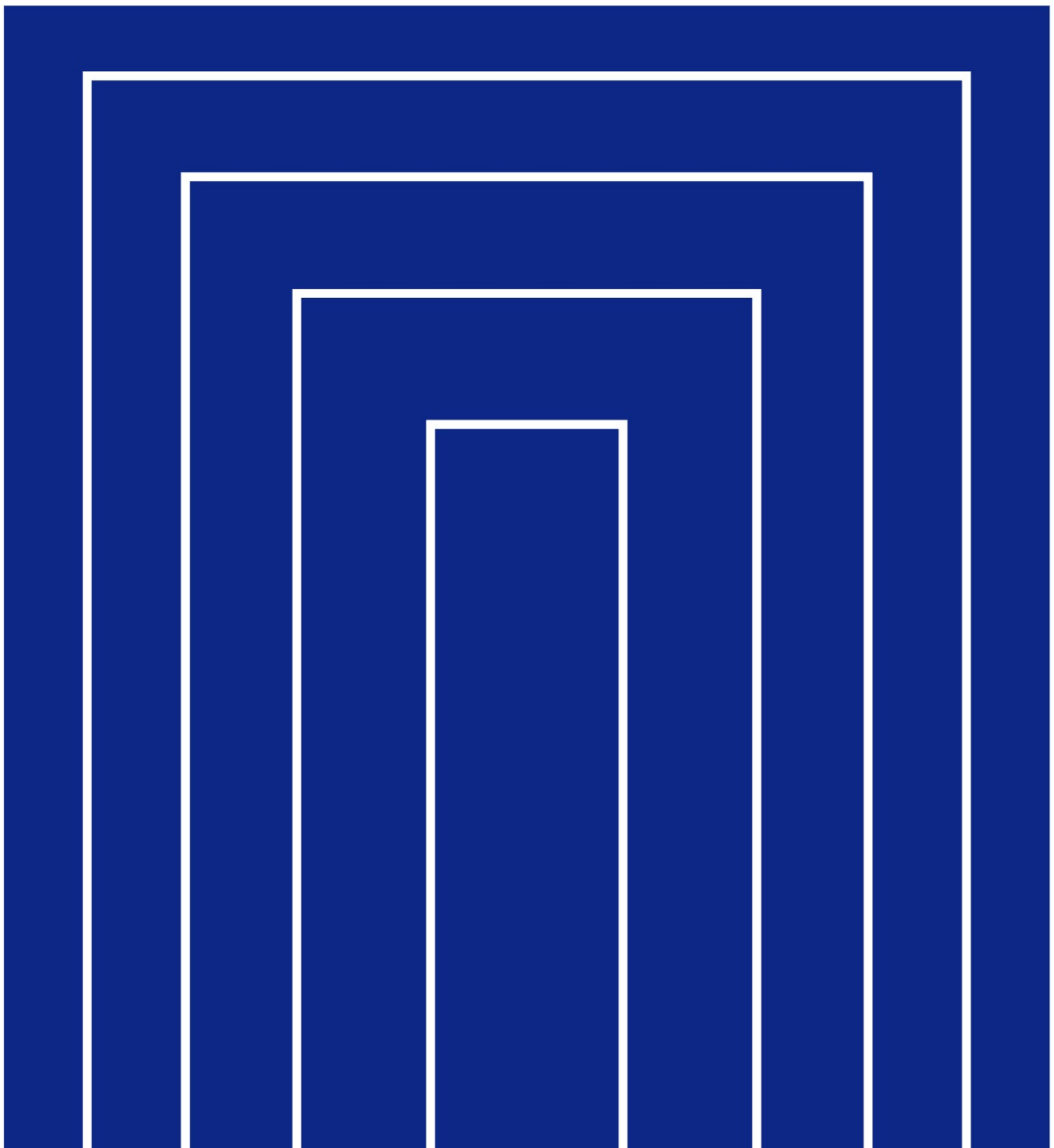
TOYOTA

3F-E

ENGINE

REPAIR MANUAL SUPPLEMENT

Aug., 1988



Pub. No. RM134E

FOREWORD

This supplement has been prepared to provide information covering general service repairs for the 3F-E engine equipped on the TOYOTA LAND CRUISER.

Application models: FJ62 series

For basic engine service repair, refer to the following repair manual

3F Engine Repair Manual (Pub. No. 36253E)

Please note that the publications below have also been prepared as relevant service manuals to the components and systems in this engine.

Manual Name	Pub. No.
• 3F-E Engine Emission Control Repair Manual	ERM045E

All information in this manual is based on the latest product information at the time of publication. However, specifications and procedures are subject to change without notice.

TOYOTA MOTOR CORPORATION

TOYOTA 3F-E ENGINE REPAIR MANUAL SUPPLEMENT

NOTE: The following screen toning letters sections refer to the 3F Engine Repair Manual (Pub. No. 36253E)

INTRODUCTION IN
ENGINE MECHANICAL EM
EFI SYSTEM FI
COOLING SYSTEM CO
LUBRICATION SYSTEM LU
IGNITION SYSTEM IG
STARTING SYSTEM ST
CHARGING SYSTEM CH
SERVICE SPECIFICATIONS A
STANDARD BOLT TORQUE SPECIFICATIONS B
SST AND SSM C

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INTRODUCTION

	Page
HOW TO USE THIS MANUAL	IN-2
IDENTIFICATION INFORMATION	IN-4
GENERAL REPAIR INSTRUCTIONS	IN-4
PRECAUTIONS FOR VEHICLES EQUIPPED WITH A CATALYTIC CONVERTER	IN-7
ABBREVIATIONS USED IN THIS MANUAL	IN-8

HOW TO USE THIS MANUAL

To assist 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.

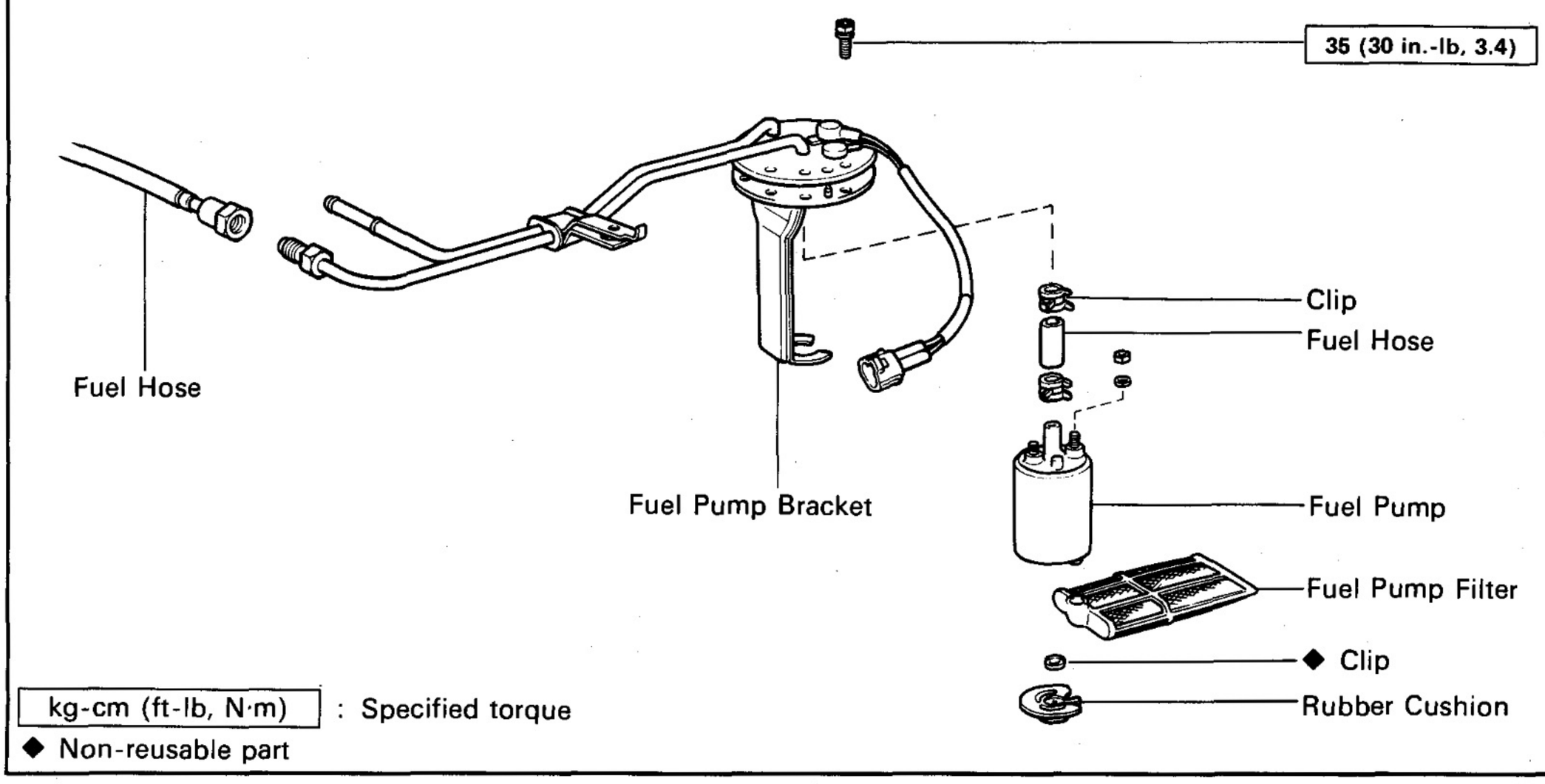
At the beginning of each section, **PRECAUTIONS** are given that pertain to *all* repair operations contained in that section. *Read these precautions before starting any repair task.*

TROUBLESHOOTING tables are included for each system to help you diagnose the 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.

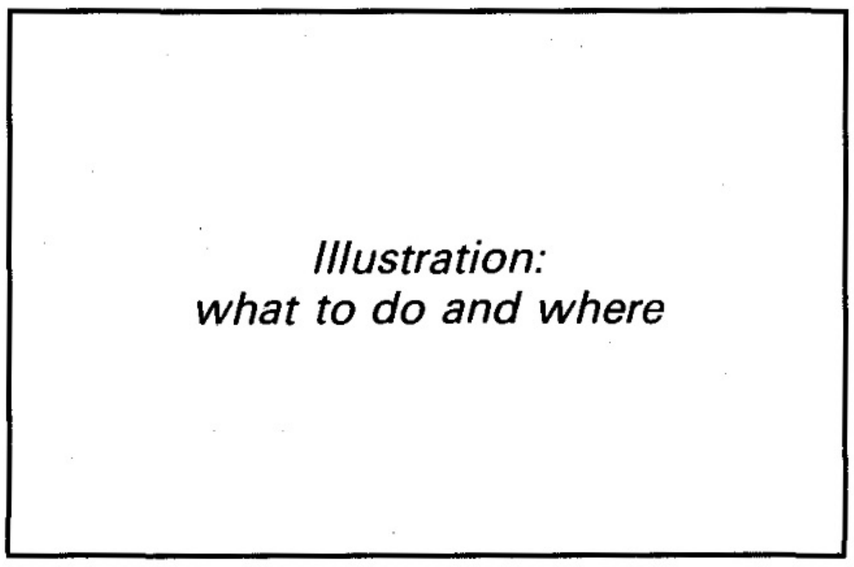
Example:



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:



Task heading: what to do

3. INSTALL FUEL PUMP BRACKET TO FUEL TANK

(a) Install a new gasket and the pump bracket with the screws.

Torque: 35 kg-cm (30 in.-lb, 3.4 N·m)

Torque Specification

Detailed text: how to do task

This format provides the experienced technician with a FAST TRACK to the information needed. The upper case task heading can be read at a glance when necessary, and the text below it provides detailed information. Important specifications and warnings always stand out in bold type.

REFERENCES

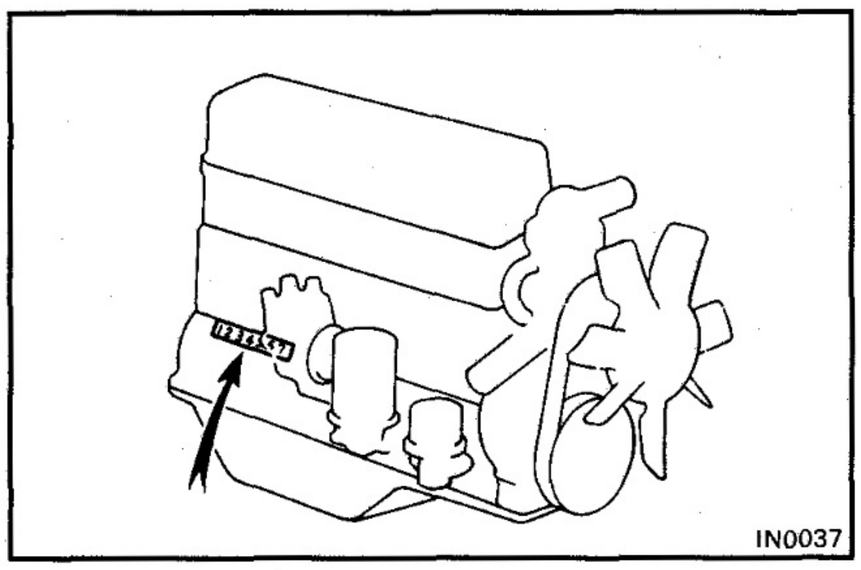
References have been kept to a minimum. However, when they are required you are given the page to refer to.

SPECIFICATIONS

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

CAUTIONS, NOTICES, HINTS

- CAUTIONS are presented in bold type, and indicate there is a 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. They provide additional information to help you perform the repair more efficiently.



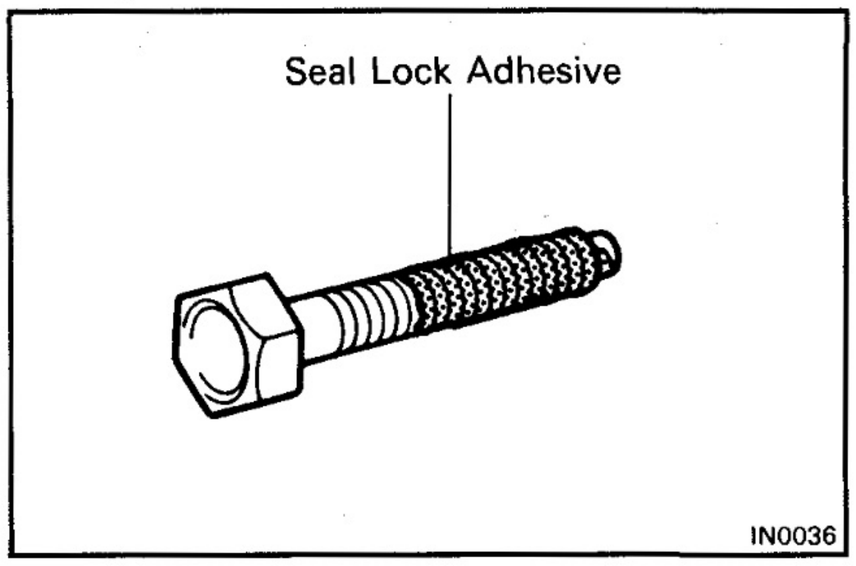
IDENTIFICATION INFORMATION

ENGINE SERIAL NUMBER

The engine serial number is stamped on the right 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 re-assembly.
3. Observe the following:
   (a) Before performing electrical work, disconnect the 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 terminal with a shop rag. Do not scrape them with a file or such.
   (e) Install the cable terminal to the battery post with the nut loose and tighten the nut after installation. Do not use a hammer or such to tap the terminal onto the post.
   (f) Be sure the cover for the positive (+) terminal is properly in place.
4. Check all hose and wiring connectors to make sure they are securely and correctly connected.
5. Non-reusable Parts
   (a) Always replace cotter pins, gaskets, O-ring and 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 bolts, nuts, etc. that are coated with a seal lock adheasive at the factory.

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

   (b) Recoating of Precoated Parts

      (1) Clean off the old adhesive from the bolts, nut or installation part threads.

      (2) Dry with compressed air.

      (3) Apply the specified seal lock adhesive to the bolt or nut 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 tightening torques. Always use a torque wrench.

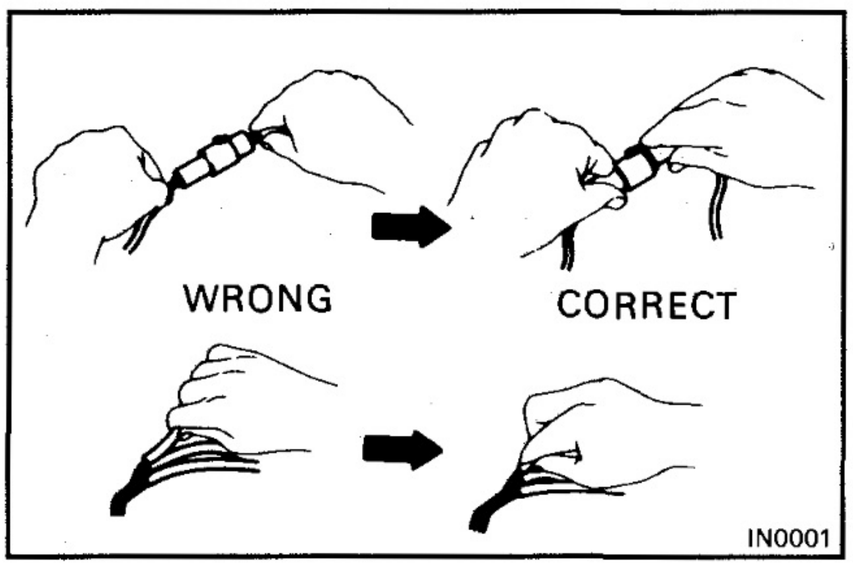
9. Use of special service tools (SST) and special service materials (SSM) may be required depending on the nature of the repair. Be sure to use SST and SSM where specified and follow the proper work procedure. A list of SST and SSM can be found at the back of this manual.

10. When replacing fuses, be sure the new fuse is the correct amperage rating. DO NOT exceed the 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 block 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 one jack alone, even for a small job that can be finished quickly.

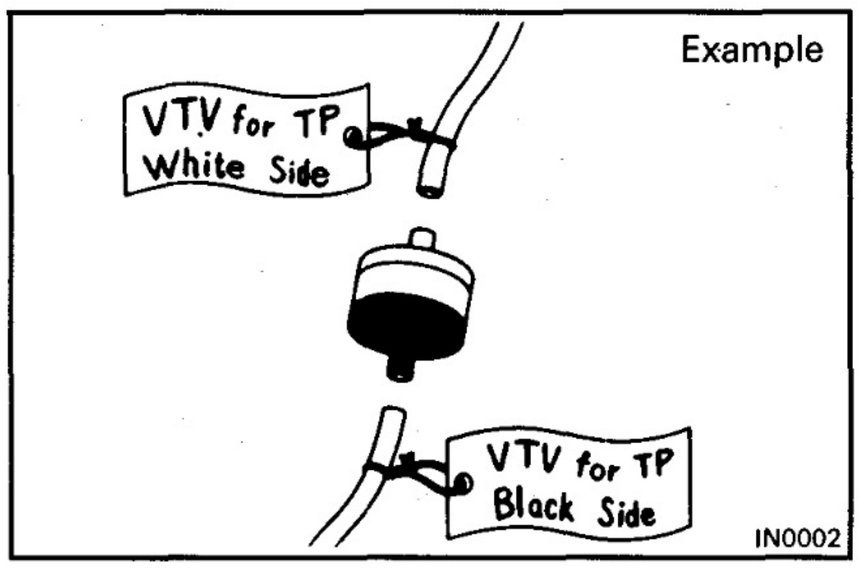


12. Observe the following precautions to avoid damage to parts:

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

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

    (c) Be careful not to drop electrical components, such as sensors or relays. If they are dropped on a hard floor, they should be replaced and not reused.



(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 temperature switches or temperature 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.

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 idle speed for more than 20 minutes.

3. **Avoid spark jump test.**

   (a) Perform a spark jump test only when absolutely necessary and as quickly as possible.

   (b) Never race the engine, while testing.

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

AI	Air Injection
ASV	Air Switching Valve
BTDC	Before Top Dead Center
DP	Dash Pot
ECU	Electronic Controlled Unit
EFI	Electronic Fuel Injection
EGR	Exhaust Gas Recirculation
ESA	Electronic Spark Advance
EX	Exhaust (manifold, valve)
IG	Ignition
IN	Intake (manifold, valve)
ISC	Idle Speed Control
OHV	Over Head Valve
O/S	Oversize
PCV	Positive Crankcase Ventilation
PS	Power Steering
SSM	Special Service Materials
SST	Special Service Tools
STD	Standard
SW	Switch
TCCS	TOYOTA Computer Controlled System
TDC	Top Dead Center
U/S	Undersize
VCV	Vacuum Control Valve
VSV	Vacuum Switching Valve
VTV	Vacuum Transmitting Valve
w/	With
w/o	Without

ENGINE MECHANICAL

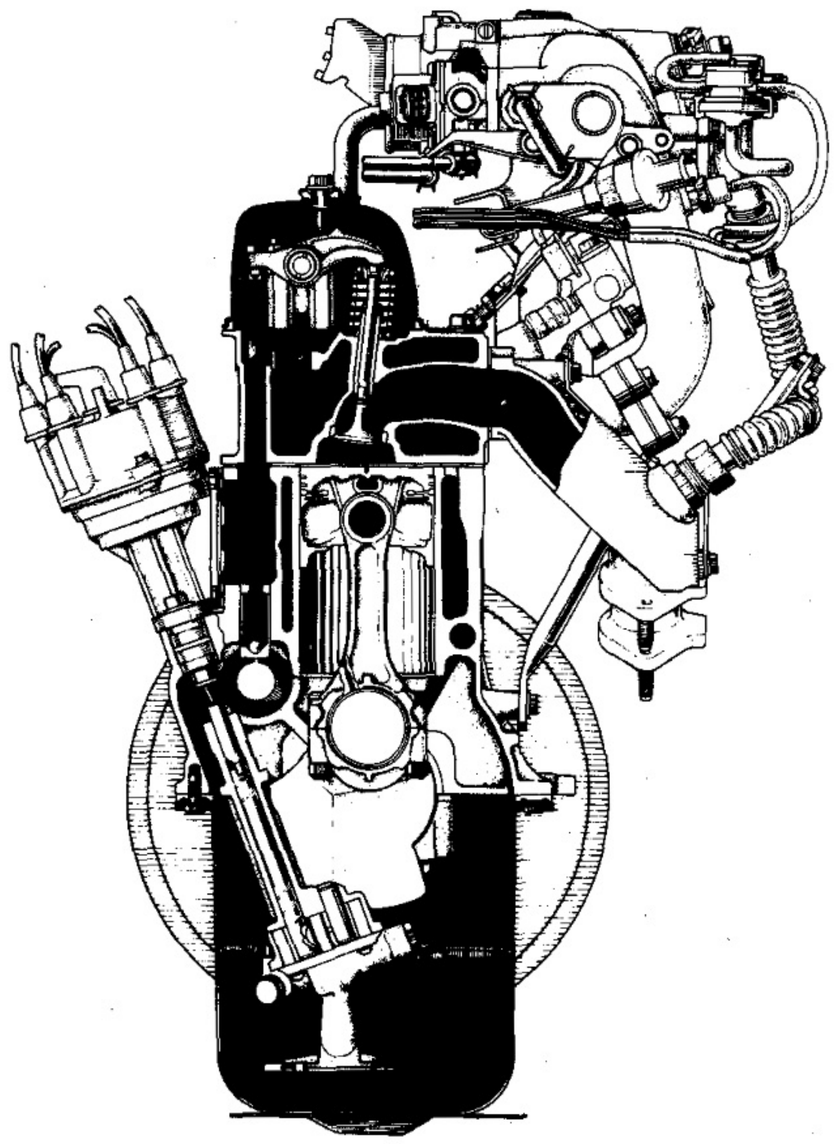
REFER TO 3F ENGINE REPAIR MANUAL (Pub. No. 36253E)

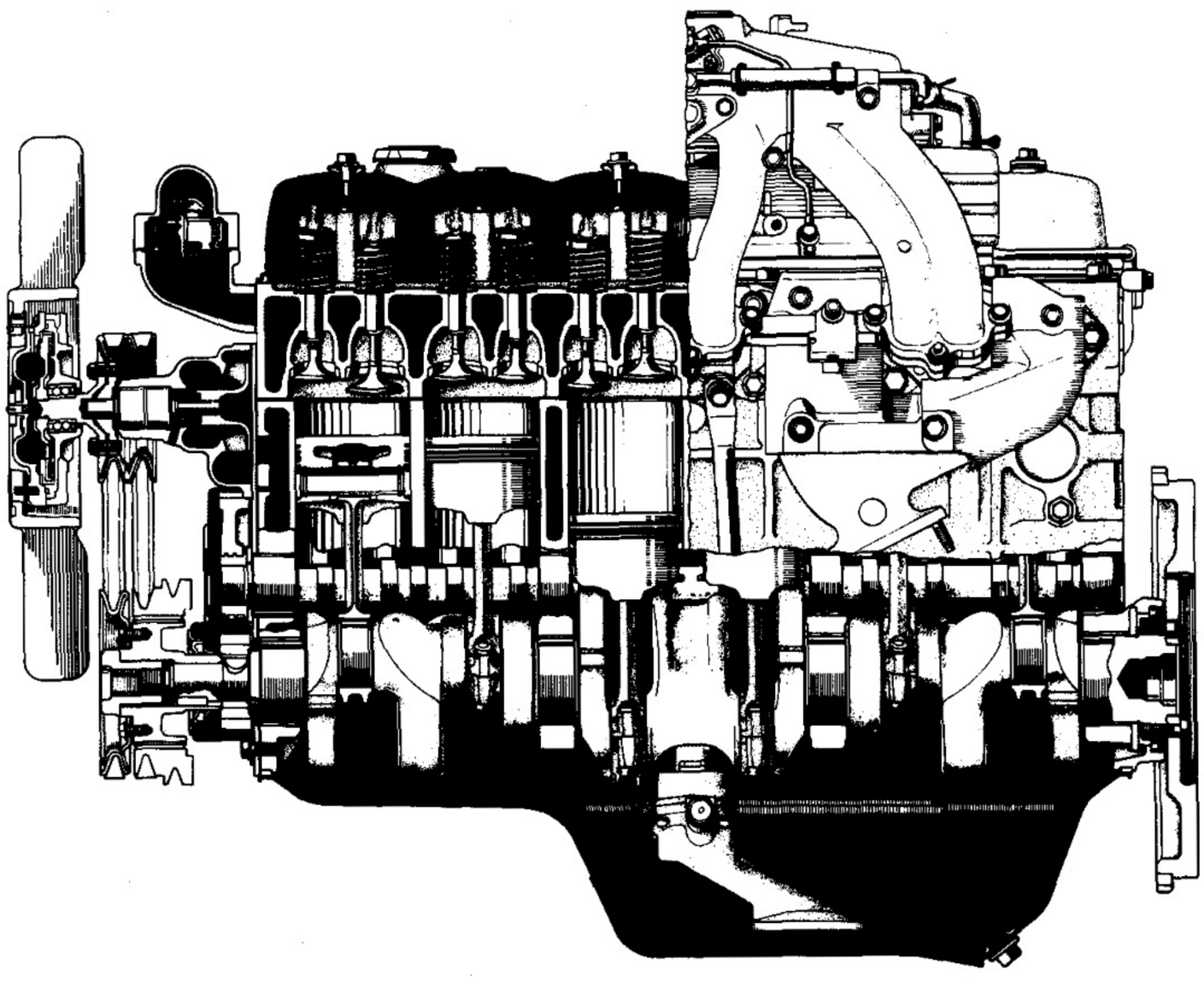
NOTE: The following pages contain only the points which differ from the above listed manual.

	Page
DESCRIPTION	EM-2
TROUBLESHOOTING	EM-4
ENGINE TUNE-UP	EM-8
IDLE HC/CO CONCENTRATION CHECK METHOD	EM-13
INSPECTION AND ADJUSTMENT OF DASH POT (DP) SETTING SPEED	EM-15
COMPRESSION CHECK	EM-16
CYLINDER HEAD	EM-17
TIMING GEARS AND CAMSHAFT	EM-32
CYLINDER BLOCK	EM-40

DESCRIPTION

The 3F-E engine is an in-line 6-cylinder 4.0 liter OHV 12-valve engine.





EM5416
EM5417

The 3F-E engines are an in-line 6-cylinder engine with the cylinders numbered 1-2-3-4-5-6 from the front. The crankshaft is supported by 4 bearings specified by the inside of the crankcase.

The crankshaft is integrated with 9 weights which are cast along with it for balance. Oil holes are built into the center of the crankshaft for supplying oil to the connecting rods, pistons and other components.

These engine's ignition order is 1-5-3-6-2-4. The cylinder head is made of case iron, with a counter-flow type intake and exhaust layout and with wedge type combustion chambers. The spark plugs are located in the right side of the combustion chambers.

Exhaust and intake valves are equipped with irregular pitch springs which are capable of following the valves even at high engine speeds.

Each valve lifter is lifted up by the rotation of the camshaft so that valve is driven via a push rod and rocker arm.

The camshaft is located in the cylinder block. The camshaft is turned by the crankshaft by means of the timing gears. To rotate the camshaft once, the crankshaft must rotate twice because the camshaft timing gear has twice as many teeth as the crankshaft timing gear.

Pistons are made of high temperature-resistant aluminum alloy.

Piston pins are the full-floating type, with the pins fastened to neither the piston boss nor the connecting rods. Instead, snap rings are fitted on both ends of the pins, preventing the pins from falling out.

The No. 1 compression ring is made of 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 the oil ring works to scrape oil off the cylinder walls to prevent it from entering the combustion chamber.

The cylinder block is made of cast iron. It has 6 cylinders which are approximately 1.6 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 onto 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 in 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.

TROUBLESHOOTING

ENGINE OVERHEATING

Problem	Possible cause	Remedy	Page
Engine overheats	Cooling system faulty	Troubleshoot cooling system	
	Incorrect ignition timing	Reset timing	EM-11

HARD STARTING

Problem	Possible cause	Remedy	Page
Engine will not crank or cranks slowly	Starting system faulty	Troubleshoot starting system	
Engine will not start / hard to start (cranks OK)	No fuel supply to injector • No fuel in tank • Fuel pump no working • Fuel filter clogged • Fuel line clogged or leaking	Troubleshoot EFI system	FI-9
	EFI system problems	Repair as necessary	
	Ignition problems • Ignition coil • Igniter • Distributor	Perform spark test	IG-5
	Spark plug faulty	Inspect plugs	IG-6
	High-tension cords disconnected broken	Inspect cords	IG-6
	Vacuum leaks • PCV line • EGR line • Intake manifold • Air intake chamber • Throttle body • ISC valve • Brake booster line	Repair as necessary	
	Pulling in air between air flow meter and throttle body	Repair as necessary	
	Low compression	Check compression	EM-16

ROUGH IDLING

Problem	Possible cause	Remedy	Page
Rough idle, stalls or misses	Spark plug faulty	Inspect plugs	IG-6
	High-tension cord faulty	Inspect cords	IG-6
	Ignition problems		
	• Ignition coil	Inspect coil	IG-7
	• Igniter	Inspect igniter	IG-5
	• Distributor	Inspect distributor	IG-7
	Incorrect ignition timing	Reset timing	EM-11
	Vacuum leaks • PCV line • EGR line • Intake manifold • Air intake chamber	Repair as necessary	

ROUGH IDLING (Cont'd)

Problem	Possible cause	Remedy	Page
Rough idle, stalls or misses (Cont'd)	• Throttle body • ISC valve • Brake booster line		
	Pulling in air between air flow meter and throttle body		
	Incorrect idle speed	Check ISC system	FI-40,67
	Incorrect valve clearance	Adjust valve clearance	EM-10
	EFI system problems	Repair as necessary	
	Engine overheats	Check cooling system	
	Low compression	Check compression	EM-16

ENGINE HESITATES/POOR ACCELERATION

Problem	Possible cause	Remedy	Page
Engine hesitates/ poor acceleration	Spark plug faulty	Inspect plugs	IG-6
	High-tension cord faulty	Inspect cords	IG-6
	Vacuum leaks • PCV line • EGR line • Intake manifold • Air intake chamber • Throttle body • ISC valve • Brake booster line	Repair as necessary	
	Pulling in air between air flow meter and throttle body	Repair as necessary	
	Incorrect ignition timing	Reset timing	EM-11
	Incorrect valve clearance	Adjust valve clearance	EM-10
	Fuel system clogged	Check fuel system	
	Air cleaner clogged	Check air cleaner	EM-8
	EFI system problems	Repair as necessary	
	Emission control system problem (Cold engine) • EGR system always on	Check EGR system	
	Engine overheats	Check cooling system	
	Low compression	Check compression	EM-16

ENGINE DIESELING

Problem	Possible cause	Remedy	Page
Engine diesels (runs after ignition switch turned off)	EFI system problems	Repair as necessary	

AFTER FIRE, BACKFIRE

Problem	Possible cause	Remedy	Page
Muffler explosion (after fire) on deceleration only	Deceleration fuel cut system always off	Check EFI (fuel cut) system	
Muffler explosion (after fire) all the time	Air cleaner clogged	Check air cleaner	EM-8
	EFI system problem	Repair as necessary	
	Incorrect ignition timing	Reset timing	EM-11
Engine backfires	EFI system problem	Repair as necessary	
	Vacuum leak • PCV line • EGR line • Intake manifold • Air intake chamber • Throttle body • ISC valve • Brake booster line	Check hoses and repair as necessary	
	Pulling in air between air flow meter and throttle body	Repair as necessary	
	Insufficient fuel flow	Troubleshoot fuel system	FI-9
	Incorrect ignition timing	Reset timing	EM-11
	Incorrect valve clearance	Adjust valve clearance	EM-10
	Carbon deposits in combustion chambers	Inspect cylinder head	

EXCESSIVE OIL CONSUMPTION

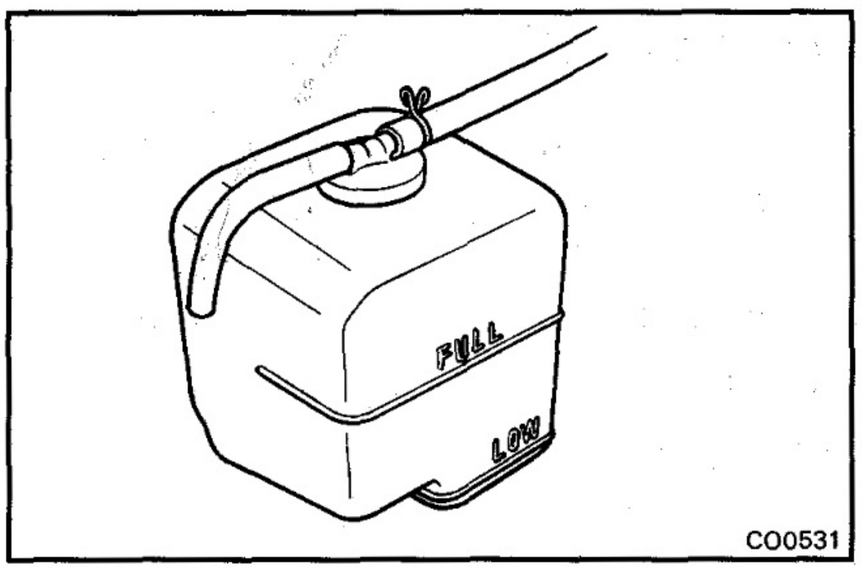
Problem	Possible cause	Remedy	Page
Excessive oil consumption	Oil leak	Repair as necessary	
	PCV line clogged	Check PCV system	
	Piston ring worn or damaged	Check rings	EM-45
	Valve stem and guide bushing worn	Check valves and guide bushing	
	Valve stem oil seal worn	Check seals	

POOR GASOLINE MILEAGE

Problem	Possible cause	Remedy	Page
Poor gasoline mileage	Fuel leak	Repair as necessary	
	Air cleaner clogged	Check air cleaner	EM-8
	Incorrect ignition timing	Reset timing	EM-11
	EFI system problems • Injector faulty • Deceleration fuel cut system faulty	Repair as necessary	
	Idle speed too high	Check ISC system	FI-40,67
	Spark plug faulty	Inspect plugs	IG-6
	EGR system always on	Check EGR system	
	Low compression	Check compression	EM-16
	Tires improperly inflated	Inflate tires to proper pressure	
	Brakes drag	Troubleshoot brakes	

UNPLEASANT ODOR

Problem	Possible cause	Remedy	Page
Unpleasant odor	Incorrect idle speed	Check ISC system	FI-40,67
	Incorrect ignition timing	Reset timing	EM-11
	Vacuum leaks • PCV line • EGR line • Intake manifold • Air intake chamber • Throttle body • ISC valve • Brake booster line	Repair as necessary	
	EFI system problems	Repair as necessary	



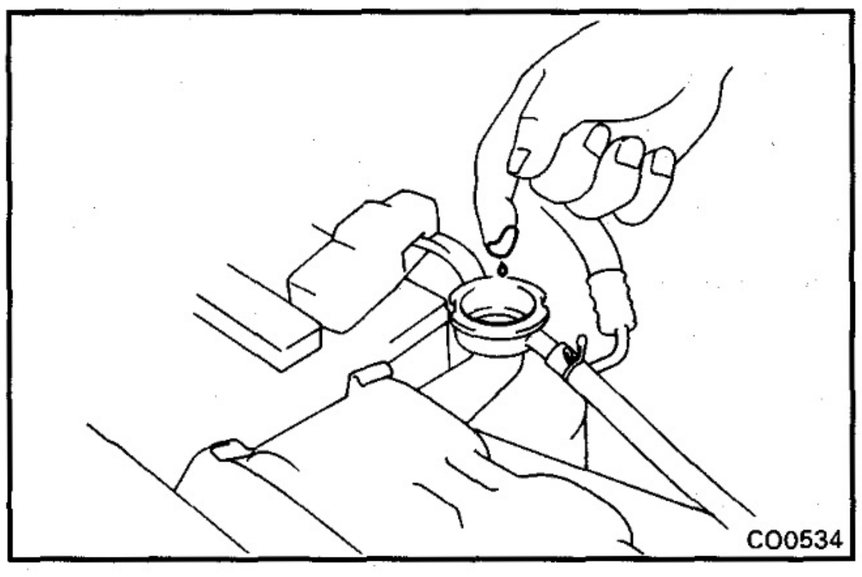
ENGINE TUNE-UP

INSPECTION OF ENGINE COOLANT

1. CHECK ENGINE COOLANT LEVEL AT RESERVE TANK

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

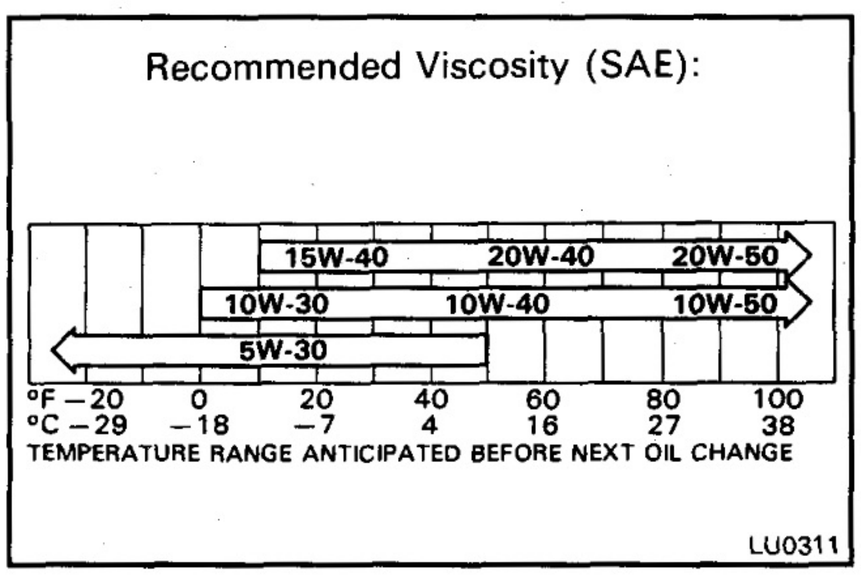
If low, check for leaks and add coolant up to the "FULL" line.



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.



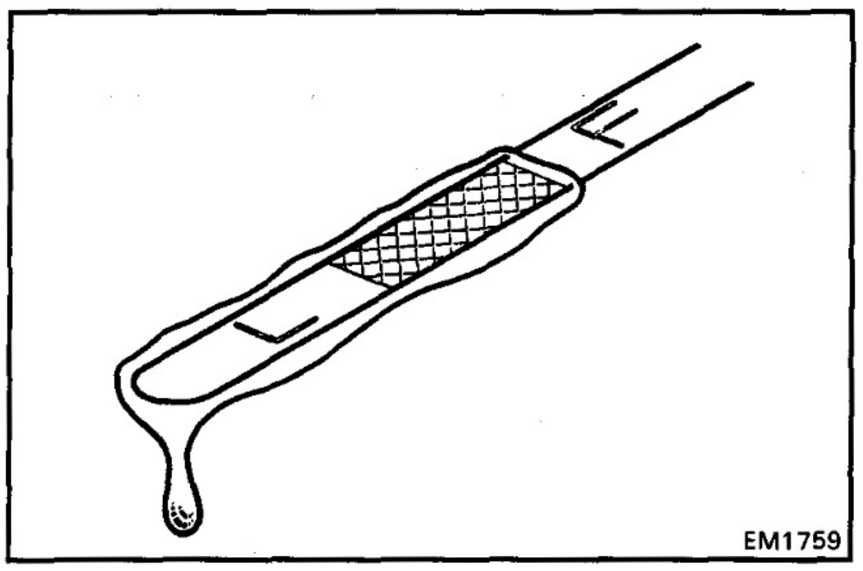
INSPECTION OF ENGINE OIL

1. CHECK ENGINE OIL QUALITY

Check the oil for deterioration, entry of water, discoloring or thinning.

If the quality is poor, replace the oil.

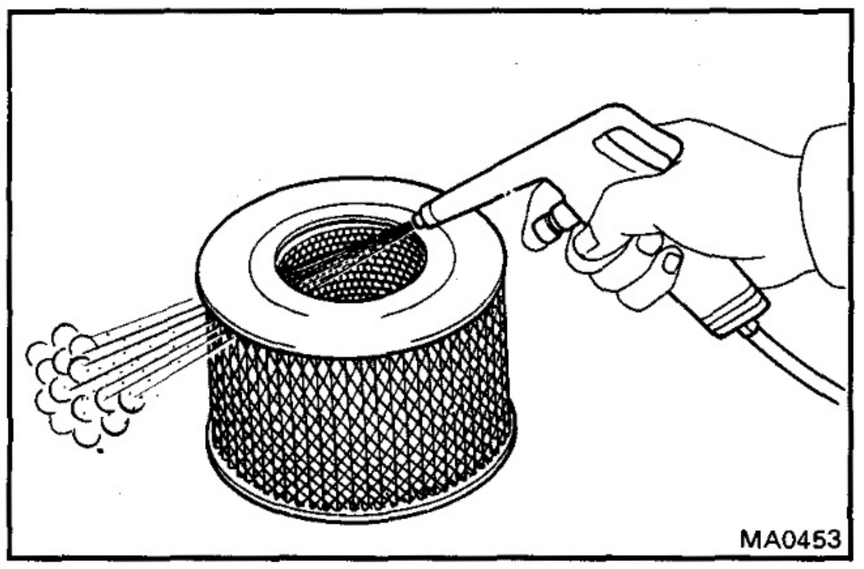
Use API grade SC, SD, SE, SF or better and recommended viscosity oil.



2. CHECK ENGINE OIL LEVEL

The oil level should be between the "L" and "F" marks on the dipstick.

If low, check for leakage and add oil up to the "F" mark.



INSPECTION OF AIR FILTER

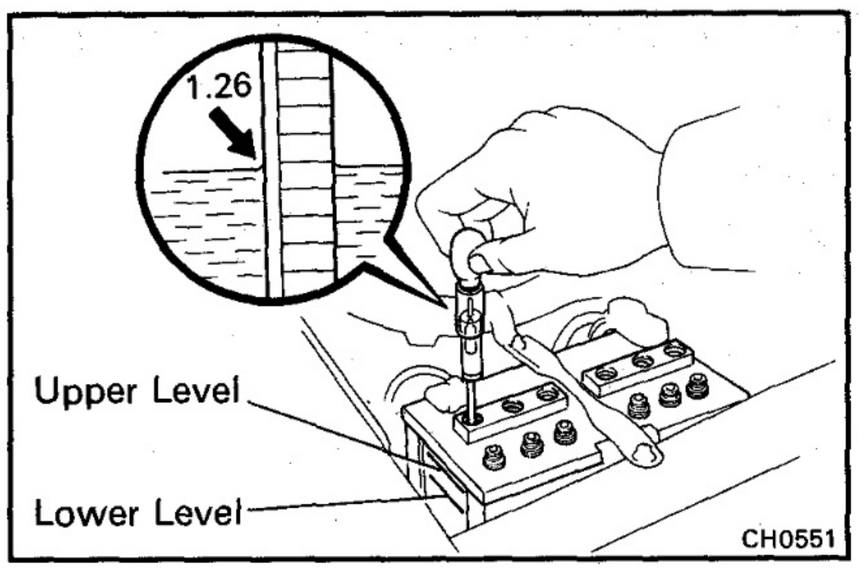
INSPECT AIR FILTER

(a) Visually check that the air cleaner element is not excessively dirty, damaged or oily.

If necessary, replace the air cleaner element.

(b) Clean the element with compressed air.

First blow from inside thoroughly, then blow off the outside of the element.



INSPECTION OF BATTERY

1. CHECK BATTERY SPECIFIC GRAVITY

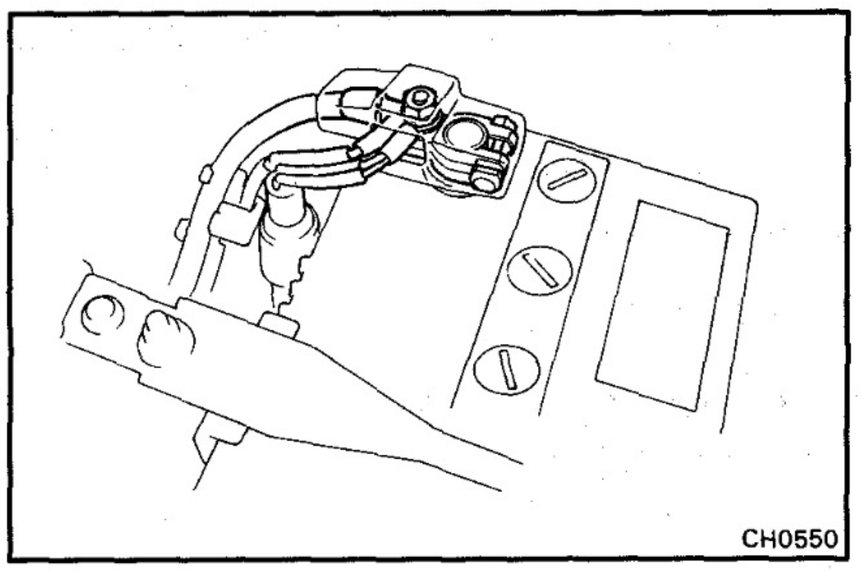
(a) Check the specific gravity of each cell.

Standard specific gravity
When fully charged at 20°C (68°F): 1.25 – 1.27

If not within specification, charge the battery.

(b) Check the electrolyte quantity of each cell.

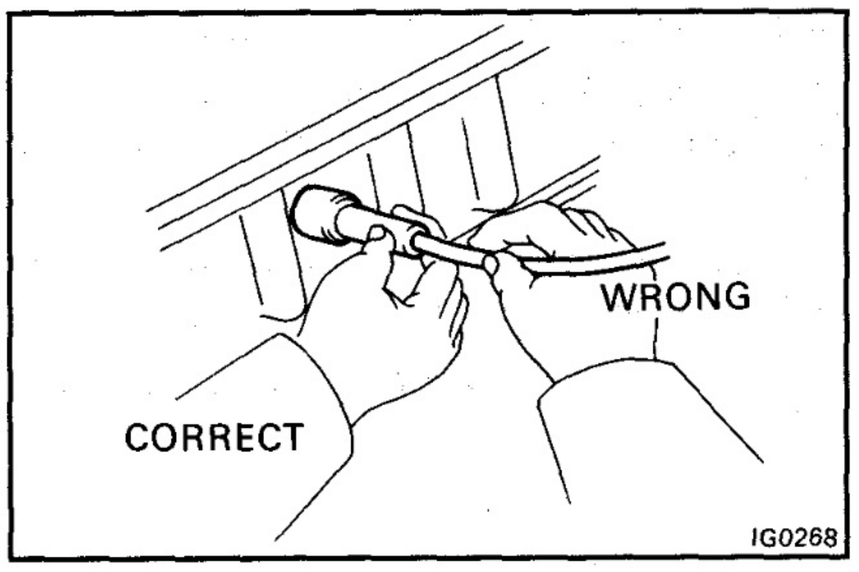
If insufficient, refill with distilled (or purified) water.



2. CHECK BATTERY TERMINALS, FUSIBLE LINKS AND FUSES

(a) Check that the battery terminals are not loose or corroded.

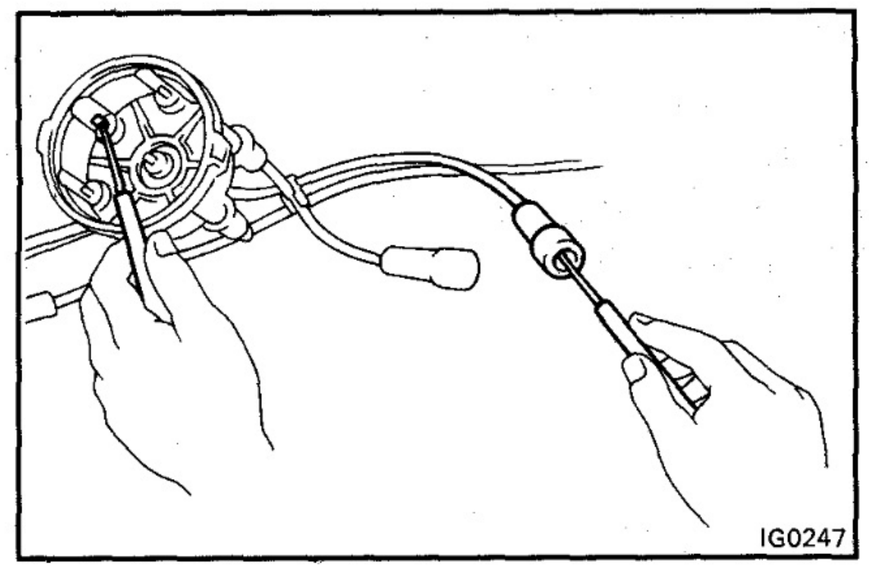
(b) Check the fusible links and fuses for continuity.



INSPECTION OF HIGH-TENSION CORDS

1. CAREFULLY REMOVE HIGH-TENSION CORDS BY THEIR RUBBER BOOTS FROM SPARK PLUGS

NOTICE: Pulling on or bending the cords may damage the conductor inside.

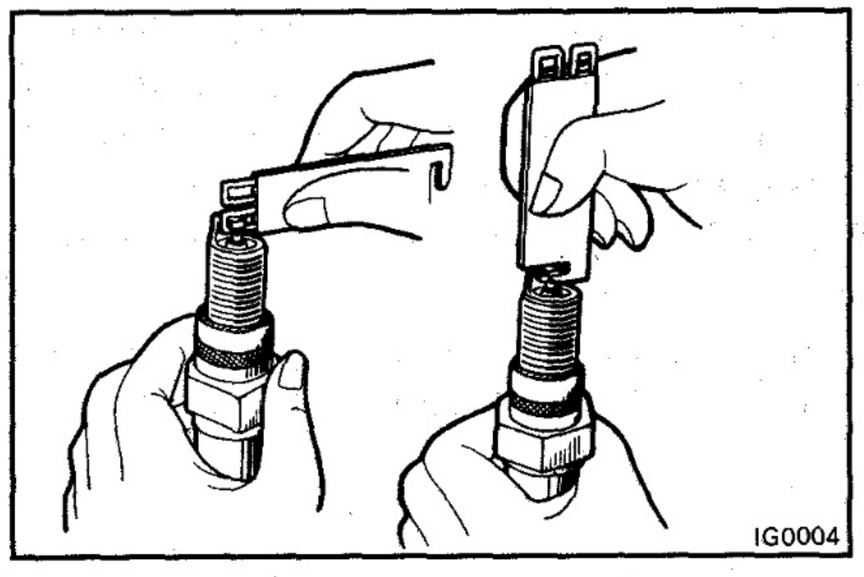


2. INSPECT HIGH-TENSION CORD RESISTANCE

Using an ohmmeter, measure the resistance without disconnecting the distributor cap.

Maximum resistance: 25 kΩ per cord

If resistance is greater than maximum, check the terminals. If necessary, replace the high-tension cord and/or distributor cap.



INSPECTION OF SPARK PLUGS

(See page IG-6)

Recommended spark plug: ND W16EXR-U
NGK BPR5EY

Correct electrode gap: 0.8 mm (0.031 in.)

INSPECTION OF ALTERNATOR DRIVE BELT

(See page CH-4)

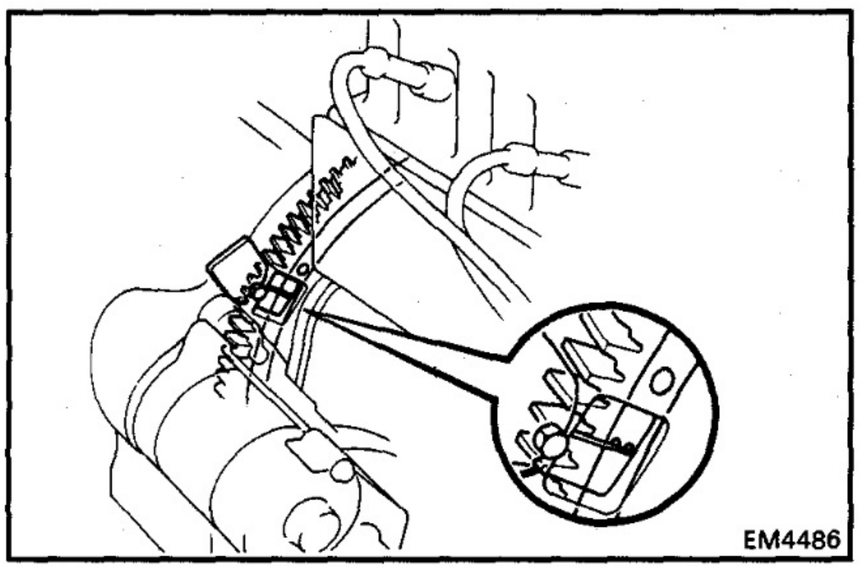
Drive belt deflection:
New belt 7.0 – 9.0 mm (0.278 – 0.354 in.)
Used belt 9.0 – 12.0 mm (0.354 – 0.472 in.)
Drive belt tension:
New belt 55 – 65 kg
Used belt 30 – 45 kg

INSPECTION AND ADJUSTMENT OF VALVE CLEARANCE

HINT: Inspect and adjust the valve clearance after engine has reached normal operating temperature.

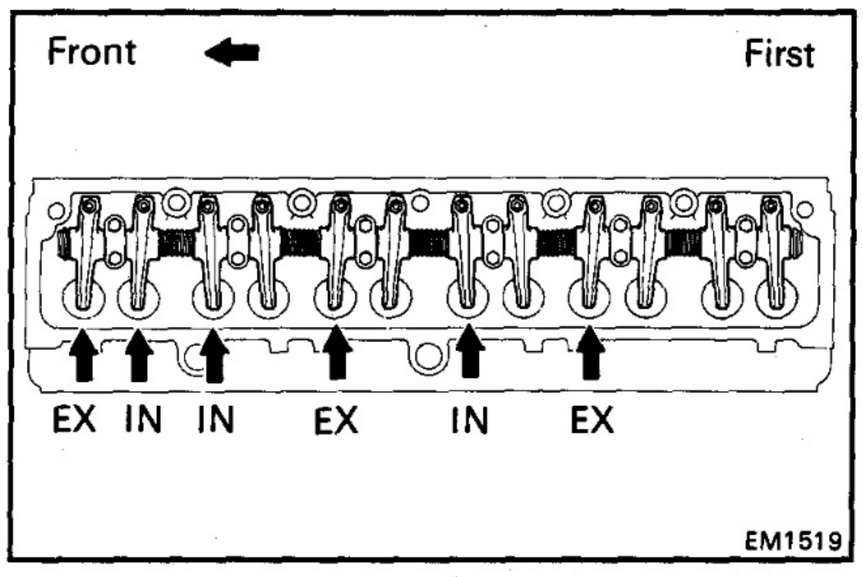
1. **REMOVE AIR CLEANER HOSE**

2. **REMOVE CYLINDER HEAD COVER**
(See step 21 on page EM-19)


EM4486

3. **SET NO. 1 CYLINDER TO TDC/COMPRESSION**
   (a) Align the TDC mark of the drive plate with the timing pointer by turning the crankshaft clockwise with a wrench.
   (b) Check that the rocker arms on the No. 1 cylinder are loose and rocker arms on the No. 6 are tight.

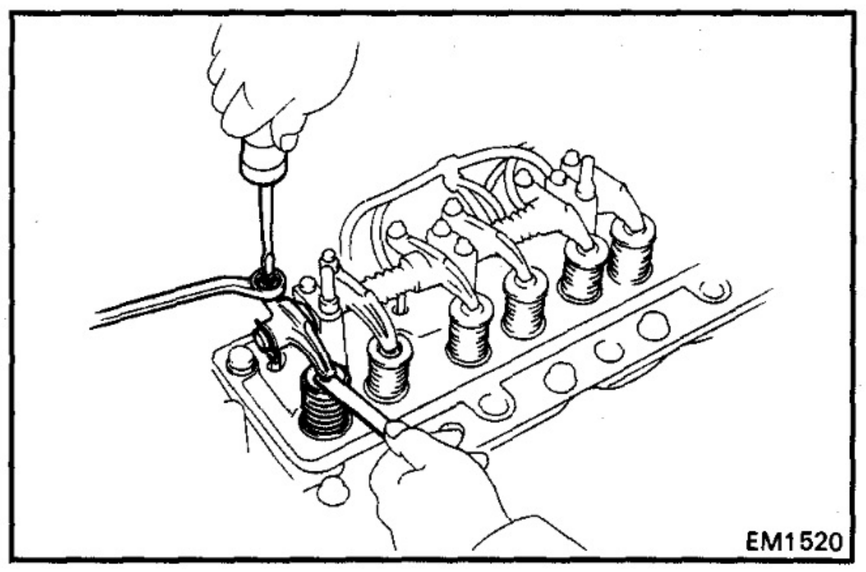
   If not, turn the crankshaft one revolution (360°) and align the mark as above.



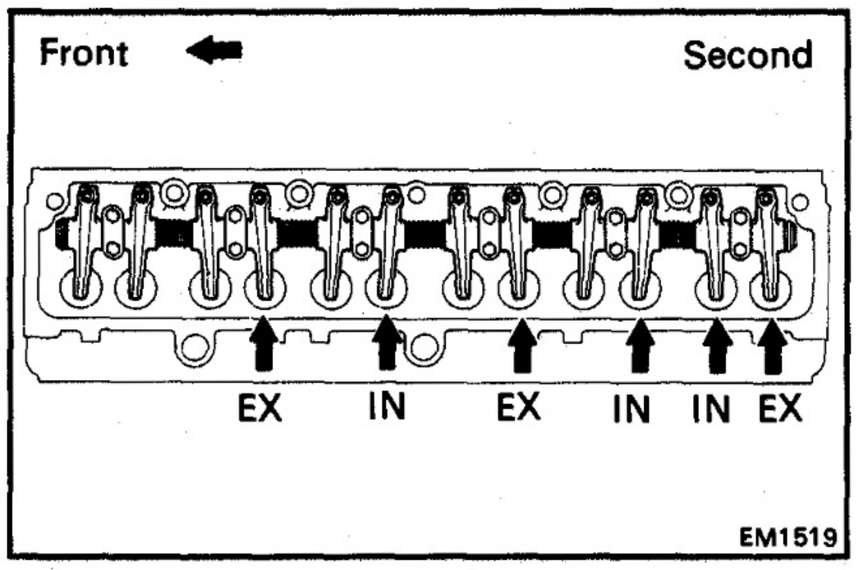
EM1519

4. **INSPECT AND ADJUST VALVE CLEARANCE**
   (a) Measure only those valves indicated by arrows.

Valve clearance (Hot):
Intake 0.20 mm (0.008 in.)
Exhaust 0.35 mm (0.014 in.)


EM1520

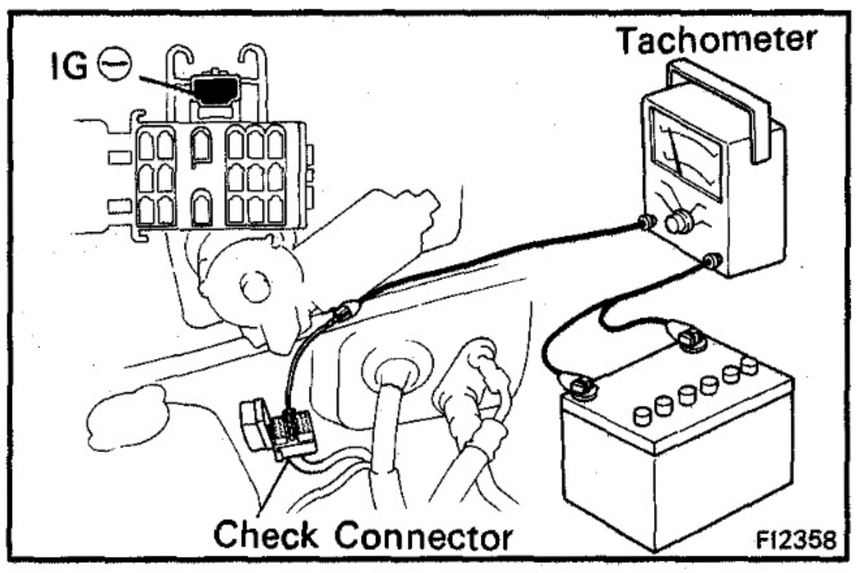
- Using a thickness gauge, measure the valve clearance between the valve stem and rocker arm.
  Loosen the lock nut and turn the adjusting screw to set the proper clearance.
  Hold the adjusting screw in position and tighten the lock nut.
- Recheck the valve clearance. The thickness gauge should slide with a very slight drag.



(b) Turn the crankshaft pulley one revolution (360°) and align the mark as above.
Adjust only the valves indicated by arrows.

5. **INSTALL CYLINDER HEAD COVER**
(See step 6 on page EM-29)

6. **INSTALL AIR CLEANER HOSE**



INSPECTION AND ADJUSTMENT OF IGNITION TIMING

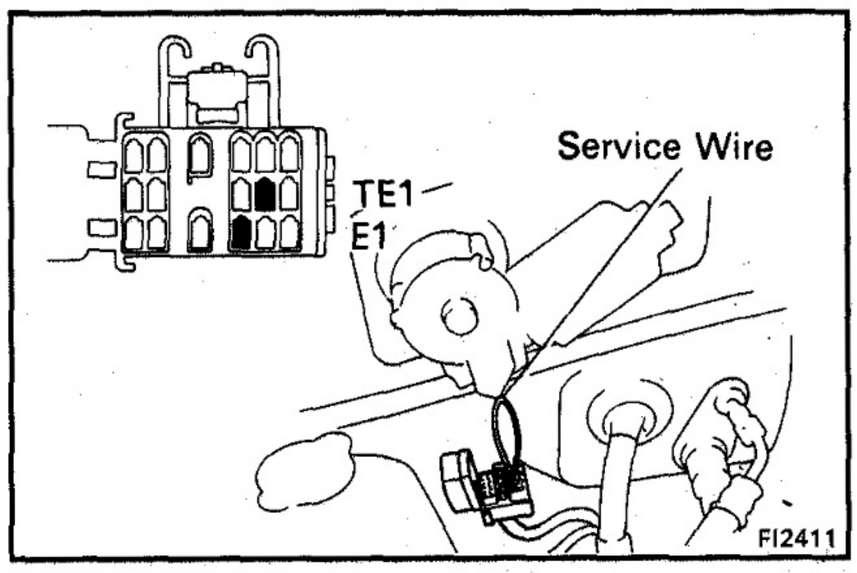
1. **WARM UP ENGINE**

Allow the engine to reach normal operating temperature.

2. **CONNECT TACHOMETER AND TIMING LIGHT TO ENGINE**

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

NOTICE:
- **NEVER allow the tachometer terminals 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 using.**

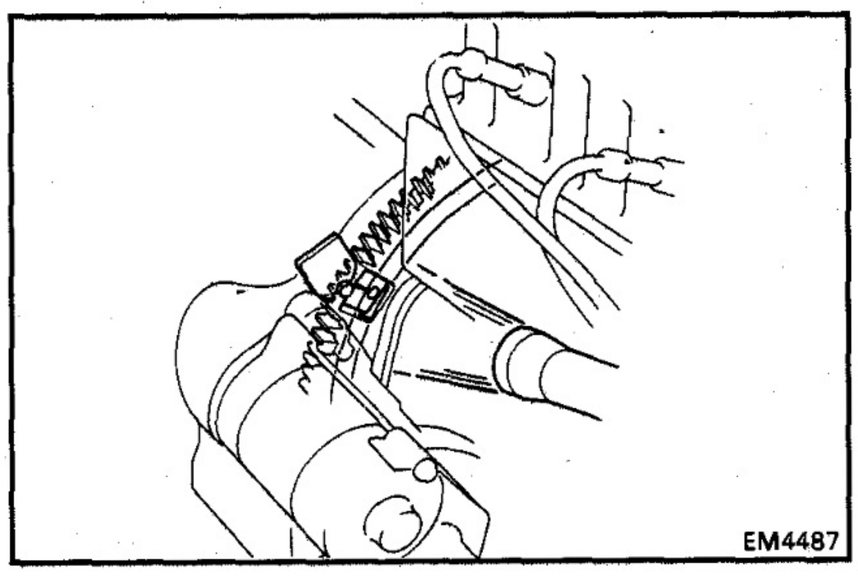


3. **INSPECT AND ADJUST IGNITION TIMING**

(a) Using a service wire, connect terminals TE1 and E1 of the check connector.

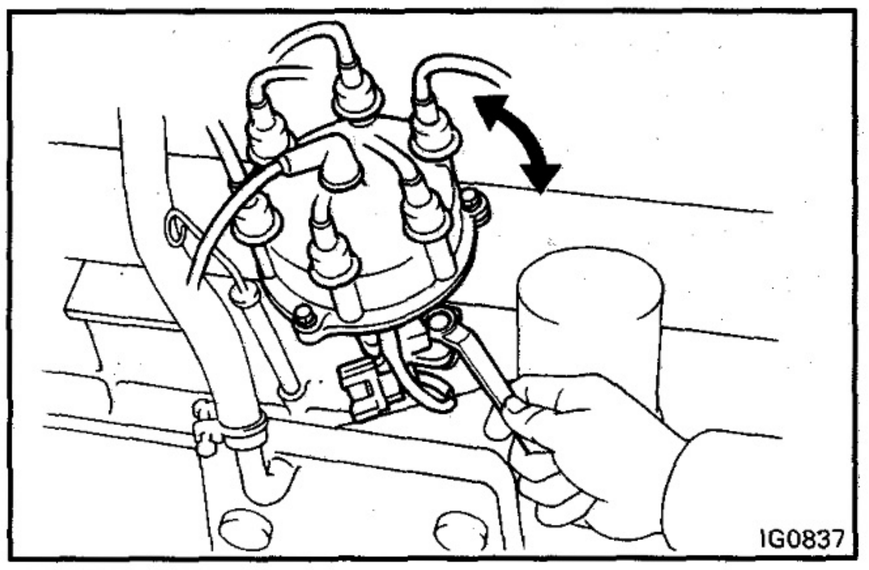
(b) Check the idle speed.

Idle speed: 650 rpm



(c) Using a timing light, check the ignition timing.

Ignition timing: 7° BTDC @ idle
(w/ connected TE1-E1,
Transmission in N position)



If necessary, loosen the distributor bolts and turn the distributor until the timing on the drive plate is aligned with the 7° mark.

(d) Tighten the distributor bolt and recheck the ignition timing,

Torque: 175 kg-cm (13 ft-lb, 17 N·m)

(e) Remove the service wire.

4. FURTHER CHECK IGNITION TIMING

Ignition timing: 12° BTDC @ idle
(Transmission in N range)

5. DISCONNECT TACHOMETER AND TIMING LIGHT FROM ENGINE

IDLE HC/CO CONCENTRATION CHECK METHOD

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

1. INITIAL CONDITIONS

(a) Engine at 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.

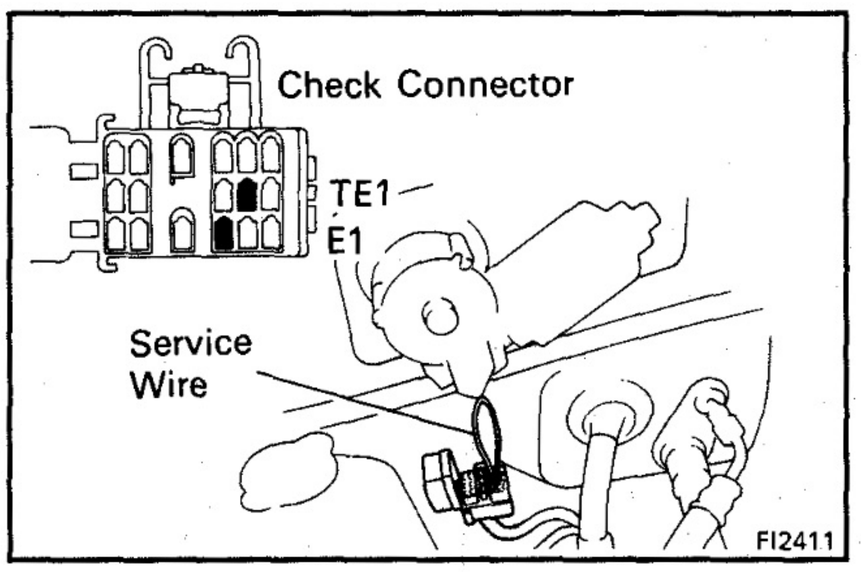
(f) EFI system wiring connectors fully plugged

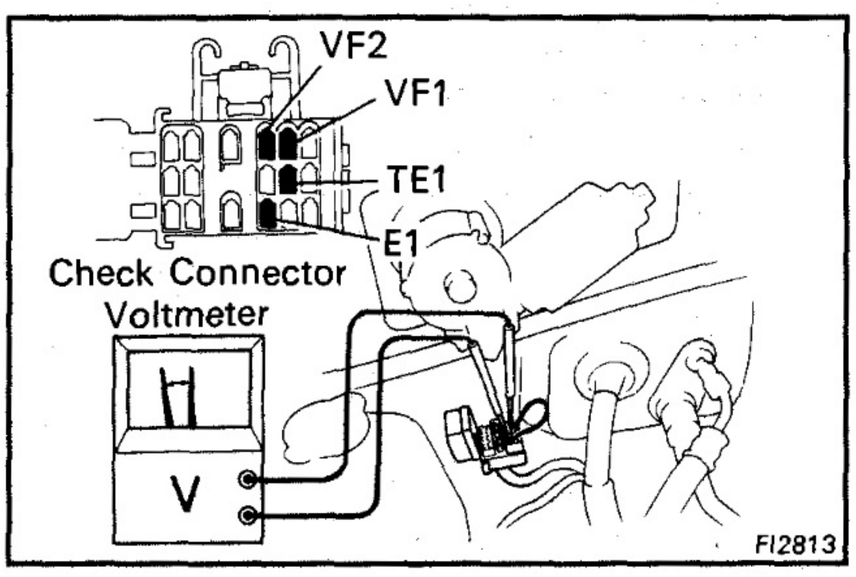
(g) Ignition timing set correctly

(h) Transmission in "N" range

(i) Tachometer and HC/CO meter at hand and calibrated

2. START ENGINE





3. CHECK OXYGEN SENSORS OPERATION

(a) Using a service wire, connect terminals TE1 and E1 of the check connector.

(b) Connect the positive (+) probe of a voltmeter to terminal VF1 (VF2) of the check connector, and negative (–) probe to terminals E1.

(c) Hold the engine speed at 2,500 rpm for approx. 2 minutes.

(d) Then, maintaining engine at 2,500 rpm, count how many times needle of voltmeter fluctuates between 0 and 5 V.

Minimum needle fluctuation:
8 times for every 10 seconds

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

4. **RACE ENGINE AT 2,500 RPM FOR APPROX. 2 MINUTES**

5. **INSERT HC/CO METER TESTING PROBE INTO TAIL PIPE AT LEAST 40 cm (1.3 ft)**

6. **MEASURE HC/CO CONCENTRATION AT IDLE**

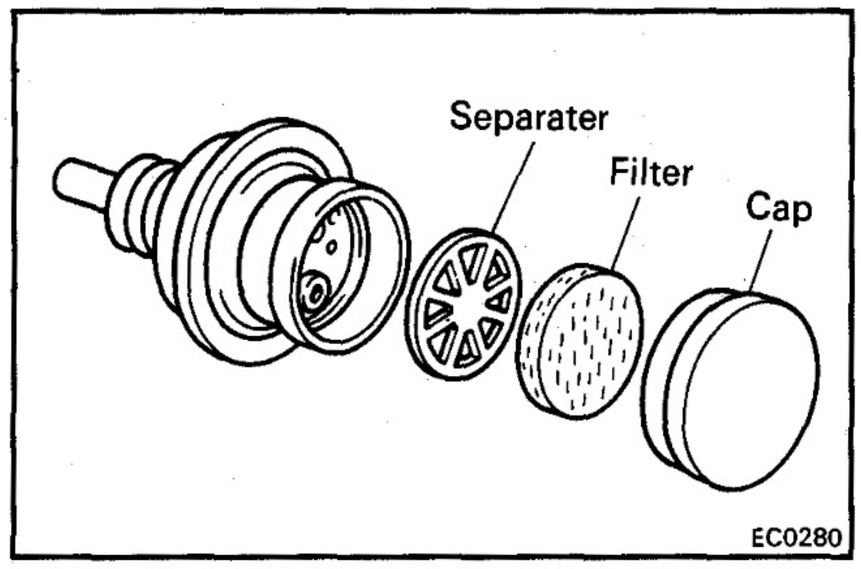
   Wait at least one minute before measuring to allow the concentration to stabilize.

   Complete the measuring within three minutes.

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

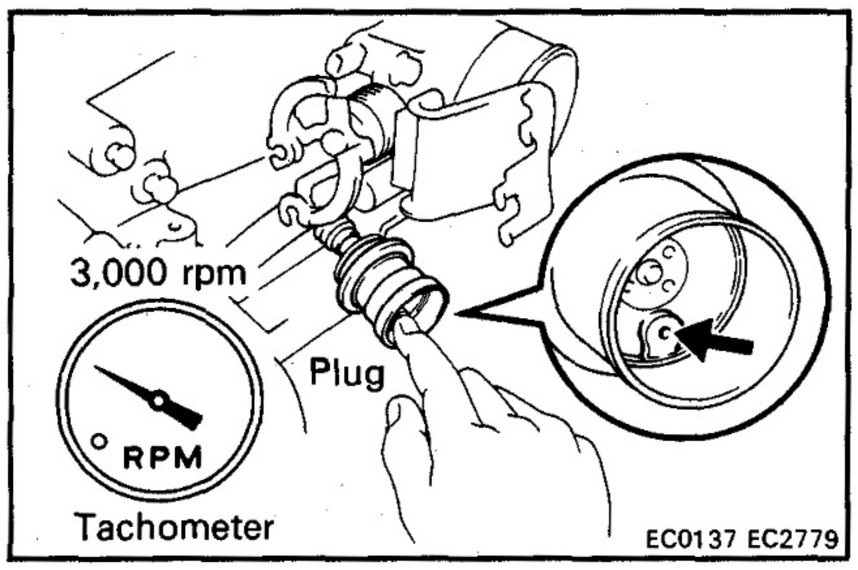
Troubleshooting

HC	CO	Problem	Cause
High	Normal	Rough idle	1. Faulty ignition: • Incorrect timing • Fouled, shorted or improperly gapped plugs • Open or crossed high-tension cords • Cracked distributor cap 2. Incorrect valve clearance 3. Leaky EGR valve 4. Leaky intake and exhaust valves 5. Leaky cylinder
High	Low	Rough idle (Fluctuating HC reading)	1. Vacuum leak: • PCV hose • EGR valve • Intake manifold • Air intake chamber • Throttle body • ISC valve • Brake booster line 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Faulty EFI system • Faulty pressure regulator • Clogged fuel return line • Defective water temp. sensor • Defective air temp. sensor • Faulty ECU • Faulty injector • Faulty cold start injector • Faulty throttle position sensor • Air flow meter

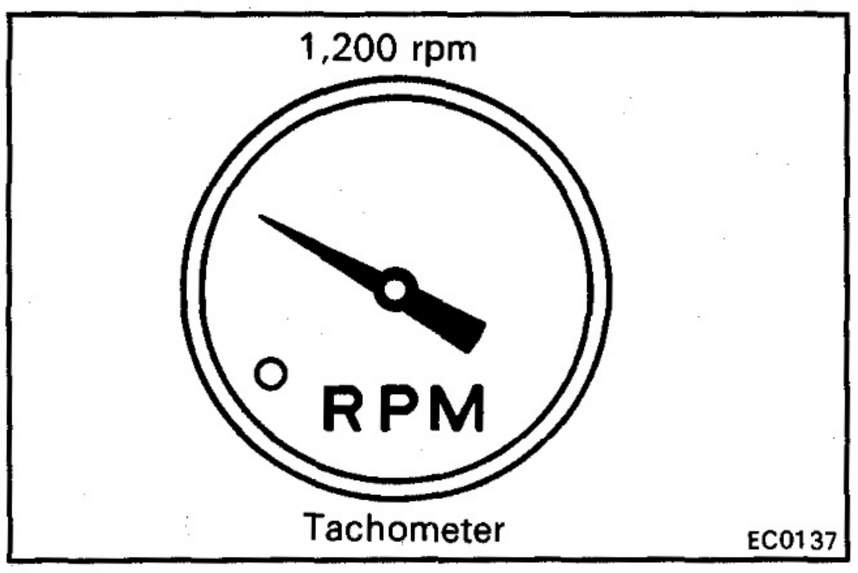


INSPECTION AND ADJUSTMENT OF DASH POT (DP) SETTING SPEED

1. **WARM UP ENGINE**
2. **CHECK IDLE SPEED**
3. **DISCONNECT ISC CONNECTOR**
4. **REMOVE CAP, FILTER AND SEPARATER FROM DP**

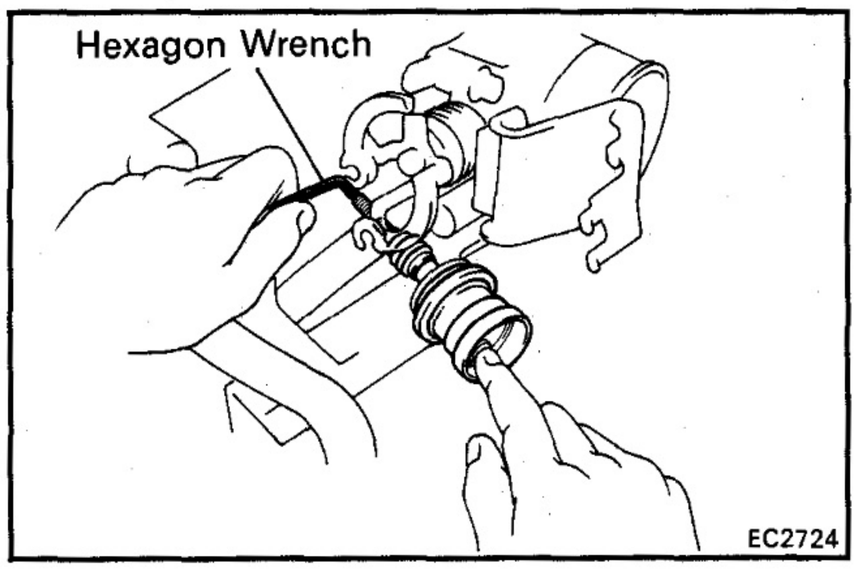


5. **CHECK DP SETTING SPEED**
   (a) Maintain engine speed at 2,500 rpm.
   (b) Plug the VTV hole with your finger.

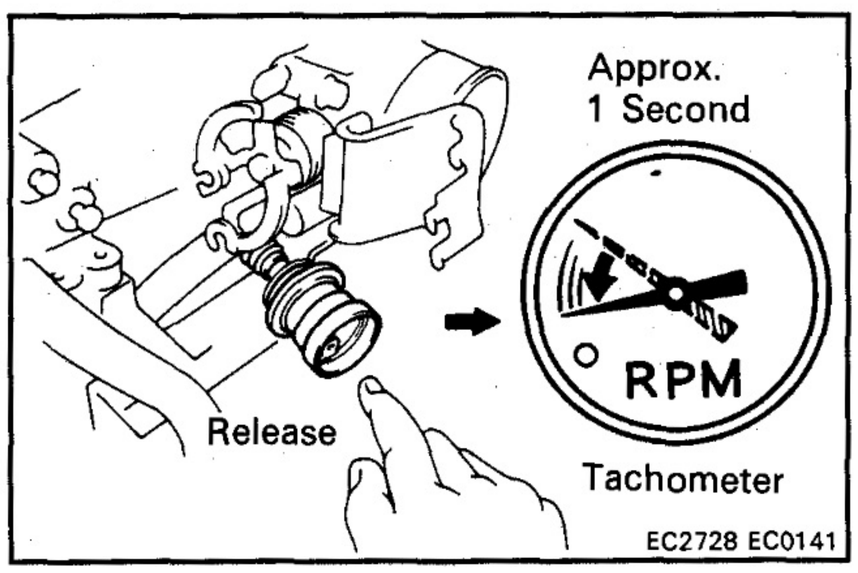


(c) Release the throttle valve.
(d) Check that the DP is set.

DP setting speed: 1,200 rpm.



If not as specified, adjust with the DP adjusting screw.



6. **CHECK OPERATION OF VTV**
   (a) Set the DP speed in the same procedure as above; (a) to (c).
   (b) Release the plugged hole and check that the engine returns to idle in approx. 1 second.
7. **REINSTALL DP SEPARATER, FILTER AND CAP**
8. **RECONNECT ISC CONNECTOR**

COMPRESSION CHECK

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

1. **WARM UP AND STOP ENGINE**
2. **DISCONNECT DISTRIBUTOR CONNECTOR**
3. **DISCONNECT COLD START INJECTOR CONNECTOR**
4. **REMOVE SPARK PLUGS**
5. **CHECK CYLINDER COMPRESSION PRESSURE**
   (a) Insert a compression gauge into the spark plug hole.
   (b) Fully open the throttle valve.
   (c) While cranking the engine with the starter, measure the compression pressure.

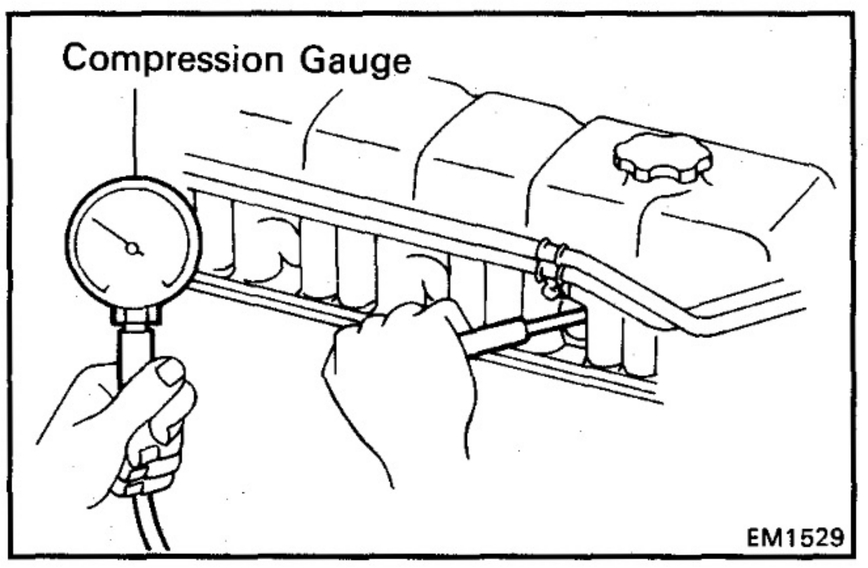
   HINT: Always use a fully charged battery to obtain engine revolutions of more than 200 rpm.

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

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

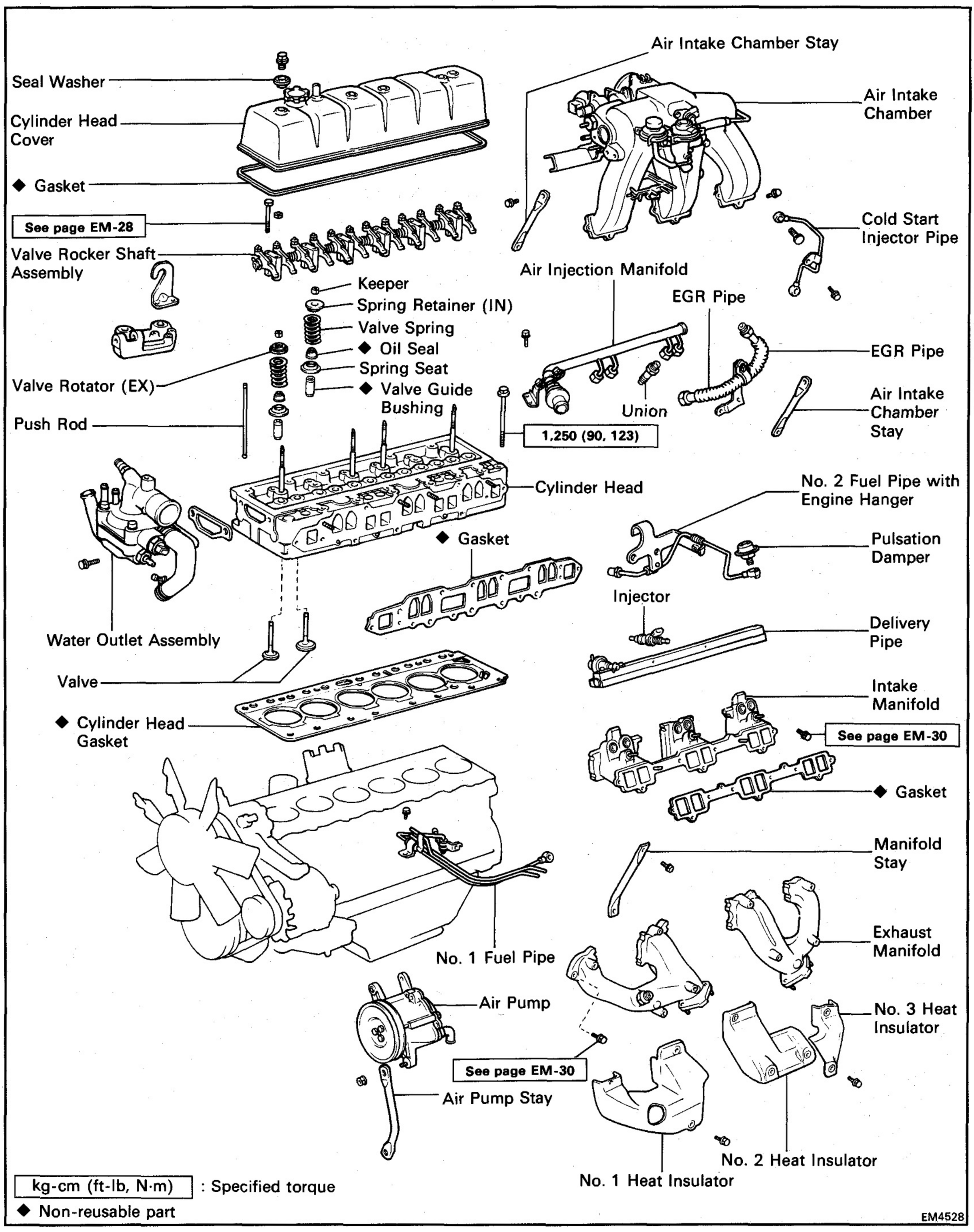
   Compression pressure:
   10.5 kg/cm² (149 psi, 1,030 kPa) or more
   Minimum pressure:
   8.0 kg/cm² (114 psi, 785 kPa)
   Difference between each cylinder:
   0.5 kg/cm² (7 psi, 49 kPa) or less

   (e) If compression of one or more cylinders is low, pour a small amount of engine oil into that cylinder through the spark plug hole and repeat steps (a) through (c) for the cylinder with low compression.
   - If adding oil helps the compression, probably the piston rings and / or cylinder bore are worn or damaged.
   - If pressure stays low, a valve may be sticking or seated improperly, or there may be leakage past the gasket surface.
6. **REINSTALL SPARK PLUGS**
   Torque: 180 kg-cm (13 ft-lb, 18 N·m)
7. **RECONNECT COLD START INJECTOR CONNECTOR**
8. **RECONNECT DISTRIBUTOR CONNECTOR**



CYLINDER HEAD

COMPONENTS



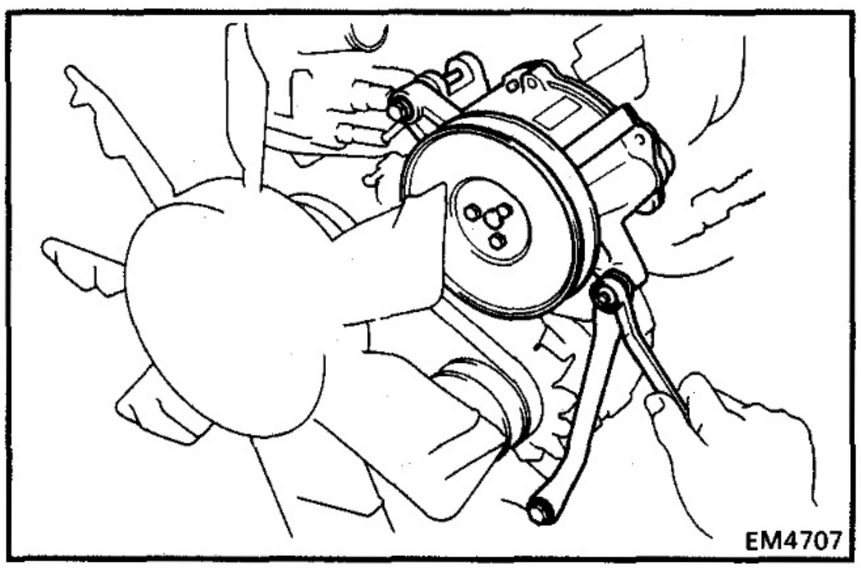
REMOVAL OF CYLINDER HEAD

(See page EM-17)

1. **DRAIN ENGINE COOLANT**

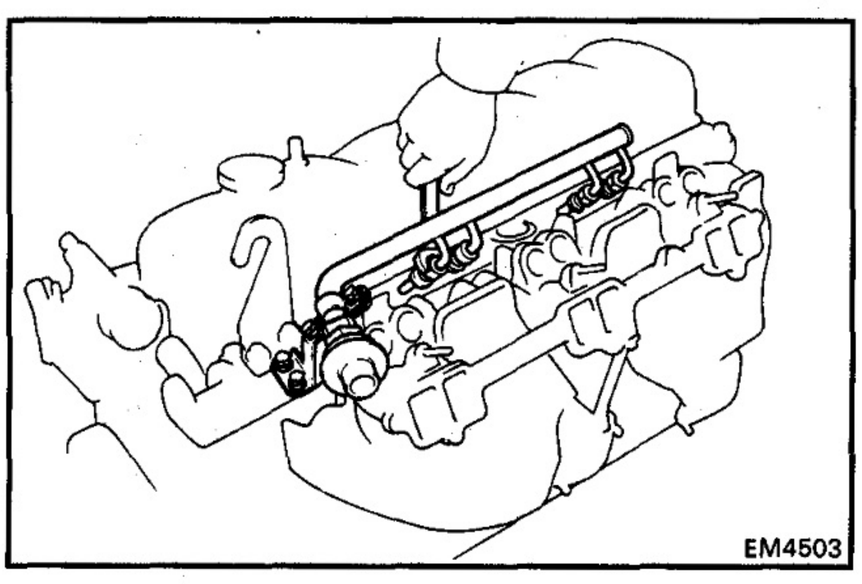
2. **REMOVE PS PUMP BRACKETS**

3. **DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS AND IGNITION COIL**

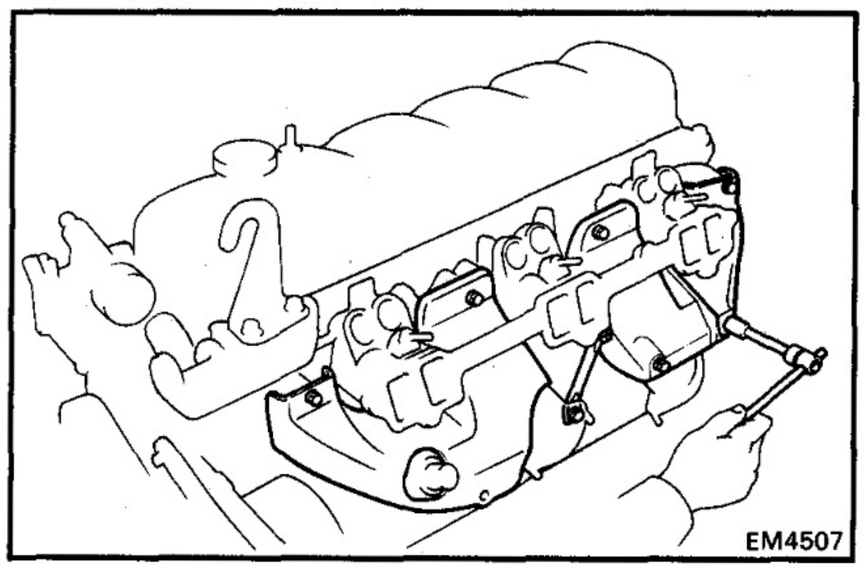


4. **REMOVE AIR PUMP**
   (a) Disconnect the air hose.
   (b) Remove the bolt, nut and air pump stay.
   (c) Remove the through bolt, nut and air pump.

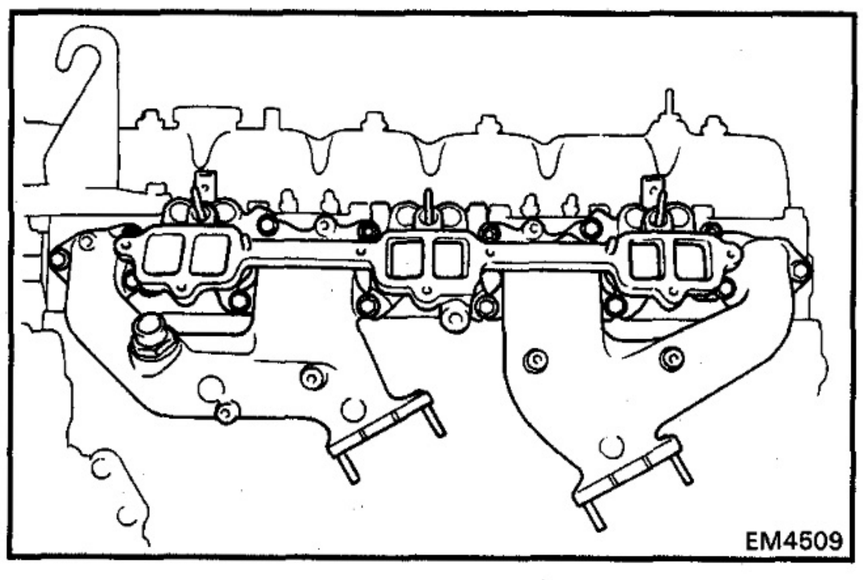
5. **REMOVE DELIVERY PIPE AND INJECTORS**
   (See steps 4 to 9 on pages FI-56 and 57)



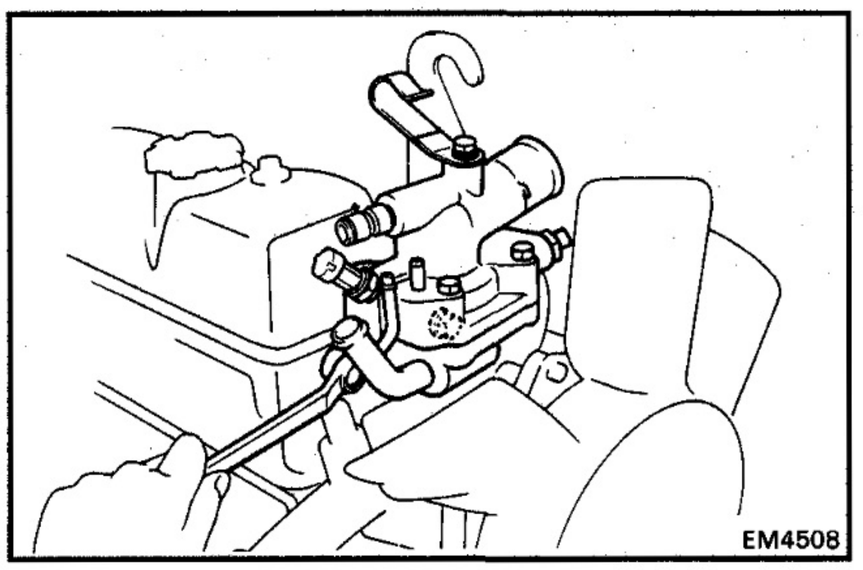
6. **REMOVE AIR INJECTION MANIFOLD**
   Remove the two bolts, four union nuts and air injection manifold.



7. **REMOVE INTAKE AND EXHAUST MANIFOLDS**
   (a) Remove the two bolts and manifold stay.
   (b) Remove the six bolts and three manifold heat insulators.



   (c) Remove the ten bolts, four nuts, intake manifold, exhaust manifolds and gasket.

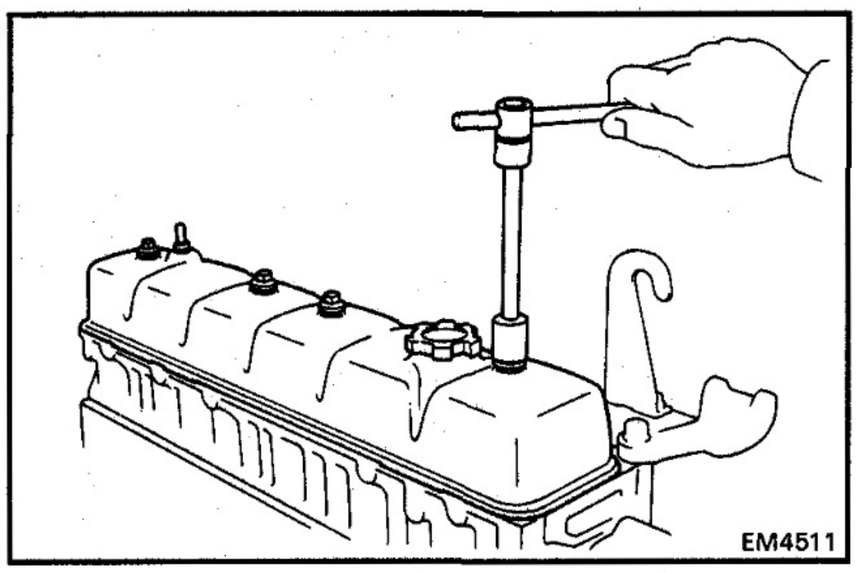


8. REMOVE WATER OUTLET ASSEMBLY

(a) Disconnect the water by-pass hose from the water outlet.

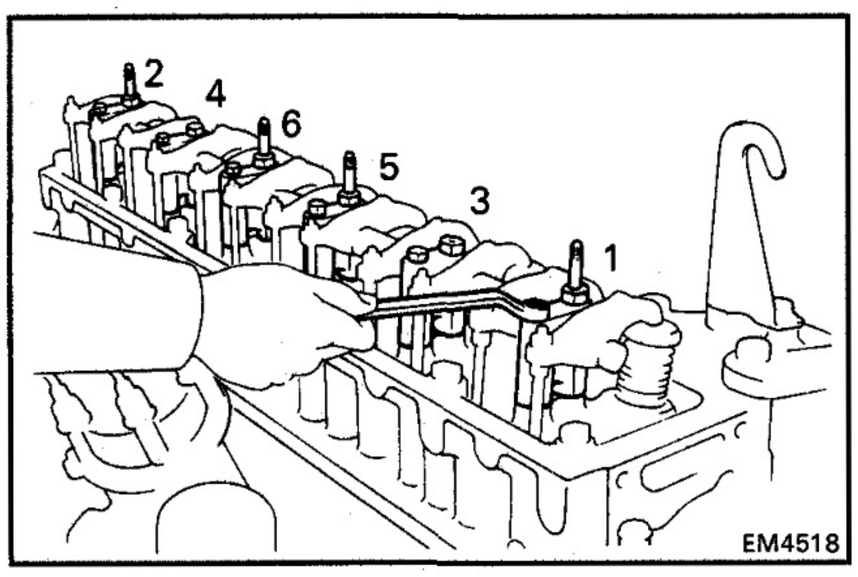
(b) Remove the two bolts holding the water outlet housing to the cylinder head, and remove the water outlet assembly and gasket.

9. REMOVE SPARK PLUGS



10. REMOVE CYLINDER HEAD COVER

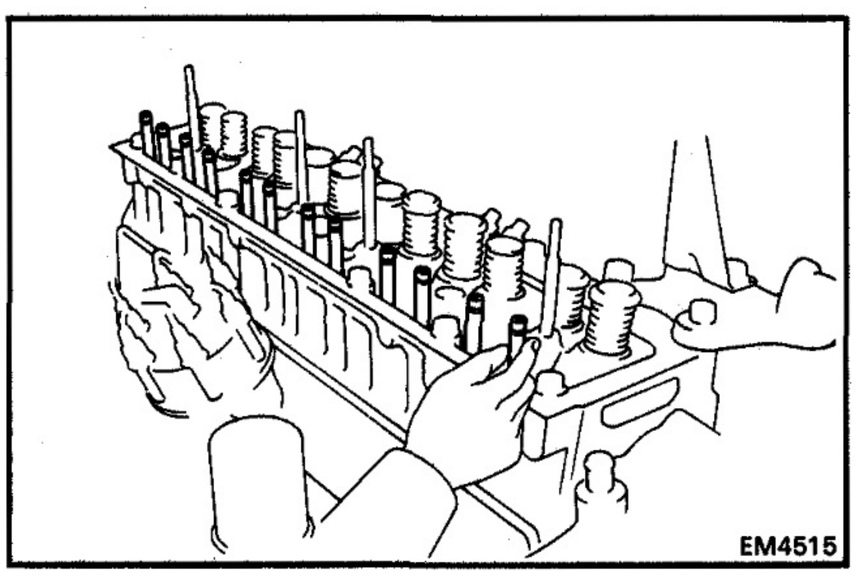
Remove the four cap nuts, seal washers, cylinder head cover and gasket.



11. REMOVE VALVE ROCKER SHAFT ASSEMBLY

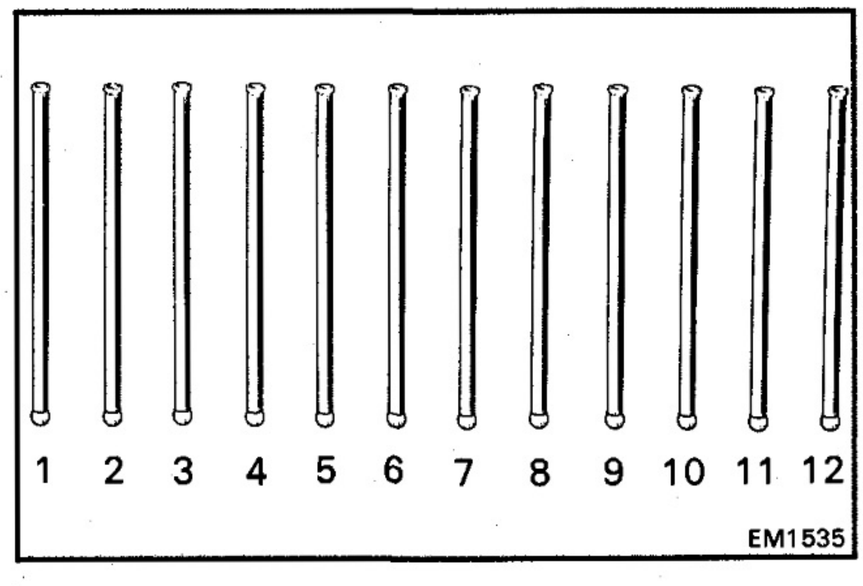
(a) Uniformly loosen and remove the eight bolts and four nuts in several passes, in the sequence shown.

(b) Remove the rocker shaft assembly.

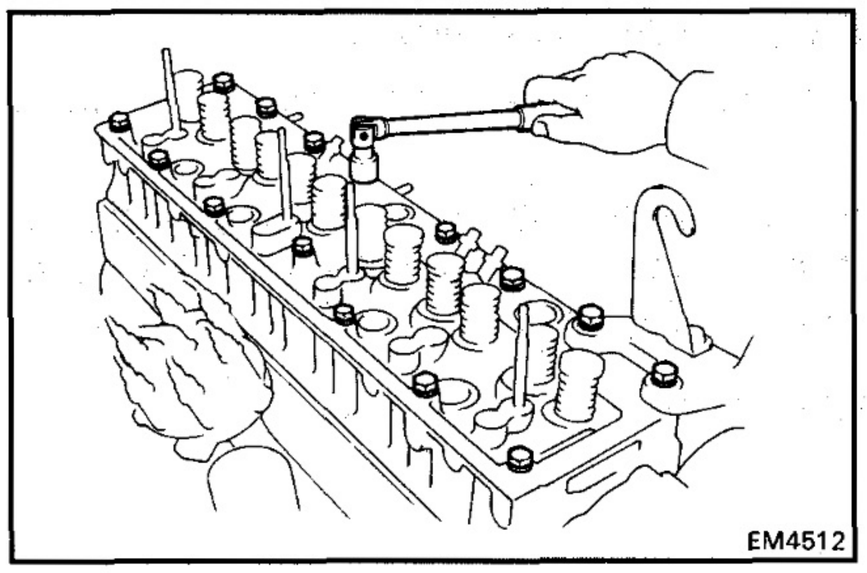


12. REMOVE PUSH RODS

Remove the twelve push rods in order, beginning from the No. 1 push rod.



HINT: Arrange the push rods in correct order.

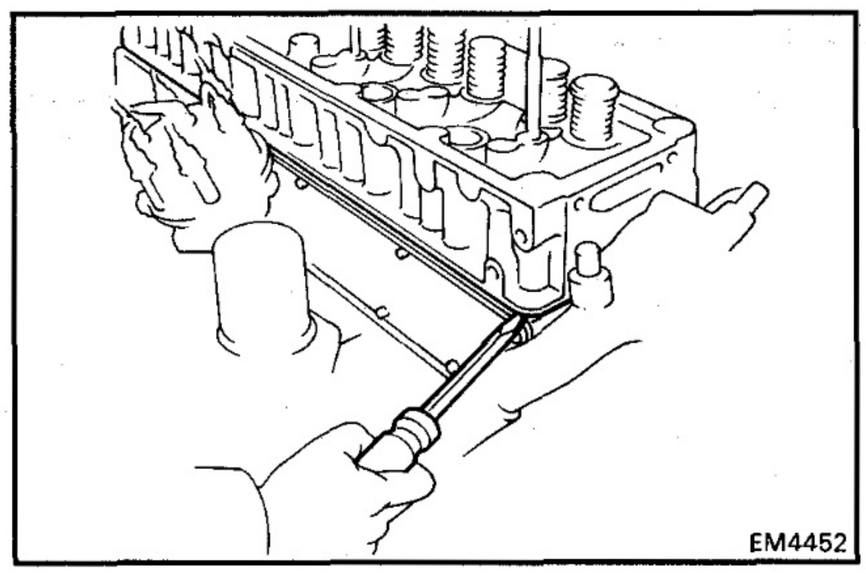


13. REMOVE CYLINDER HEAD

(a) Uniformly loosen and remove the fifteen head bolts in several passes, in the sequence shown.

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

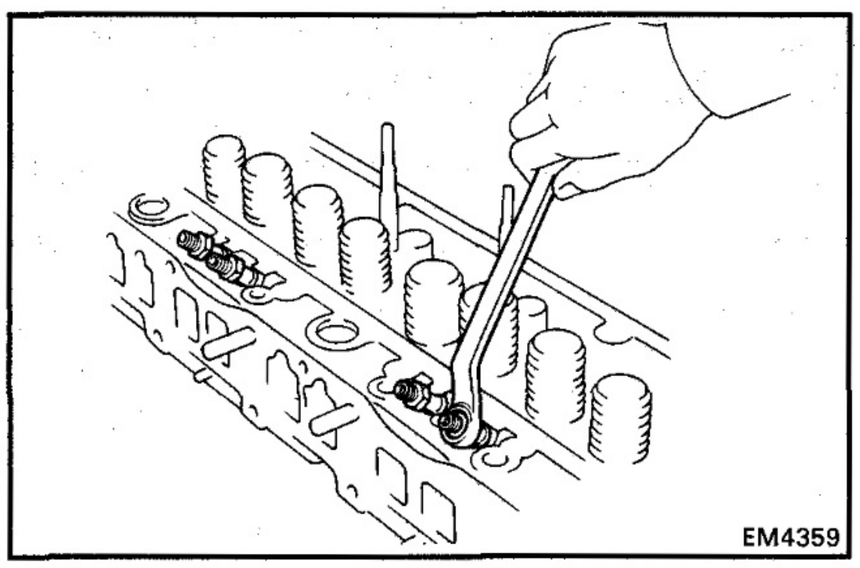
(b) Remove the air pump bracket with engine hanger.



(c) Lift the cylinder head from the dowels on the cylinder block and place it 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.

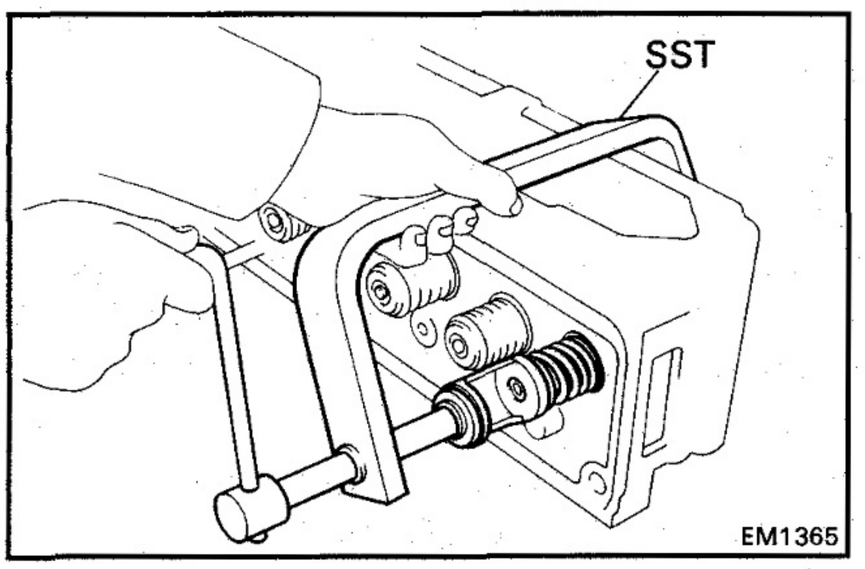
NOTICE: Be careful not to damage the cylinder head and block surface on the cylinder and head gasket sides.



DISASSEMBLY OF CYLINDER HEAD

(See page EM-17)

1. REMOVE AIR INJECTION MANIFOLD UNIONS

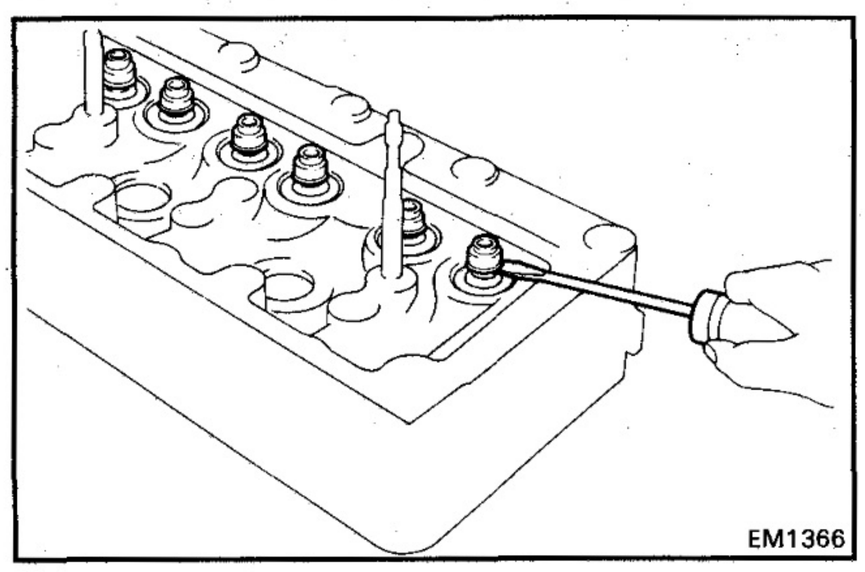


2. REMOVE VALVES

(a) Using SST, press the valve springs and remove the two keepers.

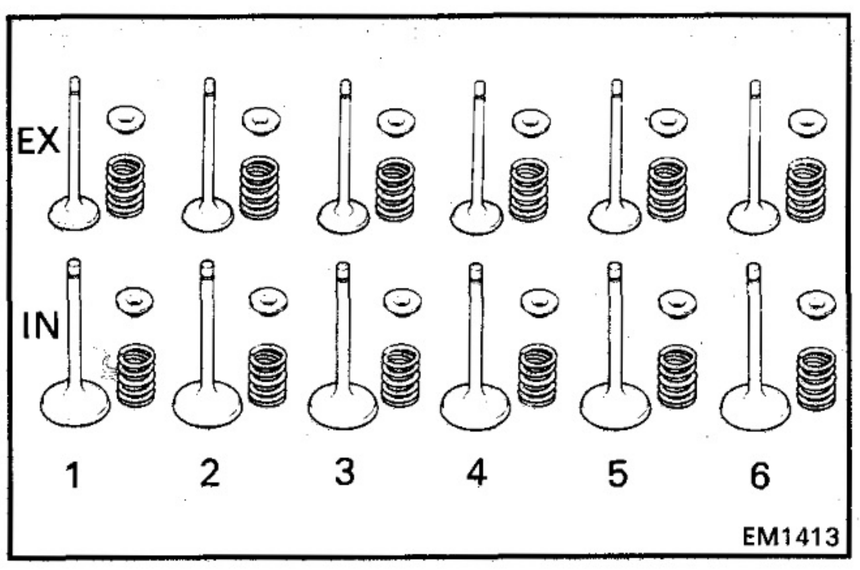
SST 09202-43013

(b) Remove the spring retainer (or valve rotator), valve springs and valve.

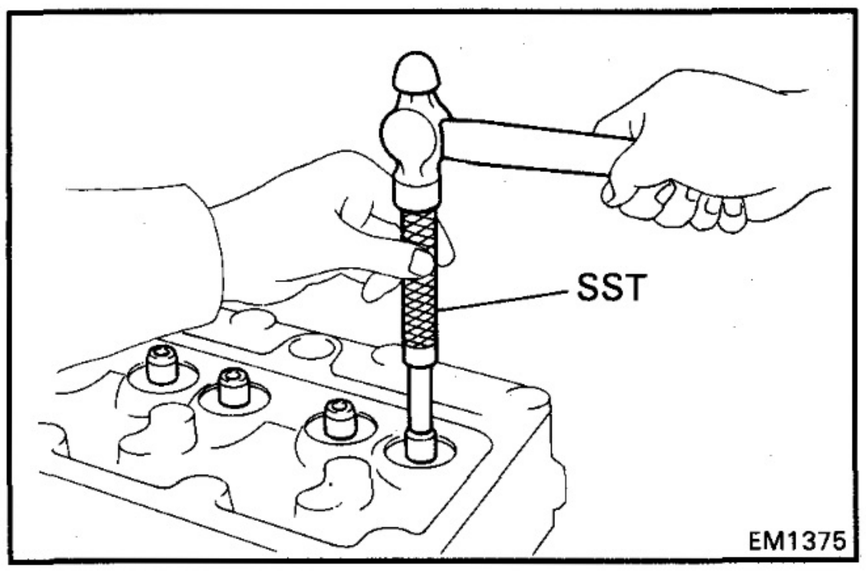


(c) Using a screwdriver, pry out the valve stem oil seal.

(d) Remove the valve spring seat.



NOTE: Arrange the valves, valve springs and spring retainers (or valve rotators) in correct order.

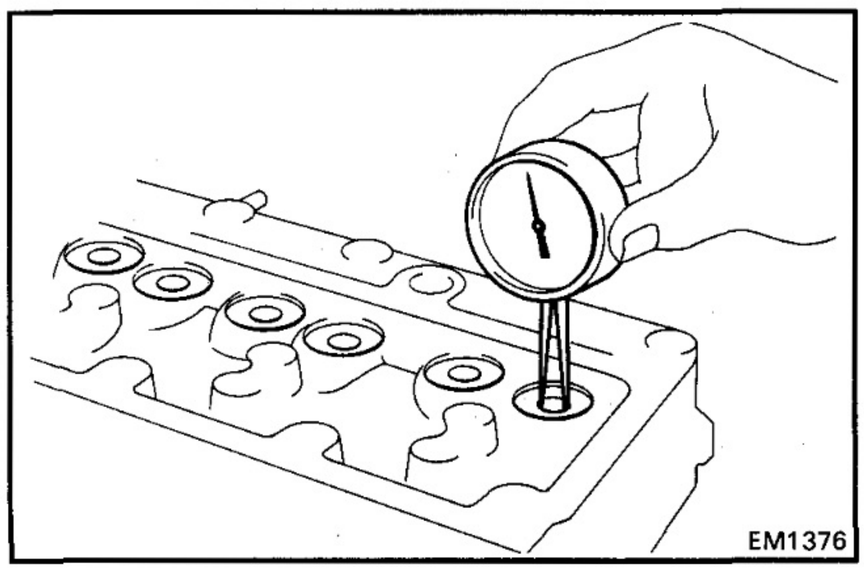


INSPECTION, CLEANING AND REPAIR OF CYLINDER HEAD COMPONENTS

10. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

(a) Using SST and a hammer, drive out the valve guide bushing.

SST 09201-60011



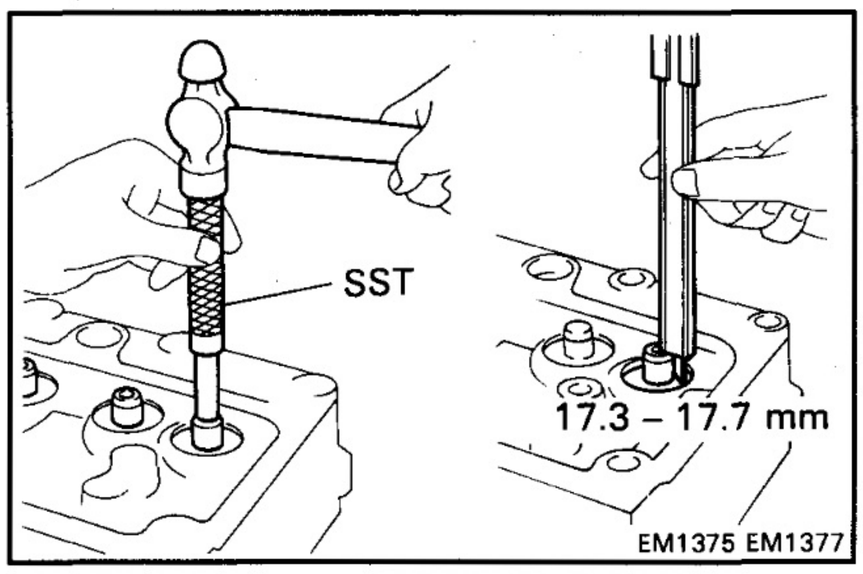
(b) Using a caliper gauge, measure the bushing bore diameter of the cylinder head.

Standard valve guide bore (cold):
14.000 – 14.018 mm (0.5512 – 0.5519 in.)

If the bushining bore diameter of the cylinder head is more than 14.018 mm (0.5512 in.), machine the bore to the following dimensions and install an oversized bushing (O/S 0.05).

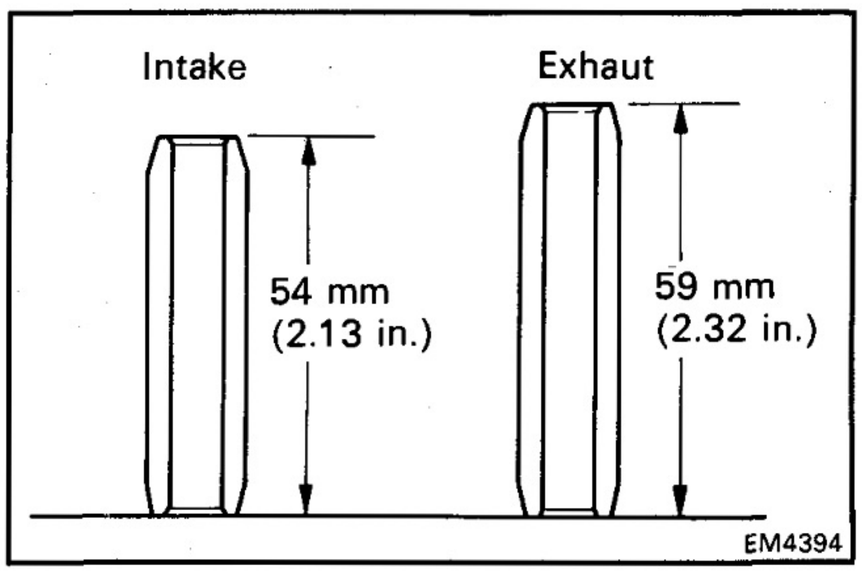
Rebored cylinder head bushing bore dimension:
14.050 – 14.068 mm (0.5531 – 0.5539 in.)

If the bushing bore diameter of the cylinder head is greater than 14.068 mm (0.5539 in.), replace the cylinder head.

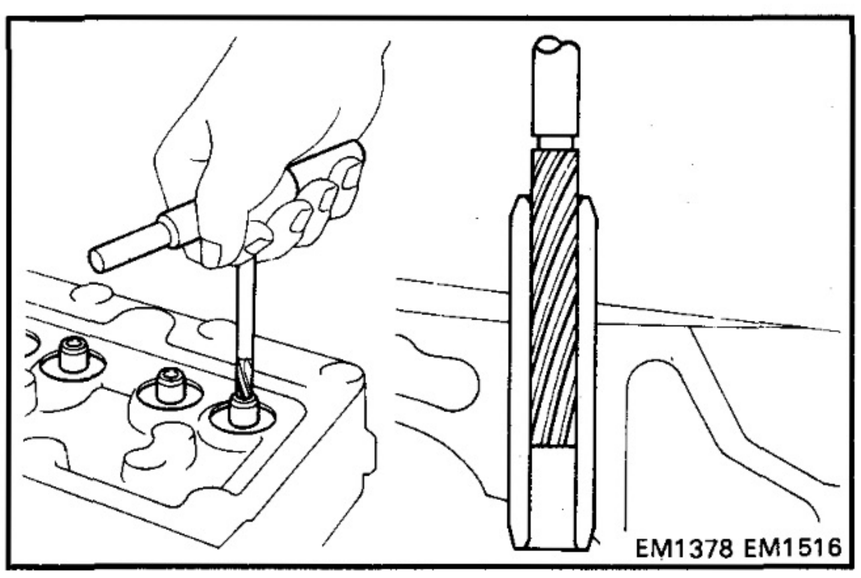


(c) Using SST and a hammer, drive in a new valve guide bushing so it is protruding 17.3 – 17.7 mm (0.681 – 0.697 in.) from the cylinder head.

SST 09201-60011

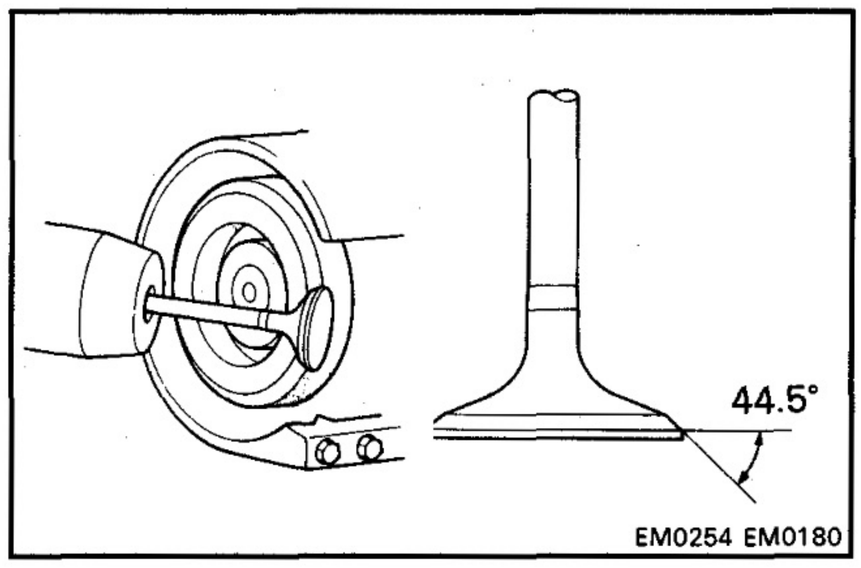


HINT: Different bushings are used for the intake and exhaust.



(d) Using a sharp 8.0 mm reamer, ream the valve guide bushing to obtain the specified clearance between the valve guide bushing and the new valve.

Intake clearance: **0.025 – 0.060 mm (0.0010 – 0.0024 in.)**
Exhaust clearance: **0.035 – 0.070 mm (0.0014 – 0.0028 in.)**

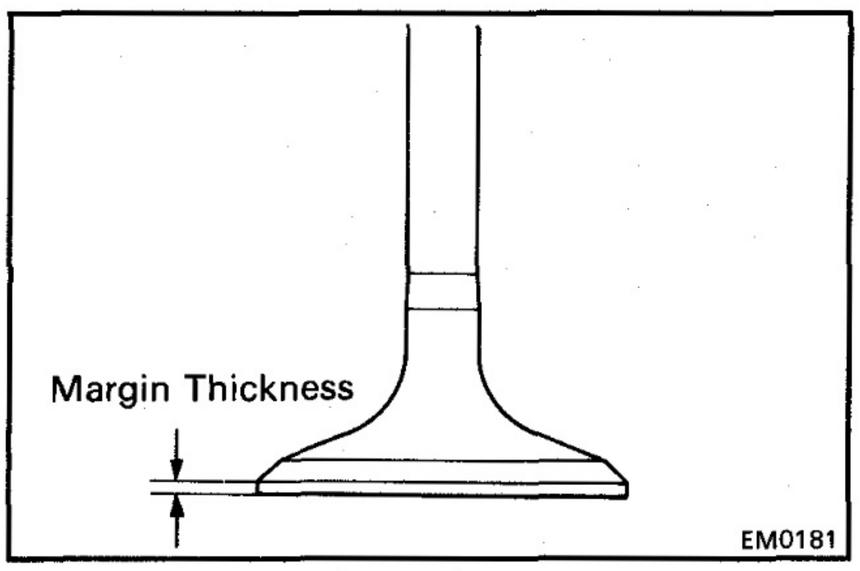


11. INSPECT AND GRIND VALVES

(a) Grind the valve only enough to remove pits and carbon.

(b) Check that the valve is ground to the correct valve face angle.

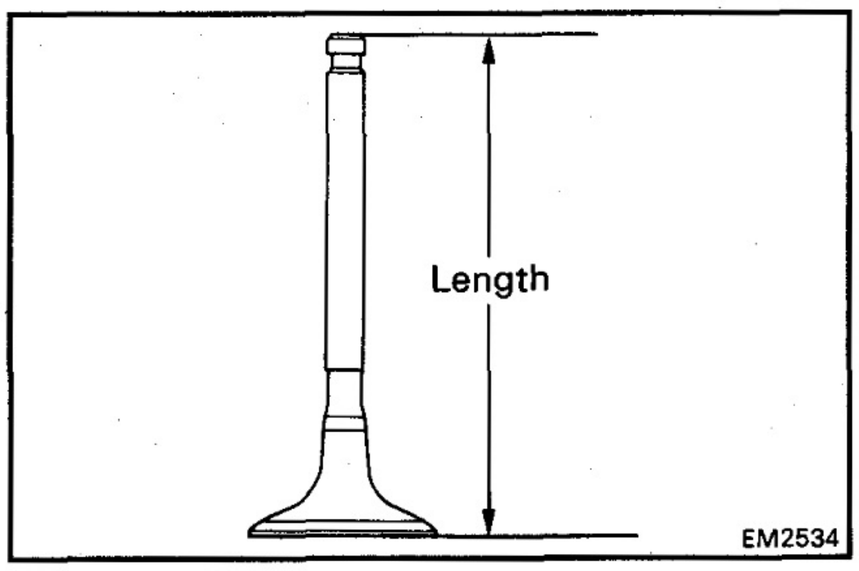
Valve face angle: 44.5°



(c) Check the valve head margin thickness.

Standard margin thickness:
Intake 1.5 – 2.1 mm (0.059 – 0.083 in.)
Exhaust 1.7 – 2.3 mm (0.067 – 0.091 in.)
Minimum margin thickness:
Intake 1.0 mm (0.039 in.)
Exhaust 1.2 mm (0.047 in.)

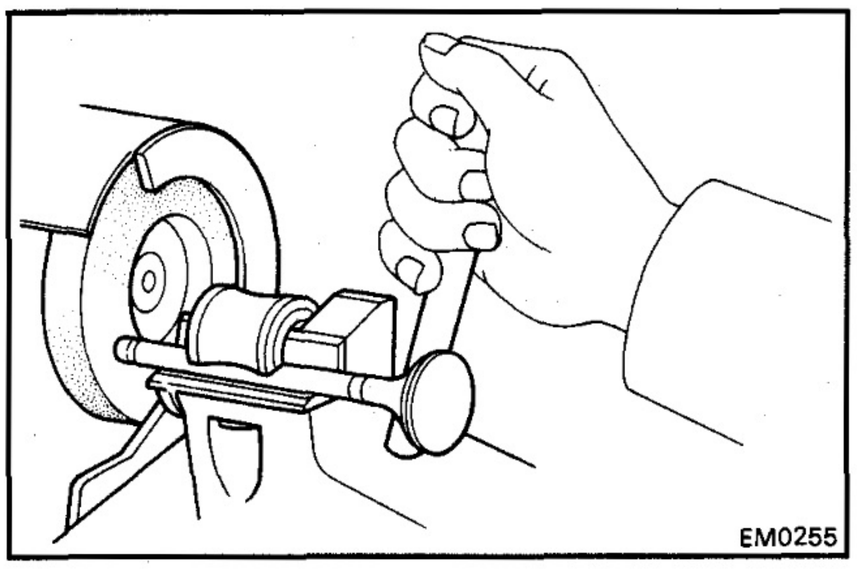
If the valve head margin thickness is less than minimum, replace the valve.



(d) Check the valve overall length.

Standard overall length:
Intake 124.8 mm (4.913 in.)
Exhaust 128.0 mm (5.039 in.)
Minimum overall length:
Intake 124.3 mm (4.894 in.)
Exhaust 127.5 mm (5.020 in.)

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



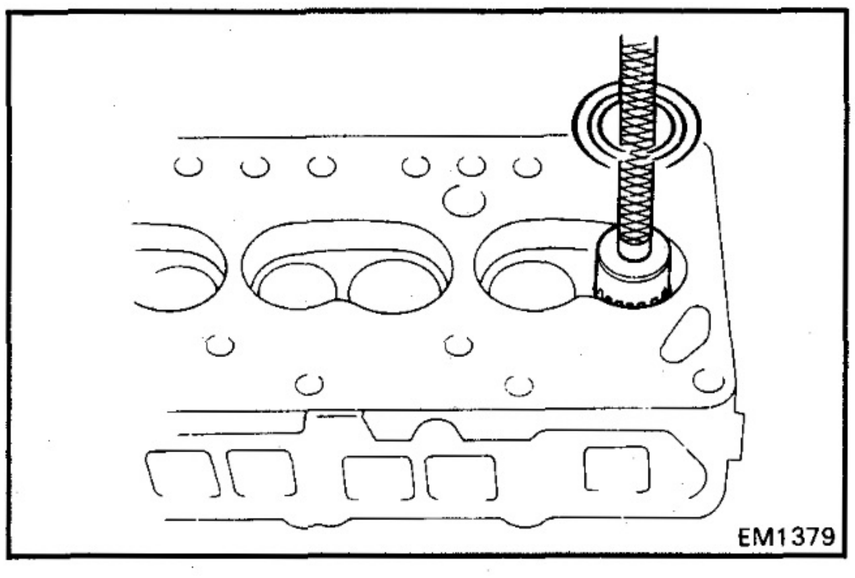
(e) Check the surface of the valve stem tip for wear.

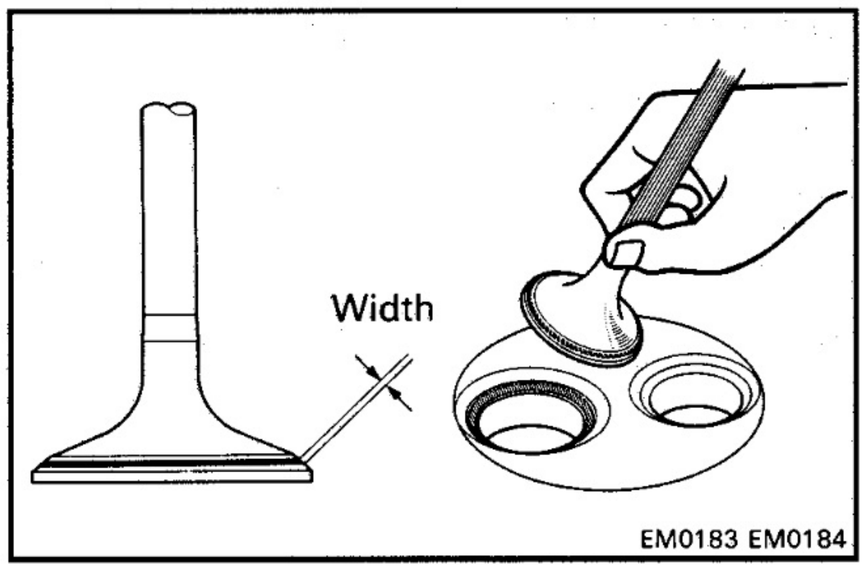
If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

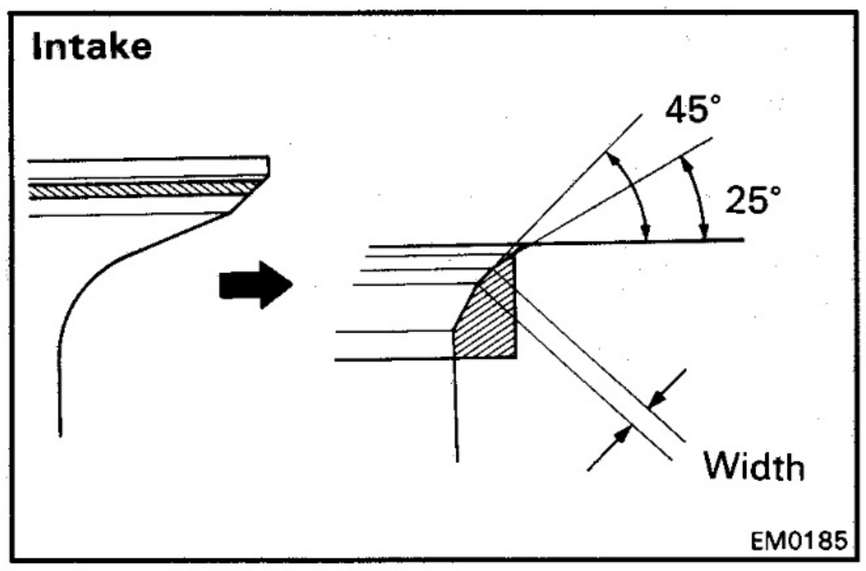
CAUTION: Do not grind off more than the minimum overall length.

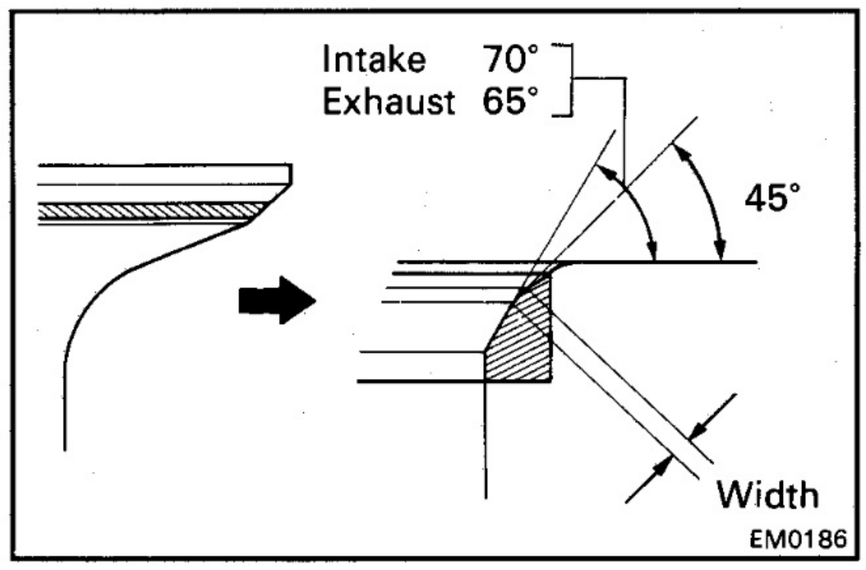
12. INSPECT AND CLEAN VALVE SEATS

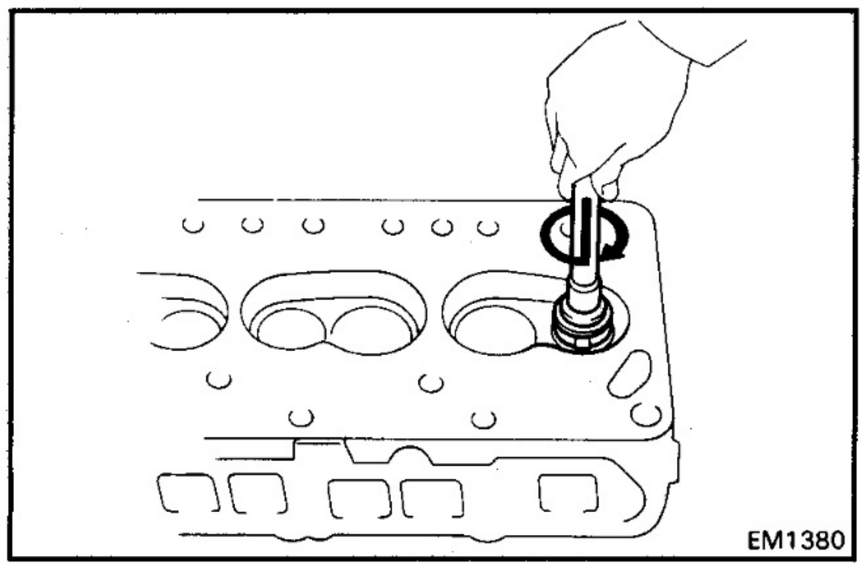
(a) Using a 45° carbide cutter, resurface the valve seats. Remove only enough metal to clean the seats.











(b) Check the valve seating position.
Apply a thin coat of prussian blue (or white lead) to the valve face. Install the valve. While applying light pressure to the valve, rotate the valve against the seat.

(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 seat are concentric. If not, resurface the seat.
- Check that the seat contact is on the middle of the valve face with the following width:

Intake 1.1 – 1.7 mm (0.043 – 0.067 in.)
Exhaust 1.4 – 2.0 mm (0.055 – 0.079 in.)

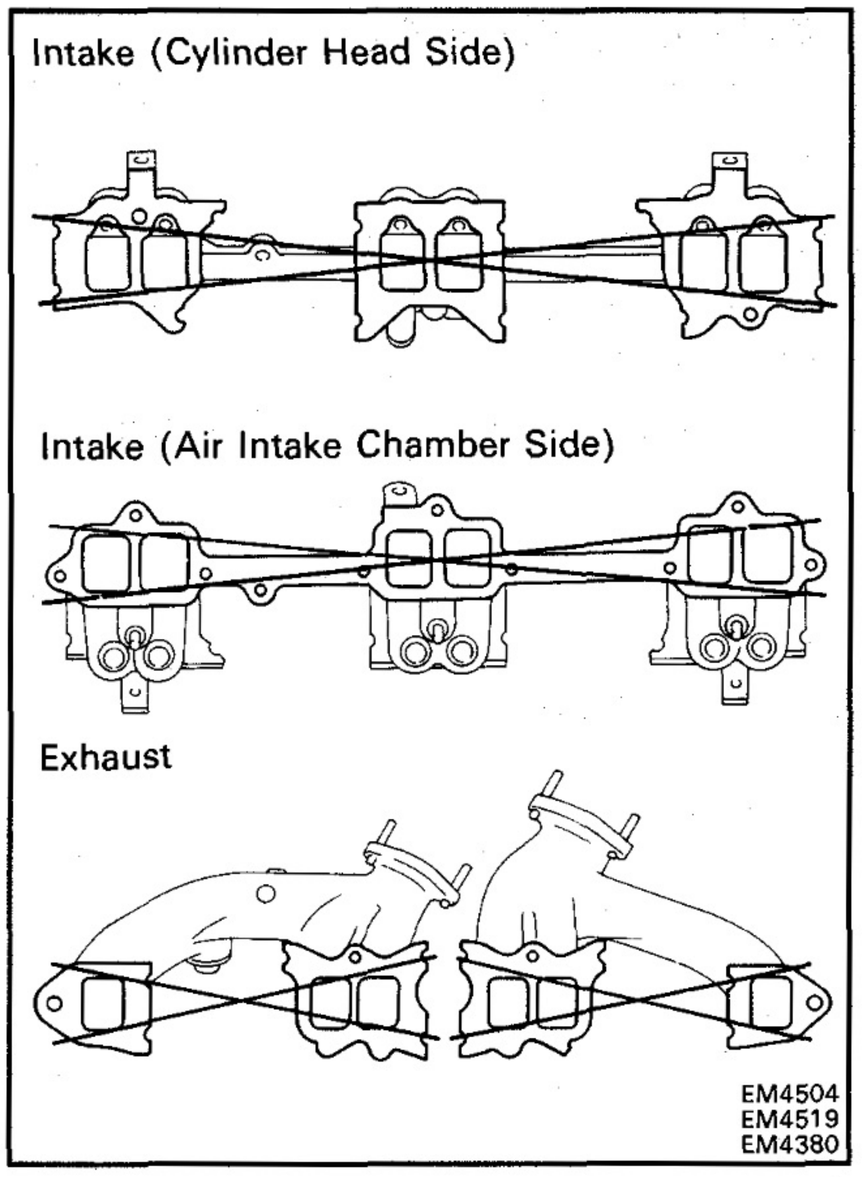
If not, correct the valve seat as follows:

(1) (Intake)
If the seating is too high on the valve face, use 25° (IN) and 45° cutters to correct the seat.

(2) If the seating is too low on the valve face, use 70° (IN) or 65° (EX) 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.

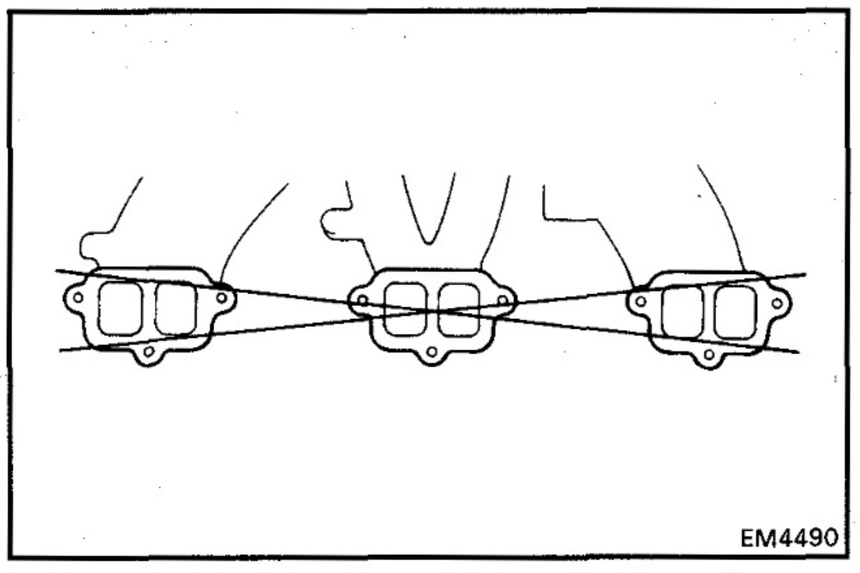


16. INSPECT INTAKE AND EXHAUST MANIFOLDS

Using a precision straight edge and thickness gauge, measure the surfaces contacting the cylinder head and air intake chamber for warpage.

Maximum warpage: 0.50 mm (0.0197 in.)

If the warpage is greater than maximum, replace the manifold.



17. INSPECT AIR INTAKE CHAMBER

Using a precision straight edge and thickness gauge, measure the surfaces contacting the intake manifold for warpage.

Maximum warpage: 0.2 mm (0.008 in.)

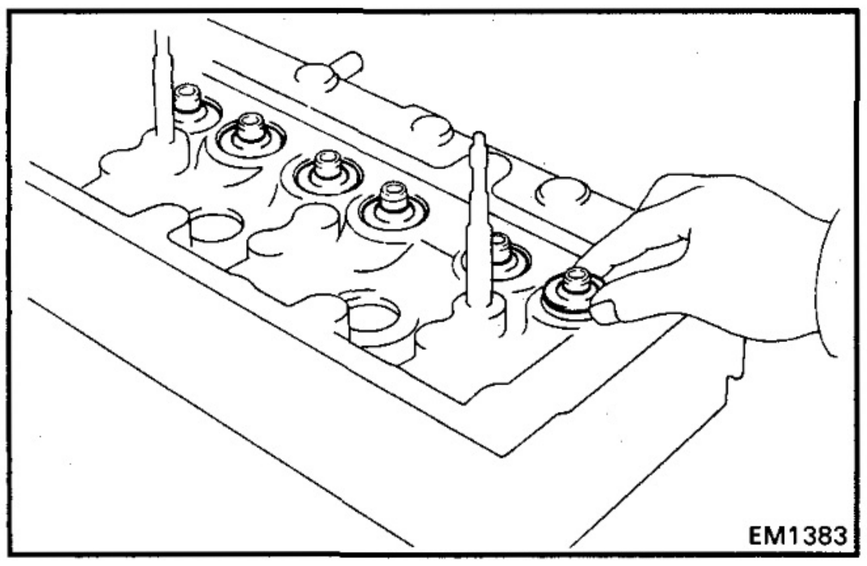
If the warpage is greater than maximum, replace the air intake chamber.

ASSEMBLY OF CYLINDER HEAD

(See page EM-17)

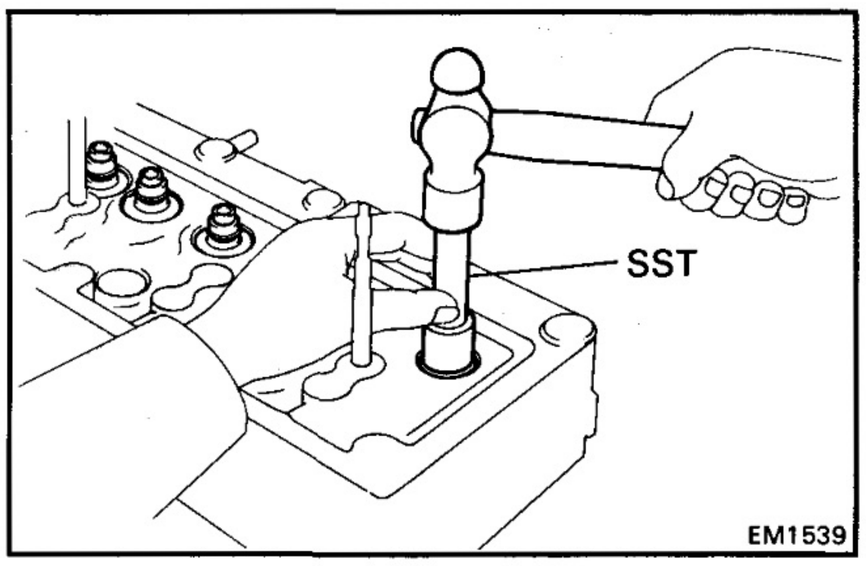
HINT:

- 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.



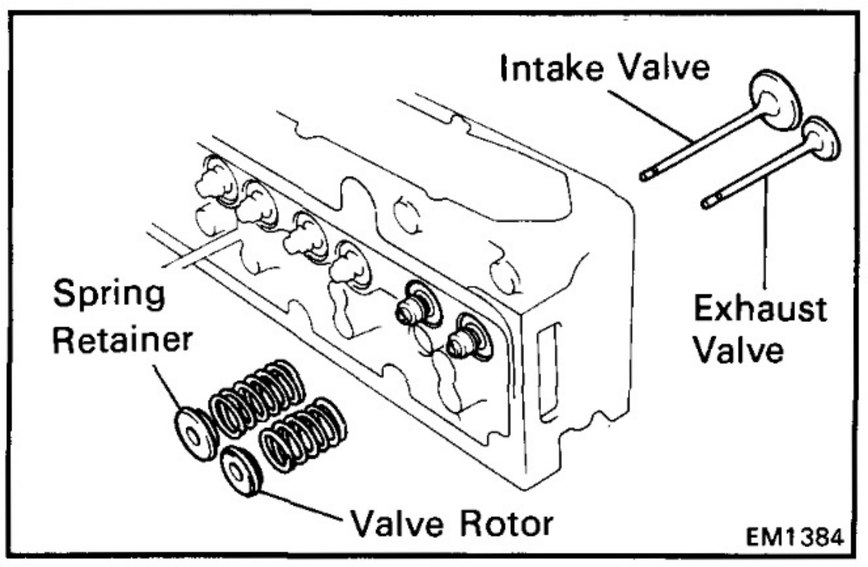
1. INSTALL VALVES

(a) Place the valve spring seat on spring seat.

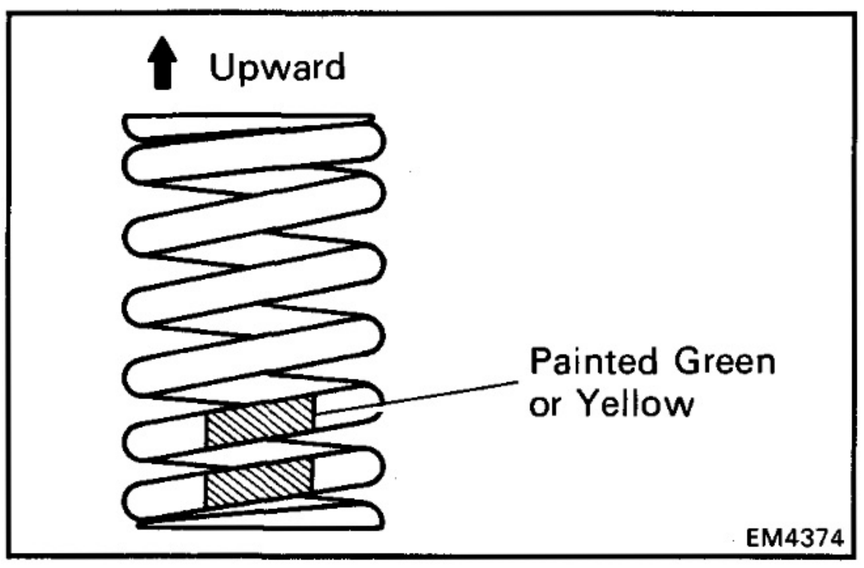


(b) Using SST and a hammer, tap in a new oil seal.

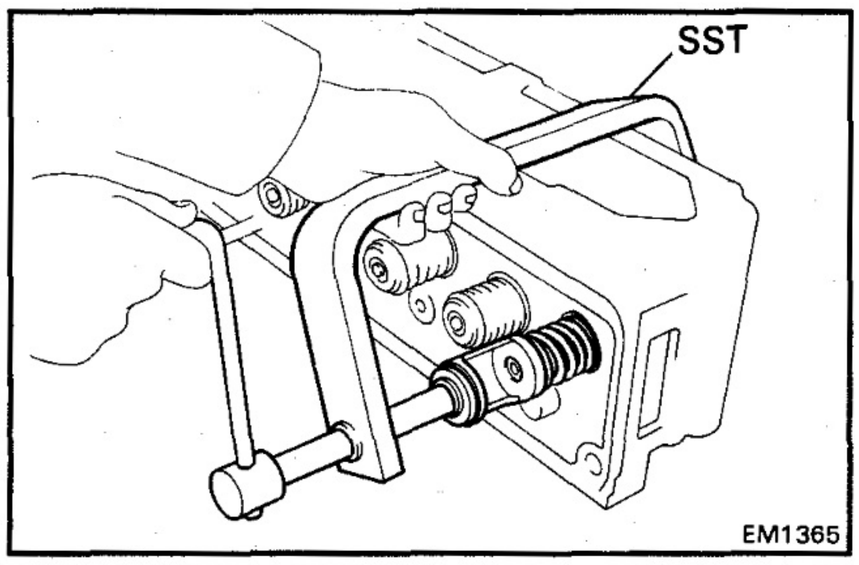
SST 09201-31010



(c) Install the valve, spring and spring retainer (or valve rotator).

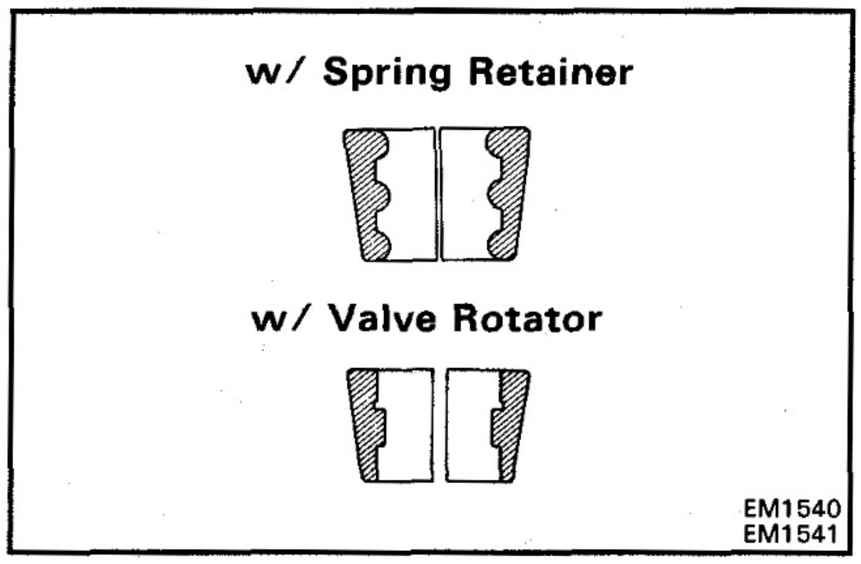


HINT: Install the spring in the correct direction as shown.

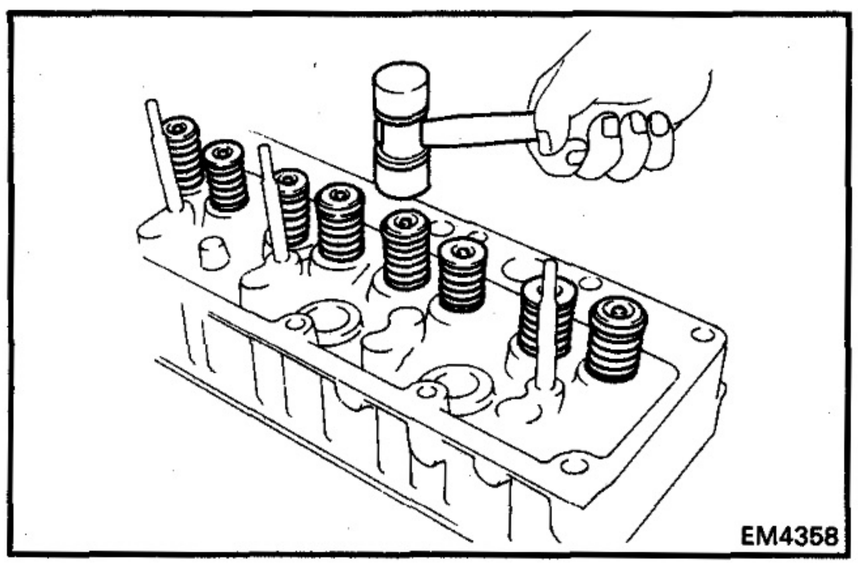


(d) Using SST, compress the valve spring and place the two keepers around the valve stem.

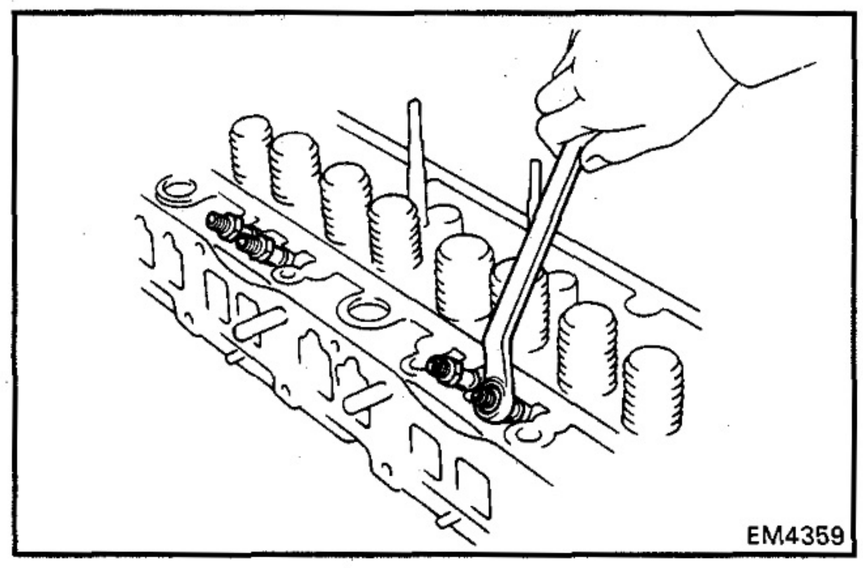
SST 09202-43013



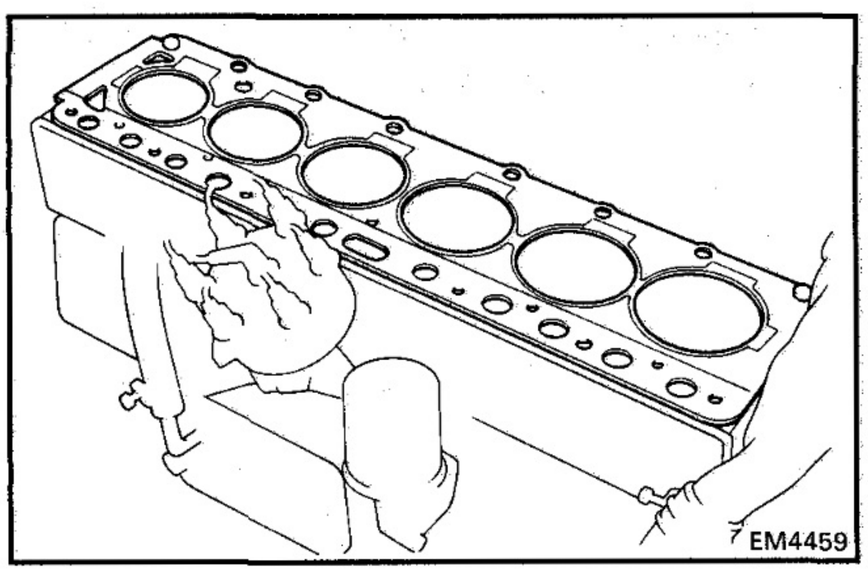
HINT: Different keepers are used for the spring retainer and valve rotator.



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



2. INSTALL AIR INJECTION MANIFOLD UNIONS



INSTALLATION OF CYLINDER HEAD

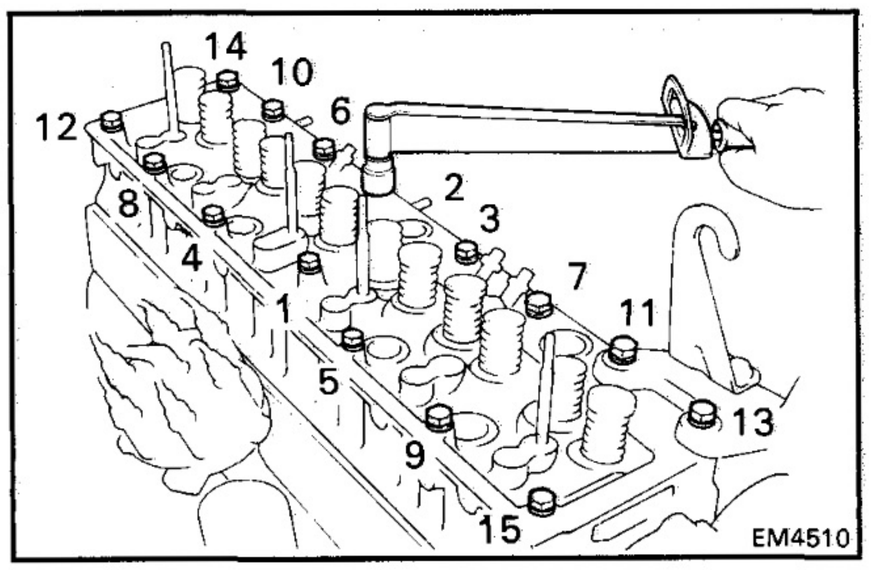
(See page EM-17)

1. INSTALL CYLINDER HEAD

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

NOTICE: Be careful of the installation direction.

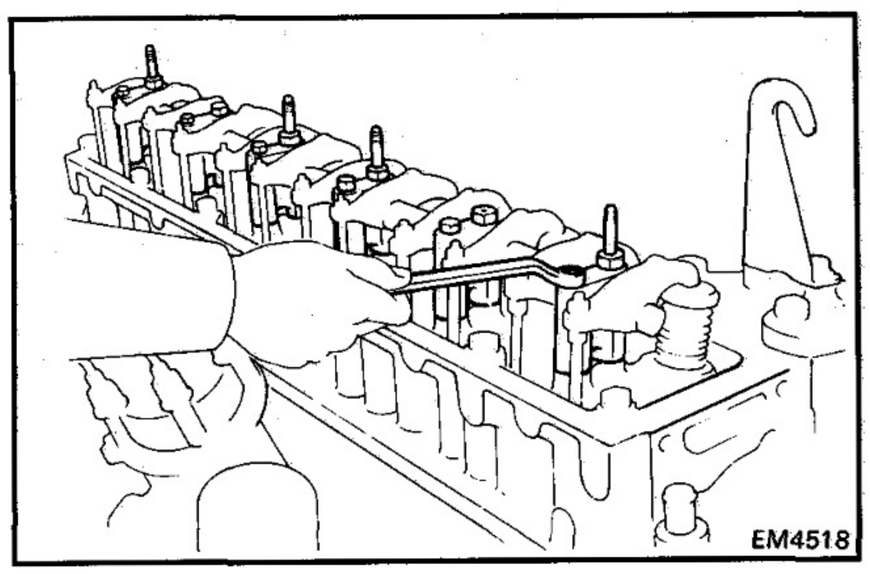
(b) Place the cylinder head on the cylinder head gasket.



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

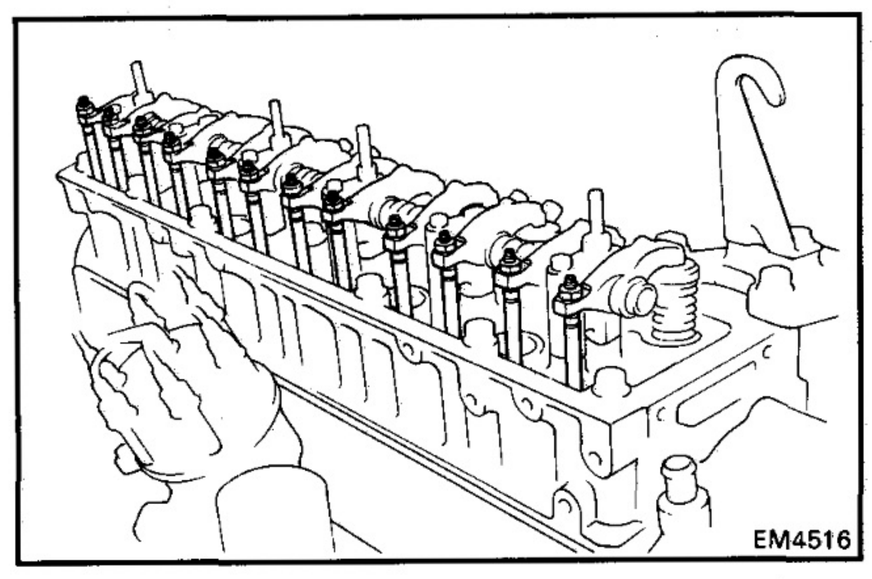
(d) Install and uniformly tighten the ten cylinder head bolts with the plate washers in several passes, in the sequence shown.

Torque: 1,250 kg-cm (90 ft-lb, 123 N·m)



2. INSTALL PUSH RODS

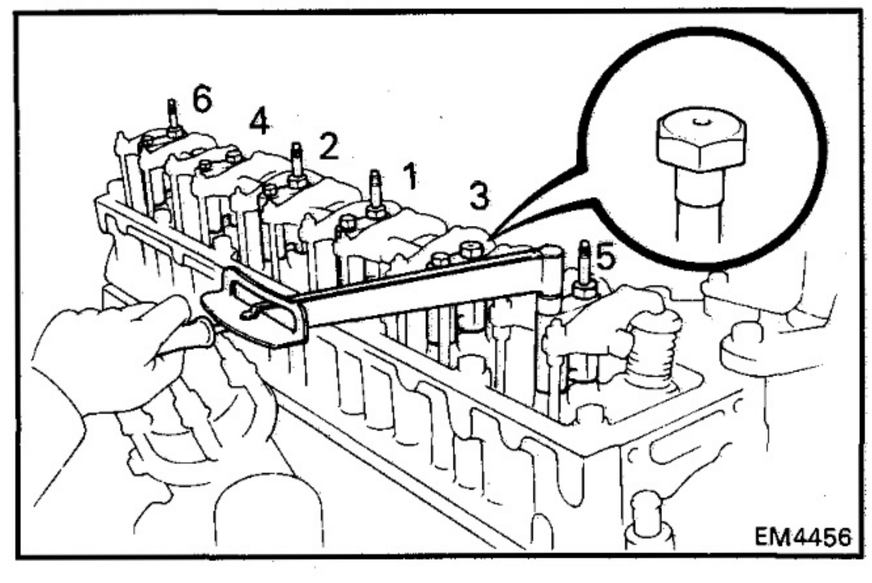
Install the twelve push rods.



3. INSTALL VALVE ROCKER SHAFT ASSEMBLY

(a) Place the rocker shaft assembly on the cylinder head.

(b) Align the rocker arm adjusting screws with the heads of the push rods.



(c) Install and uniformly tighten the eight bolts and four nuts in several passes, in the sequence shown.

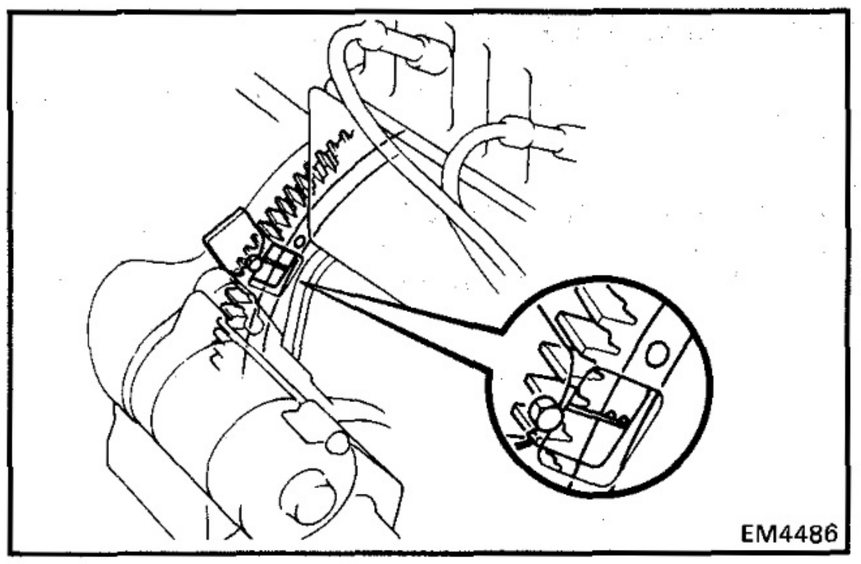
Torque:

12 mm bolt head

240 kg-cm (17 ft-lb, 24 N·m)

14 mm bolt head and nut

340 kg-cm (25 ft-lb, 33 N·m)

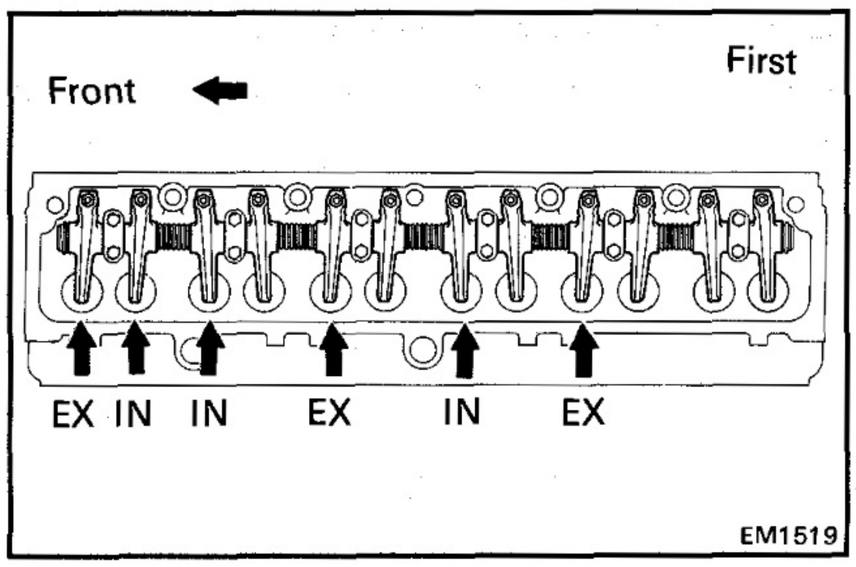

EM4486

4. ADJUST VALVE CLEARANCE

(a) Set the No. 1 cylinder to TDC/compression.

- Align the TDC mark of the drive plate with the timing pointer by turning the crankshaft clockwise with a wrench.
- Check that the rocker arms on the No. 1 cylinder are loose and rocker arms on the No. 6 are tight.

If not, turn the crankshaft one revolution (360°) and align the mark as above.



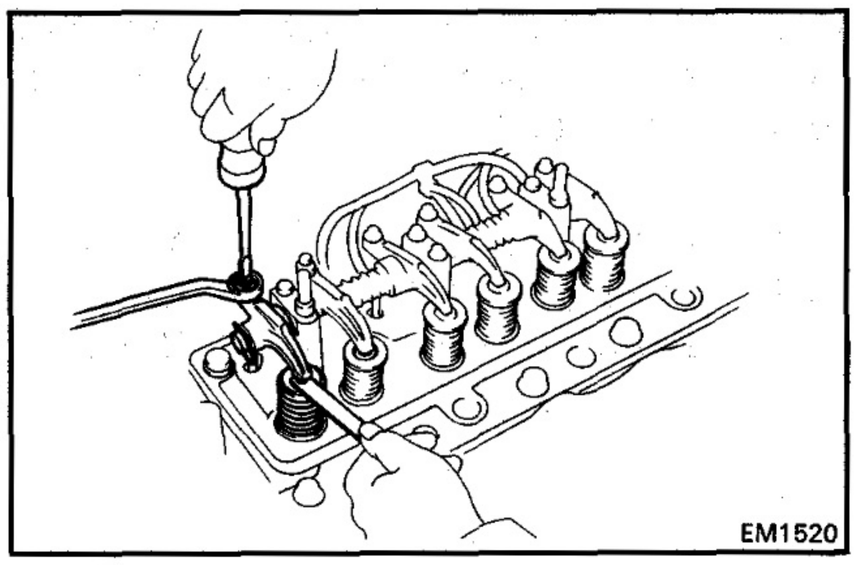
EM1519

(b) Adjust only those valves indicated by arrows.

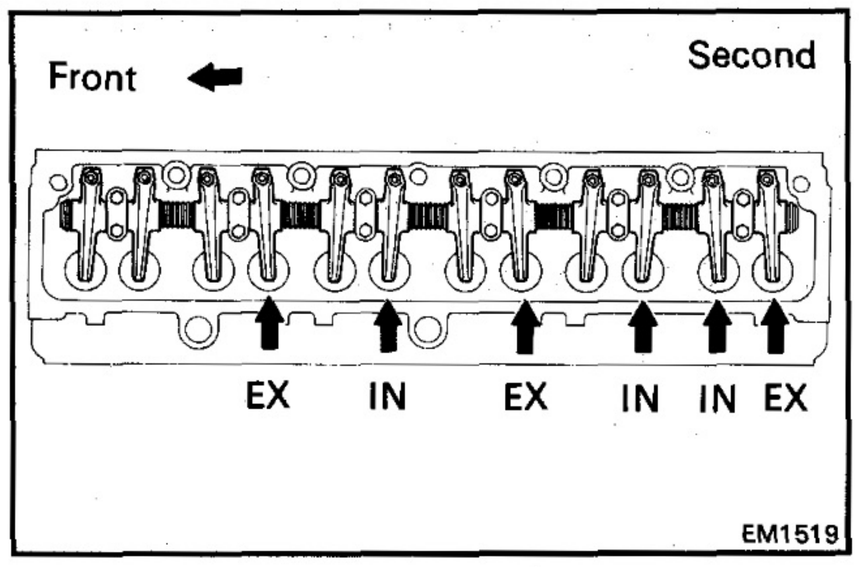
Valve clearance:

Intake	**0.20 mm (0.008 in.)**
Exhaust	**0.35 mm (0.014 in.)**

NOTE: After warm up, readjust the valve clearance.


EM1520

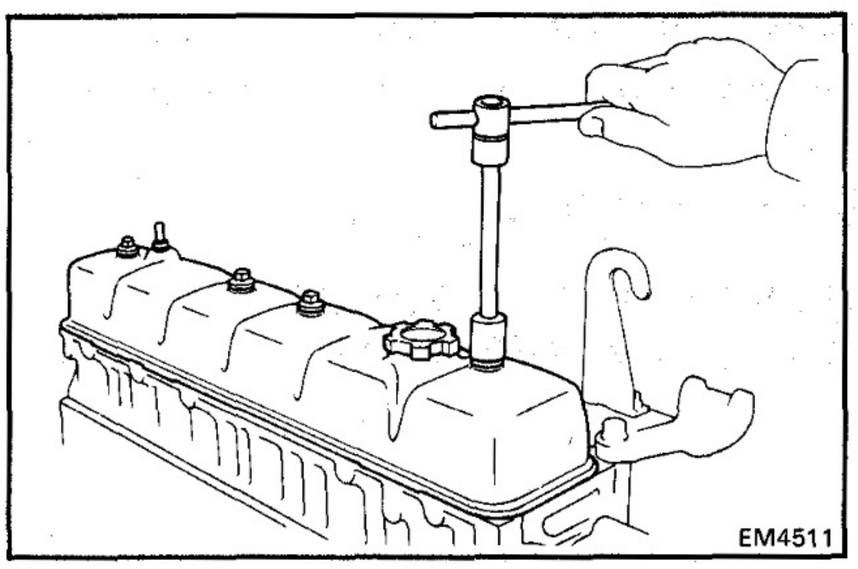
- Using a thickness gauge, measure the valve clearance between the valve stem and rocker arm. Loosen the lock nut and turn the adjusting screw to set the proper clearance.
  Hold the adjusting screw in position and tighten the lock nut.
- Recheck the valve clearance. The thickness gauge should slide with a very slight drag.



EM1519

(c) Turn the crankshaft pulley one revolution (360°) and align the mark as above.
Adjust only the valves indicated by arrows.

5. INSTALL SPARK PLUGS

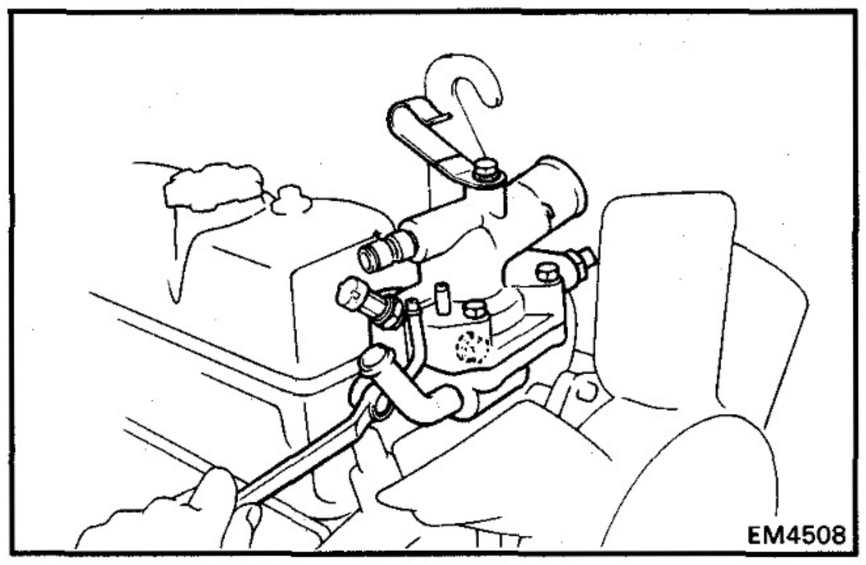

EM4511

6. INSTALL CYLINDER HEAD COVER

(a) Install a new gasket to the cylinder head cover.

(b) Install the cylinder head cover with four seal washer and cap nuts.

Torque: 90 kg-cm (78 in.-lb, 8.8 N·m)

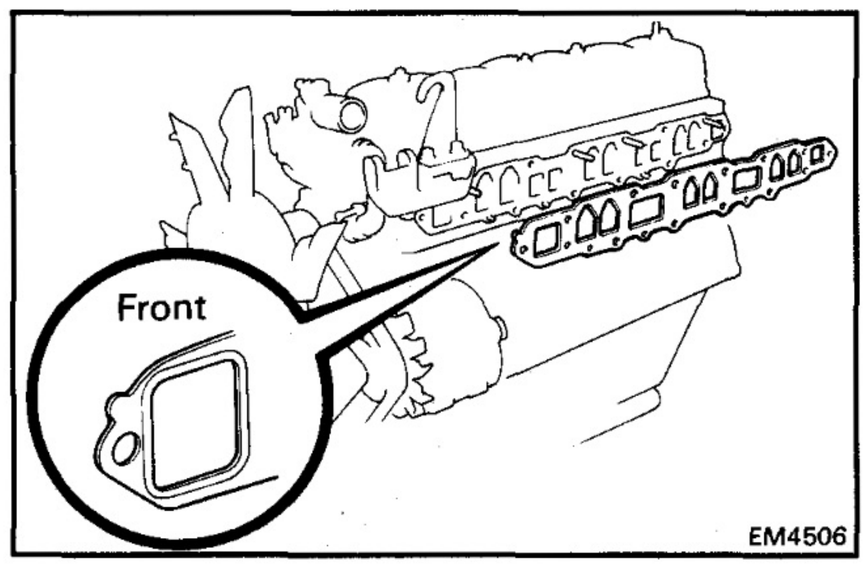


7. INSTALL WATER OUTLET ASSEMBLY

(a) Install a new gasket and the water outlet assembly with the two bolts.

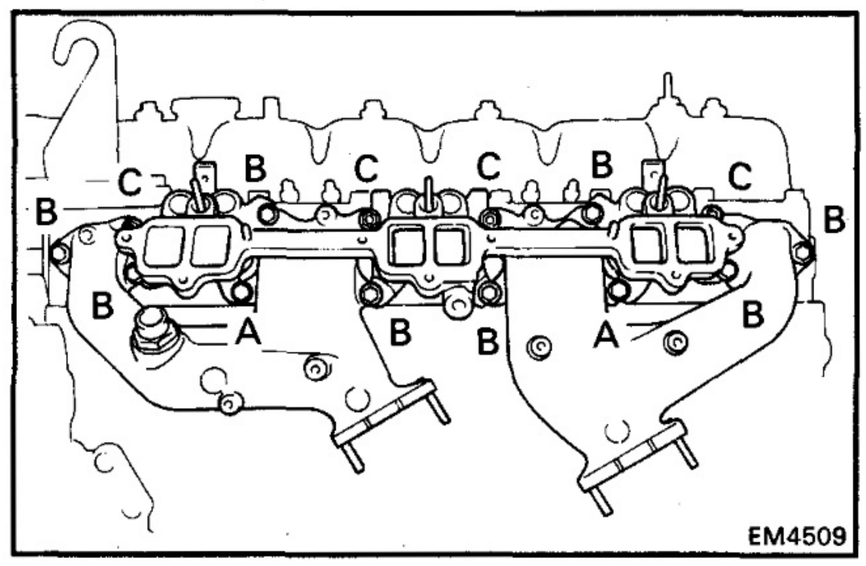
Torque: 250 kg-cm (18 ft-lb, 25 N·m)

(b) Connect the water by-pass hose.



8. INSTALL INTAKE AND EXHAUST MANIFOLDS

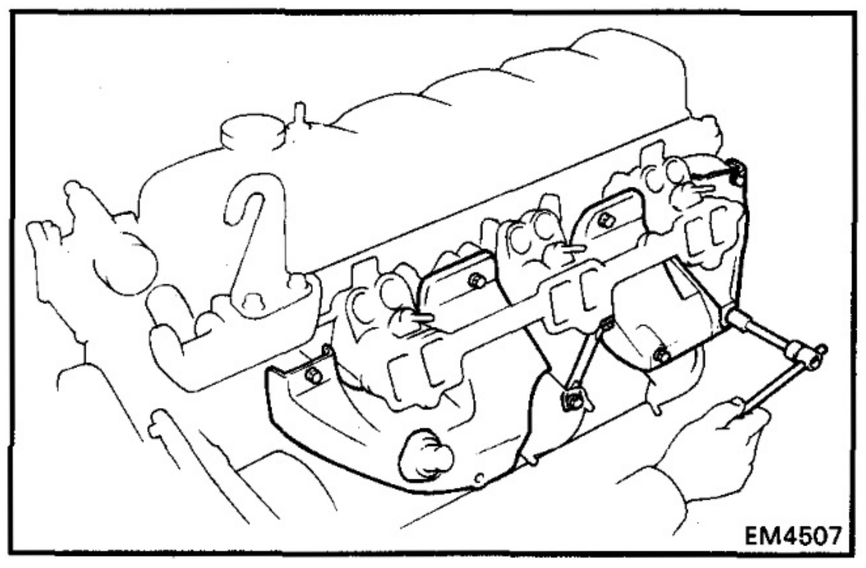
(a) Place a new gasket so that the front mark is toward the front side.



(b) Install the intake manifold and exhaust manifolds with the ten bolts, four plate washers and nuts. Torque the bolts and nuts.

Torque:

17 mm bolt (A)	**700 kg-cm (51 ft-lb, 69 N·m)**
14 mm bolt (B)	**510 kg-cm (37 ft-lb, 50 N·m)**
Nut (C)	**570 kg-cm (41 ft-lb, 56 N·m)**

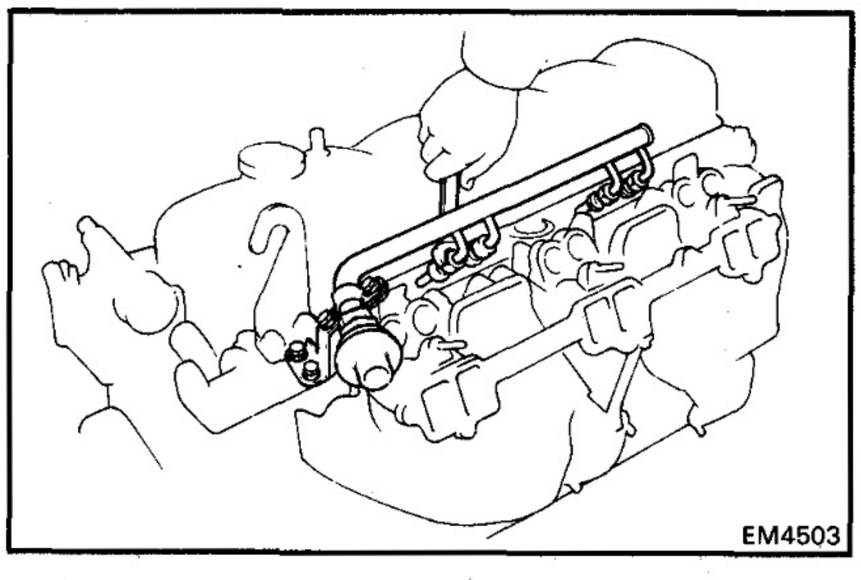


(c) Install the three manifold heat insulators with the six bolts.

Torque: 120 kg-cm (9 ft-lb, 12 N·m)

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

Torque: 300 kg-cm (22 ft-lb, 29 N·m)

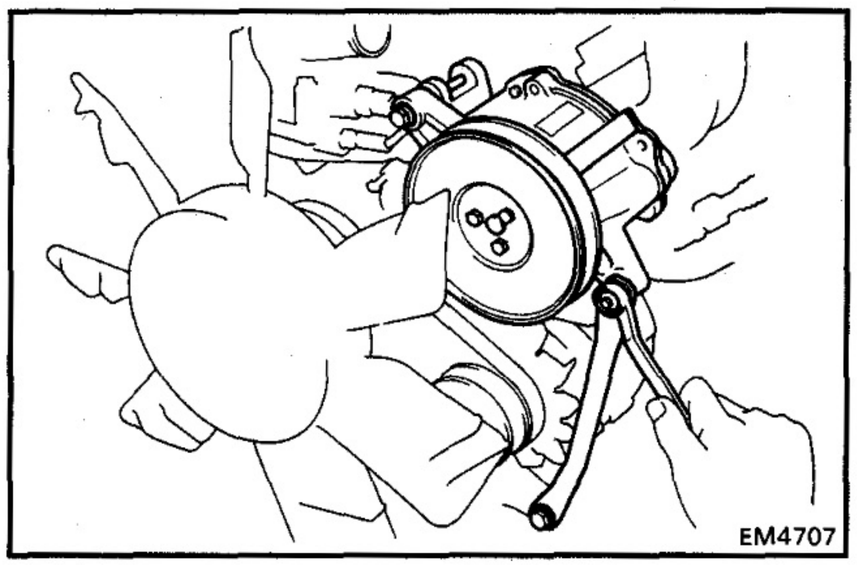


9. INSTALL AIR INJECTION MANIFOLD

Install the air injection manifold with the four union nuts and two clamp bolts.

Torque: 210 kg-cm (15 ft-lb, 21 N·m)

10. INSTALL INJECTORS AND DELIVERY PIPE
(See steps 1 to 6 on pages FI-59 to 61)



11. INSTALL AIR PUMP

(a) Install the air pump with the through bolt and nut.
(b) Install the air pump stay with the bolt and nut.
(c) Connect the air hose.

12. CONNECT HIGH-TENSION CORDS TO SPARK PLUGS AND IGNITION COIL

13. INSTALL PS PUMP BRACKETS

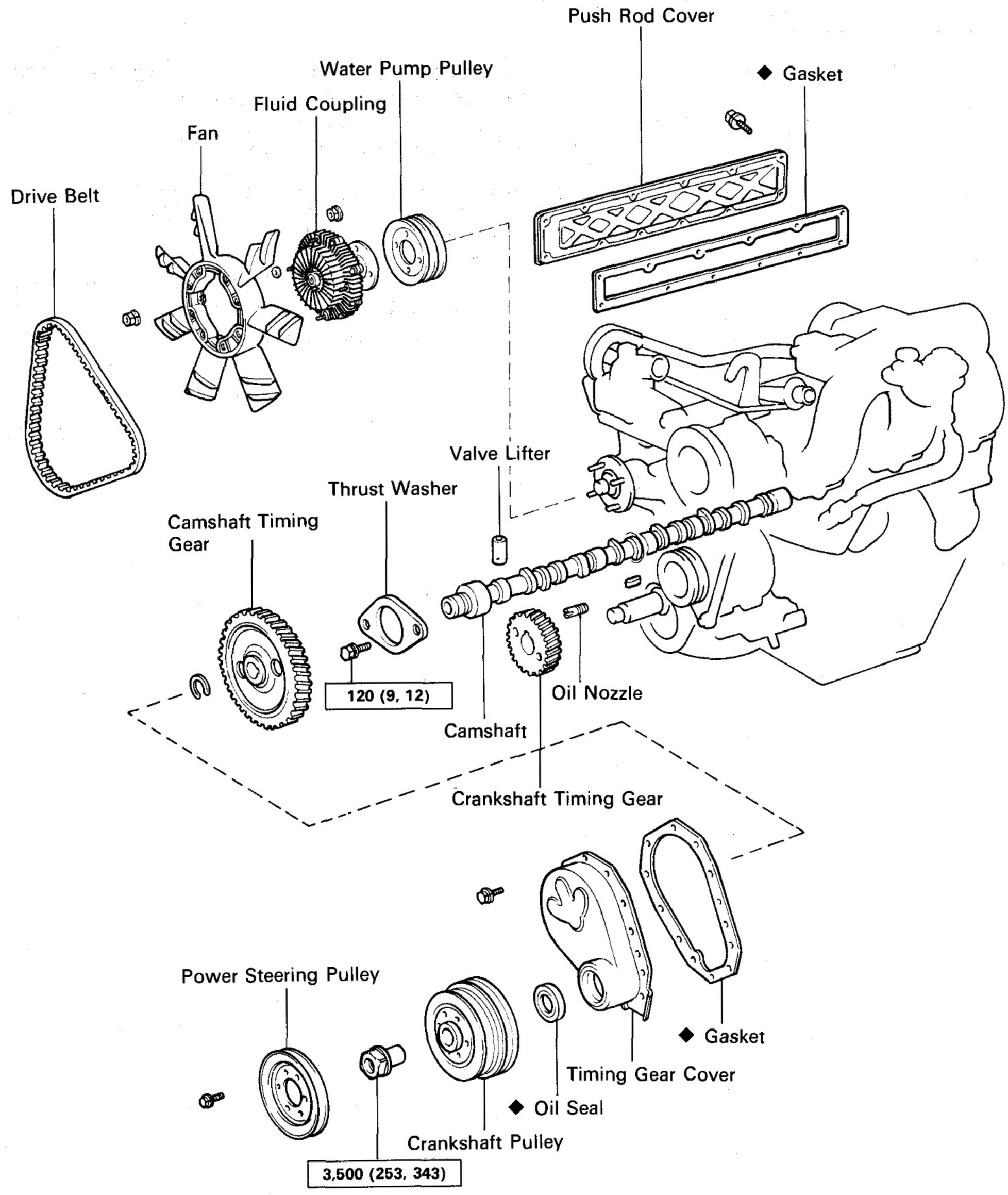
14. REFILL WITH ENGINE COOLANT

Capacity:

w/ Front heater
17.5 liters (18.5 US qts, 15.4 Imp. qts)
w/ Front and rear heaters
19.5 liters (20.6 US qts, 17.2 Imp. qts)

TIMING GEARS AND CAMSHAFT

COMPONENTS



kg-cm (ft-lb, N·m) : Specified torque

◆ Non-reusable part

EM4521

REMOVAL OF TIMING GEARS AND CAMSHAFT

(See page EM-32)

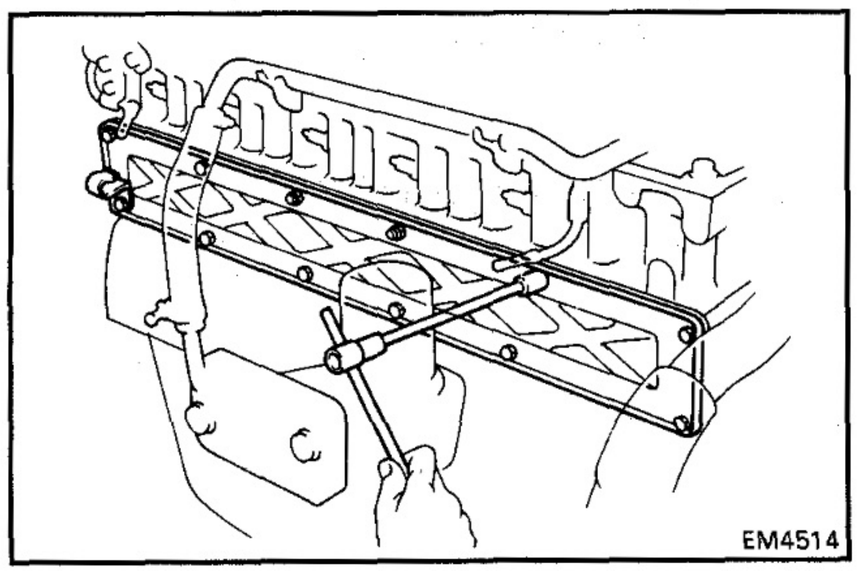
1. DRAIN ENGINE COOLANT

2. REMOVE FLUID COUPLING WITH FAN AND WATER PUMP PULLEY

3. REMOVE PS BRACKETS

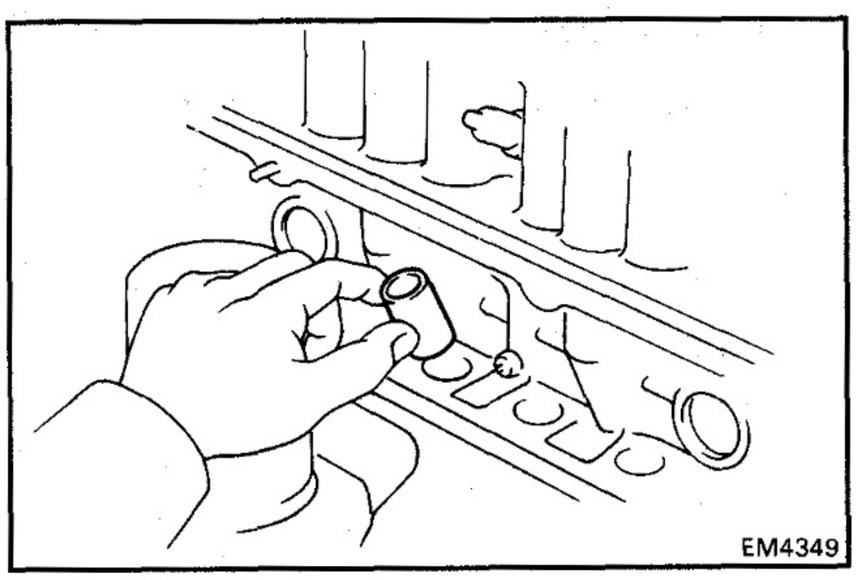
4. REMOVE DISTRIBUTOR

5. REMOVE VALVE ROCKER SHAFT ASSEMBLY
(See steps 10 to 12 on pages EM-19)



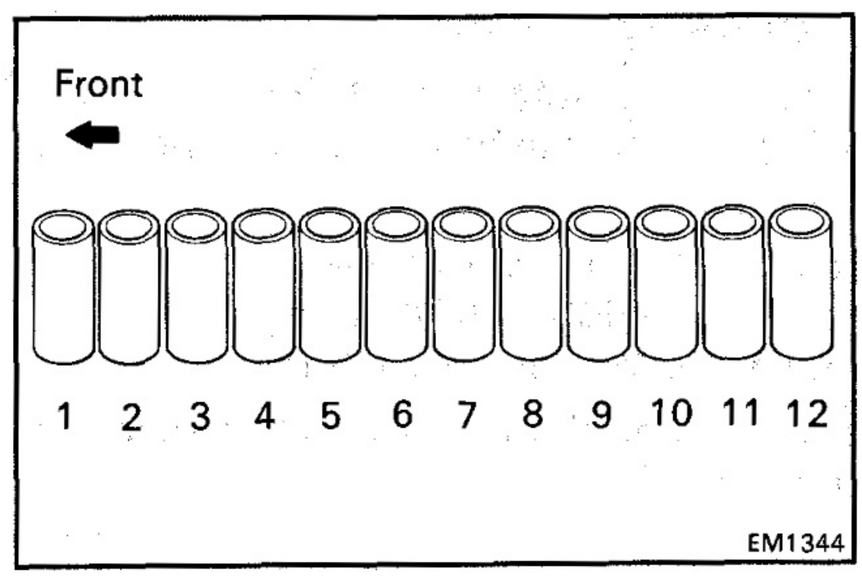
6. REMOVE PUSH ROD COVER

Remove the ten bolts, two nuts, push rod cover and gasket.

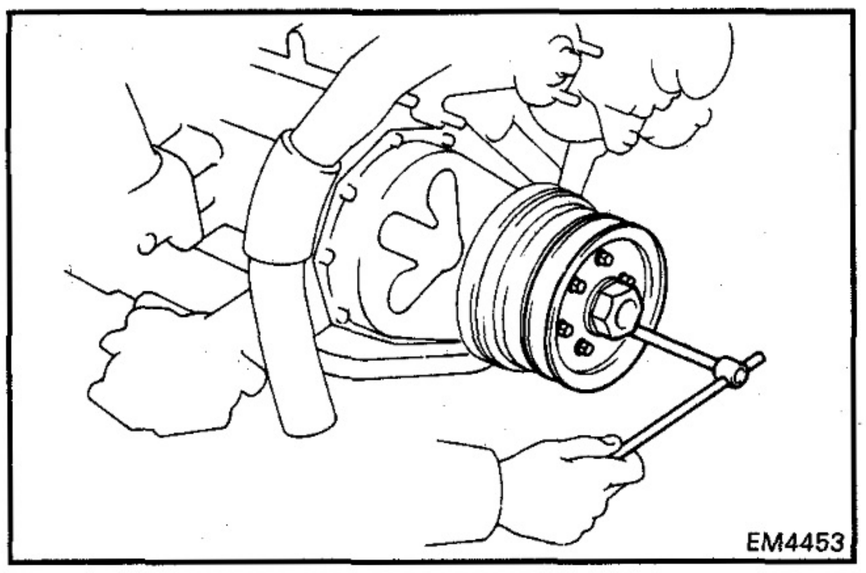


7. REMOVE VALVE LIFTERS

Remove the twelve valve lifters in order, beginning from the No. 1 valve lifter.

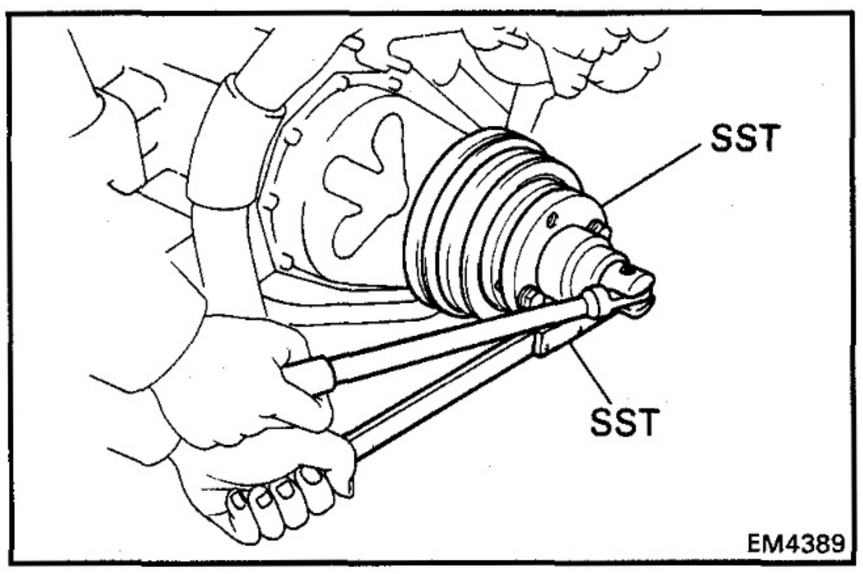


HINT: Arrange the valve lifters in correct order.



8. REMOVE PS PULLEY FROM CRANKSHAFT PULLEY

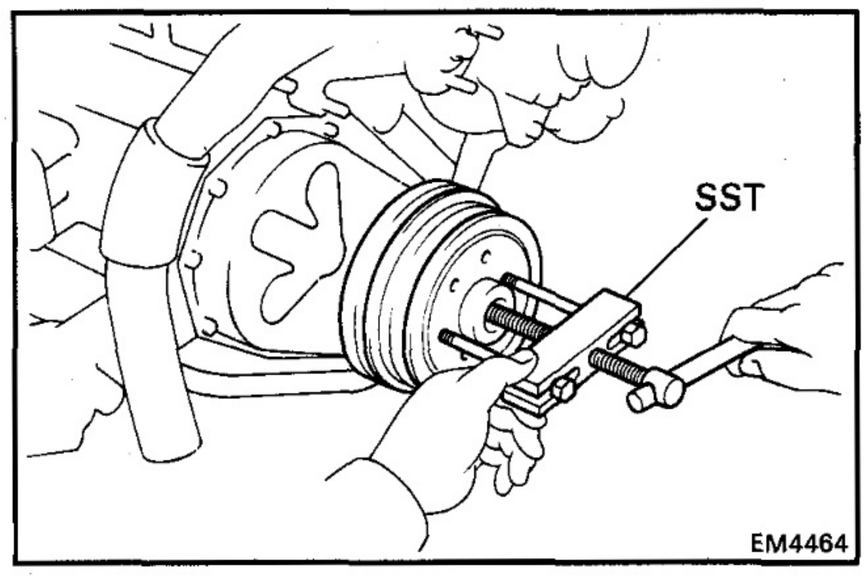
Remove the six bolts and PS pulley.



9. REMOVE CRANKSHAFT PULLEY

(a) Using SST and a 46 mm socket wrench, remove the pulley mount bolt.

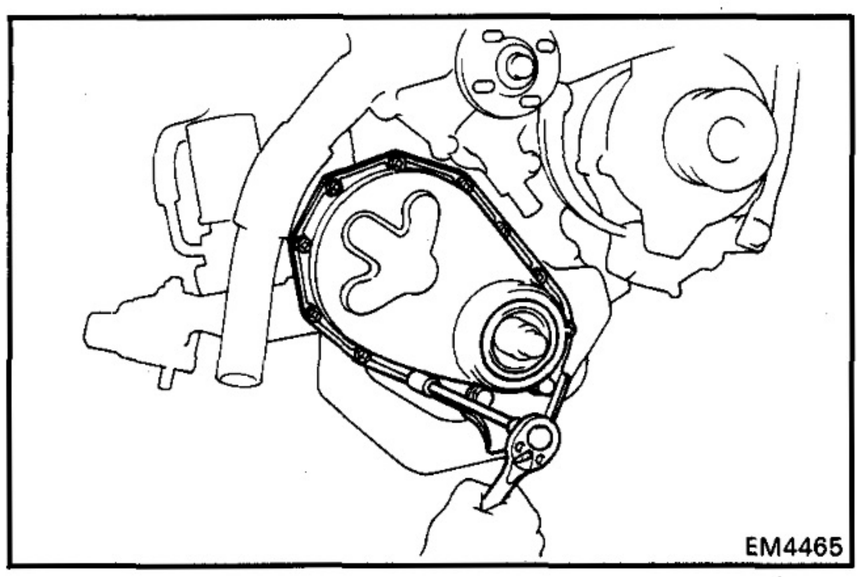
SST 09213-58011 and 09330-00021



(b) Using SST, remove the pulley.

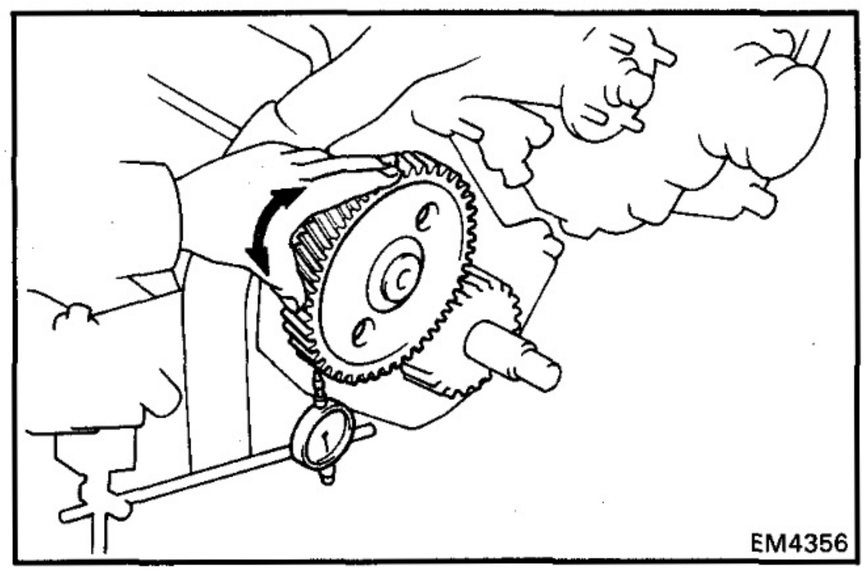
SST 09213-60017

10. REMOVE OIL COOLER PIPE WITH HOSE



11. REMOVE TIMING GEAR COVER

Remove the twelve bolts, gear cover and gasket.



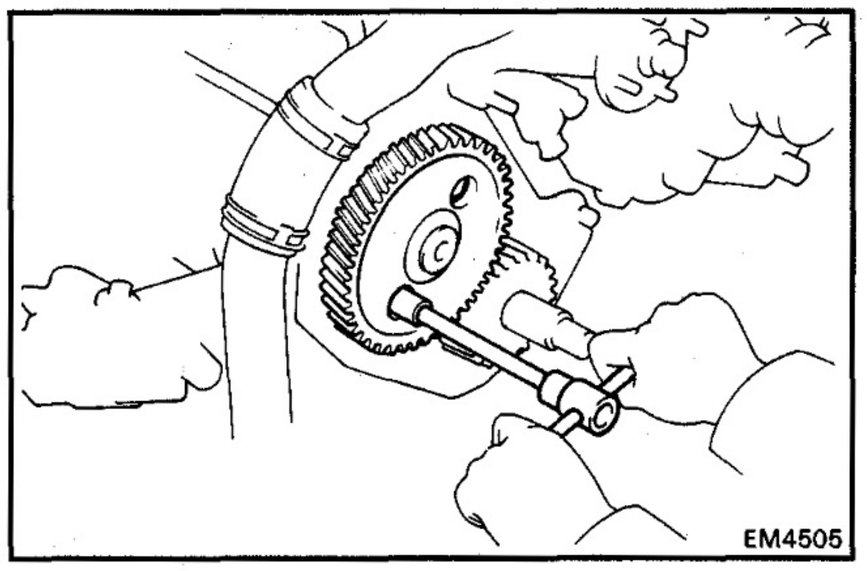
12. CHECK TIMING GEAR BACKLASH

Using a dial indicator, measure the backlash at several places while turning the camshaft clockwise and counterclockwise.

Standard backlash: **0.100 – 0.183 mm (0.0039 – 0.0072 in.)**

Maximum backlash: **0.25 mm (0.0098 in.)**

If the backlash is greater than maximum, replace the camshaft timing gears.



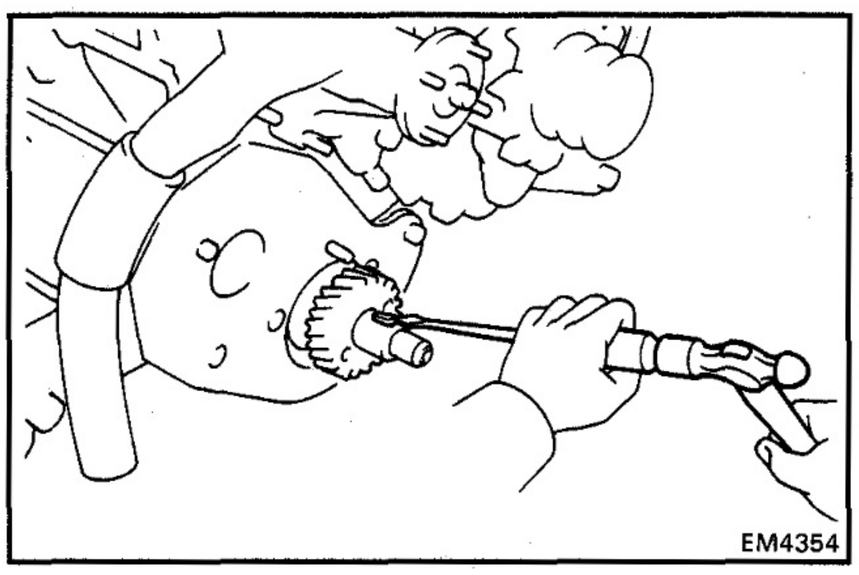
13. REMOVE CAMSHAFT TIMING GEAR AND CAMSHAFT ASSEMBLY

(a) Remove the two bolts mounting the thrust plate to the cylinder block.



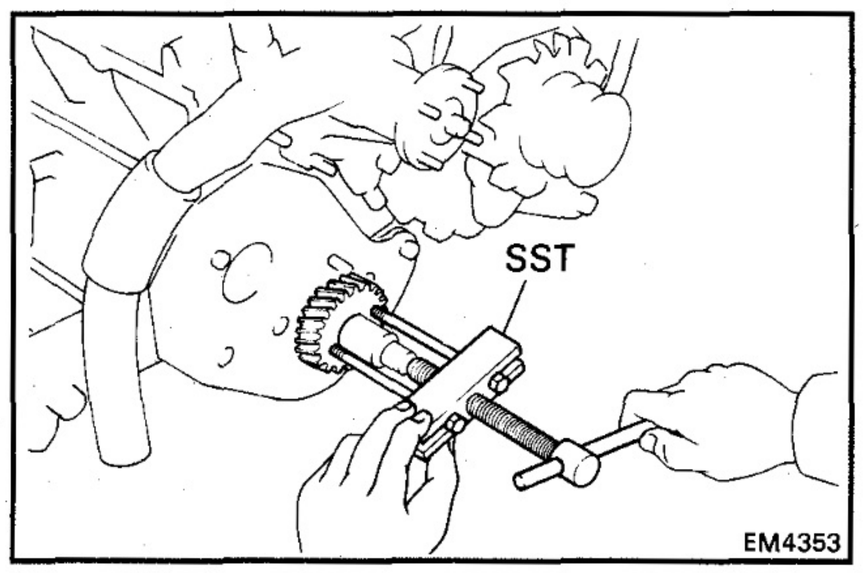
(b) Carefully pull out the camshaft and timing gear assembly.

NOTICE: Be careful not to damage the camshaft bearing.



14. REMOVE CRANKSHAFT TIMING GEAR

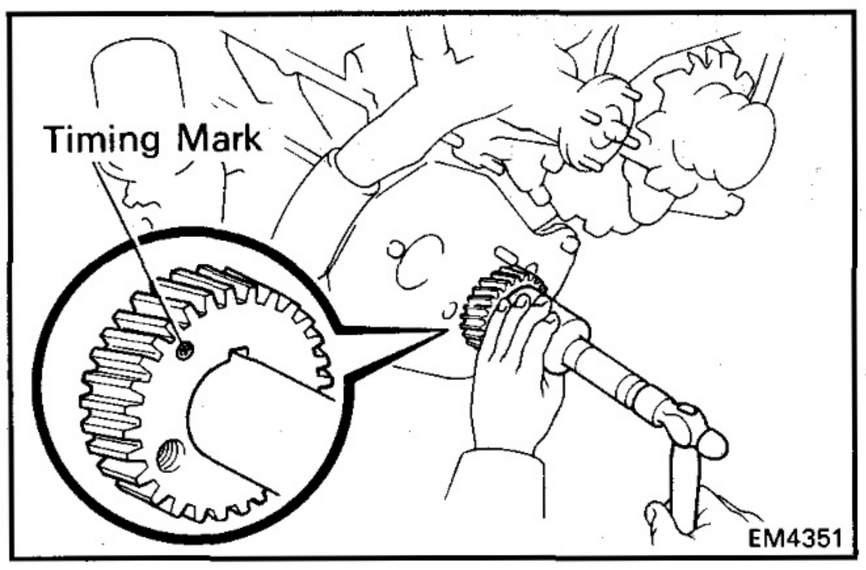
(a) Using a screwdriver and hammer, tap out the crankshaft pulley set key.

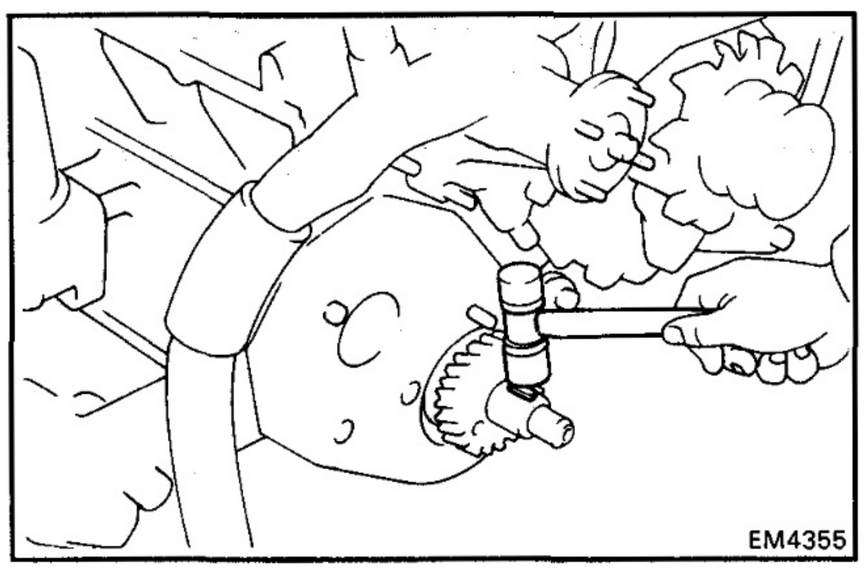


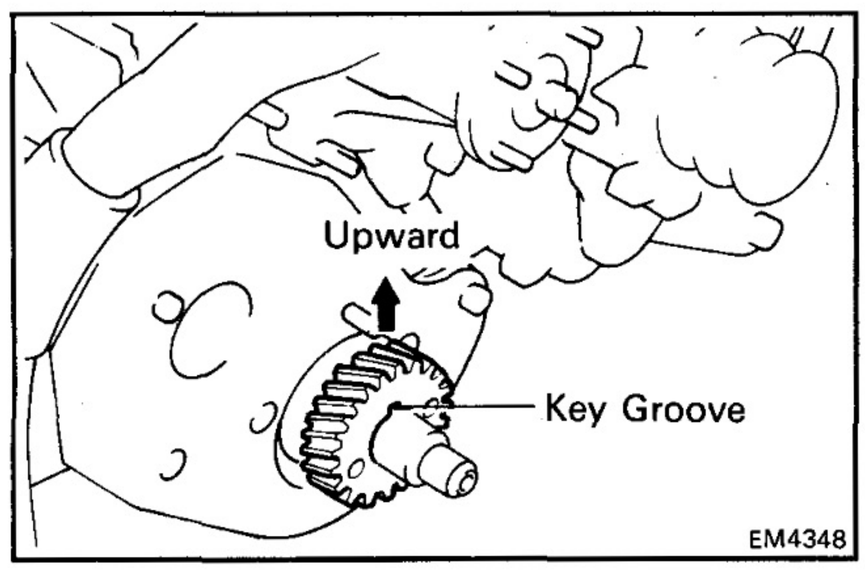
(b) Using SST, remove the timing gear.

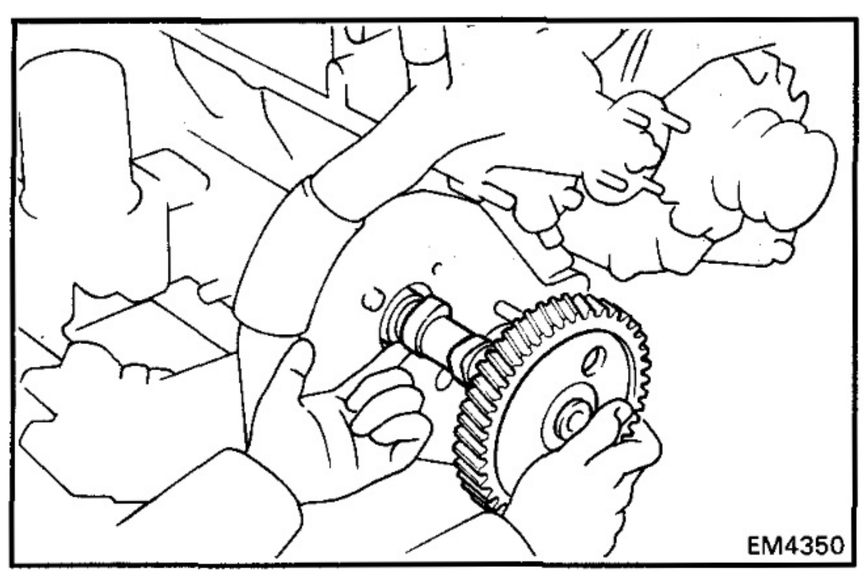
SST 09213-60017 (09213-00020, 09213-00030, 09213-00090)

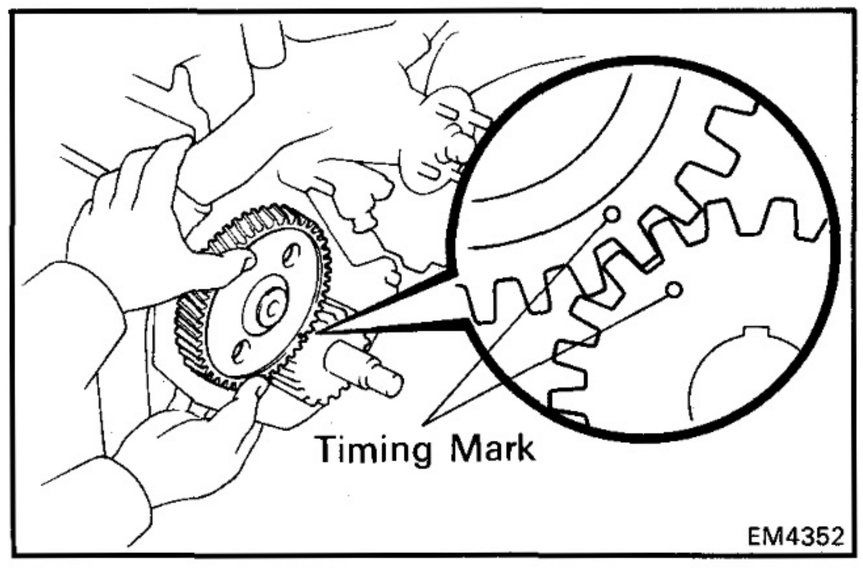
15. IF NECESSARY, REMOVE OIL NOZZLE











INSTALLATION OF TIMING GEARS AND CAMSHAFT

(See page EM-32)

1. INSTALL CRANKSHAFT TIMING GEAR

(a) Put the timing gear on the crankshaft with timing mark facing forward.

(b) Align the timing gear set key with the key groove of the timing gear.

(c) Using SST and a hammer, tap in the timing gear.

SST 09214-60010

(d) Using a plastic-faced hammer, tap in the crankshaft pulley set key.

2. INSTALL CAMSHAFT TIMING GEAR AND CAMSHAFT ASSEMBLY

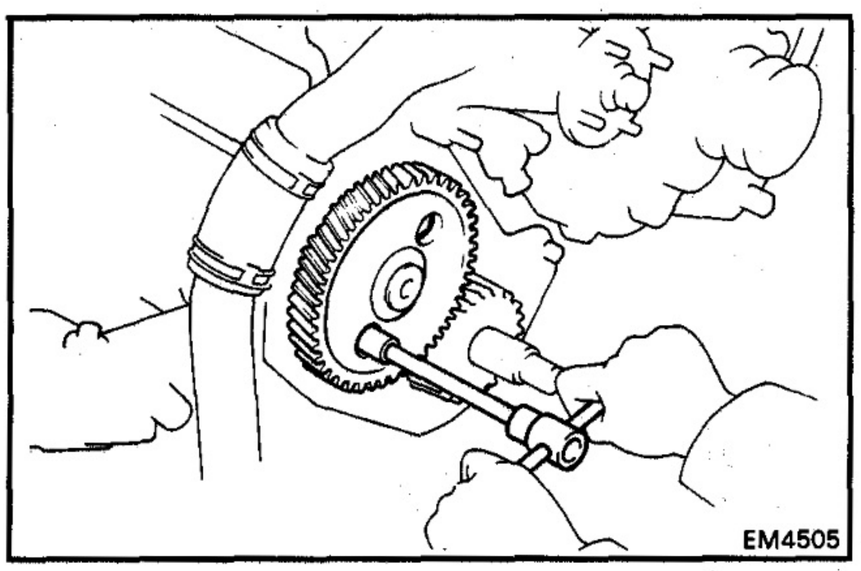
(a) Set the crankshaft timing gear with the key groove facing upward by turning the crankshaft clockwise.

(b) Insert the camshaft into the cylinder block.

NOTICE: Be careful not to damage the camshaft bearings.

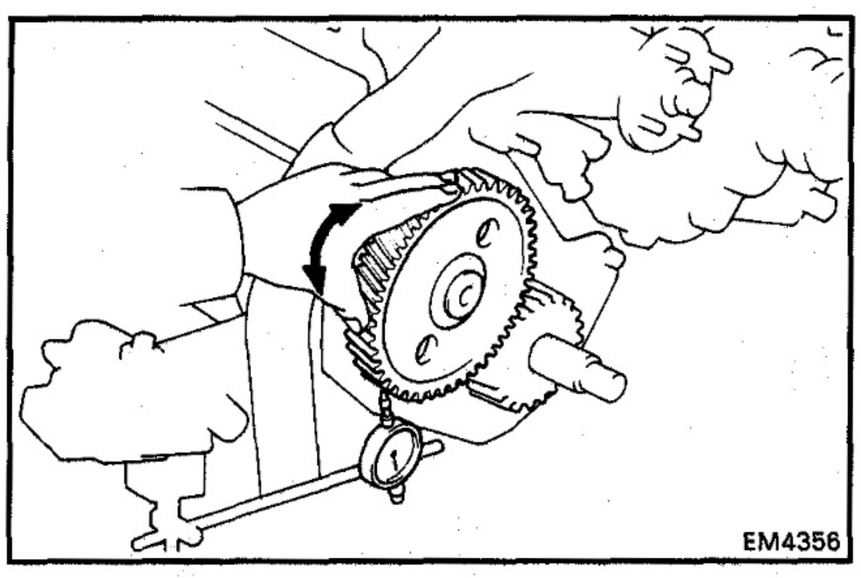
(c) Align the timing marks of the crankshaft and camshaft timing gears and mesh the gears.

HINT: At this time, No 6 cylinder should be at TDC / compression.



(d) Install the two bolts mounting the thrust washer to the cylinder block. Torque the bolts.

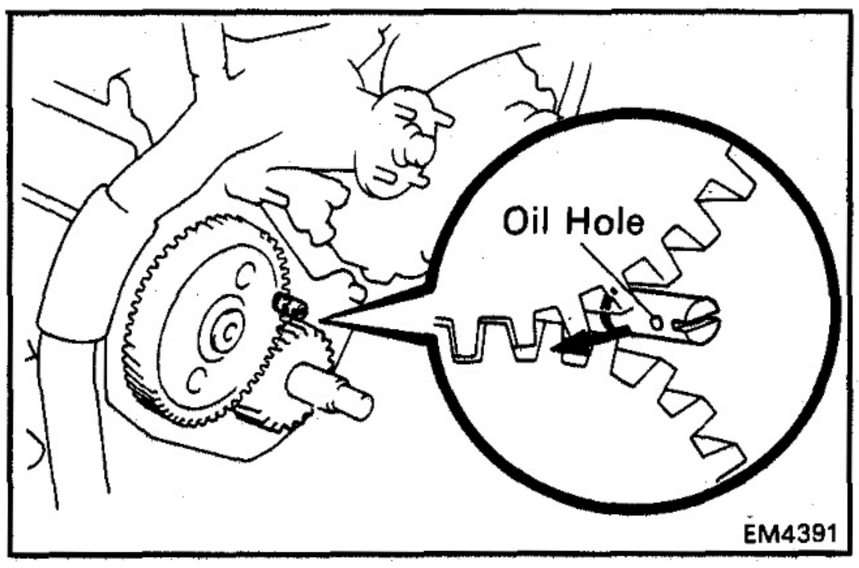
Torque: 120 kg-cm (9 ft-lb, 12 N·m)



3. CHECK TIMING GEAR BACKLASH

Using a dial indicator, measure the backlash at several places while turning the camshaft clockwise and counterclockwise.

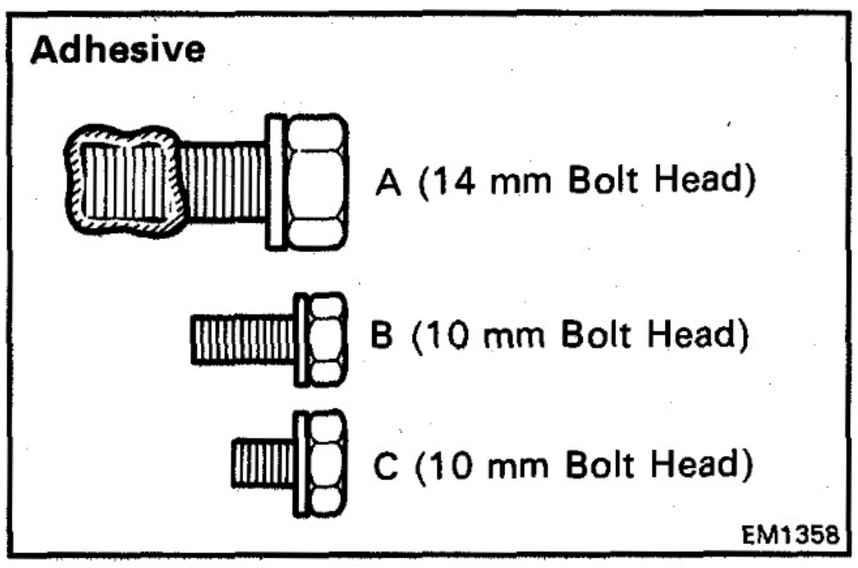
Standard backlash: 0.100 – 0.183 mm (0.0039 – 0.0072 in.)
Maximum backlash: 0.25 mm (0.0098 in.)



4. INSTALL OIL NOZZLE

(a) Install and set the oil nozzle in position.

(b) Using a chisel and hammer, stake the threads of the oil nozzle.

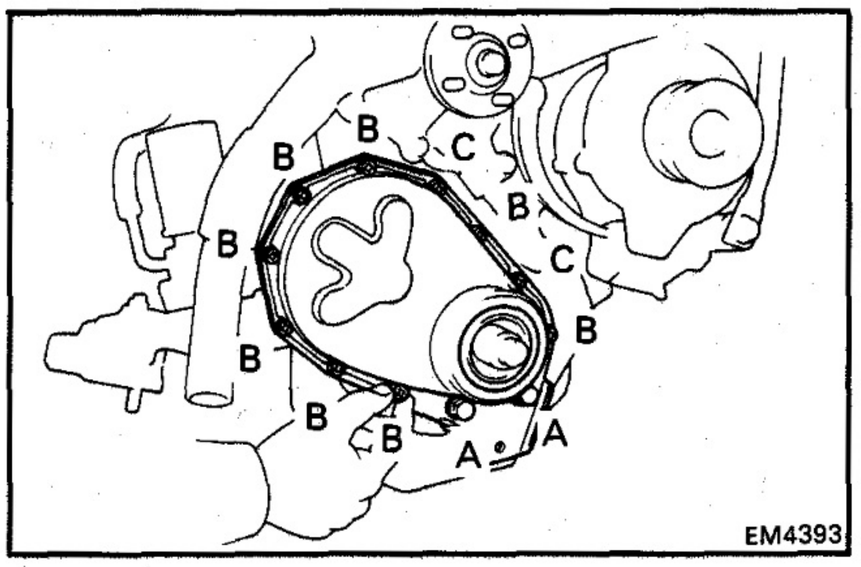


5. INSTALL TIMING GEAR COVER AND CRANKSHAFT PULLEY

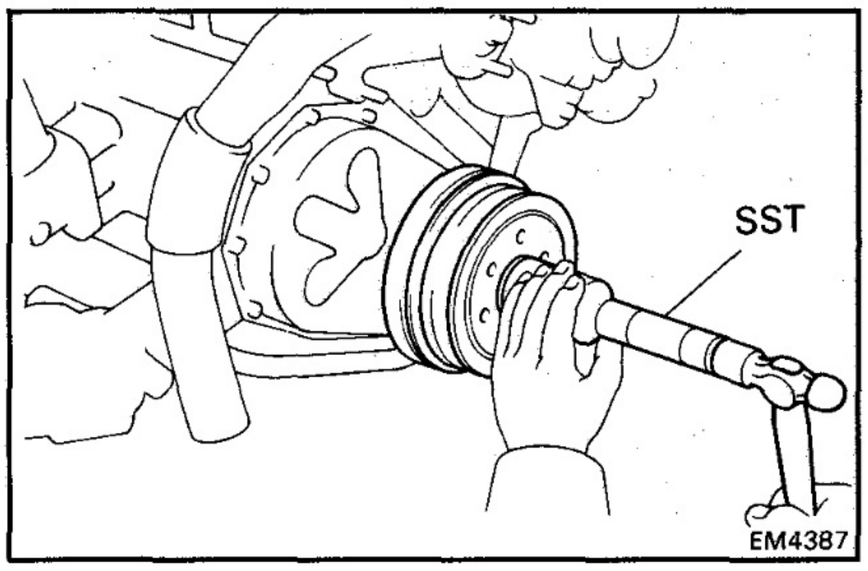
HINT: There are three sizes of timing gear cover bolts indicated A, B and C.

(a) Apply adhesive to the threads of the two A bolts.

Adhesive: Part No. 08833-00080, THREE BOND 1344, LOCTITE 242 or equivalent



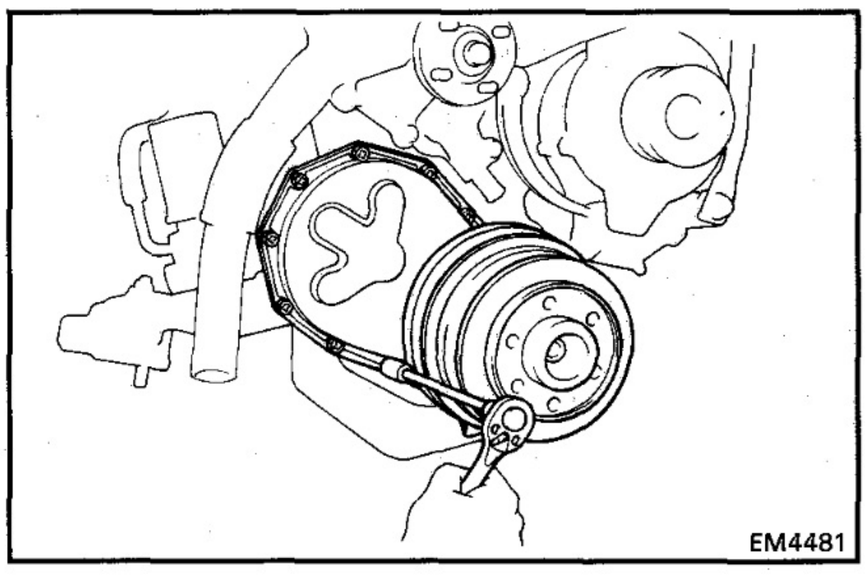
(b) Install a new gasket and the gear cover with the twelve bolts. Finger tighten all bolts.



(c) Align the pulley set key with the key groove of the pulley.

(d) Using SST and a hammer, tap in the pulley.

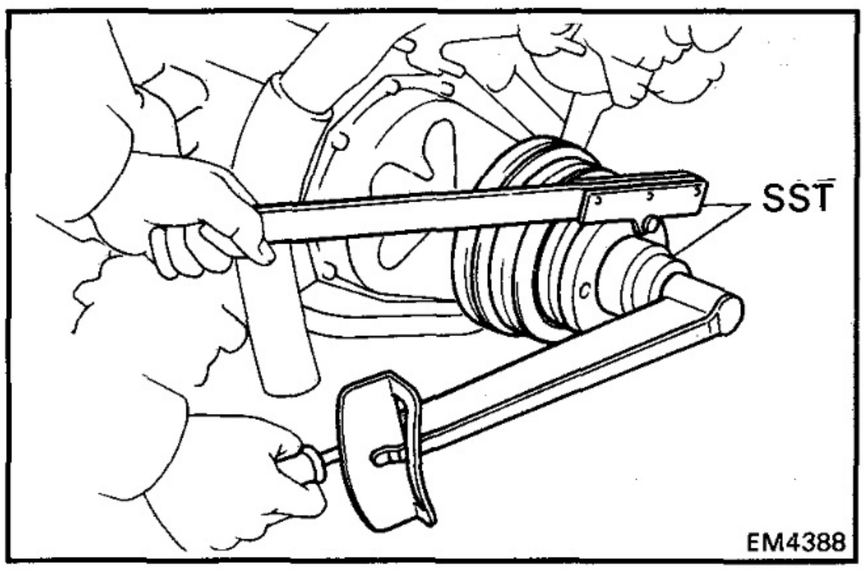
SST 09214-60010



(e) After installing the pulley, torque the cover bolts.

Torque:

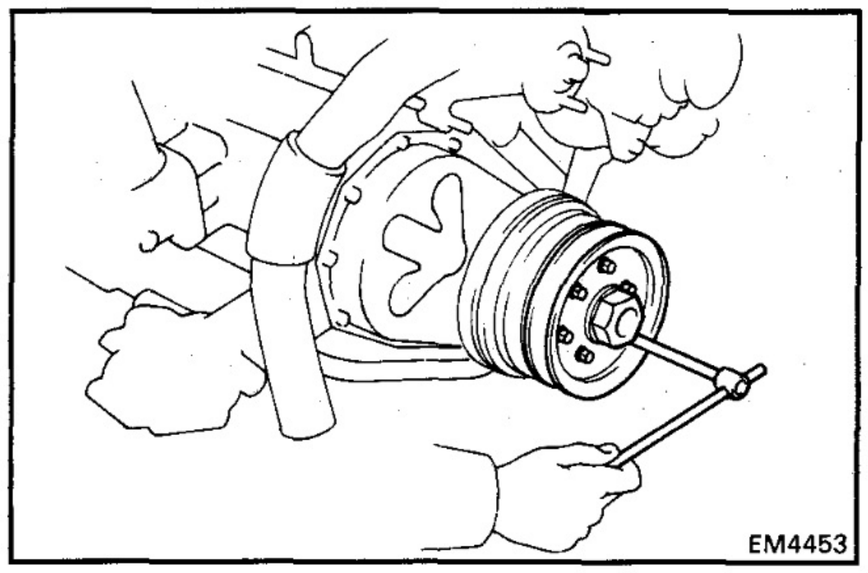
Bolts A	**250 kg-cm (18 ft-lb, 25 N·m)**
Bolts B and C	**50 kg-cm (43 in-lb, 4.9 N·m)**



(f) Using SST and a 46-mm socket wrench, install and torque the pulley mount bolt.

SST 09213-58011 and 09330-00021

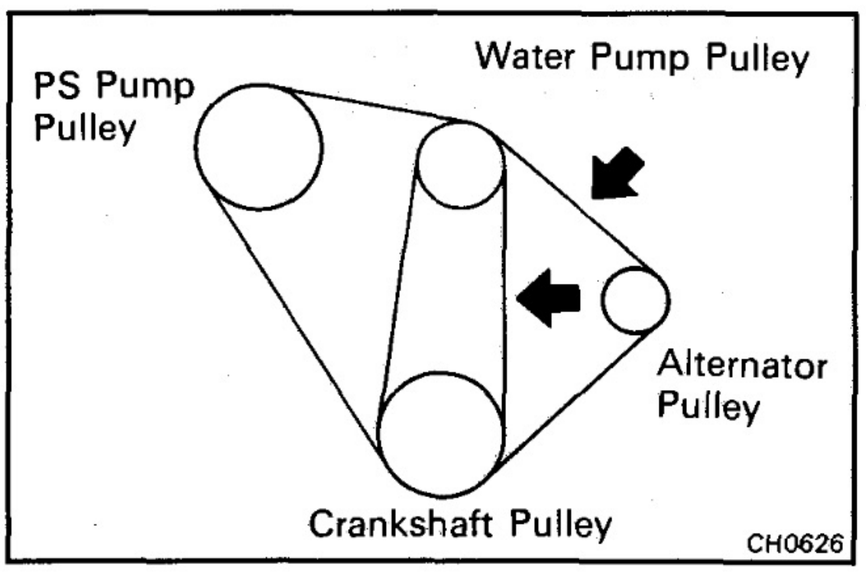
Torque: 3,500 kg-cm (253 ft-lb, 343 N·m)



6. INSTALL PS PULLEY TO CRANKSHAFT PULLEY

Install the PS pulley with the six bolts. Torque the bolts.

Torque: 185 kg-cm (13 ft-lb, 18 N·m)



7. INSTALL AND ADJUST DRIVE BELTS

Check the drive belt deflection by pressing on the belt at the points indicated in the figure with 10 kg (22.0 lb, 98 N) of pressure.

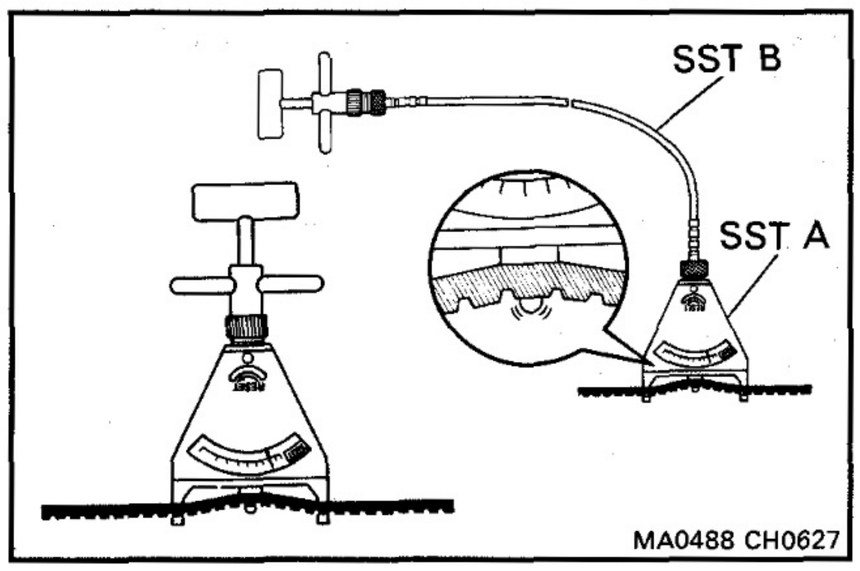
Drive belt deflection:

Alternator to water pump –

New belt	**7.0 – 9.0 mm (0.278 – 0.354 in.)**
Used belt	**9.0 – 12.0 mm (0.354 – 0.472 in.)**

PS pump to crankshaft –

New belt	**7.0 – 9.5 mm (0.278 – 0.374 in.)**
Used belt	**8.0 – 10.0 mm (0.315 – 0.393 in.)**



(Reference)

Using SST, check the drive belt tension.

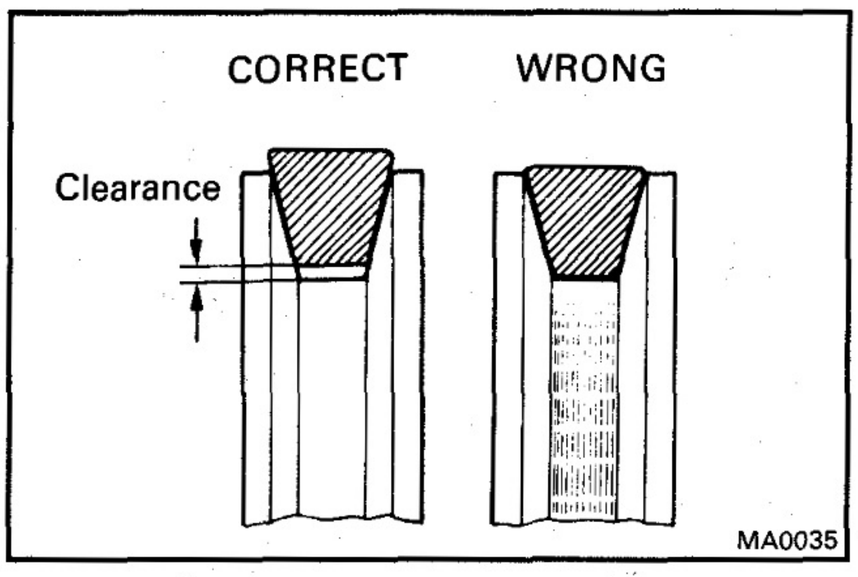
SST A 09216-00020
SST B 09216-00030

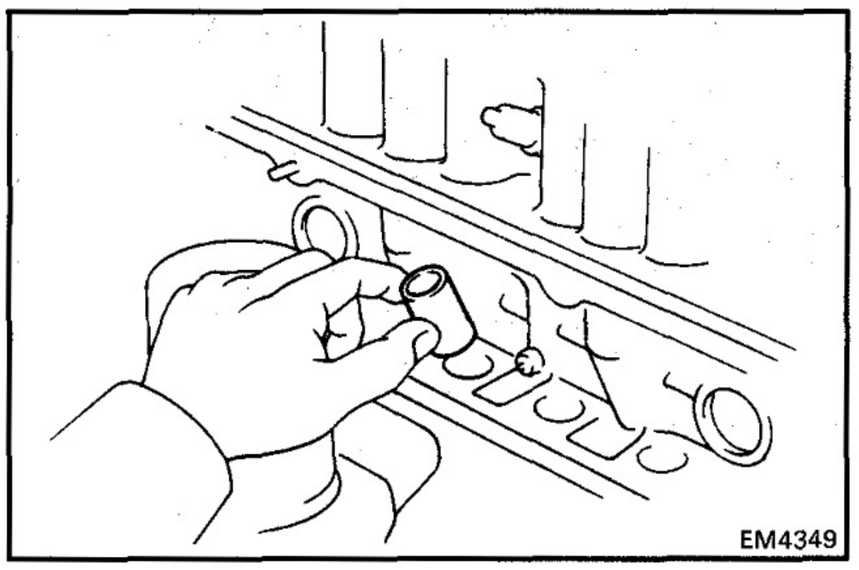
Drive belt tension:

Alternator to water pump –
New belt 55 – 65 kg
Used belt 30 – 45 kg
PS pump to crankshaft –
New belt 45 – 55 kg
Used belt 20 – 35 kg

HINT:

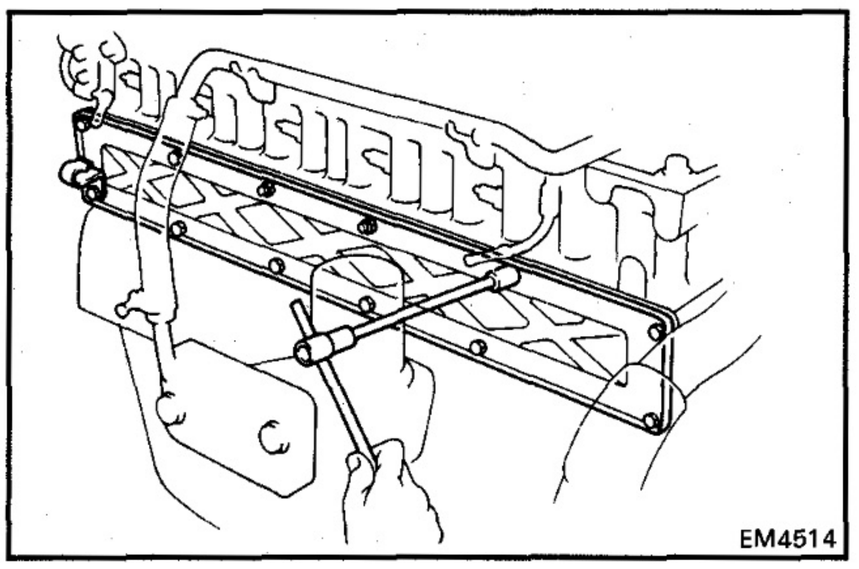
- "New belt" refers to a belt which has been used, less than 5 minutes on a running engine.
- "Used belt" refers to a belt which has been used on a running engine for 5 minutes or more.
- Check that the belt does not touch the bottom of the pulley groove.
- After installing a new belt, run the engine for about 5 minutes and then recheck the deflection (tension).





8. INSTALL VALVE LIFTERS

Carefully insert the twelve lifters into the lifter bore.



9. INSTALL PUSH ROD COVER

Install a new gasket and the push rod cover with the ten bolts and two nuts.

Torque: 40 kg-cm (35 in.-lb, 3.9 N·m)

10. INSTALL VALVE ROCKER SHAFT ASSEMBLY (See steps 2 to 4 on pages EM-28, 29)

11. INSTALL DISTRIBUTOR (See page IG-10)

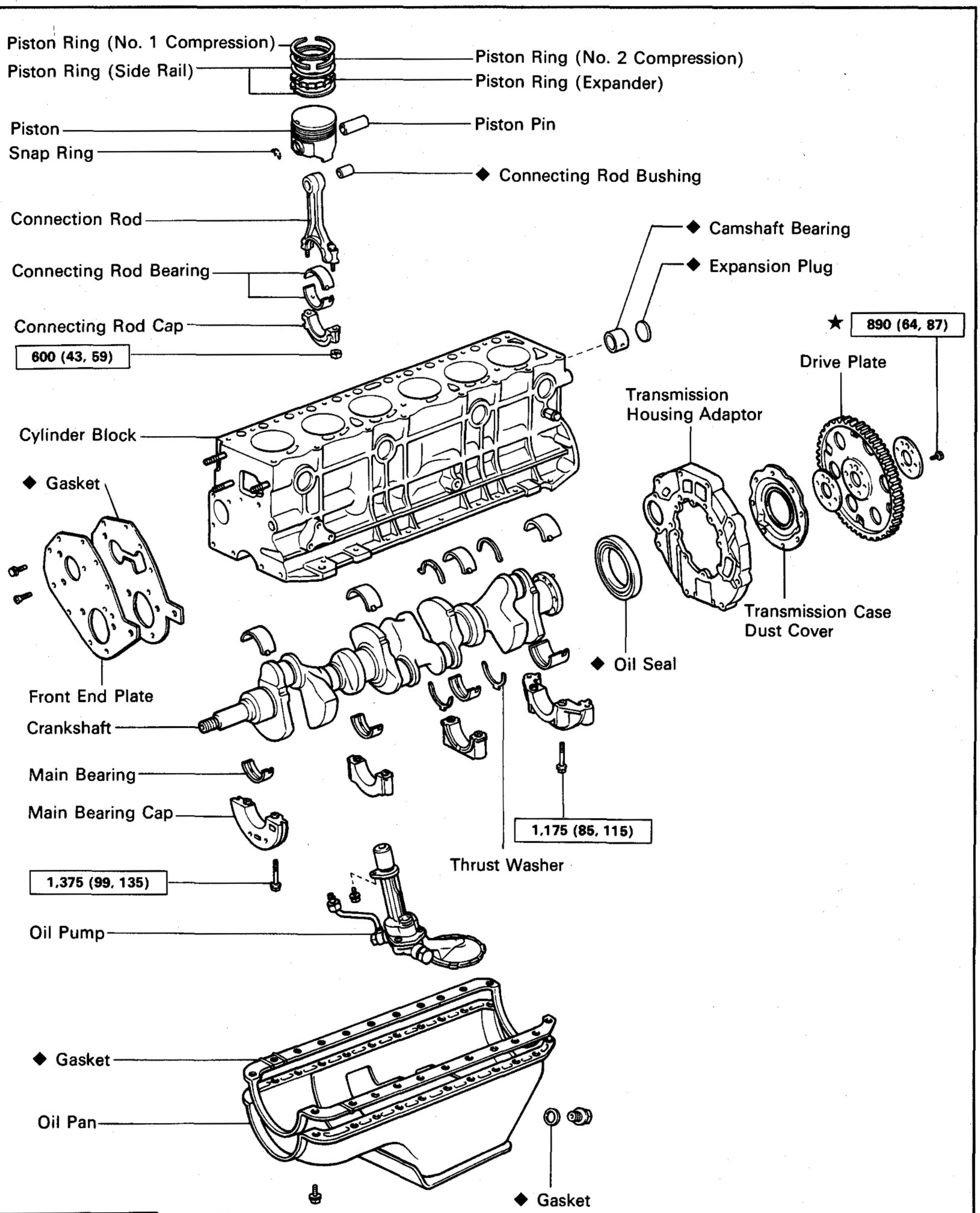
12. INSTALL WATER PUMP PULLEY AND FLUID COUPLING WITH FAN

13. INSTALL PS BRACKETS

14. REFILL WITH ENGINE COOLANT

CYLINDER BLOCK

COMPONENTS



kg-cm (ft-lb, N·m) : Specified torque

◆ Non-reusable part

★ Precoated part

EM4483

PREPARATION FOR DISASSEMBLY

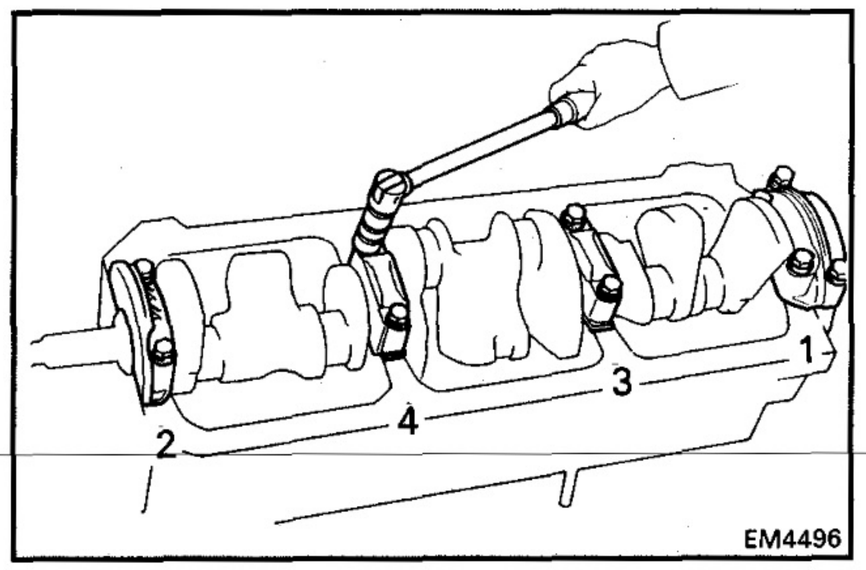
1. REMOVE DRIVE PLATE
2. REMOVE TRANSMISSION HOUSING ADAPTOR
3. INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY
4. REMOVE CYLINDER HEAD
(See page EM-18)
5. REMOVE ALTERNATOR
6. REMOVE WATER PUMP
7. REMOVE TIMING GEAR AND CAMSHAFT
(See page EM-32)
8. REMOVE OIL COOLER AND OIL FILTER BRACKET
9. REMOVE OIL PAN AND OIL PUMP

DISASSEMBLY OF CYLINDER BLOCK

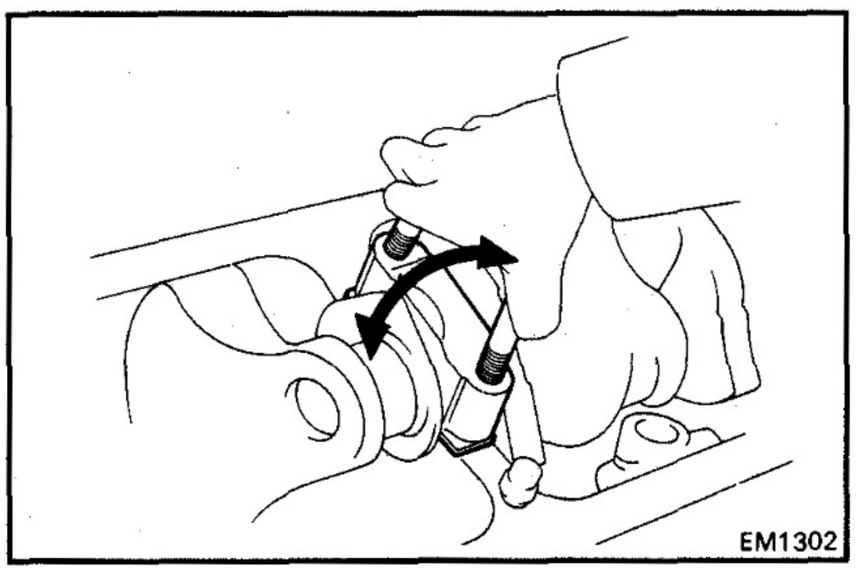
(See page EM-40)

15. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE

(a) Uniformly loosen and remove the main bearing cap bolts in several passes, in the sequence shown.



(b) Using the removed main bearing cap bolts, wiggle the cap back and forth, and remove the caps, lower bearings and lower thrust washers (No. 3 cap only).

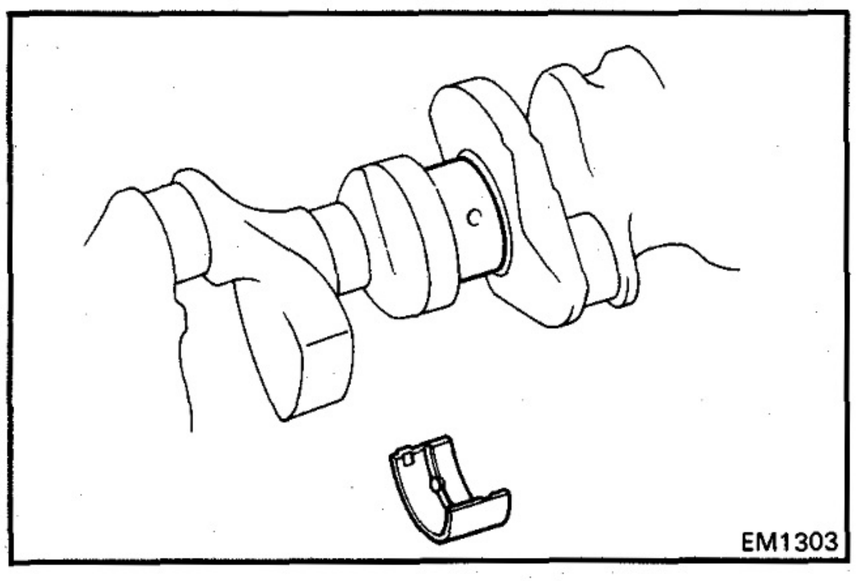


HINT:

- Keep the lower bearing and main bearing cap together.
- Arrange the main bearing caps and lower thrust washers in correct order.

(c) Lift out the crankshaft.

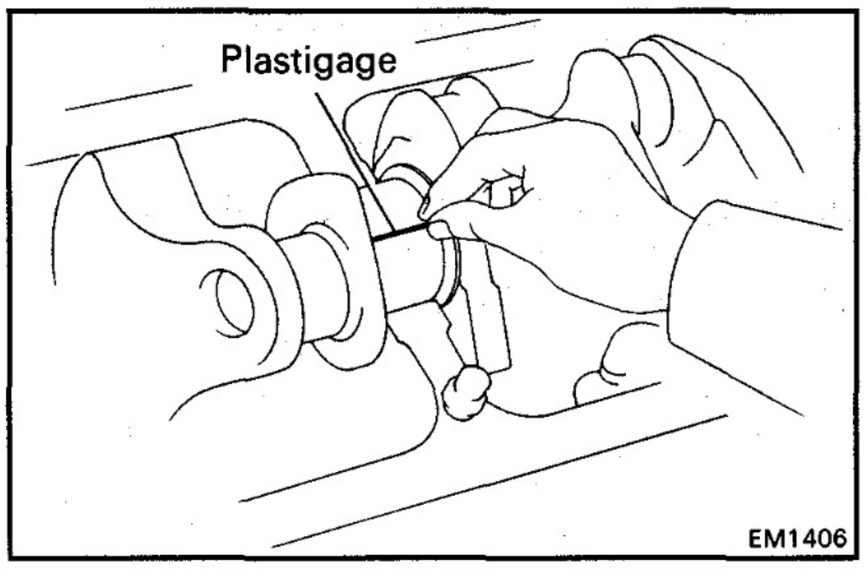
HINT: Keep the upper bearings and upper thrust washers together with the cylinder block.



(d) Clean each journal and bearing.

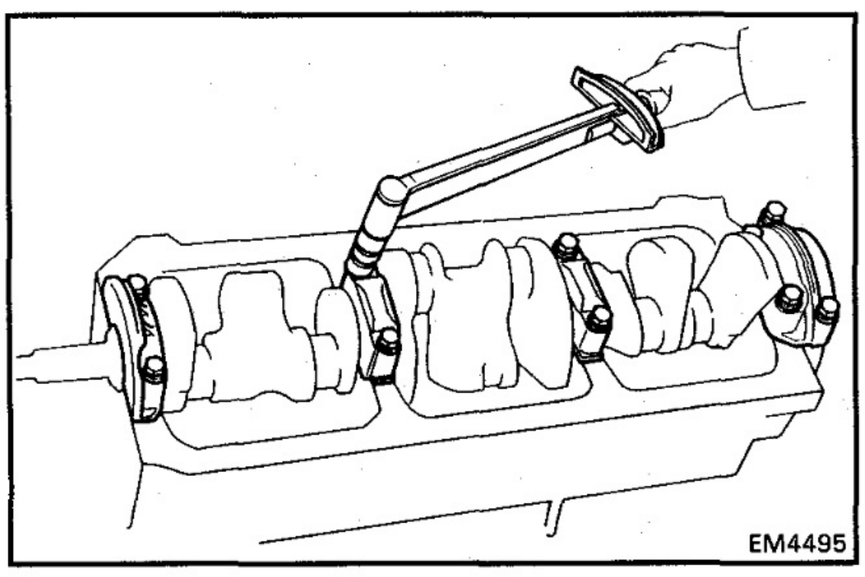
(e) Check each journal and bearing for pitting and scratches.

If the journal or bearing is damaged, replace the bearings. If necessary, grind or replace the crankshaft.



(f) Place the crankshaft on the cylinder block.

(g) Lay a strip of Plastigage across each journal.



(h) Install the main caps.

Torque:

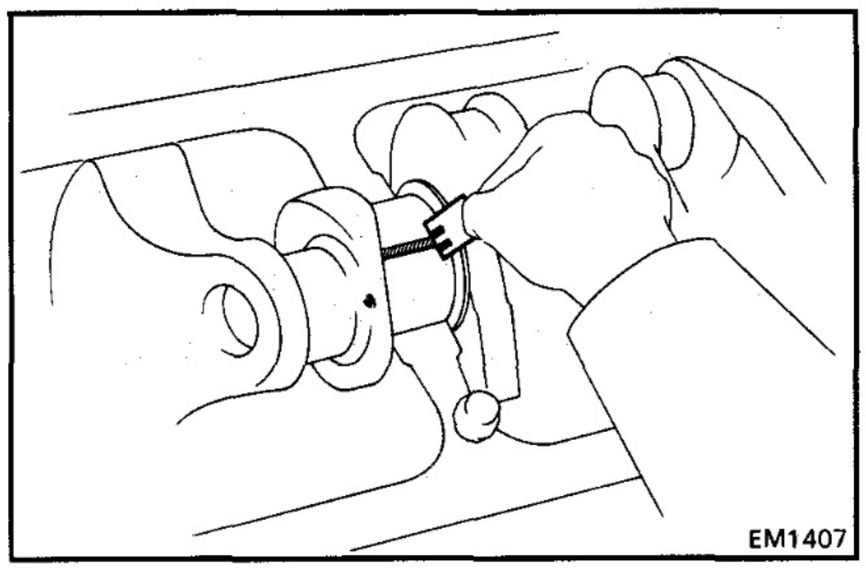
19 mm bolt head

1,375 kg-cm (99 ft-lb, 135 N·m)

17 mm bolt head

1,175 kg-cm (85 ft-lb, 115 N·m)

HINT: Do not turn the crankshaft.



(i) Remove the main bearing caps.

(j) Measure the Plastigage at its widest point.

Standard oil clearance:

STD size	**0.020 – 0.044 mm (0.0008 – 0.0017 in.)**
U/S 0.25 and 0.50	**0.021 – 0.067 mm (0.0008 – 0.0026 in.)**

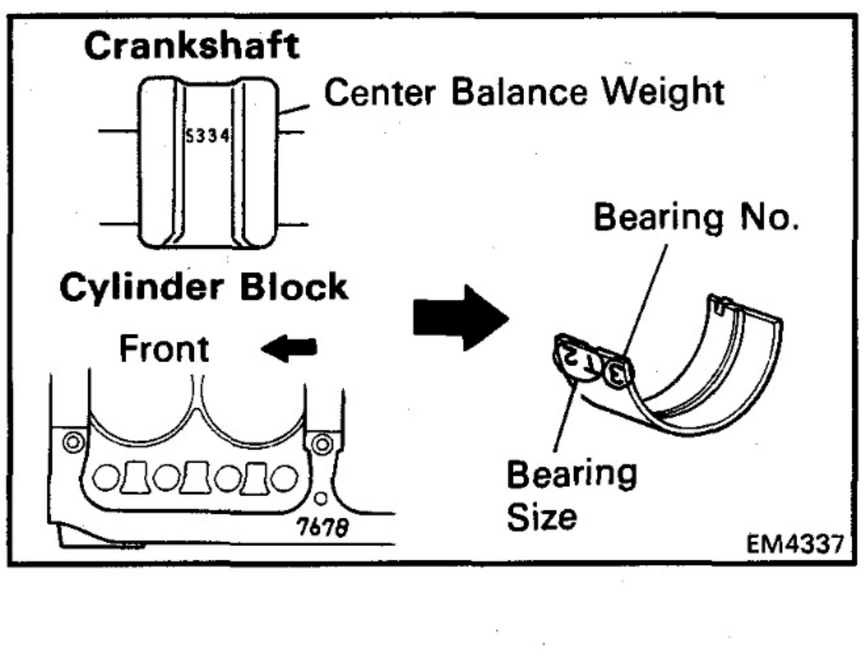
Maximum oil clearance: 0.10 mm (0.0039 in.)

HINT: If replacing the cylinder block subassembly the bearing standard clearance will be:
0.004 – 0.060 mm (0.002 – 0.0024 in.)

If the oil clearance is greater than maximum, replace the bearings. If necessary, grind or replace the crankshaft.

HINT: If replacing a standard size bearing with a standard oil clearance, replace with one having the same number. If the number of the bearing cannot be determined, select a bearing from the table below according to the numbers imprinted on the cylinder block and crankshaft.

There are five sizes of standard bearings, marked T1, T2, T3, T4 and T5.



	Number marked								
Crankshaft	3			4			5		
Cylinder block	6	7	8	6	7	8	6	7	8
Bearing	T3	T4	T5	T2	T3	T4	T1	T2	T3

Example: Crankshaft "5", Cylinder Block "7"
= Bearing "T2"

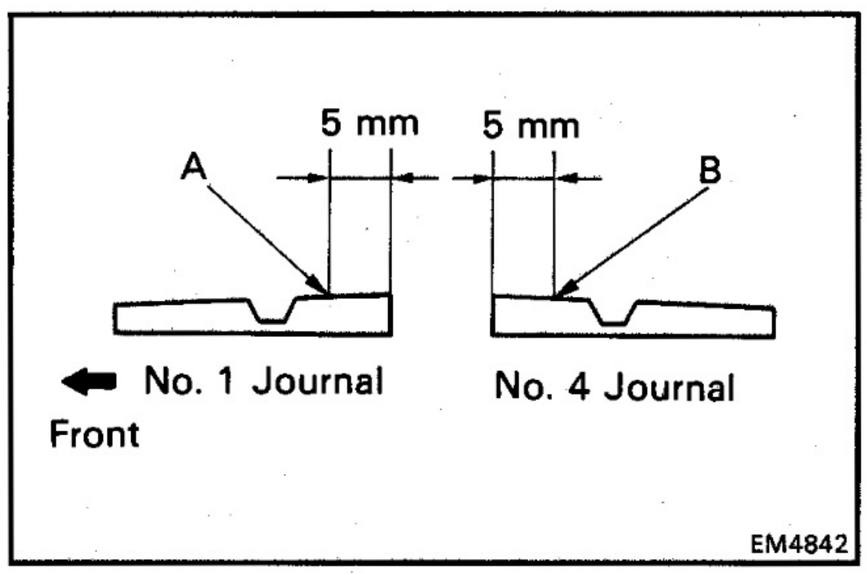
(Reference)

Crankshaft journal diameter:

Mark "3"	No.1	66.972 – 66.980 mm (2.6367 – 2.6370 in.)
	No.2	68.472 – 68.480 mm (2.6957 – 2.6961 in.)
	No.3	69.972 – 69.980 mm (2.7548 – 2.7551 in.)
	No.4	71.472 – 71.480 mm (2.8139 – 2.8142 in.)
Mark "4"	No.1	66.980 – 66.988 mm (2.6370 – 2.6373 in.)
	No.2	68.480 – 68.488 mm (2.6961 – 2.6964 in.)
	No.3	69.980 – 69.988 mm (2.7551 – 2.7554 in.)
	No.4	71.480 – 71.488 mm (2.8142 – 2.8145 in.)
Mark "5"	No.1	66.988 – 66.996 mm (2.6373 – 2.6376 in.)
	No.2	68.488 – 68.496 mm (2.6964 – 2.6967 in.)
	No.3	69.988 – 69.996 mm (2.7554 – 2.7557 in.)
	No.4	71.488 – 71.496 mm (2.8145 – 2.8148 in.)

Cylinder block main journal bore diameter:

Mark "6"	No.1	72.010 – 72.018 mm (2.8350 – 2.8353 in.)
	No.2	73.510 – 73.518 mm (2.8941 – 2.8944 in.)
	No.3	75.010 – 75.018 mm (2.9531 – 2.9535 in.)
	No.4	76.510 – 76.518 mm (3.0122 – 3.0125 in.)
Mark "7"	No.1	72.018 – 72.026 mm (2.8353 – 2.8357 in.)
	No.2	73.518 – 73.526 mm (2.8944 – 2.8947 in.)
	No.3	75.018 – 75.026 mm (2.9535 – 2.9538 in.)
	No.4	76.518 – 76.526 mm (3.0125 – 3.0128 in.)
Mark "8"	No.1	72.026 – 72.034 mm (2.8357 – 2.8360 in.)
	No.2	73.526 – 73.534 mm (2.8947 – 2.8950 in.)
	No.3	75.026 – 75.034 mm (2.9538 – 2.9541 in.)
	No.4	76.526 – 76.534 mm (3.0128 – 3.0131 in.)

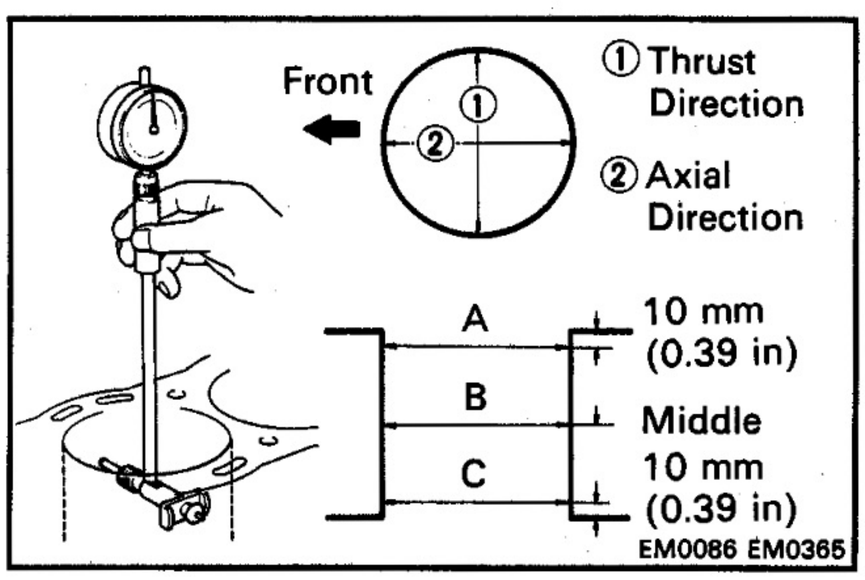


Standard bearing thickness (at center wall):

Mark "T1"	**2.493 – 2.497 mm (0.0981 – 0.0983 in.)**
Mark "T2"	**2.497 – 2.501 mm (0.0983 – 0.0985 in.)**
Mark "T3"	**2.501 – 2.505 mm (0.0985 – 0.0986 in.)**
Mark "T4"	**2.505 – 2.509 mm (0.0986 – 0.0988 in.)**
Mark "T5"	**2.509 – 2.513 mm (0.0988 – 0.0989 in.)**

HINT: Check the bearing thickness of No. 1 and No. 4 journals in the positions A, B shown in the illustration.

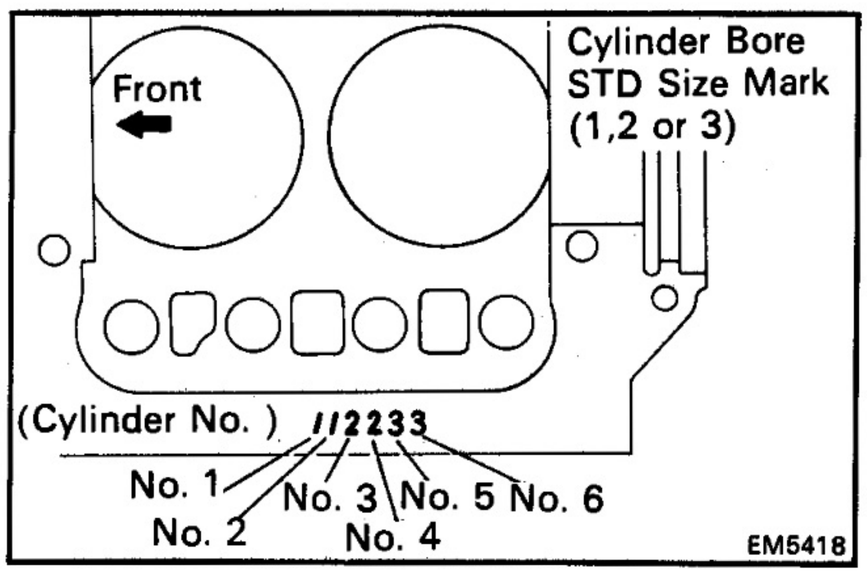
(k) completely remove the Plastigage.



INSPECTION OF CYLINDER BLOCK

5. INSPECT CYLINDER BORE DIAMETER

Using a cylinder gauge, measure the cylinder bore diameter at positions A, B and C in the thrust and axial directions.



HINT: There are 3 standard sizes for the cylinder bore diameter which are marked on the cylinder block as shown in the illustration.

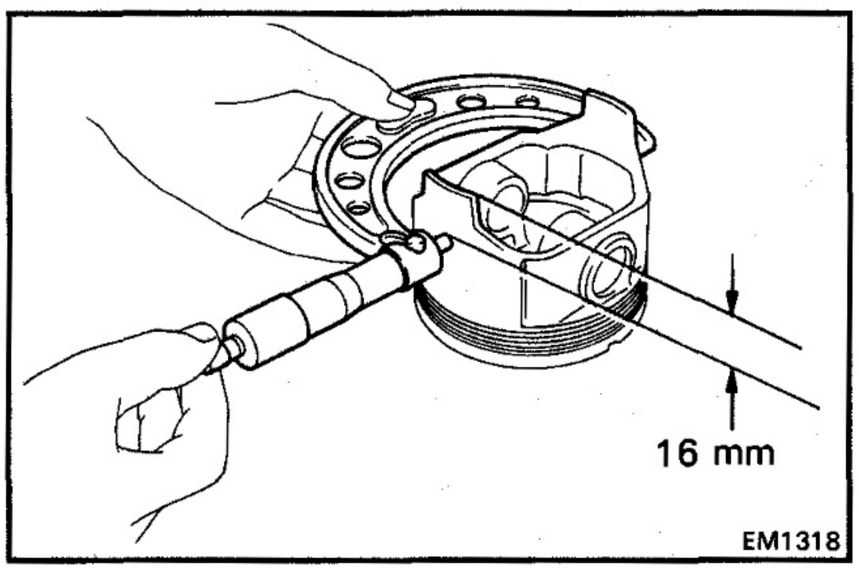
Standard diameter:

STD size	**Mark "1"**	**94.000 – 94.010 mm (3.7008 – 3.7012 in.)**
	Mark "2"	**94.010 – 94.020 mm (3.7012 – 3.7016 in.)**
	Mark "3"	**94.020 – 94.030 mm (3.7016 – 3.7020 in.)**

Maximum diameter:

STD size	**94.23 mm (3.7098 in.)**
O/S 0.50	**94.73 mm (3.7295 in.)**
O/S 1.00	**95.23 mm (3.7492 in.)**
O/S 1.50	**95.73 mm (3.7689 in.)**

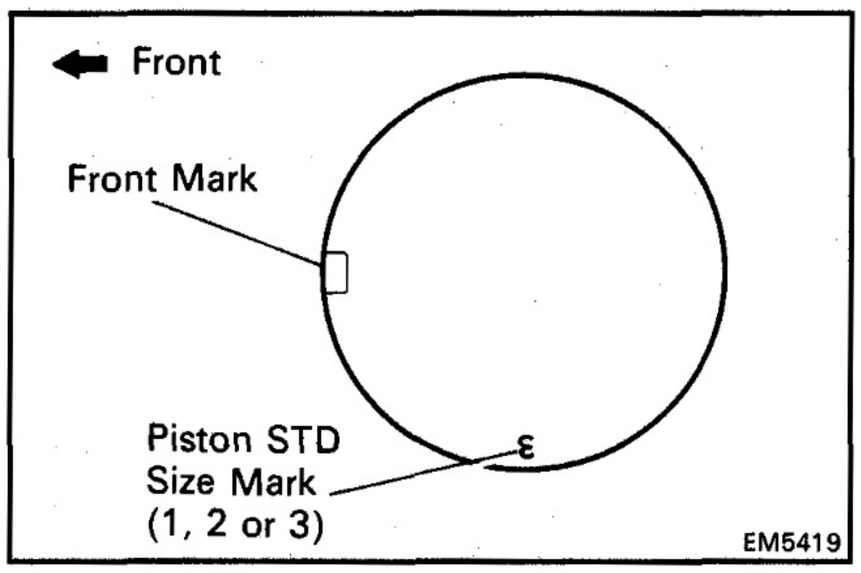
If the diameter is greater than maximum, rebore all six cylinders. If necessary, replace the cylinder block.



INSPECTION OF PISTON AND CONNECTING ROD ASSEMBLIES

2. INSPECT PISTON DIAMETER AND OIL CLEARANCE

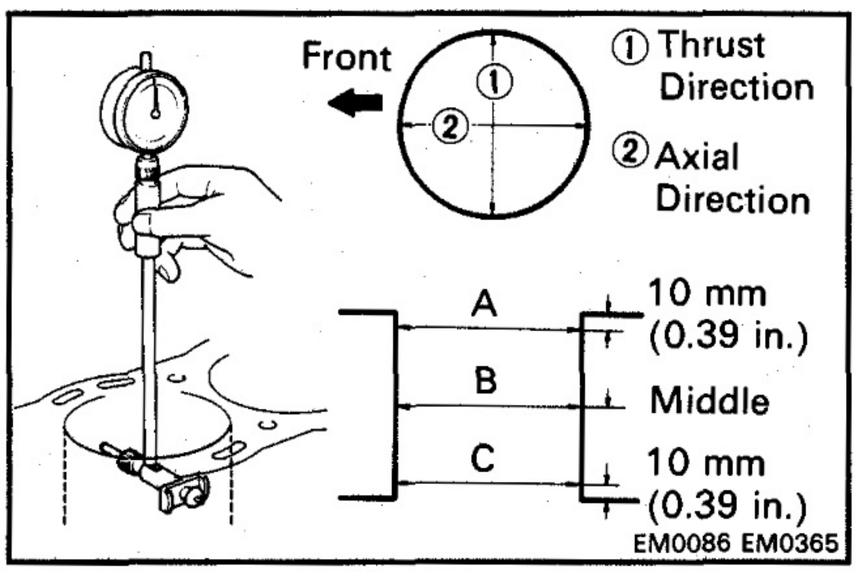
(a) Using a micrometer, measure the piston diameter at a right angle to the piston pin hole center line, 16 mm (0.63 in.) below the skirt bottom edge.



HINT: There are 3 sizes of standard pistons, marked 1, 2 or 3 as shown in the illustration.

Standard diameter:

STD size	**Mark "1"**	**93.963 – 93.973 mm (3.6993 – 3.6997 in.)**
	Mark "2"	**93.973 – 93.983 mm (3.6997 – 3.7001 in.)**
	Mark "3"	**93.983 – 93.993 mm (3.7001 – 3.7005 in.)**
O/S 0.50		**94.463 – 94.493 mm (3.7190 – 3.7202 in.)**
O/S 1.00		**94.963 – 94.993 mm (3.7387 – 3.7399 in.)**
O/S 1.50		**95.463 – 95.493 mm (3.7584 – 3.7596 in.)**

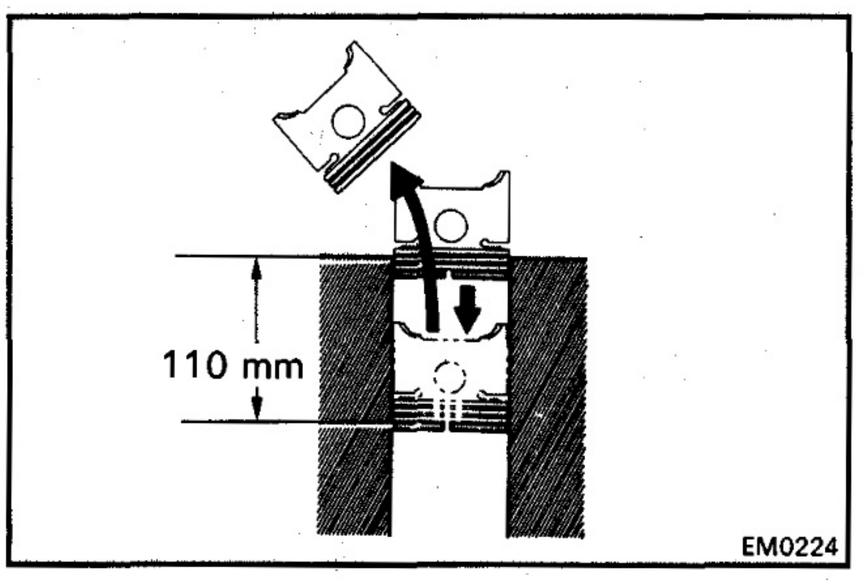


(b) Measure the cylinder bore diameter in thrust directions (See step 5 on page EM-44)

(c) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Oil clearance: 0.027 – 0.047 mm (0.0011 – 0.0019 in.)

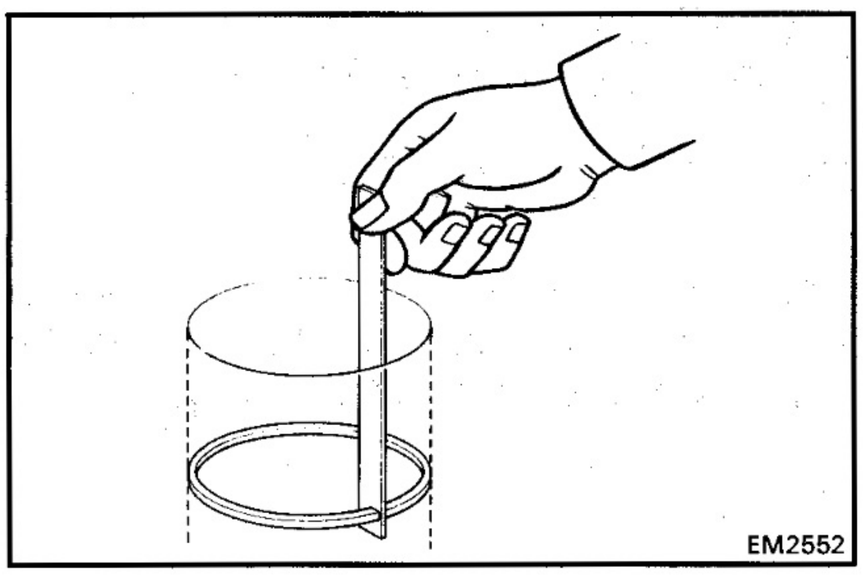
If the oil clearance is not within specification, replace the piston. If necessary, rebore all six cylinders and replace all six pistons. If necessary, replace the cylinder block, install a piston with the same mark as marked on the cylinder block.



4. INSPECT PISTON RING END GAP

(a) Insert the piston ring into the cylinder bore.

(b) Using a piston, push the piston ring a little beyond the bottom of the ring travel.
(110 mm or 4.33 in. from top surface of cylinder block)


EM2552

(c) Using a thickness gauge, measure the end gap.

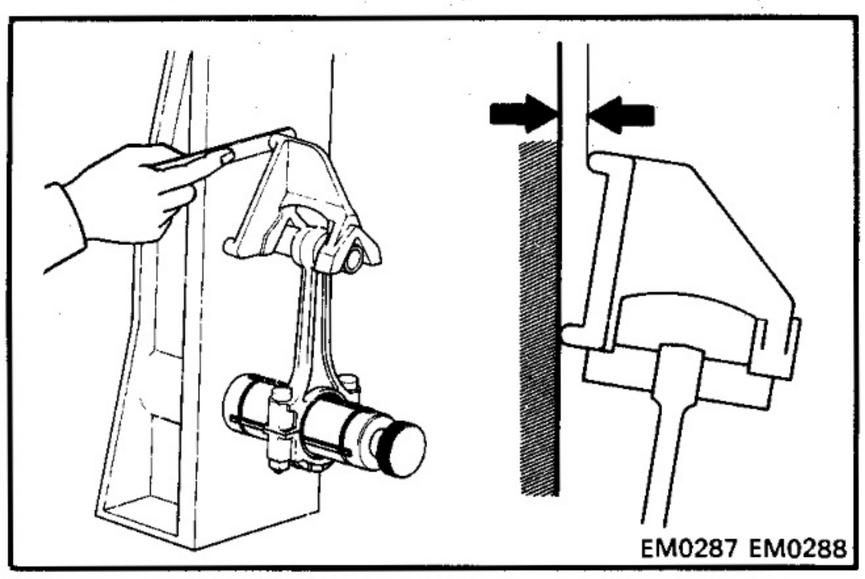
Standard end gap:

No. 1	**0.200 – 0.420 mm (0.0079 – 0.0165 in.)**
No. 2	**0.500 – 0.720 mm (0.0197 – 0.0283 in.)**
Oil (side rail)	**0.200 – 0.820 mm (0.0079 – 0.0323 in.)**

Maximum end gap:

No. 1	**1.02 mm (0.0402 in.)**
No. 2	**1.32 mm (0.0520 in.)**
Oil (Side rail)	**1.42 mm (0.0559 in.)**

If the gap is greater than maximum, replace the piston ring. If the gap is greater than maximum, even with a new piston ring, rebore the cylinder and use an O/S piston ring.


EM0287 EM0288

6. INSPECT CONNECTING RODS

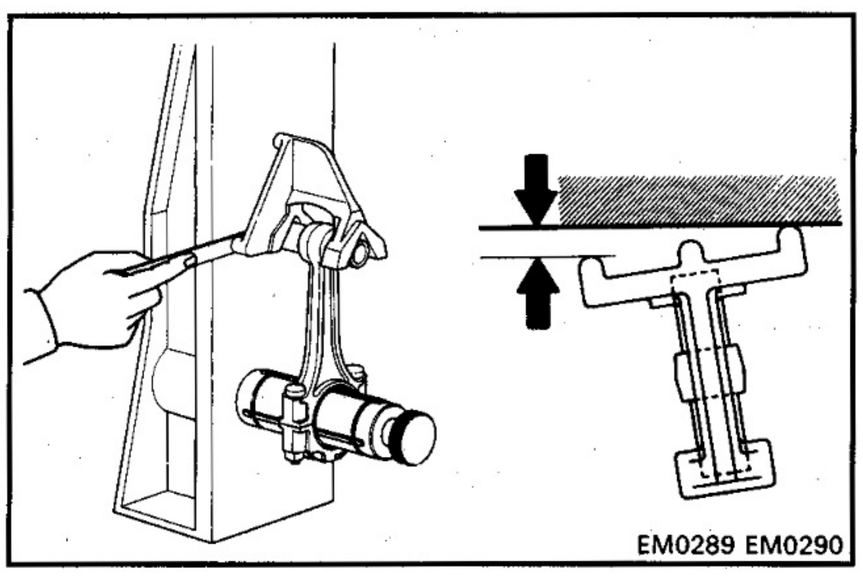
(a) Using a rod aligner and thickness gauge, check the connecting rod alignment.

- Check for bend.

Maximum bend:

0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

If bend is greater than maximum, replace the connecting rod assembly.

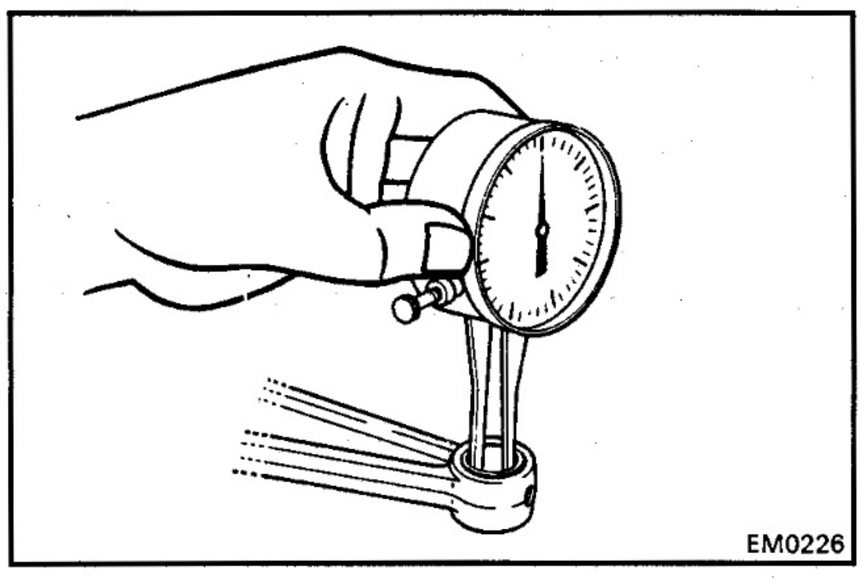

EM0289 EM0290

- Check for twist.

Maximum twist:

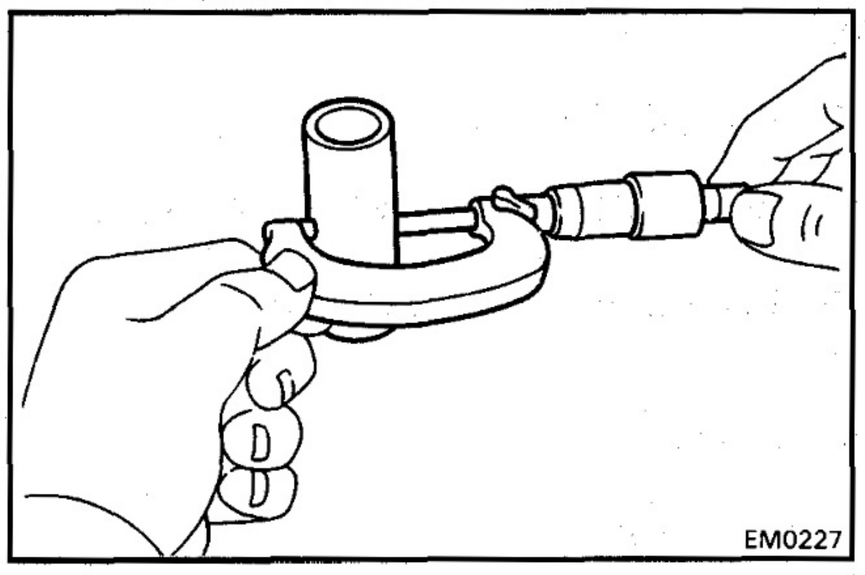
0.15 mm (0.0059 in.) per 100 mm (3.94 in.)

If twist is greater than maximum, replace the connecting rod assembly.


EM0226

(b) Using a caliper gauge, measure the inside diameter of the connecting rod bushing.

Bushing inside diameter: 22.012 – 22.027 mm (0.8666 – 0.8672 in.)



(c) Using a micrometer, measure the piston pin diameter.

Piston pin diameter: 22.004 – 22.019 mm (0.8663 – 0.8669 in.)

(d) Subtract the piston pin diameter measurement from the busing inside diameter measurement.

Standard oil clearance: 0.005 – 0.011 mm (0.0002 – 0.0004 in.)

Maximum oil clearance: 0.03 mm (0.0012 in.)

If the oil clearance is greater than maximum, replace the connecting rod bushing. If necessary, replace the piston and piston pin assembly.

BORING OF CYLINDERS

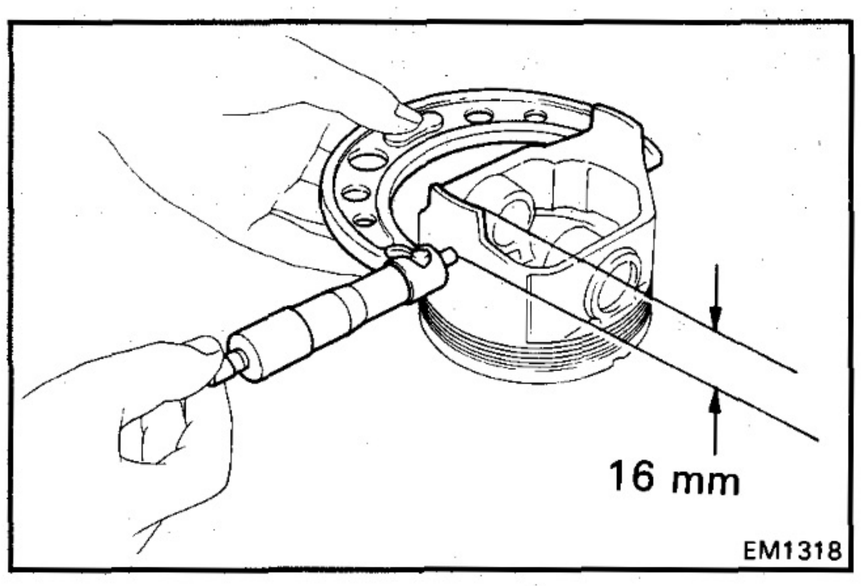
HINT:

- Bore all six cylinders for the oversized piston outside diameter.
- Replace the piston rings with ones to match the oversized pistons.

1. SELECT OVERSIZED PISTONS

Oversized piston diameter:

O/S	**0.50**	**94.463 – 94.493 mm (3.7190 – 3.7202 in.)**
O/S	**1.00**	**94.963 – 94.993 mm (3.7387 – 3.7399 in.)**
O/S	**1.50**	**95.463 – 95.493 mm (3.7584 – 3.7596 in.)**



2. CALCULATE AMOUNT TO BORE CYLINDER

(a) Using a micrometer, measure the piston diameter at a right angle to the piston pin hole center line, 16 mm (0.63 in.) below the skirt bottom edge.

(b) Calculate the amount each cylinder is to be rebored as follows:

Size to be rebored = P + C – H

P = Piston diameter

C = Piston clearance

0.027 – 0.047 mm (0.0012 – 0.0020 in.)

H = Allowance for honing

0.02 mm (0.0008 in.) or less

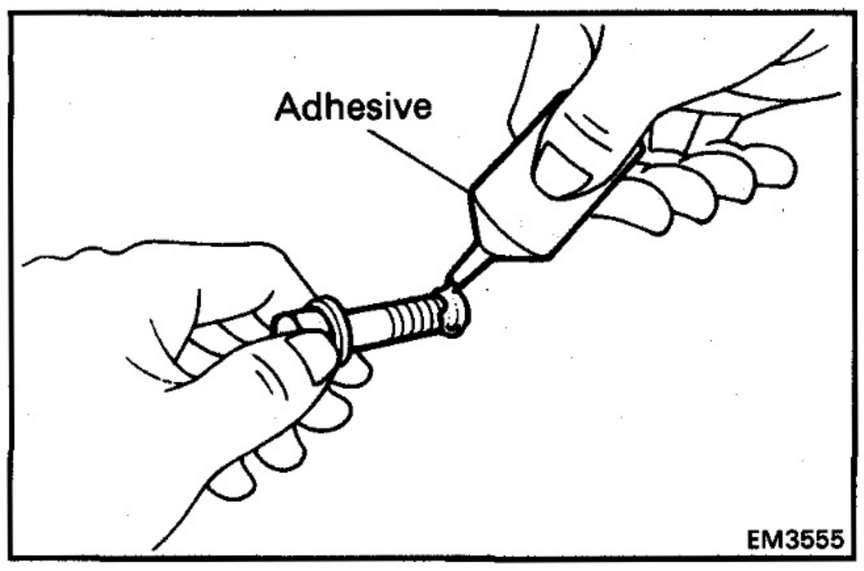
3. BORE AND HONE CYLINDERS TO CALCULATED DIMENSIONS

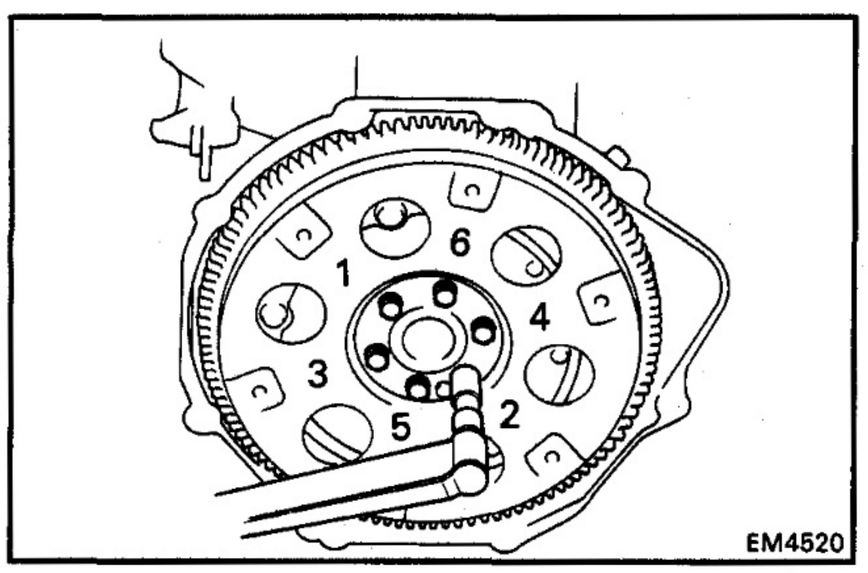
Maximum honing: 0.02 mm (0.0008 in.)

NOTICE: Excess honing will destroy the finished roundness.

POST ASSEMBLY

1. **INSTALL OIL PUMP AND OIL PAN**
2. **INSTALL OIL COOLER AND OIL FILTER BRACKET**
3. **INSTALL TIMING GEARS AND CAMSHAFT**
   (See page EM-36)
4. **INSTALL WATER PUMP**
5. **INSTALL CYLINDER HEAD**
   (See page EM-28)
6. **REMOVE ENGINE STAND**
7. **INSTALL TRANSMISSION HOUSING ADAPTOR**





8. **INSTALL DRIVE PLATE**
   (a) Clean the mount bolt threads and crankshaft bolt holes of any residual sealer, oil or foreign particles. Remove any oil with kerosene or gasoline.
   (b) Apply adhesive to two or three threads of the mount bolt end.

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

HINT:
- This sealant will not harden while exposed to air.
- It will act as a sealer or binding agent only when applied to threads, etc. when the air is cut off.

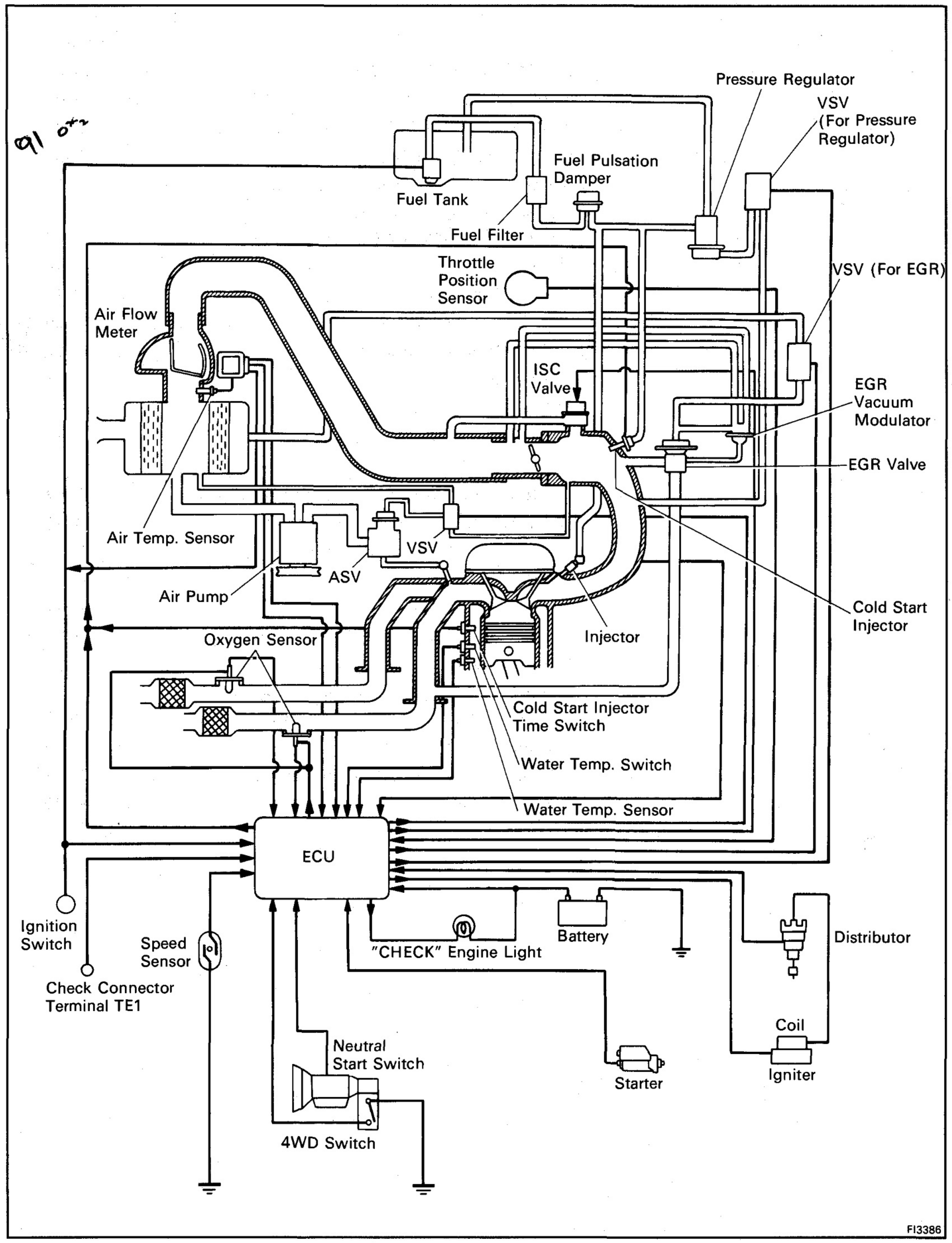
   (c) Install the drive plate on the crankshaft.
   (d) Install and uniformly tighten the bolts in several passes, in the sequence shown.

Torque: 890 kg-cm (64 ft-lb, 87 N·m)

EFI SYSTEM

	Page
SYSTEM DESCRIPTION	FI-2
PRECAUTIONS	FI-4
INSPECTION PRECAUTIONS	FI-4
TROUBLESHOOTING	FI-9
DIAGNOSIS SYSTEM	FI-21
TROUBLESHOOTING WITH VOLT/OHMMETER	FI-27
FUEL SYSTEM	FI-44
Fuel Pump	FI-44
Cold Start Injector	FI-50
Fuel Pressure Regulator	FI-53
Injectors	FI-55
AIR INDUCTION SYSTEM	FI-62
Air Flow Meter	FI-62
Throttle Body	FI-64
Idle Speed Control (ISC) Valve	FI-67
ELECTRONIC CONTROL SYSTEM	FI-69
Location of Electronic Control Parts	FI-69
EFI Main Relay	FI-70
Circuit Opening Relay	FI-71
Cold Start Injector Time Switch	FI-72
Water Temperature Sensor	FI-73
High Temperature Line Pressure Up System	FI-74
Oxygen Sensors	FI-75
Electronic Controlled Unit (ECU)	FI-77
Fuel Cut RPM	FI-80

SYSTEM DESCRIPTION



The EFI system is composed of three basic subsystems: Fuel, Air Induction and Electronic Control Systems.

FUEL SYSTEM

Fuel is supplied under constant pressure to the EFI injectors by an electric fuel pump. The injectors inject a measured quantity of fuel into the intake manifold 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

The 3F-E engine is equipped with a Toyota Computer Control System (TCCS) which centrally controls the EFI, ESA, ISC, Diagnosis systems, etc. by means of an Electronic Control Unit (ECU – formerly EFI computer) employing a microcomputer.

By means of 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 air volume
   Intake air temperature
   Coolant temperature
   Engine rpm
   Acceleration / deceleration
   Exhaust oxygen content 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. Idle Speed Control (ISC)

   The ECU is programmed with target idling speed values to respond to different engine conditions (coolant temperature, air conditioner on/off, etc.). Sensors transmit signals to the ECU which control the flow of air through the bypass of the throttle valve and adjust idle speed to the target value.
   (See pages FI-40, 71)

4. Exhaust Gas Recirculation (EGR)

   The ECU controls the EGR system according to coolant temperature, engine rpm, throttle angle, vehicle speed and inlet air flow rate.

5. Air Injection (AI)

   The ECU controls the AI system according to coolant temperature, engine rpm, throttle angle, vehicle speed and inlet air rate.

6. 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 short-circuited. The diagnostic codes are referred to in a later page.
   (See pages FI-24, 25)

7. Fail-Safe Function

   When an abnormality occurs in any of the ECU input signals, the ECU substitutes a standard valve stored in the microcomputer memory in order to prevent engine malfunction. Also, if the abnormality is serious, the ECU stops the engine.

8. Back-Up Function

   Even when an abnormality occurs in the ECU, it provides regular fuel injection and control of the ignition timing to provide vehicle driveability.

PRECAUTIONS

1. **Before working on the fuel system, disconnect the cable from the negative (–) terminal of the battery.**

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

2. **Do not smoke or work on open flame when working on the fuel system.**

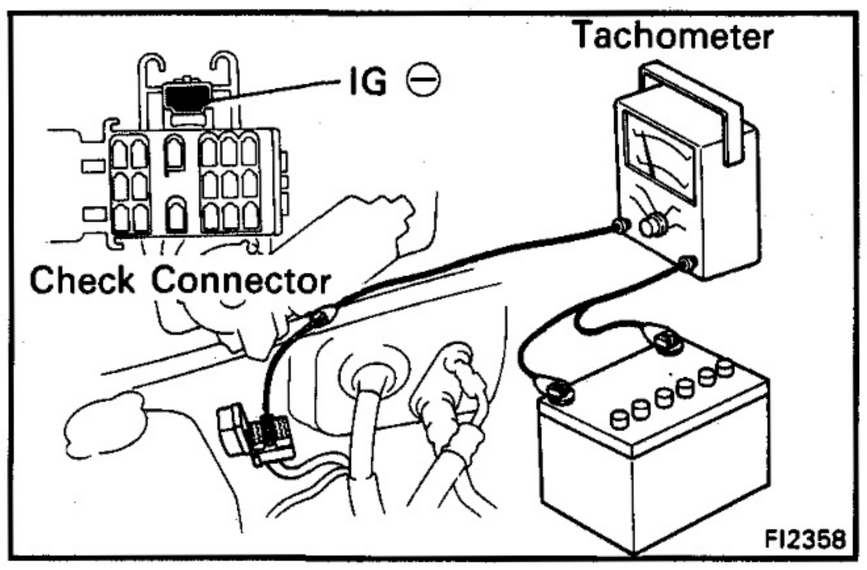
3. **Keep gasoline off rubber or leather parts.**

INSPECTION PRECAUTIONS

MAINTENANCE PRECAUTIONS

1. CHECK CORRECT ENGINE TUNE-UP

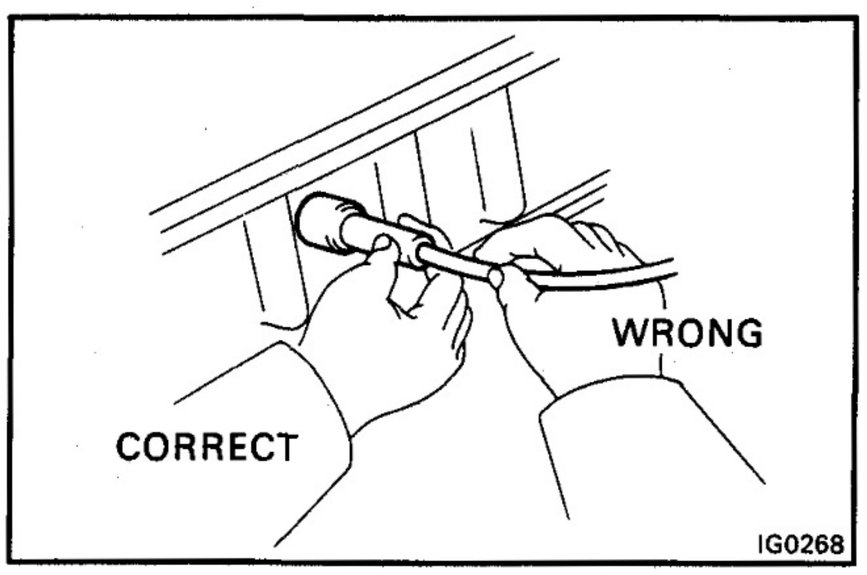
(See page EM-11)



2. PRECAUTIONS WHEN CONNECTING GAUGE

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

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



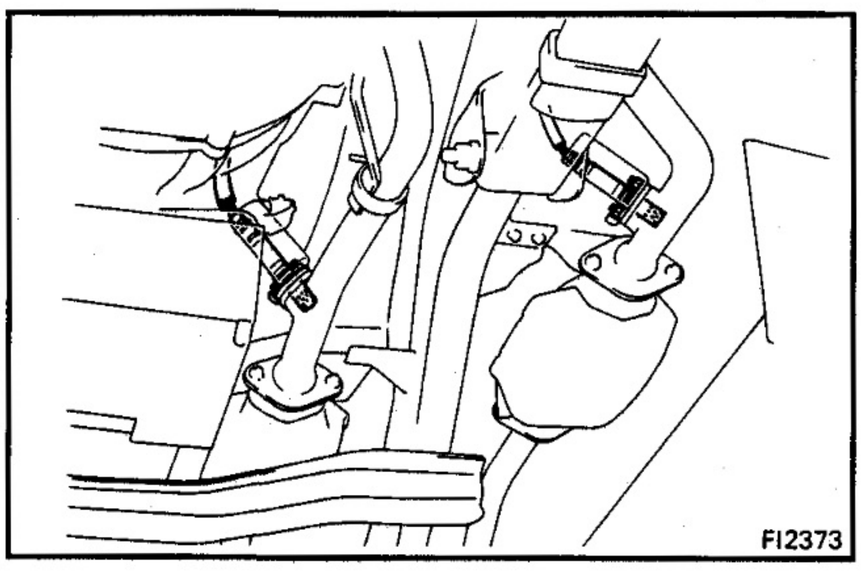
3. IN EVENT OF ENGINE MISFIRE FOLLOWING PRECAUTIONS SHOULD BE TAKEN

(a) Check proper connection of battery terminals, etc.

(b) Handle high-tension cords carefully.

(c) After repair work, check that the ignition coil terminals and all other ignition system lines are reconnected securely.

(d) When cleaning the engine compartment, be especially careful to protect the electrical system from water.



4. PRECAUTIONS WHEN HANDLING OXYGEN SENSORS

(a) Do not allow oxygen sensor to drop or hit against an object.

(b) Do not allow the sensor to come into contact with water.

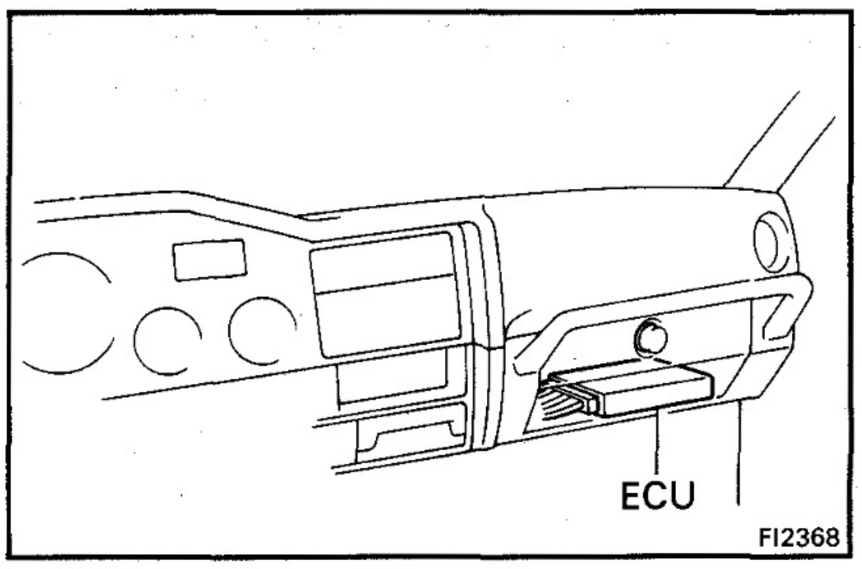
IF VEHICLE IS EQUIPPED WITH MOBILE RADIO SYSTEM (HAM, CB, ETC.)

The ECU has been designed so that it will not be affected by outside interference.

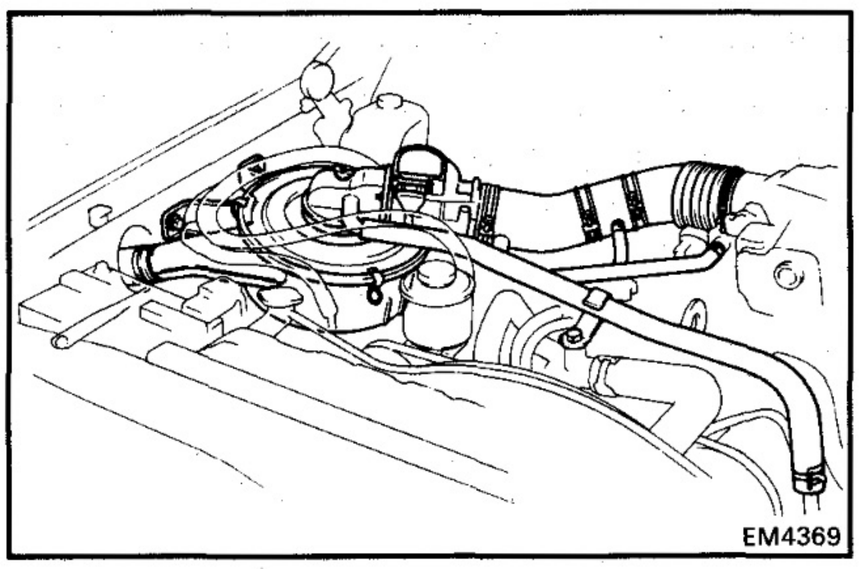
However, if your vehicle is equipped with a CB radio transceiver, etc. (even one with about 10 W output), it may, at times, have an affect upon ECU operation, especially if the antenna and feeder are installed nearby.

Therefore, observe the following precautions:

1. Install the antenna as far as possible from the ECU. The ECU is located behind the glove box, so the antenna should be installed at the rear side of the vehicle.
2. Keep the antenna feeder as far away as possible from the ECU wires – at least 20 cm (7.87 in.) – and, especially, do not wind them together.
3. Check that the feeder and antenna are properly adjusted.
4. Do not equip your vehicle with a powerful mobile radio system.
5. 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.)

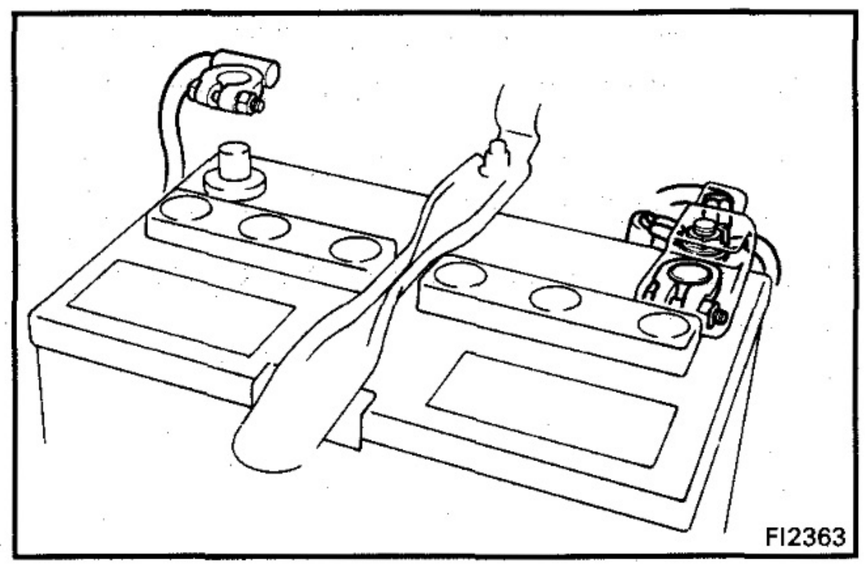


FI2368


EM4369

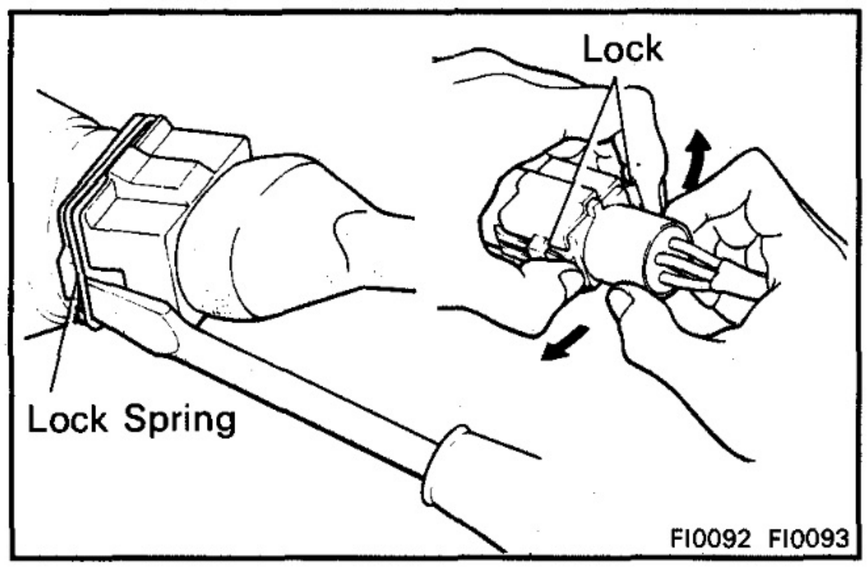
AIR INDUCTION SYSTEM

1. Separation of the engine oil dipstick, oil filler cap, PCV hose, etc. may cause the engine to run out of tune.
2. Disconnection, looseness or cracks in the parts of the air induction system between the air flow meter and cylinder head will allow air suction and cause the engine to run out of tune.

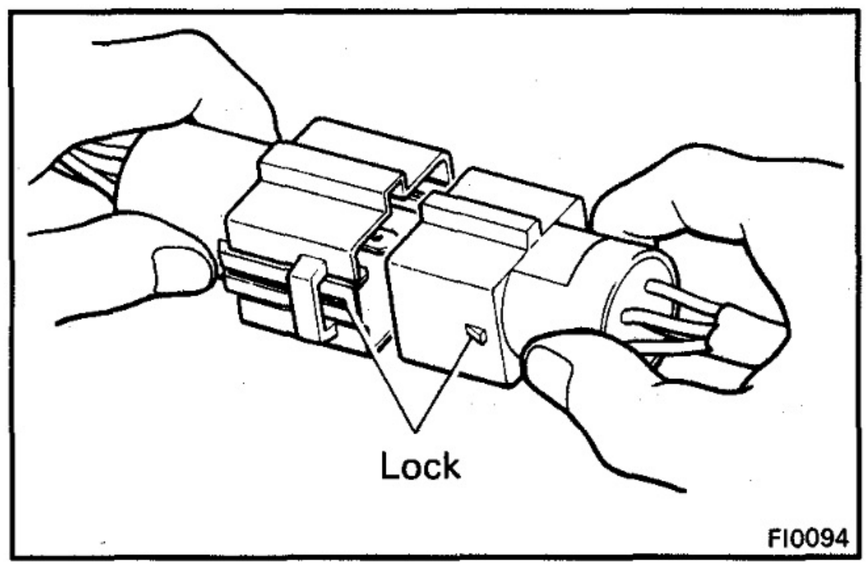

FI2363

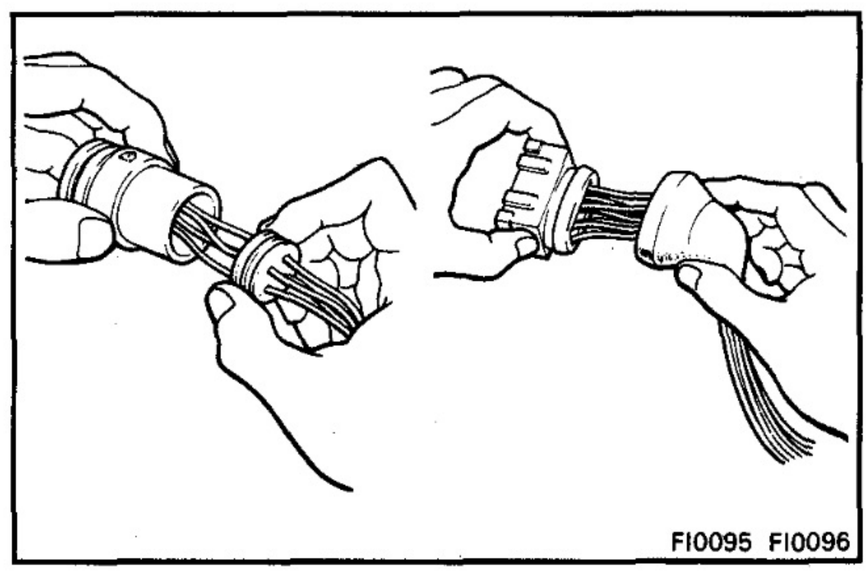
ELECTRONIC CONTROL SYSTEM

1. Before removing EFI wiring connectors, terminals, etc., first disconnect the power by either turning the ignition switch OFF 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 jolt parts during removal or installation. Handle all EFI parts carefully, especially the ECU.
4. Do not be careless during troubleshooting as there are numerous transistor circuits and contact with terminal can cause further trouble.
5. When inspecting during rainy weather, take care to prevent entry of water. Also, when washing the engine compartment, prevent water from getting on EFI parts and wiring connectors.
6. Parts should be replaced as an assembly.

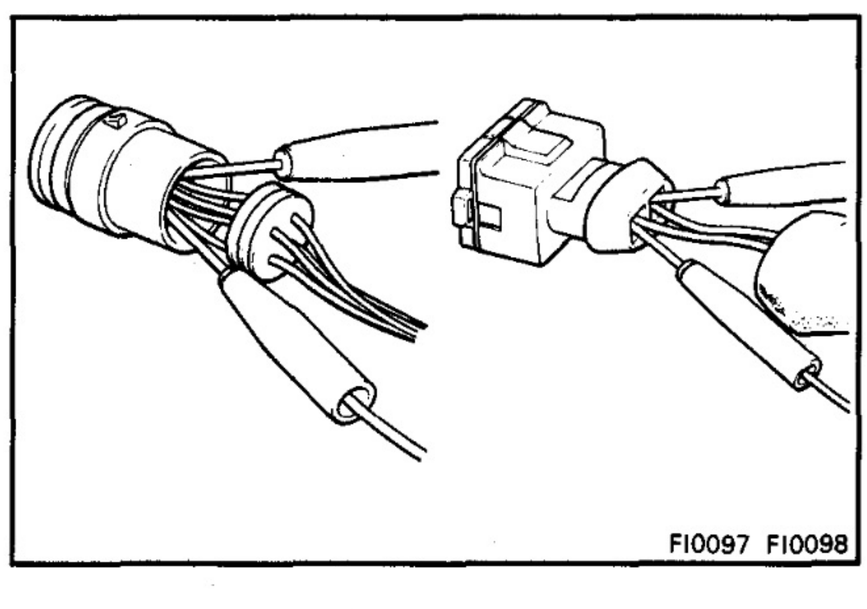


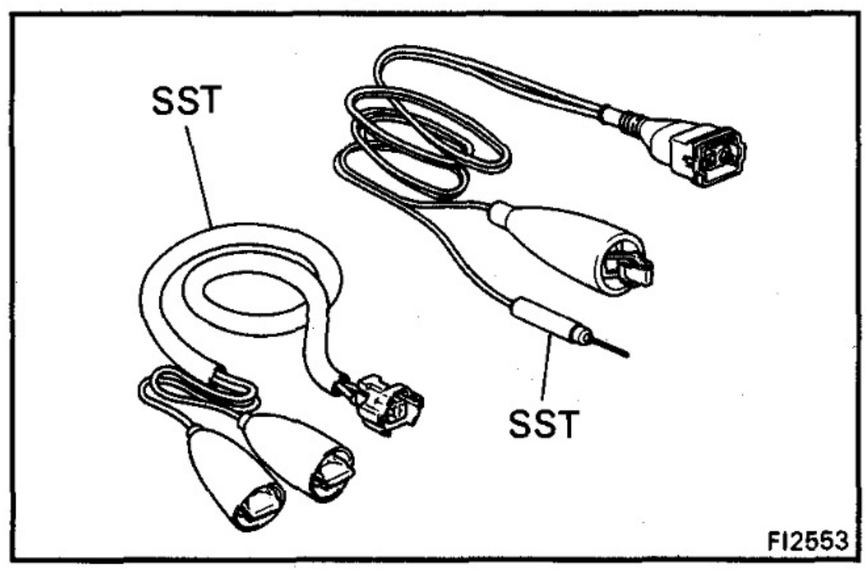
7. Care is required when pulling out and inserting wiring connectors.
   (a) Release the lock and pull out the connector.
   (b) Fully insert the connector and check that it is locked.



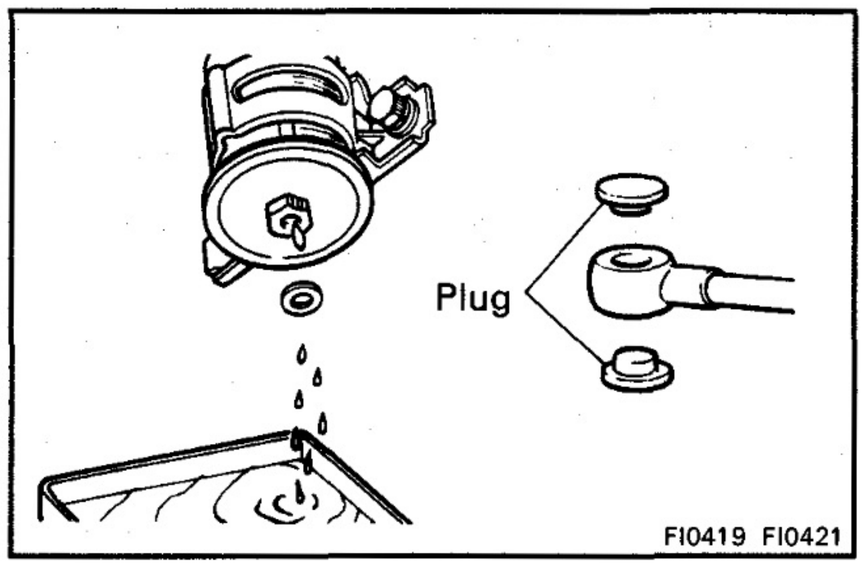


8. When inspecting a connector with a volt/ohmmeter.
   (a) Carefully take out the water-proofing rubber if it is a water-proof type connector.
   (b) Insert the test probe into the connector from the wiring side when checking continuity, amperage or voltage.
   (c) Do not apply unnecessary force to the terminal.
   (d) After checking, install the water-proofing rubber on the connector securely.



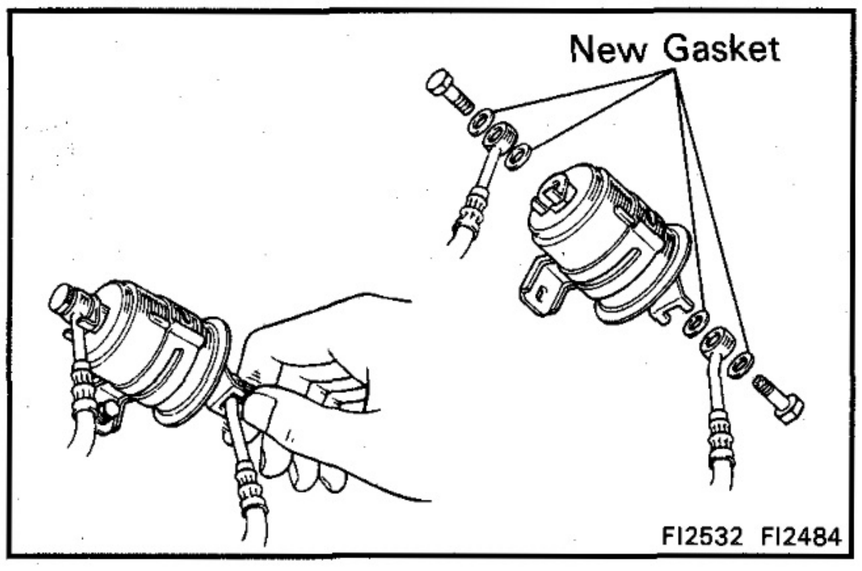


9. Use SST for inspection or test of the injector, cold start injector or its wiring connector.
   SST 09842-30050 and 09842-30070



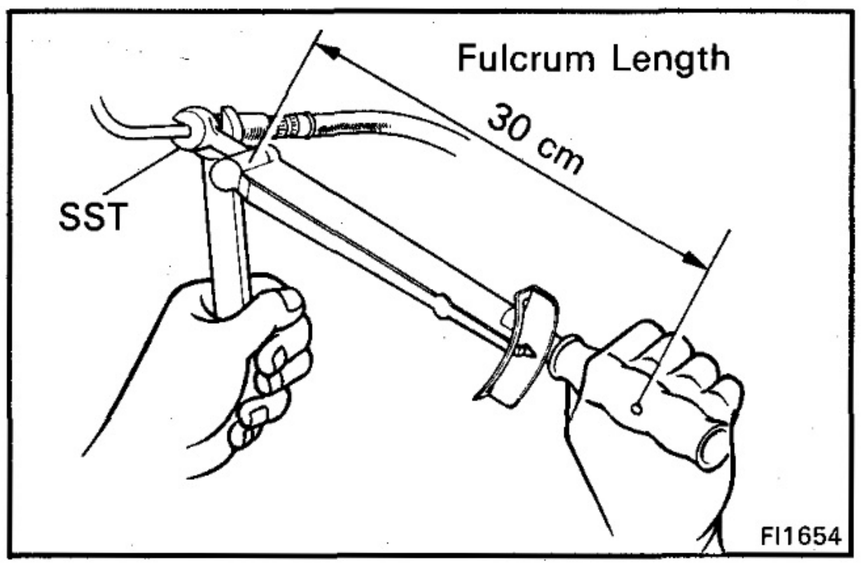
FUEL SYSTEM

1. When disconnecting the high fuel pressure line, a large amount of gasoline will spill out, so 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) Tighten the union bolt by hand.
   (c) Tighten the union bolt to the specified torque.

   Torque: 300 kg-cm (22 ft-lb, 29 N·m)

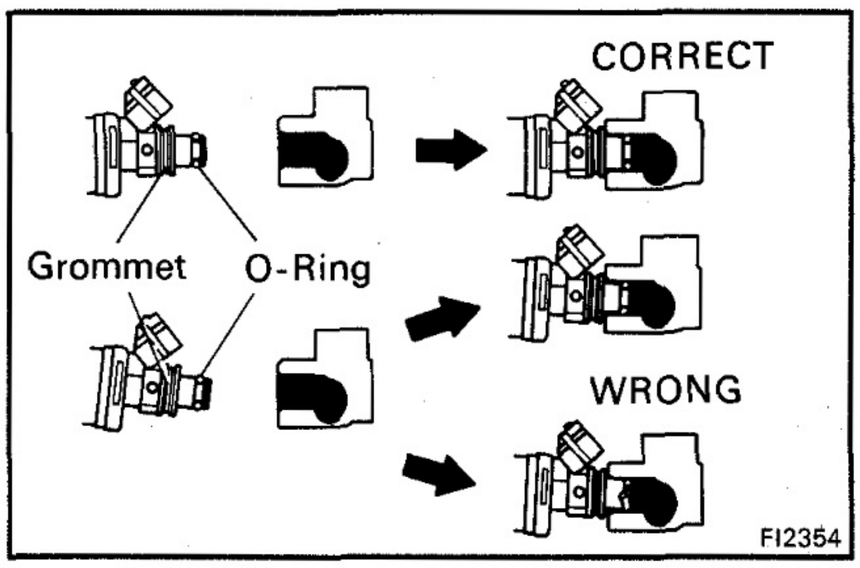


   (Flare Nut Type)
   (a) Apply a light coat of engine oil to the flare and tighten the flare nut by hand.
   (b) Using SST, tighten the flare nut to specified torque.

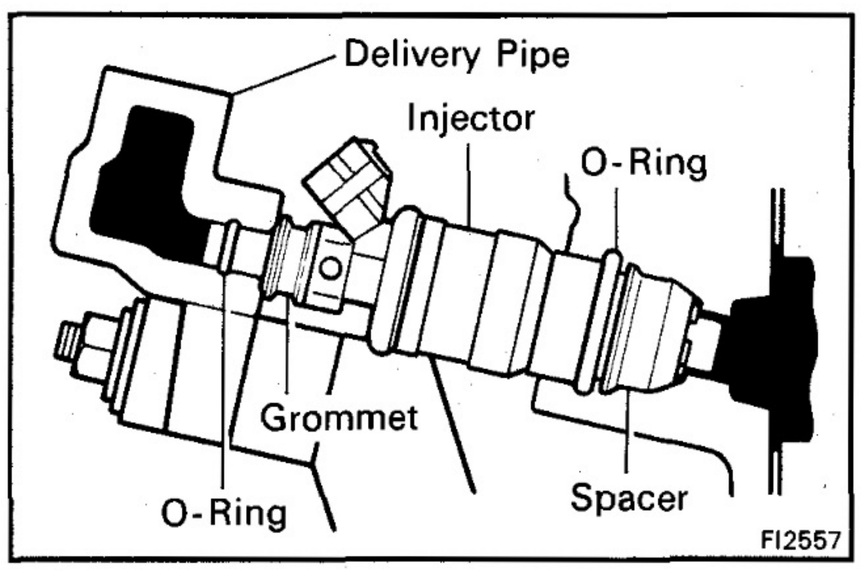
   SST 09631-22020

   Torque: 310 kg-cm (22 ft-lb, 30 N·m)

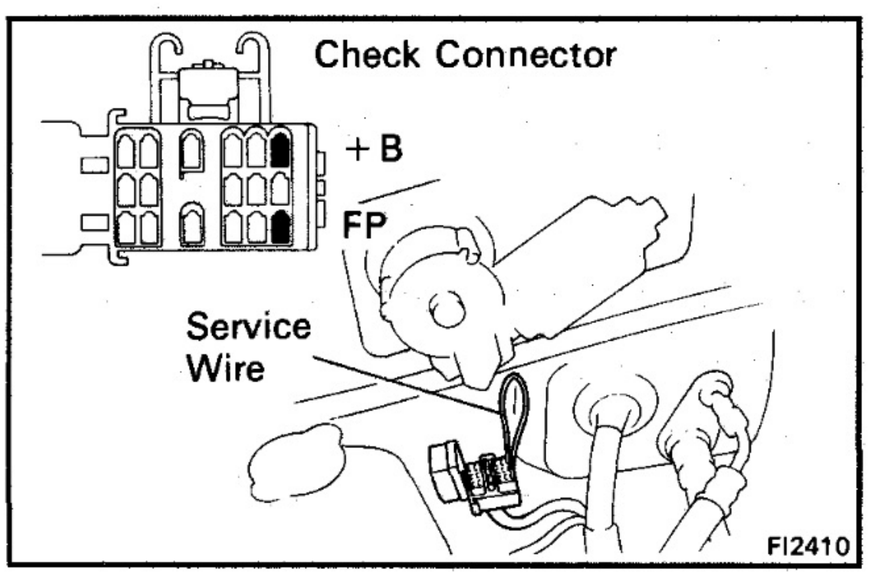
   HINT: Use a torque wrench with a fulcrum length of 30 cm (11.81 in.).



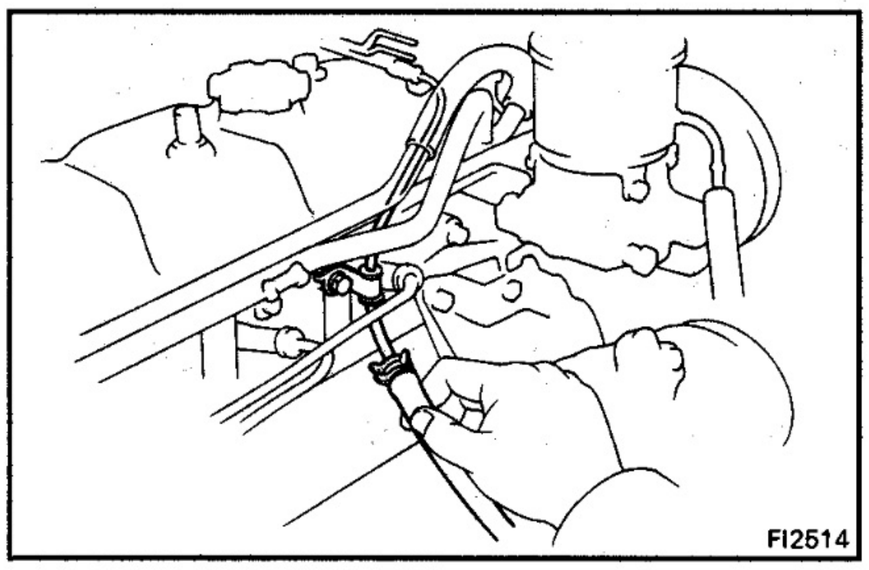
3. Observe the following precautions when removing and installing the injectors.
   (a) Never reuse the O-ring.
   (b) When placing a new O-ring on the injector, take care not to damage it in any way.
   (c) Coat the new O-ring with spindle oil or gasoline before installing – never use engine, gear or brake oil.



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



5. Check that there are no fuel leaks after performing any maintenance on the fuel system.
   (a) With engine stopped, turn the ignition switch ON.
   (b) Using a service wire, short terminals +B and FP of the check connector.



   (c) When the fuel return hose is pinched, the pressure within high pressure line will rise to approx. 4 kg / cm^2 (57 psi, 392 kPa). In this state, check to see that there are no leaks from any part of the fuel system.

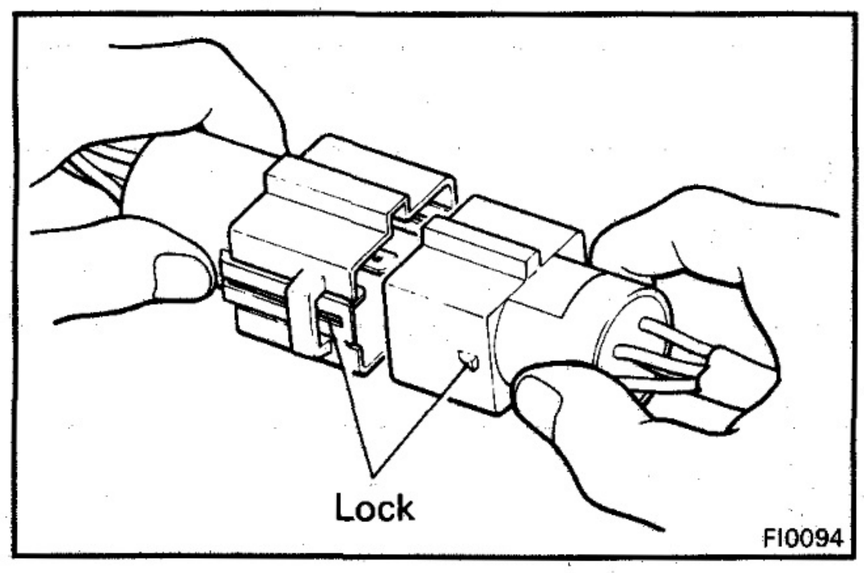
NOTICE: Always pinch the hose. Avoid bending as it may cause the hose to crack.

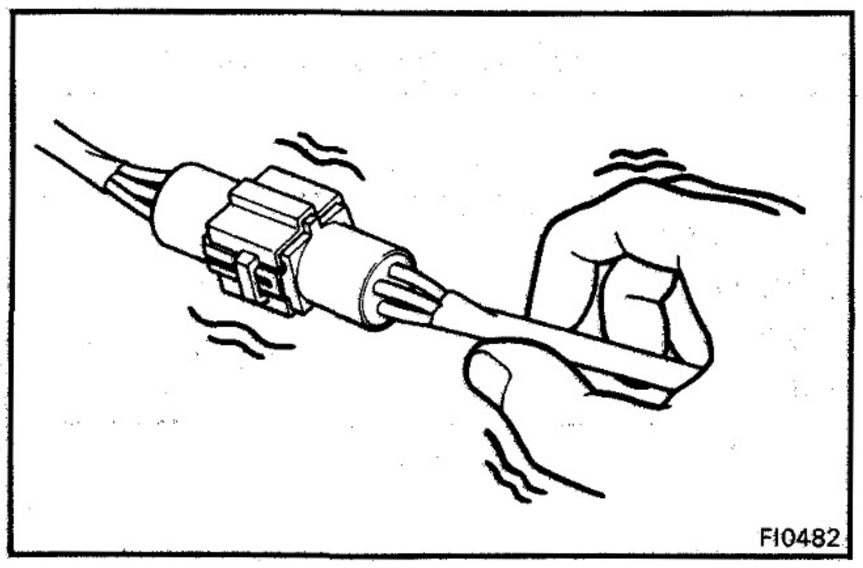
TROUBLESHOOTING

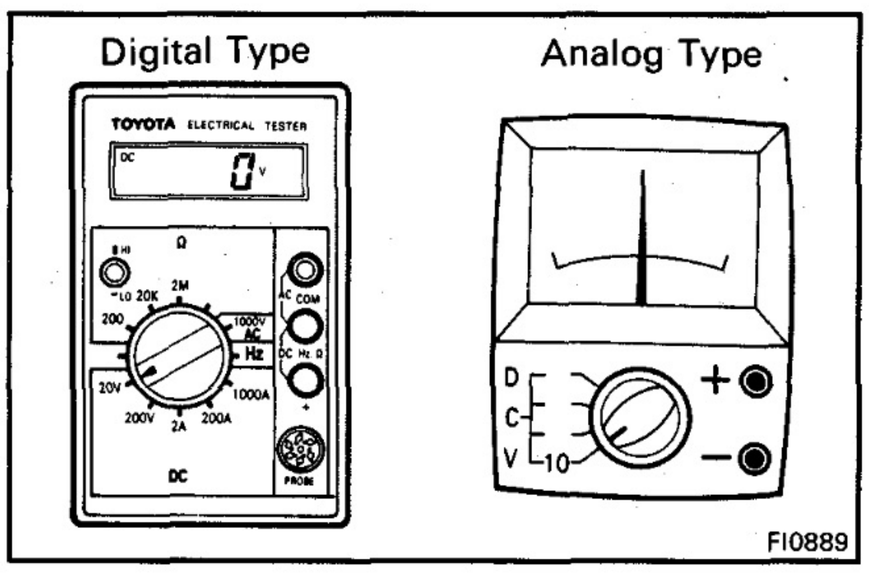
TROUBLESHOOTING HINTS

1. Engine troubles are usually not caused by the EFI system. When troubleshooting, always first 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
      - Distributor
      - Ignition coil
      - Igniter
   (e) Air induction system
      - Vacuum leaks
   (f) Emission control system
      - PCV system
      - EGR system
      - AI system
   (g) Others
      - Ignition timing (ESA system)
      - Idle speed (ISC system)
      - 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 troubleshoot for other causes before replacing the ECU, as the ECU is of high quality and it is expensive.







4. Use a volt / ohmmeter with high impedance (10 kΩ / V minimum) for troubleshooting of the electrical circuit. (See page FI-27)

TROUBLESHOOTING PROCEDURES

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

CHECK ELECTRIC SOURCE

BAD →
1. Battery
   (1) Connection
   (2) Gravity – Drive belt – charging system
   (3) Voltage
2. Fusible links

OK ↓

CHECK STARTING SYSTEM

BAD →
1. Ignition switch
2. Starter
3. Neutral start switch
4. Wiring / Connection

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

CHECK DIAGNOSIS SYSTEM
Check for output of diagnostic code.
(See page FI-21)

Malfunction code(s) →
Diagnostic code(s)
(See pages FI-24, 25)

Normal code ↓

DOES ENGINE START WITH ACCELERATOR PEDAL DEPRESSED?

OK →
ISC system
(1) ISC valve
(2) Wiring connection

NO ↓

CHECK FOR VACUUM LEAKS IN AIR INTAKE LINE

BAD →
1. Oil filler cap
2. Oil dipstick
3. Hose connections
4. PCV hoses
5. EGR system – EGR valve stays open

OK ↓

CHECK IGNITION SPARK
(See page IG-5)

BAD →
1. High-tension cords
2. Distributor
3. Ignition coil
4. Igniter

OK CONTINUED ON PAGE FI-11 ↓

OK CONTINUED FROM PAGE FI-10

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: 8.0 kg/cm² (114 psi, 785 kPa) at 200 rpm
3. Valve clearance (Hot)
   Standard: IN 0.20 mm (0.008 in.)
   EX 0.35 mm (0.014 in.)

BAD (All Plugs WET) →
1. Injector(s) – shorted or leaking
2. Injector wiring – short circuited
3. Cold start injector – leakage (See page FI-50)
4. Cold start injector time switch (See page FI-72)

OK ↓

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-45)

BAD →
1. Fuel line – Leakage – deformation
2. Fuse
3. Fuel pump (See page FI-44)
4. Fuel filter
5. Fuel pressure regulator (See page FI-53)

OK ↓

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-62)

OK ↓

CHECK IGNITION TIMING
1. Connect terminals TE1 and E1 of the check connector.
2. Check ignition timing.
   Standard: 7°BTDC @ idle (w/ connected TE1 and E1)

NO →
Ignition timing – Adjust (See page EM-11)

OK ↓

CHECK EFI ELECTRONIC CIRCUIT USING VOLT/OHMMETER
(See page FI-27)

BAD →
1. Wiring connection
2. Power to ECU
   (1) Fusible links
   (2) Fuses
   (3) EFI main relay (See page FI-70)
3. Air flow meter (See page FI-62)
4. Water temp. sensor (See page FI-73)
5. Air temp. sensor (See page FI-62)
6. Injection signal circuit
   (1) Injector wiring
   (2) ECU (See page FI-77)

SYMPTOM – ENGINE OFTEN STALLS

CHECK DIAGNOSIS SYSTEM
Check for output of diagnostic code.
(See page FI-21)

→ Malfunction code(s) → Diagnostic code(s) (See pages FI-24, 25)

↓ Normal code

CHECK FOR VACUUM LEAKS IN AIR INTAKE LINE

→ BAD →
1. Oil filler cap
2. Oil dipstick
3. Hose connections
4. PCV hoses
5. EGR system – EGR valve stays open

↓ OK

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-45)

→ BAD →
1. Fuel line – Leakage – Deformation
2. Fuses
3. Fuel pump (See page FI-44)
4. Fuel filter
5. Fuel pressure regulator (See page FI-53)

↓ OK

CHECK AIR FILTER ELEMENT

→ BAD → Element – Clean or replace

↓ OK

CHECK IDLE SPEED
Standard: 650 rpm

→ BAD →
ISC system
   (1) Wiring connections
   (2) ISC valve (See page FI-67)
   (3) ECU (test by substitution)

↓ OK

CHECK IGNITION TIMING
1. Connect terminals TE1 and E1 of the service connector.
2. Check ignition timing.
   Standard: 7° BTDC @ idle (w/ connected TE1 and E1)

→ NO → Ignition timing – Adjust (See page EM-11)

↓ OK

CHECK SPARK PLUGS
Plug gap: 0.8 mm (0.031 in.)
HINT: Check compression pressure and valve clearance if necessary.

→ NO →
1. Spark plugs
2. Compression pressure
   Minimum: 8.0 kg/cm² (114 psi, 785 kpa) at 200 rpm
3. Valve Clearance (Hot)
   Standard: IN 0.20 mm (0.008 in.)
   EX 0.35 mm (0.014 in.)

↓ OK CONTINUED ON PAGE FI-13

OK CONTINUED FROM PAGE FI-12

CHECK COLD START INJECTOR
(See page FI-50)

BAD →
1. Cold start injector (See page FI-50)
2. Cold start injector time switch (See page FI-72)

OK

RECHECK FUEL PRESSURE
(See page FI-45)

BAD →
1. Fuel pump (See page FI-44)
2. Fuel filter
3. Fuel pressure regulator (See page FI-53)

OK

CHECK INJECTORS
(See page FI-55)

BAD → Injection condition

OK

CHECK FEI ELECTRONIC CIRCUIT USING VOLT/OHMMETER
(See page FI-27)

BAD →
1. Wiring connections
2. Power to ECU
   (1) Fusible links
   (2) Fuses
   (3) EFI main relay (See page FI-70)
3. Air flow meter (See page FI-62)
4. Water temp. sensor (See page FI-73)
5. Air temp. sensor (See page FI-62)
6. Injection signal circuit
   (1) Injector wiring
   (2) ECU (See page FI-77)

SYMPTOM – ENGINE SOMETIMES STALLS

CHECK DIAGNOSIS SYSTEM
Check for output of diagnostic code.
(See page FI-21)

Malfunction code (s) → Diagnostic code(s) (See pages FI-24, 25)

Normal code

CHECK AIR FLOW METER
(See page FI-62)

BAD → Air flow meter

OK

CHECK WIRING CONNECTORS AND RELAYS
Check for signal change when the connector or relay is slightly tapped or wiggled.

BAD →
1. Connectors
2. EFI main relay (See page FI-70)
3. Circuit opening relay (See page FI-71)

SYMPTOM – ROUGH IDLING AND/OR MISSING

CHECK DIAGNOSIS SYSTEM
Check for output of diagnostic code.
(See page FI-21)

→ Malfunction code (s) → Diagnostic code(s) (See pages FI-24, 25)

↓ Normal code

CHECK FOR VACUUM LEAKS IN AIR INTAKE LINE

→ BAD →
1. Oil filler cap
2. Oil dipstick
3. Hose connections
4. PCV hoses
5. EGR system – EGR valve stays open

↓ OK

CHECK AIR FILTER ELEMENT

→ BAD → Element – Clean or replace

↓ OK

CHECK IDLE SPEED
STD: 650 rpm

→ NO →
ISC system
(1) Wiring connections
(2) ISC valve (See page FI-67)
(3) ECU

↓ OK

CHECK IGNITION TIMING
1. Connect terminals TE1 and E1 of the check connector.
2. Check ignition timing.
Standard: 7° BTDC @ idle (w/ connected TE1 and E1)

→ NO → Ignition timing – Adjust (See page EM-11)

↓ OK

CHECK SPARK PLUGS
Plug gap: 0.8 mm (0.043 in.)
HINT: Check compression pressure and valve clearance if necessary.

→ BAD →
1. Spark plugs and high-tension cords
2. Compression pressure
Minimum: 8.0 kg/cm² (114 psi, 785 kpa) at 200 rpm
3. Valve clearance (Hot)
Standard: IN 0.20 mm (0.008 in.)
EX 0.35 mm (0.014 in.)

↓ OK

CHECK COLD START INJECTOR
(See page FI-50)

→ BAD →
1. Cold start injector (See page FI-50)
2. Cold start injector time switch. (See page FI-72)

↓ OK CONTINUED ON PAGE FI-15

OK CONTINUED FROM PAGE FI-14

CHECK FUEL PRESSURE
(See page FI-45)

BAD →
1. Fuel pump (See page FI-44)
2. Fuel filter
3. Fuel pressure regulator (See page FI-53)

OK

CHECK INJECTORS
(See page FI-55)

BAD →
Injection condition

OK

CHECK EFI ELECTRONIC CIRCUIT USING VOLT/OHMMETER
(See page FI-27)

BAD →
1. Wiring connections
2. Power to ECU
   (1) Fusible links
   (2) Fuses
   (3) EFI main relay (See page FI-70)
3. Air flow meter (See page FI-62)
4. Water temp. sensor (See page FI-73)
5. Air temp. sensor (See page FI-62)
6. Injection signal circuit
   (1) Injector wiring
   (2) ECU (See page FI-77)
7. Oxygen sensors (See page FI-75)

SYMPTOM – HIGH ENGINE IDLE SPEED (NO DROP)

CHECK ACCELERATOR LINKAGE → BAD → Linkage – Stuck

OK ↓

CHECK AIR CONDITIONER IDLE-UP CIRCUIT → BAD → ISC valve

OK ↓

CHECK DIAGNOSIS SYSTEM
Check for output of diagnostic code. (See page FI-21) → Malfunction code(s) → Diagnostic code(s) (See pages FI-24, 25)

Normal code ↓

CHECK ISC SYSTEM → BAD →
1. Wiring connections
2. ISC valve (See page FI-67)
3. Air conditioner switch

OK ↓

CHECK THROTTLE POSITION SENSOR (See page FI-64) → BAD → Throttle body

OK ↓

CHECK FUEL PRESSURE (See page FI-45) → BAD → Fuel pressure regulator – High pressure

OK ↓

CHECK COLD START INJECTOR (See page FI-50) → BAD → Cold start injector – linkage

OK ↓

CHECK INJECTORS (See page FI-55) → BAD → Injectors – Leakage, Injection quantity

OK ↓

CHECK EFI ELECTRONIC CIRCUIT USING VOLT/OHMMETER (See page FI-27) → BAD →
1. Wiring connection
2. Power to ECU
   (1) Fusible links
   (2) Fuses
   (3) EFI main relay (See page FI-70)
3. Air flow meter (See page FI-62)
4. Water temp. sensor (See page FI-73)
5. Air temp. sensor (See page FI-62)
6. Injection signal circuit
   (1) Injector wiring
   (2) ECU (See page FI-77)

SYMPTOM – ENGINE BACKFIRES-Lean Fuel Mixture

CHECK DIAGNOSIS SYSTEM
Check for output of diagnostic code.
(See page FI-21)

→ Malfunction code(s) → Diagnostic code(s) (See pages FI-24, 25)

↓ Normal code

CHECK FOR VACUUM LEAKS IN AIR INTAKE LINE

→ BAD →
1. Oil filler cap
2. Oil dipstick
3. Hose connections
4. PCV hose(s)
5. EGR system – EGR valve stays open

↓ OK

CHECK IGNITION TIMING
1. Connect terminals TE1 and E1 of the check connector.
2. Check ignition timing.
   Standard: 7° BTDC @ idle (w/ connected TE1 and E1)

→ NO → Ignition timing – Adjust (See page EM-11)

↓ OK

CHECK COLD START INJECTOR
(See page FI-50)

→ BAD →
1. Cold start injector (See page FI-50)
2. Cold start injector time switch. (See page FI-72)

↓ OK

CHECK FUEL PRESSURE
(See page FI-45)

→ BAD →
1. Fuel pump (See page FI-44)
2. Fuel filter
3. Fuel pressure regulator (See page FI-53)

↓ OK

CHECK INJECTORS
(See page FI-55)

→ BAD → Injectors – Clogged

↓ OK

CHECK EFI ELECTRONIC CIRCUIT USING VOLT/OHMMETER
(See page FI-27)

→ BAD →
1. Wiring connection
2. Power to ECU
   (1) Fusible links
   (2) Fuses
   (3) EFI main relay (See page FI-70)
3. Air flow meter (See page FI-62)
4. Water temp. sensor (See page FI-73)
5. Air temp. sensor (See page FI-62)
6. Throttle position sensor (See page FI-64)
7. Injection signal circuit
   (1) Injector wiring
   (2) Fuel cut RPM (See page FI-80)
   (3) ECU (See page FI-77)
8. Oxygen sensors (See page FI-75)

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

CHECK DIAGNOSIS SYSTEM
Check for output of diagnostic code.
(See page FI-21)

→ Malfunction code(s) → Diagnostic code(s) (See pages FI-24, 25)

↓ Normal code

CHECK IGNITION TIMING
1. Connect terminals TE1 and E1 of the check connector.
2. Check ignition timing.
   Standard: 7° BTDC @ idle (w/ connected TE1 and E1)

→ NO → Ignition timing – Adjust (See page EM-11)

↓ OK

CHECK COLD START INJECTOR
(See page FI-50)

→ BAD →
1. Cold start injector (See page FI-50)
2. Cold start injector time switch (See page FI-72)

↓ OK

CHECK FUEL PRESSURE
(See page FI-45)

→ BAD → Fuel pressure regulator (See page FI-53)

↓ OK

CHECK INJECTORS (See page FI-55)

→ BAD → Injectors – Leakage

↓ OK

CHECK SPARK PLUGS
Plug gap: 0.8 mm (0.031 in.)
HINT: Check compression pressure and valve clearance if necessary.

→ NO →
1. Spark plugs
2. Compression pressure
   Minimum: 8.0 kg/cm² (114 psi, 785 kpa) at 200 rpm
3. Valve clearance (Hot)
   Standard: IN 0.20 mm (0.008 in.)
   EX 0.35 mm (0.014 in.)

↓ OK

CHECK EFI ELECTRONIC CIRCUIT USING VOLT/OHMMETER
(See page FI-27)

→ BAD →
1. Throttle position sensor
2. Injection signal circuit
   (1) Injector wiring
   (2) Fuel cut RPM (See page FI-80)
   (3) ECU (See page FI-77)
3. Oxygen sensors (See page FI-75)

SYMPTOM – ENGINE HESITATES AND/OR POOR ACCELERATION

CHECK BRAKES → BAD → Brakes – Drag

OK ↓

CHECK FOR VACUUM LEAKS IN AIR INTAKE LINE → BAD →
1. Oil filler cap
2. Oil dipstick
3. Hose connections
4. PCV hose(s)
5. EGR system – EGR valve stays open

OK ↓

CHECK AIR FILTER ELEMENT → BAD → Element – Clean or replace

OK ↓

CHECK DIAGNOSIS SYSTEM
Check for output of diagnostic code.
(See page FI-21)
→ Malfunction code(s) → Diagnostic code(s) (See pages FI-24, 25)

Normal code ↓

CHECK IGNITION SPARK
(See page IG-5)
→ BAD →
1. High-tension cords
2. Distributor
3. Ignition coil
4. Igniter

OK ↓

CHECK IGNITION TIMING
1. Connect terminals TE1 and E1 of the check connector.
2. Check ignition timing.
   Standard: 7° BTDC @ idle (w/ connected TE1 and E1)

→ NO → Ignition timing – Adjust (See page EM-11)

OK ↓

CHECK FUEL PRESSURE
(See page FI-45)
→ BAD →
1. Fuel pump (See page FI-44)
2. Fuel filter
3. Fuel pressure regulator (See page FI-53)

OK ↓

CHECK INJECTORS
(See page FI-55)
→ BAD → Injection condition

OK CONTINUED ON PAGE FI-20 ↓

OK CONTINUED FROM PAGE FI-19

CHECK SPARK PLUGS
Plug gap: 0.8 mm (0.031 in.)
HINT: Check compression pressure and valve clearance if necessary.

NO →
1. Spark plugs
2. Compression pressure
   Minimum: 8.0 kg/cm² (114 psi, 785 kpa) at 200 rpm
3. Valve clearance (Hot)
   Standard: IN 0.20 mm (0.008 in.)
   EX 0.35 mm (0.014 in.)

OK ↓

CHECK EFI ELECTRONIC CIRCUIT USING VOLT/OHMMETER
(See page FI-27)

BAD →
1. Wiring connections
2. Power to ECU
   (1) Fusible links
   (2) Fuses
   (3) EFI main relay (See page FI-70)
3. Air flow meter (See page FI-62)
4. Water temp. sensor (See page FI-73)
5. Air temp. sensor (See page FI-62)
6. Throttle position sensor (See page FI-64)
7. Injection signal circuit
   (1) Injector wiring
   (2) ECU (See page FI-77)

DIAGNOSIS SYSTEM

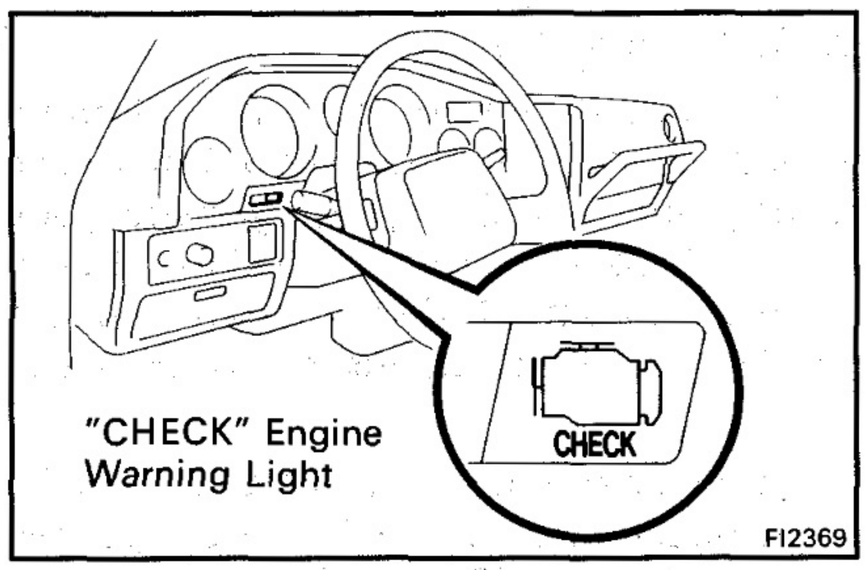
DESCRIPTION

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 tables (See pages FI-24, 25) 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 EFI fuse 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.



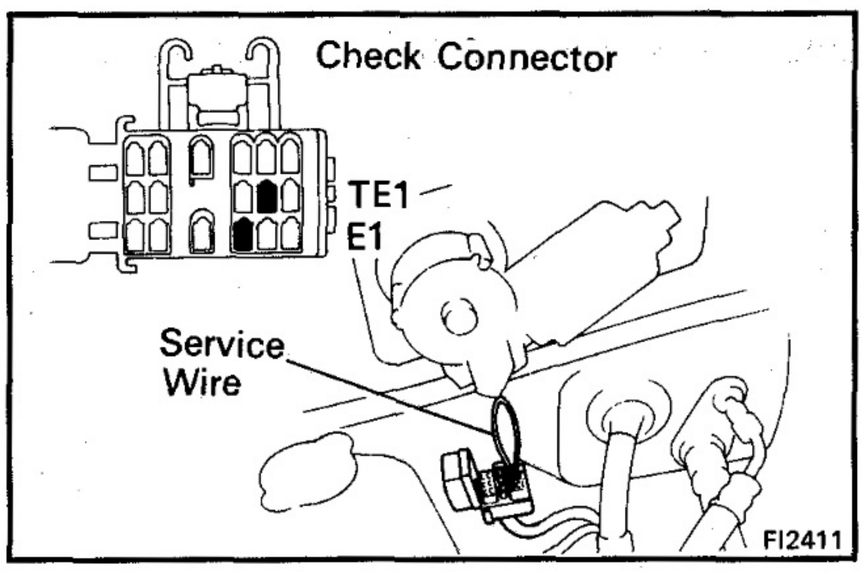
"CHECK" ENGINE WARNING LIGHT CHECK

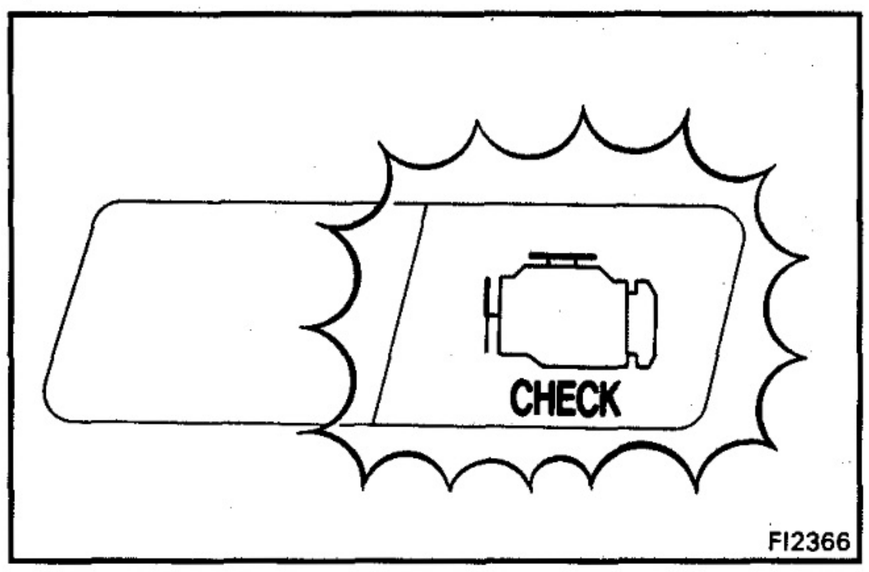
1. The "CHECK" engine warning light will come on when the ignition switch is placed at ON and the engine is not running.
2. When the engine is started, the "CHECK" engine warning light should go out.
   If the light remains on, the diagnosis system has detected a malfunction or abnormality in the system.

OUTPUT OF DIAGNOSTIC CODES

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

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



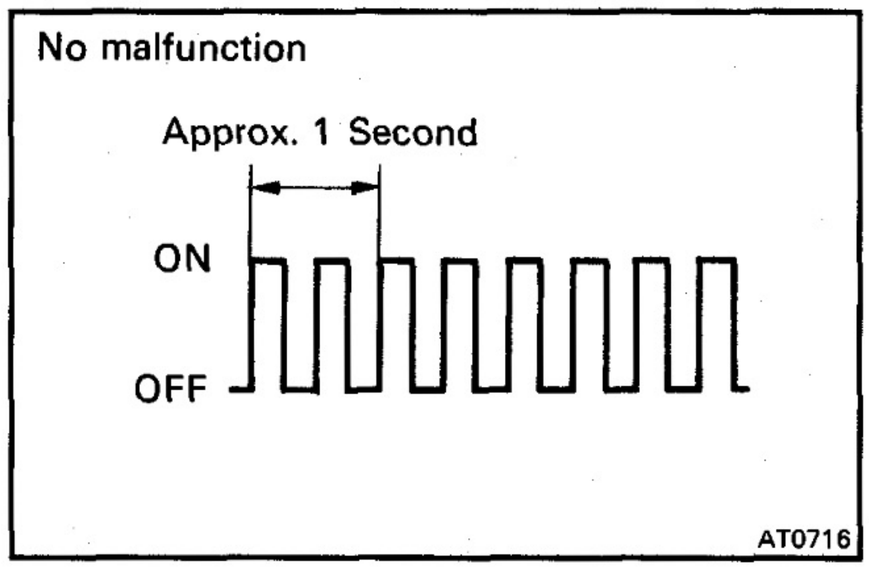


4. Read the diagnostic code as indicated by the number of flashes of the "CHECK" engine warning light.

Diagnostic Codes (See pages FI-24, 25)

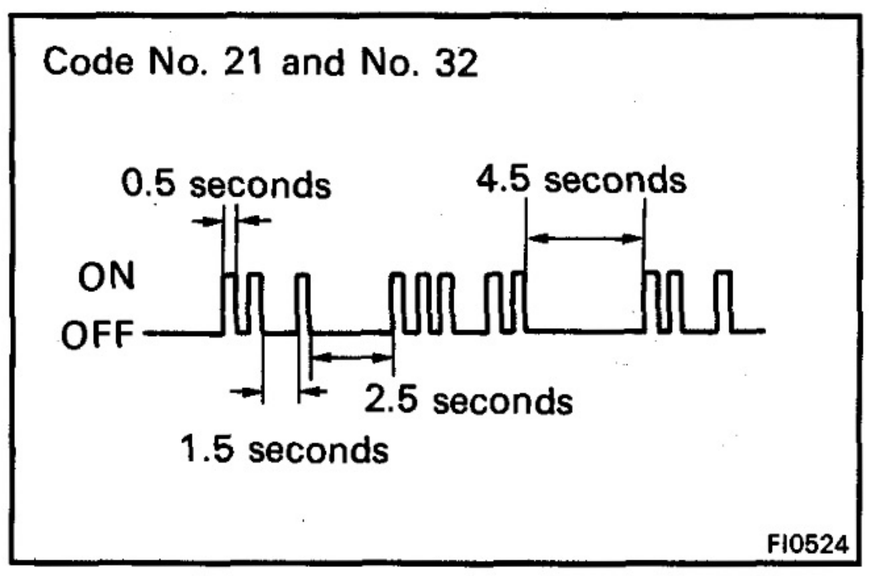
(a) Normal System Operation (no malfunction)

- The light will alternately blink ON and OFF 2 times per second.

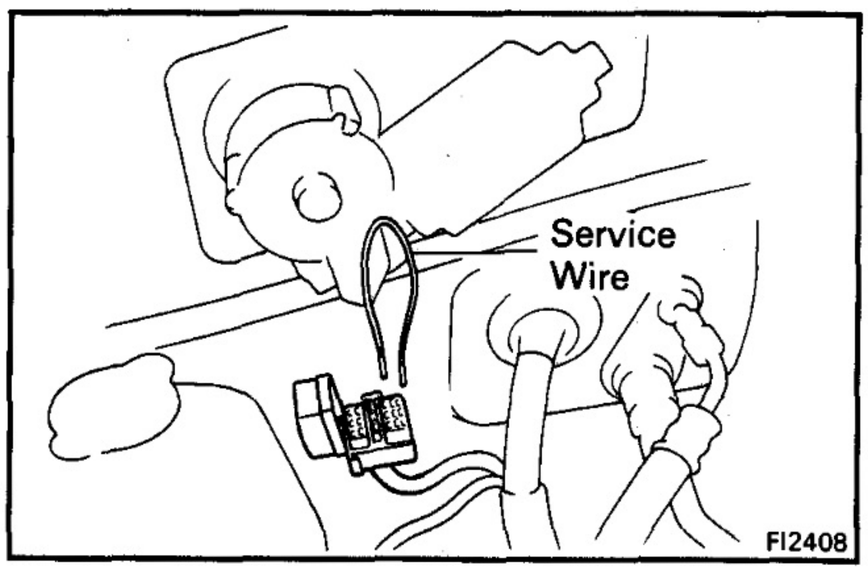


(b) Malfunction Code Indication

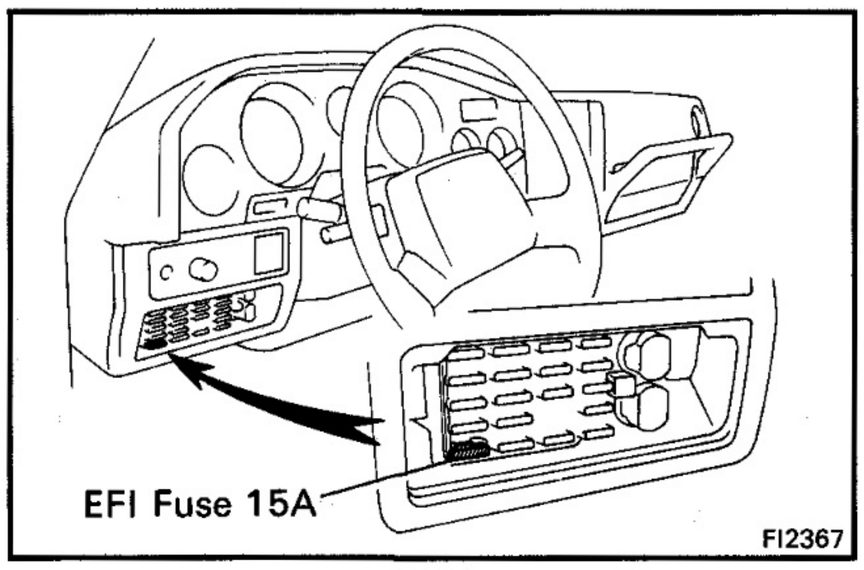
- In the event of a malfunction, the light will blink every 0.5 seconds. The first number of blinks will equal the first digit of a 2-digit diagnostic code and, after a 1.5 second pause, the 2nd number of blinks will equal the 2nd. If there are two or more codes, there will be a 2.5 second pause between each.
- 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 the service wire.



CANCELLING DIAGNOSTIC CODE

1. After repair of the trouble area, the diagnostic code retained in memory by the ECU must be cancelled out by removing the EFI fuse (15A) for 30 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 has been recorded.

2. After cancellation, road test 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 18 diagnostic codes.

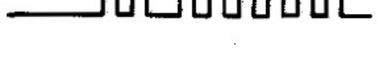
2. When 2 or more codes are indicated, the lowest number (code) will appear first.

   However, no other code will appear along with code No.11.

3. All detected diagnostic codes, except code No.51, will be retained in memory by the ECU from the time of detection until cancellation.

4. Once the malfunction is cleared, the "CHECK" engine warning light on the instrument panel will go out but the diagnostic code(s) remains stored in ECU memory (except for code No.51).

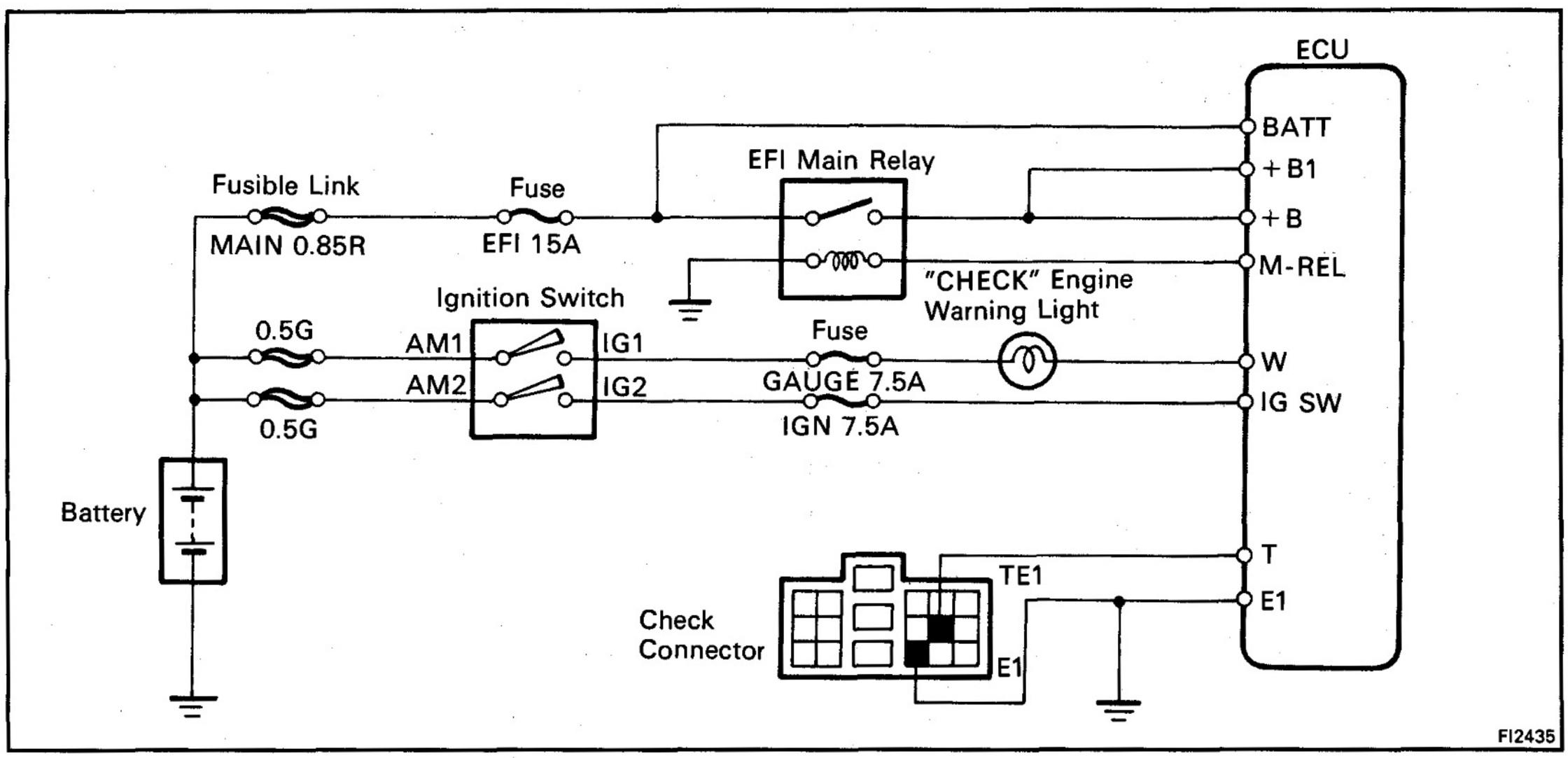
DIAGNOSTIC CODES

Code No.	Number of Check engine blinks	System	Diagnosis	Trouble area	See page
—	 FI1604	Normal	This appears when none of the other codes are identified.	—	—
11	 FI1605	ECU (+B)	Momentary interruption in power supply to ECU.	• Ignition switch circuit • Ignition switch • Main relay circuit • Main relay • ECU	FI-30
12	 FI1606	PRM Signal	No "NE" or "G" signal to ECU within 2 seconds after engine has been cranked.	• Distributor circuit • Distributor • Starter signal circuit • ECU	IG-4
13	 FI1607	RPM Signal	No "NE" signal to ECU when engine speed is above 1,000 rpm.	• Distributor circuit • Distributor • ECU	–
14	 FI1608	Ignition Signal	No "IGF" signal to ECU 6 – 8 times in succession.	• Igniter and ignition coil circuit • Igniter and ignition coil • ECU	FI-41
21	 FI1609	Oxygen Sensor Signal	Detects deterioration of oxygen sensor.	• Oxygen sensor circuit • Oxygen sensor • ECU	FI-44
		Oxygen Sensor Heater Signal	Open or short circuit in oxygen sensor heater signal.	• Oxygen sensor heater circuit • Oxygen sensor heater • ECU	
22	 FI1610	Water Temp. Sensor Signal	Open or short circuit in water temp. sensor signal.	• Water temp. sensor circuit • Water temp. sensor • ECU	FI-37
24	 FI1611	Intake Air Temp. Sensor Signal	Open or short circuit in intake air temp. sensor signal.	• Intake air temp. sensor circuit • Intake air temp. sensor • ECU	FI-36
25	 FI2562	Air-fuel Ratio Lean Malfunction	(1) When air-fuel ratio feedback compensation value or adaptive control value continues at the upper (lean) or lower (rich) limit. (2) When air-fuel ratio feedback compensation value or adaptive control value feedback frequency is abnormally high during feedback condition. HINT: For condition (2), neither a lean (Code No. 25) nor a rich (Code No. 26) diagnosis is displayed consecutively.	• Injector circuit • Injector • Fuel line pressure • Air flow meter • Air intake system • Oxygen sensor circuits • Oxygen sensors • Ignition system • ECU	—
26	 FI2563	Air-fuel Ratio Rich Malfunction		• Injector circuit • Injector • Fuel line pressure • Air flow meter • Cold start injector • ECU	—
28	 FI2698	No. 2 Oxygen Sensor Signal	Same as code No. 21	Same as code No. 21	FI-44
		No. 2 Oxygen Sensor Heater			

DIAGNOSTIC CODES (Cont'd)

Code No.	Number of Check engine blinks	System	Diagnosis	Trouble area	See page
31	 FI1612	Air flow Meter Signal	Open circuit in VC signal or short circuit between VS and E2 when idle contacts are closed.	• Air flow meter circuit • Air flow meter • ECU	FI-35
32	 FI1613	Air Flow Meter Signal	Open circuit in E2 or short circuit between VC and VS.	• Air flow meter circuit • Air flow meter • ECU	FI-35
35	 FI2699	HAC Sensor Signal	Open circuit in altitude compensation sensor signal.	• ECU	—
41	 FI1614	Throttle Position Sensor Signal	Open or short circuit in throttle position sensor signal.	• Throttle position sensor circuit • Throttle position sensor • ECU	FI-33
42	 FI1615	Vehicle Speed Sensor Signal	No "SPD" signal for 8 seconds when engine speed in between 2,000 rpm and 5,000 rpm and coolant temp. is below 80°C (176°F) except when racing the engine.	• Vehicle speed sensor circuit • Vehicle speed sensor • ECU	—
43	 FI1616	Starter Signal	No "STA" signal to ECU until engine speed reaches 800 rpm with vehicle not moving	• Ignition switch circuit • Ignition switch • ECU	FI-39
51	 FI1617	Switch Signal	No "IDL" signal or "NSW" signal to ECU, with the check terminals E1 and TE1 shorted.	• Throttle position sensor circuit • Throttle position sensor • Neutral start switch • Acceleration pedal and cable • ECU	—

INSPECTION OF DIAGNOSIS CIRCUIT



1.

Does "CHECK" engine warning light come on when ignition switch is at ON?
- YES → System Normal
- NO → Does "CHECK" engine warning light come on when ECU terminal W is grounded to the body?
  - YES → Check wiring between ECU terminal E1 and body ground.
    - OK → Try another ECU.
    - BAD → Repair or replace.
  - NO → Check bulb, fuse and wiring between ECU and ignition switch.
    - BAD → Repair or replace.

2.

Does "CHECK" engine warning light go off when the engine is started?
- YES → System Normal
- NO → Check wiring between ECU and "CHECK" engine warning light.
  - BAD → Repair.
  - OK → Is there diagnostic code output when check connector terminals TE1 and E1 are connected circuited?
    - NO → Check wiring between ECU terminal T and check connector terminal TE1, and ECU terminal E1 and check connector terminal E1.
      - OK → Try another ECU.
    - YES → Does "CHECK" engine warning light go out after repair according to malfunction code?
      - NO → Further repair required.
      - YES → System OK → Cancel out diagnostic code.

TROUBLESHOOTING WITH VOLT/OHMMETER

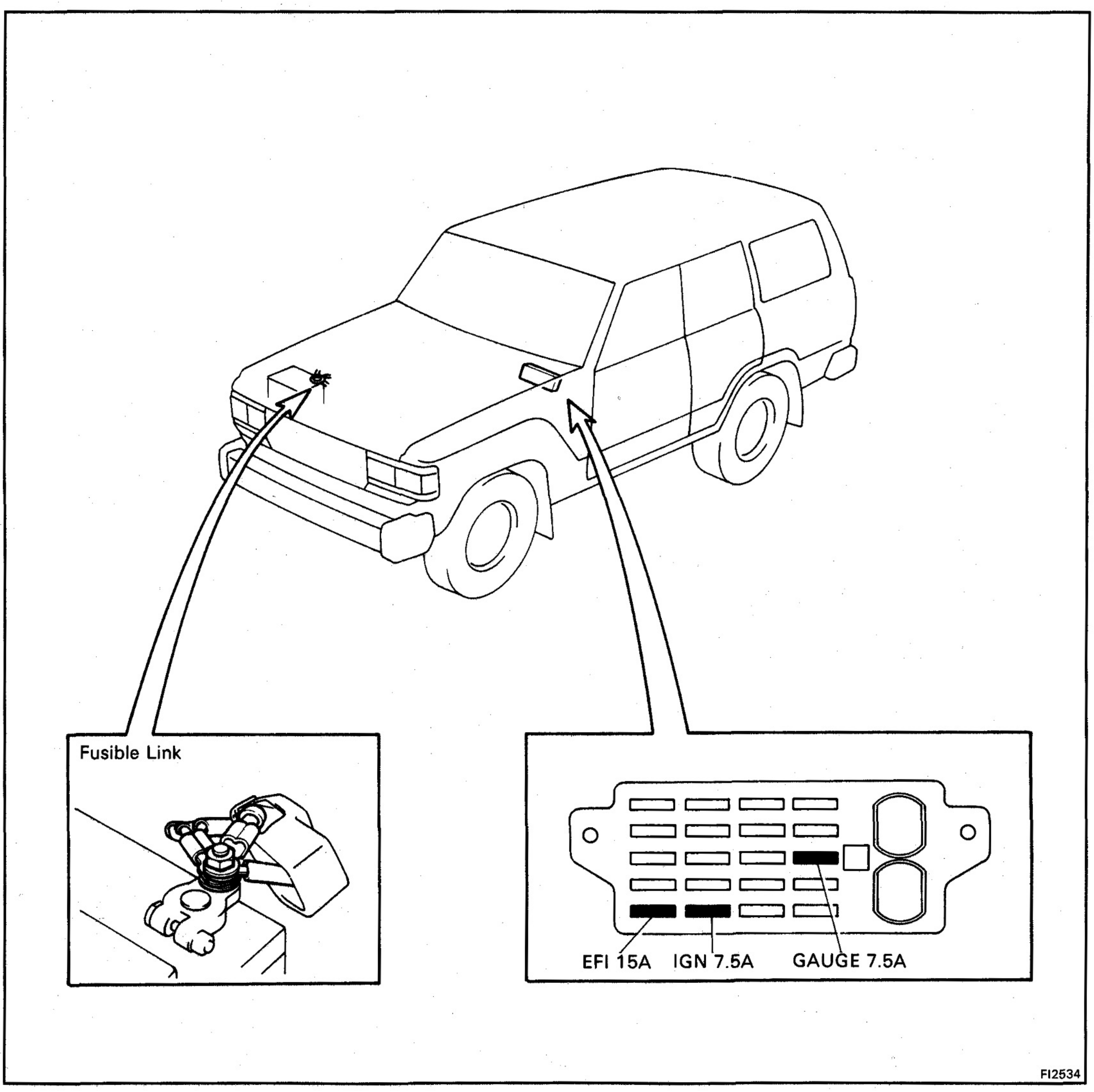
HINT: The following troubleshooting procedures are designed for inspection of each separate system, and therefore the actual procedure may vary somewhat. However, troubleshooting should be performed referring to the inspection methods described in this manual.

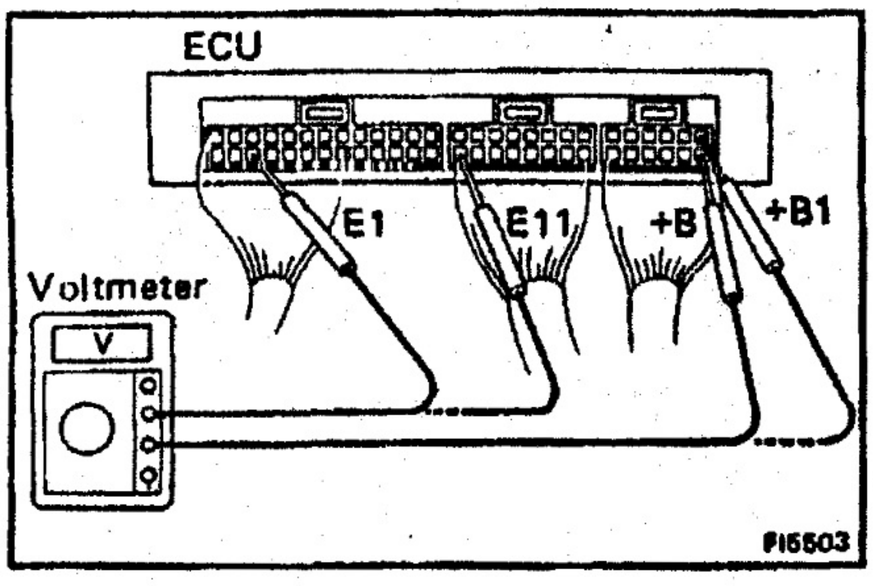
Before beginning inspection, it is best to first make a simple check of the fuses, fusible links and condition of the connectors.

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 a short circuit within the computer.

If engine trouble occurs even though 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





EFI SYSTEM CHECK PROCEDURE

HINT:

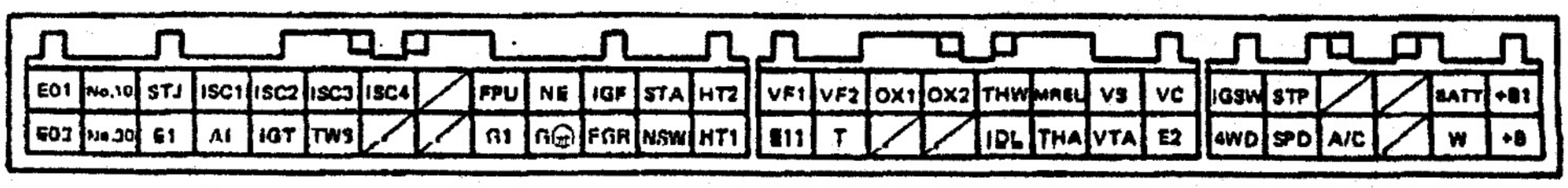
- Perform all voltage measurements with the connectors connected.
- Verify that the battery voltage is 11 V or more when the ignition switch is "ON".

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

Terminals of ECU

Symbol	Terminal Name	Symbol	Terminal Name	Symbol	Terminal Name
E01	ENGINE GROUND	G –	DISTRIBUTOR	M-REL	EFI MAIN RELAY
E02	ENGINE GROUND	IGF	IGNITER	THA	AIR TEMP. SENSOR
No.10	INJECTOR (No.1,2,3)	EGR	EGR VSV	VS	AIR FLOW METER
No.20	INJECTOR (No.4,5,6)	STA	STARTER SWITCH	VTA	THROTTLE POSITION SENSOR
STJ	COLD START INJECTOR	NSW	NEUTRAL START SWITCH	VC	AIR FLOW METER or THROTTLE POSITION SENSOR
E1	COMPUTER GROUND	HT2	OXYGEN SENSOR HEATER	E2	SENSOR GROUND
ISC1	ISC MOTOR No.1 COIL	HT1	OXYGEN SENSOR HEATER	IG SW	IGNITION SWITCH
AI	AI VSV	VFI	CHECK CONNECTOR	4WD	CENTER DIFFLOCK INDICATOR
ISC2	ISC MOTOR No.2 COIL	E11	COMPUTER GROUND	STP	STOP LIGHT SWITCH
IGT	IGNITER	VF2	CHECK CONNECTOR	SPD	SPEED SENSOR
ISC3	ISC MOTOR No.3 COIL	T	CHECK CONNECTOR	A/C	A/C MAGNET SWITCH
TWS	WATER TEMP. SWITCH	OX1	OXYGEN SENSOR	BATT	BATTERY
ISC4	ISC MOTOR No.4 COIL	OX2	OXYGEN SENSOR	W	WARNING LIGHT
FPU	FPU VSV			+B	EFI MAIN RELAY
G1	DISTRIBUTOR	THW	WATER TEMP. SENSOR	+B1	EFI MAIN RELAY
NE	DISTRIBUTOR	IDL	THROTTLE POSITION SENSOR		

ECU Terminals

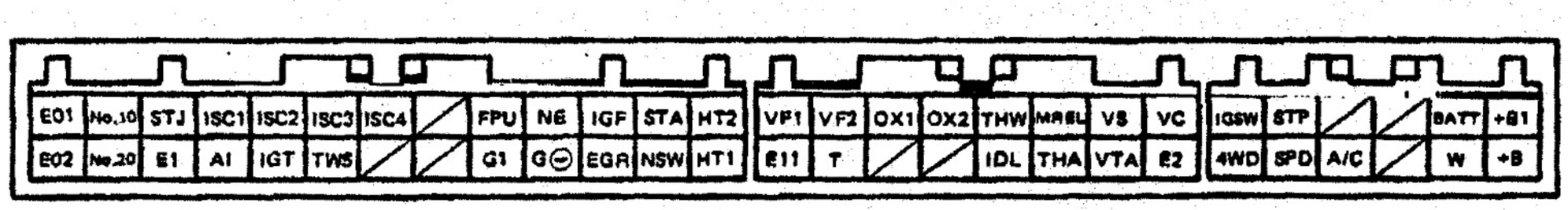


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Voltage at ECU Wiring Connectors

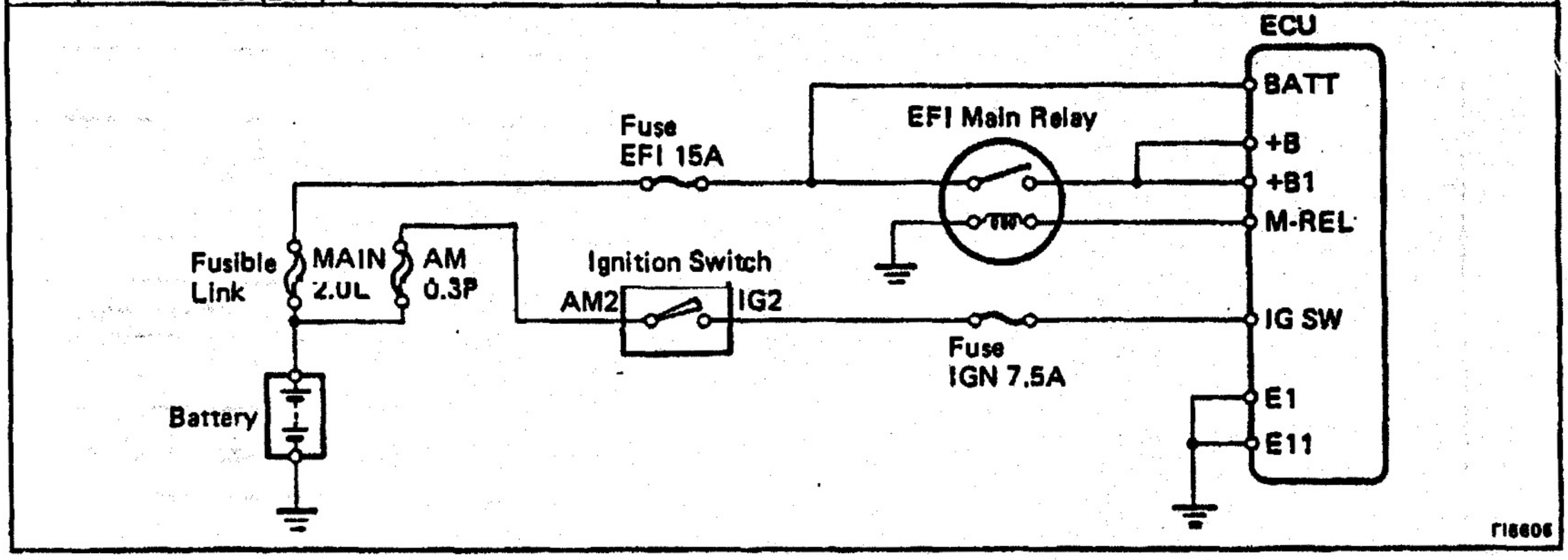
No.	Terminals	Condition		STD Voltage	See page
1	BATT–E1 (E11)			10 – 14	FI-30
	IG SW–E1 (E11)	Ignition switch ON		10 – 14	FI-31
	M-REL–E1 (E11)				
	+B (+B1)–E1 (E11)				FI-32
2	IDL–E2	Ignition switch ON	Throttle valve open	4 – 6	FI-33
	VC–E2		—	4 – 6	FI-34
	VTA–E2		Throttle valve fully closed	0.1 – 1.0	
			Throttle valve fully open	3 – 5	
3	VC–E2	Ignition switch ON	—	4 – 6	FI-35
	VS–E2		Measuring plate fully closed	4 – 5	
			Measuring plate fully open	0.02 – 0.08	
		Idling		2 – 4	
		3,000 rpm		0.3 – 1.0	
4	THA–E2	Ignition switch ON	Intake air temperature 20°C (68°F)	1 – 3	FI-36
5	THW–E2	Ignition switch ON	Coolant temperature 80°C (176°F)	0.1 – 1.0	FI-37
6	No.10–E01 No.20–E02	Ignition switch ON		10 – 14	FI-38
7	STA–E1 (E11)	Cranking		6 – 14	FI-39
8	ISC1 ~ ISC4 –E1 (E11)	Ignition switch ON		10 – 14	FI-40
9	IGT–E1 (E11)	Idling		0.7 – 1.0	FI-41
10	W–E1 (E11)	No trouble ("CHECK" engine warning light off) and engine running		10 – 14	FI-42
11	A/C–E1 (E11)	Air conditioning ON		10 – 14	FI-43

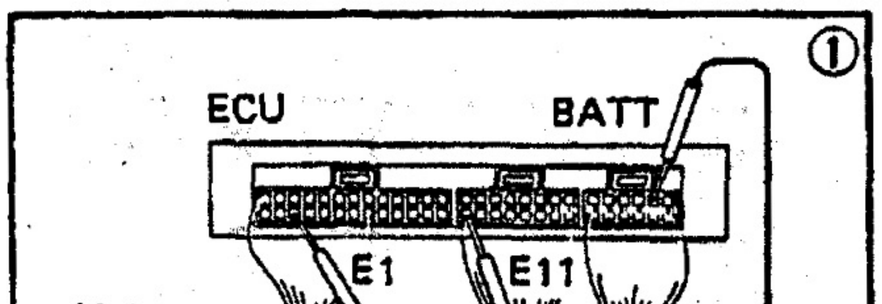
ECU Terminals

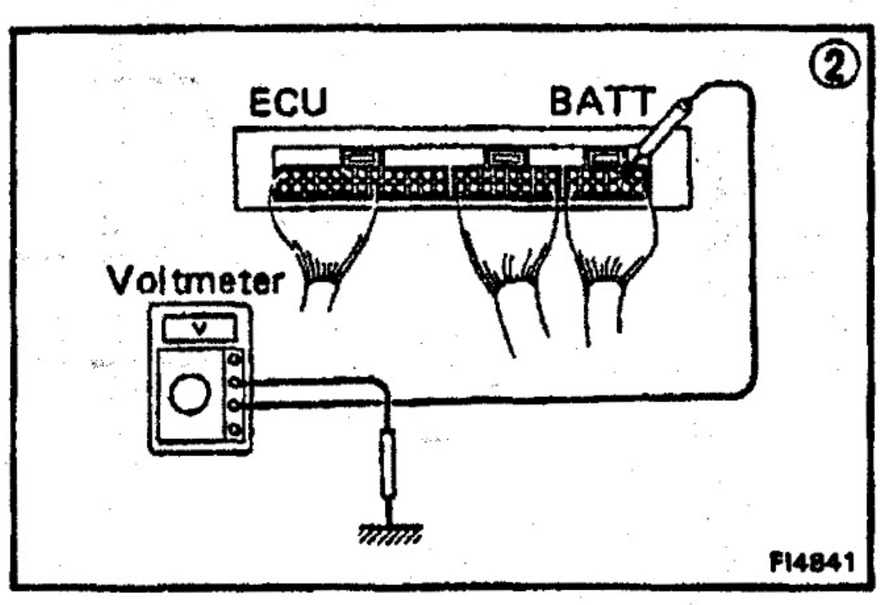


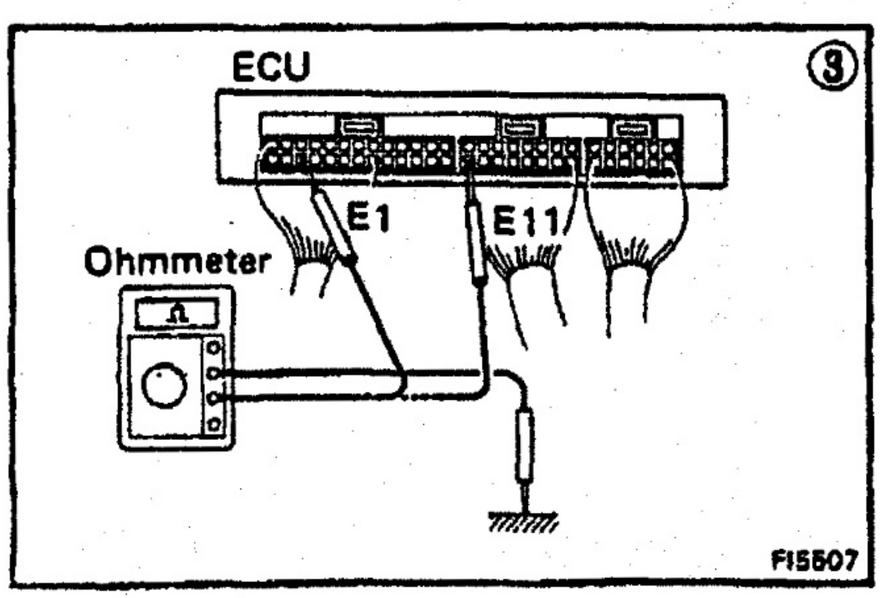
FI4786

No.	Terminals	Trouble	Condition	STD Voltage
1	BATT–E1 (E11)	No voltage	—	10 – 14 V
	IG SW–E1 (E11)	No voltage	Ignition switch ON	10 – 14 V
	M-REL–E1 (E11)	No voltage	Ignition switch ON	10 – 14 V
	+B (+B1) –E1 (E11)	No voltage	Ignition switch ON	10 – 14 V









• BATT–E1 (E11)

① There is no voltage between ECU terminals BATT and E1 (E11).

② Check that there is voltage between ECU terminal BATT and body ground.

NO → ③ Check wiring between ECU terminal E1 (E11) and body ground.

③ OK → Try another ECU.

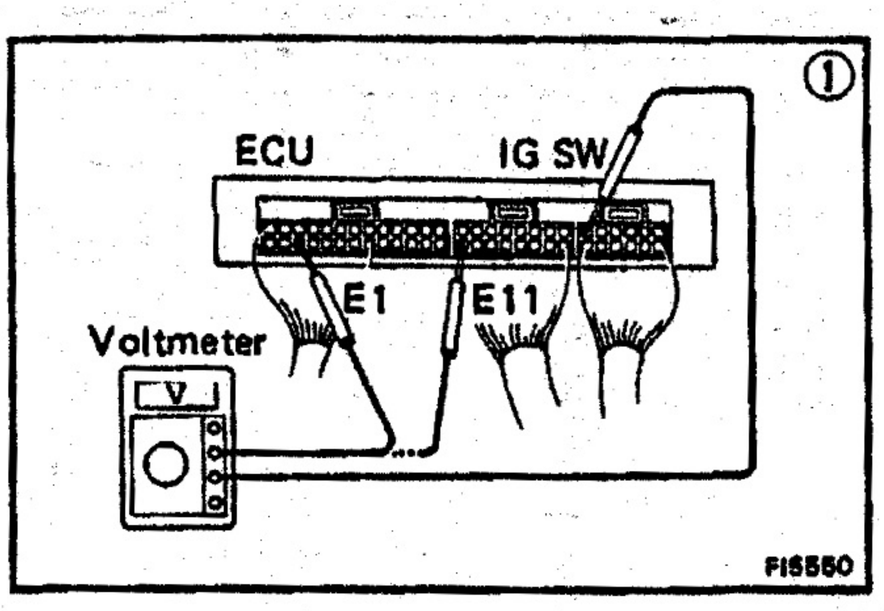
③ BAD → Repair or replace.

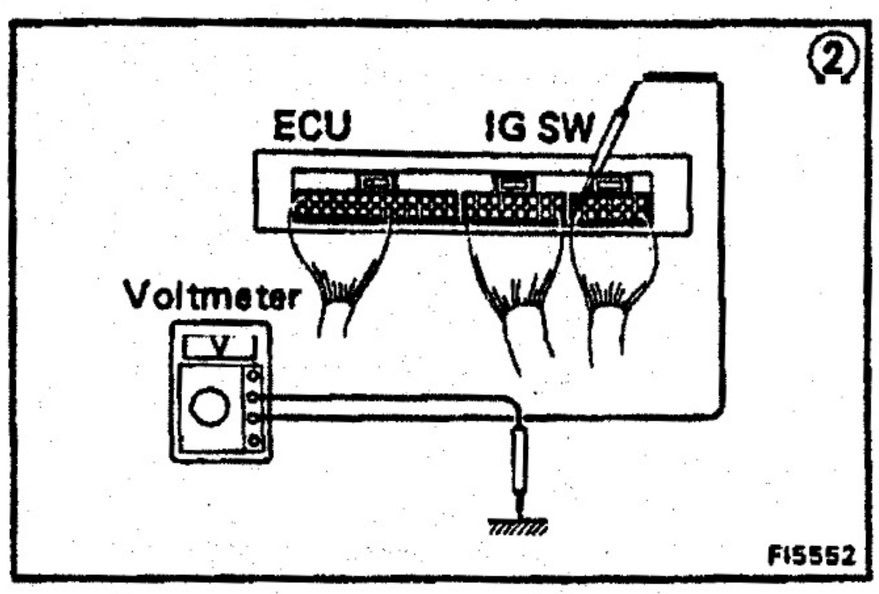
② OK → Check fuse and fusible link.

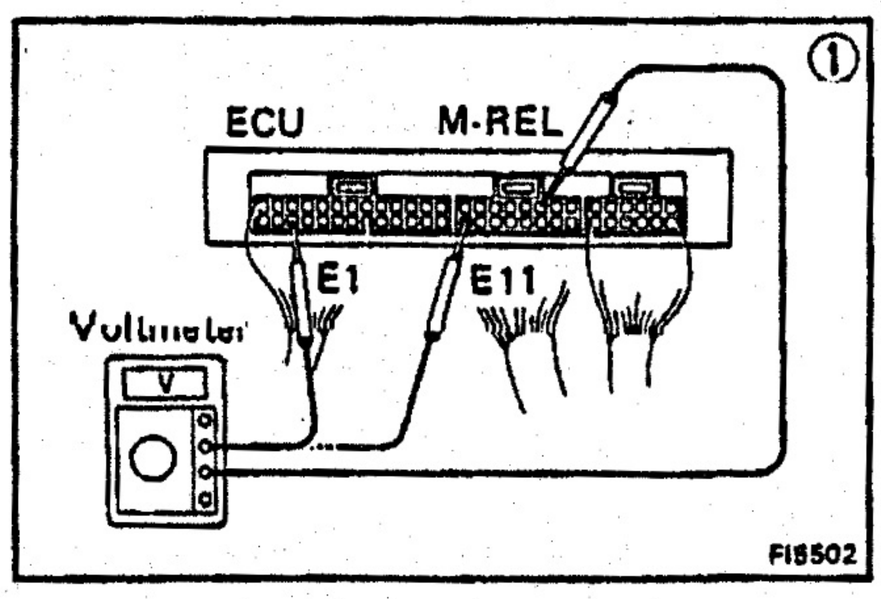
Check fuse and fusible link. BAD → Replace.

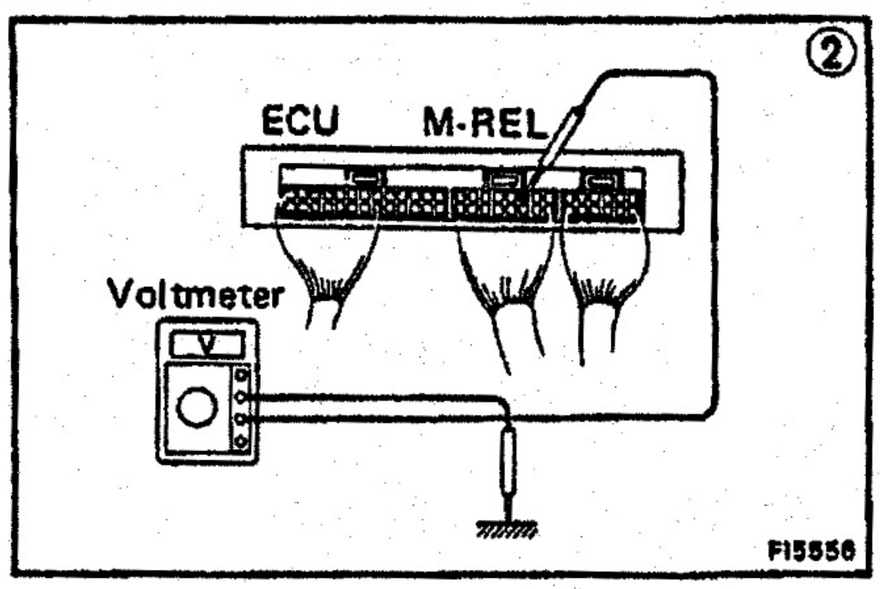
Check fuse and fusible link. OK → Check wiring between ECU terminal and battery.

Check wiring between ECU terminal and battery. BAD → Repair or replace.









• IG SW—E1 (E11)

① There is no voltage between ECU terminals IG SW and E1 (E11). (IG SW ON)

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

NO → Check fuse, fusible link and ignition switch.
- BAD → Repair or replace.

OK → Check wiring between ECU terminal E1 (E11) and body ground.
- OK → Try another ECU.
- BAD → Replace or repair.

• M-REL—E1 (E11)

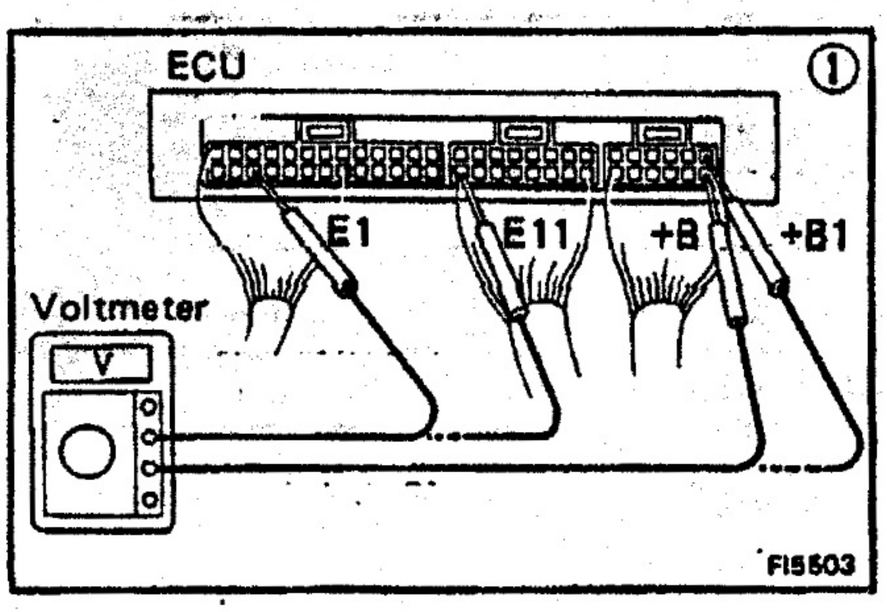
① There is no voltage between ECU terminals M-REL and E1 (E11). (IG SW ON)

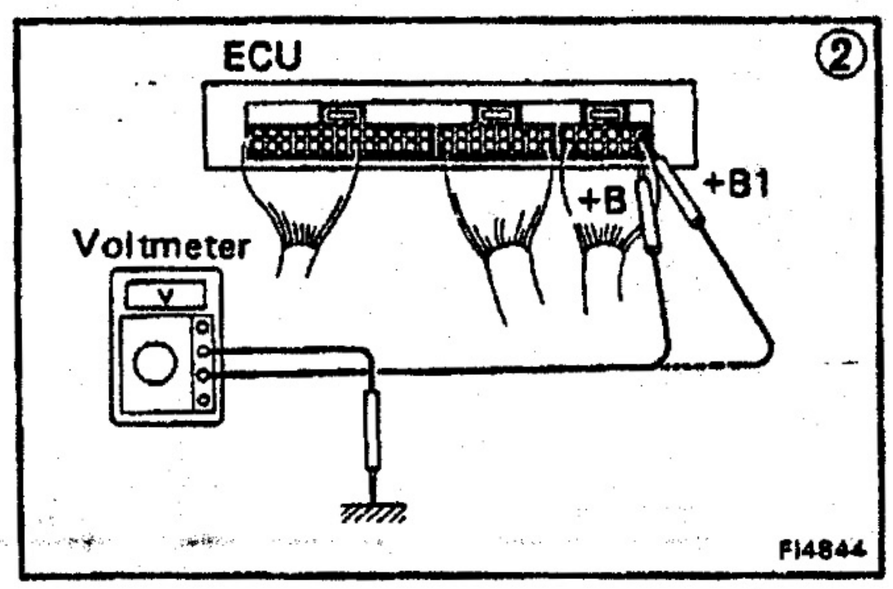
② Check that there is voltage between ECU terminal M-REL and body ground. (IG SW ON)

NO → Check EFI main relay and wiring harness. (See page FI-74)
- BAD → Replace.

OK → Check wiring between ECU terminal E1 (E11) and body ground.
- OK → Try another ECU.
- BAD → Replace or repair.

OK → Try another ECU.





• +B (+B1)—E1 (E11)

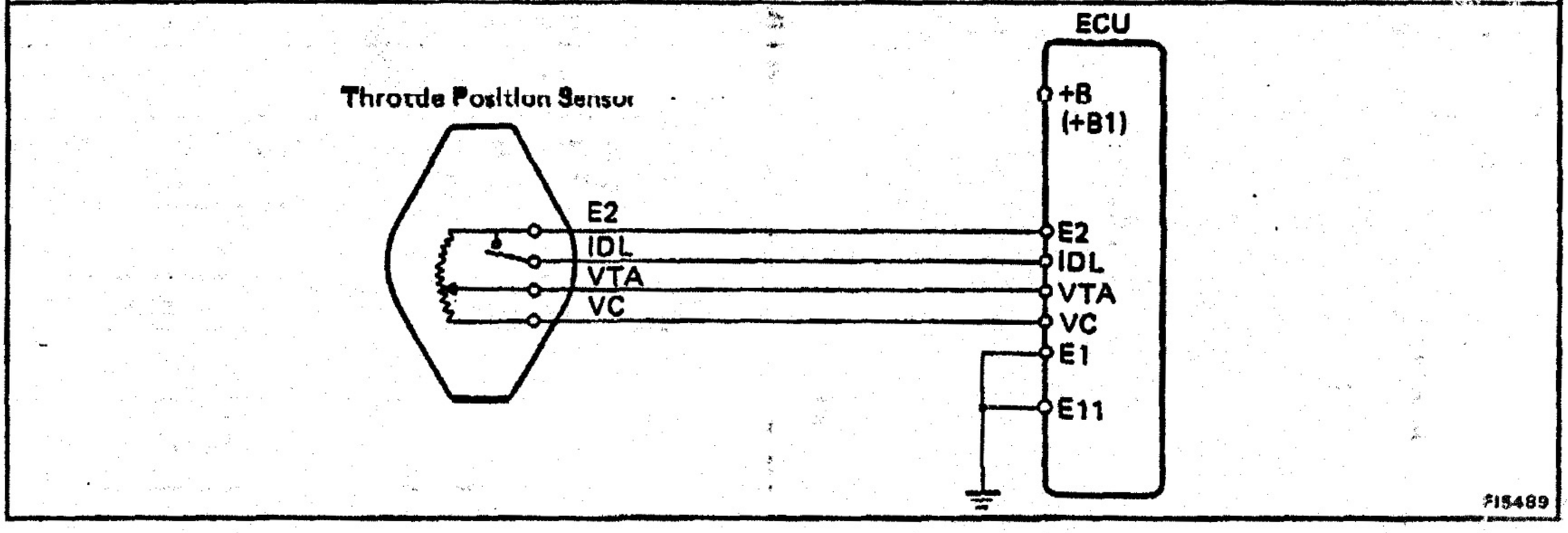
① There is no voltage between ECU terminals +B (+B1) and E1 (E11). (IG SW ON)

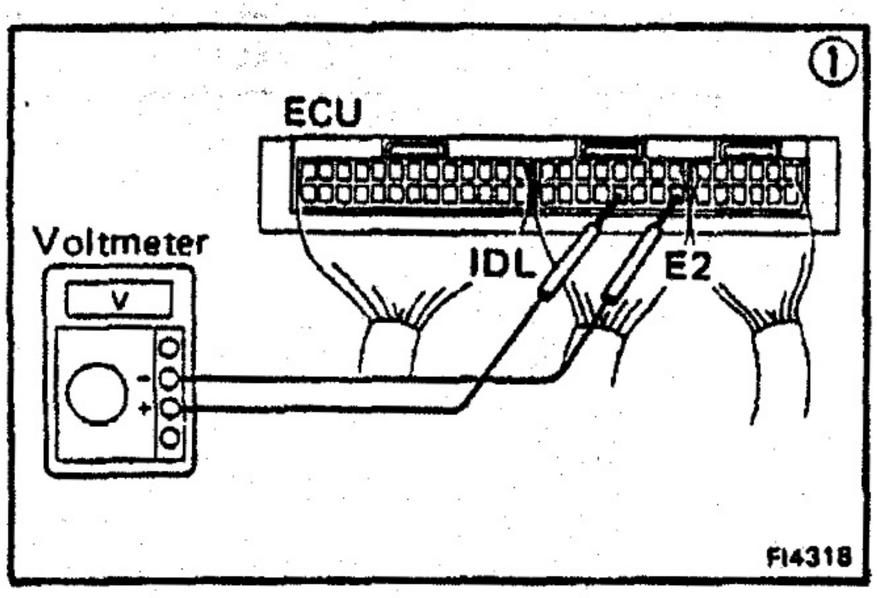
② Check that there is voltage between ECU terminal +B (+B1) and body ground. (IG SW ON)

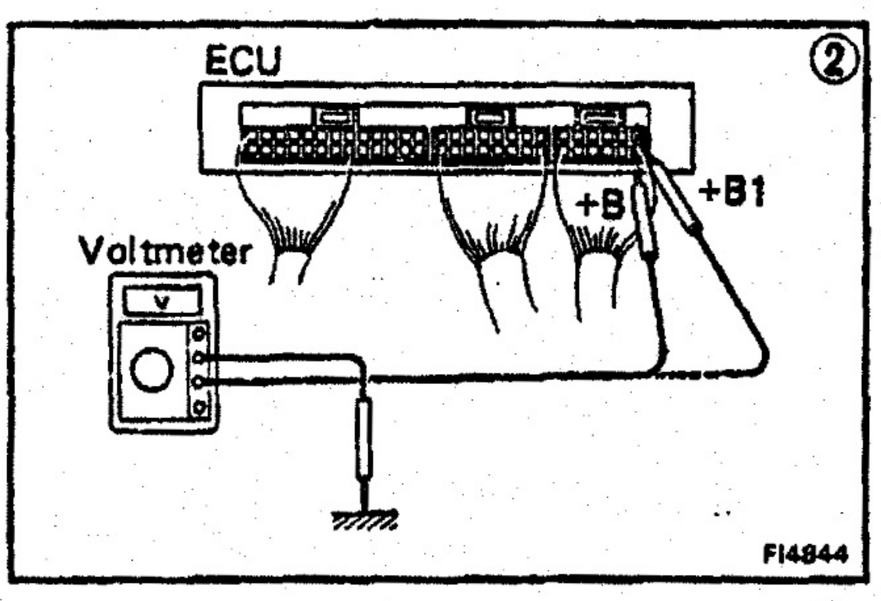
NO → Check fuse, fusible link and wiring harness.
- BAD → Repair or replace.
- OK → Check EFI main relay.
  - BAD → Replace.
  - OK → Refer to M-REL—E1 (E11) trouble section.

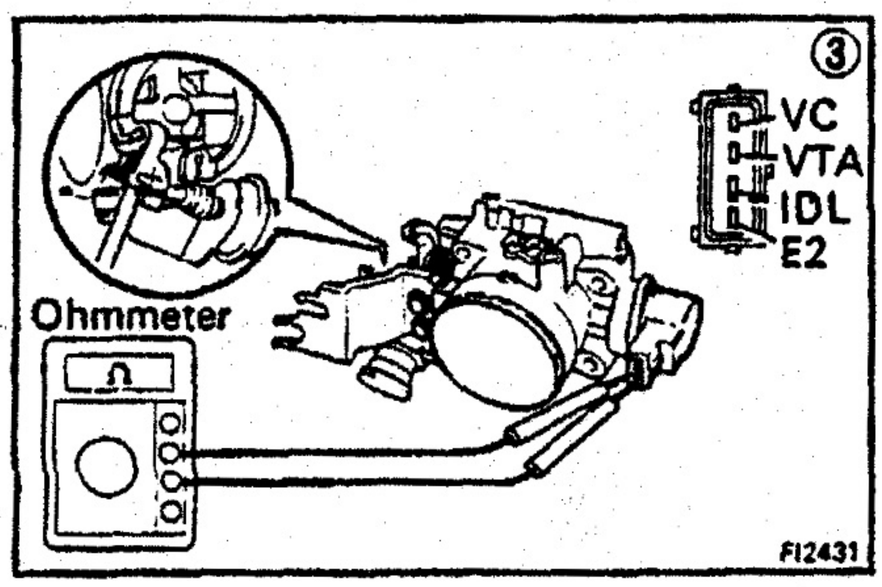
OK → Check wiring between ECU terminal E1 (E11) and body ground.
- OK → Try another ECU.
- BAD → Replace or repair.

No.	Terminals	Trouble	Condition		STD Voltage
2	IDL – E2	No voltage	Ignition switch ON	Throttle valve open	4 – 6 V
	VC – E2			—	4 – 6 V
	VTA E2			Throttle valve fully closed	0.1 – 1.0 V
				Throttle valve fully open	3 – 5 V









• IDL – E2

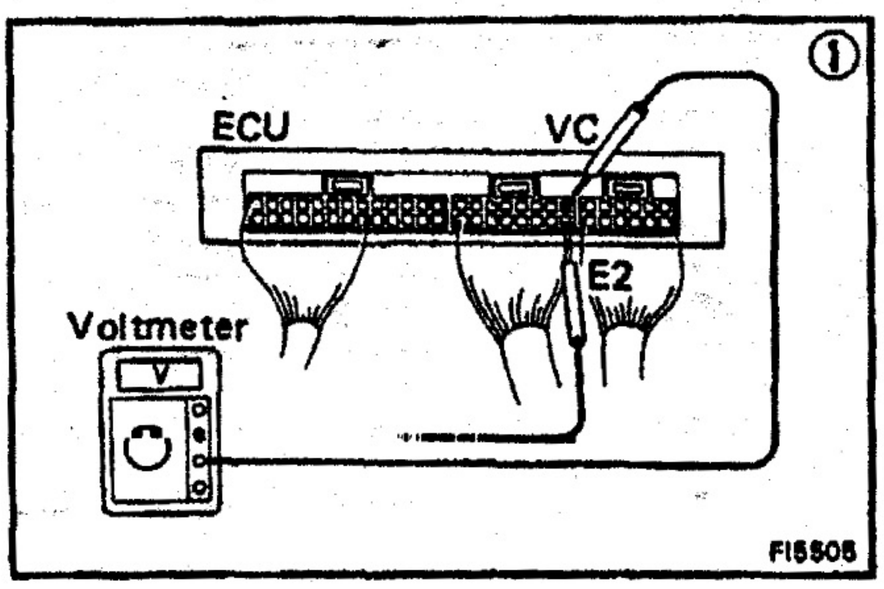
① There is no voltage between ECU terminals IDL and E2. (IG SW ON) (Throttle valve open)

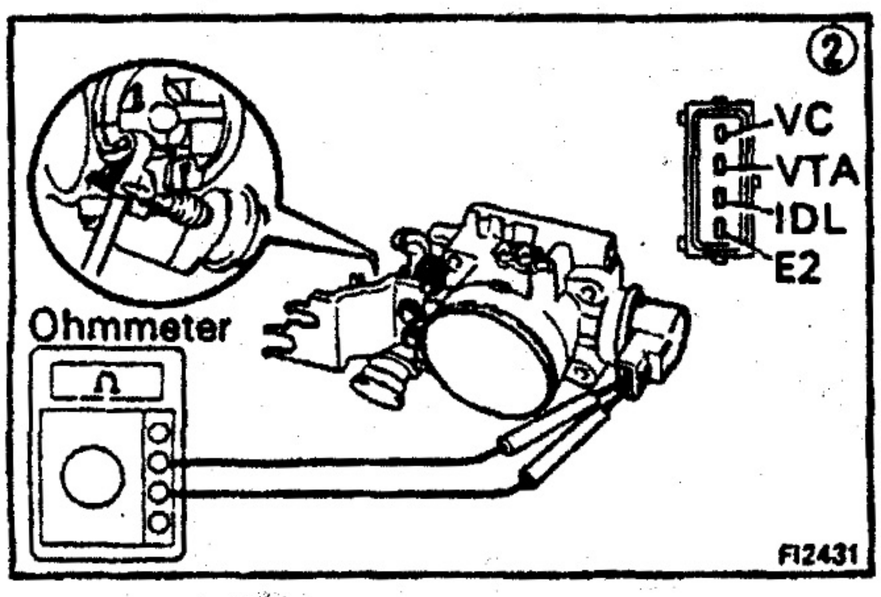
↓

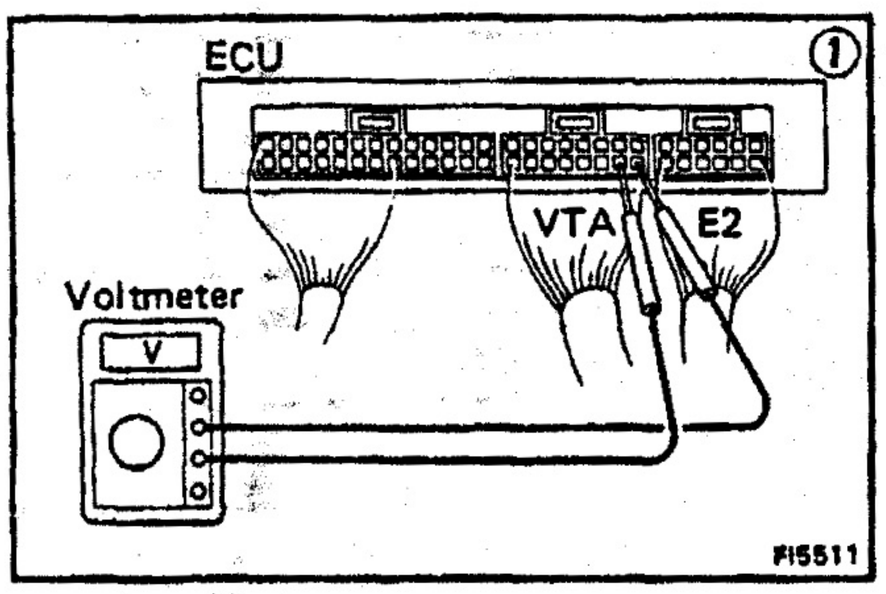
② Check that there is voltage between ECU terminal +B (+B1) and body ground. (IG SW ON)

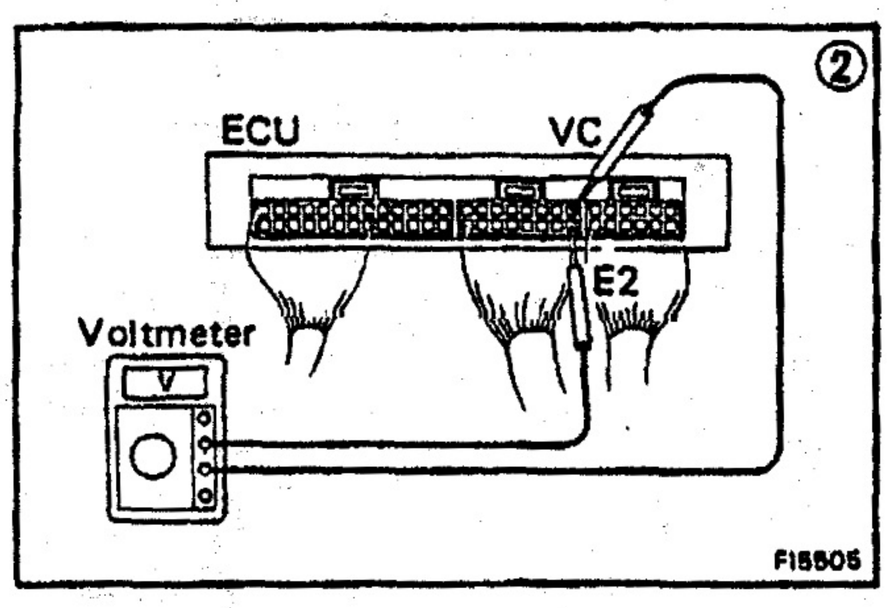
NO → Check wiring between ECU terminal E1 (E11) and body ground.
- OK → Try another ECU.
- BAD → Replace or repair.

OK → Refer to No. 1.
- BAD → Replace or repair.
- OK → ③ Check throttle position sensor.
  - BAD → Replace or repair throttle position sensor
  - OK → Check wiring between ECU and throttle position sensor.
    - BAD → Replace or repair.
    - OK → Try another ECU.









• VC – E2

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

↓

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

OK ↓

② Check throttle position sensor. (See page FI-68)

BAD ↓

Repair or replace.

OK ↓

Check wiring between ECU and throttle position sensor.

OK ↓

Try another ECU.

NO →

Refer to No. 1. (See page FI-30)

BAD →

Repair or replace wiring.

• VTA – E2

① THere is no specified voltage at ECU terminals VTA and E2. (IG SW ON)

↓

② Check that there is voltage between ECU terminal VC and E2. (IG SW ON)

NO ↓

Refer to VC – E2 trouble section.

OK ↓

OK →

③ Check throttle position sensor.

BAD →

Repair or replace.

OK ↓

Check wiring between ECU and throttle position sensor.

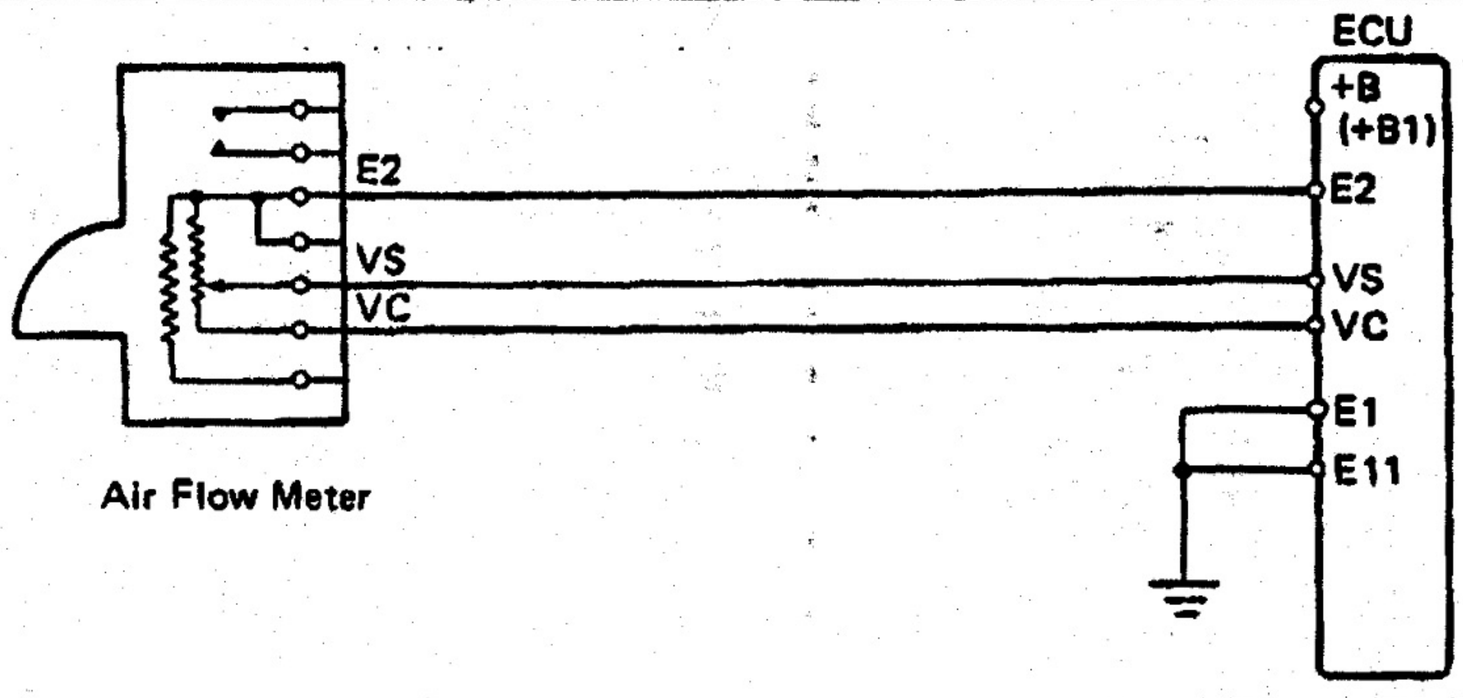
BAD →

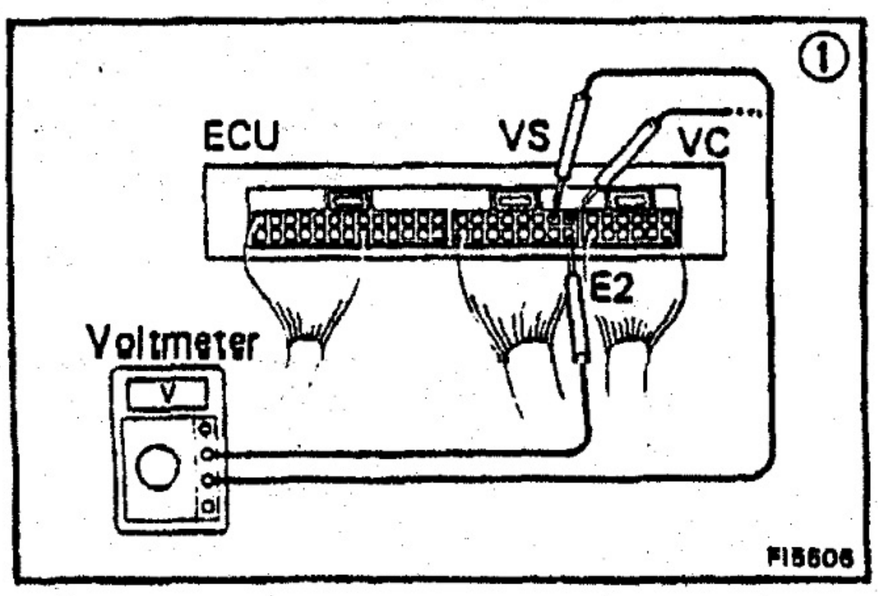
Repair or replace.

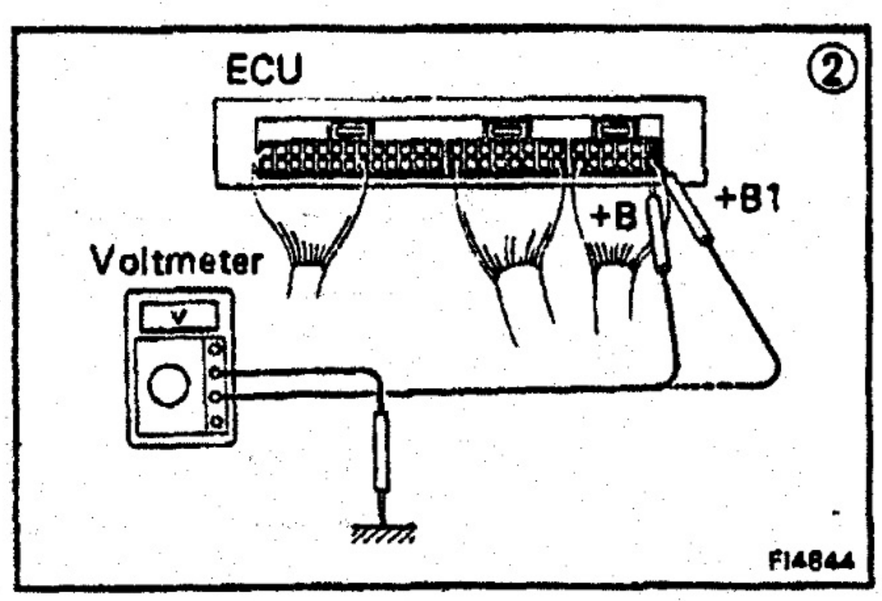
OK ↓

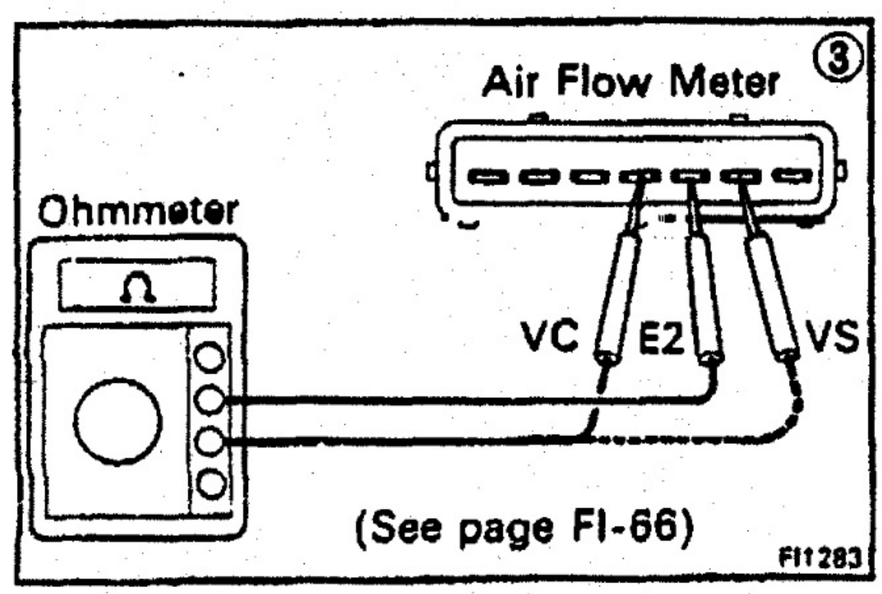
Try another ECU.

No.	Terminals	Trouble	Condition		STD Voltage
3	VC – E2	No voltage	Ignition switch ON	—	4 – 6 V
	VS – E2			Measuring plate fully closed	4 – 5 V
	VS – E2			Measuring plate fully open	0.02 – 0.08 V
	VS – E2		Idling	—	2 – 4 V
	VS – E2		3,000 rpm	—	0.3 – 1.0 V









① There is no voltage between ECU terminals VC or VS 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 No. 1. (See page FI-30)

↓

Check wiring between ECU terminal E1 (E11) and body ground.

OK ↓

BAD → Repair or replace.

↓

③ Check air flow meter. (See page FI-66)

BAD ↓

Replace air flow meter.

OK ↓

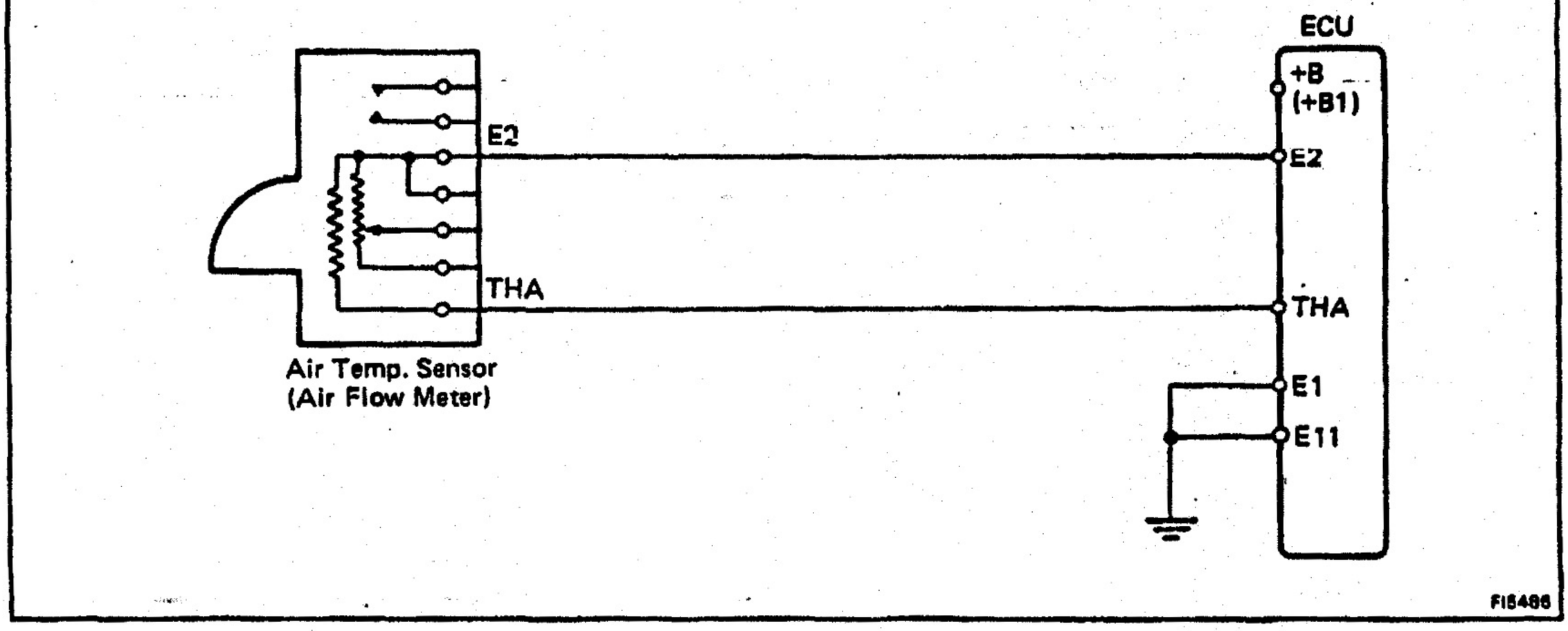
Check wiring between ECU and air flow meter.

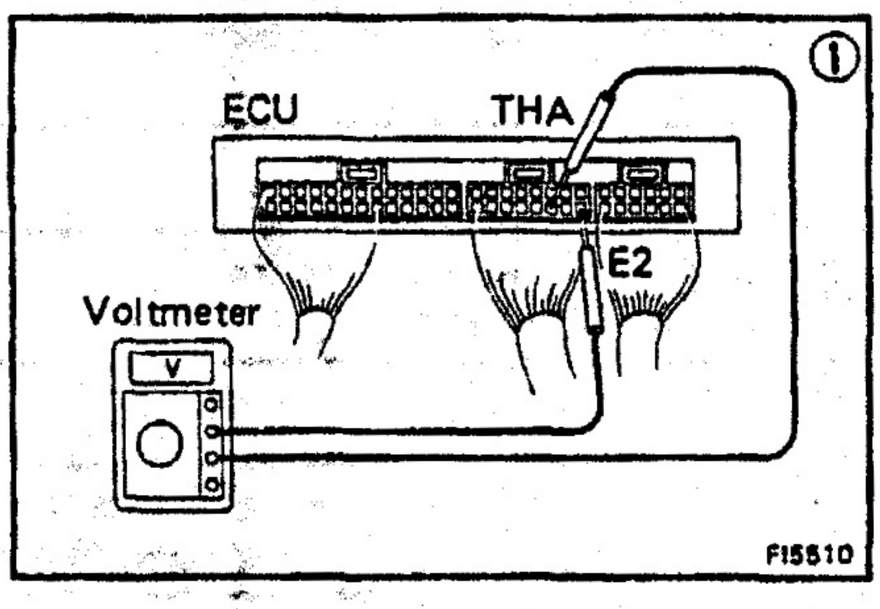
OK ↓

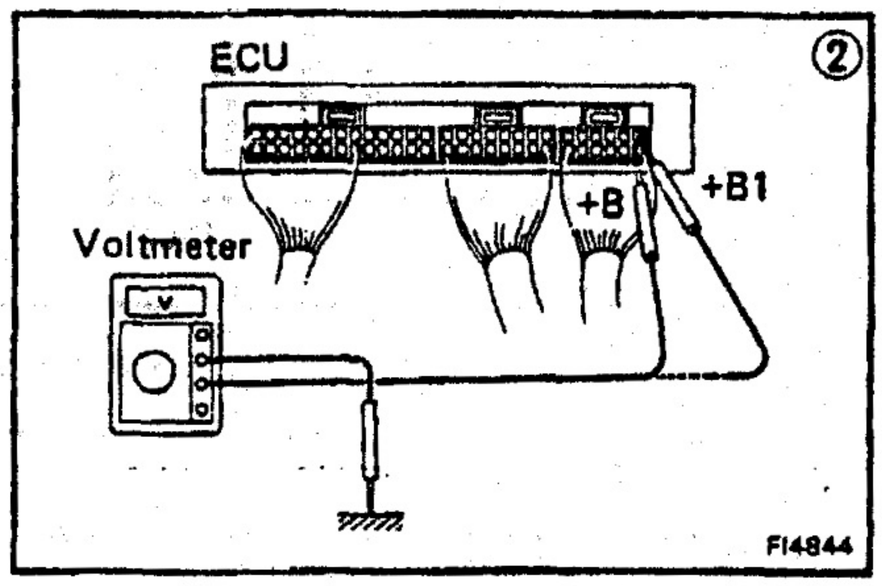
Try another ECU.

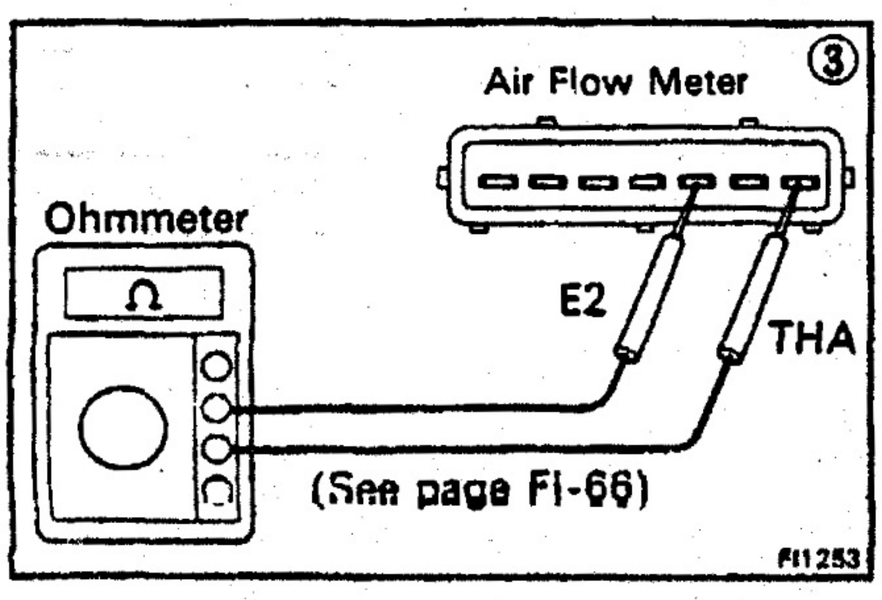
BAD → Repair or replace.

No.	Terminals	Trouble	Condition		STD Voltage
4	THA – E2	No voltage	Ignition switch ON	Intake air temperature 20°C (68°F)	1 – 3 V









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 No. 1. (See page FI-30)

↓

Check wiring between ECU terminal E1 (E11) and body ground.

OK ↓

BAD → Repair or replace.

↓

③ Check air temp. sensor. (See page FI-66)

BAD ↓

Replace air flow meter.

OK ↓

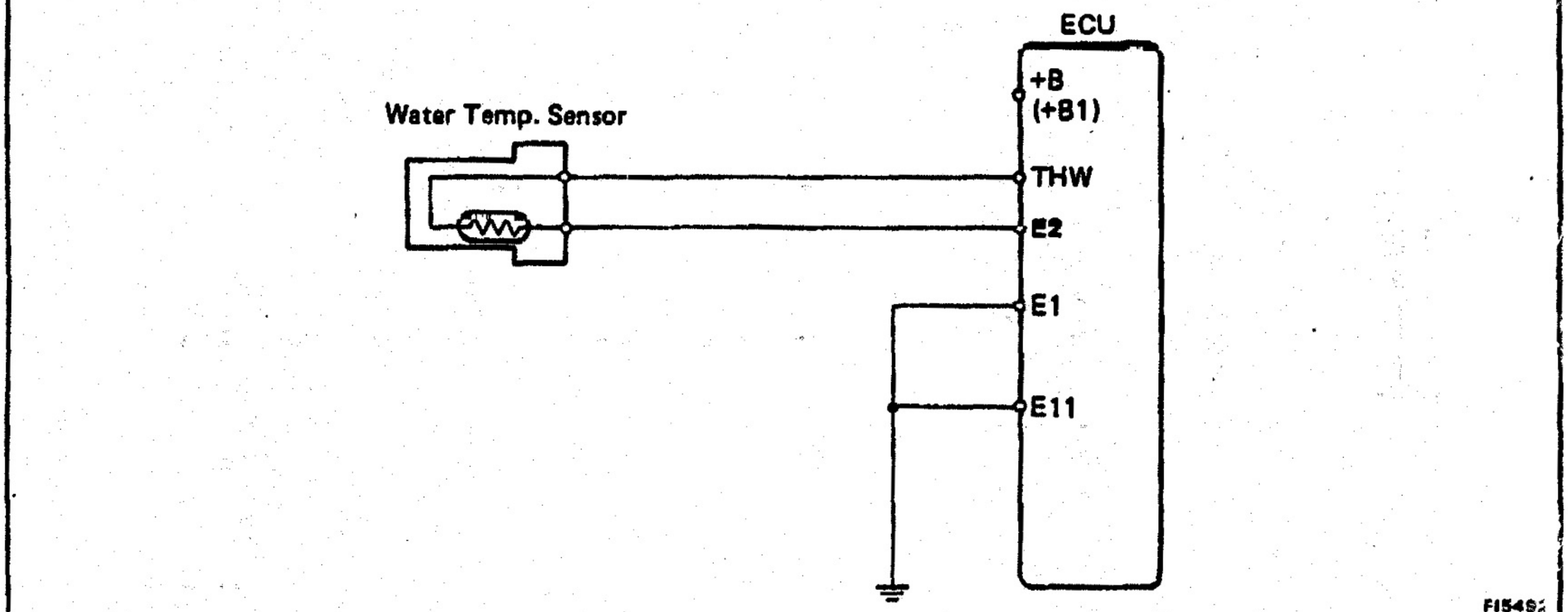
Check wiring between ECU and air temp. sensor.

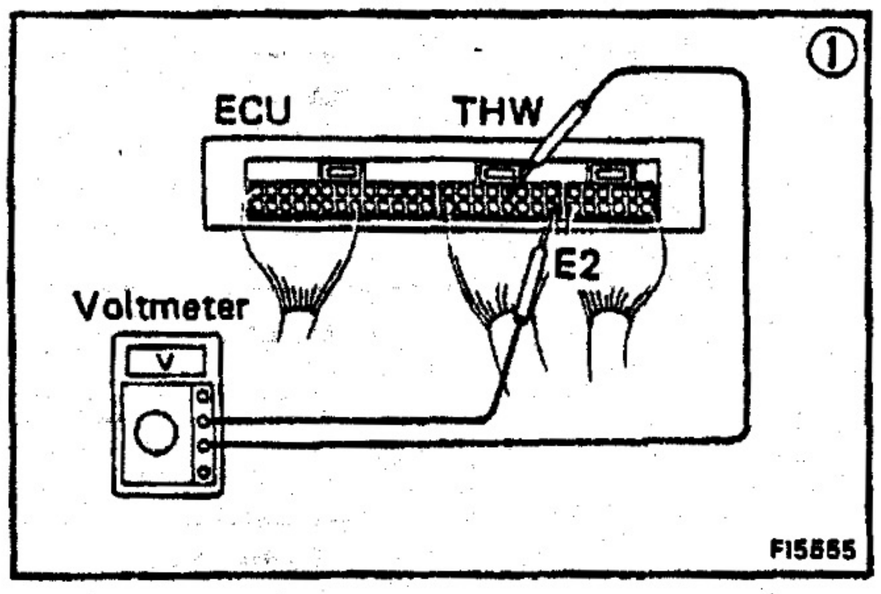
OK ↓

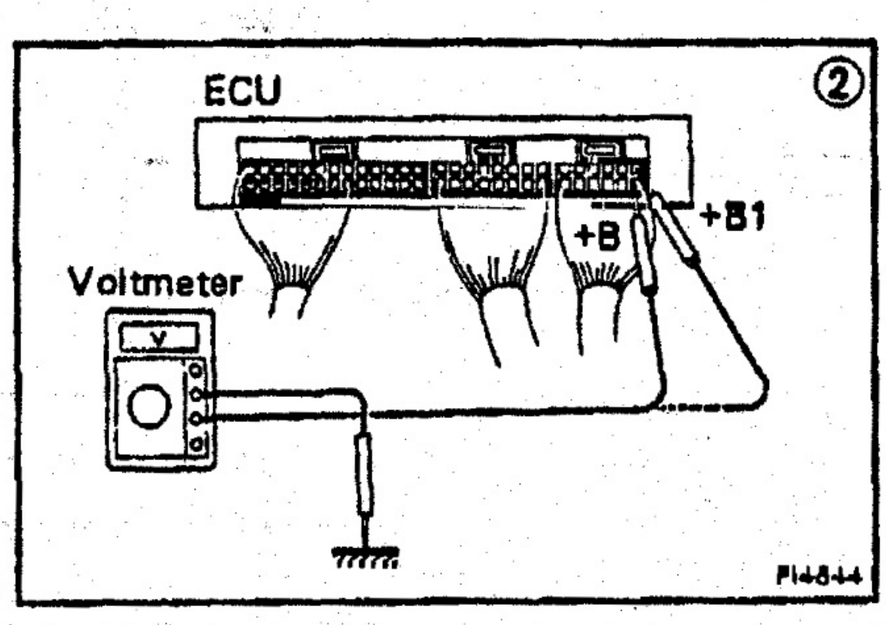
Try another ECU.

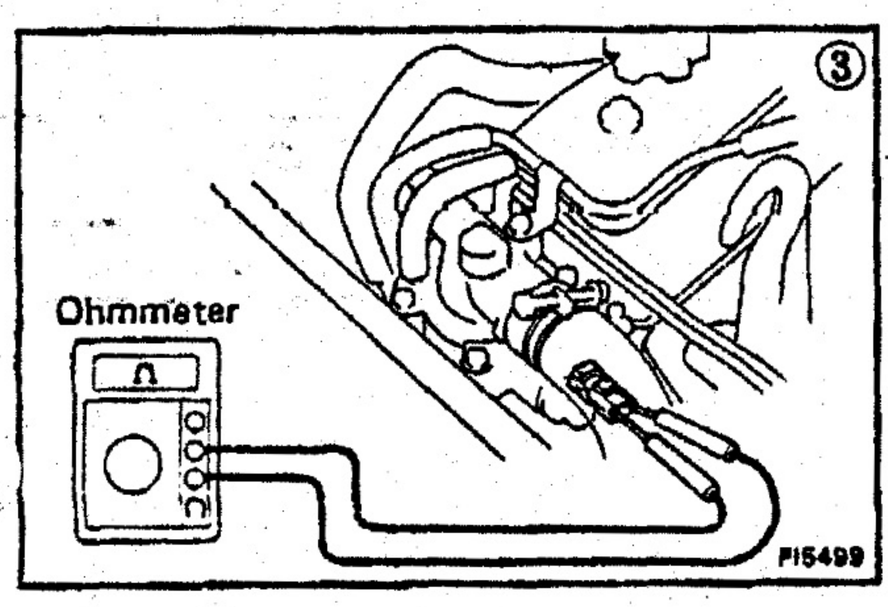
BAD → Repair or replace.

No.	Terminals	Trouble	Condition		STD Voltage
5	THW – E2	No voltage	Ignition switch ON	Coolant temperature 80°C (176°F)	0.1 – 1.0 V









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 No. 1. (See page FI-30)

↓

Check wiring between ECU terminal E1 (E11) and body ground.

OK → ↓

BAD → Repair or replace.

↓

③ Check water temp. sensor. (See page FI-77)

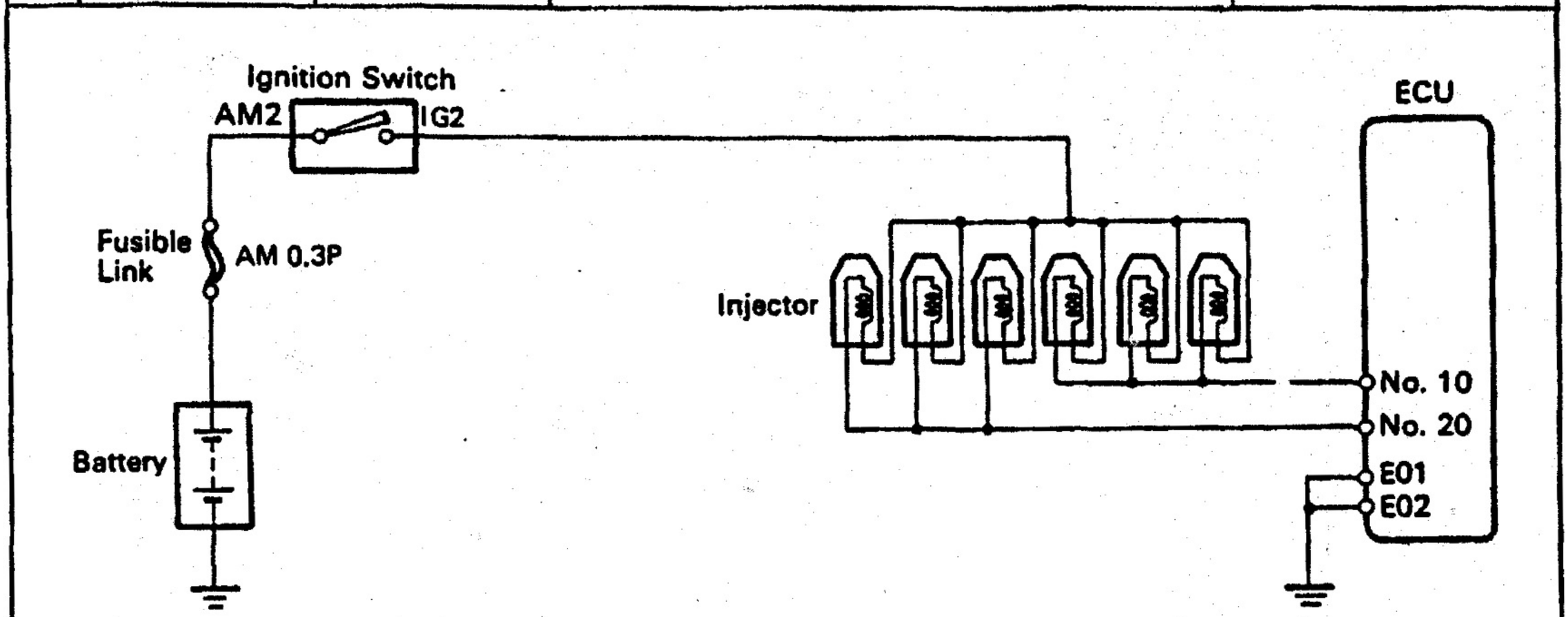
BAD → ↓ Replace water temp. sensor.

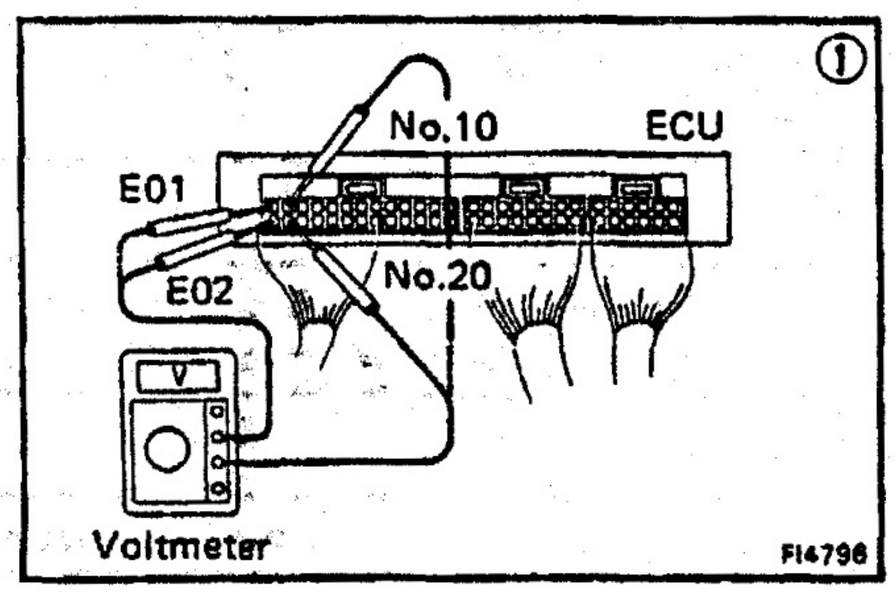
OK → ↓ Check wiring between ECU and water temp. sensor.

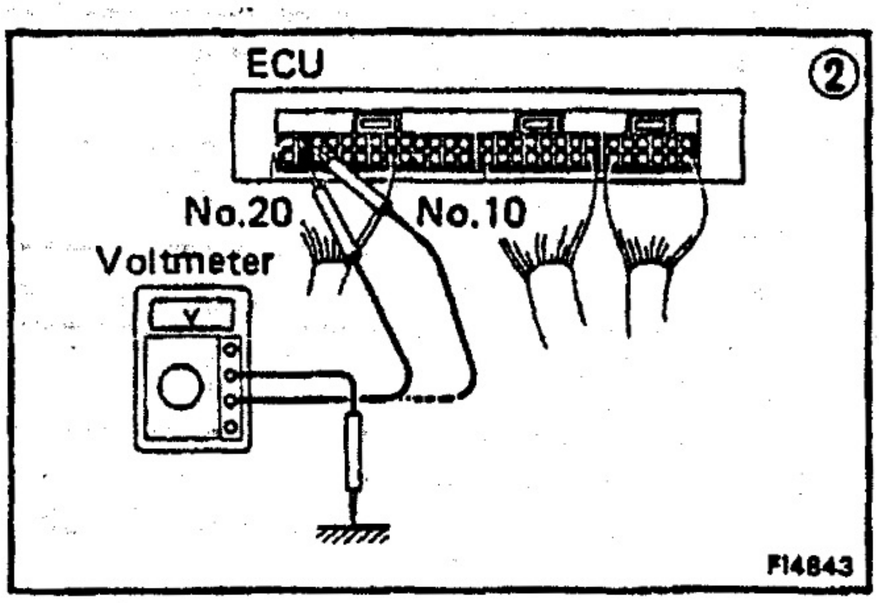
OK → ↓ Try another ECU.

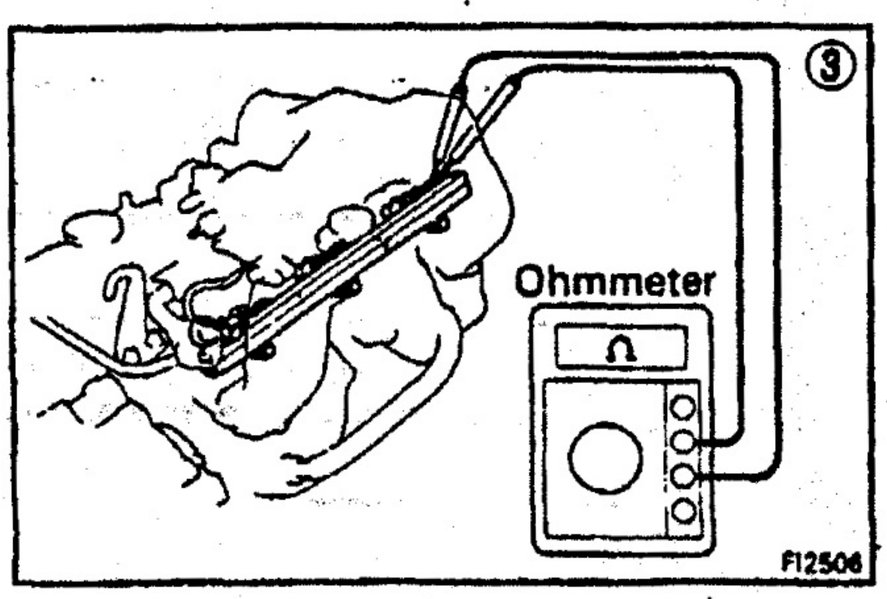
BAD → Repair or replace.

No.	Terminals	Trouble	Condition	STD Voltage
6	No. 10 – E01 No. 20 – E02	No voltage	Ignition switch ON	10 – 14 V









① There is no voltage between ECU terminal No. 10 and/or No. 20 and E01 and/or E02. (IG SW ON)

↓

② Check that there is voltage between ECU terminal No. 10 or No. 20 and body ground.

NO → OK

OK → Check wiring between ECU terminal E01 and/or E02 and body ground.

OK → Try another ECU.

BAD → Repair or replace.

NO → Check fusible link and ignition switch.

BAD → Repair or replace.

OK

↓

③ Check resistance of magnetic coil in each injector.
STD resistance: Approx. 13.8 Ω

OK

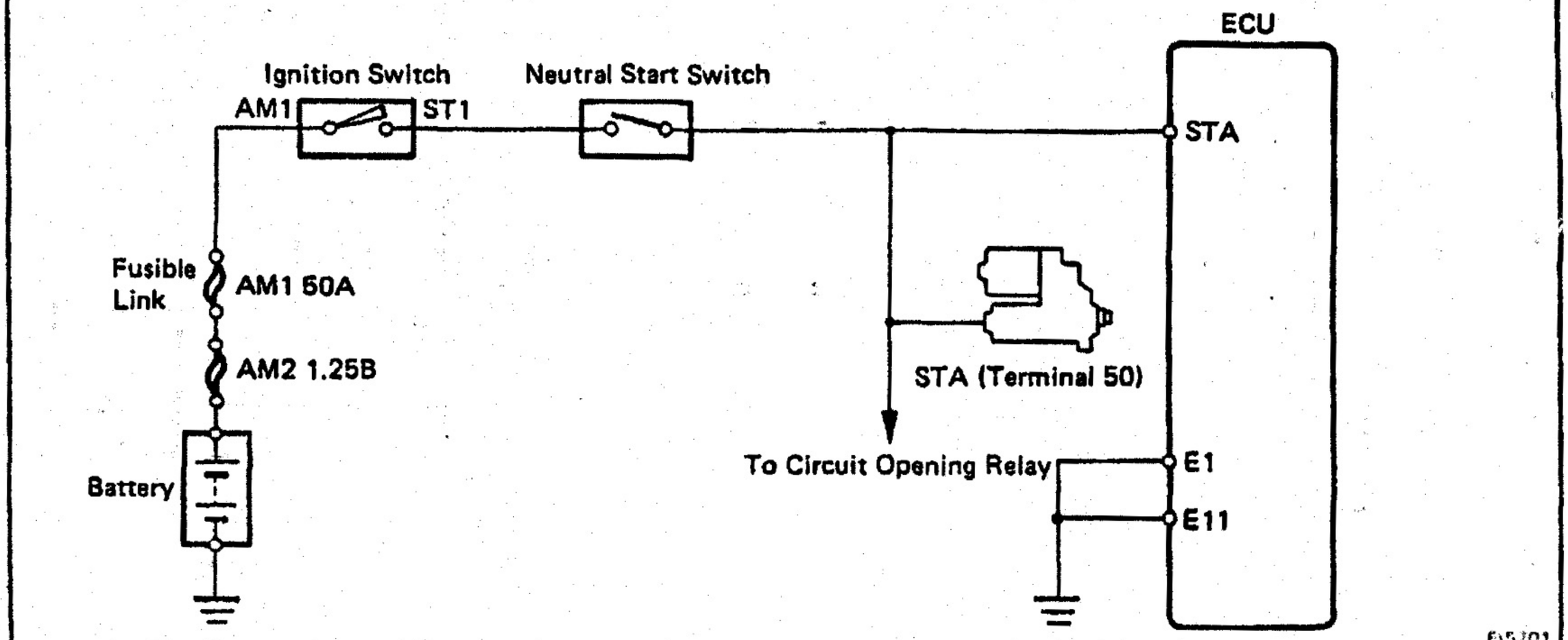
↓

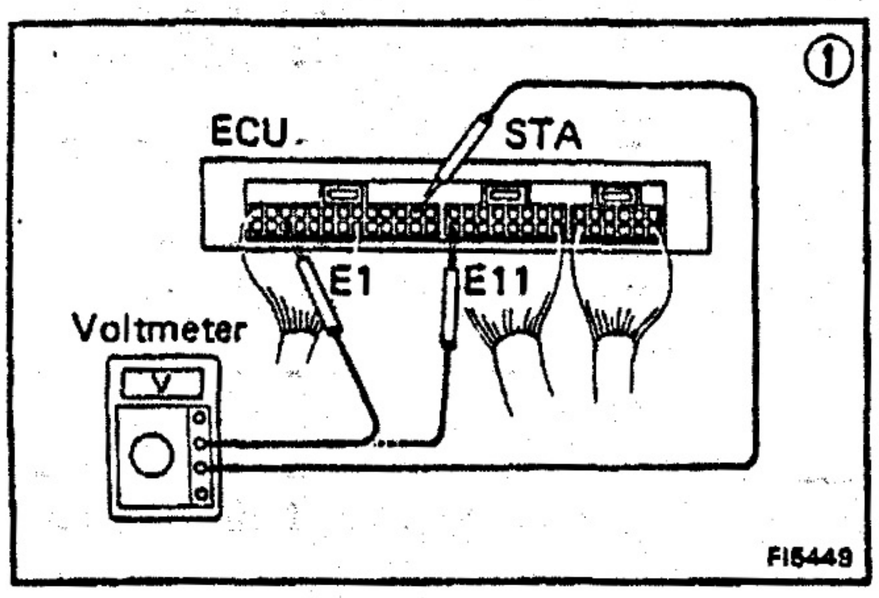
Check wiring between ECU terminal No. 10 and/or No. 20 and battery.

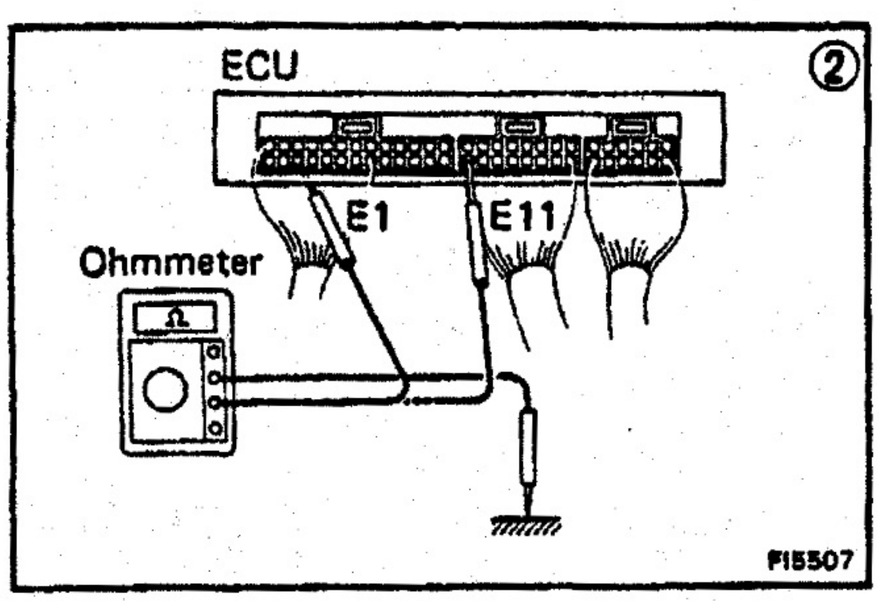
BAD → Repair or replace.

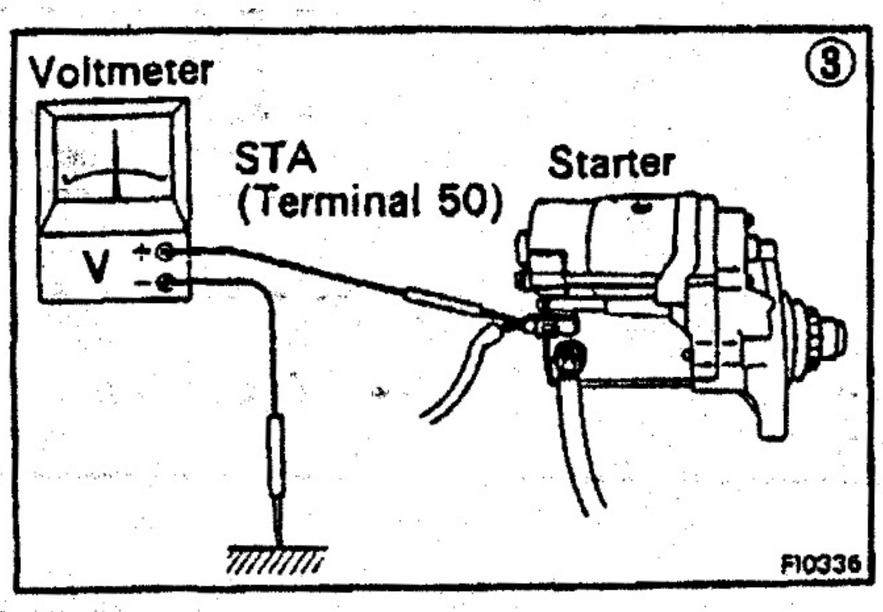
BAD → Replace injector.

No.	Terminals	Trouble	Condition	STD Voltage
7	STA–E1(E11)	No voltage	Cranking	6 – 14 V









① There is no voltage between ECU terminals STA and E1 (E11). (IG SW START)

Check starter operation. → OK → Check wiring between ECU terminal STA and ignition switch terminal ST1.

BAD → Repair or replace.

OK → ② Check wiring between ECU terminal E1 (E11) and body ground.

OK → Try another ECU.

BAD → Repair or replace.

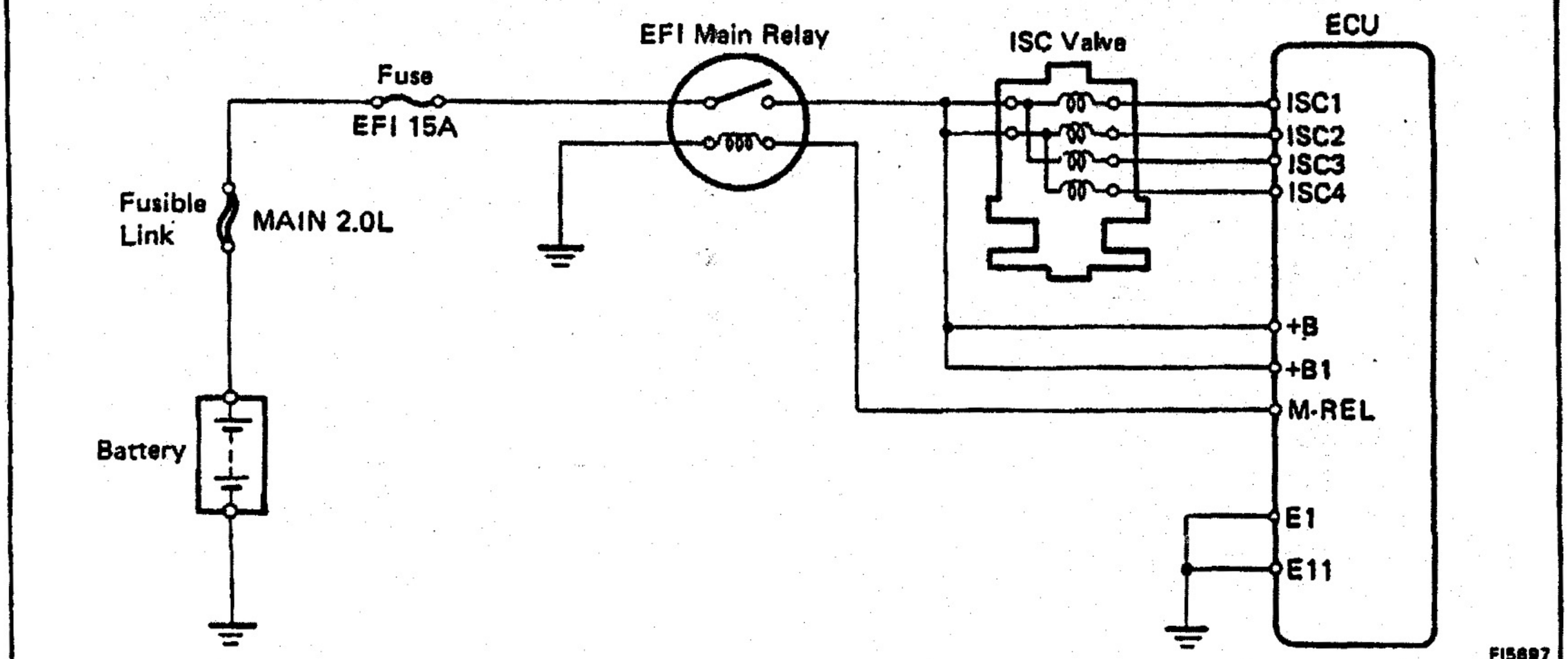
Check fusible link, battery, wiring, ignition switch and neutral start switch. → BAD → Repair or replace.

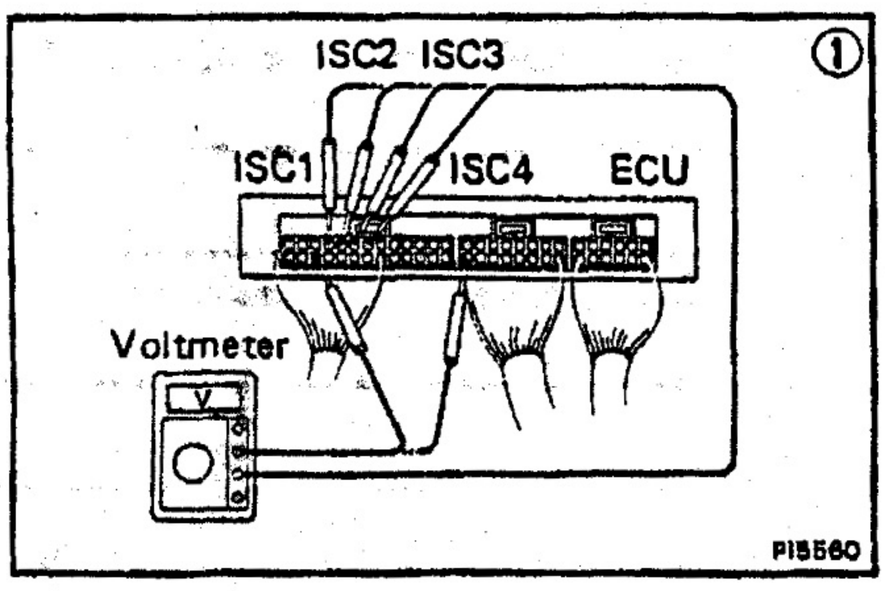
OK → ③ Check that there is voltage at STA (50) terminal of starter. (IG SW START) STD voltage: 6 – 14 V

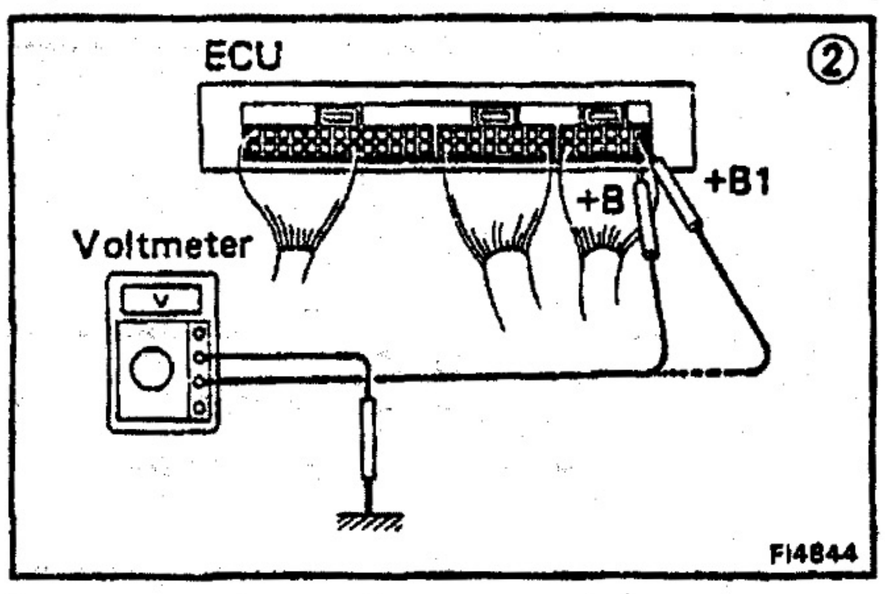
OK → Check starter.

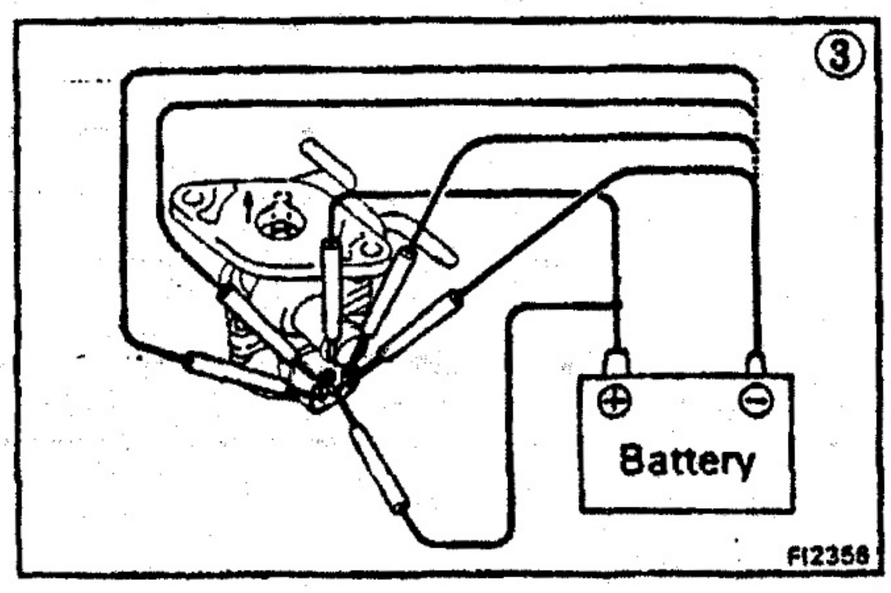
NO → Check wiring between ignition switch terminal ST1 and starter terminal STA (50).

No.	Terminals	Trouble	Condition	STD Voltage
8	ISC1 ~ ISC4 – E1 (E11)	No voltage	Ignition switch ON	10 – 14 V









① There is no voltage between ECU terminals ISC1 ~ ISC4 and E1 (E11). (IG SW ON)

↓

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

OK ↓

NO → Refer to No. 1. (See page FI-30)

↓

Check wiring between ECU terminal E1 (E11) and body ground.

OK ↓

BAD → Repair or replace.

↓

③ Check ISC valve. (See page FI-71)

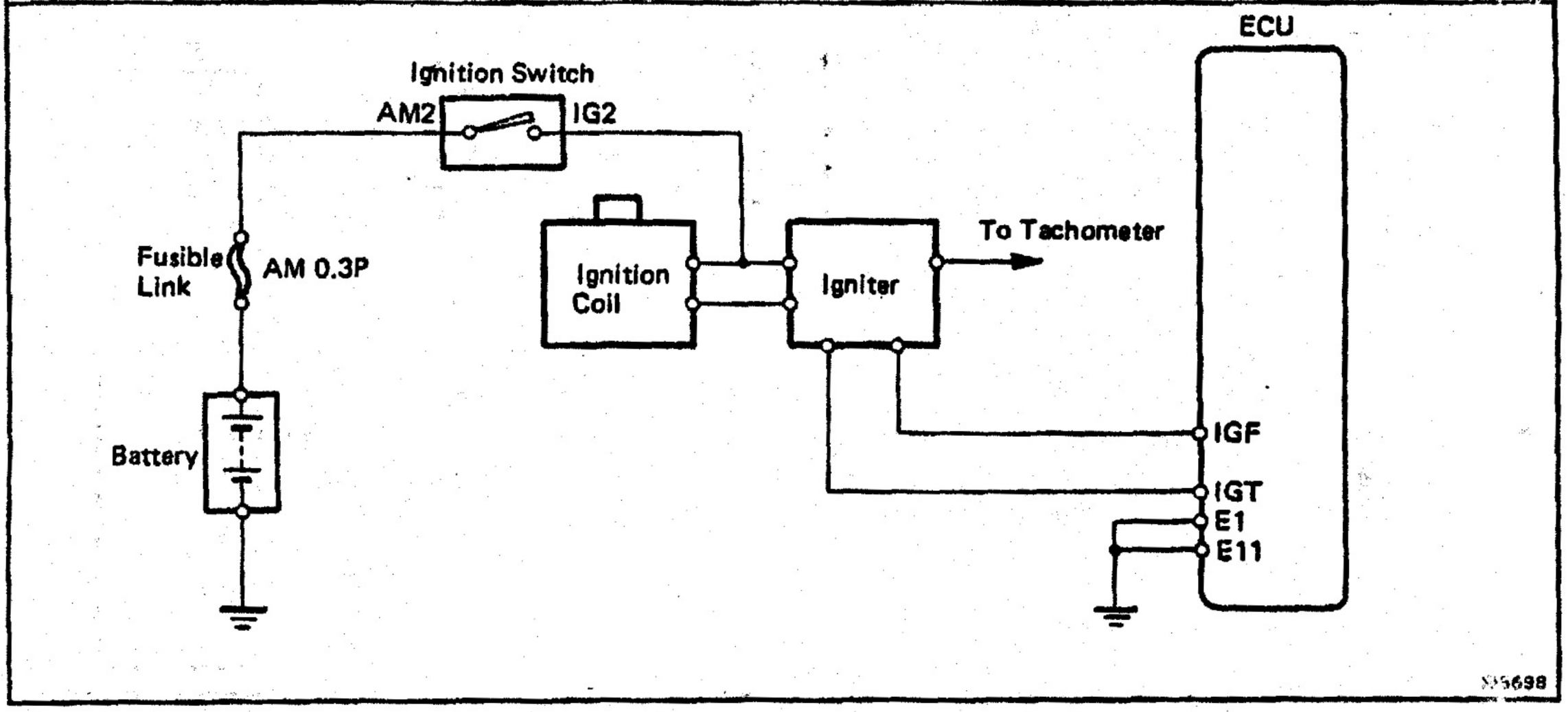
BAD → Replace ISC valve.

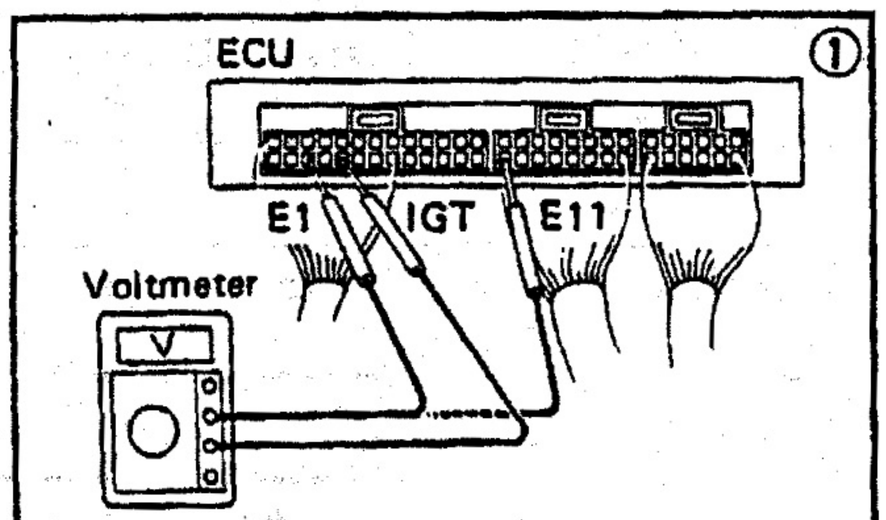
OK → Check wiring between ECU and EFI main relay.

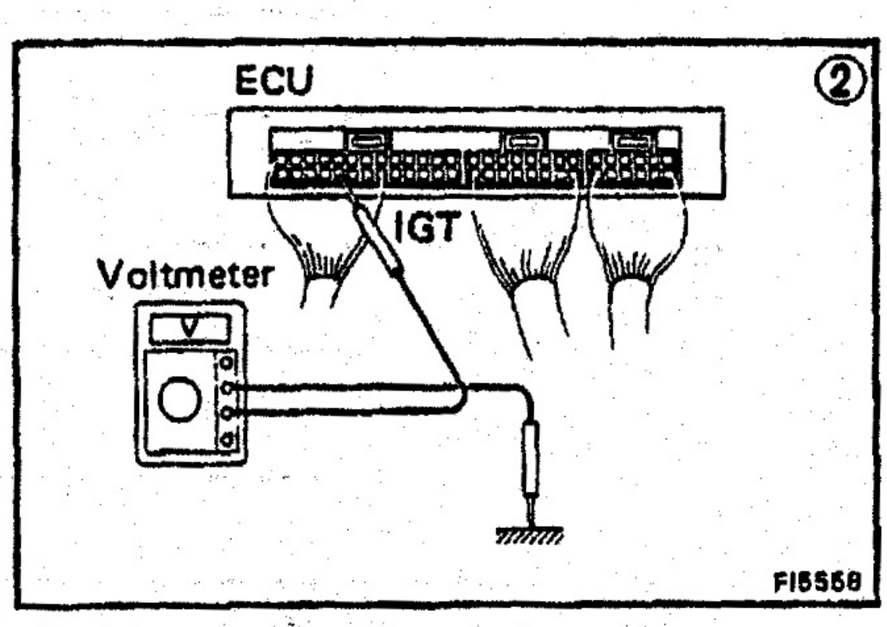
OK → Try another ECU.

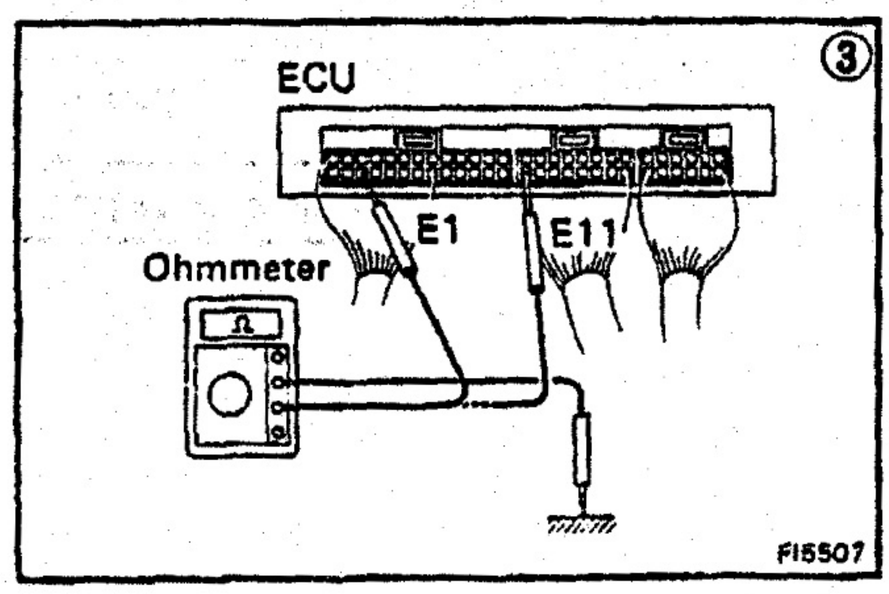
BAD → Repair or replace.

No.	Terminals	Trouble	Condition	STD Voltage
9	IGT—E1 (E11)	No voltage	Idling	0.7 – 1.0 V









① There is no voltage between ECU terminals IGT and E1 (E11). (Idling)

↓

② Check that there is voltage between ECU terminal IGT and body ground. (Idling)

NO → ③ Check wiring between ECU terminal E1 (E11) and body ground. — BAD → Repair or replace.

③ OK → Try another ECU.

② OK →

Check fusible link and ignition switch. — BAD → Repair or replace.

OK ↓

Check distributor. (See page IG-7) — BAD → Repair or replace.

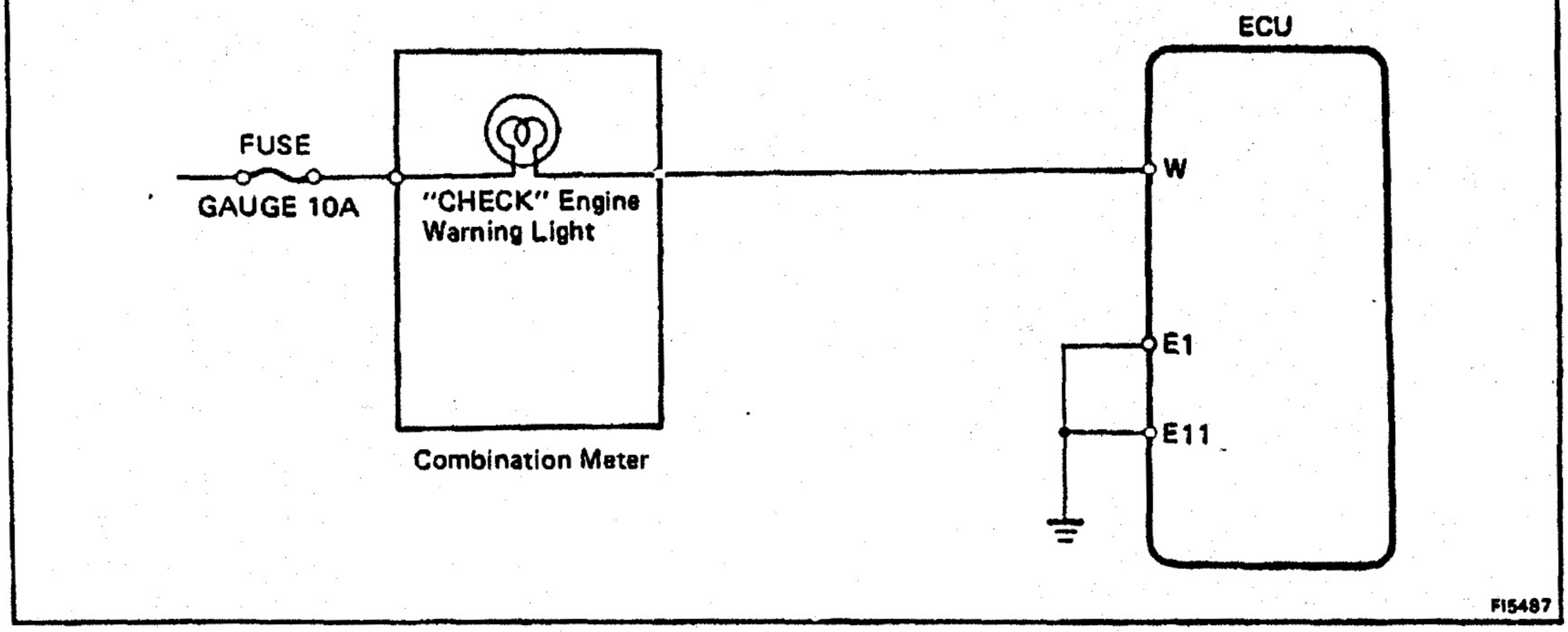
OK ↓

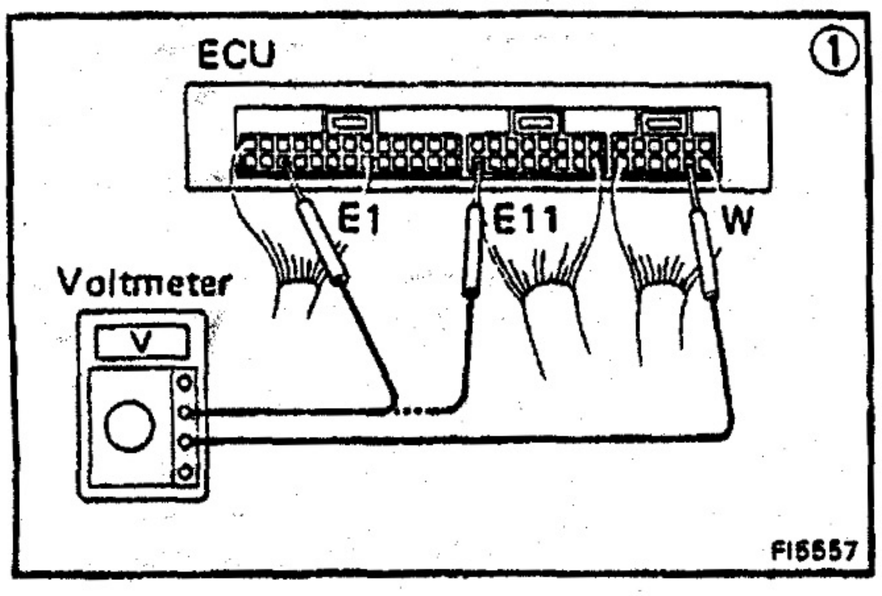
Check wiring between ECU and battery. — BAD → Repair or replace.

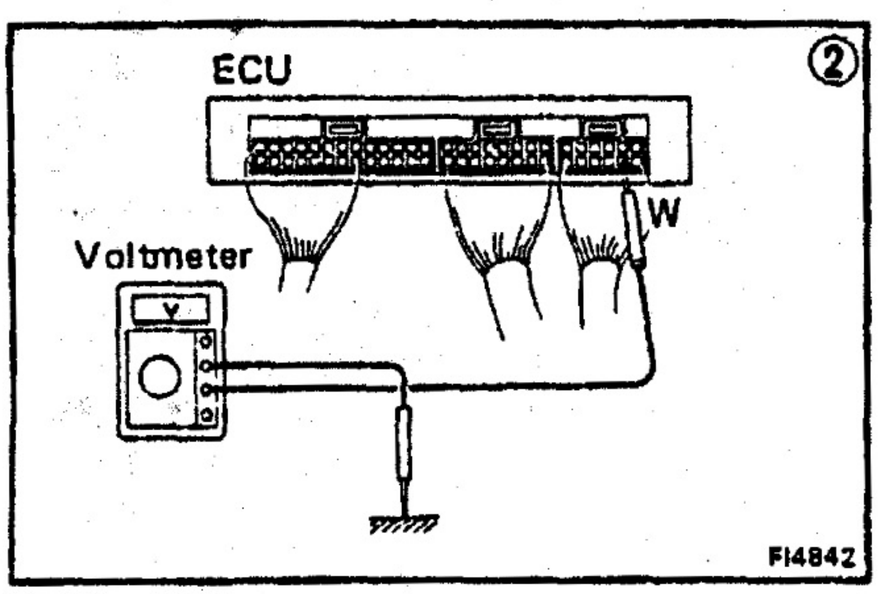
OK ↓

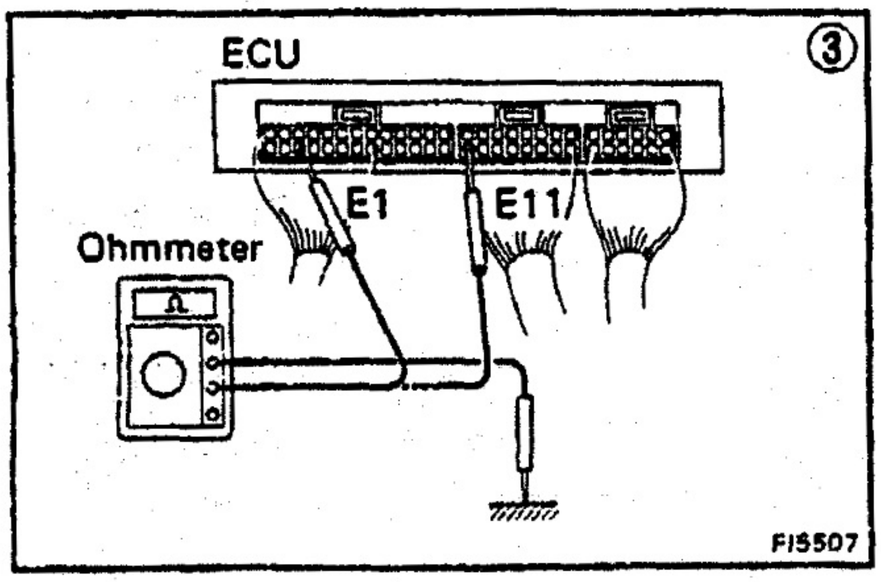
Check igniter. (See page IG-7) — BAD → Repair or replace.

No.	Terminals	Trouble	Condition	STD Voltage
10	W—E1 (E11)	No voltage	No trouble ("CHECK" engine warning light off) and engine running	10 – 14 V









① There is no voltage between ECU terminals W and E1 (E11). (Idling)

↓

② Check that there is voltage between ECU terminal W and body ground.

NO → ③ Check wiring between ECU terminal E1 (E11) and body ground.

- OK → Try another ECU.
- BAD → Repair or replace.

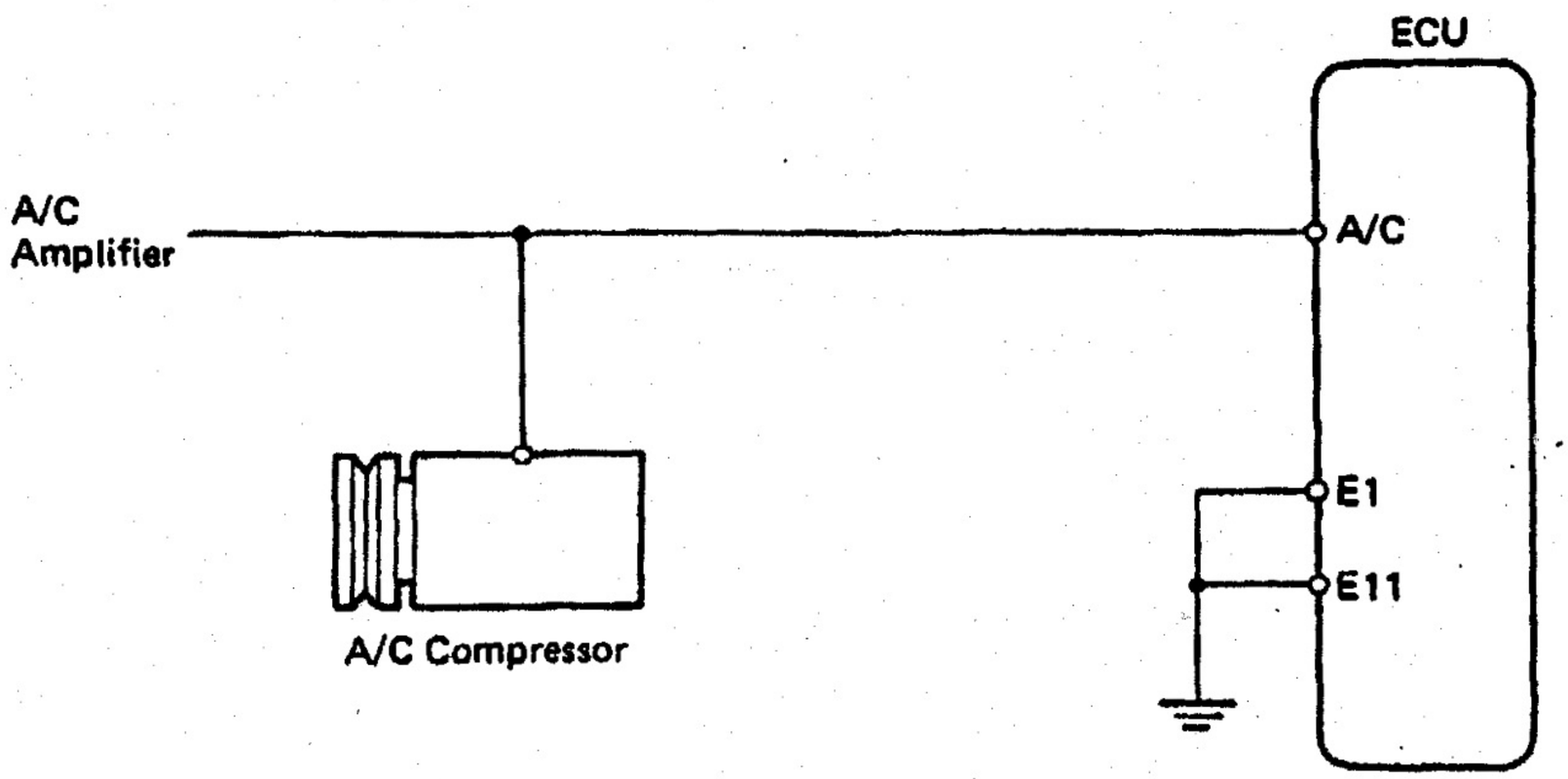
OK → Check GAUGE fuse (10A) and "CHECK" engine warning light.

- OK → Check wiring between ECU terminal W and fuse.
- BAD → Repair or replace.

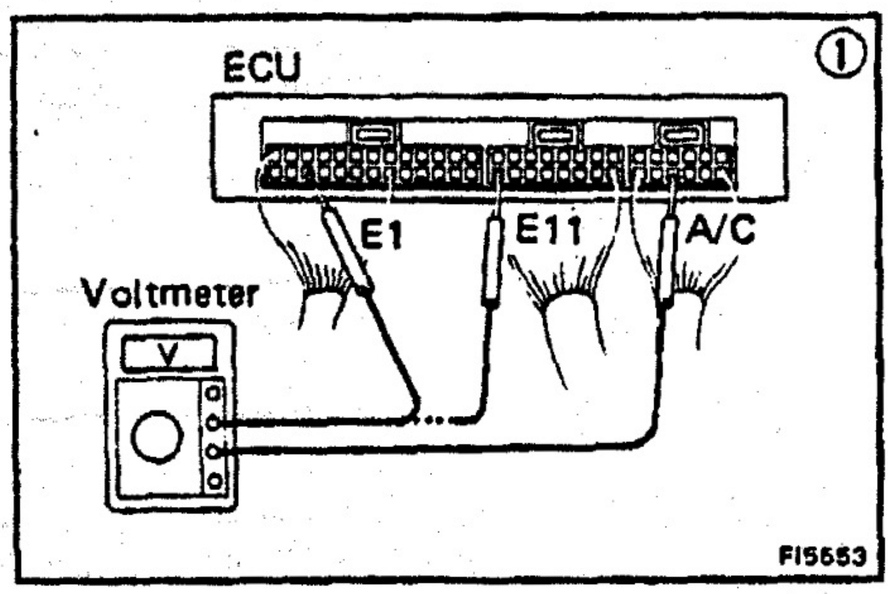
Fuse blows again → Check wiring between ECU terminal W and fuse.

BAD → Repair or replace.

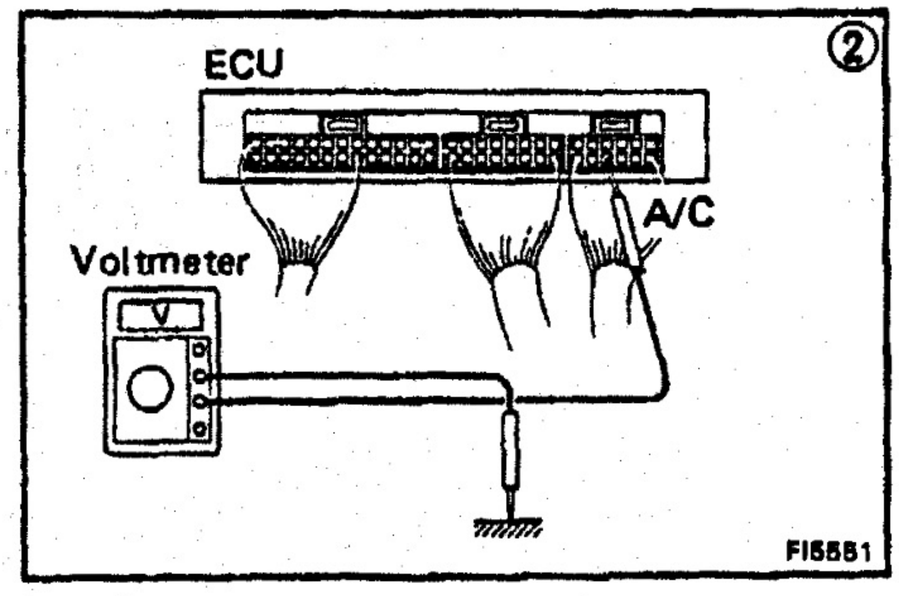
No.	Terminals	Trouble	Condition	STD Voltage
11	A/C–E1(E11)	No voltage	Air conditioning ON	10 – 14 V



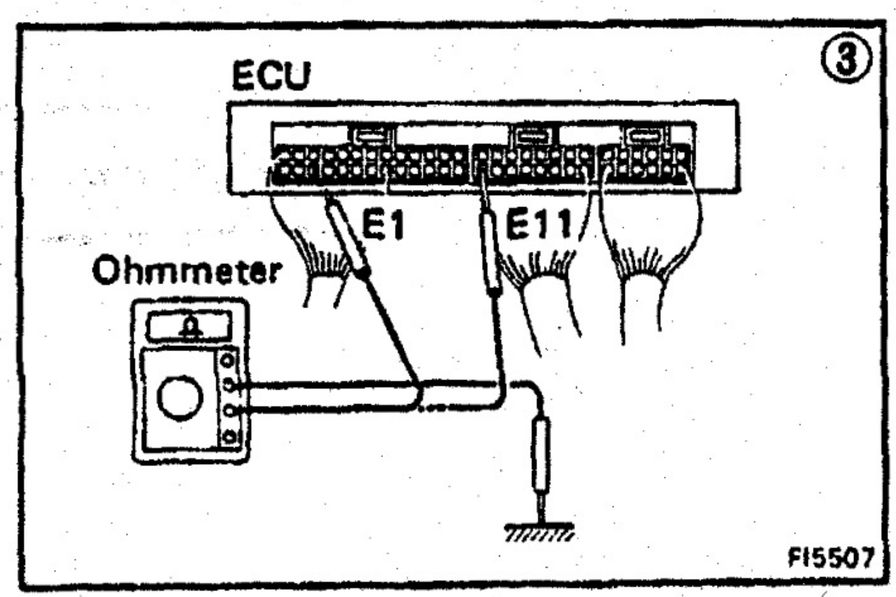
FI5490



FI5553



FI5551



FI5507

① There is no voltage between ECU terminals A/C and E1 (E11). (Air conditioning ON)

② Check that there is voltage between ECU terminal A/C and body ground.

NO

③ Check wiring between ECU terminal E1 (E11) and body ground.

OK

Try another ECU.

BAD

Repair or replace.

OK

Check compressor running.

OK

Check wiring between ECU terminal A/C and amplifier.

BAD

Repair or replace.

BAD

Check that there is voltage between amplifier terminal and body ground.

BAD

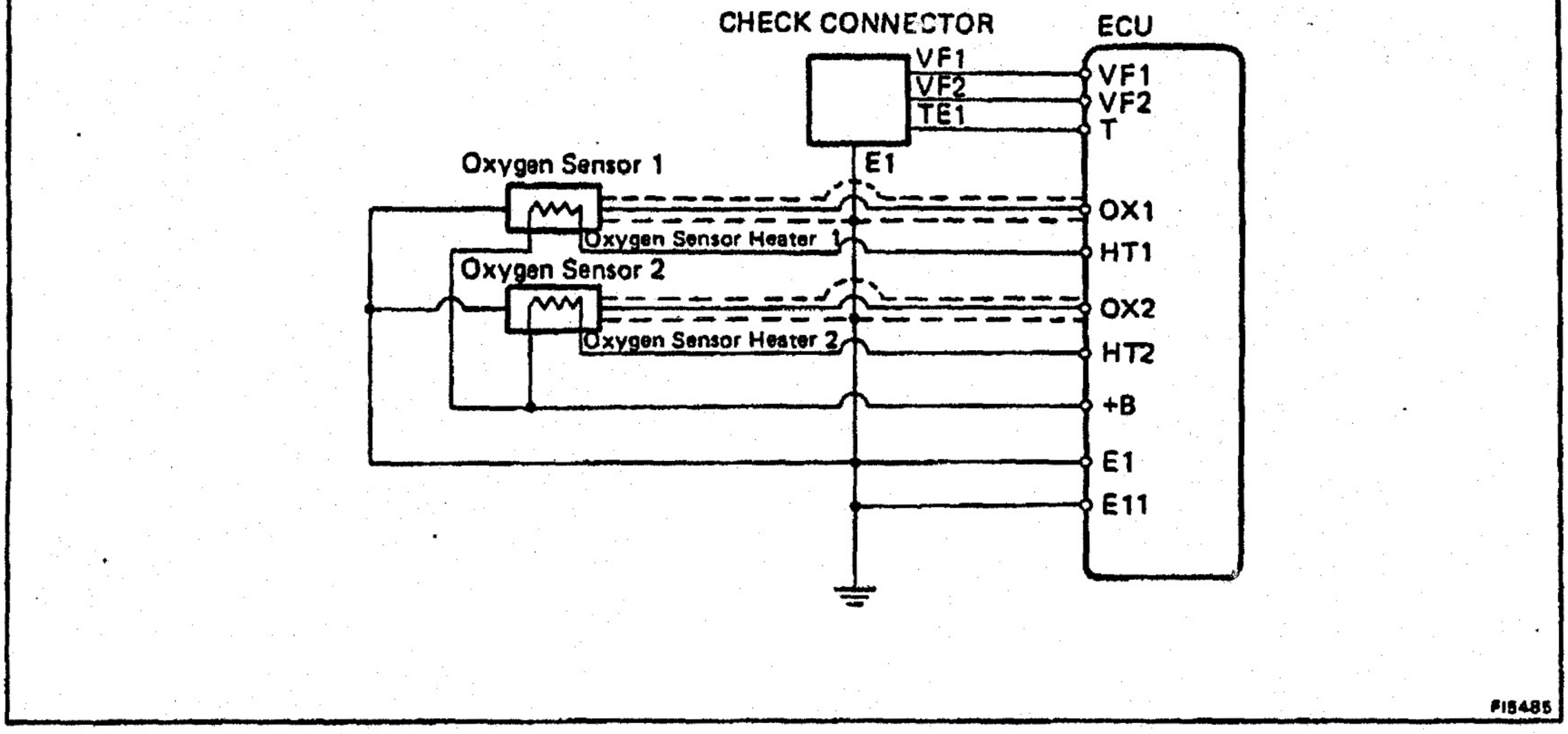
Repair or replace.

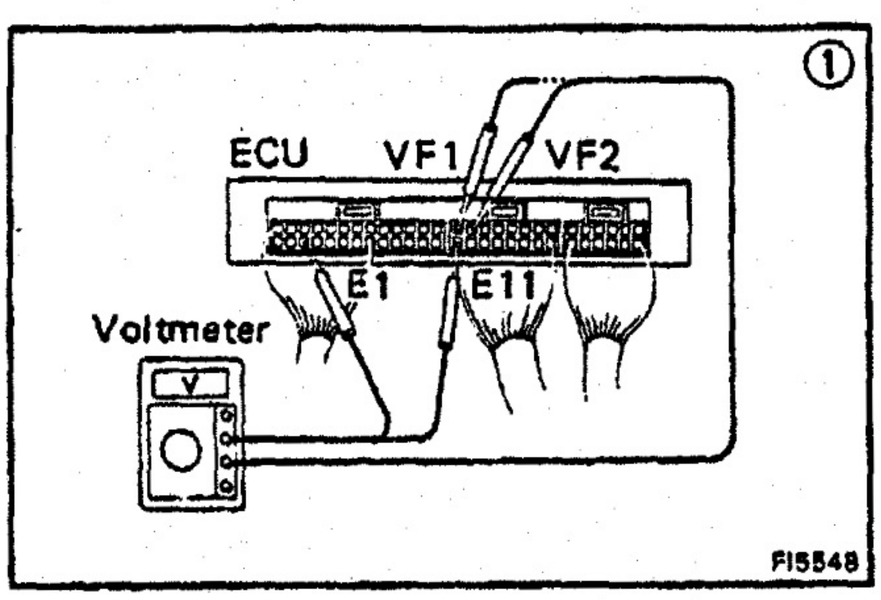
OK

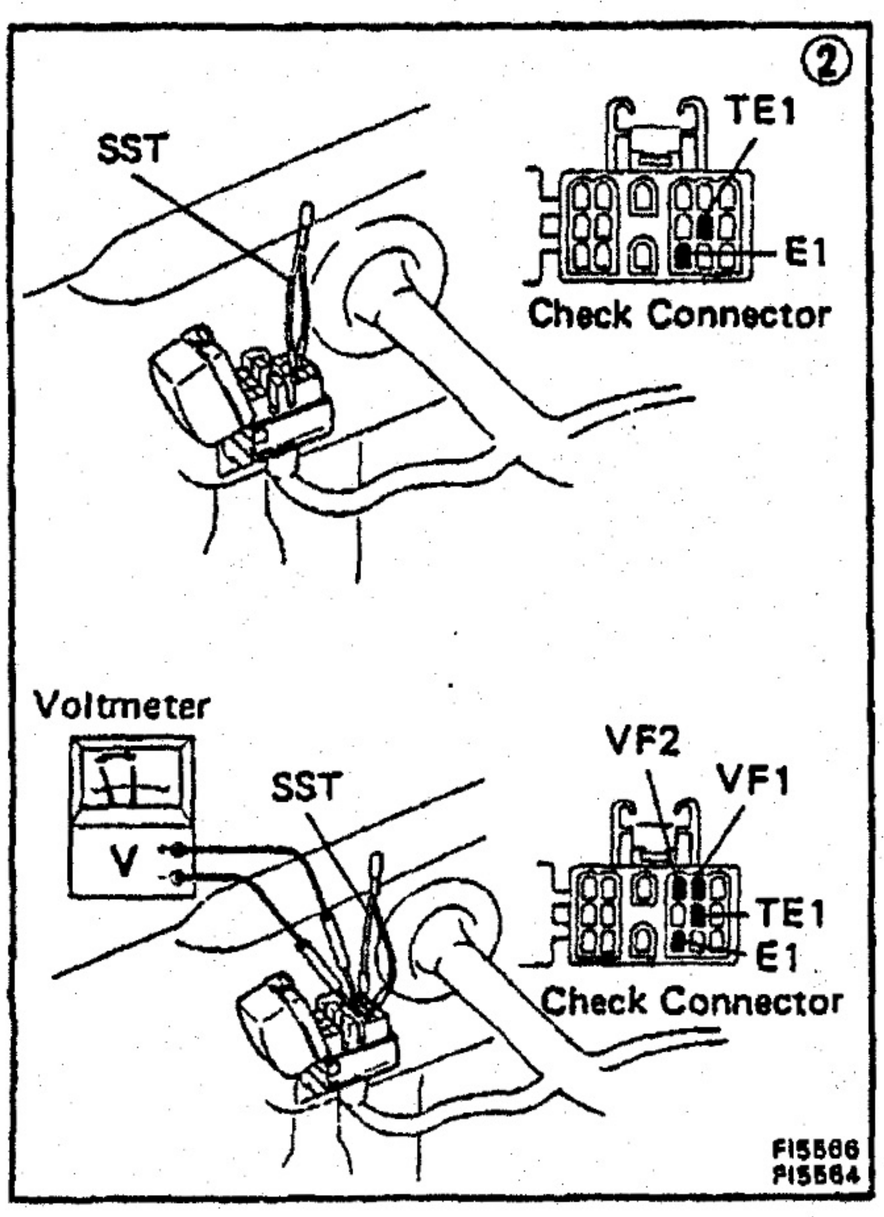
Check wiring between amplifier and ECU or compressor.

BAD

Repair or replace.







① There is no voltage between ECU terminals VF1 or VF2 and E1 (E11).

Check that there is specified voltage between ECU terminal VF1 or VF2 and body ground.

NO → OK

Check wiring between ECU terminal E1 (E11) and body ground.

OK → Try another ECU.

BAD → Repair or replace.

Check for air suction into exhaust system. BAD → Repair air suction.

OK

Check for air leak from air induction system. BAD → Repair air leak.

OK

Check spark plugs. BAD → Repair or replace.

OK

Check distributor and ignition system. BAD → Repair or replace.

OK

Check fuel pressure. BAD → Repair or replace.

OK

Check injectors. BAD → Repair or replace.

OK

Check cold start injector. * BAD → Repair or replace.

OK

Check air flow meter. BAD → Repair or replace.

OK

② Check operation of oxygen sensors. OK → System normal.

BAD

Check wiring between oxygen sensors and ECU connectors. BAD → Repair wiring.

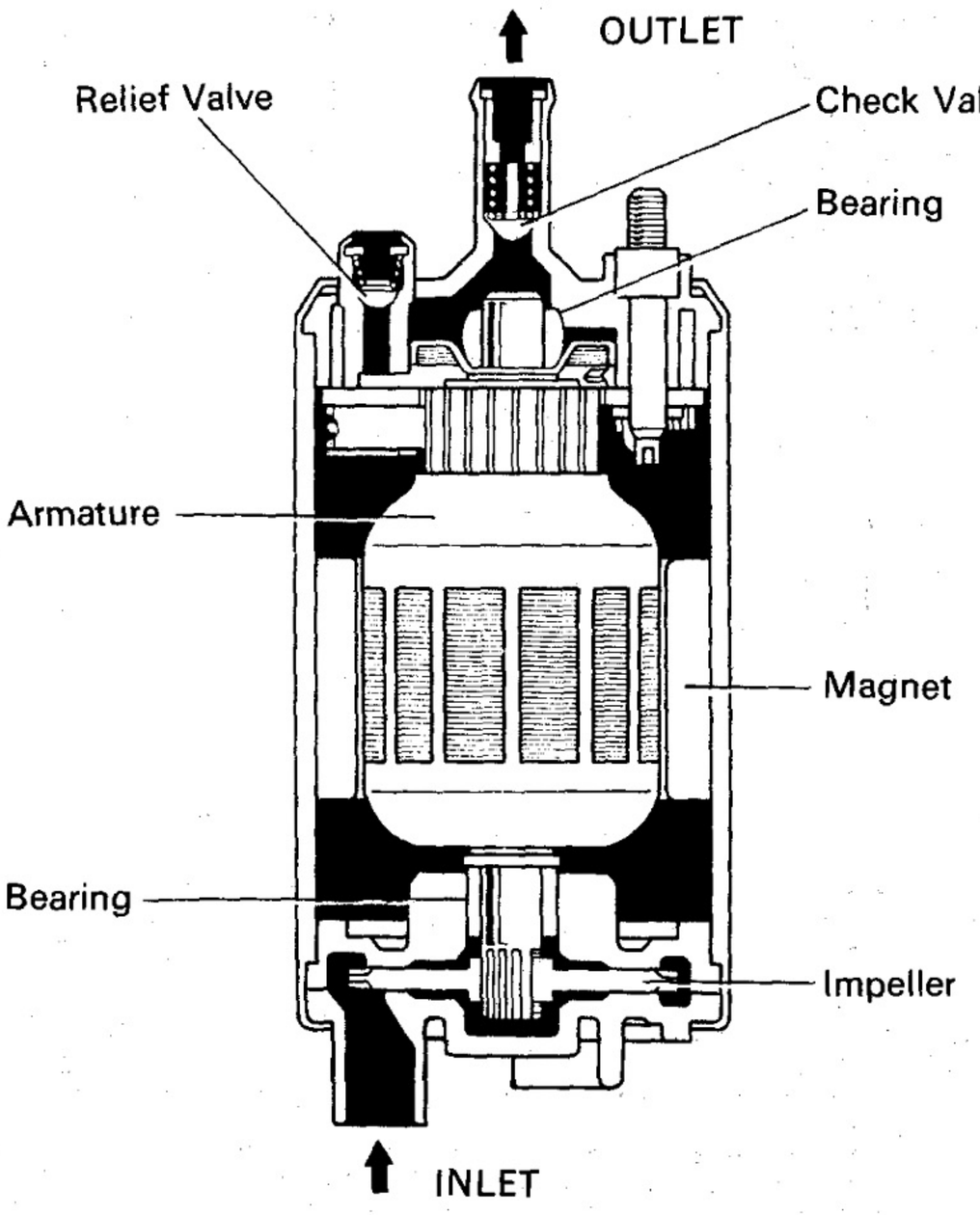
OK

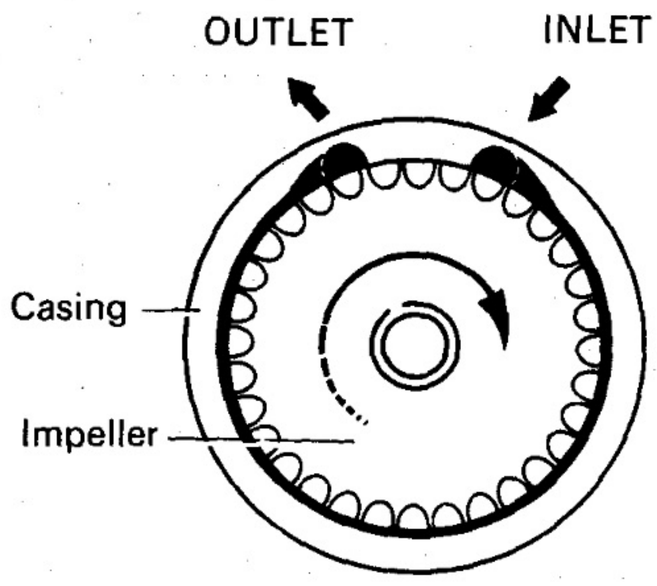
Replace oxygen sensors.

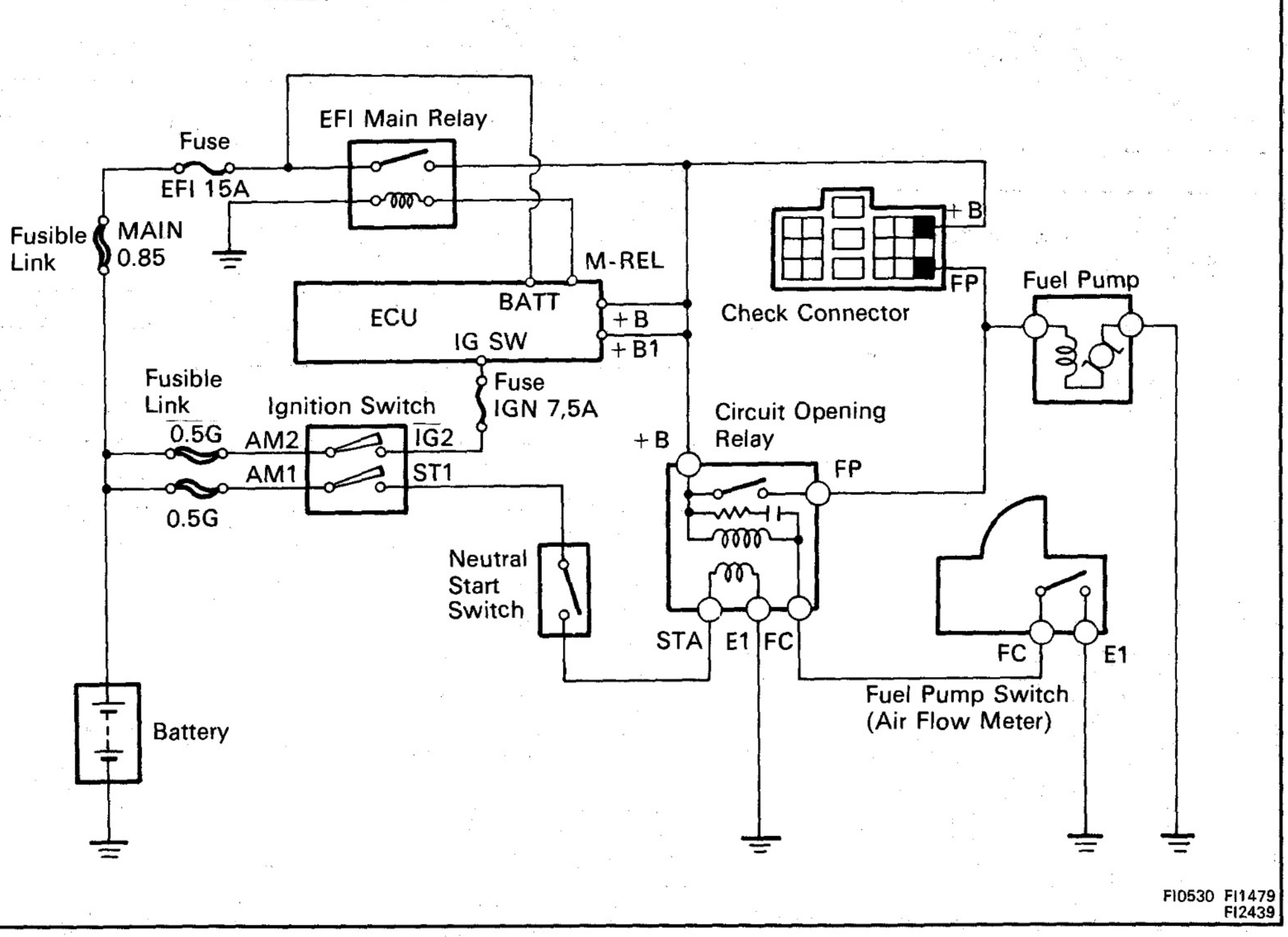
* Rich malfunction only

FUEL SYSTEM

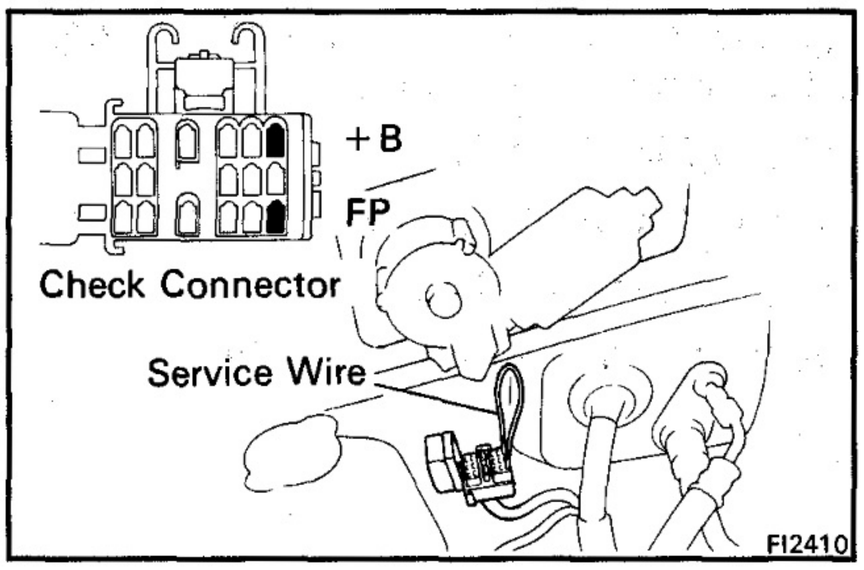
Fuel Pump







FI0530 FI1479 FI2439



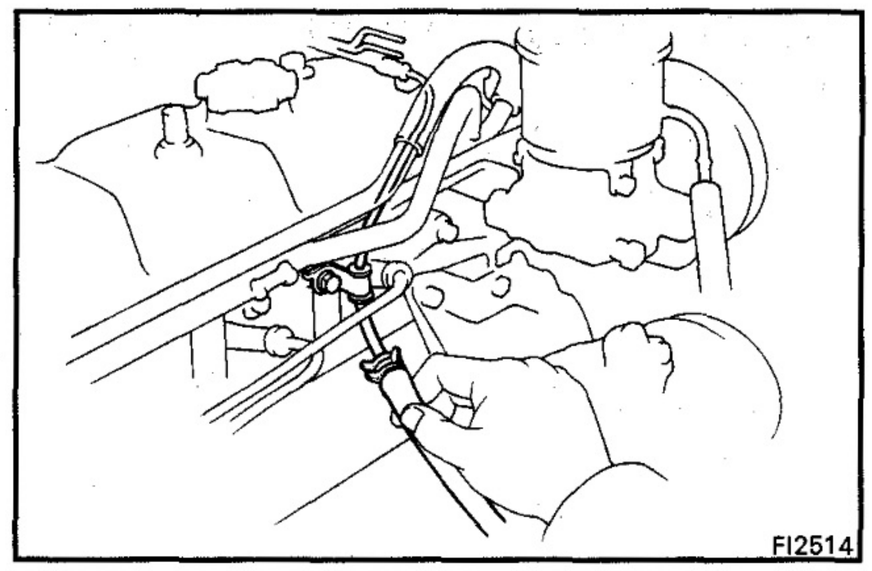
ON-VEHICLE INSPECTION

1. INSPECT FUEL PUMP OPERATION

(a) Turn the ignition switch ON.

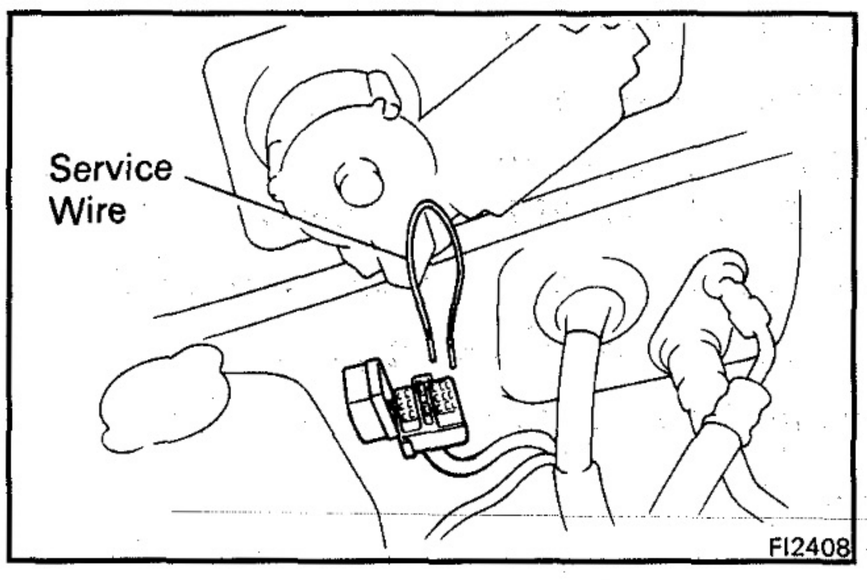
HINT: Do not start the engine.

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



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

NOTE: At this time, you will hear fuel return noise.



(d) Remove the service wire.

(e) Turn the ignition switch OFF.

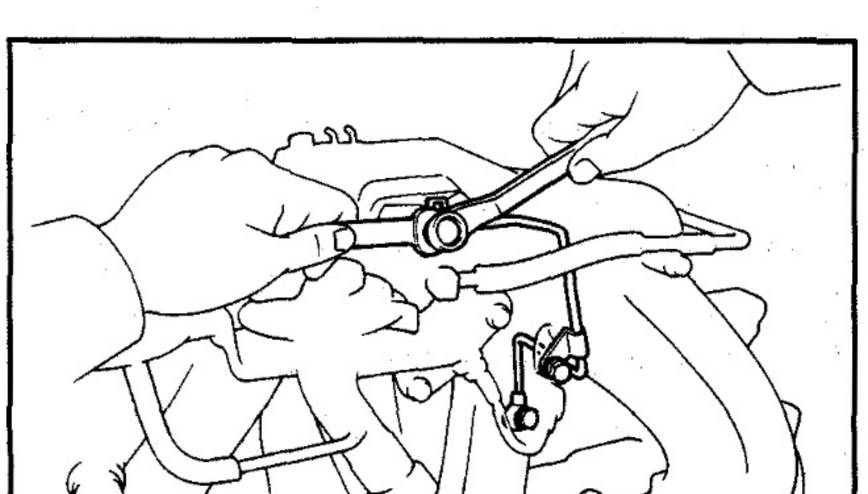
If there is no pressure, check the following parts:

- Fusible links
- Fuse (EFI 15A or IGN 7.5A)
- EFI main relay
- Fuel pump
- ECU
- Wiring connections

2. INSPECT FUEL PRESSURE

(a) Check the battery voltage above 11 volts.

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

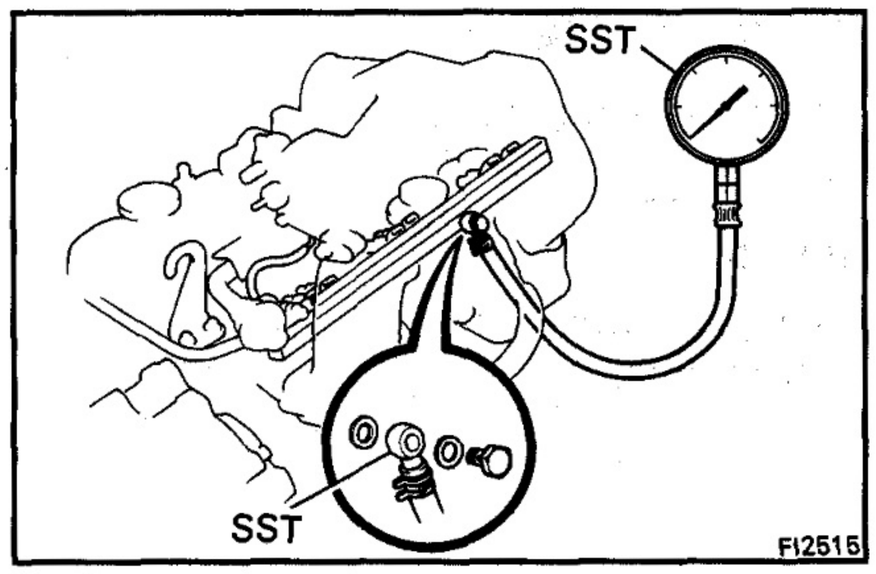


(c) Disconnect the cold start injector connector.

(d) Put a suitable container or shop towel under the cold start injector pipe.

(e) Remove the two union bolts, four gaskets, pipe clamp bolt and cold start injector pipe.

HINT: Slowly loosen the union bolt.



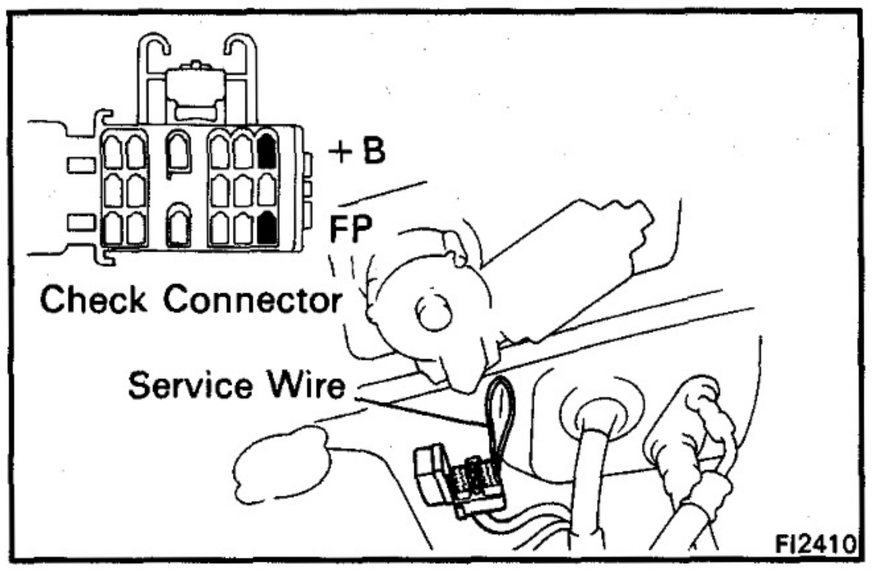
(f) Install SST (pressure gauge) to the delivery pipe with new two gaskets and union bolt.

SST 09268-45012 (09268-41080)

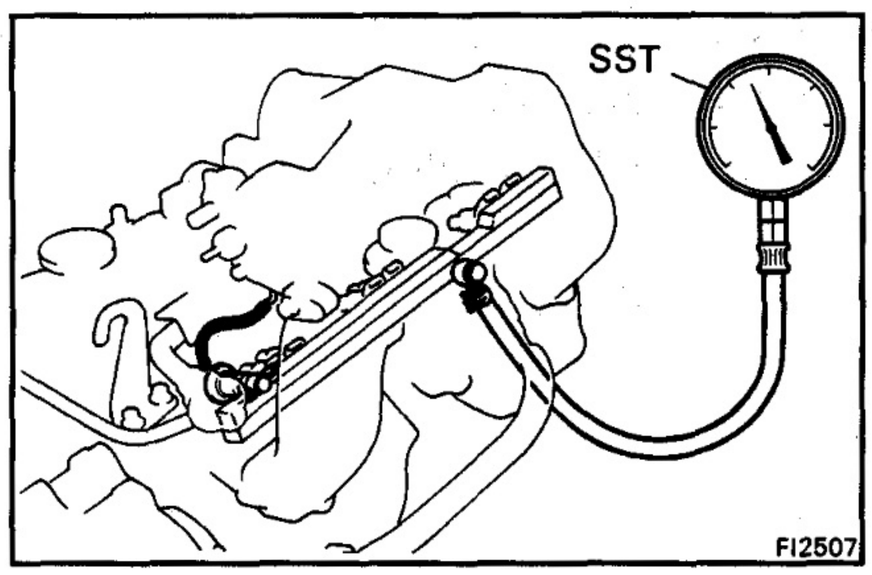
Torque: 180 kg-cm (13 ft-lb, 18 N·m)

(g) Wipe off any splattered gasoline.

(h) Reconnect the battery negative (–) cable.



(i) Using a service wire, connect terminals +B and FP of the check connector.



(j) Turn the ignition switch ON.

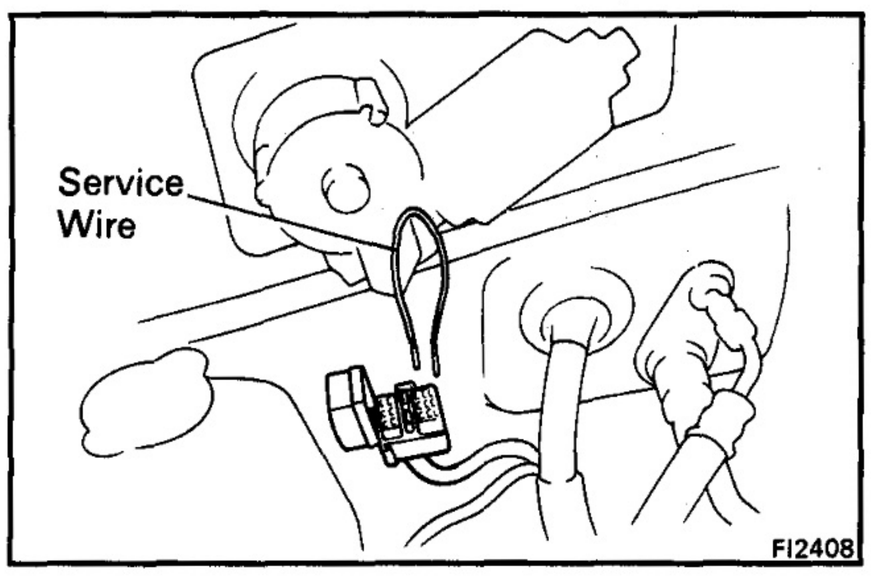
(k) Measure the fuel pressure.

Fuel pressure: 2.6 – 3.2 kg/cm² (37 – 46 psi, 255 – 314 kPa)

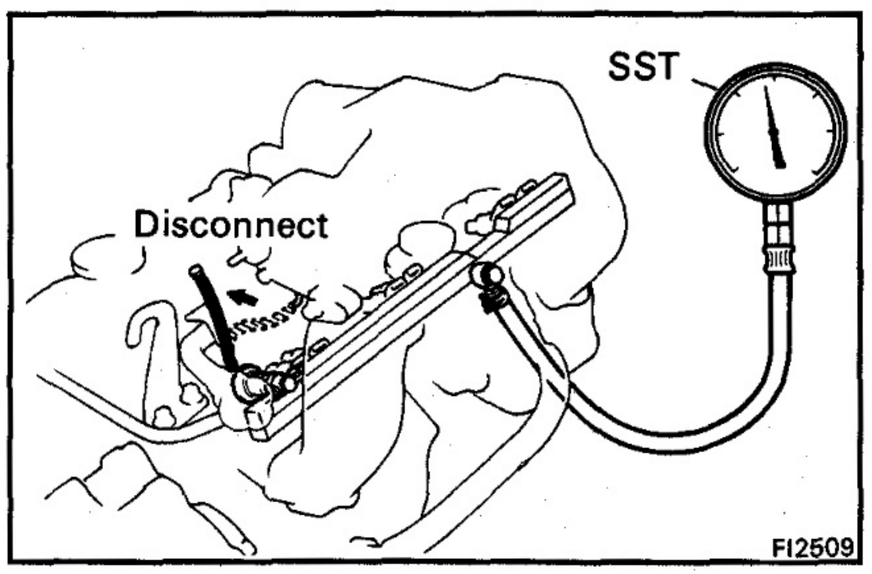
If pressure is high, replace the fuel pressure regulator.

If pressure is low, check the following parts:

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



(l) Remove the service wire.

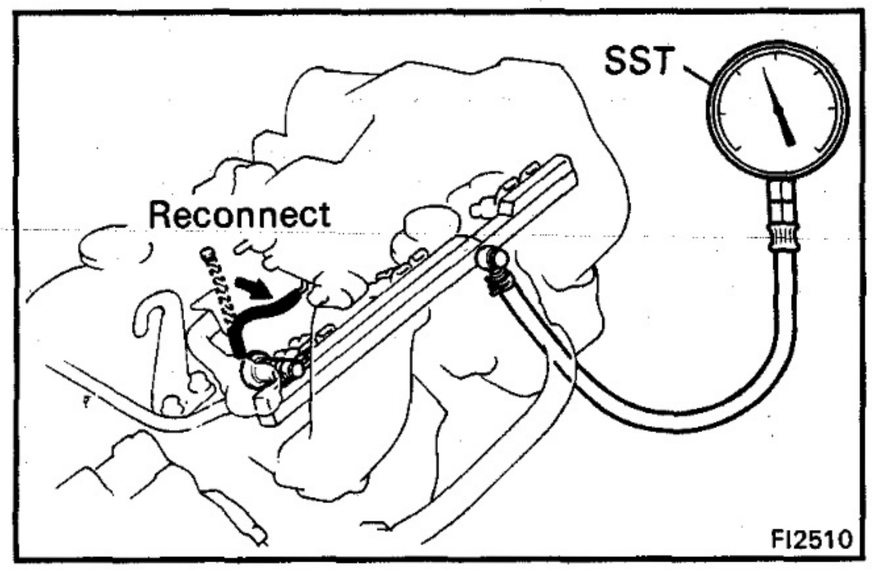


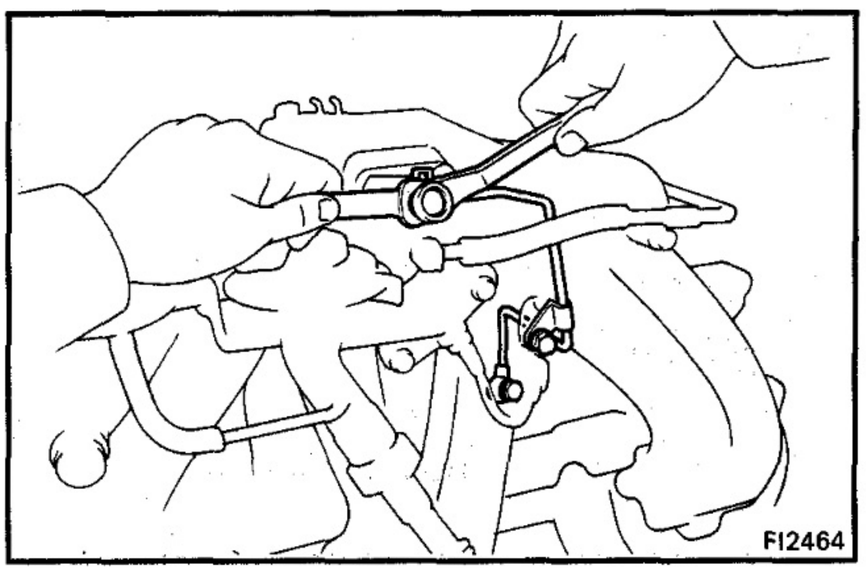
(m) Start the engine.

(n) Disconnect the vacuum sensing hose from the fuel pressure regulator.

(o) Measure the fuel pressure at idling.

Fuel pressure: 2.6 – 3.2 kg/cm² (37 – 46 psi, 255 – 314 kPa)





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

(q) Measure the fuel pressure at idling.

Fuel pressure: 2.3 – 2.6 kg/cm² (33 – 37 psi, 226 – 265 kPa)

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

(r) 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.

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

SST 09268-45012 (09268-41080)

(t) Install the cold start injector pipe with new four gaskets, the union bolts and pipe clamp bolt.

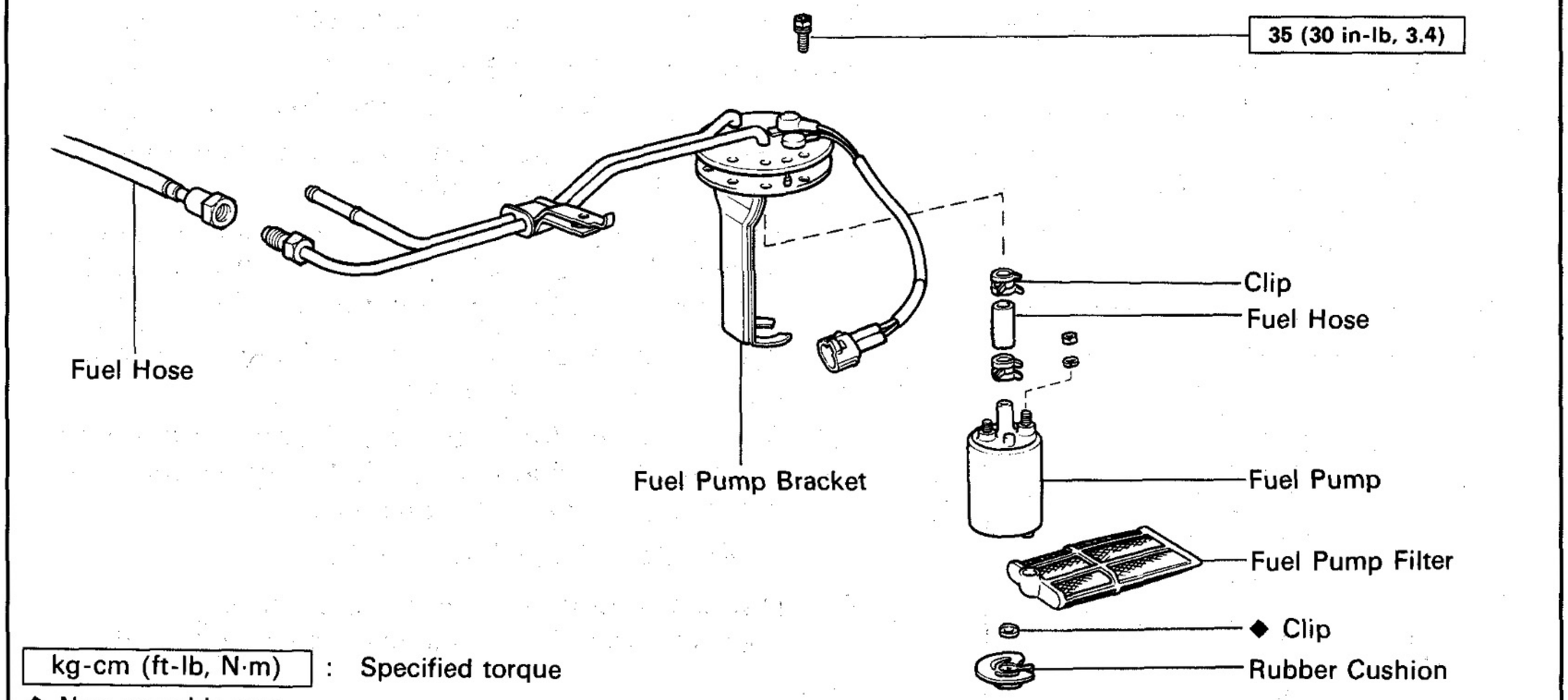
Torque:
Union bolt 180 kg-cm (13 ft-lb, 18 N·m)
Clamp bolt 120 kg-cm (9 ft-lb, 12 N·m)

(u) Reconnect the cold start injector connector.

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

(w) Check for fuel leakage.

REMOVAL OF FUEL PUMP

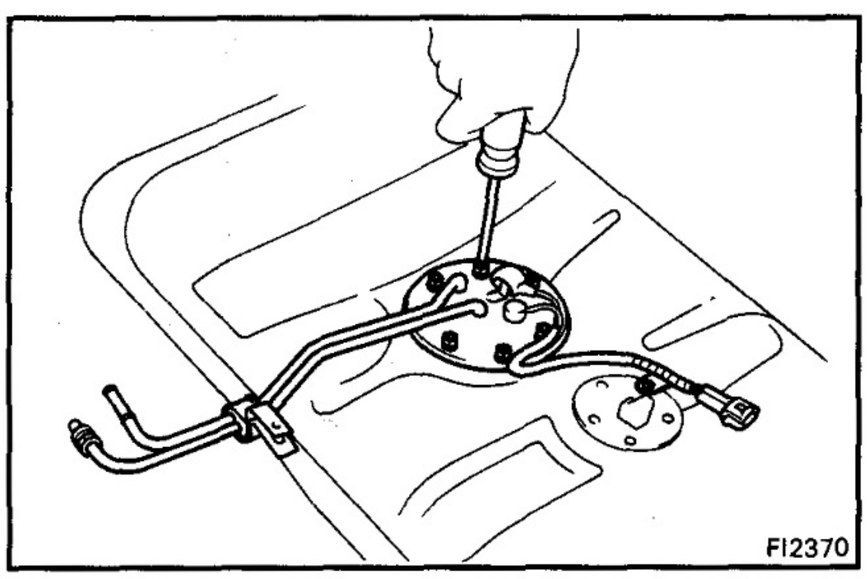


1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**

2. **DRAIN FUEL FROM FUEL TANK**

   CAUTION: Do not smoke or work near an open flame when working on the fuel pump.

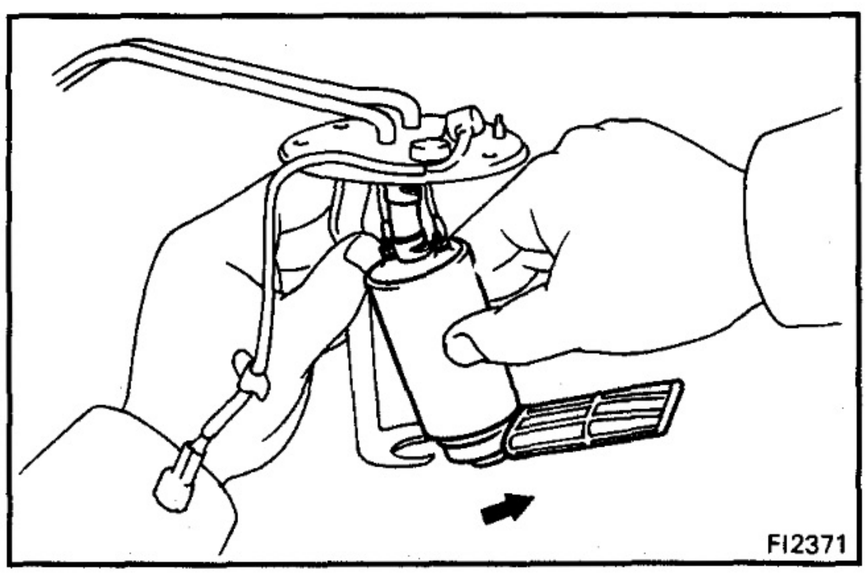
3. **REMOVE FUEL TANK**



4. **REMOVE FUEL PUMP BRACKET FROM FUEL TANK**

   (a) Remove the screw of the wire clamp.

   (b) Remove the screws, pull out the pump bracket.

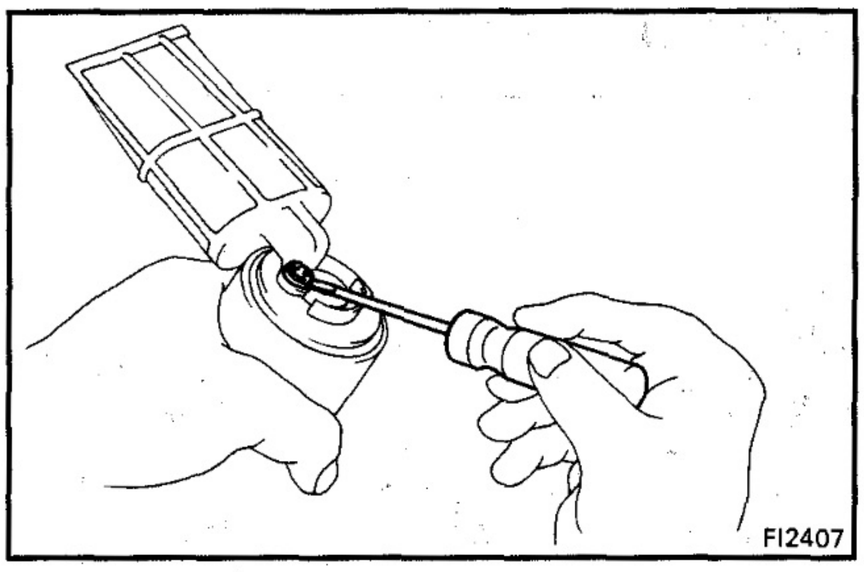


5. **REMOVE FUEL PUMP FROM FUEL PUMP BRACKET**

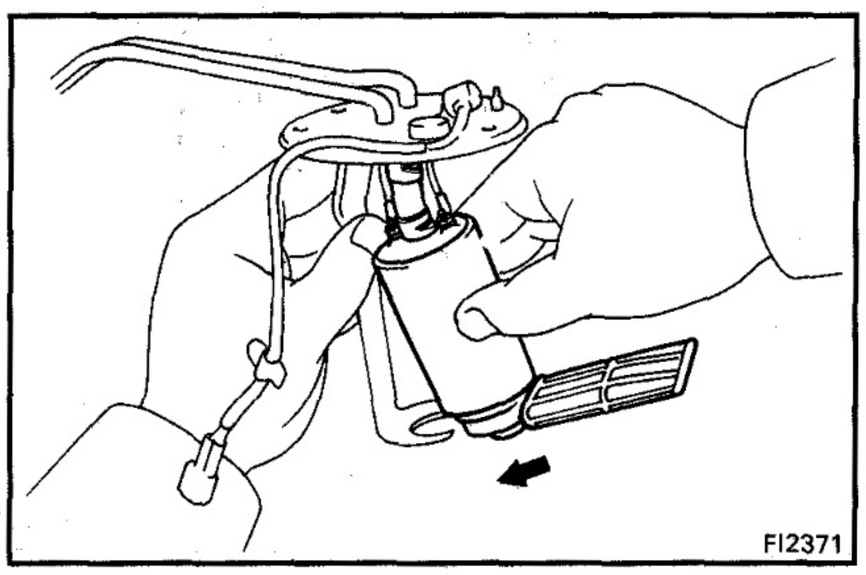
   (a) Pull off the lower side of the fuel pump from the bracket.

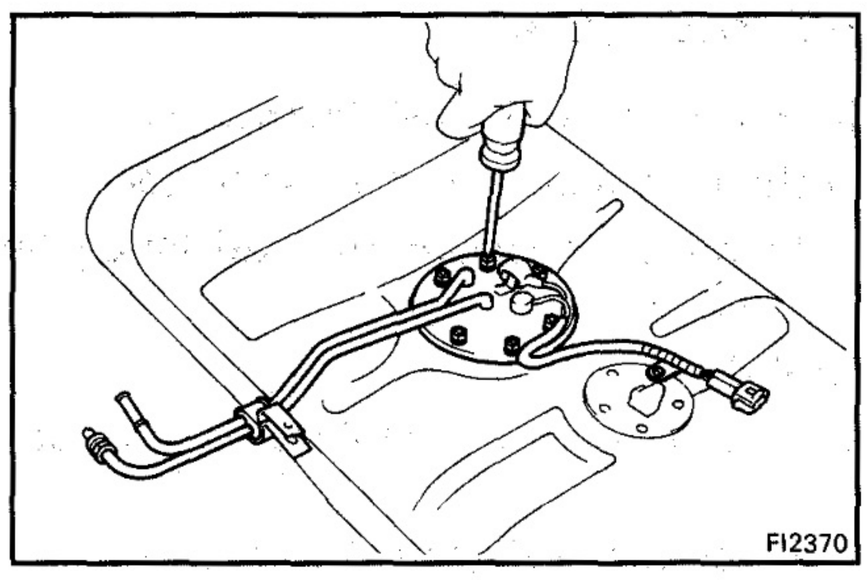
   (b) Remove the two nuts, and disconnect the wires from the fuel pump.

   (c) Remove the fuel pump from the fuel hose.



6. **REMOVE FUEL PUMP FILTER FROM FUEL PUMP**
   (a) Remove the rubber cushion.
   (b) Using a small screwdriver, remove the clip.
   (c) Pull out the pump filter.





INSTALLATION OF FUEL PUMP

(See page FI-48)

1. **INSTALL FUEL PUMP FILTER TO FUEL PUMP**
   (a) Install the pump filter with a new clip.
   (b) Install the rubber cushion.

2. **INSTALL FUEL PUMP TO FUEL PUMP BRACKET**
   (a) Connect the fuel hose to the outlet port of the fuel pump.
   (b) Connect the wires to the fuel pump with the two nuts.
   (c) Push the lower side of the fuel pump, and install the fuel pump.

3. **INSTALL FUEL PUMP BRACKET TO FUEL TANK**
   (a) Install a new gasket and the pump bracket with the screws.

   Torque: 35 kg-cm (30 in.-lb, 3.4 N·m)

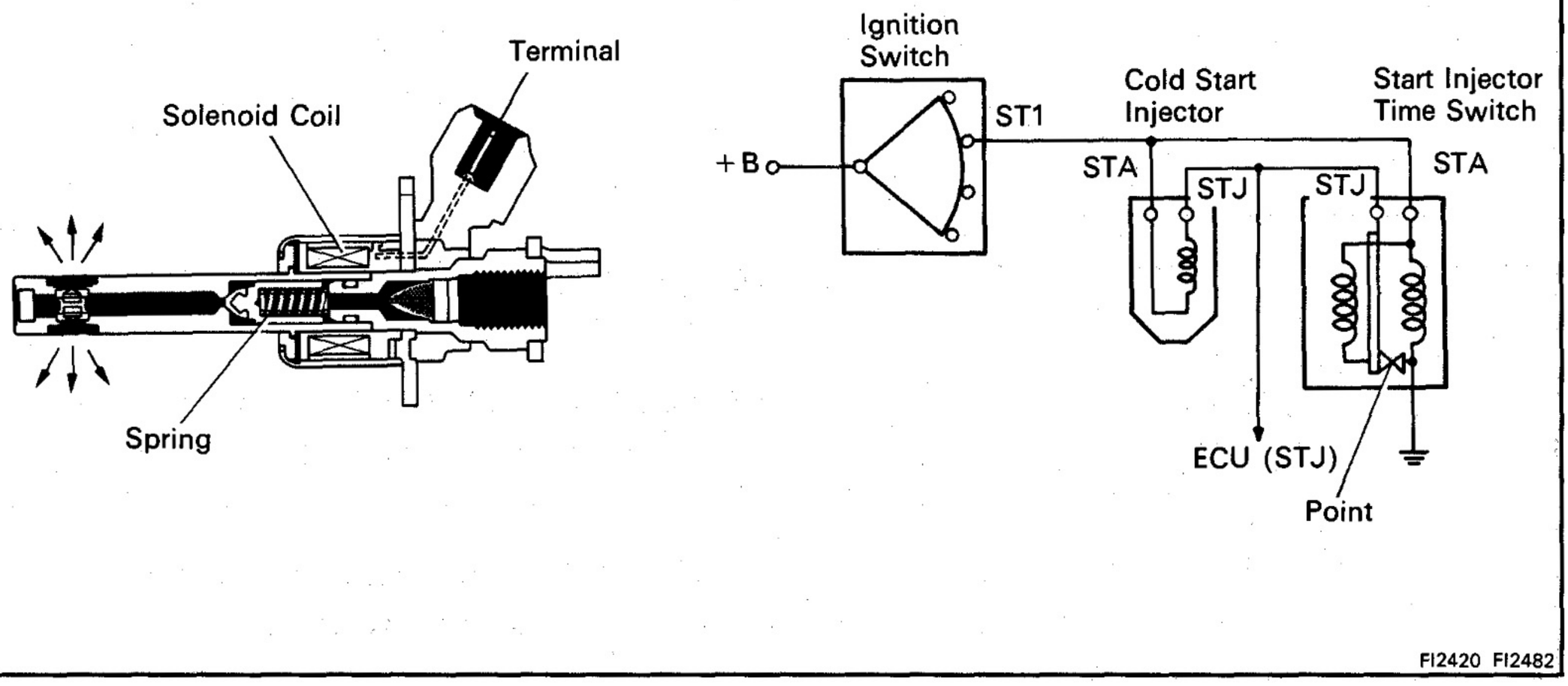
   (b) Connect the wire clamp with the screw.

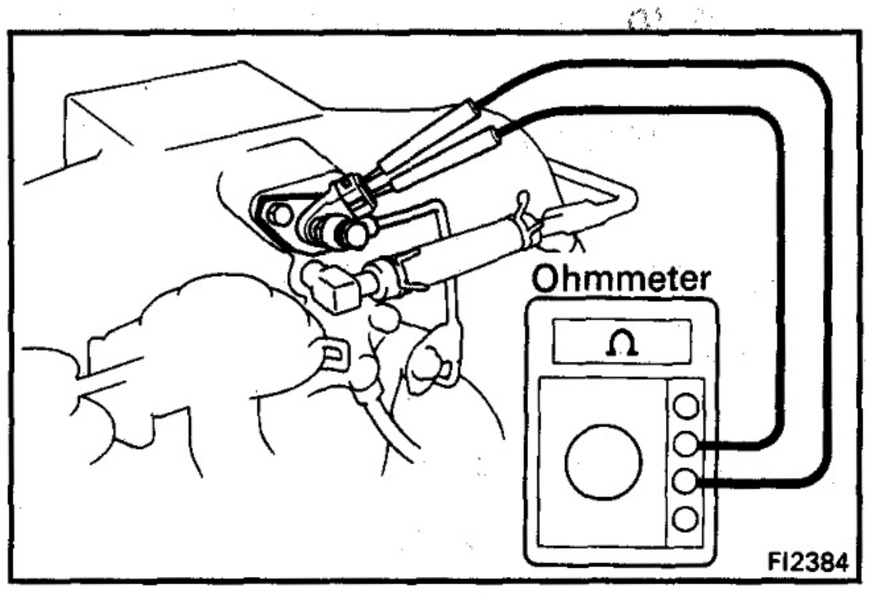
   Torque: 20 kg-cm (17 in.-lb, 2.0 N·m)

4. **INSTALL FUEL TANK**

5. **CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**

Cold Start Injector





ON-VEHICLE INSPECTION

INSPECT RESISTANCE OF COLD START INJECTOR

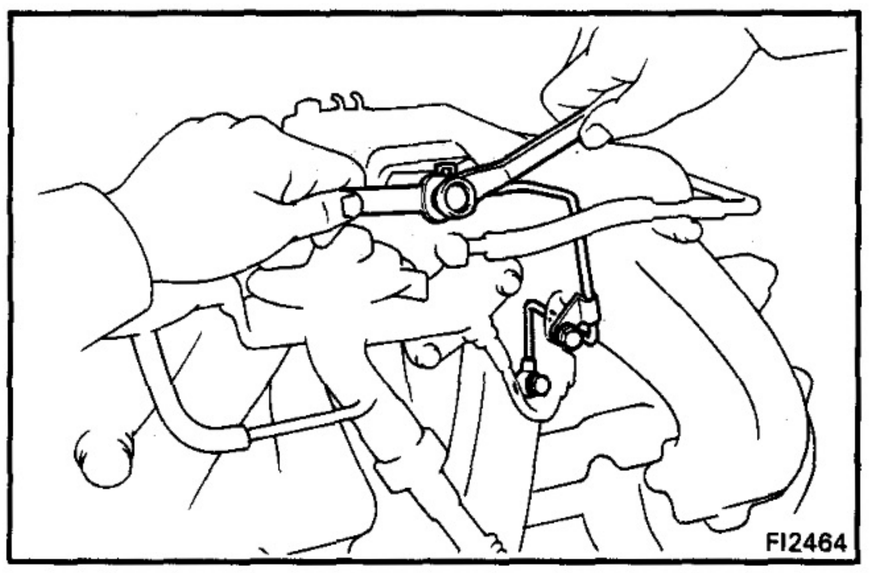
(a) Disconnect the cold start injector connector.

(b) Using an ohmmeter, measure the resistance between the terminals.

Resistance: 2 – 4 Ω

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

(c) Reconnect the cold start injector connector.



REMOVAL OF COLD START INJECTOR

1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**

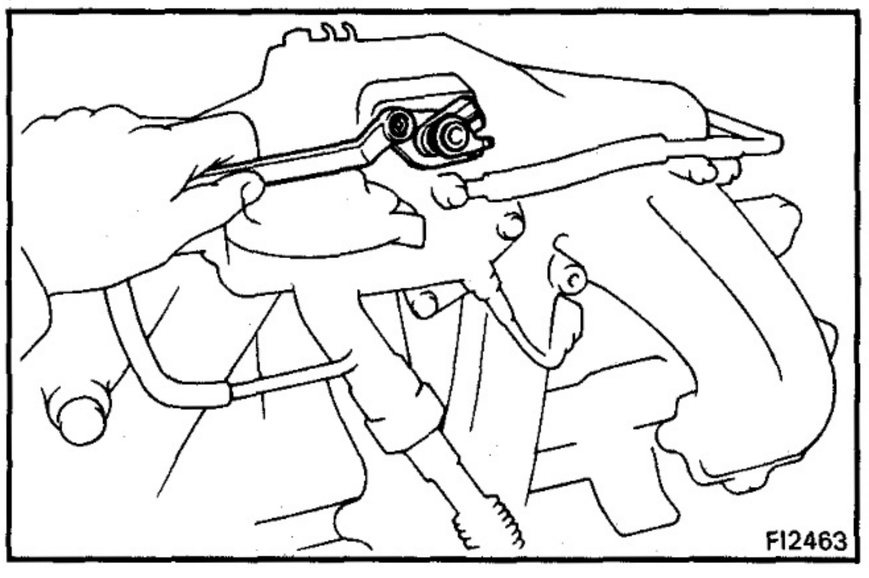
2. **DISCONNECT COLD START INJECTOR CONNECTOR**

3. **REMOVE COLD START INJECTOR PIPE**

(a) Put a suitable container or shop towel under the injector pipe.

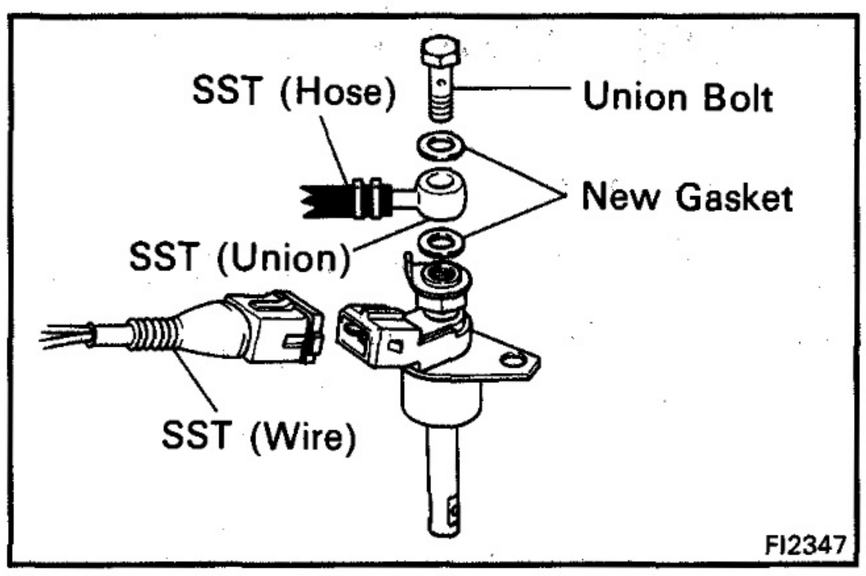
(b) Remove the two union bolts, four gaskets, pipe clamp bolt and injector pipe.

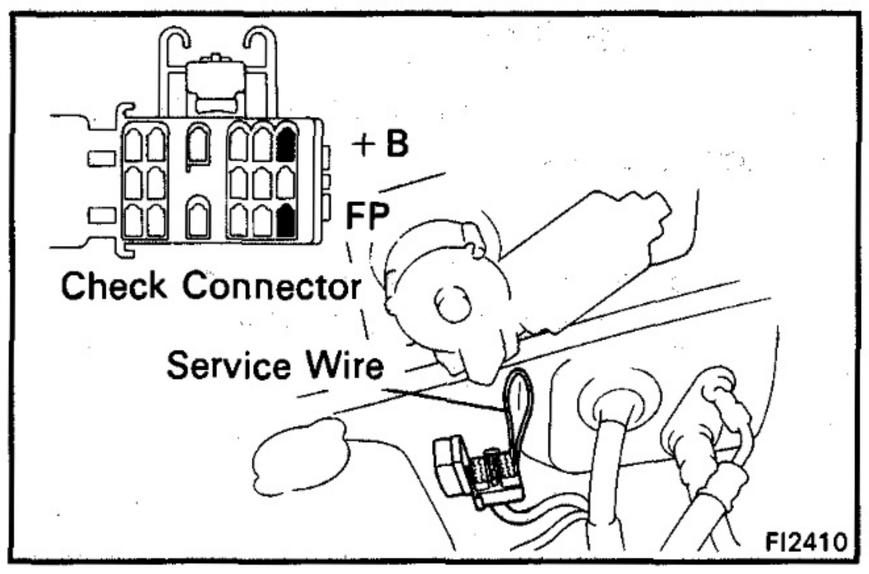
HINT: Slowly loosen the union bolts.

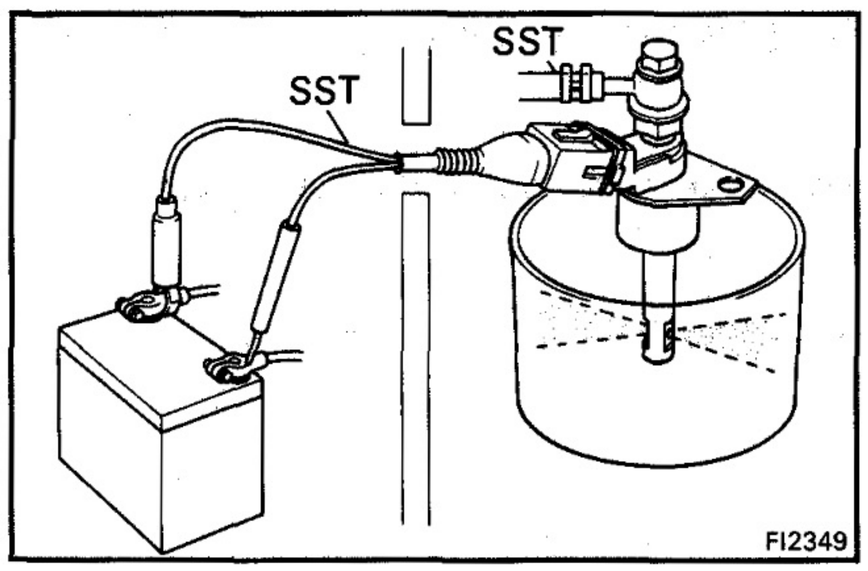


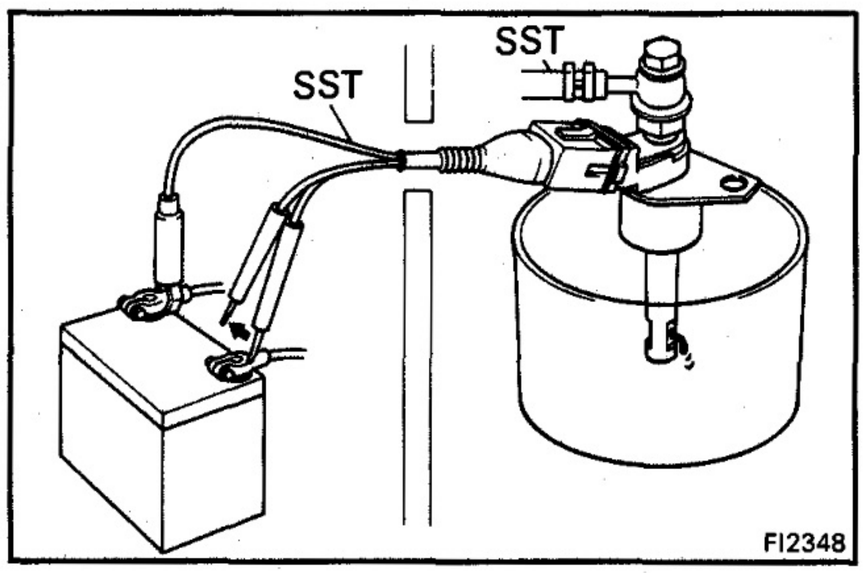
4. **REMOVE COLD START INJECTOR**

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 unions.

SST 09268-41045

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

SST 09842-30050

(d) Put a container under the injector.

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

(f) Turn the ignition switch ON.

HINT: Do not start the engine.

(g) Using a service wire, connect terminals +B and FP of the check connector.

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

SST 09842-30050

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.

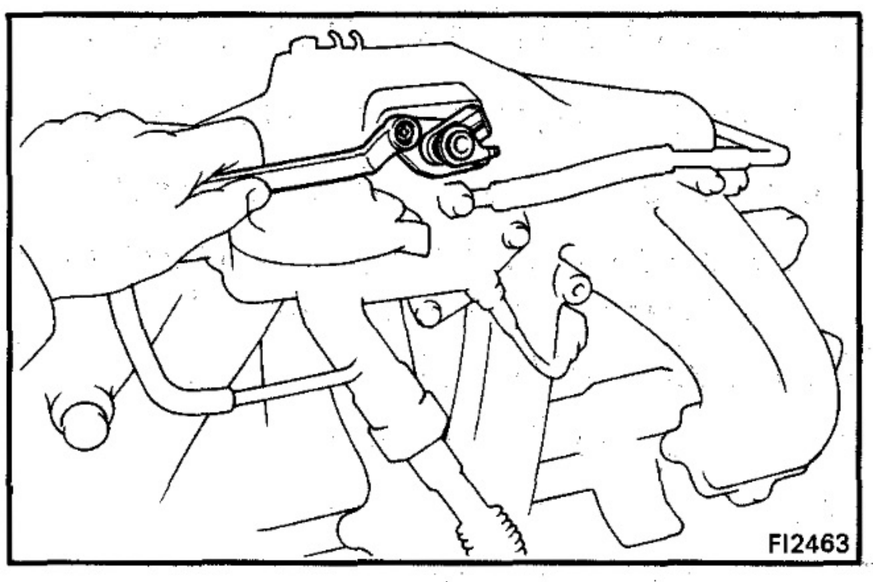
SST 09268-30050

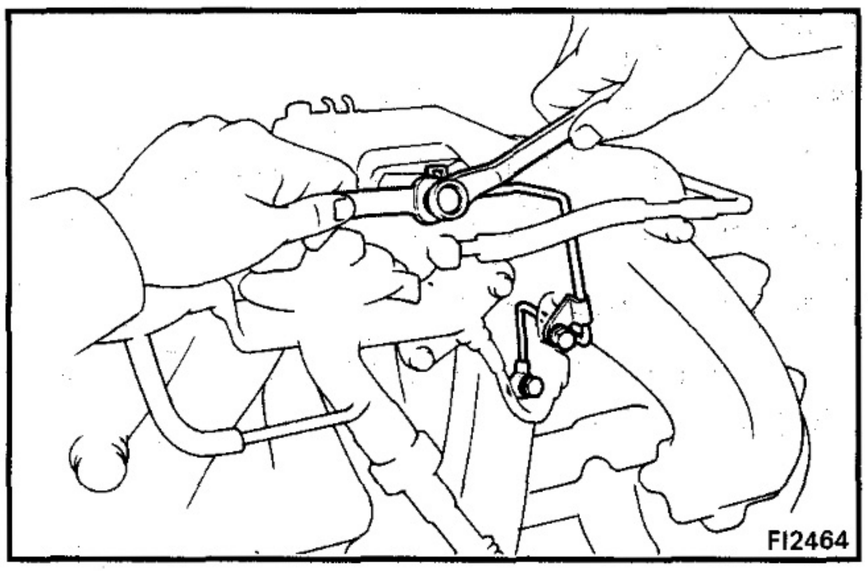
Fuel drop: One drop or less per minute

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

(c) Remove SST and the service wire.

SST 09268-41045 (09268-41080) and 09842-30050





INSTALLATION OF COLD START INJECTOR

1. INSTALL COLD START INJECTOR

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

Torque: 50 kg-cm (43 in.-lb, 4.9 N·m)

2. INSTALL COLD START INJECTOR PIPE

Install the cold injector pipe with new four gaskets, the two union bolts and pipe clamp bolt.

Torque:

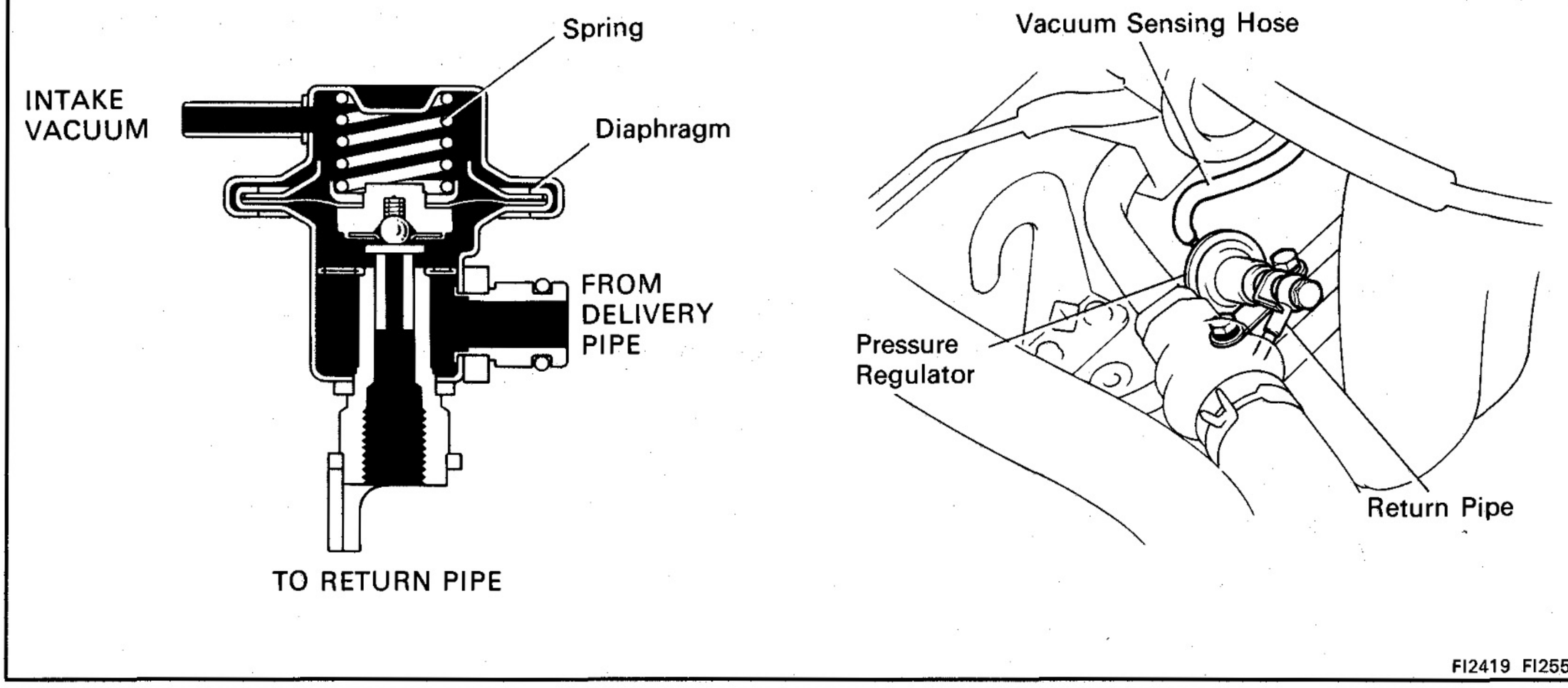
Union bolt	**180 kg-cm (13 ft-lb, 18 N·m)**
Clamp bolt	**120 kg-cm (9 ft-lb, 12 N·m)**

3. CONNECT COLD START INJECTOR CONNECTOR

4. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

5. CHECK FOR FUEL LEAKAGE (See page FI-8)

Fuel Pressure Regulator

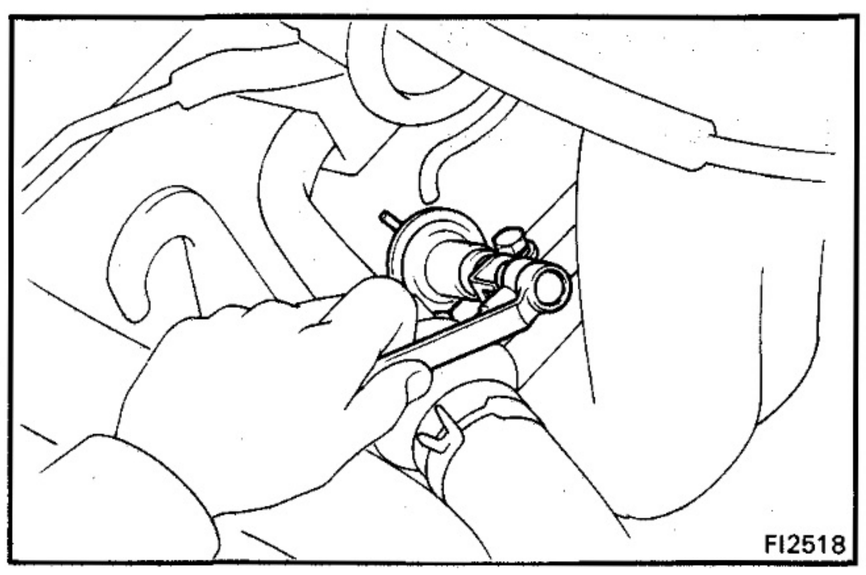


ON-VEHICLE INSPECTION

INSPECT FUEL PRESSURE (See page FI-45)

REMOVAL OF FUEL PRESSURE REGULATOR

1. DISCONNECT VACUUM SENSING HOSE

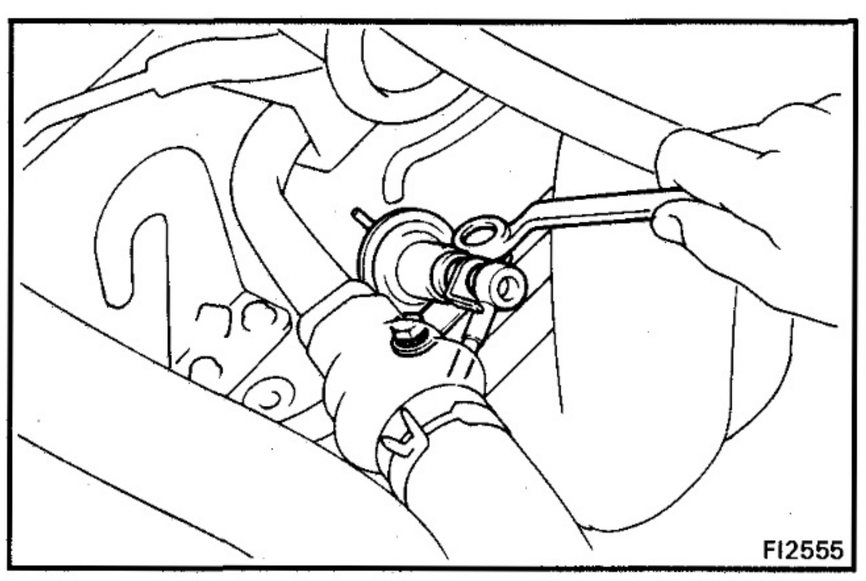


2. DISCONNECT FUEL RETURN PIPE

(a) Put a suitable container or shop towel under the pressure regulator.

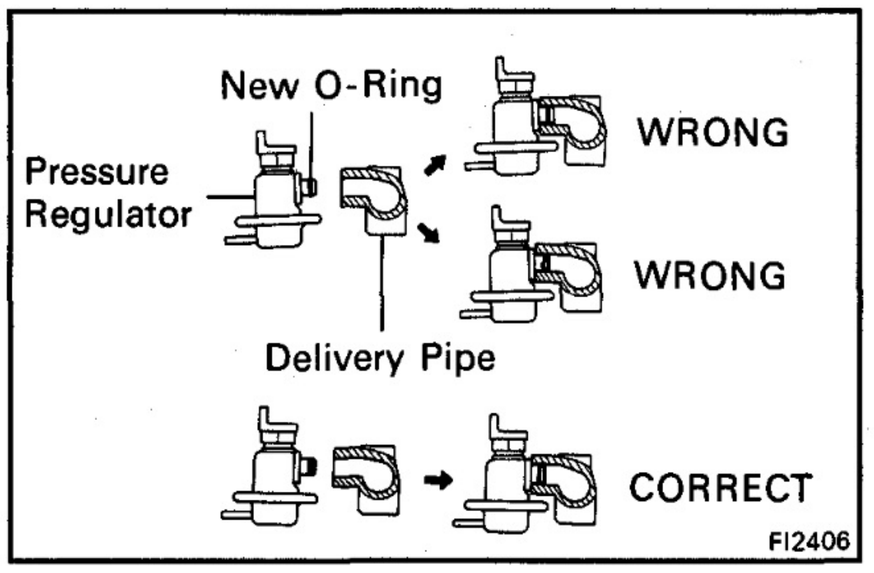
(b) Remove the union bolt and two gaskets, and disconnect the return pipe.

HINT: Slowly loosen the union bolt.



3. REMOVE FUEL PRESSURE REGULATOR

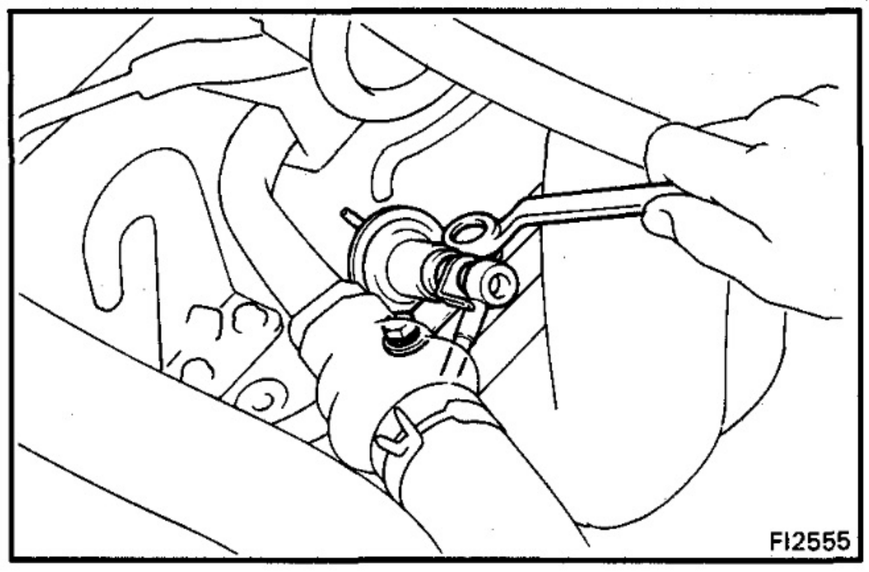
Remove the two bolts, and pull out the pressure regulator.



INSTALLATION OF FUEL PRESSURE REGULATOR

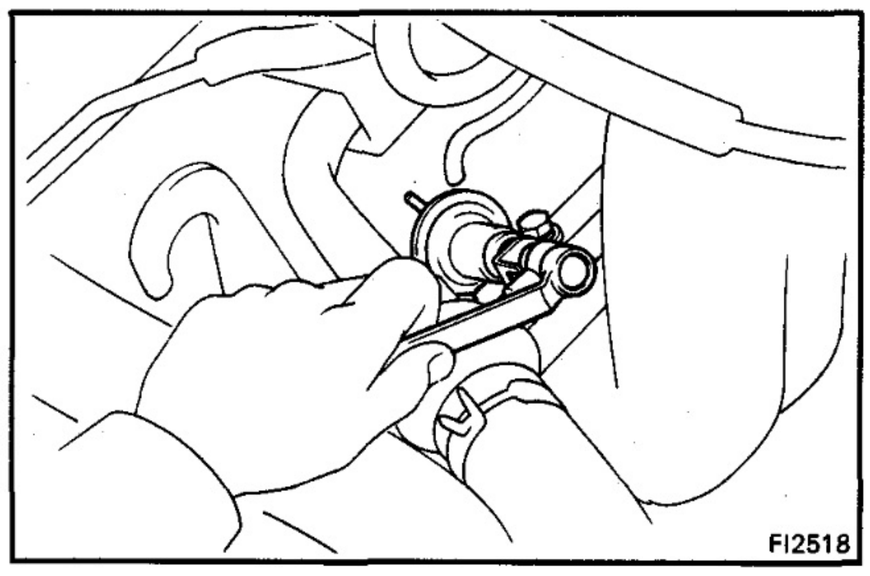
1. INSTALL FUEL PRESSURE REGULATOR

(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: 50 kg-cm (43 in.-lb, 4.9 N·m)



2. CONNECT FUEL RETURN PIPE

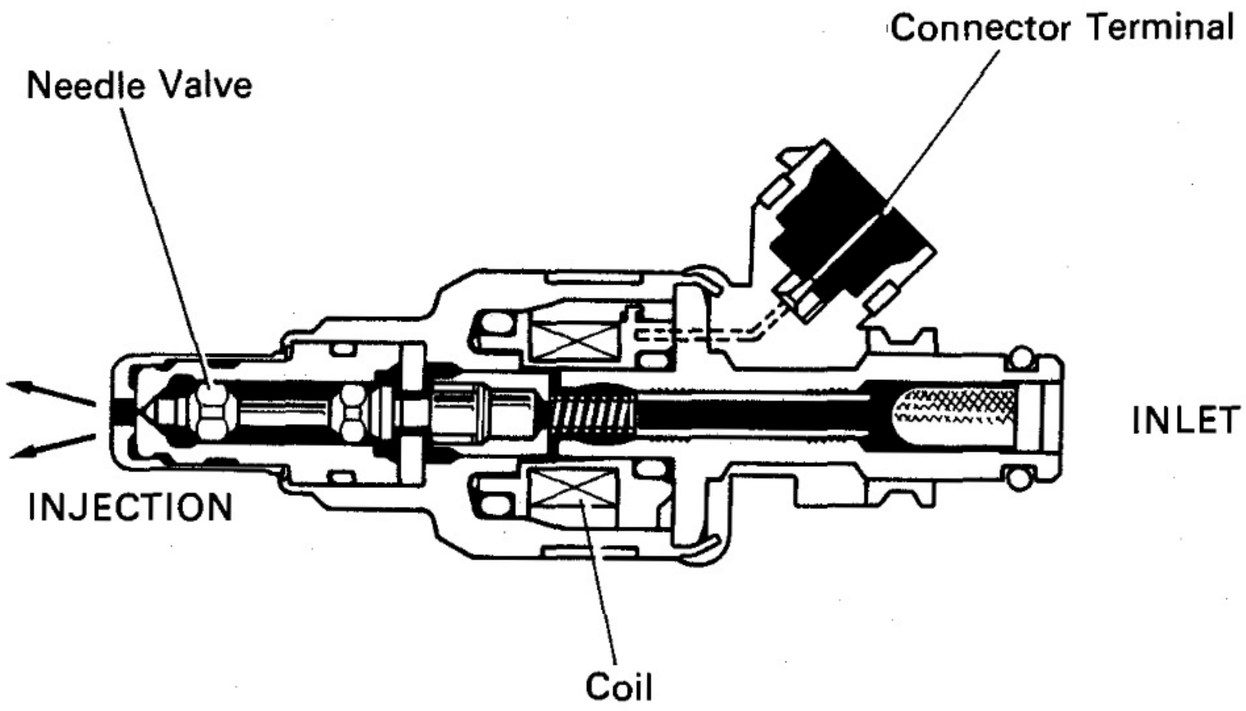
Install the return pipe with new two gaskets and the union bolt.

Torque: 180 kg-cm (13 ft-lb, 18 N·m)

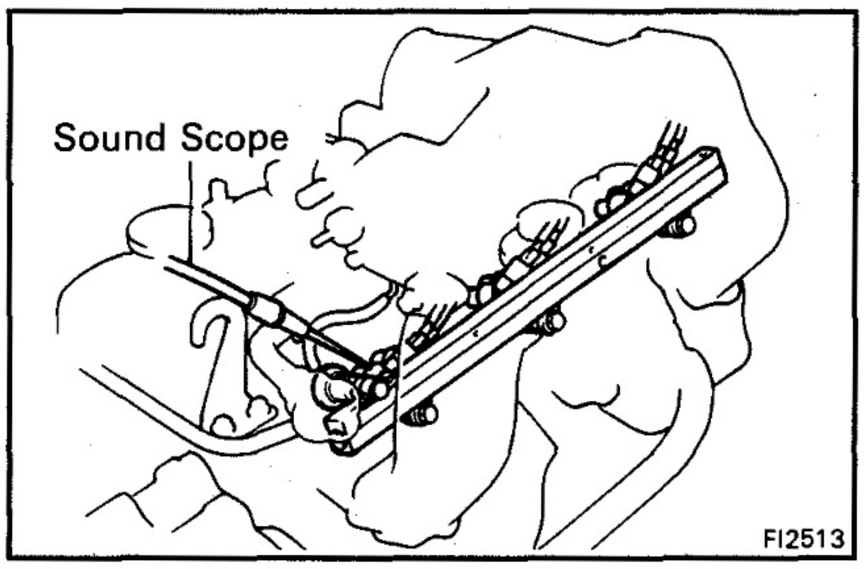
3. CONNECT VACUUM SENSING HOSE

4. CHECK FOR FUEL LEAKAGE (See page FI-8)

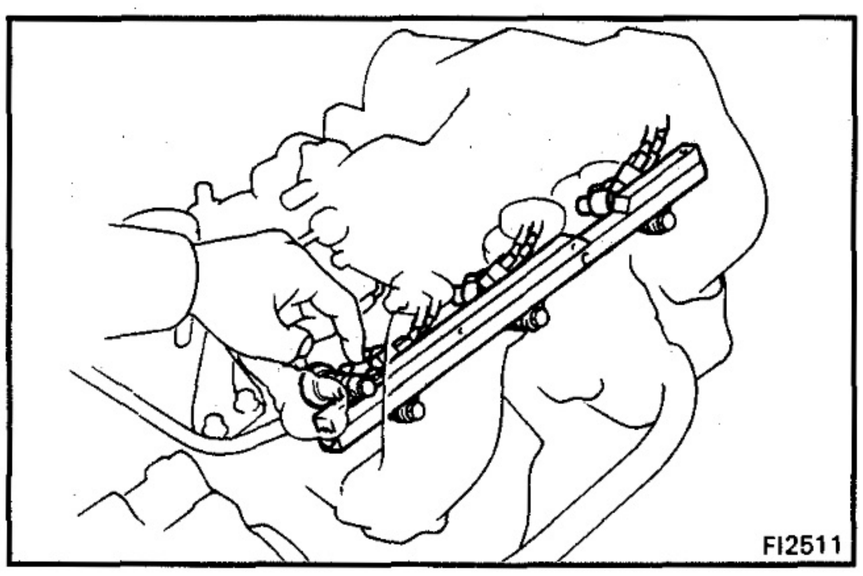
Injectors



FI2478



FI2513



FI2511

ON-VEHICLE INSPECTION

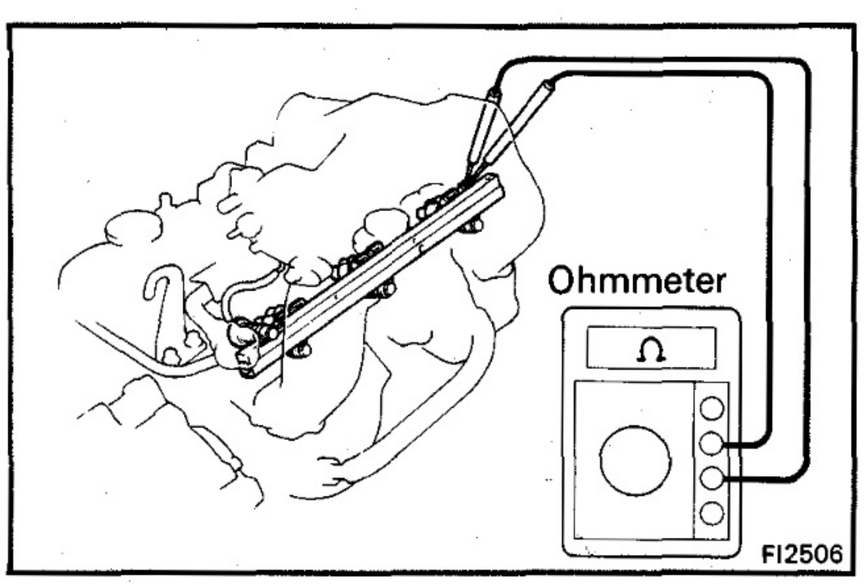
1. INSPECT INJECTOR OPERATION

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.

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



FI2506

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 INJECTOR

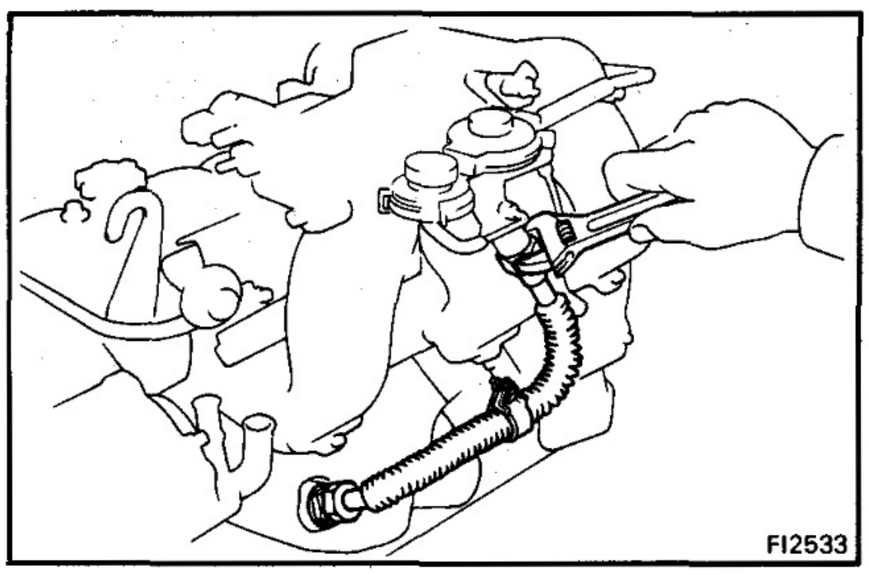
1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**

2. **DISCONNECT ACCELERATOR AND THROTTLE CABLES**

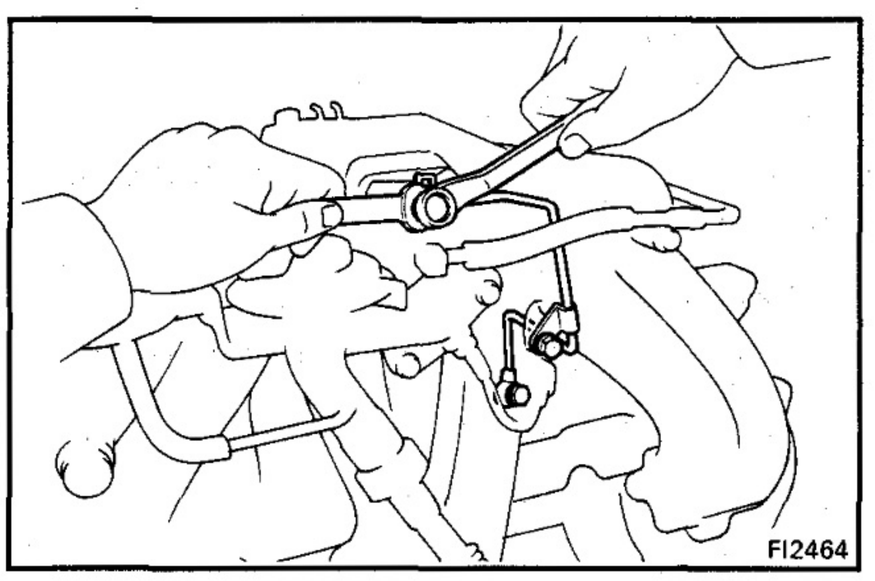
3. **REMOVE AIR INTAKE HOSE**

4. **DISCONNECT FOLLOWING HOSES:**
   (a) Emission control hoses
   HINT: Before disconnecting the emission control hoses, use tags to identify how they should be reconnected.
   (b) Air hose from AI check valve
   (c) Vacuum sensing hose
   (d) PCV hose
   (e) Vacuum hose for transfer
   (f) Brake booster hose

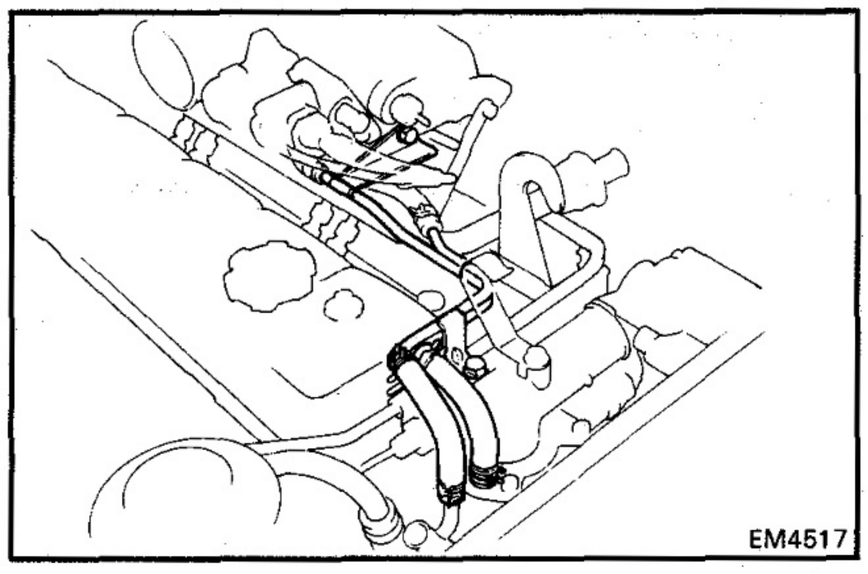
5. **DISCONNECT FOLLOWING CONNECTORS AND WIRE:**
   (a) ISC valve connector
   (b) Throttle position sensor connector
   (c) Oxygen sensor connector
   (d) Manifold temperature sensor connector
   (e) Cold start injector connector
   (f) EGR gas sensor connector
   (g) Ground strap


FI2533

6. **REMOVE AIR INTAKE CHAMBER**
   (a) Loosen the two union nuts, and remove the two clamp bolts and EGR pipe.

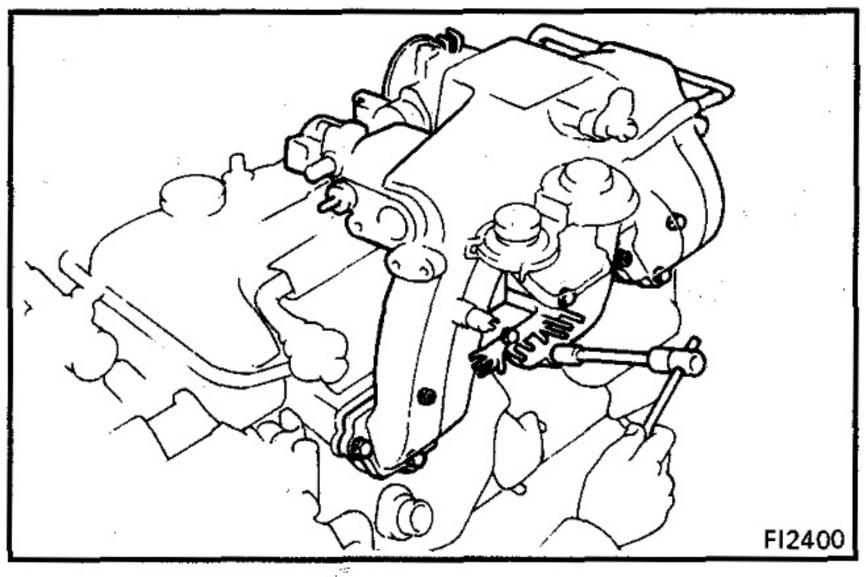

FI2464

   (b) Remove the two union bolts, four gaskets, clamp bolt and cold start injector pipe.


EM4517

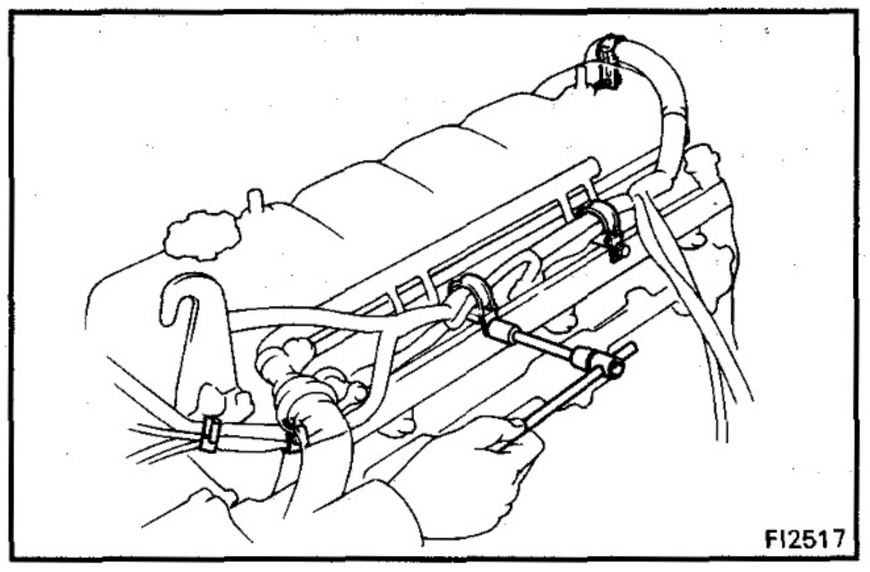
(c) Disconnect the water hoses and remove the two bolts and water by-pass pipe.

(d) Remove the four bolts and two intake chamber stays.


FI2400

(e) Remove the seven bolts, two nuts and air intake chamber.

(f) Remove the bolt, manifold temperature sensor with stay and air intake chamber gasket.


FI2517

7. DISCONNECT ENGINE WIRE HARNESS ON INTAKE MANIFOLD

(a) Disconnect the following connectors:

(1) Cold start injector time switch connector

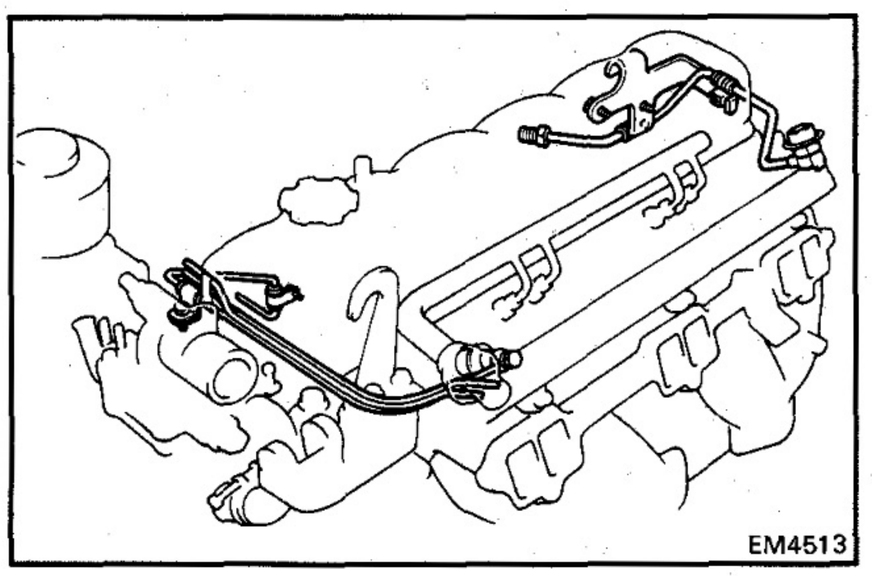
(2) Water temperature sensor connector

(3) Water temperature sender gauge connector

(4) Water temperature switch

(5) Six injector connectors

(b) Remove the two clamps and three clamp bolts, and disconnect the engine wire harness.


EM4513

8. REMOVE NO.1 FUEL PIPE AND NO.2 FUEL PIPE WITH ENGINE HANGER

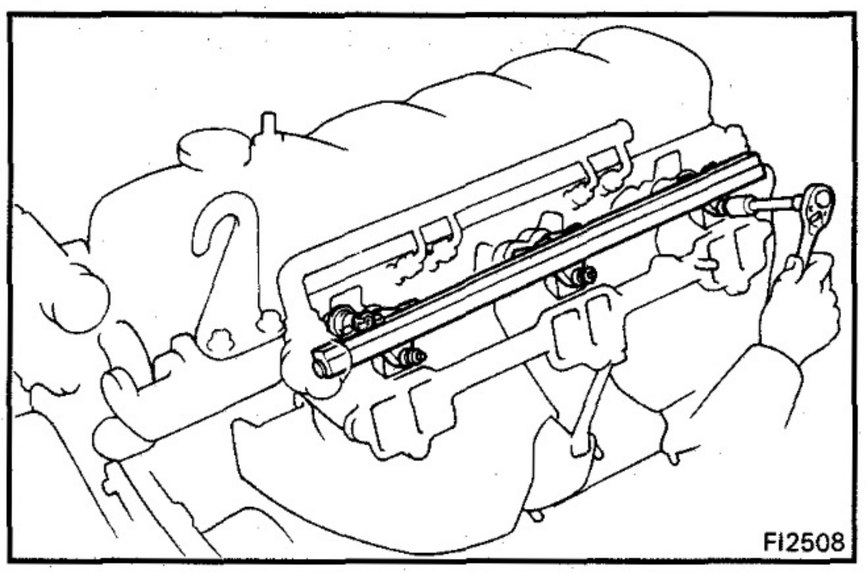
(a) Disconnect the fuel and vacuum hoses.

(b) Remove the pulsation damper and two gaskets.

(c) Remove the two bolts and No.2 fuel pipe with engine hanger.

(d) Remove the union bolt and two gaskets from the pressure regulator.

(e) Remove the two bolts and No.1 fuel pipe.


FI2508

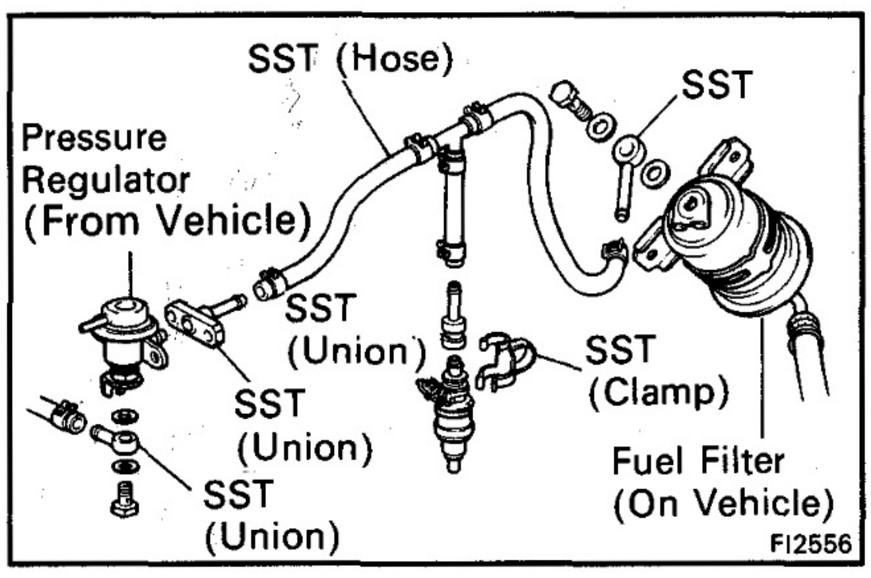
9. REMOVE DELIVERY PIPE AND INJECTORS

(a) Remove the three nuts, plate washers, spacers and delivery pipe together with the six injectors.

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

(b) Remove the six insulators, six spacers and three collars from the intake manifold.

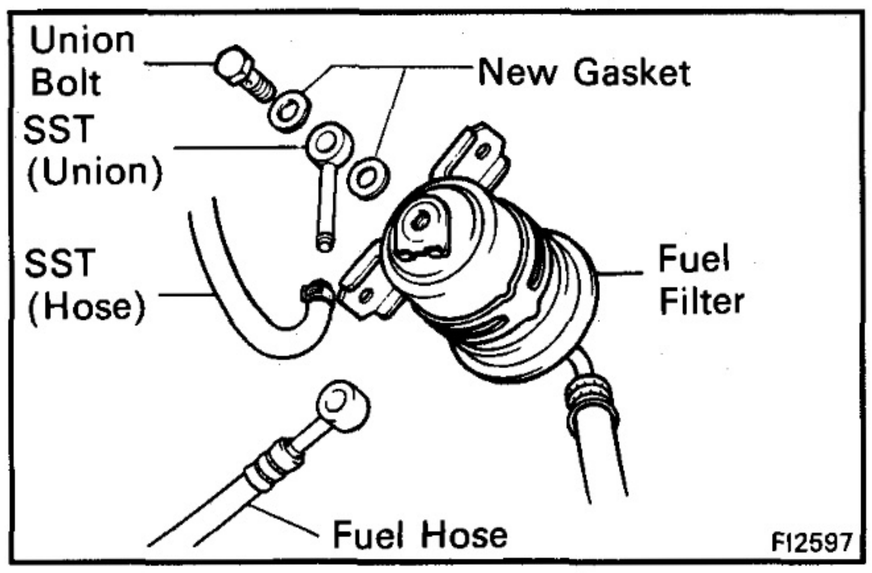
(c) Pull out the six injectors from the delivery pipe.



INSPECTION OF INJECTORS

1. INSPECT INJECTOR INJECTION

CAUTION: Keep clear of sparks during the test.

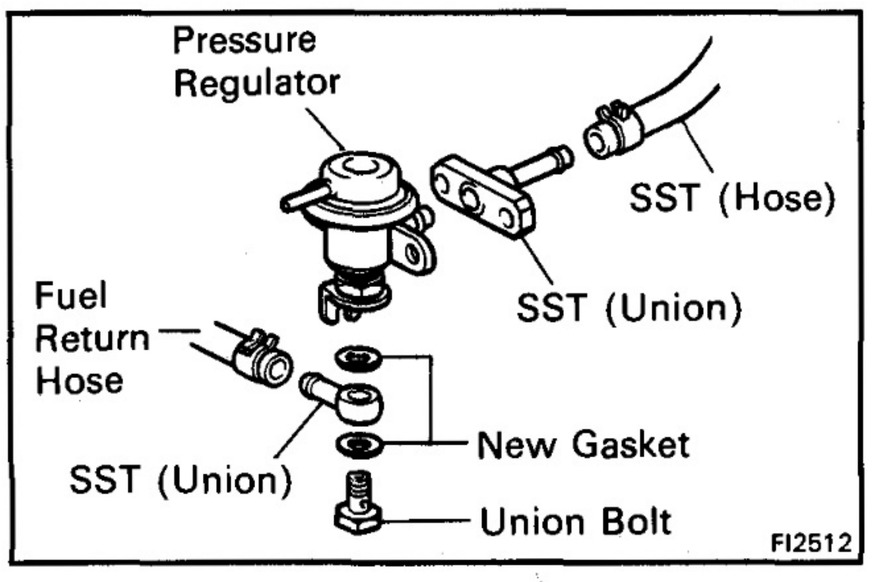


(a) Disconnect the fuel hose from the fuel filter outlet.

(b) Connect SST (union and hose) to the fuel filter outlet with new gaskets and the union bolt.

SST 09268-41045 (90405-09015)

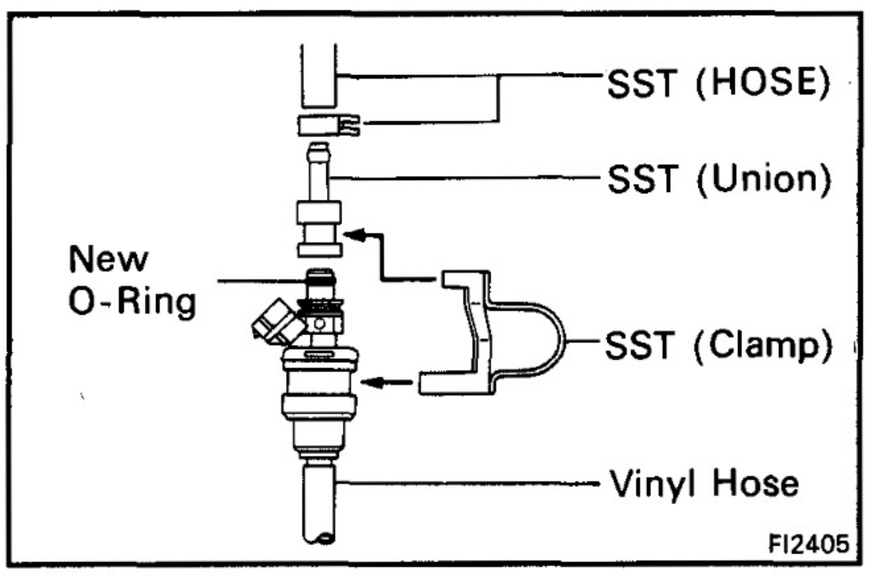
NOTE: Use the vehicle's fuel filter.



(c) Remove the pressure regulator. (See page FI-53)

(d) Connect the fuel return hose and SST (hose) to the pressure regulator with SST (unions), new gaskets and union bolt.

SST 09268-41045 (09268-41080, 09268-41090)



(e) Connect SST (union and hose) to the injector, and hold the injector and union with SST (clamp).

SST 09268-41045

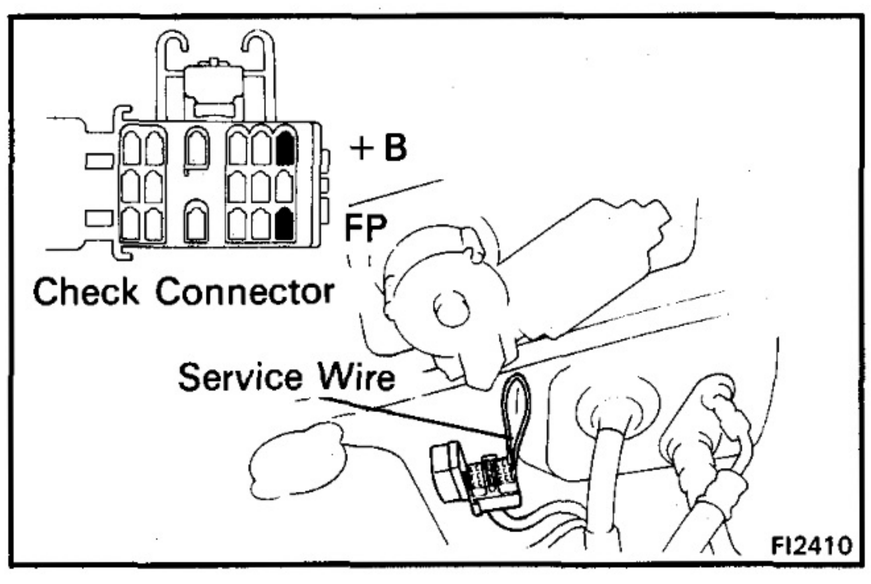
(f) Put the injector into the graduated cylinder.

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

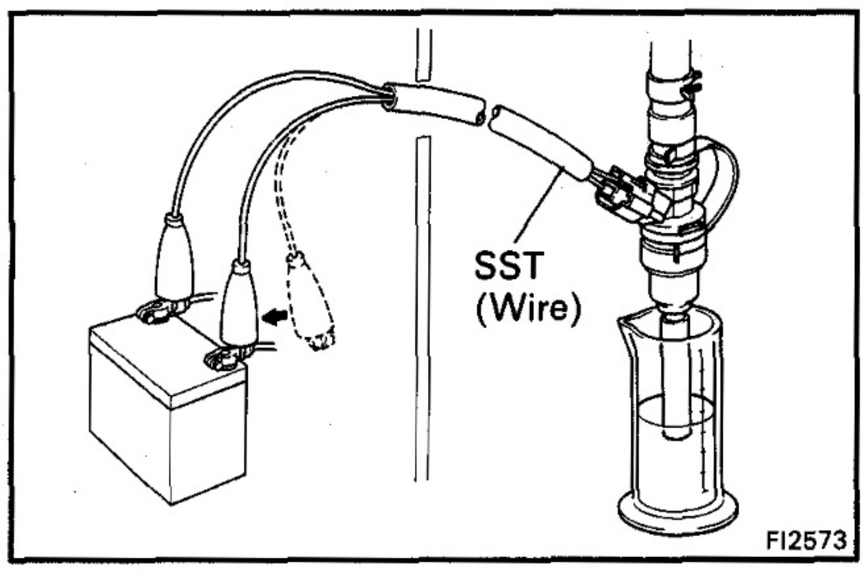
(g) Reconnect the battery negative (–) cable.

(h) Turn the ignition switch ON.

HINT: Do not start the engine.



(i) Using a service wire, connect terminals +B and FP of the check connector.



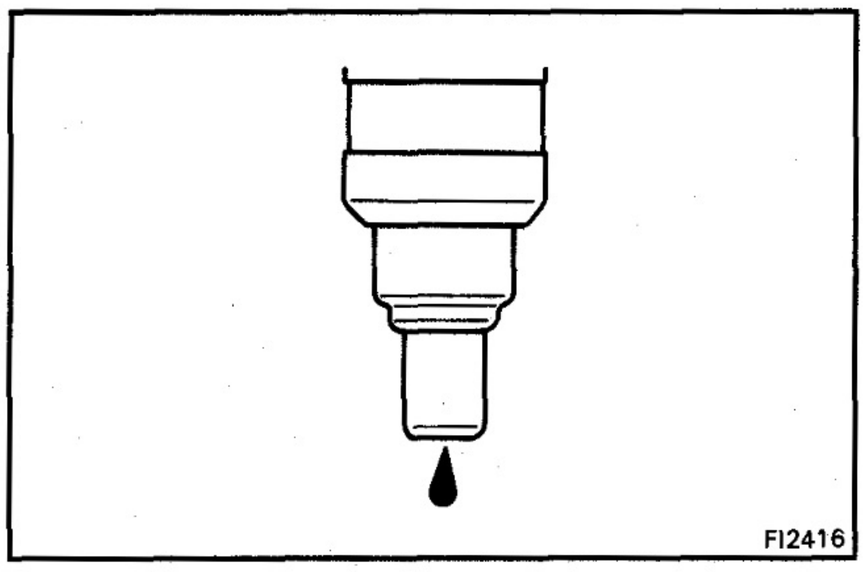
(j) Connect SST (wire) to the injector and battery for 15 seconds, and measure the injection volume with a graduated cylinder. Test each injector two or three times.

SST 09842-30070

Volume: 47 – 59 cc (2.9 – 3.6 cu in.) per 15 sec.

Difference between each injector:
5 cc (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.

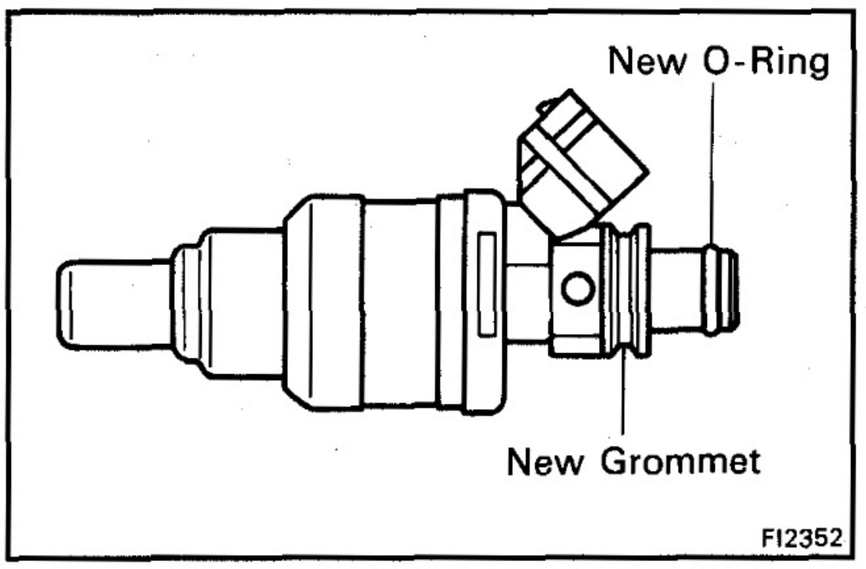
SST 09842-30070

Fuel drop: One drop or less per minute.

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

(c) Remove SST and the service wire.

SST 09268-41045

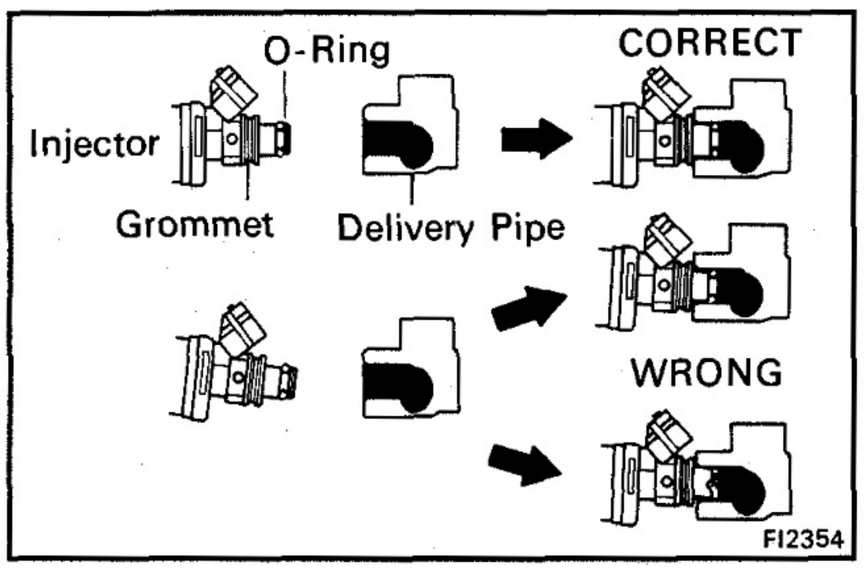


INSTALLATION OF INJECTORS

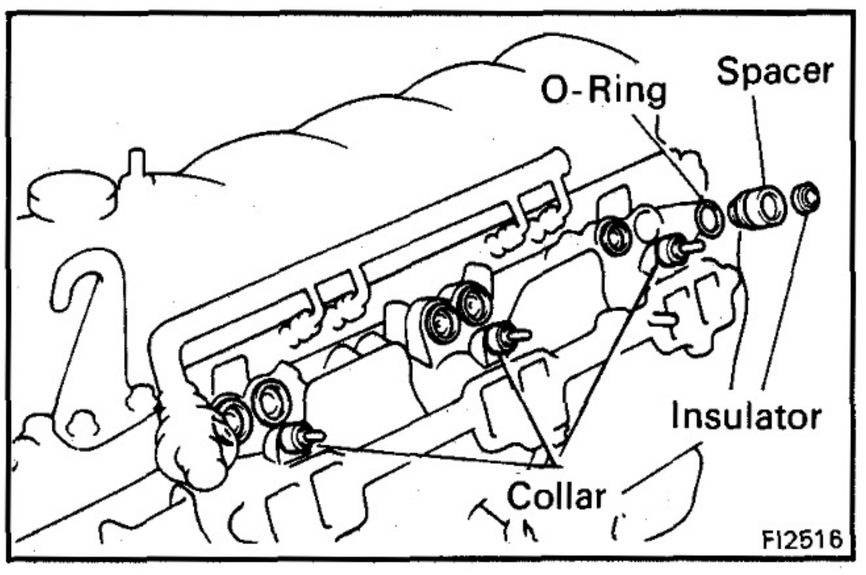
1. INSTALL INJECTORS AND DELIVERY PIPE

(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.

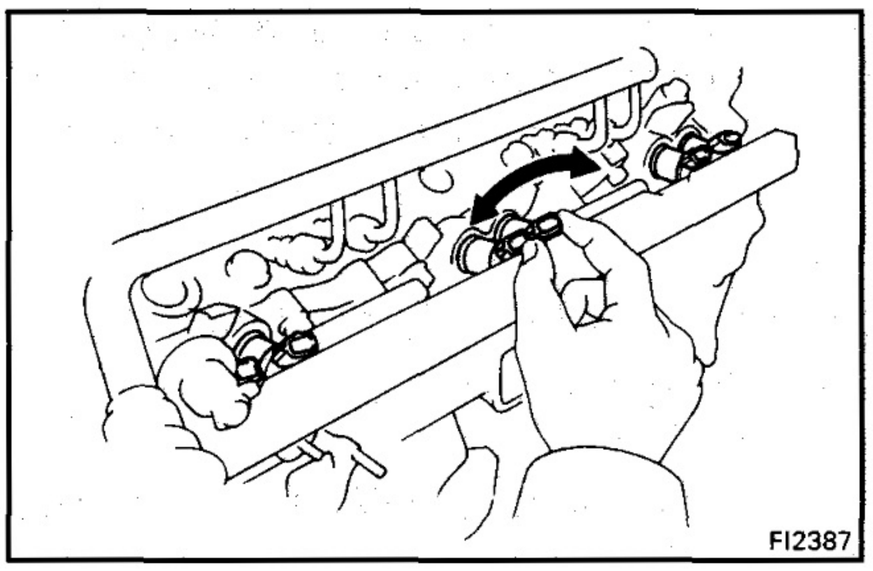


(c) While turning the injector left and right, install it to the delivery pipe. Install the six injectors.



(d) Install a new O-ring to the insulator.

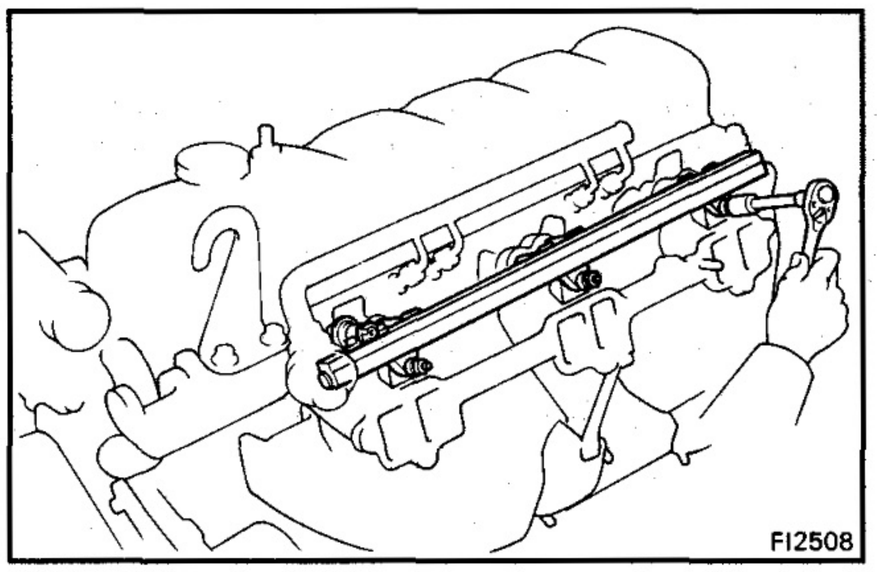
(e) Place the six insulators, six spacers and three collars in position on the intake manifold.



(f) Place the injectors together with the delivery pipe in position on the intake manifold.

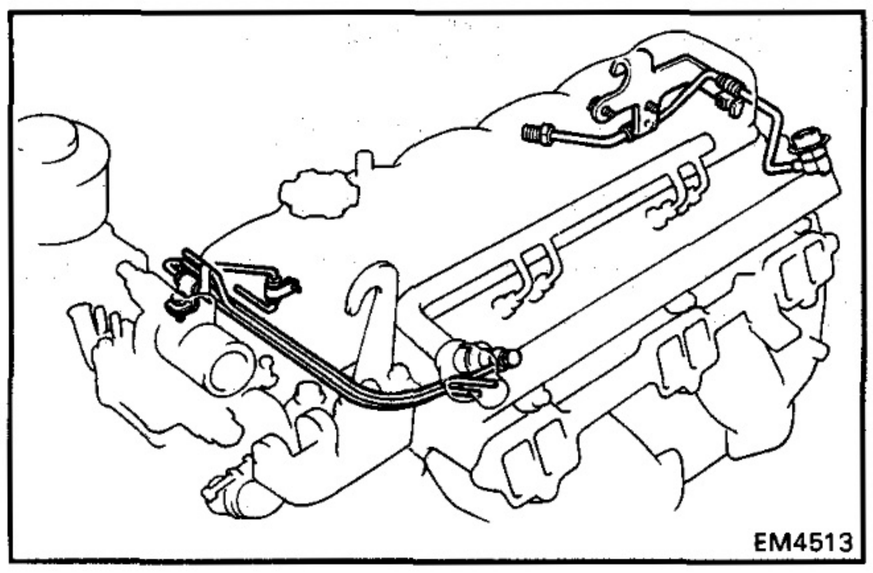
(g) Check that the injectors rotate smoothly.

HINT: If injectors do not rotate smoothly, the probable cause is incorrect installation of O-rings. Replace the O-rings.



(h) Install the three spacers, plate washers and nuts. Torque the nuts.

Torque: 120 kg-cm (9 ft-lb, 12 N·m)



2. INSTALL NO.1 FUEL PIPE AND NO.2 FUEL PIPE WITH ENGINE HANGER

(a) Install the No.1 fuel pipe with the two bolts.

(b) Install the union bolt and new two gaskets to the pressure regulator.

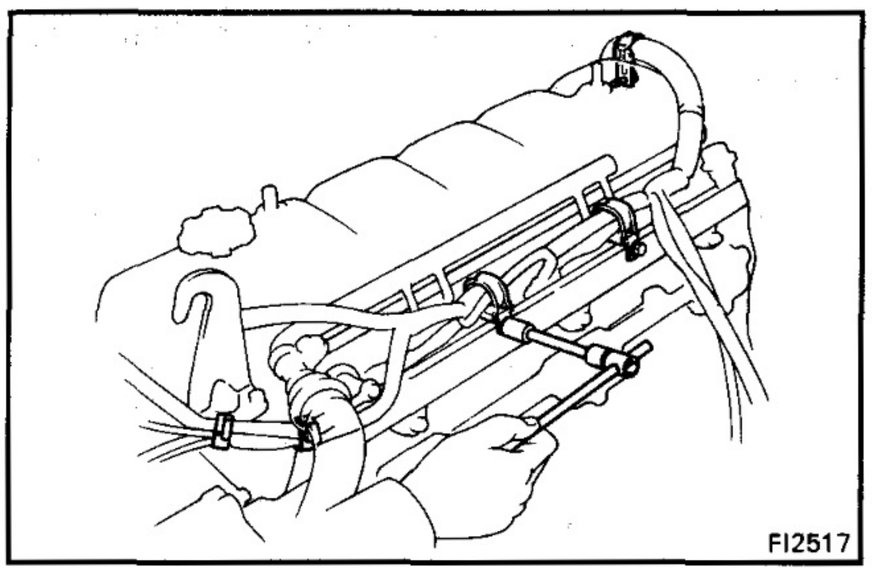
Torque: 195 kg-cm (14 ft-lb, 19 N·m)

(c) Install the No.2 fuel pipe with engine hanger with the two bolts.

(d) Install the pulsation damper with the two new gasket.

Torque: 300 kg-cm (22 ft-lb, 29 N·m)

(e) Connect the two fuel hoses and vacuum hoses.



3. CONNECT ENGINE WIRE HARNESS ON INTAKE MANIFOLD

(a) Connect the following connectors:

(1) Cold start injector time switch connector

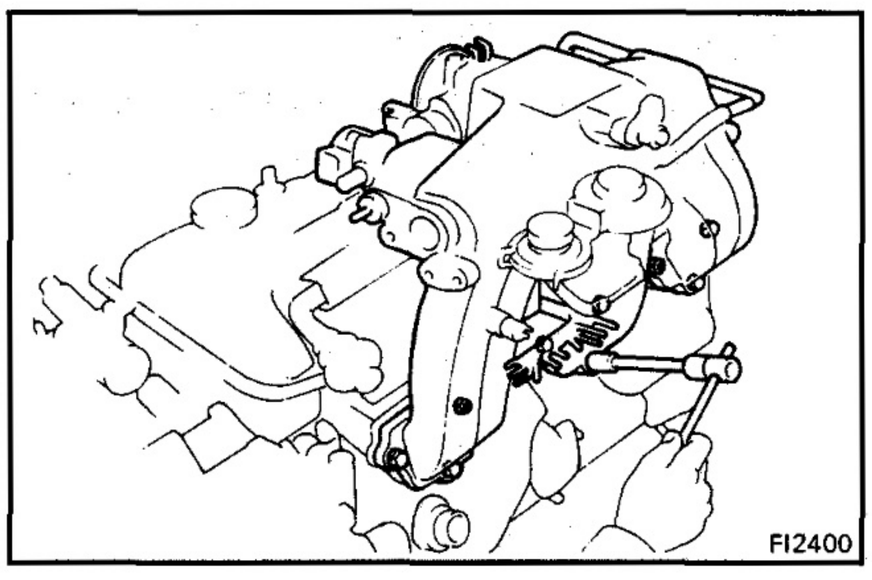
(2) Water temperature sensor connector

(3) Water temperature sender gauge connector

(4) Water temperature switch

(5) Six injector connectors

(b) Install the three clamp bolts and two clamp.



4. INSTALL AIR INTAKE CHAMBER

(a) Install a new gasket and air intake chamber with the seven bolts and two nuts.

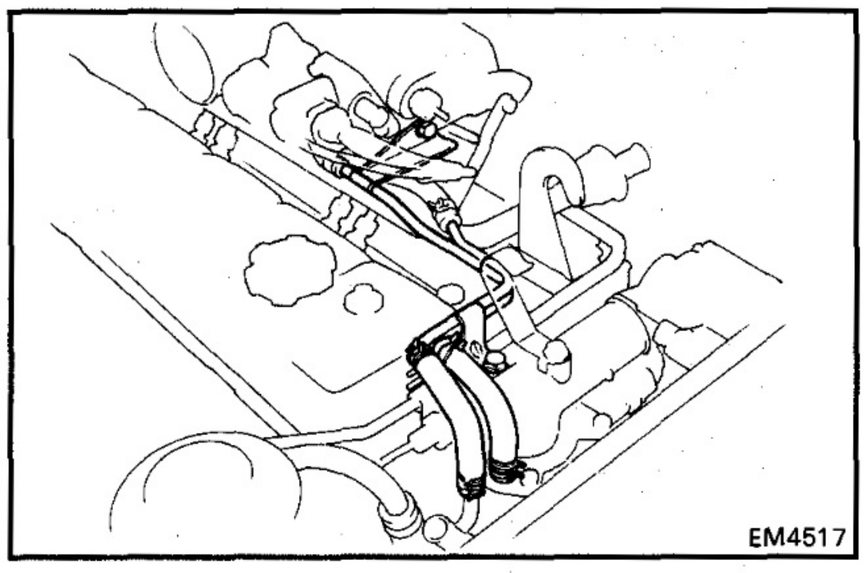
Torque: 250 kg-cm (18 ft-lb, 25 N·m)

(b) Install the manifold temperature sensor with stay with the bolt.

Torque: 120 kg-cm (9 ft-lb, 12 N·m)

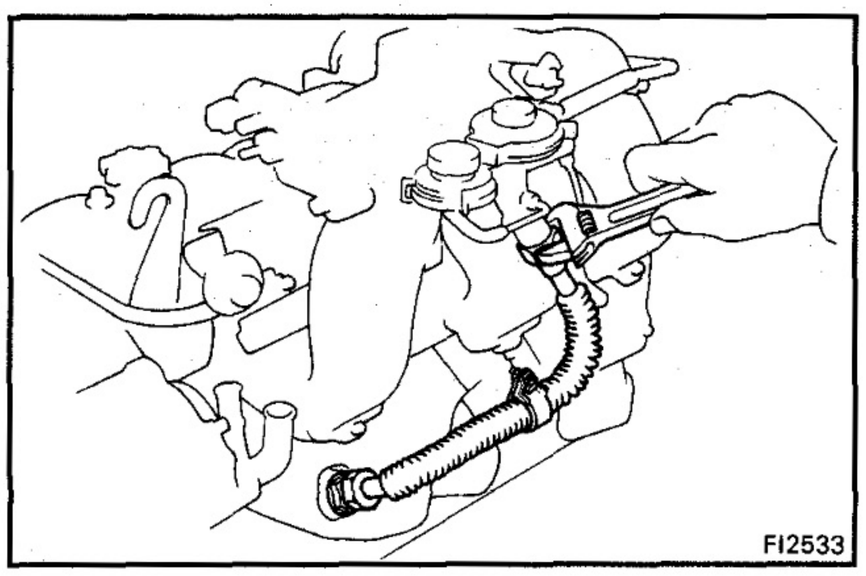
(c) Install the two intake chamber stays with the four bolts.

Torque: 120 kg-cm (9 ft-lb, 12 N·m)



(d) Install the water by-pass pipe with the two bolts and connect the water hoses.

(e) Install the cold start injector pipe.
(See page FI-52)



(f) Install the EGR pipe with the two union nuts.

Torque: 800 kg-cm (58 ft-lb, 78 N·m)

(g) Install the two clamp mount bolts.

5. CONNECT FOLLOWING CONNECTORS AND WIRE:

(a) ISC valve connector
(b) Throttle position sensor connector
(c) Oxygen sensor connector
(d) Manifold temperature sensor connector
(e) Cold start injector connector
(f) EGR gas sensor connector
(g) Ground strap

6. CONNECT FOLLOWING HOSES:

(a) Emission control hoses
(b) Air hose from AI check valve
(c) Vacuum sensing hose
(d) PCV hose
(e) Vacuum hose for transfer
(f) Brake booster hose

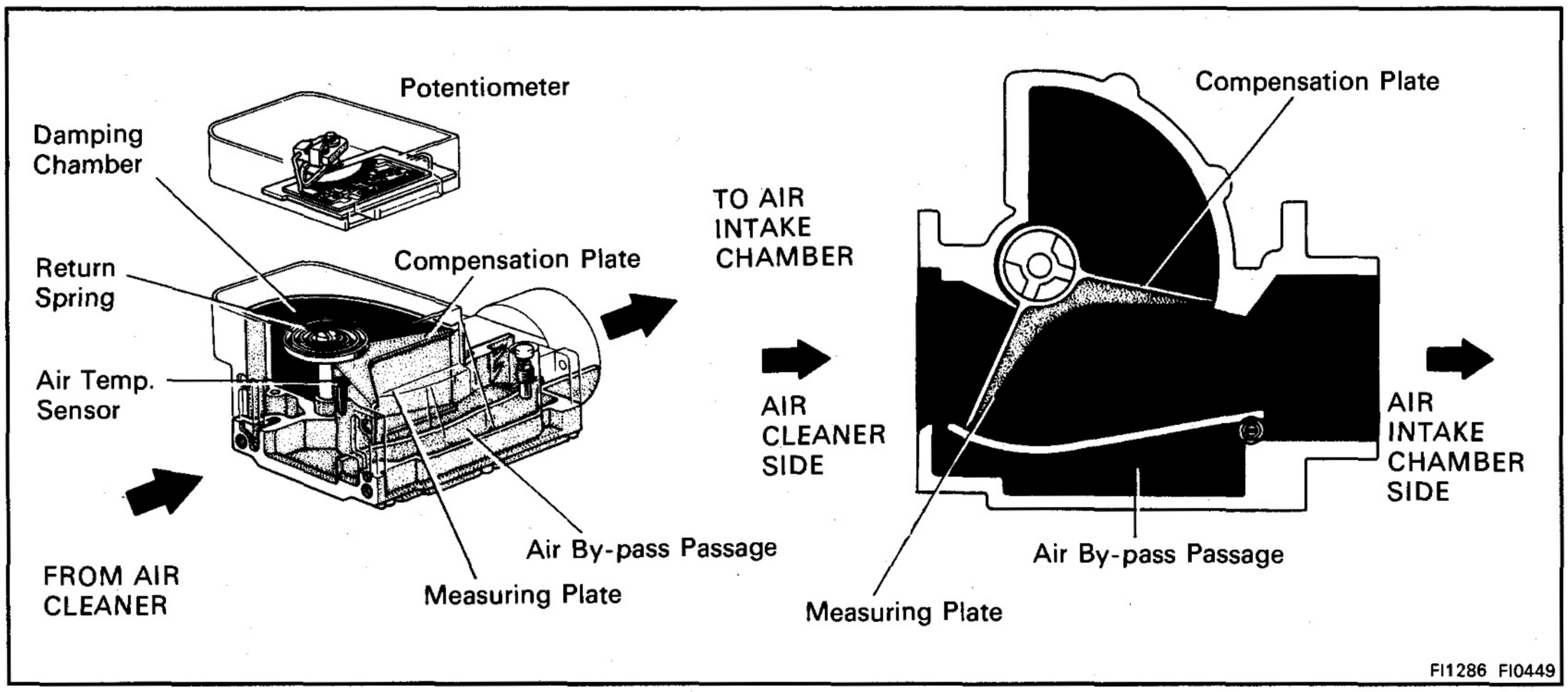
7. INSTALL AIR INTAKE HOSE

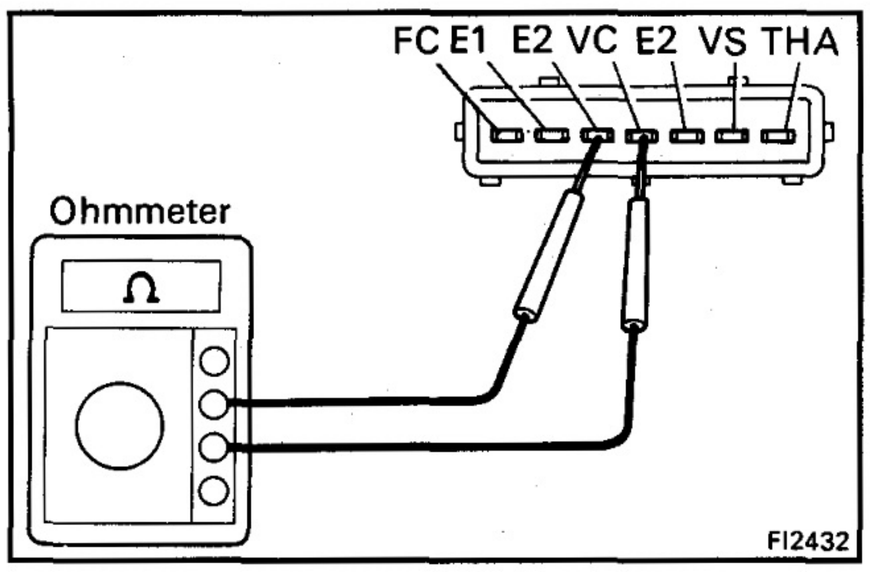
8. CONNECT ACCELERATOR AND THROTTLE CABLES, AND ADJUST THEM

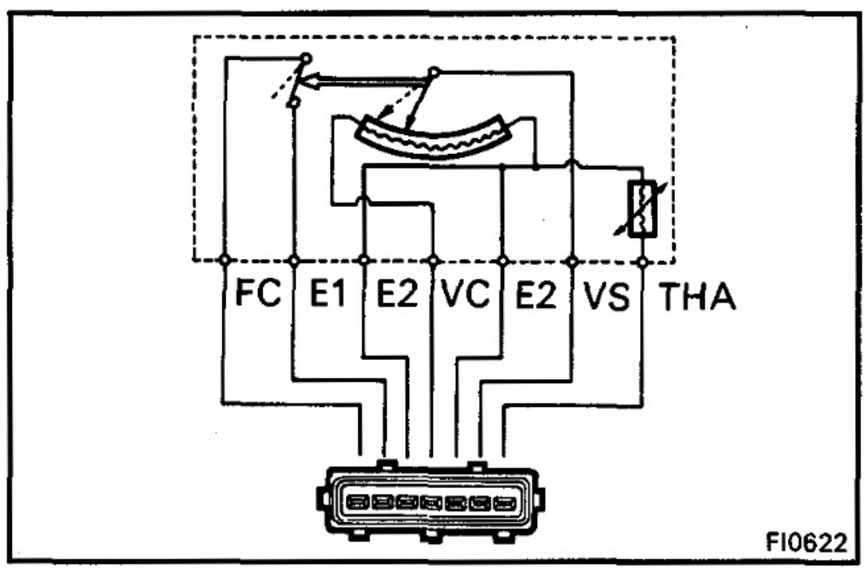
9. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

AIR INDUCTION SYSTEM

Air Flow Meter







ON-VEHICLE INSPECTION

INSPECT RESISTANCE OF AIR FLOW METER

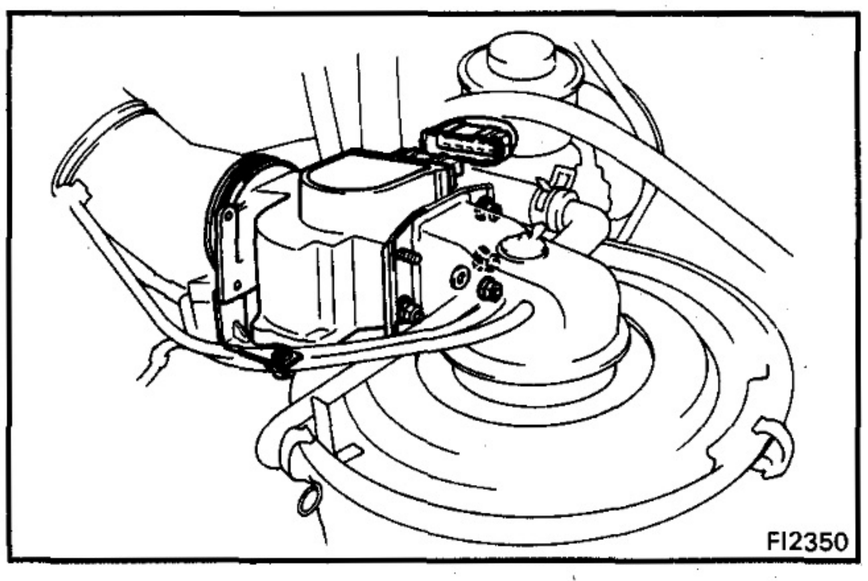
(a) Disconnect the air flow meter connector.

(b) Using an ohmmeter, measure the resistance between each terminal.

Between terminals	Resistance	Temperature
E2 – VS	200 – 600 Ω	–
E2 – VC	200 – 400 Ω	–
E2 – THA	10 – 20 kΩ 4 – 7 kΩ 2 – 3 kΩ 0.9 – 1.3 kΩ 0.4 – 0.7 kΩ	–20°C (–4°F) 0°C (32°F) 20°C (68°F) 40°C (104°F) 60°C (140°F)
E1 – FC	Infinity	–

If the resistance is not as specified, replace the air flow meter.

(c) Reconnect the air flow meter connector.



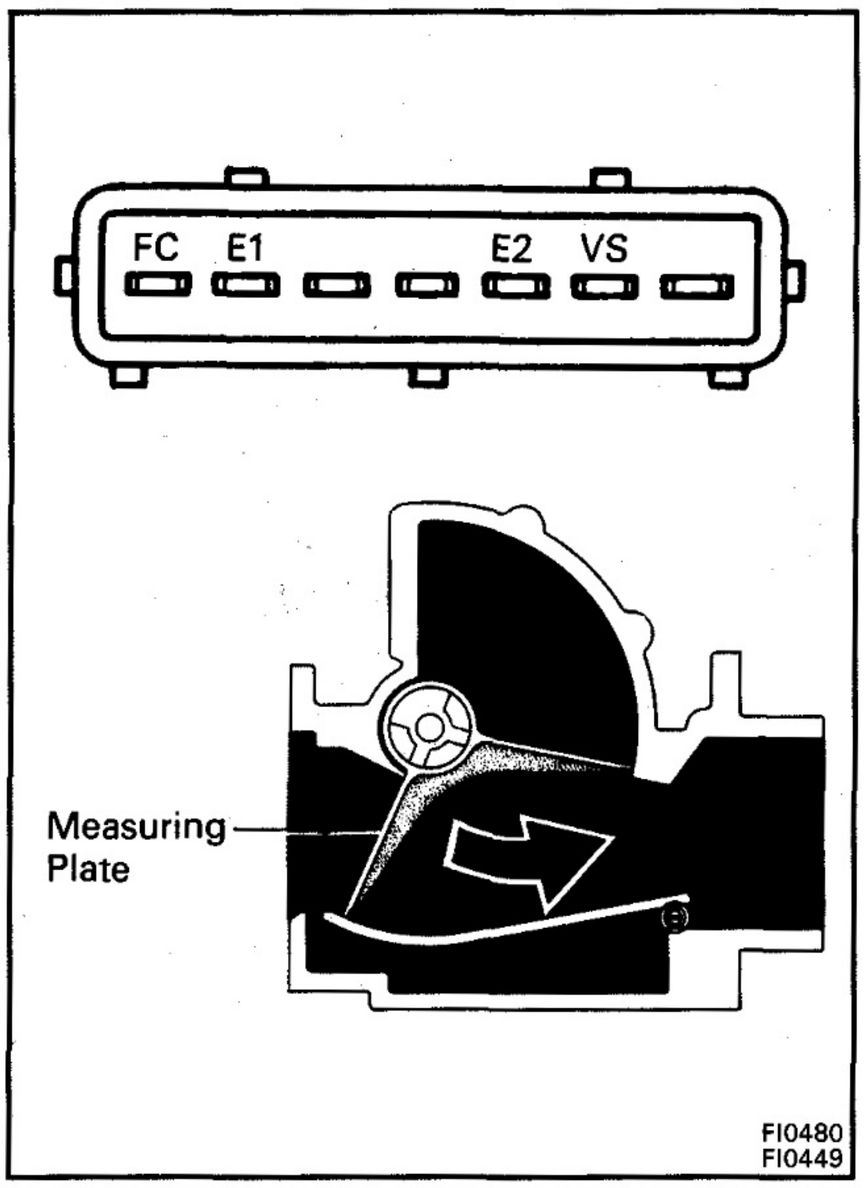
REMOVAL OF AIR FLOW METER

1. DISCONNECT AIR FLOW METER CONNECTOR

2. DISCONNECT AIR CLEANER HOSE

3. REMOVE AIR FLOW METER

   Remove the bolt, four nuts and air flow meter.



FI0480
FI0449

INSPECTION OF AIR FLOW METER

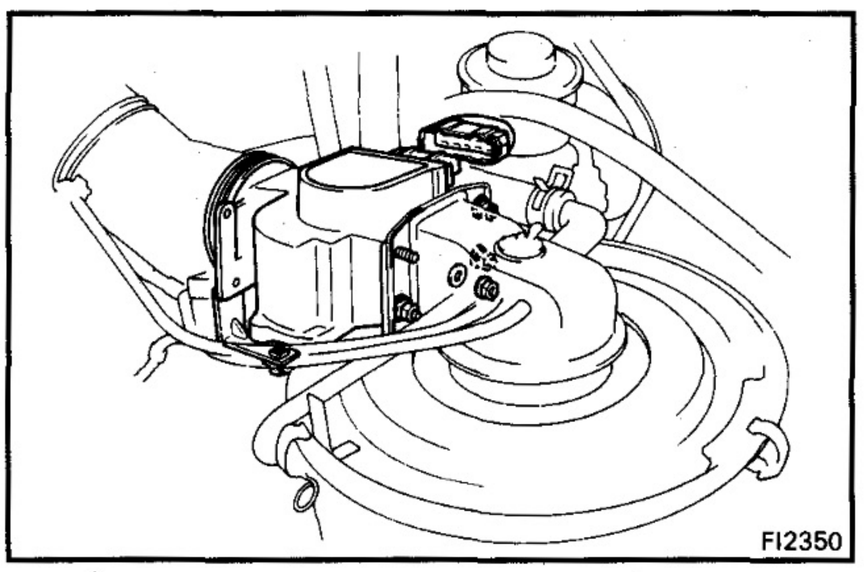
INSPECT RESISTANCE OF AIR FLOW METER

Using an ohmmeter, measure the resistance between each terminal by moving the measuring plate.

Between Terminals	Resistance (Ω)	Measuring plate opening
E1 – FC	Infinity	Fully closed
	Zero	Other than closed
E2 – VS	200 – 600	Fully closed
	20 – 1,200	Fully open

HINT: Resistance between terminals E2 and VS will change in a wave pattern as the measuring plate slowly opens.

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

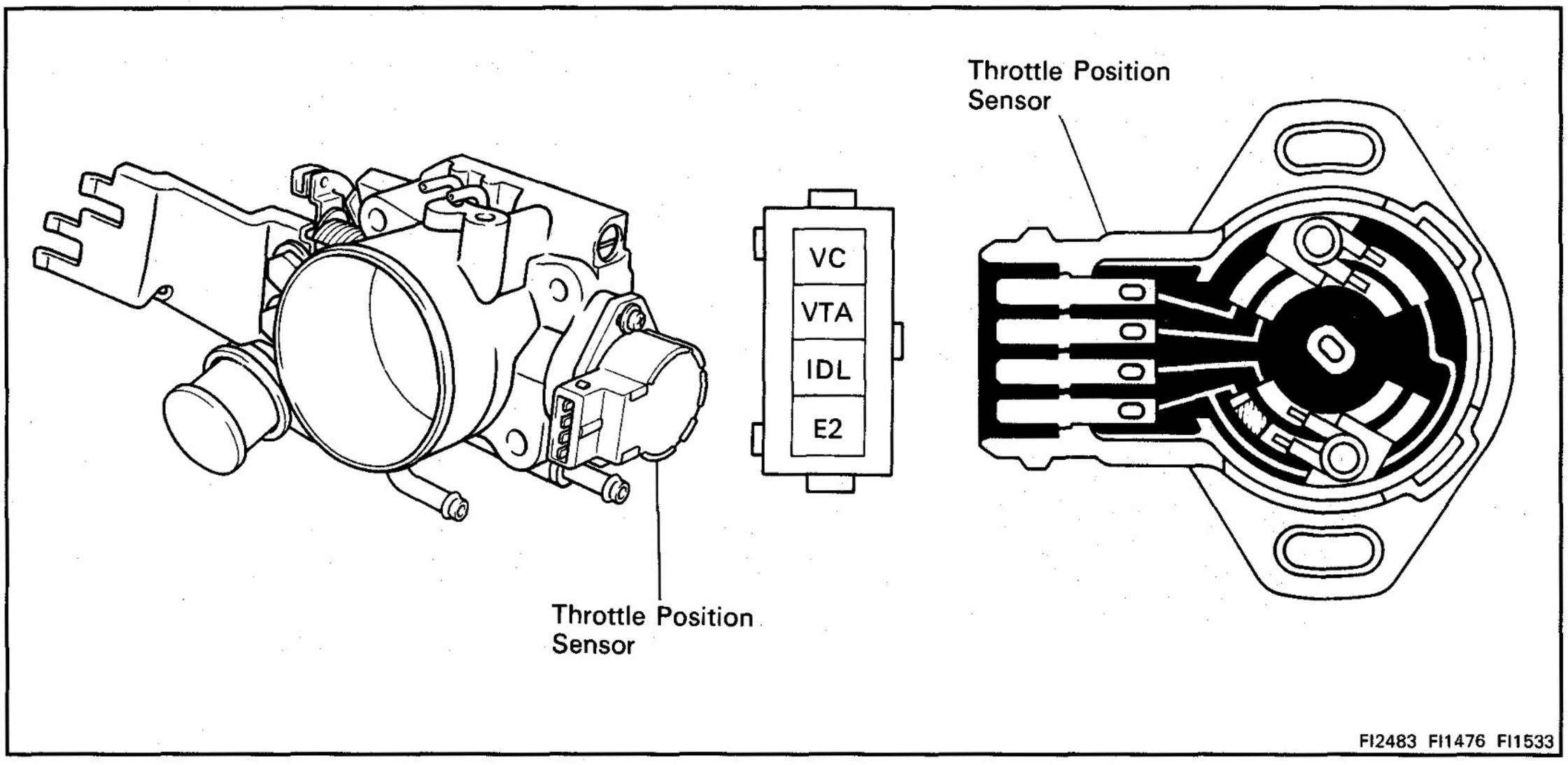


FI2350

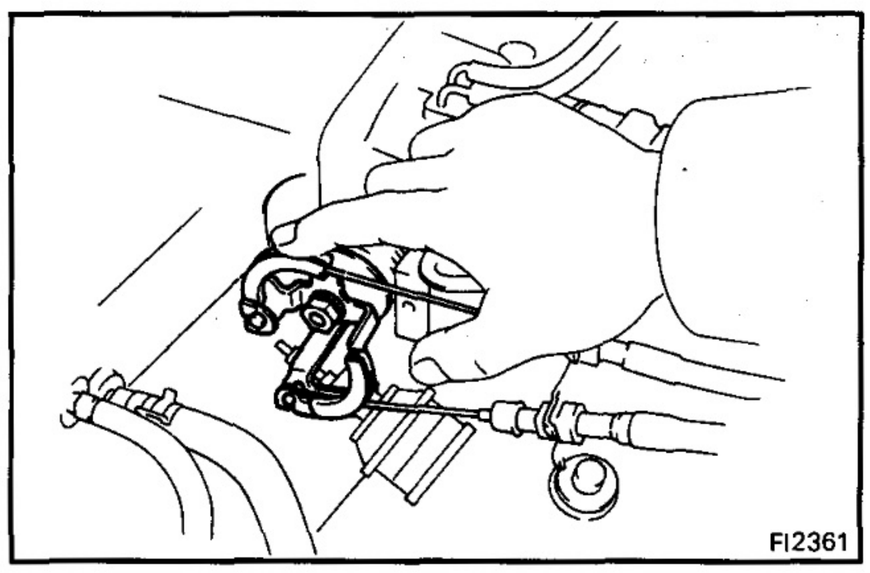
INSTALLATION OF AIR FLOW METER

1. **INSTALL AIR FLOW METER**
2. **CONNECT AIR CLEANER HOSE**
3. **CONNECT AIR FLOW METER CONNECTOR**

Throttle Body



FI2483 FI1476 FI1533

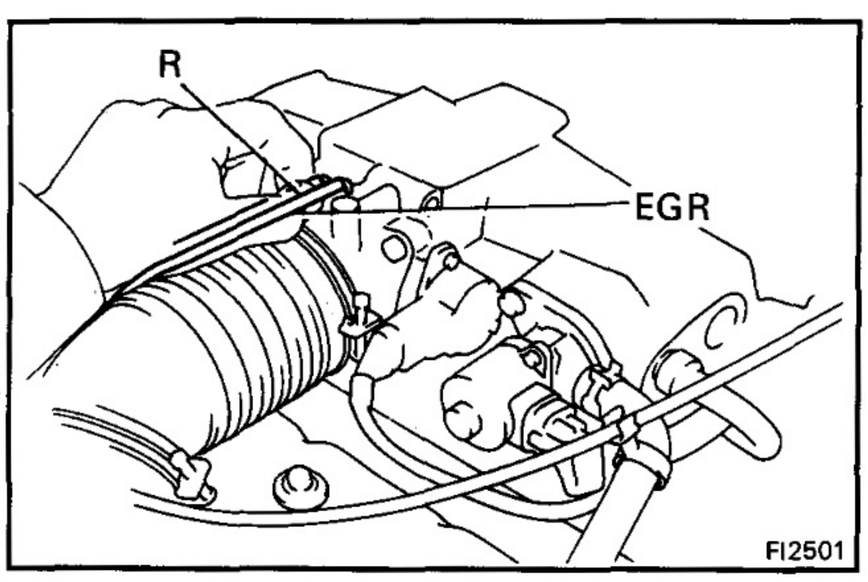


FI2361

ON-VEHICLE INSPECTION

1. INSPECT THROTTLE BODY

(a) Check that the throttle linkage moves smoothly.

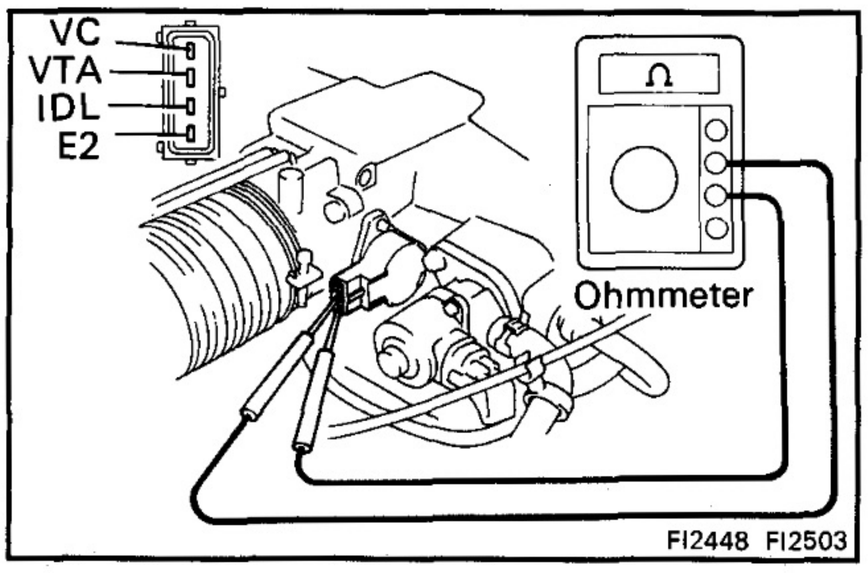


FI2501

(b) Check the vacuum at each port.

- Start the engine.
- Check the vacuum with your finger.

Port No.	At idling	Other than idling
EGR	No vacuum	Vacuum
R	No vacuum	Vacuum



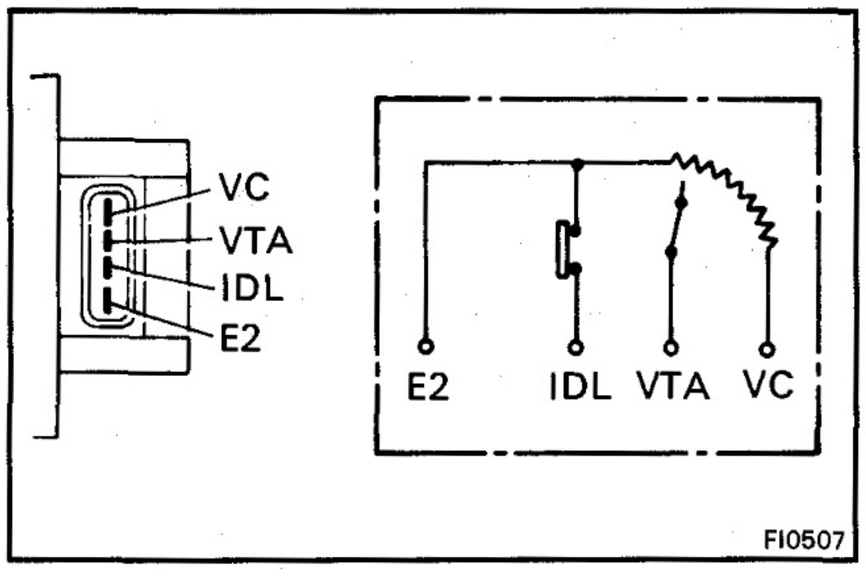
FI2448 FI2503

2. INSPECT THROTTLE POSITION SENSOR

(a) Disconnect the sensor connector.

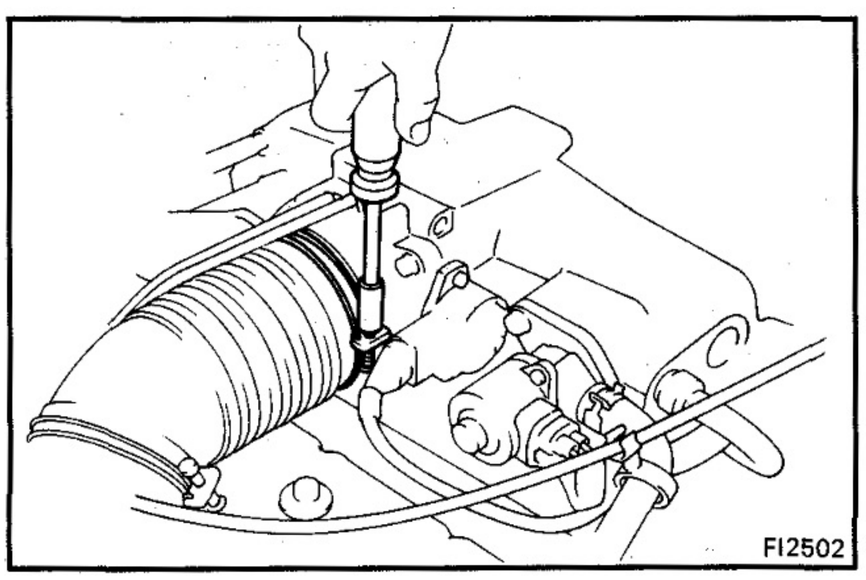
(b) Insert a thickness gauge between the throttle stop screw and stop lever.

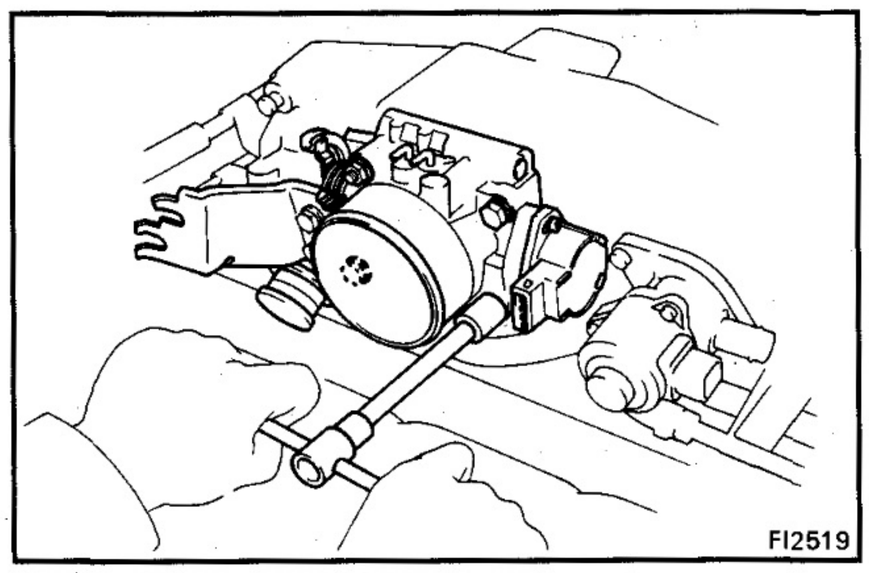
(c) Using an ohmmeter, measure the resistance between each terminal.

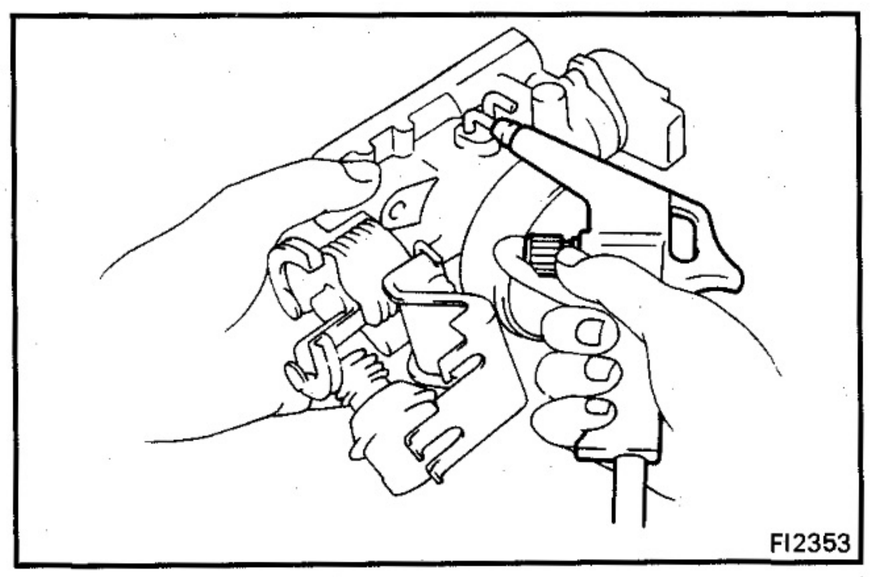


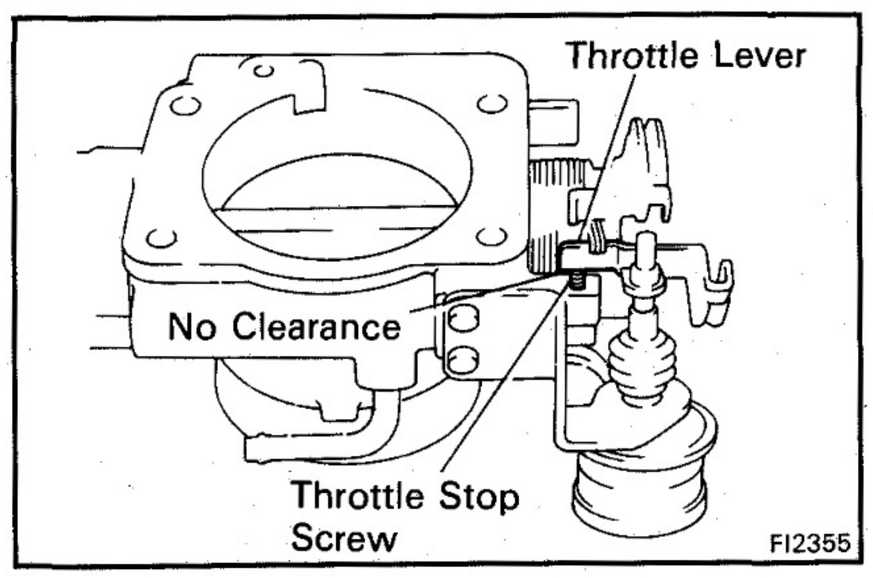
Clearance between lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA – E2	0.3 – 6.3 kΩ
0.77 mm (0.0303 in.)	IDL – E2	Less than 2.3 kΩ
1.09 mm (0.0429 in.)	IDL – E2	Infinity
Throttle valve fully opened position	VTA – E2	3.5 – 10.3 kΩ
—	VC – E2	4.25 – 8.25 kΩ

(d) Reconnect the sensor connector.









REMOVAL OF THROTTLE BODY

1. **DRAIN ENGINE COOLANT**
2. **DISCONNECT ACCELERATOR AND THROTTLE CABLES**
3. **DISCONNECT AIR CLEANER HOSE**
4. **DISCONNECT THROTTLE POSITION SENSOR CONNECTOR**
5. **DISCONNECT WATER HOSES**
6. **DISCONNECT VACUUM HOSES**
7. **REMOVE THROTTLE BODY**

   Remove the three bolts, nut, throttle body and gasket.

INSPECTION OF THROTTLE BODY

1. **CLEAN THROTTLE BODY**

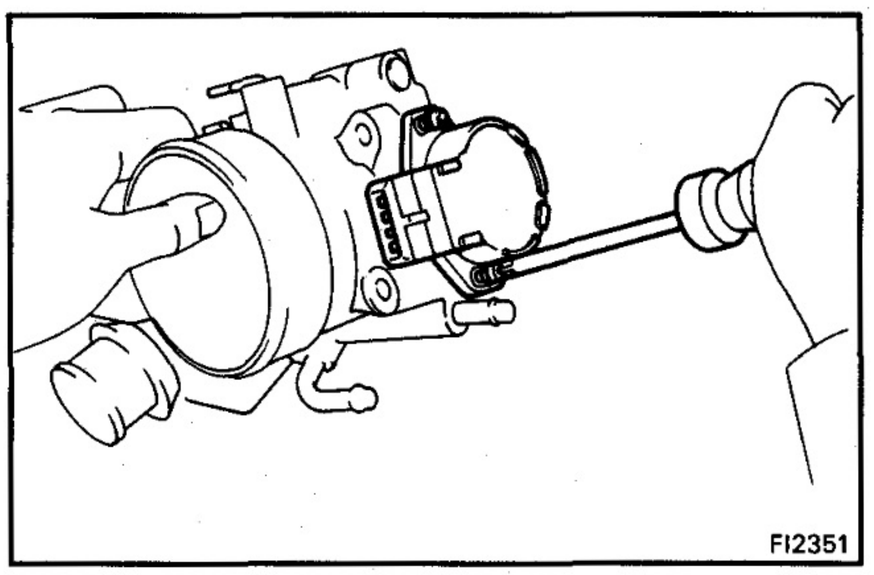
   (a) Using a soft brush and carburetor cleaner, clean the cast parts.

   (b) Using compressed air, clean all the passages and apertures.

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

2. **INSPECT THROTTLE VALVE**

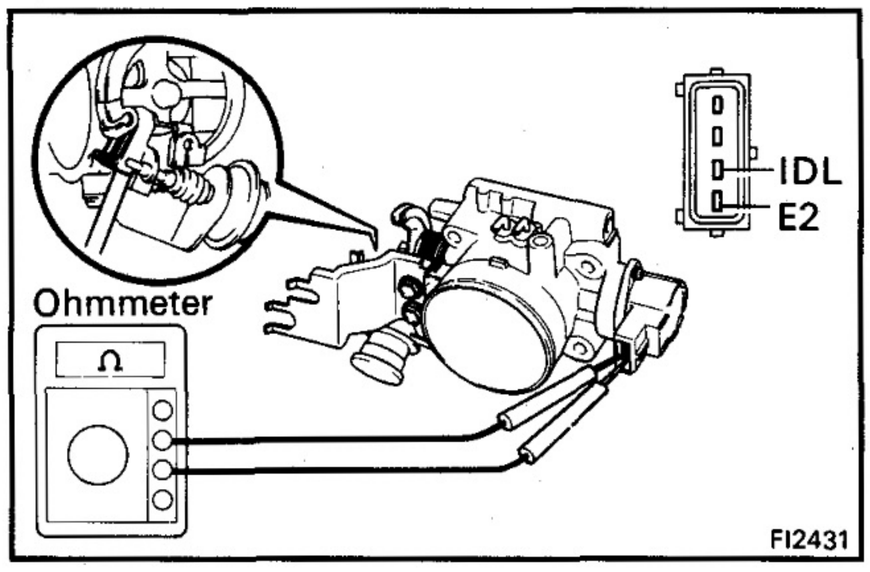
   Check that there is no clearance between the throttle stop screw and throttle lever when the throttle valve is fully closed.



3. **INSPECT THROTTLE POSITION SENSOR**
(See step 2 on page FI-64)

4. **IF NECESSARY, ADJUST THROTTLE POSITION SENSOR**

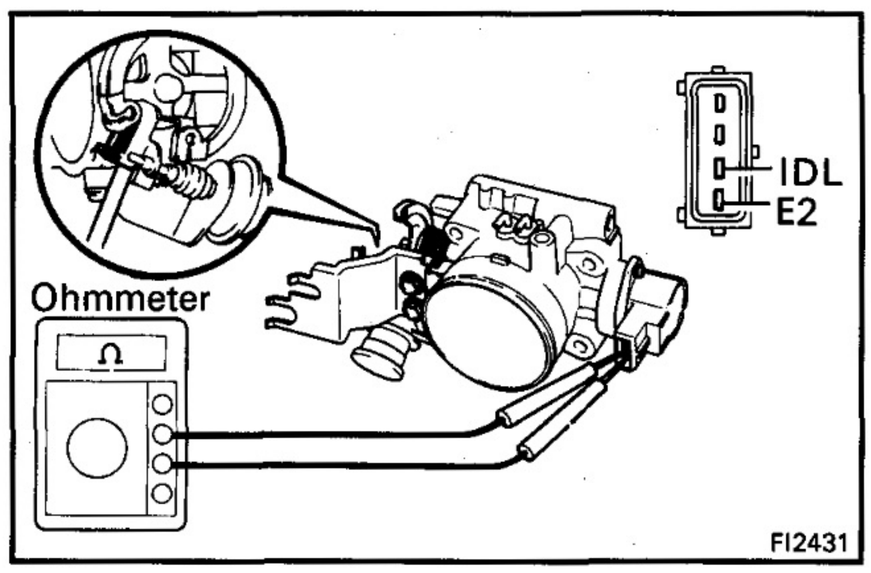
(a) Loosen the two set screws of the sensor.



(b) Insert a 0.93 mm (0.0366 in.) thickness gauge, between the throttle stop screw and stop lever.

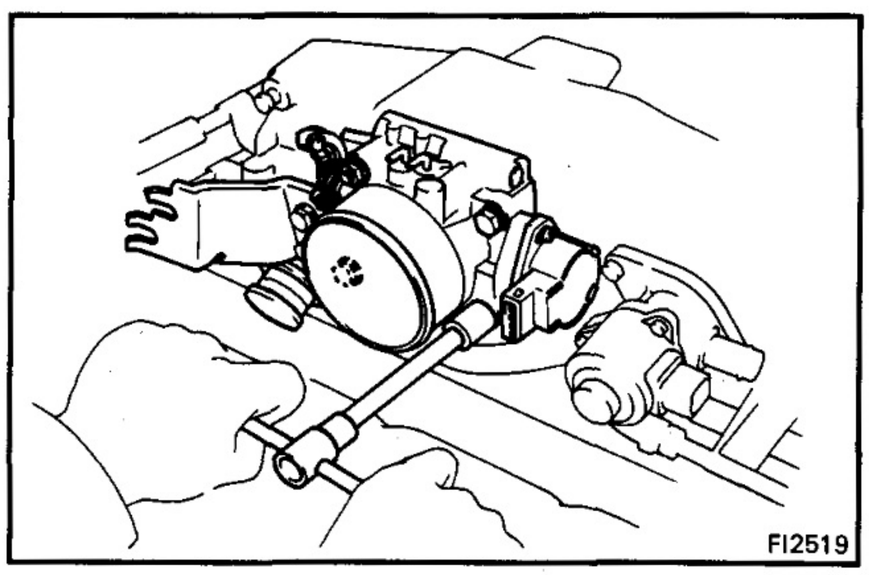
(c) Connect the test probe of an ohmmeter to the terminals IDL and E2 of the sensor.

(d) Gradually turn the sensor clockwise 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	Conitinuity (IDL — E2)
0.77 mm (0.0303 in.)	Continuity
1.09 mm (0.0429 in.)	No continuity



INSTALLATION OF THROTTLE BODY

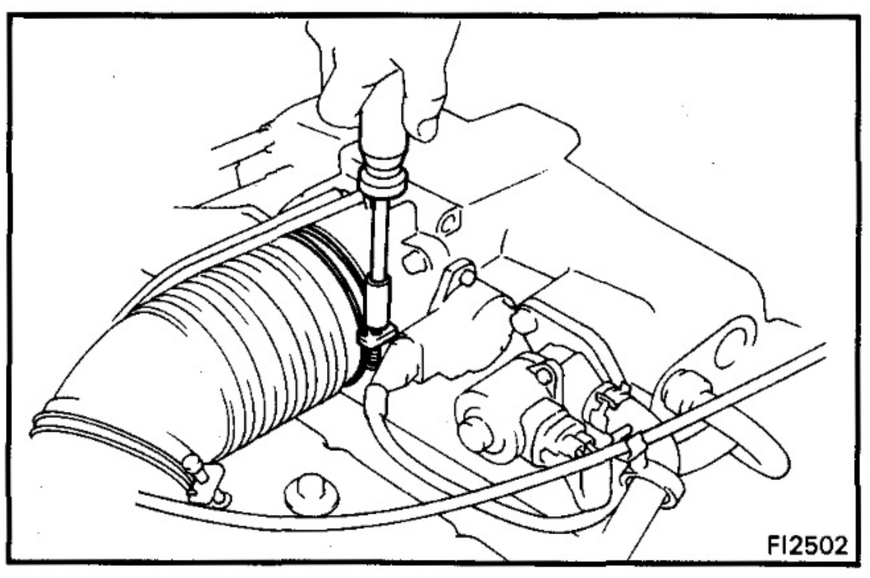
1. **INSTALL THROTTLE BODY**

Install a new gasket and the throttle body with the three bolts and nut.

Torque: 120 kg-cm (9 ft-lb, 12 N·m)

2. **CONNECT WATER HOSES**

3. **CONNECT VACUUM HOSES**



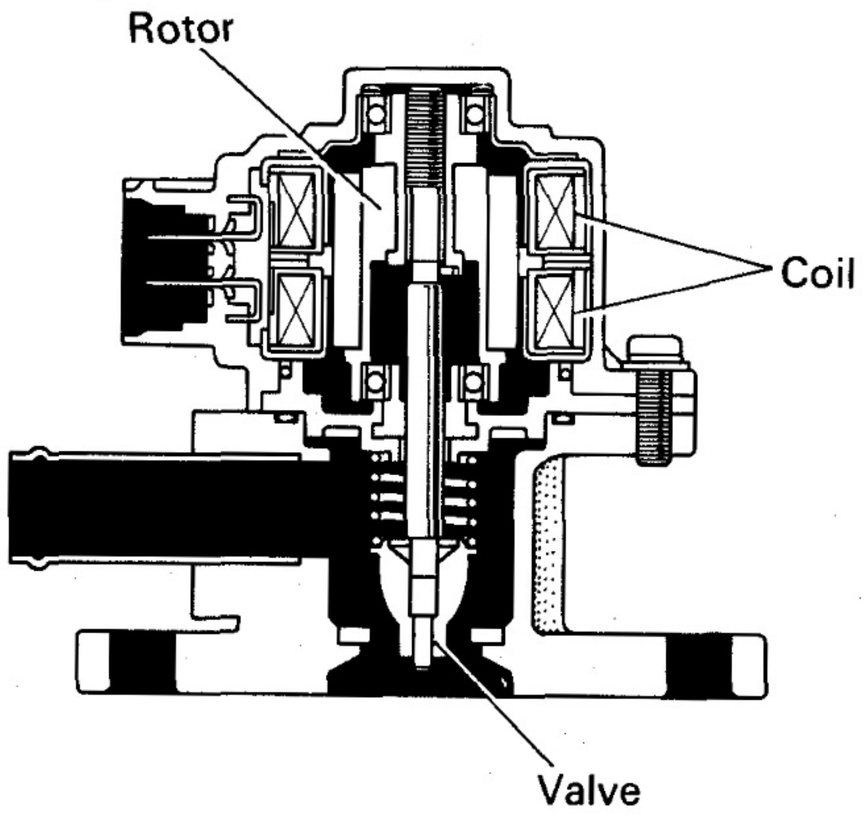
4. **CONNECT THROTTLE POSITION SENSOR CONNECTOR**

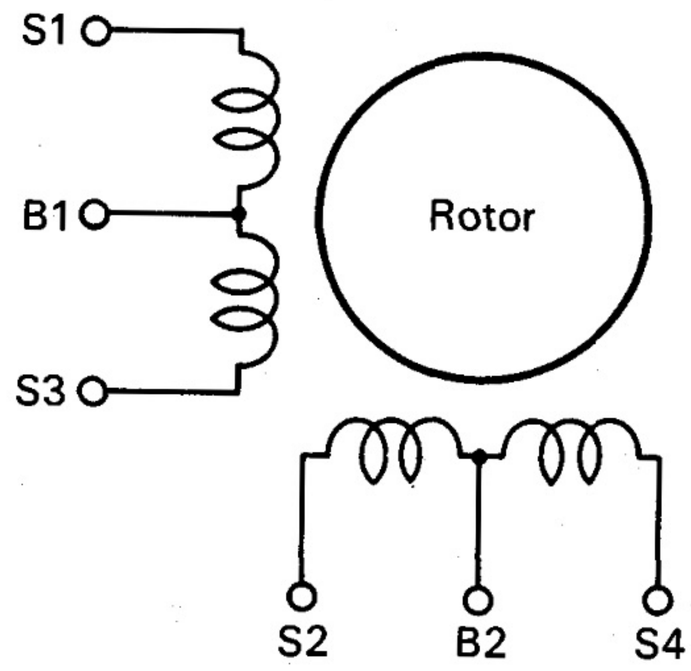
5. **CONNECT AIR CLEANER HOSE**

6. **CONNECT ACCELERATOR AND THROTTLE CABLES, AND ADJUST THEM**

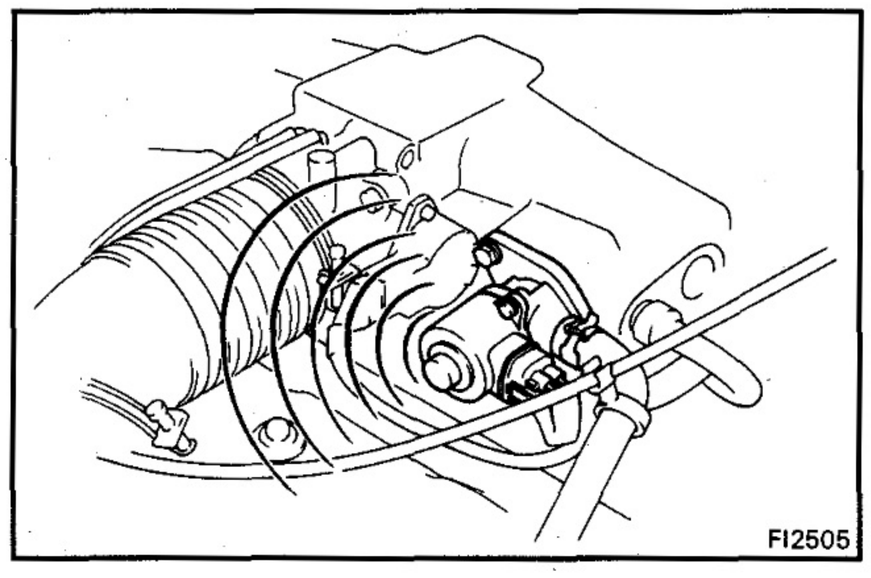
7. **FILL WITH ENGINE COOLANT**

Idle Speed Control (ISC) Valve





FI2372 FI1692



FI2505

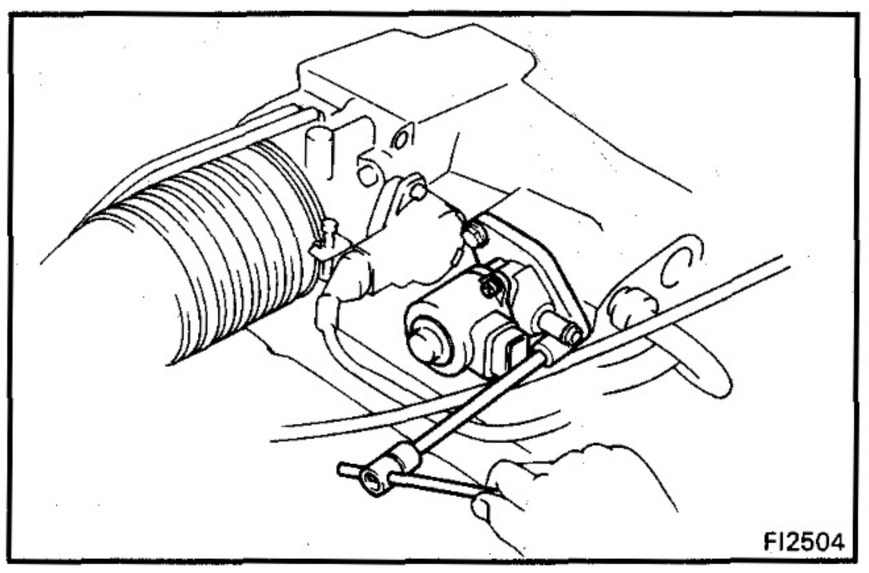
ON-VEHICLE INSPECTION

CHECK FOR OPERATING SOUND FROM ISC VALVE

Check that there is a clicking sound immediately after stopping the engine.

REMOVAL OF ISC VALVE

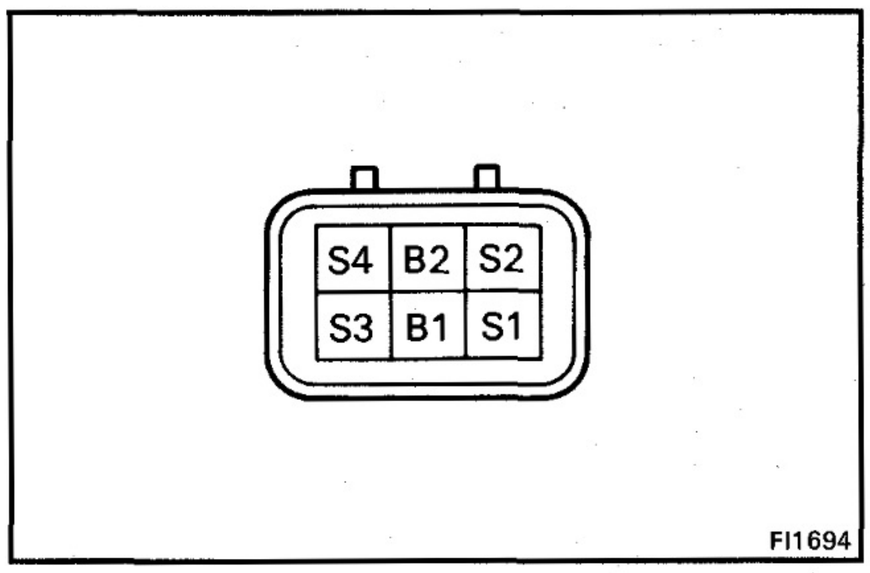
1. **DRAIN ENGINE COOLANT**
2. **DISCONNECT ISC VALVE CONNECTOR**
3. **DISCONNECT AIR AND TWO WATER BY-PASS HOSES**



FI2504

4. **REMOVE ISC VALVE**

Remove the two bolts, ISC valve and gasket.



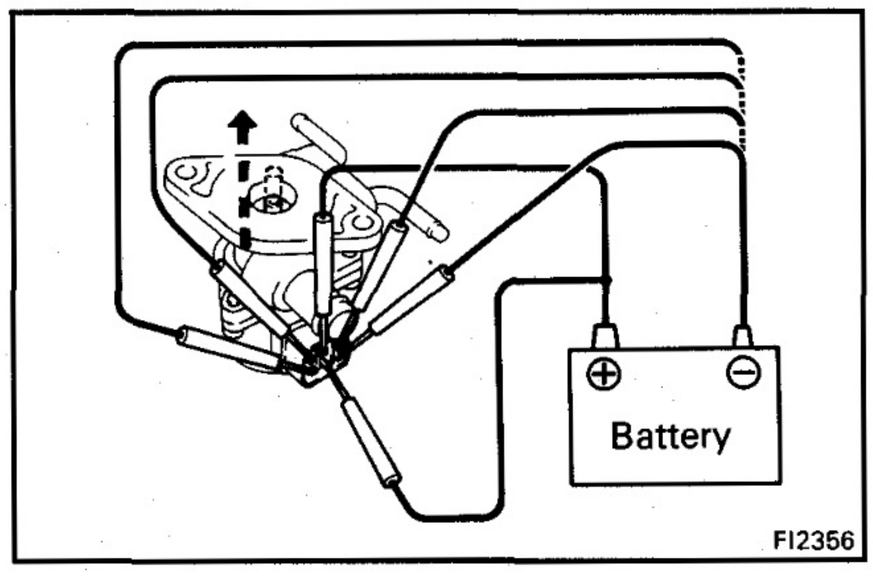
INSPECTION OF ISC VALVE

1. INSPECT ISC VALVE RESISTANCE

Using an ohmmeter, measure the resistance between terminal B1 – S1 or S3, and B2 – S2 or S4.

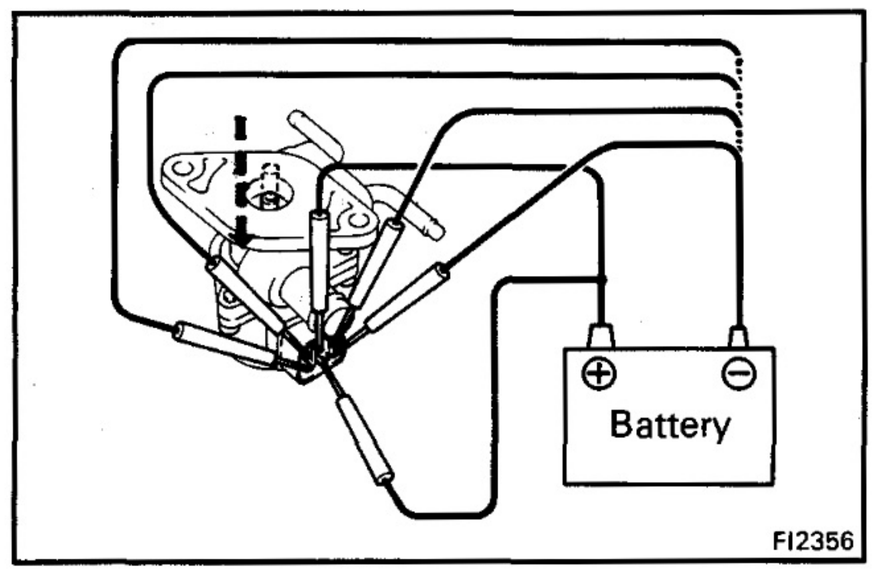
Resistance: B1 – S1 or S3 10 – 30 Ω
B2 – S2 or S4 10 – 30 Ω

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



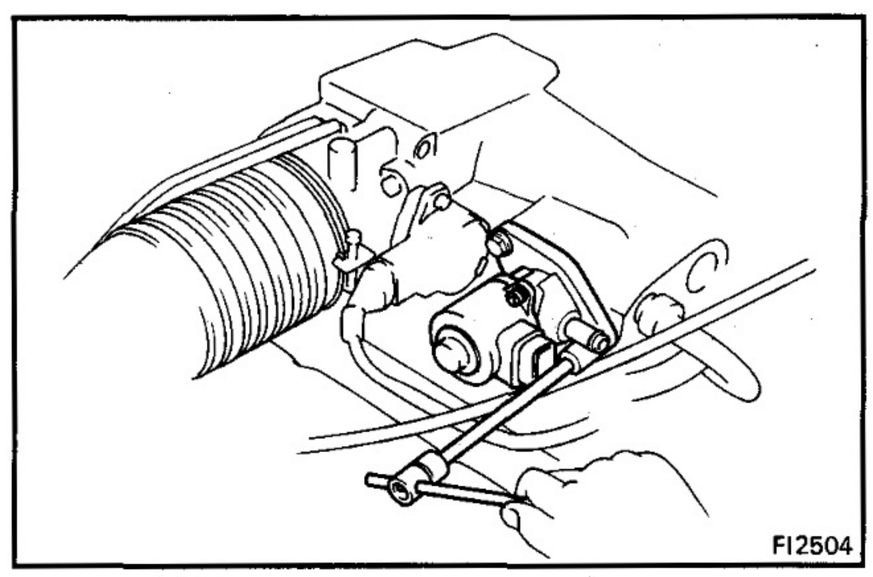
2. INSPECT ISC VALVE OPERATION

(a) Apply battery voltage to terminals B1 and B2, and while repeatedly grounding S1 – S2 – S3 – S4 – S1 in sequence, check that the valve moves toward the closed position.



(b) Apply battery voltage to terminals B1 and B2, and while repeatedly grounding S4 – S3 – S2 – S1 – S4 in sequence, check that the valve moves toward the opened position.

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



INSTALLATION OF ISC VALVE

1. INSTALL ISC VALVE

Install a new gasket and ISC valve with the two bolts.

Torque: 120 kg-cm (9 ft-lb, 12 N·m)

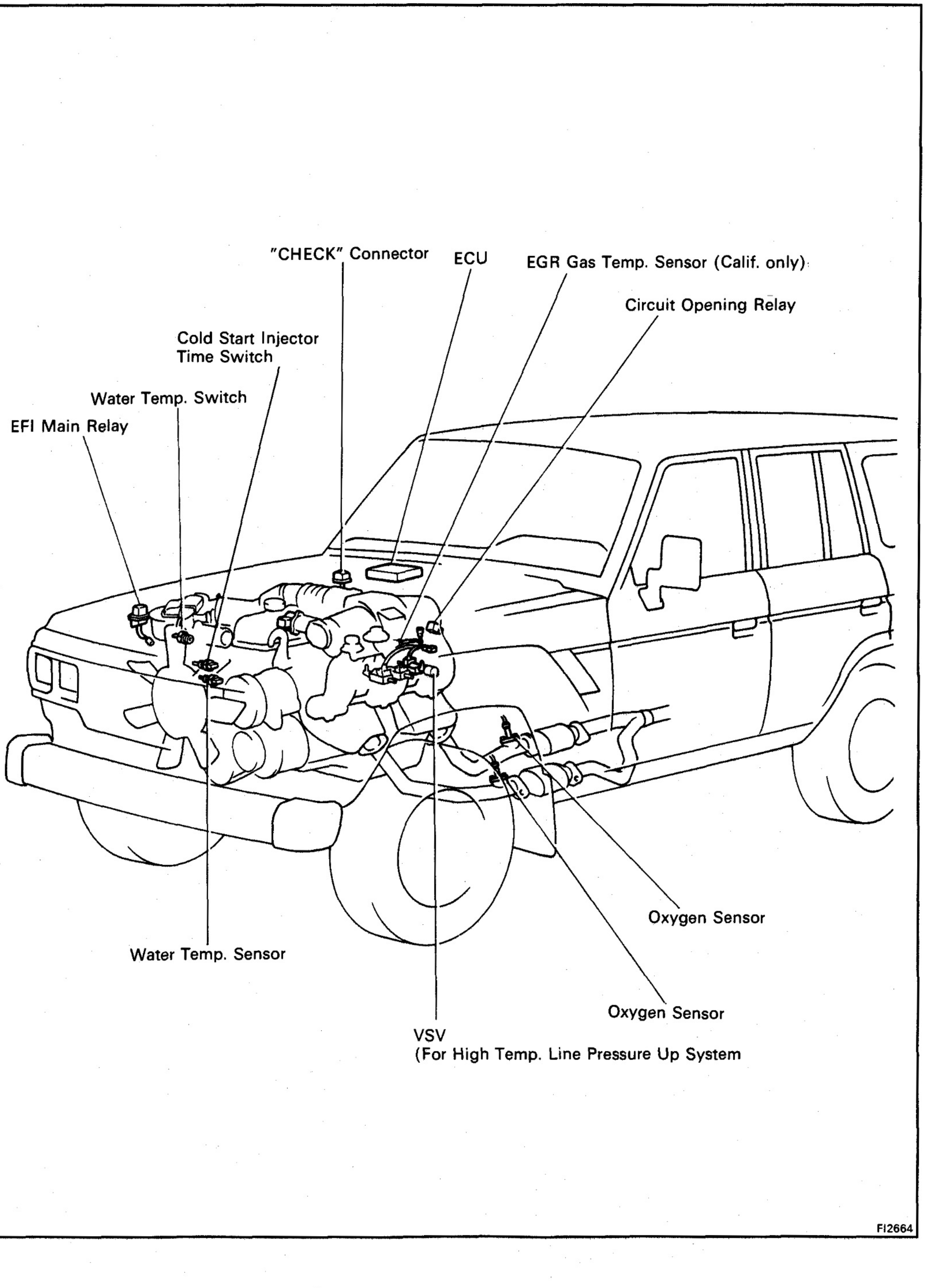
2. CONNECT TWO WATER BY-PASS AND AIR HOSES

3. CONNECT ISC VALVE CONNECTOR

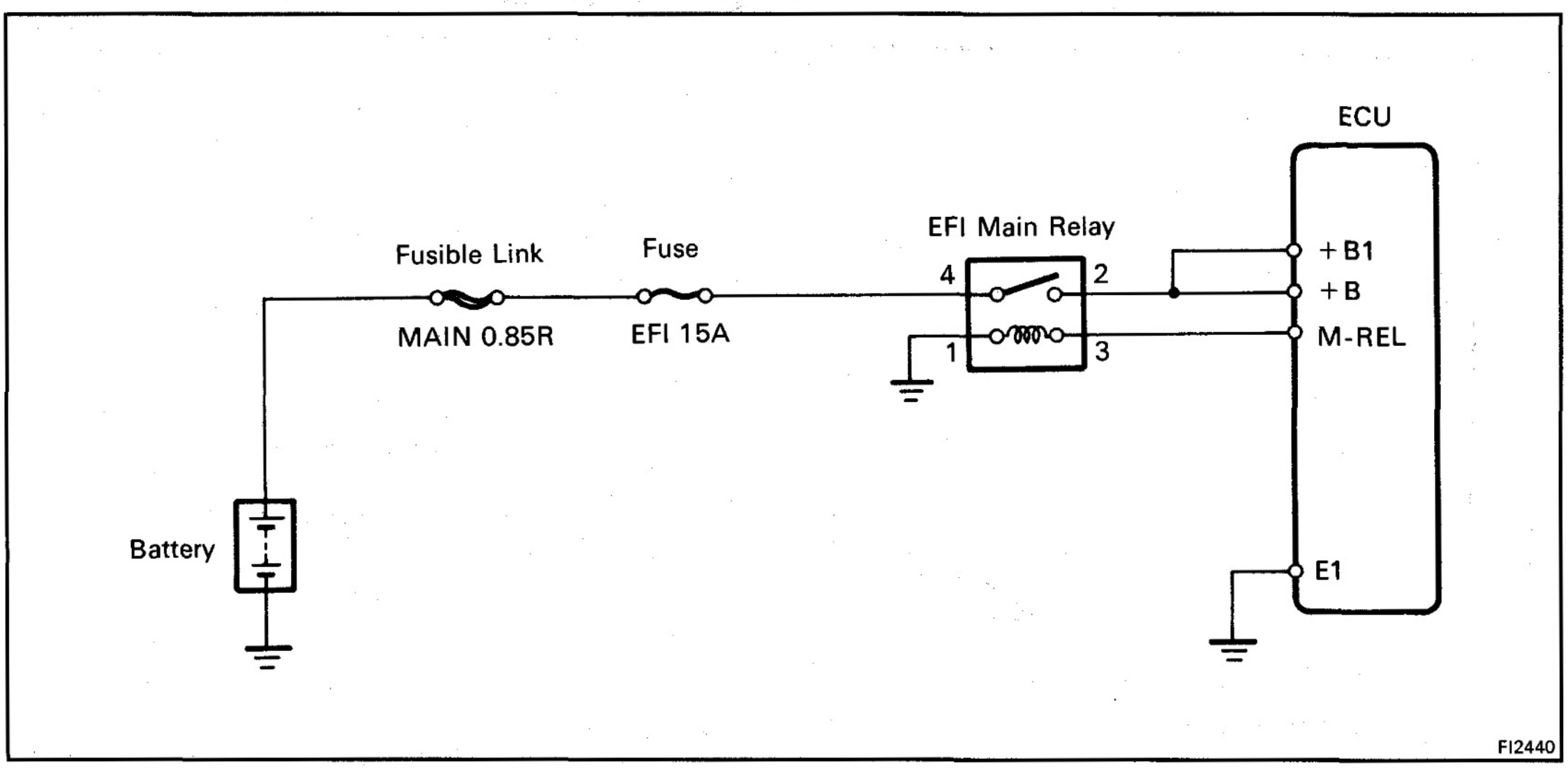
4. FILL WITH ENGINE COOLANT

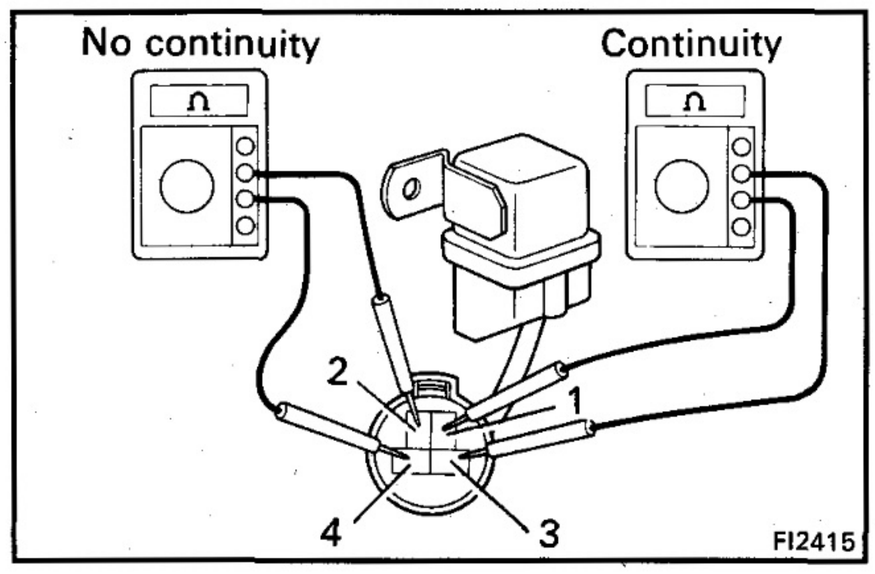
ELECTRONIC CONTROL SYSTEM

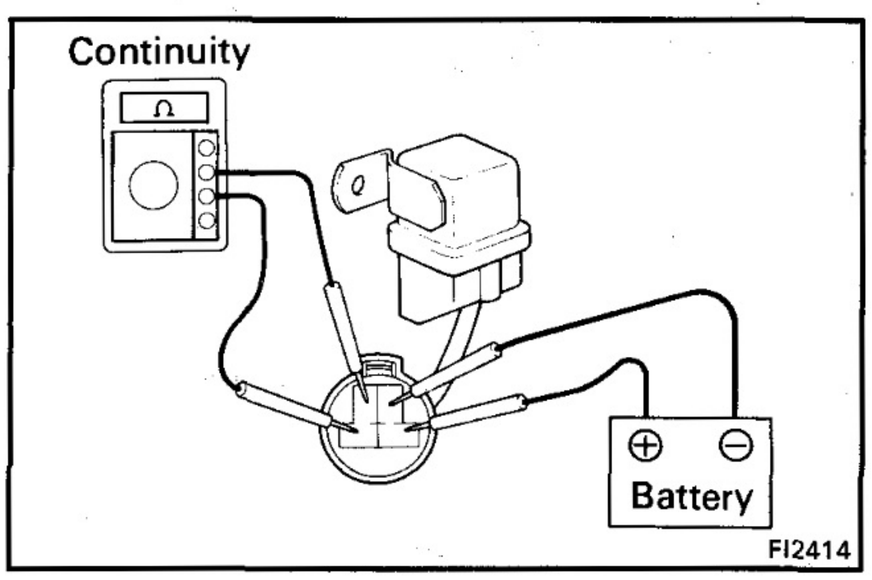
Location of Electronic Control Parts



EFI Main Relay







INSPECTION OF EFI MAIN RELAY

1. INSPECT RELAY CONTINUITY

(a) Using an ohmmeter, check that there is continuity between terminals 1 and 3.

(b) Check that there is no continuity between terminals 2 and 4.

If continuity is not as specified, replace the relay.

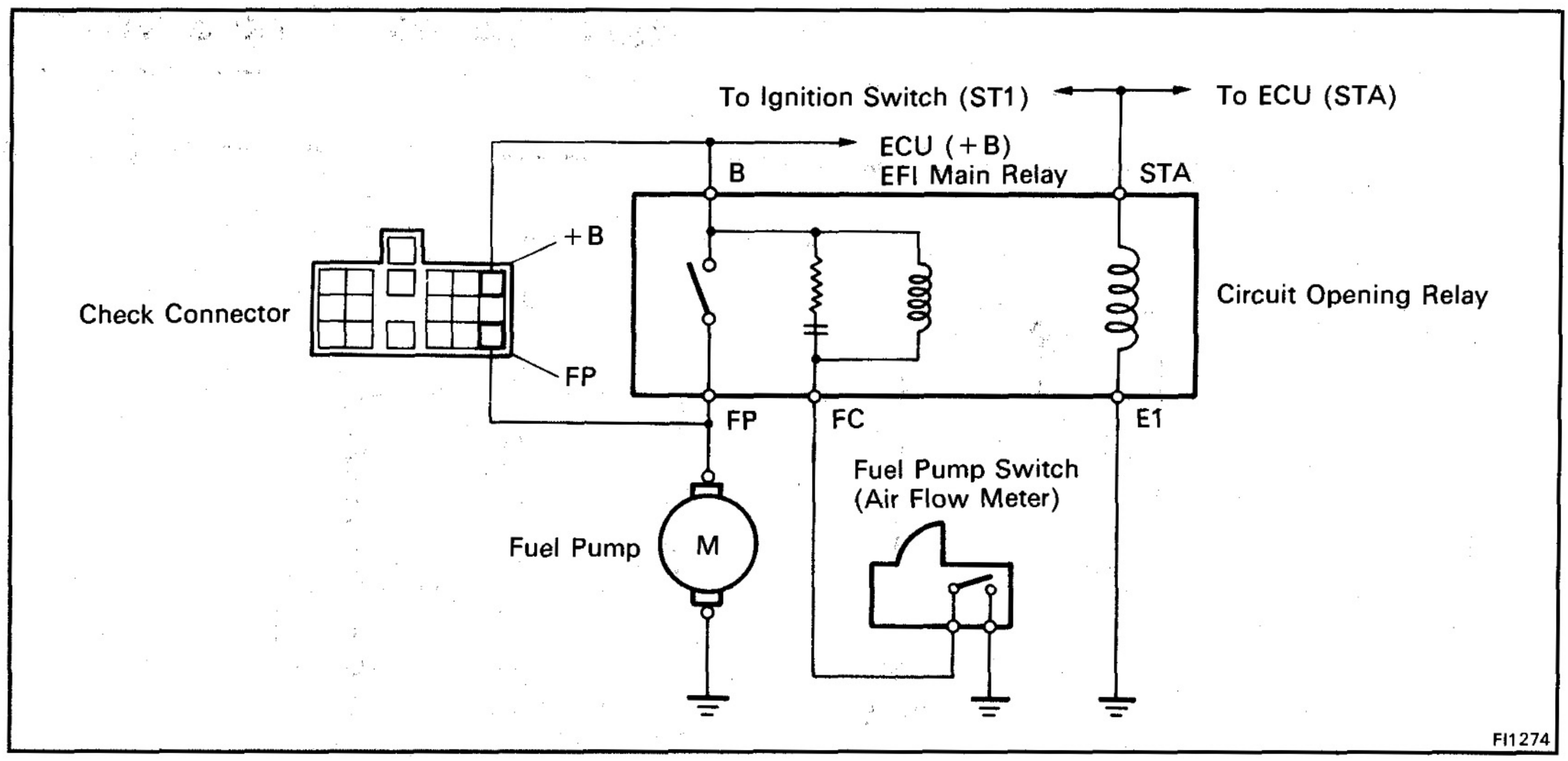
2. INSPECT RELAY OPERATION

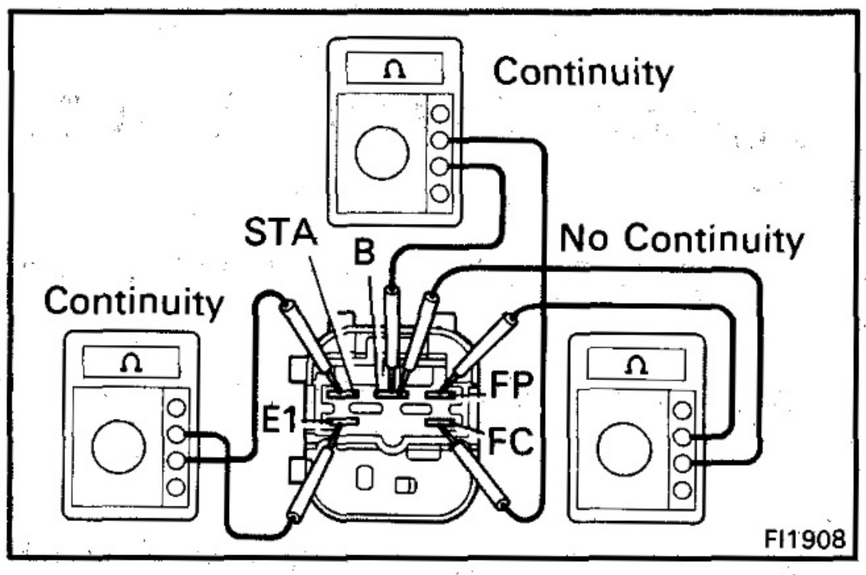
(a) Apply battery voltage across terminals 1 and 3.

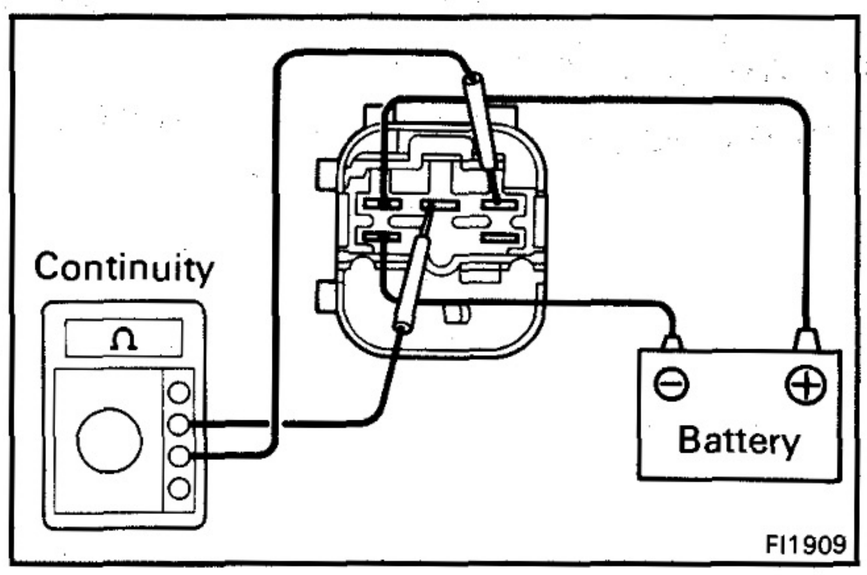
(b) Using an ohmmeter, check that there is continuity between terminals 2 and 4.

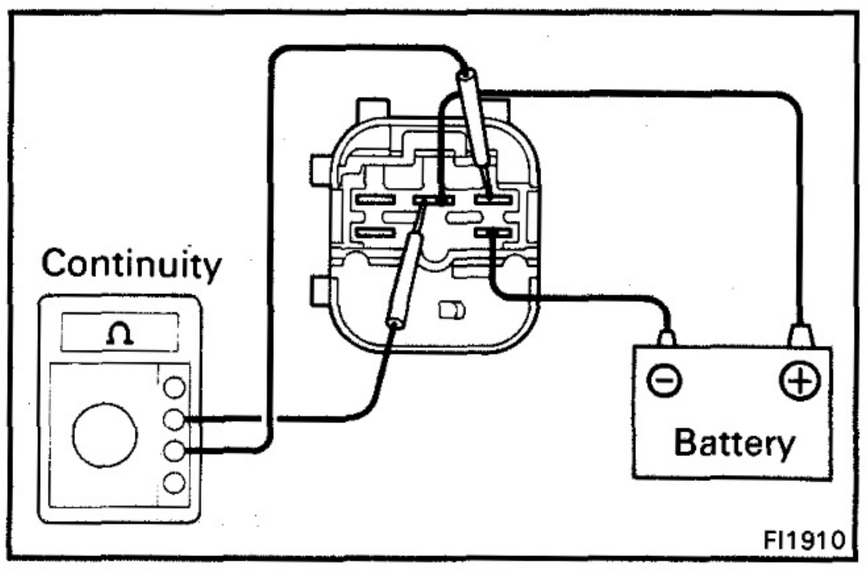
If operation is not as specified, replace the relay.

Circuit Opening Relay









INSPECTION OF CIRCUIT OPENING RELAY

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.

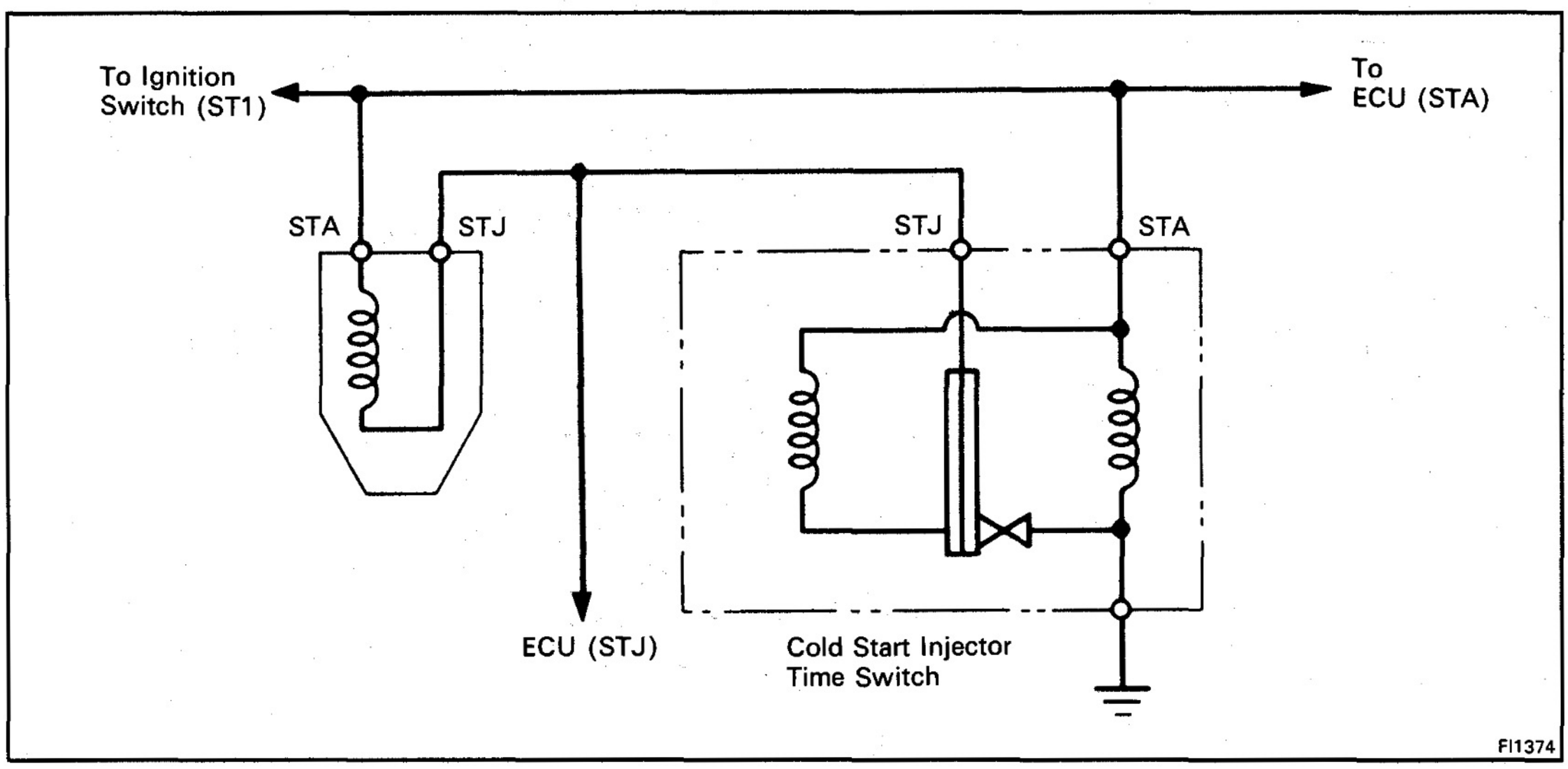
(b) Using an ohmmeter, check that there is continuity between terminals B and FP.

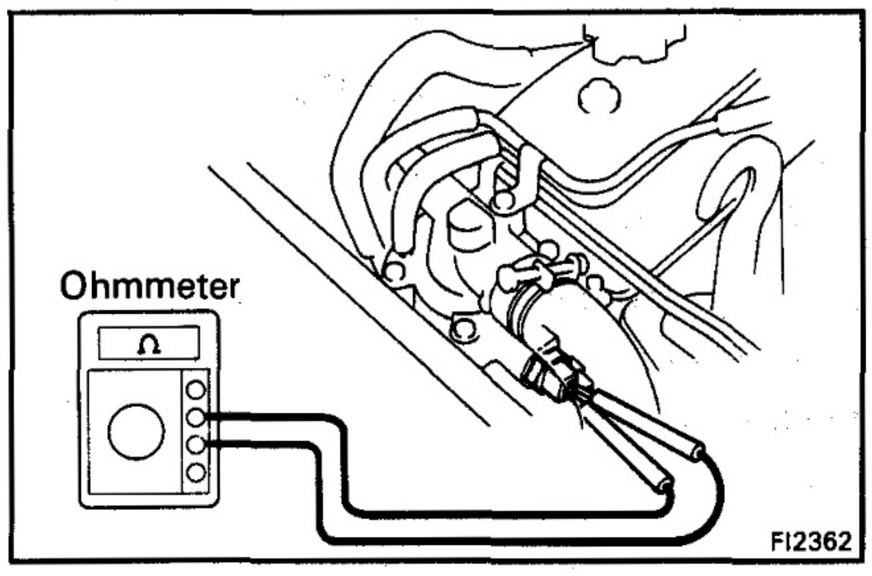
(c) Apply battery voltage across terminals B and FC.

(d) Check that there is continuity between terminals B and FP.

If operation is not as specified, replace the relay.

Cold Start Injector Time Switch





INSPECTION OF COLD START INJECTOR TIME SWITCH

INSPECT RESISTANCE OF COLD START INJECTOR TIME SWITCH

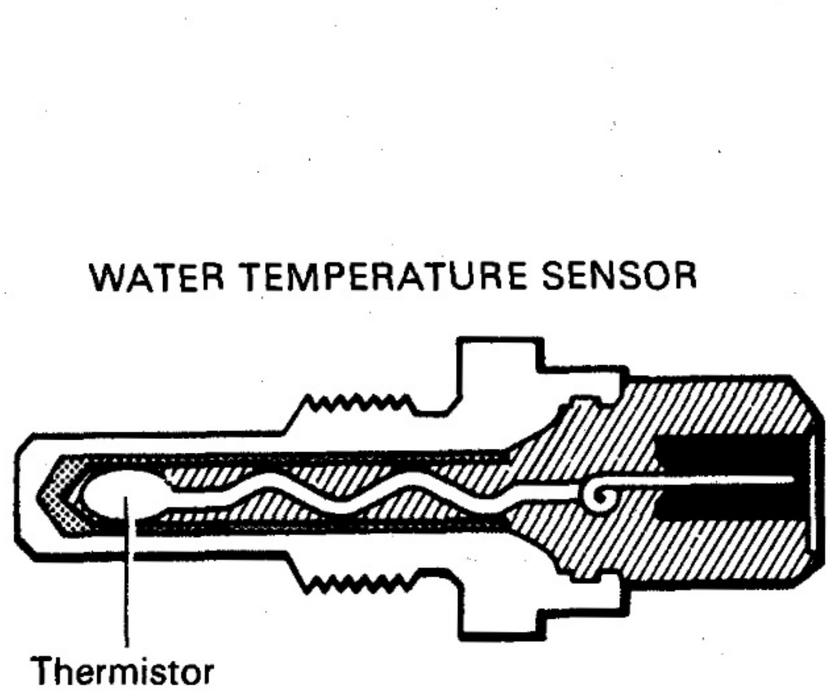
Using an ohmmeter, measure the resistance between each terminal.

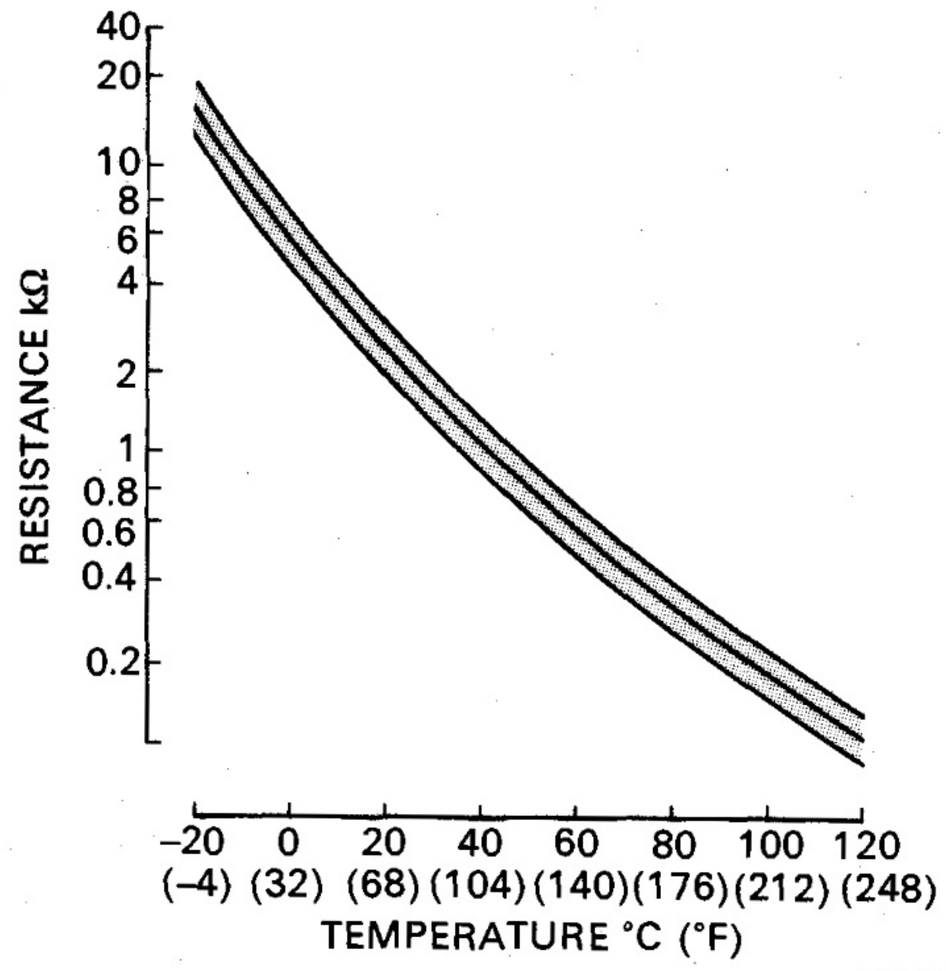
Resistance:

STA – STJ	**30 – 50 Ω below 15°C (59°F)**
	70 – 90 Ω above 30°C (86°F)
STA – Ground	**30 – 90 Ω**

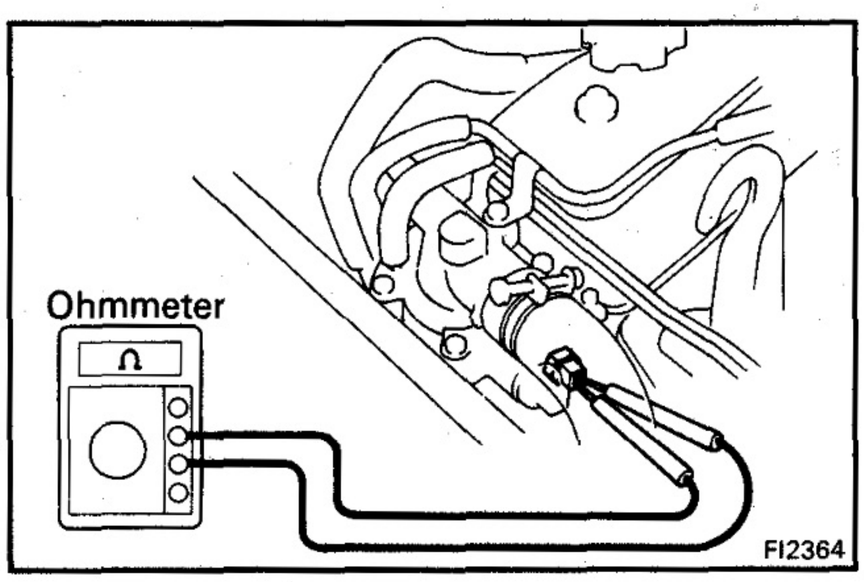
If the resistance is not as specified, replace the switch.

Water Temperature Sensor





FI0515 FI0709



INSPECTION OF WATER TEMPERATURE SENSOR

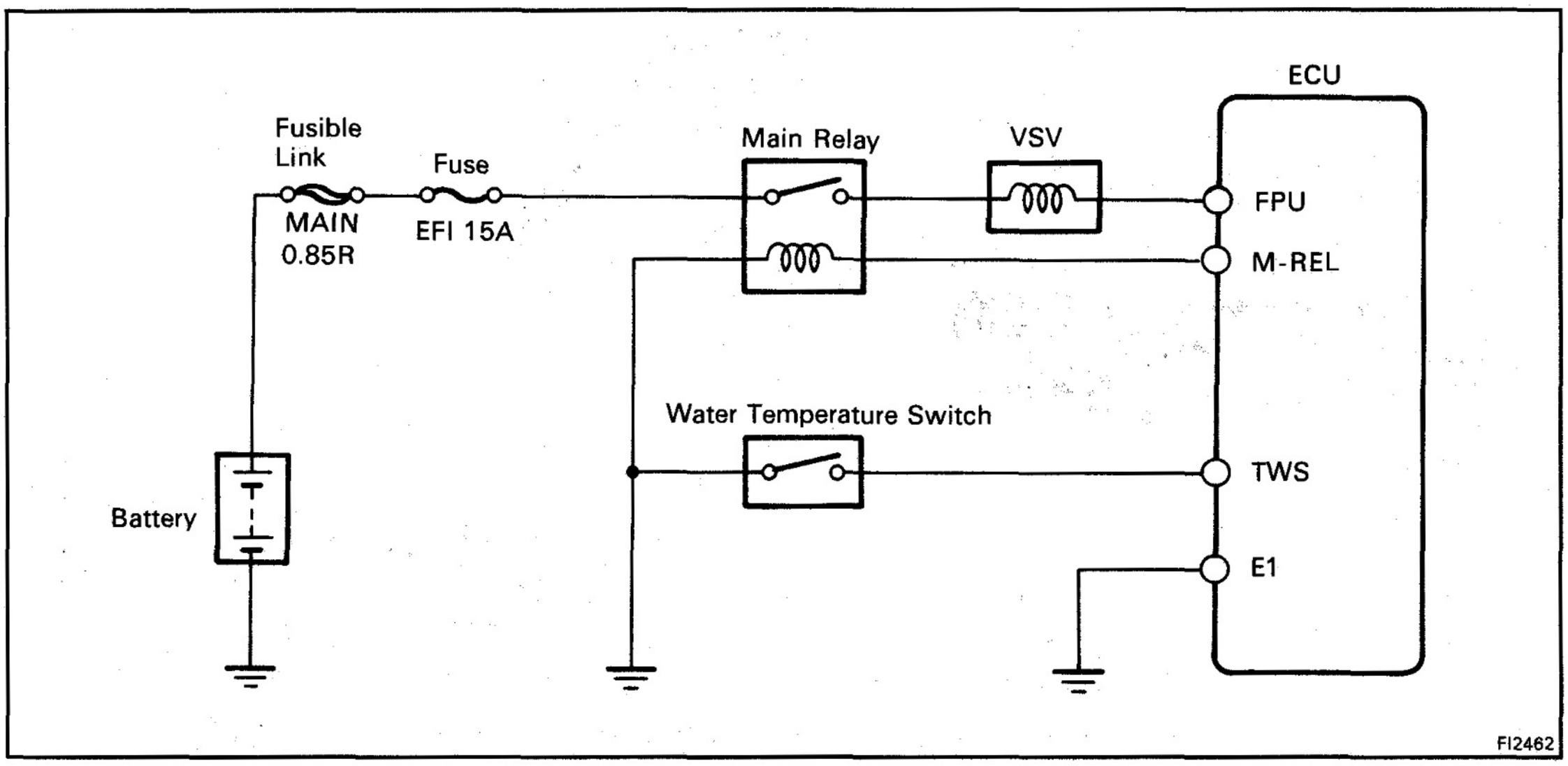
INSPECT RESISTANCE OF WATER TEMPERATURE SENSOR

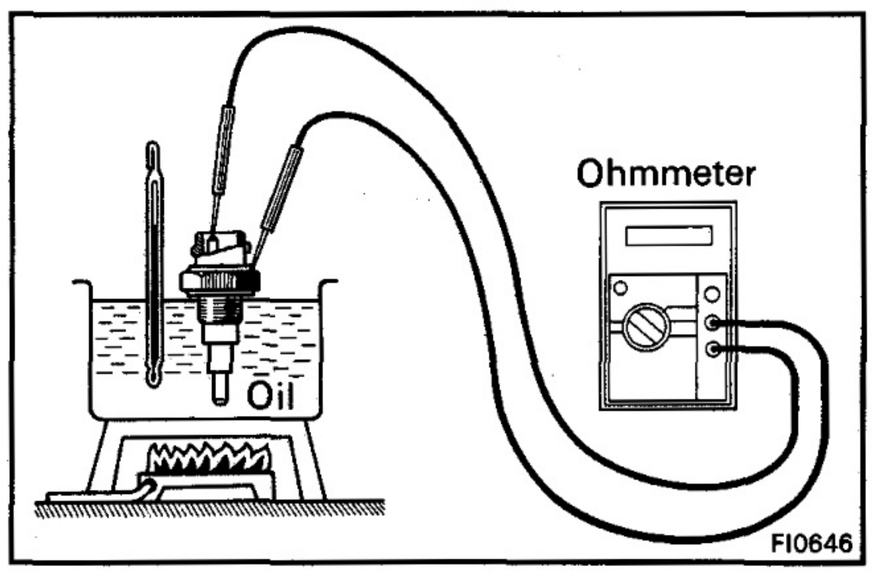
Using an ohmmeter, measure the resistance between the terminals.

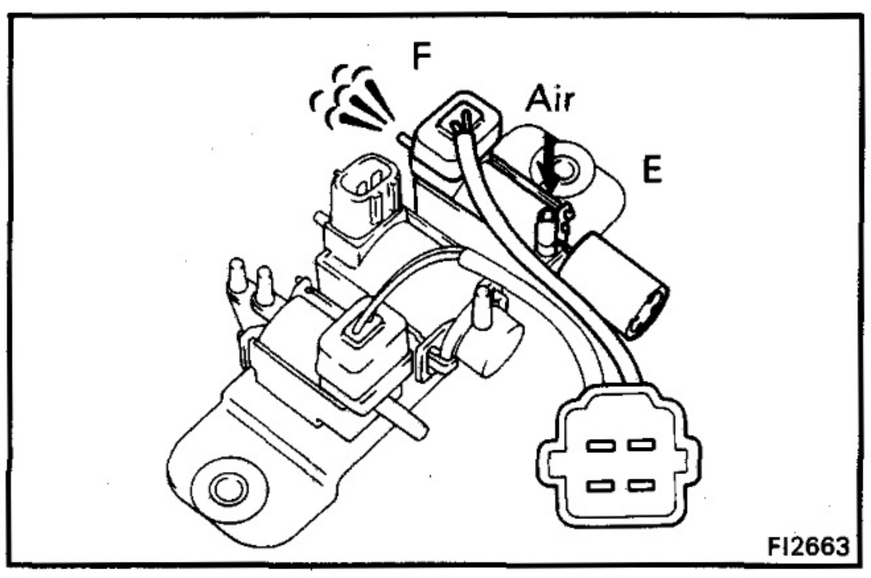
Resistance: Refer to chart

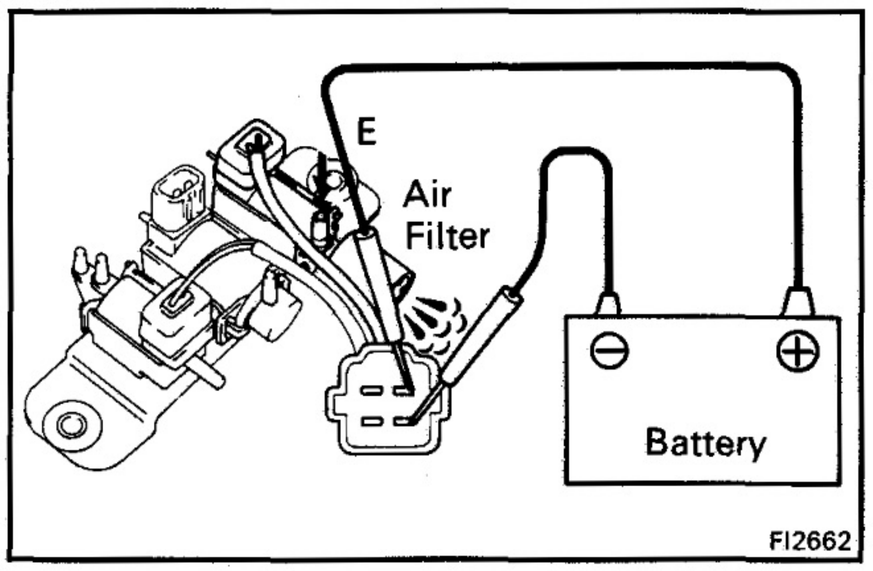
If the resistance is not as specified, replace the sensor.

High Temperature Line Pressure Up System









INSPECTION OF HIGH TEMPERATURE LINE UP SYSTEM

1. INSPECT WATER TEMPERATURE SWITCH

(a) Using an ohmmeter, check that there is no continuity between the terminal and body when the oil temperature is below 98°C (208°F).

(b) Check that there is continuity between the terminal and body when the oil temperature is above 105°C (221°F).

If operation is not as specified, replace the switch.

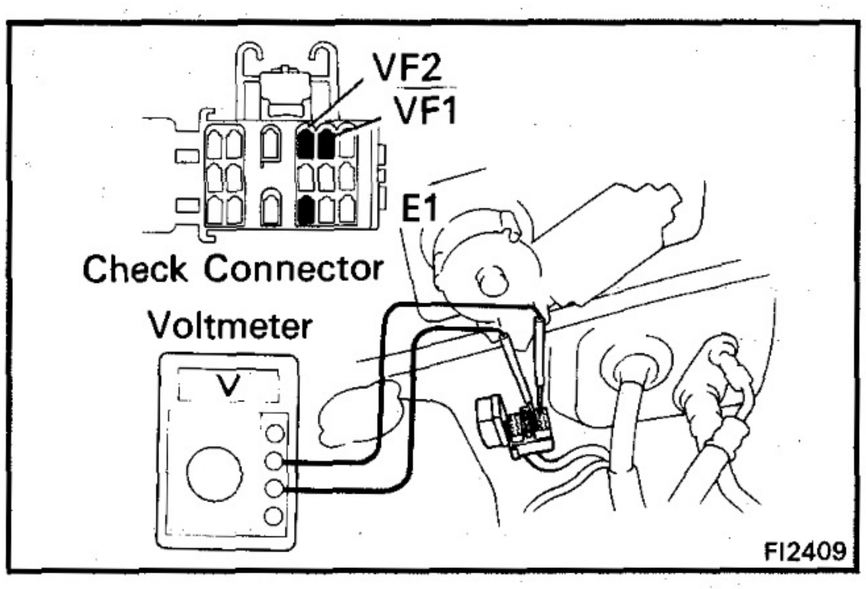
2. INSPECT VSV

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

(b) Apply battery voltage across the terminals.

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

If operation is not as specified, replace the VSV.



Oxygen Sensors

INSPECTION OF OXYGEN SENSOR

1. WARM UP ENGINE

Allow the engine to reach normal operating temperature.

2. INSPECT FEEDBACK VOLTAGE

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:

Warm up the oxygen sensor with the engine at 2,500 rpm for approx. 120 seconds.

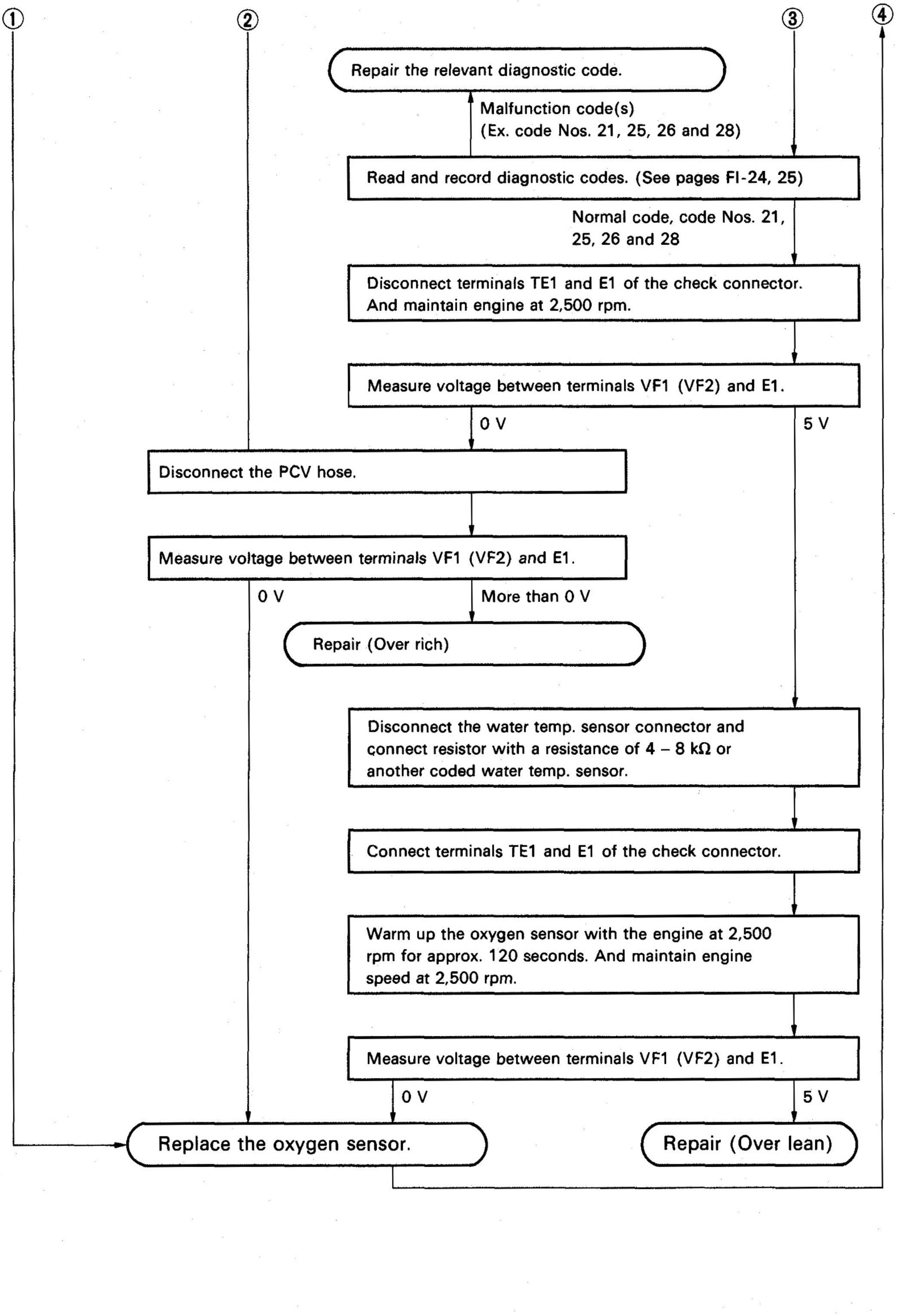
Connect terminals TE1 and E1 of the check connector. And maintain engine speed at 2,500 rpm.

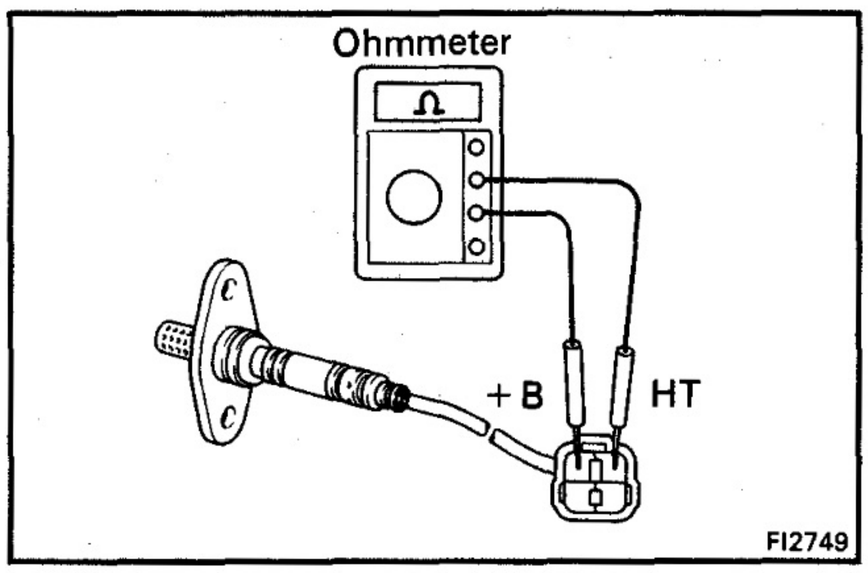
Check the number of times the voltmeter needle fluctuates in 10 seconds.

- Less than 8 times → Warm up the oxygen sensor with the engine at 2,500 rpm for approx. 120 seconds. And maintain engine at 2,500 rpm.
  - Check the number of times the voltmeter needle fluctuates in 10 seconds.
    - Less than 8 times → Disconnect terminals TE1 and E1 of the check connector. And maintain engine speed at 2,500 rpm.
      - Measure voltage between terminals VF1 (VF2) and E1
        - More than 0 V → ①
        - 0 V → Read and record diagnostic codes. (See pages FI-24, 25)
          - Normal code, code Nos. 21, 25, 26 and 28 → ②
          - Malfunction code(s) (Ex. code Nos. 21, 25, 26 and 28) → Repair the relevant diagnostic code.
    - 8 times or more → Normal
    - Zero → ③
- 8 times or more → Normal
- Zero → Replace the ECU. → After replacing the oxygen sensor → Zero again → Check the number of times the voltmeter needle fluctuates in 10 seconds. → ④

CONTINUED ON PAGE FI-76

CONTINUED FROM PAGE FI-75



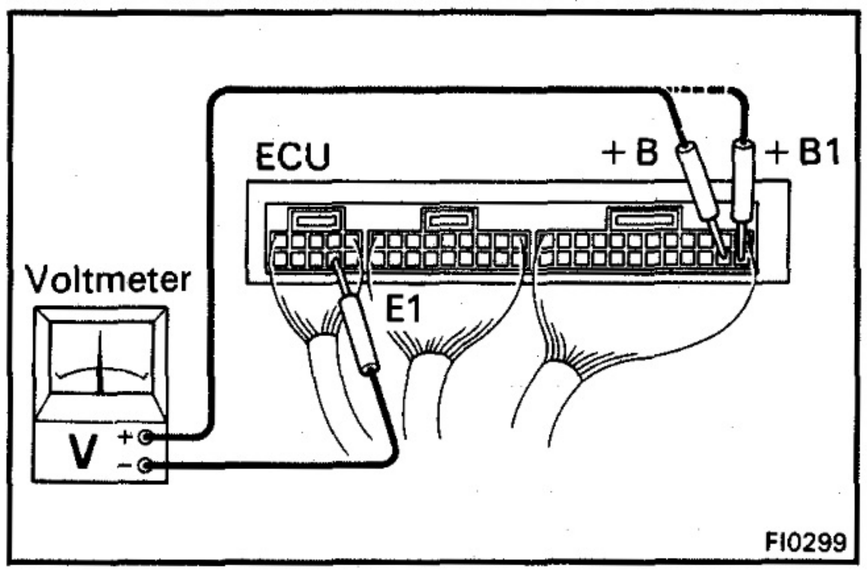


3. INSPECT HEATER RESISTANCE OF OXYGEN SENSOR

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

Resistance (Cold): 5.1 – 6.3 Ω

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



Electronic Controlled Unit (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. INSPECT VOLTAGE OF 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 11V or more when the ignition switch is ON.

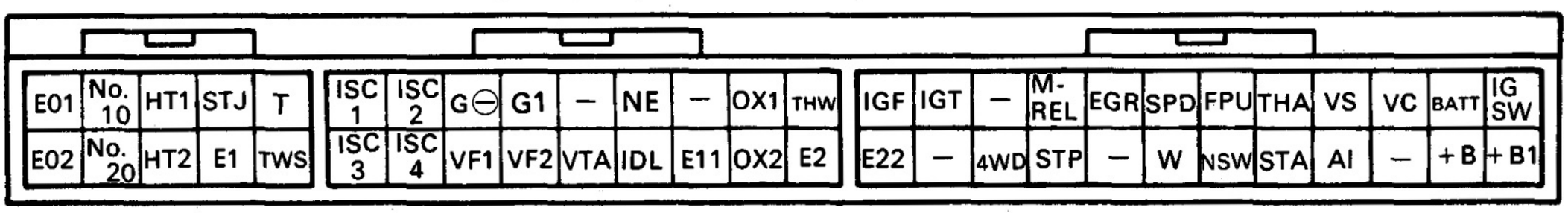
Voltage at ECU Wiring Connectors

Terminals	STD Voltage	Condition	
BATT – E1	10 – 14	—	
IG SW – E1		Ignition switch ON	
M-REL – E1			
+B (+B1) – E1			
IDL – E2	4 – 6	Ignition switch ON	Throttle valve open
VC – E2	4 – 6		—
VTA – E2	0.1 – 1.0		Throttle valve fully closed
	4 – 5		Throttle valve fully open
VC – E22	4 – 6	Ignition switch ON	—
VS – E22	4 – 5		Measuring plate fully closed
	0.02 – 0.08		Measuring plate fully open
	2 – 4	Idling	
	0.3 – 1.0	3,000 rpm	

Voltage at ECU Wiring Connectors (Cont'd)

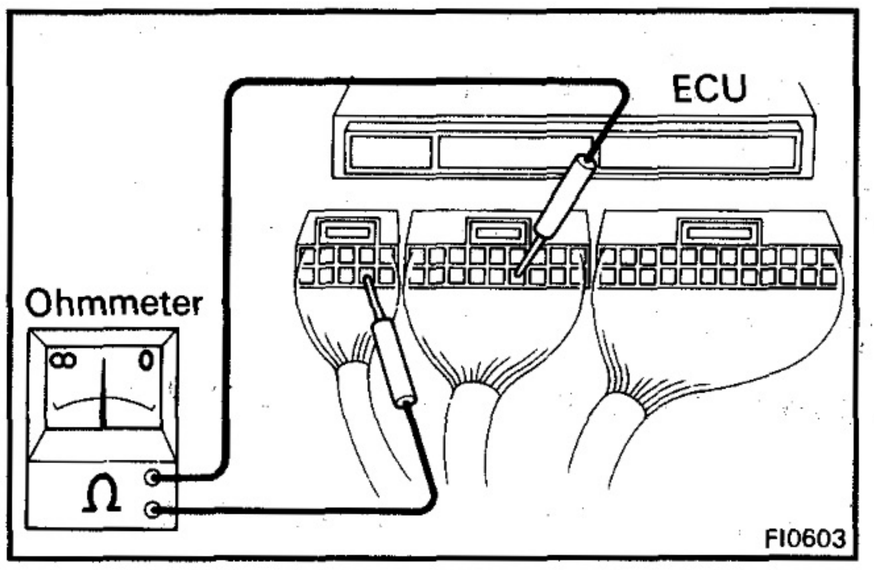
Terminals	STD Voltage	Condition	
THA – E2	1 – 3	Ignition switch ON	Intake air temperature 20°C (68°F)
THW – E2	0.1 – 1.0	Ignition switch ON	Coolant temperature 80°C (176°F)
No. 10 E01 ≀ – No. 20 E02	10 – 14	Ignition switch ON	
STA – E1	6 – 14	Cranking	
ISC1 ≀ – E1 ISC4	10 – 14	Ignition switch ON	
IGT – E1	0.7 – 1.0	Idling	
W – E1	10 – 14	No trouble ("CHECK" engine warning light off) and engine running	
T – E1	4 – 6	Ignition switch ON	Check connector TE1-E1 not connect
	0		Check connector TE1-E1 connect
NSW – E1	0	Ignition switch ON	Shift position P or N range
	10 – 14		Ex. P or N range
4WD – E1	10 – 14	Ignition switch ON	4WD switch ON
	0		4WD switch OFF
STP – E1	10 – 14	Ignition switch ON	Stop light switch ON
	0		Stop light switch OFF

ECU Terminals



* FOR 54 PIN ECU PLEASE REFER TO PP. FI-28

FI0574



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.

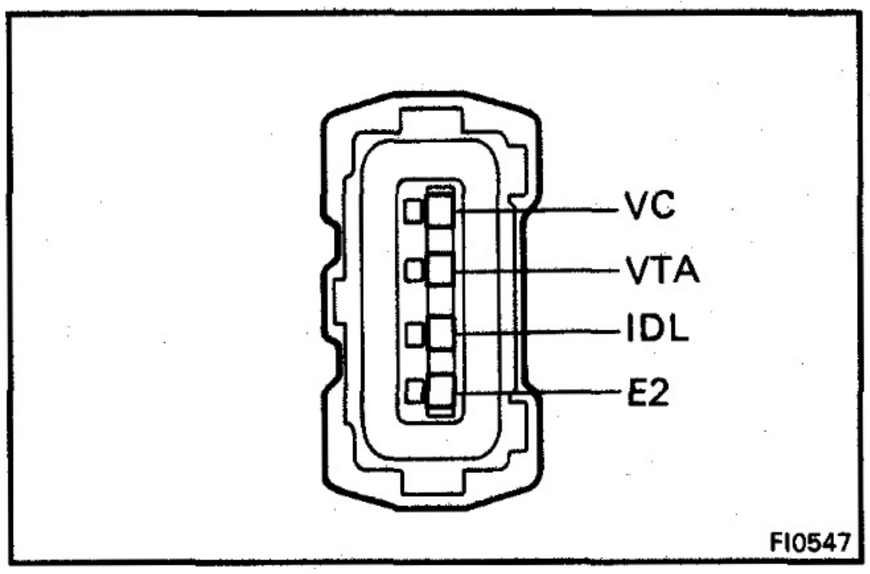
Resistance of ECU Wiring Connectors

Terminals	Condition	Resistance (Ω)
IDL – E2	Throttle valve open	∞
	Throttle valve fully closed	Less than 2,300
VTA – E2	Throttle valve fully open	3,500 – 10,300
	Throttle valve fully closed	300 – 6,300
VC – E2	—	4,250 – 8,250
VC – E22	—	200 – 400
VS – E22	Measuring plate fully closed	200 – 600
	Measuring plate fully open	20 – 1,200
THA – E2	Intake air 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⊖	—	
ISC1, ISC2 ISC3, ISC4 – +B	—	10 – 30

ECU Terminals

E01	No. 10	HT1	STJ	T	ISC 1	ISC 2	G⊖	G1	–	NE	–	OX1	THW	IGF	IGT	–	M-REL	EGR	SPD	FPU	THA	VS	VC	BATT	IG SW
E02	No. 20	HT2	E1	TWS	ISC 3	ISC 4	VF1	VF2	VTA	IDL	E11	OX2	E2	E22	–	4WD	STP	–	W	NSW	STA	AI	–	+B	+B1

FI0574



Fuel Cut RPM

INSPECTION OF FUEL CUT RPM

1. WARM UP ENGINE

Allow the engine to reach normal operating temperature.

2. INSPECT FUEL CUT RPM

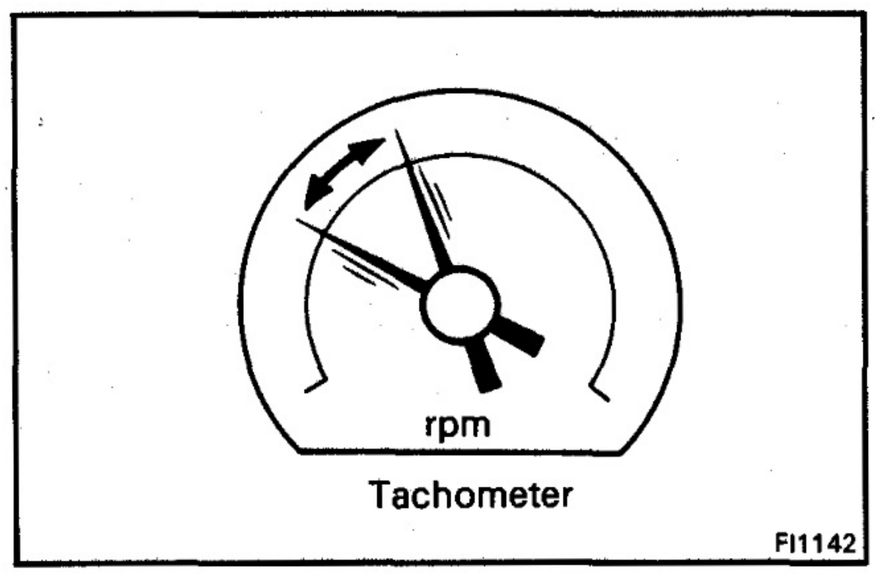
(a) Disconnect the connector from the throttle position sensor.

(b) Connect terminals IDL and E2 of the wiring connector.

(c) 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.

Fuel cut rpm: 1,300 rpm
Fuel return rpm: 1,000 rpm



COOLING SYSTEM

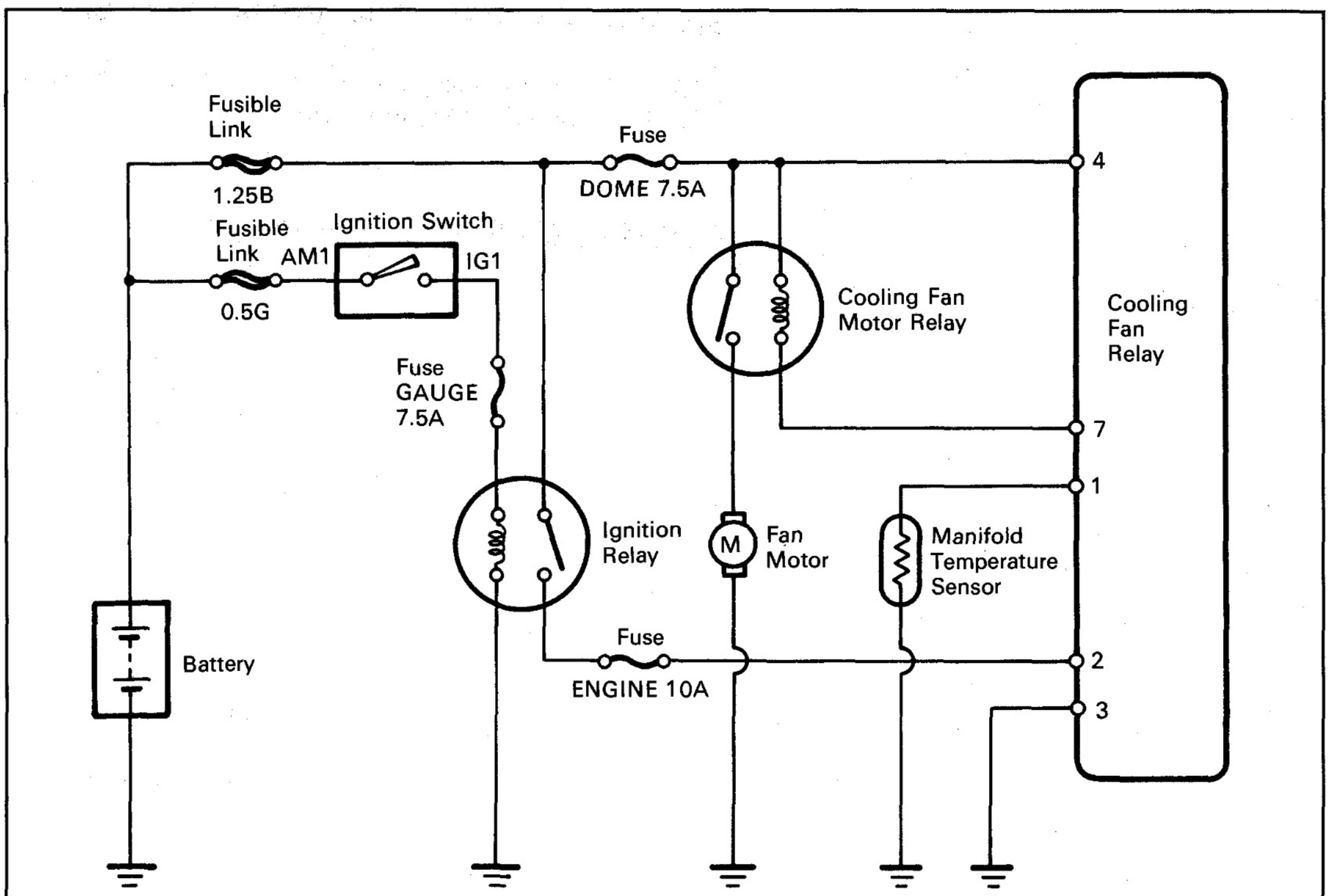
REFER TO 3F ENGINE REPAIR MANUAL (Pub. No. 36253E)

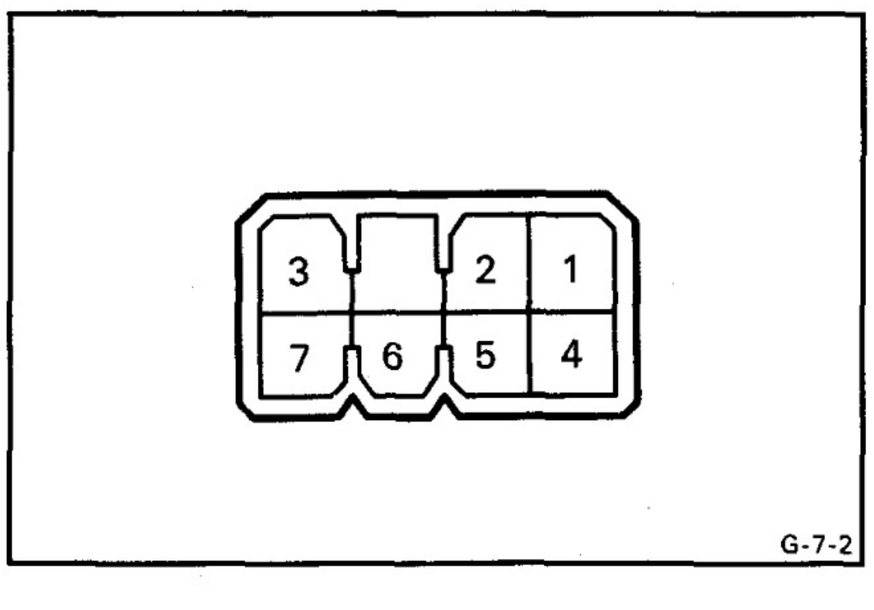
NOTE: The following pages contain only the points which differ from the above listed manual.

	Page
ENGINE COMPARTMENT COOLING FAN	**CO-2**

ENGINE COMPARTMENT COOLING FAN

ENGINE COMPARTMENT COOLING FAN CIRCUIT





INSPECTION OF ENGINE COMPARTMENT COOLING FAN COMPONENTS

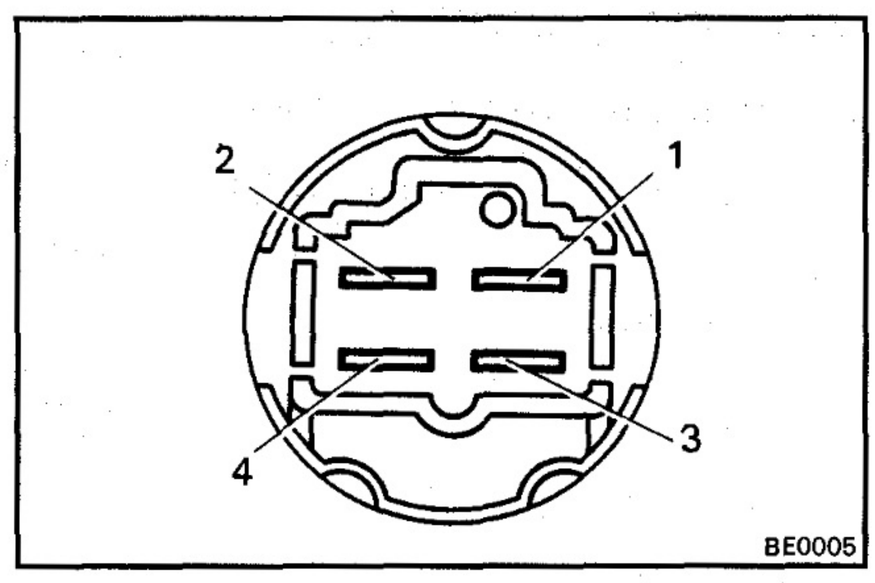
Cooling Fan Relay

INSPECT COOLING FAN RELAY CIRCUIT

(a) Remove the driver's cowl side trim.

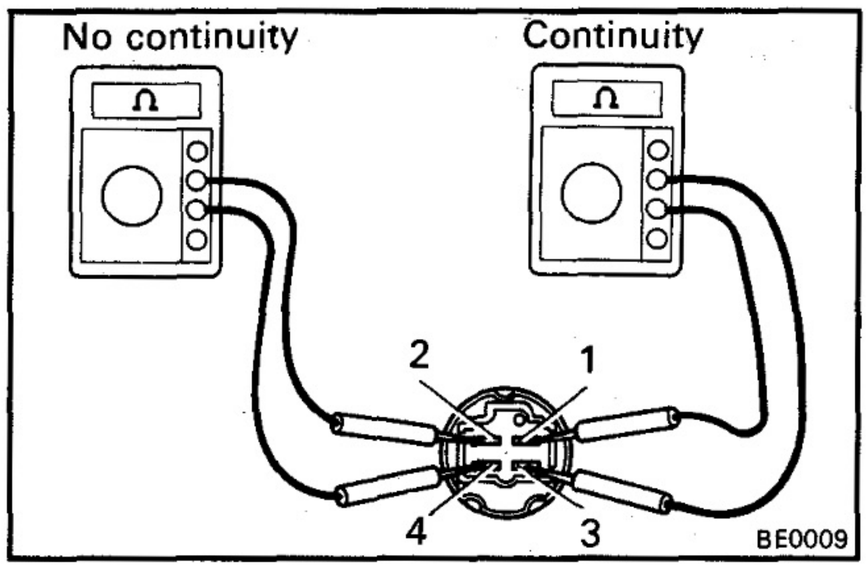
(b) Disconnect the relay connector and inspect the connector on wire harness side as shown in the chart below.

Check for	Between terminals	Condition	Specified value
Continuity	1 – Body ground	Always	Continuity
Voltage	2 – Body ground	Ignition switch ON	Battery voltage
Continuity	3 – Body ground	Always	Continuity
Voltage	4 – Body ground	Always	Battery voltage
Voltage	7 – Body ground	Fan motor does not operate	Battery voltage



Cooling Fan Motor Relay

LOCATION: Inside of the driver's cowl side trim.



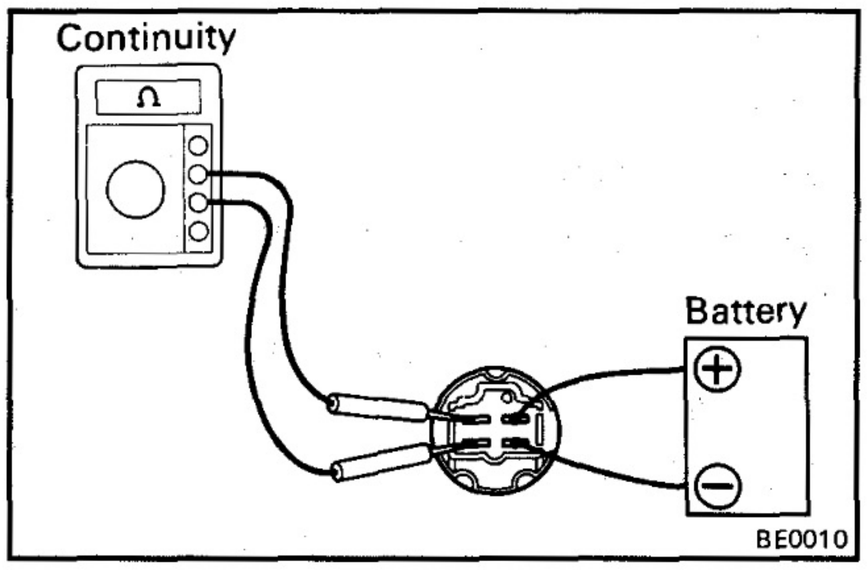
INSPECT COOLING FAN MOTOR RELAY

A. Inspect relay continuity

(a) Check that there is continuity between terminals 1 and 3.

(b) Check that there is no continuity between terminals 2 and 4.

If continuity is not as specified, replace the relay.

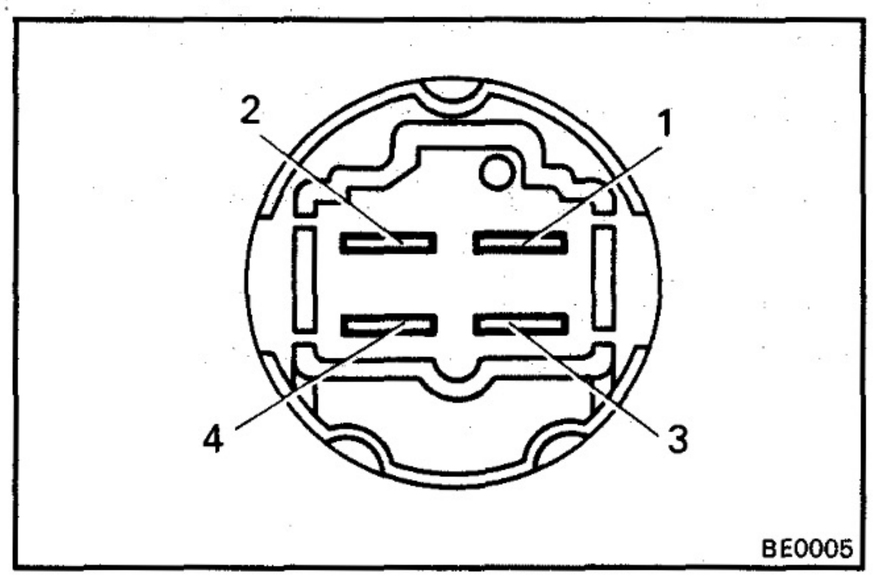


B. Inspect relay operation

(a) Apply battery voltage across terminals 1 and 3.

(b) Check that there is continuity between terminals 2 and 4.

If operation is not as described, replace the relay.

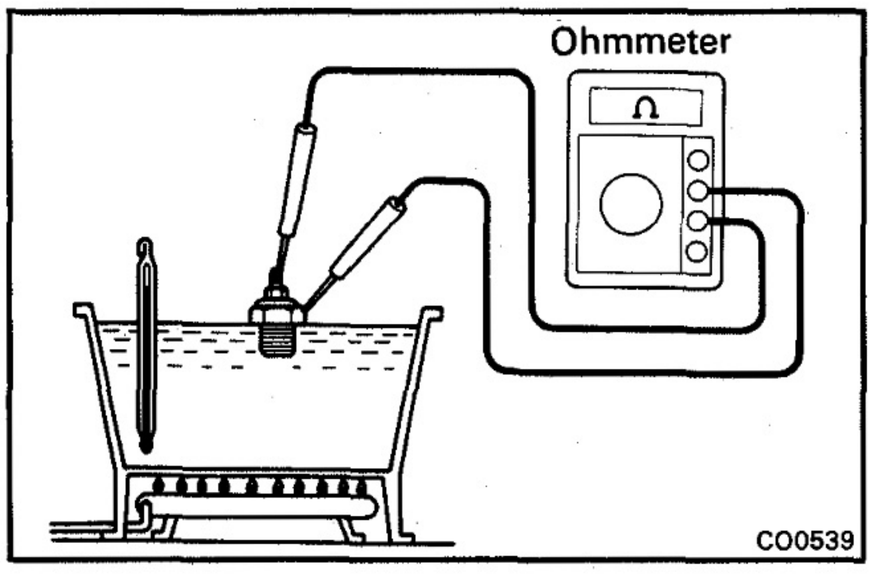


Ignition relay

LOCATION: Under the instrument panel on the driver's side.

INSPECT IGNITION RELAY

(Refer to the cooling fan motor relay)



Manifold Temperature Sensor

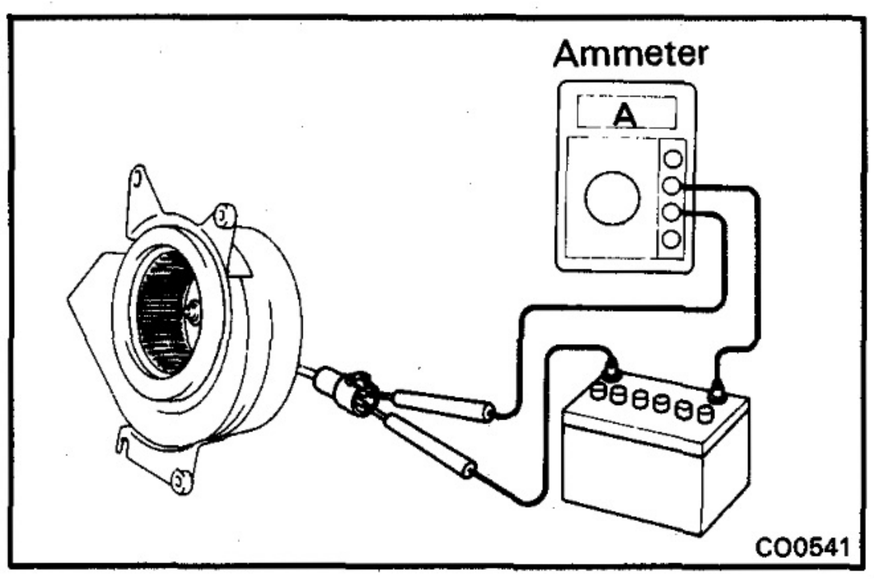
LOCATION: Near the intake chamber.

INSPECT MANIFOLD TEMPERATURE SENSOR

Using an ohmmeter, measure the resistance of the temperature sensor terminals.

Oil temperature °C (°F)	Resistance (Ω)
90°C (194°F)	Approx. 4 kΩ
110°C (230°F)	Approx. 2 kΩ

If each resistance value is not as shown in the table above, replace the temperature sensor.



Fan Motor

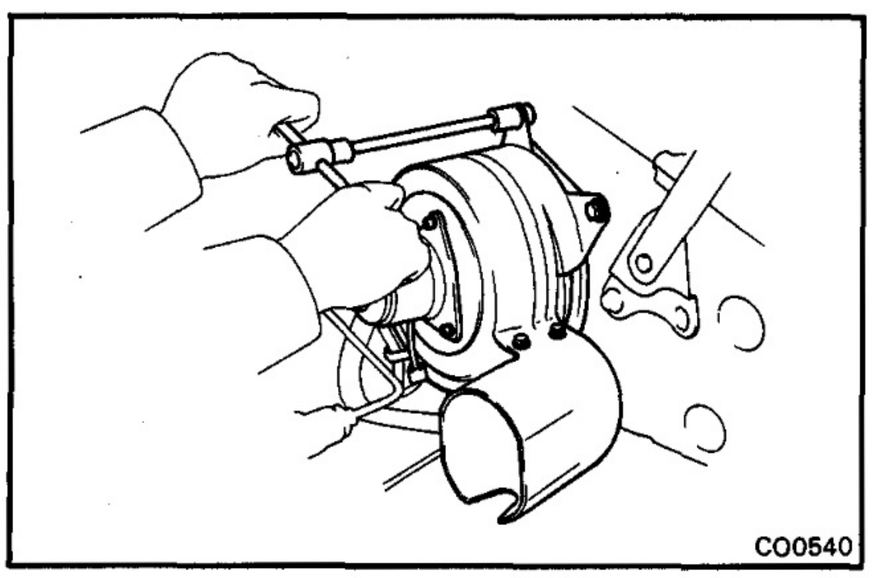
INSPECT FAN MOTOR

(a) Remove the shroud.

(b) Connect the battery and ammeter to the fan motor connector.

(c) Check to see that the motor rotates smoothly, and current is as follows:

Current: 2.8 – 3.8 A



REMOVAL OF ELECTRIC COOLING FAN

1. **DISCONNECT FAN MOTOR CONNECTOR**
2. **DISCONNECT LH HOOD LOCK BALANCER**
3. **REMOVE ELECTRIC COOLING FAN**

Remove the four bolts and cooling fan.

INSTALLATION OF ELECTRIC COOLING FAN

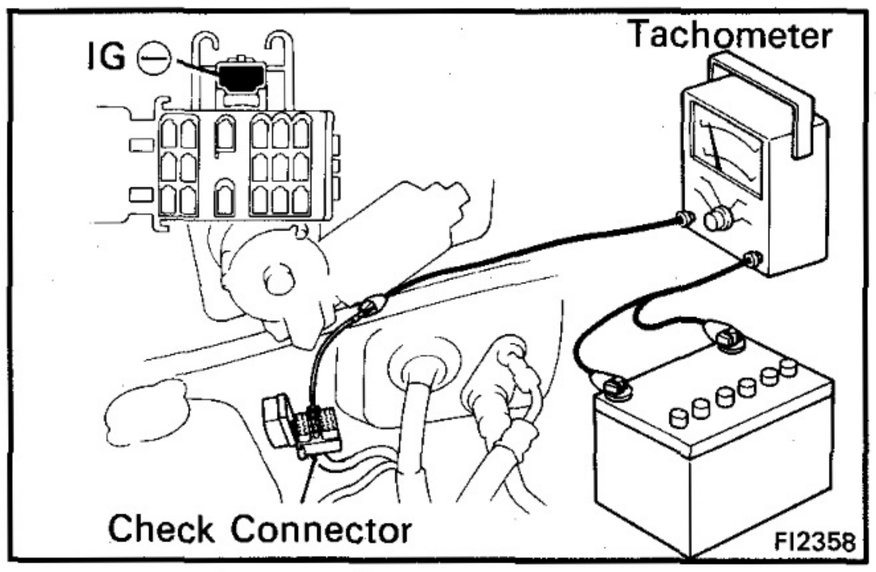
1. **INSTALL ELECTRIC COOLING FAN**
2. **CONNECT LH HOOD LOCK BALANCER**
3. **CONNECT FAN MOTOR CONNECTOR**

IGNITION SYSTEM

	Page
PRECAUTIONS	IG-2
TROUBLESHOOTING	IG-3
IGNITION SYSTEM CIRCUIT	IG-4
ON-VEHICLE INSPECTION	IG-5
DISTRIBUTOR	IG-8

PRECAUTIONS

1. **Do not leave the ignition switch on for more than 10 minutes if the engine will not start.**

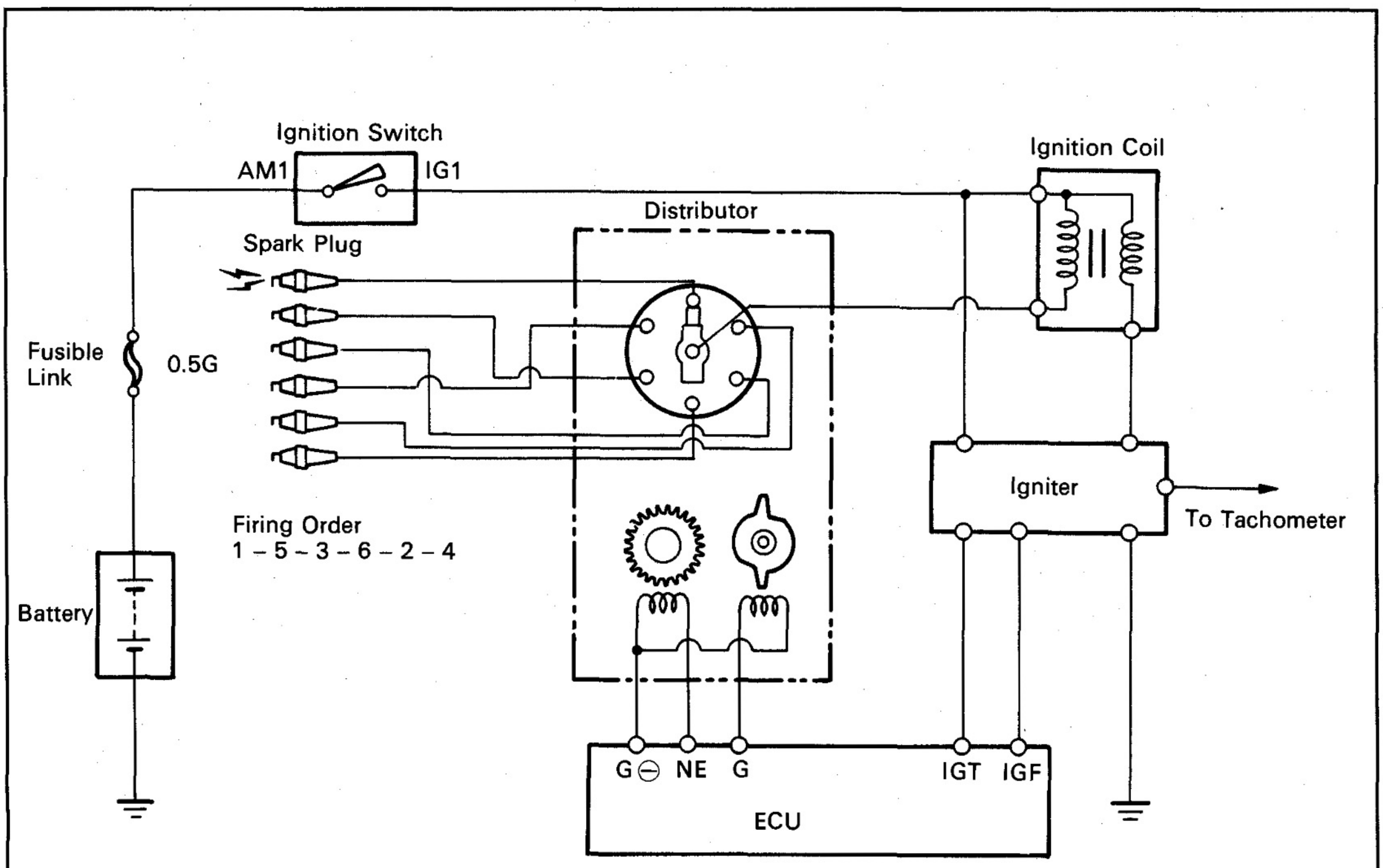


2. **When a tachometer is connected to the system, connect the tachometer test probe to terminal IG ⊖ of the check connector.**
3. **As some tachometers are not compatible with this ignition system, we recommend that you confirm the compatibility of your unit before using.**
4. **NEVER allow the tachometer terminals to touch ground as this could damage the igniter and/or ignition coil.**
5. **Do not disconnect the battery when the engine is running.**
6. **Make sure that the igniter is properly grounded to the body.**

TROUBLESHOOTING

Problem	Possible cause	Remedy	Page
Engine will not start / hard to start (cranks ok)	Incorrect ignition timing	Reset timing	EM-11
	Ignition problems		
	• Ignition coil	Inspect coil	IG-7
	• Igniter	Inspect igniter	IG-7
	• Distributor	Inspect distributor	IG-7
	• High-tension cords	Inspect high-tension cords	IG-6
	Ignition wiring disconnected or broken	Inspect wiring	
Rough idle or stalls	Spark plugs faulty	Inspect plugs	IG-6
	Ignition wiring faulty	Inspect wiring	
	Incorrect ignition timing	Reset timing	EM-11
	Ignition problems		
	• Ignition coil	Inspect coil	IG-7
	• Igniter	Inspect igniter	IG-7
	• Distributor	Inspect distributor	IG-7
	• High-tension cords	Inspect high-tension cords	IG-6
Engine hesitates / poor acceleration	Spark plugs faulty	Inspect plugs	IG-6
	Ignition wiring faulty	Inspect wiring	
	Incorrect ignition timing	Reset timing	EM-11
Engine dieseling (runs after ignition switch is turned off)	Incorrect ignition timing	Reset timing	EM-11
Muffler explosion (after fire) all the time	Incorrect ignition timing	Reset timing	EM-11
Engine backfires	Incorrect ignition timing	Reset timing	EM-11
Poor gasoline mileage	Spark plugs faulty	Inspect plugs	IG-6
	Incorrect ignition timing	Reset timing	EM-11
Engine overheats	Incorrect ignition timing	Reset timing	EM-11

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

SPARK TEST

CHECK THAT SPARK OCCURS

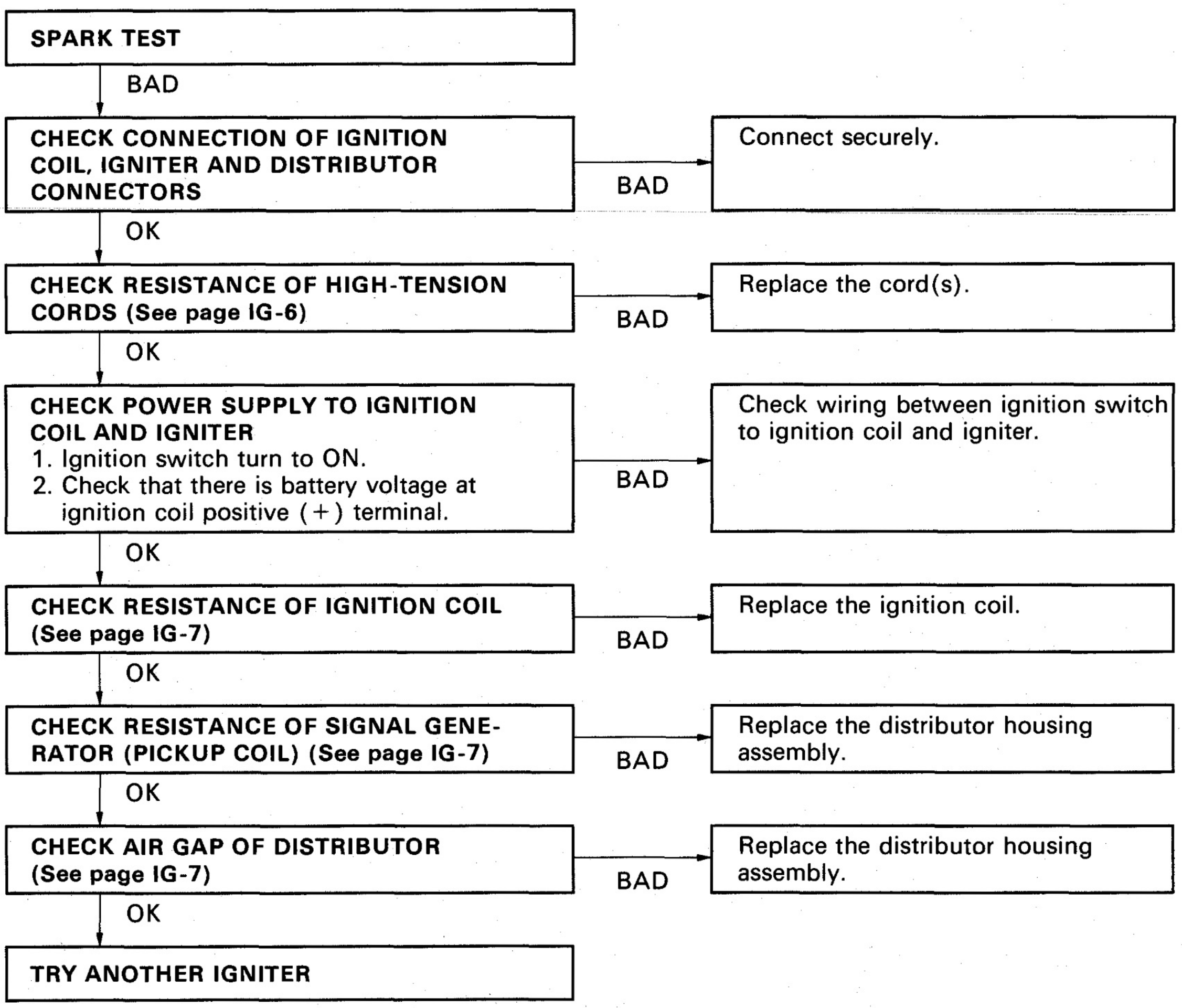
(a) Disconnect high-tension cord from distributor.

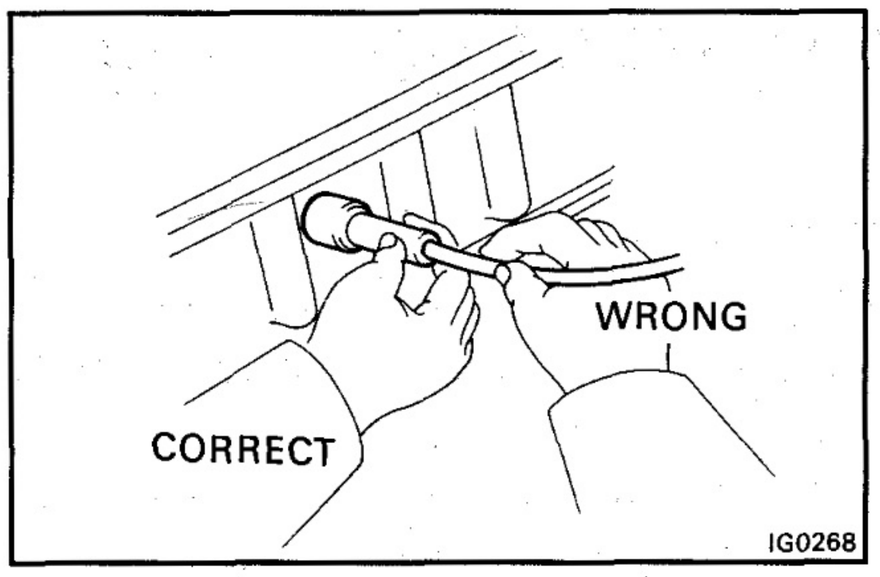
(b) Hold the end approx. 12.5 mm (0.50 in.) from body of vehicle.

(c) See 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:

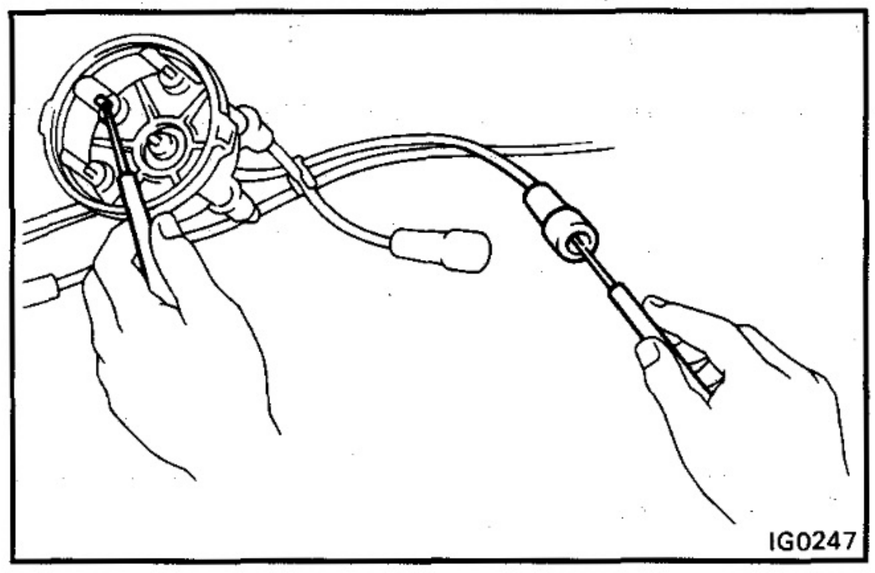




INSPECTION OF HIGH-TENSION CORDS

1. CAREFULLY REMOVE HIGH-TENSION CORDS BY THEIR RUBBER BOOTS FROM SPARK PLUGS

NOTICE: Pulling on or bending the cords may damage the conductor inside.

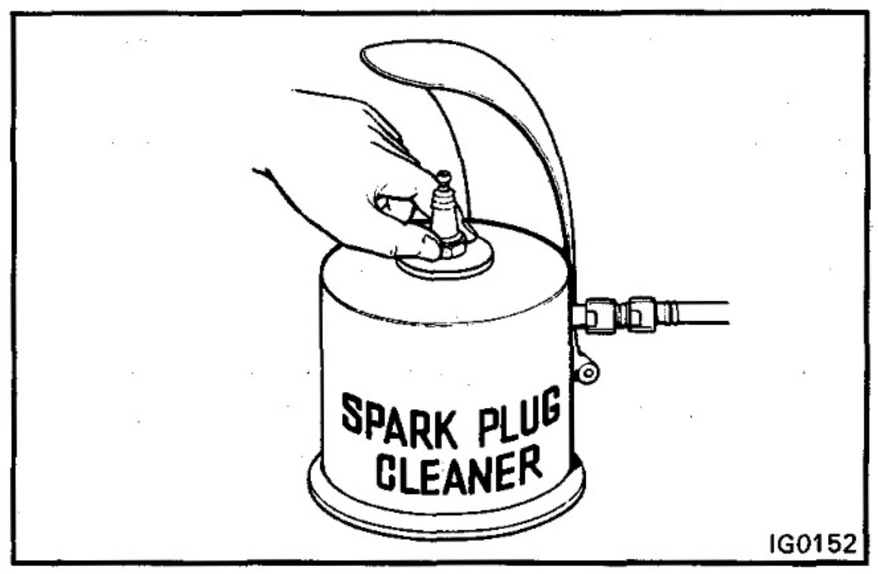


2. INSPECT HIGH-TENSION CORD RESISTANCE

Using an ohmmeter, measure the resistance without disconnecting the distributor cap.

Maximum resistance: 25 kΩ per cord

If resistance is greater than maximum, check the terminals. If necessary, replace the high-tension cord and/or distributor cap.

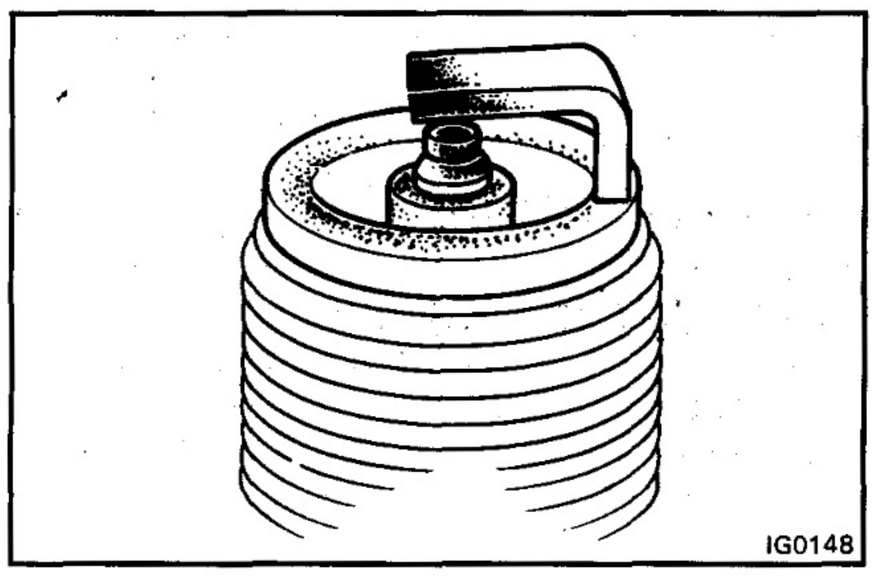


INSPECTION OF SPARK PLUGS

1. REMOVE SPARK PLUGS

2. CLEAN SPARK PLUGS

Using a spark plug cleaner or wire brush, clean the spark plug.

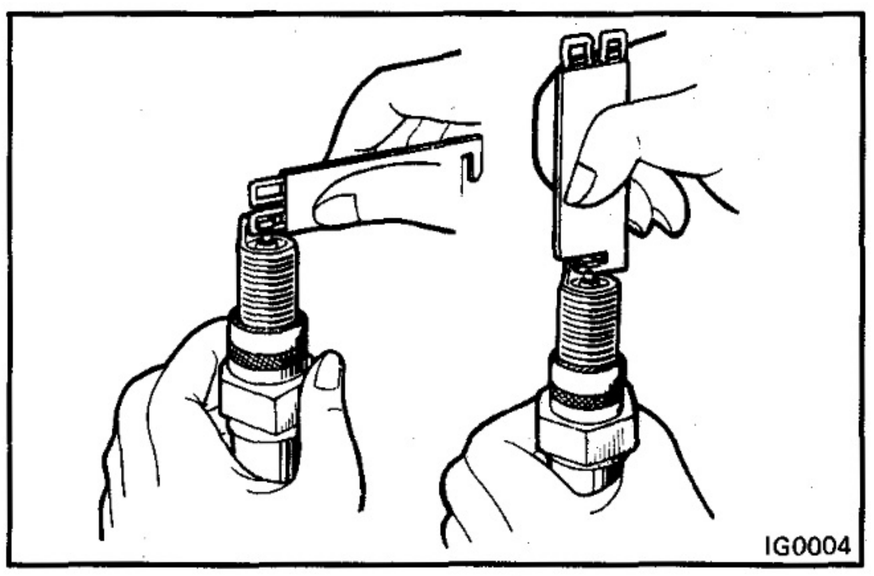


3. VISUALLY INSPECT SPARK PLUGS

Check the spark plug for electrode wear, thread damage and insulator damage.

If abnormal, replace the plugs.

Recommended spark plugs: ND W16EXR-U
NGK BPR5EY



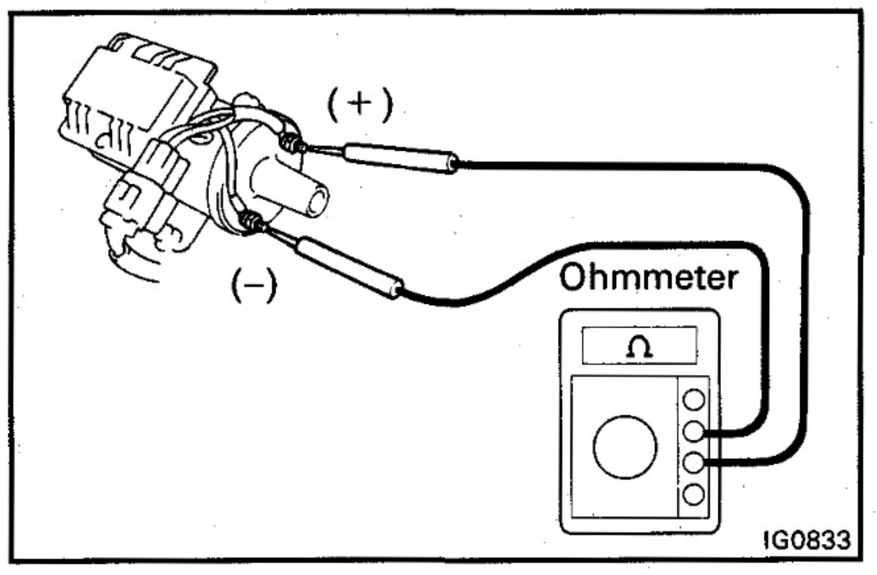
4. ADJUST ELECTRODE CAP

Carefully bend the outer electrode to obtain the correct electrode gap.

Correct electrode gap: 0.8 mm (0.031 in.)

5. INSTALL SPARK PLUGS

Torque: 180 kg-cm (13 ft-lb, 18 N·m)



INSPECTION OF IGNITION COIL

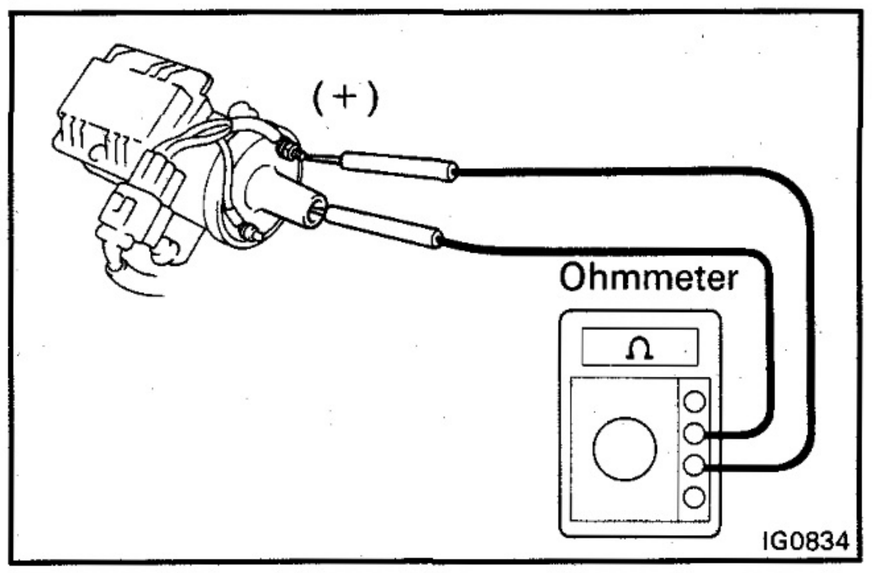
1. **DISCONNECT HIGH-TENSION CORD**

2. **INSPECT PRIMARY COIL RESISTANCE**

Using an ohmmeter, measure the resistance between the positive (+) and negative (–) terminals.

Primary coil resistance (cold): 0.52 – 0.64 Ω

If the resistance is not as specified, replace the ignition coil.



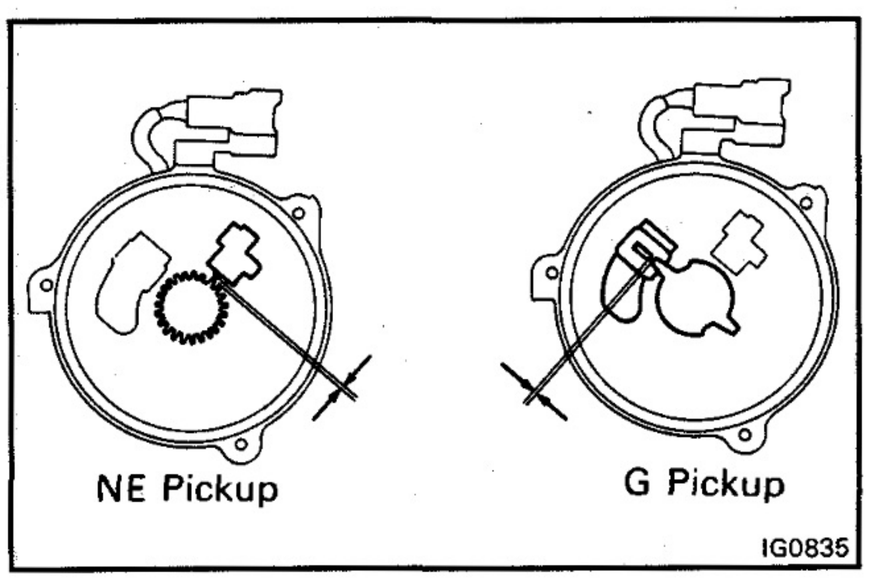
3. **INSPECT SECONDARY COIL RESISTANCE**

Using an ohmmeter, measure the resistance between the positive (+) terminal and high-tension terminal.

Secondary coil resistance (Cold): 11.5 – 15.5 kΩ

If the resistance is not as specified, replace the ignition coil.

4. **RECONNECT HIGH-TENSION CORD**



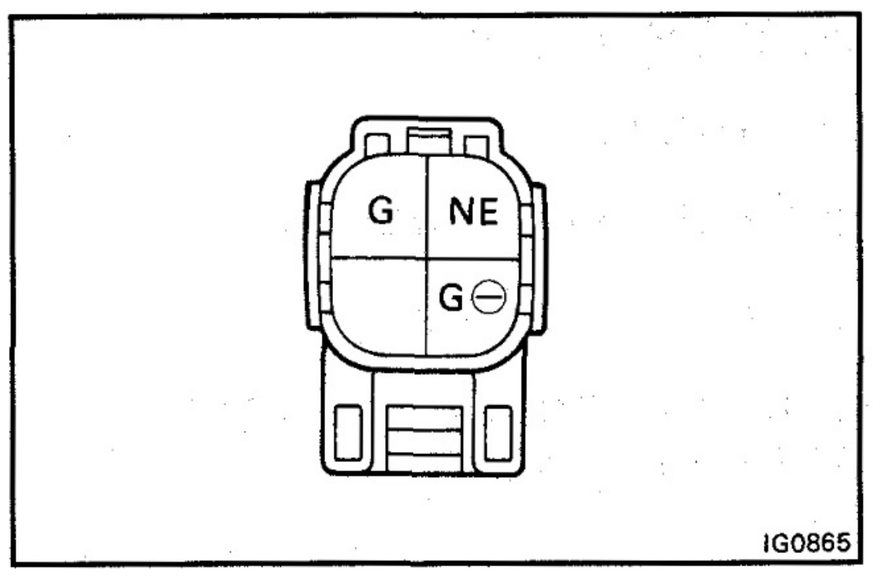
INSPECTION OF DISTRIBUTOR

1. **INSPECT AIR GAPS**

Using a thickness gauge, measure the gap between the signal rotor and pickup coil projection.

Air gap: 0.2 mm (0.008 in.) or more

If the gap is not as specified, replace the distributor.



2. **INSPECT PICKUP COIL RESISTANCES**

Using an ohmmeter, measure the resistance between the terminals.

G pickup coil resistance (G – G⊖):
185 – 265 Ω
NE pickup coil resistance (NE – G⊖):
185 – 265 Ω

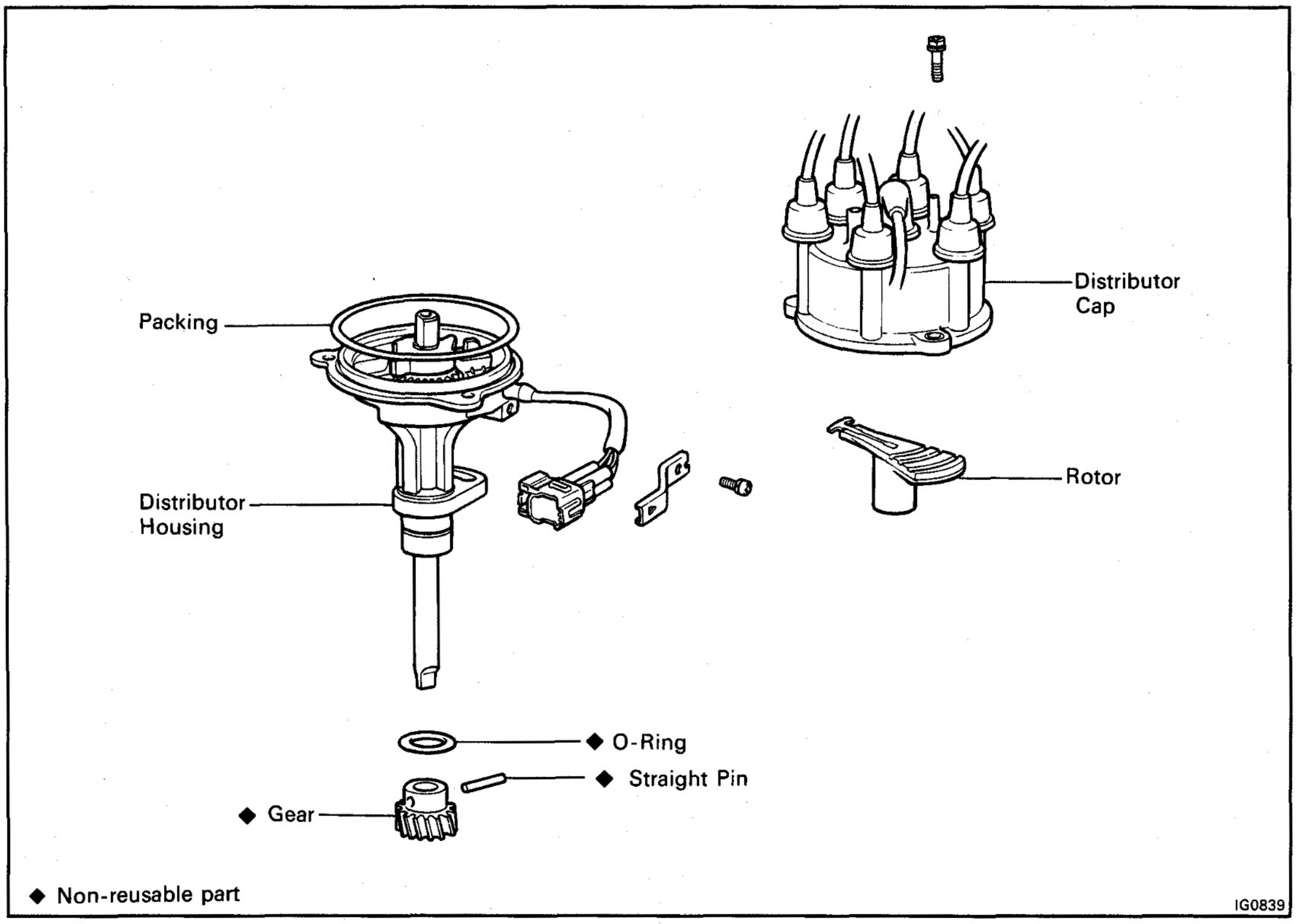
If the resistance is not as specified, replace the distributor.

INSPECTION OF IGNITER

(See procedure Spark Test on page IG-5)

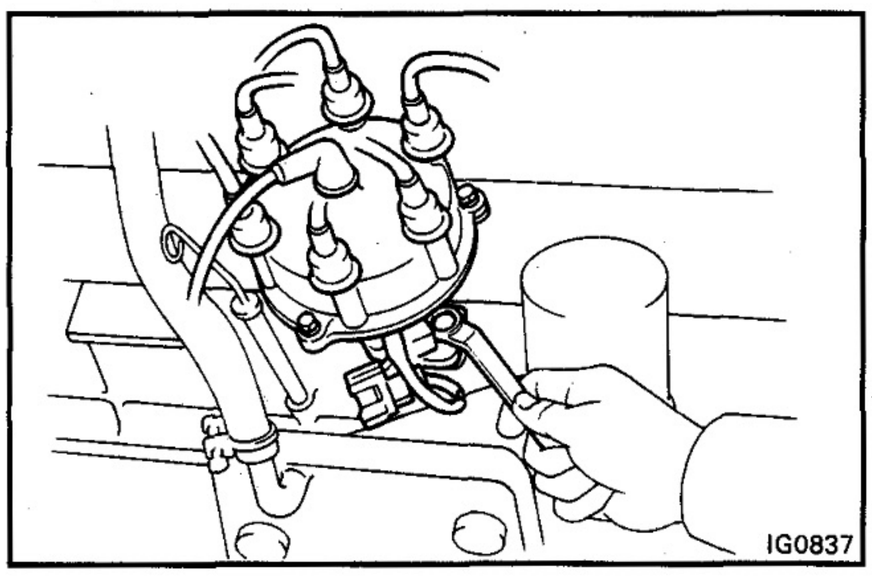
DISTRIBUTOR

COMPONENTS



REMOVAL OF DISTRIBUTOR

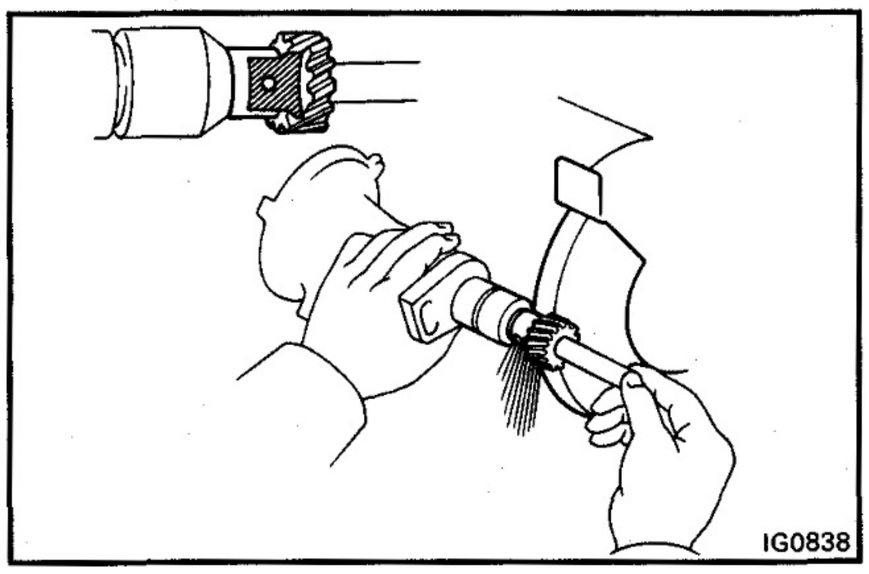
1. **REMOVE AIR CLEANER HOSE**
2. **DISCONNECT DISTRIBUTOR CONNECTOR**
3. **DISCONNECT VENTILATION HOSES**
4. **DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS AND IGNITION COIL**

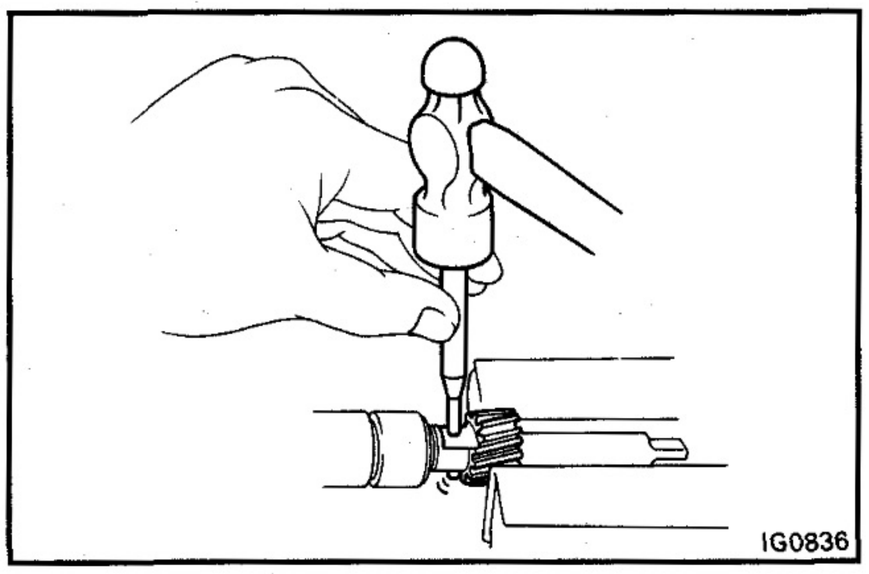


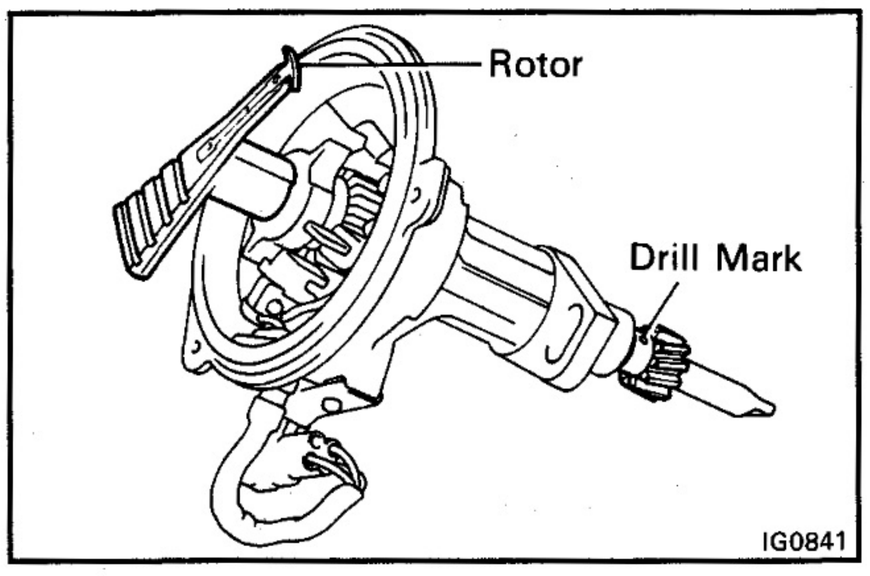
5. **REMOVE DISTRIBUTOR**

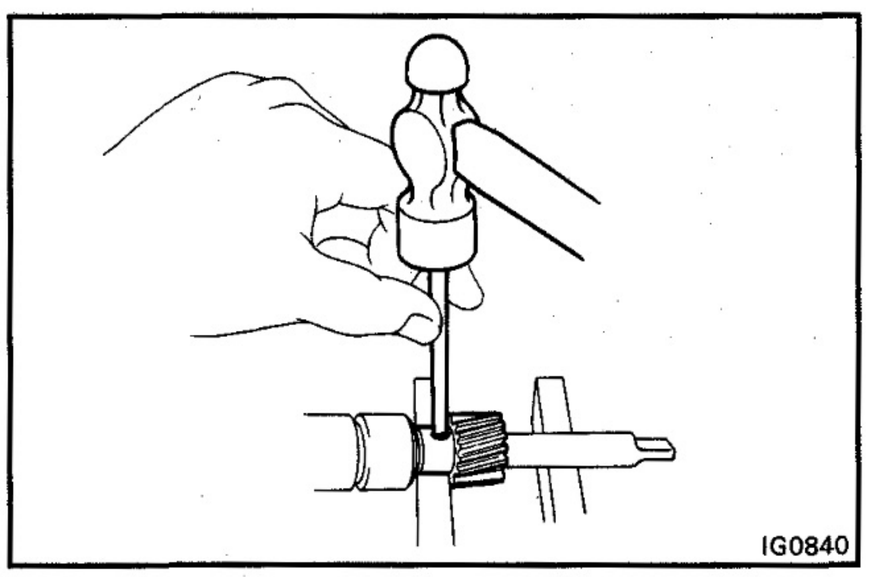
   Remove the mount bolt and pull out the distributor.

6. **REMOVE O-RING FROM DISTRIBUTOR HOUSING**









REPLACEMENT OF DISTRIBUTOR DRIVEN GEAR

1. REMOVE DRIVEN GEAR

(a) Using a grinder, grind the driven gear and straight pin.

NOTICE: Be careful not to damage the governor shaft.

(b) Mount the driven gear in a vise.

(c) Using a pin punch and hammer, tap out the straight pin.

(d) Remove the driven gear.

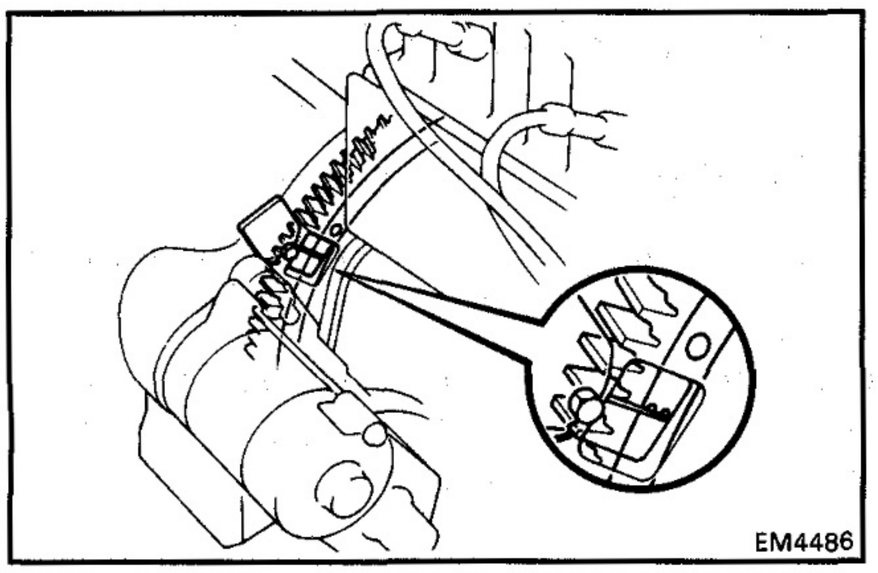
2. INSTALL NEW DRIVEN GEAR

(a) Slide a new driven gear onto the governor shaft.

(b) Position the drill mark on the driven gear and rotor as shown.

(c) Install a new straight pin.

(d) Secure the ends of the straight pin.

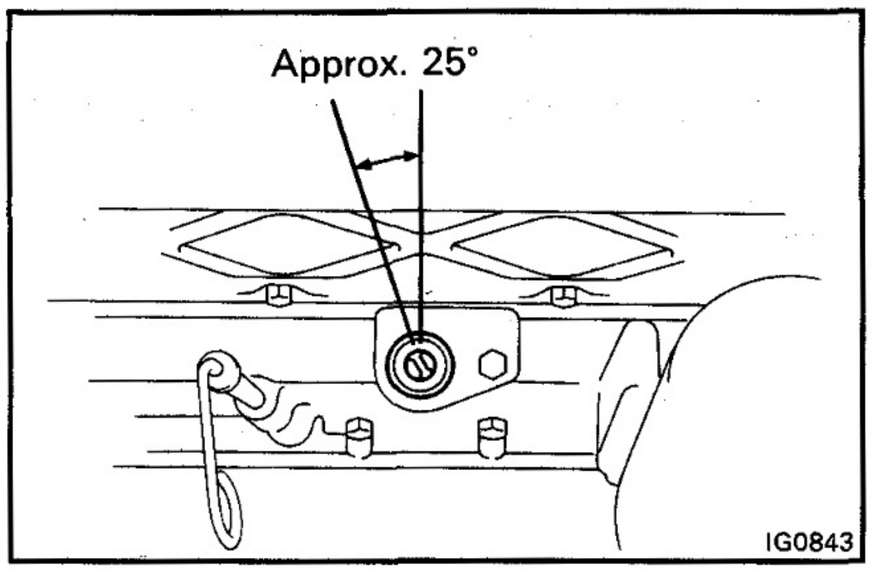


INSTALLATION OF DISTRIBUTOR

1. SET NO. 1 CYLINDER TO TDC/COMPRESSION

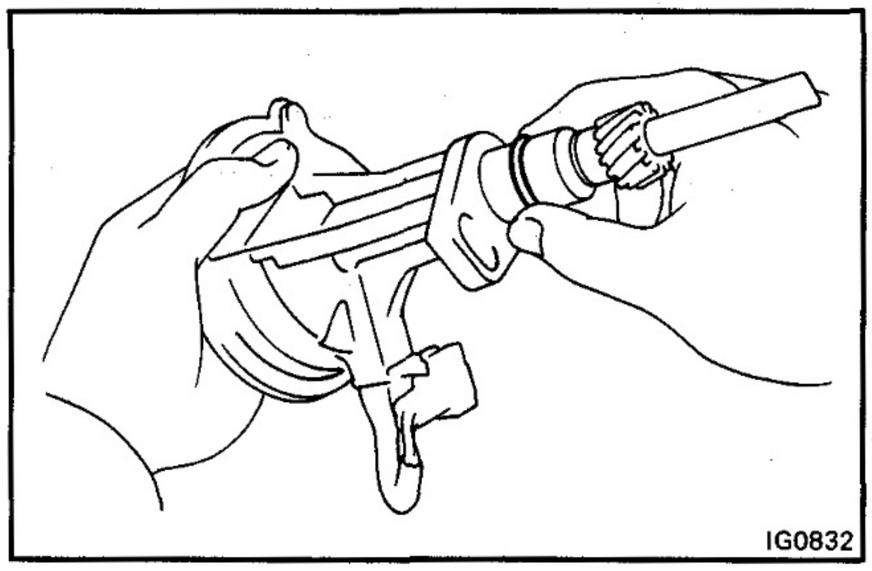
Set to TDC/compression in the following manner.

- Remove the No. 1 spark plug.
- Place your finger over the hole of the No. 1 spark plug and turn the crankshaft clockwise to TDC/compression. If pressure is felt on your finger, this is TDC/compression. If not, repeat the process.
- Install the No. 1 spark plug.



2. SET OIL PUMP SHAFT SLOT

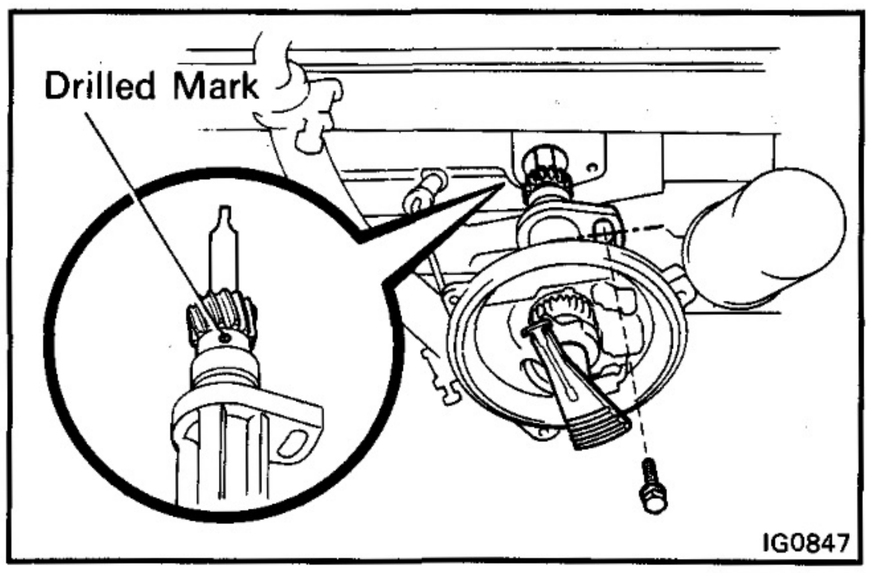
Position the oil pump shaft slot in the direction shown in the illustration.



3. INSTALL NEW O-RING

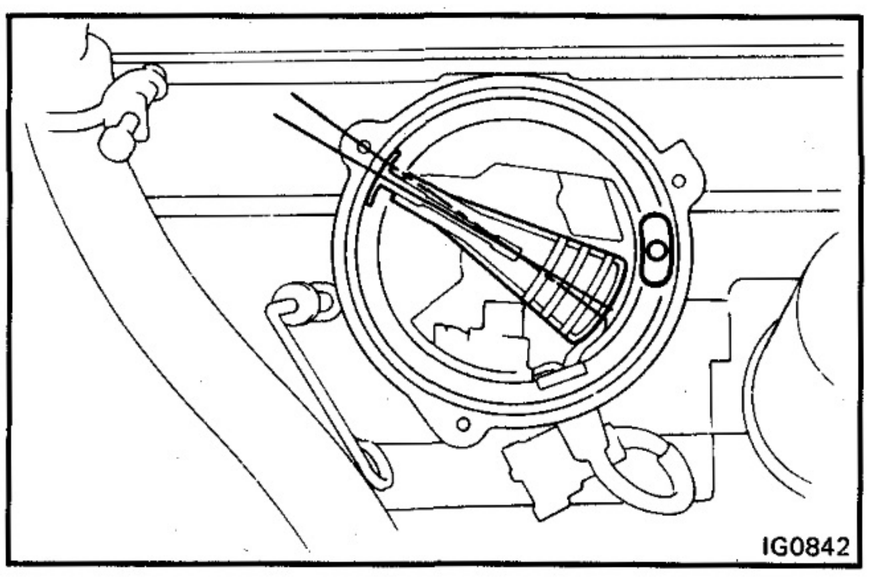
(a) Install a new O-ring to the housing.

(b) Apply a light coat of engine oil on the O-ring.



4. INSTALL DISTRIBUTOR

(a) Insert the distributor, aligning the center of the flange with that of the bolt hole on the cylinder head with drilled mark facing upward.



(b) When fully installed, the distributor should point as shown in the illustration.

(c) Lightly tighten the hold-down bolt.

5. INSTALL DISTRIBUTOR CAP WITH HIGH-TENSION CORDS

6. CONNECT HIGH-TENSION CORDS TO SPARK PLUGS

   Firing order: 1 – 5 – 3 – 6 – 2 – 4

7. CONNECT VENTILATION HOSES

8. CONNECT DISTRIBUTOR CONNECTOR

9. INSTALL AIR CLEANER HOSE

10. ADJUST IGNITION TIMING (See page EM-11)

    Ignition timing: 7° BTDC @ idle
    (w/ connected TE1 - E1, Transmission in N position)

CHARGING SYSTEM

	Page
PRECAUTIONS	CH-2
TROUBLESHOOTING	CH-2
CHARGING SYSTEM CIRCUIT	CH-3
ON-VEHICLE INSPECTION	CH-3
ALTERNATOR	CH-7
IGNITION MAIN RELAY	CH-15
CHARGE LIGHT RELAY	CH-16

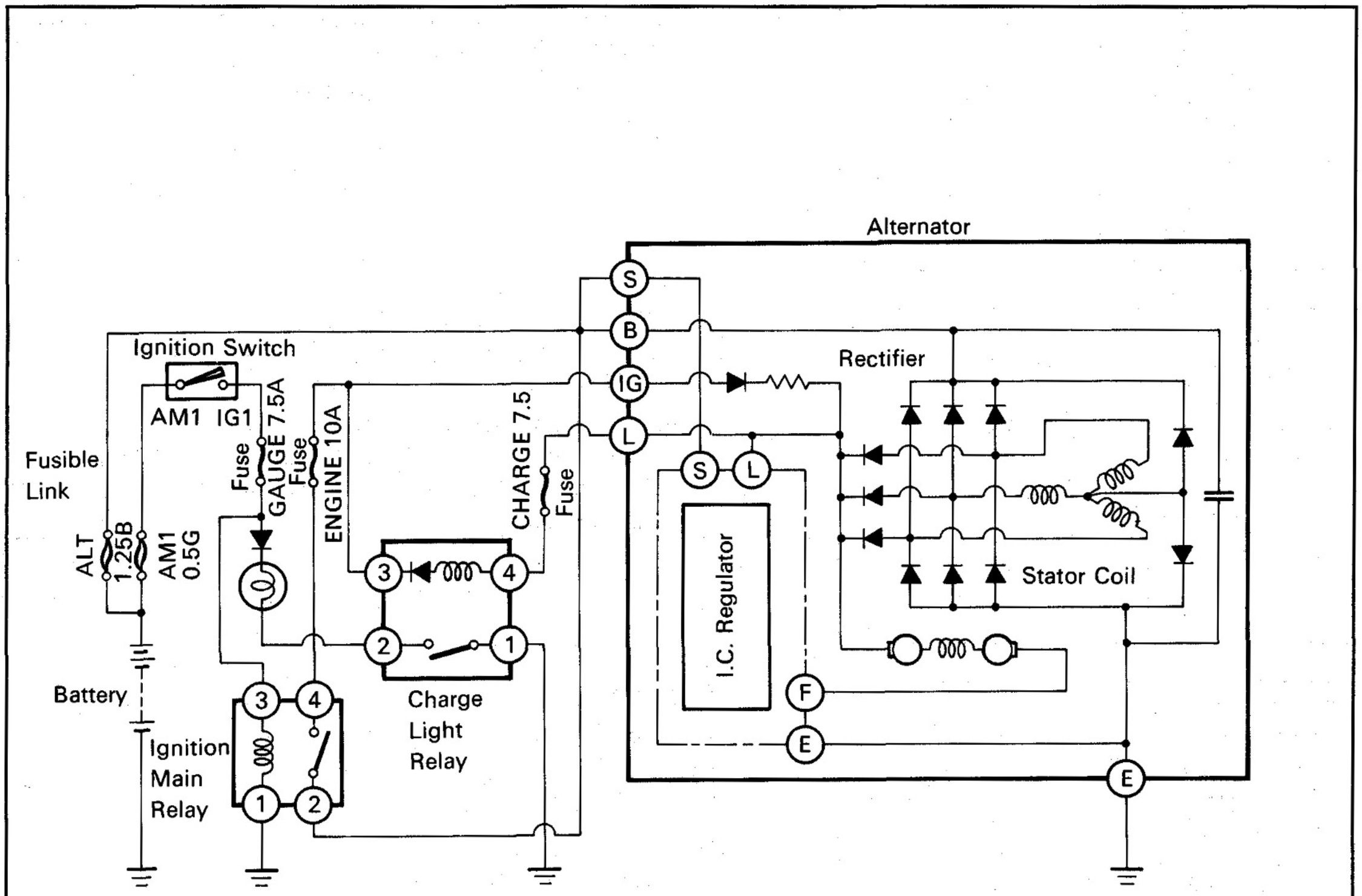
PRECAUTIONS

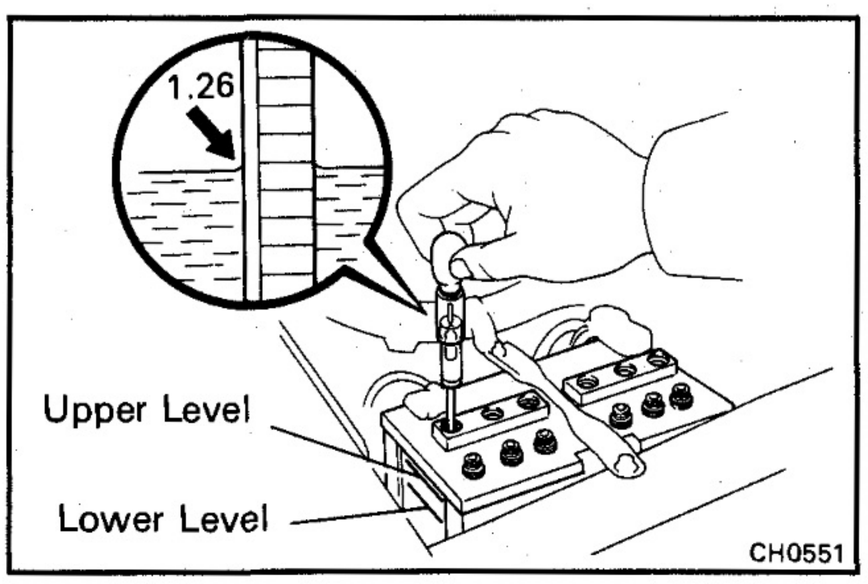
1. **Check that the battery cables are connected to the correct terminals.**
2. **Disconnect the battery cables when the battery is given a quick charge.**
3. **Do not perform tests with a high voltage insulation resistance tester.**
4. **Never disconnect the battery while the engine is running.**

TROUBLESHOOTING

Problem	Possible cause	Remedy	Page
Discharge warning light does not light with ignition ON and and engine not running	Fuse blown	Check "CHARGE" and "GAUGE" fuses	
	Light burned out	Replace light	
	Wiring connections loose	Tighten loose connections	
	IC regulator faulty	Replace IC regulator	CH-8
Discharge warning light does not go out with engine running (battery requires frequent recharging)	Drive belt loose or worn	Adjust or replace drive belt	CH-4
	Battery cables loose, corroded or worm	Repair or replace cables	
	Fuse blown	Check "ENGINE" fuse	
	Fusible link blown	Replace fusible link	
	IC regulator or alternator faulty	Check charging system	CH-5
	Wiring faulty	Repair wiring	

CHARGING SYSTEM CIRCUIT





ON-VEHICLE INSPECTION

1. CHECK BATTERY SPECIFIC GRAVITY

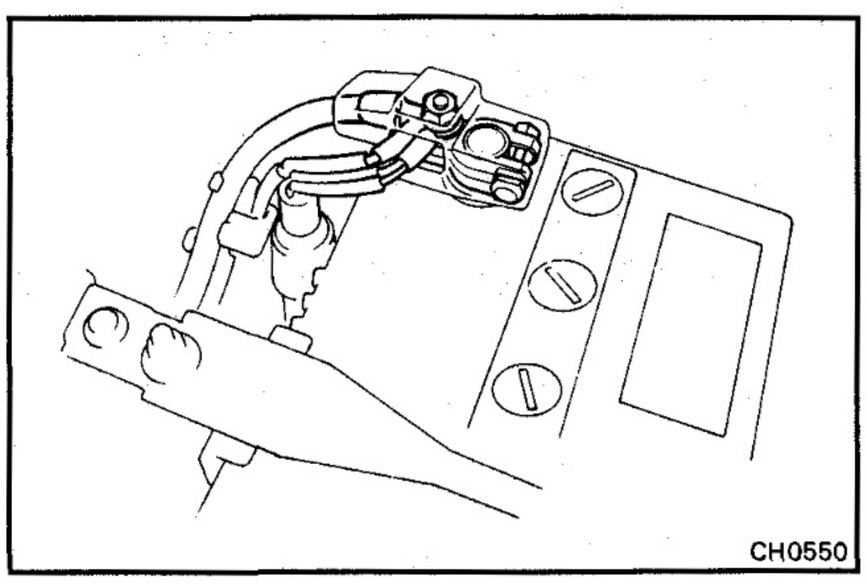
(a) Check the specific gravity of each cell.

Standard specific gravity
When fully charged at 20°C (68°F): 1.25 – 1.27

If not within specification, charge the battery.

(b) Check the electrolyte quantity of each cell.

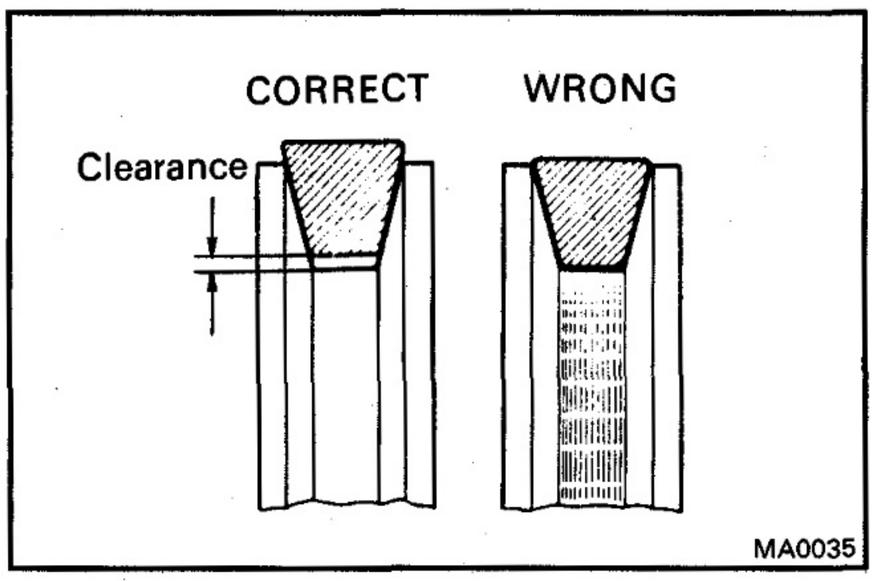
If insufficient, refill with distilled (or purified) water.



2. CHECK BATTERY TERMINALS, FUSIBLE LINKS AND FUSES

(a) Check that the battery terminals are not loose or corroded.

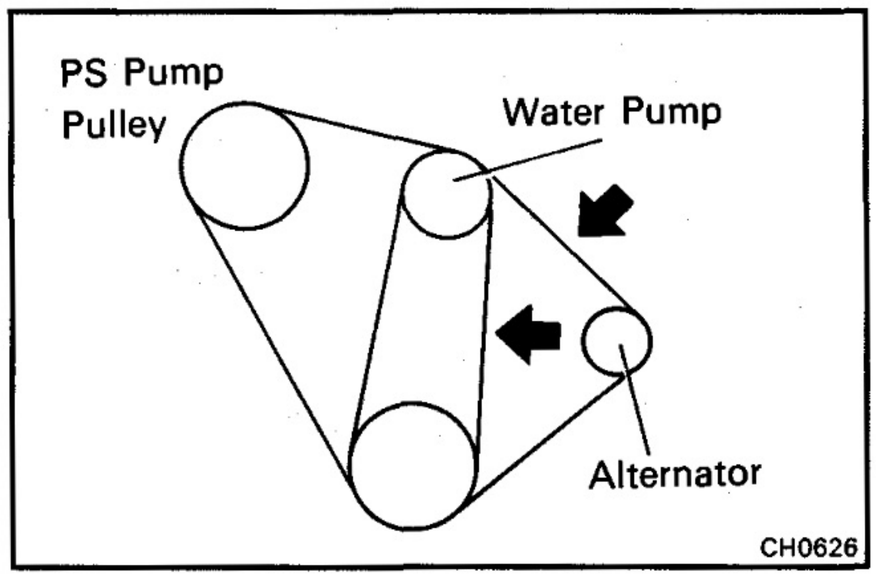
(b) Check the fusible links and fuses for continuity.



3. INSPECT DRIVE BELT

(a) Visually check the drive belt for cracks, oiliness or wear. Check that the belt does not touch the bottom of the pulley groove.

If necessary, replace the drive belt.

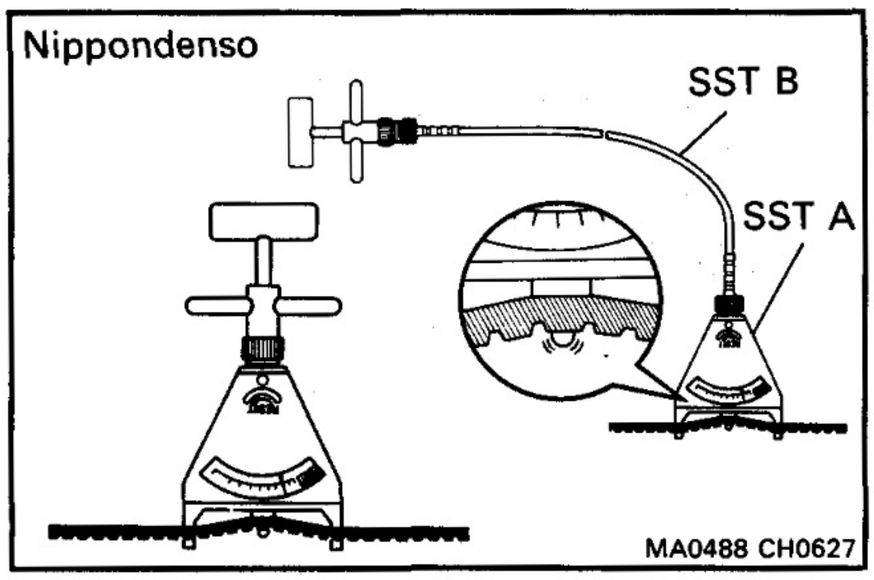


(b) Check the drive belt deflection by pressing on the belt at the points indicated in the figure with 10 kg (22.0 lb, 98 N) of pressure.

Drive belt deflection:

New belt	**7.0 – 9.0 mm (0.278 – 0.354 in.)**
Used belt	**9.0 – 12.0 mm (0.354 – 0.472 in.)**

If the belt deflection is not within specification, adjust it.



(Reference)

Using SST, check the drive belt tension.

SST A 09216-00020
SST B 09216-00030

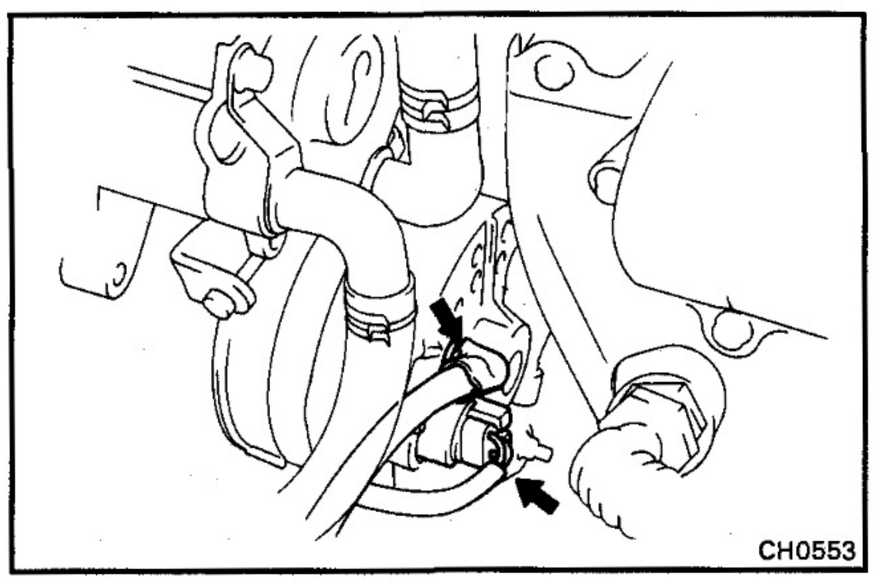
Drive belt tension:

New belt	**55 – 65 kg**
Used belt	**30 – 45 kg**

If necessary, adjust the drive belt tension.

HINT:

- When checking the tension, be sure the gauge is on the belt protrusion.
- "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 belt, run the engine for about 5 minutes and recheck the 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 noises from the alternator while the engine is running.

5. CHECK DISCHARGE WARNING LIGHT CIRCUIT

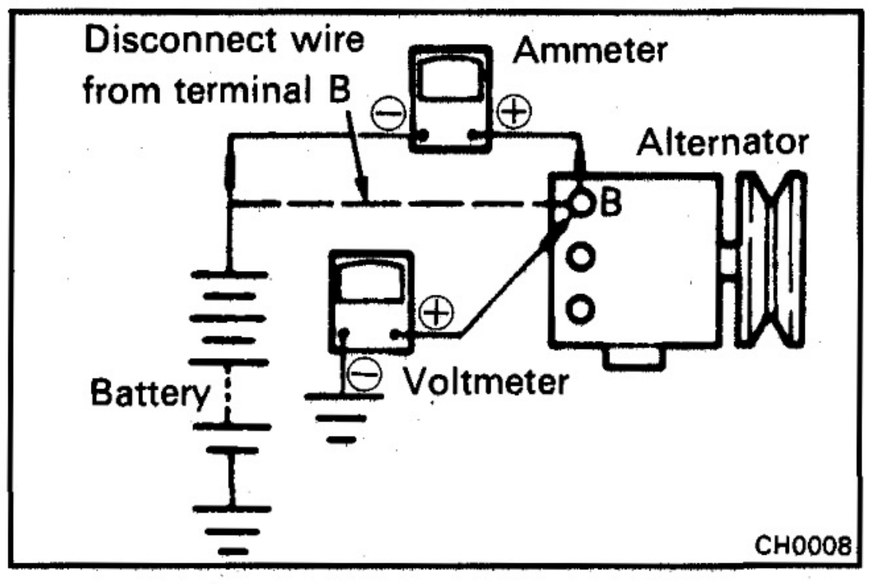
(a) Warm up the engine and turn it off.

(b) Turn off all accessories.

(c) Turn the ignition switch to "ON". Check that the charge light is lit.

(d) Start the engine. Check that the light goes out.

If the light does come on and go off as specified, troubleshoot the discharge light circuit.

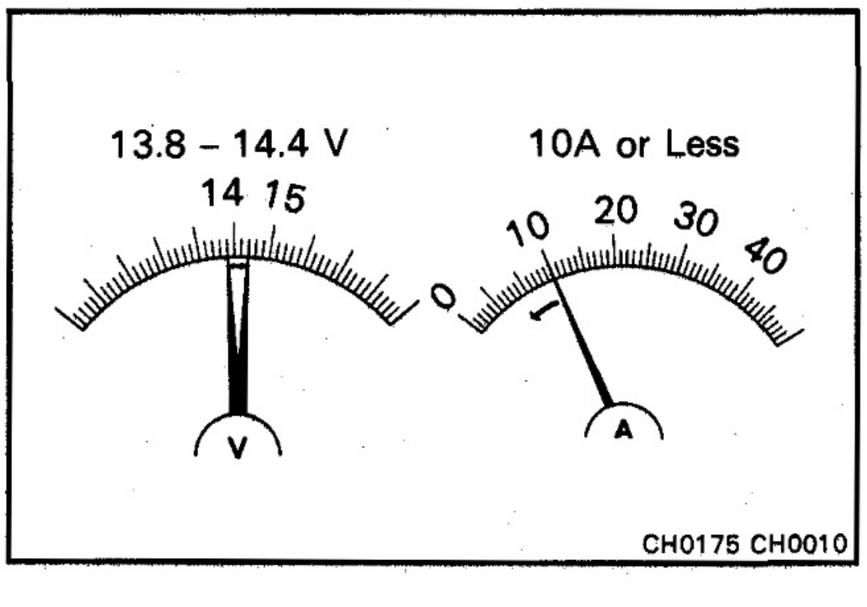


6. INSPECT CHARGING CIRCUIT WITHOUT LOAD

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:

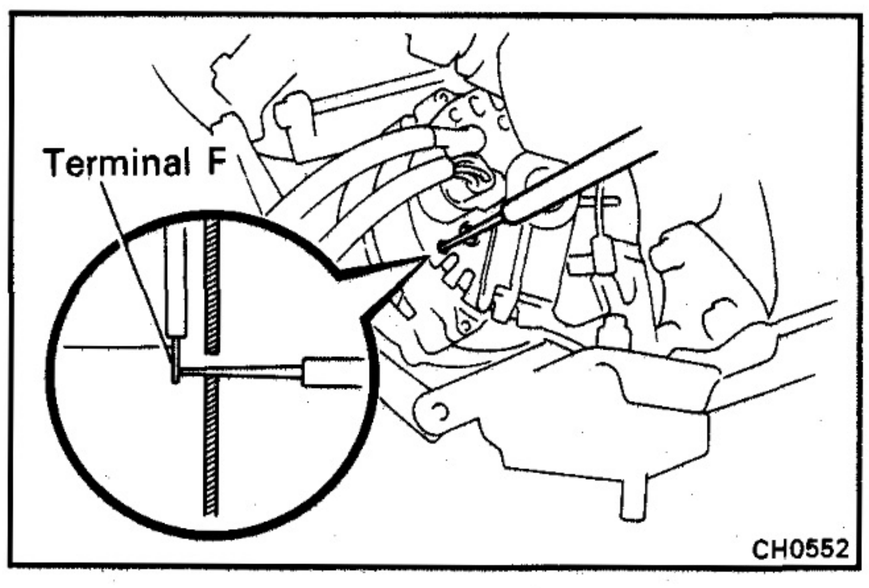
- Disconnect the wire from terminal B of the alternator and connect the wire to the negative (–) terminal of the ammeter.
- Connect the test lead from the position (+) terminal of the ammeter to terminal B of the alternator.
- Connect the positive (+) lead of the voltmeter to terminal B of the alternator.
- 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.

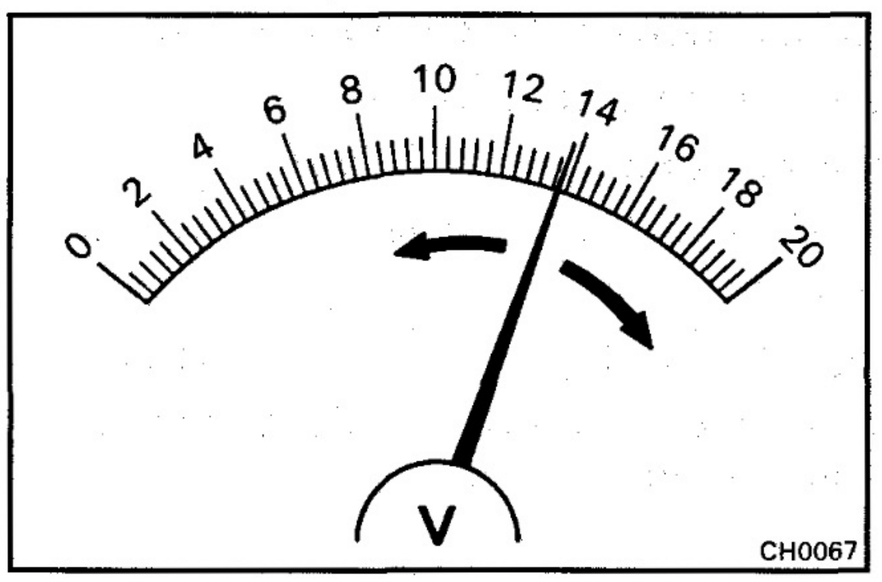
Standard amperage: 10 A or less
Standard voltage: 13.8 – 14.4 V at 25°C (77°F)

If the voltage reading is not within standard voltage, replace the IC regulator.

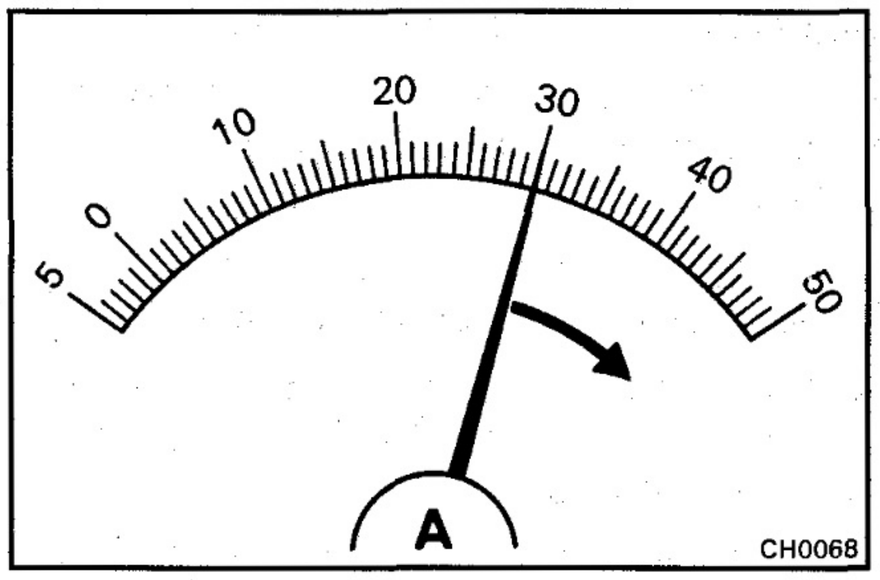


If the voltage reading is less than standard voltage, check the IC regulator and alternator as follows:

- With terminal F grounded, start the engine and check the voltage reading of terminal B.



- If the voltage reading is more than standard voltage, replace the IC regulator.
- If the voltage reading is less than standard voltage, check the alternator.

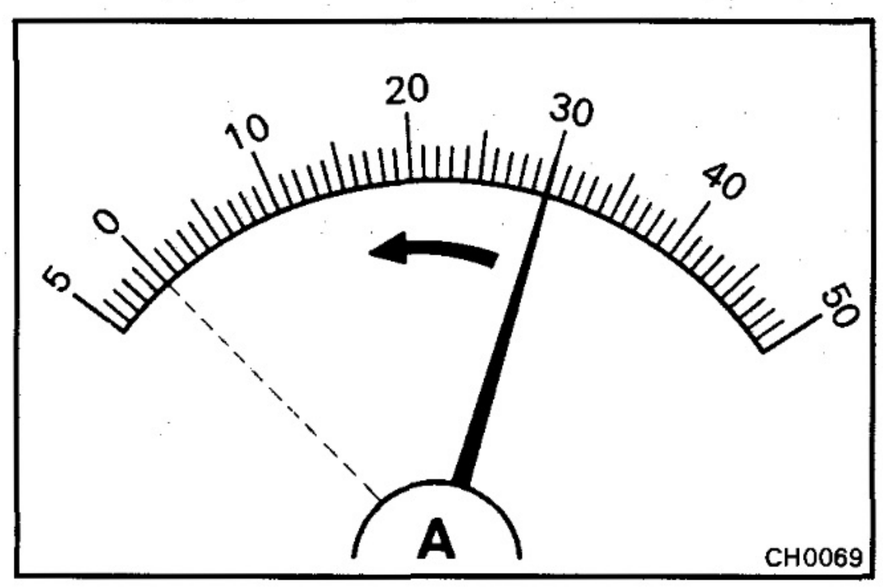


7. INSPECT CHARGING CIRCUIT WITH LOAD

(a) With the engine running at 2,000 rpm, turn on the high beam headlights and place the heater blower switch at "HI".

(b) Check the reading on the ammeter.

Standard amperage: 30 A or more

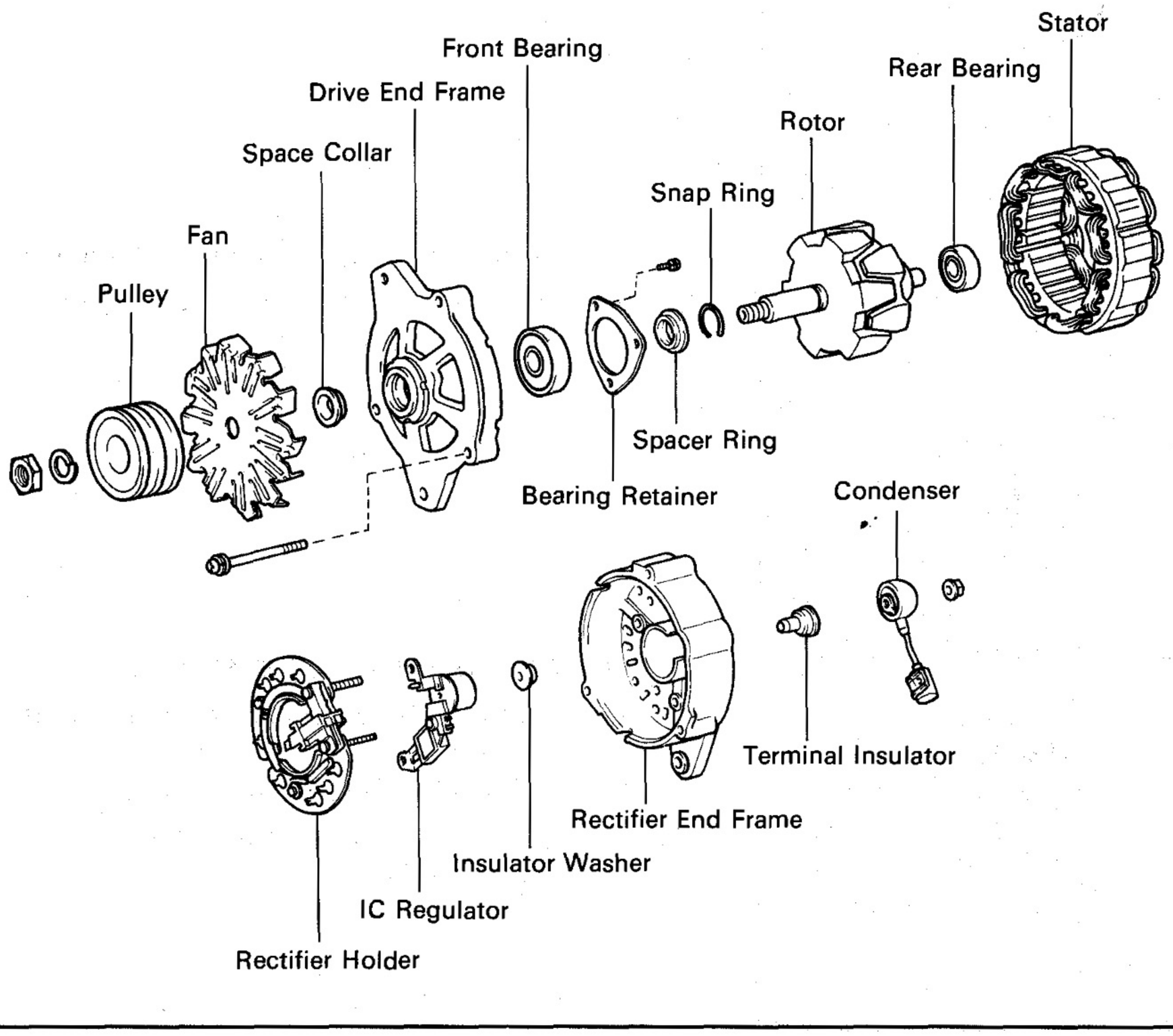


If the ammeter reading is less than 30 A, repair the alternator. (See page CH-7)

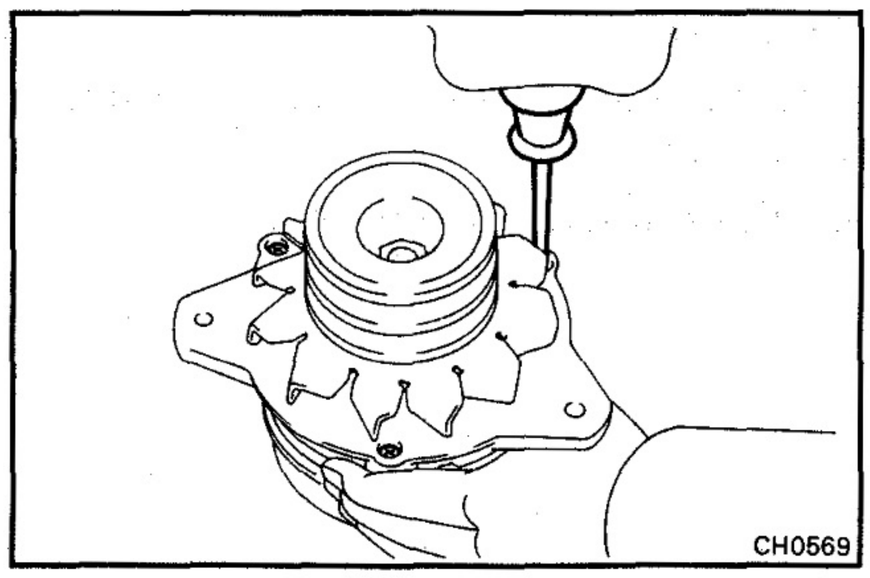
HINT: When the battery is fully charged, the indication will sometimes be less than 30 A.

ALTERNATOR

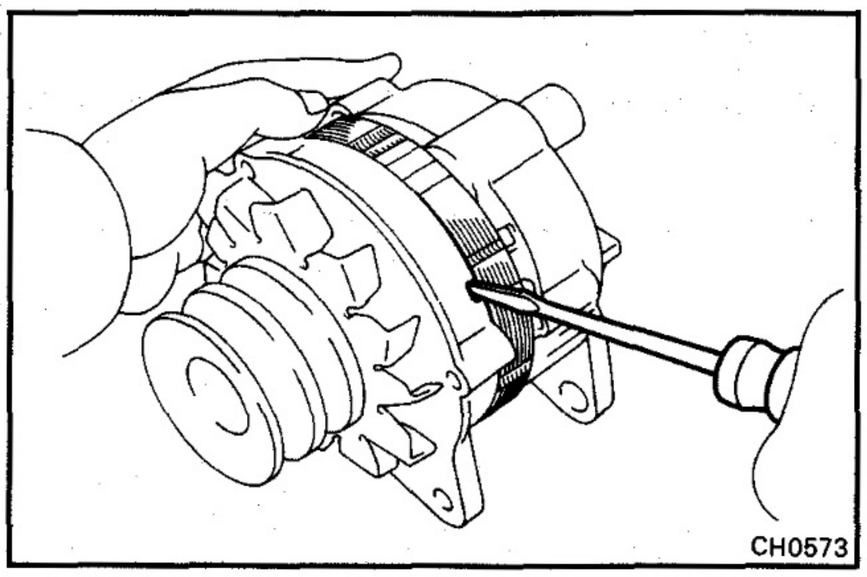
COMPONENTS



CH0586



CH0569



CH0573

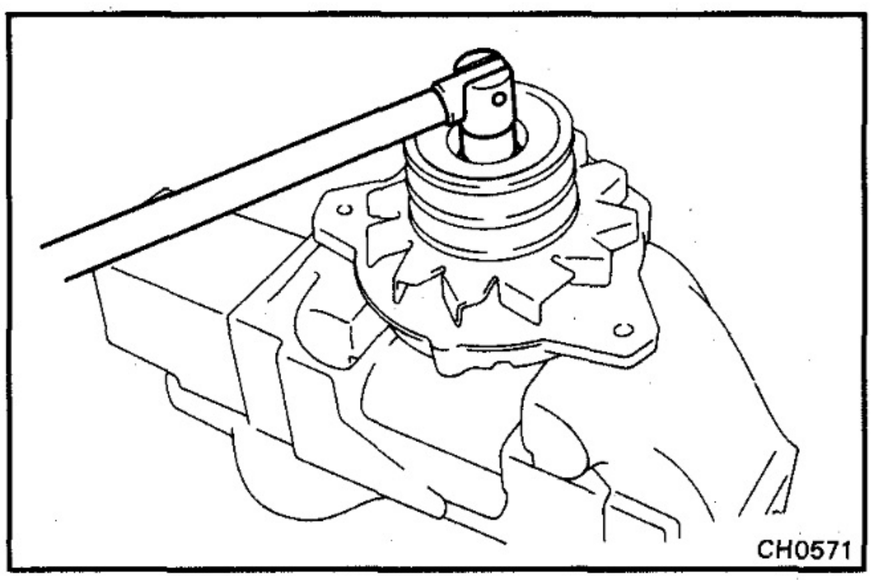
DISASSEMBLY OF ALTERNATOR

1. REMOVE DRIVE END FRAME AND ROTOR ASSEMBLY FROM STATOR

(a) Remove the three through screws.

(b) Using a screwdriver, pry the end frame and remove it together with the rotor.

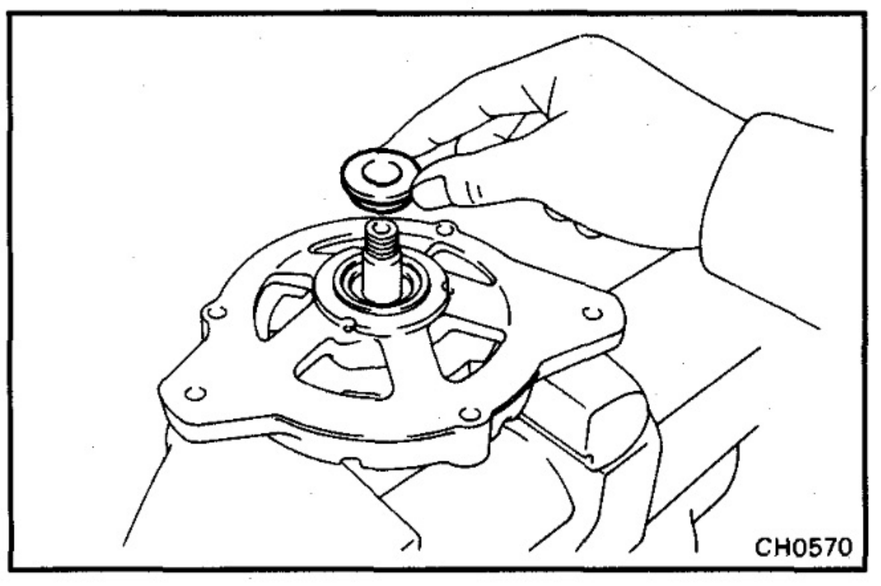
NOTICE: Do not pry the coil wires.



2. REMOVE PULLEY, FAN AND DRIVE END FRAME FROM ROTOR

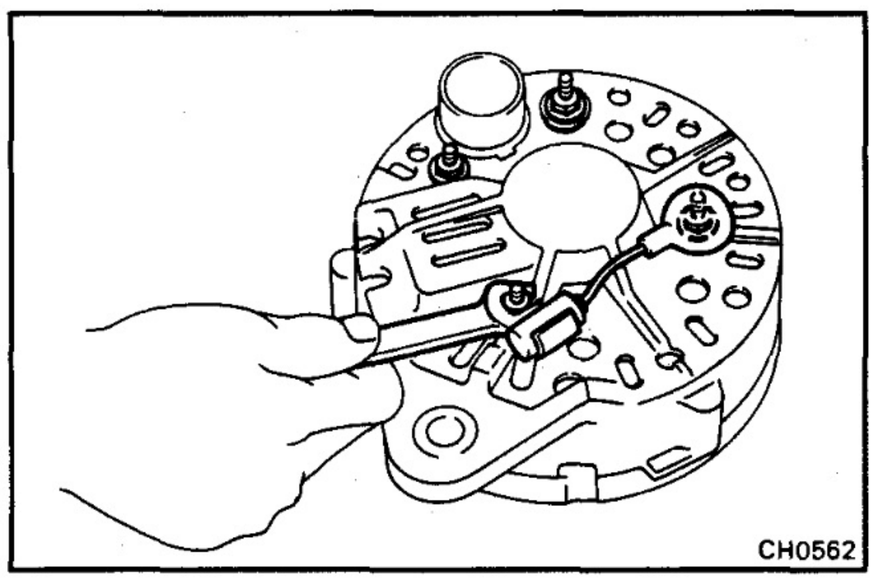
(a) Mount the rotor in a soft jaw vise.

(b) Remove the pulley nut, spring washer, pulley and fan.



(c) Remove the spacer collar and drive end frame.

(d) Remove the spacer ring and snap ring.

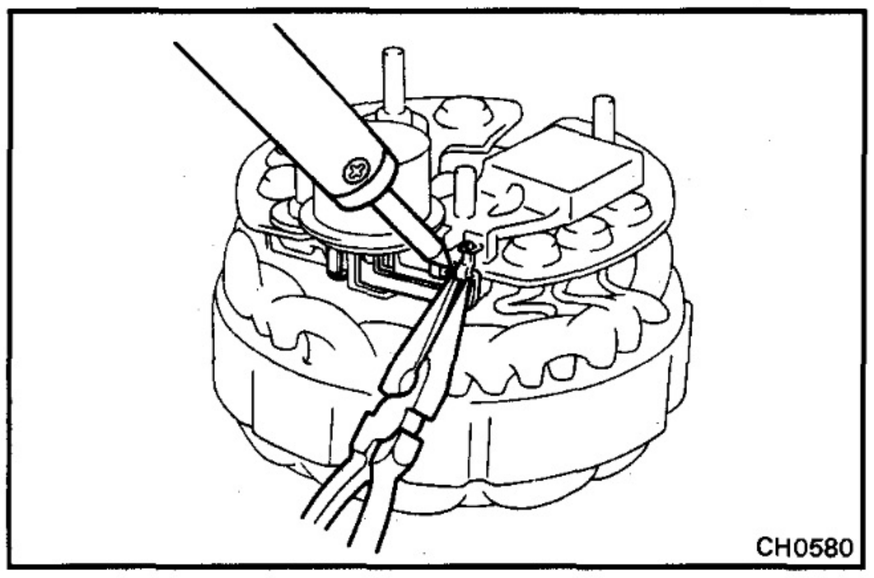


3. REMOVE RECTIFIER END FRAME

(a) Remove the four nuts, condenser and two terminal insulators.

(b) Remove the rectifier end frame.

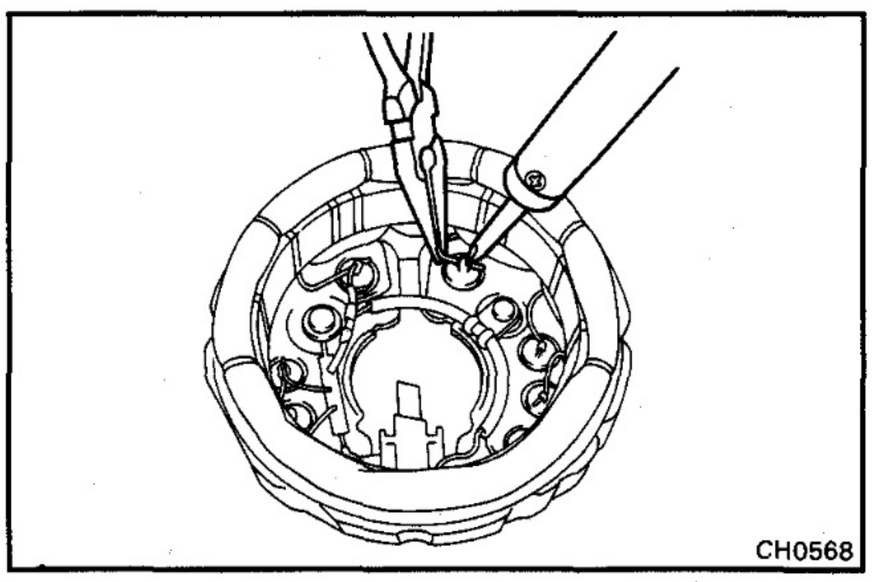
(c) Remove the insulator washer from the rectifier holder stud.



4. REMOVE IC REGULATOR

Hold the IC regulator terminal with needle-nose pliers, and unsolder the terminals.

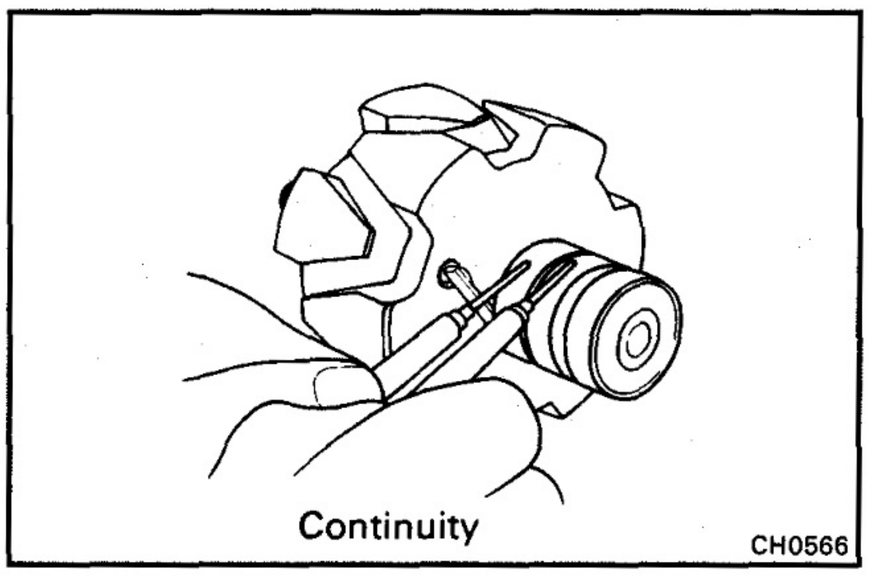
NOTICE: Protect the rectifiers from heat.



5. REMOVE RECTIFIER HOLDER

Hold the stator coil lead with needle-nose pliers, and unsolder the leads.

NOTICE: Protect the rectifiers from heat.



INSPECTION AND REPAIR OF ALTERNATOR

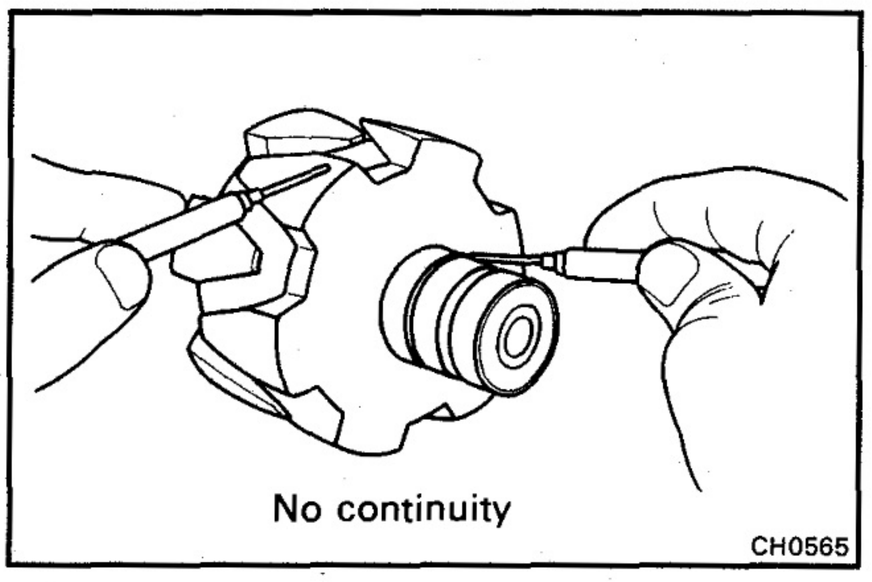
Rotor

1. INSPECT ROTOR FOR OPEN CIRCUIT

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

Standard resistance: 2.8 – 3.0 Ω

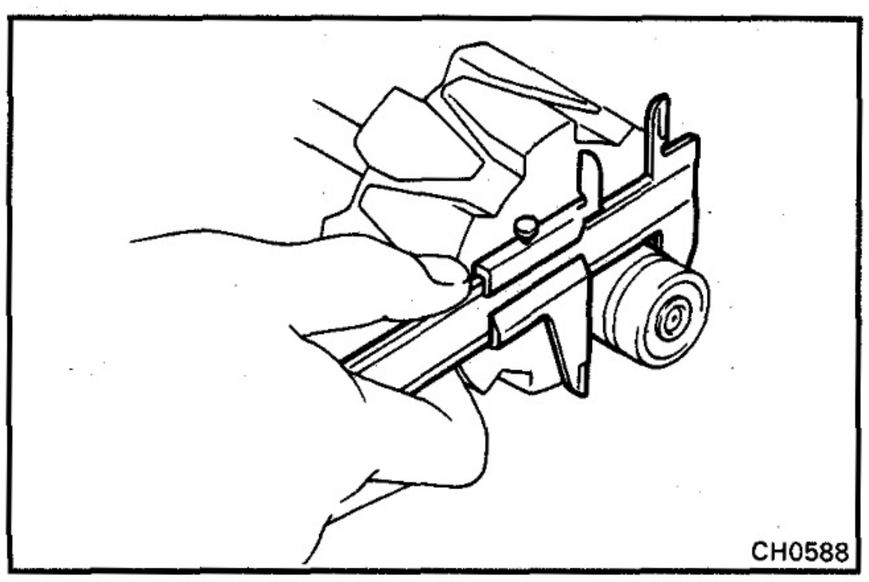
If there is no continuity, replace the rotor.



2. INSPECT ROTOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the slip ring and the rotor.

If there is continuity, replace the rotor.



3. INSPECT SLIP RINGS

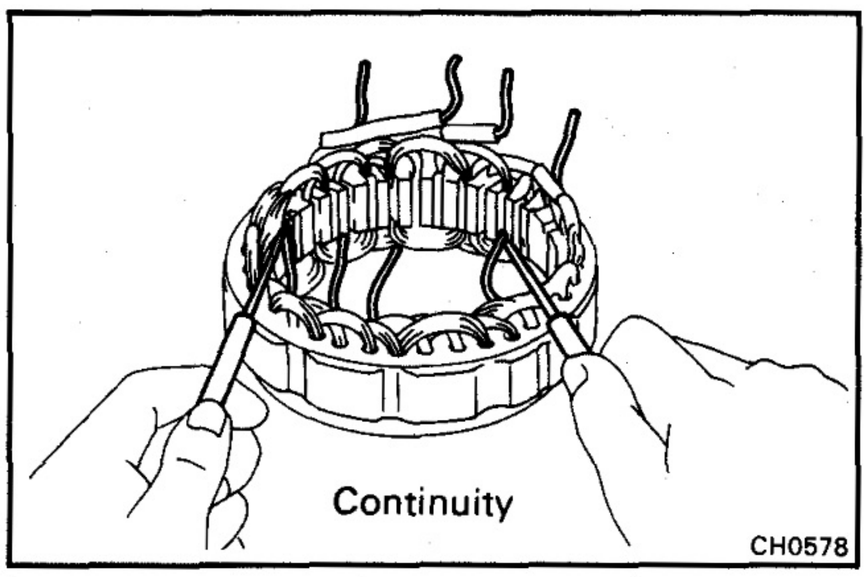
(a) Check the slip rings are not rough or scored.

If rough or scored, replace the rotor.

(b) Using calipers, measure the slip ring diameters.

Standard diameter: 32.3 – 32.5 mm (1.272 – 1.280 in.)
Minimum diameter: 32.1 mm (1.264 in.)

If the diameter is less than minimum, replace the rotor.

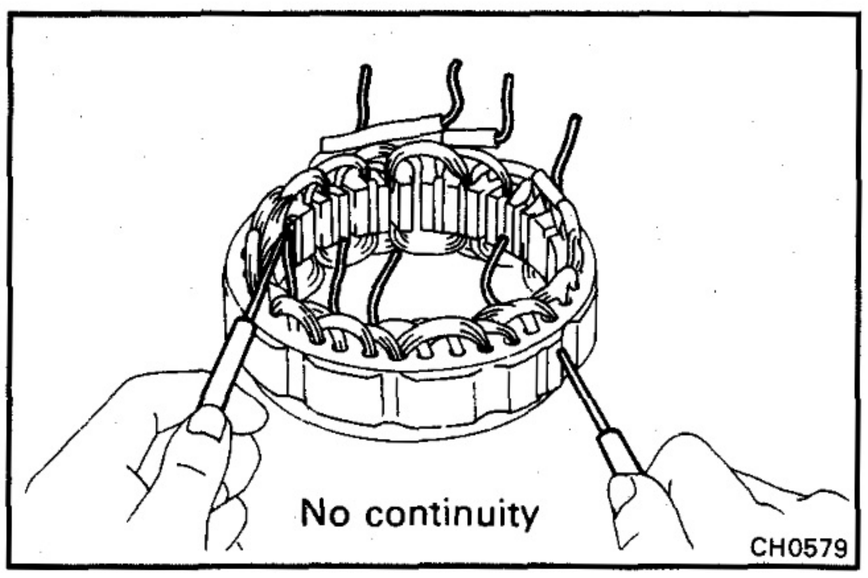


Stator

1. INSPECT STATOR FOR OPEN CIRCUIT

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

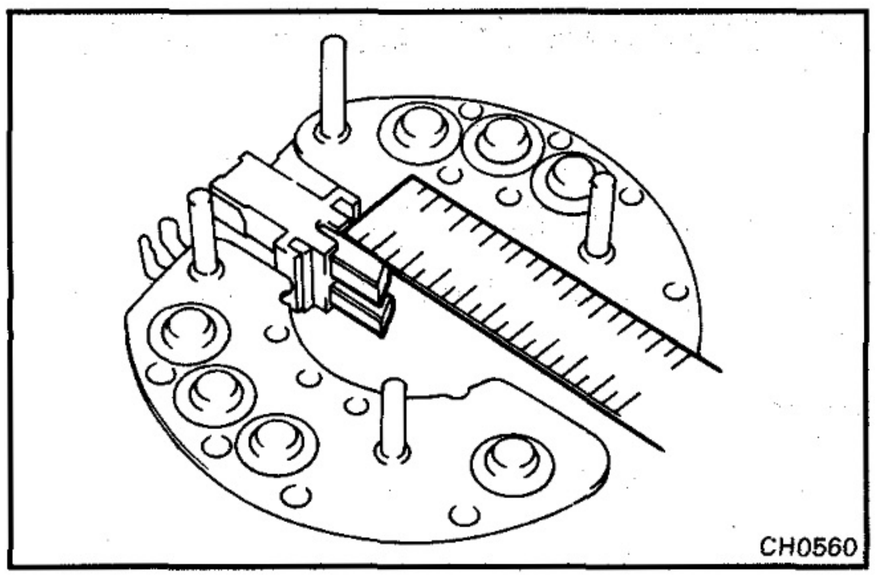
If there is no continuity, replace the stator.



2. INSPECT STATOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the coil leads and stator core.

If there is continuity, replace the stator.



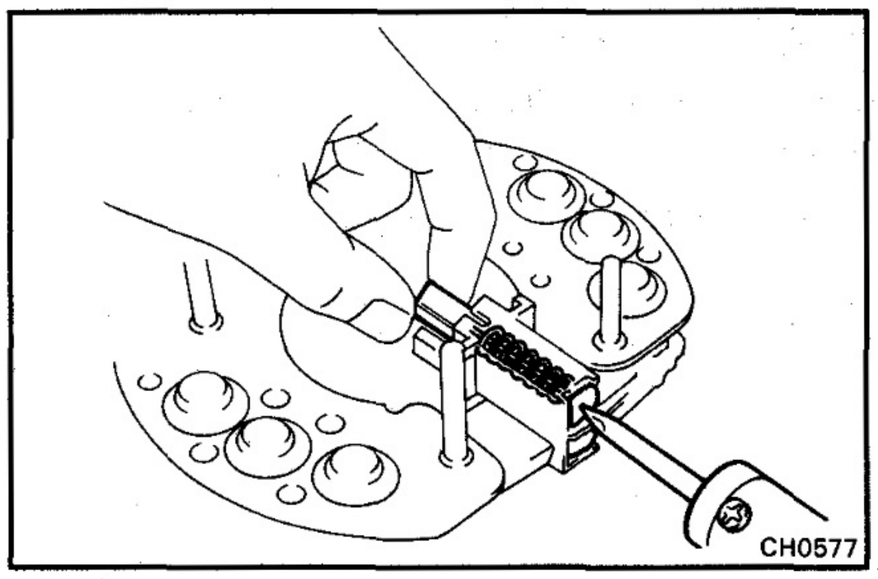
Brushes

1. **INSPECT EXPOSED BRUSH LENGTH**

Using a scale, measure the exposed brush length.

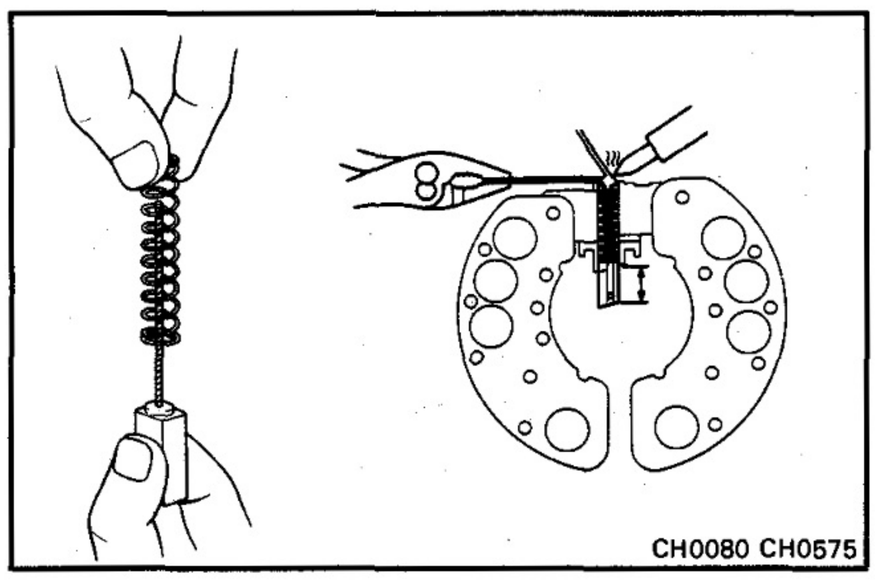
Standard exposed length: 20.0 mm (0.787 in.)
Minimum exposed length: 5.5 mm (0.217 in.)

If the length is less than minimum, replace the brushes.



2. **IF NECESSARY, REPLACE BRUSHES**

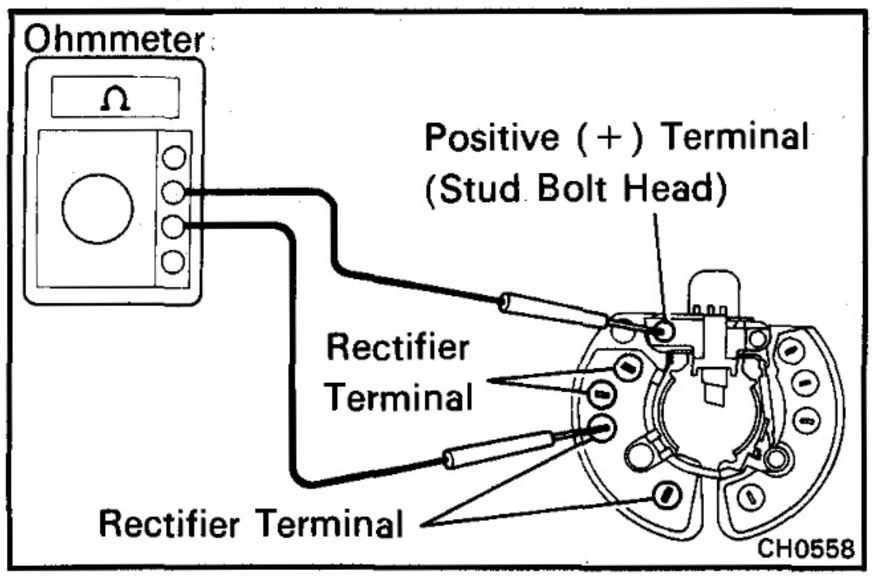
(a) Unsolder and remove the brush and spring.



(b) Insert the brush wire through the spring.
(c) Install the brush in the brush holder.
(d) Solder the wire to the brush holder at specified exposed length.

Exposed length: 20.0 mm (0.787 in.)

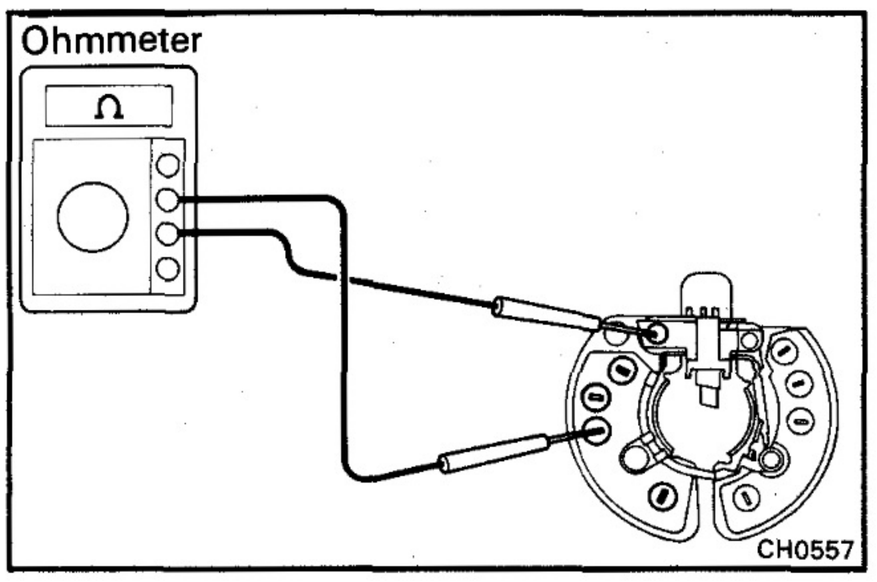
(e) Check that the brush moves smoothly in the brush holder.
(f) Cut off any excess wire.



Rectifiers (Rectifier Holder)

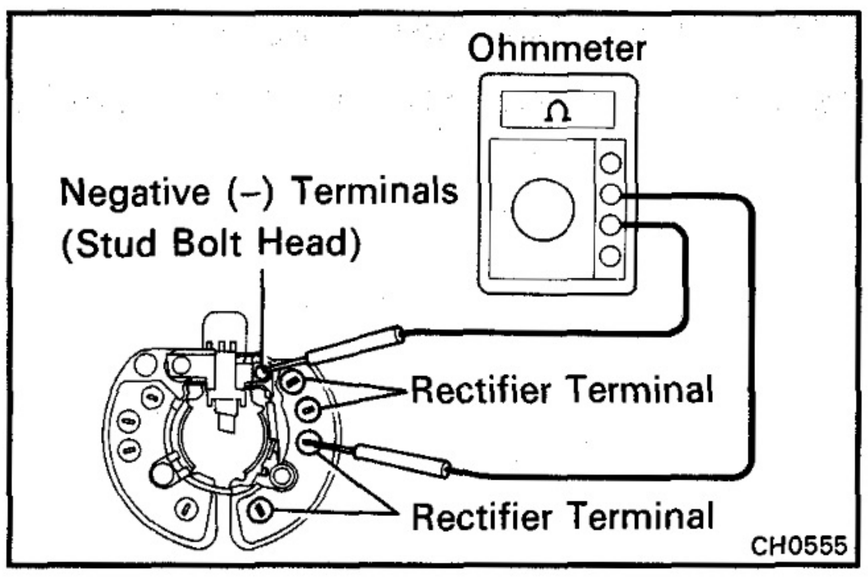
1. **INSPECT POSITIVE SIDE RECTIFIER**

(a) Using an ohmmeter, connect one tester probe to the positive (+) terminal and the other to each rectifier terminal.



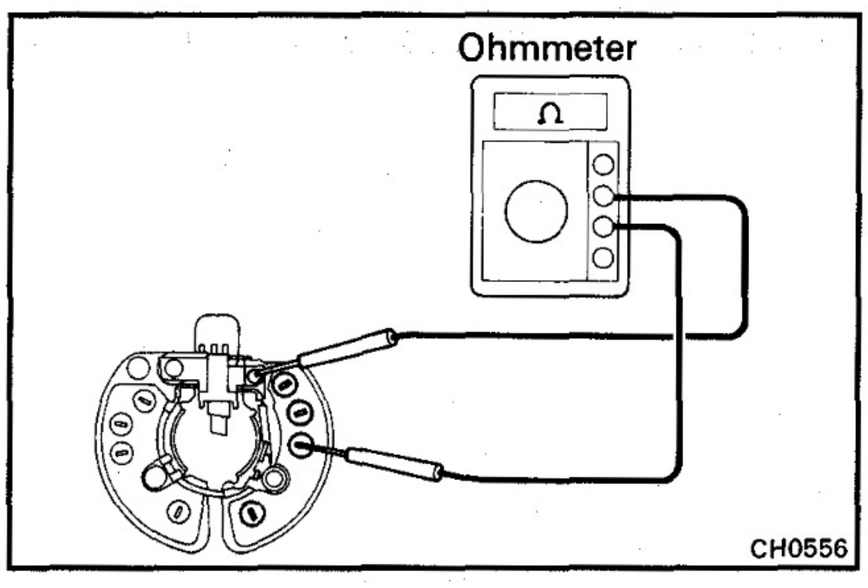
(b) Reverse the polarity of the tester and repeat step (a).
(c) Check that one shows continuity and the other shows no continuity.

If continuity is not as specified, replace the rectifier holder.



2. INSPECT NEGATIVE SIDE RECTIFIER

(a) Using an ohmmeter, connect one tester probe to the negative (–) terminal and the other to each rectifier terminal.

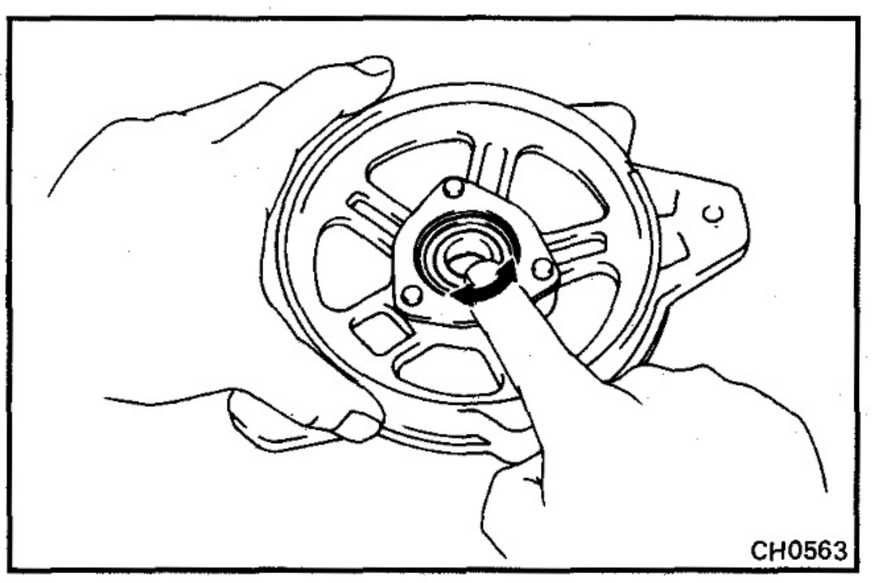


(b) Reverse the polarity of the tester probes and repeat step (a).

(c) Check that one shows continuity and the other shows no continuity.

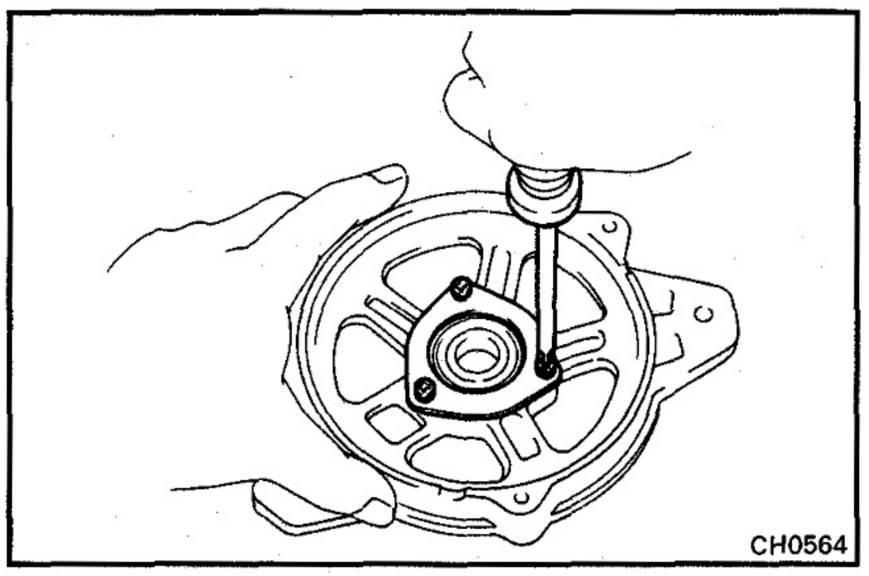
If continuity is not as specified, replace the rectifier holder.

Bearings



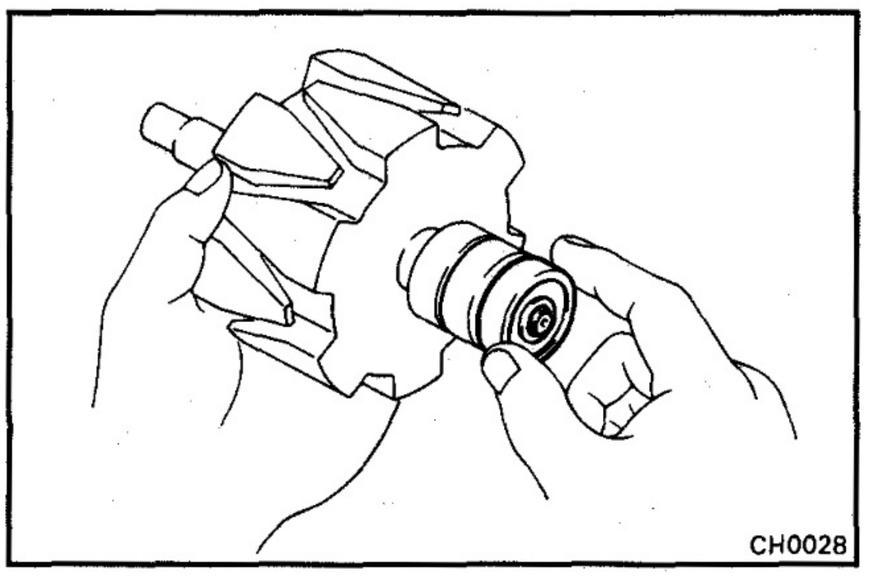
1. INSPECT FRONT BEARING

Check that the bearing is not rough or worn.



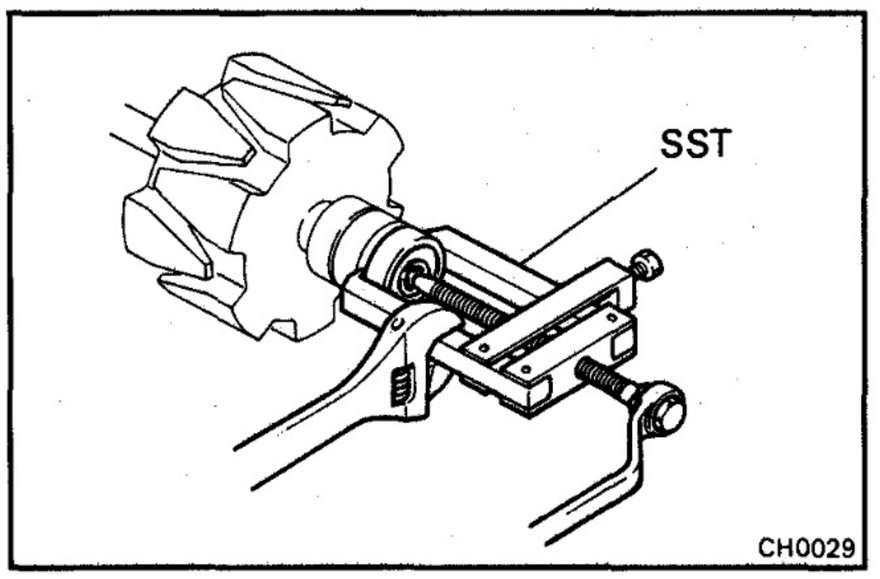
2. IF NECESSARY, REPLACE FRONT BEARING

Remove the three screws and bearing retainer, and replace the bearing.



3. INSPECT REAR BEARING

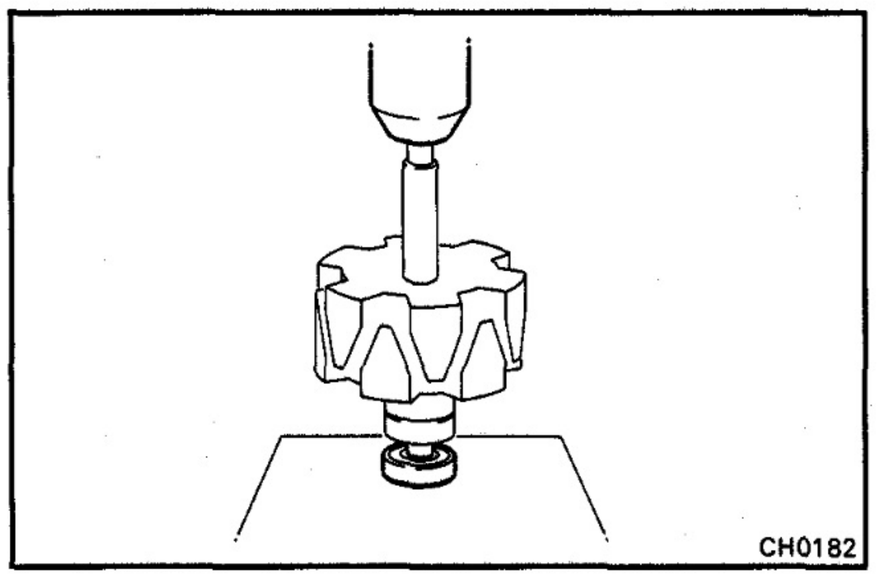
Check that the bearing is not rough or worn.



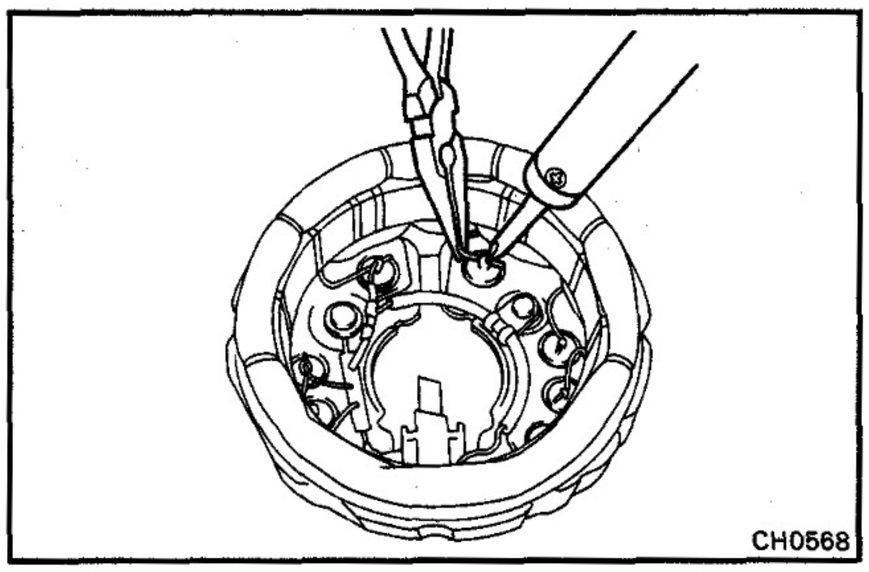
4. IF NECESSARY, REPLACE REAR BEARING

(a) Using SST, remove the bearing from the rotor shaft.

SST 09286-46011



(b) Using a press, press in a new rear bearing onto the rotor shaft.



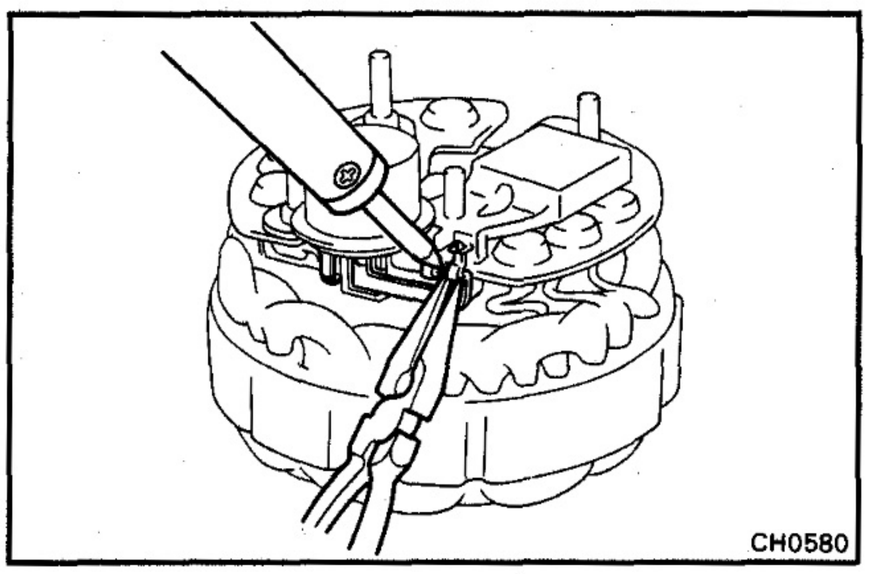
ASSEMBLY OF ALTERNATOR

(See page CH-7)

1. INSTALL RECTIFIER HOLDER TO STATOR

Hold the stator coil lead with needle-nose pliers while soldering the leads.

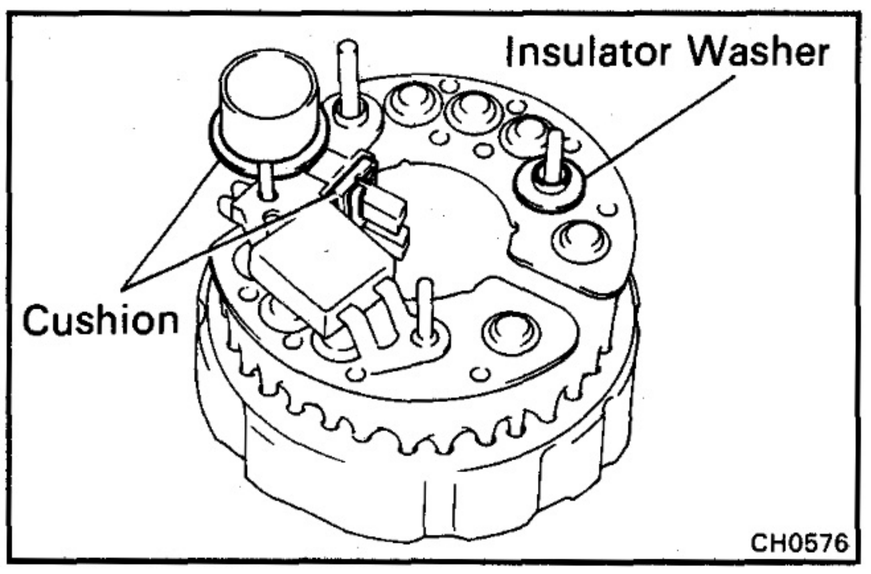
NOTICE: Protect the rectifiers from heat.



2. INSTALL IC REGULATOR

Hold the IC regulator terminal with needle-nose pliers while soldering the terminals.

NOTICE: Protect the rectifiers from heat.



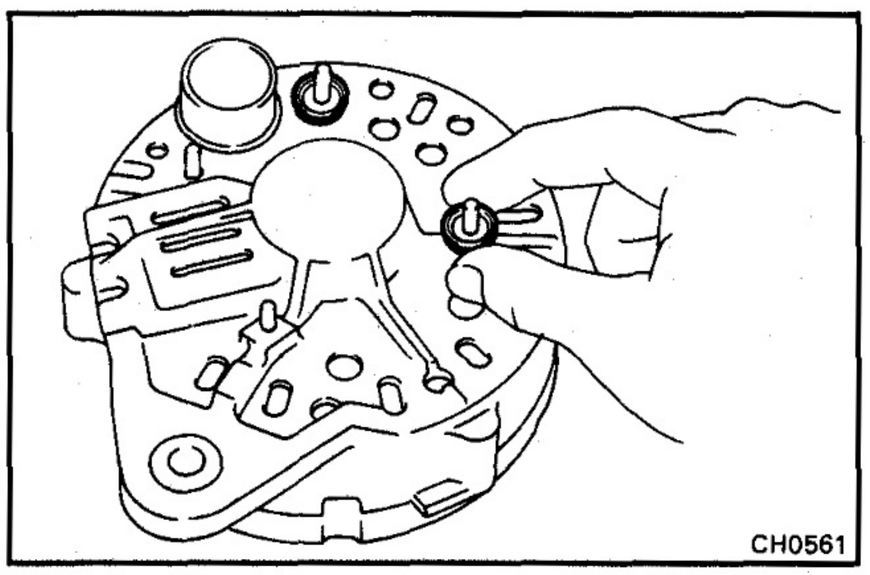
3. INSTALL RECTIFIER END FRAME TO RECTIFIER HOLDER

(a) Place the insulator washer on the positive (+) stud of the rectifier holder.

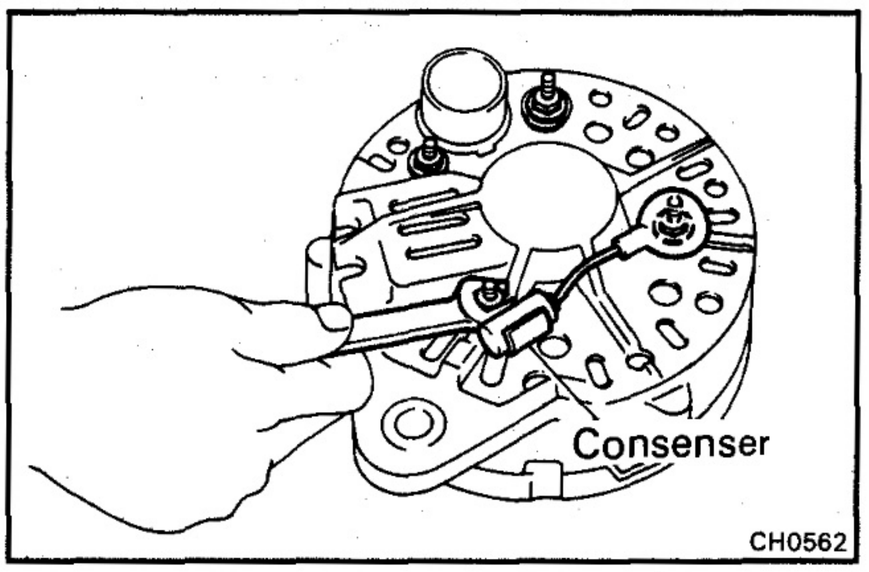
(b) Place the two cushions on the brush holder and alternator terminal.

(c) Place the rectifier end frame on the rectifier holder.

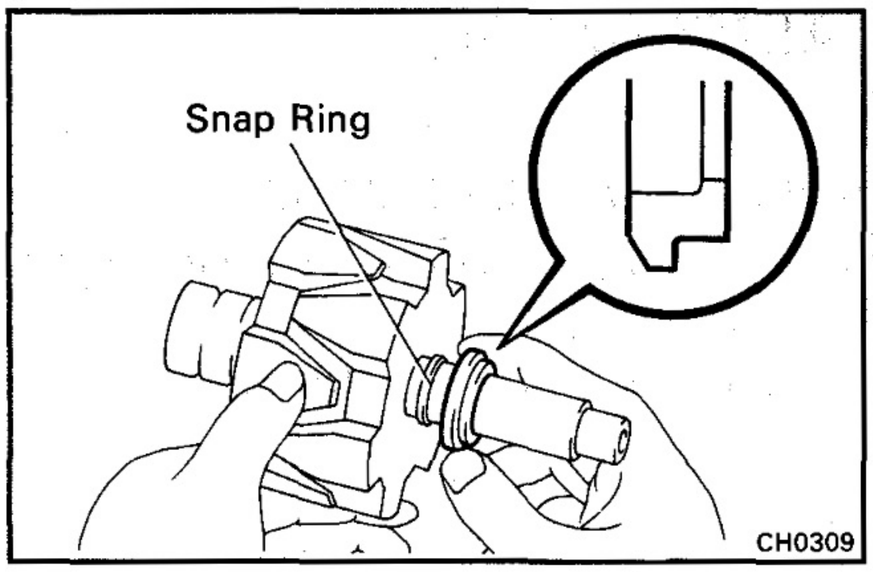
(d) Check that the wires are not touching the rectifier end frame.



(e) Place the two terminal insulators on the positive (+) studs of the rectifier holder.

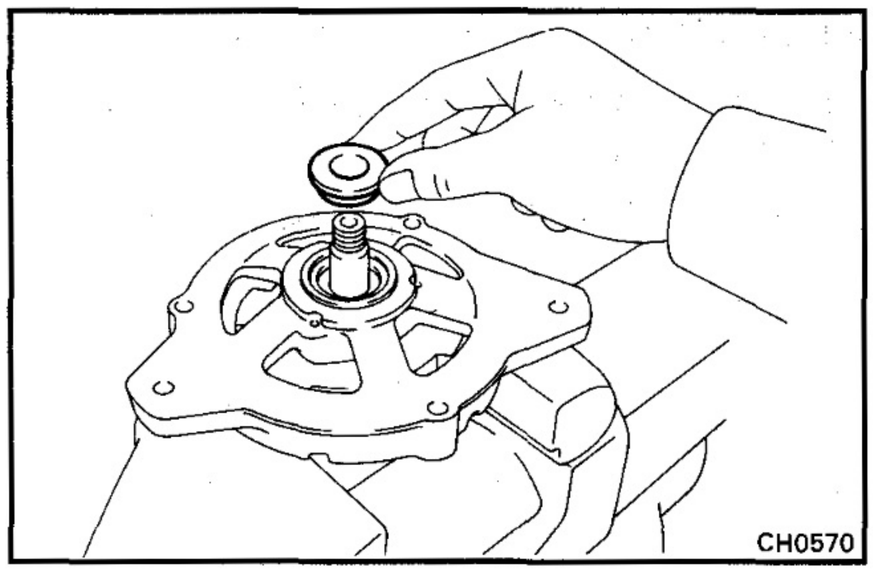


(f) Install the condenser and four nuts.



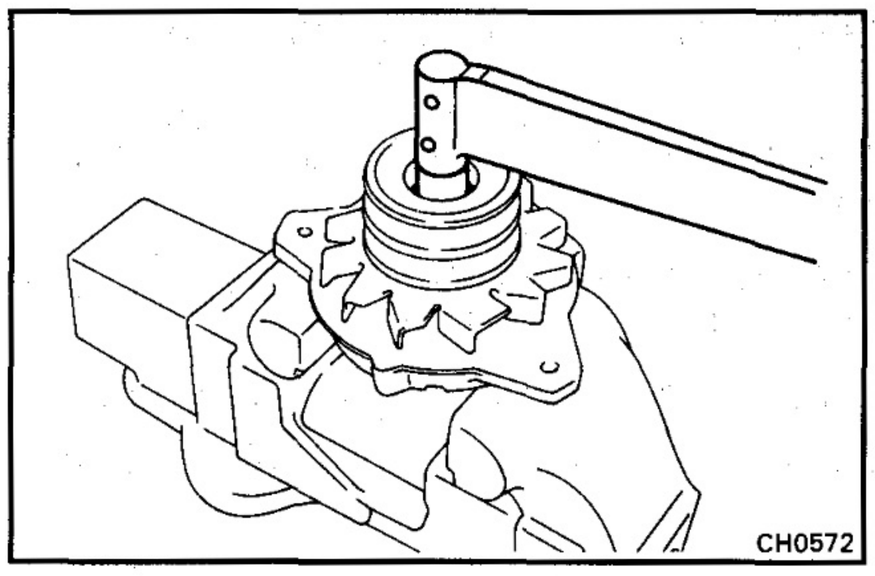
4. INSTALL DRIVE END FRAME, FAN AND PULLEY TO ROTOR

(a) Slide the snap ring and spacer ring onto the rotor shaft.



(b) Mount the rotor in a soft jaw vise.

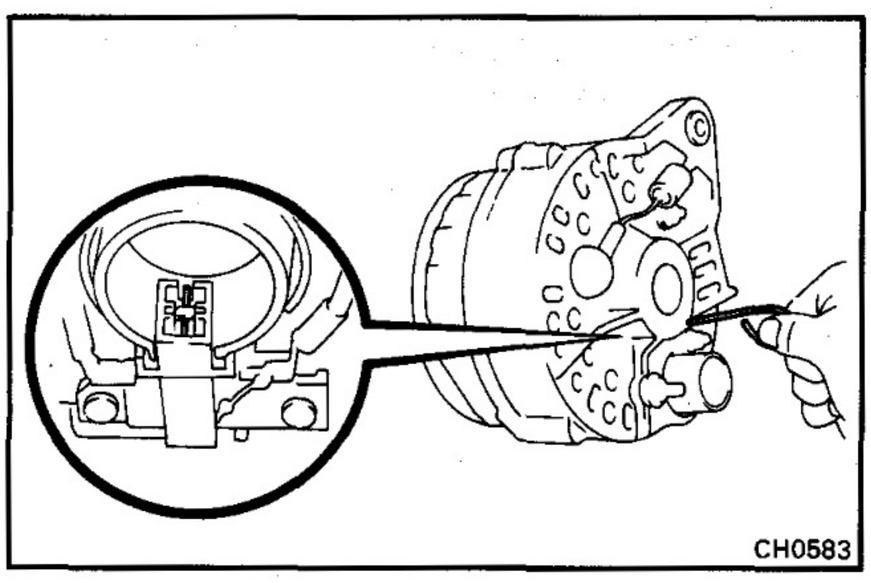
(c) Slide the drive end frame and spacer collar.



(d) Slide the fan, pulley and spring washer onto the rotor shaft.

(e) Install and torque the nut.

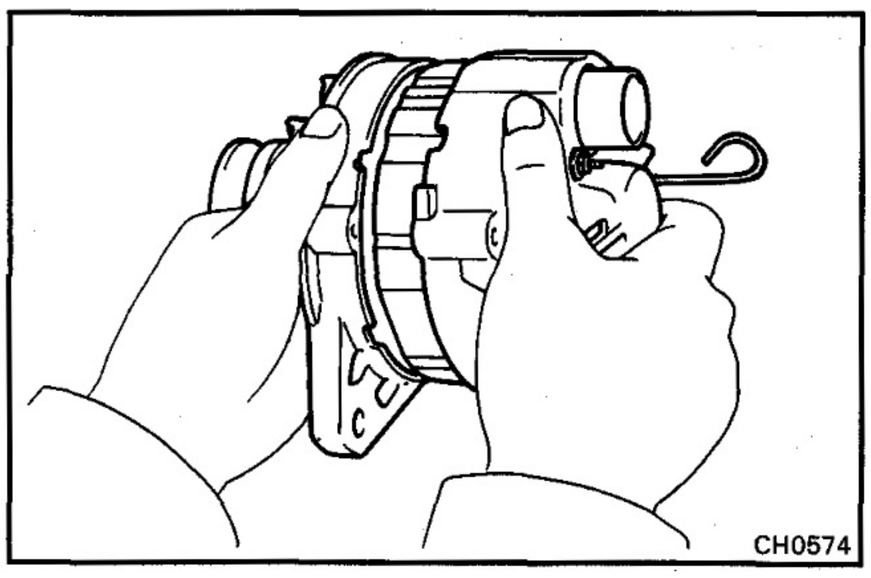
Torque: 900 kg-cm (65 ft-lb, 88 N·m)



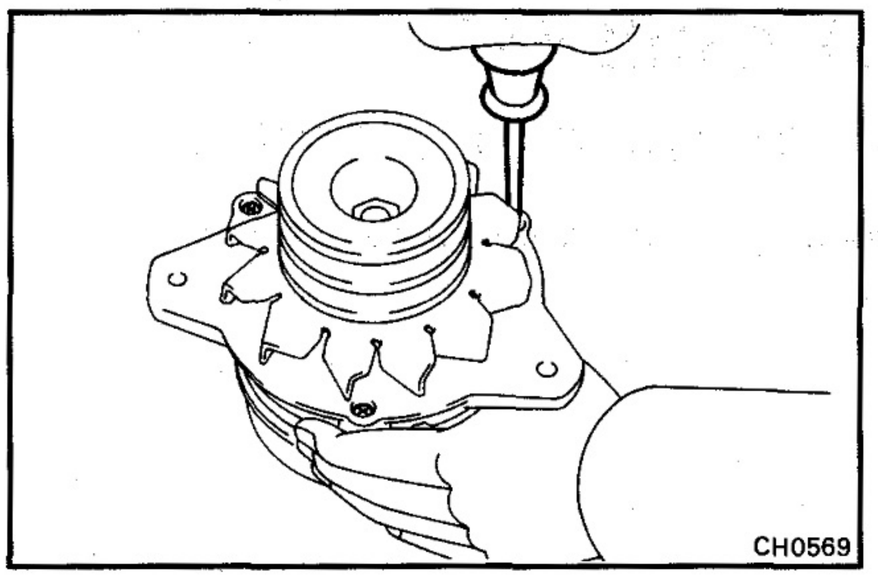
5. ASSEMBLE DRIVE END FRAME AND RECTIFIER END FRAME

(a) Bend the rectifier lead wires back to clear the rotor.

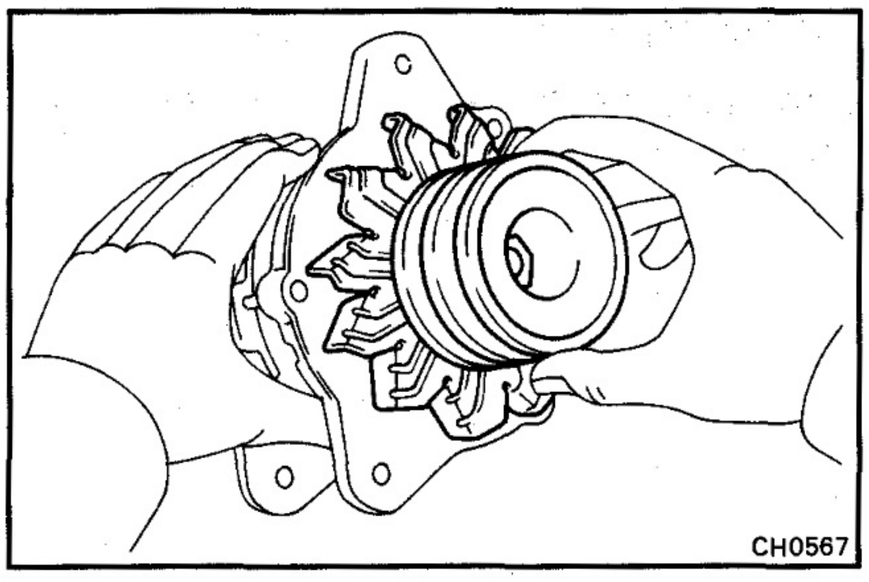
(b) Using a curved tool, push the brushes in as far as they will go and hold them in place by inserting a stiff wire through the access hole in the rectifier end frame.



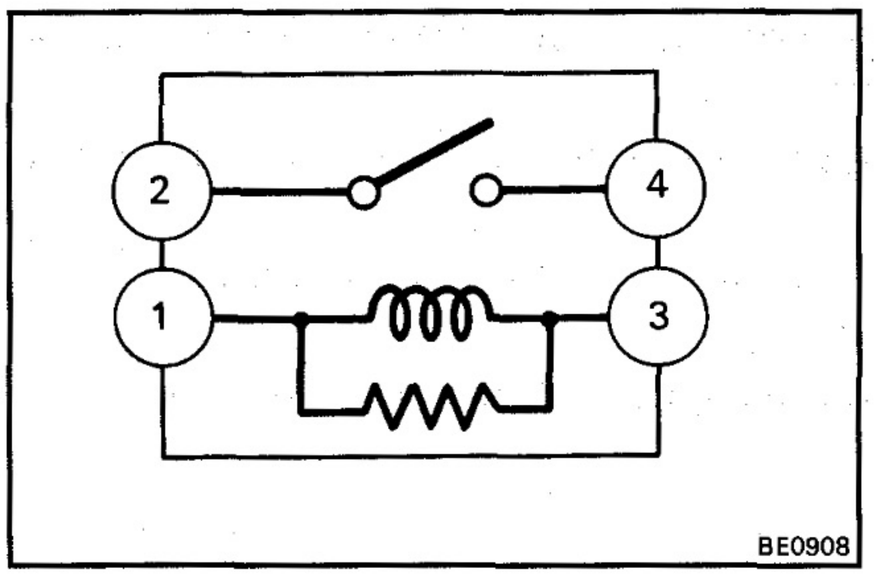
(c) Assemble the drive end frame and the rectifier end frame by inserting the rear bearing on the rotor shaft into the rectifier end frame.



(d) Install the three through screws.
(e) Remove the stiff wire from the access hole.



(f) Check that the rotor rotates smoothly.
(g) Seal the access hole.

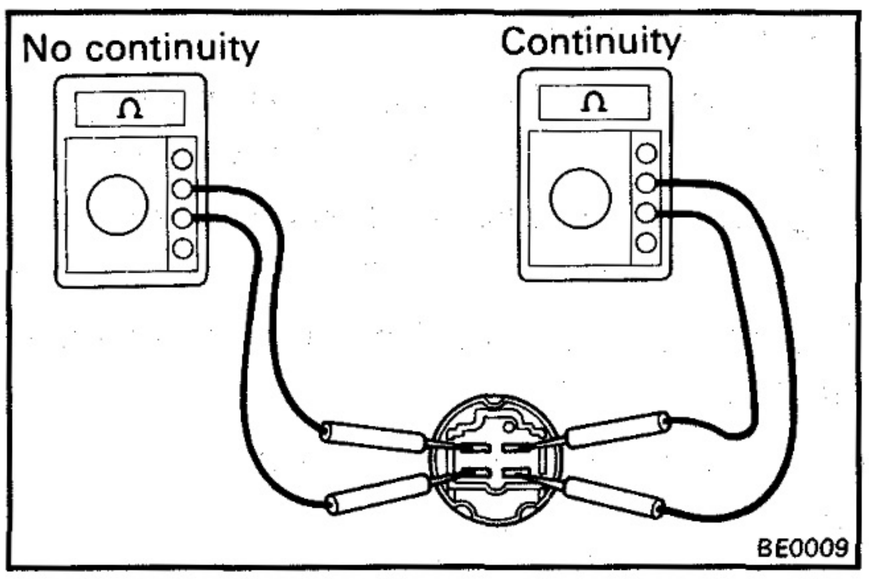


IGNITION MAIN RELAY

INSPECTION OF IGNITION MAIN RELAY

1. INSPECT IGNITION MAIN RELAY

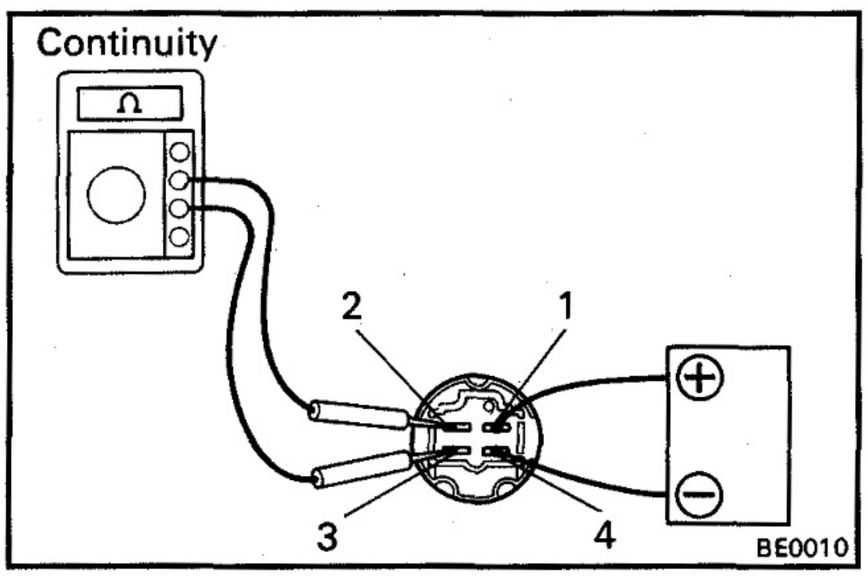
HINT: The relay located in relay block of the left cowl side.



2. INSPECT RELAY CONTINUITY

(a) Check that there is continuity between terminals 1 and 3.
(b) Check that there is no continuity between terminals 2 and 4.
(c) Check that there is no continuity between terminals 3 and 4.

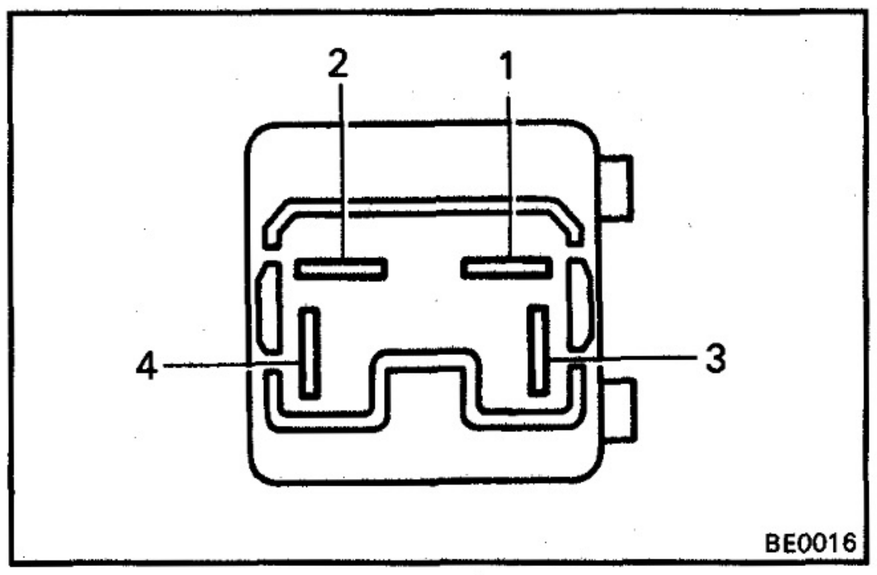
If continuity is not as specified, replace the relay.



3. INSPECT RELAY OPERATION

(a) Apply battery voltage across terminals 1 and 3.
(b) Check that there is continuity between terminals 2 and 4.
(c) Check that there is no continuity between terminals 3 and 4.

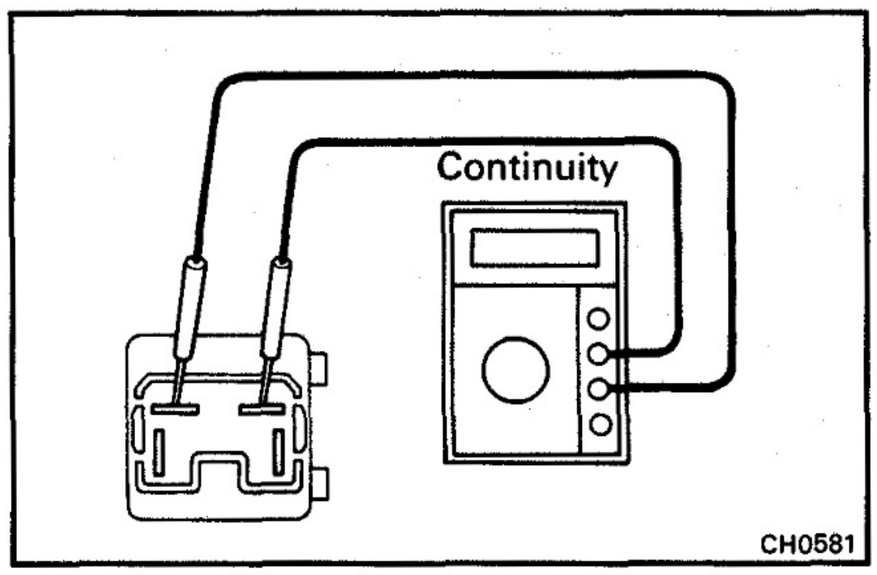
If operation is not as described, replace the relay.



CHARGE LIGHT RELAY

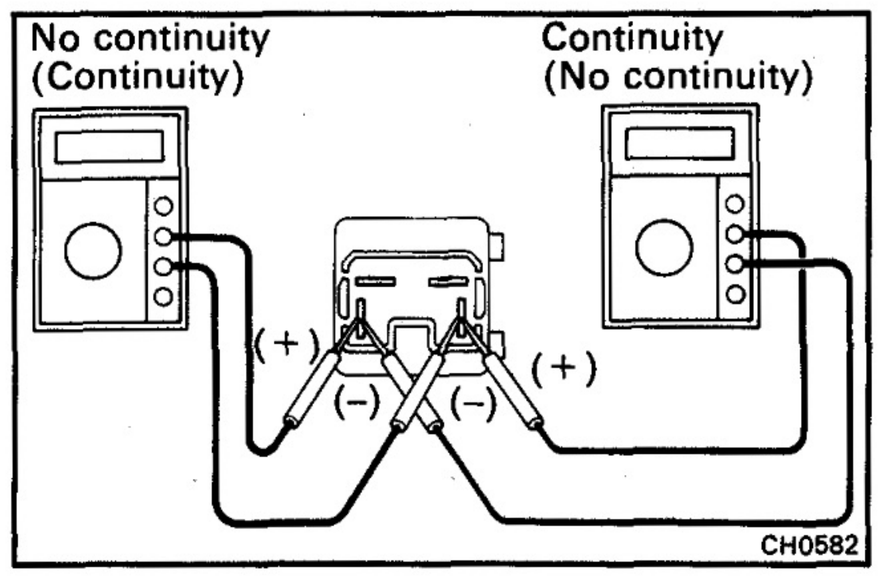
INSPECTION OF CHARGE LIGHT RELAY

LOCATION: Inside of the passenger's cowl side trim.



1. INSPECT RELAY CONTINUITY

(a) Using an ohmmeter, check that there is no continuity between terminals 1 and 2.

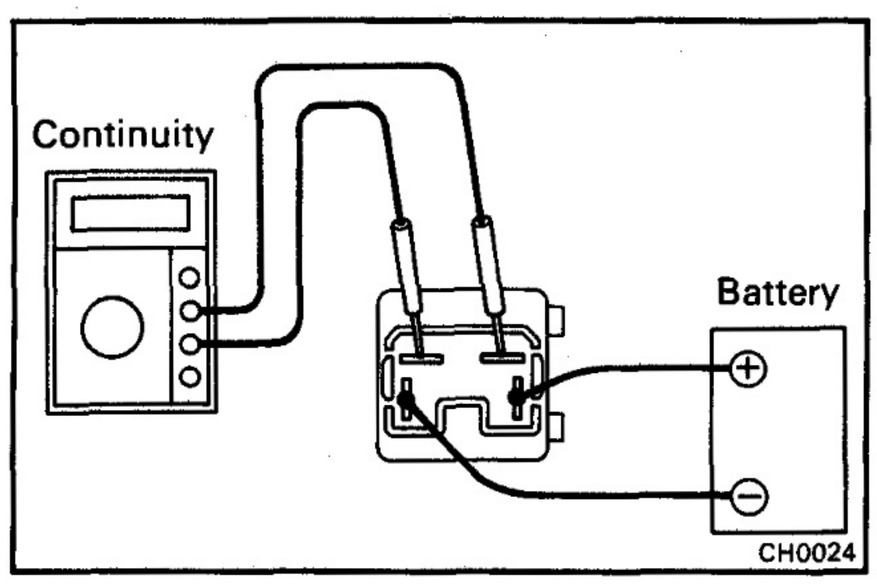


(b) Connect the one test probe to terminal 3 and the other to terminal 4.

(c) Reverse the polarity of test probes, and repeat step (b).

(d) Check that one shows continuity and other shows no continuity.

If continuity is not as specified, replace the relay.



2. INSPECT RELAY OPERATION

(a) Connect a positive (+) lead from the battery to terminal 3.

(b) Connect a negative (–) lead from the battery to terminal 4.

(c) Using an ohmmeter, check for continuity between terminals 1 and 2.

If operation is not as specified, replace the relay.

SERVICE SPECIFICATIONS

	Page
ENGINE MECHANICAL	A-2
EFI SYSTEM	A-7
IGNITION SYSTEM	A-10
CHARGING SYSTEM	A-10

ENGINE MECHANICAL

Specifications

Engine coolant capacity				
	w/ Front heater	17.5 liters	18.5 US qts	15.4 Imp. qts
	w/ Front and rear heaters	19.5 liters	20.6 US qts	17.2 Imp. qts
Engine oil capacity				
Drain and refill	w/o Oil filter change	7.0 liters	7.4 US qts	6.2 Imp. qts
	w/ Oil filter change	7.8 liters	8.2 US qts	6.9 Imp. qts
Dry fill		8.0 liters	8.5 US qts	7.0 Imp. qts
Battery gravity when fully charged at 20°C (68°F)		1.25 – 1.27		
High-tension cord	Resistance	25 kΩ per cord		
Spark plug				
Type	ND	W16EXR-U		
	NGK	BPR5EY		
Correct electrode gap		0.8 mm	0.031 in.	
Firing order		1 – 5 – 3 – 6 – 2 – 4		
Drive belt deflection with 10 kg (22.0 lb, 98 N)				
Alternator – Water pump	New belt	7.0 – 9.0 mm	0.278 – 0.354 in.	
	Used belt	9.0 – 12.0 mm	0.354 – 0.472 in.	
PS pump – Crankshaft	New belt	7.0 – 9.5 mm	0.278 – 0.374 in.	
	Used belt	8.0 – 10.0 mm	0.315 – 0.393 in.	
Valve clearance at hot	IN	0.20 mm	0.008 in.	
	EX	0.35 mm	0.014 in.	
Ignition timing		7° BTDC @ Idle		
Dash pot setting speed		1,200 rpm		
Intake manifold vacuum	at idle speed	420 mmHg (16.54 in.Hg, 56.0 kPa) or more		
Compression pressure	at 200 rpm STD	10.5 kg/cm² (149 psi, 1,030 kPa) or more		
	Limit	8.0 kg/cm² (114 psi, 785 kPa)		
Pressure difference between each cylinder		0.5 kg/cm² (7 psi, 49kPa) or less		

Specifications (Cont'd)

Cylinder head	Cylinder block surface warpage		Limit	0.15 mm	0.0059 in.
	Manifold surface warpage		Limit	0.10 mm	0.0039 in.
	Valve seat	Refacing angle	Intake	25°, 45°, 70°	
			Exhaust	45°, 65°	
		Contacting angle		45°	
		Contacting width	Intake	1.1 – 1.7 mm	0.043 – 0.067 in.
			Exhaust	1.4 – 2.0 mm	0.055 – 0.079 in.
Valve guide bushing	Inside diameter			8.010 – 8.030 mm	0.3154 – 0.3161 in.
	Outside diameter	STD		14.028 – 14.041 mm	0.5523 – 0.5528 in.
		O/S 0.05		14.078 – 14.091 mm	0.5543 – 0.5548 in.
Valve	Overall length	STD	Intake	124.8 mm	4.913 in.
			Exhaust	128.0 mm	5.039 in.
		Limit	Intake	124.3 mm	4.894 in.
			Exhaust	127.5 mm	5.020 in.
	Face angle		IN & EX	44.5°	
	Stem diameter		Intake	7.970 – 7.985 mm	0.3138 – 0.3144 in.
			Exhaust	7.960 – 7.975 mm	0.3134 – 0.3140 in.
	Stem oil clearance	STD	Intake	0.025 – 0.060 mm	0.0010 – 0.0024 in.
			Exhaust	0.035 – 0.070 mm	0.0014 – 0.0028 in.
		Limit	Intake	0.10 mm	0.0039 in.
			Exhaust	0.12 mm	0.0047 in.
	Margin thickness	STD	Intake	1.5 – 2.1 mm	0.059 – 0.083 in.
			Exhaust	1.7 – 2.3 mm	0.067 – 0.091 in.
		Limit	Intake	1.0 mm	0.039 in.
			Exhaust	1.2 mm	0.047 in.
Valve spring	Squareness		Limit	1.8 mm	0.071 in.
	Free length		STD	51.5 mm	2.028 in.
			Limit	50.0 mm	1.967 in.
	Installed tension at 43.0 mm (1.693 in.)				
			STD	32.5 kg / 71.6 lb	319 N
			Limit	27 kg / 59.5 lb	265 N
Valve rocker arm and shaft	Rocker arm inside diameter		STD	18.494 – 18.515 mm	0.7281 – 0.7289 in.
	Shaft diameter		STD	18.464 – 18.485 mm	0.7269 – 0.7278 in.
	Rocker arm oil clearance		STD	0.009 – 0.051 mm	0.0004 – 0.0020 in.
			Limit	0.08 mm	0.0031 in.
Push rod	Circle runout		Limit	1.0 mm	0.039 in.
Manifold	Warpage		Limit	0.50 mm	0.0197 in.
Air intake chamber	Warpage			0.20 mm	0.008 in.
Timing gear	Backlash		STD	0.100 – 0.183 mm	0.0039 – 0.0072 in.
			Limit	0.25 mm	0.0098 in.

Specifications (Cont'd)

Camshaft and bearing	Circle runout	Limit		0.30 mm	0.0118 in.
	Cam lobe height	STD	IN	38.36 – 38.46 mm	1.5102 – 1.5142 in.
			EX	38.25 – 38.35 mm	1.5059 – 1.5098 in.
		Limit	IN	38.0 mm	1.496 in.
			EX	37.9 mm	1.492 in.
	Journal diameter	STD	No. 1	47.955 – 47.975 mm	1.8880 – 1.8888 in.
			No. 2	46.455 – 46.475 mm	1.8289 – 1.8297 in.
			No. 3	44.955 – 44.975 mm	1.7699 – 1.7707 in.
			No. 4	43.455 – 43.475 mm	1.7108 – 1.7116 in.
		U/S 0.25	No. 1	47.715 – 47.725 mm	1.8785 – 1.8789 in.
			No. 2	46.215 – 46.225 mm	1.8195 – 1.8199 in.
			No. 3	44.715 – 44.725 mm	1.7604 – 1.7608 in.
			No. 4	43.215 – 43.225 mm	1.7014 – 1.7018 in.
		U/S 0.50	No. 1	47.465 – 47.475 mm	1.8687 – 1.8691 in.
			No. 2	45.965 – 45.975 mm	1.8096 – 1.8888 in.
			No. 3	44.465 – 44.475 mm	1.7506 – 1.7510 in.
			No. 4	42.965 – 42.975 mm	1.6915 – 1.6919 in.
	Bearing inside diameter	STD	No. 1	48.000 – 48.030 mm	1.8898 – 1.8909 in.
			No. 2	46.500 – 46.530 mm	1.8307 – 1.8319 in.
			No. 3	45.000 – 45.030 mm	1.7717 – 1.7728 in.
			No. 4	43.500 – 43.530 mm	1.7126 – 1.7138 in.
		U/S 0.25	No. 1	47.750 – 47.825 mm	1.8799 – 1.8829 in.
			No. 2	46.250 – 46.325 mm	1.8209 – 1.8238 in.
			No. 3	44.750 – 44.820 mm	1.7618 – 1.7646 in.
			No. 4	43.250 – 43.320 mm	1.7028 – 1.7055 in.
		U/S 0.50	No. 1	47.500 – 47.575 mm	1.8701 – 1.8730 in.
			No. 2	46.000 – 46.075 mm	1.8110 – 1.8140 in.
			No. 3	44.500 – 44.570 mm	1.7520 – 1.7547 in.
			No. 4	43.000 – 43.070 mm	1.6929 – 1.6957 in.
	Journal oil clearance				
	STD	STD		0.025 – 0.075 mm	0.0010 – 0.0030 in.
		U/S 0.25 and 0.50			
		No. 1 and No. 2		0.025 – 0.110 mm	0.0010 – 0.0043 in.
		No. 3 and No. 4		0.025 – 0.105 mm	0.0010 – 0.0041 in.
	Limit	STD		0.10 mm	0.0039 in.
		U/S 0.25 and 0.50		0.15 mm	0.0059 in.
	Thrust clearance	STD		0.200 – 0.290 mm	0.0079 – 0.0114 in.
		Limit		0.33 mm	0.0130 in.
Valve lifter	Lifter diameter	STD		21.387 – 21.404 mm	0.8420 – 0.8427 in.
		O/S 0.05		21.437 – 21.454 mm	0.8440 – 0.8446 in.
	Cylinder block lifter bore diameter			21.417 – 21.443 mm	0.8432 – 0.8442 in.
	Lifter oil clearance		STD	0.013 – 0.056 mm	0.0005 – 0.0022 in.
			Limit	0.10 mm	0.0039 in.

Specifications (Cont'd)

Cylinder block	Warpage		Limit	0.15 mm	0.0059 in.
	Cylinder bore diameter	STD	Mark "1"	94.000 – 94.010 mm	3.7008 – 3.7012 in.
			Mark "2"	94.010 – 94.020 mm	3.7012 – 3.7016 in.
			Mark "3"	94.020 – 94.030 mm	3.7016 – 3.7020 in.
			Limit	94.23mm	3.7098 in.
		O/S 0.50	Limit	94.73 mm	3.7295 in.
		O/S 1.00	Limit	95.23 mm	3.7492 in.
		O/S 1.50	Limit	95.73 mm	3.7689 in.
Piston and piston ring	Piston diameter	STD	Mark "1"	93.963 – 93.973 mm	3.6993 – 3.6997 in.
			Mark "2"	93.973 – 93.983 mm	3.6997 – 3.7001 in.
			Mark "3"	93.983 – 93.993 mm	3.7001 – 3.7005 in.
		O/S 0.50		94.463 – 94.493 mm	3.7190 – 3.7202 in.
		O/S 1.00		94.963 – 94.993 mm	3.7387 – 3.7399 in.
		O/S 1.50		95.463 – 95.493 mm	3.7584 – 3.7596 in.
	Piston oil clearance			0.027 – 0.047 mm	0.0011 – 0.0019 in.
	Piston ring groove clearance				
		No. 1		0.030 – 0.070 mm	0.0012 – 0.0028 in.
		No. 2		0.050 – 0.090 mm	0.0020 – 0.0035 in.
	Piston ring end gap	STD	No. 1	0.200 – 0.420 mm	0.0079 – 0.0165 in.
			No. 2	0.500 – 0.720 mm	0.0197 – 0.0283 in.
			Oil	0.200 – 0.820 mm	0.0079 – 0.0323 in.
		Limit	No. 1	1.02 mm	0.0402 in.
			No. 2	1.32 mm	0.0520 in.
			Oil	1.42 mm	0.0559 in.
Connecting rod and piston pin	Thrust clearance	STD		0.160 – 0.300 mm	0.0063 – 0.0118 in.
		Limit		0.40 mm	0.0156 in.
	Connecting rod bearing center wall thickness				
		STD	Mark A	1.484 – 1.488 mm	0.0584 – 0.0586 in.
			Mark B	1.488 – 1.492 mm	0.0586 – 0.0587 in.
			Mark C	1.492 – 1.496 mm	0.0587 – 0.0589 in.
	Connecting rod oil clearance				
		STD STD		0.020 – 0.050 mm	0.0008 – 0.0020 in.
			U/S 0.25 and 0.50	0.019 – 0.063 mm	0.0007 – 0.0025 in.
		Limit		0.10 mm	0.0039 in.
	Bend per 100 mm (3.94 in.)				
		Limit		0.05 mm	0.0020 in.
	Twist per 100 mm (3.94 in.)				
		Limit		0.15 mm	0.0059 in.
	Bushing inside diameter			22.012 – 22.027 mm	0.8666 – 0.8672 in.
	Piston pin diameter			22.004 – 22.019 mm	0.8663 – 0.8669 in.
	Piston pin to bushing oil clearance				
		STD		0.005 – 0.011 mm	0.0002 – 0.0004 in.
		Limit		0.03 mm	0.0012 in.
Crankshaft and bearing	Thrust clearance	STD		0.015 – 0.204 mm	0.0006 – 0.0080 in.
		Limit		0.30 mm	0.0118 in.
	Thrust washer thickness	STD		2.430 – 2.480 mm	0.0957 – 0.0976 in.
		O/S 0.125		2.493 – 2.543 mm	0.0981 – 0.1001 in.
		O/S 0.250		2.555 – 2.605 mm	0.1006 – 0.1026 in.
	Main journal oil clearance				
		STD STD		0.020 – 0.044 mm	0.0008 – 0.0017 in.
			U/S 0.25 and 0.50	0.021 – 0.067 mm	0.0008 – 0.0026 in.
		Limit		0.10 mm	0.0039 in.

Specifications (Cont'd)

Crankshaft and bearing (cont'd)	Main journal diameter	STD	No. 1	66.972 – 66.996 mm	2.6367 – 2.6376 in.
			No. 2	68.472 – 68.496 mm	2.6957 – 2.6967 in.
			No. 3	69.972 – 69.996 mm	2.7548 – 2.7557 in.
			No. 4	71.472 – 71.496 mm	2.8139 – 2.8148 in.
		U/S 0.25	No. 1	66.745 – 66.755 mm	2.6278 – 2.6281 in.
			No. 2	68.245 – 68.255 mm	2.6868 – 2.6872 in.
			No. 3	69.745 – 69.755 mm	2.7459 – 2.7463 in.
			No. 4	71.245 – 71.255 mm	2.8049 – 2.8053 in.
		U/S 0.50	No. 1	66.495 – 66.505 mm	2.6179 – 2.6183 in.
			No. 2	67.995 – 68.005 mm	2.6770 – 2.6774 in.
			No. 3	69.495 – 69.505 mm	2.7360 – 2.7364 in.
			No. 4	70.995 – 71.005 mm	2.7951 – 2.7955 in.
	Main bearing center wall thickness				
		STD	Mark T1	2.493 – 2.497 mm	0.0981 – 0.0983 in.
			Mark T2	2.497 – 2.501 mm	0.0983 – 0.0985 in.
			Mark T3	2.501 – 2.505 mm	0.0985 – 0.0986 in.
			Mark T4	2.505 – 2.509 mm	0.0986 – 0.0988 in.
			Mark T5	2.509 – 2.513 mm	0.0988 – 0.0989 in.
	Crank pin diameter		STD	52.988 – 53.000 mm	2.0861 – 2.0866 in.
			U/S 0.25	52.701 – 52.711 mm	2.0748 – 2.0752 in.
			U/S 0.50	52.451 – 52.461 mm	2.0650 – 2.0654 in.
	Circle runout		Limit	0.12 mm	0.0048 in.
	Taper and out-of-round				
	Main journal and crank pin		Limit	0.02 mm	0.0008 in.

Torque Specifications

Part tightened		kg-cm	ft-lb	N·m
Cylinder head x Cylinder block		1,250	90	123
Valve rocker support x Cylinder head				
	12 mm bolt head	240	17	24
	14 mm bolt head and nut	340	25	33
Manifold x Cylinder head	14 mm bolt head	510	37	50
	17 mm bolt head	700	51	69
	Nut	570	41	56
Cylinder head cover x Cylinder head		90	78 in.-lb	8.8
Intake manifold x Intake manifold stay		300	22	29
Cylinder block x Intake manifold stay		300	22	29
Air injection manifold x Cylinder head		210	15	21
Exhaust manifold x Exhaust pipe		630	46	62
Water outlet housing x Cylinder head		250	18	25
Camshaft thrust washer x Cylinder block		120	9	12
Timing gear cover x Front end plate or cylinder block				
	10 mm bolt head	50	43 in.-lb	4.9
	14 mm bolt head	250	18	25
Crankshaft pulley x Crankshaft		3,500	253	343

Torque Specifications (Cont'd)

Part tightened	kg-cm	ft-lb	N·m
PS pulley x Crankshaft pulley	185	13	18
Push rod cover x Cylinder block	40	35 in.-lb	3.9
Main bearing cap x Cylinder block			
19 mm bolt head	1,375	99	135
17 mm bolt head	1,175	85	115
Connecting rod cap x Connecting rod	600	43	59
Front end plate x Cylinder block			
Screw	250	18	25
Bolt	310	22	30
Drive plate x Crankshaft	890	64	87

EFI SYSTEM

Specifications

Fuel pressure regulator	Fuel pressure at No vacuum		2.6 – 3.2 kg/cm² (37 – 46 psi, 255 – 314 kPa)
Cold start injector	Resistance		2 – 4 Ω
	Fuel leakage		One drop or less per minute
Injector	Resistance		Approx. 13.8 Ω
	Injection volume		47 – 59 cc (2.9 – 3.6 cu in.) per 15 sec.
	Difference between each injector		5 cc (0.31 cu in.) or less
	Fuel leakage		One drop or less per minute
Throttle position sensor	Clearance between stop screw and lever	Between terminals	Resistance
	0 mm 0 in.	VTA – E2	0.3 – 6.3 kΩ
	0.77 mm 0.0303 in.	IDL – E2	Less than 2.3 kΩ
	1.09 mm 0.0429 in.	IDL – E2	Infinity
	Throttle valve fully opened position	VTA – E2	3.5 – 10.3 kΩ
	—	VC – E2	4.25 – 8.25 kΩ
ISC valve	Resistance	B1 – S1 or S3	10 – 30 Ω
		B2 – S2 or S4	10 – 30 Ω
Cold start injector time switch	Resistance STA – E1	below 15°C (59°F)	30 – 50 Ω
		above 30°C (86°F)	70 – 90 Ω
	STA – Ground		30 – 90 Ω
Air flow meter	Resistance	E2 – VS	200 – 600 Ω (Measuring plate fully closed)
			20 – 1,200 Ω (Measuring plate fully open)
		E2 – VC	200 – 400 Ω
		E1 – FC	Infinity (Measuring plate fully closed)
			Zero (Other than closed position)

Specifications (Cont'd)

<table>
<tr><td>Air flow meter (cont'd)</td><td>Resistance (cont'd)</td><td>E2 – THA</td><td>at –20°C (–4°F)
at 0°C (32°F)
at 20°C (68°F)
at 40°C (104°F)
at 60°C (140°F)</td><td>10 – 20 kΩ
4 – 7 kΩ
2 – 3 kΩ
0.9 – 1.3 kΩ
0.4 – 0.7 kΩ</td></tr>
<tr><td>Water temp. sensor</td><td>Resistance</td><td></td><td>at –20°C (–4°F)
at 0°C (32°F)
at 20°C (68°F)
at 40°C (104°F)
at 60°C (140°F)
at 80°C (176°F)</td><td>10 – 20 kΩ
4 – 7 kΩ
2 – 3 kΩ
0.9 – 1.3 kΩ
0.4 – 0.7 kΩ
0.2 – 0.4 kΩ</td></tr>
<tr><td>Oxygen sensor</td><td>Heater resistance</td><td></td><td></td><td>5.1 – 6.3 Ω</td></tr>
<tr><td>EGR gas temp. sensor (calif. only)</td><td>Resistance</td><td></td><td>at 50°C (112°F)
at 100°C (212°F)
at 150°C (302°F)</td><td>69.40 – 88.50 kΩ
11.89 – 14.37 kΩ
2.79 – 3.59 kΩ</td></tr>
<tr><td>ECU</td><td colspan="4">HINT:
• Perform all voltage and resistance measurements with the computer connected.
• Verity that the battery voltage is 11 V or above with the ignition switch is ON.</td></tr>
<tr><td></td><td colspan="4">Voltage
<table><tr><th>Terminals</th><th>Condition</th><th></th><th>STD voltage (V)</th></tr><tr><td>BATT – E1</td><td colspan="2">—</td><td>10 – 14</td></tr><tr><td>IG SW – E1</td><td colspan="2">Ignition switch ON</td><td>10 – 14</td></tr><tr><td>M-REL – E1</td><td colspan="2">Ignition switch ON</td><td>10 – 14</td></tr><tr><td>+B (+B1) – E1</td><td colspan="2">Ignition switch ON</td><td>10 – 14</td></tr><tr><td>IDL – E2</td><td rowspan="3">Ignition switch ON</td><td>Throttle valve open</td><td>4 – 6</td></tr><tr><td>VC – E2</td><td>—</td><td>4 – 6</td></tr><tr><td>VTA – E2</td><td>Throttle valve fully closed</td><td>0.1 – 1.0</td></tr><tr><td></td><td></td><td>Throttle valve fully open</td><td>4 – 5</td></tr><tr><td>VC – E22</td><td rowspan="3">Ignition switch ON</td><td>—</td><td>4 – 6</td></tr><tr><td rowspan="3">VS– E22</td><td>Measuring plate fully closed</td><td>4 – 5</td></tr><tr><td></td><td>Measuring plate fully open</td><td>0.02 – 0.08</td></tr><tr><td></td><td colspan="2">Idling</td><td>2 – 4</td></tr><tr><td>•</td><td colspan="2">3,000 rpm</td><td>0.3 – 1.0</td></tr><tr><td>THA – E2</td><td>Ignition switch ON</td><td>Intake air temperature 20°C (68°F)</td><td>1 – 3</td></tr><tr><td>THW – E2</td><td>Ignition switch ON</td><td>Coolant temperature 80°C (176°F)</td><td>0.1 – 1.0</td></tr><tr><td>No. 10 – E01
No. 20 – E02</td><td colspan="2">Ignition switch ON</td><td>10 – 14</td></tr><tr><td>STA – E1</td><td colspan="2">Cranking</td><td>6 – 14</td></tr><tr><td>ISC1 ≀ ISC4 – E1</td><td colspan="2">Ignition switch ON</td><td>10 – 14</td></tr><tr><td>IGT – E1</td><td colspan="2">Idling</td><td>0.7 – 1.0</td></tr><tr><td>W – E1</td><td colspan="2">No trouble ("CHECK" engine warning light off) and engine running</td><td>10 – 14</td></tr></table></td></tr>
</table>

Specifications (Cont'd)

ECU (cont'd)	Terminals	Condition		STD voltage (V)
	T – E1	Ignition switch ON	Check connector TE1 – E1 not connect	4 – 6
			Check connector TE1 – E1 connect	0
	NSW – E1	Ignition switch ON	Shift position P or N range	0
			Ex. P or N range	10 – 14
	4WD – E1	Ignition switch ON	4WD switch ON	10 – 14
			4WD switch OFF	0
	STP – E1	Ignition switch ON	Stop light switch ON	10 – 14
			Stop light switch OFF	0
	Resistance			
	Terminals	Condition		Resistance (Ω)
	IDL – E2	Throttle valve fully open		Infinity
		Throttle valve fully closed		Less than 2,300
	VTA – E2	Throttle valve fully open		3,500 – 10,300
		Throttle valve fully closed		300 – 6,300
	VC – E2	—		4,250 – 8,250
	VC – E22	—		200 – 400
	VS – E22	Measuring plate fully closed		200 – 600
		Measuring plate fully open		20 – 1,200
	THA – E2	Intake air temperature 20°C (68°F)		2,000 – 3,000
	THW – E2	Coolant temperature 80°C (176°F)		200 – 400
	GI – G⊖	—		140 – 180
	NE – G⊖	—		140 – 180
	ISC1, ISC2 ISC3, ISC4 – +B	—		10 – 30
Fuel cut rpm	Fuel cut rpm		1,300 rpm	
	Fuel return rpm		1,000 rpm	

Torque Specifications

Part tightened	kg-cm	ft-lb	N·m
Cold start injector pipe x Cold start injector	180	13	18
Cold start injector pipe x Delivery pipe	180	13	18
Cold start injector clamp bolt	120	9	12
Fuel pump bracket x Fuel tank	35	30 in.-lb	3.4
Pressure regulator x Delivery pipe	50	43 in.-lb	4.9
Fuel return pipe x Pressure regulator	180	13	18
Delivery pipe x Intake manifold	120	9	12
Pulsation damper x Delivery pipe	300	22	29
Air intake chamber x Intake manifold	250	18	25
Intake chamber stay mount bolt	120	9	12
EGR pipe union nut	800	58	78
Throttle body x Air intake chamber	120	9	12
ISC valve x Air intake chamber	120	9	12

IGNITION SYSTEM

Ignition timing			7° BTDC @ idle (Check connector TE1 and E1 connected)
Firing order			1 – 5 – 3 – 6 – 2 – 4
High-tension cord	Resistance	Limit	25 kΩ per cord
Spark plug	Type	ND NGK	W16EXR-U BPR5EY
	Correct electrode gap		0.8 mm 0.031 in.
Ignition coil	Primary coil resistance at cold		0.52 – 0.64 Ω
	Secondary coil resistance at cold		11.5 – 15.5 kΩ
Distributor	Air gap G and NE pickups		0.2 mm (0.008 in.) or more
	Pickup coil resistance G and NE pickups		140 – 180 Ω

CHARGING SYSTEM

Drive belt tension			See page A-2	
Battery specific gravity	when fully charged at 20°C (68°F)		1.25 – 1.27	
Alternator	Rated output		12 V 80A	
	Rotor coil resistance		2.8 – 3.0 Ω	
	Slip ring diameter	STD	32.3 – 32.5 mm	1.272 – 1.280 in.
		Limit	32.1 mm	1.264 in.
	Brush exposed length	STD	20.0 mm	0.789 in.
		Limit	5.5 mm	0.217 in.
Alternator regulator	Regulating voltage	at 25°C (77°F)	13.8 – 14.4 V	

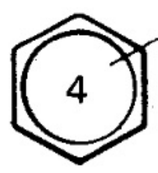
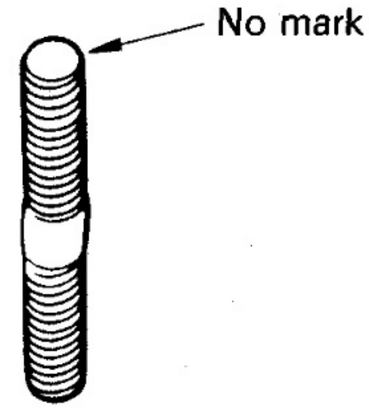
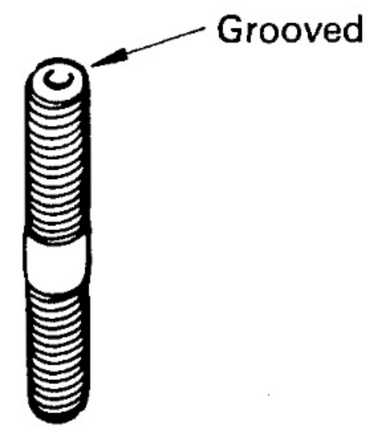
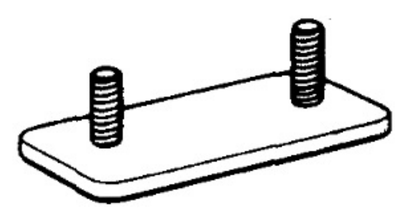
STANDARD BOLT TORQUE SPECIFICATIONS

Page

STANDARD BOLT TORQUE SPECIFICATIONS B-2

STANDARD BOLT TORQUE SPECIFICATIONS

HOW TO DETERMINE BOLT STRENGTH

	Mark	Class		Mark	Class
Hexagon Head bolt	 Bolt head No. 4 – 5 – 6 – 7 –	4T 5T 6T 7T	Stud bolt	 No mark	4T
	 No mark	4T			
Hexagon flange bolt w / washer hexagon bolt	 No mark	4T		 Grooved	6T
Hexagon head bolt	 Two protruding lines	5T			
Hexagon flange bolt w / washer hexagon bolt	 Two protruding lines	6T	Welded bolt		4T
Hexagon head bolt	 Three protruding lines	7T			

SPECIFIED TORQUE FOR STANDARD BOLTS

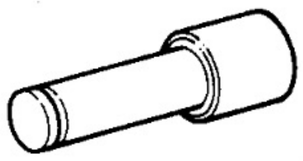
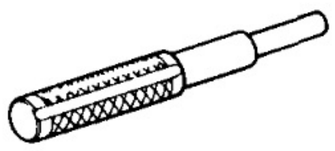
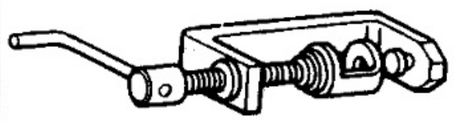
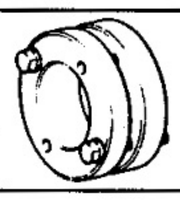
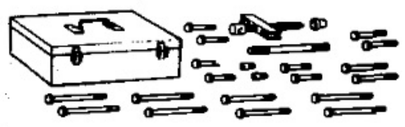
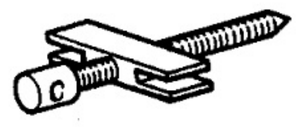
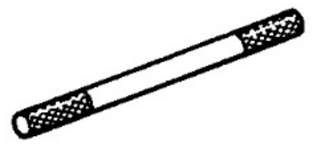
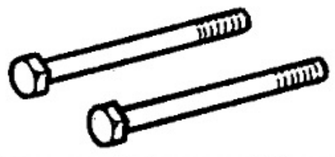
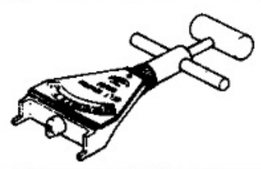
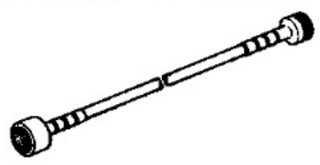
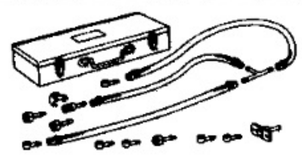
Class	Diameter mm	Pitch mm	Specified torque					
			Hexagon head bolt			Hexagon flange bolt		
			kg-cm	ft-lb	N·m	kg-cm	ft-lb	N·m
4T	6	1	55	48 in.-lb	5.4	60	52 in.-lb	5.9
	8	1.25	130	9	13	145	10	14
	10	1.25	260	19	25	290	21	28
	12	1.25	480	35	47	540	39	53
	14	1.5	760	55	75	850	61	83
	16	1.5	1,150	83	113	–		
5T	6	1	65	56 in.-lb	6.4	–		
	8	1.25	160	12	16	–		
	10	1.25	330	24	32	–		
	12	1.25	600	43	59	–		
	14	1.5	930	67	91	–		
	16	1.5	1,400	101	137	–		
6T	6	1	80	69 in.-lb	7.8	90	78 in.-lb	8.8
	8	1.25	195	14	19	215	16	21
	10	1.25	400	29	39	440	32	43
	12	1.25	730	53	72	810	59	79
	14	1.5		–		1,250	90	123
7T	6	1	110	8	11	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	103
	14	1.5	1,500	108	147	1,700	123	167
	16	1,5	2,300	166	226	–		

SST AND SSM

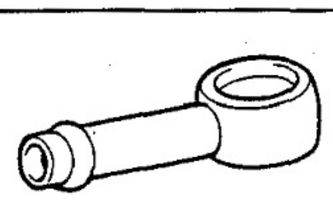
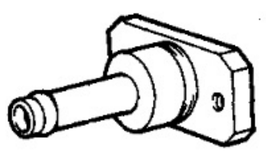
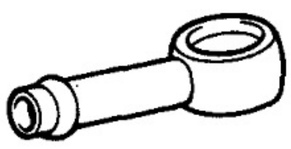
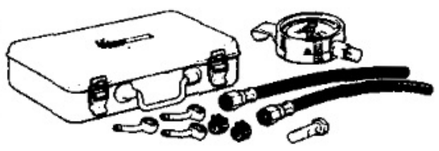
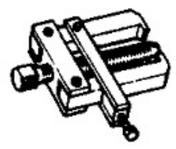
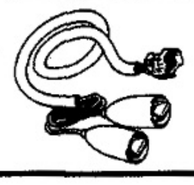
	Page
SST (SPECIAL SERVICE TOOLS)	C-2
SSM (SPECIAL SERVICE MATERIALS)	C-3

SST (SPECIAL SERVICE TOOLS)

HINT: Classification
A = SST required for vehicle inspections and minor repairs and multipurpose SST.
B = SST required for major repairs involving disassembly of components.
C = SST required for rather special, less frequent work not of classifiable as either A or B.

Section / Classification / Part Name / Part No. / Illustration				EM	FI	CH	Note
	09201-31010	(Valve Stem Oil Seal Replacer)	B	●			
	09201-60011	(Valve Guide Bushing Remover & Replacer)	A	●			
	09202-43013	(Valve Spring Compressor)	A	●			
	09213-58011	(Crankshaft Pulley Holding Tool)	A	●			
	09213-60017	(Crankshaft Pulley & Gear Pulley Set)	A	●			
	(09213-00020)	(Body with Bolt)		●			
	(09213-00030)	(Handle)		●			
	(09213-00090)	(Bolt Set)		●			
	09214-60010	(Crankshaft Pulley & Gear Replacer)	B	●			
	09216-00020	(Belt Tension Gauge)	A	●		●	
	09216-00030	(Belt Tension Cable)	A	●		●	
	09268-41045	(Injection Measuring Tool Set)	B		●		

SST (SPECIAL SERVICE TOOLS) (Cont'd)

Section / Classification / Part Name / Part No. / Illustration			EM	FI	CH	Note
	**(09268-41080)**	(No. 6 Union)		●		
	**(09268-41090)**	(No.7 Union)		●		
	**(90405-09015)**	(No. 1 Union)		●		
	**09268-45012**	(EFI Fuel Pressure Gauge)	A		●	
	**09286-46011**	(Injection Pump Spline Shaft Puller)	C			● Rotor rear bearing
	**09330-00021**	(Companion Flange Holding Tool)	A	●		
	**09842-30050**	(Wiring "A" EFI Inspection)	B		●	
	**09842-30070**	(Wiring "F" EFI Inspection)	B		●	

SSM (SPECIAL SERVICE MATERIALS)

Part Name	Part No.	Sec.	Use etc.
Seal packing or equivalent	08826-00080	EM	Main bearing caps No. 1 and No. 4
Adhesive 1324, Three bond 1324, or equivalent	08833-00070	EM	Drive plate mount bolt
Adhesive 1344, Three bond 1344, Loctite 242 or equivalent	08833-00080	EM	Timing gear cover