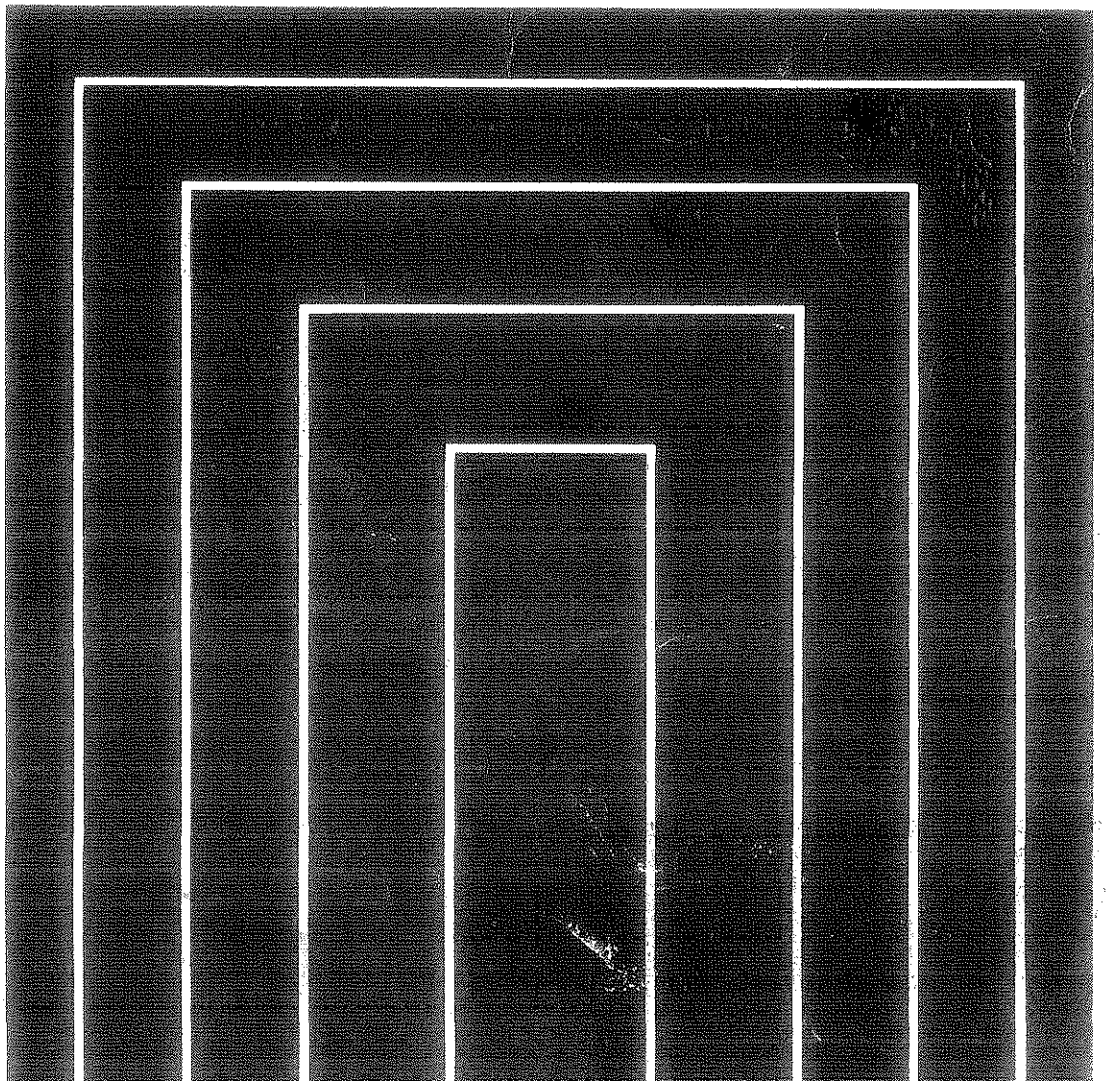
TOYOTA

3S-GTE ENGINE

REPAIR MANUAL SUPPLEMENT

Aug., 1991



FOREWORD

This supplement has been prepared to provide information covering general service repairs for the 3S-GTE engine mounted on the TOYOTA CELICA 4WD.

Applicable model: ST185 series

For basic engine service repair, refer to the following repair manual. This manual should be used with the supplement as a set.

Manual Name	Pub. No.
3S-GE, 3S-GTE, 5S-FE Engine Repair Manual	RM164E

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

TOYOTA MOTOR CORPORATION

TOYOTA 3S-GTE ENGINE REPAIR MANUAL SUPPLEMENT

INTRODUCTION

HOW TO USE THIS MANUAL

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

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

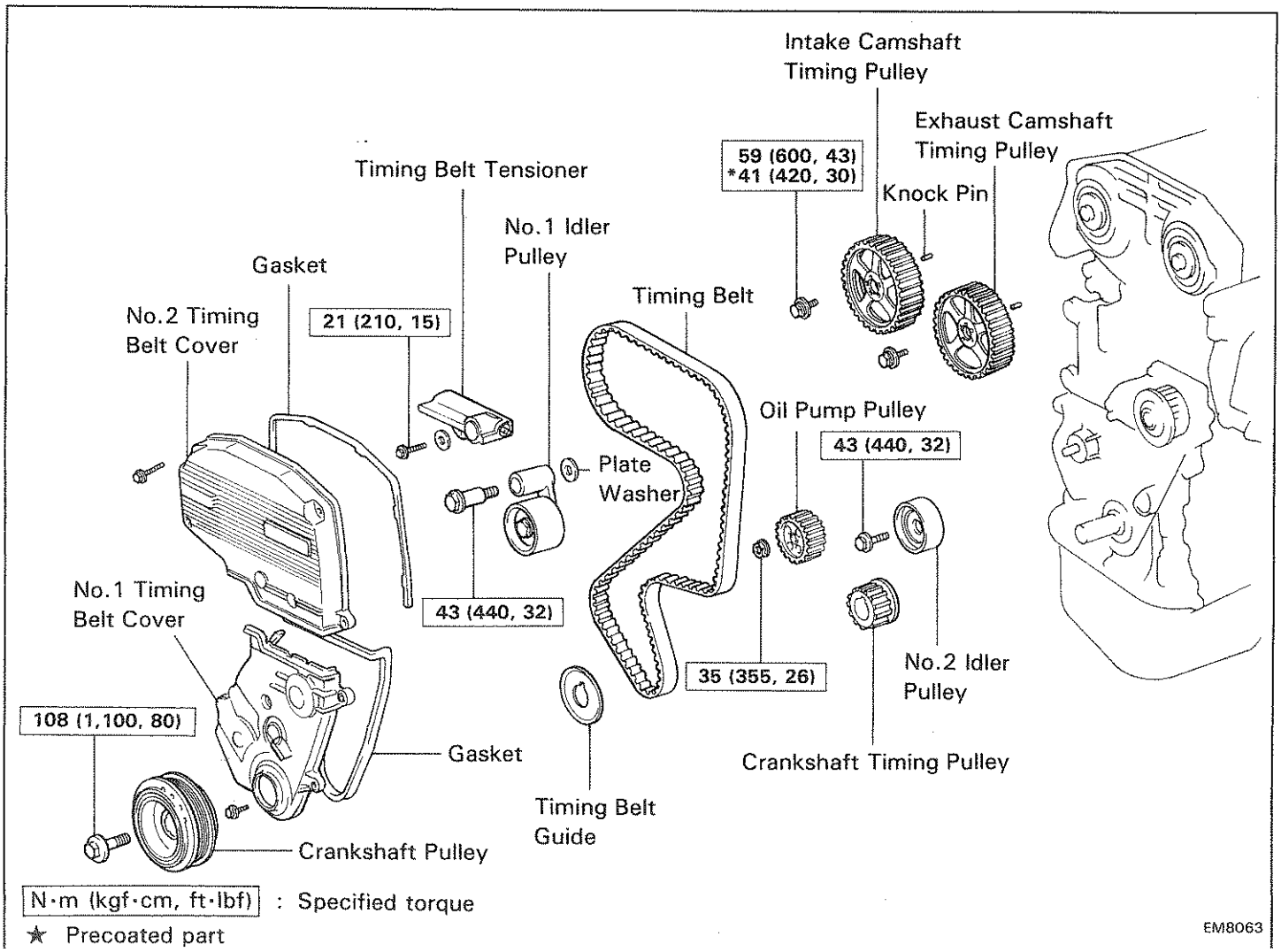
At the beginning of each section, **PRECAUTIONS** are given that pertain to *all* repair operations contained in that section. *Read these precautions before starting any repair task.*

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

REPAIR PROCEDURES

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

Example:



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

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

Example:

Illustration: What to do and where

Task heading: what to do

3. **DISCONNECT CONNECTING ROD FROM PISTON**

(a) Using SST, press out the pin from the piston.

SST 09221-25024 (09221-00020, 09221-00030, 09221-00181, 09221-00190, 09221-00200)

Set part No. *Component part No.*

Detailed text: how to do the task

Using a thickness gauge, measure the clearance between the piston ring and the ring land.

Standard ring groove clearance: 0.03 — 0.07 mm (0.0012 — 0.0028 in.)

Specification

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

REFERENCES

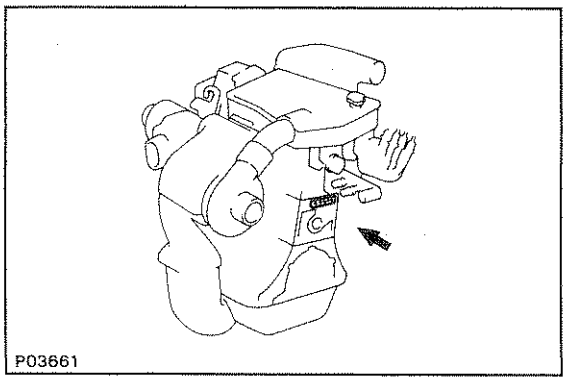
References have been kept to a minimum. However, when they are required you are given the page to refer to.

SPECIFICATIONS

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

CAUTIONS, NOTICES, HINTS:

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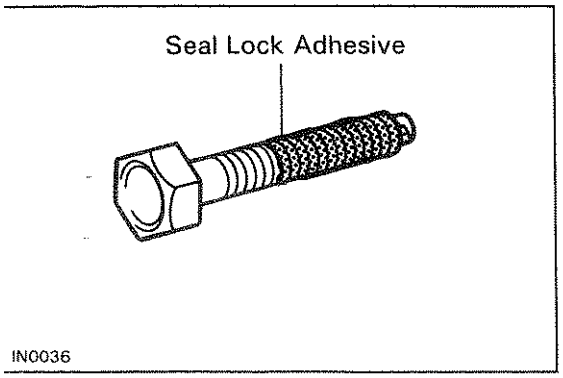
IDENTIFICATION INFORMATION

ENGINE SERIAL NUMBER

The engine serial number is stamped on the engine block as shown.

GENERAL REPAIR INSTRUCTIONS

1. Use fender seat and floor covers to keep the vehicle clean and prevent damage.
2. During disassembly, keep parts in the appropriate 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 and oil seals etc. with new ones.
   (b) Non-reusable parts are indicated in the component illustrations by the "◆" symbol.



6. Precoated parts

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

   (a) If a precoated part is retightened, 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 bolt, nut or threads.

      (2) Dry with compressed air.

      (3) Apply the specified seal lock adhesive to the bolt or nut threads.

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

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

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

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

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

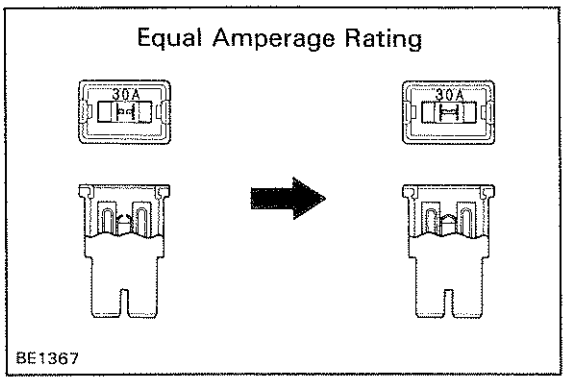
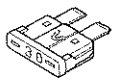
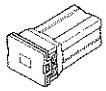
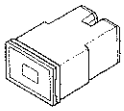
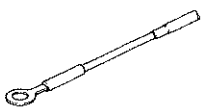
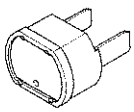
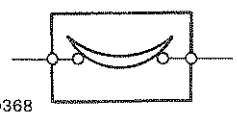
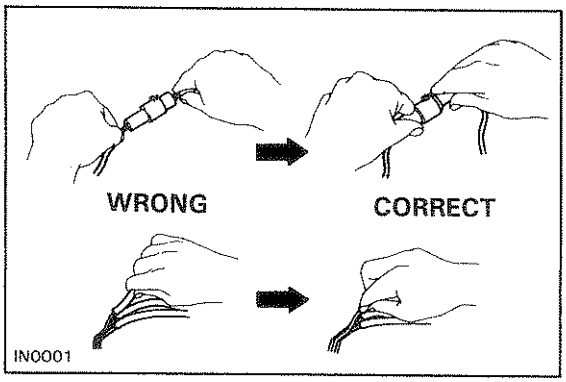
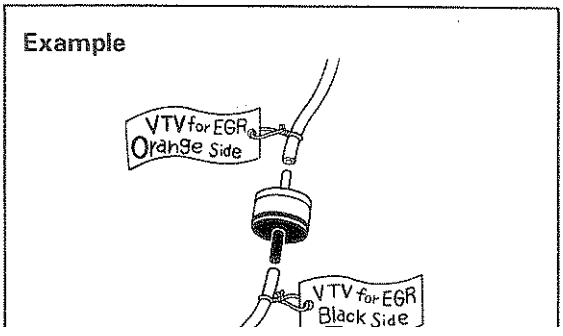


Illustration	Symbol	Part Name	Abbreviation
 BE5594	 IN0365	FUSE	FUSE
 BE5595	 IN0366	MEDIUM CURRENT FUSE	M-FUSE
 BE5596	 IN0367	HIGH CURRENT FUSE	H-FUSE
 BE5597	 IN0367	FUSIBLE LINK	FL
 BE5598	 IN0368	CIRCUIT BREAKER	CB

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 at the opposite end 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 a vehicle raised on a jack alone, even for a small job that can be finished quickly.



12. Observe the following precautions to avoid damage to the parts:
    (a) Do not open the cover or 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, not the middle of the hose.
    (c) To pull apart electrical connectors, pull on the connector itself, not the wires.
    (d) Be careful not to drop electrical components, such as sensors or relays. If they are dropped on a hard floor, they should be replaced and not reused.
    (e) When steam cleaning an engine, protect the distributor, coil and air filter from water.
    (f) Never use an impact wrench to remove or install temperature switches or temperature sensors.
    (g) When checking continuity at the wire connector, insert the tester probe carefully to prevent terminals from bending.
    (h) 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 recennected.
    (b) After completing a job, double check that the vacuum hoses are properly connected. A label under the hood shows the proper layout.

PRECAUTIONS FOR VEHICLES EQUIPPED WITH A CATALYTIC CONVERTER

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

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

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

   Engine compression tests must be made as rapidly 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
APPROX.	Approximately
AS	Air Suction
A/T	Automatic Transmission
BTDC	Before Top Dead Center
BVSV	Bimetal Vacuum Switching Valve
DP	Dash Pot
ECU	Electronic Control Unit
EFI	Electronic Fuel Injection
EGR	Exhaust Gas Recirculation
ESA	Electronic Spark Advance
FIPG	Formed in Place Gasket
H-Fuse	High Current Fuse
IG	Ignition
LH	Left-Hand
MP	Multipurpose
M/T	Manual Transmission
PCV	Positive Crankcase Ventilation
RH	Right-Hand
SSM	Special Service Materials
SST	Special Service Tools
STD	Standard
SW	Switch
TCCS	Toyota Computer Controlled System
U/S	Undersize
VSV	Vacuum Switching Valve
VTV	Vacuum Transmitting Valve
4WD	Four Wheel Drive Vehicles (4 × 4)
w/	With
w/o	Without

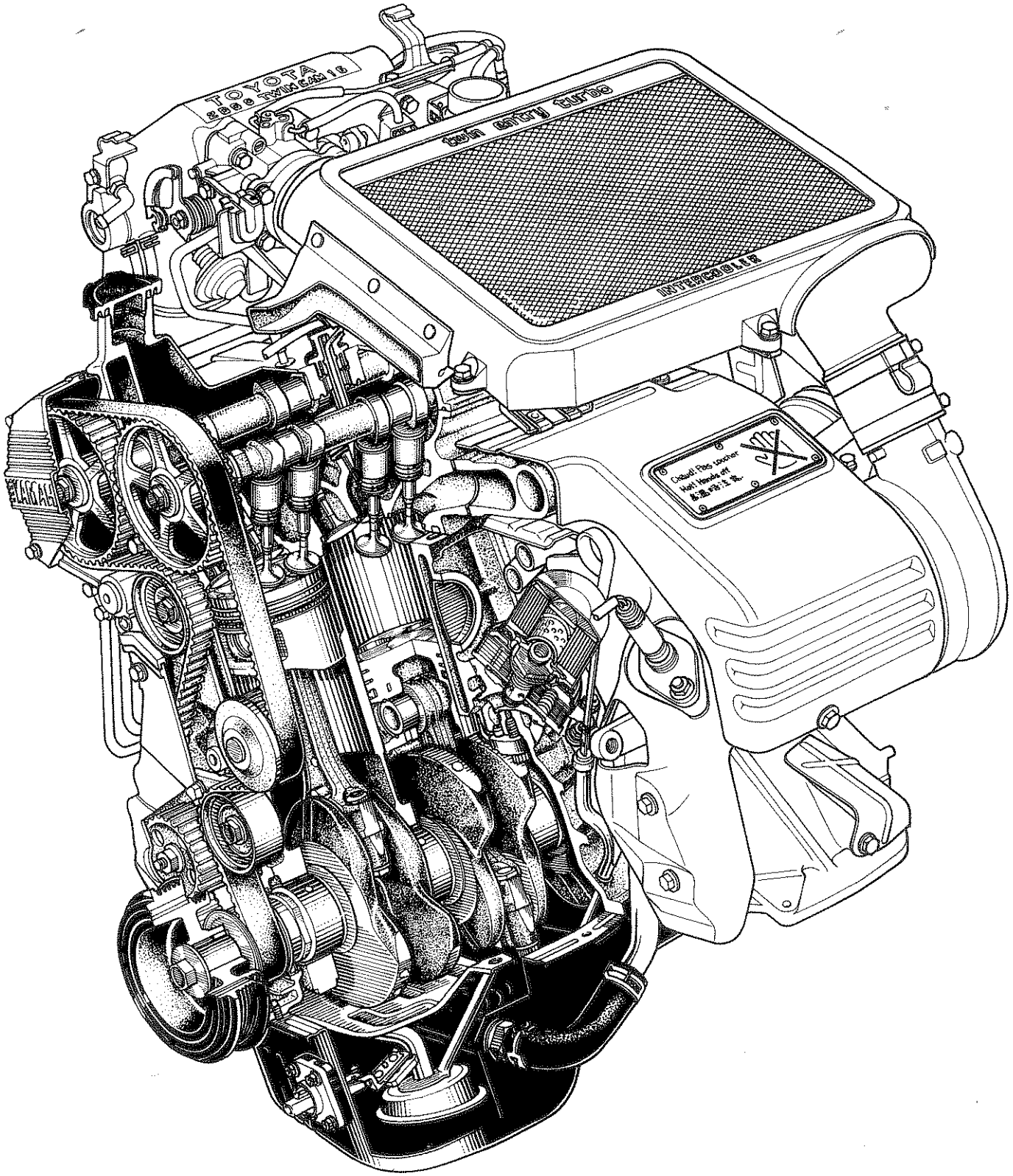
ENGINE MECHANICAL

EM

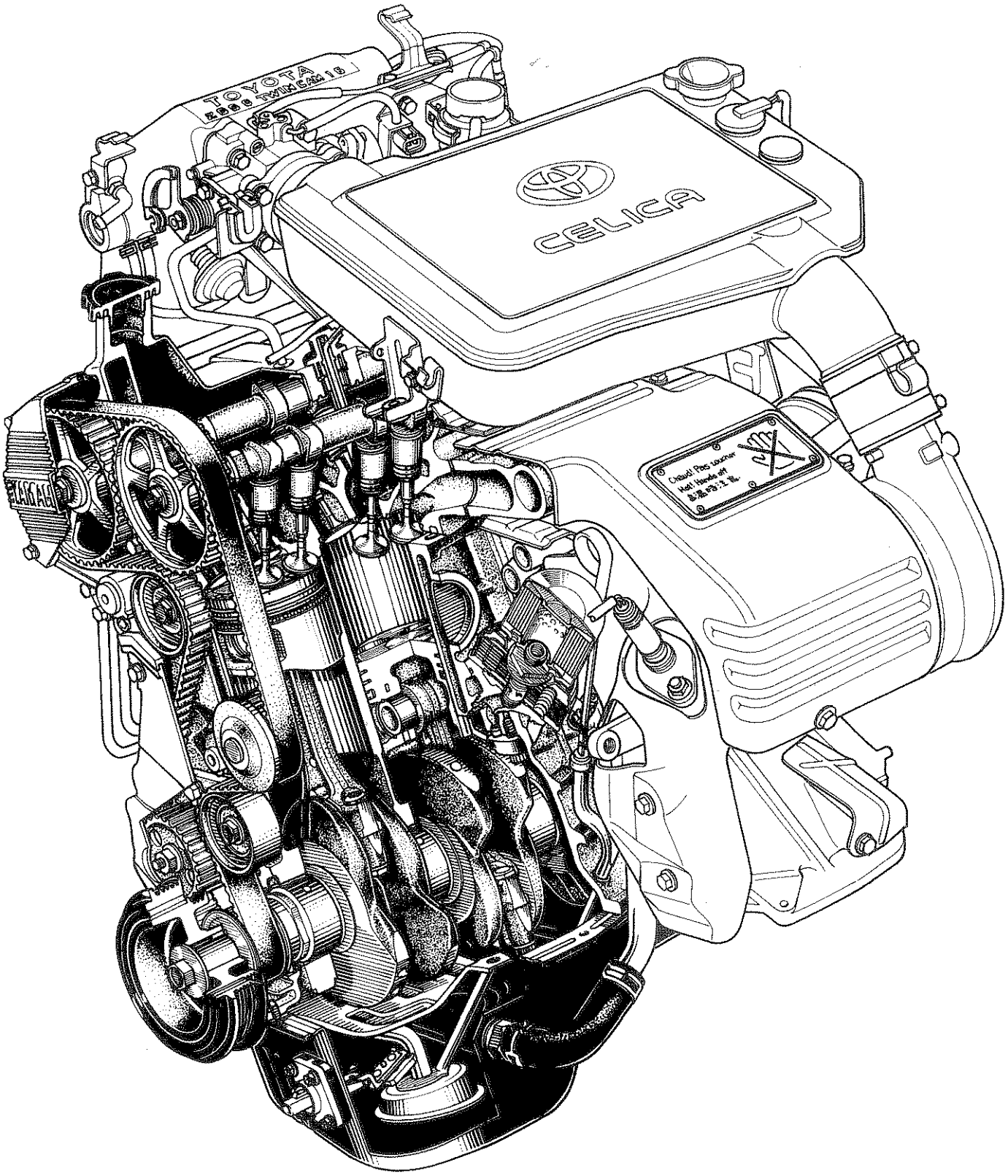
DESCRIPTION

The 3S-GTE engine is an in-line, 4-cylinder, 2.0 liter DOHC 16-valve engine.

(Air Cooling Type)



(Water Cooling Type)



The 3S-GTE 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 bearings inside the crankcase. These bearings are made of aluminum alloy.

The crankshaft is integrated with 8 weights for balance. Oil holes are placed 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 and 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.

Both the intake camshaft and the exhaust camshaft 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 journals and cam is accomplished by oil 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.

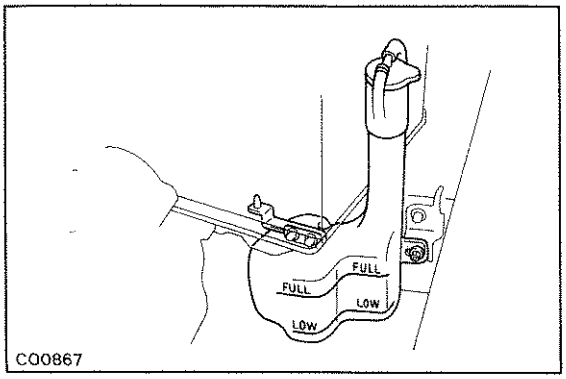
Pistons are made of high temperature-resistant aluminum alloy, and a depression is built into the piston head to prevent interference with the valves.

Piston pins are the full-floating type, with the pins fastened to the neither the piston boss nor 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 gas leakage from the cylinder and an oil ring works to clear 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 twice the length of the piston stroke. The top of the cylinders are closed off by the cylinder head and the lower end of the cylinders becomes the crankcase, in which the crankshaft is installed. In addition, the cylinder block contains a water jacket, through which coolant is pumped to cool the cylinders.

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



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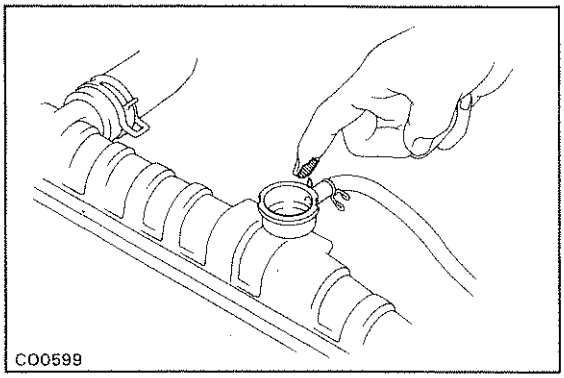
ENGINE TUNE-UP

INSPECTION OF ENGINE COOLANT

1. **INSPECT ENGINE COOLANT LEVEL AT RESERVOIR TANK**

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

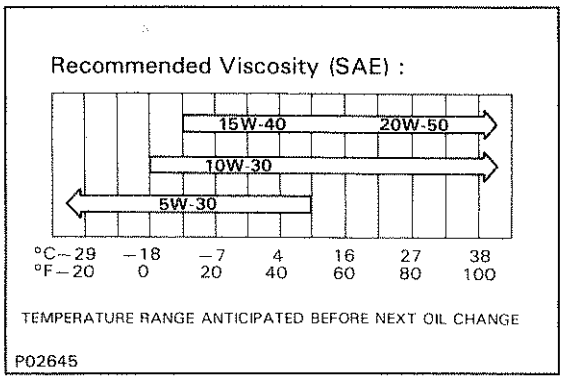
If low, check for leaks and add coolant up to the "FULL" line.


CO0599

2. **INSPECT ENGINE COOLANT QUALITY**

There should be any excessive deposits of rust or scales around the radiator cap or reservoir tank filler hole, and the coolant should be from oil.

If excessively dirty, clean the coolant passages and replace the coolant.



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INSPECTION OF ENGINE OIL

1. **CHECK ENGINE OIL QUALITY**

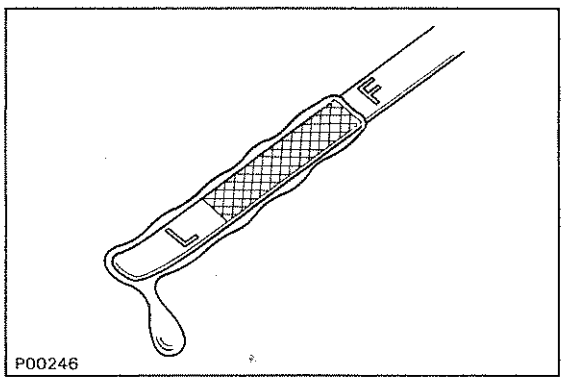
Check the oil for deterioration, entry of water, discoloring or thinning.

If the quality is poor, replace the oil.

Oil grade: API grade SG or better

If it is impossible to get SG or better you may use SF grade.

Recommended viscosity is as shown.



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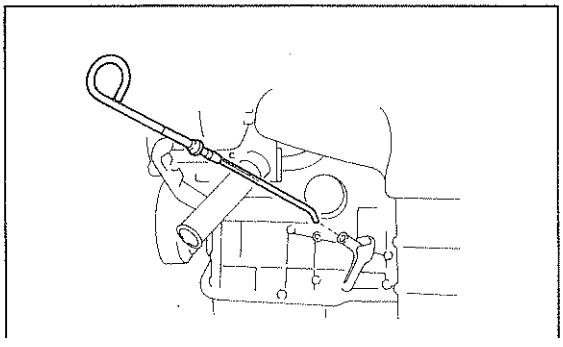
2. **CHECK ENGINE OIL LEVEL**

(a) Remove the oil dipstick.

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

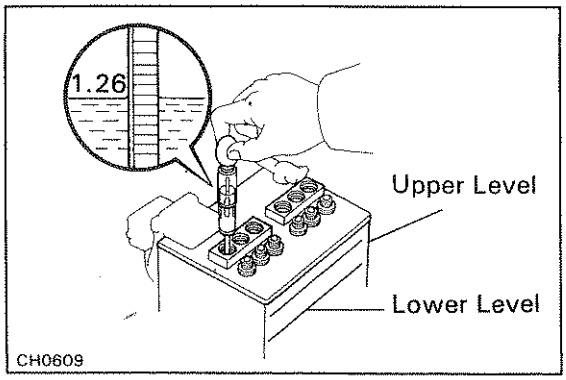
If low, check for the leakage and add oil up to "F" mark.



(c) Reinstall the oil dipstick.

NOTICE:

- **When inserting the oil dipstick, insert the curved tip of the dipstick facing the same direction as the curve of the guide.**
- **If the dipstick gets caught while it, do not force it in. Reconfirm the direction of the dipstick.**



INSPECTION OF BATTERY

1. **INSPECT BATTERY SPECIFIC GRAVITY AND ELECTROLYTE LEVEL**

(a) Check the specific gravity of each cell.

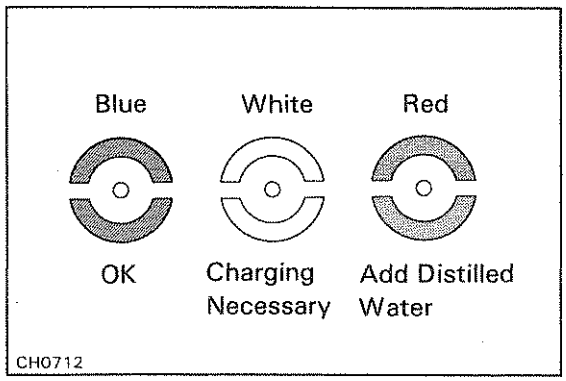
Standard specific gravity:
When fully charged at 20°C (68°F)
1.25 — 1.27 for 55D23L type
1.27 — 1.29 for 80D26L type

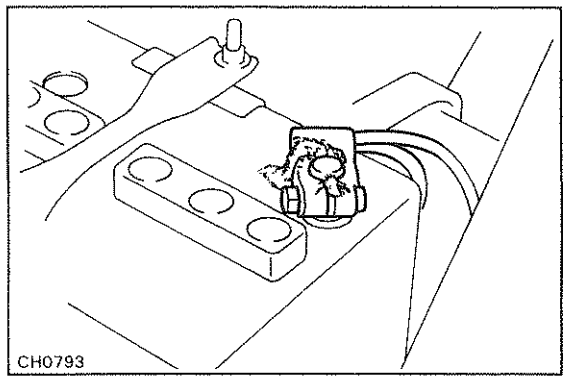
If gravity is less than specified, charge the battery.

(b) Check the electrolyte quantity of each cell.

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

HINT: Check the indicator as shown in the illustration.

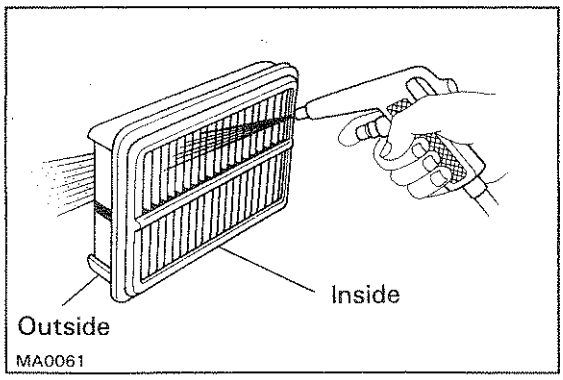




2. **CHECK BATTERY TERMINALS, FUSIBLE LINKS AND FUSES**

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

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



INSPECTION AND CLEANING OF AIR FILTER

1. **REMOVE AIR FILTER**

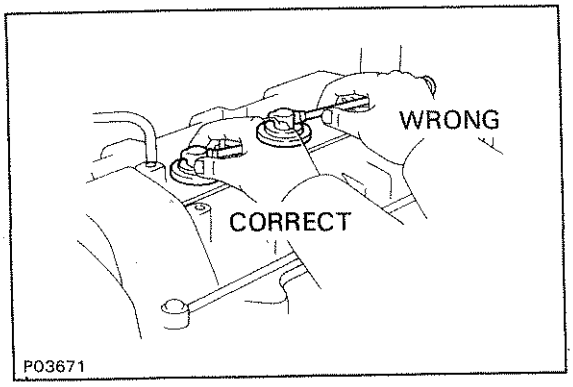
2. **INSPECT AIR FILTER**

(a) Visually check that the air filter is not excessively damaged or oily.

(b) Clean the air filter with compressed air.

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

3. **REINSTALL AIR FILTER**



INSPECTION OF HIGH-TENSION CORDS

1. **DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS**

   Disconnect the high-tension cords at rubber boot. Do not pull on the cords.

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

2. **REMOVE DISTRIBUTOR CAP WITHOUT DISCONNECTING HIGH-TENSION CORDS**

3. **INSPECT HIGH-TENSION CORD RESISTANCE**

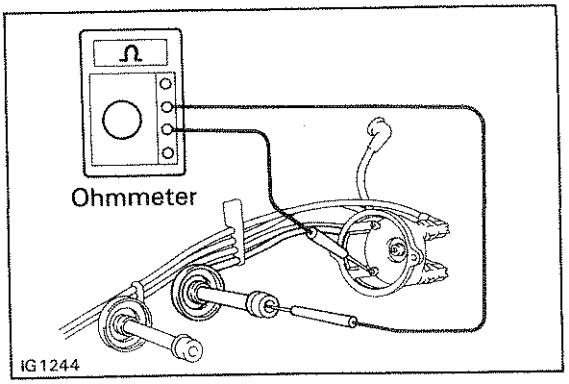
   Using an ohmmeter, measure the resistance without disconnecting the distributor cap.

   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.

4. **REINSTALL DISTRIBUTOR CAP**

5. **RECONNECT HIGH-TENSION CORDS TO SPARK PLUGS**



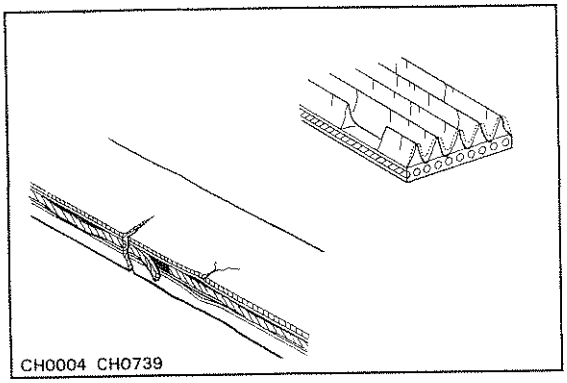
INSPECTION OF ALTERNATOR DRIVE BELT

INSPECT ALTERNATOR DRIVE BELT

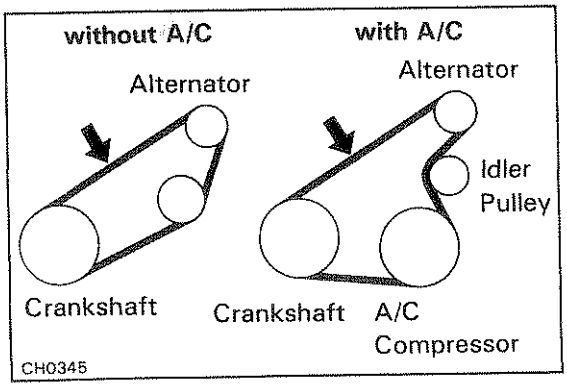
(a) Visually check the drive belt for excessive wear, frayed cords etc.

If necessary, replace the drive belt.

HINT: Cracks on rib side of a drive belt are considered acceptable. If the drive belt has chunks missing from the ribs, it should be replaced.



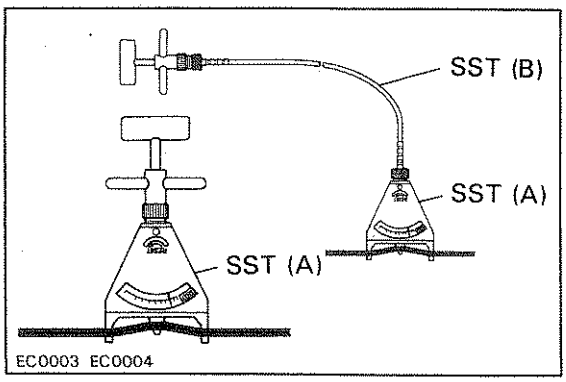
(b) Check the drive belt deflection by pressing on the drive belt at the points indicated in the figure with 98 N (10 kgf, 22.0 lbf) of pressure.

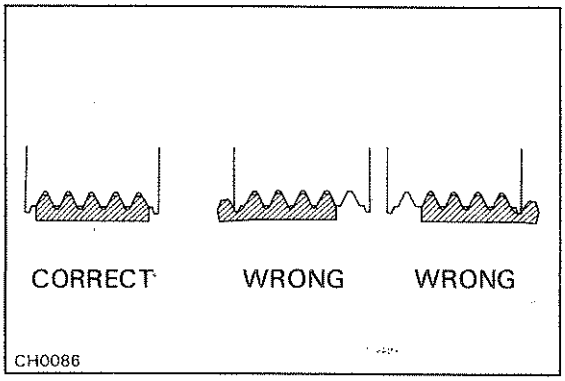


Drive belt deflection:

w/ A/C	New belt	9 — 11 mm (0.35 — 0.43 in.)
	Used belt	13 — 16 mm (0.51 — 0.63 in.)
w/o A/C	New belt	11 — 14 mm (0.43 — 0.55 in.)
	Used belt	12 — 18 mm (0.47 — 0.71 in.)

If the belt deflection is not as specified, adjust it.





(Reference)

Using SST, measure the drive belt tension.

SST 09216-00020 (A)
09216-00030 (B)

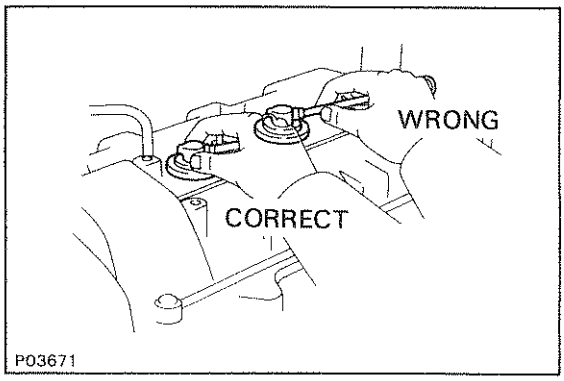
Drive belt tension:

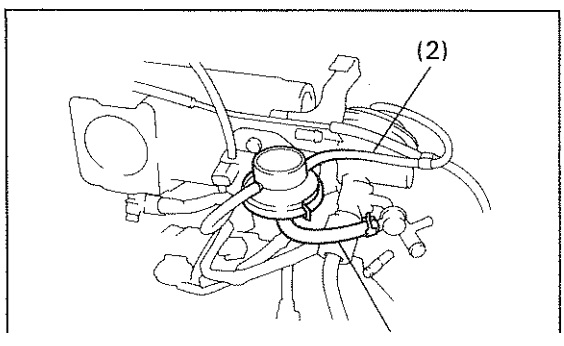
w/ A/C	New belt	70 — 80 kgf
	Used belt	30 — 45 kgf
w/o A/C	New belt	47 — 72 kgf
	Used belt	36 — 62 kgf

If the belt tension is not as specified, adjust it.

HINT:

- "New belt" refers to a belt which has been used 5 minutes or less 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 a belt, check that it fits properly in the ribbed grooves.
- Check by hand to confirm that the belt has not slipped out of the groove on the bottom of the pulley.
- After installing a new belt, run the engine for about 5 minutes and recheck the belt tension.





INSPECTION AND ADJUSTMENT OF VALVE CLEARANCE

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

1. **REMOVE INTERCOOLER**
   (See steps 5,6 on pages TC-12,13)

2. **DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS**

   Disconnect the high-tension cords at rubber boot. Do not pull on the cords.

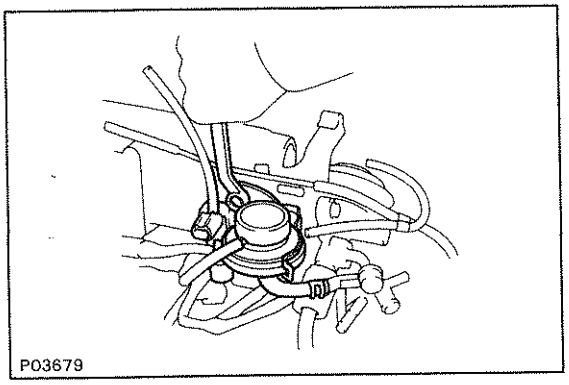
   NOTICE: Pulling on or bending the cords may damage the conductor inside.

3. **REMOVE EGR VACUUM MODULATOR AND VSV**

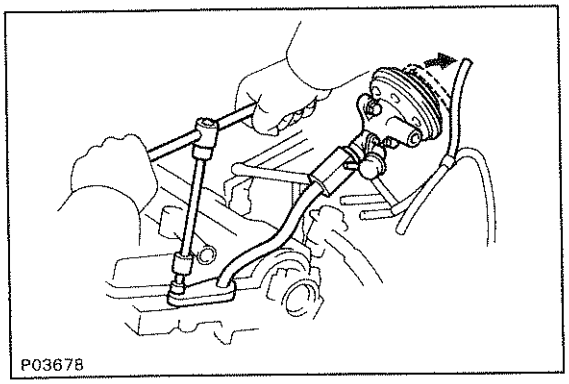
   (a) Disconnect the EGR VSV connector.

   (b) Disconnect the following vacuum hoses:

   (1) Vacuum hose from EGR valve



(c) Remove the bolt, vacuum modulator and VSV assembly.

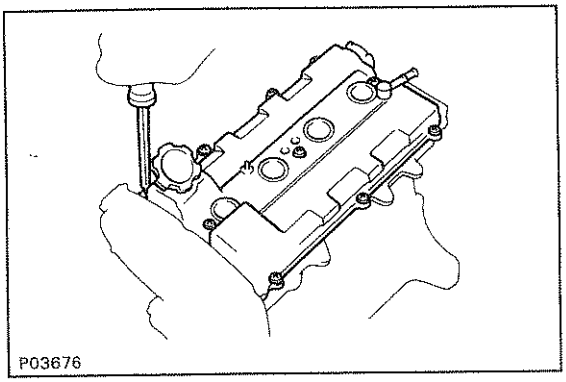


4. **REMOVE EGR VALVE AND PIPE**

(a) Disconnect the vacuum hose from the EGR valve.

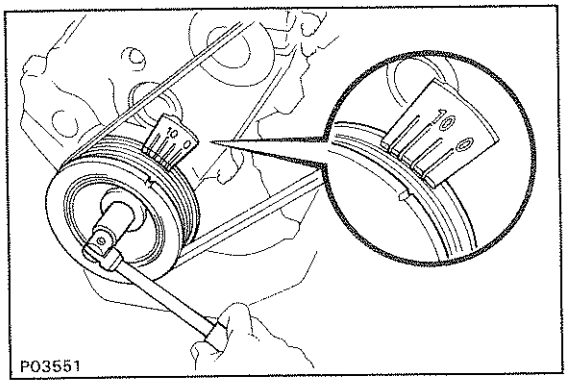
(b) Remove the four bolts, the EGR valve, pipe assembly and two gaskets.

5. **REMOVE THROTTLE BODY**
(See page FI-35)



6. **REMOVE CYLINDER HEAD COVER**

Remove the ten screws, seal washers, head cover and two gaskets.

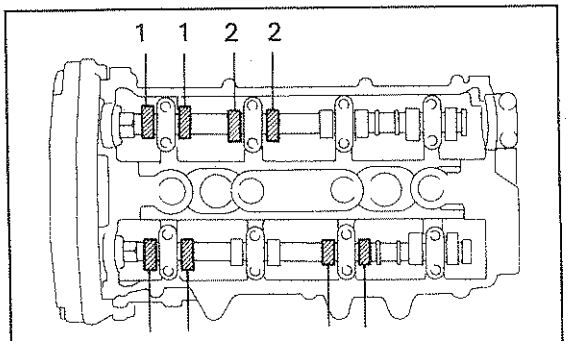


7. **SET NO.1 CYLINDER TO TDC/COMPRESSION**

(a) Turn the crankshaft pulley and align its groove with 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 No.4 are tight.

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



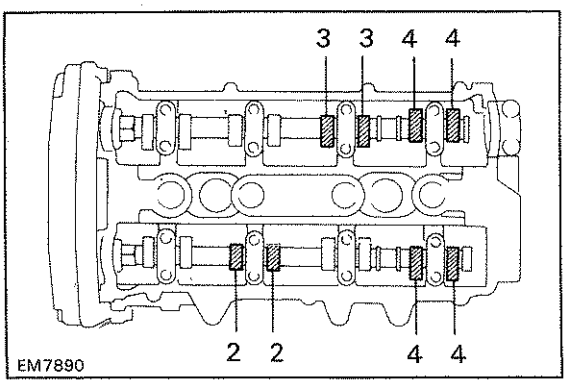
8. **INSPECT VALVE CLEARANCE**

(a) Check only those valves indicated.

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

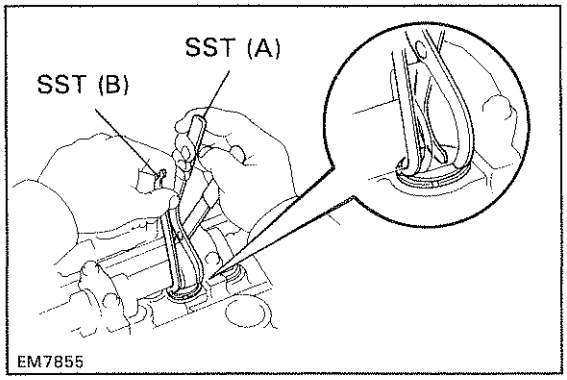
Valve clearance (Cold):

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



(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))



9. ADJUST VALVE CLEARANCE

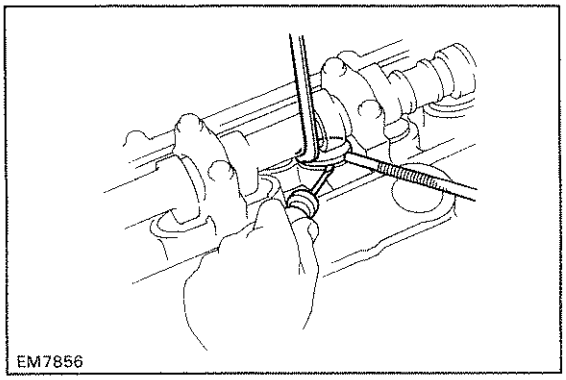
(a) Remove the adjusting shim.

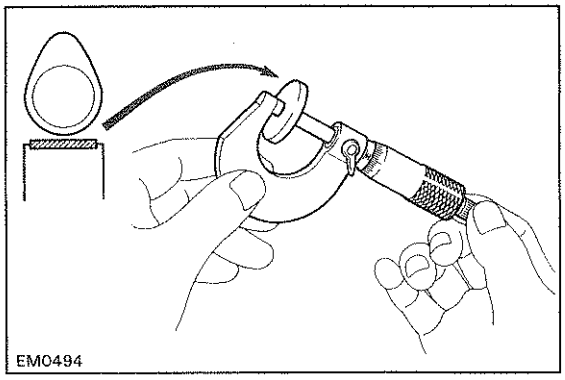
- Turn the crankshaft to position the cam lobe of the camshaft on the adjusting valve upward.
- Using SST (A), press down the valve lifter and place SST (B) between the camshaft and valve lifter. Remove SST (A).

SST 09248-55020 (09248-05011(A), 09248-05021(B))

HINT: Before pressing down the valve lifter, position its notch toward the spark plug side.

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





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

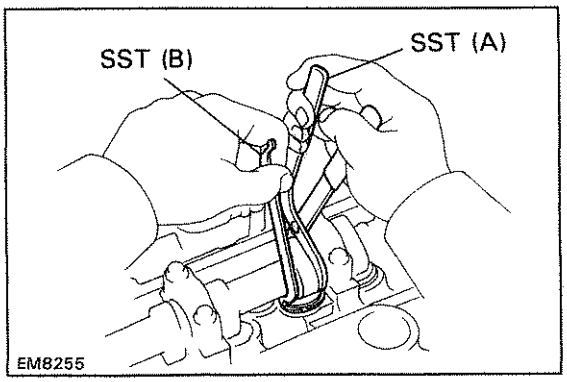
- Using a micrometer, measure the thickness of the removal shim.
- Calculate the thickness of a new shim so that the valve clearance comes within the specified value.

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 − 0.33 mm (0.013 in.))

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

HINT: Shims are available in twenty-seven sizes of 0.05 mm (0.0020 in.), from 2.00 mm (0.0787 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 09248-55020 (09248-05011(A), 09248-05021(B))

(d) Recheck the valve clearance.

Adjusting Shim Selection Chart (Intake)

Measured clearance mm (in.) \ Installed shim thickness mm (in.)	2.000 (0.0787)	2.025 (0.0797)	2.050 (0.0807)	2.075 (0.0817)	2.100 (0.0827)	2.125 (0.0837)	2.150 (0.0846)	2.175 (0.0856)	2.200 (0.0866)	2.225 (0.0876)	2.250 (0.0886)	2.275 (0.0896)	2.300 (0.0905)	2.325 (0.0915)	2.350 (0.0925)	2.375 (0.0935)	2.400 (0.0945)	2.425 (0.0955)	2.450 (0.0965)	2.475 (0.0974)	2.500 (0.0984)	2.525 (0.0994)	2.550 (0.1004)	2.575 (0.1014)	2.600 (0.1024)	2.625 (0.1033)	2.650 (0.1043)	2.675 (0.1053)	2.700 (0.1063)	2.725 (0.1073)	2.750 (0.1083)	2.775 (0.1093)	2.800 (0.1102)	2.825 (0.1112)	2.850 (0.1122)	2.875 (0.1132)	2.900 (0.1142)	2.925 (0.1152)	2.950 (0.1161)	2.975 (0.1171)	3.000 (0.1181)	3.025 (0.1191)	3.050 (0.1201)	3.075 (0.1211)	3.100 (0.1220)	3.125 (0.1230)	3.150 (0.1240)	3.175 (0.1250)	3.200 (0.1260)	3.225 (0.1270)	3.250 (0.1280)	3.275 (0.1289)	3.300 (0.1299)
0.000 – 0.020 (0.0000 – 0.0008)																											1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13
0.021 – 0.040 (0.0008 – 0.0016)																										1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14
0.041 – 0.060 (0.0016 – 0.0024)																								1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14
0.061 – 0.080 (0.0024 – 0.0031)																							1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14
0.081 – 0.100 (0.0032 – 0.0039)																						1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15
0.101 – 0.120 (0.0040 – 0.0047)																						1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15
0.121 – 0.140 (0.0048 – 0.0055)																					1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16
0.141 – 0.149 (0.0056 – 0.0059)																					1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16
0.150 – 0.250 (0.0059 – 0.0098)																																																					
0.251 – 0.260 (0.0099 – 0.0102)																		1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17
0.261 – 0.280 (0.0103 – 0.0110)																	1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17
0.281 – 0.300 (0.0111 – 0.0118)																1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17
0.301 – 0.320 (0.0119 – 0.0126)																1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	
0.321 – 0.340 (0.0126 – 0.0134)															1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17		
0.341 – 0.360 (0.0134 – 0.0142)														1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17		
0.361 – 0.380 (0.0142 – 0.0150)													1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17		
0.381 – 0.400 (0.0150 – 0.0157)												1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17			
0.401 – 0.420 (0.0158 – 0.0165)												1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17				
0.421 – 0.440 (0.0166 – 0.0173)											1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17				
0.441 – 0.460 (0.0174 – 0.0181)										1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17					
0.461 – 0.480 (0.0181 – 0.0189)									1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17					
0.481 – 0.500 (0.0189 – 0.0197)								1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17							
0.501 – 0.520 (0.0197 – 0.0205)								1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17							
0.521 – 0.540 (0.0205 – 0.0213)							1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17								
0.541 – 0.560 (0.0213 – 0.0220)					1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17									
0.561 – 0.580 (0.0221 – 0.0228)				1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17										
0.581 – 0.600 (0.0229 – 0.0236)			1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17										
0.601 – 0.620 (0.0237 – 0.0244)			1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17											
0.621 – 0.640 (0.0244 – 0.0252)		1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17											
0.641 – 0.660 (0.0252 – 0.0260)	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17												
0.661 – 0.680 (0.0260 – 0.0268)	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17													
0.681 – 0.700 (0.0268 – 0.0276)	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17														
0.701 – 0.720 (0.0276 – 0.0283)	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17															
0.721 – 0.740 (0.0284 – 0.0291)	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																
0.741 – 0.760 (0.0292 – 0.0299)	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																	
0.761 – 0.780 (0.0300 – 0.0307)	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																	
0.781 – 0.800 (0.0307 – 0.0315)	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																		
0.801 – 0.820 (0.0315 – 0.0322)	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																			
0.821 – 0.840 (0.0323 – 0.0331)	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																				
0.841 – 0.860 (0.0331 – 0.0339)	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																					
0.861 – 0.880 (0.0339 – 0.0346)	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																						
0.881 – 0.900 (0.0347 – 0.0354)	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																							
0.901 – 0.920 (0.0355 – 0.0362)	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																							
0.921 – 0.940 (0.0363 – 0.0370)	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17																							
0.941 – 0.960 (0.0370 – 0.0378)	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																								
0.961 – 0.980 (0.0378 – 0.0386)	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																								
0.981 – 1.000 (0.0386 – 0.0394)	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																								
1.001 – 1.020 (0.0394 – 0.0402)	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																								
1.021 – 1.040 (0.0402 – 0.0409)	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																								
1.041 – 1.060 (0.0410 – 0.0417)	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																								
1.061 – 1.080 (0.0418 – 0.0425)	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17																								
1.081 – 1.100 (0.0426 – 0.0433)	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																								
1.101 – 1.120 (0.0433 – 0.0441)	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																								
1.121 – 1.140 (0.0441 – 0.0449)	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																								
1.141 – 1.160 (0.0449 – 0.0457)	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																								
1.161 – 1.180 (0.0457 – 0.0465)	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																								
1.181 – 1.200 (0.0465 – 0.0472)	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																									
1.201 – 1.220 (0.0473 – 0.0480)	11	12	12	13	13	14	14	15	15	16	16	17	17	17																									
1.221 – 1.240 (0.0481 – 0.0488)	12	12	13	13	14	14	15	15	16	16	17	17	17	17																									
1.241 – 1.260 (0.0489 – 0.0496)	12	13	13	14	14	15	15	16	16	17	17	17																											
1.261 – 1.280 (0.0496 – 0.0504)	12	13	13	14	14	15	15	16	16	17	17	17																											
1.281 – 1.300 (0.0504 – 0.0512)	13	13	14	14	15	15	16	16	17	17	17																												
1.301 – 1.320 (0.0512 – 0.0520)	13	14	14	15	15	16	16	17	17	17																													
1.321 – 1.340 (0.0520 – 0.0528)	14	14	15	15	16	16	17	17	17	17																													
1.341 – 1.360 (0.0528 – 0.0535)	14	15	15	16	16	17	17	17																															
1.361 – 1.380 (0.0536 – 0.0543)	14	15	15	16	16	17	17	17																															
1.381 – 1.400 (0.0544 – 0.0551)	15	15	16	16	17	17	17																																
1.401 – 1.420 (0.0552 – 0.0559)	15	16	16	17	17	17																																	
1.421 – 1.440 (0.0559 – 0.0567)	16	16	17	17	17	17																																	
1.441 – 1.460 (0.0567 – 0.0575)	16	17	17	17	17																																		
1.461 – 1.480 (0.0575 – 0.0583)	16	17	17	17																																			
1.481 – 1.500 (0.0583 – 0.0591)	17	17	17																																				
1.501 – 1.520 (0.0591 – 0.0598)	17	17																																					
1.521 – 1.540 (0.0599 – 0.0606)	17	17																																					
1.541 – 1.550 (0.0607 – 0.0610)	17																																						

P03531

New shim thickness mm (in.)

Shim No.	Thickness	Shim No.	Thickness
1	2.500 (0.0984)	10	2.950 (0.1161)
2	2.550 (0.1004)	11	3.000 (0.1181)
3	2.600 (0.1024)	12	3.050 (0.1201)
4	2.650 (0.1043)	13	3.100 (0.1220)
5	2.700 (0.1063)	14	3.150 (0.1240)
6	2.750 (0.1083)	15	3.200 (0.1260)
7	2.800 (0.1102)	16	3.250 (0.1280)
8	2.850 (0.1122)	17	3.300 (0.1299)
9	2.900 (0.1142)		

HINT: New shims have the thickness in millimeters imprinted on the face.

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

EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed, and the mea-

Adjusting Shim Selection Chart (Exhaust)

Measured clearance mm (in.) \ Installed shim thickness mm (in.)	2.000 (0.0787)	2.025 (0.0797)	2.050 (0.0807)	2.075 (0.0817)	2.100 (0.0827)	2.125 (0.0837)	2.150 (0.0846)	2.175 (0.0856)	2.200 (0.0866)	2.225 (0.0876)	2.250 (0.0886)	2.275 (0.0896)	2.300 (0.0905)	2.325 (0.0915)	2.350 (0.0925)	2.375 (0.0935)	2.400 (0.0945)	2.425 (0.0955)	2.450 (0.0965)	2.475 (0.0974)	2.500 (0.0984)	2.525 (0.0994)	2.550 (0.1004)	2.575 (0.1014)	2.600 (0.1024)	2.625 (0.1033)	2.650 (0.1043)	2.675 (0.1053)	2.700 (0.1063)	2.725 (0.1073)	2.750 (0.1083)	2.775 (0.1093)	2.800 (0.1102)	2.825 (0.1112)	2.850 (0.1122)	2.875 (0.1132)	2.900 (0.1142)	2.925 (0.1152)	2.950 (0.1161)	2.975 (0.1171)	3.000 (0.1181)	3.025 (0.1191)	3.050 (0.1201)	3.075 (0.1211)	3.100 (0.1220)	3.125 (0.1230)	3.150 (0.1240)	3.175 (0.1250)	3.200 (0.1260)	3.225 (0.1270)	3.250 (0.1280)	3.275 (0.1289)	3.300 (0.1299)
0.000 — 0.020 (0.0000 — 0.0008)																																1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11
0.021 — 0.040 (0.0008 — 0.0016)																															1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11
0.041 — 0.060 (0.0016 — 0.0024)																														1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11
0.061 — 0.080 (0.0024 — 0.0031)																													1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12
0.081 — 0.100 (0.0032 — 0.0039)																													1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12
0.101 — 0.120 (0.0040 — 0.0047)																												1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13
0.121 — 0.140 (0.0048 — 0.0055)																											1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13
0.141 — 0.160 (0.0056 — 0.0063)																										1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14
0.161 — 0.180 (0.0063 — 0.0071)																									1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14
0.181 — 0.200 (0.0071 — 0.0079)																								1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15
0.201 — 0.220 (0.0079 — 0.0087)																							1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15
0.221 — 0.240 (0.0087 — 0.0094)																						1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16
0.241 — 0.260 (0.0095 — 0.0102)																					1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16
0.261 — 0.279 (0.0103 — 0.0110)																					1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16
0.280 — 0.380 (0.0110 — 0.0150)																																																						
0.381 — 0.400 (0.0150 — 0.0157)																	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17
0.401 — 0.420 (0.0158 — 0.0165)																1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17
0.421 — 0.440 (0.0166 — 0.0173)																1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17
0.441 — 0.460 (0.0174 — 0.0181)															1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	
0.461 — 0.480 (0.0181 — 0.0189)														1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17		
0.481 — 0.500 (0.0189 — 0.0197)														1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17			
0.501 — 0.520 (0.0197 — 0.0205)													1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17				
0.521 — 0.540 (0.0205 — 0.0213)											1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17					
0.541 — 0.560 (0.0213 — 0.0220)										1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17						
0.561 — 0.580 (0.0221 — 0.0228)									1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17							
0.581 — 0.600 (0.0229 — 0.0236)									1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17							
0.601 — 0.620 (0.0237 — 0.0244)								1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17								
0.621 — 0.640 (0.0244 — 0.0252)							1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17									
0.641 — 0.660 (0.0252 — 0.0260)						1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17									
0.661 — 0.680 (0.0260 — 0.0268)					1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17										
0.681 — 0.700 (0.0268 — 0.0276)					1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17										
0.701 — 0.720 (0.0276 — 0.0283)				1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17											
0.721 — 0.740 (0.0284 — 0.0291)			1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17												
0.741 — 0.760 (0.0292 — 0.0299)		1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17												
0.761 — 0.780 (0.0300 — 0.0307)	1	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17													
0.781 — 0.800 (0.0307 — 0.0315)	1	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17														
0.801 — 0.820 (0.0315 — 0.0322)	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17														
0.821 — 0.840 (0.0323 — 0.0331)	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17	17															
0.841 — 0.860 (0.0331 — 0.0339)	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																
0.861 — 0.880 (0.0339 — 0.0346)	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																	
0.881 — 0.900 (0.0347 — 0.0354)	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																		
0.901 — 0.920 (0.0355 — 0.0362)	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																			
0.921 —0.940 (0.0363 — 0.0370)	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17	17																				
0.941 — 0.960 (0.0370 — 0.0378)	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17																					
0.961 — 0.980 (0.0378 — 0.0386)	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17																						
0.981 — 1.000 (0.0386 — 0.0394)	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17																							
1.001 — 1.020 (0.0394 — 0.0402)	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17																								
1.021 — 1.040 (0.0402 — 0.0409)	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17																									
1.041 — 1.060 (0.0410 — 0.0417)	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17																										
1.061 — 1.080 (0.0418 — 0.0425)	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17																											
1.081 — 1.100 (0.0426 — 0.0433)	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17																												
1.101 — 1.120 (0.0433 — 0.0441)	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17																												
1.121 — 1.140 (0.0441 — 0.0449)	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17																													
1.141 — 1.160 (0.0449 — 0.0457)	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17																													
1.161 — 1.180 (0.0457 — 0.0465)	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17																														
1.181 — 1.200 (0.0465 — 0.0472)	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17																															
1.201 — 1.220 (0.0473 — 0.0480)	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17																															
1.221 — 1.240 (0.0481 — 0.0488)	9	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17																															
1.241 — 1.260 (0.0489 — 0.0496)	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17																																
1.261 — 1.280 (0.0496 — 0.0504)	10	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17																																
1.281 — 1.300 (0.0504 — 0.0512)	10	11	11	12	12	13	13	14	14	15	15	16	16	17	17																																	
1.301 — 1.320 (0.0512 — 0.0520)	11	11	12	12	13	13	14	14	15	15	16	16	17	17																																	
1.321 — 1.340 (0.0520 — 0.0528)	11	12	12	13	13	14	14	15	15	16	16	17	17																																	
1.341 — 1.360 (0.0528 — 0.0535)	11	12	12	13	13	14	14	15	15	16	16	17	17																																	
1.361 — 1.380 (0.0536 — 0.0543)	12	12	13	13	14	14	15	15	16	16	17	17																																	
1.381 — 1.400 (0.0544 — 0.0551)	12	13	13	14	14	15	15	16	16	17	17																																	
1.401 — 1.420 (0.0552 — 0.0559)	13	13	14	14	15	15	16	16	17	17																																	
1.421 — 1.440 (0.0559 — 0.0567)	13	14	14	15	15	16	16	17	17																																	
1.441 — 1.460 (0.0567 — 0.0575)	13	14	14	15	15	16	16	17	17																																	
1.461 — 1.480 (0.0575 — 0.0583)	14	14	15	15	16	16	17	17																																		
1.481 — 1.500 (0.0583 — 0.0591)	14	15	15	16	16	17	17																																			
1.501 — 1.520 (0.0591 — 0.0598)	15	15	16	16	17	17																																				
1.521 — 1.540 (0.0599 — 0.0606)	15	16	16	17	17																																					
1.541 — 1.560 (0.0607 — 0.0614)	15	16	16	17	17																																					
1.561 — 1.580 (0.0615 — 0.0622)	16	16	17	17																																						
1.581 — 1.600 (0.0622 — 0.0630)	16	17	17																																							
1.601 — 1.620 (0.0630 — 0.0638)	17	17	17																																							
1.621 — 1.640 (0.0638 — 0.0646)	17	17																																								
1.641 — 1.660 (0.0646 — 0.0654)	17	17																																								

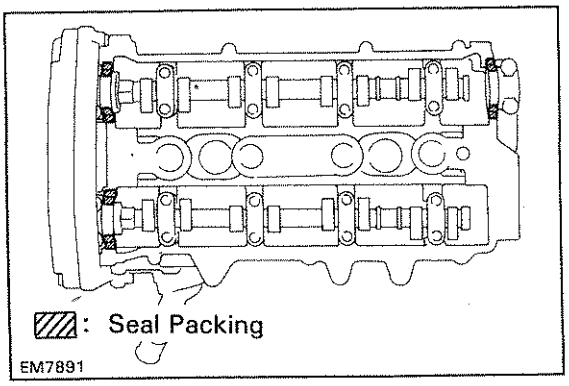
New shim thickness mm (in.)

Shim No.	Thickness	Shim No.	Thickness
1	2.500 (0.0984)	10	2.950 (0.1161)
2	2.550 (0.1004)	11	3.000 (0.1181)
3	2.600 (0.1024)	12	3.050 (0.1201)
4	2.650 (0.1043)	13	3.100 (0.1220)
5	2.700 (0.1063)	14	3.150 (0.1240)
6	2.750 (0.1083)	15	3.200 (0.1260)
7	2.800 (0.1102)	16	3.250 (0.1280)
8	2.850 (0.1122)	17	3.300 (0.1299)
9	2.900 (0.1142)		

HINT: New shims have the thickness in millimeters imprinted on the face.

Exhaust valve clearance (Cold): 0.28 — 0.38 mm (0.011 — 0.015 in.)

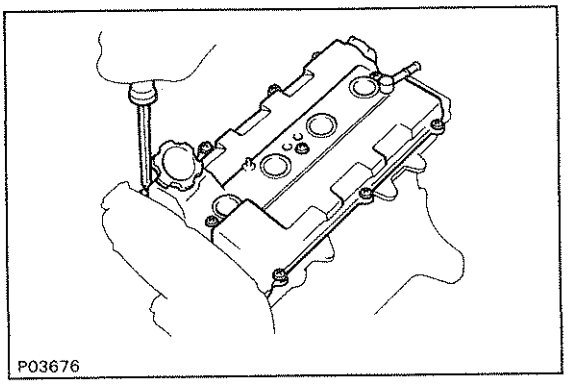
EXAMPLE: The 2.800 mm (0.1102 in.) shim is installed, and the measured clearance is 0.450 mm (0.0177 in.). Replace the 2.800 mm



10. REINSTALL CYLINDER HEAD COVERS

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

Seal packing: Part No. 08826-00080 or equivalent

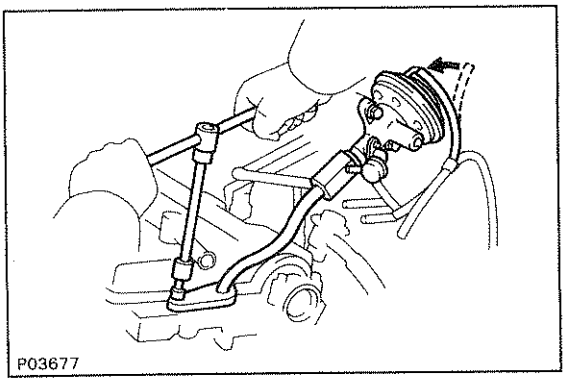


(b) Install the two gaskets to the head cover.

(c) Install the head cover with the twelve seal washers and screws. Uniformly tighten the screws in several passes.

Torque: 25 N·m (250 kgf·cm, 21 ft·lbf)

11. REINSTALL THROTTLE BODY
(See page FI-36)

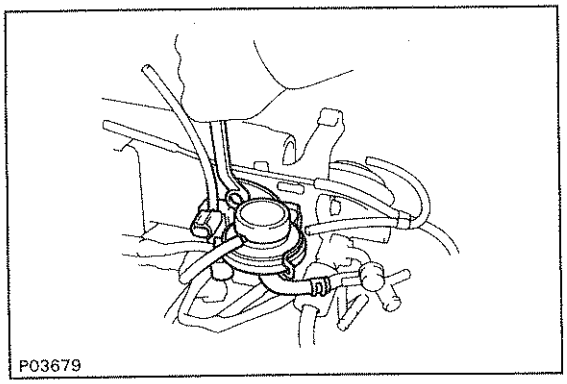


12. REINSTALL EGR VALVE AND PIPE

(a) Install two new gaskets, the EGR valve and pipe assembly with the four bolts.

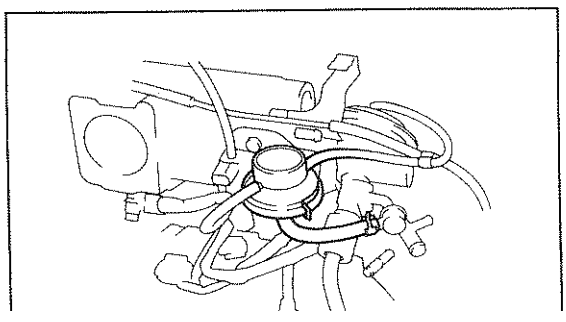
Torque: 26 N·m (260 kgf·cm, 19 ft·lbf)

(b) Connect the vacuum hose to the EGR valve.



13. REINSTALL EGR VACUUM MODULATOR AND VSV

(a) Install the EGR vacuum modulator and VSV assembly with the bolt.

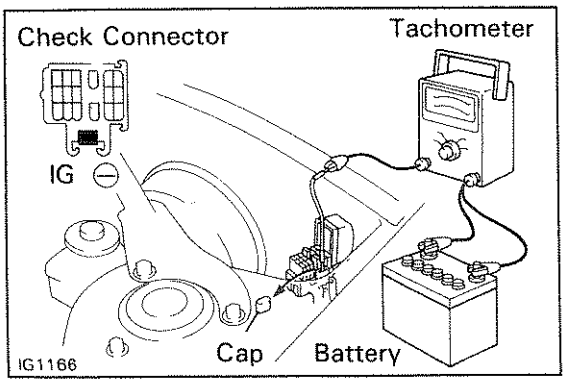


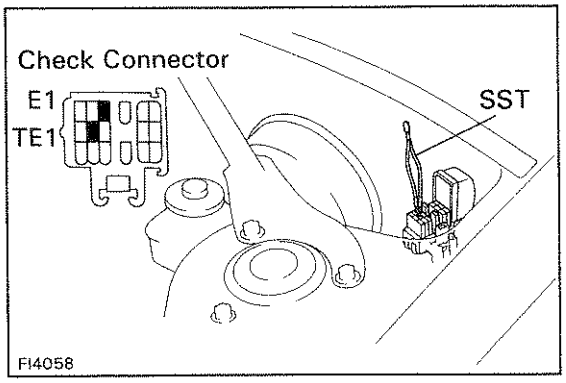
(b) Connect the two vacuum hoses to the EGR valve.

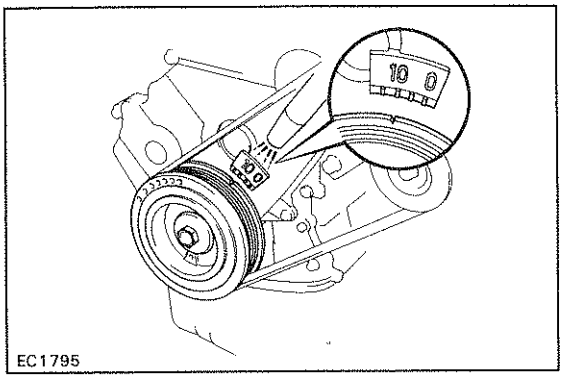
(c) Connect the EGR VSV connector.

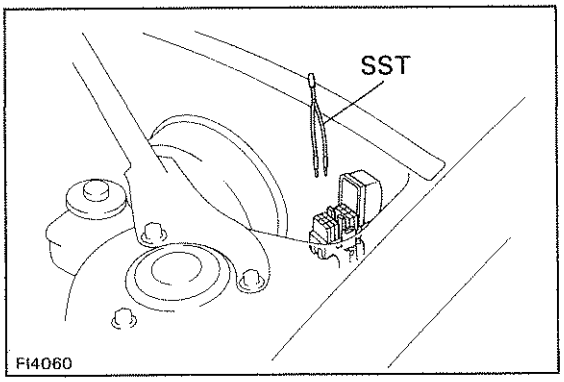
14. RECONNECT HIGH-TENSION CORDS TO SPARK PLUGS

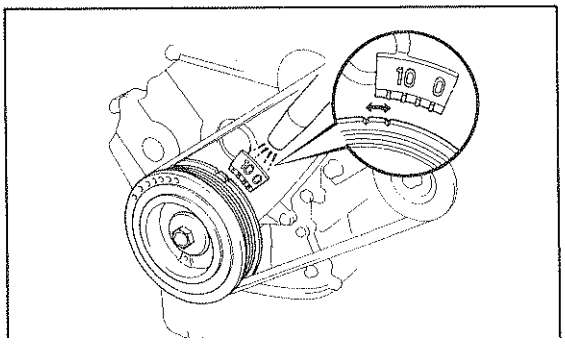
15. REINSTALL INTERCOOLER
(See steps 12,13 on page TC-20)











INSPECTION AND ADJUSTMENT OF IGNITION TIMING

1. **WARM UP ENGINE**

   Allow the engine to warm up to normal operating temperature.

2. **CONNECT TACHOMETER**

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

   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 until 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

   (c) Loosen the two hold-down bolts, and adjust by turning the DISTRIBUTOR.

   (d) Tighten the hold-down bolts, and recheck the ignition timing.

   Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

   (e) Remove SST.

   SST 09843-18020

4. **FURTHER CHECK IGNITION TIMING**

   Ignition timing 12 — 21° BTDC @ idle

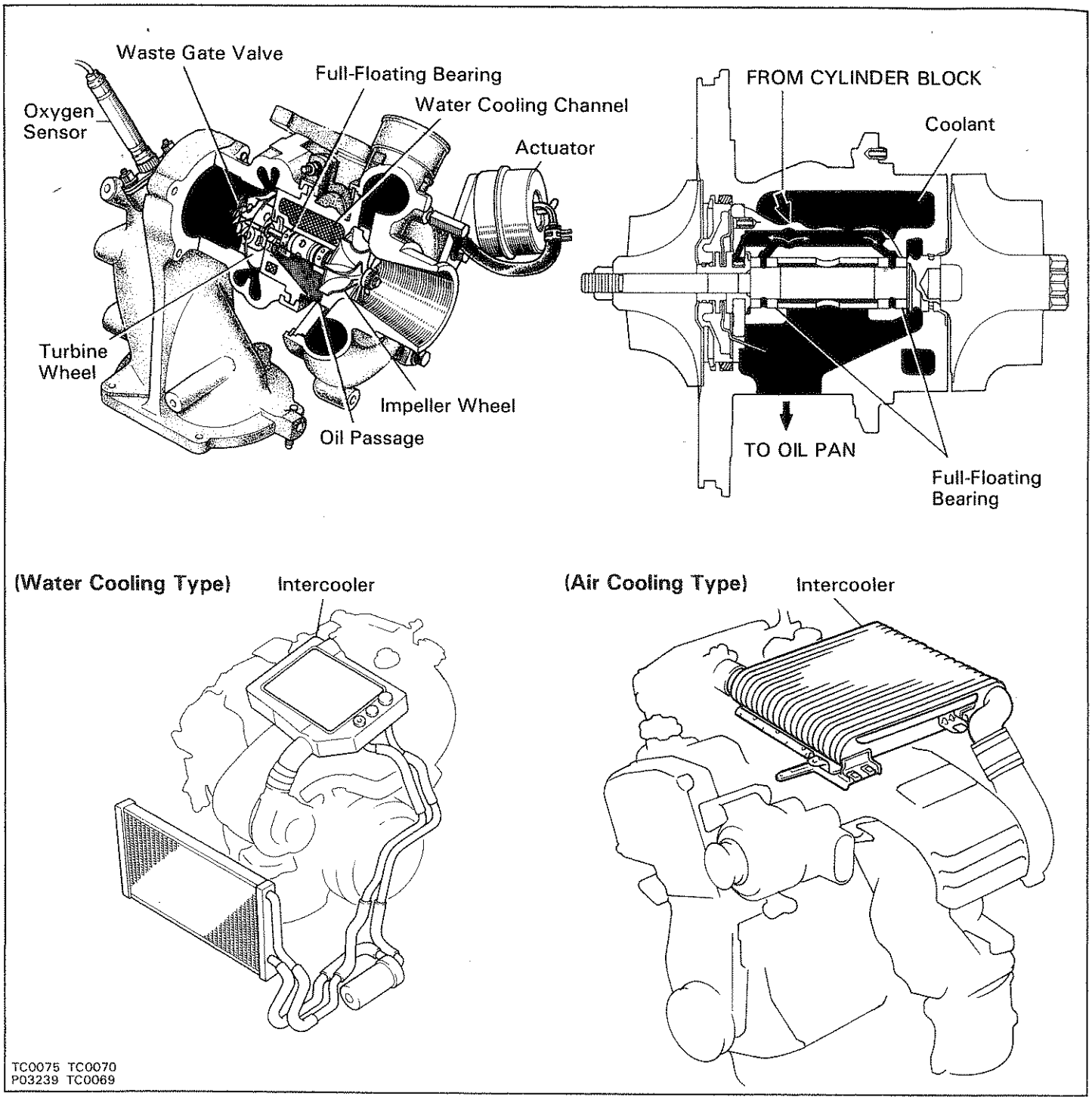
   HINT: The timing mark moves in a range between 12° and 21°.

5. **DISCONNECT TACHOMETER AND TIMING LIGHT FROM ENGINE**

TURBOCHARGER SYSTEM

TC

DESCRIPTION

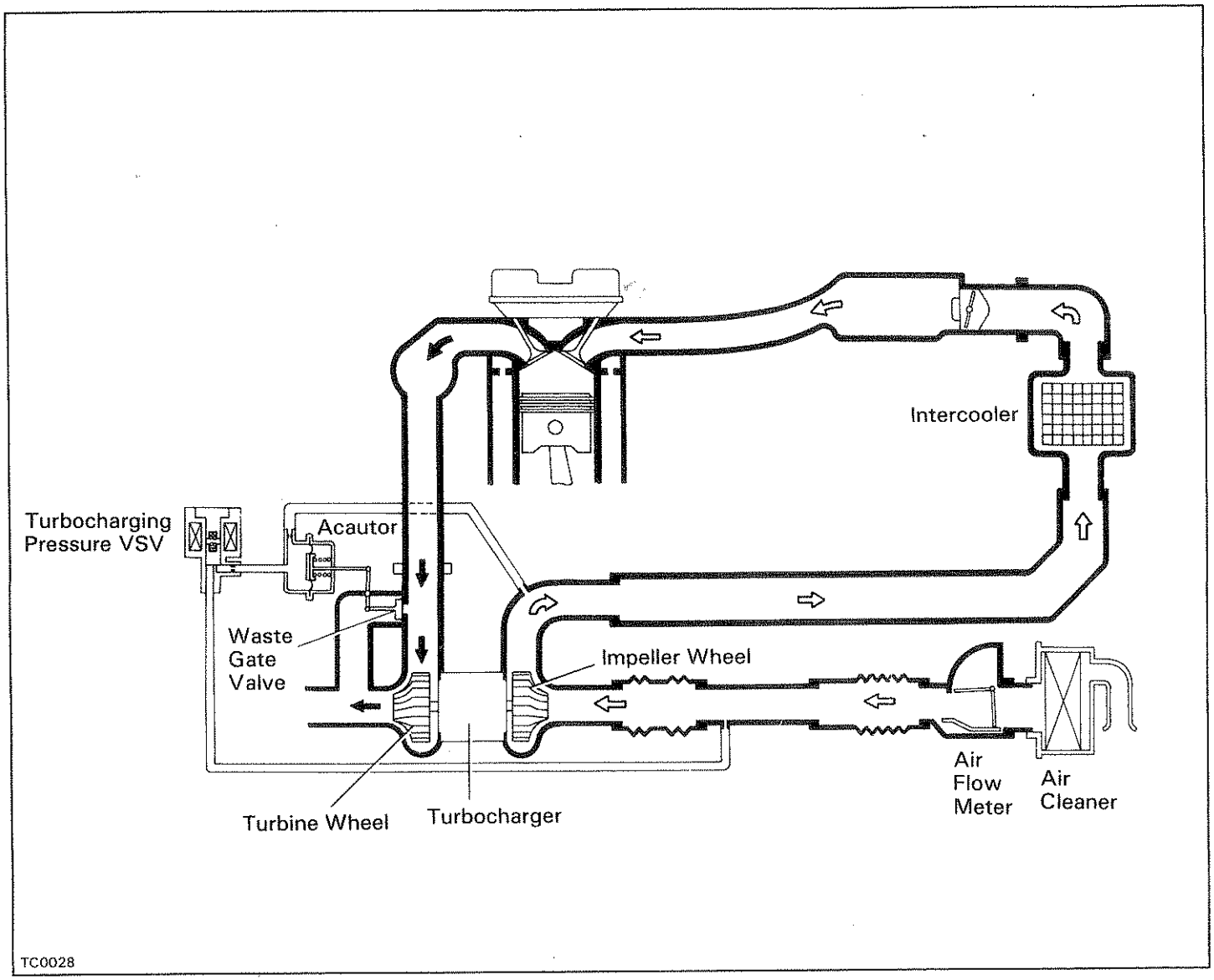


Systems which increase the amount of air sent to the engine are either turbocharger type (using exhaust gas to turn the turbine) or supercharger type (using the engine crankshaft, etc. to mechanically turn the pump, etc.). For CELICA 3S-GTE engine, the turbocharger type has been adopted.

The turbocharger is a device which increases engine output by sending a greater amount of air-fuel mixture to the engine than under normal conditions.

Engine output depends upon the volume of the air-fuel mixture ignited per unit of time. Therefore, to increase engine output, the most effective method is to send a greater amount of air-fuel mixture into the cylinder.

In other words, by installing a special turbocharger and providing a higher air-fuel mixture than usual, engine output can be increased by increasing the average combustion pressure without increasing the engine speed.



Operation of Turbocharger

Exhaust gas acts on the turbine wheel inside the turbine housing, causing it to revolve. When the turbine wheel revolves, the impeller which is located on the same shaft also revolves, compressing the intake air which has passed through the air flow meter from the air cleaner. When expelled from the compressor housing the compressed air is supplied to the cylinders. When the engine speed increases, the exhaust gas volume increases and the turbine wheel revolutions increase (approx. 20,000 — 110,000 rpm), thus the turbocharged air pressure grows greater and engine output increases.

Waste Gate Valve

Although on the one hand high output is achieved by turbo-charging, if the turbocharged air pressure becomes too high, knocking occurs and, on the contrary, a reduction in engine output is caused. If the turbocharged air pressure exceeds the prescribed air pressure, the flow of exhaust gas by-passes the turbine, controlling turbine wheel revolutions and turbocharged air pressure. This by-pass valve which controls the quantity of exhaust gas flowing to the turbine is called the waste gate valve. When the turbocharged air pressure exceeds the prescribed pressure,the actuator operates, the waste gate valve opens and part of the exhaust gas by-passes the turbine. This causes a drop in the turbine revolution rate and controls the turbocharged air within the prescribed limits.

Intercooler (Air Cooling Type)

The intercooler cools the turbocharged air (intake air) put out by the turbochager, thereby increasing the air density. As the intake air temperature decreases, the gas temperature in the combustion chamber falls and the occurrence of knocking is suppressed, giving an increase in engine output.

The Celica 2S-GTE intercooler is an air cooling type located at the top of the engine, utilizing the vehicle

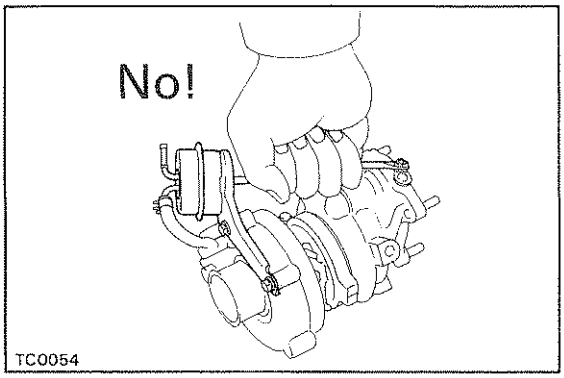
Intercooler (Water Cooling Type)

The intercooler cools the turbocharged air (intake air) put out by the turbocharger,thereby increasing the air density. As the intake air temperature decreases, the gas temperature in the combustion chamber falls and the occurrence of knocking is suppressed, giving an increase in engine output.

The Celica 3S-GTE is equipped with a water cooled intercooler with improved cooling capability. The intercooler, located above the engine, cools the boosted air by way of the water cooled by the sub-radiator located in the front of the vehicle.

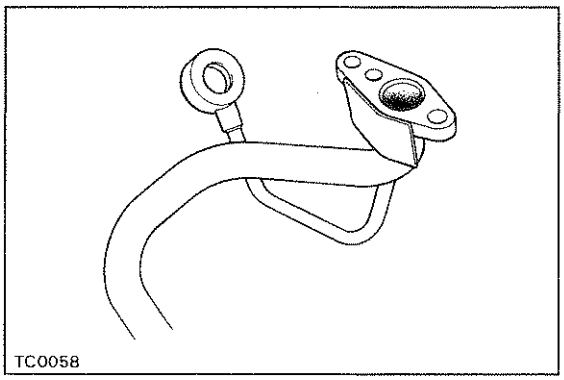
PRECAUTIONS

1. DO not stop the engine immediately after pulling a trailer or high speed or uphill driving. Idle the engine for 20 — 120 seconds, depending on the severity of the driving condition.
2. Avoid sudden racing or acceleration immediately after starting a cold engine.
3. If the engine is run with the air cleaner removed, foreign material entering will damage the wheels which run at extremely high speed.
4. If the turbocharger is defective and must be replaced, first check for the cause of the defect in reference to the following items and replace parts if necessary:
   - Engine oil level and quality
   - Conditions under which the turbocharger was used
   - Oil lines leading to the turbocharger

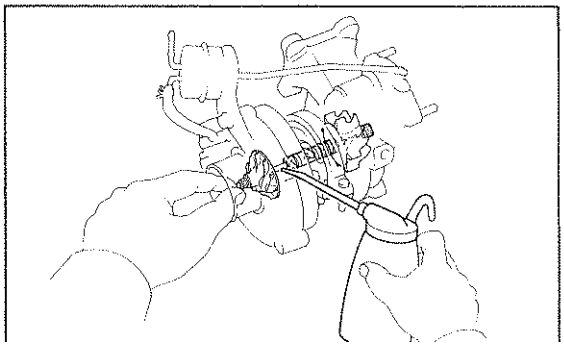


TC0054

5. Use caution when removing and reinstalling the turbocharger assembly. Do not drop it or bang it against anything or grasp it by easily-deformed parts, such as the actuator or rod, when moving it.
6. Before removing the turbocharger, plug the intake and exhaust ports and oil inlet to prevent entry of dirt or other foreign material.


TC0058

7. If replacing the turbocharger, check for accumulation of sludge particles in the oil pipes, and if necessary, replace the oil pipes.
8. Completely remove the gasket adhered to the lubrication oil pipe flange and turbocharger oil flange.
9. If replacing bolts or nuts, do so only with the specified new ones to guard against breakage or deformation.



10. If replacing the turbocharger, put 20 cc (1.2 cu in.) of oil into the turbocharger oil inlet and turn the impeller wheel by hand to spread oil to the bearing.
11. If overhauling or replacing the engine, cut the fuel supply after reassembly and crank the engine for 30 seconds to distribute oil to throughout the engine. Then allow the engine to idle for 60 seconds.

TROUBLESHOOTING

HINT: Before troubleshooting the turbocharger, first check the engine itself. (valve clearance, engine compression, ignition timing etc.)

INSUFFICIENT ACCELERATION, LACK OF POWER OR EXCESSIVE FUEL CONSUMPTION

(Possible Cause)	(Check Procedure and Correction Method)
1. TURBOCHARGING PRESSURE TOO LOW	Check turbocharging pressure. (See page TC-8) **Turbocharging pressure:** **53 — 81 kPa** **(0.54 — 0.83 kgf/cm^2, 7.8 — 11.8 psi)** If the pressure is below specification, begin diagnosis from item 2.
2. RESTRICTED INTAKE AIR SYSTEM	Check intake air system, and repair or replace parts as necessary. (See page TC-8)
3. LEAK IN INTAKE AIR SYSTEM	Check intake air system, and repair or replace parts as necessary. (See page TC-8)
4. RESTRICTED EXHAUST SYSTEM	Check exhaust system, and repair or replace parts as necessary. (See page TC-8)
5. LEAK IN EXHAUST SYSTEM	Check exhaust system, and repair or replace parts as necessary. (See page TC-8)
6. ERRATIC TURBOCHARGER OPERATION	Check rotation of impeller wheel. If it does not turn or turns with a heavy drag, replace the turbocharger assembly. Check axial and radial plays of impeller wheel. (See page TC-16) **Axial play: 0.13 mm (0.0051 in.) or less** **Radial play: 0.18 mm (0.0071 in.) or less** If not within specification, replace the turbocharger assembly.

ABNORMAL NOISE

(Possible Cause)	(Check Procedure and Correction Method)
1. TURBOCHARGING HEAT INSULATOR RESONNANCE	Check for loose, improperly installed or deformed insulator mount bolts, and repair or replace as necessary.
2. EXHAUST PIPE LEAKING OR VIBRATING	Check for deformed exhaust pipe, loose mount bolts or damaged gasket, and repair or replace as necessary.
3. ERRATIC TURBOCHARGER OPERATION	Refer to item 6 of INSUFFICIENT ACCELERATION, LACK OF POWER OR EXCESSIVE FUEL CONSUMPTION.

EXCESSIVE OIL CONSUMPTION OR WHITE EXHAUST

(Possible Cause)	(Check Procedure and Correction Method)
FAULTY TURBOCHARGER SEAL	Check for oil leakage in exhaust system. • Remove the turbine elbow from the turbocharger and check for excessive carbon deposits on the turbine wheel. Excessive carbon deposits indicated a faulty turbocharger. Check for oil leakage in intake air system. • Check for axial and radial plays in impeller wheel, and replace the turbocharger, if necessary. (See page TC-16) **Axial play: 0.13 mm (0.0051 in.) or less** **Radial play: 0.18 mm (0.0071 in.) or less** **NOTICE: There is some oil mist from the PCV in the blowby gas so care must be taken not to diagnosis this as an oil leakage from the turbocharger.**

TURBOCHARGER

ON-VEHICLE INSPECTION OF TURBOCHARGER

1. INSPECT INTAKE AIR SYSTEM

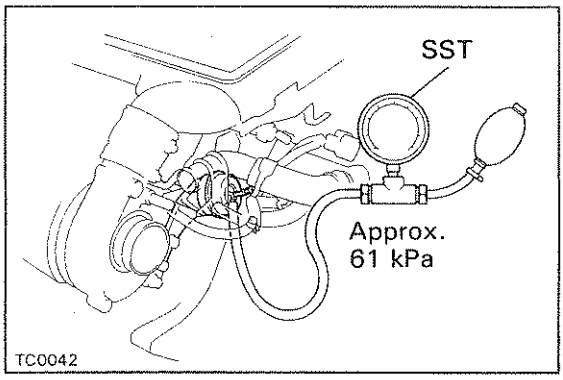
Check for leakage or clogging between the air cleaner and turbocharger inlet and between the turbocharger outlet and cylinder head.

- Clogged air cleaner ..... Clean or replace element
- Hoses collapsed or deformed ..... Repair or replace
- Leakage from connections ..... Check each connection and repair
- Cracks in components ..... Check and replace

2. INSPECT EXHAUST SYSTEM

Check for leakage or clogging between the cylinder head and turbocharger inlet and between the turbocharger outlet and exhaust pipe.

- Deformed components ..... Repair or replace
- Foreign material in passages ..... Remove
- Leakage from components ..... Repair or replace
- Cracks in components ..... Check and replace



3. INSPECT ACTUATOR OPERATION

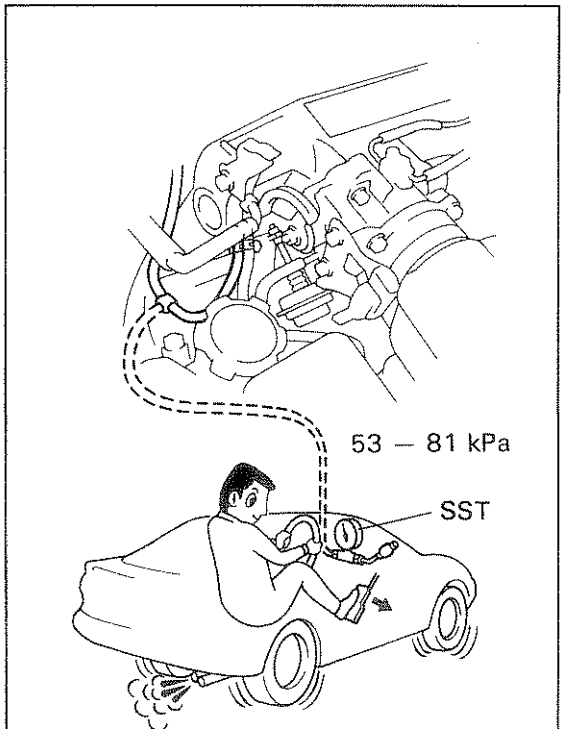
(a) Disconnect the actuator hose.

(b) Using SST (turbocharger pressure gauge), apply approx. 61 kPa (0.62 kgf/cm^2, 8.9 psi) of pressure to the actuator and check that the rod moves.

If the rod does not move, replace the turbocharger assembly.

SST 09992-00241

NOTICE: Never apply more than 98 kPa (1.0 kgf/cm^2, 14.3 psi) of pressure to the actuator.



4. CHECK TURBOCHARGING PRESSURE

(a) Using a 3-way connector, connect SST (turbocharger pressure gauge) to the hose leading to the intake manifold.

SST 09992-00241

(b) While driving with the engine running at 2,800 rpm or more with the throttle valve fully open in the 4th gear, check the turbocharging pressure.

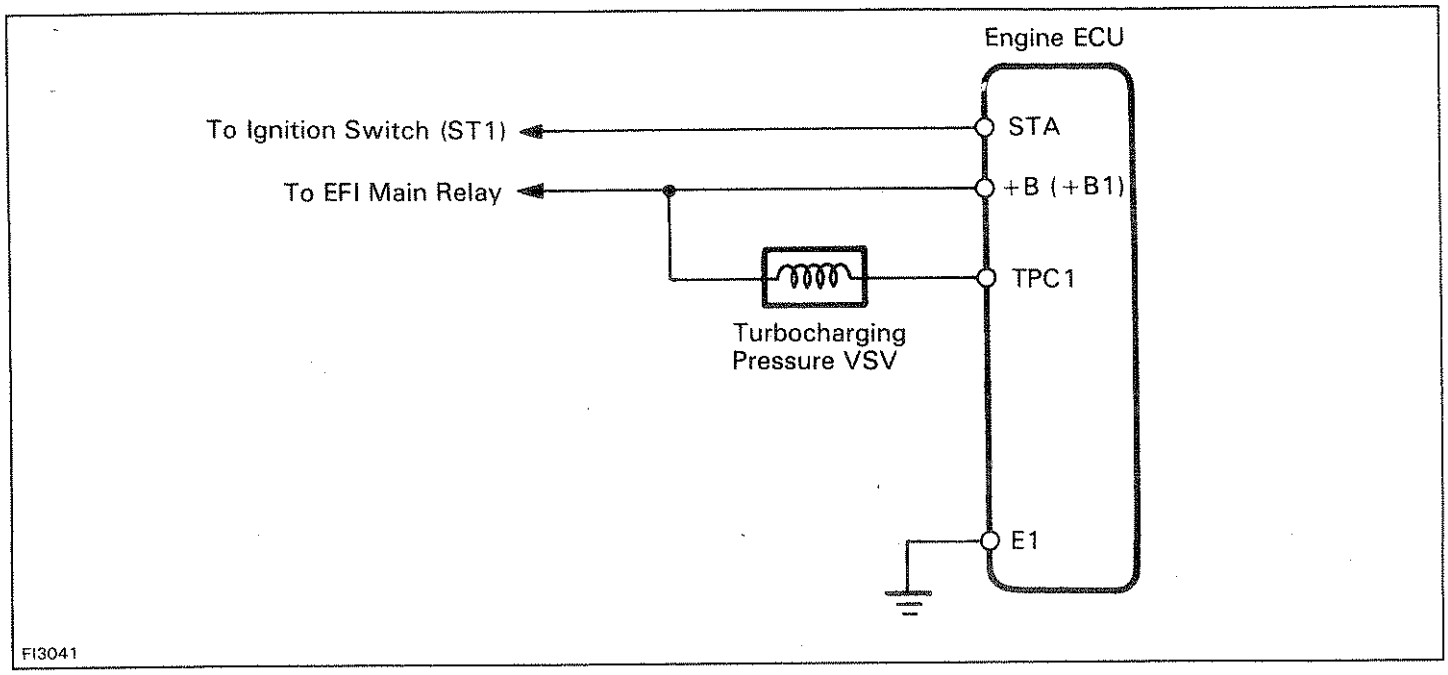
Standard pressure: 53 — 81 kPa (0.54 — 0.83 kgf/cm^2, 7.8 — 11.8 psi)

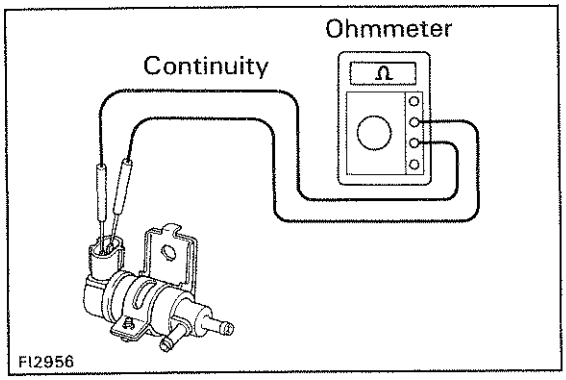
If the pressure is less than that specified, check the intake air and exhaust systems for leakage. If there is no leakage, replace the turbocharger assembly.

If the pressure is above specification, check if the actuator hose is disconnected or cracked. If not, replace the turbocharger assembly.

5. **INSPECT IMPELLER WHEEL ROTATION**
(See step 1 on page TC-16)

6. **INSPECT TURBOCHARGING PRESSURE VSV**

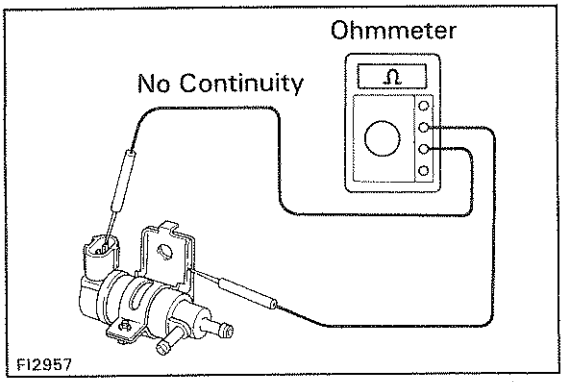




(a) Using an ohmmeter, check that there is continuity between the terminals.

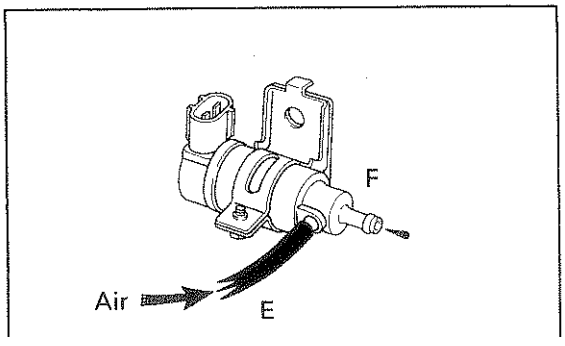
Resistance (Cold): 24 — 30 Ω

If there is no continuity, replace the VSV.



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

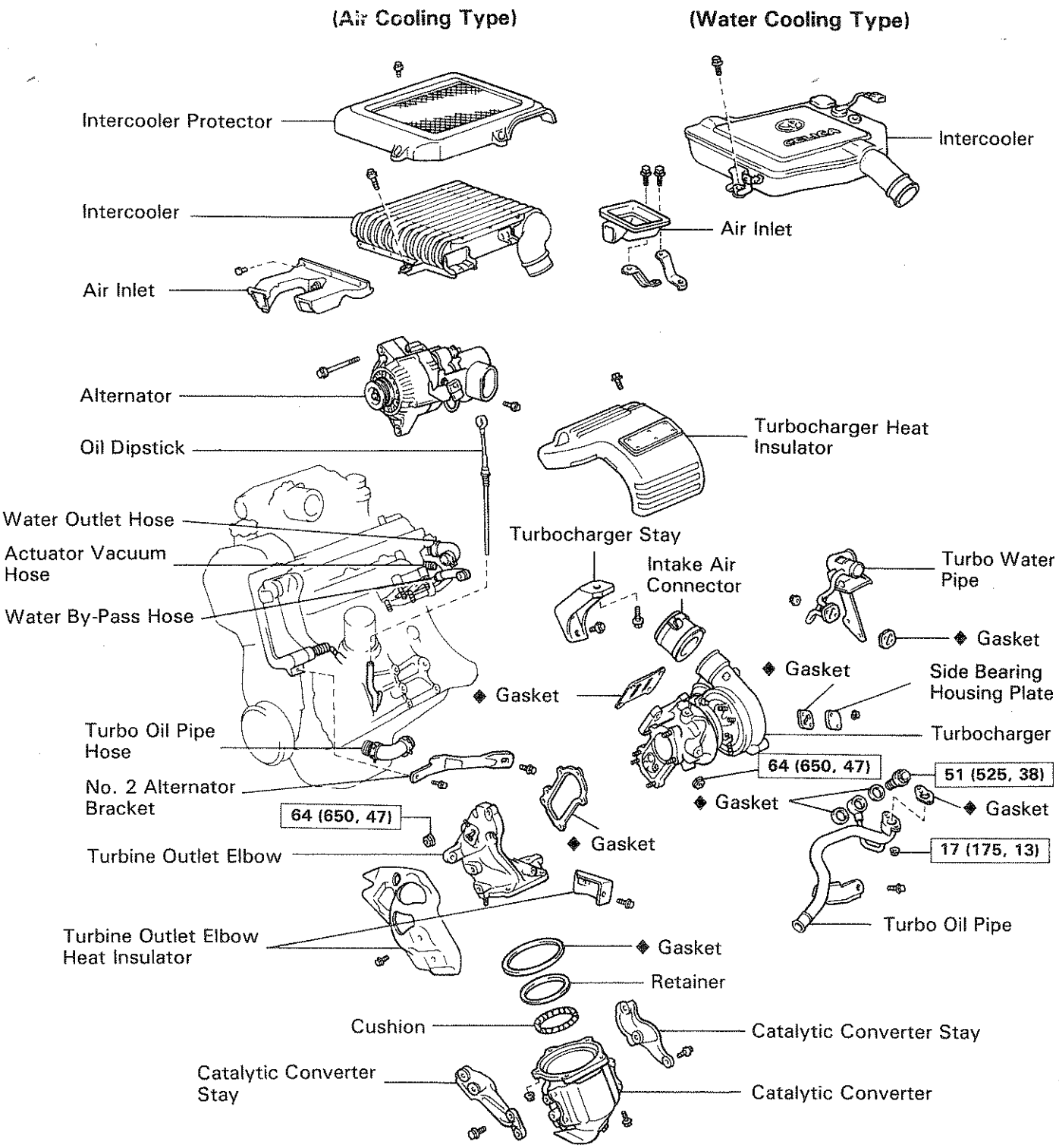
If there is continuity, replace the VSV.



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

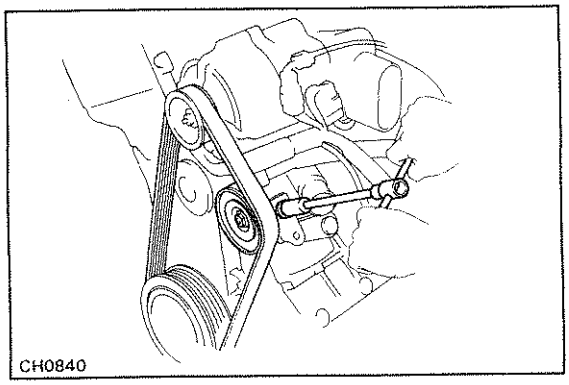
7. **INSPECT TURBOCHARGING PRESSURE SENSOR**
(See page FI-42)

COMPONENTS



N·m (kgf·cm, ft·lbf) : Specified torque

P03258

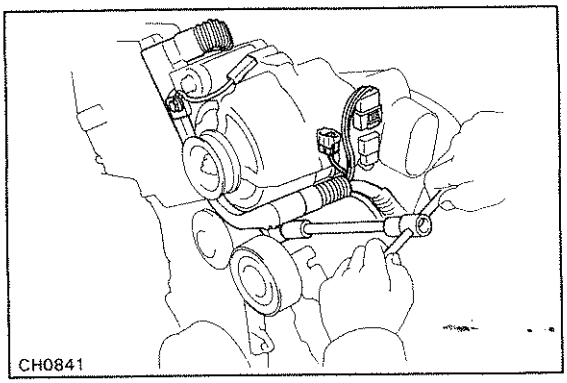

CH0840

REMOVAL OF TURBOCHARGER

1. DRAIN ENGINE COOLANT

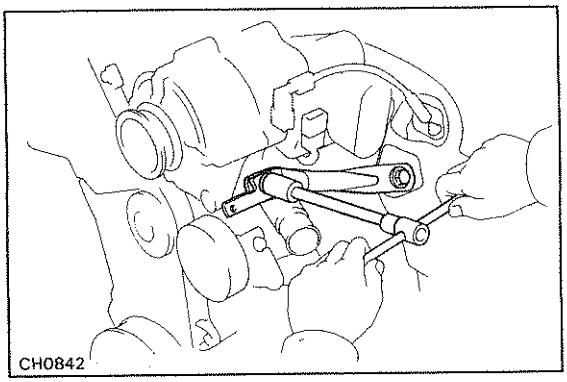
2. REMOVE ALTERNATOR

(a) Loosen the idler pulley bolt and adjusting bolt, and remove the drive belt.

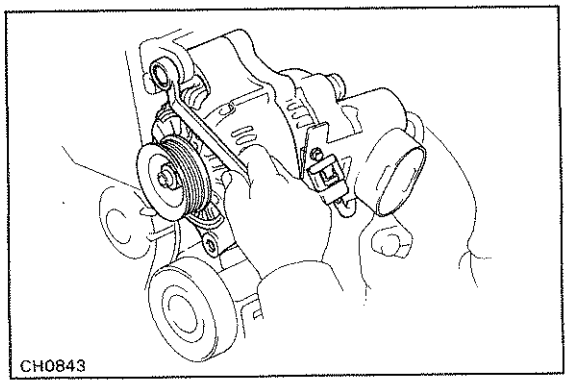

CH0841

(b) Disconnect the alternator connector from the lead wire.

(c) Remove the two bolts, disconnect the engine wire from the brackets.


CH0842

(d) Remove the two bolts and No.2 alternator bracket.

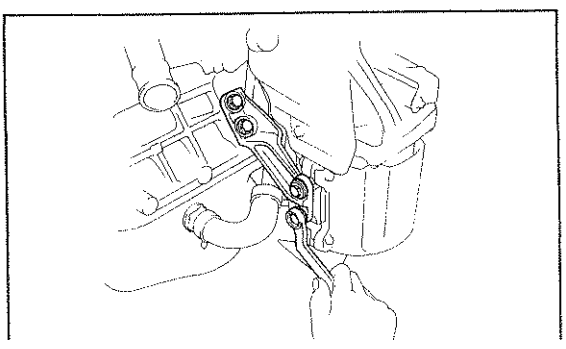

CH0843

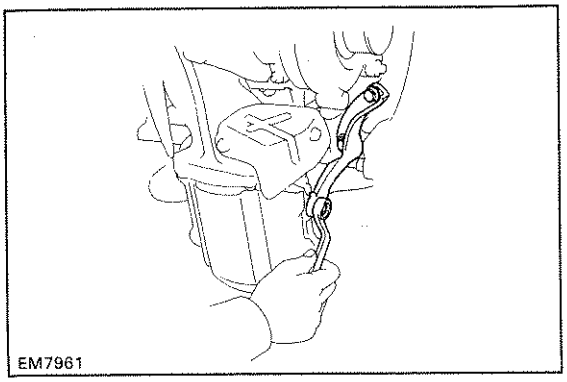
(e) Remove the nut, and disconnect the alternator wire.

(f) Remove the two bolts and alternator.

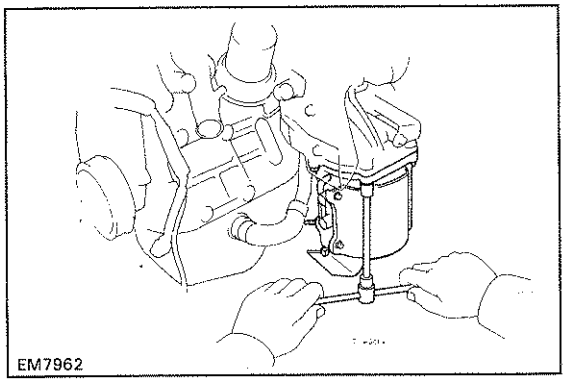
3. REMOVE CATALYTIC CONVERTER

(a) Remove the four bolts and RH converter stay.

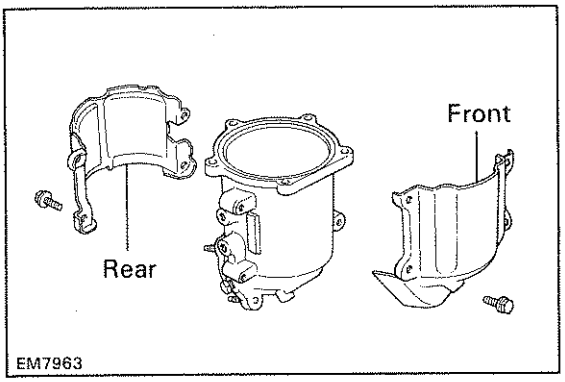



EM7961

(b) Remove the three bolts and LH converter stay.


EM7962

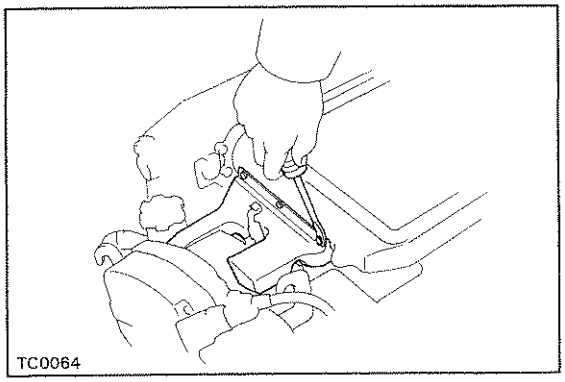
(c) Remove the three bolts, two nuts, catalytic converter. Remove the gasket, retainer and cushion.



EM7963

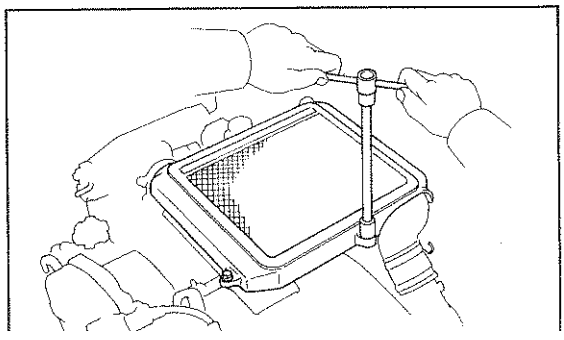
(d) Remove the five bolts and front heat insulator.

(e) Remove the four bolts and rear heat insulator.


TC0064

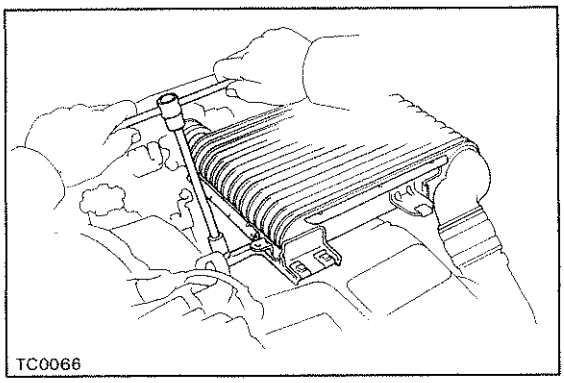
4. **REMOVE AIR INLET (Air Cooling Type)**

Using a clip remover, remove the seven clips and air inlet.

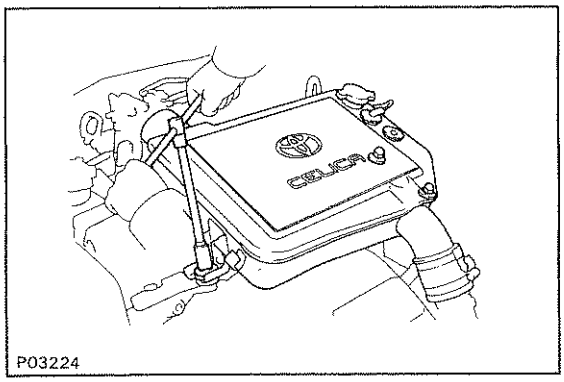


5. **REMOVE INTERCOOLER COOL COVER (Air Cooling Type)**

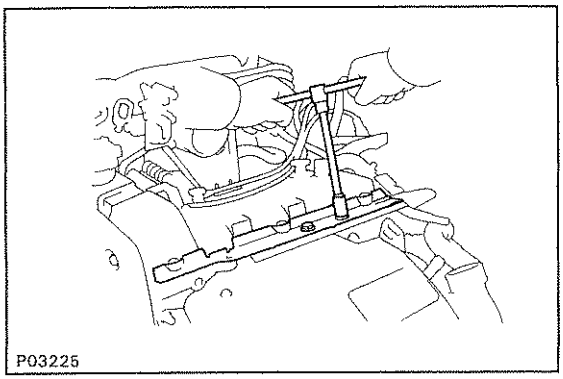
Remove the three bolts and intercooler cover.


TC0066

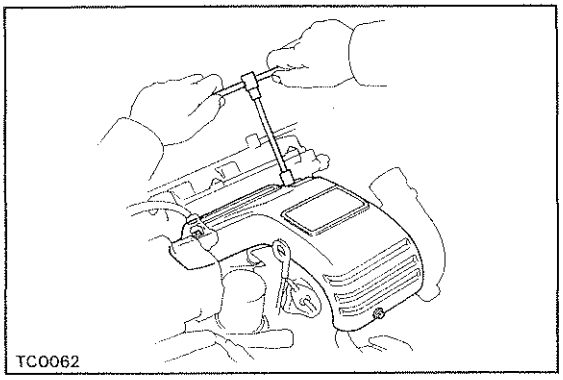
6. **REMOVE INTERCOOLER**
(Air Cooling Type)
(a) Remove the two bolts.
(b) Disconnect the intercooler from the turbocharger and intake air connector, and remove the intercooler and air hose.


P03224

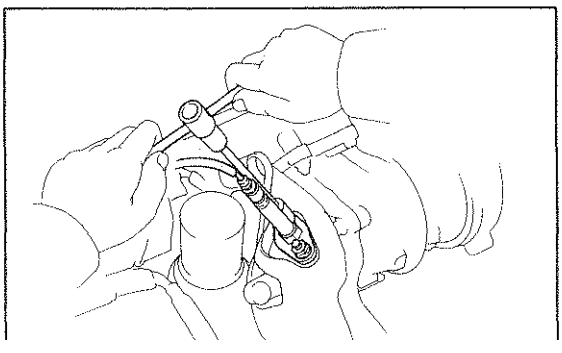
(Water Cooling Type)
(a) Remove the three bolts.
(b) Disconnect the intercooler from the turbocharger and intake air connector, and remove the intercooler and air hose.


P03225

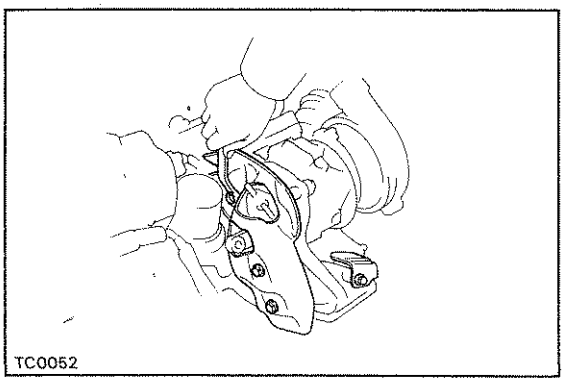
7. **REMOVE INTERCOOLER HEAT INSULATOR**
Remove the two bolts and heat insulator.


TC0062

8. **REMOVE TURBOCHARGER HEAT INSULATOR**
Remove the three bolts and heat insulator.



9. **REMOVE OXYGEN SENSOR**
(a) Disconnect the oxygen sensor connector.
(b) Remove the two nuts, oxygen sensor and gasket.

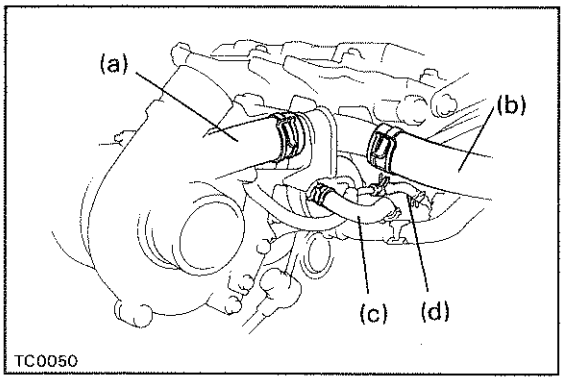

TC0052

10. REMOVE HEAT INSULATORS OF TURBINE OUTLET ELBOW

(a) Remove the oil dipstick.

(b) Remove the three bolts and RH heat insulator.

(c) Remove the two bolts and LH heat insulator.



TC0050

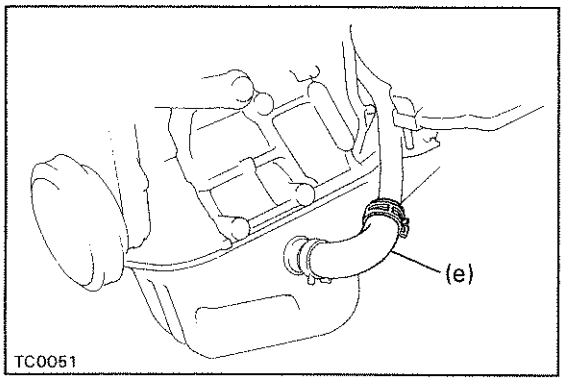
11. DISCONNECT HOSES

(a) Water hose from radiator

(b) Water hose from water inlet

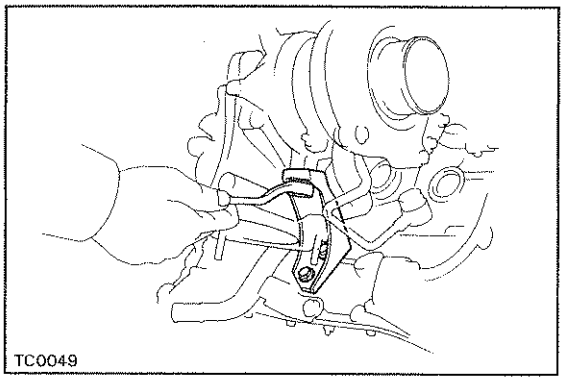
(c) Water by-pass hose from turbo water pipe

(d) Vacuum hose from actuator



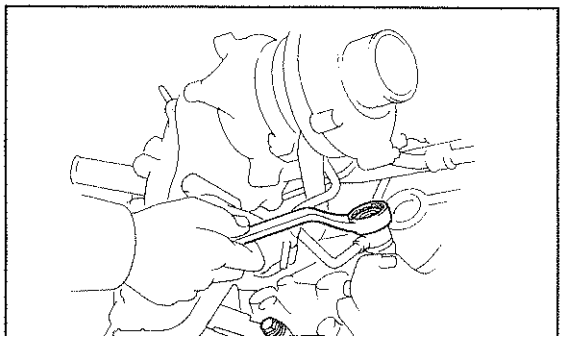
TC0051

(e) Oil hose from turbo oil pipe


TC0049

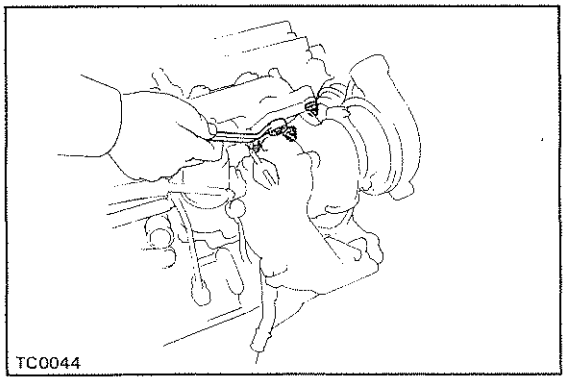
12. REMOVE TURBOCHARGER STAY

Remove the three bolts and turbocharger stay.

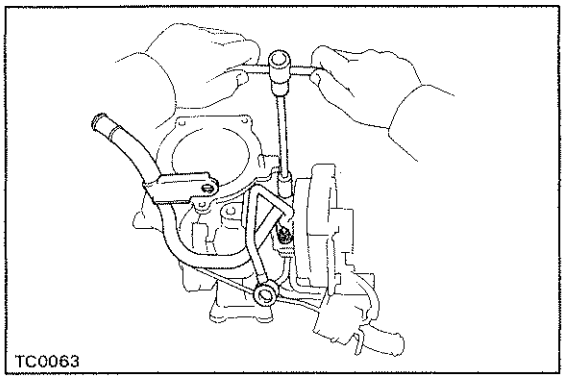


13. REMOVE TURBOCHARGER

(a) Remove the bolt and union bolt holding the No.1 turbo oil pipe to the cylinder block. Remove the two union bolt gaskets

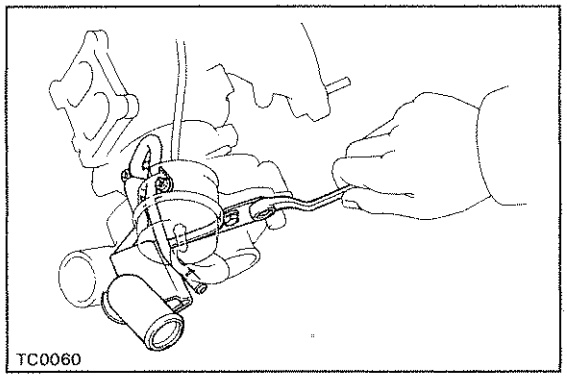

TC0044

(b) Remove the four nuts, turbocharger and gasket.


TC0063

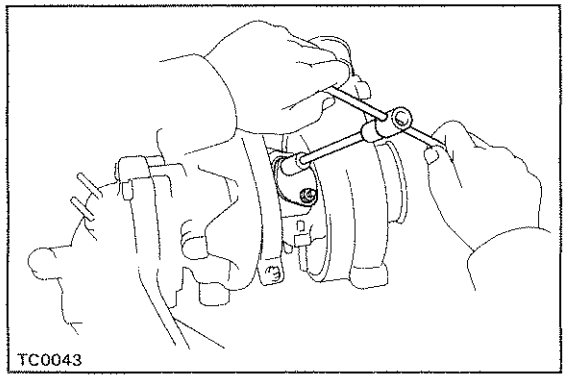
14. **REMOVE TURBO OIL PIPE**

Remove the two nuts, oil pipe and gasket.


TC0060

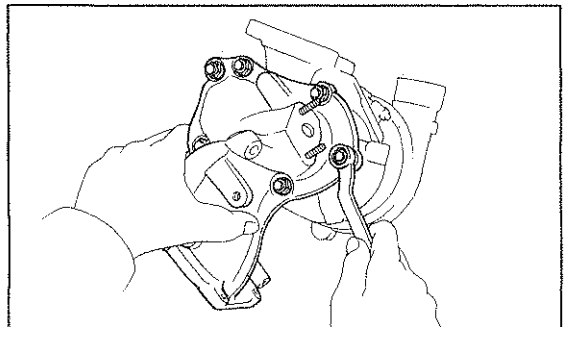
15. **REMOVE TURBO WATER PIPE**

Remove the two nuts, two bolts, water pipe and gasket.


TC0043

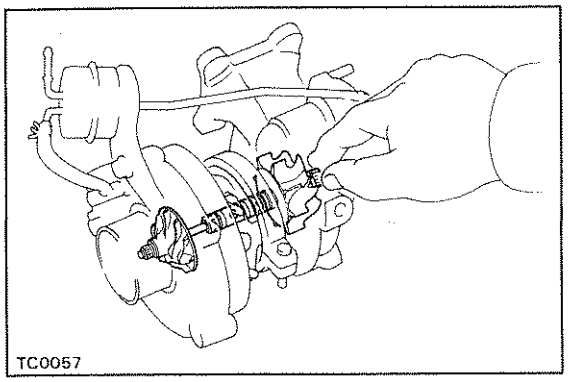
16. **REMOVE SIDE BEARING HOUSING PLATE**

Remove the two nuts, housing plate and gasket.



17. **REMOVE TURBINE OUTLET ELBOW**

Remove the six nuts, outlet elbow and gasket.

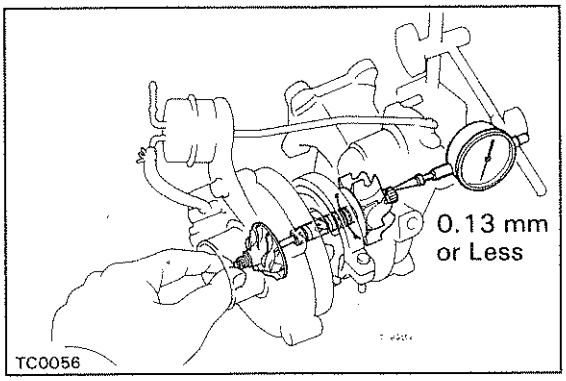

TC0057

INSPECTION OF TURBOCHARGER

1. INSPECT IMPELLER WHEEL ROTATION

Grasp the edge of the turbine wheel and turn it. Check that the impeller wheel turns smoothly.

If the impeller wheel does not turn or if it turns with a drag, replace the turbocharger assembly.



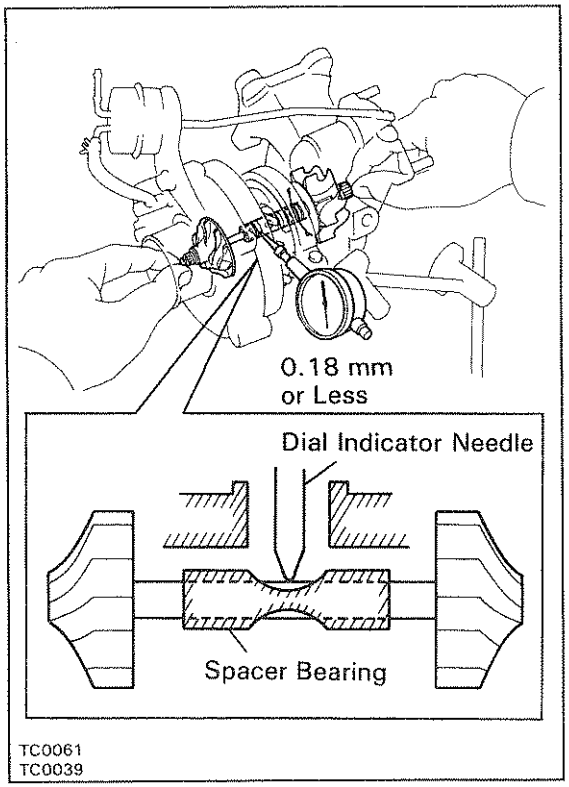
TC0056

2. INSPECT AXIAL PLAY OF IMPELLER WHEEL

Insert a dial indicator into the intake side hole the turbine wheel edge by and check the axial play.

Standard clearance: 0.13 mm (0.0051 in.) or less

If the axial play is not as specified, replace the turbocharger assembly.



TC0061
TC0039

3. INSPECT RADIAL PLAY OF IMPELLER WHEEL

(a) From oil outlet hole, insert a dial indicator through the hole in the spacer bearing and set it in the center of the impeller shaft.

(b) Move the impeller shaft in a radial directio, measure the radial play of the impeller shaft.

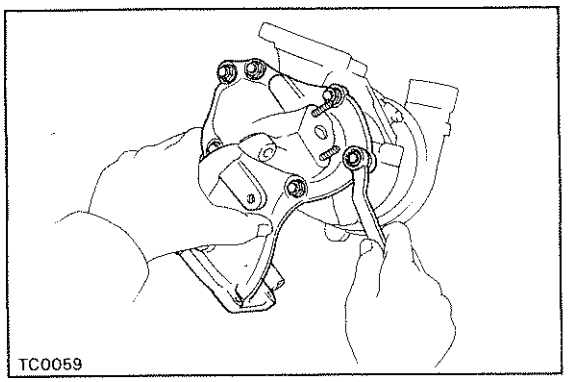
Standard clearance: 0.18 mm (0.0071 in.) or less

If the radial play is not as specified, replace the turbocharger assembly.

INSTALLATION OF TURBOCHARGER

(See page TC-10)

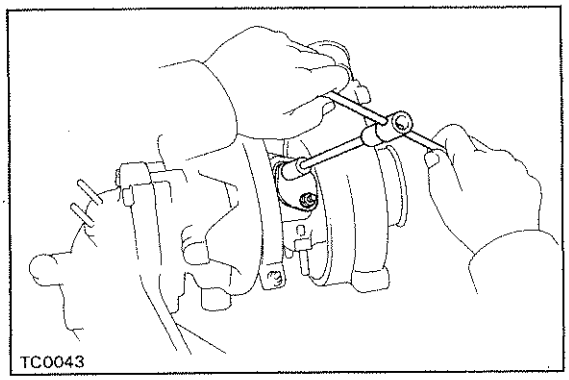
NOTICE: After replacing the turbocharger assembly, for approx. 20 cc (1.2 cu in.) of new oil into the oil inlet and turn the impeller wheel by hand to splash oil on the bearing.



1. **INSTALL TURBINE OUTLET ELBOW**

   Install a new gasket and the outlet elbow with the six nuts.

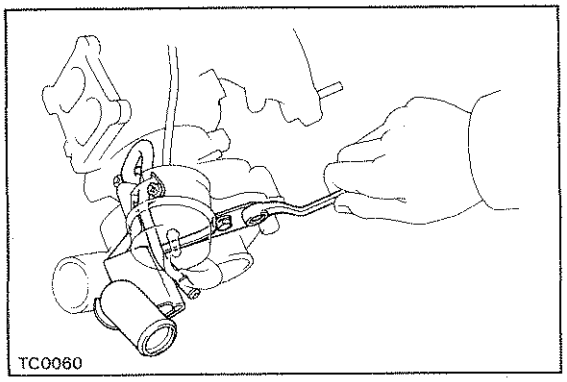
   Torque: 64 N·m (650 kgf·cm, 47 ft·lbf)



2. **INSTALL SIDE BEARING HOUSING PLATE**

   Install a new gasket and the housing plate with the two nuts.

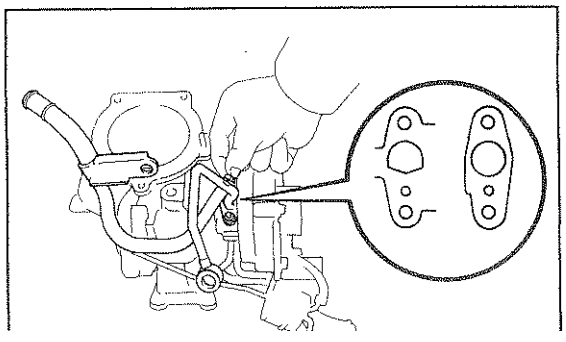
   Torque: 11 N·m (120 kgf·cm, 9 ft·lbf)



3. **INSTALL TURBO WATER PIPE**

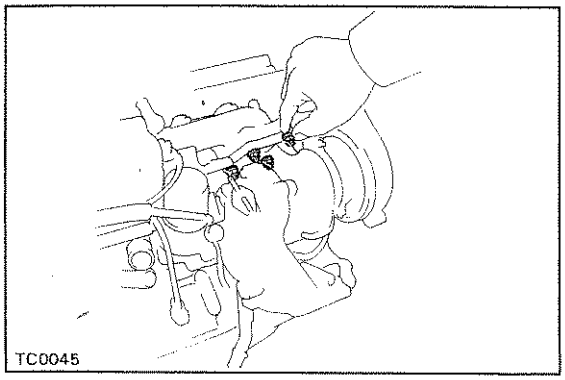
   Install a new gasket and the water pipe with the two nuts and two bolts.

   Torque: 11 N·m (120 kgf·cm, 9 ft·lbf)



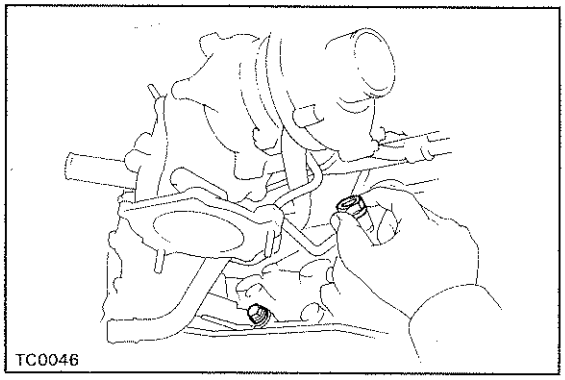
4. **INSTALL TURBO OIL PIPE**

   Install a new gasket and the oil pipe with the two nuts. Do not torque the nuts yet.

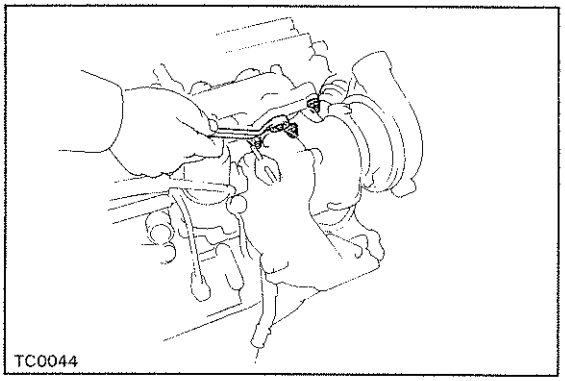

TC0045

5. INSTALL TURBOCHARGER

(a) Install a new gasket and the turbocharger with the four nuts. Do not torque the nuts.

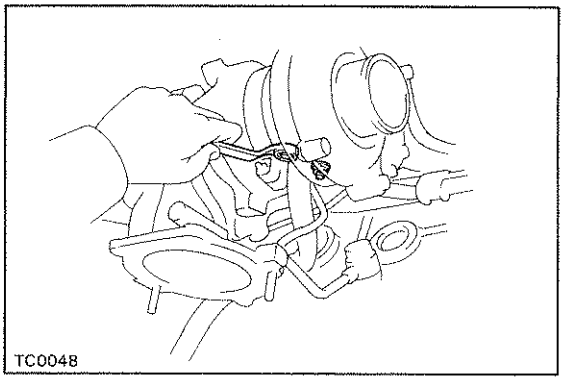

TC0046

(b) Install the oil pipe with the bolt, two new gaskets and union bolt. Do not torque the bolt and union bolt.


TC0044

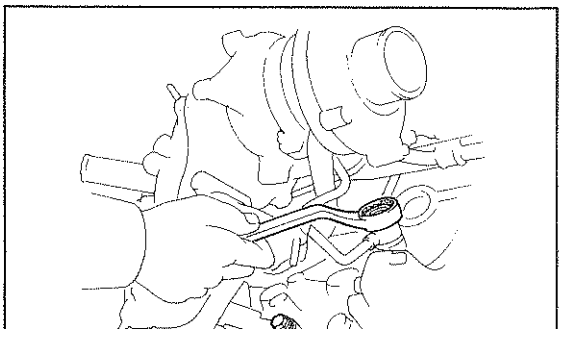
(c) Tighten the four nuts holding the turbocharger to the exhaust manifold.

Torque: 64 N·m (650 kgf·cm, 47 ft·lbf)


TC0048

(d) Tighten the two nuts holding the oil pipe to the turbocharger.

Torque: 17 N·m (175 kgf·cm, 13 ft·lbf)

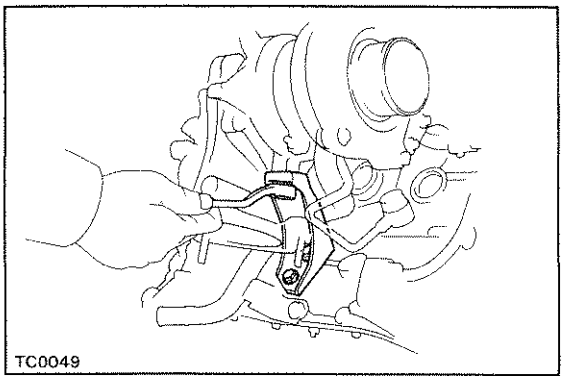


(e) Tighten the union bolt holding the oil pipe to the cylinder block.

Torque: 51 N·m (525 kgf·cm, 38 ft·lbf)

(f) Tighten the bolt holding the oil pipe to the cylinder block.

Torque: 43 N·m (440 kgf·cm, 32 ft·lbf)

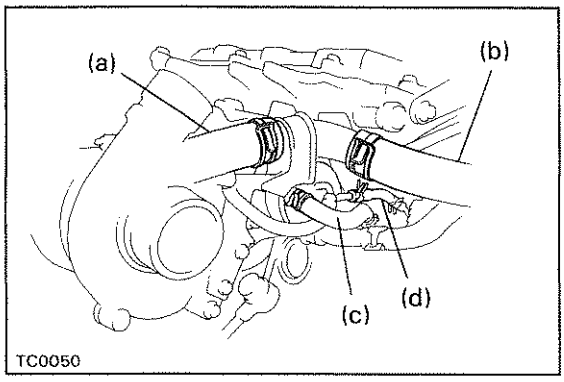

TC0049

6. **INSTALL TURBOCHARGER STAY**

Install the turbocharger stay with the three bolts.

Torque:

To turbocharger	**69 N·m (705 kgf·cm, 51 ft·lbf)**
To cylinder block	**59 N·m (600 kgf·cm, 43 ft·lbf)**



TC0050

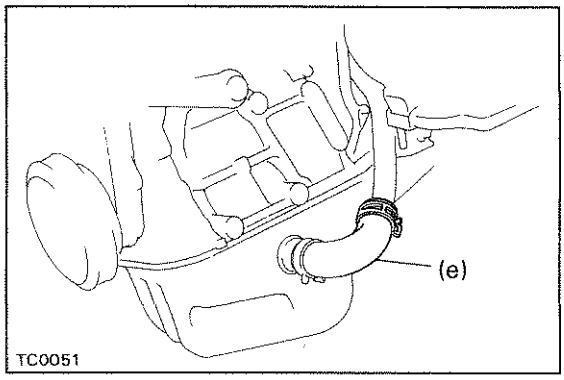
7. **CONNECT HOSES**

(a) Water hose from radiator

(b) Water hose from water inlet

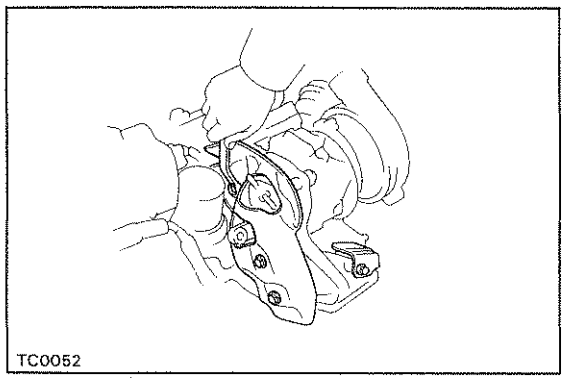
(c) Water by-pass hose from turbo water pipe

(d) Vacuum hose from actuator



TC0051

(e) Oil hose from turbo oil pipe

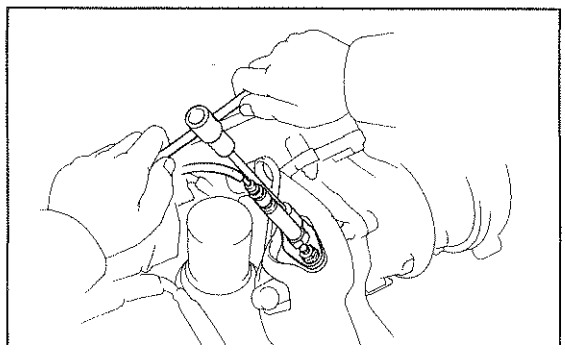

TC0052

8. **INSTALL HEAT INSULATOR OF TURBINE OUTLET ELBOW**

(a) Install the RH heat insulator with the three bolt.

(b) Install the LH heat insulator with the two bolt.

(c) Install the oil dipstick gauge.

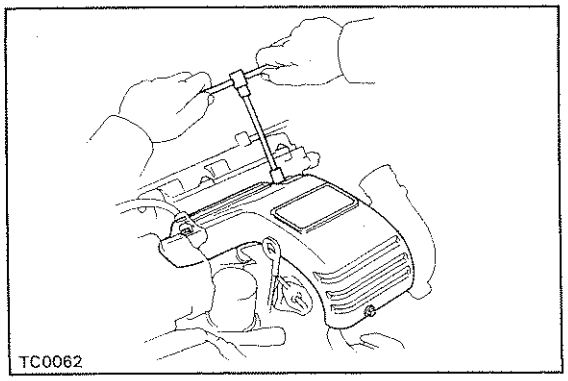


9. **INSTALL OXYGEN SENSOR**

(a) Install a new gaskets and the oxygen sensor with the two nuts.

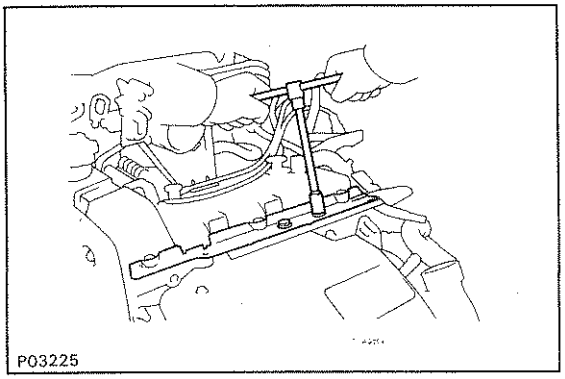
Torque: 44 N·m (450 kgf·cm, 33 ft·lbf)

(b) Connect the oxygen sensor connector.


TC0062

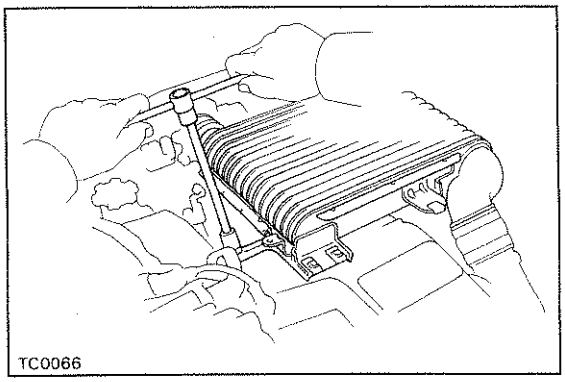
10. INSTALL TURBOCHARGER HEAT INSULATOR

Install the heat insulator with the three bolt.


P03225

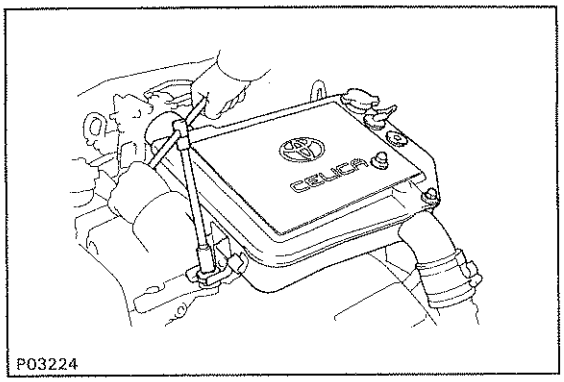
11. INSTALL INTERCOOLER HEAT INSULATOR

Install the heat insulator with two bolts.


TC0066

12. INSTALL INTERCOOLER (Air Cooling Type)

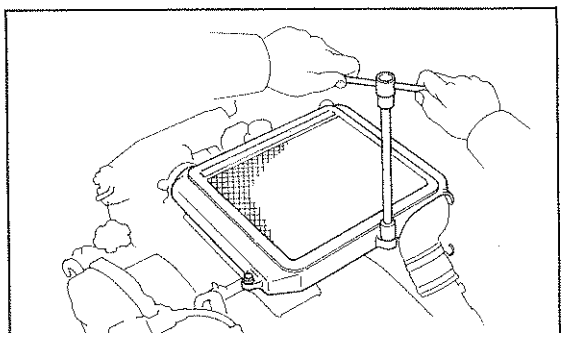
Connect the intercooler to the turbocharger and intake air connector, and install the intercooler with the two bolts.



P03224

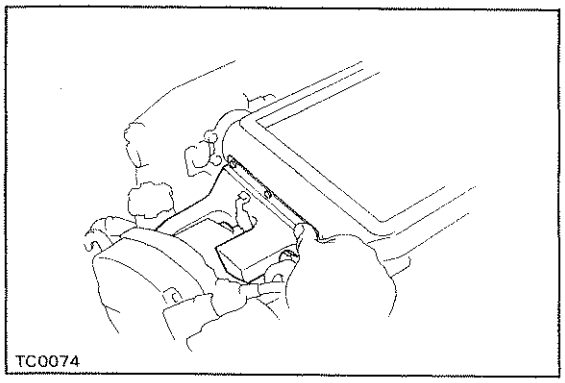
(Water Cooling Type)

Connect the intercooler to the turbocharger and intake air connector, and install the intercooler with the three bolts.



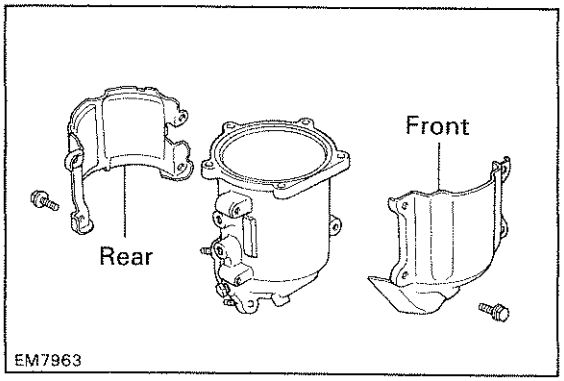
13. INSTALL INTERCOOLER COVER (Air Cooling Type)

Install the intercooler with the three bolt.


TC0074

14. **INSTALL AIR INLET (Air Cooling Type)**

Install the cool air inlet with the seven clips.

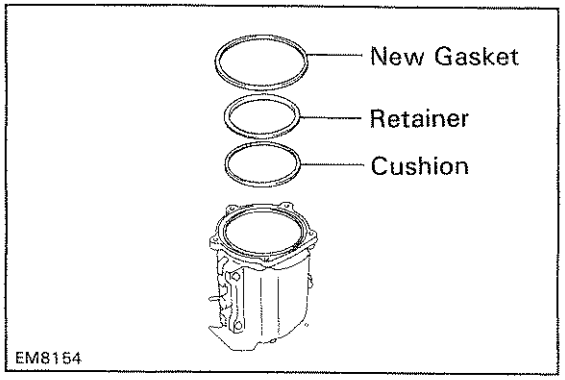


EM7963

15. **INSTALL CATALYTIC CONVERTER**

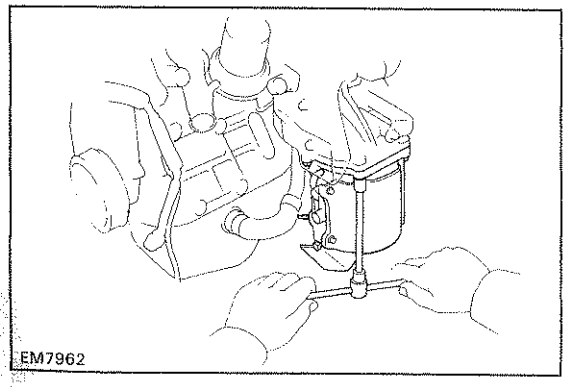
(a) Install the front heat insulator with the five bolts.

(b) Install the rear heat insulator with the four bolts.



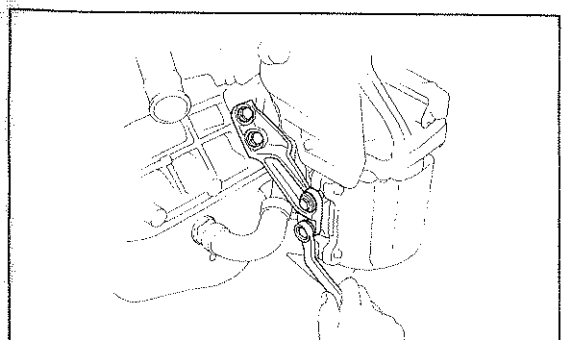
EM8154

(c) Place the cushion, retainer and new gasket on the catalytic converter.


EM7962

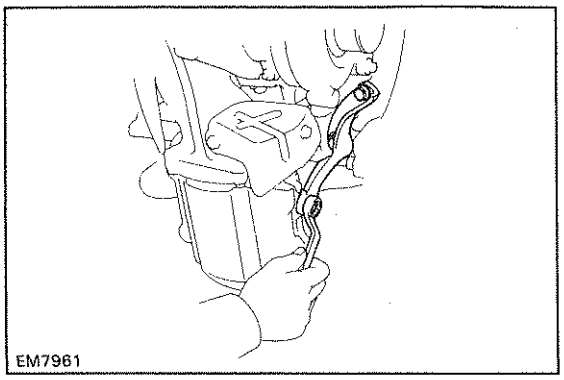
(d) Install the catalytic converter with the three bolts and two nuts.

Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)



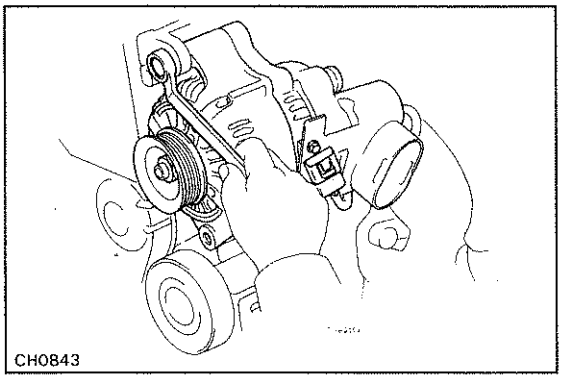
(e) Install the RH converter stay with the four bolts.

Torque: 59 N·m (600 kgf·cm, 43 ft·lbf)


EM7961

(f) Install the LH converter stay with the three bolts.

Torque: 59 N·m (600 kgf·cm, 43 ft·lbf)


CH0843

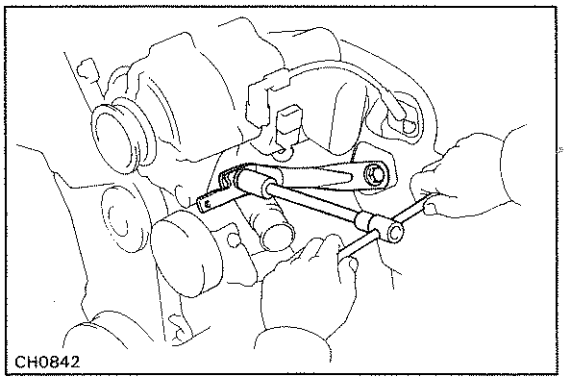
16. INSTALL ALTERNATOR

(a) Install the alternator with the two bolts.

Torque:

12 mm head bolt	**19 N·m (195 kgf·cm, 14 ft·lbf)**
14 mm head bolt	**52 N·m (530 kgf·cm, 38 ft·lbf)**

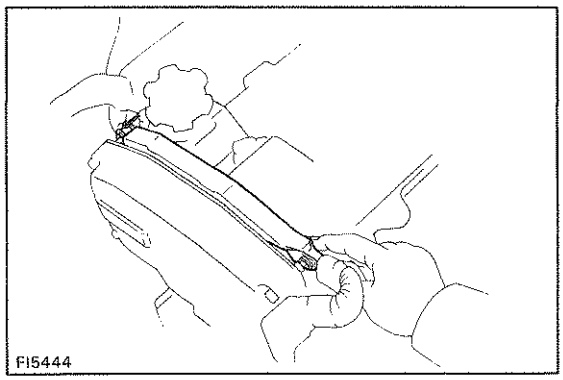
(b) Connect the alternator wire with the nut.


CH0842

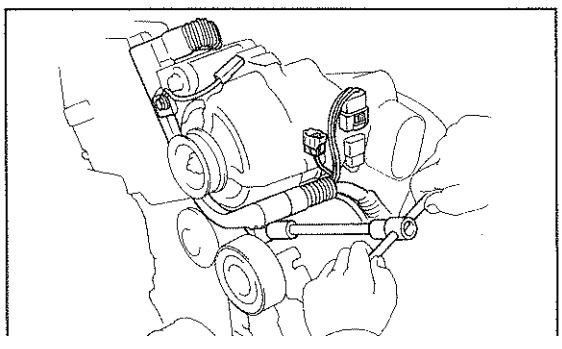
(c) Install the No.2 alternator bracket with the two bolts.

Torque:

To turbine outlet elbow
43 N·m (440 kgf·cm, 32 ft·lbf)
To No.1 alternator bracket
39 N·m (400 kgf·cm, 29 ft·lbf)


FI5444

(d) Install the two clamps of the engine wire to each No.2 timing belt cover bolt.



(e) Install the engine wire with the two bolts.

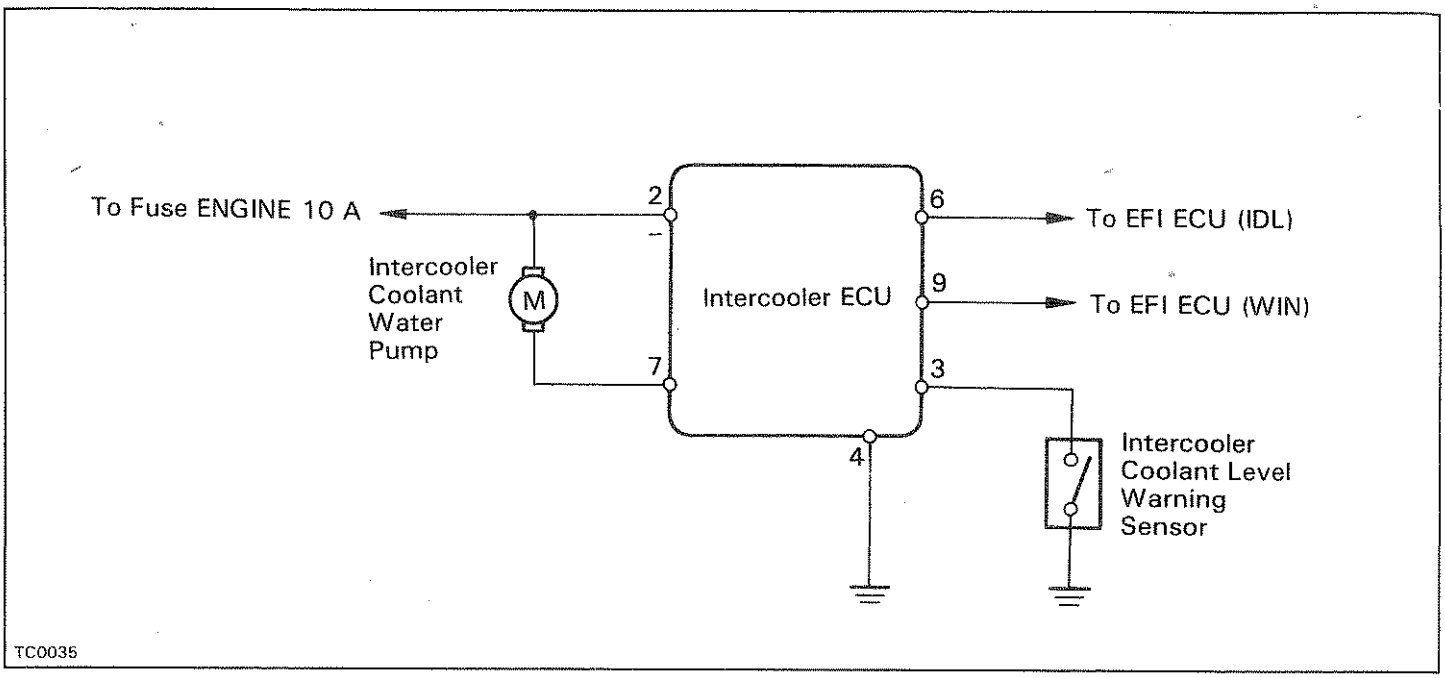
(f) Connect the alternator connector to the lead wire.

(g) Install the drive belt.

17. FILL ENGINE WITH COOLANT
18. START ENGINE AND CHECK FOR LEAKS
19. CHECK ENGINE OIL LEVEL

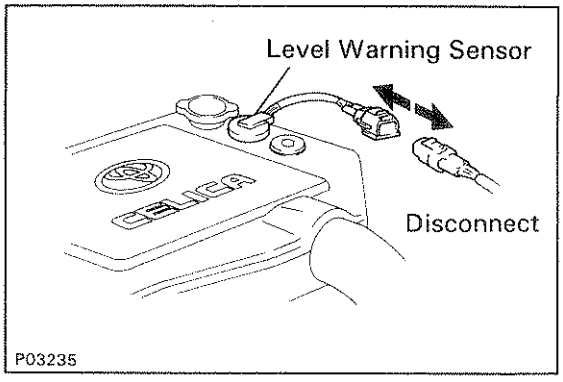
INTERCOOLER (Water Cooling Type)

SYSTEM CIRCUIT

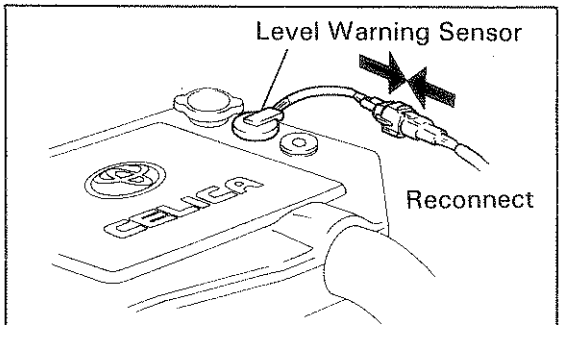


ON-VEHICLE INSPECTION OF INTERCOOLER

1. **INSPECT OPERATION OF CHECK ENGINE WARNING LIGHT**
   (a) Turn the ignition switch ON.
   (b) Check that the warning light comes on.
   (c) When the engine is started, check that the warning light goes out.



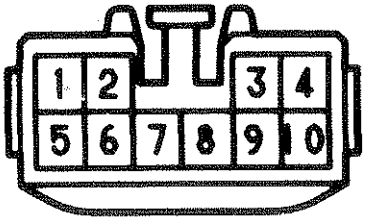
   (d) Disconnect the intercooler coolant level warning sensor connector.
   (e) Check that the warning light does not light up.
   (f) Open the throttle valve, and check that the warning light comes on after approx. 20 seconds.



   (g) Reconnect the intercooler coolant level warning sensor connector.
   (h) Check that the warning light goes out.

2. **INSPECT OPERATION OF INTERCOOLER WATER PUMP**
   (a) Turn the ignition switch ON and engine running.
   (b) Open the throttle valve, and check that the water pump rotates.
   (c) When the throttle valve is closed, check that the

Wiring Harness Side



e-10-1

INSPECTION OF INTERCOOLER ECU CIRCUIT

INSPECT INTERCOOLER ECU FOR CIRCUIT

LOCATION (ECU): Under the instrument panel on the passenger side.

Disconnect the connector from the intercooler ECU, and check the connector on the wiring harness side as shown in the chart below.

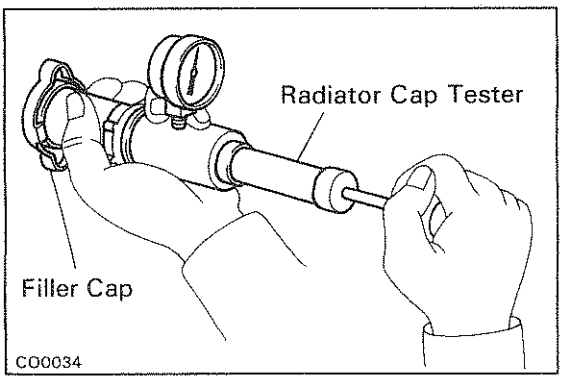
Check for	Tester connection	Condition	Specified value
Continuity	4 — Ground	—	Continuity
Voltage	7 — Ground	Ignition S/W ON	Battery voltage
	2 — Ground		
Continuity	3 — Ground	Level warning sensor ON (float up)	Continuity
		Level warning sensor OFF (float down)	No continuity

CLEANING OF INTERCOOLER RADIATOR

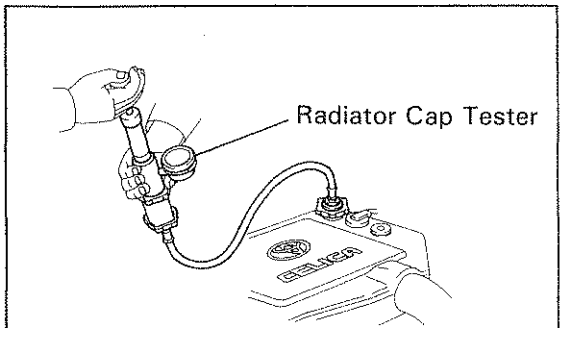
Using water or a steam cleaner, remove any mud and dirt from the radiator core.

CAUTION: If using a high pressure type cleaner, be careful not to deform the fins of the radiator core. If the cleaner nozzle pressure is 2,942 — 3,432 kPa (30 — 35 kgf/cm^2, 427 — 498 psi), keep a distance of at least 40 — 50 cm (15.75 — 19.69 in.) between the radiator core and cleaner nozzle.

INSPECTION OF INTERCOOLER RADIATOR



CO0034



1. INSPECT INTERCOOLER COOLANT FILLER CAP

Using a radiator cap tester, pump the tester and measure the relief valve opening pressure.

Standard opening pressure:
74 — 103 kPa
(0.75 — 1.05 kgf/cm^2, 10.7 — 14.9 psi)

Minimum opening pressure:
59 kPa (0.6 kgf/cm^2, 85 psi)

If the opening pressure is less than minimum, replace the filler cap.

2. INSPECT INTERCOOLER COOLING SYSTEM FOR LEAKS

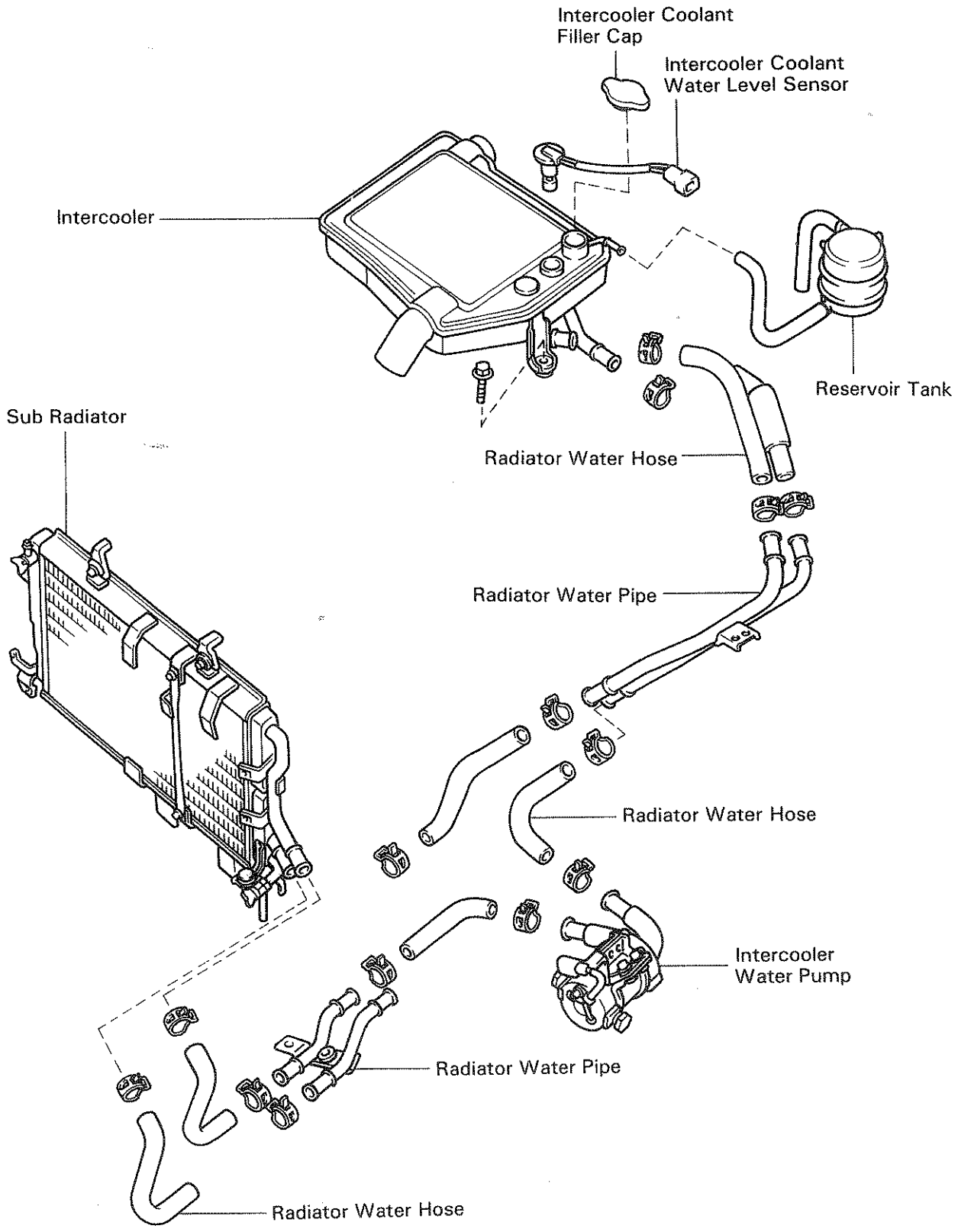
(a) Fill the cooling system with coolant, and attach a radiator cap tester.

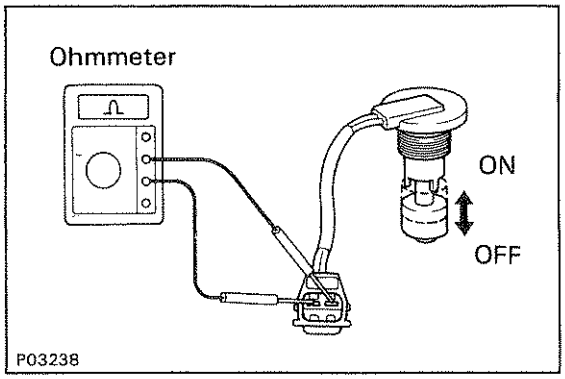
(b) Warm up the engine.

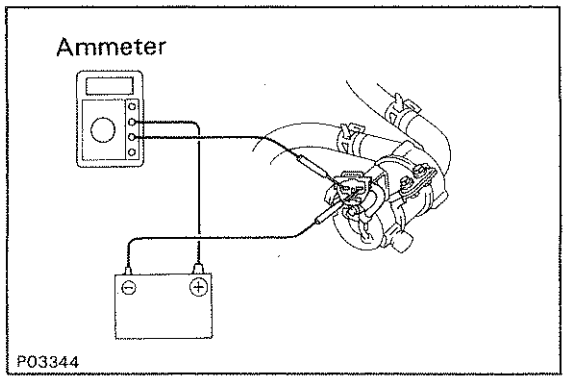
(c) Pump it to 118 kPa (1.2 kgf/cm^2, 17.1 psi), check that pressure does not drop.

If the pressure drops, check for leaks the hoses, radiator

COMPONENTS


Intercooler Coolant Filler Cap
Intercooler Coolant Water Level Sensor
Intercooler
Reservoir Tank
Sub Radiator
Radiator Water Hose
Radiator Water Pipe
Radiator Water Hose
Intercooler Water Pump
Radiator Water Pipe
Radiator Water Hose





INSPECTION OF INTERCOOLER COMPONENTS

1. **INSPECT INTERCOOLER COOLANT LEVEL WARNING SENSOR**

   (a) Check that there is continuity between the terminals with the switch ON (float up).

   (b) Check that there is no continuity between the terminals with the switch OFF (float down).

   If operation is not as specified, replace the sensor.

2. **INSPECT INTERCOOLER WATER PUMP**

   (a) Connect the battery and ammeter to the water pump connector.

   (b) Check that the water pump rotates smoothly, and check the reading on the ammeter.

   Standard amperage: 1.5 — 2.1 A

EFI SYSTEM

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 combination meter lights up.

By analyzing various signals as shown in the later table (See page FI-7) the ECU detects system malfunctions relating to the sensors or actuators.
The self-diagnosis system has two modes, a normal mode and a test mode.

If a malfunction is detected when in the normal mode, the ECU lights up the "CHECK" engine warning light to inform the driver of the occurrence of a malfunction. (For some codes the light does not come on.) The light goes off automatically when the malfunction has been repaired. But the diagnostic code(s) remains stored in the ECU memory. The ECU stores the code(s) until it is cleared by removing the EFI fuse with the ignition switch off.

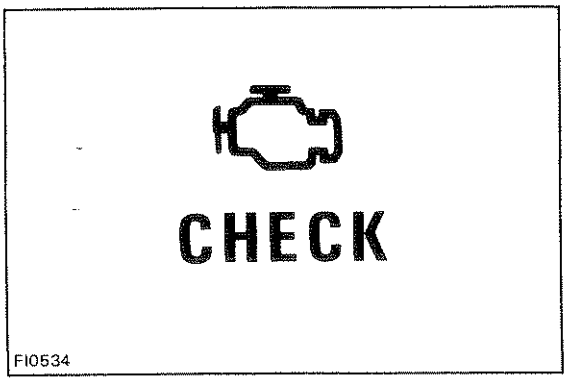
The diagnostic code can be read by the number of blinks of the "CHECK" engine warning light when TE1 and E1 terminals on the check connector are connected. When 2 or more codes are indicated, the lowest number (code) will appear first.

If a malfunction is detected when in the test mode, the ECU lights up the "CHECK" engine warning light to inform the tecnician of the occurrence of a malfunction (except for code Nos. 42, 43 and 51). In this case,TE2 and E1 terminals on the check connector should be connected as shown later. (See page FI-5).

In the test mode, even if the malfunction is corrected, the malfunction code is stored in the ECU memory even when the ignition switch is off (except code Nos. 42, 43 and 51). This also applies in the normal mode.

The diagnostic mode (normal or test) and the output of the "CHECK" engine warning light can be selected by connecting the TE1, TE2 and E1 terminals on the check connector, as shown later.

A test mode function has been added to the functions of the self-diagnosis system of the normal mode for the purpose of detecting malfunctions such as poor contact, which are difficult to detect in the normal mode. This function fills up the self-diagnosis system. The test mode can be implemented by the technician following the appropriate procedures of check terminal connection and operation described later. (See page FI-5)



"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 off.

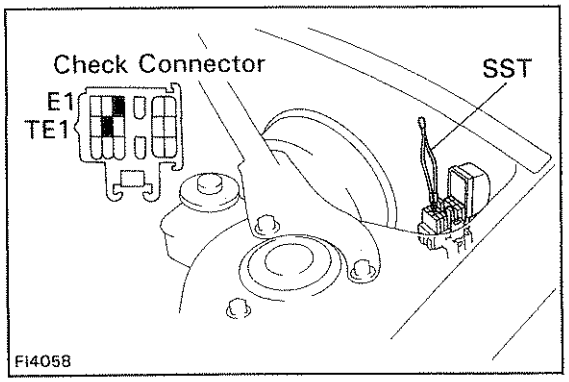
   If the light remains on, the diagnosis system has detected a malfunction or abnormality in the system.

OUTPUT OF DIAGNOSTIC CODES (Normal mode)

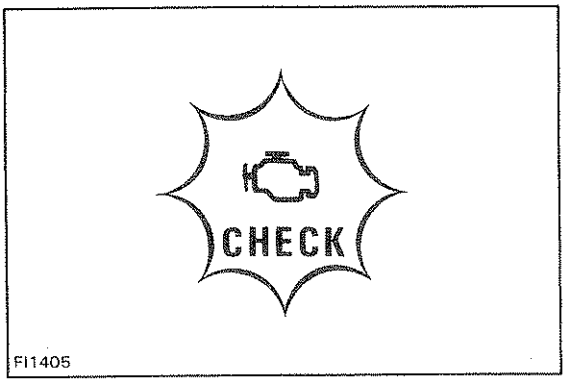
To obtain an output of diagnostic codes, proceed as follow:

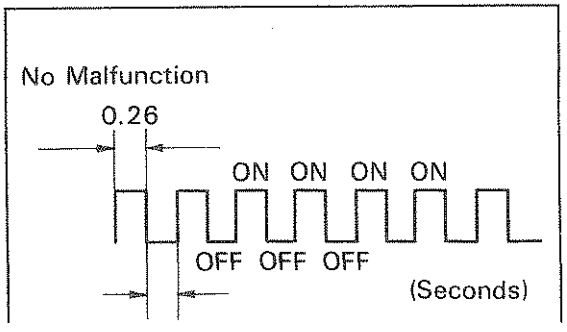
1. Initial conditions
   (a) Battery voltage 11V or more
   (b) Throttle valve fully closed (throttle position sensor IDL points closed)
   (c) Transmission in neutral range
   (d) Accessories switched OFF
   (e) Engine at normal operating temperature
2. Turn the ignition switch ON. Do not start the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

   SST 09843-18020



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

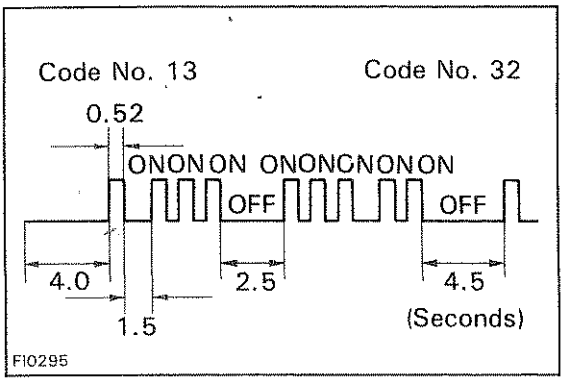




Diagnostic Codes (See page FI-7)

(a) Normal System Operation (no malfunction)

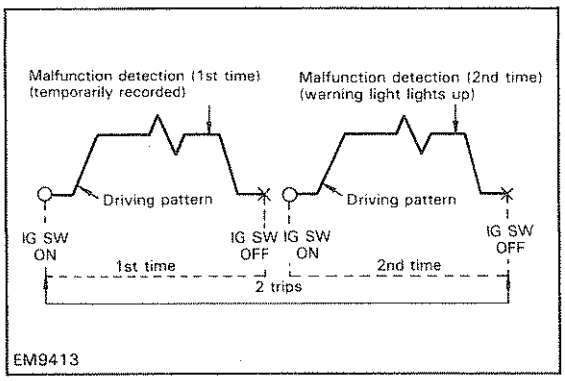
- The light will alternately blink ON and OFF at 0.26-second intervals.



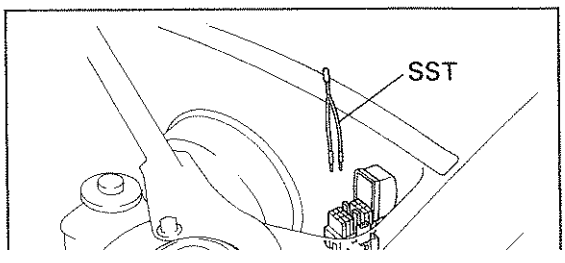
(b) Malfunction Code Indication

- In the event of a malfunction, the light will blink every 0.5 seconds. The first number of blinks will equal the first digit of a 2-digit diagnostic code and, after a 1.5-second pause, the 2nd number of blinks will equal the 2nd. 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.



(c) (2 trip detection logic)
Diagnostic codes 21 use "2 trip detection logic". With this logic, when a malfunctions is first detected, the malfunction is temporarily stored in the ECU memory. If the same case is detected again during the second drive test, this second detection causes the "CHECK" Engine Warning Light to light up.
The 2 trip repeats the same mode a 2nd time. (However, the ignition switch must be turned OFF between the 1st time and 2nd time.) In the Test Mode, the "CHECK" Engine Warning Light lights up the 1st time a malfunction is detected.



5. After the diagnostic check, remove the SST.
SST 09843-18020

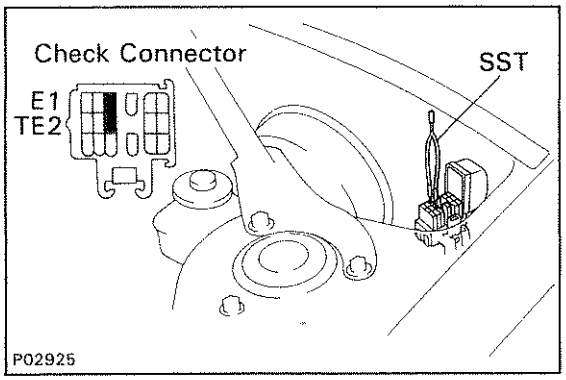
(Test mode)

HINT:

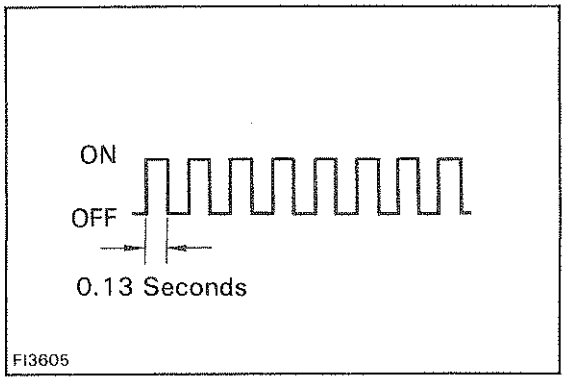
- Compared to the normal mode, the test mode has high sensing ability to detect malfunctions.
- It can also detect malfunctions in the starter signal circuit, air conditioner signal and neutral start switch signal.
- Furthermore, the same diagnostic items which are detected in the normal mode can also be detected in the test mode.

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

1. Initial conditions
   (a) Battery voltage 11 volts or more
   (b) Throttle valve fully closed (throttle position sensor IDL points closed)
   (c) Transmission in neutral range
   (d) Accessories switched OFF

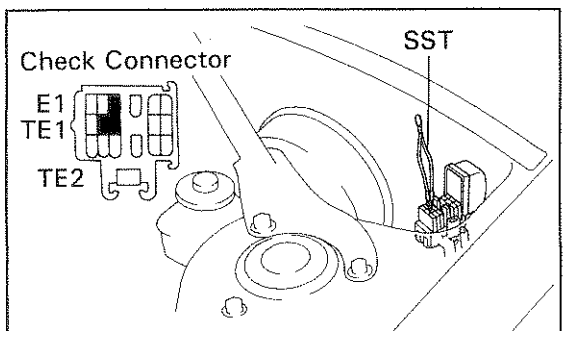


2. First, using SST, connect terminals TE2 and E1 of the check connector, then turn the ignition switch on to begin the diagnosis in the test mode.
   SST 09843-18020

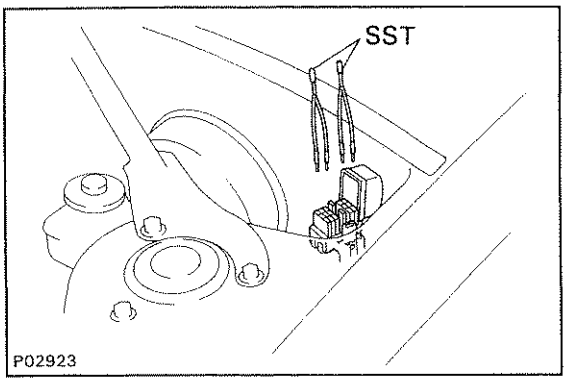


HINT: To confirm that the test mode is operating, check that the "CHECK" engine light flashes when the ignition switch is turned ON.

3. Start the engine and drive the vehicle at a speed of 10 km/h or higher.
4. Simulate the conditions of the malfunction described by the customer.



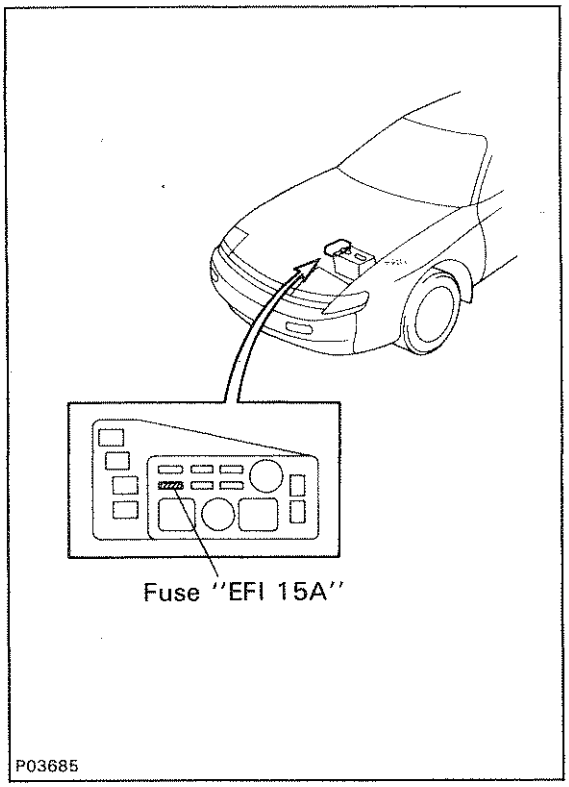
5. Using SST, connect terminals TE1 and E1 of the check connector.
   SST 09843-18020
6. Read the diagnostic code as indicated by the number of flashes of the "CHECK" engine warning light.
   (See page FI-7)



7. After the diagnosis check, remove SST.

   SST 09843-18020

   HINT:
   - The test mode will not start if terminals TE2 and E1 are connected after the ignition switch is turned on.
   - The starter signal and vehicle speed signal will be diagnosed by the ECU as malfunctions, and code Nos. 42 and 43 will be output, if the operation in 3 above is not performed.



CANCELLING DIAGNOSTIC CODE

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

2. After cancellation, perform road test of 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.

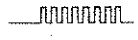
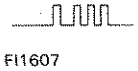
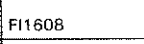
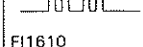
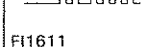
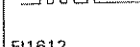
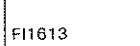
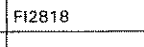
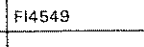
DIAGNOSIS INDICATION

1. When 2 or more codes are indicated, the lowest number (code) will appear first.
2. All detected diagnostic codes, except codes No.51 and No.53, will be retained in memory by the ECU from the time of detection until cancelled out.
3. Once the malfunction is cleared, the "CHECK" engine warning light on the combination meter will go off but the diagostic code(s) remain stored in ECU memory (except for codes No.43, No.51 and No.53).

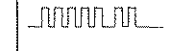
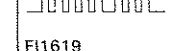
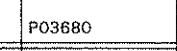
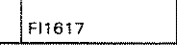
DIAGNOSTIC CODES

HINT:

* Parameters listed in the chart may not be exactly same as your reading due to type of the instruments or other factors.
* If a malfunction code is displayed during the diagnostic code check in test mode, check the circuit for that code listed in the table below (Proceed to the page given for that circuit).

Code No.	Number of blinks "CHECK" Engine Warning Light	System	*1 "CHECK" Engine Warning Light		Diagnosis	Trouble Area	*2 Memory	See Page
			Normal Mode	Test Mode				
—	 FI1401	Normal	—	—	Output when no other code is recorded.	—	—	—
12	 FI1606	RPM Signal	ON	N.A.	• No G1, G2 or NE signal is input to the ECU for 2 secs. or more after STA turns ON. • Open in GA circuit.	• Open or short in NE, G circuit • Distributor • Open or short in STA circuit • ECU	○	—
13	 FI1607	RPM Signal	ON	ON	NE signal is not input to ECU for 0.1 sec. or more when engine speed is 1,000 rpm or more.	• Open or short in NE circuit • Distributor • ECU	○	—
14	 FI1608	Ignition Signal	ON	N.A.	IGF signal from igniter is not input to ECU for 8—11 consecutive ignition.	• Open or short in IGF or IGT circuit from igniter to ECU • Igniter • ECU	○	FI-23
21	FI1609	Oxygen Sensor Signal	OFF	N.A.	Open or short in heater circuit of oxygen sensor for 0.5 sec. or more. (HT)	• Open or short in heater circuit of oxygen sensor • Oxygen sensor heater • ECU	○	FI-30
				ON	At normal driving speed (below 60 mph and engine speed is above 1,500 rpm), amplitude of oxygen sensor signal (OX1) is reduced to between 0.35—0.70 V continuously for 60 secs. or more. *3 (2 trip detection logic)	• Open or short in oxygen sensor circuit • Oxygen sensor • ECU		
22	FI1610	Water Temp. Sensor Signal	ON	ON	Open or short in water temp. sensor circuit for 0.5 sec. or more. (THW)	• Open or short in water temp. sensor circuit • Water temp. sensor • ECU	○	FI-21
24	 FI1611	Intake Air Temp. Sensor Signal	*3 ON	ON	Open or short in intake air temp. sensor circuit for 0.5 sec. or more. (THA)	• Open or short in intake air temp. sensor circuit • Intake air temp. sensor • ECU	○	FI-18
31	 FI1612	Air Flow Meter Signal	ON	ON	At idling, open or short detected continuously for 0.5 sec. or more in air flow meter circuit. • Open — VC • Short — VC—E2	• Open or short in air flow meter circuit • Air flow meter • ECU	○	FI-18
32	 FI1613	Air Flow Meter Signal	ON	ON	Open or short detected continuously for 0.5 sec. or more in air flow meter circuit. • Open — E2 • Short — VS—VC		○	FI-18
34	 FI2818	Turbo-charging Pressure Signal	ON	N.A.	Abnormal over charge during high load driving.	• Open or short in turbocharging pressure sensor circuit • Turbocharging pressure sensor • Turbocharger • ECU	○	—
35	 FI4549	Turbo-charging Pressure Sensor Signal	ON	ON	Open or short detected continuously for 0.5 sec. or more in turbocharging pressure sensor signal circuit. (PIM)		○	FI-26
41	 FI1614	Throttle Position Sensor Signal	OFF	ON	Open or short detected in throttle position sensor signal (VTA) for 0.5 sec. or more. IDL contact is ON and VTA output exceeds 1.5 V.	• Open or short in throttle position sensor circuit • Throttle position sensor • ECU	○	FI-16

DIAGNOSTIC CODES (Cont'd)

Code No.	Number of blinks "CHECK" Engine Warning Light	System	*1 "CHECK" Engine Warning Light		Diagnosis	Trouble Area	*2 Memory	See Page
			Normal Mode	Test Mode				
42	 FI1615	Vehicle Speed Sensor Signal	OFF	OFF	SPD signal is not input to the ECU for at least 8 seconds during high load driving with engine speed between 2,500 rpm and 5,000 rpm.	• Open or short in vehicle speed sensor circuit • Vehicle speed sensor • ECU	○	—
43	 FI1616	Starter Signal	N.A.	OFF	Starter signal (STA) is not input to ECU even once until engine reaches 800 rpm or more when cranking.	• Open or short in starter signal circuit. • Open or short in IG SW or main relay circuit • ECU	×	FI-22
52	 FI1618	Knock Sensor Signal	ON	N.A.	With engine speed between 1,600 rpm and 7,200 rpm, signal from knock sensor is not input to ECU for 2 revolutions. (KNK)	• Open or short in knock sensor circuit • Knock sensor (looseness, etc.) • ECU	○	—
53	 FI1619	Knock Control Signal	ON	N.A.	Engine speed is between 700 rpm and 7,200 rpm and ECU (for knock control) malfunction is detected.	• ECU	×	—
54	 P03680	Inter-cooler	ON	N.A.	Intercooler motor stop.	• Intercooler level switch • Intercooler ECU • Intercooler motor • Intercooler circuit	○	FI-28 FI-29
51	 FI1617	Switch Condition Signal	N.A.	OFF	Displayed when A/C is ON or IDL contact OFF with the check terminals E1 and TE1 connected.	• A/C switch circuit • Throttle position sensor IDL circuit • Accelerator pedal, cable • ECU	×	FI-16 FI-27

REMARKS

*1: "ON" displayed in the diagnosis mode column indicates that the "CHECK" Engine Warning Light is lighted up when a malfunction is detected.
"OFF" indicates that the "CHECK" does not light up during malfunction diagnosis, even if a malfunction is detected.
"N.A." indicates that the item is not included in malfunction diagnosis.

*2: "○" in the memory column indicates that a diagnostic code is recorded in the ECU memory when a malfunction occurs. "×" indicates that a diagnostic code is not recorded in the ECU memory even if a malfunction occurs.
Accordingly, output of diagnostic results is performed with the IG SW ON.

*3: "2 trip detection logic" (See page FI-4)

DIAGNOSIS CODE DETECTION DRIVING PATTERN

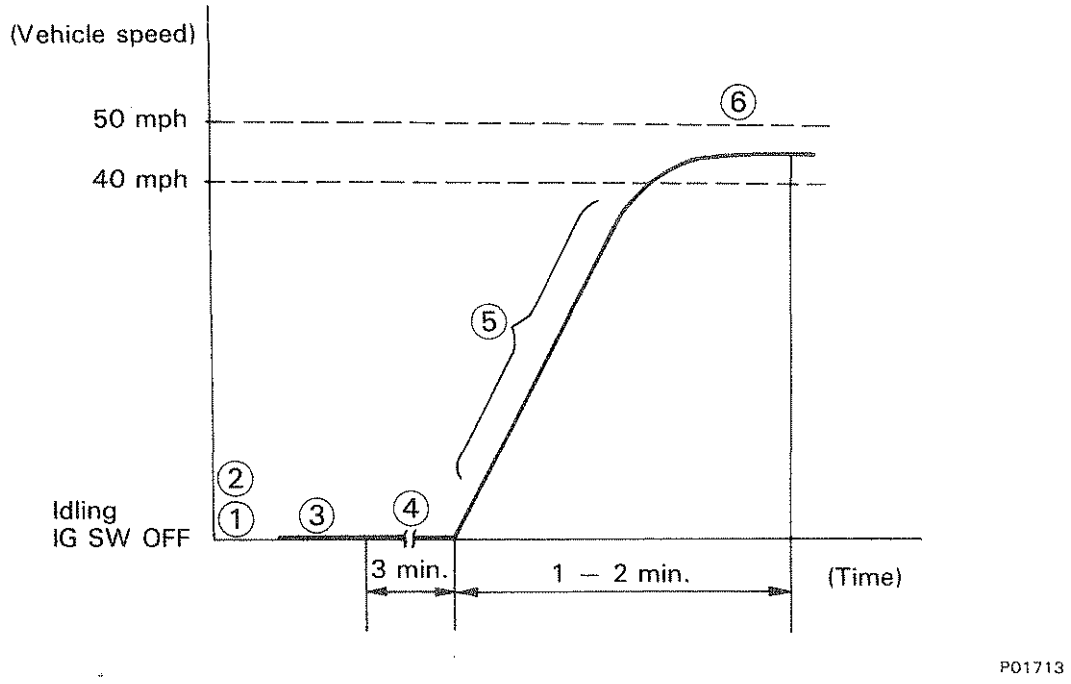
Purpose of the driving pattern.

(a) To simulate diagnosis code detecting condition after diagnosis code is recorded.

(b) To check that the malfunction is corrected when the repair is completed (confirming that diagnostic code is no longer detected.)

Code No.	21	Oxygen Sensor Circuit

Malfunction: Diterioration Oxygen Sensor



P01713

① Disconnect the EFI fuse (15 A) for 10 seconds or more, with IG SW OFF.

② Initiate test mode (Connect terminals TE2 and E1 of check connector with IG SW OFF.)

③ Start the engine and warm the engine up with all accessaries SW OFF.

④ After the engine is warmed up, let it idle for 3 minutes.

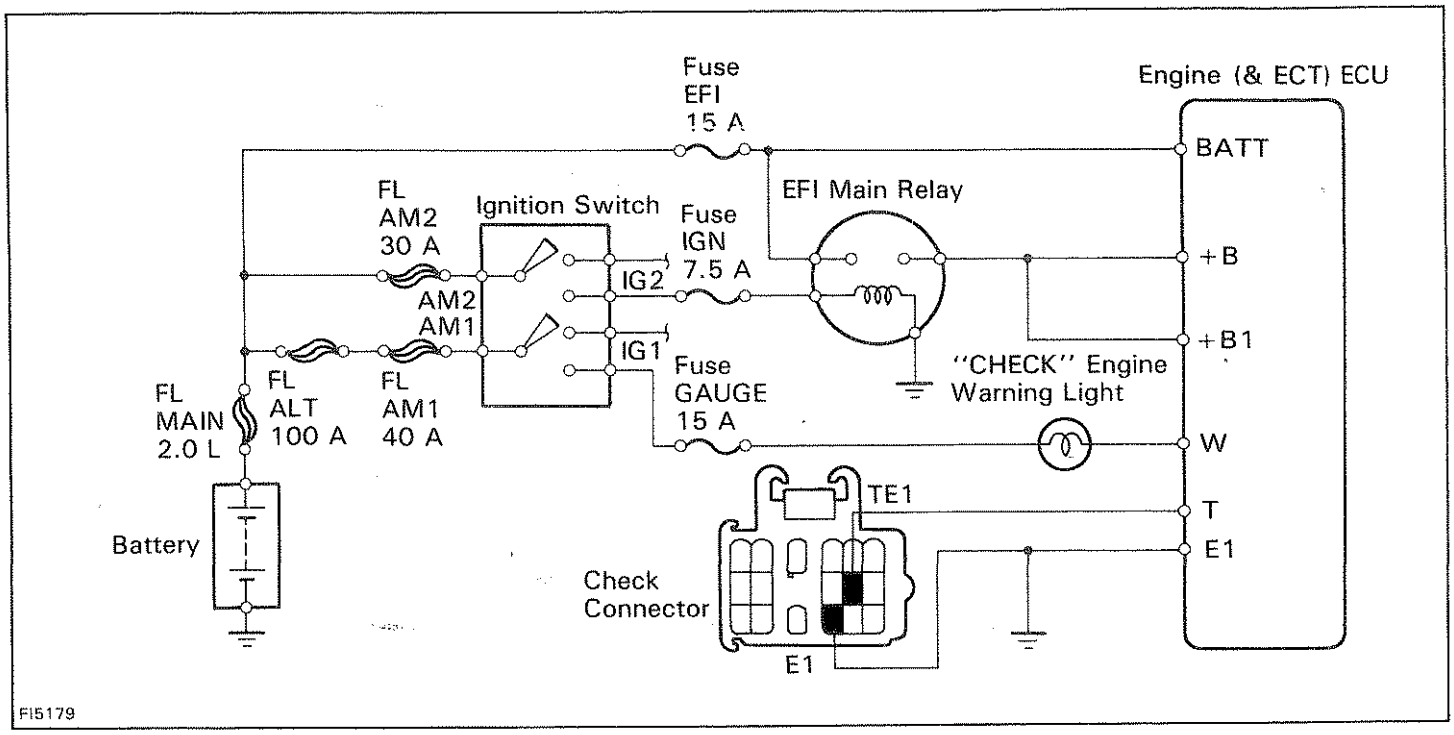
⑤ After performing the idling in ④, perform gradual acceleration with in the range 1,300 — 1,700 rpm (centered around 1,500 rpm) with the A/C SW ON.
(Take care that the engine speed does not fall below 1,200 rpm when shifting. Gradually depress the accelerator pedal and keep it, steady so that engine braking does not occur.)

⑥ Maintain the vehicle speed at 40 — 50 mph.
Keep the vehicle running for 1 — 2 minutes after starting acceleration.

HINT: If any malfunction is detected, the "CHECK" engine warning light will light up during step ⑥.

NOTICE: If the conditions in this test are not strictly followed, detection of the malfunction will not be possible.

INSPECTION OF DIAGNOSIS CIRCUIT



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

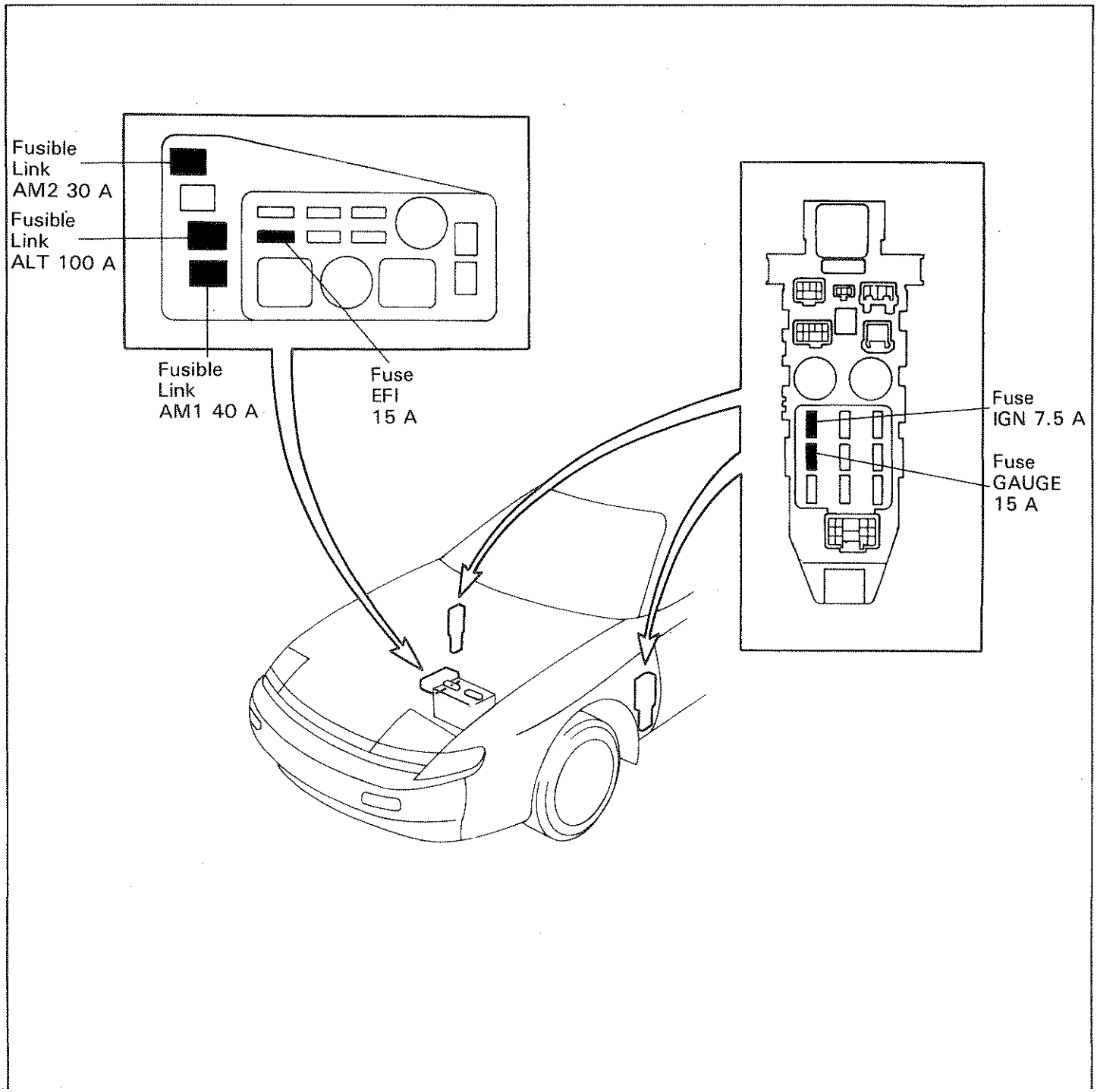
2. Does "CHECK" engine warning light go off when the engine is started?
   - YES → System Normal
   - NO → Check wiring between ECU and "CHECK" engine warning light.
     - BAD → Repair.
     - OK → Is there diagnostic code output when check connector terminals TE1 and E1 connected?
       - NO → Check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

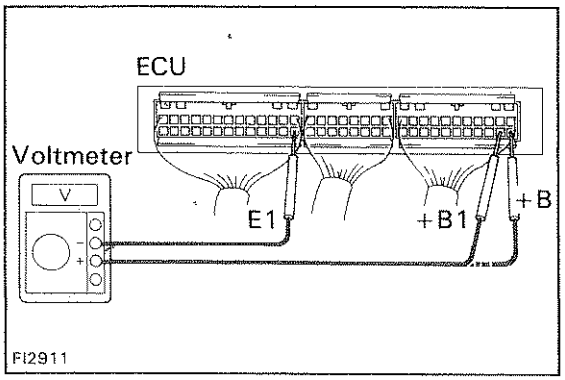
TROUBLESHOOTING WITH VOLT/OHMMETER

HINT:

- The following troubleshooting procedures are designed for inspection of each separate system, therefore the procedures may vary somewhat. However, troubleshooting should be performed while referring to the inspection methods described in this manual.
- Before beginning inspection, it is best to first make a simple check of the fuses, fusible links and the condition of the connectors.
- The following troubleshooting procedures are based on the supposition that the troble lies in either a short or open circuit in a component outside the computer or a short circuit within the computer.
- If engine trouble occurs even though proper operating voltage is detected in the computer connector, then it can be assumed that the engine (and ECT) ECU is faulty and should be replaced.

LOCATION OF FUSES AND FUSIBLE LINKS





EFI SYSTEM CHECK PROCEDURE

HINT:

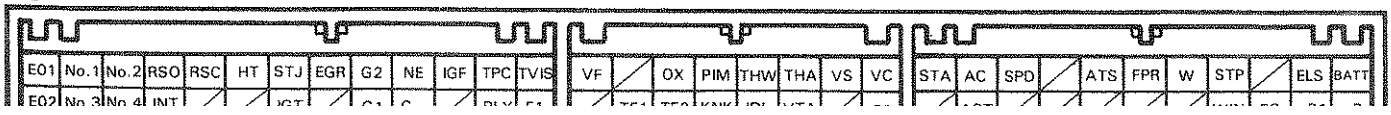
- Perform all voltage measurements with the connectors connected. (ex. Code No.10)
- Verify that the battery voltage is 11 V or more when the ignition switch is in "ON" position.

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

Terminals of Engine ECU

Symbol	Terminal name	Symbol	Terminal name	Symbol	Terminal name
EO1	POWER GROUND	G2	DISTRIBUTOR		—
EO2	POWER GROUND	G1	DISTRIBUTOR	AC1	A/C MAGNET SWITCH
No.1	INJECTOR	NE	DISTRIBUTOR	ACT	A/C AMPLIFIER
No.3	INJECTOR	E1	ENGINE GROUND	SPD	SPEED SENSOR
No.2	INJECTOR	VF	CHECK CONNECTOR		—
No.4	INJECTOR	G⊖	DISTRIBUTOR		—
STJ	COLD START INJECTOR		—		—
EGR	EGR VSV	T	CHECK CONNECTOR		—
RSC	ISC VALVE	OX1	CHECK CONNECTOR		—
RSO	ISC VALVE	OX2	CHECK CONNECTOR	FPR	FUEL PUMP RELAY
HT	OXYGEN SENSOR HEATER	KNK	KNOCK CONTROL SENSOR		—
*INT	INTERCOOLER ECU	PIM	TURBOCHARGING PRESSURE SENSOR	W	WARNING LIGHT
	—	THW	WATER TEMP. SENSOR		—
IGT	IGNITER	IDL	THROTTLE POSITION SENSOR	STP	STOP LIGHT SWITCH
TPC1	TURBOCHARGING PRESSURE VSV	THA	AIR TEMP. SENSOR	*WIN	INTERCOOLER ECU
	—	VTA	THROTTLE POSITION SENSOR		—
	—	VS	AIR FLOW METER		—
TVIS	INTAKE AIR VSV		—	ELS	TAILLIGHT and DEFOGGER
	—	VC	SENSOR POWER SOURCE	+B1	MAIN RELAY
FC	CIRCUIT OPENING RELAY	E2	SENSOR GROUND	BATT	BATTERY
IGF	IGNITER	STA	STARTER SWITCH	+B	MAIN RELAY

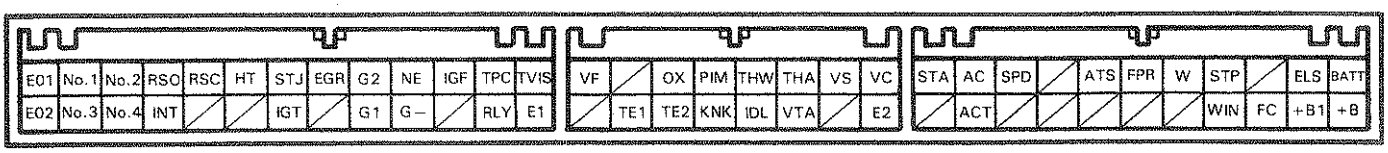
Engine ECU Terminals



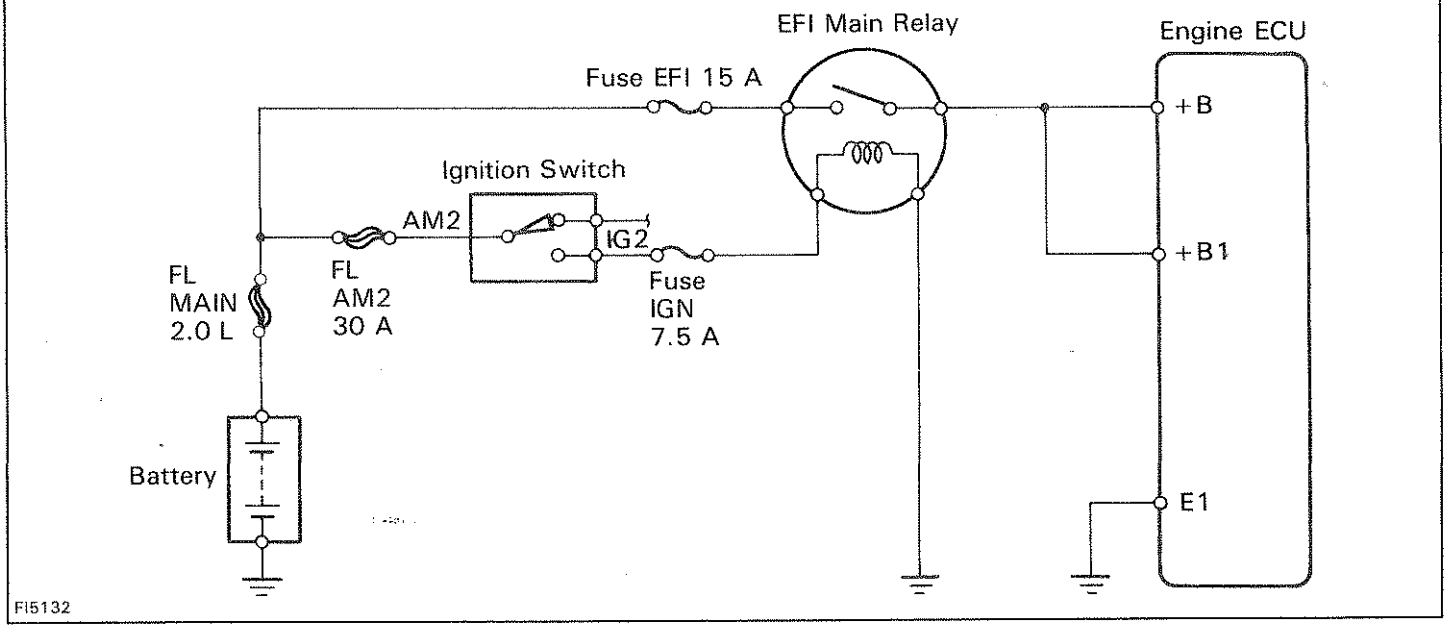
Voltage at Engine ECU Wiring Connectors

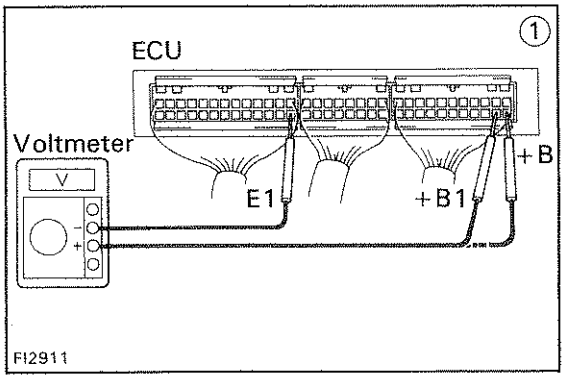
No.	Treminals	Condition		STD voltage (V)	See page
1	+B, +B1 — E1	IG SW ON		10 — 14	FI-14
2	BATT — E1	—		10 — 14	FI-15
3	IDL — E2	IG SW ON	Throttle valve open	4 — 6	FI-16
	VC — E2		—	4 — 6	
	VTA — E2		Throttle valve fully colsed	0.1 — 1.0	
			Throttle valve open	4 — 5	
4	VC — E2	IG SW ON	—	4 — 6	FI-18
	VS — E2		Measuring plate fully closed	3.7 — 4.3	
			Measuring plate fully open	0.2 — 0.5	
		Idling	—	2.3 — 3.8	
		3,000 rpm	—	1.0 — 2.0	
5	No.1, No.2, No.3, No.4 — EO1, EO2	IG SW ON		10 — 14	FI-19
6	THA — E2	IG SW ON	Intake aie temp. 20°C (68°F)	1 — 3	FI-20
7	THW — E2		Coolant temp. 80°C (176°F)	0.1 — 1.0	FI-21
8	STA — E1	Cranking		6 — 14	FI-22
9	IGT — E1	Idling		0.7 — 1.0	FI-23
10	RSC, RSO — E1	IG SW ON	Engine ECU connectors disconnected	8 — 14	FI-24
11	W — E1	No trouble (''CHECK'' engine warning light off) and engine running		10 — 14	FI-25
12	PIM — E2	IG SW ON		2.5 — 4.5	FI-26
	VC — E2			4 — 6	
13	AC1 — E1	IG SW ON	Air conditioning ON	8 — 14	FI-27
14	WIN — E1	IG SW ON		0 — 3	FI-28
15	INT — E1	Idling (More than 30 second)		0 — 3	FI-29
		Idling	Throttle valve open	10 — 14	

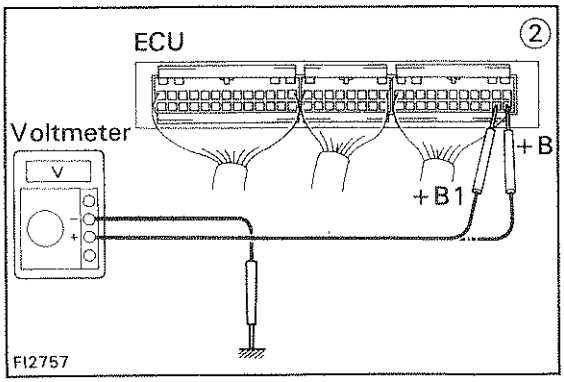
Engine ECU Terminals

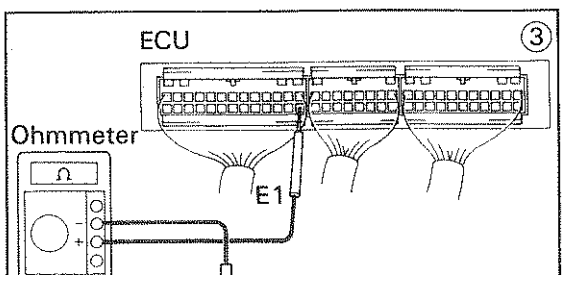


No.	Terminals	Trouble	Condition	STD Voltage
1	+B +B1 — E1	No voltage	IG SW ON	10 — 14 V









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

② Check that there is voltage between ECU terminal +B or +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.

BAD

Replace.

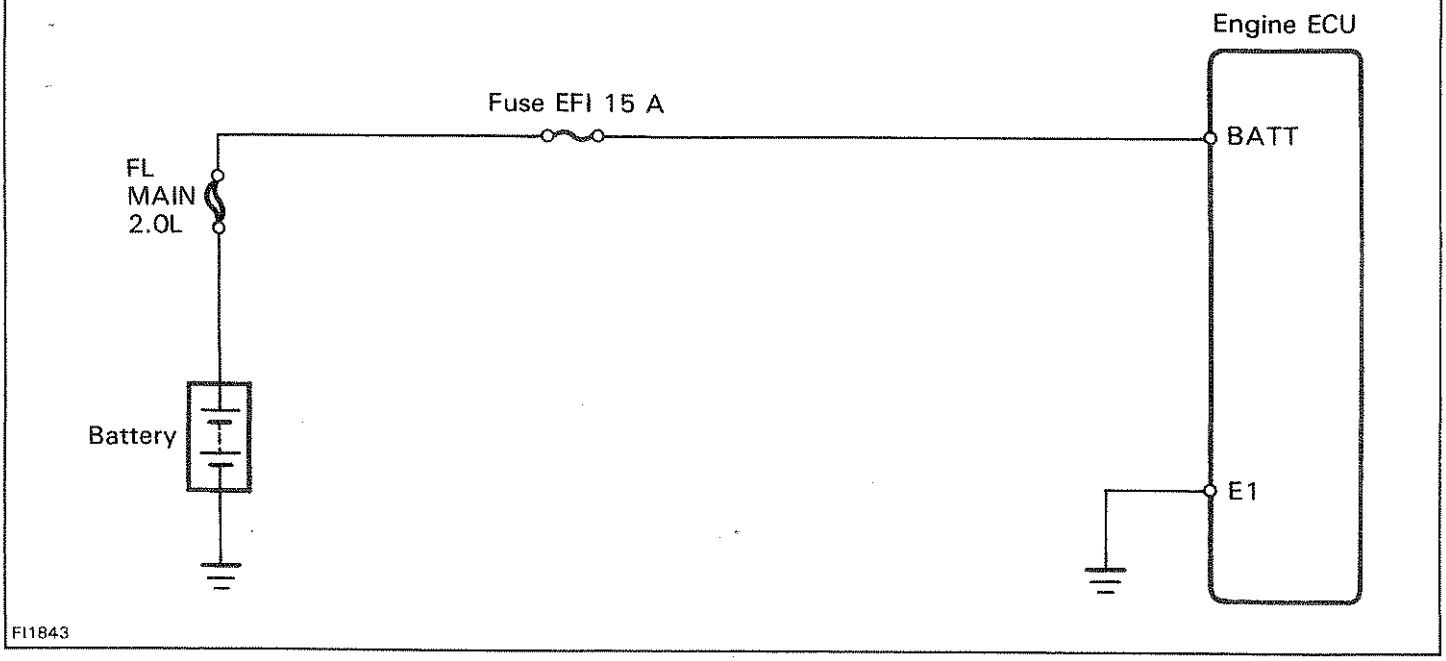
OK

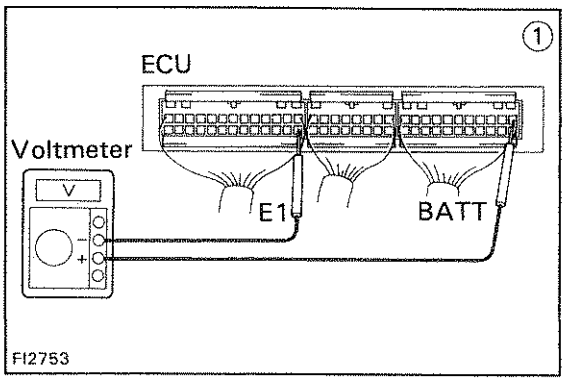
Check wiring between EFI main relay and battery.

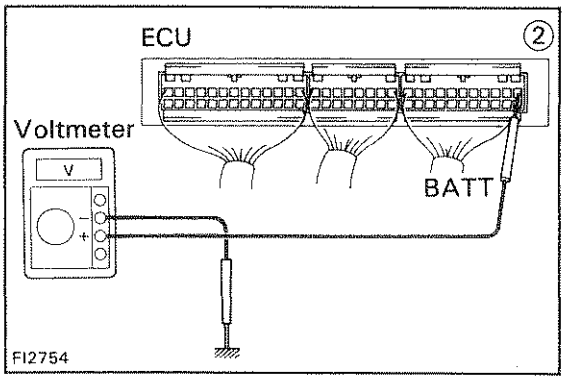
BAD

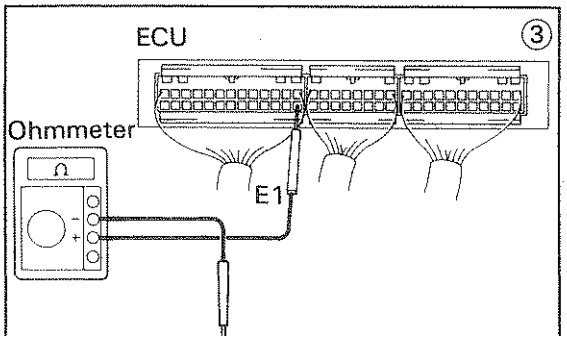
Repair or replace.

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.

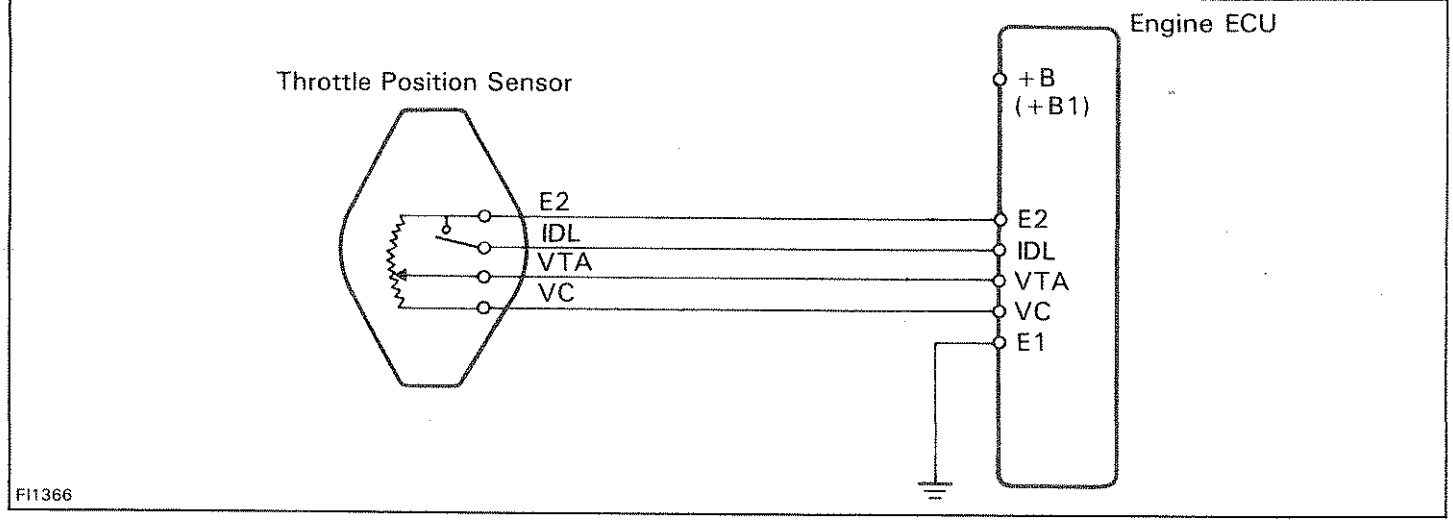
OK

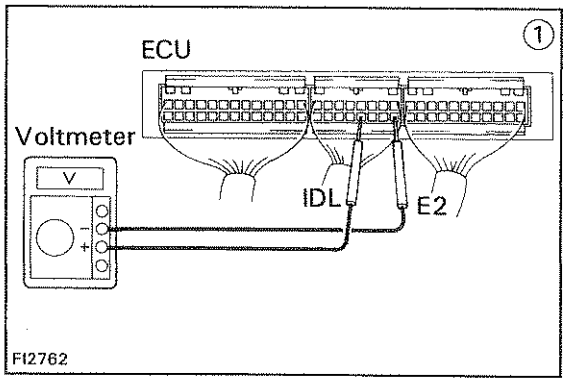
Check wiring between ECU terminal and battery.

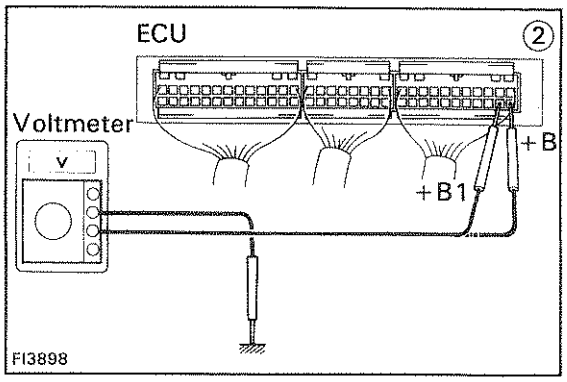
BAD

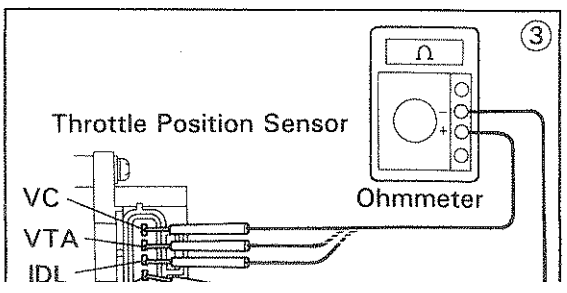
Repair or replace.

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









• **IDL — E2**

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

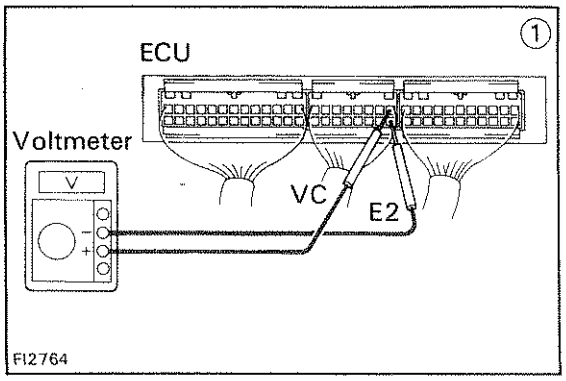
② Check that there is voltage between ECU terminal +B or +B1 and body ground. **(IG SW ON)**

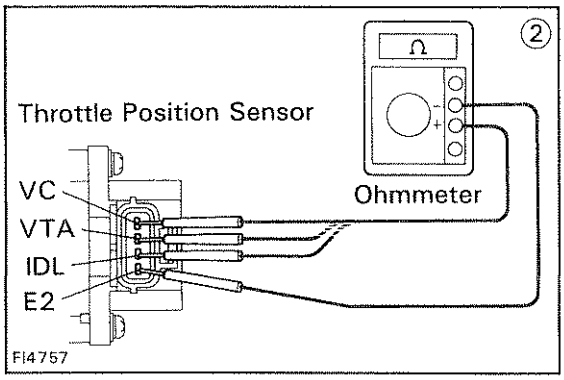
NO → Check wiring between ECU terminal E1 and body ground.
- OK → Try another ECU.
- BAD → Repair or replace.

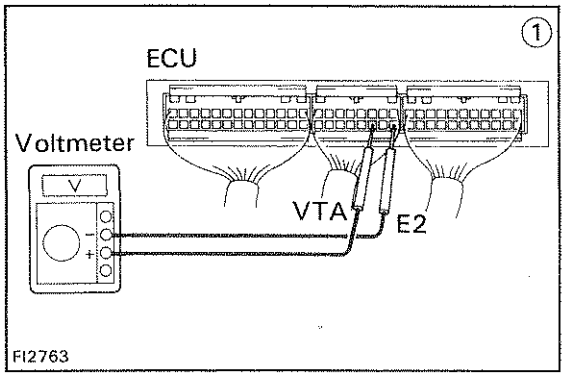
OK → Refer to +B — E1 trouble section (No.1). (See page FI-14)
- BAD → Repair or replace.

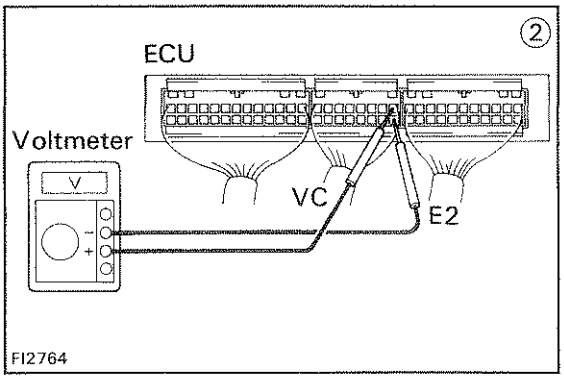
③ Check throttle position sensor. (See page FI-33)
- BAD → Repair or replace. throttle position sensor.
- OK → Check wiring between ECU and throttle position sensor.

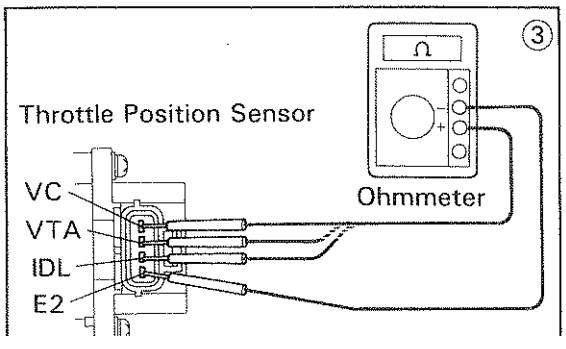
OK











• VC — E2

① No voltage between ECU terminals VC and E2. **(IG SW ON)**

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

OK

② Check throttle position sensor. (See page FI-33)

BAD

Repair or replace.

OK

Check wiring between ECU and throttle position sensor.

OK

Try another ECU.

BAD

Repair or replace.

NO

Refer to +B — E1 trouble section (No.1). (See page FI-14)

• VTA — E2

① No specified voltage at ECU terminals VTA and E2. **(IG SW ON)**

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

NO

Refer to VC — E2 trouble section.

OK

OK

③ Check throttle position sensor. (See page FI-33)

BAD

Repair or replace.

OK

Check wiring between ECU and throttle position sensor.

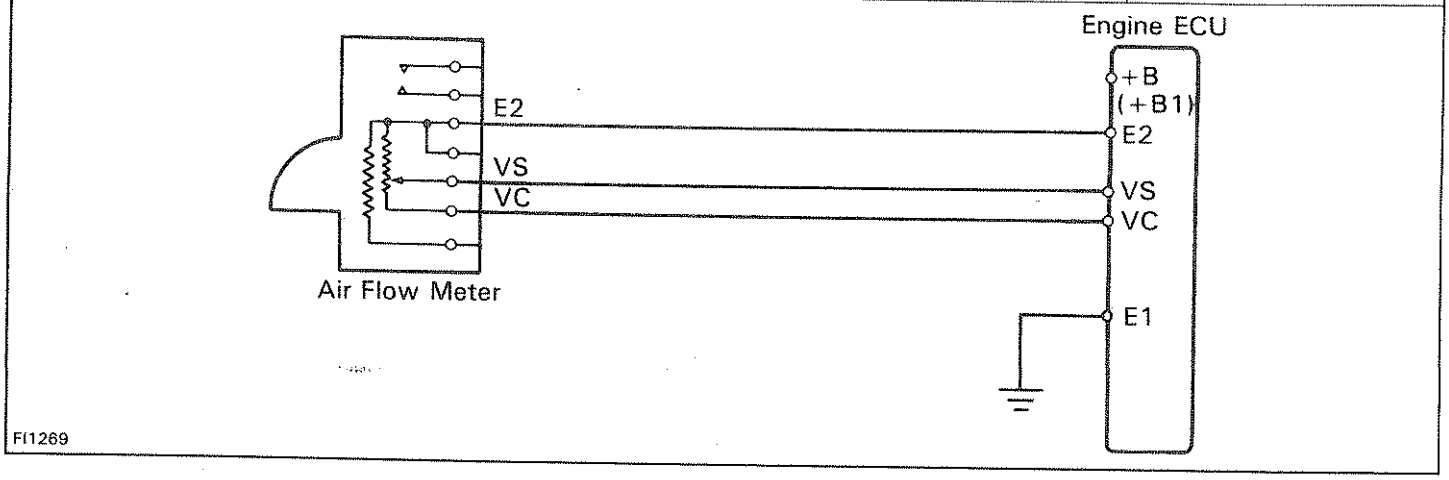
BAD

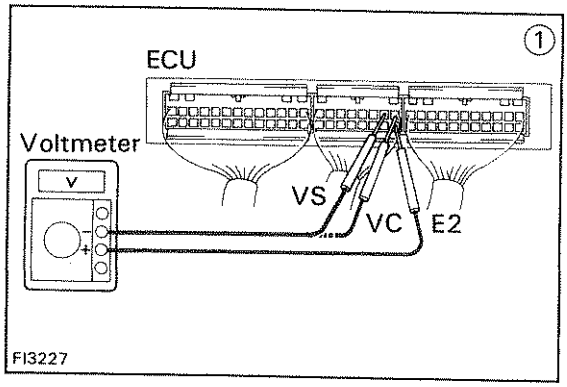
Repair or replace.

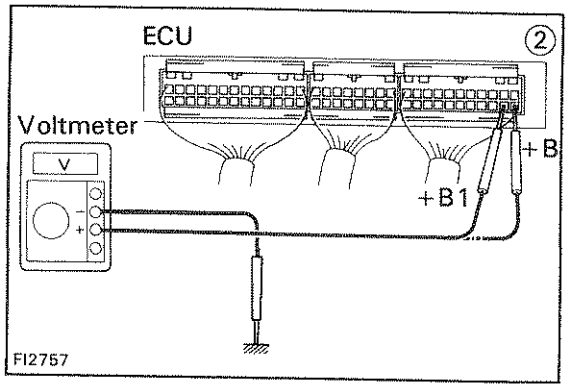
OK

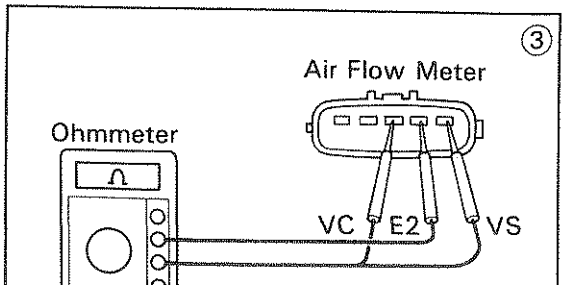
Try another ECU.

No.	Terminals	Trouble	Condition		STD Voltage
4	VC — E2	No voltage	Ignition SW ON	—	4 — 6 V
	VS — E2			Measuring plate fully closed	3.7 — 4.3 V
				Measuring plate fully open	0.2 — 0.5 V
			Idling	—	2.3 — 2.8 V
			3,000 rpm	—	1.0 — 2.0 V









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

↓

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

OK ↓

NO → Refer to +B — E1 trouble section (No.1). (See page FI-16)

↓

Check wiring between ECU terminal E1 and body ground.

OK ↓

BAD → Repair or replace.

↓

③ Check air flow meter. (See page FI-31)

BAD → Replace air flow meter.

OK ↓

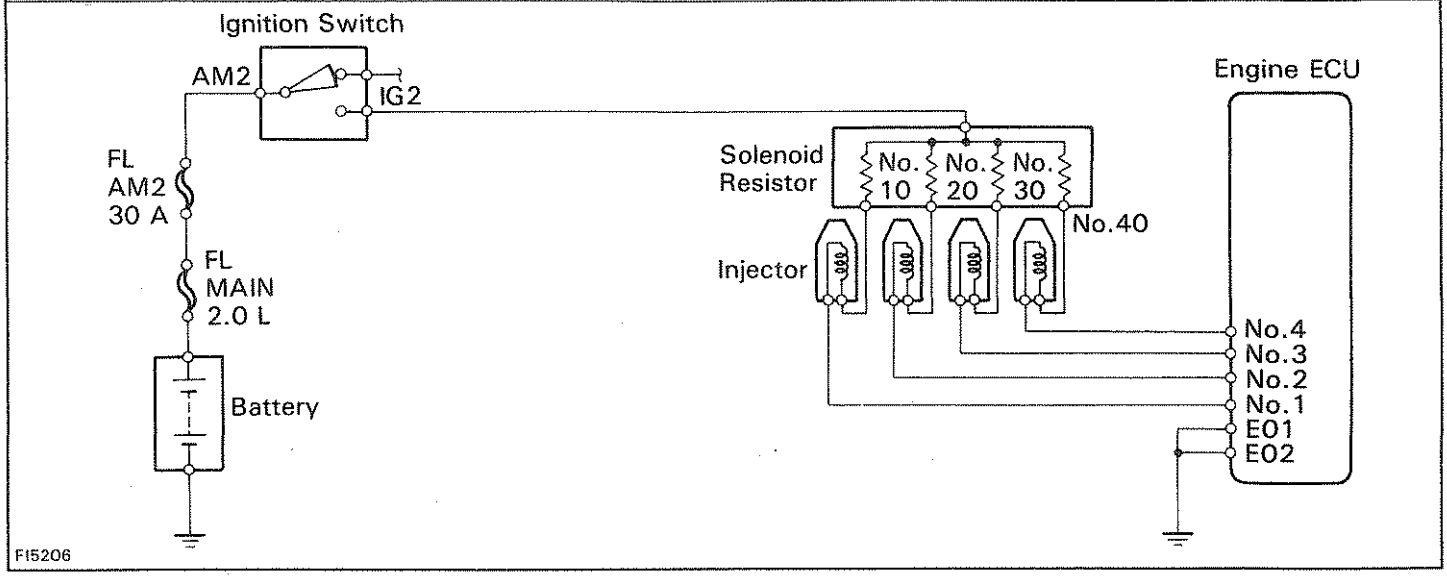
Check wiring between ECU and air flow meter.

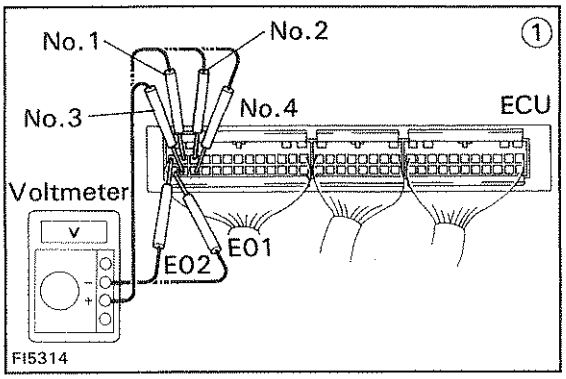
OK ↓

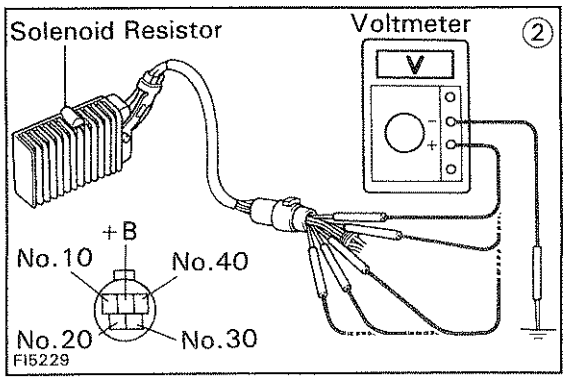
BAD → Repair or replace.

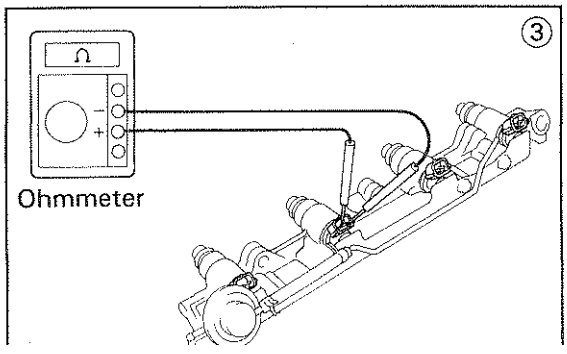
Try another ECU.

No.	Terminals	Trouble	Condition	STD Voltage
5	No.1 No.2 — E01 No.3 — E02 No.4	No voltage	IG SW ON	10 — 14 V









① There is voltage between ECU terminals No.1, No.2, No.3. and/or No.4 and E01 and/or E02. **(IG SW ON)**

↓

② Check that there is specified voltage between solenoid resistor terminal +B and body ground. **STD voltage: 10 — 14 V**

OK ↓ NO → Check fusible links, wiring and ignition switch. → BAD → Repair or replace.

OK ↓

② Check that there is specified voltage between resistor terminals (No.10, No.20, No.30 or No.40) and body ground. **STD voltage: 10 — 14 V**

OK ↓ NO → Replace resistor.

↓

Check wiring between ECU and resistor. → BAD → Repair or replace.

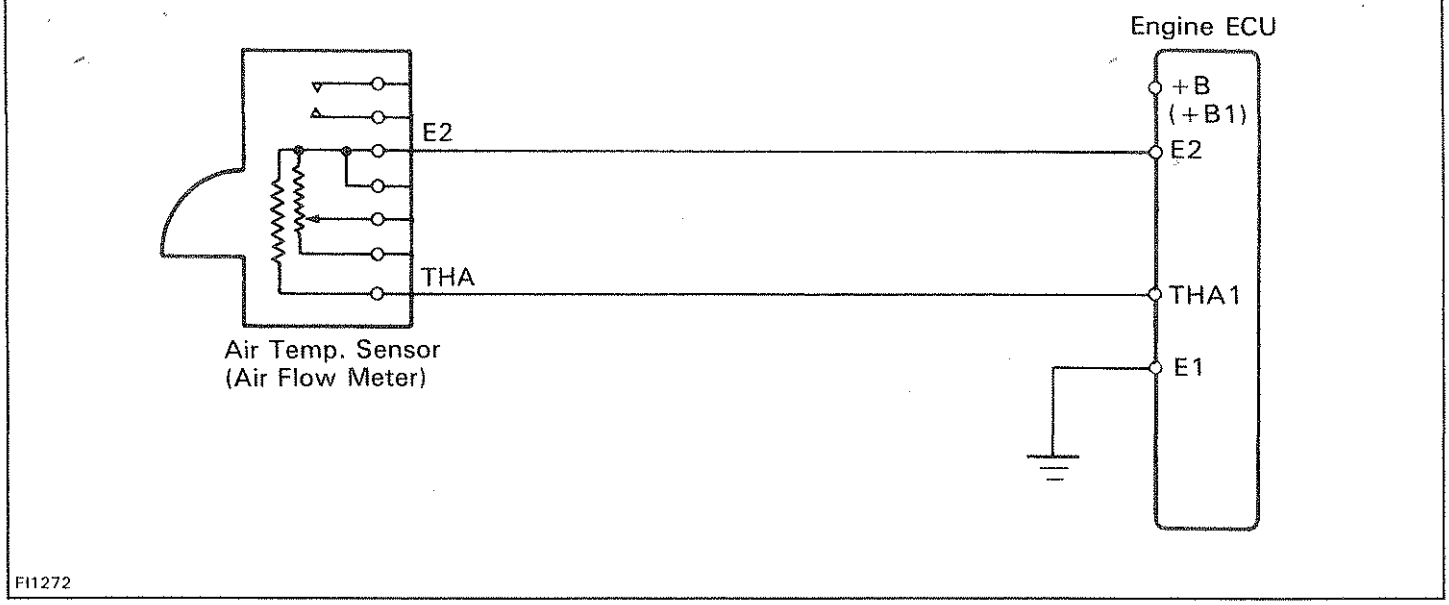
OK ↓

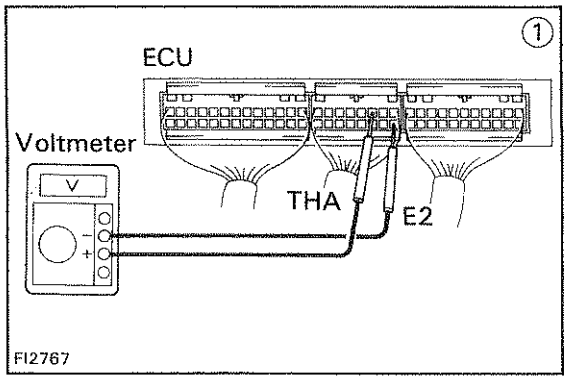
③ Check resistance of each injector. **STD resistance: 2 — 4 Ω** → BAD → Replace injector.

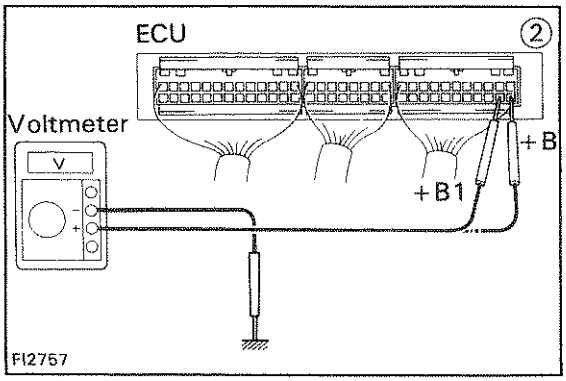
OK ↓

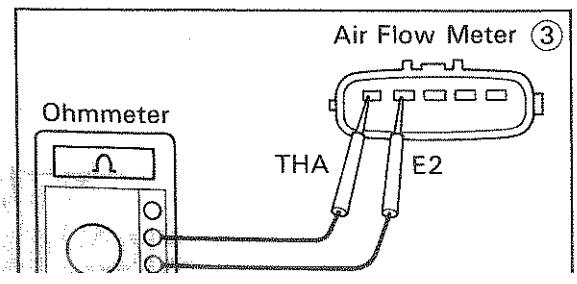
Try another ECU.

No.	Terminals	Trouble	Condition		STD Voltage
6	THA1 — E2	No voltage	IG SW ON	Intake air temperature 20°C (68°F)	1 — 3 V









① There is no voltage between ECU terminals THA1 or 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-14)

↓

Check wiring between ECU terminal E1 and body ground.

OK ↓

BAD → Repair or replace.

↓

③ Check air temp. sensor. (See page FI-31)

BAD → Replace air flow meter.

OK → Check wiring between ECU and air temp. sensor.

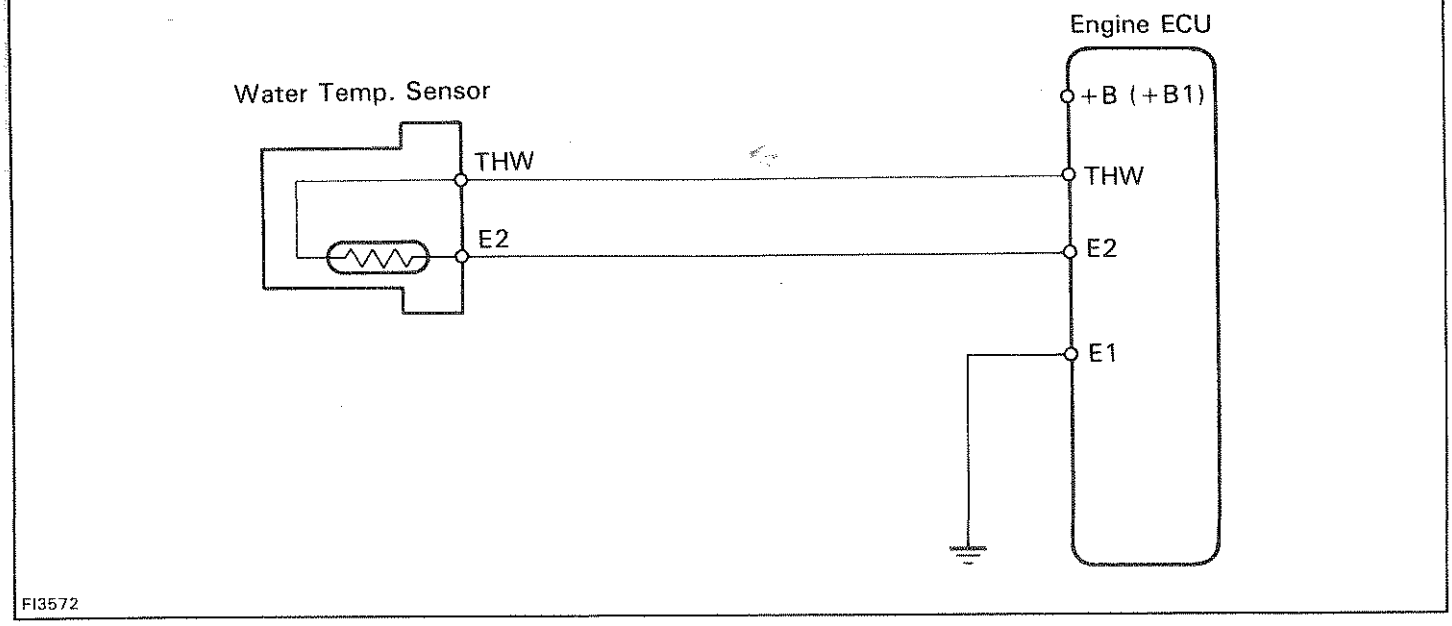
OK ↓

BAD → Repair or replace.

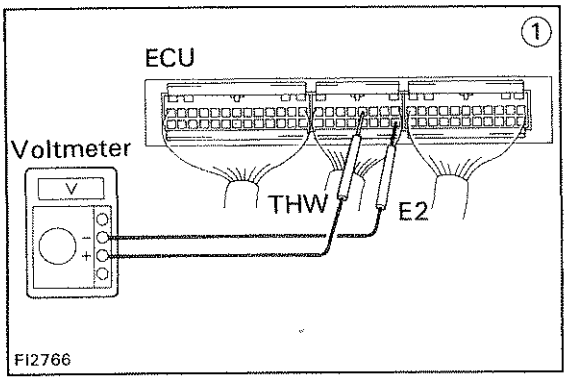
↓

Try another ECU.

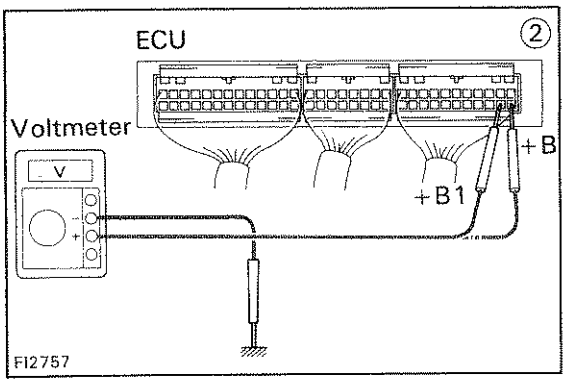
No.	Terminals	Trouble	Condition		STD Voltage
7	THW— E2	No voltage	IG SW ON	Coolant temperature 80°C (176°F)	0.1 — 1.0 V



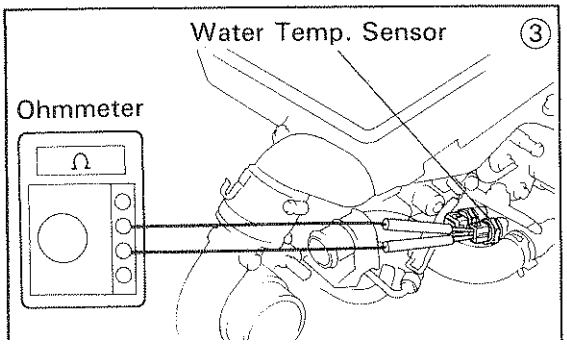
FI3572



FI2766



FI2757



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

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

OK

NO

Refer to +B — E1 trouble section (No.1). (See page FI-14)

Check wiring between ECU terminal E1 and body ground.

OK

BAD

③ Check water temp. sensor. (See page FI-41)

Repair or replace.

BAD

OK

Replace water temp. sensor.

Check wiring between ECU and water temp. sensor.

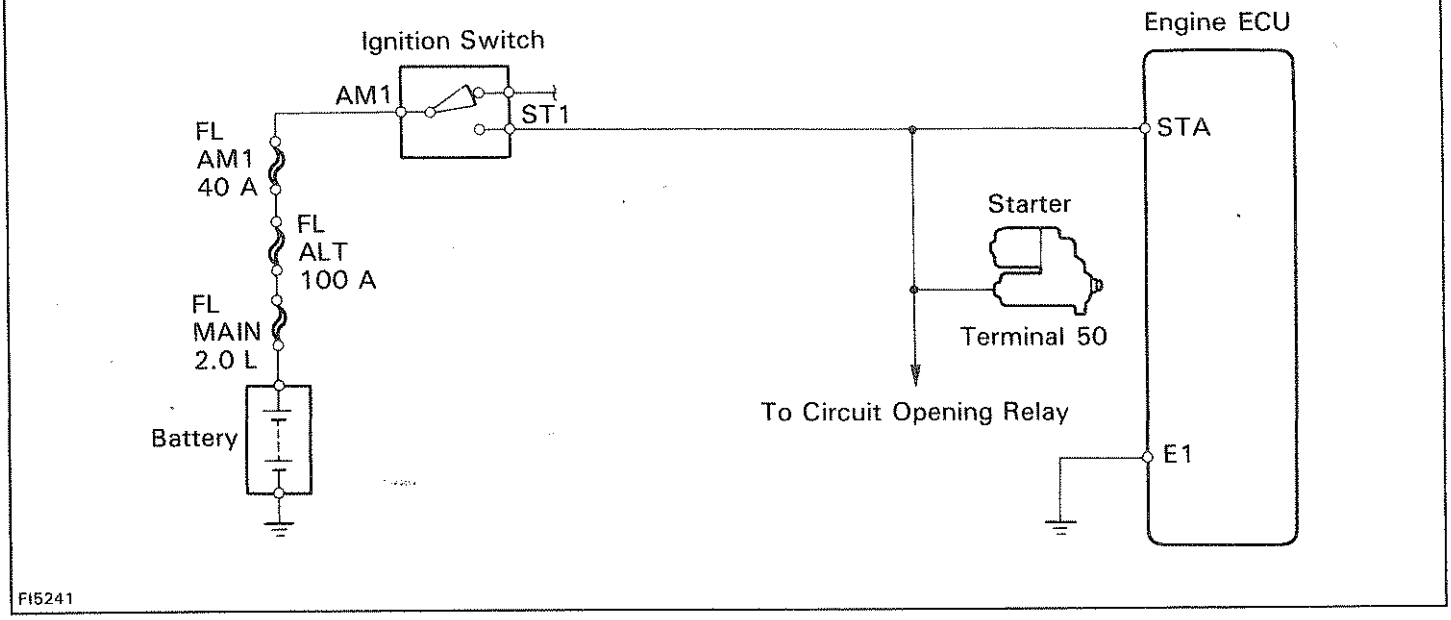
OK

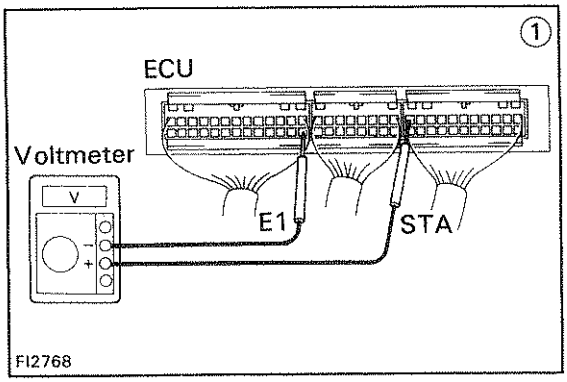
BAD

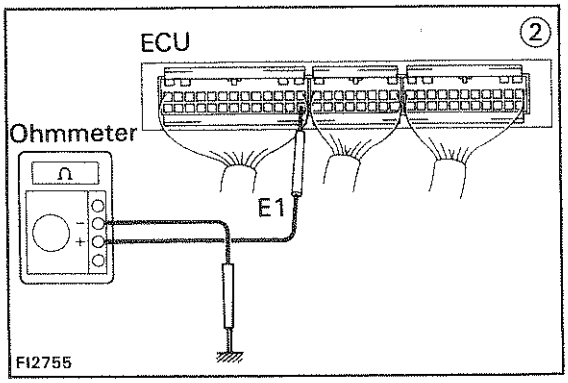
Try another ECU.

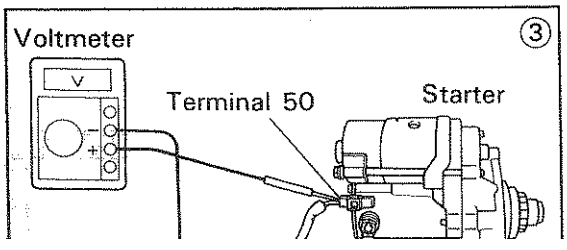
Repair or replace.

No.	Terminals	Trouble	Condition	STD Voltage
8	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.

Check starter operation. — BAD → Check fusible links, battery, wiring and ignition switch.

Check wiring between ECU terminal STA and ignition switch terminal ST1. — OK → ② Check wiring between ECU terminal E1 and body ground.

Check wiring between ECU terminal STA and ignition switch terminal ST1. — BAD → Repair or replace.

② Check wiring between ECU terminal E1 and body ground. — OK → Try another ECU.

② Check wiring between ECU terminal E1 and body ground. — BAD → Repair or replace.

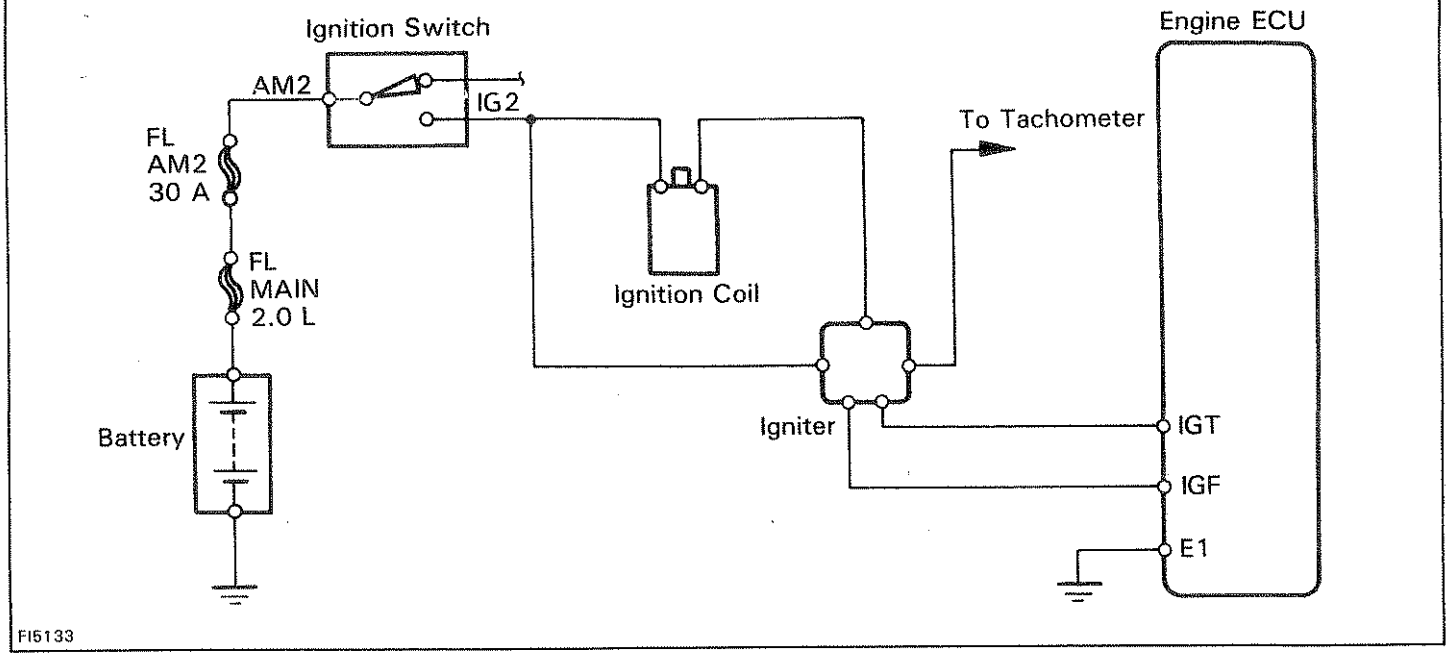
Check fusible links, battery, wiring and ignition switch. — BAD → Repair or replace.

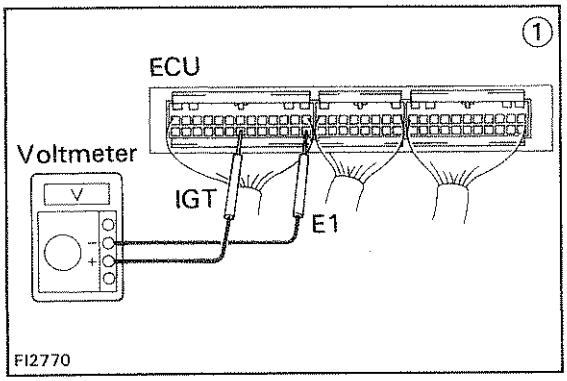
Check fusible links, battery, wiring and ignition switch. — OK → ③ Check that there is voltage at terminal 50 of starter. **(IG SW START) STD voltage: 6 — 14 V**

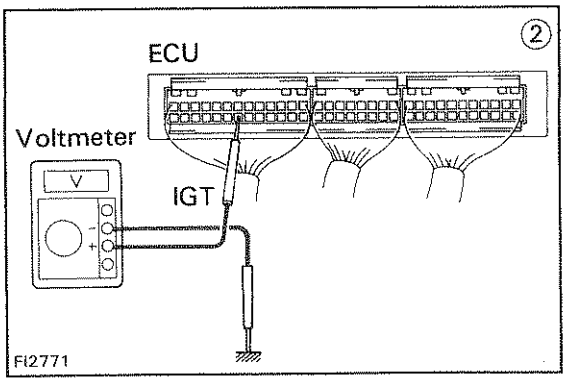
③ Check that there is voltage at terminal 50 of starter. **(IG SW START) STD voltage: 6 — 14 V** — OK → [illegible]

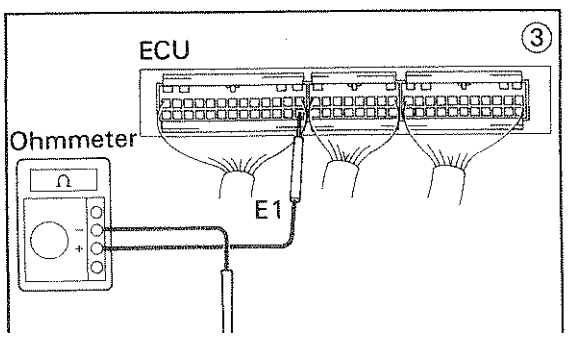
③ Check that there is voltage at terminal 50 of starter. **(IG SW START) STD voltage: 6 — 14 V** — NO → Check wiring between ignition switch

No.	Terminals	Trouble	Condition	STD Voltage
9	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 distributor. → BAD → Repair or replace.

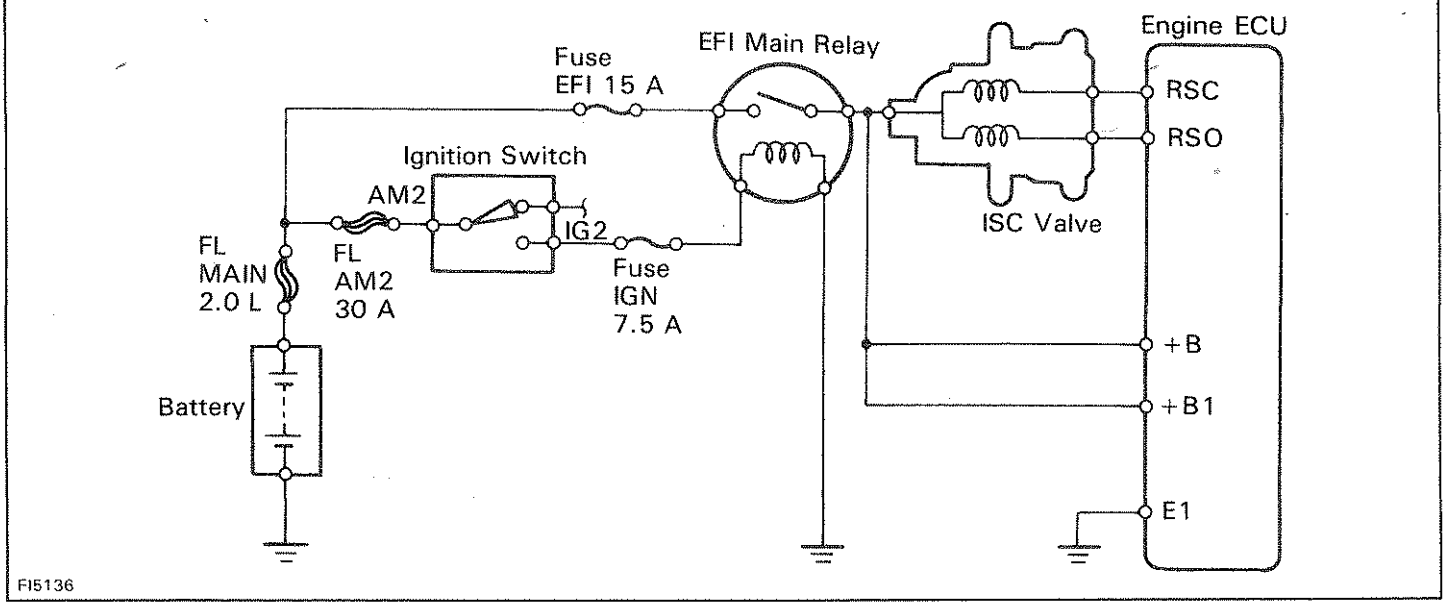
OK ↓

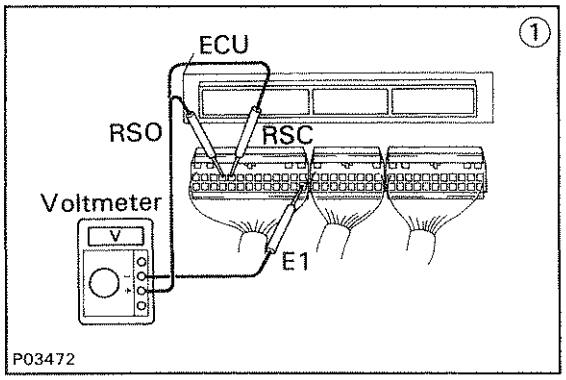
Check wiring between ECU and battery. → BAD → Repair or replace.

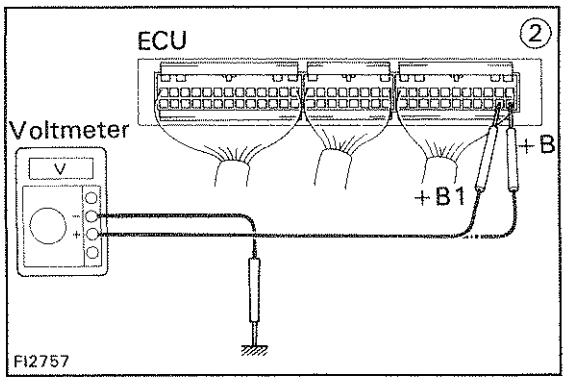
OK ↓

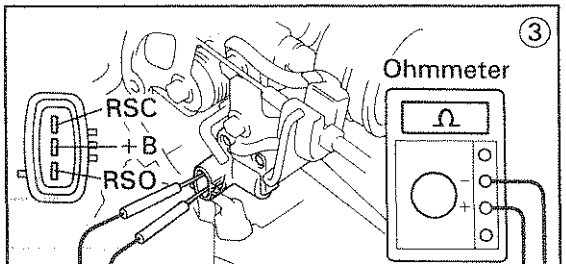
Check igniter. → BAD → Repair or replace.

No.	Terminals	Trouble	Condition		STD Voltage
10	RSC RSO — E1	No voltage	IG SW ON	Engine ECU connectors disconnected	8 — 14 V









① There is no voltage between ECU terminals RSC or RSO and E1. **(IG SW ON)**

↓

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

OK ↓

NO → Refer to +B — E1 trouble section (No.1).

③ Check resistance between ISC valve terminals +B and RSC or RSO.
STD resistance:
Approx. 19.3 — 22.3 Ω

BAD → Replace ISC valve.

OK ↓

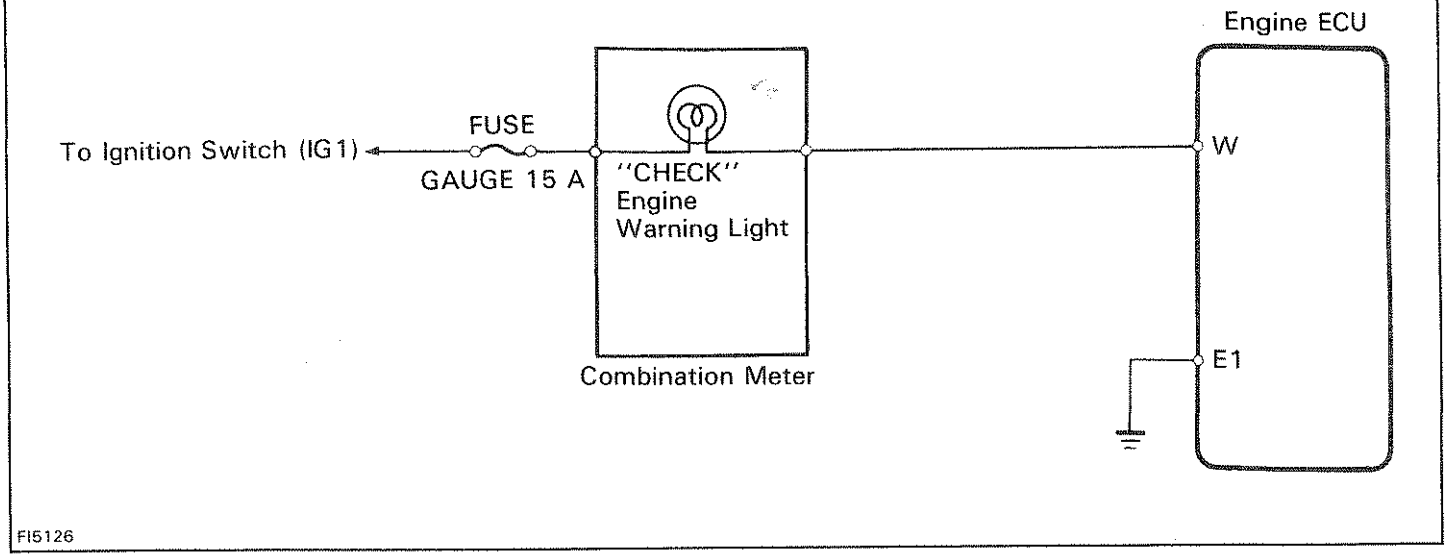
Check wiring between ECU and ISC valve.

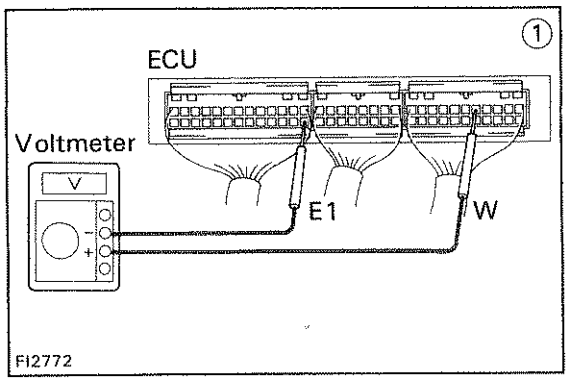
BAD → Repair or replace.

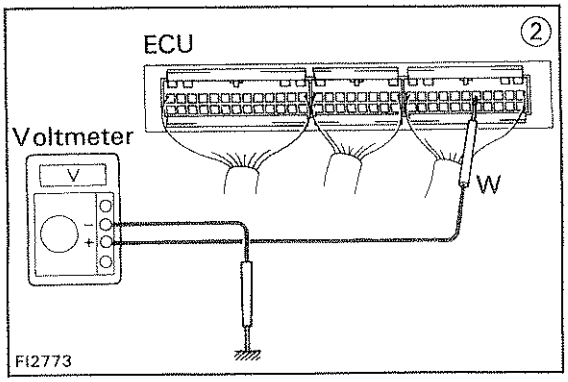
OK ↓

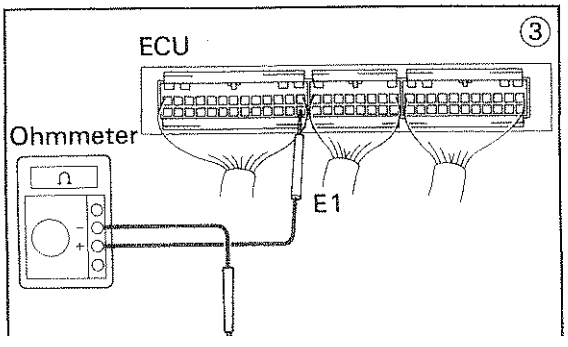
Try another ECU.

No.	Terminals	Trouble	Condition	STD Voltage
11	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.

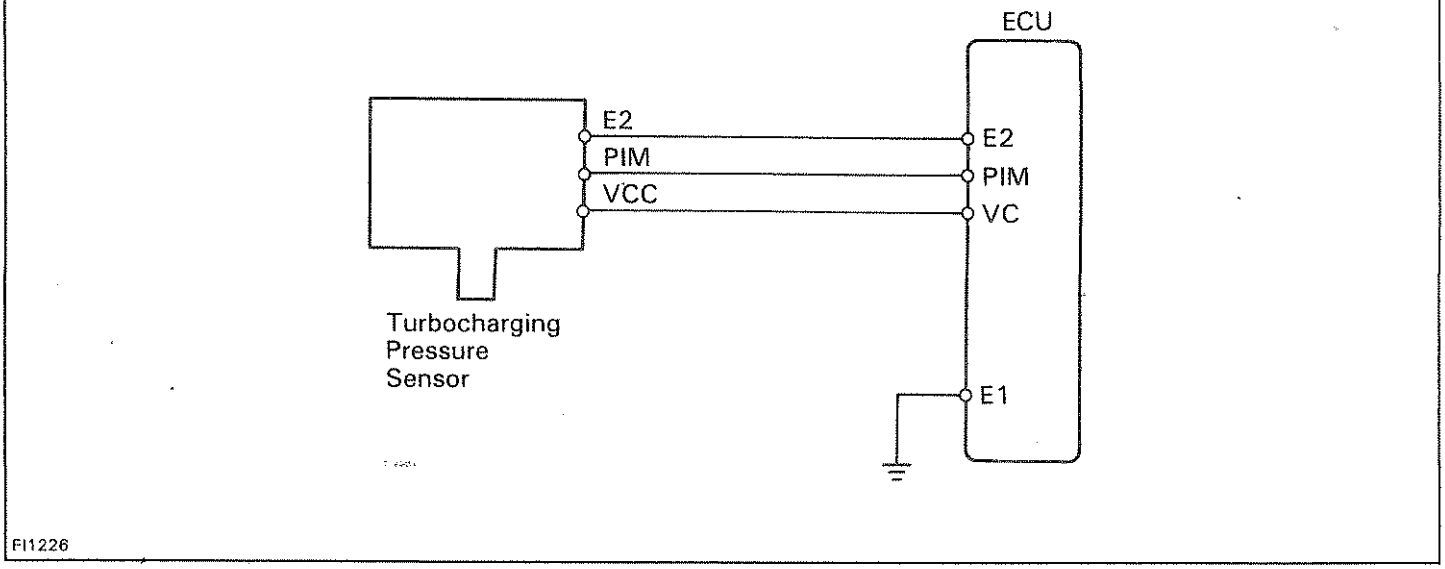
Check GAUGE fuse (15 A) and "CHECK" engine warning light.

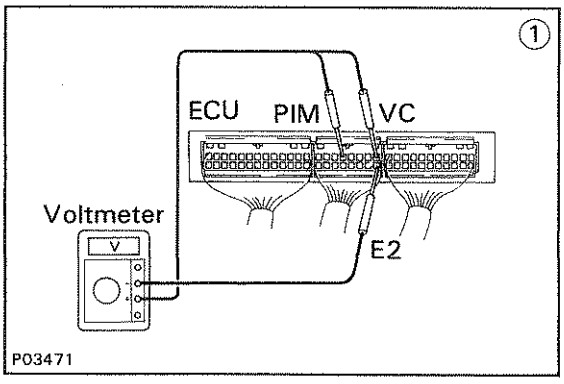
OK → BAD → Repair or replace.

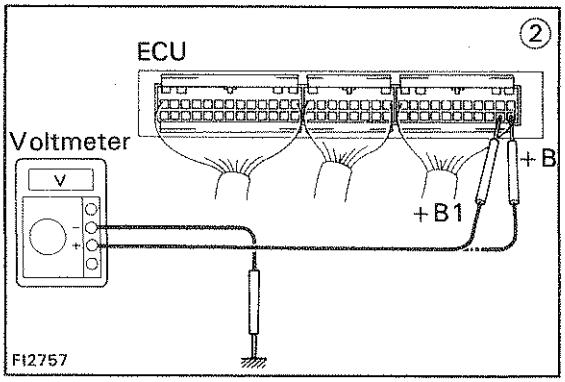
Fuse blows again

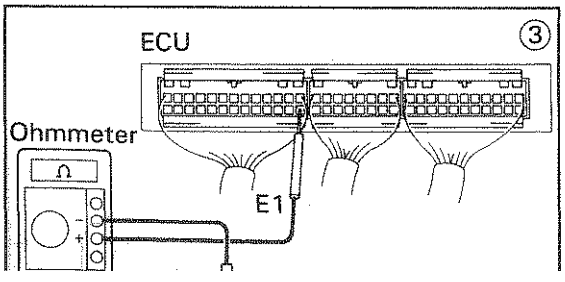
Check wiring between ECU terminal W and fuse. → BAD → Repair or replace.

No.	Terminals	Trouble	Condition	STD Voltage
11	PIM — E2	No voltage	IG SW ON	2.5 — 4.5 V
	VC — E2			4 — 6 V









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

↓

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

OK ↓

NO → Refer to +B — E1 trouble section (No.1). (See page FI-14)

↓

③ Check wiring between ECU terminal E1 and body ground.

OK ↓

BAD → Repair or replace.

Check turbocharging pressure sensor. (See page FI-42)

BAD ↓

OK → Check wiring between ECU and vacuum sensor.

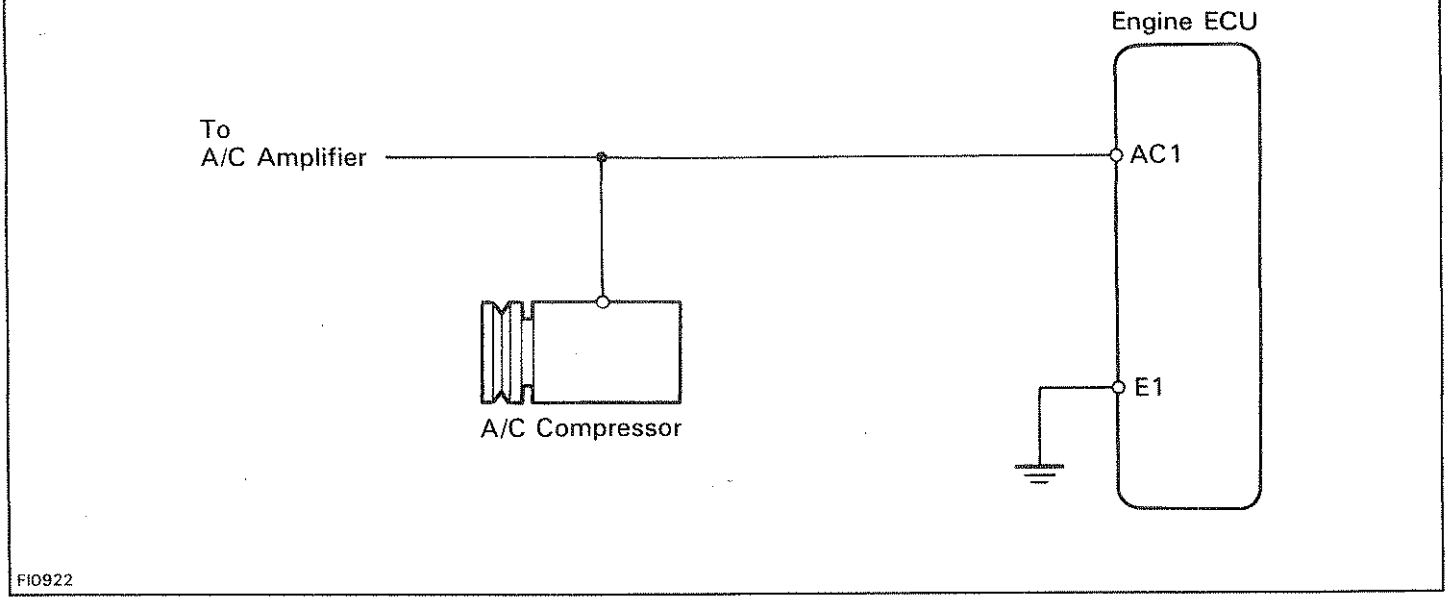
Replace turbocharging pressure sensor. ↓

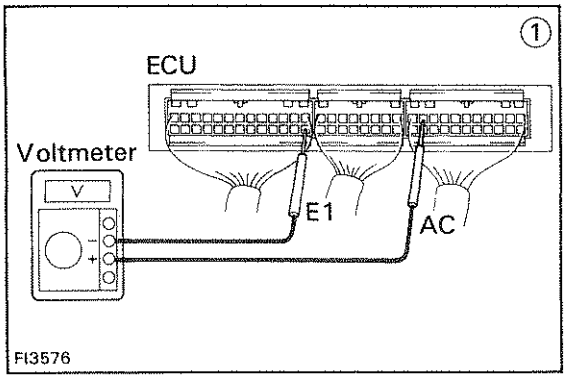
OK ↓

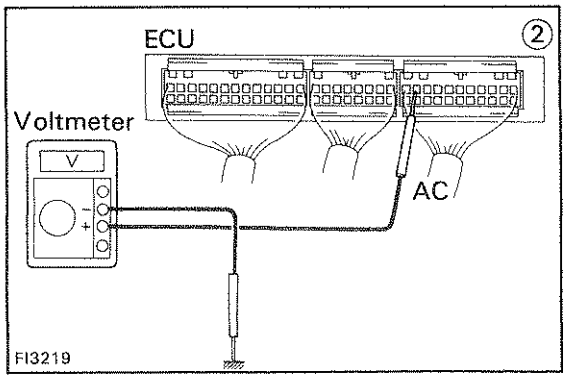
BAD → Repair or replace.

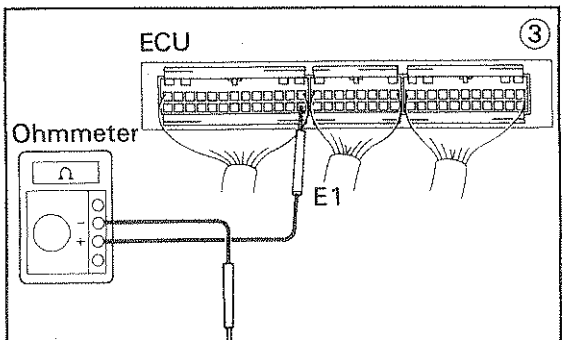
Try another ECU.

No.	Terminals	Trouble	Condition	STD Voltage
13	AC1 — E1	No voltage	Air conditioning ON	8 — 14 V









① There is no voltage between ECU terminals AC1 and E1. **(Air conditioning ON)**

② Check that there is voltage between ECU terminal AC1 and body ground.

NO

OK

③ Check wiring between ECU terminal E1 and body ground. — BAD → Repair or replace.

OK

Try another ECU.

Check compressor running. — OK → Check wiring between ECU terminal AC1 and amplifier.

BAD

BAD

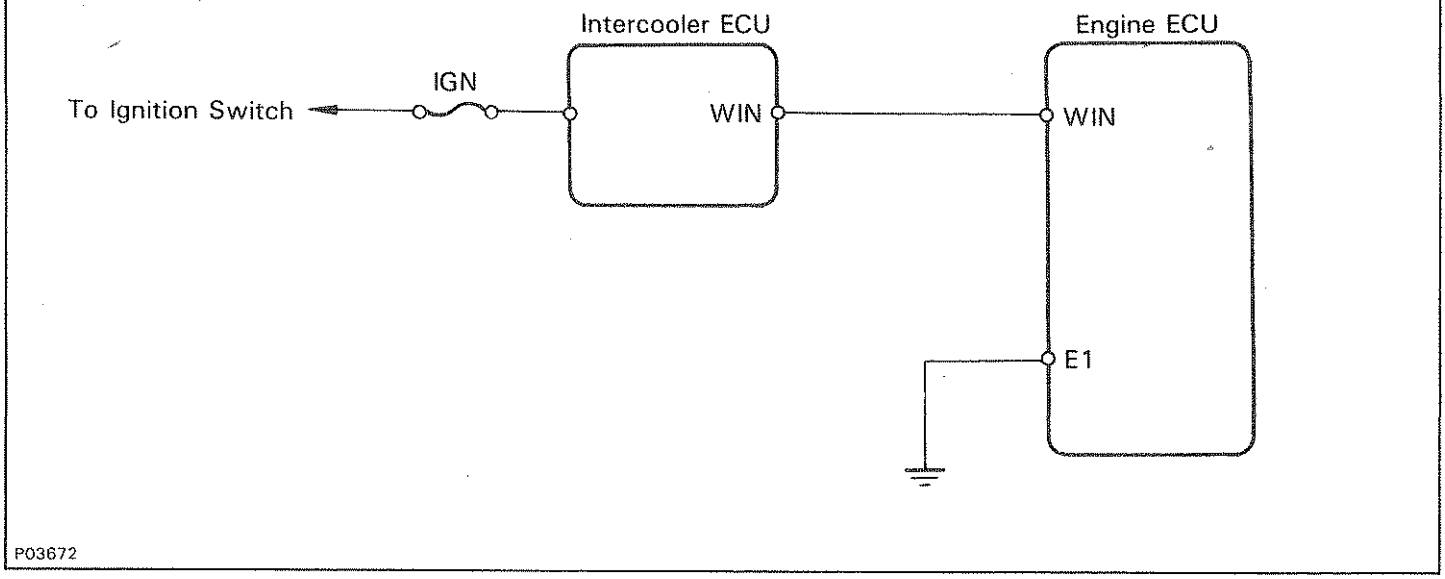
Repair or replace.

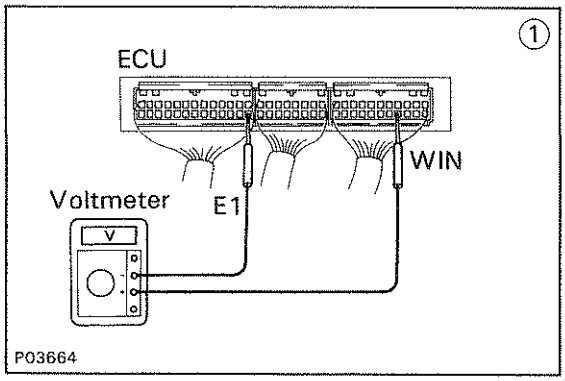
Check that there is voltage between amplifier terminal and body ground. — BAD → Repair or replace.

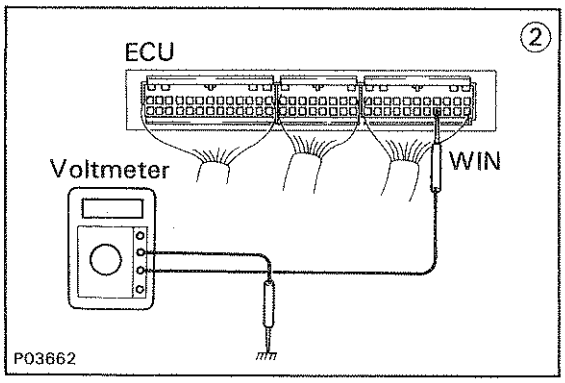
OK

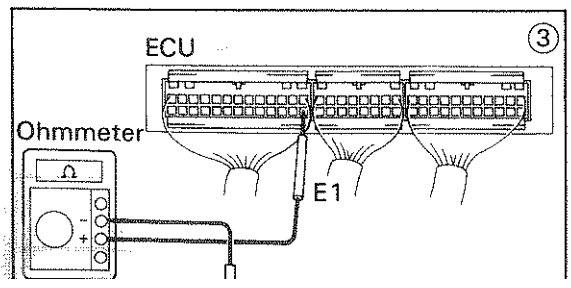
Check wiring between amplifier and ECU or compressor. — BAD → Repair or replace.

No.	Terminals	Trouble	Condition	STD Voltage
14	WIN – E1	No voltage	IG SW ON	0 – 3 V









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

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

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

③ OK → Try another ECU.

③ BAD → Repair or replace.

② OK → Check IGN fuse, intercooler ECU and ignition switch.

Check IGN fuse, intercooler ECU and ignition switch. OK → Check wiring between ECU terminal WIN and fuse.

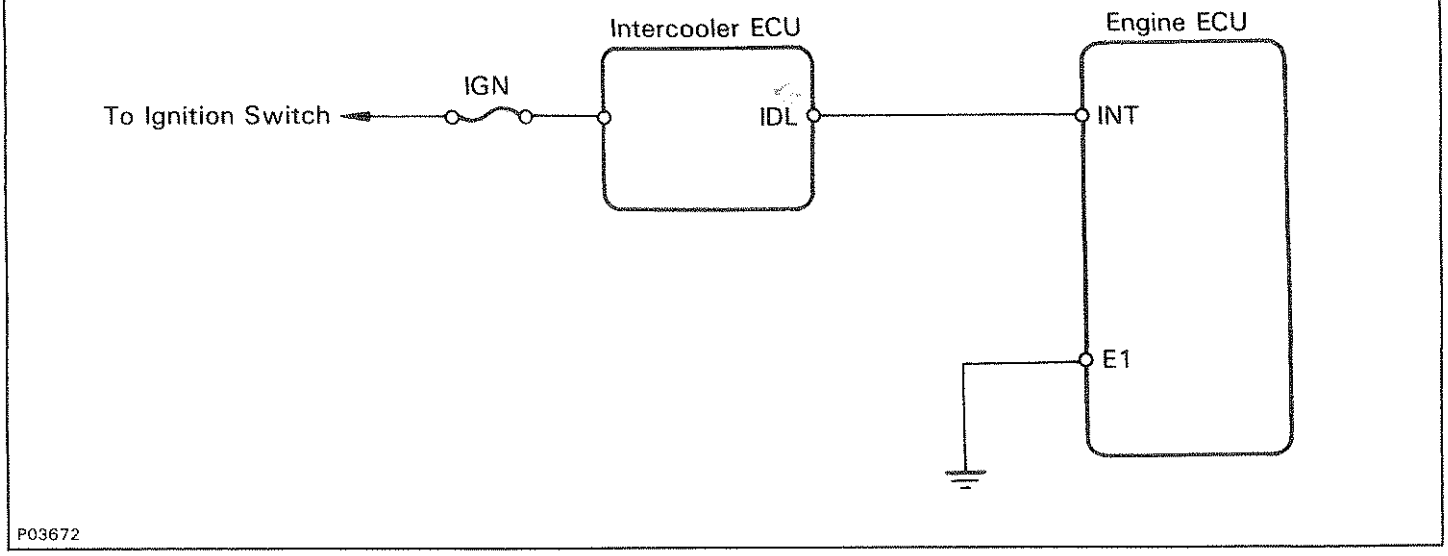
Check IGN fuse, intercooler ECU and ignition switch. BAD → Repair or replace.

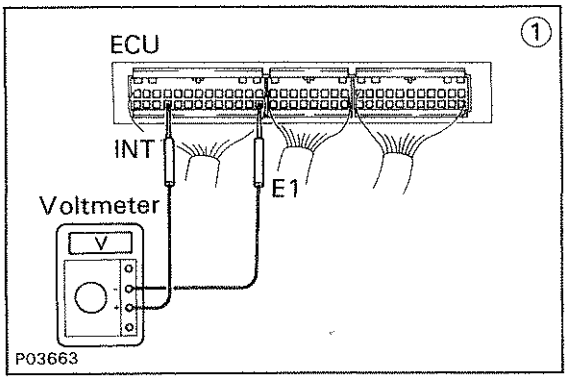
Repair or replace. → Fuse blows again → Check wiring between ECU terminal WIN and fuse.

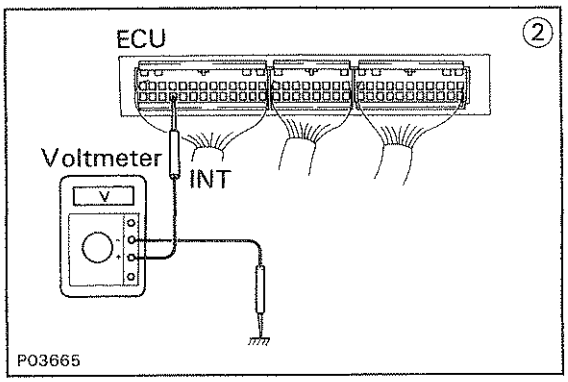
Check wiring between ECU terminal WIN and fuse. BAD → Repair or replace.

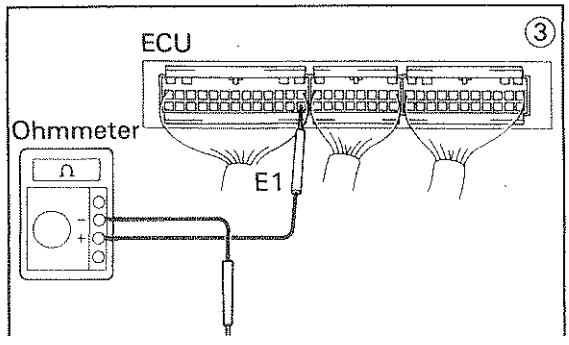
OK → Check wiring between ECU terminal WIN and fuse.

No.	Terminals	Trouble	Condition	STD Voltage
15	INT — E1	No voltage	Idling (More than 30 second)	0 — 3 V
			Idling ⇨ Throttle valve open	10 — 14 V









① There is no voltage between ECU terminals INT and E1. **(Idling)**

↓

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

NO → ↓

OK →

③ Check wiring between ECU terminal E1 and body ground.

OK → Try another ECU.

BAD → Repair or replace.

↓

Check IGN fuse intercooler ECU and ignition switch.

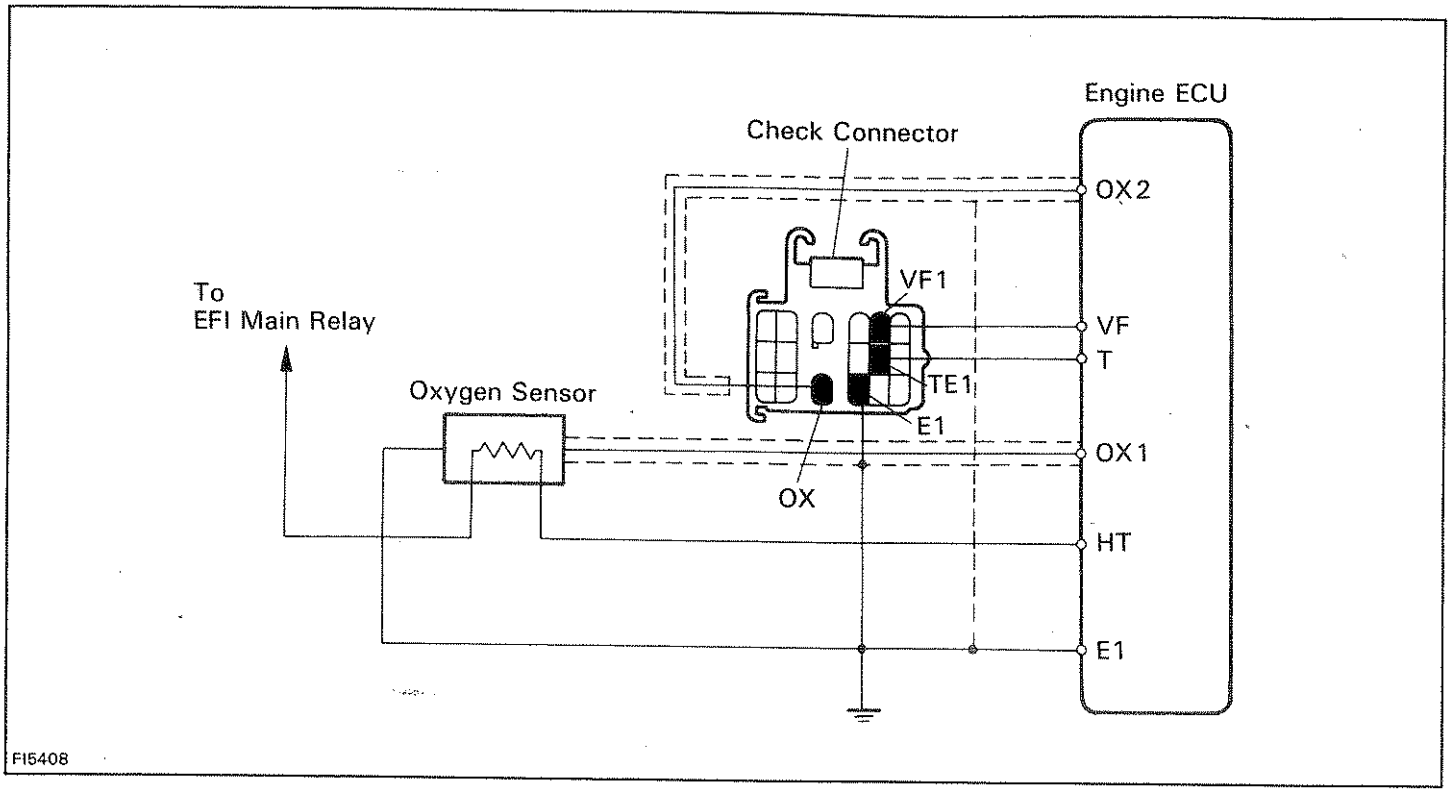
OK → ↓

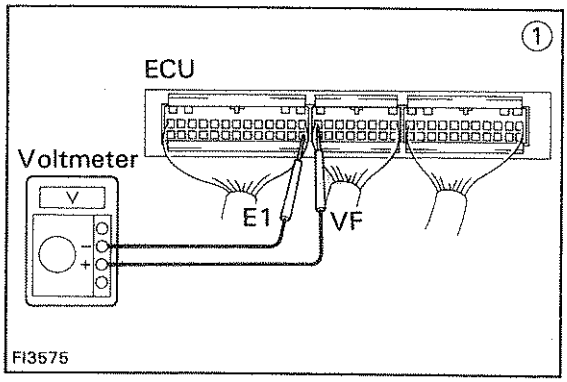
BAD → Repair or replace.

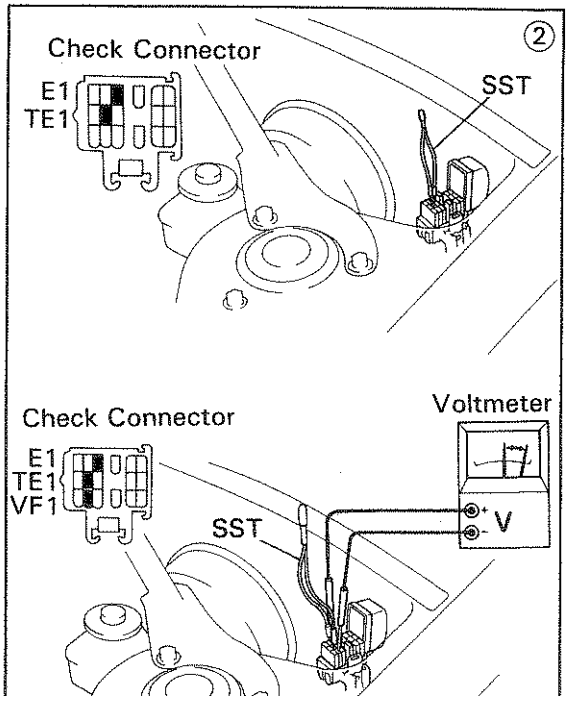
Fuse blows again → ↓

Check wiring between ECU terminal INT and fuse.

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 ground.

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

BAD → Repair or replace.

Is air leaking into air induction system? BAD → Repair or replace.

OK

Check spark plugs. BAD → Repair or replace.

OK

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

OK

Check fuel pressure. BAD → Repair or replace.

OK

Check injectors. BAD → Repair or replace.

OK

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

OK

Check air flow meter. BAD → Repair or replace.

OK

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

BAD

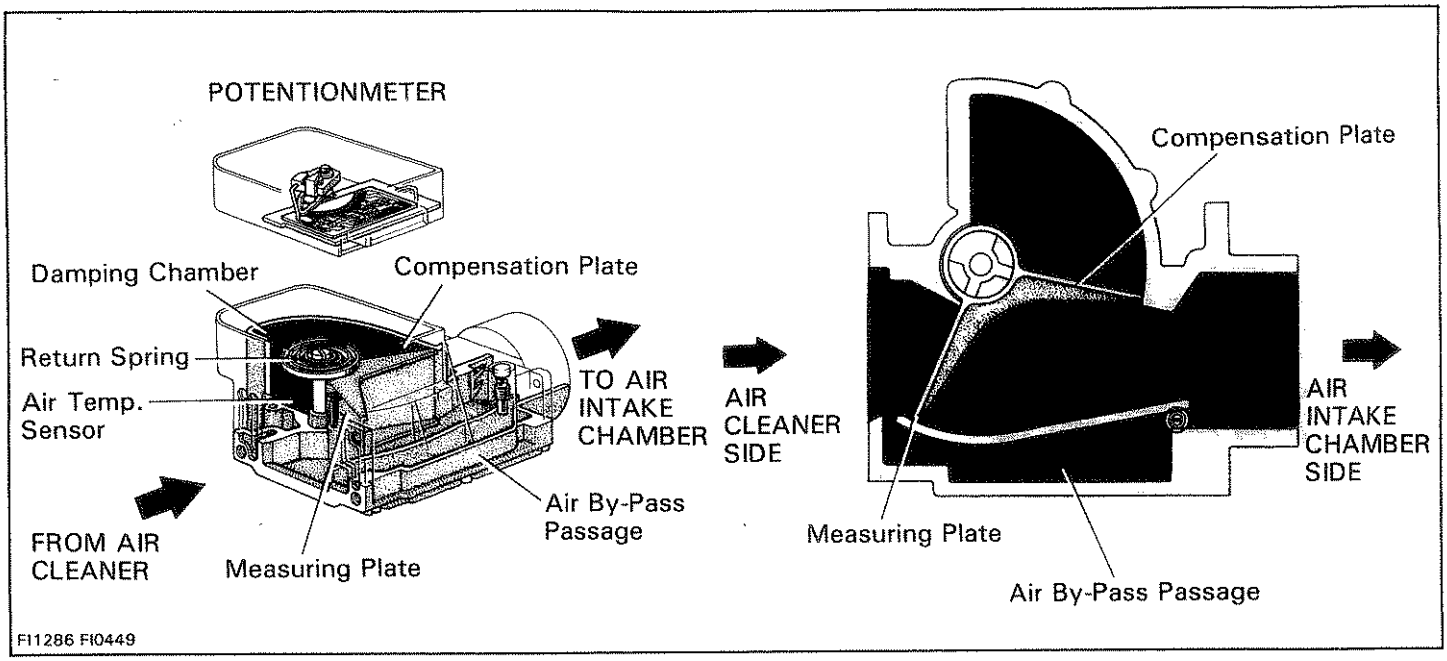
Check wiring between oxygen sensor and ECU. BAD → Repair wiring.

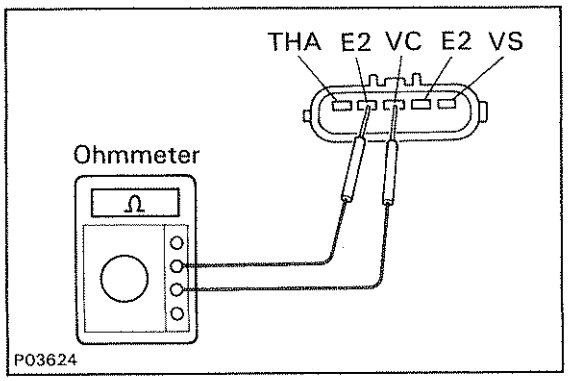
OK

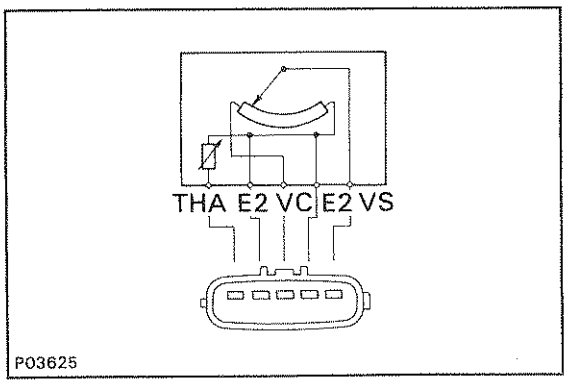
* Rich malfunction

AIR INDUCTION SYSTEM

Air Flow Meter







ON-VEHICLE INSPECTION

INSPECT RESISTANCE OF AIR FLOW METER

(a) Disconnect the air flow meter connector.

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

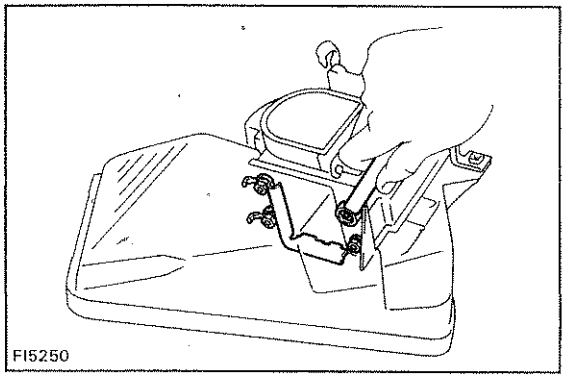
Between terminals	Resistance (Ω)	Temp. °C (°F)
E2 — VS	200 — 600	—
E2 — VC	200 — 400	—
E2 — THA	10,000 — 20,000	−20 (−4)
	4,000 — 7,000	0 (32)
	2,000 — 3,000	20 (68)
	900 — 1,300	40 (104)
	400 — 700	60 (140)

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

(c) Reconnect the air flow meter connector.

REMOVAL OF AIR FLOW METER

1. DISCONNECT AIR FLOW METER CONNECTOR
2. DISCONNECT ACCELERATOR CABLE
3. DIECONNECT AIR CLEANER HOSE
4. REMOVE AIR CLEANER CAP AND AIR FLOW METER ASSEMBLY


FI5250

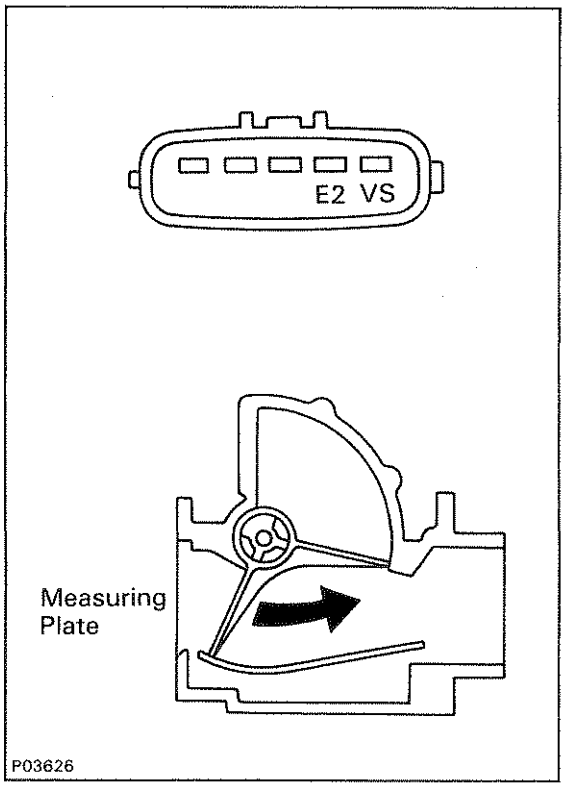
5. REMOVE AIR FLOW METER FROM AIR CLEANER CAP

Pry off the lock plates, and remove the bolt, four nuts, four plates, 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.



P03626

Between terminals	Resistance (Ω)	Measuring plate opening
E2 — VS	200 — 600	Fully closed
	20 — 1,200	Fully open

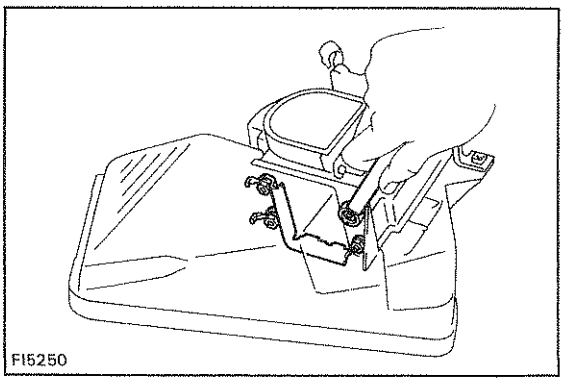
HINT: Resistance between terminals E2 and VS will change in a wave pattern as the measuring plate slowly opens.

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

INSTALLATION OF AIR FLOW METER

1. INSTALL AIR FLOW METER TO AIR CLEANER CAP

Install the air flow meter with the gasket, lock plate, four plate washers, four nuts and bolt. Pry the lock plate on the nut.


FI5250

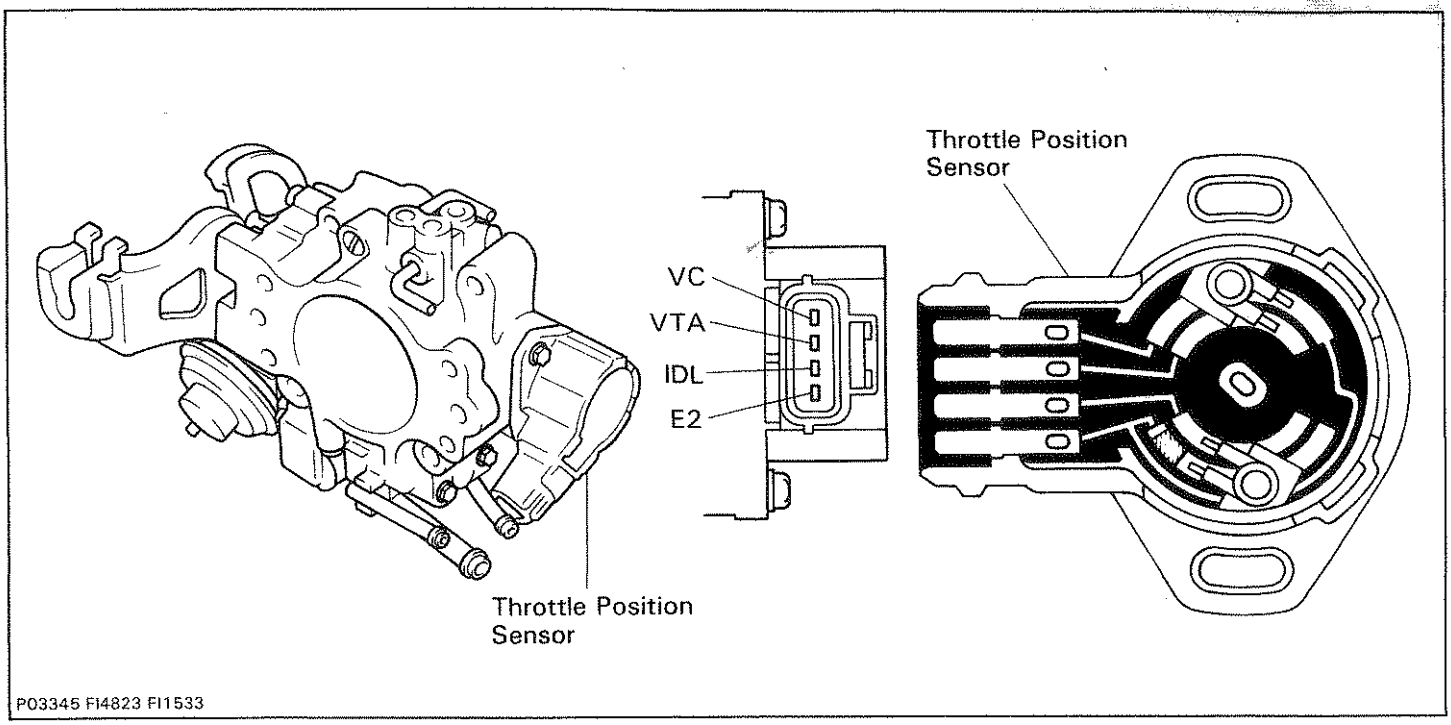
2. INSTALL AIR CLEANER CAP AND AIR FLOW METER ASSEMBLY

3. CONNECT AIR CLEANER HOSE

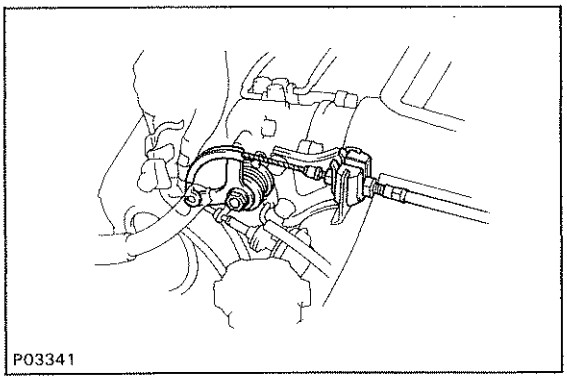
4. CONNECT ACCLERATOR CABLE TO CLAMP

5. CONNECT AIR FLOW METER CONNECTOR

Throttle Body



P03345 FI4823 FI1533

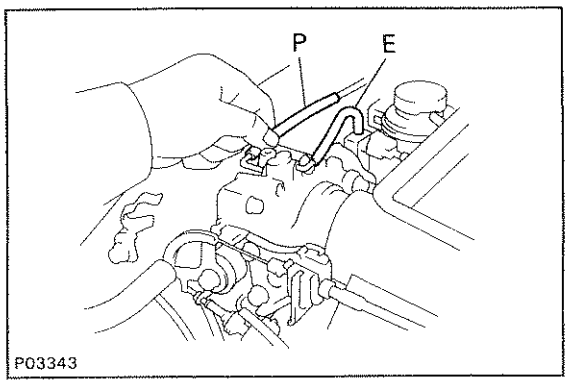


P03341

ON-VEHICLE INSPECTION

1. INSPECT THROTTLE BODY

(a) Check that the throttle linkage moves smoothly.

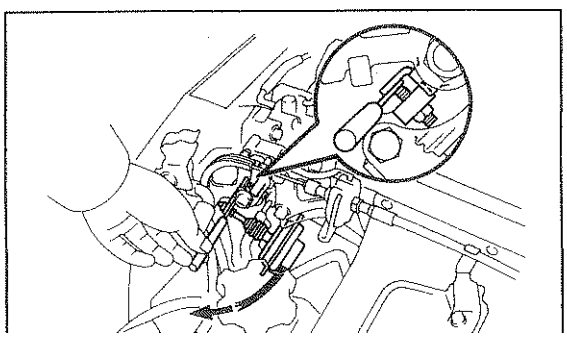


P03343

(b) Check the vacuum at each port.

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

Port name	At idling	Other than idling
P	No vacuum	Vacuum
E	No Vacuum	Vacuum



2. INSPECT THROTTLE POSITION SENSOR

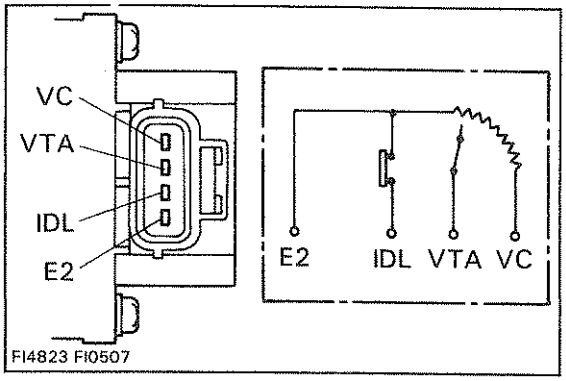
(a) Apply vacuum to the throttle opener.

(b) Disconnect the sensor connector.

(c) Insert a thickness gauge between the throttle stop screw and throttle opener.

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

SST 09240-00020



Clearance between lever and stop screw	Between terminals	Resistance
0 mm (0 in.)	VTA — E2	0.2 — 0.8 kΩ
0.50 mm (0.020 in.)	IDL — E2	2.3 kΩ or less
0.70 mm (0.028 in.)	IDL — E2	Infinity
Throttle valve fully opened	VTA — E2	3.3 — 10 kΩ
—	VC — E2	3 — 7 kΩ

(d) Reconnect the sensor connector.

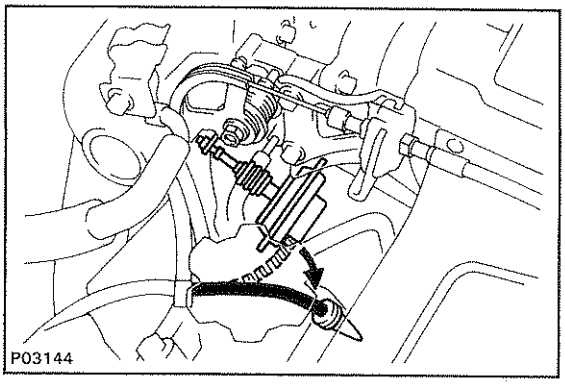
3. INSPECT THROTTLE OPENER

A. Warm up engine

Allow the engine to warm up to normal operating temperature.

B. Check idle speed

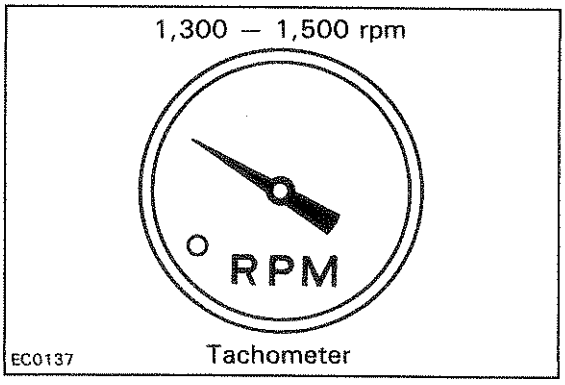
Idle speed: 800 ± 50 rpm



C. Check throttle opener setting speed

(a) Disconnect the vacuum hose from the throttle opener, and plug the hose end.

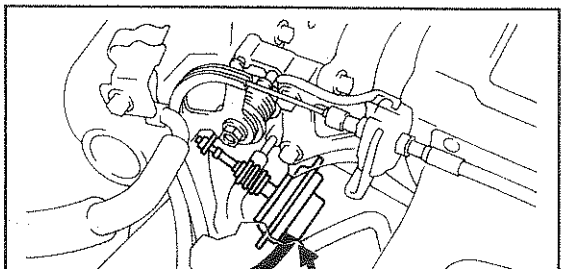
(b) Maintain the engine at 2,500 rpm.



(c) Release the throttle valve.

(d) Check that the throttle opener is set.

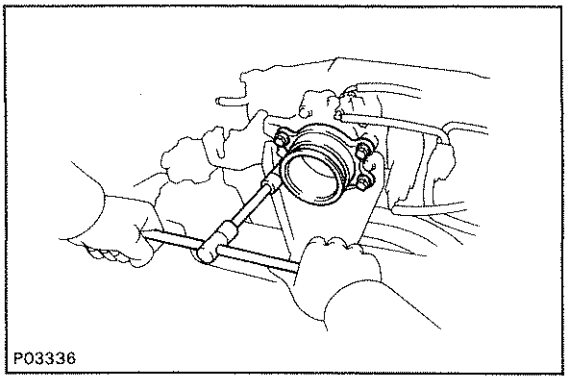
Throttle opener setting speed:
1,300 — 1,500 rpm (w/Cooling fan OFF)



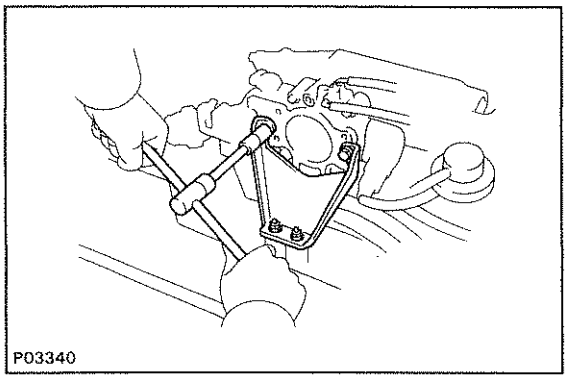
(e) Reconnect the vacuum hose to the throttle opener.

REMOVAL OF THROTTLE BODY

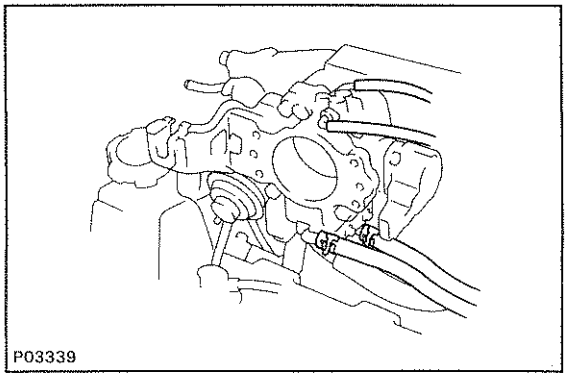
1. **DISCONNECT CABLE FROM NEGATIVE TERMINAL OF BATTERY**
2. **DRAIN ENGINE COOLANT**
3. **DISCONNECT ACCELERATOR CABLE FROM THROTTLE LINKAGE**



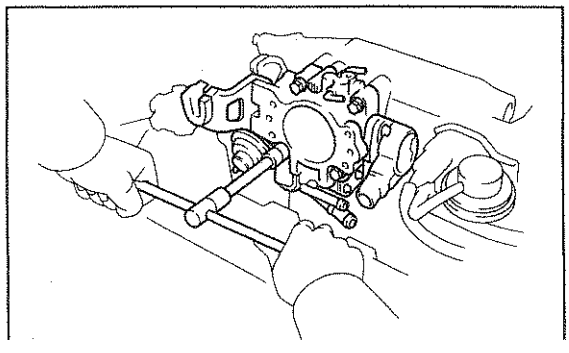
4. **REMOVE INTERCOOLER**
   (See steps 5, 6 on page TC-14)
5. **REMOVE AIR CONNECTOR**
   Remove the four bolts and air connector.



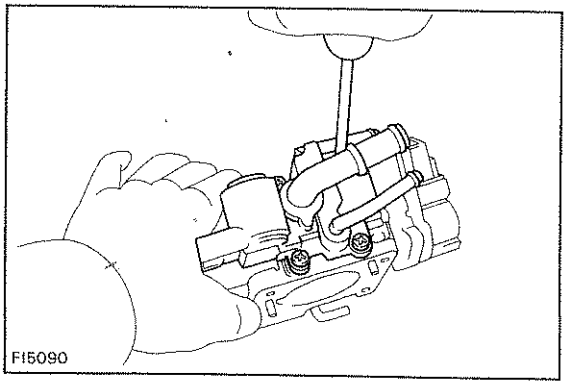
6. **REMOVE AIR CONNECTOR STAY**
   Remove the two bolts and two nuts air connector stay.
7. **DISCONNECT THROTTLE POSITION SENSOR CONNECTOR**
8. **DISCONNECT ISC VALVE CONNECTOR**



9. **DISCONNECT HOSES FROM THROTTLE BODY**
   (a) PCV hose
   (b) Water by-pass hoses from by-pass pipe
   (c) Two vacuum hoses for EGR
   (d) Air hose from by-pass pipe

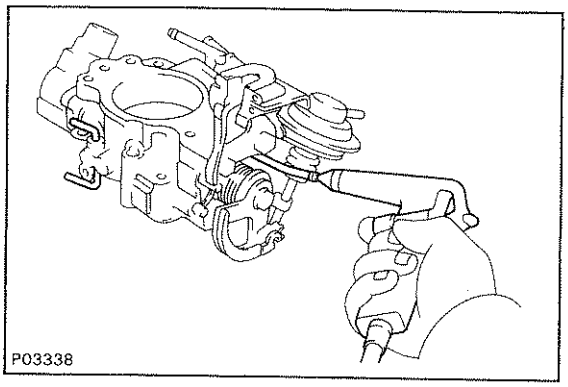


10. **REMOVE THROTTLE BODY**
    Remove the four bolts, throttle body and gasket.



11. IF NECESSARY, REMOVE ISC VALVE FROM THROTTLE BODY

Remove the four screws, ISC valve and gasket.



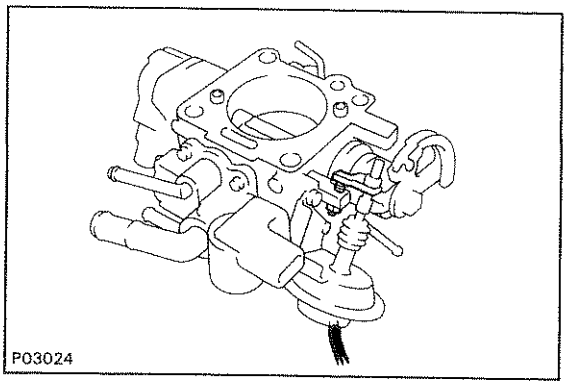
INSPECTION OF THROTTLE BODY

1. CLEAN THROTTLE BODY

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

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

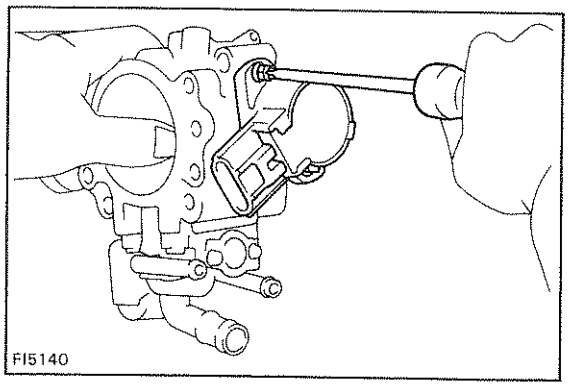
NOTICE: To pervent deterioration, do not clean the throttle position sensor.



2. INSPECT THROTTLE VALVE

(a) Apply vacuum to the throttle opener.

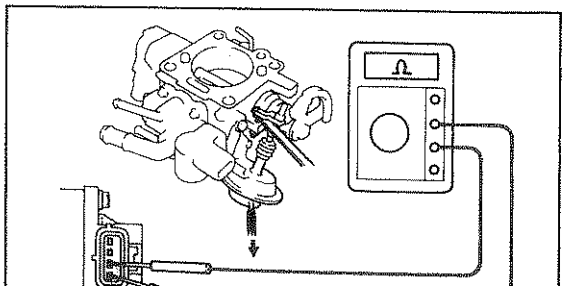
(b) Check that there is no clearance between the throttle stop screw and throttle lever when the throttle valve is fully closed.



3. INSPECT THROTTLE POSITION SENSOR
(See step 2 on page FI-33)

4. IF NECESSARY, ADJUST THROTTLE POSITION SENSOR

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

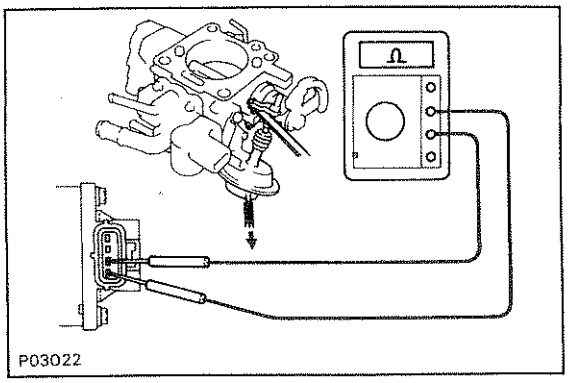


(b) Apply vacuum to the throttle opener.

(c) Insert a thickness gauge 0.60 mm (0.024 in.) between the throttle stop screw and throttle lever.

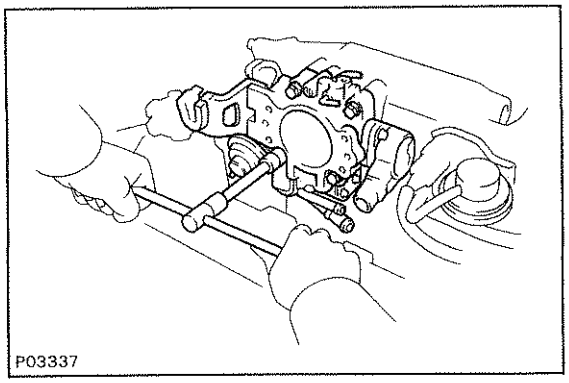
(d) Connect the test probe of an ohmmeter to the terminals IDL and E2 of the sensor.

(e) Gradually turn the sensor clockwise until the ohmmeter indicator deflects, and secure it with the



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

Cleatance between lever and stop screw	Continuity (IDL – E1)
0.50 mm (0.020 in.)	Continuity
0.90 mm (0.035 in.)	No continuity



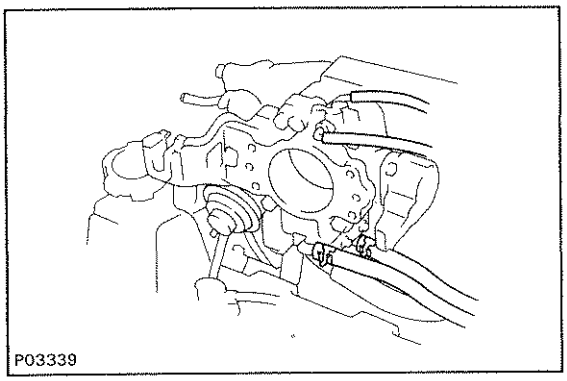
INSTALLATION OF THROTTLE BODY

1. **INSTALL ISC VALVE TO THROTTLE BODY**
(See Pub. No. RM164E FI section)

2. **INSTALL THROTTLE BODY**

Install a new gasket and the throttle body with the four bolts.

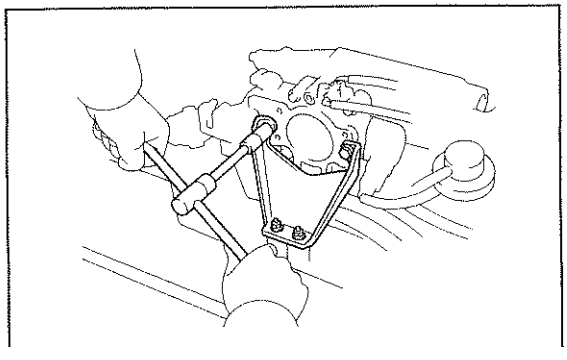
Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)



3. **CONNECT HOSES TO THROTTLE BODY**
   (a) PCV hose
   (b) Water by-pass hoses from by-pass pipe
   (c) Two vacuum hoses for EGR
   (d) Air hose from by-pass pipe

4. **CONNECT ISC VALVE CONNECTOR**

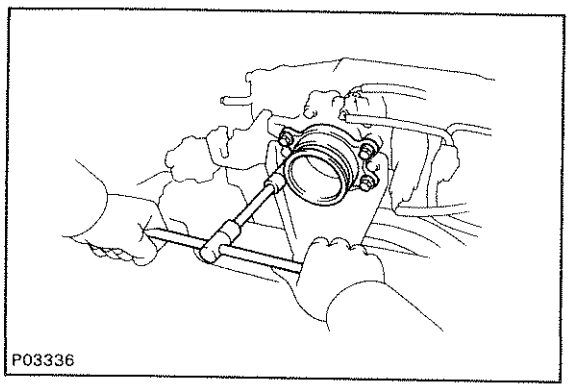
5. **CONNECT THROTTLE POSITION SENSOR CONNECTOR**



6. **INSTALL AIR CONNECTOR STAY**

Install the air connector stay with the two bolts and two nuts.

Torque:
Nut 7.8 N·m (80 kgf·cm, 69 in.·lbf)
Bolt 19 N·m (195 kgf·cm, 14 ft·lbf)



7. **INSTALL AIR CONNECTOR**

Install the air connector with the four bolts.

Torque: 19 N·m (195 kgf·cm, 14 ft·lbf)

8. **INSTALL INTERCOOLER**
(See steps 12, 13 on page TC-21)

9. **CONNECT ACCELERATOR CABLE, AND ADJUST IT**

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

11. **FILL ENGINE WITH COOLANT**

(a) Slowly fill the system with coolant.

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

Ethylene-glycol type: This type has an antifreeze and anticorrosive effect.
TOYOTA radiator conditioner: This has only an anticorrosive effect.

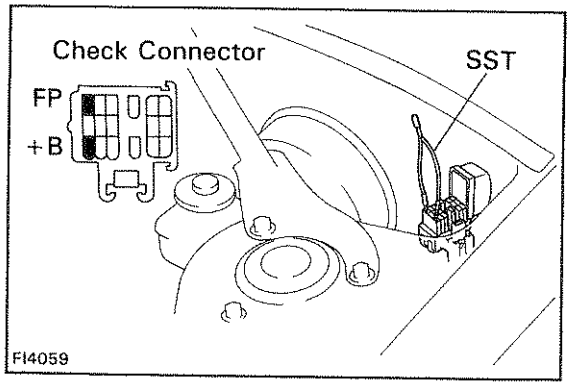
NOTICE:
- **Do not use an alcohol type coolant.**
- **The coolant should be mixed with demineralized water or distilled water.**

Capacity (w/Heater):
6.0 liters (6.3 US qts, 5.3 Imp.qts)

(b) Reinstall the radiator cap.

(c) Warm up the engine and check for leaks.

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

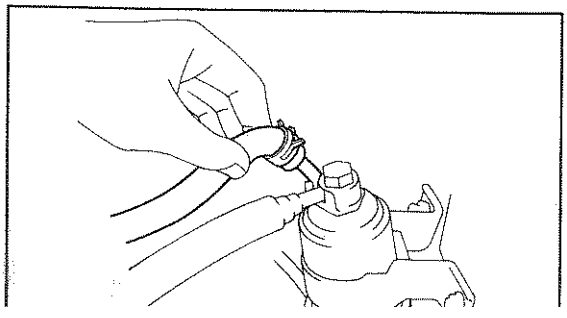


12. **CHECK FOR FUEL LEAKAGE**

(a) With engine stopped, turn the ignition switch ON.

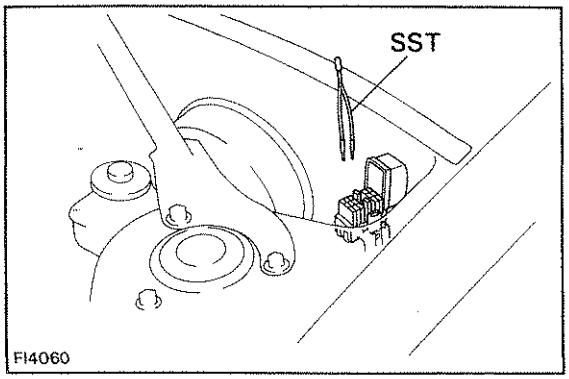
(b) Using SST, connect terminals +B and FP of the check connector.

SST 09843-18020



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

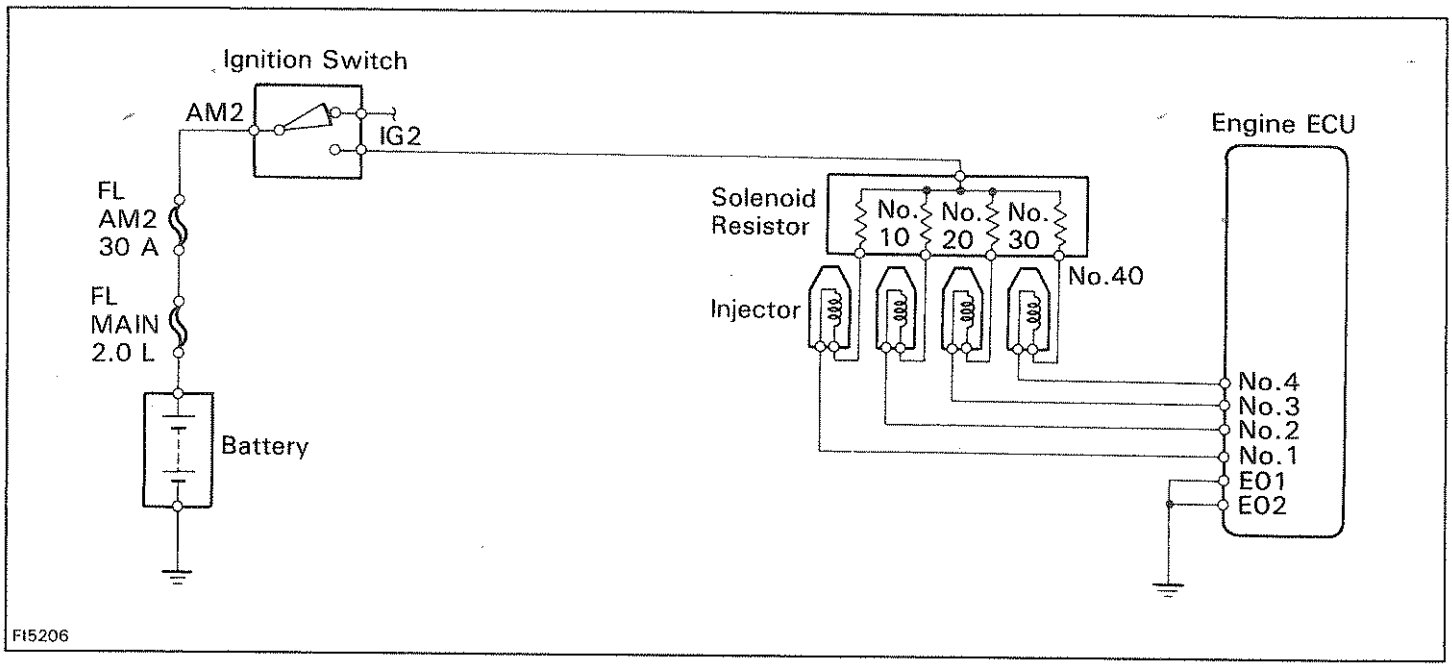
NOTICE: Always pinch the hose. Avoid bending as it may cause the hose to creck.

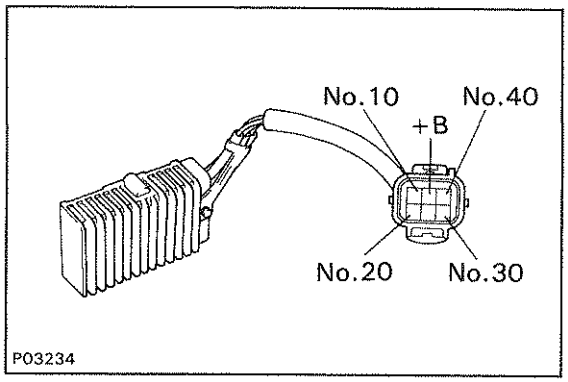


(d) Remove SST.
SST 09843-18020

ELECTRONIC CONTROL SYSTEM

Solenoid Resistor





INSPECTION OF SOLENOID RESISTOR

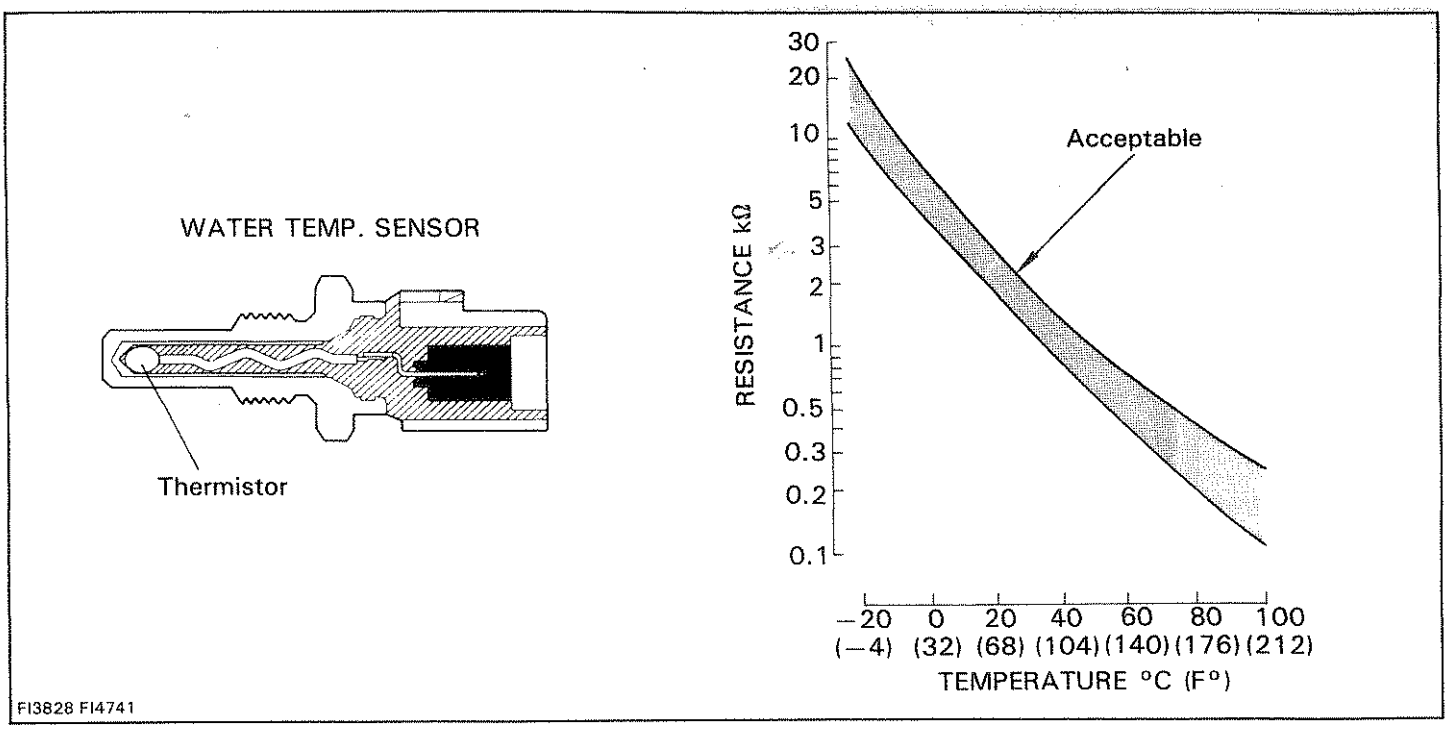
INSPECT SOLENOID RESISTOR

Using as ohmmeter, measure the resistance between terminal +B and other terminals.

Resistance: 4 — 6 Ω each

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

Water Temperature Sensor



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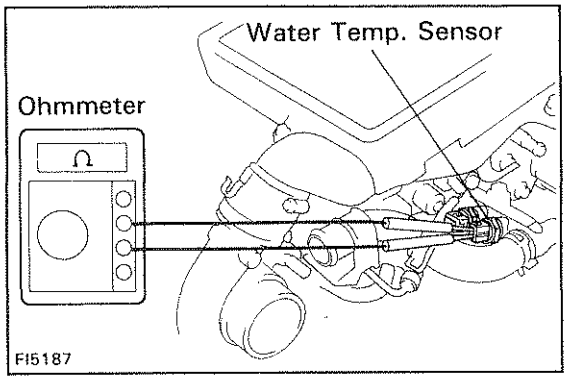


FI5187

INSPECTION OF WATER TEMPERATURE SENSOR

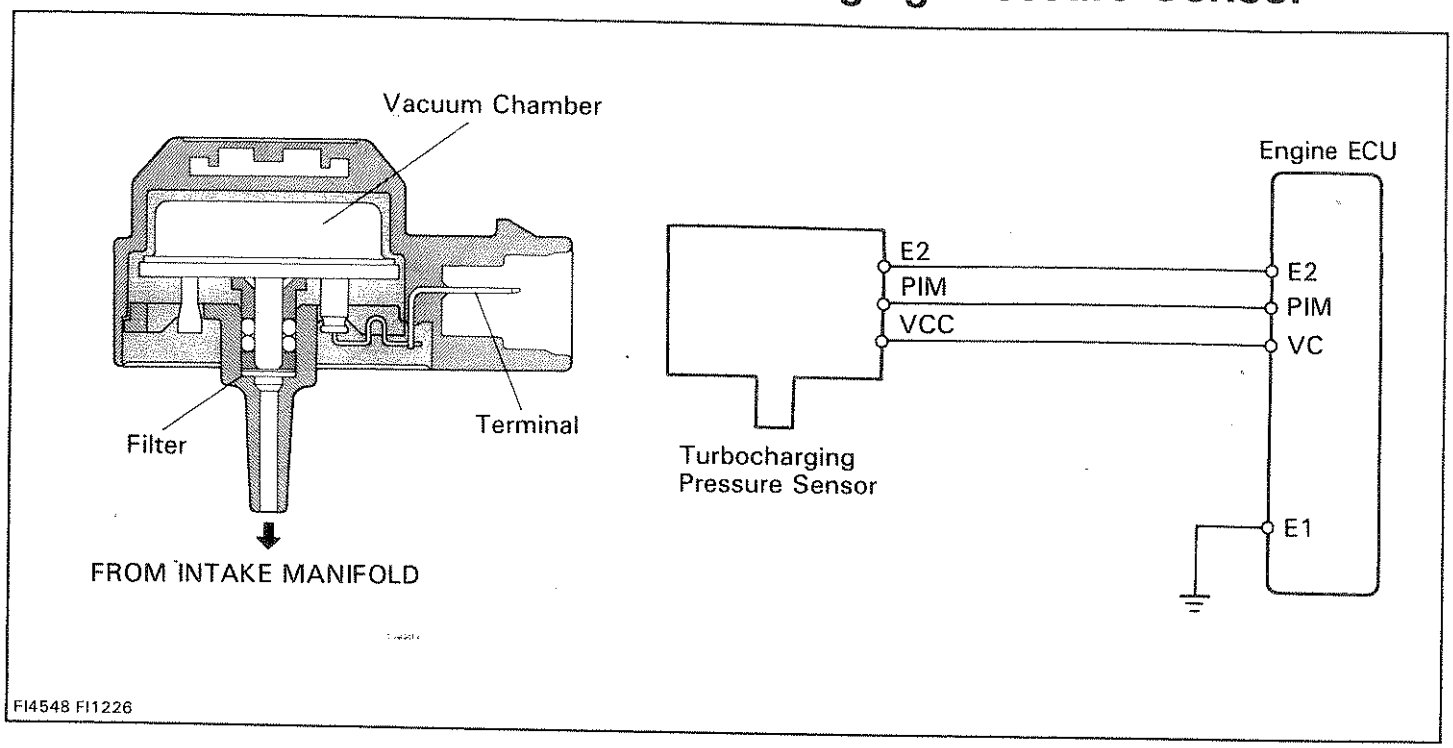
INSPECT RESISTANCE OF WATER TEMPERATURE SENSOR

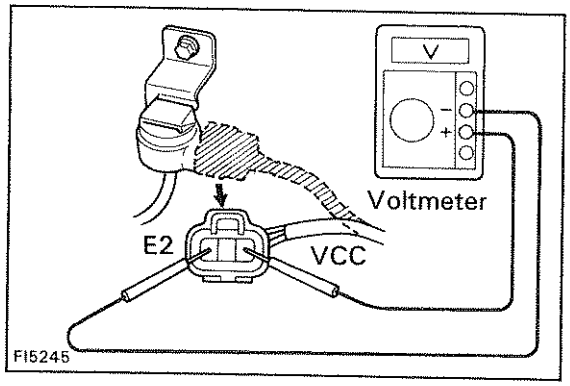
Using an ohmmeter, measure the resistance between the terminals.

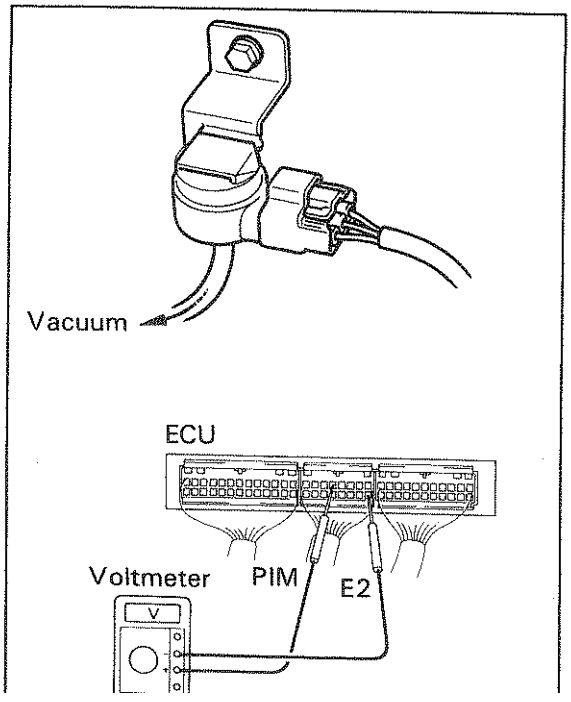
Resistance: Refer to chart

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

Turbocharging Pressure Sensor







INSPECTION OF TURBOCHARGING PRESSURE SENSOR

1. **INSPECT POWER SOURCE VOLTAGE OF TURBOCHARGING PRESSURE SENSOR**
   (a) Disconnect the turbocharging pressure sensor connector.
   (b) Turn the ignition switch ON.
   (c) Using a voltmeter, measure the voltage between terminals VCC and E2 of the vacuum sensor connector.
   Voltage: 4 — 6 V
   (d) Reconnect the turbocharging pressure sensor connector.

2. **INSPECT POWER OUTPUT OF TURBOCHARGING PRESSURE SENSOR**
   (a) Turn the ignition switch ON.
   (b) Disconnect the vacuum hose of the air intake manifold (chamber) side.
   (c) Connect a voltmeter to terminals PIM and E2 of the pressure sensor, and measure and record the output voltage under ambient atmospheric pressure.
   (d) Apply vacuum to the pressure sensor in 13.3 kPa (100 mmHg, 3.94 in.Hg) segments to 66.7 kPa (500 mmHg, 19.69 in.Hg)
   (e) Measure the voltage drop from step (c) above for each segment.

Voltage drop

Applied Vacuum kPa	13.3 (100 3.94)	26.7 (200 7.87)	40.0 (300 11.81)	53.3 (400 15.75)	66.7 (500 [illegible])

Engine (and ECT) Electronic Controlled Unit (ECU)

INSPECTION OF ENGINE (AND ECT) ECU

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

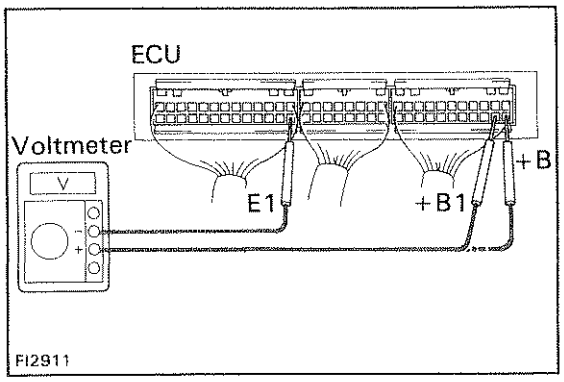
1. INSPECT VOLTAGE OF ENGINE (AND ECT) ECU

Check the voltage between each terminal of the wiring connectors.

- Turn the ignition switvh 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.

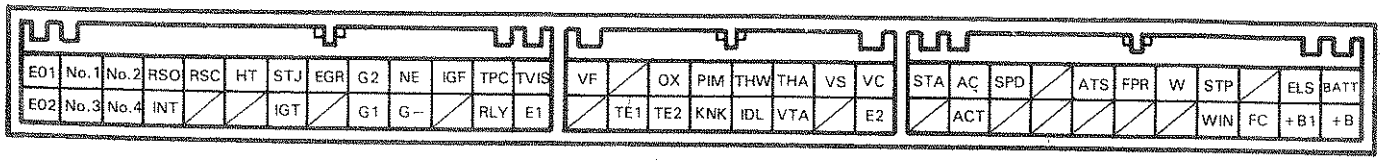


Voltage at Engine ECU Wiring Connectors

Terminals	Condition		STD voltage (V)
+B, +B1 — E1	IG SW ON		10 — 14
BATT — E1	—		10 — 14
IDL — E2	IG SW ON	Throttle valve open	4 — 6
VTA — E2		Throttle valve fully colsed	0.1 — 1.0
		Throttle valve open	4 — 5
VC — E2		—	4 — 6
VS — E2		Measuring plate fully closed	3.7 — 4.3
		Measuring plate fully open	0.2 — 0.5
	Idling		2.3 — 3.8
	3,000 rpm		1.0 — 2.0
No.1, No.2, No.3, No.4 — EO1, EO2	IG SW ON		10 — 14
THA — E2	IG SW ON	Intake air temp. 20°C (68°F)	1 — 3
THW — E2	IG SW ON	Coolant temp. 80°C (176°F)	0.1 — 1.0
STA — E1	Cranking		6 — 14
IG — E1	Idling		0.7 — 1.0
RSC, RSO — E1	IG SW ON	Engine ECU connectors disconnected	8 — 14
W — E1	No trouble (''CHECK'' engine warning light off) and engine running		10 — 14
ACF — E1	IG SW ON	Air conditioning ON	8 — 14
PIM — E2	IG SW ON		2.5 — 4.5
*1 T-VIS — E1	IG SW ON	Throttle valve fully closed	2.0 or less
		Throttle valve open	10 — 14
*2 T-VIS — E1	Idling		10 — 14
	4,200 rpm or more		2.0 or less
TE1 — E1	IG SW ON	Check connector TE1 — E1 not connect	10 — 14
		Check connector TE1 — E1 connect	1 or less

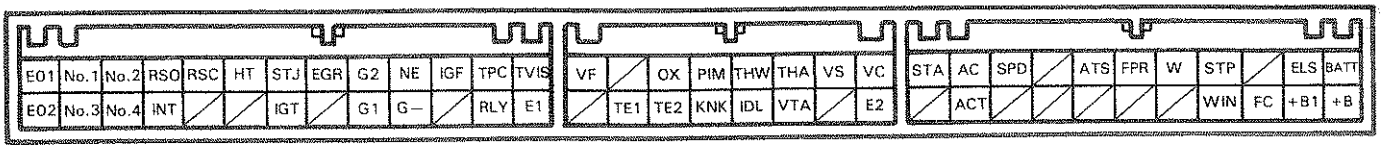
Engine ECU Terminals

*1 w/ Regular Unleaded Gasoline
*2 w/ Premium Unleaded Gasoline



Terminals	Condition	STD Voltage (V)
WIN — E1	IG SW ON	0 — 3
INT — E1	Idling (More than 30 second)	0 — 3
	Idling ⇨ Throttle valve open	10 — 14

Engine ECU Terminals



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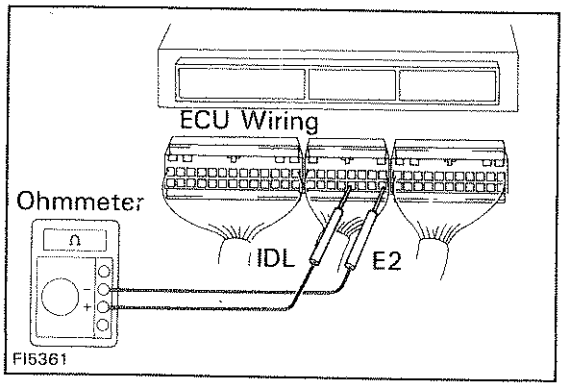


2. **INSPECT RESISTANCE OF ENGINE ECU**

NOTICE:

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

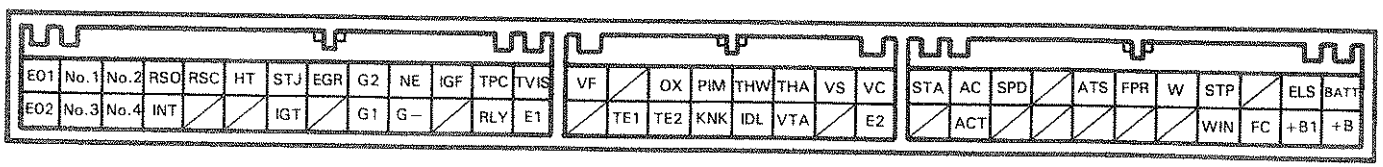
Check the resistance between each terminal of the wiring connectors.

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

Resistance of Engine ECU Wiring Connectors

Terminals	Condition	Resistance (Ω)
IDL — E2	Throttle valve open	Infinity
	Throttle valve fully closed	2,300 or less
VTA — E2	Throttle valve fullly open	3,500 — 10,000
	Throttle valve fully closed	200 — 800
VC — E2	—	200 — 400
VS — E2	Measuring plate fully closed	200 — 600
	Measuring plate fully open	20 — 1,200
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⊖	Cold	125 — 190
NE — G⊖	Cold	155 — 240
RSC, RSO — +B, +B1	—	19.3 — 22.3

Engine ECU Terminals



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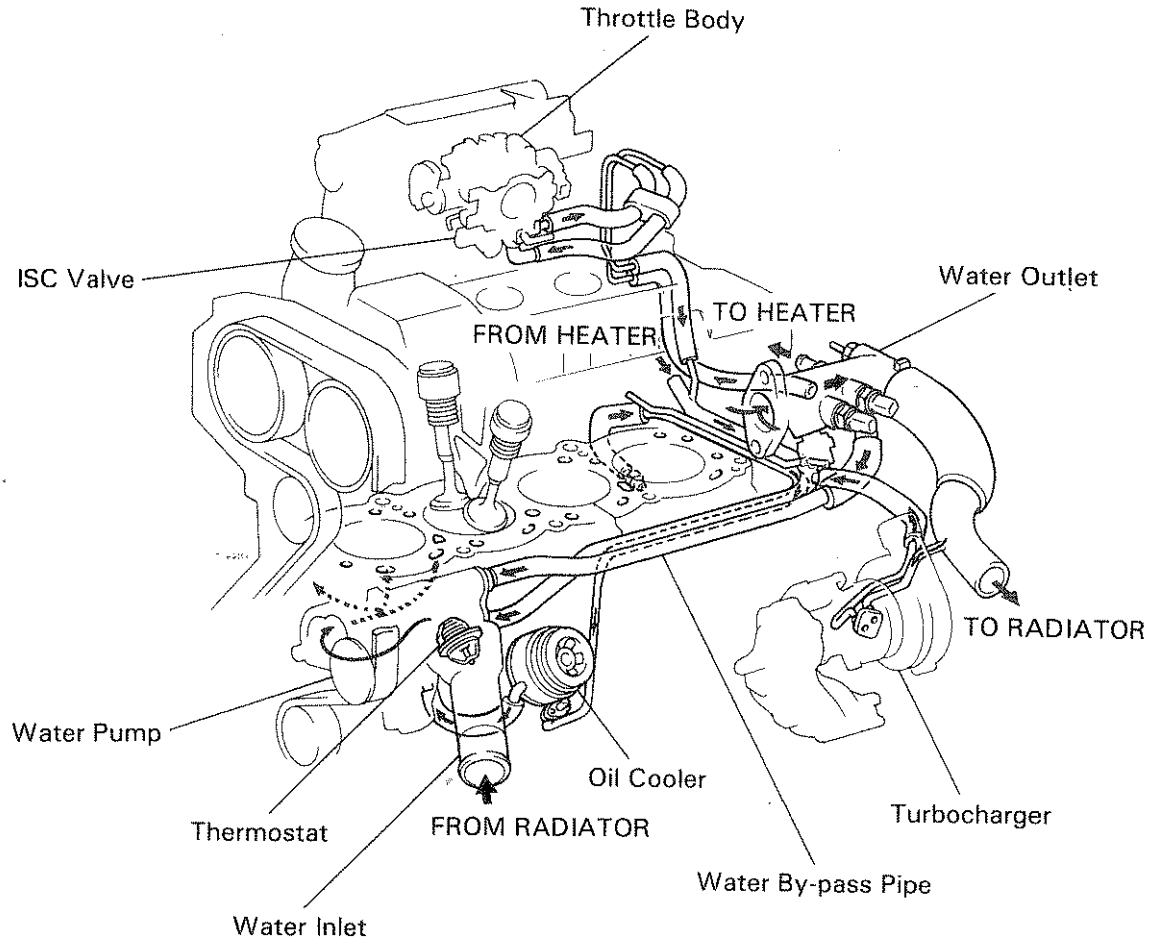
— MEMO —

COOLING SYSTEM

CO

DESCRIPTION



CO0912

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 blows 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 and combustion chambers which become hot during engine operation.

RADIATOR

The radiator performs the function of cooling the coolant which has passed through the water jacket and become hot, and it is mounted in the front of the vehicle. The radiator consists of an upper tank and lower tank, and a core which connects the two tanks. The upper tank contains coolant from the water jacket and the filler inlet. It also has a hose attached through which excess coolant can flow. The lower tank has an outlet and drain cock for the coolant. The core contains many tubes through which coolant flows from the upper tank to the lower tank as well as cooling fins which radiator 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 the coolant. Models with automatic transmission 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: 73.5 — 103.0 kPa, 0.75 — 1.05 kgf/cm^2, 10.8 — 14.9 psi). 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 the coolant in the reservoir tank to return to the cooling system.

RESERVOIR TANK

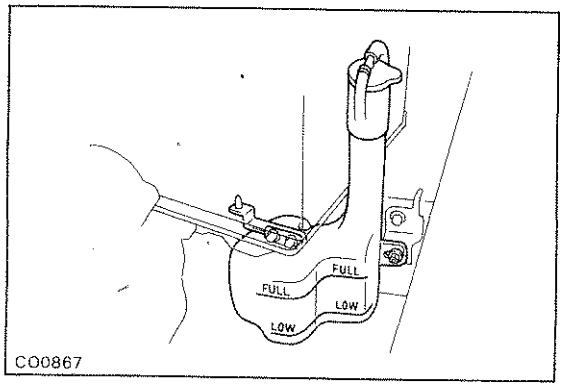
The reservoir tank is used to catch coolant which overflows the cooling system as a result of volumetric expansion when the coolant is heated. The coolant in the reservoir tank returns to the radiator when the coolant temperature drops, thus keeping the radiator full at all times and avoiding needless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

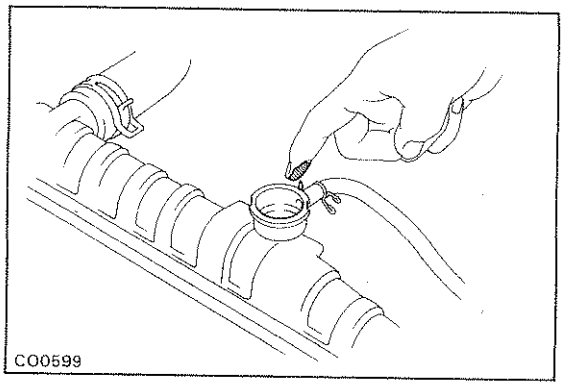
WATER PUMP

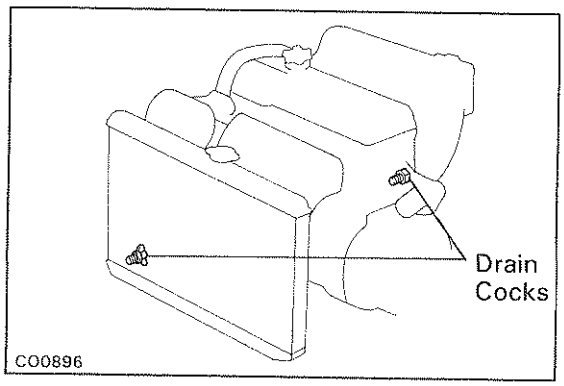
The water pump is used for forced circulation of coolant through the cooling system. It is mounted on the front of the cylinder block and driven by a timing belt.

THERMOSTAT

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







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. (When the coolant is cold.)

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

2. CHECK ENGINE COOLANT QUALITY

There should not be any excessive deposits of rust 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 the cap 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 rear left of engine block.

(c) Close the drain cocks.

Torque (Engine drain cock): 13 N·m (130 kgf·cm, 9 ft·lbf)

(d) Slowly fill the system with coolant.

Use a good brand of ethylene-glycol or TOYOTA radiator conditioner or equivalent anticorrosive, mixed according to the maker'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 an alcohol type coolant.**
- **The coolant should be mixed with demineralized water or distilled water.**

Capacity (w/ Heater):
6.0 liters (6.3 US qts, 5.3 Imp·qts)

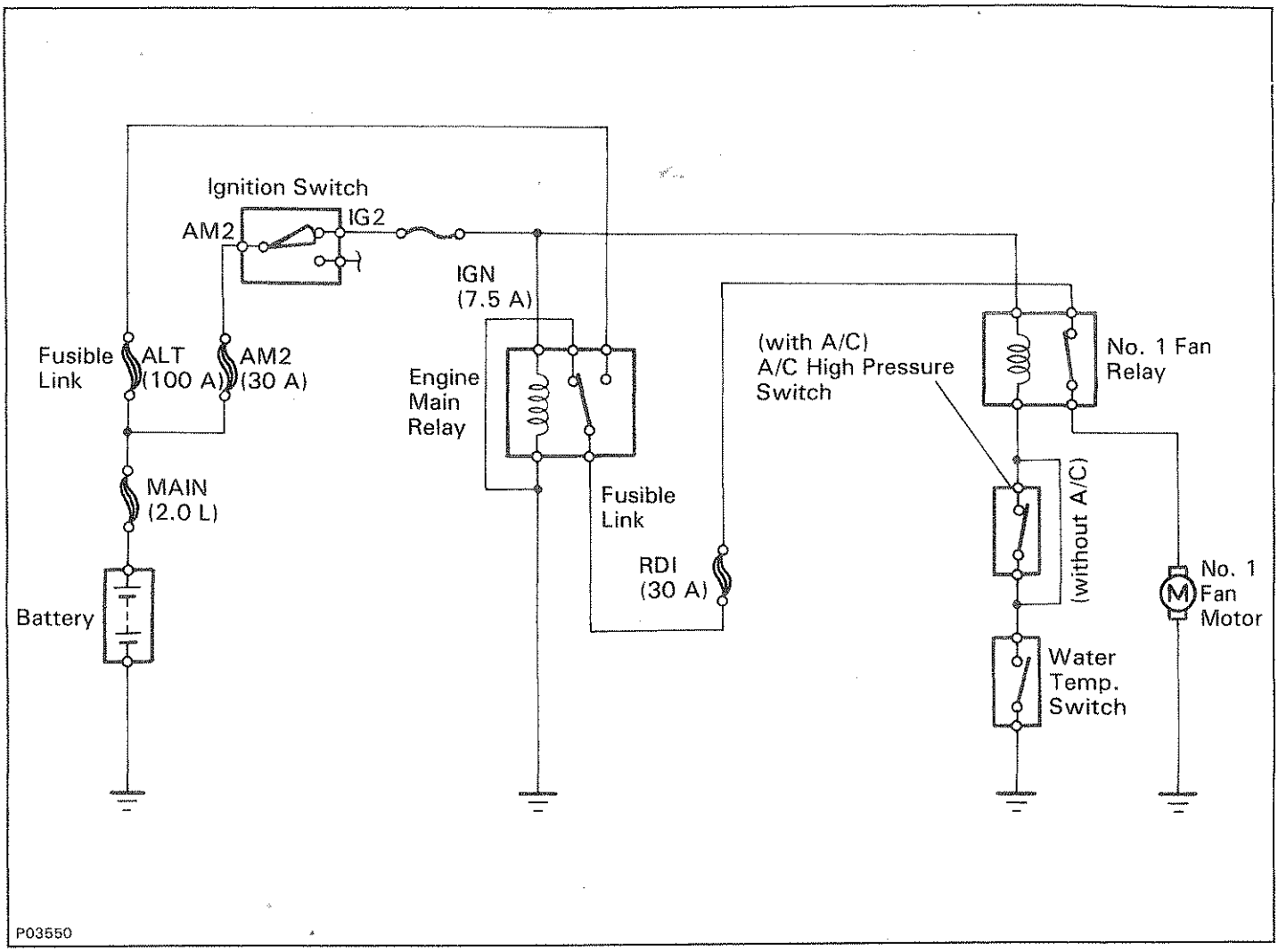
(e) Reinstall the radiator cap.

(f) Warm up the engine and check for leaks.

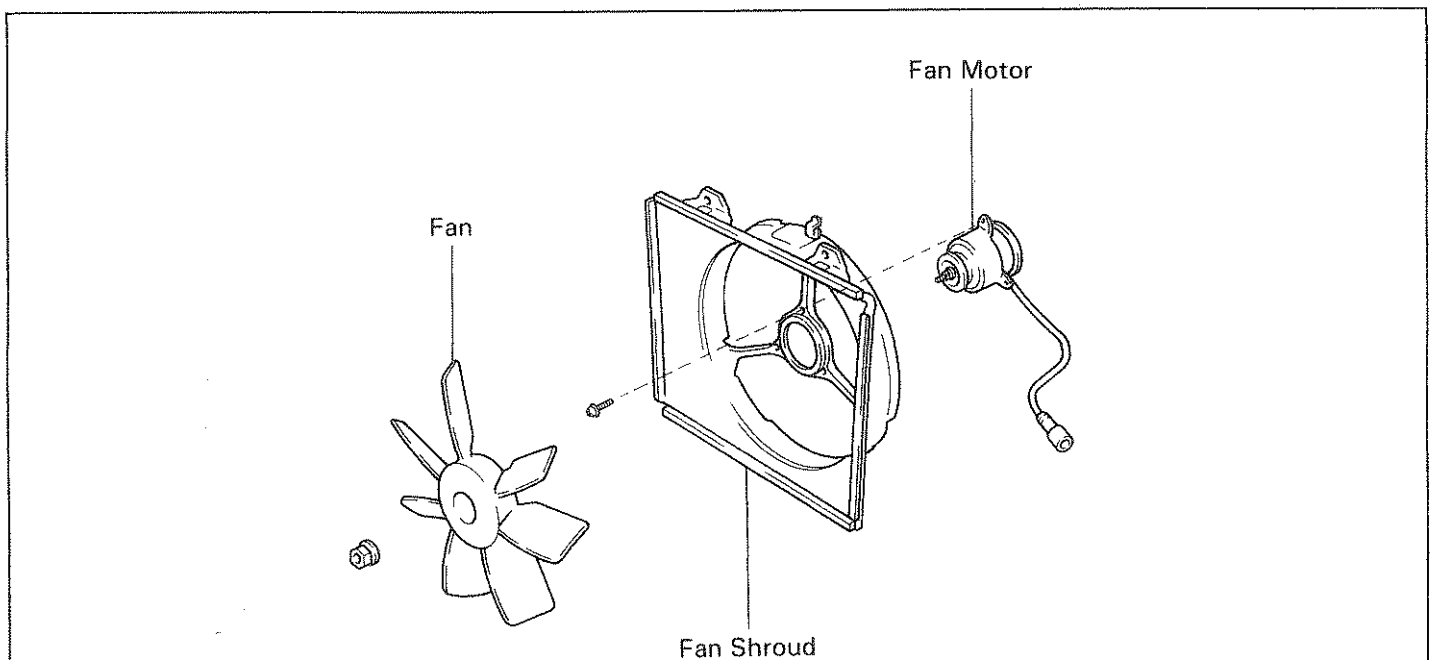
(g) Recheck the coolant level and refill as necessary.

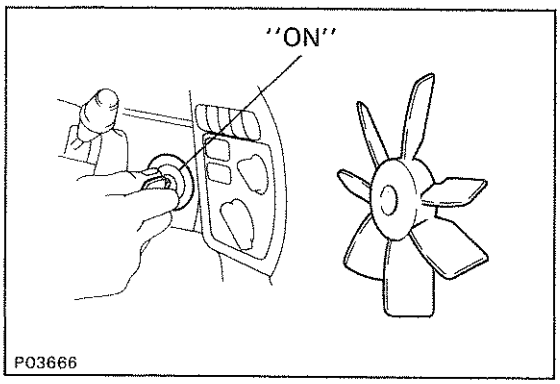
ELECTRIC COOLING FAN

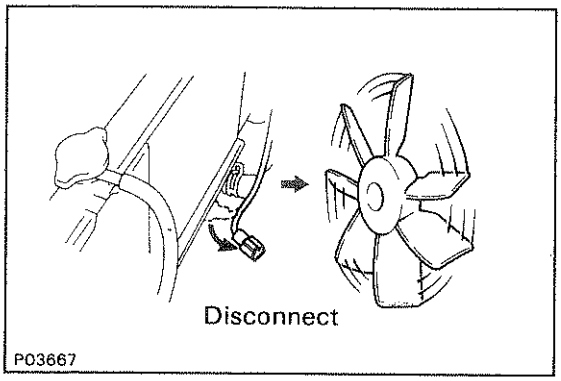
SYSTEM CIRCUIT

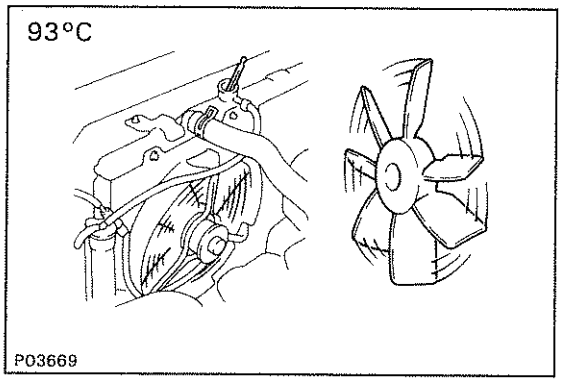


COMPONENTS









ON-VEHICLE INSPECTION

Low Temperature (Below 83°C (181°F))

1. TURN IGNITION SWITCH "ON"

   Check that the cooling fan stops.

   If not, check the cooling fan relays and water temp. switch, and check for a separated connector or severed wire between the cooling fan relay and water temp. switch.

2. DISCONNECT WATER TEMP. SWITH CONNECTOR

   Check that the cooling fan rotates.

   If not, check the cooling fan relays, cooling fan, engine main relay and fuse, and check for a short circuit between the cooling fan relay and water temp. switch.

3. CONNECT WATER TEMP. SWITCH CONNECTOR

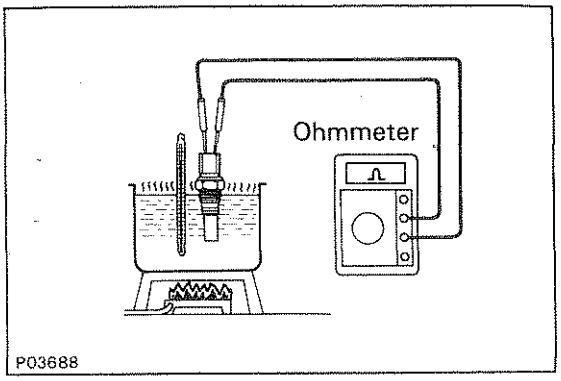
High Temperature (Above 93°C (199°F))

4. START ENGINE

   (a) Raise coolant temperature to above 93°C (199°F) or 102°C (216°F).

   (b) Check that the cooling fan rotates.

   If not, replace the water temp. switch.



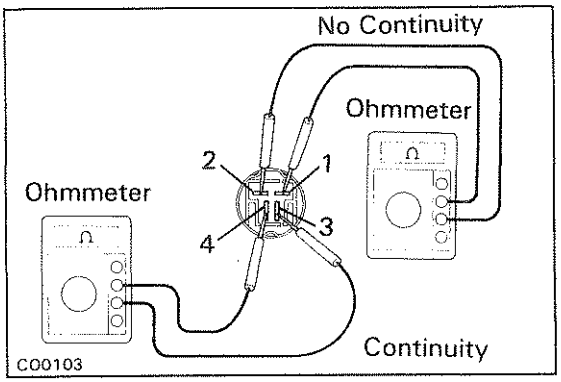
INSPECTION OF ELECTRIC COOLING FAN COMPONENTS

1. INSPECT NO.1 WATER TEMP. SWITCH

(a) Using an ohmmeter, check that there is no continuity between the terminals when the coolant temperature is above 93°C (199°F).

(b) Using an ohmmeter, check that there is continuity between the terminals when the coolant temperature is below 83°C (181°F).

If continuity is not as specified, replace the switch.



2. INSPECT NO.1 COOLING FAN RELAY

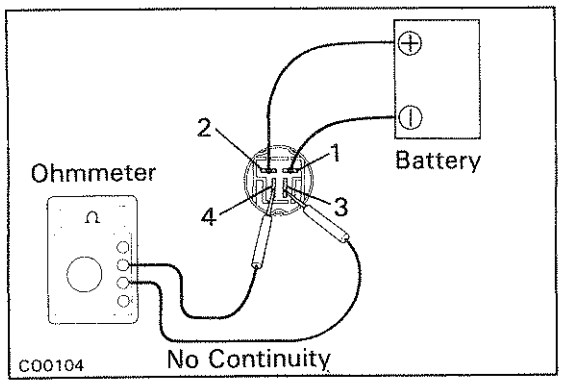
LOCATION: In the No.2 junction block

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

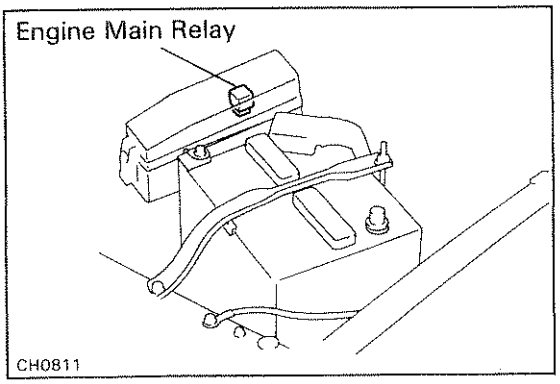
(a) Apply battery voltage across terminals 1 and 2.

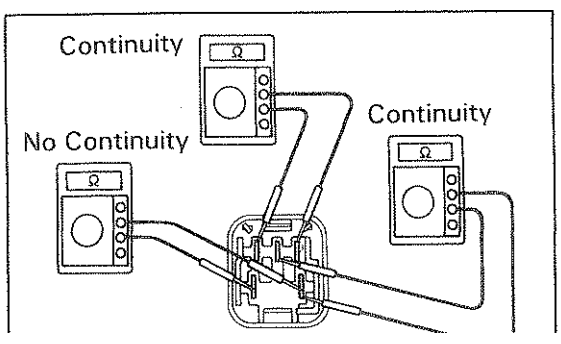
(b) Using an ohmmeter, check that there is no continuity between terminals 3 and 4.

If operation is not as specified, replace the relay.

3. INSPECT ENGINE MAIN RELAY

LOCATION: In the engine compartment relay box.





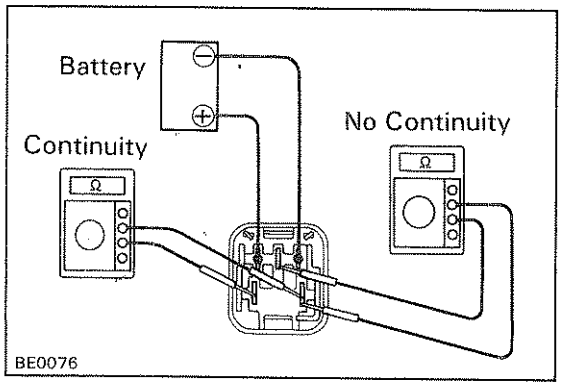
A. Inspect Relay Continuity

(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 continuity between terminals 4 and 5.

If continuity is not as specified, replace the relay.



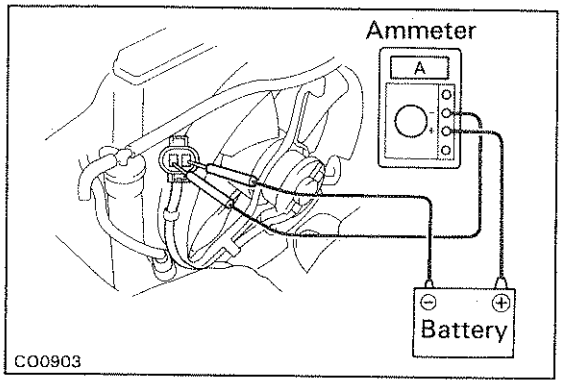
B. **Inspect Relay Operation**

(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.



4. **INSPECT COOLING FAN**

(a) Connect battery and ammeter to the cooling fan connector.

(b) Check that the cooling fan rotates smoothly, and check the reading on the ammeter.

Standard amperage: 8.8 — 10.8 A

IGNITION SYSTEM

IG

ON-VEHICLE INSPECTION

SPARK TEST

CHECK THAT SPARK OCCURS

(a) Disconnect the high-tension cord from the distributor.

(b) Hold the end about 12.5 mm (0.50 in.) from the body of car.

(c) 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 spark does not occur, 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-3)
Maximum resistance: 25 kΩ per cord → BAD → Replace the cord(s).

↓ OK

CHECK POWER SUPPLY TO IGNITION COIL AND IGNITER
1. Turn ignition switch to 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 IGNIITON COIL (See page IG-6)
Resistance (-10 — +40°C (14 — 104°F)):
Primary 0.3 — 0.6 Ω
Secondary 9 — 15 kΩ

→ BAD → Replace the ignition coil.

↓ OK

CHECK RESISTANCE OF SIGNAL GENERATOR (PICKUP COIL) (See page IG-7)
Resistance (-10 — + 40°C (14 — 104°F)):
G1 — G — 125 — 190 Ω
G2 — G — 125 — 190 Ω
NE — G — 155 — 240 Ω

→ BAD → Replace the distributor housing assembly.

↓ OK

CHECK AIR GAP OF DISTRIBUTOR (See page IG-7)
Air gap: 0.2 — 0.4 mm (0.008 — 0.016 in.)

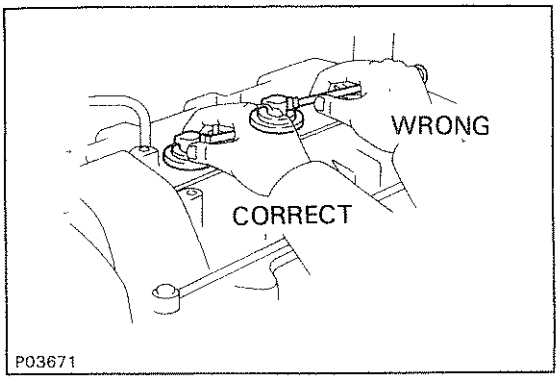
→ BAD → Replace the distributor housing assembly.

↓ OK

CHECK IGT SIGNAL FROM ECU (See pages 49, 65, 81 or 97)

→ BAD → Check wiring between ECU, distributor and igniter, only then try another ECU.

↓ OK



INSPECTION OF HIGH-TENSION CORDS

1. REMOVE INTERCOOLER
(See steps 5,6 on page TC-14)

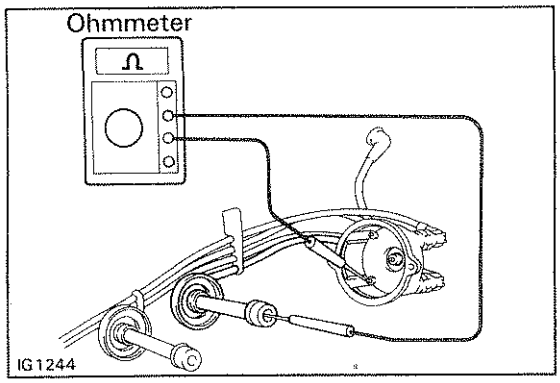
2. DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS

Disconnect the high-tension cords at the rubber boot. DO NOT pull on the cords.

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

3. DISCONNECT HIGH-TENSION CORD FROM IGNITION COIL

4. REMOVE DISTRIBUTOR CAP WITHOUT DISCONNECTING HIGH-TENSION CORDS



5. 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.

6. REINSTALL DISTRIBUTOR CAP

7. RECONNECT HIGH-TENSION CORD TO IGNITION COIL

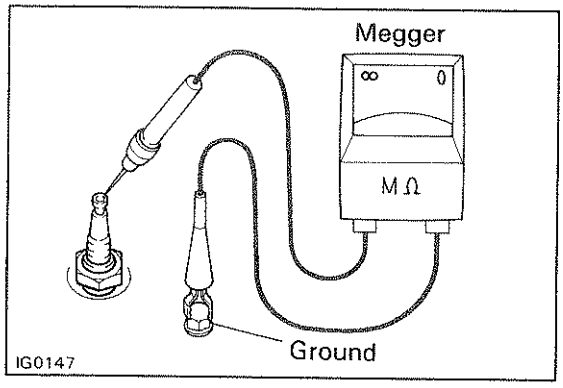
8. RECONNECT HIGH-TENSION CORDS TO SPARK PLUGS

9. REINSTALL INTERCOOLER
(See steps 12,13 on page TC-21)

INSPECTION OF SPARK PLUGS
(Platinum Tipped Type)

NOTICE:
- Never use a wire brush for cleaning.
- Never attempt to adjust gap on used plug.
- Spark plugs should be replaced every 60,000 miles (100,000 km)

1. REMOVE INTERCOOLER
(See steps 4 to 6 on page TC-12,13)



2. DISCONNECT HIGH-TENSION CORDS FROM SPARK PLUGS

3. INSPECT ELECTRODE

Using a megger (insulation resistance meter), measure the insulation resistance.

Standard insulation resistance: More than 10 MΩ

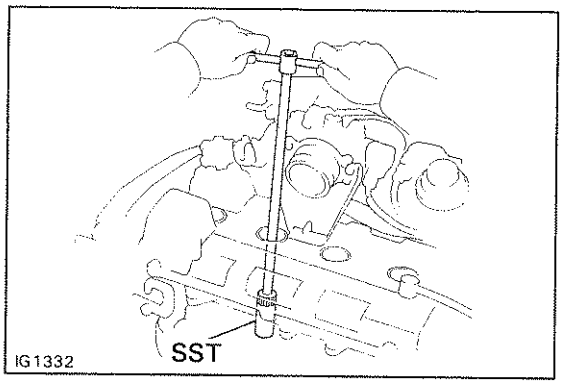
If less than 10 MΩ, proceed to step 4.

HINT: If a megger is not available, the following simple method of inspection provides fairy accurate results.

[Simple method]

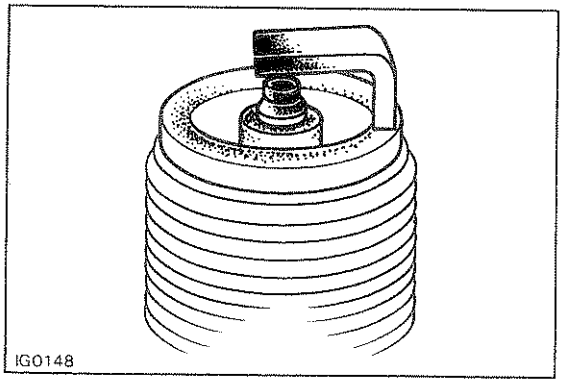
- Quickly race the engine to 4,000 rpm five times.
- Using SST, remove the spark plug.

SST 09155-16100



- Visually inspect the spark plugs.

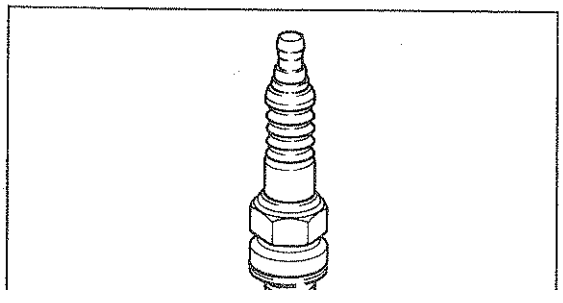
If the electrode is dry . . . Okay
If the electrode is wet . . . Proceed to step 5



4. REMOVE SPARK PLUGS

Using SST, remove the spark plug.

SST 09155-16100



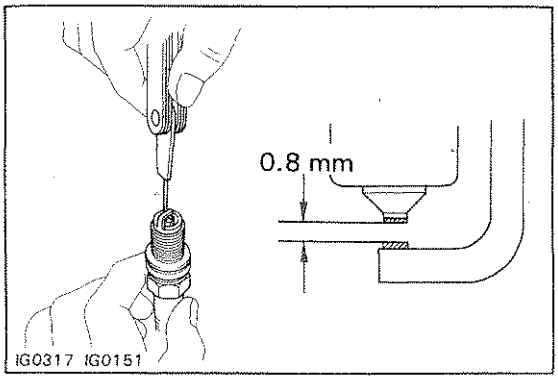
5. VISUALLY INSPECT SPARK PLUGS

Check the spark plug for thread or insulator damage.

If abnormal, replace the plug.

Recommended spark plugs:

ND	PK20R8
NGK	BKR6EP8



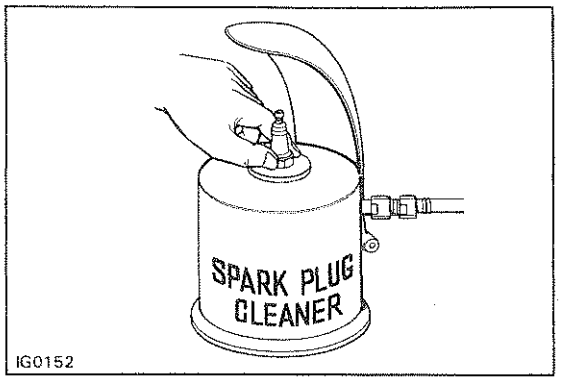
6. INSPECT ELECTRODE GAP

Maximum electrode gap: 1.0 mm (0.39 in.)

If the gap is greater than maximum, replace the plug.

Correct electrode gap of new plug: 0.8 mm (0.031 in.)

If adjusting the gap of a new plug, bend only the base of the ground electrode, do not touch the tip.

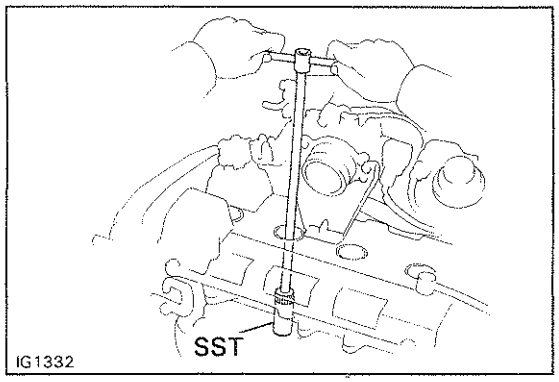


7. CLEAN SPARK PLUGS

If the electrode has traces of wet carbon, allow it to dry and then clean with a spark plug cleaner.

Air pressure: **Below 588 kPa (6 kgf/cm^2, 85 psi)**
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

Using SST, install and torque the spark plug.

SST 09155-16100

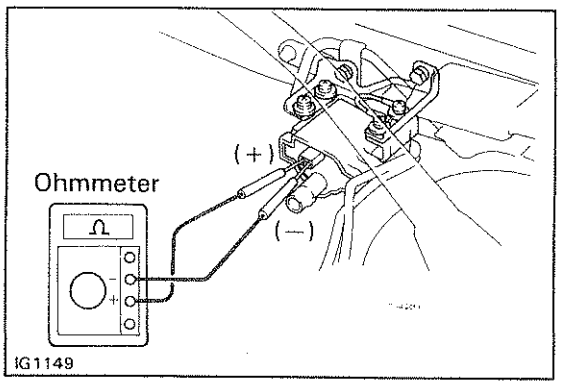
Torque: 18 N·m (180 kgf·cm, 13 ft·lbf)

9. RECONNECT HIGH-TENSION CORDS TO SPARK PLUGS

10. REINSTALL INTERCOOLER
(See steps 12,13 on page TC-20)

INSPECTION OF IGNITION COIL

1. DISCONNECT IGNITION COIL CONNECTOR
2. DISCONNECT HIGH-TENSION CORD

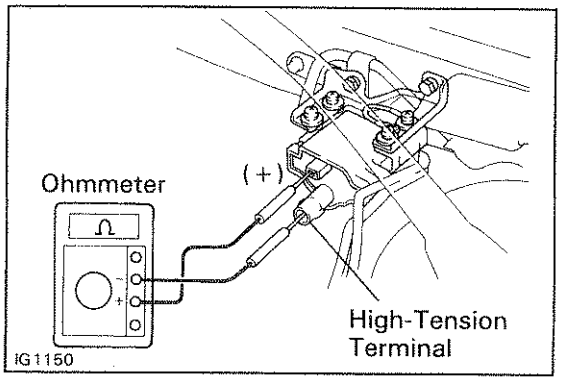


3. INSPECT PRIMARY COIL RESISTANCE

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

Primary coil resistance:
0.3 — 0.6 Ω at -10 — +40°C (14 — 104°F)

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



4. INSPECT SECONDARY COIL RESISTANCE

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

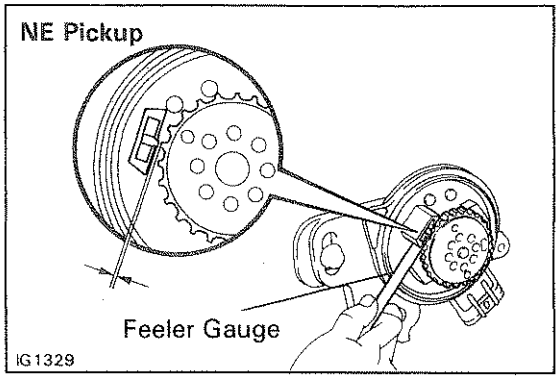
Secondary coil resistance:
9 — 15 kΩ at -10 — +40°C (14 — 104°F)

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

5. RECONNECT HIGH-TENSION CORD
6. RECONNECT IGNITION COIL CONNECTOR

INSPECTION OF DISTRIBUTOR

1. DISCONNECT DISTRIBUTOR CONNECTOR
2. REMOVE DISTRIBUTOR CAP
3. REMOVE ROTOR



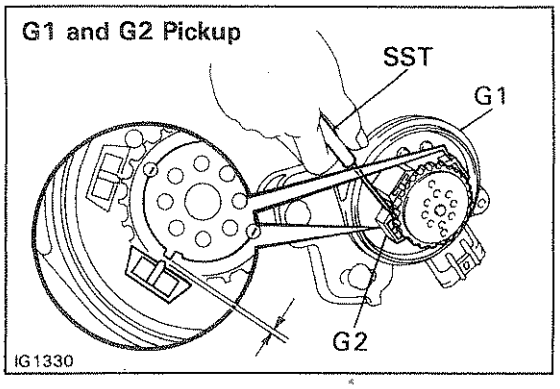
4. INSPECT AIR GAP

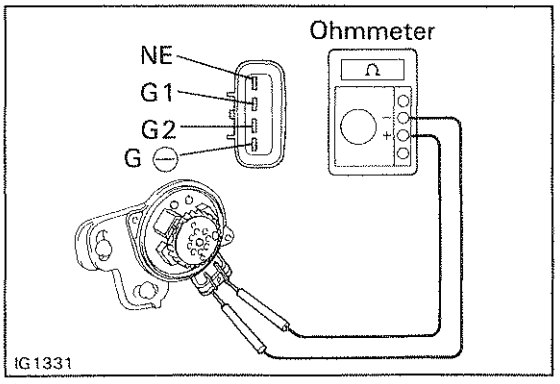
Using SST (G1 and G2 pickup) and a feeler gauge (NE pickup), measure the air gap between the signal rotor and pickup coil projection.

SST 09240-00020 for G1 and G2 pickup

Air gap: 0.2 — 0.4 mm (0.008 — 0.016 in.)

If the air gap is not as specified, replace the distributor housing assembly.





5. INSPECT SIGNAL GENERATOR (PICKUP COIL) RESISTANCE

Using an ohmmeter, measure the resistance between terminals.

Pickup coil resistance (-10 — +40°C (14 — 104°F))

G1 to G ⊖ 125 — 190 Ω
G2 to G ⊖ 125 — 190 Ω
NE to G ⊖ 155 — 240 Ω

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

6. REINSTALL ROTOR
7. REINSTALL DISTRIBUTOR CAP
8. RECONNECT DISTRIBUTOR CONNECTOR

IGNITER

(See procedure Spark Test on page IG-2)

— MEMO —

SERVICE SPECIFICATIONS

ENGINE MECHANICAL

Specifications

Engine tune-up	Drive belt				
	Deflection (Alternator)				
	w/ A/C	New belt	9 — 11 mm		0.35 — 0.43 in.
		Used belt	13 — 16 mm		0.51 — 0.63 in.
	w/o A/C	New belt	11 — 14 mm		0.43 — 0.55 in.
		Used belt	12 — 18 mm		0.47 — 0.71 in.
	Tension (Alternator) (Reference)				
	w/ A/C	New belt	70 — 80 kg		
		Used belt	30 — 45 kg		
	w/o A/C	New belt	47 — 72 kg		
		Used belt	36 — 52 kg		
	Engine coolant capacity (w/ Heater)		6.0 liters	6.3 US qts	5.3 Imp.qts
	Engine oil capacity				
	Drain and refill	w/ Oil filter change	3.9 liters	4.1 US qts	3.4 Imp.qts
		w/o Oil filter change	3.6 liters	3.8 US qts	3.2 Imp.qts
	Dry fill		4.3 liters	4.5 US qts	3.8 Imp.qts
	Engine oil API grade		SD, SE 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 type				
	Type	ND	K20R-U		
		NGK	BKR6EYA		
	Air gap		0.8 mm		0.031 in.
	Platinum tipped type (Reference)				
	Type	ND	PK20R8		
		NGK	BKR6EP8		
	Air gap		0.8 mm		0.031 in.
	Valve clearance	Intake	0.15 — 0.25 mm		0.006 — 0.010 in.
		Exhaust	0.28 — 0.38 mm		0.011 — 0.015 in.
	Ignition timing		10° BTDC @ idle (w/ Terminals TE1 and E1 connected)		
	Firing order		1 — 3 — 4 — 2		
	Idle speed		800 ± 50 rpm		
Idle CO concentration		w/ TWC	0 — 0.5%		
		w/o TWC	1.0 ± 0.5%		
Intake manifold vacuum	at Idle speed		60 kPa (450 mmHg, 17.7 in.Hg)		

Specifications (Cont'd)

Compression pressure	at 250 rpm STD	1,128 kPa (11.5 kgf/cm^2, 164 psi) or more	
	Limit	883 kPa (9.0 kgf/cm^2, 128 psi)	
	Difference of pressure between each cylinder	98 kPa (1.0 kgf/cm^2, 14 psi) or less	
Timing belt tensioner	Protrusion	8.5 — 9.5 mm	0.335 — 0.374 in.
Cylinder head	Warpage Cylinder block side Limit	0.20 mm	0.0079 in.
	Intake manifold side Limit	0.20 mm	0.0079 in.
	Exhaust manifold side Limit	0.30 mm	0.0118 in.
	Valve seat Refacing angle	30°, 45°, 75°	
	Contacting angle	45°	
	Contacting width	1.0 — 1.4 mm	0.039 — 0.055 in.
Valve guide bushing	Inside diameter	6.000 — 6.018 mm	0.2362 — 0.2369 in.
	Outside diameter (for repair part) STD	11.030 — 11.041 mm	0.4343 — 0.4347 in.
	O/S 0.05	11.080 — 11.091 mm	0.4362 — 0.4367 in.
Valve	Valve overall length STD Intake	100.50 mm	3.9567 in.
	Exhaust	99.55 mm	3.9193 in.
	Limit Intake	99.80 mm	3.9291 in.
	Exhaust	98.85 mm	3.8917 in.
	Valve face angle	44.5°	
	Stem diameter Intake	5.960 — 5.975 mm	0.2346 — 0.2352 in.
	Exhaust	5.955 — 5.970 mm	0.2344 — 0.2350 in.
	Stem oil clearance STD Intake	0.025 — 0.058 mm	0.0010 — 0.0023 in.
	Exhaust	0.030 — 0.063 mm	0.0012 — 0.0025 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	Squareness Limit	2.0 mm	0.079 in.
	Free length	44.43 mm	1.7492 in.
	Installed tension at 34.4 mm (1.354 in.)	201 — 236 N (20.5 — 24.1 kg, 45.2 — 53.1 lb)	
Valve lifter	Lifter diameter	27.975 — 27.985 mm	1.1014 — 1.1018 in.
	Lifter bore diameter	28.000 — 28.021 mm	1.1024 — 1.1032 in.
	Oil clearance STD	0.015 — 0.046 mm	0.0006 — 0.0018 in.
	Limit	0.07 mm	0.0028 in.
Manifold	Warpage Limit	0.20 mm	0.0079 in.

Specifications (Cont'd)

Camshaft	Thrust clearance	STD	0.120 — 0.240 in.	0.0047 — 0.0094 in.
		Limit	0.30 mm	0.0118 in.
	Journal oil clearance	STD	0.025 — 0.062 mm	0.0010 — 0.0024 in.
		Limit	0.08 mm	0.0031 in.
	Journal diameter		26.959 — 26.975 mm	1.0614 — 1.0620 in.
	Circle runout	Limit	0.06 mm	0.0024 in.
	Cam lobe height	STD	41.010 — 41.110 mm	1.6146 — 1.6185 in.
		Limit	39.90 mm	1.5709 in.
T-VIS valve	Warpage	Limit	0.20 mm	0.0079 in.
Cylinder block	Cylinder head surface warpage	Limit	0.05 mm	0.0020 in.
	Cylinder bore diameter			
	STD	Mark 1	86.000 — 86.010 mm	3.3858 — 3.3862 in.
		Mark 2	86.010 — 86.020 mm	3.3862 — 3.3866 in.
		Mark 3	86.020 — 86.030 mm	3.3866 — 3.3870 in.
	Limit		86.23 mm	3.3949 in.
Piston and piston ring	Piston diameter	Mark 1	85.920 — 85.930 mm	3.3827 — 3.3831 in.
		Mark 2	85.930 — 85.940 mm	3.3831 — 3.3835 in.
		Mark 3	85.940 — 85.950 mm	3.3835 — 3.3839 in.
	Piston oil clearance			
		STD	0.070 — 0.090 mm	0.0028 — 0.0035 in.
		Limit	0.110 mm	0.0043 in.
	Piston ring groove clearance	No.1	0.040 — 0.080 mm	0.0016 — 0.0031 in.
		No.2	0.030 — 0.070 mm	0.0012 — 0.0028 in.
	Piston ring end gap			
	STD w/ TWC	No.1	0.330 — 0.550 mm	0.0130 — 0.0217 in.
		No.2	0.450 — 0.670 mm	0.0177 — 0.0264 in.
		Oil	0.200 — 0.600 mm	0.0079 — 0.0236 in.
	w/o TWC	No.1	0.330 — 0.550 mm	0.0130 — 0.0217 in.
		No.2	0.200 — 0.420 mm	0.0079 — 0.0165 in.
		Oil	0.300 — 1.000 mm	0.0118 — 0.0394 in.
	Limit w/ TWC	No.1	0.85 mm	0.0335 in.
		No.2	0.97 mm	0.0382 in.
		Oil	0.90 mm	0.0354 in.
	w/o TWC	No.1	0.85 mm	0.0335 in.
		No.2	0.72 mm	0.0283 in.
		Oil	1.30 mm	0.0512 in.

Specifications (Cont'd)

Connecting rod	Thrust clearance		STD	0.160 — 0.312 mm	0.0063 — 0.0123 in.
			Limit	0.35 mm	0.35 in.
	Connecting rod bearing center wall thickness				
		STD	Mark 1	1.484 — 1.488 mm	0.0584 — 0.0586 in.
			Mark 2	1.488 — 1.492 mm	0.0586 — 0.0587 in.
			Mark 3	1.492 — 1.496 mm	0.0587 — 0.0589 in.
	Connecting rod oil clearance				
		STD	STD	0.024 — 0.055 mm	0.0009 — 0.0022 in.
			U/S	0.023 — 0.069 mm	0.0009 — 0.0027 in.
		Limit		0.08 mm	0.0031 in.
	Rod bending	Limit per 100 mm (3.94 in.)		0.05 mm	0.0020 in.
	Rod twist	Limit per 100 mm (3.94 in.)		0.15 mm	0.0059 in.
	Bushing inside diameter			22.005 — 22.017 mm	0.8663 — 0.8668 in.
	Piston pin diameter			21.997 — 22.009 mm	0.8660 — 0.8665 in.
	Piston pin oil clearance		STD	0.005 — 0.011 mm	0.0002 — 0.0004 in.
			Limit	0.05 mm	0.0020 in.
Crankshaft	Thrust clearance		STD	0.020 — 0.220 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 No.3	STD	0.025 — 0.044 mm	0.0010 — 0.0017 in.
			U/S 0.25	0.021 — 0.061 mm	0.0008 — 0.0024 in.
		Others		0.015 — 0.034 mm	0.0006 — 0.0013 in.
			U/S 0.25	0.029 — 0.069 mm	0.0011 — 0.0027 in.
		Limit		0.08 mm	0.0031 in.
	Main journal diameter		STD	54.988 — 55.003 mm	2.1653 — 2.1655 in.
			U/S	54.745 — 54.755 mm	2.1553 — 2.1557 in.
	Main bearing center wall thickness				
		STD No.3	Mark 1	1.992 — 1.995 mm	0.0784 — 0.0785 in.
			Mark 2	1.995 — 1.998 mm	0.0785 — 0.0787 in.
			Mark 3	1.998 — 2.001 mm	0.0787 — 0.0788 in.
			Mark 4	2.001 — 2.004 mm	0.0788 — 0.0789 in.
			Mark 5	2.004 — 2.007 mm	0.0789 — 0.0790 in.
		STD Others	Mark 1	1.997 — 2.000 mm	0.0786 — 0.0787 in.
			Mark 2	2.000 — 2.003 mm	0.0787 — 0.0789 in.
			Mark 3	2.003 — 2.006 mm	0.0789 — 0.0790 in.
			Mark 4	2.006 — 2.009 mm	0.0790 — 0.0791 in.
			Mark 5	2.009 — 2.012 mm	0.0791 — 0.0792 in.
	Crank pin diameter		STD	47.985 — 48.000 mm	1.8892 — 1.8898 in.
			U/S	47.745 — 47.755 mm	1.8797 — 1.8801 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 taper and out-of-round				

Torque Specifications

Part tightened		N·m	kgf·cm	ft·lbf
Oil pump pulley × Oil pump drive shaft		35	355	26
No.2 idler pulley × Cylinder block		43	440	32
No.1 idler pulley bracket × Cylinder head		43	440	32
Crankshaft pulley × Crankshaft		108	1,100	80
Camshaft timing pulley × Camshaft		59	600	43
	For SST	41	420	30
Timing belt tensioner × Cylinder head		21	210	15
RH engine mounting bracket × Cylinder block		52	530	38
Cylinder head × Cylinder block	1st	49	500	36
	2nd		Turn 90°	
Camshaft bearing cap × Cylinder head		19	190	14
No.3 timing belt cover × Cylinder head		2.5	25	21 in.·lbf
Cylinder head cover × Cylinder head		18	180	13
RH rear engine hanger × Cylinder head		19	195	14
Intake manifold × Cylinder head		19	195	14
Intake manifold stay × Intake manifold		25	260	19
Intake manifold stay × Cylinder block		25	260	19
Water by-pass pipe × Water pump cover		7.8	80	69 in.·lbf
Water outlet × Cylinder head		39	400	29
EGR valve × Intake manifold		19	195	14
EGR pipe × Cylinder head		26	260	19
LH engine hanger × Cylinder head	12 mm head bolt	13	130	9
	14 mm head bolt	19	195	14
Exhaust manifold × Cylinder head		52	530	38
Catalytic converter × Turbine outlet elbow		29	300	22
Catalytic converter stay × Catalytic converter		59	600	43
No.1 alternator bracket × Cylinder head		39	400	29
Alternator × No.1 alternator bracket	12 mm head bolt	19	195	14
	14 mm head bolt	52	530	38
No.2 alternator bracket × No.1 alternator bracket		39	400	29
No.2 alternator bracket × Turbine outlet elbow		43	440	32
Main bearing cap × Cylinder block		59	600	43
Connecting rod cap × Connecting rod		67	680	49
Rear oil seal retainer × Cylinder block		9.3	95	82 in.·lbf
Knock sensor × Cylinder head		44	450	33
PS pump bracket × Cylinder block		43	440	32
Rear end plate × Cylinder block		9.3	95	82 in.·lbf
Flywheel × Crankshaft		108	1,100	80

TURBOCHARGER SYSTEM

Specifications

Turbocharger	Turbocharging pressure	53 — 81 kPa (0.54 — 0.83 kgf/cm^2, 7.8 — 11.8 psi)
	Impeller wheel axial play	0.13 mm (0.0051 in.) or less
	Impeller wheel radial play	0.18 mm (0.0071 in.) or less
	Intercooler filler cap opening pressure	
	STD	74 — 103 kPa (0.75 — 1.05 kgf/cm^2, 10.7 — 14.9 psi)
	Limit	59 kPa (0.6 kgf/cm^2, 85 psi)
	Intercooler water pump amperage	1.5 — 2.1 A

Torque Specifications

Part tightened	N·m	kgf·cm	ft·lbf
Turbine outlet elbow × Turbocharger	64	650	47
Side bearing housing plate × Turbocharger	11	120	9
Turbo water pipe × Turbocharger	11	120	9
Turbocharger × Exhaust manifold	64	650	47
Oil pipe × Turbocharger	17	175	13
Oil pipe × Cylinder block (Union bolt)	51	525	38
Turbocharger stay × Turbocharger	69	705	51
Turbocharger stay × Cylinder block	59	600	43
Oxygen sensor × Turbine outlet elbow	44	450	33

EFI SYSTEM

Specifications

Fuel pressure regulator	Fuel pressure at No vacuum	226 — 265 kPa (2.3 — 2.7 kgf/cm^2, 33 — 38 psi)
Cold start injector	Resistance	2 — 4 Ω
	Fuel leakage	One drop or less per minute
Injector	Resistance	2 — 4 Ω
	Injection volume	101 — 114 cc (6.2 — 7.0 cu in.) per 15 sec.
	Difference between each cylinder	5 cc (0.3 cu in.) or less
	Fuel leakage	One drop or less per minute
Throttle body	Throttle body fully closed angle	6°

Throttle position sensor	Clearance between stop screw and lever	Between terminals	Resistance
	0 mm (0 in.)	VTA — E2	0.2 — 0.8 kΩ
	0.50 mm (0.020 in.)	IDL — E2	2.3 kΩ or less
	0.70 mm (0.028 in.)	IDL — E2	Infinity
	Throttle valve fully opened position	VTA — E2	3.3 — 10 kΩ
	—	VC — E2	3 — 7 kΩ

ISC valve	Resistance +B — RSC or RSO		19.3 — 22.3 Ω
Cold start injector time switch	Resistance STA — STJ	below 10°C (50°F)	30 — 50 Ω
		above 25°C (77°F)	70 — 90 Ω
	STA — Ground		30 — 90 Ω
Air flow meter	Resistance VS — E2		200 — 600 Ω (Measuring plate fully closed)
			20 — 1,000 Ω (Measuring plate fully open)
	VC — E2		200 — 400 Ω
	FC — E1		Infinity (Measuring plate fully closed)
			Zero (Others)
	THA — E2	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
Fuel pump resistor	Resistance		Approx. 0.73 Ω
Solenoid resistor	Resistance +B — No.10, No.20, No.30 or No.40		4 — 6 Ω
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 — 7 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
Oxygen sensor	Heater coil resistance		5.1 — 6.3 Ω
T-VIS VSV	Resistance		33 — 39 Ω
EGR VSV	Resistance		33 — 39 Ω
Turbocharging pressure VSV	Resistance		24 — 30 Ω
Fuel cut rpm	w/ Vehicle speed 0 km/h and coolant temp. 80°C (176°F)		
	Fuel cut rpm		2,000 rpm
	Fuel return rpm		1,600 rpm

Specifications (Cont'd)

ECU (cont'd)	Resistance		
	Terminals	Condition	STD resistance (Ω)
	IDL — E2	Throttle valve open	Infinity
		Throttle valve fully closed	2,300 or less
	VTA — E2	Throttle valve fully open	3,500 — 10,000
		Throttle valve fully closed	200 — 800
	VC — E2	—	200 — 400
	VS — E2	Measuring plate fully closed	200 — 600
		Measuring plate fully open	20 — 1,200
	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 ⊖	Cold	125 — 190
	NE — G ⊖	Cold	155 — 240
	RSC — +B, RSO — +B1	—	19.3 — 22.3

Torque Specifications

Part tightened		N·m	kgf·cm	ft·lbf
Fuel line	Union bolt type	29	300	22
	Flare nut type	38	385	28
Fuel pump × Fuel tank		2.9	30	26 in.·lbf
Fuel inlet pipe × Fuel tank		2.9	30	26 in.·lbf
Cold start injector × Intake manifold (Air intake chamber)		5.9	60	52 in.·lbf
Cold start injector pipe × Cold start injector		18	180	13
Cold start injector pipe × Delivery pipe		18	180	13
Fuel pressure regulator × Delivery pipe		29	300	22
Delivery pipe × Cylinder head		19	195	14
Fuel inlet hose × Delivery pipe		29	300	22
Throttle body × Intake manifold (Air intake chamber)		19	195	14
Air connector stay × Throttle body		19	195	14
Air connector stay × Cylinder head		7.8	80	69 in.·lbf
Air connector × Throttle body		19	195	14

Specifications (Cont'd)

ECU

HINT:
- Perform all voltage and resistance measurements with the ECU connected.
- Verity that the battery voltage is 11 V or above with the ignition switch is ON.

Voltage

Terminals	Condition		STD voltage (V)
+B, +B1 — E1	IG SW ON		10 — 14
BATT — E1	—		10 — 14
IDL — E2	IG SW ON	Throttle valve open	4 — 6
VTA — E2		Throttle valve fully closed	0.1 — 1.0
		Throttle valve open	4 — 5
VC — E2		—	4 — 6
VS — E2		Measuring plate fully closed	3.7 — 4.3
		Measuring plate fully open	0.2 — 0.5
	Idling		2.3 — 3.8
	3,000 rpm		1.0 — 2.0
No.1, No.2, No.3, No.4 — E01, E02	IG SW ON		10 — 14
THA — E2	IG SW ON	Intake air temp. 20°C (68°F)	1 — 3
THW — E2		Coolant temp. 80°C (176°F)	0.1 — 1.0
STA — E1	Cranking		6 — 14
IGT — E1	Cranking or idling		0.7 — 1.0
RSC, RSO — E1	IG SW ON	Engine ECU connectors disconnected	8 — 14
W — E1	No trouble ("CHECK" engine warning light off) and engine running		10 — 14
PIM — E2	IG SW ON		2.5 — 4.5
*1AC1 — E1	IG SW ON	Air conditioning ON	8 — 14
*2T-VIS — E1		Throttle valve fully closed	2.0 or less
		Throttle valve open	10 — 14
*3T-VIS — E1	Idling		2.0 or less
	4,200 rpm or more		10 — 14
T — E1	IG SW ON	Check connector T — E1 not connected	10 — 14
		Check connector T — E1 connected	1 or less
WIN — E1	IG SW ON		0 — 3
INT — E1	Idling (More than 30 second)		0 — 3
	Idling ⇨ Throttle valve open		10 — 14

*1w/ A/C *2w/ Regular Unleaded Gasoline *3w/ Premium Unleaded Gasoline

COOLING SYSTEM

Specifications

Engine coolant capacity			See page A-2
Radiator cap	Relief valve opening pressure	STD	73.5 — 103 kPa (0.75 — 1.05 kgf/cm^2, 10.8 — 14.9 psi)
		Limit	59 kPa 0.6 kgf/cm^2 8.5 psi
Thermostat	Valve opening temperature		80 — 84°C 176 — 183°F
	Valve lift at 95°C (203°F)		8 mm (0.31 in.) or more

Torque Specifications

Part tightened	N·m	kgf·cm	ft·lbf
Engine coolant × Drain plug	13	130	9
Water pump × Water pump cover	9.3	95	82 in.·lbf
Water pump × Cylinder block	9.3	95	82 in.·lbf
Water by-pass pipe × Water pump	9.3	95	82 in.·lbf
Water inlet × Water pump	8.8	90	78 in.·lbf

LUBRICATION SYSTEM

Specifications

Engine oil capacity			See page A-2
	at idling		29 kPa (0.3 kgf/cm^2, 4.3 psi) or more
	at 3,000 rpm		245 — 490 kPa (2.5 — 5.0 kgf/cm^2, 36 — 71 psi)
Oil pump	Body clearance	STD	0.10 — 0.16 mm 0.0039 — 0.0063 in.
		Limit	0.20 mm 0.0079 in.
	Tip clearance	STD	0.04 — 0.16 mm 0.0016 — 0.0063 in.
		Limit	0.20 mm 0.0079 in.

Torque Specifications

Part tightened	N·m	kgf·cm	ft·lbf
Engine oil drain plug	25	250	18
Oil pump body cover × Oil pump body	8.8	90	78 in.·lbf
Oil pump × Cylinder block	7.8	80	69 in.·lbf
Oil strainer × Cylinder block	5.4	55	48 in.·lbf
Oil strainer × Oil pump	5.4	55	48 in.·lbf
Oil pan × Cylinder block	5.4	55	48 in.·lbf
Oil pan × Oil pump	5.4	55	48 in.·lbf
Stiffener plate × Cylinder block	37	380	27
Oil cooler × Oil cooler bracket	78	800	58
Oil cooler bracket × Cylinder block	7.8	80	69 in.·lbf
Oil nozzle × Cylinder block	9.1	93	81 in.·lbf

IGNITION SYSTEM

Firing order		1 — 3 — 4 — 2	
Spark plug		See page A-2	
High-tension cord	Resistance	25 kΩ per cord	
Ignition coil	Primary coil resistance	0.3 — 0.6 Ω	
	Secondary coil resistance	9.0 — 15.0 kΩ	
Distributor	Air gap	0.2 — 0.4 mm	0.008 — 0.016 in.
	Signal generator (pickup coil) resistance		
	G1 to G ⊖	125 — 190 Ω	
	G2 to G ⊖	125 — 190 Ω	
	NE to G ⊖	155 — 240 Ω	

STARTING SYSTEM

Starter	Rated voltage and output power		12 V 1.0 kW	
	No-load characteristic	Current	90 A or less at 11.5 V	
		rpm	3,000 rpm or more	
	Brush length	STD	13.5 mm	0.531 in.
		Limit	8.5 mm	0.335 in.
	Commutator			
	Outer diameter	STD	30 mm	1.18 in.
		Limit	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.
	Spring installed load	STD	17 — 24 N	
			(1.79 — 2.41 kg, 3.9 — 5.3 lb)	

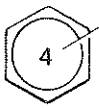
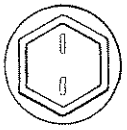
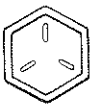
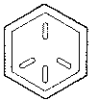
CHARGING SYSTEM

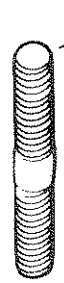
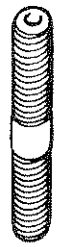
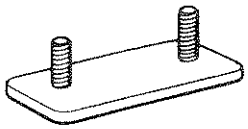
Drive belt tension			See page A-2	
Battery specific gravity When fully charged at 20°C (68°F)			1.25 — 1.27	
Alternator	Rated output		12 V — 70 A	
	Rotor coil resistance		2.8 — 3.0 Ω	
	Slip ring diameter	STD	14.2 — 14.4 mm	0.559 — 0.567 in.
		Limit	12.8 mm	0.504 in.
	Brush exposed length	STD	10.5 mm	0.413 in.
		Limit	1.5 mm	0.059 in.
Alternator regulator (IC)	Regulating voltage	at 25°C (77°F)	13.9 — 15.1 V	
		at 115°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

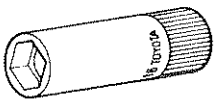
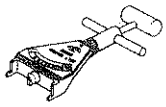
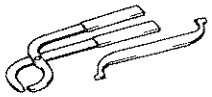
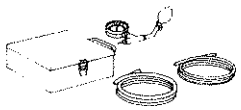
SPECIFIED TORQUE FOR STANDARD BOLTS

Class	Diameter mm	Pitch mm	Specified torque					
			Hexagon head bolt			Hexagon flange bolt		
			N·m	kgf·cm	ft·lbf	N·m	kgf·cm	ft·lbf
4T	6	1	5	55	48 in.·lbf	6	60	52 in.·lbf
	8	1.25	12.5	130	9	14	145	10
	10	1.25	26	260	19	29	290	21
	12	1.25	47	480	35	53	540	39
	14	1.5	74	760	55	84	850	61
	16	1.5	115	1,150	83	—	—	—
5T	6	1	6.5	65	56 in.·lbf	7.5	75	65 in.·lbf
	8	1.25	15.5	160	12	17.5	175	13
	10	1.25	32	330	24	36	360	26
	12	1.25	59	600	43	65	670	48
	14	1.5	91	930	67	100	1,050	76
	16	1.5	140	1,400	101	—	—	—
6T	6	1	8	80	69 in.·lbf	9	90	78 in.·lbf
	8	1.25	19	195	14	21	210	15
	10	1.25	39	400	29	44	440	32
	12	1.25	71	730	53	80	810	59
	14	1.5	110	1,100	80	125	1,250	90
	16	1.5	170	1,750	127	—	—	—
7T	6	1	10.5	110	8	12	120	9
	8	1.25	25	260	19	28	290	21
	10	1.25	52	530	38	58	590	43
	12	1.25	95	970	70	105	1,050	76
	14	1.5	145	1,500	108	165	1,700	123
	16	1.5	230	2,300	166	—	—	—
8T	8	1.25	29	300	22	33	330	24
	10	1.25	61	620	45	68	690	50
	12	1.25	110	1,100	80	120	1,250	90
9T	8	1.25	34	340	25	37	380	27
	10	1.25	70	710	51	78	790	57
	12	1.25	125	1,300	94	140	1,450	105
10T	8	1.25	38	390	28	42	430	31
	10	1.25	78	800	58	88	890	64
	12	1.25	140	1,450	105	155	1,600	116
11T	8	1.25	42	430	31	47	480	35
	10	1.25	87	890	64	97	990	72
	12	1.25	155	1,600	116	175	1,800	130

— MEMO —

SST AND SSM

SST (SPECIAL SERVICE TOOLS)

Section / Part Name / Part No. / Illustration			EM	TC	FI	LU	IG	ST	CH	Note
	09155-16100	Spark Plug Wrench					●			
	09216-00020	Belt Tension Gauge							●	
	09216-00030	Belt Tension Gauge Cable							●	
	09248-55020	Valve Clearance Adjust Tool Set	●							
	09843-18020	Diagnosis Check Wiring	●		●					
	09992-00241	Turbocharger Pressure Gauge		●						

SSM (SPECIAL SERVICE MATERIALS)

Part Name	Part No.	Sec.	Use etc.
Seal packing or equivalent	08826-00080	EM	Cylinder head cover

— MEMO —

TOYOTA

QUALITY SERVICE