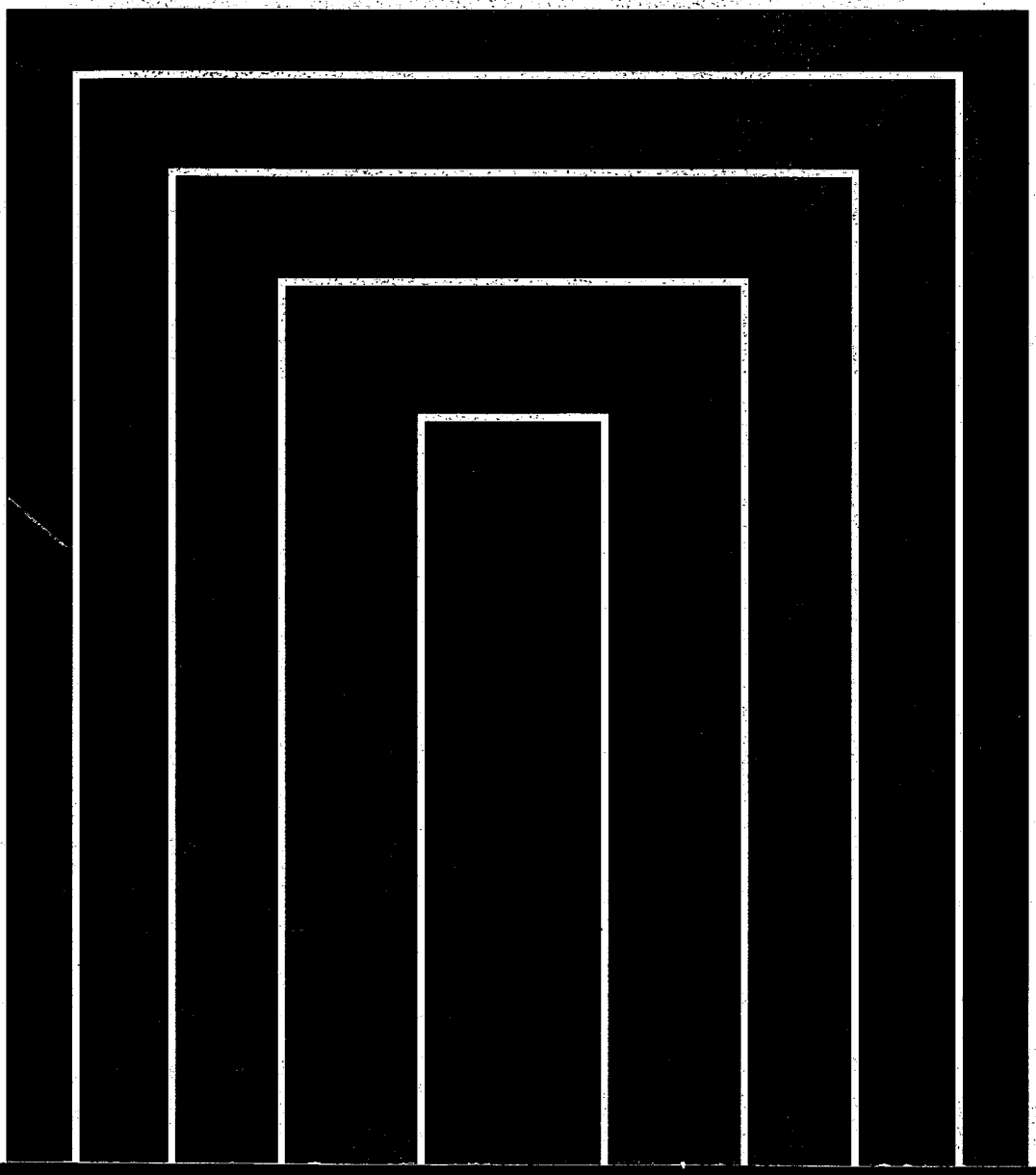
TOYOTA

4A-FE,4A-GE

ENGINE

REPAIR MANUAL

Sep., 1989



Pub.No.RM163E

FOREWORD

This repair manual has been prepared to provide information covering general service repairs for the 4A-FE and 4A-GE engines equipped on the TOYOTA COROLLA, CARINA II and CELICA.

Applicable models:
- 4A-FE engine
  - AE92, 95, AT171 (Ex. 4A-FE Engine w/ Lean Burn), AT180 series
- 4A-GE engine
  - AE92 series

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

Manual Name	Pub. No.
● Celica New Car Features (For Europe)	NCF 057E
● 4A-FE Engine Repair Manual Supplement (For Carina II)	RM 100E
● 4A-FE, 4A-GE Engine For Emission Control (For Europe)	ERM 052E

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

CAUTION

This manual does not include all the necessary items about repair and service. this manual is made for the purpose of the use for the persons who have special techniques and certifications. In the cases that non-specialized or uncertified technicians perform repair or service only using this manual or without proper equipment or tool, that may cause severe injury to you or other people around and also cause damage to your customer's vehicle.

In order to prevent dangerous operation and damages to your customer's vehicle, be sure to follow the instruction shown below.

- Must read this manual thoroughly. It is especially important to have good understanding all the contents written in the PRECAUTION of "IN" section.

- The service method written in this manual is very effective to perform repair and service. When performing the operations following the procedures using this manual, be sure to use tools specified and recommended. If using non-specified or recommended tools and service method, be sure to confirm safety of the technicians and any possibility of causing personal injury or damage to the customer's vehicle before starting the operation.

- If part replacement is necessary, must replace the part with the same part number or equivalent part. Do not replace it with inferior quality.

- It is important to note that this manual contains various "Cautions" and "Notices" that must be carefully observed in order to reduce the risk of personal injury during service or repair, or the possibility that improper service or repair may damage the vehicle or render it unsafe. It is also important to understand that these "Cautions" and "Notices" are not exhaustive, because it is important to warn of all the possible hazardous consequences that might result from failure to follow these instructions.

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

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INTRODUCTION

HOW TO USE THIS MANUAL

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

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

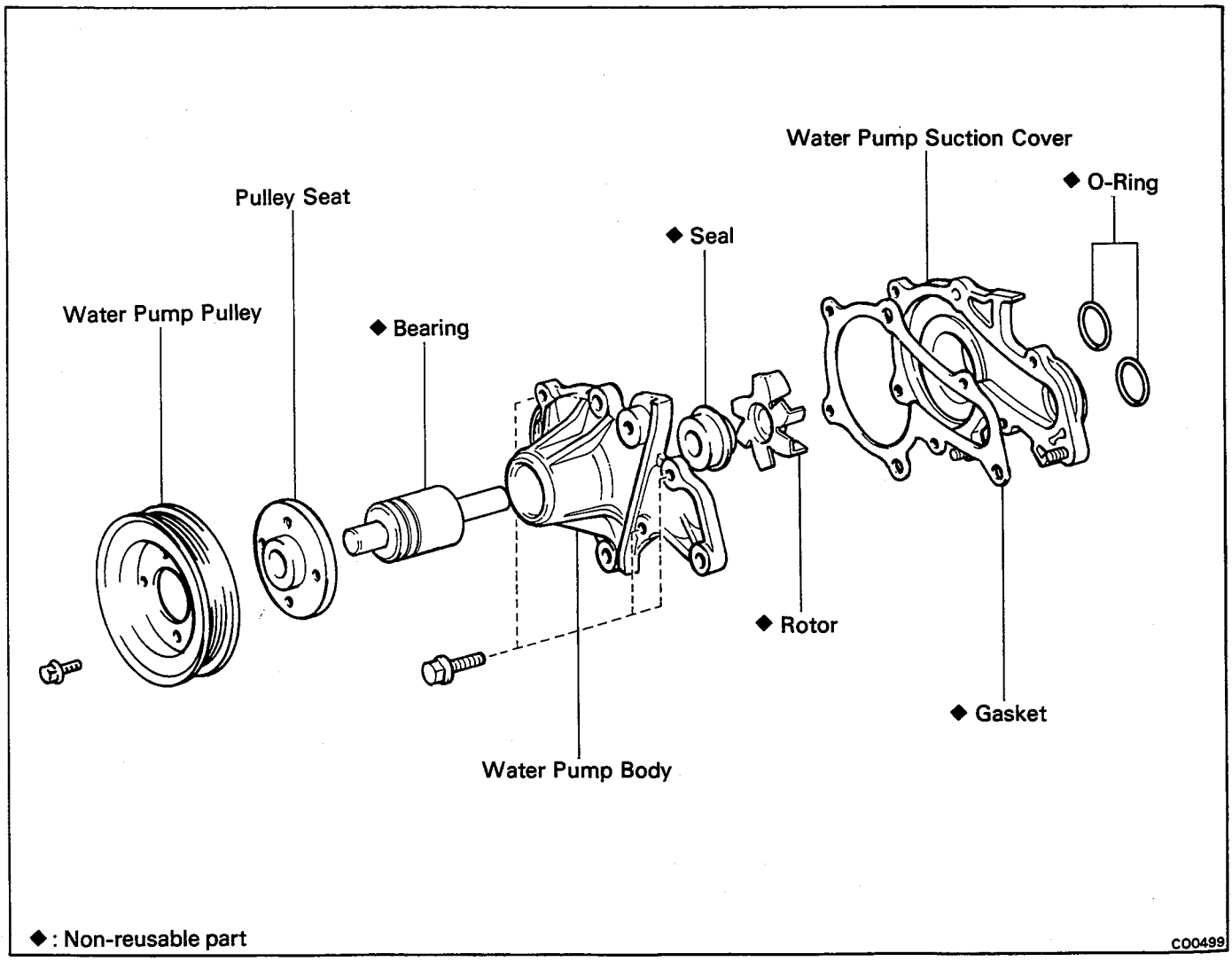
At the beginning of each section, **PRECAUTIONS** are given that pertain to *all* repair operations contained in that section. *Read these precautions before starting any repair task.*

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

REPAIR PROCEDURES

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

Example:



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

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

Example:

Illustration: what to do and where

Task heading: what to do

3. DISCONNECT CONNECTING ROD FROM PISTON

Using SST, press out the pin from the piston.

SST 09221-25022
(09221-00050, 09221-00130, 09221-00140)

Set part No. *Component part No.*

Detail text: how to do it

(d) Install and alternately tighten the cap nuts in several passes.

Torque: 500 kg-cm (36 ft-lb, 49 N·m)

Specification

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

REFERENCES

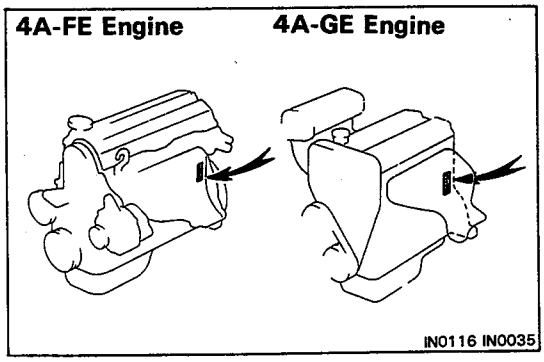
References have been kept to a minimum. However, when they are required, you are given the page to go to.

SPECIFICATIONS

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

CAUTIONS, NOTICES, HINTS:

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



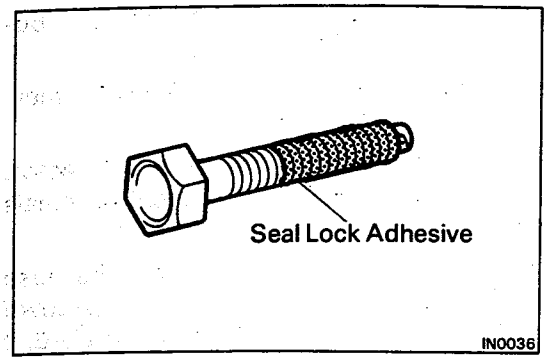
IDENTIFICATION INFORMATION

ENGINE SERIAL NUMBER

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

GENERAL REPAIR INSTRUCTIONS

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



6. Precoated Parts

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

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

   (b) Recoating of Precoated Parts

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

      (2) Dry with compressed air.

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

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

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

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

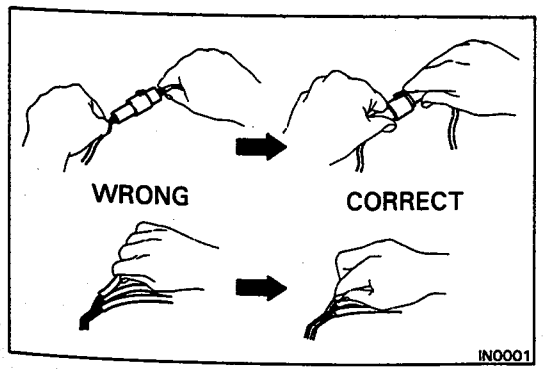
9. Use of special service tools (SST) and special service materials (SSM) may be required, depending on the nature of the repair. Be sure to use SST and SSM where specified and follow the proper work procedure. A list of SST and SSM can be found at the back of this manual.

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

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

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

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



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

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

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

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

(d) When steam cleaning an engine, protect the distributor, coil, air filter, and VCV from water.

(e) Never use an impact wrench to remove or install thermo switches or thermo sensors.

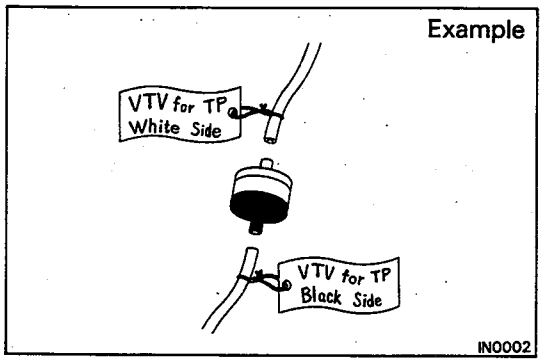
(f) When checking continuity at the wire connector, insert the tester probe carefully to prevent terminals from bending.

(g) When using a vacuum gauge, never force the hose onto a connector that is too large. Use a step-down adapter instead. Once the hose has been stretched, it may leak.

13. Tag hoses before disconnecting them:

(a) When disconnecting vacuum hoses, use tags to identify how they should be reconnected.

(b) After completing a job, double check that the vacuum hoses are properly connected. A label under the hood shows the proper layout.



PRECAUTIONS FOR VEHICLES EQUIPPED WITH A CATALYTIC CONVERTER

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

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

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

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

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

ABBREVIATIONS USED IN THIS MANUAL

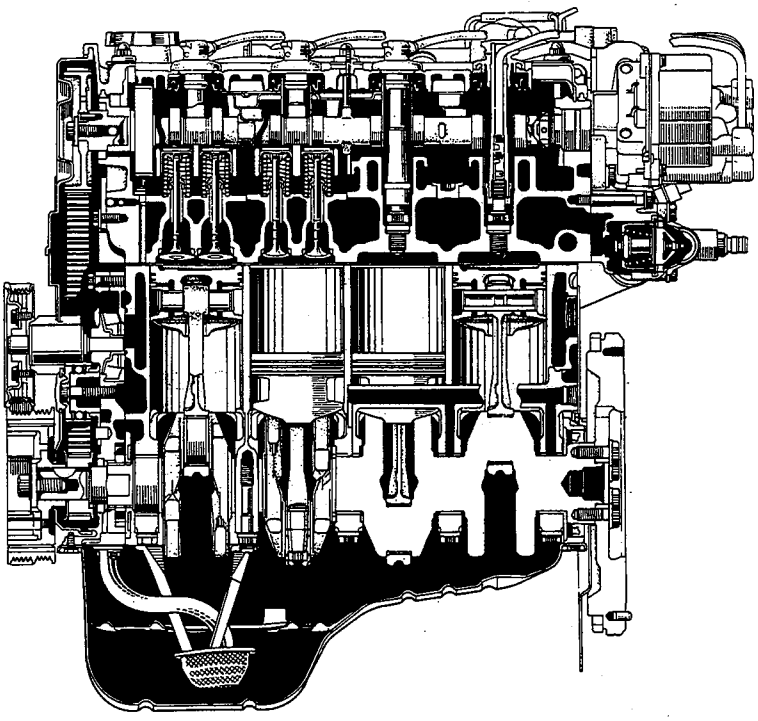
A/C	Air Conditioner
ACV	Air Control Valve
Approx.	Approximately
A/T	Automatic Transmission
BTDC	Before Top Dead Center
BVSV	Bi-metal Vacuum Switching Valve
DP	Dash Pot
ECU	Electronic Controlled Unit
EFI	Electronic Fuel Injection
EGR	Exhaust Gas Recirculation
ESA	Electronic Spark Advance
EX	Exhaust (manifold,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

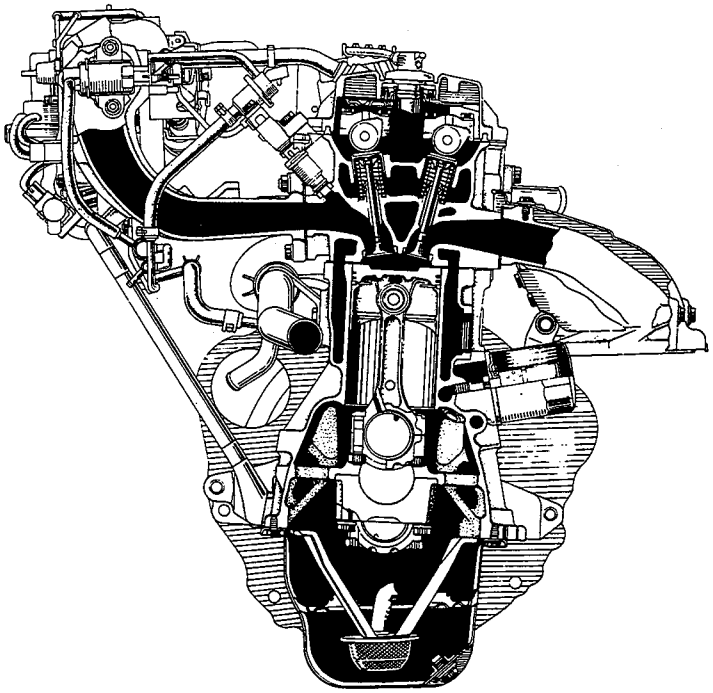
ENGINE MECHANICAL

DESCRIPTION

4A-FE ENGINE

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





EM7830
EM7831

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

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

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

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

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

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

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

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

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

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

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

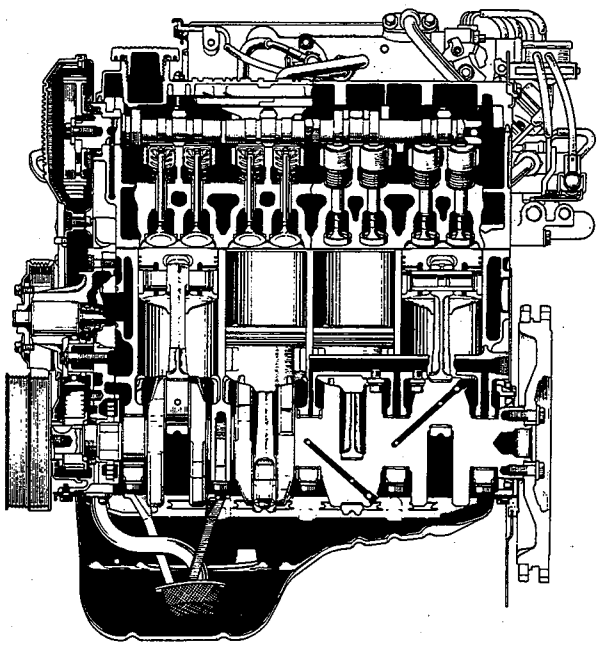
The cylinder block is made of cast iron. It has 4 cylinders which are approximately 2 times the length of the piston stroke. The top of the cylinders is closed off by the cylinder head and the lower end of the cylinders becomes the crankcase, in which the crankshaft is installed. In addition, the cylinder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

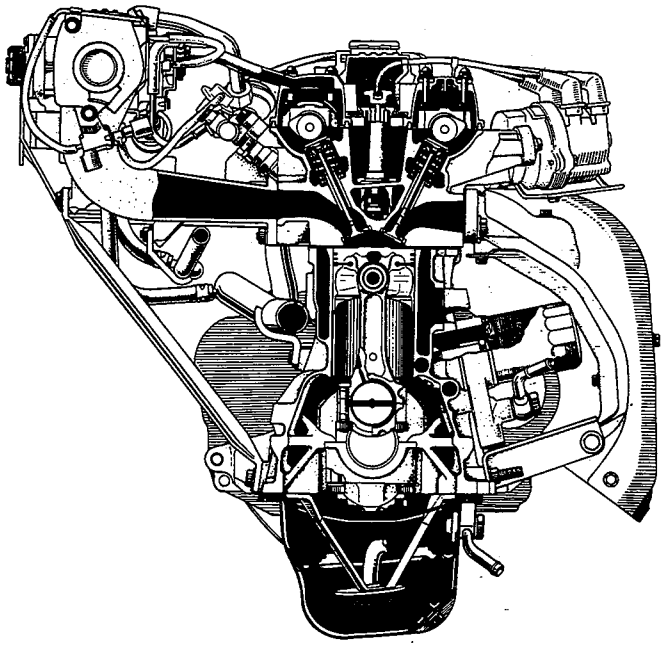
The oil pan is bolted to the bottom of the cylinder block. The oil pan is an oil reservoir made of pressed steel sheet. A dividing plate is included inside the oil pan to keep sufficient oil at the bottom of the pan even when the vehicle is tilted. This dividing plate also prevents the oil from making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

DESCRIPTION

4A-GE ENGINE

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





EM7657
EM7658

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

The crankshaft is integrated with 8 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.

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

The intake manifold has 8 independent long ports and utilizes the inertial supercharging effect to improve engine torque at low and medium speeds.

Exhaust and intake valves are equipped with irregular pitch springs made of oil tempered silicon chrome steel wire which are capable of following the valves even at high engine speeds.

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

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

The resin timing belt cover is made of 3 pieces. A service hole is provided in the No.2 belt cover for adjusting the timing belt tension.

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

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

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

TROUBLESHOOTING (4A-FE)

ENGINE OVERHEATING

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

HARD STARTING

Problem	Possible cause	Remedy	Page
Engine will not crank or cranks slowly	Starting system faulty	Troubleshoot starting system	ST-2
Engine will not start/ hard to start (cranks OK)	No fuel supply to carburetor ● No fuel in tank ● Fuel pump not working ● Fuel line clogged or leaking	Troubleshoot EFI system	FI-10
	EFI system problems	Repair as necessary	
	Ignition problems ● Ignition coil ● Igniter ● Distributor (IIA)	Perform spark test	IG-6
	Spark plugs faulty	Inspect plugs	IG-7
	High-tension cords disconnected or broken	Inspect cords	IG-7
	Vacuum leaks ● PCV line ● EGR line (w/ EGR system) ● Intake manifold ● Throttle body ● Brake booster line	Repair as necessary	
	Low compression	Check compression	EM-38

ROUGH IDLING

Problem	Possible cause	Remedy	Page
Rough idle, stalls or misses	Spark plugs faulty	Inspect plugs	IG-7
	High-tension cords faulty	Inspect cords	IG-7
	Ignition wiring faulty	Inspect wiring	
	Ignition problems		
	● Ignition coil	Inspect coil	
	● Igniter	Inspect igniter	
	● Distributor (IIA)	Inspect IIA	
	Incorrect ignition timing	Reset timing	EM-20
	Incorrect valve clearance	Adjust valve clearance	EM-16
	Vacuum leaks	Repair as necessary	
	● PCV line		
	● EGR line (w/ EGR system)		
	● Intake manifold		
	● Throttle body		
	● Brake booster line		
	Incorrect idle speed	Adjust idle speed	EM-22, 23
	EFI system problems	Repair as necessary	
	EGR valve faulty (w/ EGR system)	Check EGR valve	
	Engine overheats	Check cooling system	
	Low compression	Check compression	EM-38

ENGINE HESITATES/POOR ACCELERATION

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

ENGINE DIESELING

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

AFTER FIRE, BACKFIRE

Problem	Possible cause	Remedy	Page
Muffler explosion (after fire) on deceleration only	Deceleration fuel cut system always off	Check fuel cut system	
	DP system always off	Check DP system	
Muffler explosion (after fire) all the time	Air cleaner clogged	Check air cleaner	EM-15
	EFI system problem	Repair as necessary	
	Incorrect ignition timing	Reset timing	EM-20
	Incorrect valve clearance	Adjust valve clearance	EM-16
Engine backfires	EFI system problem	Repair as necessary	
	Vacuum leak ● PCV hoses ● Intake manifold ● Throttle body ● Brake booster line	Check hoses and repair as necessary	
	Insufficient fuel flow	Troubleshoot fuel system	
	Incorrect ignition timing	Reset timing	EM-20
	Incorrect valve clearance	Adjust valve clearance	EM-16
	Carbon deposits in combustion chambers	Inspect cylinder head	EM-68

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-130
	Valve stem and guide bushing worn	Check valves and guide bushings	EM-70
	Valve stem oil seal worn or damaged	Check oil seals	

POOR GASOLINE MILEAGE

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

UNPLEASANT ODOR

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

TROUBLESHOOTING (4A-GE)

ENGINE OVERHEATING

Problem	Possible cause	Remedy	Page
Engine overheats	Cooling system faulty	Troubleshoot cooling system	CO-4
	Incorrect ignition timing	Reset timing	EM-28

HARD STARTING

Problem	Possible cause	Remedy	Page
Engine will not crank or cranks slowly	Starting system faulty	Troubleshoot starting system	ST-2
Engine will not start/ hard to start (crank OK)	No fuel supply to injector ● No fuel in tank ● Fuel pump not working ● Fuel line clogged or leaking	Troubleshoot EFI system	FI-10
	EFI system problems	Repair as necessary	
	Ignition problems ● Ignition coil ● Igniter ● Distributor	Perform spark test	IG-10
	Spark plug faulty	Inspect plugs	IG-11, 12
	High-tension cord disconnected or broken	Inspect cords	IG-11
	Vacuum leaks ● PCV line ● EGR line (w/ EGR system) ● Intake manifold ● Throttle body ● Brake booster line	Repair as necessary	
	Air suction between air flow meter and throttle body	Repair as necessary	
	Low compression	Check compression	EM-38

ROUGH IDLING

Problem	Possible cause	Remedy	Page
Rough idle, stalls or misses	Spark plug faulty	Inspect plugs	IG-11, 12
	High-tension cord faulty	Inspect cords	IG-11
	Ignition wiring faulty	Inspect wiring	
	Ignition problems ● Ignition coil ● Igniter ● Distributor	 Inspect coil Inspect igniter Inspect distributor	
	Incorrect ignition timing	Reset timing	EM-28
	Incorrect valve clearance	Adjust valve clearance	EM-26

ROUGH IDLING (Cont'd)

Problem	Possible cause	Remedy	Page
Rough idle, stalls or misses (Cont'd)	Vacuum leaks ● PCV line ● EGR line (w/ EGR system) ● Intake manifold ● Throttle body ● Brake booster line	Repair necessary	
	Air suction between air flow meter and throttle body	Repair as necessary	
	Incorrect idle speed	Adjust idle speed	EM-30, 31
	EFI system problems	Repair as necessary	
	EGR valve faulty (w/ EGR system)	Check EGR valve	
	Engine overheats	Check cooling system	CO-4
	Low compression	Check compression	EM-38

ENGINE HESITATES/POOR ACCELERATION

Problem	Possible cause	Remedy	Page
Engine hesitates/ poor acceleration	Spark plug faulty	Inspect plugs	IG-11, 12
	High-tension cord faulty	Inspect cords	IG-11
	Vacuum leaks ● PCV line ● EGR line (w/ EGR system) ● Intake manifold ● Throttle body ● Brake booster line	Repair as necessary	
	Air suction between air flow meter and throttle body	Repair as necessary	
	Incorrect ignition timing	Reset timing	EM-28
	Incorrect valve clearance	Adjust valve clearance	EM-26
	Fuel system clogged	Check fuel system	
	Air cleaner clogged	Check air cleaner	EM-25
	EFI system problems	Repair as necessary	
	Engine overheats	Check cooling system	CO-4
	Low compression	Check compression	EM-38

ENGINE DIESELING

Problem	Possible cause	Remedy	Page
Engine dieseling (turns when ignition switch is turned off)	EFI system problems	Repair as necessary	
	Incorrect ignition timing	Reset timing	EM-28
	EGR system faulty (w/ EGR system)	Check EGR system	

AFTER FIRE, BACKFIRE

Problem	Possible cause	Remedy	Page
Muffler explosion (after fire) on deceleration only	Deceleration fuel cut system always off	Check EFI (fuel cut) system	
	DP system always off	Check DP system	
Muffler explosion (after fire) all the time	Air cleaner clogged	Check air cleaner	EM-25
	EFI system problem	Repair as necessary	
	Incorrect ignition timing	Reset timing	EM-28
	Incorrect valve clearance	Adjust valve clearance	EM-26
Engine backfires	EFI system problem	Repair as necessary	
	Vacuum leak • PCV hoses • Intake manifold • Throttle body • Brake booster line	Check hoses and repair as neccessary	
	Air suction between air flow meter and throttle body	Repair as necessary	
	Insufficient fuel flow	Troubleshoot fuel system	
	Incorrect ignition timing	Reset timing	EM-28
	Incorrect valve clearance	Adjust valve clearance	EM-26
	Carbon deposits in combustion chambers	Inspect cylinder head	EM-99

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-130
	Valve stem and guide bushing worn	Check valves and guide bushings	EM-100
	Valve stem oil seal worn or damaged	Check oil seals	

EXCESSIVE FUEL CONSUMPTION

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

UNPLEASANT ODOR

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

ENGINE TUNE-UP (4A-FE)

INSPECTION OF ENGINE COOLANT

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

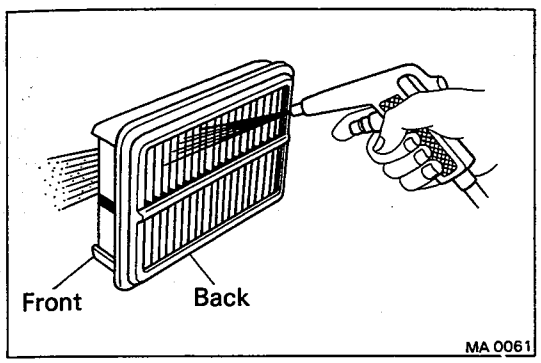
INSPECTION OF ENGINE OIL

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

INSPECTION OF BATTERY

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

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



INSPECTION OF AIR FILTER

1. **INSPECT AIR FILTER**

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

2. **CLEAN AIR FILTER**

   Clean the element with compressed air.
   First blow from the back thoroughly. Then blow off the front of the element.

INSPECTION OF HIGH-TENSION CORDS

(See page IG-5)

Maximum resistance: 25 kΩ per cord

INSPECTION OF SPARK PLUGS

(See page IG-6)

Correct electrode gap: 0.8 mm (0.031 in.)
Recommended spark plugs:
ND Q16R-U
NGK BCPR5EY

INSPECTION OF ALTERNATOR DRIVE BELT

(See page 3 on page CH-3)

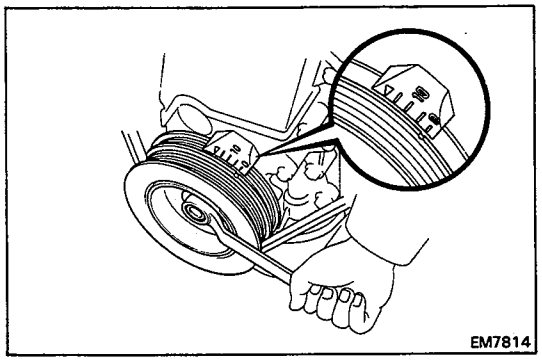
Drive belt deflection:
Used belt 10.0 – 12.0 mm (0.394 – 0.472 in.)
New belt 8.5 – 10.5 mm (0.335 – 0.413 in.)
Drive belt tension (Reference):
Used belt 40 – 55 kg
New belt 60 – 70 kg

INSPECTION AND ADJUSTMENT OF VALVE CLEARANCE

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

1. DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS

2. REMOVE CYLINDER HEAD COVER (See page EM-62)

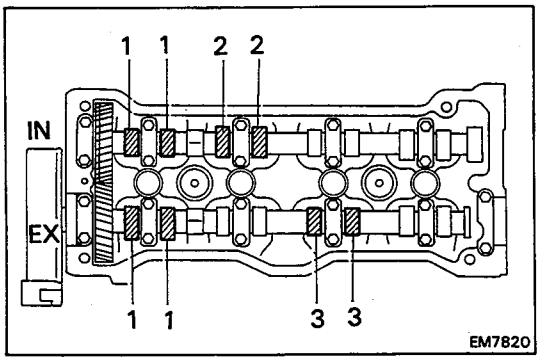


3. SET NO.1 CYLINDER TO TDC/COMPRESSION

(a) Turn the crankshaft pulley and align its groove with the timing mark "0" of the No.1 timing belt cover.

(b) Check that the valve lifters on the No.1 cylinder are loose and valve lifters on the No.4 cylinder are tight.

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



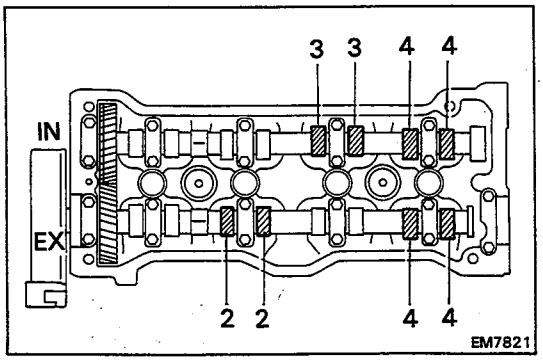
4. INSPECT VALVE CLEARANCE

(a) Check only those valves indicated in the illustration.

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

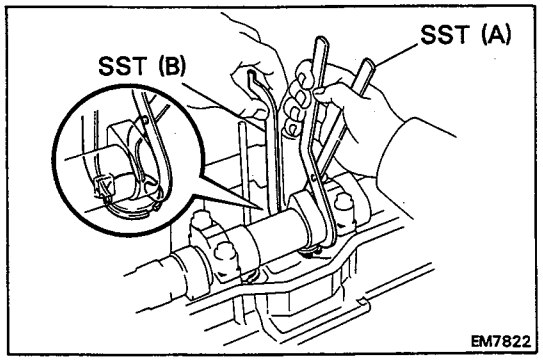
Valve clearance (Cold):

Intake	**0.15 – 0.25 mm (0.006 – 0.010 in.)**
Exhaust	**0.20 – 0.30 mm (0.008 – 0.012 in.)**



(b) Turn the crankshaft one revolution (360°) and align the mark as above. (See procedure step 3)

(c) Check only the valves indicated as shown. Measure the valve clearance. (See procedure step (a)).

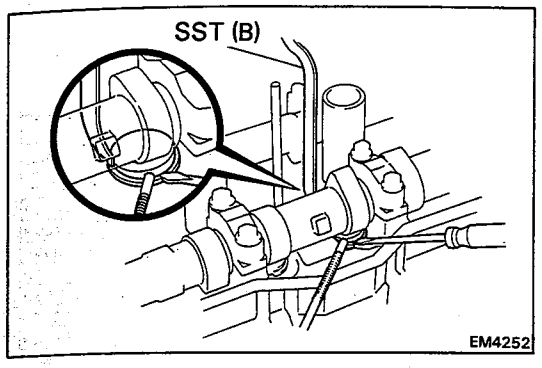


5. ADJUST VALVE CLEARANCE

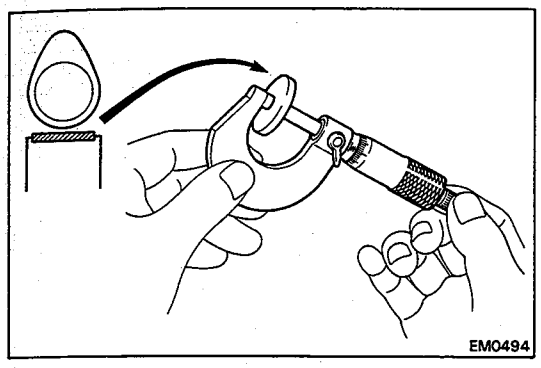
(a) Remove the adjusting shim.

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

SST 09248-55010



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



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

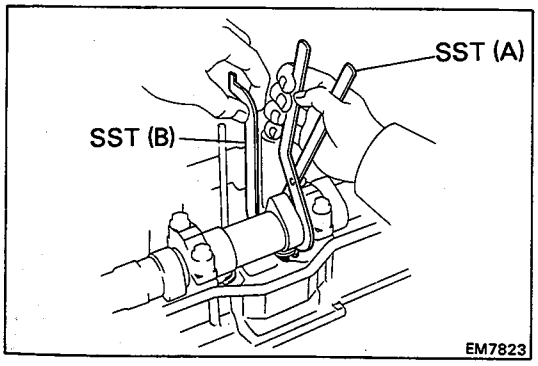
- Using a micrometer, measure the thickness of the shim which was removed.
- Calculate the thickness of the new shim so the valve clearance comes within specified value.

T ..... Thickness of shim used
A ..... Valve clearance measured
N ..... Thickness of new shim

Intake: N = T + (A − 0.20 mm (0.008 in.))
Exhaust: N = T + (A − 0.25 mm (0.010 in.))

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

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



(c) Install a new adjusting shim.

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

SST 09248-55010

(d) Recheck the valve clearance.

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

7. CONNECT HIGH-TENSION CORDS TO SPARK PLUGS

Adjusting Shim Selection Chart

INTAKE

Measured Clearance (mm)	Installed Shim Thickness (mm)																																																							
	2.500	2.525	2.550	2.575	2.600	2.620	2.625	2.640	2.650	2.660	2.675	2.680	2.700	2.720	2.725	2.740	2.750	2.760	2.775	2.780	2.800	2.820	2.825	2.840	2.850	2.860	2.875	2.880	2.900	2.920	2.925	2.940	2.950	2.960	2.975	2.980	3.000	3.020	3.025	3.040	3.050	3.060	3.075	3.080	3.100	3.120	3.125	3.140	3.150	3.160	3.175	3.180	3.200	3.225	3.250	3.275	3.300
0.000 - 0.009											02	02	02	04	04	04	04	04	06	06	06	08	08	08	08	08	10	10	10	12	12	12	12	12	14	14	14	16	16	16	16	16	18	18	18	20	20	20	20	20	22	22	22	24	24	26	26
0.010 - 0.025										02	02	02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	26	26
0.026 - 0.029									02	02	02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	26	26	28
0.030 - 0.040								02	02	02	02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	26	26	28
0.041 - 0.050								02	02	02	02	02	04	04	04	06	06	06	06	06	08	08	08	10	10	10	10	10	12	12	12	14	14	14	14	14	16	16	16	18	18	18	18	18	20	20	20	22	22	22	22	22	24	24	26	26	28
0.051 - 0.070						02	02	02	02	02	04	04	04	06	06	06	06	06	08	08	08	10	10	10	10	10	12	12	12	14	14	14	14	14	16	16	16	18	18	18	18	18	20	20	20	22	22	22	22	22	24	24	24	26	26	28	28
0.071 - 0.075					02	02	02	02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	28	28
0.076 - 0.090					02	02	02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	28	28	30
0.091 - 0.100					02	02	02	04	04	04	04	04	06	06	06	08	08	08	08	08	10	10	10	12	12	12	12	12	14	14	14	16	16	16	16	16	18	18	18	20	20	20	20	20	22	22	22	24	24	24	24	24	26	26	28	28	30
0.101 - 0.120				02	02	04	04	04	04	04	06	06	06	08	08	08	08	08	10	10	10	12	12	12	12	12	14	14	14	16	16	16	16	16	18	18	18	20	20	20	20	20	22	22	22	24	24	24	24	24	26	26	26	28	28	30	30
0.121 - 0.125			02	02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	30	30
0.126 - 0.140			02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	30	30	32
0.141 - 0.149			02	02	04	04	04	06	06	06	06	06	08	08	08	10	10	10	10	10	12	12	12	14	14	14	14	14	16	16	16	18	18	18	18	18	20	20	20	22	22	22	22	22	24	24	24	26	26	26	26	26	28	28	30	30	32
0.150 - 0.250																																																									
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0.571 - 0.575	16	18	18	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																								
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0.591 - 0.600	18	18	20	20	22	22	22	24	24	24	24	24	26	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34	34																										
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0.621 - 0.625	18	20	20	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																												
0.626 - 0.640	20	20	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																													
0.641 - 0.650	20	20	22	22	24	24	24	26	26	26	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34	34	34	34																													
0.651 - 0.670	20	22	22	24	24	26	26	26	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34	34	34	34																															
0.671 - 0.675	20	22	22	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																																
0.676 - 0.690	22	22	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																																		
0.691 - 0.700	22	22	24	24	26	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34	34																																		
0.701 - 0.720	22	24	24	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34	34																																				
0.721 - 0.725	22	24	24	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																																				
0.726 - 0.740	24	24	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																																					
0.741 - 0.750	24	24	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34	34	34																																						
0.751 - 0.770	24	26	26	28	28	30	30	30	30	30	32	32	32	34	34	34	34	34																																							
0.771 - 0.775	24	26	26	28	28	30	30	30	30	32	32	32	32	34	34	34	34																																								
0.776 - 0.790	26	26	28	28	30	30	30	30	32	32	32	32	34	34	34	34																																									
0.791 - 0.800	26	26	28	28	30	30	30	32	32	32	32	32	34	34	34																																											
0.801 - 0.820	26	28	28	30	30	32	32	32	32	32	34	34	34																																														
0.821 - 0.825	26	28	28	30	30	32	32	32	32	34	34	34	34																																														
0.826 - 0.840	28	28	30	30	32	32	32	32	34	34	34	34																																															
0.841 - 0.850	28	28	30	30	32	32	32	34	34	34	34	34																																															
0.851 - 0.870	28	30	30	32	32	34	34	34	34	34																																																		
0.871 - 0.875	28	30	30	32	32	34	34	34	34																																																			
0.876 - 0.890	30	30	32	32	34	34	34	34																																																					
0.891 - 0.900	30	30	32	32	34	34	34																																																						
0.901 - 0.925 |30|32|32|34|34|																																																									
0.926 - 0.950	32	32	34	34																																																											
0.951 - 0.975 |32|34|34|																																																											
0.976 - 1.000 |34|34|																																																												
1.001 - 1.025 |34|																																																													

Shim thicknesses mm (in.)

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

Intake valve clearance (cold):
0.15 – 0.25 mm (0.006 – 0.010 in.)

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

Adjusting Shim Selection Chart

EXHAUST

Measured Clearance (mm)	Installed Shim Thickness (mm)																																																							
	2.500	2.525	2.550	2.575	2.600	2.620	2.625	2.640	2.650	2.660	2.675	2.680	2.700	2.720	2.725	2.740	2.750	2.760	2.775	2.780	2.800	2.820	2.825	2.840	2.850	2.860	2.875	2.880	2.900	2.920	2.925	2.940	2.950	2.960	2.975	2.980	3.000	3.020	3.025	3.040	3.050	3.060	3.075	3.080	3.100	3.120	3.125	3.140	3.150	3.160	3.175	3.180	3.200	3.225	3.250	3.275	3.300
0.000 - 0.009													02	02	02	02	02	04	04	04	06	06	06	06	06	08	08	08	10	10	10	10	10	12	12	12	14	14	14	14	14	16	16	16	18	18	18	18	18	20	20	20	22	22	24	24
0.010 - 0.025													02	02	02	02	04	04	04	06	06	06	06	06	08	08	08	10	10	10	10	10	12	12	12	14	14	14	14	14	16	16	16	18	18	18	18	18	20	20	20	22	22	22	24	26
0.026 - 0.040												02	02	02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	24	24	26
0.041 - 0.050											02	02	02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	24	24	26
0.051 - 0.070										02	02	02	04	04	04	04	04	06	06	06	08	08	08	08	08	10	10	10	12	12	12	12	12	14	14	14	16	16	16	16	16	18	18	18	20	20	20	20	20	22	22	22	24	24	26	26
0.071 - 0.090								02	02	02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	26	26	28
0.091 - 0.100							02	02	02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	26	26	28
0.101 - 0.120					02	02	02	02	02	04	04	04	06	06	06	06	06	08	08	08	10	10	10	10	10	12	12	12	14	14	14	14	14	16	16	16	18	18	18	18	18	20	20	20	22	22	22	22	22	24	24	24	26	26	28	28
0.121 - 0.140				02	02	02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	28	28	30
0.141 - 0.150				02	02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	28	28	30
0.151 - 0.170			02	02	04	04	04	04	04	06	06	06	08	08	08	08	08	10	10	10	12	12	12	12	12	14	14	14	16	16	16	16	16	18	18	18	20	20	20	20	20	22	22	22	24	24	24	24	24	26	26	26	28	28	30	30
0.171 - 0.190		02	02	04	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	30	30	32
0.191 - 0.199		02	02	04	04	04	06	06	06	06	08	08	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	30	30	32
0.200 - 0.300																																																									
0.301 - 0.320	04	06	06	08	08	10	10	10	10	10	12	12	12	14	14	14	14	14	16	16	16	18	18	18	18	18	20	20	20	22	22	22	22	22	24	24	24	26	26	26	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34		
0.321 - 0.325	04	06	06	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34		
0.326 - 0.340	06	06	08	08	10	10	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34			
0.341 - 0.350	06	06	08	08	10	10	10	12	12	12	12	12	14	14	14	16	16	16	16	16	18	18	18	20	20	20	20	20	22	22	22	24	24	24	24	24	26	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34			
0.351 - 0.370	06	08	08	10	10	12	12	12	12	12	14	14	14	16	16	16	16	16	18	18	18	20	20	20	20	20	22	22	22	24	24	24	24	24	26	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34	34				
0.371 - 0.375	06	08	08	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34				
0.376 - 0.390	08	08	10	10	12	12	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34					
0.391 - 0.400	08	08	10	10	12	12	12	14	14	14	14	14	16	16	16	18	18	18	18	18	20	20	20	22	22	22	22	22	24	24	24	26	26	26	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34	34	34	34					
0.401 - 0.420	08	10	10	12	12	14	14	14	14	14	16	16	16	18	18	18	18	18	20	20	20	22	22	22	22	22	24	24	24	26	26	26	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34	34	34	34							
0.421 - 0.425	08	10	10	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34								
0.426 - 0.440	10	10	12	12	14	14	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34									
0.441 - 0.450	10	10	12	12	14	14	14	16	16	16	16	16	18	18	18	20	20	20	20	20	22	22	22	24	24	24	24	24	26	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34	34										
0.451 - 0.470	10	12	12	14	14	16	16	16	16	16	18	18	18	20	20	20	20	20	22	22	22	24	24	24	24	24	26	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34	34												
0.471 - 0.475	10	12	12	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34												
0.476 - 0.490	12	12	14	14	16	16	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34													
0.491 - 0.500	12	12	14	14	16	16	16	18	18	18	18	18	20	20	20	22	22	22	22	22	24	24	24	26	26	26	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34	34	34	34													
0.501 - 0.520	12	14	14	16	16	18	18	18	18	18	20	20	20	22	22	22	22	22	24	24	24	26	26	26	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34	34	34	34															
0.521 - 0.525	12	14	14	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																
0.526 - 0.540	14	14	16	16	18	18	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																	
0.541 - 0.550	14	14	16	16	18	18	18	20	20	20	20	20	22	22	22	24	24	24	24	24	26	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34	34																		
0.551 - 0.570	14	16	16	18	18	20	20	20	20	20	22	22	22	24	24	24	24	24	26	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34	34																				
0.571 - 0.575	14	16	16	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																				
0.576 - 0.590	16	16	18	18	20	20	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																					
0.591 - 0.600	16	16	18	18	20	20	20	22	22	22	22	22	24	24	24	26	26	26	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34	34	34	34																					
0.601 - 0.620	16	18	18	20	20	22	22	22	22	22	24	24	24	26	26	26	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34	34	34	34																							
0.621 - 0.625	16	18	18	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																								
0.626 - 0.640	18	18	20	20	22	22	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																									
0.641 - 0.650	18	18	20	20	22	22	22	24	24	24	24	24	26	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34	34																										
0.651 - 0.670	18	20	20	22	22	24	24	24	24	24	26	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34	34																												
0.671 - 0.675	18	20	20	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																												
0.676 - 0.690	20	20	22	22	24	24	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																													
0.691 - 0.700	20	20	22	22	24	24	24	26	26	26	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34	34	34	34																													
0.701 - 0.720	20	22	22	24	24	26	26	26	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34	34	34	34																															
0.721 - 0.725	20	22	22	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																																
0.726 - 0.740	22	22	24	24	26	26	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																																	
0.741 - 0.750	22	22	24	24	26	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34	34																																		
0.751 - 0.770	22	24	24	26	26	28	28	28	28	28	30	30	30	32	32	32	32	32	34	34	34																																				
0.771 - 0.775	22	24	24	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																																				
0.776 - 0.790	24	24	26	26	28	28	28	28	30	30	30	30	32	32	32	32	34	34	34	34																																					
0.791 - 0.800	24	24	26	26	28	28	28	30	30	30	30	30	32	32	32	34	34	34	34	34																																					
0.801 - 0.820	24	26	26	28	28	30	30	30	30	30	32	32	32	34	34	34	34	34																																							
0.821 - 0.825	24	26	26	28	28	30	30	30	30	32	32	32	32	34	34	34	34																																								
0.826 - 0.840	26	26	28	28	30	30	30	30	32	32	32	32	34	34	34	34																																									
0.841 - 0.850	26	26	28	28	30	30	30	32	32	32	32	32	34	34	34																																										
0.851 - 0.870	26	28	28	30	30	32	32	32	32	32	34	34	34																																												
0.871 - 0.875	26	28	28	30	30	32	32	32	32	34	34	34	34																																												
0.876 - 0.890	28	28	30	30	32	32	32	32	34	34	34	34																																													
0.891 - 0.900	28	28	30	30	32	32	32	34	34	34	34	34																																													
0.901 - 0.925	28	30	30	32	32	34	34	34	34																																																	
0.926 - 0.950	30	30	32	32	34	34	34																																																			
0.951 - 0.975	30	32	32	34	34																																																					
0.976 - 1.000	32	32	34	34																																																						
1.001 - 1.025	32	34	34																																																							
1.026 - 1.050	34	34																																																								
1.051 - 1.075	34																																																									

Shim thicknesses mm (in.)

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

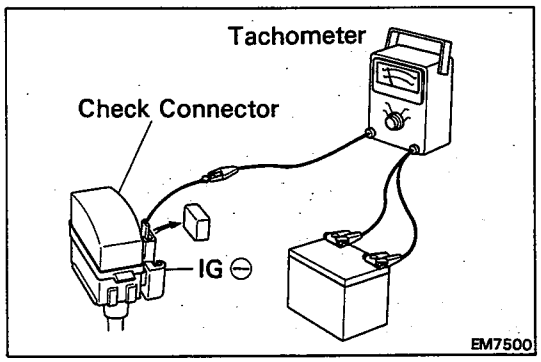
Exhaust valve clearance (cold):
0.20 – 0.30 mm (0.008 – 0.012 in.)

Example: **A 2.800 mm shim is installed and the measured clearance is 0.450 mm. Replace the 2.800 mm shim with shim No. 22 (3.000 mm).**

INSPECTION AND ADJUSTMENT OF IGNITION TIMING

1. WARM UP ENGINE

Allow the engine to reach normal operating temperature.



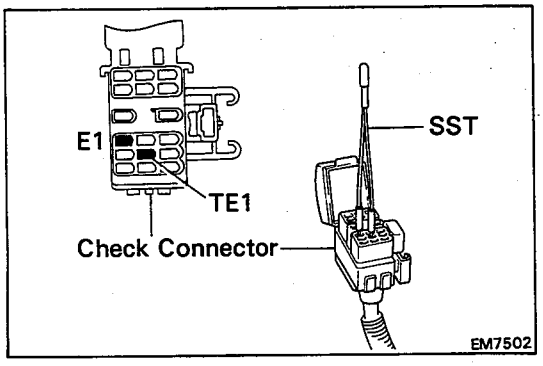
2. CONNECT TACHOMETER

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

LOCATION: See page FI-133

NOTICE:

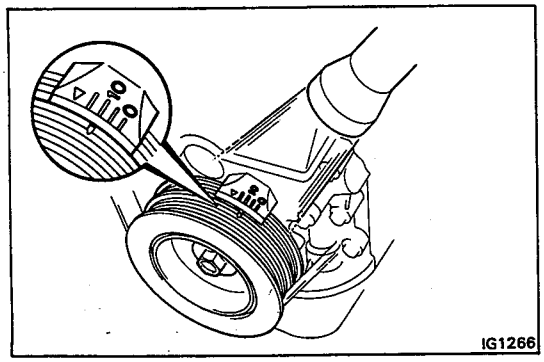
- **NEVER allow the tachometer terminal to touch ground as it could result in damage to the igniter and/or ignition coil.**
- **As some tachometers are not compatible with this ignition system, we recommend that you confirm the compatibility of your unit before use.**



3. INSPECT AND ADJUST IGNITION TIMING

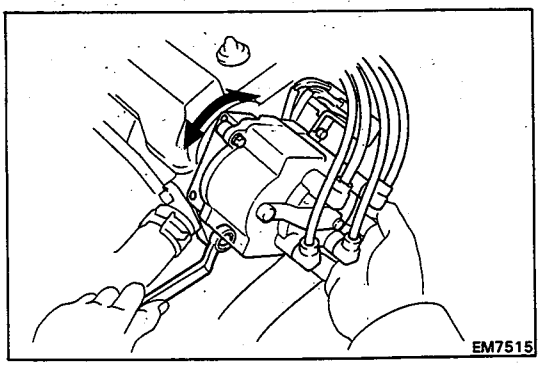
(a) Using SST, connect terminals TE1 and E1 of the check connector.

SST 09843-18020



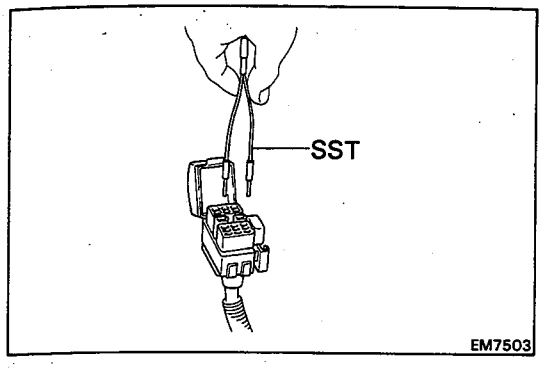
(b) Using a timing light, check the ignition timing.

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



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

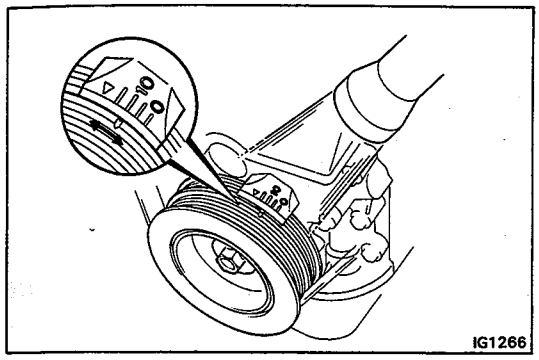
Torque: 200 kg-cm (14 ft-lb, 20 N·m)



4. FURTHER CHECK IGNITION TIMING

(a) Remove SST from the check connector.

SST 09843-18020



(b) Check the ignition timing.

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

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

5. DISCONNECT TACHOMETER AND TIMING LIGHT FROM ENGINE

INSPECTION AND ADJUSTMENT OF IDLE SPEED (w/ TWC)

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

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

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

2. **WARM UP ENGINE**
   Allow the engine to reach normal operating temperature.

3. **CONNECT TACHOMETER (See page EM-20)**

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

5. **INSPECT AND ADJUST IDLE SPEED**
   (a) Race the engine at 2,500 rpm for about 90 seconds.
   (b) Using SST, connect terminals TE1 and E1 of the check connector.

   SST 09843-18020

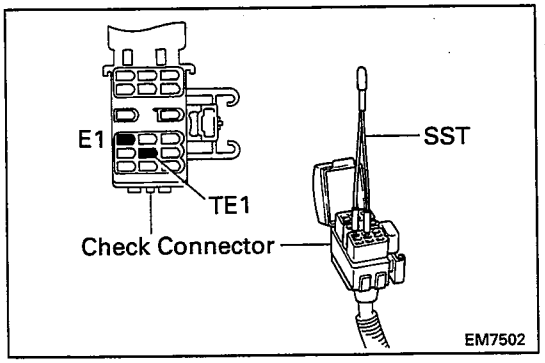
   (c) Check the idle speed.

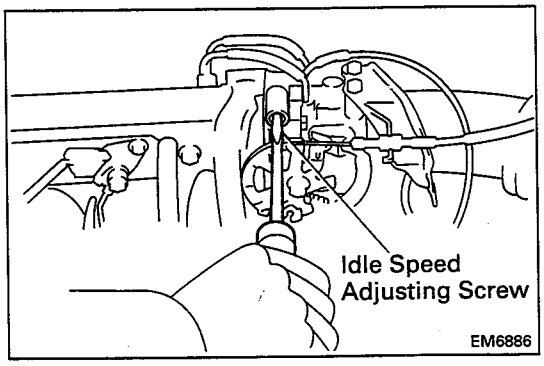
   Idle speed: 800 rpm (w/ Cooling fan OFF)

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

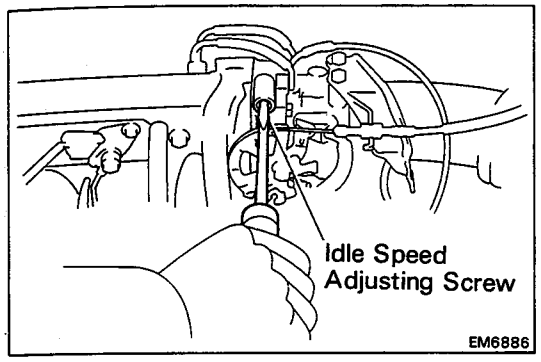
   (d) Remove the tachometer and SST.

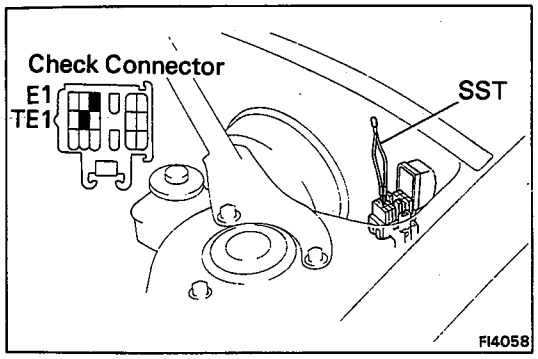
   SST 09843-18020

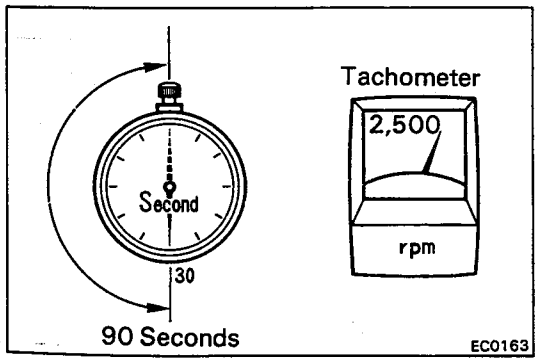


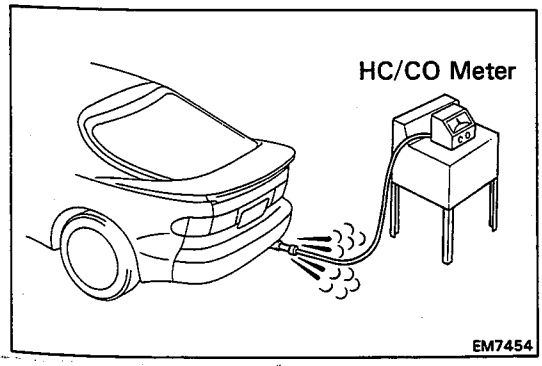


INSPECTION AND ADJUSTMENT OF IDLE SPEED AND IDLE MIXTURE (w/o TWC)









1. INITIAL CONDITIONS

(a) Air cleaner installed

(b) Normal engine operating temperature

(c) All pipes and hoses of air induction system connected

(d) All accessories switched off

(e) EFI system wiring connectors fully plugged

(f) Ignition timing set correctly

(g) Transmission in "neutral" range

(h) HC/CO meter operates normally

2. WARM UP ENGINE

Allow the engine to reach normal operating temperature.

3. CONNECT TACHOMETER (See page EM-20)

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

5. INSPECT AND ADJUST IDLE SPEED

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

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

6. ADJUST IDLE MIXTURE

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

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

SST 09843-18020

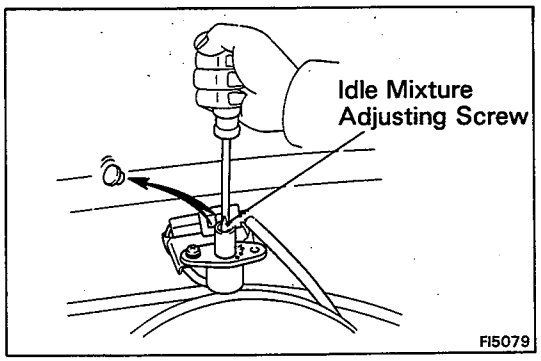
NOTICE: When short-circuiting of the terminal TE1, engine idle speed will be changed. Even so don't adjust engine idle speed.

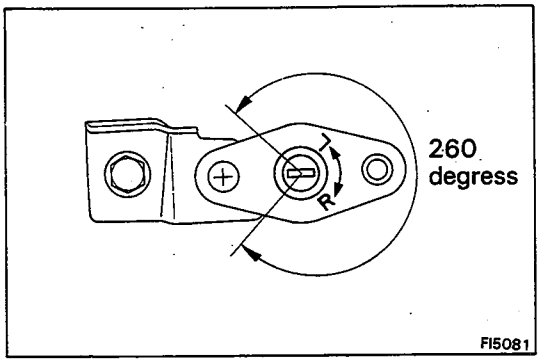
(b) Race the engine at 2,500 rpm for approx. 90 seconds.

(c) Insert a testing probe at least 40 cm (1.3 ft) into the tailpipe.

(d) Measure the concentration 1 – 3 minutes after racing the engine to allow the concentration to stabilize.

Idle CO concentration: 1.5 ± 0.5 % (w/ Cooling fan OFF)





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

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

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

Troubleshooting

HC	CO	SYMPTOMS	CAUSES
High	Normal	Rough idle	1. Faulty ignition: ● Incorrect timing ● Fouled, shorted or improperly gapped plugs ● Open or crossed ignition wires ● Cracked IIA cap 2. Incorrect valve clearance 3. Leaky EGR valve (w/ EGR system) 4. Leakt intake and exhaust valves 5. Leaky cylinder
High	Low	Rough idle (Fluctuating HC reading)	1. Vacuum leak: ● Vacuum hose ● EGR valve (w/ EGR system) ● Intake manifold ● PCV line ● Throttle body ● Cylinder head gasket ● Brake booster line 2. Lean mixture causing misfire
HIgh	High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Plugged PCV valve 3. Faulty EFI system ● Faulty pressure regulator ● Clogged fuel return line ● Faulty vacuum sensor ● Defective water temp. sensor ● Defective intake air temp. sensor ● Faulty ECU ● Faulty injector ● Faulty cold start injector ● Faulty throttle position sensor

ENGINE TUNE-UP (4A-GE)

INSPECTION OF ENGINE COOLANT

(See steps 1 and 2 page CO-5)

INSPECTION OF ENGINE OIL

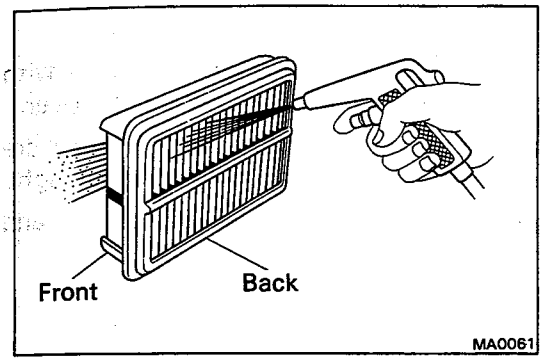
(See steps 1 and 2 on page LU-6)

INSPECTION OF BATTERY

(See steps 1 and 2 page CH-3)

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

INSPECTION OF AIR FILTER



1. INSPECT AIR FILTER

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

2. CLEAN AIR FILTER

Clean the element with compressed air.

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

INSPECTION OF HIGH-TENSION CORDS

(See page IG-11)

Maximum resistance: 25 kΩ per cord

INSPECTION OF SPARK PLUGS

Conventional Tipped Type
(See page IG-11)

Correct electrode gap: 0.8 mm (0.031 in.)
Recommended spark plugs:
ND K20R-U
NGK BKR6EYA

Platinum Tipped Type
(See page IG-12)

Maximum electrode gap: 1.0 mm (0.039 in.)
Correct electrode gap of new plug:
0.8 mm (0.031 in.)
Recommended spark plugs:
ND PK20R8
NGK BKP6EP8

INSPECTION OF ALTERNATOR DRIVE BELT

(See step 3 page CH-3)

Drive belt deflection:
New belt 4 – 5 mm (0.16 – 0.20 in.)
Used belt 6 – 7 mm (0.24 – 0.28 in.)
Drive belt tension (Reference):
New belt 70 – 80 kg
Used belt 30 – 45 kg

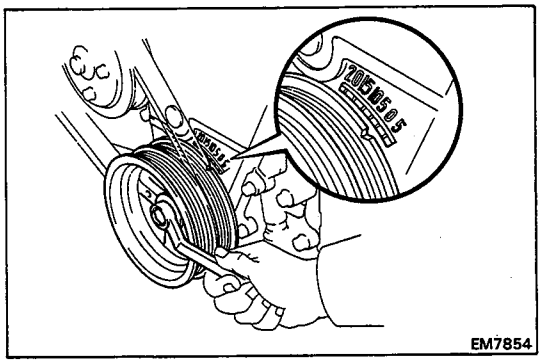
INSPECTION AND ADJUSTMENT OF VALVE CLEARANCE

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

1. REMOVE PLUG CORD COVER

2. DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS

3. REMOVE CYLINDER HEAD COVERS (See page EM-95)

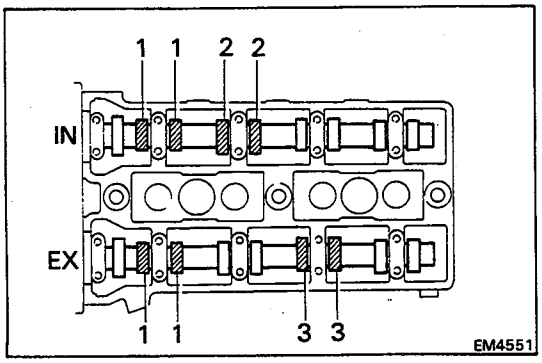


4. SET NO.1 CYLINDER TO TDC/COMPRESSION

(a) Turn the crankshaft pulley and align its groove with the timing mark "0" of the No.1 timing belt cover.

(b) Check that the valve lifters on the No.1 cylinder are loose and valve lifters on the No.4 cylinder are tight.

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



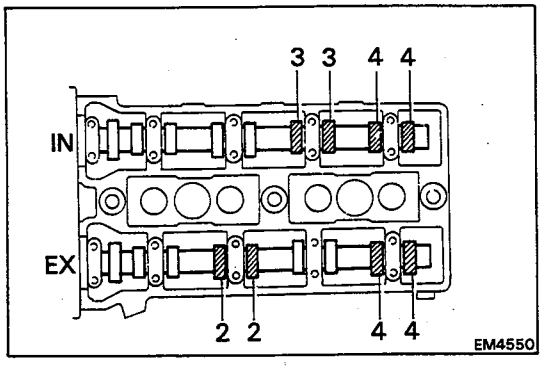
5. INSPECT VALVE CLEARANCE

(a) Check only those valves indicated as shown.

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

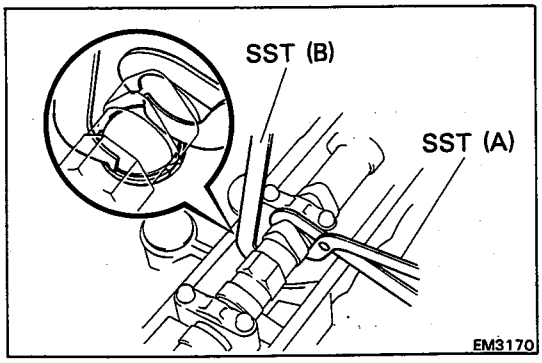
Valve clearance (Cold):

Intake	**0.15 – 0.25 mm (0.006 – 0.010 in.)**
Exhaust	**0.20 – 0.30 mm (0.008 – 0.012 in.)**



(b) Turn the crankshaft one revolution (360°) and align the mark as above. (See procedure step 4)

(c) Check only the valves indicated as shown. Measure the valve clearance. (See procedure step (a)).

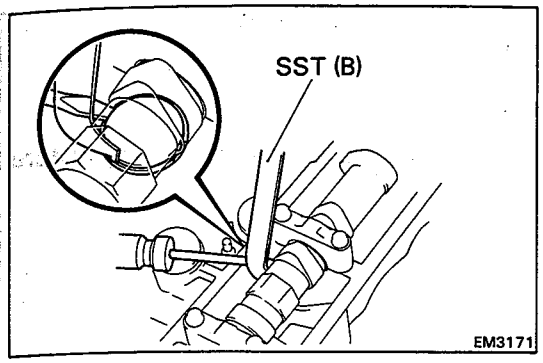


6. ADJUST VALVE CLEARANCE

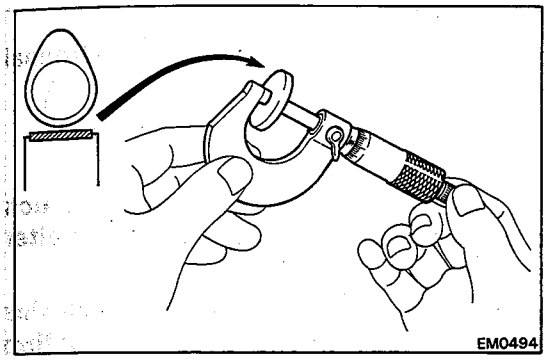
(a) Remove the adjusting shim.

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

SST 09248-55010



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



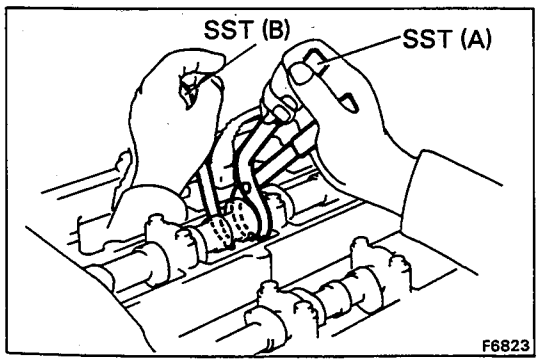
(b) Determine the replacement adjusting shim size by using the following Formula or Charts:
- Using a micrometer, measure the thickness of the shim which was removed.
- Calculate the thickness of a new shim so the valve clearance comes within specified value.

T ..... Thickness of used shim
A ..... Measured valve clearance
N ..... Thickness of new shim

Intake N = T + (A − 0.20 mm (0.008 in.))
Exhaust N = T + (A − 0.25 mm (0.010 in.))

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

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



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

SST 09248-55010

(d) Recheck the valve clearance.

7. REINSTALL CYLINDER HEAD COVERS
(See page EM-113)

8. CONNECT HIGH-TENSION CORDS TO SPARK PLUGS

9. REINSTALL PLUG CORD COVER

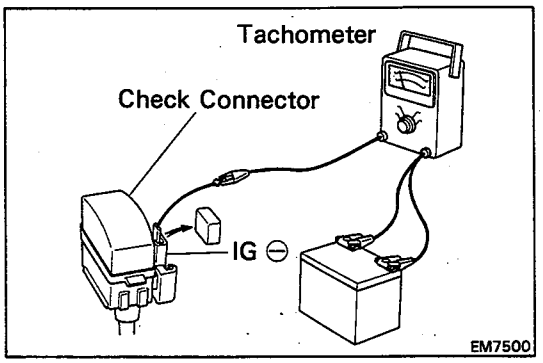
Adjusting Shim Selection Chart

(See pages EM-18 and 19)

INSPECTION AND ADJUSTMENT OF IGNITION TIMING

1. WARM UP ENGINE

Allow the engine to reach normal operating temperature.



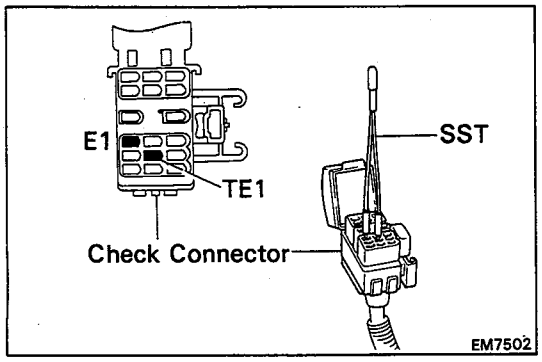
2. CONNECT TACHOMETER

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

LOCATION: See page FI-133.

NOTICE:

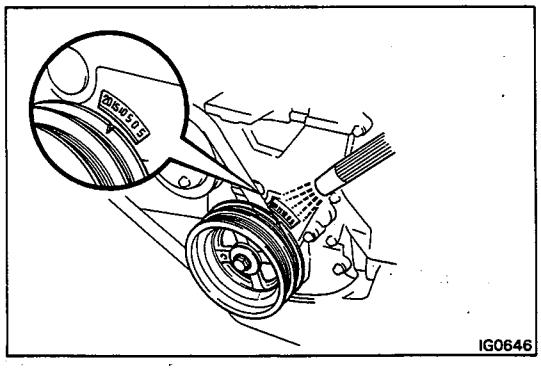
- **NEVER allow the tachometer terminal to touch ground as it could result in damage to the igniter and/or ignition coil.**
- **As some tachometers are not compatible with this ignition system, we recommend that you confirm the compatibility of your unit before using.**



3. INSPECT AND ADJUST IGNITION TIMING

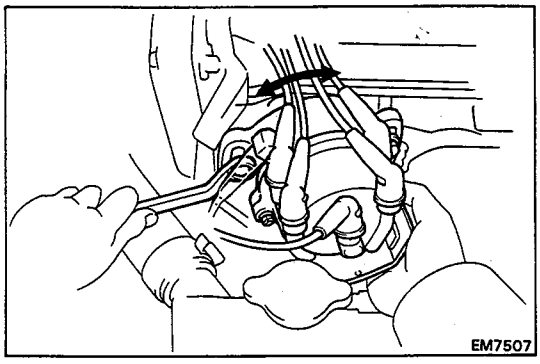
(a) Using SST, connect terminals TE1 and E1 of the check connector.

SST 09843-18020



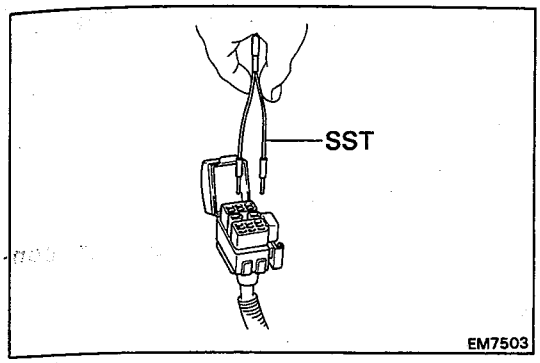
(b) Using a timing light, check the ignition timing.

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



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

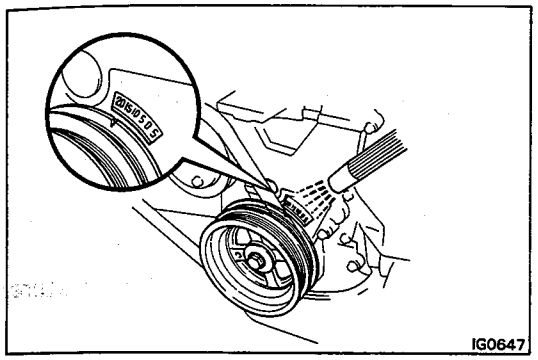
Torque: 200 kg-cm (14 ft-lb, 20 N·m)



4. FURTHER CHECK IGNITION TIMING

(a) Remove SST from the check connector.

SST 09843-18020



(b) Check the ignition timing.

Ignition timing: Approx. 16° BTDC @ idle (Transmission in neutral range)

5. DISCONNECT TACHOMETER AND TIMING LIGHT FROM ENGINE

INSPECTION AND ADJUSTMENT OF IDLE SPEED (w/ TWC)

1. INITIAL CONDITIONS

(a) Air cleaner installed

(b) Normal engine operating temperature

(c) All pipes and hoses of air induction system connected

(d) All vacuum lines connected

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

(e) All accessories switched off

(f) EFI system wiring connectors fully plugged

(g) Ignition timing set correctly

(h) Transmission in "neutral" range

2. WARM UP ENGINE

Allow the engine to reach normal operating temperature.

3. CONNECT TACHOMETER (See page EM-28)

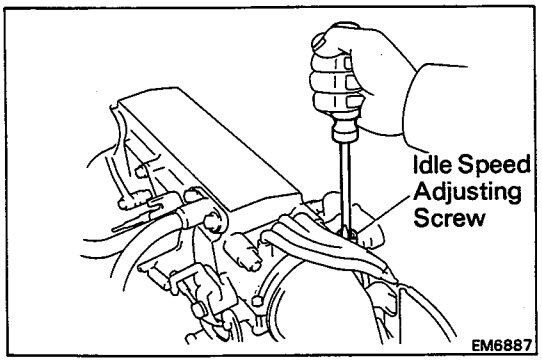
4. CHECK AIR VALVE OPERATION (See page FI-131)

5. INSPECT AND ADJUST IDLE SPEED

(a) Race the engine at 2,500 rpm for a few seconds.

(b) Check the idle speed.

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



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

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

1. INITIAL CONDITIONS

(a) Air cleaner installed

(b) Normal engine operating temperature

(c) All pipes and hoses of air induction system connected

(d) All accessories switched off

(e) EFI system wiring connectors fully plugged

(f) Ignition timing set correctly

(g) Transmission in "neutral" range

(h) HC/CO meter operates normally

2. WARM UP ENGINE

Allow the engine to reach normal operating temperature.

3. CONNECT TACHOMETER (See page EM-28)

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

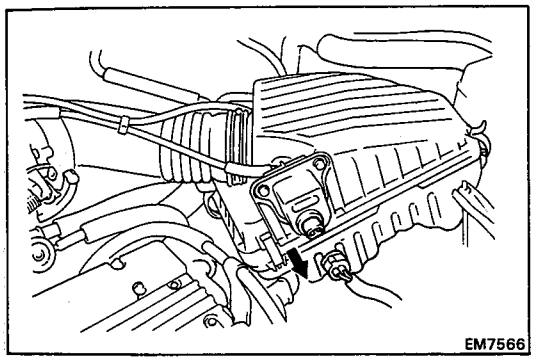
5. INSPECT AND ADJUST IDLE SPEED

(a) Disconnect the ACV connector.

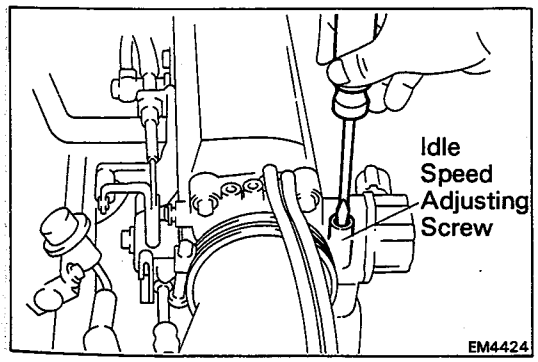
(b) Race the engine at 2,500 rpm for a few seconds.

(c) Check the idle speed.

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


EM7566

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



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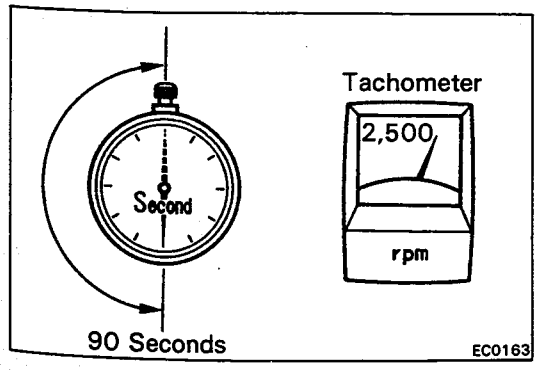
(d) Connect the ACV connector.

6. ADJUST IDLE MIXTURE

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

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



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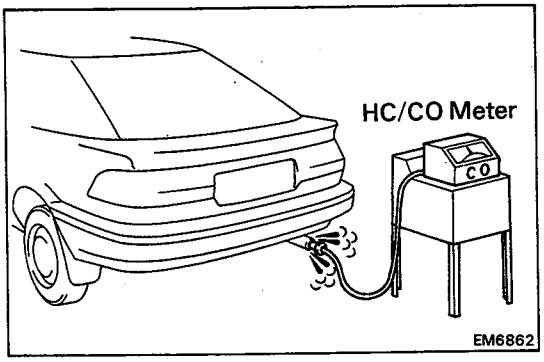
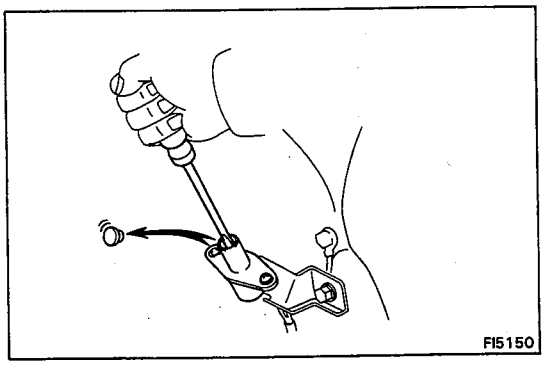


(b) Insert a testing probe at least 40 cm (1.3 ft) into the tailpipe.

(c) Measure the concentration 1 – 3 minutes after racing the engine to allow the concentration to stabilize.

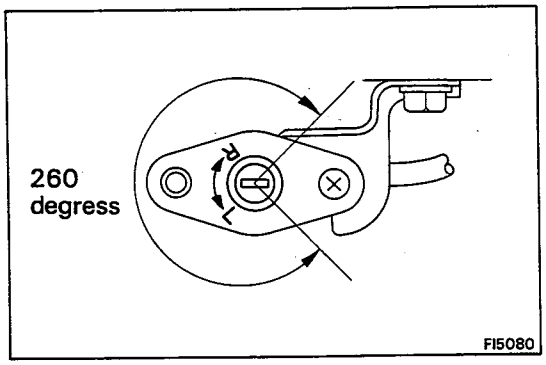
Idle CO concentration: 1.5 ± 0.5 %
(w/ Cooling fan OFF)



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

- If the concentration is within specification, the adjustment is complete.
- If the CO concentration cannot be corrected by idle mixture adjustment, see the table on page EM-34 for other possible causes.

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



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

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

1. INITIAL CONDITIONS

(a) Engine to reach normal operating temperature

(b) Air cleaner installed

(c) All pipes and hoses of air induction system connected

(d) All accessories switched off

(e) All vacuum lines properly connected

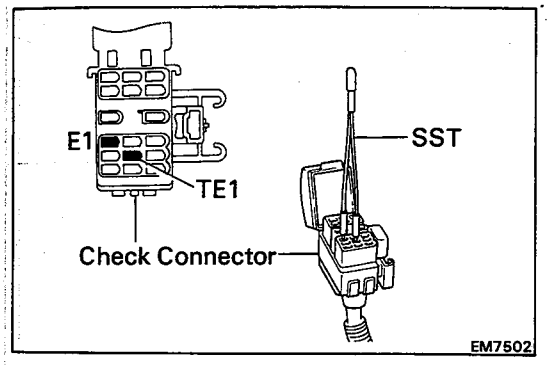
HINT: All vacuum hoses for EGR systems, etc. should be properly connected.

(f) EFI system wiring connectors fully plugged

(g) Ignition timing set correctly

(h) Transmission in neutral range

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



2. START ENGINE

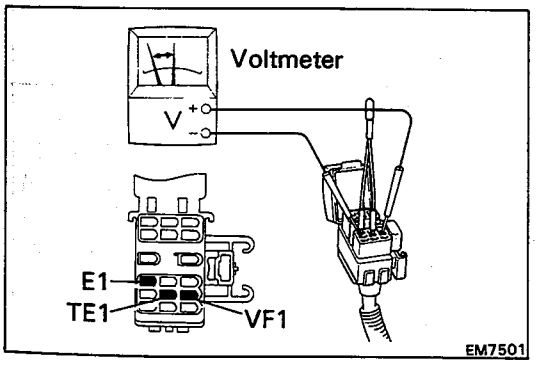
3. CHECK IDLE SPEED

Idle speed: 800 rpm

4. CHECK OXYGEN SENSOR OPERATION

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

SST 09843-18020



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

(c) Hold the engine speed at 2,500 rpm for approx. 90 seconds to warm up the oxygen sensor.

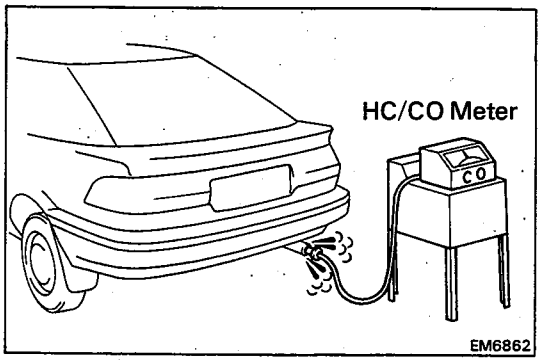
(d) Then, maintaining engine at 2,500 rpm. count how many times the needle of the voltmeter fluctuates between 0 and 5 V.

Minimum needle fluctuation:

4A-FE 8 times for every 10 seconds

4A-GE 6 times for every 10 seconds

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



5. **RACE ENGINE AT 2.500 PRM FOR APPROX. 120 SECONDS**

6. **INSERT CO METER TESTING PROBE INTO TAILPIPE AT LEST 40 cm (1.3 ft)**

7. **CHECK HC/CO CONCENTRATION AT IDLE**

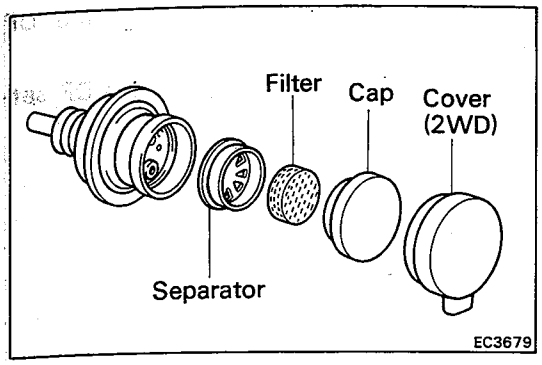
Wait at least one minute before measuring to allow the concentration to stabilize. Complete the measuring within three minutes.

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

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

Troubleshooting

HC	CO	SYMPTOMS	CAUSES
High	Normal	Rough idle	1. Faulty ignition: ● Incorrect timing ● Fouled, shorted or improperly gapped plugs ● Open or crossed ignition wires ● Cracked IIA or distributor cap 2. Incorrect valve clearance 3. Leaky EGR valve (w/ EGR system) 4. Leaky intake and exhaust valves 5. Leaky cylinder
High	Low	Rough idle (Fluctuating HC reading)	1. Vacuum leak: ● Vacuum hose ● EGR valve (w/ EGR system) ● Intake manifold ● PCV line ● Throttle body ● Cylinder head gasket ● Brake booster line 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Clogged air filter 2. Plugged PCV valve (4A-FE) 3. Faulty EFI system ● Faulty pressure regulator ● Clogged fuel return line ● Faulty air flow meter (w/ air flow meter) ● Faulty vacuum sensor (w/o air flow meter) ● Defective water temp. sensor ● Defective intake air temp. sensor ● Faulty ECU ● Faulty injector ● Faulty cold start injector ● Faulty throttle position sensor



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

1. WARM UP AND STOP ENGINE

Allow the engine to reach normal operating temperature.

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

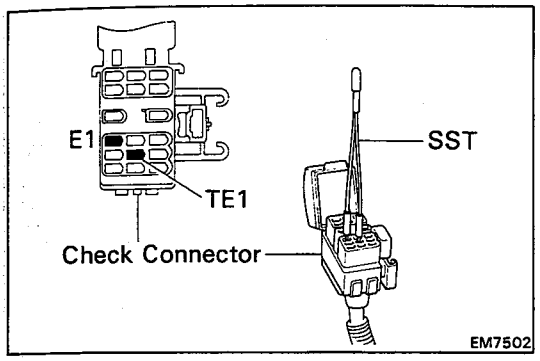
3. REMOVE COVER (2WD), CAP, FILTER AND SEPARATOR FROM DP

4. ADJUST DP SETTING SPEED

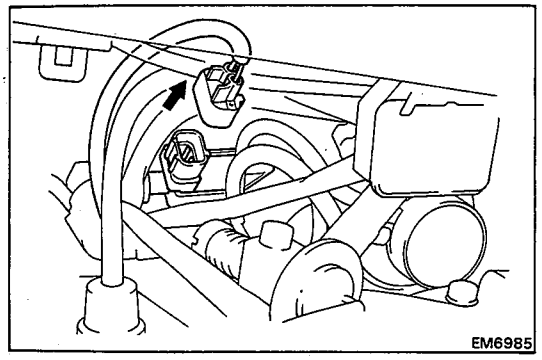
(a) (2WD)
Using SST, connect terminals TE1 and E1 of the check connector.

SST 09843-18020

LOCATION: See page FI-133

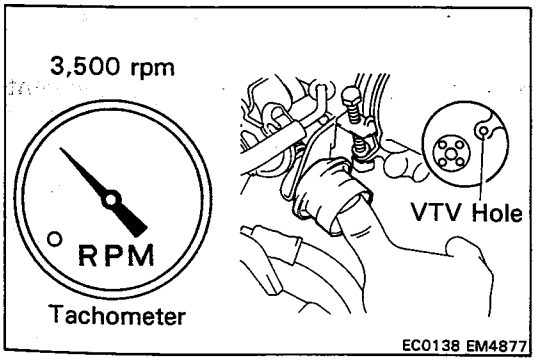


(b) (2WD w/ EGR system)
Disconnect the VSV connector.



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

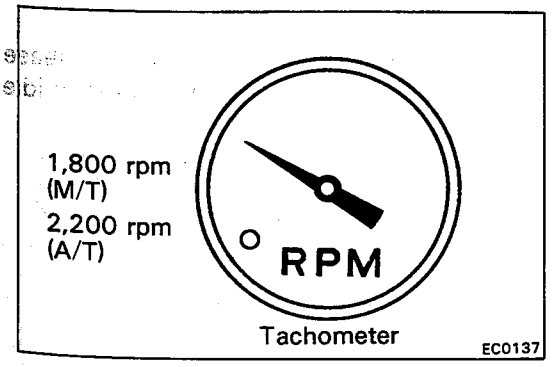
(d) Plug the VTV hole with your finger.

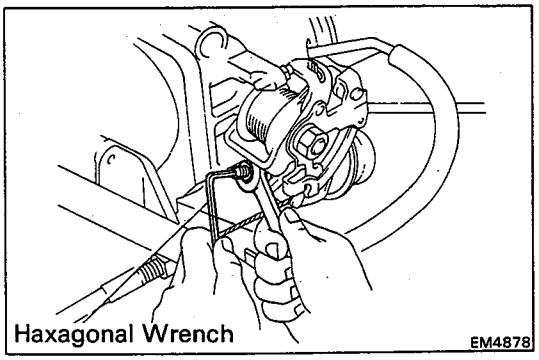


(e) Release the throttle valve.

(f) Check the DP setting speed.

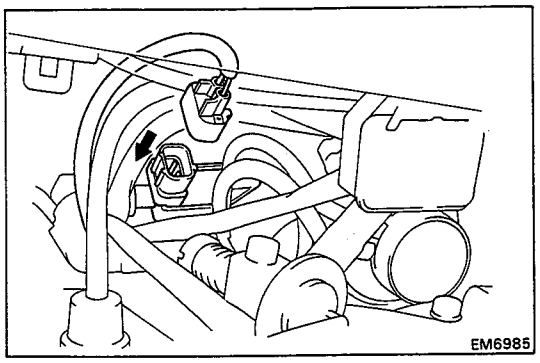
DP setting speed: M/T 1,800 rpm
A/T 2,200 rpm
(w/ Cooling fan OFF)



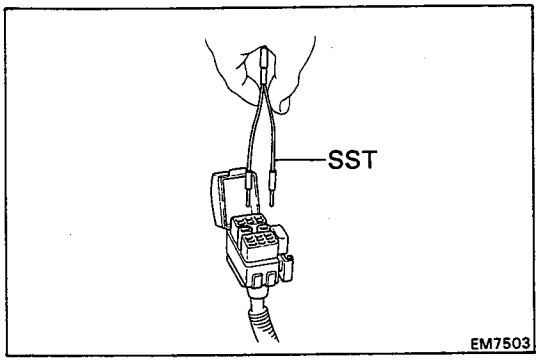


(g) Adjust the DP setting speed by turning the DP ADJUSTING SCREW.

(h) Repeat steps from (c) to (e), and recheck the DP setting speed.

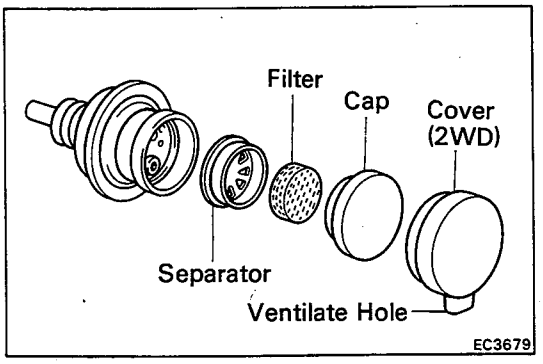


(i) (2WD w/ EGR system)
Connect the VSV connector.



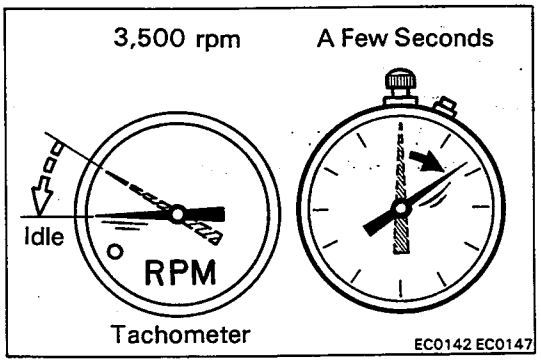
(j) (2WD)
Remove SST from the check connector.

SST 09843-18020



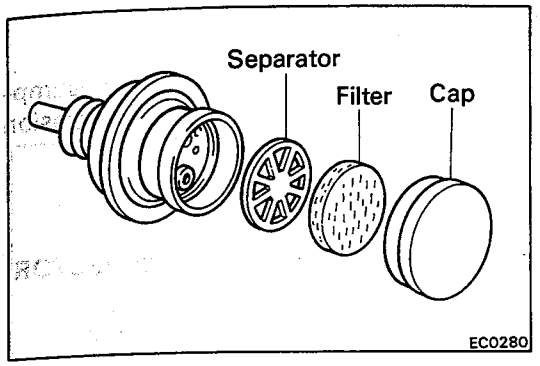
5. REINSTALL DP SEPARATOR, FILTER, CAP AND COVER (2WD)

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



6. CHECK VTV OPERATION

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



INSPECTION AND ADJUSTMENT OF DASH POT (DP) SYSTEM (4A-GE w/ AIR FLOW METER)

1. WARM UP AND STOP ENGINE

Allow the engine to reach normal operating temperature.

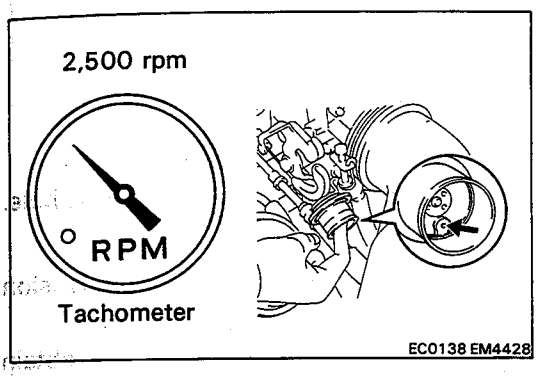
2. CHECK IDLE SPEED (See page EM-30)

3. REMOVE CAP, FILTER AND SEPARATOR FROM DP

4. ADJUST DP SETTING SPEED

(a) Race the engine at 2,500 rpm for a few seconds.

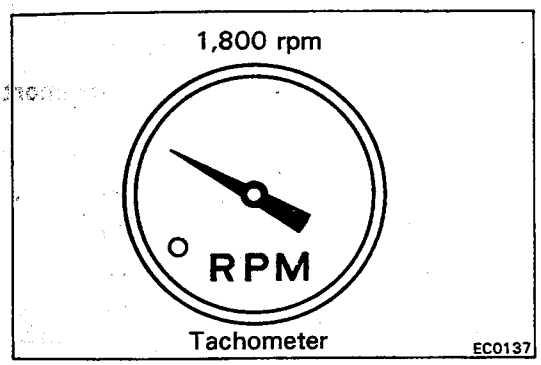
(b) Plug the VTV hole with your finger.



(c) Release the throttle valve.

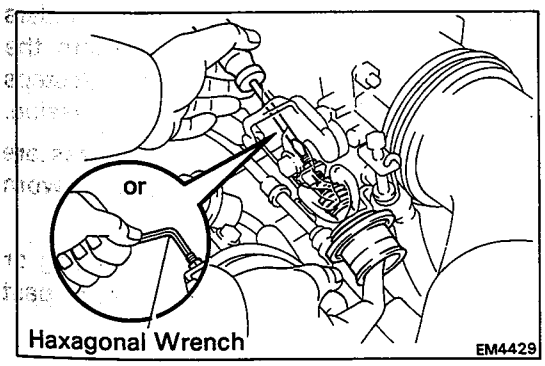
(d) Check the DP setting speed.

DP setting speed: 1,800 rpm (w/ Cooling fan OFF)



(e) Adjust the DP setting speed by turning the DP ADJUSTING SCREW.

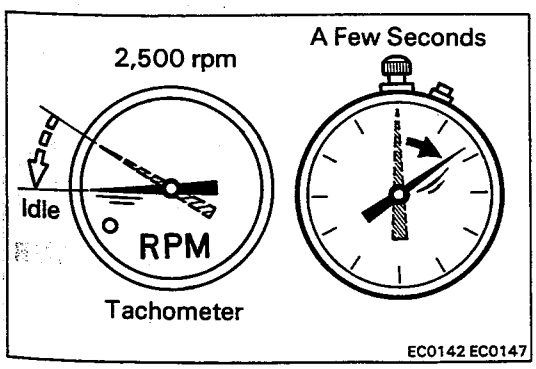
(f) Repeat steps from (a) to (c), and recheck the DP setting speed.



5. REINSTALL DP SEPARATOR, FILTER AND CAP

6. CHECK VTV OPERATION

Race the engine at 2,500 rpm for a few seconds, release the throttle valve and check that the engine returns to idle in a few seconds.



COMPRESSION CHECK

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

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

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

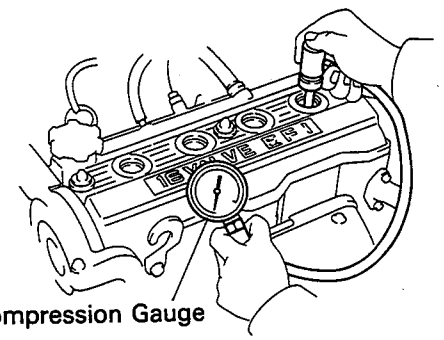
   (d) Repeat steps (a) through (c) for each cylinder.

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

   Compression pressure:
   4A-FE 13.5 kg/cm² (191 psi, 1,320 kPa)
   4A-GE 13.4 kg/cm² (190 psi, 1,314 kPa)
   Minimum pressure:
   10.0 kg/cm² (142 psi, 981 kPa)
   Difference between each cylinder:
   1.0 kg/cm² (14 psi, 98 kPa) or less

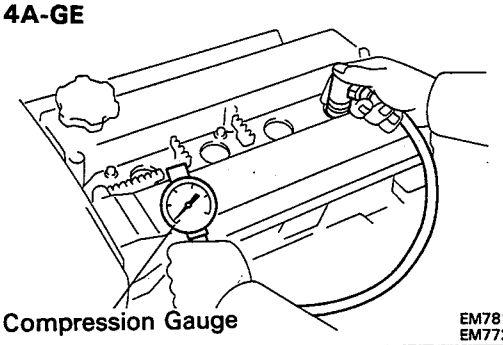
   (e) If the cylinder compression in one or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat steps (a) through (c) for the cylinder with low compression.
   - If adding oil helps the compression, chances are that the piston rings and/or cylinder bore are worn or damaged.
   - If pressure stays low, a valve may be sticking or seating improperly, or there may be leakage past the gasket.
7. **REINSTALL SPARK PLUGS (See page IG-8, 12)**
   Torque: 180 kg-cm (13 ft-lb, 18 N·m)
8. **(4A-GE)**
   INSTALL PLUG CORD COVER
9. **RECONNECT DISTRIBUTOR CONNECTOR(S)**
10. **RECONNECT COLD START INJECTOR CONNECTOR**

4A-FE



Compression Gauge

4A-GE

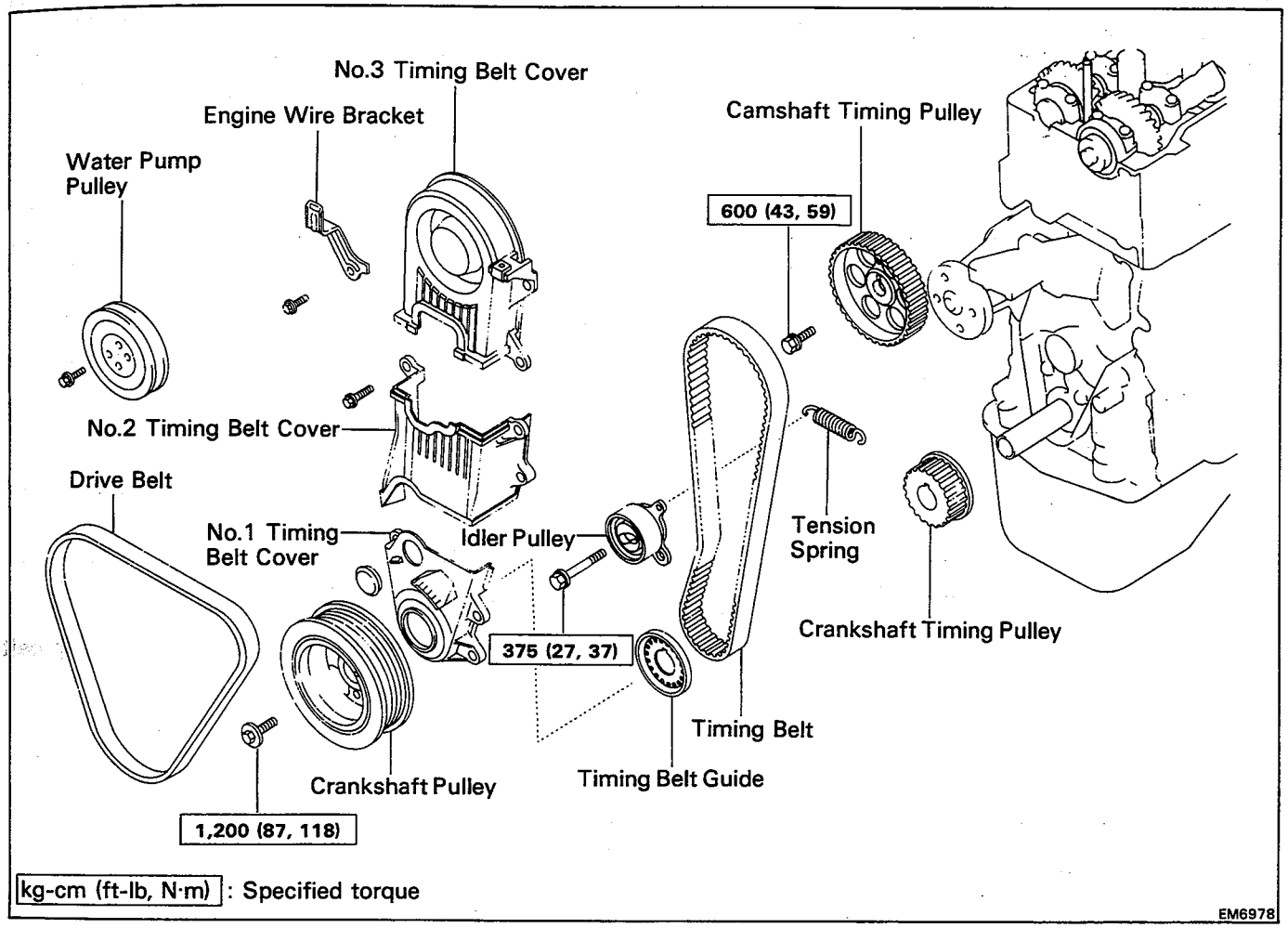


Compression Gauge

EM7816
EM7724

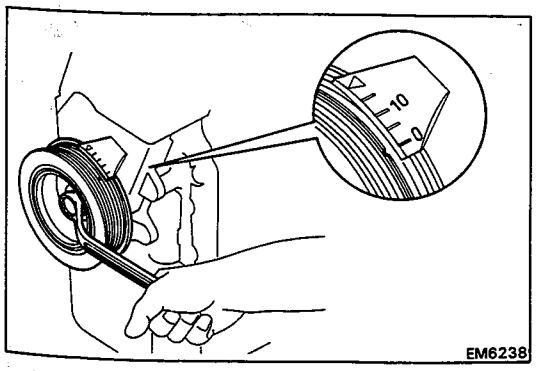
TIMING BELT (4A-FE)

COMPONENT



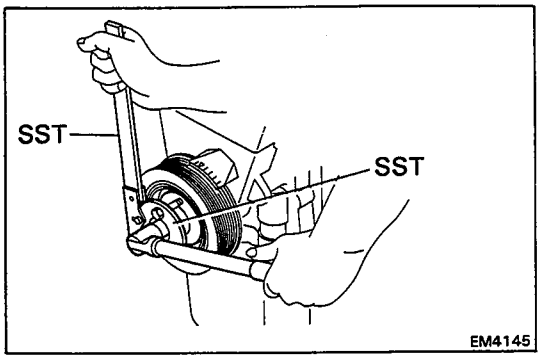
REMOVAL OF TIMING BELT

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



4. **SET NO.1 CYLINDER TO TDC/COMPRESSION**
   (a) Turn the crankshaft pulley and align its groove with the timing mark "0" of the No.1 timing belt cover.
   (b) Check that the hold of the camshaft timing pulley is aligned with the timing mark of the bearing cap.

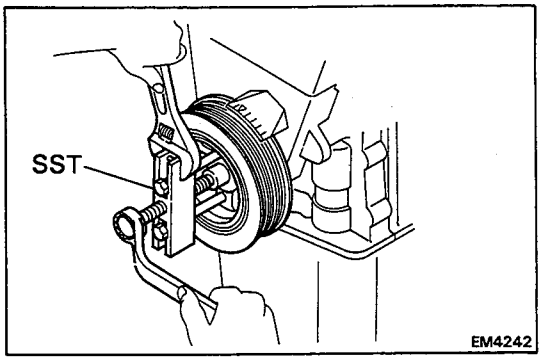
   If not, turn the crankshaft one revolution (360°).



5. REMOVE CRANKSHAFT PULLEY

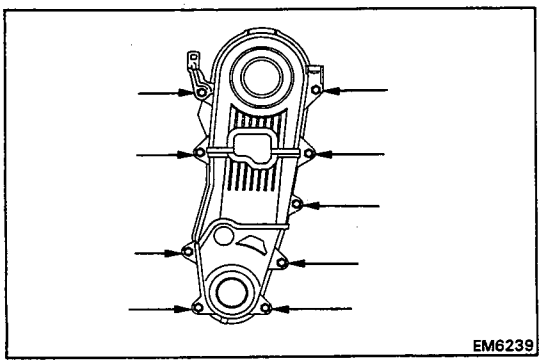
(a) Using SST to hold the crankshaft pulley, remove the pulley bolt.

SST 09213-14010 and 09330-00021



(b) Using SST, remove the pulley.

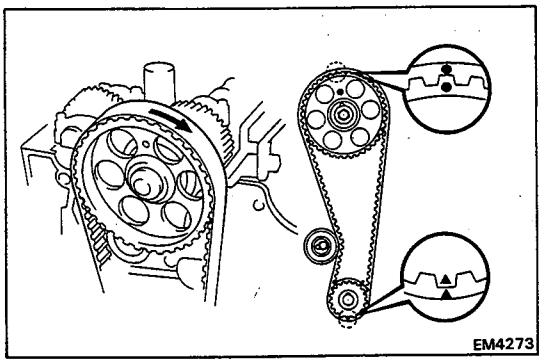
SST 09213-31021 w/o Dynamic Damper
SST 09213-60017 (09213-00020, 09213-00030 09213-00060) w/ Dynamic Damper



6. REMOVE TIMING BELT COVERS

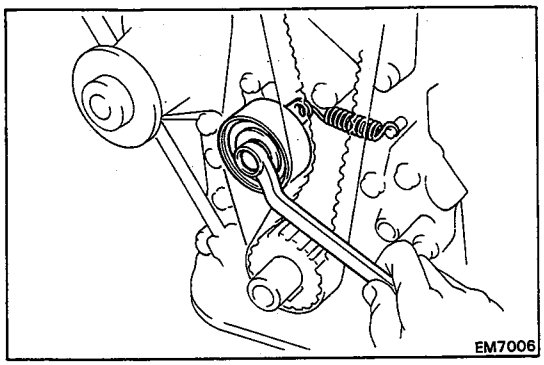
Remove the nine bolts, engine wire bracket and timing belt covers.

7. REMOVE TIMING BELT GUIDE



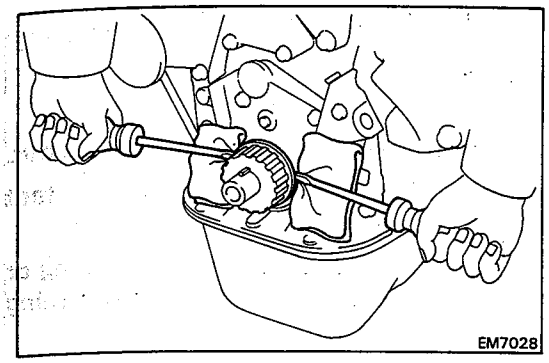
8. REMOVE TIMING BELT AND IDLER PULLEY

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



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

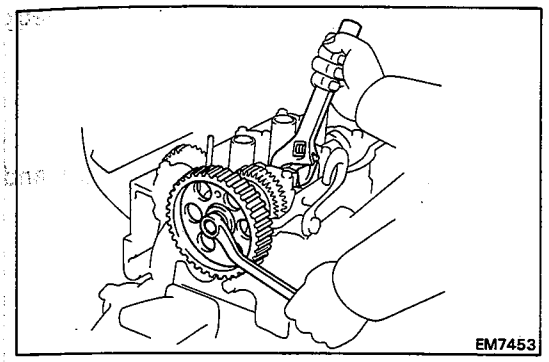
(b) Remove the belt.



9. REMOVE CRANKSHAFT TIMING PULLEY

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

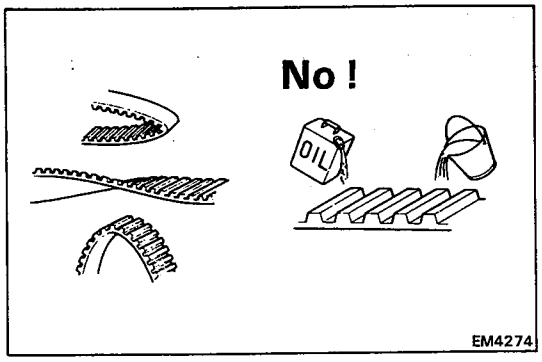
NOTICE: Position shop rags as shown to prevent damage.

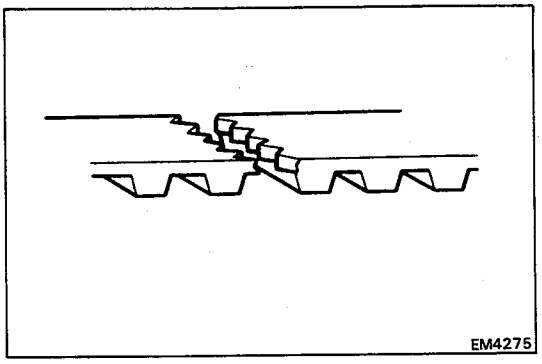


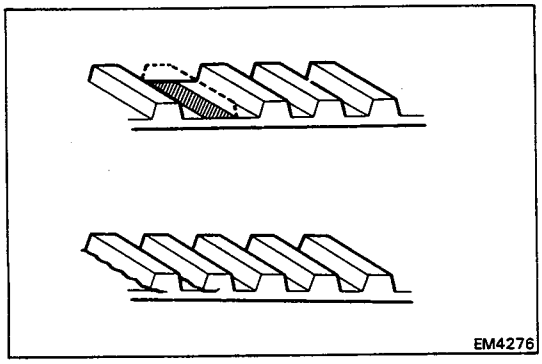
10. REMOVE CAMSHAFT TIMING PULLEY

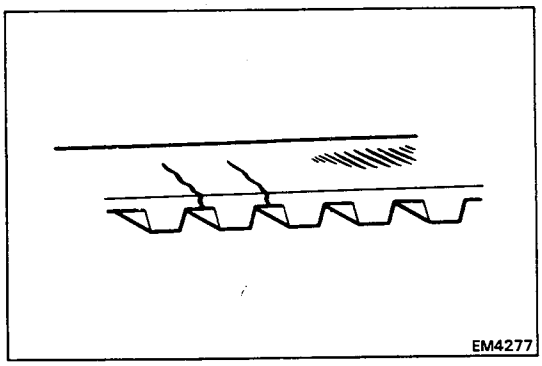
Hold the hexagonal head wrench portion of the camshaft with a wrench, and remove the bolt and timing pulley.

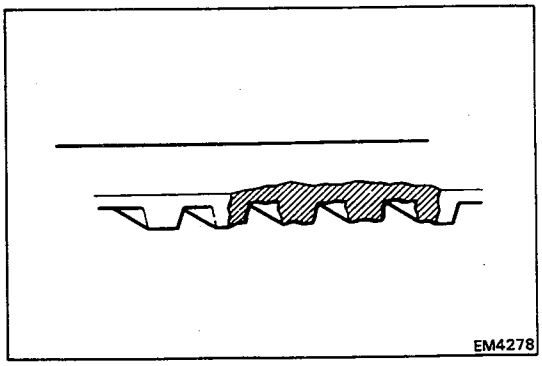
NOTICE: Be careful not to damage the cylinder head with the wrench.











INSPECTION OF TIMING COMPONENTS

1. INSPECT TIMING BELT

NOTICE:

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

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

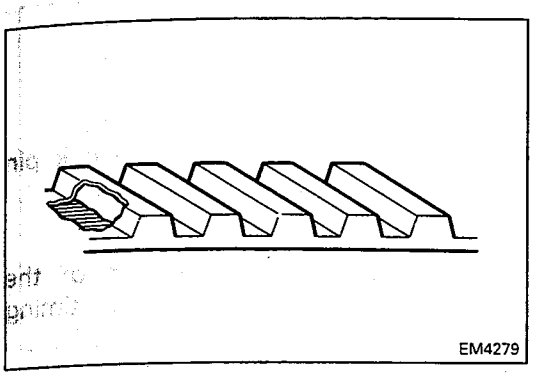
(a) Premature splitting

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

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

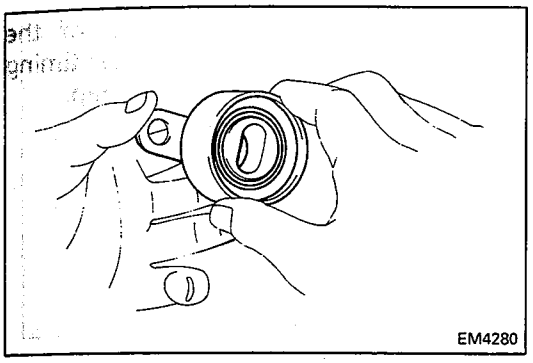
(c) If there is noticeable wear or cracks on the belt face, check to see if there are nicks on one side of the idler pulley lock.

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


EM4279

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

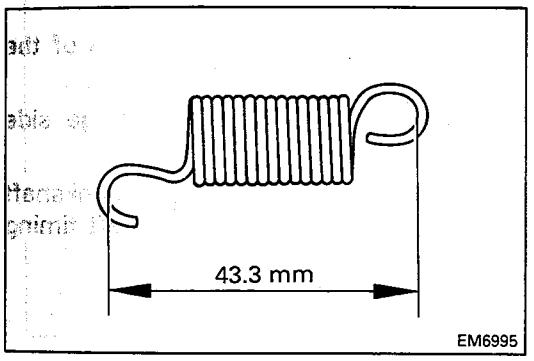
If necessary, replace the timing belt.


EM4280

2. **INSPECT IDLER PULLEY**

Check the turning smoothness of the idler pulley.

If necessary, replace the idler pulley.



EM6995

3. **INSPECT TENSION SPRING**

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

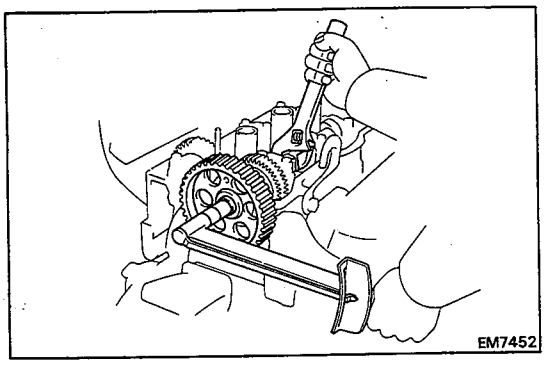
Free length: 43.3 mm (1.705 in.)

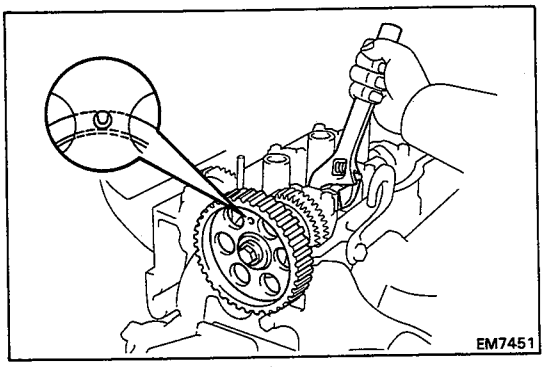
If the free length is not as specified, replace the tension spring.

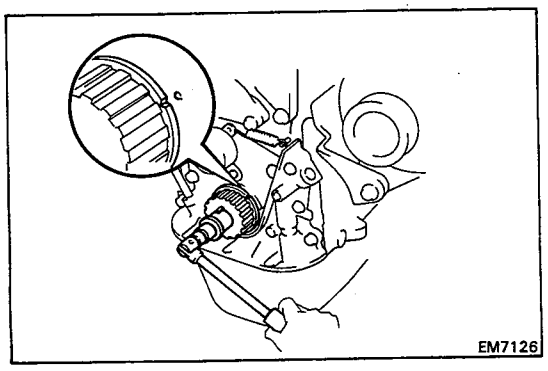
(b) Measure the tension of the tension spring at the specified installed length.

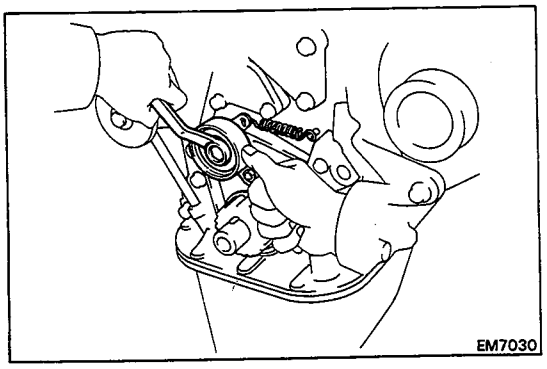
Installed tension:
65 – 73 N (6.6 – 7.4 kgf, 14.6 – 16.3 lbf)
at 50.2 mm (1.976 in.)

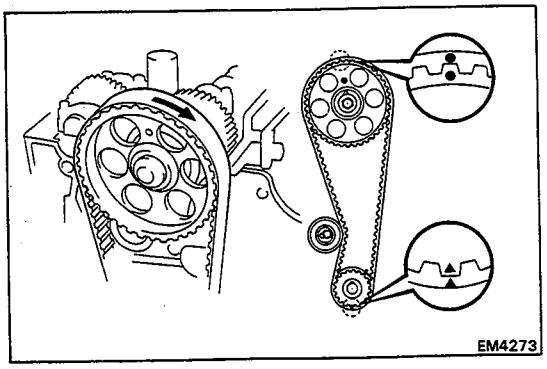
If the tension is not as specified, replace the tension spring.











INSTALLATION OF TIMING BELT

(See page EM-39)

1. INSTALL CAMSHAFT TIMING PULLEY

(a) Align the camshaft knock pin with the knock pin groove of the pulley, and slide on the pulley.

(b) Temporarily install the timing pulley bolt.

(c) Hold the hexagonal wrench head portion of the camshaft with a wrench, and tighten the timing pulley bolt.

Torque: 600 kg-cm (43 ft-lb, 59 N·m)

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

2. INSTALL CRANKSHAFT TIMING PULLEY

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

(b) Slide on the timing pulley, facing the flange side inward.

(c) Using the crankshaft pulley bolt, turn the crankshaft and align the timing marks of the crankshaft timing pulley and oil pump body.

3. TEMPORARILY INSTALL IDLER PULLEY AND TENSION SPRING

(a) Install the idler pulley with the bolt. Do not tighten the bolt yet.

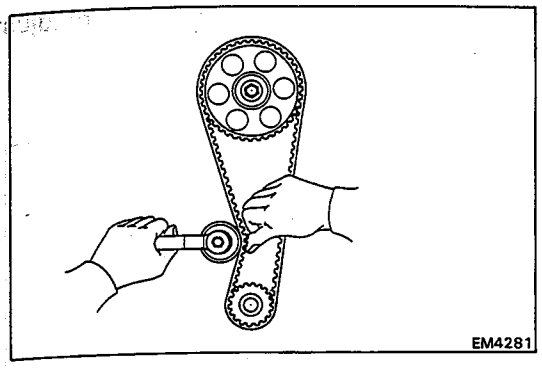
(b) Install the tension spring.

(c) Push the pulley toward the left as far as it will go and tighten the bolt.

4. INSTALL TIMING BELT

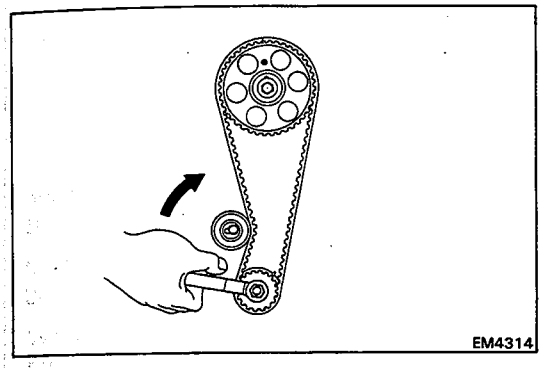
NOTICE: The engine should be cold.

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



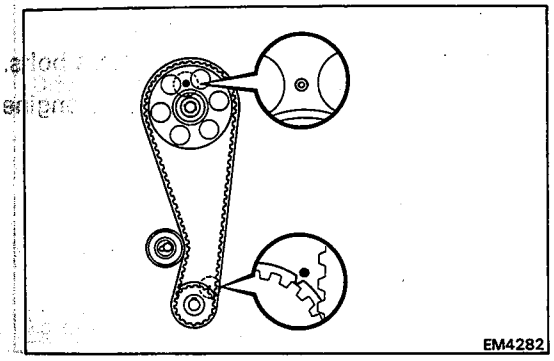
5. CHECK VALVE TIMING AND TIMING BELT TENSION

(a) Loosen the idler pulley bolt.

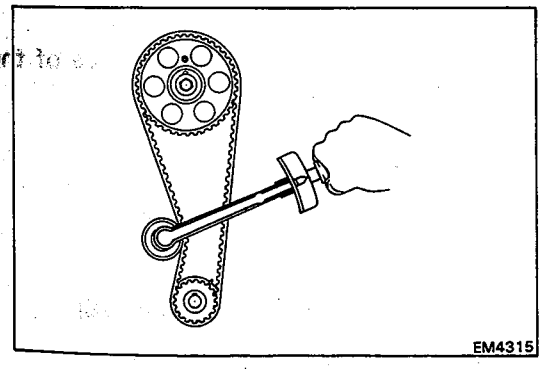


(b) Temporarily install the crank pulley bolt and turn the crankshaft two revolutions from TDC to TDC.

HINT: Always turn the crankshaft clockwise.



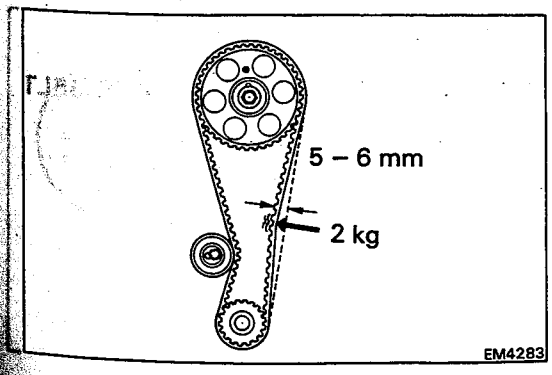
(c) Check the valve timing.
Ensure that each pulley aligns with the marks as shown in the illustration.



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

Torque: 375 kg-cm (27 ft-lb, 37 N·m)

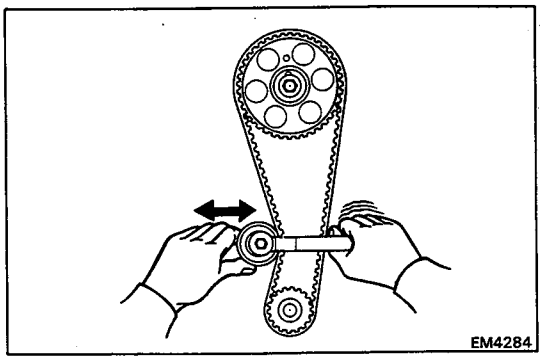
(e) Remove the temporarily installed crank pulley bolt.



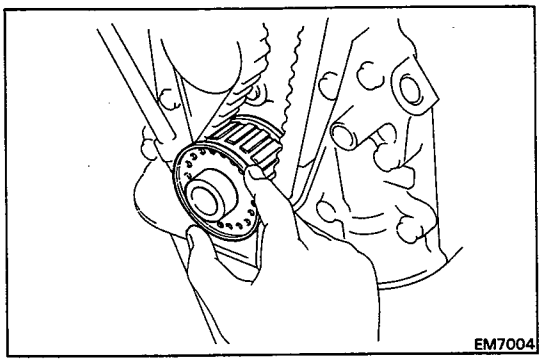
(Reference)

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

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

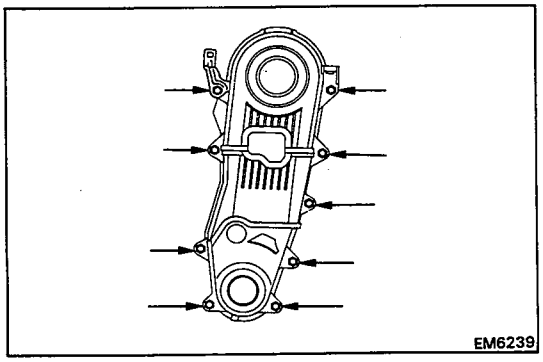


(b) If the measured value is not within standard, readjust with the idler pulley.



6. INSTALL TIMING BELT GUIDE

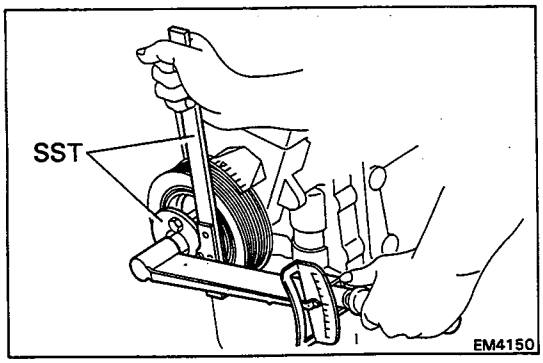
Install the guide, facing the cup side outward.



7. INSTALL TIMING BELT COVERS

(a) Install the No.1 timing belt cover with the three bolts.

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



8. INSTALL CRANKSHAFT PULLEY

(a) Align the pulley set key with the key groove of the pulley, and slide on the pulley.

(b) Temporarily install the pulley bolt.

SST 09213-14010 and 09330-00021

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

9. INSTALL CYLINDER HEAD COVER
(See steps 14 and 18 on pages EM-86 and 88)

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

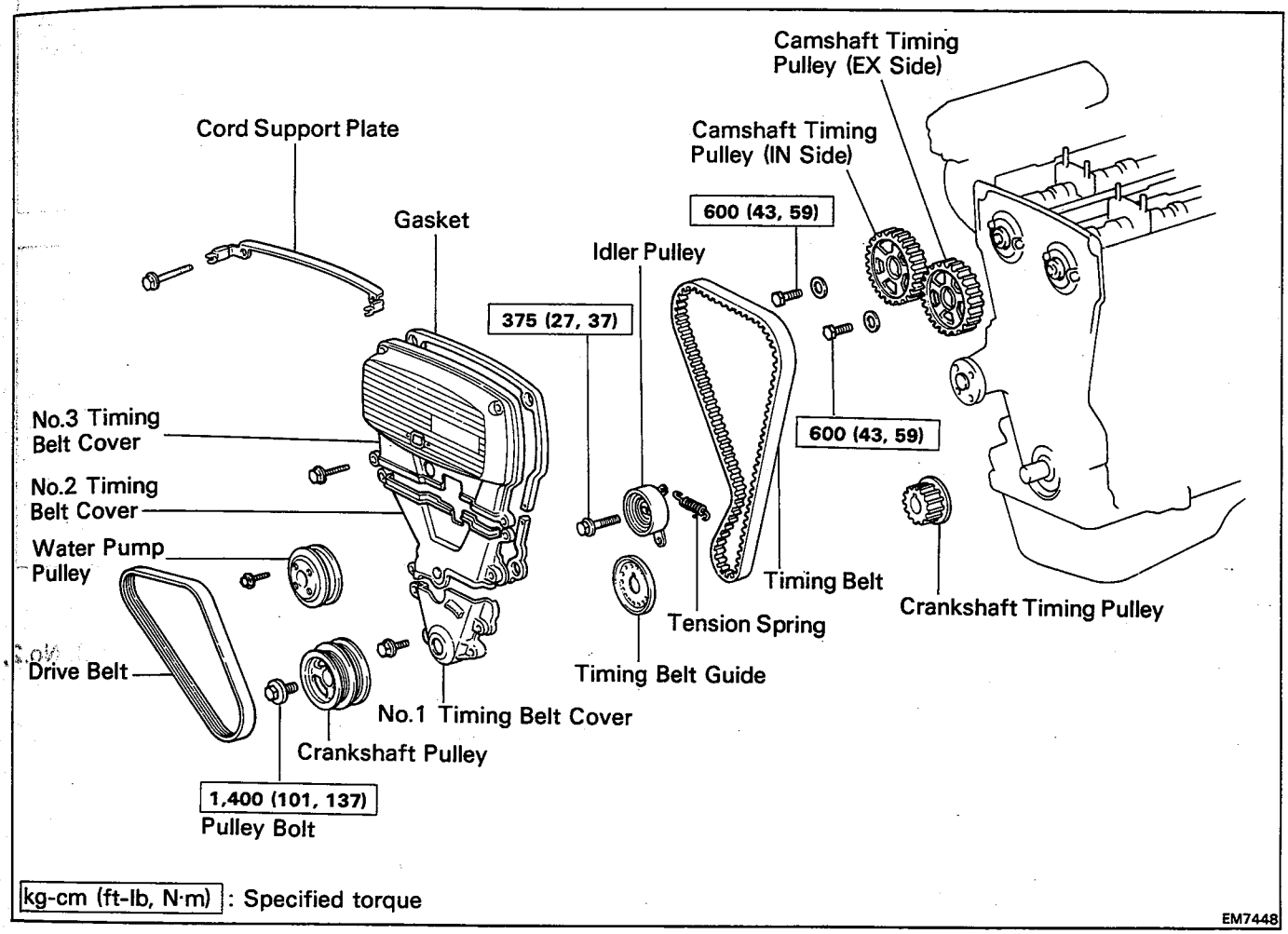
Torque: 180 kg-cm (13 ft-lb, 18 N·m)

11. INSTALL WATER PUMP PULLEY AND DRIVE BELT

12. CHECK AND ADJUST DRIVE BELT
(See step 3 on pages CH-3 and 4)

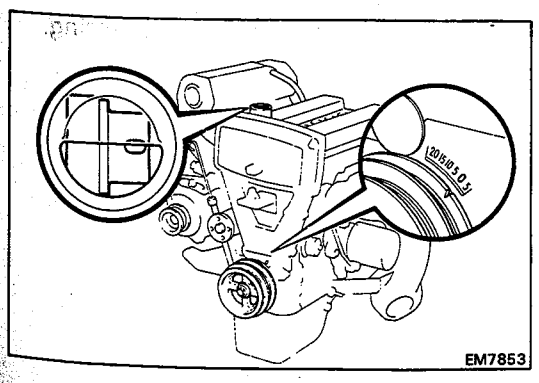
TIMING BELT (4A-GE)

COMPONENTS



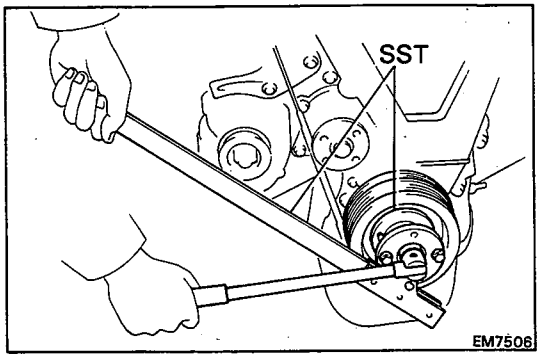
REMOVAL OF TIMING BELT

1. **REMOVE WATER PUMP PULLEY AND DRIVE BELT**
2. **DISCONNECT ENGINE WIRE FROM NO.4 TIMING BELT COVER**
   (See step 2 on page EM-93)
3. **REMOVE PLUG CORD COVER**
4. **REMOVE SPARK PLUGS (See page IG-11)**



5. **SET NO.1 CYLINDER TO TDC/COMPRESSION**
   (a) Turn the crankshaft pulley and align its groove with the timing mark "O" of the No. 1 timing belt cover.
   (b) Remove the oil filler cap and check that you can see the cavity in the camshaft.

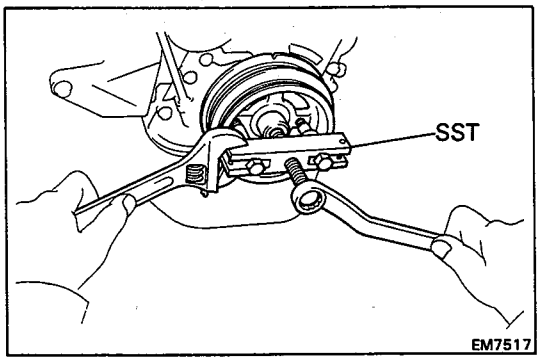
   If not, turn the crankshaft pulley one revolution (360°).



6. REMOVE CRANKSHAFT PULLEY

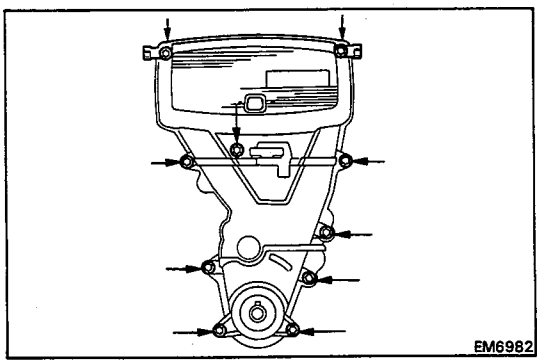
(a) Using SST, remove the pulley mount bolt.

SST 09213-70010 and 09330-00021



(b) Using SST, remove the pulley.

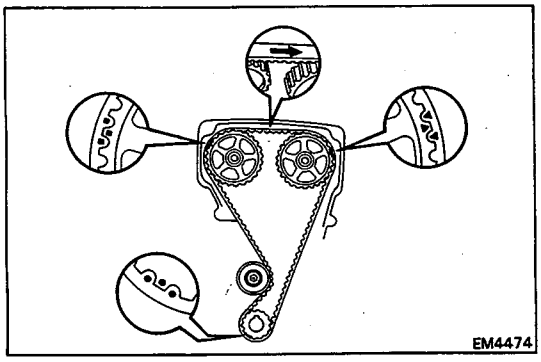
SST 09213-31021



7. REMOVE TIMING BELT COVERS

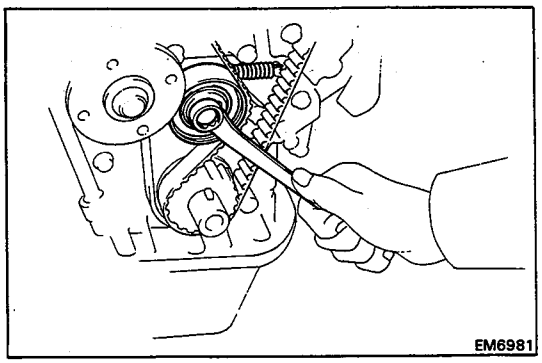
Remove the ten bolts, cord support plate, the No.3, No.2, No.1 belt covers and gaskets.

8. REMOVE TIMING BELT GUIDE



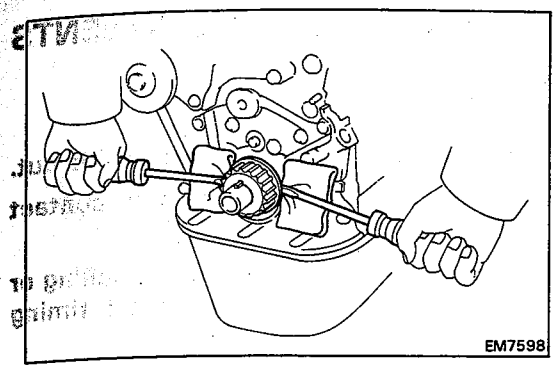
9. REMOVE TIMING BELT AND IDLER PULLEY

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



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

(b) Remove the belt.

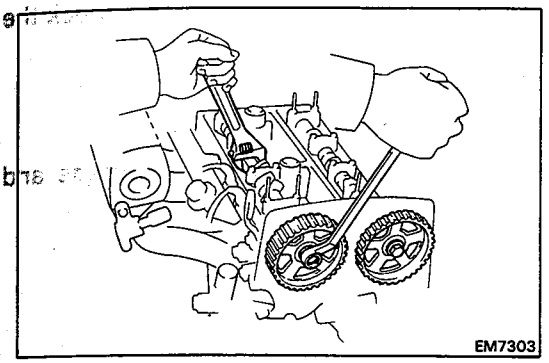


10. REMOVE CRANKSHAFT TIMING PULLEY

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

NOTICE: Position shop rags as shown to prevent damage.

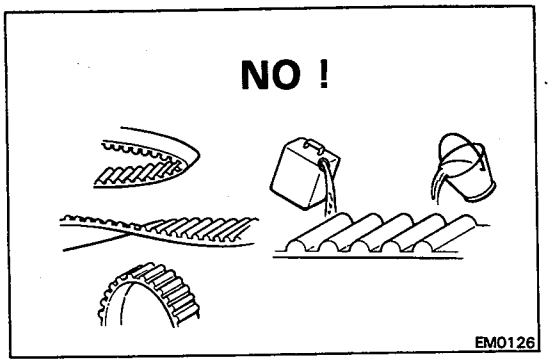
11. REMOVE CYLINDER HEAD COVERS
(See step 16 on page EM-95)

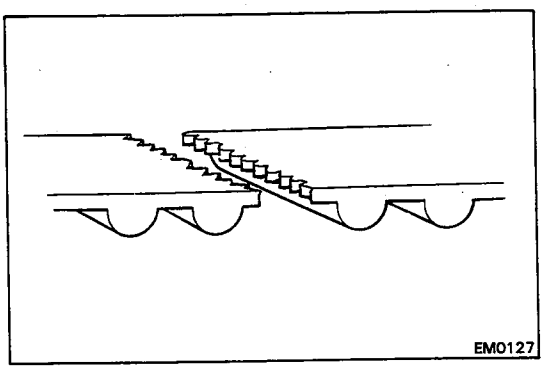


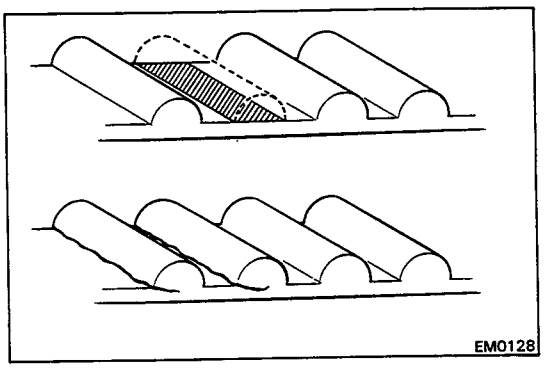
12. REMOVE CAMSHAFT TIMING PULLEYS

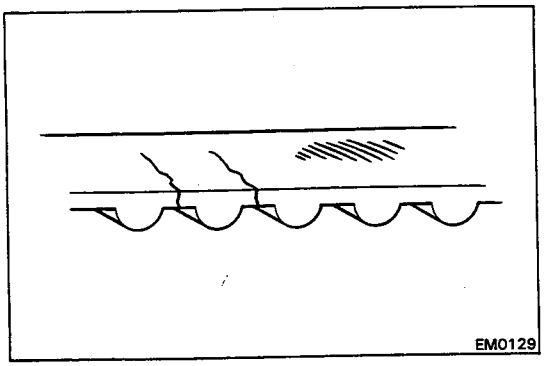
Hold the hexagonal head wrench portion of the camshaft with a wrench, and remove the bolt and timing pulley.

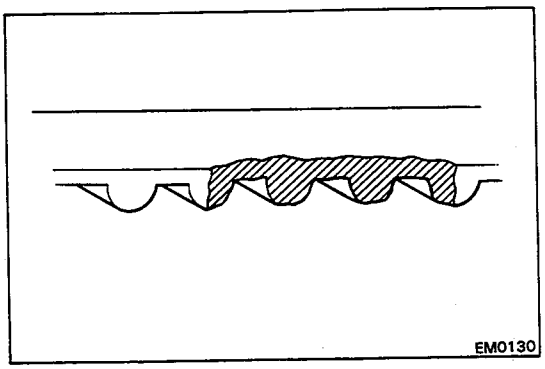
NOTICE: Be careful not to damage the cylinder head with the wrench.











INSPECTION OF TIMING BELT COMPONENTS

1. INSPECT TIMING BELT

NOTICE:

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

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

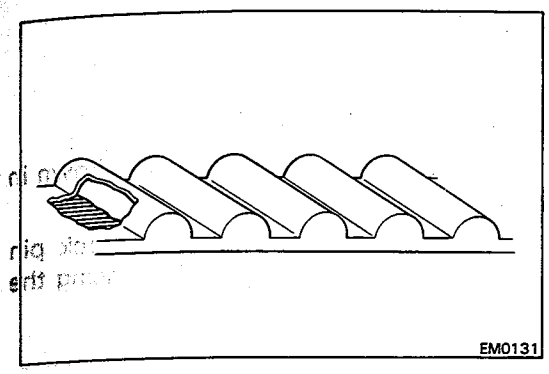
(a) Premature splitting

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

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

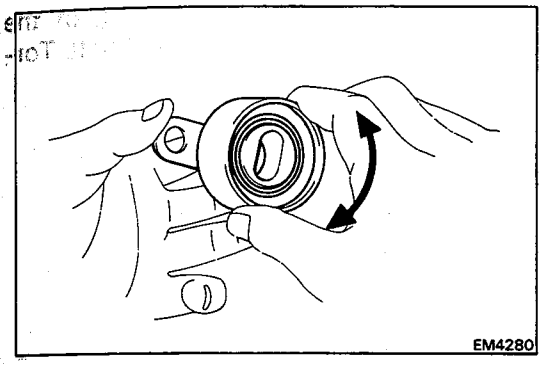
(c) If there is noticeable wear or cracks on the belt face check to see if there are nicks on one side of the idle pulley lock.

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



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

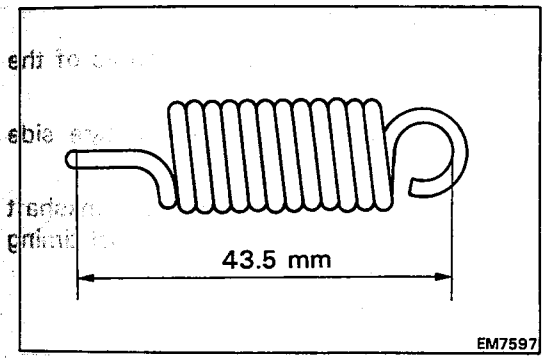
If necessary, replace the timing belt.



2. INSPECT IDLER PULLEY

Check the turning smoothness of the idler pulley.

If necessary, replace the idler pulley.



3. INSPECT TENSION SPRING

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

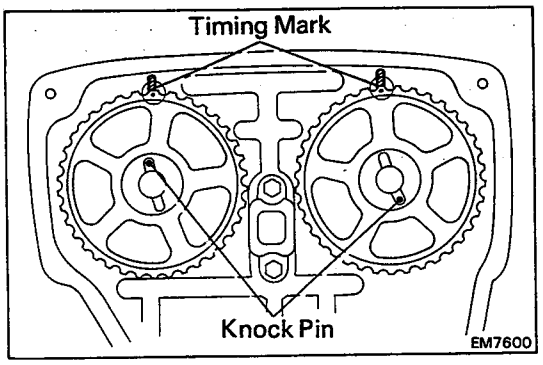
Free length: 43.5 mm (1.713 in.)

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

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

Installed tension:
9.47 – 10.47 kg (20.9 – 23.11 lb, 93 – 103 N) at 50.2 mm (1.976 in.)

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



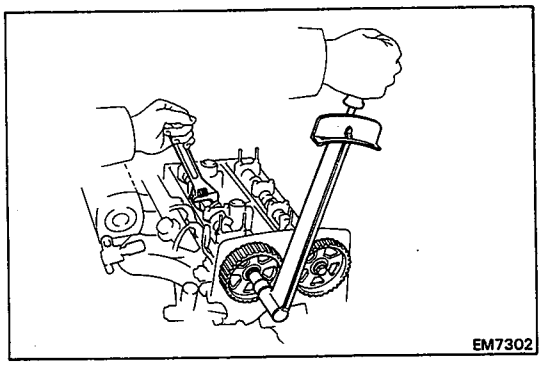
INSTALLATION OF TIMING BELT

(See page EM-47)

1. INSTALL CAMSHAFT TIMING PULLEYS

(a) Position the knock pin of the camshafts as shown in the illustration.

(b) Align the camshaft knock pin with the knock pin groove of the pulley, and slide the pulley, facing the timing mark upward.

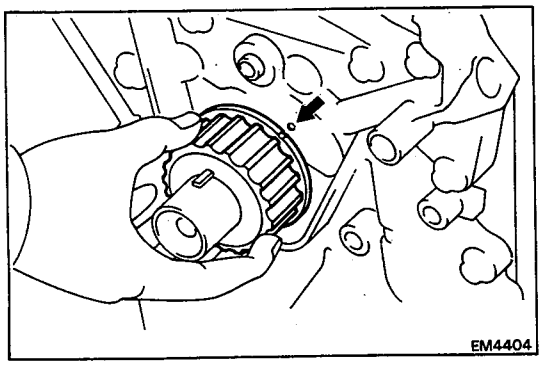


(c) Secure the hexagonal wrench head portion of the camshaft, and install the plate washer and bolt. Torque the bolt.

Torque: 600 kg-cm (43 ft-lb, 59 N·m)

2. INSTALL CYLINDER HEAD COVERS

(See step 12 on page EM-113)

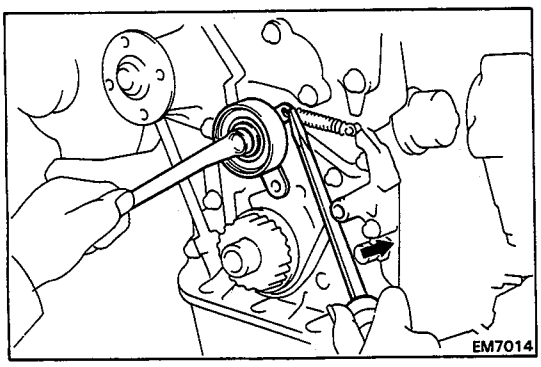


3. INSTALL CRANKSHAFT TIMING PULLEY

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

(b) Slide on the timing pulley, facing the flange side inward.

(c) Using the crankshaft pulley bolt, turn the crankshaft and align the timing marks of the crankshaft timing pulley and oil pump body.

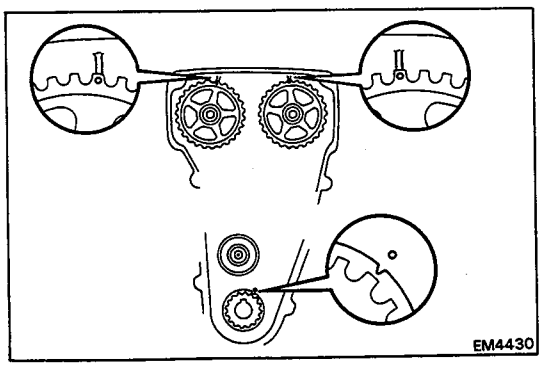


4. TEMPORARILY INSTALL IDLER PULLEY AND TENSION SPRING

(a) Install the pulley with the bolt. Do not tighten the bolt yet.

(b) Install the tension spring.

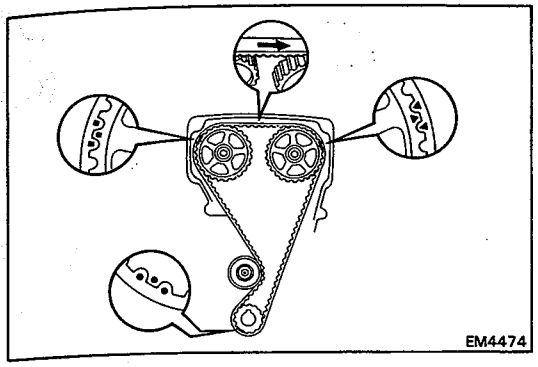
(c) Pry the pulley toward the left as far as it will go and tighten the bolt.



5. SET NO.1 CYLINDER TO TDC/COMPRESSION

(a) Align the timing marks of the camshaft timing pulleys and No.4 timing belt cover by turning the camshafts.

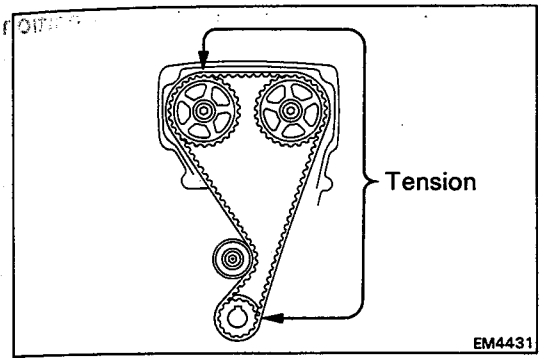
(b) Align the timing marks of the crankshaft timing pulley and oil pump body by turning the crankshaft.



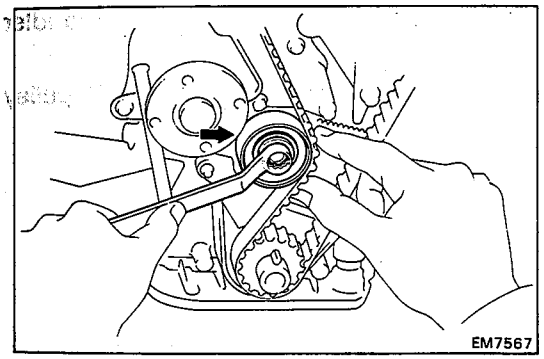
6. INSTALL TIMING BELT

NOTICE: The engine should be cold.

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

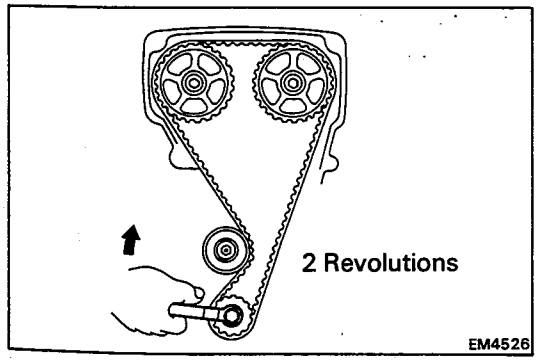


Install the timing belt, insuring the tension between the intake camshaft and crankshaft timing pulleys.



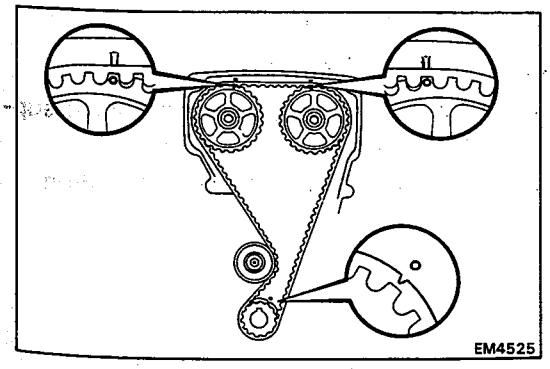
7. CHECK VALVE TIMING AND TIMING BELT TENSION

(a) Slowly loosen the idler pulley bolt.



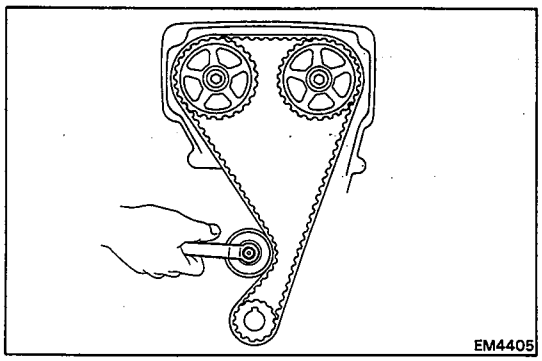
(b) Temporarily install the crankshaft pulley bolt, and turn the crankshaft pulley two revolutions from TDC to TDC.

HINT: Always turn the crankshaft clockwise.



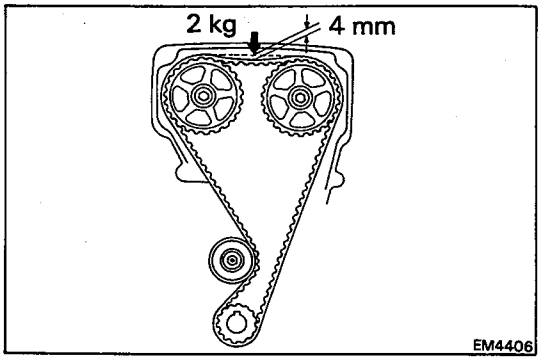
(c) Check that each pulley aligns with the timing marks as shown in the illustration.

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



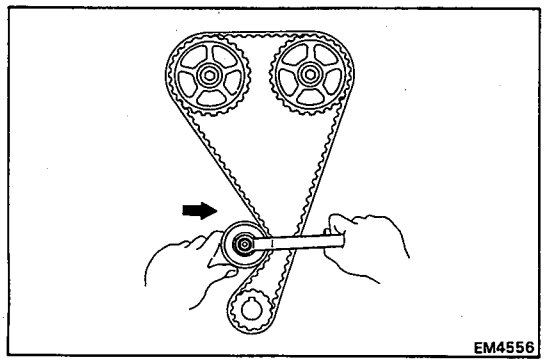
(d) Torque the idler pulley bolt.

Torque: 375 kg-cm (27 ft-lb, 37 N·m)



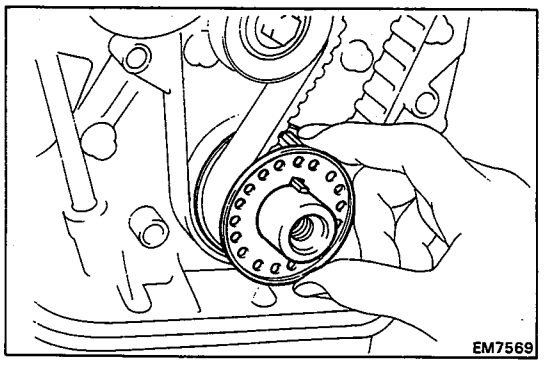
(e) Check that there is belt deflection at the position indicated in the illustration.

Deflection: 4 mm (0.16 in.)
at 2 kg (4.4 lb, 20 N)



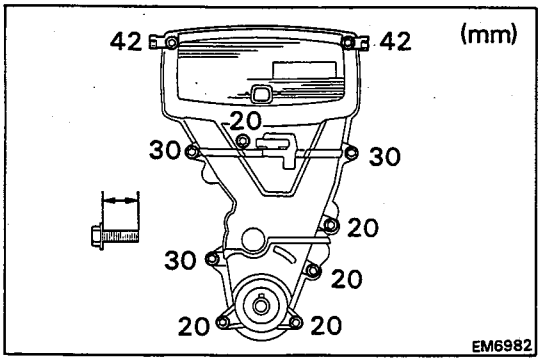
If the deflection is not as specified, adjust with the idler pulley.

(f) Remove the temporarily installed crankshaft pulley bolt.



8. INSTALL TIMING BELT GUIDE

Install the guide, facing the cup side outward.

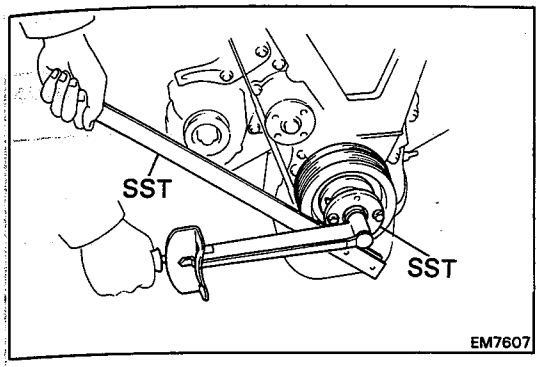


9. INSTALL TIMING BELT COVERS

(a) Install the gaskets to the belt covers.

(b) Install the No.1, No.2, No.3 belt cover and cord support plate with the ten bolts.

HINT: Each bolt length is indicated in the illustration.



10. INSTALL CRANKSHAFT PULLEY

(a) Align the pulley set key with the key groove of the pulley, slide the pulley.

(b) Using SST, install and torque the the bolt.

SST 09213-70010 and 09330-00021

Torque: 1,400 kg-cm (101 ft-lb, 137 N·m)

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

Torque: 180 kg-cm (13 ft-lb, 18 N·m)

12. INSTALL PLUG CORD COVER

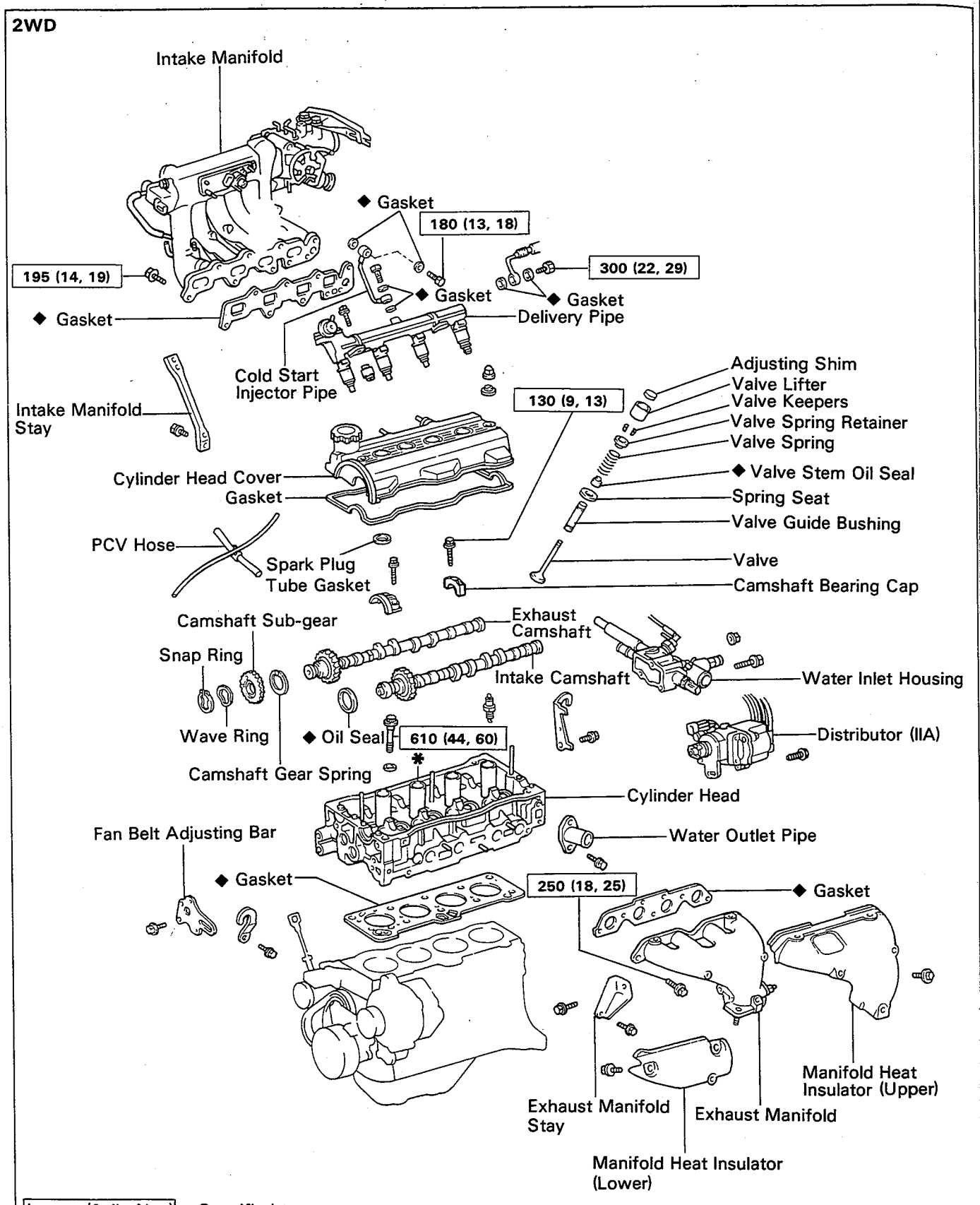
13. CONNECT ENGINE WIRE TO TIMING BELT COVER NO.4
(See step 26 on page EM-116)

14. INSTALL WATER PUMP PULLEY AND DRIVE BELT

15. CHECK AND ADJUST DRIVE BELT
(See step 3 on pages CH-3 and 4)

CYLINDER HEAD (4A-FE)

COMPONENTS



kg-cm (ft-lb, N·m) : Specified torque

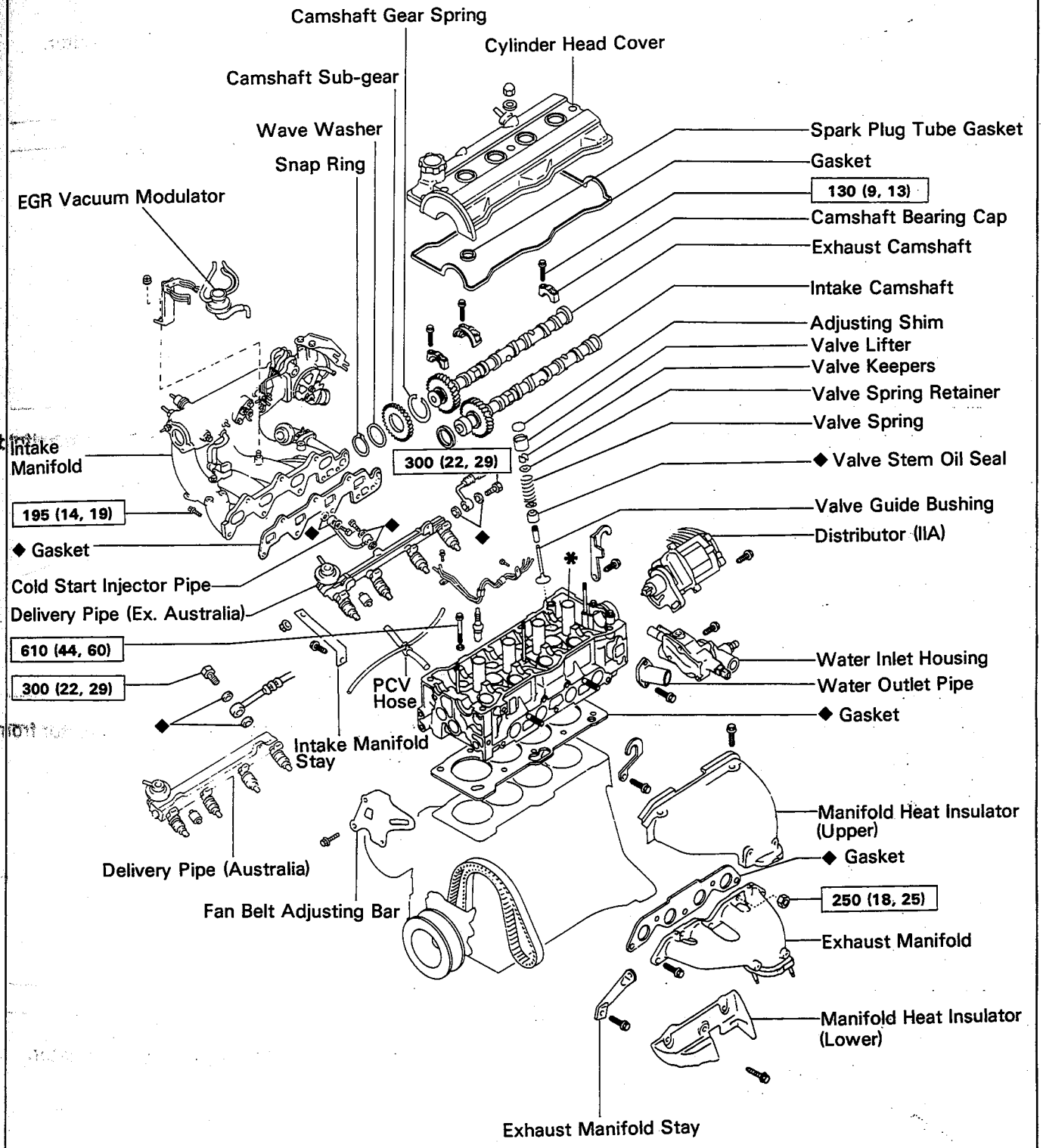
◆ Non-reusable part

*: Must not remove the spark plug tube

EM7577

COMPONENTS (Cont'd)

4WD

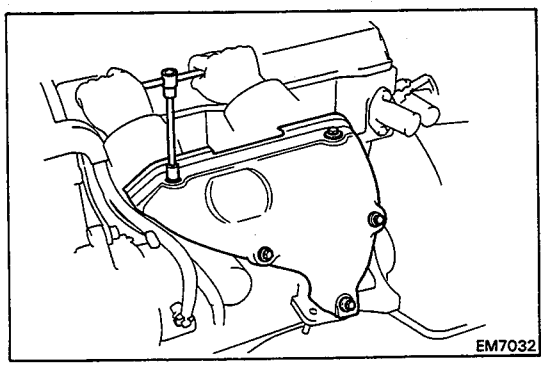


kg-cm (ft-lb, N·m) : Specified torque

◆ Non-reusable part

✱ : Must not remove the spark plug tube

EM6979



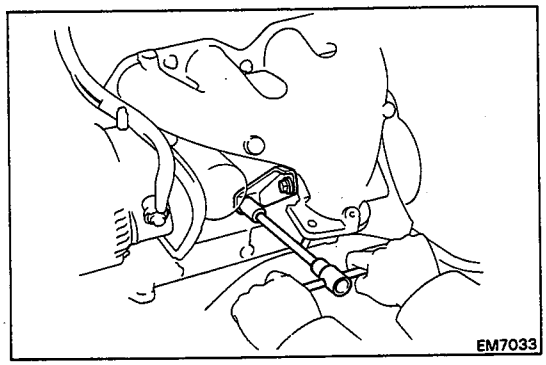
REMOVAL OF CYLINDER HEAD

(See pages EM-56, 57)

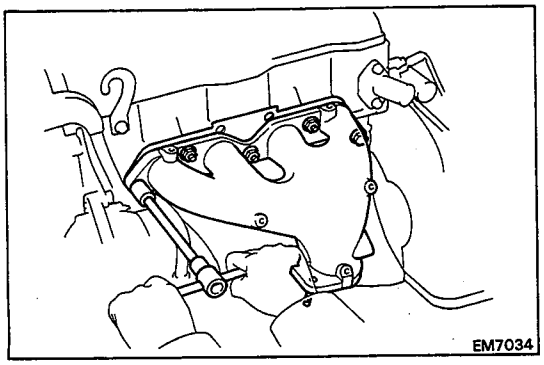
1. REMOVE IIA

2. REMOVE EXHAUST MANIFOLD (2WD)

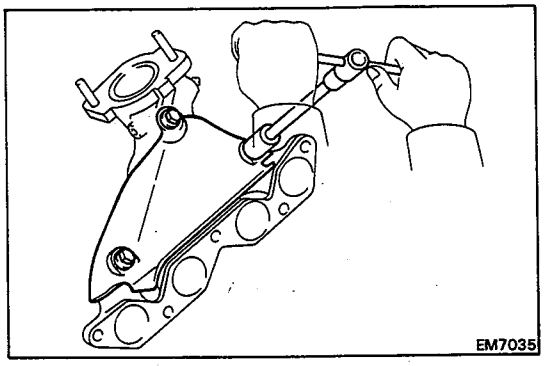
(a) Remove the five bolts and upper heat insulator.



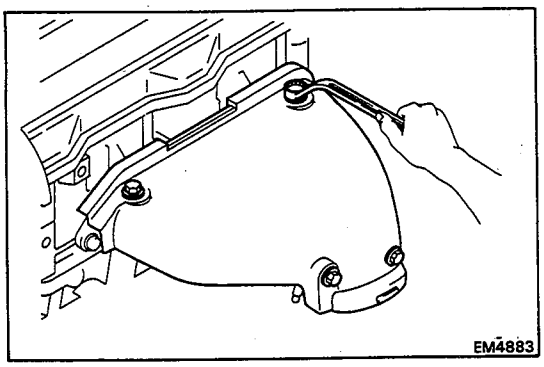
(b) Remove the two bolts and manifold stay.



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

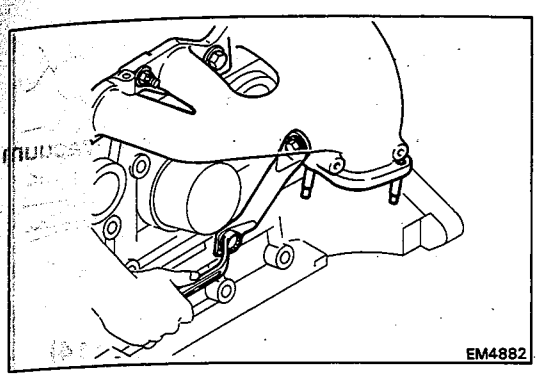


(d) Remove the three bolts and lower heat insulator from the exhaust manifold.

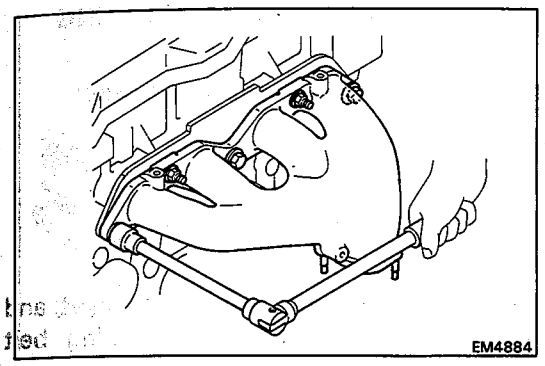


(4WD)

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

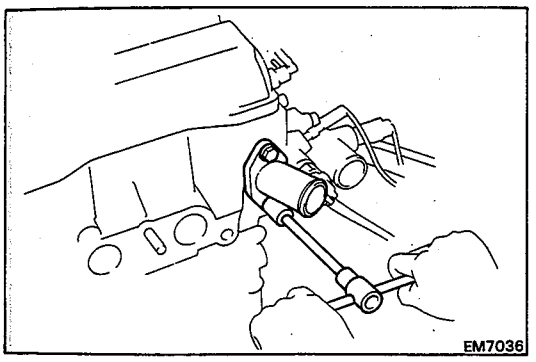


(b) Remove the two bolts and manifold stay.



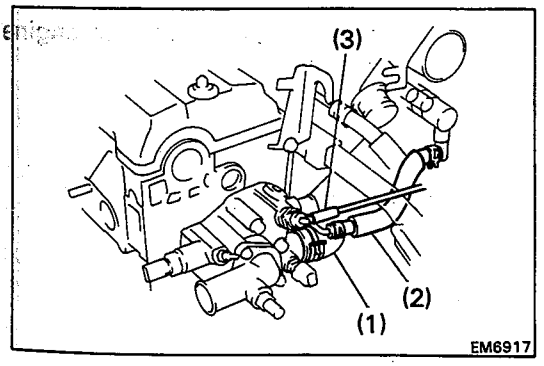
(c) Remove the three bolts, two nuts, manifold and gasket.

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



3. REMOVE WATER OUTLET

Remove the two bolts and water outlet.

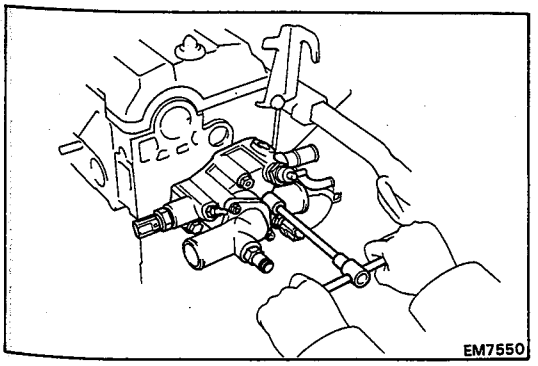


4. REMOVE WATER INLET AND INLET HOUSING

(a) Disconnect the following connectors:
- Water temperature sender gauge connector
- Water temperature sensor connector
- Start injector time switch connector

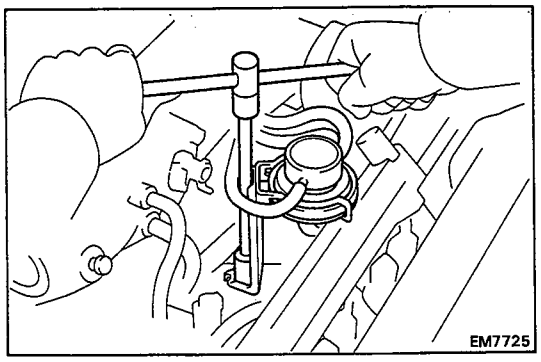
(b) Disconnect the following hoses:
(1) Inlet water hose
(2) Water by-pass hose
(3) BVSV vacuum hose(s)

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



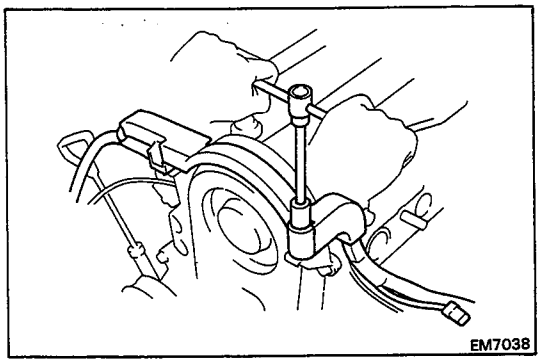
5. REMOVE COLD START INJECTOR PIPE

(See step 3 on page FI-105)

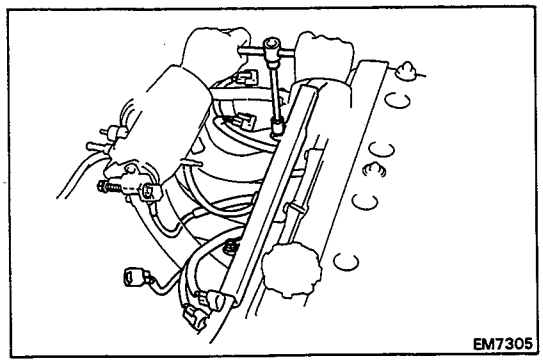

EM7725

6. **(4WD)**
REMOVE EGR VACUUM MODULATOR
   (a) Disconnect the four vacuum hoses.
      (1) Three port vacuum hoses of the EGR vacuum modulator.
      (2) EGR valve hose.
   (b) Remove the nut and vacuum modulator.

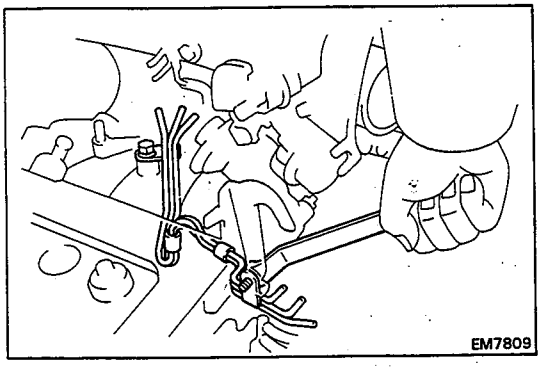
7. **REMOVE DELIVERY PIPE AND INJECTORS**
(See steps 3 to 6 and 8 on pages FI-113 and 114)


EM7038

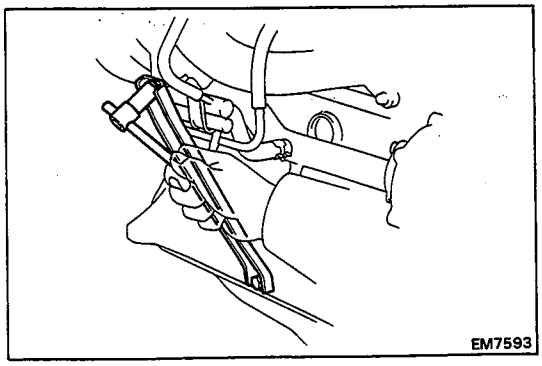
8. **DISCONNECT ENGINE WIRE FROM NO.3 TIMING BELT COVER**
   (a) Disconnect the following connectors and wire:
      - Alternator connector
      - Alternator wire
      - Oil pressure switch connector
   (b) Remove the bolt.
   (c) Disconnect the wire clamp from the wire bracket, and disconnect the engine wire from the timing belt cover.


EM7305

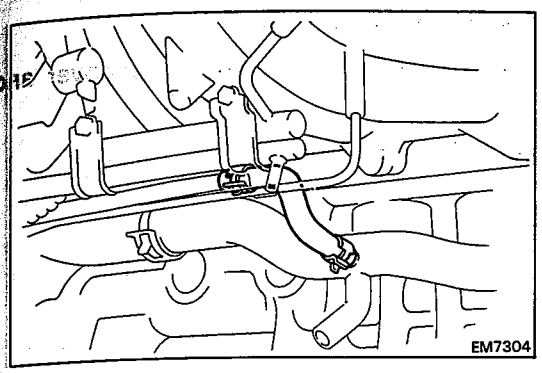
9. **DISCONNECT ENGINE WIRE FROM INTAKE MANIFOLD**
   (a) Disconnect the following connectors:
      - Throttle position sensor connector
      - ISC valve connector
      - (2WD w/ EGR system)
        EGR VSV connector
      - Cold start injector connector
   (b) Disconnect the wire clamp from the vacuum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


EM7809

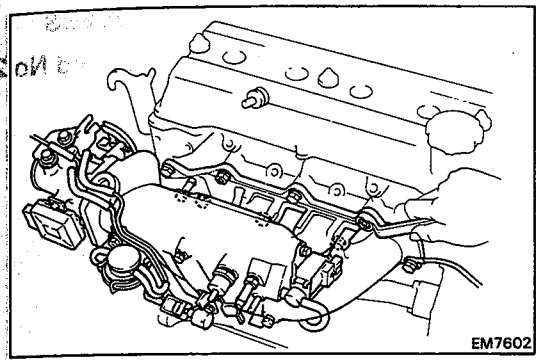
10. **(4WD)**
REMOVE VACUUM PIPE
   (a) Disconnect the three vacuum hoses.
   (b) Remove the two bolts and vacuum pipe.


EM7593

11. **REMOVE INTAKE MANIFOLD**
(2WD)
   (a) Remove the two bolts and manifold stay.

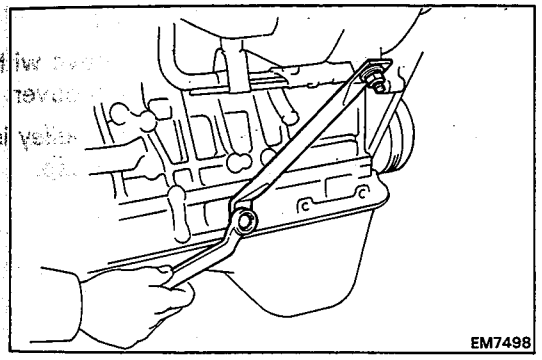

EM7304

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

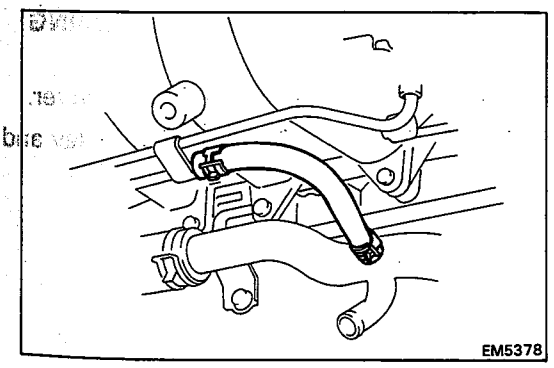

EM7602

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

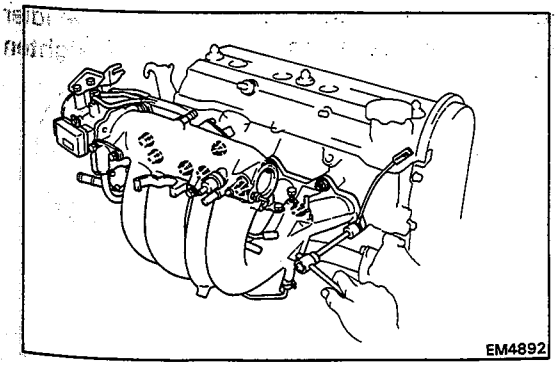
(4WD)


EM7498

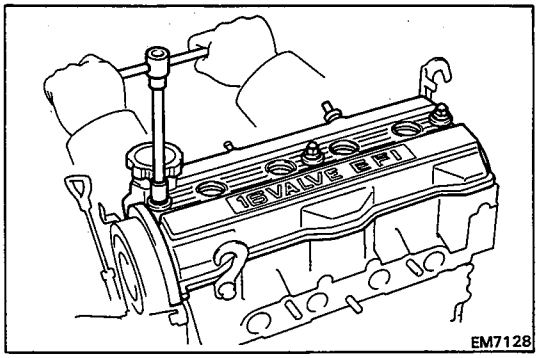
(a) Remove the bolt, nut and manifold stay.


EM5378

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


EM4892

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

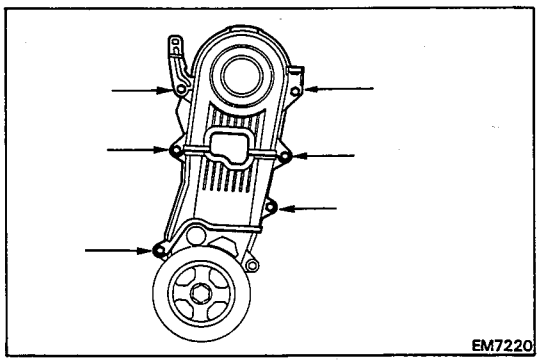


EM7128

12. REMOVE CYLINDER HEAD COVER

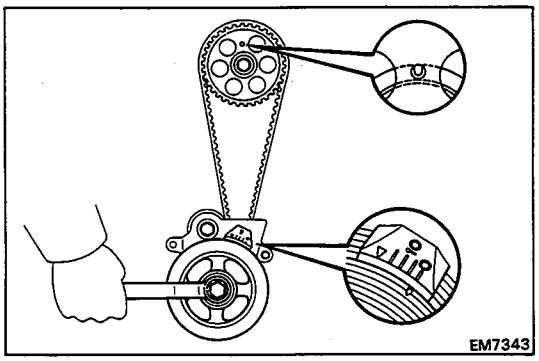
Remove the three cap nuts, grommets, head cover an gasket.

13. REMOVE SEMI-CIRCULAR PLUG


EM7220

14. REMOVE NO.3 AND NO.2 TIMING BELT COVERS

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

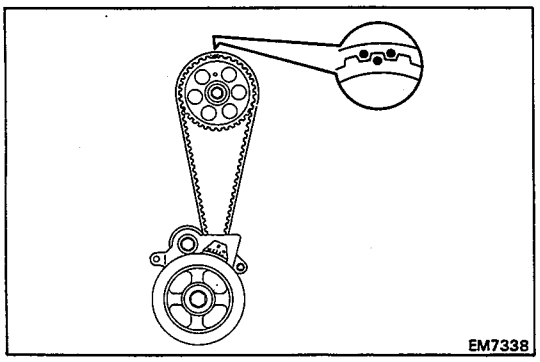

EM7343

15. SET NO.1 CYLINDER TO TDC/COMPRESSION

(a) Turn the crankshaft pulley and align its groove wit the timing mark "0" of the No.1 timing belt cover.

(b) Check that the hole of the camshaft timing pulley i aligned with the timing mark of the bearing cap.

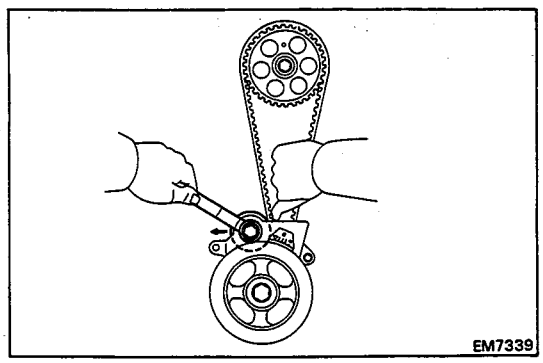
If not, turn the crankshaft one revolution (360°).


EM7338

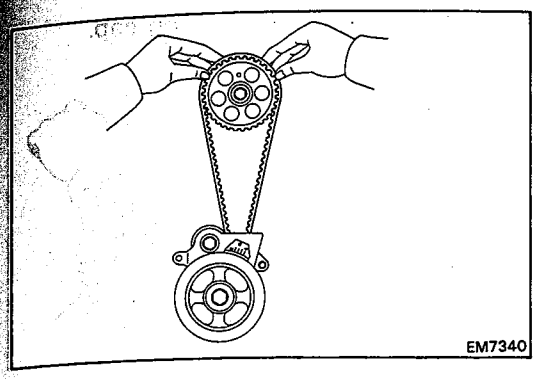
16. REMOVE TIMING BELT FROM CAMSHAFT TIMING PULLEY

(a) Remove the plug from the No.1 timing belt cover.

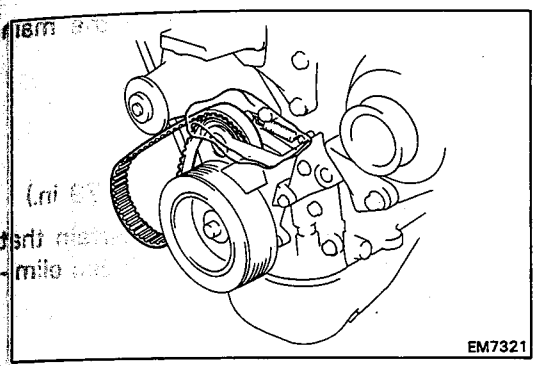
(b) Place matchmarks on the camshaft timing pulley ar belt.


EM7339

(c) Loosen the idler pulley mount bolt and push the idl pulley toward the left as far as it will go, then tighte it temporarily.



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



NOTICE:

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

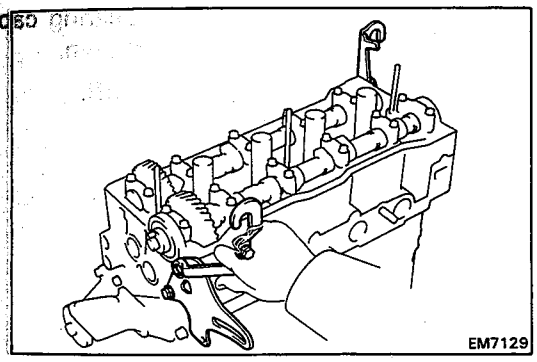
17. REMOVE CAMSHAFT TIMING PULLEY
(See step 10 on page EM-41)

18. REMOVE FAN BELT ADJUSTING BAR

Remove the two bolts and adjusting bar.

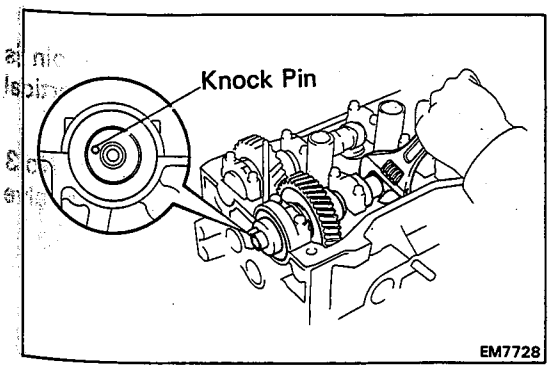
19. REMOVE ENGINE HANGERS

Remove the two bolts and engine hangers.



20. REMOVE CAMSHAFTS

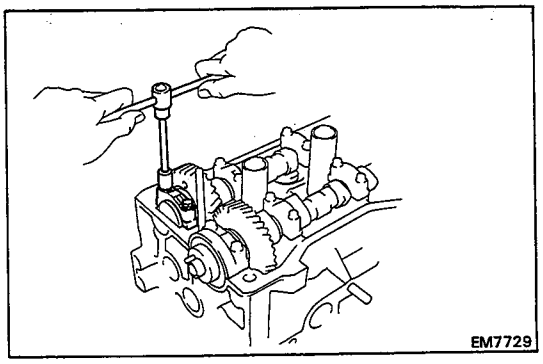
NOTICE: Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following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



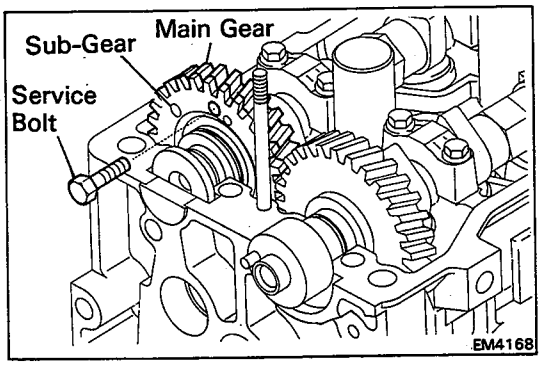
A. Remove intake camshaft

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

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



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

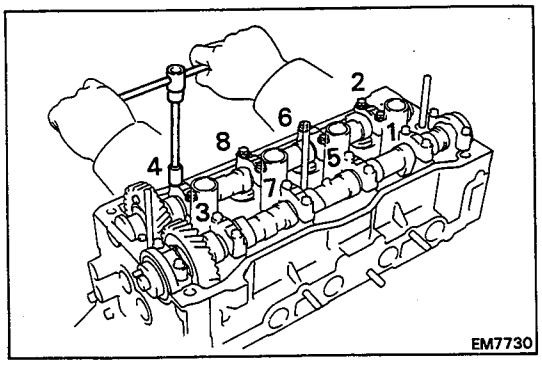


(c) Secure the intake camshaft sub-gear to the main gear with a service bolt.

Recommended service bolt:

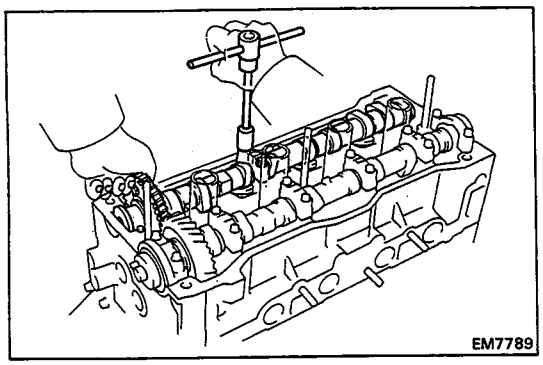
Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 – 20 mm (0.63 – 0.79 in.)

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



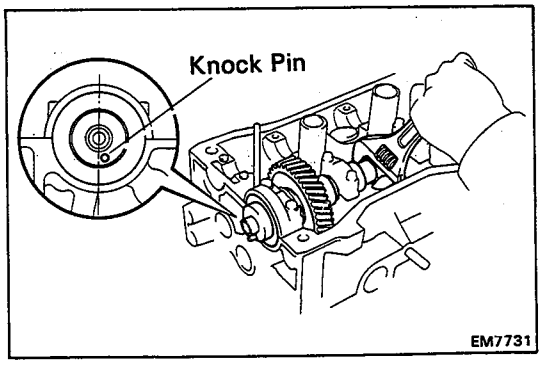
(d) Uniformly loosen and remove the eight bearing cap bolts in several passes in the sequence shown.

(e) Remove the four bearing caps and camshaft.



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

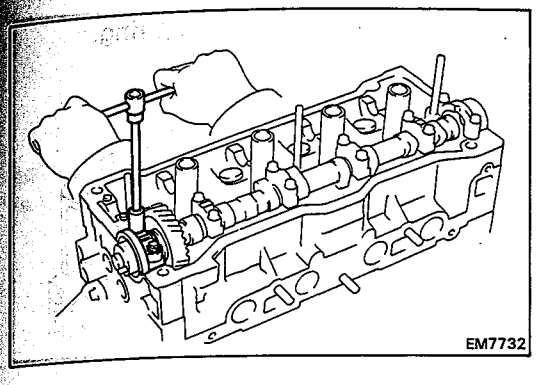
NOTICE: Do not pry on or attempt to force the camshaft with a tool or other objects.



B. Remove exhaust camshaft

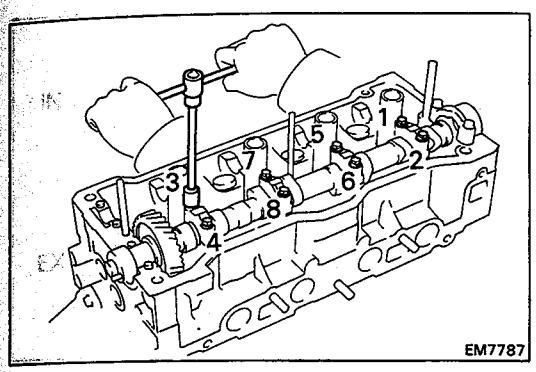
(a) Set the exhaust camshaft so that the knock pin is located slightly counterclockwise from the vertical axis of the camshaft.

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



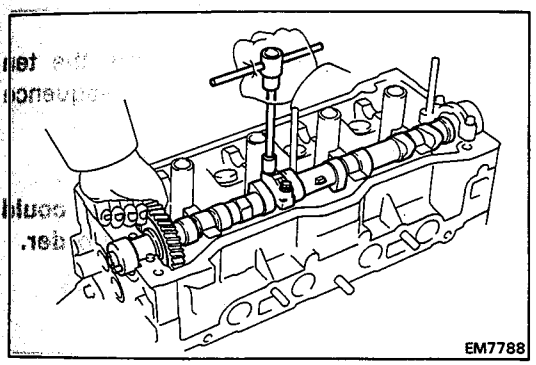
(b) Remove the two bolts, front bearing cap and oil seal.

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



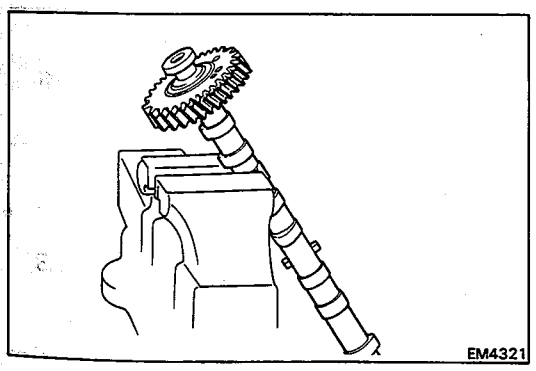
(c) Uniformly loosen and remove the eight bearing cap bolts in several passes in the sequence shown.

(d) Remove the four bearing caps and camshaft.



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

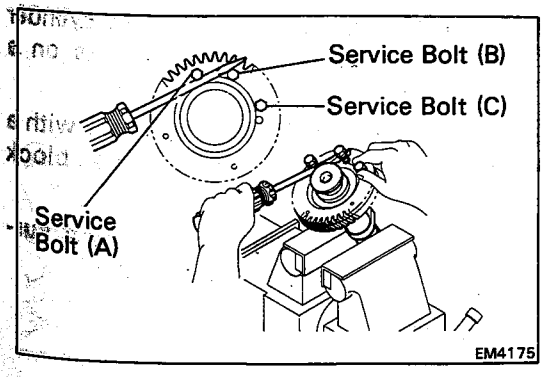
NOTICE: Do not pry on or attempt to force the camshaft with a tool or other objects.



21. DISASSEMBLE INTAKE CAMSHAFT

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

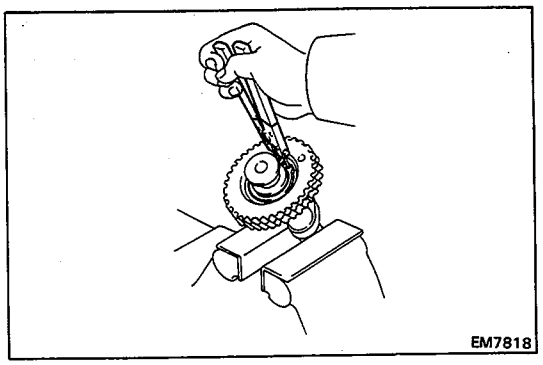
NOTICE: Be careful not to damage the camshaft.



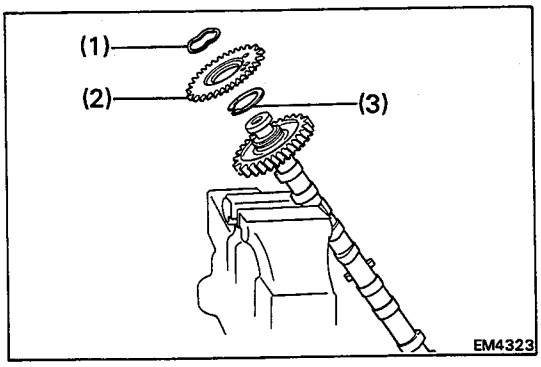
(b) Insert service bolts (A) and (B) into the service holes of the camshaft sub-gear.

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

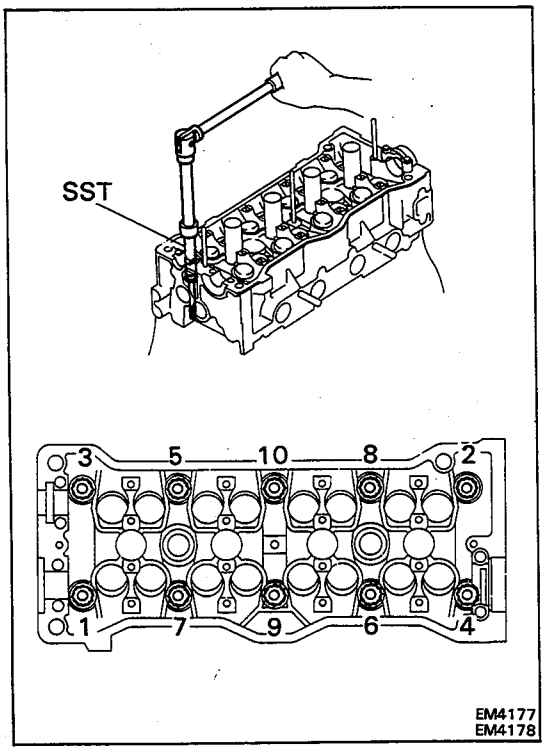
NOTICE: Be careful not to damage the camshaft.



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



(e) Remove the following parts:
(1) Wave washer
(2) Camshaft sub-gear
(3) Camshaft gear spring

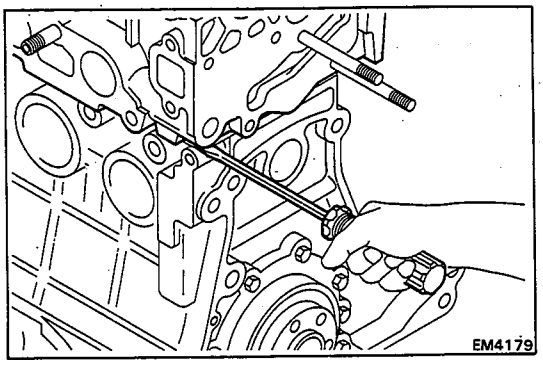


22. REMOVE CYLINDER HEAD

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

SST 09205-16010

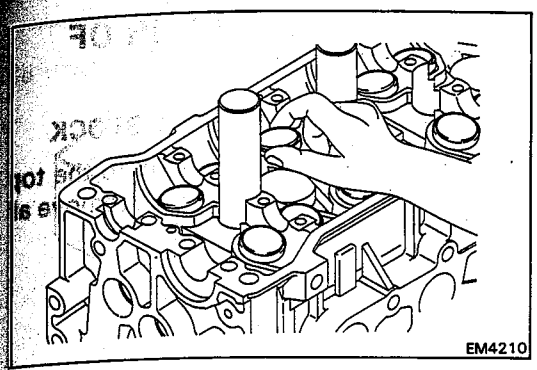
NOTICE: Cylinder head warpage or cracking coul result from removing the bolts in an incorrect order.



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

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

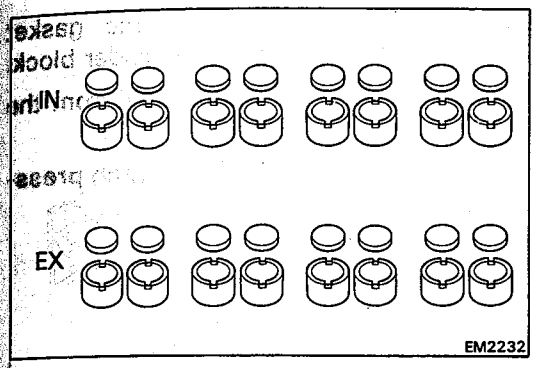
NOTICE: Be careful not to damage the contact su faces of the cylinder head and cylinder block.


EM4210

DISASSEMBLY OF CYLINDER HEAD

(See pages EM-56, 57)

1. REMOVE VALVE LIFTERS AND SHIMS



EM2232

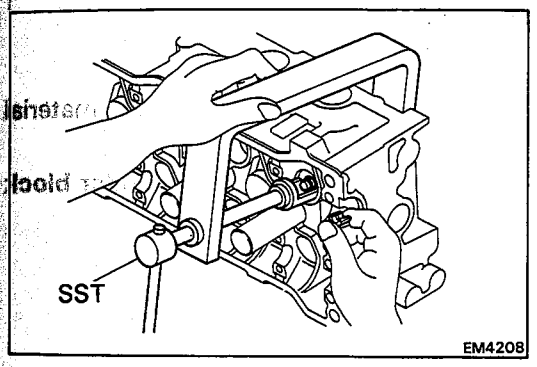
HINT: Arrange the valve lifters and shims in correct order.

2. REMOVE VALVES

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

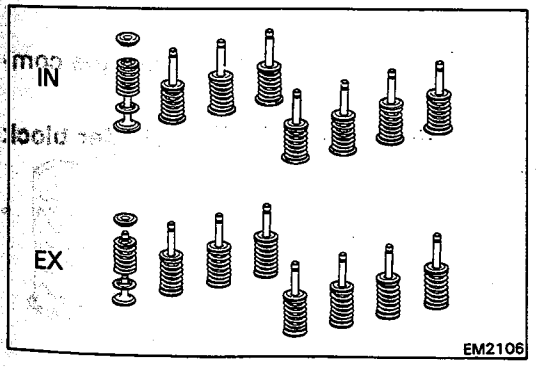
SST 09202-70010

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



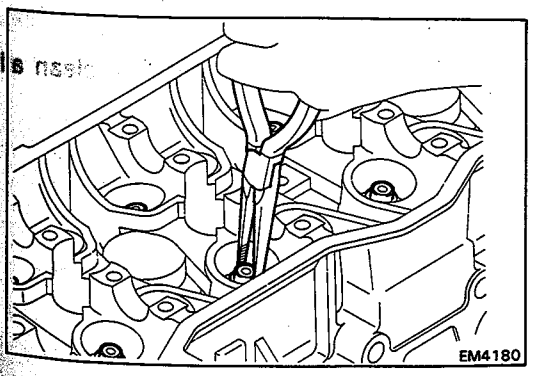
EM4208

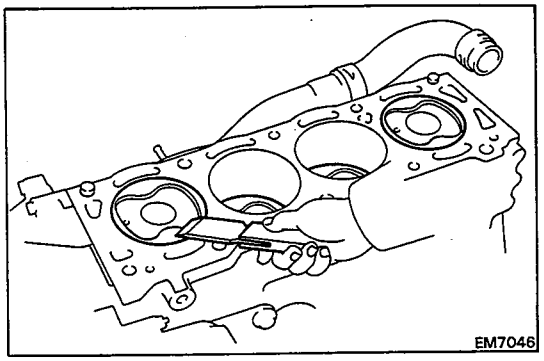
HINT: Arrange the valves, valve springs, spring seats and spring retainers in correct order.



EM2106

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

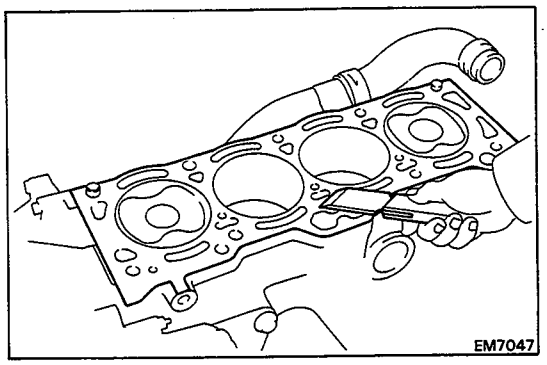

EM4180


EM7046

INSPECTION, CLEANING AND REPAIR OF CYLINDER HEAD COMPONENTS

1. CLEAN TOP SURFACES OF PISTONS AND BLOCK

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


EM7047

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

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

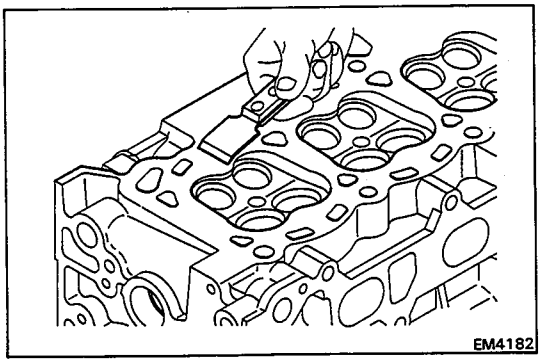
CAUTION: Protect your eyes when using high pressure compressed air.

2. CLEAN CYLINDER HEAD

A. Remove gasket material

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

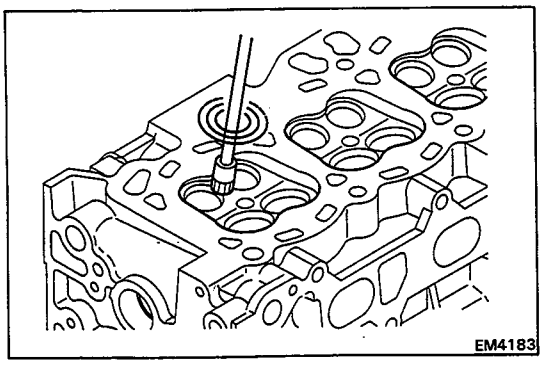
NOTICE: Be careful not to scratch the cylinder block contact surface.


EM4182

B. Clean combustion chambers

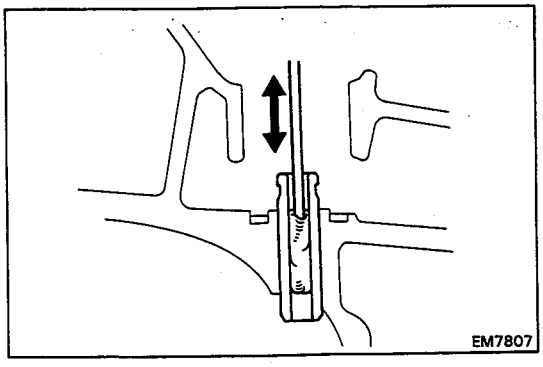
Using a wire brush, remove all the carbon from the combustion chambers.

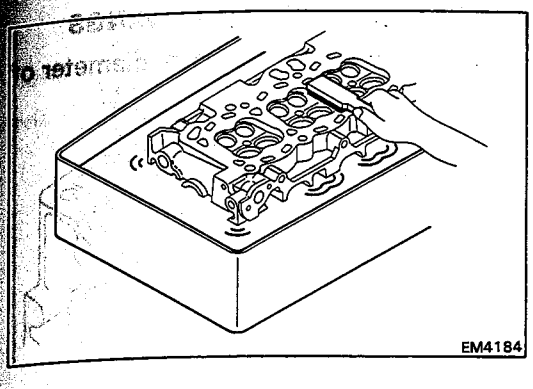
NOTICE: Be careful not to scratch the cylinder block contact surface.


EM4183

C. Clean valve guide bushings

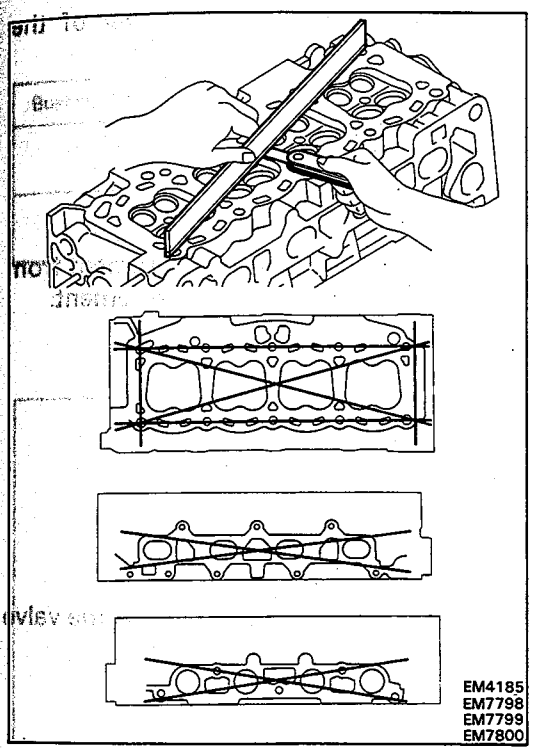
Using a valve guide bushing brush and solvent, clean the guide bushings.


EM7807


EM4184

D. Clean cylinder head

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


EM4185
EM7798
EM7799
EM7800

3. INSPECT CYLINDER HEAD

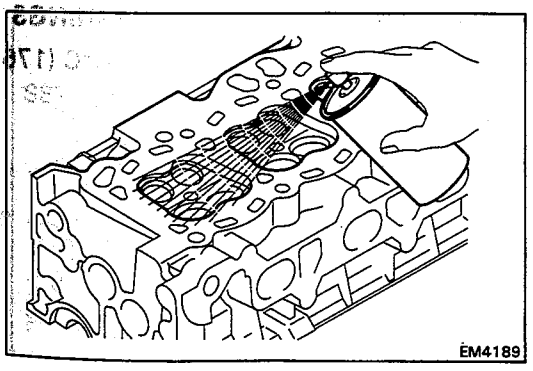
A. Inspect for flatness

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

Maximum warpage:

Cylinder block side	**0.05 mm (0.0021 in.)**
Manifold side	**0.10 mm (0.0039 in.)**

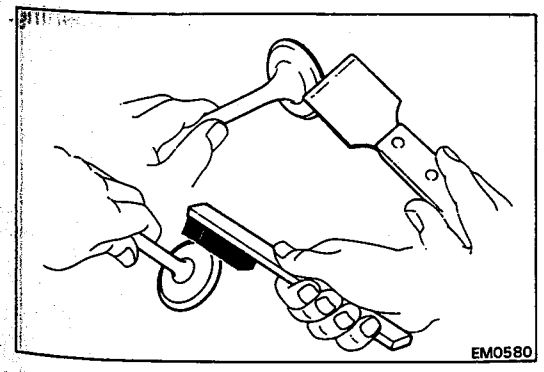
If warpage is greater than maximum, replace the cylinder head.


EM4189

B. Inspect for cracks

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

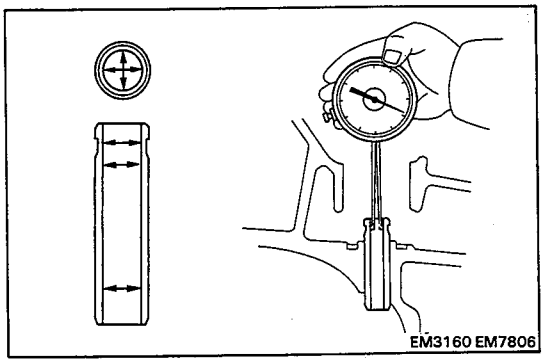
If cracked, replace the cylinder head.


EM0580

4. CLEAN VALVES

(a) Using a gasket scraper, chip off any carbon from the valve head.

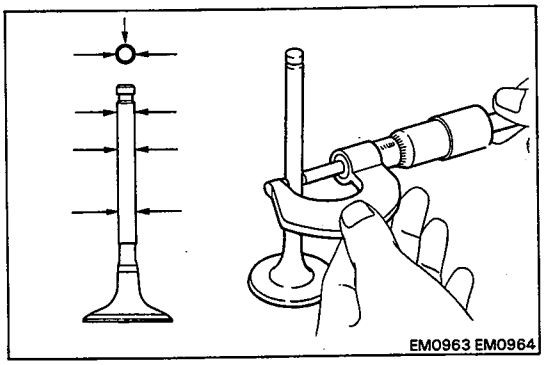
(b) Using a wire brush, thoroughly clean the valve.



5. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

Bushing inside diameter:
6.01 – 6.03 mm (0.2366 – 0.2374 in.)



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

Valve stem diameter:

Intake	**5.970 – 5.985 mm (0.2350 – 0.2356 in.)**
Exhaust	**5.965 – 5.980 mm (0.2348 – 0.2354 in.)**

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

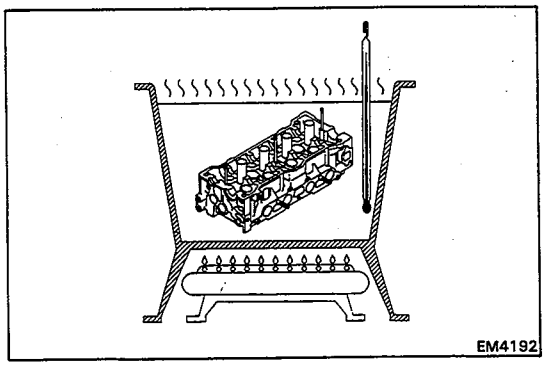
Standard oil clearance:

Intake	**0.025 – 0.060 mm (0.0010 – 0.0024 in.)**
Exhaust	**0.030 – 0.065 mm (0.0012 – 0.0026 in.)**

Maximum oil clearance:

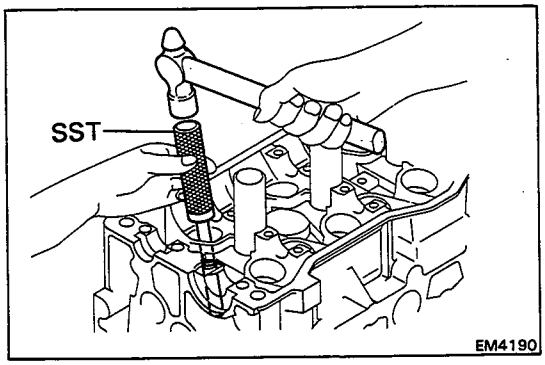
Intake	**0.08 mm (0.0031 in.)**
Exhaust	**0.10 mm (0.0039 in.)**

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



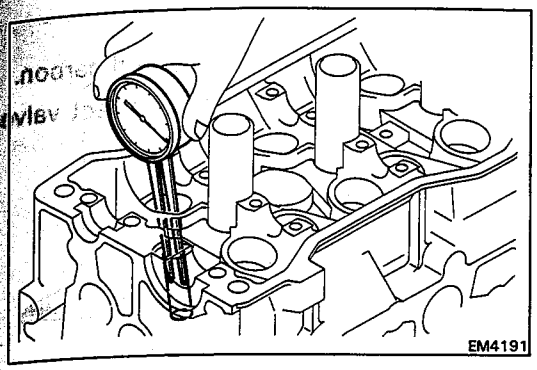
6. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

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



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

SST 09201-70010


EM4191

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

Standard valve guide bore (cold):
11.000 – 11.027 mm (0.4331 – 0.4341 in.)

Both intake and exhaust

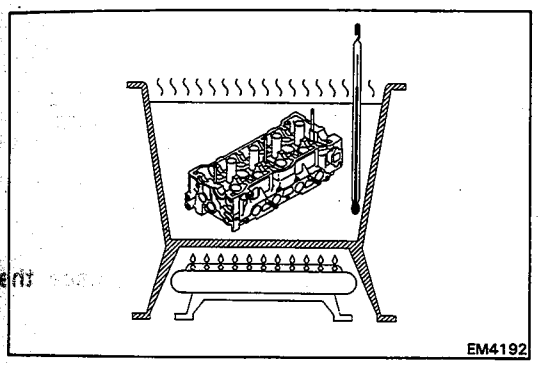
Bushing bore diameter mm (in.)	Bushing size
11.000 – 11.027 (0.4331 – 0.4341)	Used STD
11.050 – 11.077 (0.4350 – 0.4361)	Used O/S 0.05

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

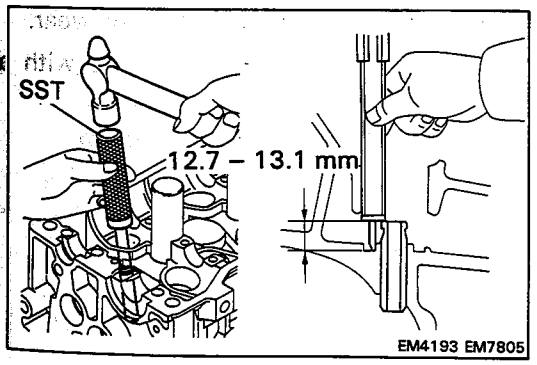
If the bushing bore diameter of the cylinder head is greater than 11.027 mm (0.4341 in.), machine the bushing bore to the following dimensions:

Rebored cylinder head bushing bore dimesion
11.050 – 11.077 mm (0.4350 – 0.4361 in.)

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


EM4192

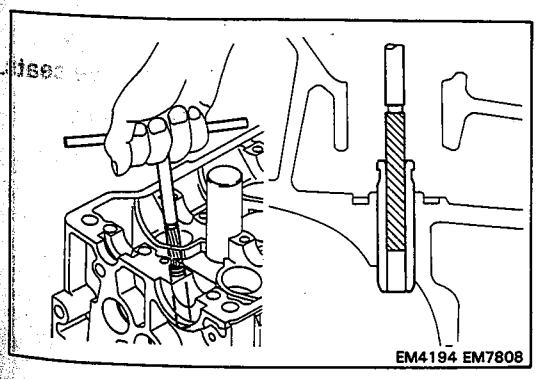
(e) Gradually heat the cylinder head to 80 – 100°C (176 – 212°F)



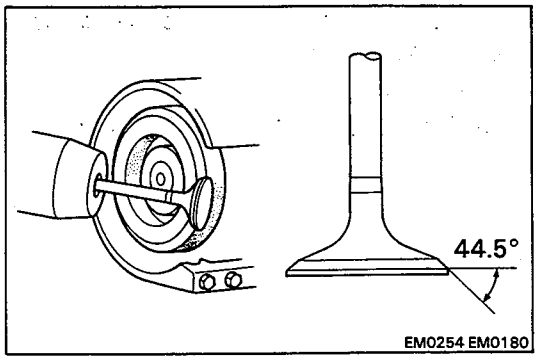
EM4193 EM7805

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

SST 09201-70010


EM4194 EM7808

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

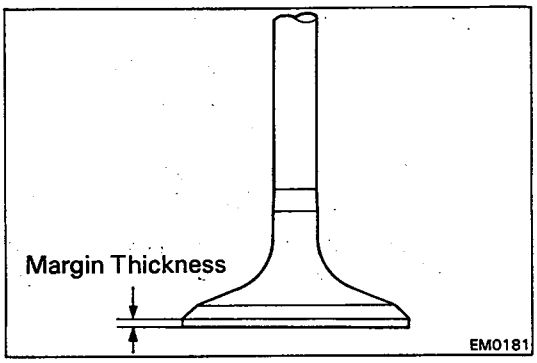


7. INSPECT AND GRIND VALVES

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

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

Valve face angle: 44.5°



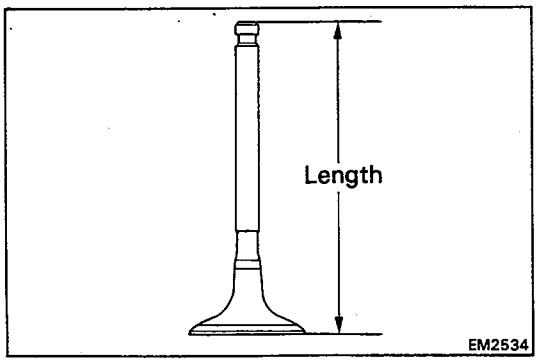
(c) Check the valve head margin thickness.

Standard margin thickness:

Intake	**1.05 – 1.45 mm (0.0413 – 0.0571 in.)**
Exhaust	**1.19 – 1.59 mm (0.0469 – 0.0626 in.)**

Minimum margin thickness: 0.5 mm (0.020 in.)

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



(d) Check the valve overall length.

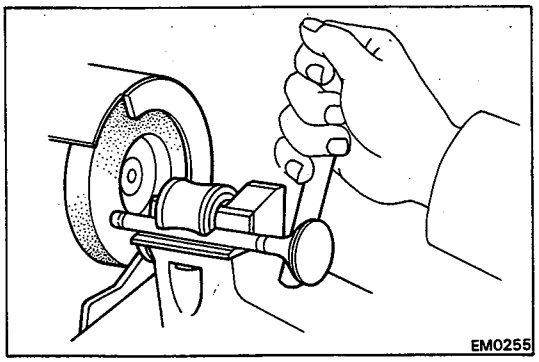
Standard overall length:

Intake	**91.45 mm (3.6004 in.)**
Exhaust	**91.90 mm (3.6181 in.)**

Minimum overall length:

Intake	**90.95 mm (3.5807 in.)**
Exhaust	**91.40 mm (3.5984 in.)**

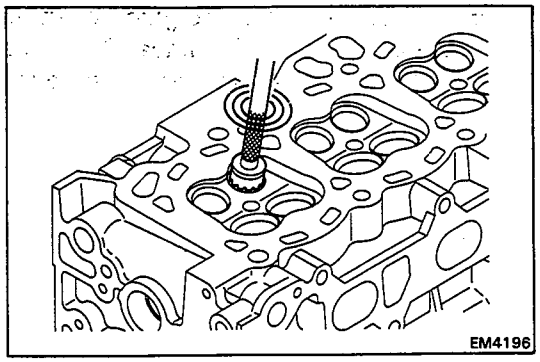
If the overall length is less than minimum, replace the valve.



(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.

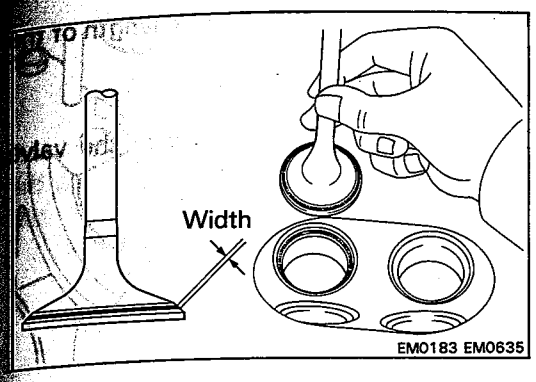
NOTICE: Do not grind off more than minimum.



8. INSPECT AND CLEAN VALVE SEATS

(a) Using a 45° carbide cutter, resurface the valve seat.

Remove only enough metal to clean the seats.



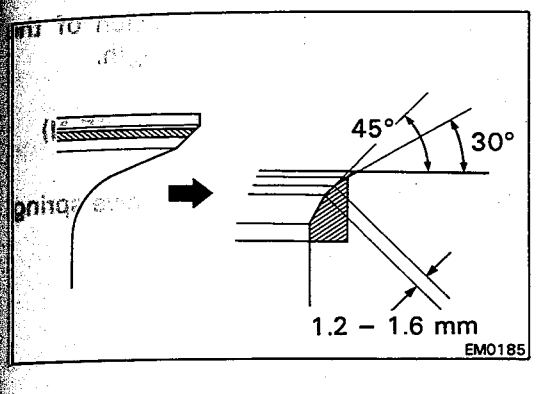
(b) Check the valve seating position.

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

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

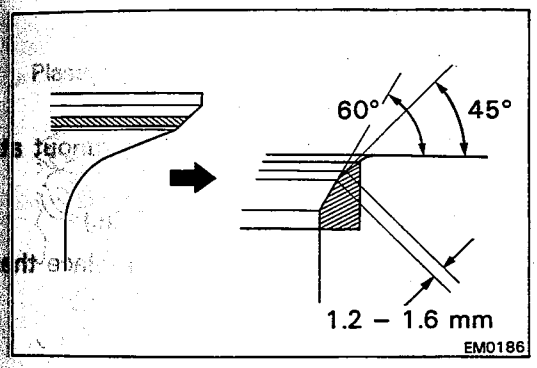
- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
- If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
- Check that the seat contact is in the middle of the valve face with the following width:

1.2 – 1.6 mm (0.047 – 0.063 in.)

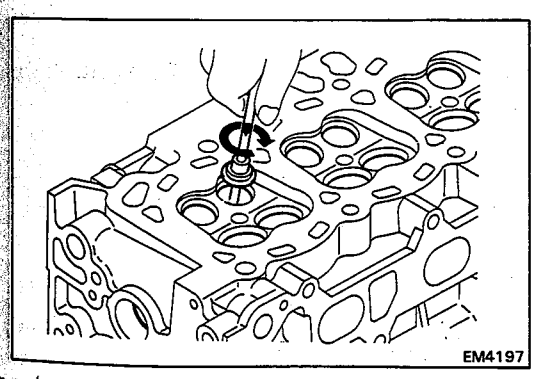


If not, correct the valve seats as follows:

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

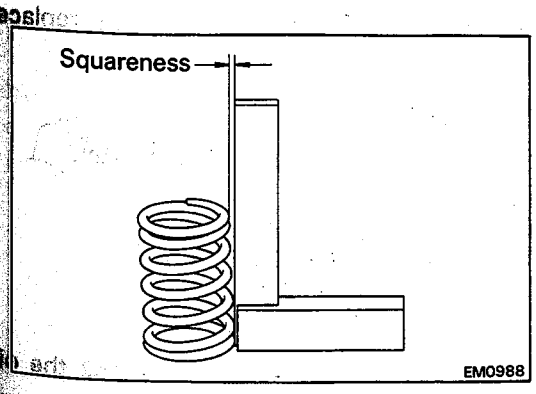


(2) If the seating is too low on the valve face, use 60° and 45° cutters to correct the seat.



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

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

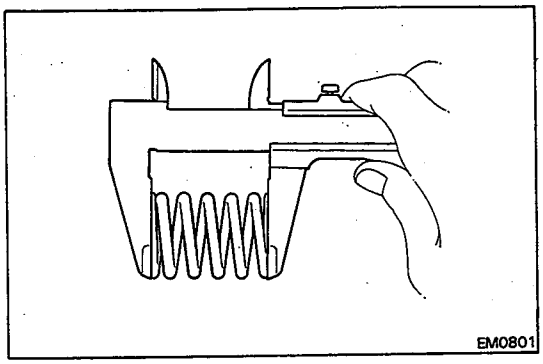


9. INSPECT VALVE SPRINGS

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

Maximum squareness: 2.0 mm (0.075 in.)

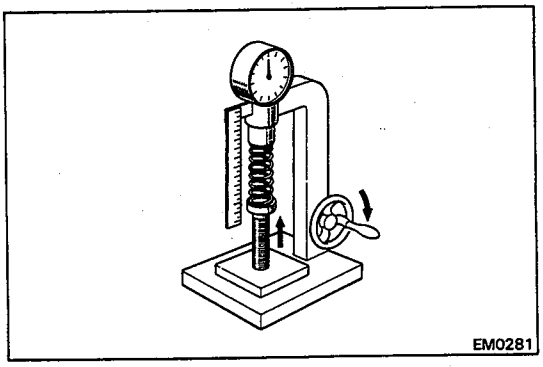
If squareness is greater than maximum, replace the valve spring.


EM0801

(b) Using a vernier caliper, measure the free length of the valve spring.

Free length: 43.8 mm (1.724 in.)

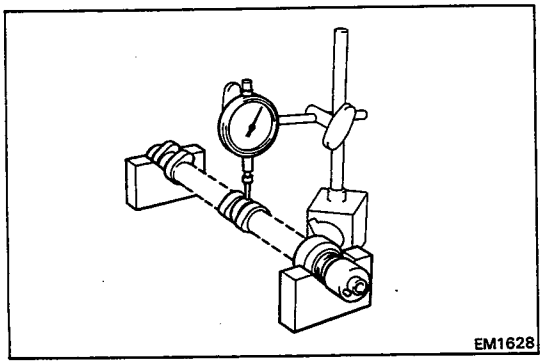
If the free length is not as specified, replace the valve spring.


EM0281

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

Installed tension:
14.6 — 15.8 kg (32.3 — 34.8 lb, 143 — 155 N) at 34.7 mm (1.366 in.)

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


EM1628

10. INSPECT CAMSHAFTS AND BEARINGS

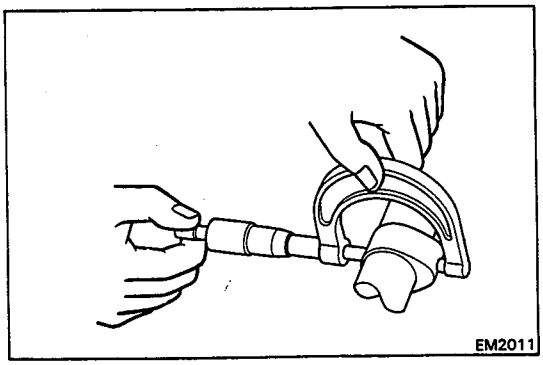
A. Inspect camshaft for runout

(a) Place the camshaft on V-blocks.

(b) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout: 0.04 mm (0.0016 in.)

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


EM2011

B. Inspect cam lobes

Using a micrometer, measure the cam lobe height.

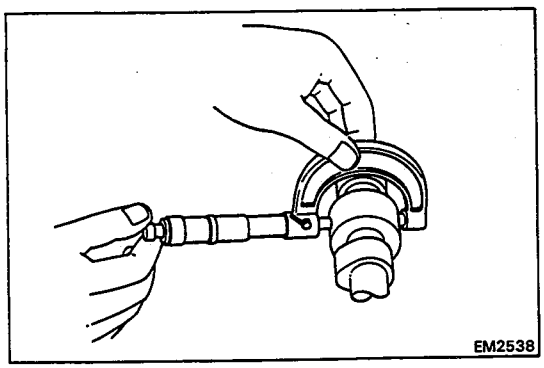
Standard cam lobe height:

Intake	**35.21 — 35.31 mm (1.3862 — 1.3092 in.)**
Exhaust	**34.91 — 35.01 mm (1.3744 — 1.3783 in.)**

Minimum cam lobe height:

Intake	**34.81 mm (1.3705 in.)**
Exhaust	**34.51 mm (1.3587 in.)**

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


EM2538

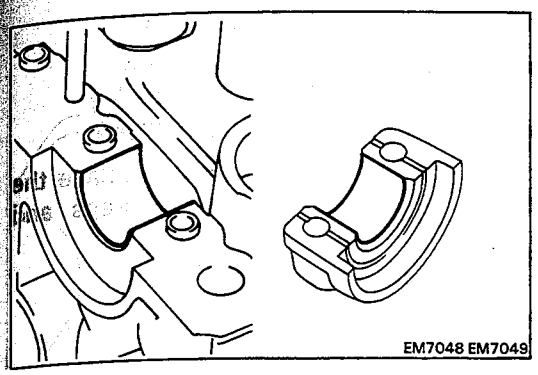
C. Inspect camshaft journals

Using a micrometer, measure the journal diameter.

Journal diameter:

Exhaust No.1	**24.949 — 24.965 mm (0.9822 — 0.9829 in.)**
Others	**22.949 — 22.965 mm (0.9035 — 0.9041 in.)**

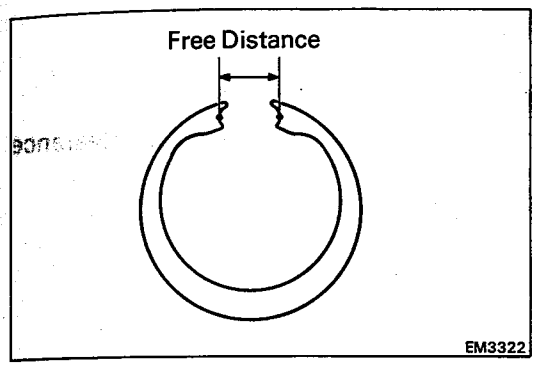
If the journal diameter is not as specified, check the oil clearance.



D. Inspect camshaft bearings

Check the bearings for flaking and scoring.

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

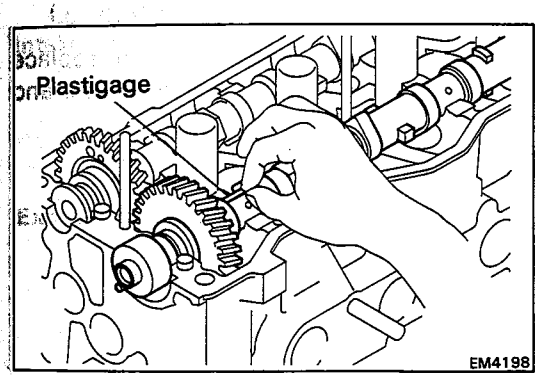


E. Inspect camshaft gear spring

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

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

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

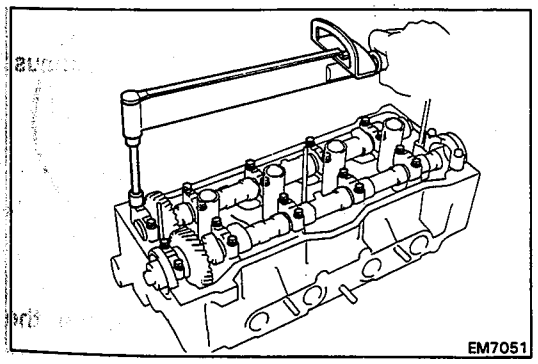


F. Inspect camshaft journal oil clearance

(a) Clean the bearing caps and camshaft journals.

(b) Place the camshafts on the cylinder head.

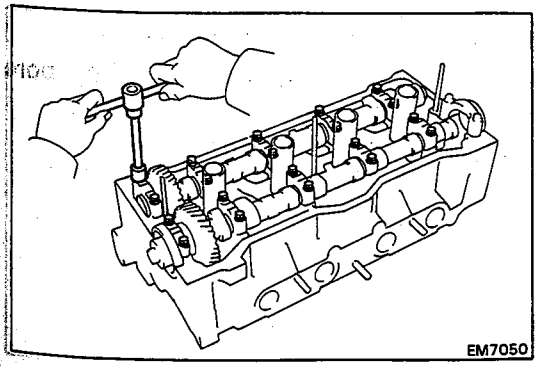
(c) Lay a strip of Plastigage across each of the camshaft journals.



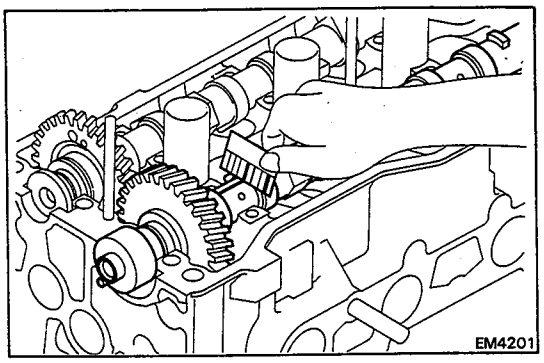
(d) Install the bearing caps.
(See step 3 on pages EM-81 to 83)

Torque: 130 kg-cm (9 ft-lb, 13 N·m)

NOTICE: Do not turn the camshaft.



(e) Remove the bearing caps.



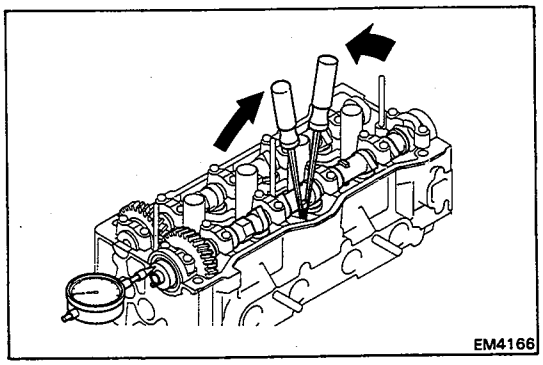
(f) Measure the Plastigage at its widest point.

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

Maximum oil clearance: 0.10 mm (0.0039 in.)

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

(g) Completely remove the Plastigage.



G. Inspect camshaft thrust clearance

(a) Install the camshaft.
(See step 3 on pages EM-81 to 83)

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

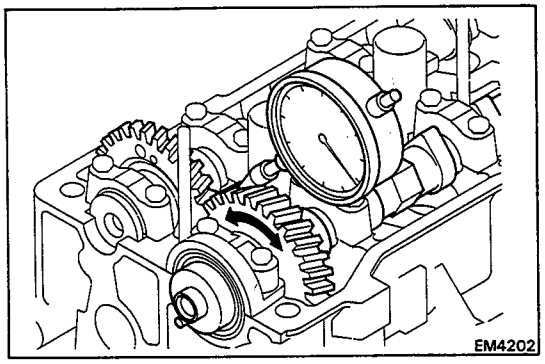
Standard thrust clearance:

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

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

Maximum thrust clearance: 0.11 mm (0.0043 in.)

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



H. Inspect camshaft gear backlash

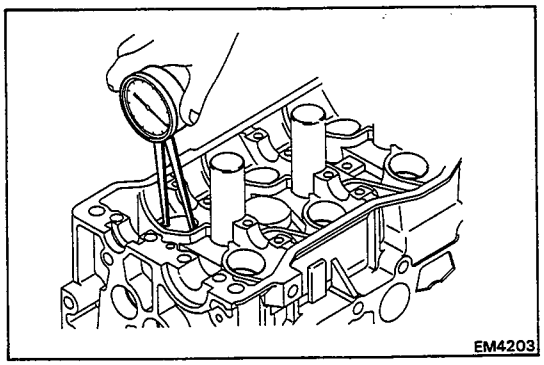
(a) Install the camshafts without installing the exhaust camshaft sub-gear.
(See step 3 on page EM-81 to 83)

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

Standard back lash: 0.020 – 0.200 mm (0.0008 – 0.0079 in.)

Maximum back lash: 0.30 mm (0.0188 in.)

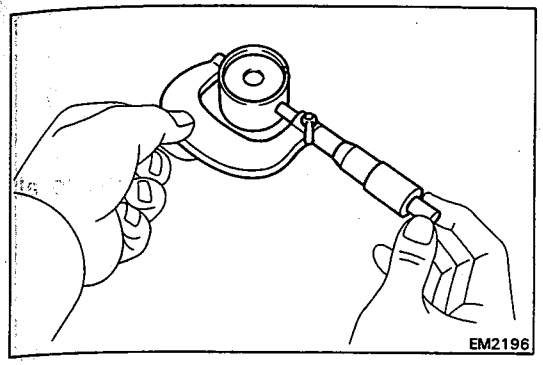
If the backlash is greater than maximum, replace the camshafts.



11. INSPECT VALVE LIFTERS AND LIFTER BORES

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

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



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

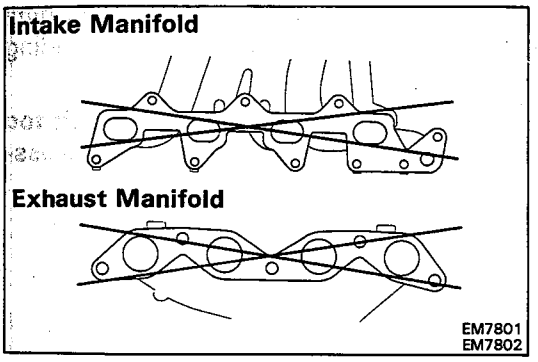
Lifter diameter: 27.975 – 27.985 mm (1.1014 – 1.1018 in.)

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

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

Maximum oil clearance: 0.07 mm (0.0028 in.)

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



12. INSPECT INTAKE AND EXHAUST MANIFOLDS

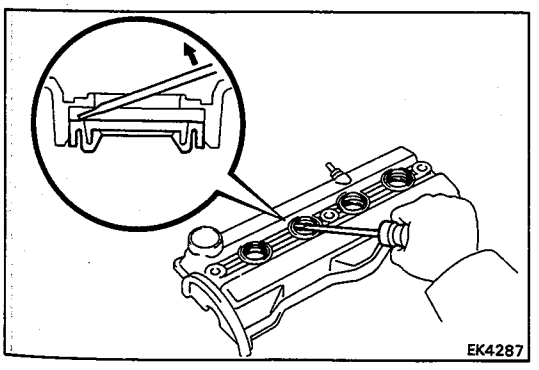
Using precision straight edge and feeler gauge, measure the surface contacting the cylinder head for warpage.

Maximum warpage:

Intake 0.20 mm (0.0079 in.)

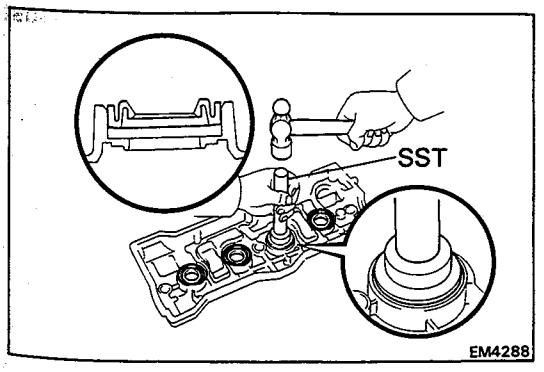
Exhaust 0.30 mm (0.0118 in.)

If warpage is greater than maximum, replace the manifold.



13. IF NECESSARY, REPLACE SPARK PLUG TUBE GASKET

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



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

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

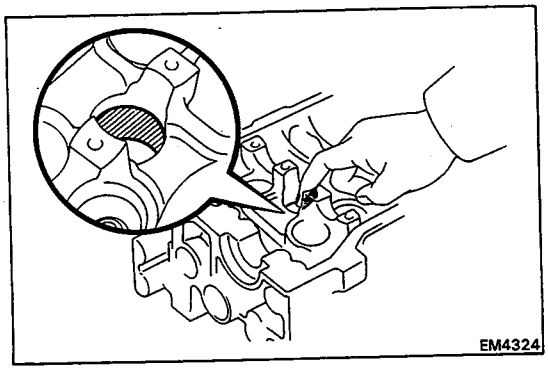
(c) Apply a light coat of MP grease to the gasket lip.

ASSEMBLY OF CYLINDER HEAD

(See pages EM-56, 57)

HINT:

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

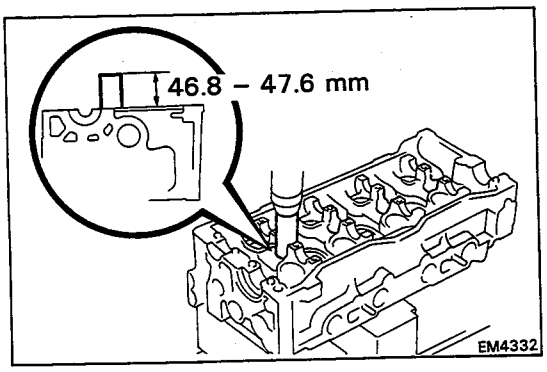


1. INSTALL SPARK PLUG TUBES

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

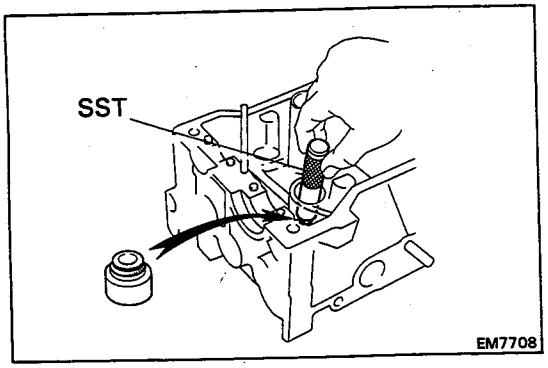
(a) Apply adhesive to the spark plug tube hole of the cylinder head.

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



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

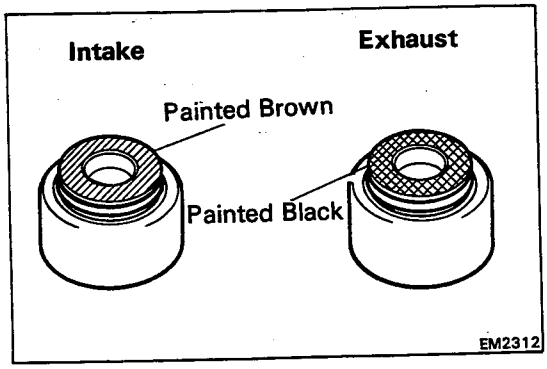
NOTICE: Avoid tapping a new spark plug tube in too far by measuring the amount of protrusion while pressing.



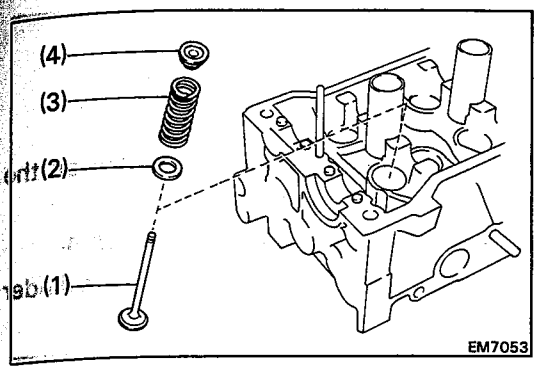
2. INSTALL VALVES

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

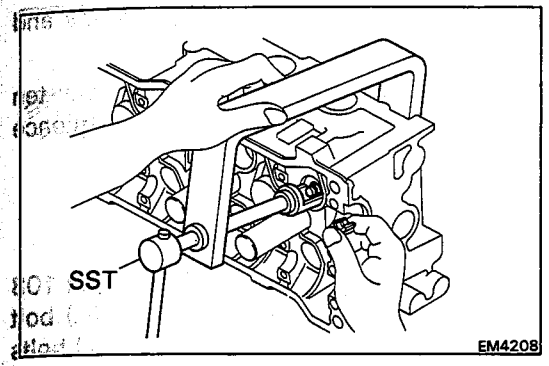
SST 09201-41020



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

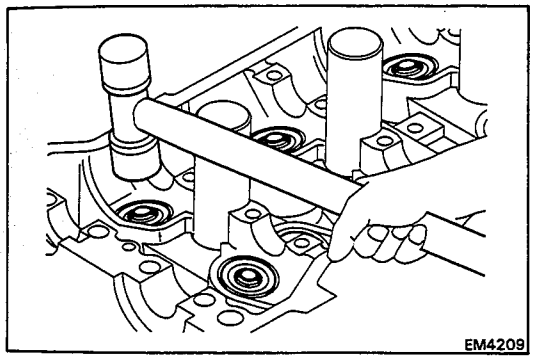


(b) Install the following parts:
(1) Valve
(2) Spring seat
(3) Valve spring
(4) Spring retainer

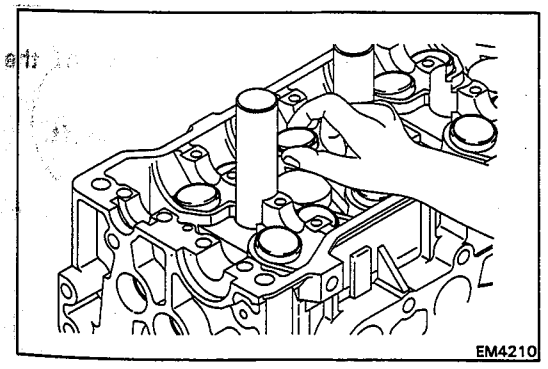


(c) Using SST, compress the valve spring and place the two keepers around the valve stem.

SST 09202-70010



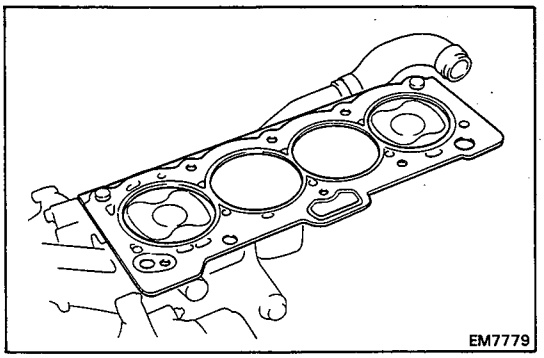
(d) Using a plastic-faced hammer, lightly tap the valve stem tip to assure proper fit.



3. INSTALL VALVE LIFTERS AND SHIMS

(a) Install the valve lifter and shim.

(b) Check that the valve lifter rotates smoothly by hand.


EM7779

INSTALLATION OF CYLINDER HEAD

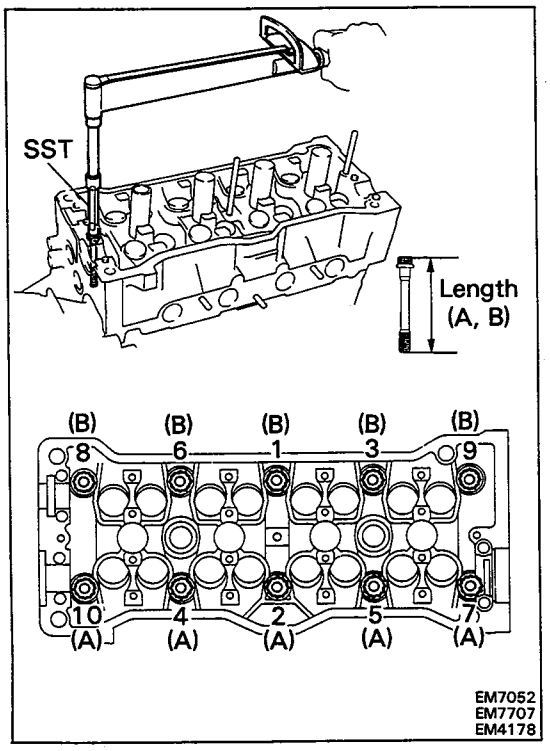
(See page EM-56, 57)

1. INSTALL CYLINDER HEAD

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

NOTICE: Be careful of the installation direction.

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



EM7052
EM7707
EM4178

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

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

SST 09205-16010

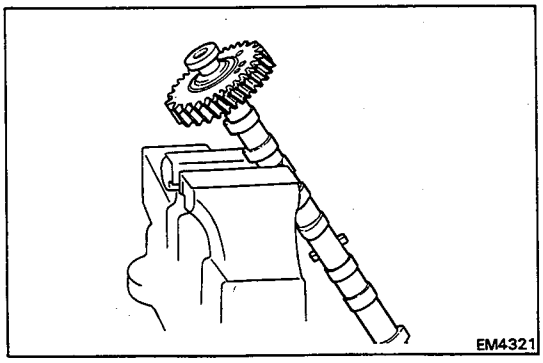
Torque: 610 kg-cm (44 ft-lb, 60 N·m)

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

2. ASSEMBLE INTAKE CAMSHAFT

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

NOTICE: Be careful not to damage the camshaft.

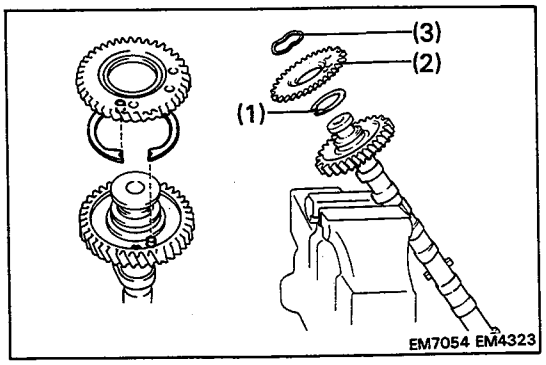

EM4321

(b) Install the following parts:

(1) Camshaft gear spring.

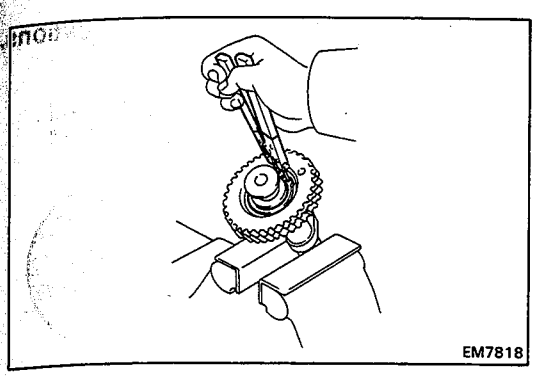
(2) Camshaft sub-gear

(3) Wave washer

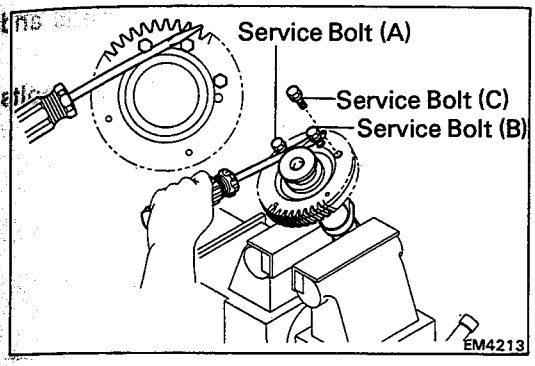


EM7054 EM4323

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



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



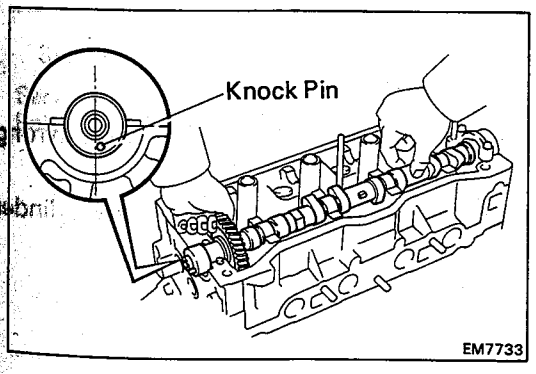
(d) Insert service bolts (A) and (B) into the service hole of the camshaft sub-gear.

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

NOTICE: Be careful not to damage the camshaft.

3. INSTALL CAMSHAFTS

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

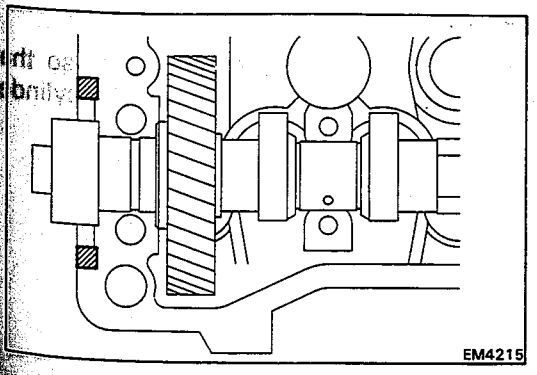


A. Install exhaust camshaft

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

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

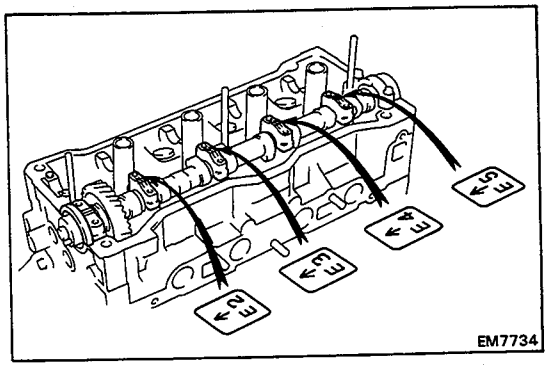
HINT: The above angle allows the No.1 and No.3 cylinder cam lobes of the exhaust camshaft to push their valve lifters evenly.



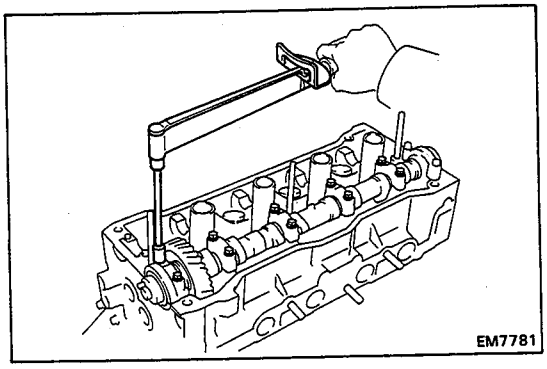
(c) Remove the old packing (FIPG) material.

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

Seal packing: Part No. 08826-00080 or equivalent



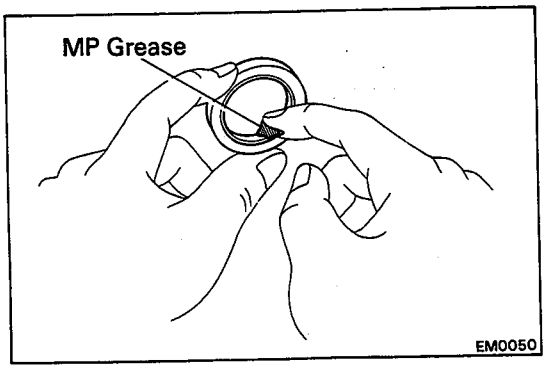
(e) Install the five bearing caps in their proper locations.



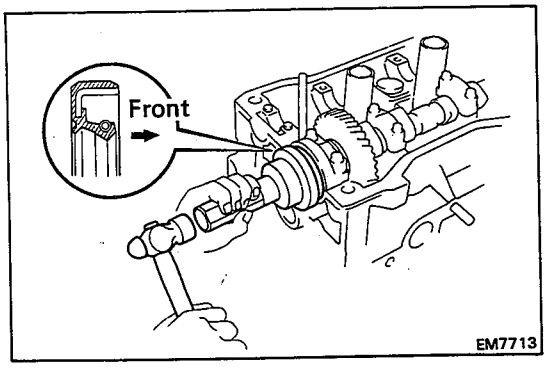
(f) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

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

Torque: 130 kg-cm (9 ft-lb, 13 N·m)



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

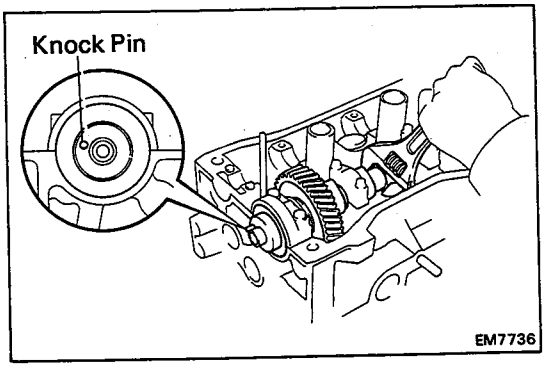


(i) Using SST, tap in the oil seal.

SST 09223-46011

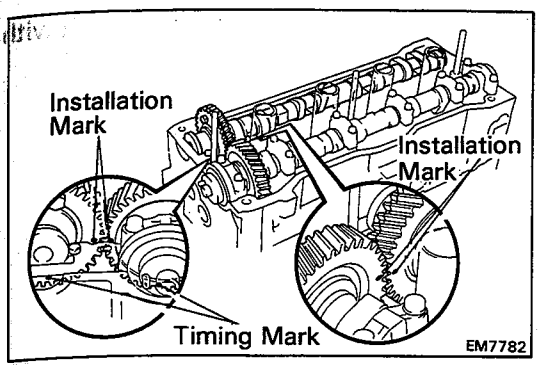
HINT:

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



B. Install intake camshaft

(a) Set the knock pin of the exhaust camshaft so tha the knock pin is slightly above the top of the cylinde head.



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

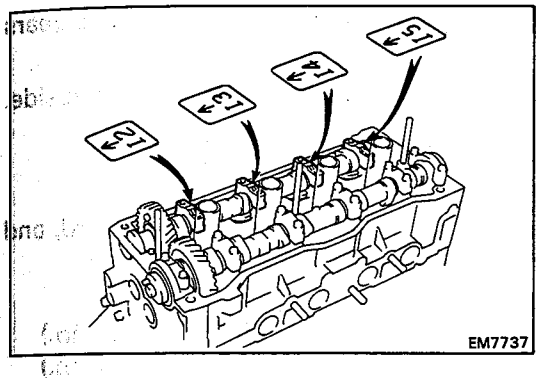
(c) Engage the intake camshaft gear to the exhaust camshaft gear by matching the assembly installation marks on each gear.

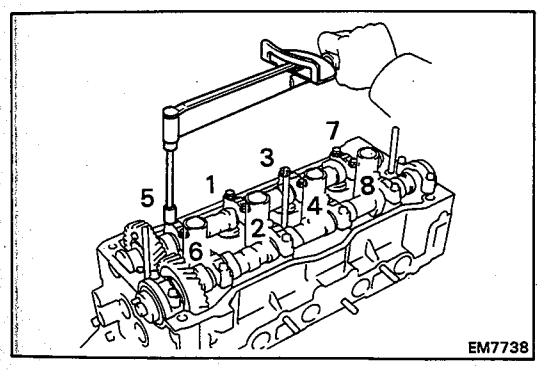
NOTICE: There are also timing marks (for TDC) on each gear as shown in the illustration. Do not use these marks.

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

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

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

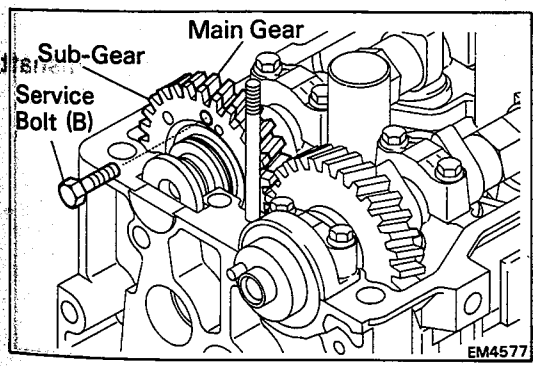




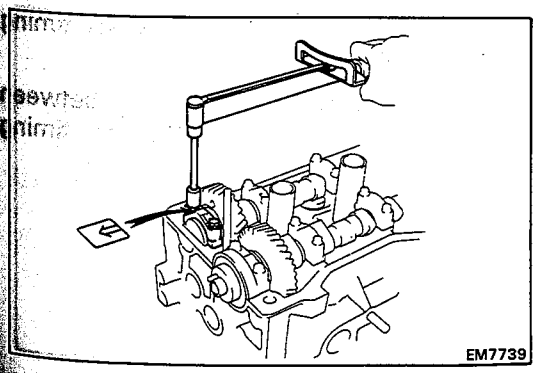
(f) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

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

Torque: 130 kg-cm (9 ft-lb, 13 N·m)



(h) Remove the service bolt (B).



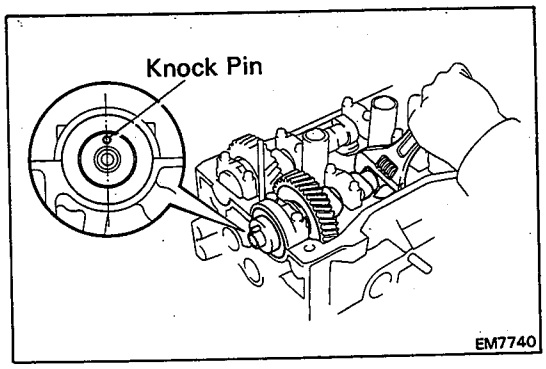
(i) Install the No. 1 bearing cap with the arrow mark facing forward.

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

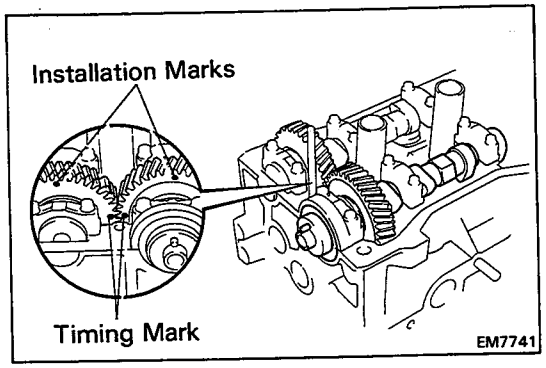
(j) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

(k) Install and alternately tighten the two bolts in several passes.

Torque: 130 kg-cm (9 ft-lb, 13 N·m)



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



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

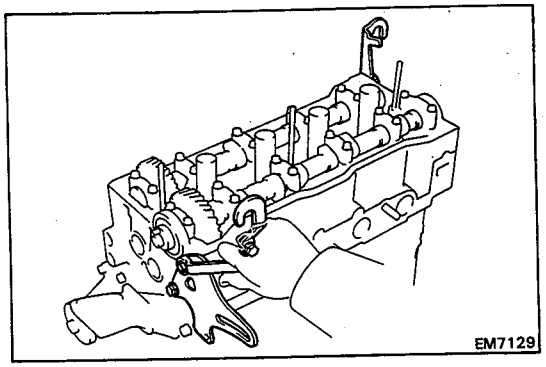
HINT: The assembly installation marks are on the upside.

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

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

Valve clearance (Cold):

Intake	**0.15 — 0.25 mm (0.006 — 0.010 in.)**
Exhaust	**0.20 — 0.30 mm (0.008 — 0.012 in.)**



5. INSTALL ENGINE HANGERS

Install the two engine hangers with the two bolts.

Torque: 280 kg-cm (20 ft-lb, 27 N·m)

6. INSTALL FAN BELT ADJUSTING BAR

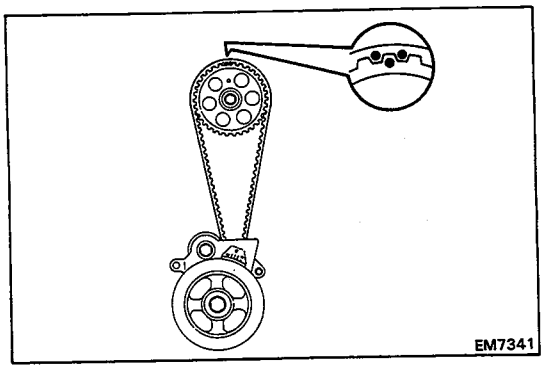
Install the adjusting bar with the two bolts.

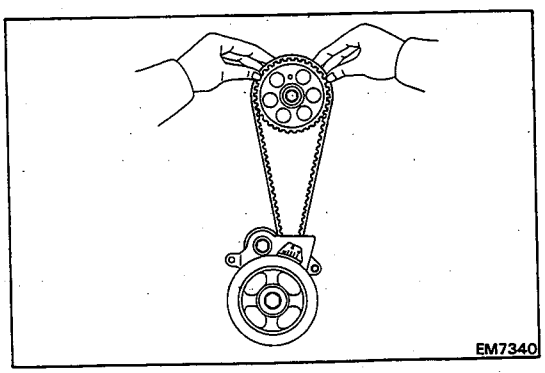
Torque: 200 kg-cm (14 ft-lb, 20 N·m)

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

8. INSTALL TIMING BELT

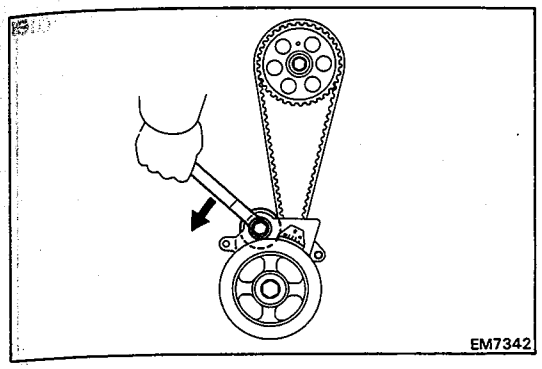
Align the matchmarks of the timing belt and camshaft timing pulley.





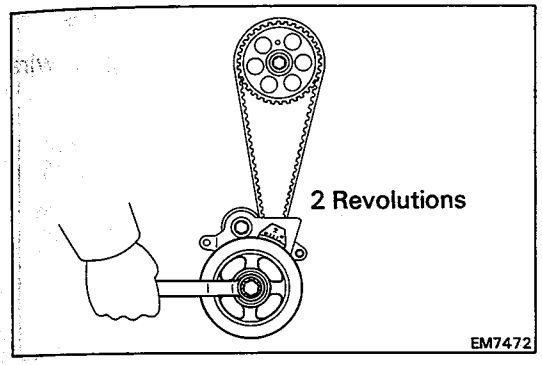
(a) Remove any oil or water on the camshaft timing pulley, and keep it clean.

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



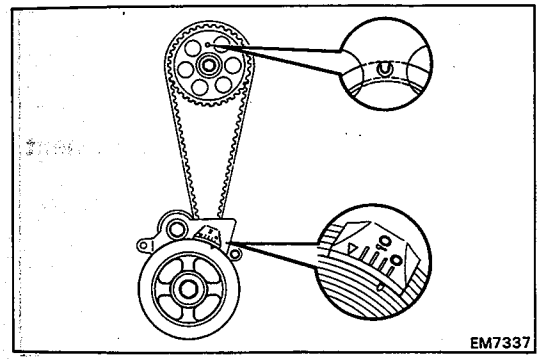
9. INSTALL VALVE TIMING

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



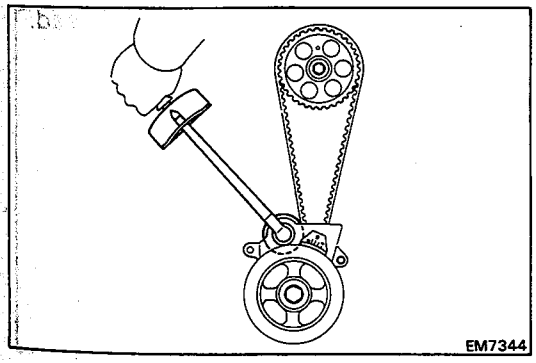
(b) Turn the crankshaft pulley two revolutions from TDC to TDC.

NOTICE: Always turn the crankshaft clockwise.



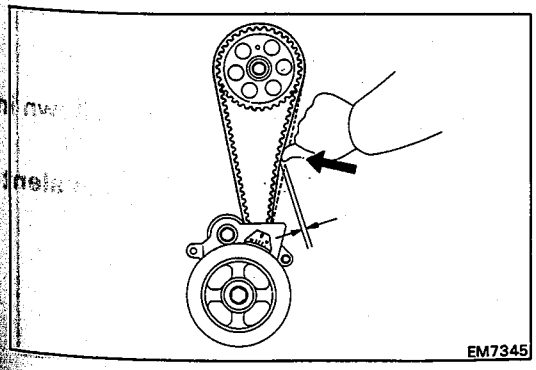
(c) Check that each pulley aligns with the timing marks as shown in the illustration.

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



(d) Tighten the idler pulley bolt.

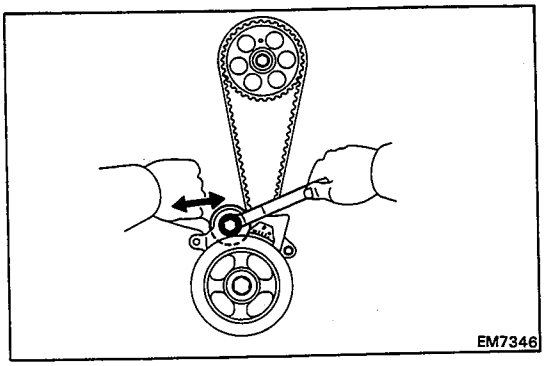
Torque: 375 kg-cm (27 ft-lb, 37 N·m)



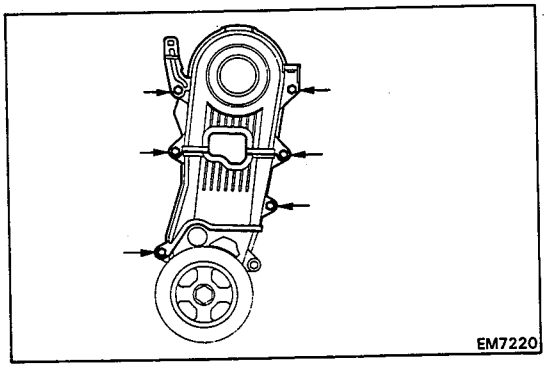
10. (REFERENCE)
INSTALL TIMING BELT TENSION

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

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



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

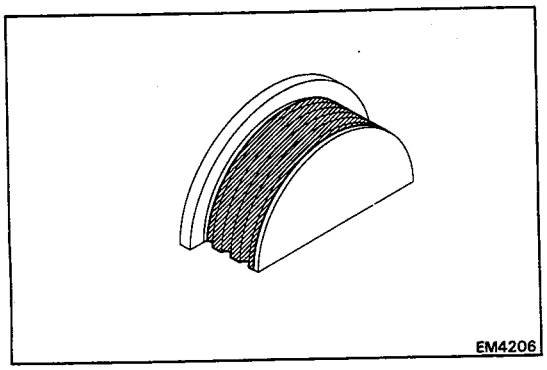


11. INSTALL NO.2 AND NO.3 TIMING BELT COVERS

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

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

Torque: 180 kg-cm (13 ft-lb, 18 N·m)

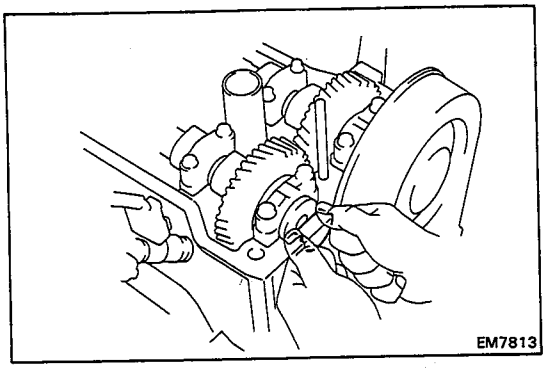


13. INSTALL SEMI-CIRCULAR PLUG

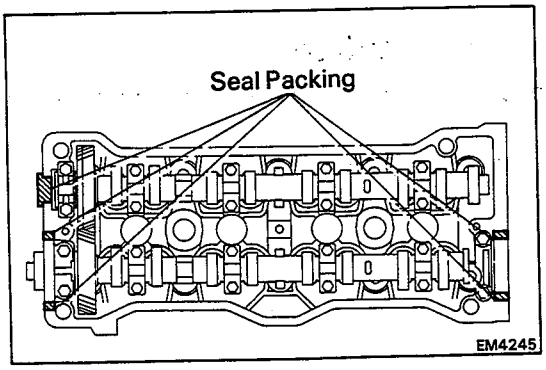
(a) Remove any old packing (FIPG) material.

(b) Apply seal packing to the circular plug.

Seal packing: Part No. 08826-00080 or equivalent



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

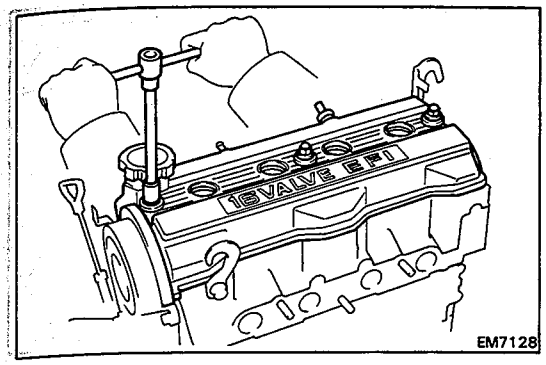


14. INSTALL CYLINDER HEAD COVER

(a) Remove any old packing (FIPG) material.

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

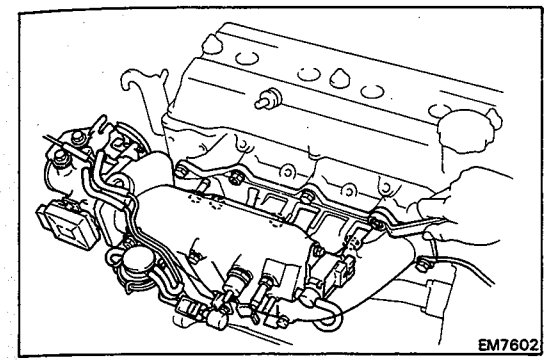
Seal packing: Parts No. 08826-00080 or equivalent



(c) Install the gasket to the head cover.

(d) Install the head cover with the three grommets and cap nuts.

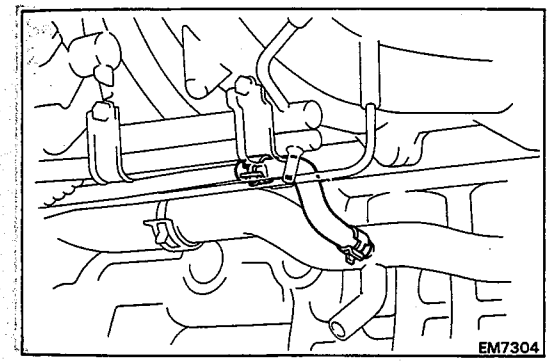
Torque: 80 kg-cm (69 in.-lb, 7.8 N·m)



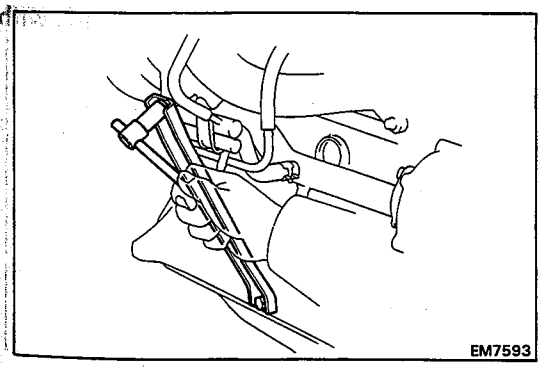
15. INSTALL INTAKE MANIFOLD (2WD)

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

Torque: 195 kg-cm (14 ft-lb, 19 N·m)



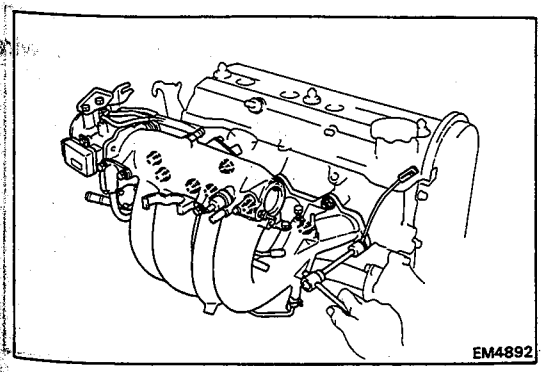
(b) Connect the water by-pass hose to the air pipe.



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

Torque:

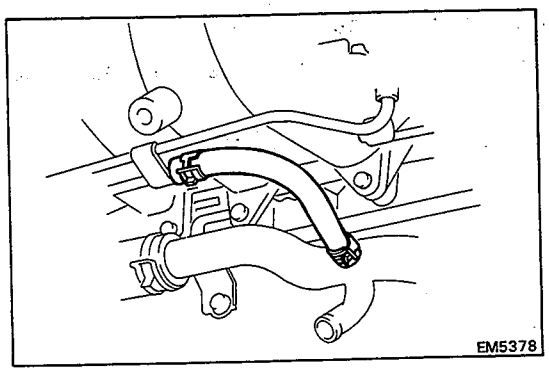
12 mm bolt head 195 kg-cm (14 ft-lb, 19 N·m)
14 mm bolt head 400 kg-cm (29 ft-lb, 39 N·m)



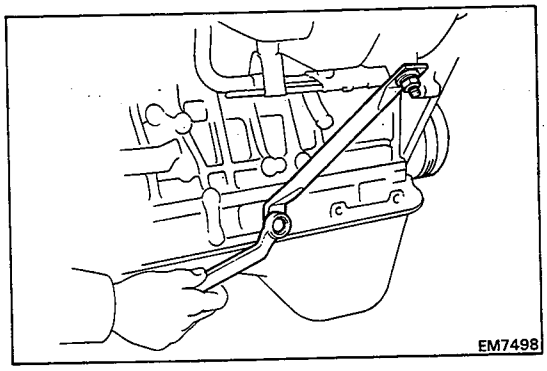
(4WD)

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

Torque: 195 kg-cm (14 ft-lb, 19 N·m)

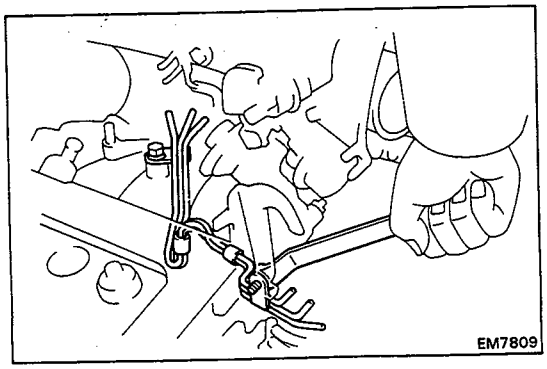


(b) Connect the water by-pass hose to the air pipe.



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

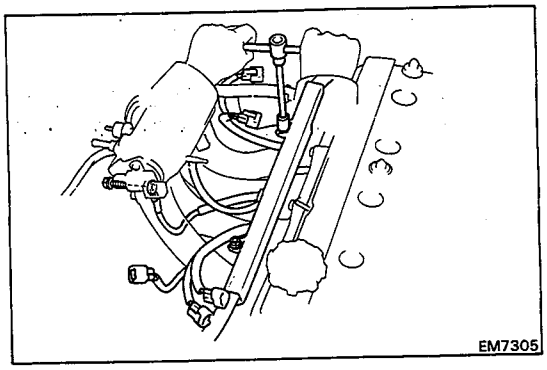
Torque: 195 kg-cm (14 ft-lb, 19 N·m)



16. (4WD)
INSTALL VACUUM PIPE

(a) Install the vacuum pipe with the two bolts.

(b) Connect the three vacuum hoses.



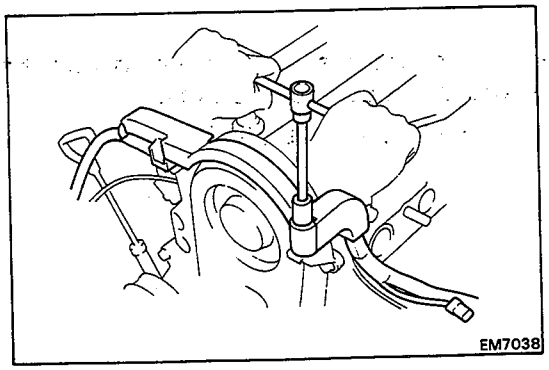
17. INSTALL ENGINE WIRE TO INTAKE MANIFOLD

(a) Install the engine wire with the three bolts.

(b) Install the engine wire the engine to vacuum pipe with the wire clamp.

(c) Connect the following connectors:

- Throttle position sensor connector
- ISC valve connector
- (2WD w/ EGR system) EGR VSV connector
- Cold start injector connector



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

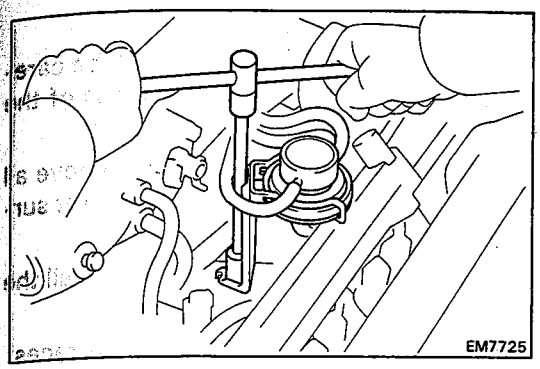
(a) Install the wire clamp on engine wire to the wire bracket.

(b) Install the engine wire with the bolt.

(c) Connect the following connectors and wire:

- Alternator connector
- Alternator wire
- Oil pressure switch connector

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


EM7725

20. (4WD)
INSTALL EGR VACUUM MODULATOR

(a) Install the vacuum modulator and nut.

(b) Connect the four vacuum hoses.

(1) EGR valve hose.

(2) Three port vacuum hoses from the EGR vacuum modulator.

21. INSTALL COLD START INJECTOR PIPE
(See step 2 on page FI-108)

22. INSTALL WATER INLET AND INLET HOUSING

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

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

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

Seal packing: Part No. 08826-00100 or equivalent

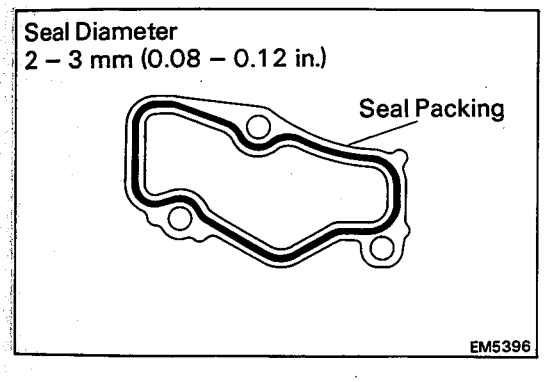
- Install a nozzle that has been cut with a 2 – 3 mm (0.08 – 0.12 in.) opening.

HINT: Avoid applying an excessive amount to the surface.

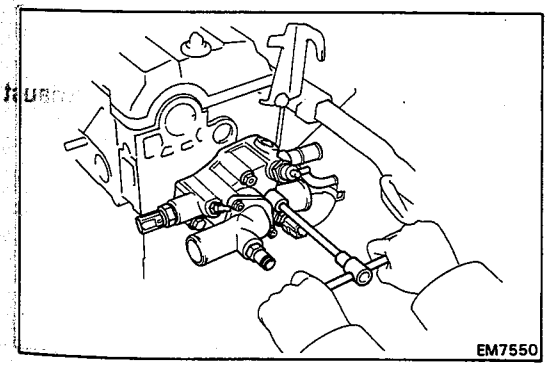
- Parts must be assembled within 15 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

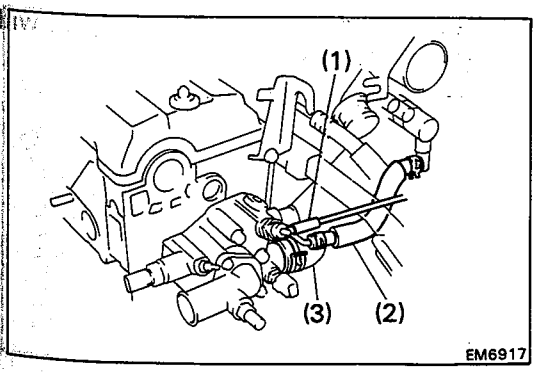
(c) Install the water inlet and inlet housing assembly with the bolt and two nuts.

Torque: 200 kg-cm (14 ft-lb, 20 N·m)



EM5396


EM7550



EM6917

(d) Connect the following hoses:

(1) BVSV vacuum hose(s)

(2) Water by-pass hose

(3) Inlet water hose

(e) Connect the following connectors:

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

23. INSTALL WATER OUTLET

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

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

(b) Apply seal packing to the water outlet groove.

Seal packing: Part No. 08826-00100 or equivalent

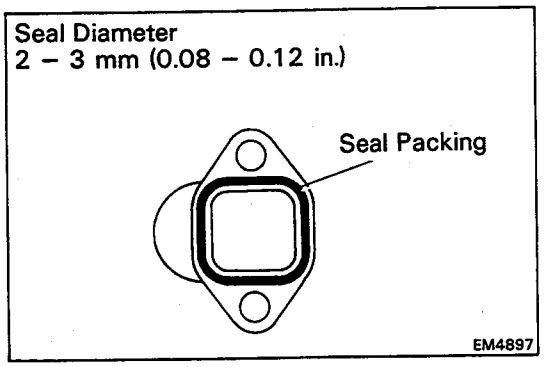
- Install a nozzle that has been cut with a 2 – 3 mm (0.08 – 0.12 in.) opening.

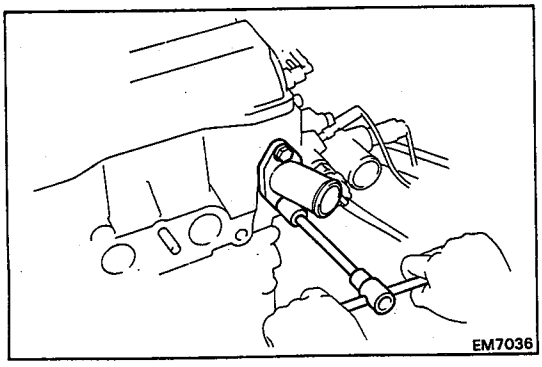
HINT: Avoid applying an excessive amount to the surface.

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

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

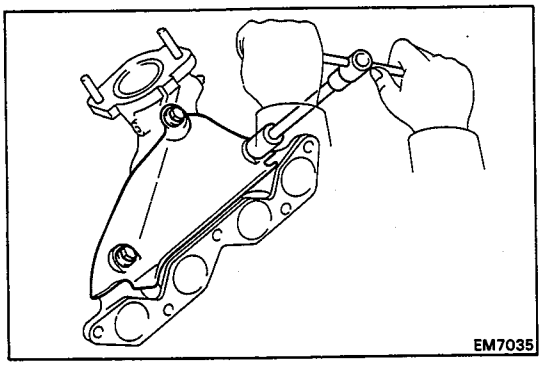
Torque: 150 kg-cm (11 ft-lb, 15 N·m)





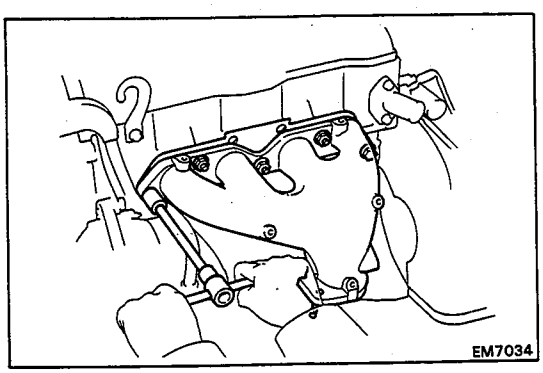
24. INSTALL EXHAUST MANIFOLD (2WD)

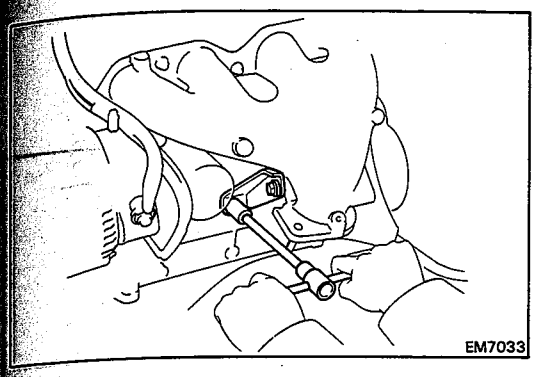
(a) Install the lower heat insulator to the exhaust manifold with the three bolts.



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

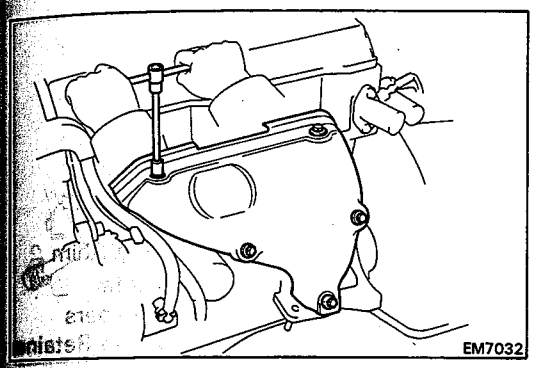
Torque: 250 kg-cm (18 ft-lb, 25 N·m)





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

Torque: 400 kg-cm (29 ft-lb, 39 N·m)



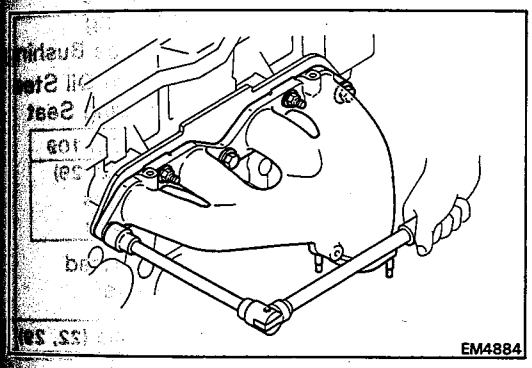
(d) Install the upper heat insulator with the five bolts.

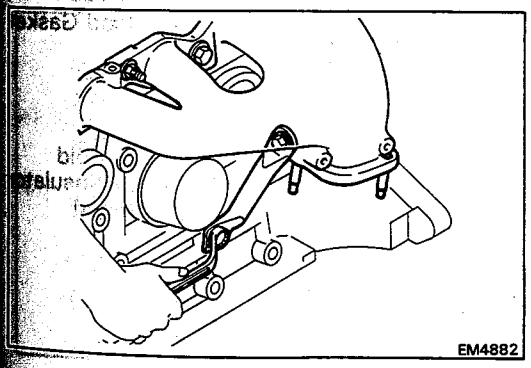
(4WD)

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

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

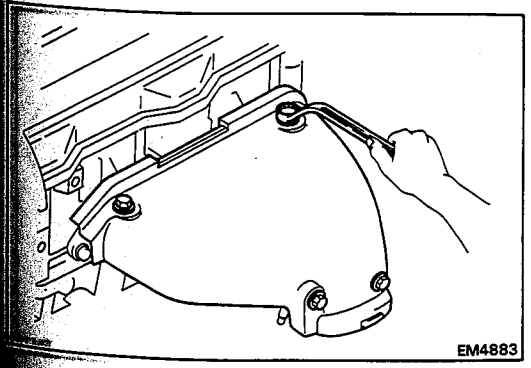
Torque: 250 kg-cm (18 ft-lb, 25 N·m)





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

Torque: 400 kg-cm (29 ft-lb, 39 N·m)

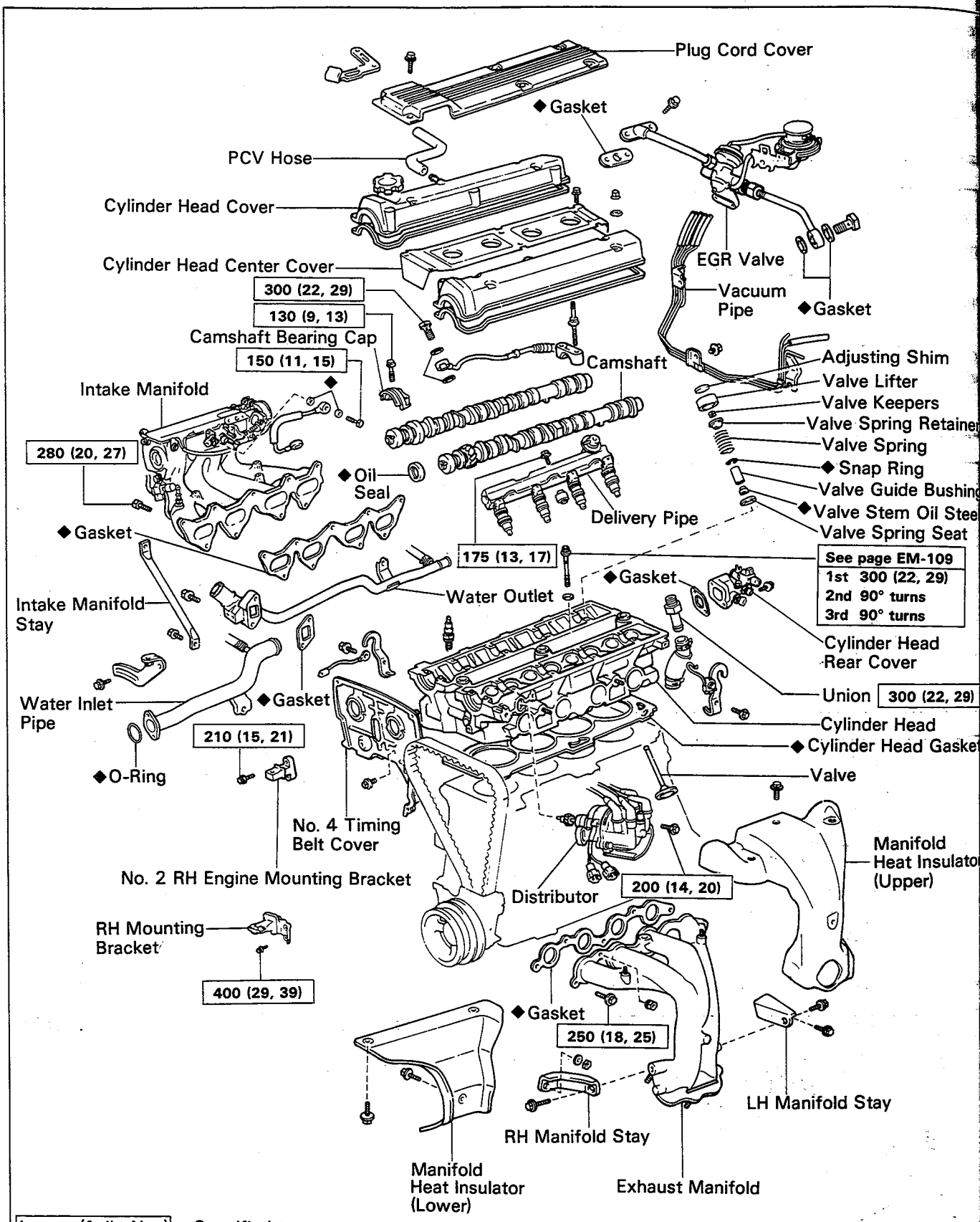


(d) Install the upper heat insulator with the four bolts.

25. INSTALL IIA (See page IG-18)

CYLINDER HEAD (4A-GE)

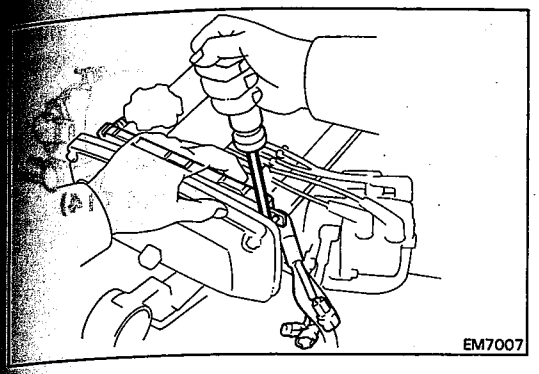
COMPONENTS

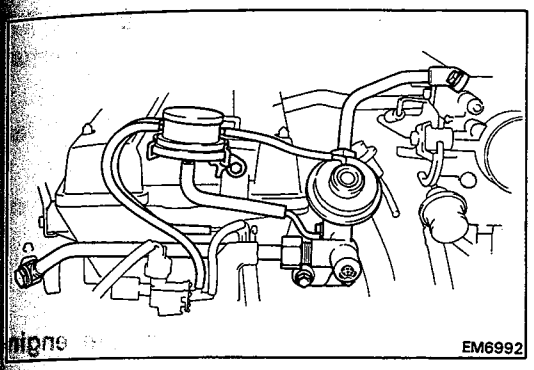


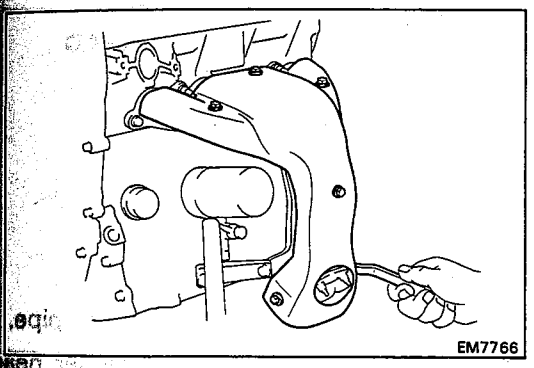
kg-cm (ft-lb, N·m) : Specified torque

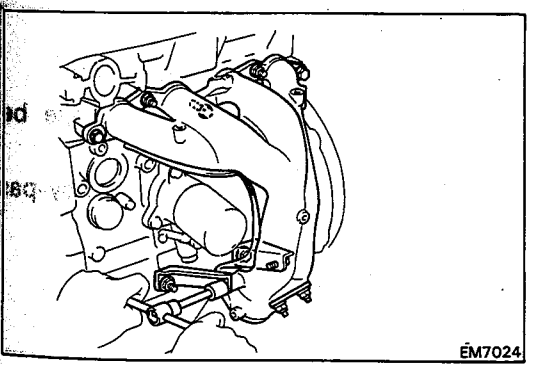
◆ Non-reusable part

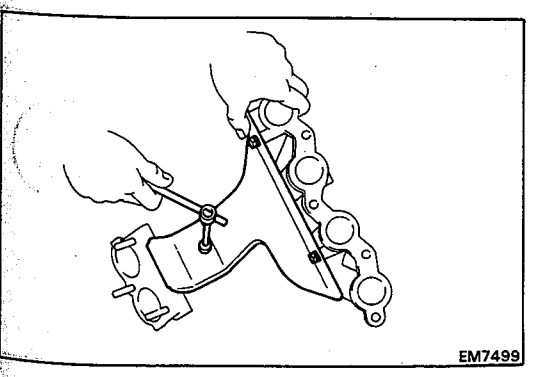
EM75


EM7007


EM6992


EM7766


EM7024


EM7499

REMOVAL OF CYLINDER HEAD

(See page EM-92)

1. **DRAIN ENGINE COOLANT (See page CO-5)**

2. **DISCONNECT ENGINE WIRE FROM NO.4 TIMING BELT COVER**
   (a) Disconnect the following connectors:
   - Distributor wire connectors
   - Oil pressure sender gauge connector

   (b) Disconnect the engine wire from the timing belt cover.

3. **REMOVE DISTRIBUTOR**

4. **(w/ EGR SYSTEM)**
   REMOVE EGR VALVE AND MODULATOR
   (a) Disconnect the vacuum hoses from the vacuum pipe.
   (b) Remove the bolt and EGR vacuum modulator.
   (c) Remove the union bolt, four bolts, the EGR valve, pipes assembly and gaskets.

5. **REMOVE EXHAUST MANIFOLD**
   (a) Remove the six bolts and upper heat insulator.

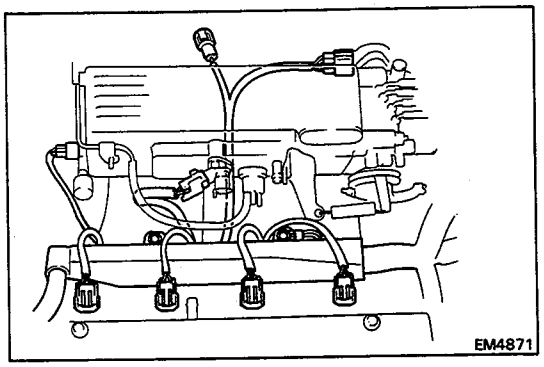
   (b) Remove the three bolts, nut, RH and LH manifold stays.
   (c) Remove the three bolts, two nuts exhaust manifold and gasket.

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

6. REMOVE PCV HOSE

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

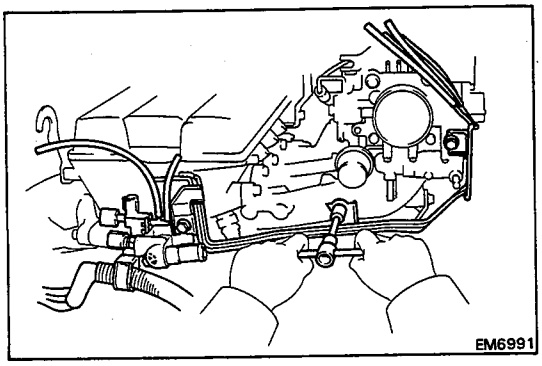
9. REMOVE DELIVERY PIPE AND INJECTORS
(See steps 3 to 6 and 8 on page FI-113 and 114)


EM4871

9. DISCONNECT ENGINE WIRE FROM INTAKE MANIFOLD

(a) Disconnect the following connectors:
- Knock sensor connector
- Throttle position sensor connector
- Cold start injector connector
- (Europe)
  Fuel pressure VSV connector

(b) Remove the two bolts, and disconnect the engine wire from the intake manifold.

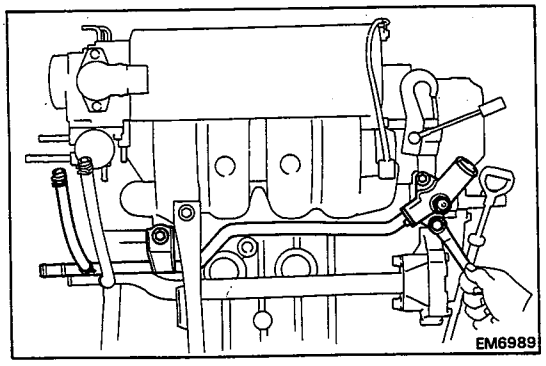

EM6991

10. REMOVE VACUUM PIPE AND CYLINDER HEAD REAR COVER

(a) Disconnect the following connectors:
- Start injector time switch connector
- Water temp. sensor connector
- (w/ EGR system)
  EGR VSV connector

(b) Remove the vacuum hoses from the vacuum pipe.

(c) Remove the four bolts, vacuum pipe, cylinder head rear cover and wire clamp.

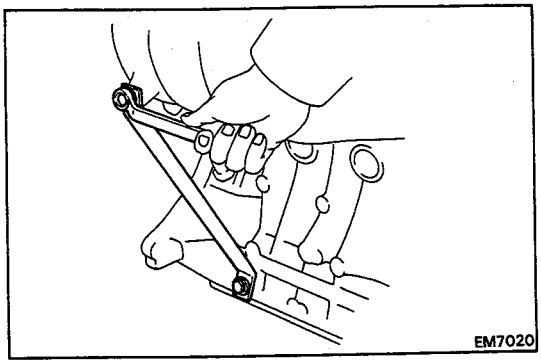

EM6989

11. REMOVE WATER OUTLET AND BY-PASS PIPE

(a) Remove the three bolts and alternator drive belt adjusting bar.

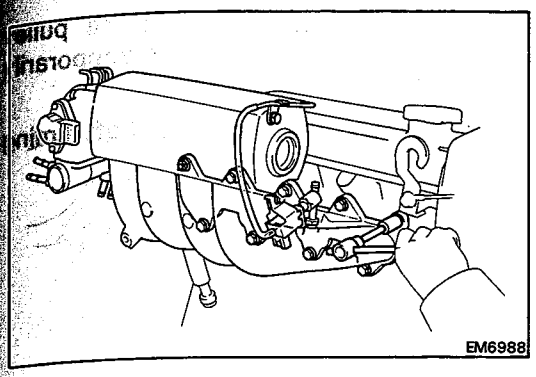
(b) Remove the three bolts, the water outlet, by-pass pipe assembly and gasket.

12. REMOVE WATER INLET PIPE
(See step 4 on page CO-6)

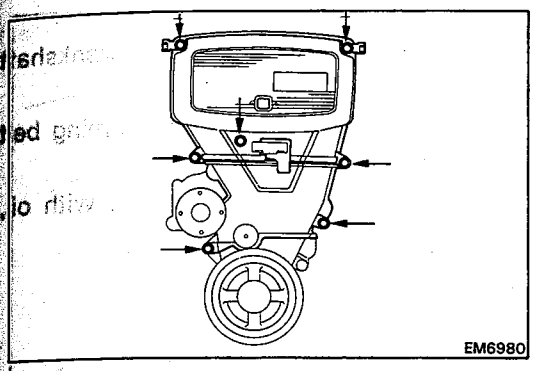

EM7020

13. REMOVE INTAKE MANIFOLD

(a) Remove the two bolts and manifold stay.



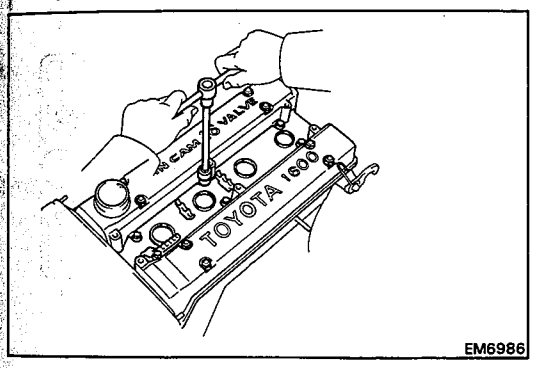
(b) Remove the seven bolts, two nuts and intake manifold.



14. REMOVE WATER PUMP PULLEY AND DRIVE BELT

15. REMOVE NO.3 AND NO.2 TIMING BELT COVERS

Remove the seven bolts, cord support plate, No.3, No.2 belt covers and gaskets.

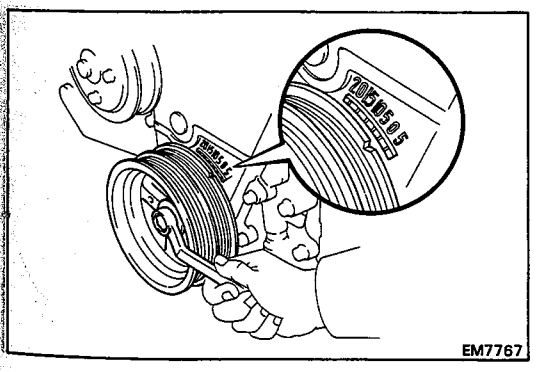


16. REMOVE CYLINDER HEAD COVERS

(a) Remove the six bolts, center cover and gasket.

(b) Remove the eight cap nuts, seal washers, two head covers and gaskets.

17. REMOVE SPARK PLUGS (See page IG-12)

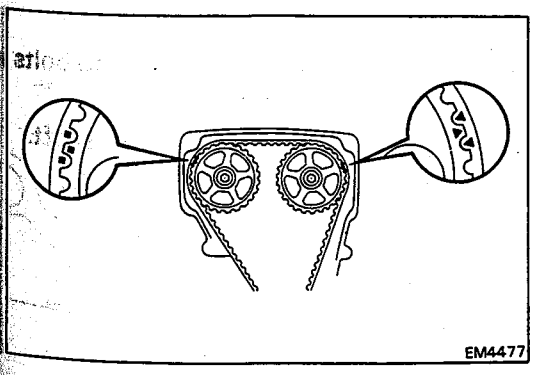


18. SET NO.1 CYLINDER TO TDC/COMPRESSION

(a) Turn the crankshaft pulley and align its groove with the timing mark "0" of the No.1 timing belt cover.

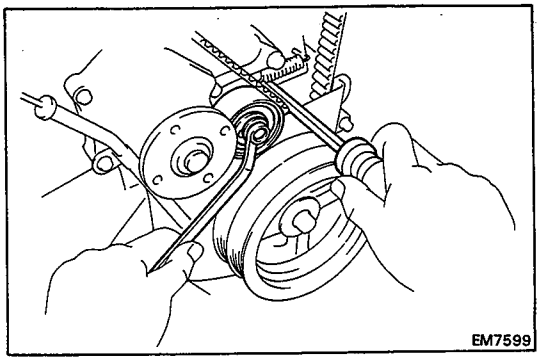
(b) Check that the valve lifters on the No.1 cylinder are loose and valve lifters on the No.4 cylinder are tight.

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



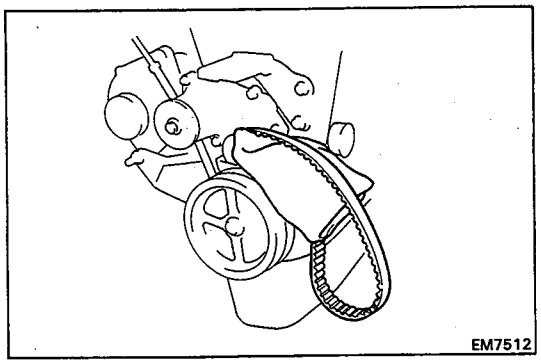
19. DISCONNECT TIMING BELT FROM CAMSHAFT TIMING PULLEYS

(a) Place matchmarks on the camshaft timing pulleys and timing belt.



(b) Loosen the idler pulley bolt and shift the pulley toward the left as for as it will go, and temporarily tighten it.

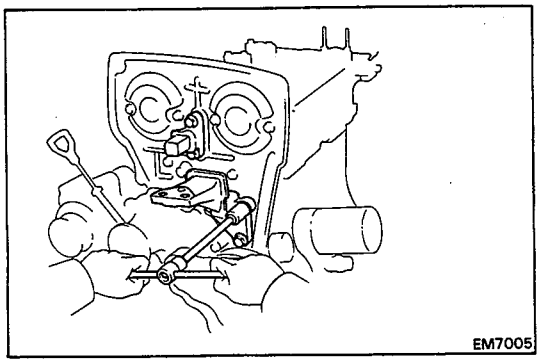
(c) Remove the timing belt from the camshaft timing pulleys.



HINT:

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

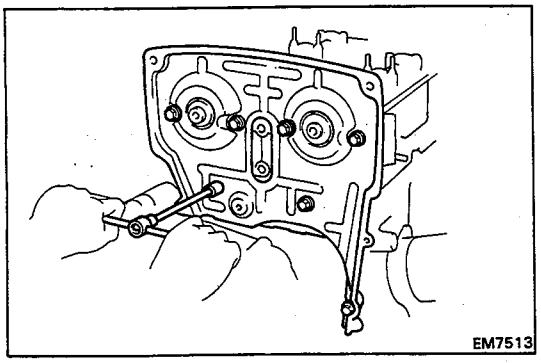
20. REMOVE CAMSHAFT TIMING PULLEYS
(See step 12 on page EM-49)



21. REMOVE RH MOUNTING BRACKETS

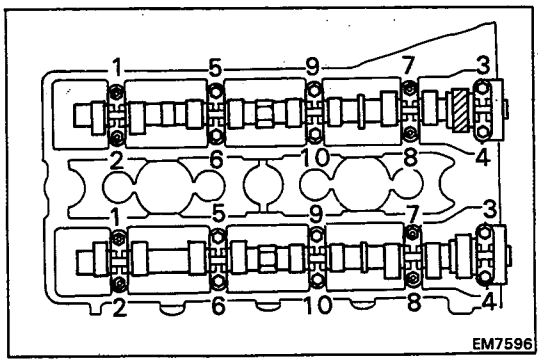
(a) Remove the two bolts and No.2 bracket.

(b) Remove the three bolts and bracket.



22. REMOVE NO.4 TIMING BELT COVER

Remove the seven bolts and belt cover.

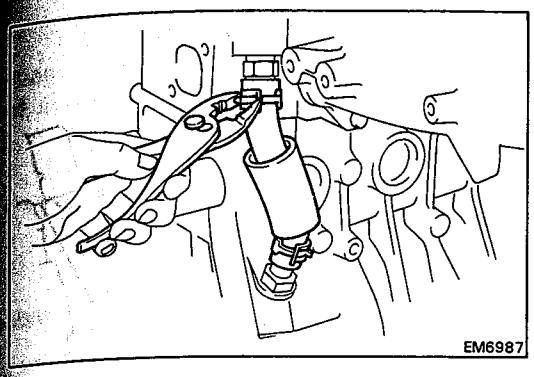


23. REMOVE CAMSHAFTS

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

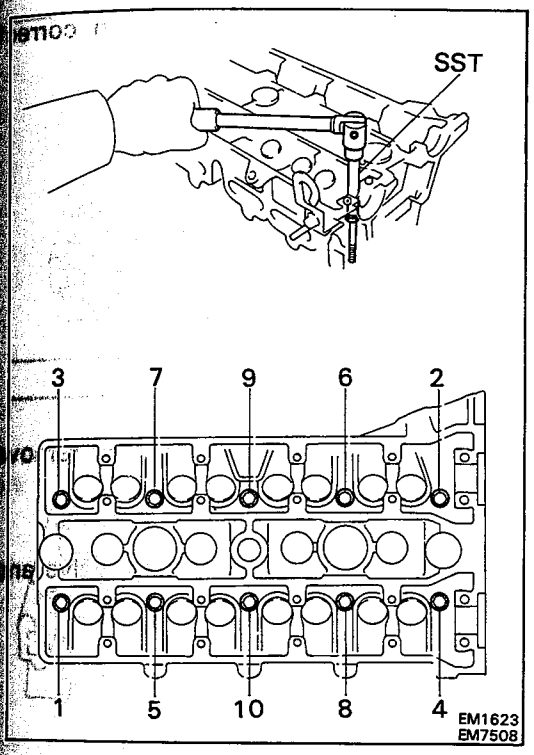
(b) Remove the bearing caps, oil seal and camshaft.

HINT: Arrange the intake and exhaust camshafts.


EM6987

24. REMOVE PCV HOSE

Remove the two clamps, and disconnect the PCV hose from the cylinder head.



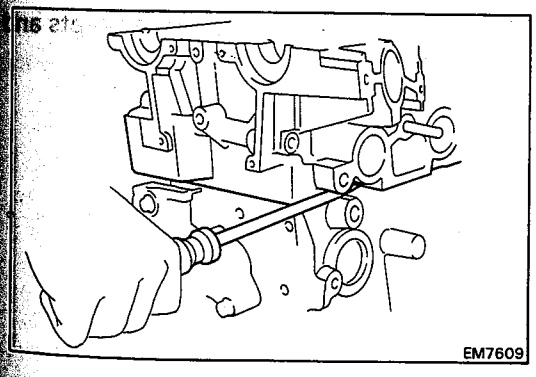
EM1623
EM7508

25. REMOVE CYLINDER HEAD

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

SST 09205-16010

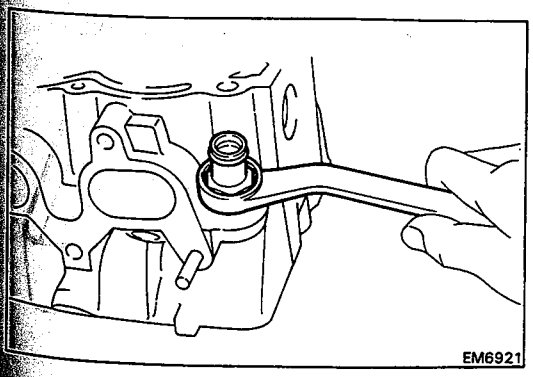
NOTICE: Head warpage or cracks could result from removing bolts in an incorrect order.


EM7609

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

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

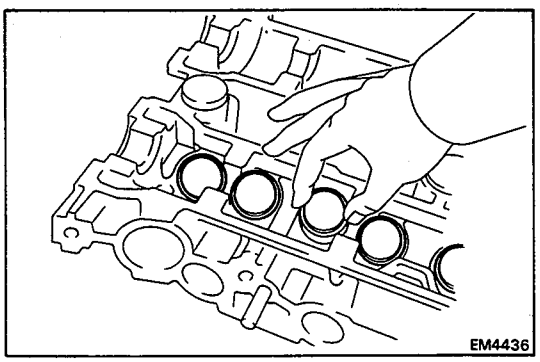
NOTICE: Be careful not to damage the cylinder head and cylinder block surfaces of the cylinder head gasket side.


EM6921

26. REMOVE ENGINE HANGERS

Remove the two bolts, ground strap and two engine hangers.

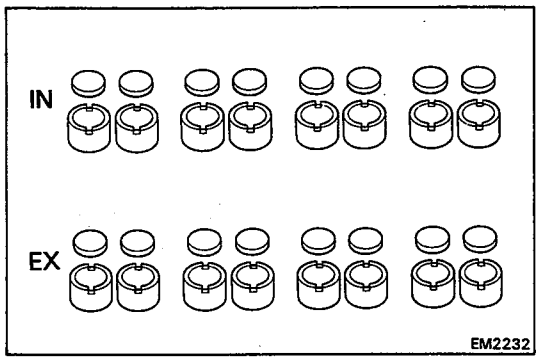
27. REMOVE UNION


EM4436

DISASSEMBLY OF CYLINDER HEAD

(See page EM-92)

1. REMOVE VALVE LIFTERS AND SHIMS



EM2232

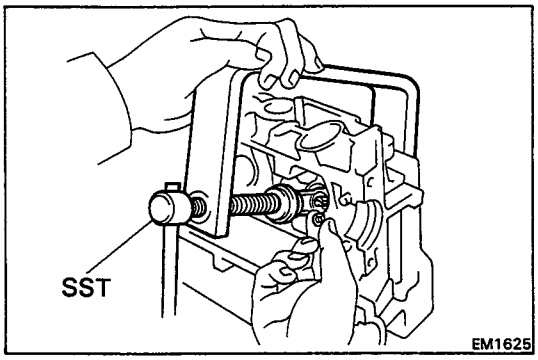
HINT: Arrange the valve lifters and shims in corre order.

2. REMOVE VALVES

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

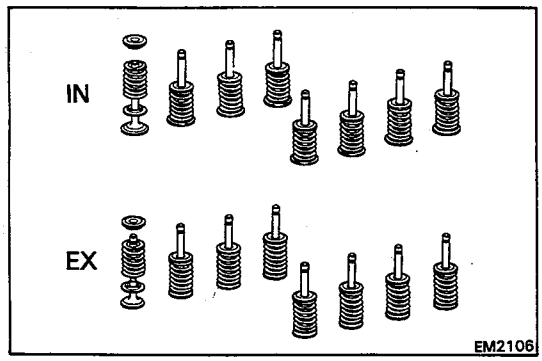
SST 09202-70010

(b) Remove the spring retainer, valve spring, valve an spring seat.



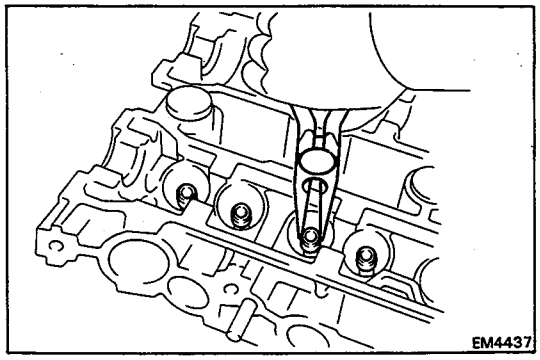
EM1625

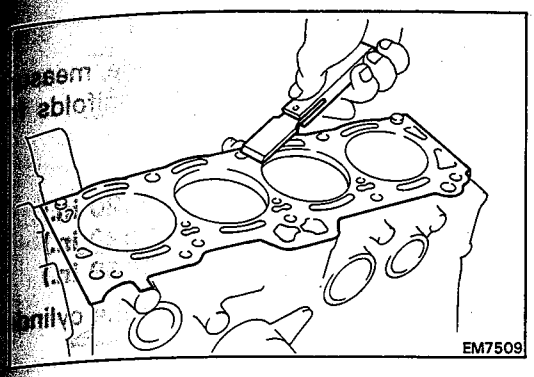
HINT: Arrange the valves, valve springs, spring seats an spring retainers in correct order.

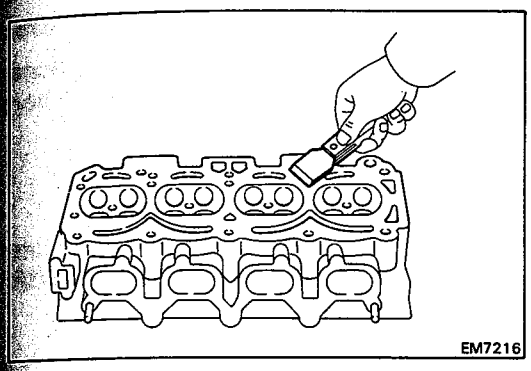


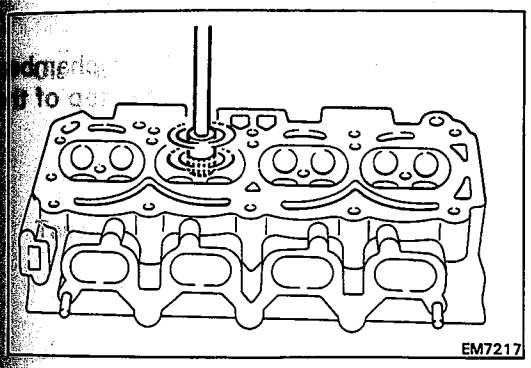
EM2106

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


EM4437


EM7509


EM7216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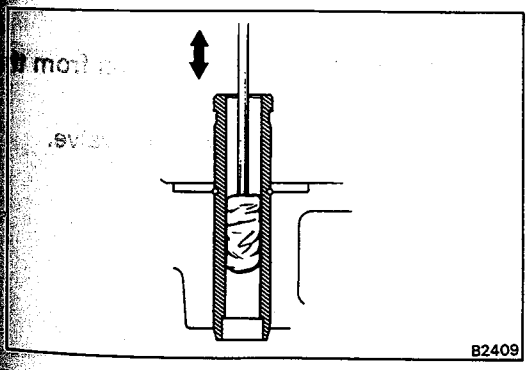
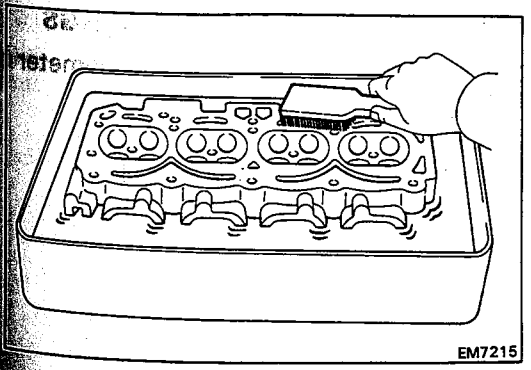

B2409


EM7215

INSPECTION, CLEANING AND REPAIR OF CYLINDER HEAD COMPONENTS

1. CLEAN TOP OF PISTONS AND TOP OF BLOCK

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

(b) Remove all the gasket material from the top of the cylinder block.

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

CAUTION: Protect your eyes when using high pressure air.

2. REMOVE GASKET MATERIAL

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

NOTICE: Be careful not scratch the surfaces.

3. CLEAN COMBUSTION CHAMBERS

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

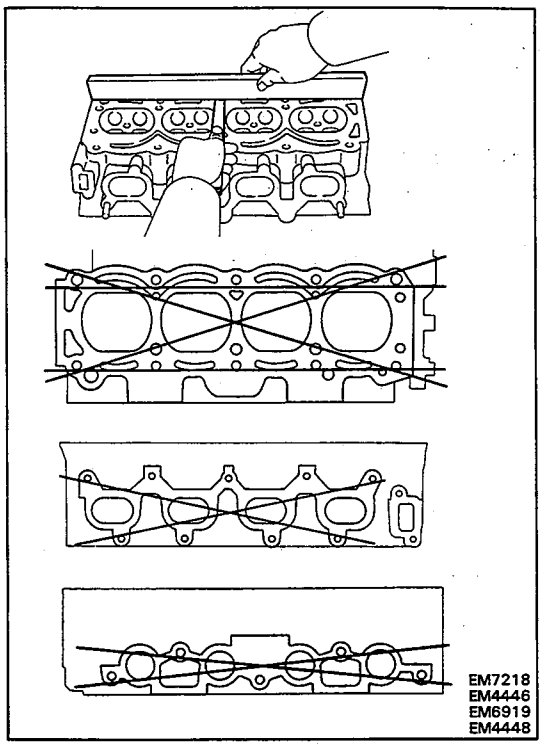
NOTICE: Be careful not to scratch the head gasket contact surface.

4. CLEAN VALVE GUIDE BUSHINGS

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

5. CLEAN CYLINDER HEAD

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



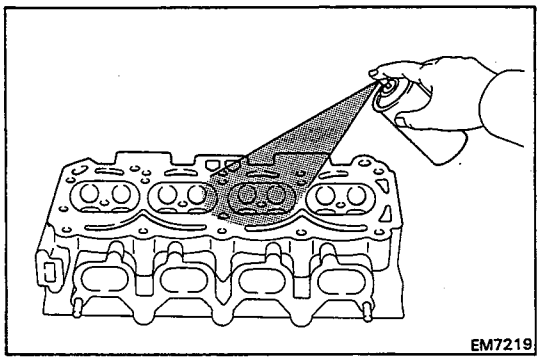
6. INSPECT CYLINDER HEAD FOR FLATNESS

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

Maximum warpage:

Cylinder block side	**0.05 mm (0.0020 in.)**
Intake manifold side	**0.05 mm (0.0020 in.)**
Exhaust manifold side	**0.10 mm (0.0039 in.)**

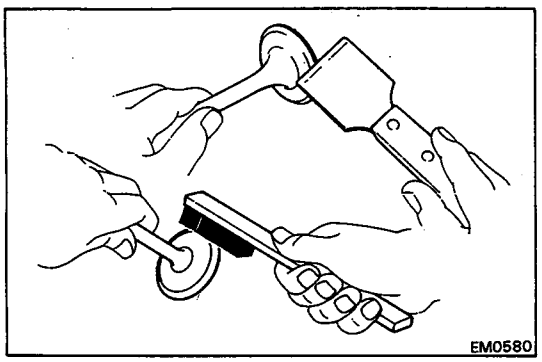
If warpage is greater than maximum, replace the cylind head.



7. INSPECT CYLINDER HEAD FOR CRACKS

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

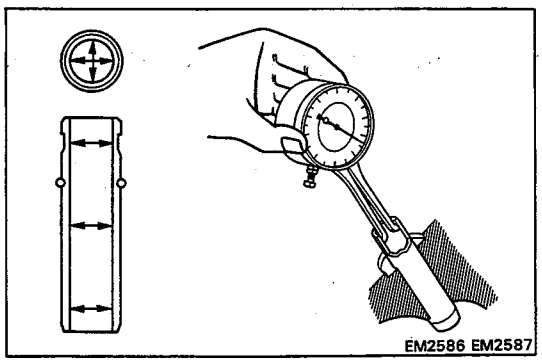
If cracked, replace the cylinder head.



8. CLEAN VALVES

(a) Using a gasket scraper, chip off any carbon from t valve head.

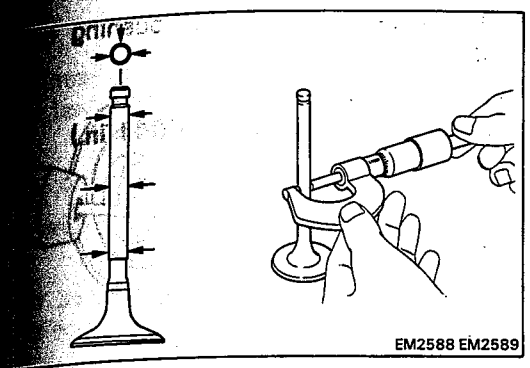
(b) Using a wire brush, thoroughly clean the valve.



9. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

Bushing inside diameter:
6.01 – 6.03 mm (0.2366 – 0.2374 in.)


EM2588 EM2589

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

Valve stem diameter:

Intake	**5.970 – 5.985 mm (0.2350 – 0.2356 in.)**
Exhaust	**5.965 – 5.980 mm (0.2348 – 0.2354 in.)**

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

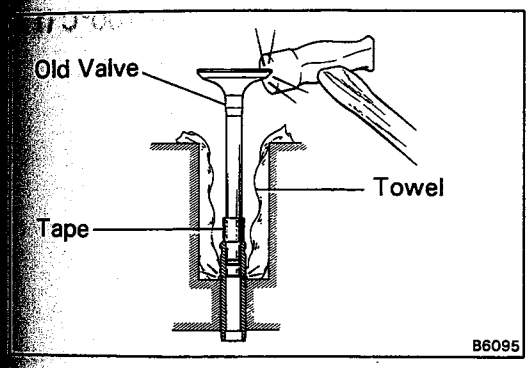
Standard oil clearance:

Intake	**0.025 – 0.060 mm (0.0010 – 0.0024 in.)**
Exhaust	**0.030 – 0.065 mm (0.0012 – 0.0026 in.)**

Maximum oil clearance:

Intake	**0.08 mm (0.0031 in.)**
Exhaust	**0.10 mm (0.0039 in.)**

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

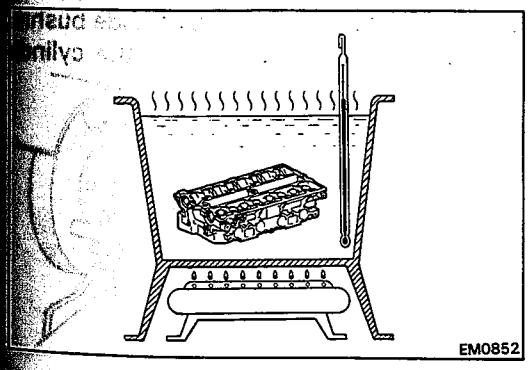


B6095

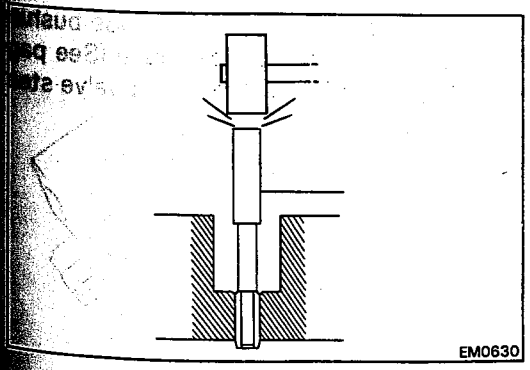
10. IF NECESSARY, REPLACE VALVE GUIDE BUSHINGS

(a) Insert an old valve wrapped with tape into the valve guide bushing, and break off the valve guide bushing by hitting it with a hammer.

NOTICE: Be careful not to damage the lifter hole.

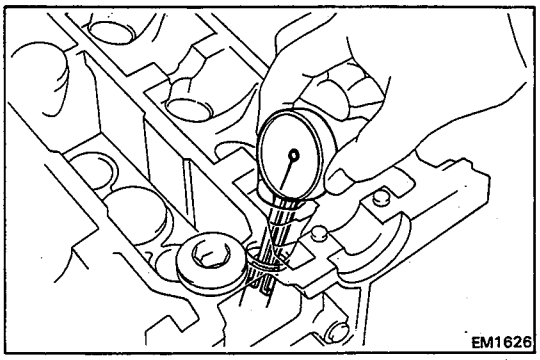

EM0852

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


EM0630

(c) Using SST and a hammer, tap out the guide bushing.

SST 09201-70010



(d) Using a caliper gauge, measure the bushing bo diameter of the cylinder head.

Standard valve guide bore (cold):
11.000 – 11.027 mm (0.4331 – 0.4341 in.)

Both intake and exhaust

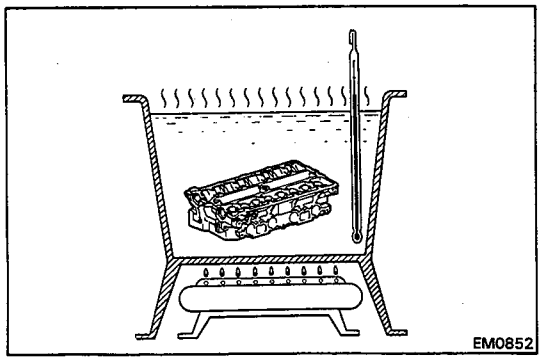
Bushing bore diameter mm (in.)	Bushing size
11.000 – 11.027 (0.4331 – 0.4341)	Used STD
11.050 – 11.077 (0.4350 – 0.4361)	Used O/S 0.05

(e) Select a new guide bushing (STD size or O/S 0.0

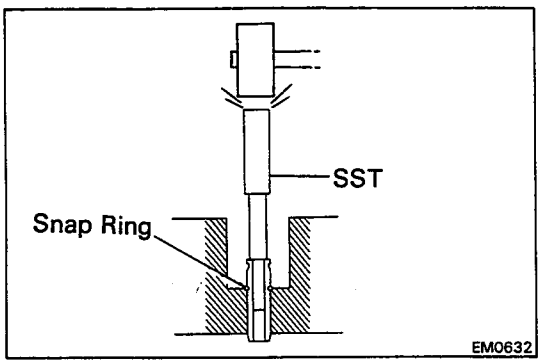
If the bushing bore diameter of the cylinder head is great than 11.027 mm (0.4341 in.), machine the bushing bo to the following dimension:

Rebored cylinder head bushing bore dimension:
11.050 – 11.077 mm (0.4350 – 0.4361 in.)

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

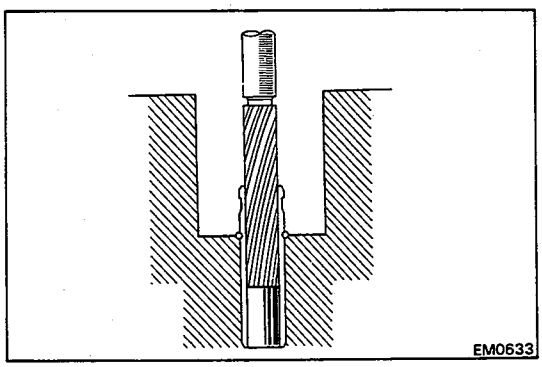


(f) Gradually heat the cylinder head to 80 – 100°C (1 – 212°F).

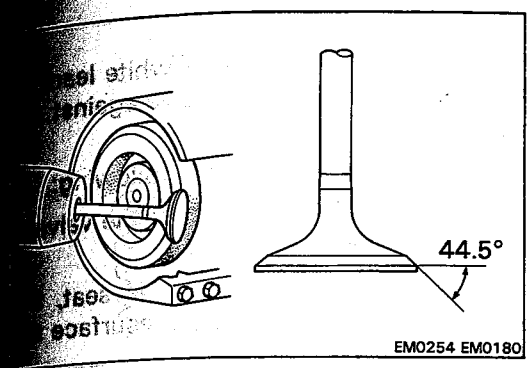


(g) Using SST and a hammer, tap in a new guide bushi until the snap ring makes contact with the cylin head.

SST 09201-70010



(h) Using a sharp 6 mm reamer, ream the guide bush to obtain the standard specified clearance (See pa EM-101) between the guide bushing and valve st

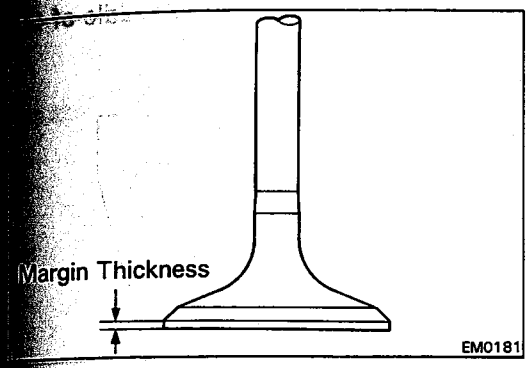


11. INSPECT AND GRIND VALVES

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

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

Valve face angle: 44.5°

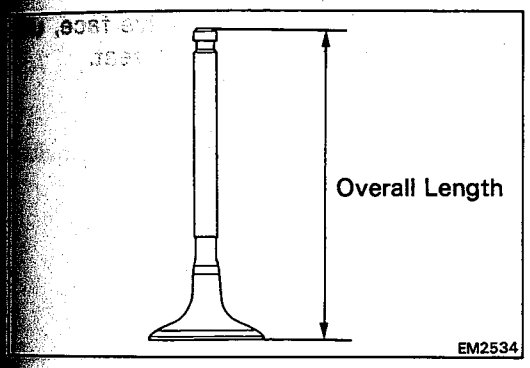


(c) Check the valve head margin thickness.

Standard margin thickness: 0.8 – 1.2 mm (0.031 – 0.047 in.)

Minimum margin thickness: 0.5 mm (0.020 in.)

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



(d) Check the valve overall length.

Standard overall length:

Intake 99.60 mm (3.9213 in.)

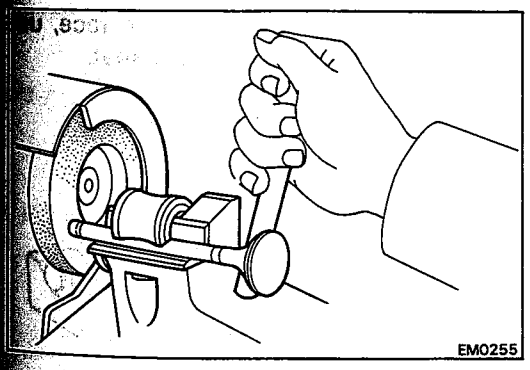
Exhaust 99.75 mm (3.9272 in.)

Minimum overall length:

Intake 99.10 mm (3.9016 in.)

Exhaust 99.25 mm (3.9075 in.)

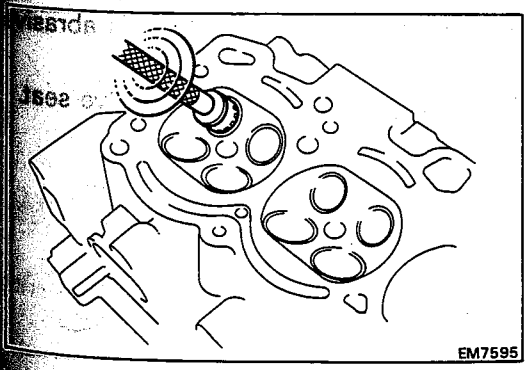
If the overall length is less than minimum, replace the valve.



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

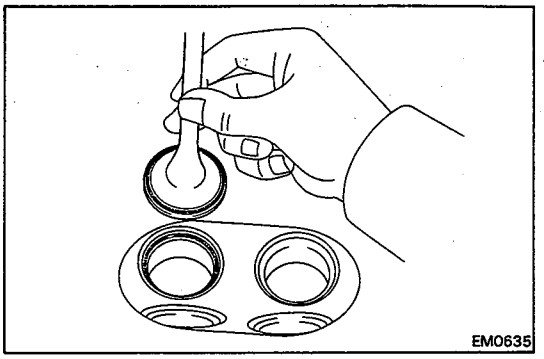
If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

NOTICE: 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.

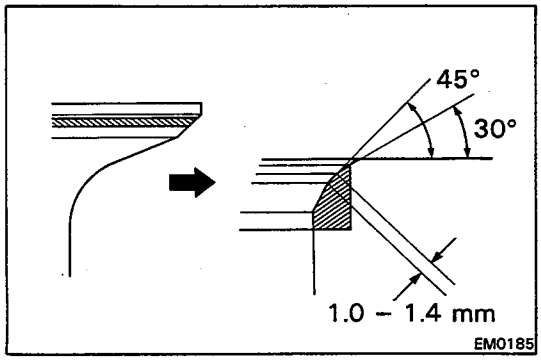
Apply a thin coat of prussian blue (or white lead) t the valve face. Lightly press to the valve against th seat. Do not rotate the valve.

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

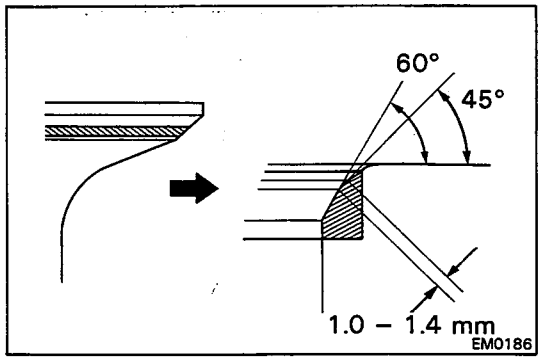
- If blue appears 360° around the face, the valve concentric. If not, replace the valve.
- If blue appears 360° around the valve seat, th guide and seat are concentric. If not, resurface th seat.
- Check that the seat contact is in the middle of th valve face with the following width.

1.0 – 1.4 mm (0.039 – 0.055 in.)

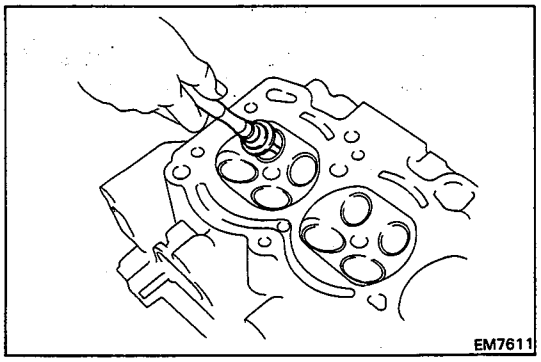
If not, correct the valve seats as follows:



(1) If the seating is too high on the valve face, us 30° and 45° cutters to correct the seat.

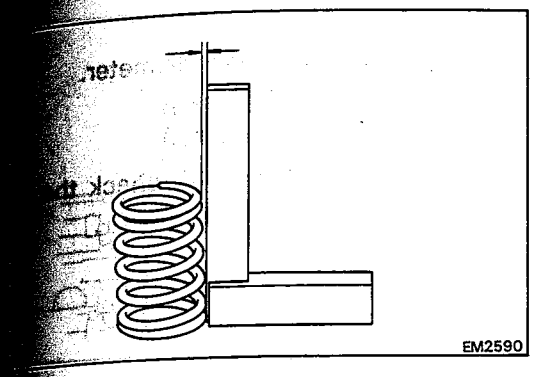


(2) If the seating is too low on the valve face, us 60° and 45° cutters to correct the seat.



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

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

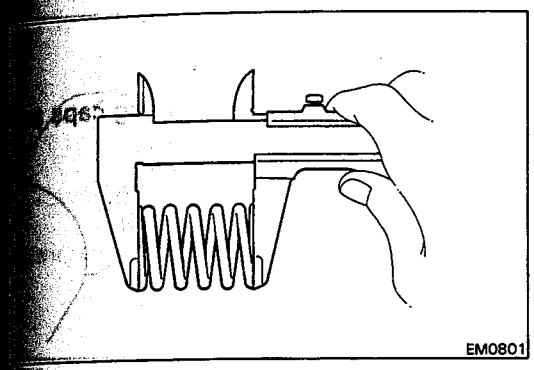

EM2590

13. INSPECT VALVE SPRINGS

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

Maximum squareness: 1.8 mm (0.071 in.)

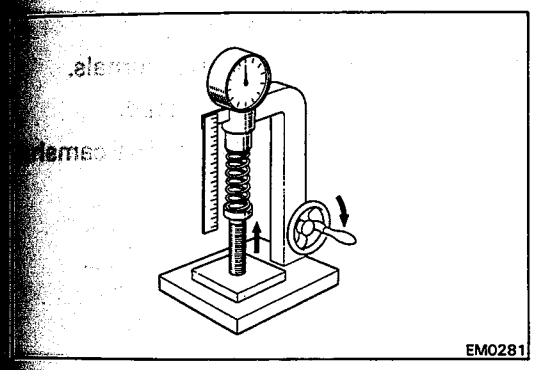
If squareness is greater maximum, replace the valve spring.


EM0801

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

Free length: 41.09 mm (1.6177 in.)

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


EM0281

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

Installed tension:
14.6 — 15.8 kg (32.3 — 34.8 lb, 143 — 155 N) at 34.7 mm (1.366 in.)

If the tension is less than minimum, replace the valve spring.

14. INSPECT CAMSHAFTS AND BEARINGS

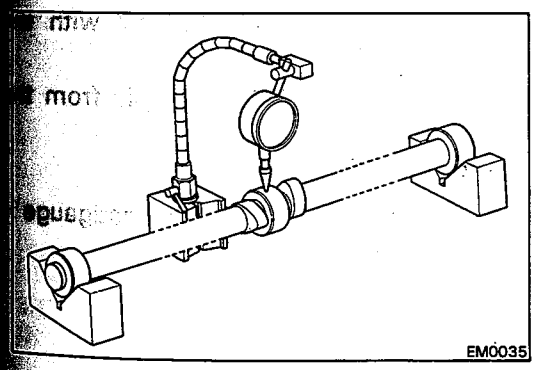
A. Inspect camshaft for runout

(a) Place the camshaft on V-blocks.

(b) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout: 0.04 mm (0.0016 in)

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

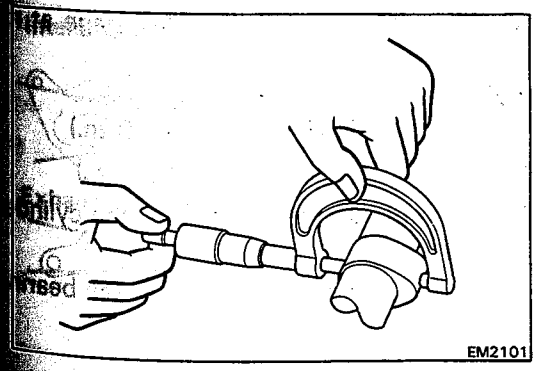

EM0035

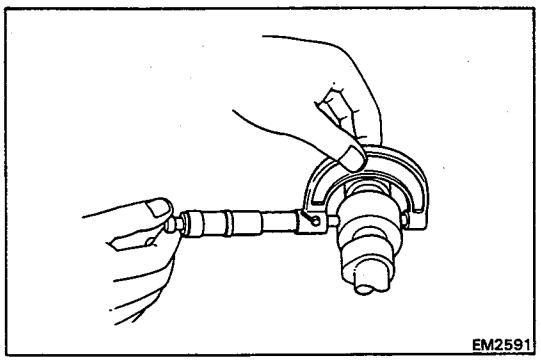
B. Inspect cam lobes

Using a micrometer, measure the cam lobe height.

Standard cam lobe height: 35.410 — 35.510 mm (1.3941 — 1.3980 in.)
Minimum cam lobe height: 35.11 mm (1.3823 in.)

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


EM2101

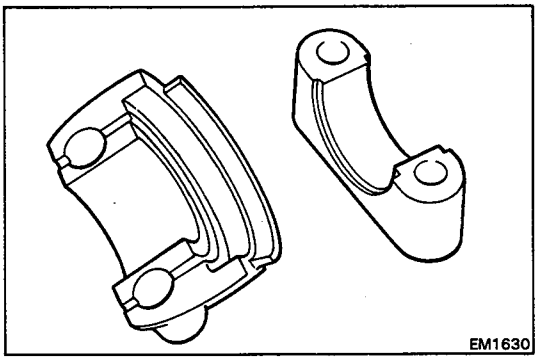

EM2591

C. Inspect camshaft journals

Using a micrometer, measure the journal diameter.

Journal diameter: 26.949 – 26.965 mm (1.0610 – 10.616 in.)

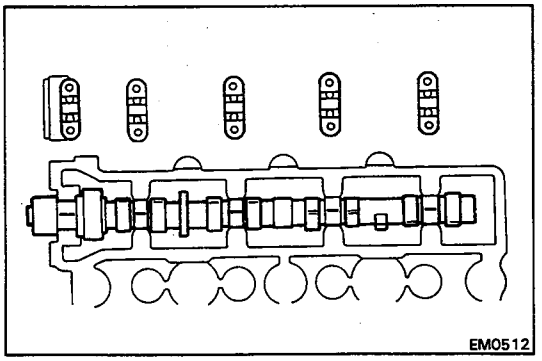
If the journal diameter is not as specified, check the clearance.


EM1630

D. Inspect camshaft bearings

Check the bearings for flaking and scoring.

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

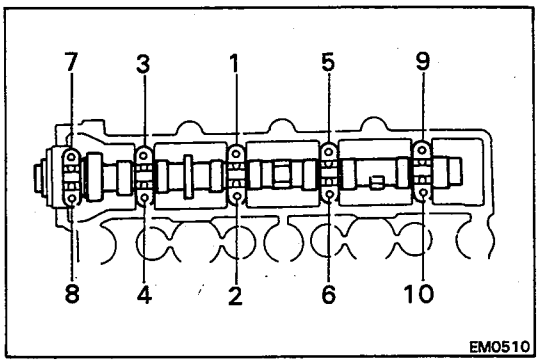

EM0512

E. Inspect camshaft journal oil clearance

(a) Clean the bearing caps and camshaft journals.

(b) Place the camshafts on the cylinder head.

(c) Lay a strip of Plastigage across each of the camsh journal.



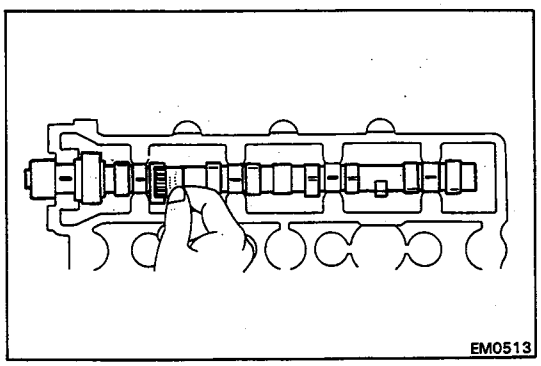
EM0510

(d) Place the bearing caps on each journal with t arrows pointing toward the front.

(e) Install and torque the cap bolts gradually from t inside in three passes.

Torque: 130 kg-cm (9 ft-lb, 13 N·m)

HINT: Do not turn the camshaft while the Plastigauge in place.


EM0513

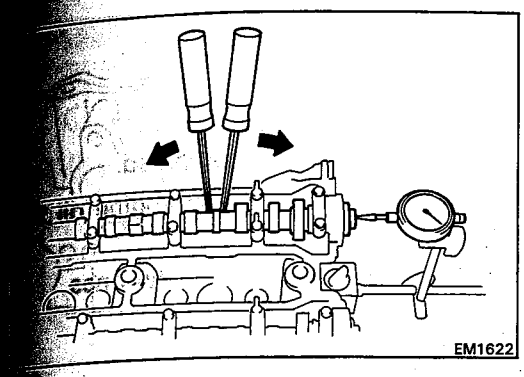
(f) Remove the caps and measure the Plastigage at widest point.

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

Maximum oil clearance: 0.10 mm (0.0039 in.)

If clearance is greater than maximum, replace the cylin head and/or camshaft.

(g) Clean out the pieces of Plastigauge from the bear caps and journals.


EM1622

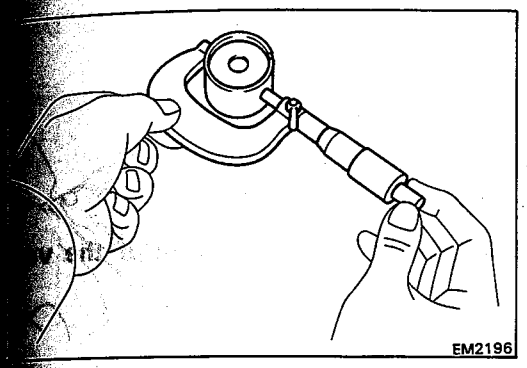
F. Inspect camshaft thrust clearance

(a) Install the camshafts.
(See step 5 on pages EM-110 and 111)

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

Standard thrust clearance: 0.080 — 0.190 mm (0.0031 — 0.0075 in.)
Maximum thrust clearance: 0.25 mm (0.0098 in.)

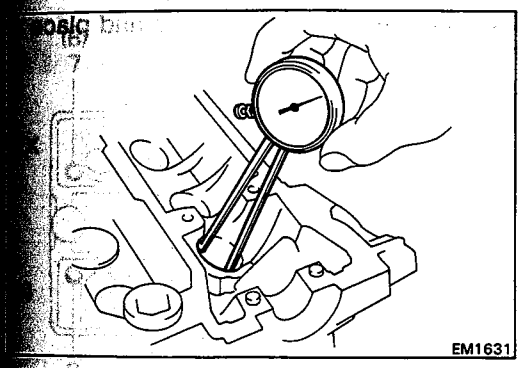
If the thrust clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.


EM2196

15. INSPECT VALVE LIFTERS AND LIFTER BORES

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

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


EM1631

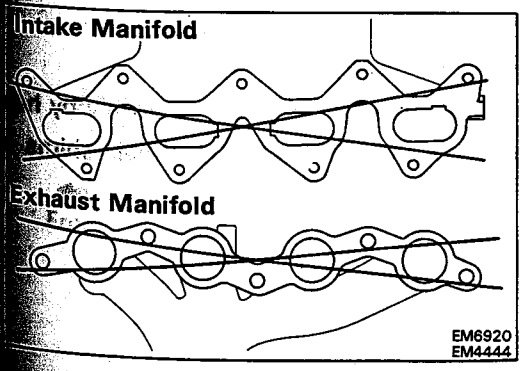
(b) Using a caliper gauge, measure the lifter bore diameter of the cylinder head.

Lifter bore diameter: 28.000 — 28.021 mm (1.1024 — 1.1032 in.)

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

Standard oil clearance: 0.015 — 0.046 mm (0.0006 — 0.0018 in.)
Maximum oil clearance: 0.07 mm (0.0028 in.)

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



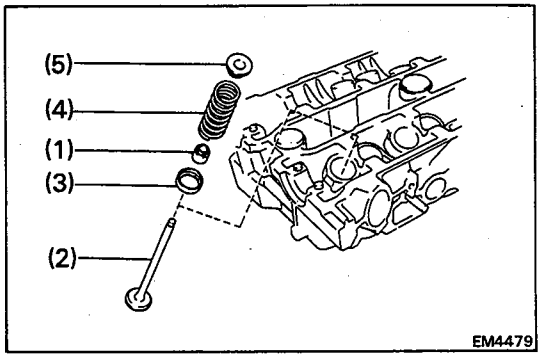
EM6920
EM4444

16. INSPECT INTAKE AND EXHAUST MANIFOLDS

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

Maximum warpage:
Intake manifold 0.05 mm (0.0020 in.)
Exhaust manifold 0.30 mm (0.0118 in.)

If warpage is greater maximum, replace the manifold.



ASSEMBLY OF CYLINDER HEAD

(See page EM-92)

HINT:

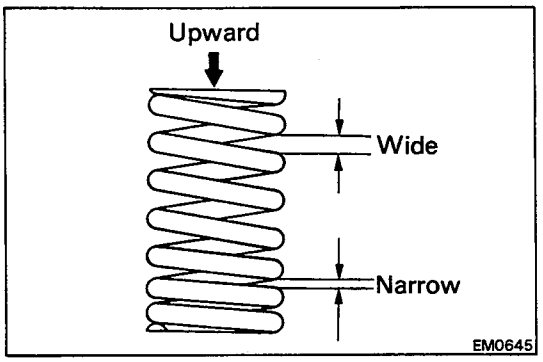
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to sliding and rotating surfaces.
- Replace all gaskets and oil seals with new ones.

1. INSTALL VALVES

(a) Install the following parts:

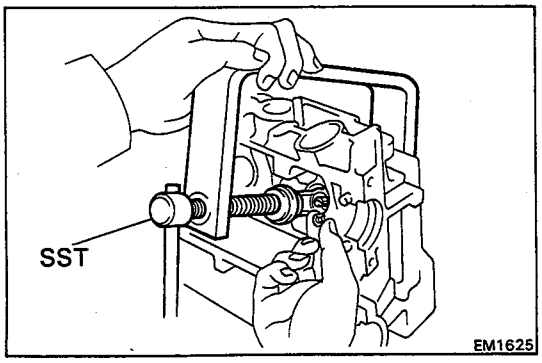
(1) New oil seal
(2) Valve
(3) Spring seat
(4) Valve spring
(5) Spring retainer

NOTICE: Confirm the correct direction of the va spring.

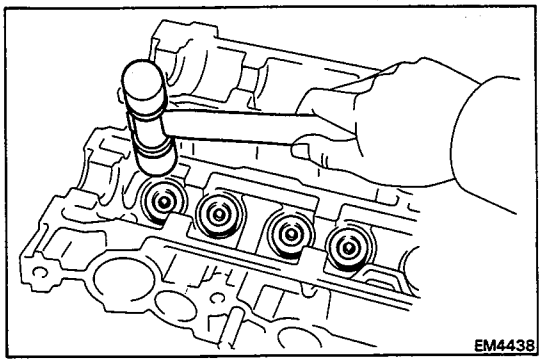


(b) Using SST, compress the valve spring and place two keepers around the valve stem.

SST 09202-70010



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

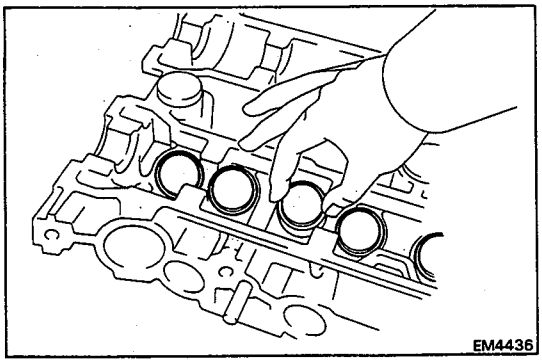


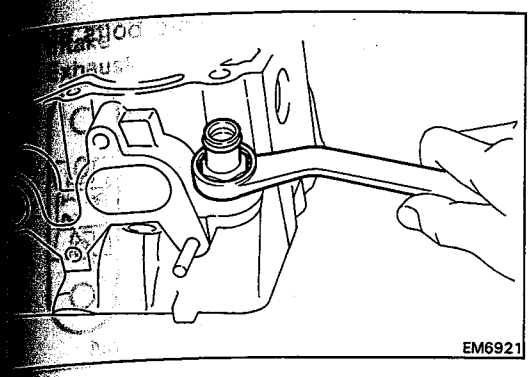
2. INSTALL VALVE LIFTERS AND SHIMS

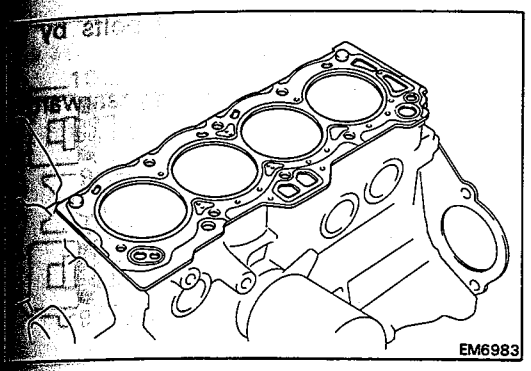
(a) Install the valve lifter and shim.

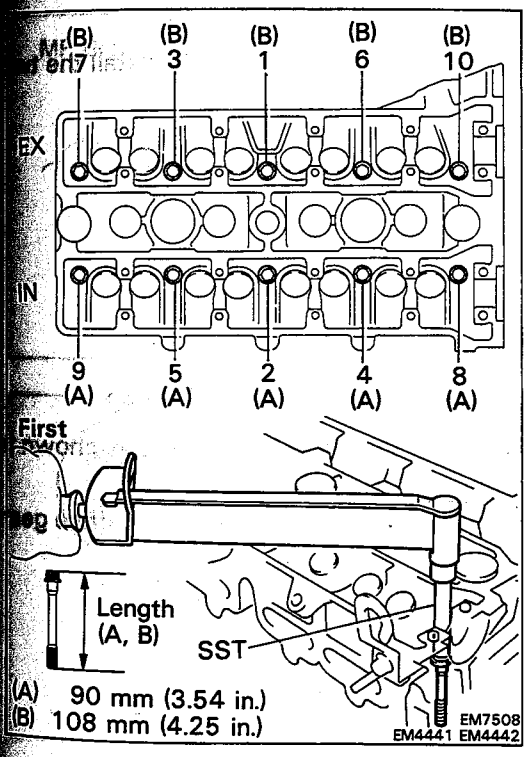
(b) Check that the valve lifter rotates smoothly by h

HINT: Make sure the valve lifters with their shims installed in the correct order.

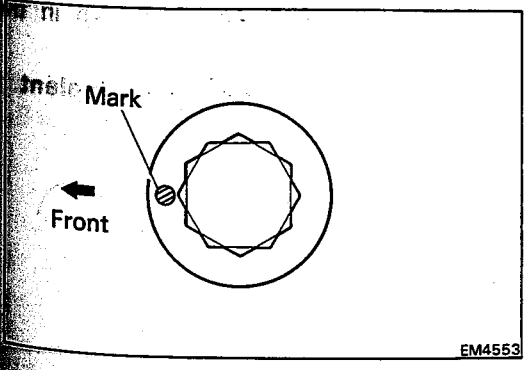



EM6921


EM6983



EM7508 EM4441 EM4442



EM4553

INSTALLATION OF CYLINDER HEAD

(See page EM-92)

1. INSTALL UNION

(a) Apply adhesive to two or three threads.

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

(b) Install and torque the union.

Torque: 300 kg-cm (22 ft-lb, 29 N·m)

2. INSTALL ENGINE HANGERS

Install the two engine hangers and ground strap with the two bolts.

Torque: 250 kg-cm (18 ft-lb, 25 N·m)

3. INSTALL CYLINDER HEAD

HINT:

- The cylinder head bolts are tighten in three progressive steps.
- If any of bolts break or defrom, replace them.

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

NOTICE: Be careful of the installation direction.

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

HINT: Apply a light coating of engine oil on the bolt threads and under the bolt head before installing.

(c) First, using SST, install and uniformly tighten the ten cylinder head bolts in several passes in the sequence shown.

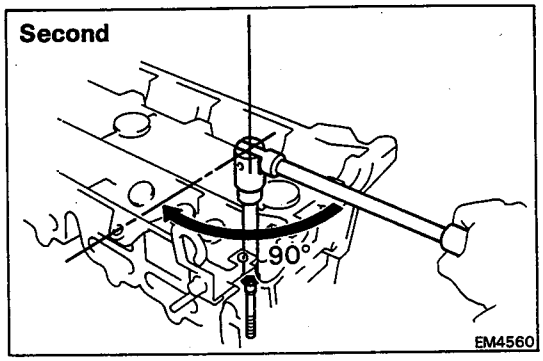
SST 09205-16010

Torque: 300 kg-cm (22 ft-lb, 29 N·m)

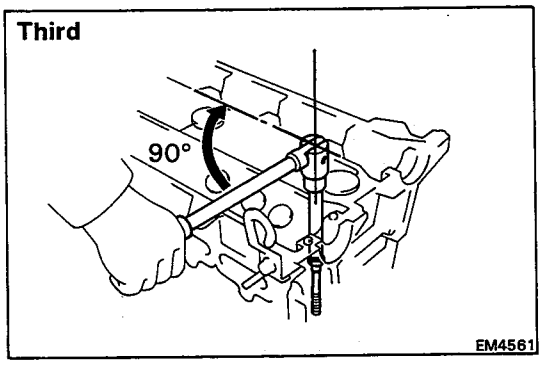
HINT: Each bolt length is indicated in the illustration.

If any one of the bolts dose not meet the torque specification, replace the bolt.

(d) Mark the front of the cylinder head bolt head with paint.

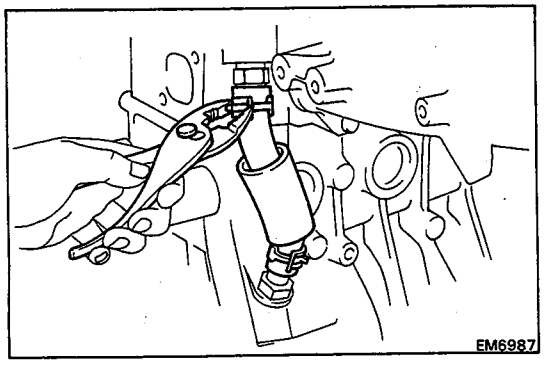


(e) Second, retighten the ten cylinder head bolts 90° the numerical order shown.



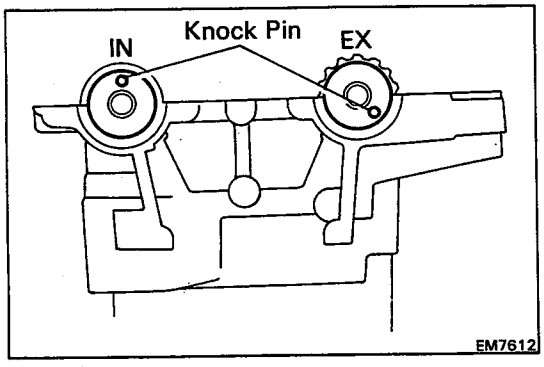
(f) Third, retighten the ten cylinder head bolts by additional 90°.

(g) Check that the paint mark is now facing rearward



4. INSTALL NO.2 PCV HOSE

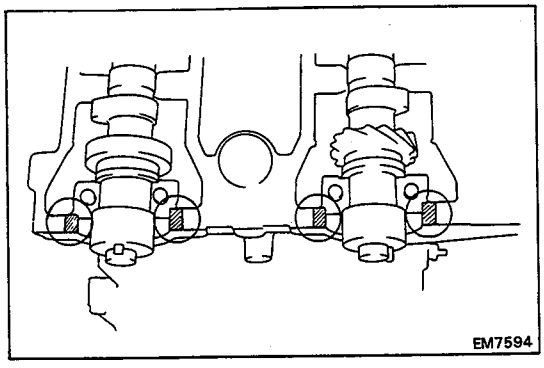
Connect the PCV hose to the cylinder head. Install the clamps.



5. INSTALL CAMSHAFTS AND BEARING CAPS

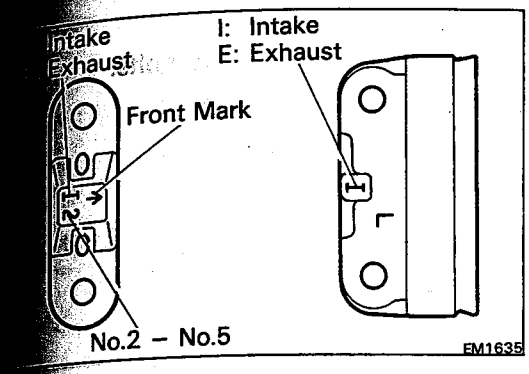
(a) Place the camshaft on the cylinder head as show the illustration.

HINT: The exhaust camshaft has a distributor drive g

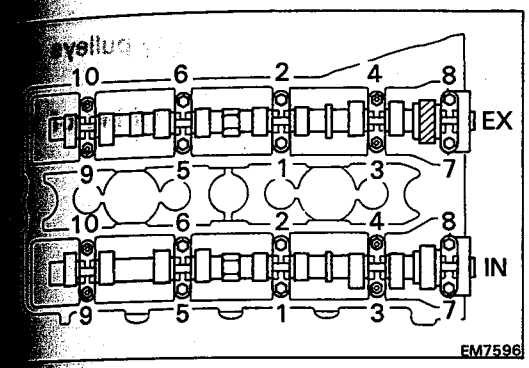


(b) Apply seal packing to the head as shown in illustration.

Seal packing: Part No.08826-00080 or equivale



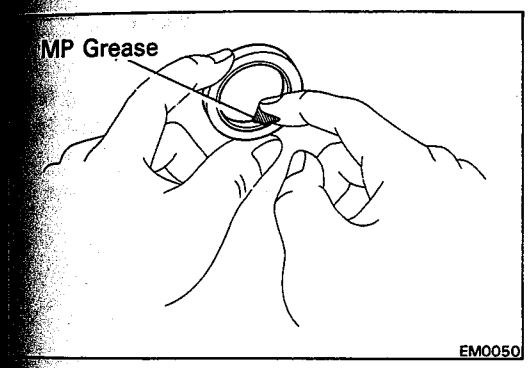
(c) Install the bearing caps in their proper locations.



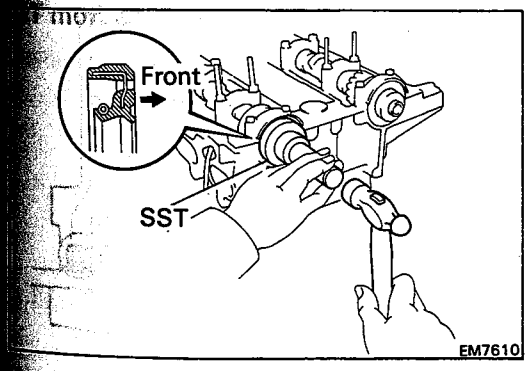
(d) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

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

Torque: 130 kg-cm (9 ft-lb, 13 N·m)



(f) Apply MP grease to new camshaft oil seals lip.

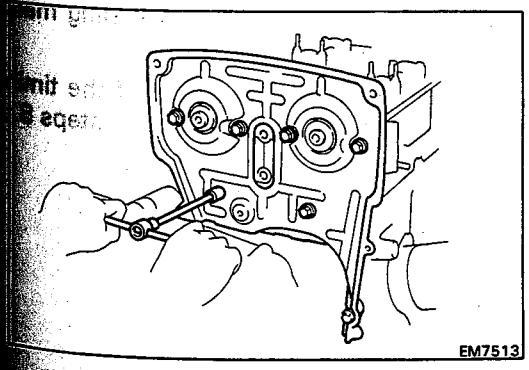


(g) Using SST, tap in new camshaft oil seals.

SST 09223-50010

HINT:

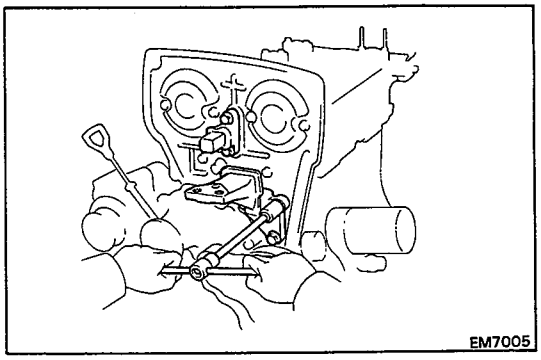
- Do not install the oil seal with the lip facing the wrong direction.
- Insert the oil seal into the deepest part of the cylinder head.



6. INSTALL NO.4 TIMING BELT COVER

Install the belt cover with the seven bolts.

Torque: 95 kg-cm (82 in-lb, 9.3 N·m)


EM7005

7. INSTALL RH MOUNTING BRACKETS

(a) Install the No.2 bracket with the two bolts.

Torque: 210 kg-cm (15 ft-lb, 21 N·m)

(b) Install the bracket with the three bolts.

Torque: 400 kg-cm (29 ft-lb, 39 N·m)

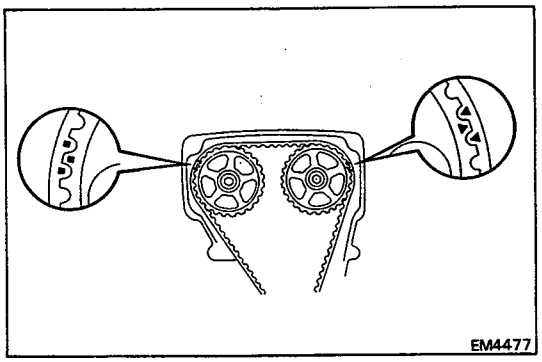
8. INSTALL CAMSHAFT TIMING PULLEYS (See step 1 on page EM-52)

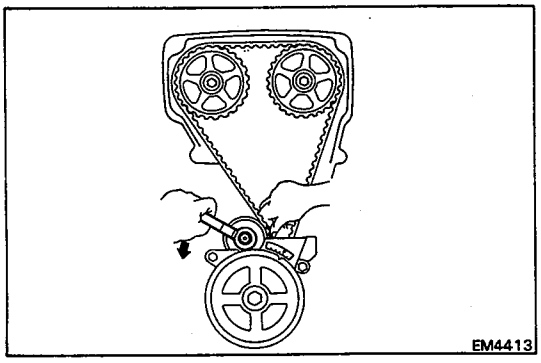
Torque: 600 kg-cm (43 ft-lb, 59 N·m)

9. INSTALL TIMING BELT

Align the matchmarks of the camshaft timing pulleys a timing belt, and install the timing belt.

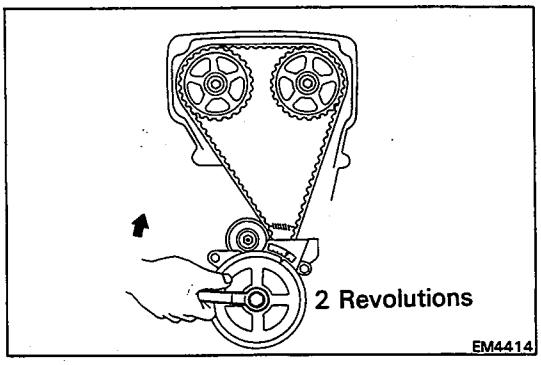
NOTICE: Be careful not to shift the meshing of t crankshaft timing pulley and timing belt.


EM4477


EM4413

10. CHECK VALVE TIMING AND TIMING BELT TENSION

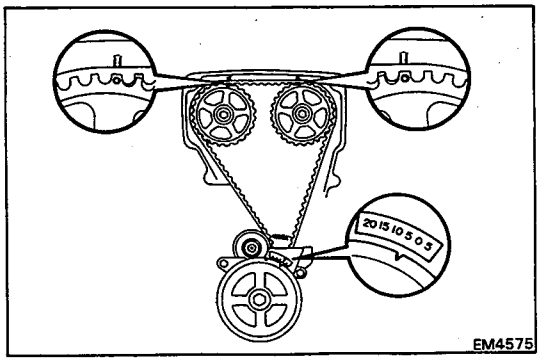
(a) Slowly loosen the idler pulley bolt.



EM4414

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

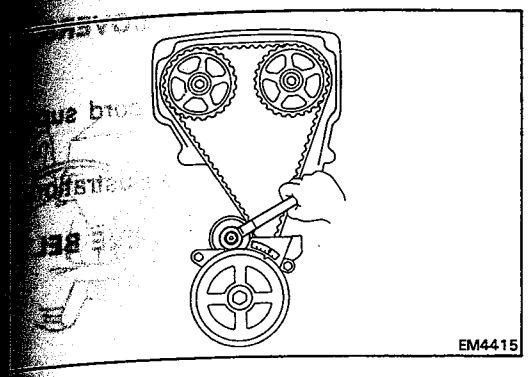
HINT: Always turn the crankshaft clockwise.



EM4575

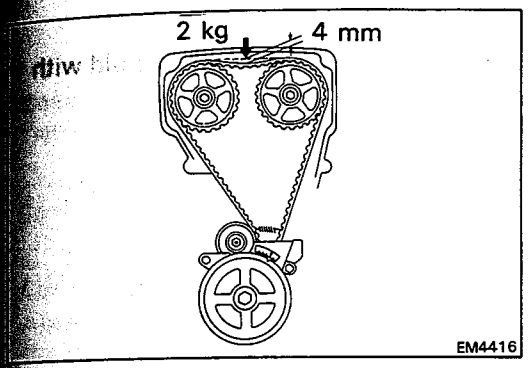
(c) Check that each pulley aligns with the timing ma as shown in the illustration.

If the marks do not align, shift the meshing of the tim belt and timing pulley and readjust according to steps 10.


EM4415

(d) Torque the idler pulley bolt.

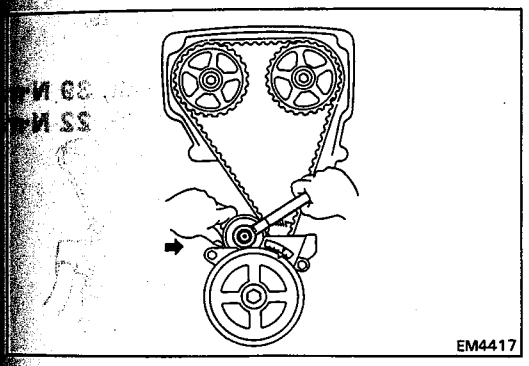
Torque: 375 kg-cm (27 ft-lb, 37 N·m)



EM4416

(e) Check that there is belt deflection at the position indicated in the illustration.

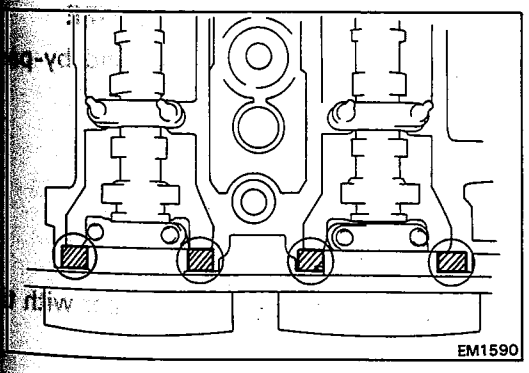
Deflection: 4 mm (0.16 in.)
at 2 kg (4.4 lb, 20 N)


EM4417

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

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

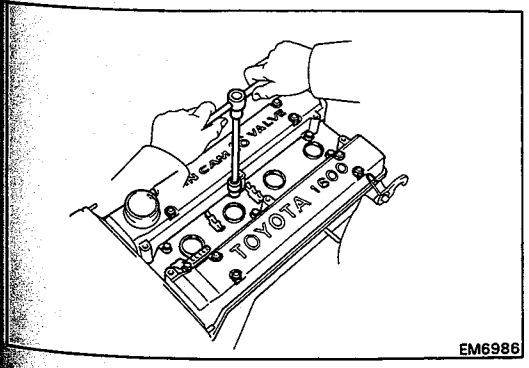
Torque: 180 kg-cm (13 ft-lb, 18 N·m)


EM1590

12. INSTALL CYLINDER HEAD COVERS

(a) Apply seal packing to the cylinder head as shown in the illustration.

Seal packing: Part No.08826-00080 or equivalent



EM6986

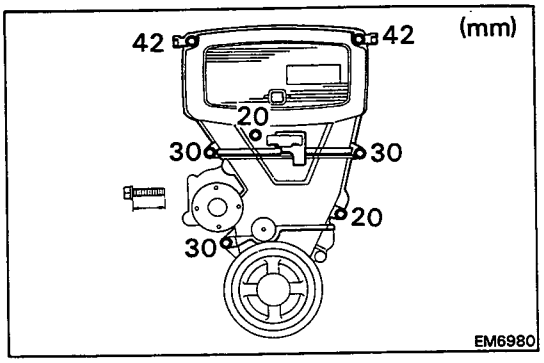
(b) Install the gaskets to the head covers.

(c) Install the two head covers with the four seal washers and cap nuts.

Torque: 80 kg-cm (5.8 ft-lb, 7.8 N·m)

(d) Install the gasket to the center cover.

(e) Install the center cover with the six bolts.



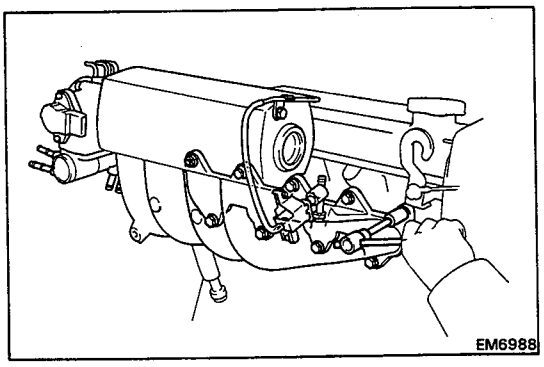
13. INSTALL NO.2 AND NO.3 TIMING BELT COVERS

(a) Install the gaskets to the belt covers.

(b) Install the No.2, No.3 belt covers and cord supp plate with the seven bolts.

HINT: Each bolt length is indicated in the illustration.

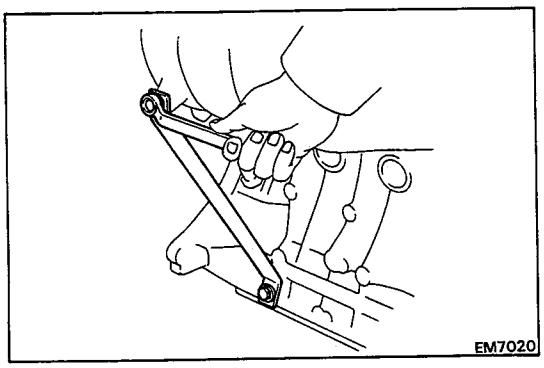
14. INSTALL WATER PUMP PULLEY AND DRIVE BELT



15. INSTALL INTAKE MANIFOLD

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

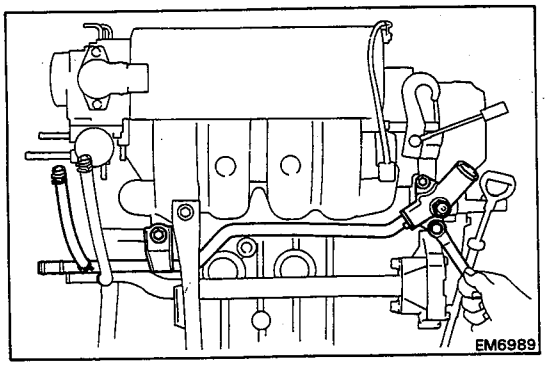
Torque: 280 kg-cm (20 ft-lb, 27 N·m)



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

Torque:
14 mm bolt head 400 kg-cm (29 ft-lb, 39 N·
12 mm bolt head 220 kg-cm (16 ft-lb, 22 N·

16. INSTALL WATER INLET PIPE
(See step 3 on page CO-11)



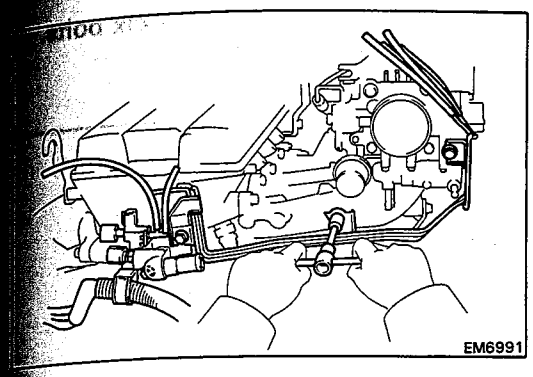
17. INSTALL WATER OUTLET AND BY-PASS PIPE

(a) Install a new gasket, the water outlet and by-p pipe assembly with the three bolts.

Torque:
Cylinder head side
280 kg-cm (20 ft-lb, 27 N·m)
Intake manifold side
130 kg-cm (9 ft-lb, 13 N·m)

(b) Install the alternator drive belt adjusting bar with three bolts.

Torque: 185 kg-cm (13 ft-lb, 18 N·m)



18. INSTALL CYLINDER HEAD REAR COVER AND VACUUM PIPE (w/ EGR SYSTEM)

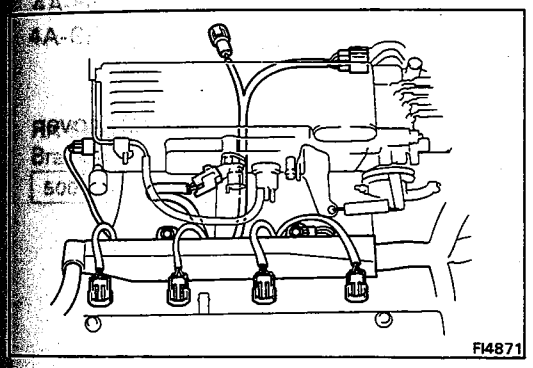
(a) (w/o EGR system)
Install a new gasket and rear cover with the two bolts.

(b) (w/ EGR system)
Install a new gasket, rear cover and vacuum pipe with the four bolts.

(c) (w/ EGR system)
Connect the vacuum hoses.

(d) Connect the following connectors:

- Start injector time switch connector
- Water temp. sensor connector
- (w/ EGR system)
  EGR VSV connector



19. CONNECT ENGINE WIRE TO INTAKE MANIFOLD

(a) Connect the engine wire to the intake manifold with the two bolts.

(b) Connect the following connectors:

- (Europe)
  Fuel pressure VSV connector
- Cold start injector connector
- Throttle position sensor connector
- Knock sensor connector

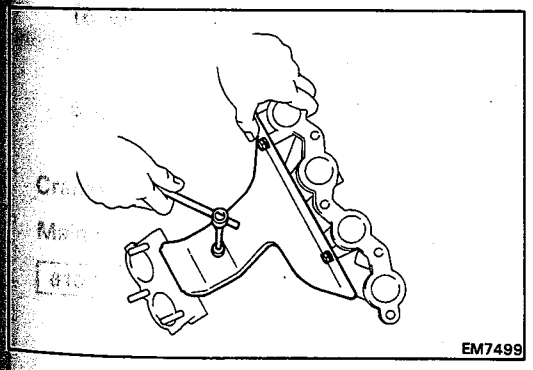
20. INSTALL INJECTOR AND DELIVERY PIPE
(See steps 1 and 3 to 6 on pages FI-116 to 119)

21. INSTALL COLD START INJECTOR PIPE
(See step 2 on page FI-108)

22. INSTALL PCV HOSE

23. INSTALL EXHAUST MANIFOLD

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

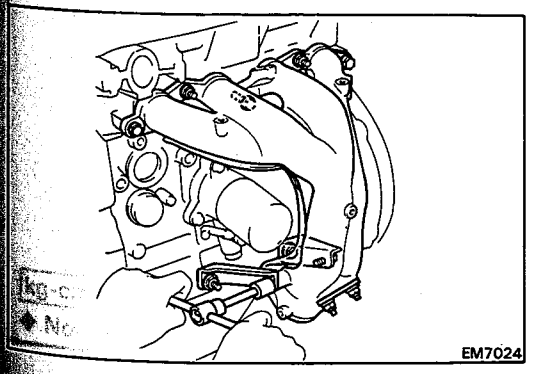


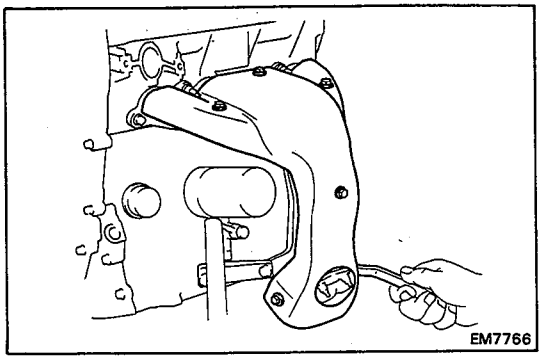
(b) Install a new gasket and the manifold with the three bolts and two nuts.

Torque: 250 kg-cm (18 ft-lb, 25 N·m)

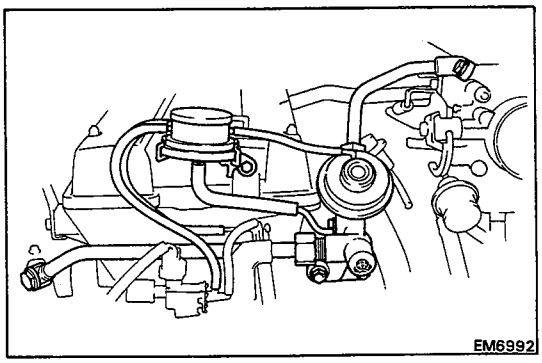
(c) Install the RH and LH manifold stay with the three bolts and nut.

Torque: 400 kg-cm (29 ft-lb, 39 N·m)





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



24. (w/ EGR SYSTEM) INSTALL EGR VALVE AND MODULATOR

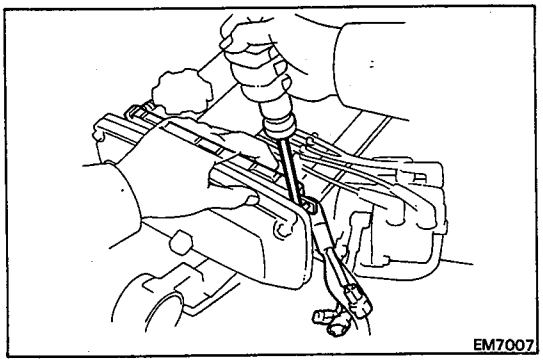
(a) Install a new gasket, the EGR valve and pipes assembly with the four bolts.

Torque:

Union bolt	**700 kg-cm (51 ft-lb, 69 N·m)**
Bolt	**190 kg-cm (14 ft-lb, 19 N·m)**

(b) Install the EGR vacuum modulator with the bolt.

(c) Install the vacuum hoses.



25. INSTALL DISTRIBUTOR (See page IG-19)

26. CONNECT ENGINE WIRE TO NO.4 TIMING BELT COVER

(a) Connect the engine wire to the timing belt cover.

(b) Connect the following connectors:

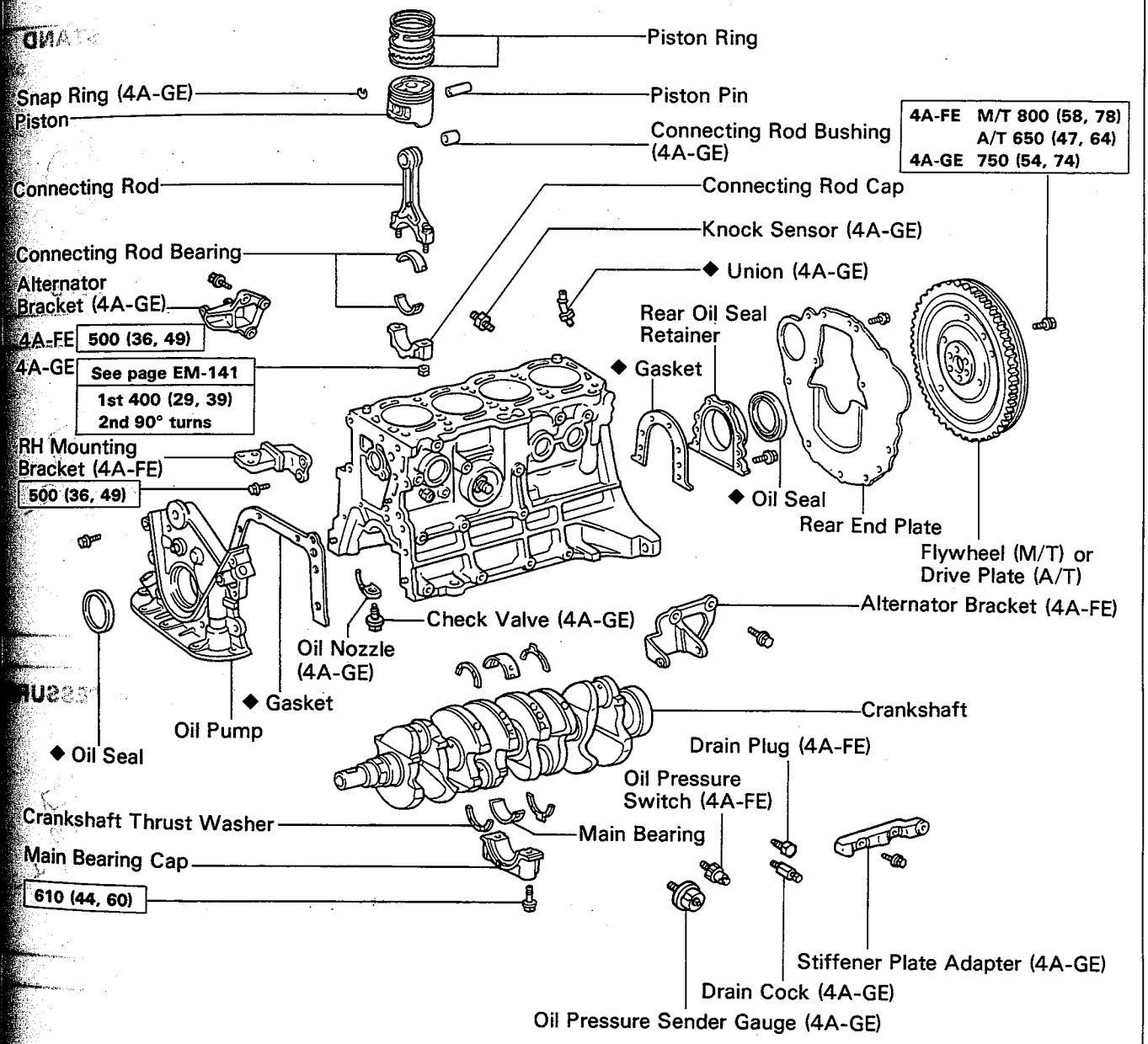
- Oil pressure sender gauge connector
- Distributor wire connectors

27. FILL WITH ENGINE COOLANT (See page CO-5)

Capacity (w/ Heater):
6.0 liters (6.3 US qts, 5.3 Imp. qts)

CYLINDER BLOCK

COMPONENTS

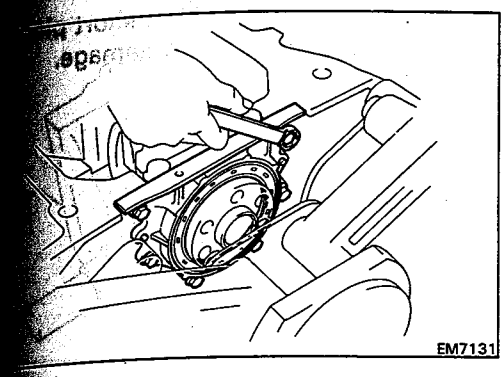


kg-cm (ft-lb, N·m) : Specified torque
◆ Non-reusable part

EM7519

PREPARATION FOR DISASSEMBLY

1. (M/T)
   REMOVE CLUTCH COVER AND DISC
2. (M/T)
   REMOVE FLYWHEEL
3. (A/T)
   REMOVE DRIVE PLATE
4. REMOVE REAR END PLATE
5. INSTALL ENGINE ASSEMBLY TO ENGINE STAND
   FOR DISASSEMBLY
6. REMOVE IIA OR DISTRIBUTOR
7. REMOVE ALTERNATOR AND BRACKET
8. (4A-FE)
   REMOVE RH MOUNTING BRACKET
9. REMOVE TIMING BELT AND TIMING PULLEYS
   4A-FE (See page EM-39)
   4A-GE (See page EM-47)
10. REMOVE CYLINDER HEAD
    4A-FE (See pages EM-56, 57)
    4A-GE (See page EM-92)
11. REMOVE WATER PUMP (See page CO-4)
12. REMOVE OIL PAN AND OIL PUMP
    (See page LU-9)
13. REMOVE OIL FILTER BRACKET
    (See page LU-17)
14. REMOVE OIL PRESSURE SWITCH OR OIL PESSU
    SENDER GAUGE
    (See page LU-6)
15. (4A-GE)
    REMOVE KNOCK SENSOR
16. (4A-GE)
    REMOVE STIFFENER PLATE ADAPTER

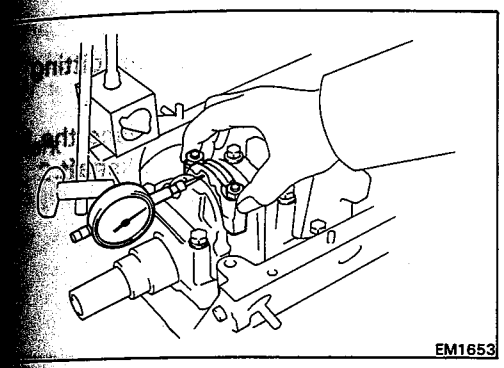

EM7131

DISASSEMBLY OF CYLINDER BLOCK

(See page EM-117)

1. REMOVE REAR OIL SEAL RETAINER

Remove the six bolts, retainer and gasket.


EM1653

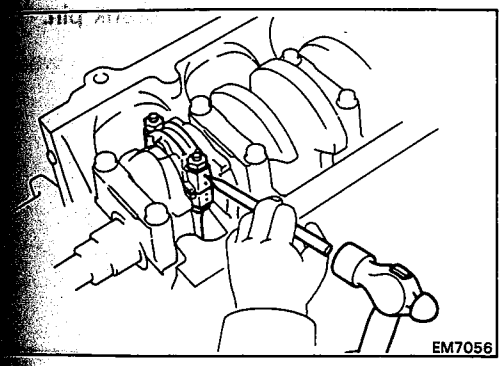
2. CHECK CONNECTING ROD THRUST CLEARANCE

Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.

Standard thrust clearance: 0.150 — 0.250 mm (0.0059 — 0.0098 in.)

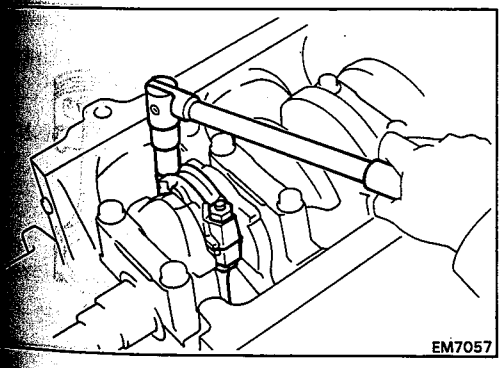
Maximum thrust clearance: 0.30 mm (0.0118 in.)

If the thrust clearance is greater than maximum, replace the connecting rod assembly. If necessary, replace the crankshaft.

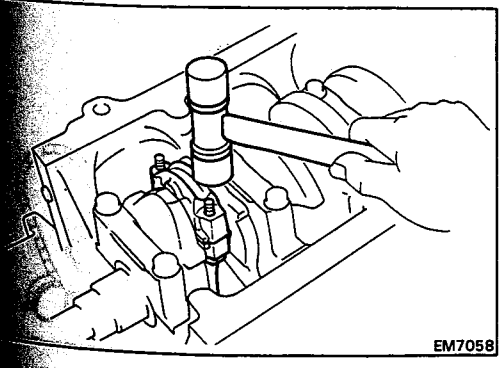

EM7056

3. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE

(a) Using a punch or numbering stamp, place the matchmarks on the connecting rod and cap to ensure correct reassembly.

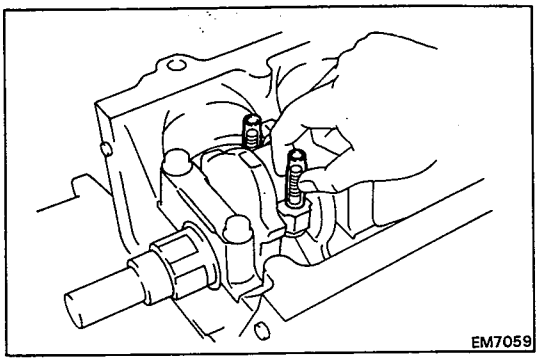

EM7057

(b) Remove the connecting rod cap nuts.

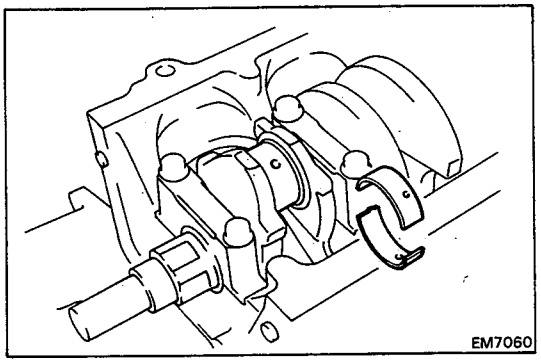

EM7058

(c) Using a plastic-faced hammer, lightly tap the connecting rod bolts and lift off the connecting rod cap.

HINT: Keep the lower bearing inserted with the connecting cap.



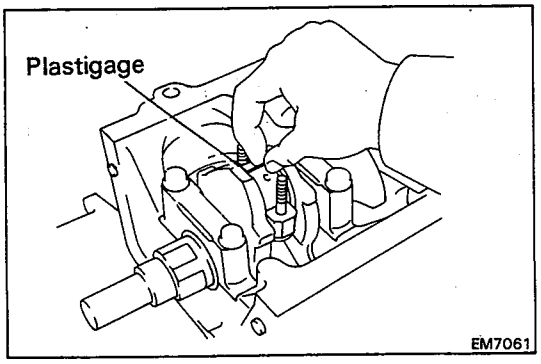
(d) Cover the connecting rod bolts with a short piece hose to protect the crankshaft from damage.



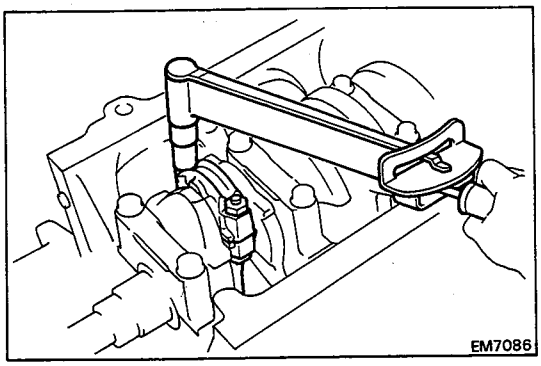
(e) Clean the crank pin and bearing.

(f) Check the crank pin and bearing for pitting scratches.

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

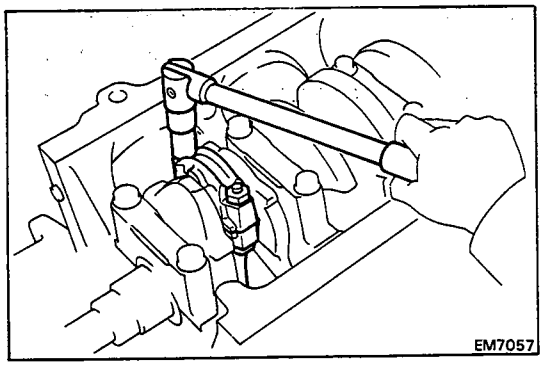


(g) Lay a strip of Plastigage across the crank pin.

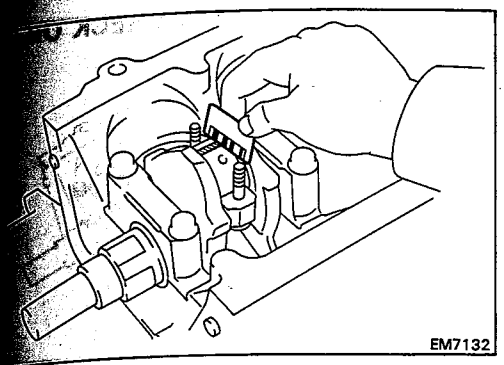


(h) Install the connecting rod cap.
(See step 7 on page EM-141)

NOTICE: Do not turn the crankshaft.



(i) Remove the connecting rod cap.
(See procedures (b) and (c) above)


EM7132

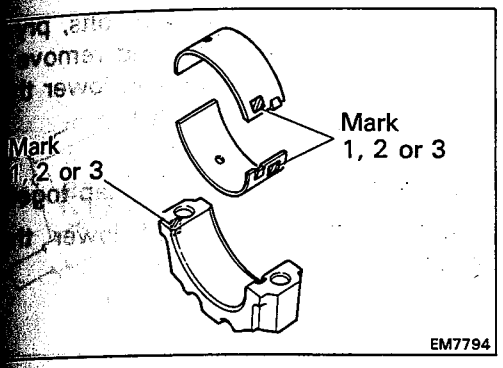
(j) Measure the Plastigage at its widest point.

Standard oil clearance:

STD	**0.020 – 0.051 mm (0.0008 – 0.0020 in.)**
U/S 0.25	**0.019 – 0.065 mm (0.0007 – 0.0026 in.)**

Maximum oil clearance: 0.08 mm (0.0031 in.)

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



EM7794

HINT: If using a standard bearing, replace with it one having the same number marked on the connecting rod cap. There are three sizes of standard bearings, marked "1", "2" and "3" accordingly.

(Reference)

Standard sized bearing center wall thickness:

Mark "1"	**1.486 – 1.490 mm (0.0585 – 0.0587 in.)**
Mark "2"	**1.490 – 1.494 mm (0.0587 – 0.0588 in.)**
Mark "3"	**1.494 – 1.498 mm (0.0588 – 0.0590 in.)**

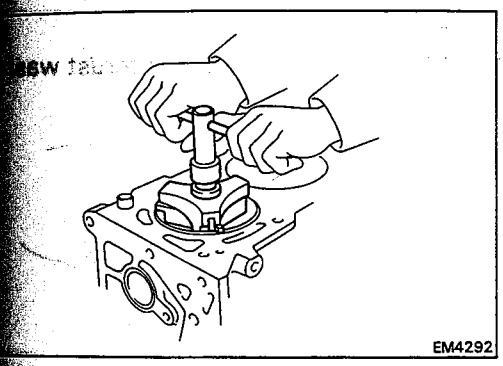
(k) Completely remove the Plastigage.

4. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

(a) Using a ridge reamer, remove all the carbon from the top of the cylinder.

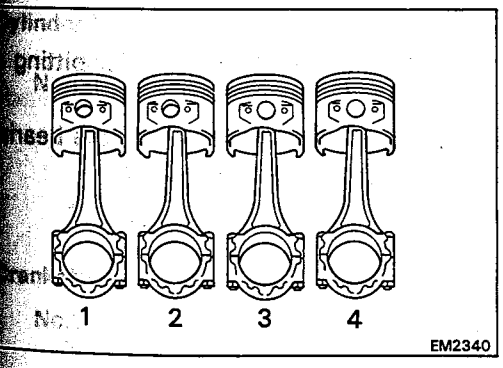
(b) Cover the connecting rod bolts.
(See page EM-120)

(c) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.


EM4292

HINT:

- Keep the bearings, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in correct order.



EM2340

5. CHECK CRANKSHAFT THRUST CLEARANCE

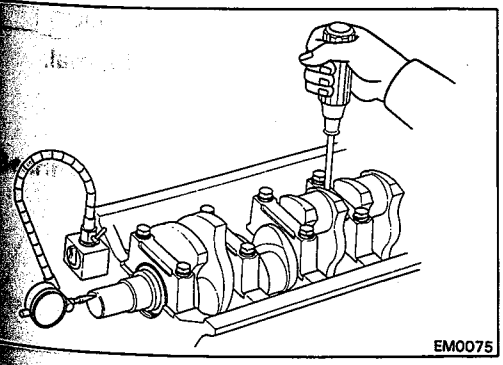
Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

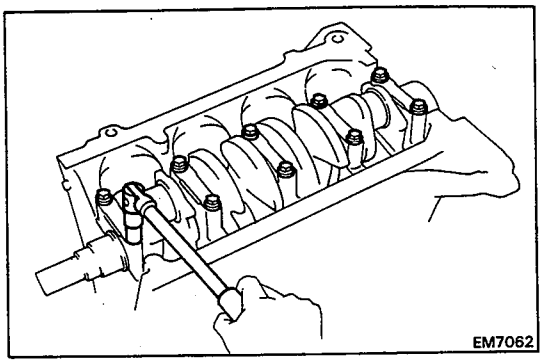
Standard thrust clearance: 0.020 – 0.220 mm (0.0008 – 0.0087 in.)

Maximum thrust clearance: 0.30 mm (0.0118 in.)

If the thrust clearance is greater than maximum, replace the thrust washers as a set.

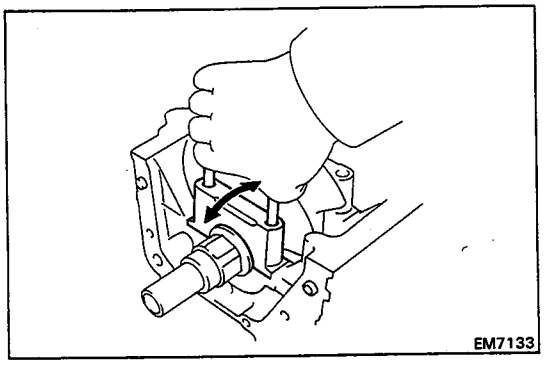
Thrust washer thickness: 2.440 – 2.490 mm (0.0961 – 0.0980 in.)


EM0075



6. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE

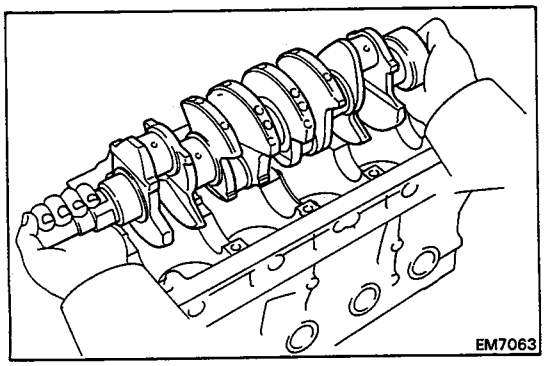
(a) Remove the main bearing cap bolts.



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

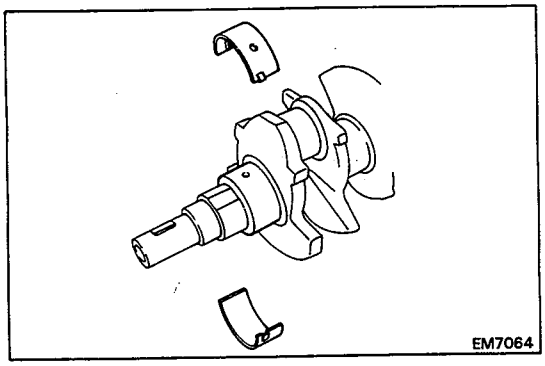
HINT:

- Keep the lower bearing and main bearing cap toget
- Arrange the main bearing caps and lower th washers in correct order.



(c) Lift out the crankshaft.

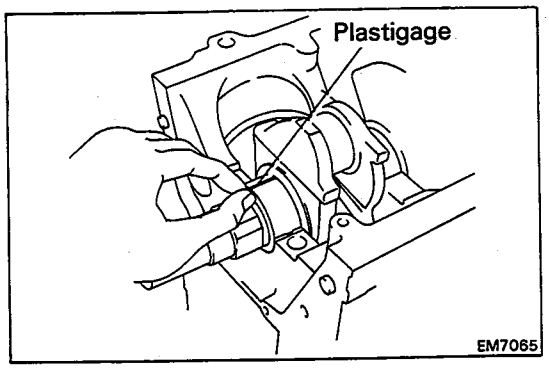
HINT: Keep the upper bearing and upper thrust was together with the cylinder block.



(d) Clean each main journal and bearing.

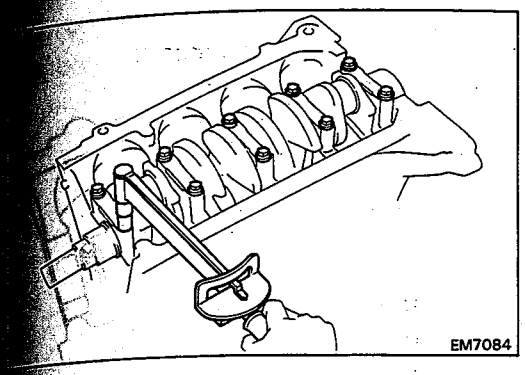
(e) Check each main journal and bearing for pitting scratches.

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



(f) Place the crankshaft on the cylinder block.

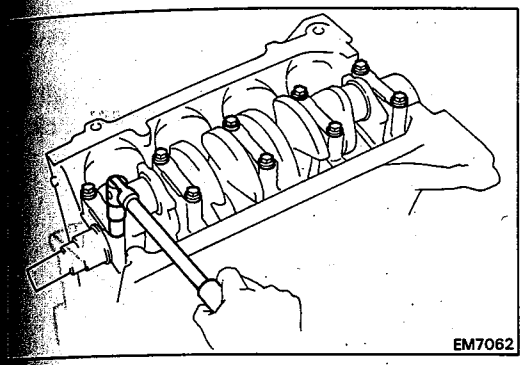
(g) Lay a strip of Plastigage across each journal.


EM7084

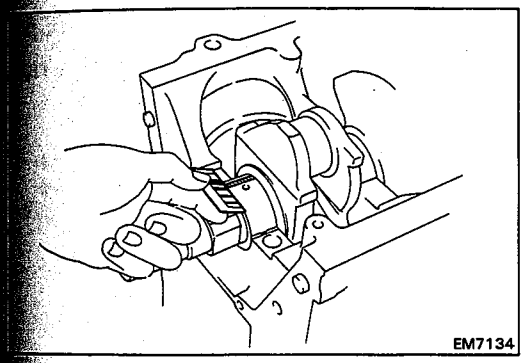
(h) Install the main bearing caps.
(See step 5 on page EM-140)

Torque: 610 kg-cm (44 ft-lb, 60 N·m)

NOTICE: Do not turn the crankshaft.


EM7062

(i) Remove the main bearing caps.
(See procedure (a) and (b) above)


EM7134

(j) Measure the Plastigage at its widest point.

Standard clearance:

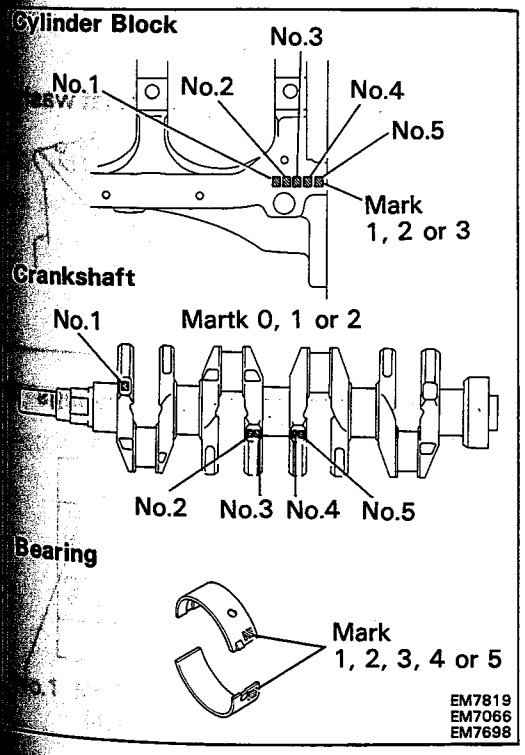
STD	**0.015 – 0.033 mm (0.0006 – 0.0013 in.)**
U/S 0.25	**0.018 – 0.056 mm (0.0007 – 0.0022 in.)**
Maximum clearance:	**0.10 mm (0.0039 in.)**

HINT: If replacing the cylinder block subassembly, the bearing standard clearance will be:

0.015 – 0.045 mm (0.0006 – 0.0018 in.)

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

HINT: If using a standard bearing, replace it with one having the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the cylinder block and crankshaft, then select the bearing with the same number as the total. There are five sizes of standard bearings, marked "1", "2", "3", "4" and "5" accordingly.



EM7819
EM7066
EM7698

	Number marked								
Cylinder block	1			2			3		
Crankshaft	0	1	2	0	1	2	0	1	2
Bearing	1	2	3	2	3	4	3	4	5

EXAMPLE: Cylinder block "2" + Crankshaft "1" = Bearing "3"

(Reference)

Cylinder block main journal bore diameter:

Mark "1"	**52.025 – 52.031 mm (2.0482 – 2.0485 in.)**
Mark "2"	**52.031 – 52.037 mm (2.0485 – 2.0487 in.)**
Mark "3"	**52.037 – 52.043 mm (2.0487 – 2.0489 in.)**

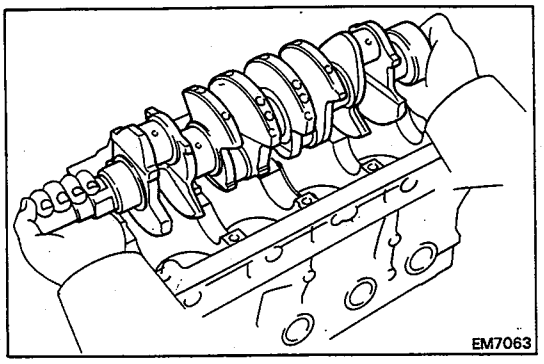
Crankshaft journal diameter:

Mark "0"	**47.994 – 48.000 mm (1.8895 – 1.8898 in.)**
Mark "1"	**47.988 – 47.994 mm (1.8893 – 1.8895 in.)**
Mark "2"	**47.982 – 47.988 mm (1.8891 – 1.8893 in.)**

Standard sized bearing center wall thickness:

Mark "1"	**2.002 – 2.005 mm (0.0788 – 0.0789 in.)**
Mark "2"	**2.005 – 2.008 mm (0.0789 – 0.0791 in.)**
Mark "3"	**2.008 – 2.011 mm (0,0791 – 0.0792 in.)**
Mark "4"	**2.011 – 2.014 mm (0.0792 – 0.0793 in.)**
Mark "5"	**2.014 – 2.017 mm (0.0793 – 0.0794 in.)**

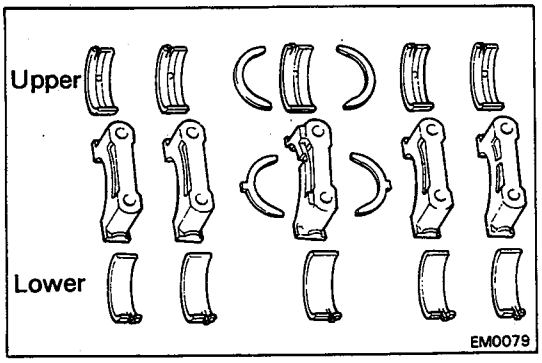
(k) Completely remove the Plastigage.


EM7063

7. REMOVE CRANKSHAFT

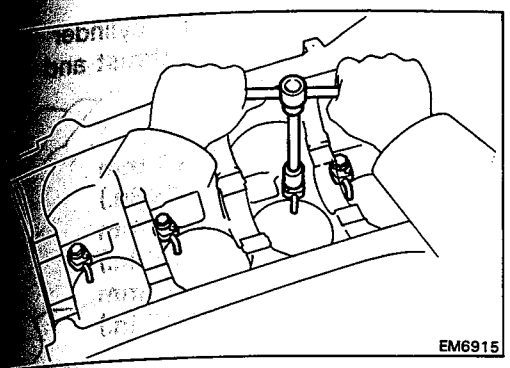
(a) Lift out the crankshaft.

(b) Remove the upper bearings and upper thrust was from cylinder block.



EM0079

HINT: Arrange the main bearing caps, bearings thrust washers in correct order.


EM6915

8. (4A-GE)
REMOVE CHECK VALVES AND OIL NOZZLES

Remove the four check valves and oil nozzles.

INSPECTION OF CYLINDER BLOCK

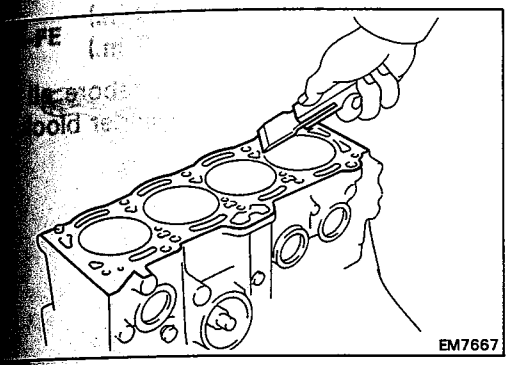
1. **CLEAN CYLINDER BLOCK**

A. **Remove gasket material**

Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.

B. **Clean cylinder block**

Using a soft brush and solvent, thoroughly clean the cylinder block.

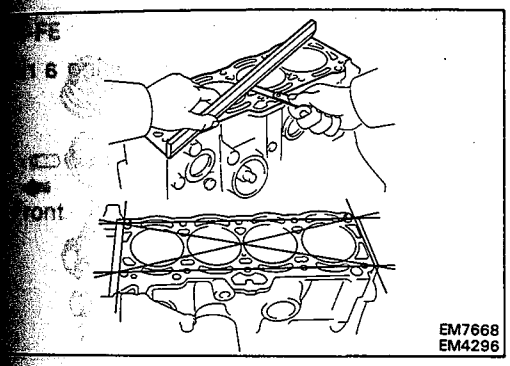

EM7667

2. **INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS**

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

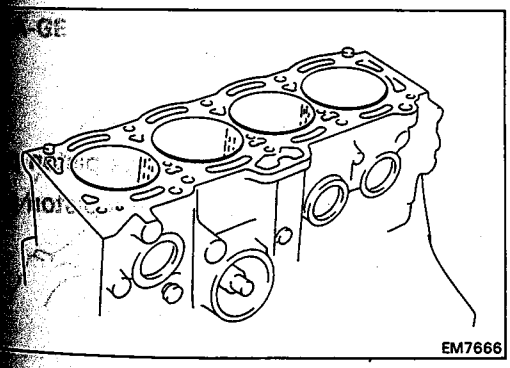
Maximum warpage: 0.05 mm (0.0020 in.)

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


EM7668
EM4296

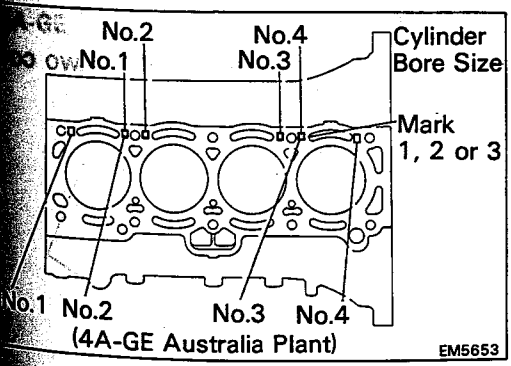
3. **INSPECT CYLINDER FOR VERTICAL SCRATCHES**

Visually check the cylinder for vertical scratches. If deep scratches are present, rebore all the four cylinders. If necessary, replace the cylinder block.

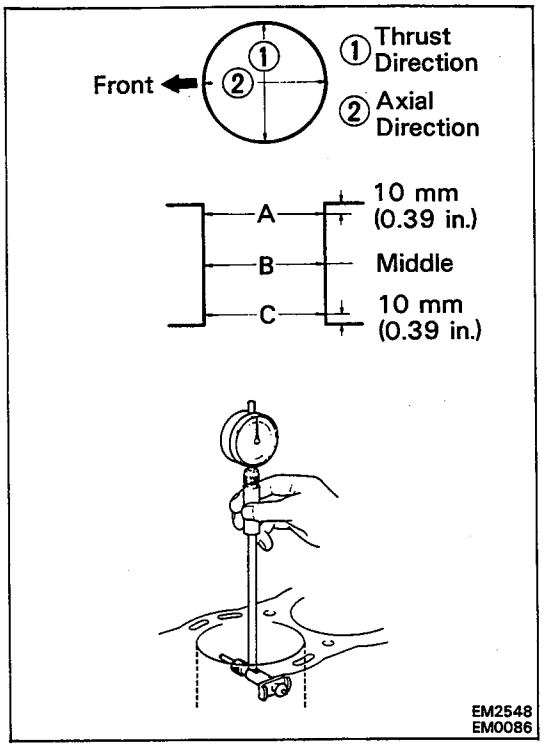

EM7666

4. **INSPECT CYLINDER BORE DIAMETER**

HINT: There are three sizes of the standard cylinder bore diameter, marked "1", "2" and "3" accordingly. The mark is stamped on top of the cylinder block.



EM5653



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

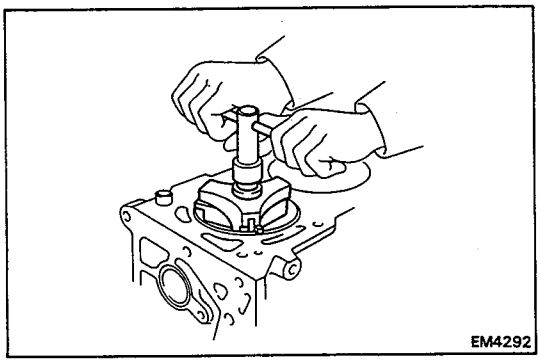
Standard diameter:

STD	**Mark "1"**	**81.000 – 81.010 mm (3.1890 – 3.1894 in.)**
	Mark "2"	**81.010 – 81.020 mm (3.1894 – 3.1898 in.)**
	Mark "3"	**81.020 – 81.030 mm (3.1898 – 3.1902 in.)**

Maximum diameter:

STD	**81.23 mm (3.1980 in.)**
O/S 0.50	**81.73 mm (3.2177 in.)**

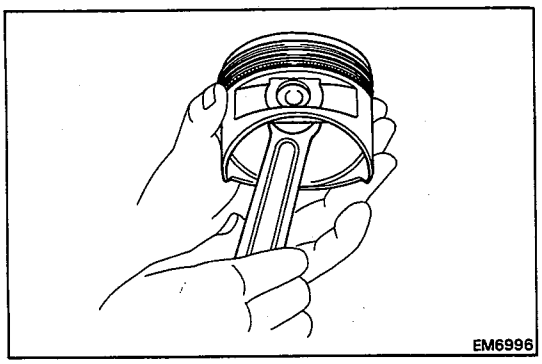
If the diameter is greater than maximum, rebore all four cylinders. If necessary, replace the cylinder block.



5. REMOVE CYLINDER RIDGE

If the wear is less than 0.2 mm (0.008 in.), using a ri reamer, grind the top of the cylinder.

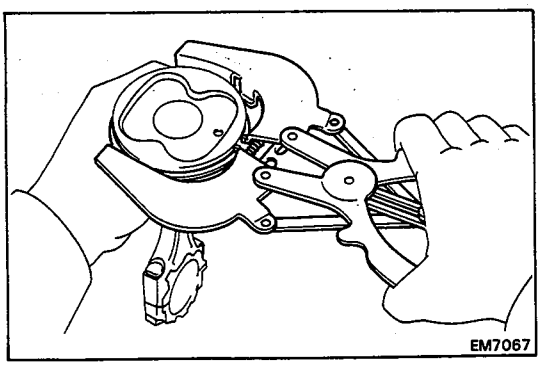
DISASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES



1. CHECK FIT BETWEEN PISTON PIN

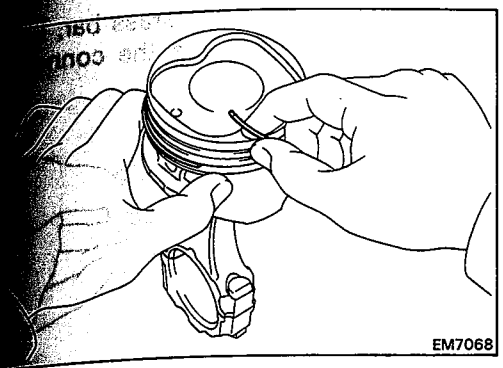
Try to move the piston back and forth on the piston

If the piston does not move at all, replace the piston pin as a set.



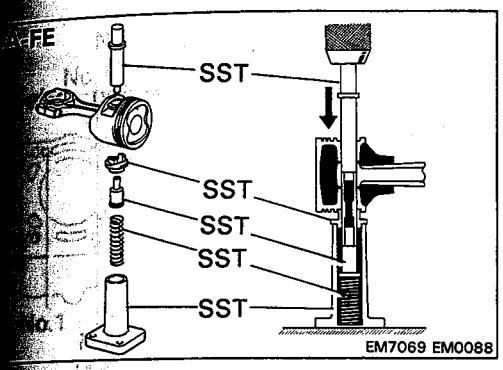
2. REMOVE PISTON RINGS

(a) Using a piston ring expander, remove the two c pression rings.



(b) Remove the two side rails and oil ring expander by hand.

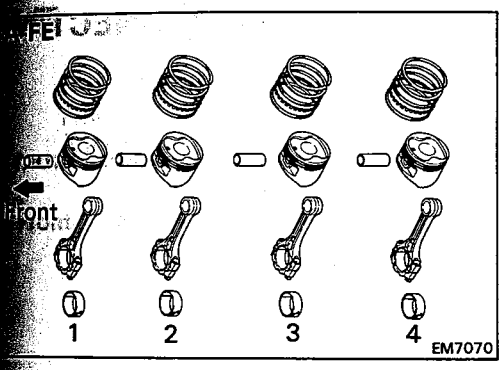
HINT: Arrange the rings in correct order only.



3. DISCONNECT CONNECTING ROD FROM PISTON (4A-FE)

Using SST, press out the piston pin from the piston. Remove the connecting rod.

SST 09221-25024 (09221-00020, 09221-00030, 09221-00050, 09221-00130, 09221-00140)

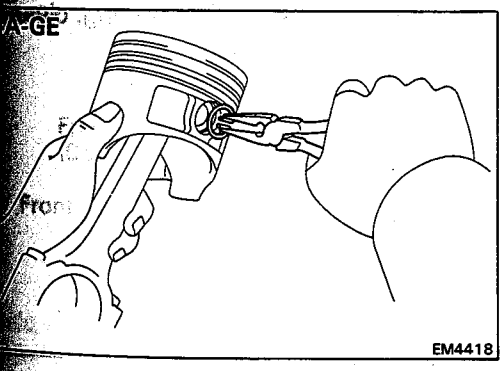


HINT:

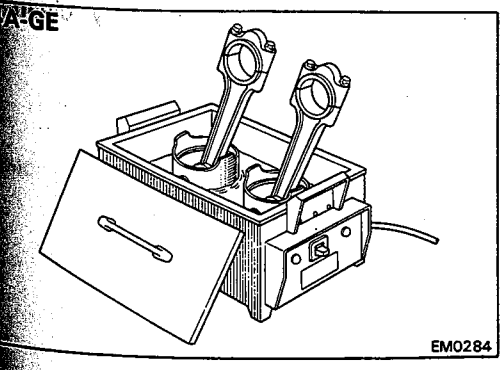
- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in correct order.

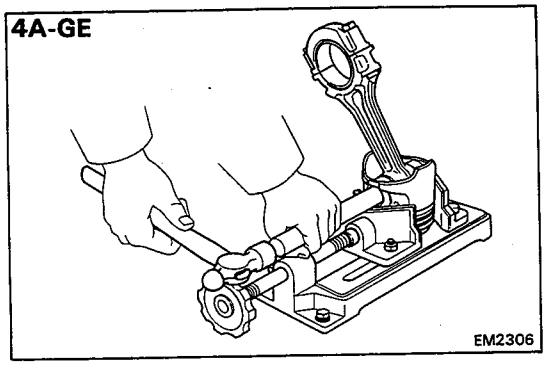
(4A-GE)

(a) Using needle-nose pliers, remove the snap rings.

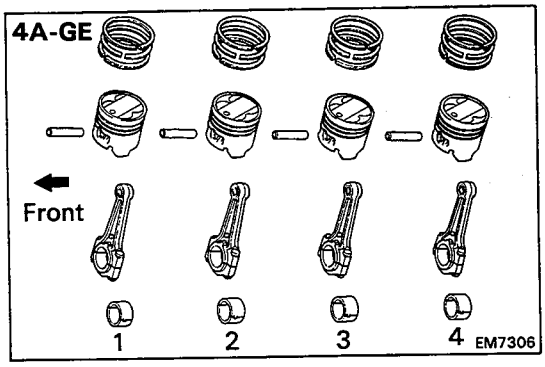


(b) Gradually heat the piston to 70 – 80°C (158 – 176°F).

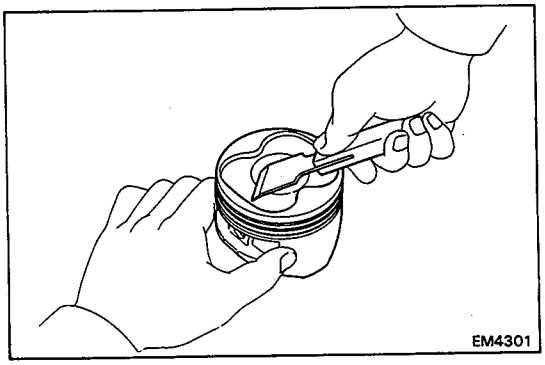




(c) Using a plastic-faced hammer and brass bar, lig
tap out the piston pin and remove the connec
rod.



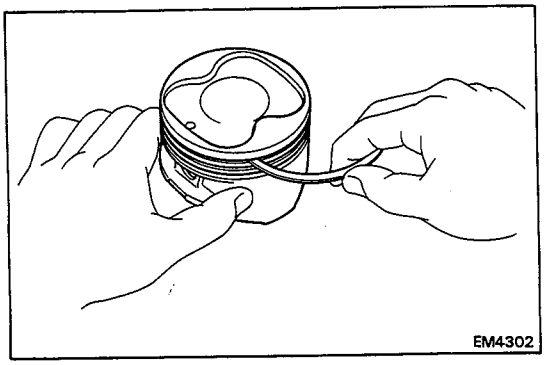
HINT:
- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods
bearings in correct order.



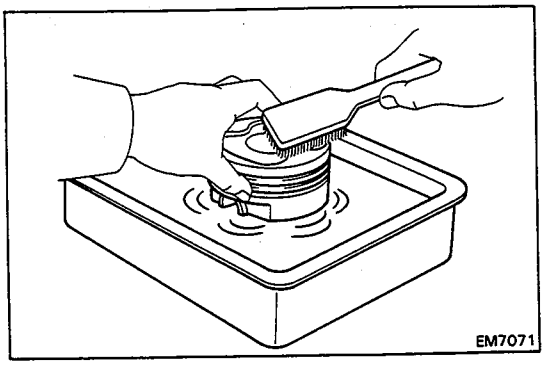
INSPECTION OF PISTON AND CONNECTIN ROD ASSEMBLIES

1. CLEAN PISTON

(a) Using a gasket scraper, remove the carbon from
piston top.

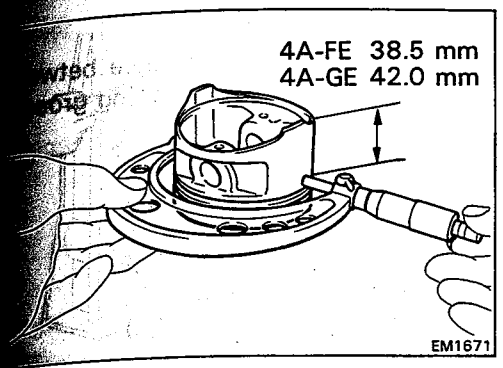


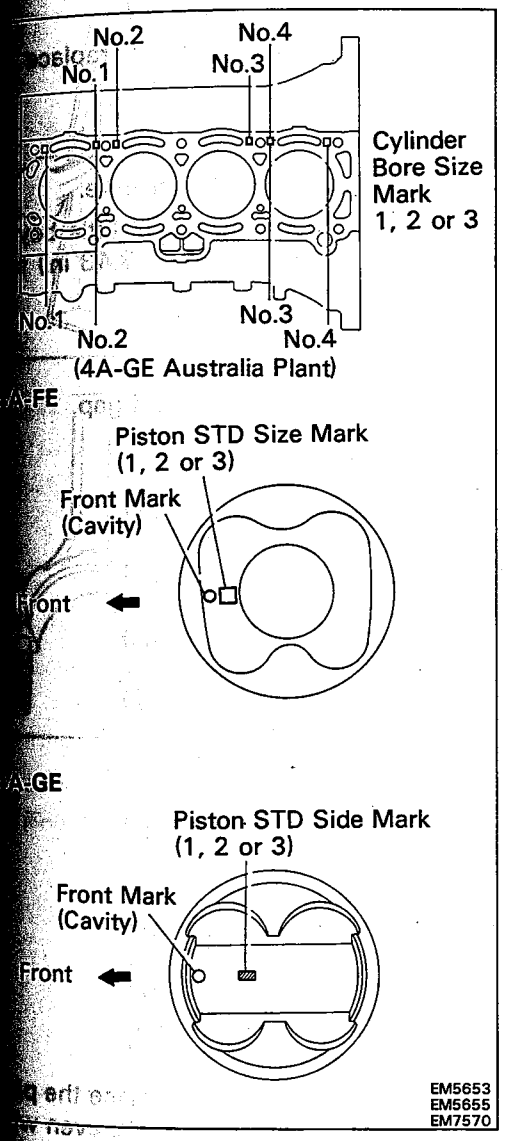
(b) Using a groove cleaning tool or broken ring, clea
piston ring grooves.



(c) Using solvent and a brush, thoroughly clear
piston.

NOTICE: Do not use a wire brush.





2. INSPECT PISTON

A. Inspect piston oil clearance

HINT: There are three sizes of the standard piston diameter, marked "1", "2" and "3" accordingly. The mark is stamped on the piston top.

(a) Using a micrometer and with the piston upside down, measure the piston diameter at a right angle to the piston pin hole center line, the indicated distance from the skirt of the bottom edge.

4A-FE 38.5 mm (1.576 in.)
4A-GE 42.0 mm (1.654 in.)

Piston diameter:

4A-FE

STD	**Mark "1"**	**80.93 – 80.94 mm (3.1862 – 3.1866 in.)**
	Mark "2"	**80.94 – 80.950 mm (3.1866 – 3.187 in.)**
	Mark "3"	**80.95 – 80.96 mm (3.1870 – 3.1874 in.)**
O/S 0.50		**81.43 – 81.46 mm (3.2059 – 3.2071 in.)**

4A-GE

STD	**Mark "1"**	**80.89 – 80.90 mm (3.1846 – 3.1850 in.)**
	Mark "2"	**80.90 – 80.91 mm (3.1850 – 3.1854 in.)**
	Mark "3"	**80.91 – 80.92 mm (3.1854 – 3.1858 in.)**
O/S 0.50		**81.39 – 81.42 mm (3.2043 – 3.2055 in.)**

(b) Measure the cylinder bore diameter in the thrust directions. (See step 4 on page EM-125)

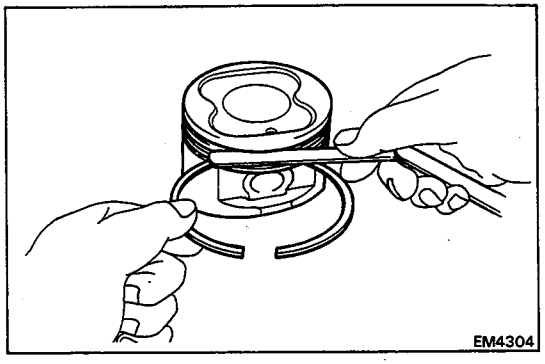
(c) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

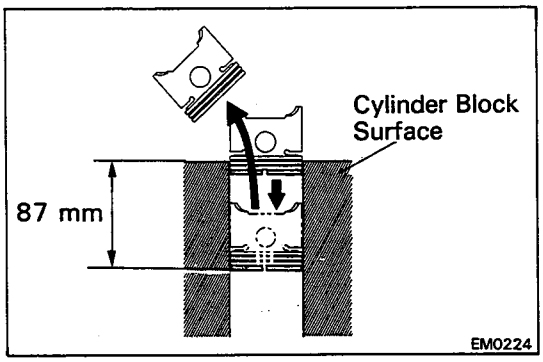
Standard oil clearance:
4A-FE 0.06 – 0.08 mm (0.0024 – 0.031 in.)
4A-GE 0.10 – 0.12 mm (0.0039 – 0.0047 in.)

Maximum oil clearance:
4A-FE 0.10 mm (0.0039 in.)
4A-GE 0.15 mm (0.0059 in.)

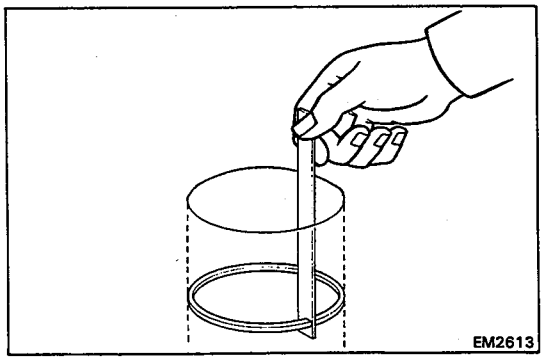
If the oil clearance is greater than maximum, replace all the four pistons and rebore all the four cylinders. If necessary, replace the cylinder block.

HINT: (Use new cylinder block): Use a piston with the same number mark as the cylinder bore diameter marked on the cylinder block.


EM4304



EM0224


EM2613

B. Inspect piston ring groove clearance.

Using a feeler gauge, measure the clearance betwee new piston ring and the wall of the piston ring groove

Ring groove clearance:

4A-FE	No.1	0.04 – 0.08 mm (0.0016 – 0.0031 in.)
	No.2	0.03 – 0.07 mm (0.0012 – 0.0028 in.)
4A-GE	No.1	0.03 – 0.08 mm (0.0012 – 0.0031 in.)
	No.2	0.03 – 0.07 mm (0.0012 – 0.0028 in.)

If the clearance is greater than maximum, replace piston.

C. Inspect piston ring end gap

(a) Inspect the piston ring in the cylinder bore.

(b) Using a piston, push the piston ring a little beyo the bottom of the ring travel, 87 mm (3.43 in.) fr the top of the cylinder block.

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

Standard piston ring end gap:

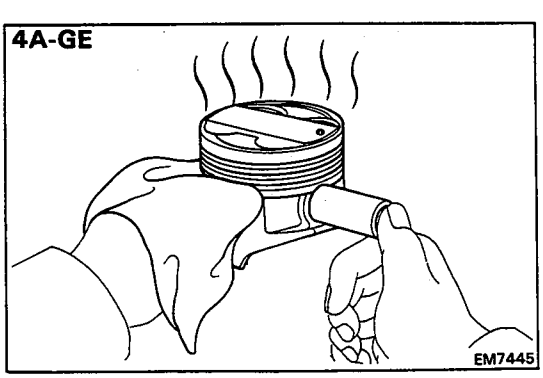
4A-FE	No.1	0.25 – 0.45 mm (0.0098 – 0.0177 in.)
	No.2	0.15 – 0.40 mm (0.0059 – 0.0157 in.)
	Oil	0.10 – 0.70 mm (0.0039 – 0.0276 in.)
4A-GE	No.1	0.25 – 0.47 mm (0.0098 – 0.0185 in.)
	No.2	0.20 – 0.42 mm (0.0079 – 0.0165 in.)
	Oil	0.15 – 0.52 mm (0.0059 – 0.0205 in.)

Maximum piston ring end gap:

4A-FE	No.1	1.05 mm (0.0413 in.)
	No.2	1.00 mm (0.0394 in.)
	Oil	1.30 mm (0.0512 in.)
4A-GE	No.1	1.07 mm (0.0421 in.)
	No.2	1.02 mm (0.0402 in.)
	Oil	1.12 mm (0.0441 in.)

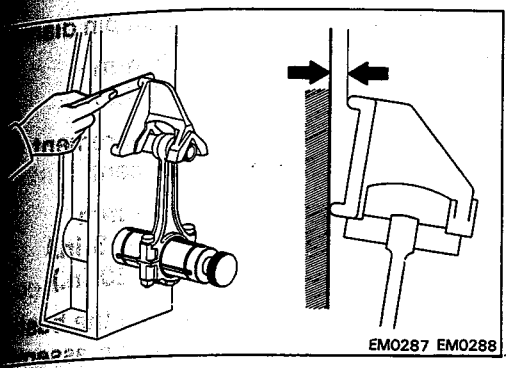
If the end gap is greater than maximum, replace the pis ring. If the end gap is greater than maximum, even wit new piston ring, rebore all the four cylinders or replace cylinder block.

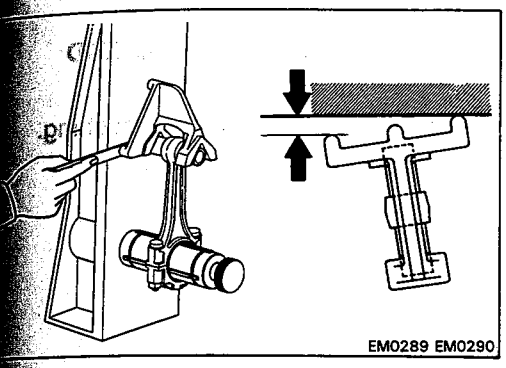
4A-GE

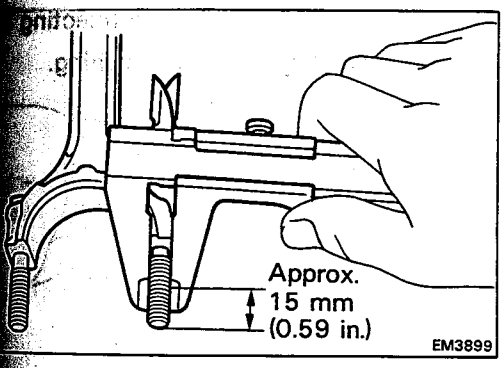

EM7445

3. (4A-GE)
INSPECT PISTON PIN FIT

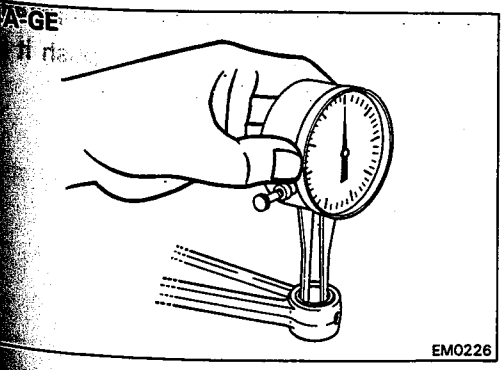
At 80°C (176°F), you should be able to push the pis pin into the piston pin hole with your thumb.


EM0287 EM0288


EM0289 EM0290



EM3899


EM0226

4. INSPECT CONNECTING ROD

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

- Check for bending.

Maximum bend:

4A-FE 0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

4A-GE 0.03 mm (0.0012 in.) per 100 mm (3.94 in.)

If bend is greater than maximum, replace the connecting rod and connecting rod cap as a set.

- Check for twist.

Maximum twist:

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

If twist is greater than maximum, replace the connecting rod and connecting rod cap as a set.

(4A-GE)

(b) Inspect connecting rod bolts.

- Fix a nut to each of the connecting rod bolts and check that the nut can be turned by hand to the end of the thread.
- If a nut cannot be moved all the way down the thread, measure the compressed thread outer diameter with a measuring gauge.
- If the location of this area cannot be judged by visual inspection, use the dimension locations in the illustration and measure the outer diameter.

Standard diameter: 8.860 — 9.000 mm (0.3488 — 0.3543 in.)

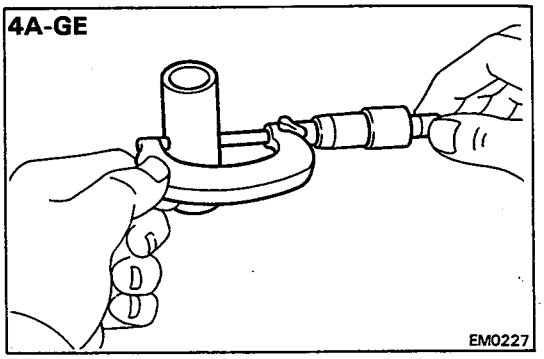
Minimum diameter: 8.600 mm (0.3386 in.)

If the diameter is not within specifications, replace the nut and connecting rod bolt.

5. (4A-GE) INSPECT PISTON PIN OIL CLEARANCE

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

Bushing inside diameter: 20.012 — 20.022 mm (0.7879 — 0.7883 in.)



(b) Using a micrometer, measure the piston pin diame

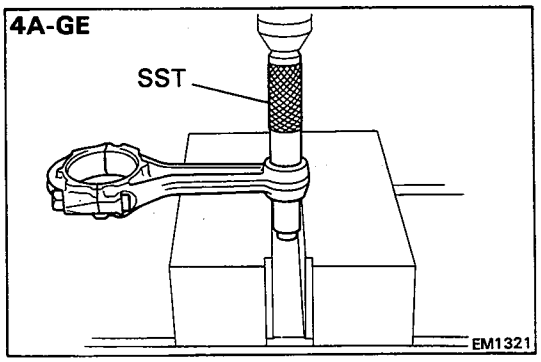
Piston pin diameter: 20.006 – 20.016 mm (0.7876 – 0.7880 in.)

(c) Subtract the piston pin diameter measurement fr the bushing inside diameter measurement.

Standard oil clearance: 0.004 – 0.008 mm (0.0002 – 0.0003 in.)

Maximum oil clearance: 0.05 mm (0.0020 in.)

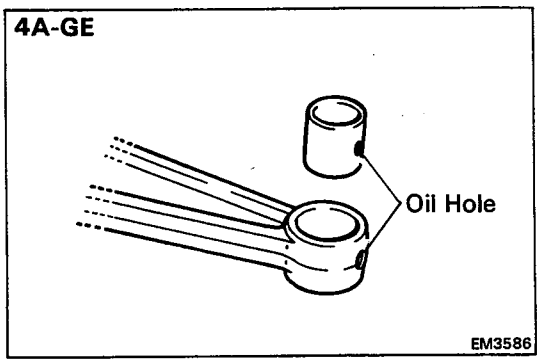
If clearance is greater than maximum, replace the bushi If necessary, replace the piston and piston pin assemb



6. **(4A-GE)**
IF NECESSARY, REPLACE CONNECTING ROD BUSHINGS

(a) Using SST and a press, push out the bushing.

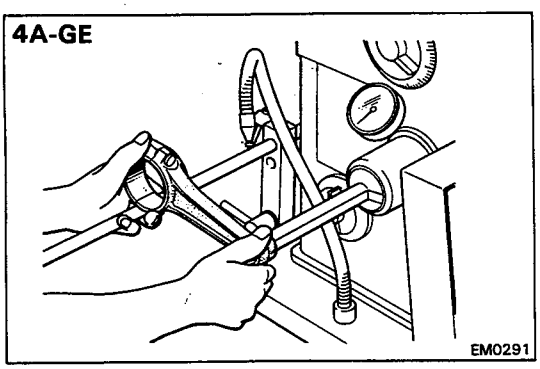
SST 09222-30010



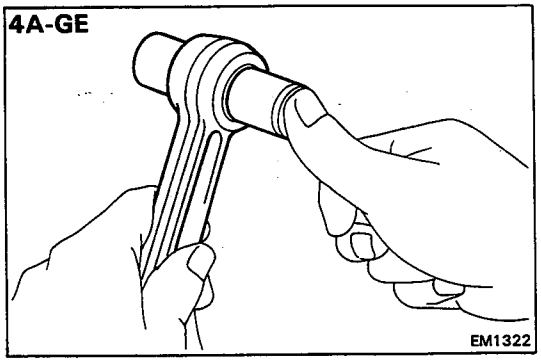
(b) Align the oil holes of the bushing and connecting r

(c) Using SST and a press, press in the bushing.

SST 09222-30010



(d) Using a pin hole grinder, hone the bushing to ob the standard specified clearance (See procedure s 5) between the bushing and piston pin.



(e) Check the piston pin fit at normal room temperat

Coat the piston pin with engine oil and push it the connecting rod with your thumb.

BORING OF CYLINDERS

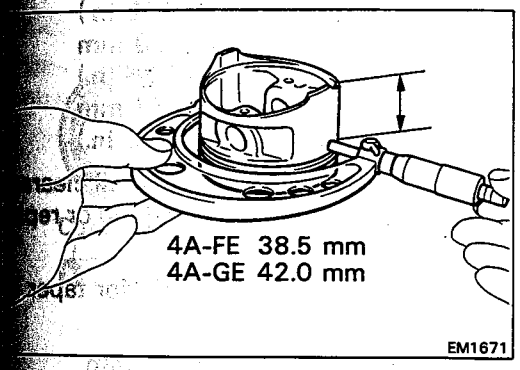
HINT:

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

1. KEEP OVERSIZED PISTON

Oversized piston diameter:

4A-FE	**O/S 0.50**	**81.43 – 81.46 mm (3.2059 – 3.2071 in.)**
4A-GE	**O/S 0.50**	**81.39 – 81.42 mm (3.2043 – 3.2055 in.)**



2. CALCULATE AMOUNT TO BORE CYLINDER

(a) Using a micrometer and with the piston upside down, measure the piston diameter at a right angle to the piston pin hole center line, the indicated distance from the skirt of the bottom edge.

4A-FE 38.5 mm (1.576 in.)
4A-GE 42.0 mm (1.654 in.)

(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

4A-FE 0.06 – 0.08 mm (0.0024 – 0.0031 in.)
4A-GE 0.10 – 0.12 mm (0.0039 – 0.0047 in.)

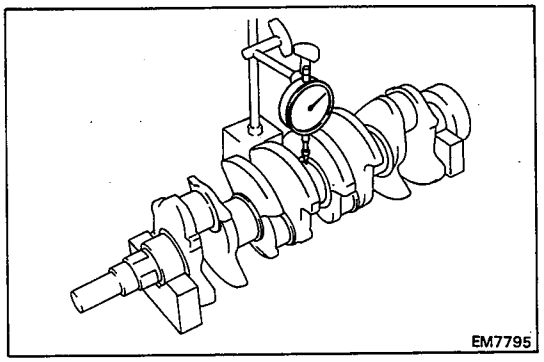
H = Allowance for honing

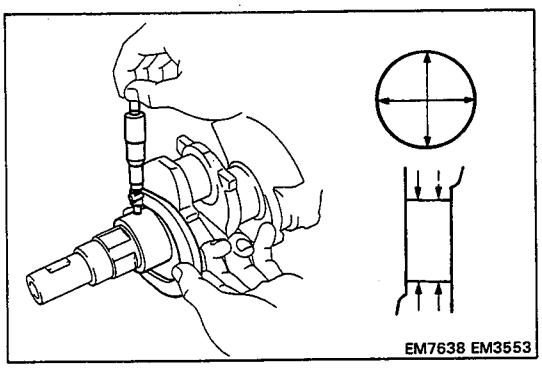
Less than 0.02 mm (0.0008 in.)

3. BORE AND HONE CYLINDERS TO CALCULATED DIMENSIONS

Amount of honing: 0.02 mm (0.0008 in.) maximum

NOTICE: Excess honing will destroy the finished roundness.


EM7795


EM7638 EM3553

INSPECTION AND REPAIR OF CRANKSHA

1. INSPECT CRANKSHAFT FOR RUNOUT

(a) Place the crankshaft on V-blocks.

(b) Using a dial indicator, measure the circle runou the center journal.

Maximum circle runout: 0.06 mm (0.0024 in.)

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

2. INSPECT MAIN JOURNALS AND CRANK PINS

(a) Using a micrometer, measure the diameter of e main journal and crank pin.

Main journal diameter:

STD		**47.982 – 48.000 mm (1.8891 – 1.8898 in.)**
U/S 0.25		**47.745 – 47.755 mm (1.8797 – 1.8881 in.)**

Crank pin diameter:

4A-FE	**STD**	**39.985 – 40.000 mm (1.5742 – 1.5748 in.)**
	U/S 0.25	**39.745 – 39.755 mm (1.5648 – 1.5652 in.)**
4A-GE	**STD**	**41.989 – 42.000 mm (1.6529 – 1.6535 in.)**
	U/S 0.25	**41.745 – 41.755 mm (1.6435 – 1.6439 in.)**

If the diameter is not as specified, check the oil clear (See pages EM-119 to 123). If necessary, grind or re the crankshaft.

(b) Check each main journal and crank pin for tape out-of-round as shown.

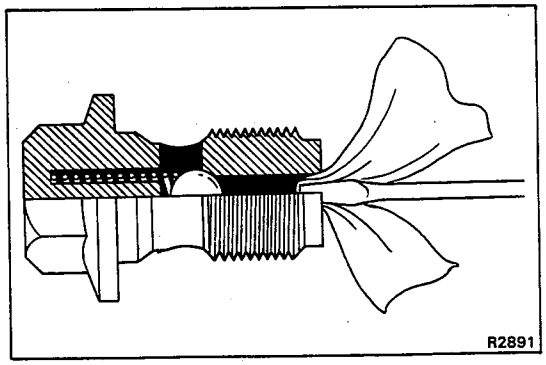
Maximum taper and out-of-round: 0.02 mm (0.0008 in.)

If the taper and out-of-round is greater than maxi replace the crankshaft.

3. IF NECESSARY, GRIND AND HONE MAIN JOURNALS AND/OR CRANKPINS

Grind and hone the main journal and/or crank pins t finished diameter.
(See procedure step 2 above).

Install new main journal and/or crank pin undersized ing.


R2891

INSPECTION OF CHECK VALVES AND OI NOZZLES (4A-GE)

1. INSPECT CHECK VALVES

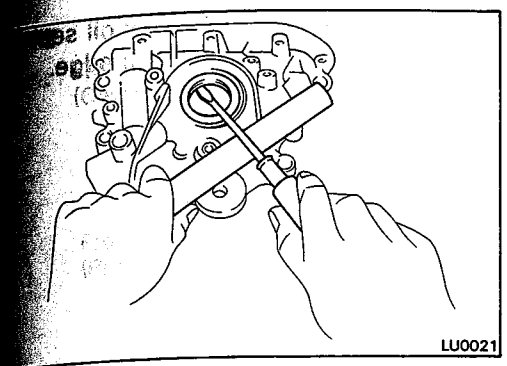
Push the valve with a screwdriver to check if it is s

If stuck, replace the check valve.

2. INSPECT OIL NOZZLES

Check the oil nozzles for damage or clogging.

If necessary, replace the oil nozzle.


LU0021

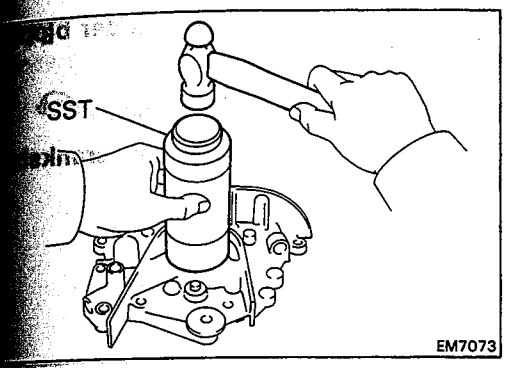
REPLACEMENT OF CRANKSHAFT OIL SEALS

HINT: There are two methods (A and B) to replace the oil seal which are as follows:

1. REPLACE CRANKSHAFT FRONT OIL SEAL

A. If oil pump is removed from cylinder block:

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



EM7073

(b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump case edge.

SST 09309-37010

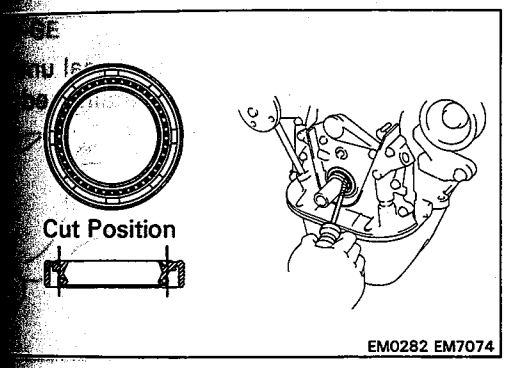
(c) Apply MP grease to the oil seal lip.

B. If oil pump is installed to the cylinder block:

(a) Using a knife, cut off the oil seal lip

(b) Using a screwdriver, pry out the oil seal.

NOTICE: Be careful not to damage the crankshaft. Tape the screwdriver tip.

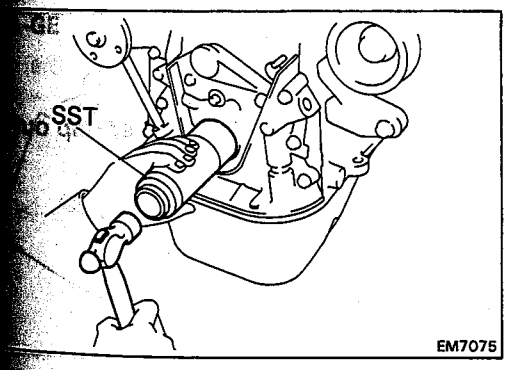


EM0282 EM7074

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

(d) Using SST and a hammer, tap in the oil seal until its surface is flush with the oil pump case edge.

SST 09309-37010

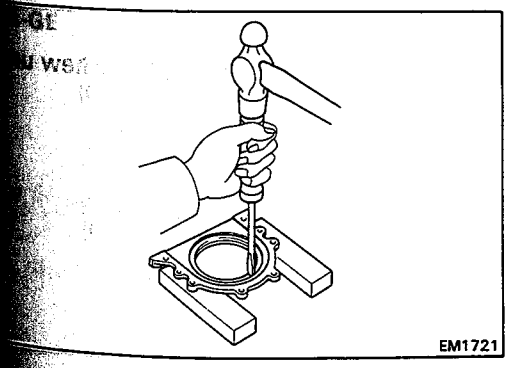


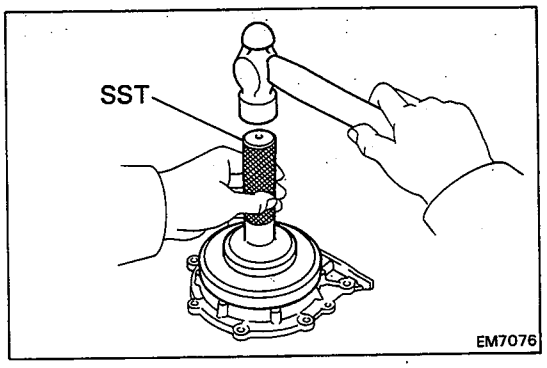
EM7075

2. REPLACE CRANKSHAFT REAR OIL SEAL

A. If rear oil seal retainer is removed from cylinder block:

(a) Using screwdriver and hammer, tap out the oil seal.

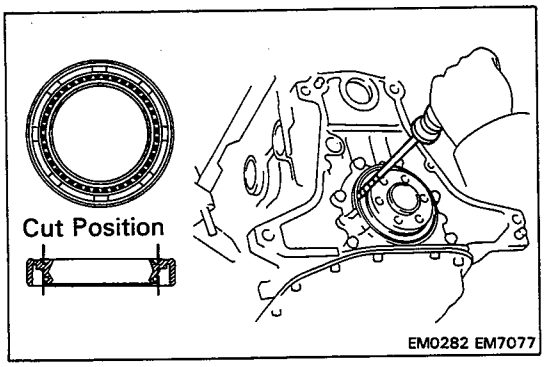

EM1721



(b) Using SST and a hammer, tap in a new oil seal u its surface is flush with the rear oil seal edge.

SST 09223–41020

(c) Apply MP grease to the oil seal lip.

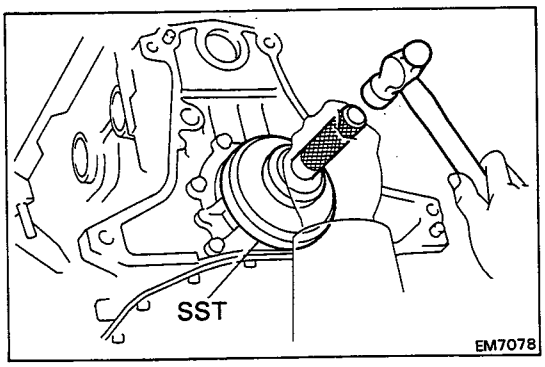


B. If rear oil seal retainer is installed to cylinder block

(a) Using a knife, cut off the oil seal lip.

(b) Using a screwdriver, pry out the oil seal.

NOTICE: Be careful not to damage the cranksh Tape the screwdriver tip.



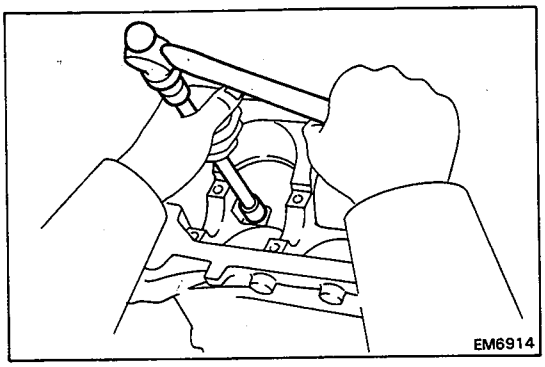
(c) Apply MP grease to a new oil seal lip.

(d) Using SST and a hammer, tap in the oil seal unti surface is flush with the rear oil seal retainer edg

SST 09223-41020

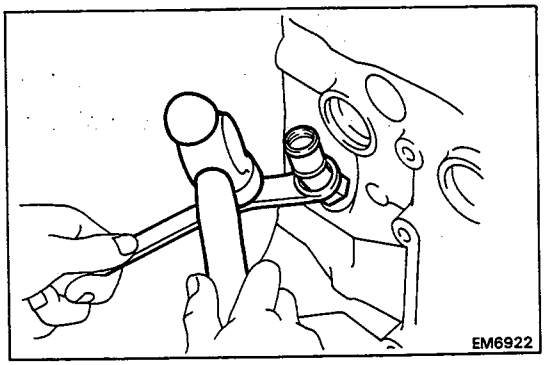
REPLACEMENT OF UNION (4A-GE)

1. REMOVE UNION

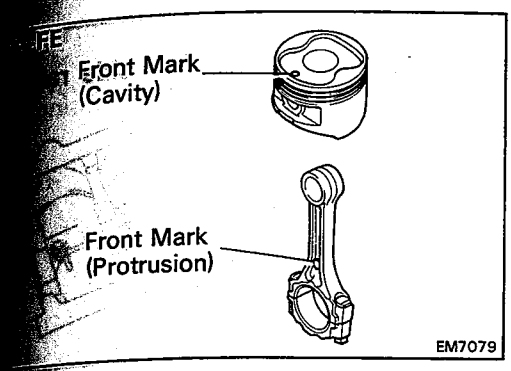


Using a 12 mm socket wrench and a hammer, tap out union.

2. INSTALL UNION



Using an offset wrench and a hammer, tap in a new u

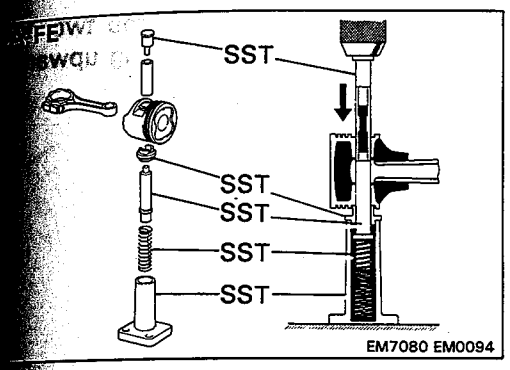


ASSEMBLY OF PISTON AND CONNECTING ROD

(See page EM-117)

1. ASSEMBLE PISTON AND CONNECTING ROD

(a) Align the front marks of the piston and connecting rod.



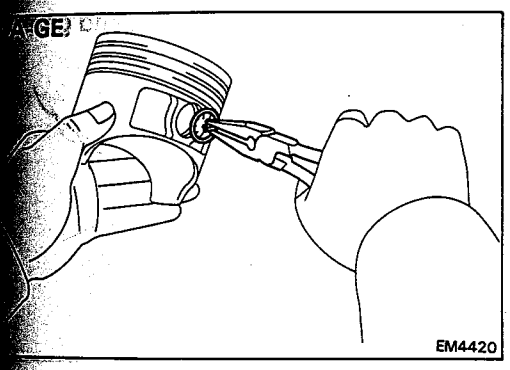
(b) Coat the piston pin and piston hole of the piston with engine oil.

(c) Using SST, press in the piston pin.

SST 09221-25024 (09221-00020, 09221-00030, 09221-00050, 09221-00130, 09221-00140)

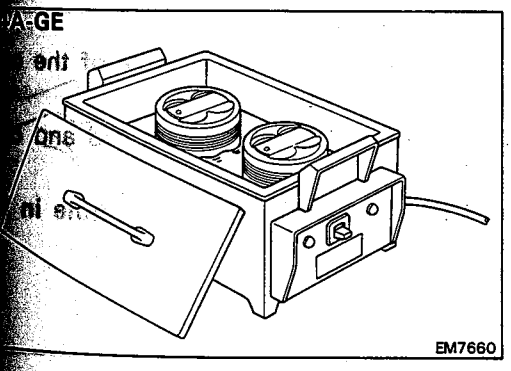
(d) Check that the piston moves smoothly back and forth on the piston pin.

(e) Check that the connecting rod and piston pin are positioned in the middle of the piston.

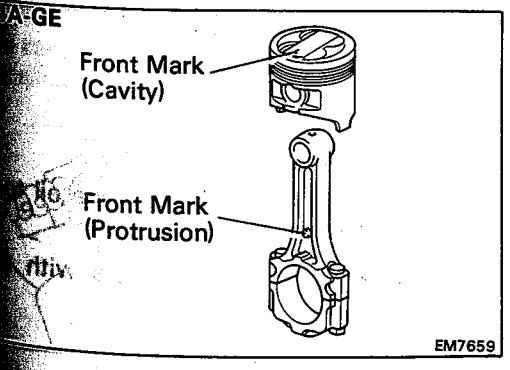


(4A-GE)

(a) Install a new snap ring on one side of the piston pin hole.



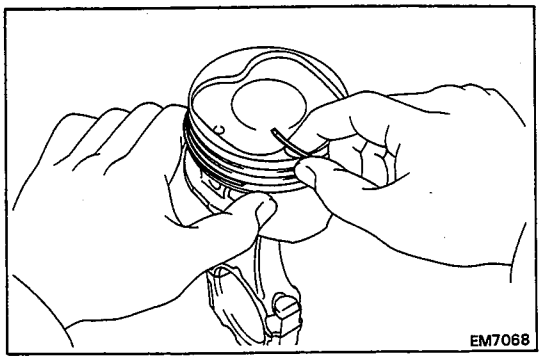
(b) Gradually heat the piston to 70 – 80°C (158 – 176°F)



(c) Coat the piston pin with engine oil.

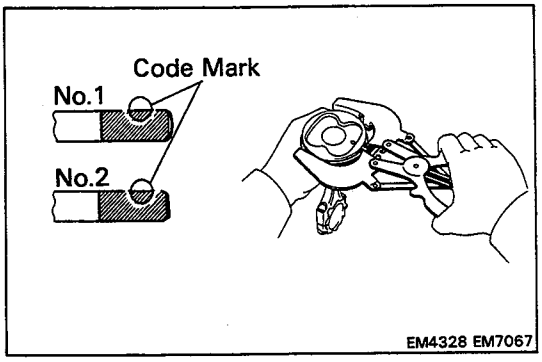
(d) Align the front marks of the piston and connecting rod, and push in the piston pin with your thumb.

(e) Install a new snap ring on the other side of the piston pin hole.


EM7068

2. INSTALL PISTON RINGS

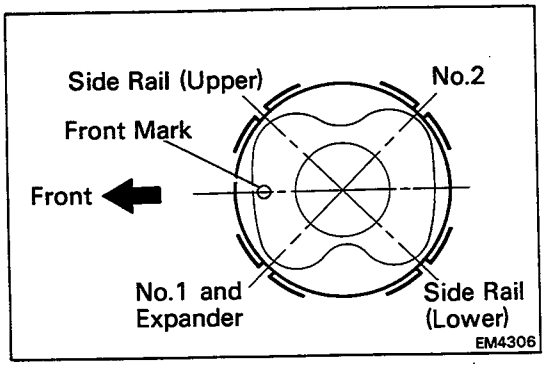
(a) Install the oil ring expander and two side rails hand.



EM4328 EM7067

(b) Using a piston ring expander, install the two c pression rings with the code mark facing upwar

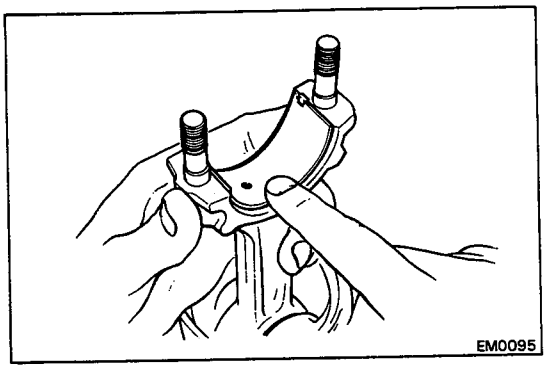
Code mark: No.1 R or T (4A-GE only)
No.2 R or T



EM4306

(C) Position the piston rings so that the ring end gap as shown.

NOTICE: Do not align the end gaps.


EM0095

3. INSTALL CONNECTING ROD BEARINGS

(a) Align the bearing claw with the groove of the necting rod or connecting rod cap.

(b) Install the bearings in the connecting rod and necting rod cap.

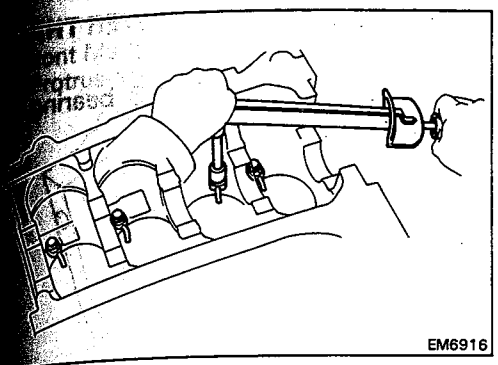
NOTICE: Install the bearing with the oil hole i connecting rod.

ASSEMBLY OF CYLINDER BLOCK

(See page EM-117)

HINT:

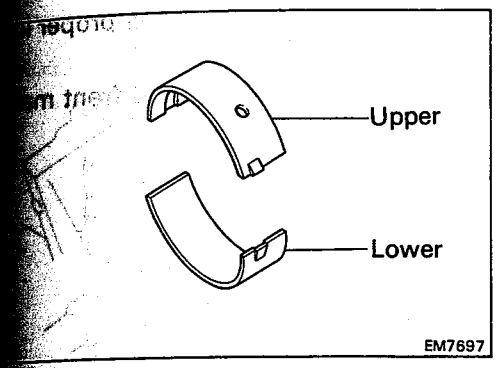
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with parts.



1. **(4A-GE)**
INSTALL OIL NOZZLES AND CHECK VALVES

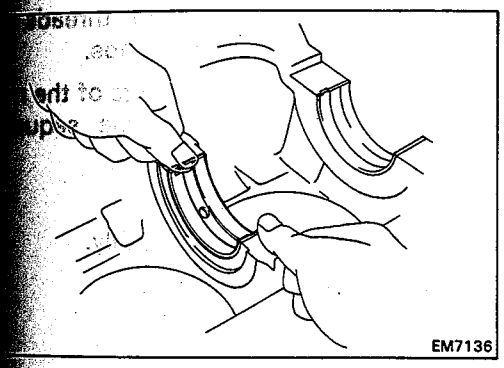
Install the nozzle with the bolt. Install the four oil nozzles. Torque the bolts.

Torque: 250 kg-cm (18 ft-lb, 25 N·m)



2. **INSTALL MAIN BEARINGS**

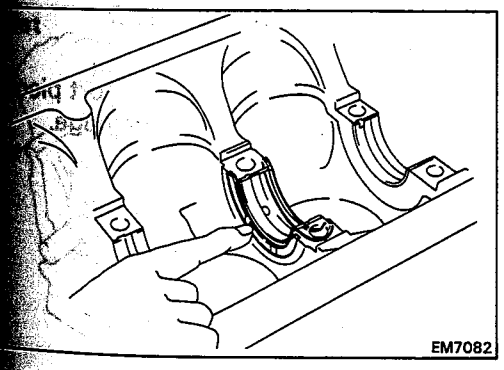
HINT: Upper bearings have an oil groove and oil holes; lower bearings do not.



(a) Align the bearing claw with the claw groove of the main bearing cap or cylinder block.

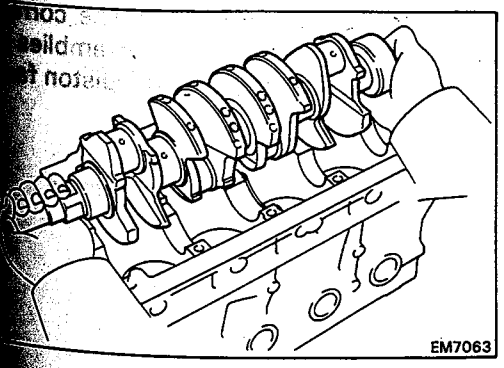
(b) Install the bearings in the cylinder block and main bearing caps.

NOTICE: Install the bearing with the oil hole in the cylinder block.

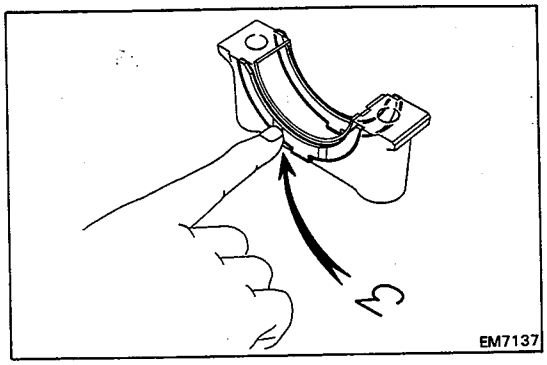


3. **INSTALL UPPER THRUST WASHERS**

Install the thrust washers under the No.3 main bearing cap position of the block with the oil grooves facing outward.

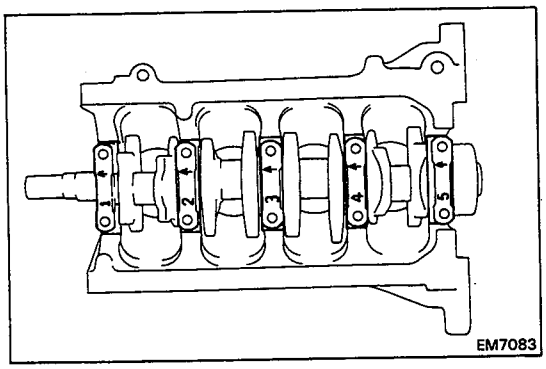


4. **PLACE CRANKSHAFT ON CYLINDER BLOCK**



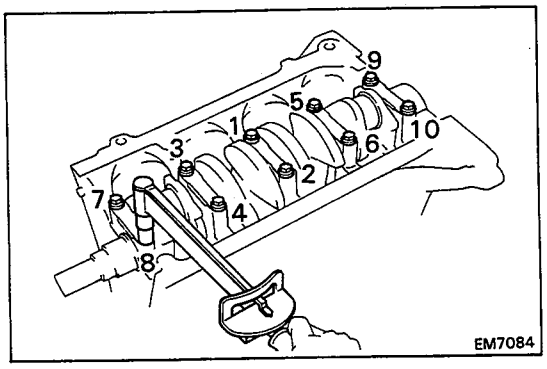
5. INSTALL MAIN BEARING CAPS AND LOWER THRU WASHERS

(a) Install the thrust washers on the No.3 bearing with the grooves facing outward.



(b) Install the five main bearing caps in their proper l tions.

HINT: Each bearing cap has a number and front ma



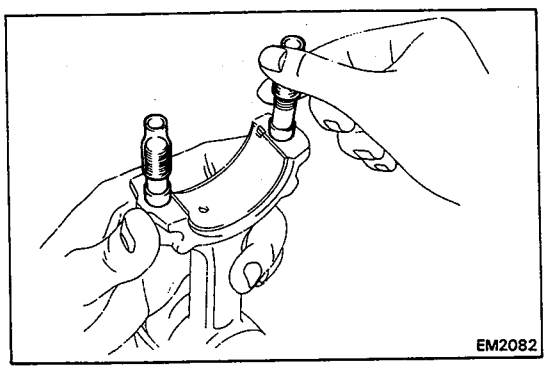
(c) Apply a light coat of engine oil on the threads under the heads of the main bearing caps.

(d) Install and uniformly tighten the ten bolts of the bearing caps in several passes in the sequ shown.

Torque: 610 kg-cm (44 ft-lb, 60 N·m)

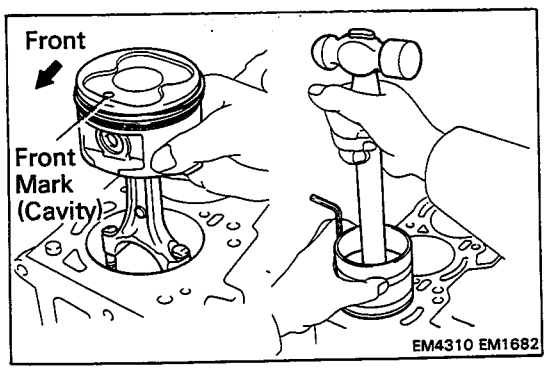
(e) Check that the crankshaft turns smoothly.

(f) Check the crankshaft thrust clearance. (See step 5 on page EM-121)

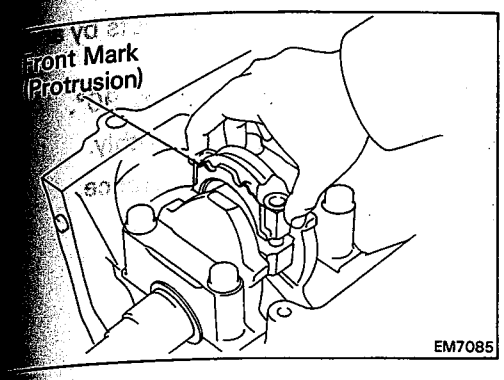


6. INSTALL PISTON AND CONNECTING ROD ASSEMBLIES

(a) Cover the connecting rod bolts with a short pie hose to protect the crankshaft from damage.



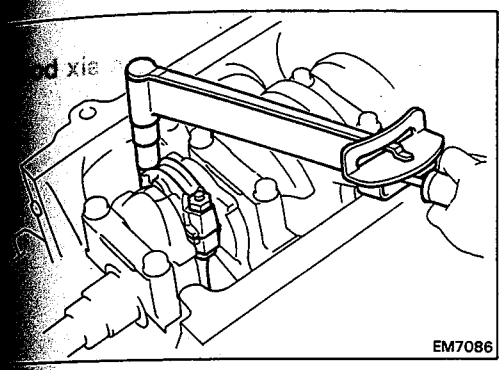
(b) Using a piston ring compressor, push the cor numbered piston and connecting rod assemblie each cylinder with the front mark of the piston f forward.



7. INSTALL CONNECTING ROD CAPS

(a) Match the numbered connecting rod cap with the connecting rod.

(b) Install the connecting rod cap with the front mark facing forward.



(4A-FE)

(c) Apply a light coat of engine oil on the threads and under the cap nuts.

(d) Install and alternately tighten the connecting rod cap nuts in several passes.

Torque: 500 kg-cm (36 ft-lb, 49 N·m)

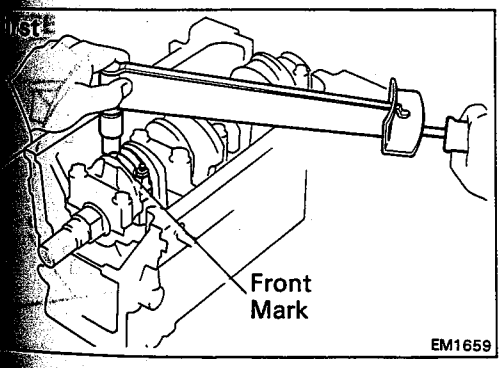
(e) Check that the crankshaft turns smoothly.

(f) Check the connecting rod thrust clearance. (See step 2 on page EM-119)

(4A-GE)

HINT:

- The connecting rod cap nuts are tightened in two progressive steps.
- If any of the cap bolts break or deform, replace them.

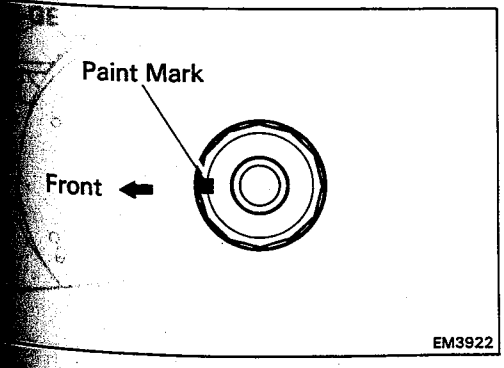


(c) Apply a light coat of engine oil on the threads and under the nuts of the connecting rod cap.

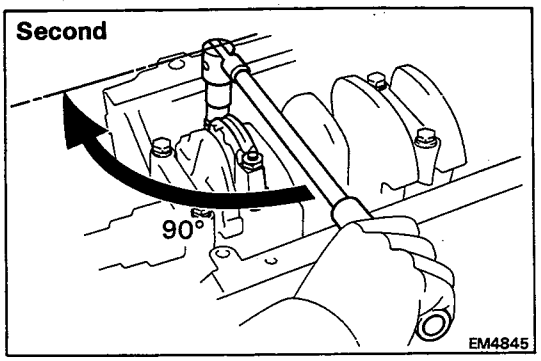
(d) First, alternately tighten the cap nuts in several passes.

Torque: 400 kg-cm (29 ft-lb, 39 N·m)

If any one of the nuts does not meet the torque specification, replace the bolt.



(e) Mark the front side of the top of cap nut with paint.

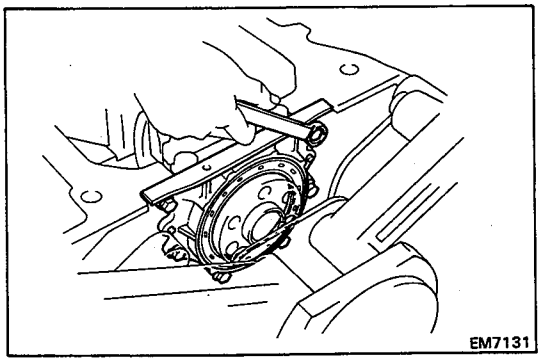


(f) Second, alternately retighten the cap nuts by an a
tional 90°.

(g) Check that the paint mark is turned by 90°.

(h) Check that the crackshaft turns smoothly.

(i) Check the connecting rod thrust clearance.
(See step 5 on page EM-121)



8. INSTALL REAR OIL SEAL RETAINER

Install a new gasket and the retainer with the six bol

Torque: 95 kg-cm (82 in.-lb, 9.3 N·m)

ASSEMBLY OF ENGINE

1. (4A-GE)
   INSTALL STIFFENER PLATE ADPTER
   Torque: 400 kg-cm (29 ft-lb, 39 N·m)

2. (4A-GE)
   INSTALL KNOCK SENSOR

3. INSTALL OIL PRESSURE SWITCH OR OIL PRESSURE SENDER GAUGE
   (See page LU-6)

4. INSTALL OIL FILTER BRACKET
   (See page LU-17)

5. INSTALL OIL PAN AND OIL PUMP
   (See page LU-15)

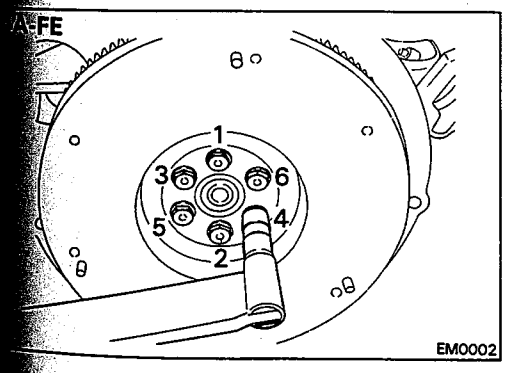
6. INSTALL WATER PUMP (See page CO-11)

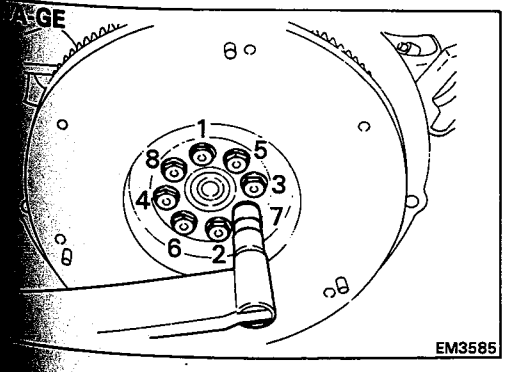
7. INSTALL CYLINDER HEAD
   4A-FE (See pages EM-56, 57)
   4A-GE (See page EM-92)

8. INSTALL TIMING PULLEYS AND TIMING BELT
   4A-FE (See page EM-39)
   4A-GE (See page EM-47)

9. (4A-FE)
   INSTALL RH MOUNTING BRACKET
   Torque: 500 kg-cm (36 ft-lb, 49 N·m)

10. INSTALL BRACKET AND ALTERNATOR
    Torque (Bracket): 500 kg-cm (36 ft-lb, 49 N·m)





11. INSTALL IIA OR DISTRIBUTOR

12. REMOVE ENGINE ASSEMBLY FROM ENGINE STAND

13. INSTALL REAR END PLATE

14. INSTALL FLYWHEEL (M/T) OR DRIVE PLATE (A/T)
    Install the flywheel or drive plate on the crankshaft. Tighten the bolts to the specified torque in two or three passes in the sequence shown.
    Torque:

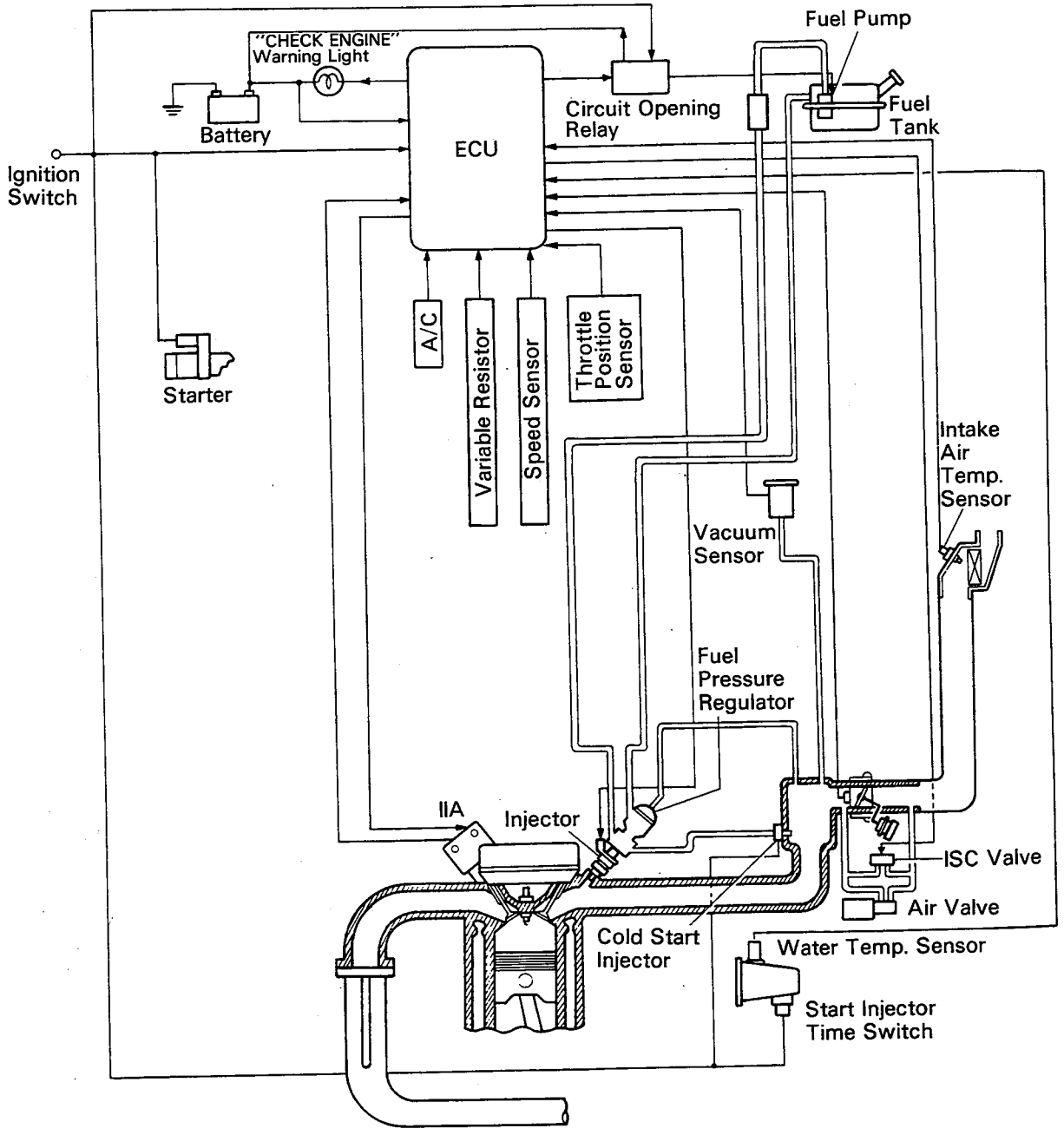
Flywheel	4A-FE	800 kg-cm (58 ft-lb, 78 N·m)
	4A-GE	750 kg-cm (54 ft-lb, 74 N·m)
Drive plate (4A-FE)		650 kg-cm (47 ft-lb, 64 N·m)

15. (M/T)
    INSTALL CLUTCH DISC AND COVER
    HINT: If necessary, inspect the clutch unit before installation.

EFI SYSTEM

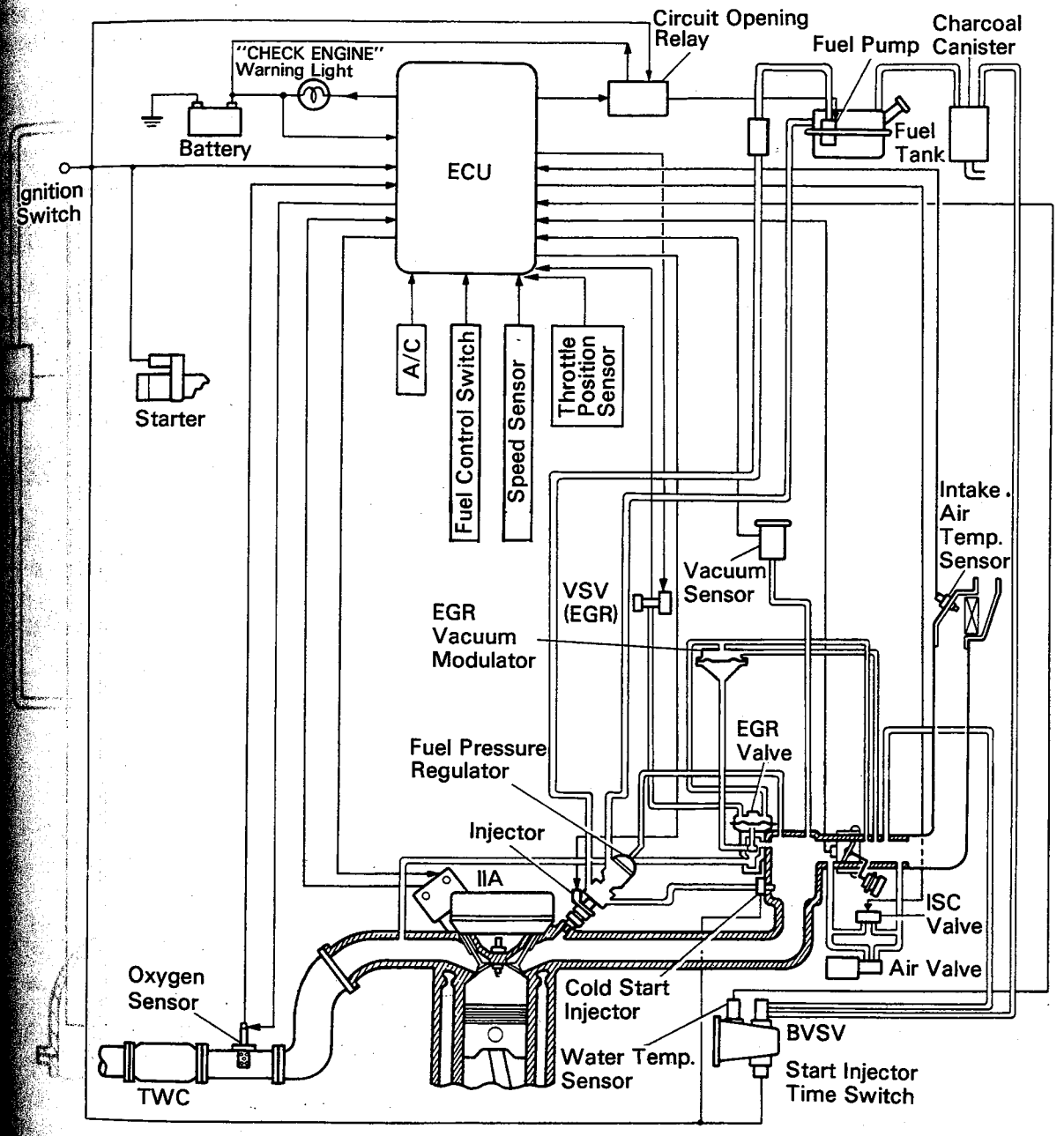
SYSTEM DESCRIPTION

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



SYSTEM DESCRIPTION (Cont'd)

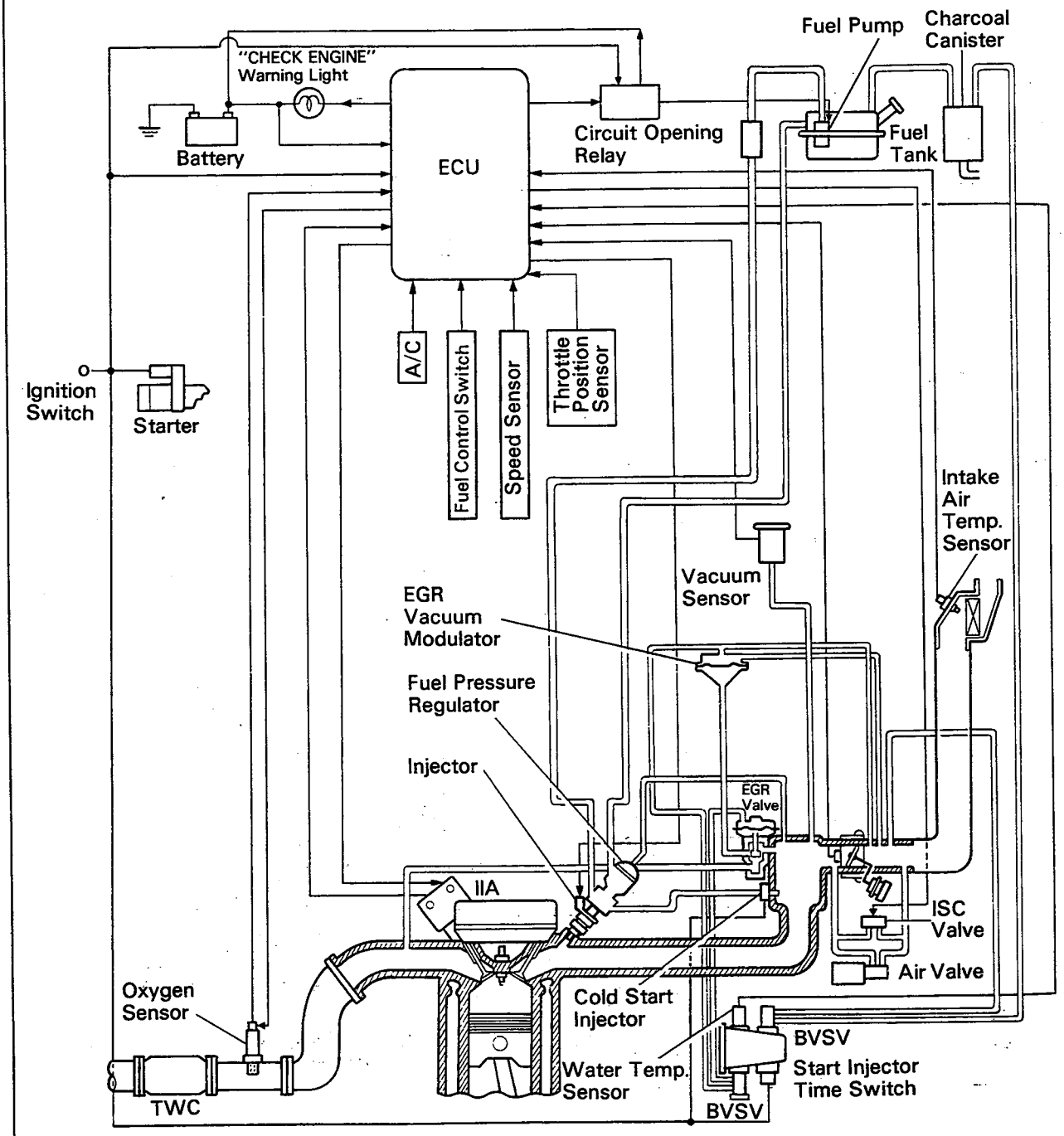
4A-FE (2WD, w/ EGR System)



FI4892

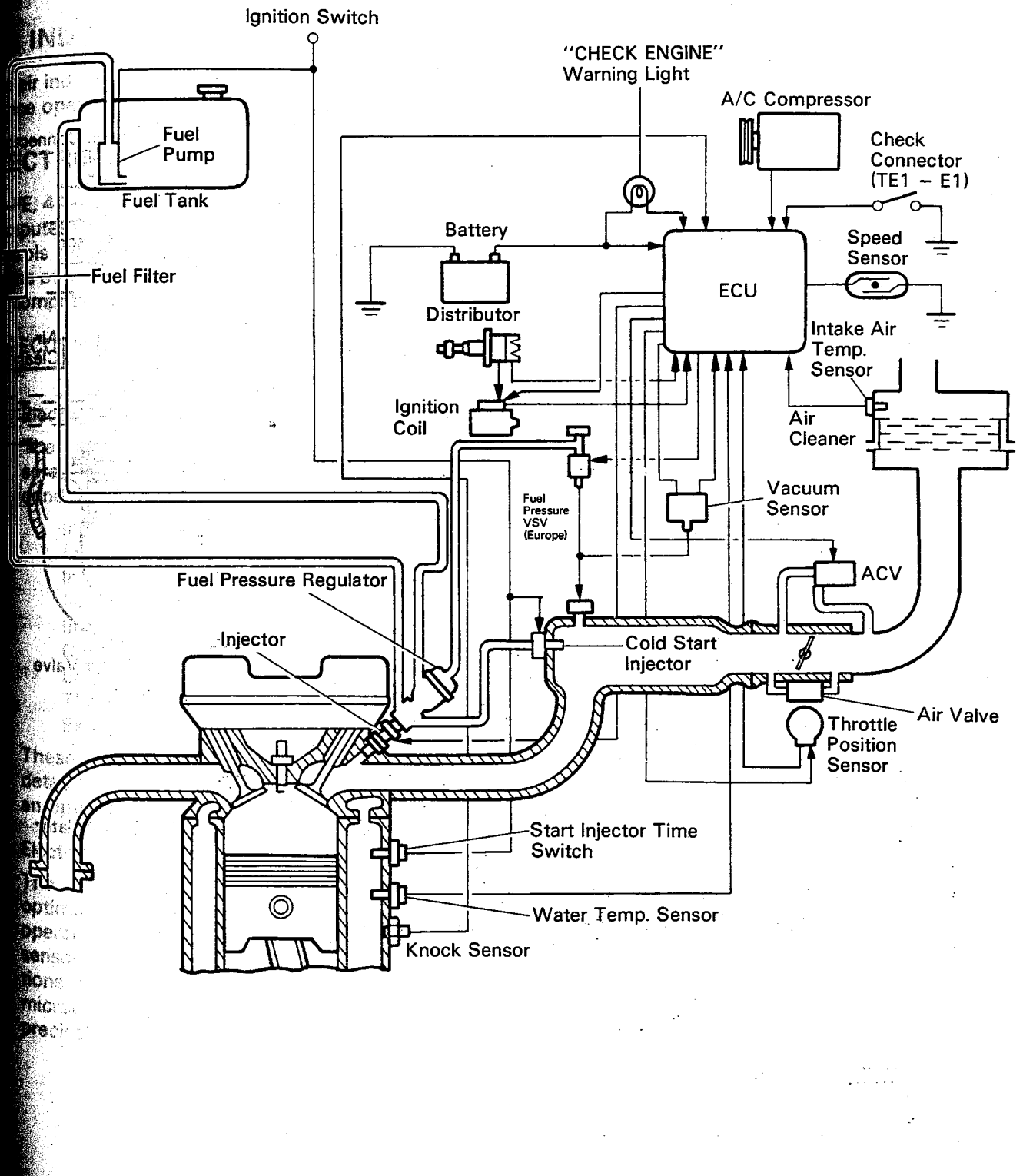
SYSTEM DESCRIPTION (Cont'd)

4A-FE (4WD)



SYSTEM DESCRIPTION (Cont'd)

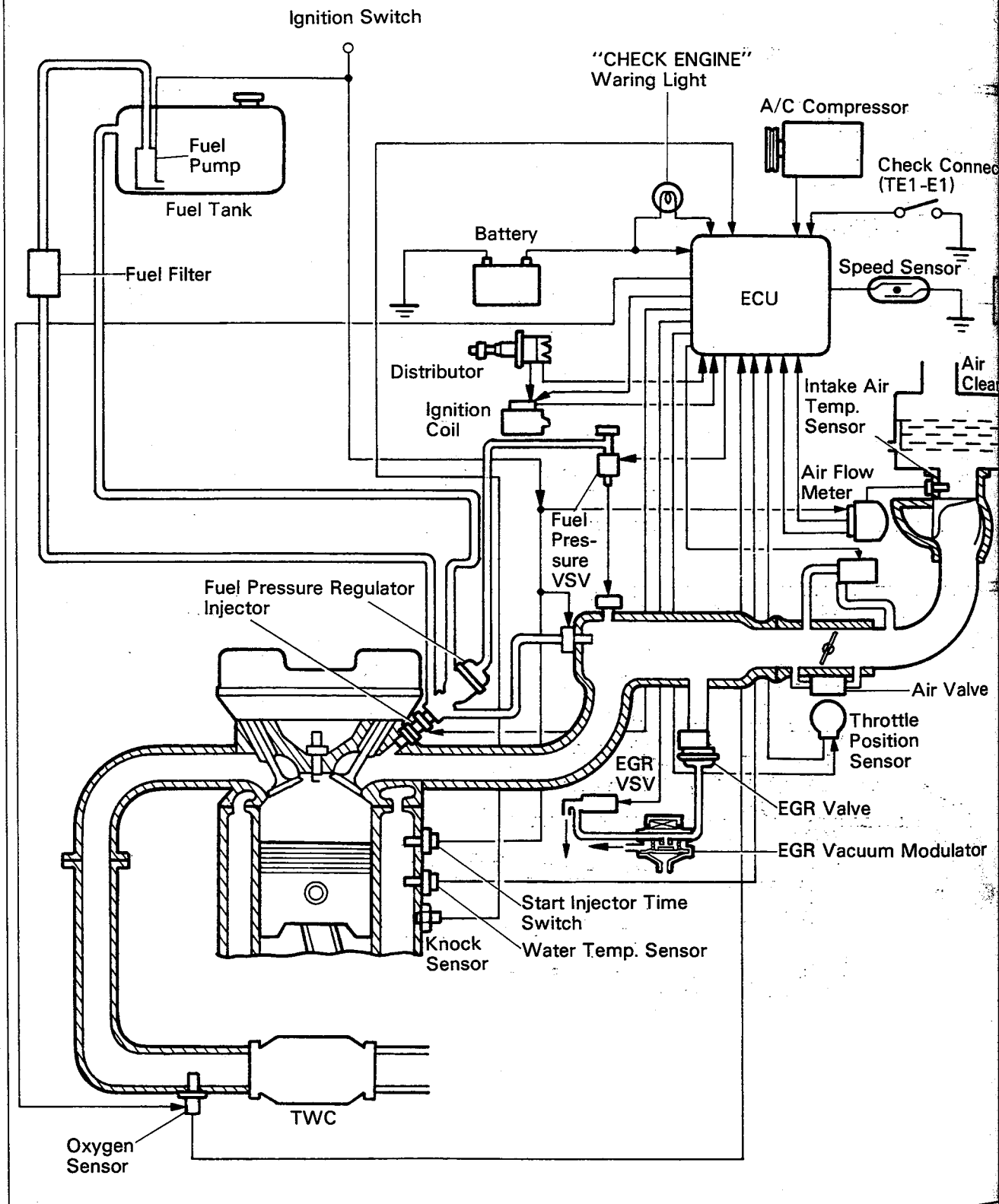
GE (w/o Air Flow Meter)



FI4895

SYSTEM DESCRIPTION (Cont'd)

4A-GE (w/ Air Flow Meter)



EFI system is composed of three basic sub-ems: Fuel, Air Induction and Electronic rol System.

SYSTEM

s supplied under constant pressure to the EFI ors by an electric fuel pump. The injectors a metered quantity of fuel into the intake in accordance with signals from the ECU tronic Control Unit).

INDUCTION SYSTEM

air induction system provides sufficient air for e operation.

CTRONIC CONTROL SYSTEM

4A-GE engines are equipped with a Toyota puter Control System (TCCS) which centrally ols the EFI, ESA, Diagnosis systems, etc. by s of an Electronic Control Unit (ECU-formerly omputer) employing a microcomputer.

CU, the TCCS controls the following func-

lectronic Fuel Injection (EFI)

he ECU receives signals from various sen-sors indicating changing engine operating conditions such as:

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

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

lectronic Spark Advance (ESA)

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

3. Diagnosis

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

4. Fail-Safe Function

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

PRECAUTIONS

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

   HINT: Any diagnostic code retained by the compute be cleared when the battery terminal is rem Therefore, if necessary, read the diagnosis before re ing the battery terminal.

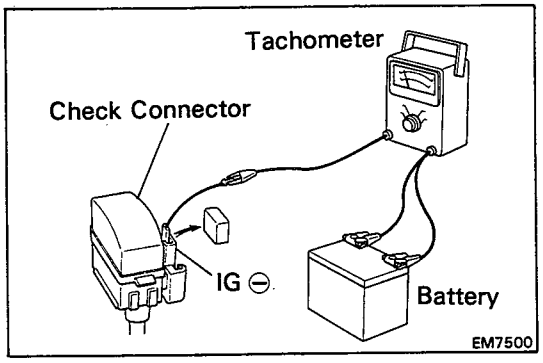
2. **(w/ AIRBAG)**
   Work must be started after approx. 20 second longer from the time the ignition switch is turne the "LOCK" position and the negative (−) term cable is disconnected from the battery.

3. **When working on the fuel system, do not smok work near any fire hazard.**

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

INSPECTION PRECAUTIONS

MAINTENANCE PRECAUTIONS

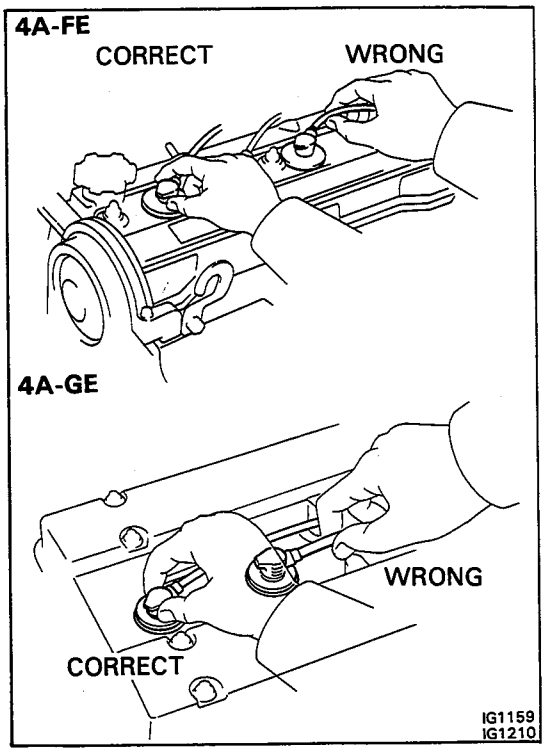


1. **CHECK CORRECT ENGINE TUNE-UP**

2. **PRECAUTIONS WHEN CONNECTING GAUGE**
   (a) Connect the tachometer test probe to IG ⊖ terminal of the check connector.

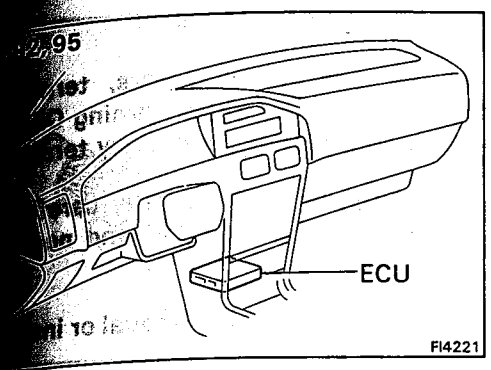
   LOCATION: See page FI-133

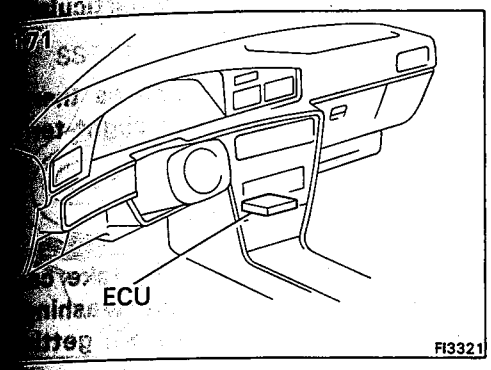
   (b) Use the battery as the power source for the ti light, tachometer, etc.

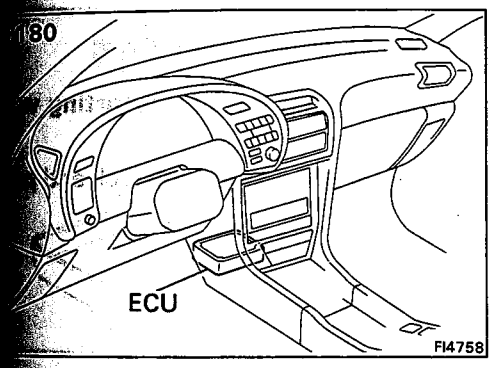


3. **IN EVENT OF ENGINE MISFIRE, THE CATALYTI VERTER MAY OVERHEAT. THEREFORE, THE FOLLOWING PRECAUTIONS SHOULD BE TAKEN**
   (a) Check proper connection of battery terminals,
   (b) Handle high-tension cords carefully.
   (c) After repair work, check that all ignition syste ings are reconnected securely.
   (d) When cleaning the engine compartment, be esp ly careful to protect the electrical system from

4. **PRECAUTIONS WHEN HANDLING OXYGEN SEN**
   (a) Do not allow the oxygen sensor to receive any p cal impact or shocks.
   (b) Do not allow water to come into contact wit sensor.







WHEN CAR IS EQUIPPED WITH A 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 an amateur radio transceiver, etc. (even one with approx. 10 W output), it may, at times, have an effect upon ECU operation, especially if the antenna and feeder are installed nearby.

Therefore, observe the following precautions.

(a) Install the antenna as far as possible from the ECU. The ECU is located below the glove box so the antenna should be installed at the rear, left side of the vehicle.

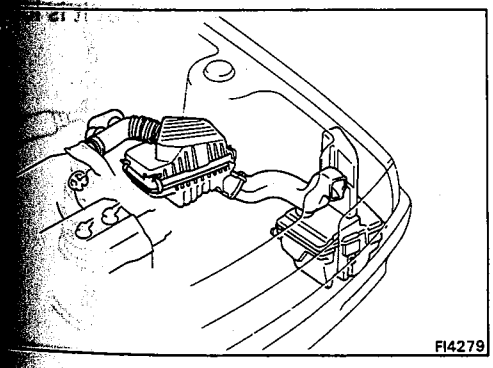
If installing on the bumper, do so on the right side, if possible.

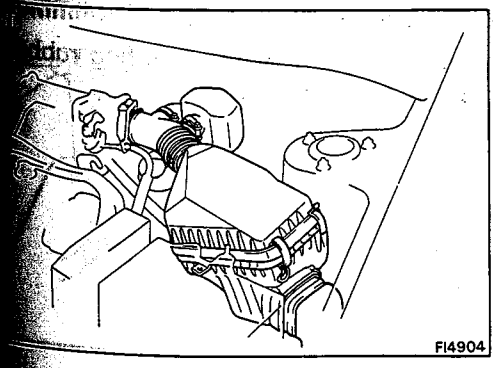
(b) Keep the antenna feeder as far away as possible from the ECU wires - at least 20 cm (7.87 in.) - and , especially, do not wind them together.

(c) Insure that the feeder and antenna are properly adjusted.

(d) Do not equip your vehicle with a powerful mobile radio system.

(e) 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.)

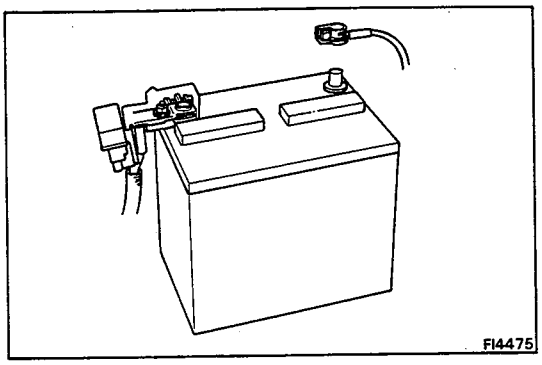




AIR INDUCTION SYSTEM

1. **Separation of the engine oil dipstick, oil filler cap, PCV hose, etc. may cause the engine to mistune.**

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 mistune.**


FI4475

ELECTRONIC CONTROL SYSTEM

1. **Before removing EFI wiring connectors, termin etc., first disconnect power by either turning OFF ignition switch or disconnecting the battery termin**

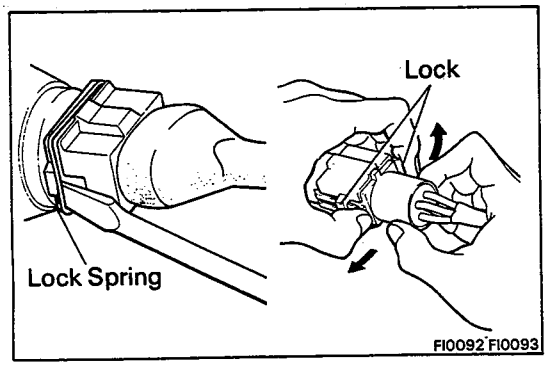
2. **When installing the battery, be especially careful to incorrectly connect the positive (+) and negat (–) cables.**

3. **Do not permit parts to touch during removal or insta tion.**
   Handle all EFI parts carefully and, in particular, ECU.

4. **Take great care during troubleshooting as there numerous transistor circuits and even slight term contact can cause further troubles.**

5. **Do not open the ECU cover.**

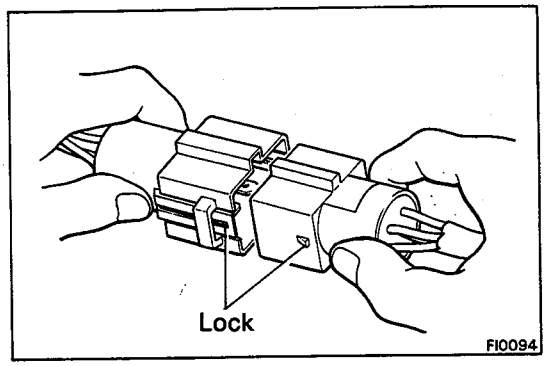
6. **When inspecting during rainy weather, take care prevent entry of water. Also, when washing engine compartment, prevent water from getting the EFI parts and wiring connectors.**



FI0092 FI0093

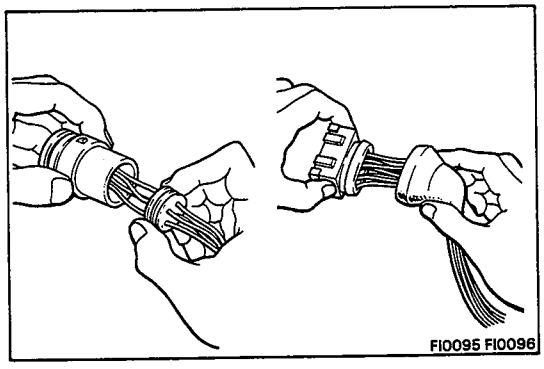
7. **Parts should be replaced as an assembly.**

8. **Care is required when pulling out and inserting wi connectors.**
   (a) To pull the connector out, release the lock and pu the connector.

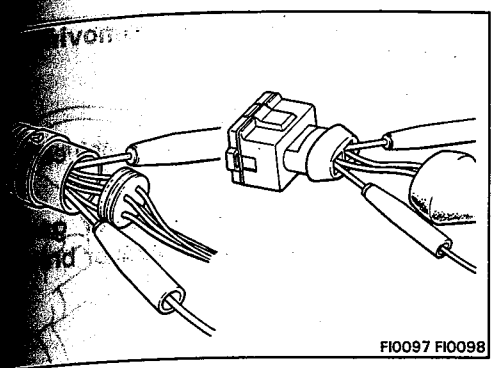


FI0094

   (b) Fully insert the connector and check that it is loc


FI0095 FI0096

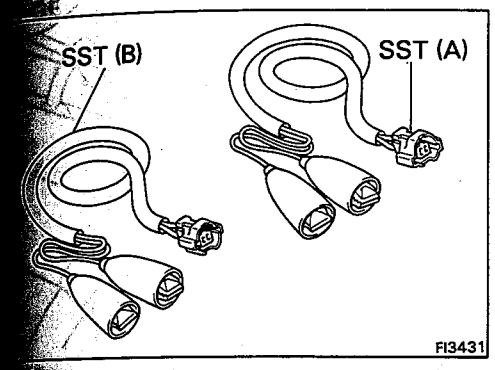
9. **When inspecting a connector with a volt/ohmmet**
   (a) Carefully move away the water-proofing rubber is a water-proof type connector.


FI0097 FI0098

(b) Insert the tester probe into the connector from wiring side when checking the continuity, amperage or voltage.

(c) Do not apply unnecessary force to the terminal.

(d) After the check, securely install the water-proofing rubber on the connector.

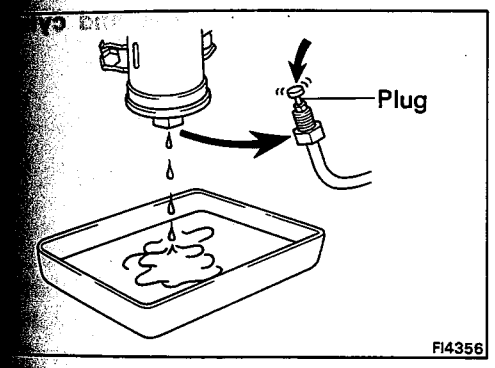


FI3431

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

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

FUEL SYSTEM



FI4356

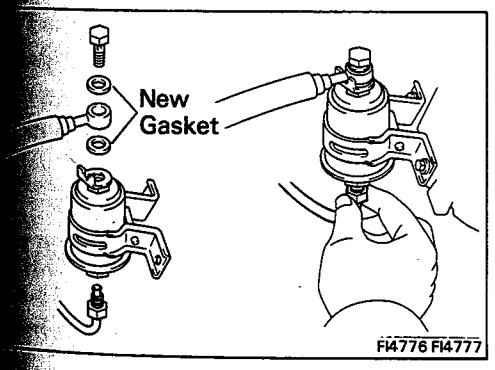
1. When disconnecting the flare nut or union bolt on the high pressure pipe union, observe the following procedure.

(a) Put a container under the connection.

(b) Slowly loosen the connection.

(c) Disconnect the connection.

(d) Plug the connection with a rubber plug.



FI4776 FI4777

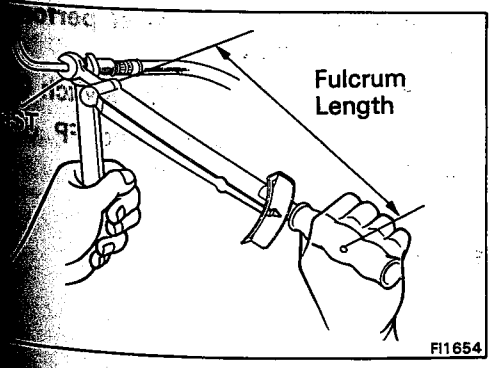
2. When connecting the flare nut or union bolt on the high pressure pipe union, observe the following procedure.

(Union bolt type)

(a) Always use a new gasket.

(b) Hand tighten the union bolt.

(c) Torque the bolt to the specified torque.



FI1654

(Flare nut type)

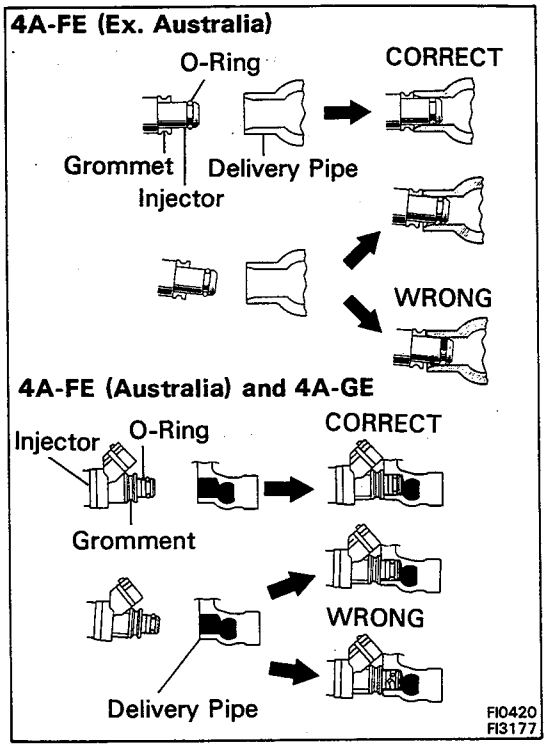
(a) Apply a thin coat of oil to the flare and tighten the flare nut.

(b) Then using SST, torque the unit to the specified torque.

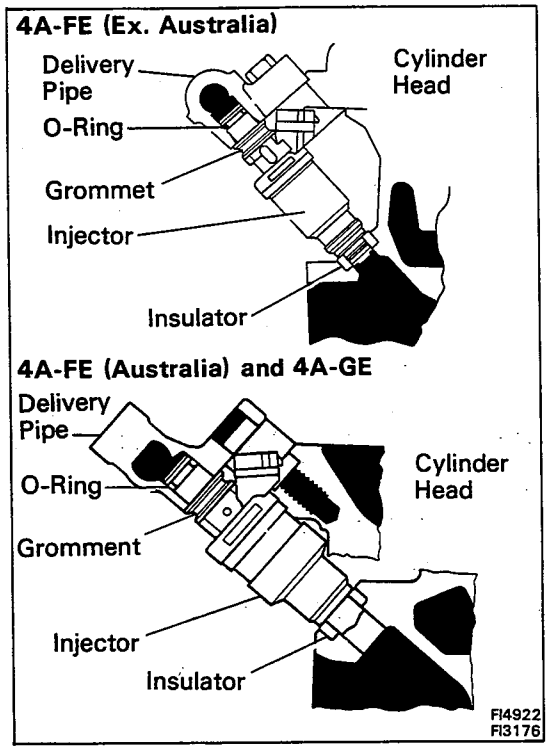
SST 09631-22020

Torque: 310 kg-cm (22 ft-lb, 30 N·m)

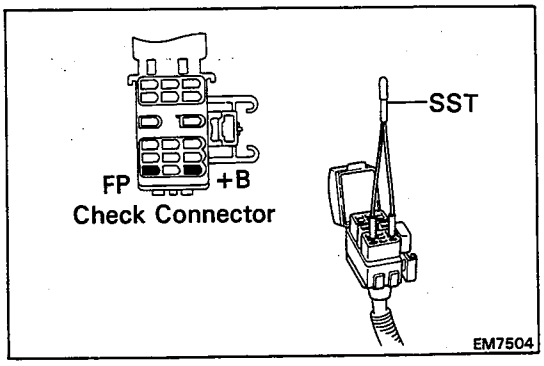
HINT: Use a torque wrench with a fulcrum length of 30 cm (11.81 in.).



3. **Take the following precautions when removing installing the injectors.**
   (a) Never reuse the O-ring.
   (b) When placing an O-ring on the injector, use care to damage it in any way.
   (c) Lubricate the O-ring with spindle oil or gaso before installing. Never use engine, gear or brake



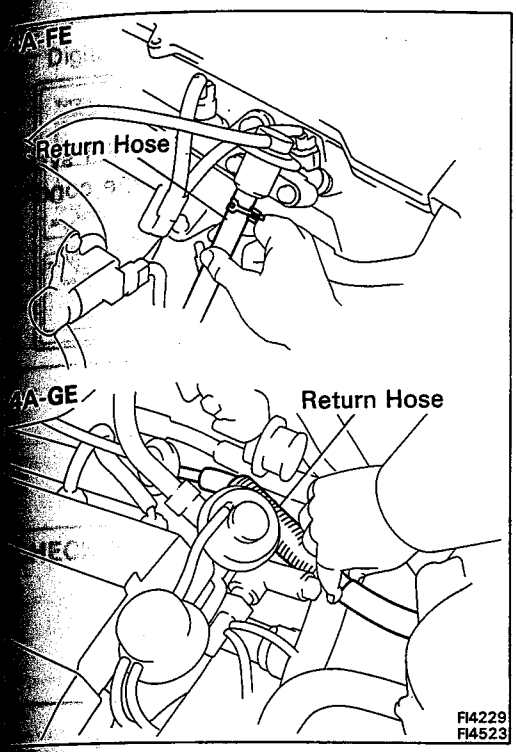
4. **Install the injector to the delivery pipe and cyli head as shown in the figure.**



5. **Confirm that there are no fuel leaks after perfor maintenance on the fuel system.**
   (a) With engine stopped, turn the ignition switch O
   (b) Using SST, connect terminals +B and FP o check connector.

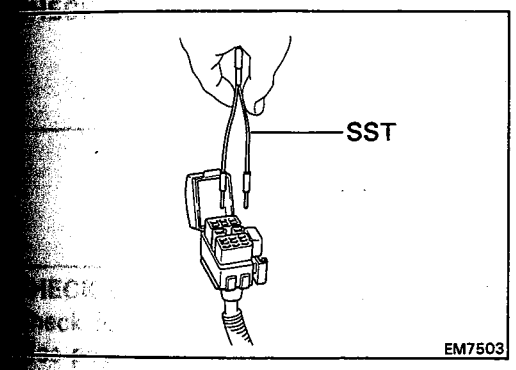
   SST 09843-18020

   LOCATION: See page FI-133



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

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



(d) Remove SST from the check connector.

SST 09843-18020

TROUBLESHOOTING

TROUBLESHOOTING HINTS

1. Engine trouble are usually not caused by the EFI syste When troubleshooting, always firstly check the conditi of the other systems.
   (a) Electronic source
      - Battery
      - Fusible links
      - Fuses

   (b) Body ground

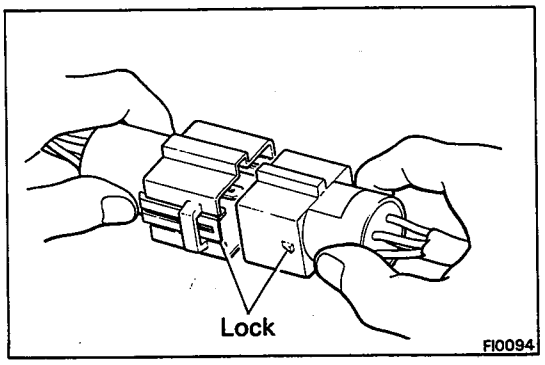
   (c) Fuel supply
      - Fuel leakage
      - Fuel filter
      - Fuel pump

   (d) Ignition system
      - Spark plugs
      - High-tension cords
      - IIA or Distributor
      - Ignition coil
      - Igniter

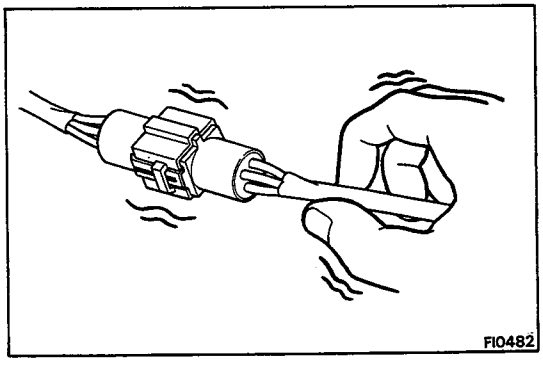
   (e) Air induction system
      - Vacuum leaks

   (f) Emission control system
      - PCV system
      - EGR system (w/ EGR system)

   (g) Others
      - Ignition timing
      - Idle speed
      - etc.

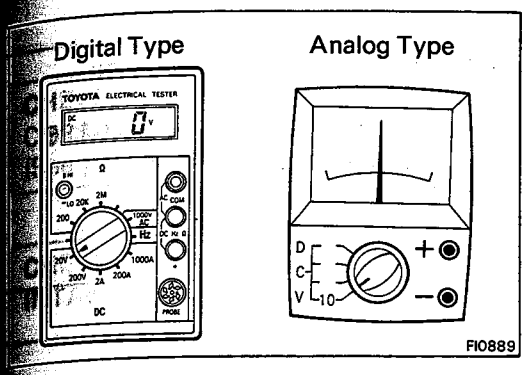


2. The most frequent cause of problems is simply a bad c tact in wiring connectors. Always check that connecti are secure.
   When inspecting the connector, pay particular attentio the following points:
   (a) Check to see that the terminals are not bent.
   (b) Check to see that the connector is pushed in c pletely and locked.



   (c) Check to see that there is no signal change when connector is slightly tapped or wiggled.

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



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

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

CHECK ELECTRIC SOURCE → BAD →
1. Battery
   (1) Connection
   (2) Gravity–Drive belt–charging system
   (3) Voltage
2. Fusible link

OK ↓

CHECK STARTING SYSTEM → BAD →
1. Ignition switch
2. Starter
3. Neutral start switch (A/T)
4. Wiring/Connection

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

CHECK DIAGNOSIS SYSTEM
Check for output of diagnosis code. (See page FI-25)
→ Malfunction code(s) →
Diagnosis code(s)
4A-FE (See page FI-28)
4A-GE (See page FI-29)

Normal code ↓

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

OK ↓

CHECK IGNITION SPARK
4A-FE (See page IG-6)
4A-GE (See page IG-10)
→ BAD →
1. High-tension cords
2. IIA, Distributor
3. Ignition coil, igniter

OK ↓

CHECK IGNITION TIMING
1. Short terminals TE1 and E1 of the check connector.
2. Check ignition timing.
Standard: 10° BTDC @ idle
→ NO →
Ignition timing — Adjust
4A-FE (See page EM-20)
4A-GE (See page EM-28)

OK ↓ CONTINUED ON PAGE FI-16

OK CONTINUED FROM PAGE FI-15

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

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

OK

(w/ AIR FLOW METER)
CHECK FUEL PUMP SWITCH IN AIR FLOW METER
Check continuity between terminals FC and E1 while measuring plate of air flow meter is open.

BAD → Air flow meter (See page FI-120)

OK

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

NO →
1. Spark plugs
2. Compression pressure
   Minimum: 10.0 kg/cm² (142 psi, 981 kPa) at 250 rpm
3. Valve clearance (Cold)
   Standard: IN 0.15 – 0.25 mm (0.006 – 0.010 in.)
   EX 0.20 – 0.30 mm (0.008 – 0.0012 in.)

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

OK

CHECK AUXILIARY AIR VALVE (See page FI-131)

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

OK

CHECK INTAKE VALVE

BAD → Intake valve – carbon deposits

OK

CHECK EFI ELECTRONIC CIRCUIT USING VOLT/OHMMETER (See page FI-34)

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

SYMPTOM — ENGINE OFTEN STALLS

CHECK DIAGNOSIS SYSTEM
Check for output of diagnostic code.
(See page FI-25)

→ Malfunction code(s) → Diagnostic code(s)
4A-FE (See page FI-28)
4A-GE (See page FI-29)

↓ Normal code

CHECK FOR VACUUM LEAKS IN AIR INTAKE LINE

→ BAD →
1. Oil dipstick
2. Hose connection(s)
3. PCV hose(s)
4. 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. (See page FI-95)

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

↓ OK

CHECK AIR FILTER ELEMENT

→ BAD → Element — Clean or replace

↓ OK

CHECK IDLE SPEED (AND IDLE CO CONCENTRATION)
Standard: 800 rpm

→ NO →
Idle speed — Adjust
4A-FE (See pages EM-22, 23)
4A-GE (See pages EM-30, 31)

↓ OK

CHECK IGNITION TIMING
1. Connect terminals TE1 and E1 of the check connector.
2. Check ignition timing.
Standard: 10° BTDC @ idle

→ NO →
Ignition timing — Adjust
4A-FE (See page EM-20)
4A-GE (See page EM-28)

↓ OK

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

→ NO →
1. Spark plugs
2. Compression pressure
Minimum: 10.0 kg/cm² (142 psi, 981 kPa) at 250 rpm
3. Valve clearance (Cold)
Standard: IN 0.15 — 0.25 mm (0.006 — 0.010 in.)
EX 0.20 — 0.30 mm (0.008 — 0.012 in.)

↓ OK

CHECK COLD START INJECTOR
(See page FI-105)

→ BAD →
1. Cold start injector
2. Start injector time switch (See page FI-137)

↓ OK CONTINUED ON PAGE FI-18

OK CONTINUED FROM PAGE FI-17

CHECK AUXILIARY AIR VALVE
(See page FI-131)

BAD →
1. Auxiliary air valve
2. Water hose(s)
3. Air hose(s)

OK

CHECK FUEL PRESSURE
(See page FI-97)

BAD →
1. Fuel pump (See page FI-94)
2. Fuel filter
3. Fuel pressure regulator (See page FI-109)

OK

CHECK INJECTORS
(See page FI-111)

BAD → Injection condition

OK

CHECK EFI ELECTRONIC CIRCUIT USING VOLT/OHMMETER
(See page FI-34)

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

SYMPTOM — ENGINE SOMETIMES STA

CHECK DIAGNOSTIC SYSTEM
Check for output of diagnostic code.
(See page FI-25)

Malfunction code(s) →
Diagnostic cord(s)
4A-FE (See page FI-28)
4A-GE (See page FI-29)

Normal code

(w/ AIR FLOW METER)
CHECK AIR FLOW METER
(See page FI-120)

BAD → Air flow meter

OK

(w/o AIR FLOW METER)
CHECK VACUUM SENSOR
(See page FI-140)

BAD → Vacuum sensor

OK

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

BAD →
1. Connectors
2. EFI main relay (See page FI-134)
3. Circuit opening relay (See page FI-1

SYMPTOM — ROUGH IDLING AND/OR MISSING

CHECK DIAGNOSIS SYSTEM
Check for output of diagnostic code.
(See page FI-25)

→ Malfunction code(s) → Diagnostic code(s)
4A-FE (See page FI-28)
4A-GE (See page FI-29)

↓ Normal code

CHECK FOR VACUUM LEAKS IN AIR INTAKE LINE

→ BAD →
1. Oil dipstick
2. Hose connection(s)
3. PCV hose(s)
4. EGR system — EGR valve stays open

↓ OK

CHECK AIR FILTER ELEMENT

→ BAD → Element — Clean or replace

↓ OK

CHECK IDLE SPEED (AND IDLE CO CONCENTRATION)
Standard: 800 rpm

→ NO →
Idle speed — Adjust
4A-FE (See pages EM-22, 23)
4A-GE (See pages EM-30, 31)

↓ OK

CHECK IGNITION TIMING
Connect terminals TE1 and E1 of the check connector
Check ignition timing.
Standard: 10° BTDC @ idle

→ NO →
Ignition timing — Adjust
4A-FE (See page EM-20)
4A-GE (See page EM-28)

↓ OK

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

→ NO →
1. Spark plugs
2. Compression pressure
   Minimum: 10.0 kg/cm² (142 psi, 981 kPa) at 250 rpm
3. Valve clearance (Cold)
   Standard: IN 0.15 — 0.25 mm (0.006 — 0.010 in.)
   EX 0.20 — 0.30 mm (0.008 — 0.012 in.)

↓ OK

CHECK COLD START INJECTOR
(See page FI-105)

→ BAD →
1. Cold start injector
2. Start injector time switch (See page FI-137)

↓ OK

CHECK FUEL PRESSURE
(See page FI-97)

→ BAD →
1. Fuel pump (See page FI-94)
2. Fuel filter
3. Fuel pressure regulator (See page FI-109)

↓ OK CONTINUED ON PAGE FI-20

OK CONTINUED FROM PAGE FI-19

CHECK INJECTORS
(See page FI-111)
BAD → Injection condition

OK

CHECK EFI ELECTRONIC CIRCUIT USING VOLT/OHMMETER
(See page FI-34)
BAD →
1. Wiring connections
2. Power to ECU
   (1) Fusible link(s)
   (2) Fuse(s)
   (3) EFI main relay
3. Air flow meter (w/ Air flow meter)
4. Vacuum sensor (w/o Air flow meter)
5. Water temp. sensor
6. Intake air temp. sensor
7. Injection signal circuit
   (1) Injector wiring
   (2) ECU
8. Oxygen sensor (w/ TWC)

OK

(w/o TWC)
CHECK VARIABLE RESISTOR
(See page FI-142)
BAD → Variable resistor

SYMPTOM – HIGH ENGINE IDLE SPEED (NO DR

CHECK ACCELERATOR LINKAGE
BAD → Linkage – Stuck

OK

CHECK AUXILIARY AIR VALVE
(See page FI-131)
BAD → Auxiliary air valve – Always open

OK

(4A-FE)
CHECK ISC VALVE
(See page FI-158)
BAD →
1. ISC valve
2. Air pipe(s)
3. Air hose(s)

OK

CHECK FOR VACUUM LEAKS IN AIR INTAKE LINE
BAD →
1. Oil dipstick
2. Hose connection(s)
3. PCV hose(s)
4. EGR system – EGR valve stays open
5. Brake booster line
6. Throttle valve adjusting (open stick)

OK

CHECK AIR CONDITIONER IDLE-UP CIRCUIT
BAD → Air valve for air conditioner – Leakage

OK

CHECK DIAGNOSIS SYSTEM
Check for output of diagnostic code.
(See page FI-25)
Malfunction code(s) →
Diagnostic code(s)
4A-FE (See page FI-28)
4A-GE (See page FI-29)

Normal code

CHECK THROTTLE POSITION SENSOR
(See page FI-123)
BAD → Throttle body

OK CONTINUED ON PAGE FI-21

OK CONTINUED FROM PAGE FI-20

CHECK FUEL PRESSURE
(See page FI-97)
→ BAD → Fuel pressure regulator – High pressure
OK

CHECK COLD START INJECTOR
(See page FI-105)
→ BAD → Cold start injector – Linkage
OK

CHECK INJECTORS
(See page FI-111)
→ BAD → Injectors – Leakage, Injection quantity
OK

CHECK EFI ELECTRONIC CIRCUIT USING VOLT/OHMMETER
(See page FI-34)
→ BAD →
1. Wiring connection
2. Power to ECU
   (1) Fusible link(s)
   (2) Fuse(s)
   (3) EFI main relay
3. Air flow meter (w/ Air flow meter)
4. Vacuum sensor (w/o Air flow meter)
5. Water temp. sensor
6. Intake air temp. sensor
7. Injection signal circuit
   (1) Injector wiring
   (2) ECU

SYMPTOM – ENGINE BACKFIRES-Lean Fuel Mixture

CHECK DIAGNOSIS SYSTEM
Check for output of diagnostic code.
(See page FI-25)
→ Malfunction code(s) →
Diagnostic code(s)
4A-FE (See page FI-28)
4A-GE (See page FI-29)
Normal code

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

CHECK IGNITION TIMING
Connect terminals TE1 and E1 of the check connector.
Check ignition timing.
Standard: 10° BTDC @ idle
→ NO →
Ignition timing – Adjust
4A-FE (See page EM-20)
4A-GE (See page EM-28)
OK

CHECK IDLE SPEED (AND IDLE CO CONCENTRATION)
Standard: 800 rpm
→ NO →
1. Idle speed – Adjust
   4A-FE (See pages EM-22, 23)
   4A-GE (See pages EM-30, 31)
2. Idle CO concentration – Adjust
OK CONTINUED ON PAGE FI-22

OK CONTINUED FROM PAGE FI-21

CHECK COLD START INJECTOR
(See page FI-105)

BAD →
1. Cold start injector
2. Start injector time switch
(See page FI-137)

OK

CHECK FUEL PRESSURE
(See page FI-97)

BAD →
1. Fuel pump (See page FI-94)
2. Fuel filter
3. Fuel pressure regulator
(See page FI-109)

OK

CHECK INJECTORS
(See page FI-111)

BAD → Injectors – Clogged

OK

CHECK EFI ELECTRONIC CIRCUIT USING VOLT/OHMMETER
(See page FI-34)

BAD →
1. Wiring connections
2. Power to ECU
(1) Fusible link(s)
(2) Fuse(s)
(3) EFI main relay
3. Air flow meter (w/ Air flow meter)
4. Vacuum sensor (w/o Air flow meter)
5. Water temp. sensor
6. Intake air temp. sensor
7. Throttle position sensor
8. Injection signal circuit
(1) Injector wiring
(2) Fuel cut RPM (See page FI-153)
(3) ECU
9. Oxygen sensor (w/ TWC)

OK

(w/o TWC)
CHECK VARIABLE RESISTOR
(See page FI-142)

BAD → Variable resistor

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

CHECK DIAGNOSIS SYSTEM
Check for output of diagnostic code.
(See page FI-25)

Malfunction code(s) →
Diagnostic code(s)
4A-FE (See page FI-28)
4A-GE (See page FI-29)

Normal

CHECK IGNITION TIMING
1. Connect terminals TE1 and E1 of the check connector
2. Check ignition timing.
Standard: 10° BTDC @ idle

NO →
Ignition timing – Adjust
4A-FE (See page EM-20)
4A-GE (See page EM-28)

OK CONTINUED ON PAGE FI-23

OK CONTINUED FROM PAGE FI-22

HECK IDLE SPEED (AND IDLE CO ONCENTRATION)
Standard: 800 rpm

NO →
1. Idle speed – Adjust
   4A-FE (See pages EM-22, 23)
   4A-GE (See pages EM-30, 31)
2. Idle CO concentration – Adjust

OK

HECK COLD START INJECTOR
(See page FI-105)

BAD →
1. Cold start injector
2. Start injector time switch.
   (See page FI-137)

OK

HECK FUEL PRESSURE
(See page FI-97)

BAD →
Fuel pressure regulator

OK

HECK THROTTLE POSITION ENSOR
A-FE (See page FI-123)
A-GE (See page FI-127)

BAD →
Throttle body

OK

HECK INJECTORS (See page FI-111)

BAD →
Injectors – Leakage

OK

HECK SPARK PLUGS
tandard: 0.8 mm (0.031 in.)
INT: Check compression pressure and lve clearance if necessary.

NO →
1. Spark plugs
2. Compression pressure
   Minimum: 10.0 kg/cm² (142 psi, 981 kPa) at 250 rpm
3. Valve clearance (Cold)
   Standard: IN 0.15 – 0.25 mm (0.006 – 0.010 in.)
   EX 0.20 – 0.30 mm (0.008 – 0.012 in.)

OK

HECK EFI ELECTRONIC CIRCUIT SING VOLT/OHMMETER
(See page FI-34)

BAD →
1. Throttle position sensor
2. Injection signal circuit
   (1) Injector wiring
   (2) Fuel cut RPM (See page FI-153)
   (3) ECU
3. Oxygen sensor (w/ TWC)

SYMPTOM — ENGINE HESITATES AND/OR POOR ACCELERATION

HECK CLUTCH OR BRAKES

BAD →
1. Clutch – Slips
2. Brakes – Drag

OK

HECK FOR VACUUM LEAKS IN AIR NTAKE LINE

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

OK CONTINUED ON PAGE FI-24

OK CONTINUED FROM PAGE FI-23

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

OK

CHECK DIAGNOSIS SYSTEM
Check for output of diagnostic code.
(See page FI-25) → Malfunction code(s) →
Diagnostic code(s)
4A-FE (See page FI-28)
4A-GE (See page FI-30)

Normal code

CHECK IGNITION SPARK
4A-FE (See page IG-6)
4A-GE (See page IG-10) → BAD →
1. High-tension cord(s)
2. IIA or Distributor
3. Ignition coil, igniter

OK

CHECK IGNITION TIMING
1. Connect terminals TE1 and E1 of the check connector
2. Check ignition timing.
Standard: 10° BTDC @ idle → NO →
Ignition timing – Adjust
4A-FE (See page EM-20)
4A-GE (See page EM-28)

OK

CHECK FUEL PRESSURE
(See page FI-97) → BAD →
1. Fuel pump (See page FI-94)
2. Fuel filter
3. Fuel pressure regulator (See page FI-109)

OK

CHECK INJECTORS
(See page FI-111) → BAD → Injection condition

OK

CHECK SPARK PLUGS
Standard: 0.8 mm (0.031 in.)
HINT: Check compression pressure and valve clearance if necessary. → BAD →
1. Spark plugs
2. Compression pressure
Minimum: 10.0 kg/cm² (142 psi, 981 kPa) at 250 rpm
3. Valve clearance (Cold)
Standard: IN 0.15 – 0.25 mm (0.006 – 0.010 in.)
EX 0.20 – 0.30 mm (0.008 – 0.012 in.)

OK

CHECK INTAKE VALVE → BAD → Intake valve – corbon deposits

OK

CHECK EFI ELECTRONIC CIRCUIT USING VOLT/OHMMETER
(See page FI-34) → NO →
1. Wiring connections
2. Power to ECU
(1) Fusible link(s)
(2) Fuse(s)
(3) EFI main relay
3. Air flow meter (w/ Air flow meter)
4. Vacuum sensor (w/o Air flow meter)
5. Water temp. sensor
6. Intake air temp. sensor
7. Throttle position sensor
8. Injector signal circuit
(1) Injector wiring
(2) ECU

DIAGNOSIS SYSTEM

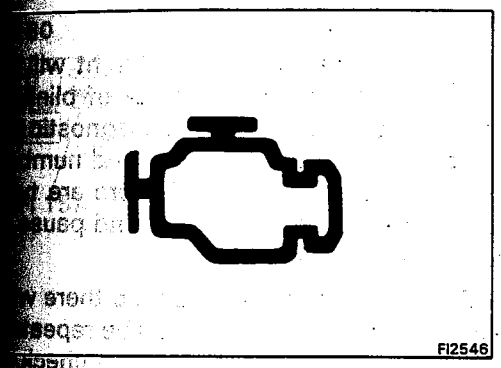
DESCRIPTION

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

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

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

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



CHECK ENGINE WARNING LIGHT CHECK

1. The "CHECK ENGINE" warning light will come on when the ignition switch is placed at ON and the engine is not running.

2. When the engine is started, the "CHECK ENGINE" warning light should go out.

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

OUTPUT OF DIAGNOSTIC CODES

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

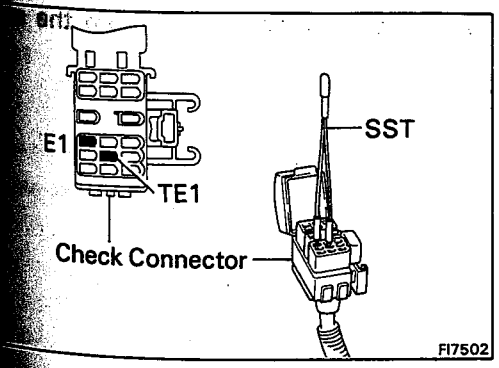
1. Initial conditions
   (a) Battery voltage 11 V or more
   (b) Throttle valve fully closed (throttle position sensor IDL points closed)
   (c) Transmission in neutral position
   (d) Accessories switched OFF

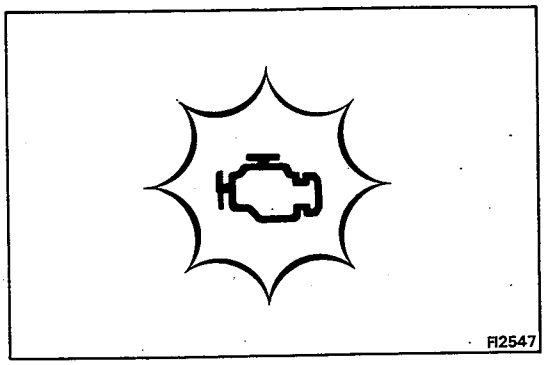
2. Turn the ignition switch to ON. Do not start the engine.

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

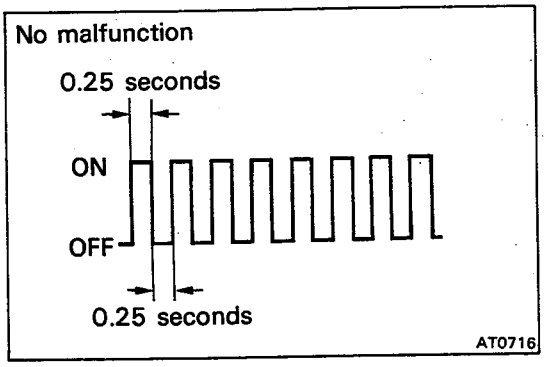
   SST 09843-18020

   LOCATION: See page FI-133




FI2547

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

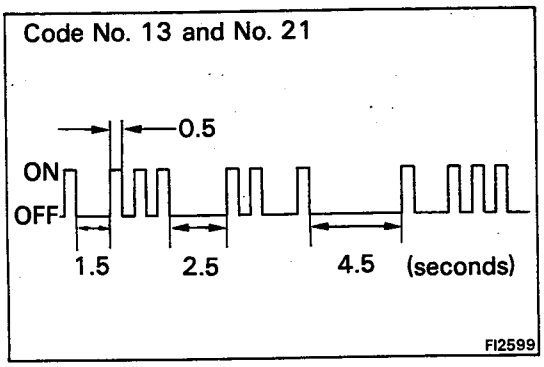


AT0716

Diagnostic Codes (See pages FI-28 to 31)

(a) Normal System Operation (no malfunction)

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

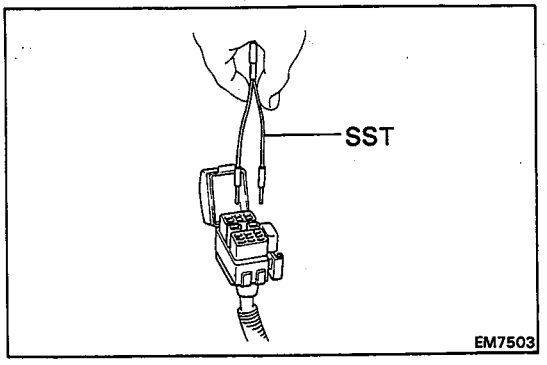


FI2599

(b) Malfunction Code Indication

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

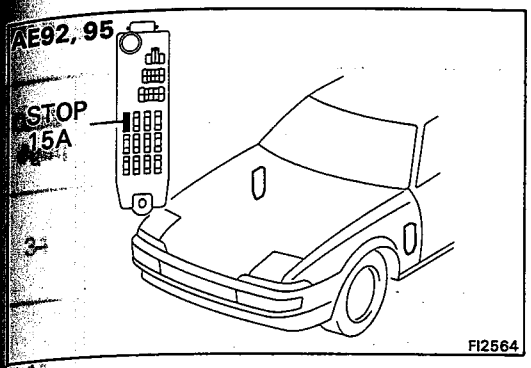
HINT: In the event of a number of trouble codes, indication will begin from the smaller value and continue to the larger.

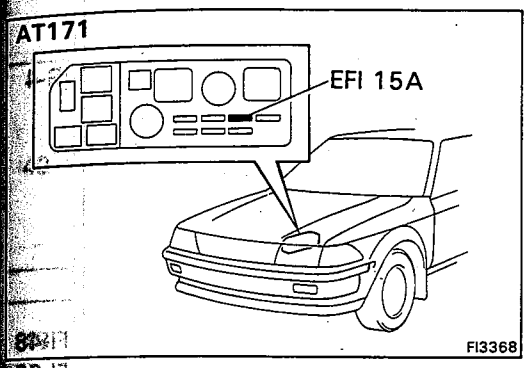


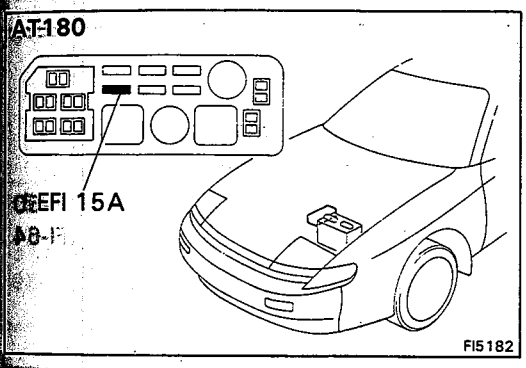
EM7503

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

SST 09843-18020







CANCELLING DIAGNOSTIC CODE

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

   HINT:
   - Cancellation can also be done by removing the battery negative (⊖) terminal, but in this case, other memory systems (clock, etc.) will also be cancelled out.
   - If the diagnostic code is not cancelled out, it will be retained by the ECU and appear along with a new code in the event of future trouble.
   - If it is necessary to work on engine components requiring removal of the battery terminal, a check must first be made to see if a diagnostic code is has been recorded.

2. After cancellation, do the road test of the vehicle the vehicle to check that a normal code is now read on the "CHECK ENGINE" warning light.

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

DIAGNOSIS INDICATION

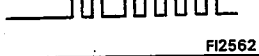
1. Including "normal", the ECU is programmed with the following diagnostic codes.

2. If two or more malfunctions are present at the same time, the lowest-numbered diagnostic code will be displayed first.

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

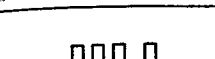
4. Once the malfunction is corrected, the "CHECK ENGINE" warning light on the instrument panel will go out but the diagnostic code(s) will remain stored in ECU memory (except for code No.51).

DIAGNOSTIC CODES (4A-FE)

Code No.	Number of blinks "CHECK ENGINE"	System	Diagnosis	Trouble area	See page
–	 ON OFF FI1401	Normal	This appears when none of the other codes are identified	–	–
12	 FI1389	PRM Signal	No "NE" or "G" signal to ECU within 2 seconds after the engine is cranked.	● Distributor (IIA) circuit ● Distributor (IIA) ● Starter signal circuit ● Igniter circuit ● Igniter ● ECU	IG-4
13	 FI1390	RPM Signal	No "NE" signal to ECU When the engine speed is above 1,000 rpm.	● Distributor (IIA) circuit ● Distributor (IIA) ● Igniter circuit ● Igniter ● ECU	
14	 FI1391	Ignition Signal	No "IGF" signal to ECU 4 times in succession.	● Igniter circuit ● Igniter ● ECU	FI-4 FI-6
*21	 FI1400	Oxygen Sensor Heater	During air-fuel ratio feedback correction, voltage output from the oxygen sensor does not exceed a set value on the lean side and the rich side continuously for a centain period.	● Oxygen sensor circuit ● Oxygen sensor	FI-5 FI-6
		Oxygen Sensor Heater	Open or short circuit in oxygen sensor heater (HT).	● Oxygen sensor heater circuit ● Oxygen sensor heater ● ECU	
22	 FI1392	Water Temp. Sensor	Open or short circuit in water temp. sensor signal (THW).	● Water temp. sensor circuit ● Water temp. sensor ● ECU	FI-4 FI-6
24	 FI1611	Intake air Temp. Sensor Signal	Open or short circuit in intake air temp. sensor signal (THA).	● Intake air temp. sensor circuit ● Intake air temp. sensor ● ECU	FI-4 FI-5
*25	 FI2562	Air-fuel Ratio Lean Malfunction	When air-fuel ratio feedback correction value cotinues at the upper (lean) limit for a certain period of time.	● Oxygen sensor circuit ● Oxygen sensor ● ECU	FI-5 FI-6
*26	 FI2563	Air-fuel Ratio Rich Malfunction			

*: w/ EGR System

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

Code No.	Number of blinks "CHECK ENGINE"	System	Diagnosis	Trouble area	See page
31	 FI1394	Vacuum Sensor Signal	Open or short circuit intake manifold pressure signal (PIM).	• Vacuum sensor circuit • Vacuum sensor • ECU	FI-44 FI-58
41	 FI1396	Throttle Position Sensor Signal	The "IDL" and "PSW" signals are output simultaneously for several seconds.	• Throttle position sensor circuit • Throttle position sensor • ECU	FI-41 FI-55
42	FI1397	Vehicle Speed Sensor Signal	No "SPD" signal for 8 seconds when engine speed is between 2,600 rpm and 4,500 rpm and coolant temp. is below 80°C (176°F) except when racing the engine.	• Vehicle speed sensor circuit • Vehicle speed sensor • ECU	–
43	 FI1398	Starter Signal	No "STA" signal to ECU until engine speed reaches 800 rpm with vehicle not moving.	• IG switch circuit • IG switch, main relay circuit • ECU	FI-47 FI-61
51	 FI1399	Switch Condition Signal	No "IDL" signal, "NSW" signal or "A/C" signal to ECU, with the check terminals E1 and TE1 connected.	• A/C switch circuit • A/C switch • A/C amplifier • Neutral start switch circuit • Neutral start switch • Accelerator pedal and cable • Throttle position sensor • circuit • Throttle position sensor • ECU	FI-49 FI-63

DIAGNOSTIC CODES (4A-GE)

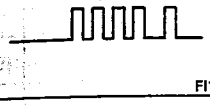
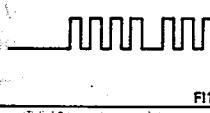
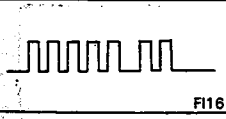
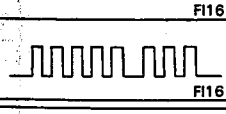
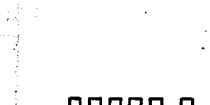
Code No.	Number of blinks "CHECK ENGINE"	System	Diagnosis	Trouble area	See page
51	 ON OFF FI1401	Normal	This appears when none of the other codes are identified.	–	–
12	 FI1389	PRM Signal	(w/o Air Flow Meter) No "NE" or "G" signal to ECU within 2 seconds after engine has been cranked.	• Distributor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

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

Code No.	Number of blinks "CHECK ENGINE"	System	Diagnosis	Trouble area	See page
13	 FI1390	RPM Signal	(w/o Air Flow Meter) No "NE" signal to ECU When the engine speed is above 1,000 rpm (w/ Air Flow Meter) No "NE" signal to ECU when the engine speed is above 1,500 rpm	● Distributor circuit ● Distributor ● ECU	IG-
14	 FI1391	Ignition Signal	(w/o Air Flow Meter) No "IGF" signal to ECU 4 – 7 times in succession. (w/ Air Flow Meter) No "IGF" signal to ECU 4 times in succession.	● Igniter circuit ● Igniter ● ECU	FI- FI-
*21	 FI1400	Oxygen Sensor Signal	During air-fuel ratio feedback correction, voltage output from the oxygen sensor does not exceed a set value on the lean side and the rich side continuously for a certain period (OX1).	● Oxygen sensor circuit ● Oxygen sensor	FI-
		Oxygen Sensor Heater Circuit	Open or short circuit in oxygen sensor heater (HT).	● Oxygen sensor heater circuit ● Oxygen sensor heater ● ECU	
22	 FI1392	Water Temp. Sensor Signal	Open or short circuit in water temp. sensor signal (THW).	● Water temp. sensor circuit ● Water temp. sensor ● ECU	FI- FI-
24	 FI1611	Intake Air Temp. Sensor Signal	Open or short circuit in intake air temp. sensor signal (THA).	● Intake air temp. sensor circuit ● Intake air temp. sensor ● ECU	FI- FI
*25	 FI2562	Air-fuel Ratio Lean Malfunction	When air-fuel ratio feedback compensation valve or adaptive control value continues at the upper (lean) or lower (rich) limit renewed for a certain period of time.	● Injector circuit ● Injector ● Oxygen sensor circuit ● Oxygen sensor ● ECU ● Fuel line pressure ● Air leak ● Air flow meter ● Air intake system	
*26	 FI2563	Air-fuel Ratio Rich Malfunction		● Injector circuit ● Injector ● Oxygen sensor circuit ● Oxygen sensor ● Fuel line pressure ● Air flow meter ● Cold start injector circuit ● Cold start injector ● Water temp. sensor ● ECU	FI

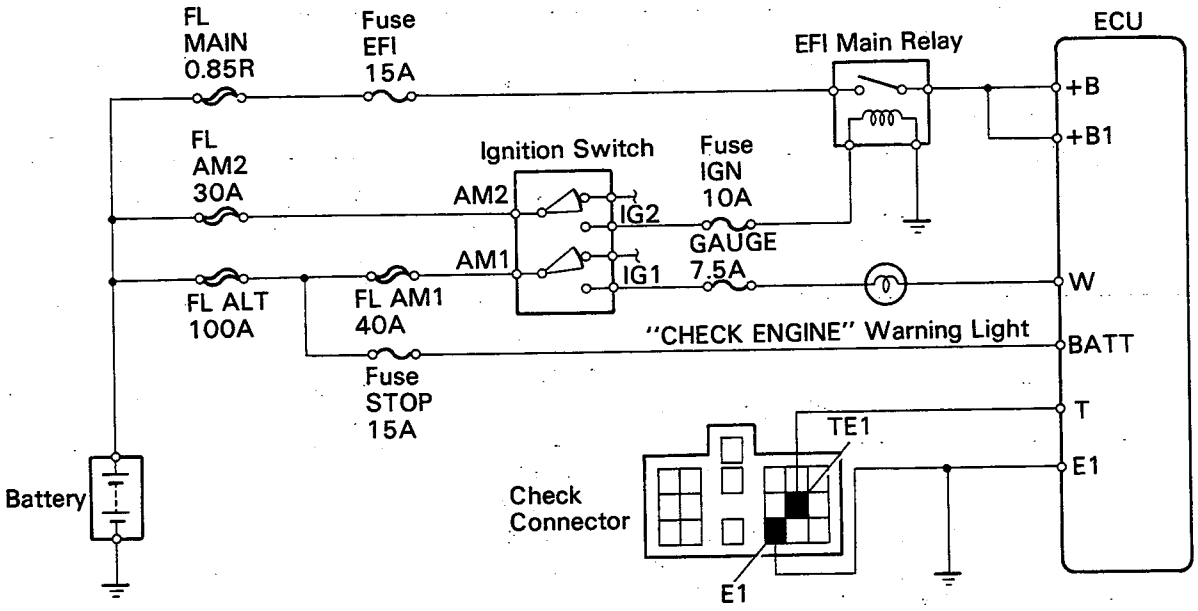
*: w/ Air Flow Mete

AGNOSTIC CODES (4A-GE) (Cont'd)

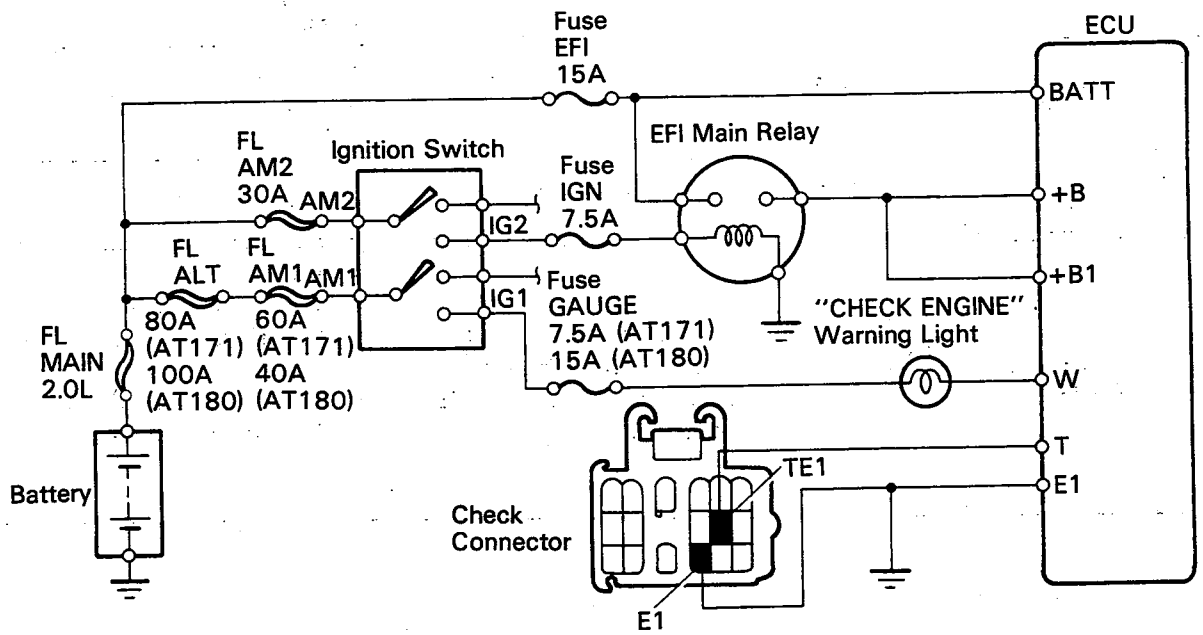
Code No.	Number of blinks "CHECK ENGINE"	System	Diagnosis	Trouble area	See page
31	 FI1394	(w/o Air Flow Meter) Vacuum Sensor Signal	Open or short circuit intake manifold pressure signal (PIM).	• Vacuum sensor circuit • Vacuum sensor • ECU	FI-73
		(w/ Air Flow Meter) Air Flow Meter Signal	Short circuit between VC and VB, VC and E2, or VS and VC.	• Air flow meter circuit • Air flow meter • ECU	FI-85
41	 FI1396	Throttle Position Sensor Signal	Open or short circuit in throttle position sensor signal (VTA).	• Throttle position sensor circuit • Throttle position sensor • ECU	FI-69 FI-83
42	 FI1397	Vehicle Speed Sensor Signal	(w/o Air Flow Meter) No "SPD" signal for 8 seconds when engine speed is between 2,500 rpm and 6,000 rpm. (w/ Air Flow Meter) No "SPD" signal for 8 seconds when engine speed is between 2,500 rpm and 5,500 rpm.	• Vehicle speed sensor circuit • Vehicle speed sensor • ECU	–
43	 FI1398	Starter Signal	No "STD" signal to ECU until engine speed reaches 800 rpm with vehicle not moving.	• Starter signal circuit • Ignition switch, main relay circuit • ECU	FI-76 FI-90
52	 FI1618	Knock Sensor Signal	Open or short circuit in knock sensor signal	• Knock sensor circuit • Knock sensor circuit • ECU	–
53	 FI1619	Knock Control Signal in ECU	Knock control in ECU faulty	• ECU	
51	 FI1399	Switch Condition Signal	No "IDL" signal, or "A/C" signal to ECU, with the check terminals E1 and TE1 connected	• A/C amplifier • A/C switch circuit • Accelerator pedal and cable • Throttle position sensor • Throttle position sensor circuit • ECU	FI-78 FI-92

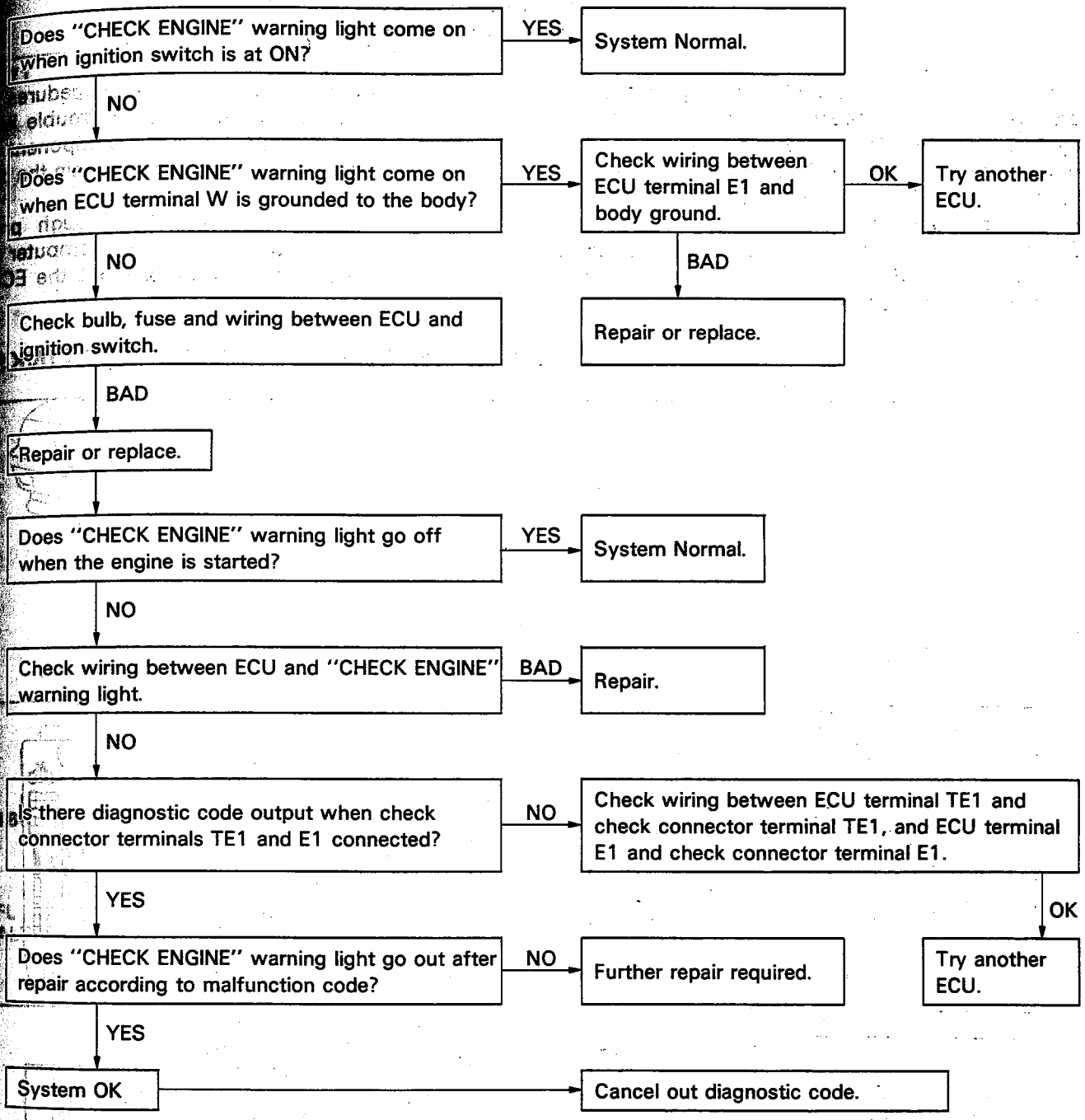
INSPECTION OF DIAGNOSIS CIRCUIT

AE



AT




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
NO
Repair or replace.
Check bulb, fuse and wiring between ECU and ignition switch.
BAD
Repair or replace.
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.
NO
Is there diagnostic code output when check connector terminals TE1 and E1 connected?
NO
Check wiring between ECU terminal TE1 and check connector terminal TE1, and ECU terminal E1 and check connector terminal E1.
OK
YES
Does "CHECK ENGINE" warning light go out after repair according to malfunction code?
NO
Further repair required.
Try another ECU.
YES
System OK
Cancel out diagnostic code.

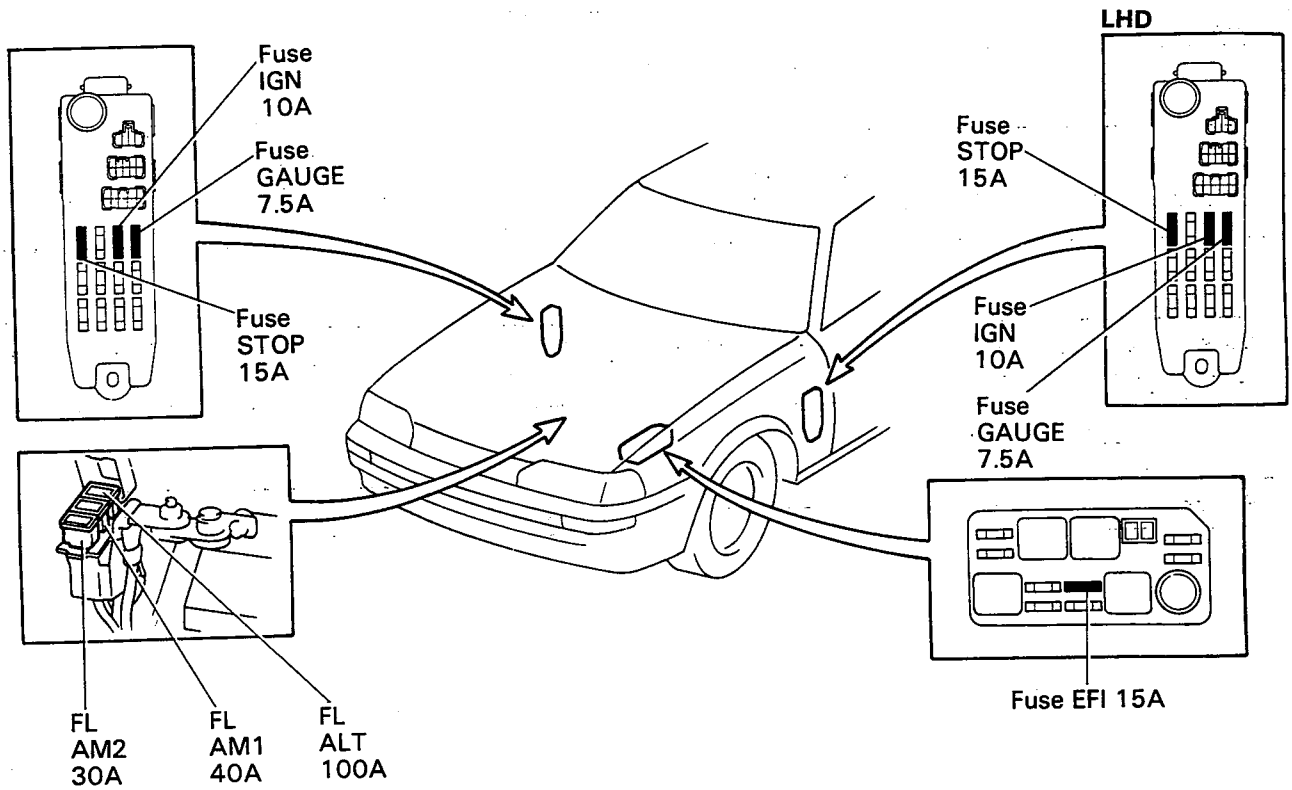
TROUBLESHOOTING WITH VOLT/OHMMETER

HINT: The following troubleshooting procedures are designed for inspection of each separate system, therefore the procedure may vary somewhat. However, troubleshooting should be performed refering to the inspection methods described in this manual.
Before beginning inspection, it is best to first make a simple check of the fuses, fusible links and the condition of the connectors.

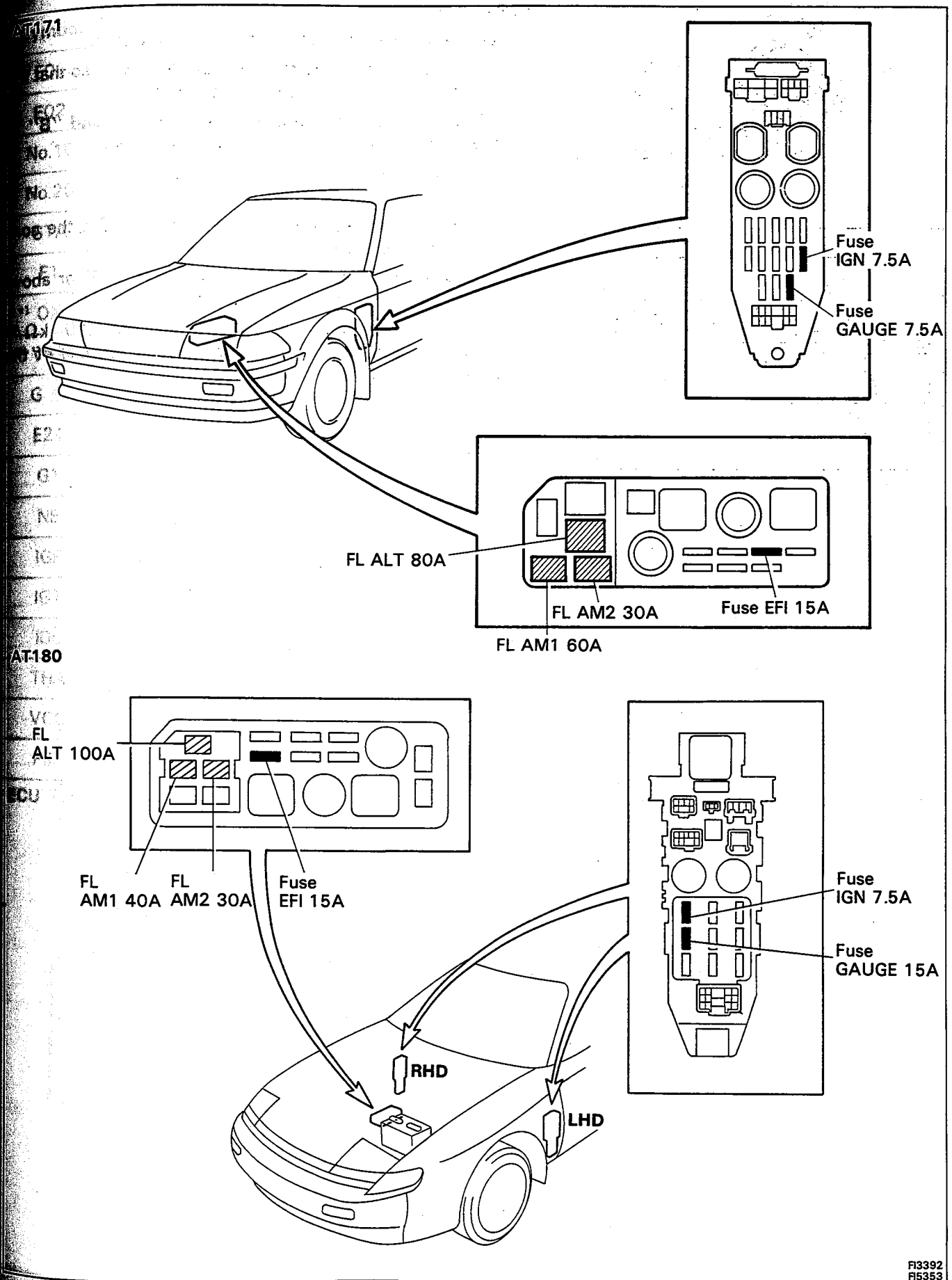
The following troubleshooting procedures ar based on the supposition that the trouble lies i either a short or open circuit in a component ou side the computer or short circuit within the com puter.
If engine trouble occurs even through prope operating voltage is detected in the computer con nector, then it can be assumed that the ECU faulty and should be replaced.

LOCATION OF FUSES AND FUSIBLE LINKS

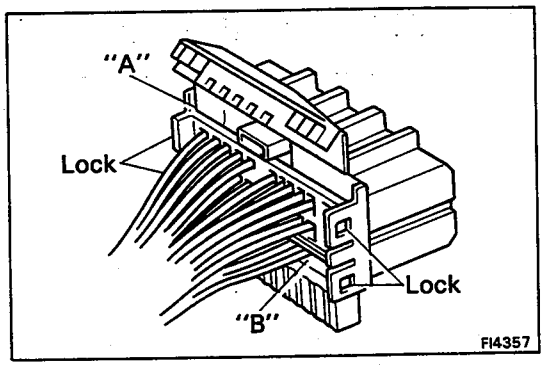
AE

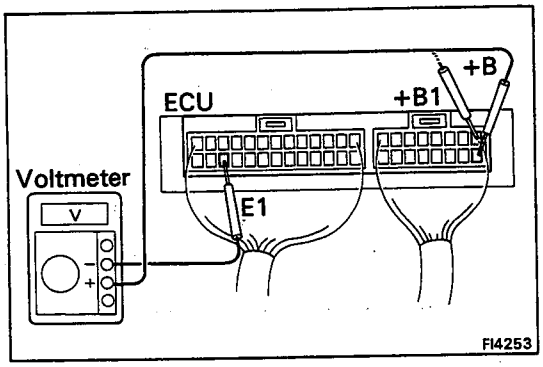


LOCATION OF FUSES AND FUSIBLE LINKS (Cont'd)



FI3392
FI5353





EFI SYSTEM CHECK PROCEDURE

PREPARATION

(a) Disconnect the connectors from the ECU.

(b) Remove the locks shown in the illustration so that the tester probe(s) can easily come in.

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

(c) Reconnect the connectors to the ECU.

HINT:

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

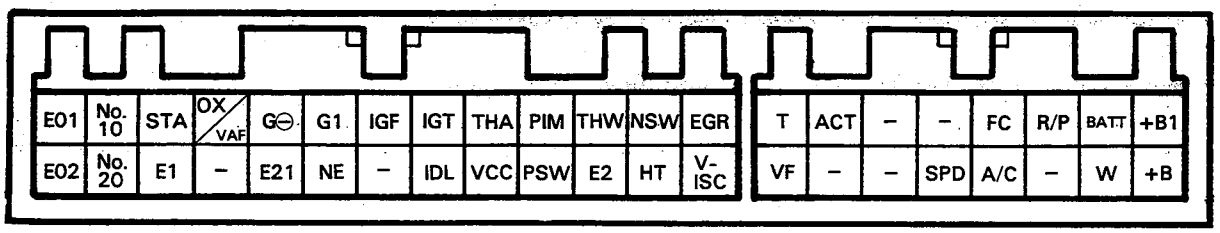
Using a voltmeter with high-impedance (10 kΩ/V minimum), measure the voltage at each terminal of the wiring connectors.

Terminals of ECU (4A-FE 2WD)

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

ECU Terminals

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

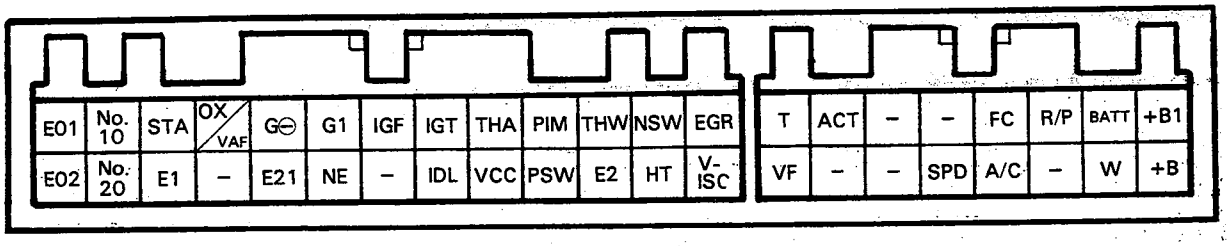


FI4266

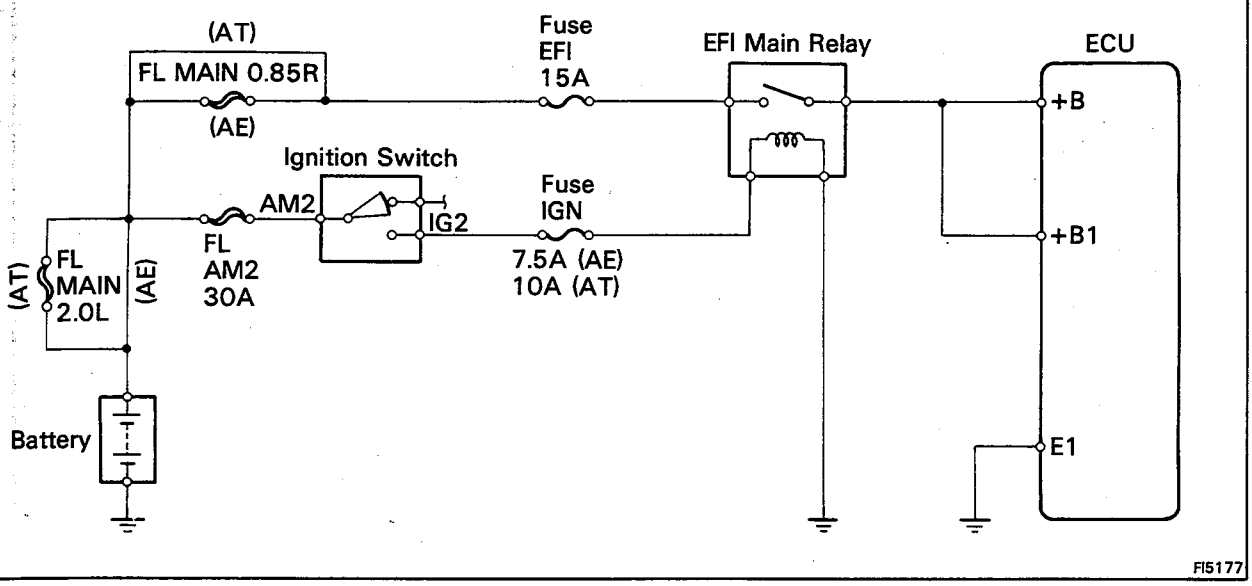
Voltage at ECU wiring connectors (4A-FE 2WD)

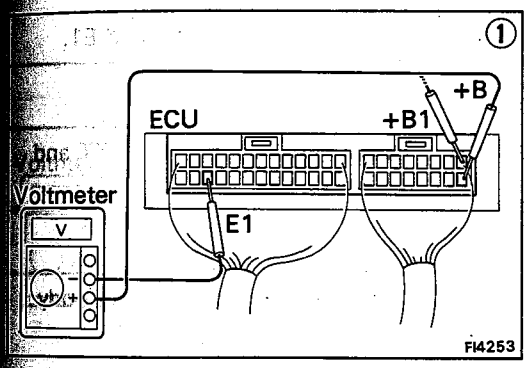
No.	Terminals	STD voltage (V)	Condition		See page
1	+B, +B1 – E1	10 – 14	Ignition SW ON		FI-39
2	BATT – E1	10 – 14	—		FI-40
3	IDL – E2	4.5 – 5.5	Ignition SW ON	Throttle valve open	FI-41
	PSW – E2			Throttle valve fully closed	
4	No.10, No.20 – E01, E02	10 – 14	Ignition SW ON		FI-42
5	W – E1	10 – 14	No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

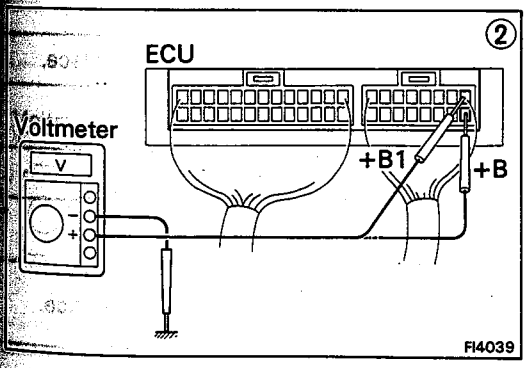
ECU Terminals

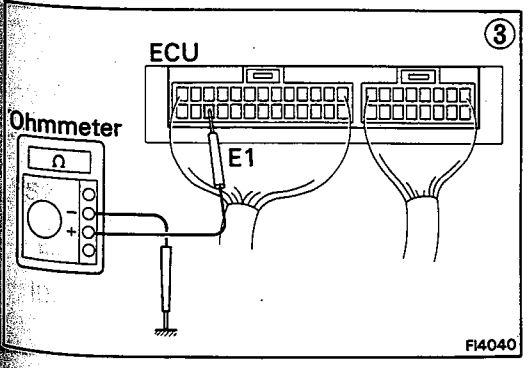


Terminals	Trouble	Condition	STD voltage
+B, +B1 – E1	No voltage	IG SW ON	10 – 14 V









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

↓

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

NO → ③ Check wiring between ECU terminal E1 and body ground.
- OK → Try another ECU.
- BAD → Repair or replace.

OK ↓

Check fuses, fusible links and ignition switch. — BAD → Repair or replace.

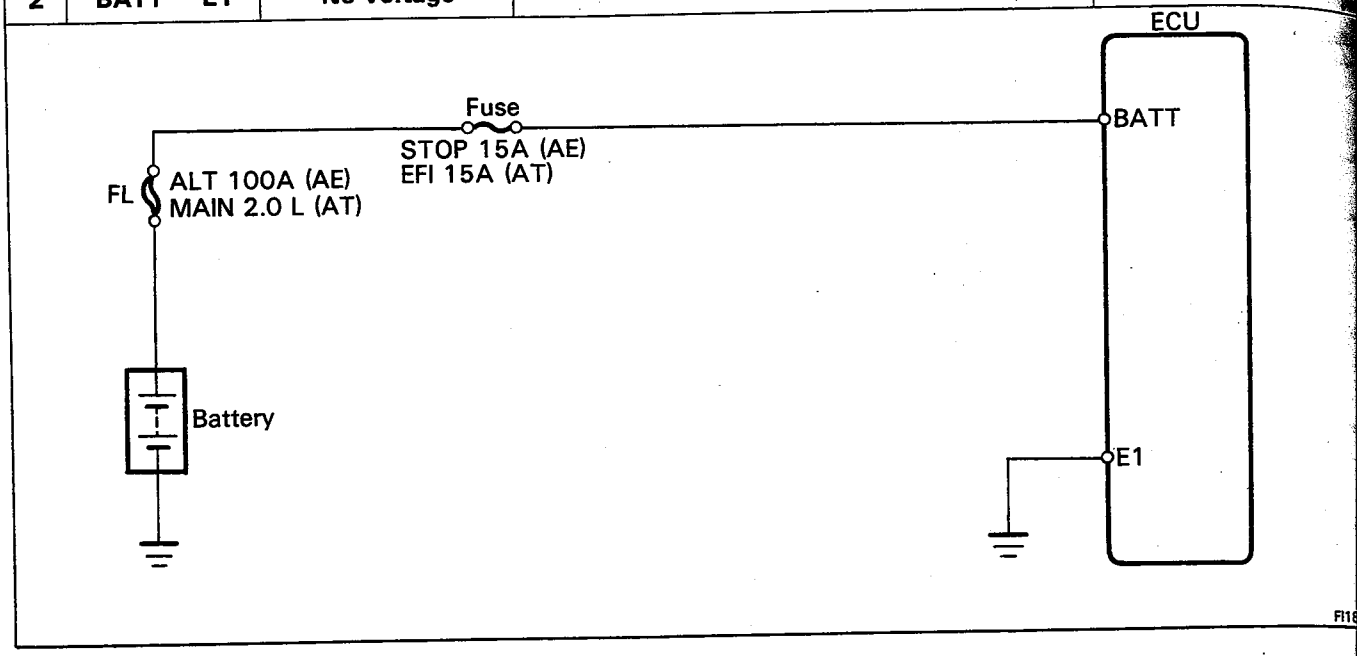
OK ↓

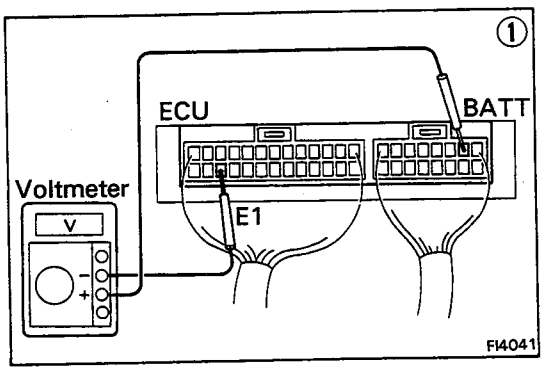
Check EFI main relay. (See page FI-134) — BAD → Replace.

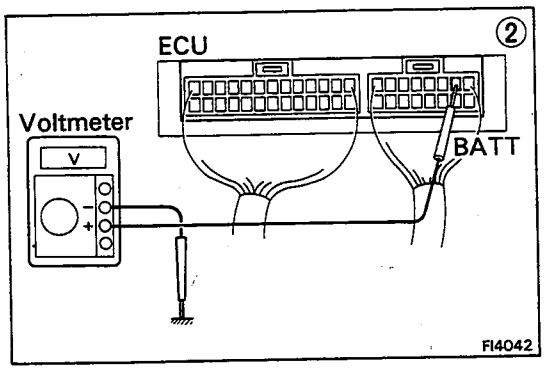
OK ↓

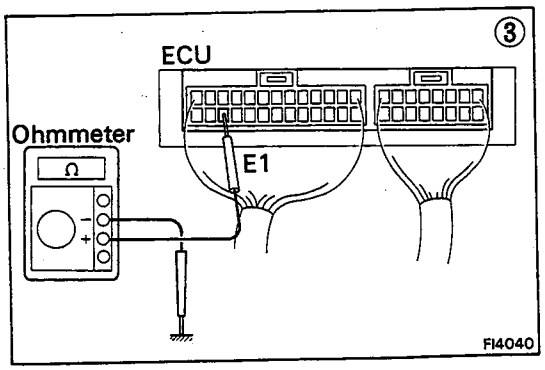
Check wiring between EFI main relay and battery. — BAD → Repair or replace.

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









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

↓

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

NO ↓ OK

③ Check wiring between ECU terminal E1 and body ground.

OK ↓ — BAD → Repair or replace.

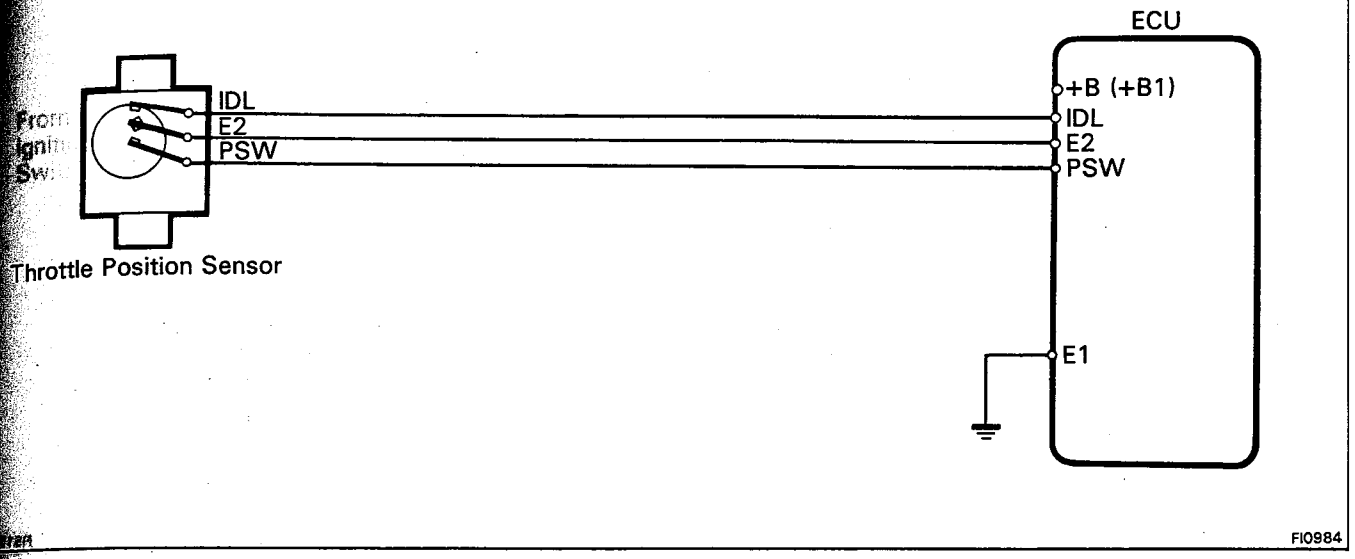
Try another ECU.

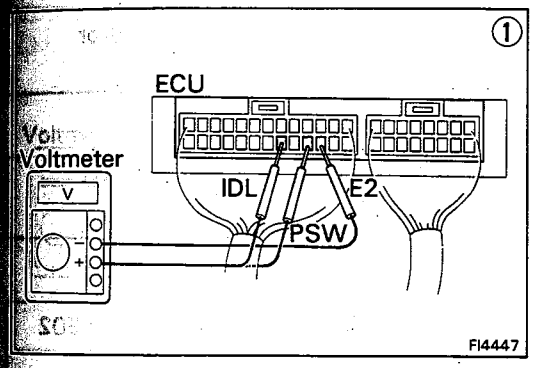
Check fuse and fusible link. — BAD → Replace.

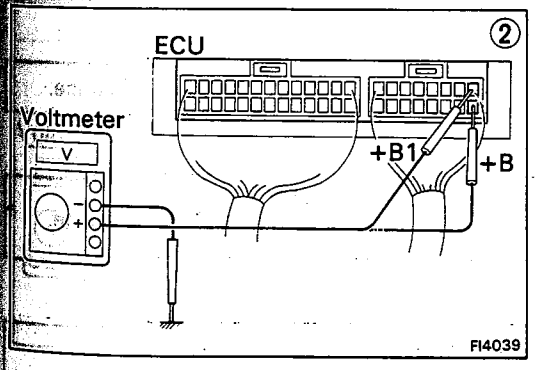
OK ↓

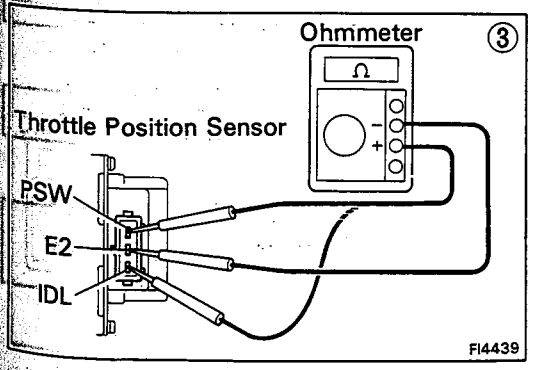
Check wiring between ECU terminal and battery. — BAD → Repair or replace.

Terminals	Trouble		Condition	STD voltage
IDL – E2	No voltage	IG SW ON	Throttle valve open	4.5 – 5.5 V
PSW – E2			Throttle valve fully closed	4.5 – 5.5 V









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

↓

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

NO → ↓ OK → Check wiring between ECU terminal E1 and body ground.

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

↓ NO

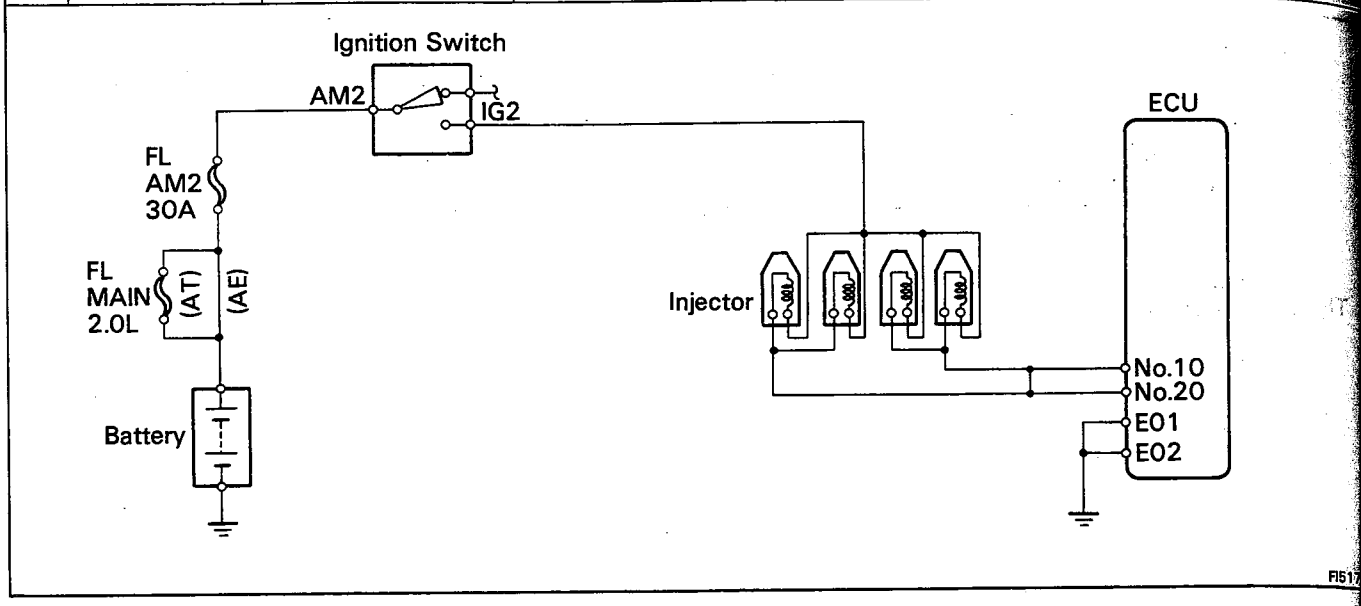
Refer to +B – E1 trouble section. (No.1) (See page FI-39)

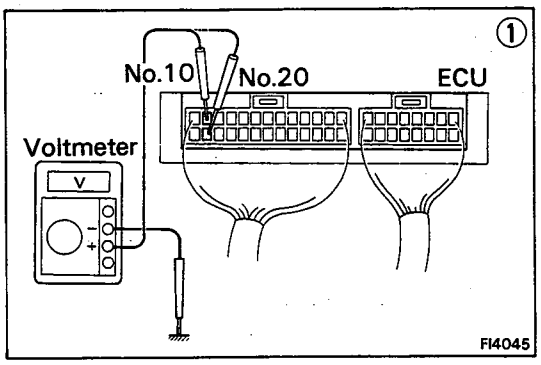
- BAD → Repair or replace.
- OK ↓

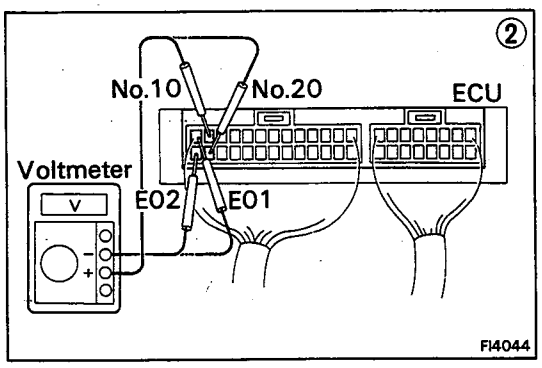
③ Check throttle position sensor. (See page FI-123)

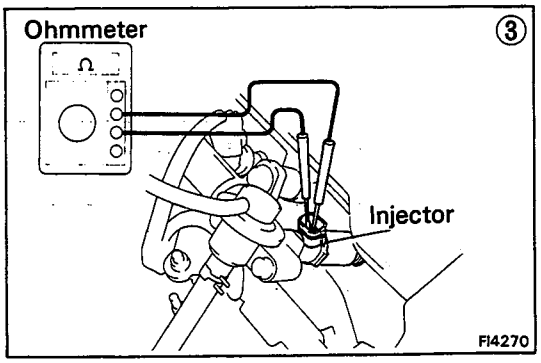
- BAD → Repair or replace throttle position sensor.
- OK → Check wiring between ECU and throttle position sensor.
  - OK ↓ Try another ECU.
  - BAD → Repair or replace.

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









① There is no voltage between ECU terminals 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 and/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 fuse, fusible link, ignition switch.

BAD → Repair or replace.

OK →

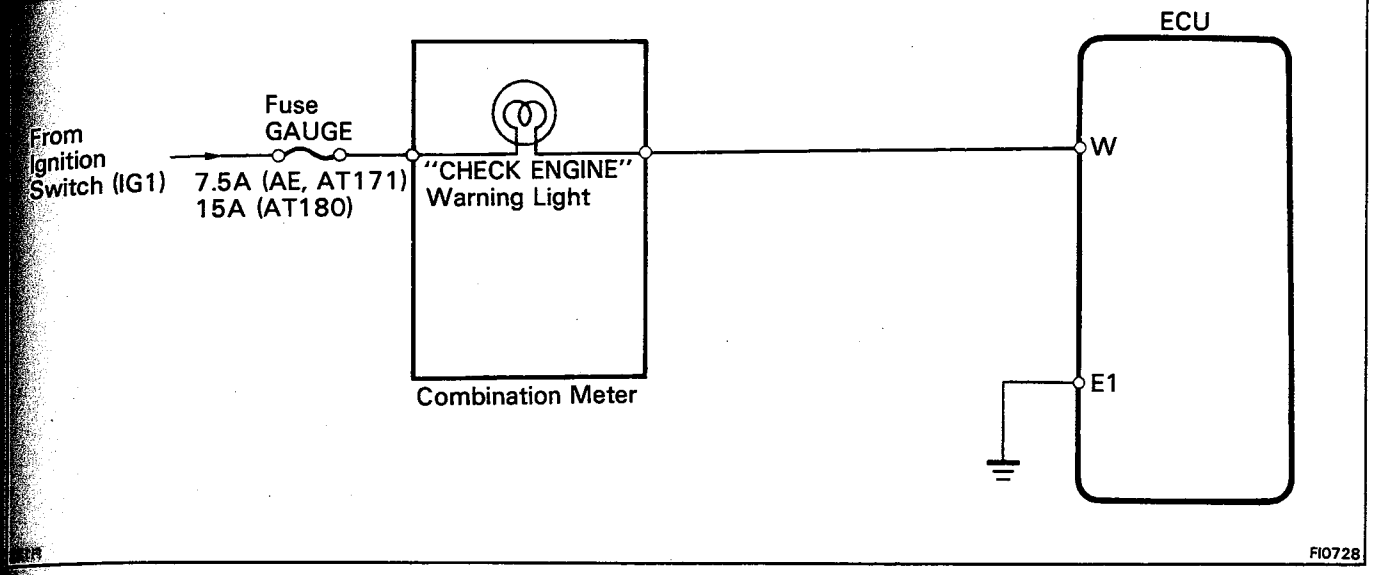
③ Check resistance of magnetic coil in each injector.
STD resistance: Approx. 13.8 Ω

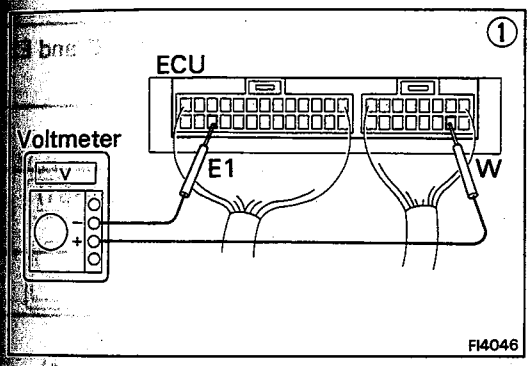
OK → Check wiring between ECU terminal No.10 and/or No.20 and battery.

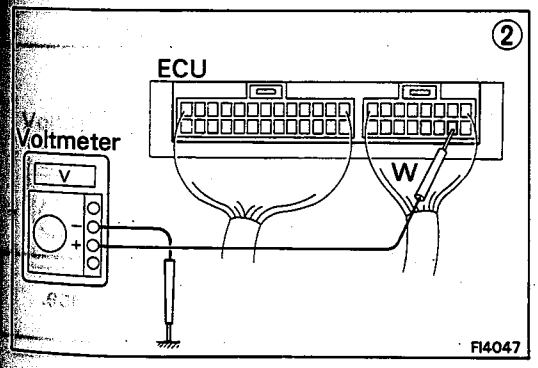
BAD → Replace injector.

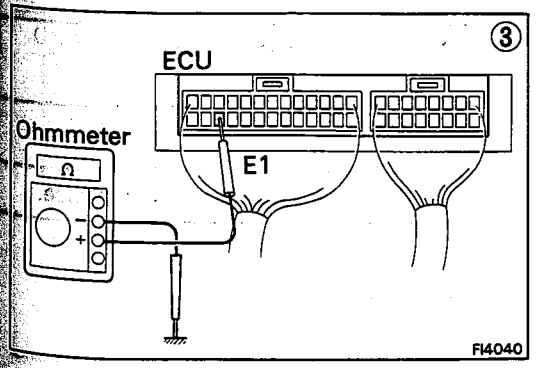
BAD → Repair or replace.

No.	Terminals	Trouble	Condition	STD voltage
5	W – E1	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. **(Idling)**

↓

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

NO → Check GAUGE fuse and "CHECK ENGINE" warning light.

OK → ③ Check wiring between ECU terminal E1 and body ground.

OK → Try another ECU.

BAD → Repair or replace.

Check GAUGE fuse and "CHECK ENGINE" warning light.

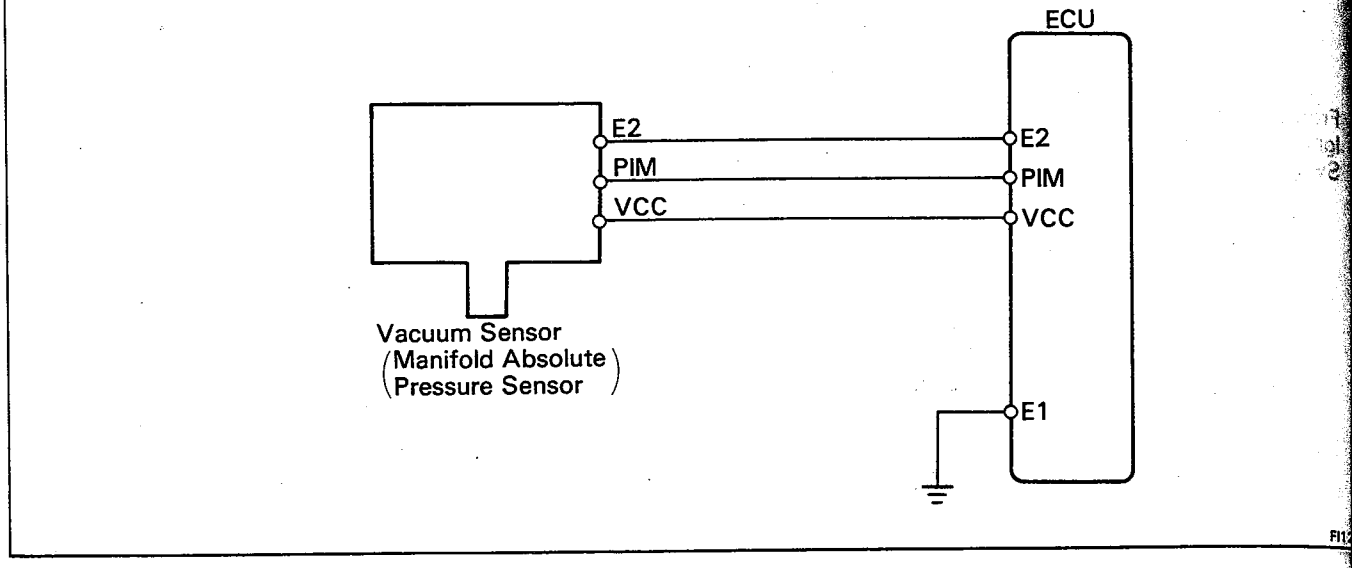
OK → Check wiring between ECU terminal W and fuse.

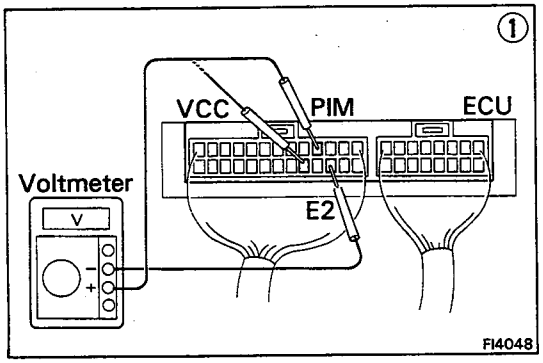
BAD → Repair or replace.

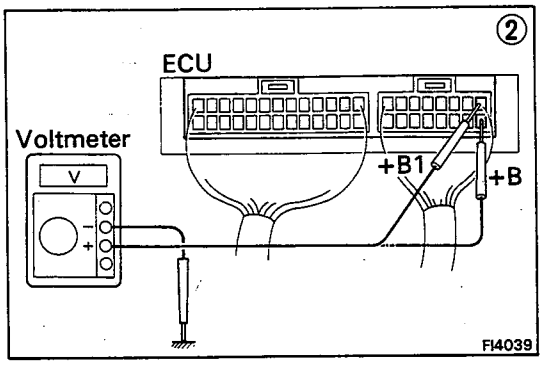
Fuse blows again → Check wiring between ECU terminal W and fuse.

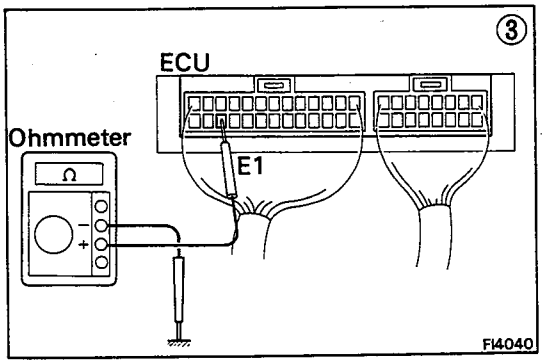
BAD → Repair or replace.

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









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

↓

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

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

NO ↓

③ Check wiring between ECU terminal E1 and body ground.

BAD → Repair or replace.

OK ↓

Check vacuum sensor. (See page FI-140)

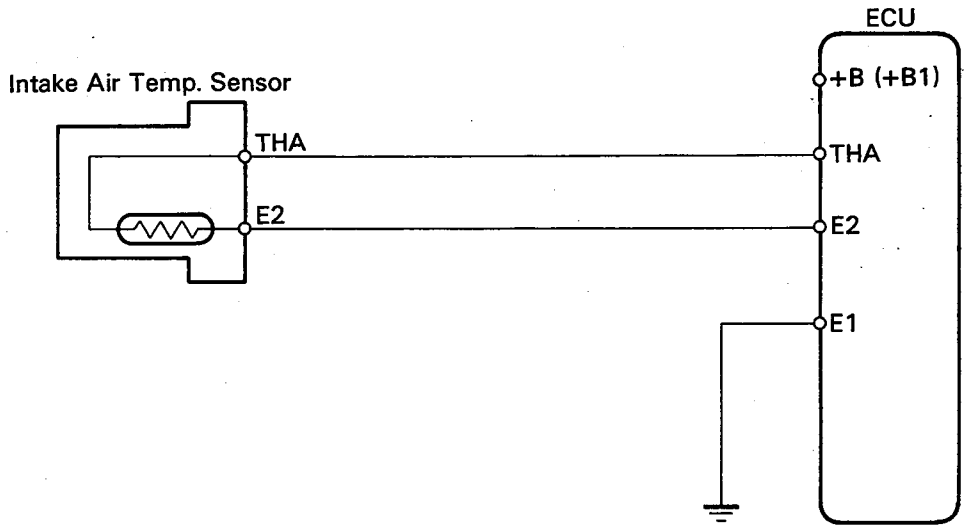
BAD → Replace vacuum sensor.

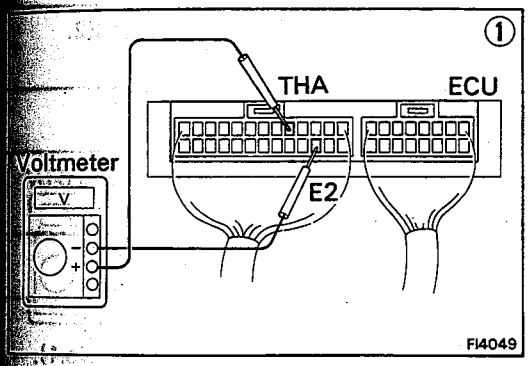
OK → Check wiring between ECU and vacuum sensor.

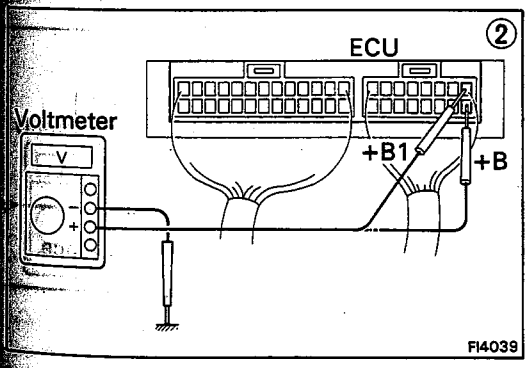
OK → Try another ECU.

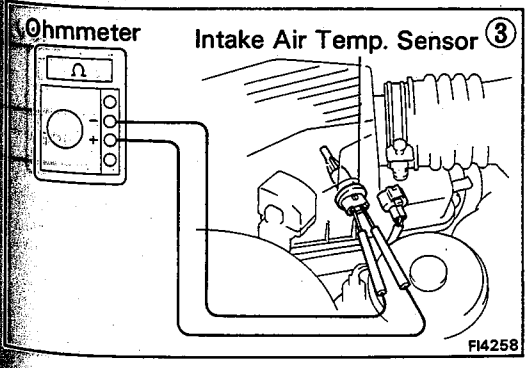
BAD → Repair or replace.

Terminals	Trouble	Condition		STD voltage
THA – E2	No voltage	IG SW ON	Intake air temperature 20°C (68°F)	2.0 – 2.5 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 +B – E1 trouble section (No.1). (See page FI-39)

↓

Check wiring between ECU terminal E1 and body ground.

OK → ↓

BAD → Repair or replace.

↓

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

BAD → Replace intake air temp. sensor

OK → ↓

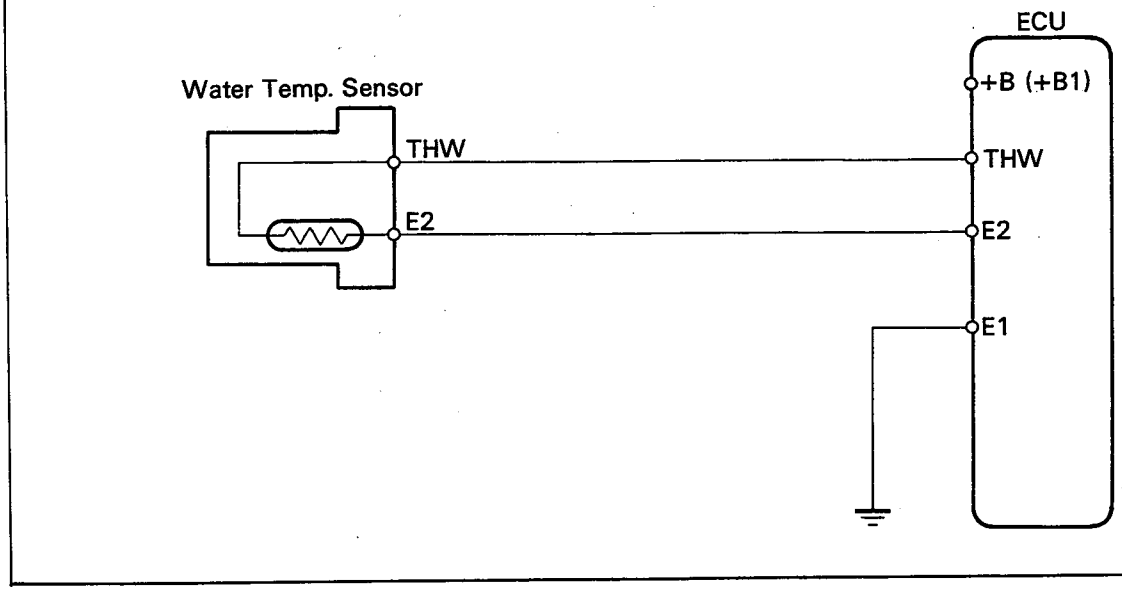
Check wiring between ECU and intake air temp. sensor.

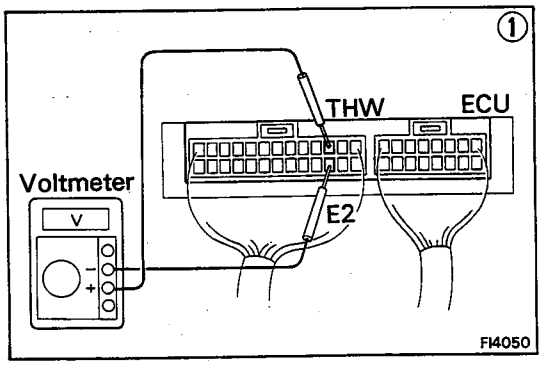
OK → ↓

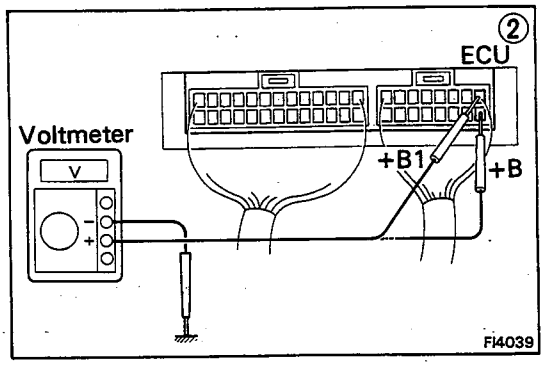
Try another ECU.

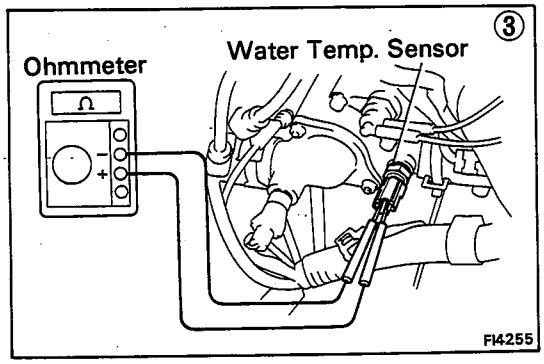
BAD → Repair or replace wiring.

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









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

↓

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

OK → ↓

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

↓

Check wiring between ECU terminal E1 and body ground.

OK → ↓

BAD → Repair or replace.

↓

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

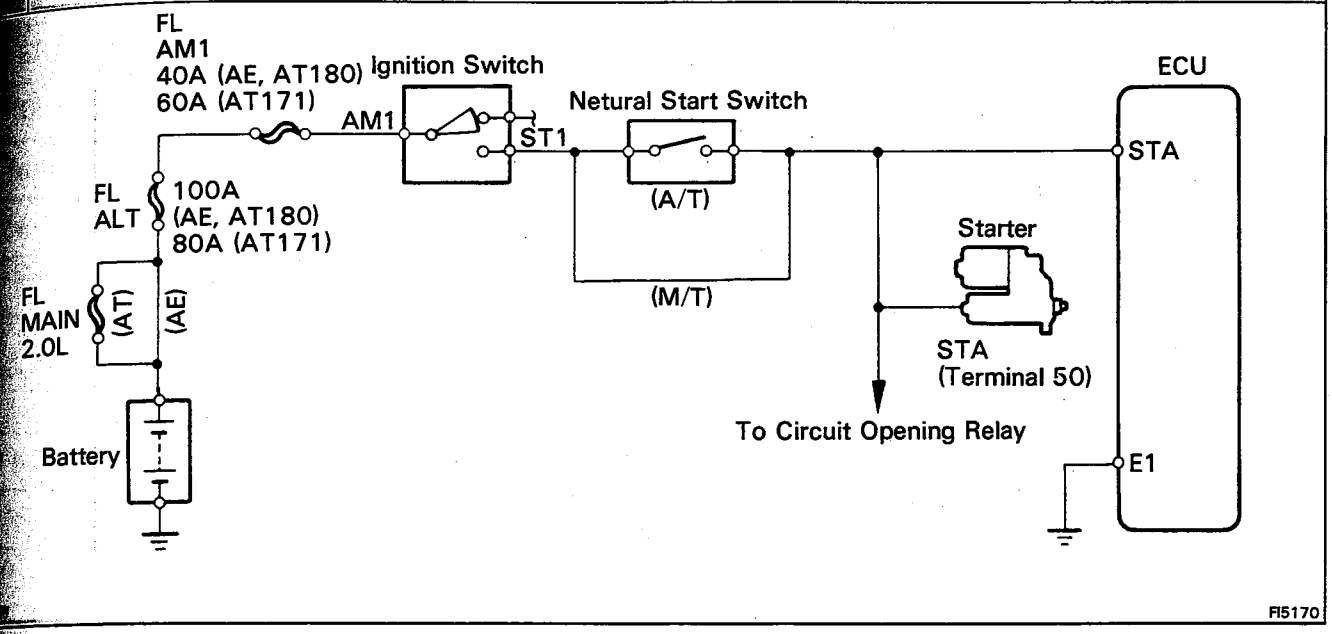
BAD → Replace water temp. sensor.

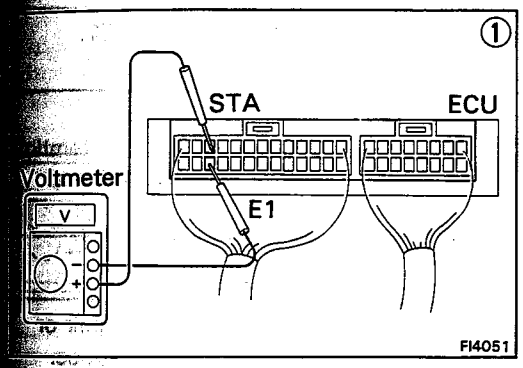
OK → Check wiring between ECU and wa temp. sensor.

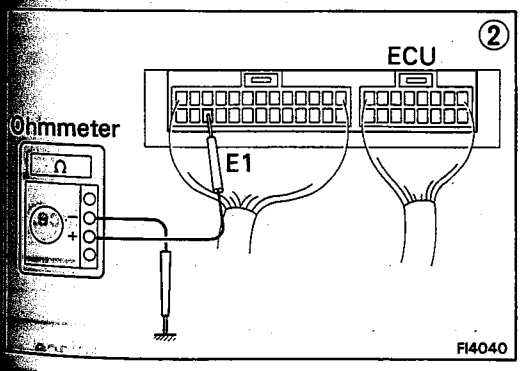
OK → Try another ECU.

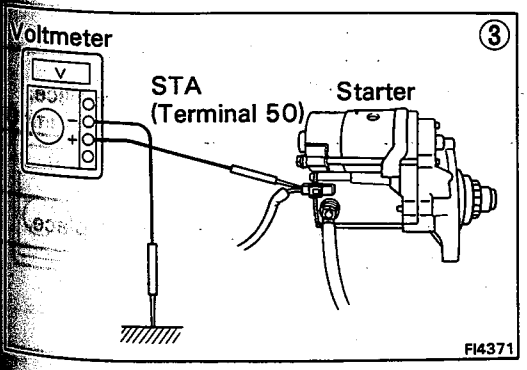
BAD → Repair or replace

Terminals	Trouble	Condition	STD voltage
V STA – E1	No voltage	Cranking	6 – 14 V









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

Check starter operation. — OK → Check wiring between ECU terminal STA and ignition switch terminal ST1. — OK → ② Check wiring between ECU terminal E1 and body ground. — OK → Try another ECU. / BAD → Repair or replace.

Check wiring between ECU terminal STA and ignition switch terminal ST1. — BAD → Replace replace.

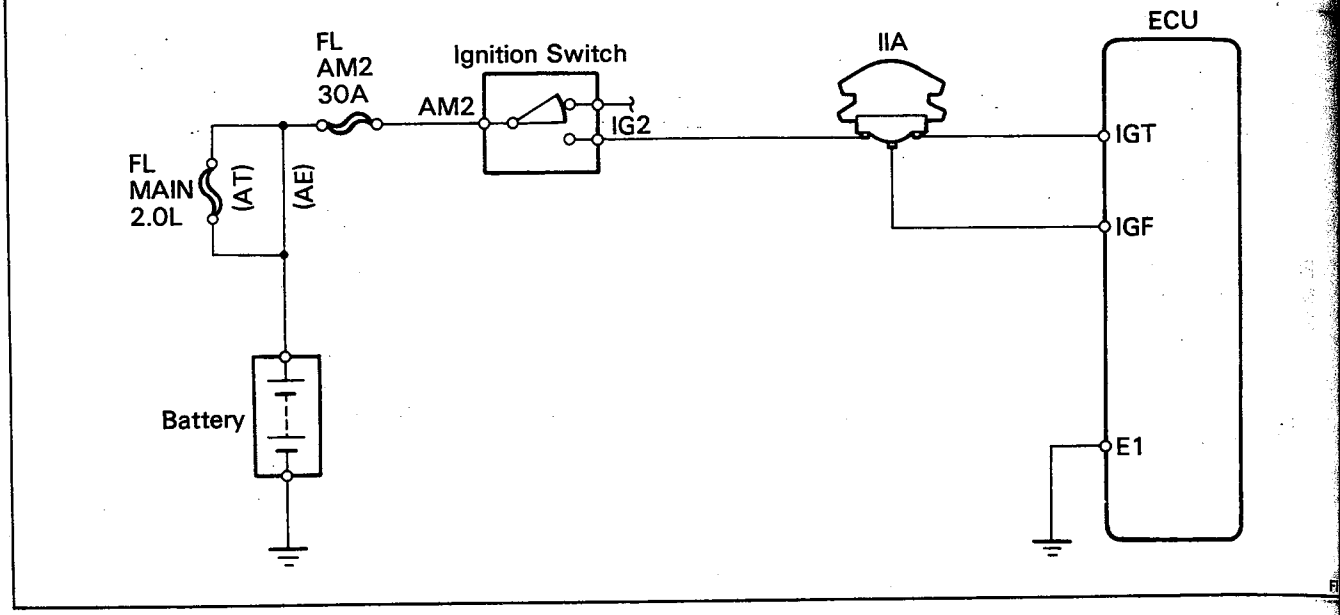
Check starter operation. — BAD → Check fusible link, battery, wiring and ignition switch. — BAD → Repair or replace.

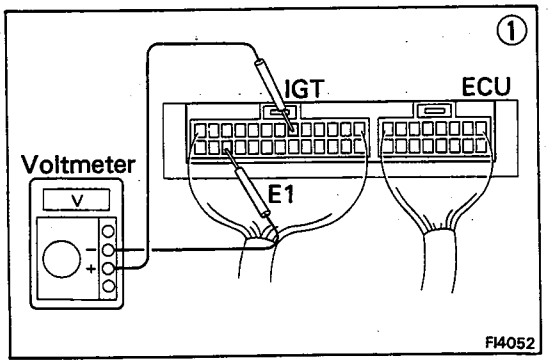
Check fusible link, battery, wiring and ignition switch. — OK → ③ Check that there is voltage at STA (50) terminal of starter. **(IG SW START) STD voltage: 6 – 14 V**

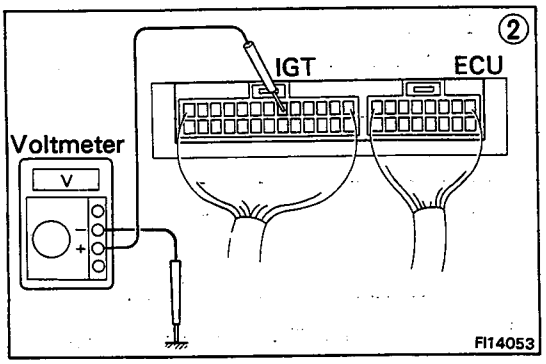
③ — OK → Check starter.

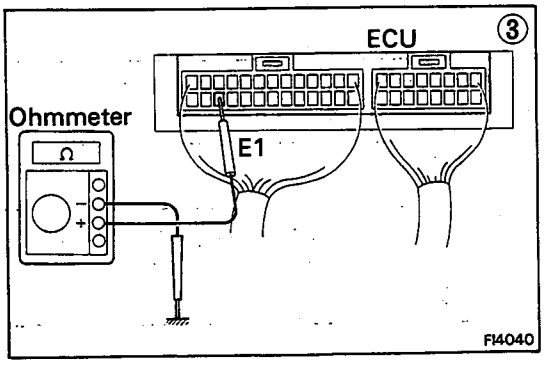
③ — NO → Check wiring between ignition switch terminal ST1 and starter terminal STA (50)

No.	Terminals	Trouble	Condition	STD voltage
10	IGT – E1	No voltage	Idling	0.7 – 1.0 V









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

↓

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

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

③ → OK → Try another ECU.

② → OK → Check fusible links and ignition switch. → BAD → Repair or replace.

↓ OK

Check IIA. (See page IG-8) → BAD → Repair or replace.

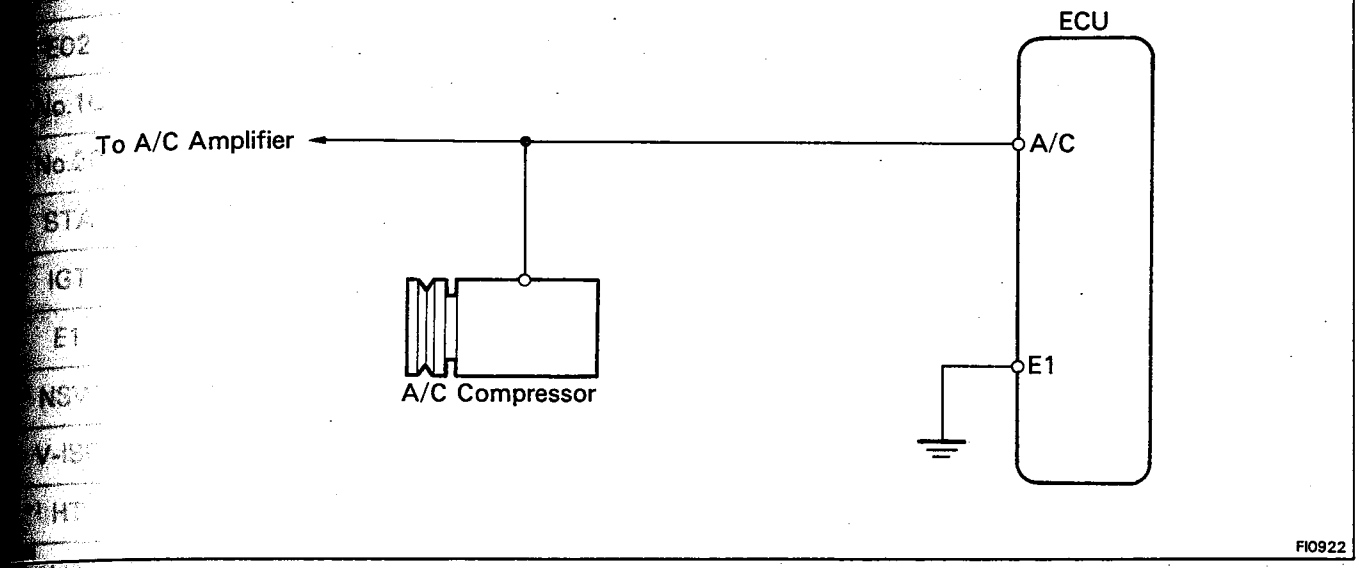
↓ OK

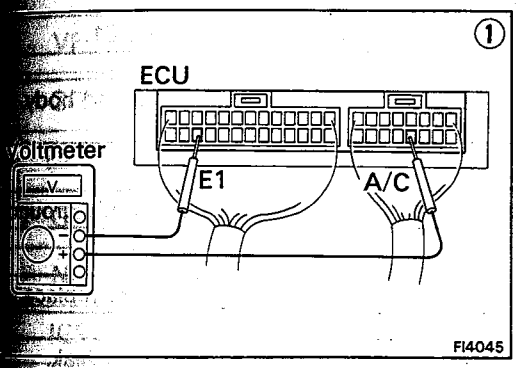
Check wiring between ECU and battery. → BAD → Repair or replace.

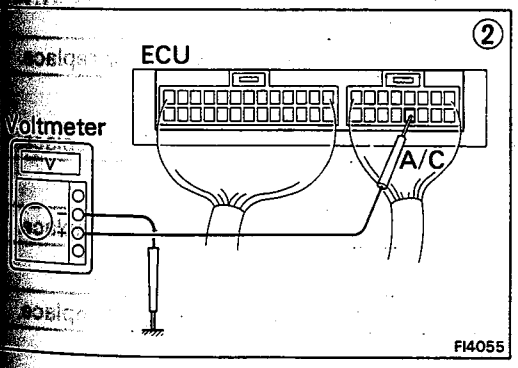
↓ OK

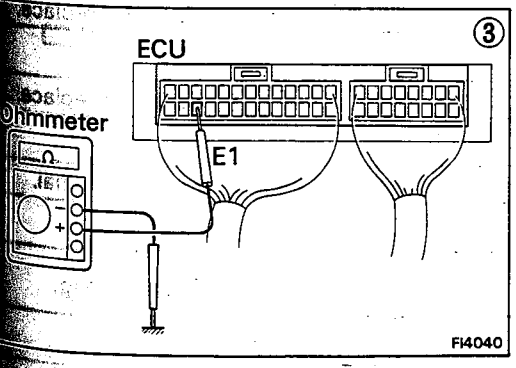
Check igniter. (See page IG-6) → BAD → Repair or replace.

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









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

↓

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

NO → ↓ OK

③ Check wiring between ECU terminal E1 and body ground.

OK → Try another ECU.

BAD → Repair or replace.

↓

Check compressor running.

OK → Check wiring between ECU terminal A/C and Amplifier.

BAD → Repair or replace.

↓ NO

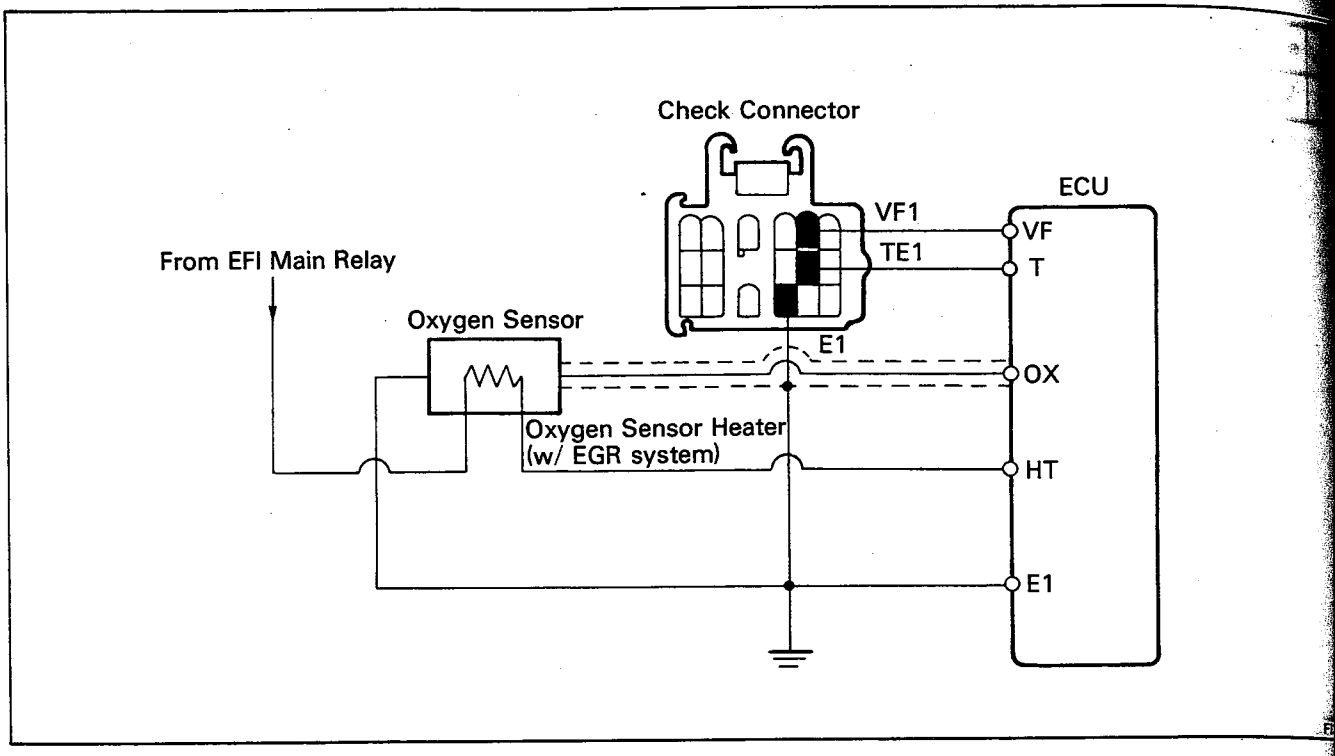
Check that there is voltage between amplifier terminal and body ground.

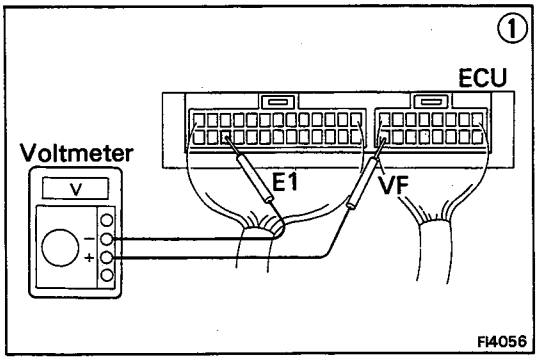
BAD → Repair or replace.

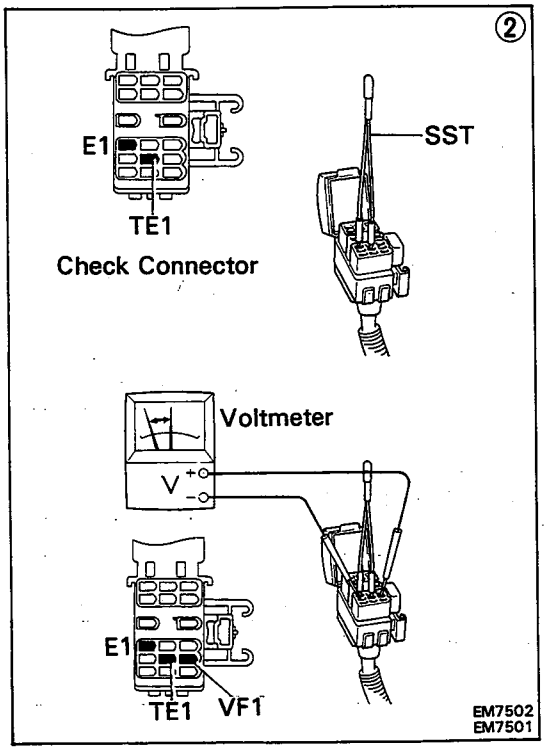
↓ OK

Check wiring between amplifier and ECU or compressor.

BAD → Repair or replace.







① There is no voltage between ECU terminals VF and E1.

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

NO → OK

Check wiring between ECU terminal E1 and body grou

OK → Try another ECU.

BAD → Repair or replace

Is air leaking into air intake 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 replac

OK

Check injector. BAD → Repair or replac

OK

Check cold start injector.* BAD → Repair or replac

OK

Check vacuum sensor. BAD → Repair or replac

OK

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

BAD

Check wiring between oxygen sensor and ECU connector. BAD → Repair wiring.

OK

Replace oxygen sensor.

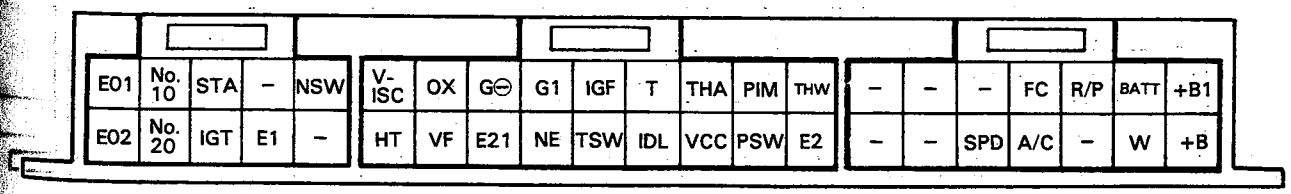
*Rich malfunction

Terminals of ECU (4A-FE 4WD)

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

ECU Terminals

*1: Europe, *2: Australia *3: A/T

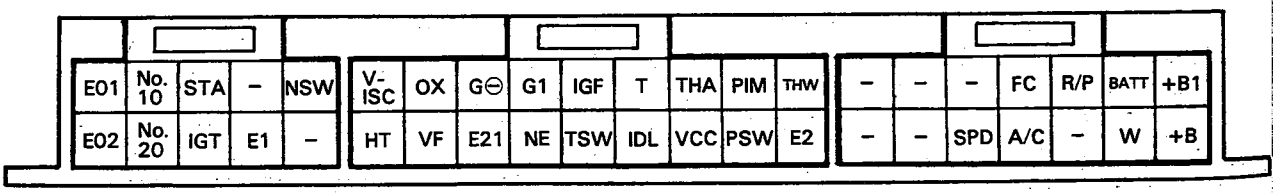


FI0234

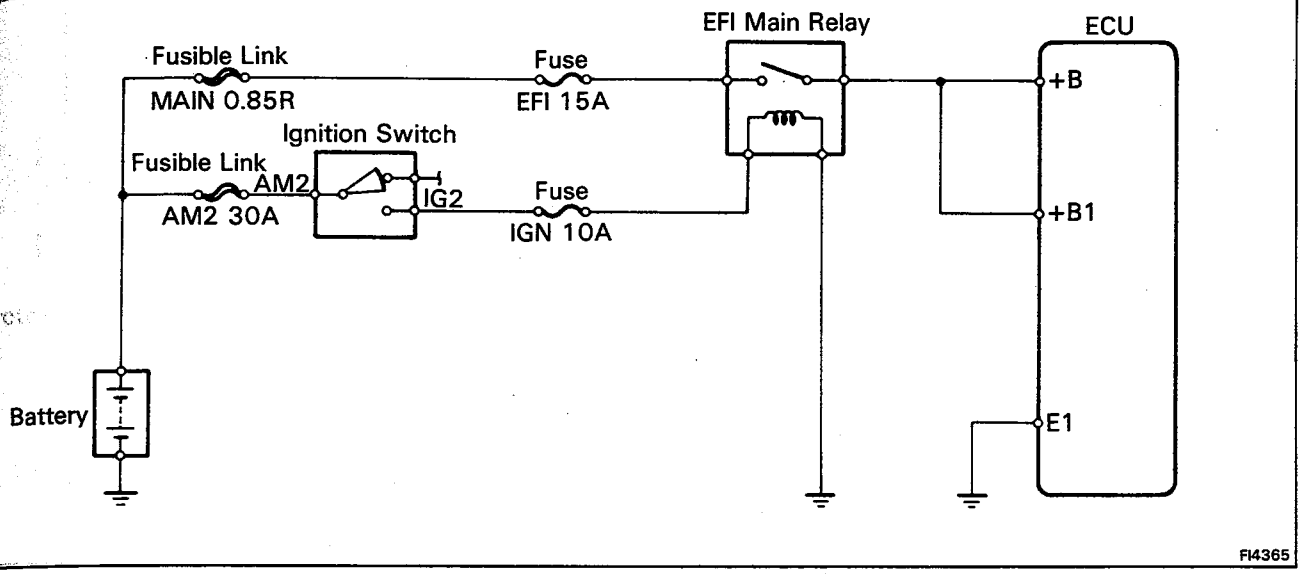
Voltage at ECU wiring connectors (4A-FE 4WD)

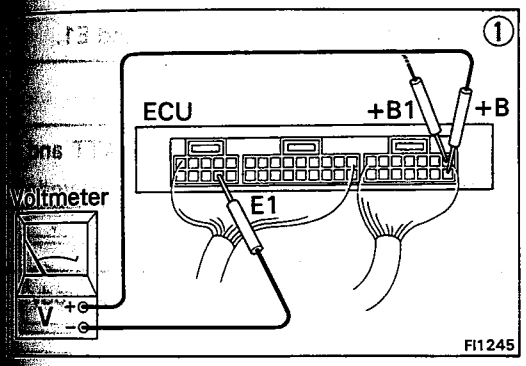
No.	Terminals	STD voltage (V)	Condition		See page
1	+B, +B1 – E1	10 – 14	Ignition SW ON		FI-53
2	BATT – E1	10 – 14	—		FI-54
3	IDL – E2	4.5 – 5.5	Ignition SW ON	Throttle valve open	FI-55
	PSW – E2			Throttle valve fully closed	
4	No.10 – E01, No.20 – E02	10 – 14	Ignition SW ON		FI-56
5	W – E1	10 – 14	No trouble ("CHECK ENGINE" warning light off) and engine running		FI-57
6	PIM – E2	3.3 – 3.9	Ignition SW ON		FI-58
	VCC – E2	4.5 – 5.5			
7	THA – E2	2.0 – 2.5	Ignition SW ON	Intake air temp. 20°C (68°F)	FI-59
8	THW – E2	0.4 – 0.7		Coolant temp. 80°C (176°F)	FI-60
9	STA – E1	6 – 14	Cranking		FI-61
10	IGT – E1	0.7 – 1.0	Idling		FI-62
11	A/C – E1	5 – 14	Air conditioning ON		FI-63

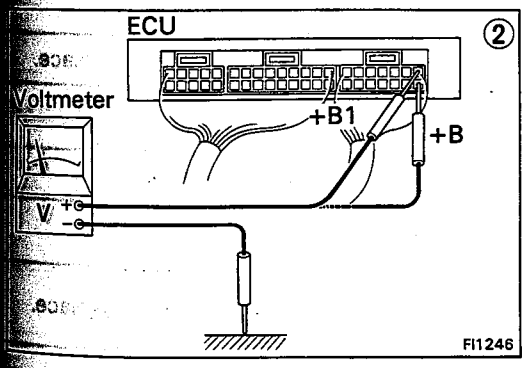
ECU Terminals

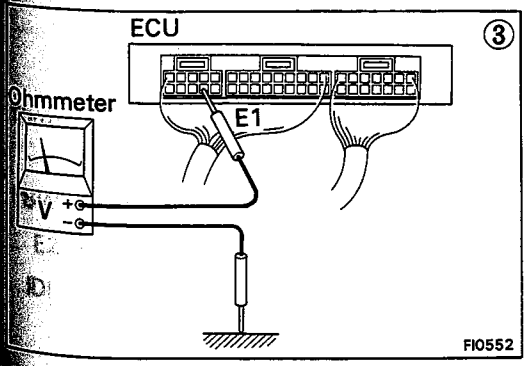


Terminals	Trouble	Condition	STD voltage
V+B, +B1 – E1	No voltage	IG SW ON	10 – 14 V









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

↓

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

NO → ↓ OK

③ Check wiring between ECU terminal E1 and body ground.

OK → Try another ECU.

BAD → Repair or replace.

↓

Check fuses, fusible links and ignition switch. — BAD → Repair or replace.

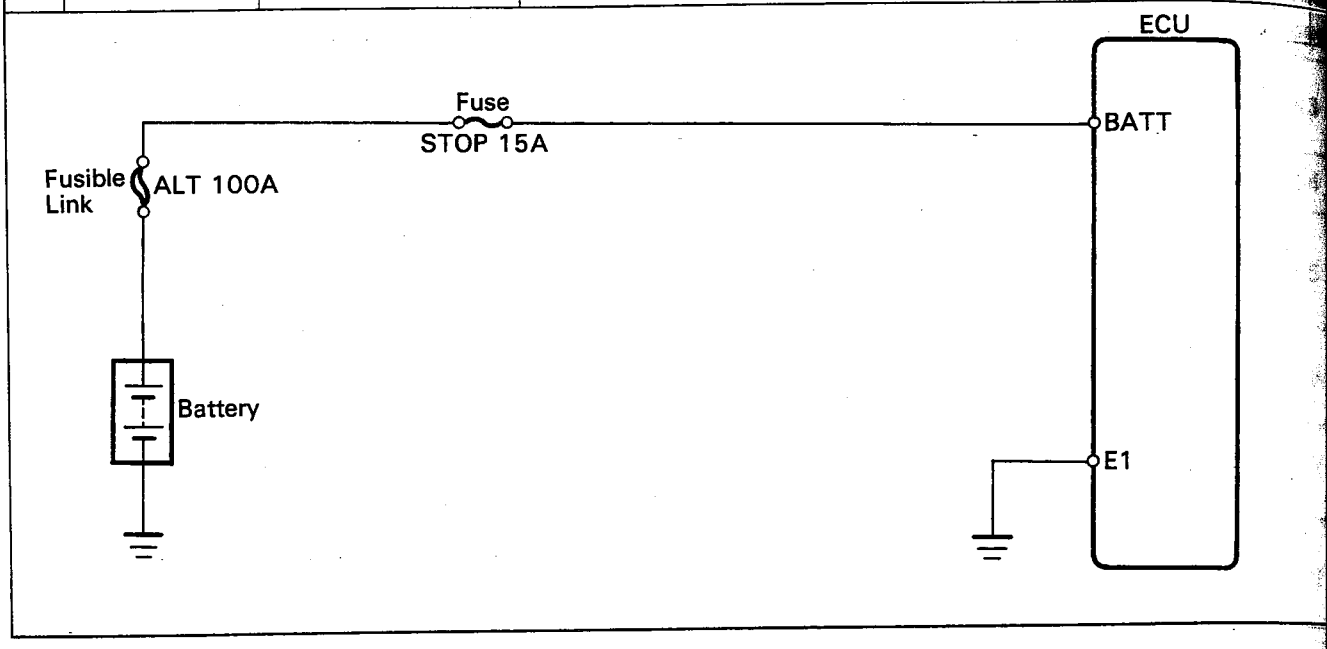
↓ OK

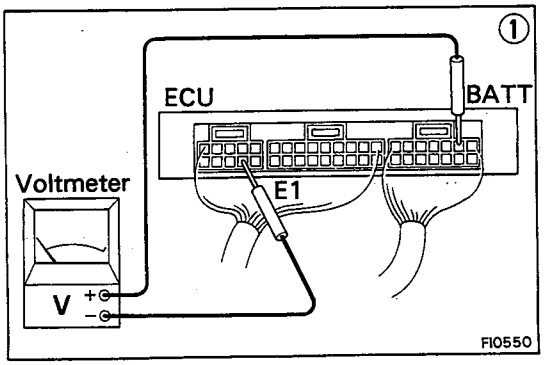
Check EFI main relay. (See page FI-134) — BAD → Replace.

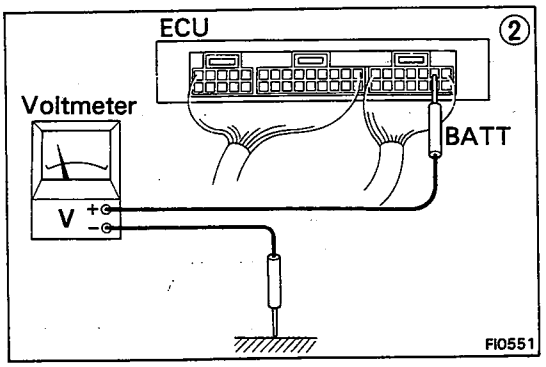
↓ OK

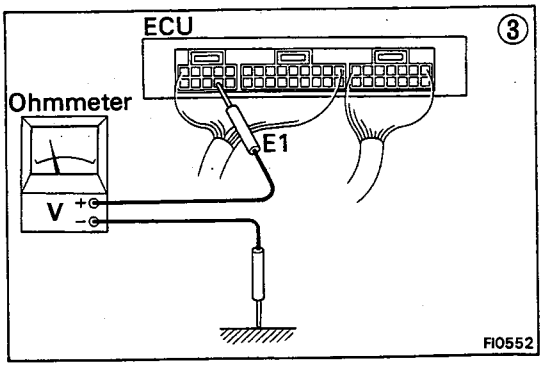
Check wiring between EFI main relay and battery. — BAD → Repair or replace.

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









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

↓

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

NO → OK

③ Check wiring between ECU terminal E1 and bod ground.

OK → Try another ECU.

BAD → Repair or replace

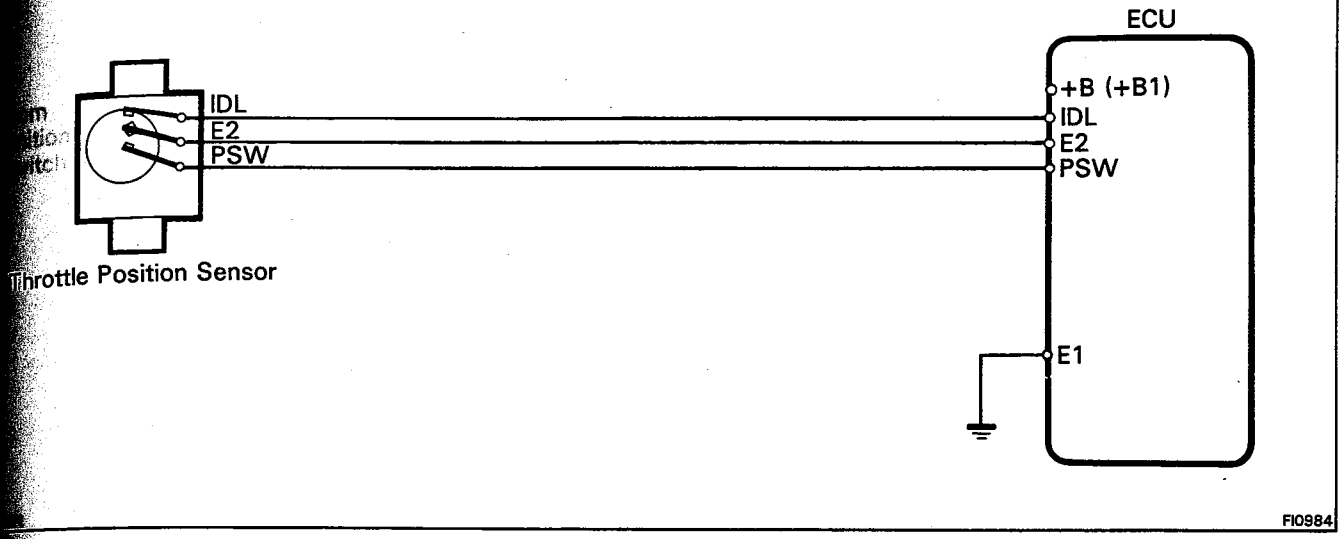
NO → Check fuse and fusible link.

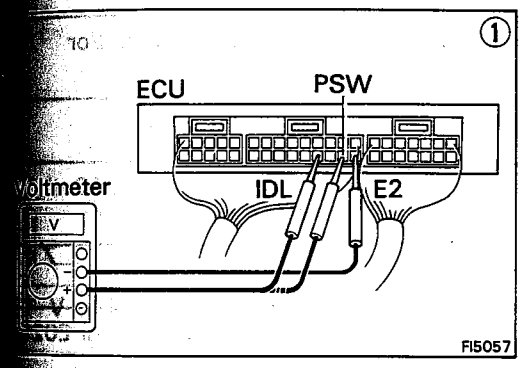
BAD → Replace.

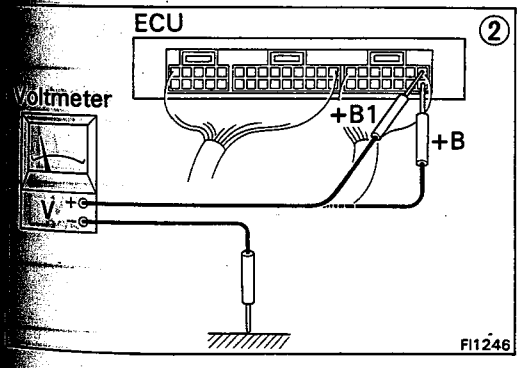
OK → Check wiring between ECU terminal and battery.

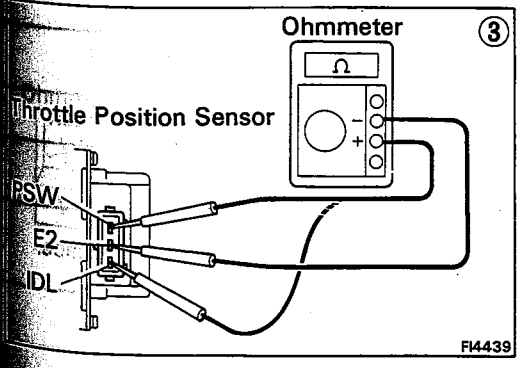
BAD → Repair or replac

Terminals	Trouble	Condition		STD voltage
IDL – E2	No voltage	IG SW ON	Throttle valve open	4.5 – 5.5 V
PSW – E2			Throttle valve fully closed	4.5 – 5.5 V









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

↓

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

NO → ↓ OK → Check wiring between ECU terminal E1 and body ground.

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

↓ NO

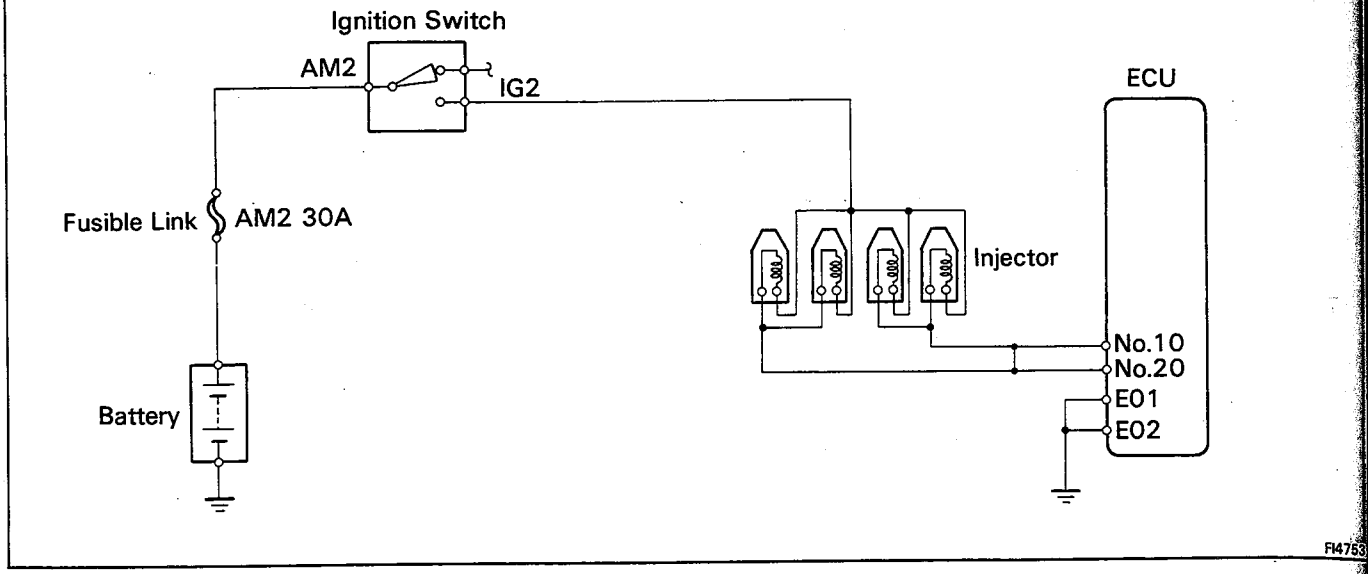
Refer to +B – E1 trouble section. (No.1) (See page FI-53)

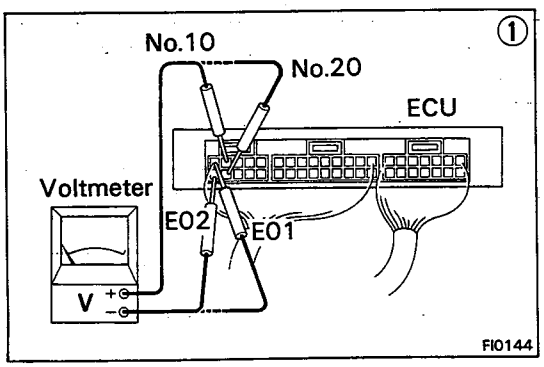
- BAD → Repair or replace.
- OK ↓

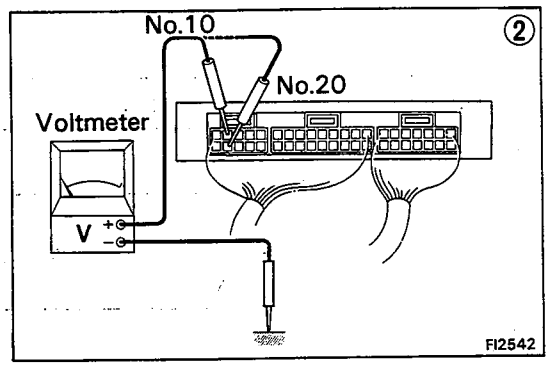
③ Check throttle position sensor. (See page FI-123)

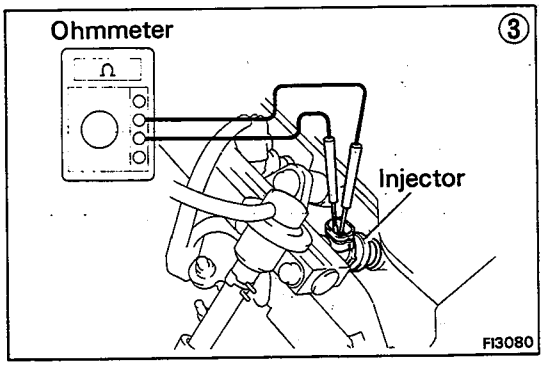
- BAD → Repair or replace throttle position sensor.
- OK → Check wiring between ECU and throttle position sensor.
  - OK → Try another ECU.
  - BAD → Repair or replace.

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









① There is no voltage between ECU terminals 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 and/or No.20 and body ground.

NO

OK

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

OK

Try another ECU.

BAD

Repair or replace.

Check fuse, fusible link, ignition switch.

BAD

Repair or replace.

OK

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

OK

BAD

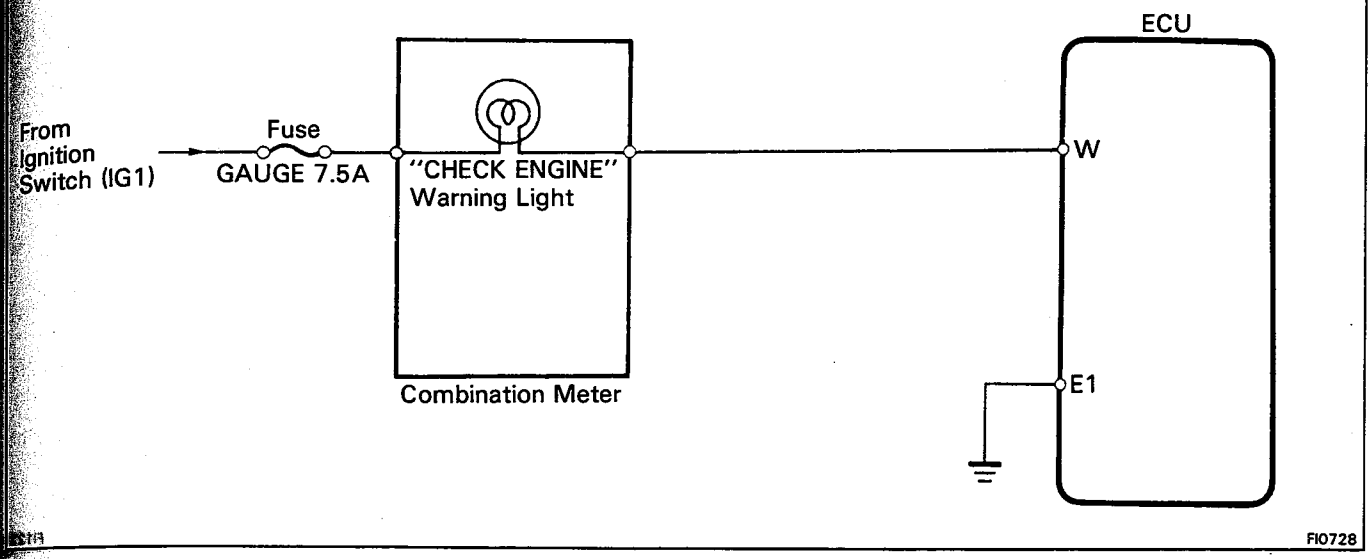
Replace injector.

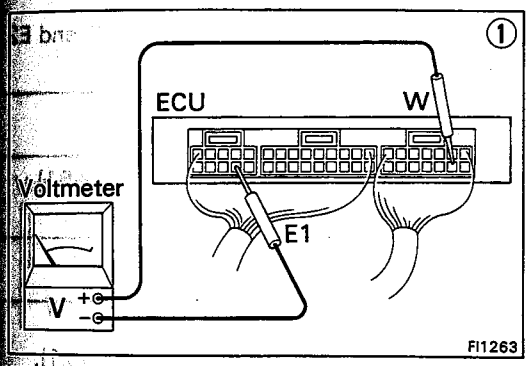
Check wiring between ECU terminal No.10 and/or No.20 and battery.

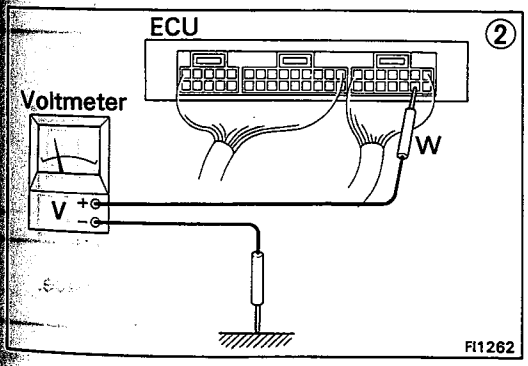
BAD

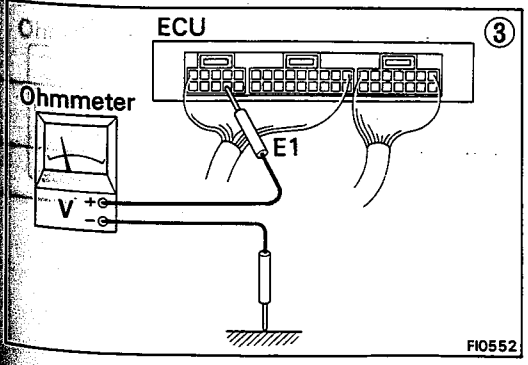
Repair or replace.

No.	Terminals	Trouble	Condition	STD voltage
5	W – E1	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. **(Idling)**

↓

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

NO → ↓

OK →

③ Check wiring between ECU terminal E1 and body ground.

OK → Try another ECU.

BAD → Repair or replace.

↓

Check GAUGE fuse and "CHECK ENGINE" warning light.

OK → ↓

BAD →

Repair or replace.

↓

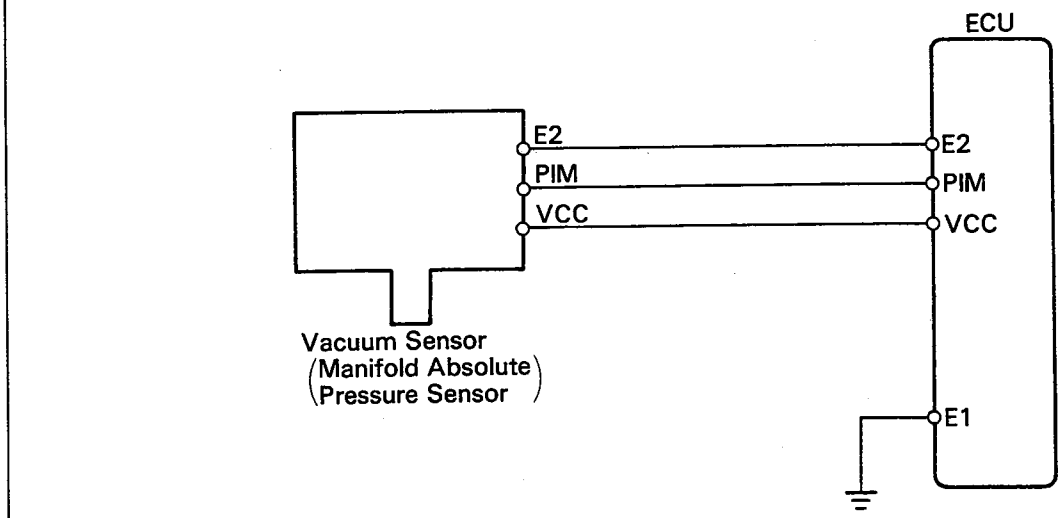
Fuse blows again

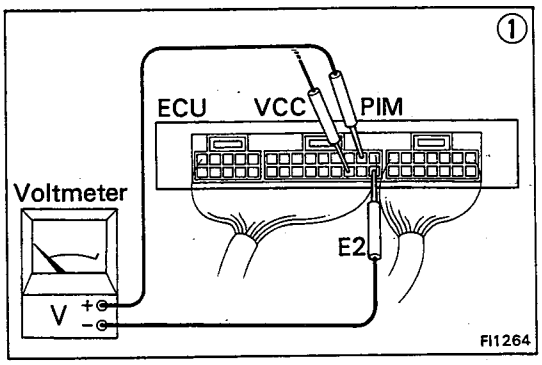
↓

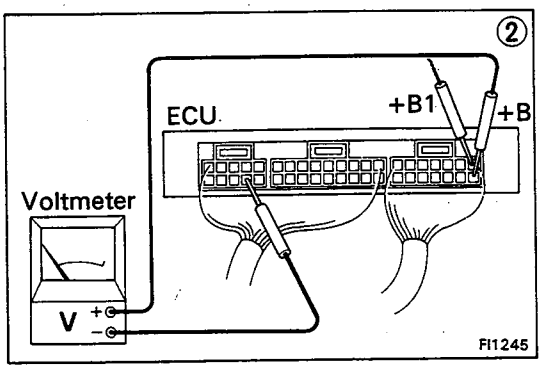
Check wiring between ECU terminal W and fuse.

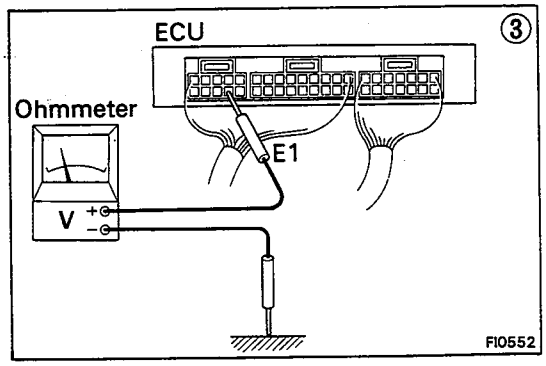
BAD → Repair or replace.

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









① There is no voltage between ECU terminals PIM or VCC and E1 **(IG SW ON)**

↓

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

NO → NO → Refer to +B – E1 trouble section (No.1) (See page FI-53)

↓ NO

③ Check wiring between ECU terminal E1 and body ground.

OK ↓ BAD → Repair or replace

Check vacuum sensor. (See page FI-140)

BAD ↓ OK →

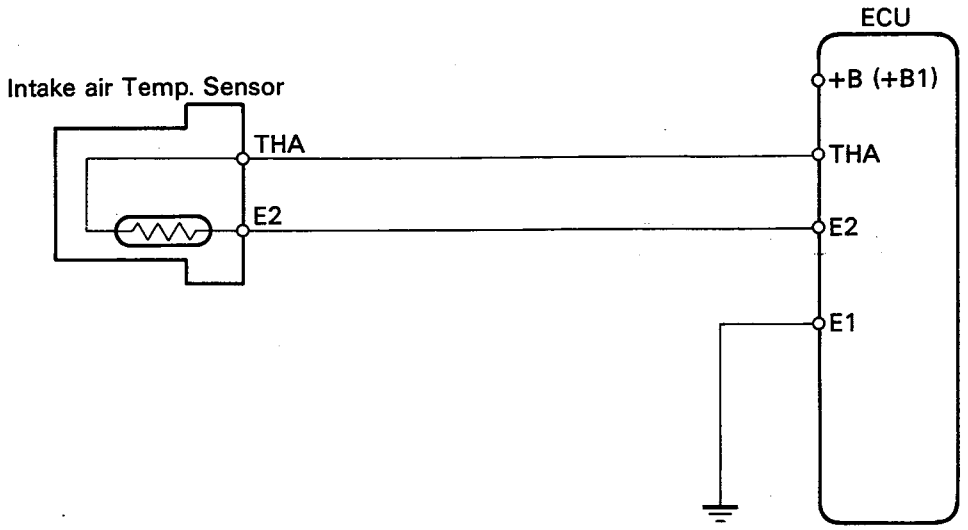
Replace vacuum sensor.

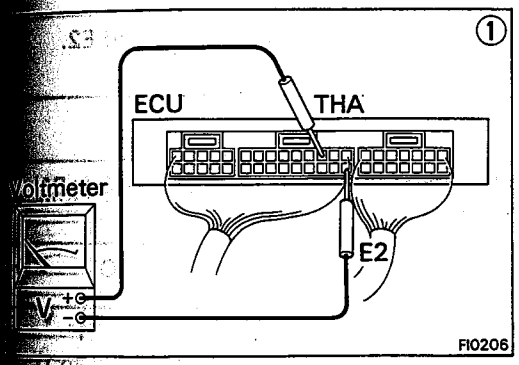
Check wiring between ECU and vacuum sensor.

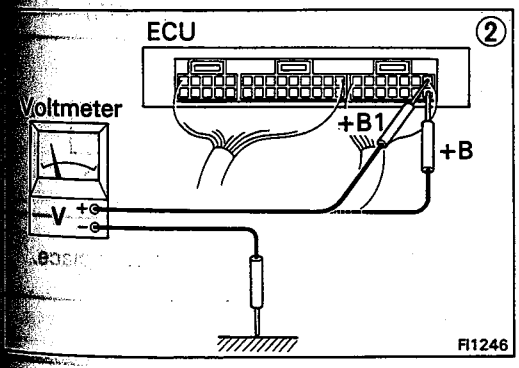
OK ↓ BAD → Repair or replace

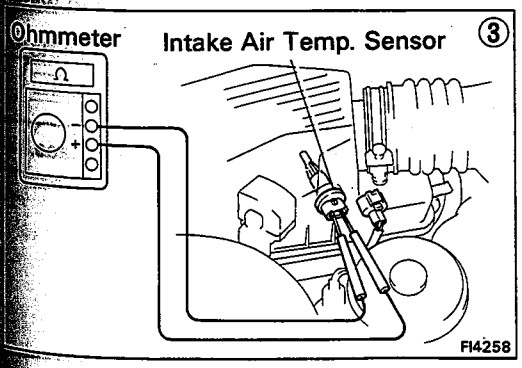
Try another ECU.

Terminals	Trouble	Condition		STD voltage
THA – E2	No voltage	IG SW ON	Intake air temperature 20°C (68°F)	2.0 – 2.5 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 → Check wiring between ECU terminal E1 and body ground.

NO → Refer to +B – E1 trouble section (No.1). (See page FI-53)

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

BAD → Repair or replace.

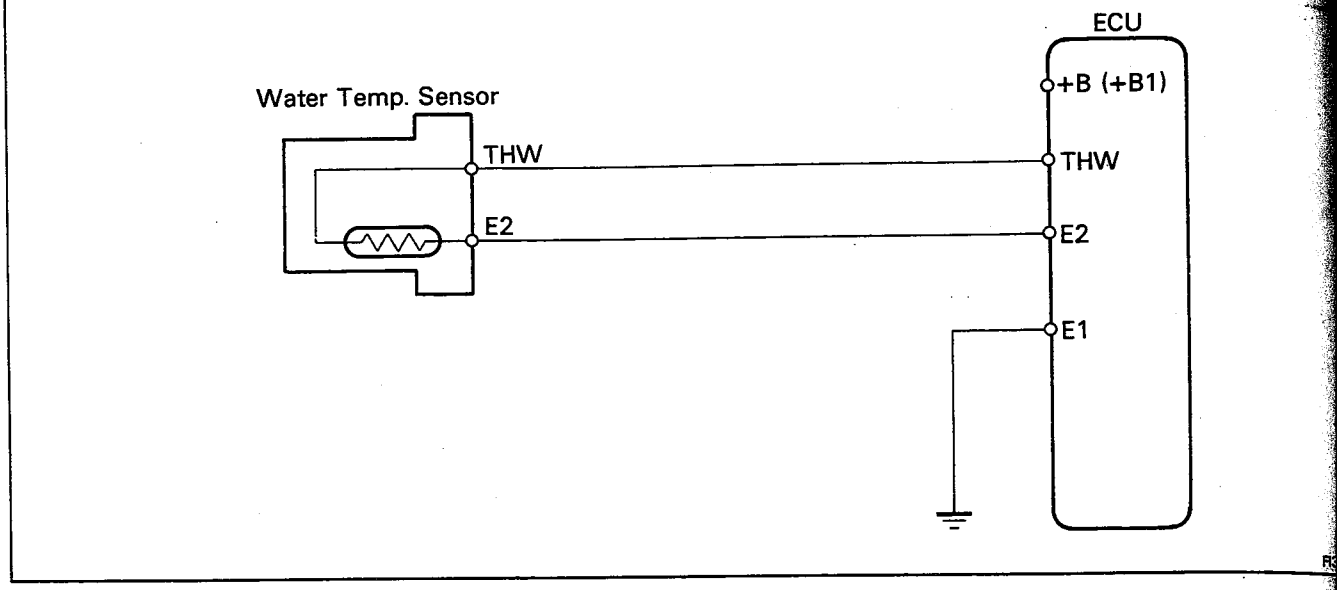
BAD → Replace intake air temp. sensor

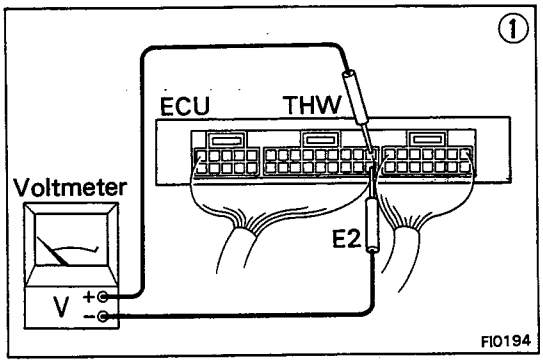
OK → Check wiring between ECU and intake air temp. sensor.

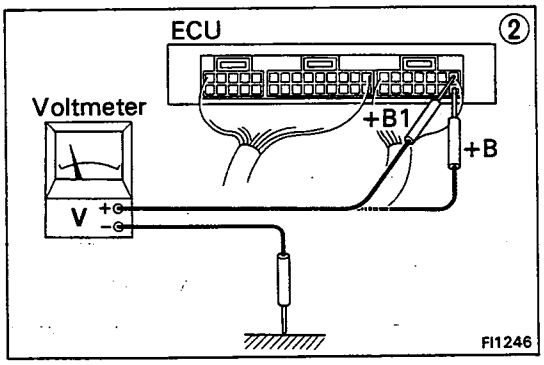
OK → Try another ECU.

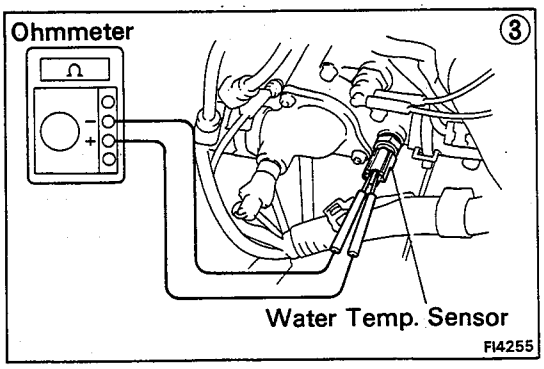
BAD → Repair or replace wiring.

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









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

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

OK

NO

Refer to +B – E1 trouble section (No.1) (See page FI-53)

Check wiring between ECU terminal E1 and body ground.

OK

BAD

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

Repair or replace.

BAD

OK

Replace water temp. sensor.

Check wiring between ECU and wa temp. sensor.

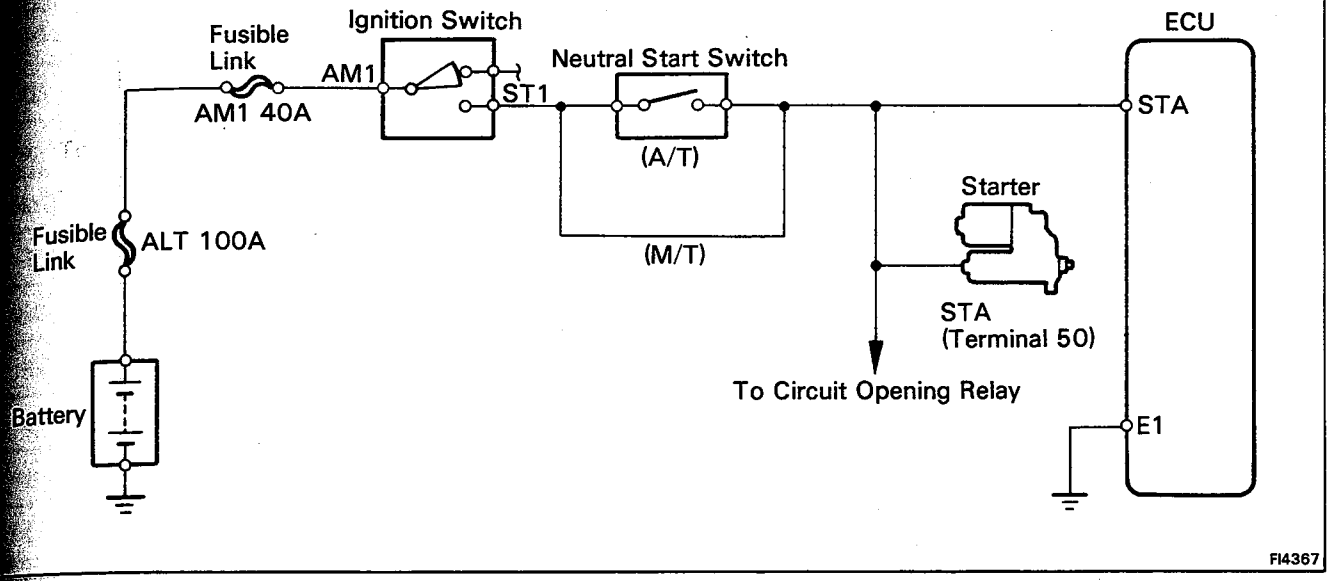
OK

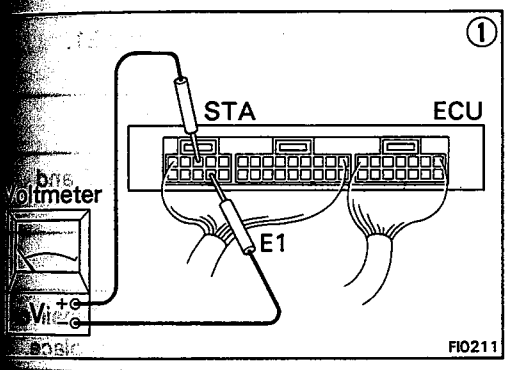
BAD

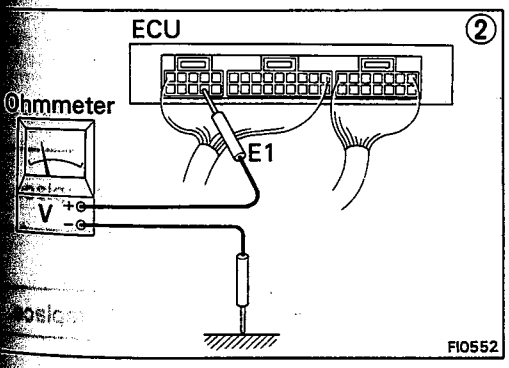
Try another ECU.

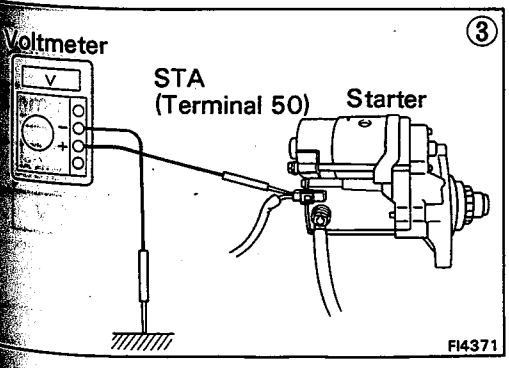
Repair or replace

Terminals	Trouble	Condition	STD voltage
STA – E2	No voltage	Cranking	6 – 14 V





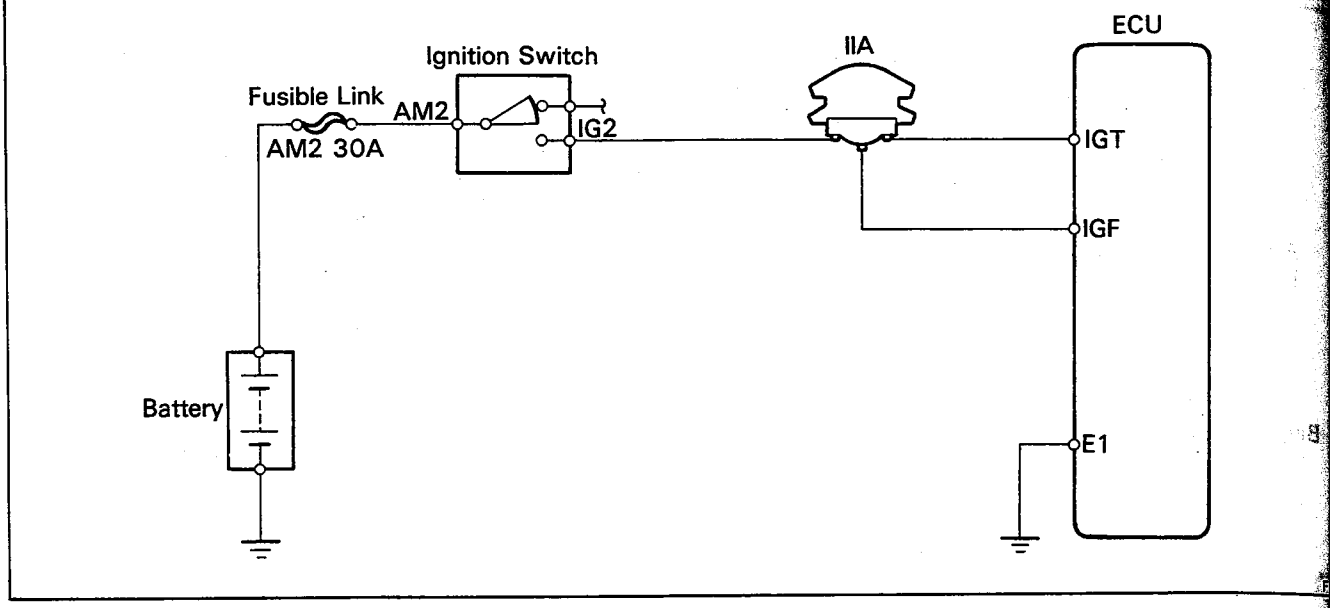


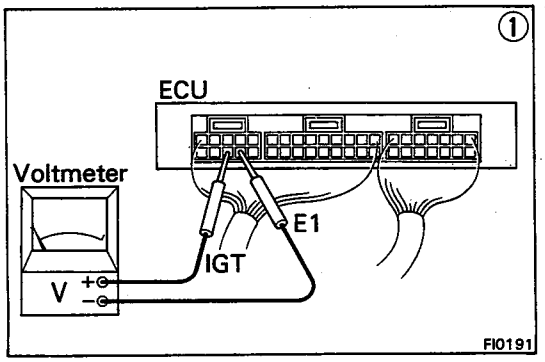


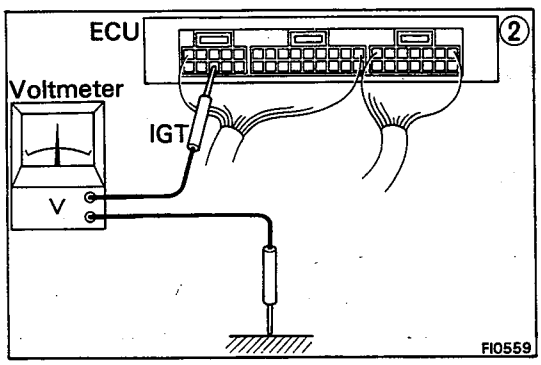
① There is no voltage between ECU terminals STA and E1. **(IG SW START)**

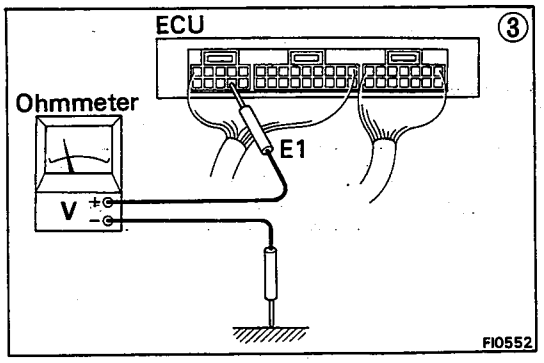
Check starter operation.
- OK → Check wiring between ECU terminal STA and ignition switch terminal ST1.
  - OK → ② Check wiring between ECU terminal E1 and body ground.
    - OK → Try another ECU.
    - BAD → Repair or replace.
  - BAD → Repair or replace.
- BAD → Check fusible link, battery wiring and ignition switch.
  - BAD → Repair or replace.
  - OK → ③ Check that there is voltage at STA (50) terminal of starter. **(IG SW START) STD voltage: 6 – 14 V**
    - OK → Check starter.
    - NO → Check wiring between ignition switch terminal ST1 and starter terminal STA (50)

No.	Terminals	Trouble	Condition	STD voltage
10	IGT – E2	No voltage	Idling	0.7 – 1.0 V









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

↓

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

NO → OK

③ Check wiring between ECU terminal E1 and body ground. → BAD → Repair or replace

OK → Try another ECU.

↓

Check fusible links and ignition switch. → BAD → Repair or replac

OK ↓

Check IIA. (See page IG-8) → BAD → Repair or replac

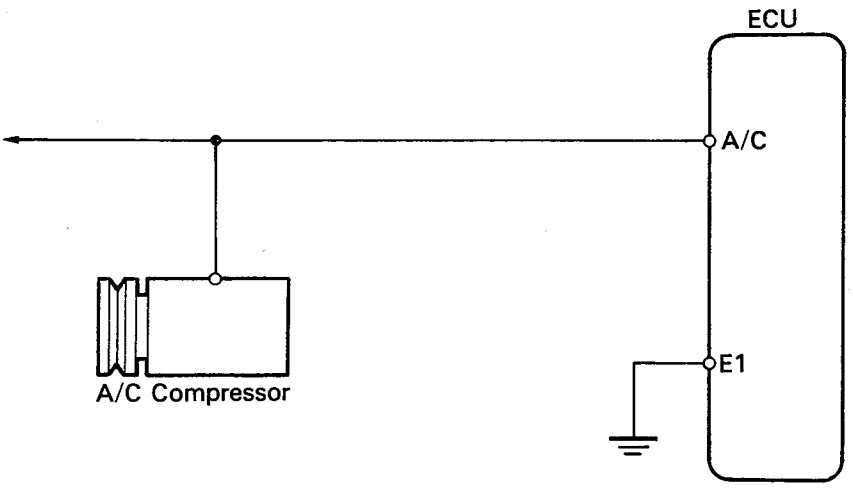
OK ↓

Check wiring between ECU and battery. → BAD → Repair or replac

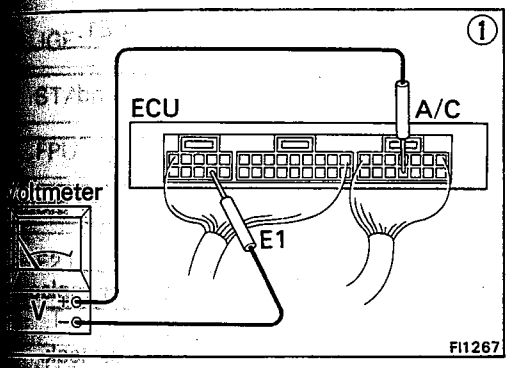
OK ↓

Check igniter. (See page IG-6) → BAD → Repair or replac

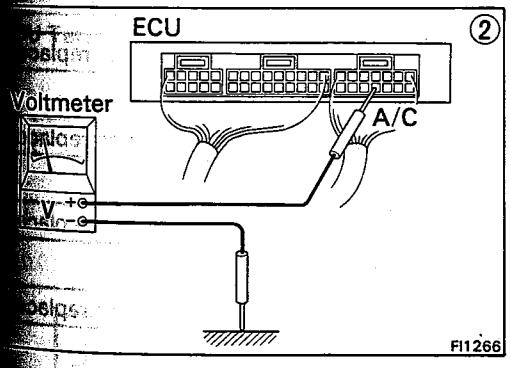
Terminals	Trouble	Condition	STD voltage
A/C – E2	No voltage	Air conditioning ON	5 – 14 V



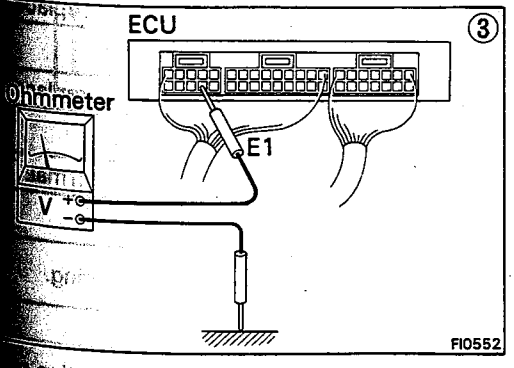
FI0922



FI1267



FI1266



FI0552

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

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

NO

OK

③ Check wiring between ECU terminal E1 and body ground.

OK

Try another ECU.

BAD

Repair or replace.

Check compressor running.

OK

Check wiring between ECU terminal A/C and Amplifier.

NO

BAD

Repair or replace.

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

BAD

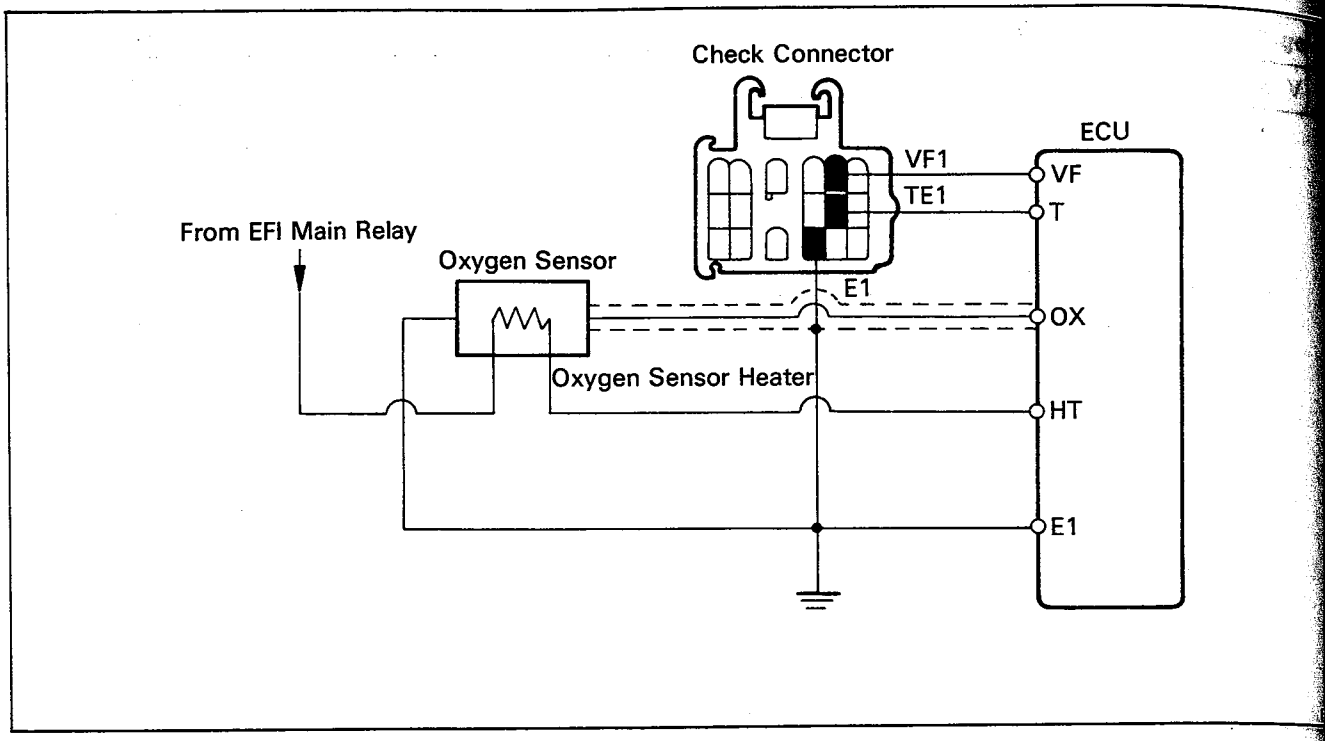
Repair or replace.

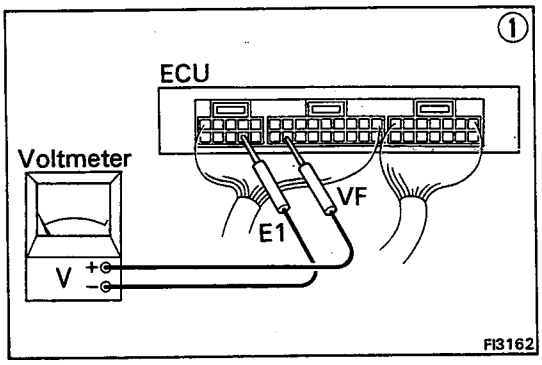
OK

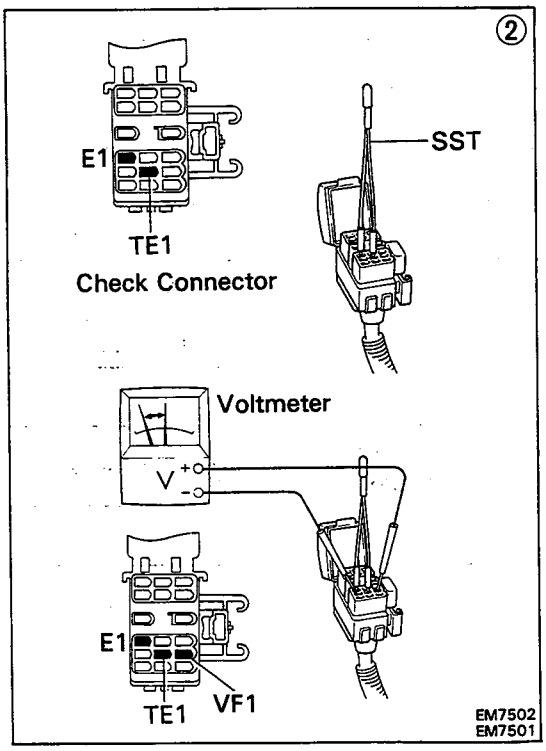
Check wiring between amplifier and ECU or compressor.

BAD

Repair or replace.







① There is no voltage between ECU terminals VF and E1.

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

NO → Check wiring between ECU terminal E1 and body grou
OK → Try another ECU.
BAD → Repair or replac

OK → Is air leaking into air intake system? BAD → Repair air leak

OK → Check spark plugs. BAD → Repair or replac

OK → Check distributor and ignition system. BAD → Repair or replac

OK → Check fuel pressure. BAD → Repair or replac

OK → Check injector. BAD → Repair or replac

OK → Check cold start injector. * BAD → Repair or replac

OK → Check vacuum sensor. BAD → Repair or replac

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

BAD → Check wiring between oxygen sensor and ECU connector. BAD → Repair wiring.

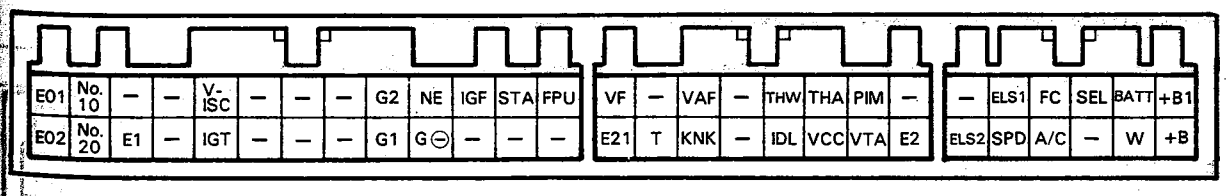
OK → Replace oxygen sensor.

* Rich malfunction

Terminals of ECU (4A-GE w/o Air Flow Meter)

Symbol	Terminal Name	Symbol	Terminal Name
E01	POWER GROUND	KNK	KNOCK SENSOR
E02	POWER GROUND	THW	WATER TEMP. SENSOR
No.10	INJECTOR	IDL	THROTTLE POSITION SENSOR
No.20	INJECTOR	THA	INTAKE AIR TEMP. SENSOR
E1	ECU GROUND	VCC	VACUUM SENSOR
V-ISC	VSV (ACV)	PIM	VACUUM SENSOR
IGT	IGNITER	VTA	THROTTLE POSITION SENSOR
G2	DISTRIBUTOR	E2	SENSOR GROUND
G1	DISTRIBUTOR	ELS2	ELECTRIC LOAD
NE	DISTRIBUTOR	ELS1	STOP LAMP
G⊖	DISTRIBUTOR	SPD	SPEED SENSOR
IGF	IGNITER	FC	CIRCUIT OPENING RELAY
STA	STARTER MAGNETIC SWITCH	A/C	A/C COMPRESSOR
FPU	FUEL PRESSURE VSV	*SEL	SENSOR GROUND
VF	CHECK CONNECTOR	BATT	BATTERY
E21	SENSOR GROUND	W	CHECK ENGINE WARING LIGHT
T	CHECK CONNECTOR	+B1	EFI MAIN RELAY
VAF	VARIABLE RESISTOR	+B	EFI MAIN RELAY

Terminals * Europe

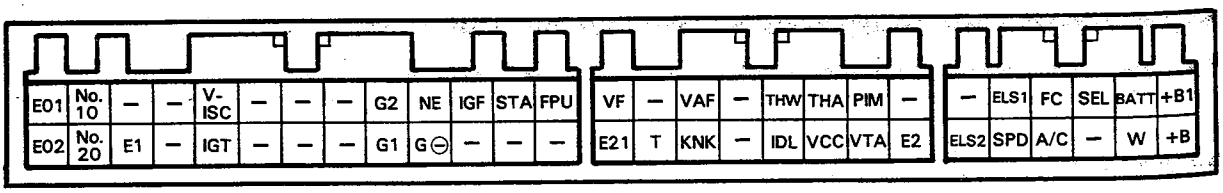


FI4265

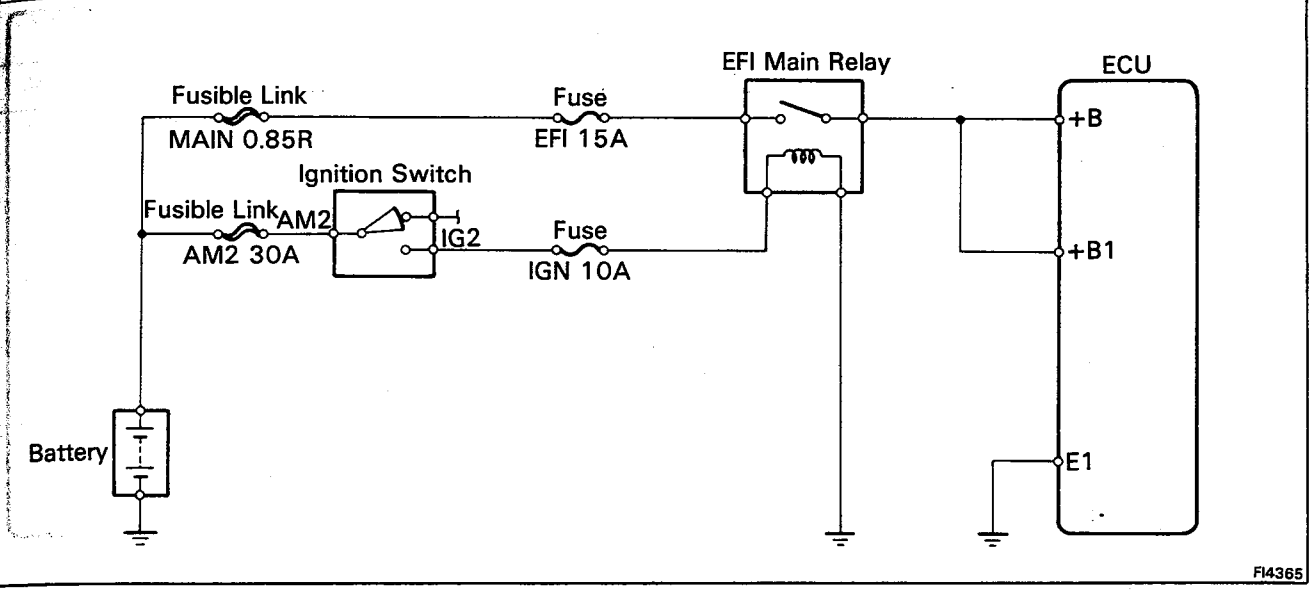
Voltage at ECU Wiring Connectors (4A-GE w/o Air Flow Meter)

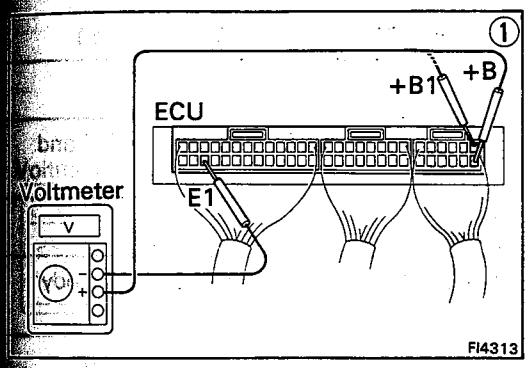
No.	Terminals	STD voltage (V)	Condition		See
1	+B, +B1 – E1	10 – 14	Ignition SW ON		FI-6
2	BATT – E1	10 – 14	–		FI-6
3	IDL – E2	4.5 – 5.5	Ignition SW ON	Throttle valve open	FI-6
	VTA – E2	0.5 or less		Throttle valve fully closed	
		3.5 – 5.5		Throttle valve fully open	
	VCC – E2	4.5 – 5.5		–	
4	No.10, No.20 – E01, E02	10 – 14	Ignition SW ON		FI-
5	W – E1	10 – 14	No trouble ("CHECK ENGINE" warning light off) and engine running.		FI-
6	PIM – E2	3.3 – 3.9	Ignition SW ON		FI-
	VCC – E2	4.5 – 5.5			
7	THA – E2	2.0 – 2.8	Ignition SW ON	Intake air temp. 20°C (68°F)	FI-
8	THW – E2	0.4 – 0.7		Coolant temp. 80°C (176°F)	FI-
9	STA – E1	6 – 14	Cranking		FI-
10	IGT – E1	0.7 – 1.0	Idling		FI-
11	A/C – E1	10 – 14	Ignition SW ON	Air conditioning ON	FI-

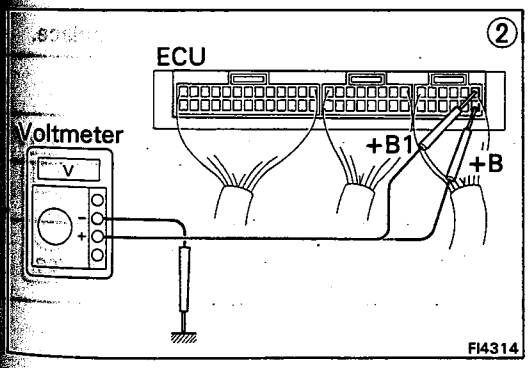
ECU Terminals

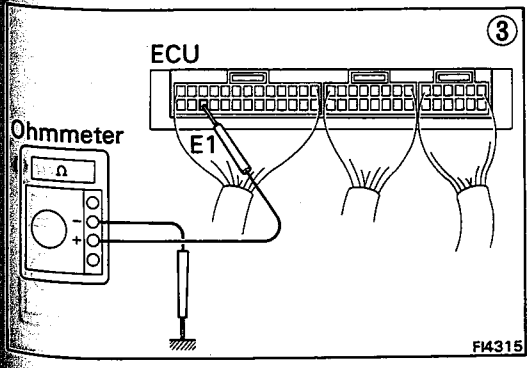


Terminals	Trouble	Condition	STD voltage
V+B, +B1 – E1	No voltage	IG SW ON	10 – 14 V









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

↓

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

NO → ↓ OK

③ Check wiring between ECU terminal E1 and body ground.

OK → ↓ Try another ECU. → Repair or replace.

BAD → Repair or replace.

↓ Check fuses, fusible links and ignition switch.

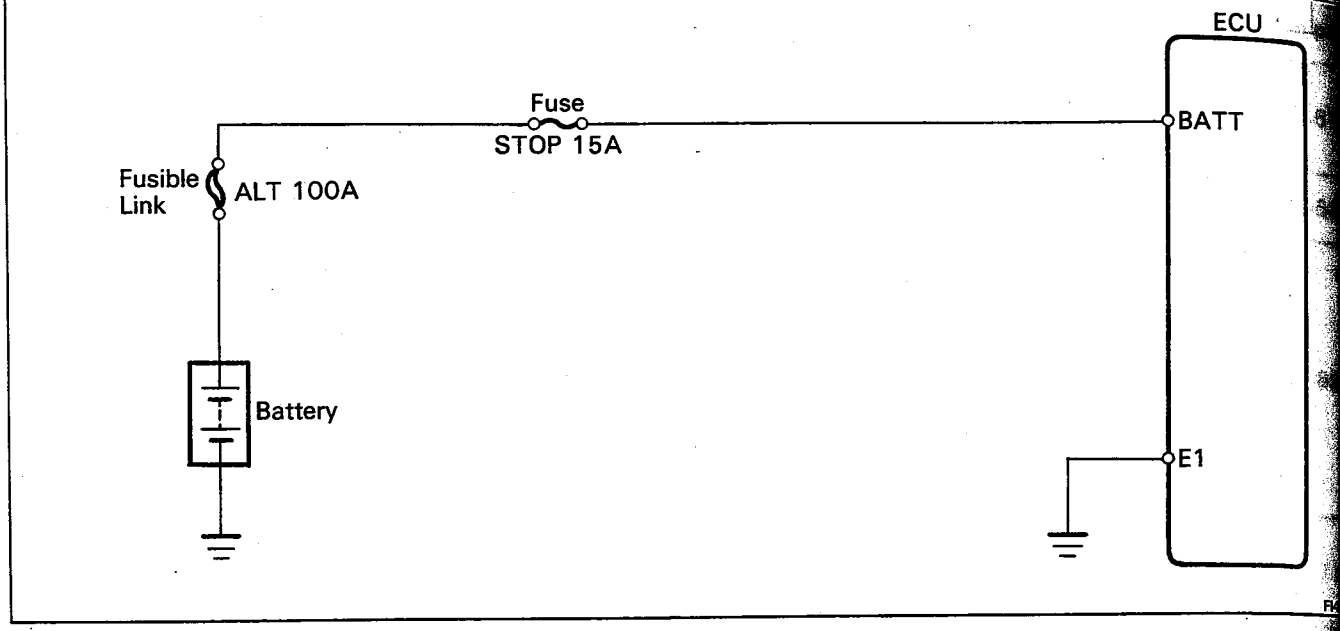
OK → ↓ Check EFI main relay. (See page FI-134)

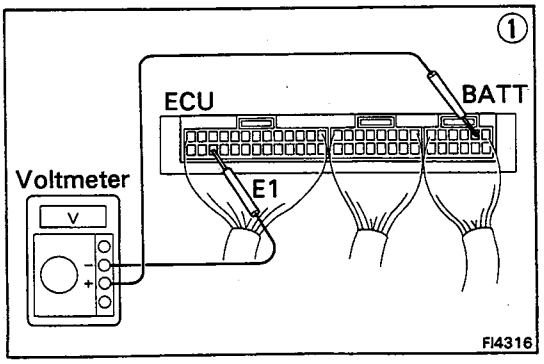
BAD → Replace.

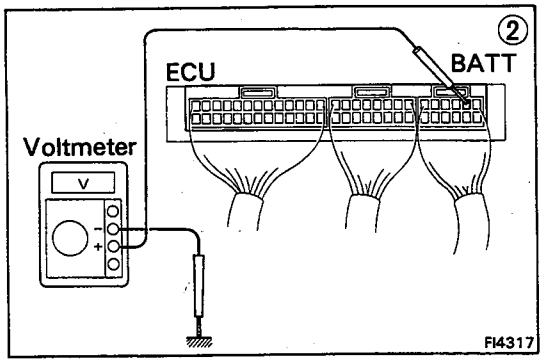
OK → ↓ Check wiring between EFI main relay and battery.

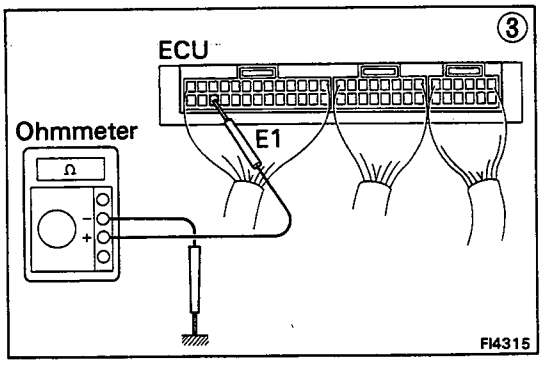
BAD → Repair or replace.

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









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

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

NO

OK

③ Check wiring between ECU terminal E1 and body ground.

OK

Try another ECU.

BAD

Repair or replace

Check fuse and fusible link.

BAD

Replace.

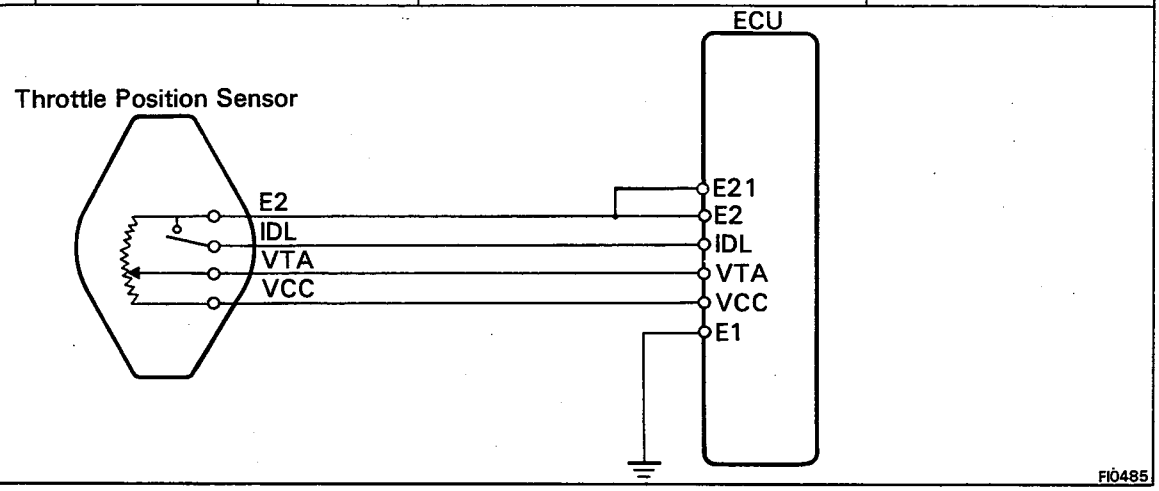
OK

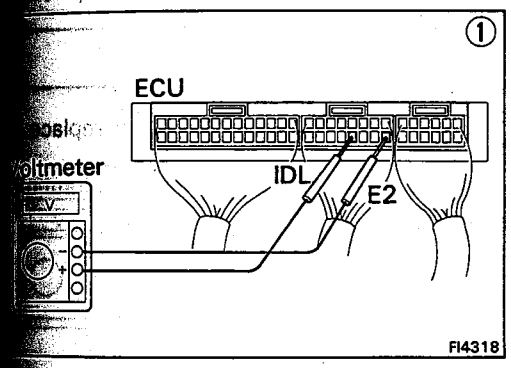
Check wiring between ECU terminal and battery.

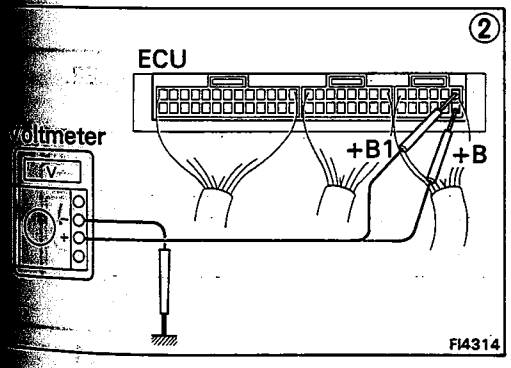
BAD

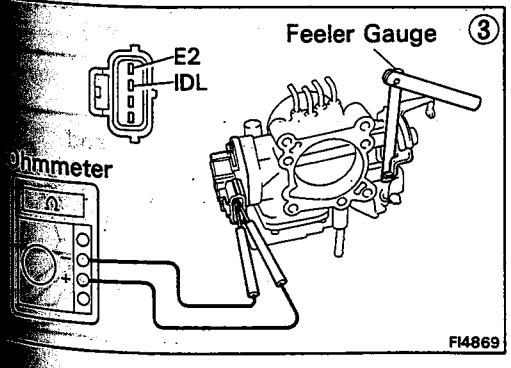
Repair or replace

Terminals	Trouble	Condition		STD voltage
IDL – E2	No voltage	IG SW ON	Throttle valve open	4.5 – 5.5 V
VTA – E2			Throttle valve fully closed	0.5 V or less
			Throttle valve fully open	3.5 – 5.5 V
VCC – E2			–	4.5 – 5.5 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 → ↓

OK → Check wiring between ECU terminal E1 and body ground.

BAD → Repair or replace.

↓

Refer to +B – E1 trouble section (No.1). (See page FI-67)

BAD → Repair or replace.

OK → ↓

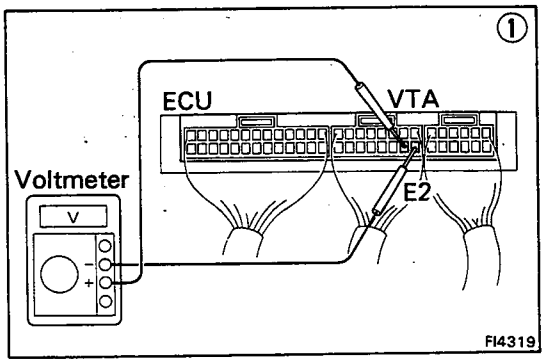
③ Check throttle position sensor. (See page FI-127)

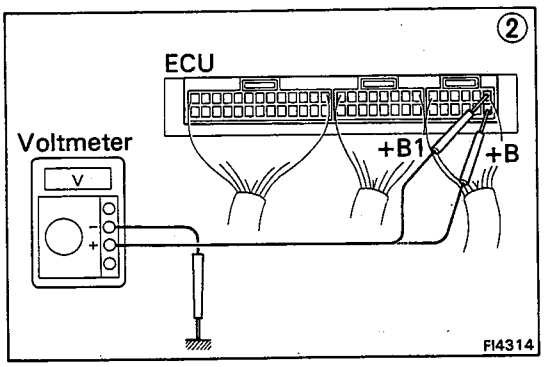
BAD → Repair or replace throttle position sensor.

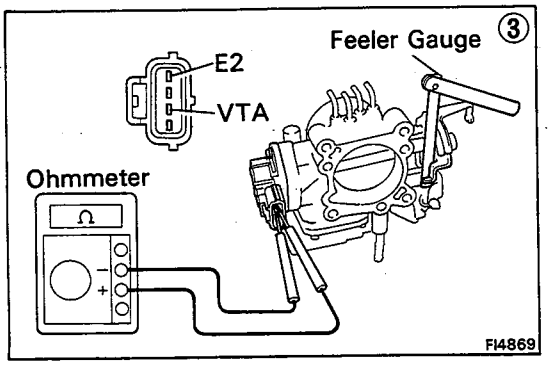
OK → Check wiring between ECU and throttle position sensor.

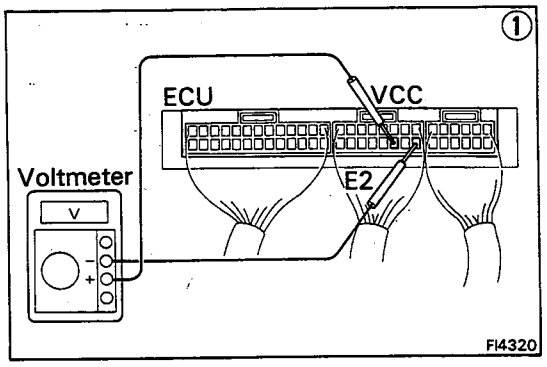
BAD → Repair or replace.

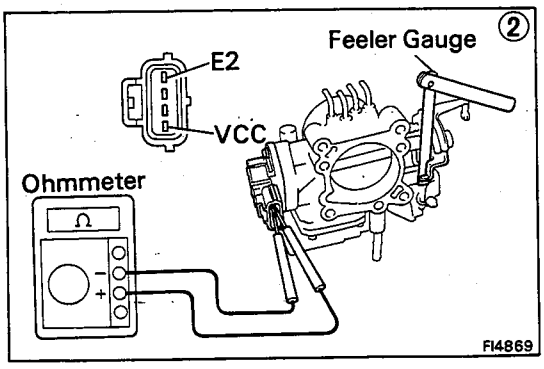
OK → Try another ECU











• 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 +B (+B1) and body ground. **(IG SW ON)**

NO → Check wiring between ECU terminal E1 and body ground.
- BAD → Repair or replace.

OK →

Refer to +B – E1 trouble section (No.1). (see page FI-67)
- BAD → Repair or replace.

OK →

③ Check throttle position sensor. (See page FI-127)
- BAD → Repair or replace.

OK →

Check wiring between ECU and throttle position sensor.
- BAD → Repair or replace.

OK →

Try another ECU.

• VCC – E2

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

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

NO → Refer to +B – E1 trouble section (No.1) (See page FI-67)

OK →

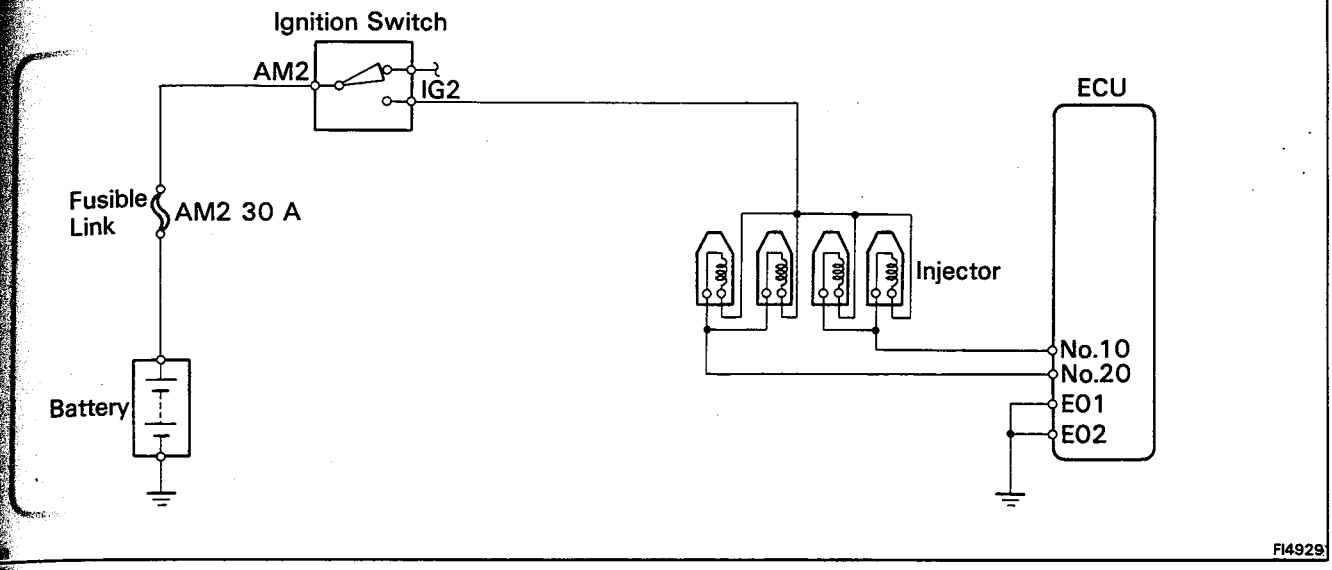
② Check throttle position sensor. (See page FI-127)

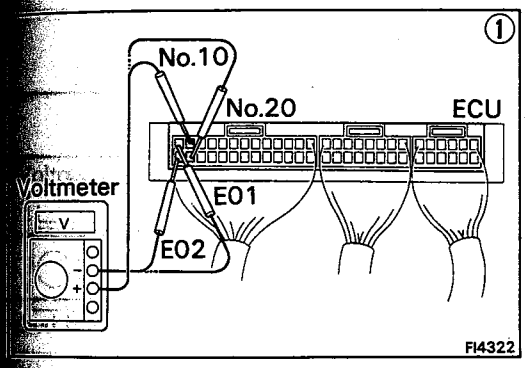
BAD → Repair or replace

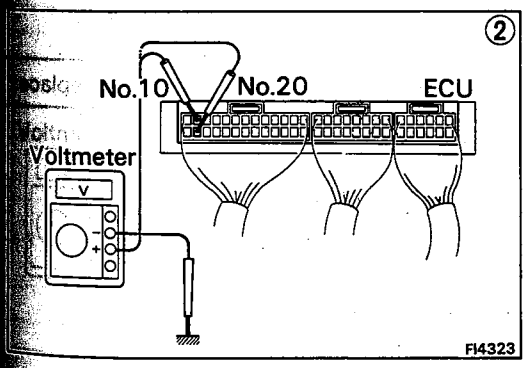
OK → Check wiring between ECU and throttle position sensor.
- BAD → Repair or replace wiring.

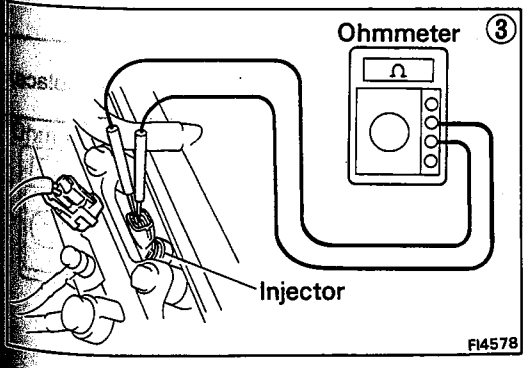
OK → Try another ECU.

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









① There is no voltage between ECU terminals 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 and/or No.20 and body ground.

NO → ↓ OK → Check wiring between ECU terminal E01 and/or E02 and body ground.

OK → Try another ECU.

BAD → Repair or replace.

↓

Check fuse, fusible link, ignition switch and starter relay. BAD → Repair or replace.

↓ OK

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

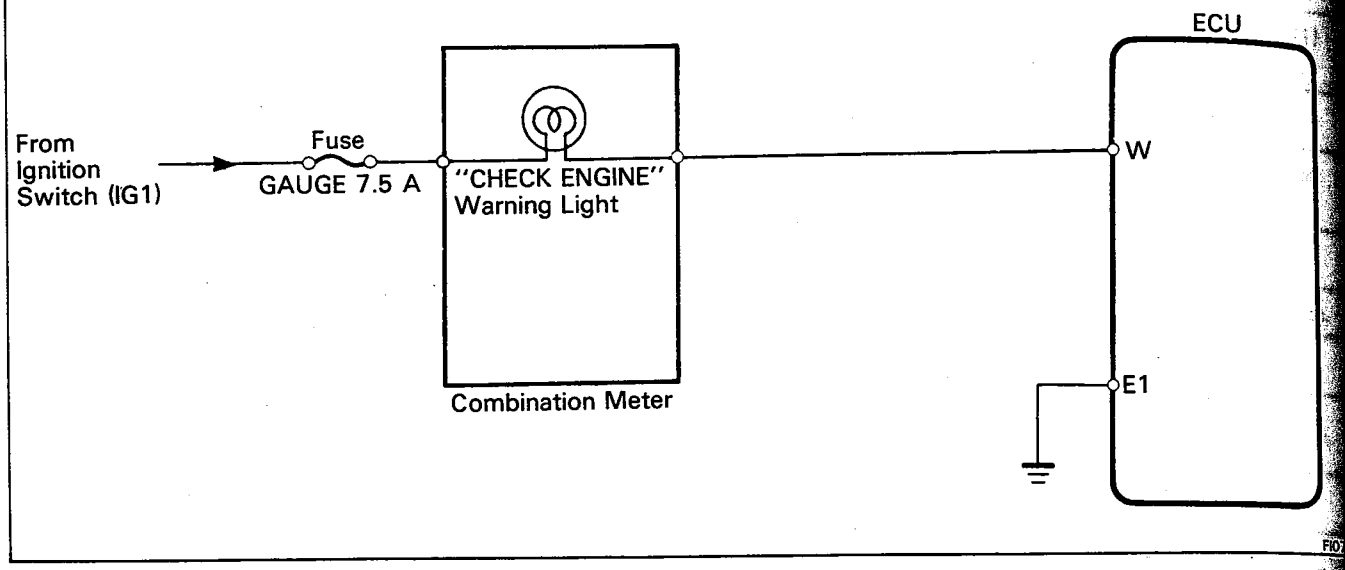
OK → ↓

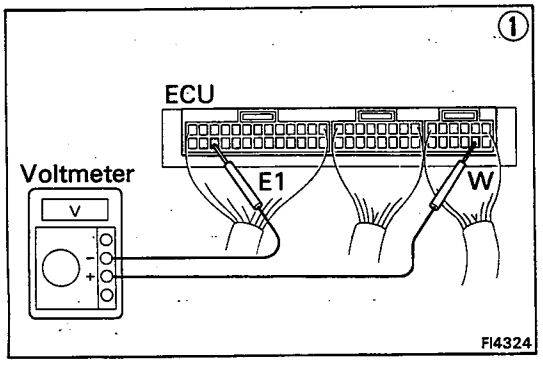
BAD → Replace injector.

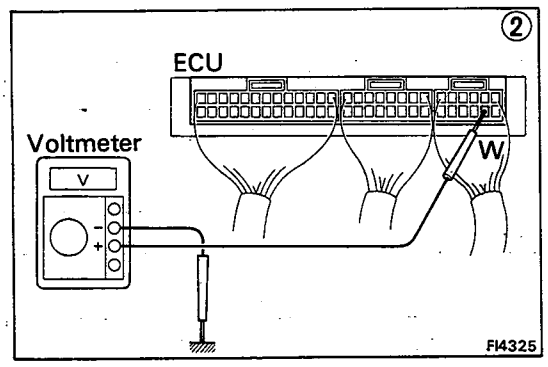
↓

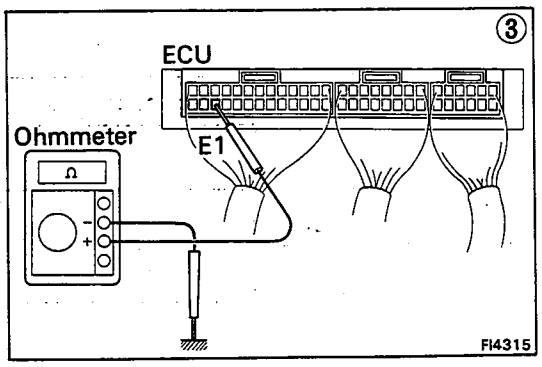
Check wiring between ECU terminal No.10 and/or No.20 and battery. BAD → Repair or replace.

No.	Terminals	Trouble	Condition	STD voltage
5	W – E1	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. **(Idling)**

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

NO

OK

③ Check wiring between ECU terminal E1 and bod ground.

OK

BAD

Try another ECU.

Repair or replac

Check GAUGE fuse and "CHECK ENGINE" warning light.

OK

BAD

Repair or replace.

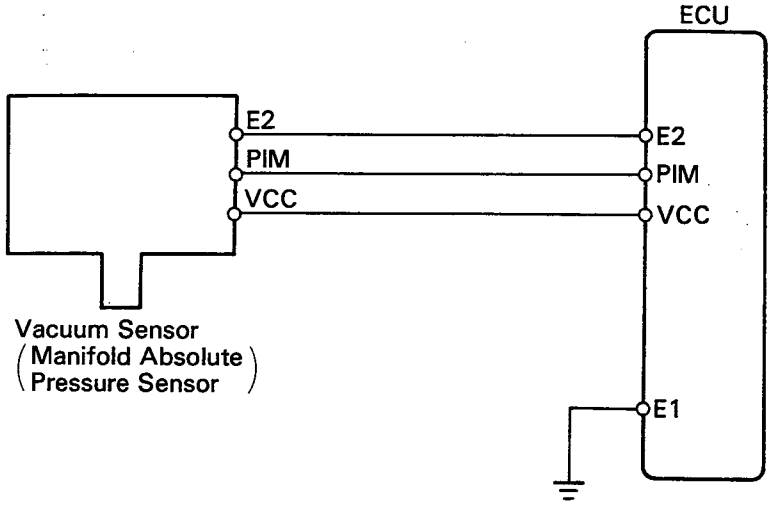
Fuse blows again

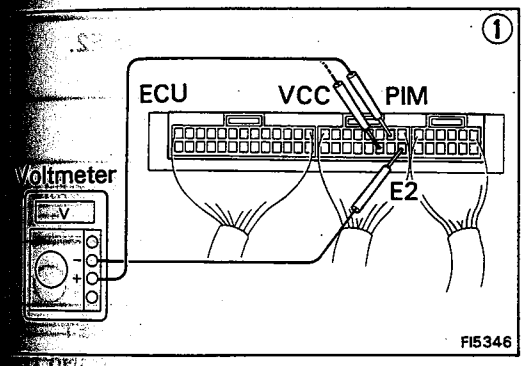
Check wiring between ECU terminal W and fuse.

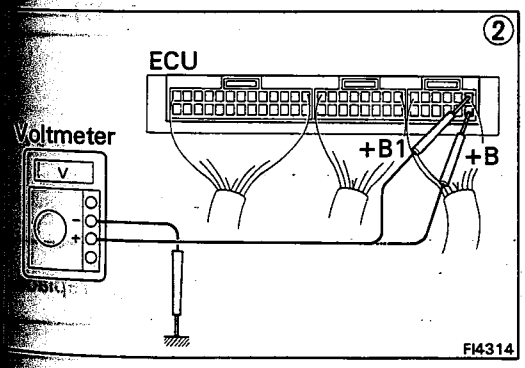
BAD

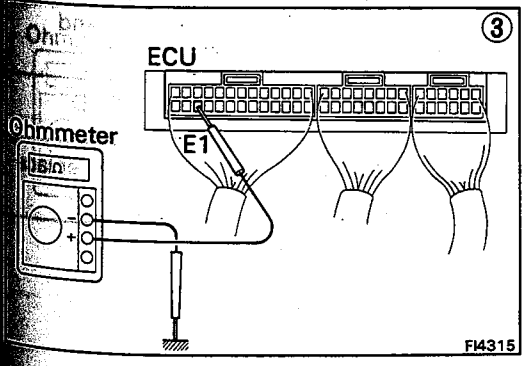
Repair or replac

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









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

↓

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

OK → ↓

NO → Refer to +B – E1 trouble section (No.1) (See page FI-67)

↓

③ Check wiring between ECU terminal E1 and body ground.

OK → ↓

BAD → Repair or replace.

Check vacuum sensor. (See page FI-140)

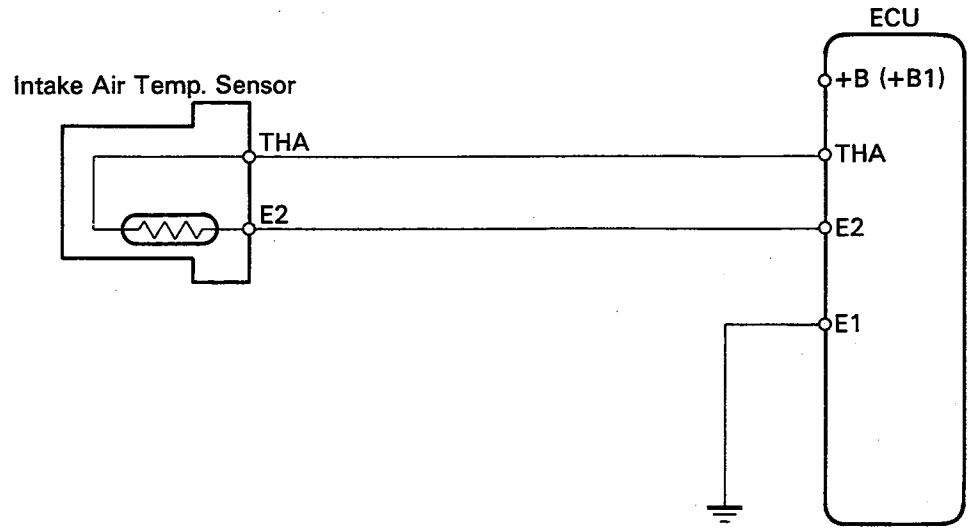
BAD → Replace vacuum sensor.

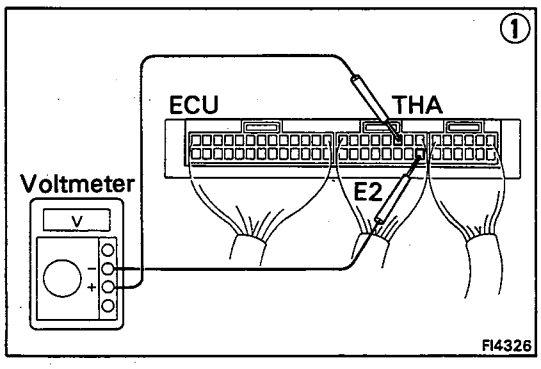
OK → Check wiring between ECU and vacuum sensor.

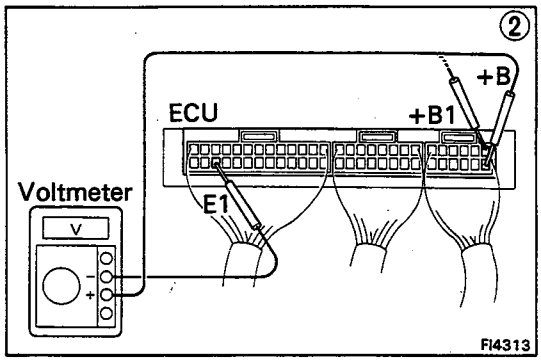
OK → Try another ECU.

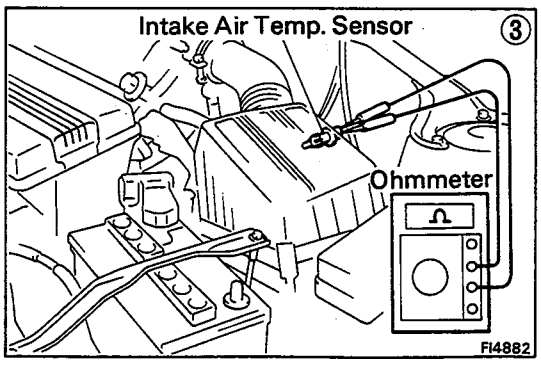
BAD → Repair or replace.

No.	Terminals	Trouble	Condition		STD voltage
7	THA – E2	No voltage	IG SW ON	Intake air temperature 20°C (68°F)	2.0 – 2.8 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 +B – E1 trouble section (No. (See page FI-67)

Check wiring between ECU terminal E1 and body ground.

OK

BAD

Repair or repl

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

BAD

OK

Replace intake air temp sensor.

Check wiring between ECU and intake air temp. sensor.

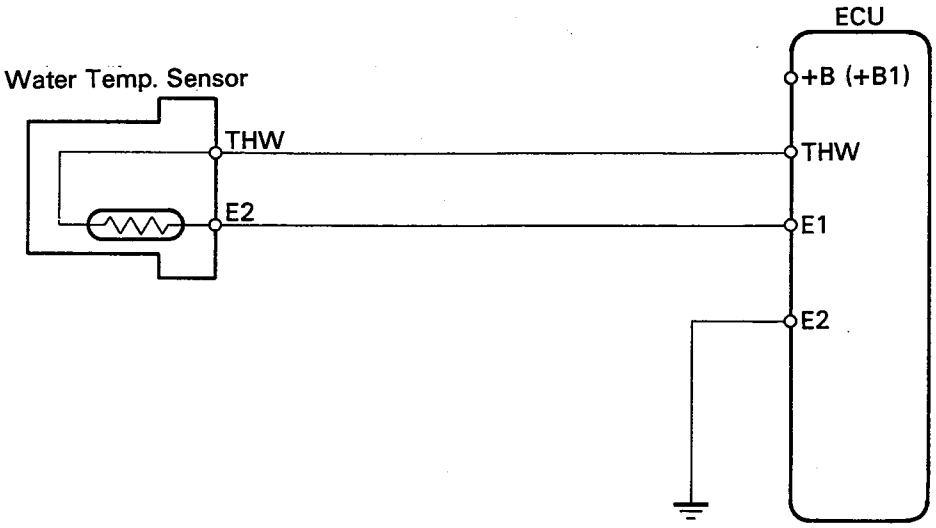
OK

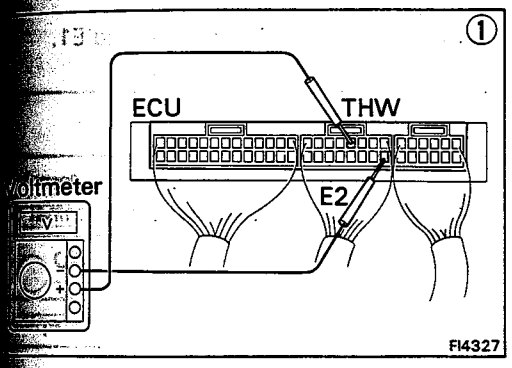
BAD

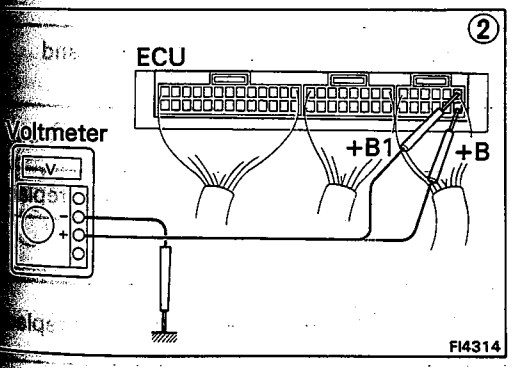
Try another ECU.

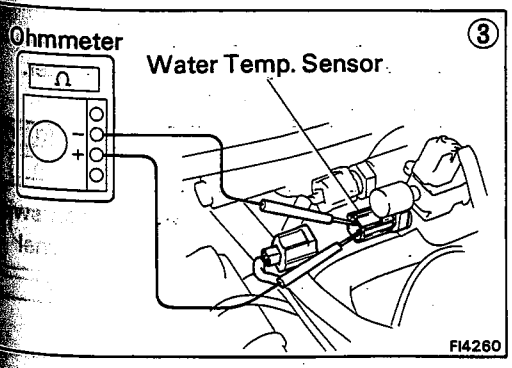
Repair or repl wiring.

Terminals	Trouble	Condition		STD voltage
THW – E2	No voltage	IG SW ON	Coolant temperature 80°C (176°F)	0.4 – 0.7 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 → ③ Check water temp. sensor (See page FI-138)

NO → Refer to +B – E1 trouble section (No.1) (See page FI-67)

Check wiring between ECU terminal E1 and body ground.

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

BAD → Repair or replace.

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

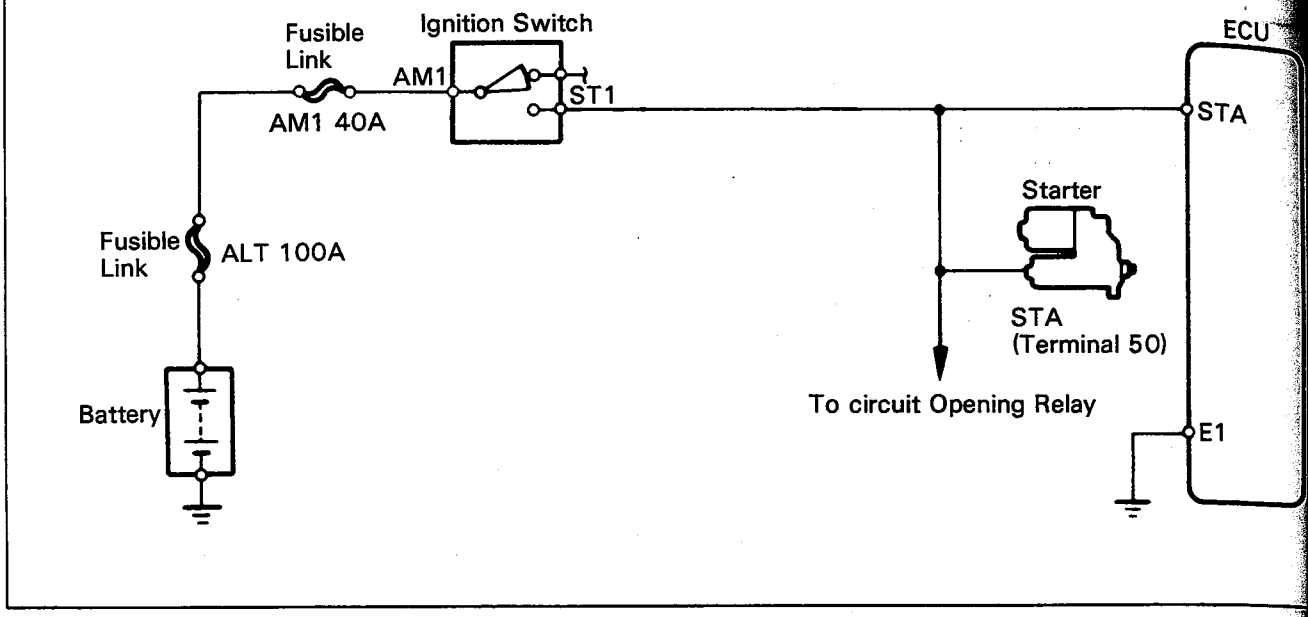
BAD → Replace water temp sensor.

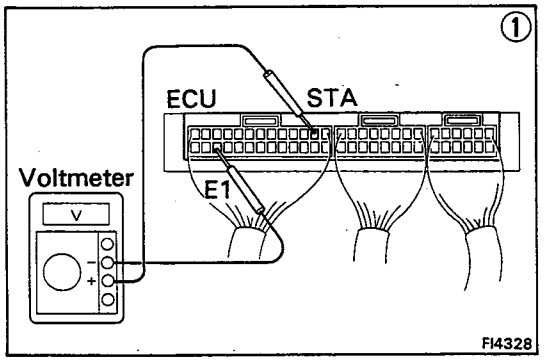
OK → Check wiring between ECU and water temp. sensor.

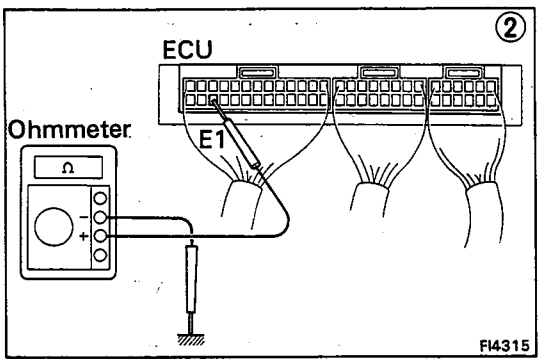
OK → Try another ECU.

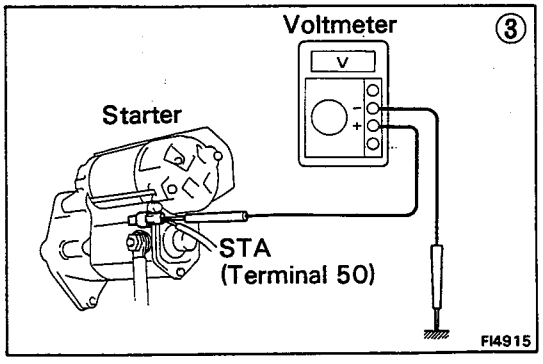
BAD → Repair or replace.

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





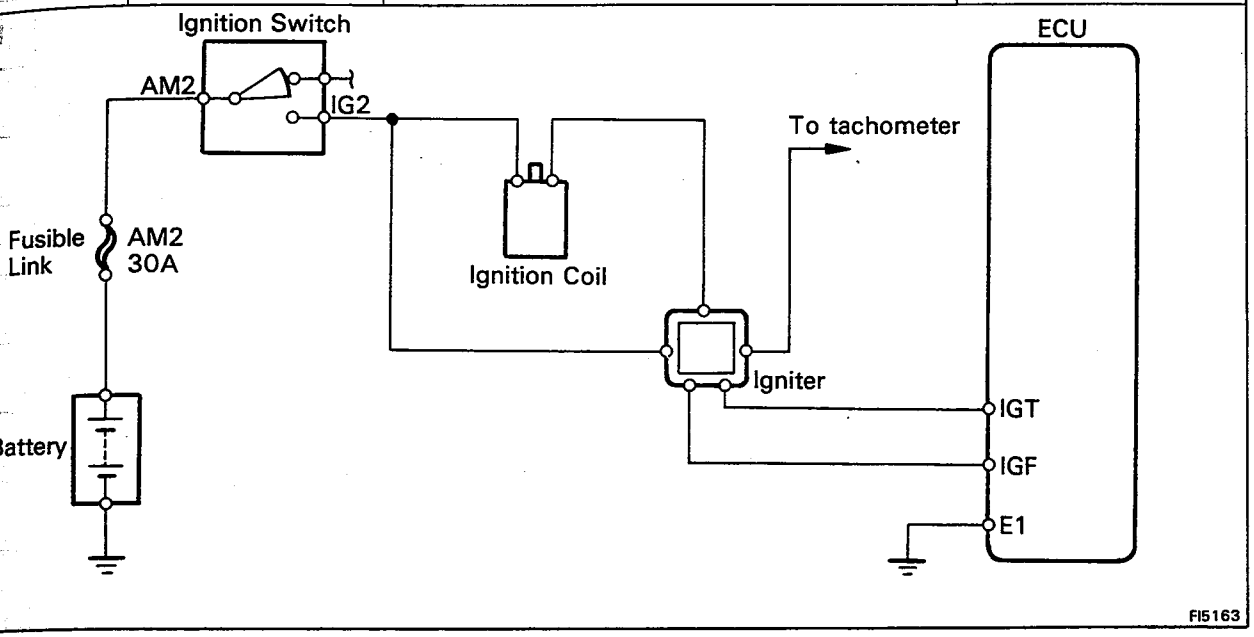


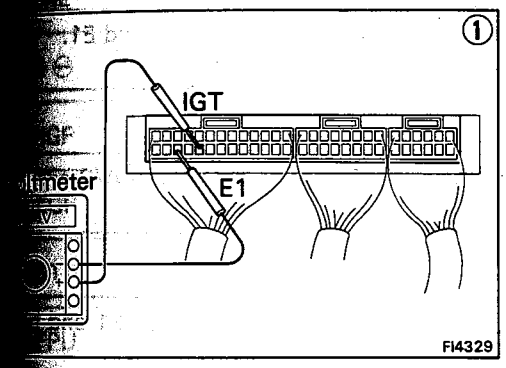


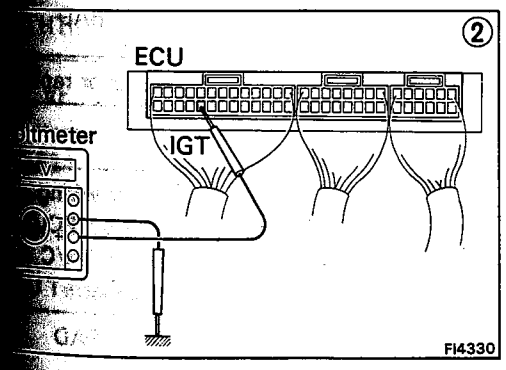
① There is no voltage between ECU terminals STA and E1. **(IG SW START)**

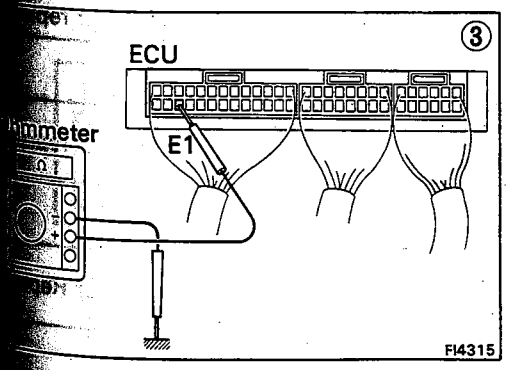
Check starter operation.
- OK → Check wiring between ECU term STA and ignition switch termina
  - OK → ② Check wiring between ECU terminal E1 and body ground.
    - OK → Try another ECU.
    - BAD → Repair or rep
  - BAD → Repair or rep
- BAD → Check fusible link, battery, wiring and ignition switch.
  - BAD → Repair or rep
  - OK → ③ Check that there is voltage at STA (50) terminal of starte **(IG SW START) STD voltage: 6 – 14 V**
    - OK → Check starter.
    - NO → Check wiring between ignition s terminal ST1 and starter termin STA (50).

Terminals	Trouble	Condition	STD voltage
IGT – E1	No voltage	Idling	0.7 – 1.0 V









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

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

NO

OK

③ Check wiring between ECU terminal E1 and body ground. — BAD → Repair or replace.

OK

Try another ECU.

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

OK

Check distributor. (See page IG-14) — BAD → Repair or replace.

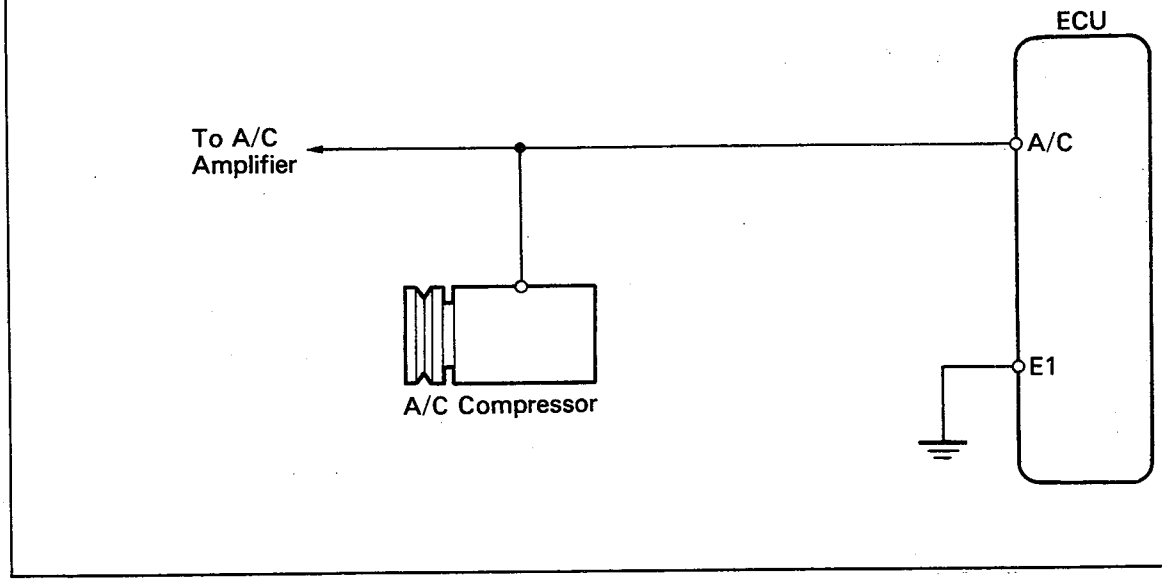
OK

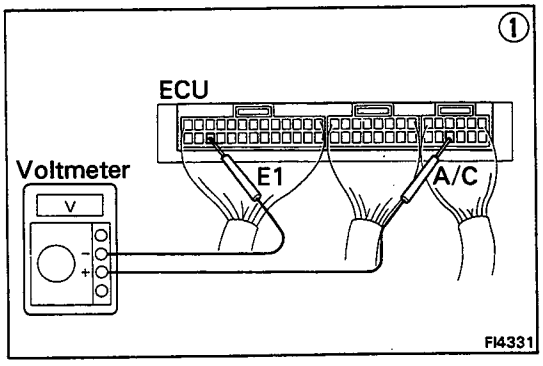
Check wiring between ECU and battery. — BAD → Repair or replace.

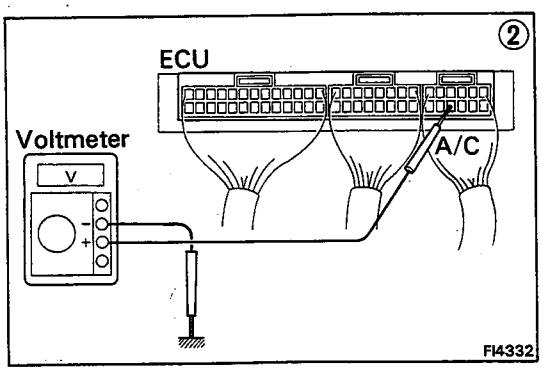
OK

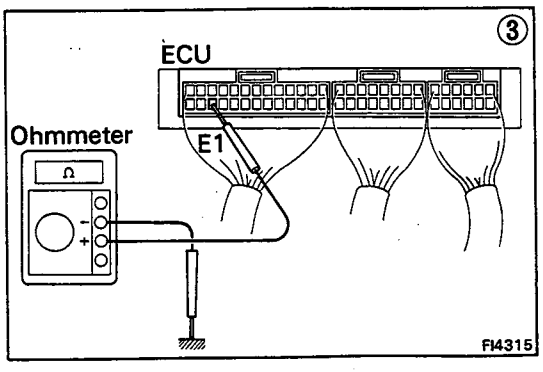
Check igniter. (See page IG-10) — BAD → Repair or replace.

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









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

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

NO

OK

③ Check wiring between ECU terminal E1 and b ground.

OK

Try another ECU.

BAD

Repair or repla

Check compressor running

OK

Check wiring between ECU terminal A/C amplifier.

NO

BAD

Repair or repl

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

BAD

Repair or repl

OK

Check wiring between amplifier and ECU or compressor.

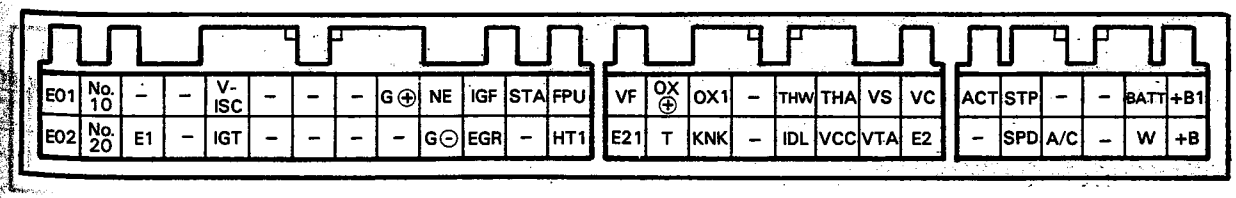
BAD

Repair or Rep

Terminals of ECU (4A-GE w/ Air Flow Meter)

Symbol	Terminal Name	Symbol	Terminal Name
E01	POWER GROUND	T	CHECK CONNECTOR
E02	POWER GROUND	OX1	OXYGEN SENSOR
No.10	INJECTOR	KNK	KNOCK SENSOR
No.20	INJECTOR	THW	WATER TEMP. SENSOR
E1	ECU GROUND	IDL	THROTTLE POSITION SENSOR
V-ISC	VSV (IDLE-UP)	THA	INLET AIR TEMP. SENSOR
IGT	IGNITER	VCC	THROTTLE POSITION SENSOR
G⊕	DISTRIBUTOR	VS	AIR FLOW METER
NE	DISTRIBUTOR	VTA	THROTTLE POSITION SENSOR
G⊖	DISTRIBUTOR	VC	AIR FLOW METER
IGF	IGNITER	ACT	A/C AMPLIFIER
EGR	VSV (EGR)	STP	STOP LIGHT SWITCH
STA	STARTER SWITCH	SPD	SPEED SENSOR
FPU	VSV (FPU)	A/C	A/C COMPRESSOR
HT1	OXYGEN SENSOR HEATER	BATT	BATTERY
VF	CHECK CONNECTOR	W	CHECK ENGINE WARNING LIGHT
E21	SENSOR GROUND	+B1	EFI MAIN RELAY
OX⊕	OXYGEN SENSOR	+B	EFI MAIN RELAY

ECU Terminals

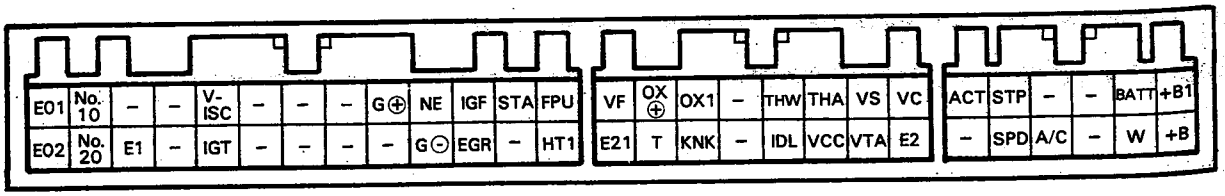


FI4265

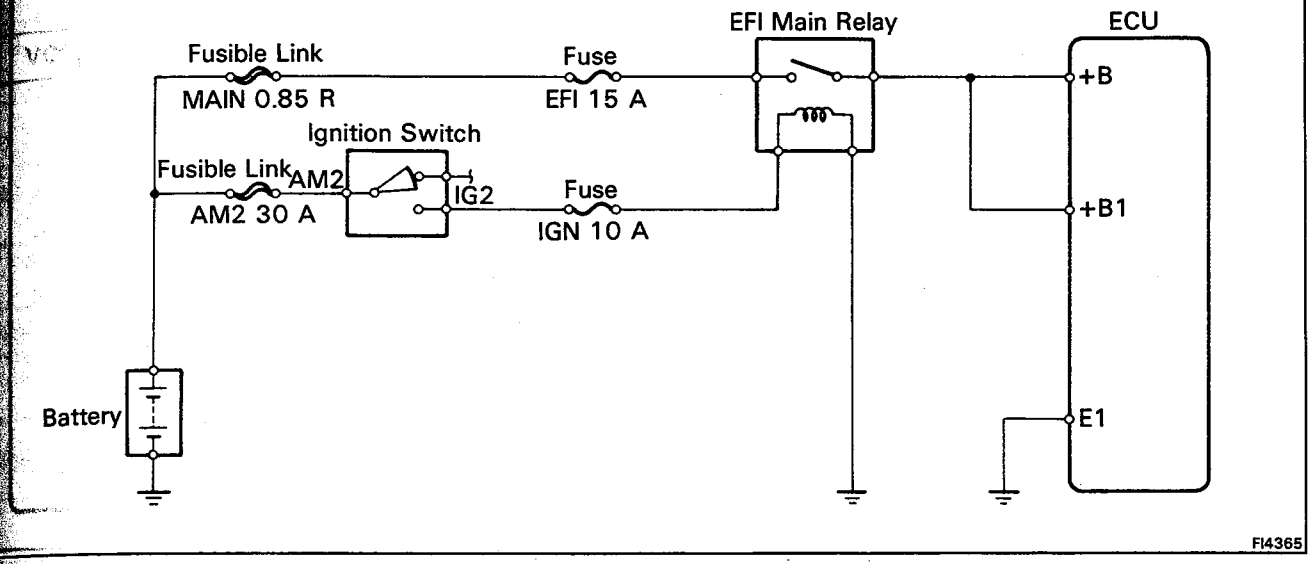
Voltage at ECU Wiring Connectors (4A-GE w/ Air Flow Meter)

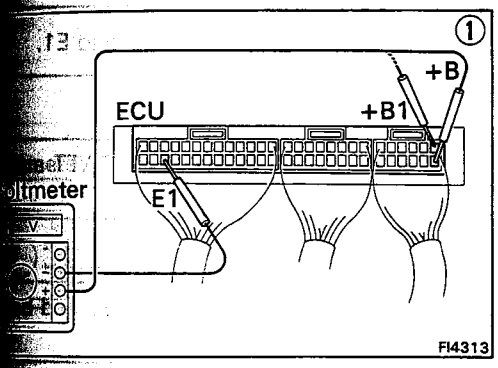
No.	Terminals	STD voltage (V)	Condition		See page
1	+B, +B1 – E1	10 – 14	Ignition SW ON		FI-81
2	BATT – E1	10 – 14	–		FI-82
3	IDL – E2	10 – 14	Ignition SW ON	Throttle valve open	FI-83
	VTA – E2	0.1 – 1.0		Throttle valve fully closed	
		4 – 5		Throttle valve fully open	
	VCC – E2	4.5 – 5.5		–	
4	VC – E2	4.5 – 5.5	Ignition SW ON	–	FI-85
	VS – E2	2.0 – 5.5		Measuring plate fully closed	
		6 – 9		Measuring plate fully open	
		2 – 8	Idling		
5	No.10, No.20 – E01, E02	10 – 14	Ignition SW ON		FI-86
6	W – E1	10 –14	No trouble ("CHECK ENGINE" warning light off) and engine running		FI-87
7	THA – E2	2.0 – 2.8	Ignition SW ON	Intake air temp. 20°C (68°F)	FI-88
8	THW – E2	0.4 – 0.7		Coolant temp. 80°C (176°F)	FI-89
9	STA – E1	6 –14	Cranking		FI-90
10	IGT – E1	0.7 – 1.0	Idling		FI-91
11	A/C – E1	10 –14	Ignition SW ON	Air conditioning ON	FI-92

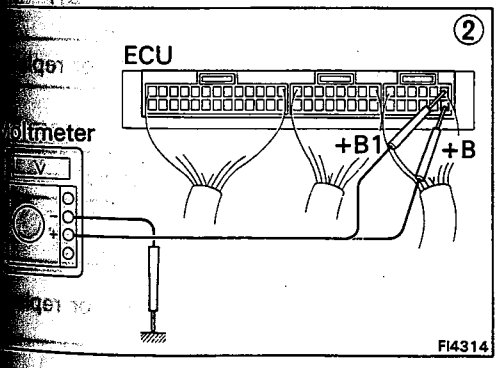
ECU Terminals

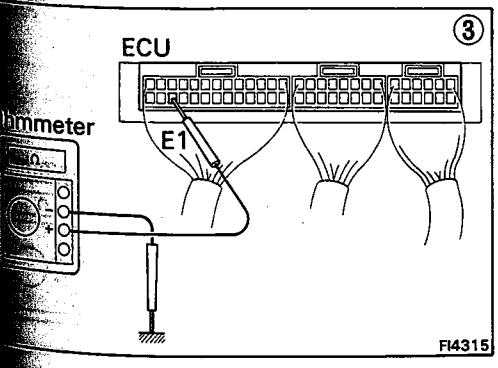


Terminals	Trouble	Condition	STD voltage
V+B – E1 +B1	No voltage	IG SW ON	10 – 14 V









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

↓

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

NO → ↓ OK → ③ Check wiring between ECU terminal E1 and body ground.

③ OK → Try another ECU.

③ BAD → Repair or replace.

↓

Check fuses, fusible links and ignition switch. BAD → Repair or replace.

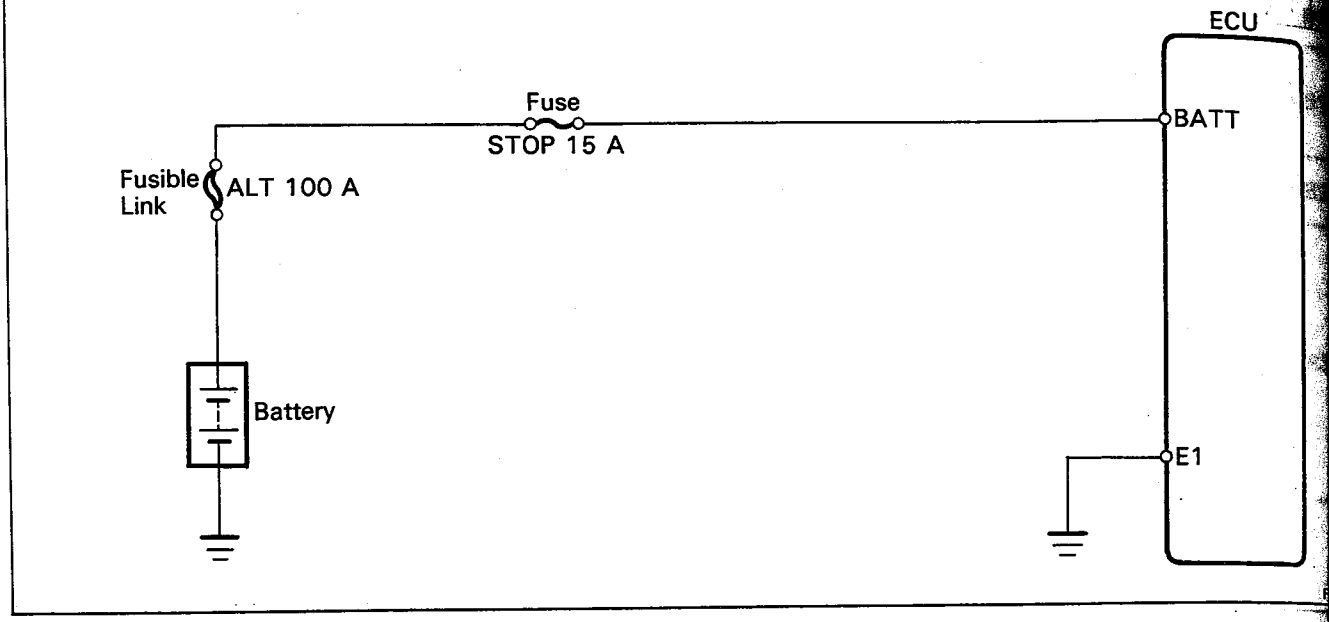
↓ OK

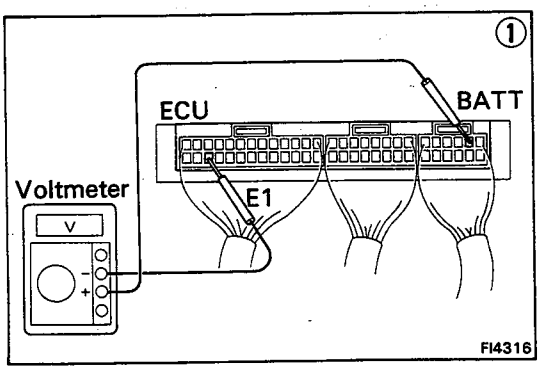
Check EFI main relay. (See page FI-134) BAD → Replace.

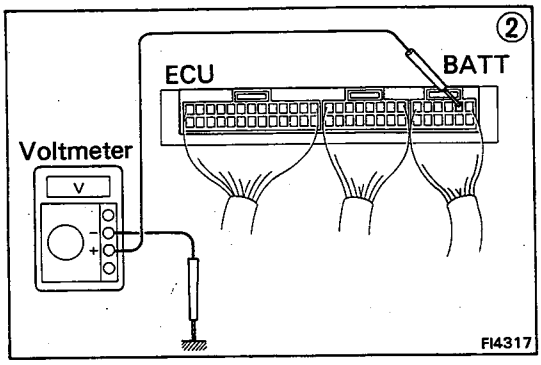
↓ OK

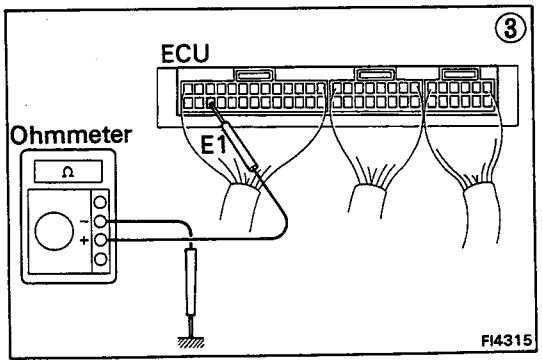
Check wiring between EFI main relay and battery. BAD → Repair or replace.

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









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

↓

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

NO → Check fuse and fusible link. → BAD → Replace.

OK → ③ Check wiring between ECU terminal E1 and body ground.

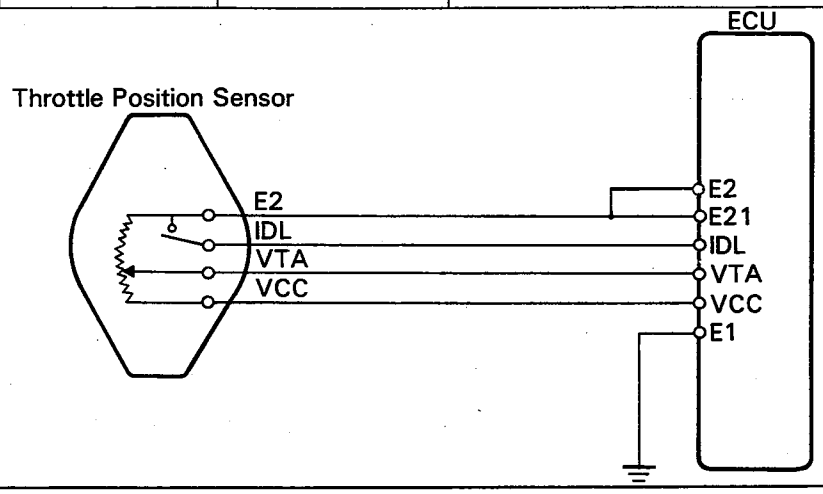
OK → Try another ECU.

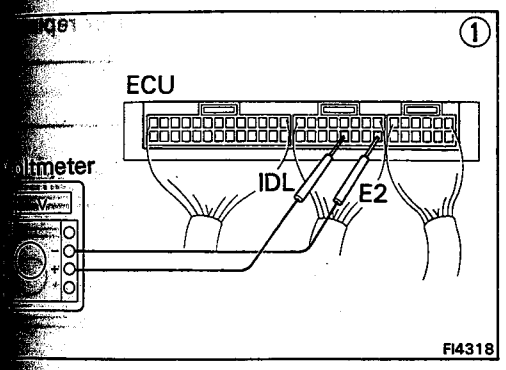
BAD → Repair or repla

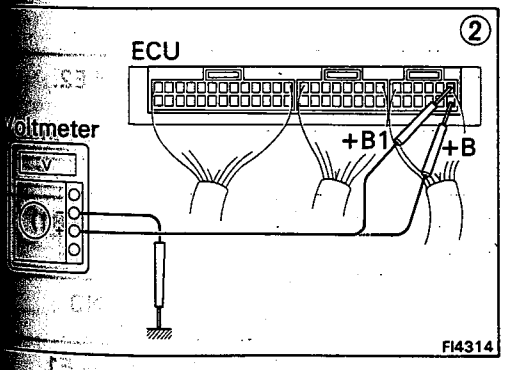
OK → Check wiring between ECU terminal and battery.

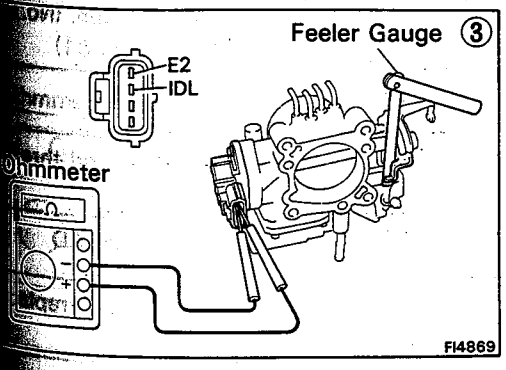
BAD → Repair or repla

Terminals	Trouble	Condition		STD voltage
IDL – E2	No voltage	IG SW ON	Throttle valve open	10 – 14 V
VTA – E2			Throttle valve fully closed	0.1 – 1.0 V
			Throttle valve fully open	4 – 5 V
VCC – E2			–	4.5 – 5.5 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

OK

Check wiring between ECU terminal E1 and body ground.

BAD

Repair or replace.

Refer to +B – E1 trouble section. (No.1) (See page FI-81)

BAD

Repair or replace.

OK

③ Check throttle position sensor. (See page FI-127)

BAD

OK

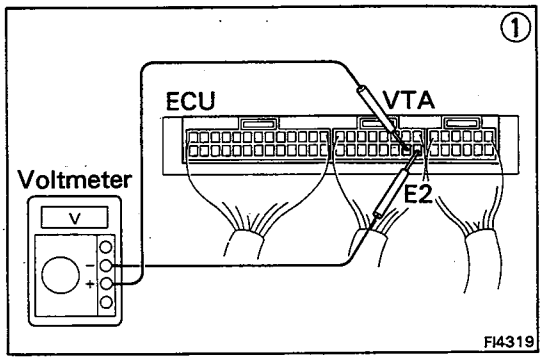
Repair or replace throttle position sensor.

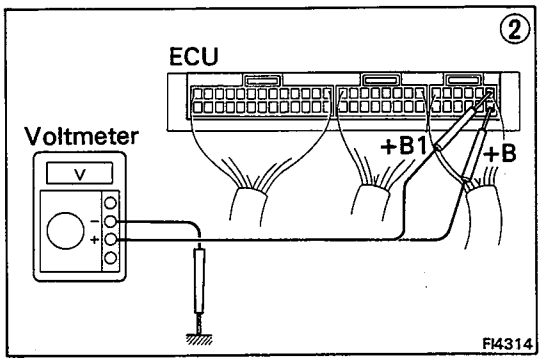
Check wiring between ECU and throttle position sensor.

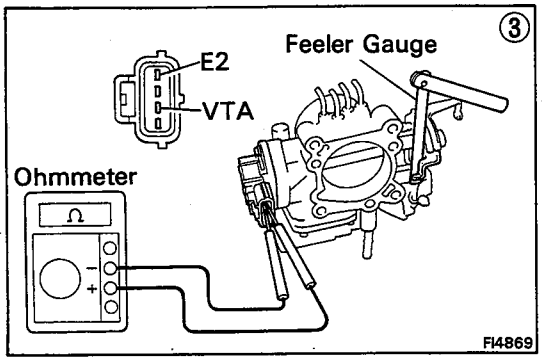
BAD

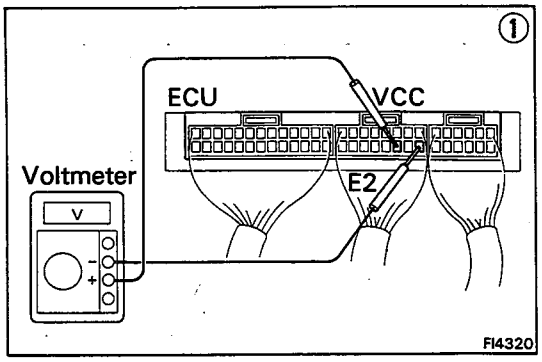
OK

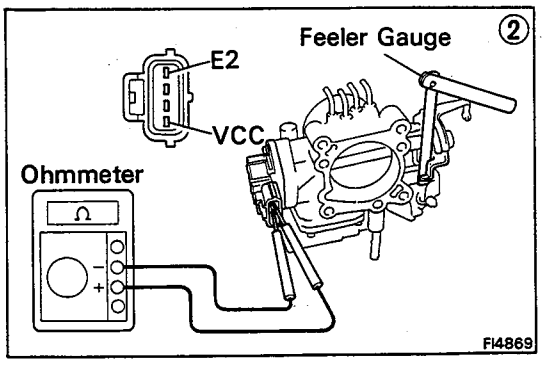
Try another ECU











- **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 +B (+B1) and body ground. **(IG SW ON)**

NO → OK

Check wiring between ECU terminal E1 and body ground.

BAD → Repair or replace

Refer to trouble section (No.1) (See page FI-81) → BAD → Repair or replace

OK

③ Check throttle position sensor. (See page FI-127) → BAD → Repair or replace

OK

Check wiring between ECU and throttle position sensor. → BAD → Repair or replace

OK

Try another ECU.

- **VCC – E2**

① There is no voltage between ECU terminals VCC 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-127)

NO → Refer to +B – E1 trouble section. (No.1) (See page FI-81)

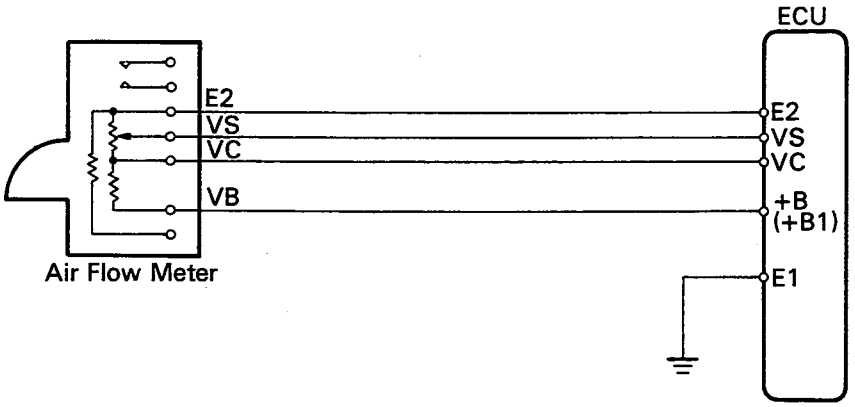
BAD → Repair or replace.

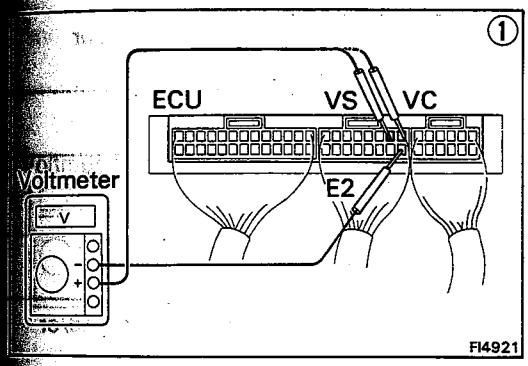
OK → Check wiring between ECU and throtti position sensor.

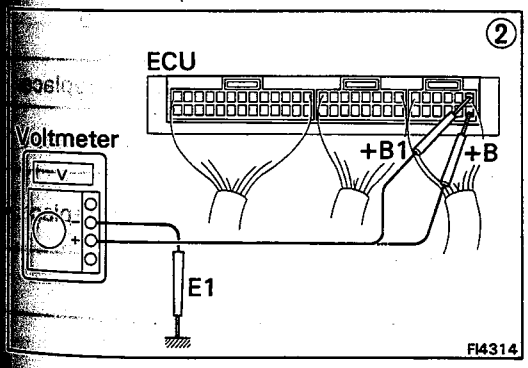
OK → Try another ECU.

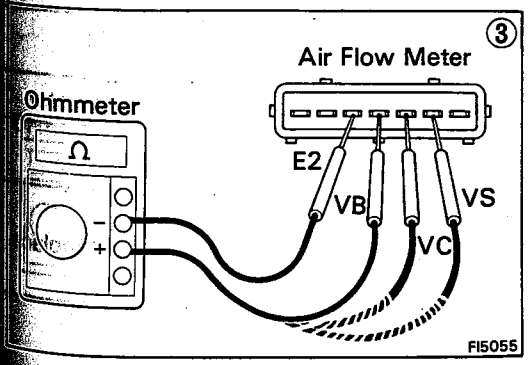
BAD → Repair or replace wiring.

Terminals	Trouble	Condition		STD voltage
VC – E2	No voltage	IG SW ON	–	4.5 – 5.5 V
VS – E2			Measuring plate fully closed	2.0 – 5.5 V
			Measuring plate fully open	6 – 9 V
		Idling		2 – 8 V









① There is no specified voltage at 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 +B – E1 trouble section (No.1) (See page FI-81)

↓

Check wiring between ECU terminal E1 and body ground.

OK → ↓

BAD → Repair or replace.

↓

③ Check air flow meter. (See page FI-120)

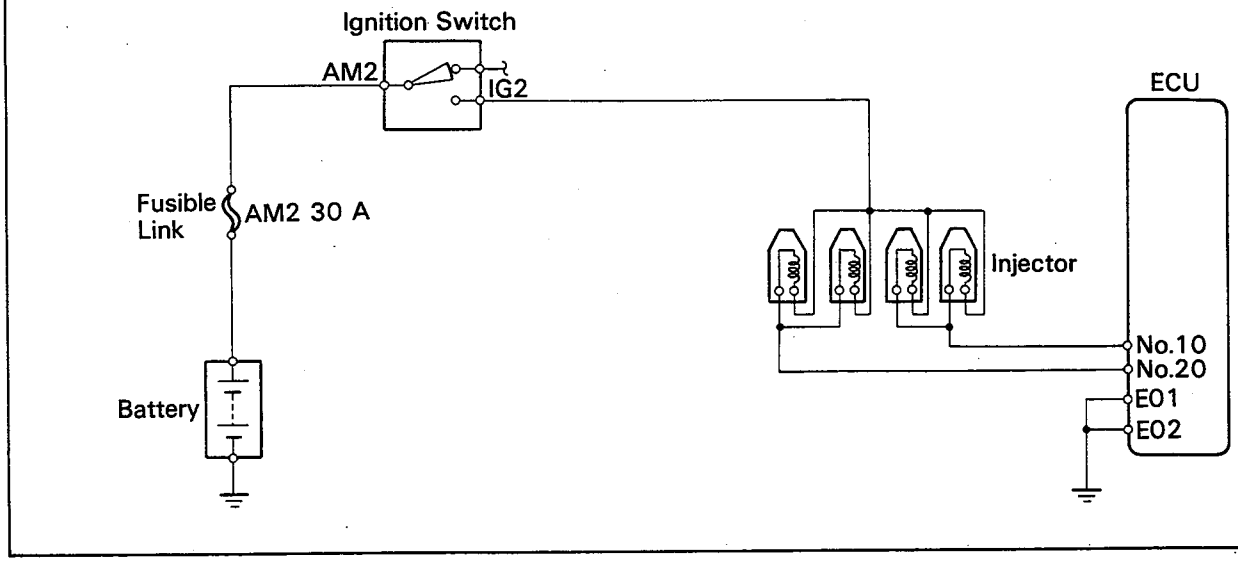
BAD → Replace air flow meter.

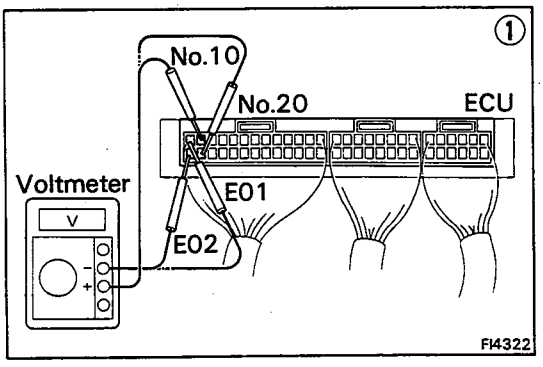
OK → Check wiring between ECU and air flow meter.

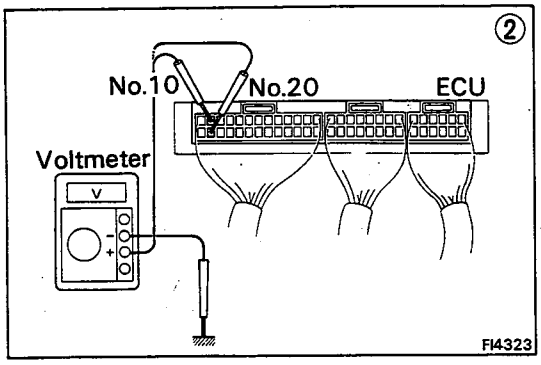
OK → Try another ECU.

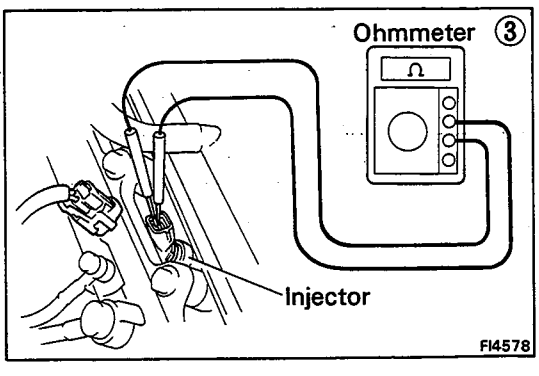
BAD → Repair or replace.

No.	Terminals	Trouble	Condition	STD voltage
5	No.10 _ E01 No.20 _ E02	No voltage	IG SW ON	10 – 14 V









① There is no voltage between ECU terminals 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 and/or No.20 and body ground.

NO → ↓ OK → Check wiring between ECU terminal E01 and/or E02 and body ground.

OK → Try another ECU.

BAD → Repair or repla

↓

Check fuse, fusible link, ignition switch and starter relay.

OK → Repair or repla

↓ OK

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

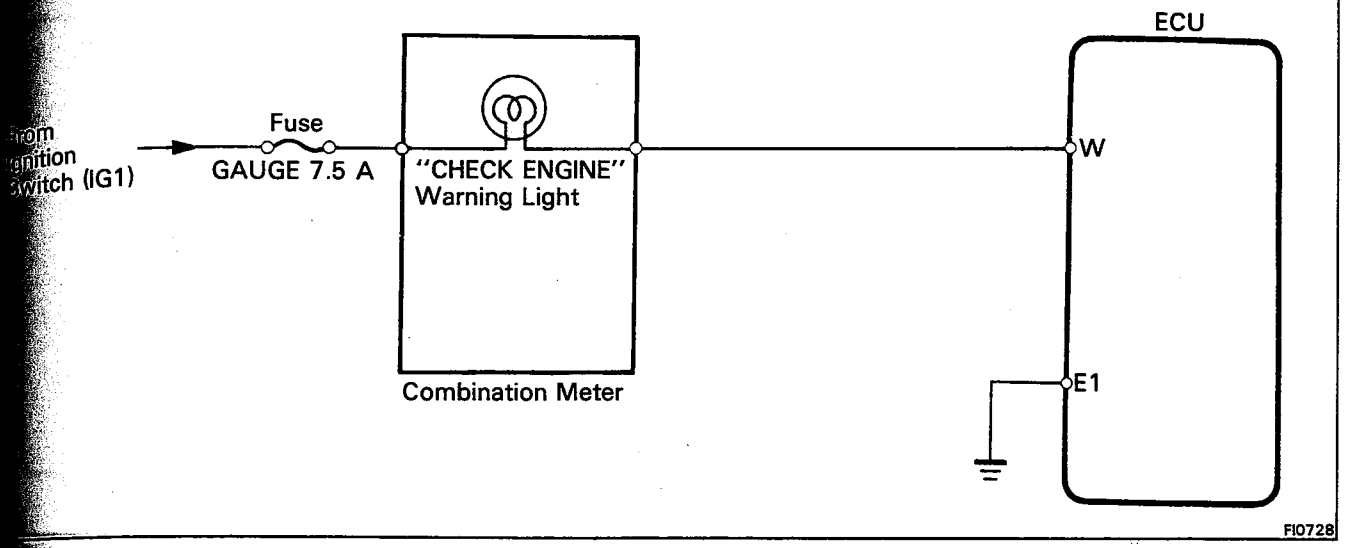
OK → ↓

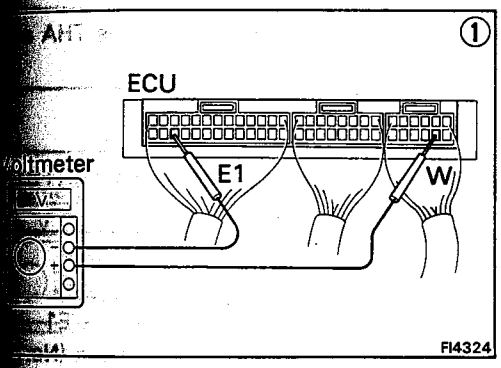
BAD → Replace injecto

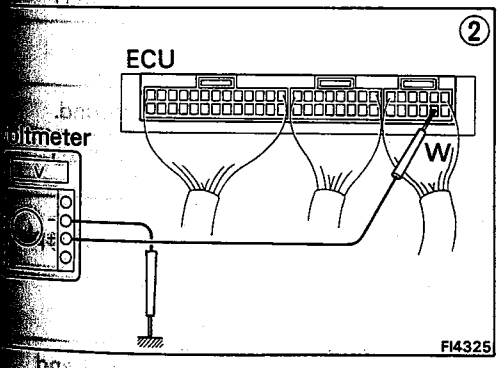
Check wiring between ECU terminal No.10 and/or No.20 and battery.

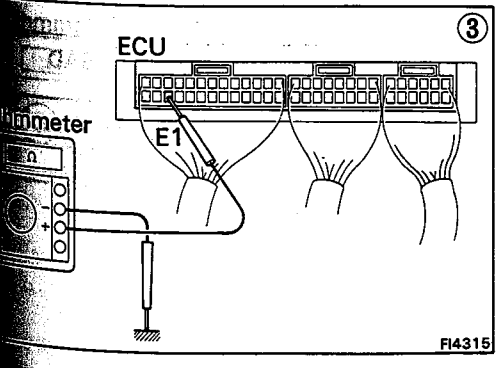
BAD → Repair or Repl

Terminals	Trouble	Condition	STD voltage
W – E1	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. **(Idling)**

↓

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

NO → Check GAUGE fuse and "CHECK ENGINE" warning light.

OK → ③ Check wiring between ECU terminal E1 and body ground.

OK → Try another ECU.

BAD → Repair or replace.

Check GAUGE fuse and "CHECK ENGINE" warning light.

OK → Check wiring between ECU terminal W and fuse.

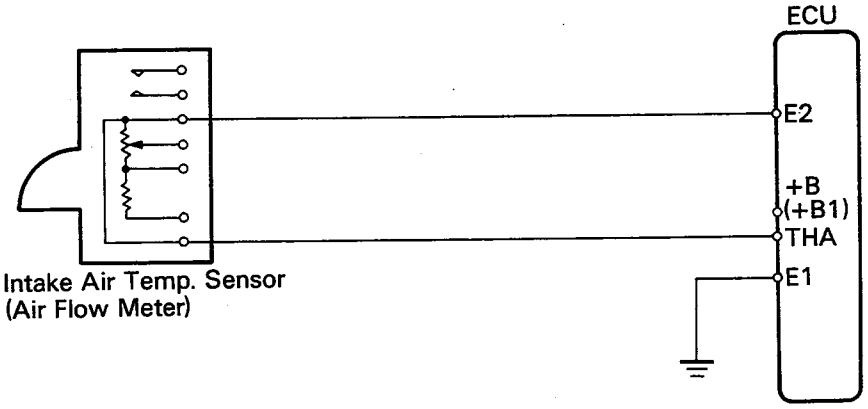
BAD → Repair or replace.

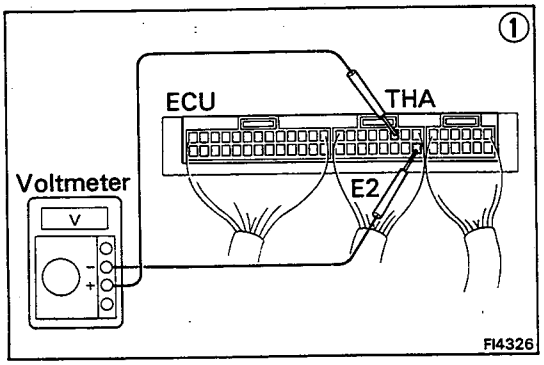
Repair or replace.

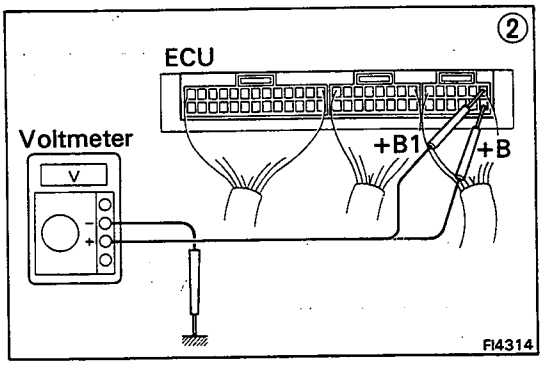
Fuse blows again → Check wiring between ECU terminal W and fuse.

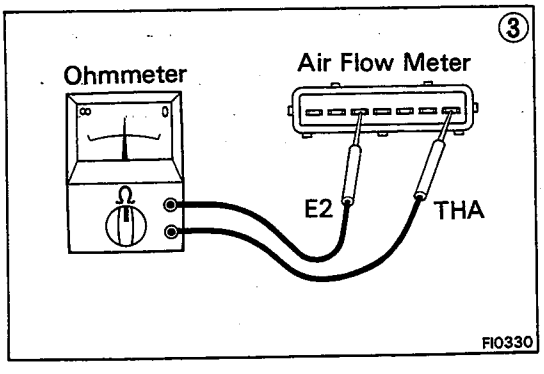
BAD → Repair or replace.

No.	Terminals	Trouble	Condition		STD voltage
7	THA – E2	No voltage	IG SW ON	Intake air temperature 20°C (68°F)	2.0 – 2.8 V









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

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

OK

NO

Refer to +B – E1 trouble section (No.1) (See page FI-81)

Check wiring between ECU terminal E1 and body ground.

OK

BAD

③ Check intake air temp. sensor. (See page FI-120)

Repair or replace

BAD

OK

Replace air flow meter.

Check wiring between ECU and intake air temp. sensor.

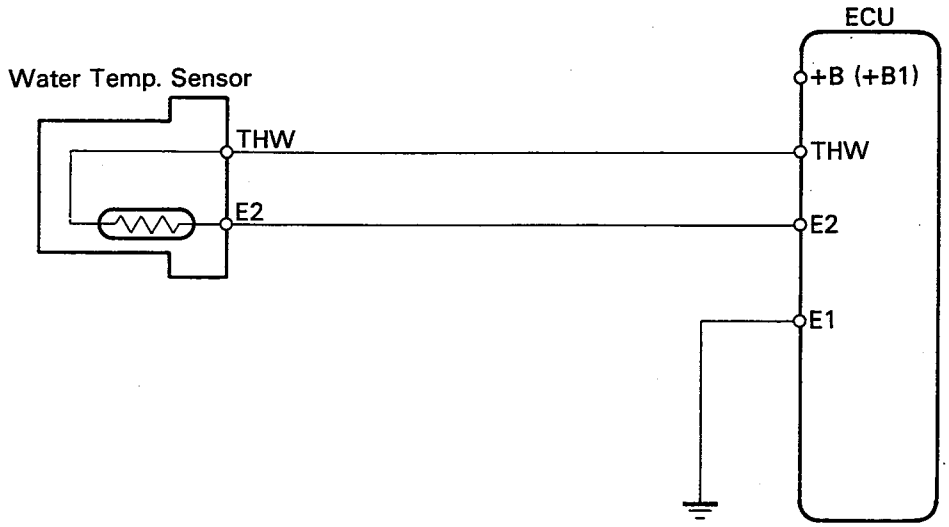
OK

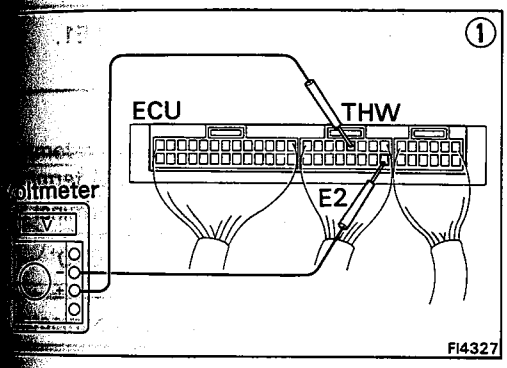
BAD

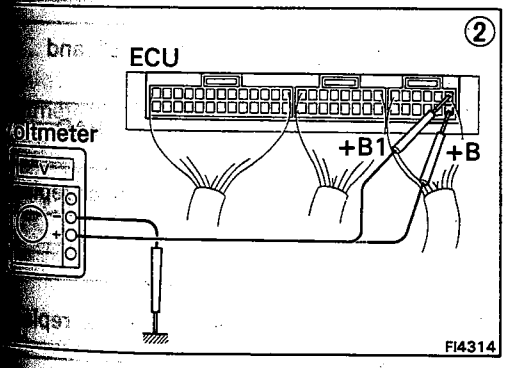
Try another ECU.

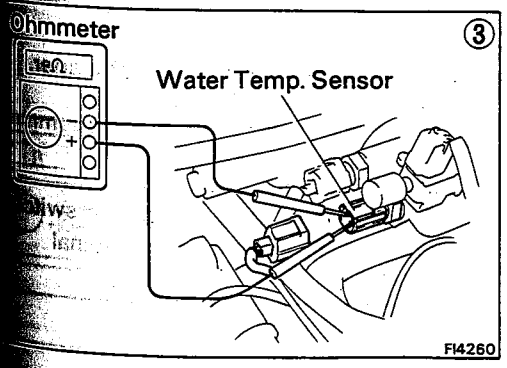
Repair or replace

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







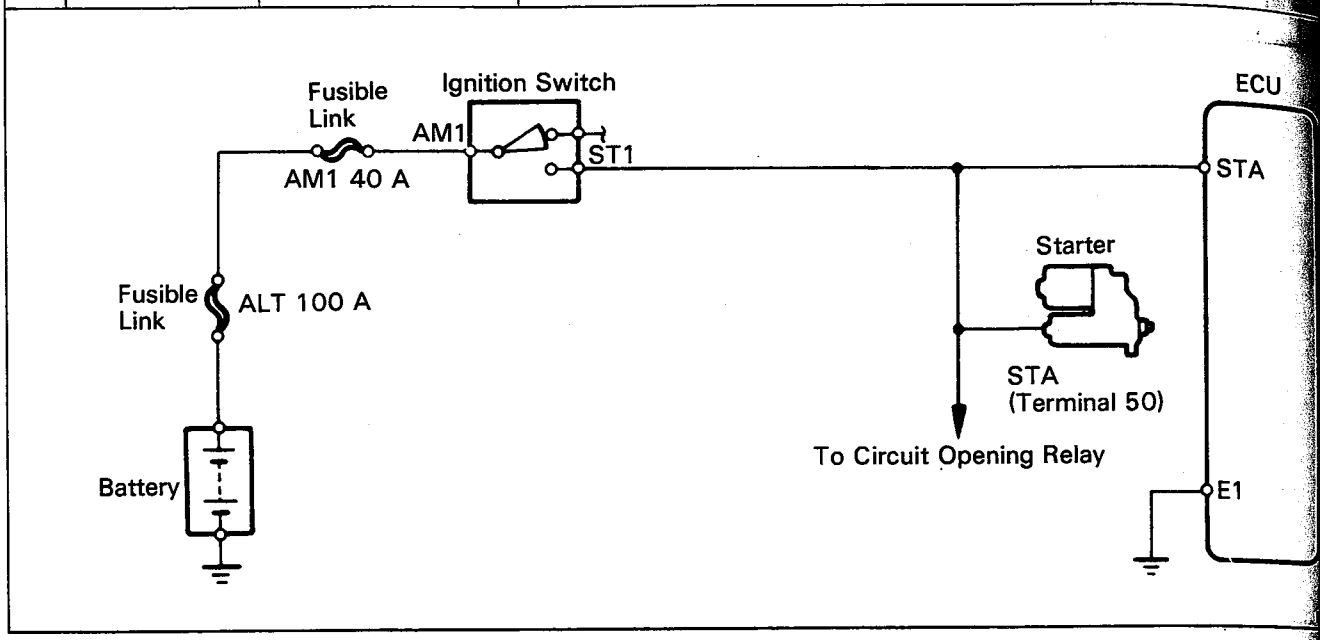


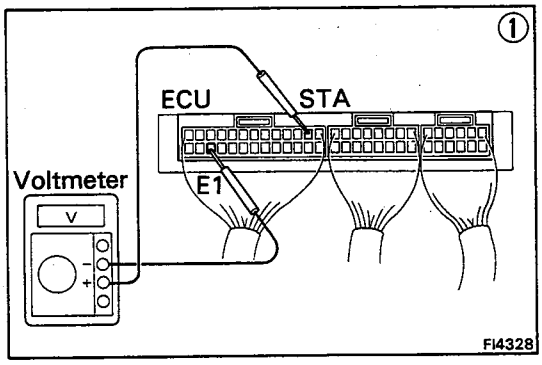
① There is no voltage between ECU terminals THW and E2. **(IG SW ON)**

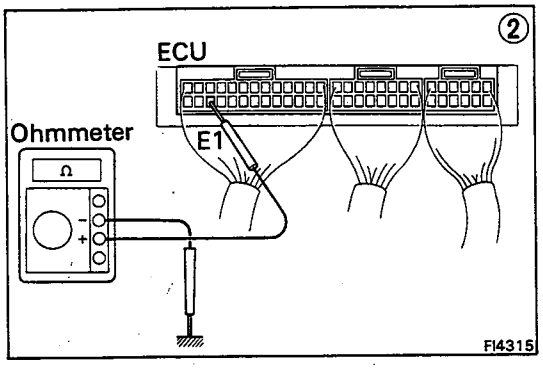
② Check that there is voltage between ECU terminal +B (+B1) and body ground. **(IG SW ON)**

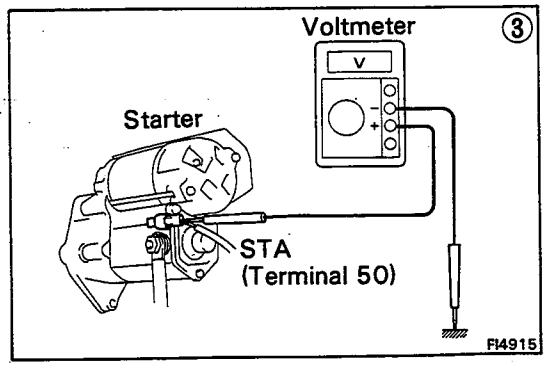
- NO → Refer to +B – E1 trouble section (No.1). (See page FI-81)
- OK → Check wiring between ECU terminal E1 and body ground.
  - BAD → Repair or replace.
  - OK → ③ Check water temp. sensor (See page FI-138)
    - BAD → Replace water temp sensor.
    - OK → Check wiring between ECU and water temp. sensor.
      - BAD → Repair or replace.
      - OK → Try another ECU.

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









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

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

BAD

OK → BAD → Replace inject

② Check wiring between ECU terminal E1 and body ground.

OK → Try another ECU.

BAD → Repair or repl

Check fusible link, battery, wiring and ignition switch. → BAD → Repair or repl

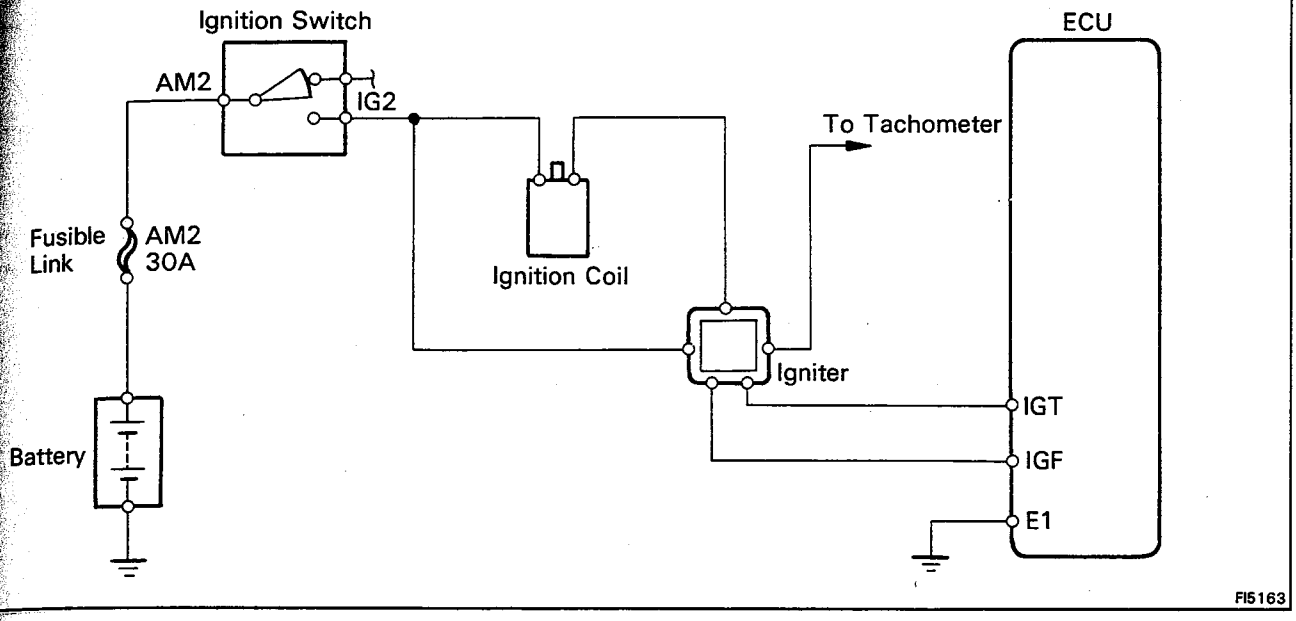
OK

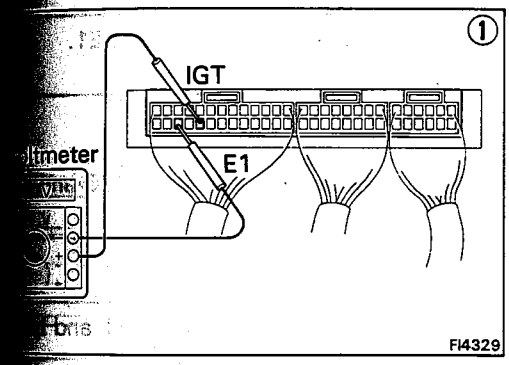
③ Check that there is voltage at STA (50) terminal of starter **(IG SW START) STD voltage: 6 – 14 V**

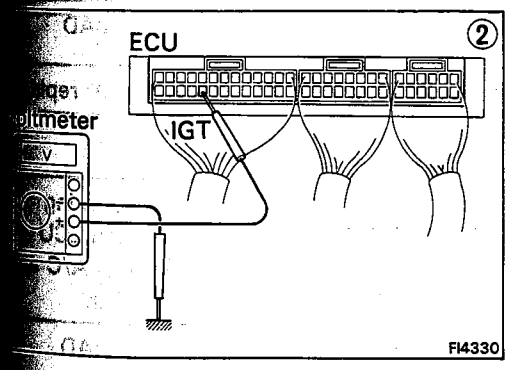
OK → Check starter.

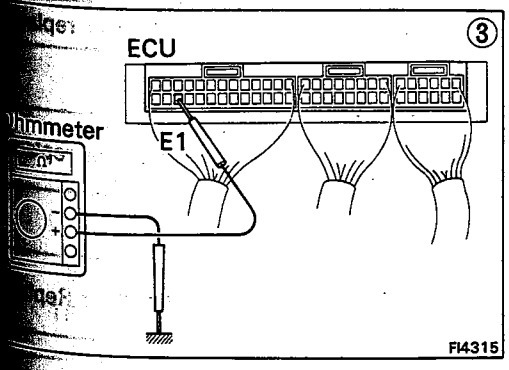
NO → Check wiring between ignition swit terminal ST1 and starter terminal STA (50).

Terminals	Trouble	Condition	STD voltage
IGT – E1	No voltage	Idling	0.7 – 1.0 V









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

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

NO

OK

③ Check wiring between ECU terminal E1 and body ground. — BAD → Repair or replace.

OK

Try another ECU.

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

OK

Check distributor. (See page IG-14) — BAD → Repair or replace.

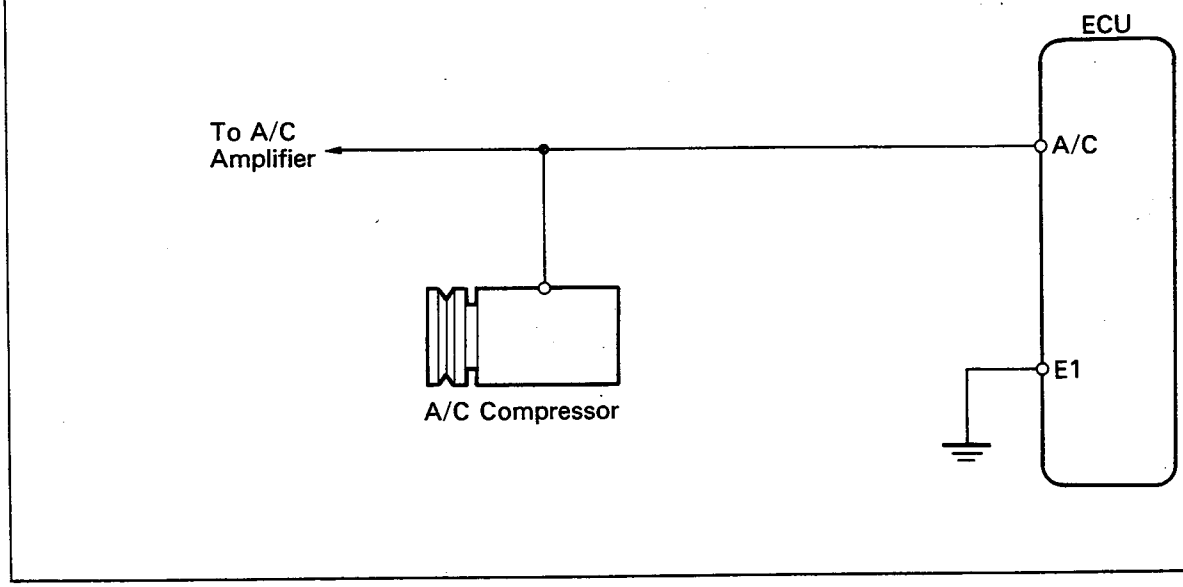
OK

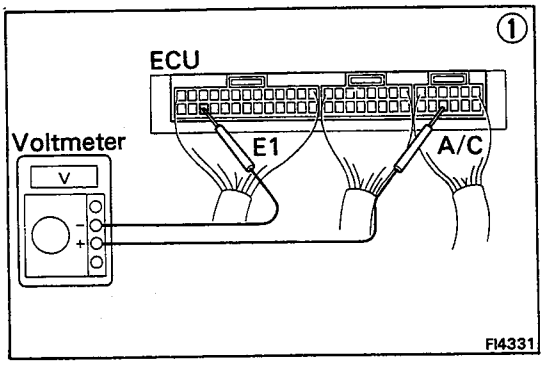
Check wiring between ECU and battery — BAD → Repair or replace.

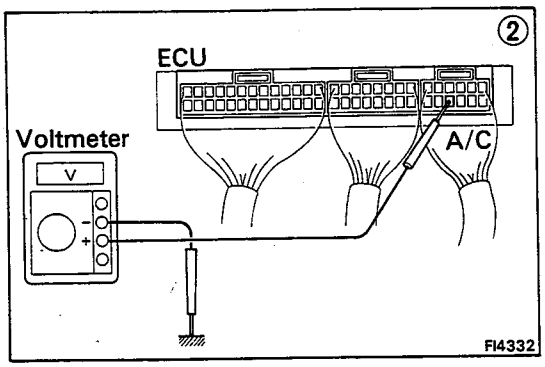
OK

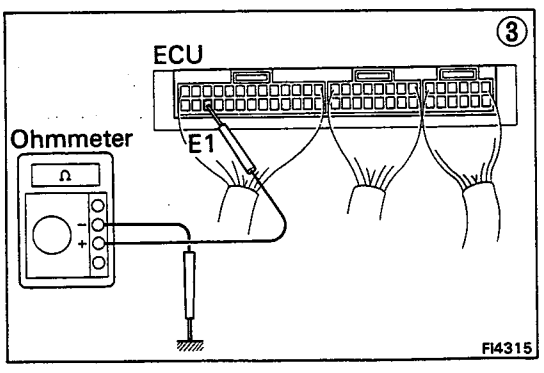
Check igniter. (See page IG-10) — BAD → Repair or replace.

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









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

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

NO

OK

③ Check wiring between ECU terminal E1 and b ground.

OK

Try another ECU.

BAD

Repair or repla

Check compressor running

OK

Check wiring between ECU terminal A/C a amplifier.

NO

BAD

Repair or repl

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

BAD

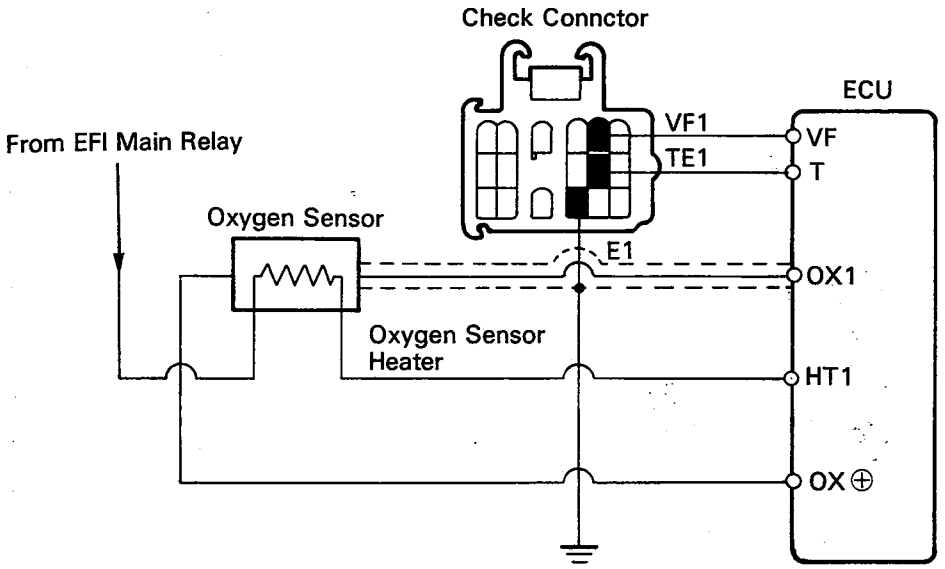
Repair or repl

OK

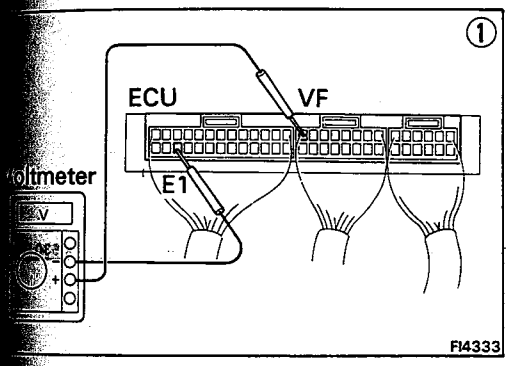
Check wiring between amplifier and ECU or compressor.

BAD

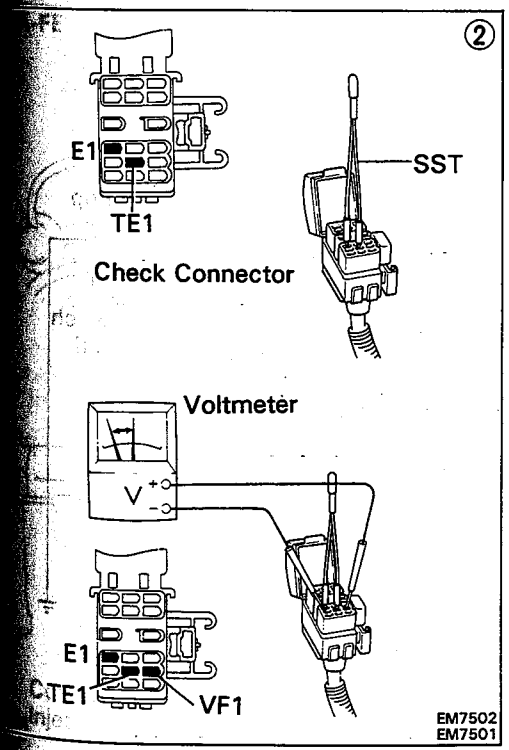
Repair or Rep



FI5171



FI4333



EM7502
EM7501

① There is no voltage between ECU terminals VF and E1.

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

NO → OK: Check wiring between ECU terminal E1 and body ground.

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

Is air leaking into air intake 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 injector
- BAD → Repair or replace.
- OK ↓

Check cold start injector.*
- BAD → Repair or replace.
- OK ↓

Check vacuum sensor.
- BAD → Repair or replace.
- OK ↓

② Check operation of oxygen sensor.
- OK → System normal.
- BAD ↓

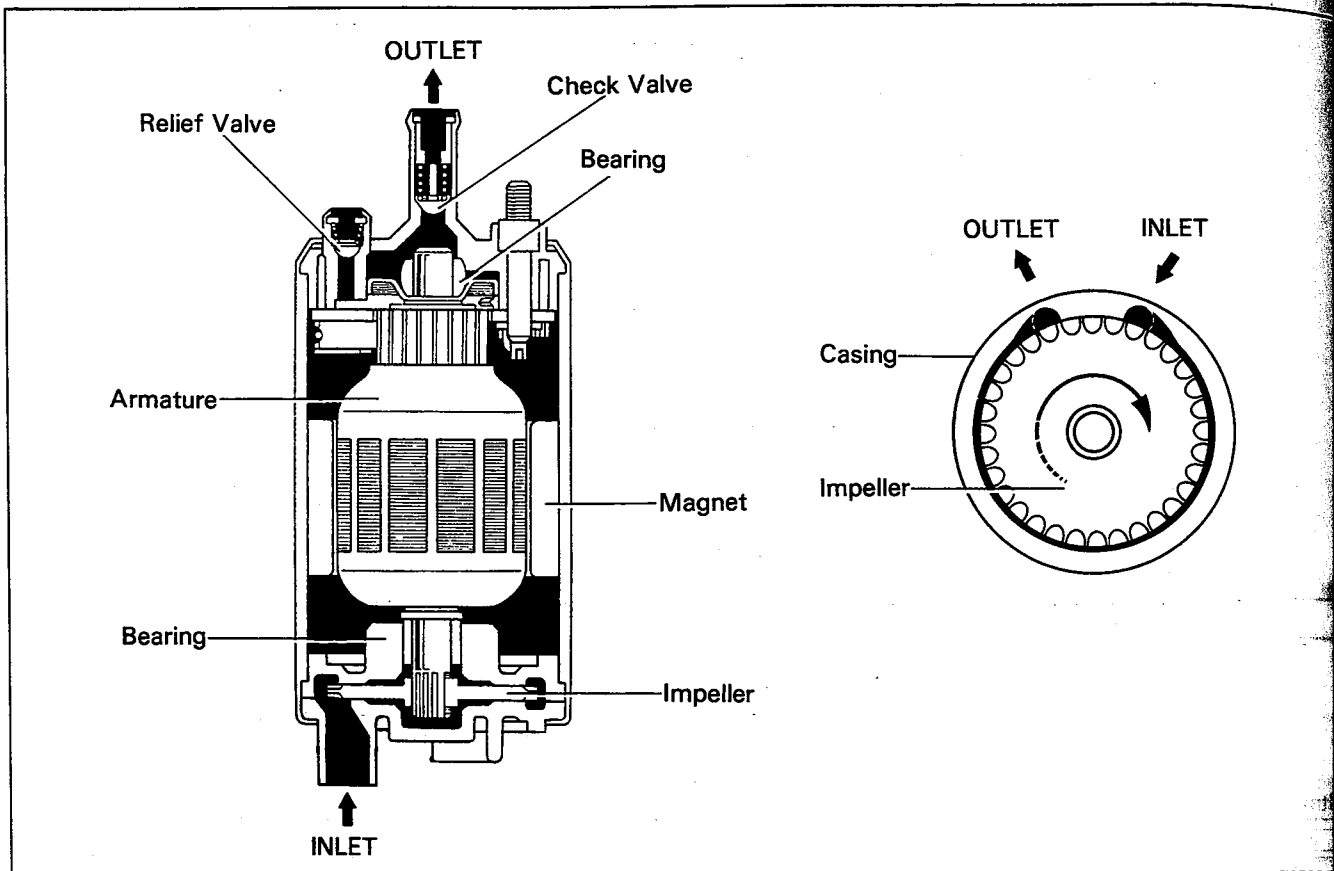
Check wiring between oxygen sensor and ECU connector.
- BAD → Repair wiring.
- OK ↓

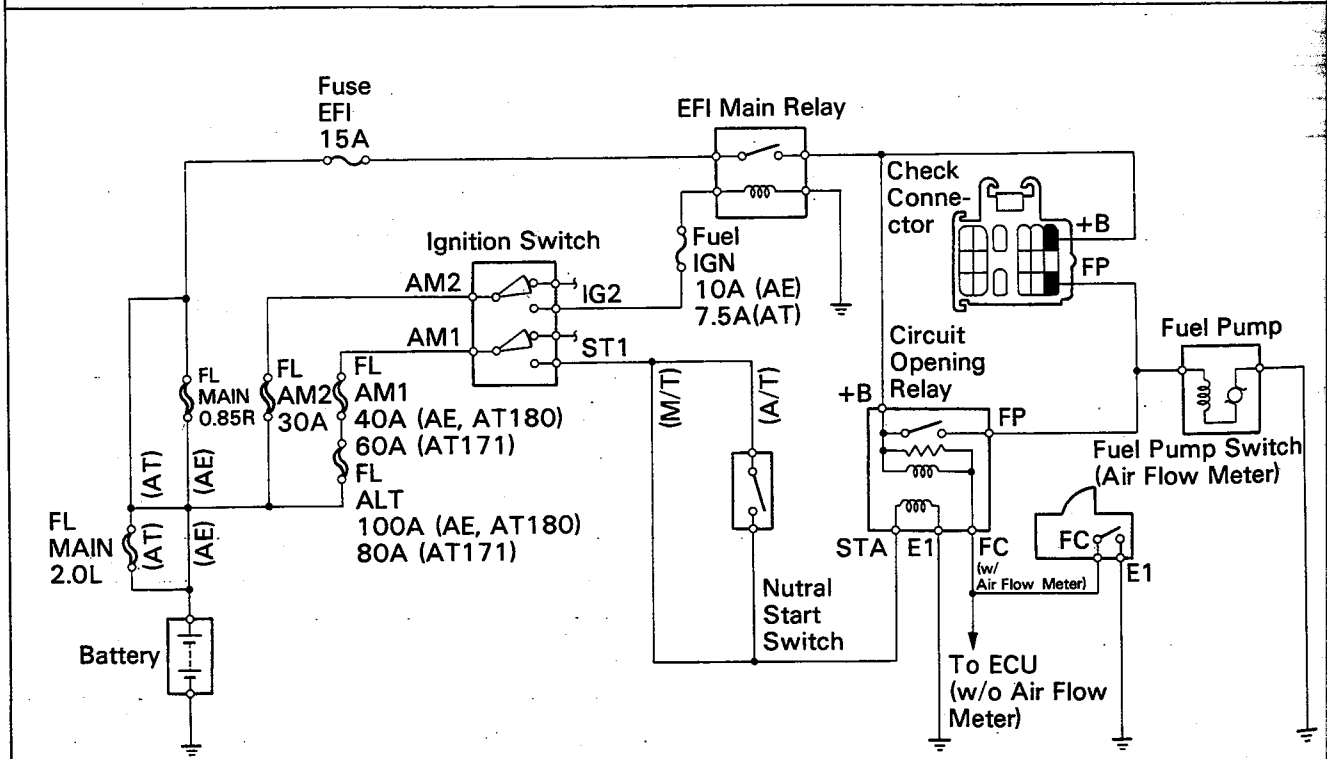
Replace oxygen sensor.

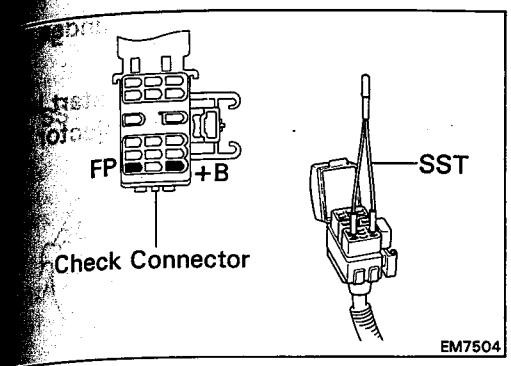
* Rich malfunction only

FUEL SYSTEM

Fuel Pump







ON-VEHICLE INSPECTION

1. CHECK FUEL PUMP OPERATION

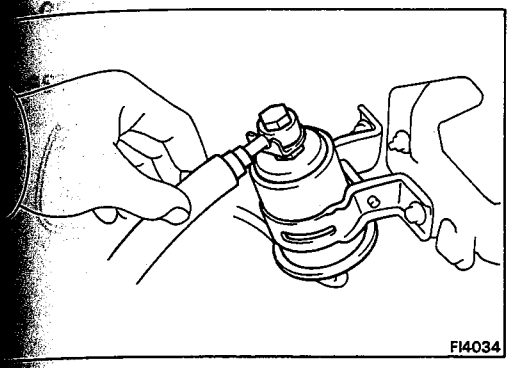
(a) Turn the ignition to ON.

HINT: Do not start the engine.

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

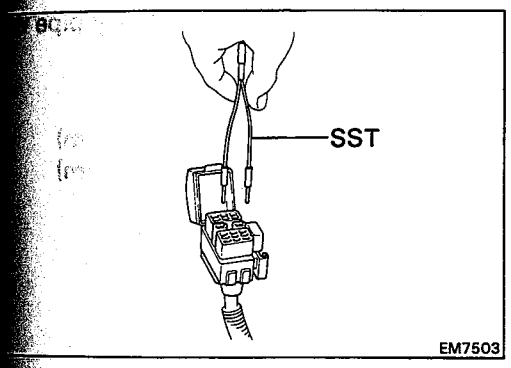
SST 09843-18020

LOCATION: See page FI-133



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

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



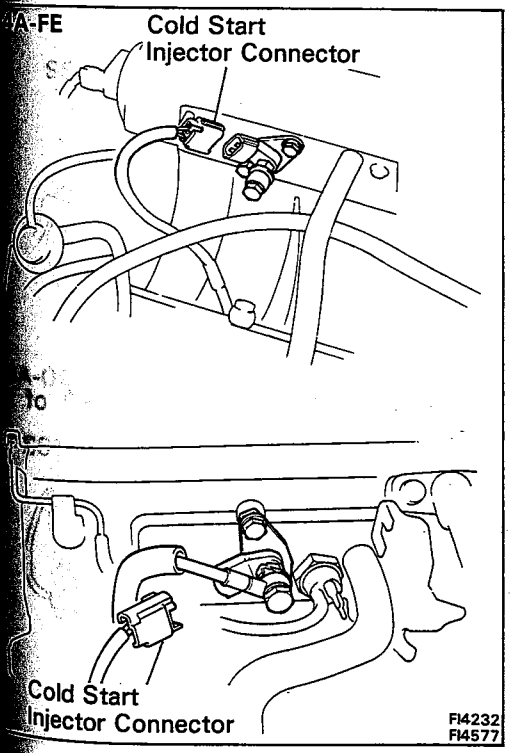
(d) Remove SST from the check connector.

SST 09843-18020

(e) Turn the ignition switch to OFF.

If there is no pressure, check the following parts:

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

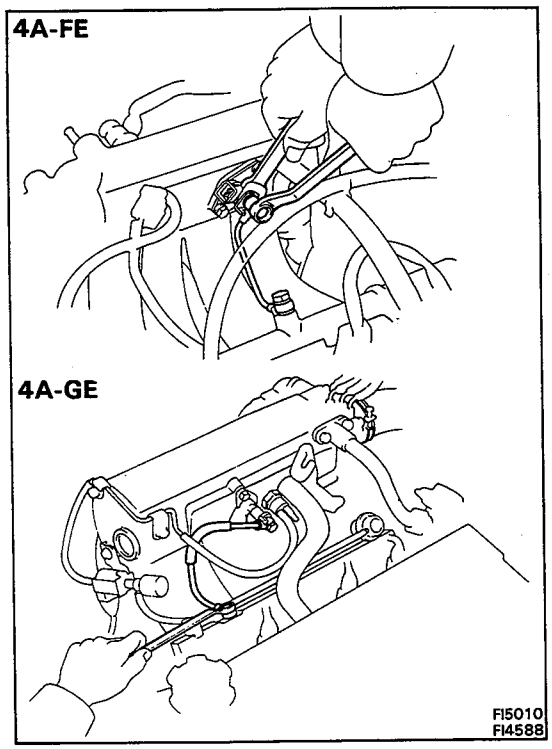


2. INSPECT FUEL PRESSURE

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

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

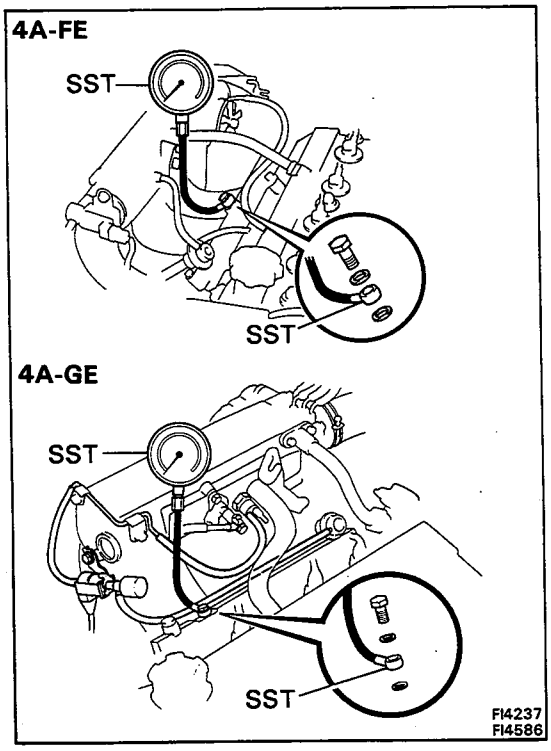
(c) Disconnect the wiring connector from the cold start injector.



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

(e) Slowly loosen the union bolts of the cold start inje tor pipe and remove the bolts, cold start injector pi and four gaskets.

(f) Drain the fuel from the delivery pipe.



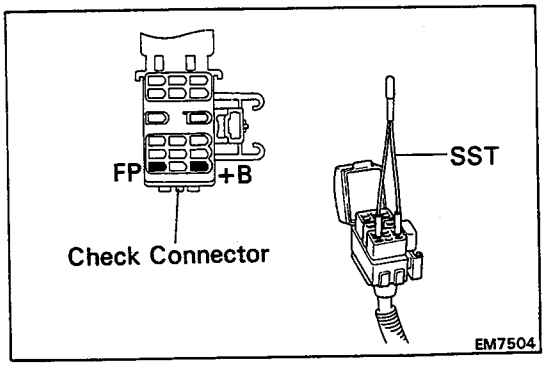
(g) Install SST (pressure gauge) to the delivery pipe w new two gasket and union bolt.

SST 09268-45012

Torque: 4A-FE 180 kg-cm (13 ft-lb, 18 N·m)
4A-GE 150 kg-cm (11 ft-lb, 15 N·m)

(h) Wipe off any splattered gasoline.

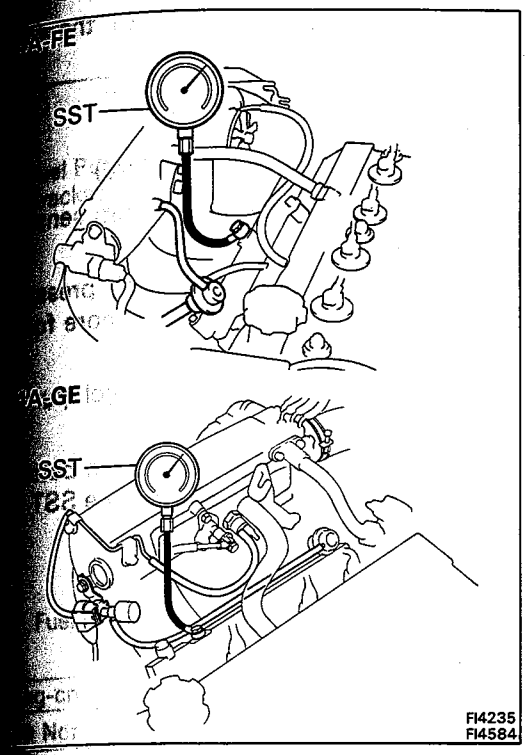
(i) Reconnect the battery negative (–) cable.



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

SST 09843-18020

LOCATION: See page FI-133



(k) Turn the ignition switch ON.

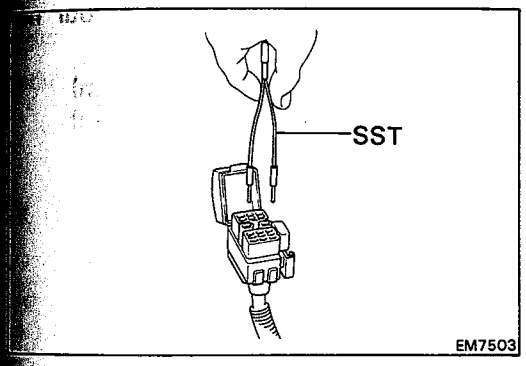
(l) Measure the fuel pressure.

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

If pressure is high, replace the fuel pressure regulator.

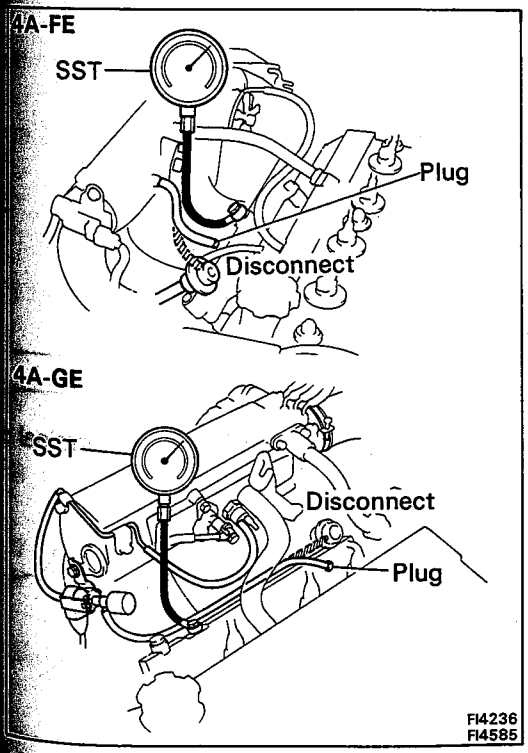
If pressure is low, check the following parts:

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



(m) Remove SST from the check connector.

SST 09843-18020

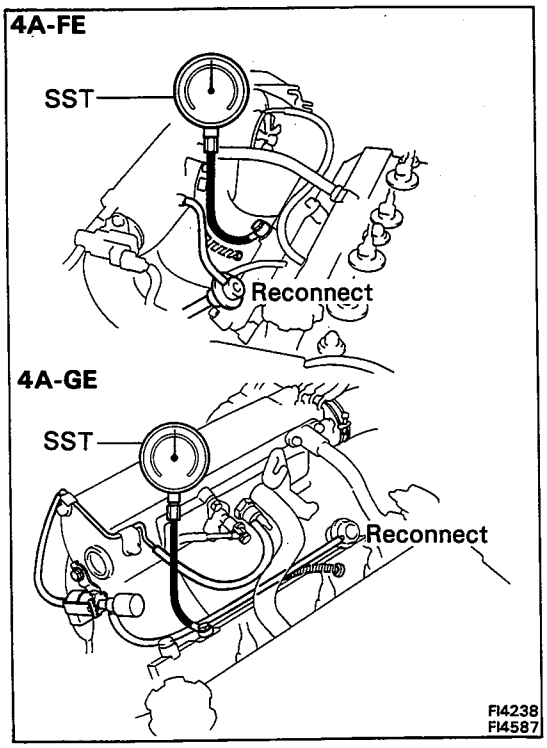


(n) Start the engine.

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

(p) Measure the fuel pressure at idling.

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



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

(r) Measure the fuel pressure at idling.

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

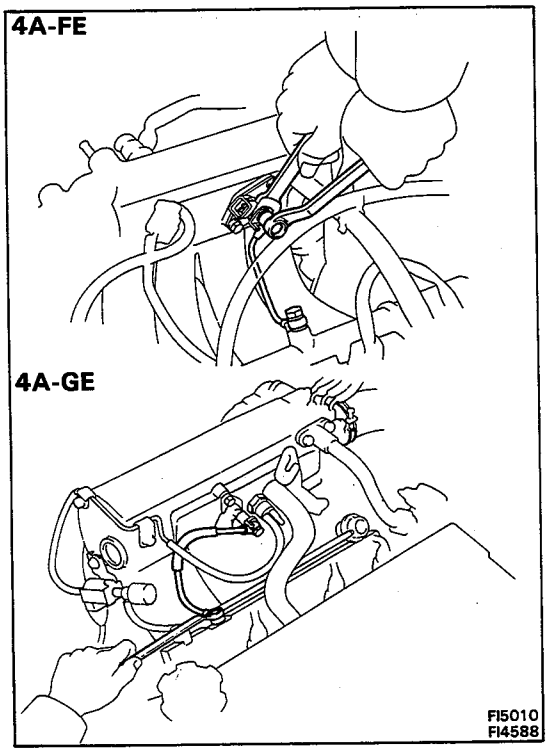
If pressure is not as specified, check the vacuum sens hose and fuel pressure regulator.

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

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

(t) After checking fuel pressure, disconnect the bat negative (—) cable and carefully remove the SS prevent gasoline from splashing.

SST 09268-45012



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

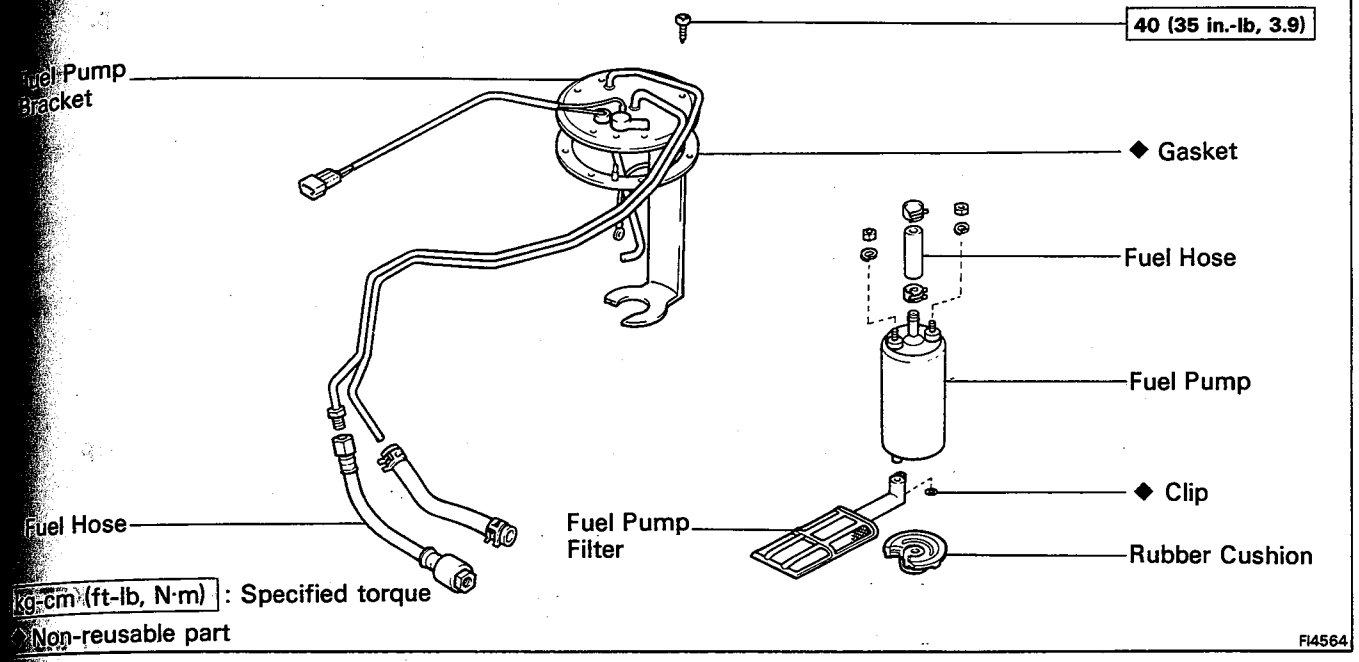
Torque: 4A-FE 180 kg-cm (13 ft-lb, 18 N·m)
4A-GE 150 kg-cm (11 ft-lb, 15 N·m)

(v) Reconnect the cold start injector connector.

(w) Reconnect the cable to the negative (—) termi the battery.

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

REMOVAL OF FUEL PUMP (AE 92, 95, AT171)

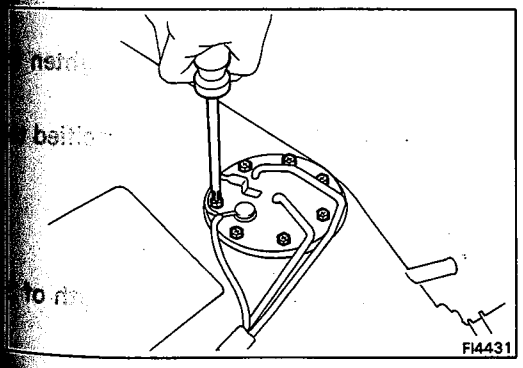


1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**

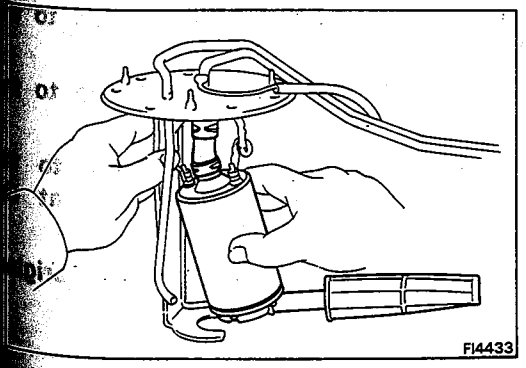
2. **DRAIN FUEL FROM FUEL TANK**

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

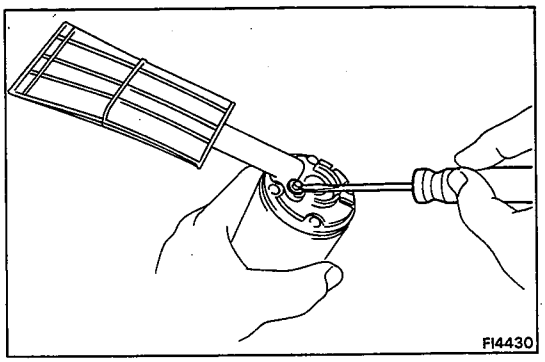
3. **REMOVE FUEL TANK**



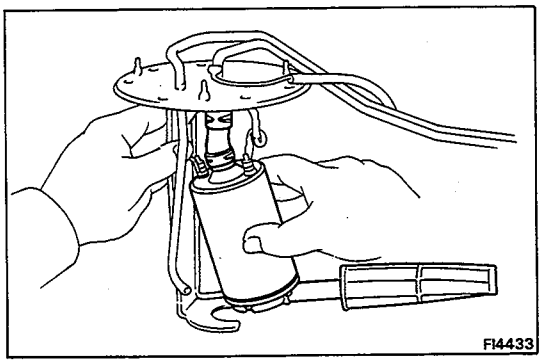
4. **REMOVE FUEL PUMP BRACKET FROM FUEL TANK**
   (a) Remove the screws.
   (b) Pull out the fuel pump bracket.



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 hose from the fuel pump.



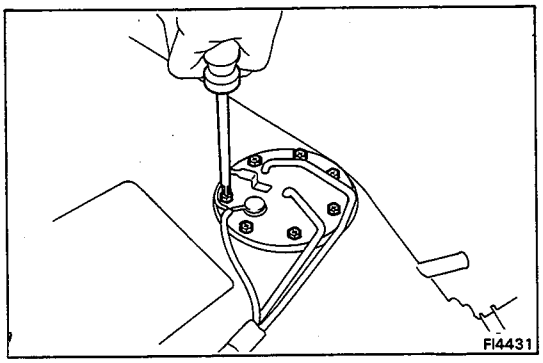
6. **REMOVE FUEL PUMP FILTER FROM FUEL PUMP**
   (a) Remove the rubber cushion.
   (b) Using a small screwdriver, remove the clip.
   (c) Pull out the pump filter.



INSTALLATION OF FUEL PUMP (AE92, 95, AT171)

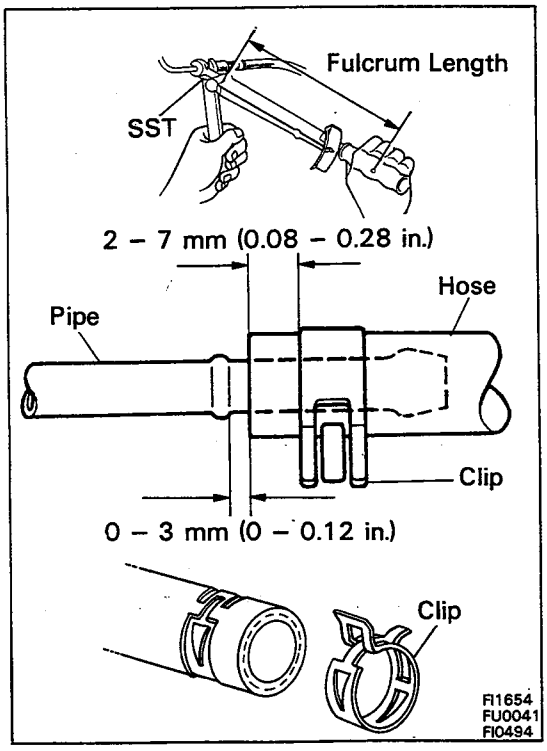
(See page FI-99)

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 ON FUEL PUMP BRACKET**
   (a) Connect the fuel hose to the outlet port of the pump.
   (b) Connect the wires to the pump with the two nu
   (c) Push the lower side of the fuel pump with the ru cushion, into the fuel pump bracket.

3. **INSTALL FUEL PUMP BRACKET**
   Install a new gasket and the pump bracket with screws.
   Torque: 40 kg-cm (35 in.-lb, 3.9 N·m)

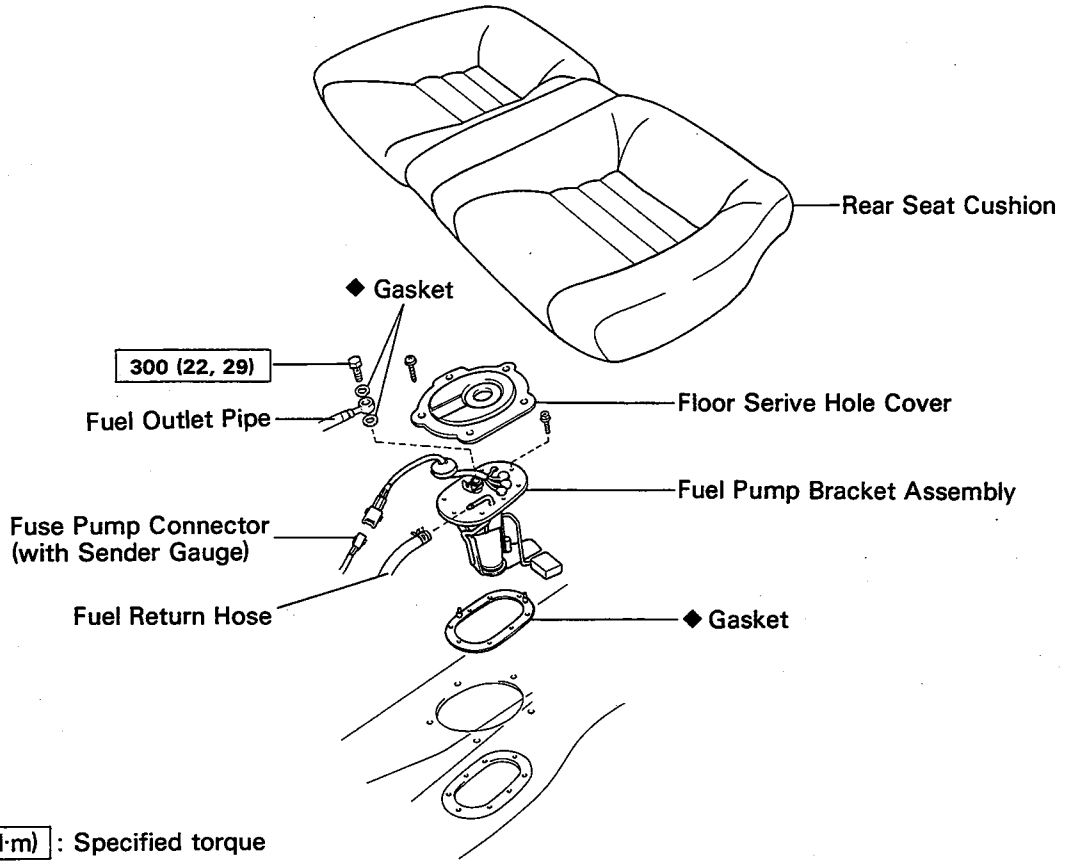


4. **INSTALL FUEL TANK**
   (a) Apply a thin coat of oil to the flare and tighte flare nut.
   (b) Then using SST, tighten the nut to the specifie que.
   SST 09631-22020
   Torque: 310 kg-cm (22 ft-lb, 30 n·m)
   HINT: Use a torque wrench with a fulcrum length cm (11.81 in.)
   NOTICE:
   - **Tighten the fuel tank mounting bolts, etc. t specified torque.**
   - **Tighten the pipe and flare nut type hose t specified torque.**
   - **Push in the pipe and insert-type hose t specified position, then install the clip a specified location.**
   - **If reusing the hose, reinstall the clip at the or location.**

5. **REFILL WITH FUEL**

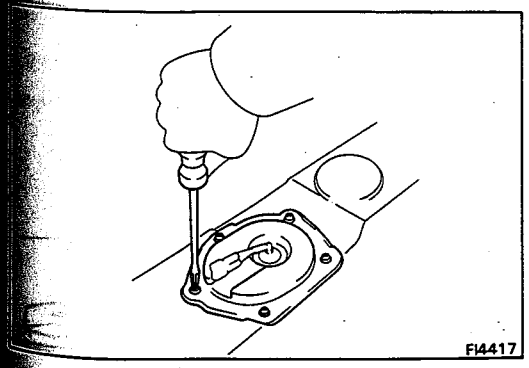
REMOVAL OF FUEL PUMP (AT180)

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

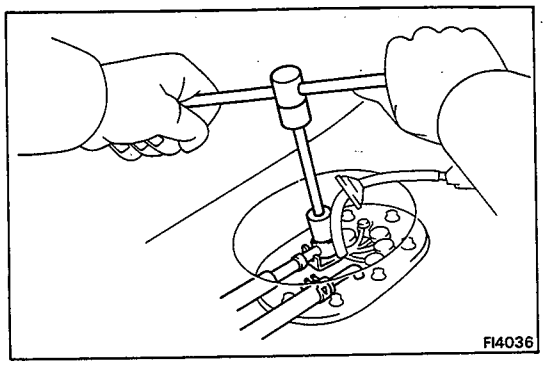


1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**

2. **REMOVE REAR SEAT CUSHION**



3. **REMOVE FLOOR SERVICE HOLE COVER**
   (a) Disconnect the fuel pump (with fuel sender gauge) connector.
   (b) Remove the five screws and service hole cover.

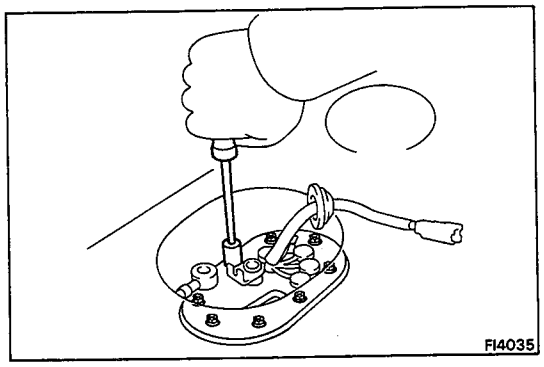


4. DISCONNECT FUEL PIPE AND HOSE FROM FUEL PUMP BRACKET

CAUTION: Remove the fuel filter cap to prevent fuel from flowing out.

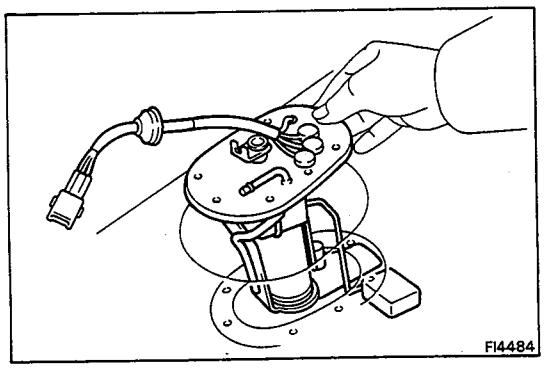
(a) Remove the union bolt and two gaskets, and disconnect the outlet pipe from the pump bracket.

(b) Disconnect the return hose from the pump bracket.



5. REMOVE FUEL PUMP BRACKET ASSEMBLY FROM FUEL TANK

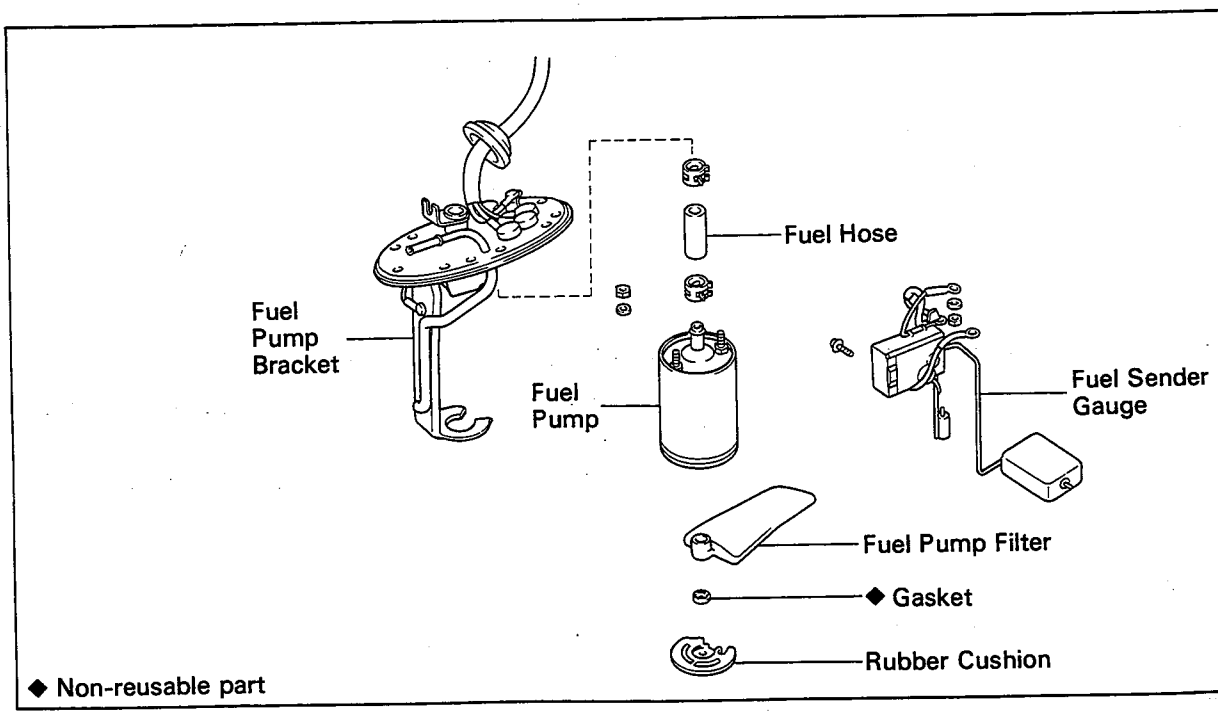
(a) Remove the eight bolts.

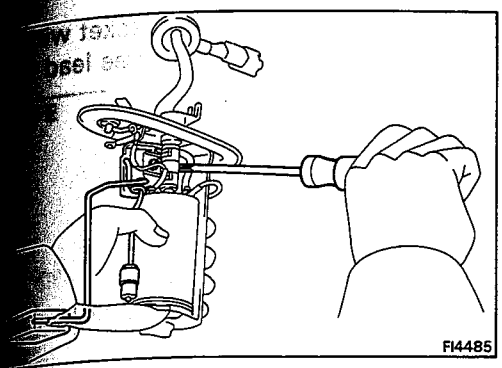


(b) Pull out the pump bracket assembly.

(c) Remove the gasket from the pump bracket.

COMPONENTS (AT180)

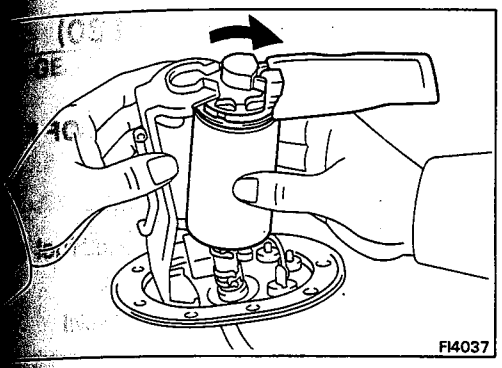




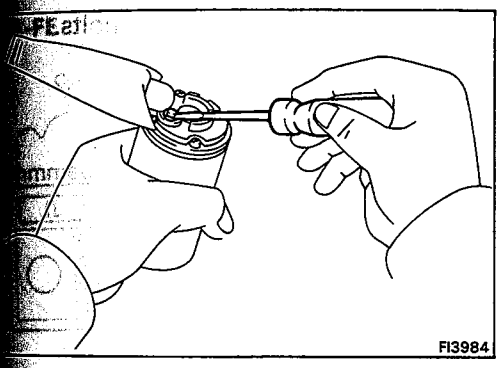
DISASSEMBLY OF FUEL PUMP (AT180)

(See page FI-102)

1. **REMOVE FUEL SENDER GAUGE FROM FUEL PUMP BRACKET**
   (a) Remove the nut and spring washer, and disconnect the lead wire from the pump bracket. Disconnect the three lead wires.
   (b) Remove the two screws and sender gauge.



2. **REMOVE FUEL PUMP FROM FUEL PUMP BRACKET**
   (a) Remove the nut and spring washers, and disconnect the lead wire from the fuel pump. Disconnect the two lead wires.
   (b) Pull out the lower side of the fuel pump from the pump bracket.
   (c) Disconnect the fuel hose from the fuel pump, and remove the fuel pump.
   (d) Remove the rubber cushion from the fuel pump.



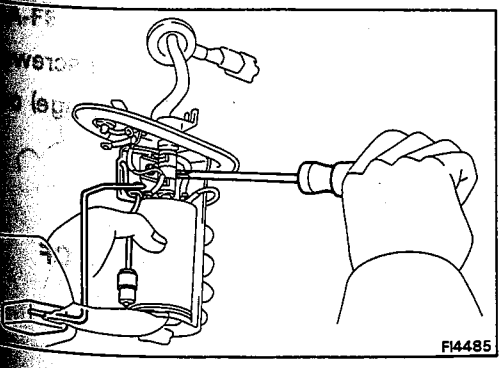
3. **REMOVE FUEL PUMP FILTER FROM FUEL PUMP**
   (a) Using a small screwdriver, remove the clip.
   (b) Pull out the pump filter.

ASSEMBLY OF FUEL PUMP (AT180)

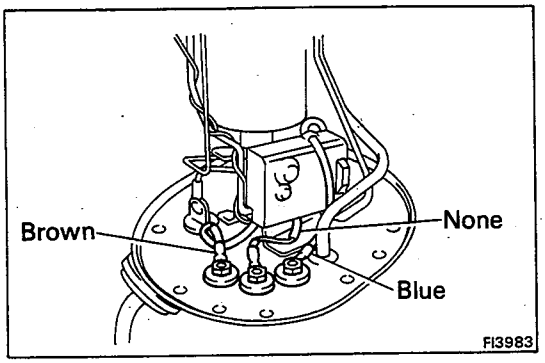
(See page FI-102)

1. **INSTALL FUEL PUMP FILTER TO FUEL PUMP**
   Install the pump filter with a new clip.

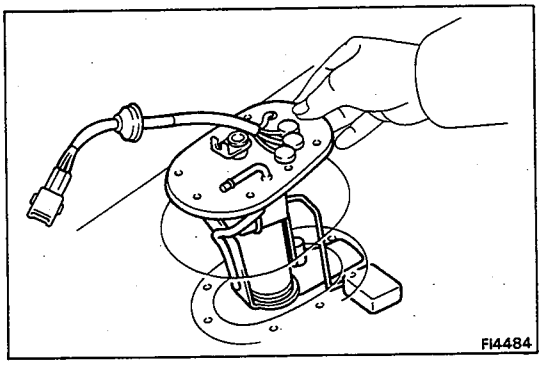
2. **INSTALL FUEL PUMP TO FUEL PUMP BRACKET**
   (a) Install the rubber cushion to the fuel pump.
   (b) Connect the fuel hose to the outlet port of the fuel pump.
   (c) Connect the lead wire to the fuel pump with the spring washer and nut. Connect the two lead wires.
   (d) Install the fuel pump by pushing the lower side of the fuel pump.



3. **INSTALL FUEL SENDER GAUGE TO FUEL PUMP BRACKET**
   (a) Install the sender gauge with the two screws.



(b) Connect the lead wire to the pump bracket with spring washer and nut. Connect the three lead wires as shown.



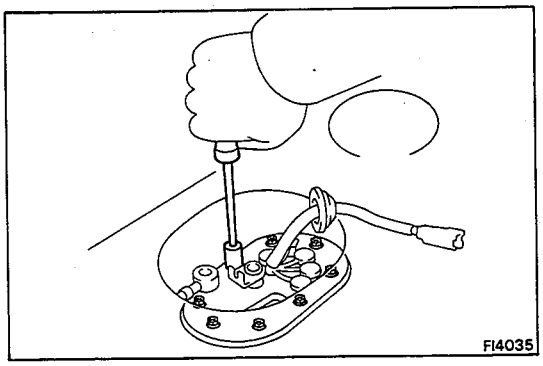
INSTALLATION OF FUEL PUMP (AT180)

(See page FI-101)

1. INSTALL FUEL PUMP BRACKET ASSEMBLY OF F TANK

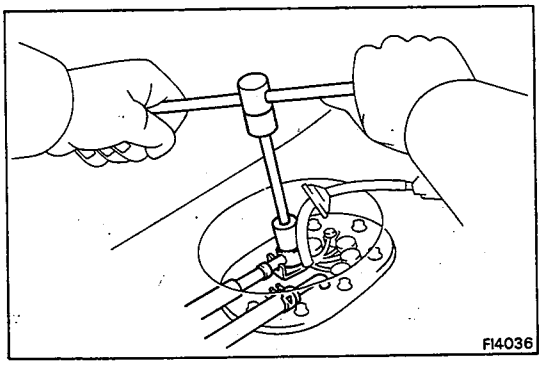
(a) Install a new gasket to the pump bracket.

(b) Insert the pump bracket assembly into the fuel



(c) Install the pump bracket with the eight bolts.

Torque: 40 kg-cm (35 in.-lb, 3.9 N·m)



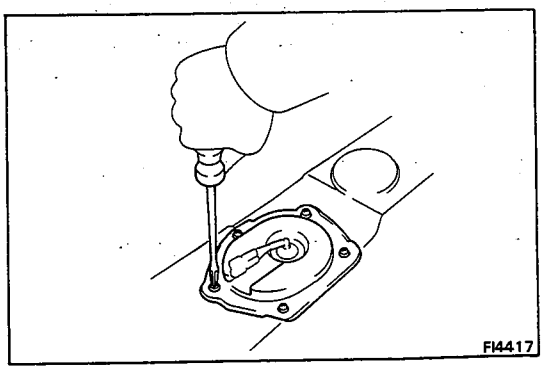
2. CONNECT FUEL PIPE AND HOSE TO FUEL PUMP BRACKET

(a) Connect the outlet pipe to the pump bracket two new gaskets and the union bolt.

Torque: 300 kg-cm (22 ft-lb, 29 N·m)

(b) Connect the return hose to the pump bracket.

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



4. INSTALL FLOOR SERVICE HOLE COVER

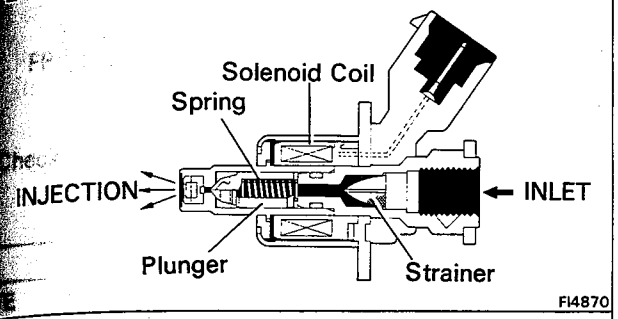
(a) Install the service hole cover with the five scre

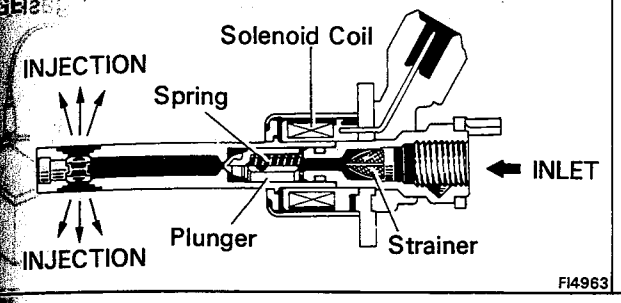
(b) Connect the fuel pump (with fuel sender gauge nector.

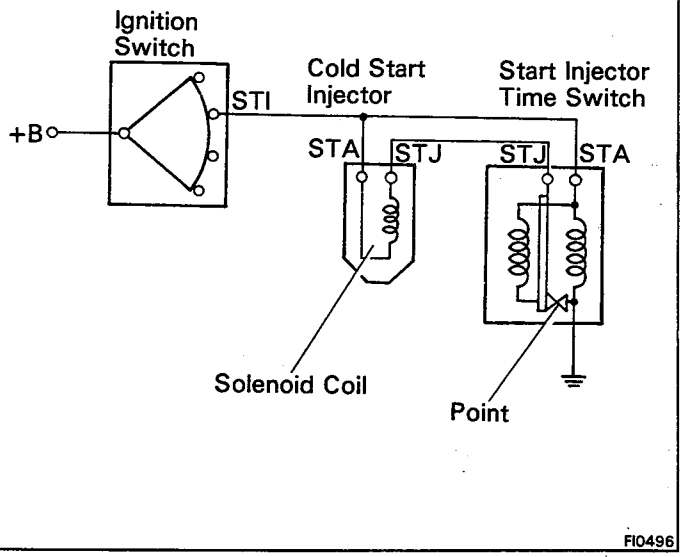
5. INSTALL REAR SEAT CUSHION

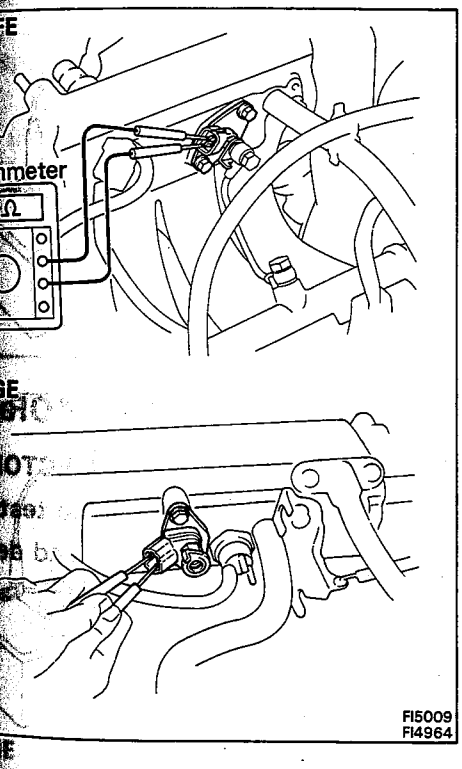
6. CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY

Cold Start Injector









ON-VEHICLE INSPECTION

INSPECT RESISTANCE OF COLD START INJECTOR

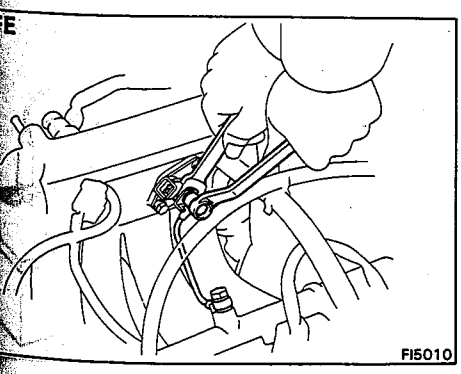
(a) Disconnect the cold start injector connector.

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

Resistance: **4A-FE 3 – 5 Ω**
4A-GE 2 – 4 Ω

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

(c) Reconnect the cold start injector connector.



REMOVAL OF COLD START INJECTOR

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

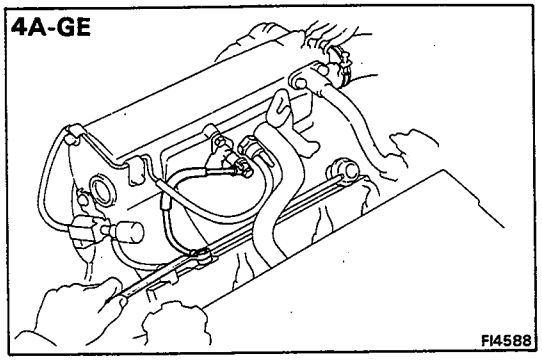
2. **DISCONNECT COLD START INJECTOR CONNECTOR**

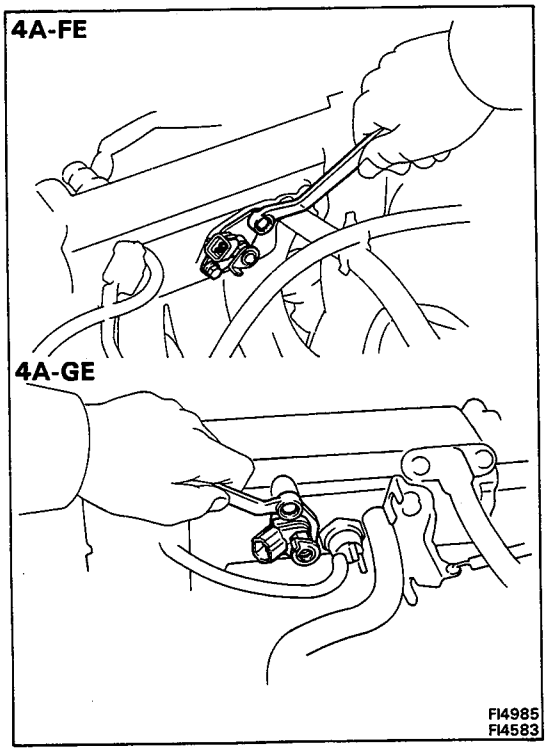
3. **REMOVE COLD START INJECTOR PIPE**

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

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

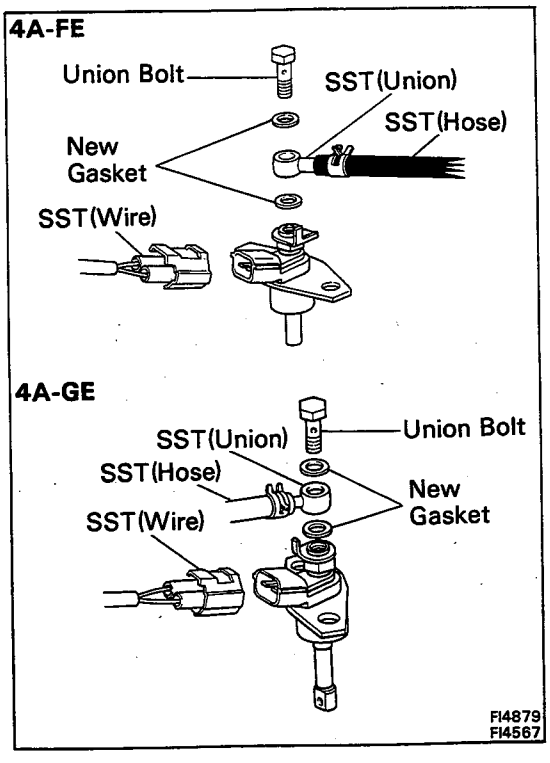
HINT: Slowly loosen the union bolts.





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 del pipe with new gaskets and the union bolts.

SST 09268-41045 (09268-41080)

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

SST 09268-41045

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

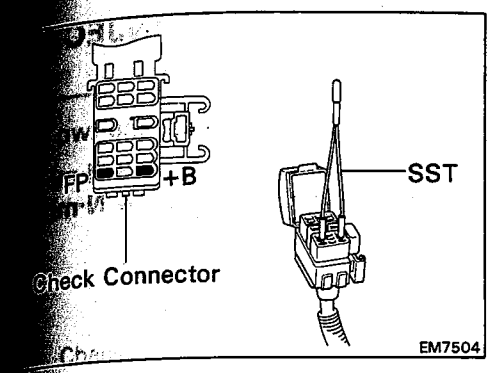
SST 09842-30055

(d) Put a container under the injector.

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

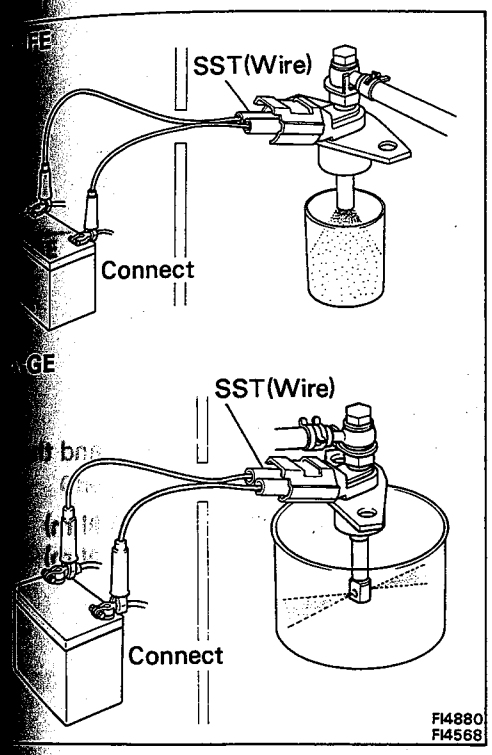
(f) Turn the ignition switch ON.

NOTICE: Do not start the engine.



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

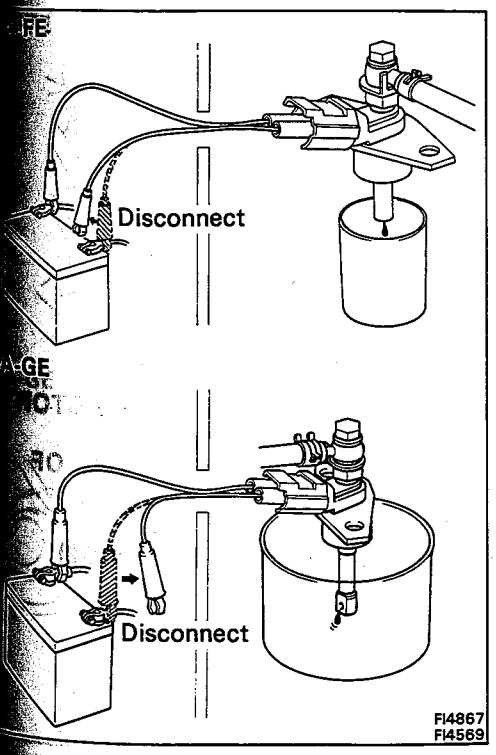
SST 09843-18020



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

SST 09842-30055

NOTICE: Perform this check within the shortest possible time.



2. INSPECT LEAKAGE

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

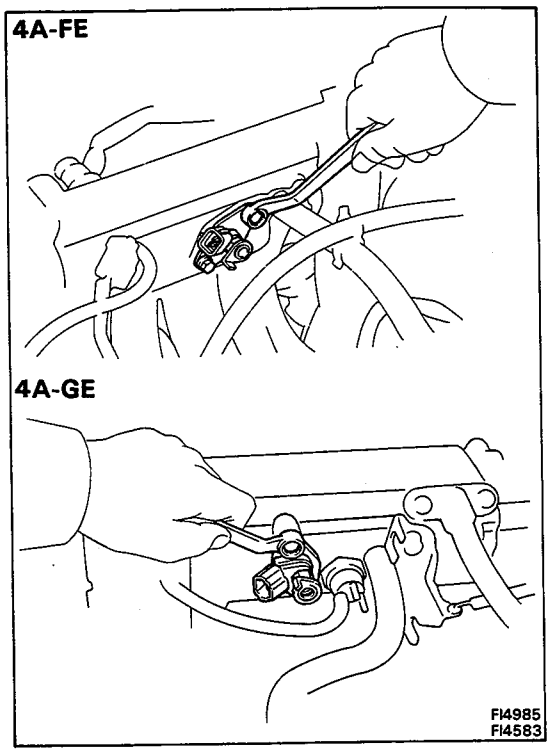
SST 09842-30055

Fuel drop: One drop or less per minute

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

(c) Remove SST.

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

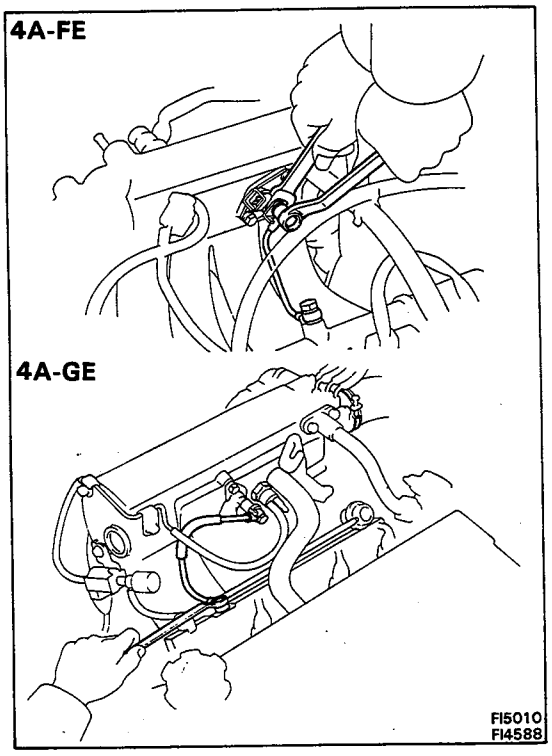


INSTALLATION OF COLD START INJECTOR

1. **INSTALL COLD START INJECTOR**

Install a new gasket and the injector with the two bolt

Torque: **4A-FE 95 kg-cm (82 in.-lb, 9.3 N·m)**
4A-GE 75 kg-cm (65 in.-lb, 7.4 N·m)



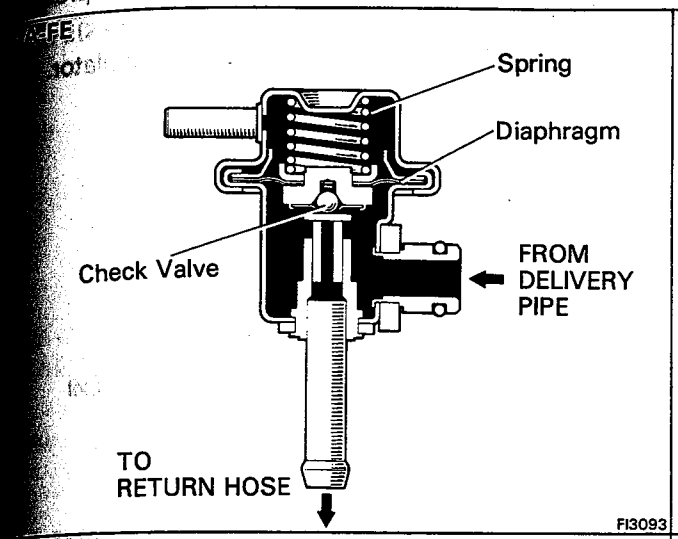
2. **INSTALL COLD START INJECTOR PIPE**

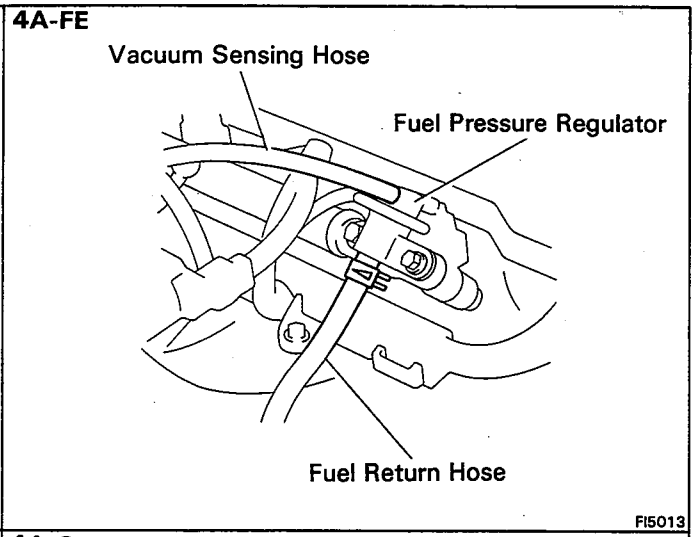
Install the injector pipe with four new gaskets and the union bolts.

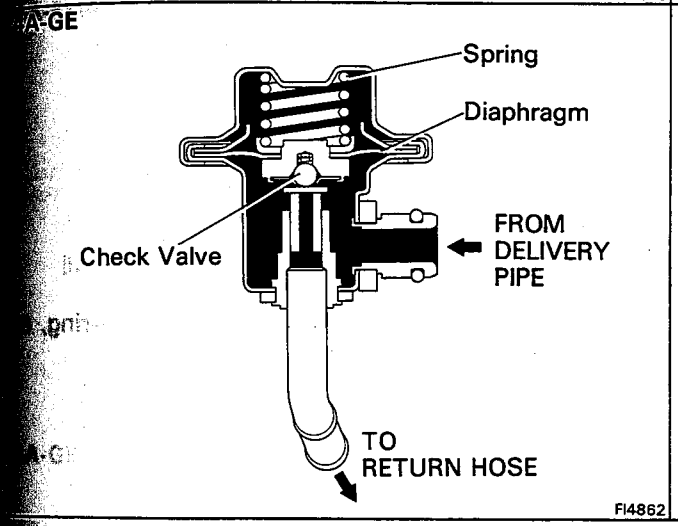
Torque: **4A-FE 180 kg-cm (13 ft-lb, 18 N·m)**
4A-GE 150 kg-cm (11 ft-lb, 15 N·m)

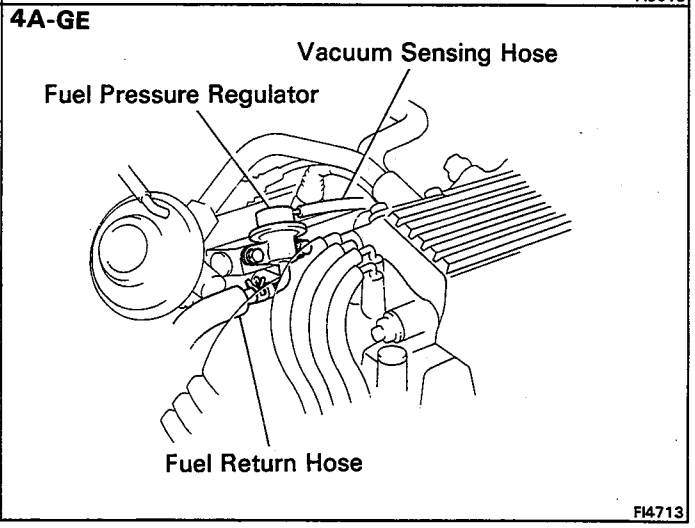
3. **CONNECT COLD START INJECTOR CONNECTOR**
4. **CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**
5. **CHECK FOR FUEL LEAKAGE (See page FI-12)**

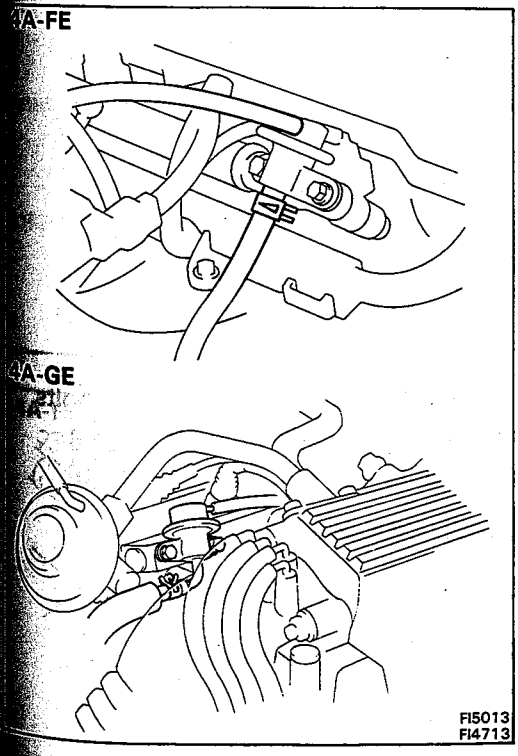
Fuel Pressure Regulator









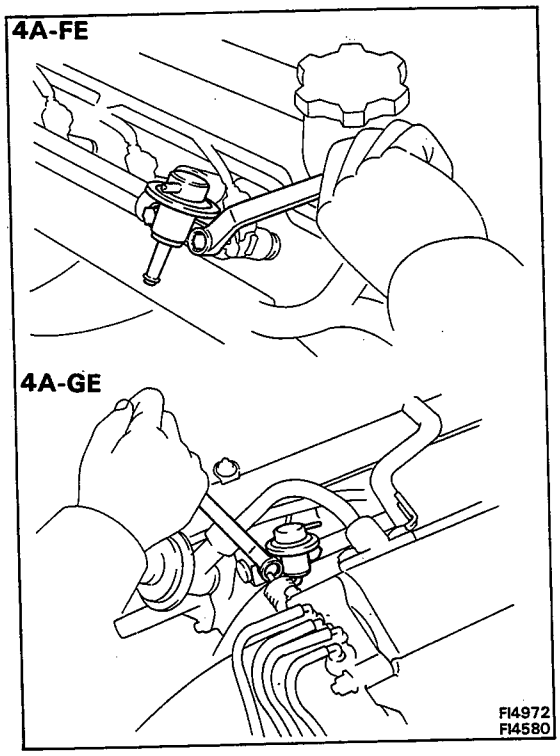


ON-VEHICLE INSPECTION

INSPECT FUEL PRESSURE (See page FI-95)

REMOVAL OF FUEL PRESSURE REGULATOR

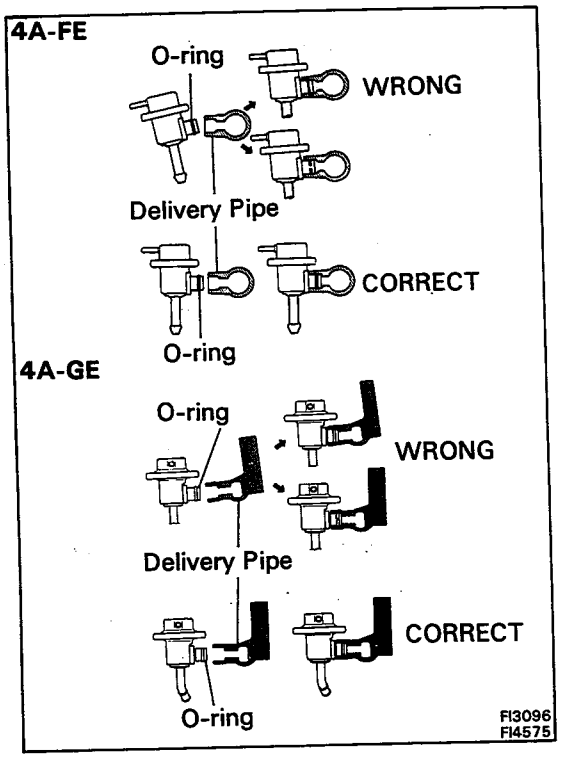
1. **DISCONNECT VACUUM SENSING HOSE**
2. **DISCONNECT FUEL RETURN HOSE**



3. **REMOVE FUEL PRESSURE REGULATOR**

(a) Remove the two bolts, and pull out the pressure regulator.

(b) Remove the O-ring from the pressure regulator.



INSTALLATION OF FUEL PRESSURE REGULATOR

1. **INSTALL FUEL PRESSURE REGULATOR**

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

(b) Install the pressure regulator with the two bolt

Torque: 4A-FE 95 kg-cm (82 in-lb, 9.3 N·m)
4A-GE 75 kg-cm (65 in-lb, 7.3 N·m)

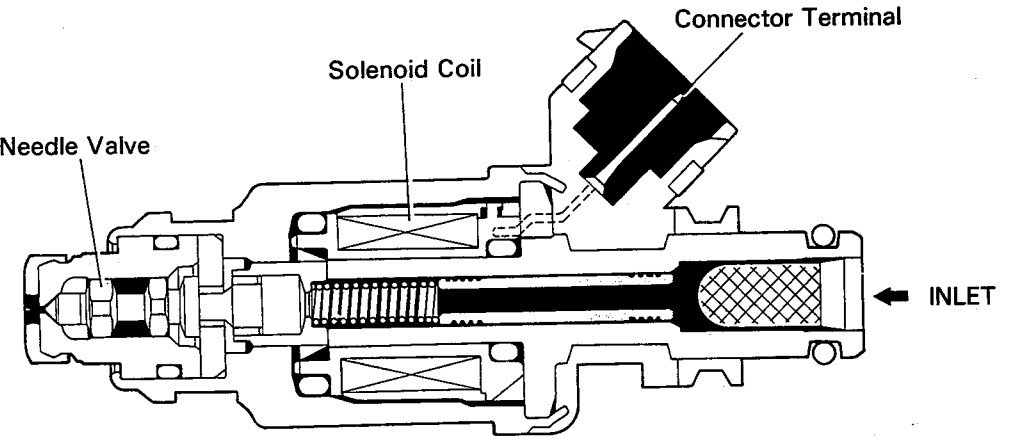
2. **CONNECT FUEL RETURN HOSE**

3. **CONNECT VACUUM SENSING HOSE**

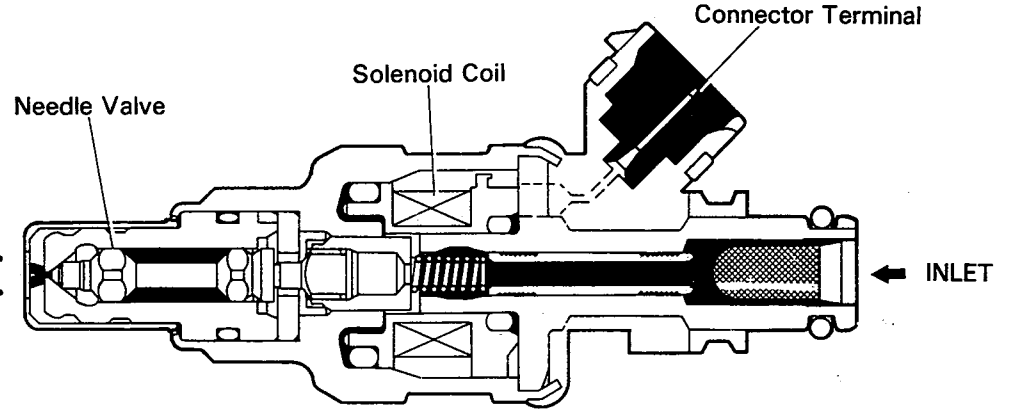
4. **CHECK FOR FUEL LEAKAGE** **(See page FI-12)**

Injector

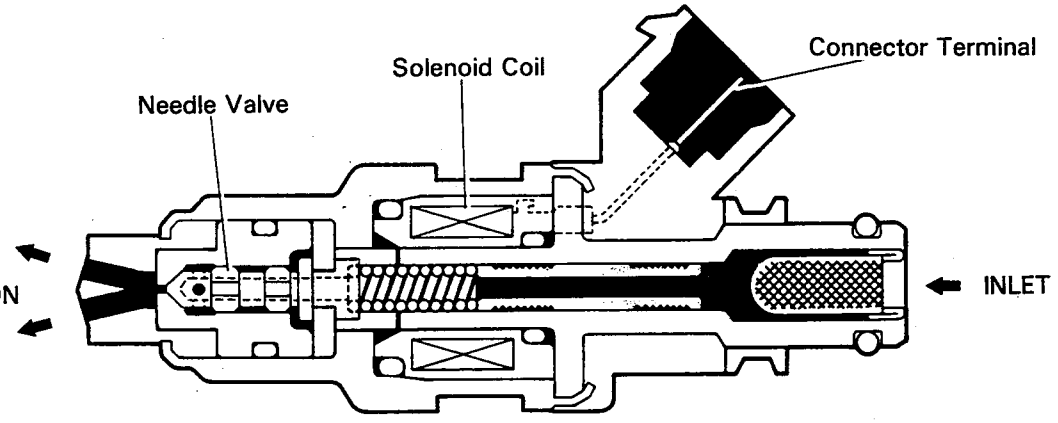
A-FE(2WD)



A-FE(4WD)

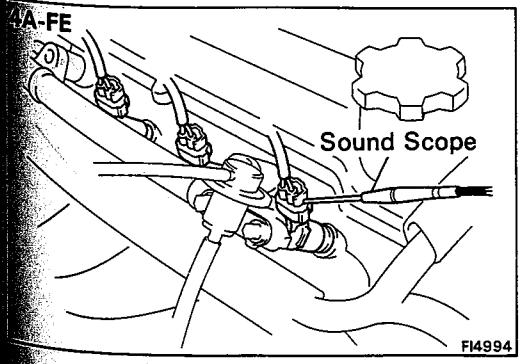


A-GE



FI4481
FI2785
FI4826

A-FE



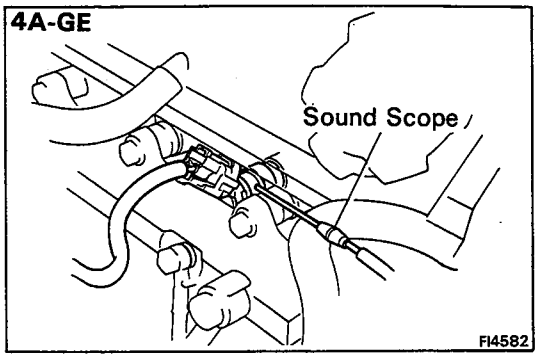
FI4994

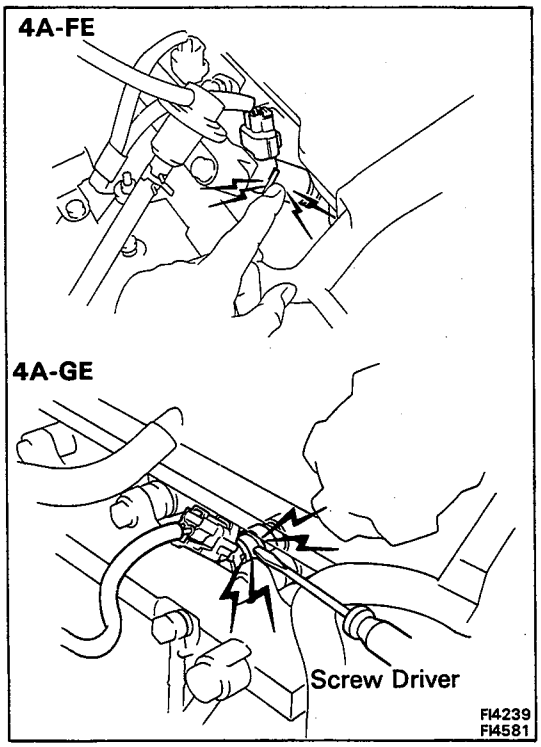
ON-VEHICLE INSPECTION

1. INSPECT INJECTOR OPERATION

Check operation sound from each injector.

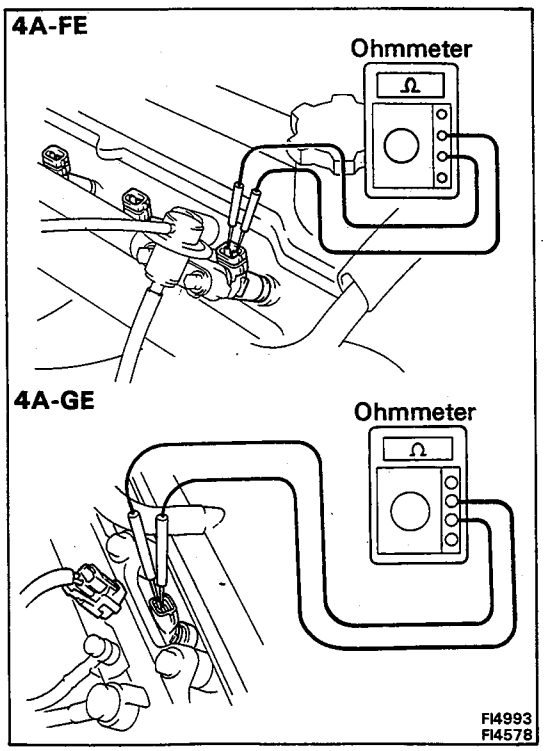
(a) With the engine running or cranking, use a sound scope to check that there is normal operating noise inproportion to engine rpm.





(b) If you have no sound scope, you can check the inj
tor transmission operation with your finger (4A-
or a screwdriver (4A-GE).

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



2. INSPECT INJECTOR RESISTANCE

(a) Disconnect the injector connector.

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

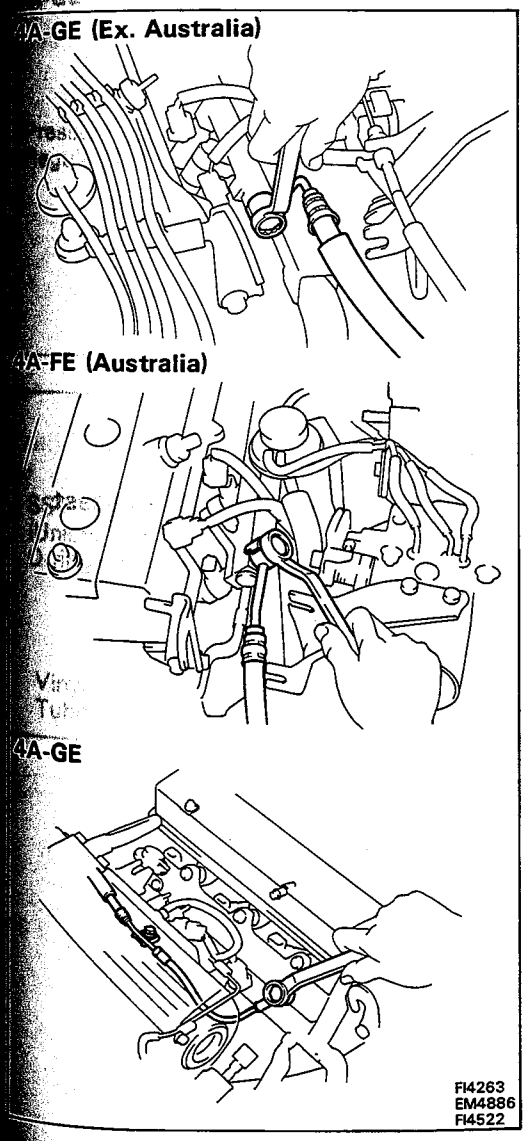
Resistance: Approx. 13.8 Ω

If the resistance is not as specified, replace the inject

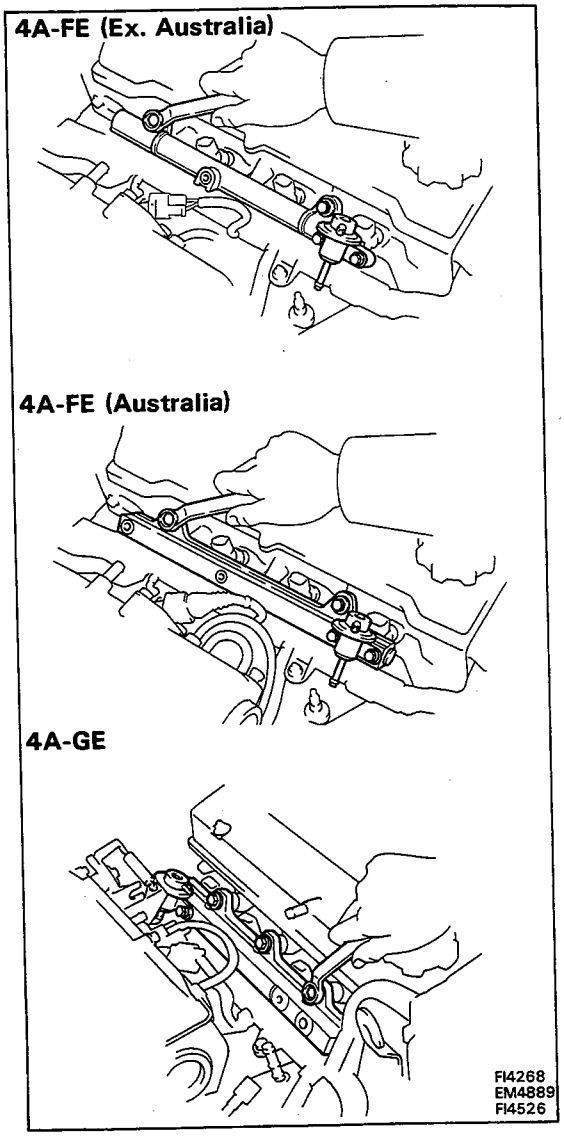
(c) Reconnect the injector connector.

REMOVAL OF INJECTORS

1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
2. **REMOVE COLD START INJECTOR PIPE (See step 3 page FI-105)**
3. **DISCONNECT VACUUM SENSING HOSE FROM FUEL PRESSURE REGULATOR**
4. **DISCONNECT INJECTOR CONNECTORS**
5. **DISCONNECT HOSE FROM FUEL RETURN PIPE**



6. **DISCONNECT FUEL INLET HOSE FROM DELIVERY PIPE**
   (a) (4A-FE)
   Remove the inlet pipe mount bolt.
   (b) Remove the union bolt and two gaskets, and disconnect the inlet hose from the delivery pipe.
7. **(4A-FE 4WD)**
   REMOVE EGR VACUUM MODULATOR (See step 6 page EM-60)



8. REMOVE DELIVERY PIPE AND INJECTORS

(a) (4A-FE)
Remove the two bolts and delivery pipe together with the four injectors.

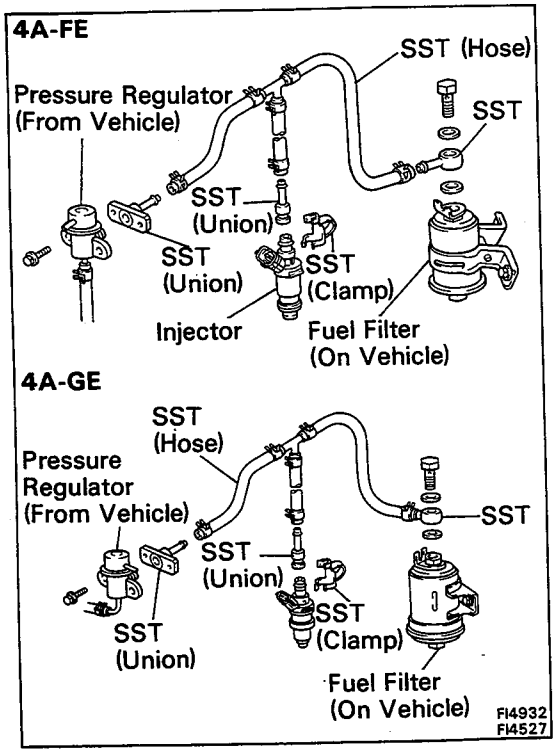
(4A-GE)
Remove the three bolts and delivery pipe together with the four injectors.

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

(b) (4A-FE)
Remove the four insulators and two spacers from the cylinder head.

(4A-GE)
Remove the four insulators and three spacers from the cylinder head.

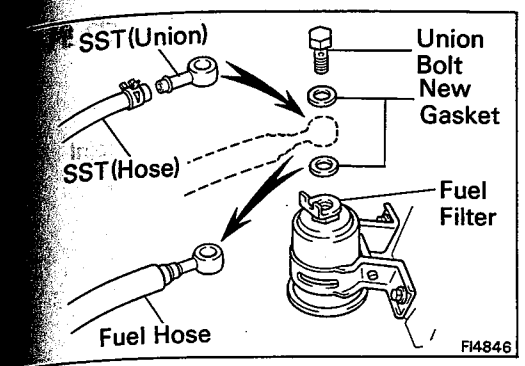
(c) Pull out the four injectors from the delivery pipe.



INSPECTION OF INJECTORS

1. INSPECT INJECTOR INJECTION

CAUTION: Keep clear of sparks during the test.

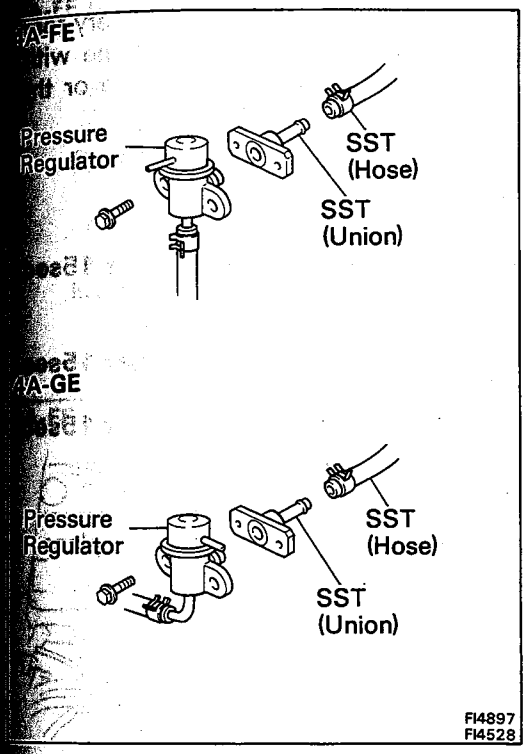


(a) Disconnect the fuel inlet hose from the fuel filter outlet.

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

SST 09268-41045 (90405-09015)

HINT: Use the vehicle's fuel filter.

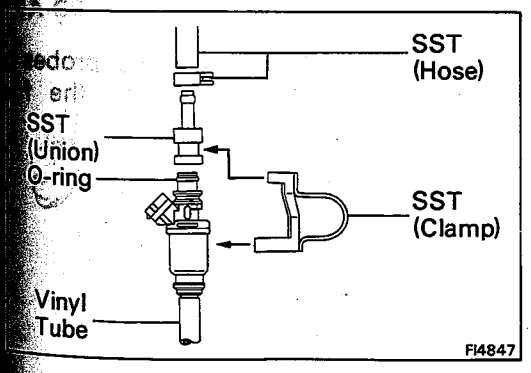


(c) Remove the pressure regulator from the delivery pipe, and connect the fuel hose to pressure regulator.

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

(e) Connect the SST (hose) to the pressure regulator with SST (union) and two bolts.

SST 09268-41045 (09268-41090)



(f) Install the grommet and a new O-ring to the injector.

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

SST 09268-41045

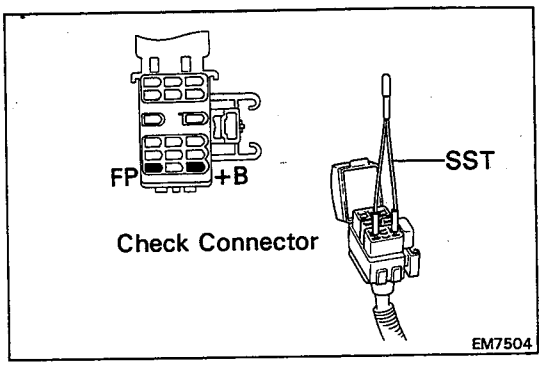
(h) Put the injector into the graduated cylinder.

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

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

(j) Turn the ignition switch ON.

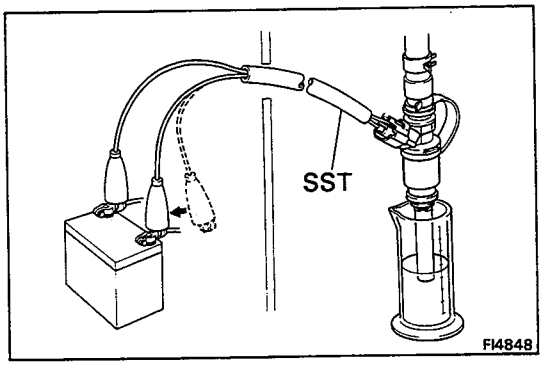
NOTICE: Do not start the engine.



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

SST 09843-18020

LOCATION: See page FI-133



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

SST 09842-30070

Volume:

4A-FE

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

4A-GE

w/o Air flow meter

44 — 49cc (2.7 — 3.0 cu in.) per 15sec

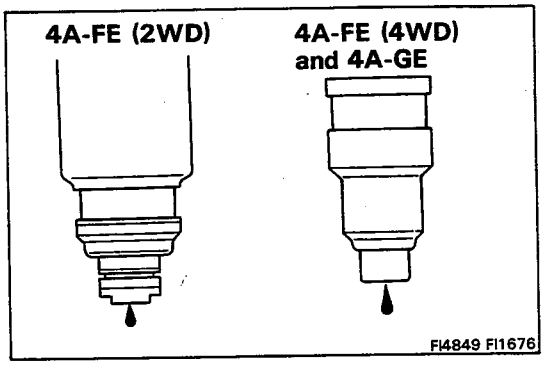
w/ Air flow meter

48 — 53cc (2.9 — 3.2 cu in.) per 15sec

Difference between each injector:

5cc (0.3 cu in.) or less

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



2. INSPECT LEAKAGE

(a) In the condition above, disconnect the test probe SST(wire) from the battery and check the leakage from the injector.

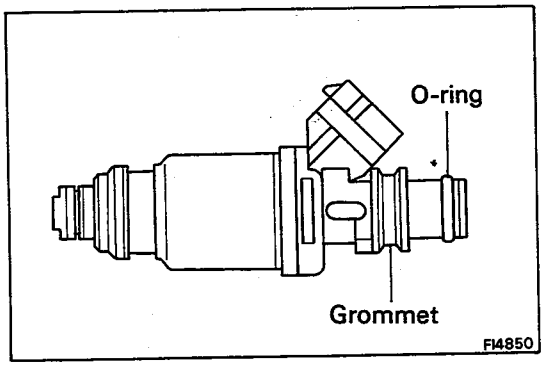
SST 09842-30070

Fuel drop: One drop or less per minute.

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

(c) Remove SST and the service wire.

SST 09268-41045

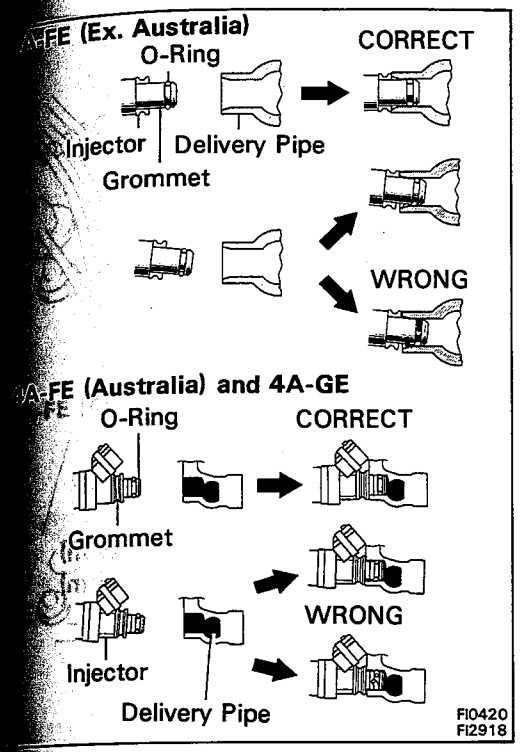


INSTALLATION OF INJECTORS

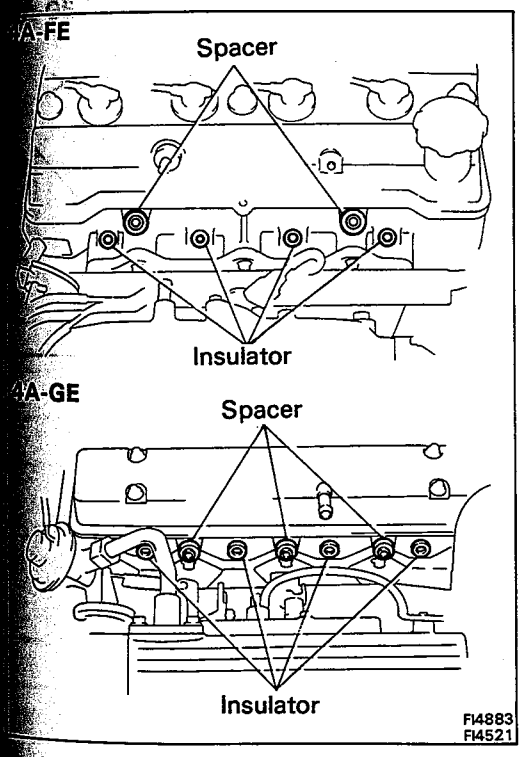
1. INSTALL INJECTORS AND DELIVERY PIPE

(a) Install a new grommet to the injector.

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

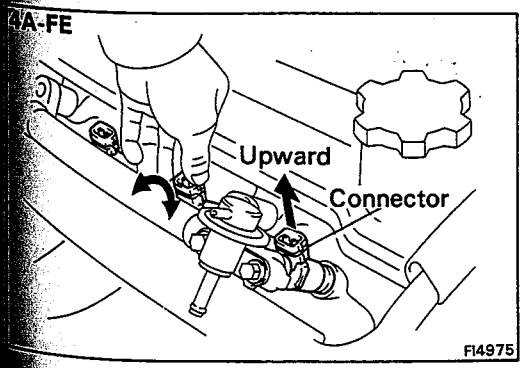


(c) While turning the injector left and right, install it to the delivery pipe. Install the four injectors.



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

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

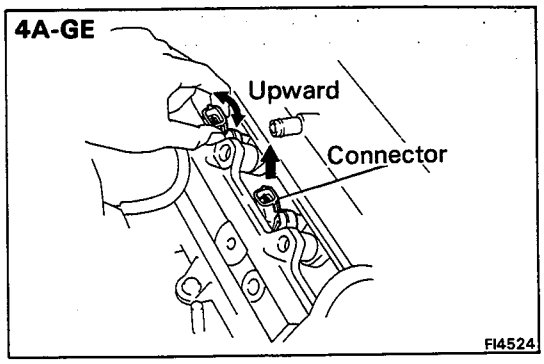


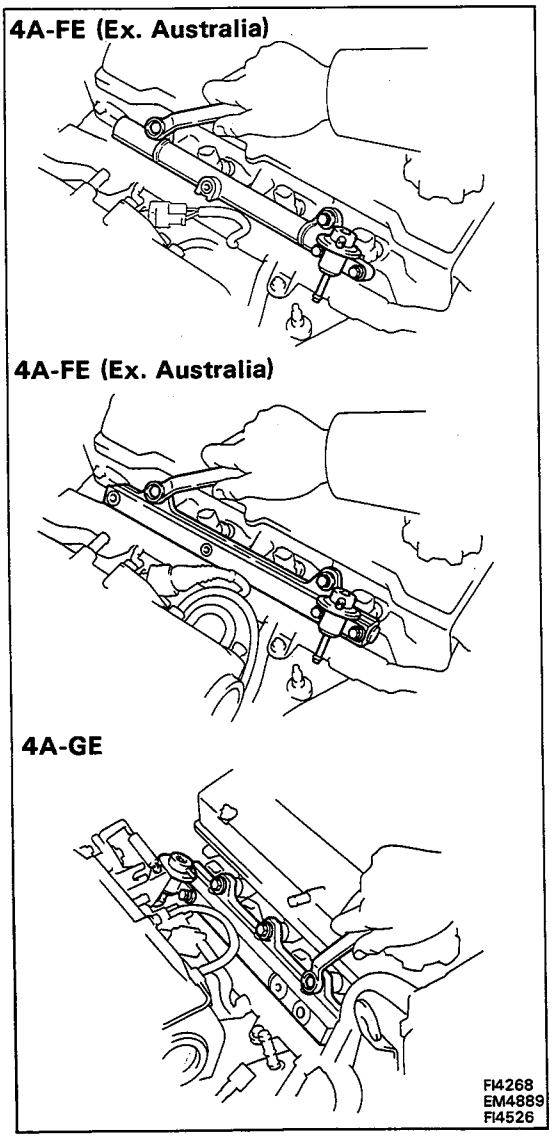
(e) Place the injectors together with the delivery pipe in position on the cylinder head.

(f) Check that the injectors rotate smoothly.

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

(g) Position the injector connector upward.



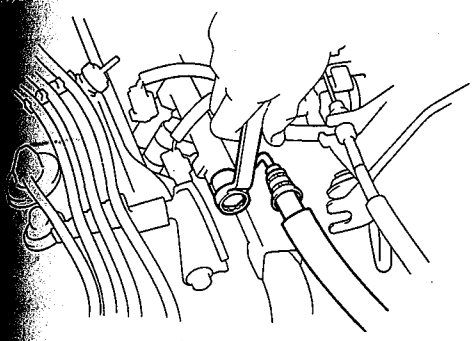


(h) (4A-FE)
Install and torque the two bolts.
(4A-GE)
Install and torque the three bolts.

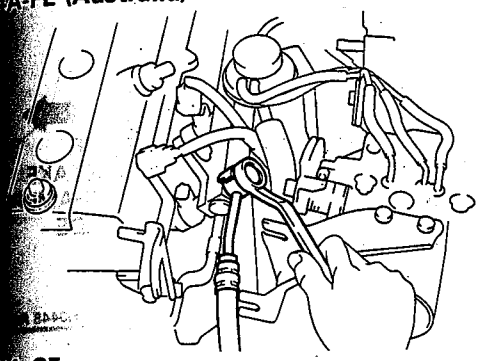
Torque: 4A-FE 150 kg-cm (11 ft-lb, 15 N·m)
4A-GE 175 kg-cm (13 ft-lb, 17 N·m)

2. (4A-FE 4WD)
INSTALL EGR VACUUM MODULATOR
(See step 20 on page EM-89)

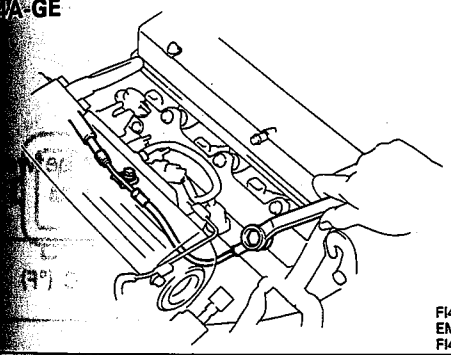
A-FE (Ex. Australia)



A-FE (Australia)



A-GE



FI4263
EM4886
FI4522

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

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

Torque: 300 kg-cm (22 ft-lb, 29 N·m)

(b) (4A-GE)
Install the inlet pipe mounting bolt.

Torque: 75 kg-cm (65 in-lb, 7.4 N·m)

4. **CONNECT FUEL RETURN HOSE**

5. **CONNECT INJECTOR CONNECTORS**

6. **CONNECT VACUUM SENSING HOSE**

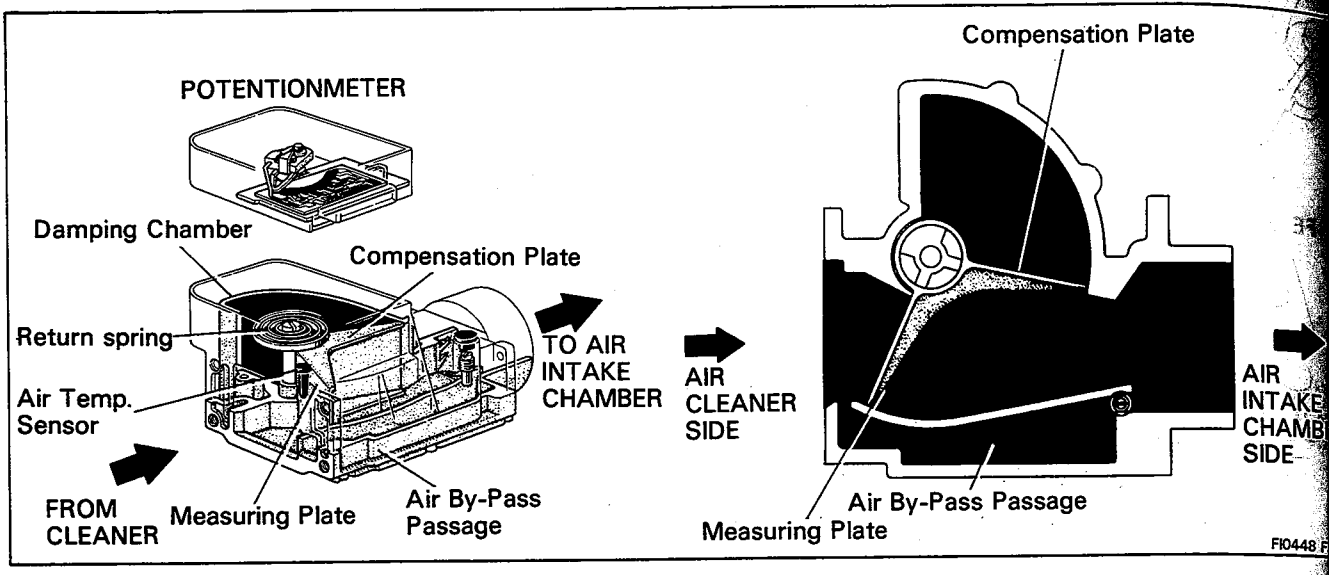
7. **INSTALL COLD START INJECTOR PIPE (See step 2 page FI-108)**

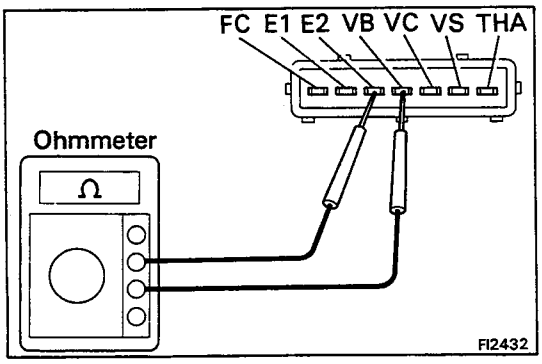
8. **CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**

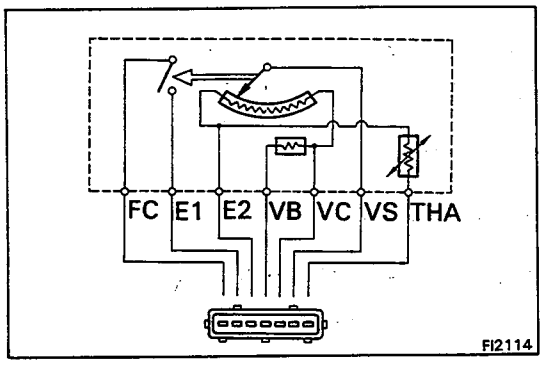
9. **CHECK FOR FUEL LEAKAGE (See page FI-12)**

AIR INDUCTION SYSTEM

Air Flow Meter (4A-GE W/ 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 betw each terminal.

Between terminals	Resistance	Temp. °C (°F
E2 – VS	20 – 400	–
E2 – VC	100 – 300	–
E2 – VB	200 – 400	–
E2 – THA	10,000 – 20,000 4,000 – 7,000 2,000 – 3,000 900 – 1,300 400 – 700	–20 (–4) 0 (32) 20 (68) 40 (104) 60 (140)
E1 – FC	Infinity	–

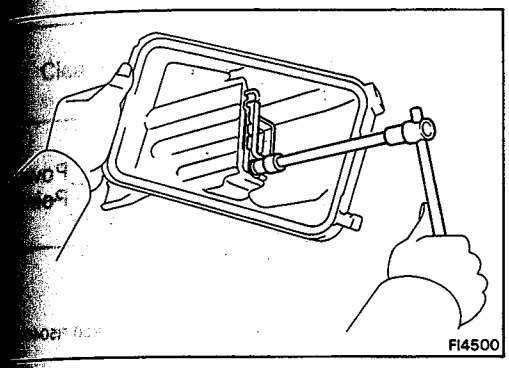
If the resistance is not as specified, replace the air meter.

(c) Reconnect the air flow meter connector.

REMOVAL OF AIR FLOW METER

1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
2. **DISCONNECT AIR CLEANER HOSE**
3. **REMOVE VSV (IDLE-UP)**
4. **DISCONNECT AIR FLOW METER CONNECTOR**
5. **REMOVE AIR CLEANER CAP WITH AIR FLOW METER**
6. **REMOVE AIR FLOW METER**

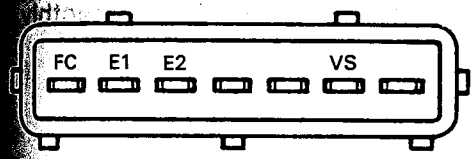
   Pry off the lock plate, and remove the four nuts, lock plate air flow meter and gasket.

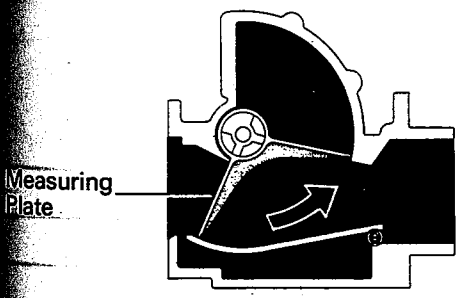


INSPECTION OF AIR FLOW METER

INSPECT RESISTANCE OF AIR FLOW METER

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





Between terminals	Resistance (Ω)	Measure plate opening
E1 – FC	Infinity	Fully closed
	Zero	Other than closed
E2 – VS	20 – 400	Fully closed
	20 – 1,000	Fully open

HINT: Resistance between terminals E2 and VS will change in accordance with the measuring plate opening.

If the resistance is not as specified, replace the meter.

INSTALLATION OF AIR FLOW METER

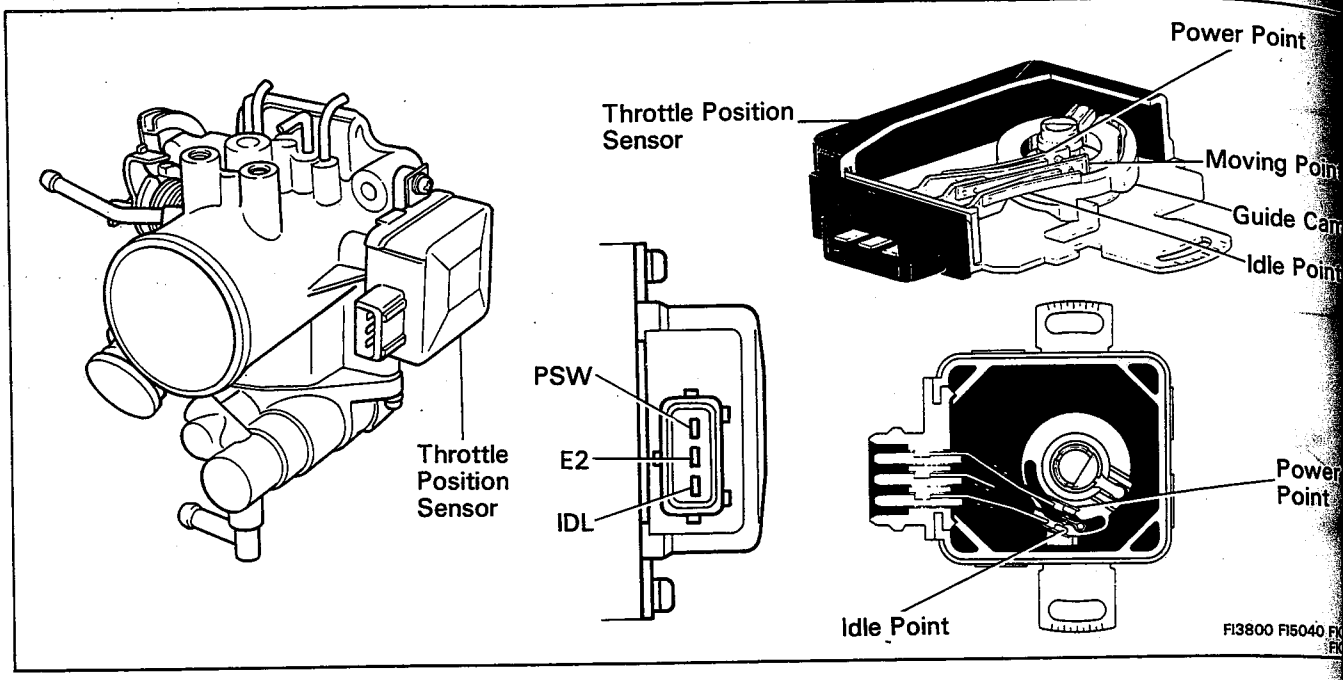
1. **INSTALL AIR FLOW METER**

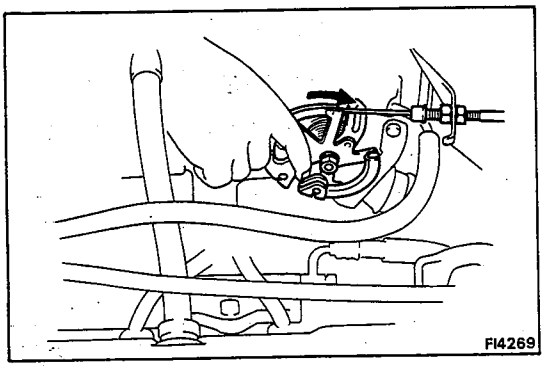
   Install the gasket and air flow meter with the lock plate and four nuts.

   If the lock plate on the nut.

2. **INSTALL AIR CLEANER WITH AIR FLOW METER**
3. **CONNECT AIR FLOW METER CONNECTOR**
4. **INSTALL VSV (IDLE-UP)**
5. **CONNECT AIR CLEANER HOSE**
6. **CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**

Throttle Body (4A-FE)

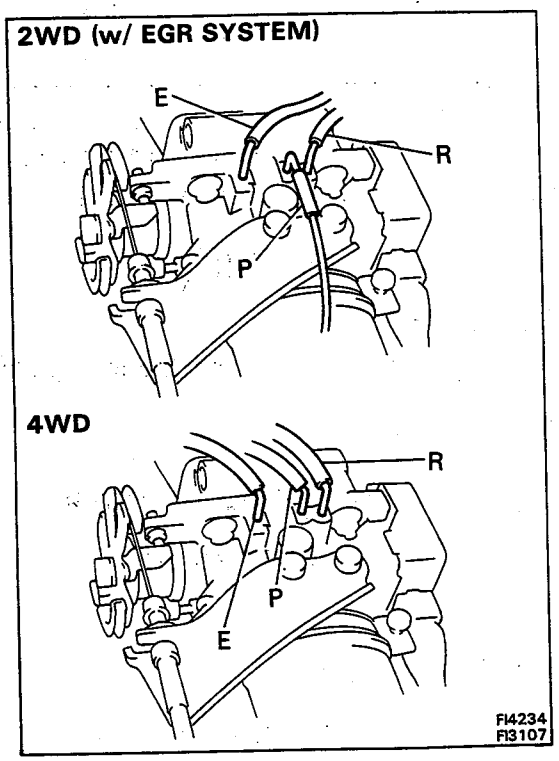




ON-VEHICLE CHECK

1. CHECK THROTTLE BODY

(a) Check that the throttle linkage moves smoothly.

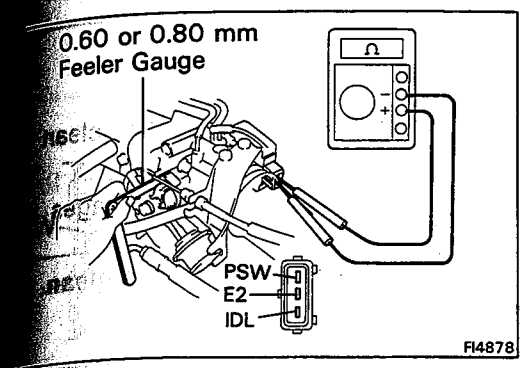


(b) Check the vacuum at each port.

- Start and warm up the engine.
- Check the vacuum with your finger.

Port	Throttle Valve Opening
P*1	Positioned more than P port.
E*2	Positioned more than E port.
R*2	Positioned more than R port.

*1: With fuel evaporative emission control system
*2: With exhaust gas recirculation system



2. INSPECT THROTTLE POSITION SENSOR

(a) Disconnect the sensor connector.

(b) Insert a feeler gauge between the throttle stop screw and stop lever.

(c) Using an ohmmeter, measure the resistance between each terminal.

If the resistance is not as specified, adjust or replace the throttle position sensor.

Clearance between lever and stop screw	Continuity between terminals		
	IDL – E2	PSW – E2	IDL – PSW
0.60 mm (0.0236 in.)	Continuity	No continuity	No continuity
0.80 mm (0.0316 in.)	No continuity	No continuity	No continuity
Throttle valve fully opened position	No continuity	Continuity	No continuity

(d) Reconnect the sensor connector.

REMOVAL OF THROTTLE BODY

1. DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY

2. DRAIN ENGINE COOLANT

3. DISCONNECT ACCELERATOR CABLE

4. (A/T)
DISCONNECT THROTTLE CABLE

5. DISCONNECT AIR CLEANER HOSE

6. REMOVE CABLE BRACKET FROM THROTTLE BODY

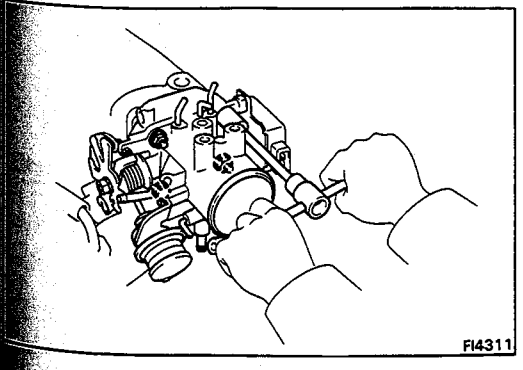
7. DISCONNECT THROTTLE POSITION SENSOR CONNECTOR

8. DISCONNECT FOLLOWING HOSES:

(a) No.2 water by-pass hose from the air valve.

(b) PCV hose from the throttle body.

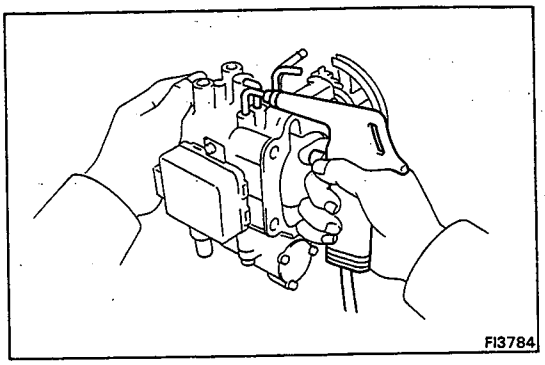
(c) Vacuum hose(s) from the port(s).



9. REMOVE THROTTLE BODY

(a) Remove the two bolts and nuts, and disconnect the throttle body and gasket.

(b) Disconnect the No.1 water by-pass hose, and remove the throttle body.


FI3784

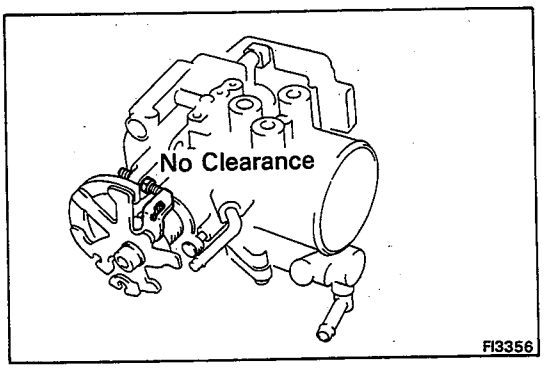
INSPECTION OF THROTTLE BODY

1. CLEAN THROTTLE BODY

(a) Using a soft brush and carburetor cleaner, clean th cast parts.

(b) Using compressed air, clean all the passages an apertures.

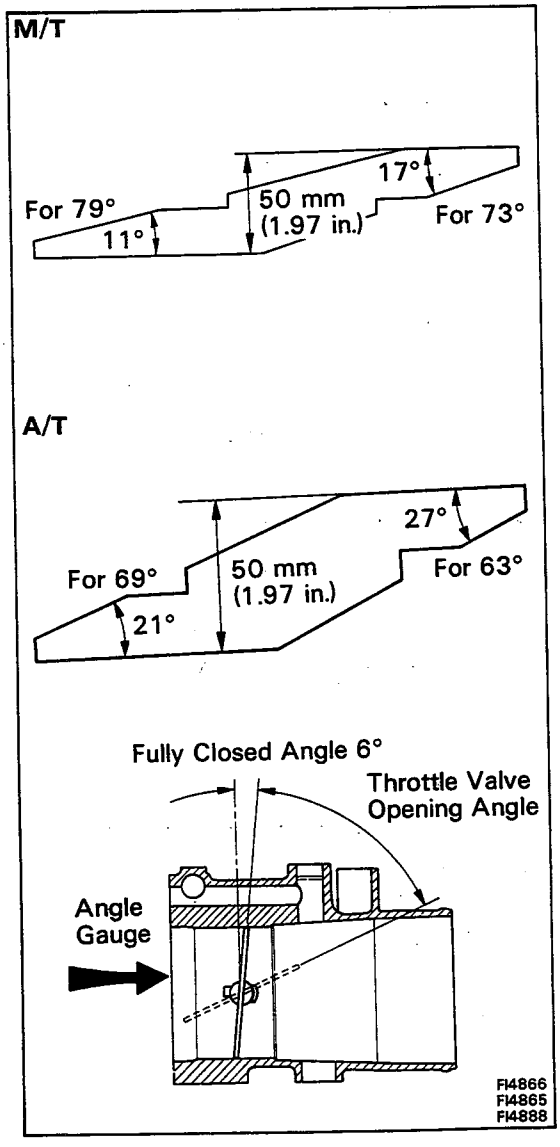
NOTICE: To prevent deterioration, do not clean th throttle position sensor.



FI3356

2. INSPECT THROTTLE BODY VALVE

Check that there is no clearance between the throttle sto screw and throttle lever when the throttle valve is ful closed.



FI4866
FI4865
FI4888

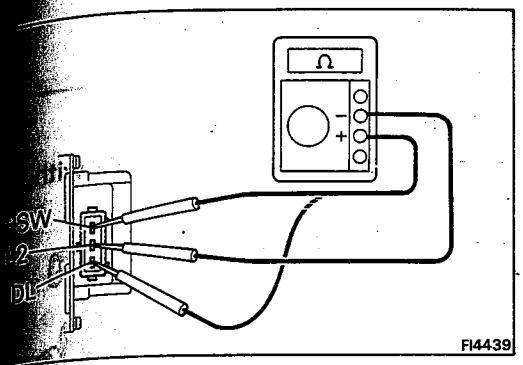
3. INSPECT THROTTLE POSITION SENSOR

(a) Make an angle gauge as shown in the figure.

(b) Set throttle valve opening angle to the specificatio below from the vertical position (incl. throttle val fully closed angle 6°).

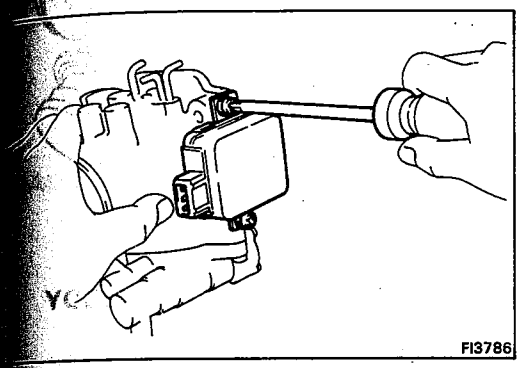
Throttle valve opening angle:

M/T	**73° or 79°**
A/T	**63° or 69°**



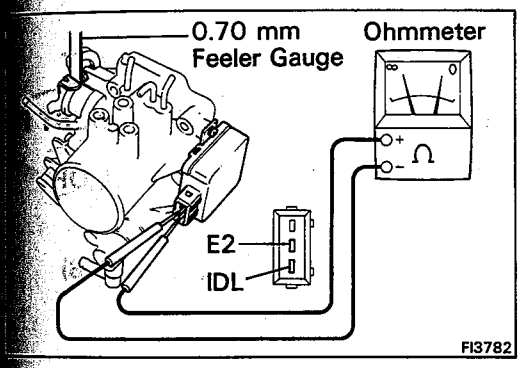
(c) Using an ohmmeter, check the continuity between each of the terminals.

Throttle valve opening angle		Continuity		
M/T	A/T	IDL – E2	PSW – E2	IDL – PSW
73° from vertical	63° from vertical	No continuity	No continuity	No continuity
79° from vertical	69° from vertical	No continuity	Continuity	No continuity
Less than 7.5 from vertical		Continuity	No continuity	No continuity



4. IF NECESSARY, ADJUST THROTTLE POSITION SENSOR

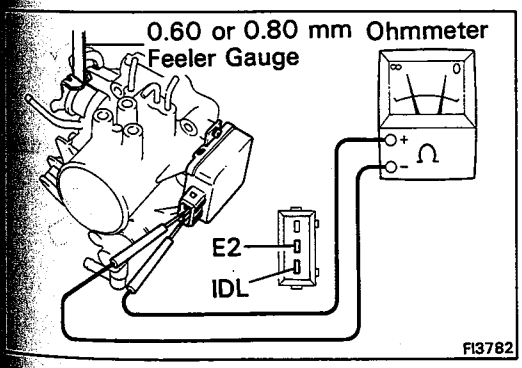
(a) Loosen the two set screws of the sensor.



(b) Insert a 0.70 mm (0.028 in.) feeler gauge, between the throttle stop screw and stop lever.

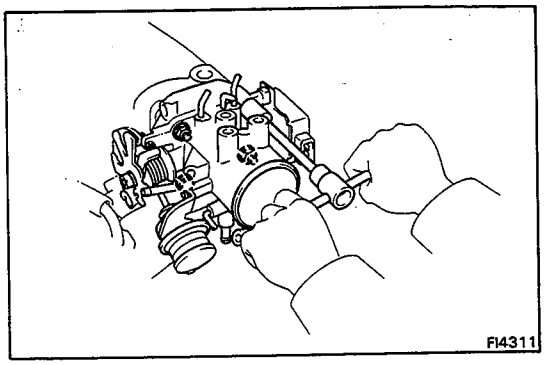
(c) Connect the test probe of an ohmmeter to the terminals IDL and E2 of the sensor.

(d) Gradually turn the sensor counterclockwise until the ohmmeter deflects, and secure it with the two screws.



(e) Recheck the continuity between terminals IDL and E2.

Clearance between lever and stop screw	Continuity (IDL – E2)
0.60 mm (0.024 in.)	Continuity
0.80 mm (0.032 in.)	No continuity



INSTALLATION OF THROTTLE BODY

1. **INSTALL THROTTLE BODY**
   (a) Connect No.1 water by-pass hose.
   (b) Install a new gasket and the throttle body with two bolts and nuts.

   Torque: 220 kg-cm (16 ft-lb, 22 N·m)

2. **CONNECT FOLLOWING HOSES:**
   (a) No.2 water by-pass hose.
   (b) PCV hose to the throttle body.
   (c) Vacuum hose(s) to the port(s).

3. **CONNECT THROTTLE POSITION SENSOR CONNECTOR**

4. **INSTALL CABLE BRACKET TO THROTTLE BODY**

5. **CONNECT AIR CLEANER HOSE**

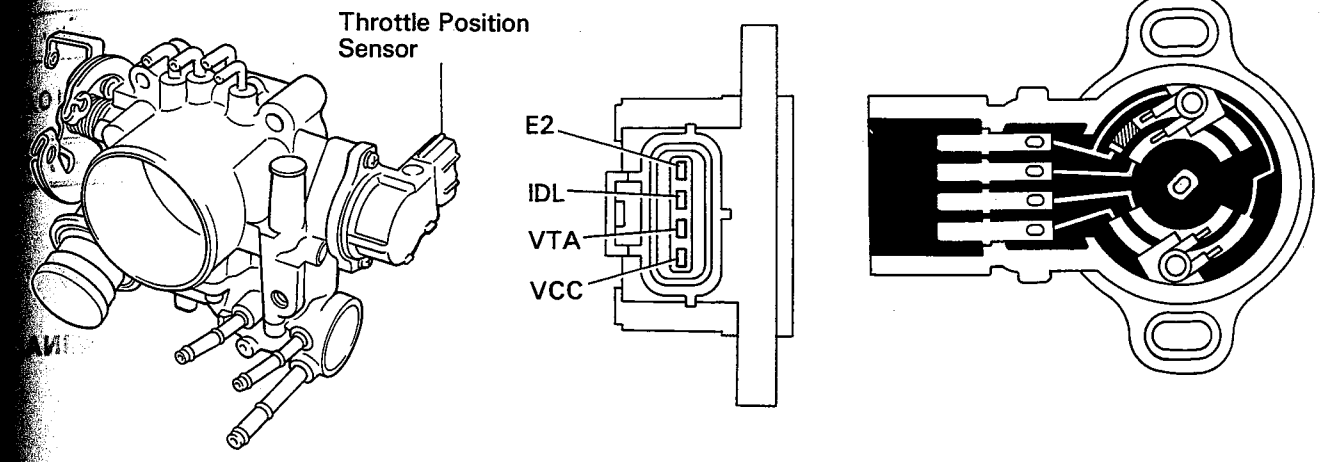
6. **(A/T)**
   CONNECT THROTTLE CABLE, AND ADJUST IT

7. **CONNECT ACCELERATOR CABLE, AND ADJUST I**

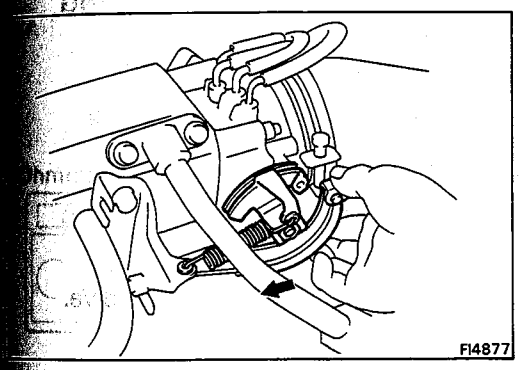
8. **CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**

9. **FILL WITH ENGINE COOLANT (See page CO-6)**

Throttle Body (4A-GE)



FI4576 FI5144 FI4143

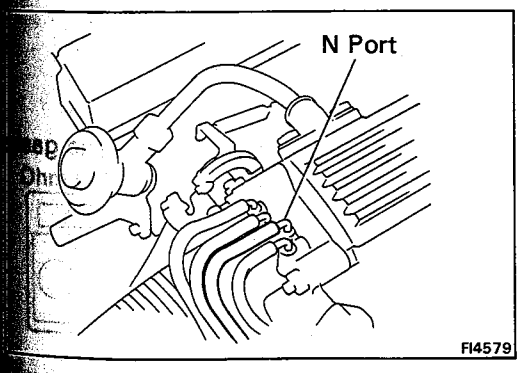


FI4877

ON-VEHICLE INSPECTION

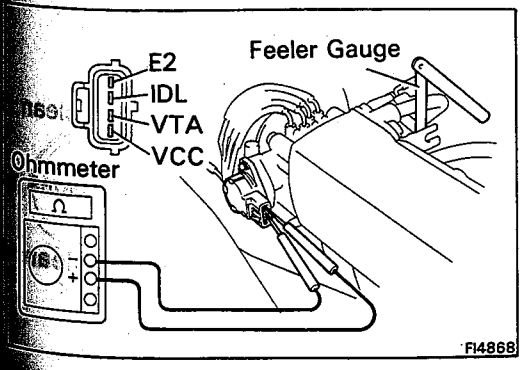
1. INSPECT THROTTLE BODY

(a) Check that the throttle linkage moves smoothly.



FI4579

(b) Check the vacuum at N port.
- Start the engine.
- Check the vacuum with your finger.



FI4868

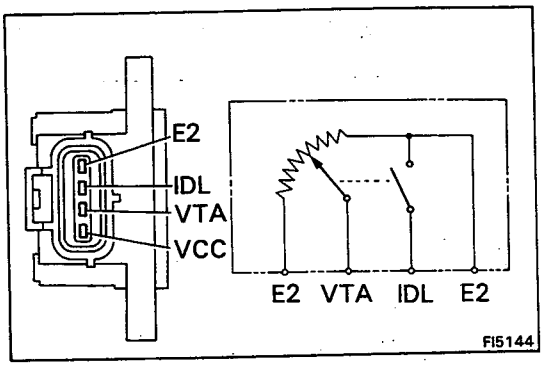
2. INSPECT THROTTLE POSITION SENSOR

(a) Disconnect the sensor connector.

(b) Insert a feeler gauge between the throttle stop screw and stop lever.

(c) Using an ohmmeter, measure the resistance between each terminal.

If the resistance is not as specified, adjust or replace the throttle position sensor.

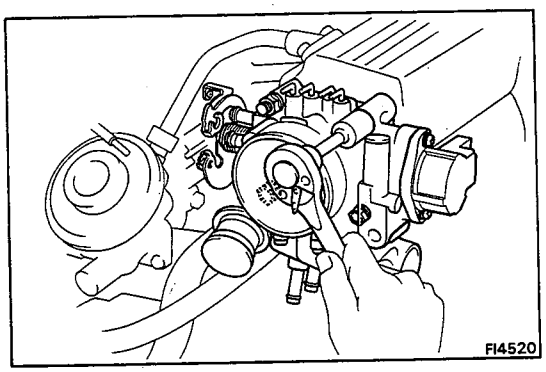


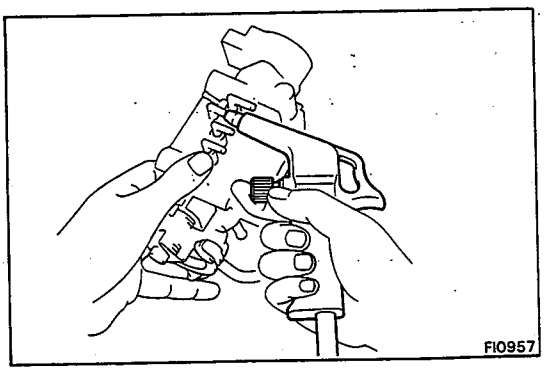
Clearance between lever and stop screw mm (in.)	Between Terminal	Resistance
0 (0)	VTA – E2	200 – 800
0.35 (0.014)	IDL – E2	2,300 or les
0.59 (0.023)	IDL – E2	Infinity
Throttle valve fully opened position	VTA – E2	3,300 – 10,0
–	VCC – E2	3,000 – 7,0

(d) Reconnect the sensor connector.

REMOVAL OF THROTTLE BODY

1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
2. **DRAIN ENGINE COOLANT**
3. **DISCONNECT AIR CLEANER HOSE**
4. **DISCONNECT ACCELERATOR RETURN SPRING**
5. **DISCONNECT ACCELERATOR CABLE**
6. **DISCONNECT THROTTLE POSITION SENSOR CONNECTOR**
7. **DISCONNECT FOLLOWING HOSES:**
   (a) Vacuum hoses from the ports.
   (b) Two water by-pass hoses from the air valve.
8. **(w/ EGR SYSTEM) REMOVE VACUUM PIPE**
   Remove the three bolts and vacuum pipe.
9. **REMOVE THROTTLE BODY**
   Remove the two bolts, two nuts, throttle body and ga

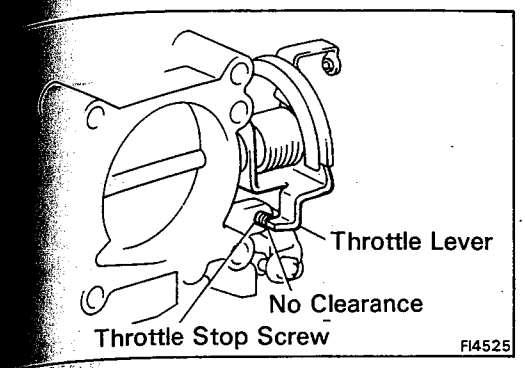




INSPECTION OF THROTTLE BODY

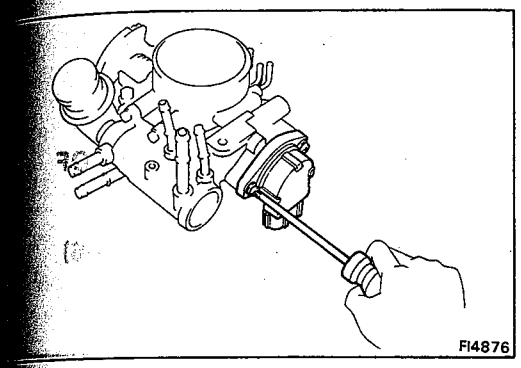
1. **CLEAN THROTTLE BODY**
   (a) Using a soft brush and carburetor cleaner, clea cast parts.
   (b) Using compressed air, clean all the passage apertures.

   NOTICE: To prevent deterioration, do not clea throttle position sensor.



2. INSPECT THROTTLE BODY VALVE

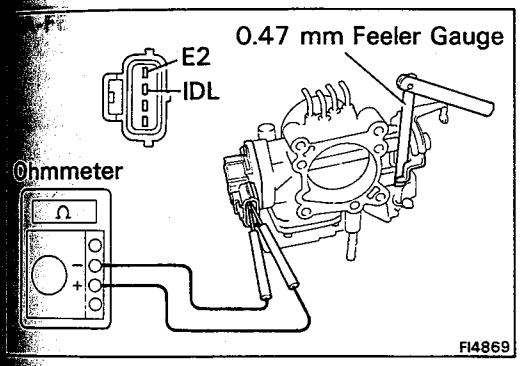
Check that there is no clearance between the throttle stop screw and throttle lever when the throttle valve is fully closed.



3. INSPECT THROTTLE POSITION SENSOR
(See step 2 on page FI-127)

4. IF NECESSARY, ADJUST THROTTLE POSITION SENSOR

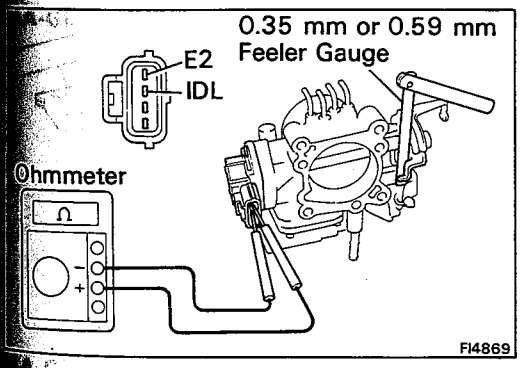
(a) Loosen the two set screws of the sensor.



(b) Insert a 0.47 mm (0.019 in.) feeler gauge, between the throttle stop screw and stop lever.

(c) Connect the test probe of an ohmmeter to the terminals IDL and E2 of the sensor.

(d) Gradually turn the sensor clockwise until the ohmmeter deflects, and secure it with the two screws.



(e) Recheck the continuity between terminals IDL and E2.

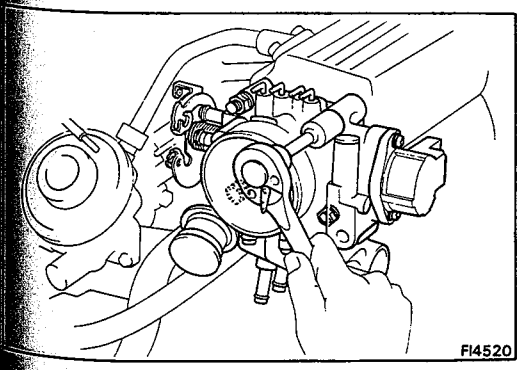
Clearance between lever and stop screw mm (in.)	Continuity (IDL – E2)
0.35 (0.014)	Continuity
0.59 (0.023)	No continuity

INSTALLATION OF THROTTLE BODY

1. INSTALL THROTTLE BODY

(a) Install a new gasket and the throttle body with the two bolts and two nuts.

Torque: 220 kg-cm (16 ft-lb, 22 N·m)



2. **(w/ EGR SYSTEM)**
   INSTALL VACUUM PIPE
   Install the vacuum pipe with the three bolts.

3. **CONNECT FOLLOWING HOSES:**
   (a) Two water by-pass hoses to the air valve.
   (b) Vacuum hoses to the ports.

4. **CONNECT THROTTLE POSITION SENSOR CONNECTOR**

5. **CONNECT ACCELERATOR CABLE, AND ADJUST**

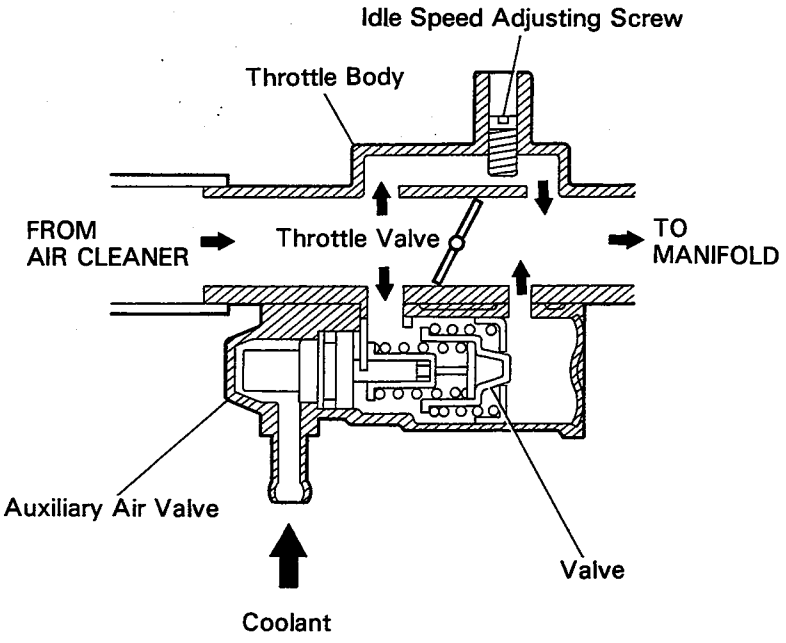
6. **CONNECT ACCELERATOR RETURN SPRING**

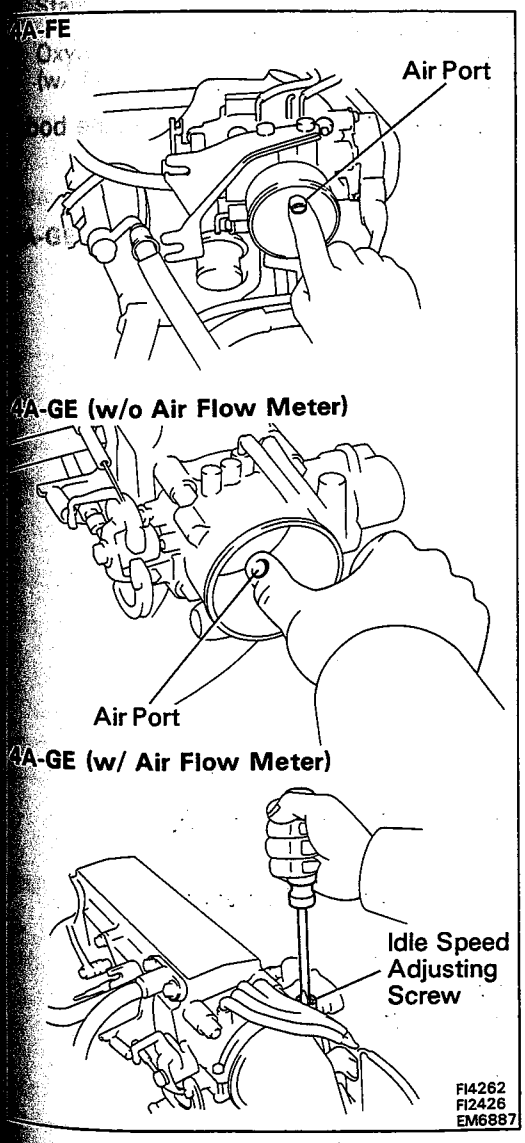
7. **CONNECT AIR CLEANER HOSE**

8. **CONNECT CABLE TO NEGATIVE TERMINAL OF BATTERY**

9. **FILL WITH ENGINE COOLANT** **(See page CO-6)**

Auxiliary Air Valve





ON-VEHICLE INSPECTION

INSPECT AIR VALVE OPERATION

(w/o Air Flow Meter)

(a) Remove the air cleaner hose.

(b) Check the engine rpm by closing the air port on the throttle body.

At low temp. (Coolant temp.: below 80°C (176°F))

- The engine RPM should drop.

After warm-up

- Check that engine RPM does not drop more than 100 rpm.

(c) Install the air cleaner hose.

If operation is not as specified, replace the air valve.

(w/ Air Flow Meter)

Check the engine rpm by fully screwing in the idle speed adjusting screw.

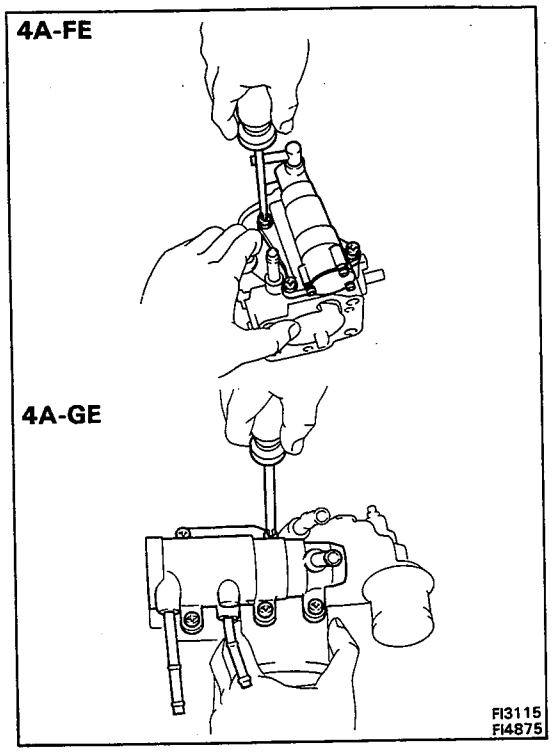
At low temp. (Coolant temp.: below 80°C (176°F))

- When the idle speed adjusting screw is in, the engine rpm should drop.

After warm-up

- When the idle speed adjusting screw is in, the engine rpm should drop below idle speed duel stop.

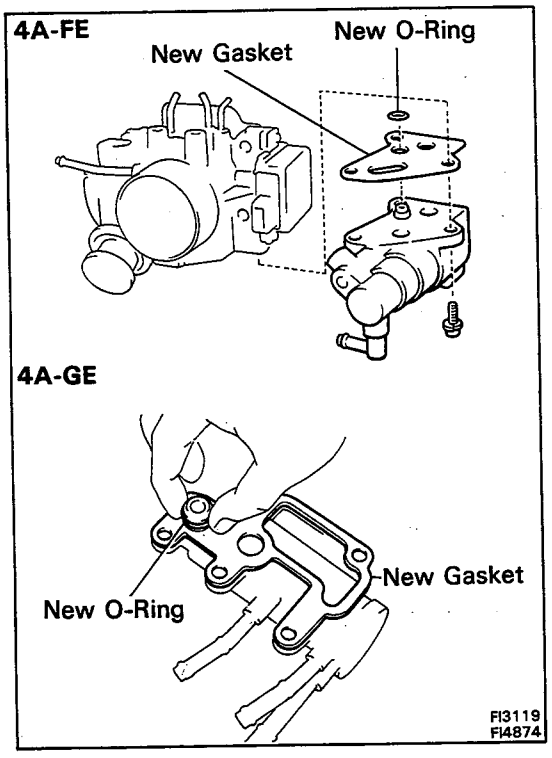
If operation is not as specified, replace the air valve.



REMOVAL OF AUXILIARY AIR VALVE

1. **REMOVE THROTTLE BODY**
   4A-FE (See page FI-123)
   4A-GE (See page FI-128)

2. **REMOVE AIR VALVE FROM THROTTLE BODY**
   (4A-FE)
   Remove the three screws, air valve, gasket and O-ring.
   (4A-GE)
   Remove the five screws, air valve, gasket and O-ring.



INSTALLATION OF AIR VALVE

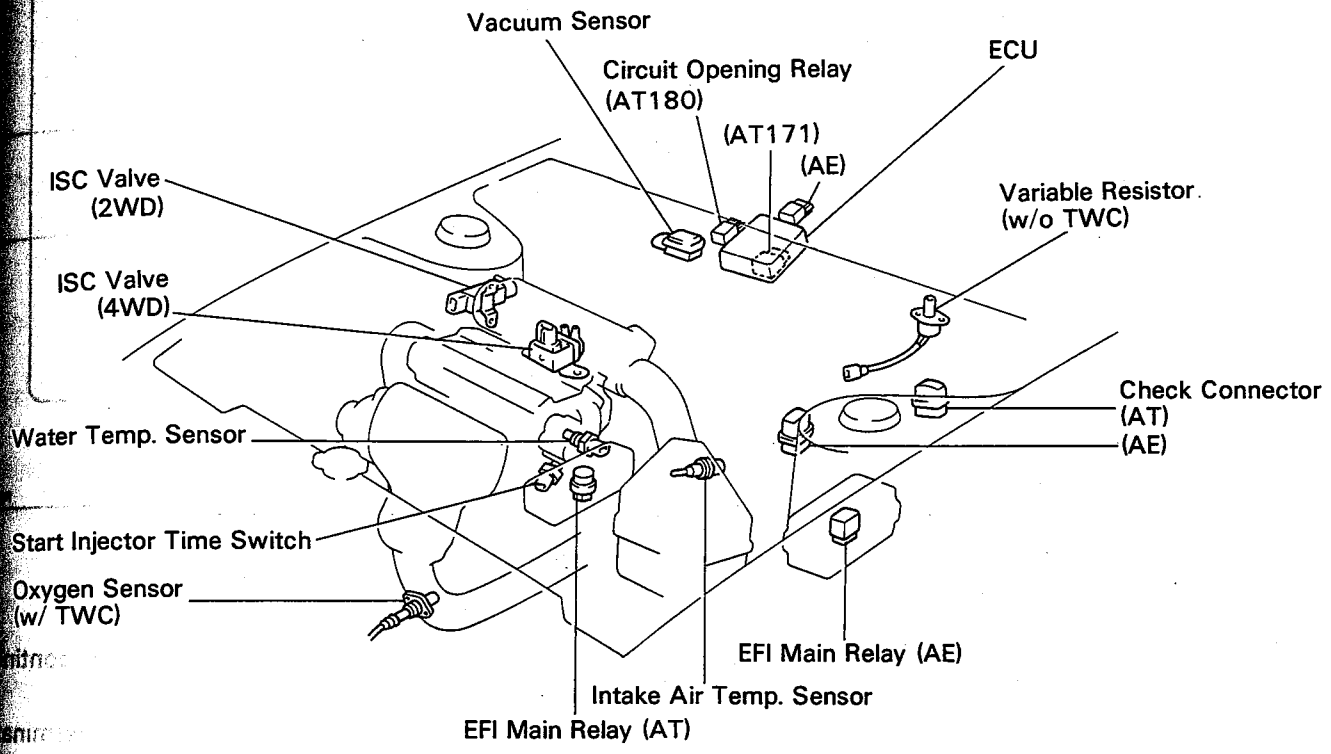
1. **INSTALL AIR VALVE TO THROTTLE BODY**
   (a) Place new gasket and O-ring on the throttle bod

   (b) (4A-FE)
   Install the air valve with the three screws.
   (4A-GE)
   Install the air valve with the five screws.

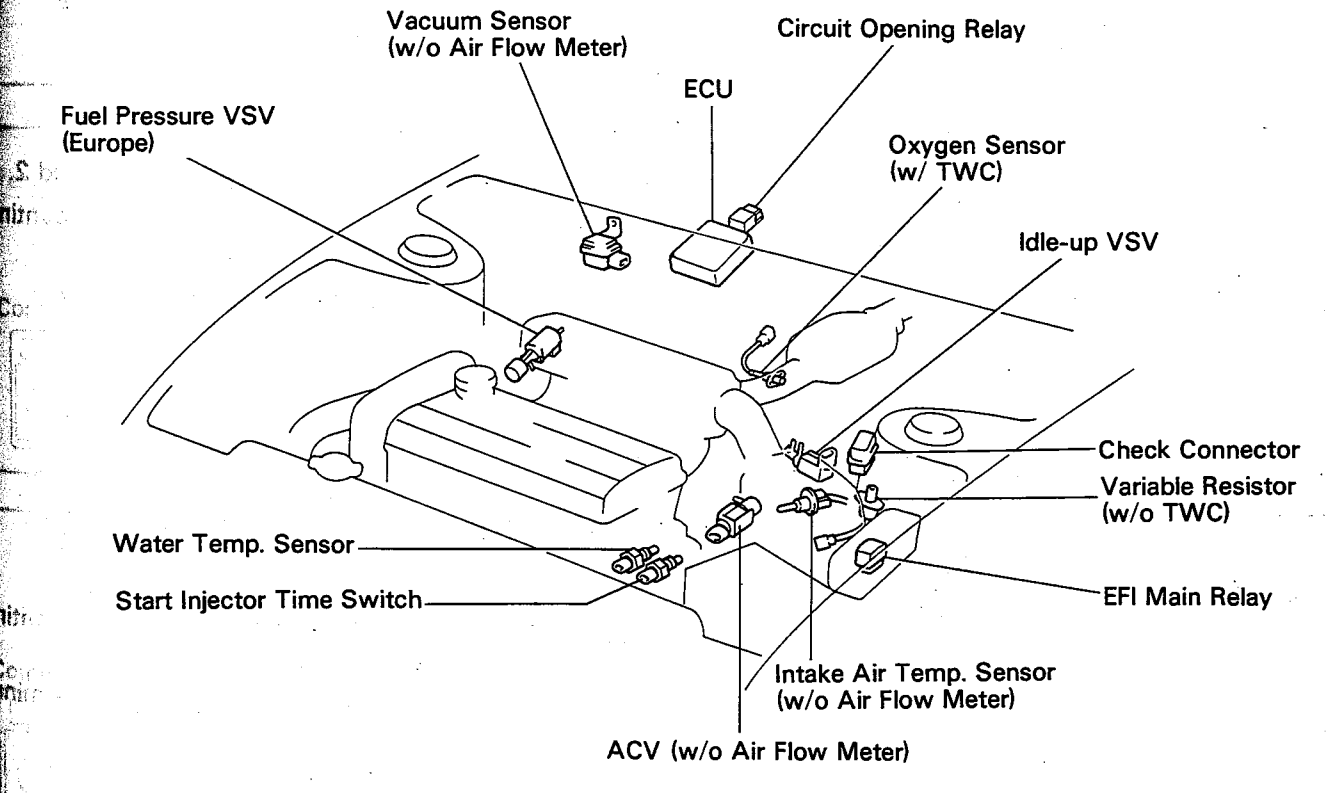
2. **INSTALL THROTTLE BODY**
   4A-FE (See page FI-126)
   4A-GE (See page FI-129)

ELECTRONIC CONTROL SYSTEM
Location of Electronic Control Parts

4A-FE

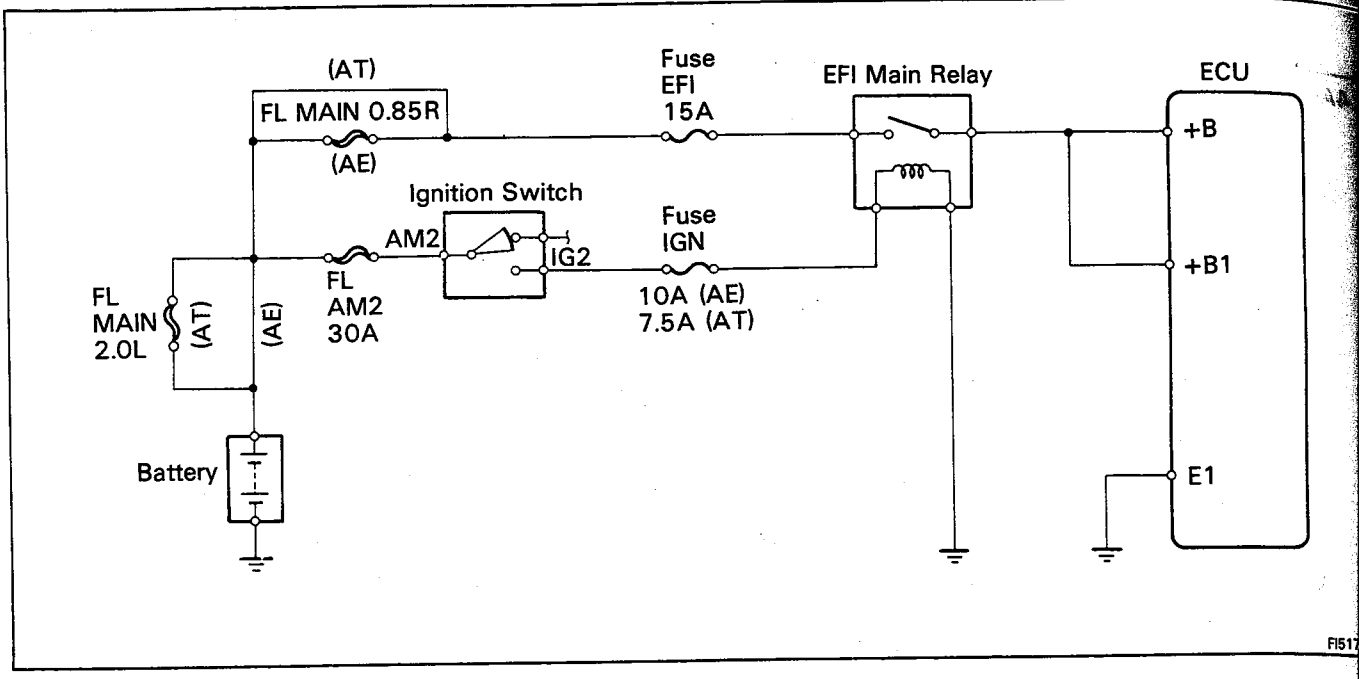


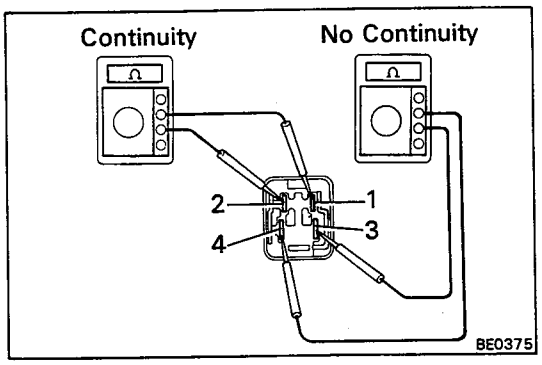
4A-GE



FI5156
FI5155

EFI Main Relay





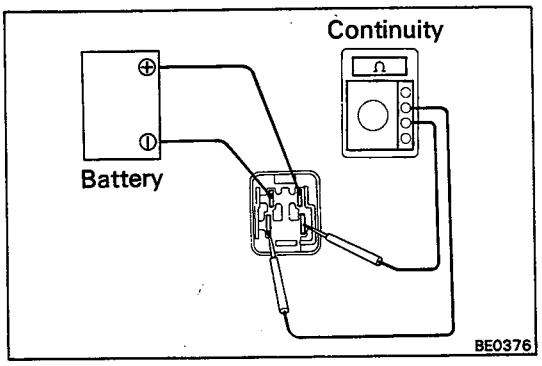
INSPECTION OF EFI MAIN RELAY (AE)

1. INSPECT RELAY CONTINUITY

(a) Using an ohmmeter, check that there is continui between terminals 1 and 2.

(b) Check that there is no continuity between terminals and 4.

If continuity is not as specified, replace the relay.

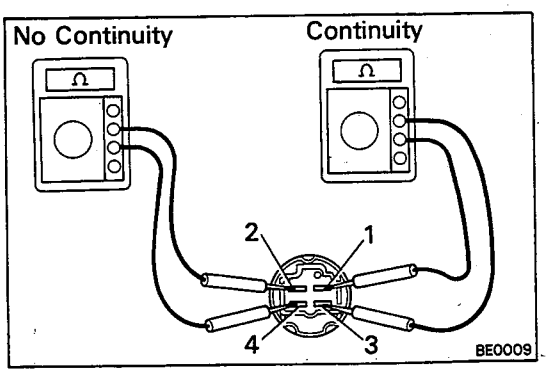


2. INSPECT RELAY OPERATION

(a) Apply battery voltage across terminals 1 and 2.

(b) Using an ohmmeter, check that there is continu between terminals 3 and 4.

If operation is not as specified, replace the relay.



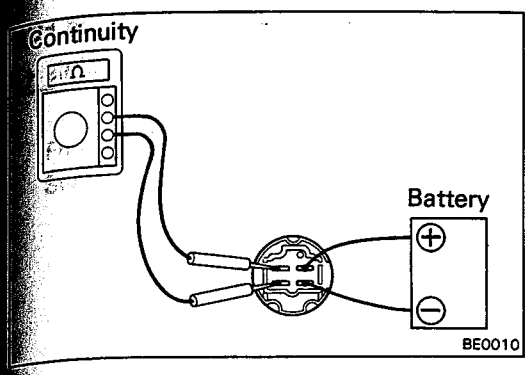
INSPECTION OF EFI MAIN RELAY (AT)

1. INSPECT RELAY CONTINUITY

(a) Using an ohmmeter, check that there is continu between terminals 1 and 3.

(b) Check that there is no continuity between terminal and 4.

If continuity is not as specified, replace the relay.



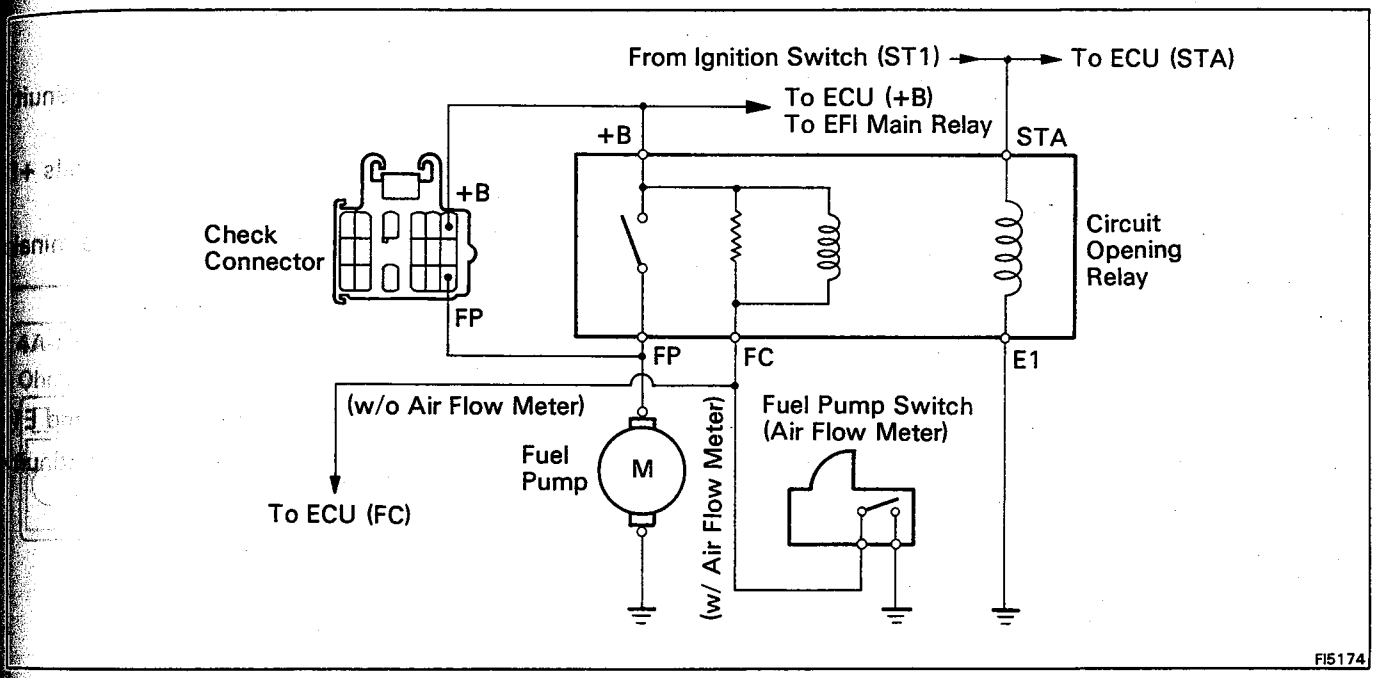
2. INSPECT RELAY OPERATION

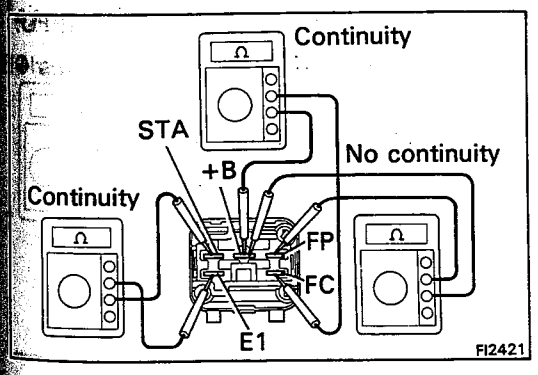
(a) Apply battery voltage across terminals 1 and 3.

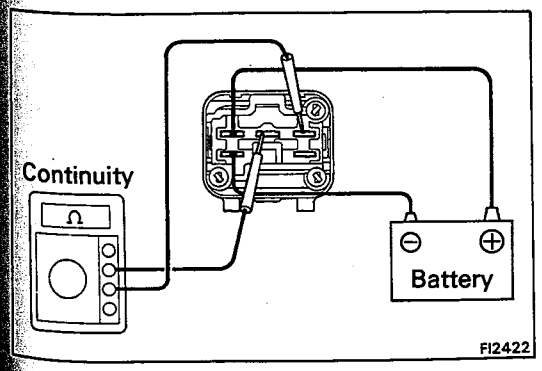
(b) Using an ohmmeter, check that there is continuity between terminals 2 and 4.

If operation is not as specified, replace the relay.

Circuit Opening Relay







INSPECTION OF CIRCUIT OPENING RELAY (w/o Air Flow Meter)

1. INSPECT RELAY CONTINUITY

(a) Using an ohmmeter, check that there is continuity between terminals STA and E1.

(b) Check that there is continuity between terminals +B and FC.

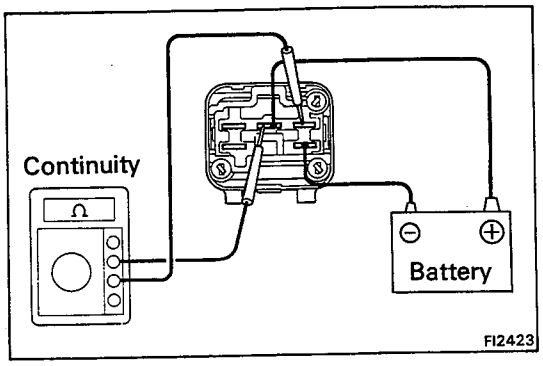
(c) Check that there is no continuity between terminals +B and FP.

If continuity is not as specified, replace the relay.

2. INSPECT RELAY OPERATION

(a) Apply battery voltage across terminals STA and E1.

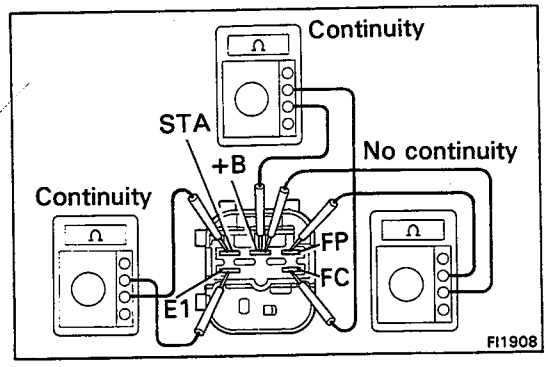
(b) Using an ohmmeter, check that there is continuity between terminals +B and FP.



(c) Apply battery voltage across terminals +B and FC.

(d) Check that there is continuity between terminals STA and FP.

If operation is not as specified, replace the relay.



INSPECTION OF CIRCUIT OPENING RELAY (w/ Air Flow Meter)

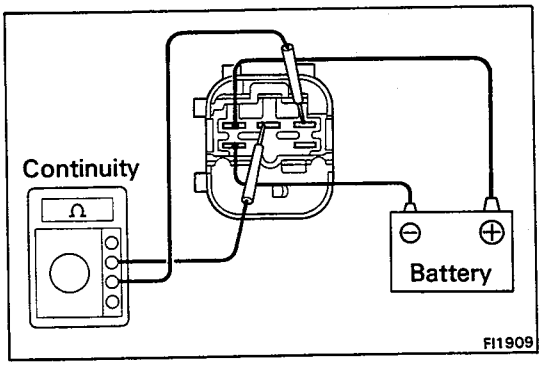
1. INSPECT RELAY CONTINUITY

(a) Using an ohmmeter, check that there is continuity between terminals STA and E1.

(b) Check that there is continuity between terminals +B and FC.

(c) Check that there is no continuity between terminals +B and FP.

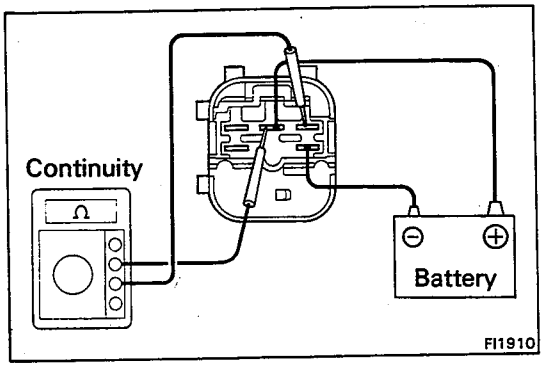
If continuity is not as specified, replace the relay.



2. INSPECT RELAY OPERATION

(a) Apply battery voltage across terminals STA and E1.

(b) Using an ohmmeter, check that there is continuity between terminals +B and FP.

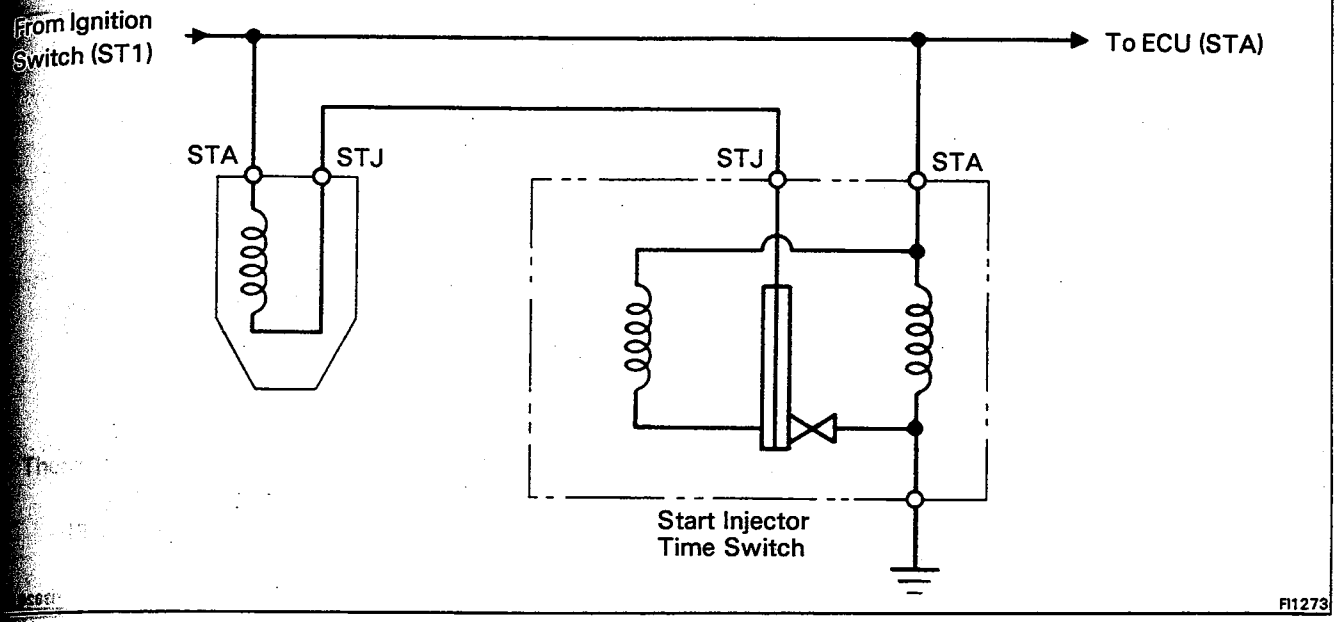


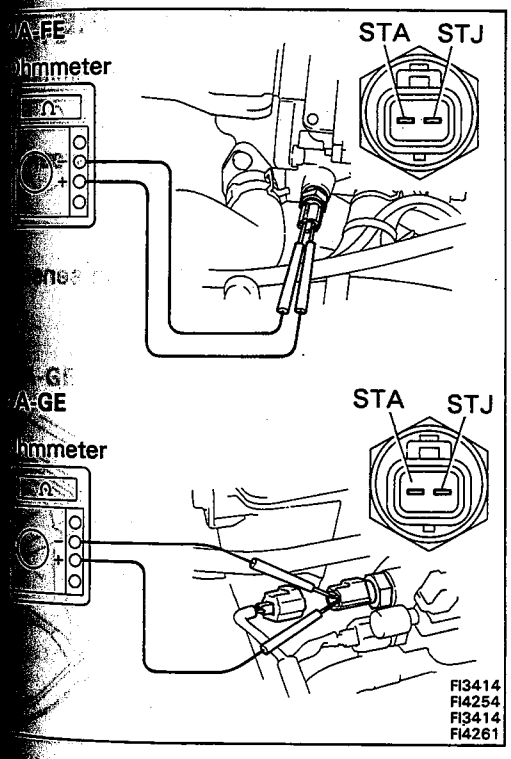
(c) Apply battery voltage across terminals +B and FC.

(d) Check that there is continuity between terminals STA and FP.

If operation is not as specified, replace the relay.

Start Injector Time Switch





INSPECTION OF START INJECTOR TIME SWITCH

INSPECT START INJECTOR TIME SWITCH

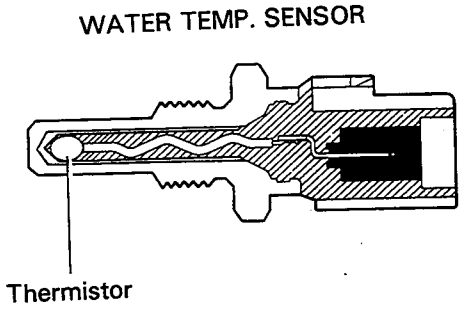
Using an ohmmeter, measure the resistance between each terminal.

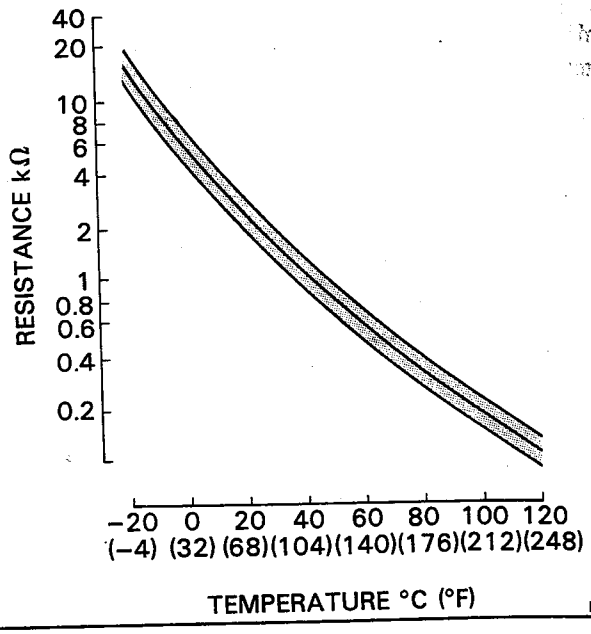
Resistance:

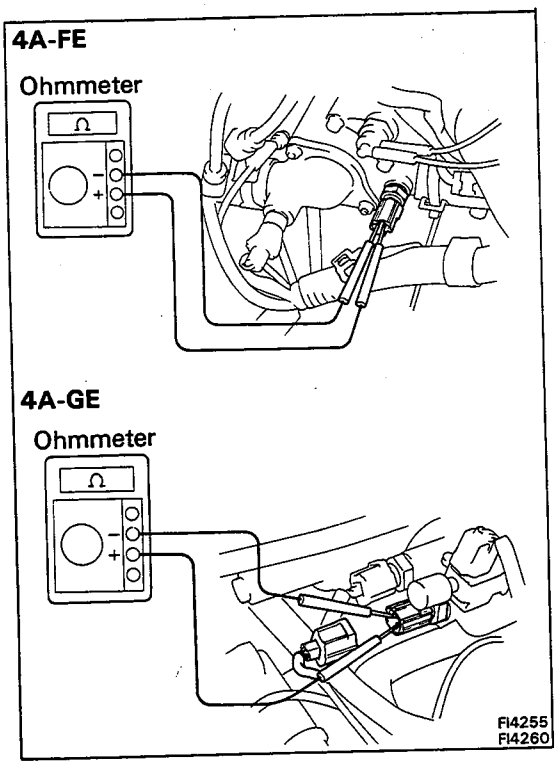
STA — STJ	**20 — 40 Ω below 30°C (86°F)**
	40 — 60 Ω above 40°C (104°F)
STA — Ground	**20 — 80 Ω**

If the resistance is not as specified, replace the switch.

Water Temperature Sensor







INSPECTION OF WATER TEMPERATURE SENSOR

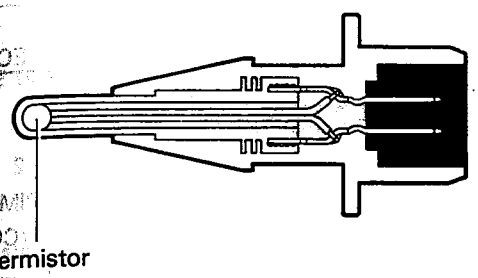
INSPECT WATER TEMPERATURE SENSOR

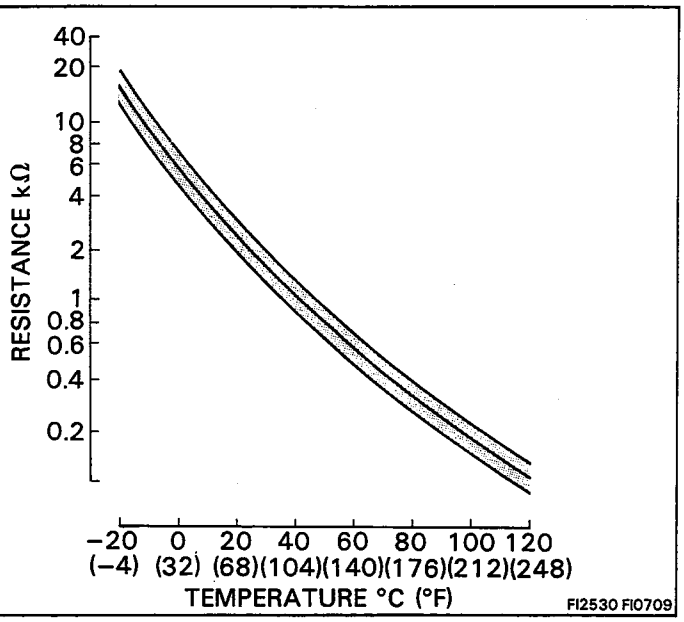
Using an ohmmeter, measure the resistance between terminals.

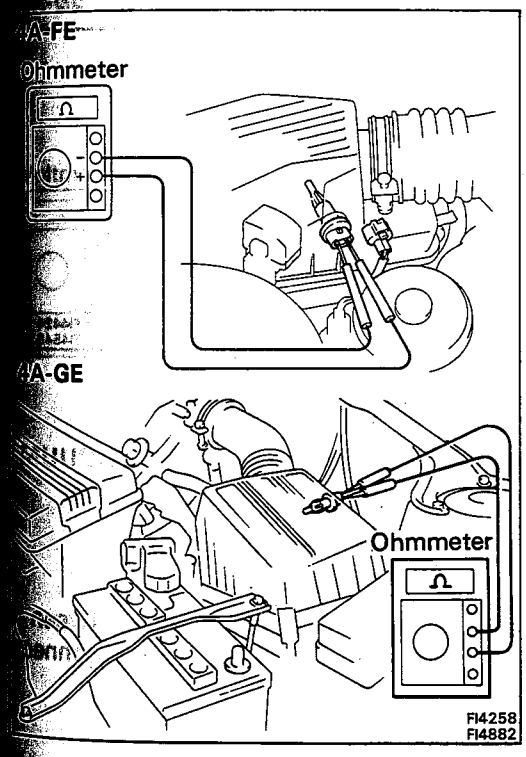
Resistance: Refer to the chart above

If the resistance is not as specified, replace the sens

Intake Air Temperature Sensor (w/o Air Flow Meter)







INSPECTION OF INTAKE AIR TEMPERATURE SENSOR

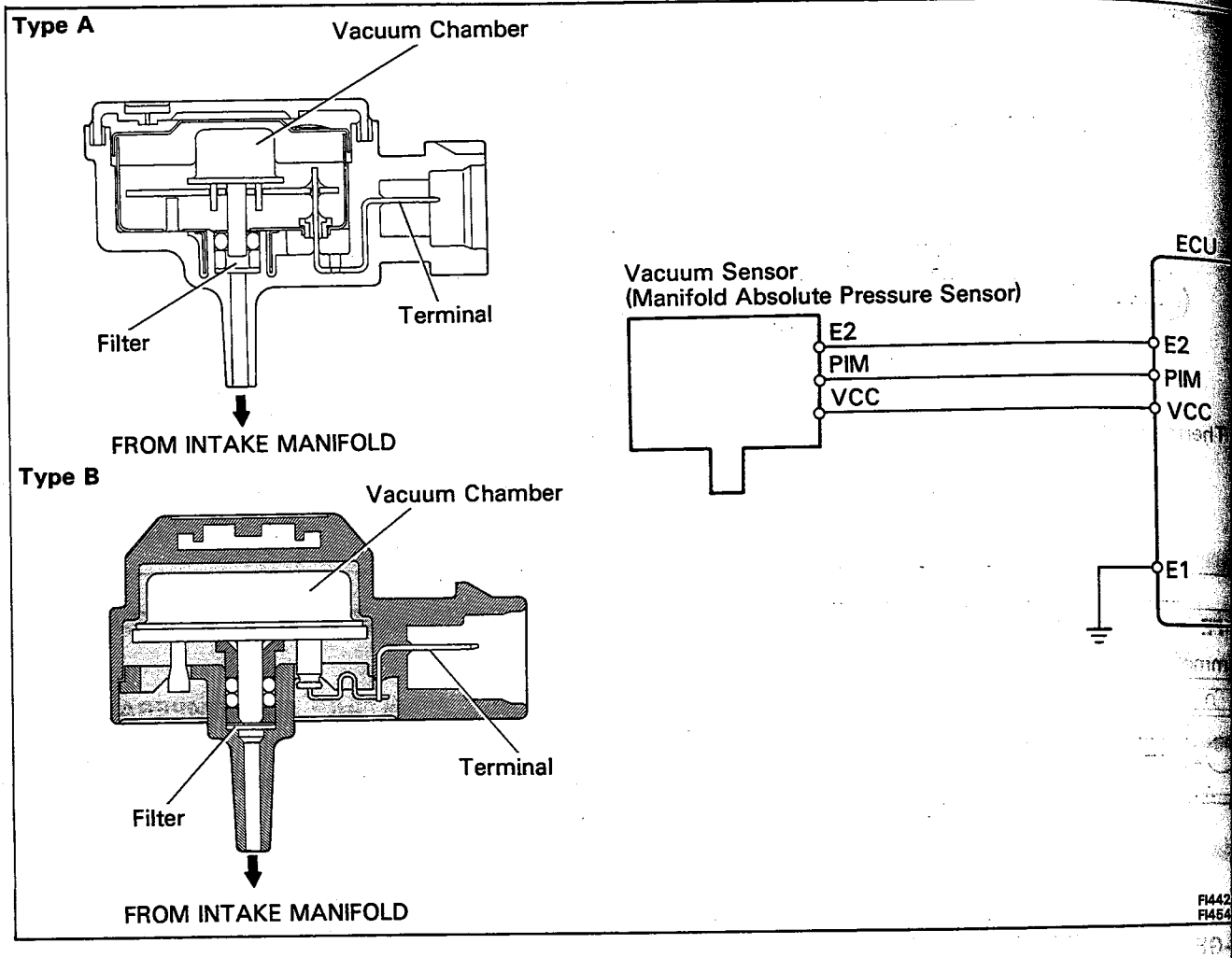
INSPECT RESISTANCE OF INTAKE AIR TEMPERATURE SENSOR

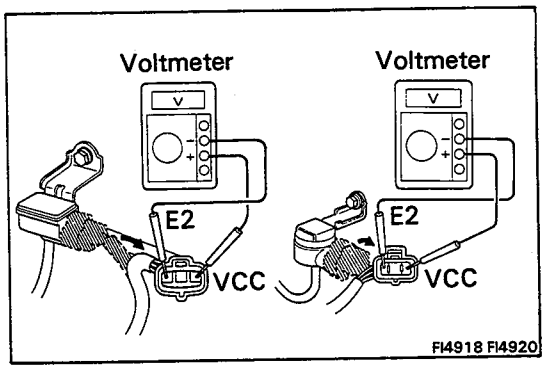
Using an ohmmeter, measure the resistance between the terminals.

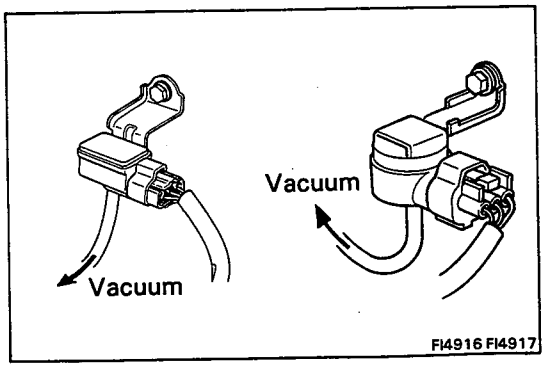
Resistance: Refer to the chart above

If the resistance is not as specified, replace the sensor.

Vacuum Sensor (w/o Air Flow Mete
(Manifold Absolute Pressure Senso





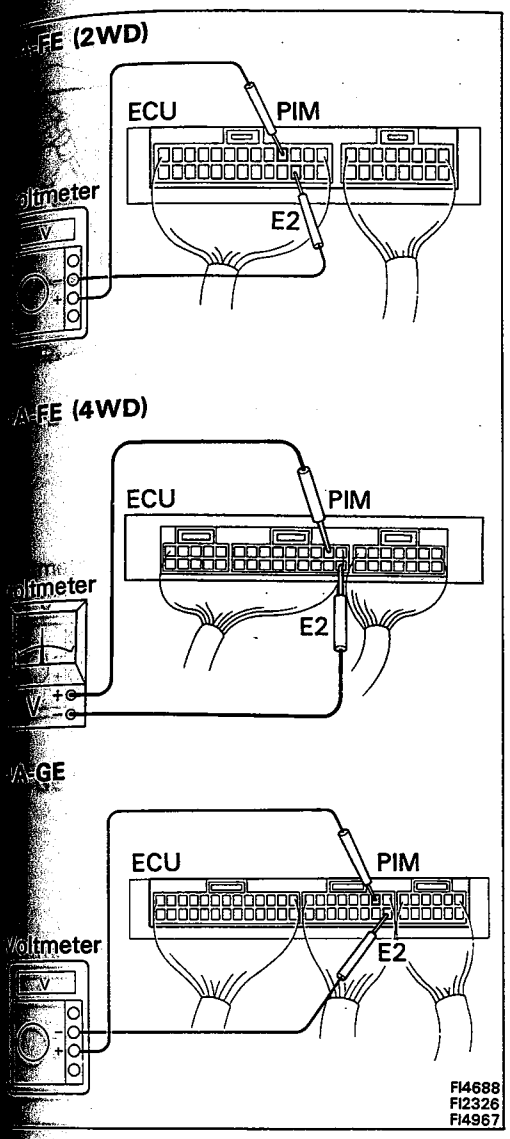


INSPECTION OF VACUUM SENSOR

1. **INSPECT POWER SOURCE VOLTAGE OF VACU SENSOR**
   (a) Disconnect the vacuum sensor connector.
   (b) Turn the ignition switch ON.
   (c) Using a voltmeter, measure the voltage betwee minals VCC and E2 of the vacuum sensor conn

   Voltage: 4 – 6 V

2. **INSPECT POWER OUTPUT OF VACUUM SENSO**
   (a) Turn the ignition switch ON.
   (b) Disconnect the vacuum hose of the intake ma side.



(c) Connect a voltmeter to terminals PIM and E2 of the ECU, and measure and record the output voltage under ambient atmospheric pressure.

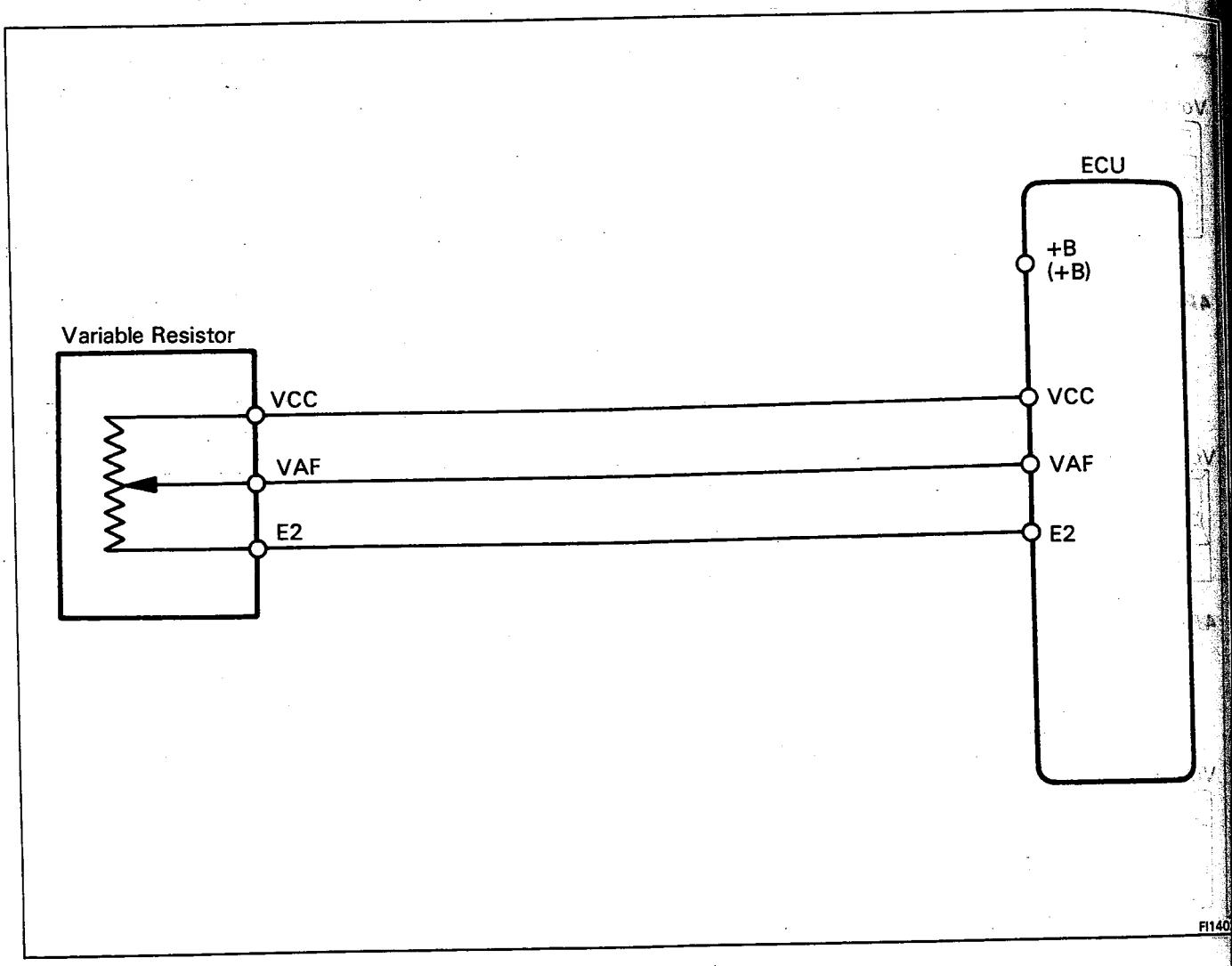
(d) Apply vacuum to the vacuum sensor in 100 mmHg (3.94 in.Hg, 13.3 kPa) segments to 500 mmHg (19.69 in.Hg, 66.7 kPa).

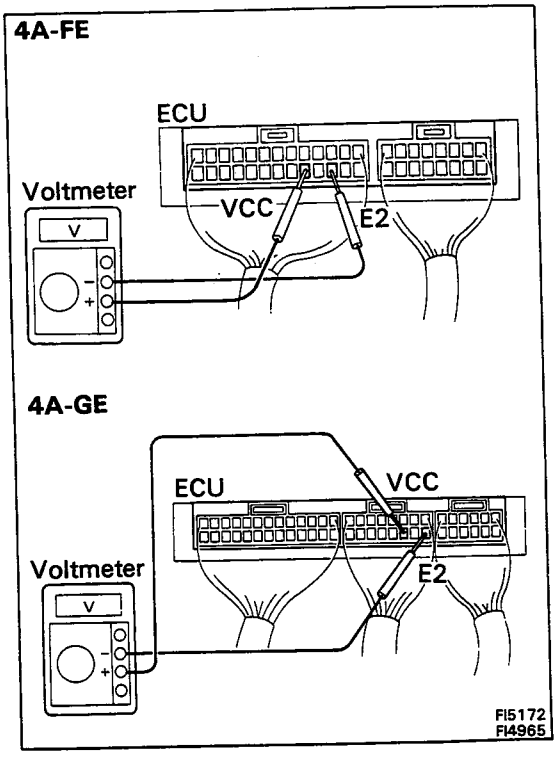
(e) Measure voltage drop from step (c) above for each segment.

Voltage drop

Applied Vacuum mmHg (in.Hg, kPa)	100 (3.94 13.3)	200 (7.87 26.7)	300 (11.81 40.0)	400 (15.75 53.3)	500 (19.69 66.7)
Voltage drop V	0.3–0.5	0.7–0.9	1.1–1.3	1.5–1.7	1.9–2.1

Variable Resistor (w/o TWC)



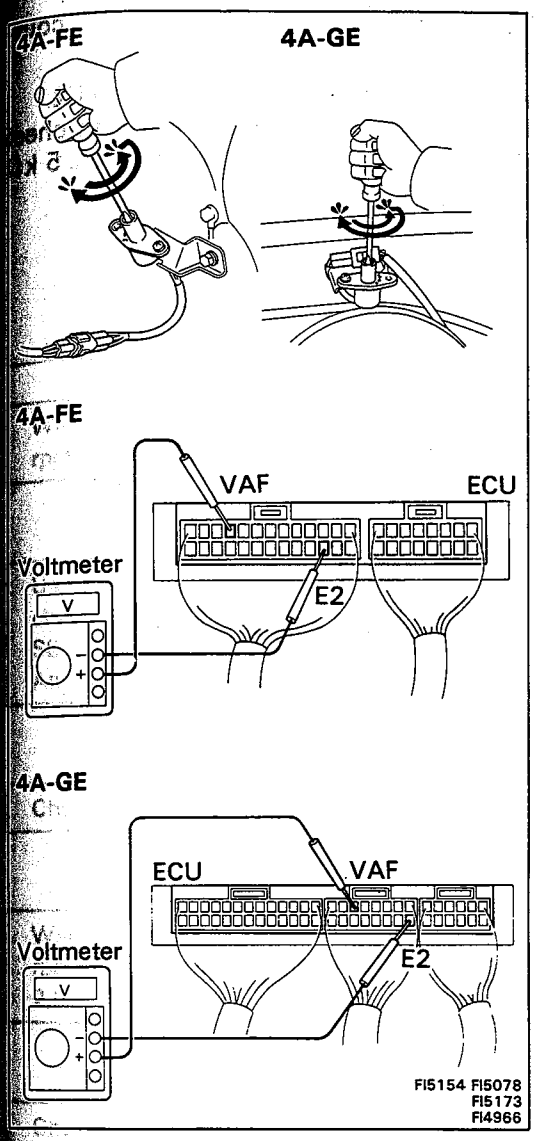


INSPECTION OF VARIABLE RESISTOR

1. INSPECT VOLTAGE OF VARIABLE RESISTOR

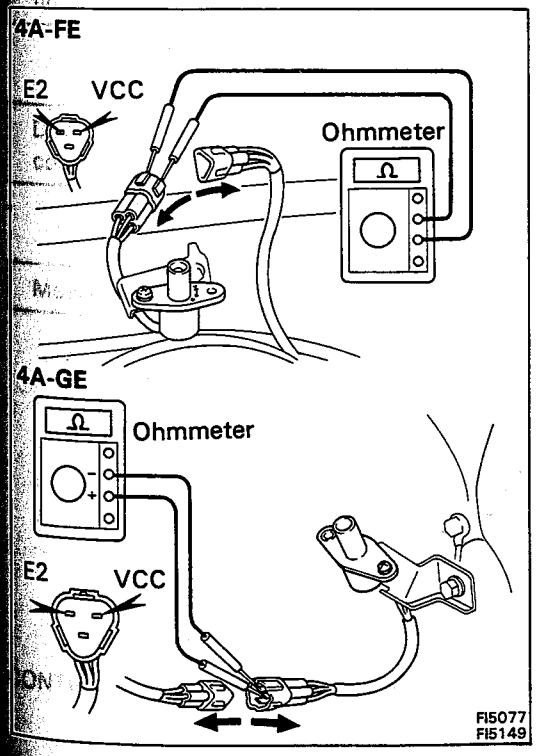
(a) Using a voltmeter, measure the voltage between ECU terminals VCC and E2.

Voltage: 4 – 6 V



(b) Measure the voltage between ECU terminals VAF and E2 while slowly turning idle mixture adjusting screw first fully counterclockwise, and then fully clockwise.

(c) Check that the voltage changes smoothly from 0 V to approx. 5 V.

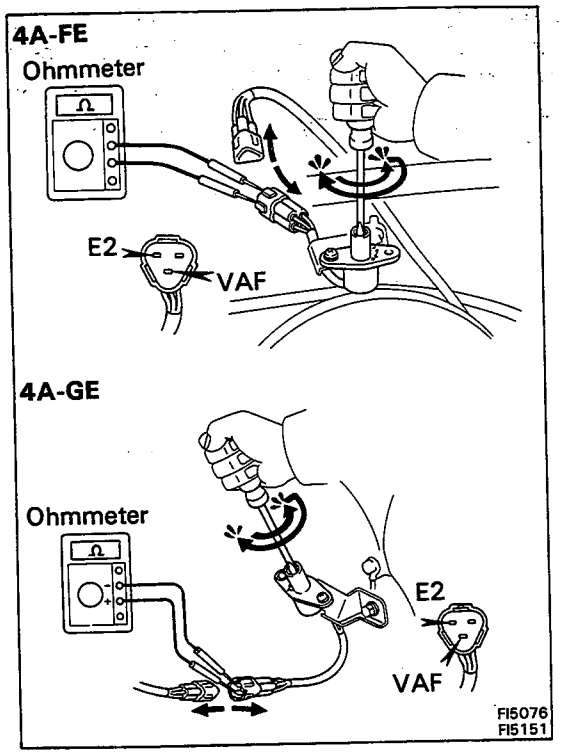


2. INSPECT RESISTANCE OF VARIABLE RESISTOR

(a) Disconnect the variable resistor connector.

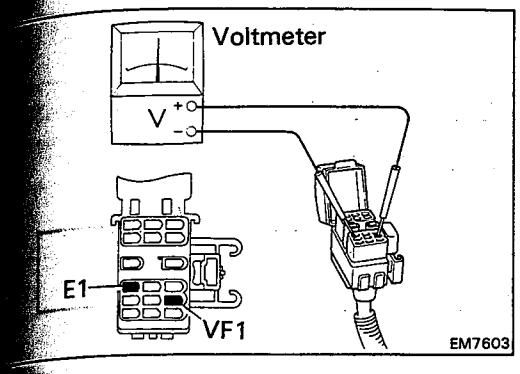
(b) Using an ohmmeter, measure the resistance between the terminals VCC and E2.

Resistance: 4 – 6 kΩ



(c) Turn the idle mixture adjusting screw fully counterclockwise.

(d) Connect an ohmmeter to terminals VAF and E2. Turn the adjusting screw fully clockwise and check that the resistance value changes from approx. 5 kΩ to 0 Ω accordingly.



Oxygen Sensor (w/ TWC)

INSPECTION OF OXYGEN SENSOR

1. WARM UP ENGINE

Allow the engine to reach normal operating temperature.

2. INSPECT FEEDBACK VOLTAGE (VF)

Connect the positive (+) probe of a voltmeter to terminal VF1 of the check connector, and negative (−) probe to terminal E1. Perform the test as follows:

Warm up the oxygen sensor with the engine at 2,500 rpm for approx. 90 seconds.

Using SST, connect terminals TE1 and E1 of the check connector.
SST 09843-18020
And maintain engine speed at 2,500 rpm

Check the number of times the voltmeter needle fluctuates in 10 seconds.

- 4A-FE Less than 8 times, 4A-GE Less than 6 times → Warm up the oxygen sensor with the engine at 2,500 rpm for approx. 90 seconds. And maintain engine at 2,500 rpm.
- 4A-FE 8 times or more, 4A-GE 6 times or more → Normal
- Zero → Replace the ECU. → Zero again / After replacing the oxygen sensor

Check the number of times the voltmeter needle fluctuates in 10 seconds.

- 6 times or more → Normal
- Zero → ③
- 4A-FE Less than 8 times, 4A-GE Less than 6 times → Disconnect terminals TE1 and E1 of the check connector. And maintain engine speed at 2,500 rpm.

Measure voltage between terminals VF1 and E1.

- More than 0 V → ①
- 0 V → Read and record diagnostic codes. (See pages FI-28 to 31)
  - Normal code and code 21 → ②
  - Malfunction code(s) (Ex. code 21) → Repair the relevant diagnostic code.

④

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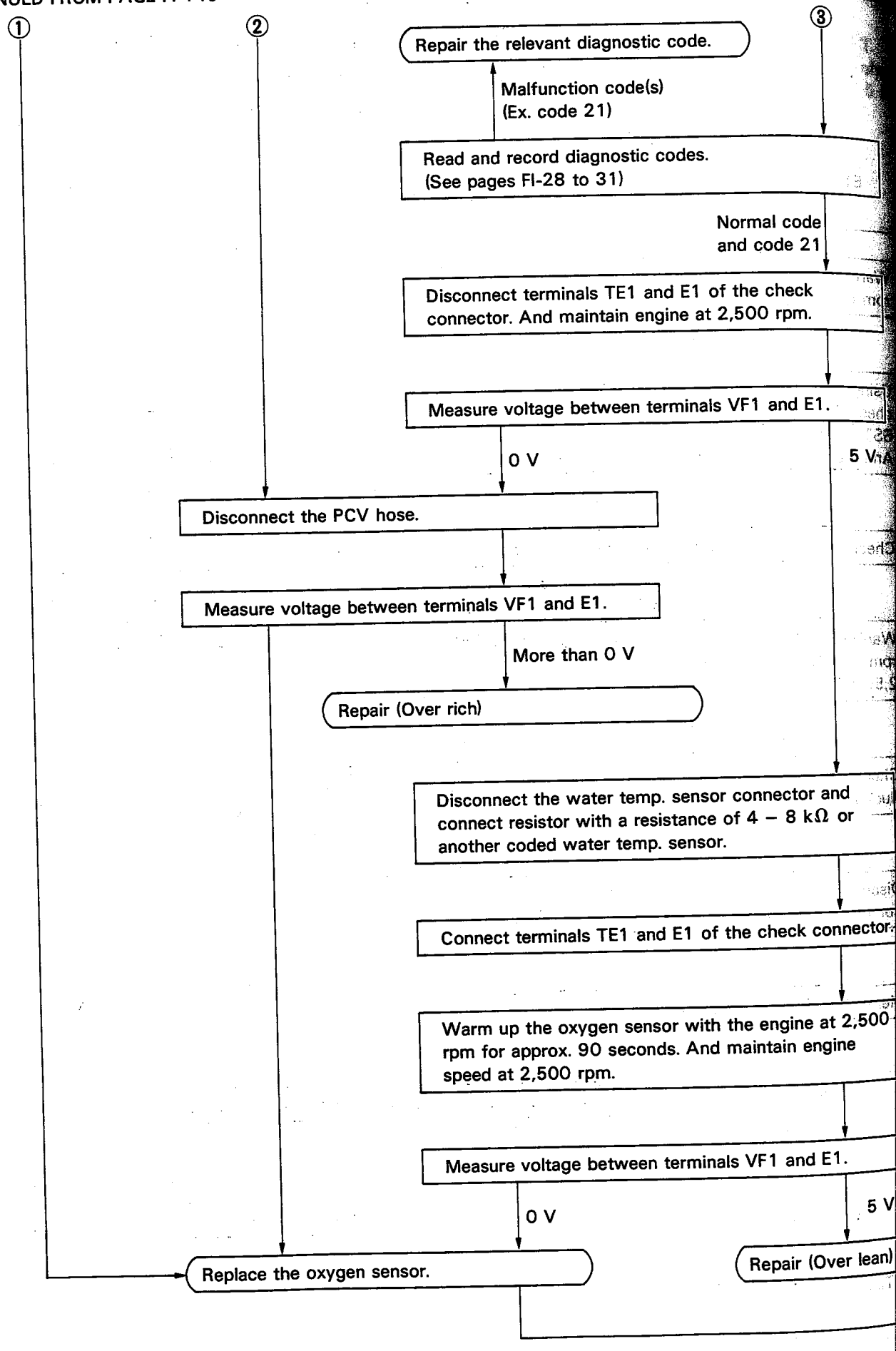
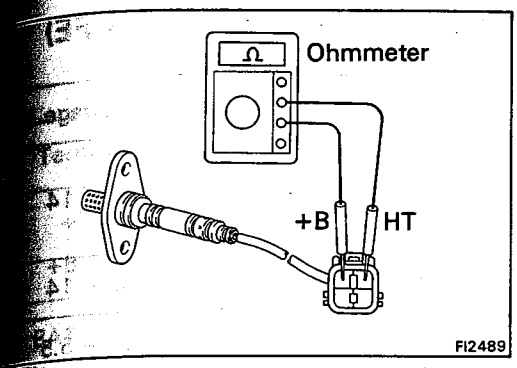
CONTINUED FROM PAGE FI-145





3. **INSPECT HEATER COIL RESISTANCE OF OXYGEN SENSOR**

Using an ohmmeter, measure the resistance between the terminals +B and HT.

Resistance: 5.1 — 6.3 Ω

If the resistance is not as specified, replace the sensor.

Engine ECU

INSPECTION OF ECU

HINT: The EFI circuit can be checked by measuring the resistance and voltage at the wiring connectors of the ECU.

1. **PREPARATION**
(See page FI-36)

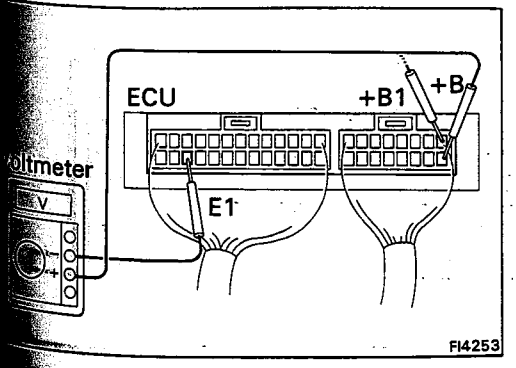
2. **INSPECT VOLTAGE OF ENGINE ECU**

Check the voltage between each terminal of the wiring connectors.

- **Turn the ignition switch ON.**
- **Measure the voltage at each terminal**

HINT:

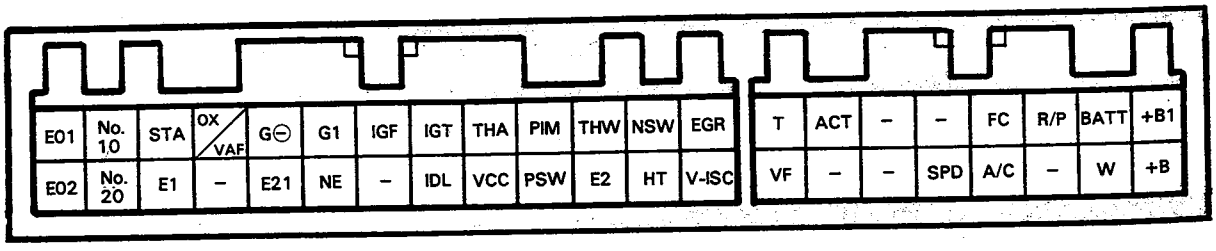
- **Perform all voltage measurements with the connectors connected.**
- **Verify that the battery voltage is 11 V or more when the ignition switch is ON position.**



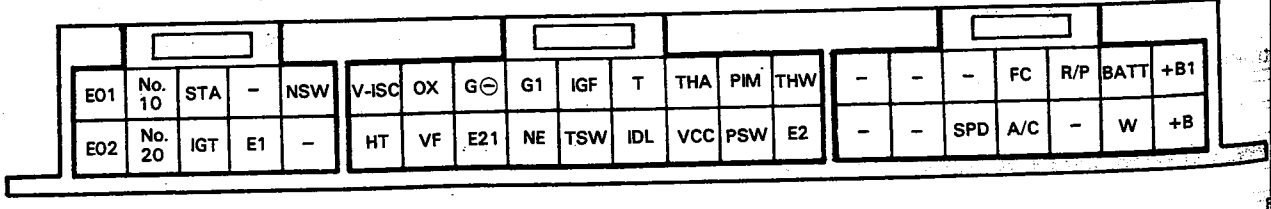
Voltage at ECU Wiring Connectors (4A-FE)

Terminals	Condition		STD voltage (V)
+B – E1	Ignition SW ON		10 – 14
+B1 – E1			
BATT – E1	–		10 – 14
IDL – E2	Ignition SW ON	Throttle valve open	4.5 – 5.5
PSW – E2		Throttle valve fully closed	4.5 – 5.5
No.10 – E01 No.20 – E02	Ignition SW ON		10 – 14
W – E1	Ignition SW ON		0
	No trouble ("CHECK ENGINE" light off) and engine running		10 – 14
PIM – E2	Ignition SW ON		3.3 – 3.9
VCC – E2			4.5 – 5.5
THA – E2	Ignition SW ON	Intake air temperature 20°C (68°F)	2.0 – 2.5
THW – E2		Coolant temperature 80°C (176°F)	0.4 – 0.7
STA – E1	Cranking		6 – 14
IGT – E1	Idling		0.7 – 1.0
A/C – E1	Ignition SW ON	A/C switch ON	5 – 14
		A/C switch OFF	0
T – E1	Ignition SW ON	Check connector TE1 – E1 not connect	10 – 14
		Check connector TE1 – E1 connect	0

ECU Terminals (2WD)



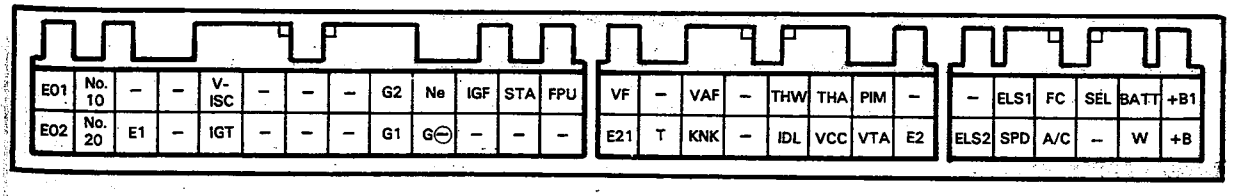
ECU Terminals (4WD)



Voltage at ECU Wiring Connectors (4A-GE w/o Air Flow Meter)

Terminals	Condition		STD voltage (V)
+B, +B1 – E1	Ignition SW ON		10 – 14
BATT – E1	–		10 – 14
IDL – E2	Ignition SW ON	Throttle valve open	4.5 – 5.5
VTA – E2		Throttle valve fully closed	0.5 or less
		Throttle valve fully open	3.5 – 5.5
VCC – E2		–	4.5 – 5.5
IGT – E1	Idling		0.7 – 1.0
STA – E2	Cranking		6 – 14
No.10, No.20 – E01, E02	Ignition SW ON		10 – 14
W – E1	No trouble ("CHECK ENGINE" warning light off) and engine running		10 – 14
PIM – E2	Ignition SW ON		3.3 – 3.9
VCC – E2			4.5 – 5.5
THA – E2	Ignition SW ON	Intake air temp. 20°C (68°F)	2.0 – 2.8
THW – E2		Coolant temp. 80°C (176°F)	0.4 – 0.7
A/C – E1		Air conditioning ON	10 – 14
T – E1		Check connector TE1 – E1 not connect	10 – 14
		Check connector TE1 – E1 connect	0.5 or less

ECU Terminals

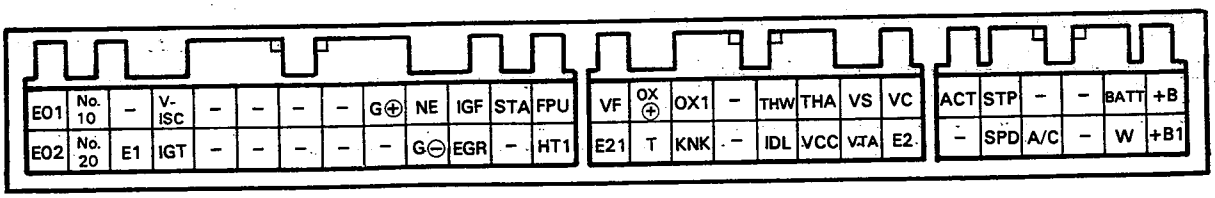


FI4265

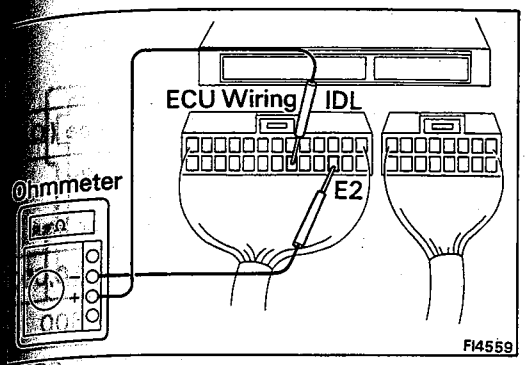
Voltage at ECU Wiring Connectors (4A-GE w/ Air Flow Meter)

Terminals	Condition		STD voltage (V)
+B, +B1 – E1	Ignition SW ON		10 – 14
BATT – E1	–		10 – 14
IDL – E2	Ignition SW ON	Throttle valve open	10 – 14
VTA – E2		Throttle valve fully closed	0.1 – 1.0
		Throttle valve fully open	4 – 5
VCC – E2		–	4.5 – 5.5
IGT – E1	Idling		0.7 – 1.0
STA – E2	Cranking		6 – 14
No.10 – E01, No.20 – E02	Ignition SW ON		10 – 14
W – E1	No trouble ("CHECK ENGINE" warning light off) and engine running		10 – 14
VC – E2	–		4.5 – 5.5
VS – E2	Ignition SW ON	Measuring plate fully closed	2.0 – 5.5
		Measuring plate fully open	6 – 9
	Idling		2 – 8
THA – E2	Ignition SW ON	Intake air temp. 20°C (68°F)	2.0 – 2.8
THW – E2		Coolant temp. 80°C (176°F)	0.4 – 0.7
A/C – E1		Air conditioning ON	10 – 14
T – E1		Check connector TE1 – E1 not connect	10 – 14
		Check connector TE1 – E1 connect	0.5 or less

ECU Terminals



FI4



2. INSPECT RESISTANCE OF ECU

NOTICE:

- **Do not touch the ECU terminals.**
- **The tester probe should be inserted into the wiring connector from the wiring side.**

Check the resistance between each terminal of the wiring connectors.

- Disconnect the connectors from the ECU.
- Measure the resistance at each terminal.

Resistance of ECU Wiring Connectors (4A-FE)

Terminals	Condition	Resistance (Ω)
IDL – E2	Throttle valve open	Infinity
	Throttle valve fully closed	0
PSW – E2	Throttle valve fully open	0
	Throttle valve fully closed	Infinity
THA – E2	Intake temperature 20°C (68°F)	2,000 – 3,000
THW – E2	Coolant temperature 80°C (176°F)	200 – 400
G1 – G ⊖	–	140 – 180
NE – G ⊖	–	140 – 180

ECU Terminals (2WD)

E01	No. 10	–	OX / VAF	G⊖	G1	IGF	IGT	THA	PIM	THW	NSW	EGR
E02	No. 20	–	–	E21	NE	–	IDL	VCC	PSW	E2	HT	V-ISC

T	ACT	–	–	FC	R/P	BATT	+B1
VF	–	–	SPD	A/C	–	W	+B

ECU Terminals (4WD)

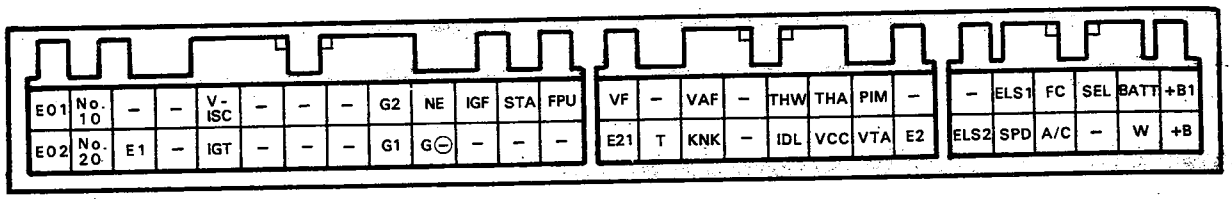
E01	No. 10	STA	–	NSW	V-ISC	OX	G⊖	G1	IGF	T	THA	PIM	THW	–	–	–	FC	R/P	BATT	+B1
E02	No. 20	IGT	E1	–	HT	VF	E21	NE	TSW	IDL	VCC	PSW	E2	–	–	SPD	A/C	–	W	+B

FI4266
FI0234

Resistance of ECU Wiring Connectors (4A-GE w/o Air Flow Meter)

Terminals	Condition	Resistance (Ω)
IDL – E2	Throttle valve open	Infinity
	Throttle valve fully closed	2,300 or less
VTA – E2	Throttle valve fully open	3,300 – 10,000
	Throttle valve fully closed	200 – 800
VCC – E2	–	3,000 – 7,000
THA – E2	Intake air temp. 20°C (68°F)	2,000 – 3,000
THW – E2	Coolant temp. 80°C (176°F)	200 – 400
G1, G2 – G⊖	–	140 – 180
NE – G⊖	–	140 – 180

ECU Terminals

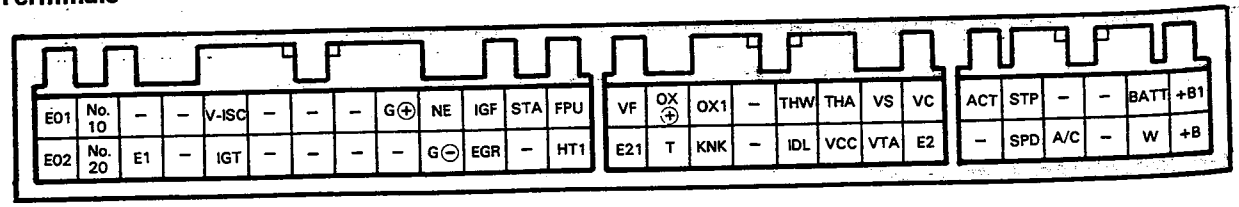


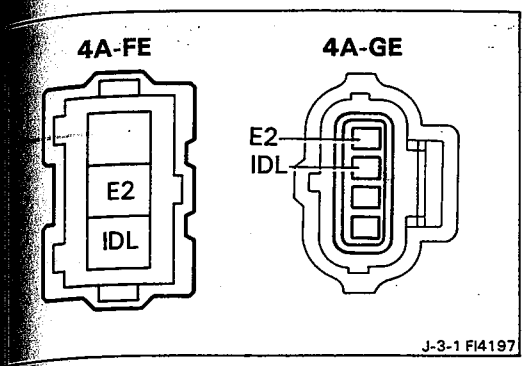
FI42

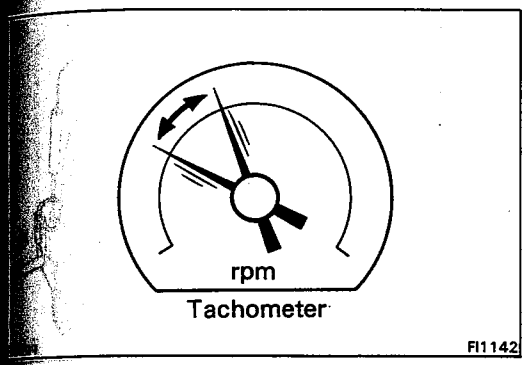
Resistance at ECU Wiring Connectors (4A-GE w/ Air Flow Meter)

Terminals	Condition	Resistance (Ω)
IDL – E2	Throttle valve open	Infinity
	Throttle valve fully closed	2,300 or less
VTA – E2	Throttle valve fully open	3,300 – 10,0
	Throttle valve fully closed	200 – 800
VCC – E2	–	3,000 – 7,00
VS – E2	Measuring plate fully closed	20 – 400
	Measuring plate fully open	20 – 3,00
VC – E2	–	100 – 300
THA – E2	Intake air temp. 20°C (68°F)	2,000 – 3,00
THW – E2	Coolant temp. 80°C (176°F)	200 – 400
G⊕ – G⊖	–	140 – 180
NE – G⊖	–	140 – 180

ECU Terminals







Fuel Cut RPM

INSPECTION OF FUEL CUT RPM

(a) Start and warm up the engine.

(b) Disconnect the connector from the throttle position sensor.

(c) Connect circuit terminals IDL and E2 on the wiring connector side.

(d) Gradually raise the engine rpm and check that there is fluctuation between the fuel cut and fuel return points.

HINT:

- The vehicle should be stopped.
- Accessories switched off.

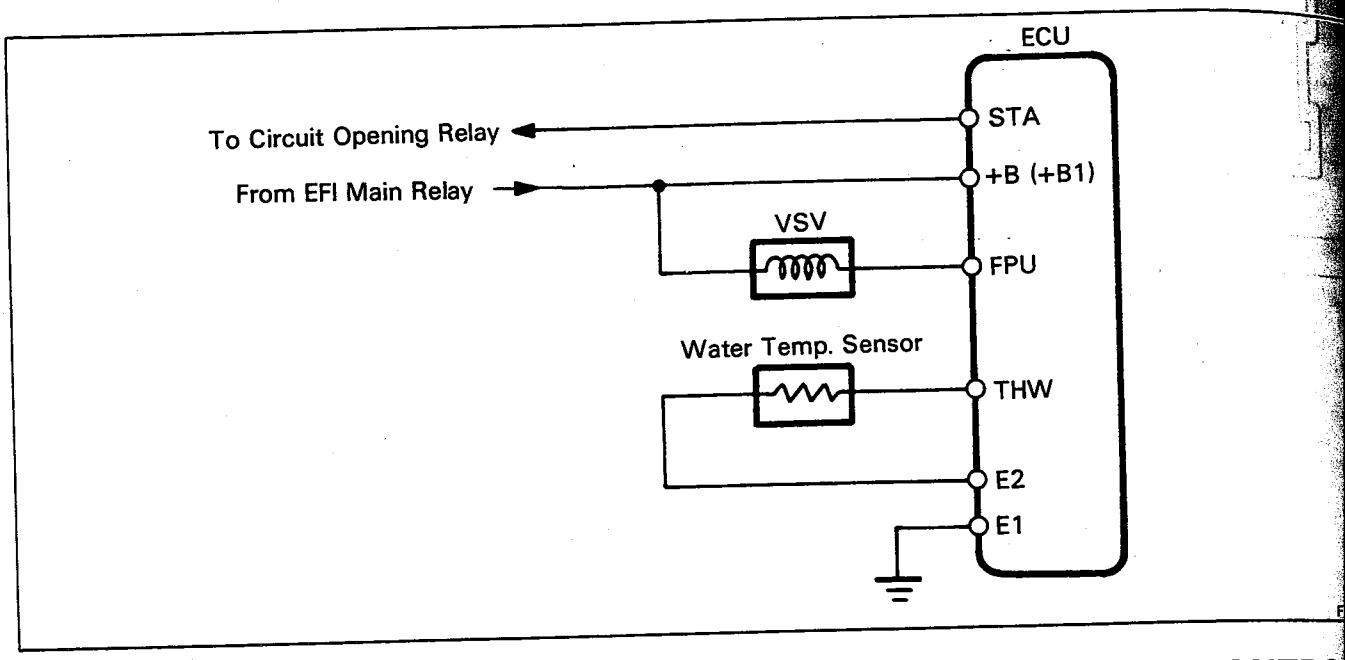
Fuel cut rpm:

4A-FE	**w/o TWC**	**1,700 rpm**
	w/ TWC	**1,900 rpm**
4A-GE	**w/o Air flow meter**	**1,450 rpm**
	w/ Air flow meter	**1,600 rpm**

Fuel return rpm:

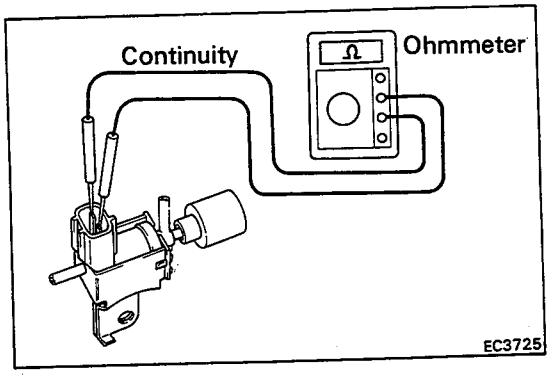
4A-FE	**w/o TWC**	**1,200 rpm**
	w/ TWC	**1,200 rpm**
4A-GE	**w/o Air flow meter**	**1,050 rpm**
	w/ Air flow meter	**1,200 rpm**

Fuel Pressure Control System (4A-GE Europe)



INSPECTION OF FUEL PRESSURE CONTRO SYSTEM

1. **INSPECT WATER TEMPERATURE SENSOR**
(See page FI-138)



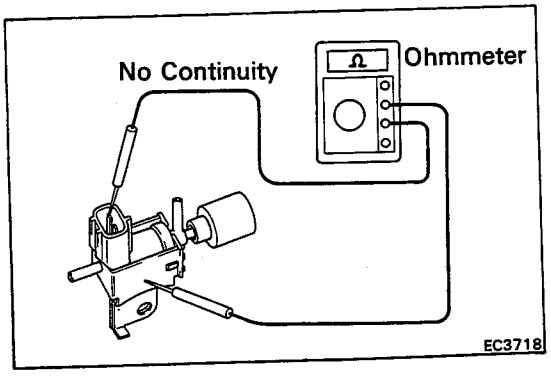
2. **INSPECT FUEL PRESSURE VSV**

A. Inspect VSV for open circuit

Using an ohmmeter, check that there is continuity ween the terminals.

Resistance (Cold): 33 – 39 Ω

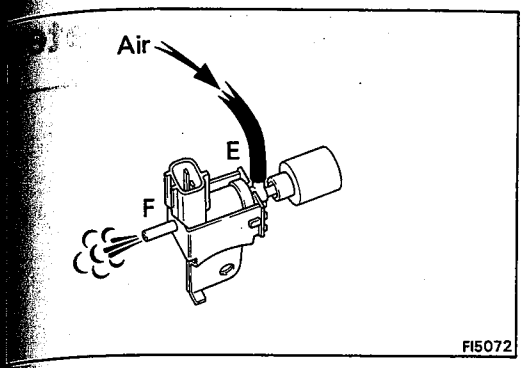
If there is no continuity, replace the VSV.



B. Inspect VSV for ground

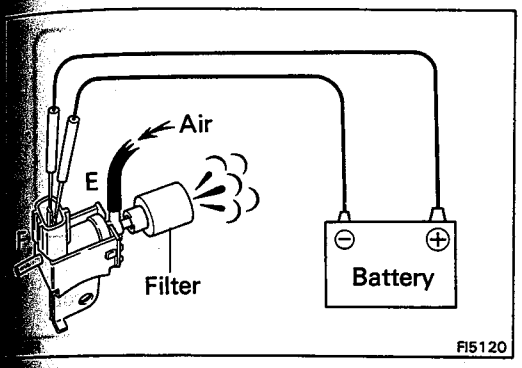
Using an ohmmeter, check that there is no continuit ween each terminal and the body.

If there is continuity, replace the VSV.



C. Inspect VSV operation

(a) Check that air does not flow from pipe E to pipe F.

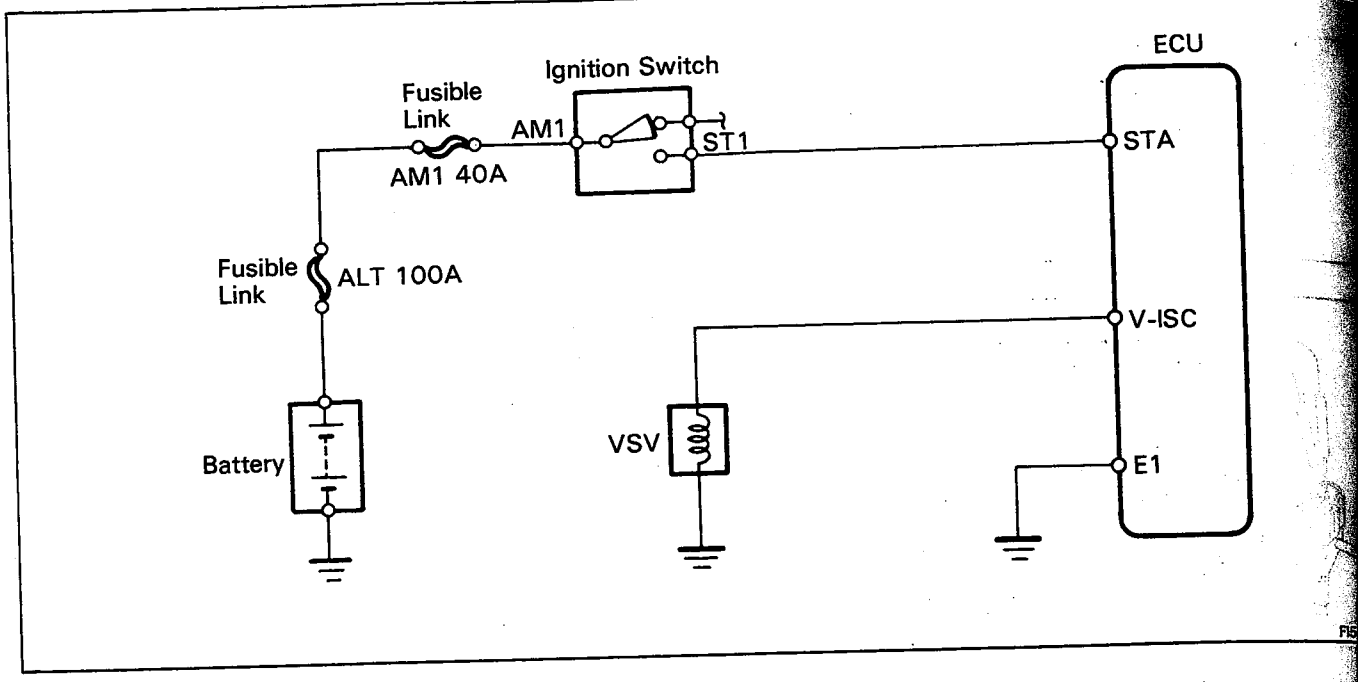


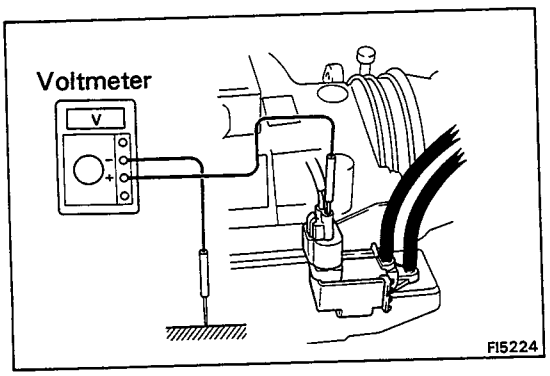
(b) Apply battery voltage across the terminals.

(c) Check that air flows from pipe E to the filter.

If operation is not as specified, replace the VSV.

Idle-up System (w/ Air Flow Meter



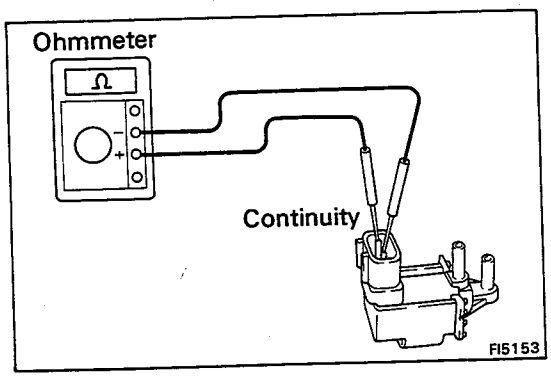


INSPECTION OF IDLE-UP SYSTEM

1. INSPECTION BATTERY VOLTAGE OF IDLE-UP VSV

(a) All accessories switched off.

(b) Using a voltmeter, check that it indicates batt voltage during cranking and for ten seconds a starting.



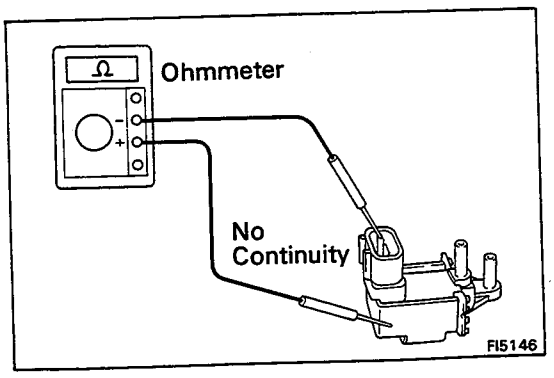
2. INSPECT IDLE-UP VSV

A. Inspect VSV for open circuit

Using an ohmmeter, check that there is continuity ween the terminals.

Resistance (Cold): 37 – 44 Ω

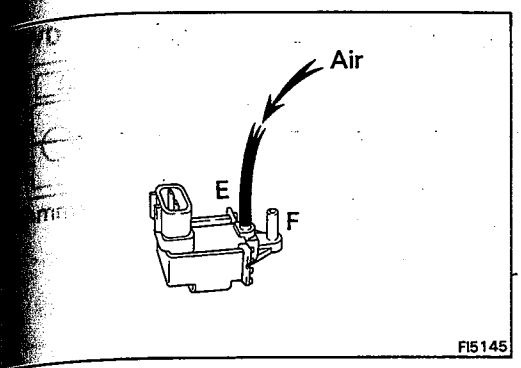
If there is no continuity, replace the VSV.



B. Inspect VSV for ground

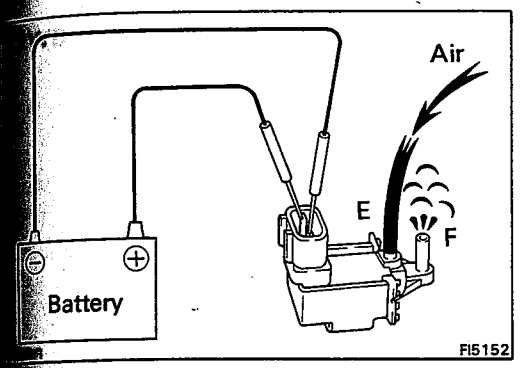
Using an ohmmeter, check that there is no continuity ween each terminal and the body.

If there is continuity, replace the VSV.



C. Inspect VSV operation

(a) Check that air flows from pipe E to pipe F.

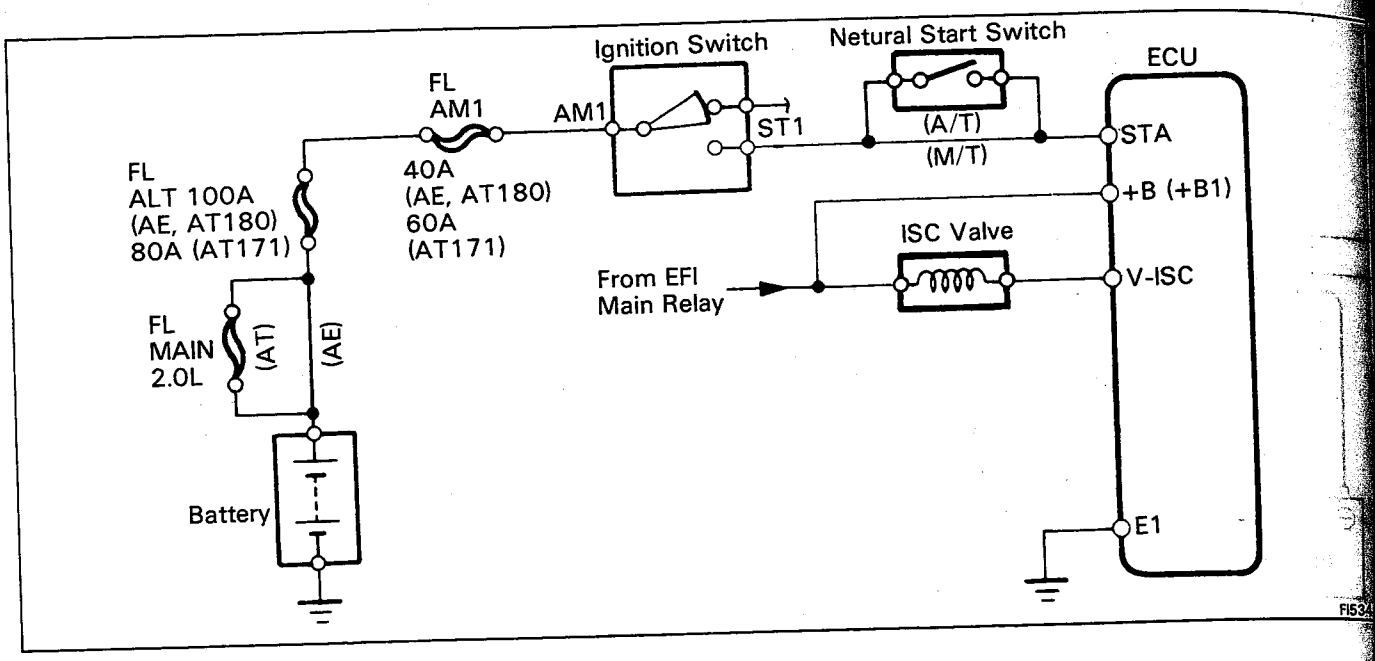


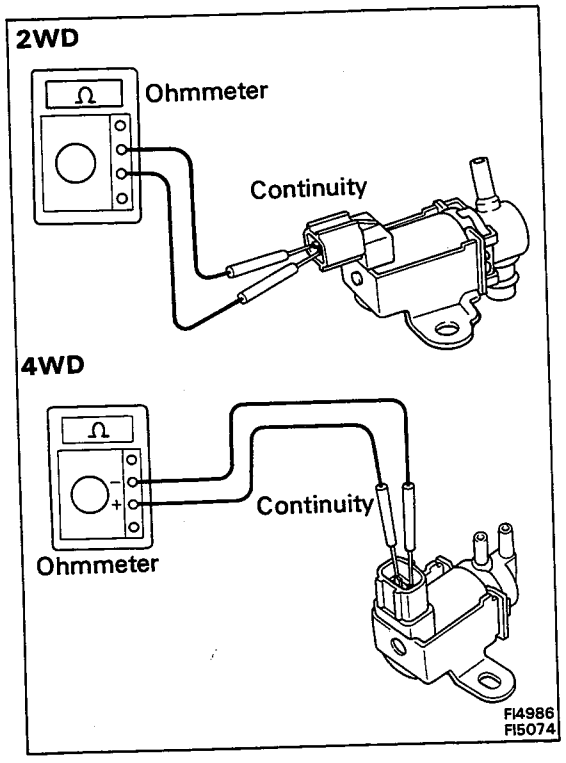
(b) Apply battery voltage across the terminals.

(c) Check that air flows from pipe E to pipe F.

If operation is not as specified, replace the VSV.

Idle Speed Control (ISC) Valve (4A-FE)





INSPECTION OF ISC VALVE

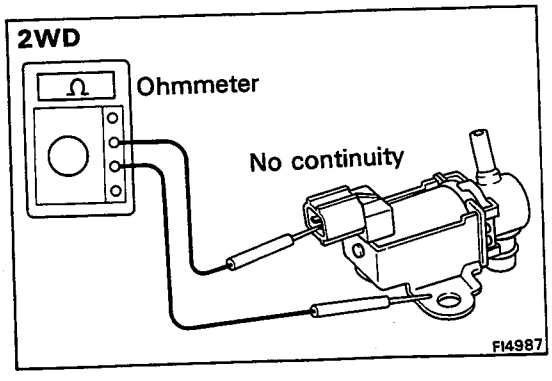
INSPECT ISC VALVE

A. Inspect ISC Valve for open circuit

Using an ohmmeter, check that there is continuity between the terminals.

Resistance: **2WD** **30 – 33 Ω**
4WD **30 – 34 Ω**

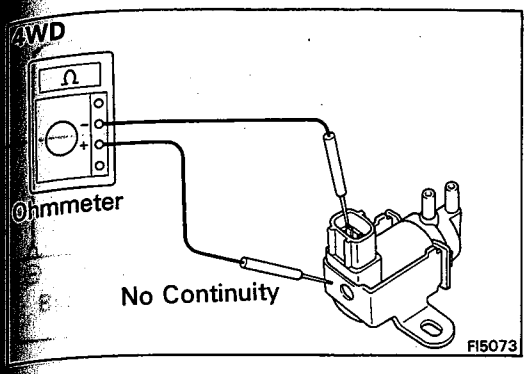
If there is no continuity, replace the ISC valve.

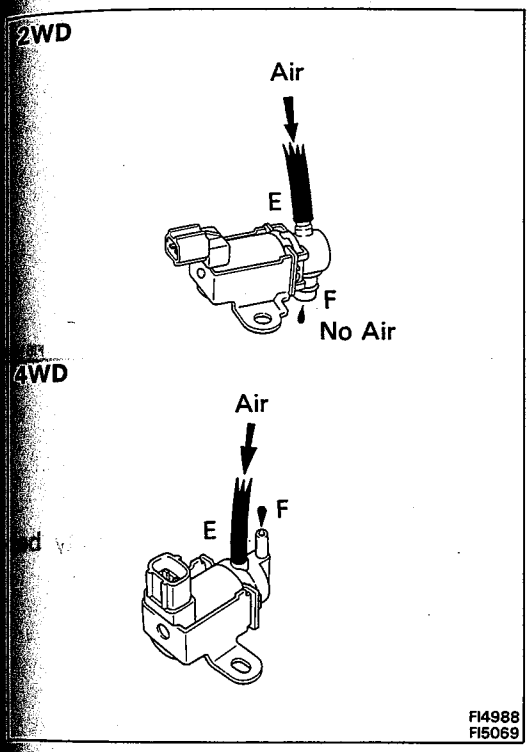


B. Inspect ISC valve for ground

Using an ohmmeter, check that there is no continuity between each terminal and body.

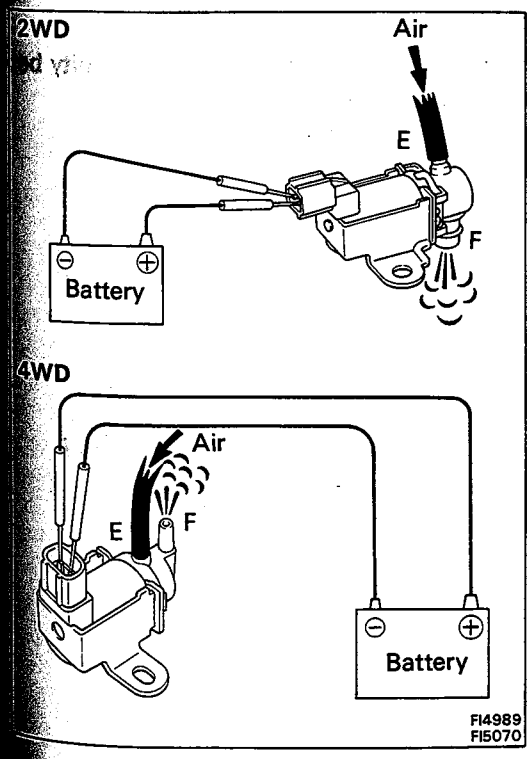
If there is continuity, replace the ISC valve.





C. Inspect ISC valve operation

(a) Check that air does not flow from pipes E to F.

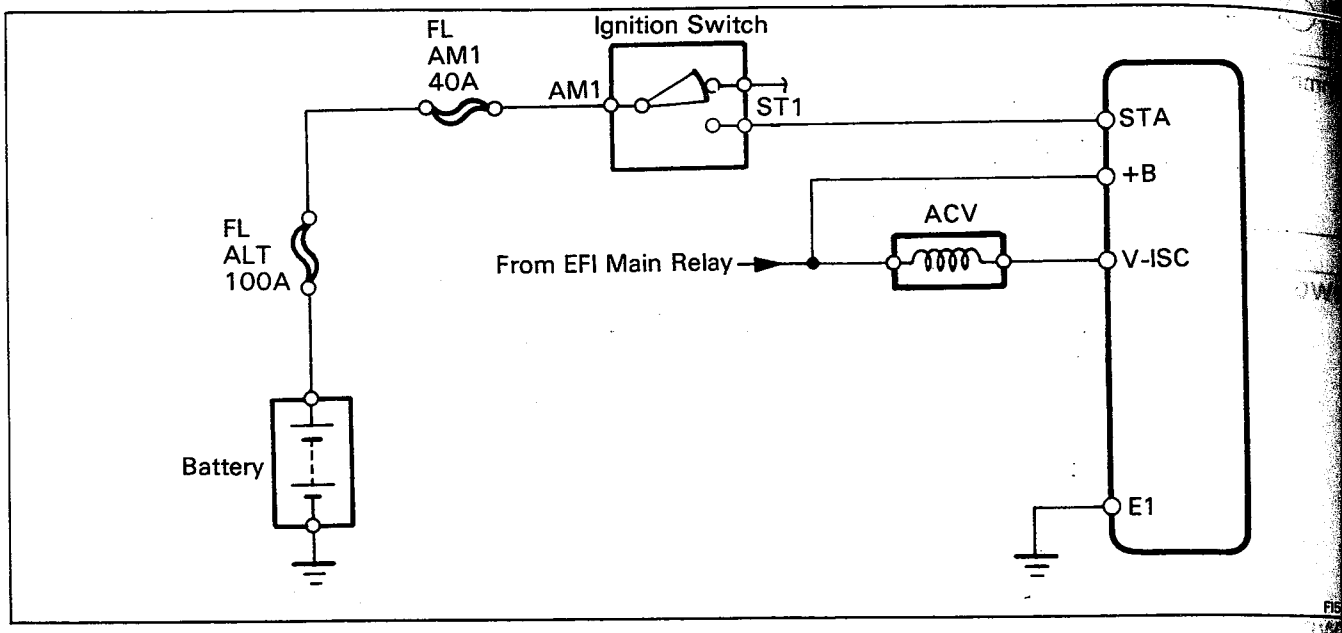


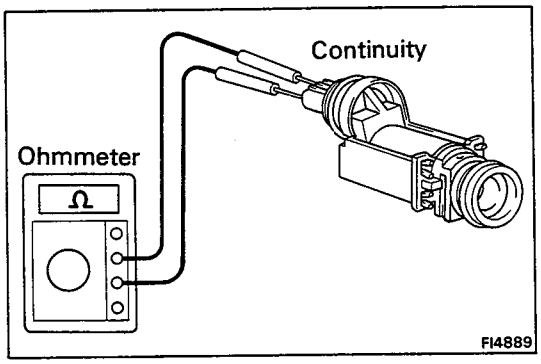
(b) Apply battery voltage across the terminals.

(c) Check that air flows pipes E to F.

If operation is not as specified, replace the ISC valve.

Air Control Valve (ACV) (4A-GE w/o Air Flow Meter)





INSPECTION OF ACV

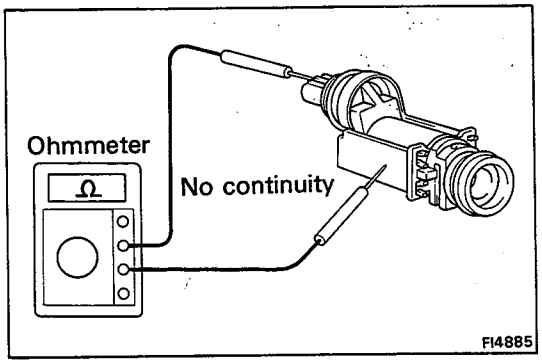
INSPECT ACV

A. Inspect ACV for open circuit

Using an ohmmeter, check that there is continuity b ween the terminals.

Resistance: 22 – 26 Ω

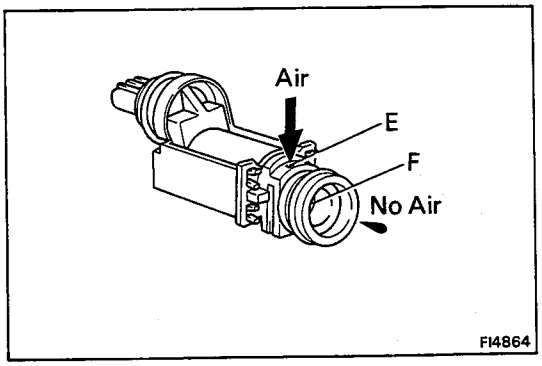
If there is no continuity, replace the ACV.



B. Inspect ACV for ground

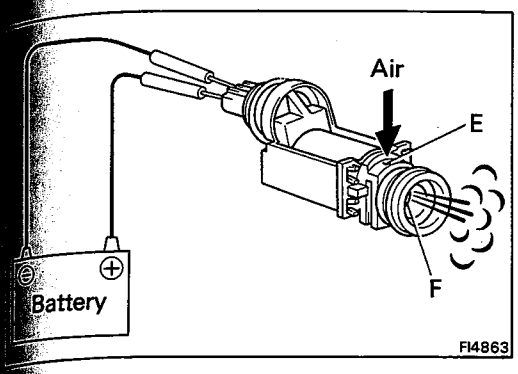
Using an ohmmeter, check that there is no continuity b ween each terminal and body.

If there is continuity, replace the ACV.



C. Inspect ACV opreration

(a) Check that air does not flow from parts E to F.



(b) Apply battery voltage across the terminals.

(c) Check that air flows from ports E to F.

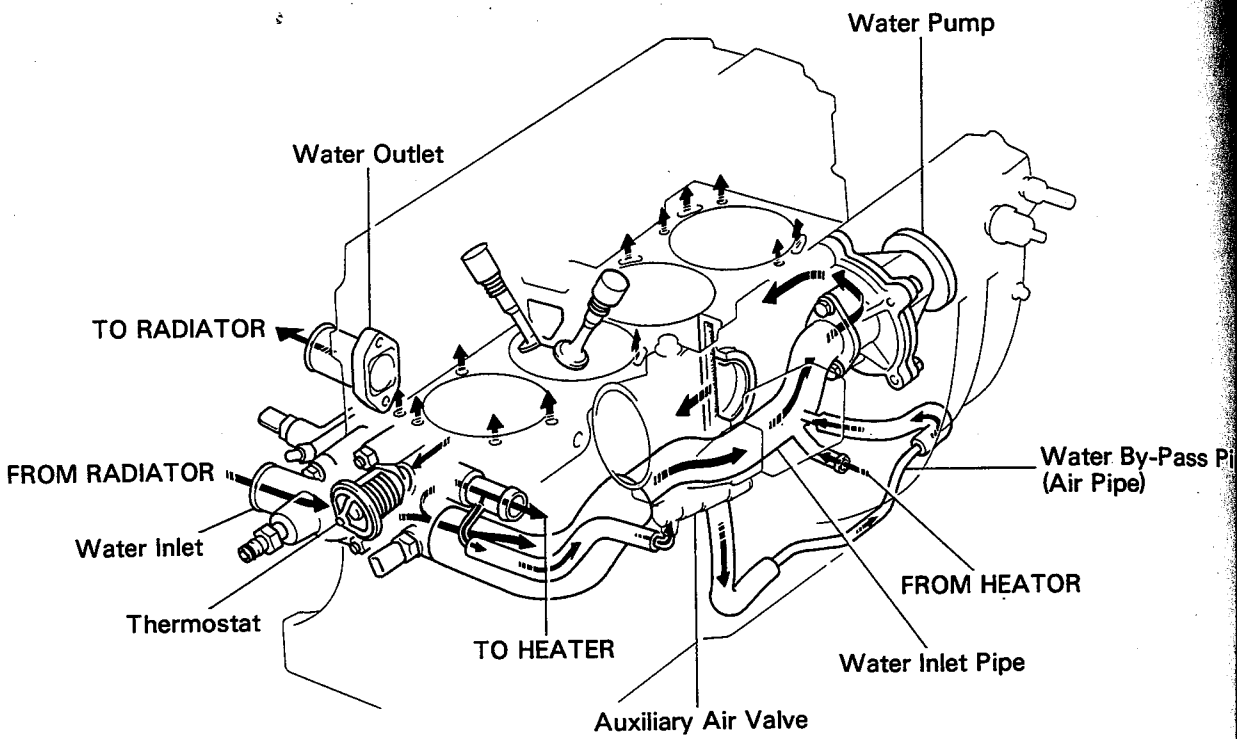
If operation is not as specified, replace the ACV.

COOLING SYSTEM

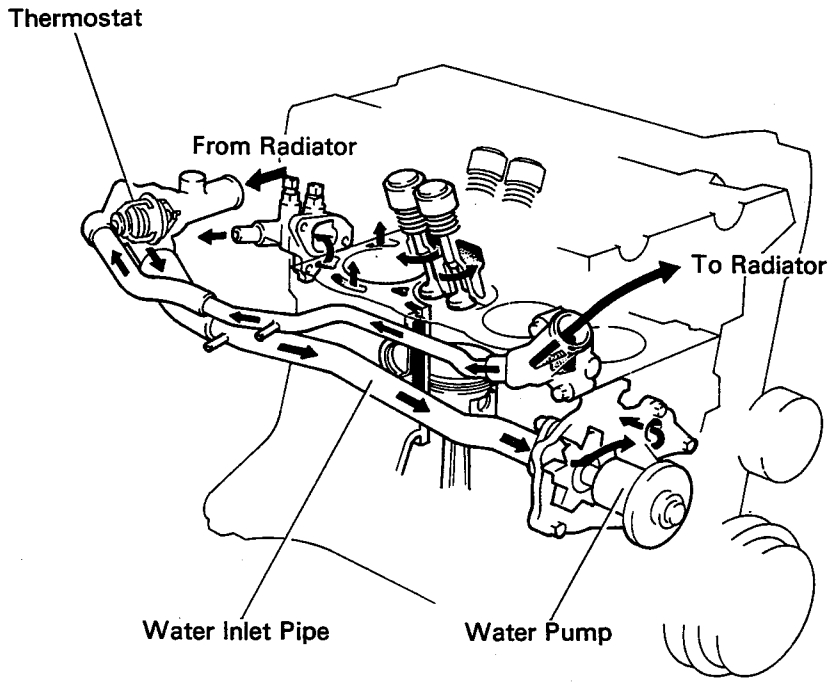
DESCRIPTION

This engine utilizes a pressurized forced circulation cooling system which includes a thermostat equip with a by-pass valve mounted on the inlet side.

4A-FE



4A-GE



The cooling system is composed of the water jacket (inside the cylinder block and cylinder head), radiator, water pump, thermostat, electric fan, hoses and other components.

Coolant which is heated in the water jacket is pumped to the radiator, through which an electric fan flows air to cool the coolant as it passes through. Coolant which has been cooled is then sent back to the engine by the water pump, where it cools the engine.

The water jacket is a network of channels in the shell of the cylinder block and cylinder head through which coolant passes. It is designed to provide adequate cooling of the cylinders in the combustion chambers which become heated during engine operation.

RADIATOR

The radiator performs the function of cooling the coolant which has passed through the water jacket and become hot, and is mounted in the front of the vehicle. The radiator consists of an upper and lower tank, and a core which connects the two tanks. The upper tank contains the inlet for coolant from the water jacket and the filter inlet. It also has a hose attached through which excess coolant or steam can flow. The lower tank contains the outlet for coolant and the drain cock. The core contains many tubes through which coolant flows from the upper tank to the lower tank as well as cooling fins which radiate heat away from the coolant in the tubes. The air sucked through the radiator by the electric fan, as well as the wind generated by the vehicle's travel, passes through the radiator, cooling it. Models with automatic transmissions include an automatic transmission fluid cooler built into the lower tank of the radiator. A fan with an electric motor is mounted behind the radiator to assist the flow of air through the radiator. The fan operates when the coolant temperature becomes high in order to prevent it from becoming too high.

RADIATOR CAP

The radiator cap is a pressure type cap which seals the radiator, resulting in pressurization of the radiator as the coolant expands. The pressurization prevents the coolant from boiling even when the coolant temperature exceeds 100°C (212°F). A relief valve (pressurization valve) and a vacuum valve (negative pressure valve) are built into the radiator cap. The relief valve opens and lets steam escape through the overflow pipe when the pressure generated inside the cooling system exceeds the limit (coolant temperature: 110 – 120°C, 230 – 248°F, pressure; 0.3 – 1.0 kg/cm², 4.3 – 14.2 psi, 29.4 – 98.1 kPa). The vacuum valve opens to alleviate the vacuum which develops in the coolant system after the engine is stopped and the coolant temperature drops. The valve's opening allows return of the coolant in the reservoir tank to the cooling system.

RESERVOIR TANK

The reservoir tank is used to catch coolant which overflows the cooling system as a result of volumetric expansion when the coolant is heated. The coolant in the reservoir tank returns to the radiator when the coolant temperature drops, thus keeping the radiator full at all times and avoiding needless coolant loss. Check the reservoir tank level to see if the coolant needs to be replenished.

WATER PUMP

The water pump is used for forced circulation of coolant through the cooling system. It is mounted on the front of the cylinder block and driven by a timing belt.

THERMOSTAT

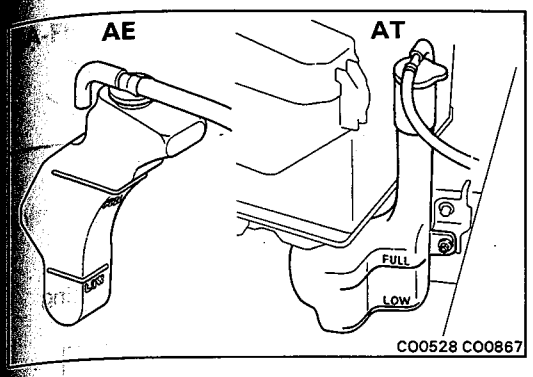
The thermostat is a wax type bypass valve and is mounted in the water inlet housing. The thermostat includes a type of automatic valve operated by fluctuations in the coolant temperature. This valve closes when the coolant temperature drops, preventing the circulation of coolant through the engine and thus permitting the engine to warm up rapidly. The valve opens when the coolant temperature has risen, allowing the circulation of coolant. Wax inside the thermostat expands when heated and contacts when cooled. Heating the wax thus generates pressure which overpowers the force of the spring which keeps the valve closed, thus opening the valve. When the wax cools, its contraction causes the force of the spring to take effect once more, closing the valve. The thermostat in this engine operates at a temperature of 82°C (180°F).

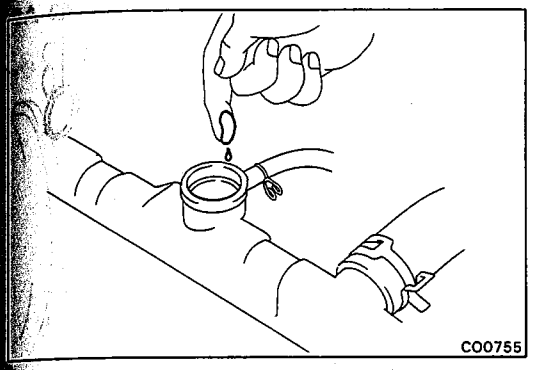
C0090
C0054

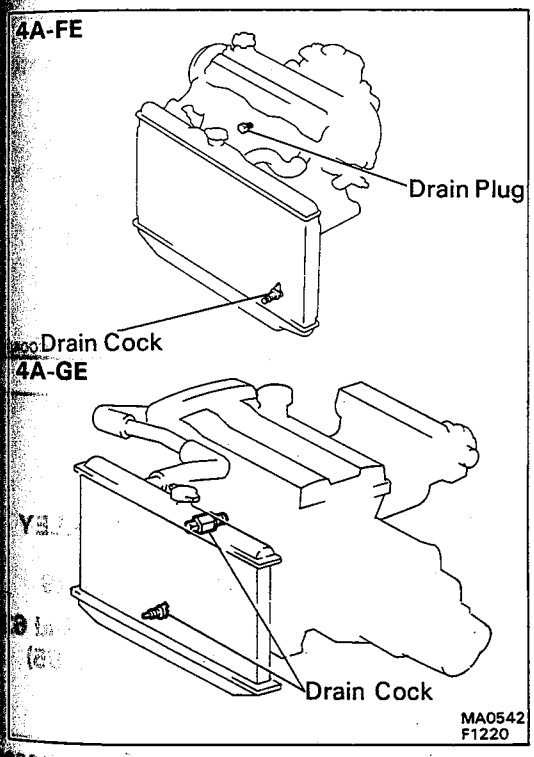
TROUBLESHOOTING

Problem	Possible cause	Remedy	Page
Engine overheats	Check coolant	Replenish coolant	
	Water pump drive belt loose or missing	Adjust or replace belt	
	Dirt, leaves or insects on radiator	Clean radiator	
	Hoses, water pump, thermostat housing, radiator, heater, core plugs or head gasket leakage	Repair as necessary	
	Thermostat faulty	Check thermostat	CO-13
	Ignition timing retarded	Set timing	
	Electric cooling system faulty	Inspect electric cooling system	CO-21
	Radiator hose plugged or rotted	Replace hose	
	Water pump faulty	Replace water pump	CO-6
	Radiator plugged or cap faulty	Check radiator	CO-15
	Cylinder head or block cracked or plugged	Repair as necessary	

HINT: The thermostat is equipped with a by-pass valve, if the engine tends to overheat, removal of the thermostat would have an adverse effect, causing a loss of cooling efficiency.







CHECK AND REPLACEMENT OF ENGINE COOLANT

1. CHECK ENGINE COOLANT LEVEL AT RESERVE TANK

The coolant level should be between the "LOW" and "FULL" lines.

If low, check for leaks and add coolant up to the "FULL" line.

2. CHECK ENGINE COOLANT QUALITY

There should not be any excessive rust deposits or scales around the radiator cap or radiator filler hole, and the coolant should be free from oil.

If excessively dirty, replace the coolant.

3. REPLACE ENGINE COOLANT

(a) Remove the radiator cap.

CAUTION: To avoid the danger of being burned, do not remove it while the engine and radiator are still hot, as fluid and steam can be blown out under pressure.

(b) Drain the coolant from the radiator and engine drain cocks. (The engine drain cock is near the oil filter.)

(c) Close the drain cocks.

Torque (Engine drain cock):
350 kg-cm (25 ft-lb, 34 N·m)

(d) Fill the system with coolant.
Use a good brand of ethylene-glycol or alcohol type antifreeze, or TOYOTA radiator conditioner or equivalent anticorrosive, mixed according to the manufacturer's directions.

Ethylene-glycol type: This type has an antifreeze and anticorrosive effect.

TOYOTA radiator conditioner: This has only an anticorrosive effect.

NOTICE:
- **Do not use alcohol type coolant.**
- **The coolant should be mixed with demineralized water or distilled water.**

Capacity (w/ Heater):

4A-FE	
AE M/T	**6.2 liters (6.5 US qts, 5.5 Imp. qts)**
AE A/T	**6.1 liters (6.4 US qts, 5.4 Imp. qts)**
AT171	**5.6 liters (5.9 US qts, 4.9 Imp. qts)**
AT180	**5.2 liters (5.5 US qts, 4.6 Imp. qts)**
4A-GE	**6.0 liters (6.3 US qts, 5.3 Imp. qts)**

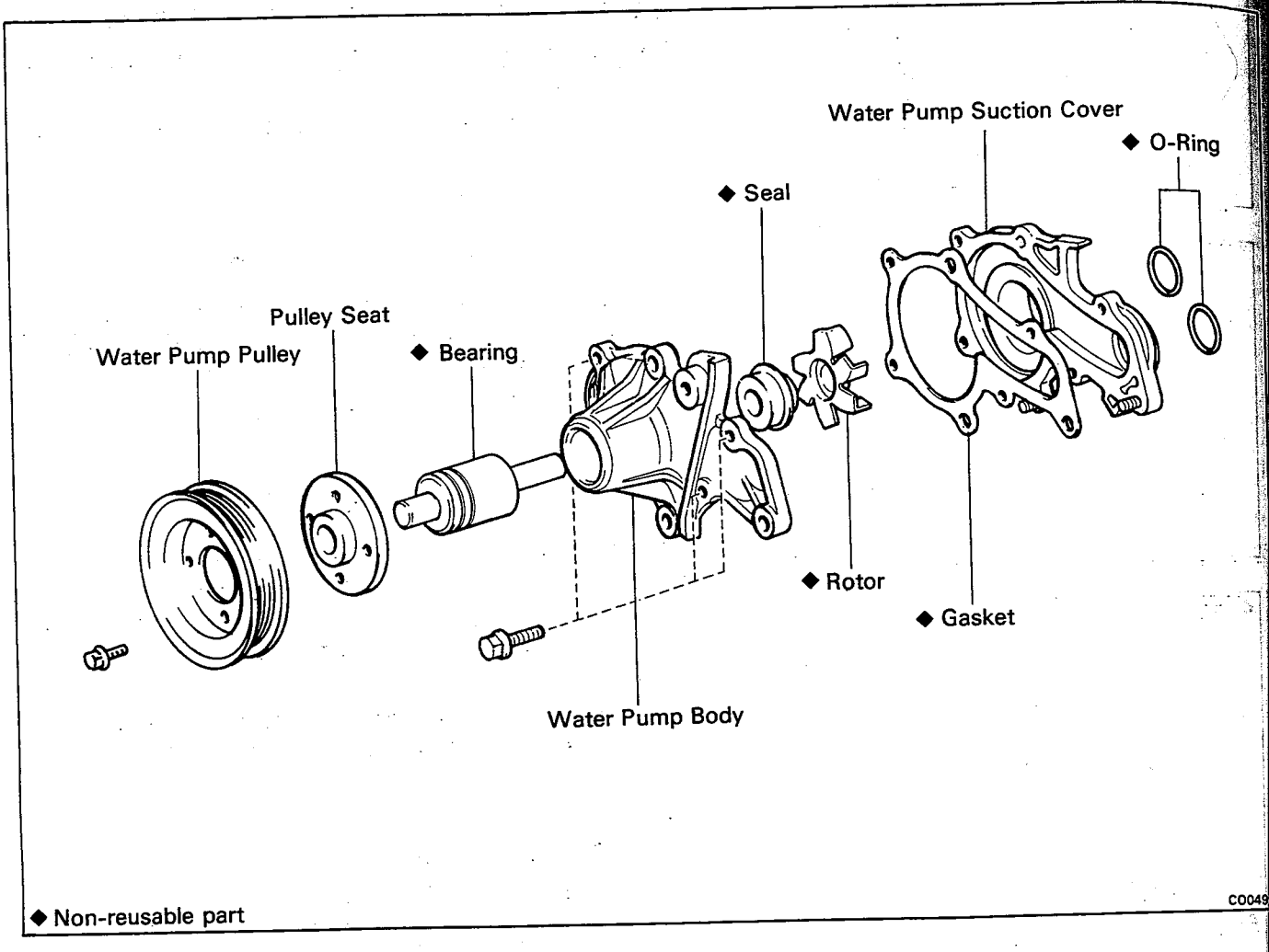
(e) Install the radiator cap.

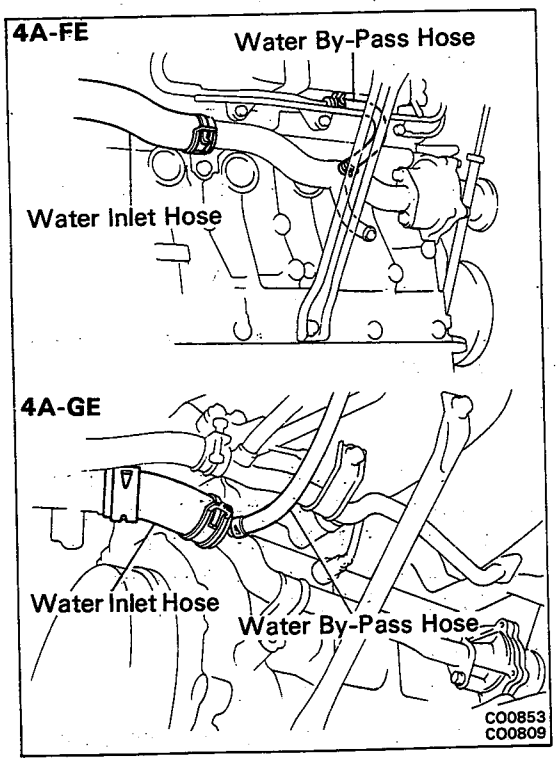
(f) Start the engine and check for leaks.

(g) Recheck the coolant level and refill as necessary.

WATER PUMP

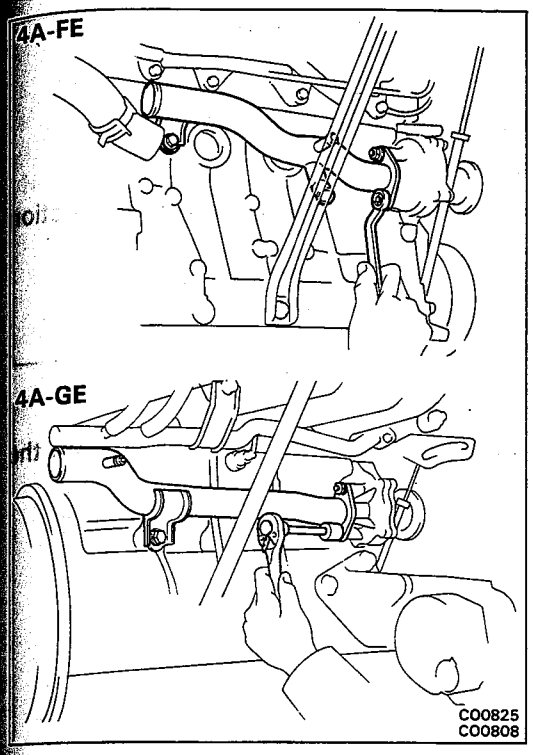
COMPONENTS





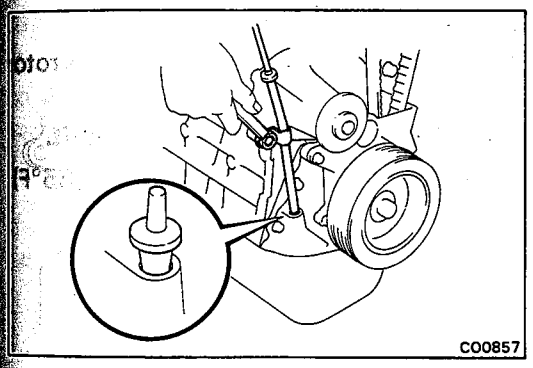
REMOVAL OF WATER PUMP

1. **DRAIN COOLANT (See page CO-5)**
2. **REMOVE DRIVE BELT AND WATER PUMP PULLEY**
3. **REMOVE NO.3 AND NO.2 TIMING BELT COVERS**
   4A-FE (See steps 8, 12 and 14 on pages EM-60 and 6
   4A-GE (See steps 2 and 15 on pages EM-93 and 95)
4. **REMOVE WATER INLET PIPE**
   (a) Disconnect the water inlet and water by-pass hos from the inlet pipe.



(b) Remove the two nuts and clamp bolt.

(c) Remove the water inlet pipe and O-ring.

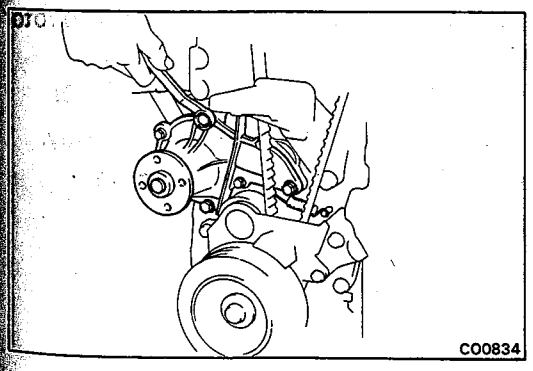


5. REMOVE OIL DIPSTICK GUIDE AND DIPSTICK

(a) Remove the dipstick.

(b) Remove the bolt, and pull out the dipstick guide. Plug the guide installation hole of the oil pump.

(c) Remove the O-ring from the dipstick guide.

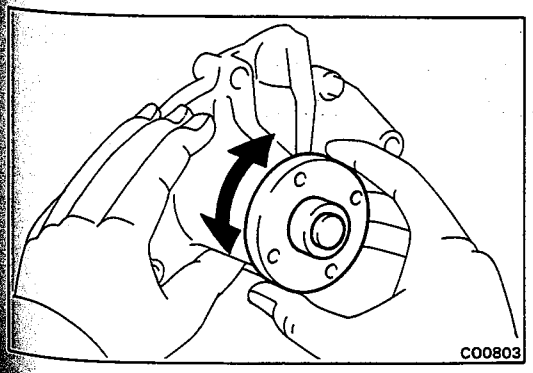


6. REMOVE WATER PUMP

(a) Remove the three bolts and water pump.

(b) Remove the O-ring.

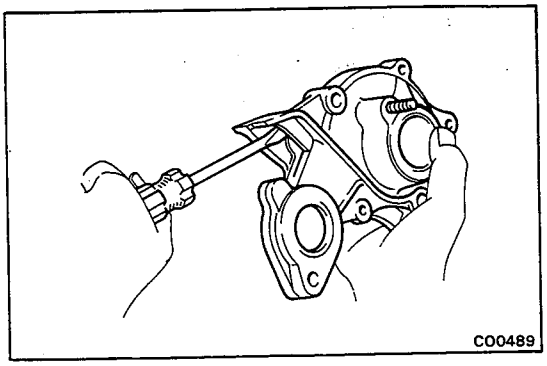
NOTICE: Be careful not to get coolant on the timing belt.



INSPECTION OF WATER PUMP

INSPECT WATER PUMP

Turn the pulley and check that the water pump bearing moves smoothly and quietly.



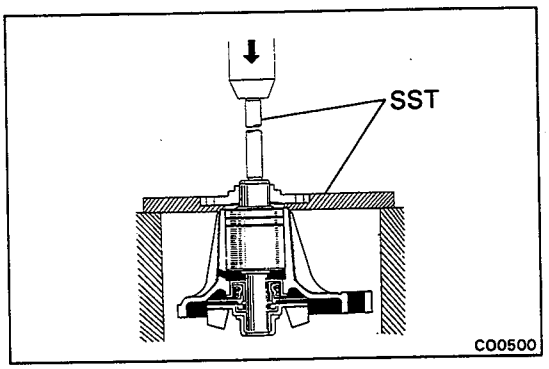
DISASSEMBLY OF WATER PUMP

(See page CO-6)

1. REMOVE WATER PUMP SUCTION COVER

(a) Remove the three bolts.

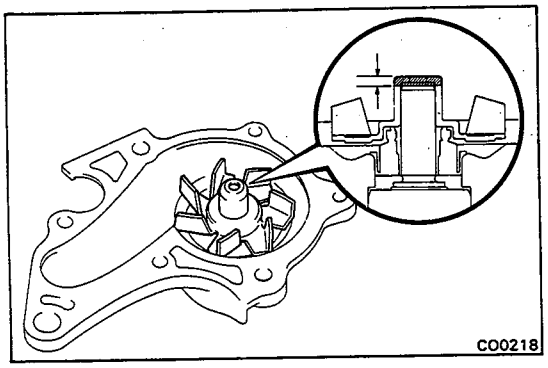
(b) Using a screwdriver, pry off the water pump suction cover.



2. REMOVE PULLEY SEAT

Using SST and a press, remove the pulley seat from the water pump bearing shaft.

SST 09236-00101 (09237-00010, 09237-00040)

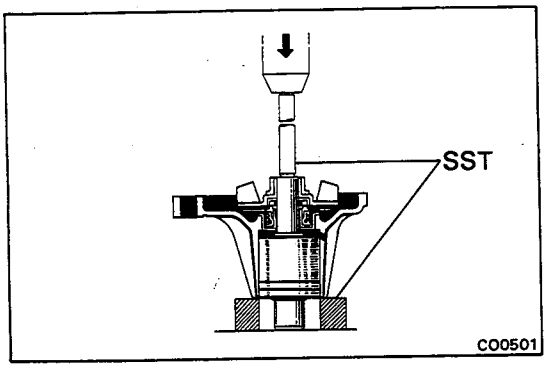


3. REMOVE WATER PUMP BEARING

(a) Using a grinding wheel, grind the water pump roto as shown.

NOTICE: Do not grind water pump bearing shaft.

(b) Heat the water pump body to approx. 85°C (185°F)

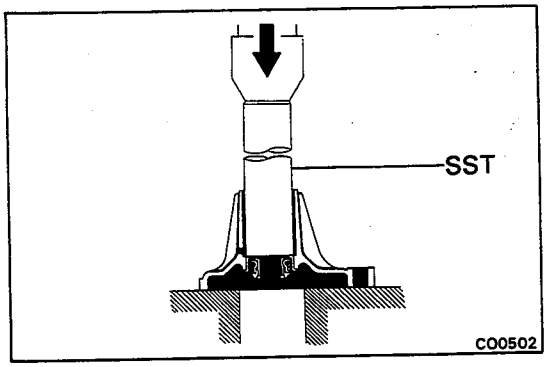


(c) Using SST and a press, remove the water pump roto and bearing.

SST 09236-00101 (09237-00010, 09237-00040)

(d) Remove the seal set from the water pump body.

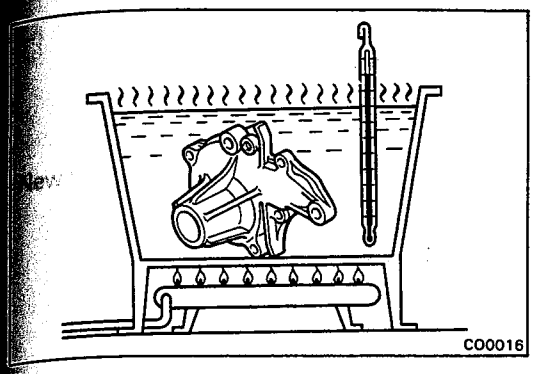
NOTICE: Do not damage the water pump body.



4. REMOVE SEAL

Using SST and a press, remove the seal.

SST 09236-00101 (09236-15010)



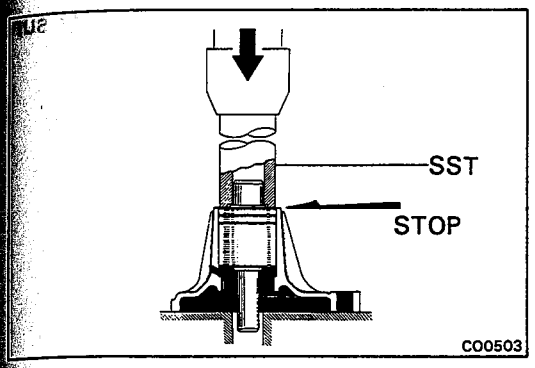
ASSEMBLY OF WATER PUMP

(See page CO-6)

HINT: Always assemble the water pump with a new seal set, a new rotor and a new bearing.

1. INSTALL WATER PUMP BEARING

(a) Gradually heat the water pump body to approx. 85°C (185°F).



(b) Using SST and a press, install a new water pump bearing into the water pump body.

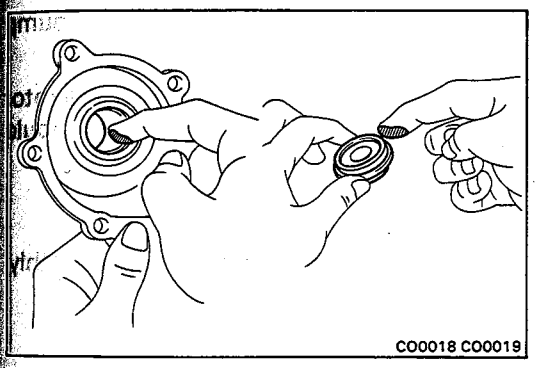
SST 09236-00101 (09237-00020)

HINT: The bearing end face should be flush with the body top surface.

2. INSTALL SEAL

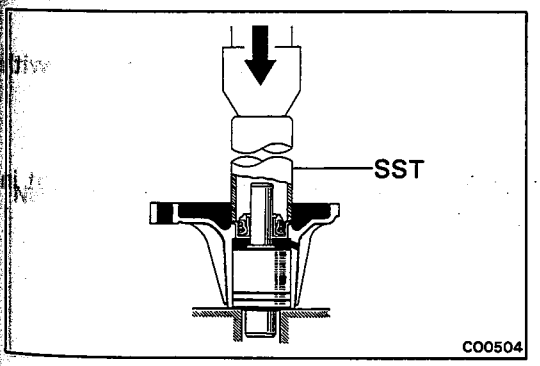
(a) Apply a seal packing No.1282-B to a new seal and pump body.

Seal packing: Part No.08826-00100 or equivalent



(b) Using SST and a press, install the seal on the water pump bearing.

SST 09236-00101 (09237-00020)



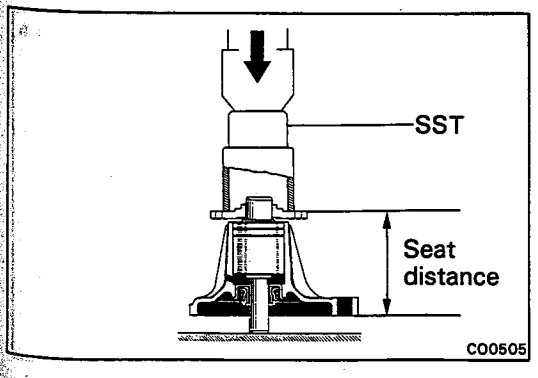
3. INSTALL PULLEY SEAT

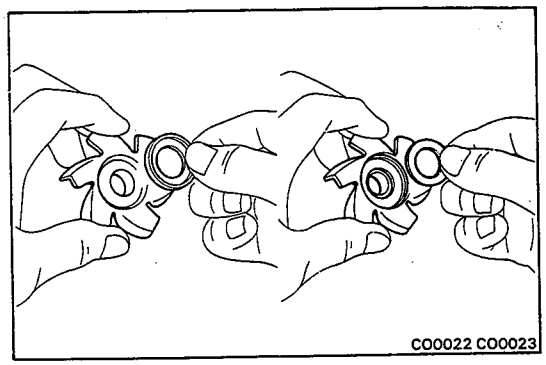
Using SST and a press, install the pulley seat on the water pump bearing shaft.

SST 09236-00101 (09237-00020)

HINT: As shown in the figure, the distance from the pulley seat to the installation surface of the pump body should be as follows:

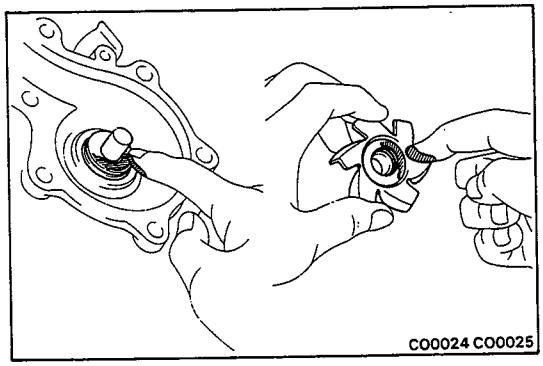
Seat distance: 76.7 mm (3.020 in.)



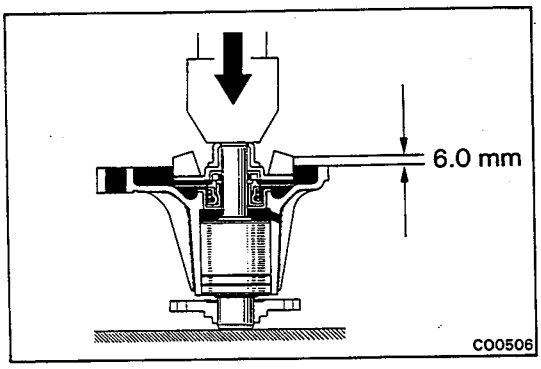

CO0022 CO0023

4. INSTALL ROTOR

(a) Install a new packing and seat into the rotor.


CO0024 CO0025

(b) Apply a little LLC to the seal and rotor contact surface.



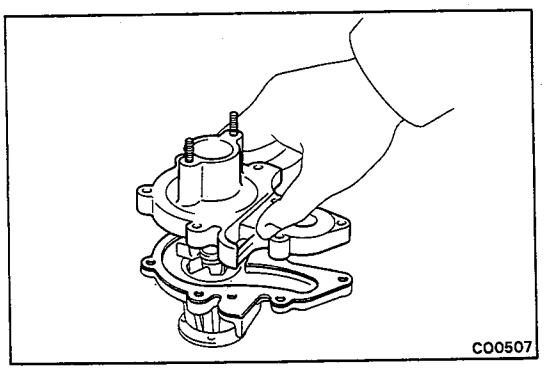
CO0506

(c) Using a press, install a new rotor on the water pump bearing shaft.

HINT: As shown in the figure, the distance from the rotor edge to the installation surface of the pump body should be 6.0 mm (0.236 in.).

5. CHECK WATER PUMP

After assembly make sure that the rotor rotates smoothly.

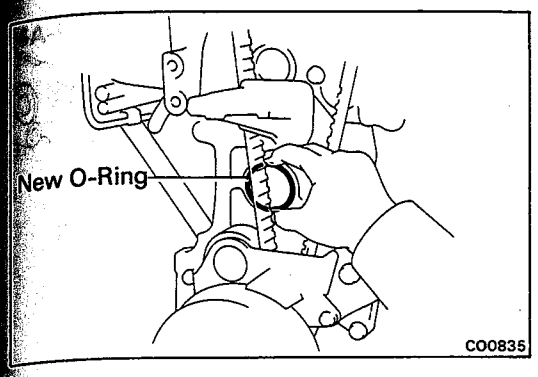

CO0507

6. INSTALL WATER PUMP SUCTION COVER

Install the water pump suction cover on a new gasket with three bolts.

Torque: 92.5 kg-cm (80 in.-lb, 9.1 N·m)

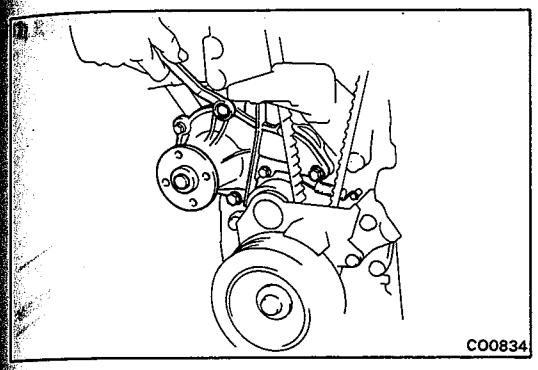
HINT: After installing, make sure that the rotor is not in contact with the water pump suction cover.



INSTALLATION OF WATER PUMP

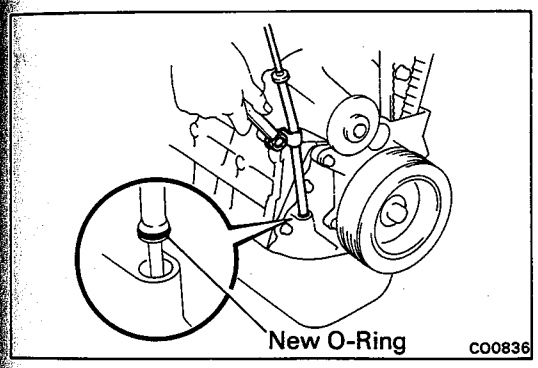
1. INSTALL WATER PUMP

(a) Place a new O-ring in position on the cylinder block.



(b) Install the water pump with the three bolts.

Torque: 150 kg-cm (11 ft-lb, 15 N·m)



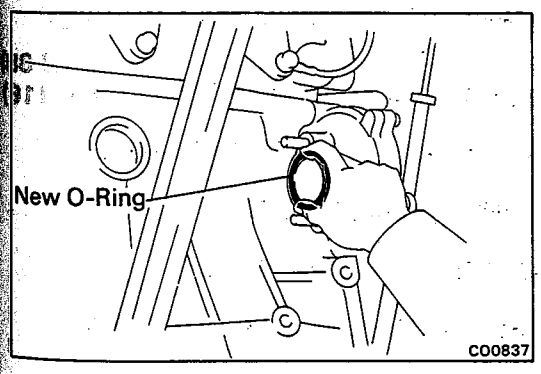
2. INSTALL OIL DIPSTICK GUIDE AND DIPSTICK

(a) Install a new O-ring to the dipstick guide.

(b) Apply soapy water to the O-ring.

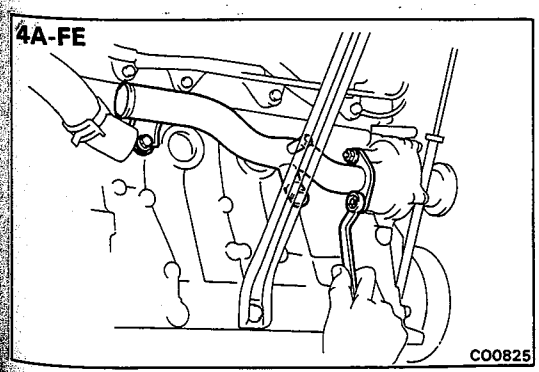
(c) Push in the dipstick guide, and install it with the bolt.

Torque: 95 kg-cm (82 in.-lb, 9.3 N·m)



3. INSTALL WATER INLET PIPE

(a) Place a new O-ring in position on the water pump.



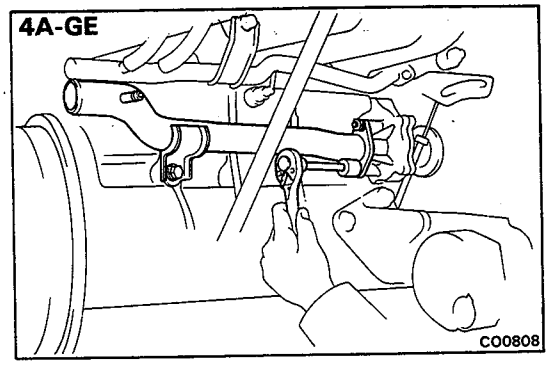
(b) Temporarily install water pump with the two nuts and bolt.

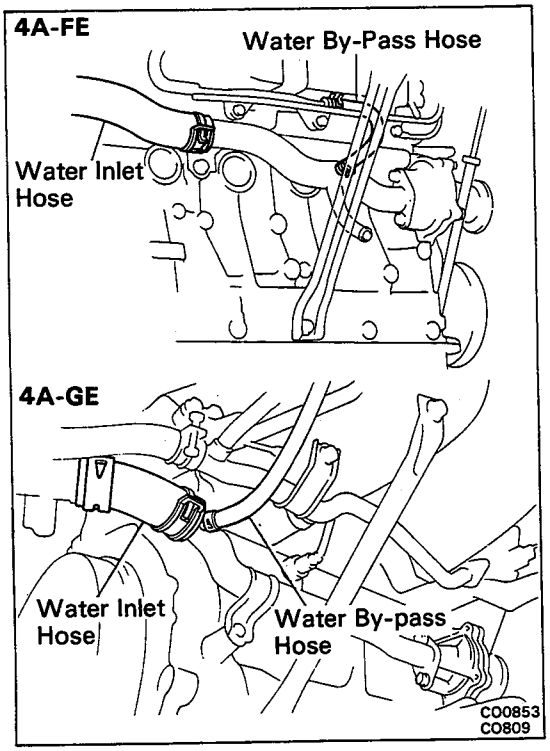
(c) Tighten the two nuts.

Torque: 200 kg-cm (14 ft-lb, 20 N·m)

(d) Tighten the bolt.

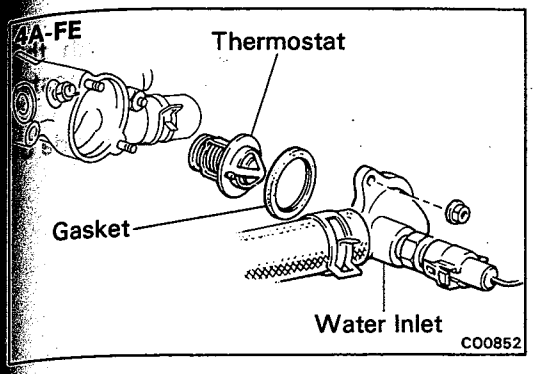
Torque: 130 kg-cm (9 ft-lb, 13 N·m)

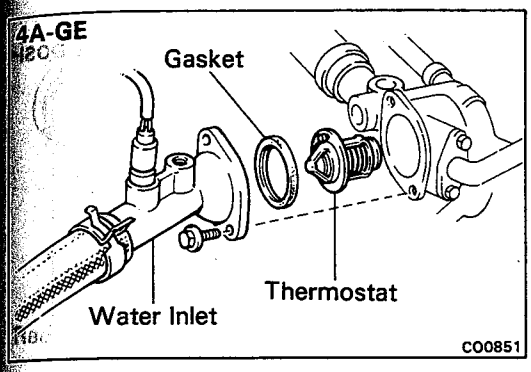




(e) Connect the water inlet and water by-pass hoses to the inlet pipe.

4. **INSTALL NO.2 AND NO.3 TIMING BELT COVERS**
   4A-FE (See steps 11, 14 and 18 on page EM-86 and 88
   4A-GE (See steps 13 and 26 on page EM-114 and 116
5. **TEMPORARILY INSTALL WATER PUMP PULLEY**
6. **INSTALL ALTERNATOR DRIVE BELT**
7. **ADJUST DRIVE BELT (See page CH-3)**
8. **FILL WITH ENGINE COOLANT (See page CO-5)**
9. **START ENGINE AND CHECK FOR LEAKS**





THERMOSTAT

REMOVAL OF THERMOSTAT

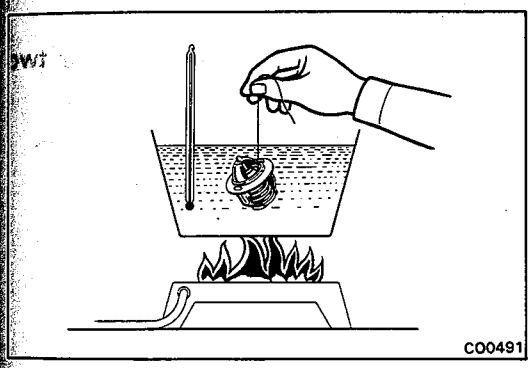
1. **DRAIN ENGINE COOLANT (See page CO-5)**

2. **REMOVE WATER INLET AND THERMOSTAT**

   (a) Remove the two nuts (4A-FE) or two bolts (4A-GE) and water inlet from the water inlet housing.

   (b) Remove the thermostat.

   (c) Remove the gasket from the thermostat.

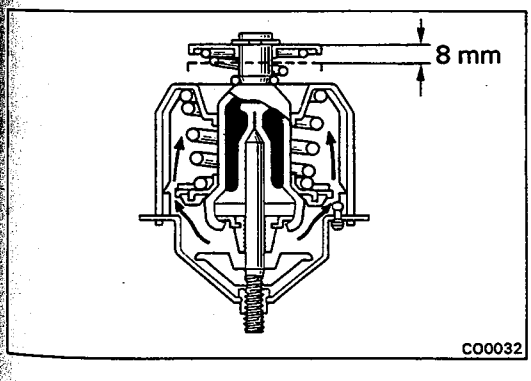


INSPECTION OF THERMOSTAT

INSPECT THERMOSTAT

HINT: The thermostat is numbered with the valve opening temperature.

(a) Immerse the thermostat in water and gradually heat the water.



(b) Check the valve opening temperature.

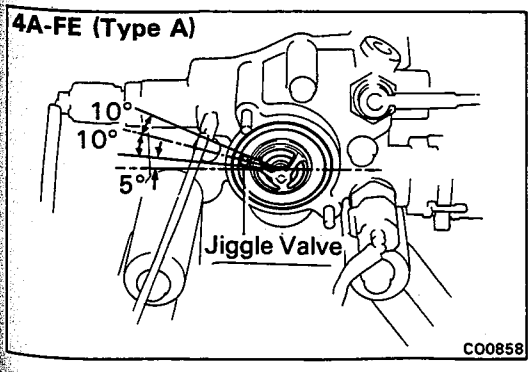
Valve opening temperature:
80 — 84°C (176 — 183°F)

If the valve opening temperature is not as specified, replace the thermostat.

(c) Check the valve lift.

Valve lift: 8 mm (0.31 in.) or more at 95°C (203°F)

If the valve lift is less than specification, replace the thermostat.



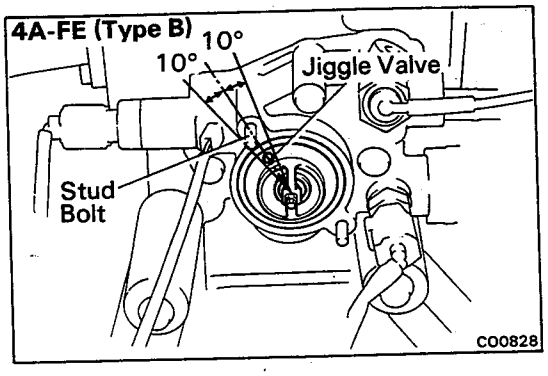
INSTALLATION OF THERMOSTAT

1. **PLACE THERMOSTAT IN WATER PUMP**

   (a) Install a new gasket to the thermostat.

   (b) (4A-FE Type A)
   Set the jiggle valve of the thermostat in angle position, and insert the thermostat in the water inlet, housing.

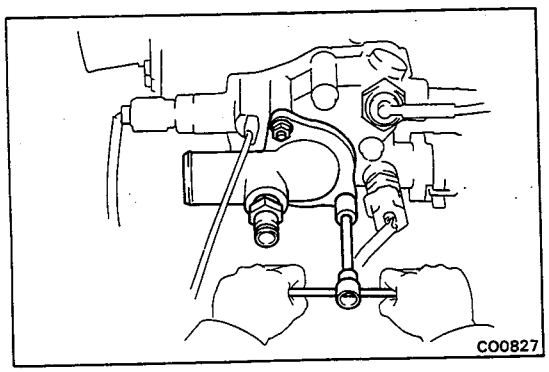
HINT: The jiggle valve may be set within 10° of eigther side of the presribed position.



(4A-FE Type B)
Align the jiggle valve of the thermostat with the upper side of the stud bolt, and insert the thermostat in the water inlet housing.

HINT: The jiggle valve be set within 10° of either side of the pressribed position.

(4A-GE)
Align the jiggle valve of thermostat so that it is positioned above the water inlet housing.



2. **INSTALL WATER INLET**

Install the water inlet with the two nuts (4A-FE) or two bolts (4A-GE).

Torque: 95 kg-cm (82 in.-lb, 9.3 N·m)

3. **FILL WITH ENGINE COOLANT (See page CO-5)**

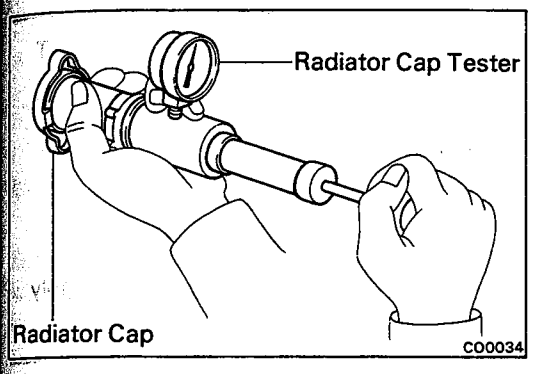
4. **START ENGINE AND CHECK FOR LEAKS**

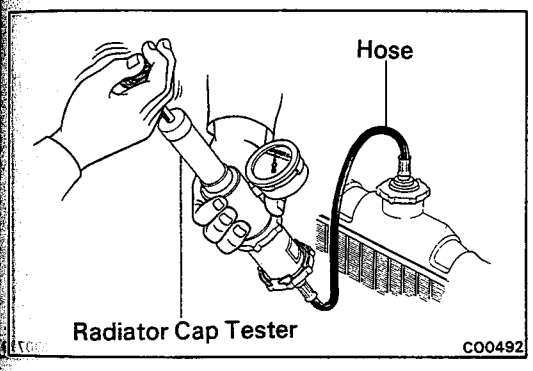
RADIATOR

CLEANING OF RADIATOR

Using water or steam cleaner, remove any mud and dirt from the radiator core.

NOTICE: If using a high pressure type cleaner, be careful not to deform the fins of the radiator core. If the cleaner nozzle pressure is 30 — 35 kg/cm² (427 — 498 psi, 2,942 — 3,432 kPa), keep a distance of at least 40 — 50 cm (15.75 — 19.69 in.) between the radiator core and cleaner nozzle.





INSPECTION OF RADIATOR

1. INSPECT RADIATOR CAP

Using a radiator cap tester, pump the tester until relief valve opens. Check that valve opens between 0.75 kg/cm² (10.7 psi, 74 kPa) and 1.05 kg/cm² (14.9 psi, 103 kPa).

Check that the pressure gauge does not drop rapidly when pressure on cap is below 0.6 kg/cm² (8.5 psi, 59 kPa). Measure the relief valve opening pressure.

If either check is not within limits, replace the radiator cap.

2. CHECK COOLING SYSTEM FOR LEAKS

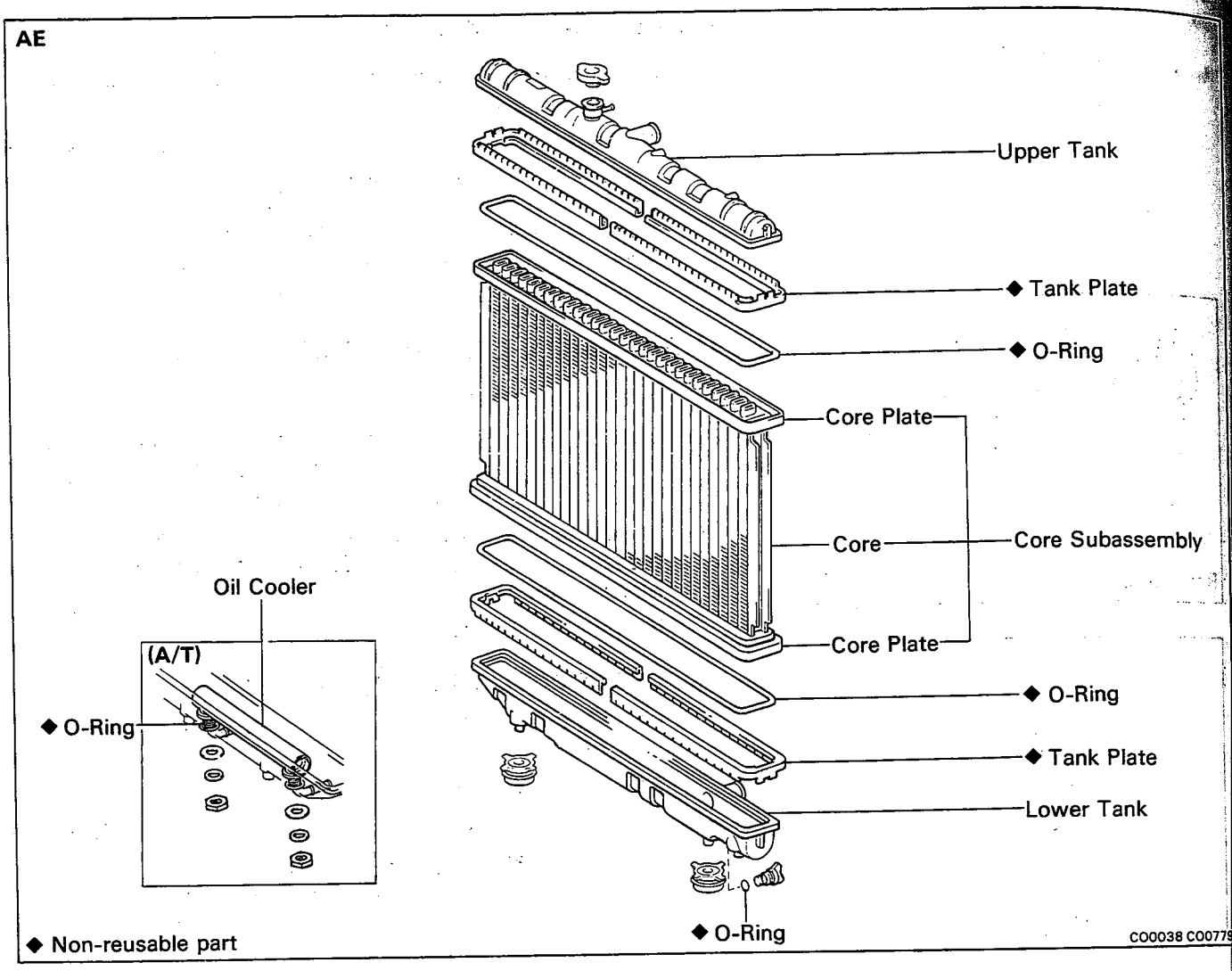
(a) Fill the radiator with coolant and attach a radiator cap tester.

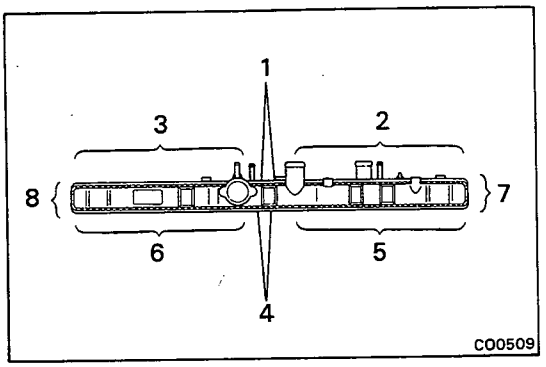
(b) Warm up the engine.

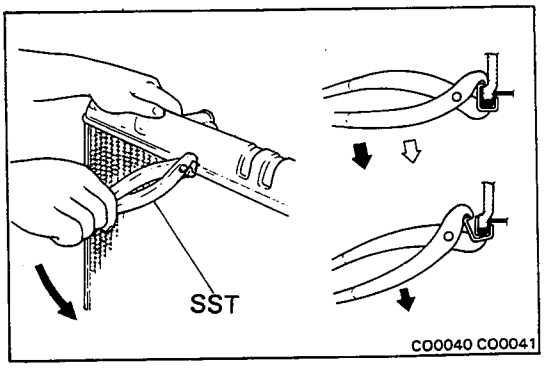
(c) Pump it to 1.2 kg/cm² (17psi, 118 kPa), check that the pressure does not drop.

If the pressure drops, check the hoses, radiator or water pump for leaks. If no external leaks are found, check the heater core, block and head.

COMPONENTS







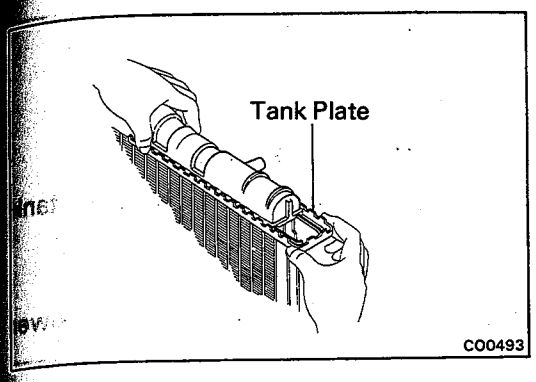
DISASSEMBLY OF RADIATOR (AE, AT171)

1. REMOVE TANK PLATE

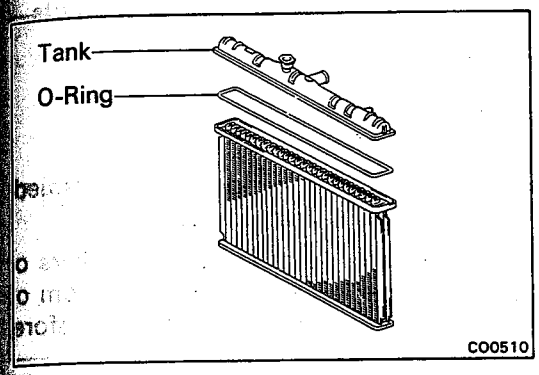
(a) Raise the claws of the tank plates with SST in th numerical order shown in the figure.

SST 09230-00010

NOTICE: Be careful not to damage the core plate.



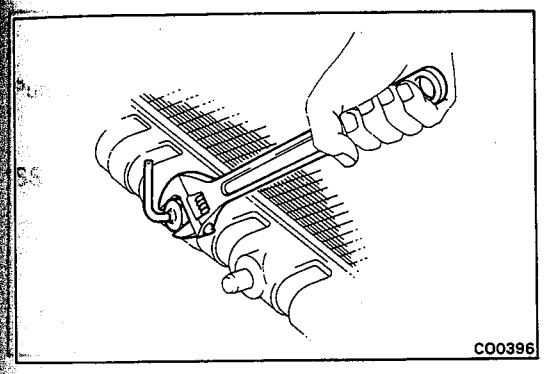
(b) Pull the tank plates outward.



2. REMOVE TANK AND O-RING

(a) Pull the tank upward.

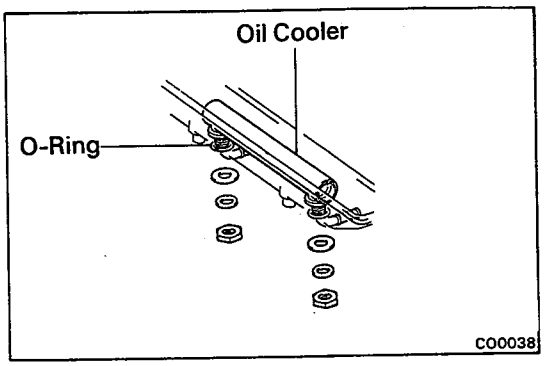
(b) Remove the O-ring.

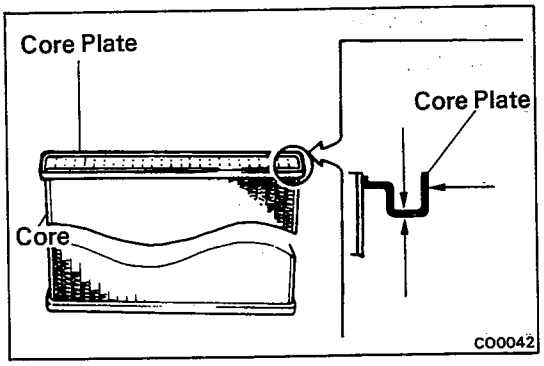


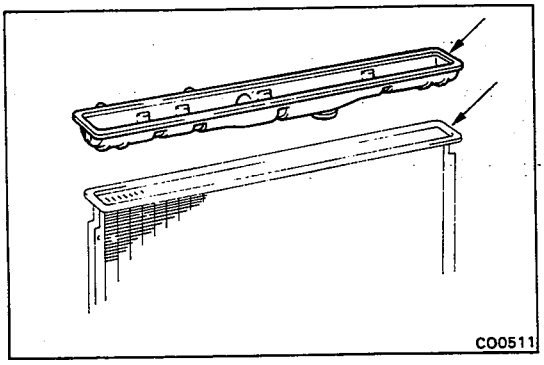
3. (A/T)
REMOVE OIL COOLER FROM LOWER TANK

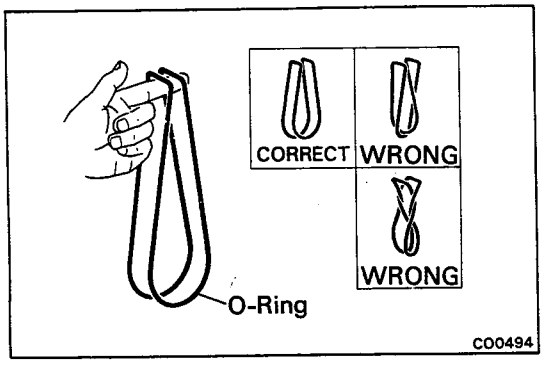
(a) Remove the two nuts, spring washers, plate washers and oil cooler.

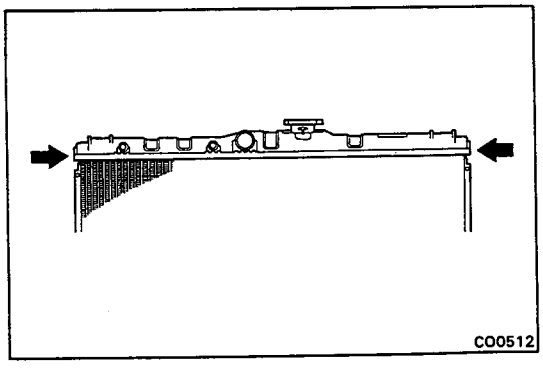
(b) Remove the O-ring from the oil cooler.











ASSEMBLY OF RADIATOR (AE, AT171)

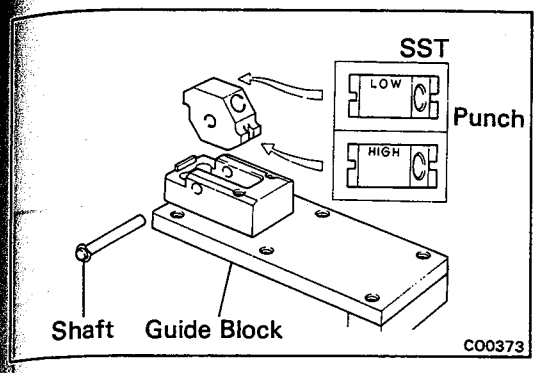
(See page CO-16)

1. (A/T)
INSTALL OIL COOLER TO LOWER TANK
   (a) Clean the O-ring contact surface of the lower tank and oil cooler.
   (b) Install new O-ring to the oil cooler.
   (c) Install the oil cooler with the O-rings to the lower tank.
   (d) Install the plate washers, spring washers and nuts.

2. **INSPECT CORE PLATE**
Inspect the core plate for damage.
HINT:
- If the sides of the core plate groove are deformed, reassembly of the tank will be impossible.
- Therefore, first correct any deformation with pliers or like object. Water leakage will result, if the bottom of the core plate groove is damaged or dented. Therefore, repair or replace if necessary.

3. **INSTALL NEW O-RING AND TANK**
HINT:
- Clean the tank and core plate.
- Take out any twists.

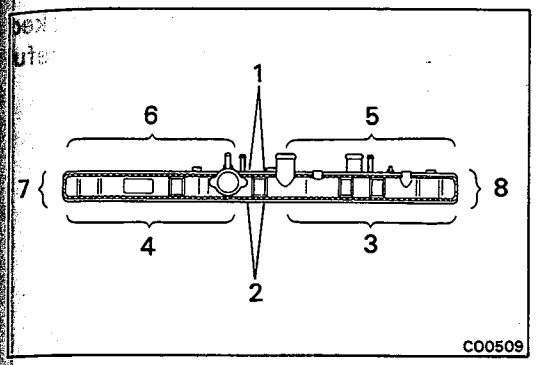
4. **INSTALL TANK PLATE**
Install the tank plates from both ends in the direction of the arrows. Insert to where the portions shown by the arrows contact with the tank.



5. STAKE CLAW OF TANK PLATE

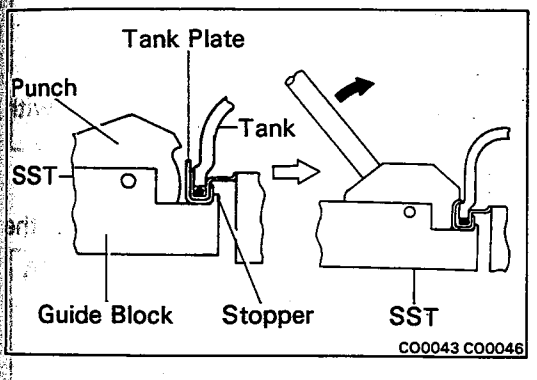
(a) Set the punch of SST to "LOW".

SST 09230-00010



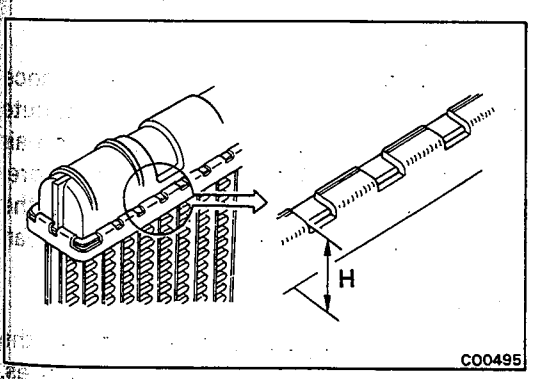
(b) Stake the claws of the tank plates with SST in the numerical order shown in the figure.

SST 09230-00010



NOTICE: If the bottom of the core plate is staked with the SST on the guide block stopper, it may result in water leakage.

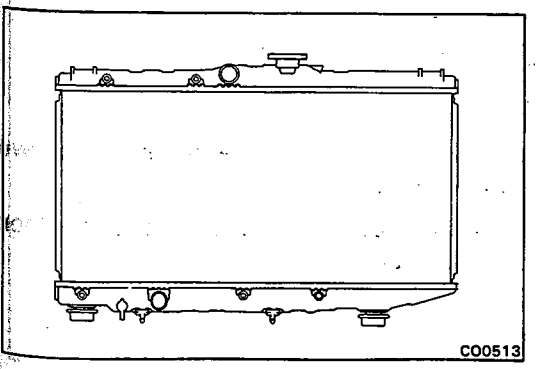
SST 09230-00010



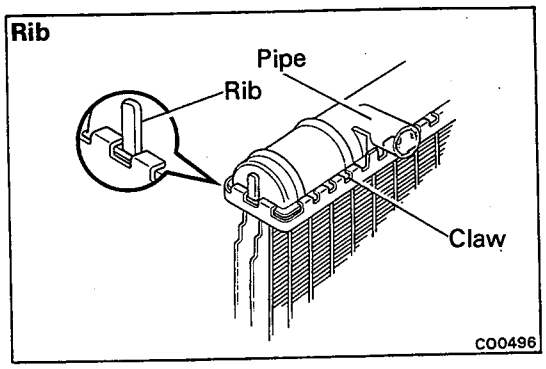
HINT:

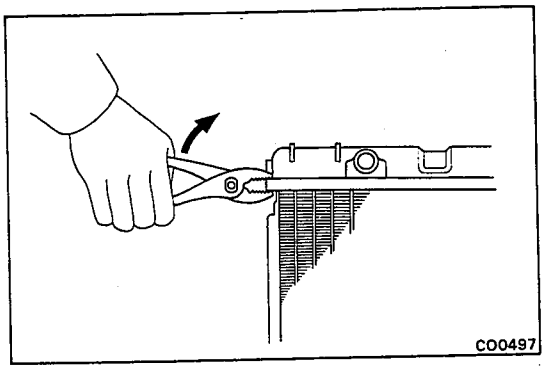
- Stake with just enough pressure to leave a mark on the claw. The staked plate height (H) should be as follows:

Plate height: 9.08 — 9.43 mm (0.3575 — 0.3713 in.)

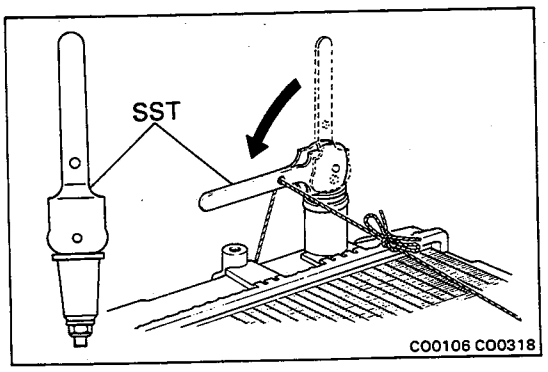


- Do not stake the areas protruding around the pipes, brackets or tank ribs.





- The points shown in the illustration cannot be staked with the SST. Use a pliers or like object and be careful not to damage the core plates.



6. INSPECT FOR WATER LEAKS

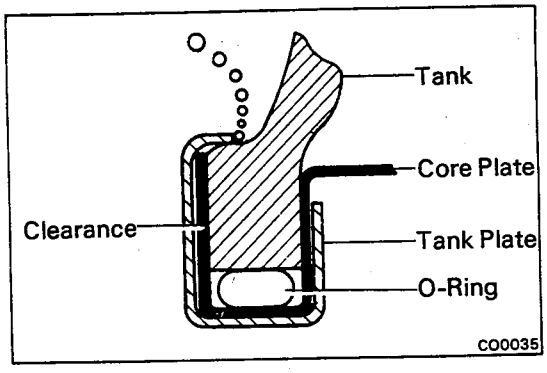
(a) Tighten the drain plug.

(b) Plug the inlet and outlet pipes of the radiator with SST.

SST 09230-00010

(c) Using a radiator cap tester, apply pressure to the radiator.

Test pressure: 1.5 kg/cm² (21 psi, 147 kPa)

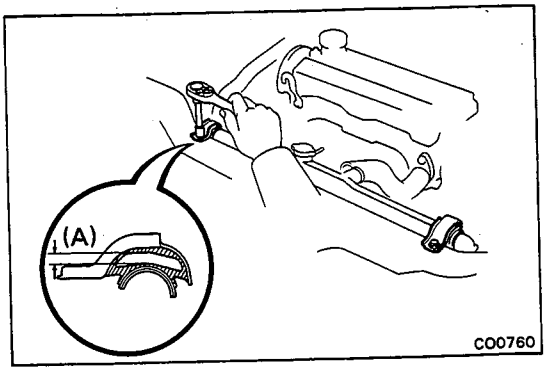


(d) Inspect for water leaks.

HINT: On radiator with resin tanks, there is a clearance between the core plate and tank plate where a minute amount of air will remain, giving the appearance of an air leak when the radiator is submerged in water. Therefore, before performing the water leak test, first switch the radiator around in the water until all air bubbles disappear.

7. PAINT TANK PLATE

HINT: If the water leak test checks out okay, allow the radiator to completely dry and then paint the tank plates.



INSTALLATION OF RADIATOR

INSTALL RADIATOR

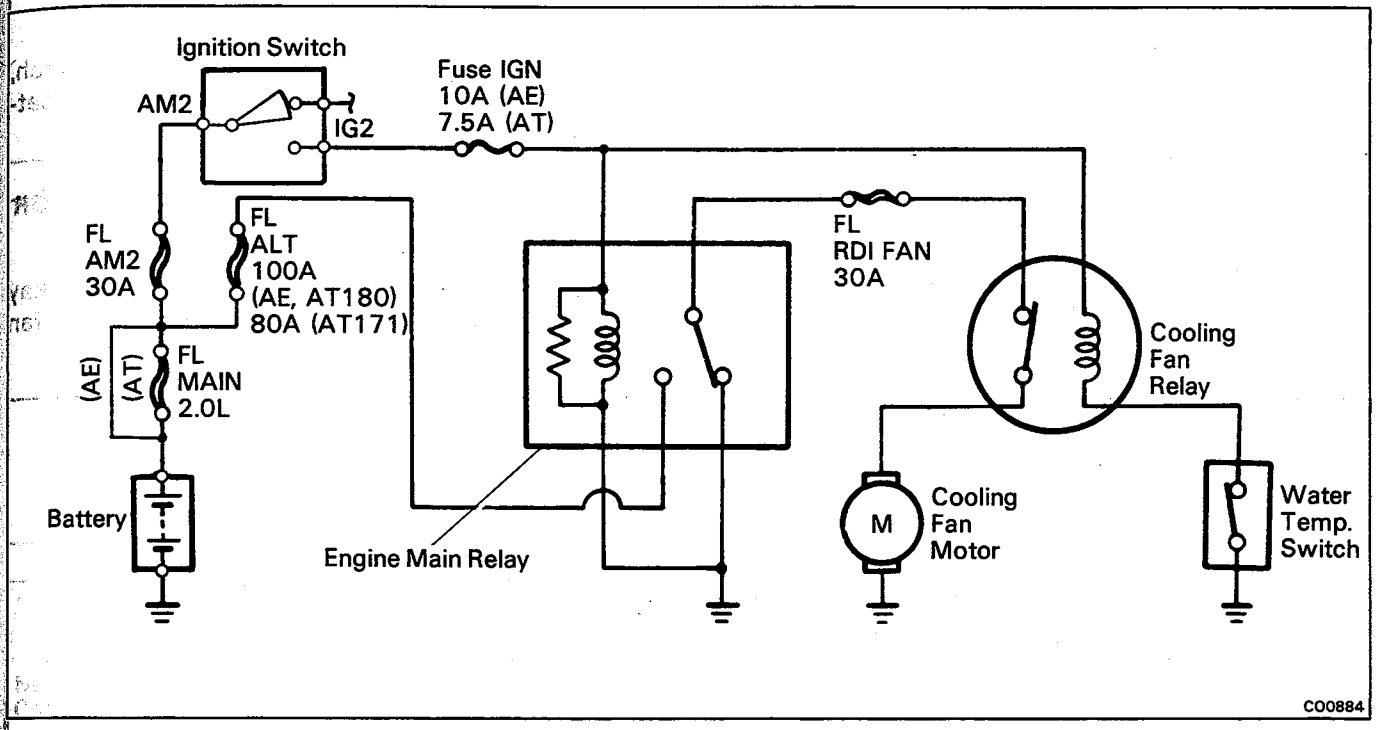
Place the radiator in installed position and install the two supports with the two bolts.

HINT: After installation, confirm that the rubber cushion (A) of the support is not depressed.

ELECTRIC COOLING FAN

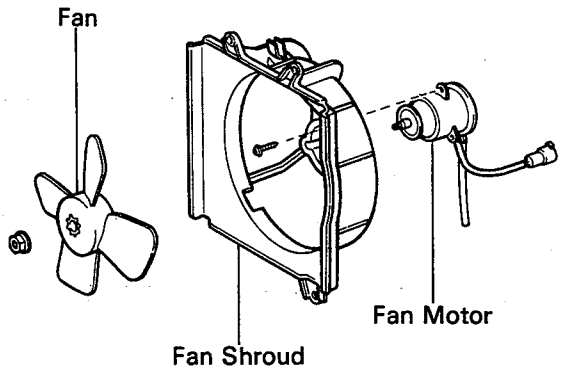
Radiator Cooling Fan

SYSTEM CIRCUIT

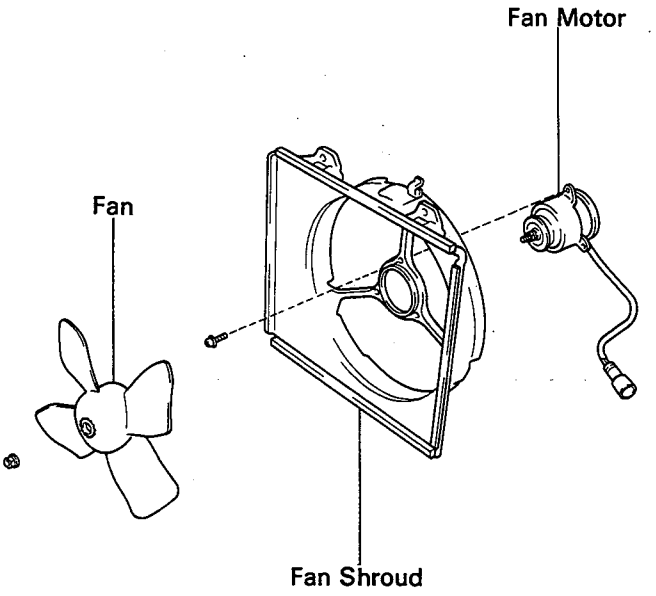


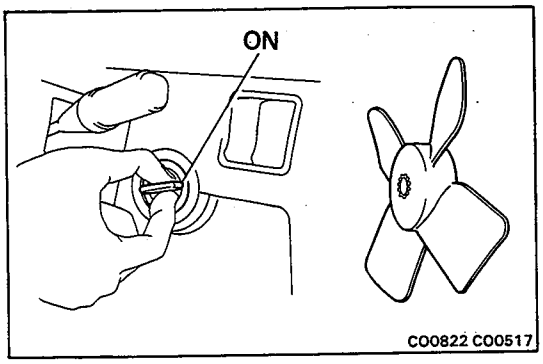
COMPONENTS

AE



AT





ON-VEHICLE INSPECTION

Low Coolant Temperature (below 83°C (181°F))

1. **TURN IGNITION SWITCH ON**

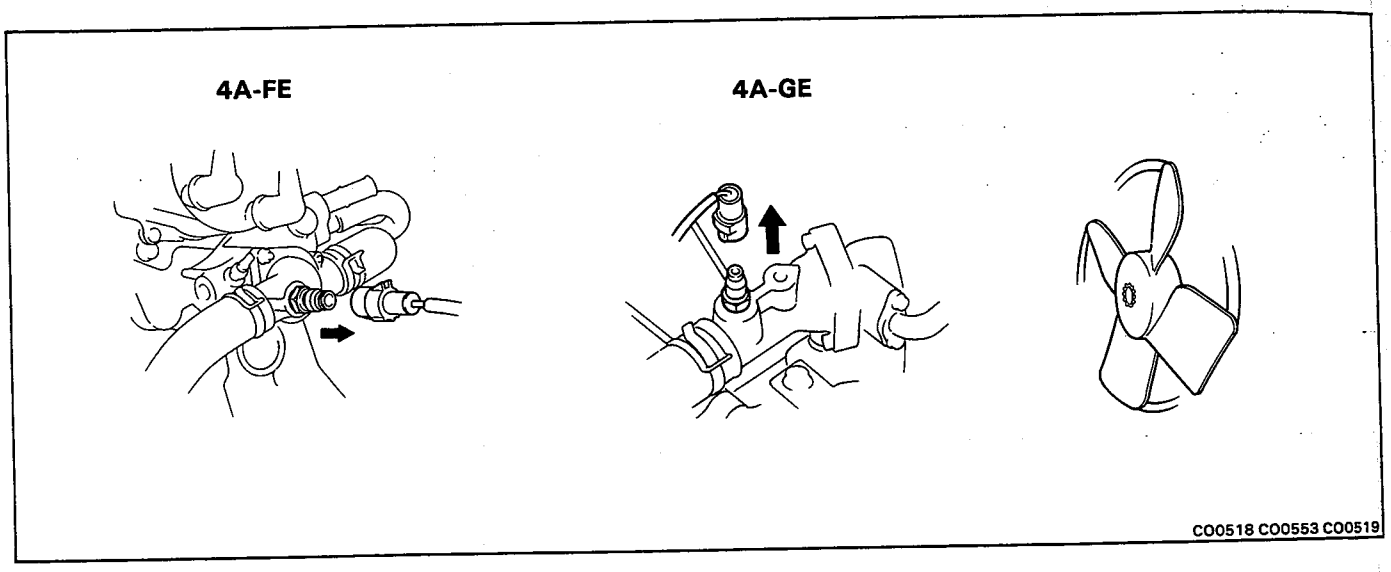
   Check that the fan does not rotate.

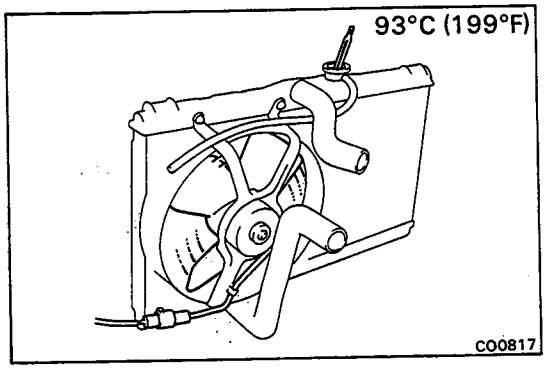
   If it rotates, check the fan relay and temperature switch, and check for a separated connector or severed wire between the relay and temperature switch.

2. **DISCONNECT TEMPERATURE SWITCH CONNECTOR**

   Check that the fan rotates.

   If it does not, check the fan relay, fan motor, ignition relay and fuse, and check for a short circuit between the fan relay and temperature switch.





3. **CONNECT TEMPERATURE SWITCH CONNECTOR**

High Coolant Temperature (above 93°C (199°F))

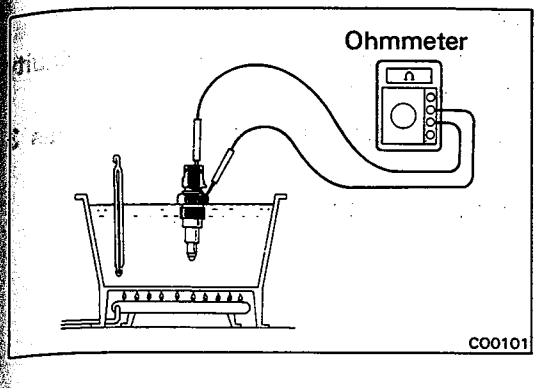
4. **START ENGINE**

   (a) Raise engine coolant temperature to above 93°C (199°F).

   (b) Check that the fan rotates.

   (c) Check that the fan stops when coolant temperature is below 83°C (181°F).

   If it doesn't replace the temperature switch.



INSPECTION OF ELECTRIC COOLING FAN

1. INSPECT TEMPERATURE SWITCH

LOCATION: On the water inlet housing.

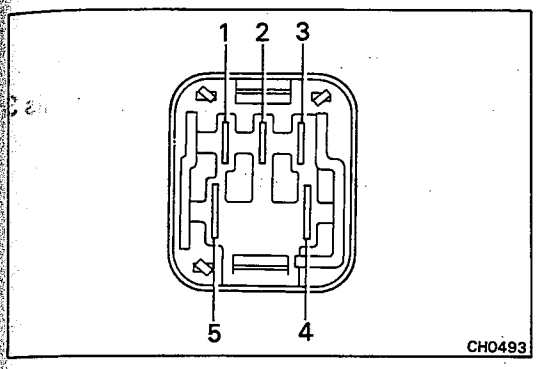
(a) Using an ohmmeter, check that there is no continuity when the coolant temperature is above 93°C (199°F).

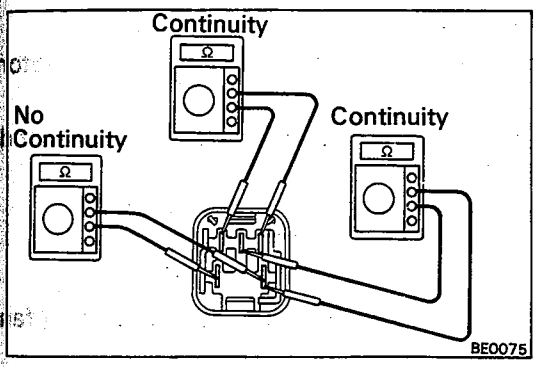
(b) Check that there is continuity when the coolant temperature is below 83°C (181°F).

If continuity is not as specified, replace the switch.

2. INSPECT ENGINE MAIN RELAY

LOCATION: In the engine compartment relay box.





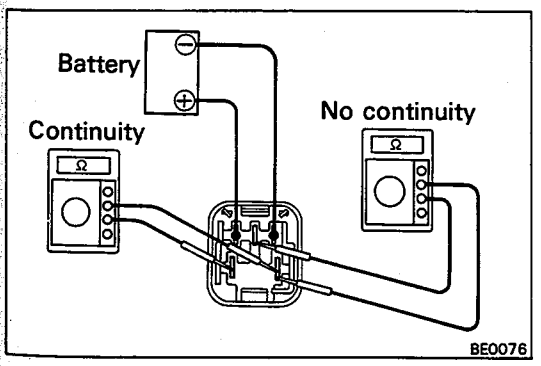
A. Inspect relay continuity

(a) Using an ohmmeter, check that there is continuity between terminals 1 and 3.

(b) Check that there is continuity between terminals 2 and 4.

(c) Check that there is no continuity between terminals 4 and 5.

If continuity is not as specified, replace the relay.



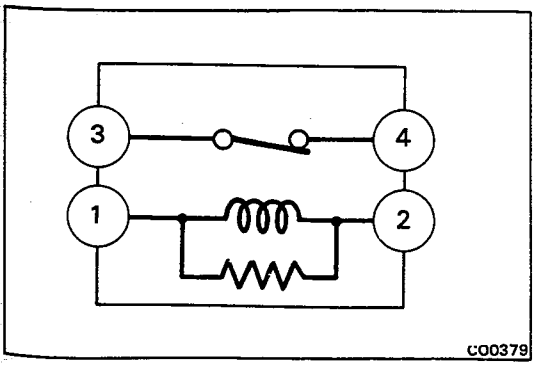
B. Inspect relay operation

(a) Apply battery voltage across terminals 1 and 3.

(b) Using an ohmmeter, check that there is continuity between terminals 4 and 5.

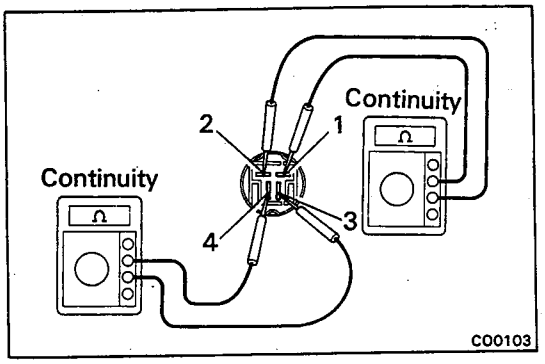
(c) Check that there is no continuity between terminals 2 and 4.

If operation is not as specified, replace the relay.



3. INSPECT COOLING FAN RELAY

LOCATION: In the engine compartment relay box.

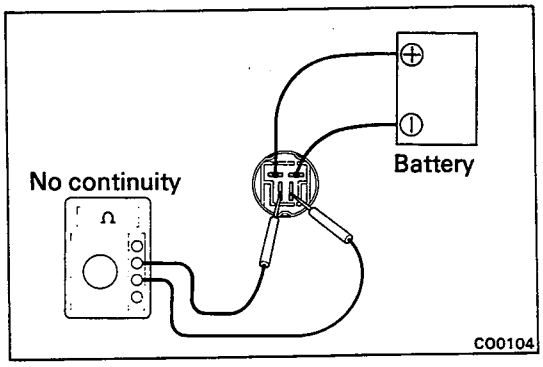


A. Inspect relay continuity

(a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

(b) Check that there is continuity between terminals 3 and 4.

If continuity is not as specified, replace the relay.

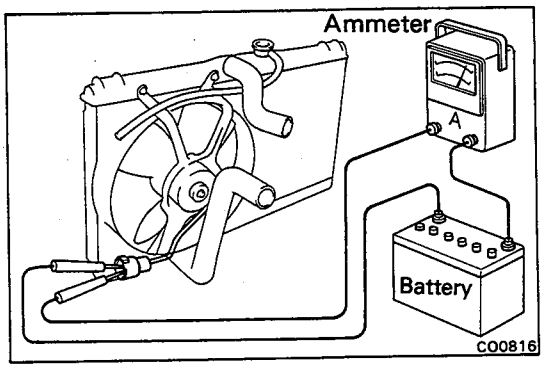


B. Inspect relay operation

(a) Apply battery voltage across terminals 1 and 2.

(b) Check that there is no continuity between terminals 3 and 4.

If operation is not as specified, replace the relay.



4. INSPECT FAN MOTOR

(a) Connect the battery and ammeter to the fan motor connector.

(b) Check to see that the motor rotates smoothly, and current is as follows:

Standard amperage:

2WD	**3.2 – 4.4A**
4WD M/T	**5.8 – 7.4A**
4WD A/T	**8.8 – 10.8A**

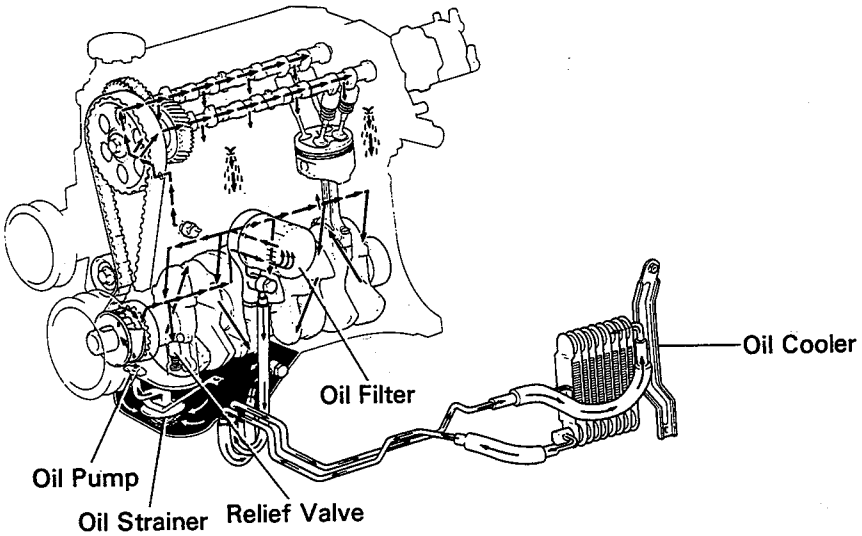
If the amperage is not as specified, replace the cooling fan motor.

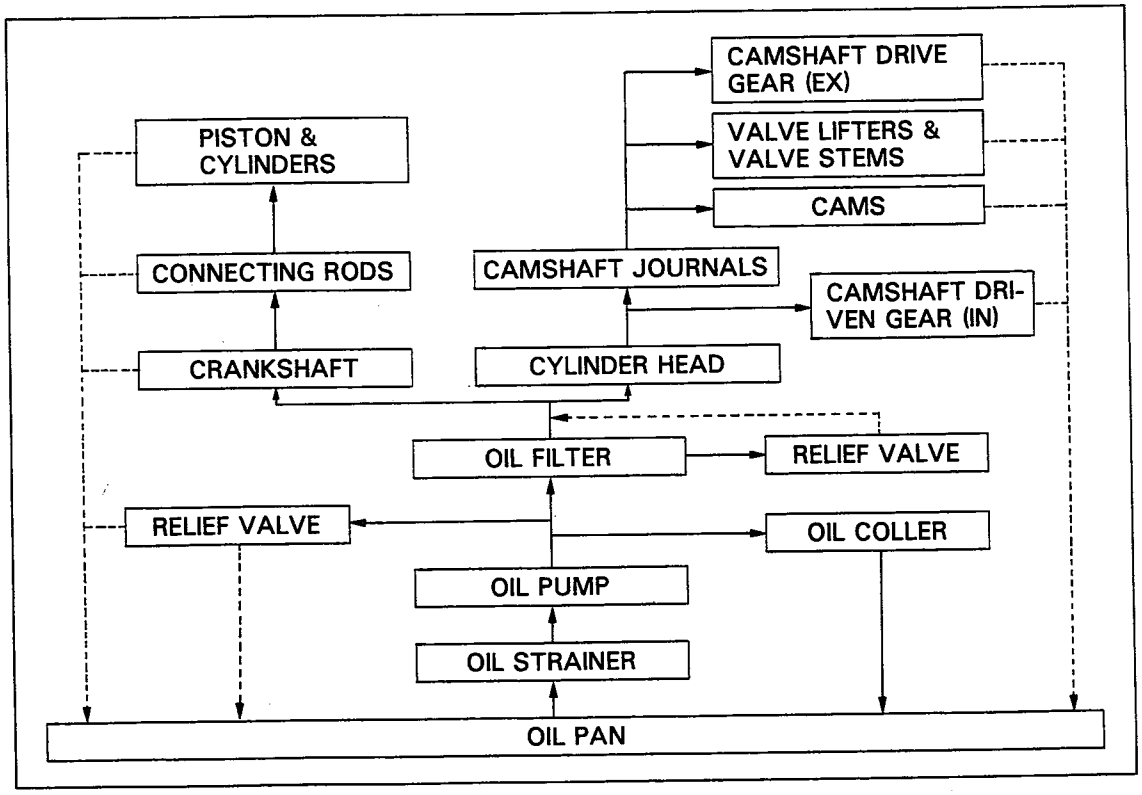
LUBRICATION SYSTEM

DESCRIPTION

A fully pressurized, fully filtered lubrication system has been adopted for this engine.

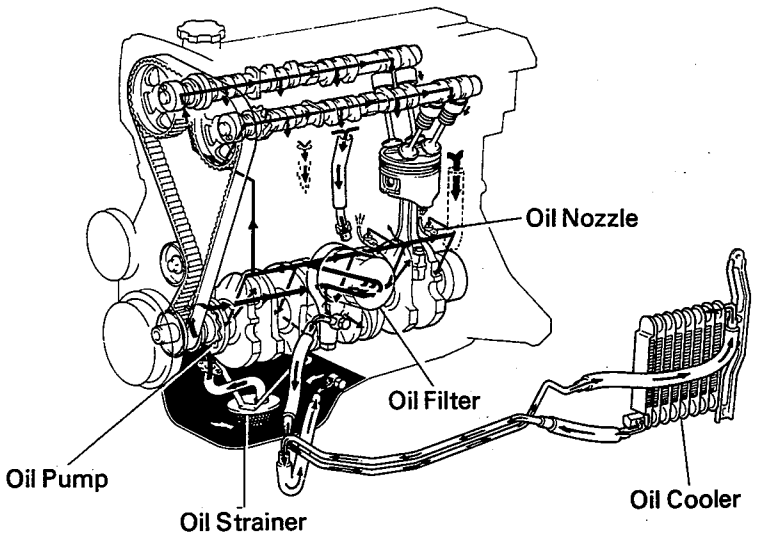
4A-FE

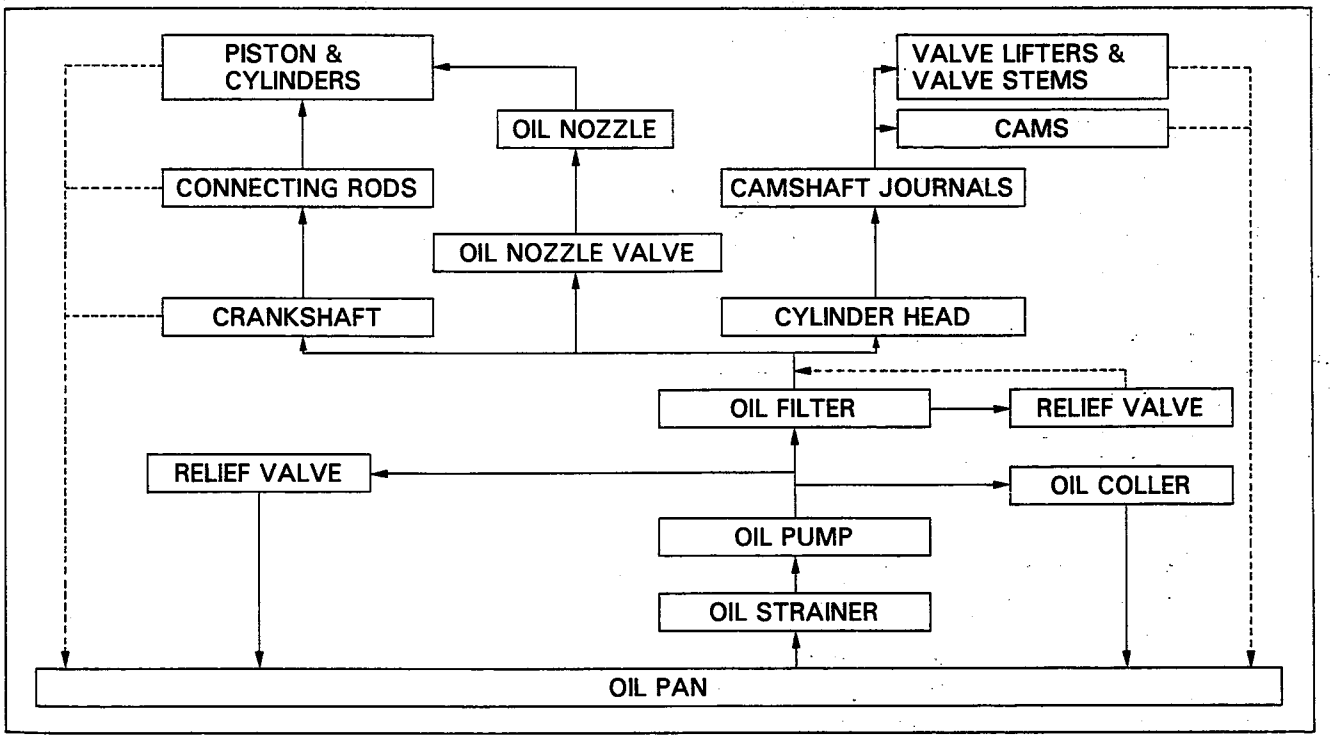




LU076

4A-GE


Oil Nozzle
Oil Filter
Oil Pump
Oil Strainer
Oil Cooler


PISTON & CYLINDERS
OIL NOZZLE
VALVE LIFTERS & VALVE STEMS
CAMS
CONNECTING RODS
CAMSHAFT JOURNALS
OIL NOZZLE VALVE
CRANKSHAFT
CYLINDER HEAD
OIL FILTER
RELIEF VALVE
RELIEF VALVE
OIL COLLER
OIL PUMP
OIL STRAINER
OIL PAN

LU0836

A pressure feeding lubrication system has been adopted to supply oil to the moving parts of this engine. The lubrication system consists of an oil pan, oil pump, oil filter and other external parts which supply oil to the moving parts in the engine block. The oil circuit is shown in the illustration at the top of the previous page. Oil from the oil pan is pumped up by the oil pump. After it passes through the oil filter, it is fed through the various oil holes in the crankshaft and cylinder block. After passing through the cylinder block and performing its lubricating function, the oil is returned by gravity to the oil pan. A dipstick on the side of the oil pump body is provided to check the oil level.

OIL PUMP

The oil pump pumps up oil from the oil pan and sends it under pressure to the various parts of the engine. An oil strainer is mounted in front of the inlet to the oil pump. The oil pump itself is a trochoid type pump, inside of which there is a drive rotor and a driven rotor. When the drive rotor rotates, the driven rotor rotates in the same direction, and since the axls of the driven rotor shaft is different from the center of the driven rotor, the space between the two rotors is changed as they rotate. Oil is drawn in when the space is wide and is discharged when the space in narrow.

OIL PRESSURE REGULATOR

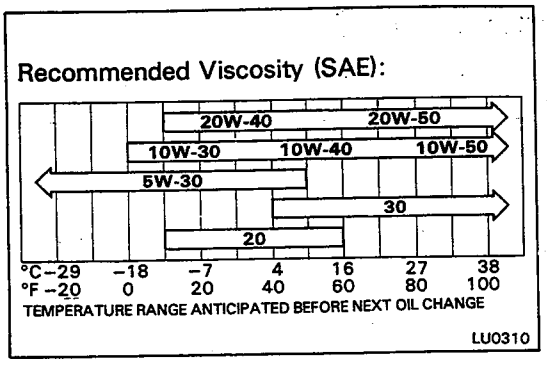
At high engine speeds, the engine oil supplied by the oil pump exceeds the capacity of the engine to utilize it. For that reason, the oil pressure regulator works to prevent an oversupply of oil. During normal oil supply, a coil spring and valve keep the bypass closed, but when too much oil is being fed, the pressure become extremely high, overpowering the force of the spring and opening the valves. This allows the excess oil to flow through the valve and return to the oil pan.

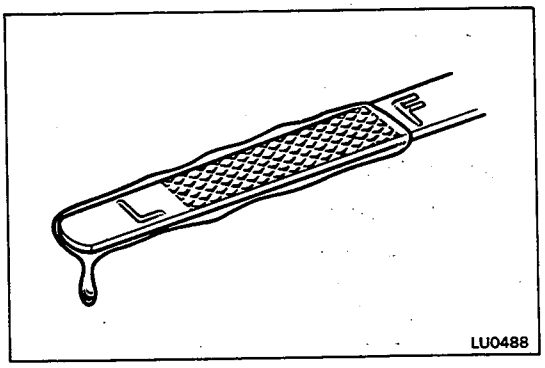
OIL FILTER

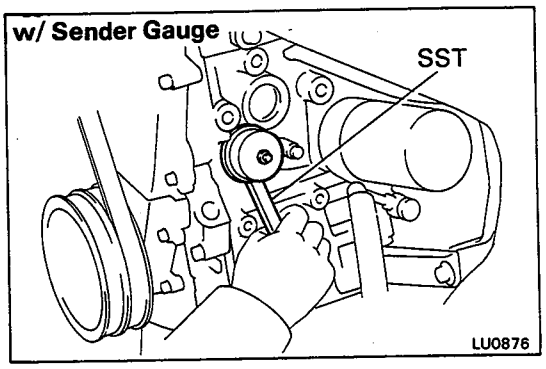
The oil filter is a full flow type filter with a built-in paper filter element. Particles of metal from wear, airborn dirt, carbon and other impurities can get into the oil during use and could cause accelerated wear or sizing if allowed to circulate through the engine. The oil filter, integrated into the oil line, removes these impurities as the oil passes through it. The filter is mounted outside the engine to simplify replacement of the filter element. A relief valve is also included ahead of the filter element to relieve the high oil pressure in case that the filter element becomes clogged with impurities. The relief valve opens when the oil pressure overpowers the force of the spring. Oil passing through the relief valve by-passes the oil filter and flows directly into the main oil hole in the engine.

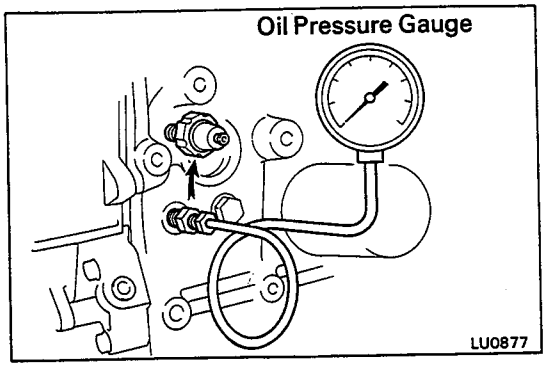
TROUBLESHOOTING

Problem	Possible cause	Remedy	Page
Oil leakage	Cylinder head, cylinder block or oil pump body damaged or cracked	Repair as necessary	
	Oil seal faulty	Replace oil seal	EM-135 LU-13
	Gasket faulty	Replace gasket	
Low oil pressure	Oil leakage	Repair as necessary	
	Relief valve faulty	Repair relief valve	LU-12,13
	Oil pump faulty	Repair oil pump	LU-9
	Poor quality engine oil	Replace engine oil	LU-6
	Crankshaft bearing faulty	Replace bearing	EM-122
	Connecting rod bearing faulty	Replace bearing	EM-119
	Oil filter clogged	Replace oil filter	LU-7
High oil pressure	Relief valve faulty	Repair relief valve	LU-12,13









OIL PRESSURE CHECK

1. CHECK ENGINE OIL QUALITY

Check the oil for deterioration, entry of water, discoloring of thinning.

If the quality is poor, replace the oil.

(4A-FE for Europe & Australia and 4A-GE)
Use API grade SE, SF, SG or better and recommended viscosity oil.

(4A-FE for Others)
Use API grade SD, SE, SF, SG or better and recommended viscosity oil.

2. CHECK ENGINE OIL LEVEL

The oil level should be between the "L" and "F" marks on the dipstick.
If low, check for leakage and add oil up to the "F" mark.

3. REMOVE OIL PRESSURE SWITCH OR SENDER GAUGE AND INSTALL OIL PRESSURE GAUGE

(a) (4A-FE)
Remove the alternator and bracket.

(b) Remove the oil pressure switch (4A-FE) or oil pressure sender gauge (4A-GE).

HINT: (w/ Sender gauge): Use SST.

SST 09027-12140

(c) Install an oil pressure gauge.

(d) (4A-FE)
Reinstall the bracket and alternator.

4. WARM UP ENGINE

Allow the engine to warm up to reach normal operating temperature.

5. CHECK OIL PRESSURE

Oil pressure:

At idling	**0.3 kg/cm² (4.3 psi, 29 kPa) or more**
At 3,000 rpm	**2.5 — 5.0 kg/cm² (36 — 71 psi, 245 — 490 kPa)**

6. REMOVE OIL PRESSURE GAUGE

(a) (4A-FE)
Remove the alternator and bracket.

(b) Remove an oil pressure gauge.

(c) Apply adhesive to two or three threads of the oil pressure switch (4A-FE) or oil pressure sender gauge (4A-GE).

Adhesive: Part No.08833-00080, THREE BOND 1344, LOCTITE 242 or equivalent.

(d) Reinstall the oil pressure switch.

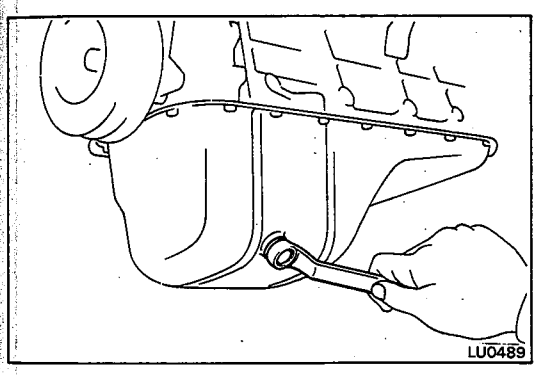
(e) (4A-FE)
Reinstall the bracket and alternator.

7. START ENGINE AND CHECK FOR LEAKS

REPLACEMENT OF ENGINE OIL AND OIL FILTER

CAUTION:

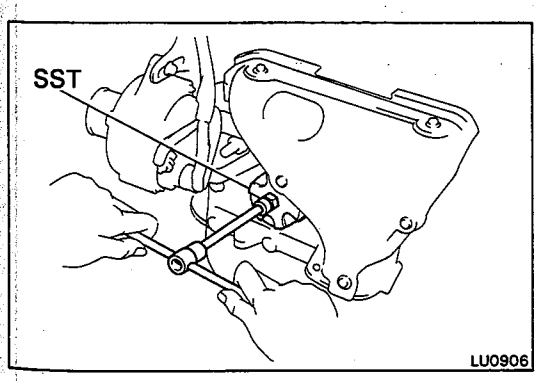
- **Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer. Adequate means of skin protection and washing facilities should be provided.**
- **Care should be taken, therefore, when changing engine oil, to minimize the frequency and length of time your skin is exposed to used engine oil. Protective clothing and gloves, that cannot be penetrated by oil, should be worn. The skin should be thoroughly washed with soap and water, or use waterless hand cleaner, to remove any used engine oil. Do not use gasoline, thinners, or solvents.**
- **In order to preserve the environment, used oil must be disposed of only at designated disposal sites.**



1. DRAIN ENGINE OIL

(a) Remove the oil filler cap.

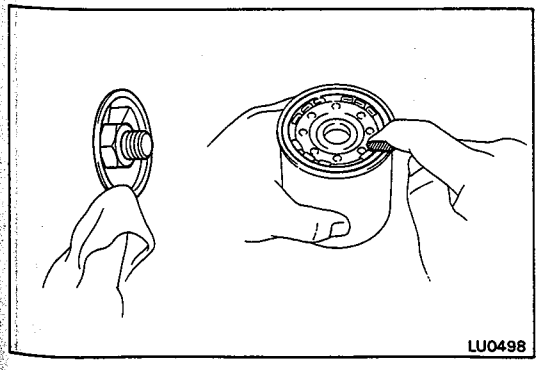
(b) Remove the oil drain plug and drain the oil into a container.



2. REPLACE OIL FILTER

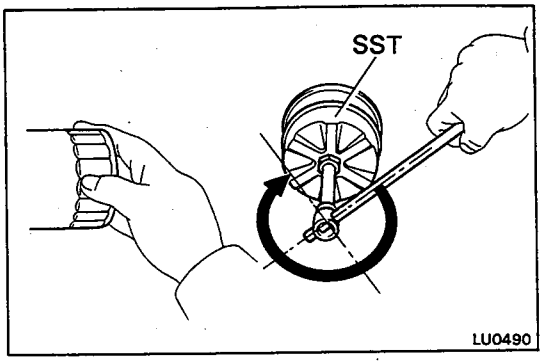
(a) Using SST, remove the oil filter (located on left side of the engine block).

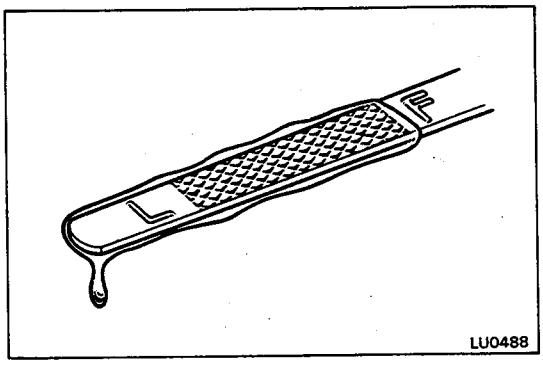
SST 09228-06500



(b) Inspect and clean the oil filter installation surface.

(c) Apply clean engine oil to the gasket of a new oil filter.





(d) Lightly screw in the filter to where you feel resistance.

(e) Then, using SST, tighten the oil filter an extra 3/4 turn.

SST 09228-06500

3. REFILL WITH ENGINE OIL

(a) Clean and install the oil drain plug with a new gasket. Torque the drain plug.

Torque: 350 kg-cm (25 ft-lb, 34 N·m)

(b) Fill the engine with new oil, API grade SD, SE, SF, SG or better.

Capacity:

4A-FE

Drain and refill

Without oil filter change

3.0 liters (3.1 US qts, 2.6 Imp.qts)

With oil filter change

3.2 liters (3.3 US qts, 2.8 Imp.qts)

Dry fill (w/ Oil cooler)

4.1 liters (4.3 US qts, 3.6 Imp.qts)

Dry fill (w/o Oil cooler)

3.7 liters (3.9 US qts, 3.3 Imp.qts)

4A-GE

Drain and refill

Without oil filter change

3.4 liters (3.6 US qts, 3.0 Imp.qts)

With oil filter change

3.7 liters (3.9 US qts, 3.3 Imp.qts)

Dry fill

4.1 liters (4.3 US qts, 3.6 Imp.qts)

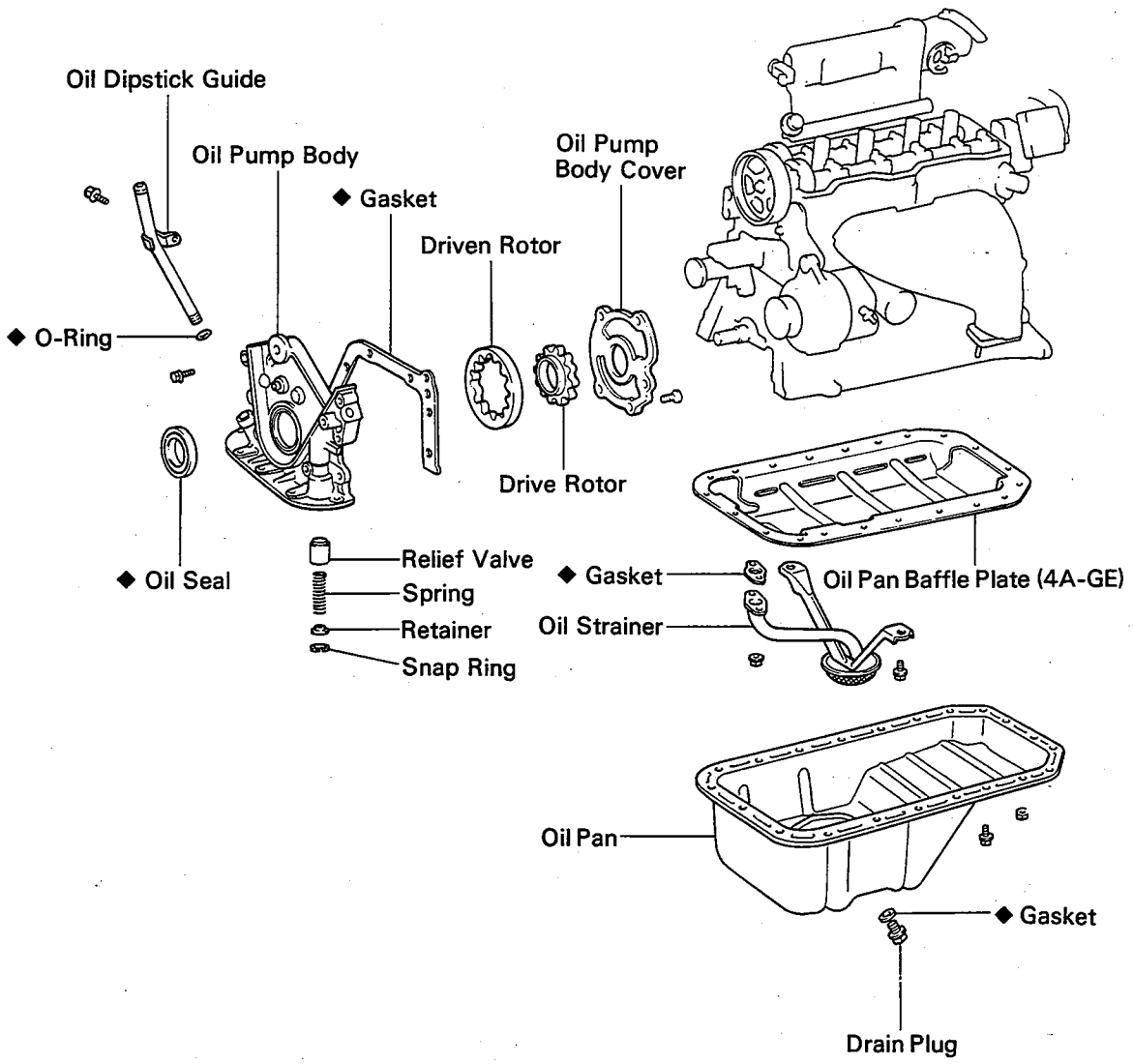
(c) Reinstall the oil filler cap with the gasket.

4. START ENGINE AND CHECK FOR LEAKS

5. RECHECK ENGINE OIL LEVEL (See page LU-6)

OIL PUMP

COMPONENTS



◆ Non-reusable part

LU0878

REMOVAL OF OIL PUMP

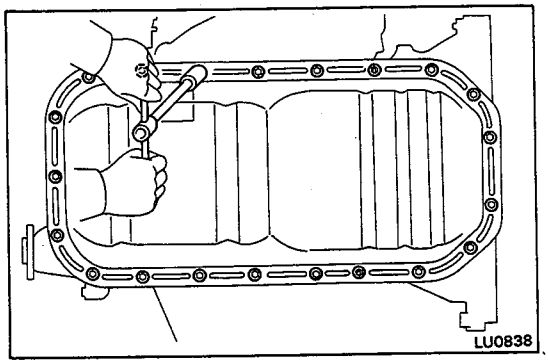
(See page LU-9)

HINT: When repairing the oil pump, the oil pan and strainer should be removed and cleaned.

1. **DRAIN ENGINE OIL (See page LU-7)**

2. **REMOVE TIMING BELT, IDLER PULLEY AND CRANKSHAFT TIMING PULLEY**

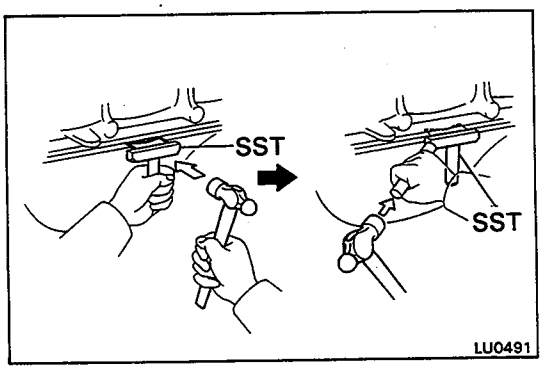
   4A-FE (See page EM-39)
   4A-GE (See page EM-47)



3. **REMOVE OIL PAN**

   (a) Remove the oil cooler hose and union from the oil pan.

   (b) Remove the two nuts and nineteen bolts.



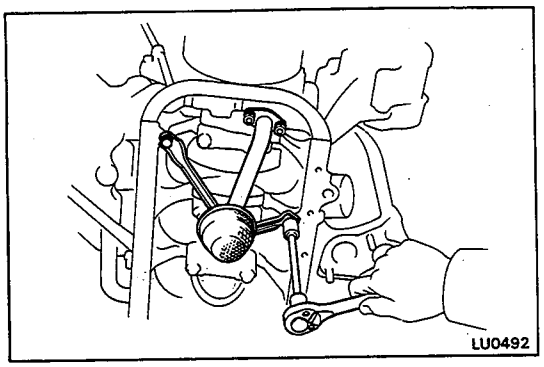
   (c) (4A-FE)
   Insert the blade of SST between the oil pan and cylinder block, cut off applied sealer and then remove the oil pan.

   SST 09032-00100

   (d) (4A-GE)
   Insert the blade of SST between the oil pan and baffle plate, cut off applied sealer and then remove the oil pan.

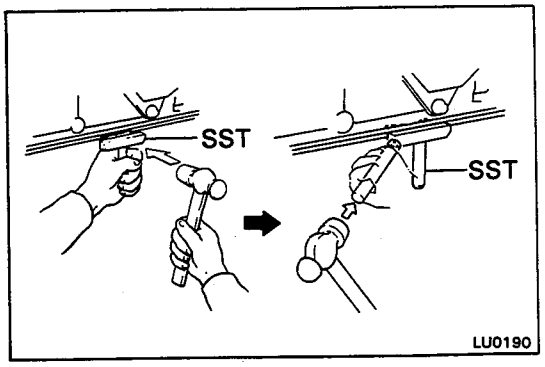
   SST 09032-00100

   NOTICE:
   - **Do not use SST for the oil pump body side. If necessary, use a screwdriver.**
   - **When removing the oil pan, be careful not to damage the oil pan flange.**



4. **REMOVE OIL STRAINER**

   Remove the two bolts, nuts, oil strainer and gasket.

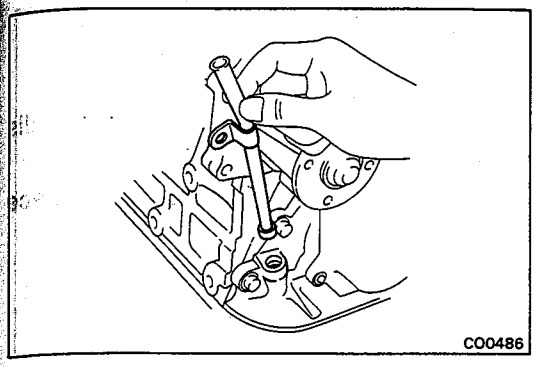


5. **(4A-GE)**
   REMOVE OIL PAN BAFFLE PLATE

   Insert the blade of SST between the cylinder block and baffle plate, cut off applied sealer and remove the baffle plate.

   SST 09032-00100

   NOTICE:
   - **Do not use SST for the oil pump body side. If necessary, use a screwdriver.**
   - **When removing the baffle plate, be careful not to damage the baffle plate flange.**

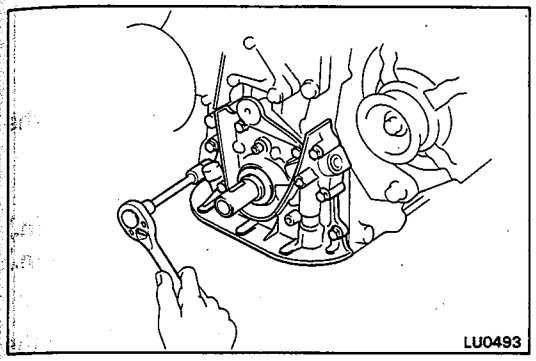


6. REMOVE OIL DIPSTICK GUIDE AND DIPSTICK

(a) Remove the dipstick.

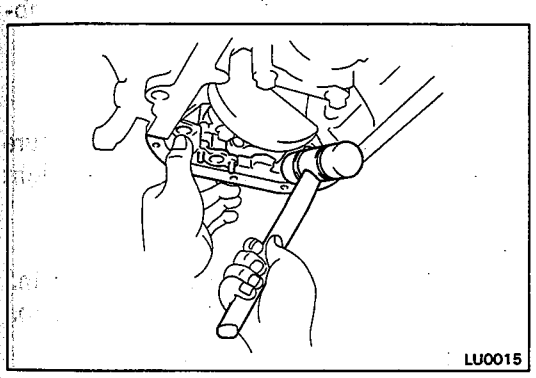
(b) Remove the bolt, and pull out the dipstick guide.

(c) Remove the O-ring from the dipstick gauide.



7. REMOVE OIL PUMP

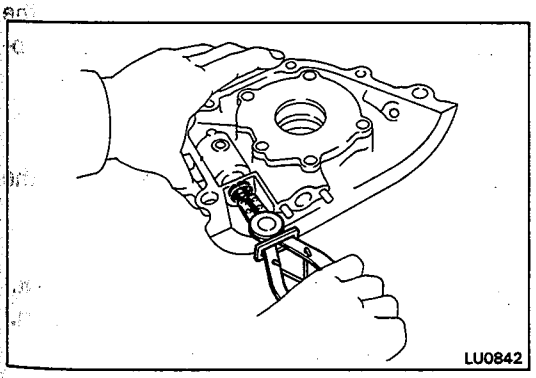
(a) Remove the seven bolts.



(b) Using a plastic-faced hammer, remove the oil pump by carefully tapping the oil pump body.

DISASSEMBLY OF OIL PUMP

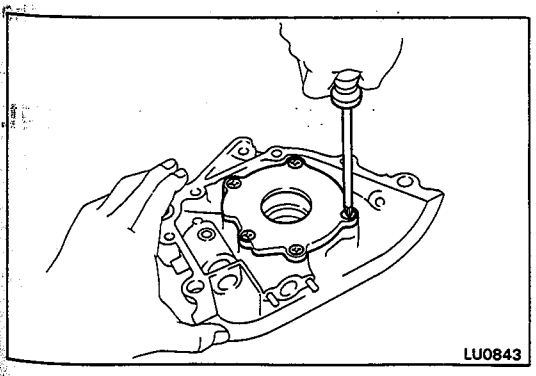
(See page LU-9)



1. REMOVE RELIEF VALVE

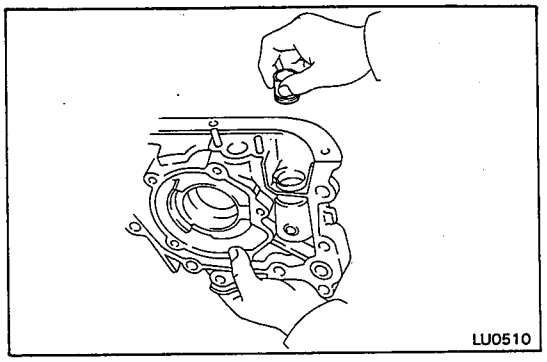
(a) Using snap ring pliers, remove the snap ring.

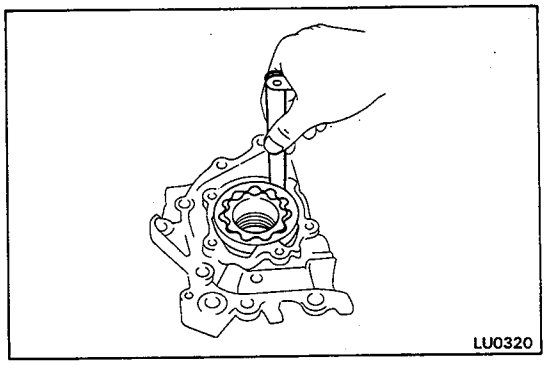
(b) Remove the retainer, spring and relief valve.

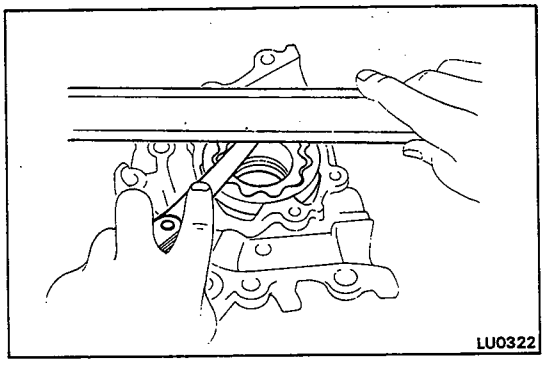


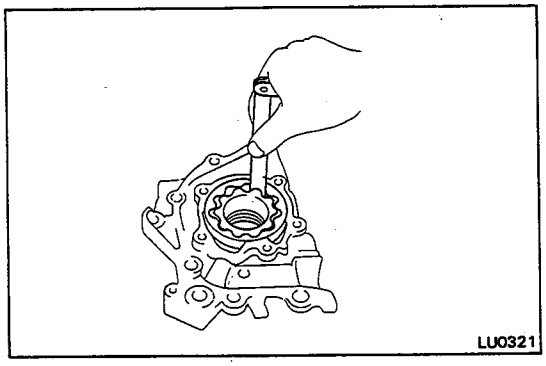
2. REMOVE DRIVE AND DRIVEN ROTORS

Remove the five screws, pump body cover, drive and driven rotors.









INSPECTION OF OIL PUMP

1. INSPECT RELIEF VALVE

Coat the valve with engine oil and check that it falls smoothly into the valve hole by its own weight.

If it doesn't, replace the relief valve. If necessary, replace the oil pump assembly.

2. INSPECT DRIVE AND DRIVEN ROTORS

A. Inspect rotor body clearance

Using a feeler gauge, measure the clearance between the driven rotor and pump body.

Standard body clearance:

4A-FE 0.080 — 0.180 mm (0.0031 — 0.0071 in.)
4A-GE 0.100 — 0.191 mm (0.0039 — 0.0075 in.)

Maximum body clearance: 0.20 mm (0.0079 in.)

If the body clearance is greater than maximum, replace the rotors as a set. If necessary, replace the oil pump assembly.

B. Inspect rotor side clearance

Using a feeler gauge and precision straight edge, measure the clearance between the rotors and precision straight edge.

Standard side clearance:

4A-FE 0.025 — 0.085 mm (0.0010 — 0.0033 in.)
4A-GE 0.025 — 0.075 mm (0.0010 — 0.0030 in.)

Maximum side clearance: 0.10 mm (0.0039 in.)

If the side clearance is greater than maximum, replace the rotors as a set. If necessary, replace the oil pump assembly.

C. Inspect rotor tip clearance

Using a feeler gauge, measure the clearance between the drive and driven rotors.

Standard tip clearance:

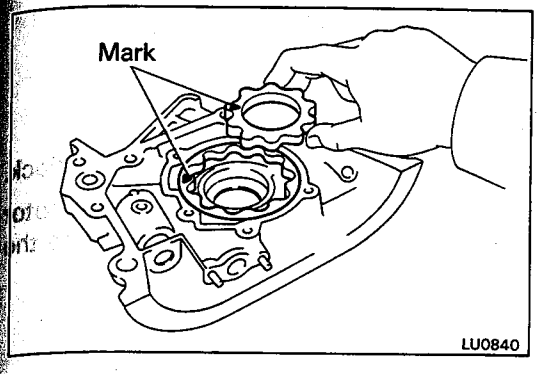
4A-FE 0.025 — 0.085 mm (0.0010 — 0.0033 in.)
4A-GE 0.060 — 0.180 mm (0.0024 — 0.0071 in.)

Maximum tip clearance: 0.35 mm (0.0138 in.)

If the tip clearance is greater than maximum, replace the rotors as a set.

REPLACEMENT OF CRANKSHAFT FRONT OIL SEAL

(See page EM-135)

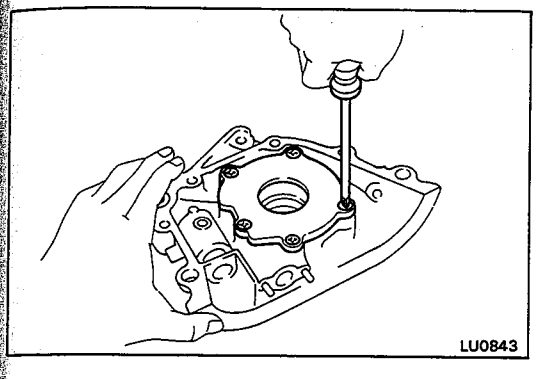


ASSEMBLY OF OIL PUMP

(See page LU-9)

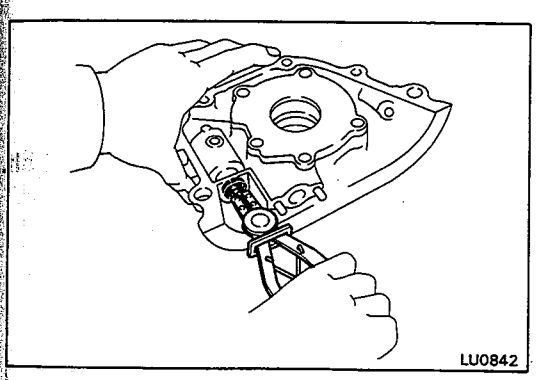
1. INSTALL DRIVE AND DRIVEN ROTORS

(a) Place the drive and driven rotors into pump body with the marks facing the pump body cover side.



(b) Install the pump body cover with the five screws.

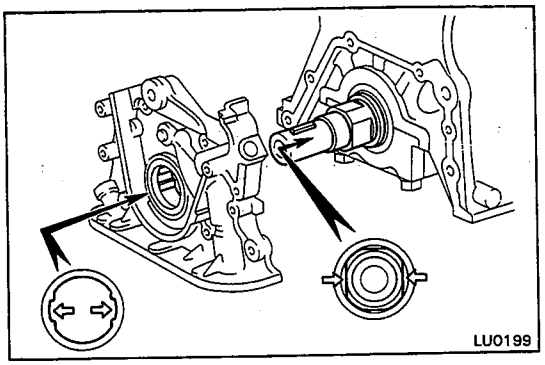
Torque: 105 kg-cm (8 ft-lb, 10 N·m)



2. INSTALL RELIEF VALVE

(a) Insert the relief valve, spring and retainer into the pump body hole.

(b) Using snap ring pliers, install the snap ring.



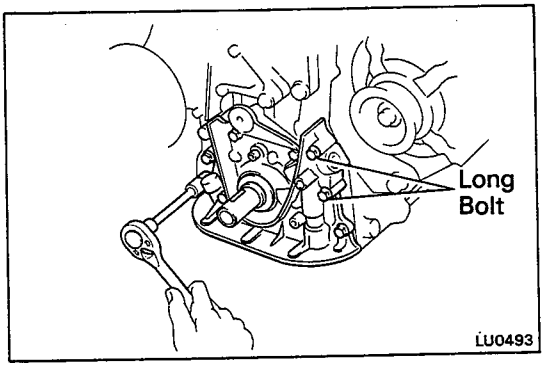
INSTALLATION OF OIL PUMP

(See page LU-9)

1. INSTALL OIL PUMP

(a) Place a new gasket in position on the cylinder block.

(b) Engage the spline teeth of the oil pump drive rotor with the large teeth of the crankshaft, and slide the oil pump.

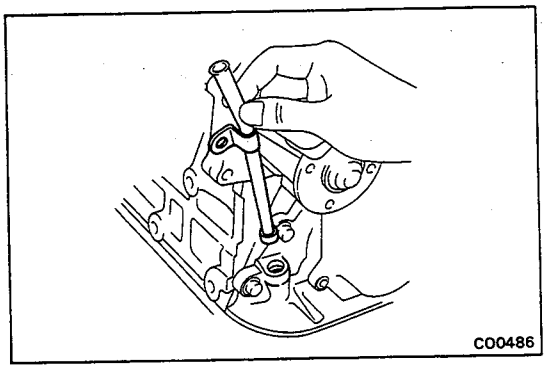


(c) Install the oil pump with the seven bolts.

Torque: 220 kg-cm (16 ft-lb, 21 N·m)

HINT: Each bolt length is indicated in the figure.

Bolt length: Long bolt 35 mm (1.38 in.)
Others 25 mm (0.98 in.)



2. INSTALL OIL DIPSTICK GUIDE AND DIPSTICK

(a) Install a new O-ring to the dipstick guide.

(b) Apply soapy water to the O-ring.

(c) Push in the dipstick guide, and install it with the bolt.

Torque: 95 kg-cm (82 in.-lb, 9.3 N·m)

(d) Install the dipstick.

3. (4A-GE) INSTALL OIL PAN BAFFLE PLATE

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contacting surfaces of the baffle plate and cylinder block.

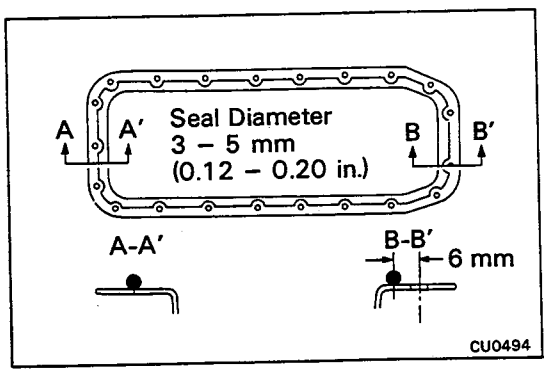
- Using a razor blade and gasket scraper, remove all the packing (FIPG) material from the gasket surfaces.
- Thoroughly clean all components to remove all the loose material.
- Clean both sealing surfaces with a non-residue solvent.

NOTICE: Do not use a solvent which will affect the painted surfaces.

(b) Apply seal packing to the baffle plate as shown in the figure.

Seal packing: Part No.08826-00080 or equivalent

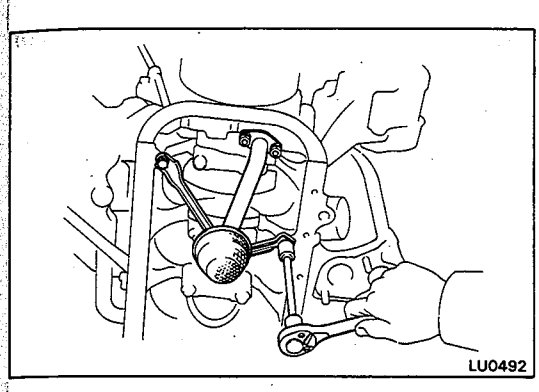
- Install a nozzle that has been cut to a 3 – 5 mm (0.12 – 0.20 in.) opening.



HINT: Avoid applying an excess amount of seal to the surface. Be particularly careful near oil passages.

- Parts must be assembled within 3 minutes of application. Otherwise, the material must be removed and reapplied.
- Immediately remove the nozzle from the tube and reinstall cap.

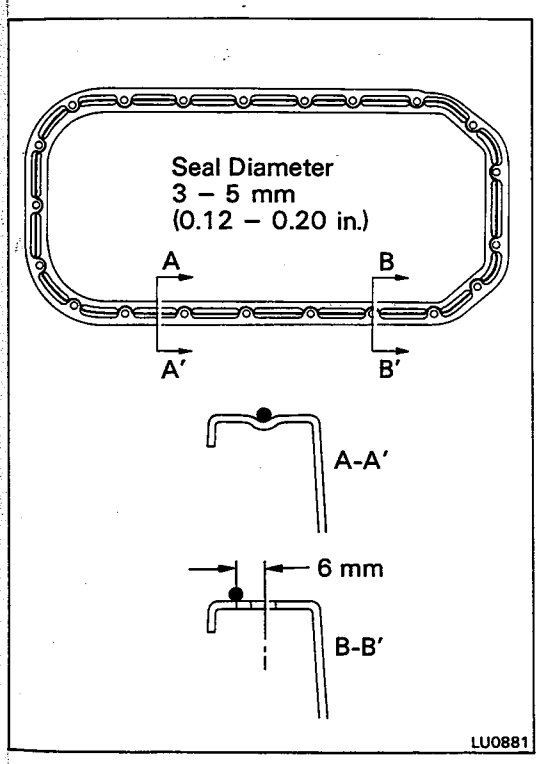
(c) Install the baffle plate.



4. INSTALL OIL STRAINER

Place a new oil strainer gasket and install the oil strainer with two bolts and two nuts.

Torque: 95 kg-cm (82 in.-lb, 9.3 N·m)



5. INSTALL OIL PAN

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contacting surfaces of the oil pan and cylinder block (4A-FE) or baffle plate (4A-GE).

- Using a razor blade and gasket scraper, remove all the packing (FIPG) material from the gasket surfaces.
- Thoroughly clean all components to remove all the loose material.
- Clean both sealing surfaces with a non-residue solvent.

NOTICE: Do not use a solvent which will affect the painted surfaces.

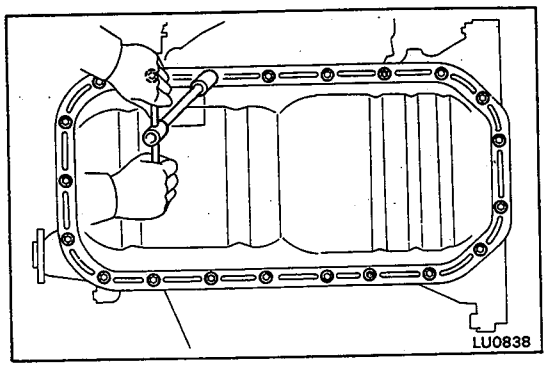
(b) Apply seal packing to the oil pan as shown in the figure.

Seal packing: Part No.08826-00080 or equivalent

- Install a nozzle that has been cut to a 3 – 5 mm (0.12 – 0.20 in.) opening.

HINT: Avoid applying an excess amount of seal to the surface. Be particularly careful near oil passages.

- Parts must be assembled within 3 minutes of application. Otherwise, the material must be removed and reapplied.
- Immediately remove the nozzle from the tube and reinstall cap.



(c) Install the oil pan over the studs on the block with the nineteen bolts and two nuts.

Torque: 50 kg-cm (43 in.-lb, 4.9 N·m)

(d) Install the cooler pipe, two new gaskets and union bolt. Torque the union bolt.

Torque: 250 kg-cm (18 ft-lb, 25 N·m)

6. **INSTALL CRANKSHAFT TIMING PULLEY, IDLER PULLEY AND TIMING BELT**

   4A-FE (See page EM-44)
   4A-GE (See page EM-52)

7. **REFILL WITH ENGINE OIL (See page LU-8)**

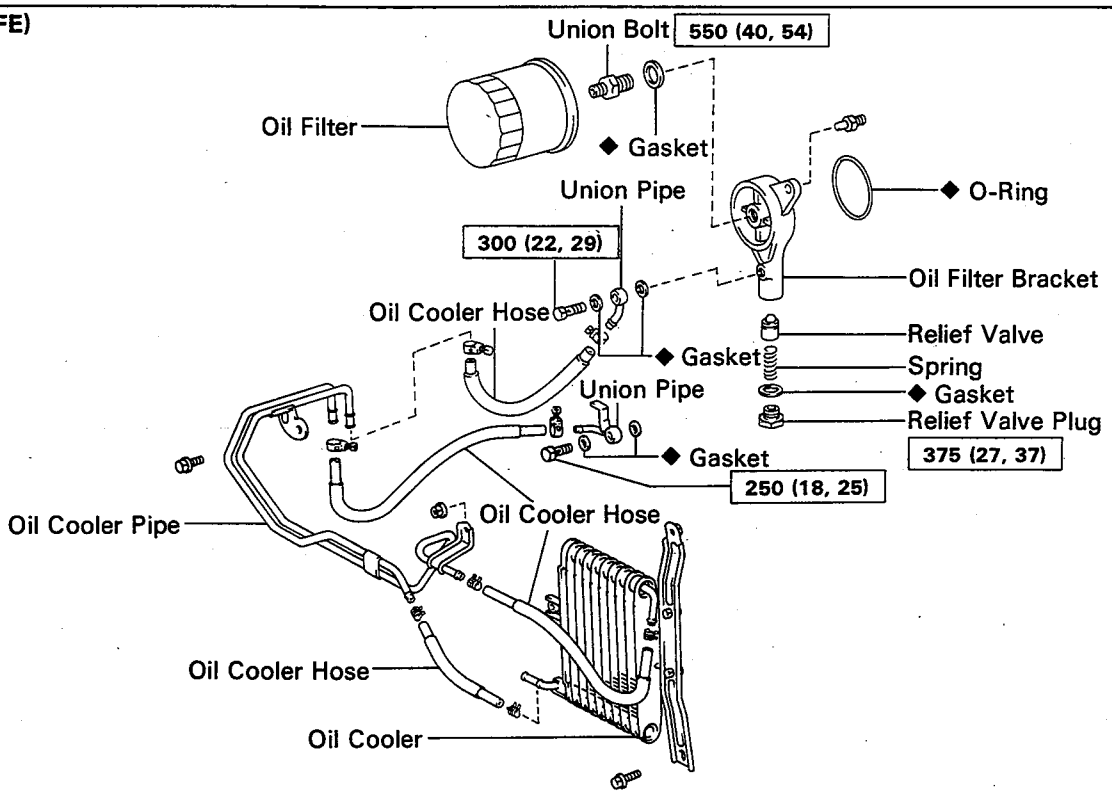
8. **START ENGINE AND CHECK FOR LEAKS**

9. **RECHECK OIL LEVEL (See page LU-6)**

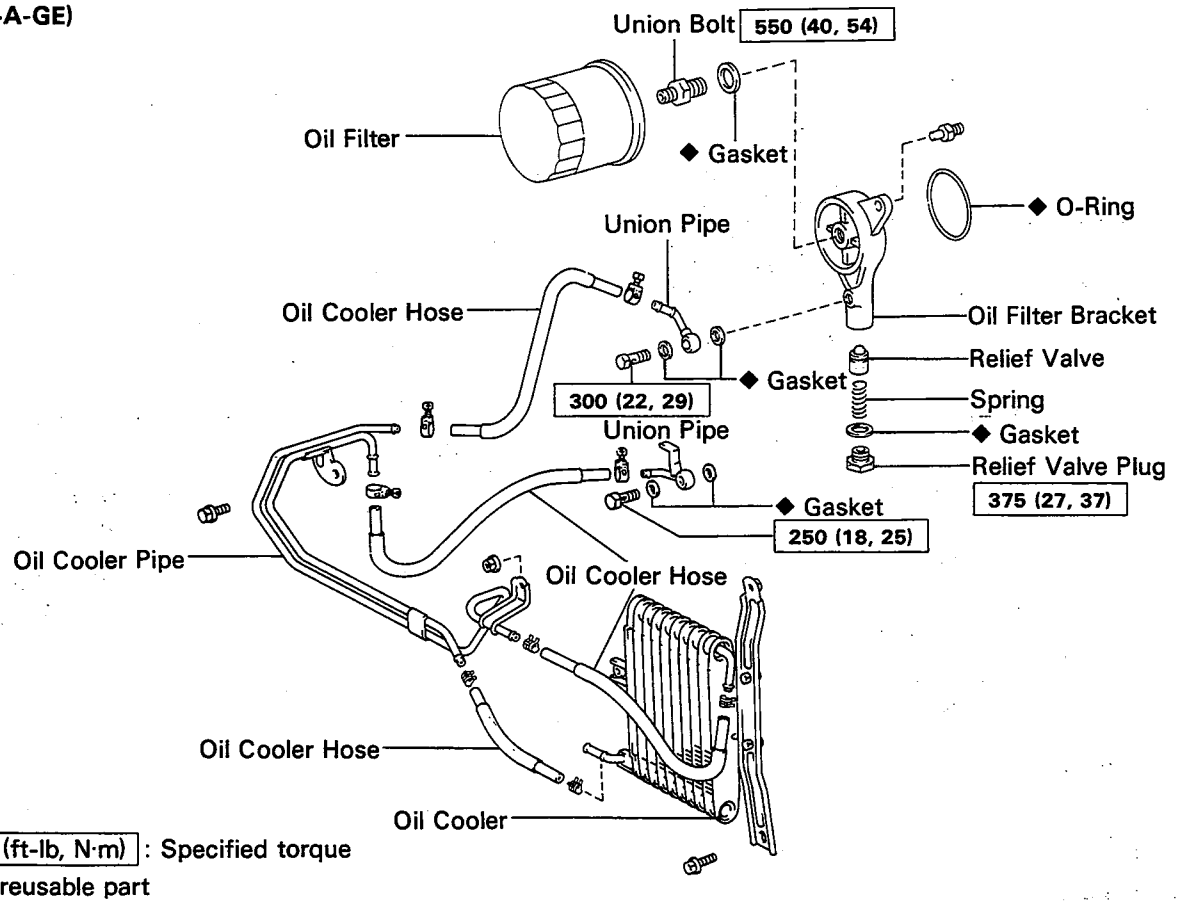
OIL COOLER AND PRESSURE REGULATOR

COMPONENTS

AE92, 95 (4A-FE)



AE92 (4A-GE)

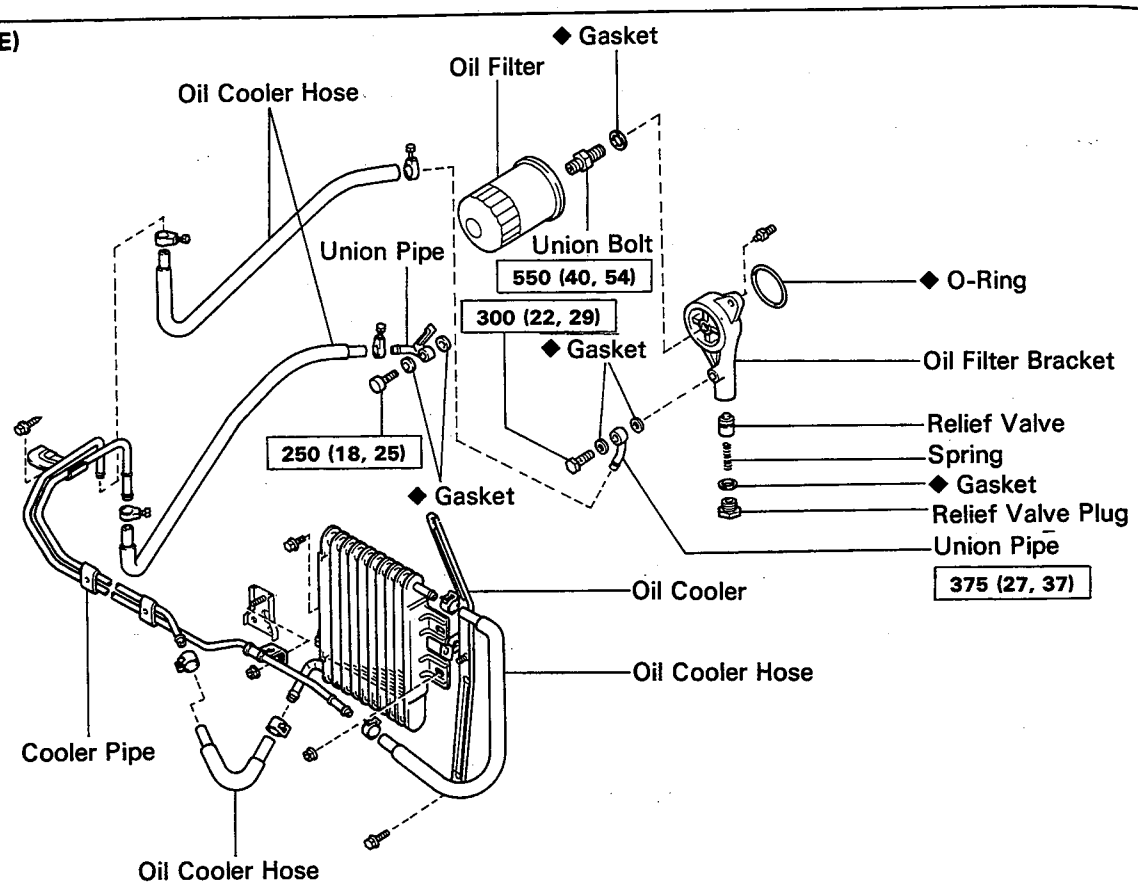


kg-cm (ft-lb, N·m) : Specified torque

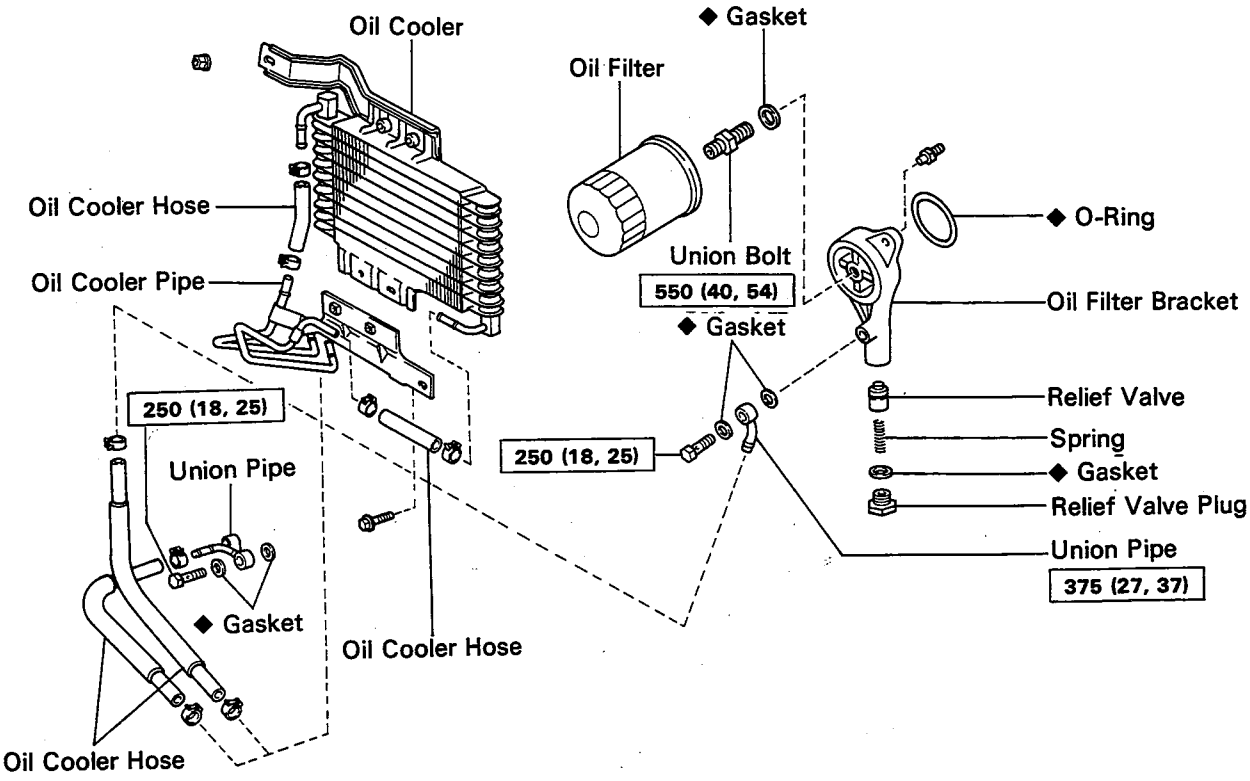
◆ Non-reusable part

COMPONENTS (Cont'd)

AT171 (4A-FE)



AT180 (4A-FE)



kg-cm (ft-lb, N·m) : Specified torque

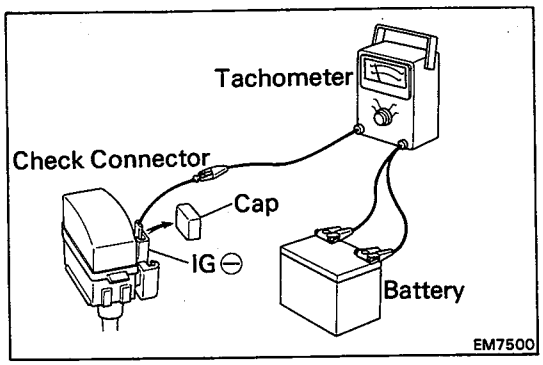
◆ Non-reusable part

LU0914
LU0915

IGNITION SYSTEM

PRECAUTIONS

1. Do not leave the ignition switch on for more than 10 minutes if the engine does not start.



2. With a tachometer is connected to the system, connect the test probe of the tachometer to terminal IG ⊖ of the check connector.

3. As some tachometers are not compatible with this ignition system, we recommended that you confirm the compatibility of your unit before using.

4. NEVER allow the tachometer terminal to touch ground as this could damage the igniter and/or ignition coil.

5. Do not disconnect the battery while the engine is running.

6. Check that the igniter is properly grounded to the body.

TROUBLESHOOTING

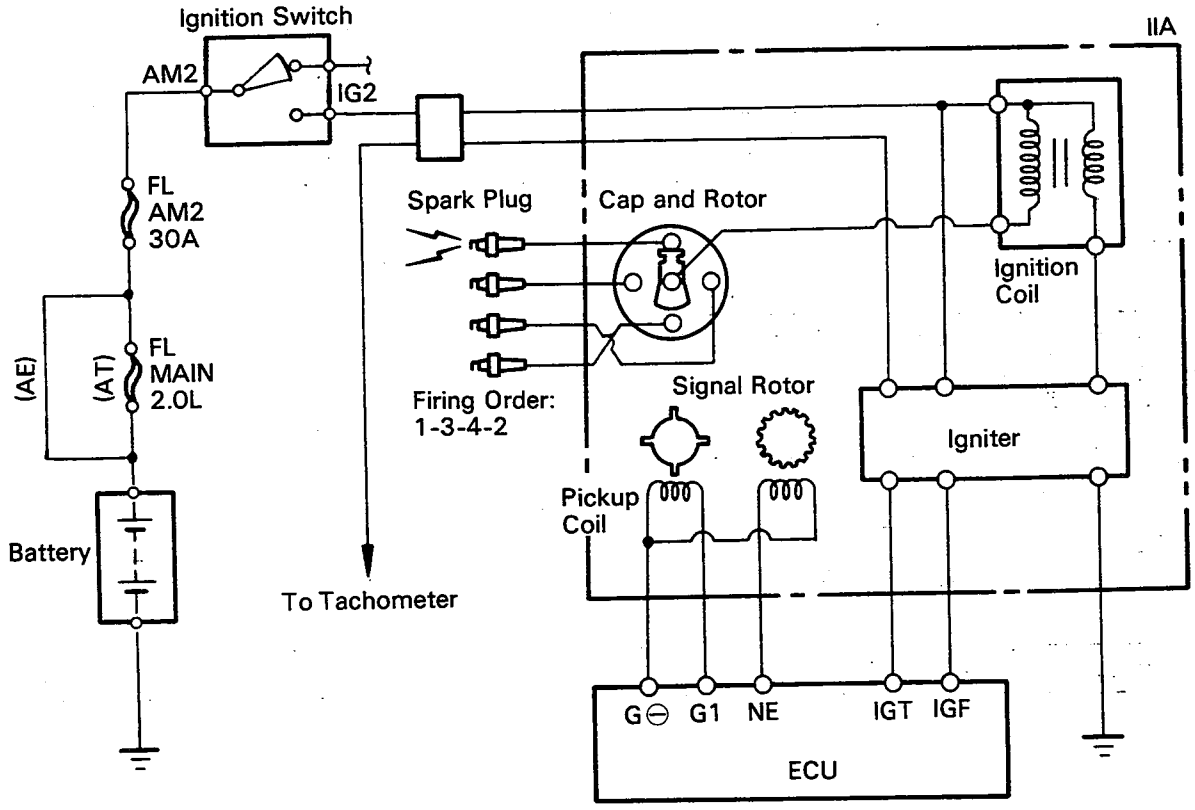
Problem	Possible cause	Remedy	Page
Engine will not start/ hard to start (cranks ok)	Incorrect ignition timing	Reset timing	EM-20,28
	Ignition coil faulty	Inspect coil	IG-8,14
	Igniter faulty	Inspect igniter	IG-9,14
	IIA or distributor faulty	Inspect IIA or distributor	IG-8,14
	High-tension cord faulty	Inspect high-tension cord	IG-7,11
	Spark plugs faulty	Inspect plugs	IG-7,11
	Ignition wiring disconnected or broken	Inspect wiring	
Rough idle or stalls	Spark plugs faulty	Inspect plugs	IG-7,11
	Ignition wiring faulty	Inspect wiring	
	Incorrect ignition timing	Reset timing	EM-20,28
	Ignition coil faulty	Inspect coil	IG-8,14
	Igniter faulty	Inspect Igniter	IG-9,14
	IIA or distributor faulty	Inspect IIA or distributor	IG-8,14
	High-tension cord faulty	Inspect high-tension cord	IG-7,11
Engine hesitates/ poor acceleration	Spark plug faulty	Inspect plugs	IG-7,11
	Ignition wiring faulty	Inspect wiring	
	Incorrect ignition timing	Reset timing	EM-20,28
Engine dieseling (runs after ignition switch is turned off)	Incorrect ignition timing	Reset timing	EM-20,28
Muffler explosion (after fire) all the time	Incorrect ignition timing	Reset timing	EM-20,28
Engine backfires	Incorrect ignition timing	Reset timing	EM-20,28
Poor fuel economy	Spark plugs faulty	Inspect plugs	IG-7,11
	Incorrect ignition timing	Reset timing	EM-20,28
Engine overheats	Incorrect ignition timing	Reset timing	EM-20,28

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, engine temperature, etc.) the microcomputer (ECU) triggers the spark at precisely the right instant.

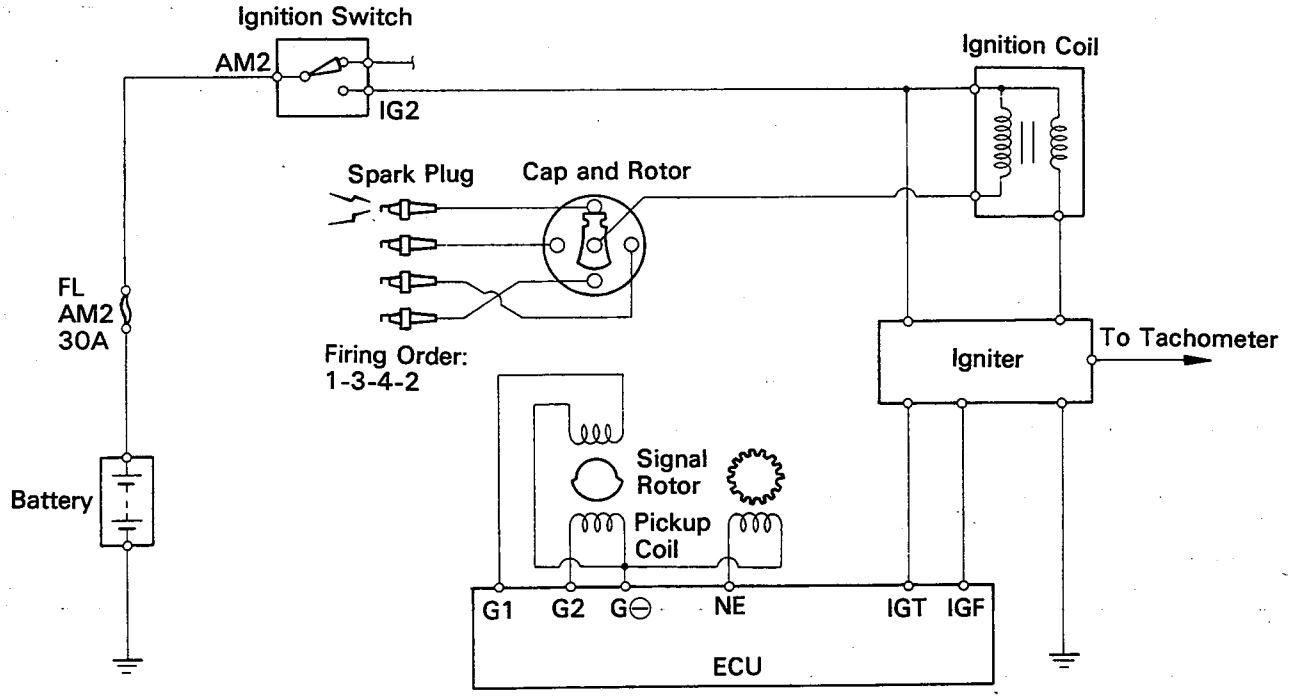
4A-FE



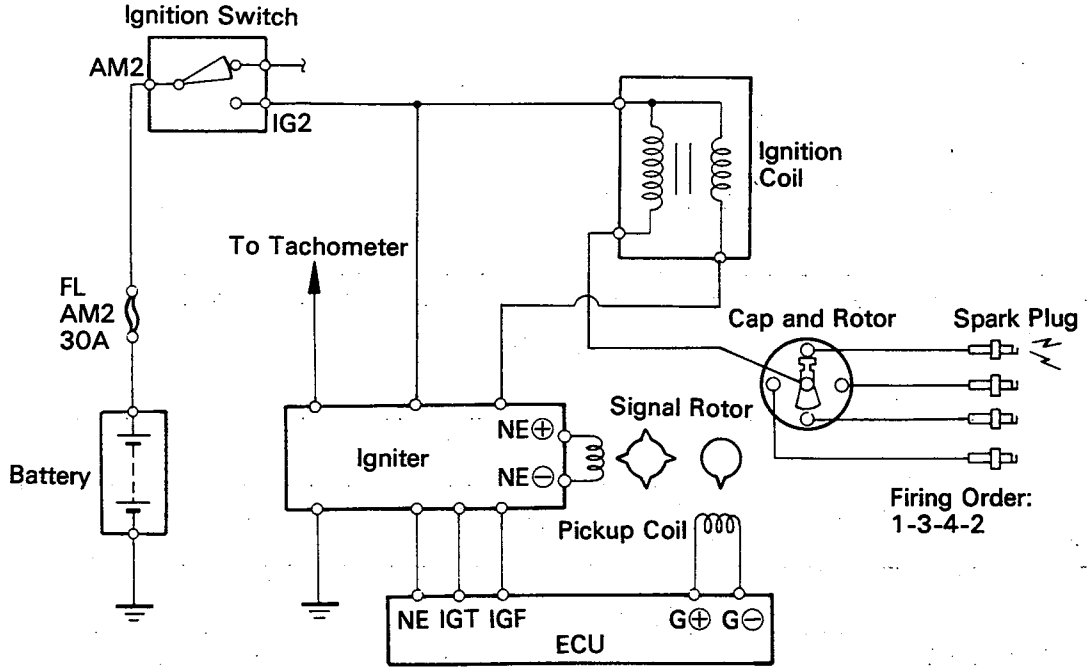
IG130

IGNITION SYSTEM CIRCUIT (Cont'd)

4A-GE (w/o Air Flow Meter)



4A-GE (w/ Air Flow Meter)



IG1328
IG1308

ON-VEHICLE INSPECTION (4A-FE)

SPARK TEST

CHECK THAT SPARK OCCURS

(a) Disconnect high-tension cords from spark plugs.

(b) Remove the spark plugs. (See page IG-7)

(c) Install the spark plugs to each high-tension cord.

(d) Ground the spark plug.

(e) Check if spark occurs while engine is being cranked.

HINT: To prevent gasoline from being injected from injectors during this test, crank the engine for no more than 1-2 seconds at a time.

If the spark does not occur, perform the test as follows.

SPARK TEST

NO

CHECK RESISTANCE OF HIGH-TENSION CORDS (See page IG-7)
Maximum resistance: 25 kΩ per cord

BAD → Replace the cords.

OK

CHECK POWER SUPPLY TO IGNITION COIL
1. Ignition switch turn to ON.
2. Check that there is battery voltage at ignition coil positive (+) terminal.

BAD → Check wiring between ignition switch and ignition coil.

OK

CHECK RESISTANCE OF IGNITION COIL
(See page IG-8)
Resistance (cold):

Primary	**2WD**	**1.28 – 1.56 Ω**
	4WD	**0.38 – 0.46 Ω**
Secondary	**2WD**	**10.4 – 14.0 kΩ**
	4WD	**7.7 – 10.3 kΩ**

BAD → Replace the ignition coil.

OK

CHECK RESISTANCE OF SIGNAL GENERATOR (PICKUP COIL)
(See page IG-9)
Resistance: 140 – 180 kΩ

BAD → Replace the IIA housing.

OK

CHECK AIR GAP OF DISTRIBUTOR
Air Gap: Each 0.2 mm (0.008 in.) or more

BAD → Replace the IIA housing.

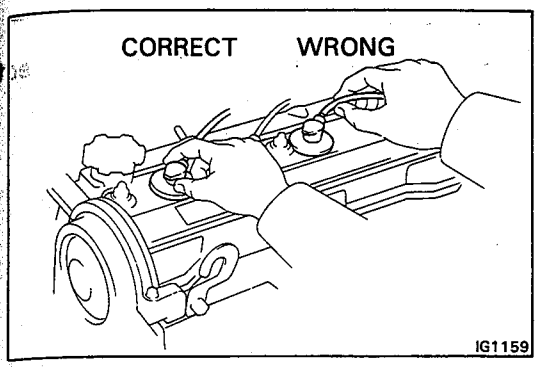
OK

CHECK IGT SIGNAL FROM ECU
(See page FI-48, 62)

BAD → Check wiring between ECU and IIA, and then try another ECU.

OK

TRY ANOTHER IGNITER

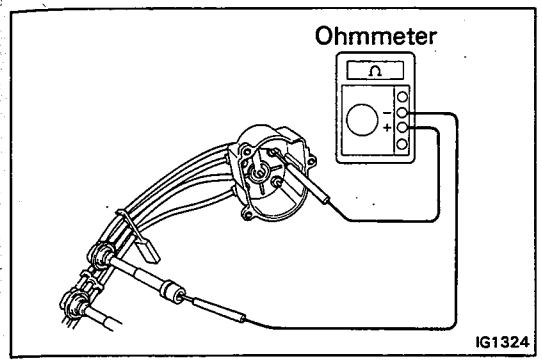


INSPECTION OF HIGH-TENSION CORDS

1. **CAREFULLY DISCONNECT HIGH-TENSION CORDS BY THEIR RUBBER BOOTS FROM SPARK PLUGS**

   NOTICE: Pulling on or bending the cords may damage the conductor inside.

2. **REMOVE IIA CAP WITHOUT DISCONNECTING HIGH-TENSION CORDS**



3. **INSPECT HIGH-TENSION CORD RESISTANCE**

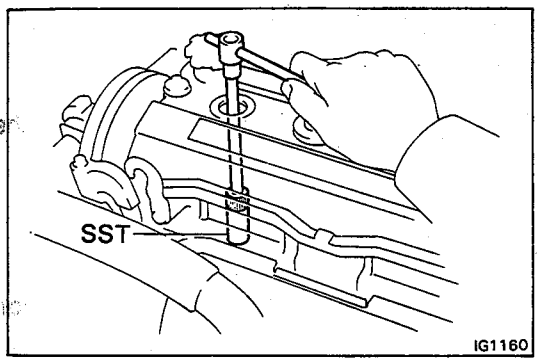
   Using an ohmmeter, measure the resistance without disconnecting the IIA cap.

   Maximum resistance: 25 kΩ per cord

   If the resistance is greater than maximum, check the terminals. If necessary, replace the high-tension cord and/or IIA cap.

4. **REINSTALL IIA CAP**

5. **RECONNECT HIGH-TENSION CORDS TO SPARK PLUGS**



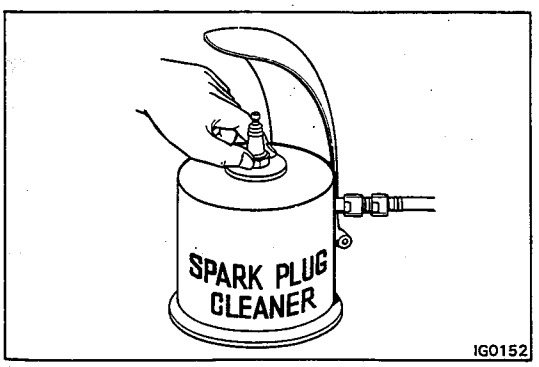
INSPECTION OF SPARK PLUGS

1. **DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS**

2. **REMOVE SPARK PLUGS**

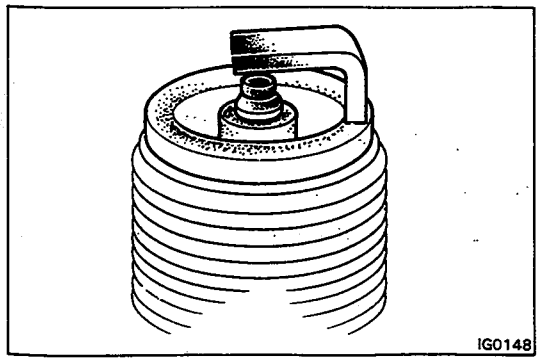
   Using SST, remove the spark plugs.

   SST 09155-16100



3. **CLEAN SPARK PLUGS**

   Using spark plug cleaner or wire brush, clean the spark plug.

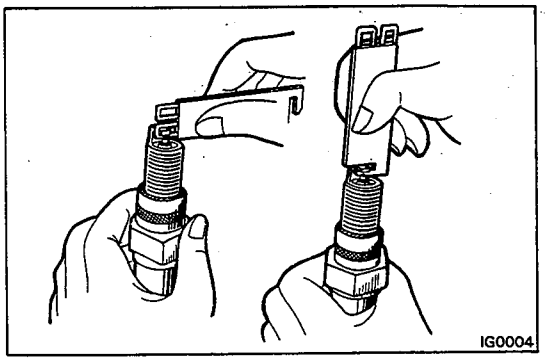


4. **VISUALLY INSPECT SPARK PLUGS**

   Check the spark plug for electrode wear, thread damage and insulator damage.

   If abnormal, replace the spark plug.

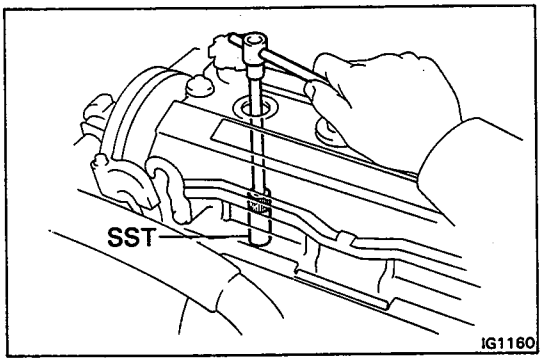
   Recommended spark plug: **ND Q16R-U**
   NGK BCPR5EY



5. ADJUST ELECTRODE GAP

Carefully bend the outer electrode to obtain the correct electrode gap.

Correct electrode gap: 0.8 mm (0.031 in.)



6. INSTALL SPARK PLUGS

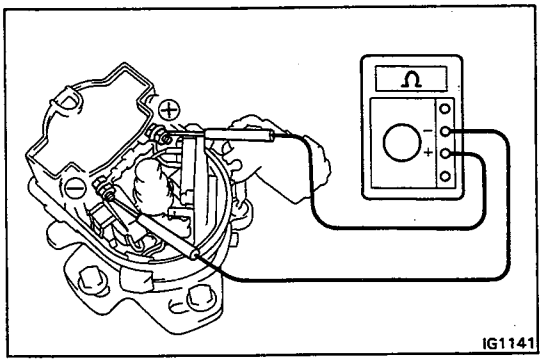
Using SST, install the spark plug.

SST 09155-16100

Torque: 180 kg-cm (13 ft-lb, 18 N·m)

7. RECONNECT HIGH-TENSION CORDS TO SPARK PLUGS

INSPECTION OF IGNITION COIL



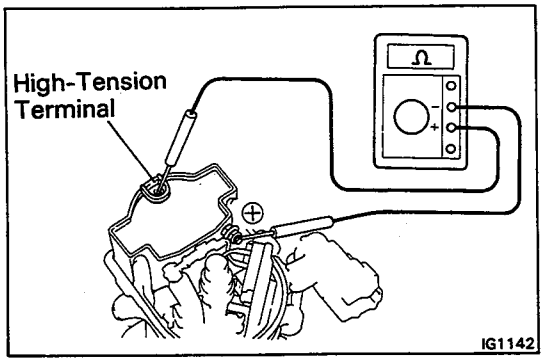
1. INSPECT PRIMARY COIL RESISTANCE

Using an ohmmeter, measure the resistance between the positive (+) and negative (−)terminal.

Primary coil resistance (Cold):

2WD 1.28 − 1.56 kΩ
4WD 0.38 − 0.46 kΩ

If the resistance is not as specified, replace the ignition coil.



2. INSPECT SECONDARY COIL RESISTANCE

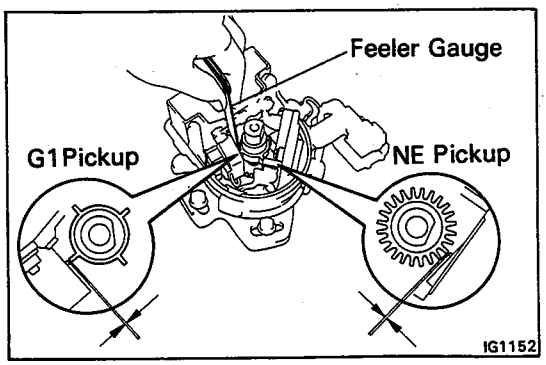
Using an ohmmeter, measure the resistance between the positive (+) terminal and high-tension terminal.

Secondary coil resistance: (Cold)

2WD 10.4 − 14.0 kΩ
4WD 7.7 − 10.3 kΩ

If the resistance is not as specified, replace the ignition coil.

DISTRIBUTOR

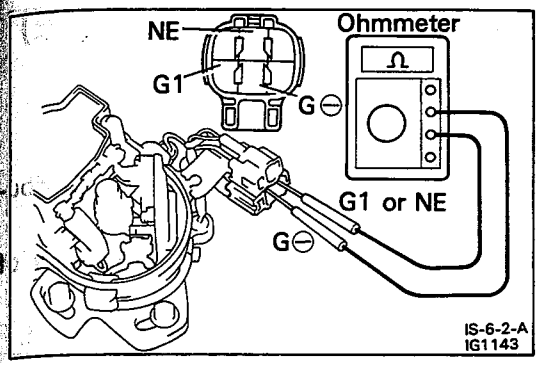


1. INSPECT AIR GAP

Using a feeler gauge, measure the gap between the signal rotor and pickup coil projection.

Air gap: 0.2 mm (0.008 in.) or more

If the air gap is not as specified, replace the IIA housing.



2. INSPECT SIGNAL GENERATOR (PICK UP COIL) RESISTANCE

Using an ohmmeter, measure the resistance between the terminals (G1 and G ⊖ , NE and G ⊖).

Pickup coil resistance (Cold): 140 – 180 Ω

If the resistance is not as specified, replace the IIA housing.

INSPECTION OF IGNITER

(See procedure Spark Test on page IG-6)

ON-VEHICLE INSPECTION (4A-GE)

SPARK TEST

CHECK THAT SPARK OCCURS

(a) Disconnect the high-tension cord from the distributor.

(b) Hold the end about 12.5 mm (1/2") from body of car.

(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 time.

If the spark does not occurs, perform the test as follows:

SPARK TEST

NO

CHECK CONNECTION OF IGNITION COIL, IGNITER AND DISTRIBUTOR CONNECTORS — BAD → Connect securely.

OK

CHECK RESISTANCE OF HIGH-TENSION CORD
(See page IG-11)
Maximum resistance: 25 kΩ per cord — BAD → Replace the cord(s).

OK

CHECK POWER SUPPLY TO IGNITION COIL AND IGNITER
1. Ignition switch turn on ON.
2. Check that there is battery voltage at ignition coil positive (⊕) terminal — BAD → Check wiring between ignition switch to ignition coil and igniter.

OK

CHECK RESISTANCE OF IGNITION COIL
(See page IG-14)
Resistance (cold) Primary: 0.41 – 0.50 Ω
Secondary: 10.2 – 13.8 kΩ — BAD → Replace the ignition coil.

OK

CHECK RESISTANCE OF SIGNAL GENERATOR (PICKUP COIL)
(See page IG-14)
Resistance: 140 – 180 Ω — BAD → Replace the distributor housing.

OK

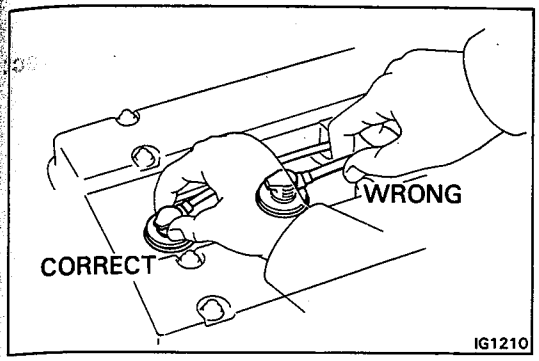
CHECK AIR GAP OF DISTRIBUTOR
(See page IG-14)
Air gap: 0.2 – 0.4 mm (0.008 – 0.016 in.) — BAD → Replace the distributor housing.

OK

CHECK IGT SIGNAL FROM ECU
(See page FI-77, 91) — BAD → Check wiring between ECU and distributor, only when try another EUC.

OK

TRY ANOTHER IGNITER

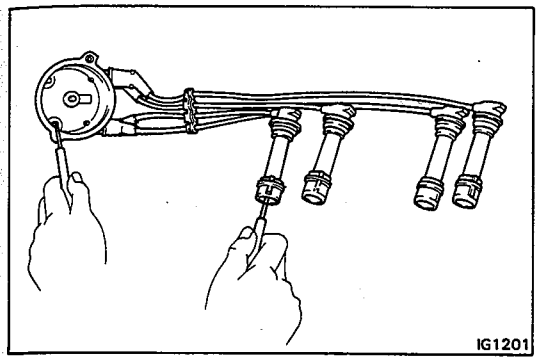


INSPECTION OF HIGH-TENSION CORDS

1. **REMOVE PLUG CORD COVER**

2. **CAREFULLY REMOVE HIGH-TENSION CORDS BY THEIR RUBBER BOOTS FROM SPARK PLUGS**

   NOTICE: Pulling on or bending the cords may damage the conductor inside.

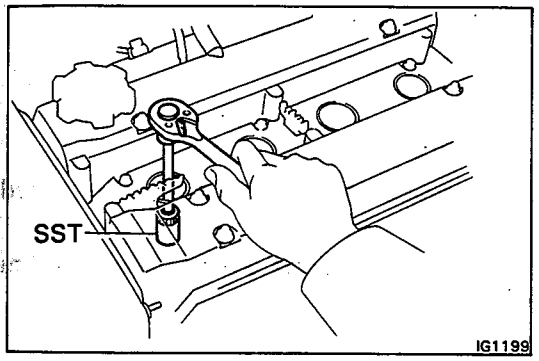


3. **INSPECT HIGH-TENSION CORD RESISTANCE**

   Using an ohmmeter, measure the resistance without disconnecting the distributor cap.

   Maximum resistance: 25 kΩ per cord

   If the resistance is greater than maximum, check the terminals. If necessary, replace the high-tension cord and/or distributor cap.



INSPECTION OF SPARK PLUG (Conventional Tipped Type)

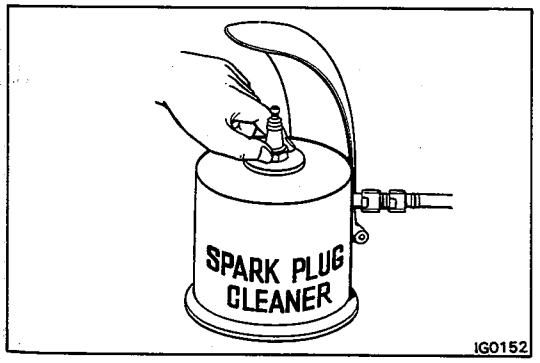
1. **REMOVE PLUG CORD COVER**

2. **DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS**

3. **REMOVE SPARK PLUGS**

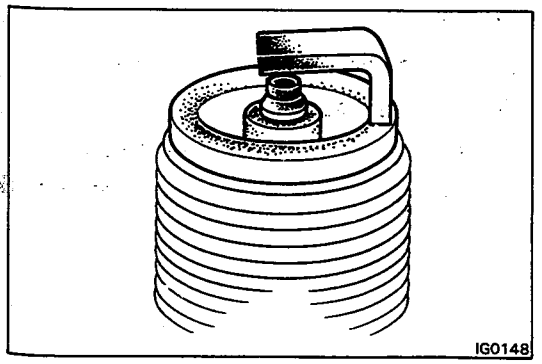
   Using SST, remove the spark plug.

   SST 09155-16100



4. **CLEAN SPARK PLUGS**

   Using a spark plug cleaner or wire brush, clean the spark plug.

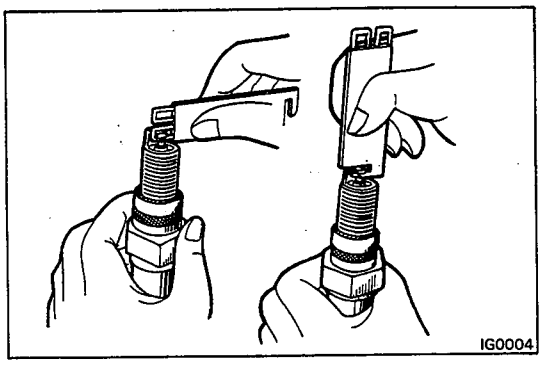


5. **VISUALLY INSPECT SPARK PLUGS**

   Check the spark plug for electrode wear, thread damage and insulator damage.

   If abnormal, replace the spark plug.

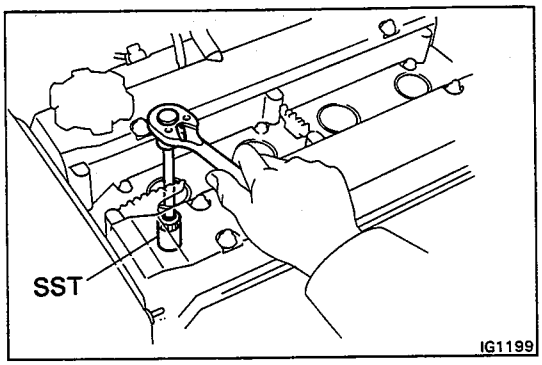
   Recommended spark plug: ND K20R-U
   NGK BKR6EYA



6. **ADJUST ELECTRODE CAP**

Carefully bent the outer electrode to obtain the correct electrode gap.

Correct electrode gap: 0.8 mm (0.31 in.)



7. **INSTALL SPARK PLUGS**

Using SST, install the spark plug.

SST 09155-16100

Torque: 180 kg-cm (13 ft-lb, 18 N·m)

8. **RECONNECT HIGH-TENSION CORDS TO SPARK PLUGS**

9. **INSTALL PLUG CORD COVER**

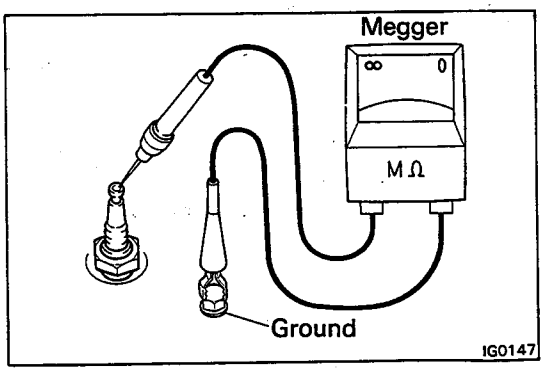
INSPECTION OF SPARK PLUGS (Platinum Tipped Type)

NOTICE:

- **Never use a wire brush for cleaning.**
- **Never attempt to adjust the electrode gap on used spark plug.**
- **Spark plug should be replaced every 100,000 km (60,000 miles).**

1. **REMOVE PLUG CORD COVER**

2. **DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS**



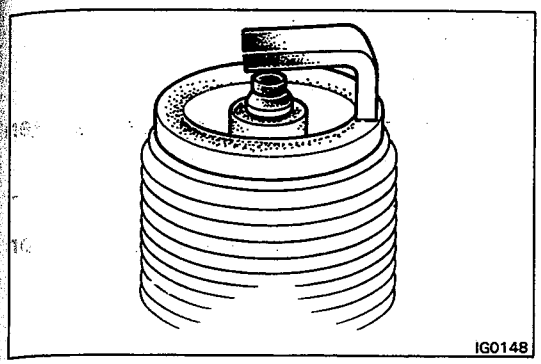
3. **INSPECT ELECTRODE**

A. **If using a megger (insulation resistance meter):**

Measure the insulation resistance.

Correct insulation resistance: 10 MΩ or more

If the resistance is less than specification, clean the spark plug.

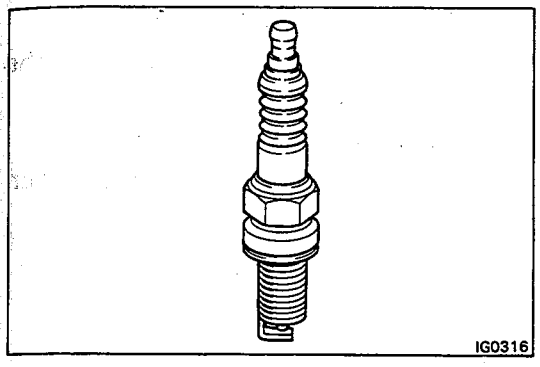


B. If not using a megger:

(a) Quickly race the engine to 4,000 rpm five times.

(b) Remove the spark plug.
(See step 3 on page IG-11)

(c) Visually check the spark plug.
If the electrode is dry . . . . Okey
If the electrode is wet . . . . Proceed to step 5



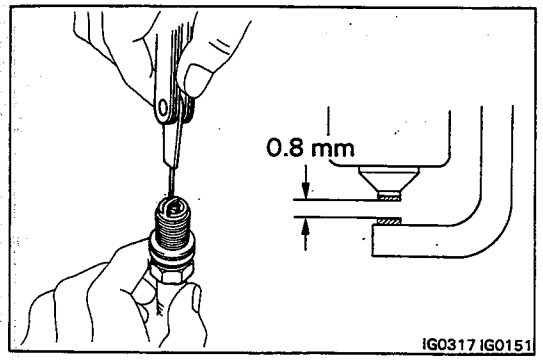
4. REMOVE SPARK PLUGS
(See step 3 on page IG-11)

5. VISUALLY INSPECT SPARK PLUGS

Check the spark plug for thread or insulation damage.

If abnormal, replace the spark plug.

Recommended spark plug: **ND PK20R8**
NGK BKR6EP8



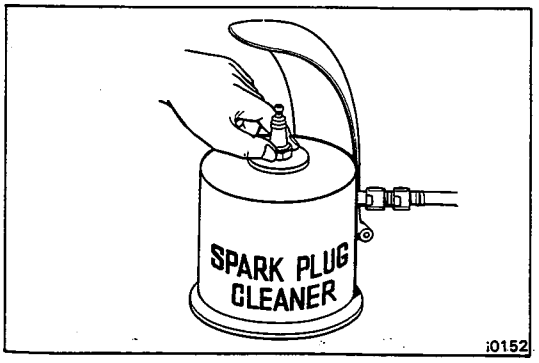
6. INSPECT ELECTRODE GAP

Maximum electrode gap: 1.0 mm (0.039 in.)

If the gap is greater than maximum, replace the spark plug.

Correct electrode gap of new spark plug:
0.8 mm (0.031 in.)

If adjusting the gap of a new spark plug, bend only the base of the ground electrode. Do not touch the tip.



7. CLEAN SPARK PLUGS

If the electrode has traces of wet carbon, allow it to dry and then clean with a spark plug cleaner.

Air pressure: **Below 6 kg/cm² (85 psi, 588 kPa)**
Duration: **20 seconds or less**

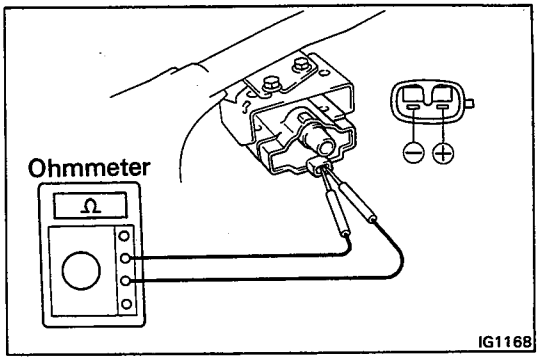
HINT: If there are traces of oil, remove it with gasoline before using the spark plug cleaner.

8. INSTALL SPARK PLUGS (See step 7 on page IG-12)

Torque: 180 kg-cm (13 ft-lb, 18 N·m)

9. RECONNECT HIGH-TENSION CORDS TO SPARK PLUGS

10. INSTALL PLUG CORD COVER



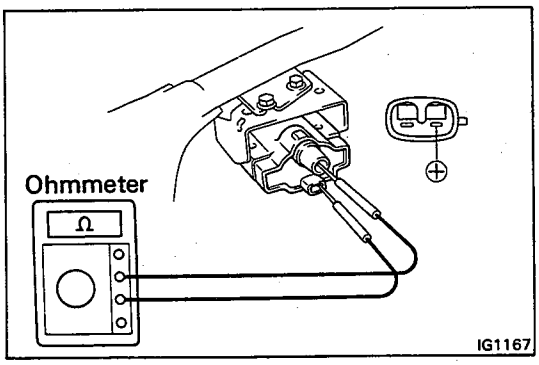
INSPECTION OF IGNITION COIL

1. INSPECT PRIMARY COIL RESISTANCE

Using an ohmmeter, measure the resistance between positive (⊕) and negative (⊖) terminals.

Primary coil resistance (Cold): 0.41 – 0.50 Ω

If the resistance is not as specified, replace the ignition coil.

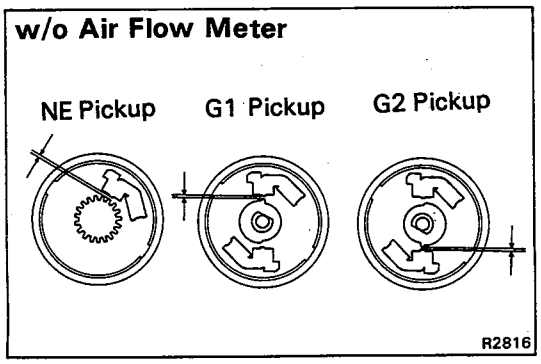


2. INSPECT SECONDARY COIL RESISTANCE

Using an ohmmeter, measure the resistance between the positive (⊕) and high-tension terminals.

Secondary coil resistance (Cold): 10.2 – 13.8 kΩ

If the resistance is not as specified, replace the ignition coil.



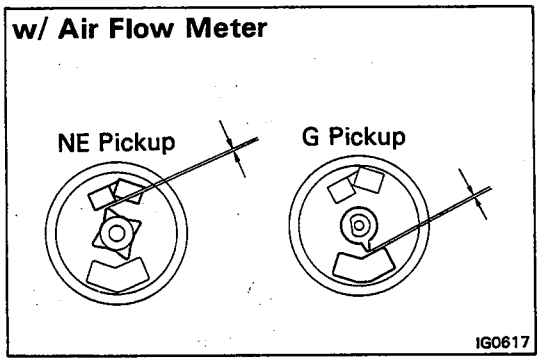
INSPECTION OF DISTRIBUTOR

1. INSPECT AIR GAP

Using a feeler gauge, measure the gap between the signal rotor and pickup coil projection.

Air gap: 0.2 – 0.4 mm (0.008 – 0.016 in.)

If the air gap is not as specified, replace the distributor housing.

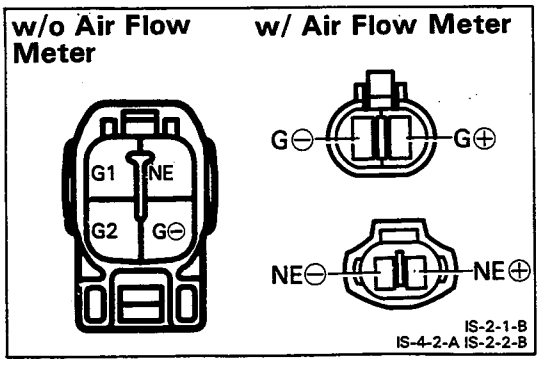


2. INSPECT SIGNAL GENERATOR (PICKUP COIL) RESISTANCE

Using an ohmmeter, measure the resistance between the terminals. (w/o Air Flow Meter: G1 to G⊖, G2 to G⊖,NE to G⊖) (w/ Air Flow Meter: G⊕ to G⊖, NE⊕ to NE⊖)

Pickup coil resistance: 140 – 180 Ω

If the resistance is not as specified, replace the distributor housing.

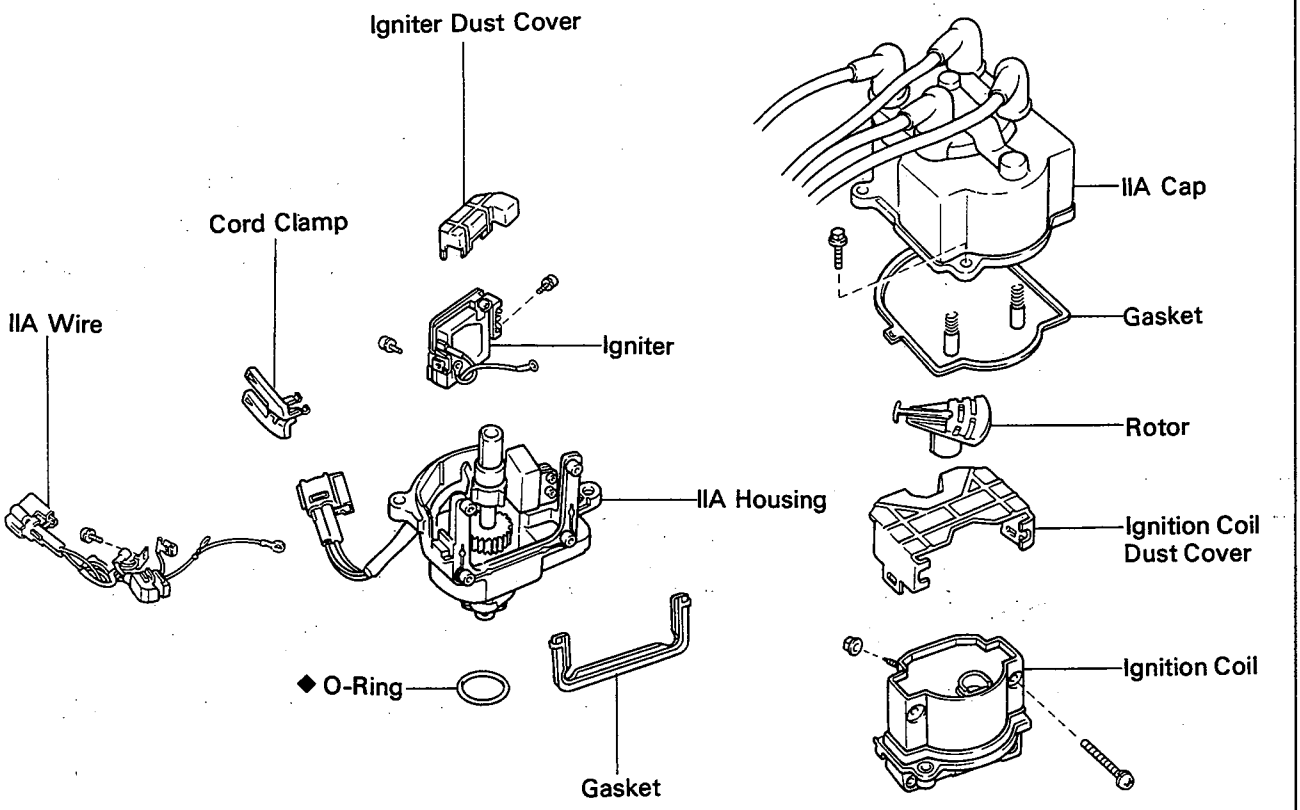


INSPECTION OF IGNITER

(See procedure of Spark Test on page IG-10)

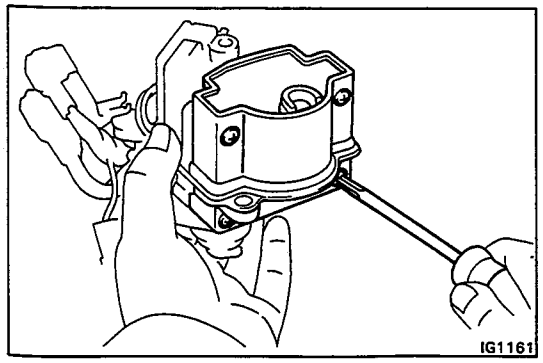
INTEGRATED IGNITION ASSEMBLY (IIA) (4A-FE)

COMPONENTS

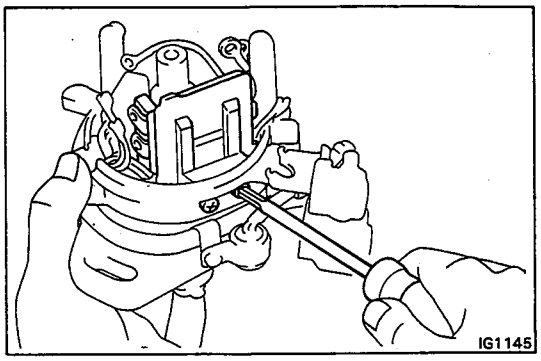


DISASSEMBLY OF IIA

1. **REMOVE DISTRIBUTOR CAP, GASKET AND ROTOR**
2. **REMOVE IGNITION COIL DUST COVER**
3. **REMOVE IGNITER DUST COVER**



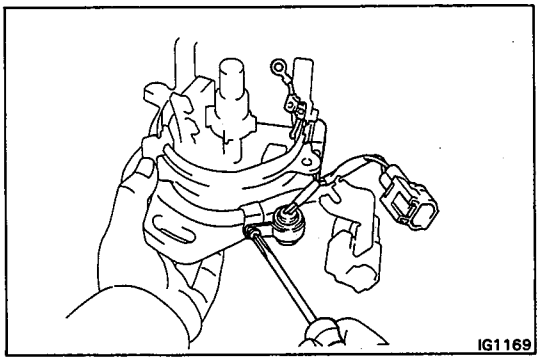
4. **REMOVE IGNITION COIL**
   (a) Remove the two nuts and disconnect the three wires from the ignition coil terminals.
   (b) Remove the four screws, ignition coil and gasket.



5. REMOVE IGNITER

(a) Remove the two nuts, and disconnect the three wires from the igniter terminals.

(b) Remove the two screws and igniter.

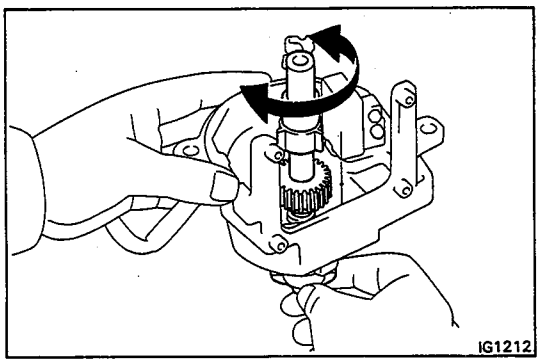


6. REMOVE IIA WIRE

(a) Disconnect the connector from the cord clamp.

(b) Remove the screw and condenser.

(c) Remove the grommet of the wire from the housing.

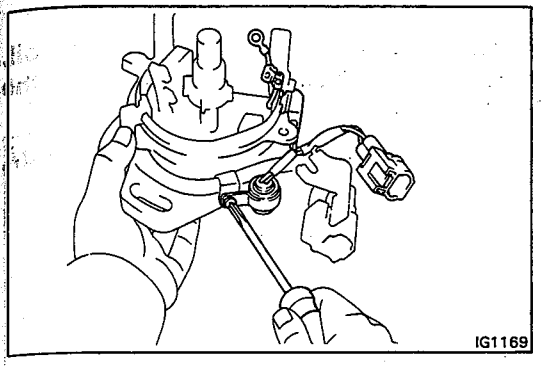


INSPECTION OF IIA

INSPECT GOVERNOR SHAFT

Turn the governor shaft and check that it is not rough or worn.

If it feels rough or worn, replace the IIA housing assembly.



ASSEMBLY OF IIA

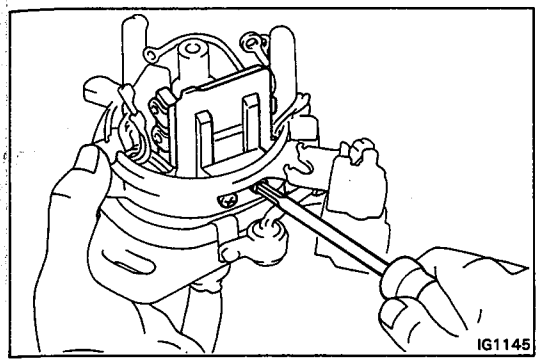
(See page IG-15)

1. INSTALL IIA WIRE

(a) Fit the wire grommet to the IIA housing.

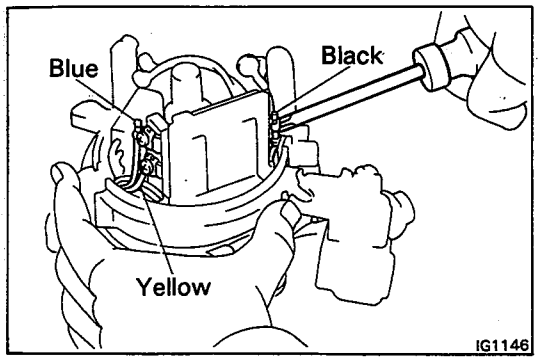
(b) Install the IIA wire with the screw.

(c) Install the connector to the cord clamp.

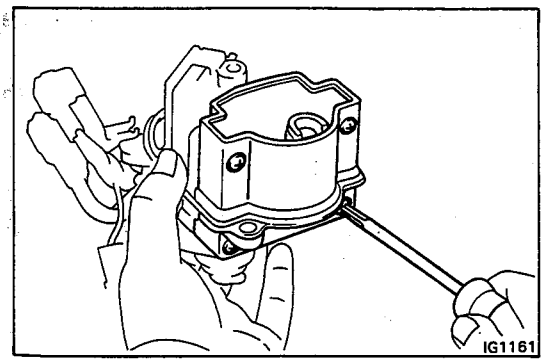


2. INSTALL IGNITER

(a) Install the igniter with the two screws.

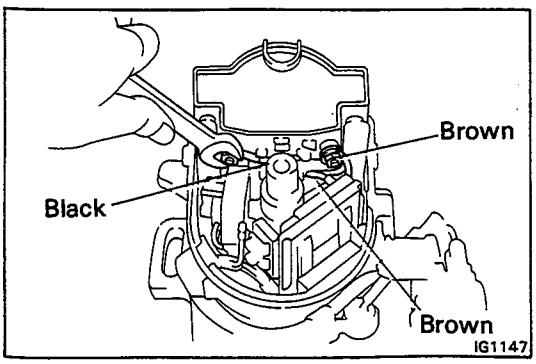


(b) Connect the three wires to the igniter terminals with the three screws.

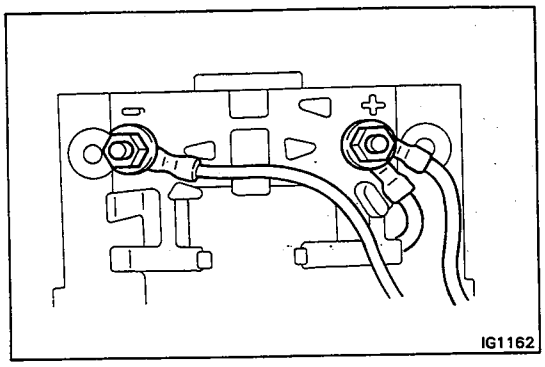


3. INSTALL IGNITION COIL

(a) Install the gasket and ignition coil with the four screws.



(b) Connect the three wires to the ignition coil terminals with the two nuts.


IG1162

NOTICE:

- **When connecting the wires to the ignition coil, insert both properly into their grooves found on the side of the ignition coil.**
- **Be sure wires do not contact with signal rotor or IIA housing.**

3. INSTALL IGNITION COIL DUST COVER

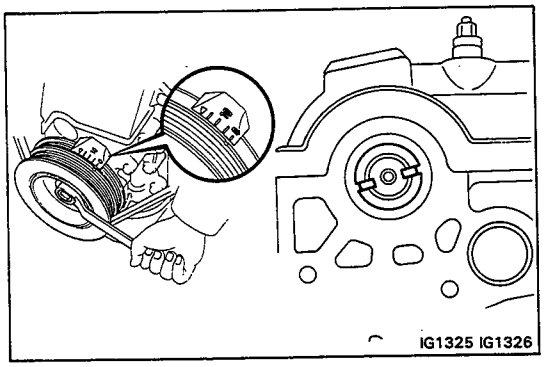
4. INSTALL ROTOR

5. INSTALL IIA CAP AND HIGH-TENSION CORDS

INSTALLATION OF IIA

1. SET NO.1 CYLINDER TO TDC/COMPRESSION

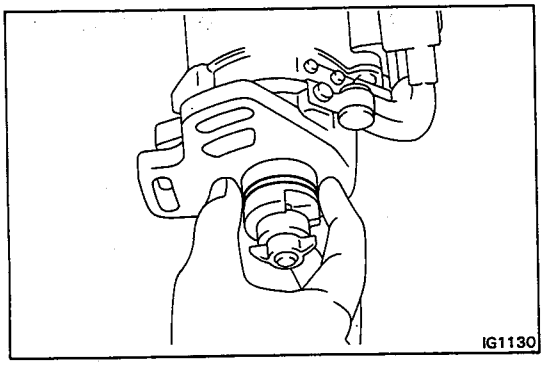
Turn the crankshaft clockwise, and position the slit of the intake camshaft as shown in the figure.


IG1325 IG1326

2. INSTALL IIA

(a) Install a new O-ring to the housing.

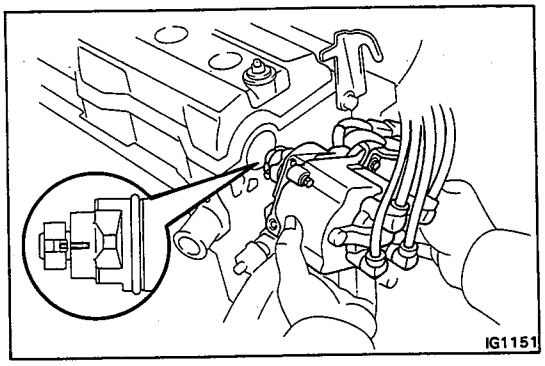
(b) Apply a light coat of engine oil on the O-ring.


IG1130

(c) Align the cutout of the coupling with the line of the housing.

(d) Insert the IIA, aligning the center of the flange with that of bolt hole on the cylinder head.

(e) Lightly tighten the two hold-down bolts.


IG1151

3. CONNECT HIGH-TENSION CORDS TO SPARK PLUGS

Firing order: 1 – 3 – 4 – 2

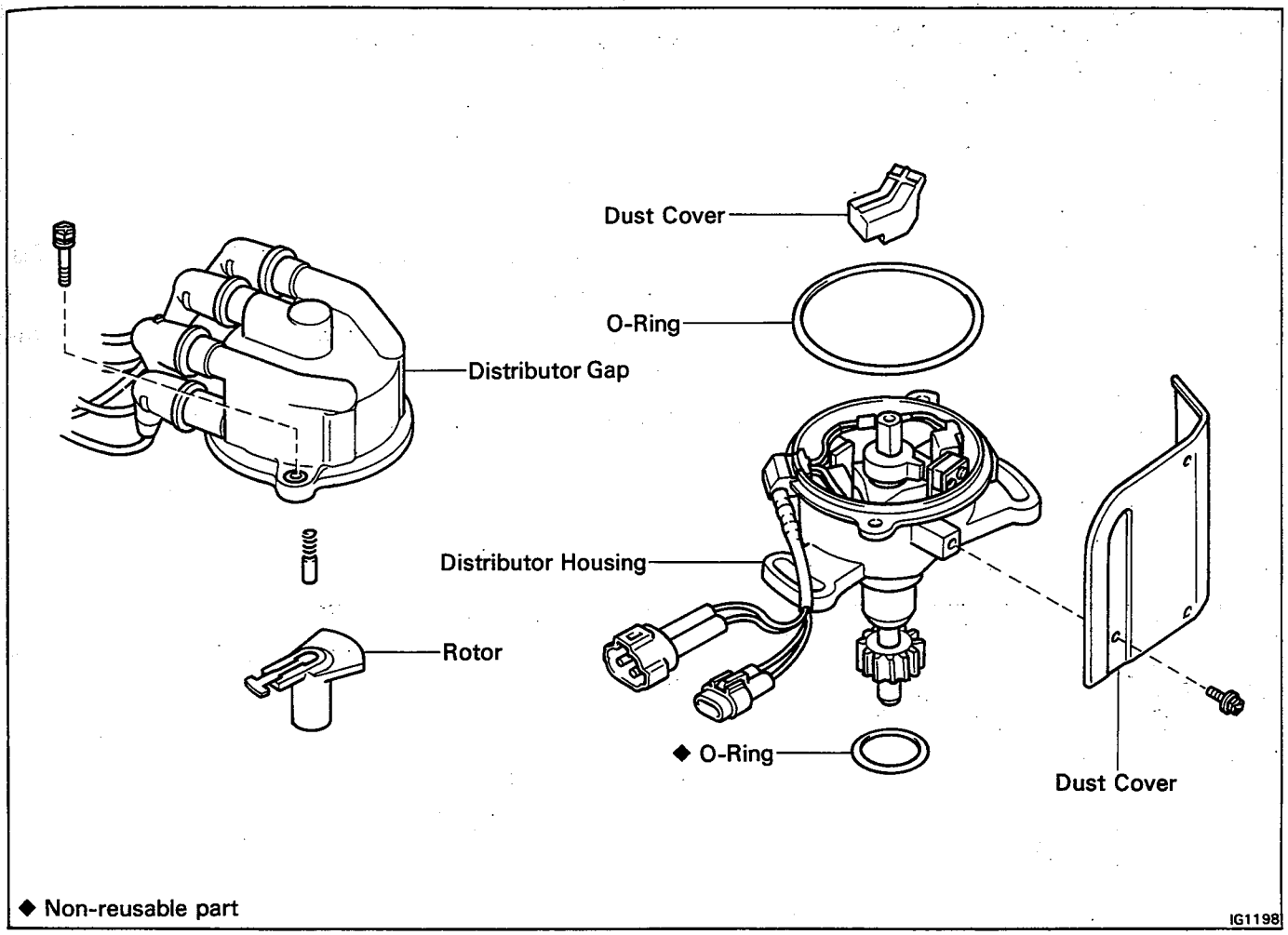
4. CONNECT IIA CONNECTORS

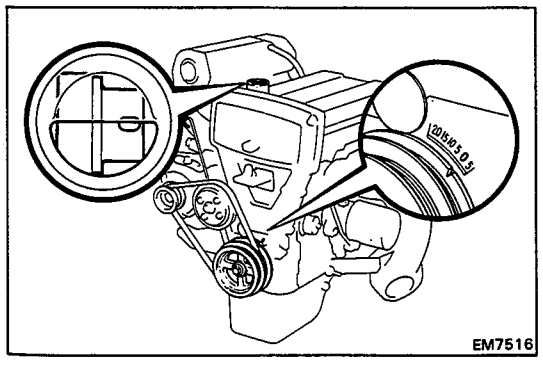
5. ADJUST IGNITION TIMING (See page EM-20)

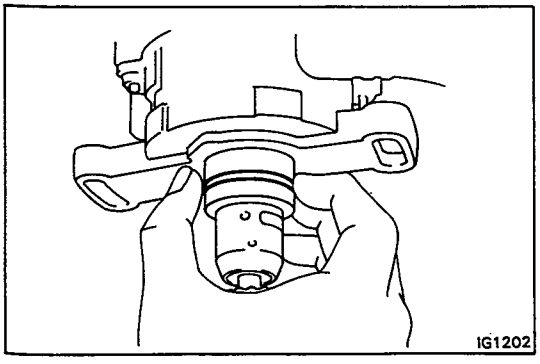
Ignition timing:
10° BTDC @ idle
(w/ Terminals TE1 and E1 connected)

DISTRIBUTOR (4A-GE)

COMPONENTS







INSTALLATION OF DISTRIBUTOR

1. SET NO.1 CYLINDER TO TDC/COMPRESSION

(a) Turn the crankshaft pulley, and align its groove with the "0" mark on the No.1 timing belt cover.

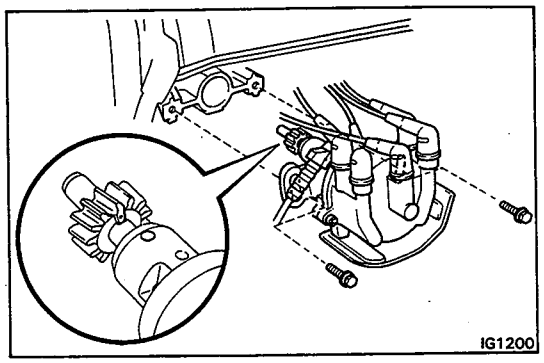
(b) Remove the oil filler cap, and check that you can see the cavity of the camshaft.

If necessary, turn the crankshaft pulley one complete revolution (360°).

2. INSTALL DISTRIBUTOR

(a) Install a new O-ring to the housing.

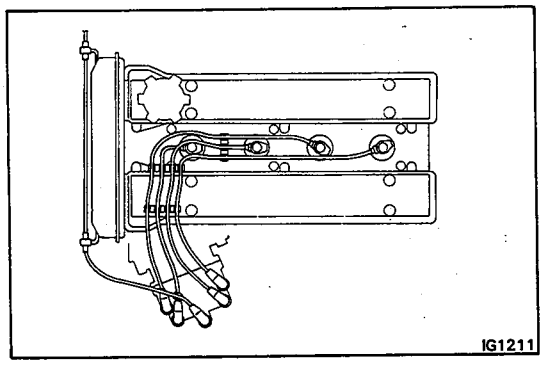
HINT: Always use a new O-ring when installing the distributor.



(c) Align the drilled mark of the driven gear with the groove of the housing.

(d) Insert the distributor, aligning the center of the flange with that of the bolt hole on the cylinder head.

(e) Lightly tighten the bolts.

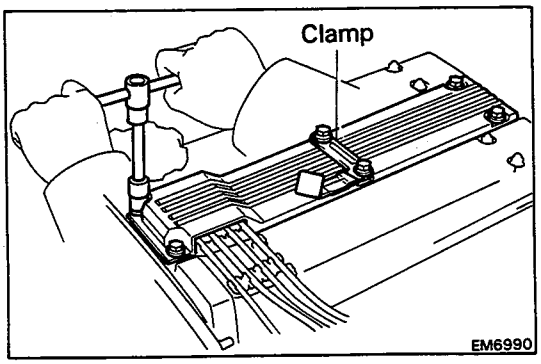


3. CONNECT HIGH-TENSION CORDS TO SPARK PLUGS

Firing order: 1 — 3 — 4 — 2

Connect the high-tension cords as shown in the illustration.

4. CONNECT DISTRIBUTOR CONNECTOR (S)



5. INSTALL PLUG CORD COVER

Install the plug cord cover and clamp (RHD M/T) with the bolts.

6. ADJUST IGNITION TIMING (See page EM-28)

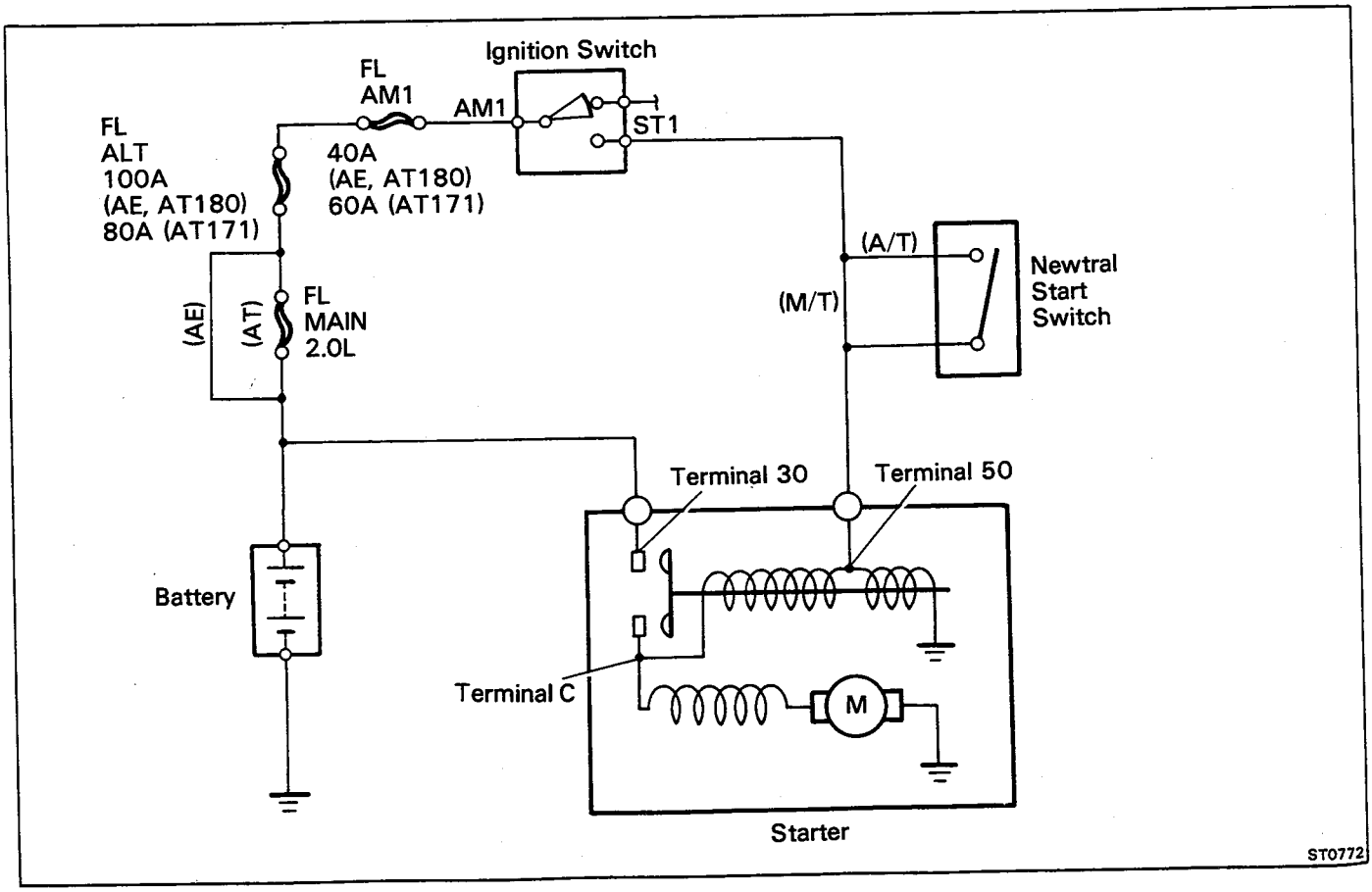
Ignition timing:
10° BTDC @ idle
(w/ Terminals TE1 and E1 connected)

STARTING SYSTEM

TROUBLESHOOTING

Problem	Possible cause	Remedy	Page
Engine will not crank	Battery charge low	Check battery specific gravity Charge or replace battery	CH-4
	Battery cables loose, corroded or worn	Repair or replace cables	
	Neutral start switch faulty (A/T)	Adjust or replace switch	
	Fusible link blown	Replace fusible link	
	Starter faulty	Repair starter	ST-3, 17
	Ignition switch faulty	Replace ignition switch	
Engine cranks slowly	Battery charge low	Check battery specific gravity Charge or replace battery	CH-4
	Battery cables loose, corroded or worn	Repair or replace cables	
	Starter faulty	Repair starter	ST-3, 17
Starter keeps running	Starter faulty	Repair starter	ST-3, 17
	Ignition switch faulty	Replace ignition switch	
	Short in wiring	Repair wiring	
Starter spins-engine will not crank	Pinion gear teeth broken or faulty starter	Repair starter	ST-3, 17
	Flywheel or drive plate teeth broken	Replace flywheel or drive plate	

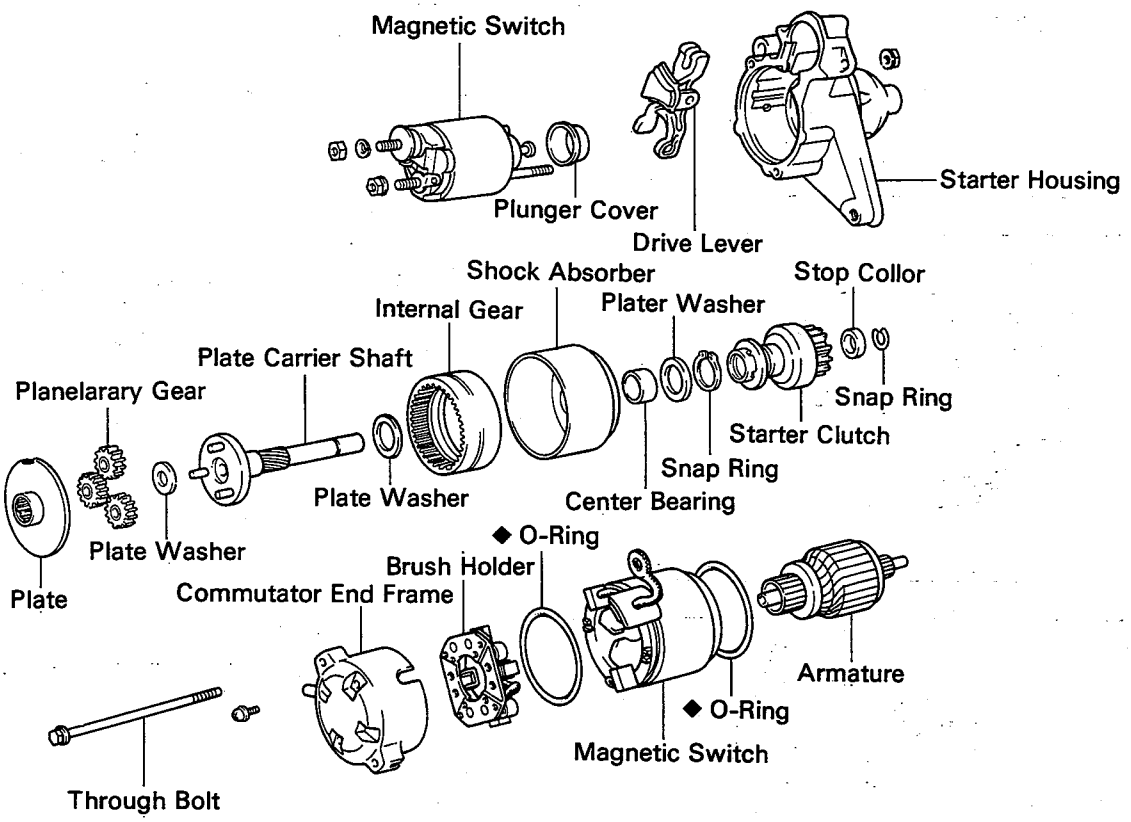
STARTING SYSTEM CIRCUIT



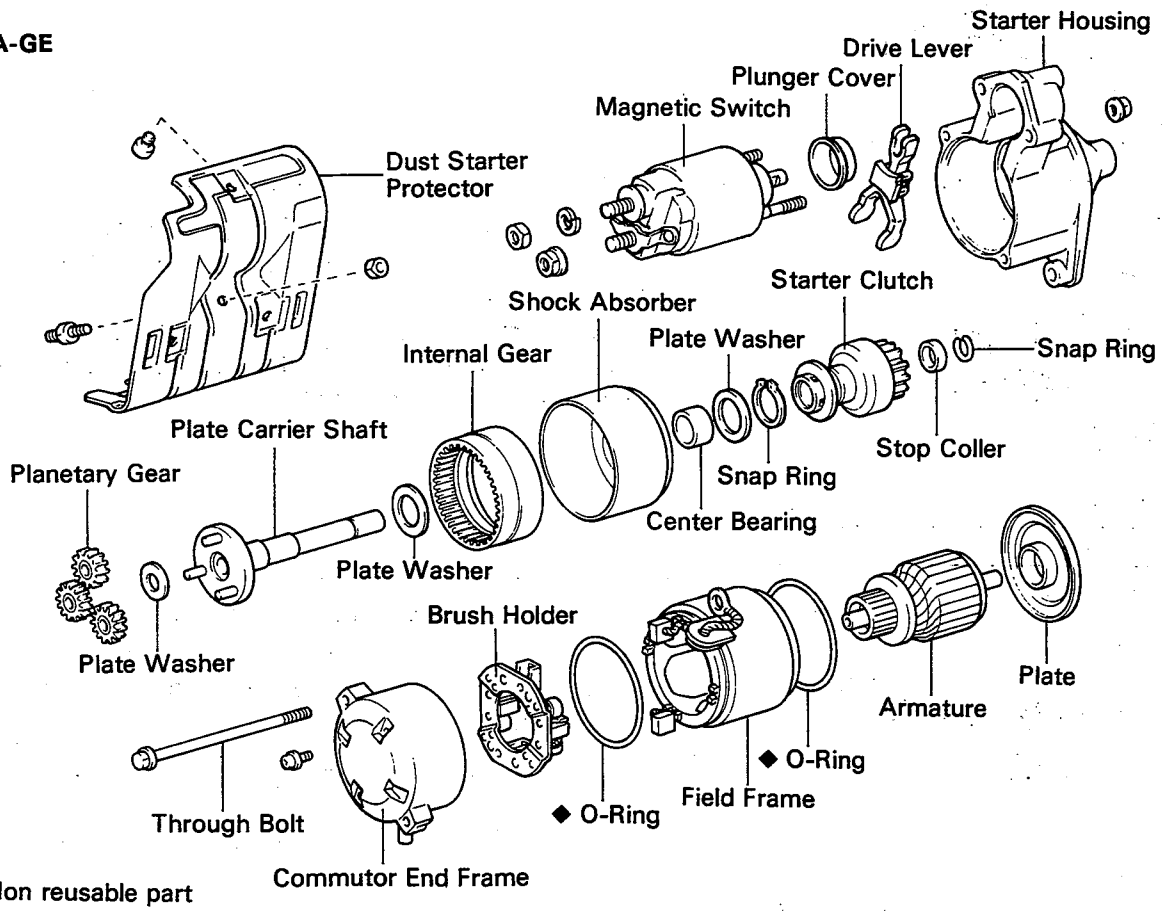
PLANETARY TYPE STARTER

CONPONENTS

4A-FE

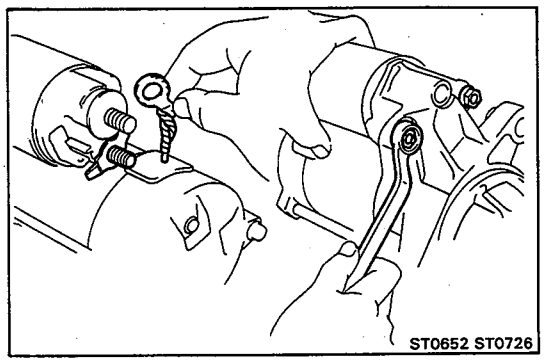


4A-GE



◆ Non reusable part

ST0719
ST0765

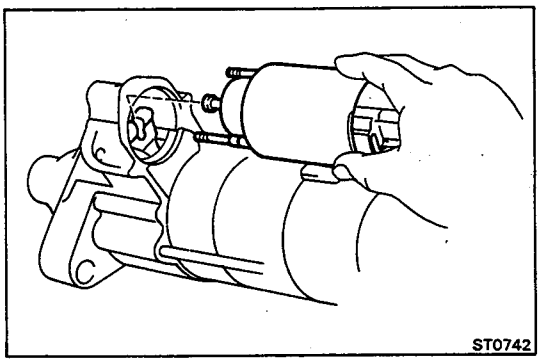

ST0652 ST0726

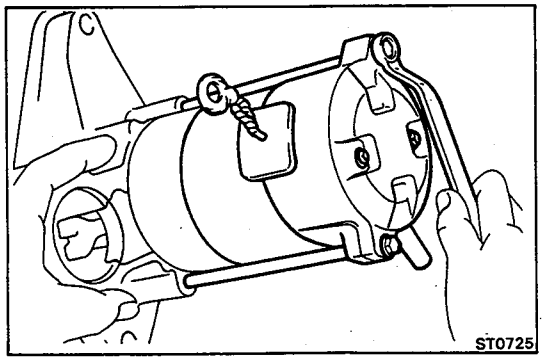
DISASSEMBLY OF PLANETARY TYPE STARTER

(See page ST-3)

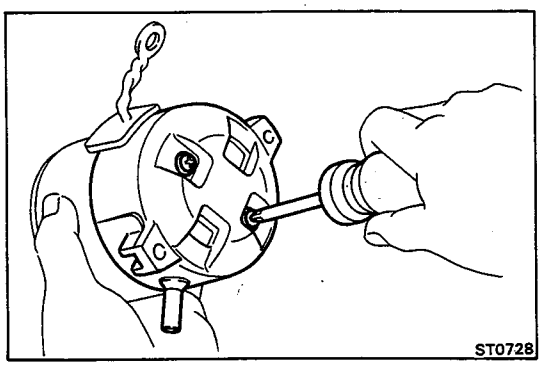
1. (4A-GE)
   REMOVE DUST STARTER PROTECTOR

2. REMOVE MAGNETIC SWITCH
   (a) Remove the nut, and disconnect the lead wire from the magnetic switch terminal.
   (b) Loosen the two nuts holding the magnetic switch to the drive housing.
   (c) Pull the magnetic switch and while lifting the front part of the magnetic switch, release the plunger hook from the drive lever, then release the magnetic switch.
   (d) Remove the plunger cover.

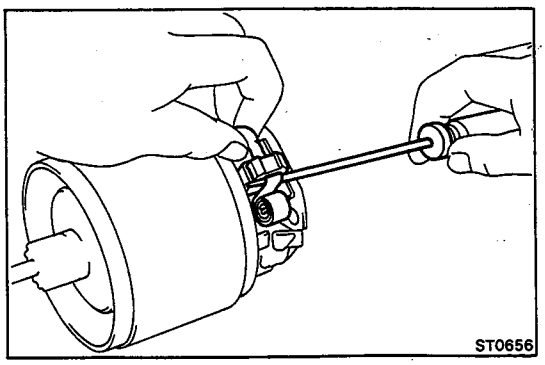

ST0742


ST0725

3. REMOVE FIELD FRAME AND ARMATURE
   Remove the two through bolts, and pull out the field frame together with the armature.


ST0728

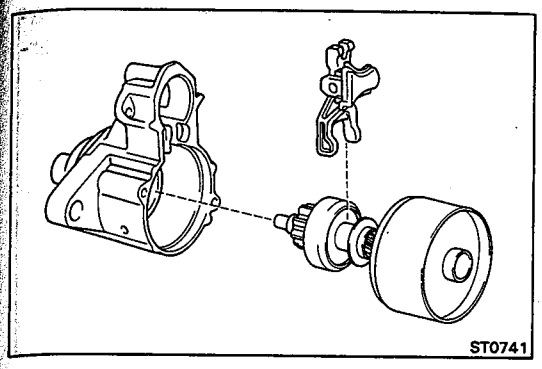
4. REMOVE COMMUTATOR END FRAME
   Remove the two screws with O-rings and commutator end frame, and hold down the lead wire while releasing the commutator end frame.
   NOTICE: To avoid interference between the brush holder and the water outlet hose, pull the commutator end frame away at an angle.


ST0656

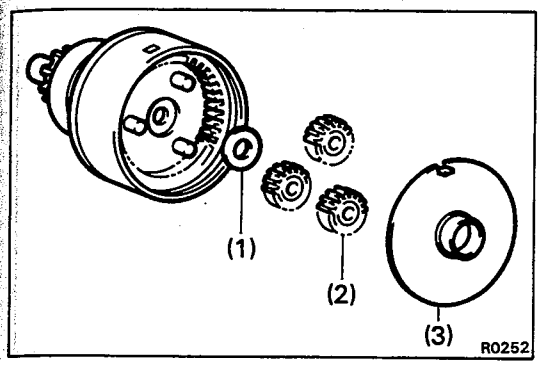
5. REMOVE BRUSH HOLDER
   (a) Using a screwdriver, hold the spring back and disconnect the brush holder.
   (b) Disconnect the four brushes, and remove the brush holder.

6. REMOVE ARMATURE FROM FIELD FRAME

7. REMOVE TWO O-RINGS FROM FIELD FRAME



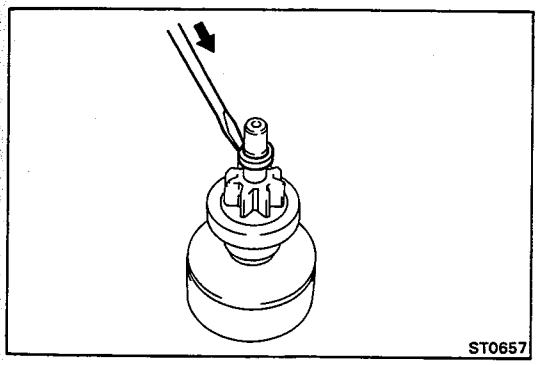
8. REMOVE DRIVE LEVER AND STARTER CLUTCH WITH SHOCK ABSORBER FROM STARTER HOUSING



9. REMOVE PLANETARY GEARS

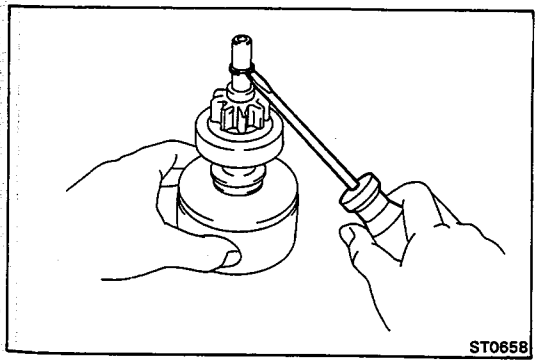
Remove the following parts from the shock absorber.

(1) Plate
(2) Three planetary gears
(3) Plate washer

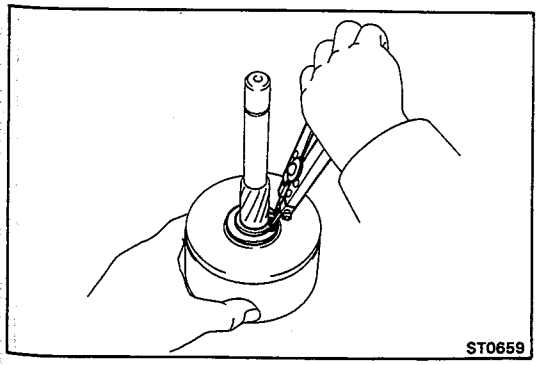


10. REMOVE STARTER CLUTCH

(a) Using a screwdriver, tap the stop collar towards the starter clutch.

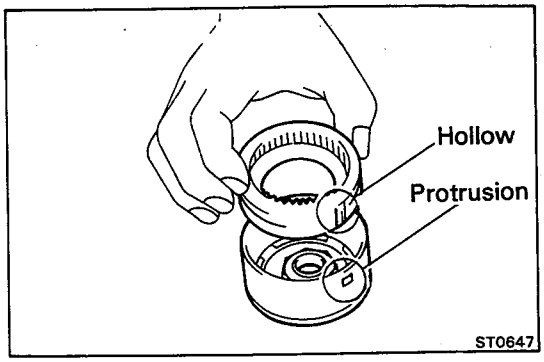


(b) Using a screwdriver, pry off the snap ring.
(c) Remove the stop collar and starter clutch.

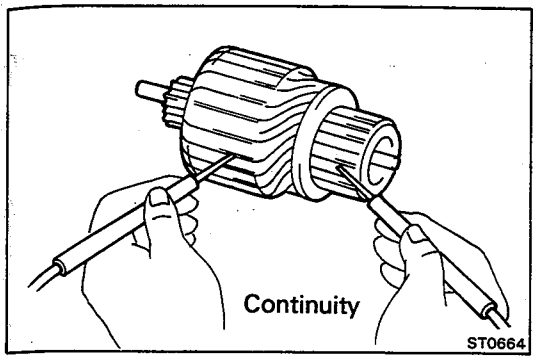


11. REMOVE PLANET CARRIER SHAFT AND INTERNAL GEAR

(a) Using snap ring pliers, remove the snap ring and plate washer.
(b) Remove the planet carrier shaft and plate washer.



(c) Align the hollow of the internal gear with the protrusion inside the shock absorber, and remove the internal gear.



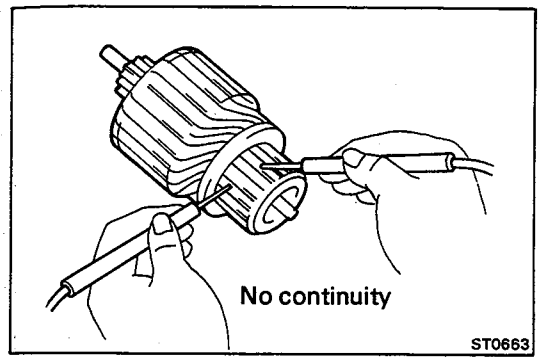
INSPECTION OF PLANETARY TYPE STARTER

Armature Coil

1. INSPECT COMMUTATOR FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the segments of the commutator.

If there is no continuity, replace the armature.



2. INSPECT COMMUTATOR FOR GROUND

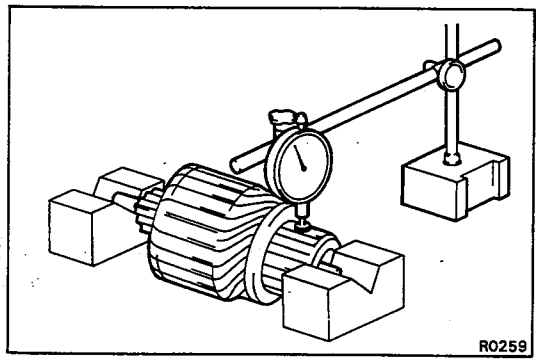
Using an ohmmeter, check that there is no continuity between the commutator and armature coil core.

If there is continuity, replace the armature.

Commutator

1. INSPECT COMMUTATOR FOR DIRTY AND BURNT SURFACES

If surface is dirty or burnt, correct with sandpaper (No.400) or a lathe.



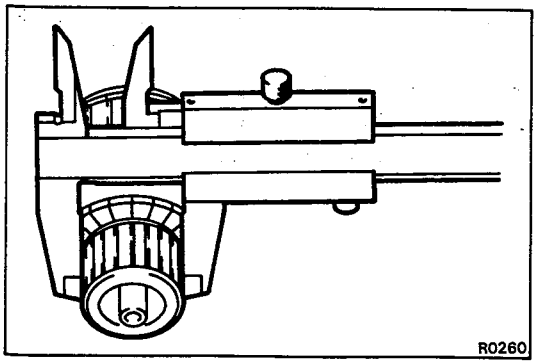
2. INSPECT COMMUTATOR CIRCLE RUNOUT

(a) Place the armature on V-blocks.

(b) Using a dial indicator, measure the circle runout.

Standard circle runout: 0.02 mm (0.0008 in.)
Maximum circle runout: 0.05 mm (0.0020 in.)

If the circle runout is greater than maximum, correct it on a lathe.

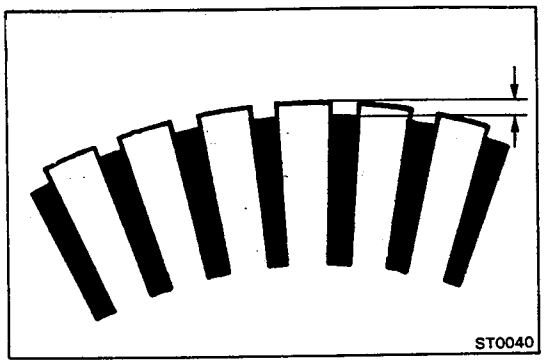


3. INSPECT COMMUTATOR DIAMETER

Using vernier calipers, measure the diameter.

Standard diameter: 28.0 mm (1.10 in.)
Minimum diameter: 27.0 mm (1.06 in.)

If the diameter is less than minimum, replace the armature.



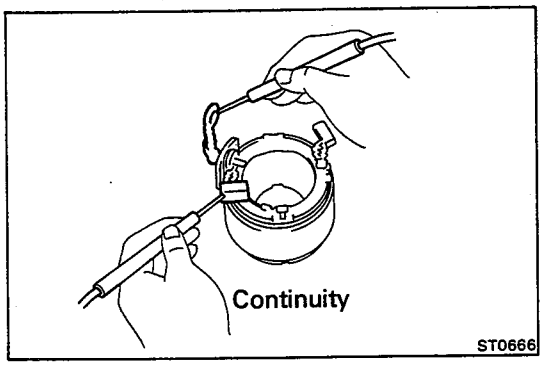
4. INSPECT UNDERCUT DEPTH

Check that the undercut depth is clean and free of foreign particles. Smooth out the edge.

Standard undercut depth: 0.6 mm (0.024 in.)
Minimum undercut depth: 0.2 mm (0.008 in.)

If the undercut depth is less than minimum, correct with a hacksaw blade and smooth out the edge.

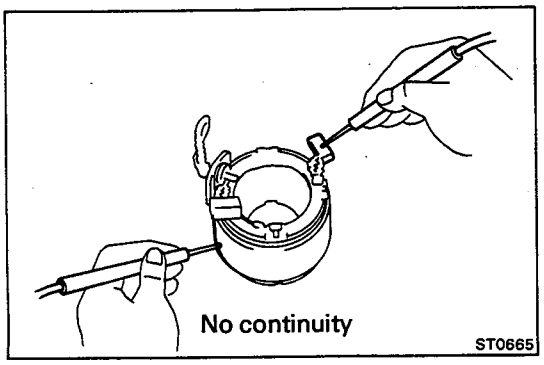
Field Coil (Field Frame)



1. INSPECT FIELD COIL FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the lead wire and field coil brush lead.

If there is no continuity, replace the field frame.

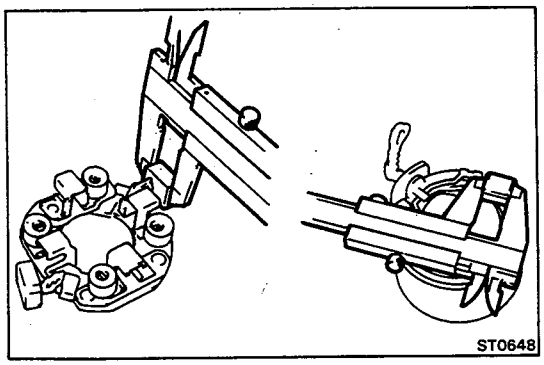


2. INSPECT FIELD COIL FOR GROUND

Using an ohmmeter, check that there is no continuity between the field coil end and field frame.

If there is continuity, replace the field coil.

Brushes

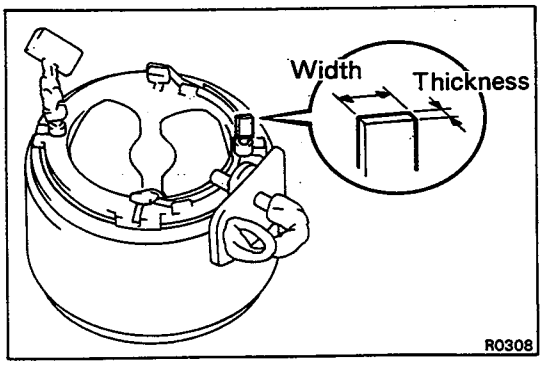


INSPECT BRUSH LENGTH

Using vernier calipers, measure the brush length.

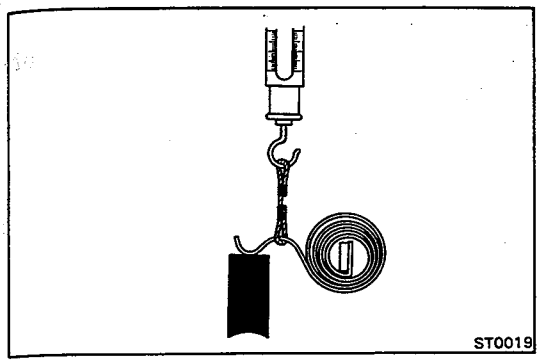
Standard length: 14.0 mm (0.551 in.)
Minimum length: 9.0 mm (0.354 in.)

If the length is less than minimum, replace the brush (field frame side) or brush holder, and dress with an emery cloth.



If replacing the brush, adjust the terminal to specification after removing the brush.

Specified width: 5.0 mm (0.197 in.)
Specified thickness: 1.5 – 1.7 mm (0.059 – 0.067 in.)



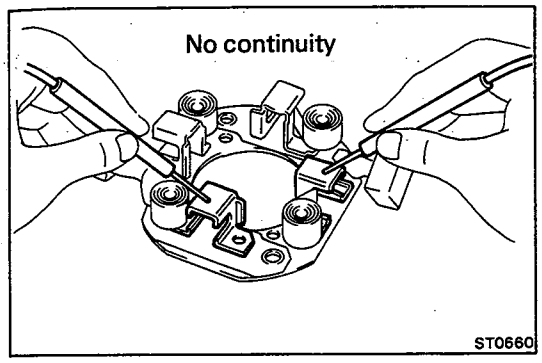
Brush Springs

INSPECT BRUSH SPRING LOAD

Take the pull scale reading the instant the brush spring separates from the brush.

Standard installed load: 1.6 kg (3.5 lb, 16N)
Minimum installed load: 0.9 kg (2.0 lb, 9N)

If the installed load is less than minimum, replace the brush springs.



Brush Holder

INSPECT BRUSH HOLDER INSULATION

Using an ohmmeter, check that there is no continuity between the positive (+) and negative (−) brush holders.

If there is continuity, repair or replace the brush holder.

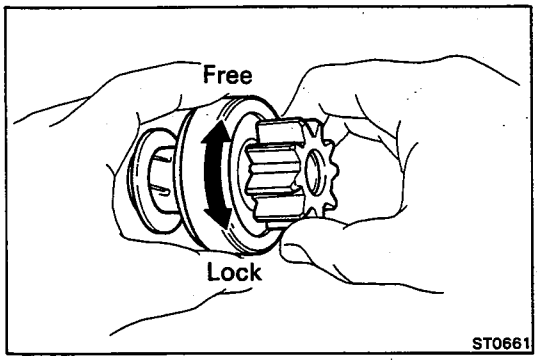
Starter Clutch and Gears

1. INSPECT GEAR TEETH

Check the gear teeth on the planetary gear, internal gear and the starter clutch for wear or damage.

If the gear is damaged, replace it.

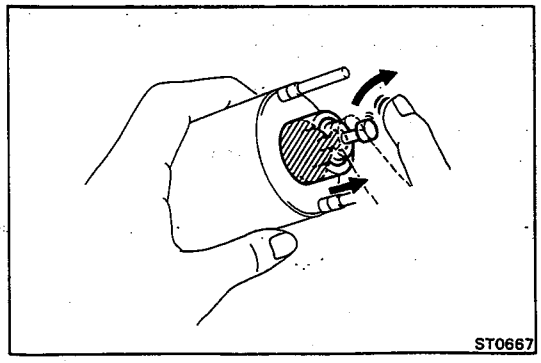
If the starter clutch teeth are damaged, replace the starter clutch and also inspect the flywheel ring gear for wear or damage.



2. INSPECT STARTER CLUTCH

Rotate the clutch pinion gear clockwise and check that it turns freely. Try to rotate the pinion counterclockwise and check that it locks.

If necessary, replace the starter clutch.

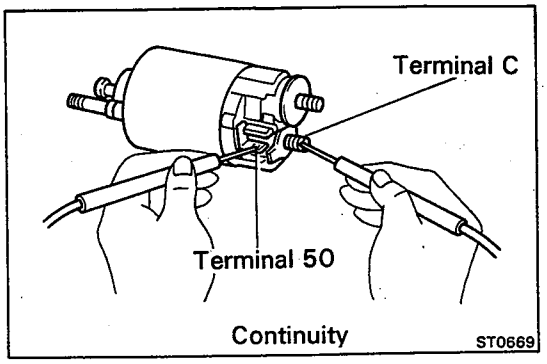


Magnetic Switch

1. INSPECT PLUNGER

Push in the plunger and replace it. Check that it returns quickly to its original position.

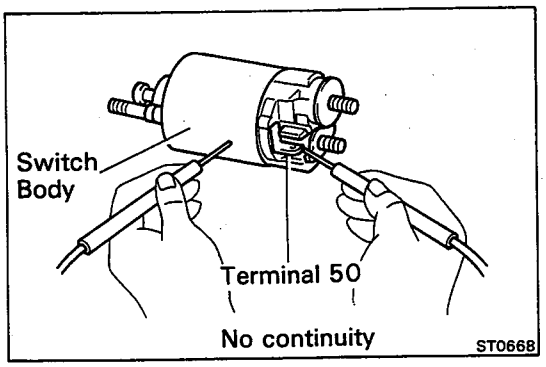
If necessary, replace the magnetic switch.



2. PERFORM PULL-IN COIL OPEN CIRCUIT TEST

Using an ohmmeter, check that there is continuity between terminal 50 and terminal C.

If there is no continuity, replace the magnetic switch.

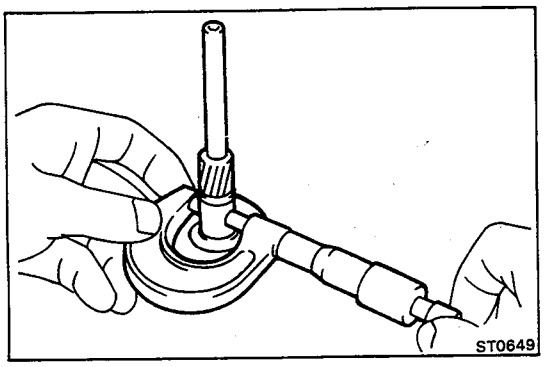


3. PERFORM HOLD-IN COIL OPEN CIRCUIT TEST

Using an ohmmeter, check that there is continuity between terminal 50 and the switch body.

If there is no continuity, replace the magnetic switch.

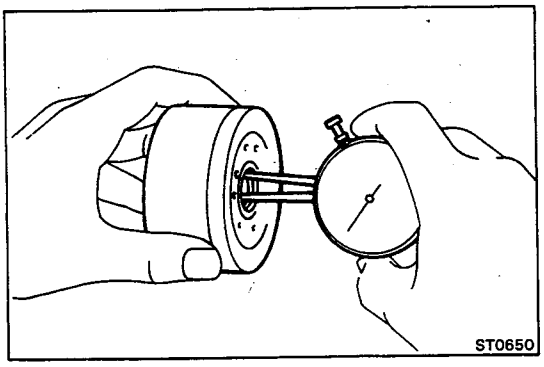
Planet Carrier Shaft and Center Bearing



1. INSPECT PLANET CARRIER SHAFT AND CENTER BEARING

(a) Using a micrometer, measure the outer diameter of the surface in contact with the center bearing of the plant carrier shaft.

Standard shaft diameter:
14.035 – 15.000 mm (0.5526 – 0.5906 in.)



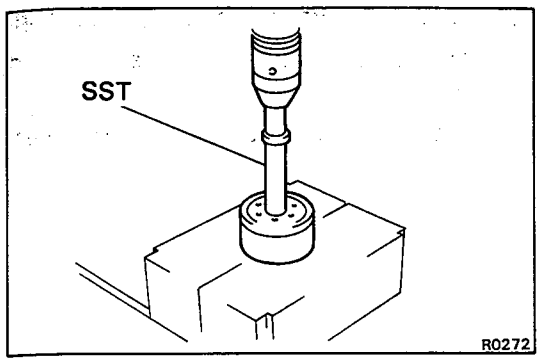
(b) Using a caliper gauge, measure the inside diameter of the center bearing.

Center bearing inside diameter:
15.000 – 15.035 mm (0.5906 – 0.5919 in.)

(c) Subtract the planet carrier shaft diameter from the bearing inside diameter measurement.

Standard center bearing oil clearance:
0.03 mm (0.0012 in.)
Maximum center bearing oil clearance:
0.1 mm (0.004 in.)

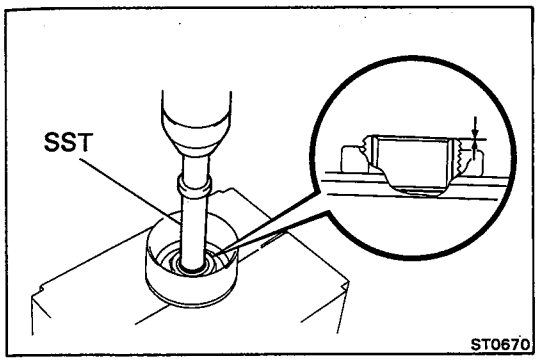
If the clearance is greater than maximum, replace the planet carrier shaft and center bearing.



2. IF NECESSARY, REPLACE CENTER BEARING

(a) Using SST and a press, press out the center bearing.

SST 09221-25024 (09221-00090)



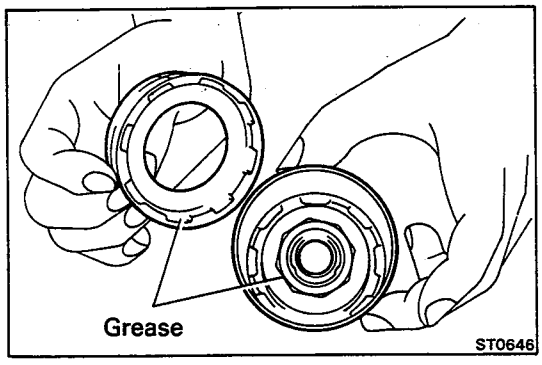
(b) Using SST and a press, press in a new center bearing to the position shown in the illustration.

SST 09221-25024 (09221-00090)

ASSEMBLY OF PLANETARY TYPE STARTER

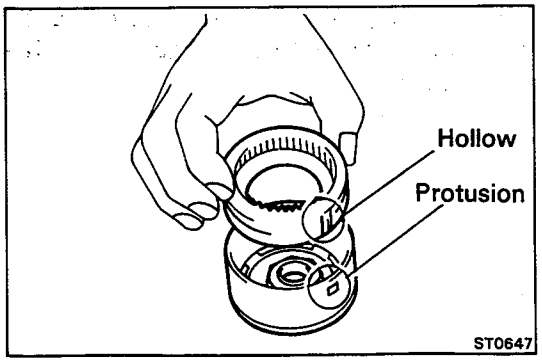
(See page ST-3)

HINT: Use high-temperature grease to lubricate the bearings and sliding parts when assembling the starter.



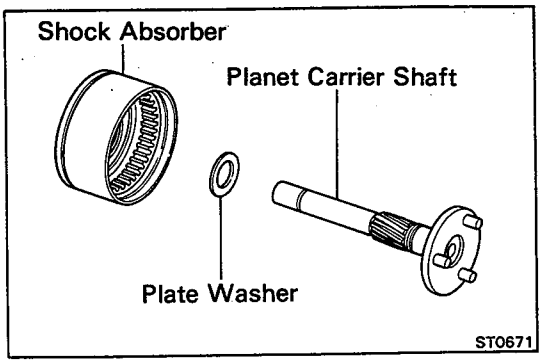
1. INSTALL INTERNAL GEAR AND PLANET CARRIER SHAFT

(a) Apply grease to the internal gear touching the sock absorber and planetary gears.



(b) Align the hollow of the internal gear with the protrusion inside the shock absorber.

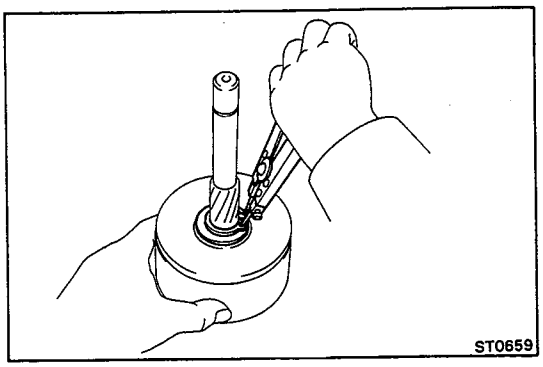
(c) Insert and turn the internal gear so that it interlocks with the shock absorber.



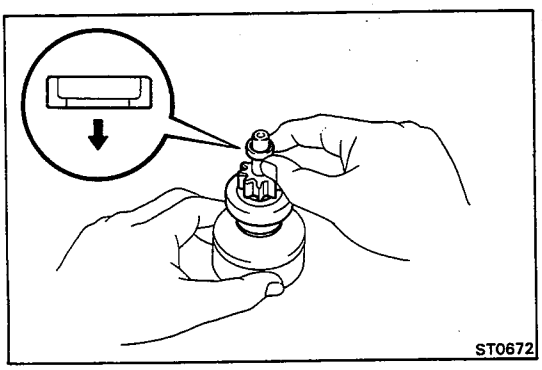
(d) Apply turbine oil with additives to the center bearing.

(e) Apply grease to the plate washer, and install it to the planet carrier shaft.

(f) Install the planet carrier shaft to the shock absorber.



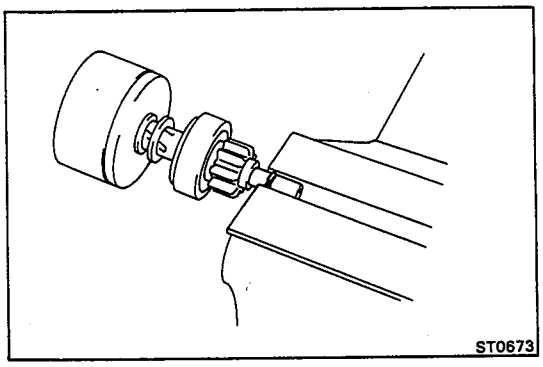
(g) Using snap ring pliers, install the plate washer and snap ring.



2. INSTALL STARTER CLUTCH

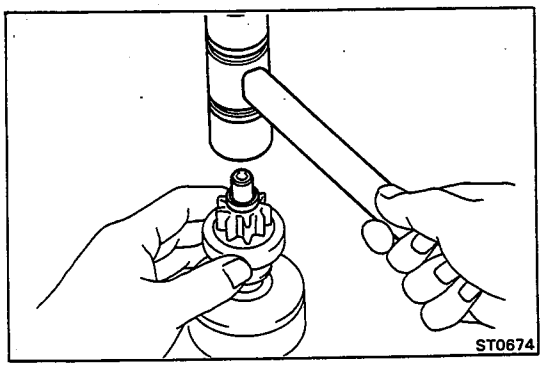
(a) Apply grease to the bushing and spline of the starter cluch stop collar.

(b) Place the starter clutch and stop collar on the planet carrier shaft.

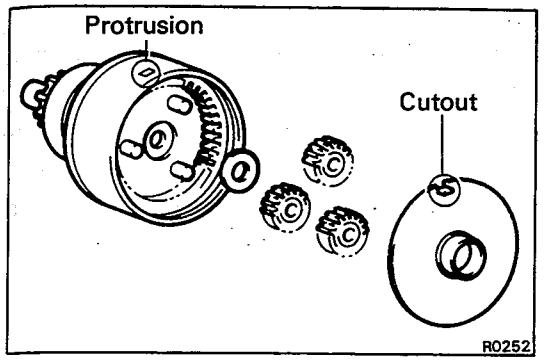


(c) Apply grease to the snap ring, and install it to the planet carrier shaft groove.

(d) Using a vise, compress the snap ring.



(e) Hold the starter clutch, tap the planet carrier shaft and install the stop collar onto the snap ring with a plastic-faced hammer.

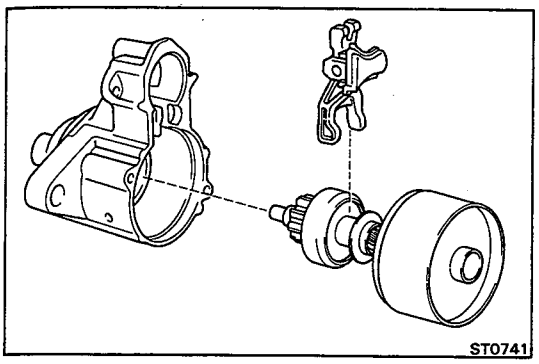


3. INSTALL PLANETARY GEARS

(a) Apply grease to the planetary gears and flange pin parts of the planet carrier shaft.

(b) Install the plate washer and three planetary gears.

(c) Align the cutout of the plate with the protrusion inside the shock absorber, and install the plate.

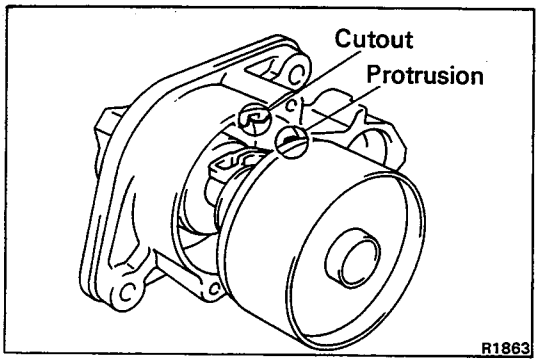


4. INSTALL DRIVE LEVER AND STARTER CLUTCH WITH SHOCK ABSORBER

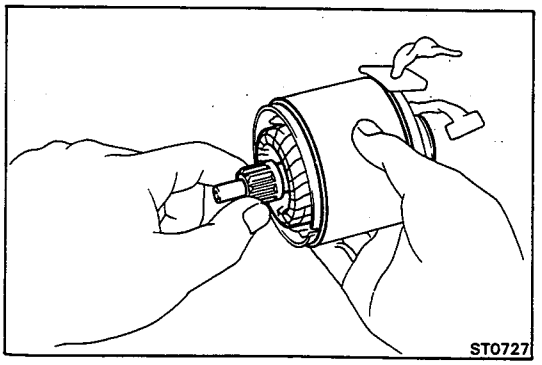
(a) Apply turbine oil with additives to the bearing of the starter drive housing.

(b) Apply grease to the drive lever touching the starter pivot part of the drive lever.

(c) Install the drive lever to the starter clutch.

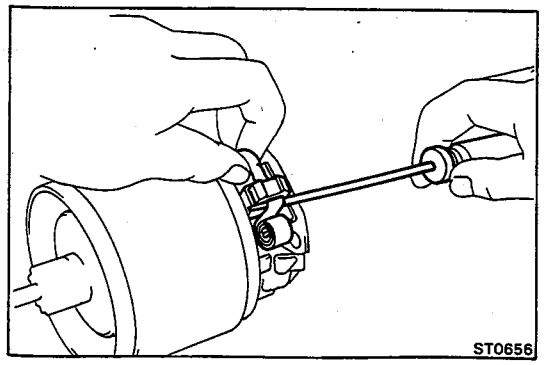


(d) Align the protrusion of the shock absorber with the cutout of the drive housing and install them.



5. INSTALL NEW O-RINGS TO FIELD FRAME

6. PLACE ARMATURE INTO FIELD FRAME

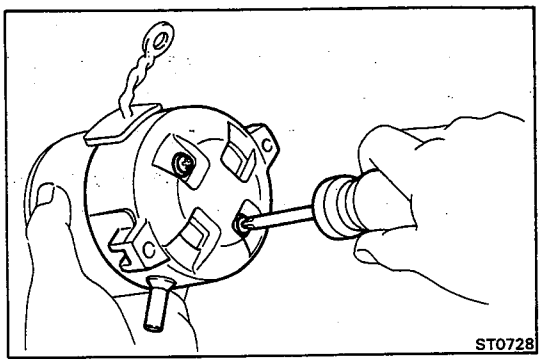


7. INSTALL BRUSH HOLDER

(a) Place the brush holder in position on the armature.

(b) Using a screwdriver, hold the brush spring back, and connect the brush into the brush holder. Connect the four brushes.

HINT: Check that positive (+) lead wires are not grounded.

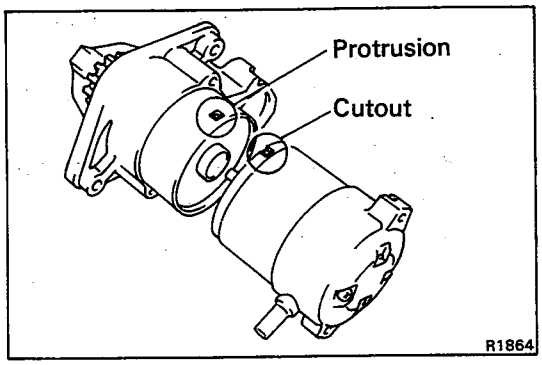


8. INSTALL COMMUTATOR END FRAME

(a) Apply turbine oil with additives to the bearing of the end frame.

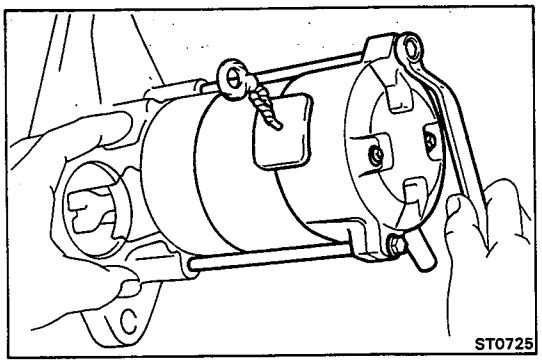
(b) Install the end frame with new two screws with O-rings.

NOTICE: To avoid interference between the brush holder and the water outlet hose, pull the commutator end frame away at an angle.

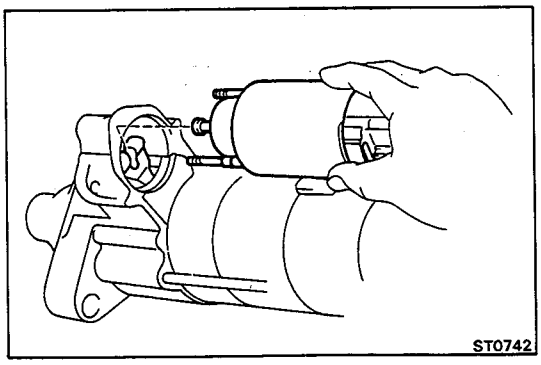


9. INSTALL FIELD FRAME AND ARMATURE ASSEMBLY

(a) Align the cutout of the field frame with the protrusion of the shock absorber.



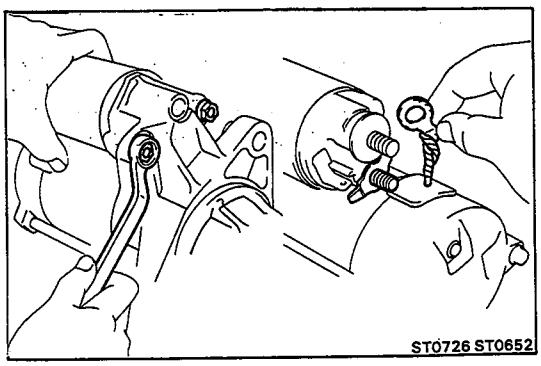
(b) Install the field frame and armature assembly with the two through bolts.



10 INSTALL MAGNETIC SWITCH

(a) Install the plunger cover to the magnetic switch.

(b) Hang the plunger of the magnetic switch to the drive lever from the upper side.



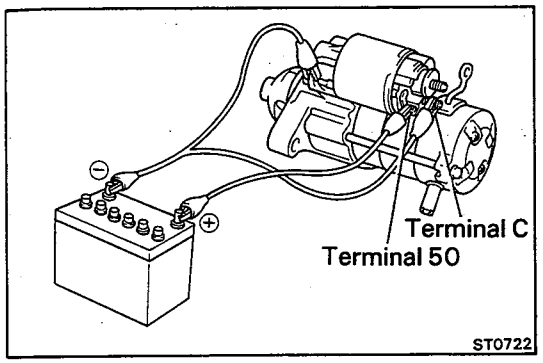
(c) Install the magnetic switch with the two nuts.

(d) Connect the lead wire to terminal C, and install the nut.

11. (4A-GE)
INSTALL DUST STARTER PROTECTOR

PERFORMANCE TEST OF PLANETARY TYPE STARTER

NOTICE: These testes must be performed within 3 to 5 seconds to avoid burning out the coil.

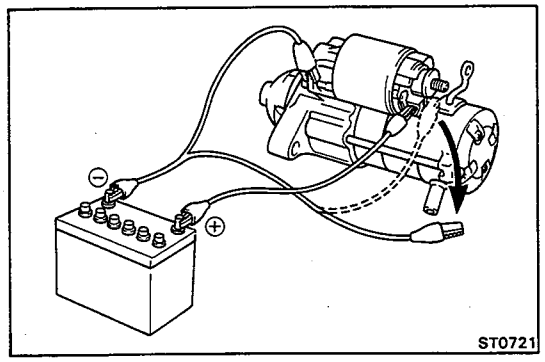


1. PERFORM PULL-IN TEST

(a) Disconnect the field coil lead from terminal C.

(b) Connect the battery to the magnetic switch as shown. Check that the clutch pinion gear moves outward.

If the clutch pinion gear does not move, replace the magnetic switch.

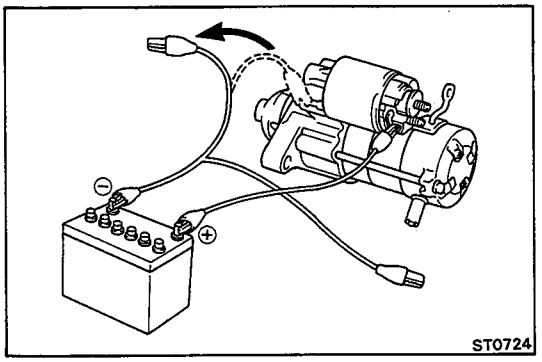


2. PERFORM HOLD-IN TEST

With the battery connected as above and with the pinion out, disconnect the negative (–) lead from terminal C.

Check that the clutch pinion remains out.

If the cluch pinion gear returns inward, replace the magnetic switch.

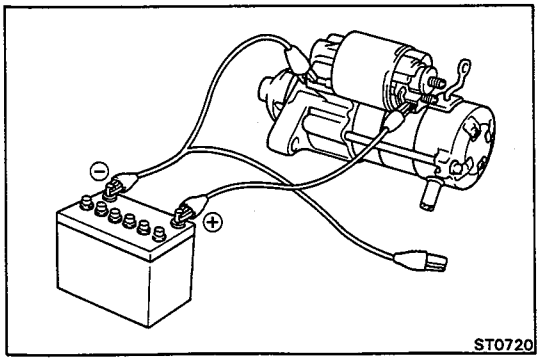


3. INSPECT CLUTCH PINION GEAR RETURN

Disconnect the negative (–) lead from the switch body.

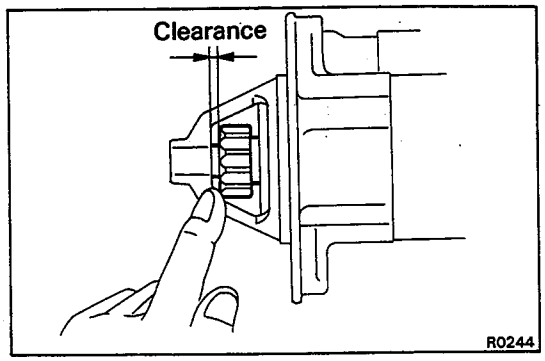
Check that the clutch pinion gear returns inward.

If the clutch pinion does not return, replace the magnetic switch.



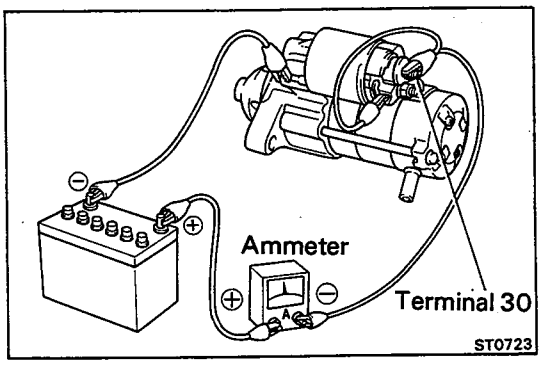
4. INSPECT CLUTCH PINION GEAR CLEARANCE

(a) Connect the battery the magnetic switch as shown.



(b) Move the pinion gear toward the armature to remove slack and measure the clearance between the pinion gear end and stop collar.

Standard clearance: 1 — 5 mm (0.04 — 0.20 in.)



5. PERFORM NO-LOAD PERFORMANCE TEST

(a) Connect the field coil lead terminal C.
Check that the lead is not grounded.

(b) Connect the battery and ammeter to the starter as shown.

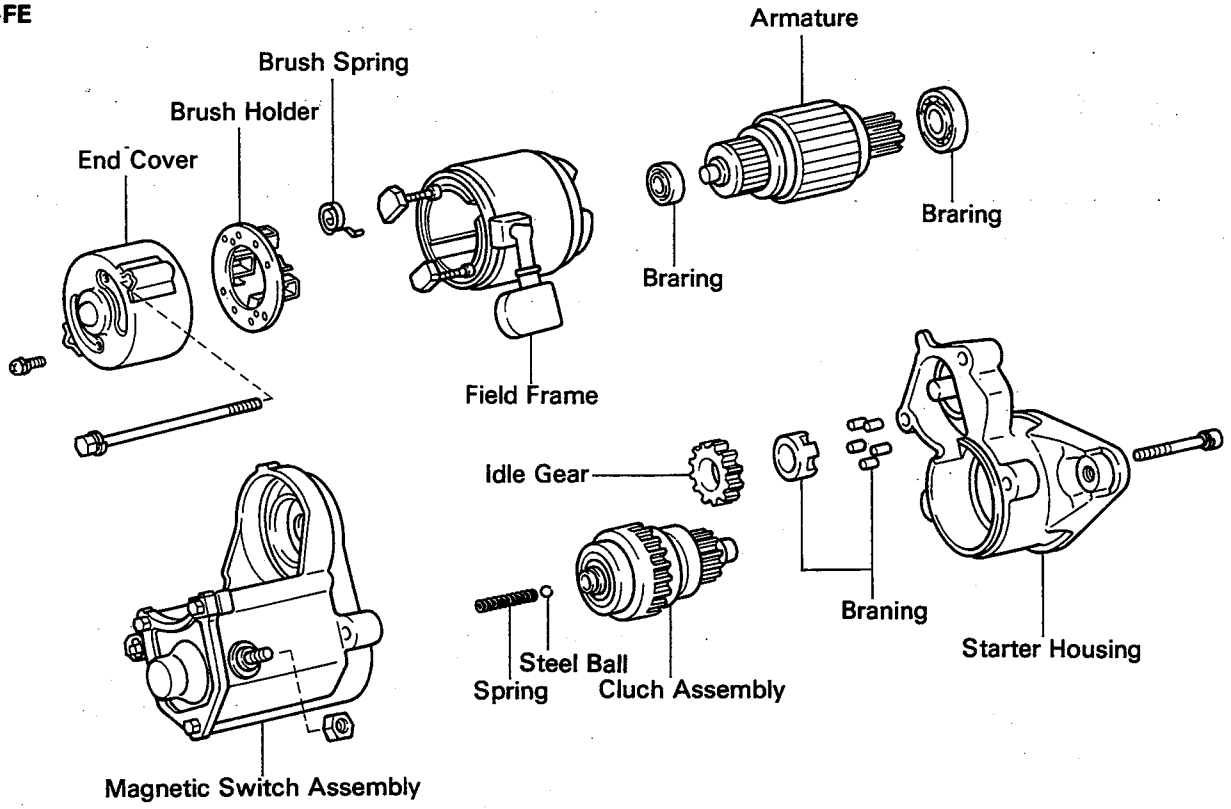
(c) Check that the starter rotates smoothly and steadily with the clutch pinion gear moving out. Check reading on the ammeter.

Specified current. 90A or less at 11.5V

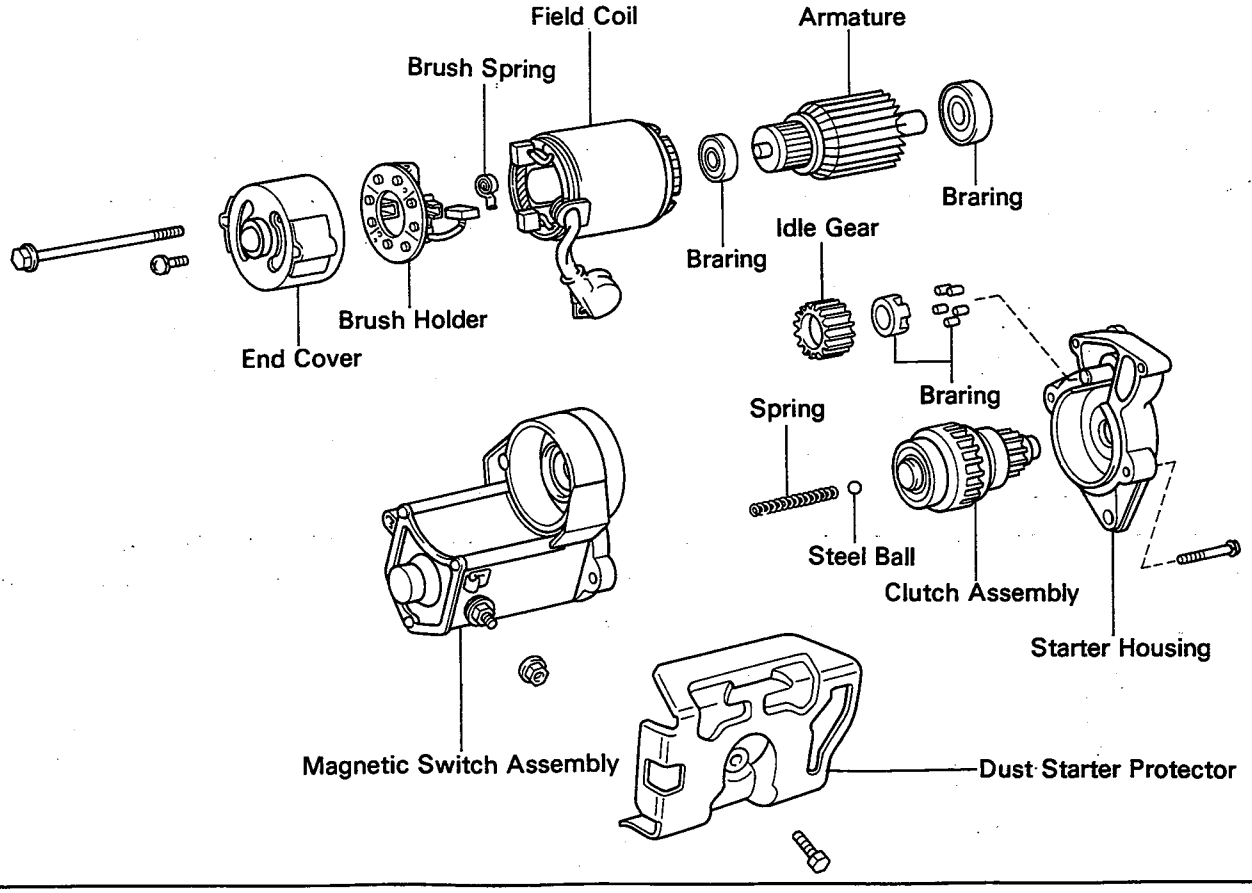
REDUCTION TYPE STARTER

COMPONENTS

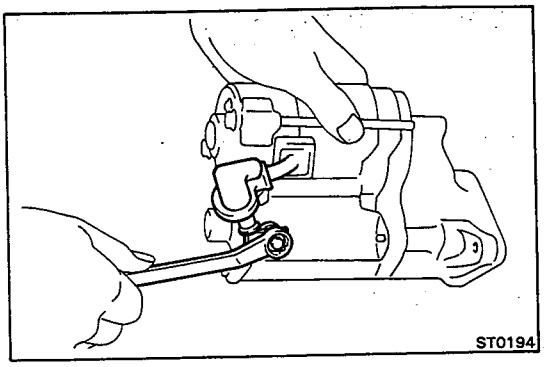
4A-FE



4A-GE



ST0713
ST0729



DISASSEMBLY OF REDUCTION TYPE STARTER

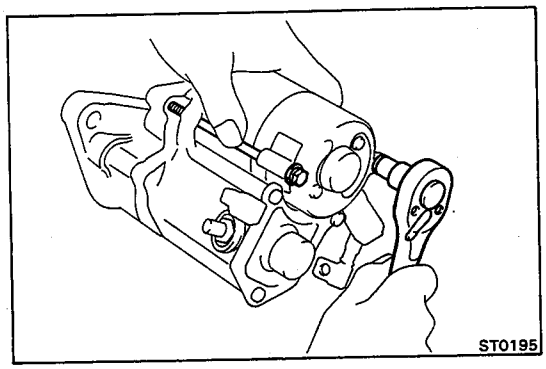
(See page ST-17)

1. (4A-GE)
   REMOVE DUST STARTER PROTECTOR

2. REMOVE FIELD FRAME WITH ARMATURE FROM MAGNETIC SWITCH

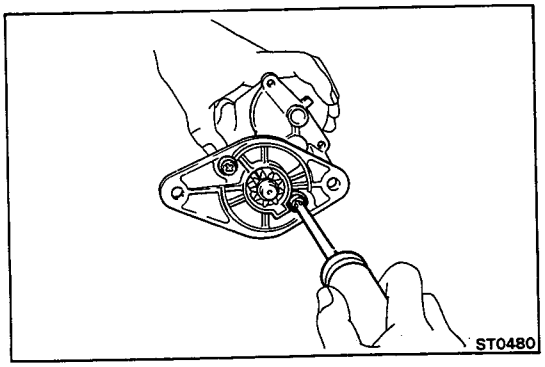
   (a) Remove the nut. Disconnect the lead wire from the magnetic switch terminal.

   (b) Remove the two through bolts. Pull out the field frame with the armature from the magnetic switch.



3. REMOVE STARTER HOUSING FROM MAGNETIC SWITCH ASSEMBLY

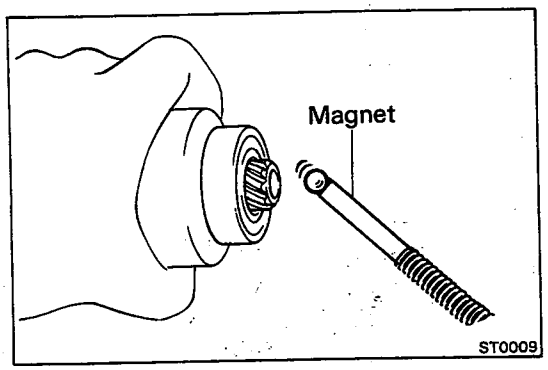
   Remove the two screws and remove the starter housing with the idler gear and clutch assembly.



4. REMOVE CLUTCH ASSEMBLY AND IDLER GEAR FROM STARTER HOUSING

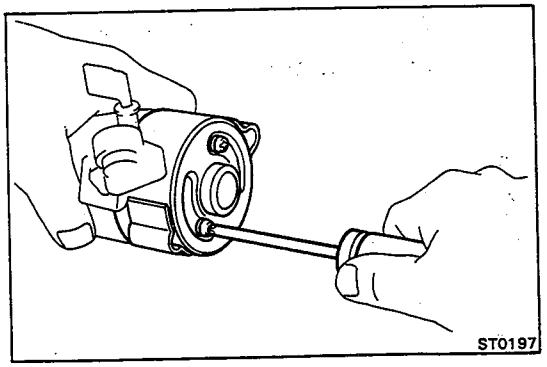
5. REMOVE STEEL BALL AND SPRING

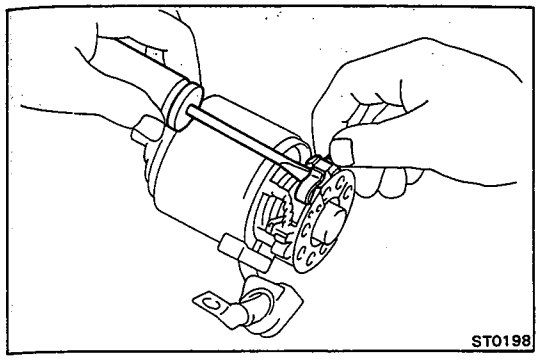
   Using a magnetic finger, remove the spring and steel ball from the clutch shaft hole.



6. REMOVE BRUSHES AND BRUSH HOLDER

   (a) Remove the two screws and end cover from the field frame.

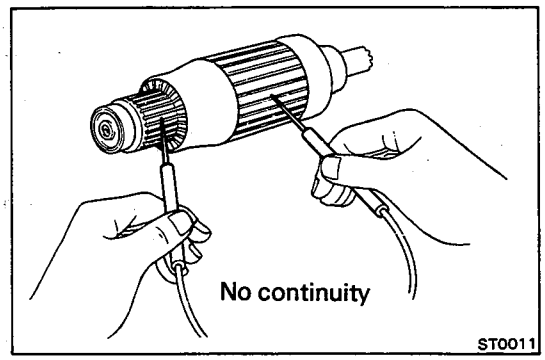


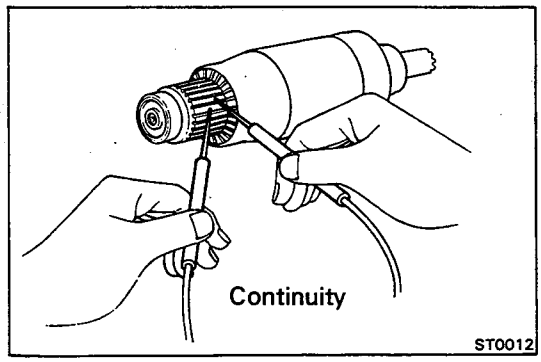


(b) Using a screwdriver or steel wire separate the brush springs, and remove the brushes from the brush holder.

(c) Pull the brush holder off the armature.

7. REMOVE ARMATURE FROM FIELD FRAME





INSPECTION OF STARTER

Armature Coil

1. INSPECT THAT COMMUTATOR IS NOT GROUNDED

Using an ohmmeter, check that there is no continuity between the commutator and armature coil core.

If there is continuity, replace the armature.

2. INSPECT COMMUTATOR FOR OPEN CIRCUIT

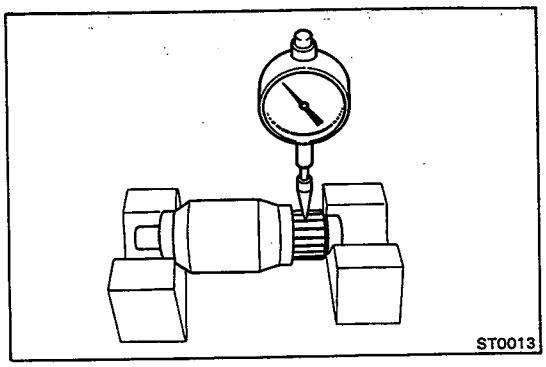
Using an ohmmeter, check for continuity between the segments of the commutator.

If there is no continuity between any segment, replace the armature.

Commutator

1. INSPECT COMMUTATOR FOR DIRTY AND BURNT SURFACES

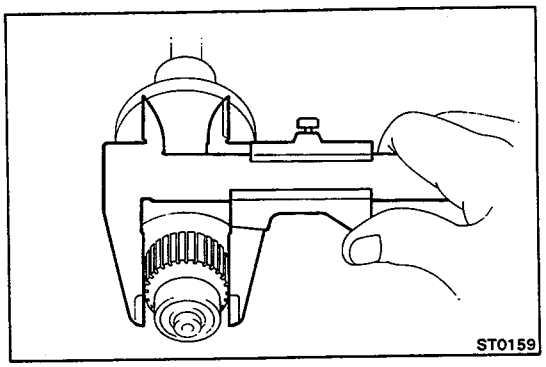
If the surface is dirty or burnt, correct with sandpaper (No.400) or a lathe.



2. **INSPECT COMMUTATOR RUNOUT**

Maximum circle runout: 0.05 mm (0.0020 in.)

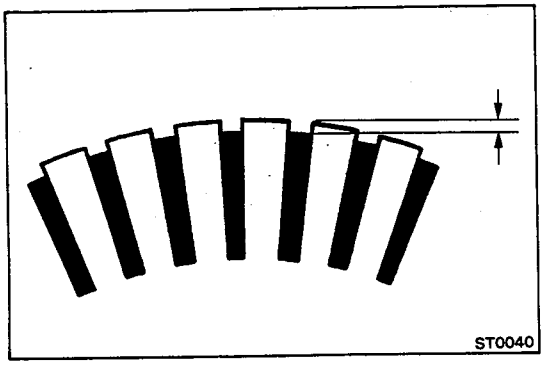
If the circle runout is greater than maximum, correct it with a lathe.



3. **MEASURE DIAMETER OF COMMUTATOR**

Standard diameter: 30 mm (1.18 in.)
Minimum diameter: 29 mm (1.14 in.)

If the diameter of the commutator is less than minimum, replace the armature.



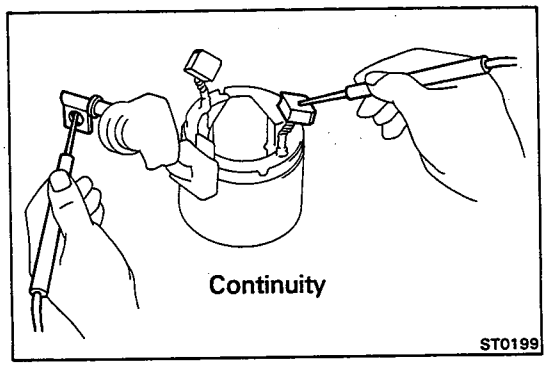
4. **CHECK SEGMENT**

Check that the segment is clean and free of foreign particles.

Standard undercut depth: 0.6 mm (0.24 in.)
Minimum undercut depth: 0.2 mm (0.008 in.)

If the undercut depth is less than minimum, correct it with a hacksaw blade and smooth out the edge.

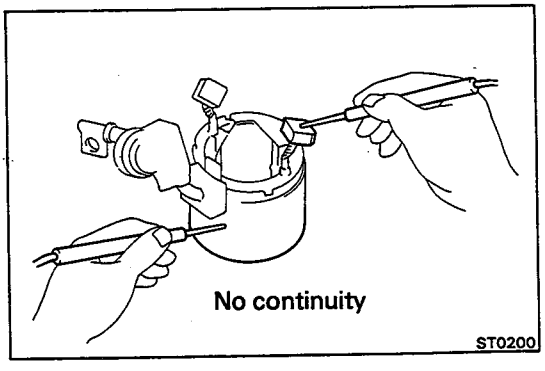
Field Coil



1. **INSPECT FIELD COIL FOR OPEN CIRCUIT**

Using an ohmmeter, check for continuity between the lead wire and field coil brush lead.

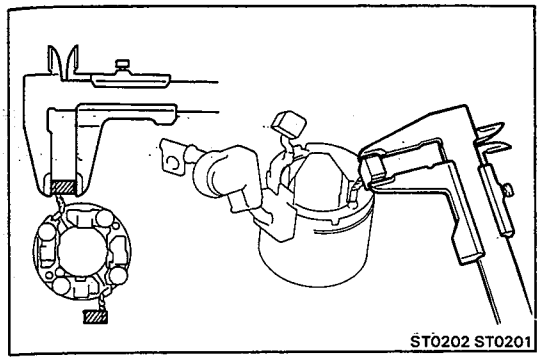
If there is no continuity, replace the field frame.



2. **INSPECT THAT FIELD COIL IS NOT GROUNDED**

Using an ohmmeter, check for no continuity between the field coil end and field frame.

If there is continuity, repair or replace the field frame.

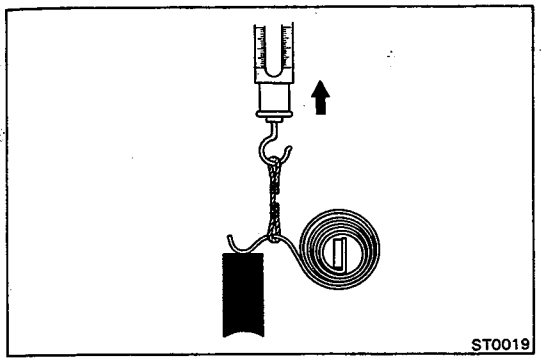


Brushes

MEASURE BRUSH LENGTH

Standard length: 13.5 mm (0.531 in.)
Minimum length: 8.5 mm (0.335 in.)

If the length is less than minimum, replace the brush and dress with an emery cloth.



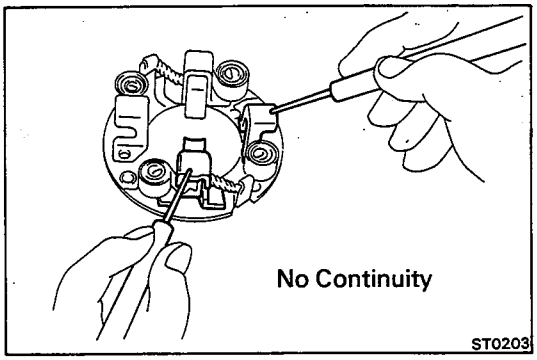
Brush Spring

MEASURE BRUSH SPRING LOAD WITH PULL SCALE

Take the pull scale reading the instant the brush spring separates from the brush.

Standard installed load: 1.785 – 2.415 kg (3.9 – 5.3 lb, 18 – 24 N)

If the installed load is less than minimum, replace the brush springs.



Brush Holder

INSPECT INSULATION OF BRUSH HOLDER

Using an ohmmeter, check for continuity between the positive and negative brush holders.

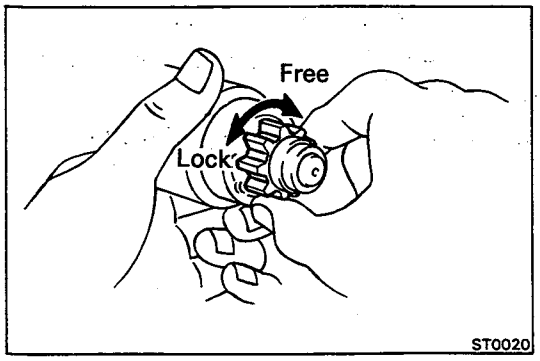
If there is continuity, repair or replace the brush holder.

Clutch and Gears

1. INSPECT GEAR TEETH

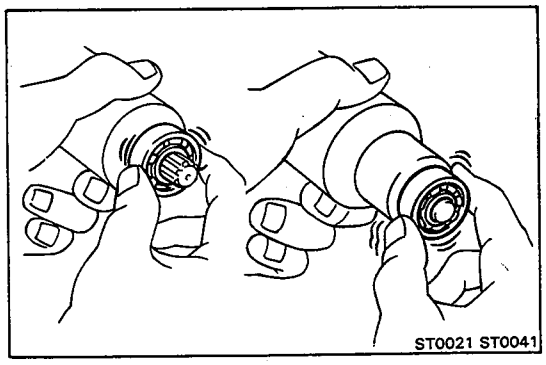
Check the gear teeth on the pinion gear, idler gear and clutch assembly for wear or damage.

If damaged, replace, and also check the flywheel ring gear for wear or damage.



2. INSPECT CLUTCH

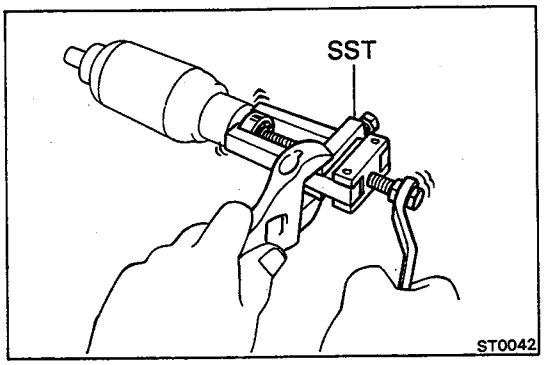
Rotate the pinion clockwise and check that it turns freely. Try to rotate the pinion counterclockwise and check that it locks.



Bearings

1. INSPECT BEARINGS

Turn each bearing by hand while applying inward force. If resistance is felt or if the bearing sticks, replace the bearing.

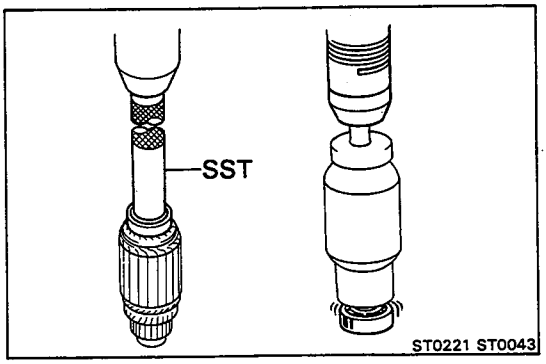


2. IF NECESSARY, REPLACE BEARINGS

(a) Using SST, remove the bearing from the armature shaft.

(b) Using SST, remove the other bearing from the opposite side.

SST 09286-46011



(c) Using SST and a press, install a new front bearing onto the shaft.

SST 09285-76010

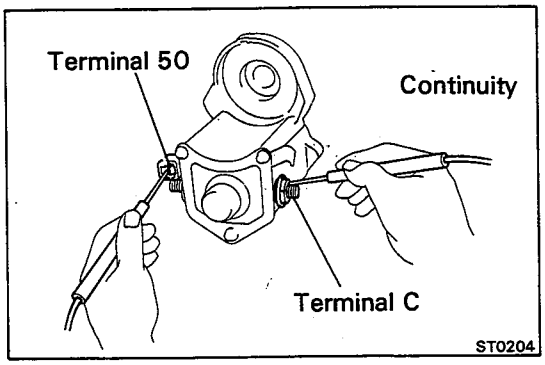
(d) Using a press, install a new rear bearing onto the shaft.

Magnetic Switch

1. PERFORM PULL-IN COIL OPEN CIRCUIT TEST

Using an ohmmeter, check for continuity between terminal 50 and terminal C.

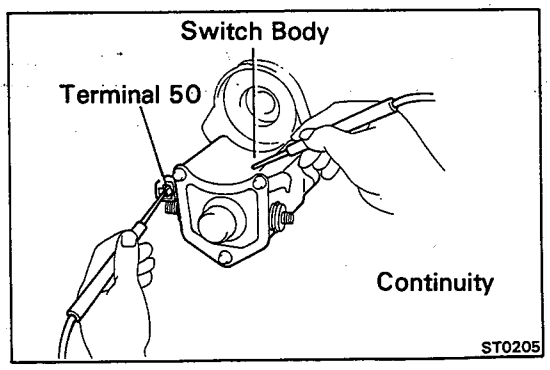
If there is no continuity, replace the magnetic switch.



2. PERFORM HOLD-IN COIL OPEN CIRCUIT TEST

Using an ohmmeter, check for continuity between terminal 50 and the switch body.

If there is no continuity, replace the magnetic switch.



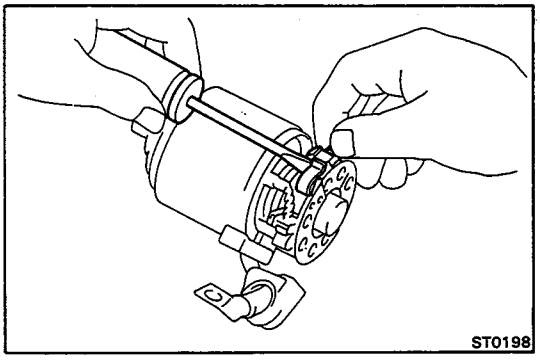
ASSEMBLY OF REDUCTION TYPE STARTER

(See page ST-17)

HINT: Use high-temperature grease to lubricate the bearings and gears when assembling the starter.

1. PLACE ARMATURE INTO FIELD FRAME

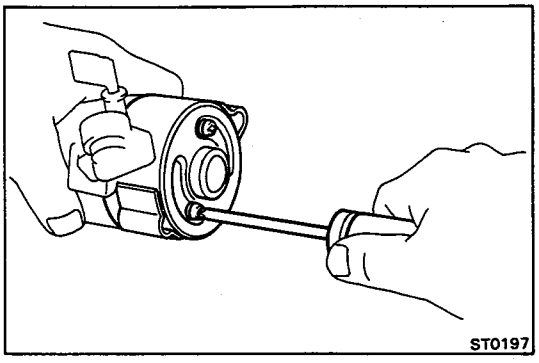
Apply grease to the armature bearings and insert the armature into the field frame.



2. INSTALL BRUSH HOLDER AND BRUSHES

(a) Using a screwdriver, hold the brush spring back, and install the brush into the brush holder. Install the four brushes.

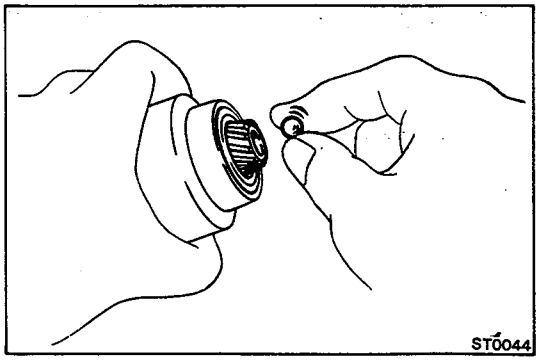
HINT: Make sure that the positive lead wires are not grounded.

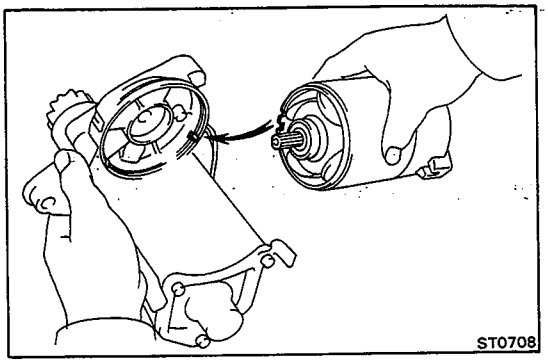


(b) Install the end cover to the field frame.

3. INSERT STEEL BALL INTO CLUTCH SHAFT HOLE

Apply grease to the ball and spring and insert them into the clutch shaft hole.

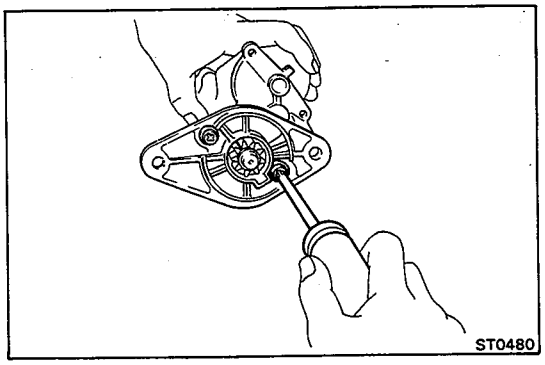




4. INSTALL GEAR AND CLUTCH ASSEMBLY

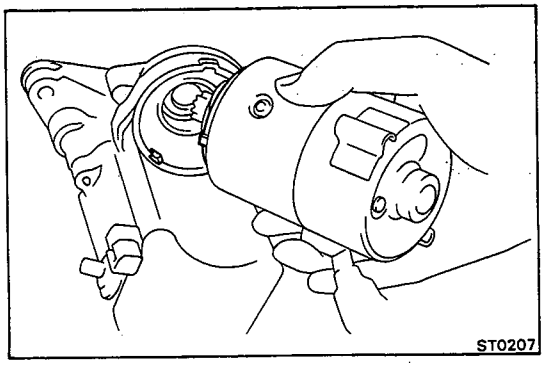
(a) Apply grease to the gear and clutch assembly.

(b) Place the clutch assembly, idler gear and bearing in the starter housing.



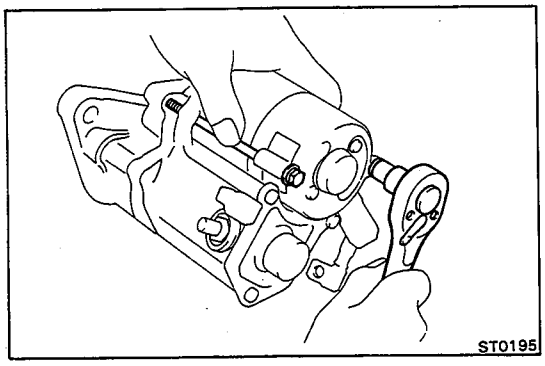
5. INSTALL STARTER HOUSING

Place the starter housing on the magnetic switch and install the two screws.

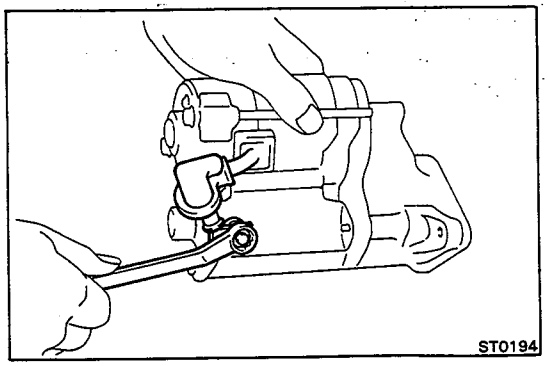


6. INSTALL FIELD FRAME WITH ARMATURE IN MAGNETIC SWITCH

(a) Match the protrusion of the field frame with the magnetic switch.

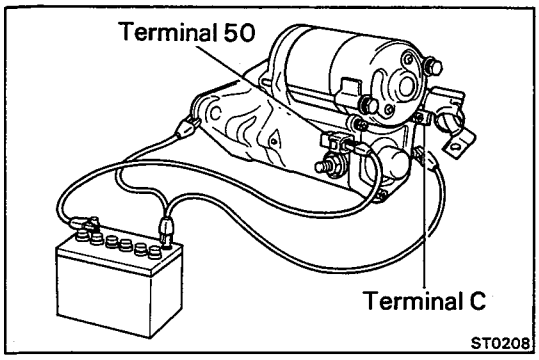


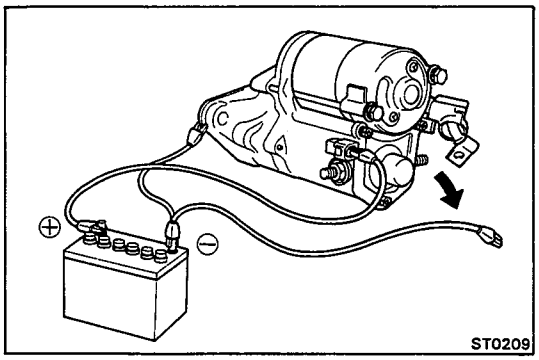
(b) Install the two through bolts.

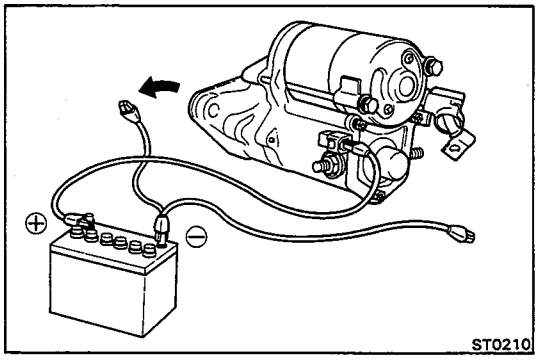


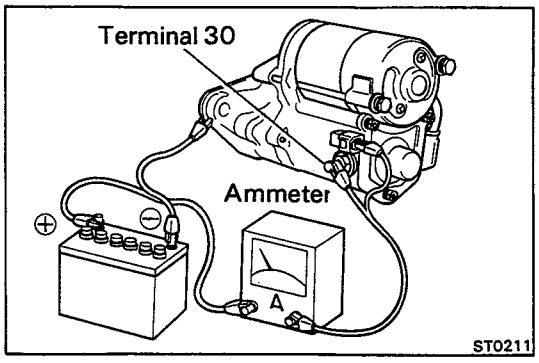
(c) Connect the coil lead to the terminal on the magnetic switch.

7. (4A-GE)
INSTALL DUST STARTER PROTECTOR









PERFORMANCE TEST OF STARTER

NOTICE: These tests must be performed within 3 to 5 seconds to avoid burning out the coil.

1. PERFORM PULL-IN TEST

(a) Disconnect the field coil lead from terminal C.

(b) Connect the battery to the magnetic switch as shown.

(c) Check that the plunger moves outward.

If the plunger does not move, replace the magnetic switch.

2. PERFORM HOLD-IN TEST

(a) While connected as above with the plunger out, disconnect the negative lead from terminal C.

(b) Check that the plunger remains out.

If the plunger returns inward, replace the magnetic switch.

3. INSPECT PLUNGER RETURN

(a) Disconnect the negative lead from the switch body.

(b) Check that the plunger returns inward.

If the plunger does not return, replace the magnetic switch.

4. PERFORM NO-LOAD PERFORMANCE TEST

(a) Connect the battery and ammeter to the starter as shown.

(b) Check that the starter rotates smoothly and steadily with the pinion moving out.

(c) Check that the ammeter reads the specified current.

Specified current: Less than 90 A at 11.5 V

CHARGING SYSTEM

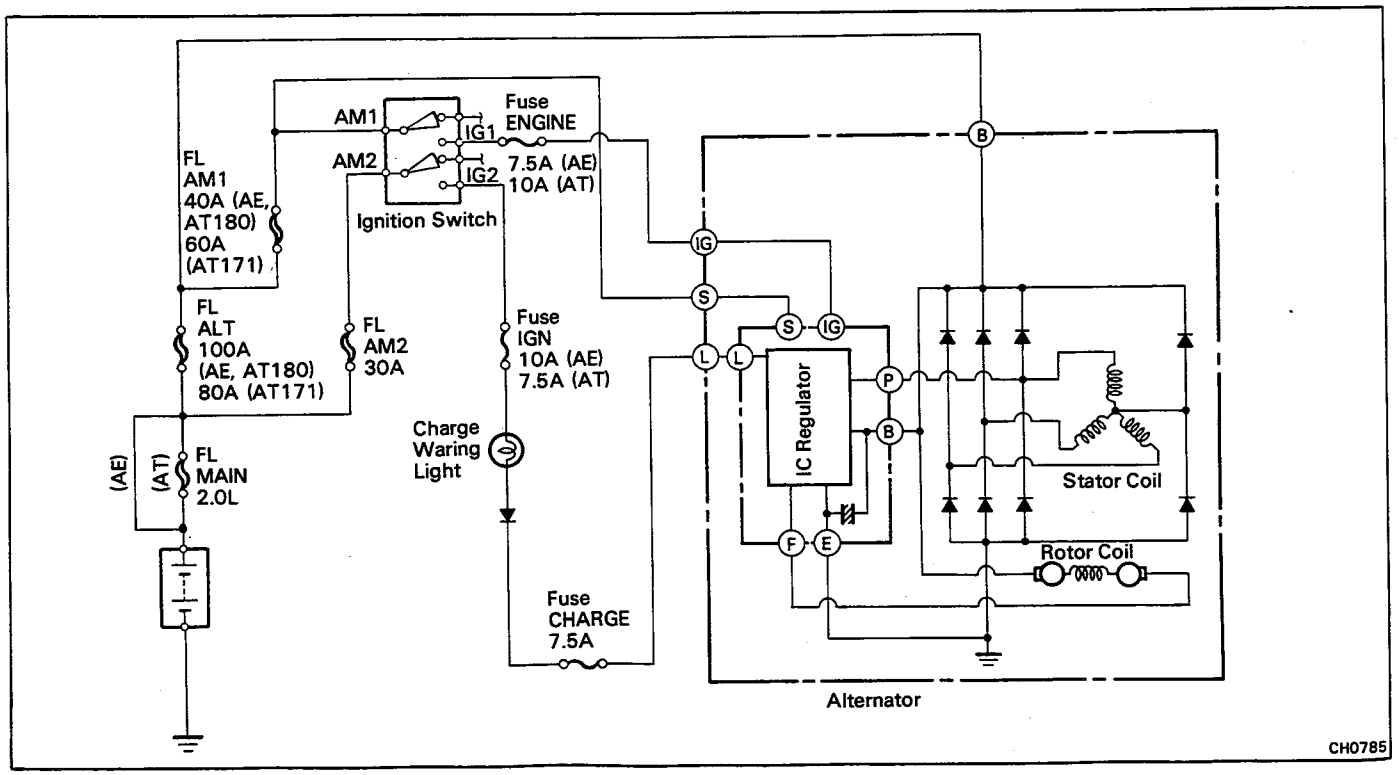
PRECAUTIONS

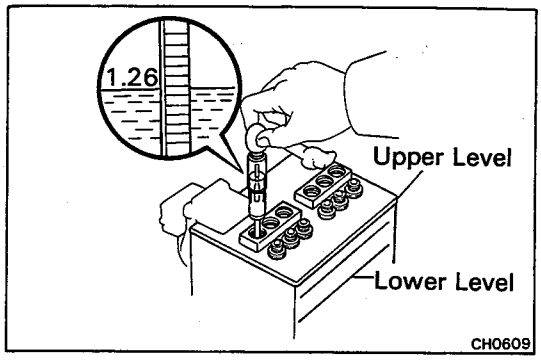
1. **Check that the battery cables are connected to the correct terminals.**
2. **Disconnect the battery cables when the battery is given a quick charge.**
3. **Do not perform tests with a high voltage insulation resistance tester.**
4. **Never disconnect the battery while the engine is running.**

TROUBLESHOOTING

Problem	Possible cause	Remedy	Page
Discharge warning light does not light with ignition ON and engine off	Fuse blown	Check "CHARGE" and "IGN" fuses	
	Light burned out	Replace light	
	Wiring connection lose	Tighten loose connections	
	IC regulator faulty	Replace IC regulator	CH-7
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-3
	Battery cables loose, corroded or worn	Repair or replace cables	
	Fuse blown	Check "CHARGE" or "ENGINE" fuse	
	Fusible link blown	Replace fusible link	
	IC regulator or alternator faulty	Check charging system	CH-2
	Wiring faulty	Repair wiring	

CHARGING CIRCUIT





ON-VEHICLE INSPECTION

1. INSPECT BATTERY SPECIFIC GRAVITY AND ELECTROLYTE LEVEL

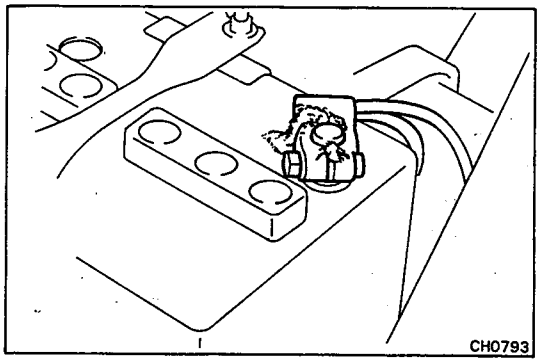
(a) Check the specific gravity of each cell.

Standard specific gravity
when fully charged at 20°C (68°F): 1.25 – 1.27

If not within specifications, charge the battery.

(b) Check the electrolyte quantity of each cell.

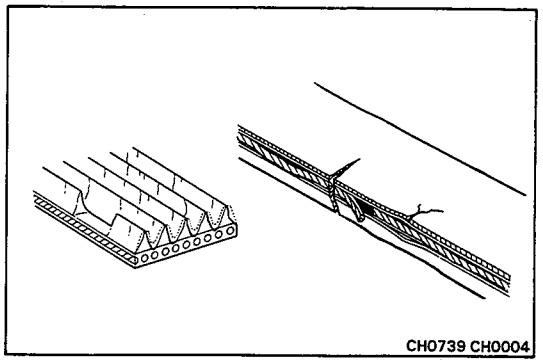
If insufficient, refill with distilled (or purified) water.



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.



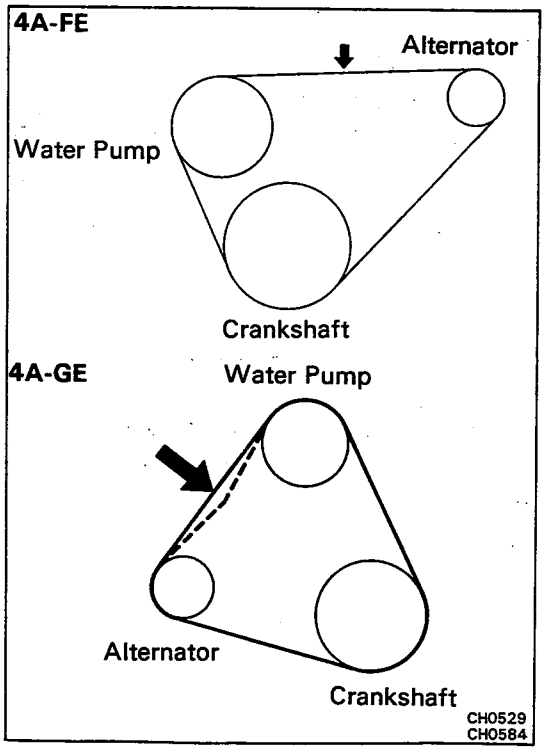
3. INSPECT DRIVE BELT

(a) Visually check the belt for excessive wear, frayed cords etc.

If necessary, replace the drive belt.

HINT: Cracks on the rib side of a belt are considered acceptable.

If the belt has chunks missing from the ribs, it should be replaced.



(b) Check the drive belt deflection of pressing on the belt at the points indicated in the figure with 10 kg (22.0 lb,98 N) pressure.

Drive belt deflection:

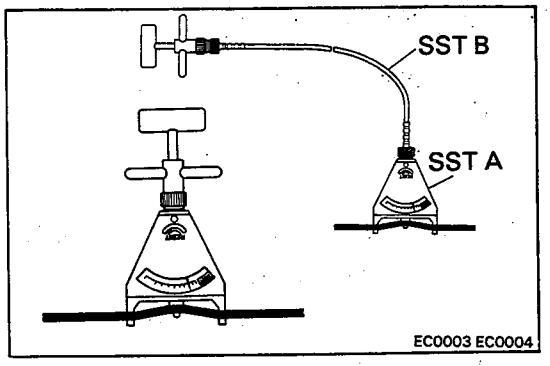
4A-FE

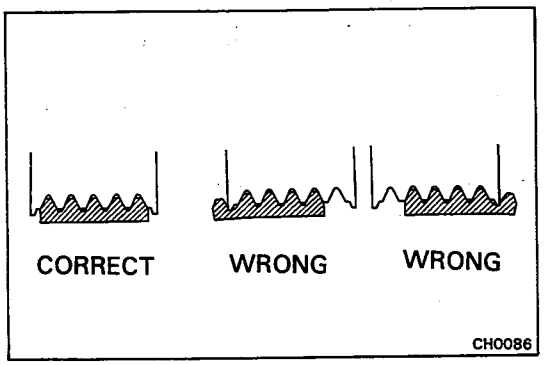
New belt	**8.5 – 10.5 mm (0.335 – 0.413 in.)**
Used belt	**10.0 – 12.0 mm (0.39 – 0.47 in.)**

4A-GE

New belt	**4 – 5 mm (0.16 – 0.20 in.)**
Used belt	**6 – 7 mm (0.24 – 0.28 in.)**

If necessary, adjust the drive belt deflection.





(Reference)
Using SST, check the drive belt tension.

SST A 09216-00020
SST B 09216-00030

Drive belt tension:

4A-FE

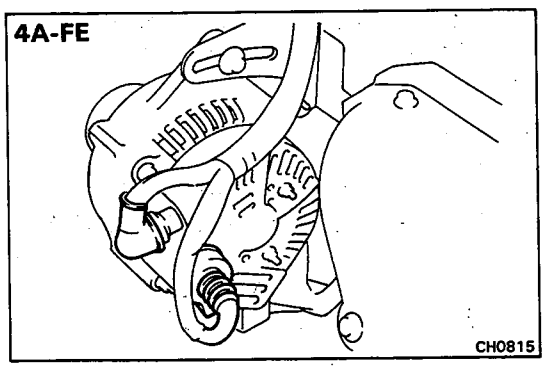
New belt	**60 – 70 kg**
Used belt	**40 – 55 kg**

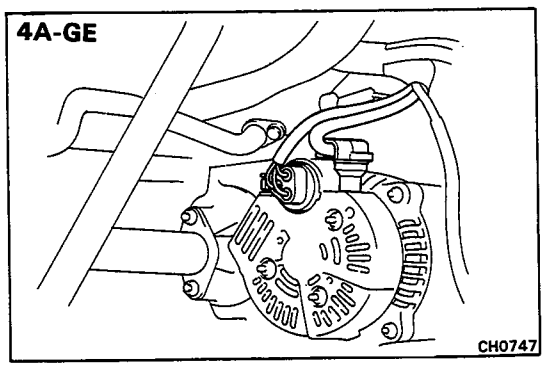
4A-GE

New belt	**70 – 80 kg**
Used belt	**30 – 45 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.
- After installing the drive belt, check that it fits properly in the ribbed grooves.
- Check with your hand to comfirm that the belt has not slipped out of the groove on the bottom of the crank pulley.
- After installing the belt, run the engine for approx. 5 minutes and recheck the deflection or tension.





4. VISUALLY CHECK ALTERNATOR WIRING AND LISTEN FOR ABNORMAL NOISES

(a) Check that the wiring is in good condition.

(b) Check that there are no abnormal noise from the alternator while the engine is running.

5. CHECK DISCHARGE WARNING LIGHT CIRCUIT

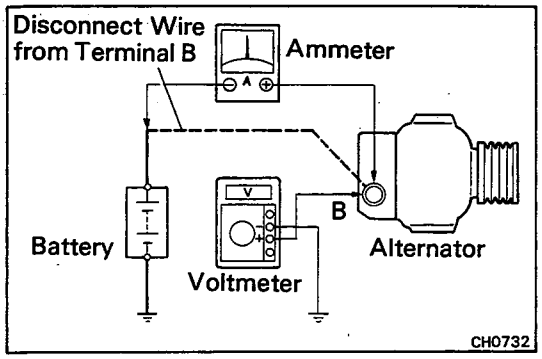
(a) Warm up the engine and then turn it off.

(b) Turn off all accessories.

(c) Turn the ignition switch to ON. Check that the discharge warning light is lit.

(d) Start the engine. Check that the light goes out.

If the light does not function as specified, troubleshoot the warning light circuit.

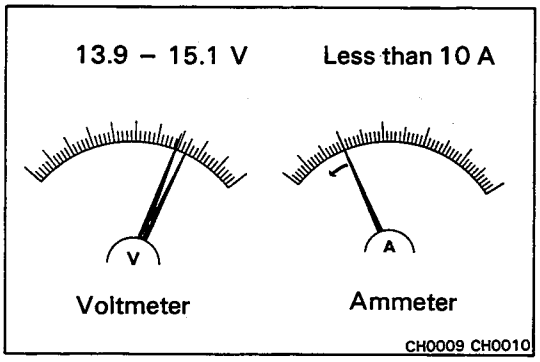


6. CHECK CHARGING CIRCUIT WITHOUT LOAD

HINT: If a battery/alternator tester is available, connect the tester to the charging circuit according to the manufacturer's instructions.

(a) If a tester is not available, connect a voltmeter and ammeter to the charging circuit as follows:

- Disconnect the wire from terminal B of the alternator and connect the wire to the negative (−) terminal of the ammeter.
- Connect the test lead from the positive (+) terminal of the ammeter to terminal B of the alternator.
- Connect the positive (+) lead of the voltmeter to terminal B of the alternator.
- Ground the negative (−) lead of the voltmeter.

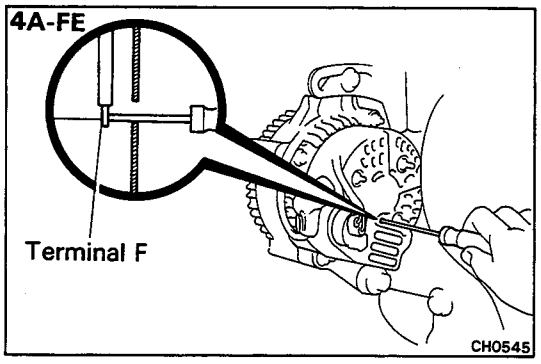


(b) Check the charging circuit as follows:

With the engine running from idling to 2,000 rpm, check the reading on the ammeter and voltmeter.

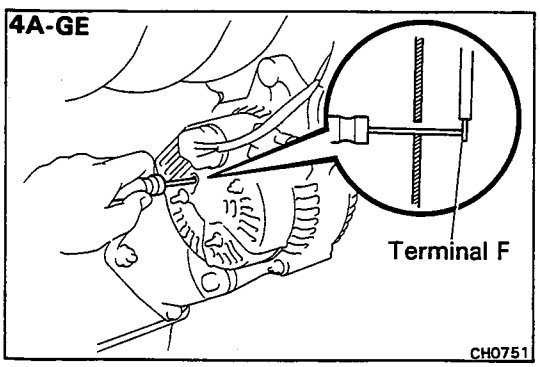
Standard amperage: **Less than 10 A**
Standard voltage: **13.9 – 15.1 V at 25°C (77°F)**
13.5 – 14.3 V at 115°C (239°F)

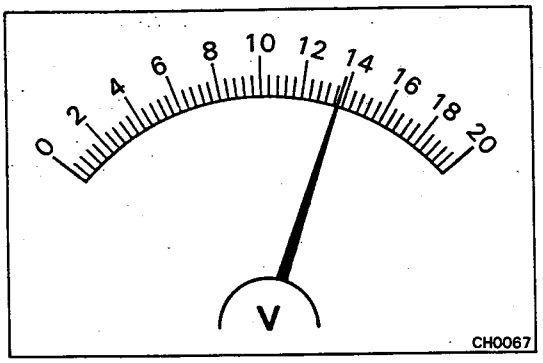
If the voltage reading is greater than standard voltage, replace the IC regulator.



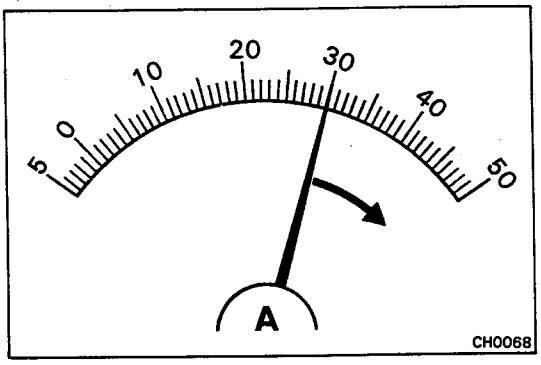
If the voltage reading is less than standard voltage, check the IC regulator and alternator as follows:

- With terminal F grounded, start the engine and check the voltage reading of terminal B.
- If the voltage reading is higher than standard voltage, replace the IC regulator.
- If the voltage reading is less than standard voltage, repair the alternator.





- If the voltmeter reading is greater than standard voltage, replace the IC regulator.
- If the voltmeter reading is less than standard voltage, check the alternator.

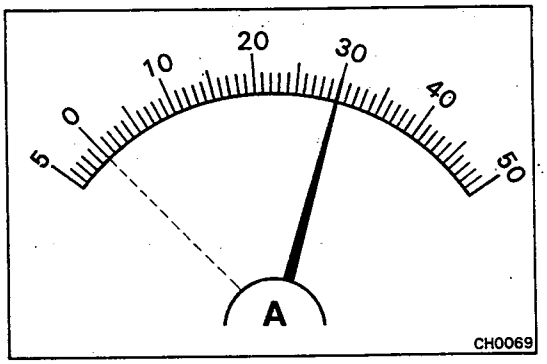


7. INSPECT CHARGING CIRCUIT WITH LOAD

(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

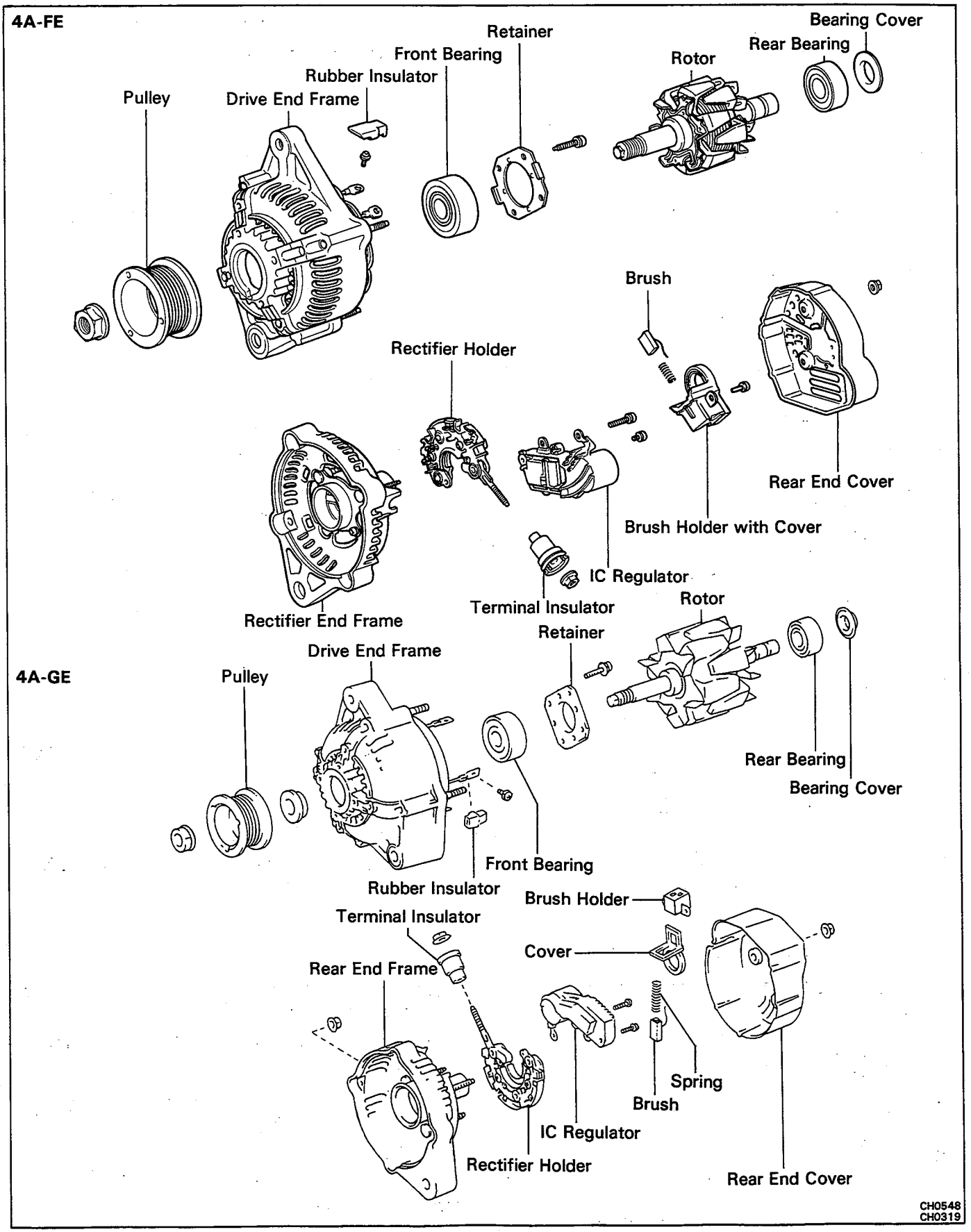


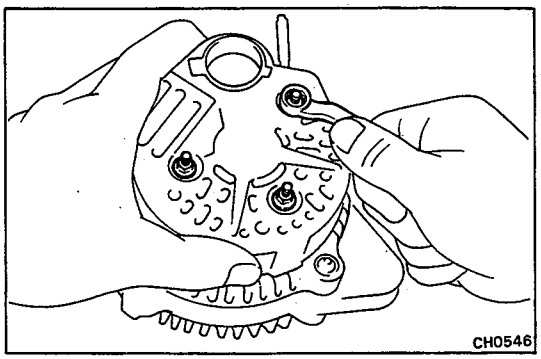
If the ammeter reading is less than standard amperage, repair the alternator. (See page CH-7)

HINT: With the battery fully charged, the indication will sometimes be less than standard amperage.

ALTERNATOR

COMPONENTS





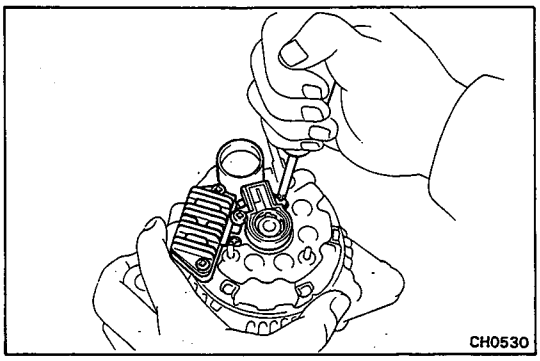
DISASSEMBLY OF ALTERNATOR

(See page CH-7)

1. REMOVE REAR END COVER

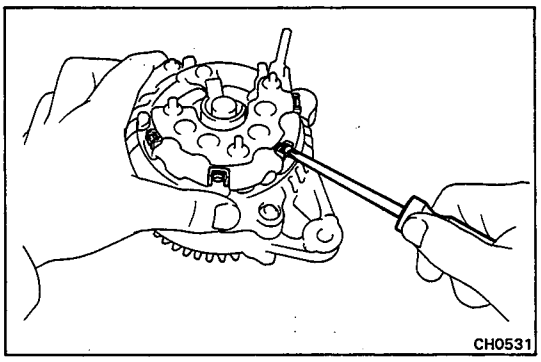
(a) Remove the nut and terminal insulator.

(b) Remove the three nuts and end cover.



2. REMOVE BRUSH HOLDER AND IC REGULATOR

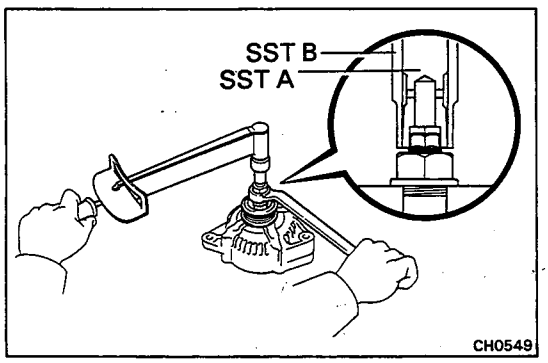
Remove the five screws, brush holder and IC regulator.



3. REMOVE RECTIFIER HOLDER

(a) Remove the four screws and rectifier holder.

(b) Remove the four rubber insulators.



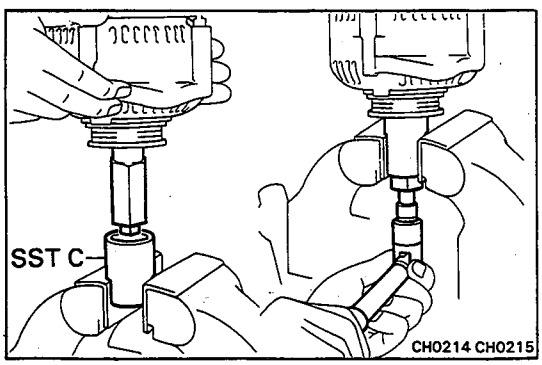
4. REMOVE PULLEY

(a) Hold SST A with a torque wrench, and tighten SST B clockwise to the specified torque.

SST 09820-63010

Torque: 400 kg-cm (29 ft-lb, 39 N·m)

(b) Check that SST A is secured to the rotor shaft.



(c) As shown in the figure, mount SST C in a vise, and install the alternator to SST C.

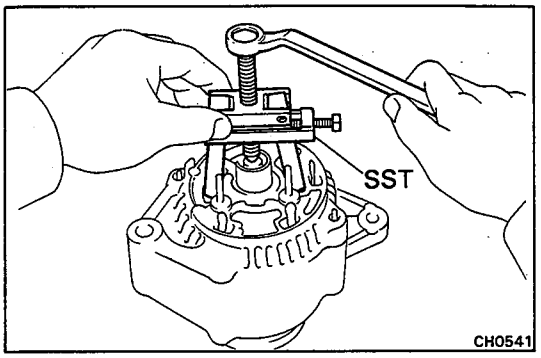
(d) To loosen the pulley nut turn SST A in the direction shown in the figure.

NOTICE: To prevent damage to the rotor shaft, do not loosen the pulley nut more than one-half of a turn.

(e) Remove the alternator from SST C.

(f) Turn SST B and remove SSTs A and B.

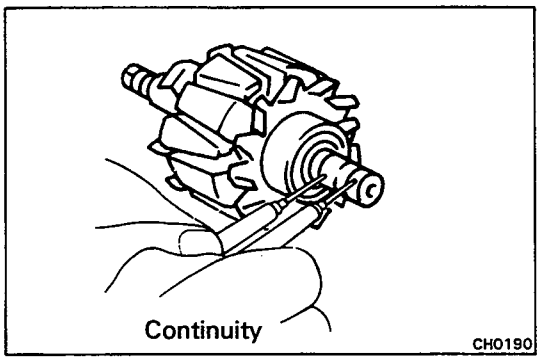
(g) Remove the pulley nut and pulley.



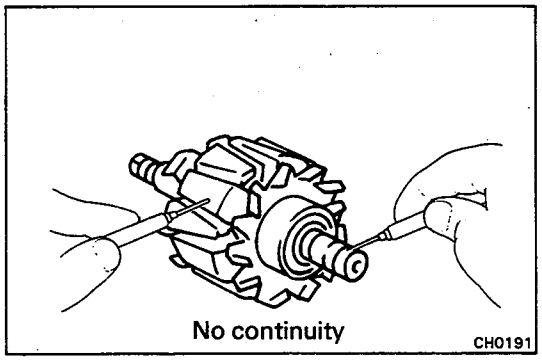
5. **REMOVE RECTIFIER END FRAME**
   (a) Remove the four nuts.
   (b) Using SST, remove the rectifier end frame.
   SST 09286-46011
6. **REMOVE ROTOR FROM DRIVE END FRAME**

INSPECTION AND REPAIR OF ALTERNATOR

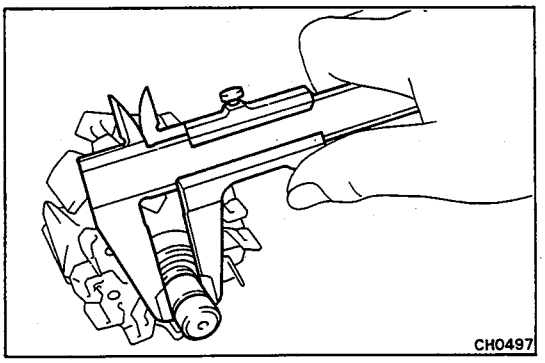
Rotor



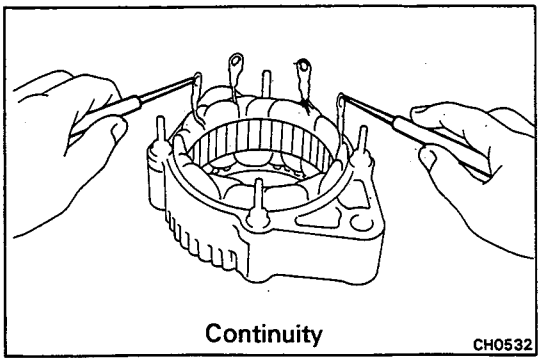
1. **INSPECT ROTOR FOR OPEN CIRCUIT**
   Using an ohmmeter, check that there is continuity between the slip rings.
   Standard resistance (cold): 2.8 — 3.0 Ω
   If there is no continuity, replace the rotor.



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.

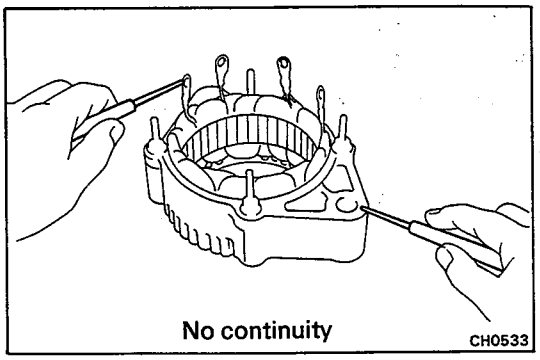


3. **INSPECT SLIP RINGS**
   (a) Check that the slip rings are not rough or scored.
   If rough or scored, replace the rotor.
   (b) Using calipers, measure the slip ring diameters.
   Standard diameter: 14.2 — 14.4 mm (0.559 — 0.567 in.)
   Minimum diameter: 14.0 mm (0.551 in.)
   If the diameter is 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 drive end frame assembly.

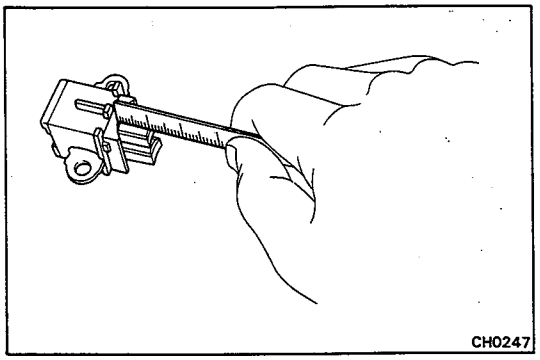


2. INSPECT STATOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the coil leads and drive end frame.

If there is continuity, replace the drive end frame assembly.

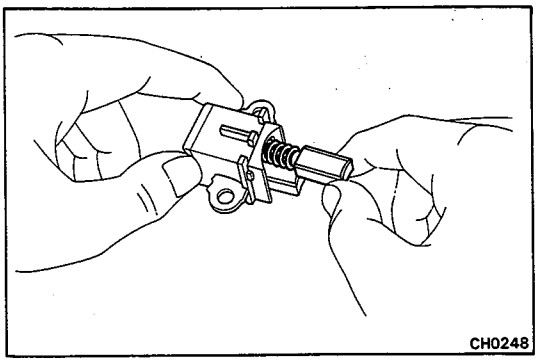
Brushes



1. MEASURE EXPOSED BRUSH LENGTH

Minimum exposed length: 4.5 mm (0.177 in.)

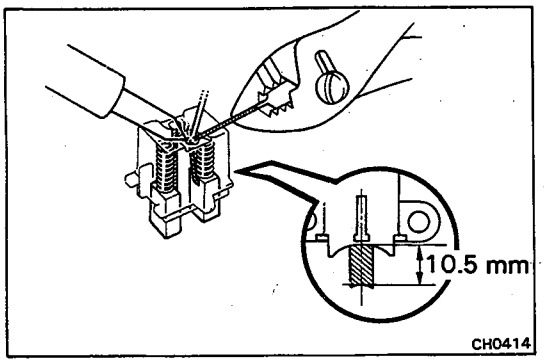
If the brush length is less than minimum, replace the brushes.



2. IF NECESSARY, REPLACE BRUSHES

(a) Unsolder and remove the brush and spring.

(b) Run the wire of the brush through the hole in the brush holder, and insert the spring and brush into the brush holder.



(c) Solder the brush wire to the brush holder at the exposed length.

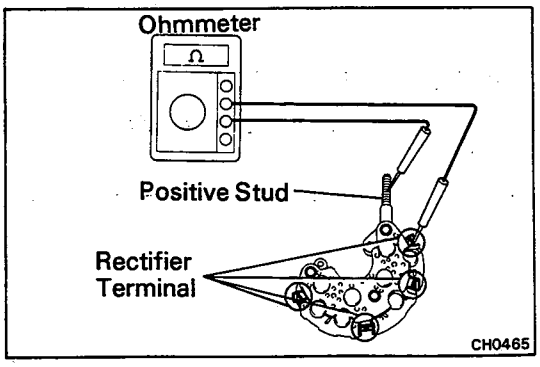
Exposed length: 10.5 mm (0.413 in.)

(d) Check that the brush moves smoothly in the brush holder.

(e) Cut off the excess wire.

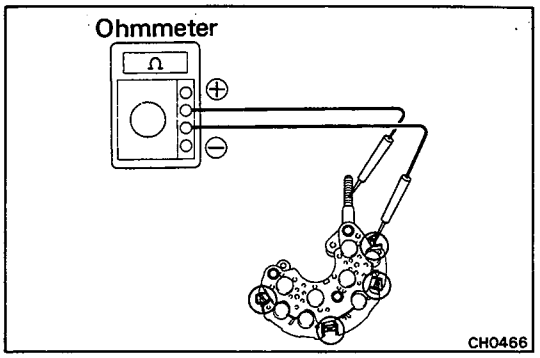
(f) Apply insulation paint to the soldered point.

Rectifier



1. INSPECT POSITIVE SIDE RECTIFIER

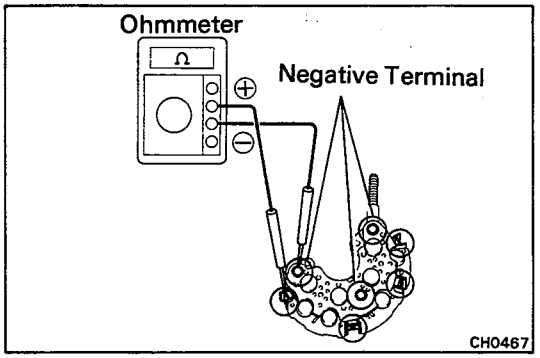
(a) Using an ohmmeter, connect one tester probe to the positive stud and the other to each rectifier terminal.



(b) Reverse the polarity of the tester probes.

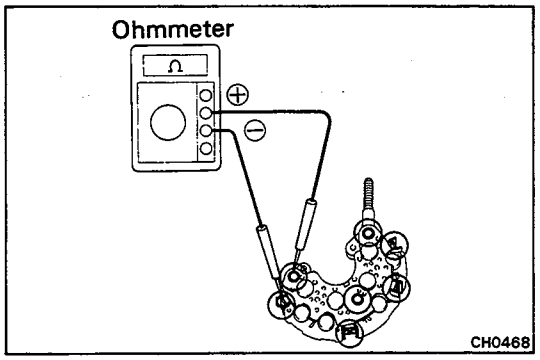
(c) Check that one shows continuity and the other shows no continuity.

If not, replace the rectifier holder.



2. INSPECT NEGATIVE SIDE RECTIFIER

(a) Connect one tester probe to each rectifier terminal and the other to each rectifier negative terminal.



(b) Reverse the polarity of the tester probes.

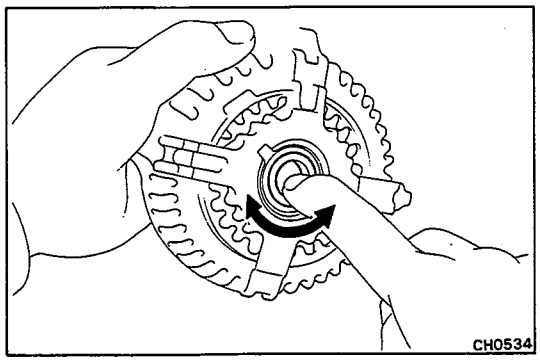
(c) Check that one shows continuity and the other shows no continuity.

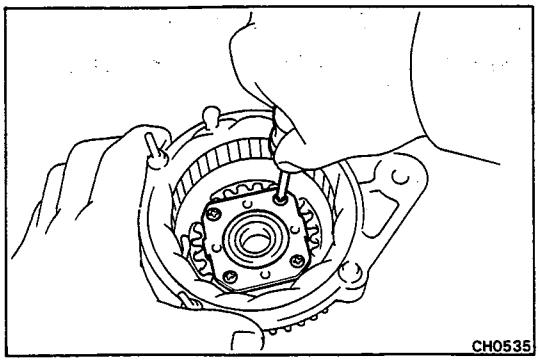
If not, replace the rectifier holder.

Bearings

1. INSPECT FRONT BEARING

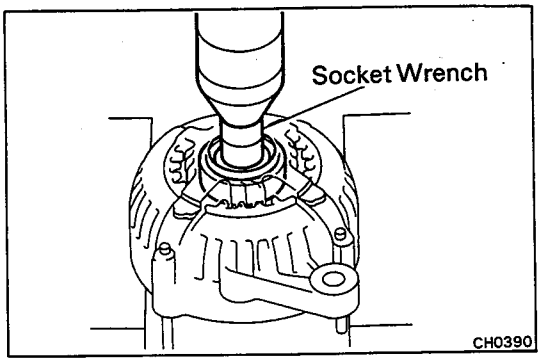
Check that the bearing is not rough or worn.



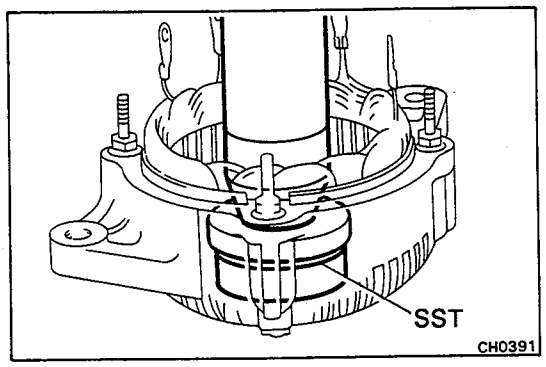


2. IF NECESSARY, REPLACE FRONT BEARING

(a) Remove the four screws and bearing retainer.

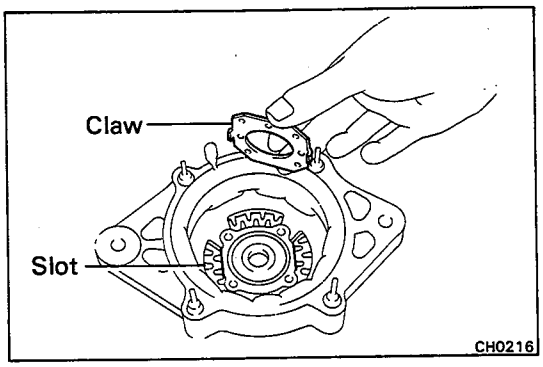


(b) Using a press and socket wrench, press out the front bearing.



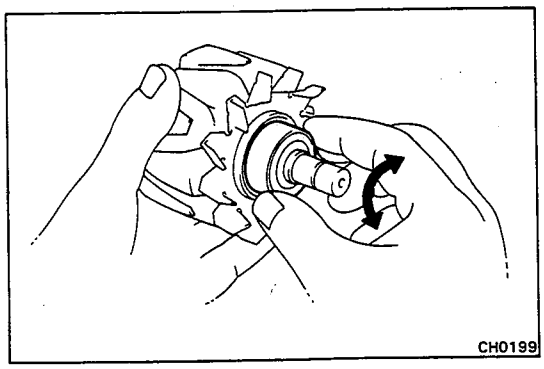
(c) Using SST and a press, press in a new front bearing into the drive end frame.

SST 09608-20012 (09608-00030)



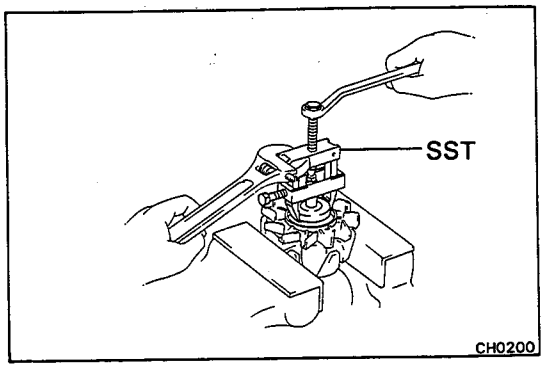
(d) Align the claws of the bearing retainer with the slots of the drive end frame.

(e) Install the bearing retainer with the four screws.



3. INSPECT REAR BEARING

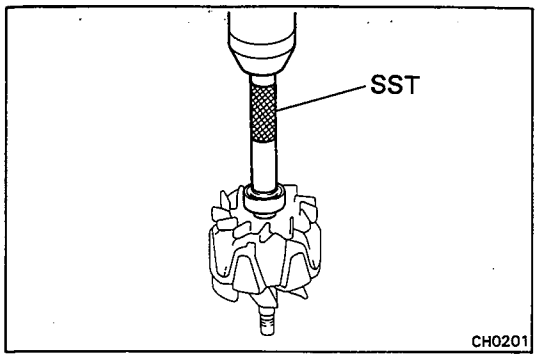
Check that the bearing is not rough or worn.



4. IF NECESSARY, REPLACE REAR BEARING

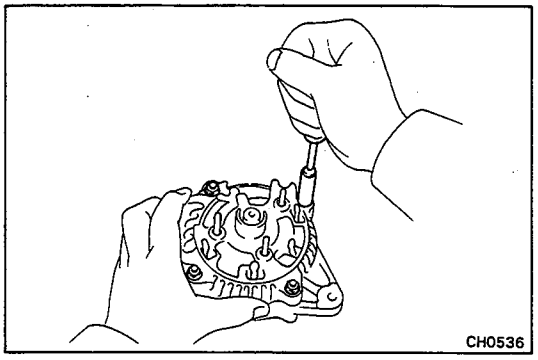
(a) Using SST, remove the bearing cover and bearing.

SST 09820-00021



(b) Using SST and a press, press in a new bearing and the bearing cover.

SST 09285-76010



ASSEMBLY OF ALTERNATOR

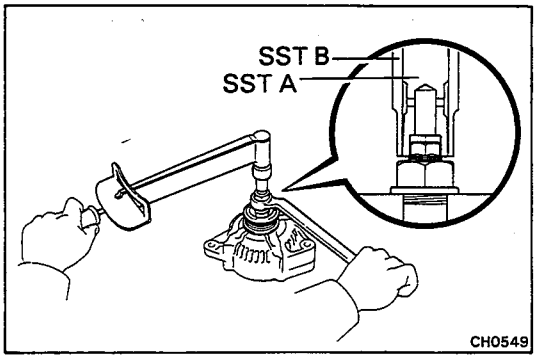
(See page CH-7)

1. INSTALL ROTOR TO DRIVE END FRAME

2. INSTALL RECTIFIER END FRAME

(a) Using a plastic-faced hammer, lightly tap in the end frame.

(b) Install the four nuts.



3. INSTALL PULLEY

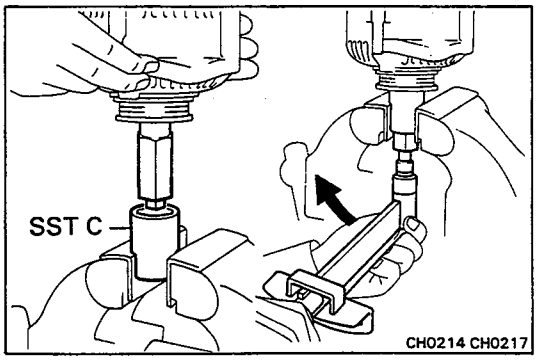
(a) Install the pulley to the rotor shaft by tightening the pulley nut by hand.

(b) Hold SST A with a torque wrench, and tighten SST B clockwise to the specified torque.

SST 09820-63010

Torque: 400 kg-cm (29 ft-lb, 39 N·m)

(c) Check that SST A is secured to the pulley shaft.



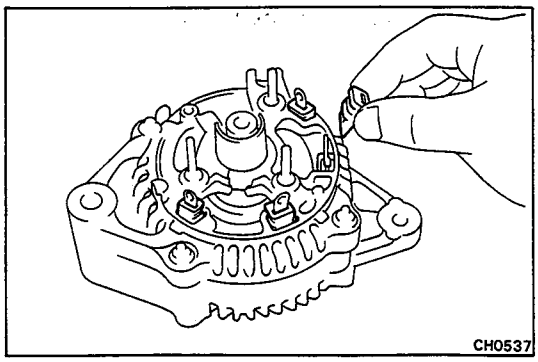
(d) As shown in the figure, mount SST C in a vise, and install the alternator to SST C.

(e) To torque the pulley nut turn SST A in the direction shown in the figure.

Torque: 1,125 kg-cm (81 ft-lb, 110 N·m)

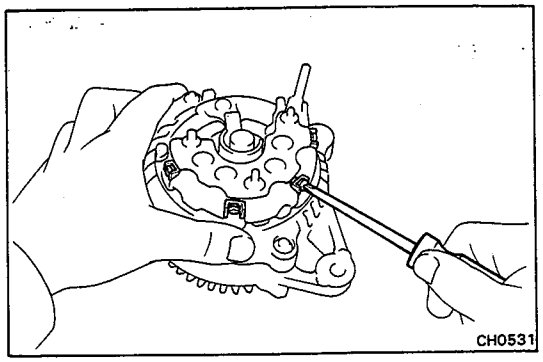
(f) Remove the alternator from SST C.

(g) Turn SST B and remove SSTs A and B.

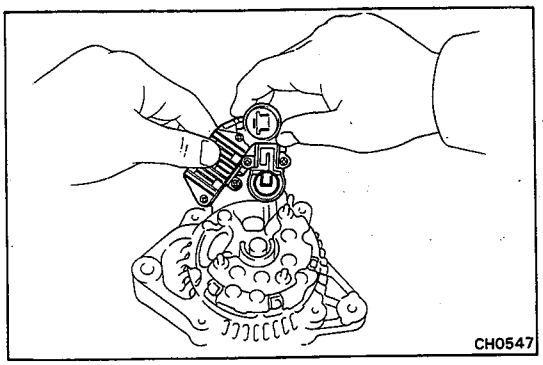


4. INSTALL RECTIFIER HOLDER

(a) Install the four rubber insulators on the lead wires.



(b) Install the rectifier holder with the four screws.

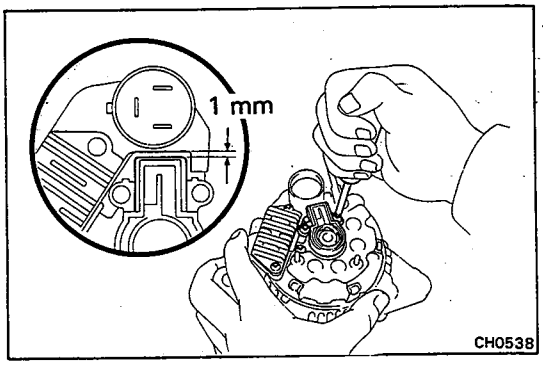


5. INSTALL BRUSH HOLDER AND IC REGULATOR

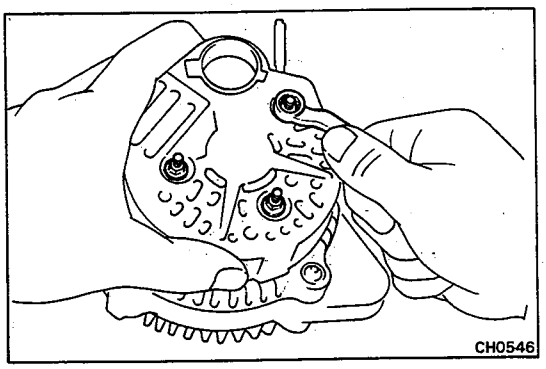
(a) Place the brush holder cover to the brush holder.

(b) Install the IC regulator and brush holder to the rear end frame horizontally as shown in the figure.

HINT: Make sure the brush holder's cover doesn't slip to one side during installation.



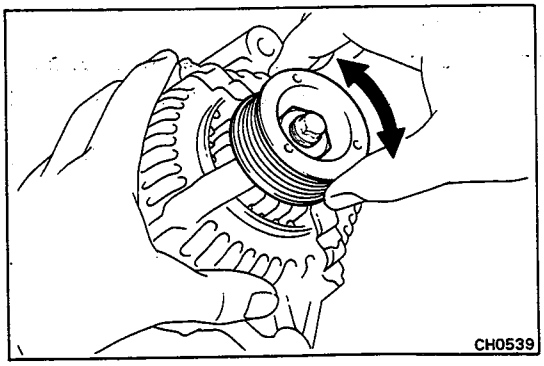
(c) Tighten the five screws until there is a clearance of at least 1 mm (0.04 in.) between the brush holder cover and connector.



6. INSTALL REAR END COVER

(a) Install the end cover with the three nuts.

(b) Install the terminal insulator with the nut.



7. MAKE SURE ROTOR ROTATES SMOOTHLY

SERVICE SPECIFICATIONS

ENGINE MECHANICAL (4A-FE)

Specifications

Engine tune-up	Drive belt (Alternator)				
	Deflection	New belt	8.5 – 10.5 mm		0.335 – 0.413 in.
		Used belt	10.0 – 12.0 mm		0.394 – 0.472 in.
	Tension (Reference)	New belt	60 – 70 kg		
		Used belt	40 – 55 kg		
	Engine coolant capacity (w/ Heater)				
	AE M/T		6.2 liters	6.5 US qts	5.5 Imp. qts
	AE A/T		6.1 liters	6.4 US qts	5.4 Imp. qts
	AT171		5.6 liters	5.9 US qts	4.9 Imp. qts
	AT180		5.2 liters	5.5 US qts	4.6 Imp. qts
	Engine oil capacity				
	w/o Oil cooler	Drain and refill			
		w/o Oil filter change	3.0 liters	3.2 US qts	2.6 Imp. qts
		w/ Oil filter change	3.3 liters	3.5 US qts	2.9 Imp. qts
		Dry fill	3.7 liters	3.9 US qts	3.3 Imp. qts
	w/ Oil cooler	Drain and refill			
		w/o Oil filter change	3.0 liters	3.2 US qts	2.6 Imp. qts
		w/ Oil filter change	3.3 liters	3.5 US qts	2.9 Imp. qts
		Dry fill	4.1 liters	4.3 US qts	3.6 Imp. qts
	Engine oil API grade				
	Europe and Australia		SE, SF, SG or better		
	Others		SD, SE, SF, SG or better		
	Battery specific gravity		1.25 – 1.27 when fully charged at 20°C (68°F)		
	High-tension cord resistance	Limit	25 kΩ per cord		
	Spark plug				
	Type	ND	Q16R-U		
		NGK	BCPR5EY		
	Gap		0.8 mm		0.031 in.
	Distributor (IIA)				
	Air gap		0.2 mm or more		0.008 in. or more
	Pickup coil resistance		140 – 180 Ω		
	Ignition timing		10° BTDC @ idle (w/ Terminals TE1 and E1 connected)		
	Firing order		1 – 3 – 4 – 2		
	Valve clearance	Intake	0.15 – 0.25 mm		0.006 – 0.010 in.
		Exhaust	0.20 – 0.30 mm		0.008 – 0.012 in.
	Idle speed		800 rpm (w/ Cooling fan OFF)		
	VF voltage		2.5 ± 0.7 V		
	Idle CO concentration	w/ TWC	0 – 0.5 %		
		w/o TWC	1.5 ± 0.5 %		
	Dash pot setting speed				
	M/T		1,800 rpm (w/ Cooling fan OFF)		
	A/T		2,200 rpm (w/ Cooling fan OFF)		
Intake manifold vacuum	at idle speed		More than 440 mmHg (17.32 in.Hg, 58.7 kPa)		

Specifications (Cont'd)

Compression pressure	at 250 rpm	STD	13.5 kg/cm²	191 psi	1,320 kPa
		Limit	10.0 kg/cm²	142 psi	981 kPa
	Differential of pressure between each cylinder		1.0 kg/cm² (14 psi, 98 kPa) or less		
Idler pulley tension spring	Free length		38.4 mm		1.512 in.
	Installed tension at 50.2 mm (1.976 in.)		3.6 – 4.0 kg	7.9 – 8.8 lb	35 – 39 N
Cylinder head	Head surface warpage	Limit	0.05 mm		0.0020 in.
	Manifold surface warpage	Limit	0.10 mm		0.0039 in.
	Cylinder head thickness		95.3 mm		3.75 in.
	Valve seat Refacing angle		30°, 45°, 60°		
	Contacting angle		45°		
	Contacting width		1.2 – 1.6 mm		0.047 – 0.063 in.
	Spark plug tube protrusion height		46.8 – 47.6 mm		1.843 – 1.874 in.
Valve guide bushing	Inside diameter		6.01 – 6.03 mm		0.2366 – 0.2374 in.
	Outside diameter	STD	11.000 – 11.027 mm		0.4331 – 0.4341 in.
		O/S 0.05	11.050 – 11.077 mm		0.4350 – 0.4361 in.
	Protrusion height		12.7 – 13.1 mm		0.500 – 0.516 in.
	Replacing temperature (cylinder head side)		80 – 100°C		176 – 212°F
Valve	Valve overall length STD	Intake	91.45 mm		3.6004 in.
		Exhaust	91.90 mm		3.6181 in.
	Limit	Intake	90.95 mm		3.5807 in.
		Exhaust	91.40 mm		3.5984 in.
	Valve face angle		45.5°		
	Stem diameter	Intake	5.970 – 5.985 mm		0.2350 – 0.2356 in.
		Exhaust	5.965 – 5.980 mm		0.2348 – 0.2354 in.
	Stem oil clearance STD	Intake	0.025 – 0.060 mm		0.0010 – 0.0024 in.
		Exhaust	0.030 – 0.065 mm		0.0012 – 0.0026 in.
	Limit	Intake	0.08 mm		0.0031 in.
		Exhaust	0.10 mm		0.0039 in.
	Valve head edge thickness Limit		1.0 mm		0.039 in.
Valve spring	Free length		43.8 mm		1.724 in.
	Installed length		34.7 mm		1.366 in.
	Installed load	STD	15.8 kg	34.8 lb	155 N
		Limit	14.6 kg	32.3 lb	143 N
	Squareness	Limit	2.0 mm		0.075 in.
Valve lifter	Outer diameter	STD	27.975 – 27.985 mm		1.1014 – 1.1018 in.
	Inner diameter (Cylinder head lifter bore)	STD	28.005 – 28.026 mm		1.1025 – 1.1033 in.
	Oil clearance	STD	0.020 – 0.051 mm		0.0008 – 0.0020 in.
		Limit	0.10 mm		0.0039 in.
Manifold	Manifold surface warpage Limit	Intake	0.20 mm		0.0079 in.
		Exhaust	0.30 mm		0.0118 in.

Specifications (Cont'd)

Camshaft	Thrust clearance	STD	Intake	0.030 – 0.085 mm	0.0012 – 0.0033 in.
			Exhaust	0.035 – 0.090 mm	0.0014 – 0.0035 in.
		Limit		0.11 mm	0.0043 in.
	Journal oil clearance	STD		0.035 – 0.072 mm	0.0014 – 0.0028 in.
		Limit		0.10 mm	0.0039 in.
	Journal diameter	STD			
		Exhaust No. 1		24.949 – 24.965 mm	0.9822 – 0.9829 in.
		Others		22.949 – 22.965 mm	0.9035 – 0.9041 in.
	Circle runout	Limit		0.04 mm	0.0016 in.
	Cam lobe height	STD	Intake	35.21 – 35.31 mm	1.3862 – 1.3902 in.
			Exhaust	34.91 – 35.01 mm	1.3744 – 1.3783 in.
		Limit	Intake	34.81 mm	1.3705 in.
			Exhaust	34.51 mm	1.3587 in.
	Camshaft gear spring end free distance			17.1 – 17.5 mm	0.6732 – 0.6890 in.
	Camshaft gear backlash		STD	0.020 – 0.200 mm	0.0008 – 0.0079 in.
			Limit	0.30 mm	0.0188 in.
Cylinder block	Cylinder head surface warpage		Limit	0.05 mm	0.0020 in.
	Cylinder bore	STD	Mark "1"	81.00 – 81.01 mm	3.1890 – 3.1894 in.
			Mark "2"	81.01 – 81.02 mm	3.1894 – 3.1898 in.
			Mark "3"	81.02 – 81.03 mm	3.1898 – 3.1902 in.
	On standard sized piston		Limit	81.23 mm	3.1980 in.
	On O/S 0.50 sized piston		Limit	81.73 mm	3.2177 in.
	Cylinder bore wear		Limit	0.2 mm	0.008 in.
	Difference of bore between cylinder			0.05 mm	0.0020 in.
	Taper and out-of-round		Limit	0.02 mm	0.0008 in.
Piston and piston ring	Piston diameter	STD	Mark "1"	80.93 – 80.94 mm	3.1862 – 3.1886 in.
			Mark "2"	80.94 – 80.95 mm	3.1866 – 3.1870 in.
			Mark "3"	80.95 – 80.96 mm	3.1870 – 3.1874 in.
		O/S 0.50		81.43 – 81.46 mm	3.2059 – 3.2071 in.
	Piston to cylinder clearance			0.06 – 0.08 mm	0.0024 – 0.0031 in.
	Piston ring end gap	No. 1	STD	0.25 – 0.45 mm	0.0098 – 0.0177 in.
			Limit	1.05 mm	0.0413 in.
		No. 2	STD	0.15 – 0.40 mm	0.0059 – 0.0157 in.
			Limit	1.00 mm	0.0394 in.
		Oil	STD	0.10 – 0.70 mm	0.0039 – 0.0276 in.
			Limit	1.30 mm	0.0512 in.
	Ring to ring groove clearance		No. 1	0.04 – 0.08 mm	0.0016 – 0.0031 in.
			No. 2	0.03 – 0.07 mm	0.0012 – 0.0028 in.
	Piston pin installing temperature			20°C	68°F
Connecting rod	Thrust clearance		STD	0.15 – 0.25 mm	0.0059 – 0.0098 in.
			Limit	0.30 mm	0.0118 in.
	Connecting rod bearing center wall thickness				
		STD	No. 1	1.486 – 1.490 mm	0.0585 – 0.0587 in.
			No. 2	1.490 – 1.494 mm	0.0587 – 0.0588 in.
			No. 3	1.494 – 1.498 mm	0.0588 – 0.0590 in.
		U/S 0.25		1.607 – 1.613 mm	0.0633 – 0.0635 in.

Specifications (Cont'd)

Connecting rod (cont'd)	Bearing oil clearance	STD	0.020 – 0.051 mm	0.0008 – 0.00020 in.
		Limit	0.08 mm	0.0031 in.
	Rod bend	Limit	0.05 mm	0.0020 in.
	Rod twist	Limit	0.05 mm	0.0020 in.
Crankshaft	Thrust clearance	STD	0.02 – 0.22 mm	0.0008 – 0.0087 in.
		Limit	0.30 mm	0.0118 in.
	Thrust washer thickness	STD	2.440 – 2.490 mm	0.0961 – 0.0980 in.
	Main journal oil clearance	STD	0.015 – 0.033 mm	0.0006 – 0.0013 in.
		U/S 0.25	0.018 – 0.056 mm	0.0007 – 0.0022 in.
		Limit	0.10 mm	0.0039 in.
	Main journal diameter STD		47.982 – 48.000 mm	1.8891 – 1.8898 in.
	Main journal finished diameter U/S 0.25		47.745 – 47.755 mm	1.8797 – 1.8801 in.
	Main bearing center wall thickness STD	Mark "1"	2.002 – 2.005 mm	0.0788 – 0.0789 in.
		Mark "2"	2.005 – 2.008 mm	0.0789 – 0.0791 in.
		Mark "3"	2.008 – 2.011 mm	0.0791 – 0.0792 in.
		Mark "4"	2.011 – 2.014 mm	0.0792 – 0.0793 in.
		Mark "5"	2.014 – 2.017 mm	0.0793 – 0.0794 in.
	U/S 0.25		2.121 – 2.127 mm	0.0835 – 0.0837 in.
	Crank pin diameter STD		39.985 – 40.000 mm	1.5742 – 1.5748 in.
	Crank pin finished diameter U/S 0.25		39.745 – 39.755 mm	1.5648 – 1.5652 in.
	Circle runout	Limit	0.06 mm	0.0024 in.
	Main journal taper and out-of-round	Limit	0.02 mm	0.0008 in.
	Crank pin journal taper and out-of-round	Limit	0.02 mm	0.0008 in.

Torque Specifications

Part tightened	kg-cm	ft-lb	N·m
Cylinder head bolt	610	44	60
Cylinder head x Camshaft bearing cap	130	9	13
Cylinder head x Spark plug	180	13	18
Cylinder head x Intake manifold	195	14	19
Cylinder head x Exhaust manifold	250	18	25
Cylinder block x Timing belt idler pulley	375	27	37
Cylinder block x Oil pump	220	16	22
Cylinder block x Crankshaft bearing cap	610	44	60
Cylinder block x Oil pan	50	43 in.-lb	4.9
Camshaft x Camshaft timing pulley	600	43	59
Crankshaft x Crankshaft pulley	1,200	87	118
Crankshaft x Flywheel	800	58	78
Connecting rod cap x Connecting rod	500	36	49
Oil pump x Oil strainer	95	82 in.-lb	9.3

ENGINE MECHANICAL (4A-GE)

Specifications

Engine tune-up	Drive belt (Alternator)				
	Deflection	New belt	4 – 5 mm		0.16 – 0.20 in.
		Used belt	6 – 7 mm		0.24 – 0.28 in.
	Tension (Reference)	New belt	70 – 80 kg		
		Used belt	30 – 45 kg		
	Engine coolant capacity (w/ Heater)		6.0 liters	6.3 US qts	5.3 Imp. qts
	Engine oil capacity				
	w/o Oil cooler	Drain and refill			
		w/o Oil filter change	3.0 liters	3.2 US qts	2.6 Imp. qts
		w/ Oil filter change	3.3 liters	3.5 US qts	2.9 Imp. qts
		Dry fill	3.7 liters	3.9 US qts	3.3 Imp. qts
	w/ Oil cooler	Drain and refill			
		w/o Oil filter change	3.4 liters	3.6 US qts	3.0 Imp. qts
		w/ Oil filter change	3.7 liters	3.9 US qts	3.3 Imp. qts
		Dry fill	4.1 liters	4.3 US qts	3.6 Imp. qts
	Engine oil API grade		SE, SF, SG or better		
	Battery specific gravity		1.25 – 1.27 when fully charged at 20°C (68°F)		
	High-tension cord resistance	Limit	25 kΩ per cord		
	Spark plug				
	Conventional tipped type				
	Type	ND	K20R-U		
		NGK	BKR6EYA		
	Air gap		0.8 mm		0.031 in.
	Platinum tipped type				
	Type	ND	PK20R8		
		NGK	BKP6EP8		
	Air gap	STD	0.8 mm		0.031 in.
		Limit	1.0 mm		0.039 in.
	Ignition timing		10° BTDC @ idle (w/ Terminals TE1 and E1 connected)		
	Firing order		1 – 3 – 4 – 2		
	Valve clearance	Intake	0.15 – 0.25 mm		0.006 – 0.010 in.
		Exhaust	0.20 – 0.30 mm		0.008 – 0.012 in.
	Idle speed		800 rpm (w/ Cooling fan OFF)		
	VF voltage		2.5 ± 1.25 V		
	Idle CO concentration	w/ TWC	0 – 0.5 %		
		w/o TWC	1.5 ± 0.5 %		
	Dash pot setting speed (w/ Air flow meter)		1,800 rpm (w/ Cooling fan OFF)		
Intake manifold vacuum	at idle speed		500 mmHg (16.69 in.Hg, 66.7 kPa)		
Compression pressure	at 250 rpm	STD	13.4 kg/cm²	190 psi	1,314 kPa
		Limit	10.0 kg/cm²	142 psi	981 kPa
	Difference of pressure between each cylinder		1.0 kg/cm² (14 psi, 98 kPa) or less		

Specifications (Cont'd)

Idler pulley tension spring	Free length			43.5 mm	1.713 in.
	Installed load at 50.2 mm (1.976 in.)			9.47 – 10.47 kg	20.9 – 23.1 lb 93 – 103N
Cylinder head	Warpage	Cylinder block side	Limit	0.05 mm	0.0020 in.
		Intake manifold side	Limit	0.05 mm	0.0020 in.
		Exhaust manifold side	Limit	0.10 mm	0.0039 in.
	Valve seat refacing angle			30°, 45°, 60°	
		Contacting angle		45°	
		Contacting width		1.0 – 1.4 mm	0.039 – 0.055 in.
Valve guide busing	Inside diameter			6.01 – 6.03 mm	0.2366 – 0.2374 in.
	Outside diameter		STD	11.033 – 11.044 mm	0.4344 – 0.4348 in.
			O/S 0.05	11.083 – 11.094 mm	0.4363 – 0.4368 in.
	Replacing temperature (Cylinder head side)			80 – 100°C	176 – 212°F
Valve	Valve overall length	STD	Intake	99.60 mm	3.9213 in.
			Exhaust	99.75 mm	3.9272 in.
		Limit	Intake	99.10 mm	3.9016 in.
			Exhaust	99.25 mm	3.9075 in.
	Valve face angle			44.5°	
	Stem diameter		Intake	5.970 – 5.985 mm	0.2350 – 0.2356 in.
			Exhaust	5.965 – 5.980 mm	0.2348 – 0.2354 in.
	Stem oil clearance	STD	Intake	0.025 – 0.060 mm	0.0010 – 0.0024 in.
			Exhaust	0.030 – 0.065 mm	0.0012 – 0.0026 in.
		Limit	Intake	0.08 mm	0.0031 in.
			Exhaust	0.10 mm	0.0039 in.
	Margin thickness	STD		0.8 – 1.2 mm	0.031 – 0.047 in.
		Limit		0.5 mm	0.020 in.
Valve spring	Free length			41.09 mm	1.6177 in.
	Installed tension at 34.7 mm (1.366 in.)				
			STD	16.3 kg 35.9 lb	160 N
			Limit	14.6 kg 32.2 lb	143 N
	Squareness		Limit	1.8 mm	0.071 in.
Valve lifter	Lifter diameter			27.975 – 27.985 mm	1.1014 – 1.1018 in.
	Inner diameter (Cylinder head lifter bore)		STD	28.000 – 28.021 mm	1.1024 – 1.1032 in.
	Oil clearance		STD	0.015 – 0.046 mm	0.0005 – 0.0018 in.
			Limit	0.07 mm	0.0028 in.
Manifold	Manifold surface warpage	Limit	Intake	0.05 mm	0.0020 in.
		Limit	Exhaust	0.30 mm	0.0118 in.
Camshaft	Thrust clearance		STD	0.08 – 0.190 mm	0.0031 – 0.0075 in.
			Limit	0.25 mm	0.0098 in.
	Journal oil clearance		STD	0.035 – 0.072 mm	0.0014 – 0.0028 in.
			Limit	0.10 mm	0.0039 in.
	Journal diameter			26.949 – 26.965 mm	1.0610 – 1.0616 in.
	Circle runout		Limit	0.04 mm	0.0016 in.
	Cam lobe height		STD	35.419 – 35.510 mm	1.3823 – 1.3980 in.
			Limit	35.21 mm	1.3862 in.

Specifications (Cont'd)

Cylinder block	Cylinder head surface warpage		Limit	0.05 mm	0.0020 in.
	Cylinder bore diameter	STD	Mark "1"	81.00 – 81.01 mm	3.1890 – 3.1894 in.
			Mark "2"	81.01 – 81.02 mm	3.1894 – 3.1898 in.
			Mark "3"	81.02 – 81.03 mm	3.1898 – 3.1902 in.
	On standard sized piston		Limit	81.23 mm	3.1980 in.
	On O/S 0.50 sized piston		Limit	81.73 mm	3.2177 in.
	Cylinder bore wear		Limit	0.2 mm	0.008 in.
	Difference of bore between cylinder			0.05 mm	0.0020 in.
	Taper and out-of-round		Limit	0.02 mm	0.0008 in.
Piston and piston ring	Piston diameter	STD	Mark "1"	80.89 – 80.90 mm	3.1846 – 3.1850 in.
			Mark "2"	80.90 – 80.91 mm	3.1850 – 3.1854 in.
			Mark "3"	80.91 – 80.92 mm	3.1854 – 3.1858 in.
		O/S 0.50		81.39 – 81.42 mm	3.2043 – 3.2055 in.
	Piston oil clearance			0.10 – 0.12 mm	0.0039 – 0.0047 in.
	Piston ring groove clearance		No. 1	0.03 – 0.08 mm	0.0012 – 0.0031 in.
			No. 2	0.03 – 0.07 mm	0.0012 – 0.0028 in.
	Piston ring end gap	STD	No. 1	0.25 – 0.47 mm	0.0098 – 0.0185 in.
			No. 2	0.20 – 0.42 mm	0.0079 – 0.0165 in.
			Oil	0.15 – 0.52 mm	0.0059 – 0.0205 in.
		Limit	No. 1	1.07 mm	0.0421 in.
			No. 2	1.02 mm	0.0402 in.
			Oil	1.12 mm	0.0441 in.
Connecting rod	Thrust clearance		STD	0.15 – 0.25 mm	0.0059 – 0.0098 in.
			Limit	0.30 mm	0.0118 in.
	Connecting rod oil clearance				
		STD	STD	0.020 – 0.051 mm	0.0008 – 0.0020 in.
			U/S 0.25	0.019 – 0.073 mm	0.0007 – 0.0029 in.
		Limit		0.08 mm	0.0031 in.
	Connecting rod bearing center wall thickness				
		STD	No. 1	1.486 – 1.490 mm	0.0585 – 0.0587 in.
			No. 2	1.490 – 1.494 mm	0.0587 – 0.0588 in.
			No. 3	1.494 – 1.498 mm	0.0588 – 0.0590 in.
			U/S 0.25	1.607 – 1.613 mm	0.0633 – 0.0635 in.
	Rod bent	Limit	per 100 mm (3.94 in.)	0.03 mm	0.0012 in.
	Rod twist	Limit	per 100 mm (3.94 in.)	0.05 mm	0.0020 in.
	Connecting rod bolt		STD	8.860 – 9.000 mm	0.3488 – 0.3543 in.
			Limit	8.600 mm	0.3386 in.
	Bushing inside diameter			20.012 – 20.022 mm	0.7879 – 0.7883 in.
	Piston pin diameter			20.006 – 20.016 mm	0.7876 – 0.7880 in.
	Piston pin oil clearance		STD	0.004 – 0.008 mm	0.0002 – 0.0003 in.
			Limit	0.05 mm	0.0020 in.

Specifications (Cont'd)

Crankshaft	Thrust clearance	STD	0.02 – 0.22 mm	0.0008 – 0.0087 in.
		Limit	0.30 mm	0.0118 in.
	Thrust washer thickness	STD	2.440 – 2.490 mm	0.0961 – 0.0980 in.
	Main journal oil clearance			
	STD	STD	0.015 – 0.033 mm	0.0006 – 0.0013 in.
		U/S 0.25	0.018 – 0.056 mm	0.0007 – 0.0022 in.
	Limit		0.10 mm	0.0039 in.
	Main journal diameter	STD	47.982 – 48.000 mm	1.8891 – 1.8898 in.
		U/S 0.25	47.745 – 47.755 mm	1.8797 – 1.8801 in.
	Main bearing center wall thickness			
	STD	Mark "1"	2.002 – 2.005 mm	0.0788 – 0.0789 in.
		Mark "2"	2.005 – 2.008 mm	0.0789 – 0.0791 in.
		Mark "3"	2.008 – 2.011 mm	0.0791 – 0.0792 in.
		Mark "4"	2.011 – 2.014 mm	0.0792 – 0.0793 in.
		Mark "5"	2.014 – 2.017 mm	0.0793 – 0.0794 in.
	U/S 0.25		2.121 – 2.127 mm	0.0835 – 0.0837 in.
	Crank pin diameter	STD	41.985 – 42.000 mm	1.6529 – 1.6535 in.
		U/S 0.25	41.745 – 41.755 mm	1.6435 – 1.6439 in.
	Circle runout	Limit	0.06 mm	0.0024 in.
	Main journal taper and out-of-round			
		Limit	0.02 mm	0.0008 in.
	Crank pin journal taper and out-of-round			
		Limit	0.02 mm	0.0008 in.

Torque Specifications

Part tightened		kg-cm	ft-lb	N·m
Camshaft timing pulley x Camshaft		600	43	59
Idler pulley x Cylinder block		375	27	37
Crankshaft pulley x Crankshaft		1,400	101	137
Cylinder head x Cylinder block	1st	300	22	29
	2nd	90° turns		
	3rd	90° turns		
Oil nozzle x Cylinder block		250	18	25
Cylinder head x Union		300	22	29
Camshaft bearing cap x Cylinder head		130	9	13
Intake manifold x Cylinder head		280	20	27
Intake manifold stay x Intake manifold		220	16	22
Intake manifold stay x Cylinder block		400	29	39
EGR pipe x Exhaust manifold		700	51	69
Exhaust manifold x Cylinder head		250	29	39
Exhaust manifold stay x Exhaust manifold		400	29	39
Exhaust manifold stay x Cylinder block		400	29	39
Main bearing cap x Cylinder block		610	44	60
Connecting rod cap x Connecting rod	1st	400	29	39
	2nd	Additional 90°		
Flywheel x Crankshaft		750	54	74

EFI SYSTEM (4A-FE)

Specifications

Fuel pressure regulator	Fuel pressure	at No vacuum	2.7 – 3.1 kg/cm² (38 – 44 psi, 265 – 304 kPa)	
Cold start injector	Resistance		2 – 4 Ω	
	Fuel leakage		Less than one drop of fuel per minute	
Injector	Resistance		Approx. 13.8 Ω	
	Injection volume		40 – 50 cc/15 sec (2.4 – 3.1 cu in.)	
	Difference between each injector		5 cc (0.31 cu in.) or less	
	Fuel leakage		One drop or less of fuel per minute	
Throttle body	Throttle valve fully closed angle		6°	
Throttle position sensor	Throttle opening angle (from vertical)	Clearance between stop screw and lever	IDL – E2	PSW – E2
	–	0.60 mm (0.0236 in.)	Continuity	No continuity
	–	0.80 mm (0.0315 in.)	No continuity	No continuity
	Less than 7.5°	–	Continuity	No continuity
	73°(M/T), 63°(A/T)	–	No continuity	No continuity
	79°(M/T), 69°(A/T)	–	No continuity	Continuity
Start injector time switch	Resistance	STA – STJ	20 – 40 Ω	Below 30°C (86°F)
			40 – 60 Ω	Above 40°C (104°F)
		STA – Ground	20 – 80 Ω	–
Water temp. sensor and intake air temp. sensor	Resistance	at –20°C (–4°F)	10 – 20 kΩ	
		0°C (32°F)	4 – 7 kΩ	
		40°C (104°F)	0.9 – 1.3 kΩ	
		60°C (140°F)	0.4 – 0.7 kΩ	
		80°C (176°F)	0.2 – 0.4 kΩ	
Oxygen sensor	Heater resistance		5.1 – 6.3 Ω	

ECU

HINT:
- Perform all voltage and resistance measurements with the ECU connected.
- Verify that the battery voltage is 11 V or above when the ignition switch is ON.
- The testing probes must not make contact with the ECU oxygen and VF terminals.

Voltage

Terminal	STD voltage (V)	Condition	
+B – E1	10 – 14	Ignition switch ON	
+B1 – E1			
BATT – E1		–	
IDL – E2	4.5 – 5.5	Ignition switch ON	Throttle valve open
PSW – E2			Throttle valve fully closed
No. 10 – E01 No. 20 – E02	10 – 14	Ignition switch ON	
W – E1	10 – 14	No trouble ("CHECK ENGINE" warning light off) and engine running	

Specifications (Cont'd)

ECU (Cont'd)

Voltage (Cont'd)

Terminals	STD voltage (V)	Condition	
PIM – E2	3.3 – 3.9	Ignition switch ON	
VCC – E2	4.5 – 5.5		
THA – E2	2.0 – 2.5	Ignition switch ON	Intake air temperature 20°C (68°F)
THW – E2	0.4 – 0.7		Coolant temperature 80°C (176°F)
STA – E1	6 – 14	Cranking	
IGT – E1	0.7 – 1.0	Idling	
A/C – E1	5 – 14	Ignition switch ON	A/C switch ON
	0		A/C switch OFF
T – E1	10 – 14	Ignition switch ON	Check connector TE1 – E1 not connect
	0		Check connector TE1 – E1 connect

Resistance

Terminals	Resistance (Ω)	Condition
IDL – E2	Infinity	Throttle valve open
	0	Throttle valve fully closed
PSW – E2	0	Throttle valve fully open
	Infinity	Throttle valve fully closed
THA – E2	2,000 – 3,000	Intake temperature 20°C (68°F)
THW – E2	200 – 400	Coolant temperature 80°C (176°F)
G1 – G⊖	140 – 180	–
NE – G⊖	140 – 180	–

Fuel cut rpm (w/ Vehicle speed 0 km/h and coolant temperature 80°C (176°F))	Fuel cut rpm	w/o TWC	1,700 rpm
		w/ TWC	1,900 rpm
	Fuel return rpm	w/o TWC	1,200 rpm
		w/ TWC	1,200 rpm

ISC valve	Resistance at cold	2WD	30 – 33 Ω
		4WD	30 – 34 Ω

Torque Specifications

Part tightened		kg-cm	ft-lb	N·m
Fuel line	Union bolt type	300	22	29
	Flare nut type	310	22	30
Fuel pump x Fuel tank		40	35 in.-lb	3.9
Cylinder head x Delivery pipe		150	11	15
Pressure regulator x Delivery pipe		95	82 in.-lb	9.3
Fuel inlet hose x Delivery pipe		300	22	29
Cold start injector pipe x Delivery pipe		180	13	18
Cold start injector pipe x Cold start injector		180	13	18
Intake manifold x Cold start injector		95	82 in.-lb	9.3
Intake manifold x Throttle body		220	16	22

EFI SYSTEM (4A-GE)

Specifications (Cont'd)

Fuel pressure regulator	Fuel pressure	at No vacuum	2.7 – 3.1 kg/cm² (38 – 44 psi, 265 – 304 kPa)	
Cold start injector	Resistance		3 – 5 Ω	
	Fuel leakage		Less than one drop of fuel per minute	
Injector	Resistance		Approx. 13.8 Ω	
	Injection volume		50 – 53 cc/15 sec (3.1 – 3.2 cu in.)	
	Difference between each injector		5 cc (0.31 cu in.) or less	
	Fuel leakage		One drop or less of fuel per minute	
Throttle body	Throttle valve fully closed angle		6°	
Throttle position sensor	Clearance between stop screw and lever		Between terminals	Resistance
	0.35 mm 0.0138 in.		IDL – E2	Less than 2.3 kΩ
	0.59 mm 0.0232 in.		IDL – E2	Infinity
	Throttle valve fully opened position		VTA – E2	3.3 – 10 kΩ
	–		VCC – E2	3 – 7 kΩ
Start injector time switch	Resistance	STA – STJ	20 – 40 Ω	Below 30°C (86°F)
			40 – 60 Ω	Above 40°C (104°F)
		STA – Ground	20 – 80 Ω	–
Intake air temp. sensor (w/o Air flow meter) and water temp. sensor	Resistance	at –20°C (–4°F)	10 – 20 kΩ	
		at 0°C (32°F)	4 – 7 kΩ	
		at 20°C (68°F)	2 – 3 kΩ	
		at 40°C (104°F)	0.9 – 1.3 kΩ	
		at 60°C (140°F)	0.4 – 0.7 kΩ	
		at 80°C (176°F)	0.2 – 0.4 kΩ	
Air flow meter (w/ Air flow meter)	Resistance	VS – E2	20 – 400 Ω (Measuring plate fully closed)	
			20 – 3,000 Ω (Measuring plate fully open)	
		VC – E2	100 – 300 Ω	
		FC – E1	∞ (Measuring plate closed)	
			0 (Measuring plate open)	
		THA – E2	10 – 20 kΩ (–20°C, –4°F)	
			4 – 7 kΩ (0°C, 32°F)	
			2 – 3 kΩ (20°C, 68°F)	
			0.9 – 1.3 kΩ (40°C, 104°F)	
			0.4 – 0.7 kΩ (60°C, 140°F)	
		VB – E2	200 – 400 Ω	
Water temp. sensor and intake air temp. sensor	Resistance	at –20°C (–4°F)	10 – 20 kΩ	
		0°C (32°F)	4 – 7 kΩ	
		40°C (104°F)	0.9 – 1.3 kΩ	
		60°C (140°F)	0.4 – 0.7 kΩ	
		80°C (140°F)	0.2 – 0.4 kΩ	
Oxygen sensor	Heater resistance	at 20°C (68°F)	5.1 – 6.3 Ω	

Specifications (Cont'd)

ECU

HINT:
- Perform all voltage and resistance measurements with the ECU connected.
- Verify that the battery voltage is 11 V or above when the ignition switch is ON.
- The testing probes must not make contact with the ECU oxygen and VF terminals.

Voltage (ECU w/o Air flow meter)

Terminal	STD voltage (V)	Condition	
+B, +B1 – E1	10 – 14	Ignition SW ON	
BATT – E1	10 – 14	–	
IDL – E2	4.5 – 5.5	Ignition SW ON	Throttle vale open
VTA – E2	0.5 or less	Ignition SW ON	Throttle valve fully closed
VTA – E2	3.5 – 5.5	Ignition SW ON	Throttle valve fully open
VCC – E2	4.5 – 5.5	Ignition SW ON	–
IGT – E1	0.7 – 1.0	Idling	
STA – E2	6 – 14	Cranking	
No. 10 – E01, No. 20 – E02	10 – 14	Ignition SW ON	
W – E1	10 – 14	No trouble ("CHECK ENGINE" warning light off) and engine running	
PIM – E2	3.3 – 3.9	Ignition SW ON	
VCC – E2	4.5 – 5.5	Ignition SW ON	
THA – E2	2.0 – 2.8	Ignition SW ON	Intake air temp. 20°C (68°F)
THW – E2	0.4 – 0.7	Ignition SW ON	Coolant temp. 80°C (176°F)
A/C – E1	10 –14	Ignition SW ON	Air conditioning ON
T – E1	10 – 14	Ignition SW ON	Check connector TE1 – E1 not connect
T – E1	0.5 or less	Ignition SW ON	Check connector TE1 – E1 connect

Resistance (ECU w/o Air flow meter)

Terminals	Resistance (Ω)	Condition
IDL – E2	Infinity	Throttle valve open
IDL – E2	2,300 or less	Throttle valve fully closed
VTA – E2	3,300 – 10,000	Throttle valve fully open
VTA – E2	200 – 800	Throttle valve fully closed
VCC – E2	3,000 – 7,000	–
THA – E2	2,000 – 3,000	Intake air temp. 20°C (68°F)
THW – E2	200 – 400	Coolant temp. 80°C (176°F)
G1, G2 – G⊖	140 – 180	–
NE – G⊖	140 – 180	–

Specification (Cont'd)

ECU (Cont'd)

HINT:
- Perform all voltage and resistance measurements with the ECU connected.
- Verify that the battery voltage is 11 V or above when the ignition switch is ON.
- The testing probes must make contact with the ECU oxygen and VF terminals.

Voltage (ECU w/ Air flow meter)

Terminals	STD voltage (V)	Condition	
+B, +B1 – E1	10 – 14	Ignition SW ON	
BATT – E1	10 – 14	–	
IDL – E2	10 – 14	Ignition SW ON	Throttle valve open
VTA – E2	0.1 – 1.0		Throttle valve fully closed
	4 – 5		Throttle valve fully open
VCC – E2	4.5 – 5.5		–
IGT – E1	0.7 – 1.0	Idling	
STA – E2	6 – 14	Cranking	
No. 10, No. 20 – E01, E02	10 – 14	Ignition SW ON	
W – E1	10 – 14	No trouble ("CHECK ENGINE" warning light off) and engine running	
VC – E2	4.5 – 5.5	–	
VS – E2	2.0 – 5.5	Ignition SW ON	Measuring fully closed
	6 – 9		Measuring plate fully open
	2 – 8	Idling	
THA – E2	2.0 – 2.8	Ignition SW ON	Intake air temp. 20°C (68°F)
THW – E2	0.4 – 0.7		Coolant temp. 80°C (176°F)
A/C – E1	10 – 14		Air conditioning ON
T – E1	10 – 14		Check connector TE1 – E1 not connect
	0.5 or less		Check connector TE1 – E1 connect

Resistance (ECU w/ Air flow meter)

Terminals	Resistance (Ω)	Condition
IDL – E2	Infinity	Throttle valve open
	2,300 or less	Throttle valve fully closed
VTA – E2	3,300 – 10,000	Throttle valve fully open
	200 – 800	Throttle valve fully closed
VCC – E2	3,000 – 7,000	–
VS – E2	20 – 400	Measuring plate fully closed
	20 – 3,000	Measuring plate fully open
VC – E2	100 – 300	–
THA – E2	2,000 – 3,000	Intake air temp. 20°C (68°F)
THW – E2	200 – 400	Coolant temp. 80°C (176°F)
G⊕ – G⊖	140 – 180	–
NE – G⊖	140 – 180	–

Specification (Cont'd)

ECU (Cont'd)	Fuel cut rpm (w/ Vehicle speed 0 km/h and coolant temperature 80°C (176°F))	Fuel cut rpm w/o Air flow meter w/ Air flow meter Fuel return rpm w/o Air flow meter w/ Air flow meter	 1,450 rpm 1,600 rpm 1,050 rpm 1,200 rpm
Fuel Pressure VSV	Resistance at cold		33 – 39 Ω
Idle-up VSV	Resistance at cold		37 – 44 Ω
ACV	Resistance at cold		22 – 26 Ω

Torque Specifications

Part tightened		kg-cm	ft-lb	N·m
Fuel line	Union bolt type	300	22	29
	Flare nut type	310	22	30
Fuel pump x Fuel tank		40	35 in.-lb	3.9
Cylinder head x Delivery pipe		175	13	17
Pressure regulator x Delivery pipe		75	65 in.-lb	7.4
Fuel inlet hose x Delivery pipe		300	22	29
Cold start injector pipe x Delivery pipe		150	11	15
Cold start injector pipe x Cold start injector		150	11	15
Intake manifold x Cold start injector		75	65 in.-lb	7.4
Intake manifold x Throttle body		220	16	22

COOLING SYSTEM

Coolant capacity (w/heater)				
	4A-FE AE M/T	6.2 liters	6.5 US qts	5.5 Imp.qts
	4A-FE AE A/T	6.1 liters	6.4 US qts	5.4 Imp.qts
	4A-FE AT171	5.6 liters	5.9 US qts	4.9 Imp.qts
	4A-FE AT180	5.2 liters	5.5 US qts	4.6 Imp.qts
	4A-GE	6.0 liters	6.3 US qts	5.3 Imp.qts
Radiator	Relief valve opening pressure STD	0.75 – 1.05 kg/cm² (1.07 – 14.9 psi, 74 – 103 kPa)		
	Limit	0.6 kg/cm²	8.5 psi	59 kPa
Thermostat	Valve opening temperature			
	Stars to open at	80 – 84°C	176 – 183°F	
	Fully opens at	95°C	203°F	
	Valve opening travel	8 mm or more	0.31 in. or more	

LUBRICATION SYSTEM

Oil pressure (normal operating temperature)		at Idle speed at 3,000 rpm	More than 0.3 kg/cm² (4.3 psi, 29 kPa) 2.5 – 5.0 kg/cm² (35.6 – 71.1 psi, 245 – 490 kPa)	
Oil pump	4A-FE			
	Body clearance	STD	0.080 – 0.180 mm	0.0031 – 0.0071 in.
		Limit	0.20 mm	0.0079 in.
	Tip clearance	STD	0.025 – 0.085 mm	0.0010 – 0.0033 in.
		Limit	0.35 mm	0.0138 in.
	Side clearance	STD	0.025 – 0.085 mm	0.0010 – 0.0033 in.
		Limit	0.10 mm	0.0039 in.
	4A-GE			
	Body clearance	STD	0.100 – 0.191 mm	0.0039 – 0.0075 in.
		Limit	0.20 mm	0.0079 in.
	Tip clearance	STD	0.060 – 0.180 mm	0.0023 – 0.0071 in.
		Limit	0.35 mm	0.0138 in.
	Side clearance	STD	0.025 – 0.075 mm	0.0010 – 0.0030 in.
		Limit	0.10 mm	0.0039 in.

IGNITION SYSTEM (4A-FE)

Ignition timing			See page A-2	
Spark plug			See page A-2	
Firing order			1 – 3 – 4 – 2	
High-tension cord	Resistance	Limit	25 kΩ per cord	
Ignition coil	Primary coil resistance	2WD	1.28 – 1.56 Ω	
		4WD	0.38 – 0.46 Ω	
	Secondary coil resistance	2WD	10.4 – 14.0 kΩ	
		4WD	7.7 – 10.3 kΩ	
Distributor (IIA)	Air gap		0.2 mm or more	0.008 in. or more
	Signal generator (pickup coil) resistance		140 – 180 Ω	

IGNITION SYSTEM (4A-GE)

Ignition timing		See page A-6
Spark plug		See page A-6
Firing order		1 – 3 – 4 – 2
High-tension cord	Resistance Limit	25 kΩ per cord
Ignition coil	Primary coil resistance	0.4 – 0.5 Ω
	Secondary coil resistance	10.2 – 13.8 kΩ
Distributor	Air gap	0.2 – 0.4 mm 0.008 – 0.016 in.
	Signal generator (pickup coil) resistance	140 – 180 Ω

STARTING SYSTEM

Starter	Type	Planetary		Reduction
	Rated voltage and output power	12 V 0.8 kW		12 V 1.0 kW
	rpm	More than 3,000 rpm		←
	Center bearing oil clearance			
	STD	0.03 mm	0.0012 in.	–
	Limit	0.1 mm	0.004 in.	–
	Brush Length STD	14.0 mm	0.551 in.	13.5 mm 0.531 in.
	Limit	9.0 mm	0.354 in.	8.5 mm 0.335 in.
	Spring installed load STD	1.6 kg (3.5 lb, 16 N)		1.785 kg – 2.415 kg (3.9 – 5.3 lb, 18 – 24 N)
	Limit	0.9 kg (2.0 lb, 9N)		1.2 kg (2.6 lb, 12 N)
	Commutator			
	Outer diameter STD	28 mm	1.10 in.	30 mm 1.18 in.
	Limit	27 mm	1.06 in.	29 mm 1.14 in.
	Undercut depth STD	0.6 mm	0.024 in.	←
	Limit	0.2 mm	0.008 in.	←
	Circle runout Limit	0.05 mm	0.0020 in.	←

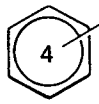
CHARGING SYSTEM

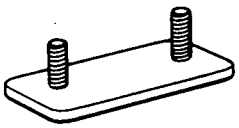
Battery specific gravity When fully charged at 20°C (68°F)		1.25 – 1.27	
Alternator	Rated output	12 V 70 A	
	Rotor coil resistance	2.8 – 3.0 Ω	
	Slip ring diameter STD	14.2 – 14.4 mm	0.559 – 0.567 in.
	Limit	14.0 mm	0.551 in.
	Brush exposed length STD	10.5 mm	0.413 in.
	Limit	4.5 mm	0.177 in.
Alternator regulator (IC)	Regulating voltage at 25°C (77°F)	13.9 – 15.1 V	
	at 155°C (239°F)	13.5 – 14.3 V	

STANDARD BOLT TORQUE SPECIFICATIONS

STANDARD BOLT TORQUE SPECIFICATIONS

HOW TO DETERMINE BOLT STRENGTH

	Mark	Class
Hexagon head bolt	 Bolt head No. 4— 5— 6— 7— 8— 9— 10— 11—	4T 5T 6T 7T 8T 9T 10T 11T
	 No mark	4T
Hexagon flange bolt w/ washer hexagon bolt	 No mark	4T
Hexagon head bolt	 Two protruding lines	5T
Hexagon flange bolt w/ washer hexagon bolt	 Two protruding lines	6T
Hexagon head bolt	 Three protruding lines	7T
Hexagon head bolt	 Four protruding lines	8T

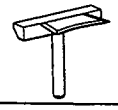
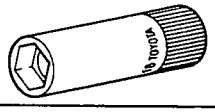
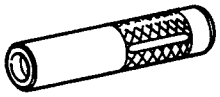
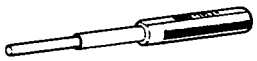
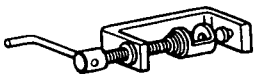
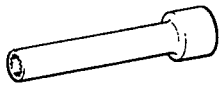
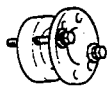
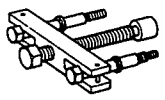
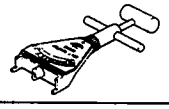
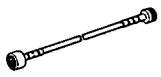
	Mark	Class
Stud bolt	 No mark	4T
	 Grooved	6T
Welded bolt		4T

SPECIFIED TORQUE FOR STANDARD BOLTS

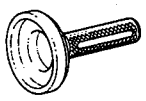
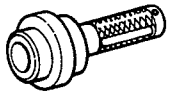
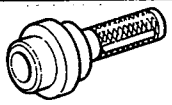
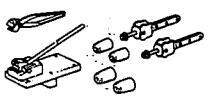
Class	Diameter mm	Pitch mm	Specified torque					
			Hexagon head bolt			Hexagon flange bolt		
			kg-cm	ft-lb	N·m	kg-cm	ft-lb	N·m
4T	6	1	55	48 in.-lb	5	60	52 in.-lb	6
	8	1.25	130	9	12.5	145	10	14
	10	1.25	260	19	26	290	21	29
	12	1.25	480	35	47	540	39	53
	14	1.5	760	55	74	850	61	84
	16	1.5	1,150	83	115	—	—	—
5T	6	1	65	56 in.-lb	6.5	75	65 in.-lb	7.5
	8	1.25	160	12	15.5	175	13	17.5
	10	1.25	330	24	32	360	26	36
	12	1.25	600	43	59	670	48	65
	14	1.5	930	67	91	1,050	76	100
	16	1.5	1,400	101	140	—	—	—
6T	6	1	80	69 in.-lb	8	90	78 in.-lb	9
	8	1.25	195	14	19	210	15	21
	10	1.25	400	29	39	440	32	44
	12	1.25	730	53	71	810	59	80
	14	1.5	1,100	80	110	1,250	90	125
	16	1.5	1,750	127	170	—	—	—
7T	6	1	110	8	10.5	120	9	12
	8	1.25	260	19	25	290	21	28
	10	1.25	530	38	52	590	43	58
	12	1.25	970	70	95	1,050	76	105
	14	1.5	1,500	108	145	1,700	123	165
	16	1.5	2,300	166	230	—	—	—
8T	8	1.25	300	22	29	330	24	33
	10	1.25	620	45	61	690	50	68
	12	1.25	1,100	80	110	1,250	90	120
9T	8	1.25	340	25	34	380	27	37
	10	1.25	710	51	70	790	57	78
	12	1.25	1,300	94	125	1,450	105	140
10T	8	1.25	390	28	38	430	31	42
	10	1.25	800	58	78	890	64	88
	12	1.25	1,450	105	140	1,600	116	155
11T	8	1.25	430	31	42	480	35	47
	10	1.25	890	64	87	990	72	97
	12	1.25	1,600	116	155	1,800	130	175

SST AND SSM

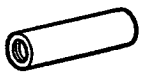
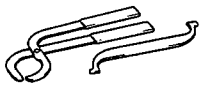
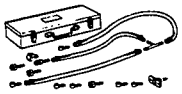
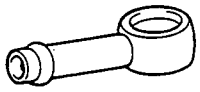
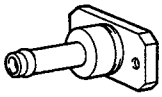
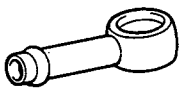
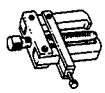
SST (SPECIAL SERVICE TOOLS)

Section / Part Name / Part No. / Illustration			EM	FI	CO	LU	IG	ST	CH	Note
	09027-12140	Angled Open End Wrench 12 x 14				●				4A-GE
	09032-00100	Oil Pan Seal Cutter				●				
	09155-16100	Spark Plug Wrench	●				●			
	09201-41020	Valve Stem Oil Seal Replacer	●							4A-FE
	09201-70010	Valve Guide Bushing Remover & Replacer	●							
	09202-70010	Valve Spring Compressor	●							
	09205-16010	Cylinder Head Bolt Wrench	●							
	09213-14010	Crankshaft Pulley Holding Tool	●							4A-FE
	09213-31021	Crankshaft Pulley Puller	●							
	09213-70010	Crankshaft Pulley Holding Tool	●							4A-GE
	09216-00020	Belt Tension Gauge	●						●	
	09216-00030	Belt Tension Cable	●						●	

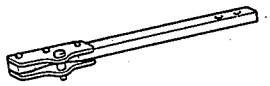
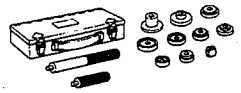
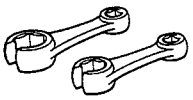
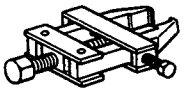
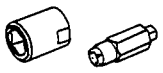
SST (SPECIAL SERVICE TOOLS) (Cont'd)

Section / Part Name / Part No. / Illustration			EM	FI	CO	LU	IG	ST	CH	Note
	09221-25024	Piston Pin Remover & Replacer	●					●		
	(09221-00020)	(Body)	●							4A-FE
	(09221-00030)	(Spring)	●							4A-FE
	(09221-00050)	(Bushing "B")	●							4A-FE
	(09221-00090)	(Guide "C")						●		Starter center bearing for planetary type
	(09221-00130)	(Guide "G")	●							4A-FE
	(09221-00140)	(Guide "H")	●							4A-FE
	09222-30010	Connecting Rod Bushing Remover & Replacer	●							4A-GE
	09223-41020	Crankshaft Rear Oil Seal Replacer	●							
	09223-46011	Crankshaft Front Oil Seal Replacer	●							4A-FE for camshaft oil seal
	09223-50010	Crankshaft Front Oil Seal Replacer	●							4A-GE for camshaft oil seal
	09228-06500	Oil Filter Wrench				●				
	09230-00010	Radiator Service Tool Set			●					AE, AT171

SST (SPECIAL SERVICE TOOLS) (Cont'd)

Section / Part Name / Part No. / Illustration			EM	FI	CO	LU	IG	ST	CH	Note
	09236-00101	Water Pump Overhaul Tool Set			●					
	(09236-15010)	(Bearing Stay)			●					
	(09237-00010)	(Water Pump Bearing Remover & Replacer)			●					
	(09237-00020)	(Bearing Stay)			●					
	(09237-00040)	(Shaft "A")			●					
	09248-55010	Valve Clearance Adjust Tool Set	●							
	09268-41045	Injection Measuring Tool Set		●						
	(09268-41080)	(No. 6 Union)		●						
	(09268-41090)	(No. 7 Union)		●						
	(90405-09015)	(No. 1 Union)		●						
	09268-45012	EFI Fuel Pressure Gauge		●						
	09285-76010	Injection Pump Camshaft Bearing Cone Replacer						*1 ●	*2 ●	*1 Starter front bearing for reduction type *2 Rear bearing
	09286-46011	Injection Pump Spline Shaft Puller						*1 ●	*2 ●	*1 Starter front bearing for reduction type *2 Rectifier end frame

SST (SPECIAL SERVICE TOOLS) (Cont'd)

Section / Part Name / Part No. / Illustration			EM	FI	CO	LU	IG	ST	CH	Note
	09309-37010	Transmission Bearing Replacer	●							Crankshaft front oil seal
	09330-00021	Companion Flange Holding Tool	●							Crankshaft pulley
	09550-10012	Replacer Set "B"	●							
	(09552-10010)	(No. 2 Replacer Handle)	●							4A-FE for spark plug tube gasker
	(09560-10010)	(Knuckle Outer Bearing Replacer)	●							4A-FE for spark plug tube gasker
	09608-20012	Front Hub & Drive Pinion Bearing Tool Set							●	
	(09608-00030)	(Replacer)							●	Rotor front bearing
	09631-22020	Power Steering Hose Nut 14 x 17 mm Wrench Set		●						Fuel line flare nut
	09820-00021	Alternator Rear Bearing Puller							●	
	09820-63010	Alternator Pulley Set Nut Wrench Set							●	
	09842-30055	Wiring "G" EFI Inspection		●						
	09842-30070	Wiring "F" EFI Inspection		●						
	09843-18020	Diagnosis Check Wiring	●	●			●			

SSM (SPECIAL SERVICE MATERIALS)

Part Name	Part No.	Sec.	Use etc.
Seal packing or equivalent	08826-00080	EM	Cylinder head cover Camshaft bearing cap No. 1 Half circle plug (for 4A-FE)
		LU	Oil pan Oil pan baffle plate (for 4A-GE)
Seal packing No. 1282-B or equivalent	08826-00100	EM	Water inlet housing (for 4A-FE) Water outlet pipe (for 4A-FE)
		CO	Water pump seal
Adhesive 1324, Three bond 1324 or equivalent	08833-00070	EM	Spark plug tube (for 4A-FE)
Adhesive 1344, Three bond 1344, Loctite 242 or equivalent	08833-00080	EM	Union (for 4A-GE)
		CO	Engine drain plug
		LU	Oil pressure switch (for 4A-GE) Oil pressure sender gauge (for 4A-GE)

TOYOTA

QUALITY SERVICE