

TOYOTA 4A-FE, 4A-GE ENGINE REPAIR MANUAL

Tune-up data
Valve Clearance
Ignition Timing
Idle Speed
Compression Check
Timing Belt

INTRODUCTION
ENGINE MECHANICAL
EFI SYSTEM
COOLING SYSTEM
LUBRICATION SYSTEM
IGNITION SYSTEM
STARTING SYSTEM
CHARGING SYSTEM

SERVICE SPECIFICATIONS
STANDARD BOLT TORQUE SPECIFICATIONS
SST AND SSM

IN
EM
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CH
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Alle monter opgivet i den håndbog
skal reduceres med

40%



4A-FE
ENGINE

REPAIR MANUAL

Sep., 1989

VIN	JT1LAT17100099603
Build Date	02/1990
Model	AT171L-ALMDKG
Body	LB LIFTBACK
Specification	LB LEFT-HAND DRIVE VEHICLES
Grade	XL XL TYPE
Market	EU EUROPE
Engine	4AFE 1600CC 16-VALVE DOHC EFI
Fuel system	G EUROPE (W/CATALYZER)
Transmission	MTM MANUAL TRANSMISSION
Gear Shift Type	5F MTM, 5-SPEED FLOOR SHIFT
Frame Number	AT171-0099603
Color Code	182

AUTO COLLEGE AALBORG
Special Edition

INTRODUCTION

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IN

HOW TO USE THIS MANUAL

To assist you in finding your way through this manual, the Section Title and major heading are given at the top of every page.

An **INDEX** is provided on the 1st page of each section to guide you to the item to be repaired.

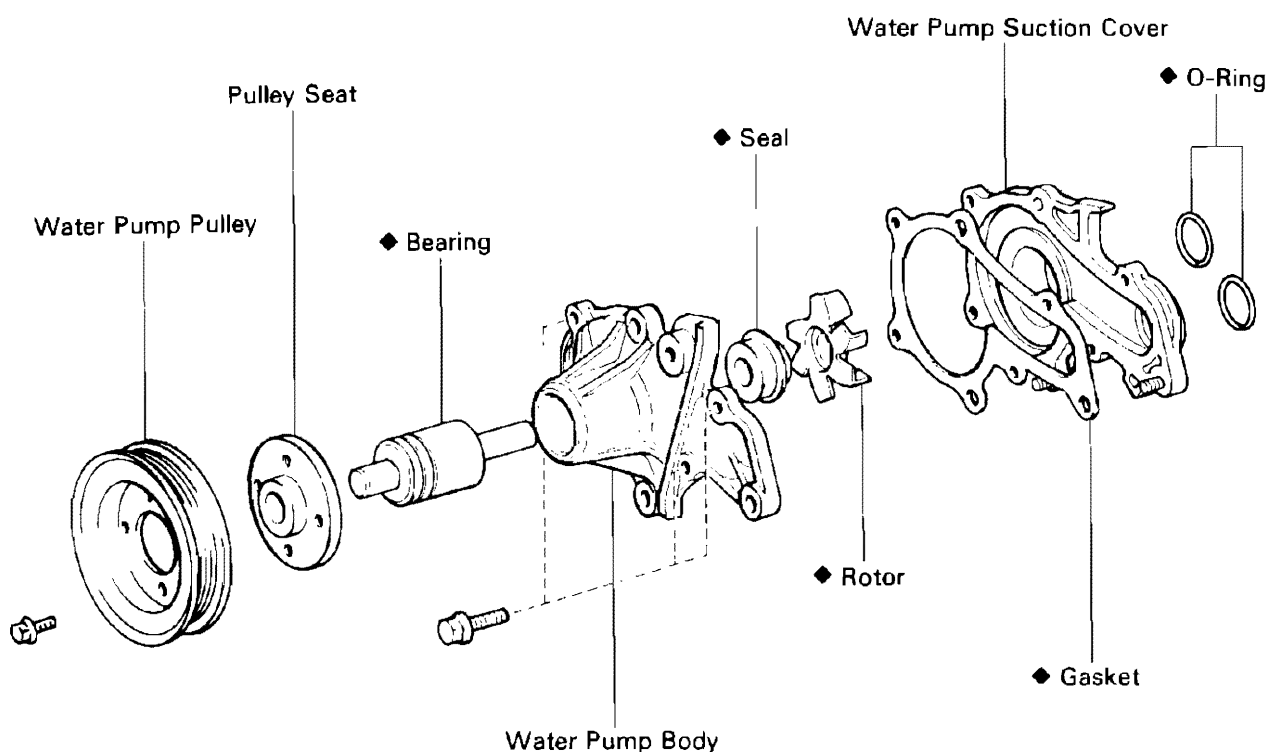
At the beginning of each section, **PRECAUTIONS** are given that pertain to *all* repair operations contained in that section. *Read these precautions before starting any repair task.*

TROUBLESHOOTING tables are included for each system to help you diagnose the system problem and find the cause. The repair for each possible cause is referenced in the remedy column to quickly lead you to the solution.

REPAIR PROCEDURES

Most repair operations begin with an overview illustration. It identifies the components and shows how the parts fit together.

Example:



The procedures are presented in a step-by-step format:

- The illustration shows *what* to do and *where* to do it.
- The task heading tells *what* to do.
- The detailed text tells *how* to perform the task and gives other information such as specifications and warnings.

Example:

*Illustration:
what to do and where*

- Task heading: what to do*
- 3. DISCONNECT CONNECTING ROD FROM PISTON**
- Using SST, press out the pin from the piston.
- SST 09221-25022
(09221-00050, 09221-00130, 09221-00140)
- Set part No.* *Component part No.*
- Detail text: how to do it*
- (d) Install and alternately tighten the cap nuts in several passes.
- Torque: 500 kg-cm (36 ft-lb, 49 N·m)**
- Specification*

This format provides the experienced technician with a FAST TRACK to the information needed. He can read the task headings and only refer to the detailed text when he needs it. Important specifications and warnings always stand out in bold type.

REFERENCES

References have been kept to a minimum. However, when they are required, you are given the page to go to.

SPECIFICATIONS

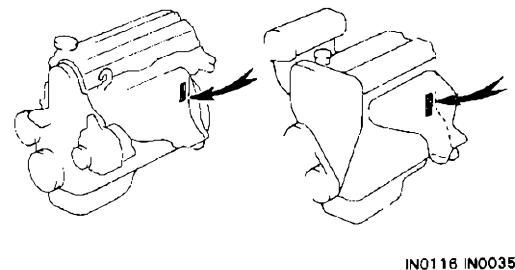
Specifications are presented in bold type throughout the text in the applicable step. You never have to leave the procedure to look up your specifications. All specifications are also found in Appendix A, for quick reference.

CAUTIONS, NOTICES, HINTS:

- **CAUTIONS** are presented in bold type, and indicate the possibility of injury to you or other people.
- **NOTICES** are also presented in bold type and indicate there is a possibility of damage to the components being repaired.
- **HINTS** are separated from the text but do not appear in bold type. They provide additional information to help you efficiently perform the repair.

4A-FE Engine

4A-GE Engine



IN0116 IN0035

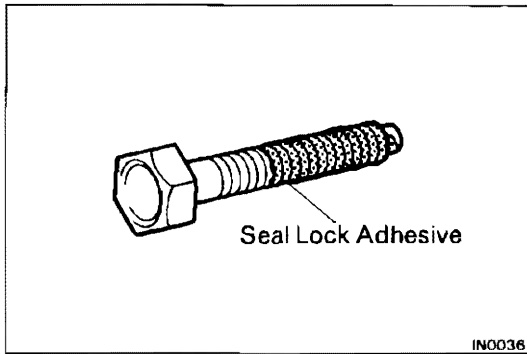
IDENTIFICATION INFORMATION

ENGINE SERIAL NUMBER

The engine serial number is stamped on the left side of the cylinder block.

GENERAL REPAIR INSTRUCTIONS

1. Use fender, seat and floor covers to keep the vehicle clean and prevent damage.
2. During disassembly, keep parts in order to facilitate reassembly.
3. Observe the following:
 - (a) Before performing electrical work, disconnect the negative cable from the battery terminal.
 - (b) If it is necessary to disconnect the battery for inspection or repair, always disconnect the cable from the negative (–) terminal which is grounded to the vehicle body.
 - (c) To prevent damage to the battery terminal post, loosen the terminal nut and raise the cable straight up without twisting or prying it.
 - (d) Clean the battery terminal posts and cable terminals with a shop rag. Do not scrape them with a file or other abrasive object.
 - (e) Install the cable terminal to the battery post with the nut loose, and tighten the nut after installation. Do not use a hammer to tap the terminal onto the post.
 - (f) Be sure the cover for the positive (+) terminal is properly in place.
4. Check hose and wiring connectors to make sure that they are secure and correct.
5. Non-reusable parts
 - (a) Always replace cotter pins gaskets, O-rings, oil seals, etc. with new ones.
 - (b) Non-reusable parts are indicated in the component illustrations by the symbol "◆".



6. Precoated Parts

Precoated parts are the bolts, nuts, etc. which are coated with a seal lock adhesive at the factory.

(a) If a precoated part is tightened, loosened or caused to move in any way, it must be recoated with the specified adhesive.

(b) Recoating of Precoated Parts

(1) Clean off the old adhesive from the part's threads.

(2) Dry with compressed air.

(3) Apply the specified seal lock adhesive to the part's threads.

(c) Precoated parts are indicated in the component illustrations by the symbol "★".

7. When necessary, use a sealer on gaskets to prevent leaks.

8. Carefully observe all specifications for bolt torques. Always use a torque wrench.

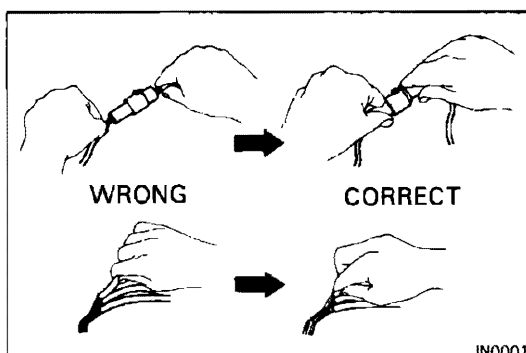
9. Use of special service tools (SST) and special service materials (SSM) may be required, depending on the nature of the repair. Be sure to use SST and SSM where specified and follow the proper work procedure. A list of SST and SSM can be found at the back of this manual.

10. When replacing fuses, be sure the new fuse is the correct amperage. DO NOT exceed the fuse amp rating or use one of a lower rating.

11. Care must be taken when jacking up and supporting the vehicle. Be sure to lift and support the vehicle at the proper locations.

(a) If the vehicle is to be jacked up only at the front or rear end, be sure to chock the wheels in order to ensure safety.

(b) After the vehicle is jacked up, be sure to support it on stands. It is extremely dangerous to do any work on the vehicle raised on a jack alone, even for a small job that can be finished quickly.



12. Observe the following precautions to avoid damaging the parts:

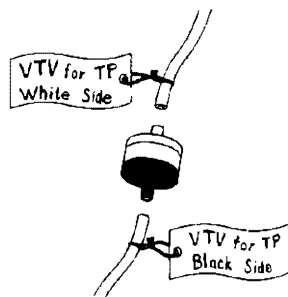
(a) Do not open the cover or the case of the ECU unless absolutely necessary. (If the IC terminals are touched, the IC may be destroyed by static electricity.)

(b) To disconnect vacuum hoses, pull on the end of the hose, not the middle.

(c) To pull apart electrical connectors, pull on the connector itself, not the wires.

- (d) When steam cleaning an engine, protect the distributor, coil, air filter, and VCV from water.
- (e) Never use an impact wrench to remove or install thermo switches or thermo sensors.
- (f) When checking continuity at the wire connector, insert the tester probe carefully to prevent terminals from bending.
- (g) When using a vacuum gauge, never force the hose onto a connector that is too large. Use a step-down adapter instead. Once the hose has been stretched, it may leak.

Example



IN0002

13. Tag hoses before disconnecting them:

- (a) When disconnecting vacuum hoses, use tags to identify how they should be reconnected.
- (b) After completing a job, double check that the vacuum hoses are properly connected. A label under the hood shows the proper layout.

PRECAUTIONS FOR VEHICLES EQUIPPED WITH A CATALYTIC CONVERTER

CAUTION: If large amounts of unburned gasoline flow into the converter, it may overheat and create a fire hazard. To prevent this, observe the following precautions and explain them to your customer.

- 1. Use only unleaded gasoline.**
- 2. Avoid prolonged idling.**

Avoid running the engine at fast idle speed for more than 10 minutes and at idle speed for more than 20 minutes.
- 3. Avoid spark jump test.**
 - (a) Perform spark jump test only when absolutely necessary and as quickly as possible.
 - (b) While testing, never race the engine.
- 4. Avoid prolonged engine compression measurement.**

Engine compression tests must be made as quickly as possible.
- 5. Do not run engine when fuel tank is nearly empty.**

This may cause the engine to misfire and create an extra load on the converter.
- 6. Avoid coasting with ignition turned off and prolonged braking.**
- 7. Do not dispose of used catalyst along with parts contaminated with gasoline or oil.**

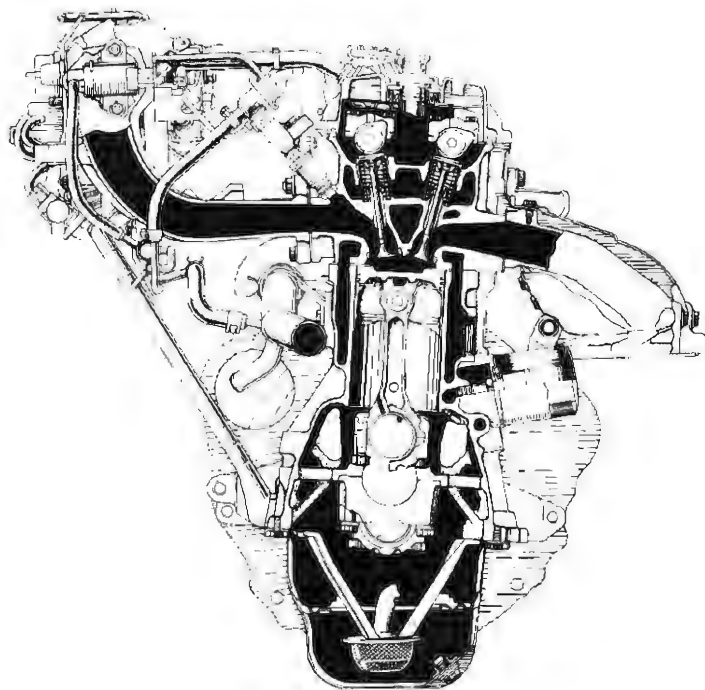
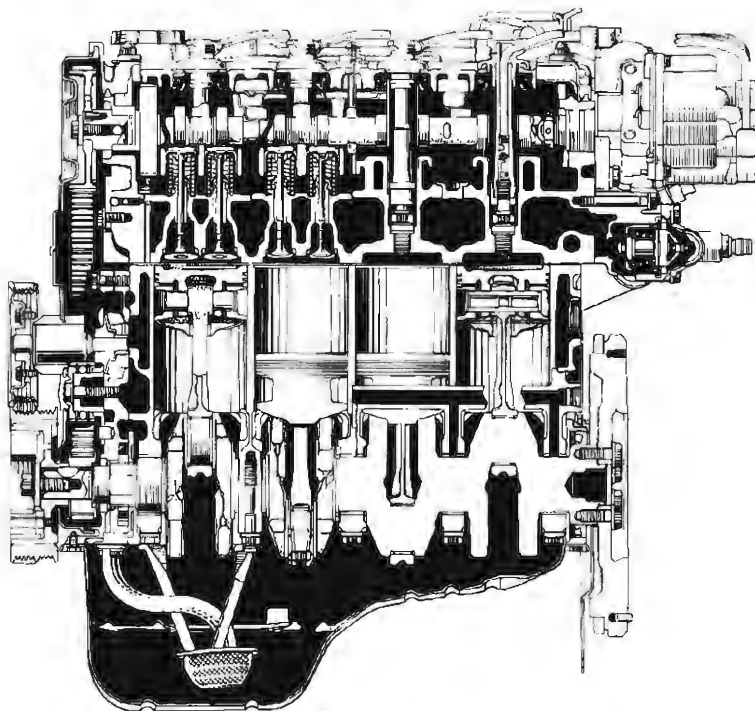
ABBREVIATIONS USED IN THIS MANUAL

A/C	Air Conditioner
ACV	Air Control Valve
Approx.	Approximately
A/T	Automatic Transmission
BTDC	Before Top Dead Center
BVSV	Bi-metal Vacuum Switching Valve
DP	Dash Pot
ECU	Electronic Controlled Unit
EFI	Electronic Fuel Injection
EGR	Exhaust Gas Recirculation
ESA	Electronic Spark Advance
EX	Exhaust (manifold, valve)
Ex.	Except
FIPG	Formed in Place Gasket
FL	Fusible Link
IG	Ignition
IIA	Integrated Ignition Assembly
IN	Intake (manifold, valve)
ISC	Idle Speed Contro.
LH	Left-Hand
LHD	Left-Hand Drive
LLC	Long Life Coolant (Year Around Coolant)
MP	Multipurpose
M/T	Manual Transmission
O/S	Oversized
PCV	Positive Crankcase Ventilation
RH	Right-Hand
RHD	Right-Hand Drive
SSM	Special Service Materials
SST	Special Service Tools
STD	Standard
SW	Switch
TDC	Top Dead Center
TEMP.	Temperature
TWC	Three-Way Catalyst
U/S	Undersized
VSV	Vacuum Switching Valve
w/	With
w/o	Without
2WD	Two Wheel Drive
4WD	Four Wheel Drive

DESCRIPTION

4A-FE ENGINE

The 4A-FE engine is an in-line 4-cylinder 1.6 liter DOHC 16 valve engine.



The 4A-FE engine is an in-line 4-cylinder engine with the cylinders numbered 1-2-3-4 from the front. The crankshaft is supported by 5 specified bearings inside the crankcase. These bearing are made of aluminum alloy.

The crankshaft is integrated with 8 weights which are cast with it for balane. Oil holes are made in the center of the crankshaft to supply oil to the connecting rods, bearing, pistons and other components.

The ignition order is 1-3-4-2. The cylinder head is made of aluminum alloy, with a cross flow type intake and exhaust layout with pent roof type combustion chambers. The spark plugs are located in the center of the combustion chamber.

The intake manifold has 4 independent long ports and utilizes the inertial supercharging effect to improve engine torque at low and medium speeds.

Exhaust and intake valves are equipped with irregular pitch springs made of special carbon steel which are capable of functioning no matter what the engine speed.

The exhaust side cam shaft is driven by a timing belt, and a gear on the exhaust side cam shaft engages with a gear on the intake side cam shaft to drive it. The cam journal is supported at 5 places between the valve lifters of each cylinder and on the front end of the cylinder head. Lubrication of the cam journal gear is accomplished by oil being supplied through the oiler port in the center of the camshaft.

Adjustment of the valve clearance is done by means of an outer shim type system, in which valve adjusting shims are located above the valve lifters. This permits replacement of the shims without removal of the camshafts.

The resin timing belt cover is made of 3 pieces. A service hole is provided in the No.1 belt cover for adjusting the timing belt tension.

Pistons are made of highly temperature-resistant aluminum alloy, and a depression is built into the piston head to prevent interference with valves.

Piston pins are the semi-floating type, with the pins fastened to the connecting rods by pressure fitting, allowing the pistons and pins to float.

The No.1 compression ring is made of stainless steel and the No.2 compression ring is made of cast iron. The oil ring is made of a combination of steel and stainless steel. The outer diameter of each piston ring is slightly larger than the diameter of the piston and the flexibility of the rings allows them to hug the cylinder walls when they are mounted on the piston. Compression rings No.1 and No.2 work to prevent the leakage of gas from the cylinder and oil ring works to scrape oil off the cylinder walls to prevent it from entering the combustion chambers.

The cylinder block is made of cast iron. It has 4 cylinders which are approximately 2 times the length of the piston stroke. The top of the cylinders is closed off by the cylinder head and the lower end of the cylinders becomes the crankcase, in which the crankshaft is installed. In addition, the cylinder block contains a water jacket, through which coolant is pumped to cool the cylinders.

The oil pan is bolted to the bottom of the cylinder block. The oil pan is an oil reservoir made of pressed steel sheet. A dividing plate is included inside the oil pan to keep sufficient oil at the bottom of the pan even when the vehicle is tilted. This dividing plate also prevents the oil from making waves when the vehicle is stopped suddenly and thus shifting the oil away from the oil pump suction pipe.

EXCESSIVE FUEL CONSUMPTION

Problem	Possible cause	Remedy	Page
Poor gasoline mileage	Fuel leak	Repair as necessary	EM-25
	Air cleaner clogged	Check air cleaner	
	Incorrect ignition timing	Reset timing	EM-28
	EFI system problems	Repair as necessary	EM-30, 31
	● Injector faulty		
	● Deceleration fuel cut system faulty		IG-11, 12
	Idle speed too high	Adjust idle speed	
	Spark plug faulty	Inspect plugs	EM-38
	EGR system always on (w/ EGR system)	Check EGR system	
	Low compression	Check compression	
	Tires improperly inflated	Inflate tires to proper pressure	
	Clutch slips	Troubleshoot clutch	
	Brakes drag	Troubleshoot brakes	

UNPLEASANT ODOR

Problem	Possible cause	Remedy	Page
Unpleasant odor	Incorrect idle speed	Adjust idle speed	EM-30, 31
	Incorrect ignition timing	Reset timing	EM-28
	Vacuum leaks	Repair as necessary	
	● PCV line		
	● EGR line (w/ EGR system)		
	● Intake manifold		
	● Throttle body		
	● Brake booster line		
	EFI system problems	Repair as necessary	

ENGINE TUNE-UP (4A-FE)

INSPECTION OF ENGINE COOLANT

(See steps 1 and 2 on page CO-5)

INSPECTION OF ENGINE OIL

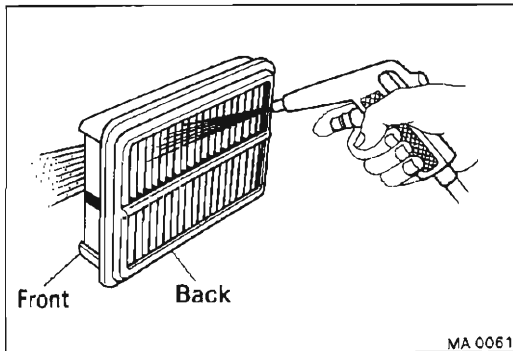
(See steps 1 and 2 on page LU-6)

INSPECTION OF BATTERY

(See page 1 and 2 on page CH-3)

Standard specific gravity:

1.25 – 1.27 when fully charged at 20°C (68°F)



INSPECTION OF AIR FILTER

1. INSPECT AIR FILTER

Visually check that the element is not excessively dirty, damaged or oily.

2. CLEAN AIR FILTER

Clean the element with compressed air.

First blow from the back thoroughly. Then blow off the front of the element.

INSPECTION OF HIGH-TENSION CORDS

(See page IG-5)

Maximum resistance: 25 Ω per cord

INSPECTION OF SPARK PLUGS

(See page IG-6)

Correct electrode gap: 0.8 mm (0.031 in.)

Recommended spark plugs:

ND Q16R-U
NGK BCPR5EY

INSPECTION OF ALTERNATOR DRIVE BELT

(See page 3 on page CH-3)

Drive belt deflection:

Used belt 10.0 – 12.0 mm (0.394 – 0.472 in.)

New belt 8.5 – 10.5 mm (0.335 – 0.413 in.)

Drive belt tension (Reference):

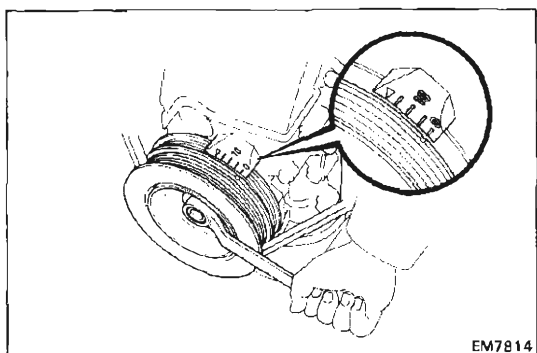
Used belt 40 – 55 kg

New belt 60 – 70 kg

INSPECTION AND ADJUSTMENT OF VALVE CLEARANCE

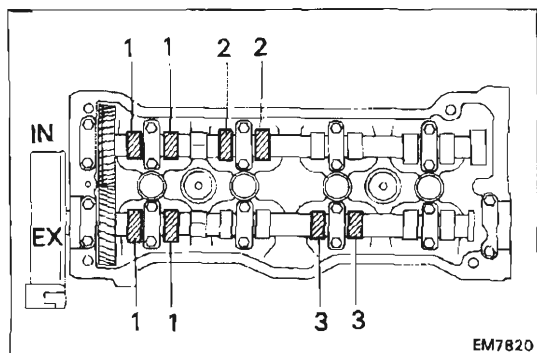
HINT: Inspect and adjust the valve clearance when the engine is cold.

1. **DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS**
2. **REMOVE CYLINDER HEAD COVER (See page EM-62)**



3. SET NO.1 CYLINDER TO TDC/COMPRESSION

- (a) Turn the crankshaft pulley and align its groove with the timing mark "O" of the No.1 timing belt cover.
- (b) Check that the valve lifters on the No.1 cylinder are loose and valve lifters on the No.4 cylinder are tight.
If not, turn the crankshaft one revolution (360°) and align the mark as above.



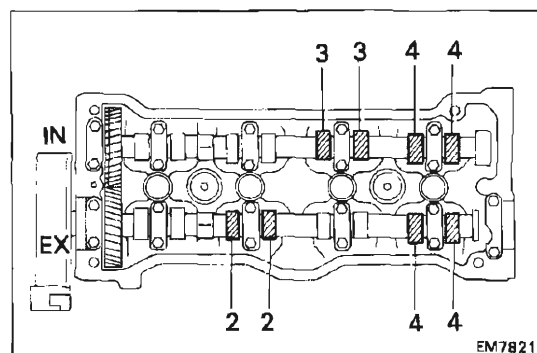
4. INSPECT VALVE CLEARANCE

- (a) Check only those valves indicated in the illustration.
 - Using a thickness gauge, measure the clearance between the valve lifter and camshaft.
 - Record the valve clearance measurements which are out of specification. They will be used later to determine the required replacement adjusting shim.

Valve clearance (Cold):

Intake 0.15 – 0.25 mm (0.006 – 0.010 in.)

Exhaust 0.20 – 0.30 mm (0.008 – 0.012 in.)

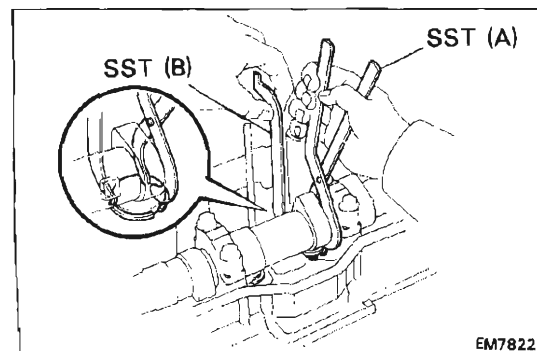


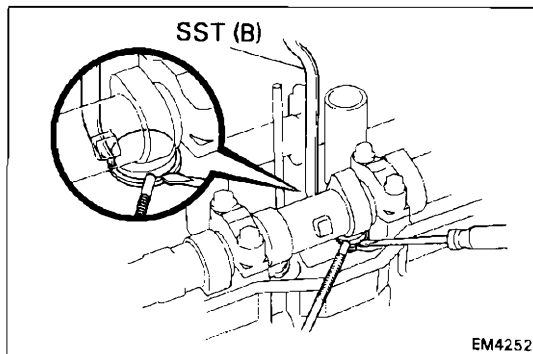
- (b) Turn the crankshaft one revolution (360°) and align the mark as above. (See procedure step 3)
- (c) Check only the valves indicated as shown. Measure the valve clearance. (See procedure step (a)).

5. ADJUST VALVE CLEARANCE

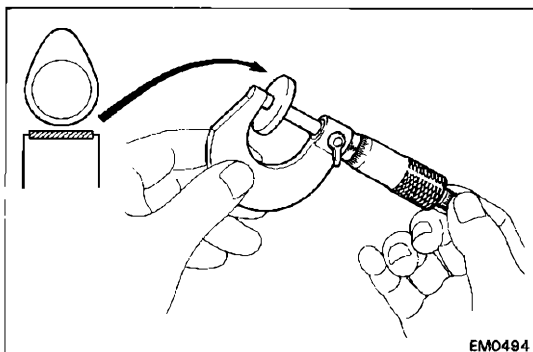
- (a) Remove the adjusting shim.
 - Turn the crankshaft to position the cam lobe of the camshaft on the adjusting valve upward.
 - Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter. Remove SST (A).

SST 09248-55010





- Remove the adjusting shim with small screwdriver and magnetic finger.



- (b) Determine the replacement adjusting shim size by using the following Formula or Charts.

- Using a micrometer, measure the thickness of the shim which was removed.
- Calculate the thickness of the new shim so the valve clearance comes within specified value.

T Thickness of shim used

A Valve clearance measured

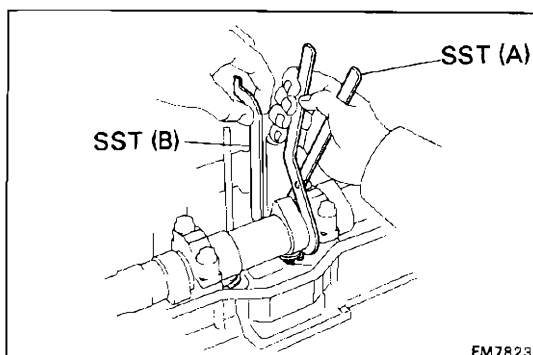
N Thickness of new shim

Intake: $N = T + (A - 0.20 \text{ mm (0.008 in.)})$

Exhaust: $N = T + (A - 0.25 \text{ mm (0.010 in.)})$

- Select a shim with a thickness as close as possible to the calculated values.

HINT: Shims are available in seventeen sizes of 0.05 mm (0.0020 in.), from 2.50 mm (0.0984 in.) to 3.30 mm (0.1299 in.).



- (c) Install a new adjusting shim.

- Place a new adjusting shim on the valve lifter.
- Using SST (A), press down the valve lifter and remove SST (B).

SST 09248-55010

- (d) Recheck the valve clearance.

6. INSTALL CYLINDER HEAD COVER (See page EM-86)

7. CONNECT HIGH-TENSION CORDS TO SPARK PLUGS

INTAKE

Example: A 2.800 mm shim is installed and the measured clearance is 0.450 mm. Replace the 2.800 mm shim with shim No. 24 (3.050 mm).

Shim thicknesses mm (in.)			
Shim No.	Thickness	Shim No.	Thickness
02	2.500 (0.0984)	20	2.950 (0.1161)
04	2.550 (0.1004)	22	3.000 (0.1181)
06	2.600 (0.1024)	24	3.050 (0.1201)
08	2.650 (0.1043)	26	3.100 (0.1220)
10	2.700 (0.1063)	28	3.150 (0.1240)
12	2.750 (0.1083)	30	3.200 (0.1260)
14	2.800 (0.1102)	32	3.250 (0.1280)
16	2.850 (0.1122)	34	3.300 (0.1299)
18	2.900 (0.1142)		

EXHAUST

Exhaust valve clearance (cold):
0.20 – 0.30 mm (0.008 – 0.012 in.)

Example: A 2.800 mm shim is installed and the measured clearance is 0.450 mm.

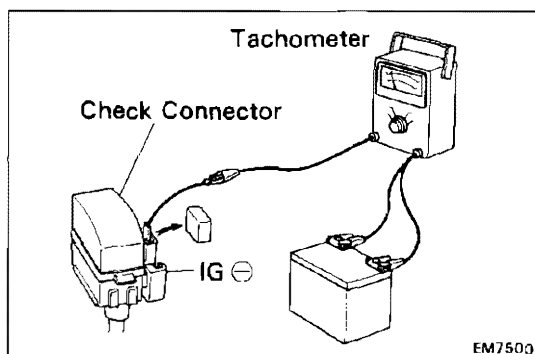
Replace the 2.800 mm shim with shim No. 22 (3.000 mm).

Shim No.	Thickness	Shim No.	Thickness
02	2.500 (0.0984)	20	2.950 (0.1161)
04	2.550 (0.1004)	22	3.000 (0.1181)
06	2.600 (0.1024)	24	3.050 (0.1201)
08	2.650 (0.1043)	26	3.100 (0.1220)
10	2.700 (0.1063)	28	3.150 (0.1240)
12	2.750 (0.1083)	30	3.200 (0.1260)
14	2.800 (0.1102)	32	3.250 (0.1280)
16	2.850 (0.1122)	34	3.300 (0.1299)
18	2.900 (0.1142)		

INSPECTION AND ADJUSTMENT OF IGNITION TIMING

1. WARM UP ENGINE

Allow the engine to reach normal operating temperature.



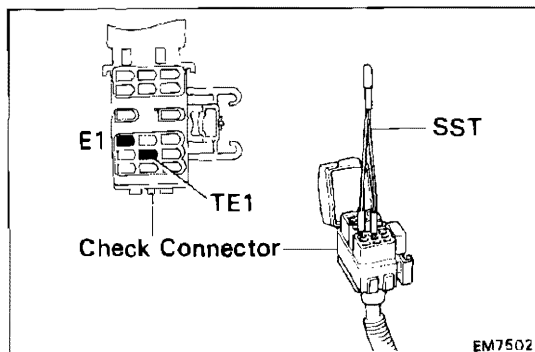
2. CONNECT TACHOMETER

Connect the test probe of a tachometer to terminal IG- of the check connector.

LOCATION: See page FI-133

NOTICE:

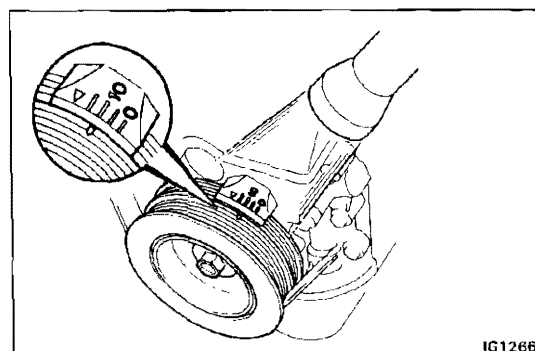
- **NEVER** allow the tachometer terminal to touch ground as it could result in damage to the igniter and/or ignition coil.
- As some tachometers are not compatible with this ignition system, we recommend that you confirm the compatibility of your unit before use.



3. INSPECT AND ADJUST IGNITION TIMING

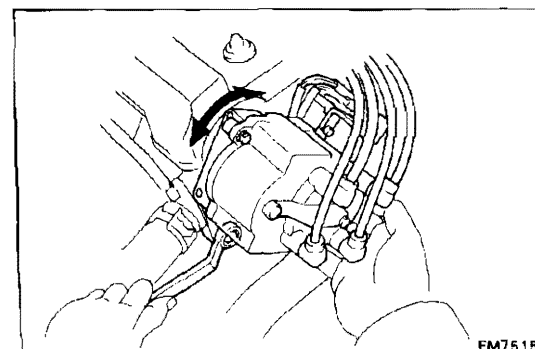
- (a) Using SST, connect terminals TE1 and E1 of the check connector.

SST 09843-18020



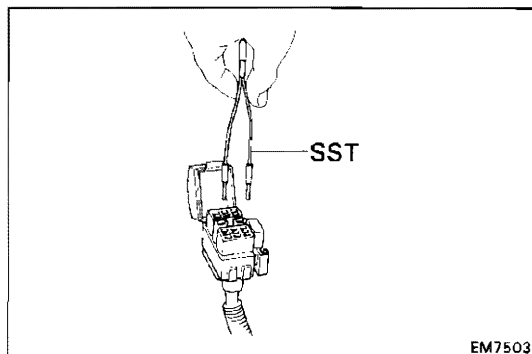
- (b) Using a timing light, check the ignition timing.

Ignition timing: 10° BTDC @ idle
(Transmission in neutral range)



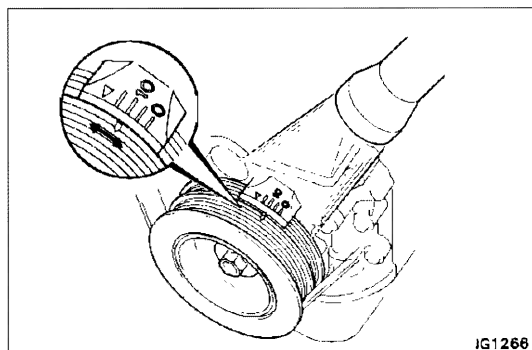
If necessary, loosen the distributor bolts and turn the distributor. Recheck the timing after tightening the distributor bolts.

Torque: 200 kg-cm (14 ft-lb, 20 N·m)



4. FURTHER CHECK IGNITION TIMING

- (a) Remove SST from the check connector.
SST 09843-18020



- (b) Check the ignition timing.

Ignition timing: 5 – 15° BTDC @ idle
(Transmission in neutral range)

HINT: The timing mark move in a range between 5° to 15°.

5. DISCONNECT TACHOMETER AND TIMING LIGHT FROM ENGINE

INSPECTION AND ADJUSTMENT OF IDLE SPEED (w/ TWC)

1. INITIAL CONDITIONS

- (a) Air clearance installed
- (b) Normal engine operating temperature
- (c) All pipes and hoses of air induction system connected
- (d) All vacuum lines connected

HINT: All vacuum hoses for EGR systems, etc. should be properly connected.

- (e) All accessories switched off
- (f) EFI system wiring connectors fully plugged
- (g) Ignition timing set correctly
- (h) Transmission in "neutral" range

2. WARM UP ENGINE

Allow the engine to reach normal operating temperature.

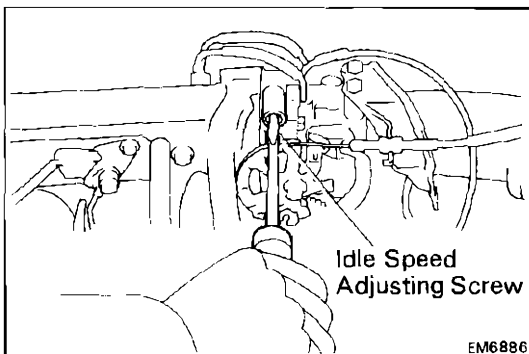
3. CONNECT TACHOMETER (See page EM-20)

4. CHECK AIR VALVE OPERATION (See page FI-131)

5. INSPECT AND ADJUST IDLE SPEED

Idle speed: 800 rpm (w/ Cooling fan OFF)

If not as specified, adjust the idle speed by turning the IDLE SPEED ADJUSTING SCREW.



INSPECTION AND ADJUSTMENT OF IDLE SPEED AND IDLE MIXTURE (w/o TWC)

1. INITIAL CONDITIONS

- (a) Air cleaner installed
- (b) Normal engine operating temperature
- (c) All pipes and hoses of air induction system connected
- (d) All accessories switched off
- (e) EFI system wiring connectors fully plugged
- (f) Ignition timing set correctly
- (g) Transmission in "neutral" range
- (h) HC/CO meter operates normally

2. WARM UP ENGINE

Allow the engine to reach normal operating temperature.

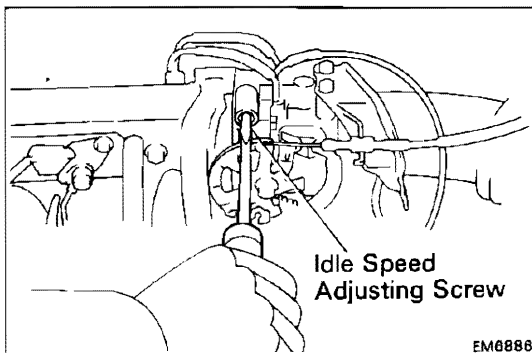
3. CONNECT TACHOMETER (See page EM-20)

4. CHECK AIR VALVE OPERATION (See page FI-131)

5. INSPECT AND ADJUST IDLE SPEED

Idle speed: 800 rpm (w/ Cooling fan OFF)

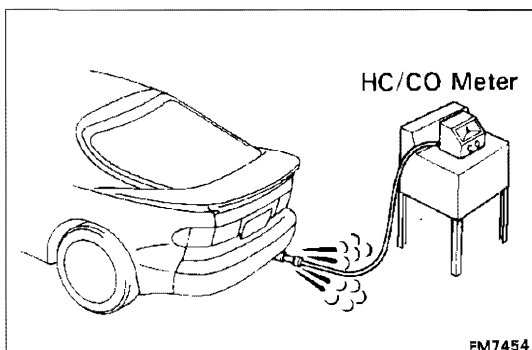
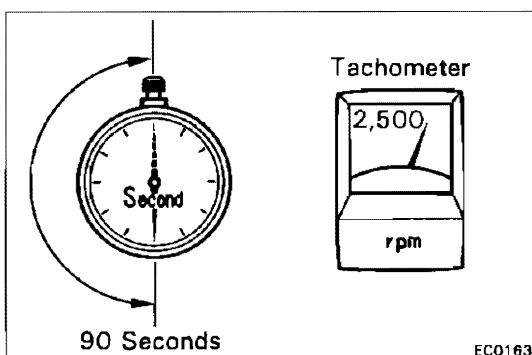
If not as specified, adjust the idle speed by turning the IDLE SPEED ADJUSTING SCREW.



6. ADJUST IDLE MIXTURE

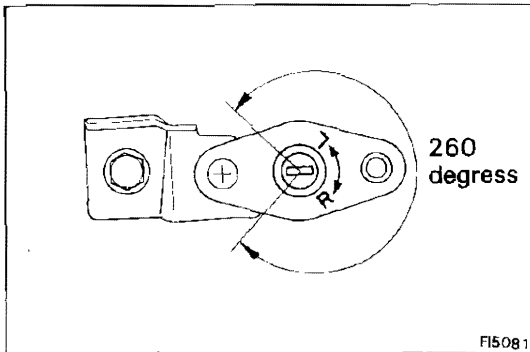
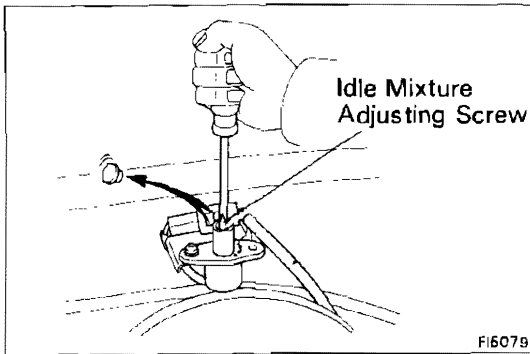
NOTICE: Always use a HC/CO meter when adjusting the idle mixture. It is not necessary to adjust with the idle mixture adjusting screw in most vehicles if they are in good condition. If a CO meter is not available, DO NOT ATTEMPT TO ADJUST IDLE MIXTURE.

- (a) Race the engine at 2,500 rpm for approx. 90 seconds.



- (b) Insert a testing probe at least 40 cm (1.3 ft) into the tailpipe.
- (c) Measure the concentration 1 – 3 minutes after racing the engine to allow the concentration to stabilize.

Idle CO concentration: $1.5 \pm 0.5 \%$
(w/ Cooling fan OFF)



If the CO concentration is not as specified, adjust the idle mixture by turning the IDLE MIXTURE ADJUSTING SCREW in the variable resistor.

- If the concentration is within specification, this adjustment is complete.
- If the CO concentration cannot be corrected by idle mixture adjustment, see the table below for other possible causes.

HINT: Always check the idle speed after turning the idle mixture adjusting screw. If it is incorrect, repeat steps 5 and 6.

Troubleshooting

HC	CO	SYMPTOMS	CAUSES
High	Normal	Rough idle	<ol style="list-style-type: none"> Faulty ignition: <ul style="list-style-type: none"> ● Incorrect timing ● Fouled, shorted or improperly gapped plugs ● Open or crossed ignition wires ● Cracked IIA cap Incorrect valve clearance Leaky EGR valve (w/ EGR system) Leaky intake and exhaust valves Leaky cylinder
High	Low	Rough idle (Fluctuating HC reading)	<ol style="list-style-type: none"> Vacuum leak: <ul style="list-style-type: none"> ● Vacuum hose ● EGR valve (w/ EGR system) ● Intake manifold ● PCV line ● Throttle body ● Cylinder head gasket ● Brake booster line Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	<ol style="list-style-type: none"> Restricted air filter Plugged PCV valve Faulty EFI system <ul style="list-style-type: none"> ● Faulty pressure regulator ● Clogged fuel return line ● Faulty vacuum sensor ● Defective water temp. sensor ● Defective intake air temp. sensor ● Faulty ECU ● Faulty injector ● Faulty cold start injector ● Faulty throttle position sensor

IDLE HC/CO CONCENTRATION CHECK METHOD (w/ TWC)

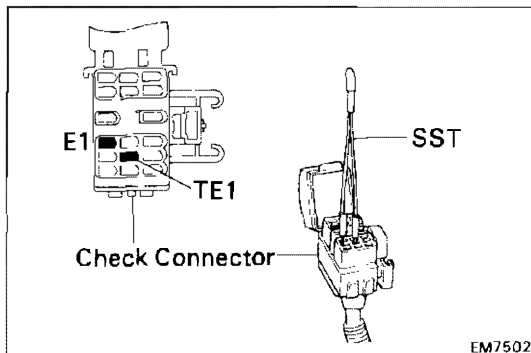
HINT: This check is used only to determine whether or not the idle HC/CO complies with regulations.

1. INITIAL CONDITIONS

- (a) Engine to reach normal operating temperature
- (b) Air cleaner installed
- (c) All pipes and hoses of air induction system connected
- (d) All accessories switched off
- (e) All vacuum lines properly connected

HINT: All vacuum hoses for EGR systems, etc. should be properly connected.

- (f) EFI system wiring connectors fully plugged
- (g) Ignition timing set correctly
- (h) Transmission in neutral range
- (i) Tachometer and HC/CO meter calibrated and at hand.



2. START ENGINE

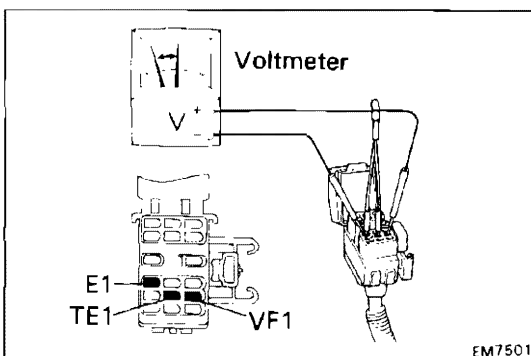
3. CHECK IDLE SPEED

Idle speed: 800 rpm

4. CHECK OXYGEN SENSOR OPERATION

- (a) Using SST, connect the terminal TE1 and E1 of the check connector.

SST 09843-18020

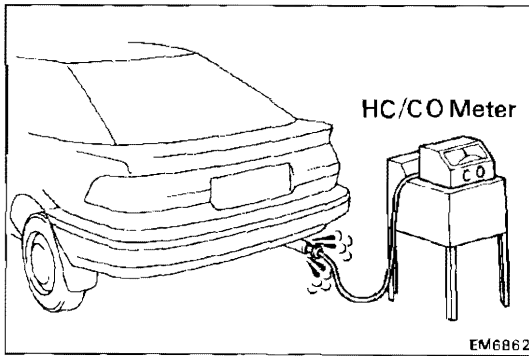


- (b) Connect the positive (+) probe of a voltmeter to terminal VF1 of the check connector, and negative (-) probe to terminal E1.
- (c) Hold the engine speed at 2,500 rpm for approx. 90 seconds to warm up the oxygen sensor.
- (d) Then, maintaining engine at 2,500 rpm. count how many times the needle of the voltmeter fluctuates between 0 and 5 V.

Minimum needle fluctuation:

4A-FE 8 times for every 10 seconds

If the fluctuation is less than minimum, check the air induction system. If necessary, see EFI SYSTEM.



5. **RACE ENGINE AT 2.500 PRM FOR APPROX. 120 SECONDS**
6. **INSERT CO METER TESTING PROBE INTO TAILPIPE AT LEST 40 cm (1.3 ft)**
7. **CHECK HC/CO CONCENTRATION AT IDLE**

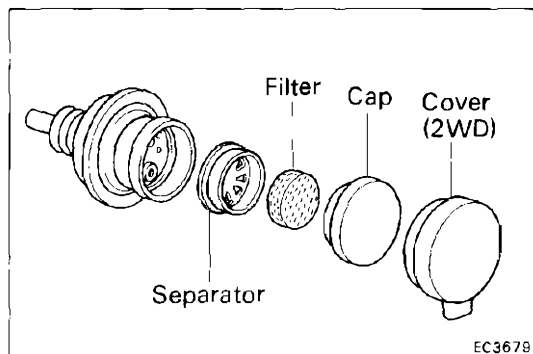
Wait at least one minute before measuring to allow the concentration to stabilize. Complete the measuring within three minutes.

**Idle CO concentration: 0 – 0.5 %
(w/ Cooling fan OFF)**

If the HC/CO concentration does not conform to regulations, see the table below for possible causes.

Troubleshooting

HC	CO	SYMPTOMS	CAUSES
High	Normal	Rough idle	<ol style="list-style-type: none"> 1. Faulty ignition: <ul style="list-style-type: none"> ● Incorrect timing ● Fouled, shorted or improperly gapped plugs ● Open or crossed ignition wires ● Cracked IIA or distributor cap 2. Incorrect valve clearance 3. Leaky EGR valve (w/ EGR system) 4. Leaky intake and exhaust valves 5. Leaky cylinder
High	Low	Rough idle (Fluctuating HC reading)	<ol style="list-style-type: none"> 1. Vacuum leak: <ul style="list-style-type: none"> ● Vacuum hose ● EGR valve (w/ EGR system) ● Intake manifold ● PCV line ● Throttle body ● Cylinder head gasket ● Brake booster line 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	<ol style="list-style-type: none"> 1. Clogged air filter 2. Plugged PCV valve (4A-FE) 3. Faulty EFI system <ul style="list-style-type: none"> ● Faulty pressure regulator ● Clogged fuel return line ● Faulty air flow meter (w/ air flow meter) ● Faulty vacuum sensor (w/o air flow meter) ● Defective water temp. sensor ● Defective intake air temp. sensor ● Faulty ECU ● Faulty injector ● Faulty cold start injector ● Faulty throttle position sensor



INSPECTION AND ADJUSTMENT OF DASH POT (DP) SYSTEM (4A-FE)

1. WARM UP AND STOP ENGINE

Allow the engine to reach normal operating temperature.

2. CHECK IDLE SPEED (See page EM-22, 23)

3. REMOVE COVER (2WD), CAP, FILTER AND SEPARATOR FROM DP

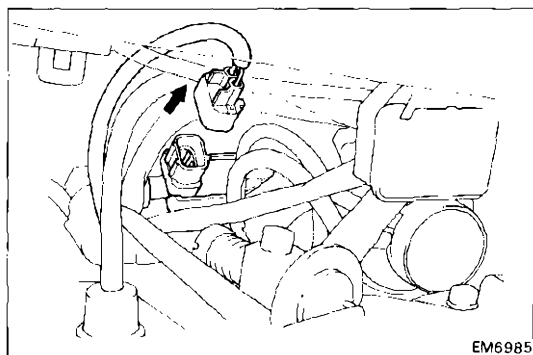
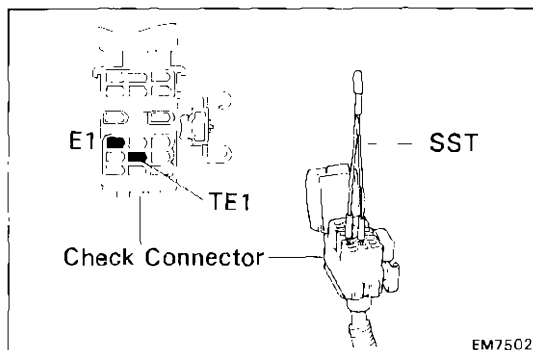
4. ADJUST DP SETTING SPEED

(a) (2WD)

Using SST, connect terminals TE1 and E1 of the check connector.

SST 09843-18020

LOCATION: See page FI-133

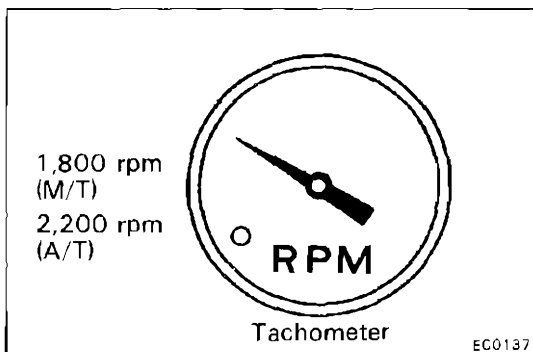
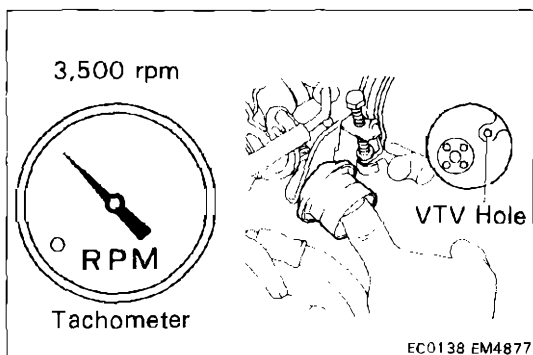


(b) (2WD w/ EGR system)

Disconnect the VSV connector.

(c) Race the engine at 3,500 rpm for a few seconds.

(d) Plug the VTV Hole with your finger.

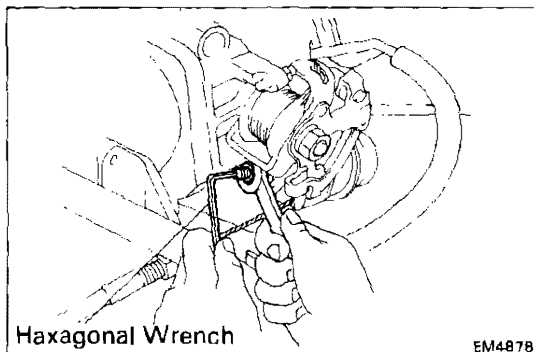


(e) Release the throttle valve.

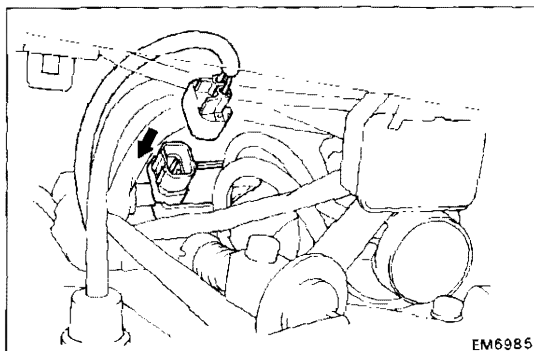
(f) Check the DP setting speed.

DP setting speed: M/T 1,800 rpm

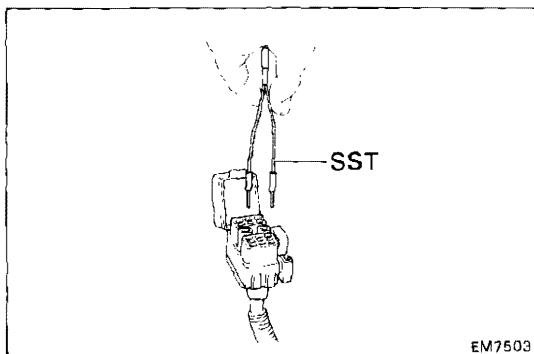
(w/ Cooling fan OFF)



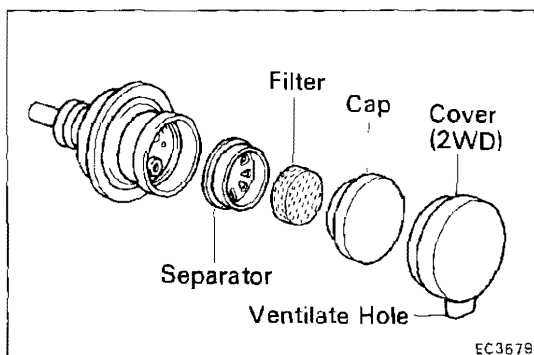
- (g) Adjust the DP setting speed by turning the DP ADJUSTING SCREW.
- (h) Repeat steps from (c) to (e), and recheck the DP setting speed.



- (i) (2WD w/ EGR system)
Connect the VSV connector.

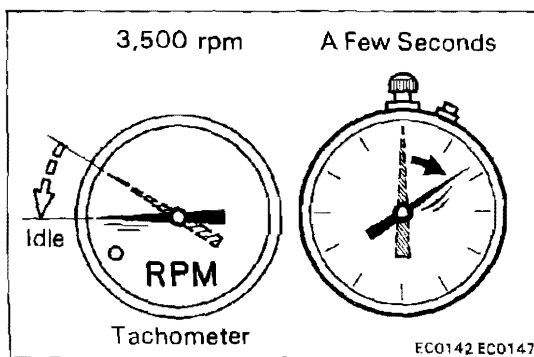


- (j) (2WD)
Remove SST from the check connector.
SST 09843-18020



5. REINSTALL DP SEPARATOR, FILTER, CAP AND COVER (2WD)

HINT: When installing the cover, install it with the ventilate holes below.



6. CHECK VTV OPERATION

Race the engine at 3,500 rpm for a few seconds, release the throttle valve and check that the engine returns to idle in a few seconds.

COMPRESSION CHECK

HINT: If there is lack of power, excessive oil consumption or poor fuel economy, measure the compression pressure.

1. **WARM UP AND STOP ENGINE**
2. **DISCONNECT COLD START INJECTOR CONNECTOR**
3. **DISCONNECT DISTRIBUTOR CONNECTOR(S)**
4. **(4A-GE)**
REMOVE PLUG CORD COVER
5. **REMOVE SPARK PLUGS (See page IG-7, 11)**
6. **CHECK CYLINDER COMPRESSION PRESSURE**
 - (a) Insert a compression gauge into the spark plug hole.
 - (b) Fully open the throttle.
 - (c) While cranking the engine, measure the compression pressure.

HINT: Always use a fully charged battery to obtain engine revolution of 250 rpm or more.

- (d) Repeat steps (a) through (c) for each cylinder.

NOTICE: This measurement must be done in as short a time as possible.

Compression pressure:

4A-FE 13.5 kg/cm² (191 psi, 1,320 kPa)

Minimum pressure:

10.0 kg/cm² (142 psi, 981 kPa)

Difference between each cylinder:

1.0 kg/cm² (14 psi, 98 kPa) or less

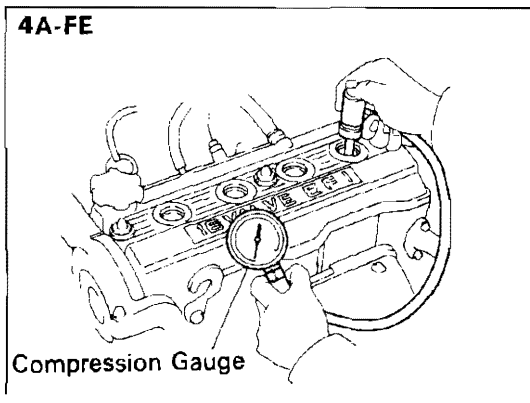
- (e) If the cylinder compression in one or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (c) for the cylinder with low compression.
 - If adding oil helps the compression, chances are that the piston rings and/or cylinder bore are worn or damaged.
 - If pressure stays low, a valve may be sticking or seating improperly, or there may be leakage past the gasket.

7. **REINSTALL SPARK PLUGS (See page IG-8, 12)**
Torque: 180 kg-cm (13 ft-lb, 18 N·m)

8.

9. **RECONNECT DISTRIBUTOR CONNECTOR(S)**
10. **RECONNECT COLD START INJECTOR CONNECTOR**

4A-FE



Compression Gauge

TROUBLESHOOTING (4A-FE)**ENGINE OVERHEATING**

Problem	Possible cause	Remedy	Page
Engine overheats	Cooling system faulty Incorrect ignition timing	Troubleshoot cooling system Reset timing	CO-4 EM-20

HARD STARTING

Problem	Possible cause	Remedy	Page
Engine will not crank or cranks slowly	Starting system faulty	Troubleshoot starting system	ST-2
Engine will not start/ hard to start (cranks OK)	No fuel supply to carburetor <ul style="list-style-type: none"> ● No fuel in tank ● Fuel pump not working ● Fuel line clogged or leaking EFI system problems Ignition problems <ul style="list-style-type: none"> ● Ignition coil ● Igniter ● Distributor (IIA) Spark plugs faulty High-tension cords disconnected or broken Vacuum leaks <ul style="list-style-type: none"> ● PCV line ● EGR line (w/ EGR system) ● Intake manifold ● Throttle body ● Brake booster line Low compression	Troubleshoot EFI system Repair as necessary Perform spark test Inspect plugs Inspect cords Repair as necessary Check compression	FI-10 IG-6 IG-7 IG-7 EM-38

ROUGH IDLING

Problem	Possible cause	Remedy	Page
Rough idle, stalls or misses	Spark plugs faulty	Inspect plugs	IG-7
	High-tension cords faulty	Inspect cords	IG-7
	Ignition wiring faulty	Inspect wiring	
	Ignition problems <ul style="list-style-type: none"> ● Ignition coil ● Igniter ● Distributor (IIA) 	Inspect coil Inspect igniter Inspect IIA	
	Incorrect ignition timing	Reset timing	EM-20
	Incorrect valve clearance	Adjust valve clearance	EM-16
	Vacuum leaks <ul style="list-style-type: none"> ● PCV line ● EGR line (w/ EGR system) ● Intake manifold ● Throttle body ● Brake booster line 	Repair as necessary	
	Incorrect idle speed	Adjust idle speed	EM-22, 23
	EFI system problems	Repair as necessary	
	EGR valve faulty (w/ EGR system)	Check EGR valve	
	Engine overheats	Check cooling system	
	Low compression	Check compression	EM-38

ENGINE HESITATES/POOR ACCELERATION

Problem	Possible cause	Remedy	Page
Engine hesitates/ poor acceleration	Spark plugs faulty	Inspect plugs	IG-7
	High-tension cords faulty	Inspect cords	IG-7
	Vacuum leaks	Repair as necessary	
	● PCV line		
	● EGR line (w/ EGR system)		
	● Intake manifold		
	● Throttle body		
	● Brake booster line		
	Incorrect ignition timing	Reset timing	EM-20
	Incorrect valve clearance	Adjust valve clearance	EM-16
	Fuel system clogged	Check fuel system	
	Air cleaner clogged	Check air cleaner	EM-15
	EFI system problems	Repair as necessary	
	Engine overheats	Check cooling system	CO-4
	Low compression	Check compression	EM-38

ENGINE DIESELING

Problem	Possible cause	Remedy	Page
Engine dieseling (runs after ignition switch is turned off)	EFI system problems	Repair as necessary	
	Incorrect ignition timing	Reset timing	EM-20
	EGR system faulty (w/EGR system)	Check EGR system	

AFTER FIRE, BACKFIRE

Problem	Possible cause	Remedy	Page
Muffler explosion (after fire) on deceleration only	Deceleration fuel cut system always off DP system always off	Check fuel cut system Check DP system	
Muffler explosion (after fire) all the time	Air cleaner clogged EFI system problem Incorrect ignition timing Incorrect valve clearance	Check air cleaner Repair as necessary Reset timing Adjust valve clearance	EM-15 EM-20 EM-16
Engine backfires	EFI system problem Vacuum leak <ul style="list-style-type: none"> ● PCV hoses ● Intake manifold ● Throttle body ● Brake booster line Insufficient fuel flow Incorrect ignition timing Incorrect valve clearance Carbon deposits in combustion chambers	Repair as necessary Check hoses and repair as necessary Troubleshoot fuel system Reset timing Adjust valve clearance Inspect cylinder head	 EM-20 EM-16 EM-68

EXCESSIVE OIL CONSUMPTION

Problem	Possible cause	Remedy	Page
Excessive oil consumption	Oil leak PCV line clogged Piston ring worn or damaged Valve stem and guide bushing worn Valve stem oil seal worn or damaged	Repair as necessary Check PCV system Check rings Check valves and guide bushings Check oil seals	EM-130 EM-70

POOR GASOLINE MILEAGE

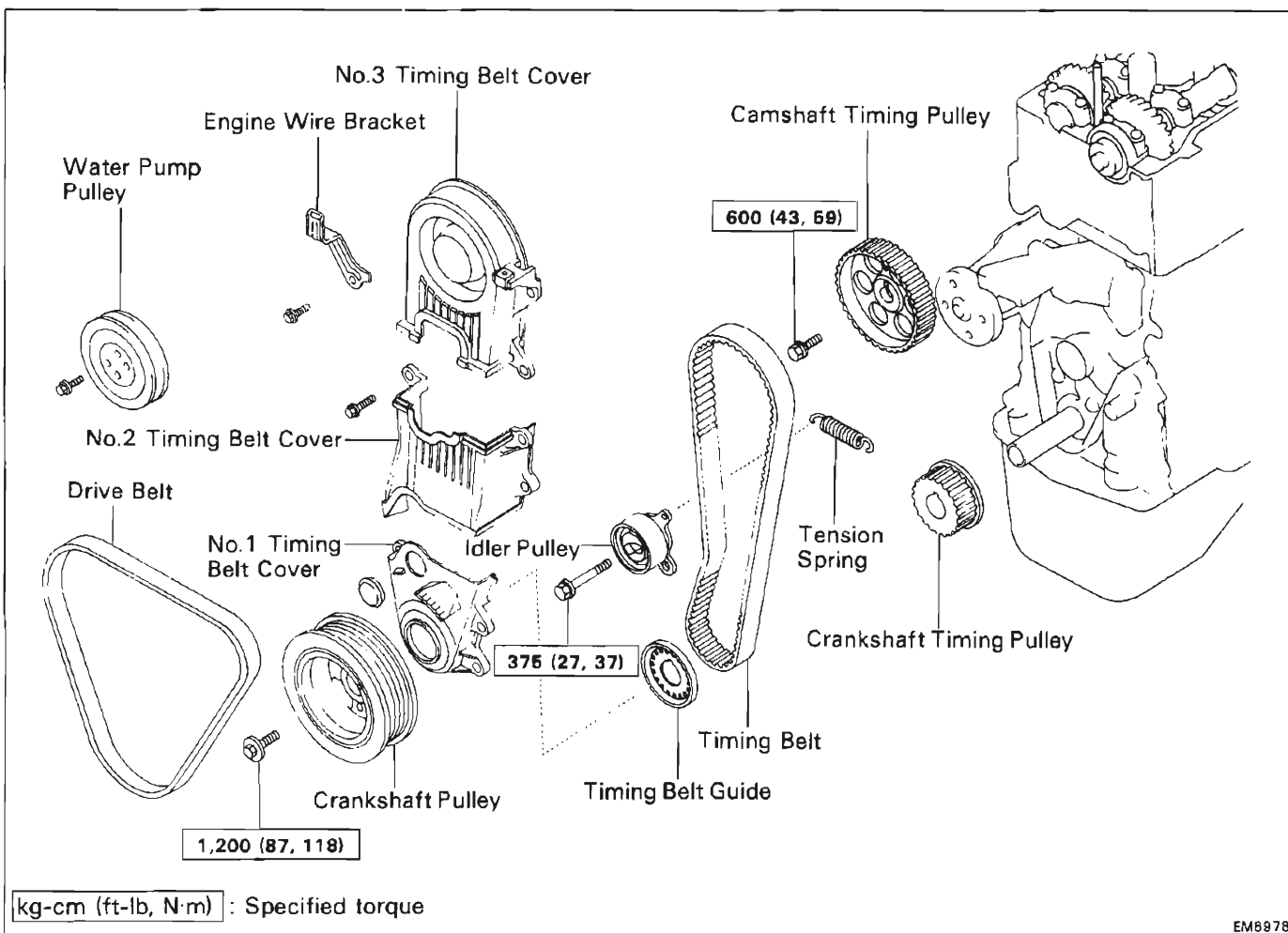
Problem	Possible cause	Remedy	Page
Poor gasoline mileage	Fuel leak	Repair as necessary	EM-20
	Air cleaner clogged	Check air cleaner	
	Incorrect ignition timing	Reset timing	
	EFI system problems	Repair as necessary	
	● Injector faulty		EM-22, 23
	● Deceleration fuel cut system faulty		
	Idle speed too high	Adjust idle speed	
	Spark plugs faulty	Inspect plugs	IG-7
	EGR system always on (w/ EGR system)	Check EGR system	EM-38
	Low compression	Check compression	
	Tires improperly inflated	Inflate tires to proper pressure	
	Clutch slips	Troubleshoot clutch	
	Brakes drag	Troubleshoot brakes	

UNPLEASANT ODOR

Problem	Possible cause	Remedy	Page
Unpleasant odor	Incorrect idle speed	Adjust idle speed	EM-22, 23
	Incorrect ignition timing	Reset timing	EM-20
	Vacuum leaks	Repair as necessary	
	● PCV line		
	● EGR line (w/ EGR system)		
	● Intake manifold		
	● Throttle body		
	● Brake booster line		
	EFI system problems	Repair as necessary	

TIMING BELT (4A-FE)

COMPONENT



EM8978

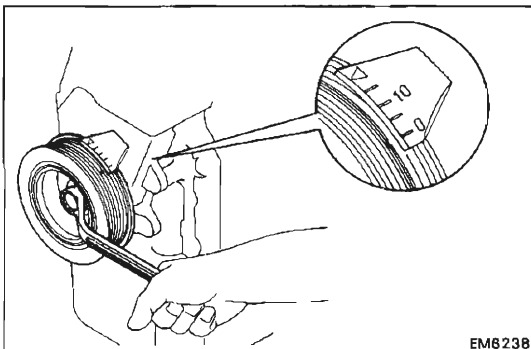
REMOVAL OF TIMING BELT

1. REMOVE DRIVE BELT AND WATER PUMP PULLEY
2. REMOVE SPARK PLUGS (See page IG-7)
3. REMOVE CYLINDER HEAD COVER
(See steps 8 and 12 on pages EM-60 and 62)

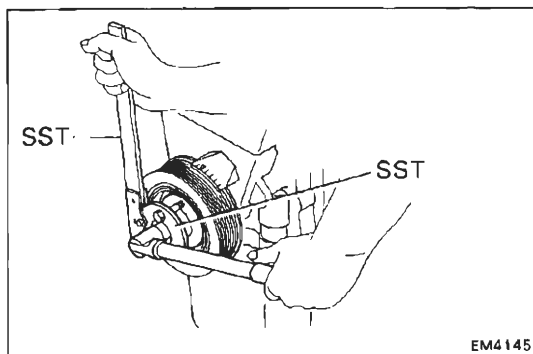
4. SET NO.1 CYLINDER TO TDC/COMPRESSION

- (a) Turn the crankshaft pulley and align its groove with the timing mark "0" of the No.1 timing belt cover.
- (b) Check that the hold of the camshaft timing pulley is aligned with the timing mark of the bearing cap.

If not, turn the crankshaft one revolution (360°).



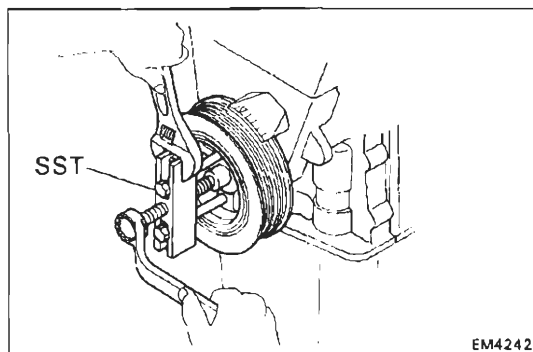
EM8238



5. REMOVE CRANKSHAFT PULLEY

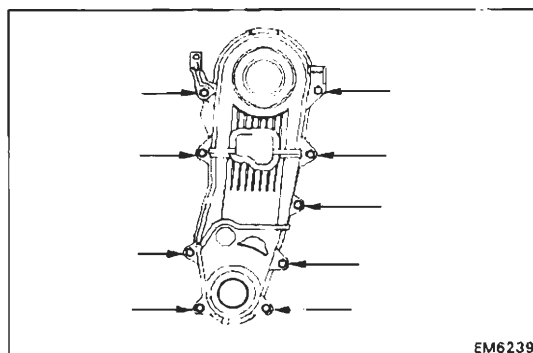
- (a) Using SST to hold the crankshaft pulley, remove the pulley bolt.

SST 09213-14010 and 09330-00021



- (b) Using SST, remove the pulley.

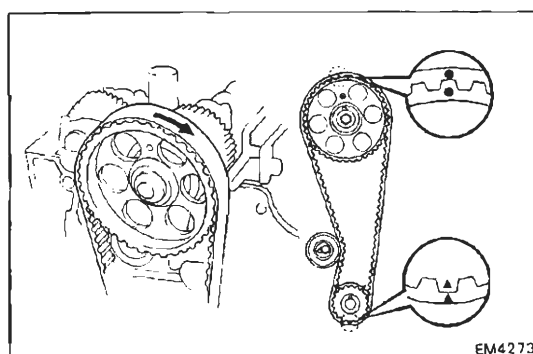
SST 09213-31021



6. REMOVE TIMING BELT COVERS

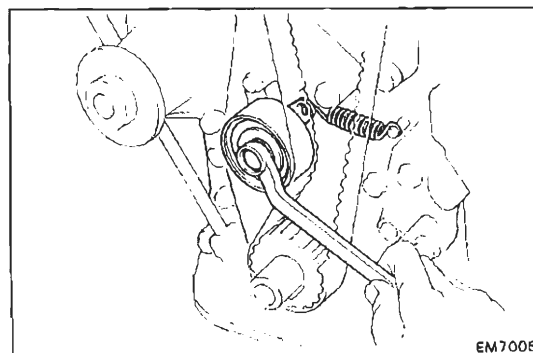
Remove the nine bolts, engine wire bracket and timing belt covers.

7. REMOVE TIMING BELT GUIDE

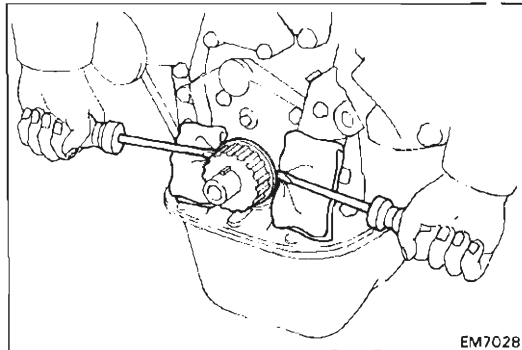


8. REMOVE TIMING BELT AND IDLER PULLEY

HINT: If reusing the timing belt, draw a direction arrow on the belt (in the direction of engine revolution), and place matchmarks on the pulleys and belt as shown in the illustration.

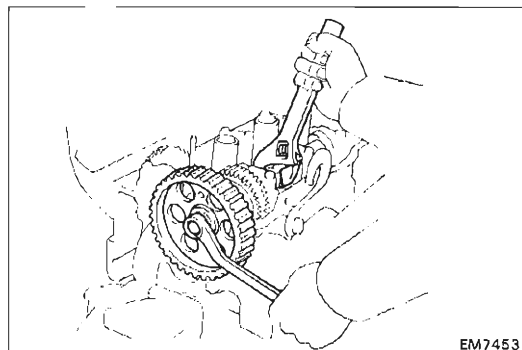


- (a) Remove the bolt, idler pulley and tension spring.
(b) Remove the belt.

**9. REMOVE CRANKSHAFT TIMING PULLEY**

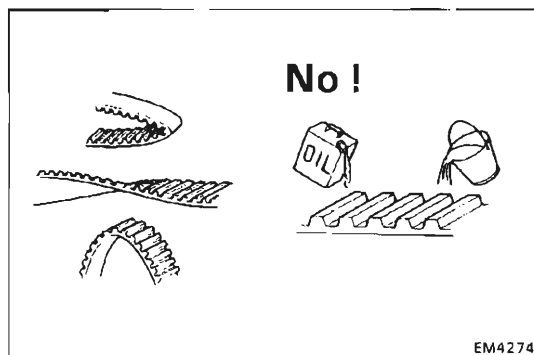
If the pulley cannot be removed by hand, use two screwdrivers.

NOTICE: Position shop rags as shown to prevent damage.

**10. REMOVE CAMSHAFT TIMING PULLEY**

Hold the hexagonal head wrench portion of the camshaft with a wrench, and remove the bolt and timing pulley.

NOTICE: Be careful not to damage the cylinder head with the wrench.



INSPECTION OF TIMING COMPONENTS

1. INSPECT TIMING BELT

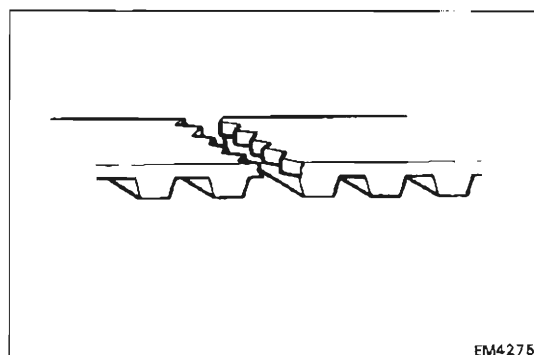
NOTICE:

- Do not bend, twist or turn the timing belt inside out.
- Do not allow the timing belt to come into contact with oil, water or steam.
- Do not utilize timing belt tension when installing or removing the mount bolt of the camshaft timing pulley.

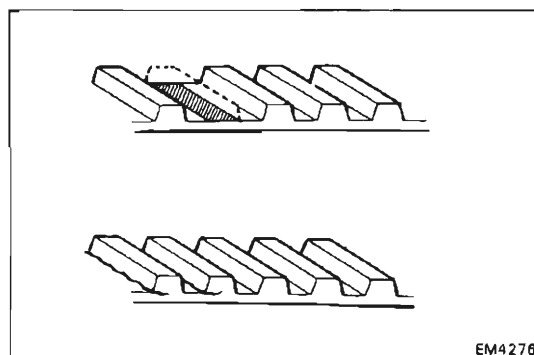
If there are any defects as shown in the illustrations, check the following points:

(a) Premature splitting

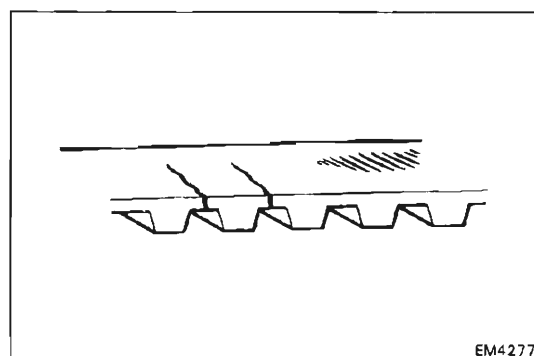
- Check the proper installation.
- Check the timing cover gasket for damage and proper installation.



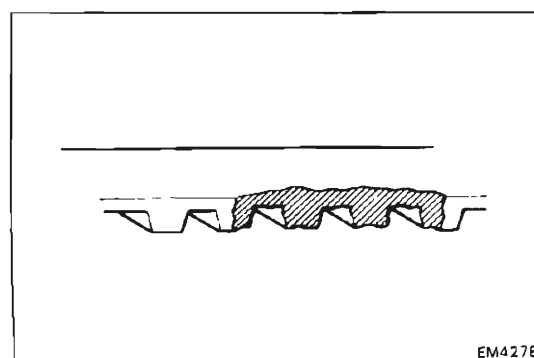
- (b) If the belt teeth are cracked or damaged, check to see if either camshaft or water pump is locked.

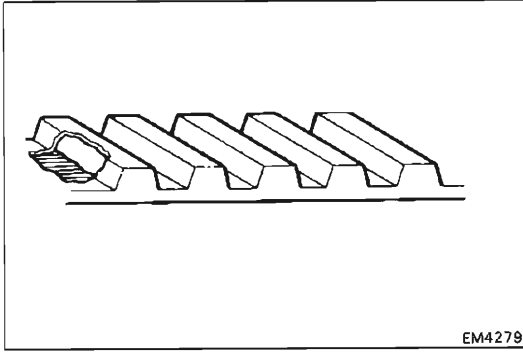


- (c) If there is noticeable wear or cracks on the belt face, check to see if there are nicks on one side of the idler pulley lock.



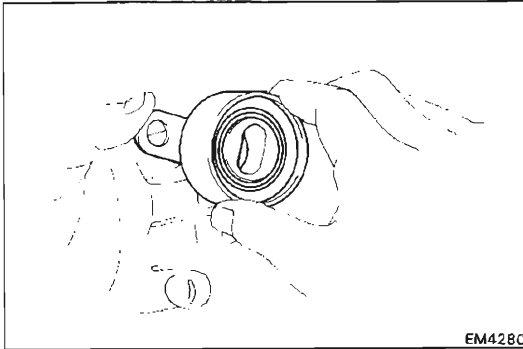
- (d) If there is wear or damage on only one side of the belt, check the belt guide and the alignment of each pulley.



RETTELSER

- (e) If there is noticeable wear on the belt teeth, check the timing cover for damage and check for correct gasket installation and for foreign material on the pulley teeth.

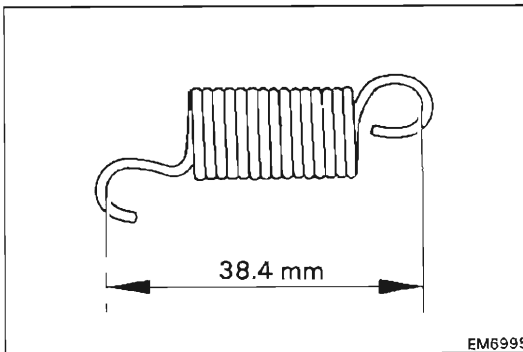
If necessary, replace the timing belt.



2. INSPECT IDLER PULLEY

Check the turning smoothness of the idler pulley.

If necessary, replace the idler pulley.



3. INSPECT TENSION SPRING

- (a) Measure the free length of the tension spring.

Free length: 38.4 mm (1.512 in.)

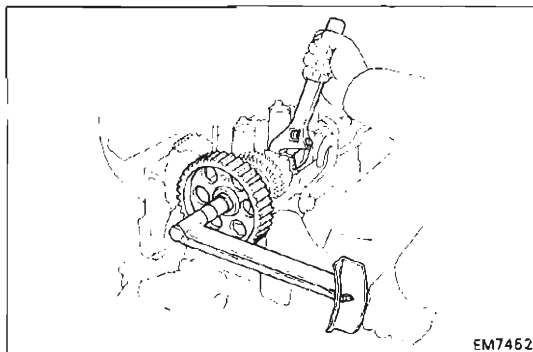
If the free length is not as specified, replace the tension spring.

- (b) Measure the tension of the tension spring at the specified installed length.

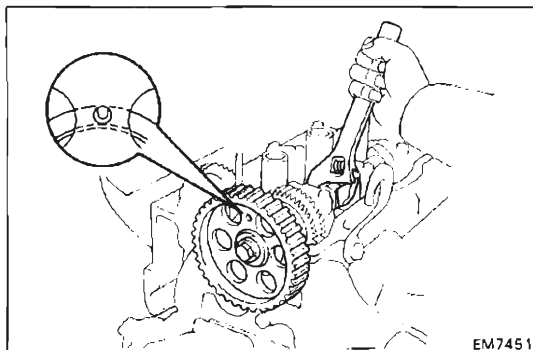
Installed tension:

**3.6 – 4.0 kg (7.9 – 8.8 lb, 35 – 39 N·m)
at 50.2 mm (1.976 in.)**

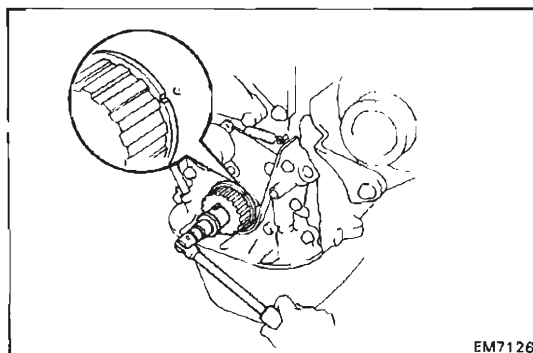
If the tension is not as specified, replace the tension spring.



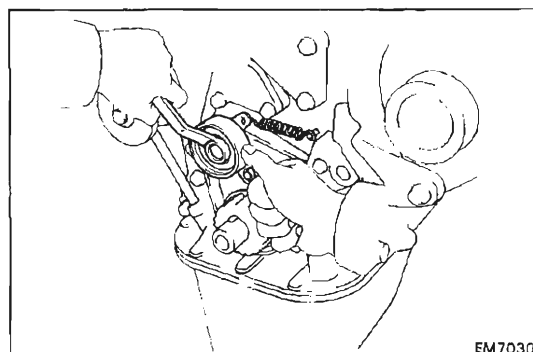
EM7452



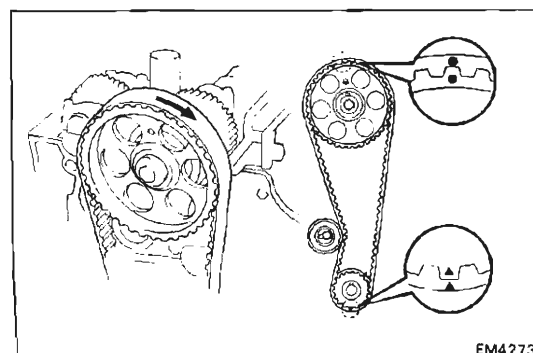
EM7451



EM7126



EM7030



EM4273

INSTALLATION OF TIMING BELT

(See page EM-39)

1. INSTALL CAMSHAFT TIMING PULLEY

- Align the camshaft knock pin with the knock pin groove of the pulley, and slide on the pulley.
- Temporarily install the timing pulley bolt.
- Hold the hexagonal wrench head portion of the camshaft with a wrench, and tighten the timing pulley bolt.

Torque: 600 kg-cm (43 ft-lb, 59 N·m)

- Turn the hexagonal wrench head portion of the camshaft, and align the hole of the camshaft timing pulley with the timing mark of the bearing cap.

2. INSTALL CRANKSHAFT TIMING PULLEY

- Align the pulley set key with the key groove of the pulley.
- Slide on the timing pulley, facing the flange side inward.
- Using the crankshaft pulley bolt, turn the crankshaft and align the timing marks of the crankshaft timing pulley and oil pump body.

3. TEMPORARILY INSTALL IDLER PULLEY AND TENSION SPRING

- Install the idler pulley with the bolt. Do not tighten the bolt yet.
- Install the tension spring.
- Push the pulley toward the left as far as it will go and tighten the bolt.

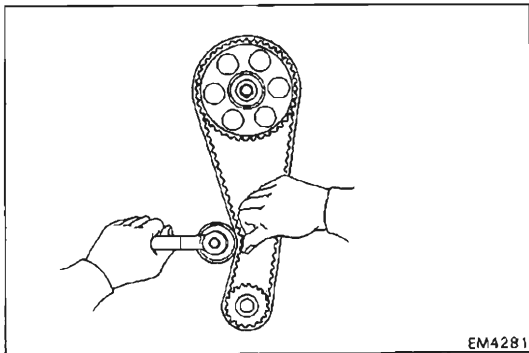
4. INSTALL TIMING BELT

NOTICE: The engine should be cold.

HINT: If reusing the timing belt, align the points marked during removal, and install the belt with the arrow pointing in the direction of engine revolution.

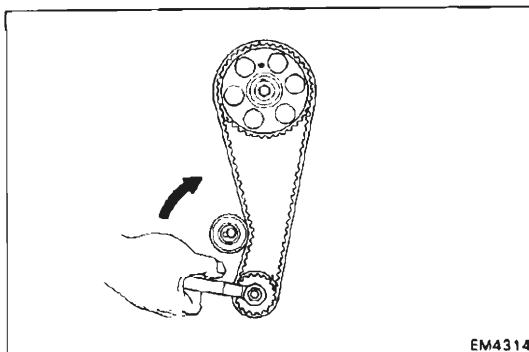
5. CHECK VALVE TIMING AND TIMING BELT TENSION

(a) Loosen the idler pulley bolt.

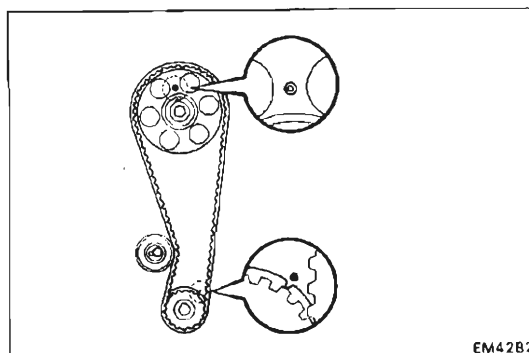


(b) Temporarily install the crank pulley bolt and turn the crankshaft two revolutions from TDC to TDC.

HINT: Always turn the crankshaft clockwise.



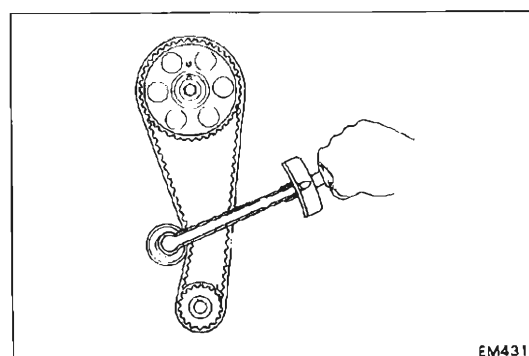
(c) Check the valve timing.
Ensure that each pulley aligns with the marks as shown in the illustration.



(d) Tighten the timing belt idler pulley mount bolt.

Torque: 375 kg-cm (27 ft-lb, 37 N·m)

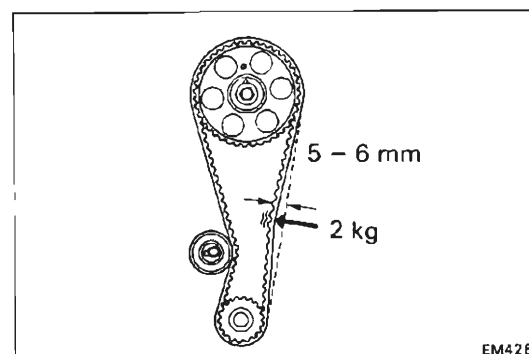
(e) Remove the temporarily installed crank pulley bolt.

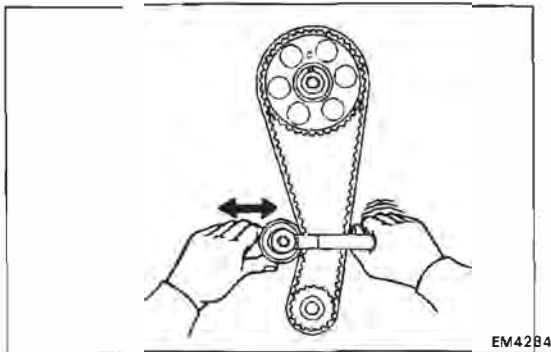


(Reference)

(a) Measure the timing belt deflection as shown in the illustration.

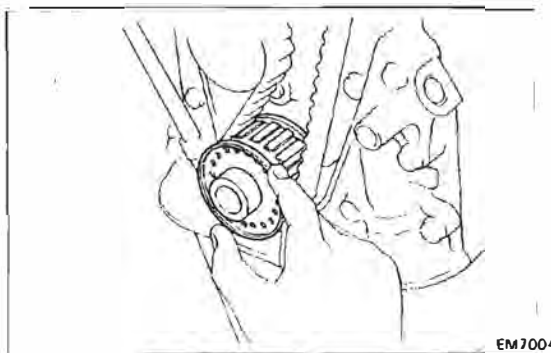
**Deflection: 5 – 6 mm (0.20 – 0.24 in.)
at 2 kg (4.4 lb, 20 N)**





EM4284

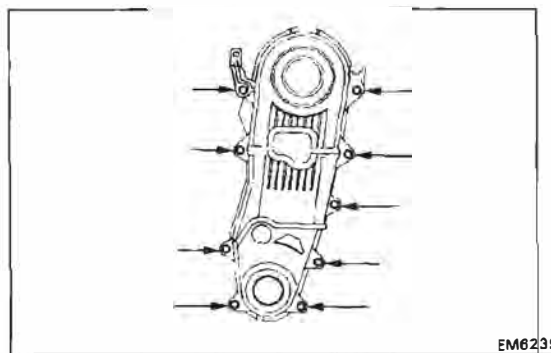
- (b) If the measured value is not within standard, readjust with the idler pulley.



EM7004

6. INSTALL TIMING BELT GUIDE

Install the guide, facing the cup side outward.



EM6239

7. INSTALL TIMING BELT COVERS

- Install the No.1 timing belt cover with the three bolts.
- Install the No.2, No.3 timing belt covers and engine wire bracket with the six bolts.

Torque: 80 kg-cm (69 in.-lb, 7.8 N·m)



EM4150

8. INSTALL CRANKSHAFT PULLEY

- Align the pulley set key with the key groove of the pulley, slide on the pulley.

- Temporarily install the pulley bolt.

SST 09213-14010 and 09330-00021

Torque: 1,200 kg-cm (87 ft-lb, 118 N·m)

9. INSTALL CYLINDER HEAD COVER

(See steps 14 and 18 on pages EM-86 and 88)

10. INSTALL SPARK PLUGS (See page IG-8)

Torque: 180 kg-cm (13 ft-lb, 18 N·m)

11. INSTALL WATER PUMP PULLEY AND DRIVE BELT

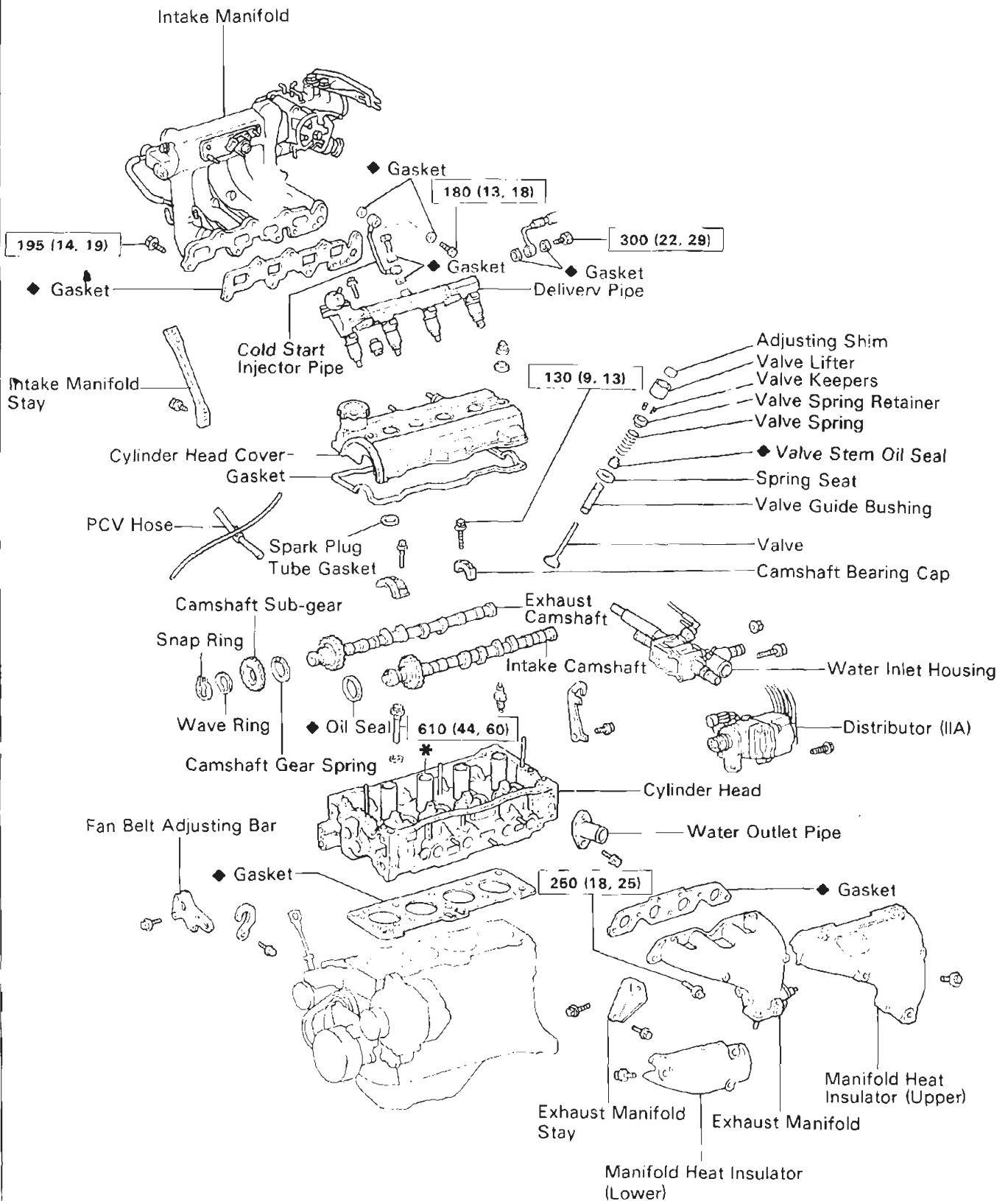
12. CHECK AND ADJUST DRIVE BELT

(See step 3 on pages CH-3 and 4)

CYLINDER HEAD (4A-FE)

COMPONENTS

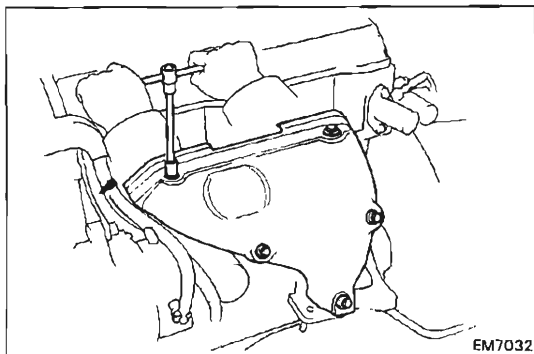
2WD



[kg-cm (ft-lb, N·m)] : Specified torque

◆ Non-reusable part

* : Must not remove the spark plug tube



REMOVAL OF CYLINDER HEAD

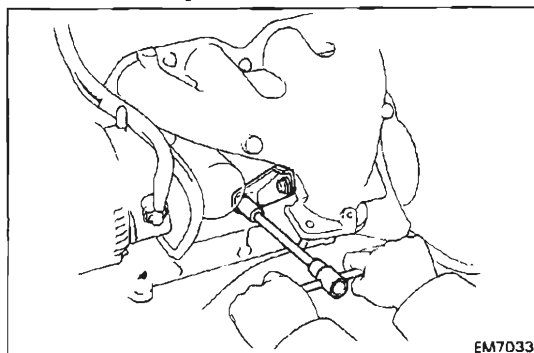
(See pages EM-56, 57)

1. REMOVE IIA

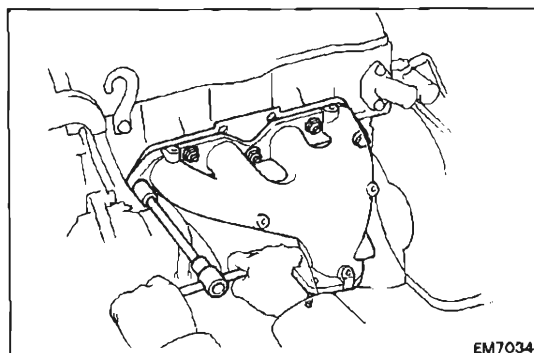
2. REMOVE EXHAUST MANIFOLD (2WD)

(a) Remove the five bolts and upper heat insulator.

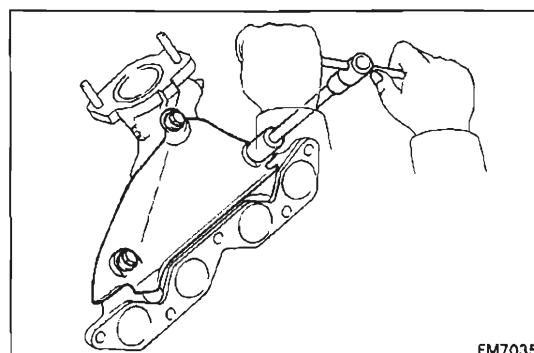
(b) Remove the two bolts and manifold stay.

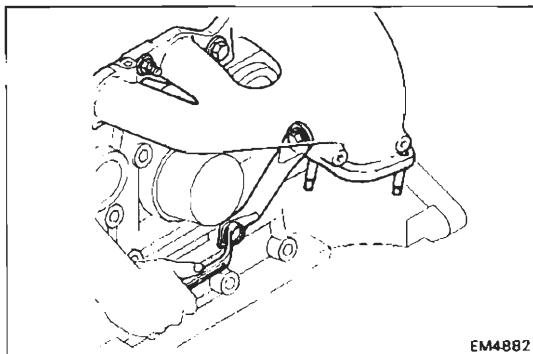


(c) Remove the two bolts, three nuts, exhaust manifold and gasket.



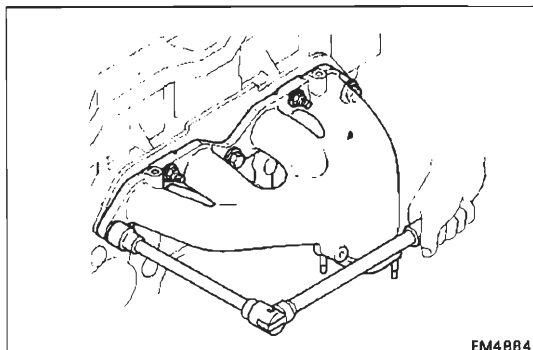
(d) Remove the three bolts and lower heat insulator from the exhaust manifold.





EM4882

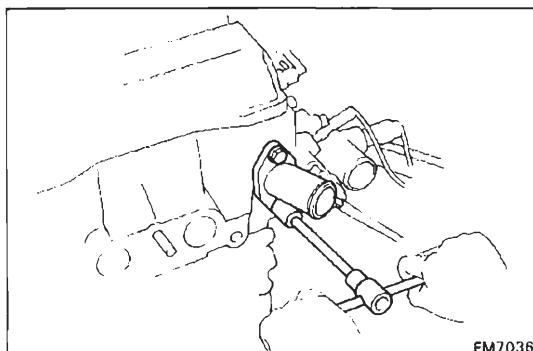
(b) Remove the two bolts and manifold stay.



EM4884

(c) Remove the three bolts, two nuts, manifold and gasket.

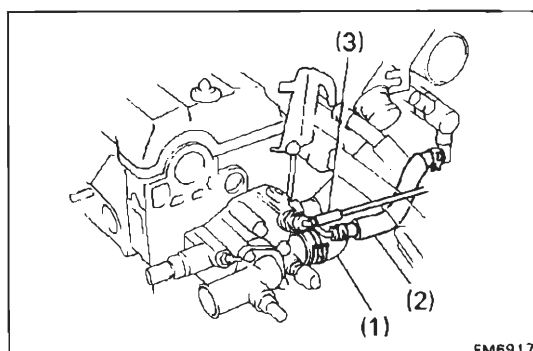
(d) Remove the three bolts and lower heat insulator from the exhaust manifold.



EM7036

3. REMOVE WATER OUTLET

Remove the two bolts and water outlet.



EM6917

4. REMOVE WATER INLET AND INLET HOUSING

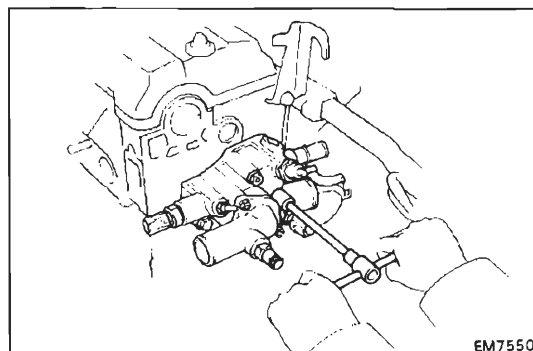
(a) Disconnect the following connectors:

- Water temperature sender gauge connector
- Water temperature sensor connector
- Start injector time switch connector

(b) Disconnect the following hoses:

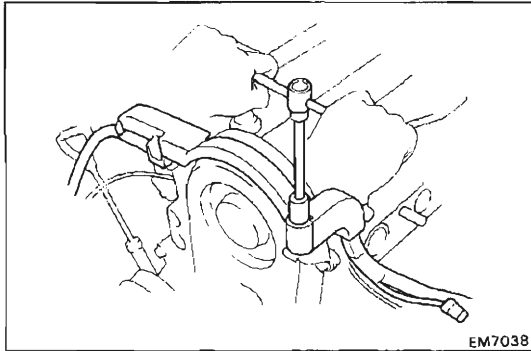
- (1) Inlet water hose
- (2) Water by-pass hose
- (3) BVSV vacuum hose(s)

(c) Remove the bolt, two nuts, the water inlet and inlet housing assembly.



EM7550

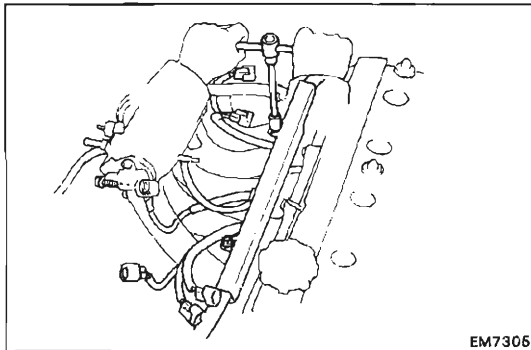
5. REMOVE COLD START INJECTOR PIPE (See step 3 on page FI-105)

6. (4WD)**7. REMOVE DELIVERY PIPE AND INJECTORS**

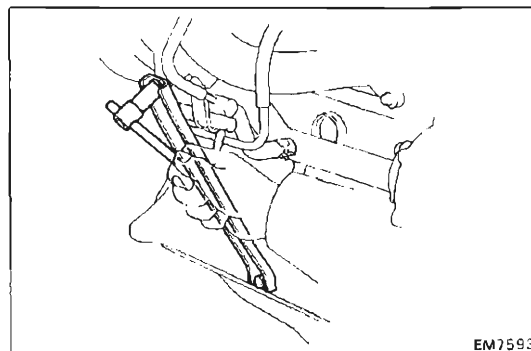
(See steps 3 to 6 and 8 on pages FI-113 and 114)

8. DISCONNECT ENGINE WIRE FROM NO.3 TIMING BELT COVER

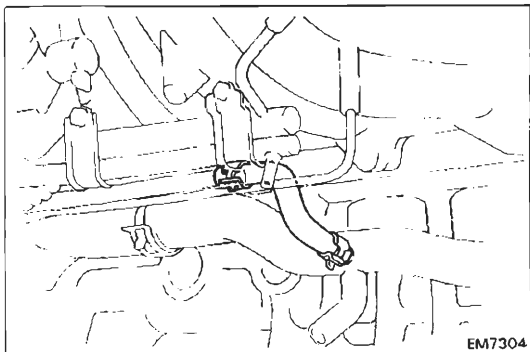
- (a) Disconnect the following connectors and wire:
 - Alternator connector
 - Alternator wire
 - Oil pressure switch connector
- (b) Remove the bolt.
- (c) Disconnect the wire clamp from the wire bracket, and disconnect the engine wire from the timing belt cover.

**9. DISCONNECT ENGINE WIRE FROM INTAKE MANIFOLD**

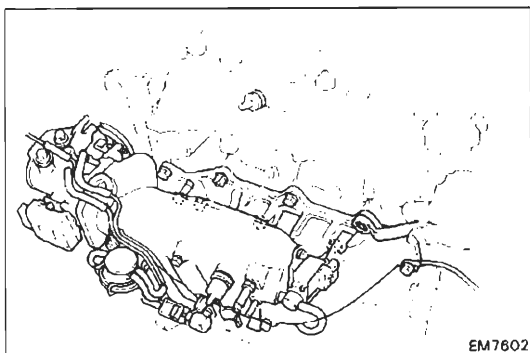
- (a) Disconnect the following connectors:
 - Throttle position sensor connector
 - ISC valve connector
 - (2WD w/ EGR system)
EGR VSV connector
 - Cold start injector connector
- (b) Disconnect the wire clamp from the vacuum pipe.
- (c) Remove the three bolts, and disconnect the engine wire from the intake manifold.

10. (4WD)**11. REMOVE INTAKE MANIFOLD (2WD)**

- (a) Remove the two bolts and manifold stay.



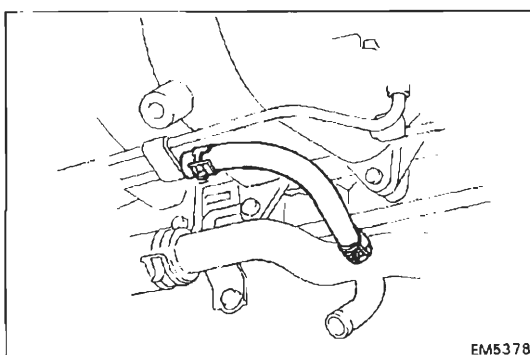
(b) Disconnect the water by-pass hose from the air pipe.



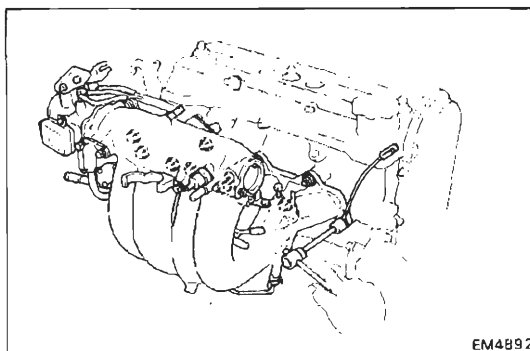
(c) Remove the seven bolts, ground strap, intake manifold and gasket.

(4WD)

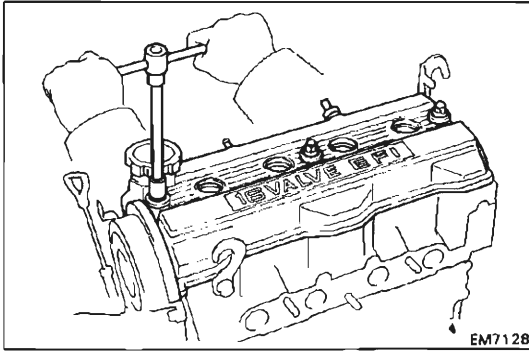
(a)



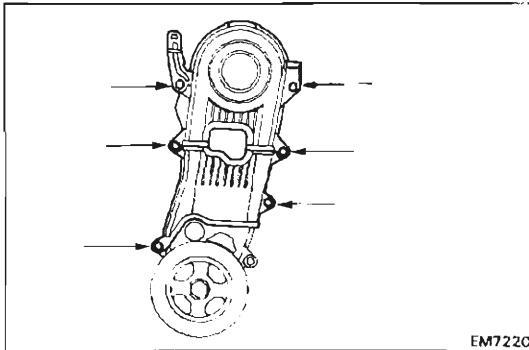
(b) Disconnect the water by-pass hose from the air pipe.



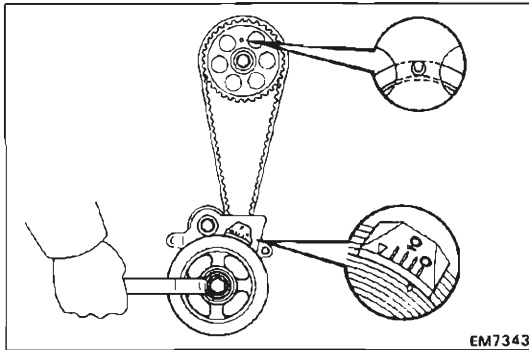
(c) Remove the seven bolts, ground strap, intake manifold and gasket.

**12. REMOVE CYLINDER HEAD COVER**

Remove the three cap nuts, grommets, head cover and gasket.

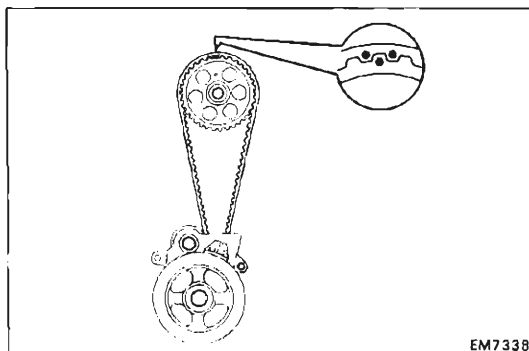
13. REMOVE SEMI-CIRCULAR PLUG**14. REMOVE NO.3 AND NO.2 TIMING BELT COVERS**

Remove the six bolts, engine wire bracket, No.3 and No.2 timing belt covers.

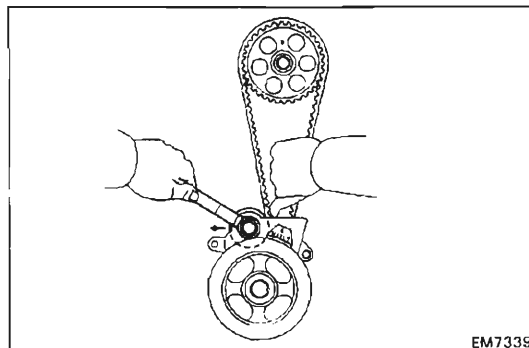
**15. SET NO.1 CYLINDER TO TDC/COMPRESSION**

- Turn the crankshaft pulley and align its groove with the timing mark "0" of the No.1 timing belt cover.
- Check that the hole of the camshaft timing pulley is aligned with the timing mark of the bearing cap.

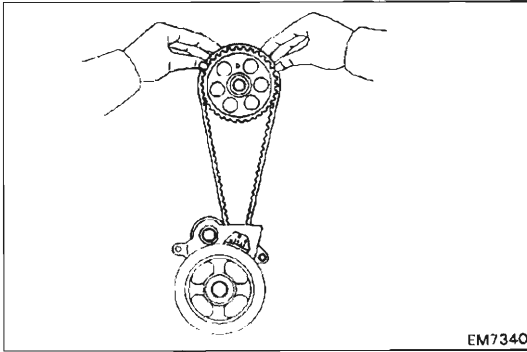
If not, turn the crankshaft one revolution (360°).

**16. REMOVE TIMING BELT FROM CAMSHAFT TIMING PULLEY**

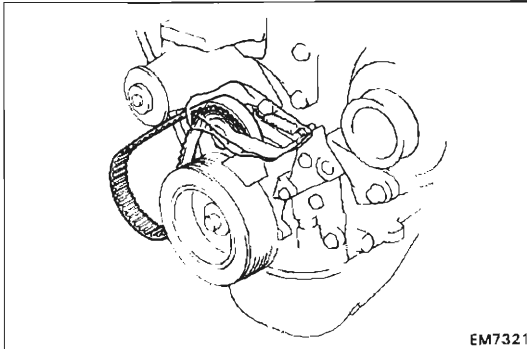
- Remove the plug from the No.1 timing belt cover.
- Place matchmarks on the camshaft timing pulley and belt.



- Loosen the idler pulley mount bolt and push the idler pulley toward the left as far as it will go, then tighten it temporarily.



- (d) Remove the timing belt from the camshaft timing pulley.



NOTICE:

- Support the belt so that the meshing of the crankshaft timing pulley and timing belt does not shift.
- Be careful not to drop anything inside the timing belt cover.
- Do not allow the belt to come in contact with oil, water or dust.

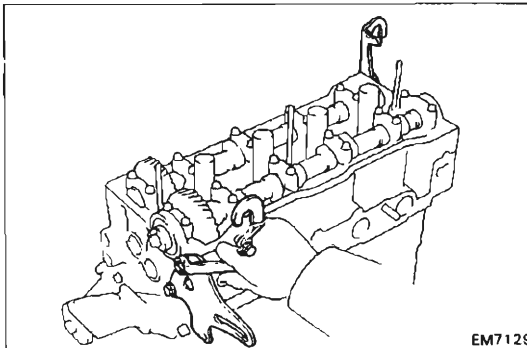
17. REMOVE CAMSHAFT TIMING PULLEY
(See step 10 on page EM-41)

18. REMOVE FAN BELT ADJUSTING BAR

Remove the two bolts and adjusting bar.

19. REMOVE ENGINE HANGERS

Remove the two bolts and engine hangers.



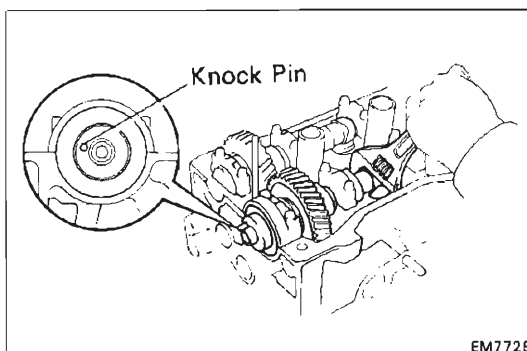
20. REMOVE CAMSHAFTS

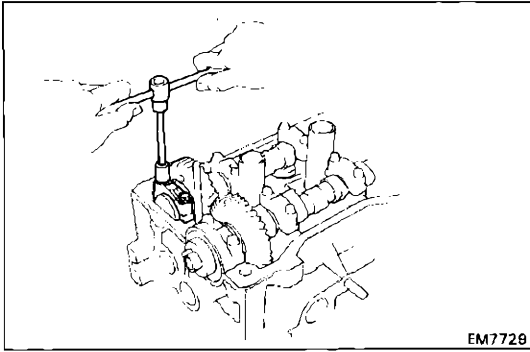
NOTICE: Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

A. Remove intake camshaft

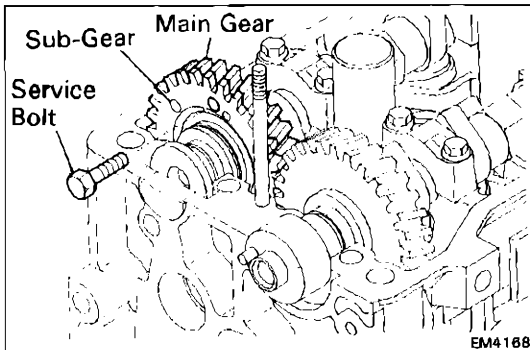
- (a) Set the intake camshaft so the knock pin is slightly above the top of the cylinder head.

HINT: The above angle allows the No.1 and No.3 cylinder cam lobes of the intake camshaft to push their valve lifters evenly.





- (b) Remove the two bolts and front bearing cap.

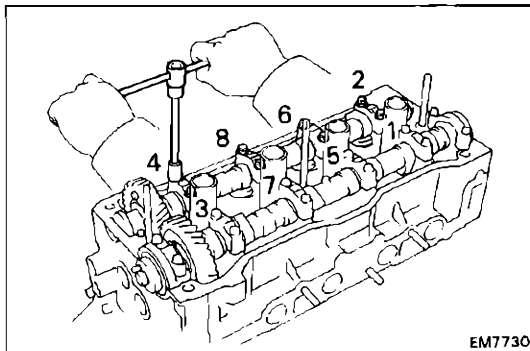


- (c) Secure the intake camshaft sub-gear to the main gear with a service bolt.

Recommended service bolt:

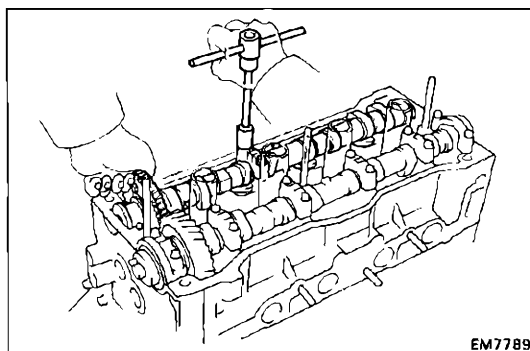
Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 – 20 mm (0.63 – 0.79 in.)

HINT: When removing the camshaft, make certain that the torsional spring force of the sub-gear has been eliminated by the above operation.



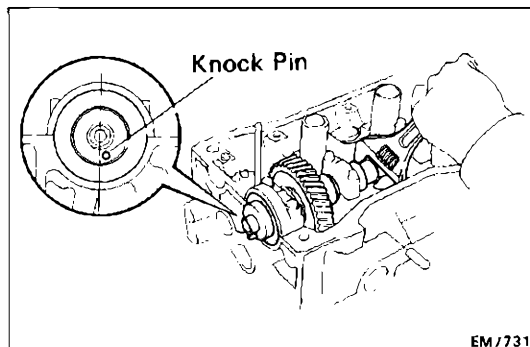
- (d) Uniformly loosen and remove the eight bearing cap bolts in several passes in the sequence shown.

- (e) Remove the four bearing caps and camshaft.



HINT: If the camshaft is not being lifted out straight and level, reinstall the bearing cap with the two bolts. Then alternately loosen and remove the bearing cap bolts with the camshaft gear pulled up.

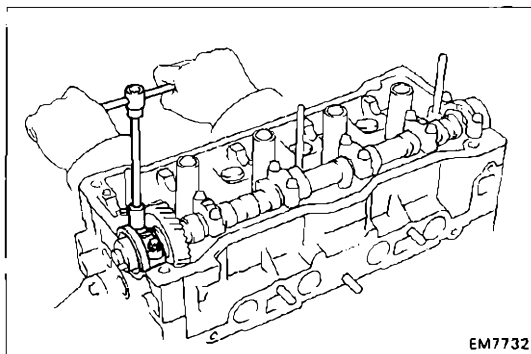
NOTICE: Do not pry on or attempt to force the camshaft with a tool or other objects.



B. Remove exhaust camshaft

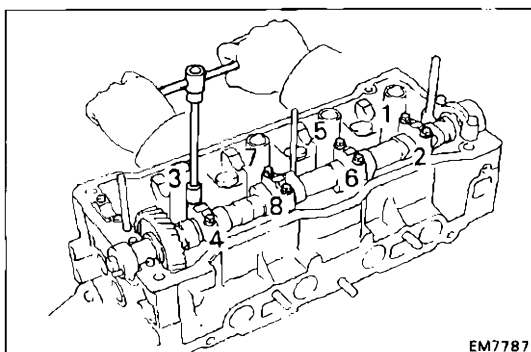
- (a) Set the exhaust camshaft so that the knock pin is located slightly counterclockwise from the vertical axis of the camshaft.

HINT: The above angle allows the No.1 and No.3 cylinder cam lobes of exhaust camshaft to push their valve lifters evenly.



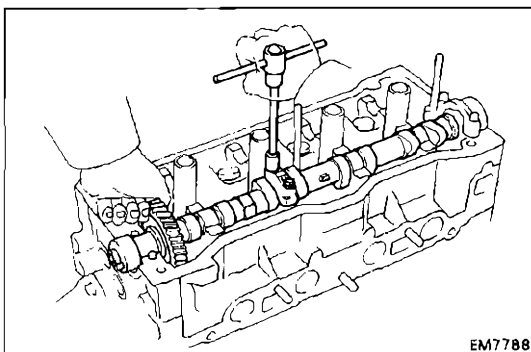
(b) Remove the two bolts, front bearing cap and oil seal.

NOTICE: If the front bearing cap is not removable by hand, do not try to remove by force but leave as it is without bolts.



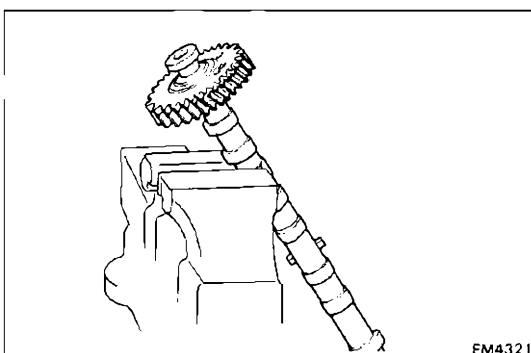
(c) Uniformly loosen and remove the eight bearing cap bolts in several passes in the sequence shown.

(d) Remove the four bearing caps and camshaft.



HINT: If the camshaft is not being lifted out straight and level, reinstall the No.3 bearing cap with the two bolts. Then alternately loosen and remove the two bearing cap bolts with the camshaft gear pulled up.

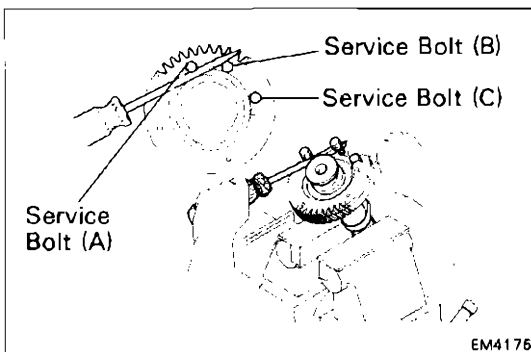
NOTICE: Do not pry on or attempt to force the camshaft with a tool or other objects.



21. DISASSEMBLE INTAKE CAMSHAFT

(a) Mount the hexagonal wrench head portion of the camshaft in a vise.

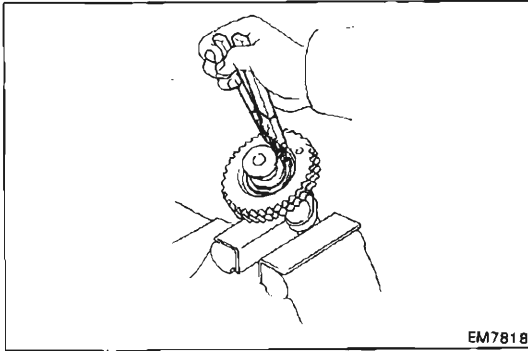
NOTICE: Be careful not to damage the camshaft.



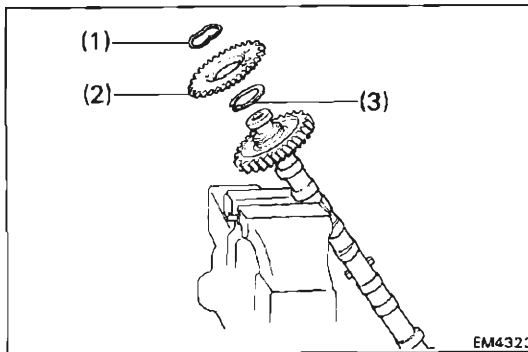
(b) Insert service bolts (A) and (B) into the service holes of the camshaft sub-gear.

(c) Using a screwdriver, turn the sub-gear clockwise, and remove the service bolt (C).

NOTICE: Be careful not to damage the camshaft.

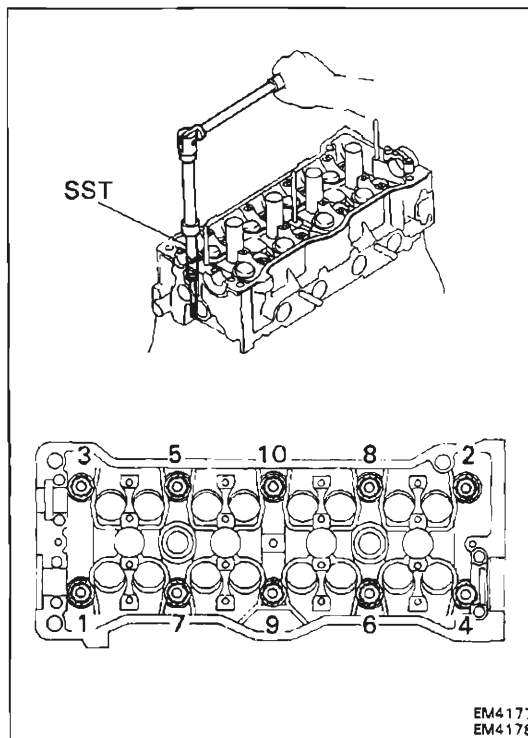


(d) Using snap ring pliers, remove the snap ring.



(e) Remove the following parts:

- (1) Wave washer
- (2) Camshaft sub-gear
- (3) Camshaft gear spring

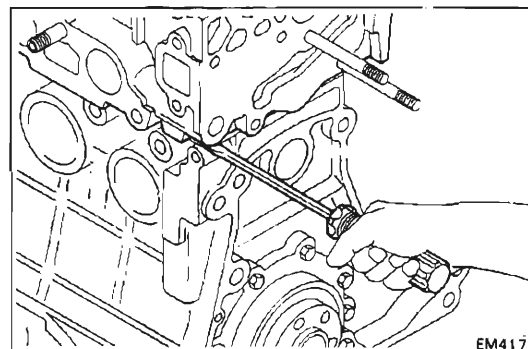


22. REMOVE CYLINDER HEAD

(a) Using SST, uniformly loosen and remove the ten cylinder head bolts in several passes in the sequence shown.

SST 09205-16010

NOTICE: Head warpage or cracking could result from removing the bolts in an incorrect order.



(b) Lift the cylinder head from the dowels of the cylinder block and place the head on wooden blocks on a bench.

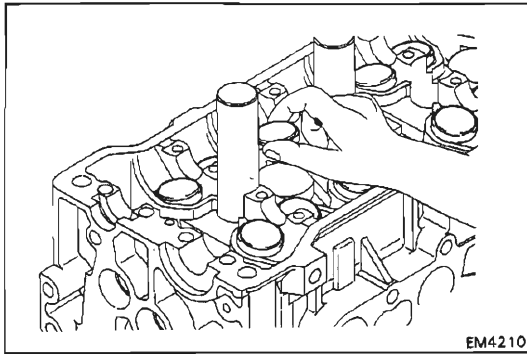
HINT: If the cylinder head is difficult to lift off, pry with a screwdriver between the cylinder head and block saliences.

NOTICE: Be careful not to damage the cylinder head and the cylinder block surfaces of the cylinder head gasket side.

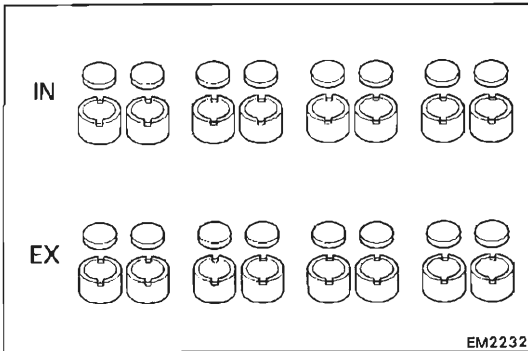
DISASSEMBLY OF CYLINDER HEAD

(See pages EM-56, 57)

1. REMOVE VALVE LIFTERS AND SHIMS



HINT: Arrange the valve lifters and shims in correct order.

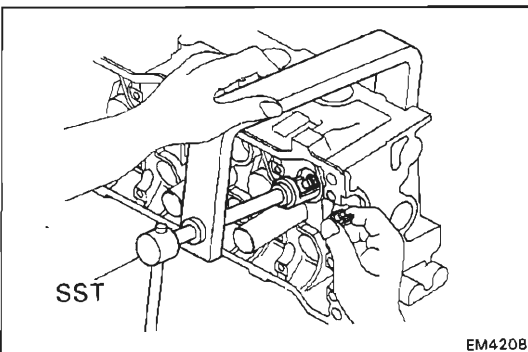


2. REMOVE VALVES

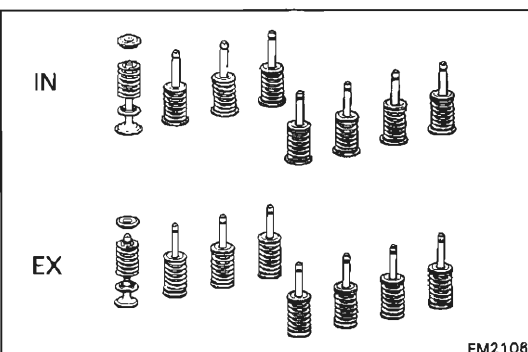
- (a) Using SST, compress the valve spring and remove the two keepers.

SST 09202-70010

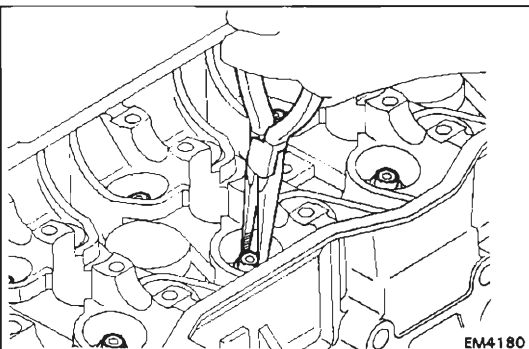
- (b) Remove the spring retainer, valve spring, valve and spring seat.

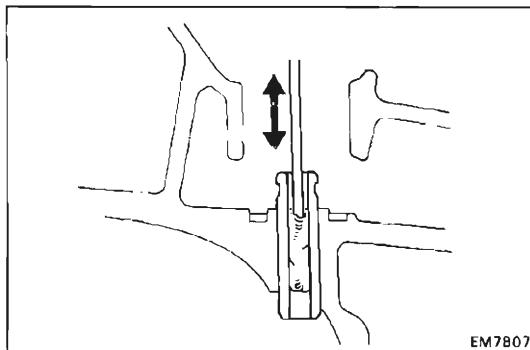
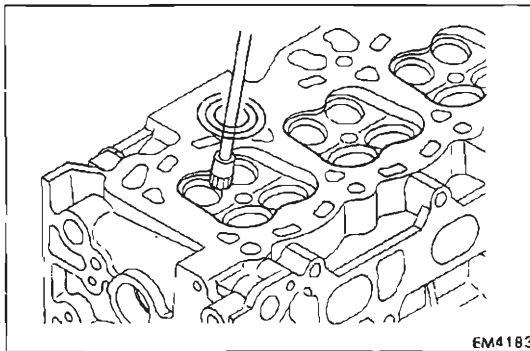
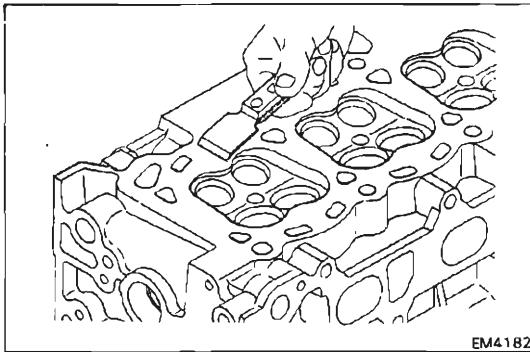
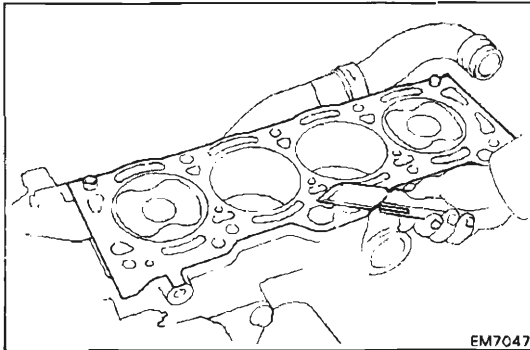
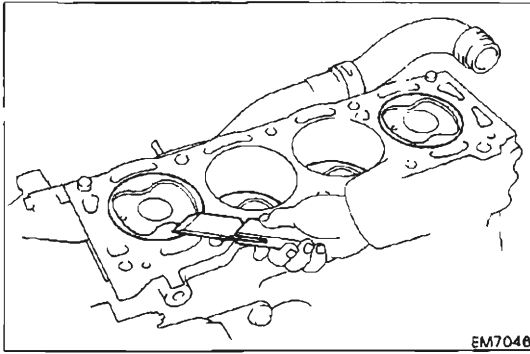


HINT: Arrange the valves, valve springs, spring seats and spring retainers in correct order.



- (c) Using needle-nose pliers, remove the oil seal.





INSPECTION, CLEANING AND REPAIR OF CYLINDER HEAD COMPONENTS

1. CLEAN TOP SURFACES OF PISTONS AND BLOCK

- (a) Turn the crankshaft and bring each piston to the top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top surface.

- (b) Using a gasket scraper, remove all the gasket material from the top surfaces of the cylinder block.

- (c) Using compressed air, blow carbon and oil from the bolt holes.

CAUTION: Protect your eyes when using high pressure compressed air.

2. CLEAN CYLINDER HEAD

A. Remove gasket material

Using a gasket scraper, remove all the gasket material from the cylinder head surface.

NOTICE: Be careful not to scratch the cylinder block contact surface.

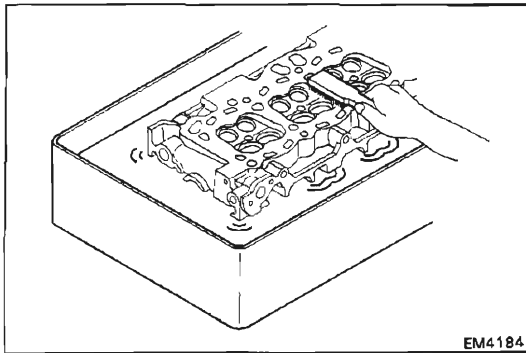
B. Clean combustion chambers

Using a wire brush, remove all the carbon from the combustion chambers.

NOTICE: Be careful not to scratch the cylinder block contact surface.

C. Clean valve guide bushings

Using a valve guide bushing brush and solvent, clean all the guide bushings.



EM4184

D. Clean cylinder head

Using a soft brush and solvent, thoroughly clean cylinder head.

3. INSPECT CYLINDER HEAD**A. Inspect for flatness**

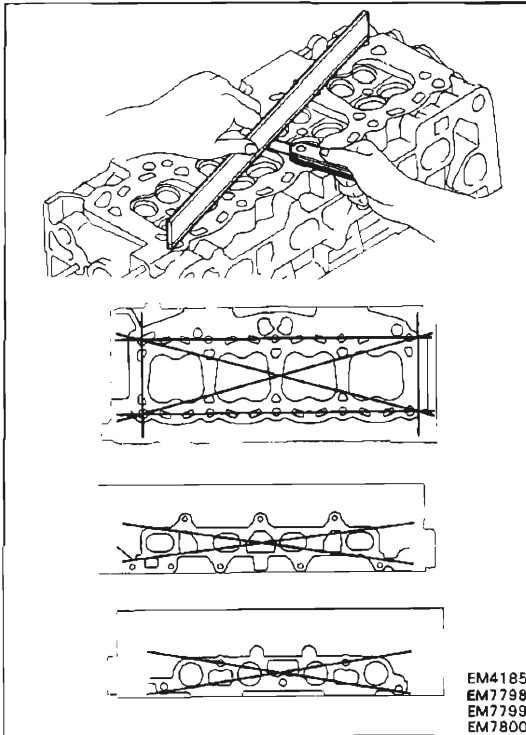
Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder block and manifolds for warpage.

Maximum warpage:

Cylinder block side 0.05 mm (0.0021 in.)

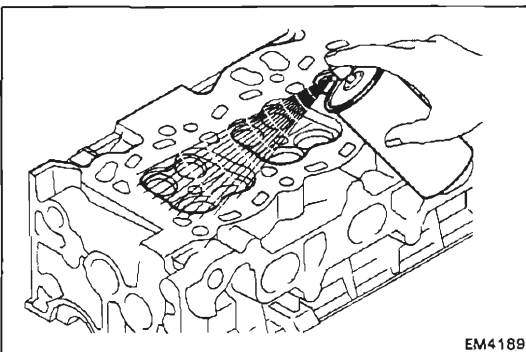
Manifold side 0.10 mm (0.0039 in.)

If warpage is greater than maximum, replace the cylinder head.

EM4185
EM7798
EM7799
EM7800**B. Inspect for cracks**

Using a dye penetrant, check the combustion chamber, intake and exhaust ports, head surface and the top of the head for cracks.

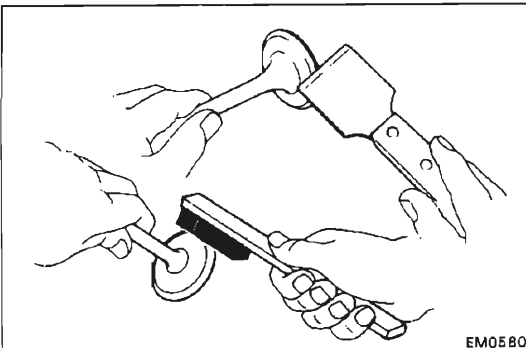
If cracked, replace the cylinder head.



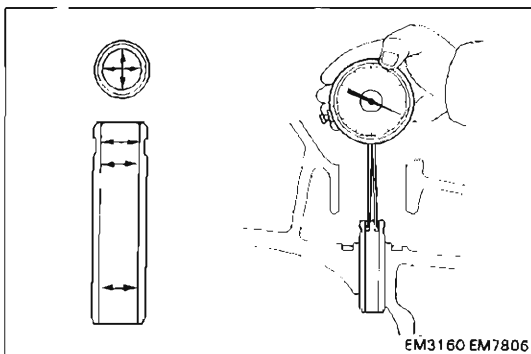
EM4189

4. CLEAN VALVES

- (a) Using a gasket scraper, chip off any carbon from the valve head.
- (b) Using a wire brush, thoroughly clean the valve.



EM0580

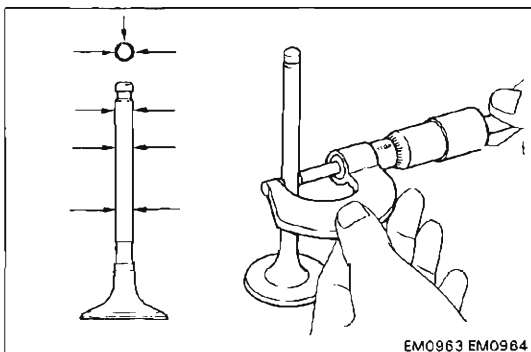


5. INSPECT VALVE STEMS AND GUIDE BUSHINGS

- (a) Using a caliper gauge, measure the inside diameter of the guide bushing.

Bushing inside diameter:

6.01 – 6.03 mm (0.2366 – 0.2374 in.)



- (b) Using a micrometer, measure the diameter of the valve stem.

Valve stem diameter:

**Intake 5.970 – 0.2356 mm
(0.2350 – 0.2356 in.)**

**Exhaust 5.965 – 5.980 mm
(0.2348 – 0.2354 in.)**

- (c) Subtract the valve stem diameter measurement from the guide bushing inside diameter measurement.

Standard oil clearance:

**Intake 0.025 – 0.060 mm
(0.0010 – 0.0024 in.)**

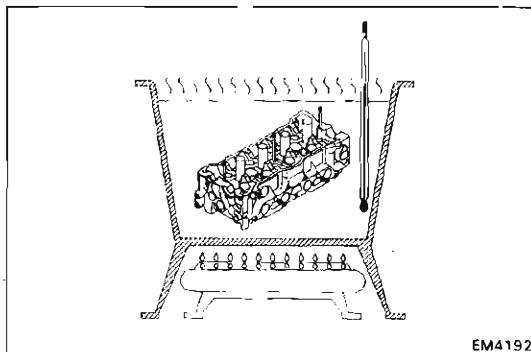
**Exhaust 0.030 – 0.065 mm
(0.0012 – 0.0026 in.)**

Maximum oil clearance:

Intake 0.08 mm (0.0031 in.)

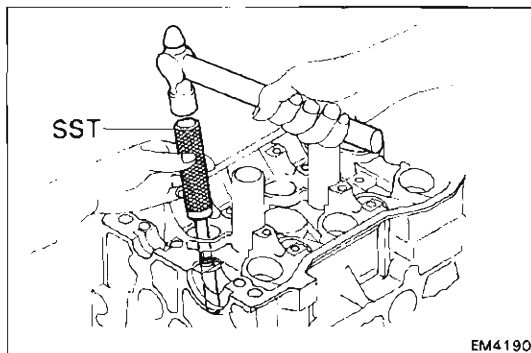
Exhaust 0.10 mm (0.0039 in.)

If the clearance is greater than maximum, replace the valve end guide bushing.

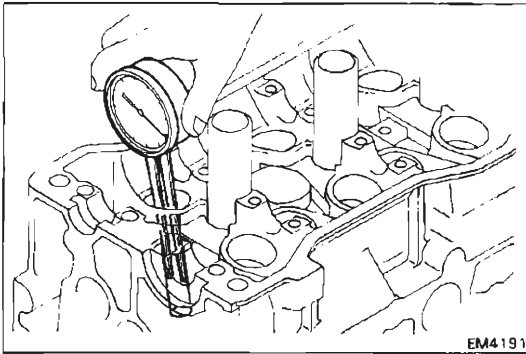


6. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

- (a) Gradually heat the cylinder head to 80 – 100°C (176 – 212°F).



- (b) Using SST and a hammer, tap out the guide bushing.
SST 09201-70010



EM4191

Both intake and exhaust

Bushing bore diameter mm (in.)	Bushing size
11.000 – 11.027 (0.4331 – 0.4341)	Used STD
11.050 – 11.077 (0.4350 – 0.4361)	Used O/S 0.05

- (c) Using a caliper gauge, measure the bushing bore diameter of the cylinder head.

Standard valve guide bore (cold):

11.000 – 11.027 mm (0.4331 – 0.4341 in.)

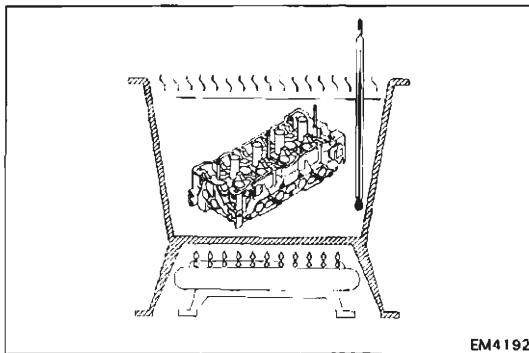
- (d) Select a new guide bushing (STD size or O/S 0.05)

If the bushing bore diameter of the cylinder head is greater than 11.027 mm (0.4341 in.), machine the bushing bore to the following dimensions:

Rebored cylinder head bushing bore dimension

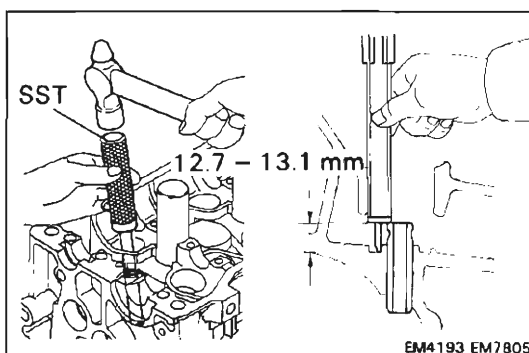
11.050 – 11.077 mm (0.4350 – 0.4361 in.)

If the bushing bore diameter of the cylinder head is greater than 11.077 mm (0.4361 in.), replace the cylinder head.



EM4192

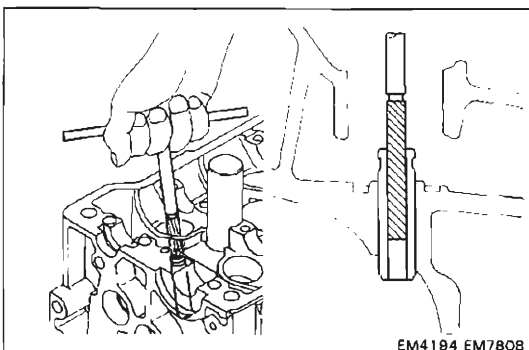
- (e) Gradually heat the cylinder head to 80 – 100°C (176 – 212°F)



EM4193 EM7805

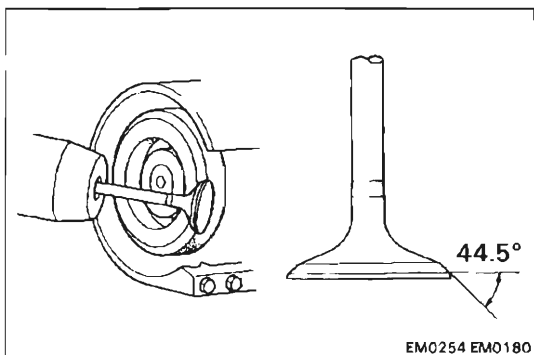
- (f) Using SST and a hammer, tap in a new guide bushing to where 12.7 – 13.1 mm (0.500 – 0.516 in.) protruding from the cylinder head.

SST 09201-70010



EM4194 EM7808

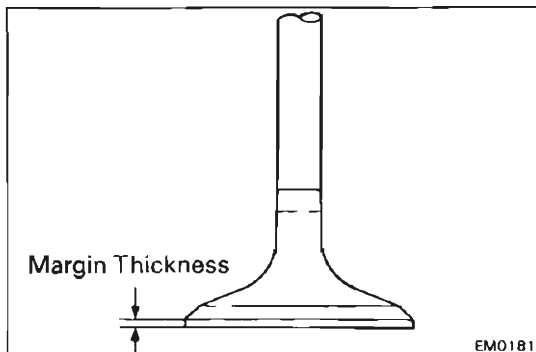
- (g) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance (See page EM-70) between the guide bushing and valve stem.



7. INSPECT AND GRIND VALVES

- Grind the valve enough to remove pits and carbon.
- Check that the valve is ground to the correct valve face angle.

Valve face angle: 44.5°



- Check the valve head margin thickness.

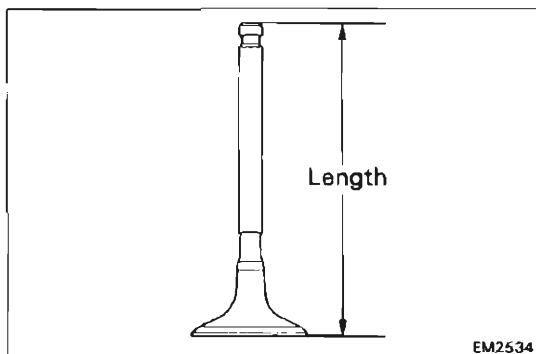
Standard margin thickness:

Intake 1.05 – 1.45 mm (0.0413 – 0.0571 in.)

Exhaust 1.19 – 1.59 mm (0.0469 – 0.0626 in.)

Minimum margin thickness: 0.5 mm (0.020 in.)

If the margin thickness is less than minimum, replace the valve.



- Check the valve overall length.

Standard overall length:

Intake 91.45 mm (3.6004 in.)

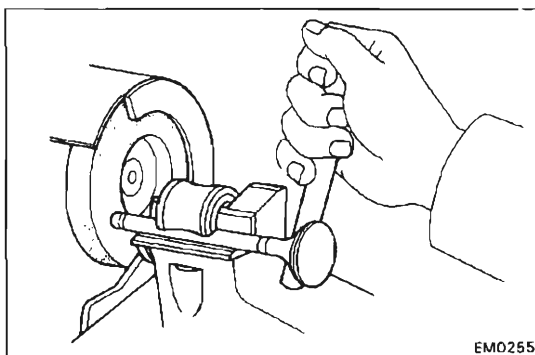
Exhaust 91.90 mm (3.6181 in.)

Minimum overall length:

Intake 90.95 mm (3.5807 in.)

Exhaust 91.40 mm (3.5984 in.)

If the overall length is less than minimum, replace the valve.



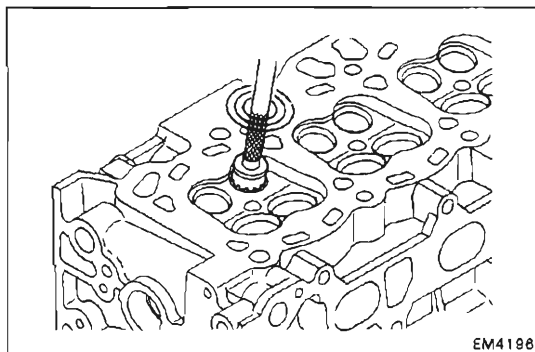
- Check the surface of the valve stem tip for wear.

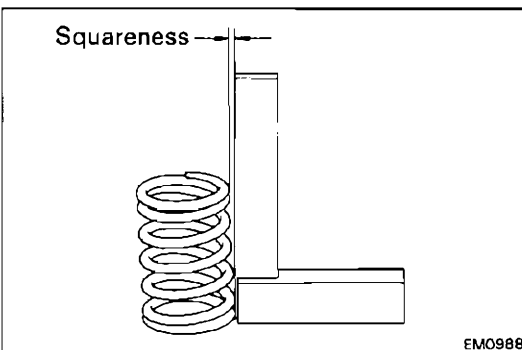
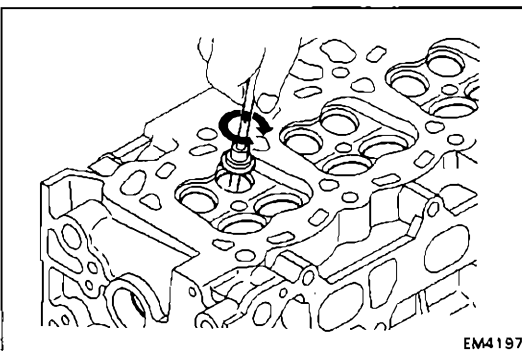
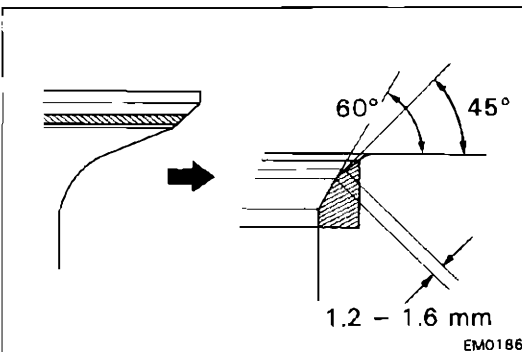
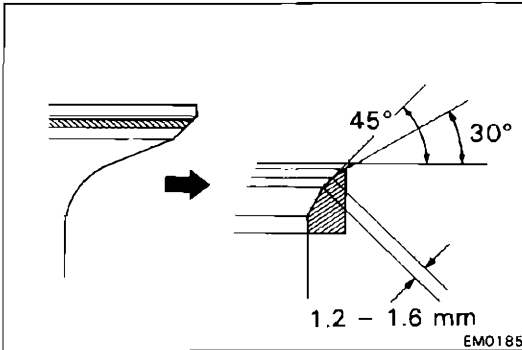
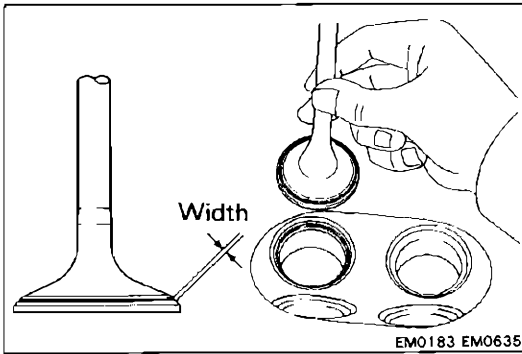
If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

NOTICE: Do not grind off more than minimum.

8. INSPECT AND CLEAN VALVE SEATS

- Using a 45° carbide cutter, resurface the valve seats. Remove only enough metal to clean the seats.





- (b) Check the valve seating position.

Apply a thin coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate the valve.

- (c) Check the valve face and seat for the following:

- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
- If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
- Check that the seat contact is in the middle of the valve face with the following width:

1.2 – 1.6 mm (0.047 – 0.063 in.)

If not, correct the valve seats as follows:

- (1) If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.
- (2) If the seating is too low on the valve face, use 60° and 45° cutters to correct the seat.

- (d) Hand-lap the valve and valve seat with an abrasive compound.

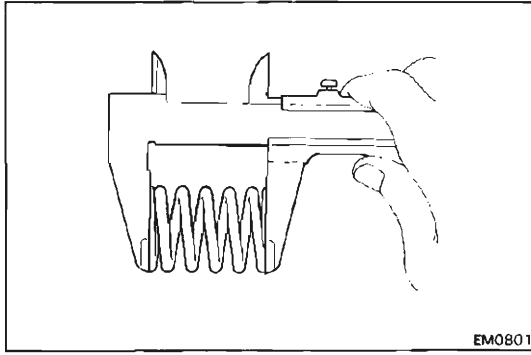
- (e) After hand-lapping, clean the valve and valve seat.

9. INSPECT VALVE SPRINGS

- (a) Using a steel square, measure the squareness of the valve spring.

Maximum squareness: 2.0 mm (0.075 in.)

If squareness is greater than maximum, replace the valve spring.

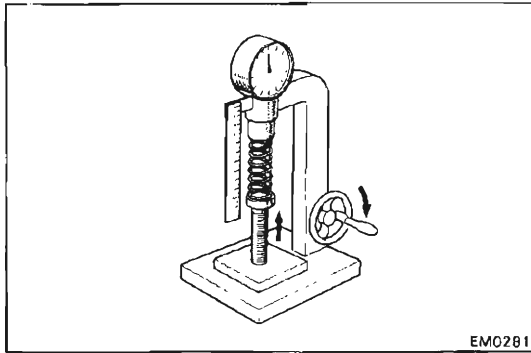


EM0801

- (b) Using vernier calipers, measure the free length of the valve spring.

Free length: 43.8 mm (1.724 in.)

If the free length is not as specified, replace the valve spring.



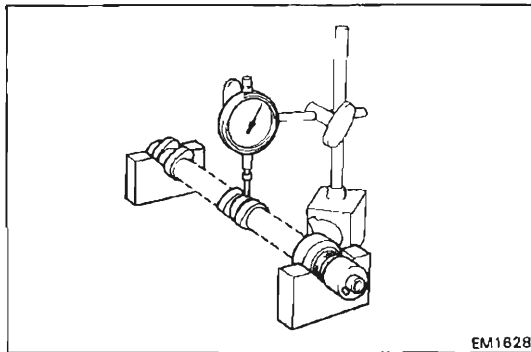
EM0281

- (c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

Installed tension:

**14.6 – 15.8 kg (32.3 – 34.8 lb, 143 – 155 N)
at 34.7 mm (1.366 in.)**

If the tension is not as specified, replace the valve spring.



EM1828

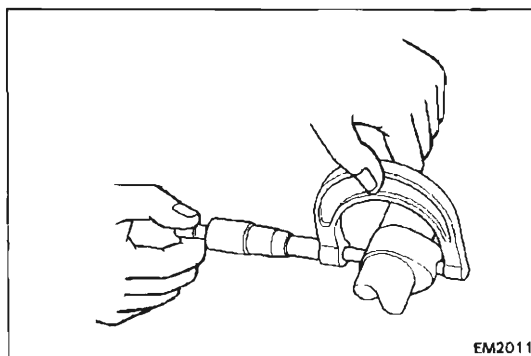
10. INSPECT CAMSHAFTS AND BEARINGS

A. Inspect camshaft for runout

- (a) Place the camshaft on V-blocks.
(b) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout: 0.04 mm (0.0016 in.)

If the circle runout is greater than maximum, replace the camshaft.



EM2011

B. Inspect cam lobes

Using a micrometer, measure the cam lobe height.

Standard cam lobe height:

**Intake 35.21 – 35.31 mm
(1.3862 – 1.3092 in.)**

**Exhaust 34.91 – 35.01 mm
(1.3744 – 1.3783 in.)**

Minimum cam lobe height:

Intake 34.81 mm (1.3705 in.)

Exhaust 34.51 mm (1.3587 in.)

If the cam lobe height is greater than minimum, replace the camshaft.

C. Inspect camshaft journals

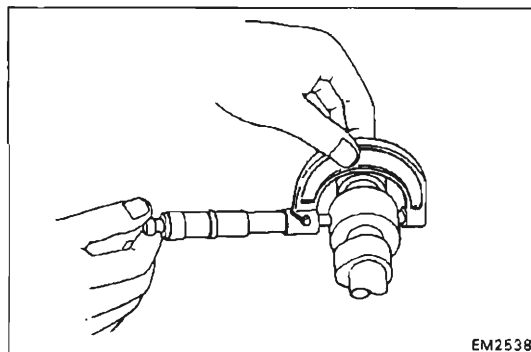
Using a micrometer, measure the journal diameter.

Journal diameter:

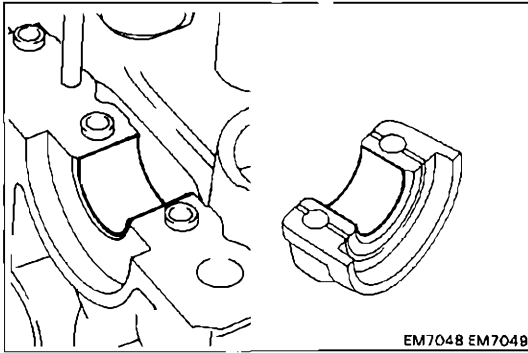
**Exhaust No.1 24.949 – 24.965 mm
(0.9822 – 0.9829 in.)**

**Others 22.949 – 22.965 mm
(0.9035 – 0.9041 in.)**

If the journal diameter is not as specified, check the oil clearance.

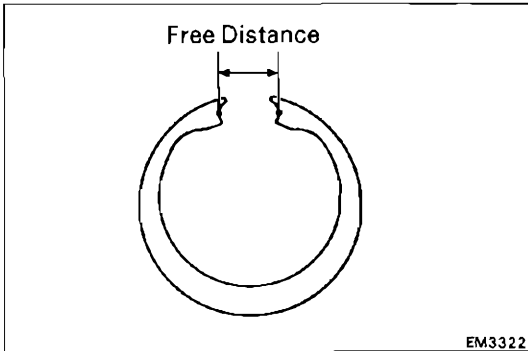


EM2538

**D. Inspect camshaft bearings**

Check the bearings for flaking and scoring.

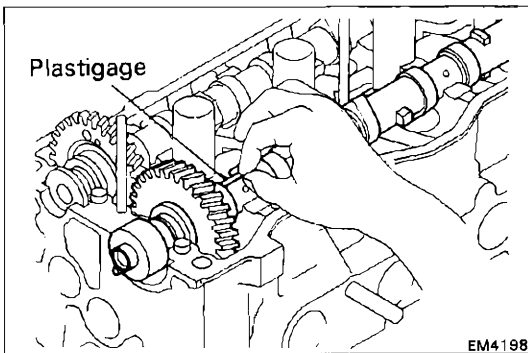
If the bearings are damaged, replace the bearing caps and cylinder head as a set.

**E. Inspect camshaft gear spring**

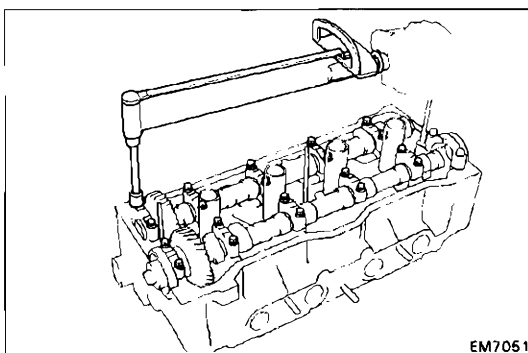
Using vernier calipers, measure the free distance between the spring end.

**Free distance: 17.1 – 17.5 mm
(0.673 – 0.689 in.)**

If the free distance is not as specified, replace the gear spring.

**F. Inspect camshaft journal oil clearance**

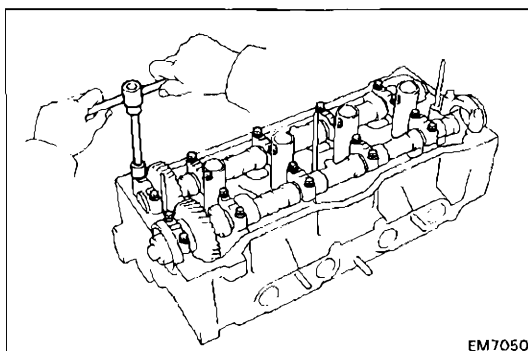
- (a) Clean the bearing caps and camshaft journals.
- (b) Place the camshafts on the cylinder head.
- (c) Lay a strip of Plastigage across each of the camshaft journals.



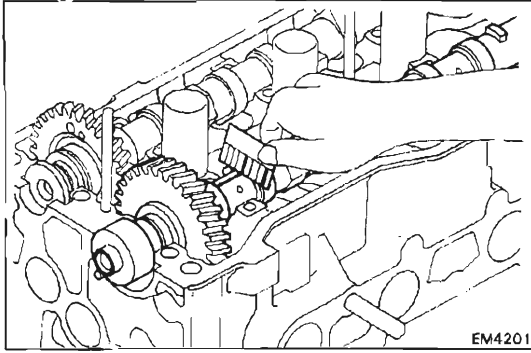
- (d) Install the bearing caps.
(See step 3 on pages EM-81 to 83)

Torque: 130 kg-cm (9 ft-lb, 13 N·m)

NOTICE: Do not turn the camshaft.



- (e) Remove the bearing caps.



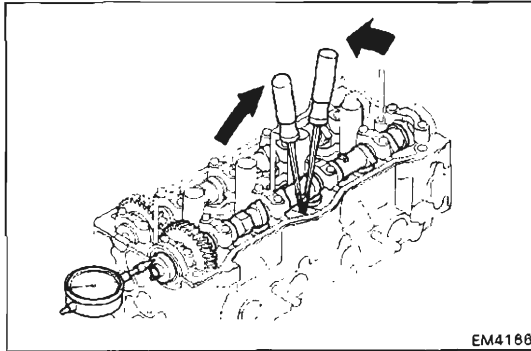
(f) Measure the Plastigage at its widest point.

Standard oil clearance: 0.035 – 0.072 mm
(0.0014 – 0.0028 in.)

Maximum oil clearance: 0.10 mm (0.0039 in.)

If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

(g) Completely remove the Plastigage.



G. Inspect camshaft thrust clearance

(a) Install the camshaft.

(See step 3 on pages EM-81 to 83)

(b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

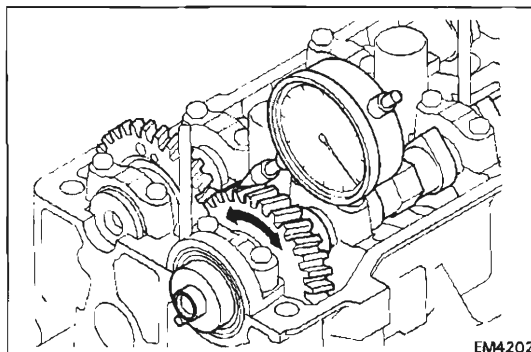
Standard thrust clearance:

Intake 0.030 – 0.085 mm
(0.0012 – 0.0033 in.)

Exhaust 0.035 – 0.090 mm
(0.0014 – 0.0035 in.)

Maximum thrust clearance: 0.11 mm (0.0043 in.)

If the thrust clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.



H. Inspect camshaft gear backlash

(a) Install the camshafts without installing the exhaust camshaft sub-gear.

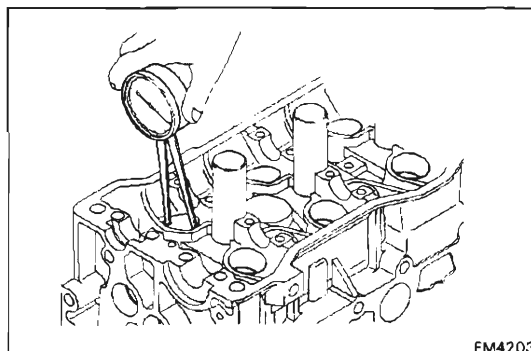
(See step 3 on page EM-81 to 83)

(b) Using a dial indicator, measure the backlash.

Standard back lash: 0.020 – 0.020 mm
(0.0008 – 0.0079 in.)

Maximum back lash: 0.30 mm (0.0188 in.)

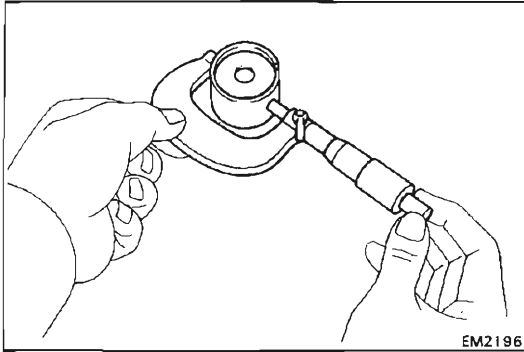
If the backlash is greater than maximum, replace the camshafts.



11. INSPECT VALVE LIFTERS AND LIFTER BORES

(a) Using a caliper gauge, measure the lifter bore diameter of the cylinder head.

Lifter bore diameter: 28.005 – 28.006 mm
(1.1026 – 1.1034 in.)



(b) Using a micrometer, measure the lifter diameter.

Lifter diameter: 27.975 – 27.985 mm
(1.1014 – 1.1018 in.)

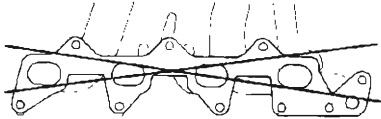
(c) Subtract the lifter diameter measurement from the lifter bore diameter measurement.

Standard oil clearance: 0.020 – 0.051 mm
(0.0008 – 0.0020 in.)

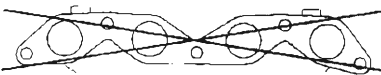
Maximum oil clearance: 0.07 mm (0.0028 in.)

If the oil clearance is greater than maximum, replace the lifter. If necessary, replace the cylinder head.

Intake Manifold



Exhaust Manifold



EM7801
EM7802

12. INSPECT INTAKE AND EXHAUST MANIFOLDS

Using precision straight edge and feeler gauge, measure the surface contacting the cylinder head for warpage.

Maximum warpage:

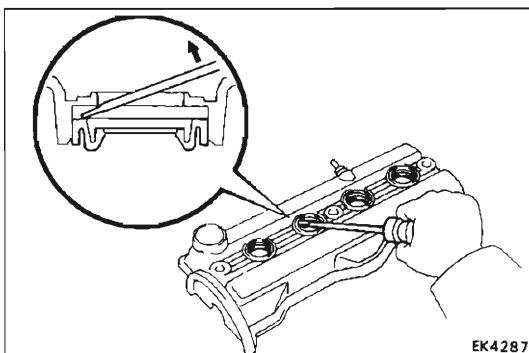
Intake 0.20 mm (0.0079 in.)

Exhaust 0.30 mm (0.0118 in.)

If warpage is greater than maximum, replace the manifold.

13. IF NECESSARY, REPLACE SPARK PLUG TUBE GASKET

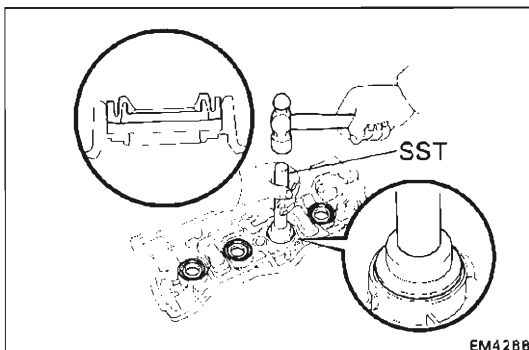
(a) Using a screwdriver, pry out the gasket.



(b) Using SST, tap in a new gasket until its surface is flush with the upper edge of the cylinder head cover.

SST 09950-10012 (09552-10010, 09560-10010)

(c) Apply a light coat of MP grease to the gasket lip.

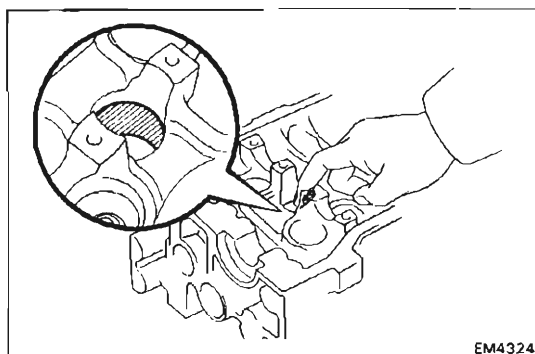


ASSEMBLY OF CYLINDER HEAD

(See pages EM-56, 57)

HINT:

- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets and oil seals with new ones.



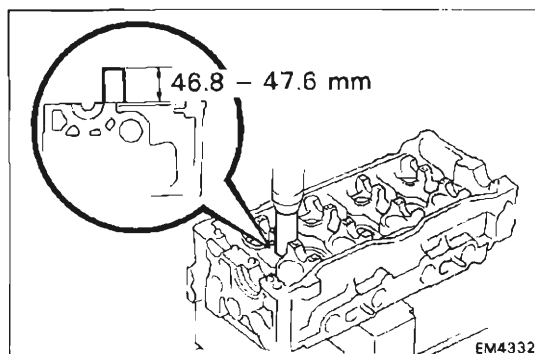
EM4324

1. INSTALL SPARK PLUG TUBES

HINT: When using a new cylinder head, spark plug tubes must be installed.

- (a) Apply adhesive to the spark plug tube hole of the cylinder head.

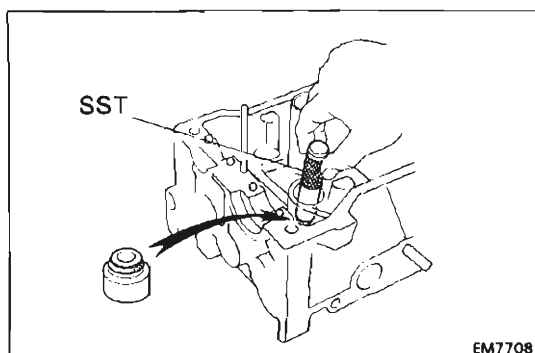
Adhesive: Part No. 08833-00070, THREE BOND 1324 or equivalent



EM4332

- (b) Using a press, press in a new spark plug tube until 46.8 – 47.6 mm (1.843 – 1.874 in.) is protruding from the cylinder head.

NOTICE: Avoid tapping a new spark plug tube in too far by measuring the amount of protrusion while pressing.

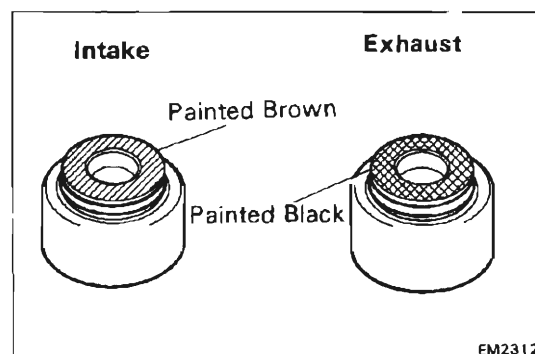


EM7708

2. INSTALL VALVES

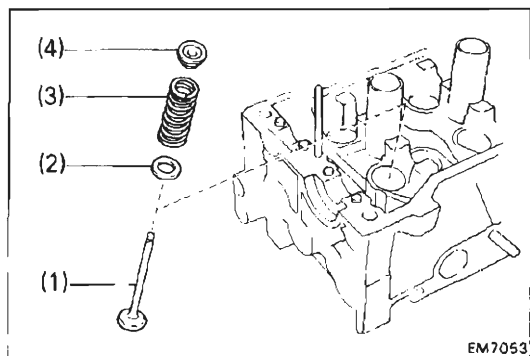
- (a) Using SST, push in a new oil seal.

SST 09201-41020



EM2312

HINT: The intake valve oil seal is brown and the exhaust valve oil seal is black.

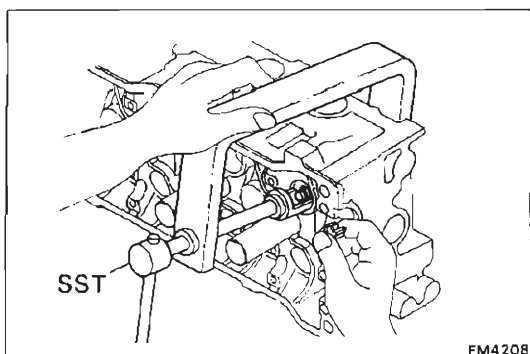


(b) Install the following parts:

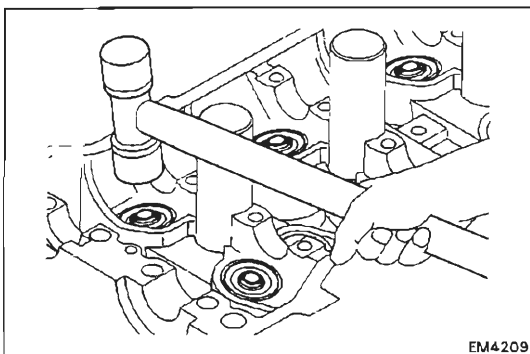
- (1) Valve
- (2) Spring seat
- (3) Valve spring
- (4) Spring retainer

(c) Using SST, compress the valve spring and place the two keepers around the valve stem.

SST 09202-70010

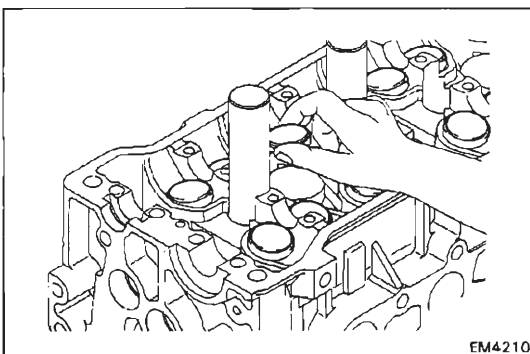


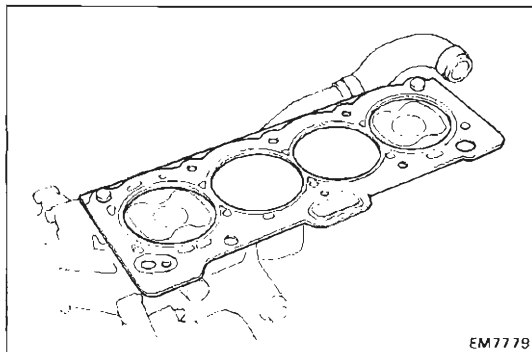
(d) Using a plastic-faced hammer, lightly tap the valve stem tip to assure proper fit.



3. INSTALL VALVE LIFTERS AND SHIMS

- (a) Install the valve lifter and shim.
- (b) Check that the valve lifter rotates smoothly by hand.





INSTALLATION OF CYLINDER HEAD

(See page EM-56, 57)

1. INSTALL CYLINDER HEAD

- (a) Place a new cylinder head gasket in position on the cylinder block.

NOTICE: Be careful of the installation direction.

- (b) Place the cylinder head in position on the cylinder head gasket.

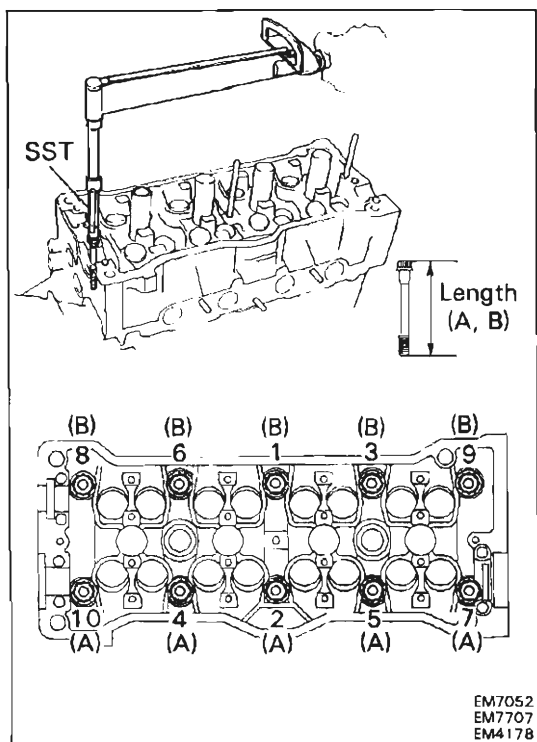
- (c) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.

- (d) Using SST, install and uniformly tighten the ten cylinder head bolts in several passes in the sequence shown.

SST 09205-16010

Torque: 610 kg-cm (44 ft-lb, 60 N·m)

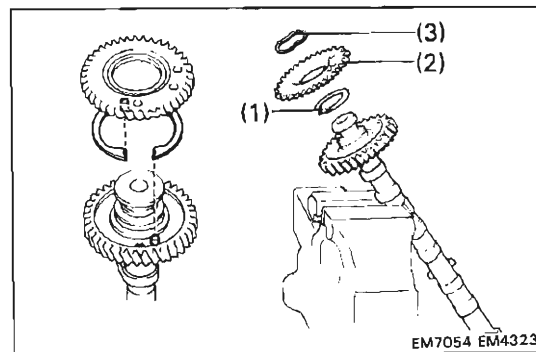
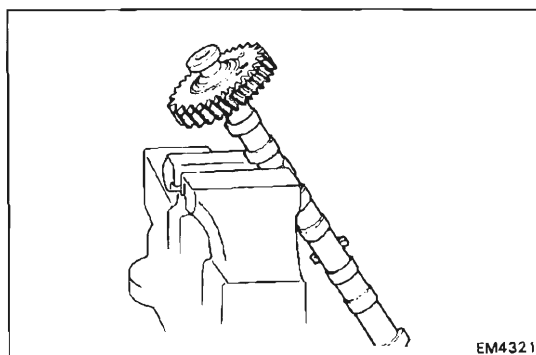
HINT: Cylinder head bolts are 90 mm (3.54 in.) and 108 mm (4.25 in.) in length. Install the 90 mm (3.54 in.) bolt (A) in RH side positions. Install the 108 mm (4.25 in.) bolts (B) in LH side position.



2. ASSEMBLE INTAKE CAMSHAFT

- (a) Mount the hexagonal wrench head portion of the camshaft in a vise.

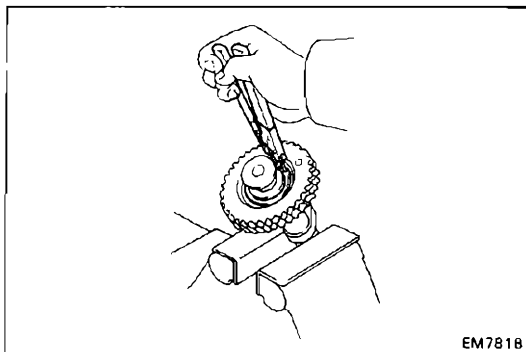
NOTICE: Be careful not to damage the camshaft.



- (b) Install the following parts:

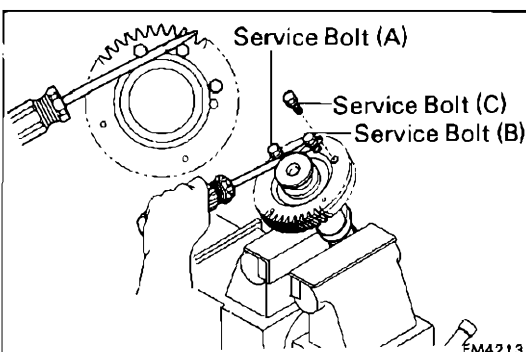
- (1) Camshaft gear spring.
- (2) Camshaft sub-gear
- (3) Wave washer

HINT: Align the pins on the gears with the gear spring ends.



EM7818

(c) Using snap ring pliers, install the snap ring.



EM4213

(d) Insert a service bolts (A) and (B) into the service hole of the camshaft sub-gear.

(e) Using a screwdriver, align the holes of the camshaft main gear and sub-gear by turning the camshaft sub-gear clockwise, and install a service bolt (C).

NOTICE: Be careful not to damage the camshaft.

3. INSTALL INTAKE AND EXHAUST CAMSHAFT

NOTICE: Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break.

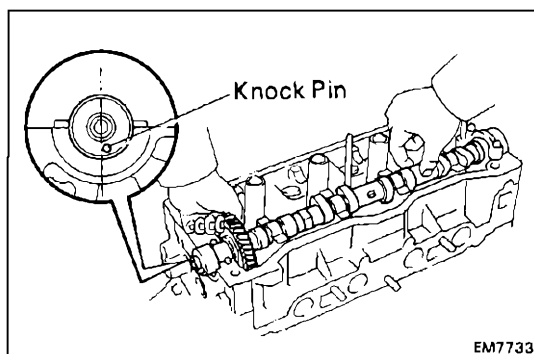
To avoid this, the following steps should be carried out.

A. Install exhaust camshaft

(a) Apply MP grease to the thrust portion of the camshaft.

(b) Place the intake camshaft at so the knock pin is located slightly counterclockwise from the vertical axis of the camshaft.

HINT: The above angle allows the No.1 and No.3 cylinder cam lobes of the exhaust camshaft to push their valve lifters evenly.

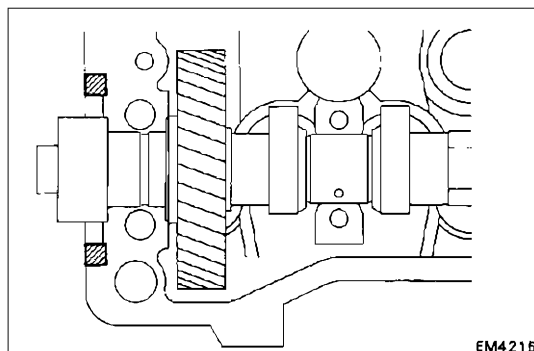


EM7733

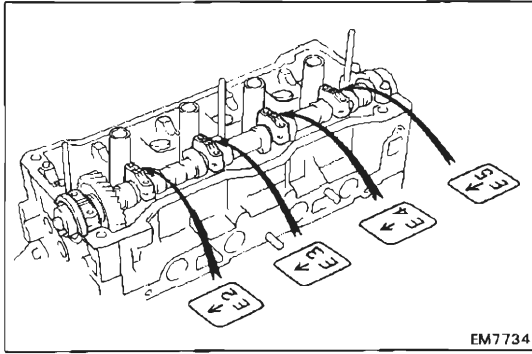
(c) Remove the old packing (FIPG) material.

(d) Apply seal packing to the cylinder head as shown in the figure.

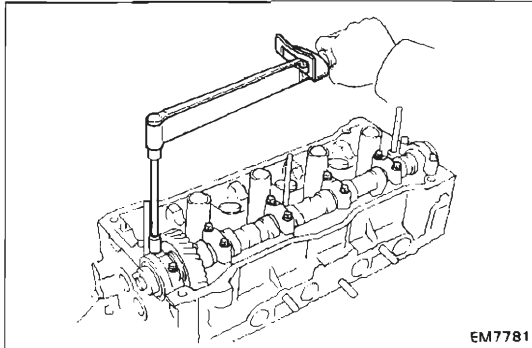
Seal packing: Part No. 08826-00080 or equivalent



EM4215

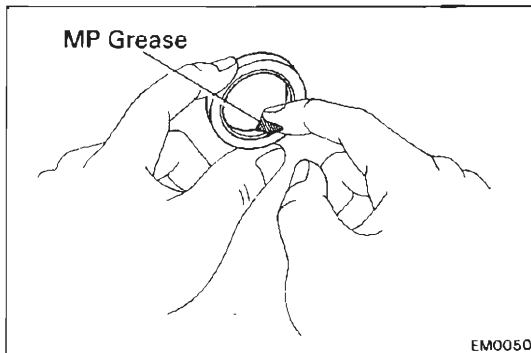


- (e) Install the five bearing caps in their proper locations.

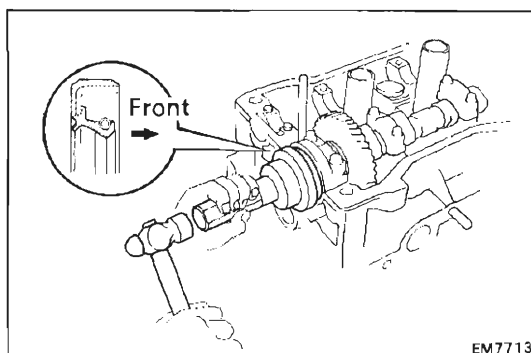


- (f) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
 (g) Install and uniformly tighten the ten bearing cap bolts in several passes in the sequence shown.

Torque: 130 kg-cm (9 ft-lb, 13 N·m)



- (h) Apply MP grease to a new oil seal lip.



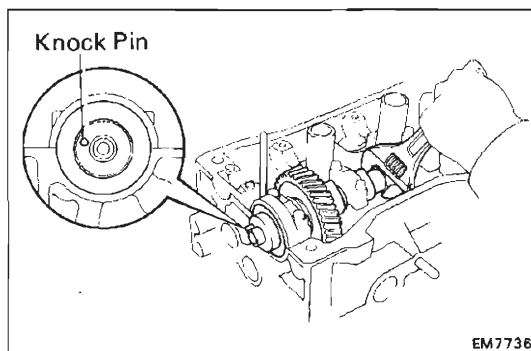
- (i) Using SST, tap in the oil seal.

SST 09223-46011

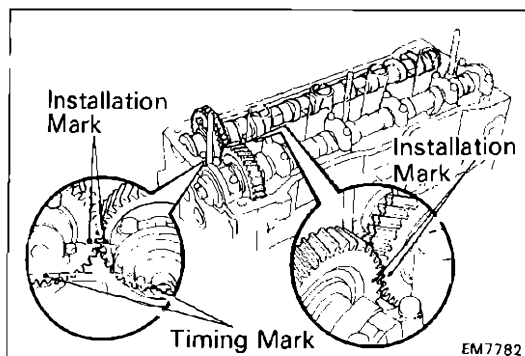
HINT:

- Do not install the oil seal with the lip facing the wrong direction.
- Insert the oil seal into the deepest part of the cylinder head.

B. Install intake camshaft



- (a) Set the knock pin of the exhaust camshaft so that the knock pin is slightly above the top of the cylinder head.



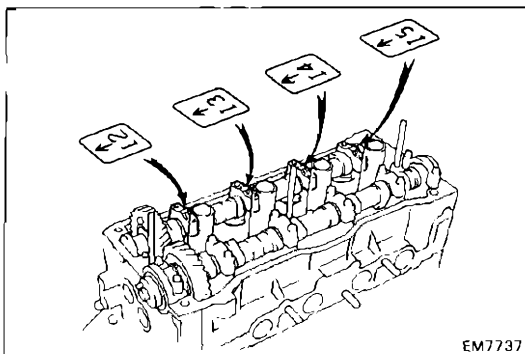
- (b) Apply MP grease to the thrust portion of the camshaft.
- (c) Engage the intake camshaft gear to the exhaust camshaft gear by matching the assembly installation marks on each gear.

NOTICE: There are also timing marks (for TDC) on each gear as shown in the illustration. Do not use these marks.

- (d) Roll down the intake camshaft onto the bearing journals while engaging gears with each other.

HINT: The above angle allows the No.1 and No.3 cylinder cam lobes of the intake camshaft to push their valve lifters evenly.

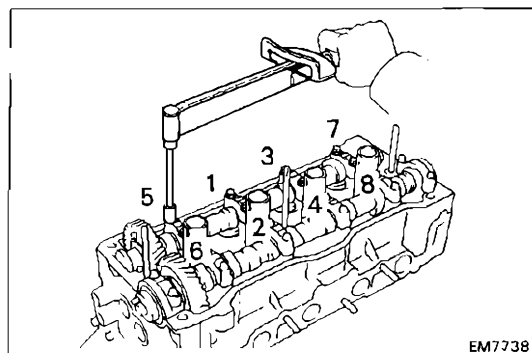
- (e) Install the four bearing caps in their proper locations.



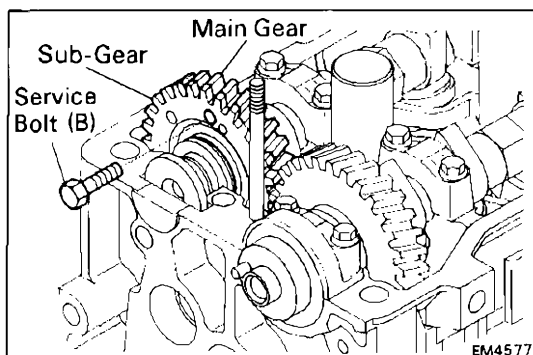
- (f) Apply a light coat of engine oil on the threads and under the heads of bearing cap bolts.

- (g) Install and uniformly tighten the eight bearing cap bolts in several passes in the sequence shown.

Torque: 130 kg-cm (9 ft-lb, 13 N·m)



- (h) Remove the service bolt (B).

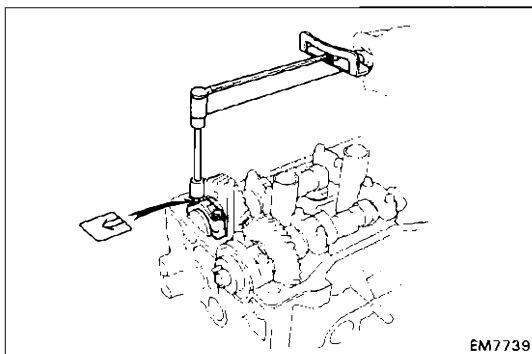


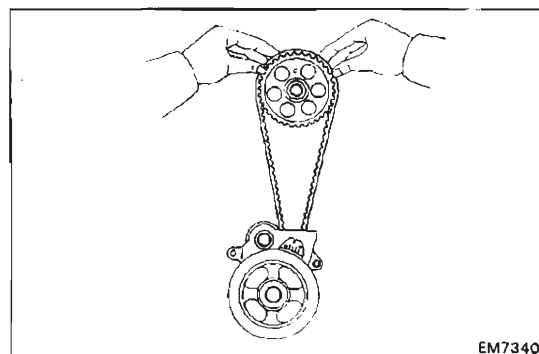
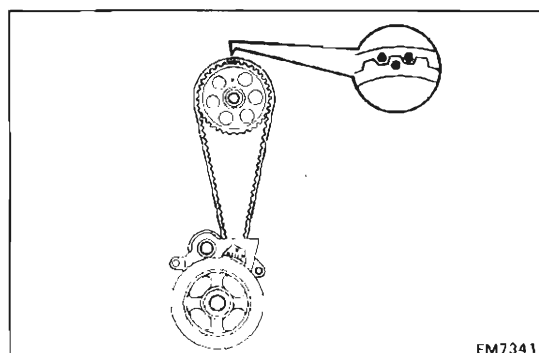
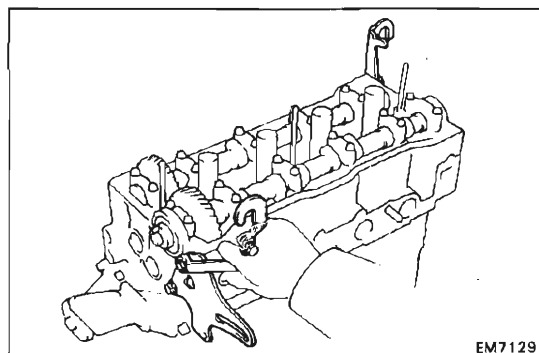
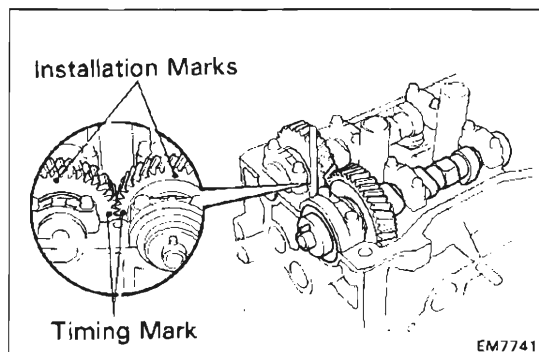
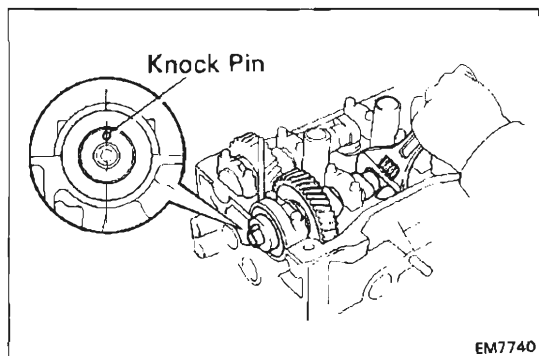
- (i) Install the No. 1 bearing cap with the arrow mark facing forward.

NOTICE: If the bearing cap does not fit properly, push the camshaft gear backwards by prying apart the cylinder head and camshaft gear with a screwdriver.

- (j) Apply a light coat of engine oil on the threads and under the heads of bearing cap bolts.
- (k) Install and alternately tighten the two bolts in several passes.

Torque: 130 kg-cm (9 ft-lb, 13 N·m)





- (l) Turn the exhaust camshaft clockwise, and set it with the knock pin facing upward.

- (m) Check that the timing marks of the camshaft gears are aligned.

HINT: The assembly installation marks are on the upside.

4. CHECK AND ADJUST VALVE CLEARANCE (See page EM-16)

Turn the camshaft and position the cam lobe upward, and check and adjust the valve clearance.

Valve clearance (Cold):

Intake 0.15 – 0.25 mm (0.006 – 0.010 in.)

Exhaust 0.20 – 0.30 mm (0.008 – 0.012 in.)

5. INSTALL ENGINE HANGERS

Install the two engine hangers with the two bolts.

Torque: 280 kg-cm (20 ft-lb, 27 N·m)

6. INSTALL FAN BELT ADJUSTING BAR

Install the adjusting bar with the two bolts.

Torque: 200 kg-cm (14 ft-lb, 20 N·m)

7. INSTALL CAMSHAFT TIMING PULLEY (See step 1 on page EM-44)

8. INSTALL TIMING BELT

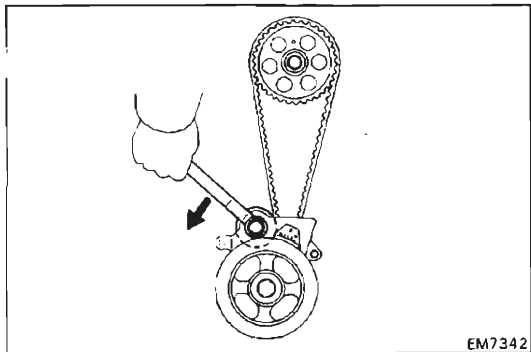
Align the matchmarks of the timing belt and camshaft timing pulley.

- (a) Remove any oil or water on the camshaft timing pulley, and keep it clean.

- (b) Install the timing belt, insuring the tension between the crankshaft timing pulley and camshaft timing pulley.

9. INSTALL VALVE TIMING

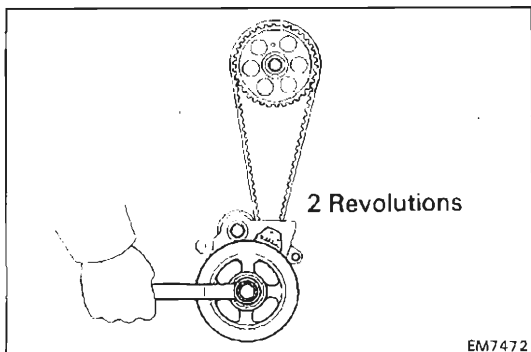
- (a) Loosen the idler pulley bolt 1/2 turn.



EM7342

- (b) Turn the crankshaft pulley two revolutions from TDC to TDC.

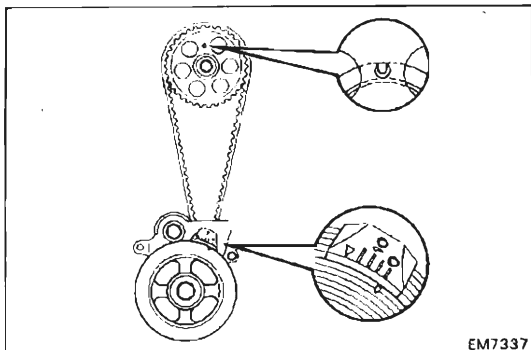
NOTICE: Always turn the crankshaft clockwise.



EM7472

- (c) Check that each pulley aligns with the timing marks as shown in the illustration.

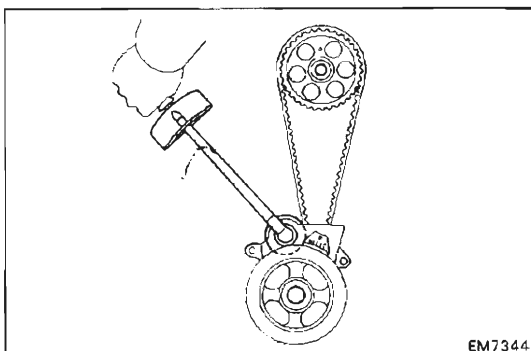
If the timing marks does not align, remove the timing belt and reinstall it.



EM7337

- (d) Tighten the idler pulley bolt.

Torque: 375 kg-cm (27 ft-lb, 37 N·m)

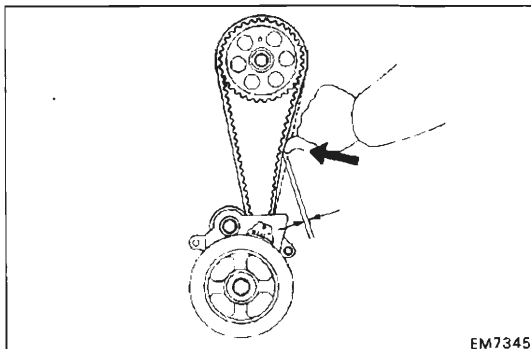


EM7344

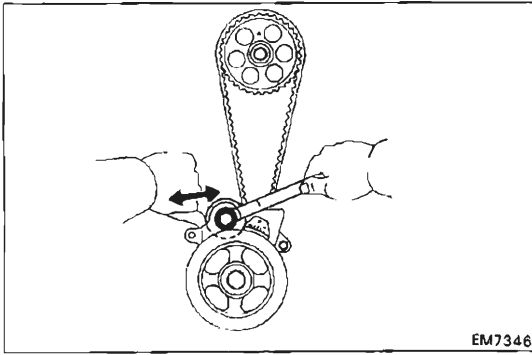
10. (REFERENCE)
INSTALL TIMING BELT TENSION

Check that there is belt tension at the portion indicated in the illustration.

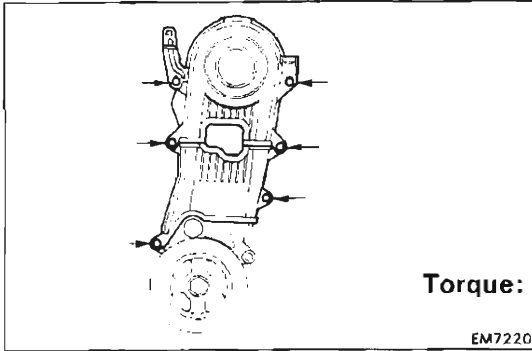
Deflection: 5 – 6 mm (0.20 – 0.24 in.)
 at 2 kg (4.4 lb, 20 N)



EM7345



If the deflection is not as specified, adjust with the idler pulley.



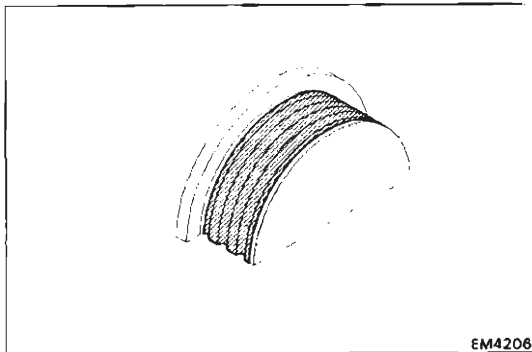
Torque: 80 kg-cm (69 in.-lb, 7.8 N·m)

11. INSTALL NO.2 AND NO.3 TIMING BELT COVERS

Install the No.2, No.3 timing belt covers and engine wire bracket with the six bolts.

12. INSTALL SPARK PLUGS (See page IG-8)

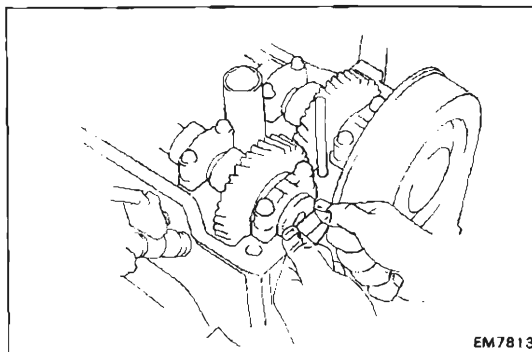
Torque: 180 kg-cm (13 ft-lb, 18 N·m)



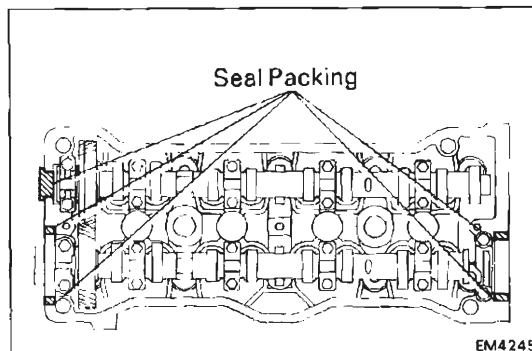
13. INSTALL SEMI-CIRCULAR PLUG

- (a) Remove any old packing (FIPG) material.
- (b) Apply seal packing to the circular plug.

Seal packing: Part No. 08826-00080 or equivalent



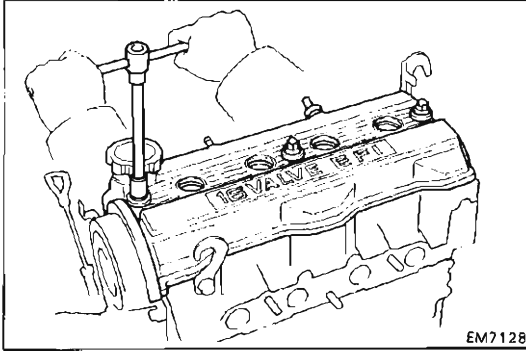
- (c) Install the semi-circular plug to the cylinder head.



14. INSTALL CYLINDER HEAD COVER

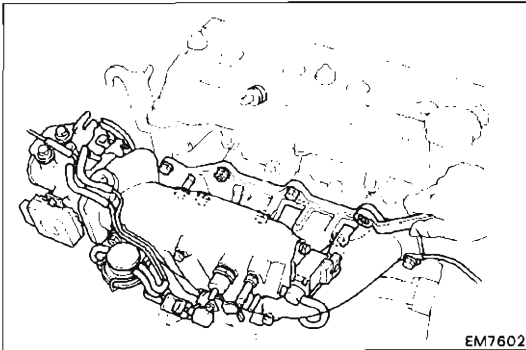
- (a) Remove any old packing (FIPG) material.
- (b) Apply seal packing to the cylinder head as shown in the figure.

Seal packing: Parts No. 08826-00080 or equivalent



- (c) Install the gasket to the head cover.
- (d) Install the head cover with the three grommets and cap nuts.

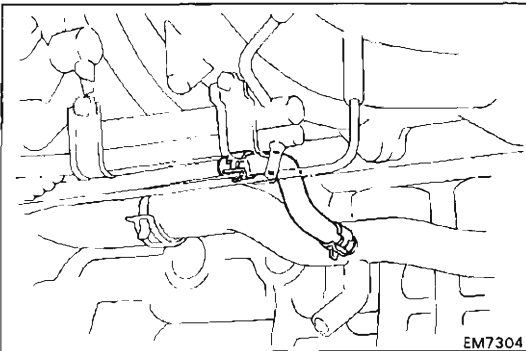
Torque: 80 kg-cm (69 in.-lb, 7.8 N·m)



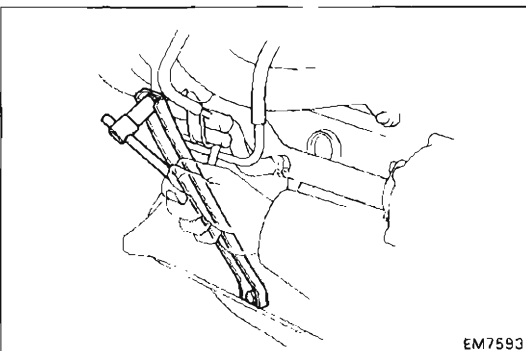
15. INSTALL INTAKE MANIFOLD (2WD)

- (a) Install a new gasket and the intake manifold with the seven bolts, ground strap and two nuts.

Torque: 195 kg-cm (14 ft-lb, 19 N·m)



- (b) Connect the water by-pass hose to the air pipe.



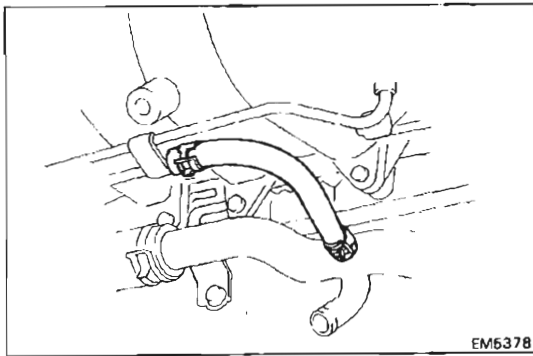
- (c) Install the manifold stay with the two bolts.

Torque:

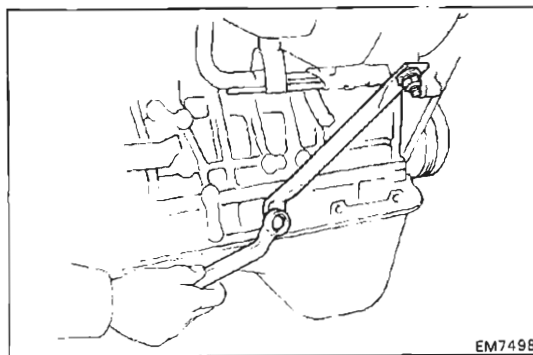
12 mm bolt head 195 kg-cm (14 ft-lb, 19 N·m)

14 mm bolt head 400 kg-cm (29 ft-lb, 39 N·m)

(4WD)



(b) Connect the water by-pass hose to the air pipe.



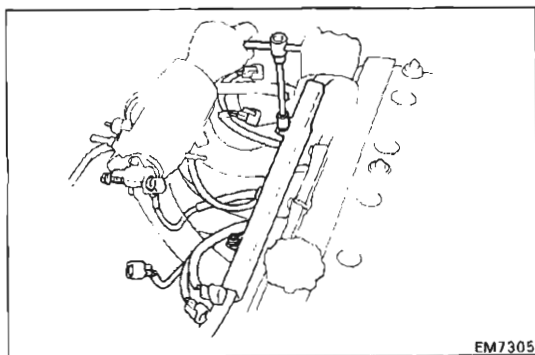
(c) Install the manifold stay with the bolt and nut.

Torque: 195 kg-cm (14 ft-lb, 19 N·m)

16. (4WD)

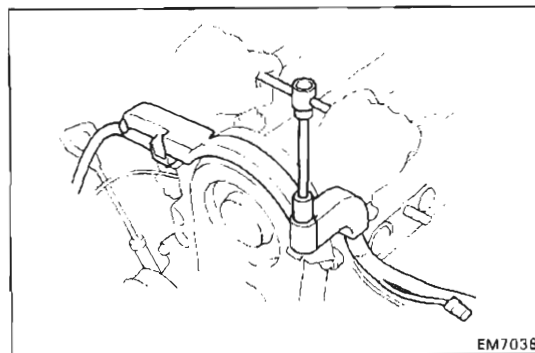
17. INSTALL ENGINE WIRE TO INTAKE MANIFOLD

- (a) Install the engine wire with the three bolts.
- (b) Install the engine wire the engine to vacuum pipe with the wire clamp.
- (c) Connect the following connectors:
 - Throttle position sensor connector
 - ISC valve connector
 - (2WD w/ EGR system)
EGR VSV connector
 - Cold start injector connector



18. INSTALL ENGINE WIRE TO NO.3 TIMING BELT COVER

- (a) Install the wire clamp on engine wire to the wire bracket.
- (b) Install the engine wire with the bolt.
- (c) Connect the following connectors and wire:
 - Alternator connector
 - Alternator wire
 - Oil pressure switch connector



19. INSTALL INJECTORS AND DELIVERY PIPE (See steps 1 and 3 to 6 on pages FI-116 to 119)

20. (4WD)

21. INSTALL COLD START INJECTOR PIPE

(See step 2 on page FI-108)

22. INSTALL WATER INLET AND INLET HOUSING

- (a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the inlet housing and cylinder head.

- Using a razor blade and gasket scraper, remove all the oil packing (FIPG) material from the gasket surfaces and sealing groove.
- Thoroughly clean all components to remove all the loose material.
- Using a non-residue, clean both sealing surfaces.

- (b) Apply seal packing to the inlet housing groove.

Seal packing: Part No. 08826-00100 or equivalent

- Install a nozzle that has been cut with a 2 – 3 mm (0.08 – 0.12 in.) opening.

HINT: Avoid applying an excessive amount to the surface.

- Parts must be assembled within 15 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

- (c) Install the water inlet housing with the bolt and two nuts.

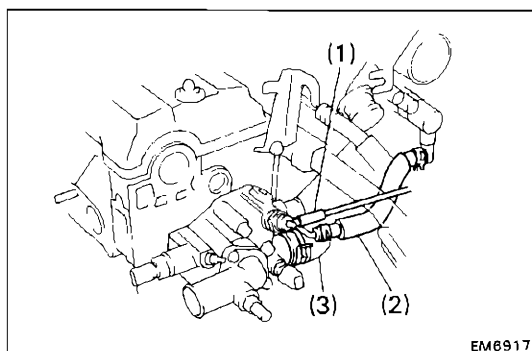
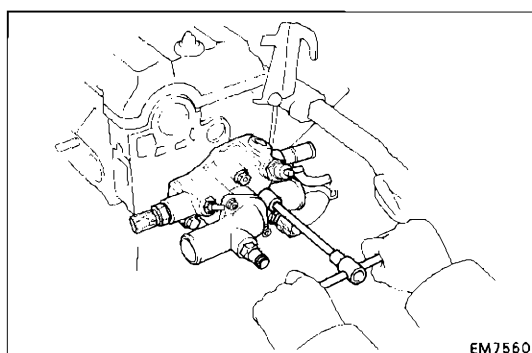
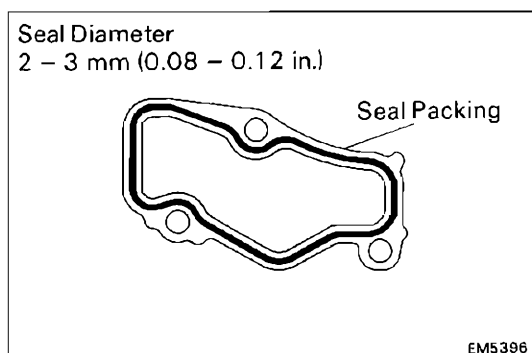
Torque: 200 kg-cm (14 ft-lb, 30 N·m)

- (d) Connect the following hoses:

- (1) BSVS vacuum hose(s)
- (2) Water by-pass hose
- (3) Inlet water hose

- (e) Connect the following connectors:

- Water temperature sender gauge connector
- Water temperature sensor connector
- Start injector time switch connector



23. INSTALL WATER OUTLET

- (a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the water outlet cylinder head.
 - Using a razor blade and gasket scraper, remove all the oil packing (FIPG) material from the gasket surfaces and sealing groove.
 - Thoroughly clean all components to remove all the loose material.
 - Using a non-residue, clean both sealing surfaces.
- (b) Apply seal packing to the water outlet groove.

Seal packing: Part No. 08826-00100 or equivalent

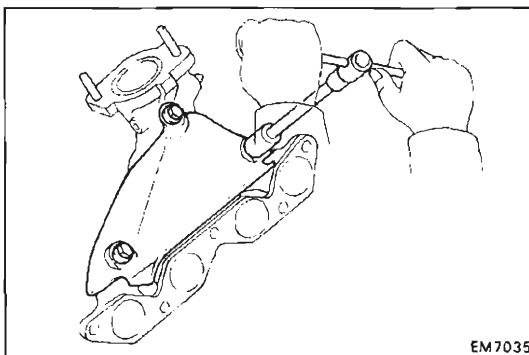
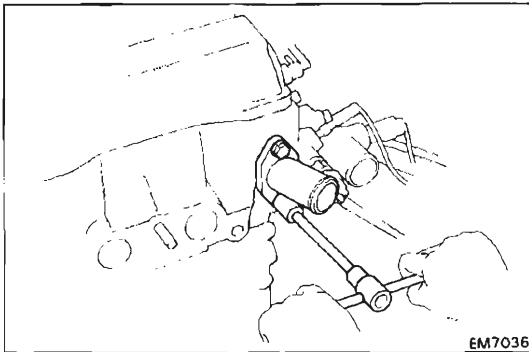
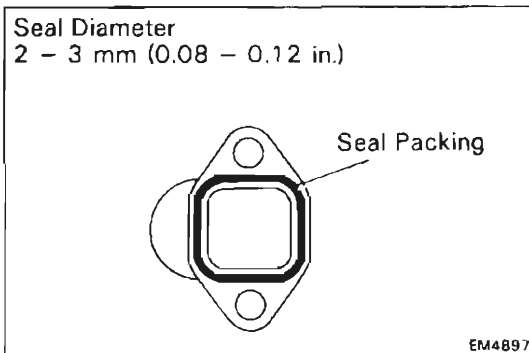
- Install a nozzle that has been cut with a 2 – 3 mm (0.08 – 0.12 in.) opening.

HINT: Avoid applying an excessive amount to the surface.

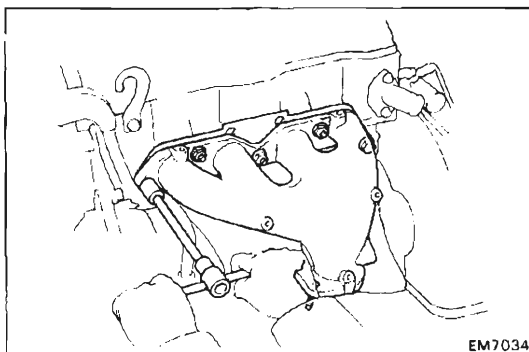
- Parts must be assembled within 15 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

- (c) Install the water outlet with the two bolts.

Torque: 150 kg-cm (11 ft-lb, 15 N·m)

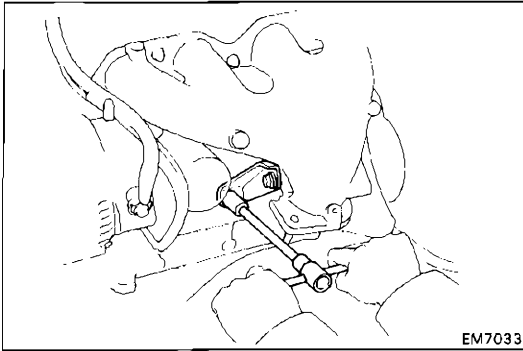
**24. INSTALL EXHAUST MANIFOLD (2WD)**

- (a) Install the lower heat insulator to the exhaust manifold with the three bolts.



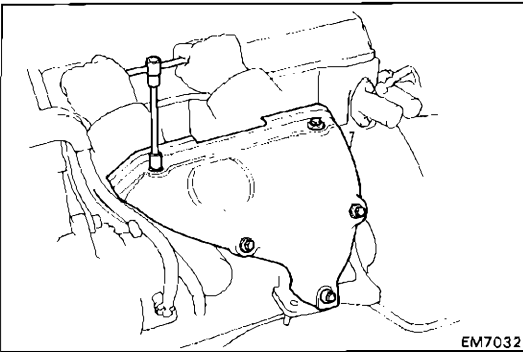
- (b) Install a new gasket and the exhaust manifold with the two bolts and three nuts.

Torque: 250 kg-cm (18 ft-lb, 25 N·m)



(c) Install the manifold stay with the two bolts.

Torque: 400 kg-cm (29 ft-lb, 39 N·m)



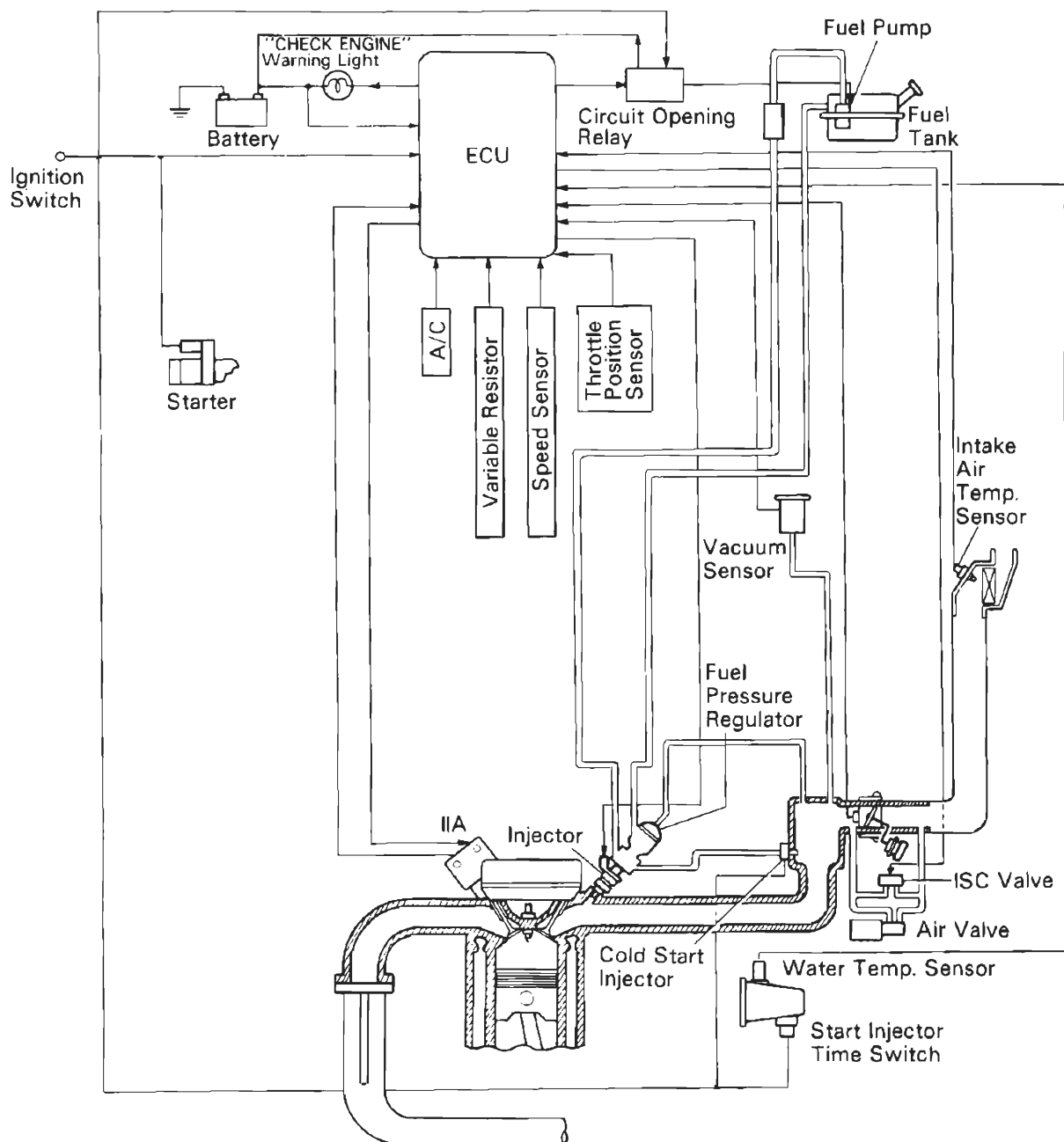
(d) Install the upper heat insulator with the five bolts.

EFI SYSTEM

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Idle-up System (w/ Air Flow Meter)	FI-156
Idle Speed Control (ISC) Valve (4A-FE)	FI-158

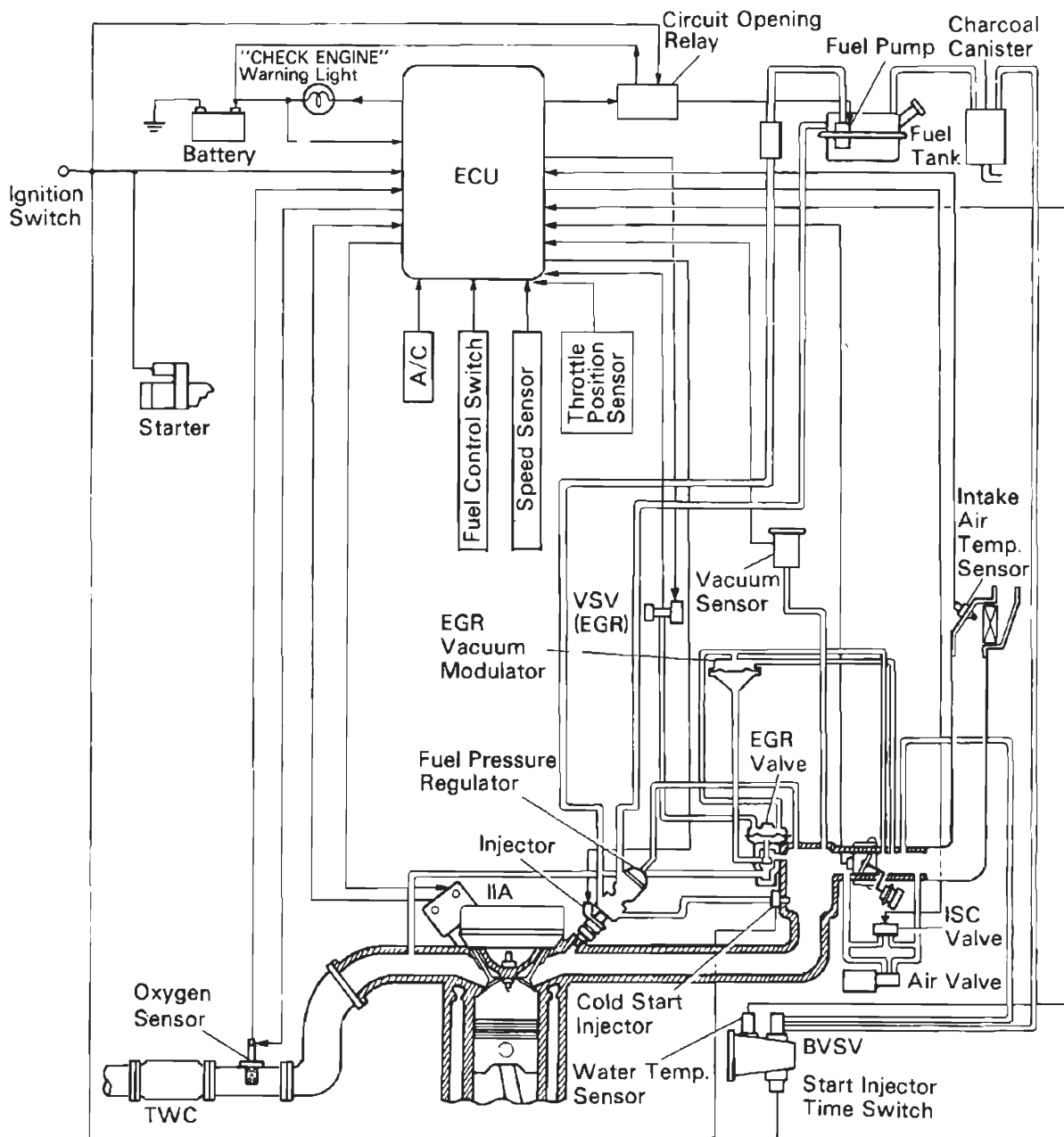
SYSTEM DESCRIPTION

4A-FE (2WD, w/o EGR System)



SYSTEM DESCRIPTION (Cont'd)

4A-FE (2WD, w/ EGR System)



The EFI system is composed of three basic sub-systems: Fuel, Air Induction and Electronic Control System.

FUEL SYSTEM

Fuel is supplied under constant pressure to the EFI injectors by an electric fuel pump. The injectors inject a metered quantity of fuel into the intake ports in accordance with signals from the ECU (Electronic Control Unit).

AIR INDUCTION SYSTEM

The air induction system provides sufficient air for engine operation.

ELECTRONIC CONTROL SYSTEM

4A-FE, 4A-GE engines are equipped with a Toyota Computer Control System (TCCS) which centrally controls the EFI, ESA, Diagnosis systems, etc. by means of an Electronic Control Unit (ECU-formerly EFI computer) employing a microcomputer.

The ECU, the TCCS controls the following functions:

1. Electronic Fuel Injection (EFI)

The ECU receives signals from various sensors indicating changing engine operating conditions such as:

- Intake manifold absolute pressure (w/o Air flow meter)
- Intake air volume (w/ Air flow meter)
- Intake air temperature
- Coolant temperature
- Engine rpm
- Throttle valve opening valve
- Exhaust oxygen content (w/ TWC) etc.

These signals are utilized by the ECU to determine the injection duration necessary for an optimum air-fuel ratio.

2. Electronic Spark Advance (ESA)

The ECU is programmed with data for optimum ignition timing under any and all operating conditions. Using data provided by sensors which monitor various engine functions (rpm, coolant temperature, etc.), the microcomputer (ECU) triggers the spark at precisely the right instant. (See IG section)

3. Diagnosis

The ECU detects any malfunctions or abnormalities in the sensor network and lights a "CHECK ENGINE" warning light on the instrument panel. At the same time, the trouble is identified and a diagnostic code is recorded by the ECU. The diagnostic code can be read by the number of blinks of the check engine warning light when terminals TE1 and E1 are connected. The diagnostic codes are referred to the later page.
(See pages FI-28 to 31)

4. Fail-Safe Function

In the event of the sensor malfunctioning, a back-up circuit will take over to provide minimal driveability, and the "CHECK ENGINE" warning light will illuminate.

PRECAUTIONS

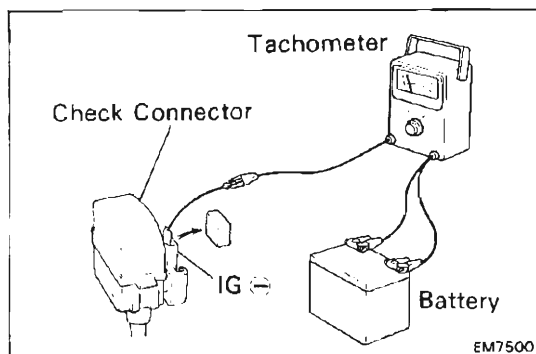
1. Before working on the fuel system, disconnect the negative (—) terminal from the battery.

HINT: Any diagnostic code retained by the computer will be cleared when the battery terminal is removed. Therefore, if necessary, read the diagnosis before removing the battery terminal.

2. (w/ AIRBAG)
Work must be started after approx. 20 seconds or longer from the time the ignition switch is turned to the "LOCK" position and the negative (—) terminal cable is disconnected from the battery.
3. When working on the fuel system, do not smoke or work near any fire hazard.
4. Keep gasoline off rubber or leather parts.

INSPECTION PRECAUTIONS

MAINTENANCE PRECAUTIONS

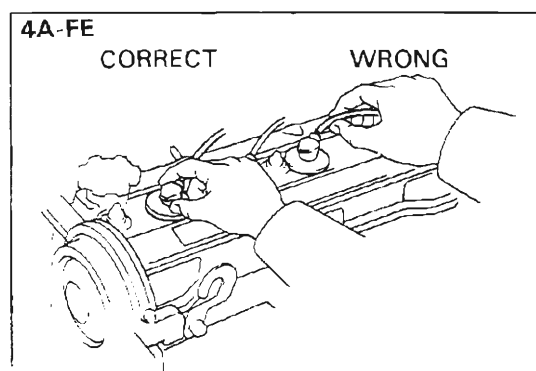


1. CHECK CORRECT ENGINE TUNE-UP
2. PRECAUTIONS WHEN CONNECTING GAUGE

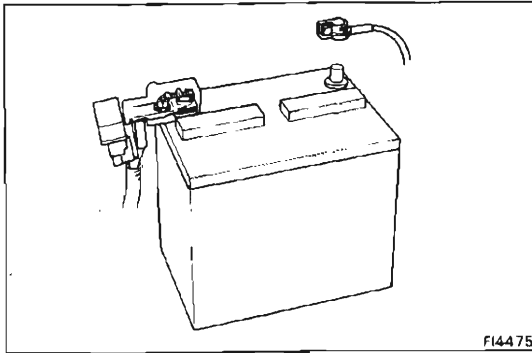
(a) Connect the tachometer test probe to the IG terminal of the check connector.

LOCATION: See page FI-133

(b) Use the battery as the power source for the timing light, tachometer, etc.

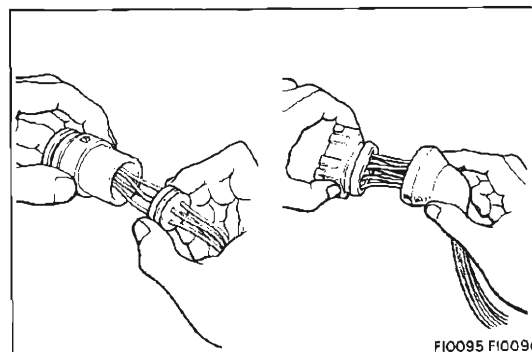
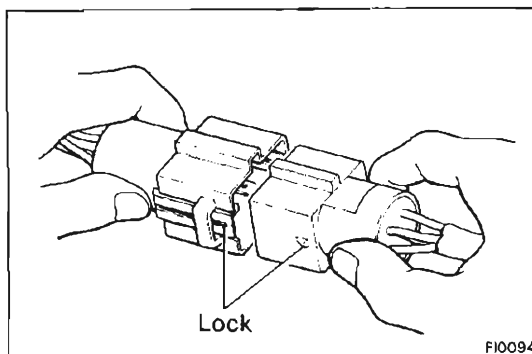
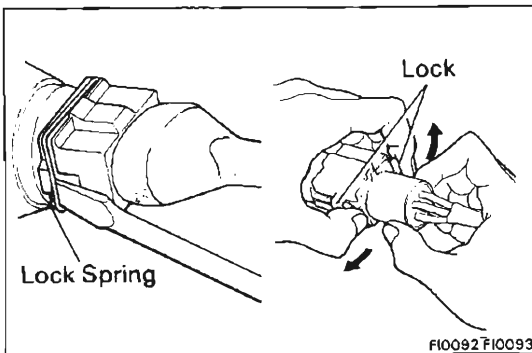


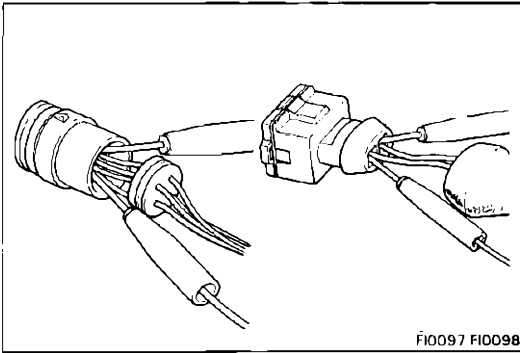
3. IN EVENT OF ENGINE MISFIRE, THE CATALYTIC CONVERTER MAY OVERHEAT. THEREFORE, THE FOLLOWING PRECAUTIONS SHOULD BE TAKEN
 - (a) Check proper connection of battery terminals, etc.
 - (b) Handle high-tension cords carefully.
 - (c) After repair work, check that all ignition system wirings are reconnected securely.
 - (d) When cleaning the engine compartment, be especially careful to protect the electrical system from water.
4. PRECAUTIONS WHEN HANDLING OXYGEN SENSOR
 - (a) Do not allow the oxygen sensor to receive any physical impact or shocks.
 - (b) Do not allow water to come into contact with the sensor.



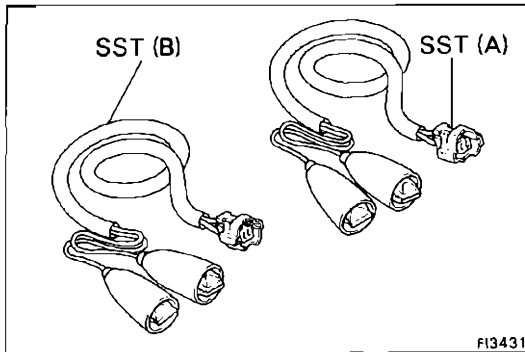
ELECTRONIC CONTROL SYSTEM

1. Before removing EFI wiring connectors, terminals, etc., first disconnect power by either turning OFF the ignition switch or disconnecting the battery terminals.
2. When installing the battery, be especially careful not to incorrectly connect the positive (+) and negative (-) cables.
3. Do not permit parts to touch during removal or installation. Handle all EFI parts carefully and, in particular, the ECU.
4. Take great care during troubleshooting as there are numerous transistor circuits and even slight terminal contact can cause further troubles.
5. Do not open the ECU cover.
6. When inspecting during rainy weather, take care to prevent entry of water. Also, when washing the engine compartment, prevent water from getting on the EFI parts and wiring connectors.
7. Parts should be replaced as an assembly.
8. Care is required when pulling out and inserting wiring connectors.
 - (a) To pull the connector out, release the lock and pull on the connector.
 - (b) Fully insert the connector and check that it is locked.



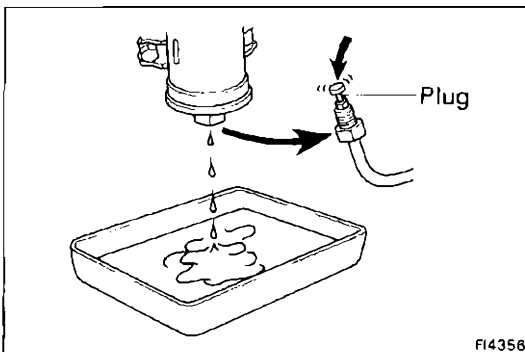


- (b) Insert the tester probe into the connector from wiring side when checking the continuity, amperage or voltage.
- (c) Do not apply unnecessary force to the terminal.
- (d) After the check, securely install the water-proofing rubber on the connector.



10. Use SST for inspection or test of the injector, cold start injector or their wiring connectors.

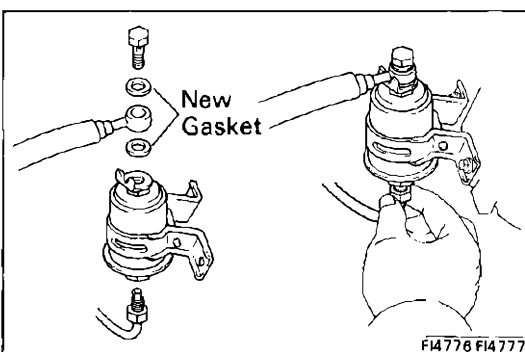
SST 09842-30055 (A) and 09842-30070 (B)



FUEL SYSTEM

1. When disconnecting the flare nut or union bolt on the high pressure pipe union, observe the following procedure.

- (a) Put a container under the connection.
- (b) Slowly loosen the connection.
- (c) Disconnect the connection.
- (d) Plug the connection with a rubber plug.



2. When connecting the flare nut or union bolt on the high pressure pipe union, observe the following procedure.

(Union bolt type)

- (a) Always use a new gasket.
- (b) Hand tighten the union bolt.
- (c) Torque the bolt to the specified torque.

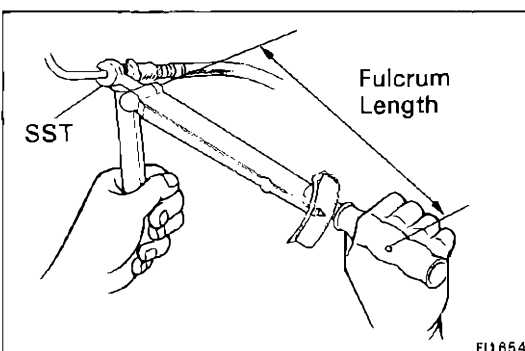
(Flare nut type)

- (a) Apply a thin coat of oil to the flare and tighten the flare nut.
- (b) Then using SST, torque the unit to the specified torque.

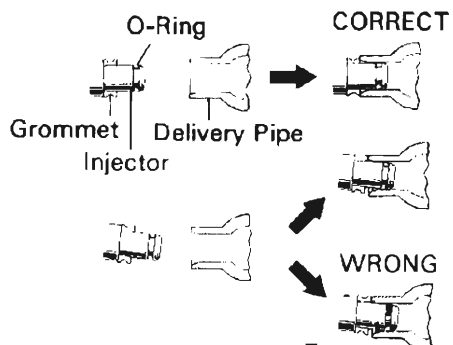
SST 09631-22020

Torque: 310 kg-cm (22 ft-lb, 30 N·m)

HINT: Use a torque wrench with a fulcrum length of 30 cm (11.81 in.).



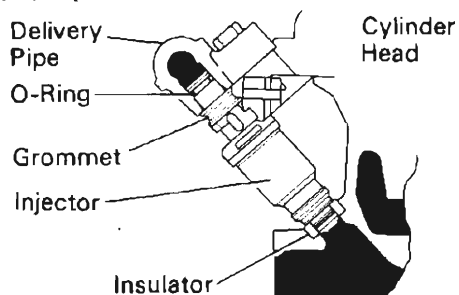
4A-FE (Ex. Australia)



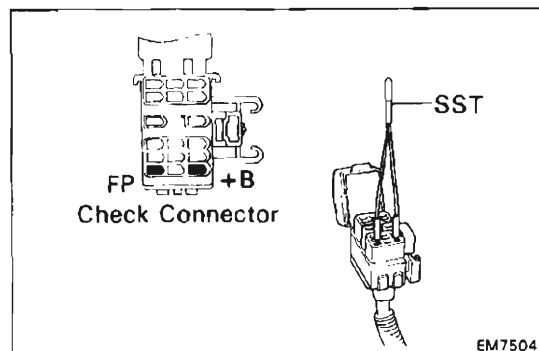
3. Take the following precautions when removing and installing the injectors.

- (a) Never reuse the O-ring.
- (b) When placing an O-ring on the injector, use care not to damage it in any way.
- (c) Lubricate the O-ring with spindle oil or gasoline before installing. Never use engine, gear or brake oil.

4A-FE (Ex. Australia)



4. Install the injector to the delivery pipe and cylinder head as shown in the figure.



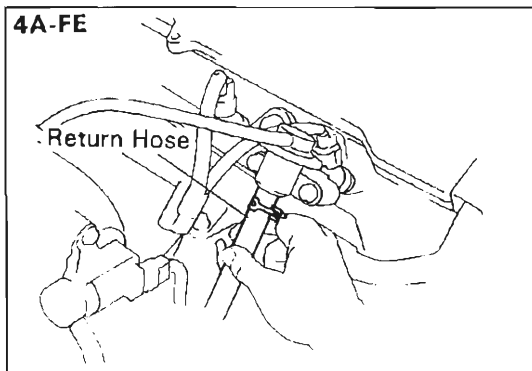
5. Confirm that there are no fuel leaks after performing maintenance on the fuel system.

- (a) With engine stopped, turn the ignition switch ON.
- (b) Using SST, connect terminals +B and FP of the check connector.

SST 09843-18020

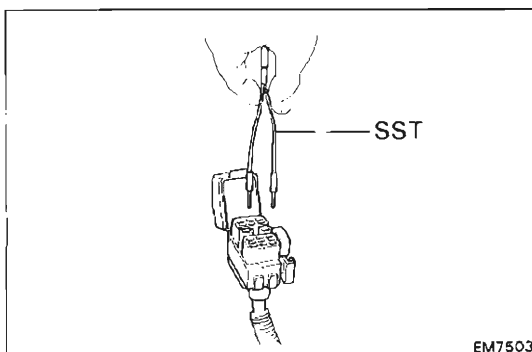
LOCATION: See page FI-133

4A-FE



- (c) When the fuel return hose is pinched, the pressure within high pressure line will rise to approx. 4 kg/cm² (57 psi, 392 kPa). In this state, check to see that there are no leaks from any part of the fuel system.

NOTICE: Always pinch the hose. Avoid bending the hose as it may cause the hose to crack.



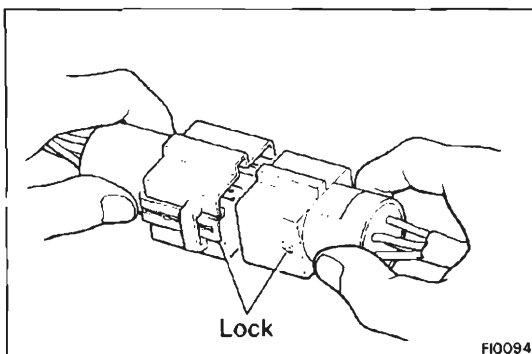
- (d) Remove SST from the check connector.
SST 09843-18020

EM7503

TROUBLESHOOTING

TROUBLESHOOTING HINTS

1. Engine trouble are usually not caused by the EFI system. When troubleshooting, always firstly check the condition of the other systems.
 - (a) Electronic source
 - Battery
 - Fusible links
 - Fuses
 - (b) Body ground
 - (c) Fuel supply
 - Fuel leakage
 - Fuel filter
 - Fuel pump
 - (d) Ignition system
 - Spark plugs
 - High-tension cords
 - IIA or Distributor
 - Ignition coil
 - Igniter
 - (e) Air induction system
 - Vacuum leaks
 - (f) Emission control system
 - PCV system
 - EGR system (w/ EGR system)
 - (g) Others
 - Ignition timing
 - Idle speed
 - etc.

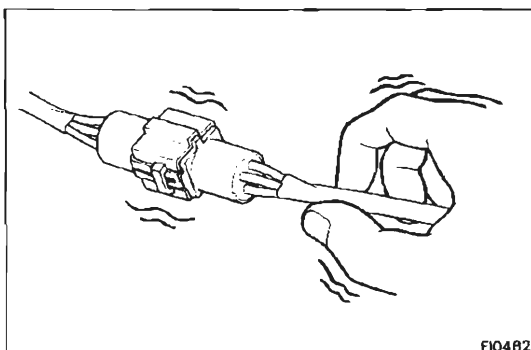


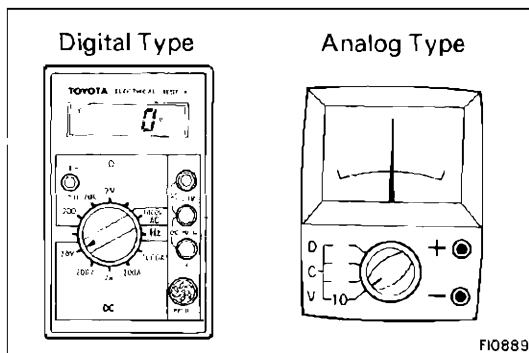
2. The most frequent cause of problems is simply a bad contact in wiring connectors. Always check that connections are secure.

When inspecting the connector, pay particular attention to the following points:

- (a) Check to see that the terminals are not bent.
- (b) Check to see that the connector is pushed in completely and locked.
- (c) Check to see that there is no signal change when the connector is slightly tapped or wiggled.

3. Sufficiently troubleshooting for other causes before replacing the ECU, as the ECU is high quality and expensive.

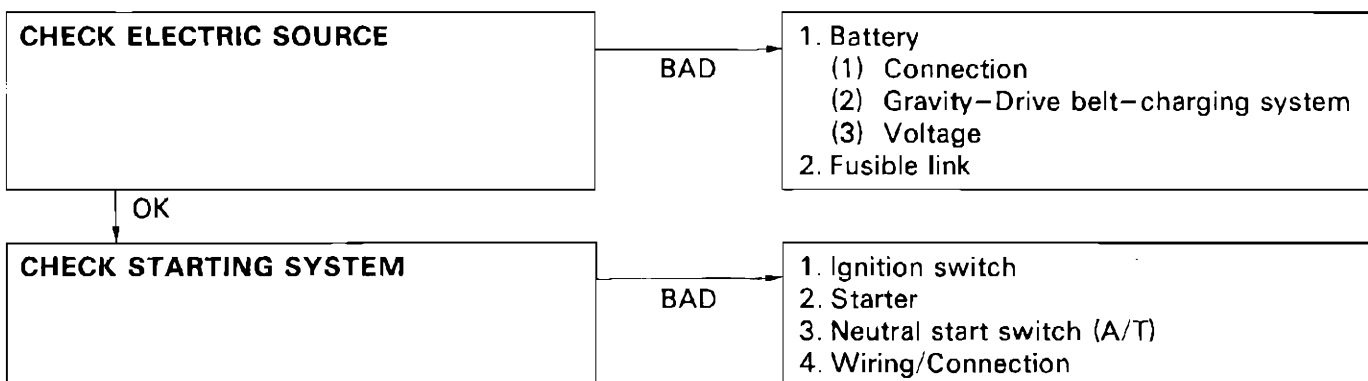




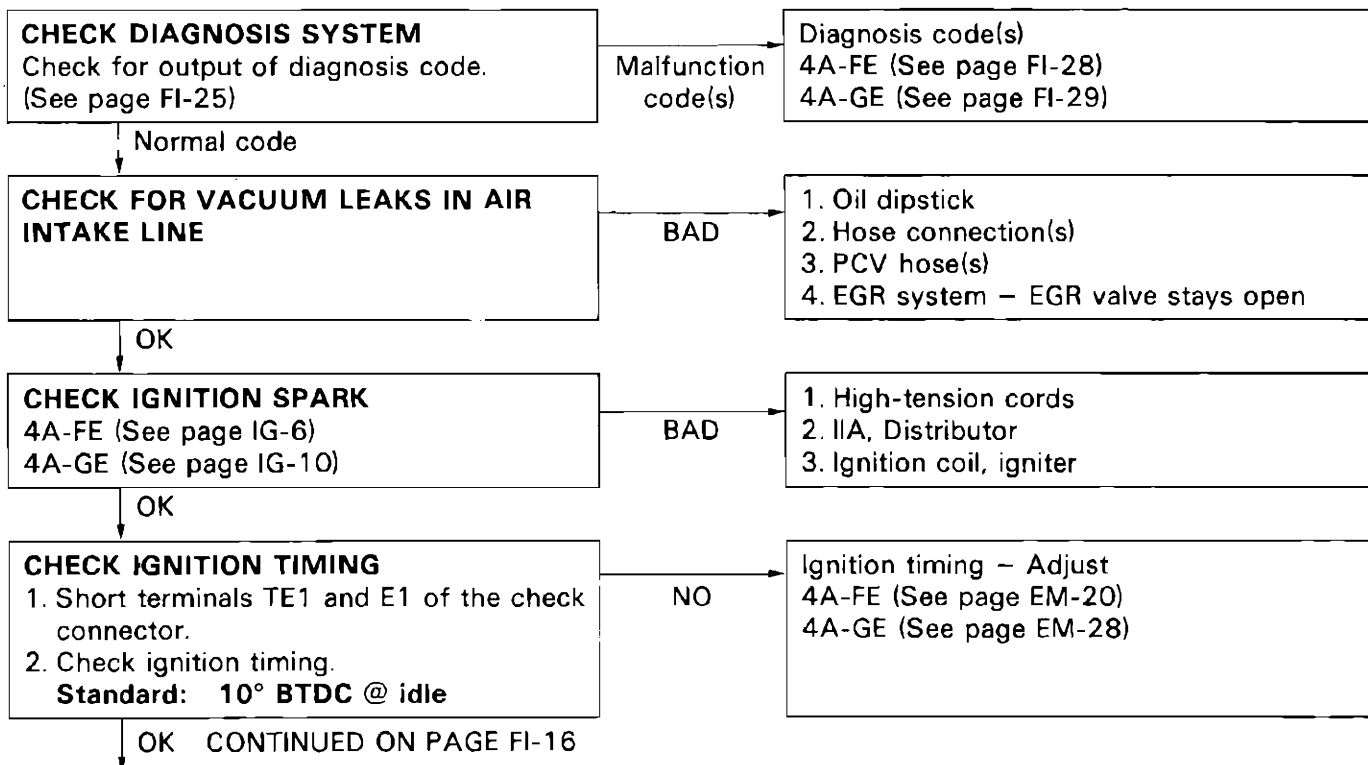
4. Use a volt/ohmmeter with high impedance (10 k Ω /V minimum) for troubleshooting of the electrical circuit. (See page FI-34)

TROUBLESHOOTING PROCEDURES

SYMPTOM — DIFFICULT TO START OR NO START (ENGINE WILL NOT CRANK OR CRANKS SLOWLY)



SYMPTOM — DIFFICULT TO START OR NO START (CRANKS OK)



OK CONTINUED FROM PAGE FI-15

CHECK FUEL SUPPLY TO INJECTOR

1. Fuel in tank
2. Fuel pressure in fuel line
 - (1) Connect terminals +B and FP of the check connector.
 - (2) Fuel pressure at fuel hose of fuel filter can be felt. (See page FI-95)

BAD

1. Fuel line — Leakage — deformation
2. Fuse
3. Circuit opening relay (See page FI-135)
4. Fuel pump (See page FI-94)
5. Fuel filter
6. Fuel pressure regulator (See page FI-109)

OK

(w/ AIR FLOW METER)**CHECK FUEL PUMP SWITCH IN AIR FLOW METER**

Check continuity between terminals FC and E1 while measuring plate of air flow meter is open.

BAD

Air flow meter (See page FI-120)

OK

CHECK SPARK PLUGS**Standard: 0.8 mm (0.031 in.)**

HINT: Check compression pressure and valve clearance if necessary.

NO

1. Spark plugs
2. Compression pressure
Minimum: 10.0 kg/cm²
(142 psi, 981 kPa)
at 250 rpm
3. Valve clearance (Cold)
Standard: IN 0.15 — 0.25 mm
(0.006 — 0.010 in.)
EX 0.20 — 0.30 mm
(0.008 — 0.012 in.)

 BAD
 (ALL)
 (Plugs)
 (WET)

1. Injectors — shorted or leaking
2. Injector wiring — short circuited
3. Cold start injector — leakage (See page FI-105)
4. Start injector time switch (See page FI-137)

OK

CHECK AUXILIARY AIR VALVE

(See page FI-130)

BAD

1. Auxiliary air valve
2. Water by-pass hose(s)
3. Air hose(s)

OK

CHECK INTAKE VALVE

BAD

Intake valve — carbon deposits

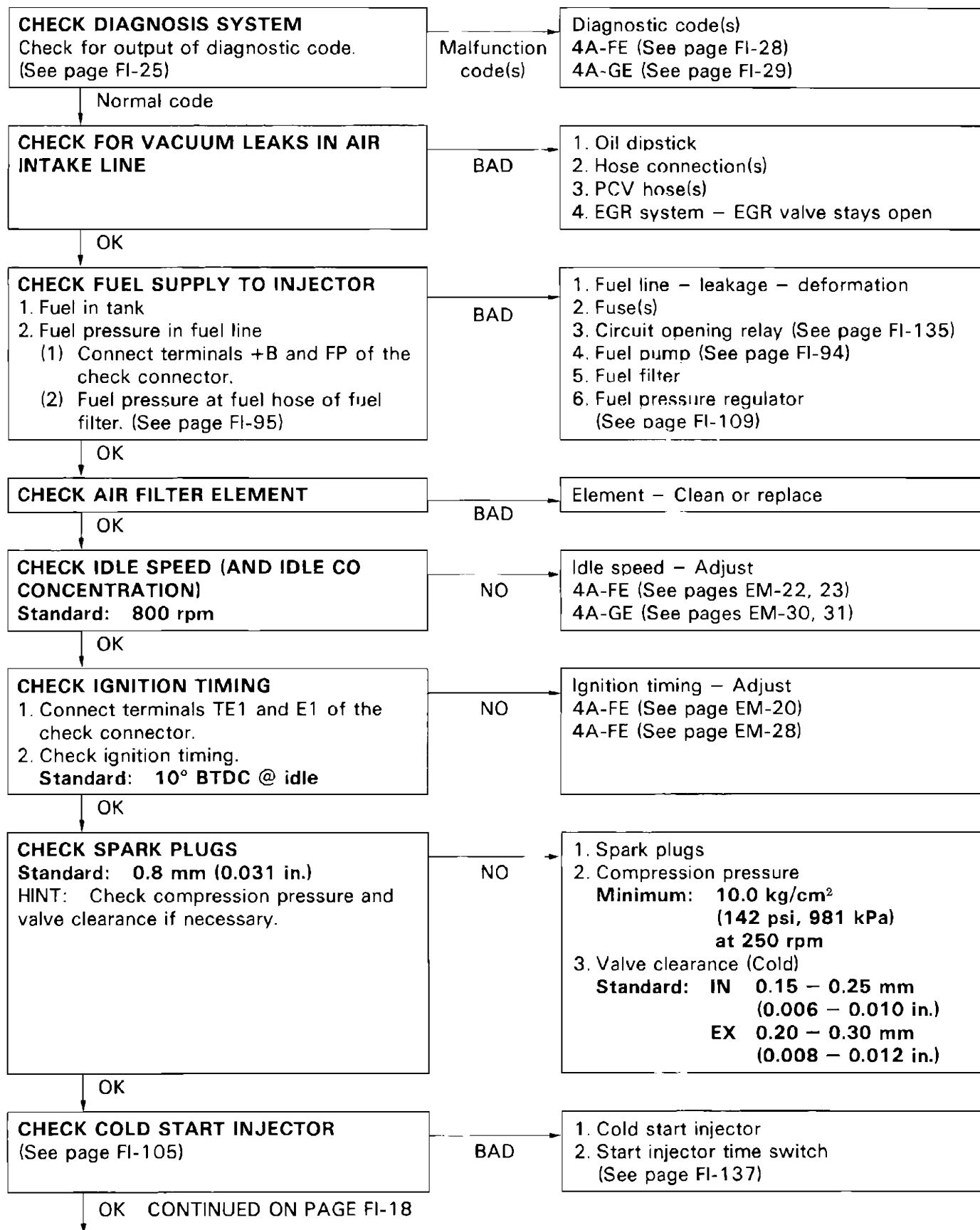
OK

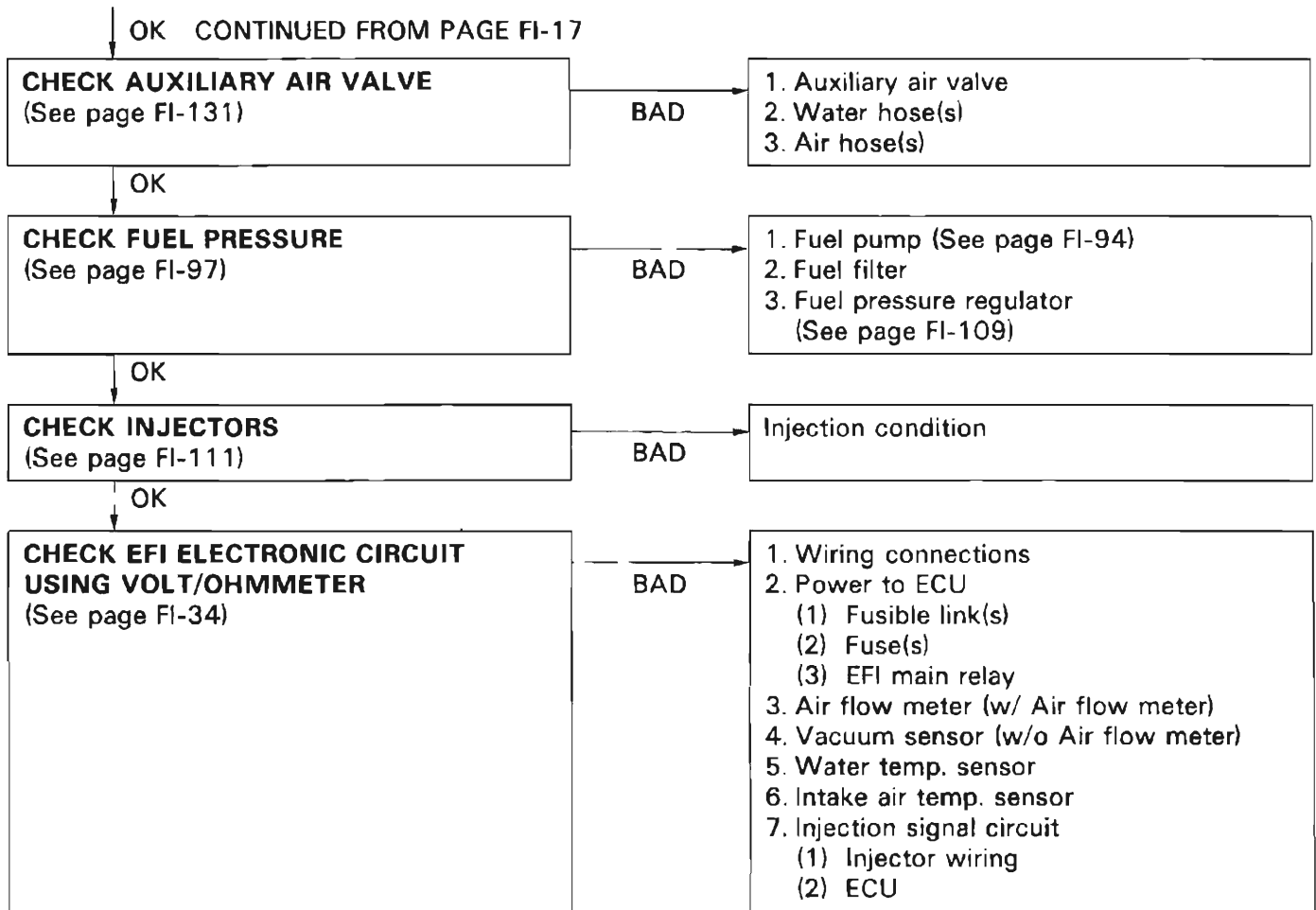
CHECK EFI ELECTRONIC CIRCUIT USING VOLT/OHMMETER

(See page FI-34)

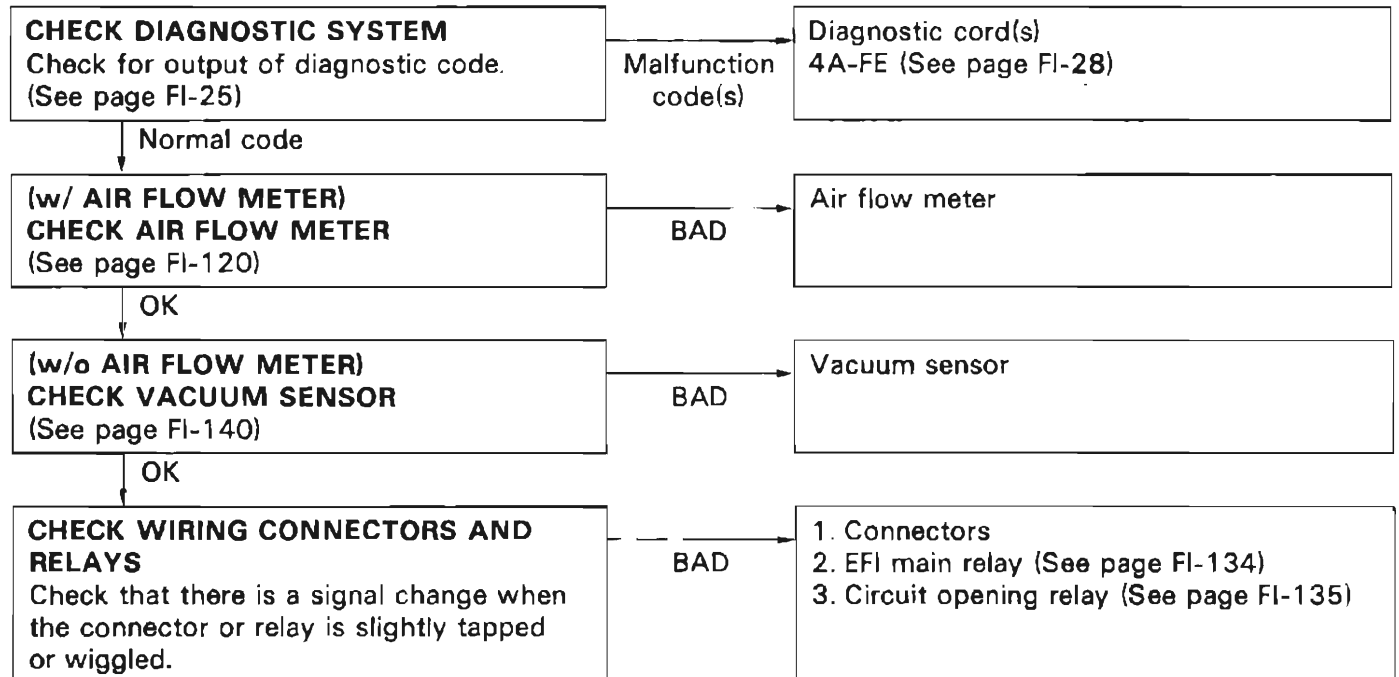
BAD

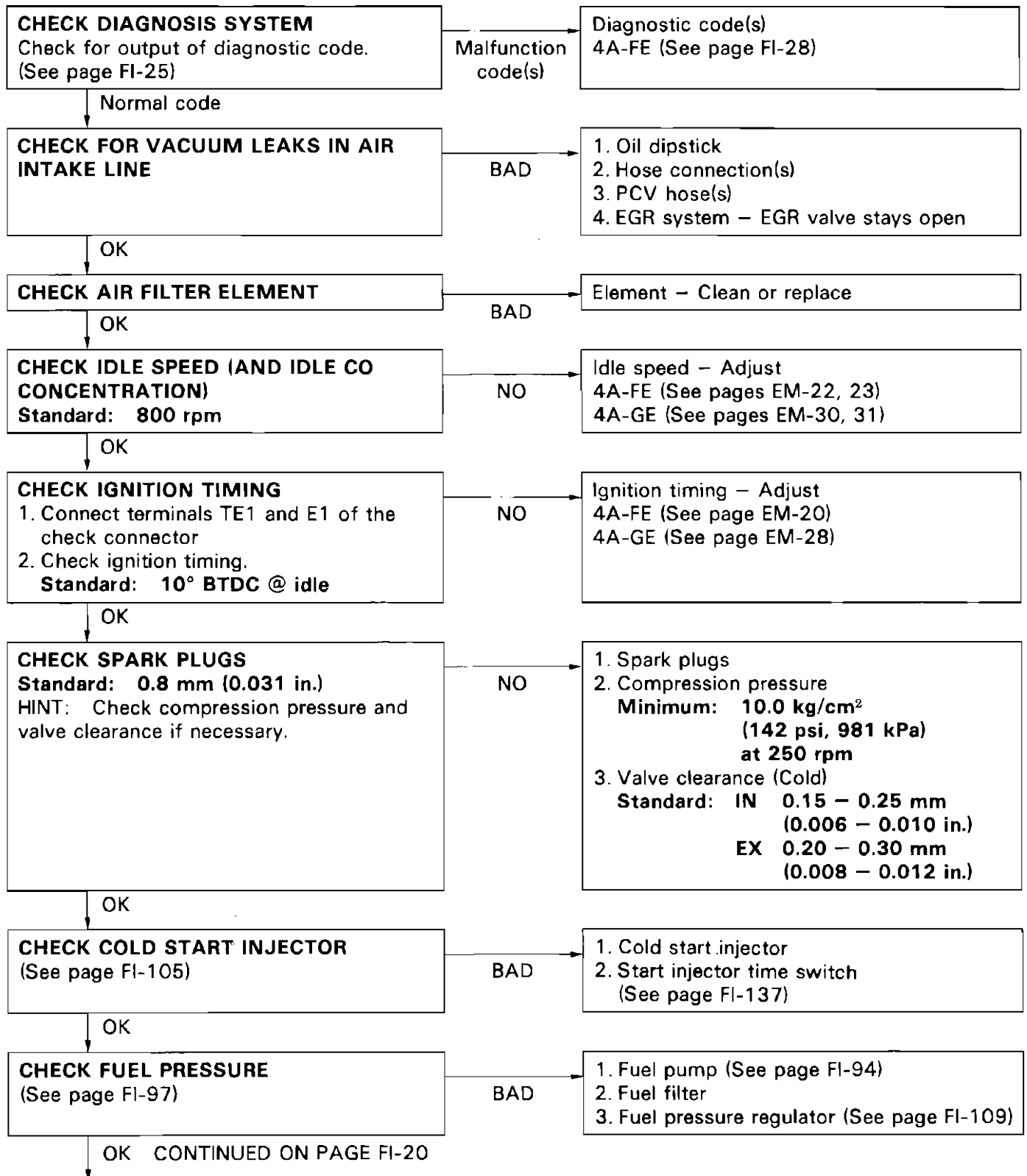
1. Wiring connection(s)
2. Power to ECU
 - (1) Fusible link(s)
 - (2) Fuse(s)
 - (3) EFI main relay
3. Air flow meter (w/ Air flow meter)
4. Vacuum sensor (w/o Air flow meter)
5. Water temp. sensor
6. Intake air temp. sensor
7. Injection signal circuit
 - (1) Injector wiring
 - (2) ECU

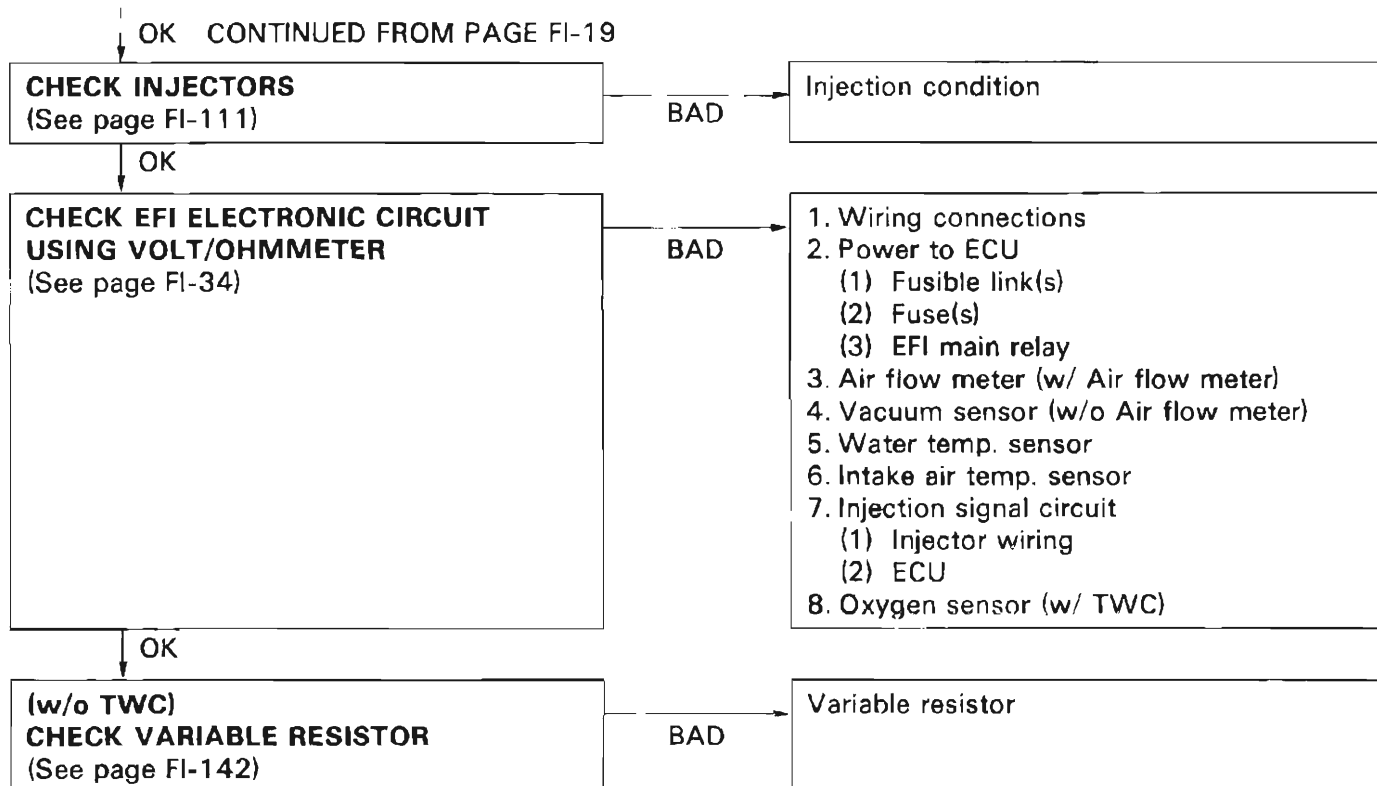
SYMPTOM — ENGINE OFTEN STALLS



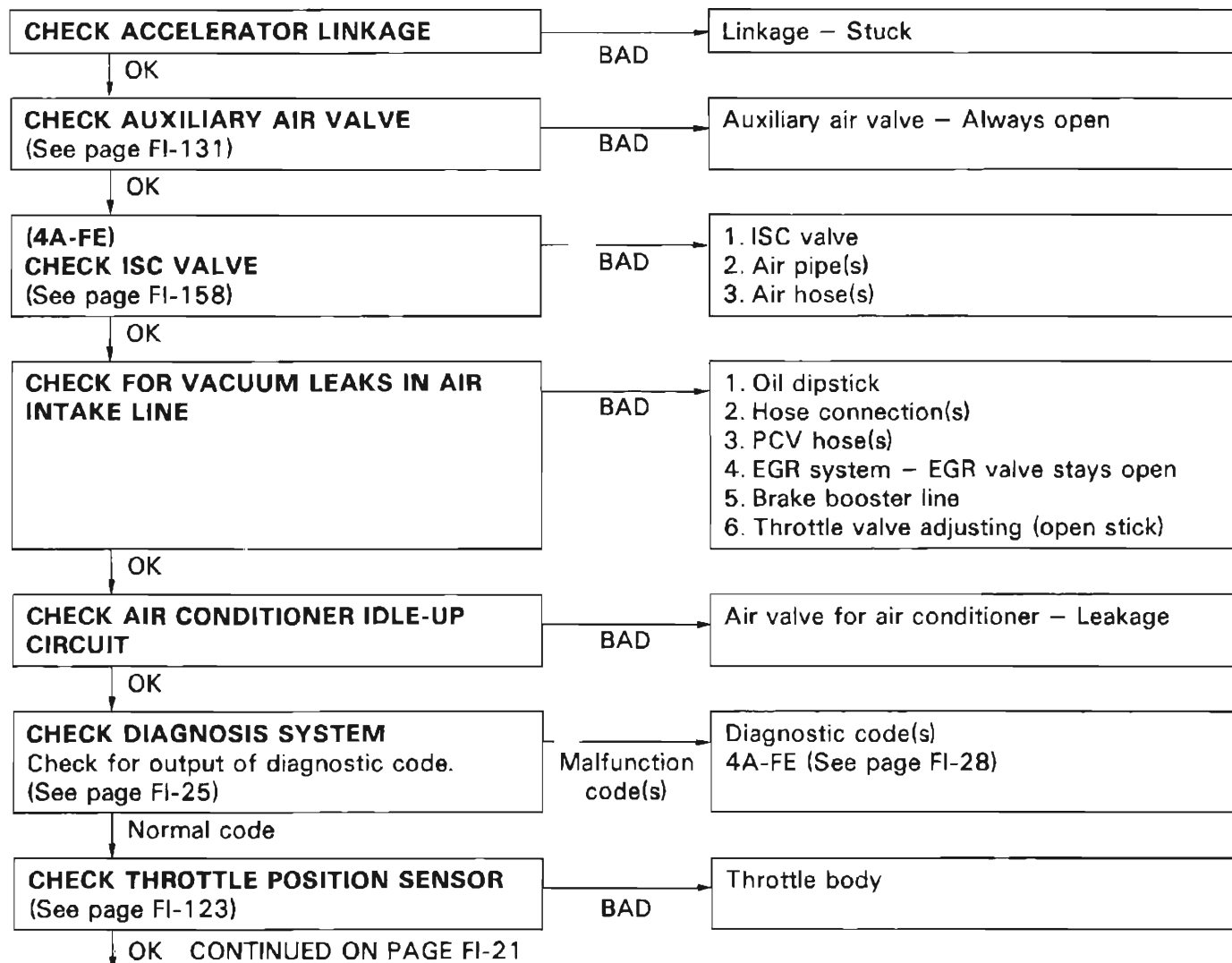
SYMPTOM — ENGINE SOMETIMES STALLS

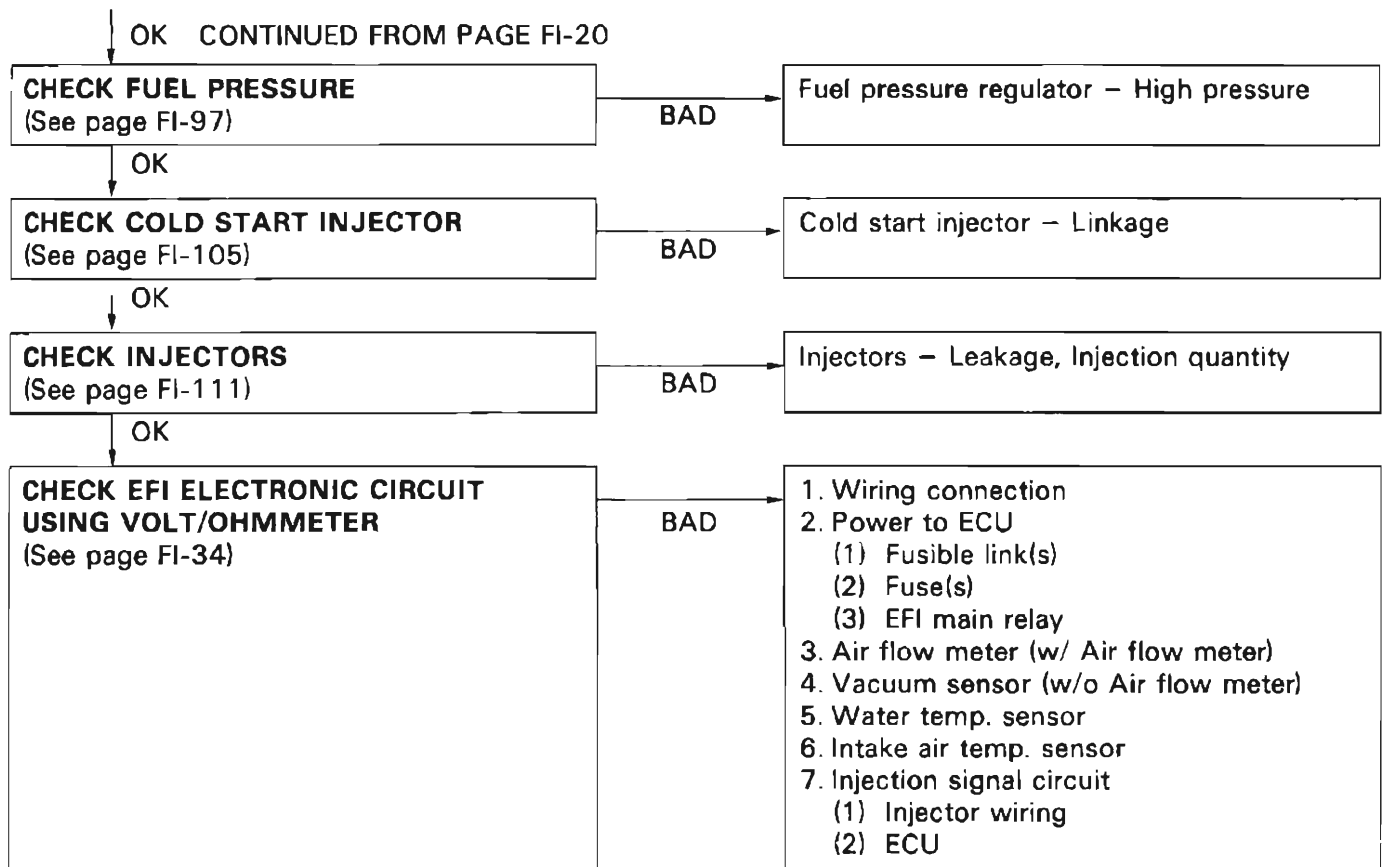


SYMPTOM — ROUGH IDLING AND/OR MISSING

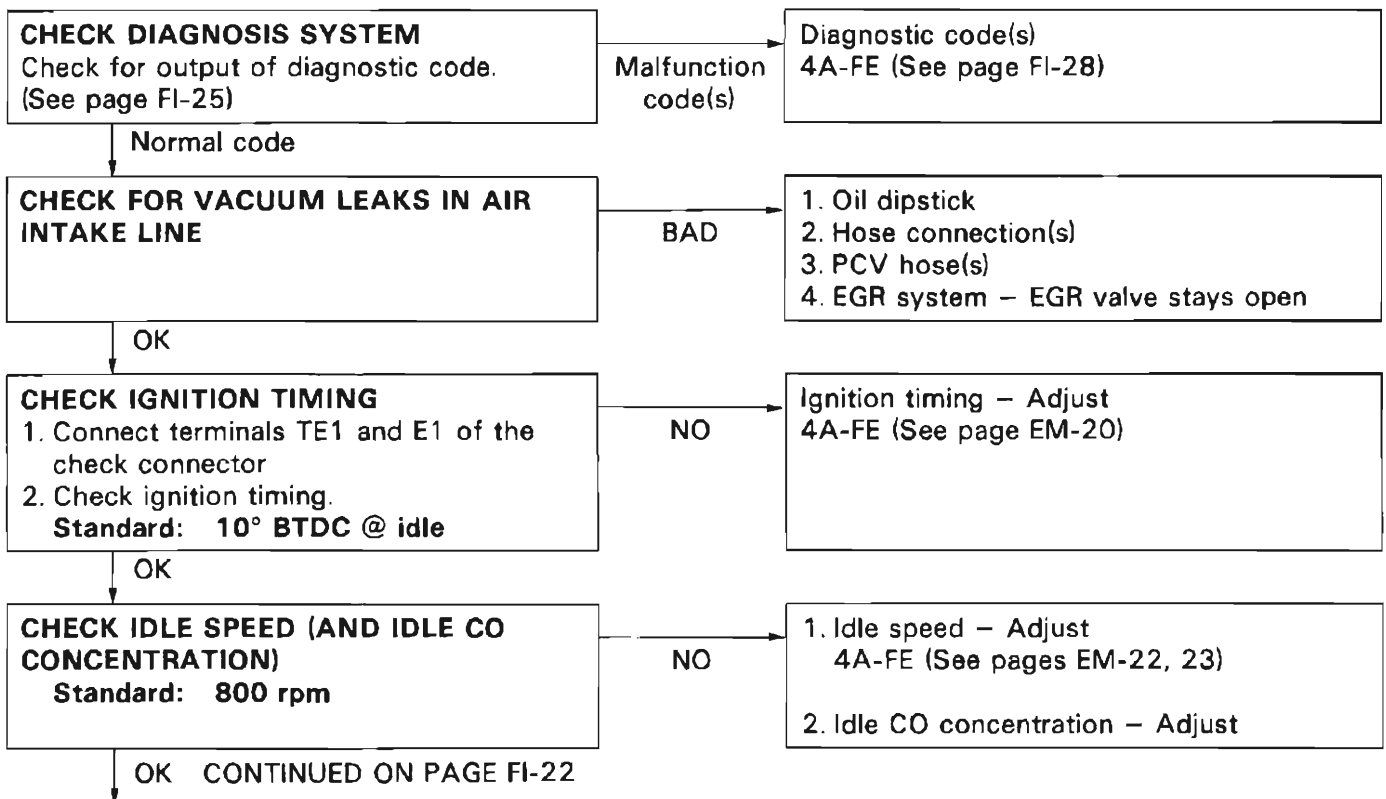


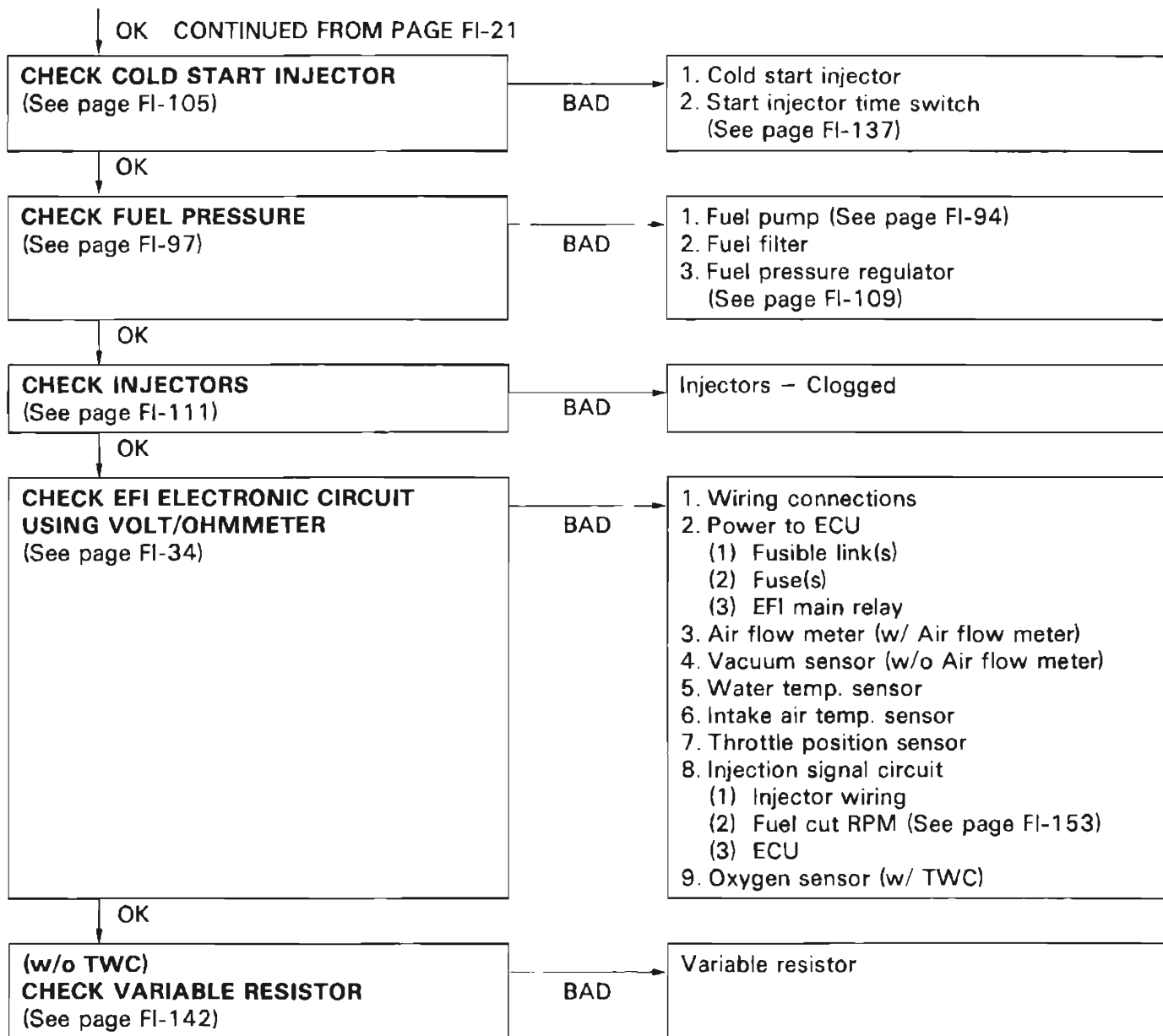
SYMPTOM — HIGH ENGINE IDLE SPEED (NO DROP)



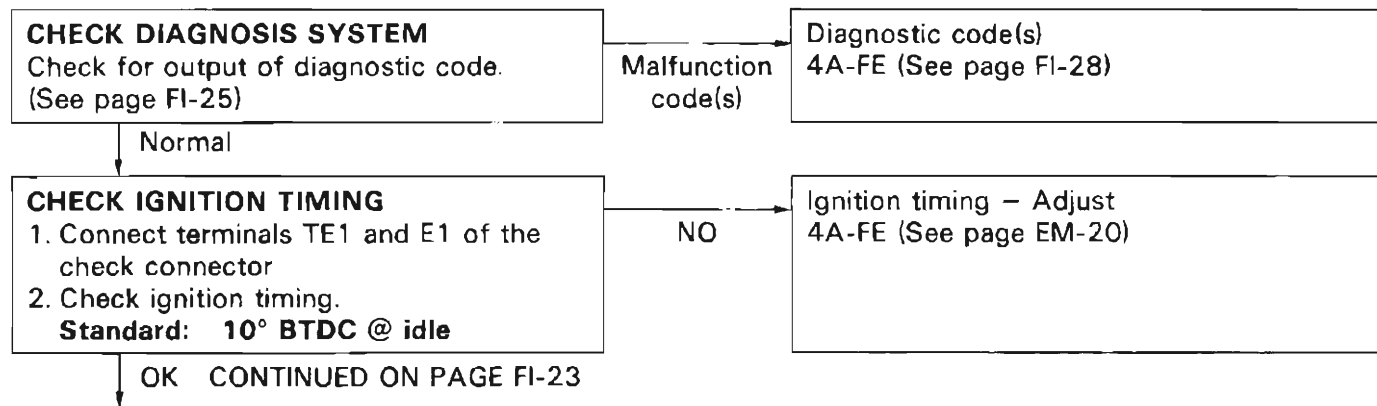


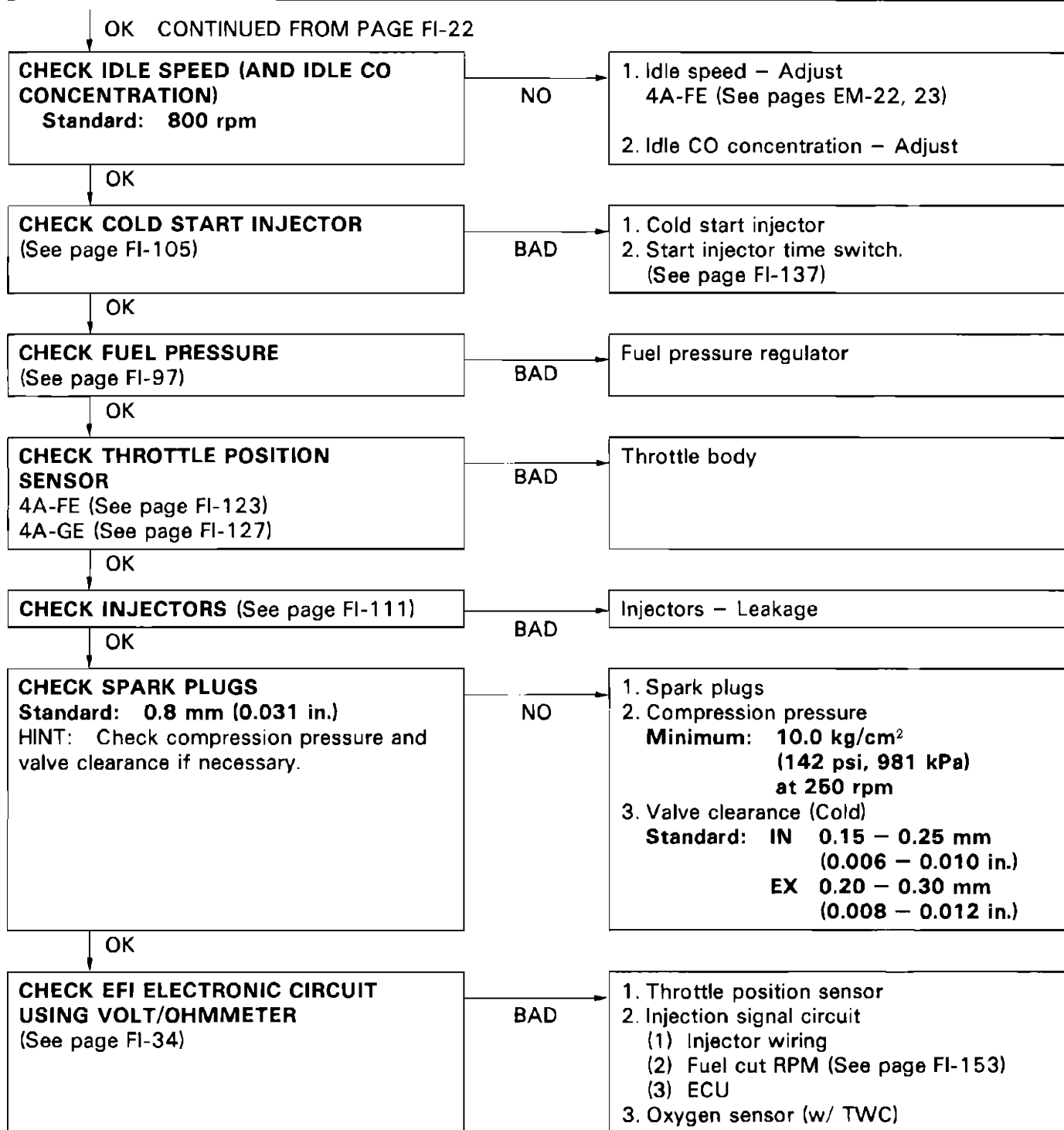
SYMPTOM — ENGINE BACKFIRES-Lean Fuel Mixture



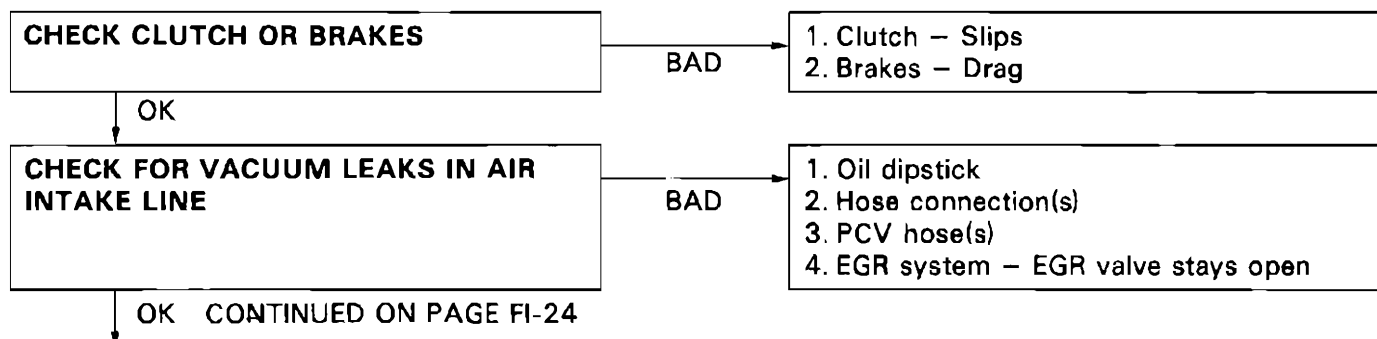


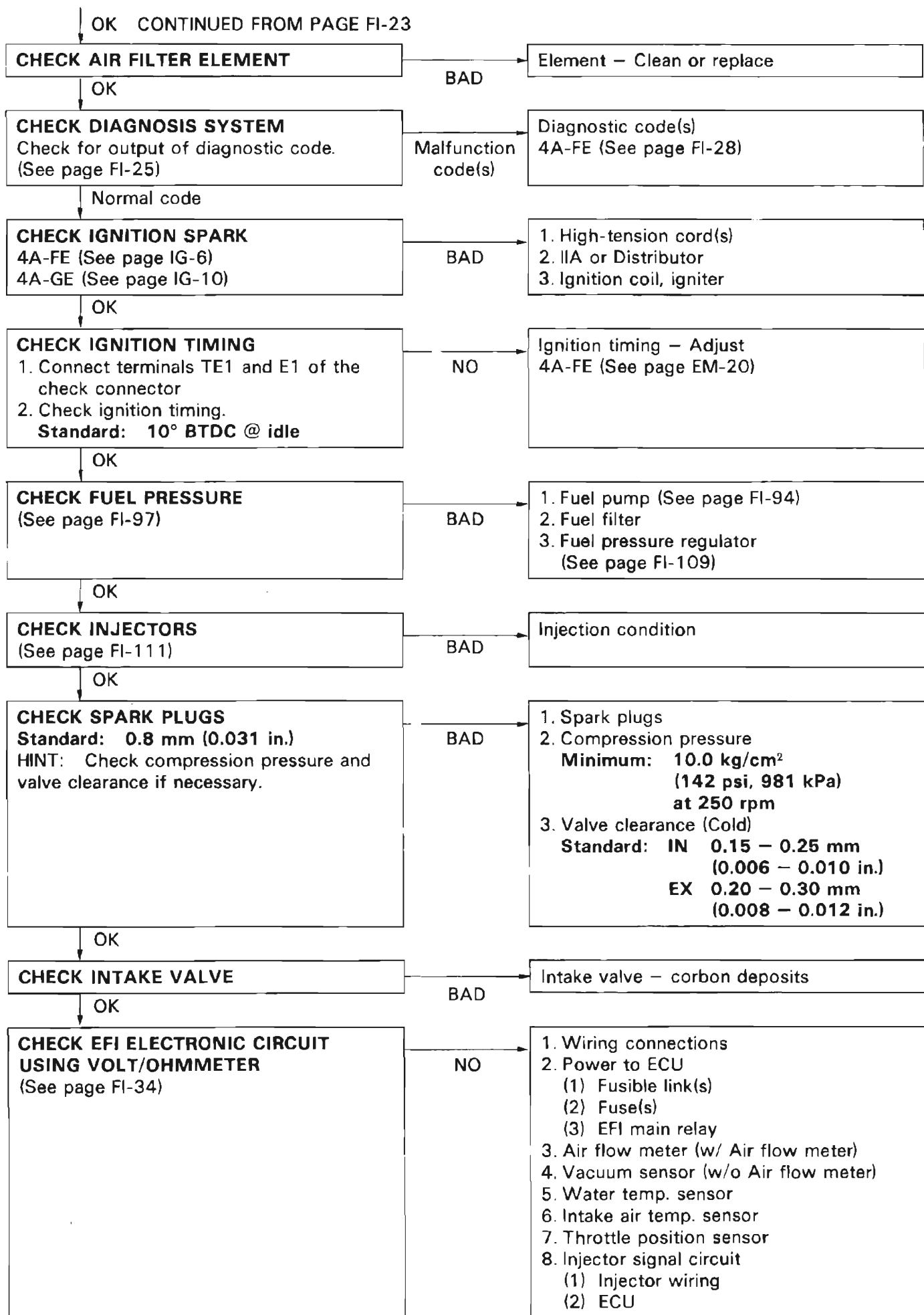
SYMPTOM — MUFFLER EXPLOSION (AFTER FIRE)-Rich Fuel Mixture-Misfire





SYMPTOM — ENGINE HESITATES AND/OR POOR ACCELERATION





DIAGNOSIS SYSTEM

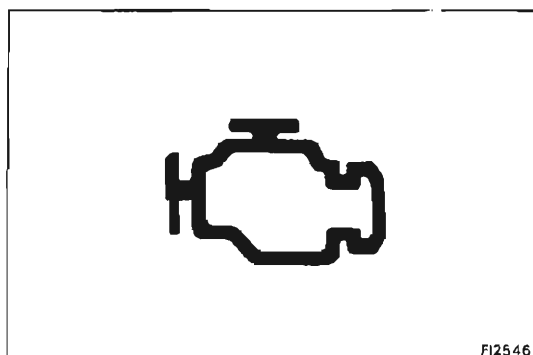
DESCRIPTION

The ECU contains a built-in self-diagnosis system by which troubles with the engine signal network are detected and a "CHECK ENGINE" warning light on the instrument panel flashes.

By analyzing various signals as shown in the later table (See pages FI-28 to 31) the ECU detects system malfunctions which are related to the various operating parameter sensors or actuator. The ECU stores the failure code associated with the detected failure until the diagnosis system is cleared by removing the fuse stop 15A (AE) or EFI 15A (AT) with the ignition switch OFF.

The "CHECK ENGINE" Warning light on the instrument panel informs the driver that a malfunction has been detected.

The light goes out automatically when the malfunction has been cleared.



FI2546

CHECK ENGINE WARNING LIGHT CHECK

1. The "CHECK ENGINE" warning light will come on when the ignition switch is placed at ON and the engine is not running.
2. When the engine is started, the "CHECK ENGINE" warning light should go out.

If the light remains on, the diagnosis system has detected a malfunction or abnormality in the system.

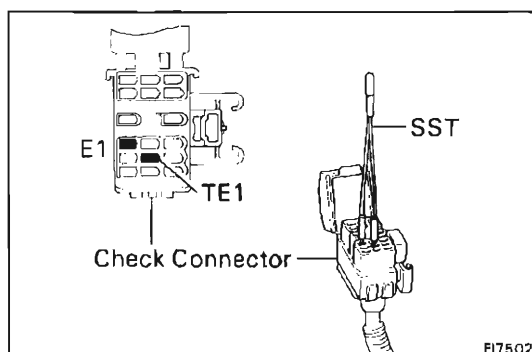
OUTPUT OF DIAGNOSTIC CODES

To obtain an output of diagnostic codes, proceed as follow:

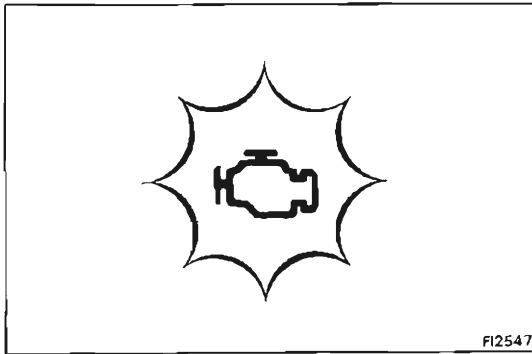
1. Initial conditions
 - (a) Battery voltage 11 V or more
 - (b) Throttle valve fully closed (throttle position sensor IDL points closed)
 - (c) Transmission in neutral position
 - (d) Accessories switched OFF
2. Turn the ignition switch to ON. Do not start the engine.
3. Using SST, connect terminals TE1 and E1 of the check connector.

SST 09843-18020

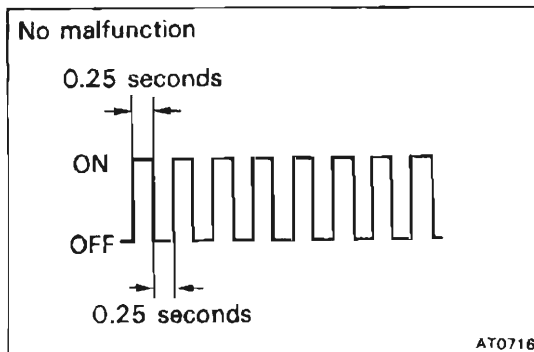
LOCATION: See page FI-133



FI7502



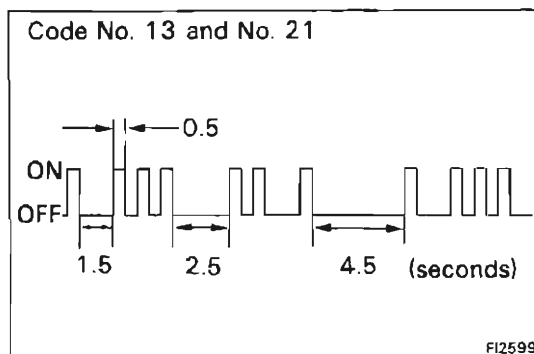
4. Read the diagnostic code as indicated by the number of flashes of the "CHECK ENGINE" warning light.



Diagnostic Codes (See pages FI-28 to 31)

(a) Normal System Operation (no malfunction)

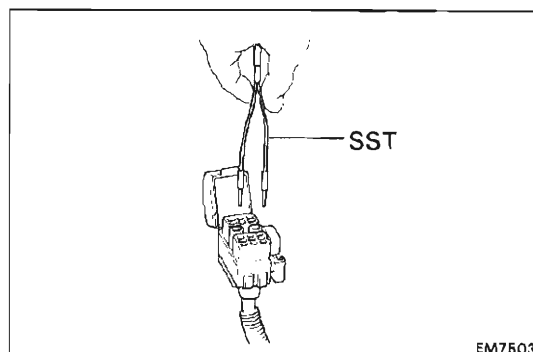
- The light will alternately blink ON and OFF at 0.25 second intervals.



(b) Malfunction Code Indication

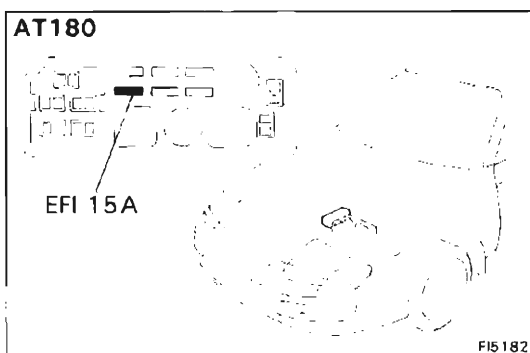
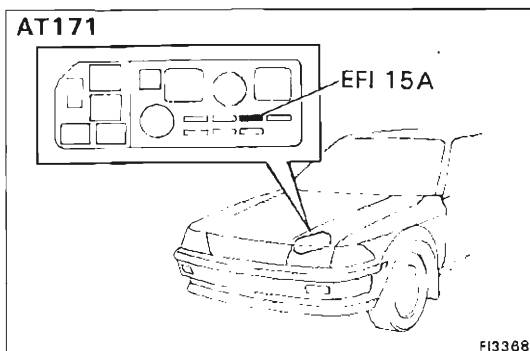
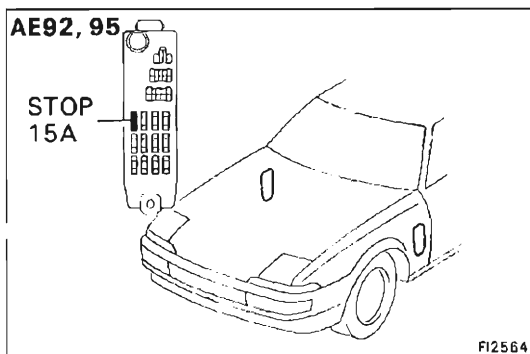
- In the event of a malfunction, the light will blink every 0.5 seconds. The first number of blinks will equal the first digit of a 2-digit diagnostic code and, after a 1.5 second pause, the 2nd number of blinks will equal the 2nd digit. If there are two or more codes, there will be a 2.5 second pause between each code.
- After all the codes have been output, there will be a 4.5 second pause and they will all be repeated as long as the terminals TE1 and E1 of the check connector are connected.

HINT: In the event of a number of trouble codes, indication will begin from the smaller value and continue to the larger.



5. After the diagnosis check, remove SST from the check connector.

SST 09843-18020



CANCELLING DIAGNOSTIC CODE

1. After repair of trouble area, the diagnostic code retained in memory by the ECU must be cancelled out by removing the fuse STOP 15A (AE) or EFI 15A (AT), located in the engine compartment relay box, for 10 seconds or more, depending on ambient temperature (the lower the temperature, the longer the fuse must be left out) with the ignition switch OFF.

HINT:










- Cancellation can also be done by removing the battery negative (⊖) terminal, but in this case, other memory systems (clock, etc.) will also be cancelled out.
 - If the diagnostic code is not cancelled out, it will be retained by the ECU and appear along with a new code in the event of future trouble.
 - If it is necessary to work on engine components requiring removal of the battery terminal, a check must first be made to see if a diagnostic code is has been recorded.
2. After cancellation, do the road test of the vehicle the vehicle to check that a normal code is now read on the "CHECK ENGINE" warning light.

If the same diagnostic code appears, it indicates that the trouble area has not been repaired thoroughly.

DIAGNOSIS INDICATION






1. Including "normal", the ECU is programmed with the following diagnostic codes.
2. If two or more malfunctions are present at the same time, the lowest-numbered diagnostic code will be displayed first.
3. All detected diagnostic codes, except code No.51, will be retained in memory by the ECU from the time of detection until cancelled out.
4. Once the malfunction is corrected, the "CHECK ENGINE" warning light on the instrument panel will go out but the diagnostic code(s) will remain stored in ECU memory (except for code No.51).

DIAGNOSTIC CODES (4A-FE)



Code No.	Number of blinks "CHECK ENGINE"	System	Diagnosis	Trouble area	See page
—	 FI1401	Normal	This appears when none of the other codes are identified	—	—
12	 FI1389	PRM Signal	No "NE" or "G" signal to ECU within 2 seconds after the engine is cranked.	<ul style="list-style-type: none"> • Distributor (IIA) circuit • Distributor (IIA) • Starter signal circuit • Igniter circuit • Igniter • ECU 	IG-4
13	 FI1390	RPM Signal	No "NE" signal to ECU When the engine speed is above 1,000 rpm.	<ul style="list-style-type: none"> • Distributor (IIA) circuit • Distributor (IIA) • Igniter circuit • Igniter • ECU 	
14	 FI1391	Ignition Signal	No "IGF" signal to ECU 4 times in succession.	<ul style="list-style-type: none"> • Igniter circuit • Igniter • ECU 	FI-48 FI-62
*21		Oxygen Sensor Heater	During air-fuel ratio feedback correction, voltage output from the oxygen sensor does not exceed a set value on the lean side and the rich side continuously for a certain period.	<ul style="list-style-type: none"> • Oxygen sensor circuit • Oxygen sensor 	FI-50 FI-64
		Oxygen Sensor Heater	Open or short circuit in oxygen sensor heater (HT).	<ul style="list-style-type: none"> • Oxygen sensor heater circuit • Oxygen sensor heater • ECU 	
22	 FI1392	Water Temp. Sensor	Open or short circuit in water temp. sensor signal (THW).	<ul style="list-style-type: none"> • Water temp. sensor circuit • Water temp. sensor • ECU 	FI-46 FI-60
24	 FI1611	Intake air Temp. Sensor Signal	Open or short circuit in intake air temp. sensor signal (THA).	<ul style="list-style-type: none"> • Intake air temp. sensor circuit • Intake air temp. sensor • ECU 	FI-45 FI-59
*25	 FI2562	Air-fuel Ratio Lean Malfunction	When air-fuel ratio feedback correction value continues at the upper (lean) limit for a certain period of time.	<ul style="list-style-type: none"> • Oxygen sensor circuit • Oxygen sensor • ECU 	FI-50 FI-64
*26	 FI2563	Air-fuel Ratio Rich Malfunction			

*: w/ EGR System only

DIAGNOSTIC CODES (4A-FE) (Cont'd)

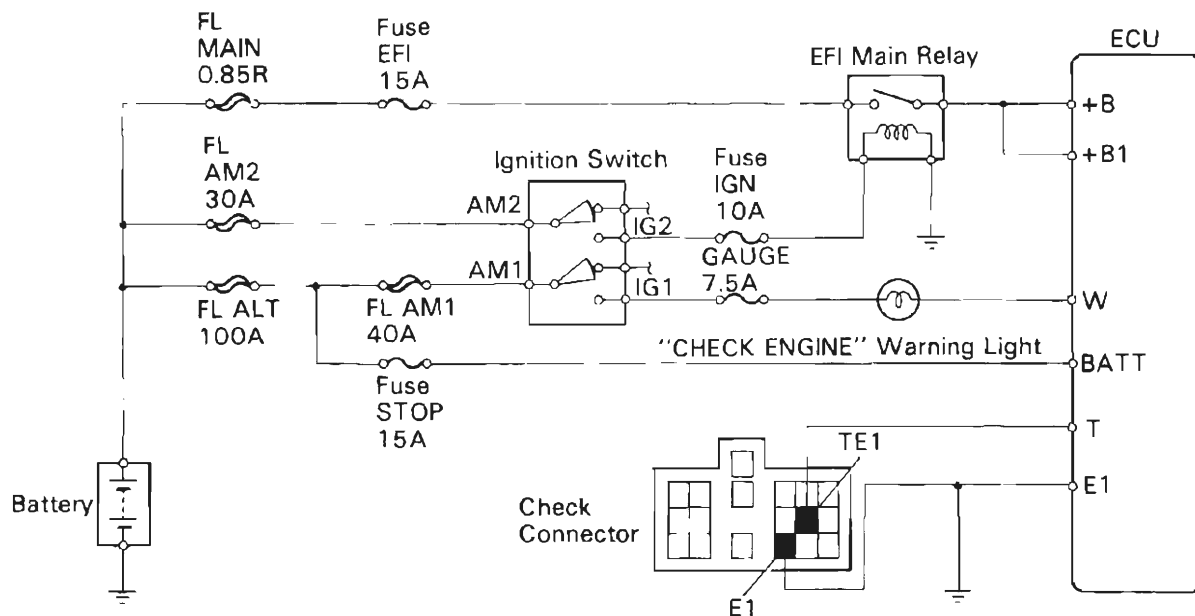
Code No.	Number of blinks "CHECK ENGINE"	System	Diagnosis	Trouble area	See page
31	 FI1394	Vacuum Sensor Signal	Open or short circuit intake manifold pressure signal (PIM).	<ul style="list-style-type: none"> ● Vacuum sensor circuit ● Vacuum sensor ● ECU 	FI-44 FI-58
41	 FI1396	Throttle Position Sensor Signal	The "IDL" and "PSW" signals are output simultaneously for several seconds.	<ul style="list-style-type: none"> ● Throttle position sensor circuit ● Throttle position sensor ● ECU 	FI-41 FI-55
42	 FI1397	Vehicle Speed Sensor Signal	No "SPD" signal for 8 seconds when engine speed is between 2,600 rpm and 4,500 rpm and coolant temp. is below 80°C (176°F) except when racing the engine.	<ul style="list-style-type: none"> ● Vehicle speed sensor circuit ● Vehicle speed sensor ● ECU 	—
43	 FI1398	Starter Signal	No "STA" signal to ECU until engine speed reaches 800 rpm with vehicle not moving.	<ul style="list-style-type: none"> ● IG switch circuit ● IG switch, main relay circuit ● ECU 	FI-47 FI-61
51	 FI1399	Switch Condition Signal	No "IDL" signal, "NSW" signal or "A/C" signal to ECU, with the check terminals E1 and TE1 connected.	<ul style="list-style-type: none"> ● A/C switch circuit ● A/C switch ● A/C amplifier ● Neutral start switch circuit ● Neutral start switch ● Accelerator pedal and cable ● Throttle position sensor circuit ● Throttle position sensor ● ECU 	FI-49 FI-63

DIAGNOSTIC CODES (4A-GE)

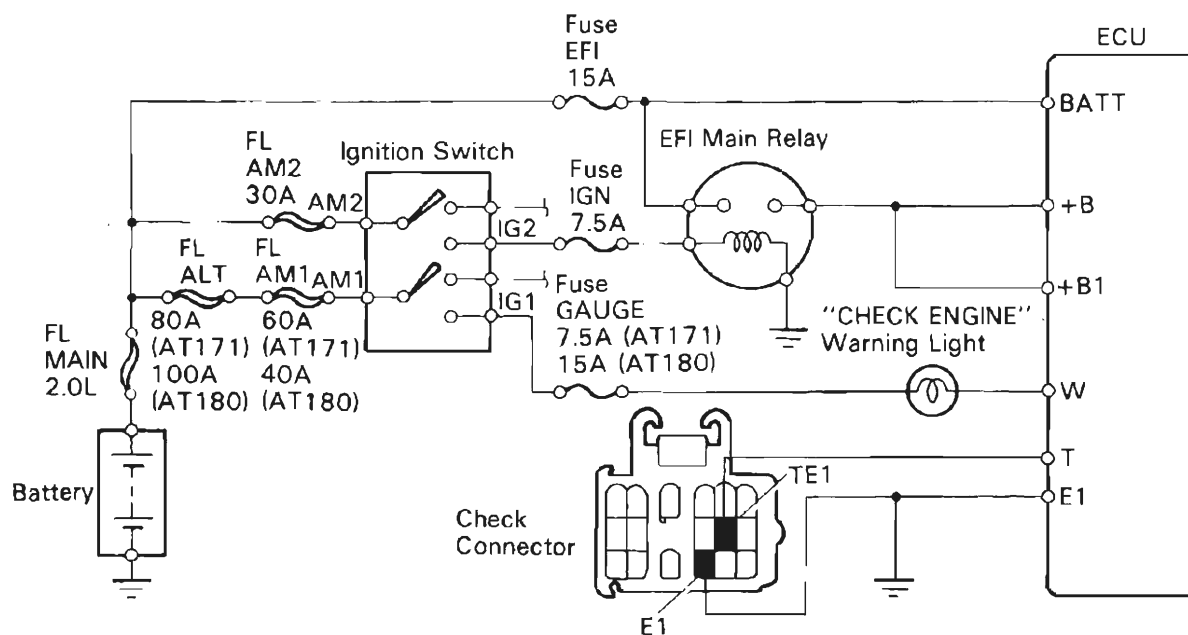
Code No.	Number of blinks "CHECK ENGINE"	System	Diagnosis	Trouble area	See page
—	 ON OFF FI1401	Normal	This appears when none of the other codes are identified.	—	—
12	 FI1389	PRM Signal	<p>(w/o Air Flow Meter) No "NE" or "G" signal to ECU within 2 seconds after engine has been cranked.</p> <p>(w/ Air Flow Meter) <ul style="list-style-type: none"> ● No "NE" signal to ECU within 2 seconds after the engine is cranked. ● No "G" signal to ECU 4 times in succession when engine speed is between 500 rpm and 4,000 rpm. </p>	<ul style="list-style-type: none"> ● Distributor circuit ● Distributor ● Starter signal circuit ● ECU 	IG-5

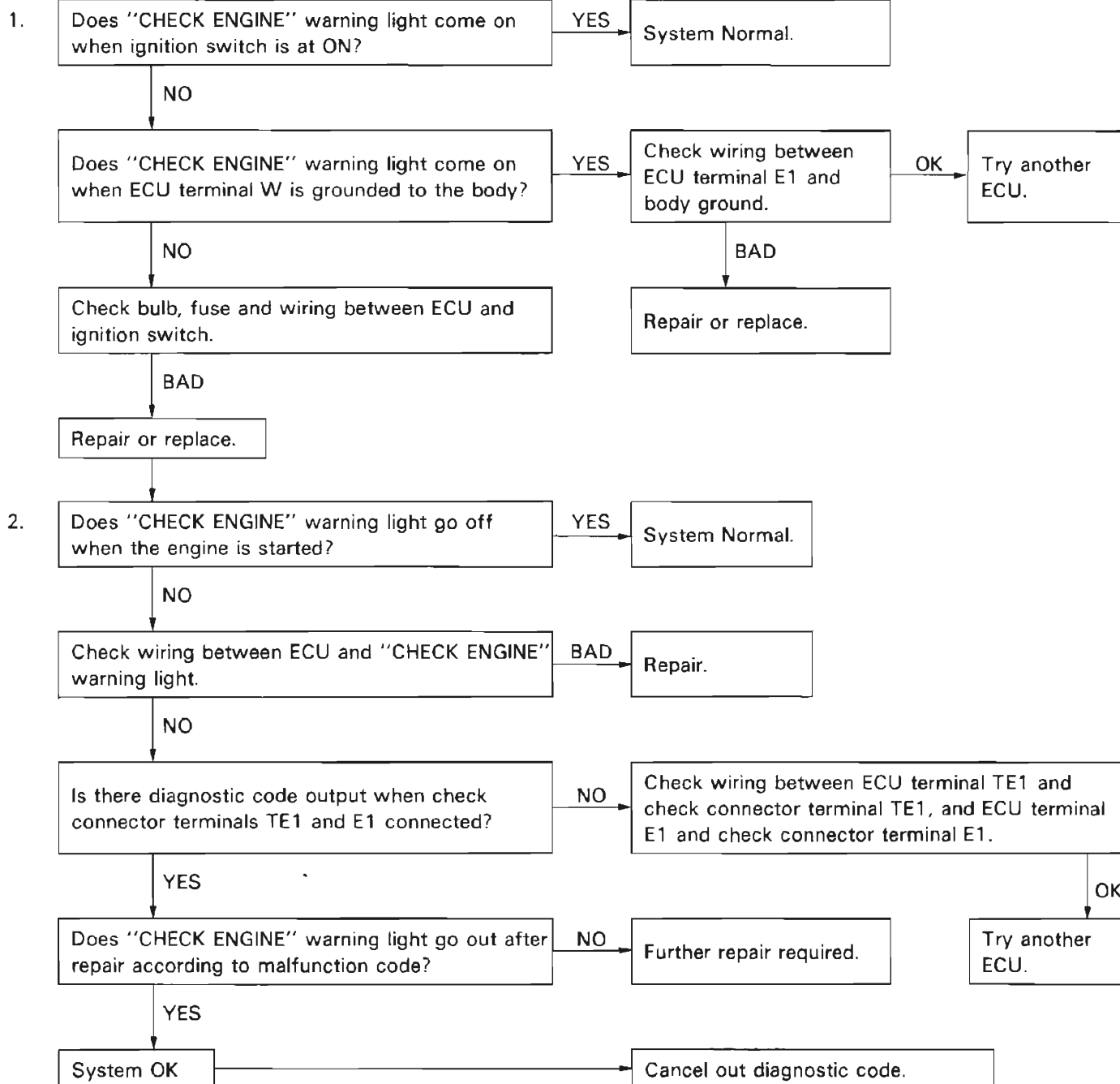
INSPECTION OF DIAGNOSIS CIRCUIT

AE



AT





TROUBLESHOOTING WITH VOLT/OHMMETER

HINT: The following troubleshooting procedures are designed for inspection of each separate system, therefore the procedure may vary somewhat. However, troubleshooting should be performed referring to the inspection methods described in this manual.

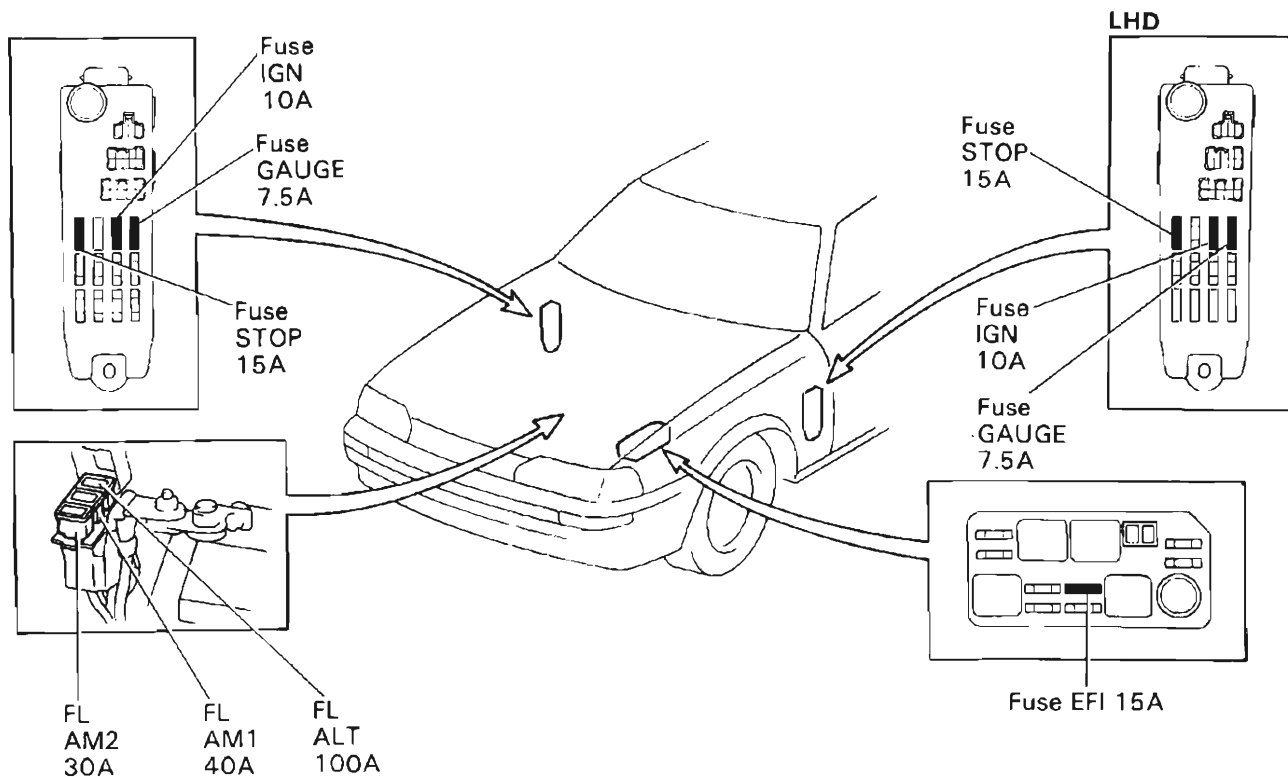
Before beginning inspection, it is best to first make a simple check of the fuses, fusible links and the condition of the connectors.

The following troubleshooting procedures are based on the supposition that the trouble lies in either a short or open circuit in a component outside the computer or short circuit within the computer.

If engine trouble occurs even through proper operating voltage is detected in the computer connector, then it can be assumed that the ECU is faulty and should be replaced.

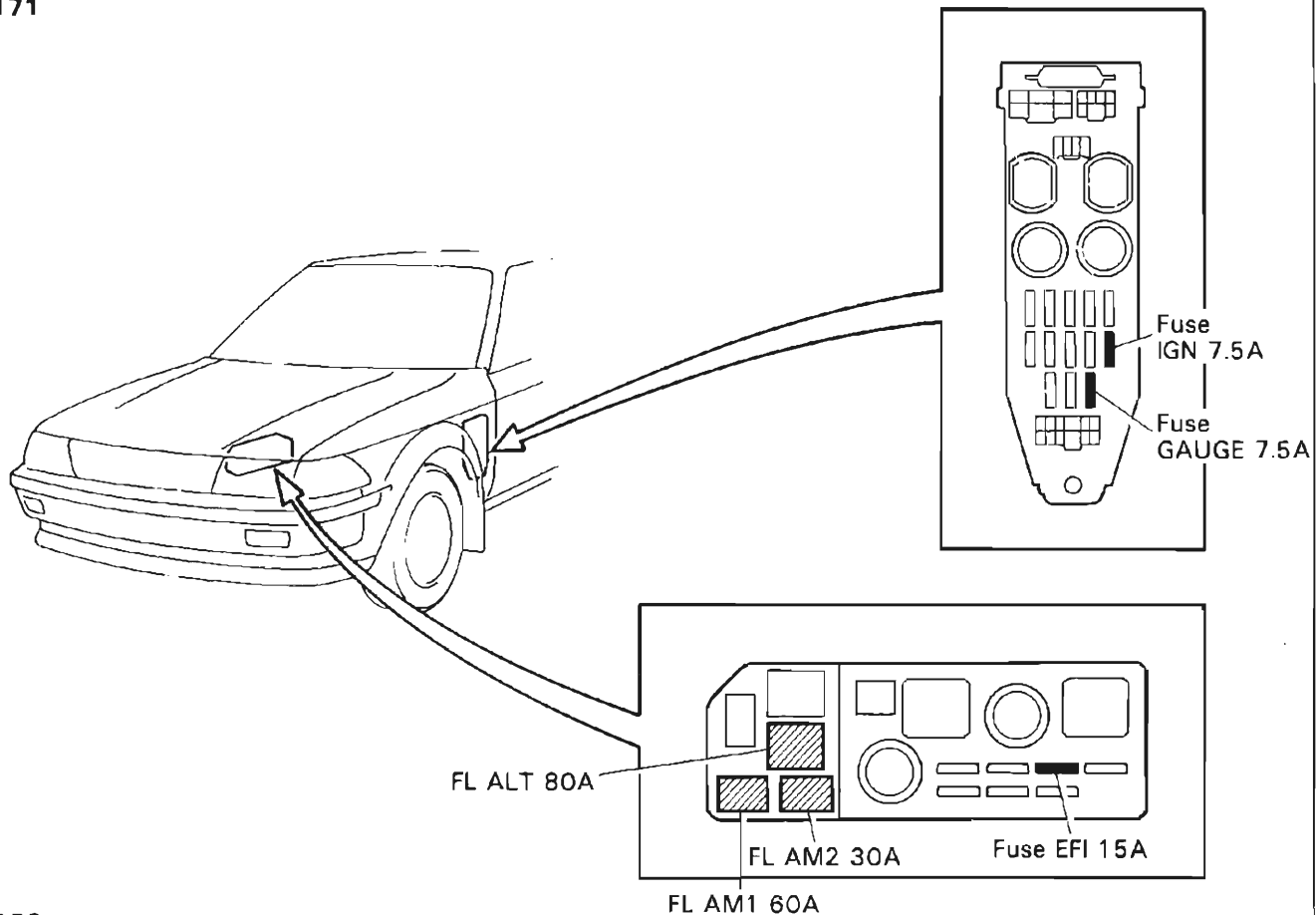
LOCATION OF FUSES AND FUSIBLE LINKS

AE

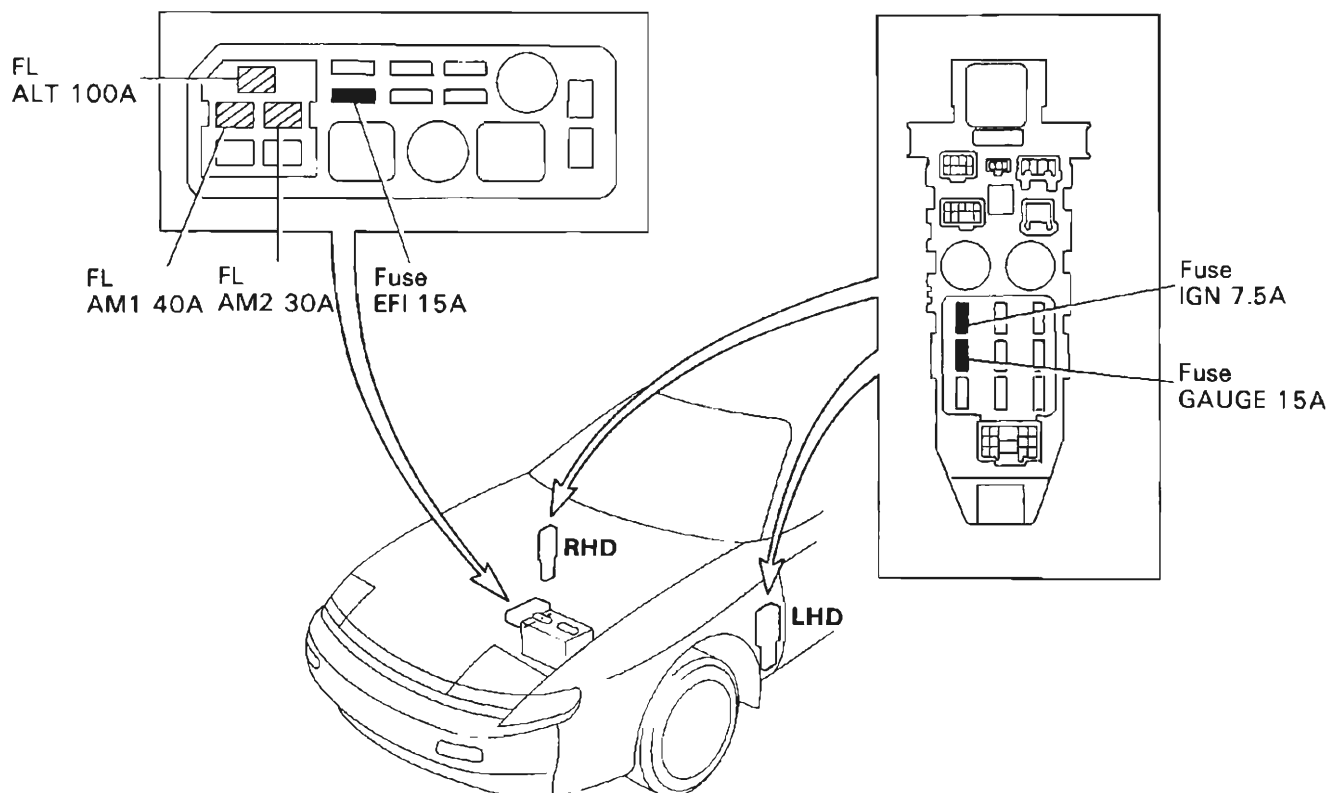


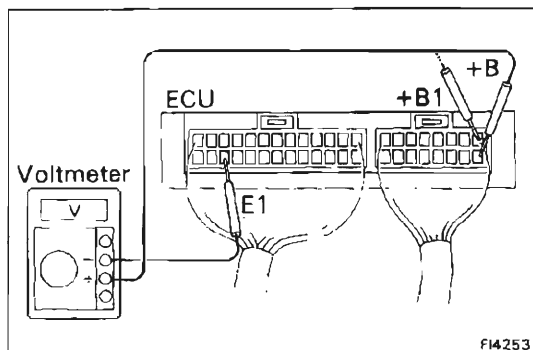
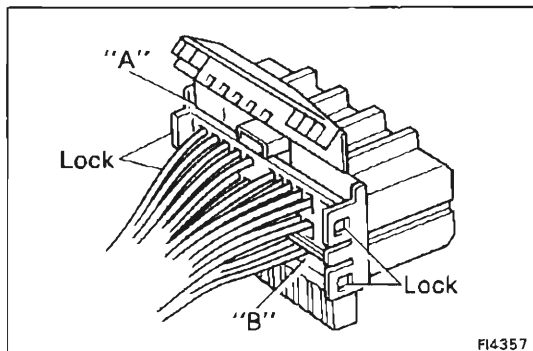
LOCATION OF FUSES AND FUSIBLE LINKS (Cont'd)

AT171



AT180





EFI SYSTEM CHECK PROCEDURE

PREPARATION

- Disconnect the connectors from the ECU.
- Remove the locks shown in the illustration so that the tester probe(s) can easily come in.

NOTICE: Pay attention to sections "A" and "B" in the illustration which can be easily broken.

- Reconnect the connectors to the ECU.

HINT:

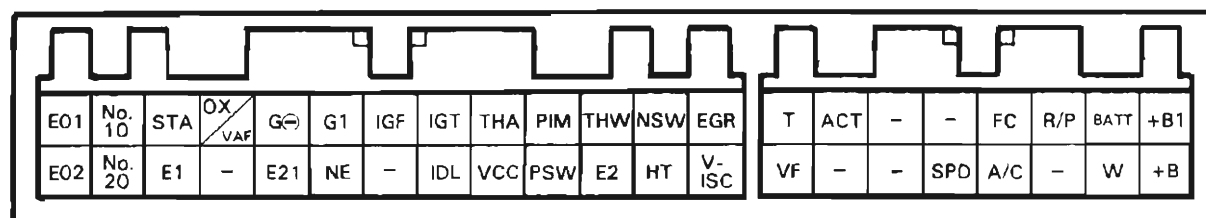
- Perform all voltage measurements with the connectors connected.
- Verify that the battery voltage is 11 V or above when the ignition switch is ON.

Using a voltmeter with high-impedance (10 k Ω /V minimum), measure the voltage at each terminal of the wiring connectors.

Terminals of ECU (4A-FE 2WD)

Symbol	Terminal Name	Symbol	Terminal Name
E01	POWER GROUND	PSW	THROTTLE POSITION SENSOR
E02	POWER GROUND	THW	WATER TEMP. SENSOR
No.10	INJECTOR	E2	SENSOR GROUND
No.20	INJECTOR	* ³ NSW	NEUTRAL START SWITCH
STA	STARTER MAGNETIC SWITCH	* ¹ HT	OXYGEN SENSOR
E1	ECU GROUND	EGR	VSV (EGR)
* ¹ OX	OXYGEN SENSOR	V-ISC	VSV (ISC VALVE)
* ² VAF	VARIABLE RESISTOR	T	CHECK CONNECTOR
G ⊖	DISTRIBUTOR	VF	CHECK CONNECTOR
E21	SENSOR GROUND	* ¹ ACT	A/C AMPLIFIER
G1	DISTRIBUTOR	SPD	SPEED SENSOR
NE	DISTRIBUTOR	FC	CIRCUIT OPENING RELAY
IGF	IGNITER	A/C	A/C COMPRESSOR
IGT	IGNITER	* ¹ R/P	FUEL CONTROL SWITCH
IDL	THROTTLE POSITION SENSOR	BATT	BATTERY
THA	INTAKE AIR TEMP. SENSOR	W	CHECK ENGINE WARNING LIGHT
VCC	VACUUM SENSOR	+B1	EFI MAIN RELAY
PIM	VACUUM SENSOR	+B	EFI MAIN RELAY

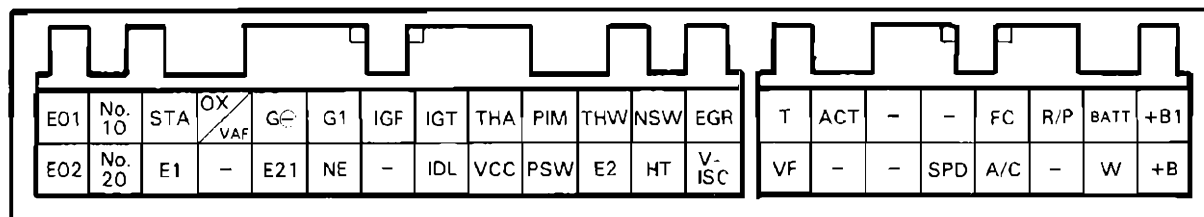
ECU Terminals

*¹: w/ EGR System, *²: w/o EGR System, *³: A/T

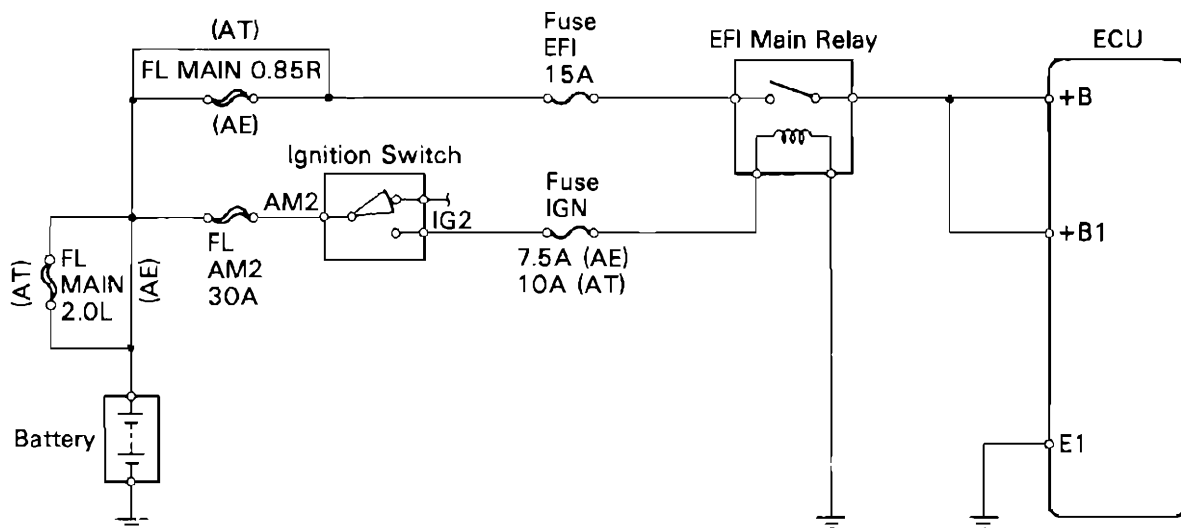
Voltage at ECU wiring connectors (4A-FE 2WD)

No.	Terminals	STD voltage (V)	Condition		See page
1	+B +B1 — E1	10 — 14	Ignition SW ON		FI-39
2	BATT — E1	10 — 14	—		FI-40
3	IDL — E2	4.5 — 5.5	Ignition SW ON	Throttle valve open	FI-41
	PSW — E2			Throttle valve fully closed	
4	No.10 — E01 No.20 — E02	10 — 14	Ignition SW ON		FI-42
5	W — E1	10 — 14	No trouble ("CHECK ENGINE" warning light off) and engine running		FI-43
6	PIM — E2	3.3 — 3.9	Ignition SW ON		FI-44
	VCC — E2	4.5 — 5.5			
7	THA — E2	2.0 — 2.5	Ignition SW ON	Intake air temp. 20°C (68°F)	FI-45
8	THW — E2	0.4 — 0.7		Coolant temp. 80°C (176°F)	FI-46
9	STA — E1	6 — 14	Cranking		FI-47
10	IGT — E1	0.7 — 1.0	Idling		FI-48
11	A/C — E1	5 — 14	Air conditioning ON		FI-49

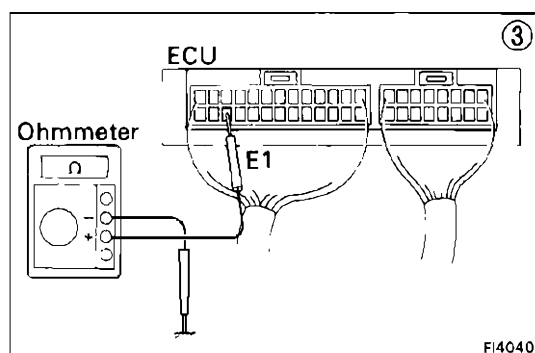
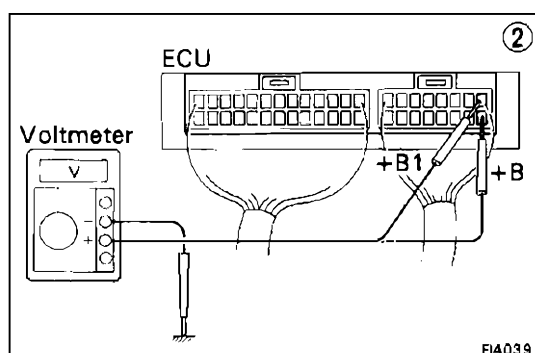
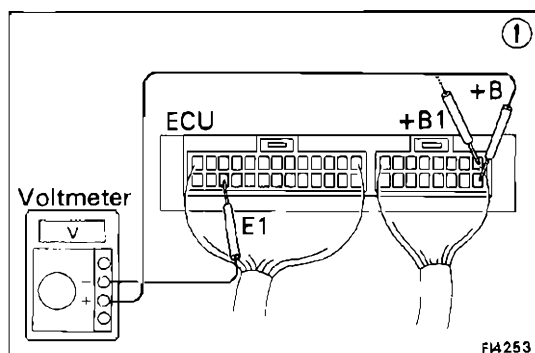
ECU Terminals



No.	Terminals	Trouble	Condition	STD voltage
1	+B +B1 — E1	No voltage	IG SW ON	10 – 14 V



FI5177



① There is no voltage between ECU terminals +B (+B1) and E1. (IG SW ON)

② Check that there is voltage between ECU terminal +B (+B1) and body ground. (IG SW ON)

NO OK

③ Check wiring between ECU terminal E1 and body ground.

OK

BAD

Try another ECU.

Repair or replace.

Check fuses, fusible links and ignition switch.

BAD

Repair or replace.

OK

Check EFI main relay. (See page FI-134)

BAD

Replace.

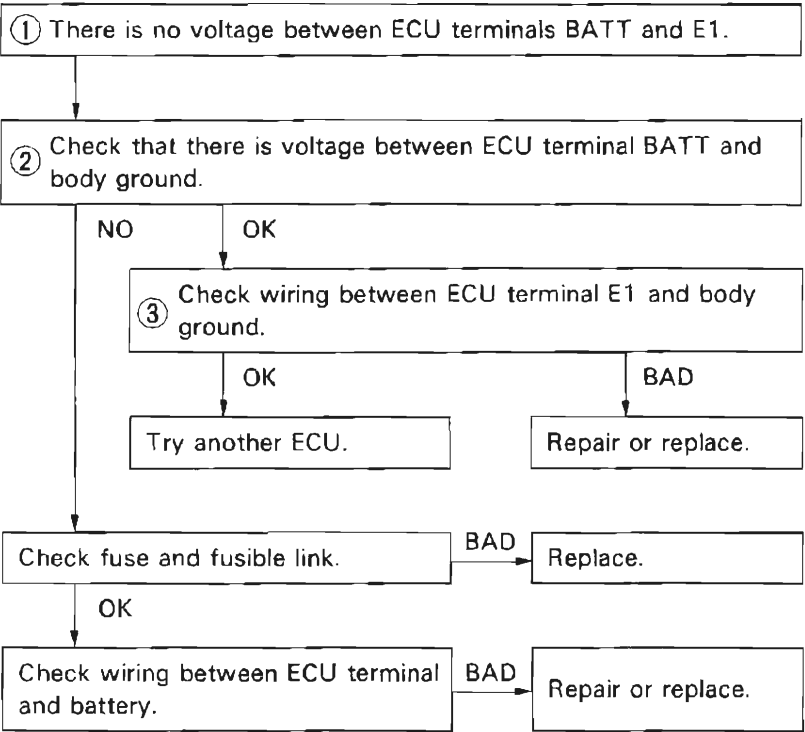
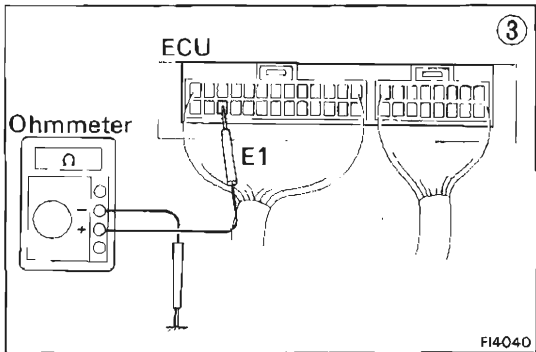
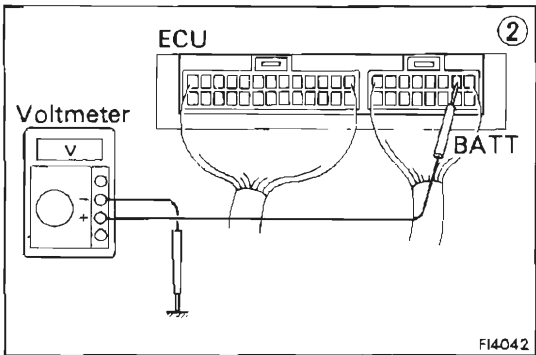
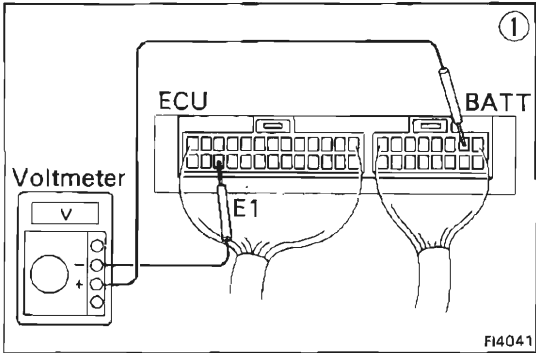
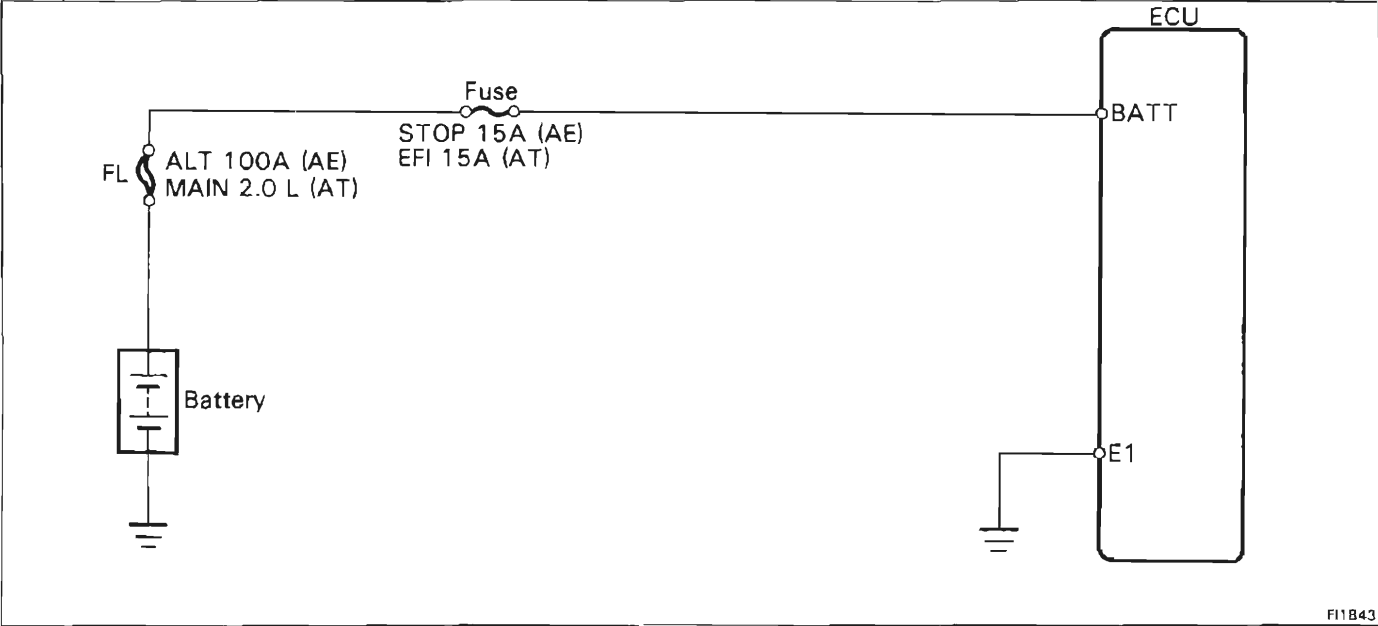
OK

Check wiring between EFI main relay and battery.

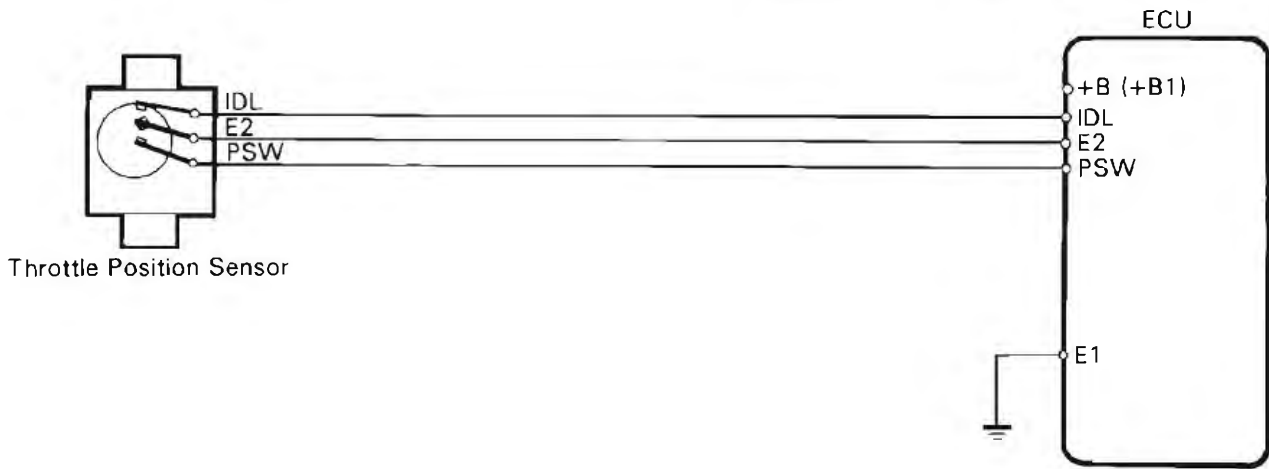
BAD

Repair or replace.

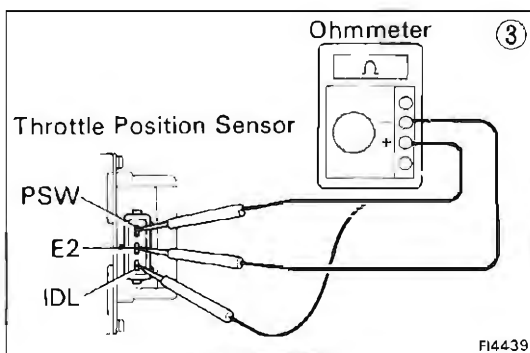
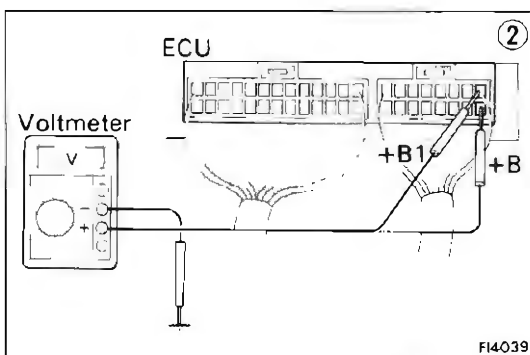
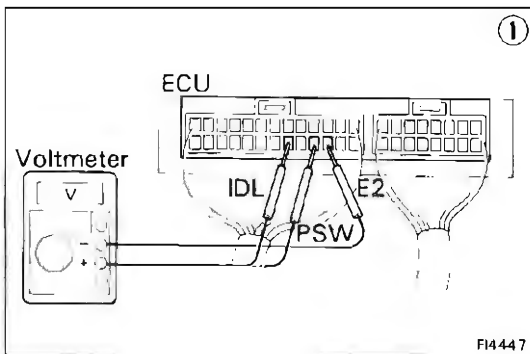
No.	Terminals	Trouble	Condition	STD voltage
2	BATT — E1	No voltage	—	10 — 14 V



No.	Terminals	Trouble	Condition	STD voltage
3	IDL — E2	No voltage	IG SW ON	Throttle valve open
	PSW — E2		Throttle valve fully closed	



FI0984



① There is no voltage between ECU terminals IDL and E2. **(IG SW ON)** (Throttle valve open)

② Check that there is voltage between ECU terminal +B (+B1) and body ground. **(IG SW ON)**

NO OK

Check wiring between ECU terminal E1 and body ground.

OK

BAD

Try another ECU.

Repair or replace.

Refer to +B — E1 trouble section. (No.1) (See page FI-39)

BAD

Repair or replace.

OK

③ Check throttle position sensor. (See page FI-123)

BAD

Repair or replace throttle position sensor.

OK

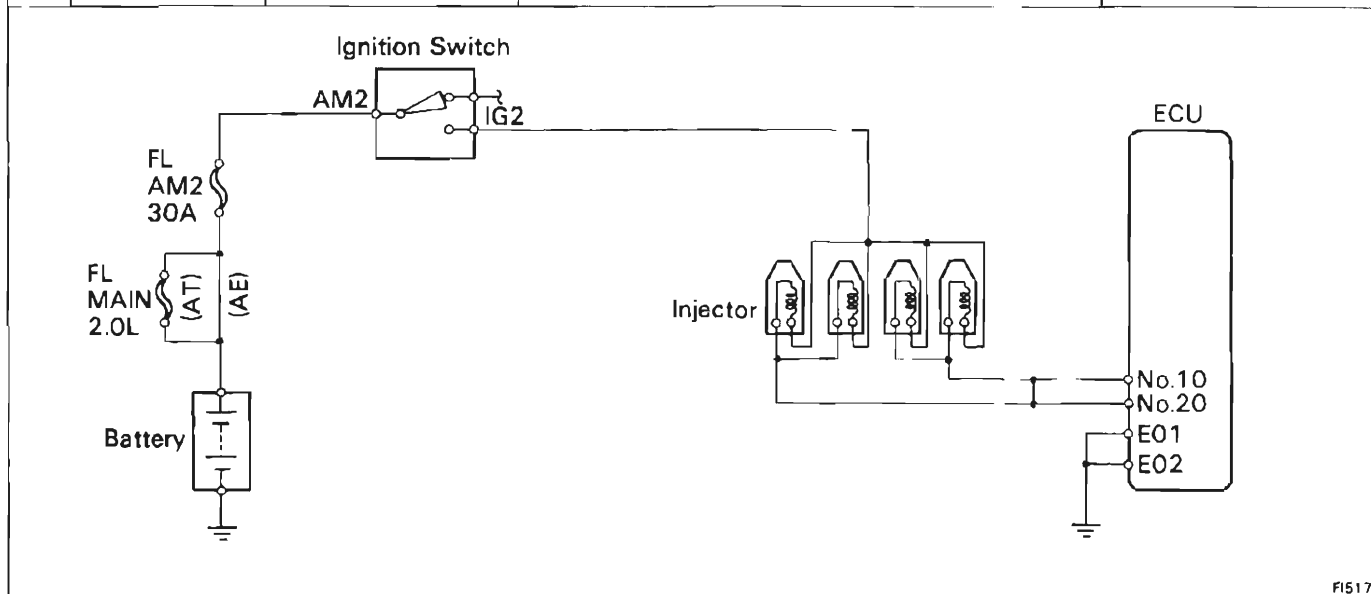
Check wiring between ECU and throttle position sensor.

BAD

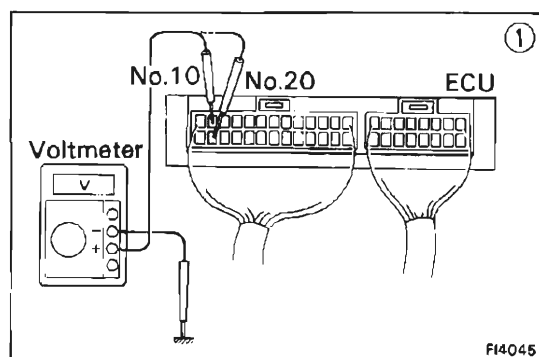
OK

Try another ECU.

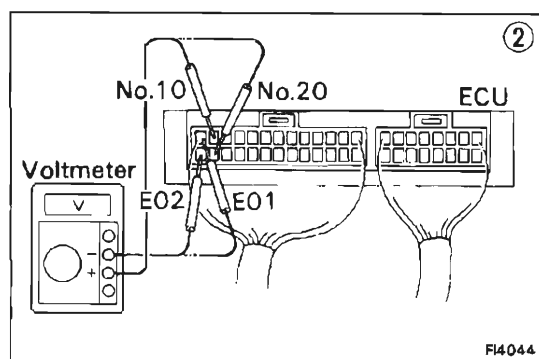
No.	Terminals	Trouble	Condition	STD voltage
4	No.10 — E01 No.20 — E02	No voltage	IG SW ON	10 — 14 V



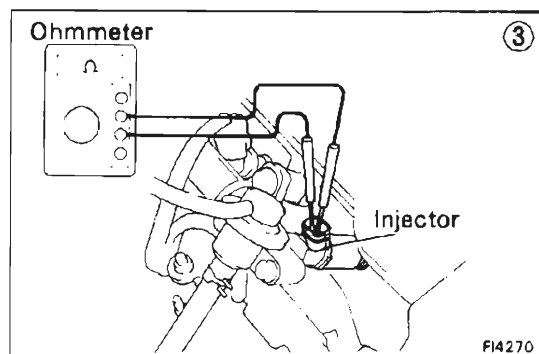
FI5178



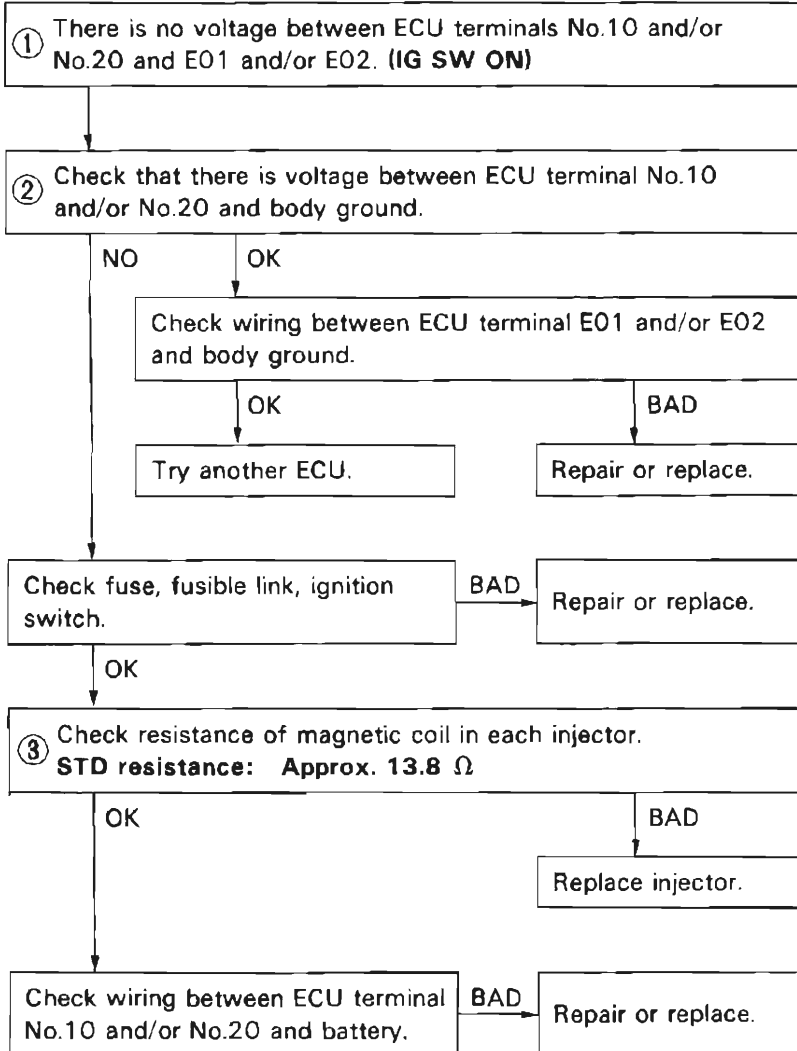
FI4045



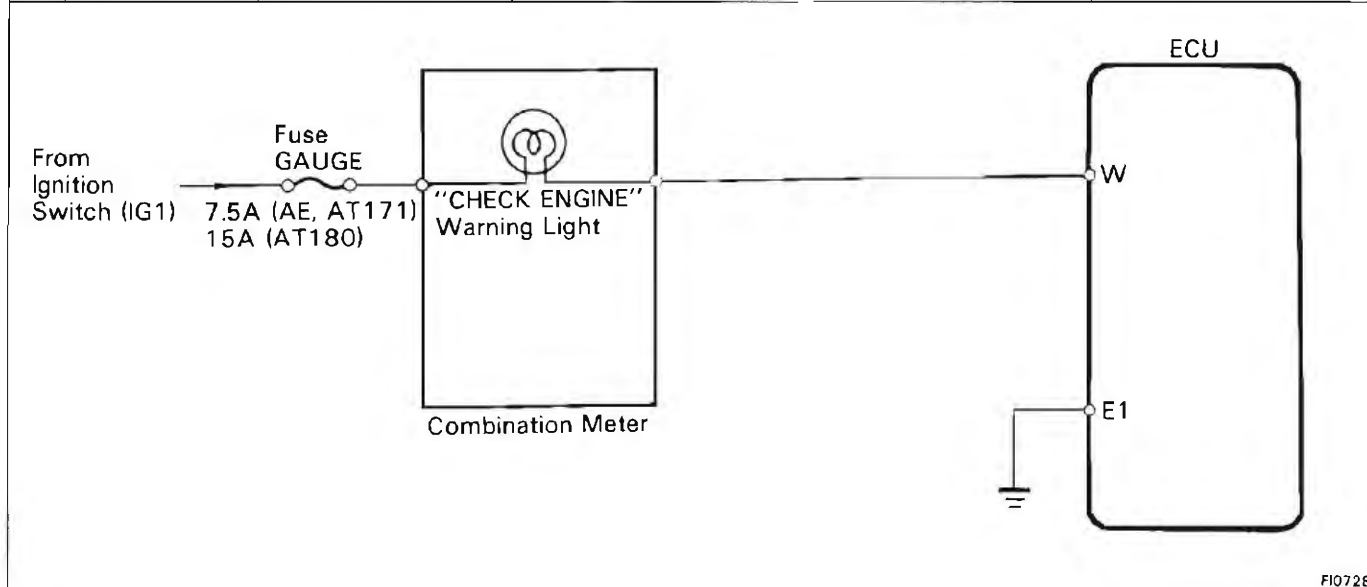
FI4044



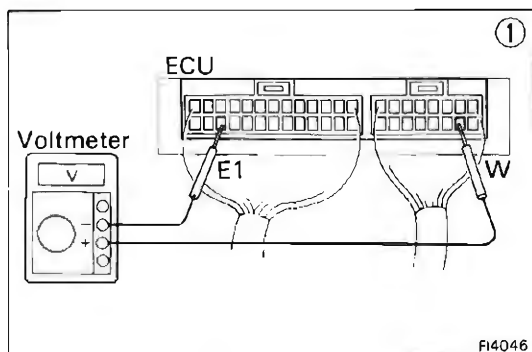
FI4270



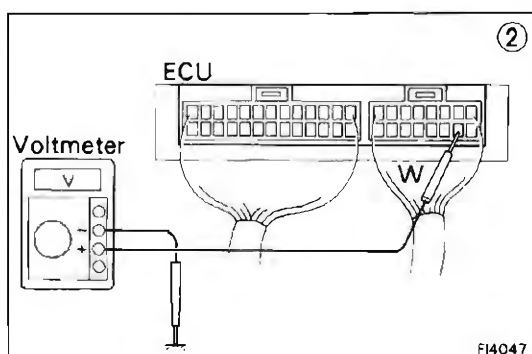
No.	Terminals	Trouble	Condition	STD voltage
5	W — E1	No voltage	No trouble ("CHECK ENGINE" warning light off) and engine running.	10 — 14 V



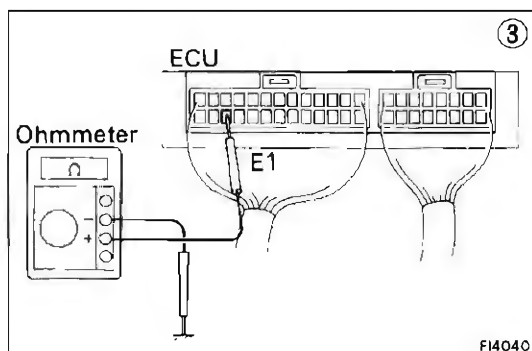
FI0728



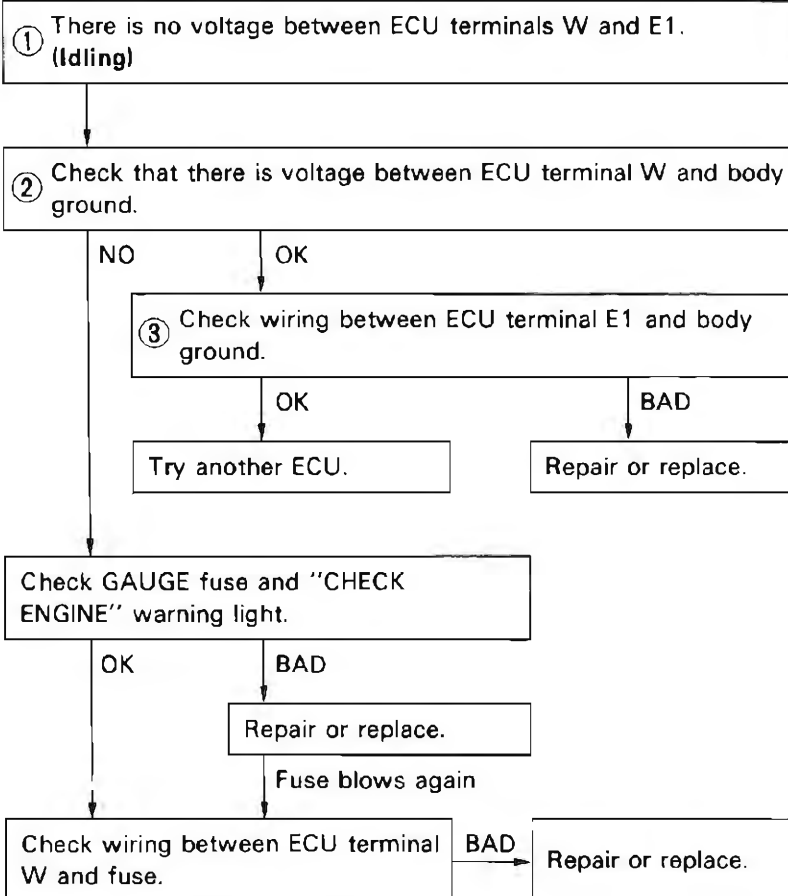
FI4046



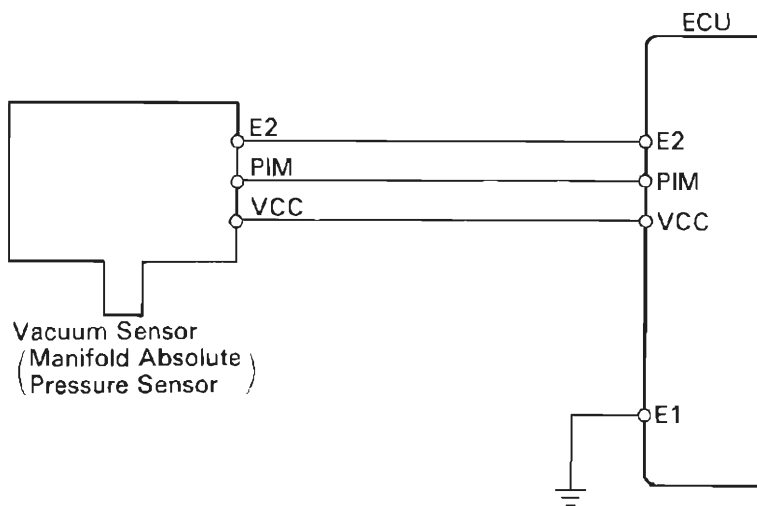
FI4047



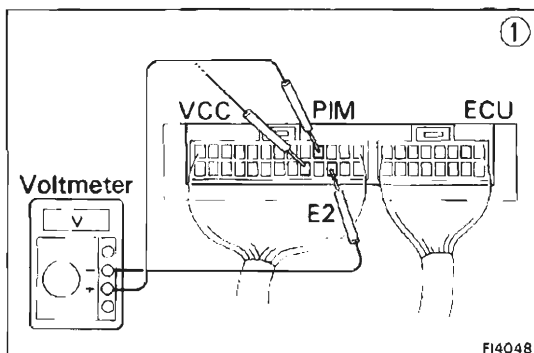
FI4040



No.	Terminals	Trouble	Condition	STD voltage
6	PIM — E2	No voltage	IG SW ON	3.3 — 3.9 V
	VCC — E2			4.5 — 5.5 V



FI1228



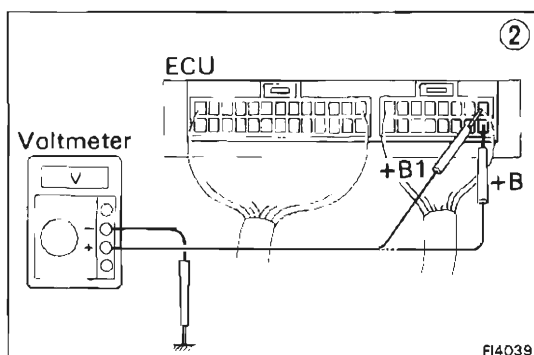
① There is no voltage between ECU terminals PIM or VCC and E2. (IG SW ON)

② Check that there is voltage between ECU terminal +B (+B1) and body ground. (IG SW ON)

NO

NO

Refer to +B — E1 trouble section (No.1).
(See page FI-39)



③ Check wiring between ECU terminal E1 and body ground.

OK

BAD

Check vacuum sensor.
(See page FI-140)

Repair or replace.

BAD

OK

Replace vacuum sensor.

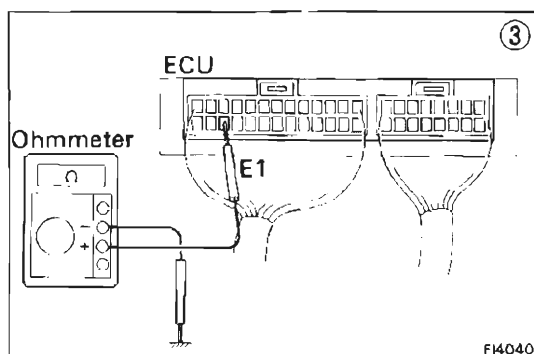
Check wiring between ECU and vacuum sensor.

OK

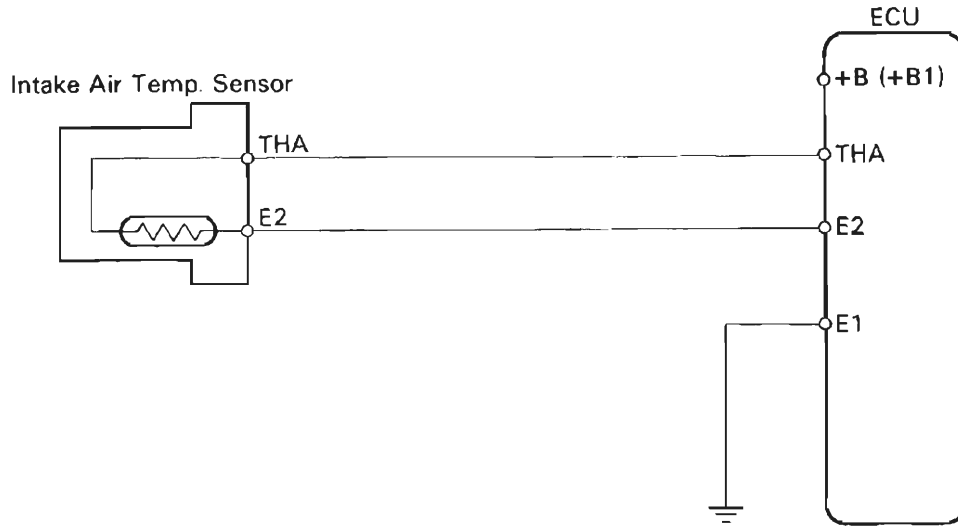
BAD

Try another ECU.

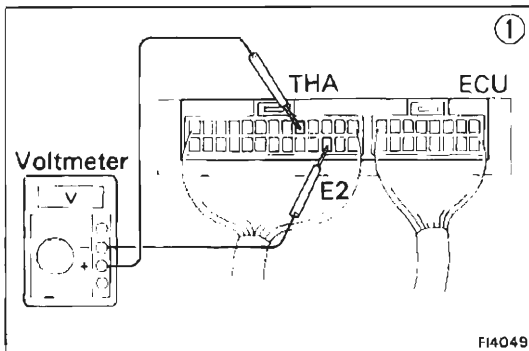
Repair or replace.



No.	Terminals	Trouble	Condition		STD voltage
7	THA — E2	No voltage	IG SW ON	Intake air temperature 20°C (68°F)	2.0 — 2.5 V



FI3572



① There is no voltage between ECU terminals THA and E2. (IG SW ON)

② Check that there is voltage between ECU terminal +B (+B1) and body ground. (IG SW ON)

OK

NO

Refer to +B — E1 trouble section (No.1). (See page FI-39)

Check wiring between ECU terminal E1 and body ground.

OK

BAD

③ Check intake air temp. sensor. (See page FI-139)

Repair or replace.

BAD

Replace intake air temp. sensor

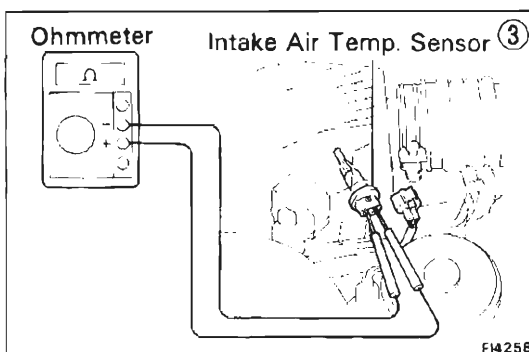
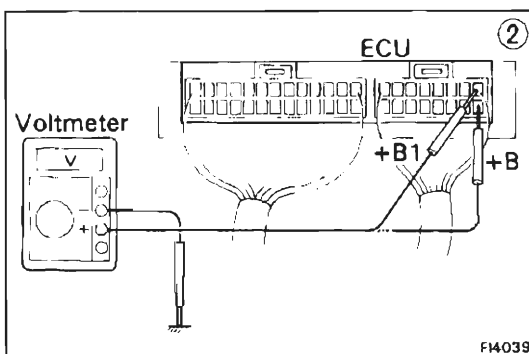
Check wiring between ECU and intake air temp. sensor.

OK

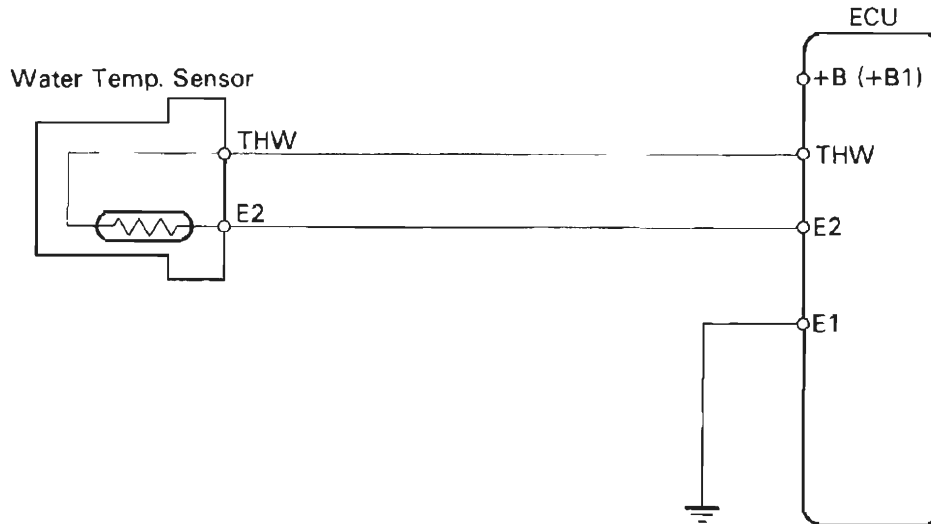
BAD

Try another ECU.

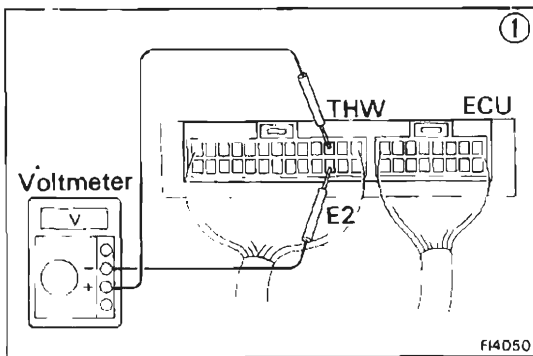
Repair or replace wiring.



No.	Terminals	Trouble	Condition		STD voltage
8	THW — E2	No voltage	IG SW ON	Coolant temperature 80°C (176°F)	0.4 — 0.7 V



FI3572



① There is no voltage between ECU terminals THW and E2. (IG SW ON)

② Check that there is voltage between ECU terminal +B (+B1) and body ground. (IG SW ON)

OK

NO

Refer to +B — E1 trouble section (No.1). (See page FI-39)

Check wiring between ECU terminal E1 and body ground.

OK

BAD

③ Check water temp. sensor. (See page FI-138)

Repair or replace.

BAD

OK

Replace water temp. sensor.

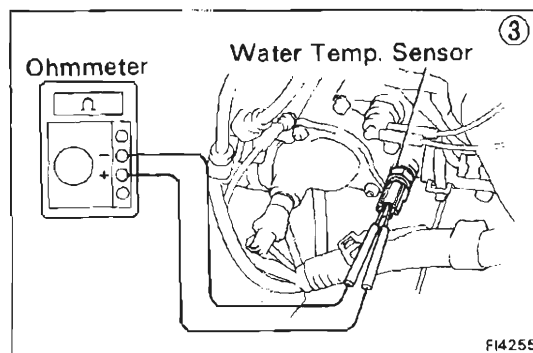
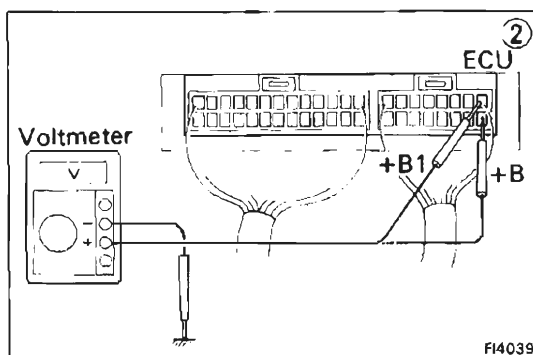
Check wiring between ECU and water temp. sensor.

OK

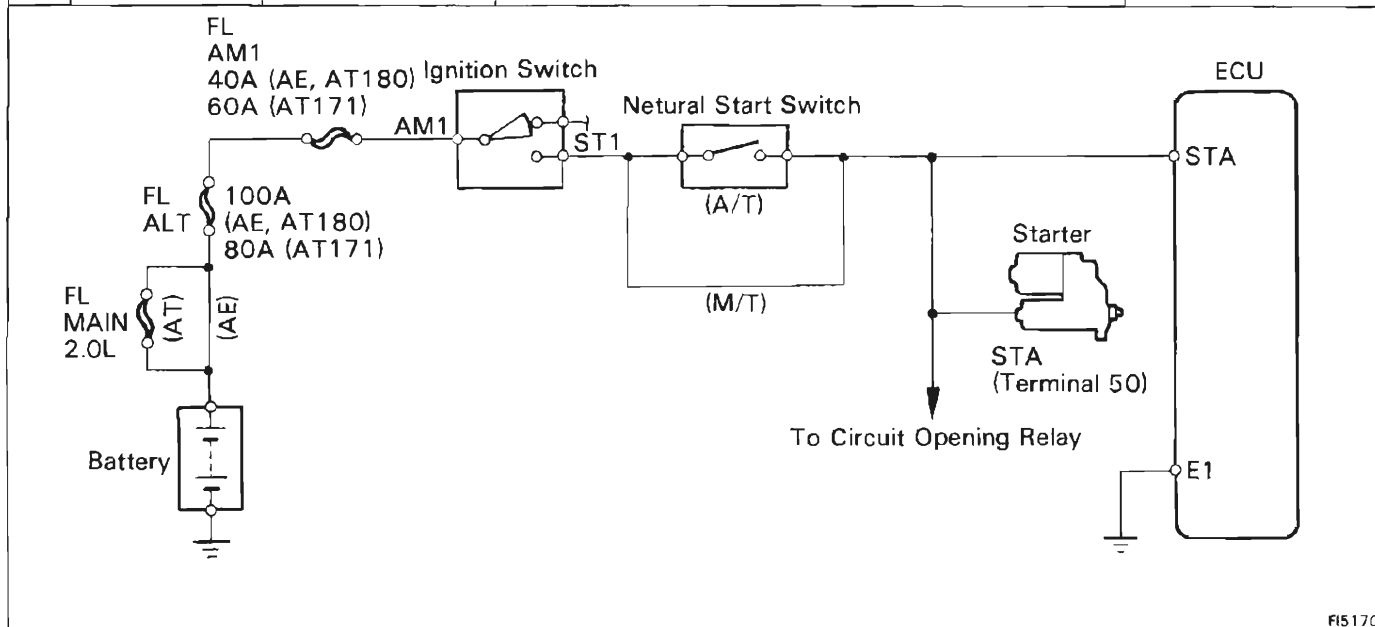
BAD

Try another ECU.

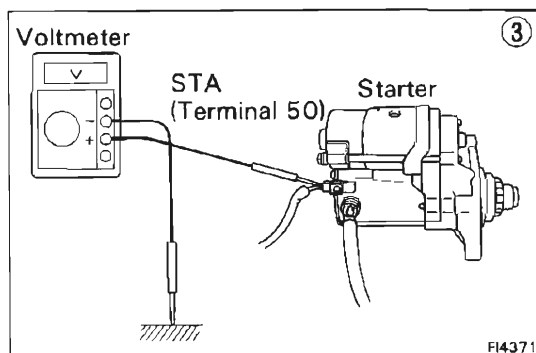
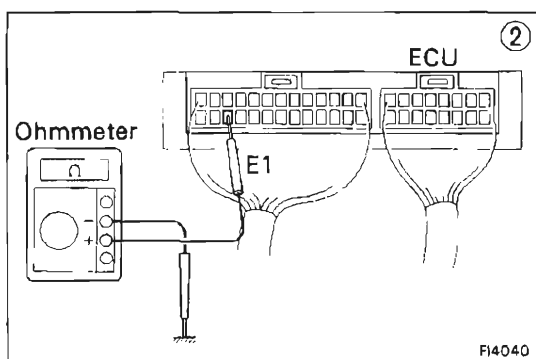
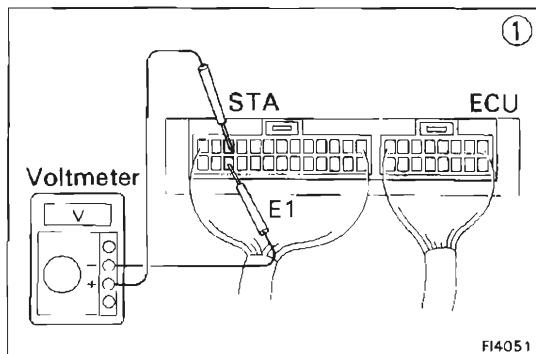
Repair or replace.



No.	Terminals	Trouble	Condition	STD voltage
9	STA — E1	No voltage	Cranking	6 — 14 V



FI5170



① There is no voltage between ECU terminals STA and E1.
(IG SW START)

Check starter operation.

OK

Check wiring between ECU terminal STA and ignition switch terminal ST1.

OK

BAD

Replace replace.

② Check wiring between ECU terminal E1 and body ground.

OK

BAD

Try another ECU.

Repair or replace.

Check fusible link, battery, wiring and ignition switch.

BAD

Repair or replace.

OK

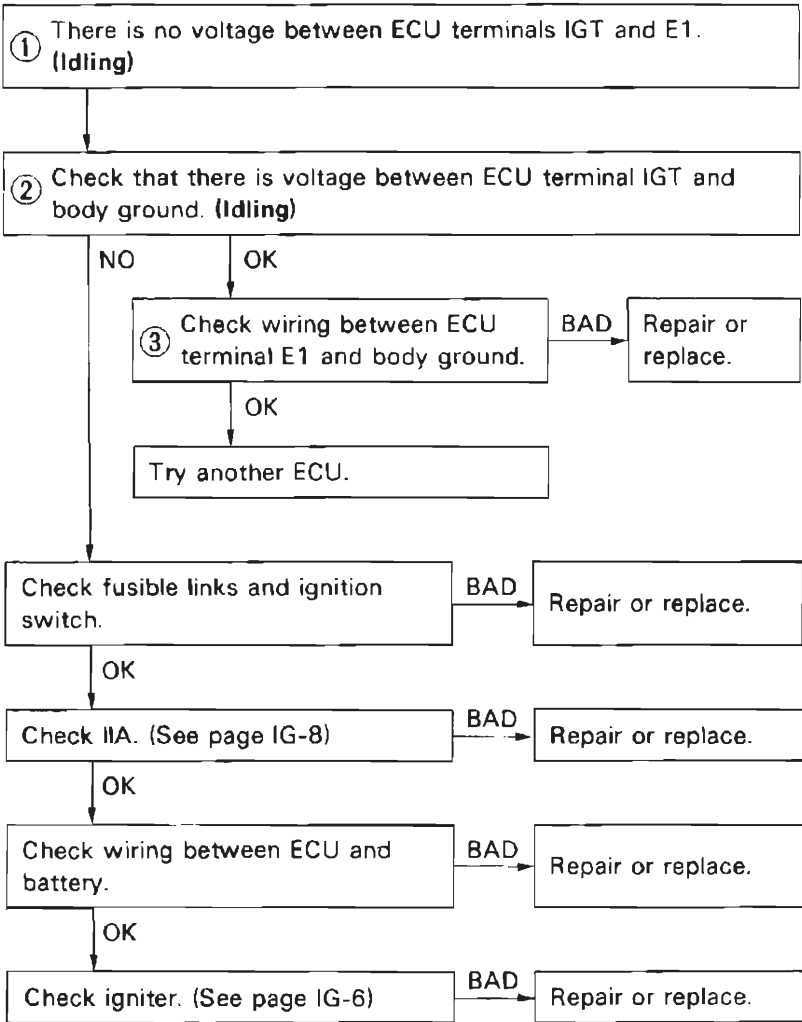
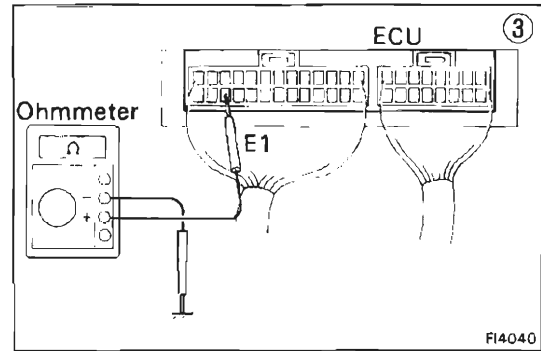
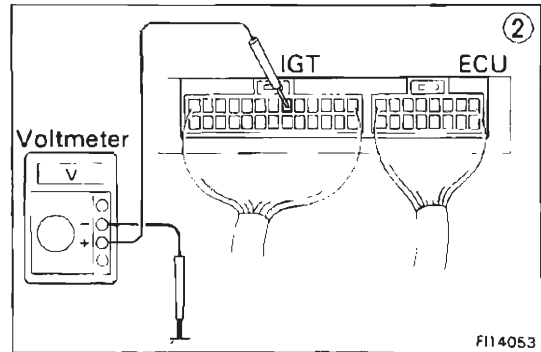
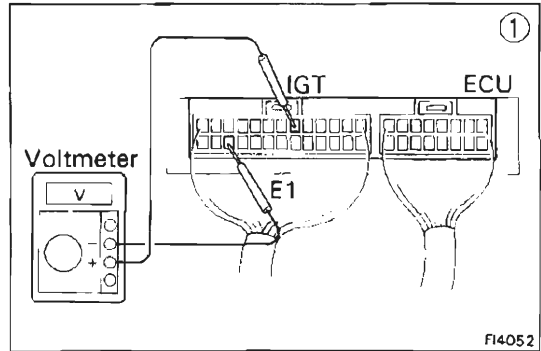
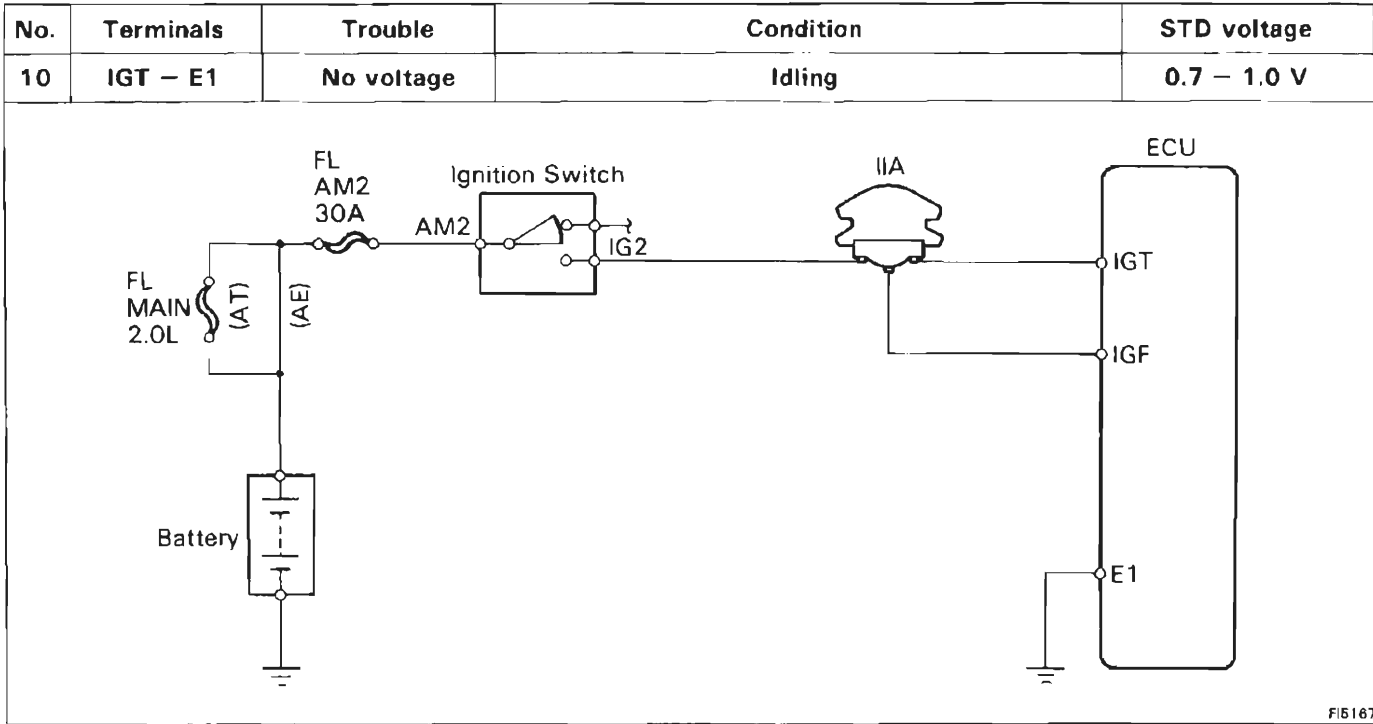
③ Check that there is voltage at STA (50) terminal of starter.
(IG SW START) STD voltage: 6 — 14 V

OK

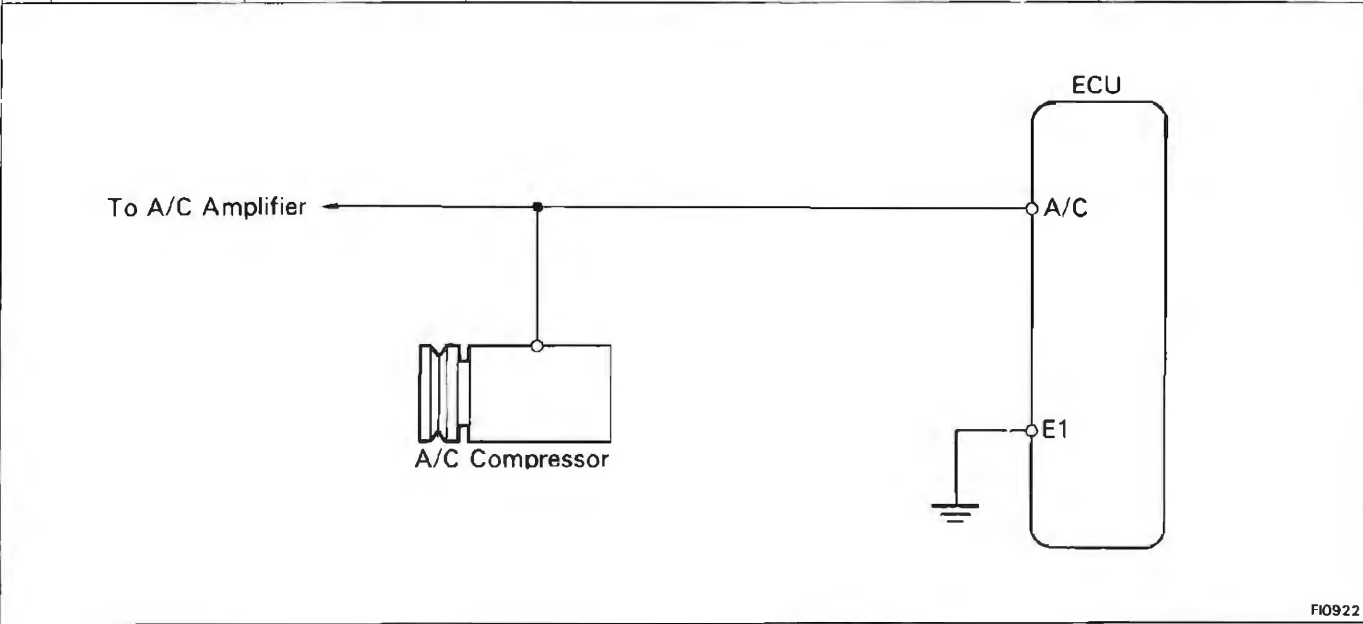
Check starter.

NO

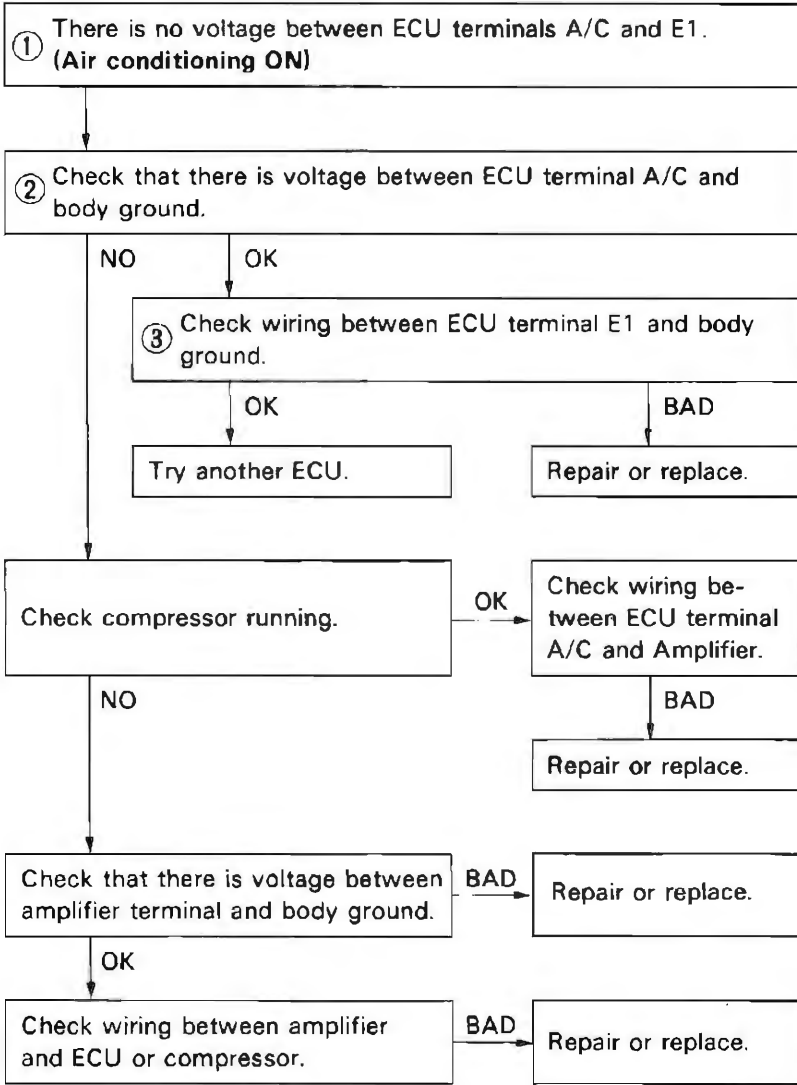
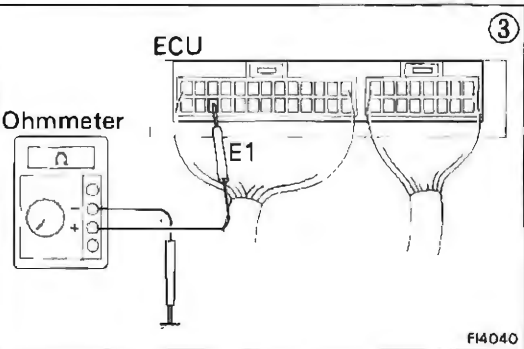
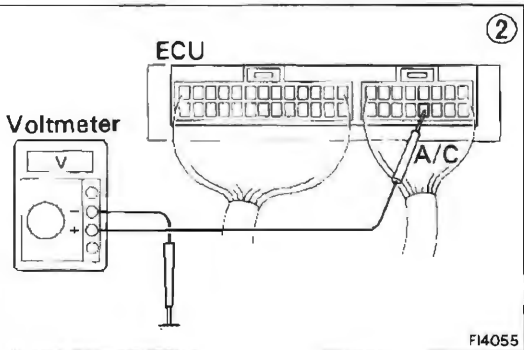
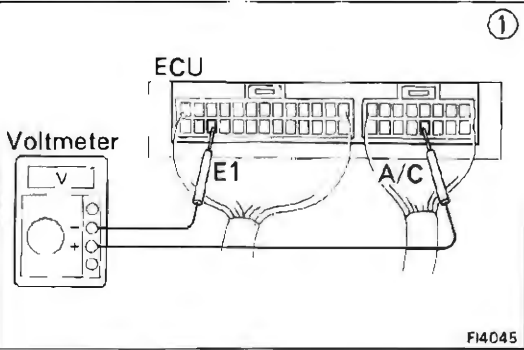
Check wiring between ignition switch terminal ST1 and starter terminal STA (50)

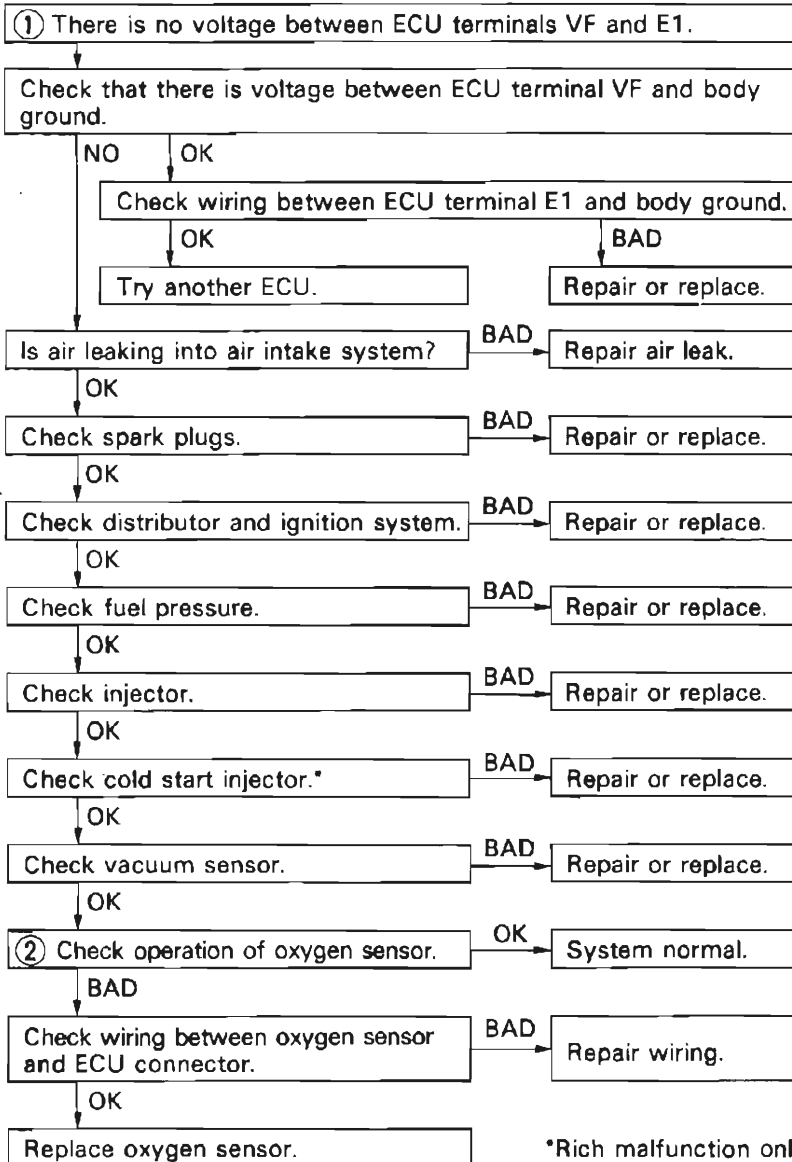
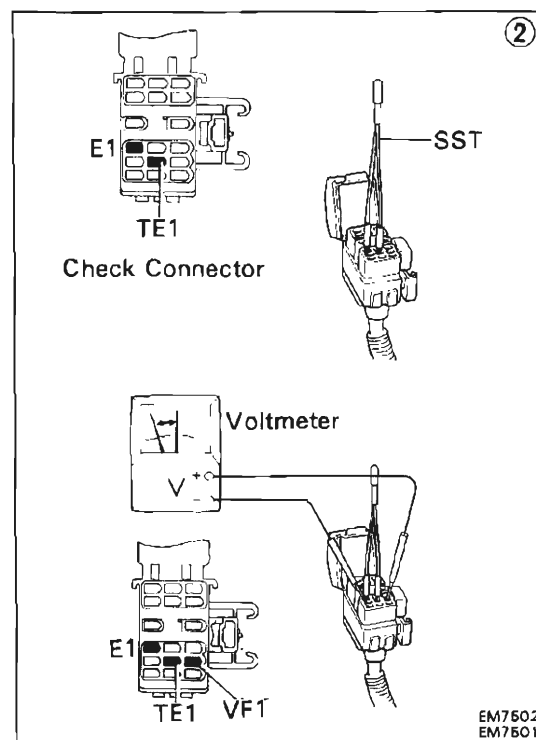
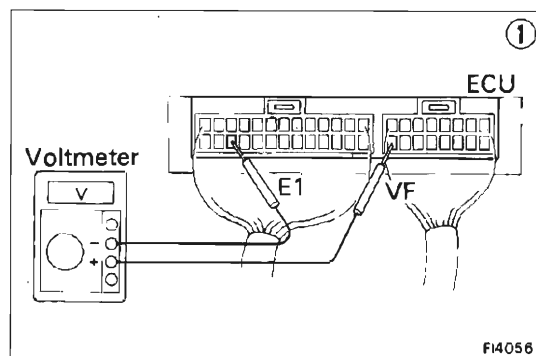
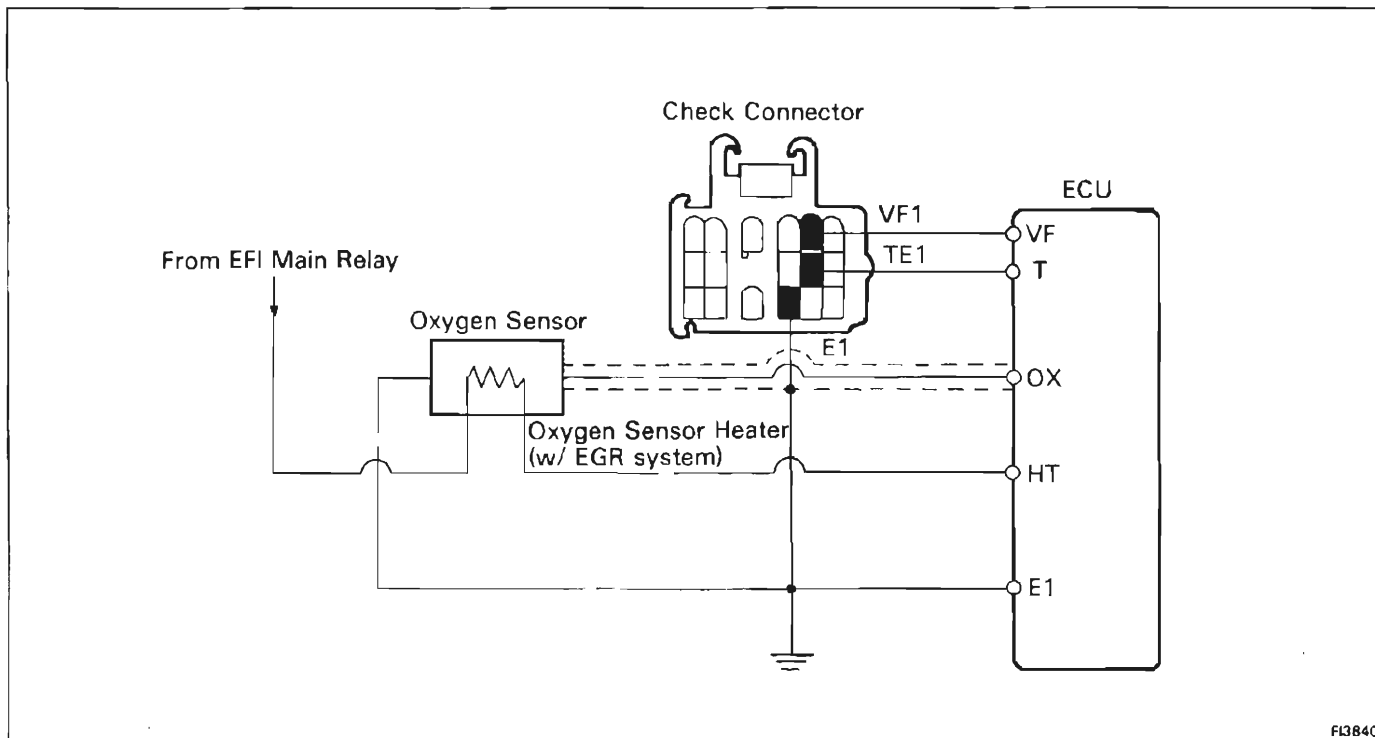


No.	Terminals	Trouble	Condition	STD voltage
11	A/C — E1	No voltage	Air conditioning ON	5 — 14 V



FI0922





*Rich malfunction only

ON-VEHICLE INSPECTION**1. CHECK FUEL PUMP OPERATION**

(a) Turn the ignition to ON.

HINT: Do not start the engine.

(b) Using SST, connect terminals +B and FP of the check connector.

SST 09843-18020

LOCATION: See page FI-133

(c) Check that there is pressure in the hose from the fuel filter.

HINT: At this time, you will hear fuel return noise from the pressure regulator.

(d) Remove SST from the check connector.

SST 09843-18020

(e) Turn the ignition switch to OFF.

If there is no pressure, check the following parts:

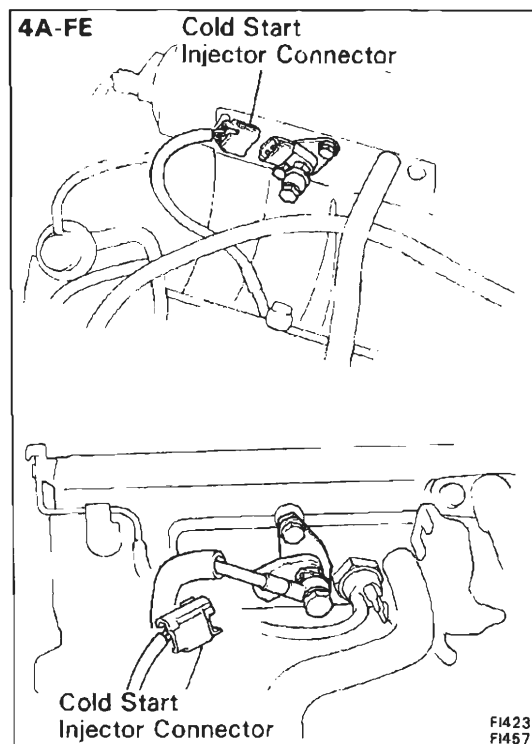
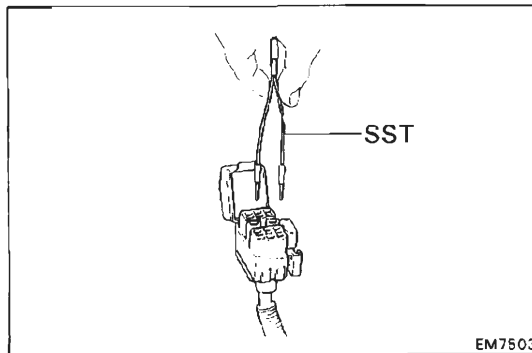
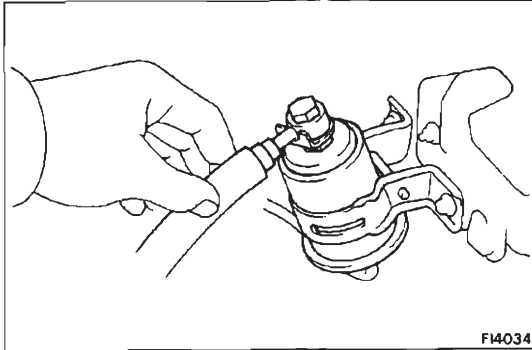
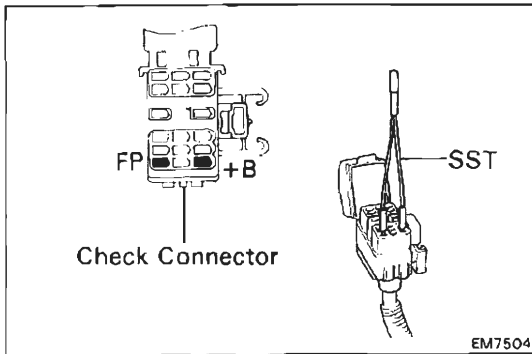
- Fusible links
- Fuses
- EFI main relay
- Circuit opening relay
- Fuel pump
- ECU
- Wiring connections

2. INSPECT FUEL PRESSURE

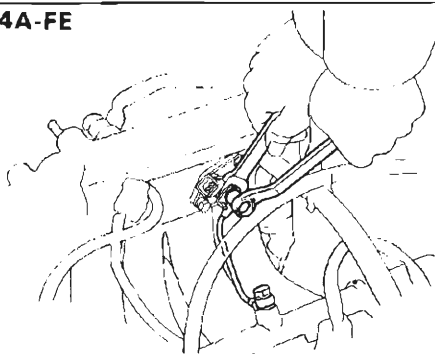
(a) Check that the battery voltage is above 12 V.

(b) Disconnect the cable from the negative (-) terminal of the battery.

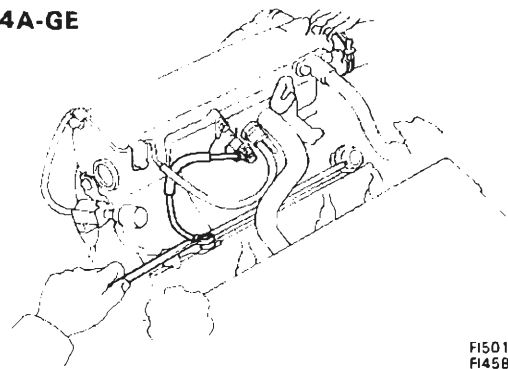
(c) Disconnect the wiring connector from the cold start injector.



4A-FE

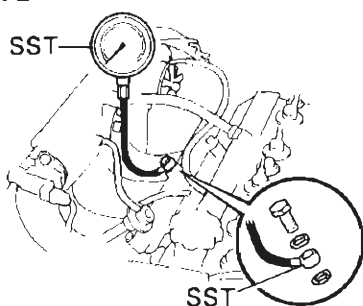


4A-GE

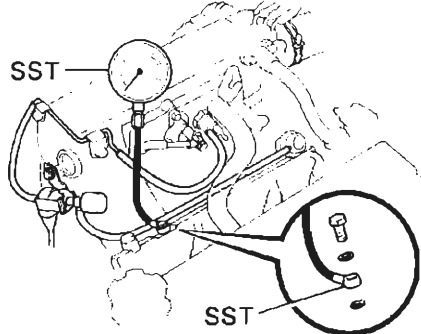
FI5010
FI4588

- (d) Put a suitable container or shop towel under cold start injector pipe.
- (e) Slowly loosen the union bolts of the cold start injector pipe and remove the bolts, cold start injector pipe and four gaskets.
- (f) Drain the fuel from the delivery pipe.

4A-FE



4A-GE

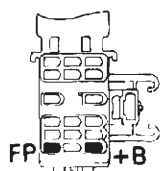
FI4237
FI4588

- (g) Install SST (pressure gauge) to the delivery pipe with new two gasket and union bolt.

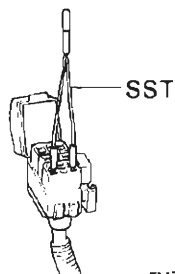
SST 09268-45012

Torque: 4A-FE 180 kg-cm (13 ft-lb, 18 N·m)

- (h) Wipe off any splattered gasoline.
- (i) Reconnect the battery negative (-) cable.



Check Connector



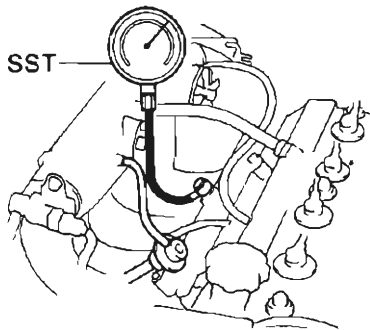
EM7504

- (j) Using SST, connect terminals +B and FP of the check connector.

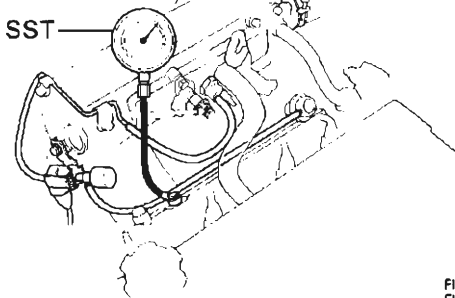
SST 09843-18020

LOCATION: See page FI-133

4A-FE



4A-GE

FI4235
FI4584

(k) Turn the ignition switch ON.

(l) Measure the fuel pressure.

Fuel pressure: 2.7 – 3.1 kg/cm²
(38 – 44 psi, 265 – 304 kPa)

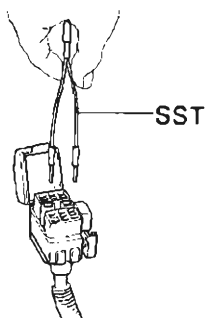
If pressure is high, replace the fuel pressure regulator.

If pressure is low, check the following parts:

- Fuel hoses and connection
- Fuel pump
- Fuel filter
- Fuel pressure regulator

(m) Remove SST from the check connector.

SST 09843-18020



EM7503

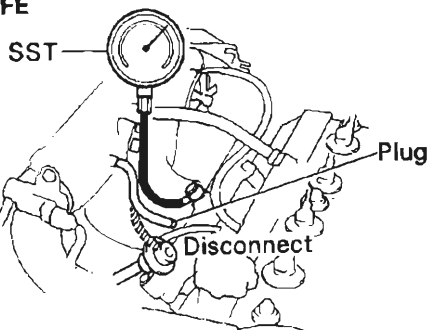
(n) Start the engine.

(o) Disconnect the vacuum sensing hose from the fuel pressure regulator, and plug the hose end.

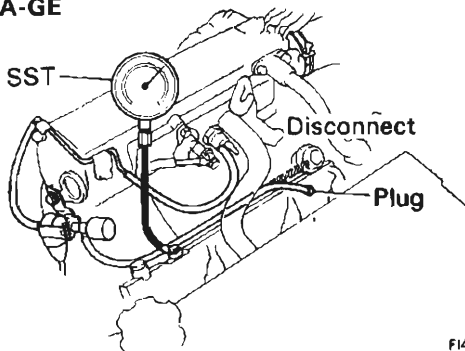
(p) Measure the fuel pressure at idling.

Fuel pressure: 2.7 – 3.1 kg/cm²
(38 – 44 psi, 265 – 304 kPa)

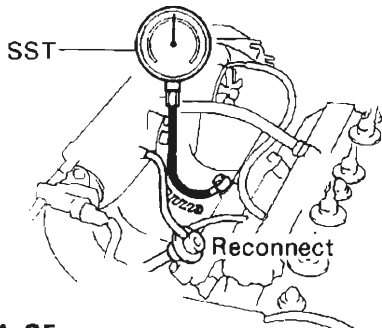
4A-FE



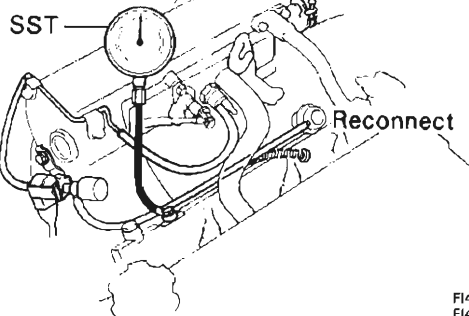
4A-GE

FI4236
FI4585

4A-FE



4A-GE

FI4238
FI4587

(q) Reconnect the vacuum sensing hose to the fuel pressure regulator.

(r) Measure the fuel pressure at idling.

Fuel pressure: 2.1 – 2.6 kg/cm²
(30 – 37 psi, 206 – 255 kPa)

If pressure is not as specified, check the vacuum sensing hose and fuel pressure regulator.

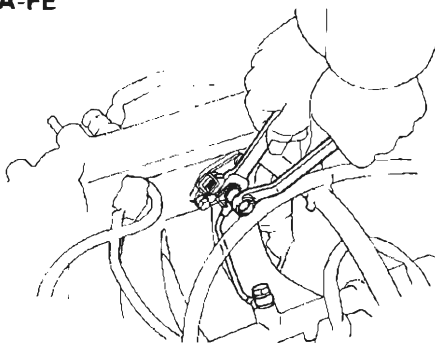
(s) Stop the engine. Check that the fuel pressure remains 1.5 kg/cm² (21 psi, 147 kPa) or more for 5 minutes after the engine is turned off.

If pressure is not as specified, check the fuel pump, pressure regulator and/or injector.

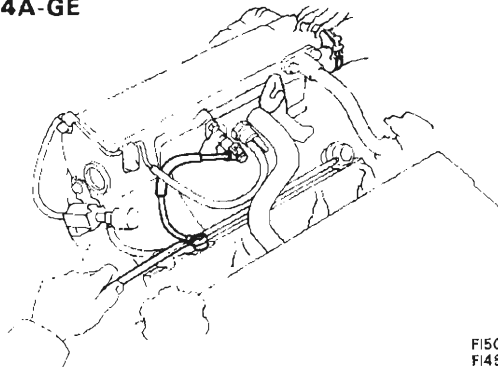
(t) After checking fuel pressure, disconnect the battery negative (–) cable and carefully remove the SST to prevent gasoline from splashing.

SST 09268-45012

4A-FE



4A-GE

FI5010
FI4588

(u) Install the cold start injector pipe with four new gaskets and two union bolts.

Torque: 4A-FE 180 kg-cm (13 ft-lb, 18 N·m)

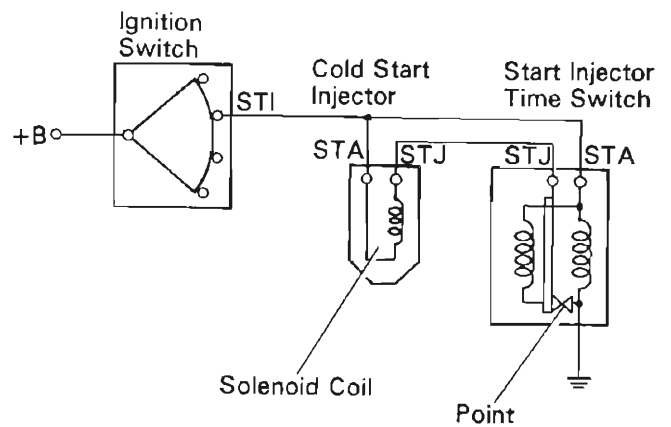
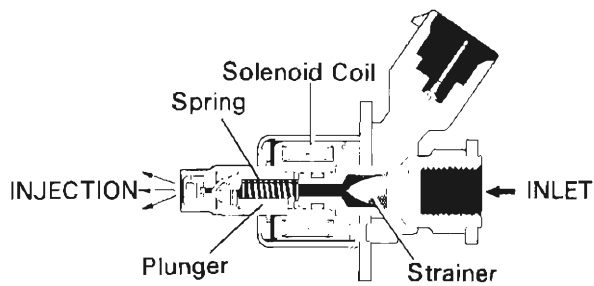
(v) Reconnect the cold start injector connector.

(w) Reconnect the cable to the negative (–) terminal of the battery.

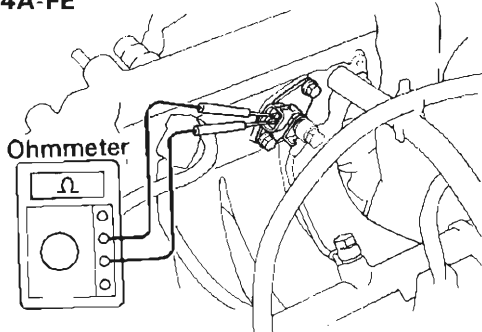
(x) Check for fuel leakage. (See page FI-12)

Cold Start Injector

4A-FE



4A-FE



ON-VEHICLE INSPECTION

INSPECT RESISTANCE OF COLD START INJECTOR

- Disconnect the cold start injector connector.
- Using an ohmmeter, measure the resistance between the terminals.

Resistance: 4A-FE 3 – 5 Ω

If the resistance is not as specified, replace the injector.

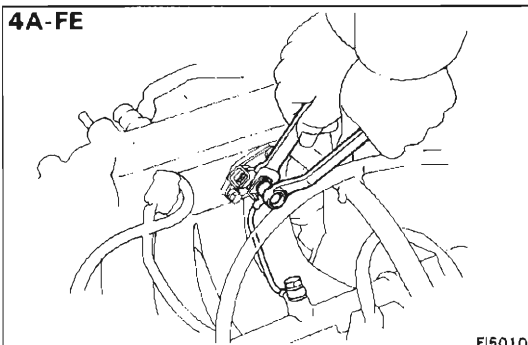
- Reconnect the cold start injector connector.

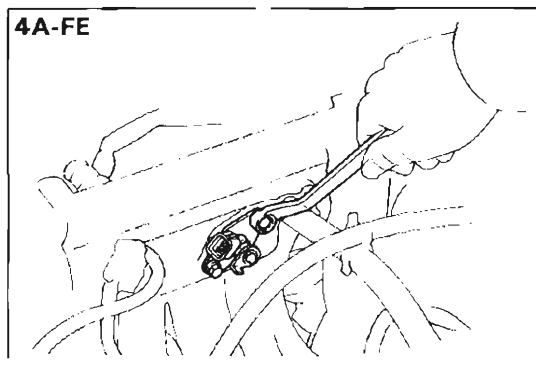
REMOVAL OF COLD START INJECTOR

- DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
- DISCONNECT COLD START INJECTOR CONNECTOR**
- REMOVE COLD START INJECTOR PIPE**
 - Put a suitable container or shop towel under the injector pipe.
 - Remove the two union bolts, four gaskets and injector pipe.

HINT: Slowly loosen the union bolts.

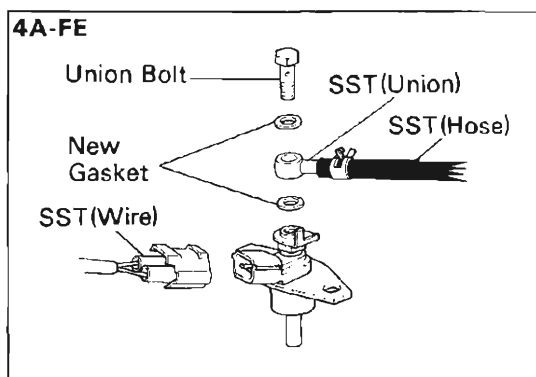
4A-FE





4. REMOVE COLD START INJECTOR

Remove the two bolts, cold start injector and gasket.



INSPECTION OF COLD START INJECTOR

1. INSPECT INJECTION OF COLD START INJECTOR

CAUTION: Keep clear of sparks during the test.

(a) Install SST (two unions) to the injector and delivery pipe with new gaskets and the union bolts.

SST 09268-41045 (09268-41080)

(b) Connect SST (hose) to the union.

SST 09268-41045

(c) Connect SST (wire) to the injector.

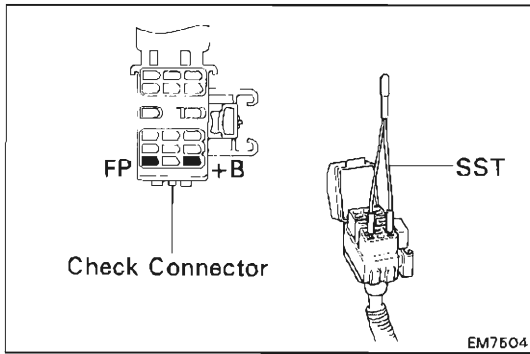
SST 09842-30055

(d) Put a container under the injector.

(e) Reconnect the battery negative (-) cable.

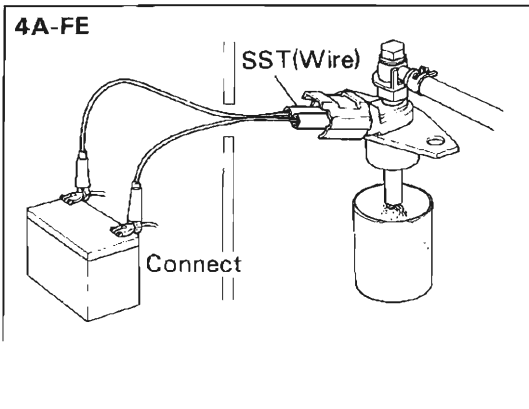
(f) Turn the ignition switch ON.

NOTICE: Do not start the engine.



- (g) Using SST, connect terminals +B and FP of the check connector.

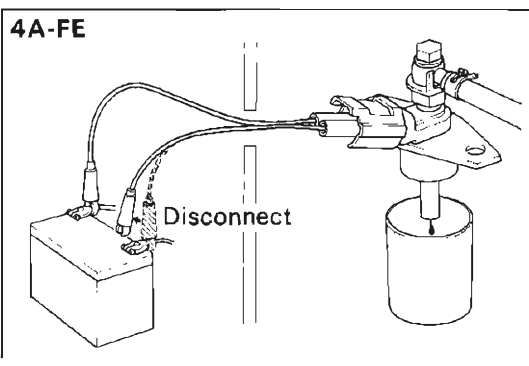
SST 09843-18020



- (h) Connect the test probes of the SST (wire) to the battery, and check that the spray is as shown.

SST 09842-30055

NOTICE: Perform this check within the shortest possible time.



2. INSPECT LEAKAGE

- (a) In the condition above, disconnect the test probes of SST(wire) from the battery and check fuel leakage from the injector.

SST 09842-30055

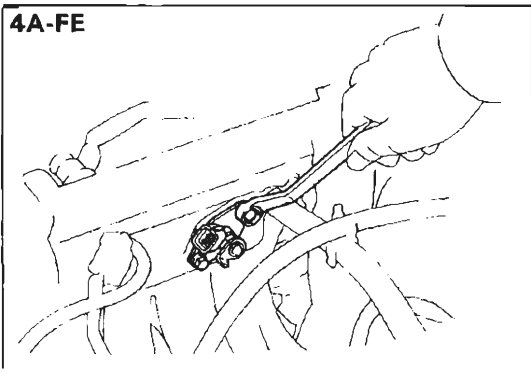
Fuel drop: One drop or less per minute

- (b) Disconnect the battery negative (-) cable.

- (c) Remove SST.

SST 09268-41045 (09268-41080) and 09842-30055
09843-18020

4A-FE



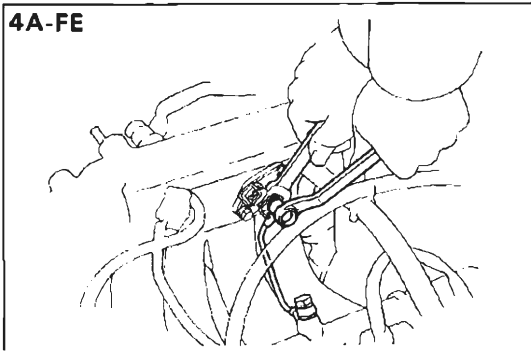
INSTALLATION OF COLD START INJECTOR

1. INSTALL COLD START INJECTOR

Install a new gasket and the injector with the two bolts.

Torque: 4A-FE 95 kg-cm (82 in.-lb, 9.3 N·m)

4A-FE



2. INSTALL COLD START INJECTOR PIPE

Install the injector pipe with four new gaskets and the two union bolts.

Torque: 4A-FE 180 kg-cm (13 ft-lb, 18 N·m)

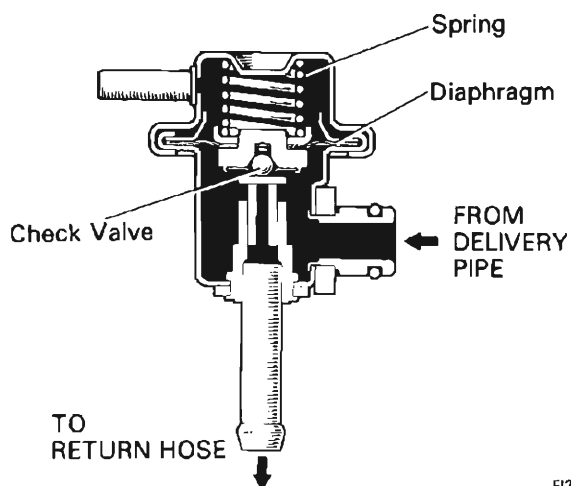
3. CONNECT COLD START INJECTOR CONNECTOR

4. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

5. CHECK FOR FUEL LEAKAGE (See page FI-12)

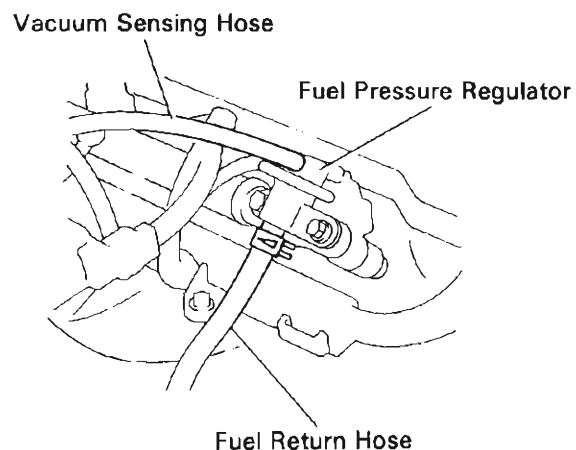
Fuel Pressure Regulator

4A-FE



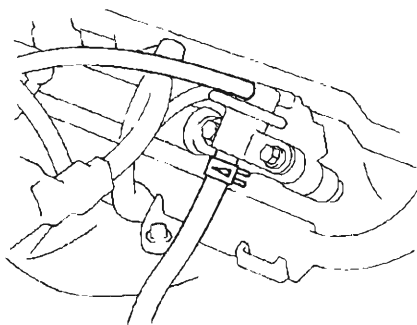
FI3093

4A-FE



FI6013

4A-FE



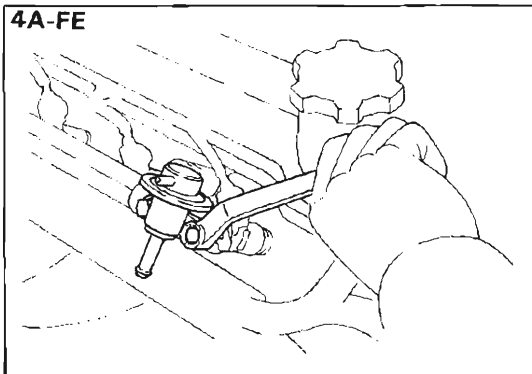
ON-VEHICLE INSPECTION

INSPECT FUEL PRESSURE (See page FI-95)

REMOVAL OF FUEL PRESSURE REGULATOR

1. DISCONNECT VACUUM SENSING HOSE
2. DISCONNECT FUEL RETURN HOSE

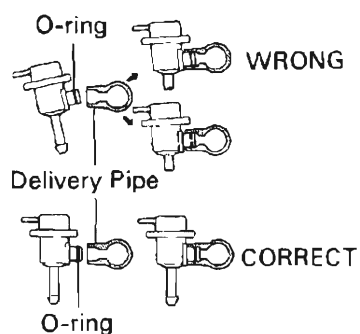
4A-FE



3. REMOVE FUEL PRESSURE REGULATOR

- (a) Remove the two bolts, and pull out the pressure regulator.
- (b) Remove the O-ring from the pressure regulator.

4A-FE



INSTALLATION OF FUEL PRESSURE REGULATOR

1. INSTALL FUEL PRESSURE REGULATOR

- (a) Apply a light coat of gasoline to a new O-ring, and install it to the pressure regulator.

- (b) Install the pressure regulator with the two bolts.

Torque: 4A-FE 95 kg-cm (82 in-lb, 9.3 N·m)

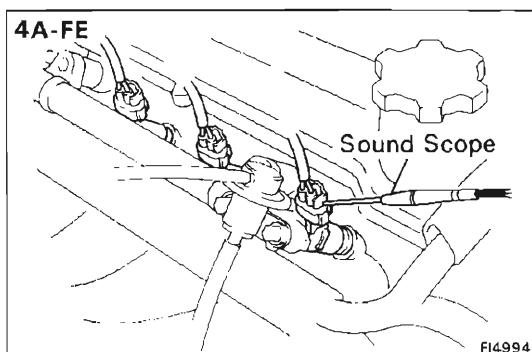
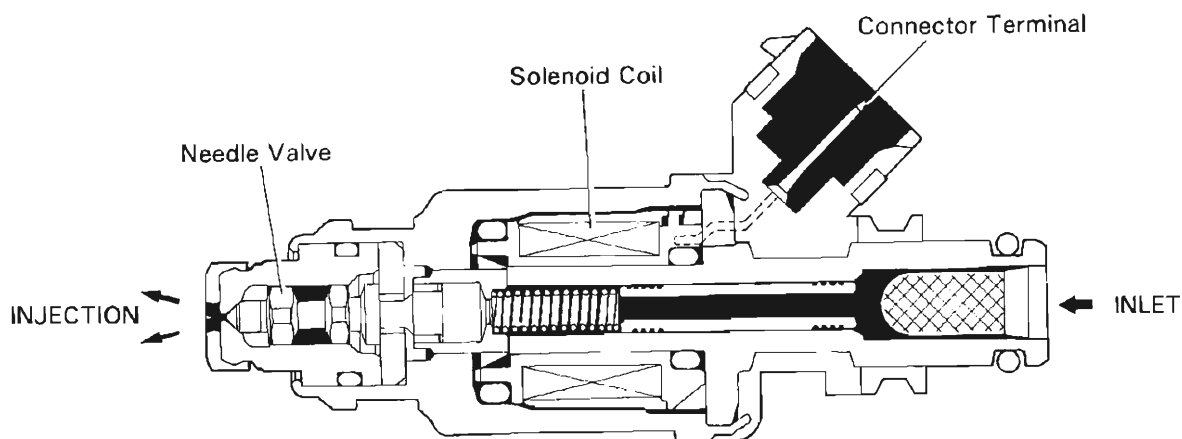
2. CONNECT FUEL RETURN HOSE

3. CONNECT VACUUM SENSING HOSE

4. CHECK FOR FUEL LEAKAGE (See page FI-12)

Injector

4A-FE(2WD)

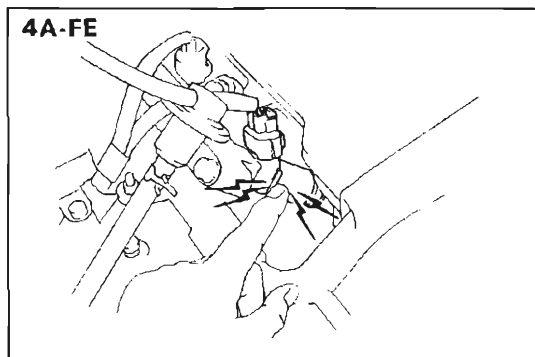


ON-VEHICLE INSPECTION

1. INSPECT INJECTOR OPERATION

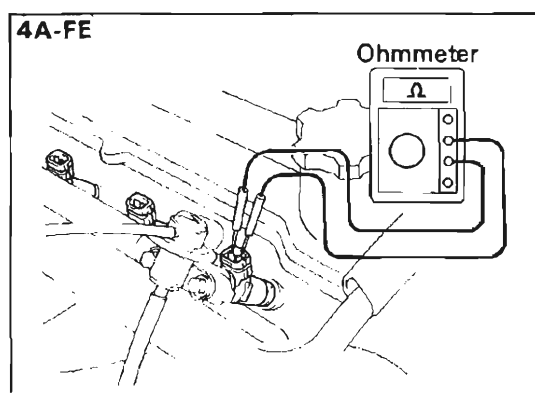
Check operation sound from each injector.

- (a) With the engine running or cranking, use a sound scope to check that there is normal operating noise in proportion to engine rpm.



- (b) If you have no sound scope, you can check the injector transmission operation with your finger (4A-FE)

If no sound or an unusual sound is heard, check the wiring connector, injector or injector signal from the ECU



2. INSPECT INJECTOR RESISTANCE

- (a) Disconnect the injector connector.
(b) Using an ohmmeter, measure the resistance between the terminals.

Resistance: Approx. 13.8 Ω

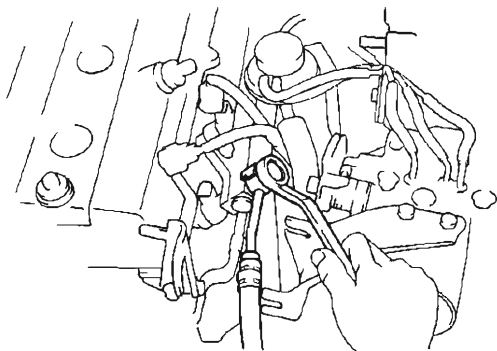
If the resistance is not as specified, replace the injector.

- (c) Reconnect the injector connector.

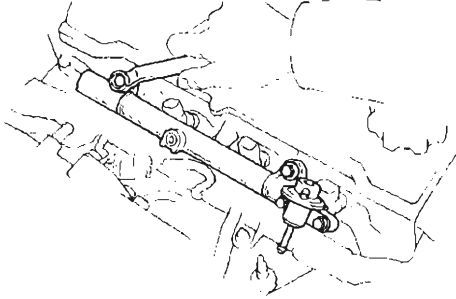
REMOVAL OF INJECTORS

1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
2. **REMOVE COLD START INJECTOR PIPE**
(See step 3 page FI-105)
3. **DISCONNECT VACUUM SENSING HOSE FROM FUEL PRESSURE REGULATOR**
4. **DISCONNECT INJECTOR CONNECTORS**
5. **DISCONNECT HOSE FROM FUEL RETURN PIPE**
6. **DISCONNECT FUEL INLET HOSE FROM DELIVERY PIPE**
 - (a) (4A-FE)
Remove the inlet pipe mount bolt.
 - (b) Remove the union bolt and two gaskets, and disconnect the inlet hose from the delivery pipe.
7. **(4A-FE 4WD)**
REMOVE EGR VACUUM MODULATOR
(See step 6 page EM-60)

4A-FE (Australia)



4A-FE (Ex. Australia)



8. REMOVE DELIVERY PIPE AND INJECTORS

(a) (4A-FE)

Remove the two bolts and delivery pipe together with the four injectors.

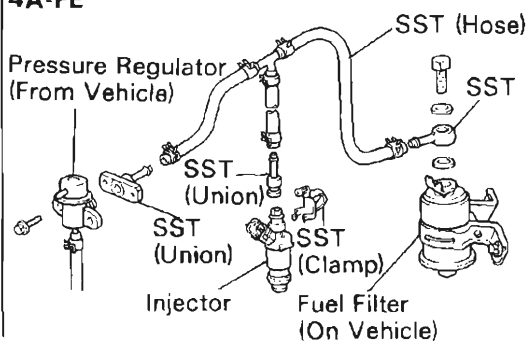
NOTICE: Be careful not to drop the injector, when removing the delivery pipe.

(b) (4A-FE)

Remove the four insulators and two spacers from the cylinder head.

(c) Pull out the four injectors from the delivery pipe.

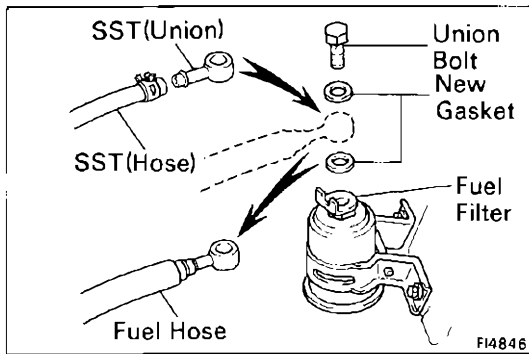
4A-FE



INSPECTION OF INJECTORS

1. INSPECT INJECTOR INJECTION

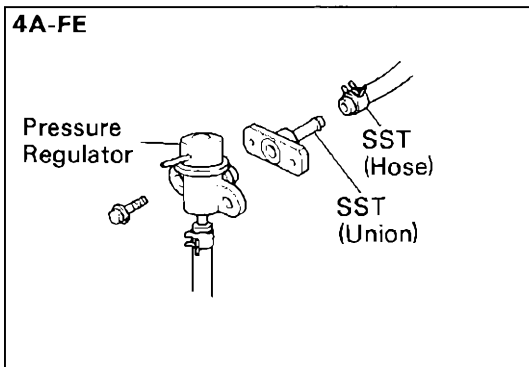
CAUTION: Keep clear of sparks during the test.



- (a) Disconnect the fuel inlet hose from the fuel filter outlet.
- (b) Connect SST (union and hose) to the fuel filter outlet with new gaskets and the union bolt.

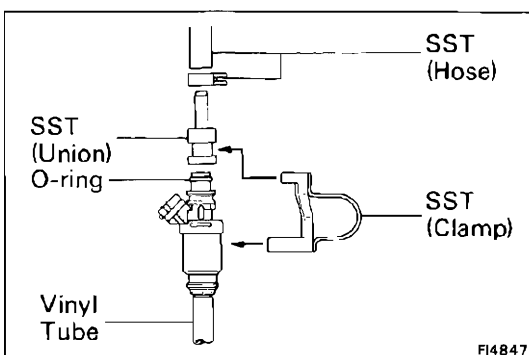
SST 09268-41045 (90405-09015)

HINT: Use the vehicle's fuel filter.



- (c) Remove the pressure regulator from the delivery pipe, and connect the fuel hose to pressure regulator.
- (d) Install a new O-ring to the pressure regulator.
- (e) Connect the SST (hose) to the pressure regulator with SST (union) and two bolts.

SST 09268-41045 (09268-41090)



- (f) Install the grommet and a new O-ring to the injector.
- (g) Connect SST (union and hose) to the injector, and hold the injector and union with SST(clamp).

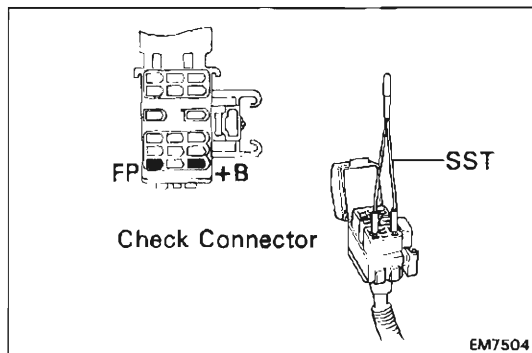
SST 09268-41045

- (h) Put the injector into the graduated cylinder.

HINT: Install the suitable vinyl hose onto the injector to prevent gasoline from splashing out.

- (i) Reconnect the battery negative (-) cable.
- (j) Turn the ignition switch ON.

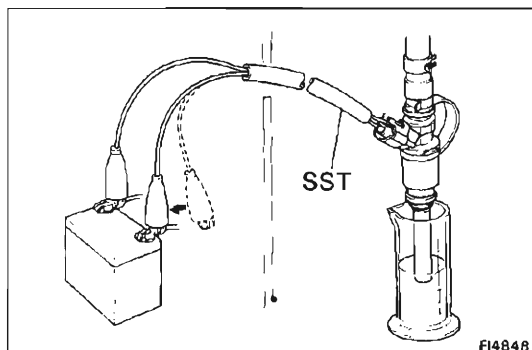
NOTICE: Do not start the engine.



- (k) Using SST, connect terminals +B and FP of the check connector.

SST 09843-18020

LOCATION: See page FI-133



- (l) Connect SST (wire) to the injector and battery for 15 seconds, and measure the injection volume with a graduated cylinder. Test each injector two or three times.

SST 09842-30070

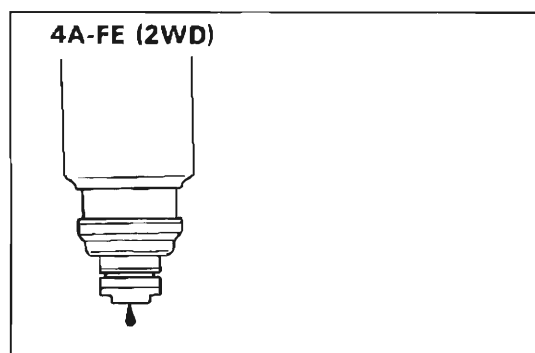
Volume:

4A-FE

40 – 50cc (2.4 – 3.1 cu in.) per 15sec.

Difference between each injector:
5cc (0.3 cu in.) or less

If the injection volume is not as specified, replace the injector.



2. INSPECT LEAKAGE

- (a) In the condition above, disconnect the test probes of SST(wire) from the battery and check the fuel leakage from the injector.

SST 09842-30070

Fuel drop: One drop or less per minute.

- (b) Disconnect the battery negative (–) cable.

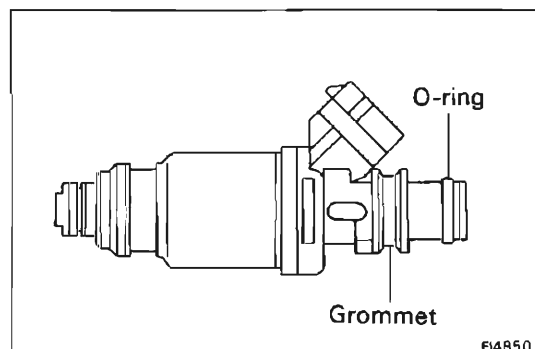
- (c) Remove SST and the service wire.

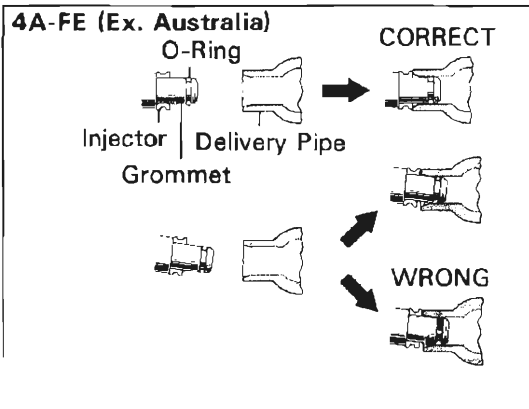
SST 09268-41045

INSTALLATION OF INJECTORS

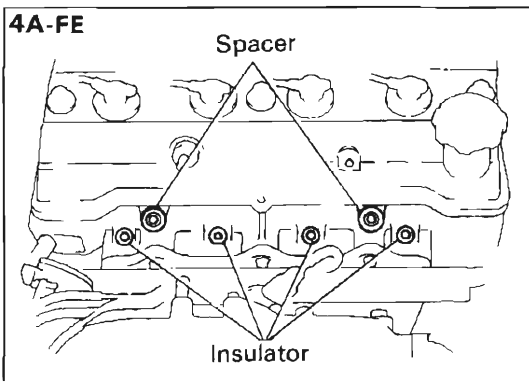
1. INSTALL INJECTORS AND DELIVERY PIPE

- (a) Install a new grommet to the injector.
- (b) Apply a light coat of gasoline to a new O-ring and install it to the injector.

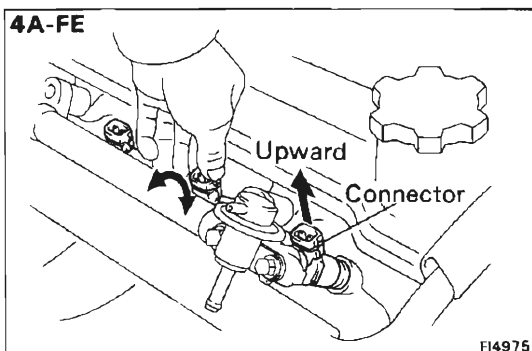




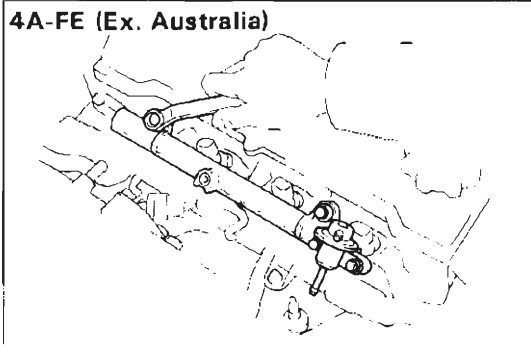
- (c) While turning the injector left and right, install it to the delivery pipe. Install the four injectors.



- (d) (4A-FE)
Place the four insulators and two spacers in position on the cylinder head.
- (4A-GE)
Place the four insulators and three spacers in position on the cylinder head.



- (e) Place the injectors together with the delivery pipe in position on the cylinder head.
- (f) Check that the injectors rotate smoothly.
- HINT: If injectors do not rotate smoothly, the probable cause is incorrect installation of O-rings. Replace the O-ring.
- (g) Position the injector connector upward.

4A-FE (Ex. Australia)

(h) (4A-FE)

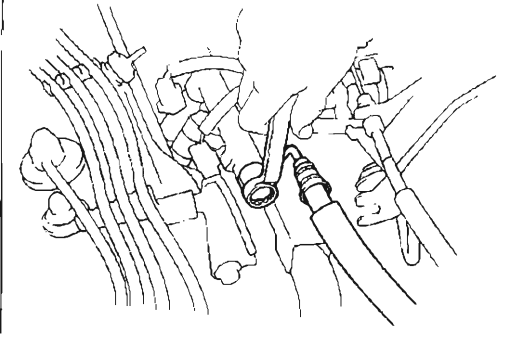
Install and torque the two bolts.

(4A-GE)

Install and torque the three bolts.

Torque: 4A-FE 150 kg-cm (11 ft-lb, 15 N·m)

4A-FE (Ex. Australia)

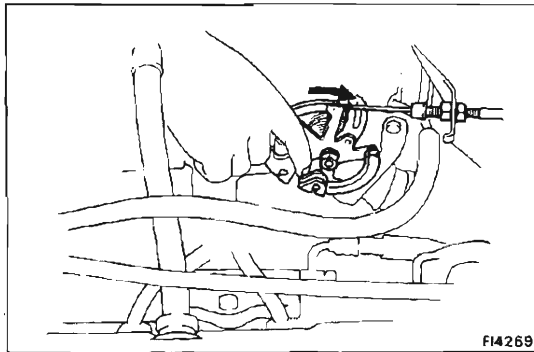
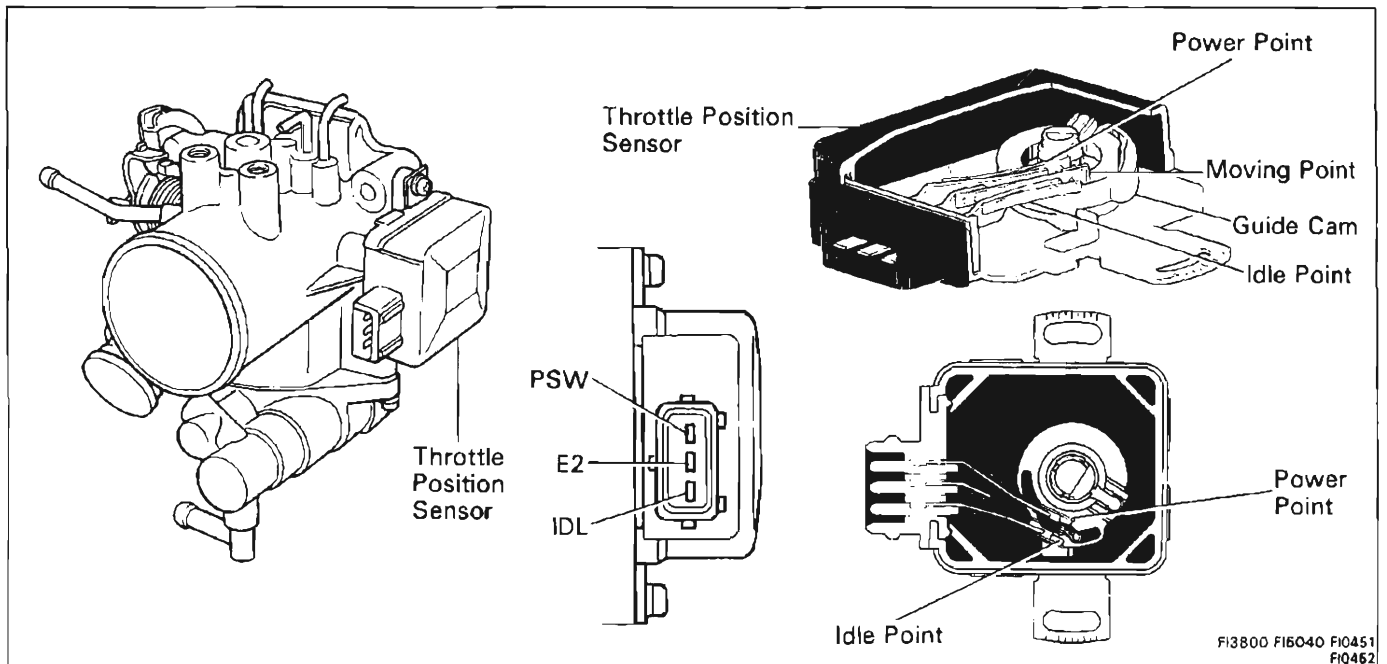
**3. CONNECT FUEL INLET HOSE TO DELIVERY PIPE**

- (a) Connect the inlet hose with two new gaskets and the union bolt.

Torque: 300 kg-cm (22 ft-lb, 29 N·m)

4. CONNECT FUEL RETURN HOSE**5. CONNECT INJECTOR CONNECTORS****6. CONNECT VACUUM SENSING HOSE****7. INSTALL COLD START INJECTOR PIPE**
(See step 2 page FI-108)**8. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY****9. CHECK FOR FUEL LEAKAGE (See page FI-12)**

Throttle Body (4A-FE)



ON-VEHICLE CHECK

1. CHECK THROTTLE BODY

(a) Check that the throttle linkage moves smoothly.

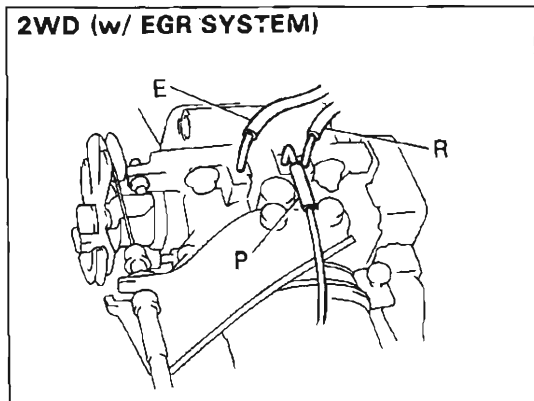
- (b) Check the vacuum at each port.
- Start and warm up the engine.
 - Check the vacuum with your finger.

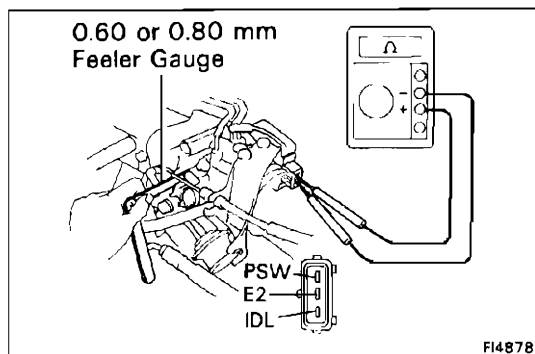
Port	Throttle Valve Opening
P* ¹	Positioned more than P port.
E* ²	Positioned more than E port.
R* ²	Positioned more than R port.

*1: With fuel evaporative emission control system

*2: With exhaust gas recirculation system

2WD (w/ EGR SYSTEM)





2. INSPECT THROTTLE POSITION SENSOR

- (a) Disconnect the sensor connector.
- (b) Insert a feeler gauge between the throttle stop screw and stop lever.
- (c) Using an ohmmeter, measure the resistance between each terminal.

If the resistance is not as specified, adjust or replace the throttle position sensor.

Clearance between lever and stop screw	Continuity between terminals		
	IDL – E2	PSW – E2	IDL – PSW
0.60 mm (0.0236 in.)	Continuity	No continuity	No continuity
0.80 mm (0.0316 in.)	No continuity	No continuity	No continuity
Throttle valve fully opened position	No continuity	Continuity	No continuity

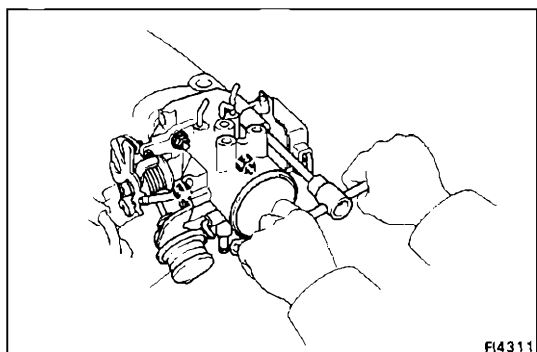
- (d) Reconnect the sensor connector.

REMOVAL OF THROTTLE BODY

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY
2. DRAIN ENGINE COOLANT
3. DISCONNECT ACCELERATOR CABLE
4. (A/T)
DISCONNECT THROTTLE CABLE
5. DISCONNECT AIR CLEANER HOSE
6. REMOVE CABLE BRACKET FROM THROTTLE BODY
7. DISCONNECT THROTTLE POSITION SENSOR CONNECTOR
8. DISCONNECT FOLLOWING HOSES:
 - (a) No.2 water by-pass hose from the air valve.
 - (b) PCV hose from the throttle body.
 - (c) Vacuum hose(s) from the port(s).

9. REMOVE THROTTLE BODY

- (a) Remove the two bolts and nuts, and disconnect the throttle body and gasket.
- (b) Disconnect the No.1 water by-pass hose, and remove the throttle body.



INSPECTION OF THROTTLE BODY

1. CLEAN THROTTLE BODY

- Using a soft brush and carburetor cleaner, clean the cast parts.
- Using compressed air, clean all the passages and apertures.

NOTICE: To prevent deterioration, do not clean the throttle position sensor.

2. INSPECT THROTTLE BODY VALVE

Check that there is no clearance between the throttle stop screw and throttle lever when the throttle valve is fully closed.

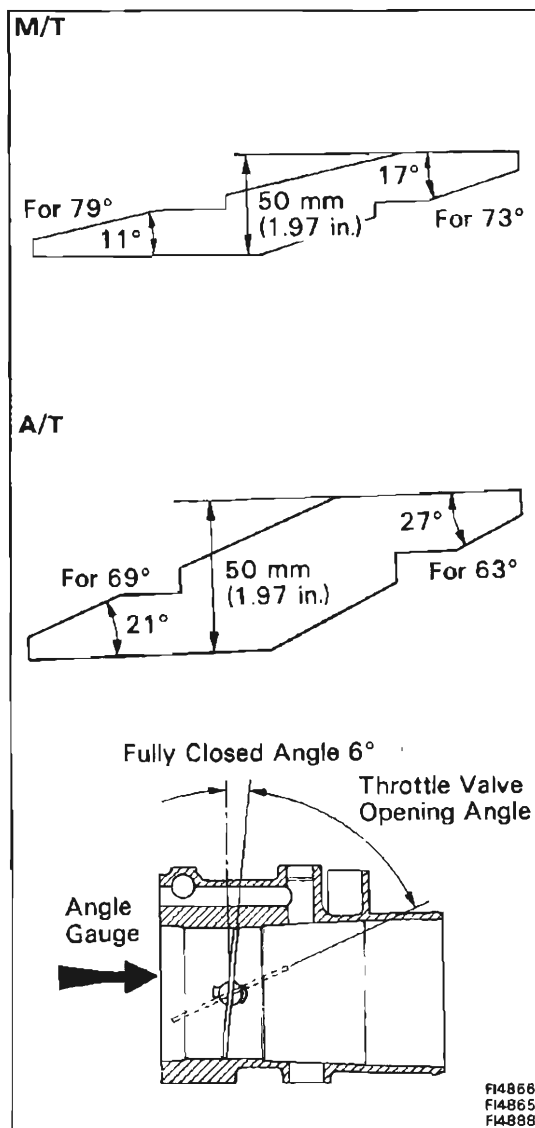
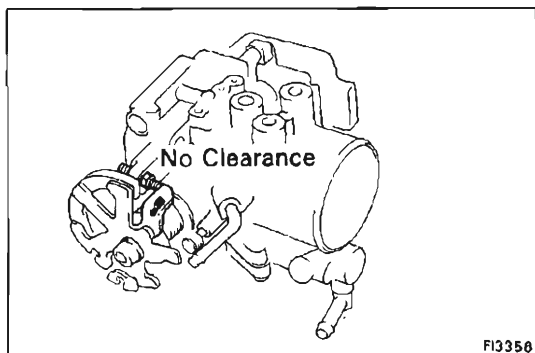
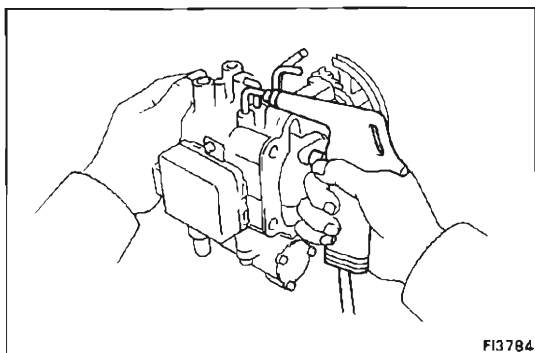
3. INSPECT THROTTLE POSITION SENSOR

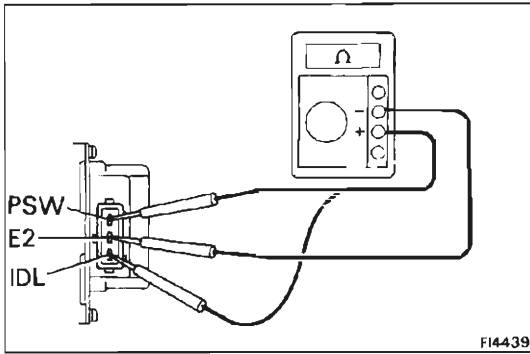
- Make an angle gauge as shown in the figure.
- Set throttle valve opening angle to the specifications below from the vertical position (incl. throttle valve fully closed angle 6°).

Throttle valve opening angle:

M/T 73° or 79°

A/T 63° or 69°



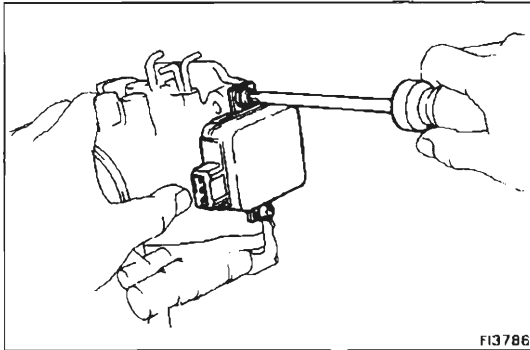


- (c) Using an ohmmeter, check the continuity between each of the terminals.

Throttle valve opening angle		Continuity		
M/T	A/T	IDL – E2	PSW – E2	IDL – PSW
73° from vertical	63° from vertical	No continuity	No continuity	No continuity
79° from vertical	69° from vertical	No continuity	Continuity	No continuity
Less than 7.5 from vertical		Continuity	No continuity	No continuity

4. IF NECESSARY, ADJUST THROTTLE POSITION SENSOR

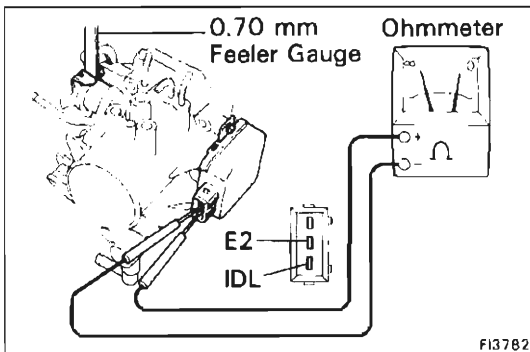
- (a) Loosen the two set screws of the sensor.



- (b) Insert a 0.70 mm (0.028 in.) feeler gauge, between the throttle stop screw and stop lever.

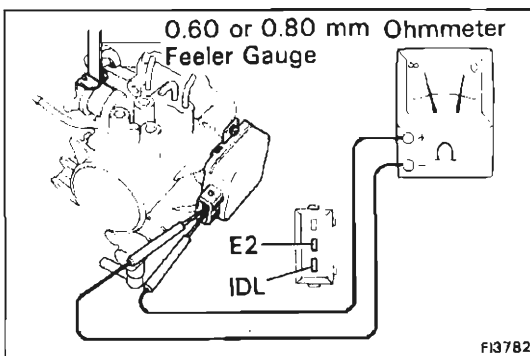
- (c) Connect the test probe of an ohmmeter to the terminals IDL and E2 of the sensor.

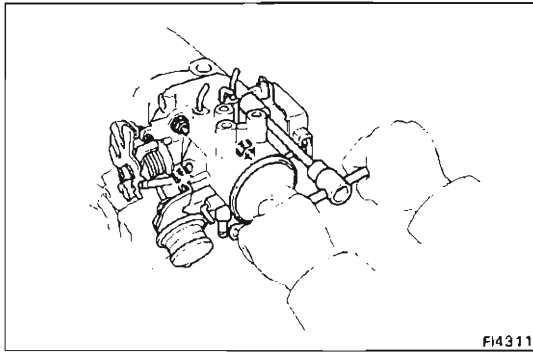
- (d) Gradually turn the sensor counterclockwise until the ohmmeter deflects, and secure it with the two screws.



- (e) Recheck the continuity between terminals IDL and E2.

Clearance between lever and stop screw	Continuity (IDL – E2)
0.60 mm (0.024 in.)	Continuity
0.80 mm (0.032 in.)	No continuity





INSTALLATION OF THROTTLE BODY

1. INSTALL THROTTLE BODY

- (a) Connect No.1 water by-pass hose.
- (b) Install a new gasket and the throttle body with the two bolts and nuts.

Torque: 220 kg-cm (16 ft-lb, 22 N·m)

2. CONNECT FOLLOWING HOSES:

- (a) No.2 water by-pass hose.
- (b) PCV hose to the throttle body.
- (c) Vacuum hose(s) to the port(s).

3. CONNECT THROTTLE POSITION SENSOR CONNECTOR

4. INSTALL CABLE BRACKET TO THROTTLE BODY

5. CONNECT AIR CLEANER HOSE

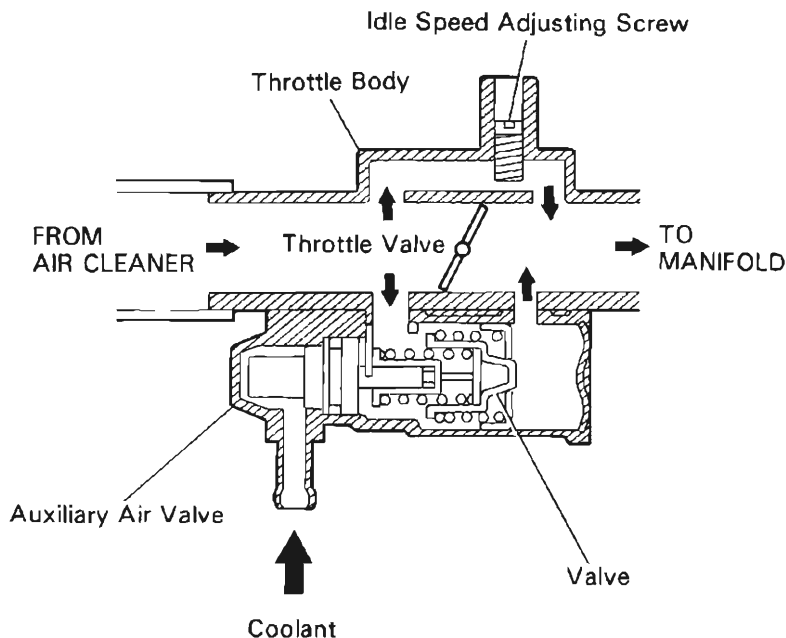
6. (A/T) CONNECT THROTTLE CABLE, AND ADJUST IT

7. CONNECT ACCELERATOR CABLE, AND ADJUST IT

8. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

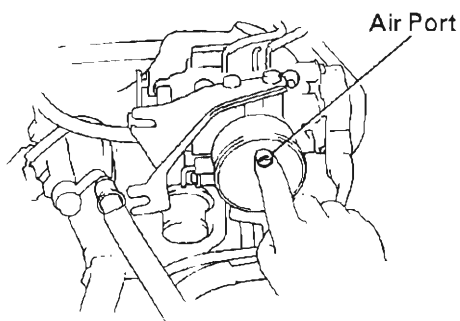
9. FILL WITH ENGINE COOLANT (See page CO-6)

Auxiliary Air Valve



FI0897

4A-FE



ON-VEHICLE INSPECTION

INSPECT AIR VALVE OPERATION

(w/o Air Flow Meter)

- (a) Remove the air cleaner hose.
- (b) Check the engine rpm by closing the air port on the throttle body.

At low temp. (Coolant temp.: below 80°C (176°F))

- The engine RPM should drop.

After warm-up

- Check that engine RPM does not drop more than 100 rpm.

- (c) Install the air cleaner hose.

If operation is not as specified, replace the air valve.

(w/ Air Flow Meter)

Check the engine rpm by fully screwing in the idle speed adjusting screw.

At low temp. (Coolant temp.: below 80°C (176°F))

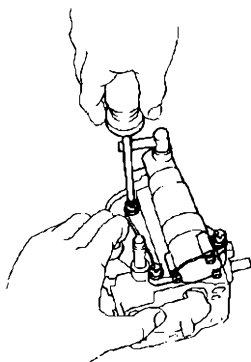
- When the idle speed adjusting screw is in, the engine rpm should drop.

After warm-up

- When the idle speed adjusting screw is in, the engine rpm should drop below idle speed dwell stop.

If operation is not as specified, replace the air valve.

4A-FE



REMOVAL OF AUXILIARY AIR VALVE

1. REMOVE THROTTLE BODY

4A-FE (See page FI-123)

2. REMOVE AIR VALVE FROM THROTTLE BODY (4A-FE)

Remove the three screws, air valve, gasket and O-ring.

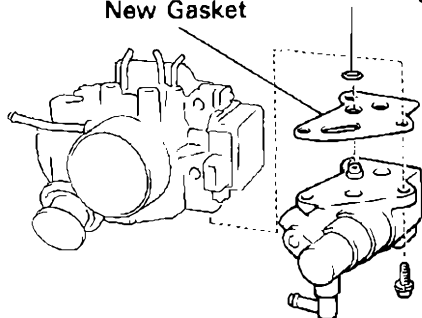
(4A-GE)

Remove the five screws, air valve, gasket and O-ring.

4A-FE

New Gasket

New O-Ring



INSTALLATION OF AIR VALVE

1. INSTALL AIR VALVE TO THROTTLE BODY

(a) Place new gasket and O-ring on the throttle body.

(b) (4A-FE)

Install the air valve with the three screws.

(4A-GE)

Install the air valve with the five screws.

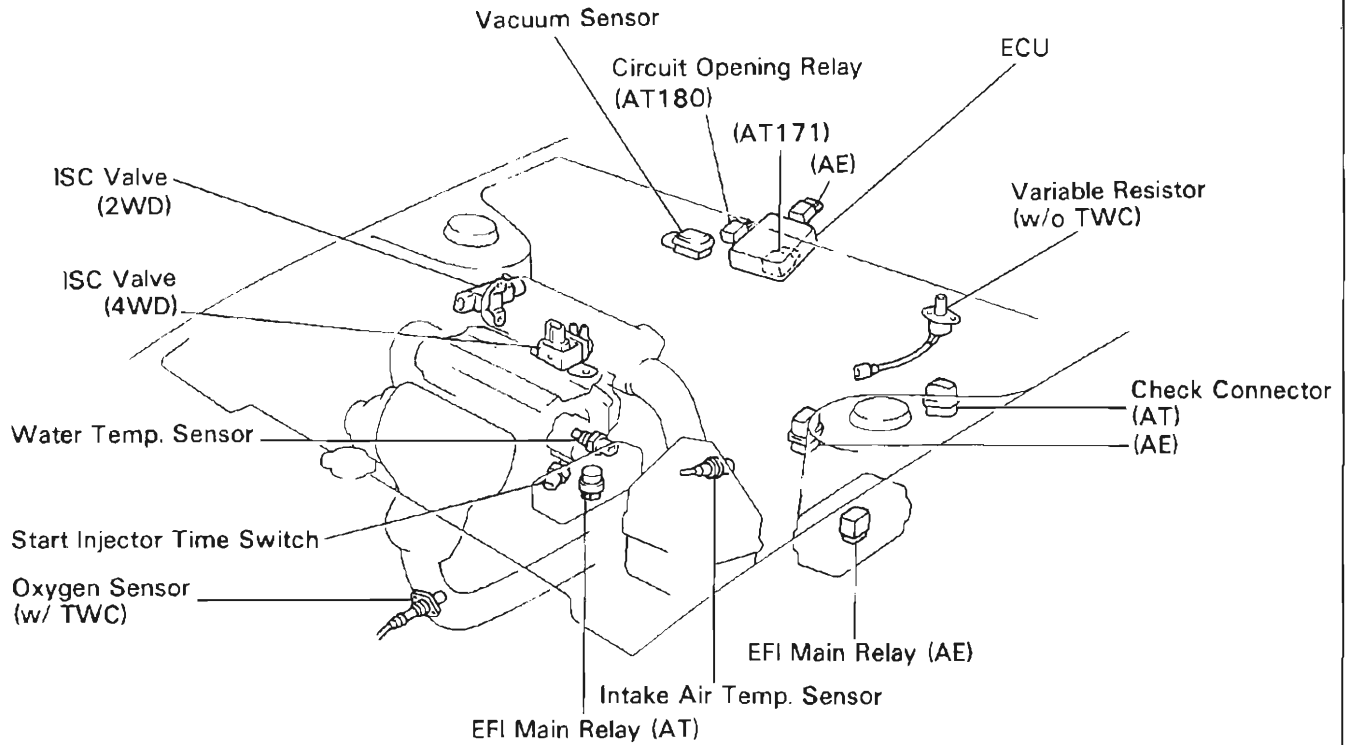
2. INSTALL THROTTLE BODY

4A-FE (See page FI-126)

ELECTRONIC CONTROL SYSTEM

Location of Electronic Control Parts

4A-FE



EFI Main Relay

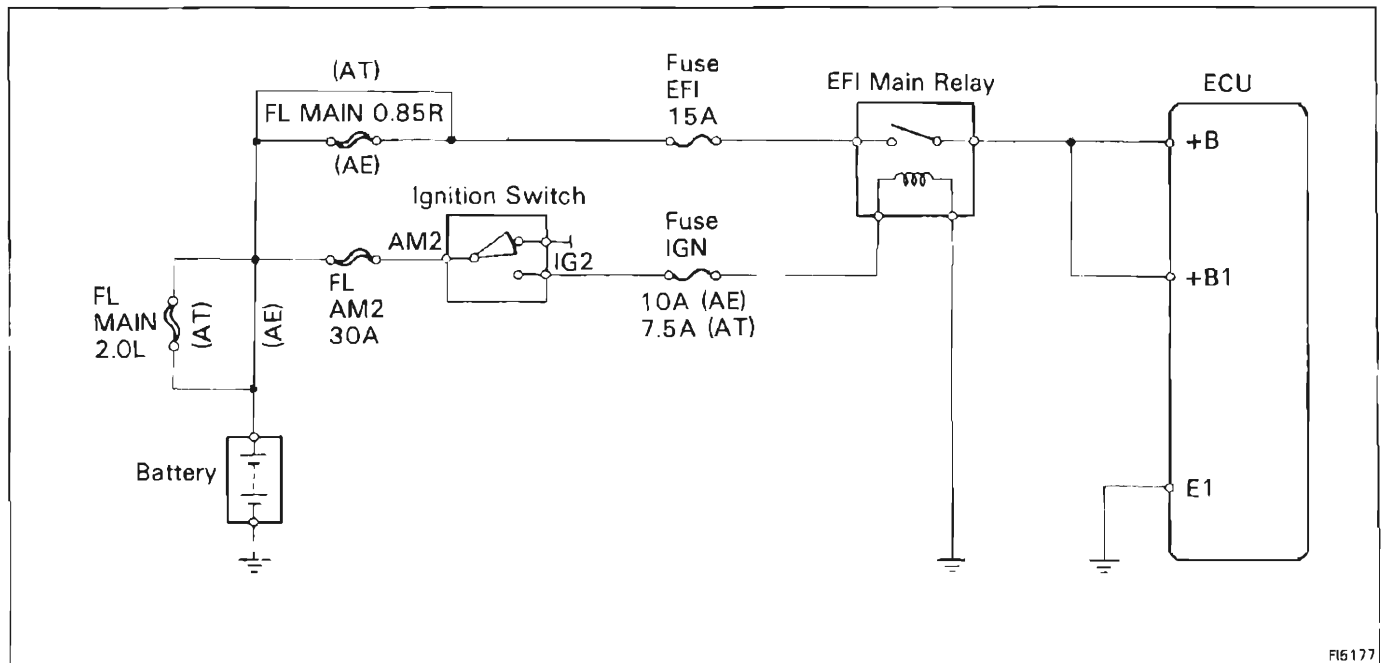
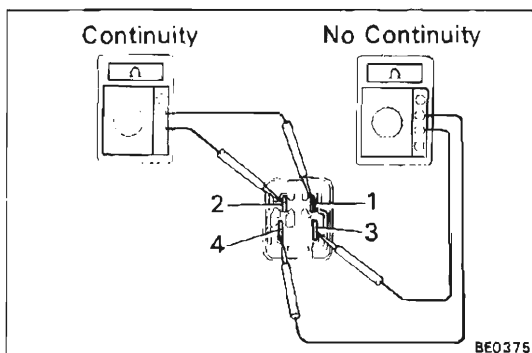


FIG177

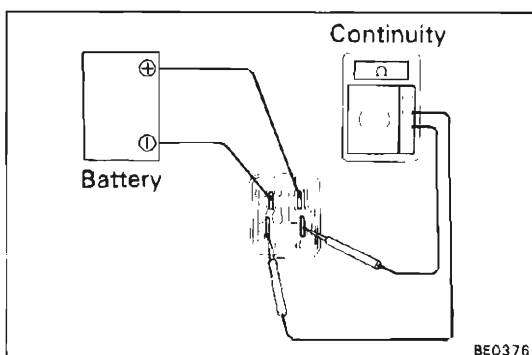


INSPECTION OF EFI MAIN RELAY (AE)

1. INSPECT RELAY CONTINUITY

- Using an ohmmeter, check that there is continuity between terminals 1 and 2.
- Check that there is no continuity between terminals 3 and 4.

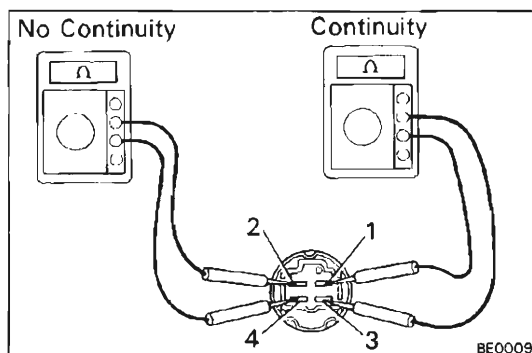
If continuity is not as specified, replace the relay.



2. INSPECT RELAY OPERATION

- Apply battery voltage across terminals 1 and 2.
- Using an ohmmeter, check that there is continuity between terminals 3 and 4.

If operation is not as specified, replace the relay.

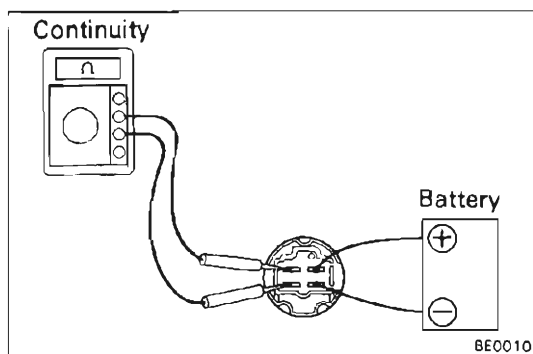


INSPECTION OF EFI MAIN RELAY (AT)

1. INSPECT RELAY CONTINUITY

- Using an ohmmeter, check that there is continuity between terminals 1 and 3.
- Check that there is no continuity between terminals 2 and 4.

If continuity is not as specified, replace the relay.

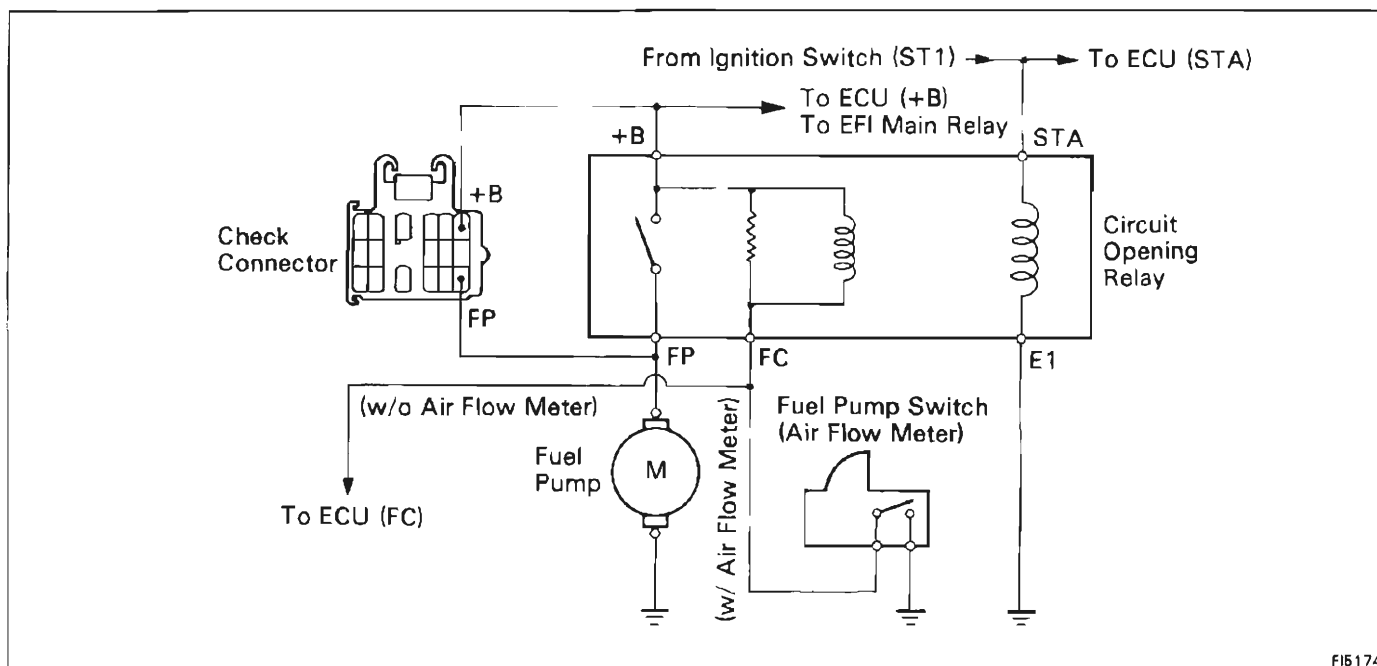


2. INSPECT RELAY OPERATION

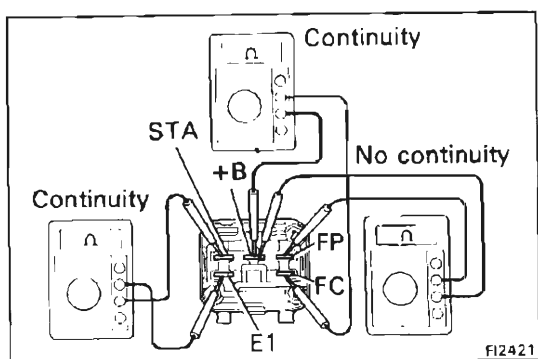
- Apply battery voltage across terminals 1 and 3.
- Using an ohmmeter, check that there is continuity between terminals 2 and 4.

If operation is not as specified, replace the relay.

Circuit Opening Relay



FI5174



INSPECTION OF CIRCUIT OPENING RELAY (w/o Air Flow Meter)

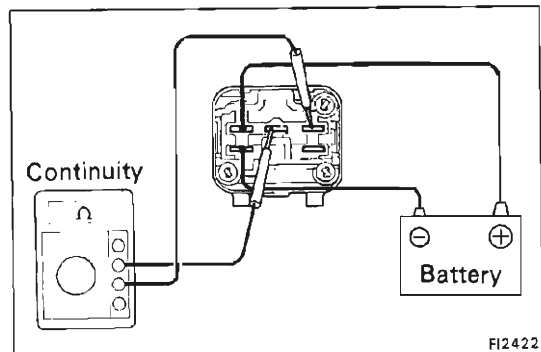
1. INSPECT RELAY CONTINUITY

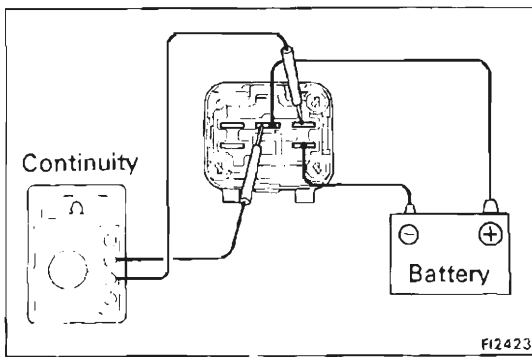
- Using an ohmmeter, check that there is continuity between terminals STA and E1.
- Check that there is continuity between terminals +B and FC.
- Check that there is no continuity between terminals +B and FP.

If continuity is not as specified, replace the relay.

2. INSPECT RELAY OPERATION

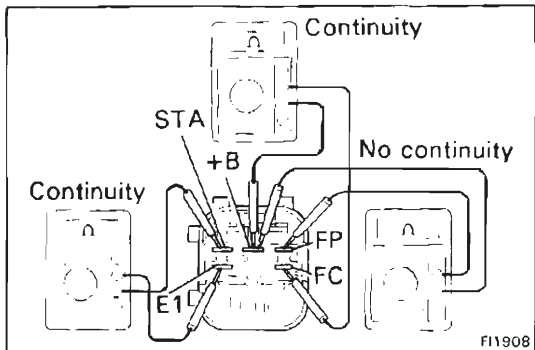
- Apply battery voltage across terminals STA and E1.
- Using an ohmmeter, check that there is continuity between terminals +B and FP.





- (c) Apply battery voltage across terminals +B and FC.
- (d) Check that there is continuity between terminals +B and FP.

If operation is not as specified, replace the relay.



INSPECTION OF CIRCUIT OPENING RELAY (w/ Air Flow Meter)

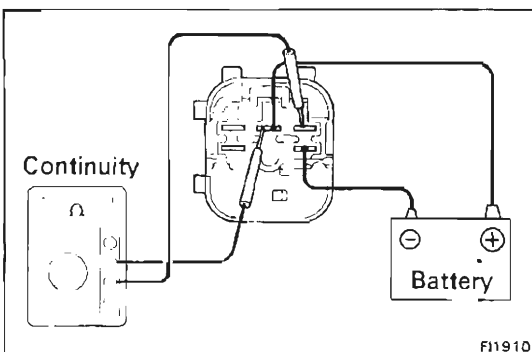
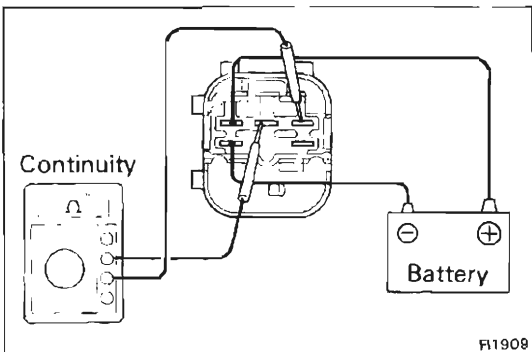
1. INSPECT RELAY CONTINUITY

- (a) Using an ohmmeter, check that there is continuity between terminals STA and E1.
- (b) Check that there is continuity between terminals +B and FC.
- (c) Check that there is no continuity between terminals +B and FP.

If continuity is not as specified, replace the relay.

2. INSPECT RELAY OPERATION

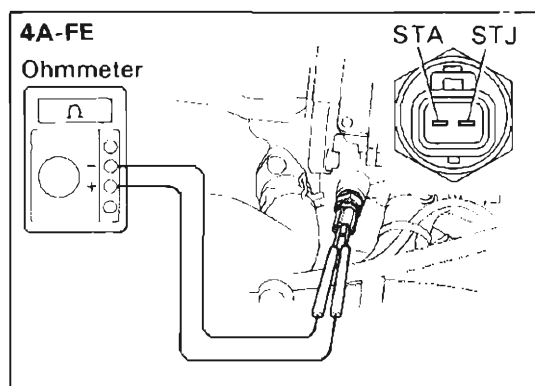
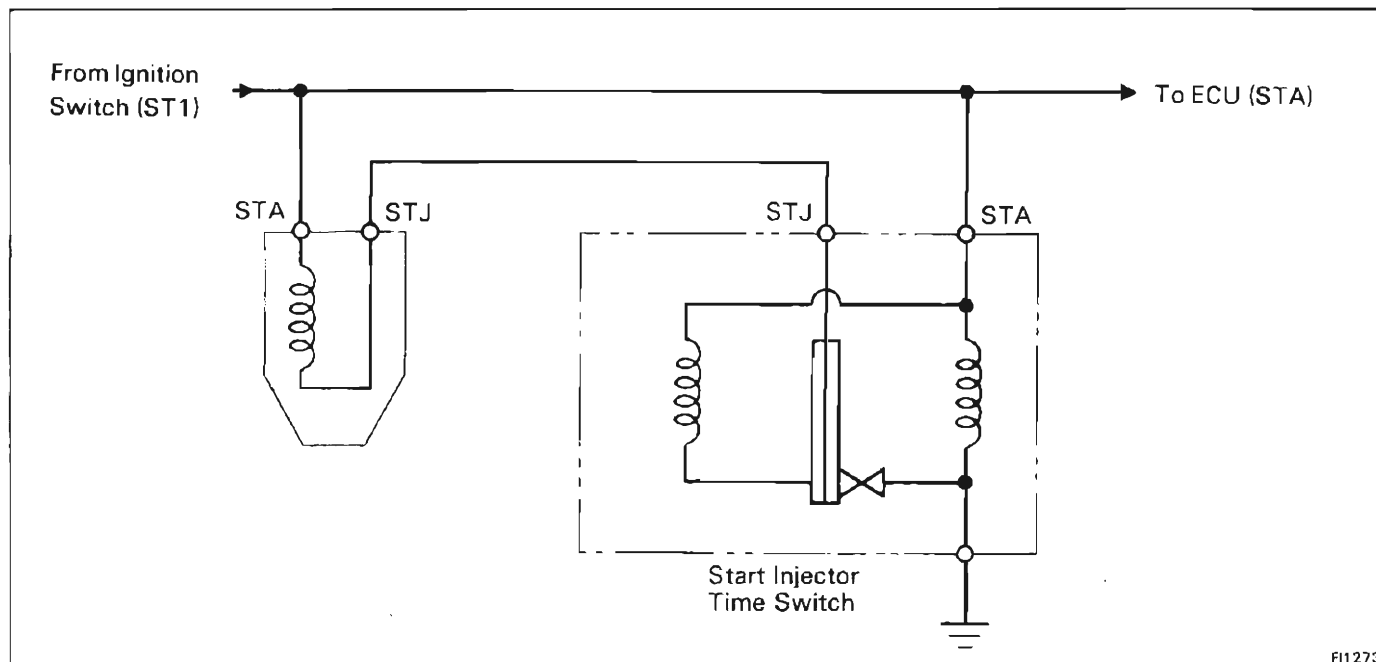
- (a) Apply battery voltage across terminals STA and E1.
- (b) Using an ohmmeter, check that there is continuity between terminals +B and FP.



- (c) Apply battery voltage across terminals +B and FC.
- (d) Check that there is continuity between terminals +B and FP.

If operation is not as specified, replace the relay.

Start Injector Time Switch



INSPECTION OF START INJECTOR TIME SWITCH

INSPECT START INJECTOR TIME SWITCH

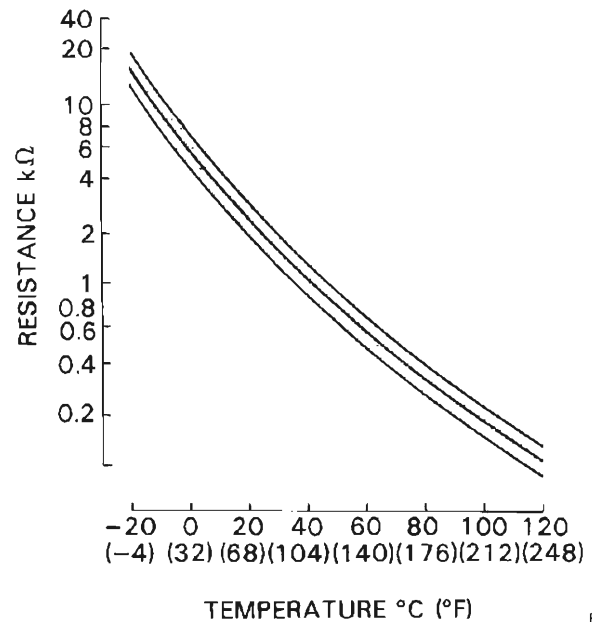
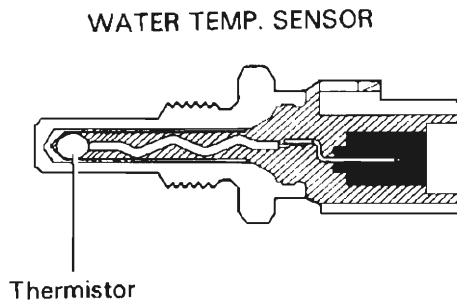
Using an ohmmeter, measure the resistance between each terminal.

Resistance.

STA — STJ	20 — 40 Ω below 30°C (86°F)
	40 — 60 Ω above 40°C (104°F)
STA — Ground	20 — 80 Ω

If the resistance is not as specified, replace the switch.

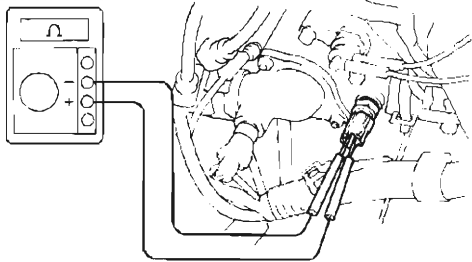
Water Temperature Sensor



FI3828 FI0709

4A-FE

Ohmmeter



INSPECTION OF WATER TEMPERATURE SENSOR

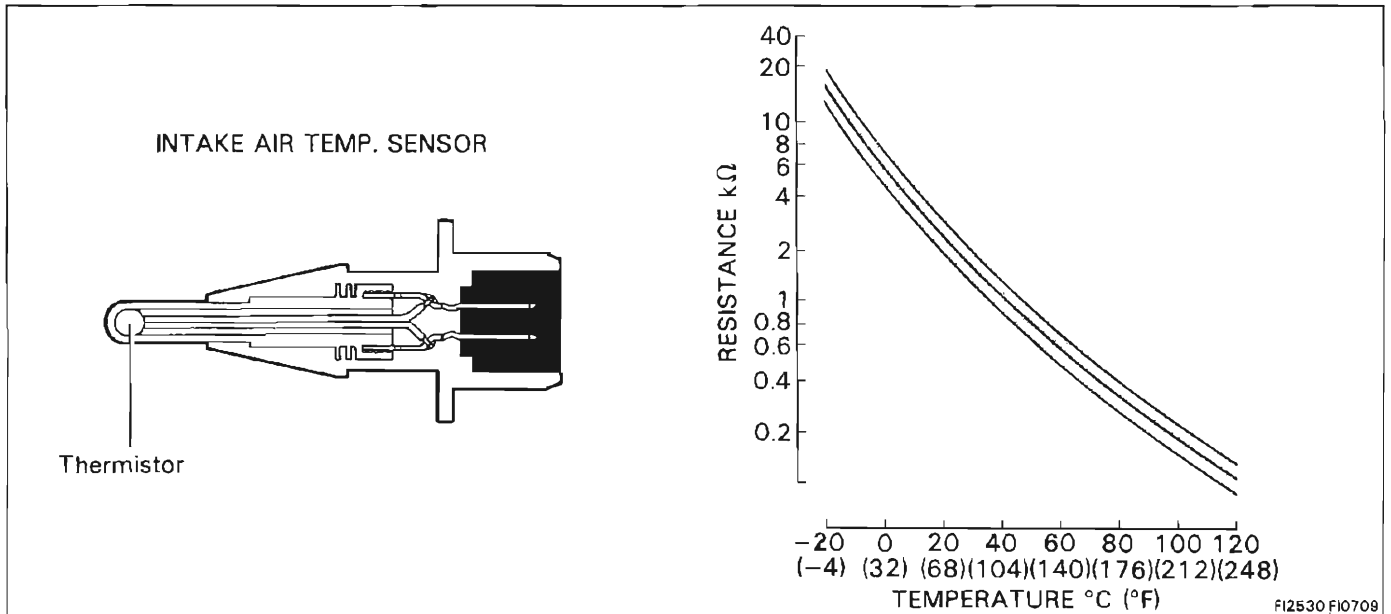
INSPECT WATER TEMPERATURE SENSOR

Using an ohmmeter, measure the resistance between the terminals.

Resistance: Refer to the chart above

If the resistance is not as specified, replace the sensor.

Intake Air Temperature Sensor (w/o Air Flow Meter)



4A-FE

Ohmmeter

INSPECTION OF INTAKE AIR TEMPERATURE SENSOR

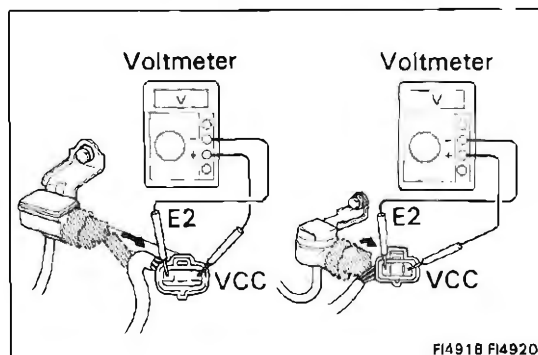
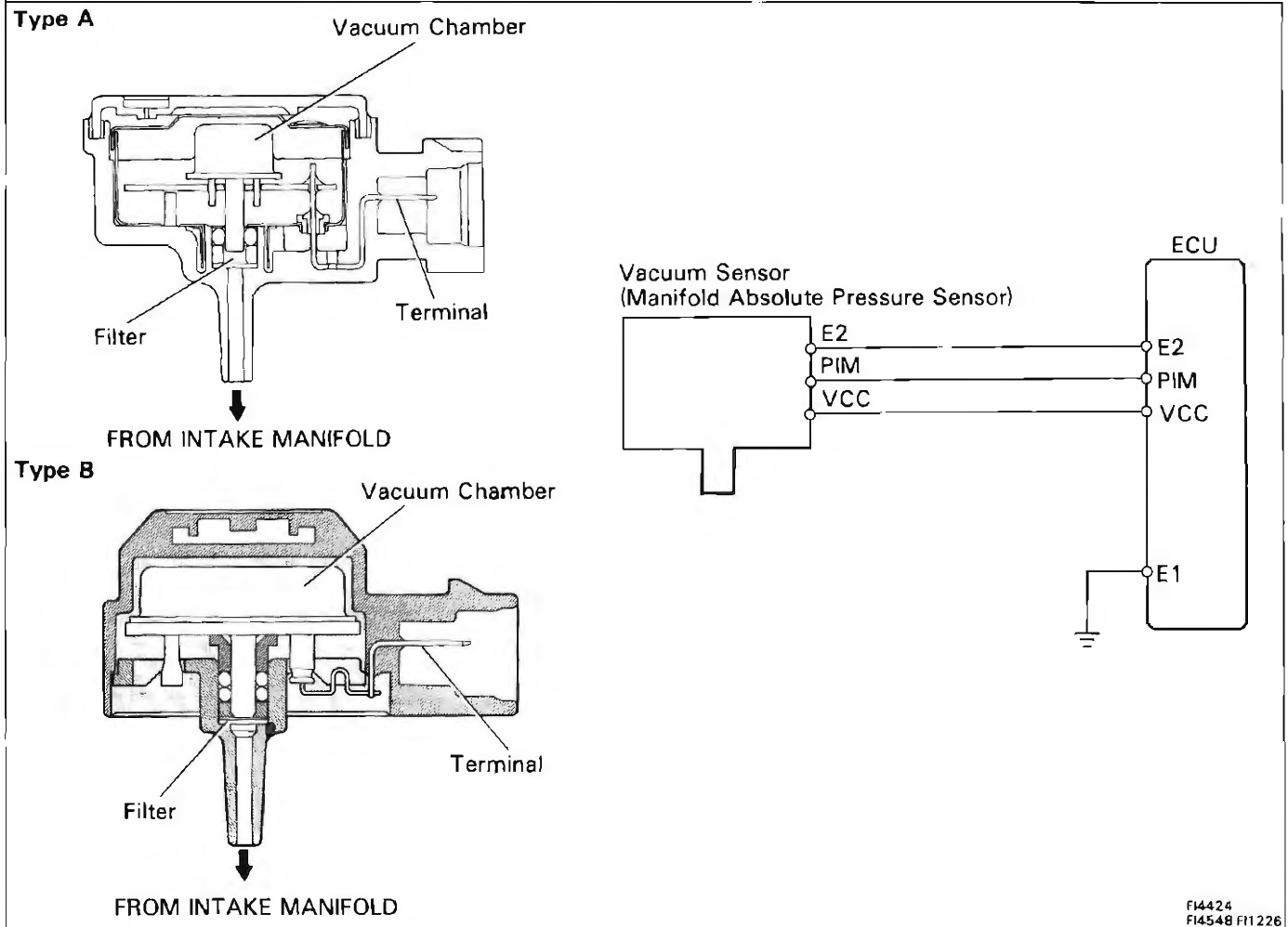
INSPECT RESISTANCE OF INTAKE AIR TEMPERATURE SENSOR

Using an ohmmeter, measure the resistance between the terminals.

Resistance: Refer to the chart above

If the resistance is not as specified, replace the sensor.

Vacuum Sensor (w/o Air Flow Meter) (Manifold Absolute Pressure Sensor)



INSPECTION OF VACUUM SENSOR

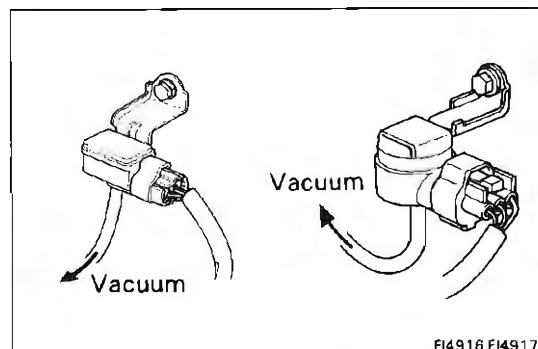
1. INSPECT POWER SOURCE VOLTAGE OF VACUUM SENSOR

- Disconnect the vacuum sensor connector.
- Turn the ignition switch ON.
- Using a voltmeter, measure the voltage between terminals VCC and E2 of the vacuum sensor connector.

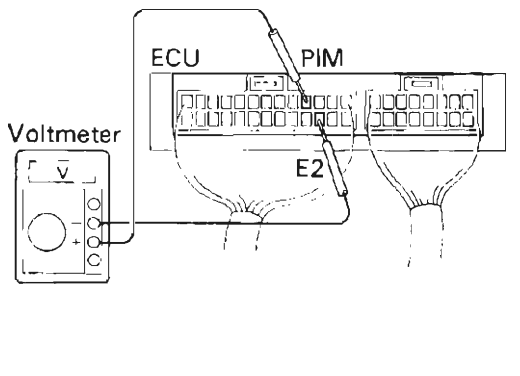
Voltage: 4 – 6 V

2. INSPECT POWER OUTPUT OF VACUUM SENSOR

- Turn the ignition switch ON.
- Disconnect the vacuum hose of the intake manifold side.



4A-FE (2WD)



- (c) Connect a voltmeter to terminals PIM and E2 of the ECU, and measure and record the output voltage under ambient atmospheric pressure.
- (d) Apply vacuum to the vacuum sensor in 100 mmHg (3.94 in.Hg, 13.3 kPa) segments to 500 mmHg (19.69 in.Hg, 66.7 kPa).
- (e) Measure voltage drop from step (c) above for each segment.

Voltage drop

Applied Vacuum mmHg (in.Hg, kPa)	100 (3.94 13.3)	200 (7.87 26.7)	300 (11.81 40.0)	400 (15.75 53.3)	500 (19.69 66.7)
Voltage drop V	0.3-0.5	0.7-0.9	1.1-1.3	1.5-1.7	1.9-2.1

4AFE - RT171

E2 - VCC 4.98 V

E2 - PIM 3.62 V

- 0.1 bar 3.23 V

- 0.2 bar 2.88 V

- 0.3 bar 2.57 V

- 0.4 bar 2.28 V

- 0.5 bar 1.92 V

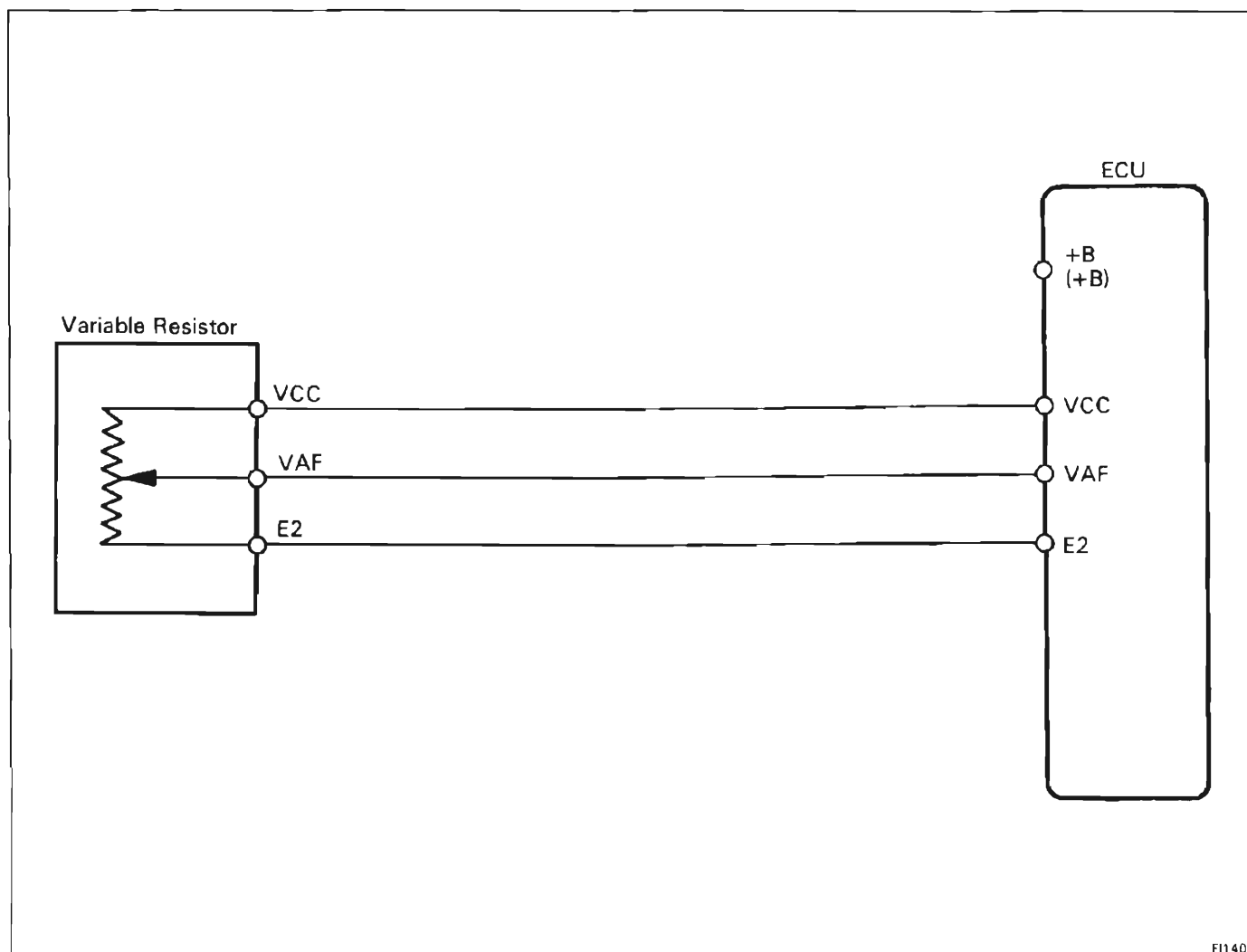
- 0.6 bar 1.61 V

- 0.7 bar 1.36 V

- 0.8 bar 1.13 V

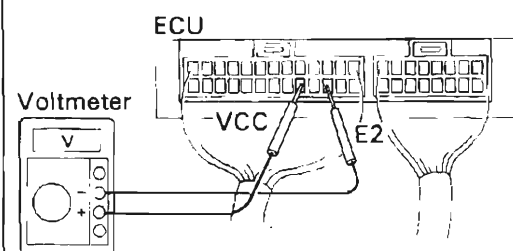
- 0.9 bar 0.83 V

Variable Resistor (w/o TWC)



FI1402

4A-FE



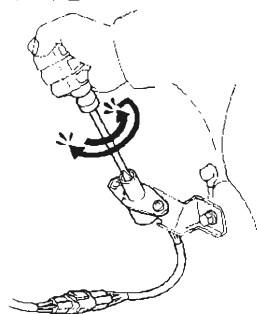
INSPECTION OF VARIABLE RESISTOR

1. INSPECT VOLTAGE OF VARIABLE RESISTOR

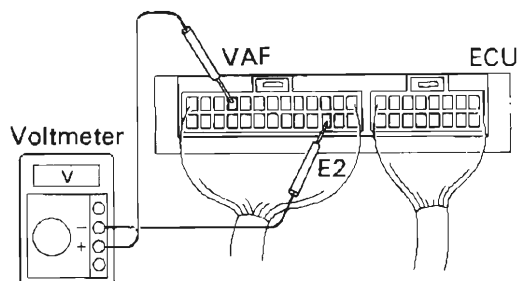
- (a) Using a voltmeter, measure the voltage between ECU terminals VCC and E2.

Voltage: 4 – 6 V

4A-FE

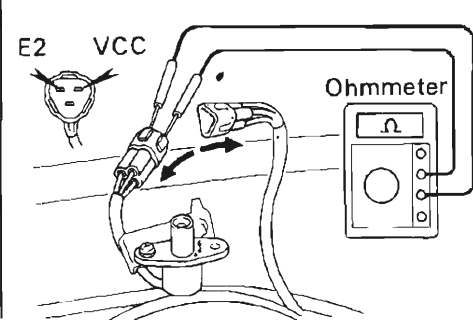


4A-FE



- (b) Measure the voltage between ECU terminals VAF and E2 while slowly turning idle mixture adjusting screw first fully counterclockwise, and then fully clockwise.
- (c) Check that the voltage changes smoothly from 0 V to approx. 5 V.

4A-FE



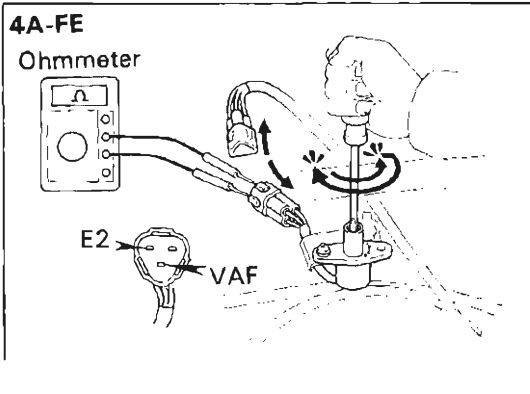
2. INSPECT RESISTANCE OF VARIABLE RESISTOR

- (a) Disconnect the variable resistor connector.
- (b) Using an ohmmeter, measure the resistance between the terminals VCC and E2.

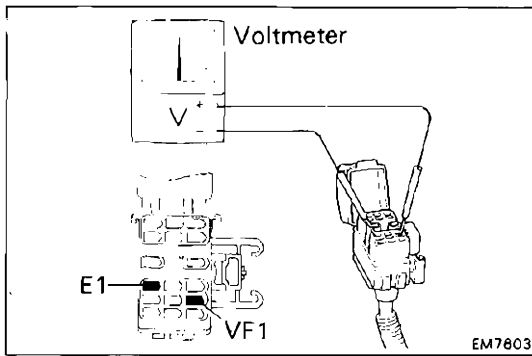
Resistance: 4 – 6 kΩ

4A-FE

Ohmmeter



- (c) Turn the idle mixture adjusting screw fully counterclockwise.
- (d) Connect an ohmmeter to terminals VAF and E2. Turn the adjusting screw fully clockwise and check that the resistance value changes from approx. 5 k Ω to 0 Ω accordingly.



Oxygen Sensor (w/ TWC)

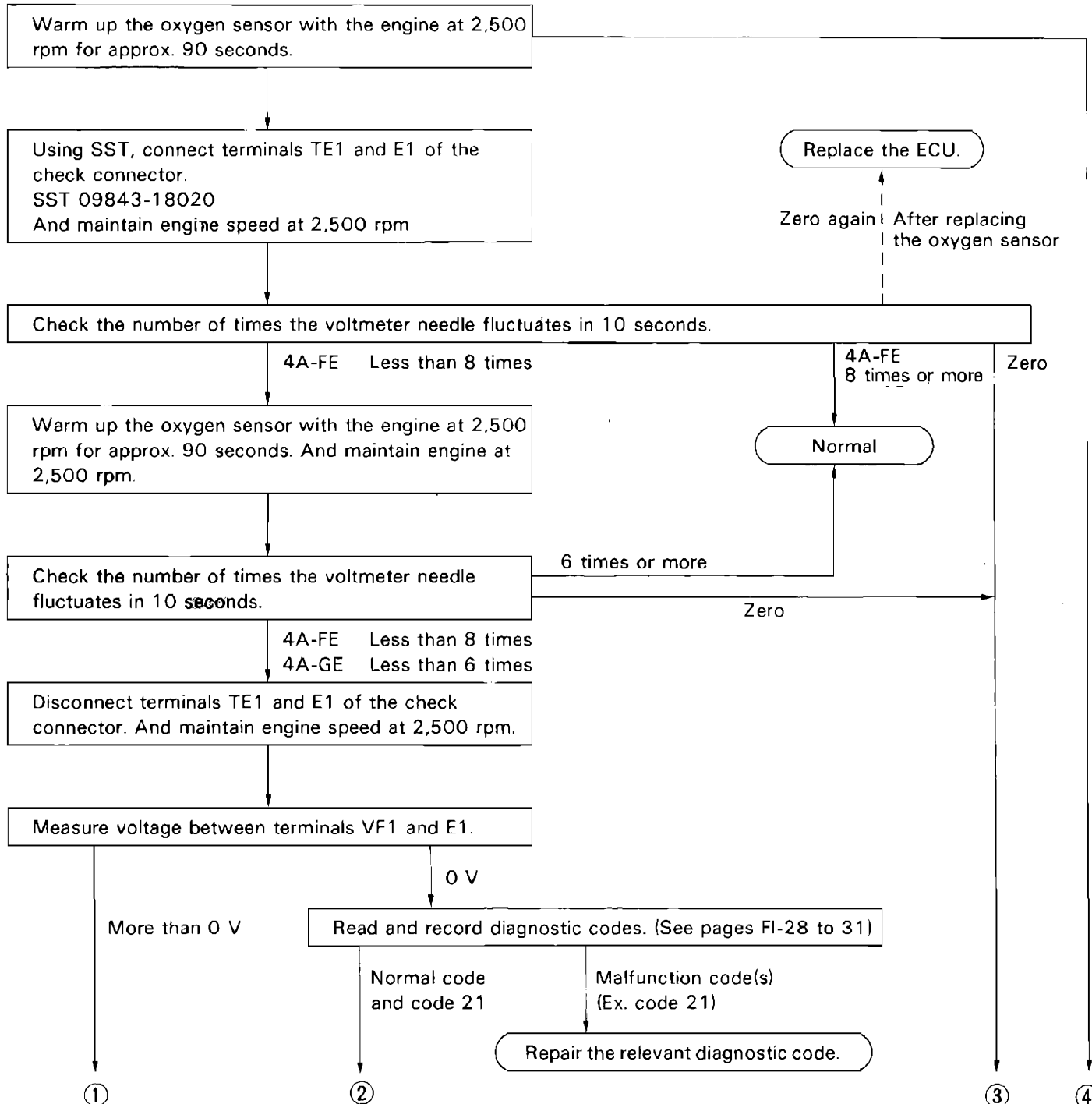
INSPECTION OF OXYGEN SENSOR

1. WARM UP ENGINE

Allow the engine to reach normal operating temperature.

2. INSPECT FEEDBACK VOLTAGE (VF)

Connect the positive (+) probe of a voltmeter to terminal VF1 of the check connector, and negative (-) probe to terminal E1. Perform the test as follows:

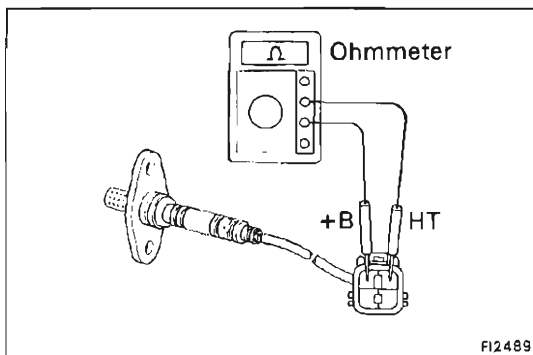


CONTINUED ON PAGE FI-146

```

graph TD
    1((1)) --> 2((2))
    2 --> 3((3))
    3 --> 4((4))
    3 --> 5[Repair the relevant diagnostic code.]
    5 --> 3
    3 --> 6[Read and record diagnostic codes.  
(See pages FI-28 to 31)]
    6 --> 7[Normal code and code 21]
    7 --> 8[Disconnect terminals TE1 and E1 of the check connector. And maintain engine at 2,500 rpm.]
    8 --> 9[Measure voltage between terminals VF1 and E1.]
    9 --> 10[0 V]
    9 --> 11[5 V]
    10 --> 12[Disconnect the PCV hose.]
    12 --> 13[Measure voltage between terminals VF1 and E1.]
    13 --> 14[More than 0 V]
    14 --> 15[Repair (Over rich)]
    15 --> 16[Disconnect the water temp. sensor connector and connect resistor with a resistance of 4 – 8 kΩ or another coded water temp. sensor.]
    16 --> 17[Connect terminals TE1 and E1 of the check connector.]
    17 --> 18[Warm up the oxygen sensor with the engine at 2,500 rpm for approx. 90 seconds. And maintain engine speed at 2,500 rpm.]
    18 --> 19[Measure voltage between terminals VF1 and E1.]
    19 --> 20[0 V]
    19 --> 21[5 V]
    20 --> 22[Replace the oxygen sensor.]
    21 --> 23[Repair (Over lean)]
    22 --> 1
    23 --> 4

```

3. INSPECT HEATER COIL RESISTANCE OF OXYGEN SENSOR

Using an ohmmeter, measure the resistance between the terminals +B and HT.

Resistance: 5.1 – 6.3 Ω

If the resistance is not as specified, replace the sensor.

Engine ECU

INSPECTION OF ECU

HINT: The EFI circuit can be checked by measuring the resistance and voltage at the wiring connectors of the ECU.

1. PREPARATION (See page FI-36)

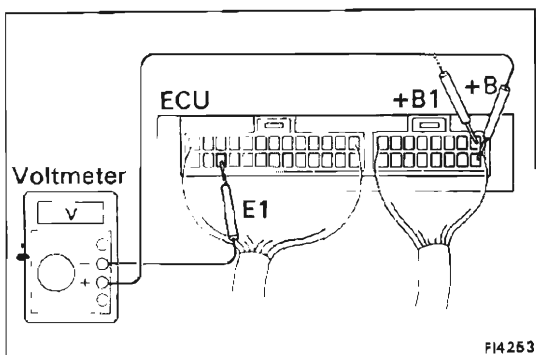
2. INSPECT VOLTAGE OF ENGINE ECU

Check the voltage between each terminal of the wiring connectors.

- Turn the ignition switch ON.
- Measure the voltage at each terminal

HINT:

- Perform all voltage measurements with the connectors connected.
- Verify that the battery voltage is 11 V or more when the ignition switch is ON position.



Voltage at ECU Wiring Connectors (4A-FE)

Terminals	Condition		STD voltage (V)
+B - E1	Ignition SW ON		10 - 14
+B1 - E1			
BATT - E1	-		10 - 14
IDL - E2	Ignition SW ON	Throttle valve open	4.5 - 5.5
PSW - E2		Throttle valve fully closed	4.5 - 5.5
No.10 - E01 No.20 - E02	Ignition SW ON		10 - 14
W - E1	Ignition SW ON		0
	No trouble ("CHECK ENGINE" light off) and engine running		10 - 14
PIM - E2	Ignition SW ON		3.3 - 3.9
VCC - E2			4.5 - 5.5
THA - E2	Ignition SW ON	Intake air temperature 20°C (68°F)	2.0 - 2.5
THW - E2		Coolant temperature 80°C (176°F)	0.4 - 0.7
STA - E1	Cranking		6 - 14
IGT - E1	Idling		0.7 - 1.0
A/C - E1	Ignition SW ON	A/C switch ON	5 - 14
		A/C switch OFF	0
T - E1	Ignition SW ON	Check connector TE1 - E1 not connect	10 - 14
		Check connector TE1 - E1 connect	0

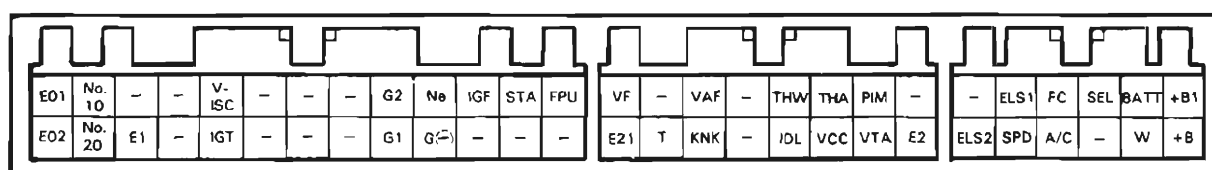
ECU Terminals (2WD)

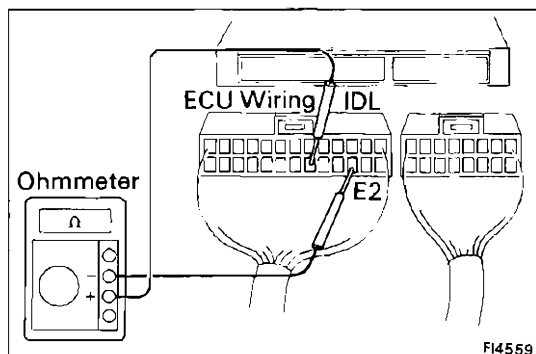
EO1	No. 10	STA	OX VAF	G(-)	G1	IGF	IGT	THA	PIM	THW	NSW	EGR	T	ACT	-	-	FC	R/P	BATT	+B1
E02	No. 20	E1	-	E21	NE	-	IDL	VCC	PSW	E2	HT	V-ISC	VF	-	-	SPD	A/C	-	W	+B

Voltage at ECU Wiring Connectors (4A-GE w/o Air Flow Meter)

Terminals	Condition		STD voltage (V)
+B +B1 — E1	Ignition SW ON		10 — 14
BATT — E1	—		10 — 14
IDL — E2	Ignition SW ON	Throttle valve open	4.5 — 5.5
VTA — E2		Throttle valve fully closed	0.5 or less
		Throttle valve fully open	3.5 — 5.5
VCC — E2		—	4.5 — 5.5
IGT — E1	Idling		0.7 — 1.0
STA — E2	Cranking		6 — 14
No.10 — E01 No.20 — E02	Ignition SW ON		10 — 14
W — E1	No trouble (“CHECK ENGINE” warning light off) and engine running		10 — 14
PIM — E2	Ignition SW ON		3.3 — 3.9
VCC — E2			4.5 — 5.5
THA — E2	Ignition SW ON	Intake air temp. 20°C (68°F)	2.0 — 2.8
THW — E2		Coolant temp. 80°C (176°F)	0.4 — 0.7
A/C — E1		Air conditioning ON	10 — 14
T — E1		Check connector TE1 — E1 not connect	10 — 14
		Check connector TE1 — E1 connect	0.5 or less

ECU Terminals





2. INSPECT RESISTANCE OF ECU

NOTICE:

- Do not touch the ECU terminals.
- The tester probe should be inserted into the wiring connector from the wiring side.

Check the resistance between each terminal of the wiring connectors.

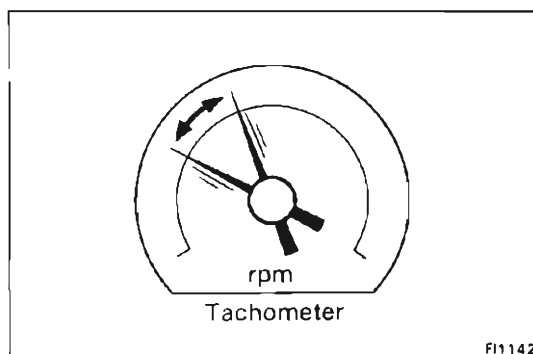
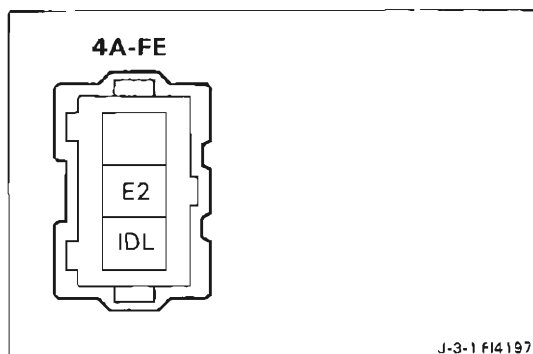
- Disconnect the connectors from the ECU.
- Measure the resistance at each terminal.

Resistance of ECU Wiring Connectors (4A-FE)

Terminals	Condition	Resistance (Ω)
IDL – E2	Throttle valve open	Infinity
	Throttle valve fully closed	0
PSW – E2	Throttle valve fully open	0
	Throttle valve fully closed	Infinity
THA – E2	Intake temperature 20°C (68°F)	2,000 – 3,000
THW – E2	Coolant temperature 80°C (176°F)	200 – 400
G1 – G ⊖	–	140 – 180
NE – G ⊖	–	140 – 180

ECU Terminals (2WD)

EO1	No. 10	–	OX VAF	G ⊖	G1	IGF	IGT	THA	PIM	THW	NSW	EGR	T	ACT	–	–	FC	R/P	BATT	+B1
EO2	No. 20	–	–	E21	NE	–	IDL	VCC	PSW	E2	HT	V-ISC	VF	–	–	SPD	A/C	–	W	+B



Fuel Cut RPM

INSPECTION OF FUEL CUT RPM

- Start and warm up the engine.
- Disconnect the connector from the throttle position sensor.
- Connect circuit terminals IDL and E2 on the wiring connector side.
- Gradually raise the engine rpm and check that there is fluctuation between the fuel cut and fuel return points.

HINT:

- The vehicle should be stopped.
- Accessories switched off.

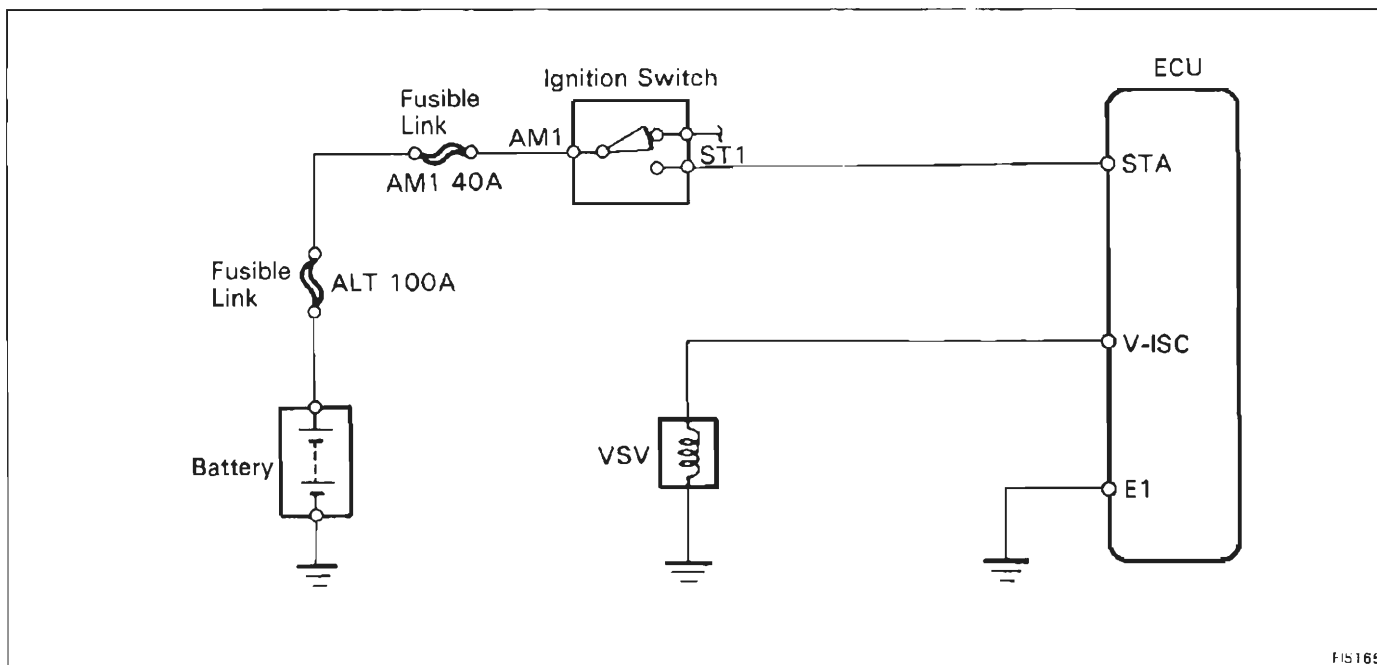
Fuel cut rpm:

4A-FE	w/o TWC	1,700 rpm
	w/ TWC	1,900 rpm

Fuel return rpm:

4A-FE	w/o TWC	1,200 rpm
	w/ TWC	1,200 rpm

Idle-up System (w/ Air Flow Meter)

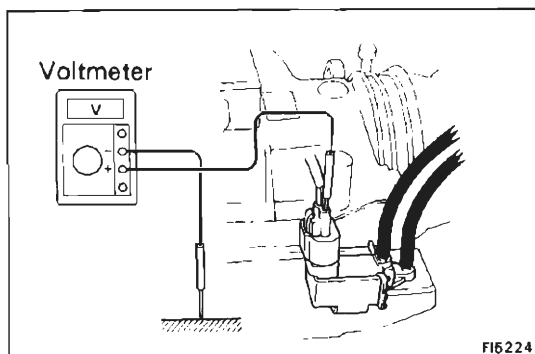


FI5165

INSPECTION OF IDLE-UP SYSTEM

1. INSPECTION BATTERY VOLTAGE OF IDLE-UP VSV

- All accessories switched off.
- Using a voltmeter, check that it indicates battery voltage during cranking and for ten seconds after starting.



FI5224

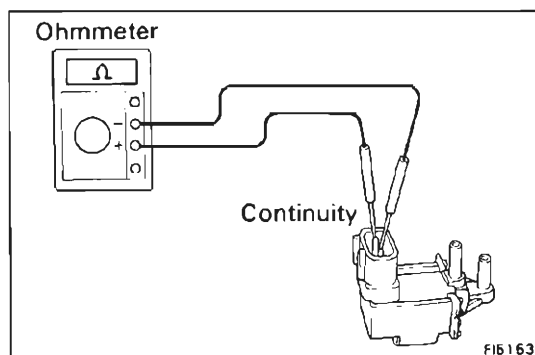
2. INSPECT IDLE-UP VSV

A. Inspect VSV for open circuit

Using an ohmmeter, check that there is continuity between the terminals.

Resistance (Cold): 37 – 44 Ω

If there is no continuity, replace the VSV.

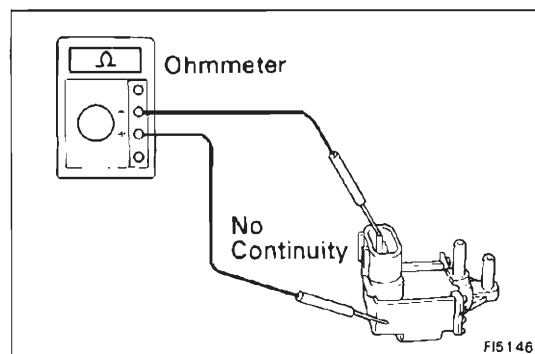


FI5163

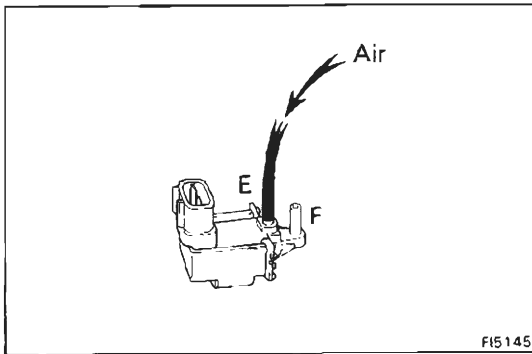
B. Inspect VSV for ground

Using an ohmmeter, check that there is no continuity between each terminal and the body.

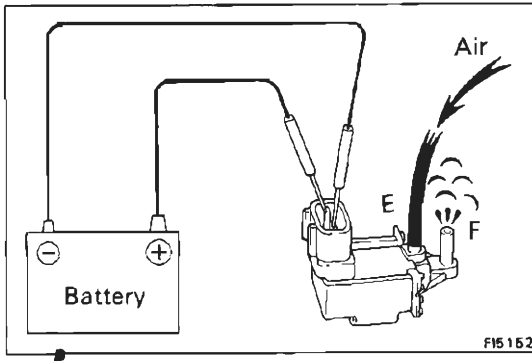
If there is continuity, replace the VSV.



FI5146

**C. Inspect VSV operation**

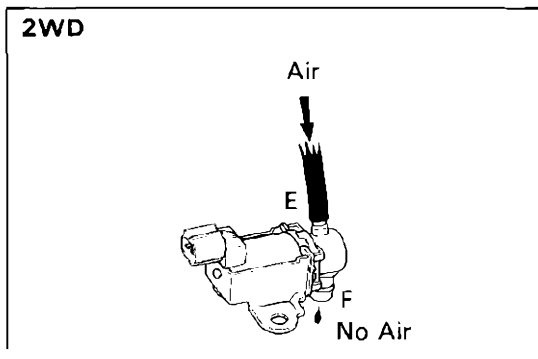
(a) Check that air flows from pipe E to pipe F.



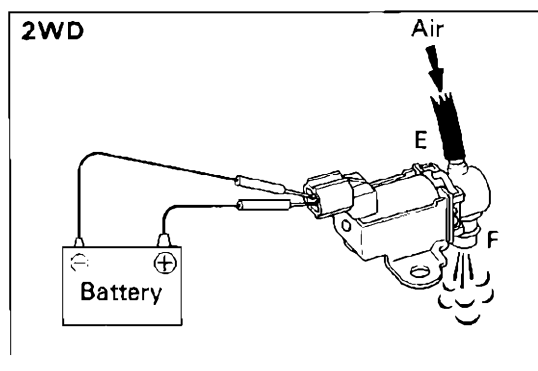
(b) Apply battery voltage across the terminals.

(c) Check that air flows from pipe E to pipe F.

If operation is not as specified, replace the VSV.

**C. Inspect ISC valve operation**

- (a) Check that air does not flow from pipes E to F.



- (b) Apply battery voltage across the terminals.

- (c) Check that air flows pipes E to F.

If operation is not as specified, replace the ISC valve.

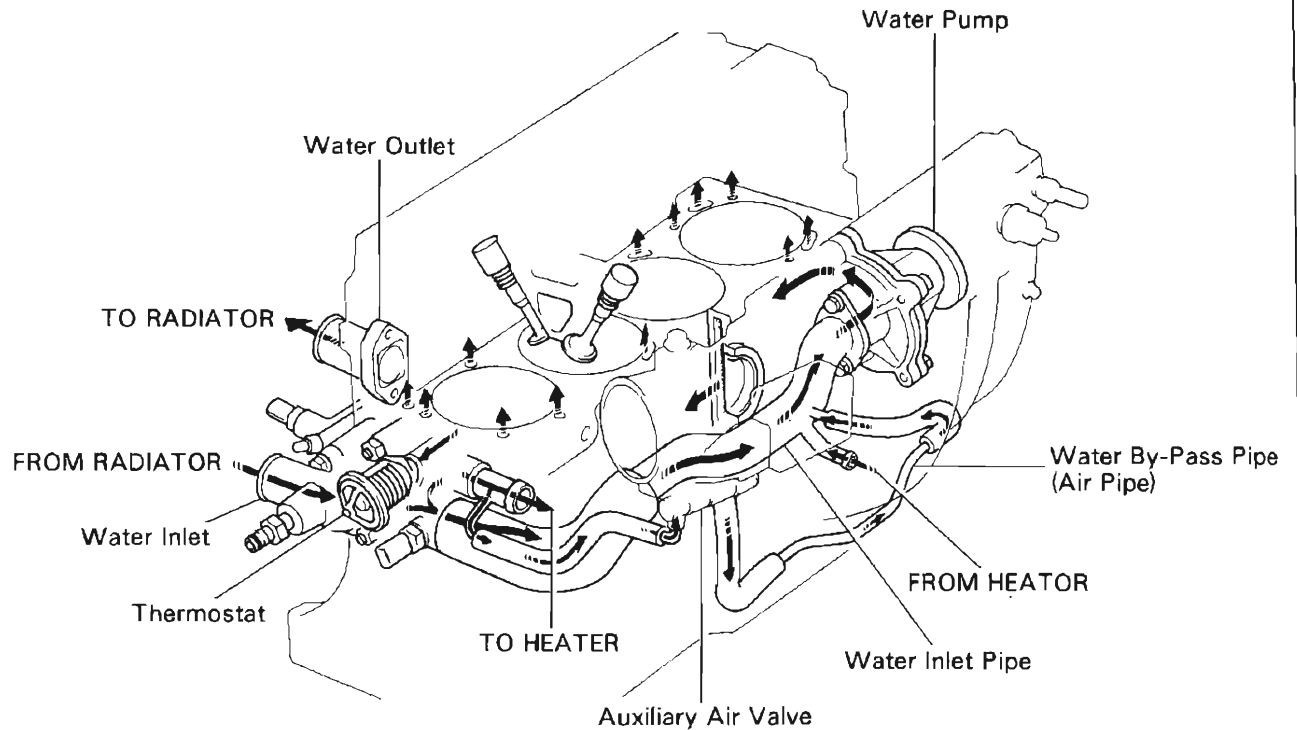
COOLING SYSTEM

	Page
DESCRIPTION	CO-2
TROUBLESHOOTING	CO-4
CHECK AND REPLACEMENT OF ENGINE	
COOLANT	CO-5
WATER PUMP	CO-6
THERMOSTAT	CO-13
RADIATOR	CO-15
ELECTRIC COOLING FAN	CO-21

DESCRIPTION

This engine utilizes a pressurized forced circulation cooling system which includes a thermostat equipped with a by-pass valve mounted on the inlet side.

4A-FE



The cooling system is composed of the water jacket (inside the cylinder block and cylinder head), radiator, water pump, thermostat, electric fan, hoses and other components.

Coolant which is heated in the water jacket is pumped to the radiator, through which an electric fan flows air to cool the coolant as it passes through. Coolant which has been cooled is then sent back to the engine by the water pump, where it cools the engine.

The water jacket is a network of channels in the shell of the cylinder block and cylinder head through which coolant passes. It is designed to provide adequate cooling of the cylinders in the combustion chambers which become heated during engine operation.

RADIATOR

The radiator performs the function of cooling the coolant which has passed through the water jacket and become hot, and is mounted in the front of the vehicle. The radiator consists of an upper and lower tank, and a core which connects the two tanks. The upper tank contains the inlet for coolant from the water jacket and the filter inlet. It also has a hose attached through which excess coolant or steam can flow. The lower tank contains the outlet for coolant and the drain cock. The core contains many tubes through which coolant flows from the upper tank to the lower tank as well as cooling fins which radiate heat away from the coolant in the tubes. The air sucked through the radiator by the electric fan, as well as the wind generated by the vehicle's travel, passes through the radiator, cooling it. Models with automatic transmissions include an automatic transmission fluid cooler built into the lower tank of the radiator. A fan with an electric motor is mounted behind the radiator to assist the flow of air through the radiator. The fan operates when the coolant temperature becomes high in order to prevent it from becoming too high.

RADIATOR CAP

The radiator cap is a pressure type cap which seals the radiator, resulting in pressurization of the radiator as the coolant expands. The pressurization prevents the coolant from boiling even when the coolant temperature exceeds 100°C (212°F). A relief valve (pressurization valve) and a vacuum valve (negative pressure valve) are built into the radiator cap. The relief valve opens and lets steam escape through the overflow pipe when the pressure generated inside the cooling system exceeds the limit (coolant temperature: 110 – 120°C, 230 – 248°F, pressure: 0.3 – 1.0 kg/cm², 4.3 – 14.2 psi, 29.4 – 98.1 kPa). The vacuum valve opens to alleviate the vacuum which develops in the coolant system after the engine is

stopped and the coolant temperature drops. The valve's opening allows return of the coolant in the reservoir tank to the cooling system.

RESERVOIR TANK

The reservoir tank is used to catch coolant which overflows the cooling system as a result of volumetric expansion when the coolant is heated. The coolant in the reservoir tank returns to the radiator when the coolant temperature drops, thus keeping the radiator full at all times and avoiding needless coolant loss. Check the reservoir tank level to see if the coolant needs to be replenished.

WATER PUMP

The water pump is used for forced circulation of coolant through the cooling system. It is mounted on the front of the cylinder block and driven by a timing belt.

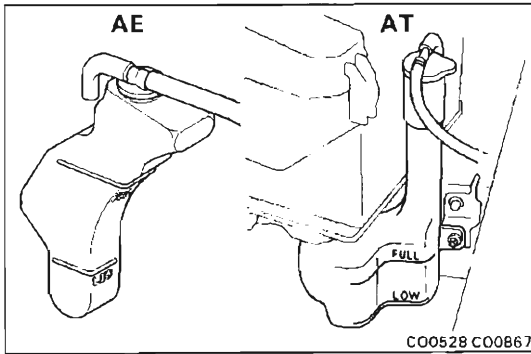
THERMOSTAT

The thermostat is a wax type bypass valve and is mounted in the water inlet housing. The thermostat includes a type of automatic valve operated by fluctuations in the coolant temperature. This valve closes when the coolant temperature drops, preventing the circulation of coolant through the engine and thus permitting the engine to warm up rapidly. The valve opens when the coolant temperature has risen, allowing the circulation of coolant. Wax inside the thermostat expands when heated and contracts when cooled. Heating the wax thus generates pressure which overpowers the force of the spring which keeps the valve closed, thus opening the valve. When the wax cools, its contraction causes the force of the spring to take effect once more, closing the valve. The thermostat in this engine operates at a temperature of 82°C (180°F).

TROUBLESHOOTING

Problem	Possible cause	Remedy	Page
Engine overheats	Check coolant	Replenish coolant	
	Water pump drive belt loose or missing	Adjust or replace belt	
	Dirt, leaves or insects on radiator	Clean radiator	
	Hoses, water pump, thermostat housing, radiator, heater, core plugs or head gasket leakage	Repair as necessary	
	Thermostat faulty	Check thermostat	CO-13
	Ignition timing retarded	Set timing	
	Electric cooling system faulty	Inspect electric cooling system	CO-21
	Radiator hose plugged or rotted	Replace hose	
	Water pump faulty	Replace water pump	CO-6
	Radiator plugged or cap faulty	Check radiator	CO-15
	Cylinder head or block cracked or plugged	Repair as necessary	

HINT: The thermostat is equipped with a by-pass valve, if the engine tends to overheat, removal of the thermostat would have an adverse effect, causing a loss of cooling efficiency.



CHECK AND REPLACEMENT OF ENGINE COOLANT

1. CHECK ENGINE COOLANT LEVEL AT RESERVE TANK

The coolant level should be between the "LOW" and "FULL" lines.

If low, check for leaks and add coolant up to the "FULL" line.

2. CHECK ENGINE COOLANT QUALITY

There should not be any excessive rust deposits or scales around the radiator cap or radiator filler hole, and the coolant should be free from oil.

If excessively dirty, replace the coolant.

3. REPLACE ENGINE COOLANT

(a) Remove the radiator cap.

CAUTION: To avoid the danger of being burned, do not remove it while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.

(b) Drain the coolant from the radiator and engine drain cocks. (The engine drain cock is near the oil filter.)

(c) Close the drain cocks.

Torque (Engine drain cock):
350 kg-cm (25 ft-lb, 34 N·m)

(d) Fill the system with coolant.

Use a good brand of ethylene-glycol or alcohol type antifreeze, or TOYOTA radiator conditioner or equivalent anticorrosive, mixed according to the manufacturer's directions.

Ethylene-glycol type: This type has an antifreeze and anticorrosive effect.

TOYOTA radiator conditioner: This has only an anticorrosive effect.

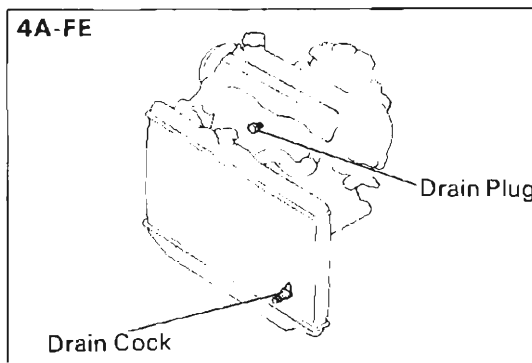
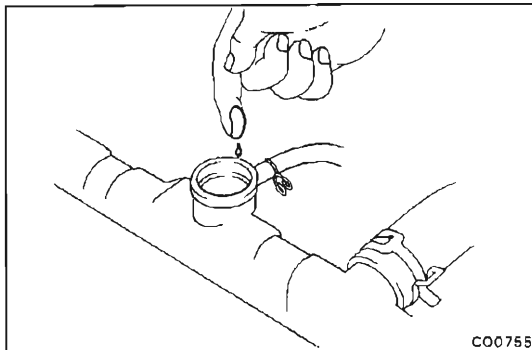
NOTICE:

- Do not use alcohol type coolant.
- The coolant should be mixed with demineralized water or distilled water.

Capacity (w/ Heater):

4A-FE

AE M/T 6.2 liters (6.5 US qts, 5.5 Imp. qts)

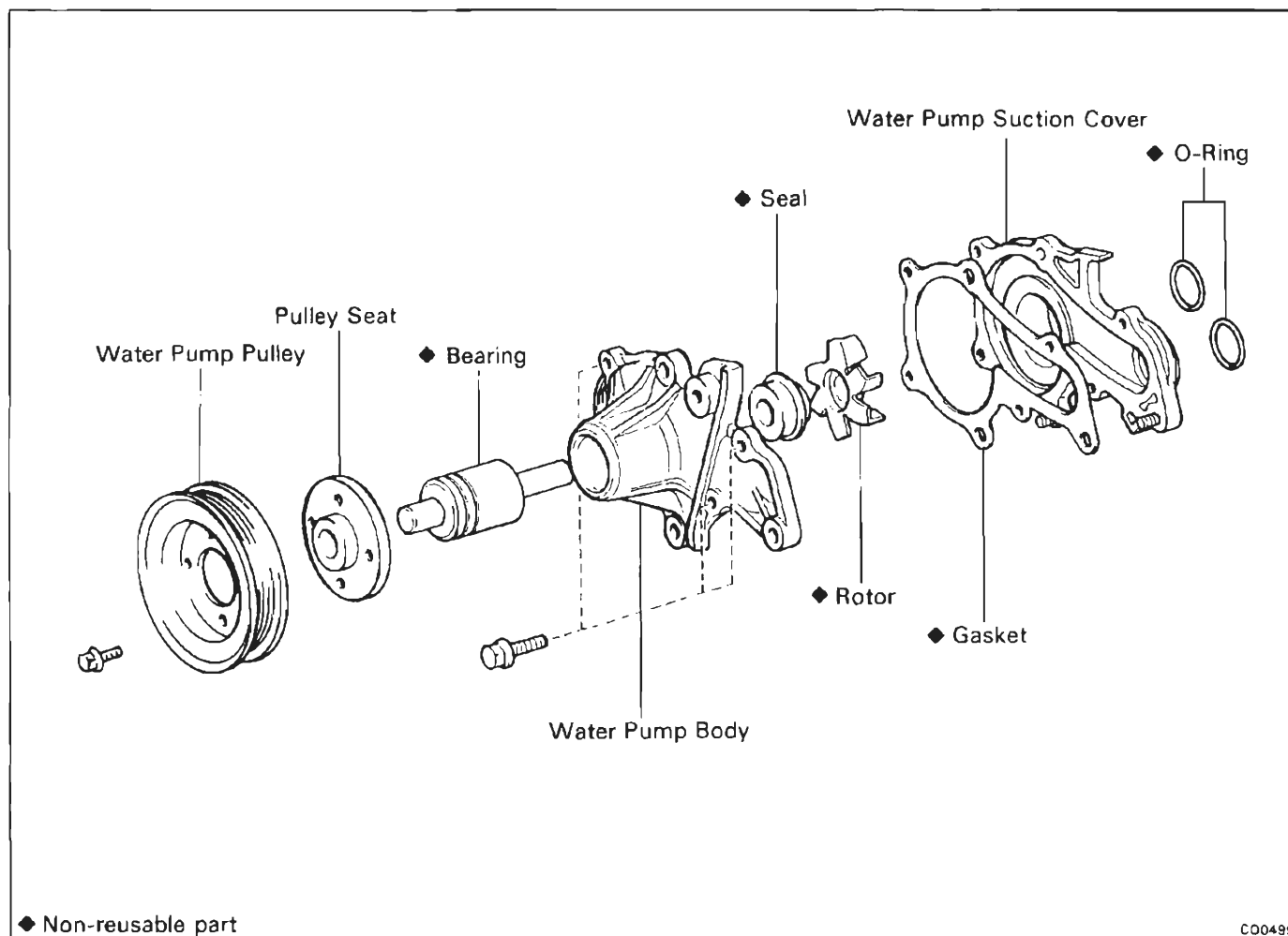


(e) Install the radiator cap.

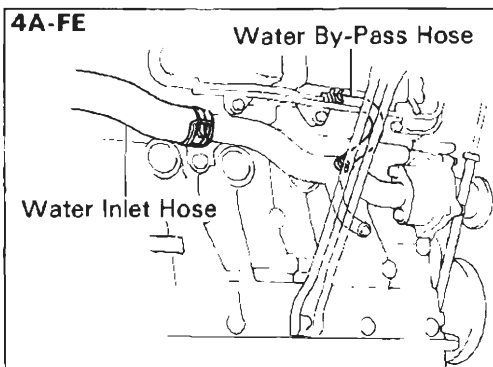
(f) Start the engine and check for leaks.

(g) Recheck the coolant level and refill as necessary.

WATER PUMP COMPONENTS



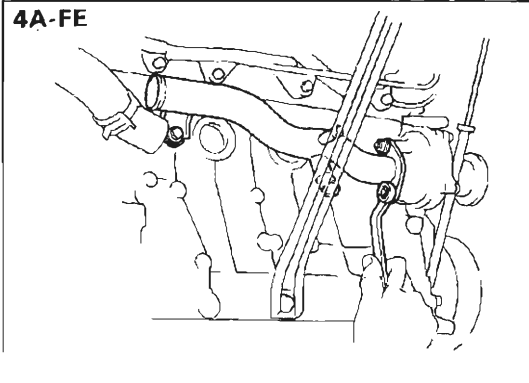
4A-FE



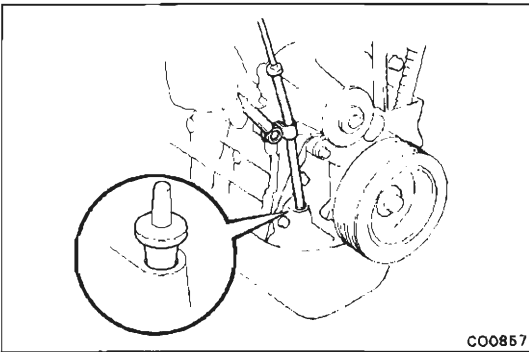
REMOVAL OF WATER PUMP

1. DRAIN COOLANT (See page CO-5)
2. REMOVE DRIVE BELT AND WATER PUMP PULLEY
3. REMOVE NO.3 AND NO.2 TIMING BELT COVERS
4A-FE (See steps 8, 12 and 14 on pages EM-60 and 62)
4. REMOVE WATER INLET PIPE
 - (a) Disconnect the water inlet and water by-pass hoses from the inlet pipe.

4A-FE

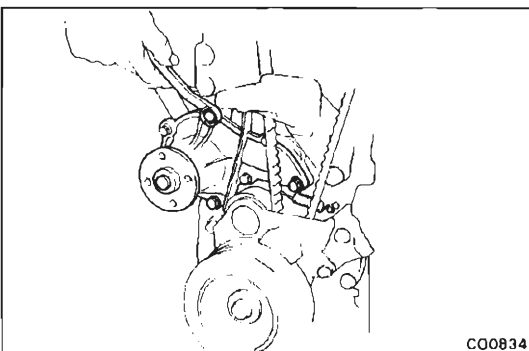


- (b) Remove the two nuts and clamp bolt.
- (c) Remove the water inlet pipe and O-ring.



5. REMOVE OIL DIPSTICK GUIDE AND DIPSTICK

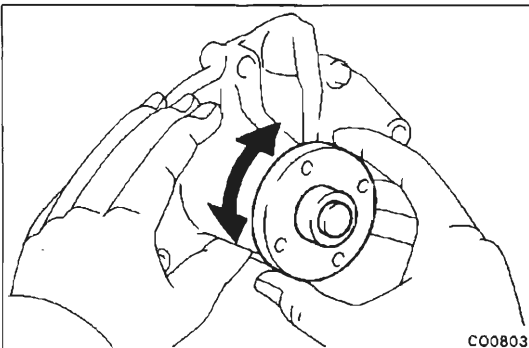
- (a) Remove the dipstick.
- (b) Remove the bolt, and pull out the dipstick guide. Plug the guide installation hole of the oil pump.
- (c) Remove the O-ring from the dipstick guide.



6. REMOVE WATER PUMP

- (a) Remove the three bolts and water pump.
- (b) Remove the O-ring.

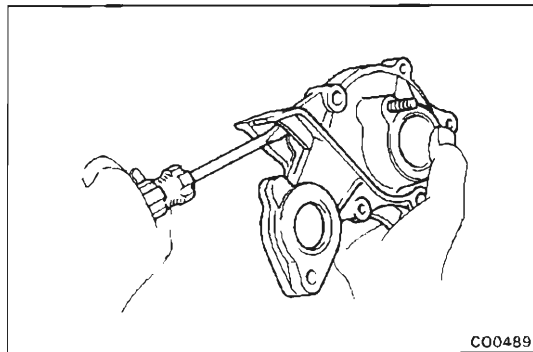
NOTICE: Be careful not to get coolant on the timing belt.



INSPECTION OF WATER PUMP

INSPECT WATER PUMP

Turn the pulley and check that the water pump bearing moves smoothly and quietly.

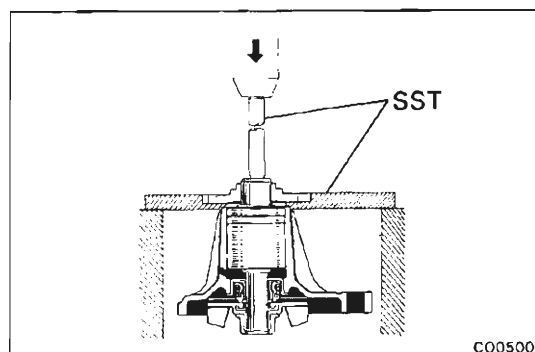


DISASSEMBLY OF WATER PUMP

(See page CO-6)

1. REMOVE WATER PUMP SUCTION COVER

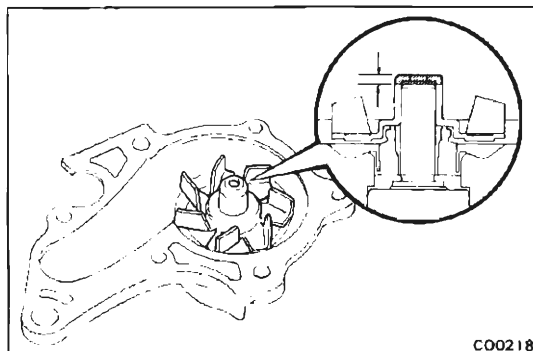
- (a) Remove the three bolts.
- (b) Using a screwdriver, pry off the water pump suction cover.



2. REMOVE PULLEY SEAT

Using SST and a press, remove the pulley seat from the water pump bearing shaft.

SST 09236-00101 (09237-00010, 09237-00040)

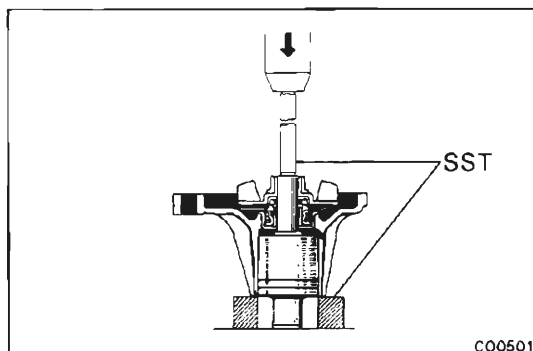


3. REMOVE WATER PUMP BEARING

- (a) Using a grinding wheel, grind the water pump rotor as shown.

NOTICE: Do not grind water pump bearing shaft.

- (b) Heat the water pump body to approx. 85°C (185°F).

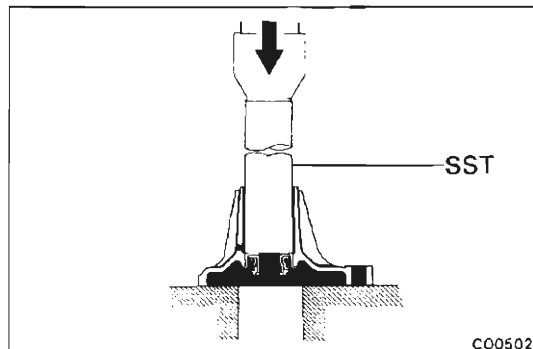


- (c) Using SST and a press, remove the water pump rotor and bearing.

SST 09236-00101 (09237-00010, 09237-00040)

- (d) Remove the seal set from the water pump body.

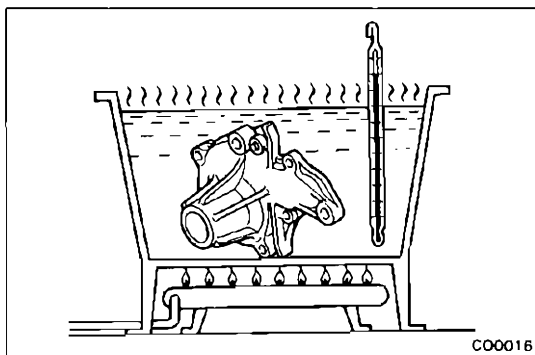
NOTICE: Do not damage the water pump body.



4. REMOVE SEAL

Using SST and a press, remove the seal.

SST 09236-00101 (09236-15010)



ASSEMBLY OF WATER PUMP

(See page CO-6)

HINT: Always assemble the water pump with a new seal set, a new rotor and a new bearing.

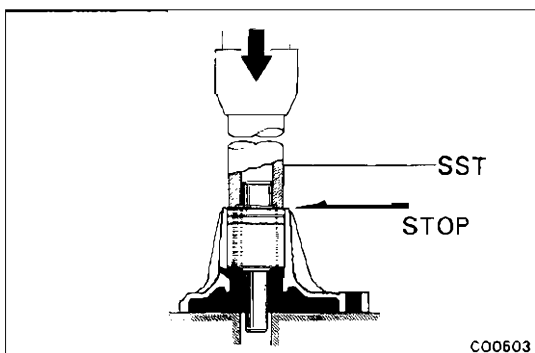
1. INSTALL WATER PUMP BEARING

- (a) Gradually heat the water pump body to approx. 85°C (185°F).

- (b) Using SST and a press, install a new water pump bearing into the water pump body.

SST 09236-00101 (09237-00020)

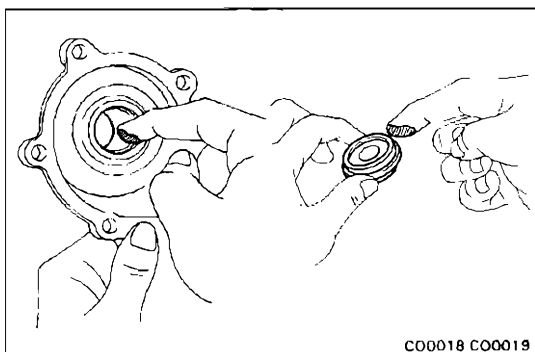
HINT: The bearing end face should be flush with the body top surface.



2. INSTALL SEAL

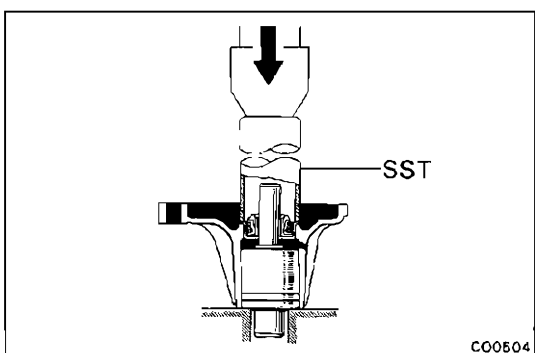
- (a) Apply a seal packing No.1282-B to a new seal and pump body.

Seal packing: Part No.08826-00100 or equivalent



- (b) Using SST and a press, install the seal on the water pump bearing.

SST 09236-00101 (09237-00020)



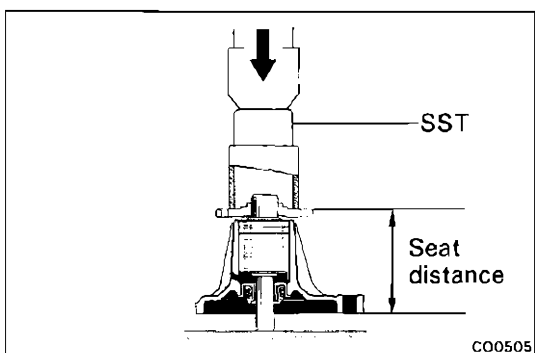
3. INSTALL PULLEY SEAT

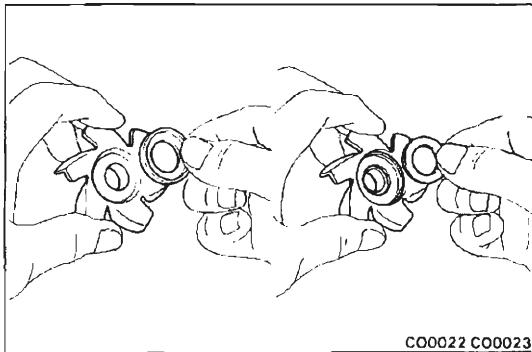
Using SST and a press, install the pulley seat on the water pump bearing shaft.

SST 09236-00101 (09237-00020)

HINT: As shown in the figure, the distance from the pulley seat to the installation surface of the pump body should be as follows:

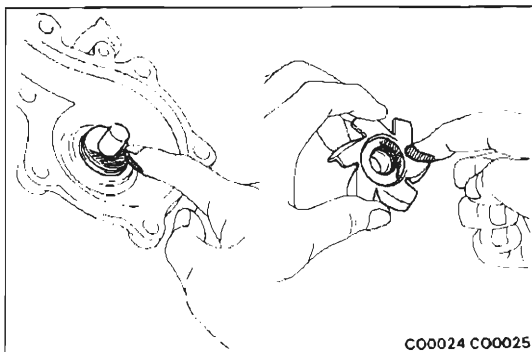
Seat distance: 76.7 mm (3.020 in.)



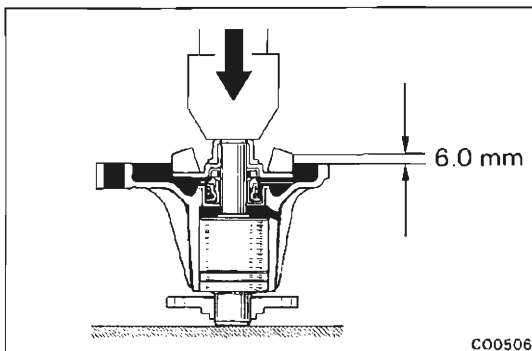


4. INSTALL ROTOR

(a) Install a new packing and seal into the rotor.



(b) Apply a little LLC to the seal and rotor contact surface.

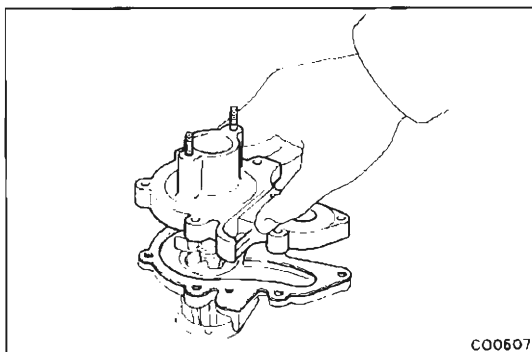


(c) Using a press, install a new rotor on the water pump bearing shaft.

HINT: As shown in the figure, the distance from the rotor edge to the installation surface of the pump body should be 6.0 mm (0.236 in.).

5. CHECK WATER PUMP

After assembly make sure that the rotor rotates smoothly.

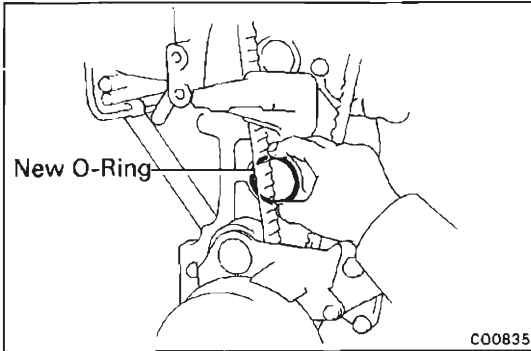


6. INSTALL WATER PUMP SUCTION COVER

Install the water pump suction cover on a new gasket with three bolts.

Torque: 92.5 kg-cm (80 in.-lb, 9.1 N·m)

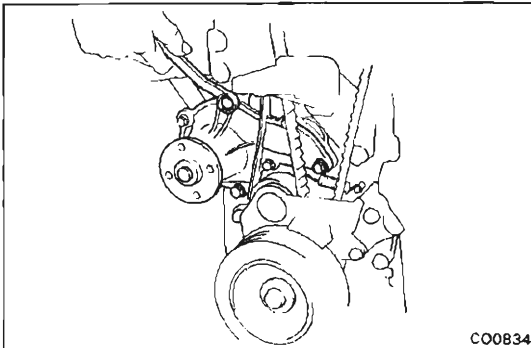
HINT: After installing, make sure that the rotor is not in contact with the water pump suction cover.



INSTALLATION OF WATER PUMP

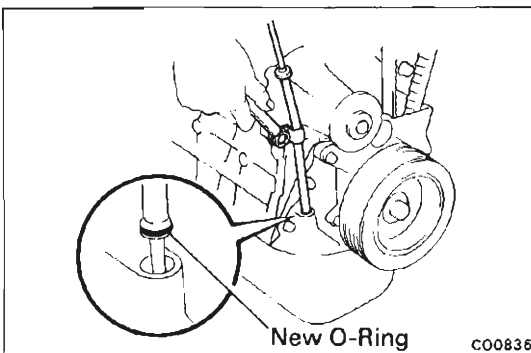
1. INSTALL WATER PUMP

- (a) Place a new O-ring in position on the cylinder block.



- (b) Install the water pump with the three bolts.

Torque: 150 kg-cm (11 ft-lb, 15 N·m)



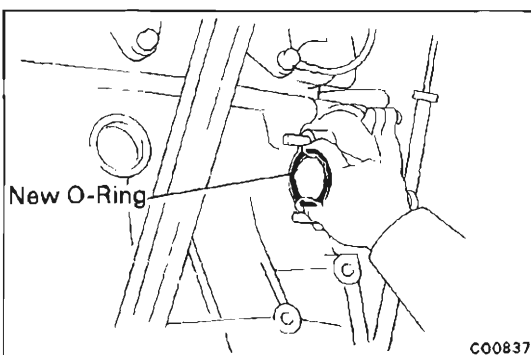
2. INSTALL OIL DIPSTICK GUIDE AND DIPSTICK

- (a) Install a new O-ring to the dipstick guide.

- (b) Apply soapy water to the O-ring.

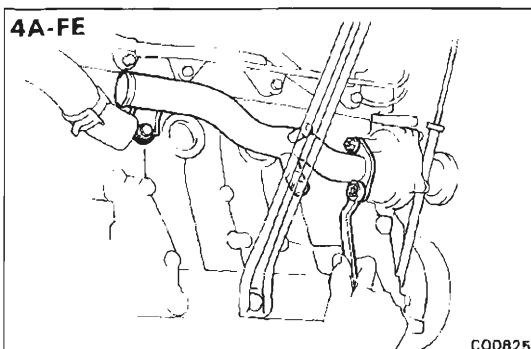
- (c) Push in the dipstick guide, and install it with the bolt.

Torque: 95 kg-cm (82 in.-lb, 9.3 N·m)



3. INSTALL WATER INLET PIPE

- (a) Place a new O-ring in position on the water pump.



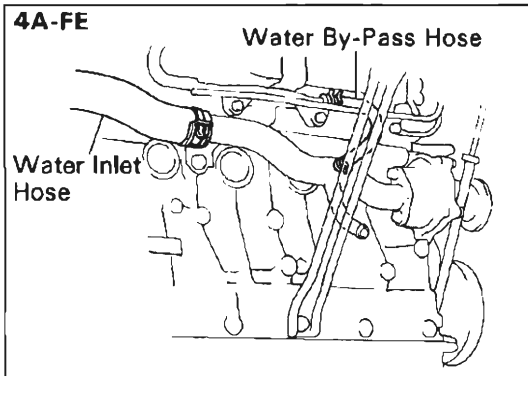
- (b) Temporarily install water pump with the two nuts and bolt.

- (c) Tighten the two nuts.

Torque: 200 kg-cm (14 ft-lb, 20 N·m)

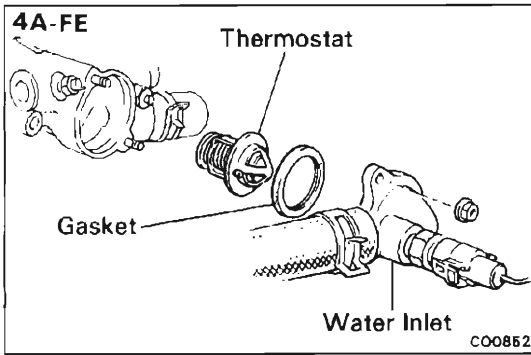
- (d) Tighten the bolt.

Torque: 130 kg-cm (9 ft-lb, 13 N·m)



- (e) Connect the water inlet and water by-pass hoses to the inlet pipe.

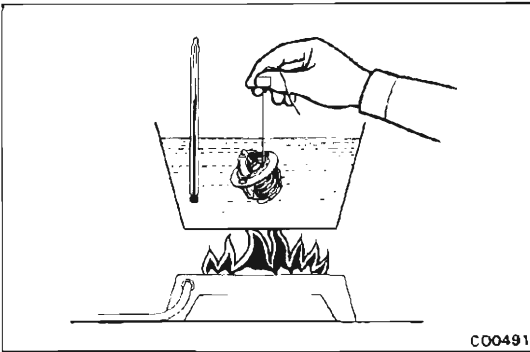
4. **INSTALL NO.2 AND NO.3 TIMING BELT COVERS**
4A-FE (See steps 11, 14 and 18 on page EM-86 and 88)
5. **TEMPORARILY INSTALL WATER PUMP PULLEY**
6. **INSTALL ALTERNATOR DRIVE BELT**
7. **ADJUST DRIVE BELT (See page CH-3)**
8. **FILL WITH ENGINE COOLANT (See page CO-5)**
9. **START ENGINE AND CHECK FOR LEAKS**



THERMOSTAT

REMOVAL OF THERMOSTAT

1. DRAIN ENGINE COOLANT (See page CO-5)
2. REMOVE WATER INLET AND THERMOSTAT
 - (a) Remove the two nuts (4A-FE) or two bolts (4A-GE) and water inlet from the water inlet housing.
 - (b) Remove the thermostat.
 - (c) Remove the gasket from the thermostat.



INSPECTION OF THERMOSTAT

INSPECT THERMOSTAT

HINT: The thermostat is numbered with the valve opening temperature.

- (a) Immerse the thermostat in water and gradually heat the water.

- (b) Check the valve opening temperature.

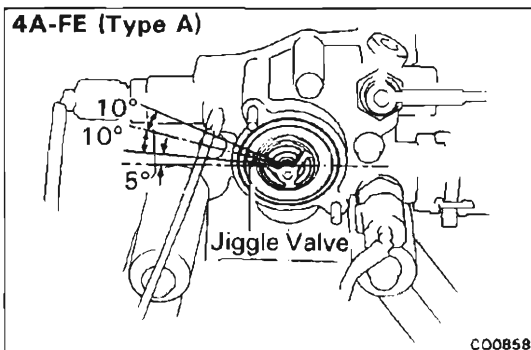
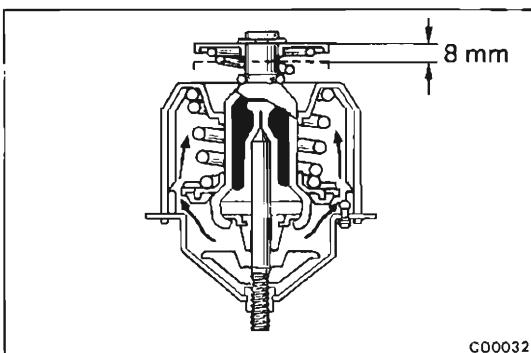
Valve opening temperature:
80 – 84°C (176 – 183°F)

If the valve opening temperature is not as specified, replace the thermostat.

- (c) Check the valve lift.

Valve lift: 8 mm (0.31 in.) or more at 95°C (203°F)

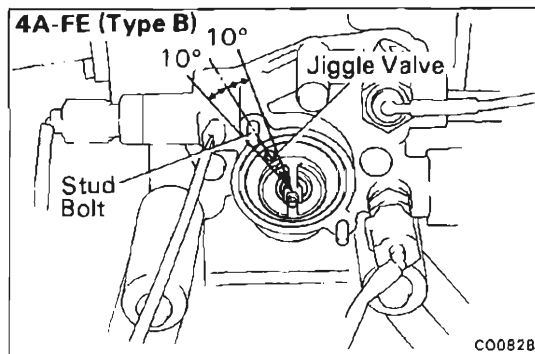
If the valve lift is less than specification, replace the thermostat.



INSTALLATION OF THERMOSTAT

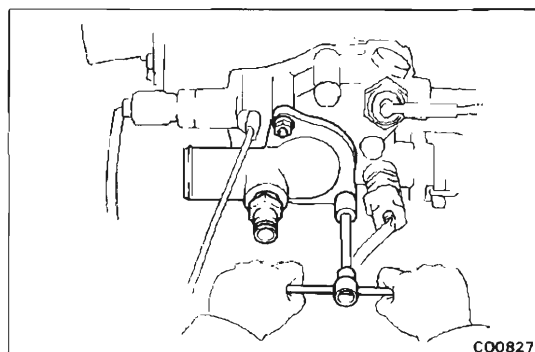
1. PLACE THERMOSTAT IN WATER PUMP
 - (a) Install a new gasket to the thermostat.
 - (b) (4A-FE Type A)
 Set the jiggle valve of the thermostat in angle position, and insert the thermostat in the water inlet, housing.

HINT: The jiggle valve may be set within 10° of either side of the prescribed position.

**(4A-FE Type B)**

Align the jiggle valve of the thermostat with the upper side of the stud bolt, and insert the thermostat in the water inlet housing.

HINT: The jiggle valve be set within 10° of either side of the prescribed position.

**2. INSTALL WATER INLET**

Install the water inlet with the two nuts (4A-FE)

Torque: 95 kg-cm (82 in.-lb, 9.3 N·m)

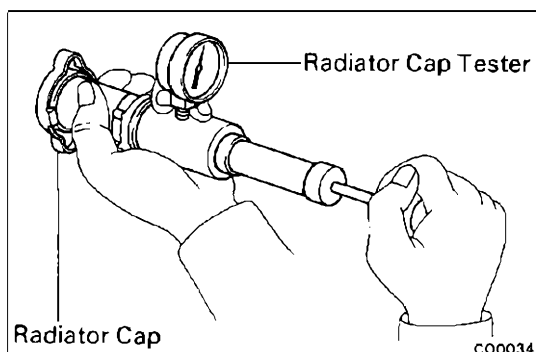
3. FILL WITH ENGINE COOLANT (See page CO-5)**4. START ENGINE AND CHECK FOR LEAKS**

RADIATOR

CLEANING OF RADIATOR

Using water or steam cleaner, remove any mud and dirt from the radiator core.

NOTICE: If using a high pressure type cleaner, be careful not to deform the fins of the radiator core. If the cleaner nozzle pressure is 30 – 35 kg/cm² (427 – 498 psi, 2,942 – 3,432 kPa), keep a distance of at least 40 – 50 cm (15.75 – 19.69 in.) between the radiator core and cleaner nozzle.



INSPECTION OF RADIATOR

1. INSPECT RADIATOR CAP

Using a radiator cap tester, pump the tester until relief valve opens. Check that valve opens between 0.75 kg/cm² (10.7 psi, 74 kPa) and 1.05 kg/cm² (14.9 psi, 103 kPa).

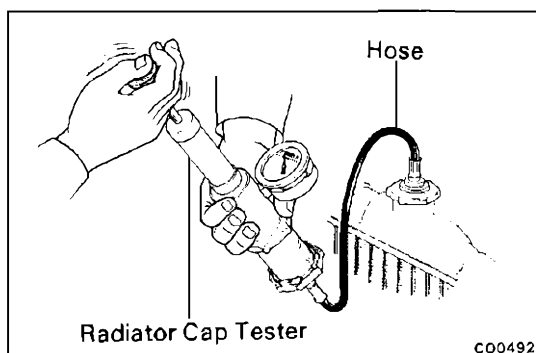
Check that the pressure gauge does not drop rapidly when pressure on cap is below 0.6 kg/cm² (8.5 psi, 59 kPa). Measure the relief valve opening pressure.

If either check is not within limits, replace the radiator cap.

2. CHECK COOLING SYSTEM FOR LEAKS

- Fill the radiator with coolant and attach a radiator cap tester.
- Warm up the engine.
- Pump it to 1.2 kg/cm² (17psi, 118 kPa), check that pressure does not drop.

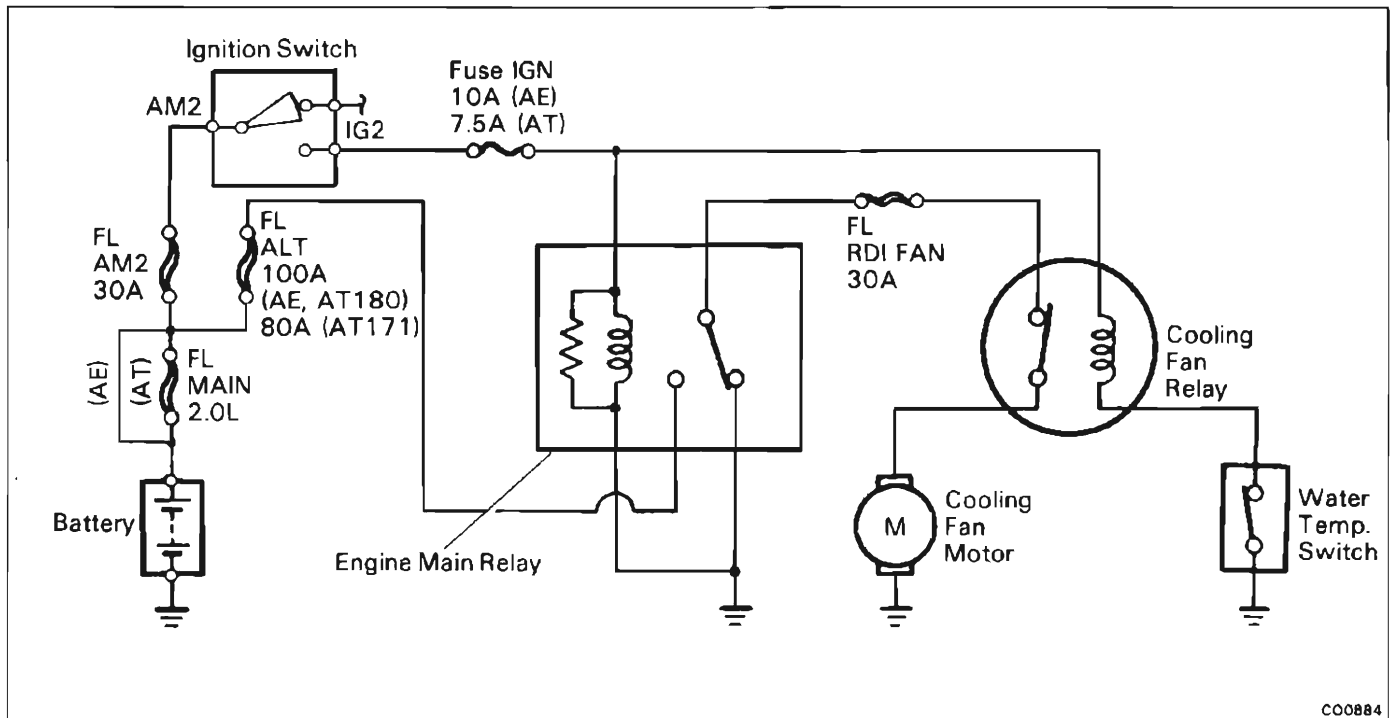
If the pressure drops, check for leaks from the hoses, radiator or water pump. If no external leaks are found, check the heater core, block and head.



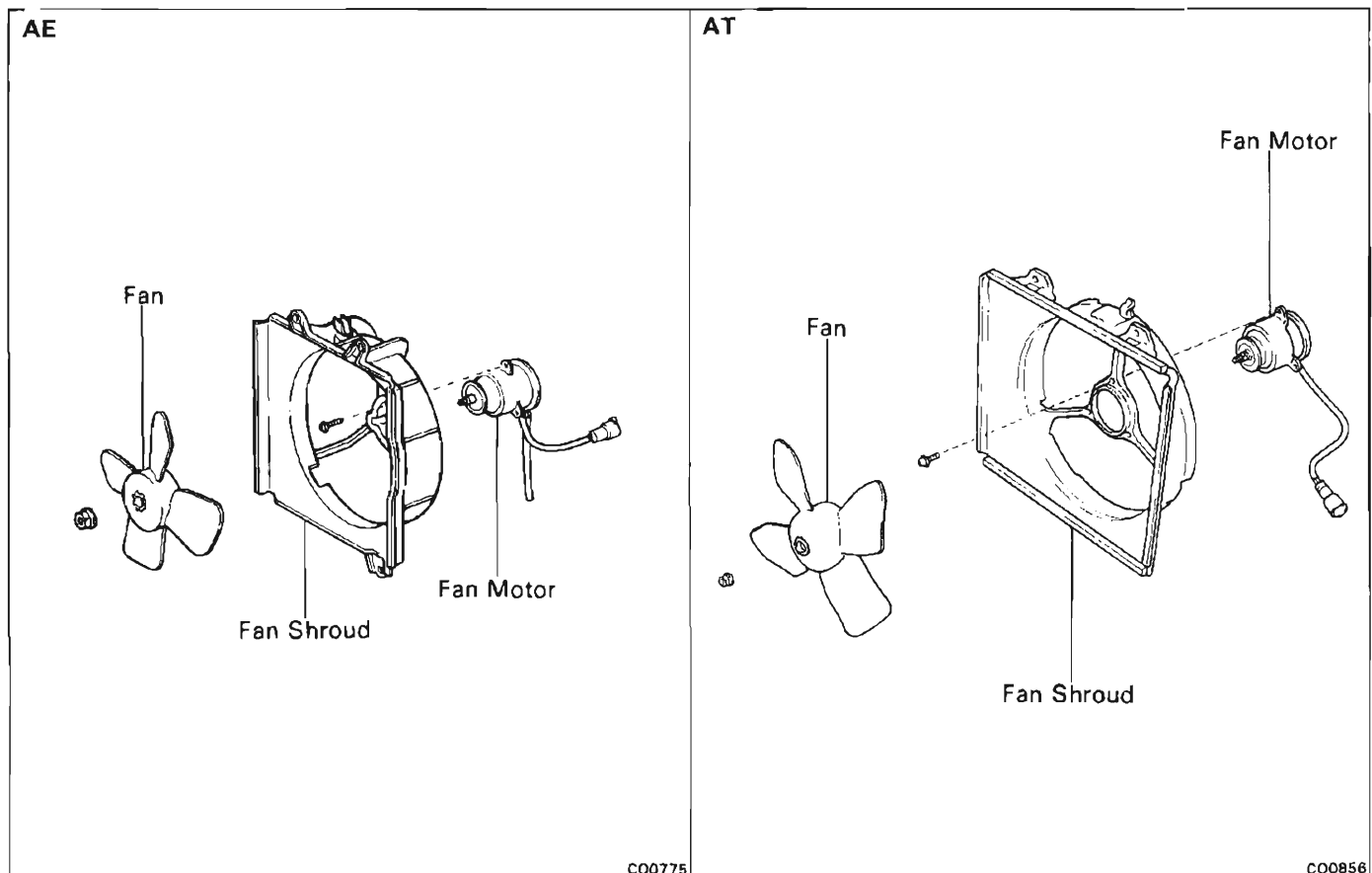
ELECTRIC COOLING FAN

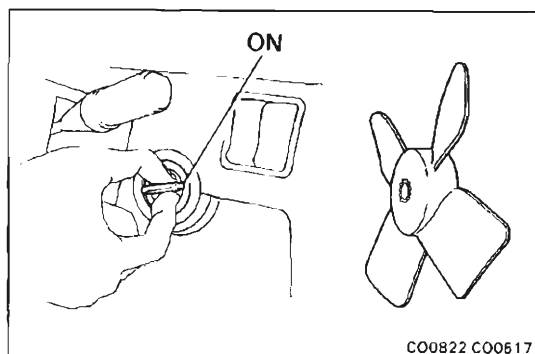
Radiator Cooling Fan

SYSTEM CIRCUIT



COMPONENTS





ON-VEHICLE INSPECTION

Low Coolant Temperature (below 83°C (181°F))

1. TURN IGNITION SWITCH ON

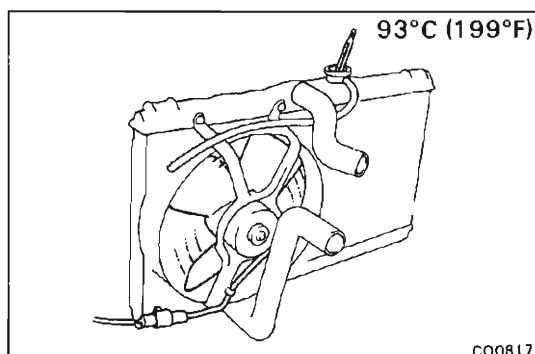
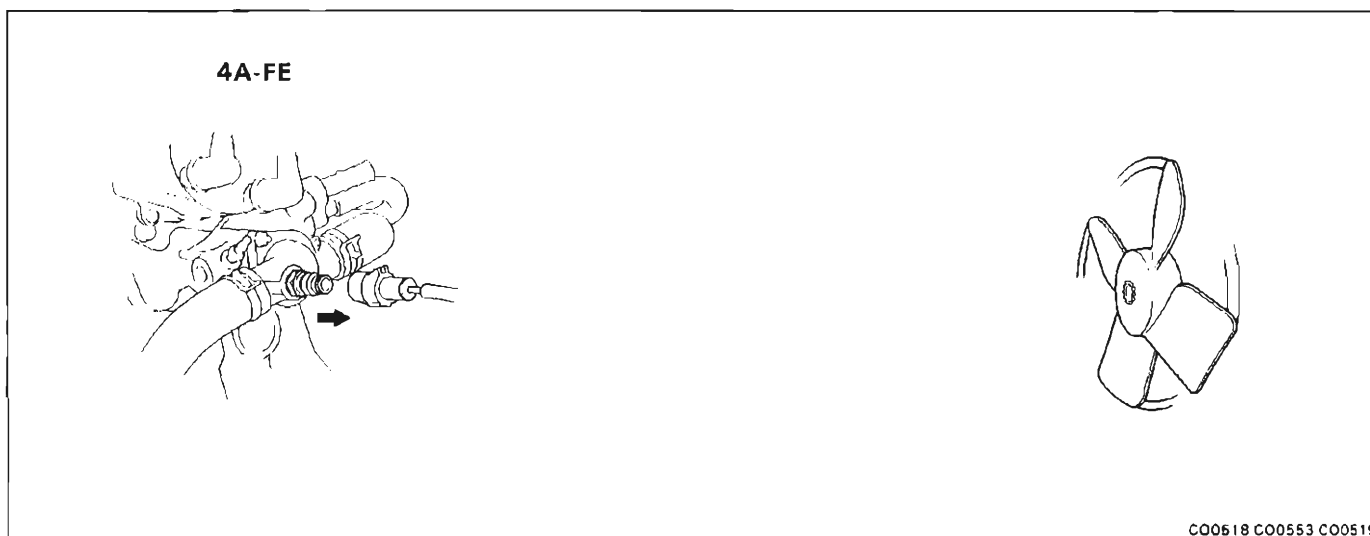
Check that the fan does not rotate.

If it rotates, check the fan relay and temperature switch, and check for a separated connector or severed wire between the relay and temperature switch.

2. DISCONNECT TEMPERATURE SWITCH CONNECTOR

Check that the fan rotates.

If it does not, check the fan relay, fan motor, ignition relay and fuse, and check for a short circuit between the fan relay and temperature switch.



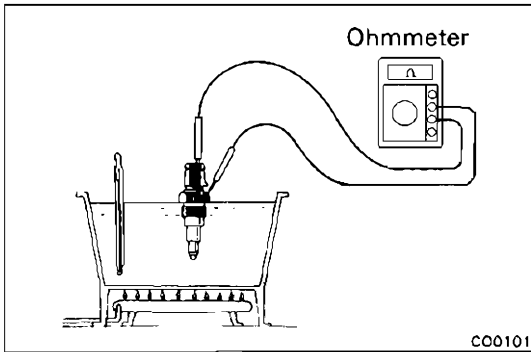
3. CONNECT TEMPERATURE SWITCH CONNECTOR

High Coolant Temperature (above 93°C (199°F))

4. START ENGINE

- Raise engine coolant temperature to above 93°C (199°F).
- Check that the fan rotates.
- Check that the fan stops when coolant temperature is below 83°C (181°F).

If it doesn't replace the temperature switch.



INSPECTION OF ELECTRIC COOLING FAN

1. INSPECT TEMPERATURE SWITCH

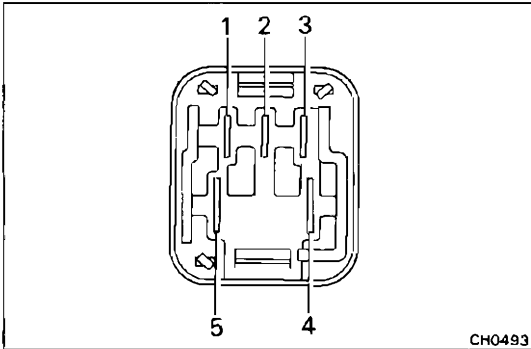
LOCATION: On the water inlet housing.

- Using an ohmmeter, check that there is no continuity when the coolant temperature is above 93°C (199°F).
- Check that there is continuity when the coolant temperature is below 83°C (181°F).

If continuity is not as specified, replace the switch.

2. INSPECT ENGINE MAIN RELAY

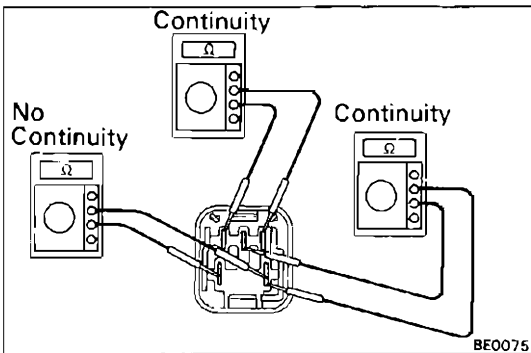
LOCATION: In the engine compartment relay box.



A. Inspect relay continuity

- Using an ohmmeter, check that there is continuity between terminals 1 and 3.
- Check that there is continuity between terminals 2 and 4.
- Check that there is no continuity between terminals 4 and 5.

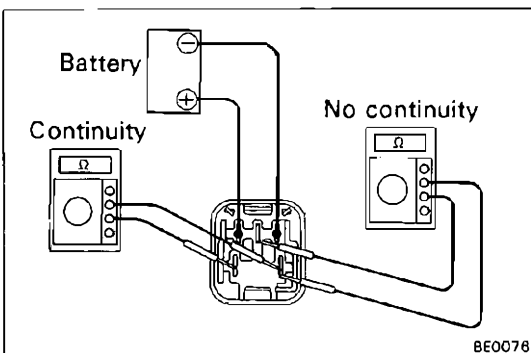
If continuity is not as specified, replace the relay.



B. Inspect relay operation

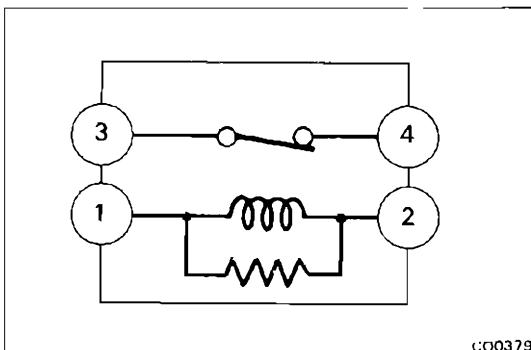
- Apply battery voltage across terminals 1 and 3.
- Using an ohmmeter, check that there is continuity between terminals 4 and 5.
- Check that there is no continuity between terminals 2 and 4.

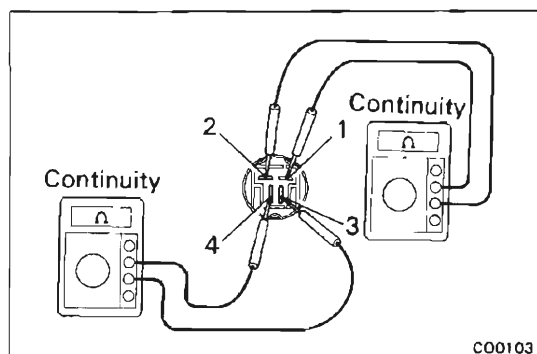
If operation is not as specified, replace the relay.



3. INSPECT COOLING FAN RELAY

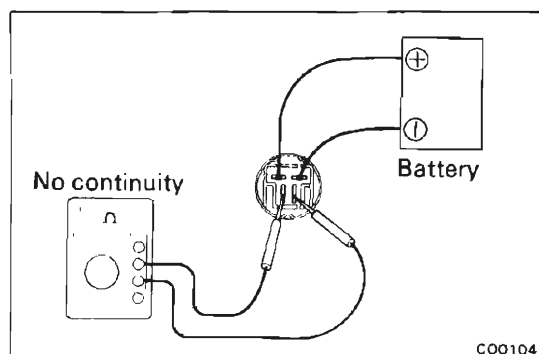
LOCATION: In the engine compartment relay box.



**A. Inspect relay continuity**

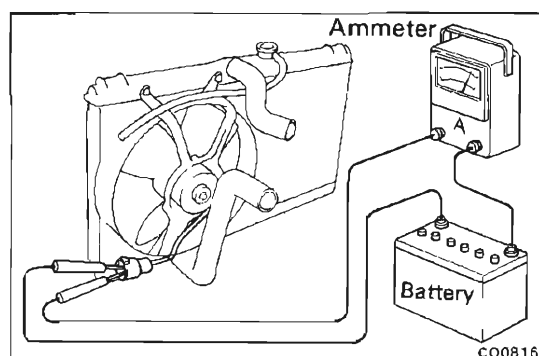
- (a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.
- (b) Check that there is continuity between terminals 3 and 4.

If continuity is not as specified, replace the relay.

**B. Inspect relay operation**

- (a) Apply battery voltage across terminals 1 and 2.
- (b) Check that there is no continuity between terminal 1 and 4.

If operation is not as specified, replace the relay.

**4. INSPECT FAN MOTOR**

- (a) Connect the battery and ammeter to the fan motor connector.
- (b) Check to see that the motor rotates smoothly, and current is as follows:

Standard amperage: 2WD 3.2 – 4.4A

If the amperage is not as specified, replace the cooling fan motor.

LUBRICATION SYSTEM

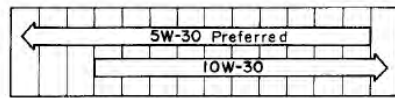
	Page
DESCRIPTION	LU-2
TROUBLESHOOTING	LU-5
OIL PRESSURE CHECK	LU-6
REPLACEMENT OF ENGINE OIL AND OIL FILTER ..	LU-7
OIL PUMP	LU-9

LU

ENGINE OIL SELECTION

Use API SH, "Energy-Conserving II" multigrade engine oil or ILSAC multigrade engine oil.

Recommended viscosity (SAE):



Temperature range anticipated before next oil change

60040-103 U

SAE 5W-30 is the best choice for your vehicle, for good fuel economy, and good starting in cold weather.

If you use SAE 10W-30 engine oil in extremely low temperatures, the engine may become difficult to start, so SAE 5W-30 engine oil is recommended.

API service symbol



60050-18

Oil identification marks

Either or both API registered marks are added to some oil containers to help you select the oil you should use.

The API Service Symbol is located anywhere on the outside of the container.

The top portion of the label shows the oil quality by API (American Petroleum Institute) designations such as SH. The center portion of the label shows the SAE viscosity grade such as SAE 5W-30. "Energy-Conserving II" shown in the lower portion, indicates that the oil has fuel-saving capabilities. Oils marked "Energy-Conserving II" will have higher fuel-saving capabilities than oil marked "Energy-Conserving".

ILSAC certification mark



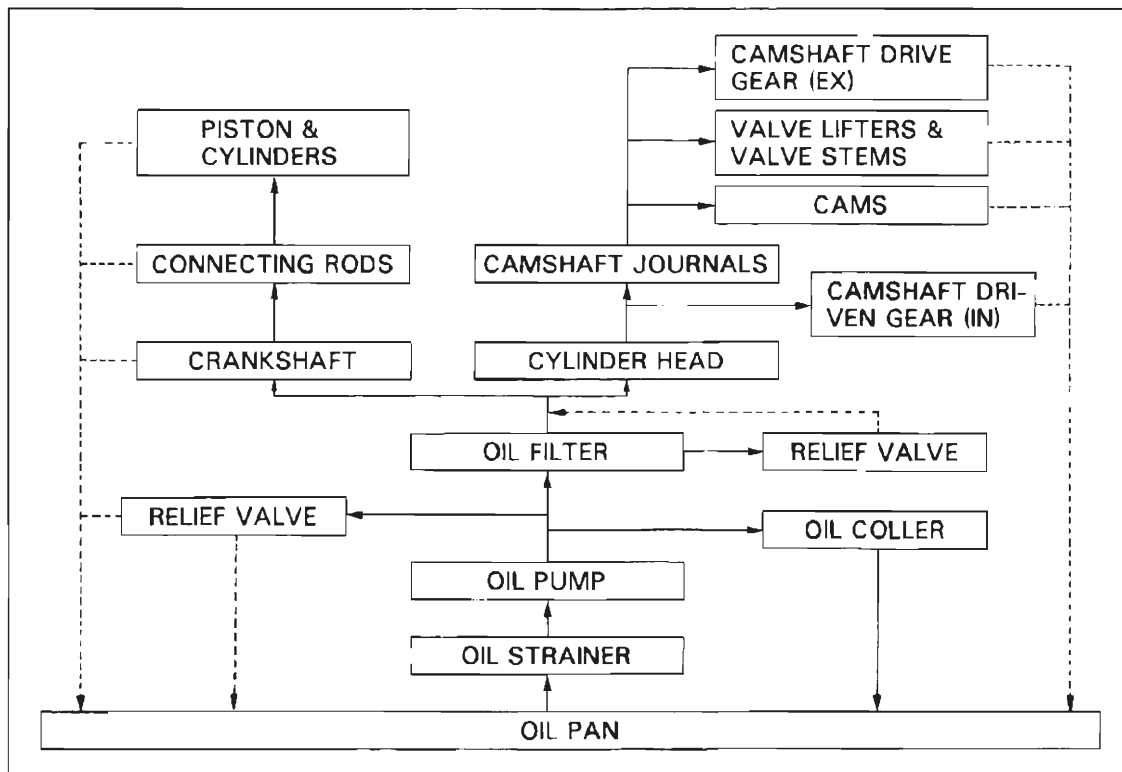
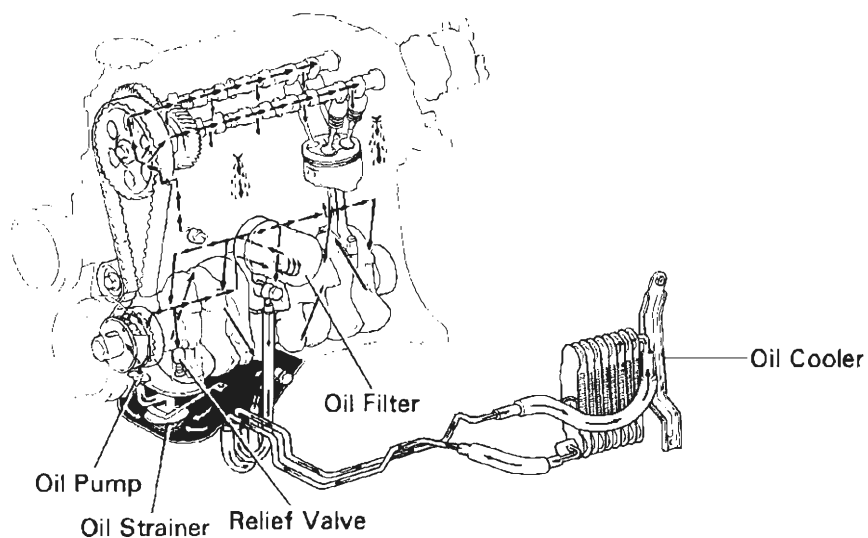
60050-17

The ILSAC (International Lubricant Standardization and Approval Committee) Certification Mark is displayed on the front of the container.

DESCRIPTION

A fully pressurized, fully filtered lubrication system has been adopted for this engine.

4A-FE



A pressure feeding lubrication system has been adopted to supply oil to the moving parts of this engine. The lubrication system consists of an oil pan, oil pump, oil filter and other external parts which supply oil to the moving parts in the engine block. The oil circuit is shown in the illustration at the top of the previous page. Oil from the oil pan is pumped up by the oil pump. After it passes through the oil filter, it is fed through the various oil holes in the crankshaft and cylinder block. After passing through the cylinder block and performing its lubricating function, the oil is returned by gravity to the oil pan. A dipstick on the side of the oil pump body is provided to check the oil level.

OIL PUMP

The oil pump pumps up oil from the oil pan and sends it under pressure to the various parts of the engine. An oil strainer is mounted in front of the inlet to the oil pump. The oil pump itself is a trochoid type pump, inside of which there is a drive rotor and a driven rotor. When the drive rotor rotates, the driven rotor rotates in the same direction, and since the axls of the driven rotor shaft is different from the center of the driven rotor, the space between the two rotors is changed as they rotate. Oil is drawn in when the space is wide and is discharged when the space is narrow.

OIL PRESSURE REGULATOR

At high engine speeds, the engine oil supplied by the oil pump exceeds the capacity of the engine to utilize it. For that reason, the oil pressure regulator works to prevent an oversupply of oil. During normal oil supply, a coil spring and valve keep the bypass closed, but when too much oil is being fed, the pressure become extremely high, overpowering the force of the spring and opening the valves. This allows the excess oil to flow through the valve and return to the oil pan.

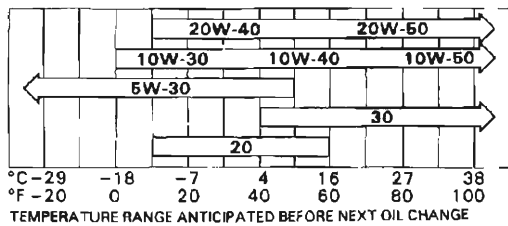
OIL FILTER

The oil filter is a full flow type filter with a built-in paper filter element. Particles of metal from wear, airborne dirt, carbon and other impurities can get into the oil during use and could cause accelerated wear or sizing if allowed to circulate through the engine. The oil filter, integrated into the oil line, removes these impurities as the oil passes through it. The filter is mounted outside the engine to simplify replacement of the filter element. A relief valve is also included ahead of the filter element to relieve the high oil pressure in case that the filter element becomes clogged with impurities. The relief valve opens when the oil pressure overpowers the force of the spring. Oil passing through the relief valve by-passes the oil filter and flows directly into the main oil hole in the engine.

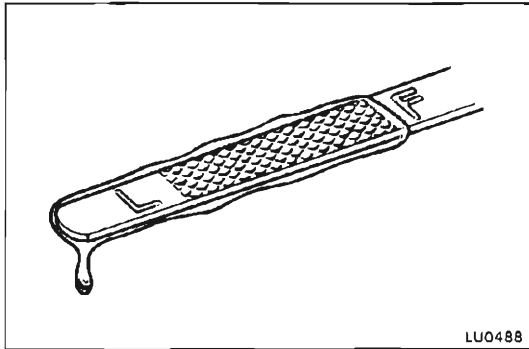
TROUBLESHOOTING

Problem	Possible cause	Remedy	Page
Oil leakage	Cylinder head, cylinder block or oil pump body damaged or cracked	Repair as necessary	EM-135 LU-13
	Oil seal faulty	Replace oil seal	
	Gasket faulty	Replace gasket	
Low oil pressure	Oil leakage	Repair as necessary	LU-12,13 LU-9 LU-6 EM-122 EM-119 LU-7
	Relief valve faulty	Repair relief valve	
	Oil pump faulty	Repair oil pump	
	Poor quality engine oil	Replace engine oil	
	Crankshaft bearing faulty	Replace bearing	
	Connecting rod bearing faulty	Replace bearing	
	Oil filter clogged	Replace oil filter	
High oil pressure	Relief valve faulty	Repair relief valve	LU-12,13

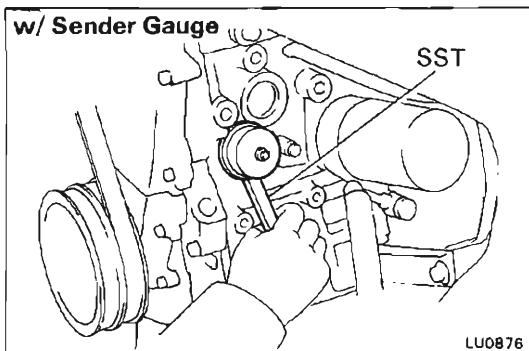
Recommended Viscosity (SAE):



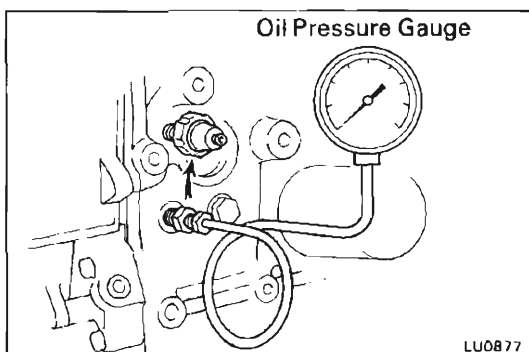
LU0310



LU0488



LU0876



LU0877

Adaptor 1/8" X 28 BSPT
Max tightening torque: 10 Nm

OIL PRESSURE CHECK

1. CHECK ENGINE OIL QUALITY

Check the oil for deterioration, entry of water, discoloring of thinning.

If the quality is poor, replace the oil.

(4A-FE for Europe & Australia and 4A-GE)

Use API grade SE, SF, SG or better and recommended viscosity oil.

(4A-FE for Others)

Use API grade SD, SE, SF, SG or better and recommended viscosity oil.

2. CHECK ENGINE OIL LEVEL

The oil level should be between the "L" and "F" marks on the dipstick.

If low, check for the leakage and add oil up to the "F" mark.

3. REMOVE OIL PRESSURE SWITCH OR SENDER GAUGE AND INSTALL OIL PRESSURE GAUGE

(a) (4A-FE)

Remove the alternator and bracket.

(b) Remove the oil pressure switch (4A-FE)

HINT: (w/ Sender gauge): Use SST.

SST 09027-12140

(c) Install an oil pressure gauge.

(d) (4A-FE)

Reinstall the bracket and alternator.

4. WARM UP ENGINE

Allow the engine to warm up to reach normal operating temperature.

5. CHECK OIL PRESSURE

Oil pressure:

At idling 0.3 kg/cm² (4.3 psi, 29 kPa)
or more

At 3,000 rpm 2.5 – 5.0 kg/cm²
(36 – 71 psi, 245 – 490 kPa)

6. REMOVE OIL PRESSURE GAUGE

(a) (4A-FE)

Remove the alternator and bracket.

(b) Remove an oil pressure gauge.

(c) Apply adhesive to two or three threads of the oil pressure switch (4A-FE)

Adhesive: Part No.08833-00080, THREE BOND 1344, LOCTITE 242 or equivalent.

(d) Reinstall the oil pressure switch.

(e) (4A-FE)

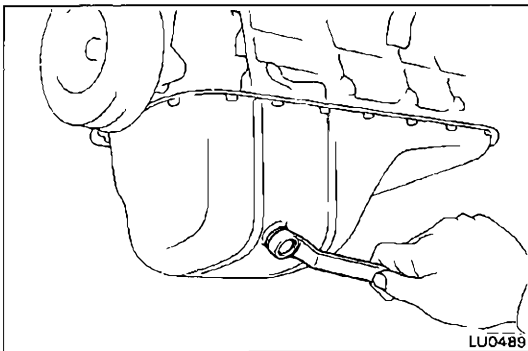
Reinstall the bracket and alternator.

7. START ENGINE AND CHECK FOR LEAKS

REPLACEMENT OF ENGINE OIL AND OIL FILTER

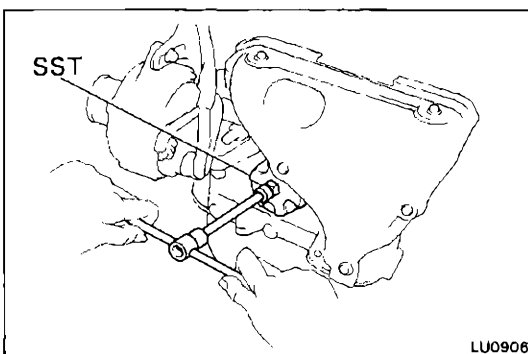
CAUTION:

- Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer. Adequate means of skin protection and washing facilities should be provided.
- Care should be taken, therefore, when changing engine oil, to minimize the frequency and length of time your skin is exposed to used engine oil. Protective clothing and gloves, that cannot be penetrated by oil, should be worn. The skin should be thoroughly washed with soap and water, or use waterless hand cleaner, to remove any used engine oil. Do not use gasoline, thinners, or solvents.
- In order to preserve the environment, used oil must be disposed of only at designated disposal sites.



1. DRAIN ENGINE OIL

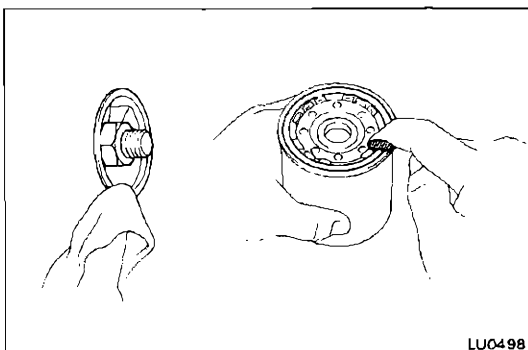
- (a) Remove the oil filler cap.
- (b) Remove the oil drain plug and drain the oil into a container.



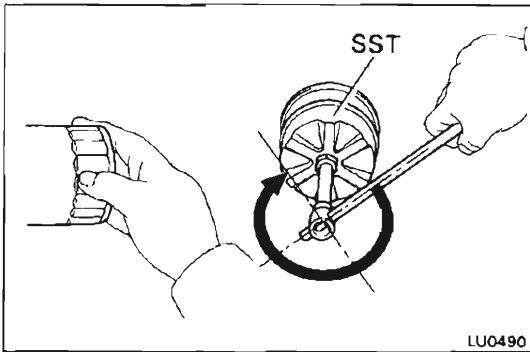
2. REPLACE OIL FILTER

- (a) Using SST, remove the oil filter (located on left side of the engine block).

SST 09228-06500



- (b) Inspect and clean the oil filter installation surface.
- (c) Apply clean engine oil to the gasket of a new oil filter.



- (d) Lightly screw in the filter to where you feel resistance.
- (e) Then, using SST, tighten the oil filter an extra 3/4 turn.

SST 09228-06500

3. REFILL WITH ENGINE OIL

- (a) Clean and install the oil drain plug with a new gasket. Torque the drain plug.

Torque: 15 Nm

- (b) Fill the engine with new oil, API grade SD, SE, SF, SG or better.

Capacity:

4A-FE

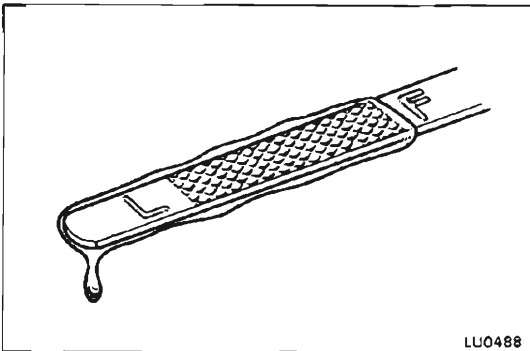
Drain and refill

Without oil filter change

3.0 liters (3.1 US qts, 2.6 Imp.qts)

With oil filter change

3.2 liters (3.3 US qts, 2.8 Imp.qts)

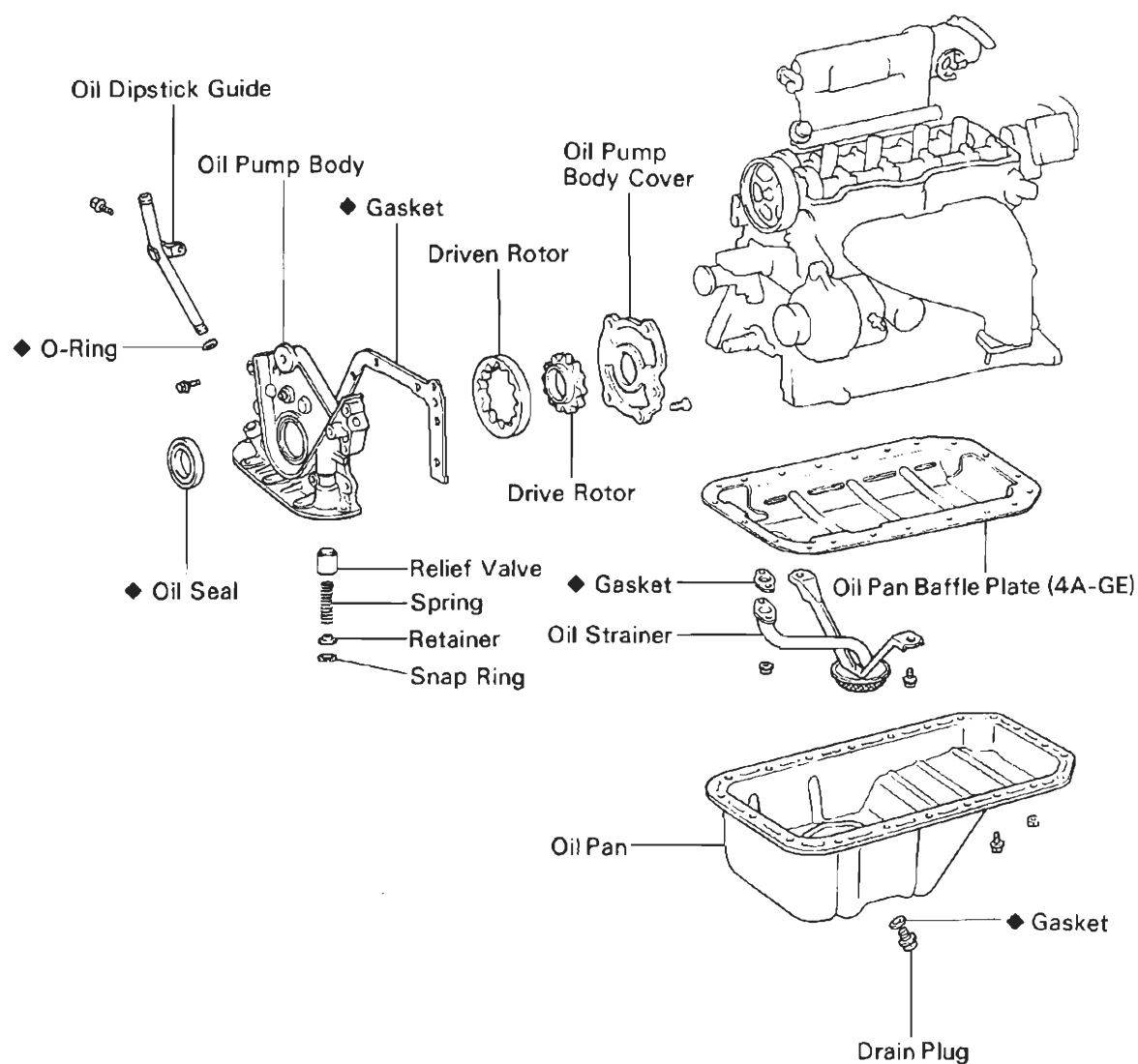


- (c) Reinstall the oil filler cap with the gasket.

4. START ENGINE AND CHECK FOR LEAKS

5. RECHECK ENGINE OIL LEVEL (See page LU-6)

OIL PUMP COMPONENTS

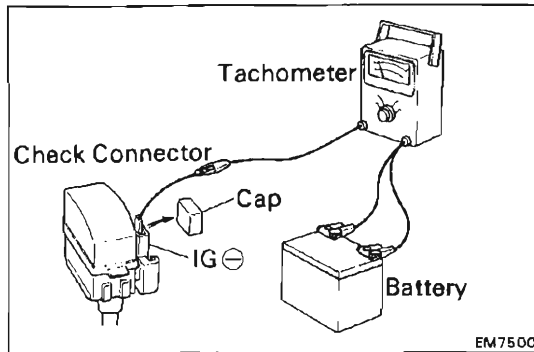


IGNITION SYSTEM

	Page
PRECAUTIONS	IG-2
TROUBLESHOOTING	IG-3
IGNITION SYSTEM CIRCUIT	IG-4
ON-VEHICLE INSPECTION	
4A-FE	IG-6
INTEGRATED IGNITION ASSEMBLY (IIA) (4A-FE) ..	IG-15

PRECAUTIONS

1. Do not leave the ignition switch on for more than 10 minutes if the engine does not start.

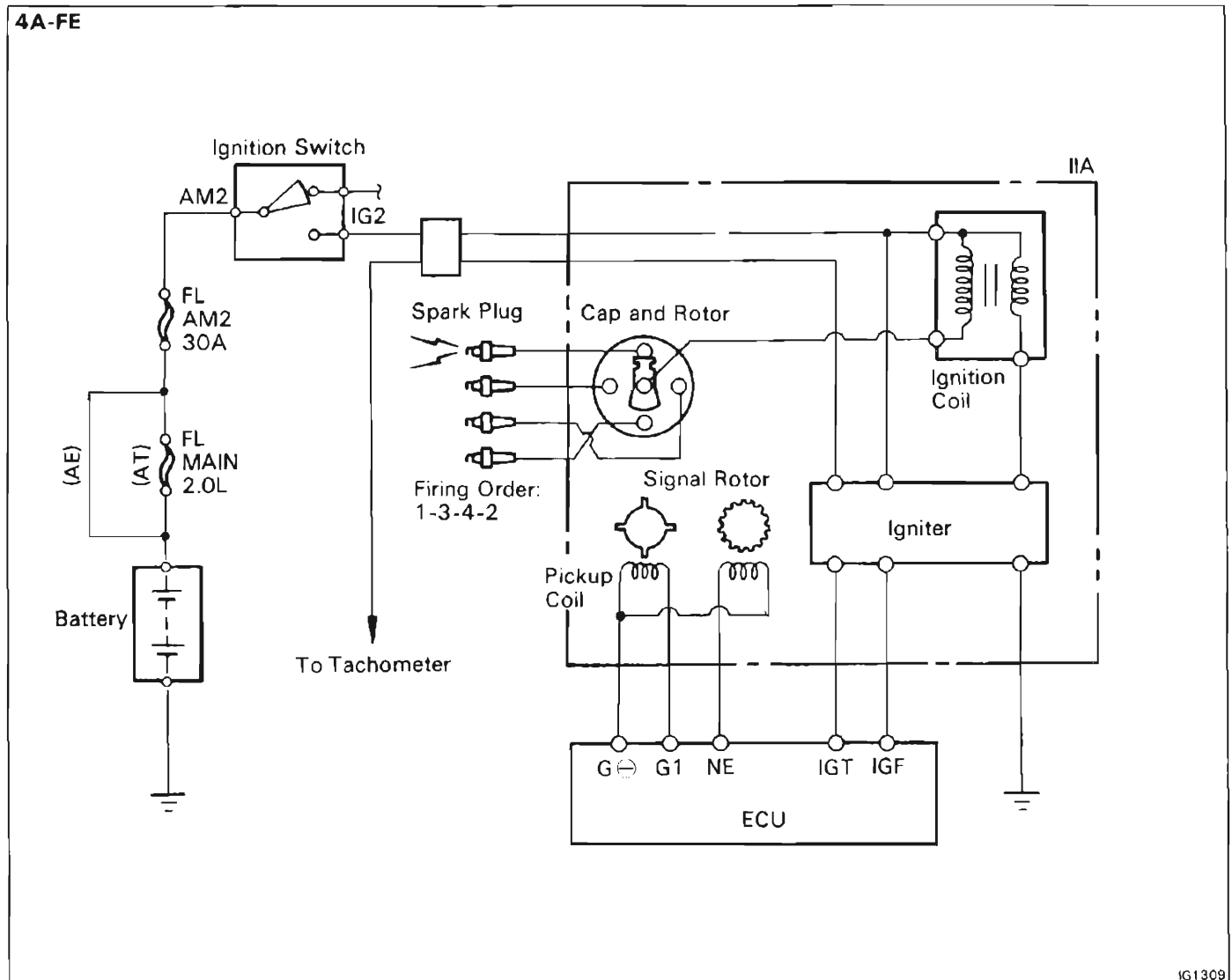


2. With a tachometer is connected to the system, connect the test probe of the tachometer to terminal IG \ominus of the check connector.
3. As some tachometers are not compatible with this ignition system, we recommended that you confirm the compatibility of your unit before using.
4. NEVER allow the tachometer terminal to touch ground as this could damage the igniter and/or ignition coil.
5. Do not disconnect the battery while the engine is running.
6. Check that the igniter is properly grounded to the body.

IGNITION SYSTEM CIRCUIT

ELECTRONIC SPARK ADVANCE (ESA)

The ECU is programmed with data for optimum ignition timing under any and all operating conditions. Using data provided by sensors which monitor various engine functions (rpm, intake air volume, eng. temperature, etc.) the microcomputer (ECU) triggers the spark at precisely the right instant.



ON-VEHICLE INSPECTION (4A-FE)

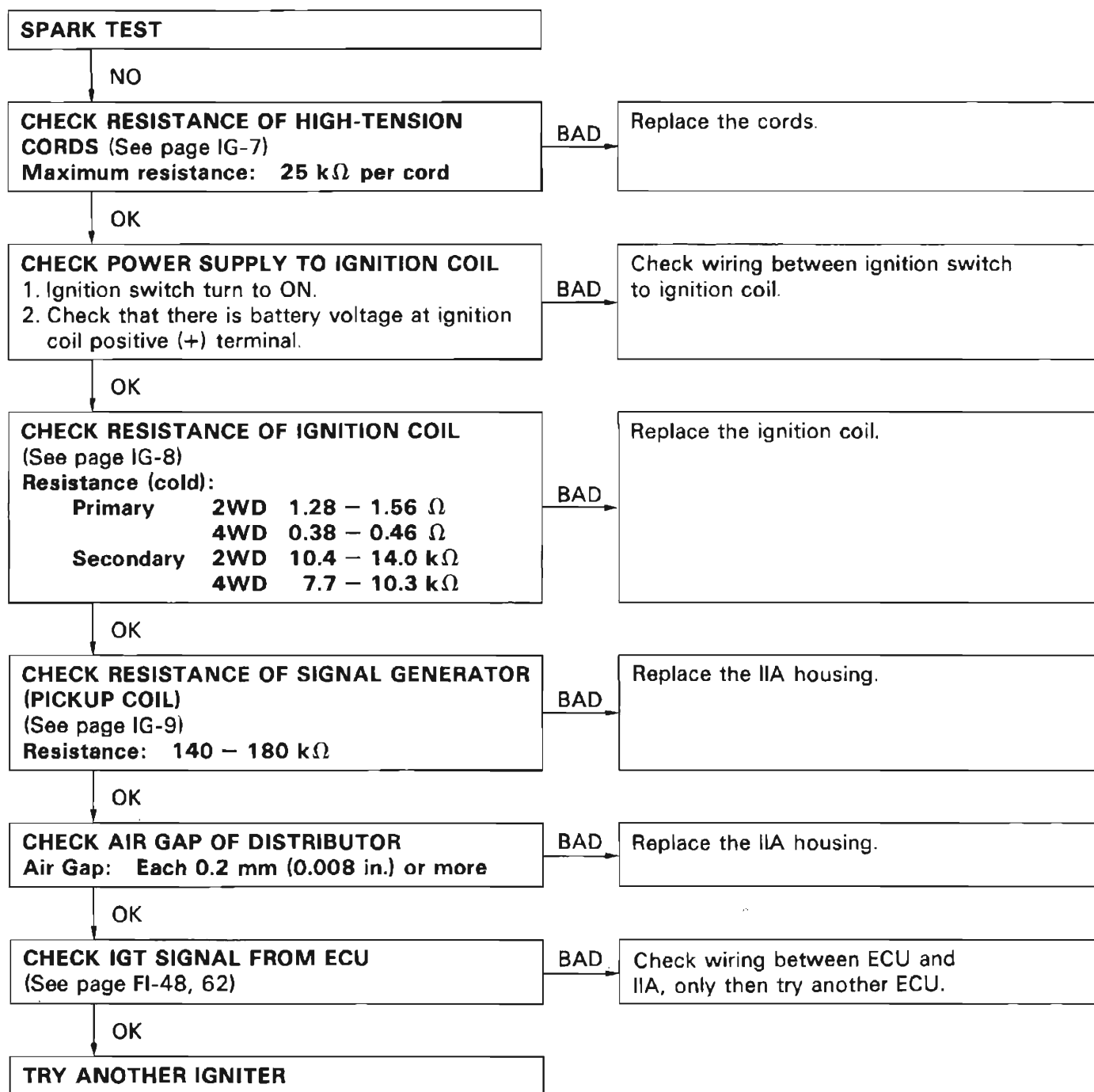
SPARK TEST

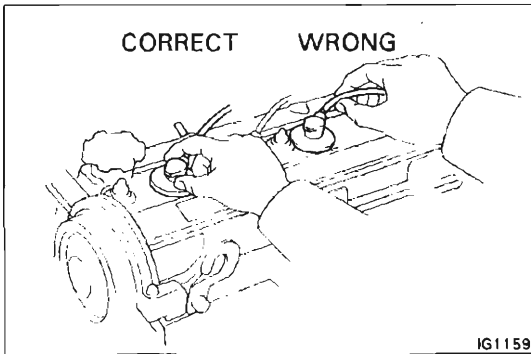
CHECK THAT SPARK OCCURS

- (a) Disconnect high-tension cords from spark plugs.
- (b) Remove the spark plugs. (See page IG-7)
- (c) Install the spark plugs to each high-tension cord.
- (d) Ground the spark plug.
- (e) Check if spark occurs while engine is being cranked.

HINT: To prevent gasoline from being injected from injectors during this test, crank the engine for no more than 1-2 seconds at a time.

If the spark does not occur, perform the test as follows.



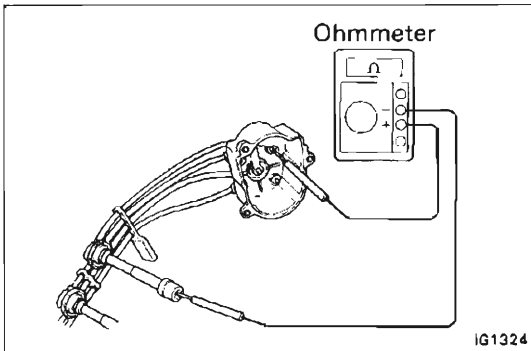


INSPECTION OF HIGH-TENSION CORDS

1. **CAREFULLY DISCONNECT HIGH-TENSION CORDS BY THEIR RUBBER BOOTS FROM SPARK PLUGS**

NOTICE: Pulling on or bending the cords may damage the conductor inside.

2. **REMOVE IIA CAP WITHOUT DISCONNECTING HIGH-TENSION CORDS**



3. **INSPECT HIGH-TENSION CORD RESISTANCE**

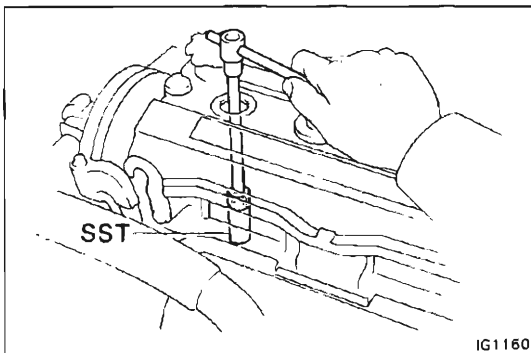
Using an ohmmeter, measure the resistance without disconnecting the IIA cap.

Maximum resistance: 25 k Ω per cord

If the resistance is greater than maximum, check the terminals. If necessary, replace the high-tension cord and/or IIA cap.

4. **REINSTALL IIA CAP**

5. **RECONNECT HIGH-TENSION CORDS TO SPARK PLUGS**



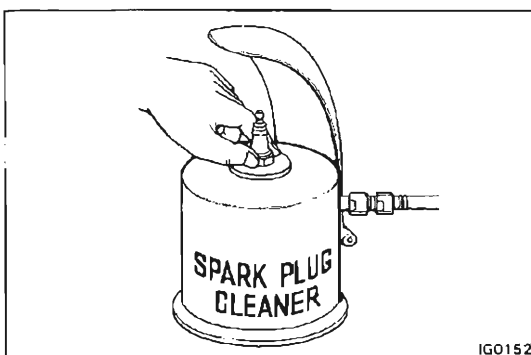
INSPECTION OF SPARK PLUGS

1. **DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS**

2. **REMOVE SPARK PLUGS**

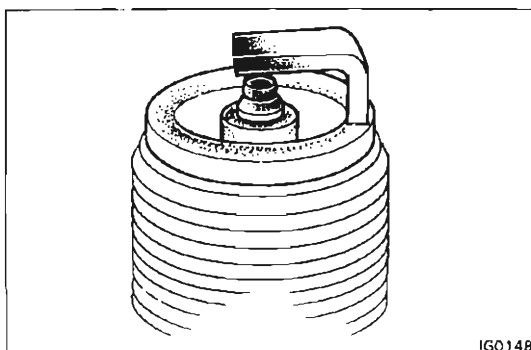
Using SST, remove the spark plugs.

SST 09155-16100



3. **CLEAN SPARK PLUGS**

Using spark plug cleaner or wire brush, clean the spark plug.

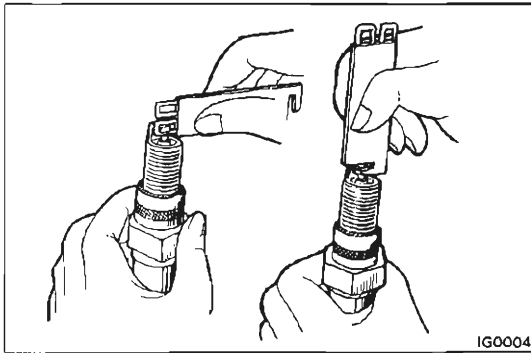


4. **VISUALLY INSPECT SPARK PLUGS**

Check the spark plug for electrode wear, thread damage and insulator damage.

If abnormal, replace the spark plug.

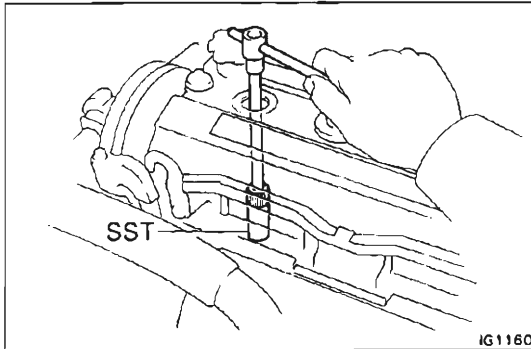
Recommended spark plug: ND Q16R-U
NGK BCPR5EY



5. ADJUST ELECTRODE GAP

Carefully bend the outer electrode to obtain the correct electrode gap.

Correct electrode gap: 0.8 mm (0.031 in.)



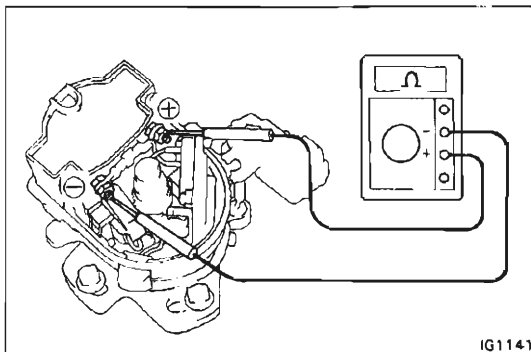
6. INSTALL SPARK PLUGS

Using SST, install the spark plug.

SST 09155-16100

Torque: 180 kg-cm (13 ft-lb, 18 N·m)

7. RECONNECT HIGH-TENSION CORDS TO SPARK PLUGS



INSPECTION OF IGNITION COIL

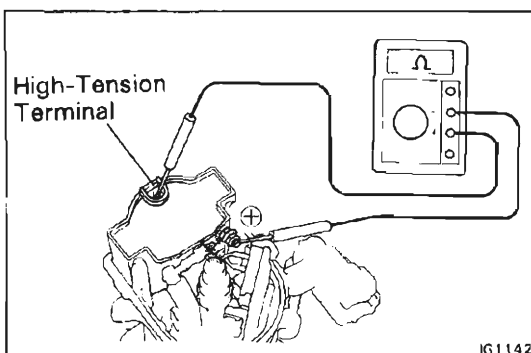
1. INSPECT PRIMARY COIL RESISTANCE

Using an ohmmeter, measure the resistance between the positive (+) and negative (-) terminal.

Primary coil resistance (Cold):

2WD 1.28 – 1.56 kΩ

If the resistance is not as specified, replace the ignition coil.



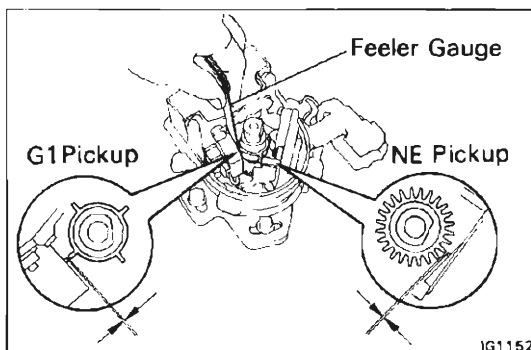
2. INSPECT SECONDARY COIL RESISTANCE

Using an ohmmeter, measure the resistance between the positive (+) terminal and high-tension terminal.

Secondary coil resistance: (Cold)

2WD 10.4 – 14.0 kΩ

If the resistance is not as specified, replace the ignition coil.



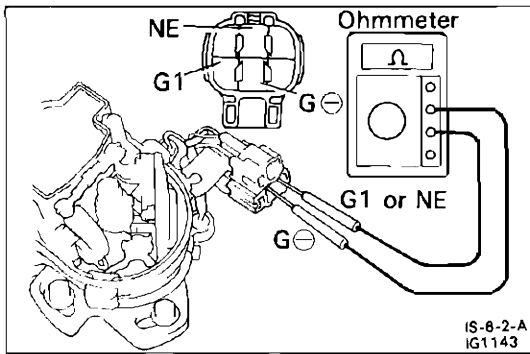
DISTRIBUTOR

1. INSPECT AIR GAP

Using a feeler gauge, measure the gap between the signal rotor and pickup coil projection.

Air gap: 0.2 mm (0.008 in.) or more

If the air gap is not as specified, replace the IIA housing.



2. INSPECT SIGNAL GENERATOR (PICK UP COIL) RESISTANCE

Using an ohmmeter, measure the resistance between the terminals (G1 and G \ominus , NE and G \ominus).

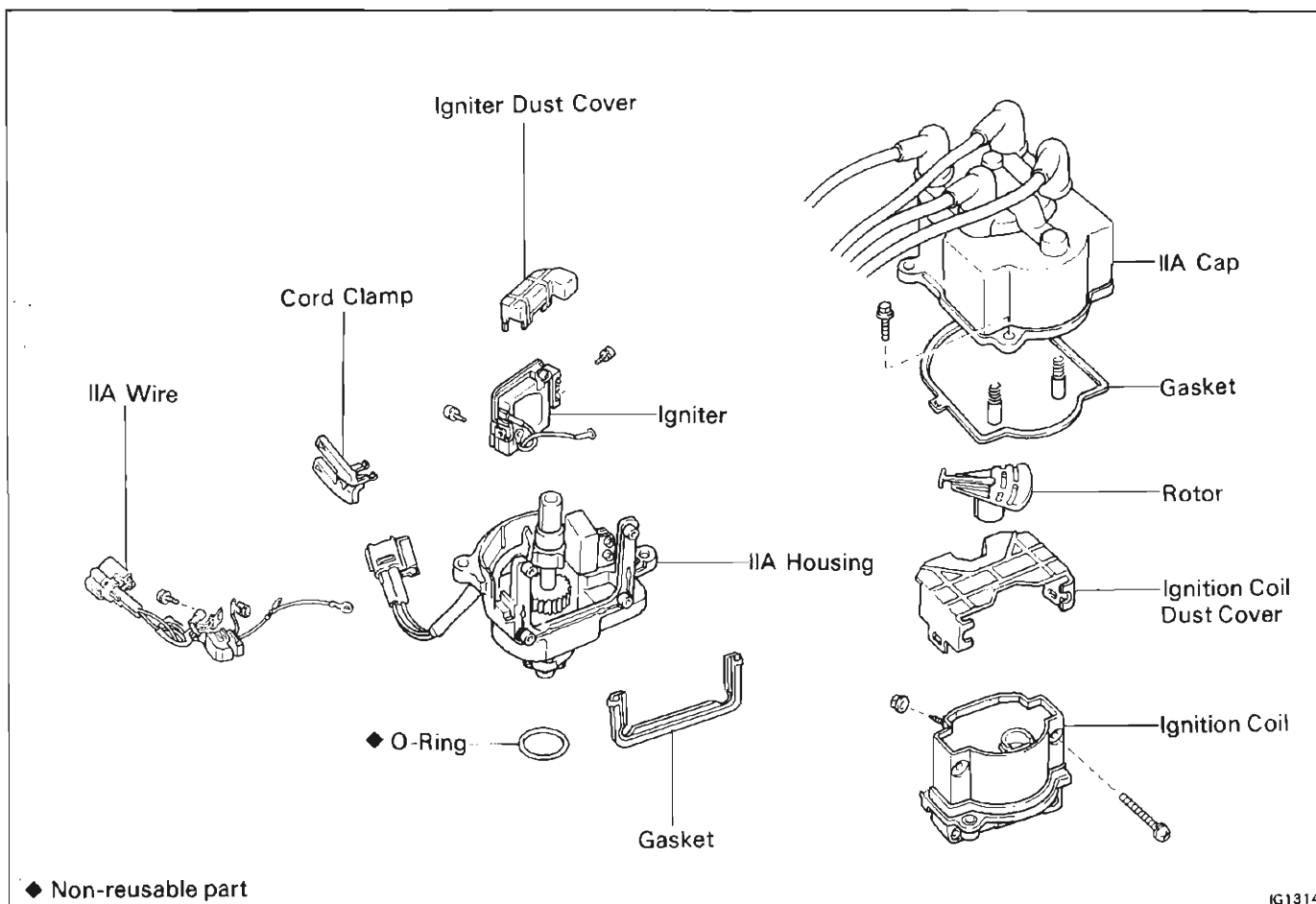
Pickup coil resistance (Cold): 140 – 180 Ω

If the resistance is not as specified, replace the IIA housing.

INSPECTION OF IGNITER

(See procedure Spark Test on page IG-6)

INTEGRATED IGNITION ASSEMBLY (IIA) (4A-FE) **COMPONENTS**

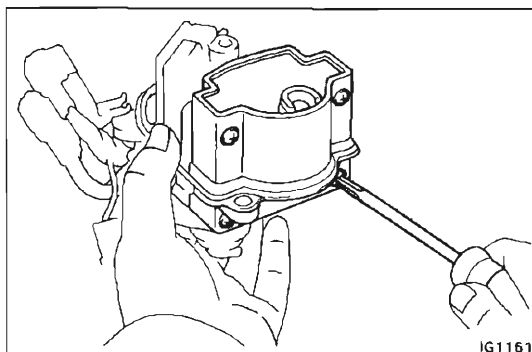


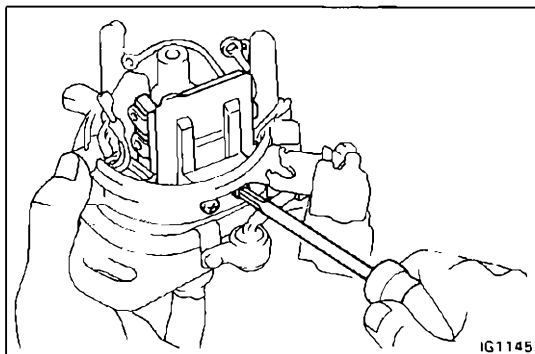
DISASSEMBLY OF IIA

1. REMOVE DISTRIBUTOR CAP, GASKET AND ROTOR
2. REMOVE IGNITION COIL DUST COVER
3. REMOVE IGNITER DUST COVER

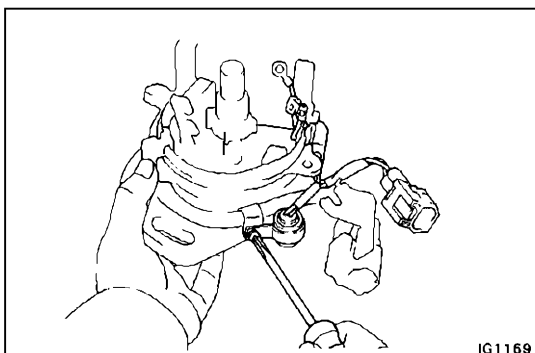
4. REMOVE IGNITION COIL

- (a) Remove the two nuts and disconnect the three wires from the ignition coil terminals.
- (b) Remove the four screws, ignition coil and gasket.

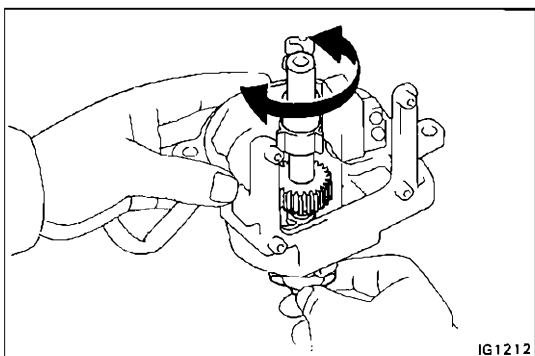


**5. REMOVE IGNITER**

- (a) Remove the two nuts, and disconnect the three wires from the igniter terminals.
- (b) Remove the two screws and igniter.

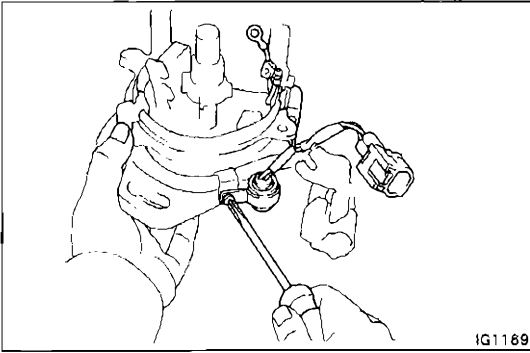
**6. REMOVE IIA WIRE**

- (a) Disconnect the connector from the cord clamp.
- (b) Remove the screw and condenser.
- (c) Remove the grommet of the wire from the housing.

**INSPECTION OF IIA****INSPECT GOVERNOR SHAFT**

Turn the governor shaft and check that it is not rough or worn.

If it feels rough or worn, replace the IIA housing assembly.

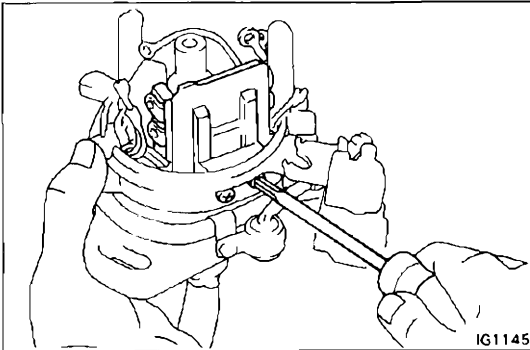


ASSEMBLY OF IIA

(See page IG-15)

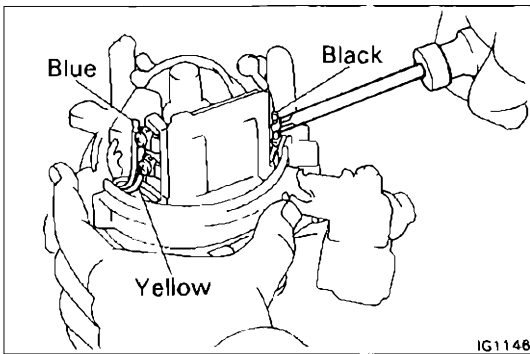
1. INSTALL IIA WIRE

- Fit the wire grommet to the IIA housing.
- Install the IIA wire with the screw.
- Install the connector to the cord clamp.

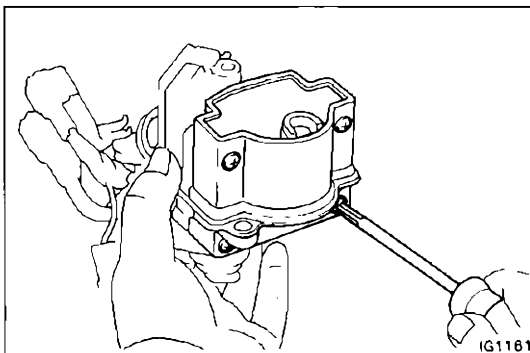


2. INSTALL IGNITER

- Install the igniter with the two screws.

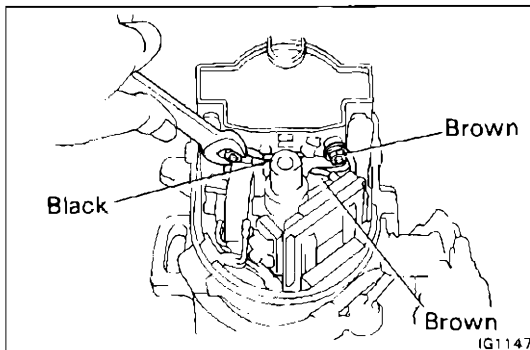


- Connect the three wires to the igniter terminals with the three screws.

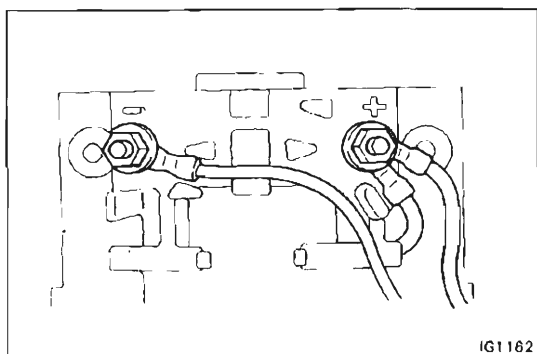


3. INSTALL IGNITION COIL

- Install the gasket and ignition coil with the four screws.



- Connect the three wires to the ignition coil terminals with the two nuts.

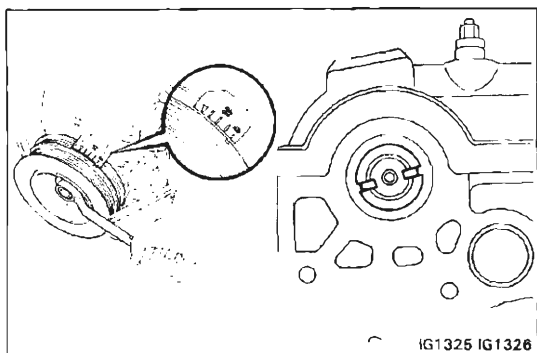
**NOTICE:**

- When connecting the wires to the ignition coil, insert both properly into their grooves found on the side of the ignition coil.
- Be sure that the wires do not contact with signal rotor or IIA housing.

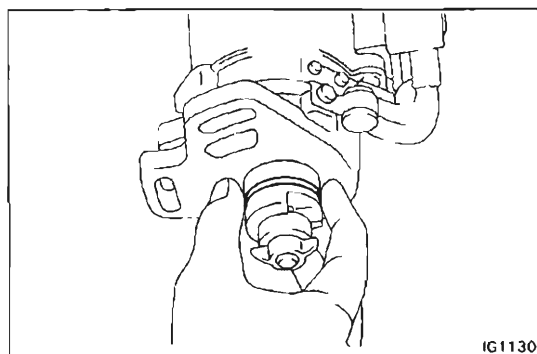
3. INSTALL IGNITION COIL DUST COVER
4. INSTALL ROTOR
5. INSTALL IIA CAP AND HIGH-TENSION CORDS

INSTALLATION OF IIA**1. SET NO.1 CYLINDER TO TDC/COMPRESSION**

Turn the crankshaft clockwise, and position the slit of the intake camshaft as shown in the figure.

**2. INSTALL IIA**

- (a) Install a new O-ring to the housing.
- (b) Apply a light coat of engine oil on the O-ring.



- (c) Align the cutout of the coupling with the line of the housing.
- (d) Insert the IIA, aligning the center of the flange with that of bolt hole on the cylinder head.
- (e) Lightly tighten the two hold-down bolts.

3. CONNECT HIGH-TENSION CORDS TO SPARK PLUGS

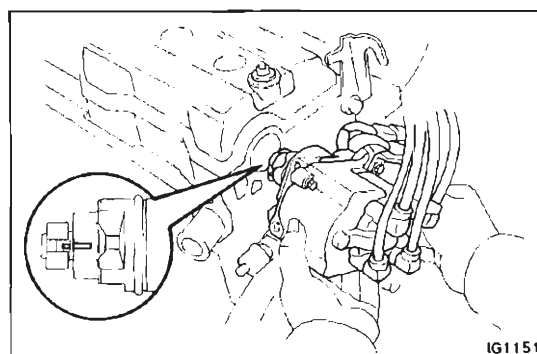
Firing order: 1 - 3 - 4 - 2

4. CONNECT IIA CONNECTORS**5. ADJUST IGNITION TIMING (See page EM-20)**

Ignition timing:

10° BTDC @ idle

(w/ Terminals TE1 and E1 connected)



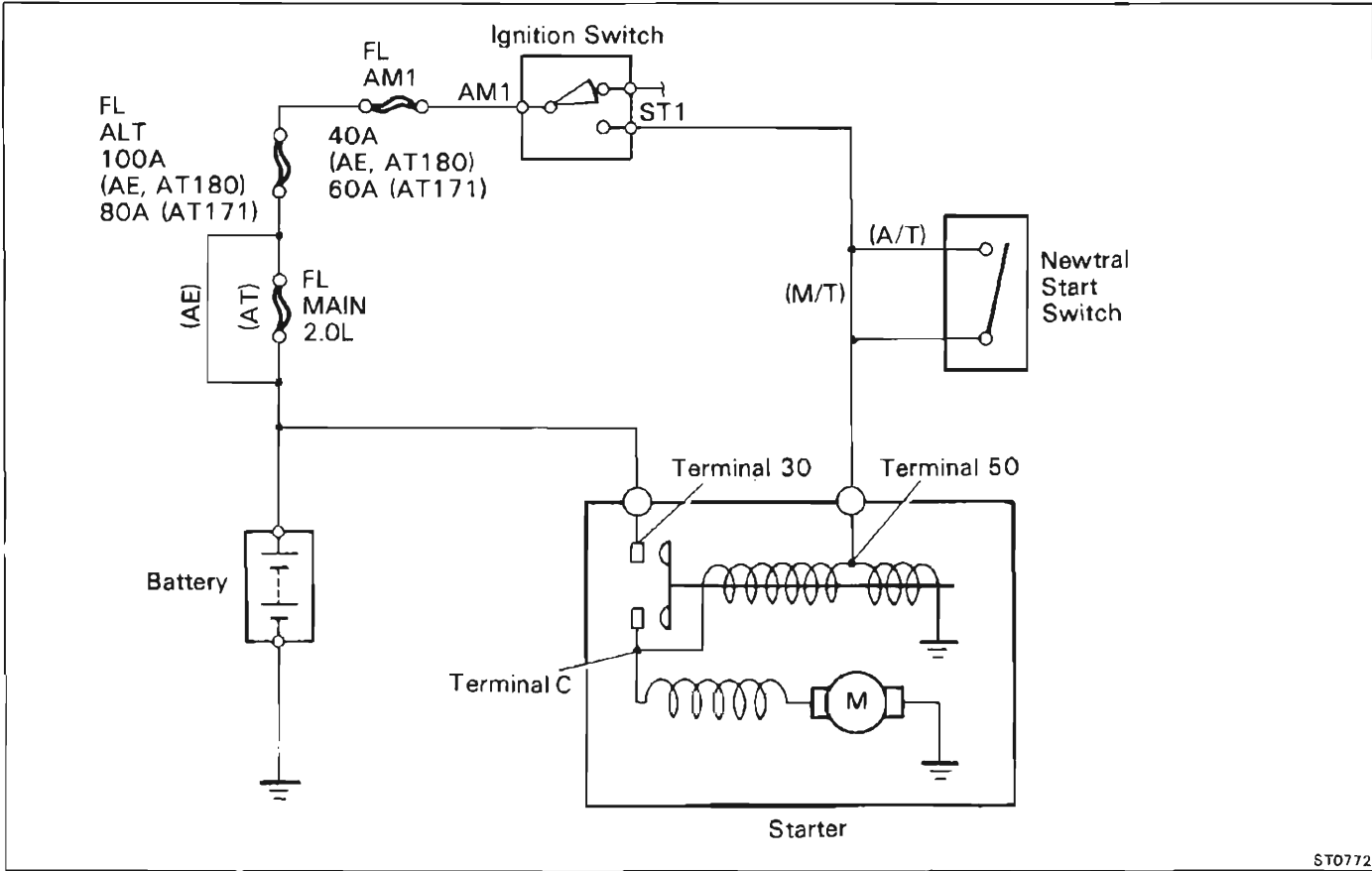
STARTING SYSTEM

	Page
TROUBLESHOOTING	ST-2
STARTING SYSTEM CIRCUIT	ST-2
PLANETARY TYPE STARTER	ST-3

TROUBLESHOOTING

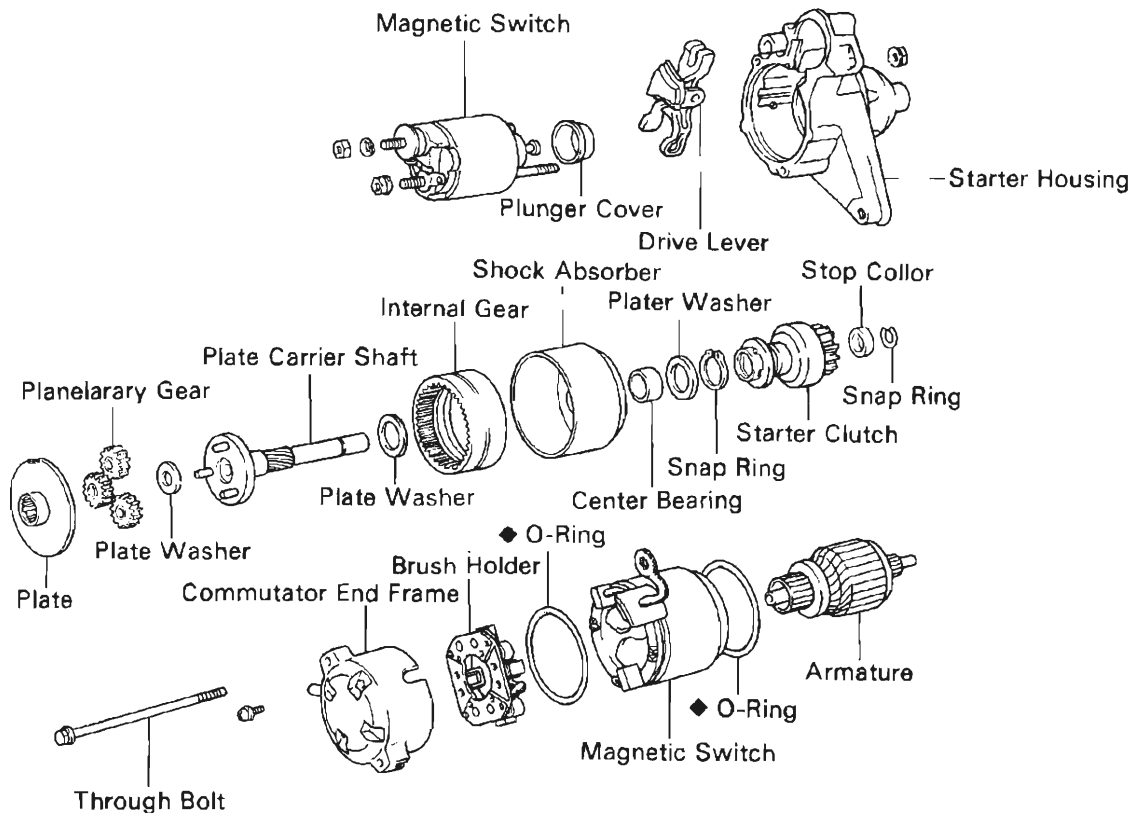
Problem	Possible cause	Remedy	Page
Engine will not crank	Battery charge low	Check battery specific gravity Charge or replace battery	CH-4 ST-3, 17
	Battery cables loose, corroded or worn	Repair or replace cables	
	Neutral start switch faulty (A/T)	Adjust or replace switch	
	Fusible link blown	Replace fusible link	
	Starter faulty	Repair starter	
	Ignition switch faulty	Replace ignition switch	
Engine cranks slowly	Battery charge low	Check battery specific gravity Charge or replace battery	CH-4 ST-3, 17
	Battery cables loose, corroded or worn	Repair or replace cables	
	Starter faulty	Repair starter	
Starter keeps running	Starter faulty	Repair starter	ST-3, 17
	Ignition switch faulty	Replace ignition switch	
	Short in wiring	Repair wiring	
Starter spins-engine will not crank	Pinion gear teeth broken or faulty starter	Repair starter	ST-3, 17
	Flywheel or drive plate teeth broken	Replace flywheel or drive plate	

STARTING SYSTEM CIRCUIT

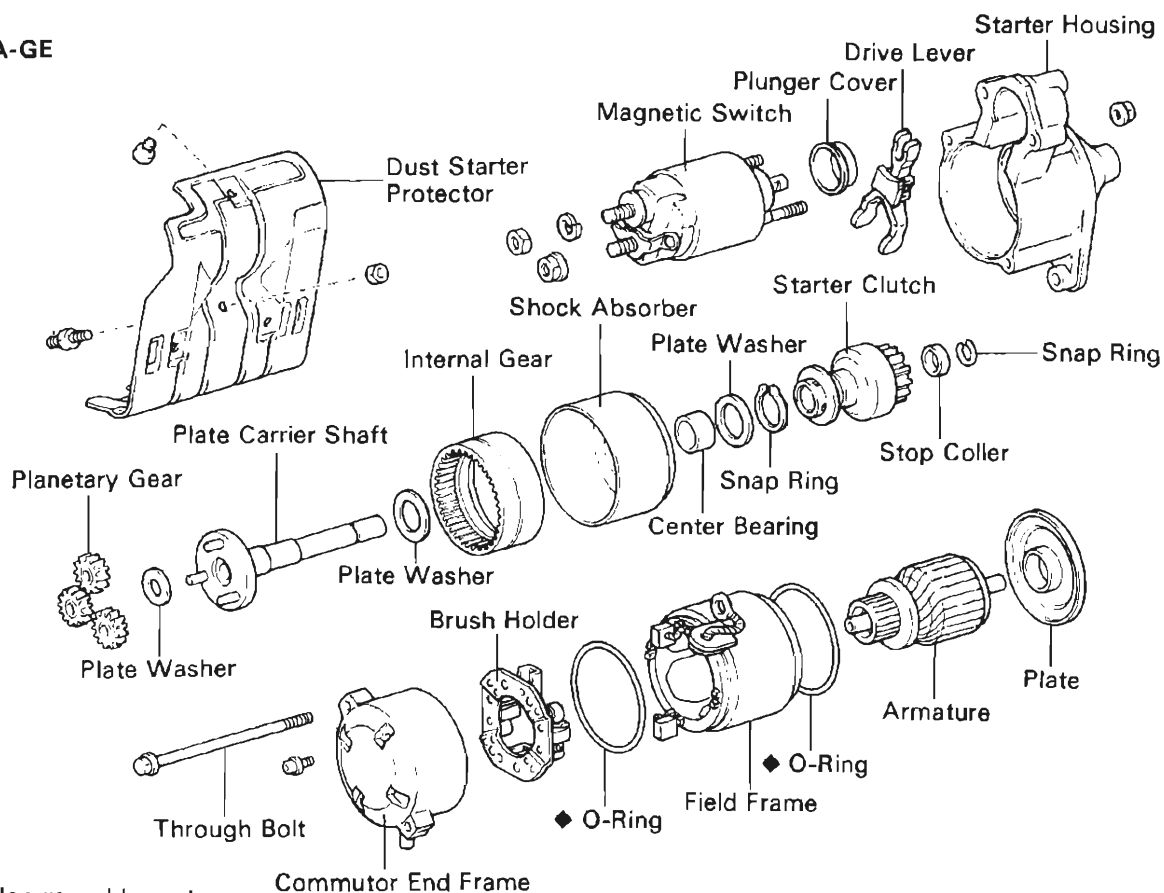


PLANETARY TYPE STARTER COMPONENTS

4A-FE



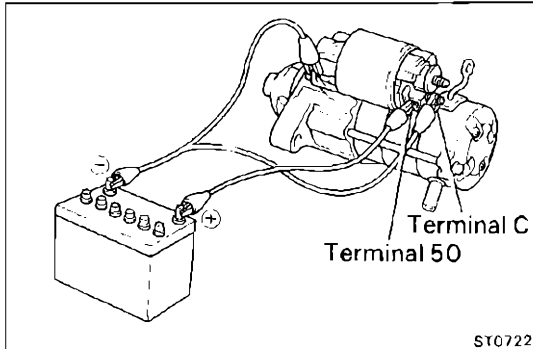
4A-GE



◆ Non reusable part

PERFORMANCE TEST OF PLANETARY TYPE STARTER

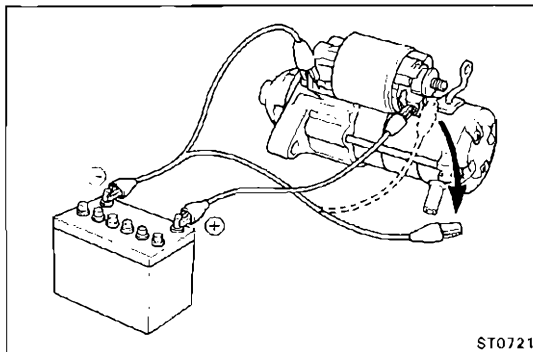
NOTICE: These tests must be performed within 3 to 5 seconds to avoid burning out the coil.



1. PERFORM PULL-IN TEST

- (a) Disconnect the field coil lead from terminal C.
- (b) Connect the battery to the magnetic switch as shown. Check that the clutch pinion gear moves outward.

If the clutch pinion gear does not move, replace the magnetic switch.

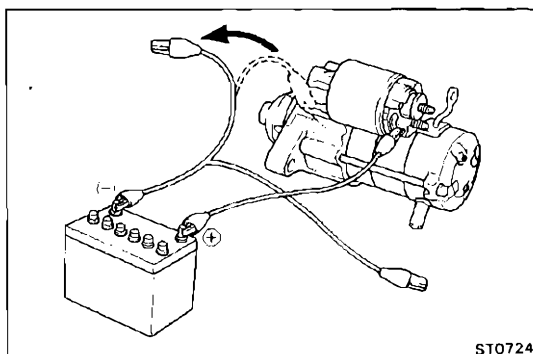


2. PERFORM HOLD-IN TEST

With the battery connected as above and with the pinion out, disconnect the negative (-) lead from terminal C.

Check that the clutch pinion remains out.

If the clutch pinion gear returns inward, replace the magnetic switch.

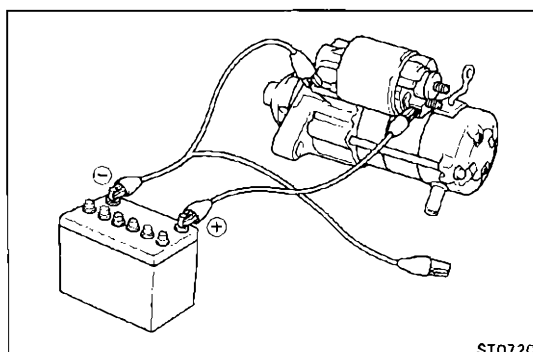


3. INSPECT CLUTCH PINION GEAR RETURN

Disconnect the negative (-) lead from the switch body.

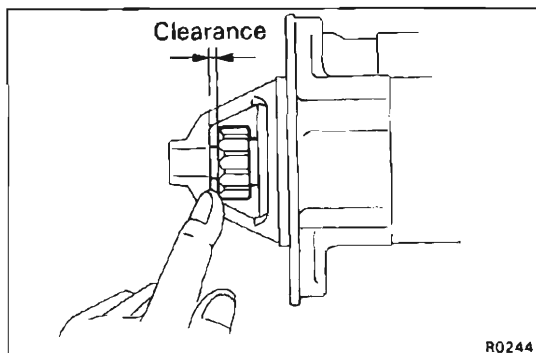
Check that the clutch pinion gear returns inward.

If the clutch pinion does not return, replace the magnetic switch.



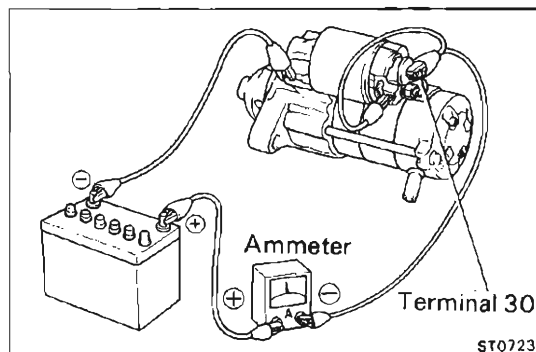
4. INSPECT CLUTCH PINION GEAR CLEARANCE

- (a) Connect the battery the magnetic switch as shown.



- (b) Move the pinion gear toward the armature to remove slack and measure the clearance between the pinion gear end and stop collar.

Standard clearance: 1 – 5 mm (0.04 – 0.20 in.)



5. PERFORM NO-LOAD PERFORMANCE TEST

- (a) Connect the field coil lead terminal C. Check that the lead is not grounded.
- (b) Connect the battery and ammeter to the starter as shown.
- (c) Check that the starter rotates smoothly and steadily with the clutch pinion gear moving out. Check reading on the ammeter.

Specified current. 90A or less at 11.5V

CHARGING SYSTEM

	Page
PRECAUTIONS	CH-2
TROUBLESHOOTING	CH-2
CHARGING CIRCUIT	CH-2
ON-VEHICLE INSPECTION	CH-3
ALTERNATOR	CH-7

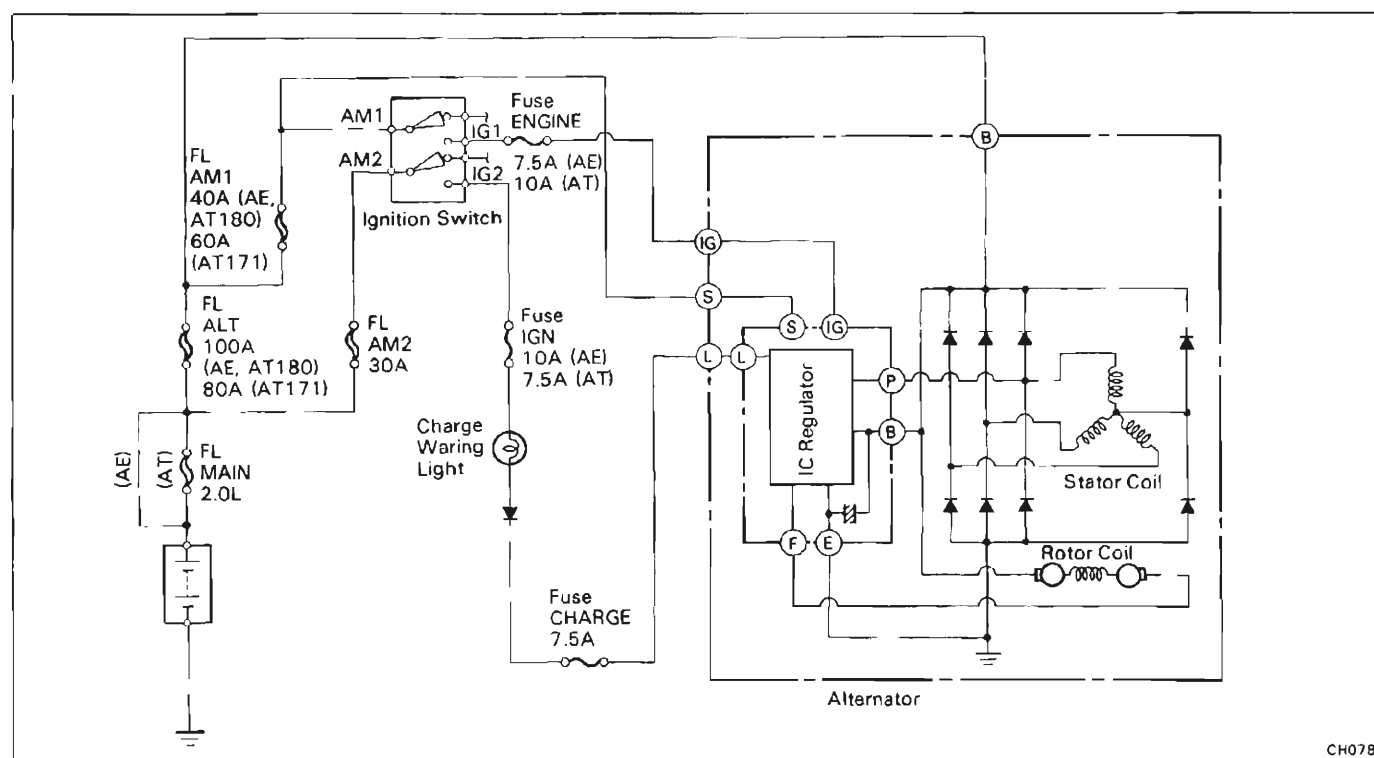
PRECAUTIONS

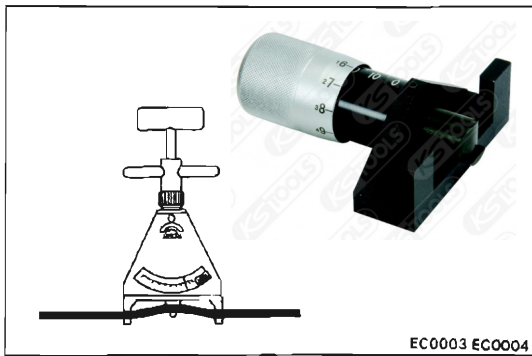
1. Check that the battery cables are connected to the correct terminals.
2. Disconnect the battery cables when the battery is given a quick charge.
3. Do not perform tests with a high voltage insulation resistance tester.
4. Never disconnect the battery while the engine is running.

TROUBLESHOOTING

Problem	Possible cause	Remedy	Page
Discharge warning light does not light with ignition ON and engine off	Fuse blown Light burned out Wiring connection loose IC regulator faulty	Check "CHARGE" and "IGN" fuses Replace light Tighten loose connections Replace IC regulator	CH-7
Discharge warning light does not go out with engine running (battery requires frequent recharging)	Drive belt loose or worn Battery cables loose, corroded or worn Fuse blown Fusible link blown IC regulator or alternator faulty Wiring faulty	Adjust or replace drive belt Repair or replace cables Check "CHARGE" or "ENGINE" fuse Replace fusible link Check charging system Repair wiring	CH-3 CH-2

CHARGING CIRCUIT

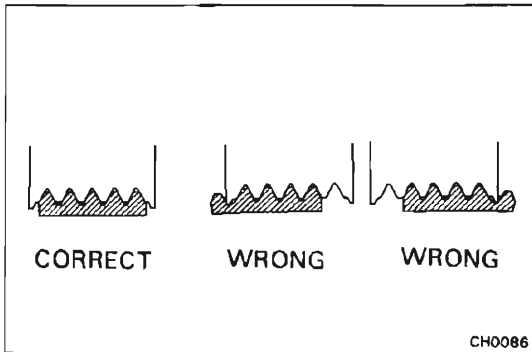


**(Reference)**

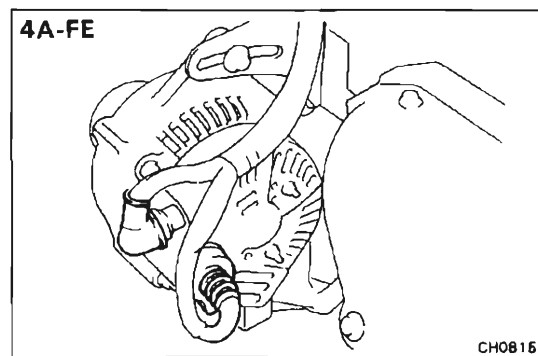
Using SST, check the drive belt tension.

Drive belt tension:

4A-FE - 15 N

**HINT:**

- "New belt" refers to a belt which has been used less than 5 minutes on a running engine.
- "Used belt" refers to a belt which has been used on a running engine for 5 minutes or more.
- After installing the drive belt, check that it fits properly in the ribbed grooves.
- Check with your hand to confirm that the belt has not slipped out of the groove on the bottom of the crank pulley.
- After installing the belt, run the engine for approx. 5 minutes and recheck the deflection or tension.



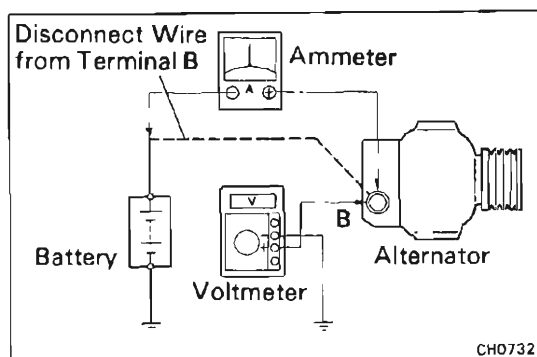
4. VISUALLY CHECK ALTERNATOR WIRING AND LISTEN FOR ABNORMAL NOISES

- (a) Check that the wiring is in good condition.
- (b) Check that there are no abnormal noise from the alternator while the engine is running.

5. CHECK DISCHARGE WARNING LIGHT CIRCUIT

- (a) Warm up the engine and then turn it off.
- (b) Turn off all accessories.
- (c) Turn the ignition switch to ON. Check that the discharge warning light is lit.
- (d) Start the engine. Check that the light goes out.

If the light does not function as specified, troubleshoot the warning light circuit.

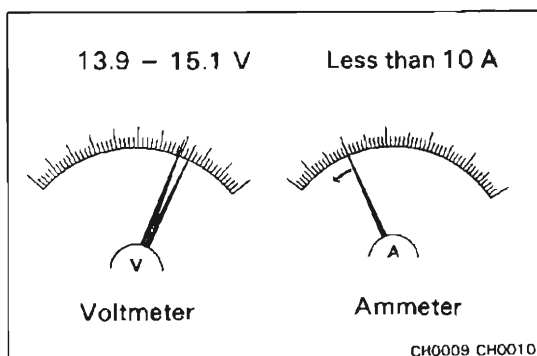


6. CHECK CHARGING CIRCUIT WITHOUT LOAD

HINT: If a battery/alternator tester is available, connect the tester to the charging circuit according to the manufacturer's instructions.

(a) If a tester is not available, connect a voltmeter and ammeter to the charging circuit as follows:

- Disconnect the wire from terminal B of the alternator and connect the wire to the negative (–) terminal of the ammeter.
- Connect the test lead from the positive (+) terminal of the ammeter to terminal B of the alternator.
- Connect the positive (+) lead of the voltmeter to terminal B of the alternator.
- Ground the negative (–) lead of the voltmeter.



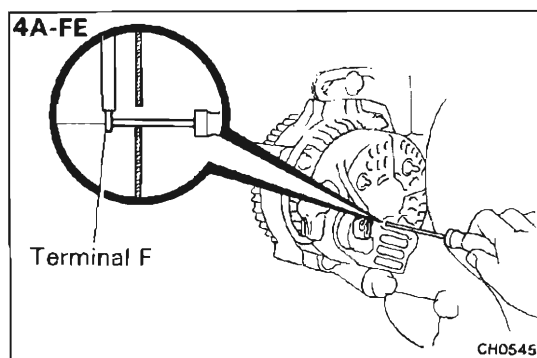
(b) Check the charging circuit as follows:

With the engine running from idling to 2,000 rpm, check the reading on the ammeter and voltmeter.

Standard amperage: Less than 10 A

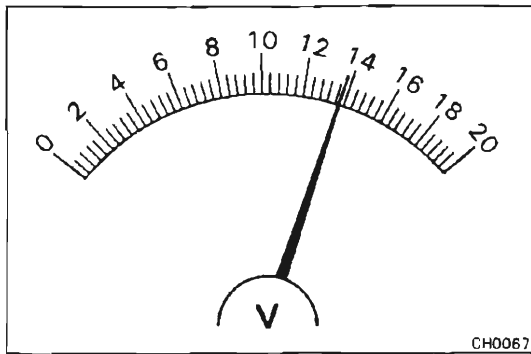
Standard voltage: 13.9 – 15.1 V at 25°C (77°F)
13.5 – 14.3 V at 115°C (239°F)

If the voltage reading is greater than standard voltage, replace the IC regulator.

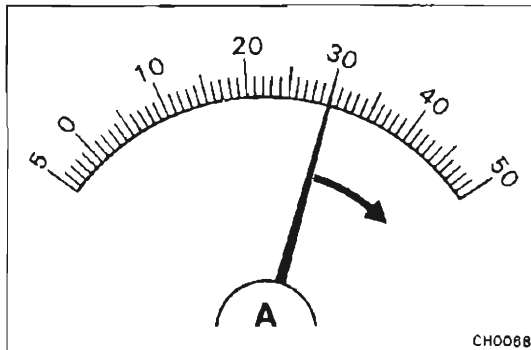


If the voltage reading is less than standard voltage, check the IC regulator and alternator as follows:

- With terminal F grounded, start the engine and check the voltage reading of terminal B.
- If the voltage reading is higher than standard voltage, replace the IC regulator.
- If the voltage reading is less than standard voltage, repair the alternator.



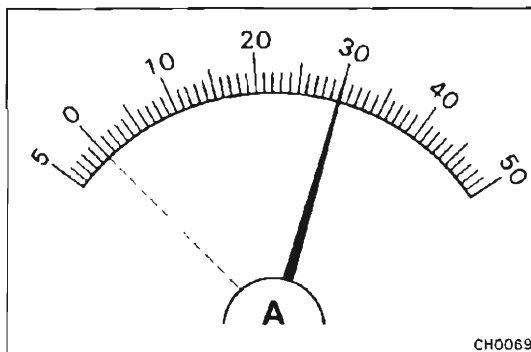
- If the voltmeter reading is greater than standard voltage, replace the IC regulator.
- If the voltmeter reading is less than standard voltage, check the alternator.



7. INSPECT CHARGING CIRCUIT WITH LOAD

- With the engine running at 2,000 rpm, turn on the high beam headlights and place the heater blower switch at "HI".
- Check the reading on the ammeter.

Standard amperage: 30 A or more

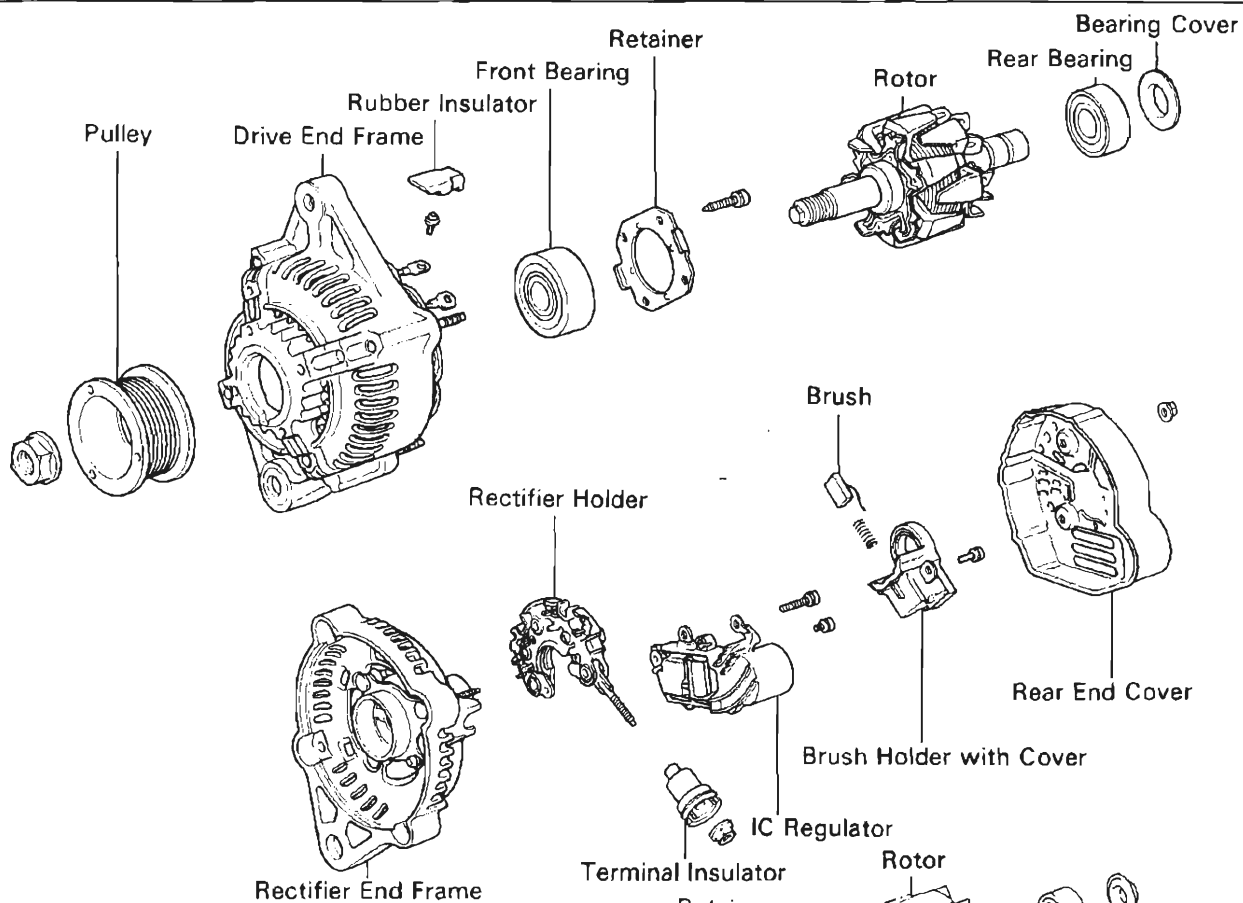


If the ammeter reading is less than standard amperage, repair the alternator. (See page CH-7)

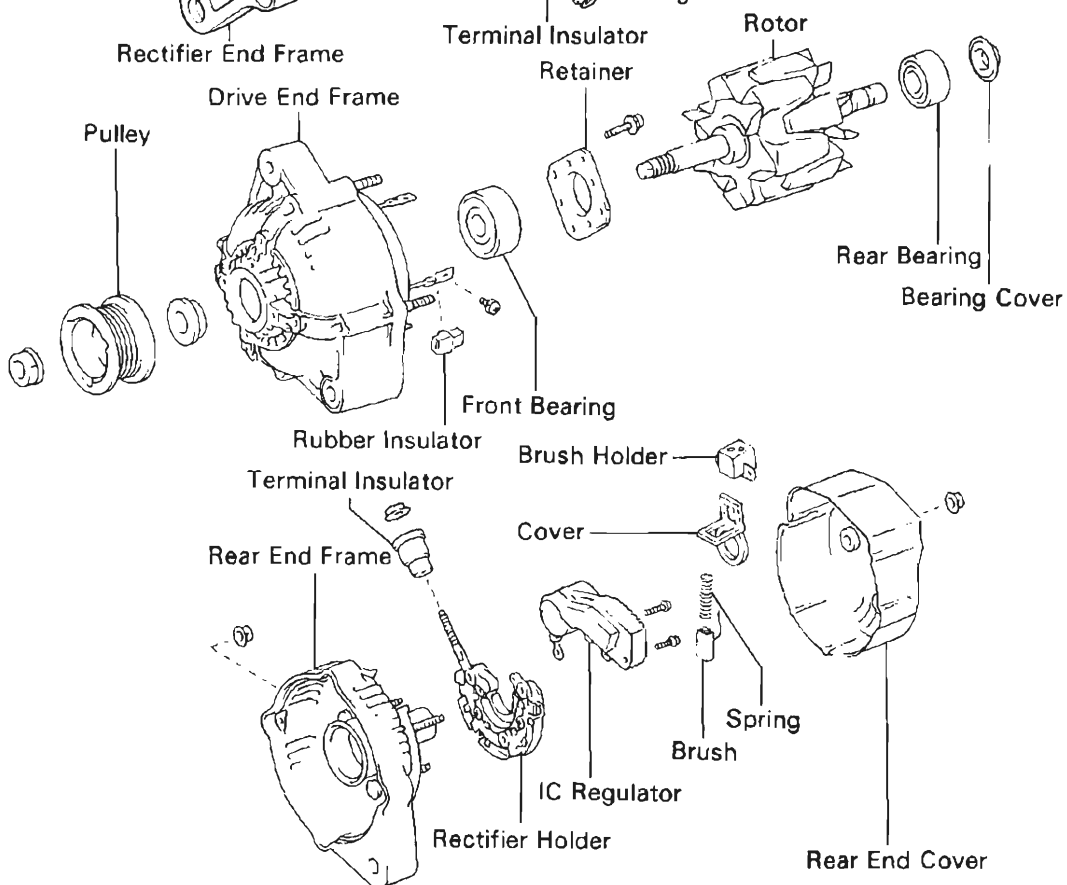
HINT: With the battery fully charged, the indication will sometimes be less than standard amperage.

ALTERNATOR COMPONENTS

4A-FE



4A-GE



SERVICE SPECIFICATIONS

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ENGINE MECHANICAL (4A-FE)	A-2
EFI SYSTEM (4A-FE)	A-10
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IGNITION SYSTEM (4A-FE)	A-16

ENGINE MECHANICAL (4A-FE)**Specifications**

Engine tune-up	Drive belt (Alternator)				
	Deflection	New belt	8.5 – 10.5 mm	0.335 – 0.413 in.	
		Used belt	10.0 – 12.0 mm	0.394 – 0.472 in.	
	Tension (Reference)	New belt	60 – 70 kg		
		Used belt	40 – 55 kg		
	Engine coolant capacity (w/ Heater)				
		AE M/T	6.2 liters	6.5 US qts	5.5 Imp. qts
		AE A/T	6.1 liters	6.4 US qts	5.4 Imp. qts
		AT171	5.6 liters	5.9 US qts	4.9 Imp. qts
		AT180	5.2 liters	5.5 US qts	4.6 Imp. qts
	Engine oil capacity				
	w/o Oil cooler	Drain and refill			
		w/o Oil filter change	3.0 liters	3.2 US qts	2.6 Imp. qts
		w/ Oil filter change	3.3 liters	3.5 US qts	2.9 Imp. qts
		Dry fill	3.7 liters	3.9 US qts	3.3 Imp. qts
	w/ Oil cooler	Drain and refill			
		w/o Oil filter change	3.0 liters	3.2 US qts	2.6 Imp. qts
		w/ Oil filter change	3.3 liters	3.5 US qts	2.9 Imp. qts
		Dry fill	4.1 liters	4.3 US qts	3.6 Imp. qts
	Engine oil API grade				
		Europe and Australia	SE, SF, SG or better		
		Others	SD, SE, SF, SG or better		
	Battery specific gravity		1.25 – 1.27 when fully charged at 20°C (68°F)		
	High-tension cord resistance	Limit	25 kΩ per cord		
	Spark plug				
	Type	ND	Q16R-U		
		NGK	BCPR5EY		
	Gap		0.8 mm	0.031 in.	
	Distributor (IIA)				
	Air gap		0.2 mm or more	0.008 in. or more	
	Pickup coil resistance		140 – 180 Ω		
	Ignition timing		10° BTDC @ idle (w/ Terminals TE1 and E1 connected)		
	Firing order		1 – 3 – 4 – 2		
	Valve clearance	Intake	0.15 – 0.25 mm	0.006 – 0.010 in.	
		Exhaust	0.20 – 0.30 mm	0.008 – 0.012 in.	
	Idle speed		800 rpm (w/ Cooling fan OFF)		
	VF voltage		2.5 ± 0.7 V		
	Idle CO concentration	w/ TWC	0 – 0.5 %		
		w/o TWC	1.5 ± 0.5 %		
	Dash pot setting speed				
		M/T	1,800 rpm (w/ Cooling fan OFF)		
		A/T	2,200 rpm (w/ Cooling fan OFF)		
Intake manifold vacuum	at idle speed		More than 440 mmHg (17.32 in.Hg, 58.7 kPa)		

Specifications (Cont'd)

Compression pressure	at 250 rpm	STD		13.5 kg/cm ²	191 psi	1,320 kPa
		Limit		10.0 kg/cm ²	142 psi	981 kPa
	Differential of pressure between each cylinder			1.0 kg/cm ² (14 psi, 98 kPa) or less		
Idle pulley tension spring	Free length			38.4 mm		1.512 in.
	Installed tension		at 50.2 mm (1.976 in.)	3.6 – 4.0 kg	7.9 – 8.8 lb	35 – 39 N
Cylinder head	Head surface warpage	Limit		0.05 mm		0.0020 in.
	Manifold surface warpage	Limit		0.10 mm		0.0039 in.
	Cylinder head thickness			95.3 mm		3.75 in.
	Valve seat	Refacing angle		30°, 45°, 60°		
		Contacting angle		45°		
		Contacting width		1.2 – 1.6 mm		0.047 – 0.063 in.
	Spark plug tube protrusion height			46.8 – 47.6 mm		1.843 – 1.874 in.
Valve guide bushing	Inside diameter			6.01 – 6.03 mm		0.2366 – 0.2374 in.
	Outside diameter	STD		11.000 – 11.027 mm		0.4331 – 0.4341 in.
		O/S 0.05		11.050 – 11.077 mm		0.4350 – 0.4361 in.
	Protrusion height			12.7 – 13.1 mm		0.500 – 0.516 in.
	Replacing temperature (cylinder head side)			80 – 100°C		176 – 212°F
Valve	Valve overall length	STD	Intake	91.45 mm		3.6004 in.
			Exhaust	91.90 mm		3.6181 in.
		Limit	Intake	90.95 mm		3.5807 in.
			Exhaust	91.40 mm		3.5984 in.
	Valve face angle			45.5°		
	Stem diameter		Intake	5.970 – 5.985 mm		0.2350 – 0.2356 in.
			Exhaust	5.965 – 5.980 mm		0.2348 – 0.2354 in.
	Stem oil clearance	STD	Intake	0.025 – 0.060 mm		0.0010 – 0.0024 in.
			Exhaust	0.030 – 0.065 mm		0.0012 – 0.0026 in.
		Limit	Intake	0.08 mm		0.0031 in.
			Exhaust	0.10 mm		0.0039 in.
	Valve head edge thickness					
		Limit		1.0 mm		0.039 in.
Valve spring	Free length			43.8 mm		1.724 in.
	Installed length			34.7 mm		1.366 in.
	Installed load	STD		15.8 kg	34.8 lb	155 N
		Limit		14.6 kg	32.3 lb	143 N
	Squareness	Limit		2.0 mm		0.075 in.
Valve lifter	Outer diameter	STD		27.975 – 27.985 mm		1.1014 – 1.1018 in.
	Inner diameter					
	(Cylinder head lifter bore)	STD		28.005 – 28.026 mm		1.1025 – 1.1033 in.
	Oil clearance	STD		0.020 – 0.051 mm		0.0008 – 0.0020 in.
		Limit		0.10 mm		0.0039 in.
Manifold	Manifold surface warpage					
		Limit	Intake	0.20 mm		0.0079 in.
			Exhaust	0.30 mm		0.0118 in.

Specifications (Cont'd)

Camshaft	Thrust clearance	STD	Intake	0.030 – 0.085 mm	0.0012 – 0.0033 in.
			Exhaust	0.035 – 0.090 mm	0.0014 – 0.0035 in.
		Limit		0.11 mm	0.0043 in.
	Journal oil clearance	STD		0.035 – 0.072 mm	0.0014 – 0.0028 in.
		Limit		0.10 mm	0.0039 in.
	Journal diameter	STD			
			Exhaust No. 1	24.949 – 24.965 mm	0.9822 – 0.9829 in.
			Others	22.949 – 22.965 mm	0.9035 – 0.9041 in.
	Circle runout	Limit		0.04 mm	0.0016 in.
	Cam lobe height	STD	Intake	35.21 – 35.31 mm	1.3862 – 1.3902 in.
			Exhaust	34.91 – 35.01 mm	1.3744 – 1.3783 in.
		Limit	Intake	34.81 mm	1.3705 in.
			Exhaust	34.51 mm	1.3587 in.
Cylinder block	Camshaft gear spring end free distance			17.1 – 17.5 mm	0.6732 – 0.6890 in.
	Camshaft gear backlash	STD		0.020 – 0.200 mm	0.0008 – 0.0079 in.
		Limit		0.30 mm	0.0188 in.
	Cylinder head surface warpage	Limit		0.05 mm	0.0020 in.
	Cylinder bore	STD	Mark "1"	81.00 – 81.01 mm	3.1890 – 3.1894 in.
			Mark "2"	81.01 – 81.02 mm	3.1894 – 3.1898 in.
			Mark "3"	81.02 – 81.03 mm	3.1898 – 3.1902 in.
	On standard sized piston	Limit		81.23 mm	3.1980 in.
	On O/S 0.50 sized piston	Limit		81.73 mm	3.2177 in.
	Cylinder bore wear	Limit		0.2 mm	0.008 in.
	Difference of bore between cylinder			0.05 mm	0.0020 in.
	Taper and out-of-round			0.02 mm	0.0008 in.
Piston and piston ring	Piston diameter	STD	Mark "1"	80.93 – 80.94 mm	3.1862 – 3.1886 in.
			Mark "2"	80.94 – 80.95 mm	3.1866 – 3.1870 in.
			Mark "3"	80.95 – 80.96 mm	3.1870 – 3.1874 in.
	O/S 0.50			81.43 – 81.46 mm	3.2059 – 3.2071 in.
	Piston to cylinder clearance			0.06 – 0.08 mm	0.0024 – 0.0031 in.
	Piston ring end gap	No. 1	STD	0.25 – 0.45 mm	0.0098 – 0.0177 in.
			Limit	1.05 mm	0.0413 in.
		No. 2	STD	0.15 – 0.40 mm	0.0059 – 0.0157 in.
			Limit	1.00 mm	0.0394 in.
	Oil	STD		0.10 – 0.70 mm	0.0039 – 0.0276 in.
		Limit		1.30 mm	0.0512 in.
	Ring to ring groove clearance	No. 1		0.04 – 0.08 mm	0.0016 – 0.0031 in.
		No. 2		0.03 – 0.07 mm	0.0012 – 0.0028 in.
	Piston pin installing temperature			20°C	68°F
Connecting rod	Thrust clearance	STD		0.15 – 0.25 mm	0.0059 – 0.0098 in.
		Limit		0.30 mm	0.0118 in.
	Connecting rod bearing center wall thickness				
	STD	No. 1		1.486 – 1.490 mm	0.0585 – 0.0587 in.
		No. 2		1.490 – 1.494 mm	0.0587 – 0.0588 in.
		No. 3		1.494 – 1.498 mm	0.0588 – 0.0590 in.
	U/S 0.25			1.607 – 1.613 mm	0.0633 – 0.0635 in.

Specifications (Cont'd)

Connecting rod (cont'd)	Bearing oil clearance	STD	0.020 – 0.051 mm	0.0008 – 0.00020 in.
		Limit	0.08 mm	0.0031 in.
	Rod bend	Limit	0.05 mm	0.0020 in.
	Rod twist	Limit	0.05 mm	0.0020 in.
Crankshaft	Thrust clearance	STD	0.02 – 0.22 mm	0.0008 – 0.0087 in.
		Limit	0.30 mm	0.0118 in.
	Thrust washer thickness	STD	2.440 – 2.490 mm	0.0961 – 0.0980 in.
	Main journal oil clearance	STD	0.015 – 0.033 mm	0.0006 – 0.0013 in.
		U/S 0.25	0.018 – 0.056 mm	0.0007 – 0.0022 in.
		Limit	0.10 mm	0.0039 in.
	Main journal diameter	STD	47.982 – 48.000 mm	1.8891 – 1.8898 in.
	Main journal finished diameter			
		U/S 0.25	47.745 – 47.755 mm	1.8797 – 1.8801 in.
	Main bearing center wall thickness			
		STD		
		Mark "1"	2.002 – 2.005 mm	0.0788 – 0.0789 in.
		Mark "2"	2.005 – 2.008 mm	0.0789 – 0.0791 in.
		Mark "3"	2.008 – 2.011 mm	0.0791 – 0.0792 in.
		Mark "4"	2.011 – 2.014 mm	0.0792 – 0.0793 in.
		Mark "5"	2.014 – 2.017 mm	0.0793 – 0.0794 in.
		U/S 0.25	2.121 – 2.127 mm	0.0835 – 0.0837 in.
	Crank pin diameter	STD	39.985 – 40.000 mm	1.5742 – 1.5748 in.
	Crank pin finished diameter			
		U/S 0.25	39.745 – 39.755 mm	1.5648 – 1.5652 in.
	Circle runout	Limit	0.06 mm	0.0024 in.
	Main journal taper and out-of-round			
		Limit	0.02 mm	0.0008 in.
	Crank pin journal taper and out-of-round			
		Limit	0.02 mm	0.0008 in.

Torque Specifications

Part tightened	kg-cm	ft-lb	N-m
Cylinder head bolt	610	44	60
Cylinder head x Camshaft bearing cap	130	9	13
Cylinder head x Spark plug	180	13	18
Cylinder head x Intake manifold	195	14	19
Cylinder head x Exhaust manifold	250	18	25
Cylinder block x Timing belt idler pulley	375	27	37
Cylinder block x Oil pump	220	16	22
Cylinder block x Crankshaft bearing cap	610	44	60
Cylinder block x Oil pan	50	43 in.-lb	4.9
Camshaft x Camshaft timing pulley	600	43	59
Crankshaft x Crankshaft pulley	1,200	87	118
Crankshaft x Flywheel	800	58	78
Connecting rod cap x Connecting rod	500	36	49
Oil pump x Oil strainer	95	82 in.-lb	9.3

EFI SYSTEM (4A-FE)

Specifications

Fuel pressure regulator	Fuel pressure	at No vacuum	2.7 – 3.1 kg/cm ² (38 – 44 psi, 265 – 304 kPa)	
Cold start injector	Resistance		2 – 4 Ω	
	Fuel leakage		Less than one drop of fuel per minute	
Injector	Resistance		Approx. 13.8 Ω	
	Injection volume		40 – 50 cc/15 sec (2.4 – 3.1 cu in.)	
	Difference between each injector		5 cc (0.31 cu in.) or less	
	Fuel leakage		One drop or less of fuel per minute	
Throttle body	Throttle valve fully closed angle		6°	
Throttle position sensor	Throttle opening angle (from vertical)	Clearance between stop screw and lever	IDL – E2	PSW – E2
	–	0.60 mm (0.0236 in.)	Continuity	No continuity
	–	0.80 mm (0.0315 in.)	No continuity	No continuity
	Less than 7.5°	–	Continuity	No continuity
	73°(M/T), 63°(A/T)	–	No continuity	No continuity
	79°(M/T), 69°(A/T)	–	No continuity	Continuity
Start injector time switch	Resistance	STA – STJ	20 – 40 Ω	Below 30° (86°F)
			40 – 60 Ω	Above 40°C (104°F)
		STA – Ground	20 – 80 Ω	–
Water temp. sensor and intake air temp. sensor	Resistance	at –20°C (–4°F)	10 – 20 kΩ	
		0°C (32°F)	4 – 7 kΩ	
		40°C (104°F)	0.9 – 1.3 kΩ	
		60°C (140°F)	0.4 – 0.7 kΩ	
		80°C (176°F)	0.2 – 0.4 kΩ	
Oxygen sensor	Heater resistance		5.1 – 6.3 Ω	
ECU	HINT:			
	● Perform all voltage and resistance measurements with the ECU connected.			
	● Verify that the battery voltage is 11 V or above when the ignition switch is ON.			
	● The testing probes must not make contact with the ECU oxygen and VF terminals.			
	Voltage			
	Terminal	STD voltage (V)	Condition	
	+B – E1	10 – 14	Ignition switch ON	
	+B1 – E1			
	BATT – E1		–	
	IDL – E2	4.5 – 5.5	Ignition switch ON	Throttle valve open
	PSW – E2			Throttle valve fully closed
	No. 10 – E01 No. 20 – E02	10 – 14	Ignition switch ON	
W – E1	10 – 14	No trouble ("CHECK ENGINE" warning light off) and engine running		

LUBRICATION SYSTEM

Oil pressure (normal operating temperature)		at Idle speed at 3,000 rpm	More than 0.3 kg/cm ² (4.3 psi, 29 kPa) 2.5 – 5.0 kg/cm ² (35.6 – 71.1 psi, 245 – 490 kPa)	
Oil pump	4A-FE			
	Body clearance	STD	0.080 – 0.180 mm	0.0031 – 0.0071 in.
		Limit	0.20 mm	0.0079 in.
	Tip clearance	STD	0.025 – 0.085 mm	0.0010 – 0.0033 in.
		Limit	0.35 mm	0.0138 in.
	Side clearance	STD	0.025 – 0.085 mm	0.0010 – 0.0033 in.
		Limit	0.10 mm	0.0039 in.

IGNITION SYSTEM (4A-FE)







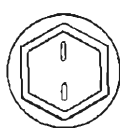
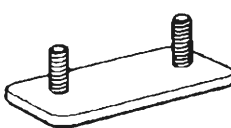


Ignition timing		See page A-2	
Spark plug		See page A-2	
Firing order		1 – 3 – 4 – 2	
High-tension cord	Resistance	Limit	25 k Ω per cord
Ignition coil	Primary coil resistance	2WD	1.28 – 1.56 Ω
	Secondary coil resistance	2WD	10.4 – 14.0 k Ω
Distributor (IIA)	Air gap		0.2 mm or more 0.008 in. or more
	Signal generator (pickup coil) resistance		140 – 180 Ω

STANDARD BOLT TORQUE SPECIFICATIONS

	Page
STANDARD BOLT TORQUE SPECIFICATIONS	B-2

STANDARD BOLT TORQUE SPECIFICATIONS

HOW TO DETERMINE BOLT STRENGTH

	Mark	Class		Mark	Class
Hexagon head bolt	<div>4—</div> <div>5—</div> <div>6—</div> <div>7—</div> <div>8—</div> <div>9—</div> <div>10—</div> <div>11—</div> <div> Bolt head No.</div>	<div>4T</div> <div>5T</div> <div>6T</div> <div>7T</div> <div>8T</div> <div>9T</div> <div>10T</div> <div>11T</div>	Stud bolt	<div> No mark</div>	4T
	<div> No mark</div>	4T			
Hexagon flange bolt w/ washer hexagon bolt	<div> No mark</div>	4T	Welded bolt	<div> Grooved</div>	6T
Hexagon head bolt	<div> Two protruding lines</div>	5T			
Hexagon flange bolt w/ washer hexagon bolt	<div> Two protruding lines</div>	6T	Welded bolt	<div></div>	4T
Hexagon head bolt	<div> Three protruding lines</div>	7T			
Hexagon head bolt	<div> Four protruding lines</div>	8T			

SPECIFIED TORQUE FOR STANDARD BOLTS

Class	Diameter mm	Pitch mm	Specified torque					
			Hexagon head bolt			Hexagon flange bolt		
			kg-cm	ft-lb	N-m	kg-cm	ft-lb	N-m
4T	6	1	55	48 in.-lb	5	60	52 in.-lb	6
	8	1.25	130	9	12.5	145	10	14
	10	1.25	260	19	26	290	21	29
	12	1.25	480	35	47	540	39	53
	14	1.5	760	55	74	850	61	84
	16	1.5	1,150	83	115	—	—	—
5T	6	1	65	56 in.-lb	6.5	75	65 in.-lb	7.5
	8	1.25	160	12	15.5	175	13	17.5
	10	1.25	330	24	32	360	26	36
	12	1.25	600	43	59	670	48	65
	14	1.5	930	67	91	1,050	76	100
	16	1.5	1,400	101	140	—	—	—
6T	6	1	80	69 in.-lb	8	90	78 in.-lb	9
	8	1.25	195	14	19	210	15	21
	10	1.25	400	29	39	440	32	44
	12	1.25	730	53	71	810	59	80
	14	1.5	1,100	80	110	1,250	90	125
	16	1.5	1,750	127	170	—	—	—
7T	6	1	110	8	10.5	120	9	12
	8	1.25	260	19	25	290	21	28
	10	1.25	530	38	52	590	43	58
	12	1.25	970	70	95	1,050	76	105
	14	1.5	1,500	108	145	1,700	123	165
	16	1.5	2,300	166	230	—	—	—
8T	8	1.25	300	22	29	330	24	33
	10	1.25	620	45	61	690	50	68
	12	1.25	1,100	80	110	1,250	90	120
9T	8	1.25	340	25	34	380	27	37
	10	1.25	710	51	70	790	57	78
	12	1.25	1,300	94	125	1,450	105	140
10T	8	1.25	390	28	38	430	31	42
	10	1.25	800	58	78	890	64	88
	12	1.25	1,450	105	140	1,600	116	155
11T	8	1.25	430	31	42	480	35	47
	10	1.25	890	64	87	990	72	97
	12	1.25	1,600	116	155	1,800	130	175