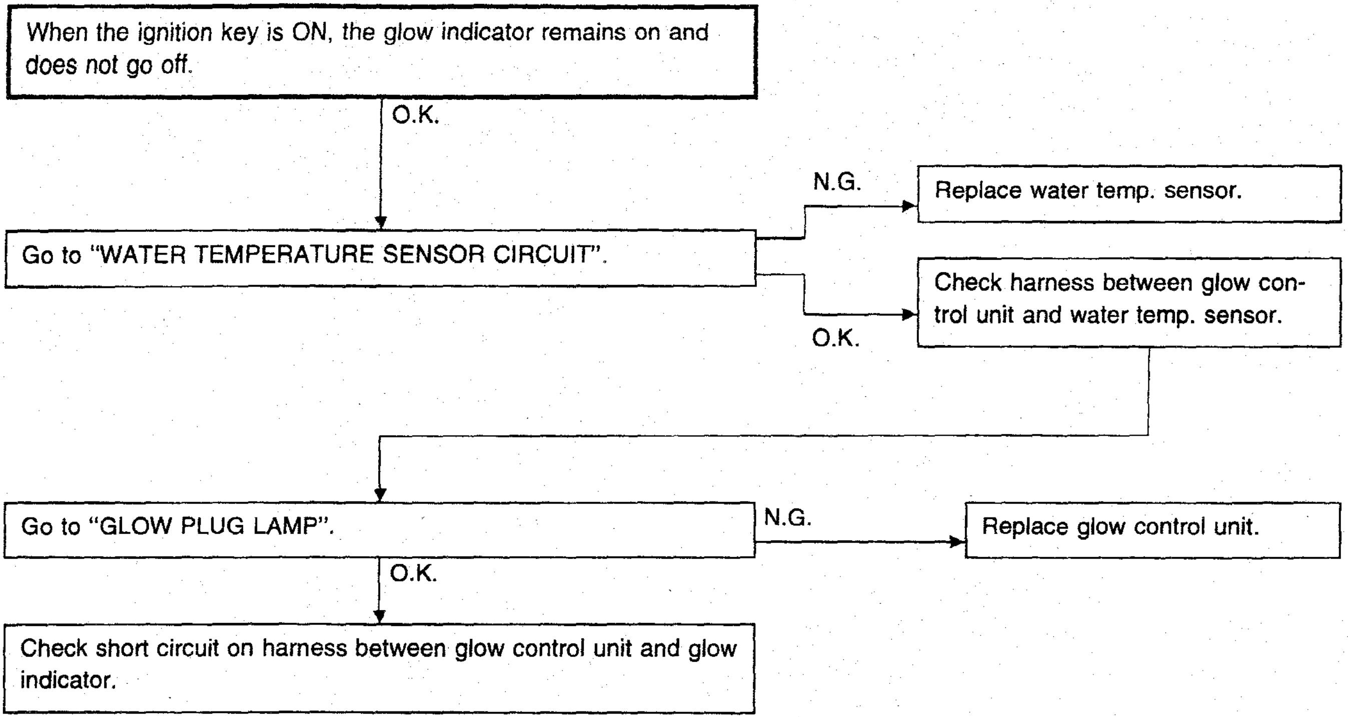
N.G.

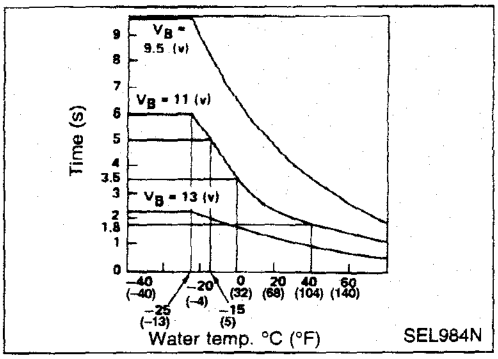
Replace glow control unit.

O.K.

Check harness between
- glow control unit and glow relay-2
- glow relay-2 and glow plug
- dropping resistor and glow plug

Trouble Diagnoses (Cont'd)



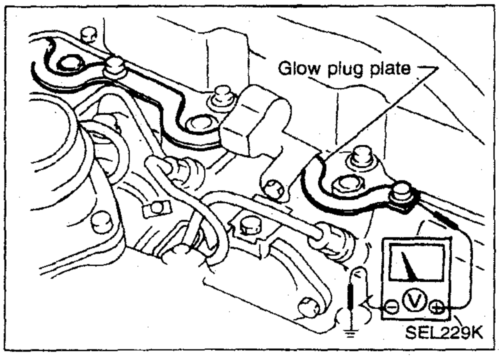


Component Parts Basic Check

GLOW LAMP

Turn ignition switch ON and measure the time that glow lamp stays lit.

Approx. 1-10 seconds
(The time will vary according to glow plug terminal voltage and water temperature.)



ENTIRE SYSTEM CHECK

[At water temperature below 10°C (50°F)]

Pre-glow control check

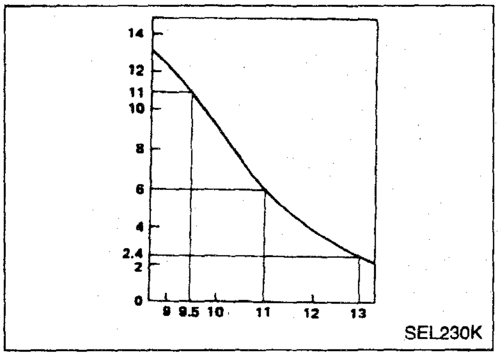
Turn ignition switch ON and measure glow plug terminal voltage.

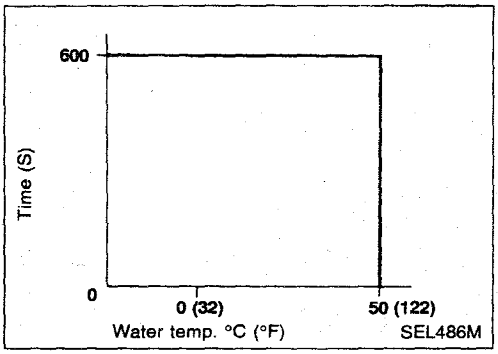
Battery voltage should appear for 2 to 13 seconds*, and then half of battery voltage for the next 30 seconds.

*** (Varies with glow plug terminal voltage)**

The time will be shortened if ignition switch is OFF for only a brief period.

Therefore, when measuring the time, leave ignition switch OFF for more than 5 minutes, and then turn it ON.



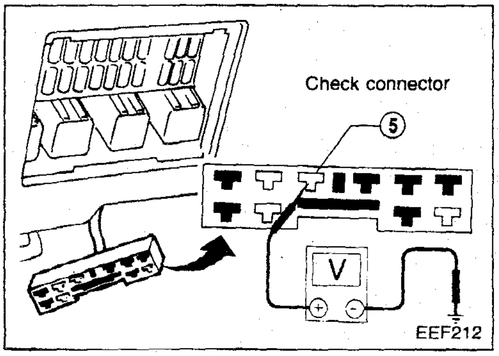


After-glow control check

Turn ignition switch to START and run engine, then measure glow plug terminal voltage.

Half of battery voltage should continue for 10 minutes.*

- **If the water temperature exceeds 50°C (122°F) in this time, or if the vehicle speed exceeds 20 km/h (12.5 mph), the voltage of the connection clip of the glow plug should fall to 0V.**



CHECK CONNECTOR

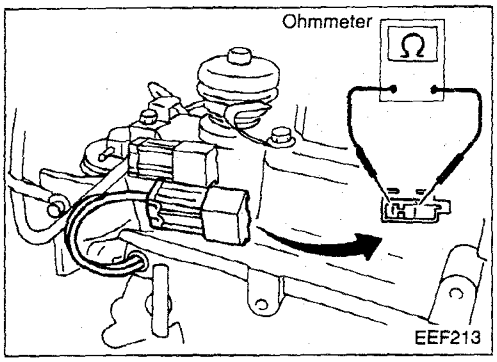
By means of this connector, the function of the quick glow system can be checked easily.

Check voltage between terminal ⑤ and ground.

Battery voltage should exist for 3 to 11 seconds*.

*** (Varies with coolant temperature.)**

Component Parts Basic Check (Cont'd)

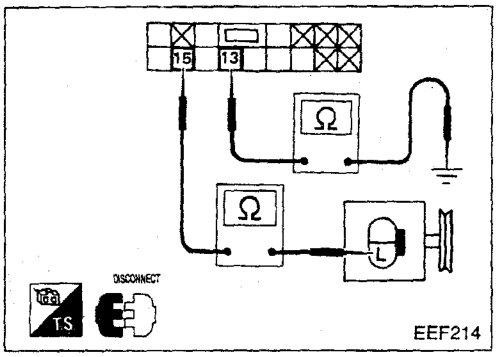


EEF213

DROPPING RESISTOR

Measure resistance between terminals.

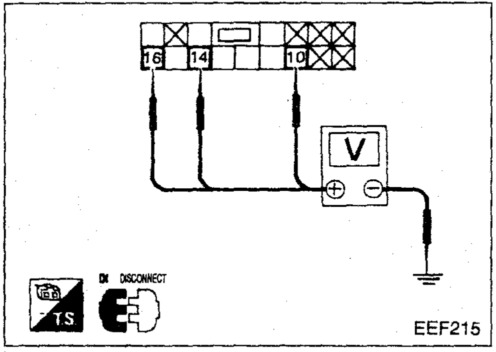
Resistance: approx. 0.3Ω



EEF214

POWER SUPPLY FOR GLOW CONTROL UNIT

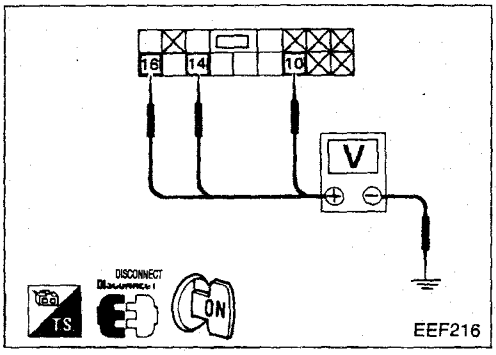
1. Disconnect "S" terminal for starter motor to prevent engine from cranking.
2. Disconnect glow control unit harness connector.
3. Check terminal ⑬ for ground continuity.
   Continuity should exist.
- If N.G., check ground harness.
4. Check continuity between terminal ⑮ of glow control unit and terminal "L" of alternator.
   Continuity should exist.



EEF215

5. Check voltage at each terminal according to the following chart.

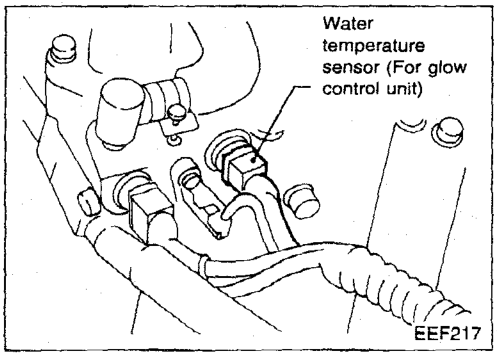
Terminal No.	Ignition switch position		Voltage
⑩	OFF		0V
	ON	START	Battery voltage
⑭	OFF		0V
	ON	START	Battery voltage
⑯	OFF	ON	0V
	START		Battery voltage



EEF216

- If N.G., check component parts and their related harness according to the following chart.

Terminal No.	Parts which should be checked				
	Battery	Fuse/ Fusible link	Ignition switch	Glow indicator bulb	Harness
⑩	X	X	X		X
⑭	X	X	X	X	X
⑯	X	X	X		X



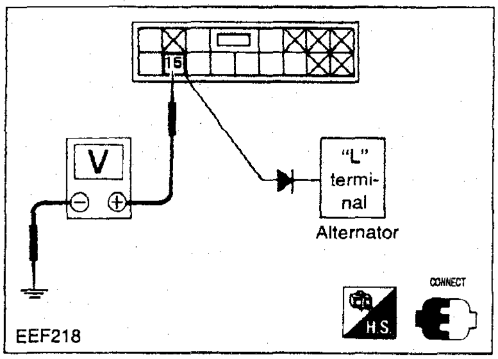
EEF217

WATER TEMPERATURE SENSOR

Check water temperature sensor resistance.

Coolant temp. °C (°F)	Resistance kΩ
−25 (−13)	19
0 (32)	5.6
20 (68)	2.5
40 (104)	1.2

Component Parts Basic Check (Cont'd)



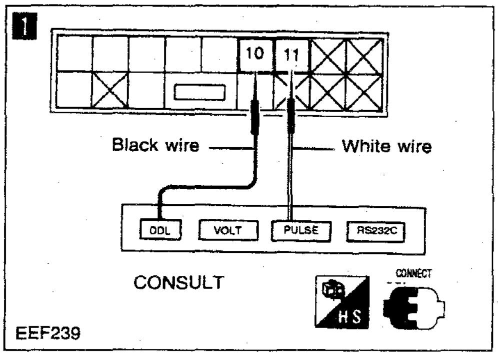
EEF218

ALTERNATOR TERMINAL "L"

Start engine and make sure that voltage between terminal ⑮ and body ground is more than 5V.

VEHICLE SPEED SENSOR

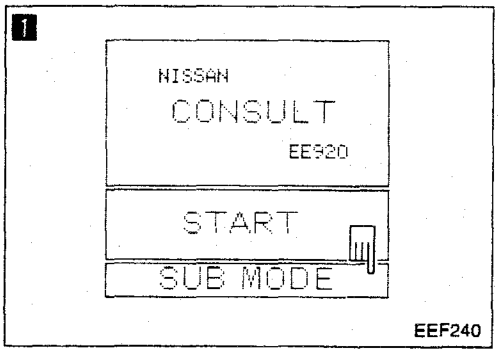
1. Ensure that the gear shift is at position "2H".
2. Jack up the rear of the vehicle.
3. Select 4th gear and let the vehicle drive at 60 km/h (37.5 mph) during the check.



EEF239

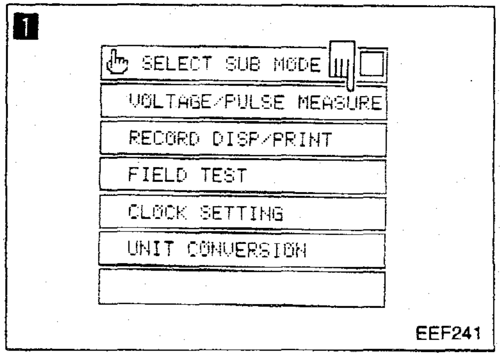
1

1) Select the correct cables for this test (black and white cables with threaded ends) and fasten them to the DCC and PULSE connection clips respectively.
2) Fasten the black and white cables to connection clips 11 and 10 respectively of the glow control unit.



EEF240

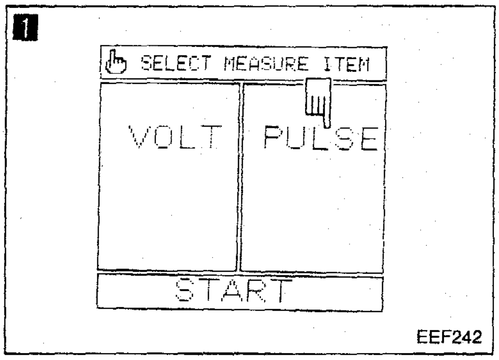
3) Press "SUB MODE".



EEF241

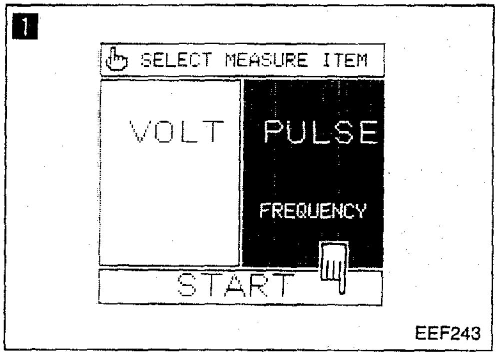
4) Press "VOLTAGE/PULSE MEASURE".

Component Parts Basic Check (Cont'd)



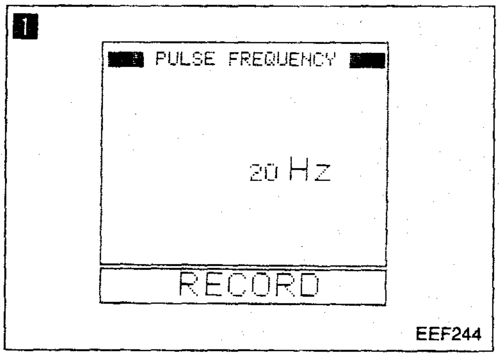
EEF242

5) Press "PULSE" until "PULSE FREQUENCY" is selected.



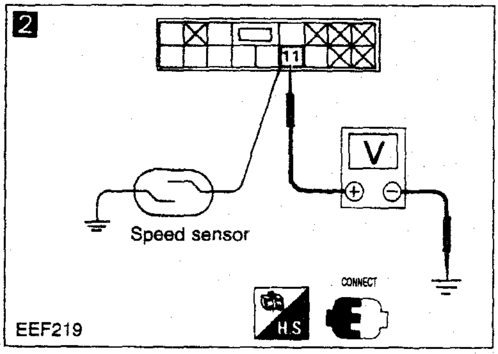
EEF243

6) Press "START".



EEF244

7) Check that the impulse frequency is approximately 20 Hz.

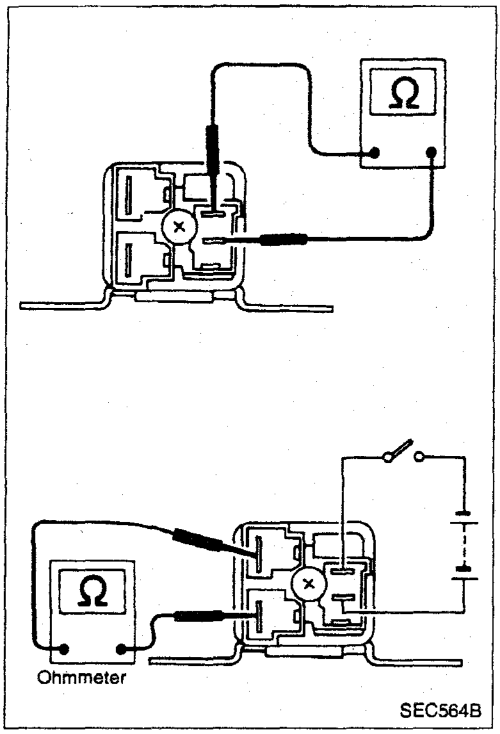


EEF219

2

Check whether the voltage between connection clip 11 of the glow control unit and earth causes the voltmeter indicator to move.

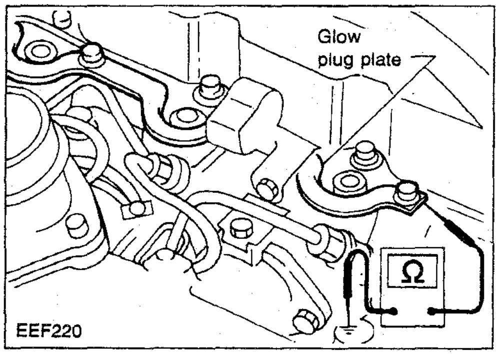
Component Parts Basic Check (Cont'd)



GLOW RELAY

1. Check relay for coil continuity.
   Continuity should exist.
2. Check relay for proper operation.

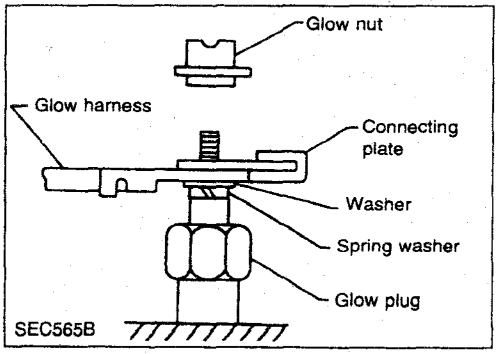
Coil voltage	Continuity	Contact point
0V	No	OFF
12V	Yes	ON



GLOW PLUG

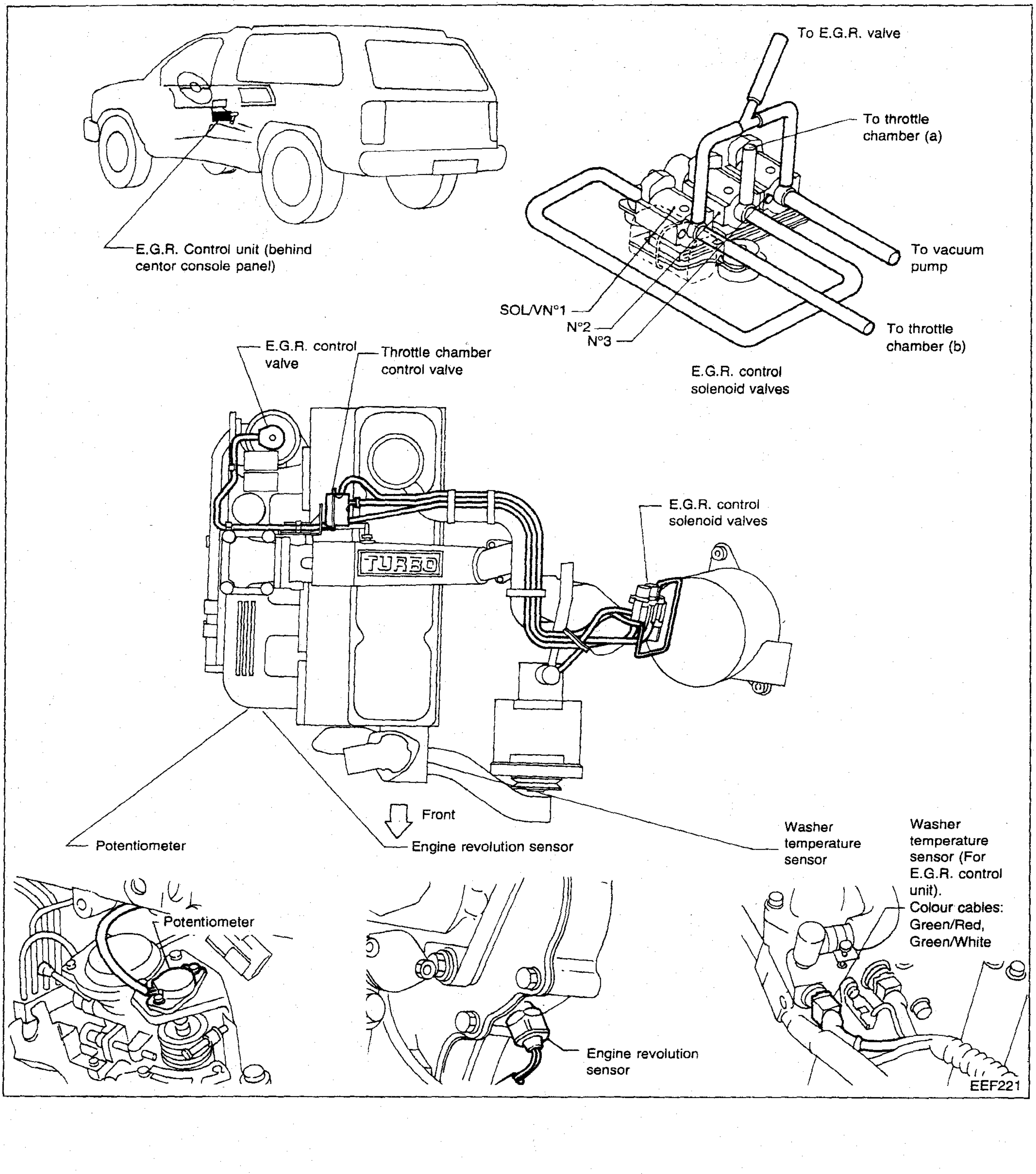
1. Disconnect glow control unit harness connector.
2. Remove glow plug connecting plate.
3. Check each glow plug for continuity.
   Continuity should exist:
   Approximately 0.65Ω

- If N.G., replace glow plug.

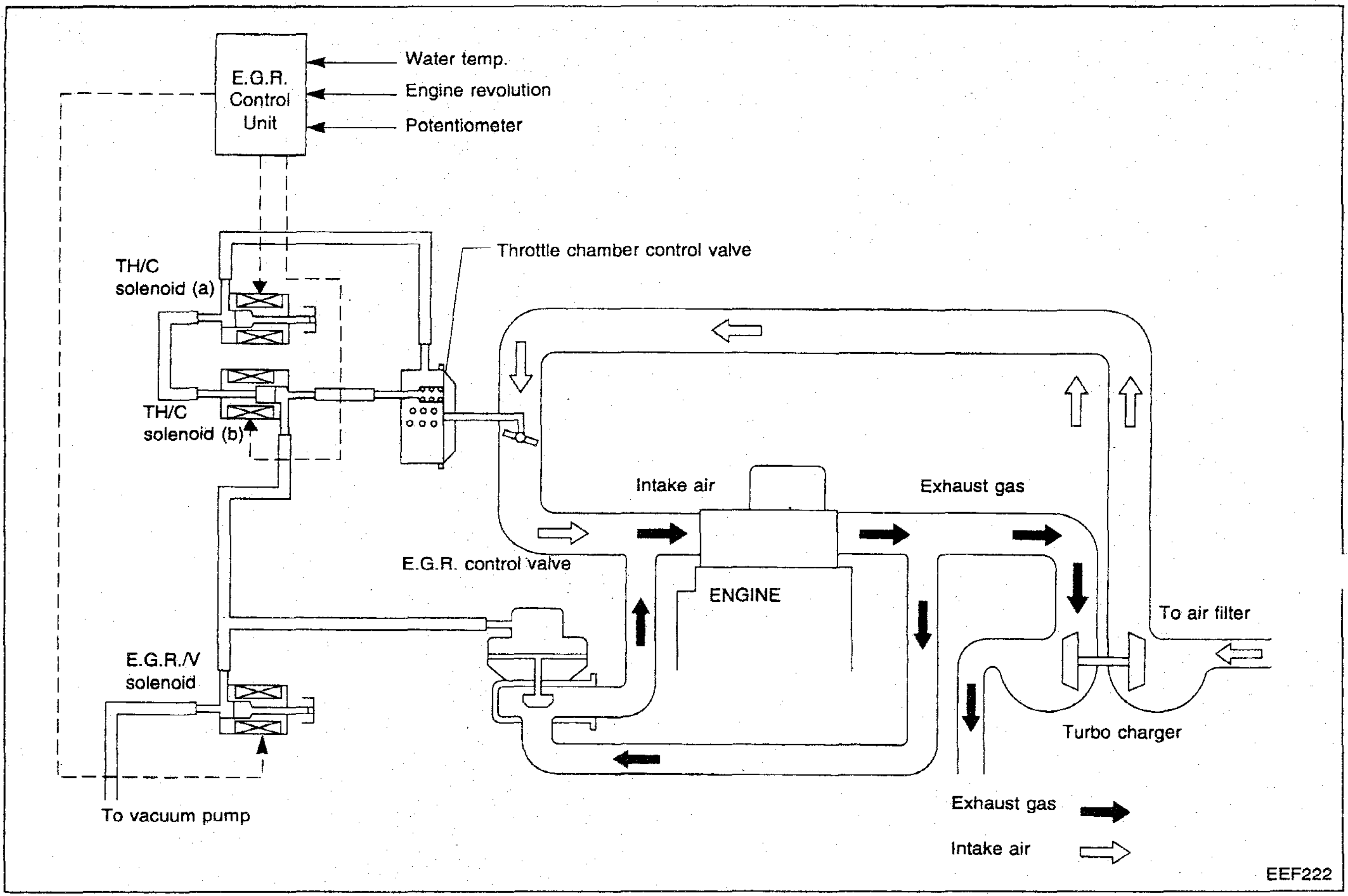


5. Install glow plug connecting plate.

System Parts Location

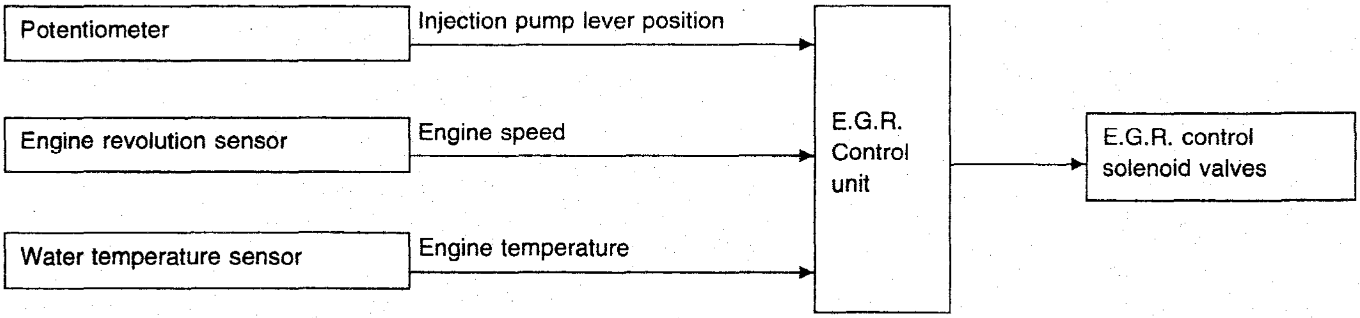


System Diagram

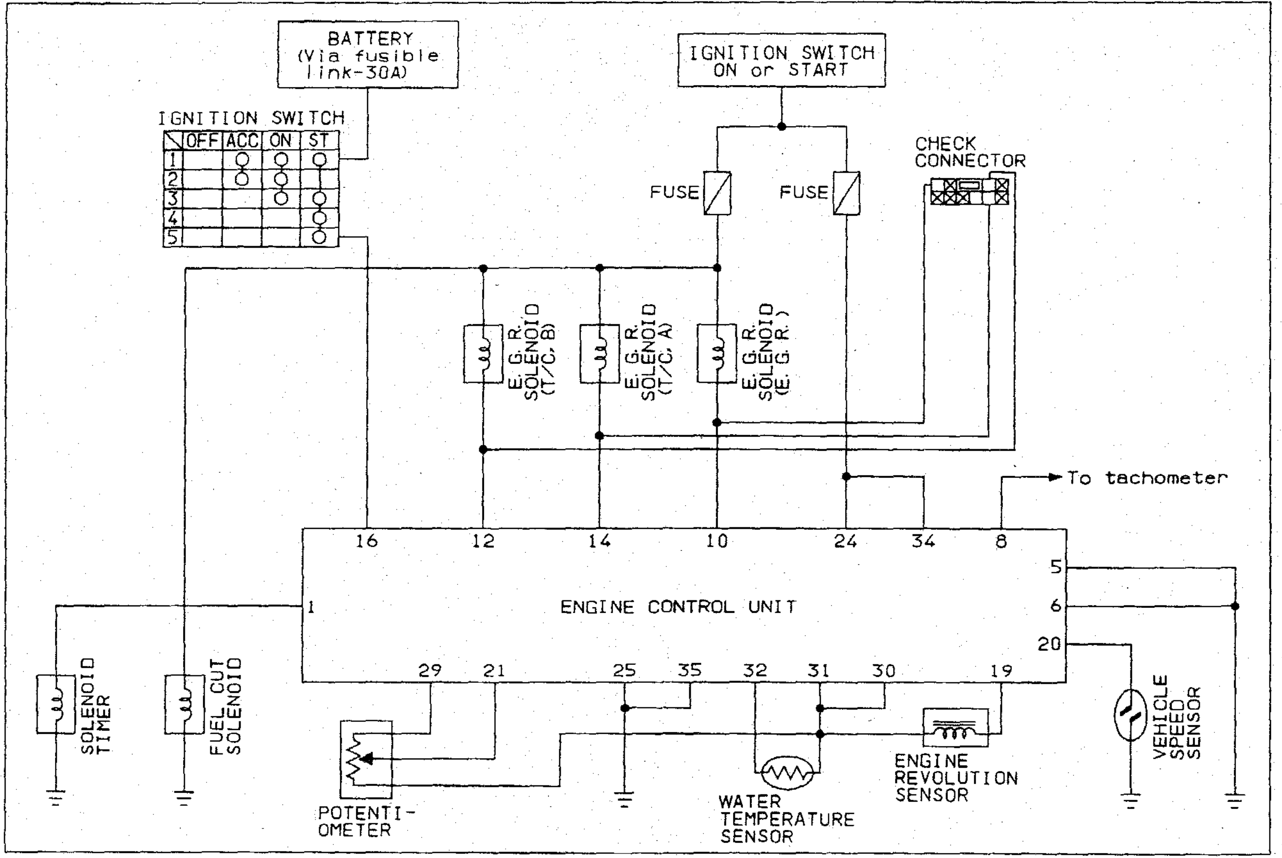


The E.G.R. system is designed to control the formation of NOx emission by recirculating the exhaust gas into the intake manifold passage through the E.G.R. control valve.

System Chart



Circuit Diagram

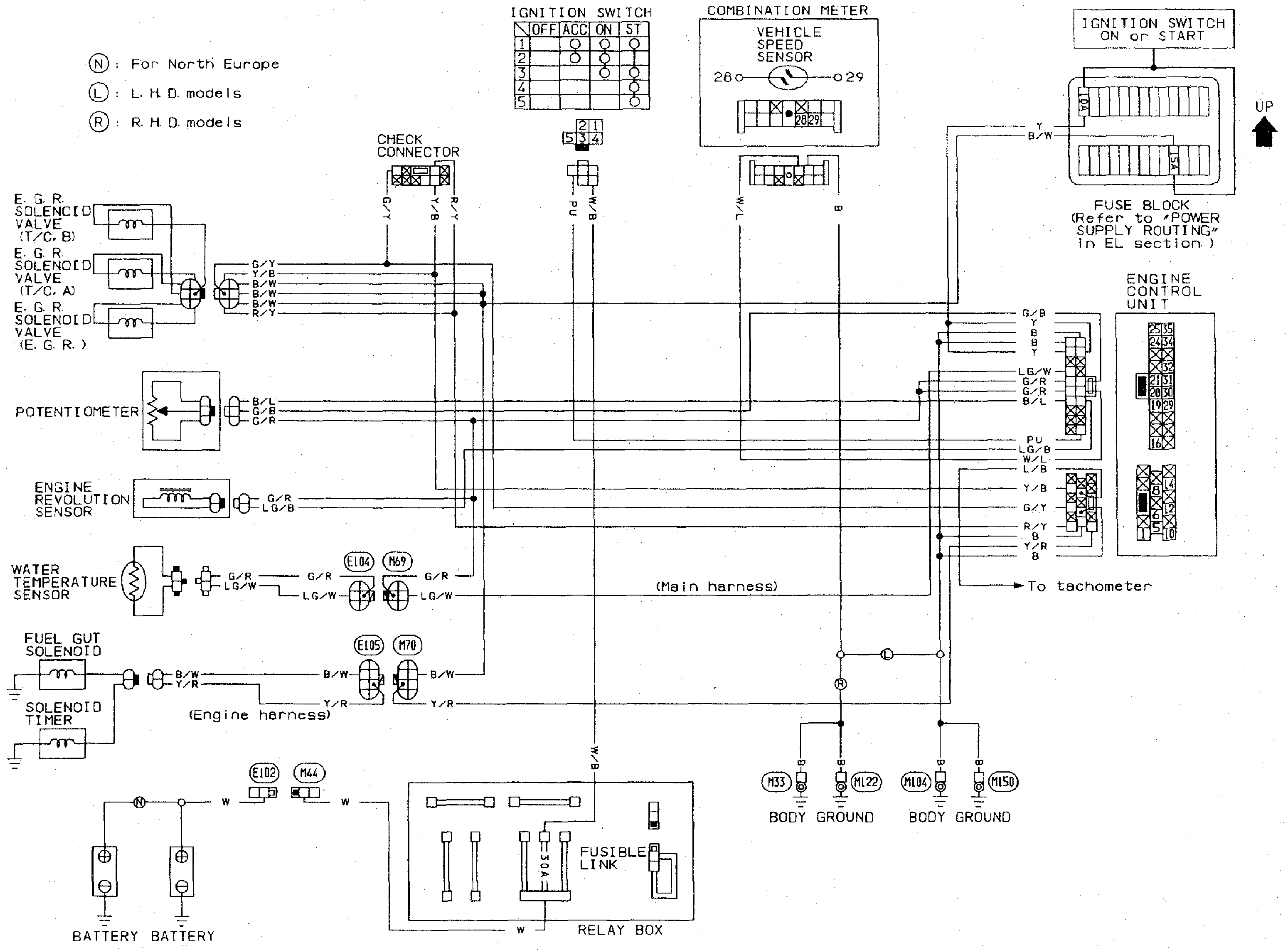


YEF058

E.G.R. SYSTEM

Wiring Diagram

TD27T



YEF059

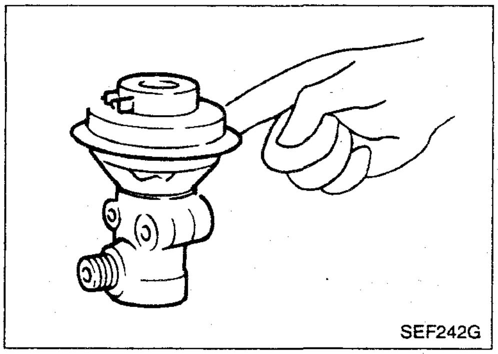
Description

Coolant temperature	Load	Solenoid valve			E.G.R. valve	Throttle chamber control valve
		TH/C (a)	TH/C (b)	E.G.R.		
60° ⩽ T ⩽ 120°C (140° ⩽ T ⩽248°F)	Light	ON	OFF	ON	Open	Nearly Closed
	Middle	OFF	ON	ON	Open	Half Open
	Middle heavy	OFF	OFF	ON	Open	Open
	Shift mode	OFF	ON	OFF		
	Heavy	OFF	OFF	OFF	Closed	Open
T > 120°C (248°F) or T < 60°C (140°F)	All	OFF	OFF	OFF	Closed	Open

The engine load signal is detected with the potentiometer installed on the fuel injection pump control lever. The engine revolution sensor located on timing gear case produces the engine speed signal.

The E.G.R. control valve is activated by the vacuum, generated by the vacuum pump. E.G.R. control solenoid valves are used to convert the electrical signal from the control device into a vacuum response.

The E.G.R. system is deactivated when the water temperature is low. The water temperature sensor is of the thermistor type that detects the temperature at the cylinder head.


SEF242G

Component Parts Basic Check

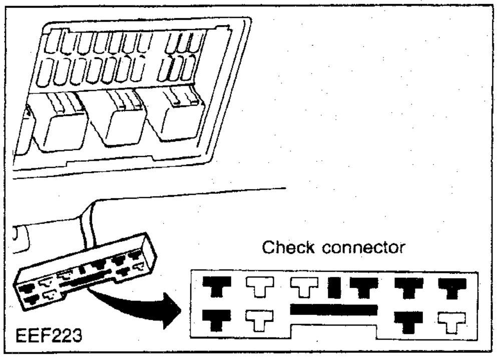
ENTIRE SYSTEM

1. Check that the vacuum hoses are not flattened and that they are properly connected.
2. Warm up engine sufficiently [water temperature over 60°C (140°F)].
3. Place your finger on E.G.R. control valve diaphragm inside the housing 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.**

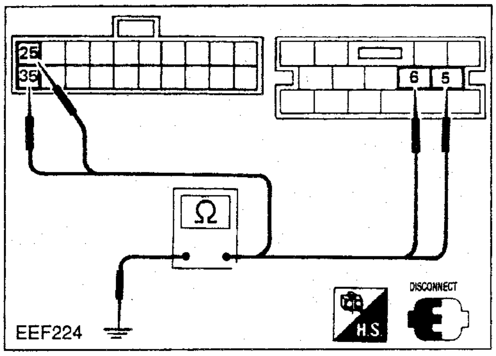
Component Parts Basic Check (Cont'd)

CHECK CONNECTOR



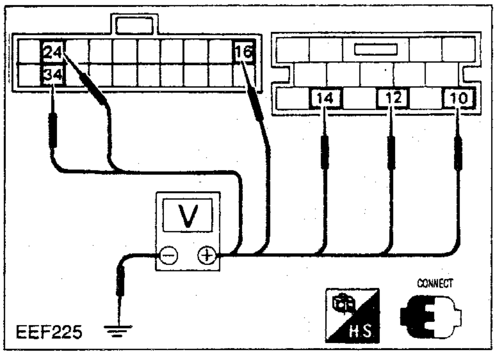
By means of the check connector, the function of the E.G.R. solenoid valves can be checked easily without disconnecting E.G.R. control unit.

POWER SUPPLY FOR E.G.R. CONTROL UNIT



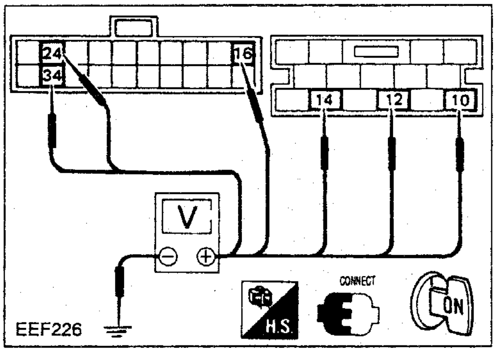
1. Disconnect for starter motor to prevent engine from cranking.
2. Check terminals ⑤, ⑥, ㉕ and ㉟ for ground continuity.
   Continuity should exist.

- If N.G., check ground harness.



3. Check voltage at each terminal according to the following chart.

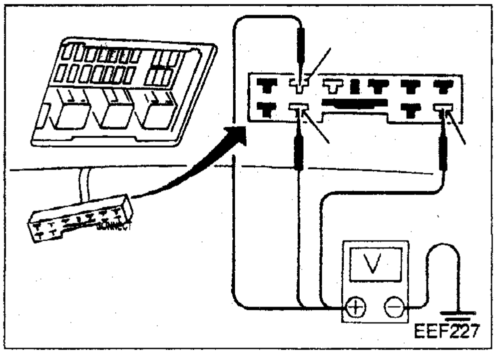
Terminal No.	Ignition switch position		Voltage
⑩ ⑫ ⑭	OFF		Approx. 0V
⑯	OFF	ON	0V
	START		Battery voltage
㉔ ㉞	OFF		0V
	ON	START	Battery voltage



- If N.G., check component parts and their related harnesses according to the following chart.

Terminal No.	Parts which should be checked				
	Battery	Fuse/ Fusible link	Solenoid valves	Ignition switch	Harness
⑩ ⑫ ⑭	X	X	X	X	X
⑯	X	X		X	X
㉔ ㉞	X	X		X	X

CONTROL UNIT OUTPUT SIGNAL

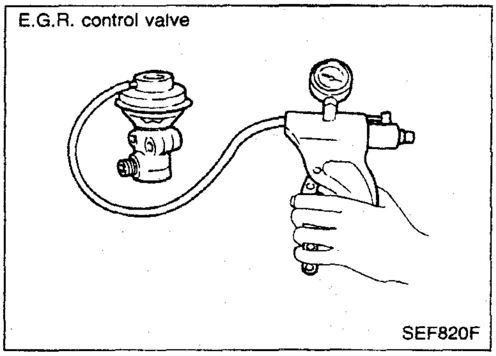


1. Check voltage between check connector terminals ②, ④ ⑥ and ground.

Water temperature °C (°F)	Voltage of control unit terminals ②, ④, ⑥
Below 60 (140)	Battery voltage
Above 60 (140)	0 - 1V

Component Parts Basic Check (Cont'd)

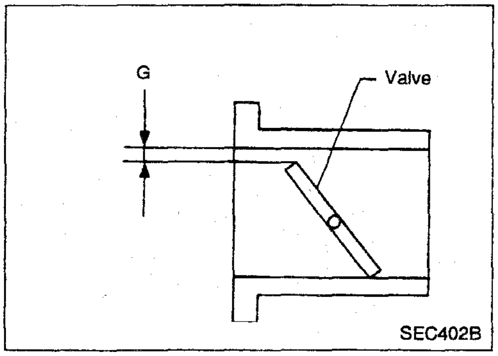
The voltage to be measured varies with the status (activated or not) of the solenoid valves. Battery voltage will be indicated if the solenoid valve is activated; 0 to 1V will be indicated if the solenoid valve is not activated.
Therefore refer to the chart in NE to know which solenoid valves are activated depending on the conditions.



E.G.R. CONTROL VALVE

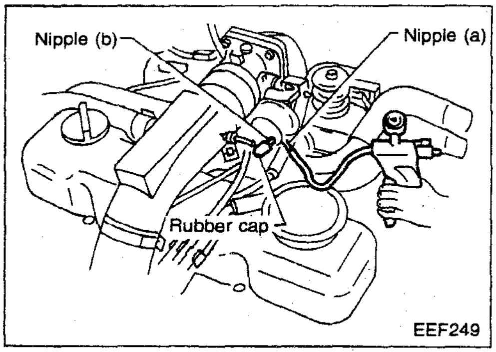
1. Supply the E.G.R. control valve with vacuum using a handy vacuum pump.
2. Place a finger on the valve diaphragm, and make sure that the diaphragm lifts up and down in response to the vacuum leading to the valve.

- **Do not supply the valve with an excessively high vacuum.**



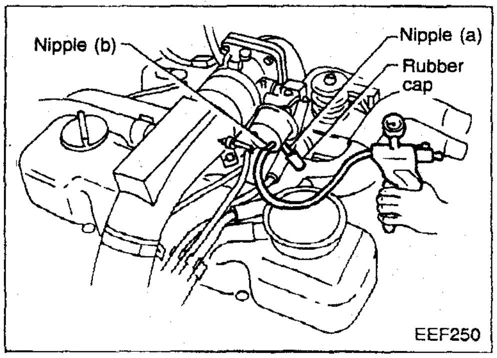
NECK CONTROL VALVE

Measure distance "G" between the valve and the body under the following conditions:



1) By putting a pressure of approximately -13.3 kPa (-133 mbar, -100 mm Hg, -1.9 psi) on the nipple while the nipple is closed.

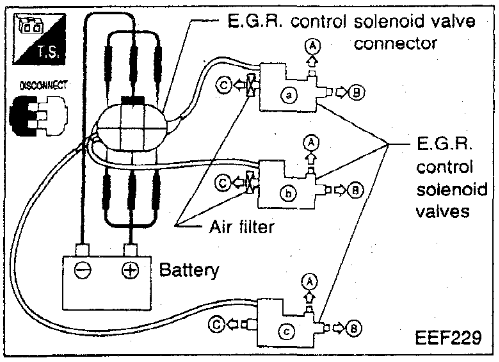
   Distance "G" (valve almost closed)
   2±0.1 mm (0.079±0.004 in)



2) By putting a pressure of approximately -13.3 kPa (-133 mbar, -100 mm Hg, -1.9 psi) on the nipple while the nipple is closed.

   Distance "G" (valve half open)
   6±0.1 mm (0.236±0.004 in)

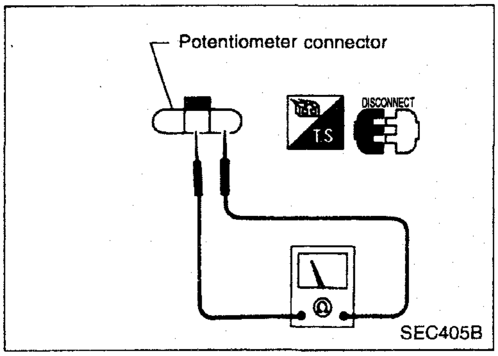
Component Parts Basic Check (Cont'd)



SOLENOID VALVES

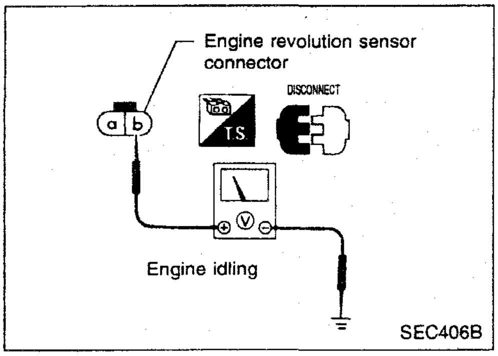
1. Disconnect solenoid valves connector.
2. Disconnect vacuum hoses.
3. Supply the solenoid valves with battery voltage, and check whether there is continuity between ports A, B and C.

Solenoid	OFF	ON
Continuity	A-C	A-B



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.

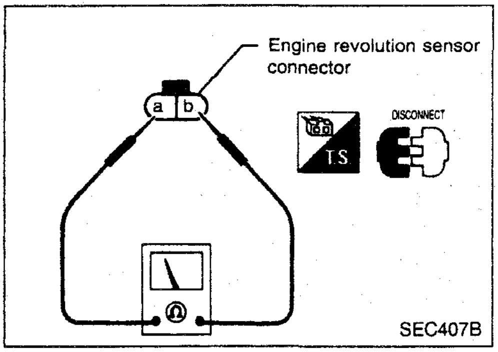


ENGINE REVOLUTION SENSOR

1. While idling engine, check AC voltage across terminals ⓑ and ground.

   Engine idling: Approx. 0.5V

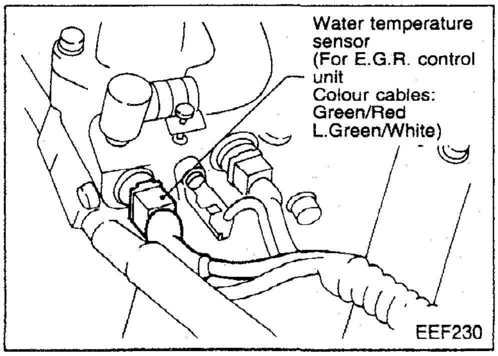
Check that AC voltage increases when engine speed is increased.



2. If voltage is not within specifications, conduct a continuity test.

   Resistance:

   Approx. 1.36 - 1.84 kΩ (continuity established)



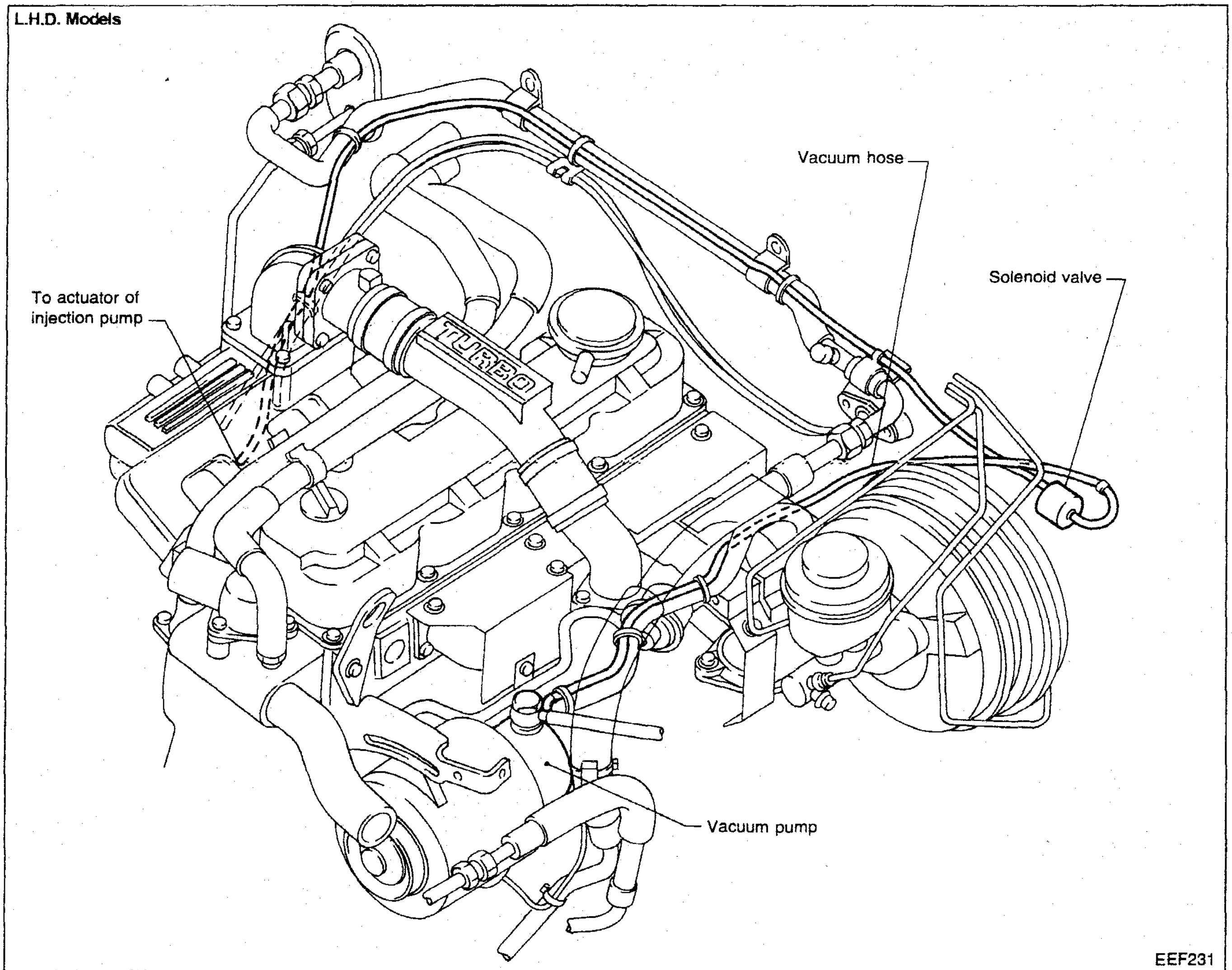
WATER TEMPERATURE SENSOR

- Check water temperature sensor resistance.

Coolant temp. °C (°F)	Resistance kΩ
20 (68)	2.5
80 (176)	0.33

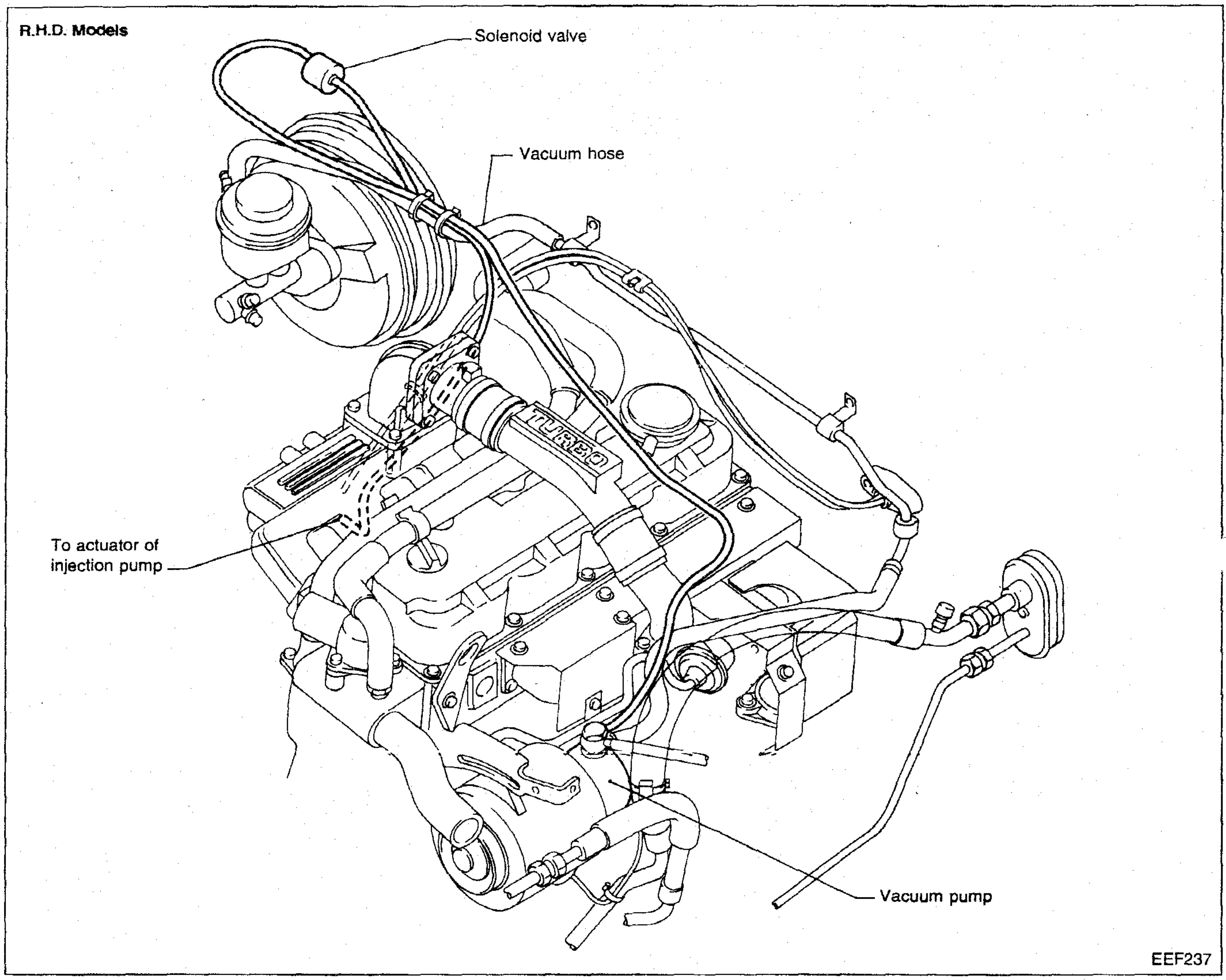
System Vacuum Circuit

L.H.D. Models



FAST IDLE CONTROL DEVICE (F.I.C.D.)

System Vacuum Circuit (Cont'd)



Injection Pump

GENERAL SPECIFICATIONS

		M/T
Idle speed rpm	F.I.C.D.: OFF	700 ± 50
	F.I.C.D.: ON	850 ± 50
Maximum engine speed rpm		5,050 ± 100
Injection timing B.T.D.C.		0 ± 1

INSPECTION AND ADJUSTMENT

Installation of injection pump

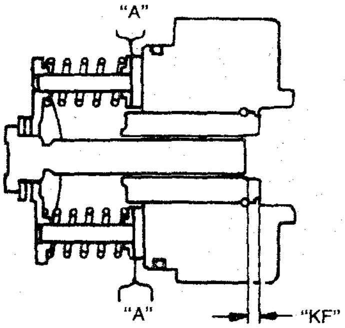
Plunger lift mm (in) in B.T.D.C.	0.38 ± 0.02 (0.0150 ± 0.0008)

Pump numbers

Pump number	Pump assembly number
16700-0F002	104645-4032

Use of adjustment value and adjusting shim when installing injection pump

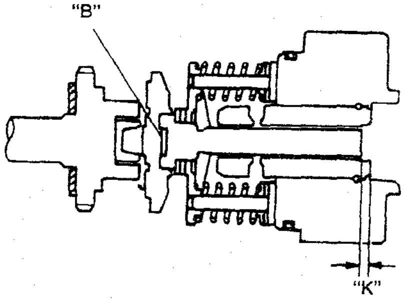
Dimension "KF" mm (in)	5.72 - 5.92 (0.2252 - 0.2331)



SEF638

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)

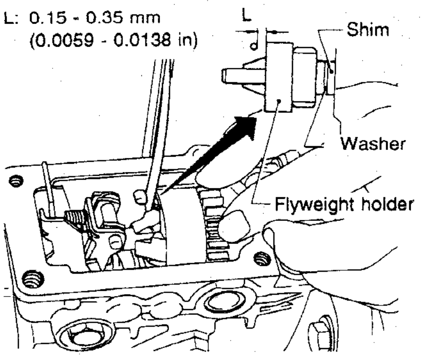


SEF639

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)

Injection Pump (Cont'd)

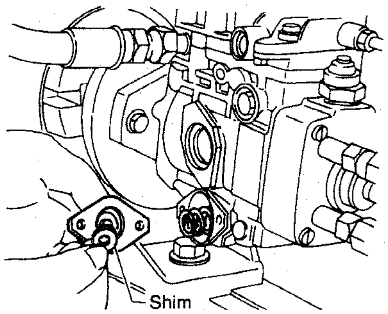
Axial play of flyweight holder "L" mm (in)	0.15 - 0.35 (0.0059 - 0.0138)



SEF047A

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)

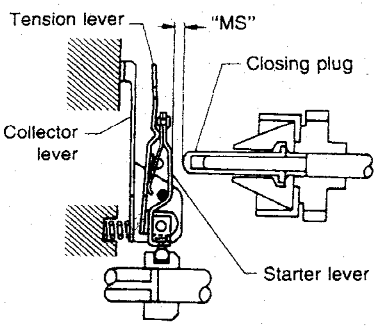


SEF575

Adjusting shim

Part number	Thickness mm (in)
16880 - V0700	0.6 (0.024)
16880 - V0701	0.7 (0.028)
16880 - V0702	0.9 (0.035)
16880 - V0703	1.0 (0.039)
16880 - V0704	1.2 (0.047)

Dimension "MS" mm (in)	0.8 - 1.0 (0.032 - 0.039)

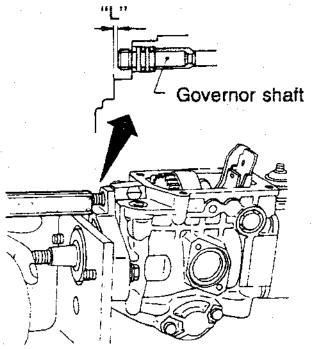


SEF856

Adjusting closing plug

Parts No.	Thickness mm (in)
16268-R8100	3.10 (0.122)
16268-R8101	3.30 (0.130)
16268-R8102	3.50 (0.138)
16268-R8103	3.70 (0.146)
16268-R8104	3.90 (0.154)
16268-R8105	4.10 (0.161)
16268-R8106	4.30 (0.169)
16268-R8107	4.50 (0.177)

Dimension "L" mm (in)	1.5 - 2.0 (0.059 - 0.079)



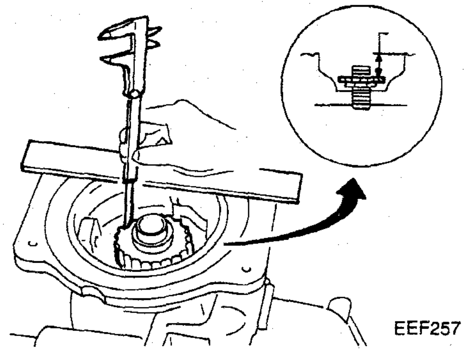
SEF500

Injection Pump (Cont'd)

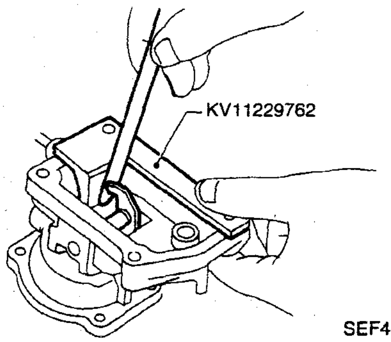
TURBOCHARGER COMPENSATOR

Stroke mm (in)	3.8 - 4.0 (0.150 - 0.158

Height "L" at regulating disc mm (in)	7.5 ± 0.5 (0.295 ± 0.020)



Clearance between lever and gauge mm (in)	0.05 (0.002)



Shims	
Part number	Thickness mm (in)
19275 - W3400	3.8 (0.150)
19275 - W3401	4.0 (0.158)
19275 - W3402	4.2 (0.165)
19275 - W3403	4.4 (0.173)
19275 - W3404	4.6 (0.181)
19275 - W3405	4.8 (0.189)
19275 - W3406	5.0 (0.197)

Adjustment of timer assembly under load

1. Adjustment

a. Set control lever in required position to meet following conditions:

Turbocharger compensating pressure (B.C.S.):
65.3 - 68.0 kPa (490 - 510 mm Hg)
Pump speed:
1,100 rpm
Fuel injection quantity:
35.5 - 36.5 cm^3 (2.166 - 2.227 cu. in)/1,000 rev
Timer stroke reduction $\triangle T_A$
0.3 - 0.7 mm

b. With control lever positioned, adjust regulating device so as to meet timer piston strokes as provided in the pump calibration data table.

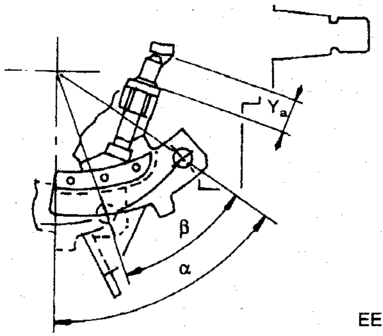
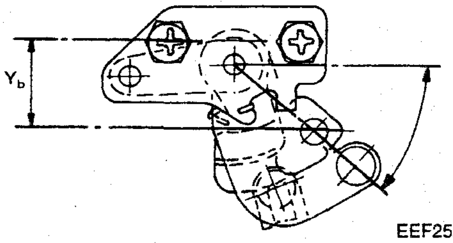
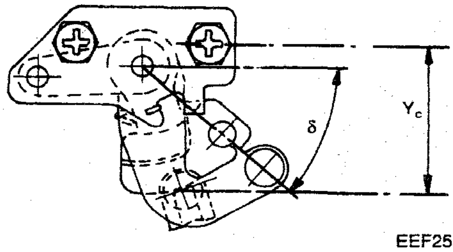
2. Checking timer characteristics
Set control lever in required position to meet following fuel delivery conditions and check timer piston stroke reductions.

Control lever position			Standard Value	
Pump speed (rpm)	Fuel delivery cm^3 (cu. in)	B.C.S. pressure kPa (mm Hg)	Timer piston stroke T_A mm (in.)	Timer stroke reduction $\triangle T_A$ mm (in.)
1,100	35.0 - 37.0 (2.136 - 2.258)	–	–	0.2 - 0.8 (0.008 - 0.032)
1,100	23.5 - 26.5 (1.434 - 1.617)	–	–	0.6 - 1.6 (0.024 - 0.063)

Injection Pump (Cont'd)

INJECTION PUMP LEVER ANGLE

Check the protrusions of adjustment screws to determine if levers are set at the correct angles.

FIGURE	LEVER TYPE	PROJECTION OF SCREW (Y) mm (in)	LEVER ANGLE Degree
 EEF278	Operating handle (opening angle)	Y_a = 9.6 - 13.8 (0.378 - 0.543)	α = 31 - 41 β = 6 - 14
 EEF252	Cold-start handle	Y_b = 23.4 (0.921)	= 39.6
 EEF253	Operating handle for accelerated tick-over (F.I.C.D.)	Y_c = 38.4 (1.51)	δ = 39.6°

Injection Pump (Cont'd)

Injection pump assembly No. (Part No.)	104645-4032 (16700-0F002)	Direction of rotation: to the right (viewed from the driver's side).

1. Test Conditions

1-1 Nozzle: 105780-0060 (NP-DN0SD1510)
1-2 Nozzle holder: 105780-2150
1-3 Nozzle opening pressure: 13,043^{+294} kPa (130.4$^{+2.9}$ bar, 133^{+3} kg/cm^2, 1,891^{+43} psi)
1-4 Injection tube: 167805 - 7320 (2 x 6 x 450 mm)
1-5 Fuel oil temperature: 45^{+5}°C (113^{+9}°F)
1-6 Supply pump pressure: 20 kPa (0.20 bar, 0.2 kg/cm^2, 2.8 psi)
1-7 Joint assembly: 157641-4720
1-8 Tube assembly: 157641-4020

2. Setting		Pump speed rpm	Settings	Charge air press kPa (mmHg, inHg)	Difference in delivery cm^3
2-1	Timer piston stroke	1,100	Timer solenoid valve (cold) ON 5.6 - 6.4 mm	65.3 - 68.0 (490 - 510)	—
		1,100	OFF 4.6 - 5.0 mm	65.3 - 68.0 (490 - 510)	
2-2	Supply pump pressure	1,100	ON 481 - 559 (4.9 - 5.7) kPa (kg/cm^2)	65.3 - 68.0 (490 - 510)	—
		1,100	OFF 422 - 481 (4.3 - 4.9) kPa (kg/cm^2)	65.3 - 68.0 (490 - 510)	
2-3	Full load delivery	1,100 (Total)	60.2 - 61.2 (cm^3/1.000 emb)	65.3 - 68.0 (490 - 510)	5.0
		800 (B.C.S.)	63.6 - 64.6 (cm^3/1.000 emb)	29.3 - 32.0 (220 - 240)	
2-4	Idle speed regulation	350	8.0 - 12.0 (cm^3/1.000 emb)	0	2.0
2-5	Start	100	60 - 85 cm^3/1.000 emb)	0	—
2-6	Full-load speed regulation	2,250	40.8 - 44.8 (cm^3/1.000 emb)	65.3 - 68.0 (490 - 510)	—
2-7	Timer adjustment under load	1,100	$T_A - \Delta T_A$ (mm)	65.3 - 68.0 (490 - 510)	—

3. Test Specifications			Timer solenoid valve (cold)					
			ON		OFF		Standard	
3-1	Timing device	N_p = rpm mm (in)	1,100 5.4 - 6.6 (0.213 - 0.260)	1,750 8.5 - 9.7 (0.335 - 0.382)	850 3.0 - 4.2 (0.118 - 0.165)	1,100 4,5 - 5,1 (0.177 - 0.201)	1,750 7.3 - 8.5 (0.287 - 0.339)	2,250 9.2 - 10.2 (0.362 - 0.402)
3-2	Supply pump	N_p = rpm kPa (kg/cm^2)	*1,100 481 - 559 (4.9 - 5.7)	1,750 647 - 726 (6.6 - 7.4)		*1,100 422 - 481 (4.3 - 4.9)	1,750 588 - 647 (6.0 - 6.6)	2,150 686 - 745 (7.0 - 7.6)
3-3	Overflow delivery	N_p = rpm cm^3/10 sec.	1.100 43 - 87 (with O-ring)		1.100 60 - 103 (without O-ring)			

3-4 Fuel injection quantities

Speed control lever position	Pump speed rpm	Fuel delivery mℓ (Imp fl oz)/1,000 st	Delivery difference (cm^3)
Max. speed	1,100 (Total)	59.7 - 61.7	55.3 - 68.0 (490 - 510)
	800 (BCS)	53.1 - 55.1	29.3 - 32.0 (220 - 240)
	500	44.7 - 50.7	0
	1,100	42.0 - 47.0	0
	2,000	54.5 - 59.5	65.3 - 68.0 (490 - 510)
	2,250	40.3 - 45.3	65.3 - 68.0 (490 - 510)
	2,500	15.1 - 24.1	65.3 - 68.0 (490 - 510)
	2,700	Below 5.0	65.3 - 68.0 (490 - 510)
Magnet valve Switch OFF	350	0 (0)	
Idling	350	7.5 - 12.5	
	750	Less than 3	

3-5 Fuel cut solenoid valve Max. cut-in voltage: 8V, Test voltage: 12 - 14V

4. Dimensions	
K	3.2 - 3.4 mm
KF	5.72 - 5.92 mm
MS	0.8 - 1.0 mm
BCS	3.8 - 4.0 mm
Control lever angle	
α	6 - 14 degrees
Y_a	9.6 - 13.8 mm
β	31 - 41 degrees
b	- mm
γ	- degrees
c	- mm

Injection Pump (Cont'd)

TIGHTENING TORQUE

UNIT	N·m	kg-m	ft-lb
Cold start device fixing bolt	5 - 7	0.5 - 0.7	3.6 - 5.1
Control shaft to control lever	7 - 10	0.7 - 1.0	5.1 - 7.2
Delivery valve to distributor head	44 - 54	4.5 - 5.5	33 - 40
Delivery valve to injection tube	20 - 25	2.0 - 2.5	14 - 18
Distributor head to pump body	10 - 14	1.0 - 1.4	7 - 10
Fast idle control lever adjusting lock nut	8 - 10	0.8 - 1.0	5.8 - 7.2
Feed pump cover to pump housing	2 - 3	0.2 - 0.3	1.4 - 2.2
Fuel cut solenoid valve	20 - 25	2.0 - 2.5	14 - 18
Fuel inlet connector to pump housing	20 - 29	2.0 - 3.0	14 - 22
Full load adjusting screw lock nut	7 - 9	0.7 - 0.9	5.1 - 6.5
Governor control shaft nut	7 - 10	0.7 - 1.0	5.1 - 7.2
Governor cover to pump housing	7- 10	0.7 - 1.0	5.1 - 7.2
Governor shaft lock nut	17 - 22	1.7 - 2.2	12 - 16
Injection pump sprocket nut	59 - 69	6.0 - 7.0	43 - 51
Regulating disc lock nut	25 - 34	2.5 - 3.5	18 - 25
Maximum and idle speed adjusting screw lock nut	4.9 - 7	(0.5 - 0.7)	3.6 - 5.1
Tappet rod nut	10 - 13	1.0 - 1.3	7 - 9
Head plug bolt	14 - 20	1.4 - 2.0	10 - 14
Plug to distributor head	59 - 78	6.0 - 8.0	43 - 58
Regulating valve to pump housing	10 - 13	1.0 - 1.3	7 - 9
Speed timer cover to pump housing	7 - 10	0.7 - 1.0	5.1 - 7.2
Injection pump			
Securing bolt	32 - 42	3.3 - 4.3	24 - 31
Securing nut	20 - 25	2.0 - 2.5	14 - 18
Injection tube			
Flare nut	20 - 25	2.0 - 2.5	14 - 18

Injection Nozzle

INSPECTION AND ADJUSTMENT

Injection nozzle assembly

Unit: kPa (bar, kg/cm², psi)

Initial injection pressure		
	New	10,297 - 11,278 (103.0 - 112.8, 105 - 115, 1,493 - 1,635)
	Used	9,807 - 10,297 (98.1 - 103.0, 100 - 105, 1,422 -1,493)

Adjusting shims

Thickness mm (in)	Parts No.
0.1 (0.004)	16613-43G00
0.2 (0.008)	16613-43G01
0.3 (0.012)	16613-43G02
0.4 (0.016)	16613-43G03
0.5 (0.020)	16613-43G04
0.52 (0.0205)	16613-43G05
0.54 (0.0213)	16613-43G06
0.56 (0.0220)	16613-43G07
0.58 (0.0228)	16613-43G08
0.8 (0.032)	16613-43G09

TIGHTENING TORQUE

Unit	N·m	kg-m	ft-lb
Injection nozzle to engine	54 - 64	5.5 - 6.5	40 - 47
Injection to tube flare nut	20 - 25	2.0 - 2.5	14 - 18
Spill tube nut	29 - 39	3.9 - 4.0	28 - 29
Nozzle holder to nozzle nut	29 - 49	3.0 - 5.0	22 - 36